MELSEC A Series

Modular
Input/Output System

Operating Manual

MT Modules

Art.-No.: 70159
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Version C

MITSUBISHI ELECTRIC INDUSTRIAL AUTOMATION

About this Manual

The texts, illustrations, diagrams and examples in this manual are only intended as aids to help explain the functioning, operation, use and programming of the modular input/output system MT series.

If you have any questions regarding the installation and operation of the equipment described in this manual, please do not hesitate to contact your sales office or one of your Mitsubishi distribution partners (see cover page). You can also obtain information updates and answers to frequently asked questions from our Internet website.

Operating Manual
MT Modules of the MELSEC A Series
Article No.: 70159

Version			Changes / Additions / Corrections
A	05/98	pdp-rs	First issue
B	08/99	pdp-rs	Added modules: MT-DP12E, MTX4Y4T, MT-Y8R5, MT-4DA, Configuration and parameterization updated to Profimap v2.00
C	09/02	pdp-rs	Updated to configuration software GX Configurator-DP 4, added Profibus master module QJ71PB92D, extended EMC conforming wiring, added update of module MT-4AD-N

Safety Information

For qualified staff only

This manual is only intended for use by properly trained and qualified electrical technicians who are fully acquainted with automation technology safety standards. All work with the hardware described, including system design, installation, setup, maintenance, service and testing, may only be performed by trained electrical technicians with approved qualifications who are fully acquainted with the applicable automation technology safety standards and regulations. Any operations or modifications of the hardware and/or software of our products not specifically described in this manual may only be performed by authorised Mitsubishi staff.

Proper use of equipment

The MT modules are only intended for the specific applications explicitly described in this manual. Please take care to observe all the installation and operating parameters specified in the manual. The design, manufacturing, testing and documentation of these products have all been carried out in strict accordance with the relevant safety standards. Under normal circumstances the products described here do not constitute a potential source of injury to persons or property provided that you precisely observe the instructions and safety information provided for proper system design, installation and operation. However, unqualified modification of the hardware or software or failure to observe the warnings on the product and in this manual can result in serious personal injury and/or damage to property. Never use any peripheral or expansion equipment with the MT modules other than that specifically approved and recommended by Mitsubishi Electric.

Any other use or application of the products is deemed to be improper.

Relevant safety regulations

All safety and accident prevention regulations relevant to your specific application must be observed in the system design, installation, setup, maintenance, servicing and testing of these products.

The regulations listed below are particularly important. This list does not claim to be complete; however, you are responsible for knowing and applying the regulations applicable to you.

- VDE Standards
  - VDE 0100 (regulations for electrical installations with rated voltages up to 1000 V)
  - VDE 0105 (operation of electrical installations)
  - VDE 0113 (electrical systems with electronic equipment)
  - VDE 0160 (configuration of electrical systems and electrical equipment)
  - VDE 0550/0551 (regulations for transformers)
  - VDE 0700 (safety of electrical appliances for household use and similar applications)
  - VDE 0860 (safety regulations for mains-powered electronic appliances and their accessories for household use and similar applications)
- Fire prevention regulations
- Accident prevention regulations
  - VBG No. 4 (electrical systems and equipment)

Safety warnings in this manual

In this manual special warnings that are important for the proper and safe use of the products are clearly identified as follows:

P

DANGER:

Personnel health and injury warnings. Failure to observe the precautions described here can result in serious health and injury hazards.

E

CAUTION:

Equipment and property damage warnings. Failure to observe the precautions described here can result in serious damage to the equipment or other property.

General safety information and precautions

The following safety precautions are intended as a general guideline for using the MT system together with other equipment. These precautions must always be observed in the design, installation and operation of all control systems.

P

DANGER:

- ***Observe all safety and accident prevention regulations applicable to your specific application. Installation, wiring and opening of the assemblies, components and devices may only be performed with all power supplies disconnected.***
- ***Assemblies, components and devices must always be installed in a shockproof housing fitted with a proper cover and protective equipment.***
- ***Devices with a permanent connection to the mains power supply must be integrated in the building installations with an all-pole disconnection switch and a suitable fuse.***
- ***Check power cables and lines connected to the equipment regularly for breaks and insulation damage. If cable damage is found, immediately disconnect the equipment and the cables from the power supply and replace the defective cabling.***
- ***Before using the equipment for the first time check that the power supply rating matches that of the local mains power.***
- ***You are responsible for taking the necessary precautions to ensure that programs interrupted by brownouts and power failures can be restarted properly and safely. In particular, you must ensure that dangerous conditions cannot occur under any circumstances, even for brief periods. If necessary you must make provision for forcing an EMERGENCY OFF condition to prevent such conditions.***
- ***EMERGENCY OFF facilities pursuant to EN 60204/IEC 204 VDE 0113 must remain fully operative at all times and in all control system operating modes. The EMERGENCY OFF facility reset function must be designed so that it cannot cause an uncontrolled or undefined restart.***
- ***You must also implement hardware and software safety precautions to prevent the possibility of undefined control system states caused by signal line cable or core breaks.***

Typographic conventions

Important information

Notes containing important information are clearly identified as follows:

NOTE | Note text

Numbering in figures and illustrations

Reference numbers in figures and illustrations are shown with white numbers in a black circle and the corresponding explanations shown beneath the illustrations are identified with the same numbers, like this:
❶ ❷ ❸ ❹

Procedures

In some cases the setup, operation, maintenance and other instructions are explained with numbered procedures. The individual steps of these procedures are numbered in ascending order with black numbers in a white circle, and they must be performed in the exact order shown:

① Text

② Text

③ Text

Footnotes in tables

Footnote characters in tables are printed in superscript and the corresponding footnotes shown beneath the table are identified by the same characters, also in superscript.

If a table contains more than one footnote, they are all listed below the table and numbered in ascending order with black numbers in a white circle, like this:

① Text
② Text
③ Text

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1 Introduction

1.1 Introduction

This manual describes the modules of the MT system (modular input/output system).

- Basic modules (→ Chapter 4),
- Input/output modules (→ Chapter 4).

In addition it contains detailed descriptions of

- Installation (→ Chapter 5),
- Setting into operation (→ Chapter 9),
- Failure diagnosis (→ Chapter 9).

The MT system is designed as modular input/output system for connection to the PROFIBUS/DP according to DIN 19245-3. It operates at any data transfer rate from 9,6 kBaud to 12 MBaud specified by this standard.

By means of the extension modules a basic module can be extended by inputs and outputs. Up to 16 extension modules can be connected to the basic module in any sequence.

The MT system within the PROFIBUS/DP can be controlled via the master devices AJ71PB92, A1SJ71PB92D, and QJ71PB92D. It can be configurated and parameterized via the parameterizing software MELSOFT GX Configurator-DP. Of cause, the MT series can be controlled by third-party PROFIBUS/DP master devices.

NOTE

Refer to the manual of the MELSOFT GX Configurator-DP for further details on parameterization and configuration.

2 Fundamentals

2.1 Features of the MT series

The MT series comprises the following modules:

- **Basic module (head station)**
  - MT-DP12
  - MT-DP-12E
- **Local extension module (for installation of an additional row of modules)**
  - MT-LE
- **Digital input module**
  - MT-X8
  - MT-X16
- **Digital output module**
  - MT-Y8T
  - MT-Y16T
  - MT-Y8T2
  - MT-Y4R
  - MT-Y8R5
- **Digital input/output module**
  - MT-X4Y4T
- **Analog input module**
  - MT-4AD-N
- **Analog output module**
  - MT-4DAV
  - MT-4DA

Mounting

The basic module and the extension modules (digital and analog input and output modules) are mounted on a DIN rail. On the DIN rail besides the basic module, extension modules can be mouted in any order. The DIN rail can be attached directly through screwed connection.

Extension capabilities

For the connection of a maximum of 16 extension modules, several modules can be mounted to an additional DIN rail. The connection to the basic module is established via a special connection cable (local system connection MT-LE-CBL50) and via a local system extension MT-LE.

Connection of modules

- Basic module MT-DP-12

  The basic module is connected to the PROFIBUS/DP via the ProfiCon connector (PROFIBUS 9-pin D-SUB male connector). The connection among the extension modules an to the basic module is established via 10-core ribbon cables with connectors and sockets.

- Basic module with inputs MT-DP12E

  A maximum of 4 digital and analog extension modules can be connected to the module MT-DP12E (72 digital I/O points or 16 analog channels + 8 digital inputs). The extension by one more DIN rail via the local system extension is not possible.

Parameterization, configuration

The MT series is completely configured over the PROFIBUS/DP through the parameterization software MELSOFT GX Configurator-DP.

3 System Configuration

3.1 PROFIBUS/DP

In the following, some characteristics of the PROFIBUS/DP network are illustrated.

Communication

The open architecture of the PROFIBUS/DP network supplies a powerful and fast exchange of data with the different slave devices, as there are:

- Remote digital I/Os
- Remote analog I/Os
- Remote intelligence PLC (FX1N, FX2N)
- Frequency inverters (FR-A 240, FR-A 540 (L), FR-E 500)
- Operator terminals (MAC E series)
- MT series (modular input/output system)

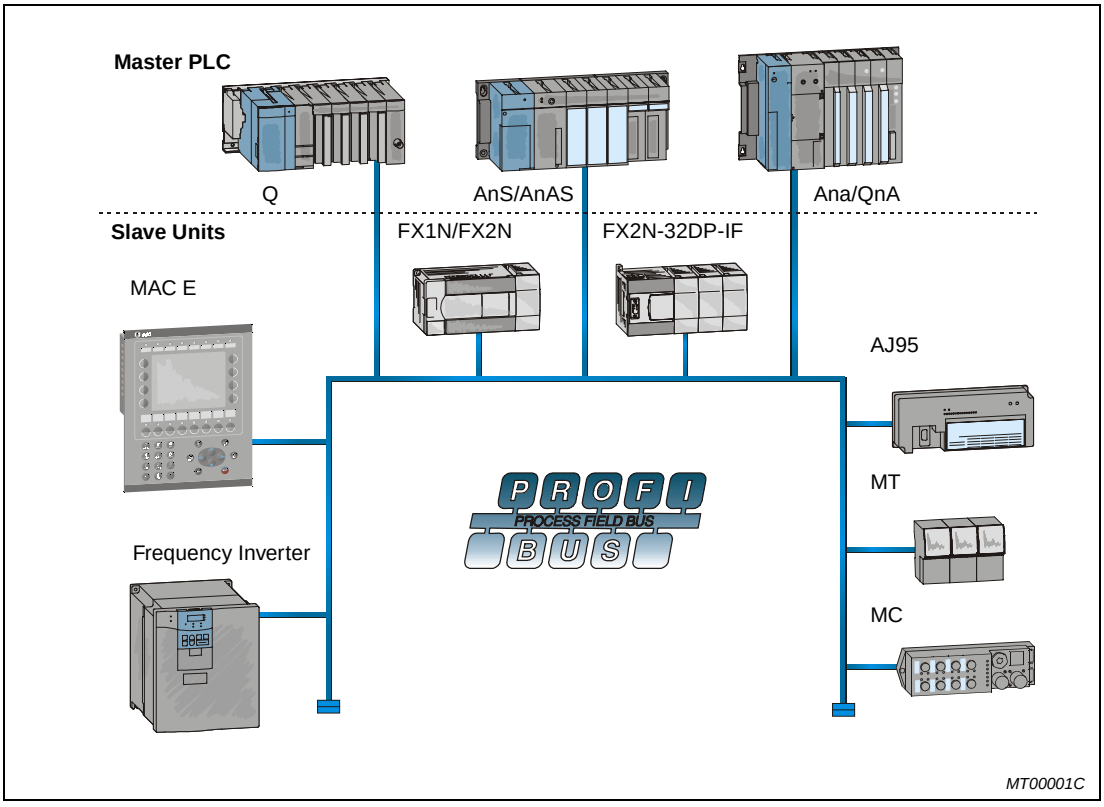


Fig. 3-1: *System configuration PROFIBUS/DP*

Structure

The maximum coverage of a bus segment is 1200 m (at a maximum of 93,75 kbit/s). Up to 3 repeaters are allowed. Thus the maximum distance between 2 stations is calculated with 4.800 m.

Cable types

To help reduce costs PROFIBUS/DP uses RS485 technology with simple twisted-pair cabling. Suitable cables include the UNITRONIC-BUSLD by LAPPKABEL and the DUE 4451 by ALCATEL.

The following table contains the specifications for the PROFIBUS/DP network for the PROFIBUS/DP masters AJ71PB92, A1SJ71PB92D, and QJ71PB92D:

Item		**Master AJ71PB92**	**Master A1SJ71PB92D**	**Master QJ71PB92D**
Communications protocol		EN 50170/ DIN 19245-T3		
Cabling		Shielded twisted pair with 24 AWG = 0,22 mm^2, impedance: 100 - 130 Ω Shielded twisted pair with 22 AWG = 0,34 mm^2, impedance: 135 - 165 Ω		
Interface		RS485		
Data transfer rate	Distance			
	1200 m	9.6/ 19.2/ 93.75 kbit/s	9.6/ 19.2/ 93.75 kbit/s	9.6/ 19.2/ 93.75 kbit/s
	1000 m	187.5 kbit/s	187.5 kbit/s	187.5 kbit/s
	400 m	500 kbit/s	500 kbit/s	500 kbit/s
	200 m	1500 kbit/s	1500 kbit/s	1500 kbit/s
	100 m	—	12/6/3 Mbit/s	12/6/3 Mbit/s
Max. total distance		4800 m (3 repeaters)		
Slave units per master		60		
Stations per segment		32		
Repeaters per network		3		
Accessories		ProfiCon: PROFIBUS 9-pin D-SUB plug connector for up to 12 MBaud		

Tab. 3-1: *Specifications of the PROFIBUS/DP master modules of the MELSEC A and Q series*

The basic module (head station) is connected to the PROFIBUS/DP master with a 9-pin D-SUB plug connector, that can be securely screwed on to the PB-DP connector (see picture 3-2).

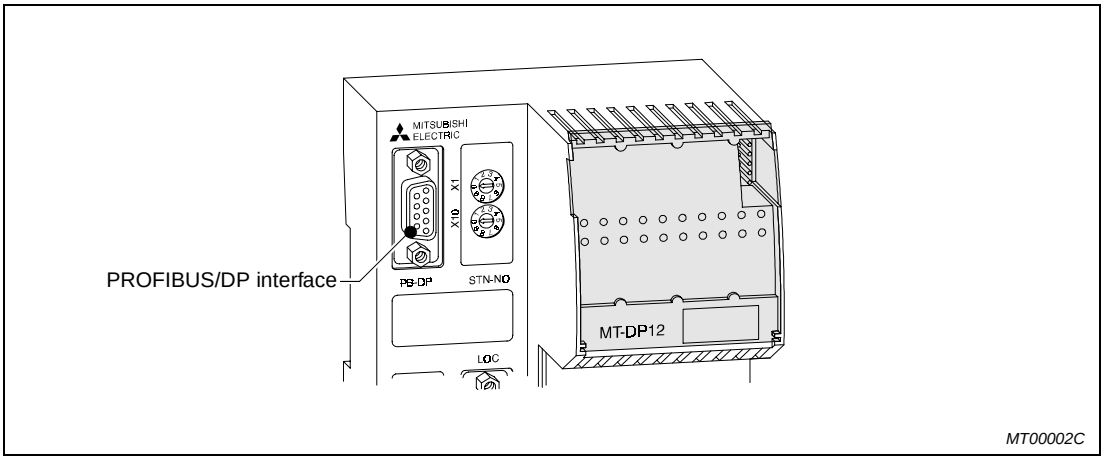
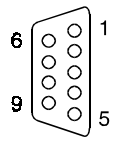


Fig. 3-2: *PROFIBUS/DP interface PB-DP*

The pin assignment complies with the PROFIBUS/DP standard:

Pin layout	Pin No.	Assignment
 MT0002AC	1	n.c.
	2	n.c.
	3	B-line (red)
	4	RTS
	5	GND
	6	5V
	7	n.c.
	8	A-line (green)
	9	n.c.

Tab. 3-2: *Pin assignment ProfiCon*

NOTE

The PROFIBUS connector ProfiConT provides built-in network terminators. These terminators must be activated on the first and the last device each in the PROFIBUS/DP segment.

The PROFIBUS connector ProfiCon does not supply integrated network termination. Thus terminating resistors have to be added to the first and the last device each in the PROFIBUS/DP segment.

The master modules A1SJ71PB92D, AJ71PB92, and QJ71PB92D supply built-in, switchable terminating resistors.

3.2 Local and internal system connection

To any MT-DP12 basic module, up to 16 extension modules can be connected. These units are connected via the internal or local system connection.

To any MT-DP12E basic module, up to 4 digital and analog extension modules can be connected. An extension via the local system connection is not supported.

The local and internal system connection is used to connect extension modules. The internal system connection is established via a 10-core ribbon cable and a plug connector complying with DIN 41651 that can be connected directly to the adjacent extension module.

Via the local system connection the extension modules can be connected from a different location. For this purpose, a local system extension is required. The connection is established via an extension cable with 9-pin D-SUB connector. The local system adaptor is connected to the basic module via an extension cable.

The picture below shows the configuration mounted on 2 DIN rails. The basic module and the extension modules are mounted to the upper rail. The local system extension and several extension modules are mounted to the lower DIN rail.

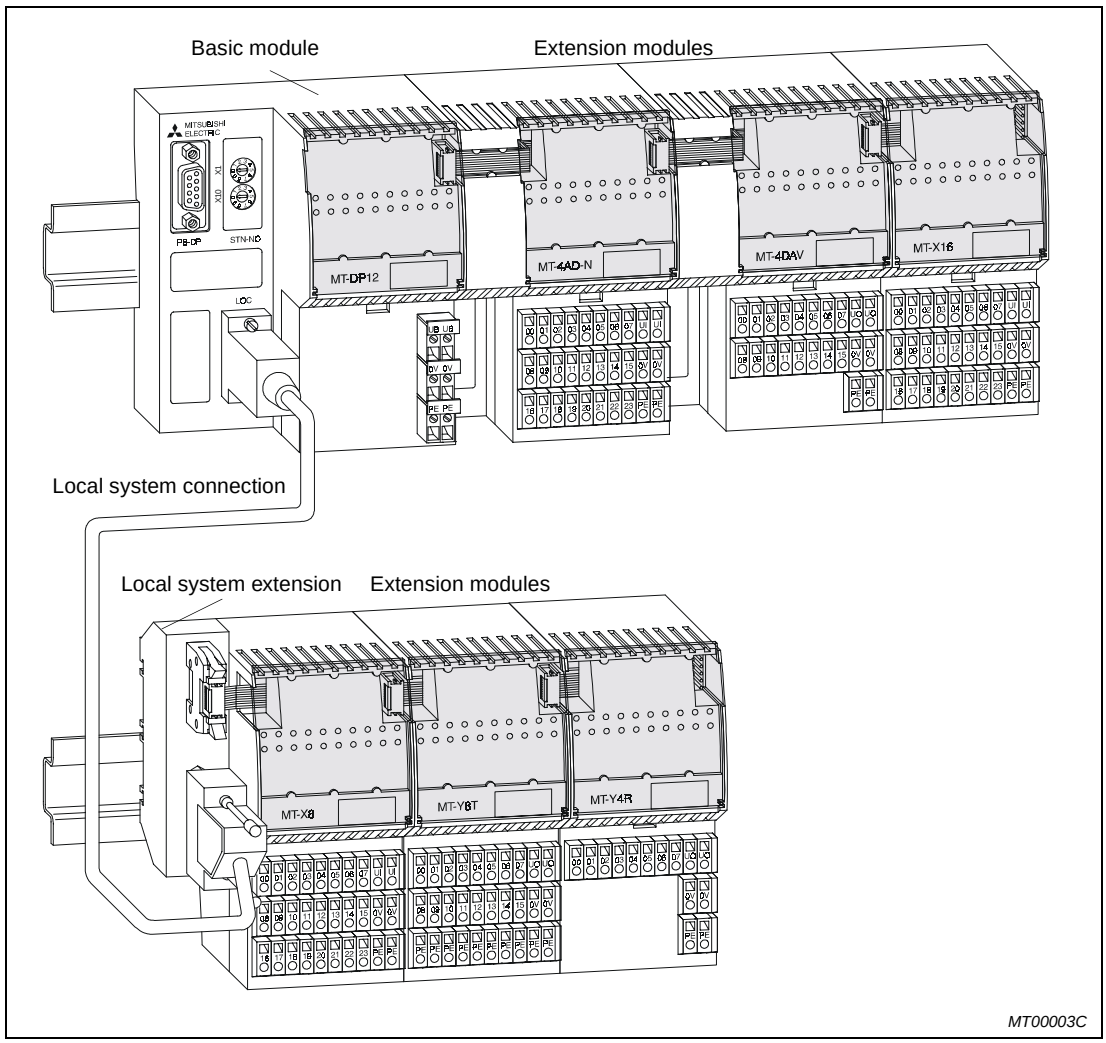


Fig. 3-3: *Sample configuration (MT-DP12)*

E

CAUTION:

- ***Always connect or remove the local and internal system connectors with the system components switched off.***
  Always keep the sequence of mounting and dismounting instructions for the modules.

Mounting and dismounting instructions for the MT modules

- Mounting:
  1. Open the cover of last module on the rail.
  2. Remove the label.
  3. Mount the new module and connect the connector of the ribbon cable to the last module on the rail.
  4. Insert the label again.
  5. Close both covers.
- Dismounting:
  1. Open the cover of the module to be removed and of that it is connected to.
  2. Remove the labels of both modules.
  3. Remove the connector of the ribbon cable.
  4. Insert the label again in the remaining module.
  5. Close the cover of the remaining module.

3.3 Communication

The PROFIBUS/DP master modules facilitate a data exchange with the slave devices of up to 244 send-bytes and 244 receive-bytes; i.e. up to 488 bytes can be exchanged with a slave per network cycle.

The number of send-bytes and receive-bytes depends on the operation mode of the master module.

In standard operation mode 32 send- and 32 receive-bytes per network cycle can be exchanged with the slaves.

In enhanced operation mode an optimized buffer memory management allows to exchange 244 send- and 244 receive-bytes can be exchanged per cycle.

3.3.1 Buffer memory allocation in standard operation mode

In standard mode the Mitsubishi PROFIBUS/DP master modules supply buffer memory for 32 send-bytes and 32 receive-bytes for a maximum of 60 stations each that can be connected.

The so called send-bytes are bytes to be sent to the modules of the MT series.

The receive-bytes are bytes to be sent from modules of the MT series to the master. These bytes are data bytes that contain user data like digital inputs, analog values etc.

In standard operation mode the send- and receive-bytes are written to an area of 32 bytes separated for one station in the buffer memory. If one station does not require this number of bytes, the remaining bytes remain unused.

The following figure illustrates the buffer memory allocation:

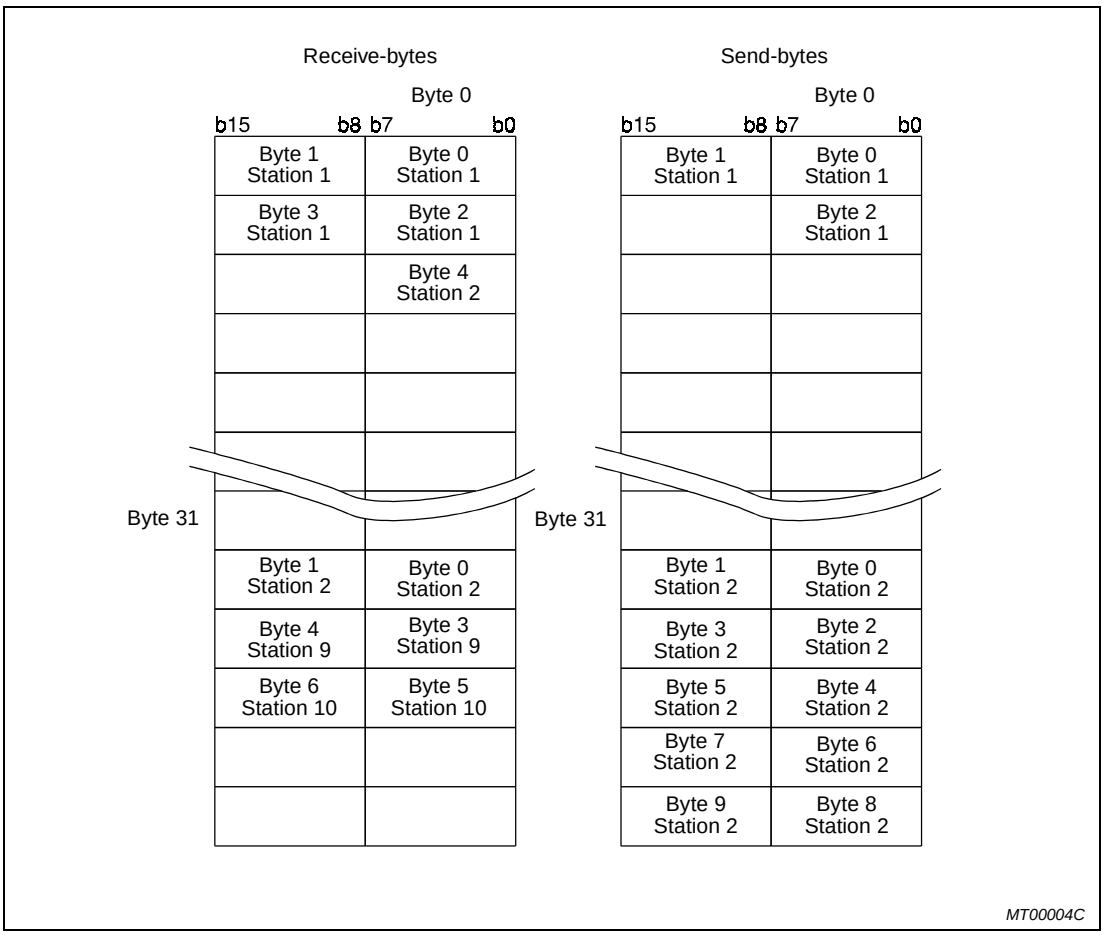


Fig. 3-4: *Buffer memory allocation (standard operation mode)*

3.3.2 Buffer memory allocation in enhanced operation mode

The PROFIBUS master modules of the new generation support the enhancedt operation mode. In enhanced operation mode up to 244 send- and receive-bytes can be exchanged with 7 stations that can be connected at maximum. In standard operation mode only those bytes of one station each are written to the area of the receive and send buffer reserved for this station. Those registers not required for the send- and receive-bytes of this station remain unused in standard mode. In enhanced mode the data of the send- and receive-bytes of all connected stations is successively written to the next free low byte of the next free register of the send and receive buffer each. This way the enhanced operation mode provides a more efficient usage of the entire send and receive buffer memory of the master modules.

Figure 3-5 below illustrates the allocation of the buffer memory in extended operation mode by a sample configuration:.

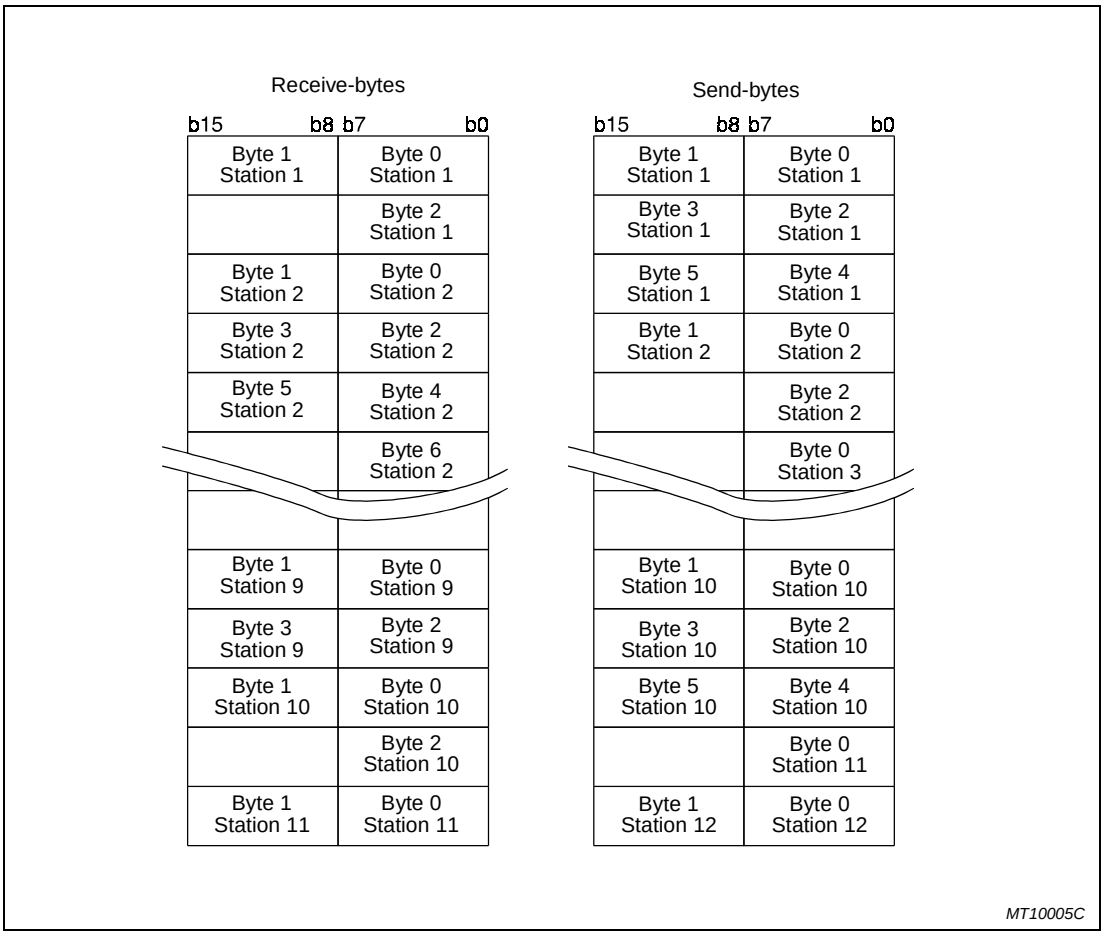


Abb. 3-5: *Buffer memory allocation (enhanced operation mode)*

3.3.3 PROFIBUS/DP protocol frame

The protocol frame depends on whether it contains configuration, parameterization, data or diagnostics information.

The protocol frame consists of the so called header following the PNO guideline and the actual bytes containing the corresponding information of the modules..

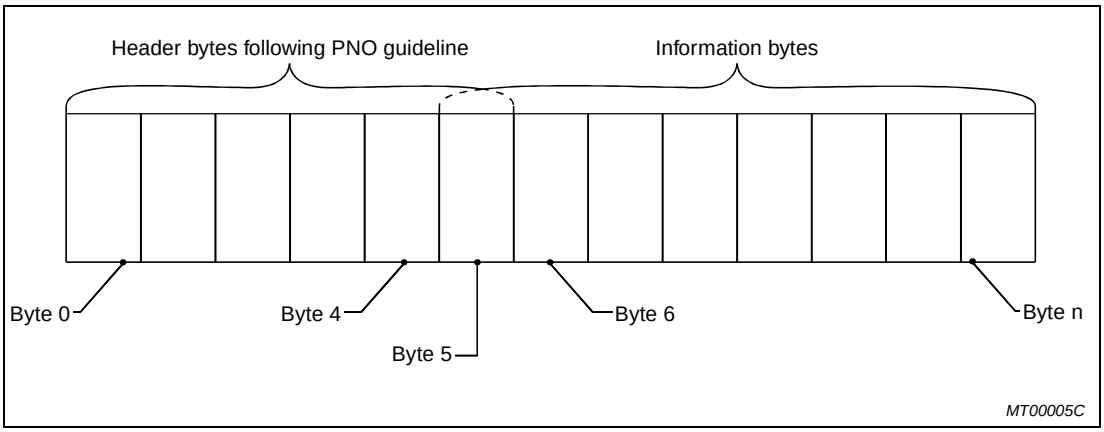


Fig. 3-6: *PROFIBUS/DP protocol frame*

The number of header bytes (5 or 6) depends on the type of protocol frame (parameterization, diagnostics etc.).

3.3.4 Data bytes

The data bytes contain information of the digital inputs and outputs or the information of the analog input and output channels. Each digital input or output uses one bit. The analog values of the analog I/O modules are analog-digital converted. The data value is resolved into 16 bits (2 bytes) per channel. As described in chapter 3.3., the master buffer memory contains 244 receive- and 244 send-bytes. Therefore, the number of modules that can be managed by the buffer memory is limited.

Basic module MT-DP12

The table below gives an overview of the maximum number of modules that can be installed to the basic module MT-DP12:

Product	Technology	Input bytes	Output bytes	Maximum number of modules	Total of input bytes	Total of output bytes	LN
MT-X8	Digital input module 8 inputs	1	—	16	16	—	1,37
MT-X16	Digital input module 16 inputs	2	—	16	32	—	1,28
MT-Y8T	Digital output module 8 transistor outputs	—	1	16	—	16	1,44
MT-Y16T	Digital output module 16 transistor outputs	—	2	16	—	32	1,31
MT-Y8T2	Digital output module 8 transistor outputs/2A	—	1	16	—	16	1,32
MT-Y4R	Digital output module 4 relays	—	1	16	—	16	1,36
MT-Y8R5	Digital output module 8 relays/5A	—	1	16		16	1,32
MT-X4Y4T	Digital input/output module, 4 inputs, 4 outputs	1	1	16	16	16	1,00
MT-4AD-N	Analog input module 4 channels	8	—	8	32	—	1,80
MT-4DAV	Analog output module 4 channels (voltage output)	—	8	8	—	32	1,23
MT-4DA	Analog output module 4 channels (voltage and current output)	—	8	8	—	32	1,56

Tab. 3-3: *Assignment of the number of data bytes (MT-DP12)*

Basically, up to 16 digital and 8 analog extension modules can be connected to one basic module MT-DP12.

In addition, the maximum number of extension modules that can be connected is limited by the **total load**. The total load is calculated as the sum of the individual **load numbers** (LN, refer to table 3-3) of all extension modules on one MT station. The total load must not exceed a value of 16 each for the internal and the local system extension.

If you intend to connect the maximum number of extension modules to the internal system connection but the calculated total load exceeds a value of 16, also connect extension modules to the local system connection via a local system extension and an extension cable.

Basic module MT-DP12E

The MT-DP12E module is a basic module with 8 integrated inputs. This module assigns one input byte.

Table 3-4 gives an overview of the maximum number of modules that can be installed to the basic module MT-DP12E:

Product	Technology	Input bytes	Output bytes	Maximum number of modules	Total of input bytes	Total of output bytes
MT-X8	Digital input module 8 inputs	1	—	4	4	—
MT-X16	Digital input module 16 inputs	2	—	4	8	—
MT-Y8T	Digital output module 8 transistor outputs	—	1	4	—	4
MT-Y16T	Digital output module 16 transistor outputs	—	2	4	—	8
MT-Y8T2	Digital output module 8 transistor outputs/2A	—	1	4	—	4
MT-Y4R	Digital output module 4 relays	—	1	4	—	4
MT-Y8R5	Digital output module 8 relays/5A	—	1	4	—	4
MT-X4Y4T	Digital input/output module 4 inputs, 4 outputs	1	1	4	4	4
MT-4AD-N	Analog input module 4 channels	8	—	4	32	—
MT-4DAV	Analog output module 4 channels (voltage output)	—	8	4	—	32
MT-4DA	Analog output module 4 channels (voltage and current output)	—	8	4	—	32

Tab. 3-4: *Assignment of the number of data bytes (MT-DP12E)*

NOTE The local system connection can not be connected to the module MT-DP12E.

Correct installation order

Since the data bytes are read into the word orientated buffer memory in the order of the modules. First the word orientated modules (16 bits ⇒ 2 bytes) and then the byte orientated modules (8 bits ⇒ 1 byte) should be mounted. The advantage of this installation order is that the 16 bits (2 bytes) wide information of a module can also be written into a 16-bit register of the buffer memory (see picture 3-7).

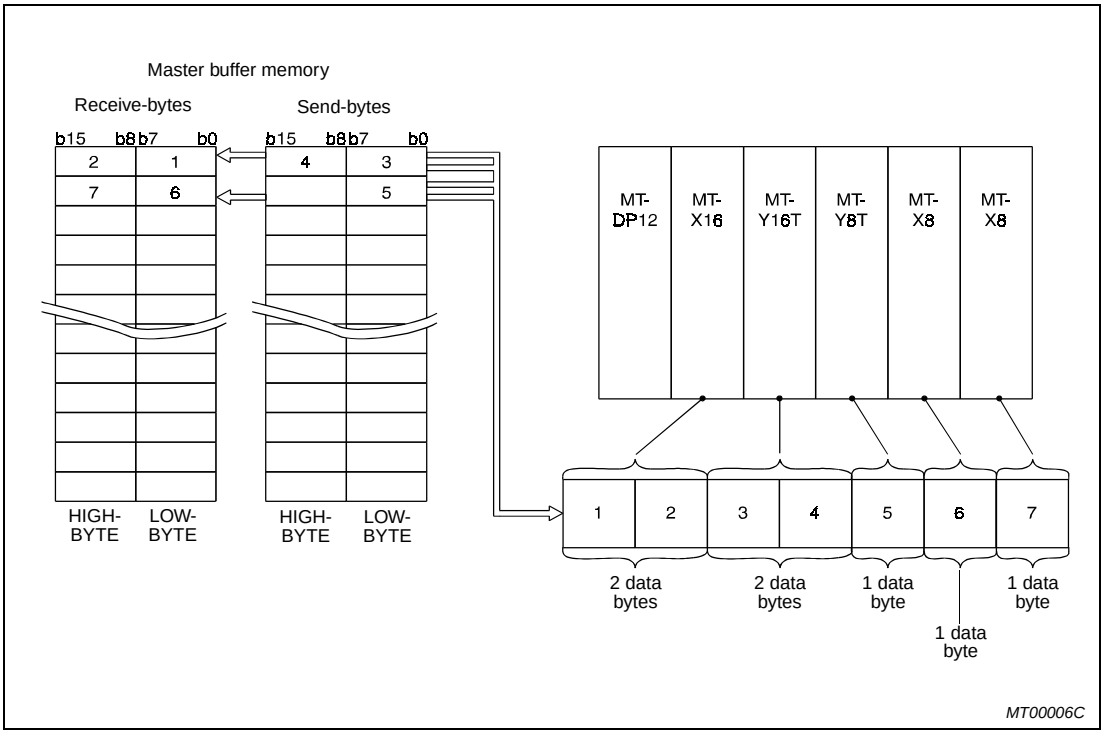


Fig. 3-7: *Correct installation order*

Incorrect installation order

If the byte orientated modules are installed first, the 16-bit information of the word orientated modules might be split into 2 registers of the buffer memory (see picture 3-8). The processing of this data requires an increased programming effort because the data words (16-bit, 2-byte) of the word orientated modules cannot be read from or written to one entire register.

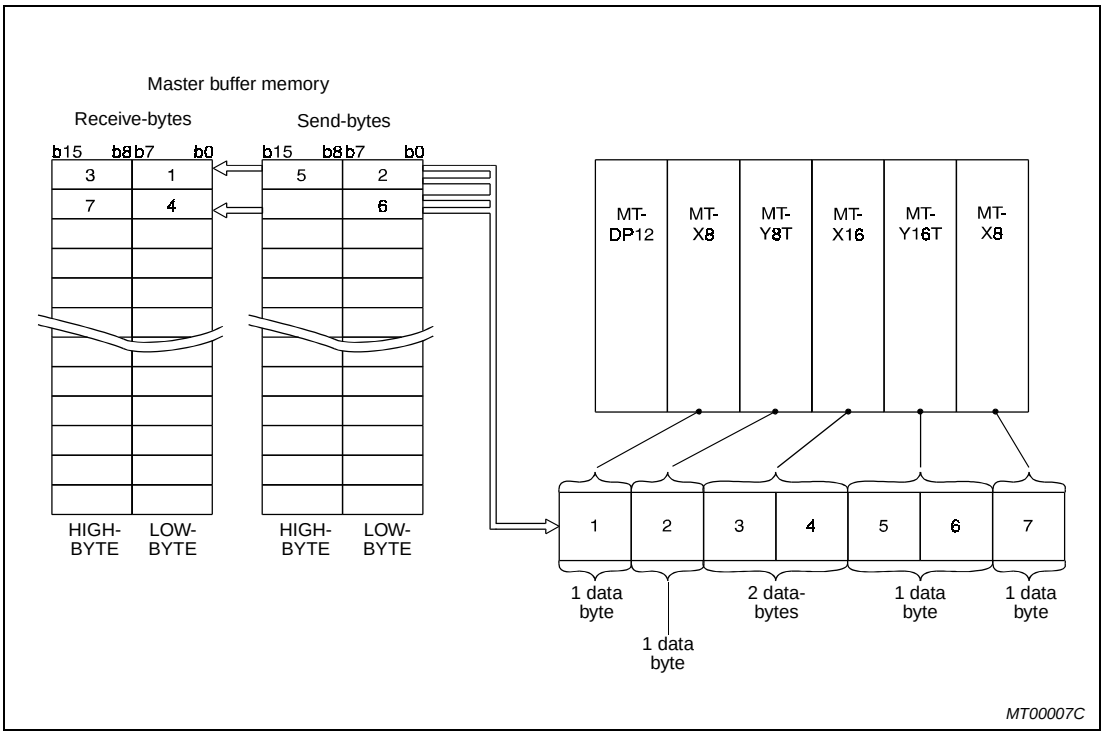


Fig. 3-8: *Incorrect installation order*

3.3.5 Configuration bytes

The configuration protocol frame transmits the configuration of the remote I/O system to the master. The head station and the digital I/O modules are assigned particular hexadecimal values that are transmitted as configuration bytes in a protocol frame. For analog I/O modules each of the 4 channels is assigned a configuration byte. The structure of configuration data and configuration bytes is described in the chapter 6 on configuration.

3.3.6 Parameter bytes

The modules of the remote I/O system are parameterized through a parameterization frame conveying information concerning error messages, failure diagnosis, byte exchange, mean forming, channel operation mode etc. The structure of parameterization frames and parameter bytes is described in chapter 7 on parameterization.

3.3.7 Diagnostics bytes

For evaluation purposes of errors that occured in the modules of the remote I/O system, the modules send diagnostic protocol frames containing diagnostics bytes to the master. These diagnostic bytes contain information on the type (error type 0 - 4) and location (module) of error. The structure of diagnostic protocol frames and diagnostics bytes is described in the chapter 9 on failure diagnosis.

4 Description of the Modules

4.1 Precautions

Never drop the module or subject it to strong shock or impact since the case, the terminal block cover, etc. are made of plastics and may break.
Never remove the printed circuit boards from the module.
Never let foreign matter get inside the module, such as wire or metal chips.
Never tighten the fixing screws of the terminal block to a higher torque than 0,4 Nm.

NOTE

The total current of all cache clamp and screw terminals must not exceed 10 A. If several output modules (MT-Y8T2) are integrated within one MT system, the total current with the terminals UO1 and UO2 bridged might exceed 10 A.

Remedy:
Use of external shunt distributor or several power supplies.

When mounting the terminal blocks pay attention to the exact specification of the according terminal block because these are not mechanically coded for the corresponding modules (risk of confusion).

4.2 Basic module MT-DP12

The basic module (head station) handles the connection between the PROFIBUS/DP and the extension modules of the MT series. The data communication is performed via the PROFIBUS/DP, via the head station, and via the internal system connections to the extension modules. The modules on a separate DIN mounting rail are supplied with data and the system power US from the head station via an extension cable and a local system extension.

4.2.1 Operating items of the basic module MT-DP12

The following figure shows the operating items and accessories of the MT-DP12 module:

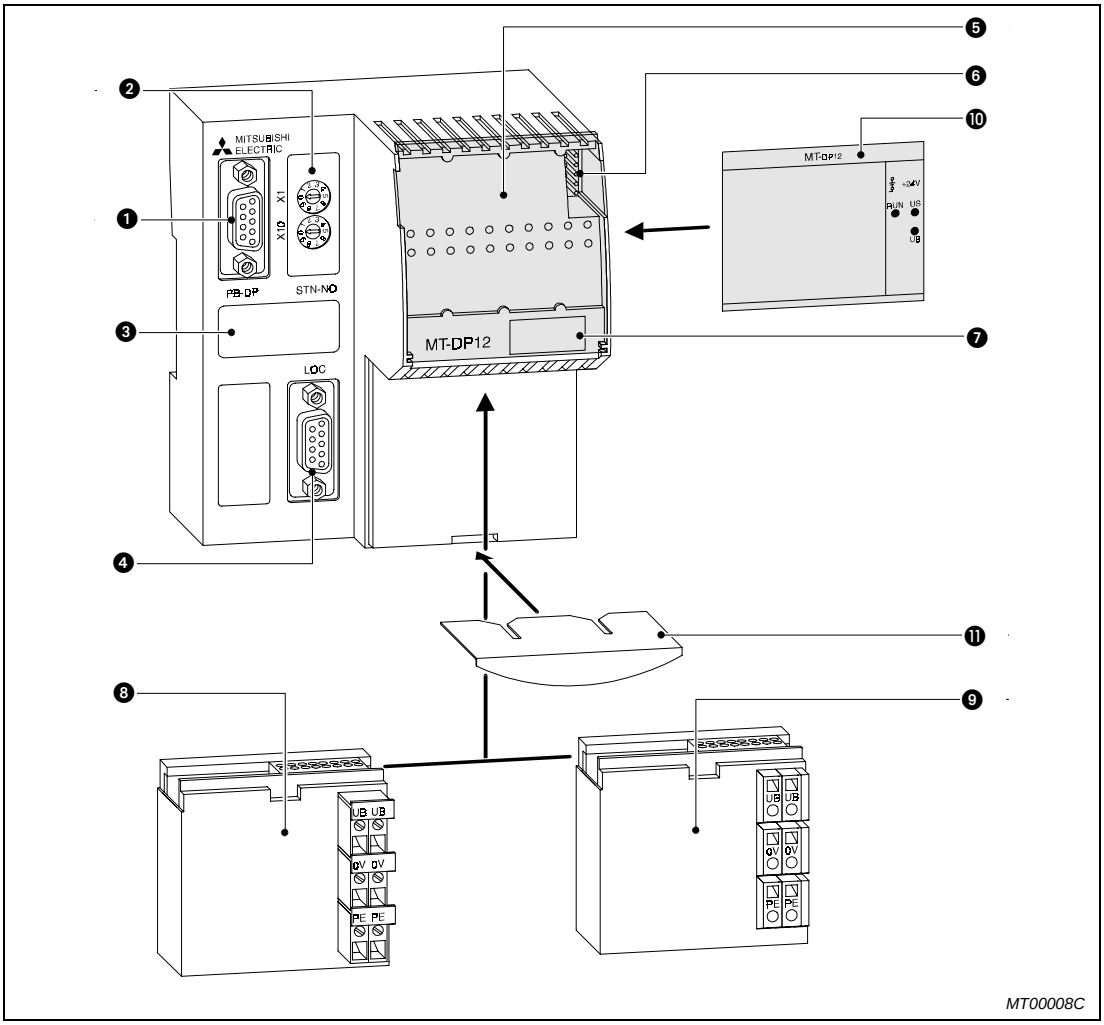


Fig. 4-1: *Head station MT-DP12*

Table 4-1 describes the operating items of figure 4-1:

Position	Item	Description
❶	PROFIBUS/DP interface connector (PB-DP)	D-SUB 9-pin female connector
❷	Address setting switch	The upper rotary switch determines the digit of ones, the lower one determines the digit of tens.
❸	Cover	This cover is intended for future extensions and without function by now.
❹	Local system interface connector (LOC)	To this interface several extension modules on a separate DIN mounting rail are connected via an extension cable and a local system extension.
❺	Cover of labeling strip	This cover protects the labeling strips, displays, and internal system connectors against dust and dirt.
❻	Internal system connector	Connector for the adjacent module. Here, the 10-core ribbon cable connector plug is connected.
❼	Labeling field	In the labeling field the module can be identified.
❽	Terminal block with screw terminals (MT-DP12-TBS)	Here, the power supply, the corresponding ground connection, and the PE connection are connected to screw terminals. The terminal block can be withdrawn towards the bottom.
❾	Terminal block with cache clamp terminals (MT-DP12-TBC)	Here, the power supply, the corresponding ground connection, and the PE connection are connected to cache clamp terminals. The terminal block can be withdrawn towards the bottom.
❿	Labeling strip	On the labeling strip the inputs and outputs can be identified. For an improved overview the fields for the signal identification align with the according terminals. In addition a status LED is integrated in each signal identification field. The right part of the labeling strip contains the diagnostic LEDs.
⓫	Locking plate	The locking plate locks the terminal blocks to the module.

Tab. 4-1: *Operating items MT-DP12*

4.2.2 Terminal block assignment of the MT-DP12 module

The terminal blocks are assigned as follows:

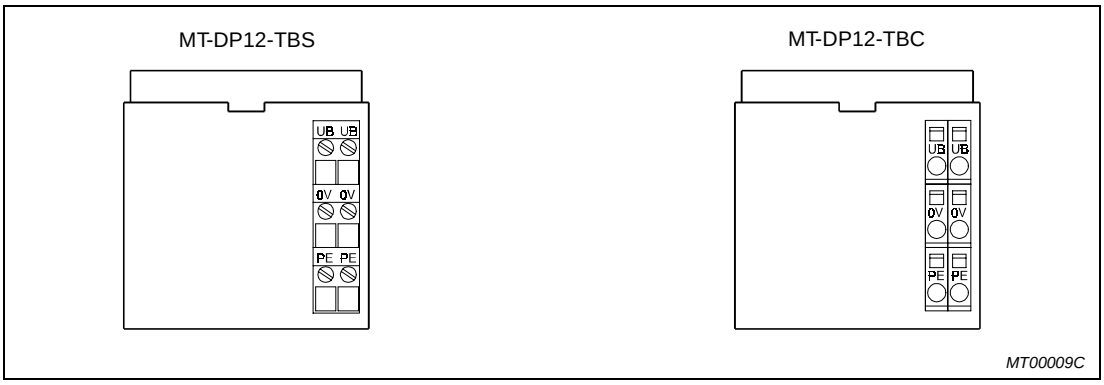


Fig. 4-2: *Terminal blocks MT-DP12-TBS und MT-DP12-TBC*

UB: Power supply 24 V DC
0V: Ground connection
PE: Protective earth

NOTE

The protective earth PE is also connected via the DIN mounting rail when mounted. The power supply of the MT-DP12 module supplies the circuits of the module and the system interfaces of all connected extension modules. Therefore the extension modules only require the power supply for the I/O level.

4.3 Basic module MT-DP12E

The basic module MT-DP12E (head station) establishes the connection between the PROFIBUS/DP and the extension modules of the MT series. The data communication with the extension modules is performed via the PROFIBUS/DP, the head station, and the internal system connection.

This module provides 8 integrated digital inputs. Figure 4-3 shows the block diagram of the inputs of the basic module:

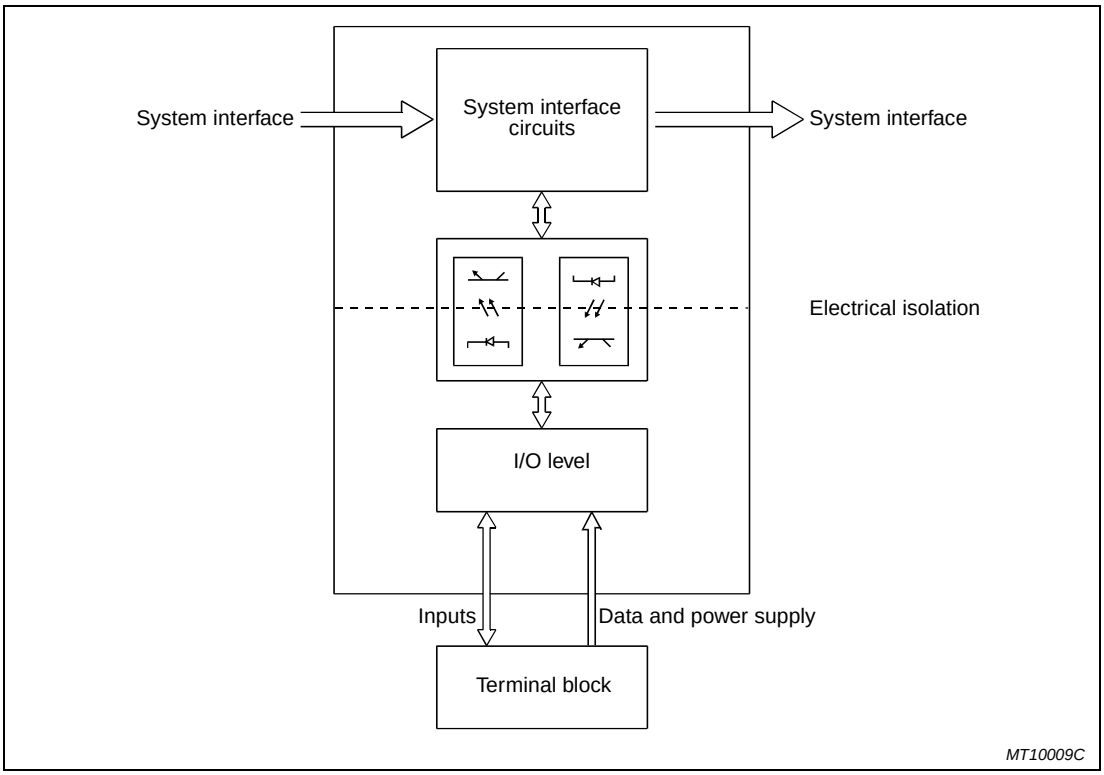


Fig. 4-3: *Block diagram of the digital inputs of the MT-DP12E module*

NOTE

The supply of modules on a separate DIN rail with data and the system voltage US via the extension cable and the local system extension is not available for the usage of the basic module MT-DP12E with integrated inputs.

4.3.1 Operating items of the basic module MT-DP12E

The figure below shows the operating items and accessories of the MT-DP12E module:

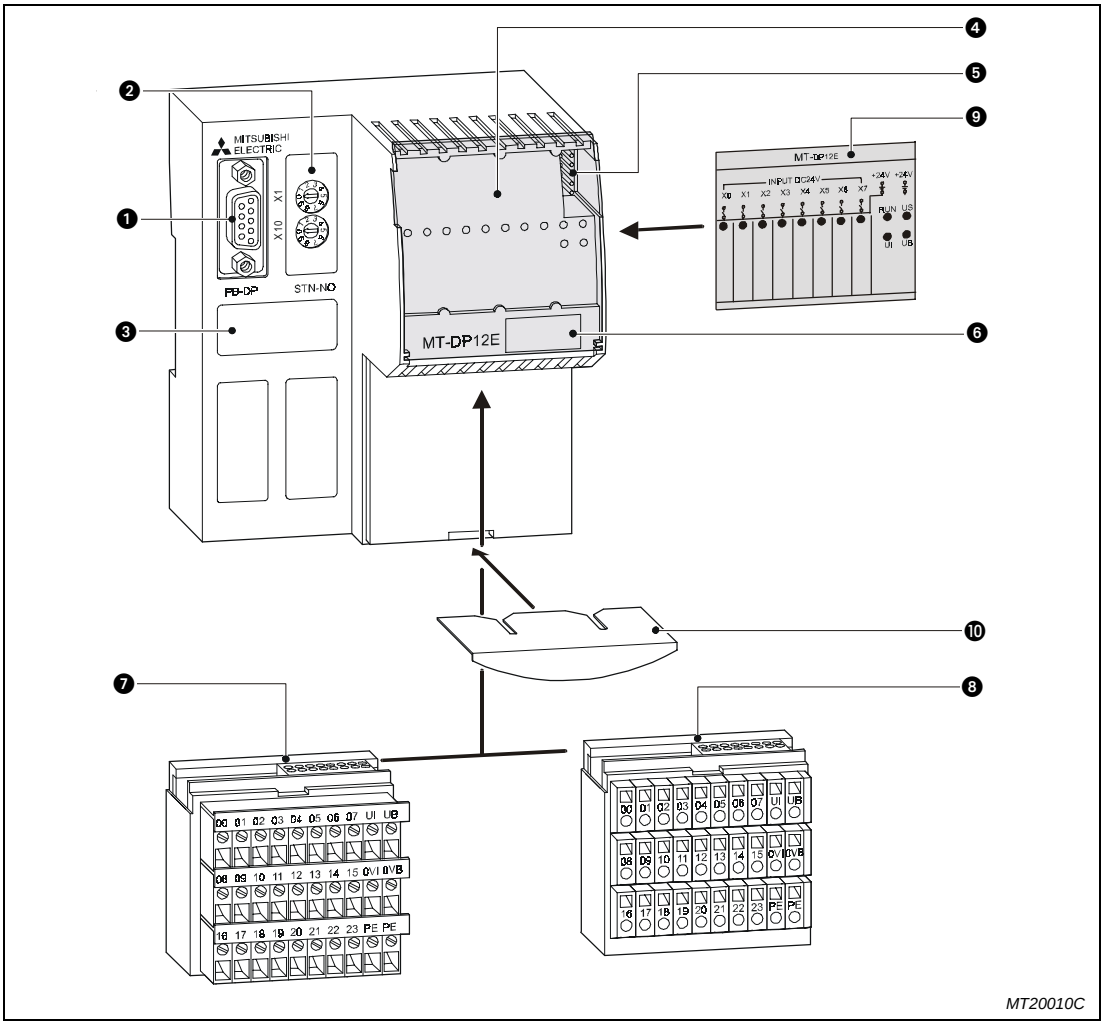


Fig. 4-4: *Head station MT-DP12E*

Tab. 4-2 describes the operating items of Fig. 4-4:

Position	Item	Description
❶	PROFIBUS/DP-interface (PB-DP)	D-SUB 9-pin female connector for the connection to the PROFIBUS
❷	Adress setting switch	The upper rotary switch determines the digit of ones, the lower one determines the digit of tens.
❸	Cover	This cover is intended for future extensions and without function by now.
❹	Cover of labeling strip	This cover protects the labeling strips, displays, and internal system connectors against dust and dirt.
❺	Internal system connector	Connector for the adjacent module. Here, the 10-core ribbon cable connector plug is connected.
❻	Labeling field	In the labeling field the module can be identified.
❼	Terminal block with screw terminals (MT-DP12-TBS)	Here, the power supply, the corresponding ground connection, and the PE connection are connected to screw terminals. The terminal block can be withdrawn towards the bottom.
❽	Terminal block with cache clamp terminals (MT-DP12-TBC)	Here, the power supply, the corresponding ground connection, and the PE connection are connected to cache clamp terminals. The terminal block can be withdrawn towards the bottom.
❾	Labeling strip	On the labeling strip the inputs and outputs can be identified. For an improved overview the fields for the signal identification align with the according terminals. In addition a status LED is integrated in each signal identification field. The right part of the labeling strip contains the diagnostic LEDs.
❿	Locking plate	The locking plate locks the terminal blocks to the module.

Tab. 4-2: *Operating items MT-DP12E*

4.3.2 Terminal block assignment of the MT-DP12E module

The terminal blocks are assigned as follows:

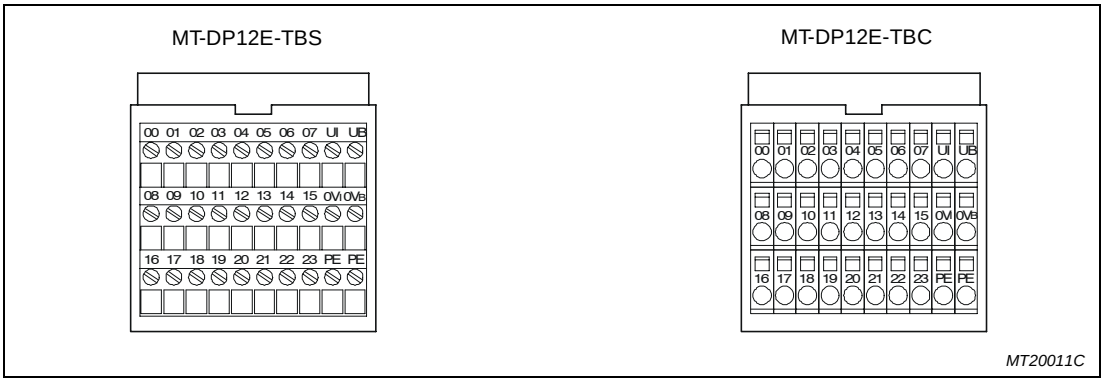


Fig. 4-5: *Terminal blocks MT-DP12E-TBS and MT-DP12E-TBC*

UB:	Power supply 24 V DC
UI:	Power supply of the sensory circuits with 24 V DC
0VB:	Ground connection of the power supply 24 V DC
0VI:	Ground connection of the power supply of the sensory circuits
PE:	Protective earth
00 to 07:	Inputs 0 to 7
08 to 15:	Power supply output 24 V DC for sensors, short-circuit-proof
16 to 23:	Ground connections of the sensors

NOTE

The protective earth PE is also connected via the DIN mounting rail when mounted. The power supply of the MT-DP12 module supplies the circuits of the module and the system interfaces of all connected extension modules. Therefore the extension modules only require the power supply for the I/O level.

4.4 Digital Input Modules

The digital input modules are classified as follows:

- Digital input module with 8 semiconductor inputs (MT-X8)
- Digital input module with 16 semiconductor inputs (MT-X16)

The following figure shows the block diagram of the digital input modules:

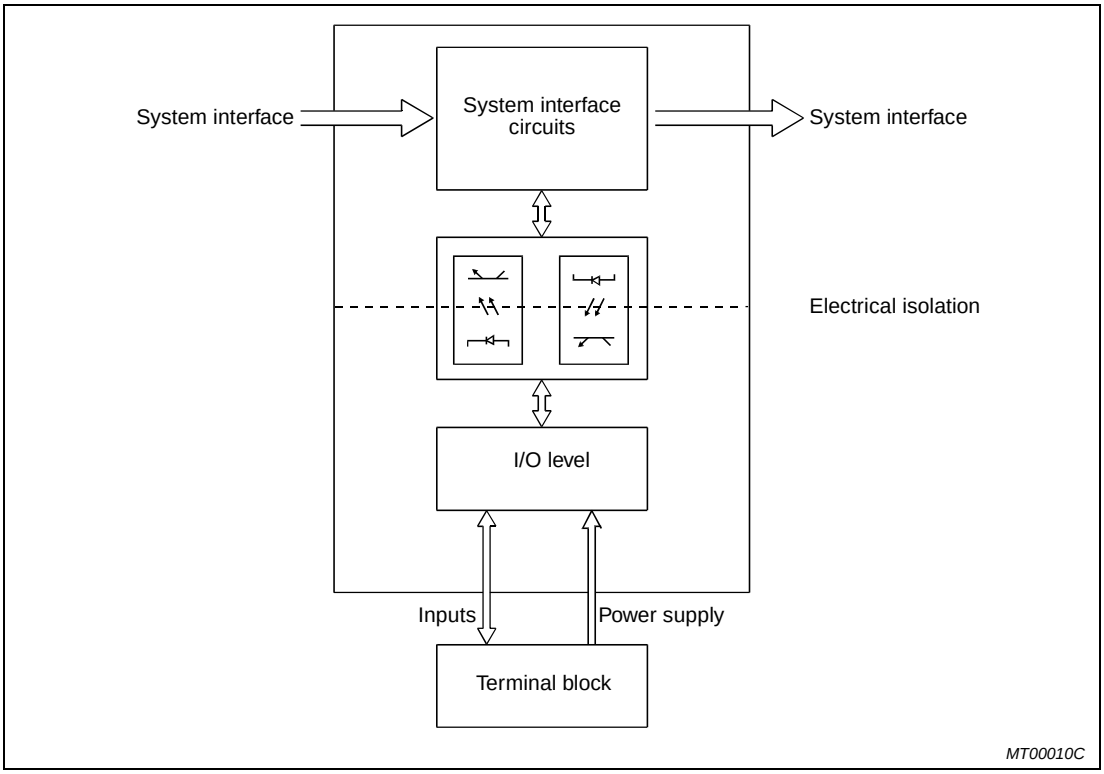


Fig. 4-6: *Block diagram of the digital extension modules*

4.4.1 Operating items of the digital input module MT-X8

The following figure shows the operating items and accessories of the MT-X8 module (8 digital inputs):

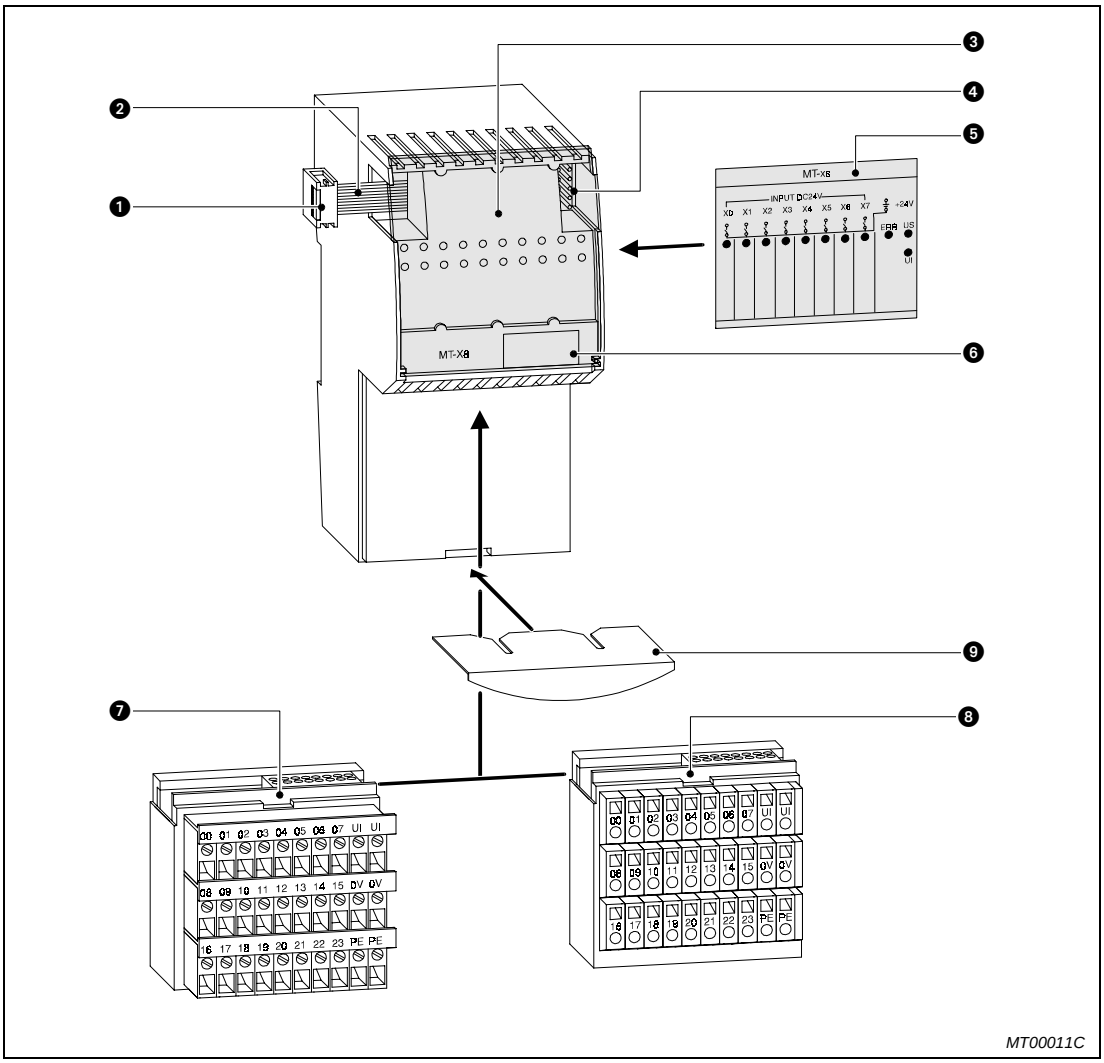


Fig. 4-7: *Digital input module MT-X8*

Table 4-3 describes the operating items of figure 4-7:

Position	Item	Description
❶	10-pole ribbon cable connector	Male connector for connection of the module to the basic module or to another extension module or for local extension.
❷	10-pole ribbon cable	Connection cable of the modules (internal system connection).
❸	Cover of labeling strip	This cover protects the labeling strips, displays, and internal system connectors against dust and dirt.
❹	Internal system connector	Connector for the adjacent module. Here, the 10-core ribbon cable connector plug is connected.
❺	Labeling strip	On the labeling strip the inputs and outputs can be identified. For an improved overview the fields for the signal identification align with the according terminals. In addition a status LED is integrated in each signal identification field. The right part of the labeling strip contains the diagnostic LEDs.
❻	Labeling field	In the labeling field the module can be identified.
❼	Terminal block with screw terminals (MT-X8-TBS)	Here, the inputs, the power supply, the corresponding ground connection, and the PE connection are connected to screw terminals. The terminal block can be withdrawn towards the bottom.
❽	Terminal block with cache clamp terminals (MT-X8-TBC)	Here, the inputs, the power supply, the corresponding ground connection, and the PE connection are connected to cache clamp terminals. The terminal block can be withdrawn towards the bottom.
❾	Locking plate	The locking plate locks the terminal blocks to the module.

Tab. 4-3: *Operating items MT-X8*

4.4.2 Terminal block assignment of the MT-X8 module

The terminal blocks are assigned as follows:

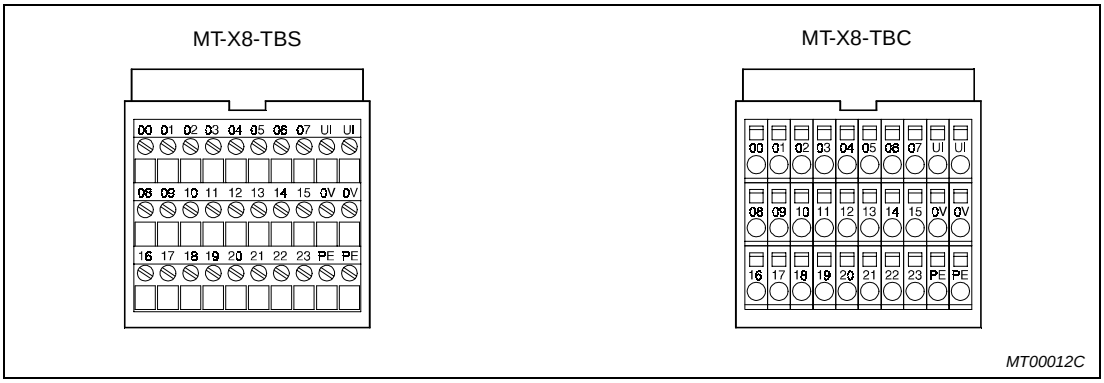


Fig. 4-8: *Terminal blocks MT-X8-TBS and MT-X8-TBC*

UI:	Power supply of the sensory circuits with 24 V DC
0V:	Ground connection
PE:	Protective earth

00 to 07:	Inputs 0 to 7
08 to 15:	Power supply output 24 V DC for sensors, short-circuit-proof
16 to 23:	Ground connection of the sensors

4.4.3 Operating items of the digital input module MT-X16

The following figure shows the operating items and accessories of the MT-X16 module (16 digital inputs):

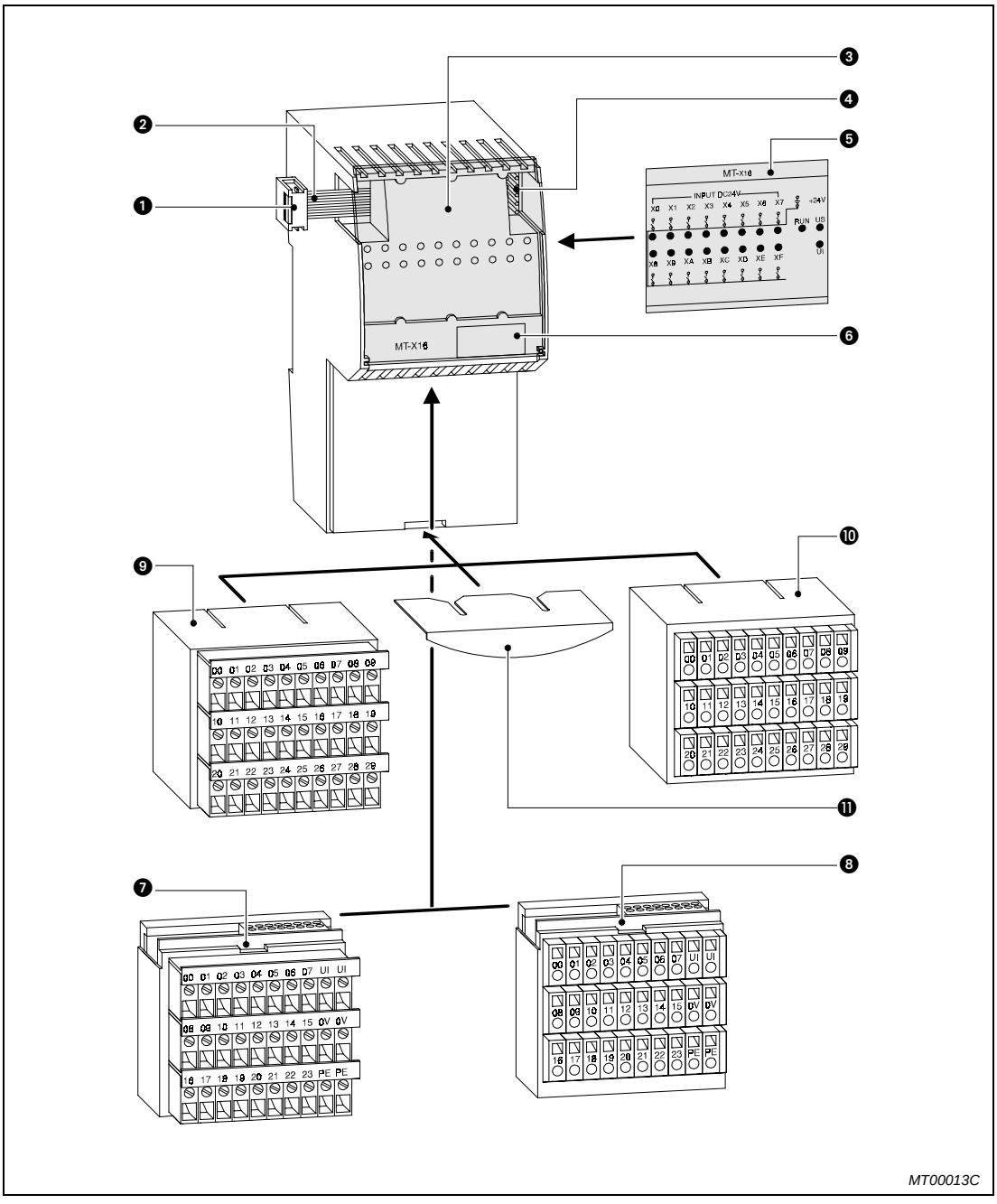


Fig. 4-9: *Digital input module MT-X16*

Table 4-4 describes the operating items of figure 4-9:

Position	Item	Description
❶	10-pole ribbon cable connector	Male connector for connection of the module to the basic module or to another extension module or for local extension.
❷	10-pole ribbon cable	Connection cable of the modules (internal system connection).
❸	Cover of labeling strip	This cover protects the labeling strips, displays, and internal system connectors against dust and dirt.
❹	Internal system connector	Connector for the adjacent module. Here, the 10-core ribbon cable connector plug is connected.
❺	Labeling strip	On the labeling strip the inputs and outputs can be identified. For an improved overview the fields for the signal identification align with the according terminals. In addition a status LED is integrated in each signal identification field. The right part of the labeling strip contains the diagnostic LEDs.
❻	Labeling field	In the labeling field the module can be identified.
❼	Terminal block with screw terminals (MT-X16-TBS)	Here, the inputs, the power supply, the corresponding ground connection, and the PE connection are connected to screw terminals. The terminal block can be withdrawn towards the bottom.
❽	Terminal block with clamp terminals (MT-X16-TBC)	Here, the inputs, the power supply, the corresponding ground connection, and the PE connection are connected to cache clamp terminals. The terminal block can be withdrawn towards the bottom.
❾	Potential terminal block with screw terminals (MT-X16-PTBS)	The potential terminal blocks extend the number of supply points for the input sensors. The terminals are of the screw-type.
❿	Potential terminal block with cache clamp terminals (MT-X16-PTBC)	The potential terminal blocks extend the number of supply points for the input sensors. The terminals are of the cache clamp type.
⓫	Locking plate	The locking plate locks the terminal blocks to the module.

Tab. 4-4: *Operating items MT-X16*

4.4.4 Terminal block assignment of the MT-X16 module

The terminal blocks are assigned as follows:

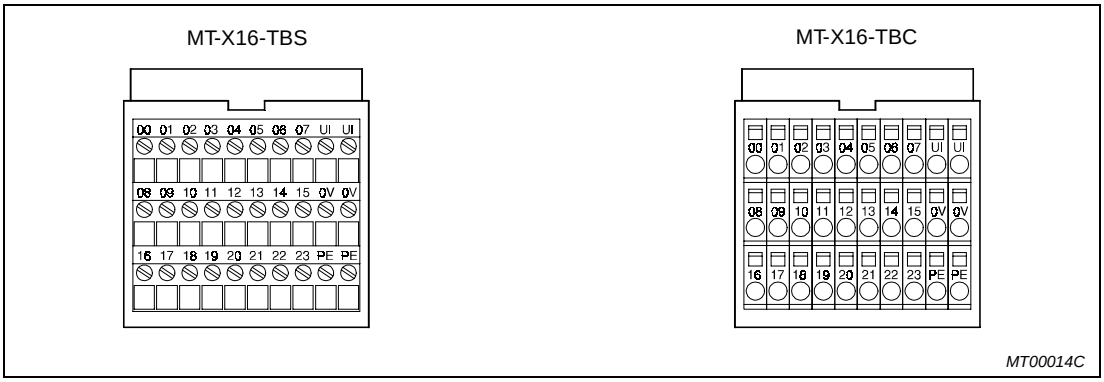


Fig. 4-10: *Terminal blocks MT-X16-TBS and MT-X16-TBC*

UI:	Power supply of the sensory circuits with 24 V DC
0V:	Ground connection
PE:	Protective earth

00 to 07:	Inputs 0 to 7
08 to 15:	Inputs 8 to 15
16 to 23:	Power supply output 24 V DC for sensors, short-circuit-proof

The potential terminal blocks are assigned as follows:

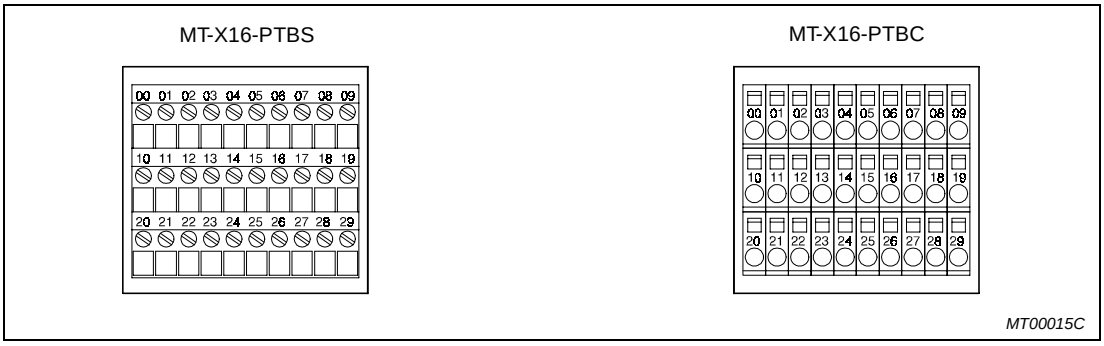


Fig. 4-11: *Potential terminal blocks MT-X16-PTBS and MT-X16-PTBC*

00 bis 09:	Terminals for the 24 V DC power supply for the sensors
10 bis 19:	Ground connection for the sensors
20 bis 29:	Ground connection for the sensors

4.5 Digital Output Modules

The digital output modules are classified as follows:

- Digital output module with 8 transistor outputs with 0,5 A output current (MT-Y8T)
- Digital output module with 16 transistor outputs with 0,5 A output current (MT-Y16T)
- Digital output module with 8 transistor outputs with 2 A output current (MT-Y8T2)
- Digital output module with 4 relay outputs with 2 A output current (MT-Y4R)

The following figure shows the block diagram of the digital output modules:

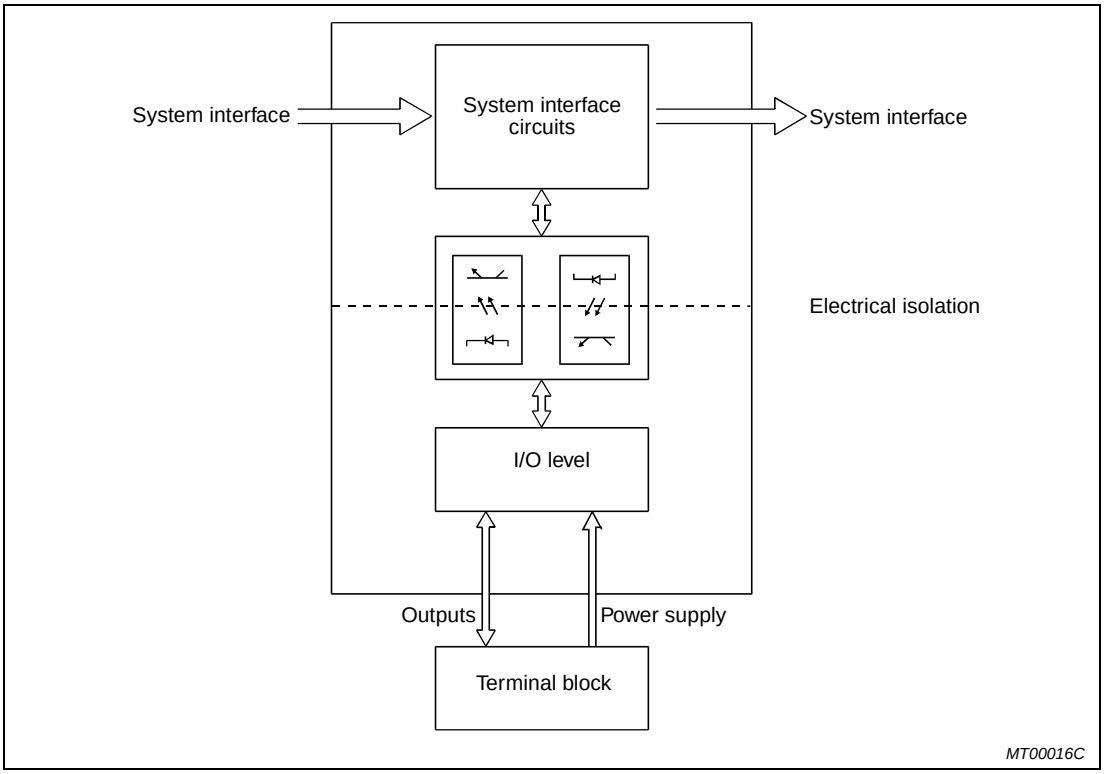


Fig. 4-12: *Block diagram of the digital output modules*

4.5.1 Operating items of the digital output module MT-Y8T

The following figure shows the operating items and accessories of the MT-Y8T module (8 transistor outputs, 0.5 A):

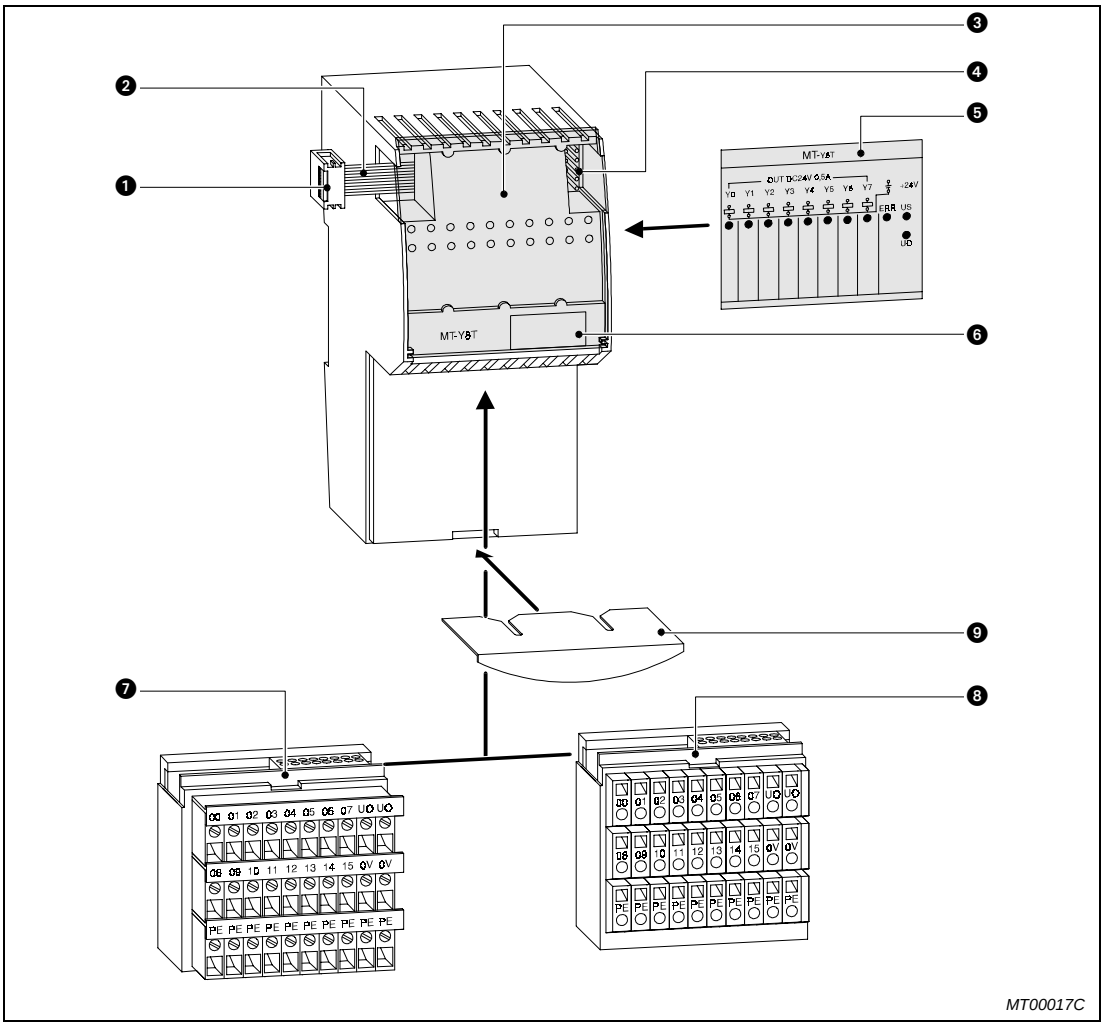


Fig. 4-13: *Digital output module MT-Y8T*

Table 4-5 describes the operating items of figure 4-13:

Position	Item	Description
❶	10-pole ribbon cable connector	Male connector for connection of the module to the basic module or to another extension module or for local extension.
❷	10-pole ribbon cable	Connection cable of the modules (internal system connection).
❸	Cover of labeling strip	This cover protects the labeling strips, displays, and internal system connectors against dust and dirt.
❹	Internal system connector	Connector for the adjacent module. Here, the 10-core ribbon cable connector plug is connected.
❺	Labeling strip	On the labeling strip the inputs and outputs can be identified. For an improved overview the fields for the signal identification align with the according terminals. In addition a status LED is integrated in each signal identification field. The right part of the labeling strip contains the diagnostic LEDs.
❻	Labeling field	In the labeling field the module can be identified.
❼	Terminal block with screw terminals (MT-Y8-TBS)	Here, the outputs, the power supply, the corresponding ground connection, and the PE connection are connected to screw terminals. The terminal block can be withdrawn towards the bottom.
❽	Terminal block with cache clamp terminals (MT-Y8-TBC)	Here, the outputs, the power supply, the corresponding ground connection, and the PE connection are connected to cache clamp terminals. The terminal block can be withdrawn towards the bottom.
❾	Locking plate	The locking plate locks the terminal blocks to the module.

Tab. 4-5: *Operating items MT-Y8T*

4.5.2 Terminal block assignment of the MT-Y8T module

The terminal blocks are assigned as follows:

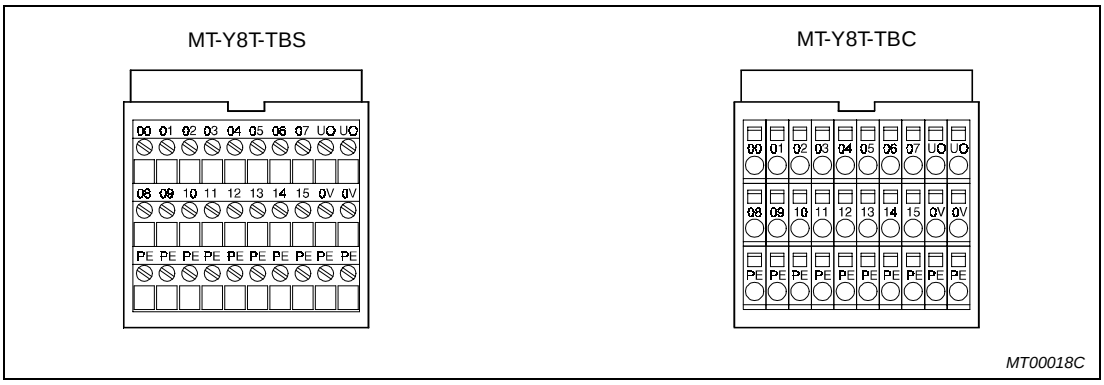


Fig. 4-14: *Terminal blocks MT-Y8T-TBS and MT-Y8T-TBC*

UO: Power supply 24 V DC for outputs 0 to 7
0V: Ground connection
PE: Protective earth

00 to 07: Outputs 0 to 7
08 to 15: Ground connection of the outputs

4.5.3 Operating items of the digital output module MT-Y16T

The following figure shows the operating items and accessories of the MT-Y16T module (16 transistor outputs, 0.5 A):

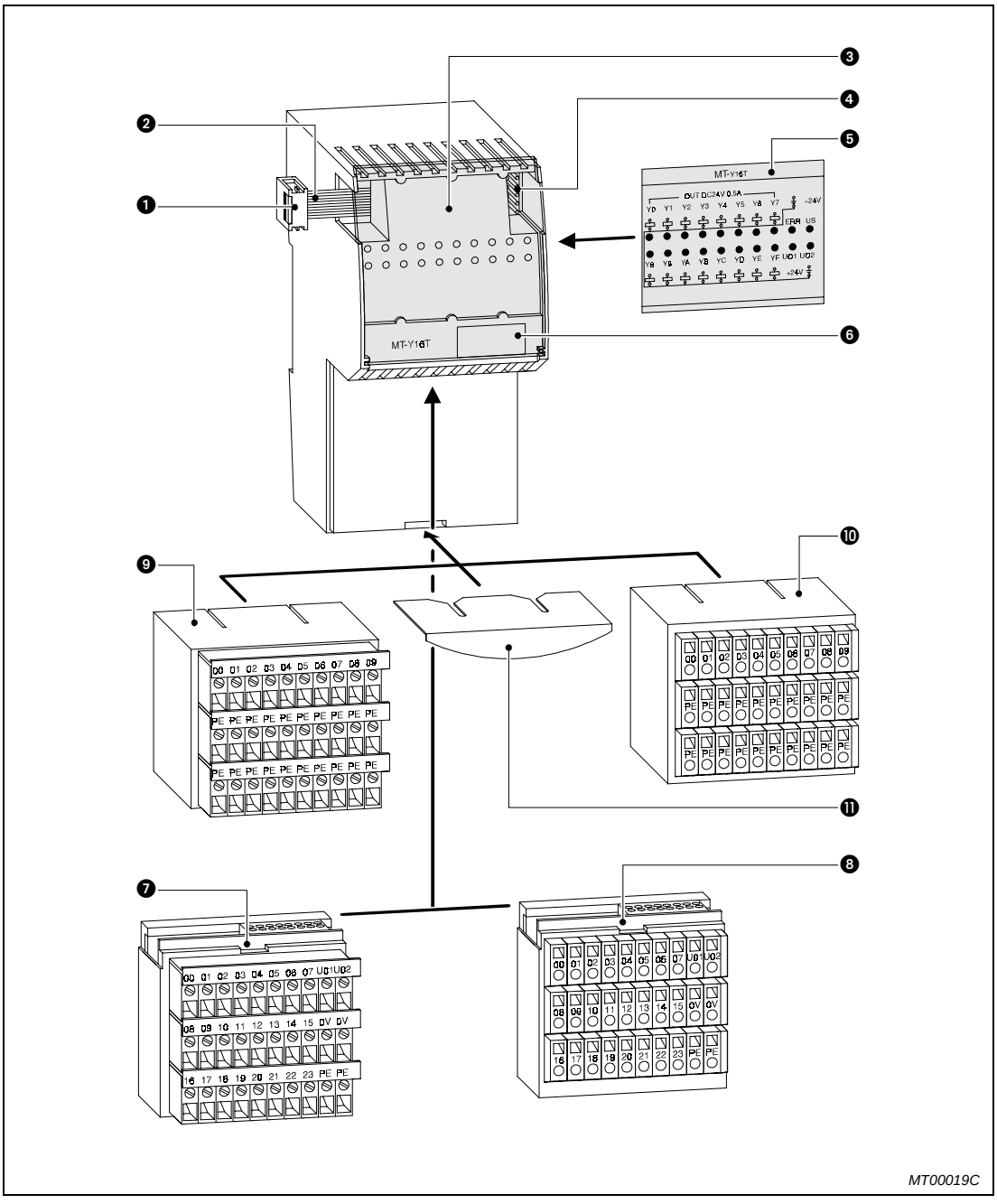


Fig. 4-15: *Digital output module MT-Y16T*

Table 4-6 describes the operating items of figure 4-15:

Nummer	Bezeichnung	Beschreibung
❶	10-pole ribbon cable connector	Male connector for connection of the module to the basic module or to another extension module or for local extension.
❷	10-pole ribbon cable	Connection cable of the modules (internal system connection).
❸	Cover of labeling strip	This cover protects the labeling strips, displays, and internal system connectors against dust and dirt.
❹	Internal system connector	Connector for the adjacent module. Here, the 10-core ribbon cable connector plug is connected.
❺	Labeling strip	On the labeling strip the inputs and outputs can be identified. For an improved overview the fields for the signal identification align with the according terminals. In addition a status LED is integrated in each signal identification field. The right part of the labeling strip contains the diagnostic LEDs.
❻	Labeling field	In the labeling field the module can be identified.
❼	Terminal block with screw terminals (MT-Y16T-TBS)	Here, the outputs, the power supply, the corresponding ground connection, and the PE connection are connected to screw terminals. The terminal block can be withdrawn towards the bottom.
❽	Terminal block with cache clamp terminals (MT-Y16T-TBC)	Here, the outputs, the power supply, the corresponding ground connection, and the PE connection are connected to cache clamp terminals. The terminal block can be withdrawn towards the bottom.
❾	Potential terminal block with screw terminals (MT-Y16T-PTBS)	The potential terminal blocks extend the number of supply points for the input sensors. The terminals are of the screw-type.
❿	Potential terminal block with cache clamp terminals (MT-Y16T-PTBC)	The potential terminal blocks extend the number of supply points for the input sensors. The terminals are of the cache clamp type.
⓫	Locking plate	The locking plate locks the terminal blocks to the module.

Tab. 4-6: *Operating items MT-Y16T*

4.5.4 Terminal block assignment of the MT-Y16T module

The MT-Y16T supplies power separately for each 8 outputs. The terminal blocks are assigned as follows:

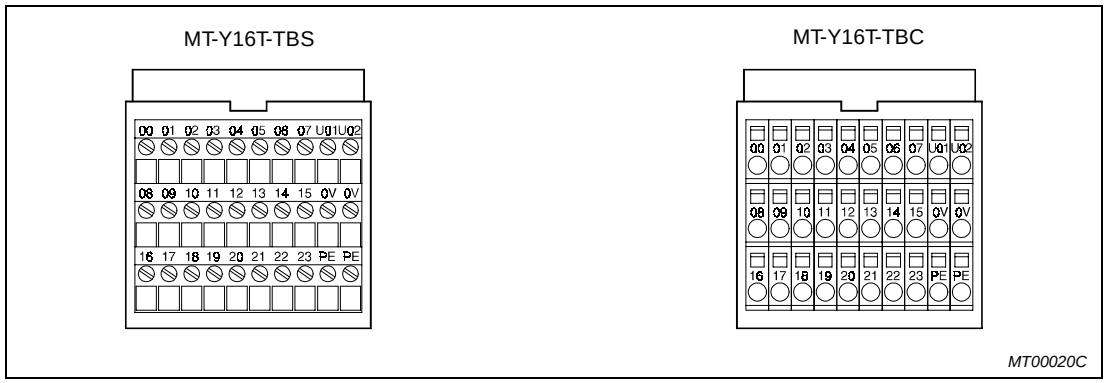


Fig. 4-16: *Terminal blocks MT-Y16T-TBS and MT-Y16T-TBC*

UO1:	Power supply 24 V DC for outputs 0 to 7
UO2:	Power supply 24 V DC for outputs 8 to 15
0V:	Ground connection
PE:	Protective earth

00 bis 07:	Outputs 0 to 7
08 bis 15:	Outputs 8 to 15
16 bis 23:	Ground connection of the outputs

The potential terminal blocks are assigned as follows:

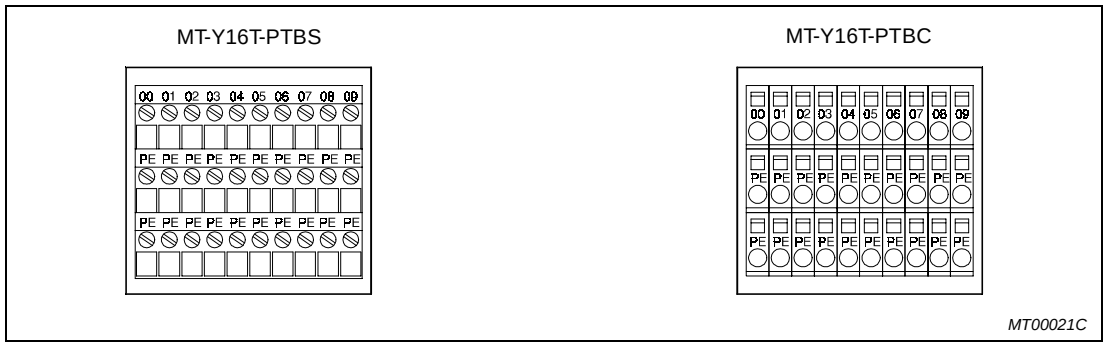


Fig. 4-17: *Potential terminal blocks MT-Y16T-PTBS and MT-Y16T-PTBC*

PE:	Protective earth
00 to 09:	Ground connection of the outputs

4.5.5 Operating items of the digital output module MT-Y8T2

The following figure shows the operating items and accessories of the MT-Y8T2 module (8 transistor outputs, 2 A):

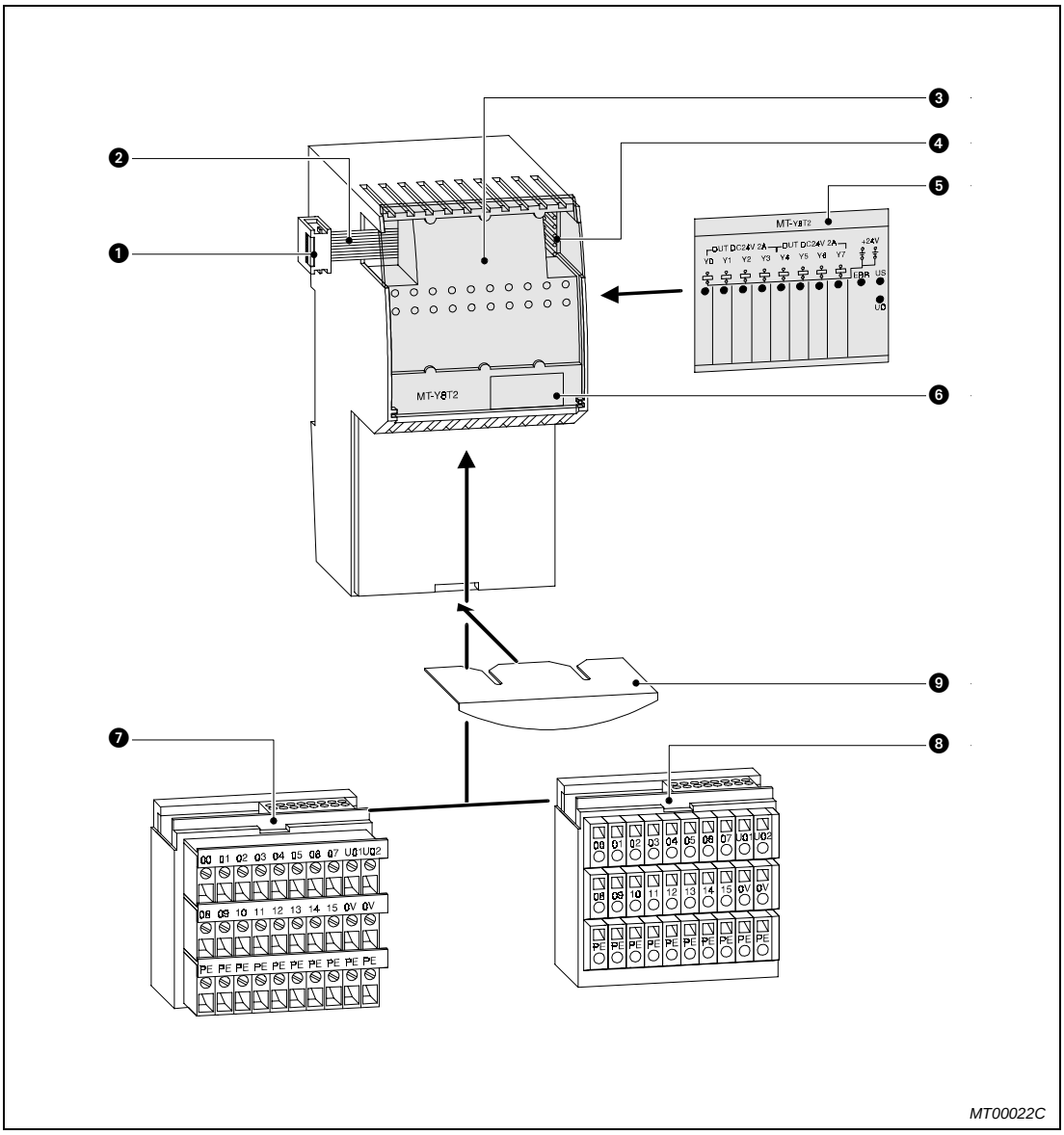


Fig. 4-18: *Digital output module MT-Y8T2*

Table 4-7 describes the operating items of figure 4-18:

Position	Item	Description
❶	10-pole ribbon cable connector	Male connector for connection of the module to the basic module or to another extension module or for local extension.
❷	10-pole ribbon cable	Connection cable of the modules (internal system connection).
❸	Cover of labeling strip	This cover protects the labeling strips, displays, and internal system connectors against dust and dirt.
❹	Internal system connector	Connector for the adjacent module. Here, the 10-core ribbon cable connector plug is connected.
❺	Labeling strip	On the labeling strip the inputs and outputs can be identified. For an improved overview the fields for the signal identification align with the according terminals. In addition a status LED is integrated in each signal identification field. The right part of the labeling strip contains the diagnostic LEDs.
❻	Labeling field	In the labeling field the module can be identified.
❼	Terminal block with screw terminals (MT-Y8T2-TBS)	Here, the outputs, the power supply, the corresponding ground connection, and the PE connection are connected to screw terminals. The terminal block can be withdrawn towards the bottom.
❽	Terminal block with cache clamp terminals (MT-Y8T2-TBC)	Here, the outputs, the power supply, the corresponding ground connection, and the PE connection are connected to cache clamp terminals. The terminal block can be withdrawn towards the bottom.
❾	Locking plate	The locking plate locks the terminal blocks to the module.

Tab. 4-7: *Operating items MT-Y8T2*

4.5.6 Terminal block assignment of the MT-Y8T2 module

The terminal blocks are assigned as follows:

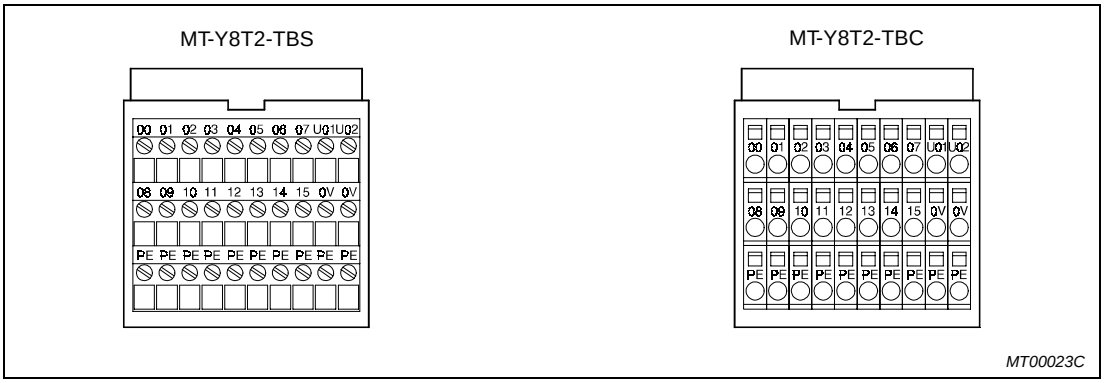


Fig. 4-19: *Terminal blocks MT-Y8T2-TBS and MT-Y8T2-TBC*

UO (UO1): Power supply 24 V DC for outputs 0 to 3
UO (UO2): Power supply 24 V DC for outputs 4 to 7
0V: Ground connection
PE: Protective earth

00 bis 07: Outputs 0 to 3 and 4 bis 7
08 bis 15: Ground connection of the outputs

NOTE

The advantage ot the two separate power supply terminals UO1 and UO2 is, that the outputs Y0 through Y3 and Y4 through Y7 can be fused separately. However different power supplies are **not** checked and indicated separately but indicated as group message through LED UO. Therefore, one missing power supply is not recognized and indicated by the system.

Remedy:
For accurate indication of a missing power supply the terminal block MT-Y8T-TB(S/C) should be used. It bridges the terminal UO internally with the power supplies UO1 and UO2. Though in this case the outputs cannot be fused separately.

4.5.7 Operating items of the digital output module MT-Y4R

The following figure shows the operating items and accessories of the MT-Y4R module (4 relay outputs, 2 A):

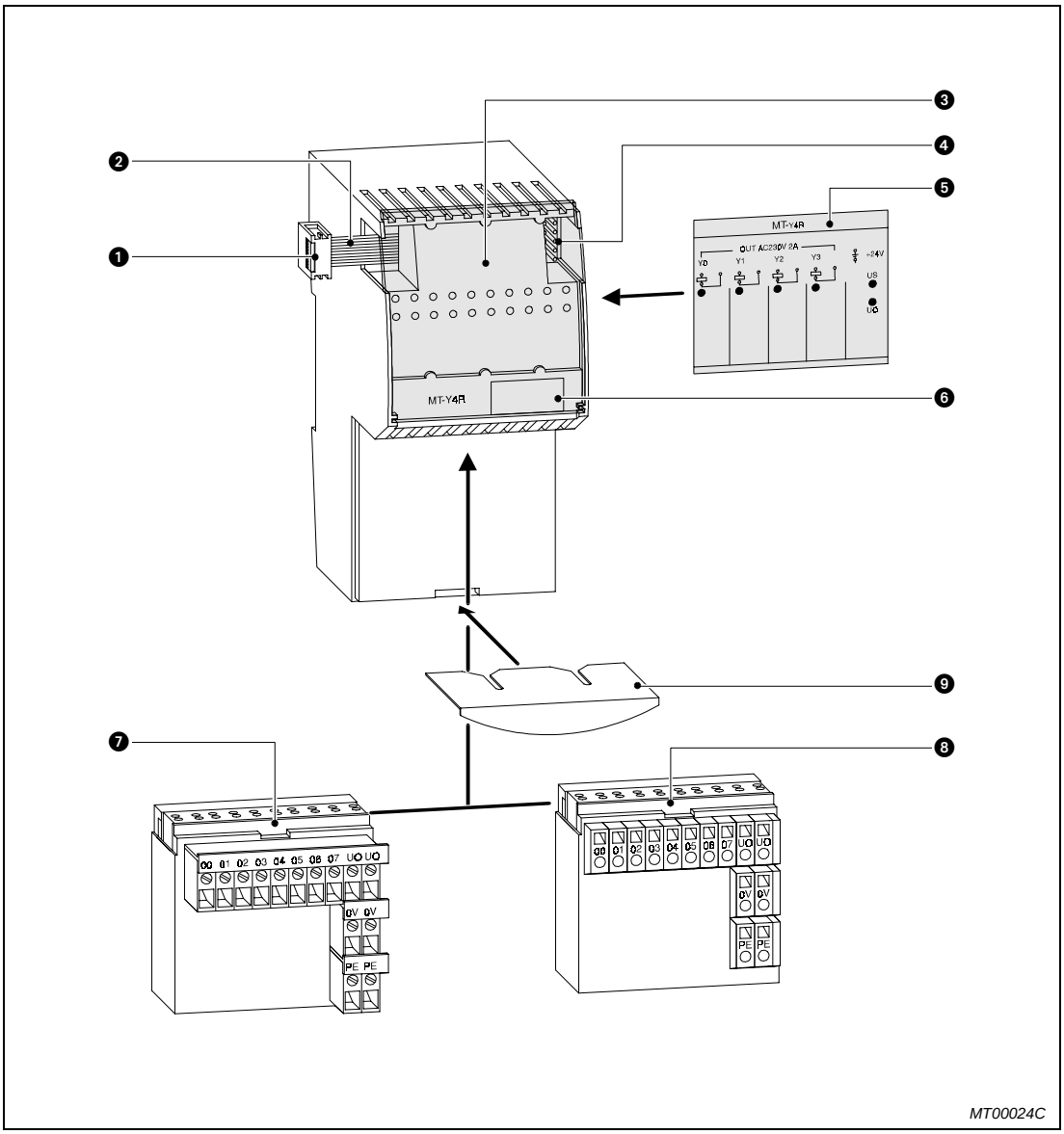


Fig. 4-20: *Digital output module MT-Y4R*

Refer to the table below for the switching current of the relays for the voltage groups AC15 according to VDE 0660 part 20 and DC13 according to VDE 0660 part 300:

Switching voltage	Switching current AC15	Switching current DC13
24 V	2 A	1,3 A
110 V	2 A	0,25 A
230 V	2 A	0,1 A

Tab. 4-8: *Relay switching current*

Table 4-9 describes the operating items of figure 4-20:

Position	Item	Description
❶	10-pole ribbon cable connector	Male connector for connection of the module to the basic module or to another extension module or for local extension.
❷	10-pole ribbon cable	Connection cable of the modules (internal system connection).
❸	Cover of labeling strip	This cover protects the labeling strips, displays, and internal system connectors against dust and dirt.
❹	Internal system connector	Connector for the adjacent module. Here, the 10-core ribbon cable connector plug is connected.
❺	Labeling strip	On the labeling strip the inputs and outputs can be identified. For an improved overview the fields for the signal identification align with the according terminals. In addition a status LED is integrated in each signal identification field. The right part of the labeling strip contains the diagnostic LEDs.
❻	Labeling field	In the labeling field the module can be identified.
❼	Terminal block with screw terminals (MT-Y4R-TBS)	Here, the outputs, the power supply, the corresponding ground connection, and the PE connection are connected to screw terminals. The terminal block can be withdrawn towards the bottom.
❽	Terminal block with cache clamp terminals (MT-Y4R-TBC)	Here, the outputs, the power supply, the corresponding ground connection, and the PE connection are connected to cache clamp terminals. The terminal block can be withdrawn towards the bottom.
❾	Locking plate	The locking plate locks the terminal blocks to the module.

Tab. 4-9: *Operating items MT-Y4R*

4.5.8 Terminal block assignment of the MT-Y4R module

To each terminal block for the relays 4 NO contacts (normally open) can be connected.
The terminal blocks are assigned as follows:

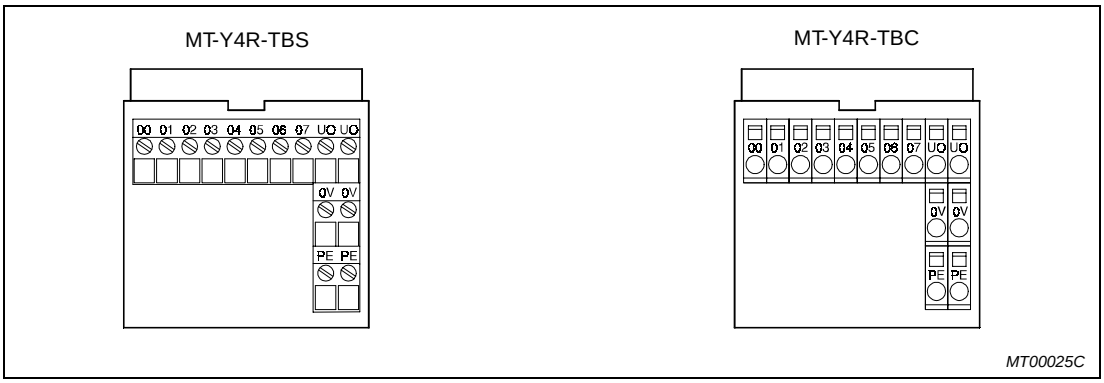


Fig. 4-21: *Terminalblocks MT-Y4R-TBS and MT-Y4R-TBC*

UO:	Power supply 24 V DC for relays
0V:	Ground connection
PE:	Protective earth

00, 01:	NO contact 0
02, 03:	NO contact 1
04, 05:	NO contact 2
06, 07:	NO contact 3

4.5.9 Operating items of the digital output module MT-Y8R5

Fig. 4-22 shows the operating items and accessories of the MT-Y8R5 module (8 relay outputs, 5 A):

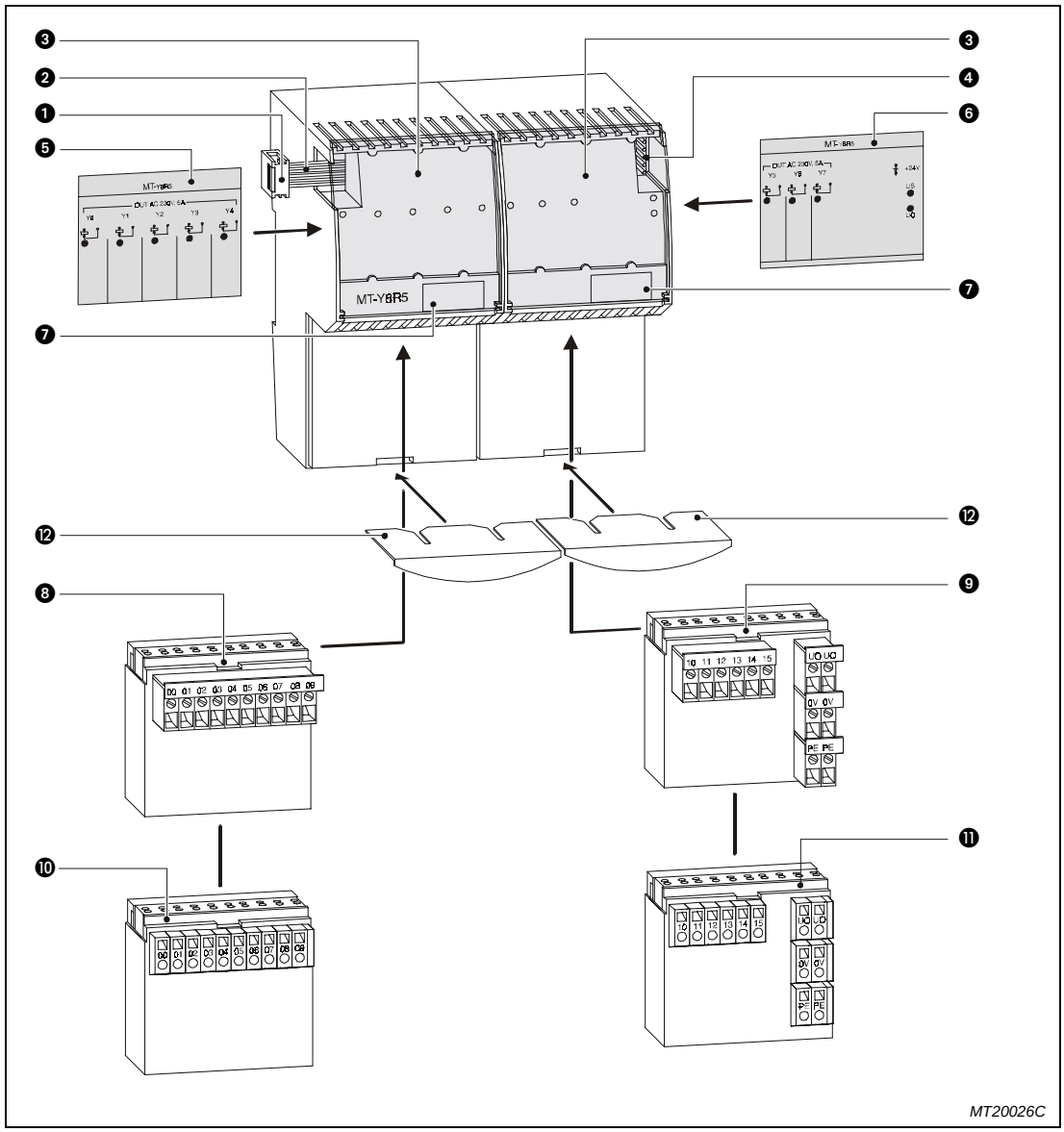


Fig. 4-22: *Digital output module MT-Y8R5*

The switching currents of the relays for the voltage groups AC12 and AC15 conforming to VDE 0660, part 20 and DC13 conforming to VDE 0660, part 300 are shown in Tab. 4-10:

Switching voltage	Switching current AC12	Switching current AC15	Switching current DC13
24 V	5 A	3 A	1,0 A
110 V	5 A	3 A	0,2 A
230 V	5 A	3 A	0,1 A

Tab. 4-10: *Switching currents of relays (MT-Y8R5)*

Tab. 4-11 describes figure 4-22.

Position	Item	Description
❶	10-pole ribbon cable connector	Male connector for connection of the module to the basic module or to another extension module or for local extension.
❷	10-pole ribbon cable	Connection cable of the modules (internal system connection).
❸	Cover of labeling strip	This cover protects the labeling strips, displays, and internal system connectors against dust and dirt.
❹	Internal system connector	Connector for the adjacent module. Here, the 10-core ribbon cable connector plug is connected.
❺	Labeling strip, left	On the labeling strip the inputs and outputs can be identified. For an improved overview the fields for the signal identification align with the according terminals. In addition a status LED is integrated in each signal identification field. The right part of the right labeling strip contains the diagnostic LEDs.
❻	Labeling strip, right	
❼	Labeling field	In the labeling field the module can be identified.
❽	Terminal block with screw terminals, left (MT-Y8R5-TBSL)	Here, the outputs are connected to screw terminals. The terminal block can be withdrawn towards the bottom. The module is mounted on the left side
❾	Terminal block with screw terminals, right (MT-Y8R5-TBSR)	Here, the outputs, the power supplies, the corresponding ground connection, and the PE connection are connected to screw terminals. The terminal block can be withdrawn towards the bottom. The module is mounted on the right side.
❿	Terminal block with cache clamp terminals, left (MT-Y8R5-TBCL)	Here, the outputs are connected to cache clamp terminals. The terminal block can be withdrawn towards the bottom. The module is mounted on the left side.
⓫	Terminal block with cache clamp terminals, right (MT-Y8R5-TBCR)	Here, the outputs, the power supplies, the corresponding ground connection, and the PE connection are connected to cache clamp terminals. The terminal block can be withdrawn towards the bottom. The module is mounted on the right side.
⓬	Locking plate	The locking plate locks the terminal blocks to the module.

Tab. 4-11: *Operating items MT-Y8R5*

4.5.10 Terminal block assignment of the MT-Y8R5 module

To each terminal block for the relays 8 NO contacts (normally open) can be connected.
The terminal blocks are assigned as follows:

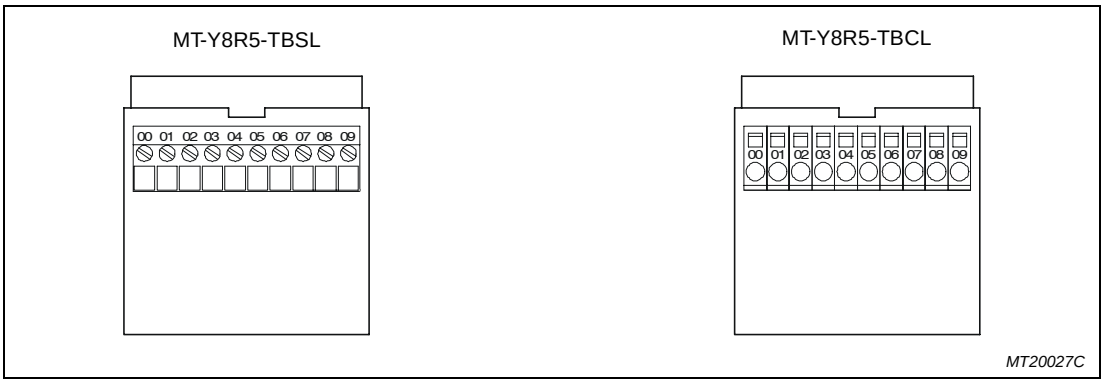


Fig. 4-23: *Terminal blocks MT-Y8R5-TBS and MT-Y8R5-TBC*

00, 01: NO contact 0
02, 03: NO contact 1
04, 05: NO contact 2
06, 07: NO contact 3
08, 09: NO contact 4

The right terminal blocks are assigned as follows:

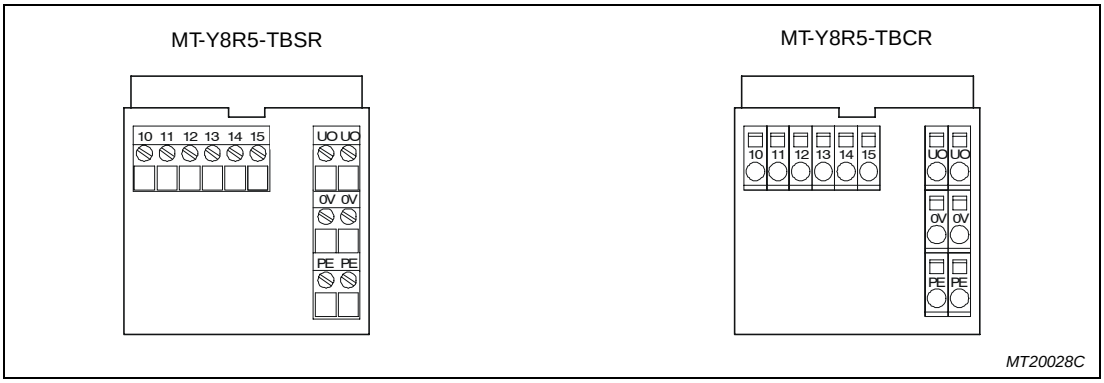


Fig. 4-24: *Terminal blocks MT-Y8R5-TBS and MT-Y8R5-TBC*

UO: Power supply 24 V DC for relays
0V: Ground connection
PE: Protective earth

10, 11: NO contact 5
12, 13: NO contact 6
14, 15: NO contact 7

4.6 Digital Input/Output Modules

The combined digital input/output modules are featured as follows:

- Digital input/output module with 4 semiconductor input and 4 transistor outputs (MT-X4Y4T)

Fig. 4-25 shows the block diagram of the input/output module in principle:

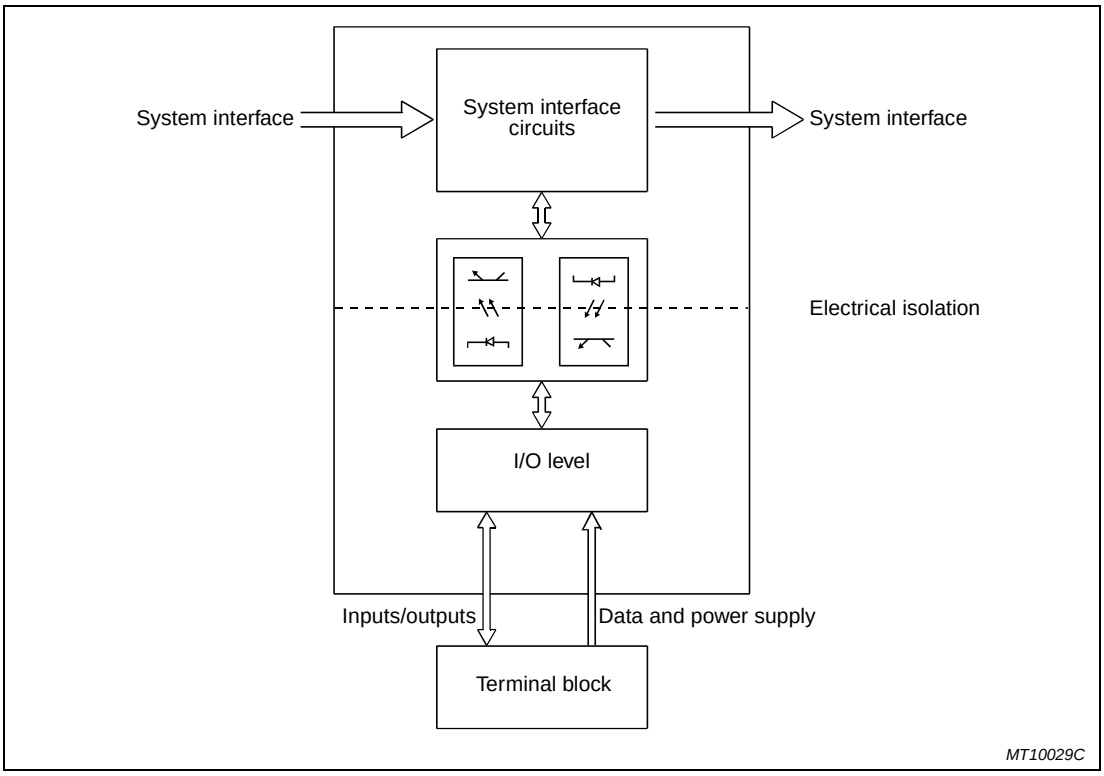


Fig. 4-25: *Block diagram of the digital input/output modules*

4.6.1 Operating items of the digital input/output module MT-X4Y4T

Fig. 4-26 shows the operating items and accessories of the MT-X4Y4T module (4 digital inputs, 4 transistor outputs):

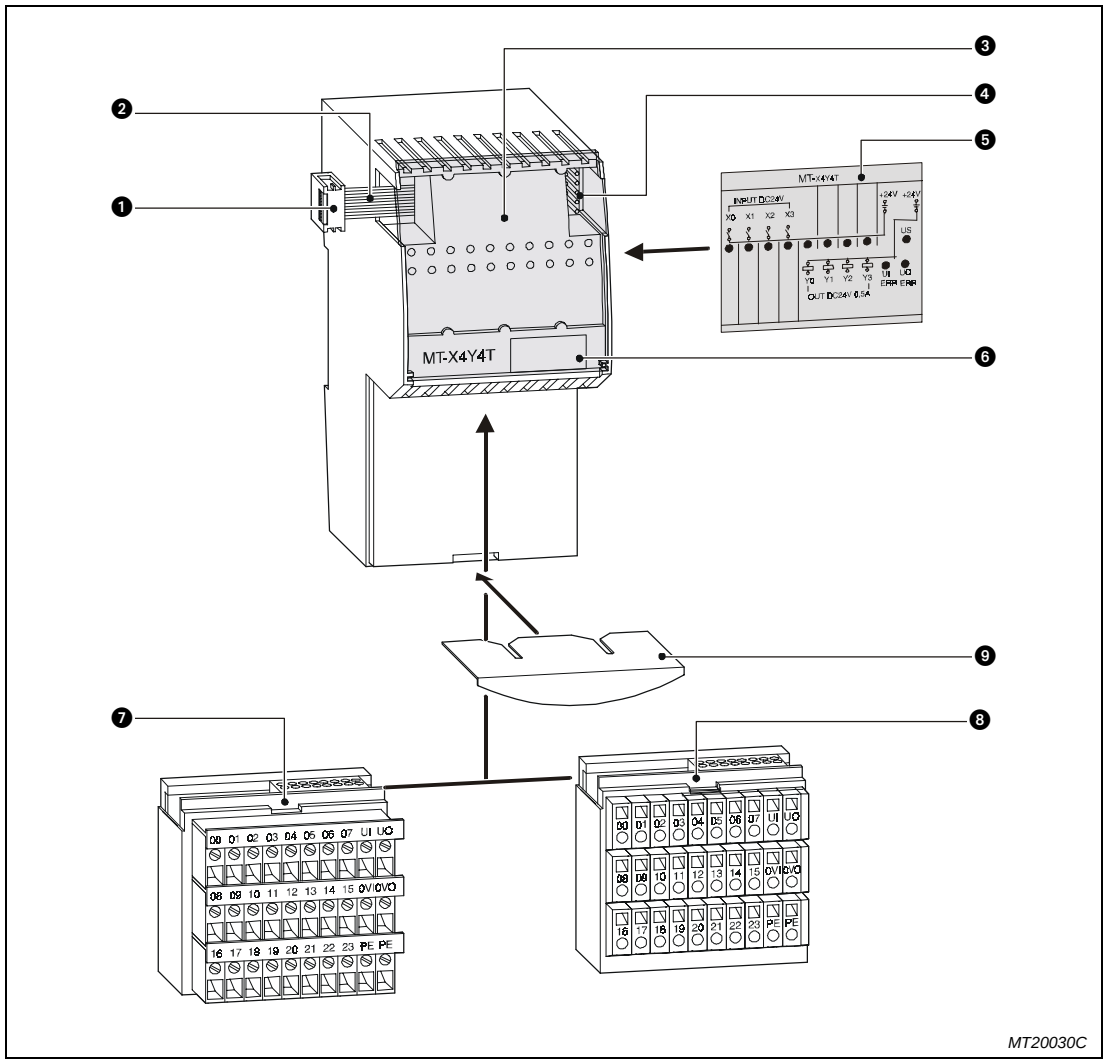


Fig. 4-26: *Digital input/output module MT-X4Y4T*

Tab. 4-12 describes figure 4-26.

Position	Item	Description
❶	10-pole ribbon cable connector	Male connector for connection of the module to the basic module or to another extension module or for local extension.
❷	10-core ribbon cable	Connection cable of the modules (internal system connection).
❸	Cover of labeling strip	This cover protects the labeling strips, displays, and internal system connectors against dust and dirt.
❹	Internal system connector	Connector for the adjacent module. Here, the 10-pole ribbon cable connector plug is connected.
❺	Labeling strip	On the labeling strip the inputs and outputs can be identified. For an improved overview the fields for the signal identification align with the according terminals. In addition a status LED is integrated in each signal identification field. The right part of the labeling strip contains the diagnostic LEDs.
❻	Labeling field	In the labeling field the module can be identified.
❼	Terminal block with screw terminals (MT-X4Y4T-TBS)	Here, the inputs, the power supply, the corresponding ground connection, and the PE connection are connected to screw terminals. The terminal block can be withdrawn towards the bottom.
❽	Terminal block with cache clamp terminals (MT-X4Y4T-TBC)	Here, the inputs, the power supply, the corresponding ground connection, and the PE connection are connected to cache clamp terminals. The terminal block can be withdrawn towards the bottom.
❾	Locking plate	The locking plate locks the terminal blocks to the module.

Tab. 4-12: *Operating items MT-X4Y4T*

4.6.2 Terminal block assignment of the MT-X4Y4T module

The terminal blocks are assigned as follows:

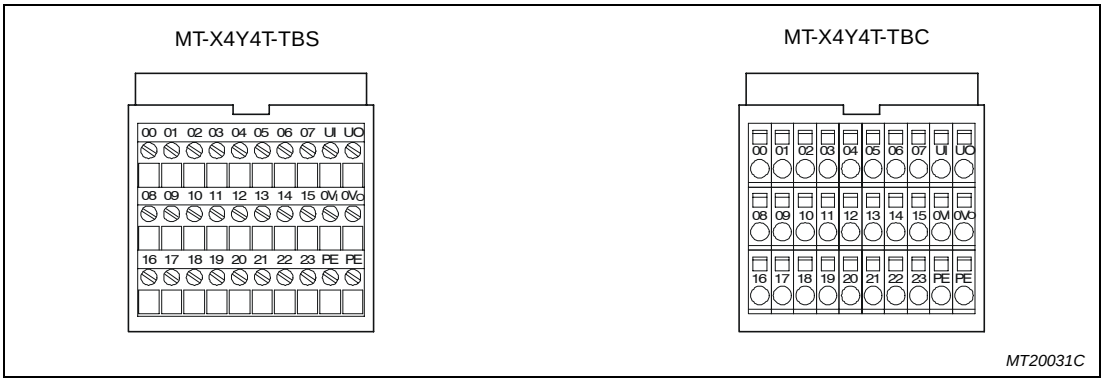


Fig. 4-27: *Terminal blocks MT-X4Y4T-TBS and MT-X4Y4T-TBC*

UI:	Power supply of the sensory circuits with 24 V DC
UO:	Power supply 24 V DC for outputs
0VI:	Ground connection for the power supply of the sensory circuits
0VO	Ground connection for the power supply of the outputs
PE:	Protective earth

00 to 03:	Inputs 0 to 3
04 to 07:	Outputs 0 to 3
08 to 11:	Power supply outputs 24 V DC for sensors, short-circuit-proof
12 to 15:	Ground connection of the outputs
16 to 19:	Ground connection of the sensors
20 to 23:	Protective earth

4.7 Analog Input Modules

The analog input modules support the following measurements:

- Voltage measurement ±10 V, two-wire cabling
- Current measurement ±20 mA, 4 – 20 mA
- PT100 temperature measurement

The following figure shows the block diagram of the analog input modules:

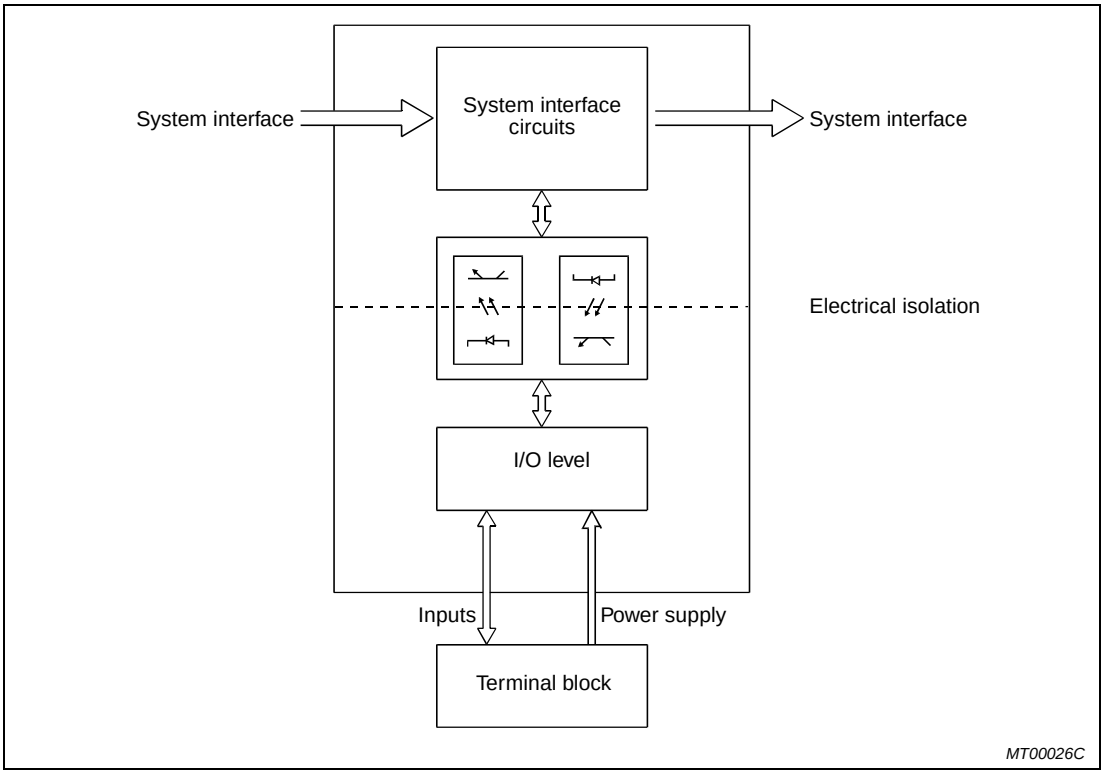


Fig. 4-28: *Block diagram of the analog input module*

4.7.1 Operating items of the analog input module MT-4AD-N

The following figure shows the operating items and accessories of the MT-4AD-N module:

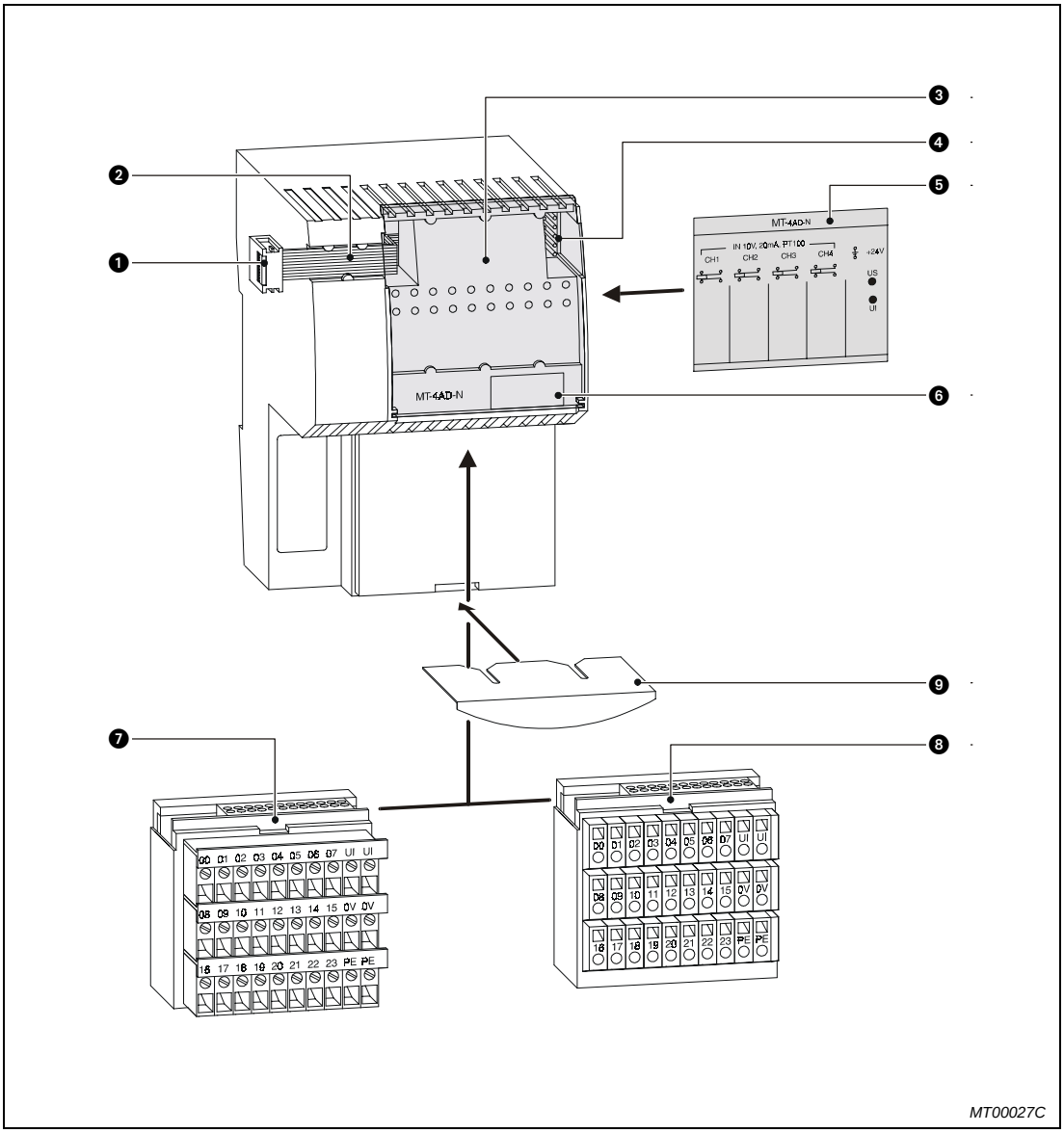


Fig. 4-29: *Analog input module MT-4AD-N*

Table 4-13 describes the operating items of figure 4-29:

Position	Item	Description
❶	10-pole ribbon cable connector	Male connector for connection of the module to the basic module or to another extension module or for local extension.
❷	10-pole ribbon cable	Connection cable of the modules (internal system connection).
❸	Cover of labeling strip	This cover protects the labeling strips, displays, and internal system connectors against dust and dirt.
❹	Internal system connector	Connector for the adjacent module. Here, the 10-core ribbon cable connector plug is connected.
❺	Labeling strip	On the labeling strip the inputs and outputs can be identified. For an improved overview the fields for the signal identification align with the according terminals. In addition a status LED is integrated in each signal identification field. The right part of the labeling strip contains the diagnostic LEDs.
❻	Labeling field	In the labeling field the module can be identified.
❼	Terminal block with screw terminals (MT-4AD-TBS-N)	Here, the outputs, the power supply, the corresponding ground connection, and the PE connection are connected to screw terminals. The terminal block can be withdrawn towards the bottom.
❽	Terminal block with cache clamp terminals (MT-4AD-TBC-N)	Here, the outputs, the power supply, the corresponding ground connection, and the PE connection are connected to cache clamp terminals. The terminal block can be withdrawn towards the bottom.
❾	Locking plate	The locking plate locks the terminal blocks to the module.

Tab. 4-13: *Operating items MT-4AD-N*

4.7.2 Terminal block assignment of the MT-4AD-N module

The MT-4AD-N module supplies 4 input channels that can be parameterized for ±10 V, ±20 mA, 4 - 20 mA or PT100 (measuring range -180 – 600°C).

The measuring range is set via jumpers and parameters.
The jumper setting for the different measuring ranges is shown below:

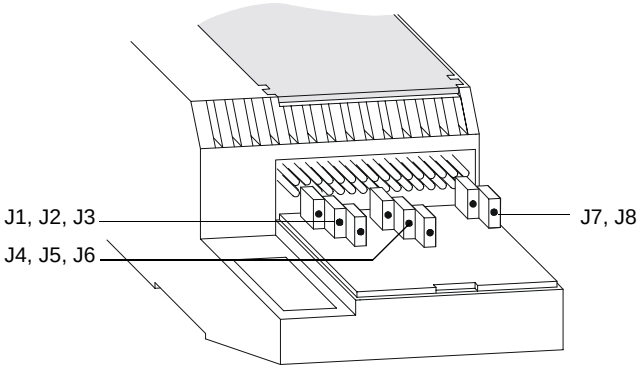


Fig. 4-30: *Selection of measuring range via jumpers*

The following table shows the jumper settings for the measuring range and channel selection:

Measuring range	Ch.	J1	J2	J3	J4	J5	J6	J7	J8	Remarks
Voltage	0	●	—	—	—	—	—	—	—	
	1	—	—	●	—	—	—	—	—	
	2	—	—	—	—	●	—	—	—	
	3	—	—	—	—	—	—	●	—	
Current	0	●	●	—	—	—	—	—	—	Default
	1	—	—	●	●	—	—	—	—	Default
	2	—	—	—	—	●	●	—	—	Default
	3	—	—	—	—	—	—	●	●	Default
PT 100	0	—	●	—	—	—	—	—	—	
	1	—	—	—	●	—	—	—	—	
	2	—	—	—	—	—	●	—	—	
	3	—	—	—	—	—	—	—	●	

Tab. 4-14: Jumper settings for the measuring range and channel selection

● = Jumper closed

Refer to chapter 6 on parameterization for details on setting the measuring range via parameters.

The terminal blocks are assigned as follows:

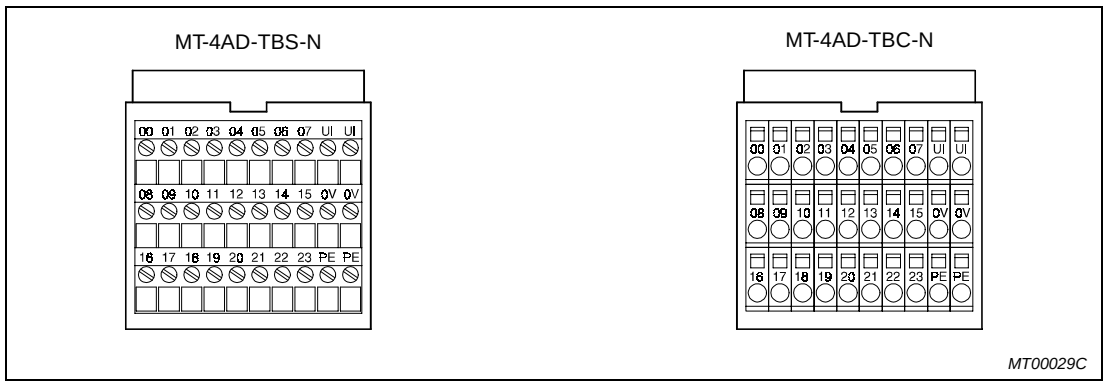


Fig. 4-31: *Terminal blocks MT-4AD-TBS-N and MT-4AD-TBC-N*

UI	Power supply 24 V DC for inputs 0 - 3
0V:	Ground connection
PE:	Protective earth
00, 02, 04, 06:	Voltage inputs +
01, 03, 05, 07:	Current inputs +
09, 11, 13, 15:	Common minus (Voltage, current)
08, 10, 12, 14:	Current driver PT100
16, 18, 20, 22:	Analog ground
17, 19, 21, 23:	Protective earth

4.7.3 Voltage measurement ±10 V, two-wire cabling

The following figure shows the connection of the measuring leads to the terminal block for the ±10 V voltage measurement:

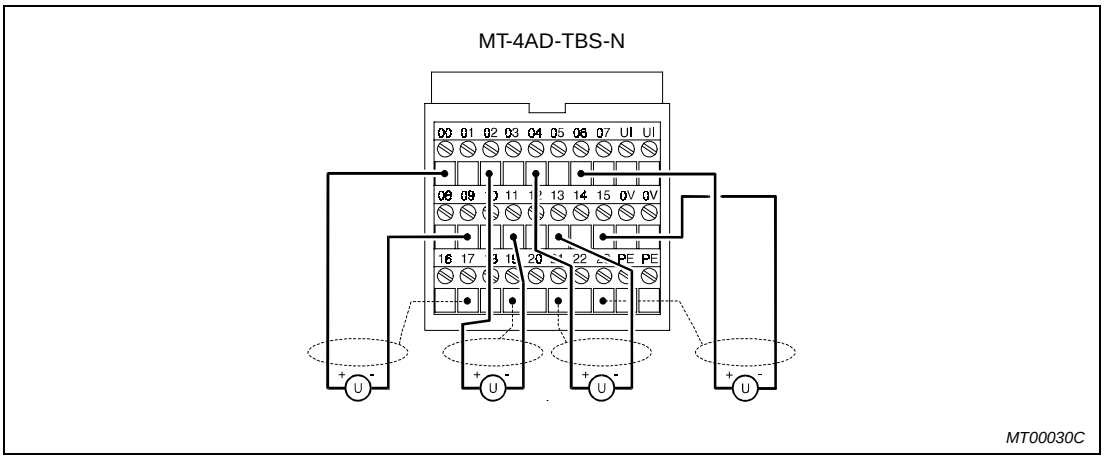


Fig. 4-32: *Sample connection for voltage measurement*

4.7.4 Voltage input characteristics (measuring range ±10 V)

Fig. 4-33 shows the graph of the voltage input characteristics:

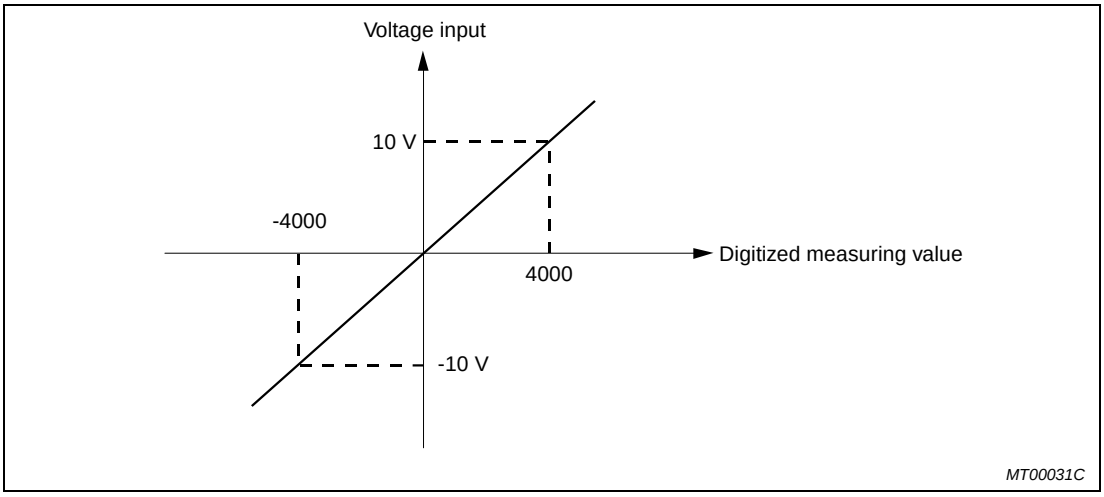


Fig. 4-33: *Voltage input characteristics*

E

CAUTION
The maximum input voltage of ±35 V must not be exceeded. This would result in malfunction or damage of the devices.

NOTE

In order to select the voltage input characteristics for the measuring range ±10 V, besides the jumper settings (see fig. 4-30) the bits 5 – 7 in the parameter byte for the according analog channel in the PROFIBUS/DP have to be set as follows:

Bit	Status
5	0
6	0
7	0

Tab. 4-15:
Parameter bits for measuring range ±10 V

For an analog input that exceeds the maximum digital output value of 4000 or falls below the minimum output value of -4000 overflows (> 10 V ⇒ >= 4000, < -10 V ⇒ < -4000) are returned.

4.7.5 Current measurement ±20 mA, 4 – 20 mA

The following figure shows the connection of the measuring leads to the terminal block for the current measurement:

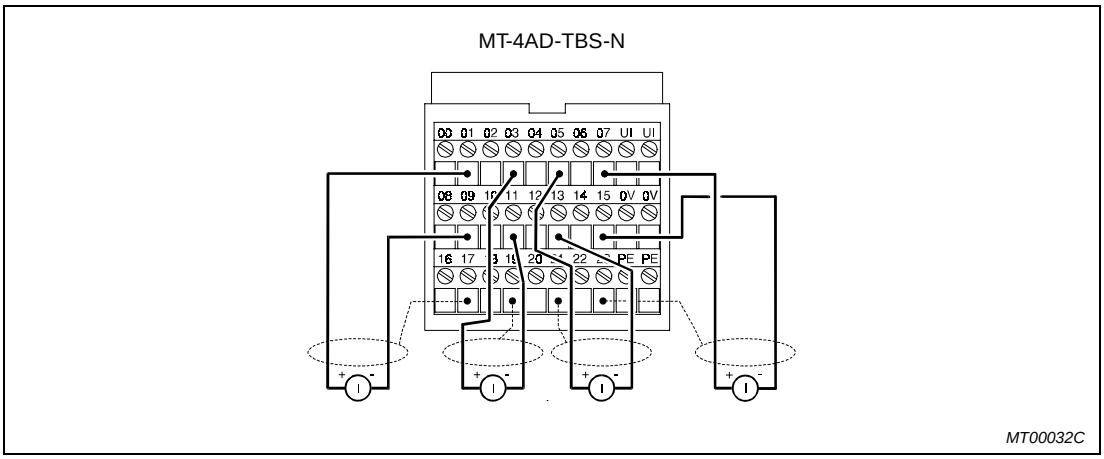


Fig. 4-34: *Sample connection for current measurement*

4.7.6 Current input characteristics (measuring range ±20 mA)

Fig. 4-35 shows the graph of the current input characteristics after changing the input range setting:

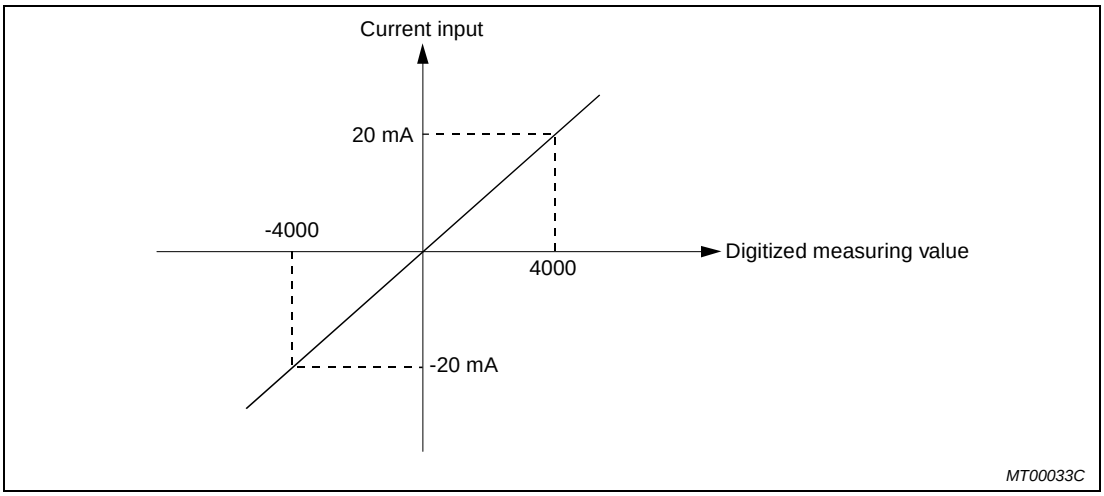


Fig. 4-35: *Current input characteristics*

E

CAUTION
The maximum input current of ±30 mA must not be exceeded. This would result in malfunction or damage of the devices.

NOTE

In order to select the current input characteristics for the measuring range ±20 mA, besides the jumper settings (see fig. 4-30) the bits 5 – 7 in the parameter byte for the according analog channel in the PROFIBUS/DP have to be set as follows:

Bit	Status
5	1
6	0
7	0

Tab. 4-16:
Parameter bits for measuring range ±20 mA

For an analog input that exceeds the maximum digital output value of 4000 or falls below the minimum output value of -4000 overflows (> 20,475 mA ⇒ >= 4000, < 20,48 mA ⇒ < -4000) are returned.

4.7.7 Current input characteristics (measuring range 4 – 20 mA)

Fig. 4-36 shows the graph of the current input characteristics after changing the input range setting:

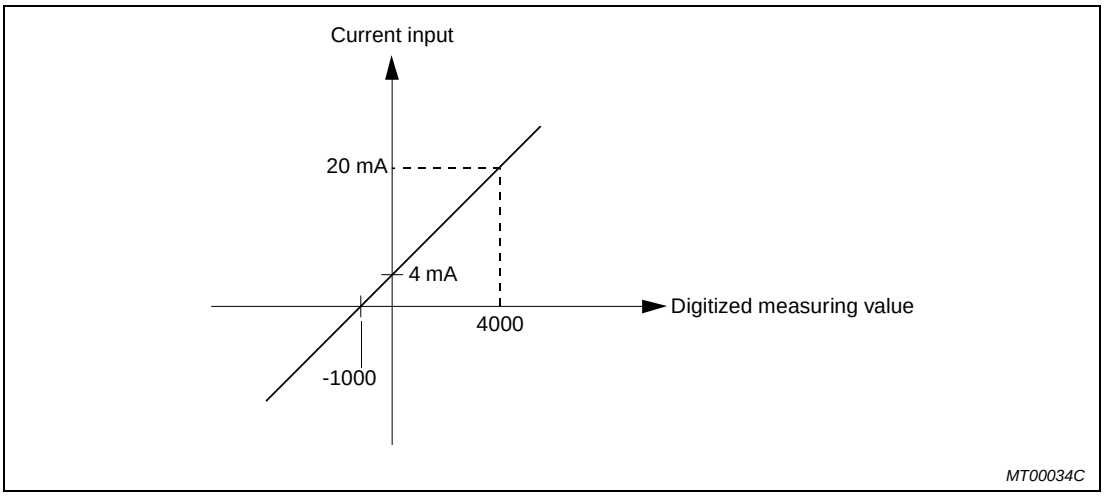


Fig. 4-36: *Current input characteristics*

E

CAUTION
The maximum input current of ±30 mA must not be exceeded. This would result in malfunction or damage of the devices.

NOTE

In order to select the current input characteristics for the measuring range 4 – 20 mA, besides the jumper settings (see fig. 4-30) the bits 5 – 7 in the parameter byte for the according analog channel in the PROFIBUS*I*DP have to be set as follows:

Bit	Status
5	0
6	1
7	0

Tab. 4-17:
Parameter bits for measuring range 4 – 20 mA

For an analog input that exceeds the maximum digital output value of 4000 an overflow (> 20,38 mA ⇒ >= 4000) is returned. A negatve digitized measuring value indicates an open circuit in the wiring.

4.7.8 PT100 measurement

The following figure shows the connection of the measuring leads to the terminal block for the temperature measurement:

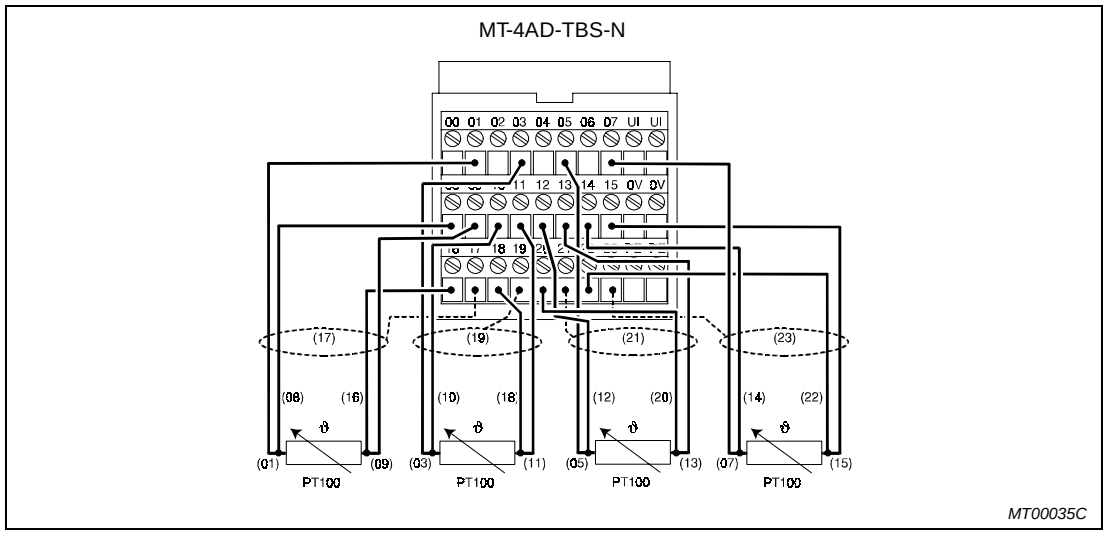


Fig. 4-37: *Sample connection for PT100 measurement*

4.7.9 Temperature input characteristics (measuring range PT100)

Fig. 4-38 shows the graph of the temperature input characteristics:

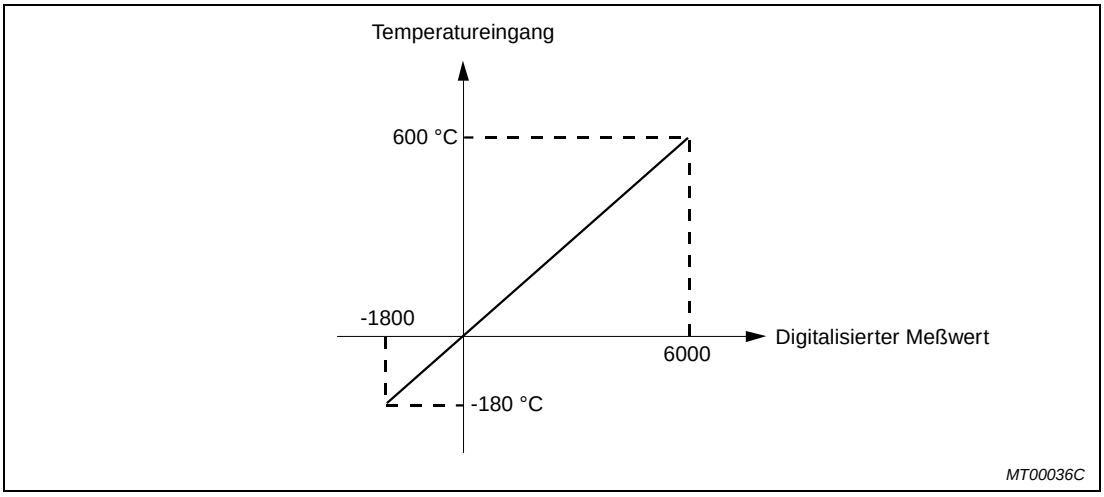


Fig. 4-38: *Temperature input characteristics*

NOTE

In order to select the temperature input characteristics for the measuring range -180 – 600 °C, besides the jumper settings (see fig. 4-30) the bits 5 – 7 in the parameter byte for the according analog channel in the PROFIBUS/DP have to be set as follows:

Bit	Status
5	1
6	1
7	0

Tab. 4-18:
Parameter bits; measuring range -180 – 600 °C

For an analog input that exceeds the maximum digital output value of 6000 an overflow is returned. If it falls below the minimum output value of -1800, the minimum value -1800 is returned. The overflow or the underflow are transferred to the master device as diagnostic diagram.

4.7.10 Overall accuracy of the MT-4AD-N module

The overall accuracy always refers to the entire digital output range. In the following figures, the overall accuracies of the measuring ranges ±10 V, ±20 mA, 4 – 20 mA and PT100 are specified.

The overall accuracy of the voltage measurement is calculated as follows:

|Overall accuracy**|** = **|**main accuracy**|** + **|**measuring accuracy**|**

The main accuracy results from 0,15 % of the rating 4000 to ±6 LSB.

The measuring accuracy at 25 °C is specified ±2 LSB .

Therefore, the overall accuracy at 25 °C results from ±(6 LSB + 2 LSB) to ±8 LSB. This equals ±20 mV.

The measuring accuracy between 0 and 55 °C is specified ±10 LSB.

Therefore, the overall accuracy between 0 and 55 °C results from ±(6 LSB + 10 LSB) to ±16 LSB. This equals ±40 mV.

Thus, the characteristic curve of the overall accuracy of the voltage measurement shown in figure 4-39 results:

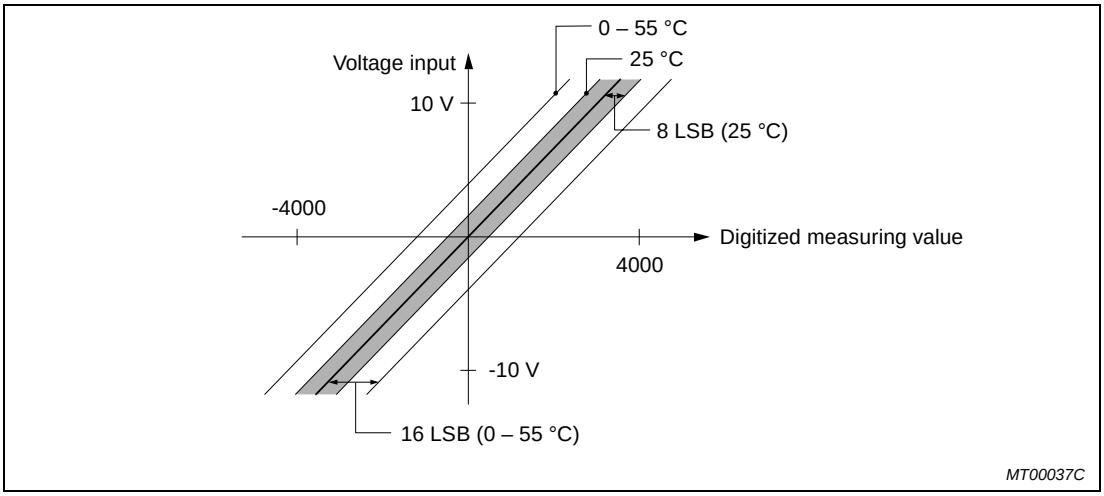


Fig. 4-39: *Overall accuracy of the voltage input characteristics*

The overall accuracy of the current input characteristics (±20 mA) is calculated as follows:

|Overall accuracy**|** = **|**main accuracy**|** + **|**measuring accuracy**|**

The main accuracy results from 0,15 % of the rating 4000 to ±6 LSB.

The measuring accuracy at 25 °C is specified ±2 LSB .

Therefore, the overall accuracy at 25 °C results from ±(6 LSB + 2 LSB) to ±8 LSB. This equals ±40 µA.

The measuring accuracy between 0 and 55 °C is specified ±10 LSB.

Therefore, the overall accuracy between 0 and 55 °C results from ±(6 LSB + 10 LSB) to ±16 LSB. This equals ±80 µA.

Thus, the characteristic curve of the overall accuracy of the current input characteristics (±20 mA) shown in figure 4-40 results:

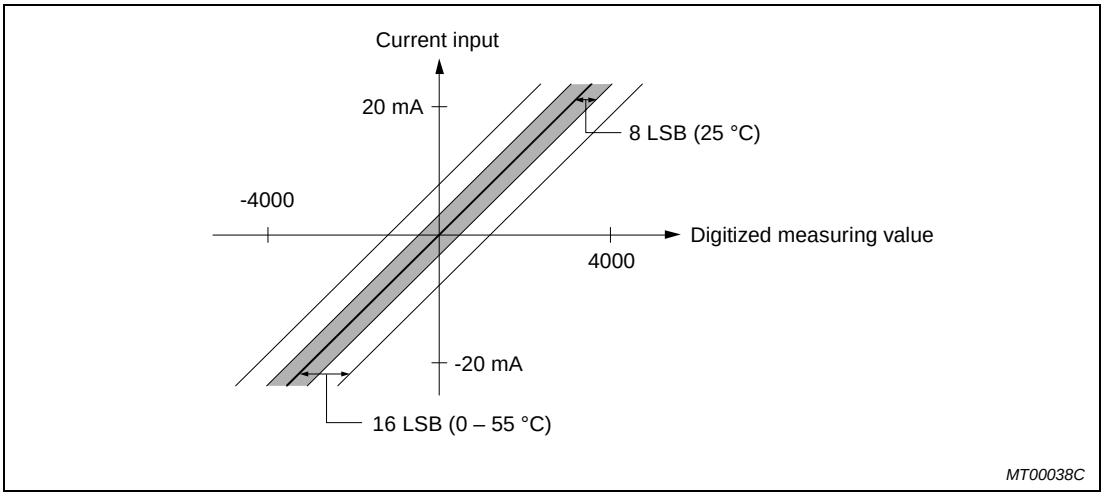


Fig. 4-40: *Overall accuracy of the current input characteristics (±20 mA)*

The overall accuracy of the current input characteristics (4 – 20 mA) is calculated as follows:

|Overall accuracy**|** = **|**main accuracy**|** + **|**measuring accuracy**|**

The main accuracy results from 0,15 % of the rating 4000 to ±6 LSB.

The measuring accuracy at 25 °C is specified ±3 LSB .

Therefore, the overall accuracy at 25 °C results from ±(6 LSB + 3 LSB) to ±9 LSB. This equals ±36 µA.

The measuring accuracy between 0 and 55 °C is specified ±13 LSB.

Therefore, the overall accuracy between 0 and 55 °C results from ±(6 LSB + 13 LSB) to ±19 LSB. This equals ±76 µA.

Thus, the characteristic curve of the overall accuracy of the current input characteristics (4 - 20 mA) shown in figure 4-41 results:

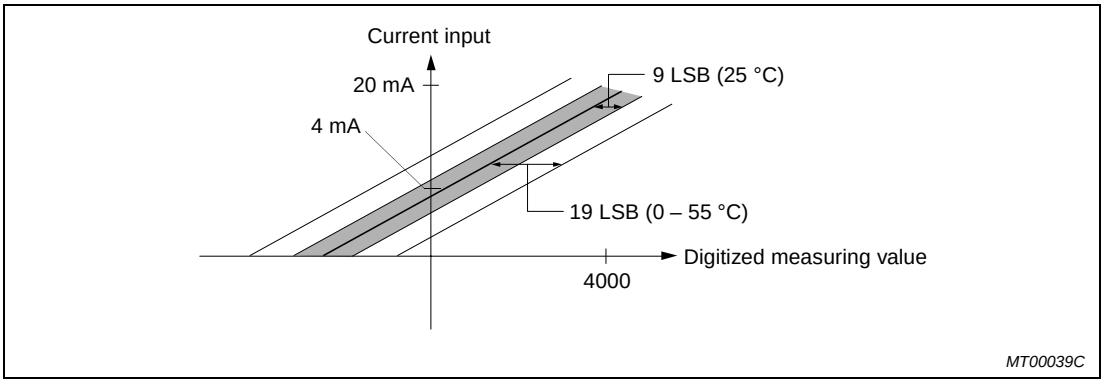


Fig. 4-41: *Overall accuracy of the current input characteristics (4 – 20 mA)*

The overall accuracy of the temperature input characteristics is calculated as follows:

|Overall accuracy**|** = **|**main accuracy**|** + **|**measuring accuracy**|**

The main accuracy results from 0,25 % of the rating 6000 to ±15 LSB.

The measuring accuracy at 25 °C is specified ±10 LSB .

Therefore, the overall accuracy at 25 °C results from ±(15 LSB + 10 LSB) to ±25 LSB. This equals ±2,5 °C.

The measuring accuracy between 0 and 55 °C is specified ±27 LSB.

Therefore, the overall accuracy between 0 and 55 °C results from ±(15 LSB + 27 LSB) to ±42 LSB. This equals ±4,2 °C.

Thus, the characteristic curve of the overall accuracy of the temperature input characteristics shown in figure 4-42 results:

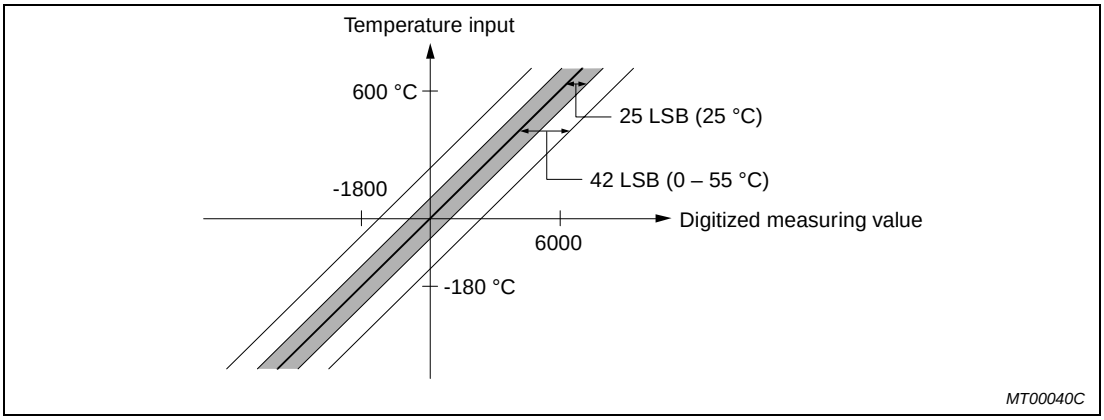


Fig. 4-42: *Overall accuracy of the temperature input characteristics*

4.8 Analog Output Modules

The analog output modules are distinguished as follows:

- MT-4DAV (voltage output 0 – 10 V)
- MT-4DA (voltage output -10 – +10 V, current output 0 – 20 mA/4 – 20 mA)

The following figure shows the block diagram of the analog output modules:

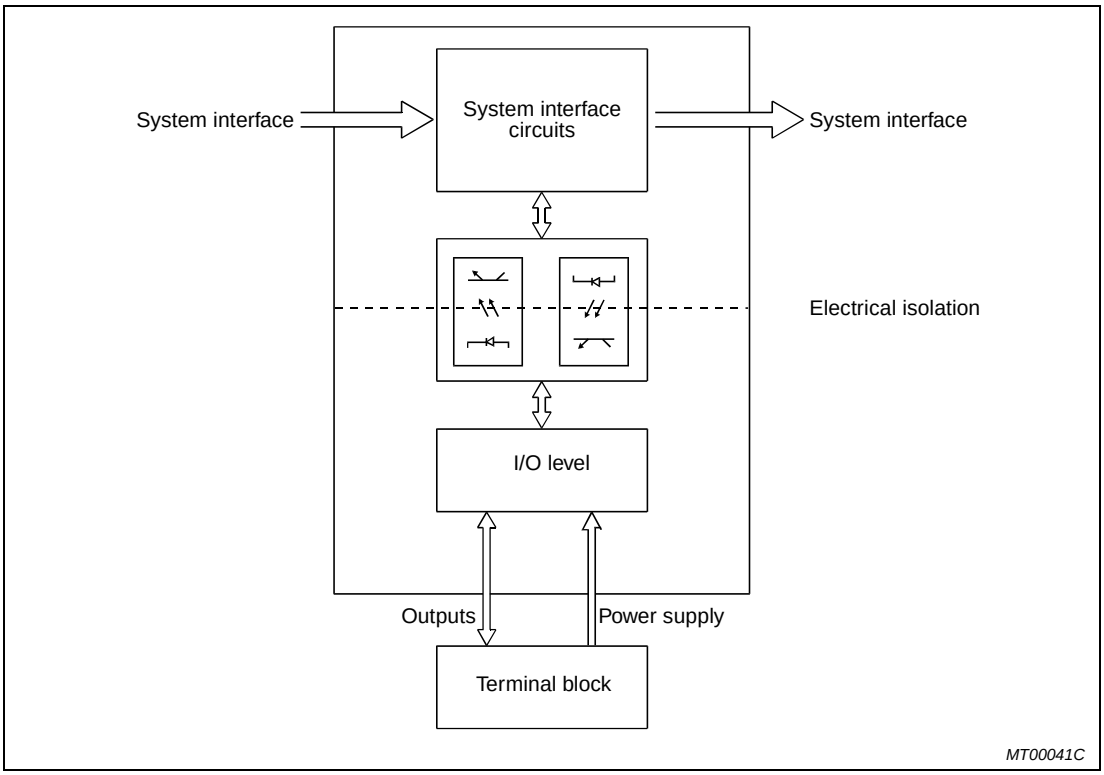


Fig. 4-43: *Block diagram of the analog output modules*

4.8.1 Operating items of the analog output module MT-4DAV

The following figure shows the operating items and accessories of the analog output module MT-4DAV:

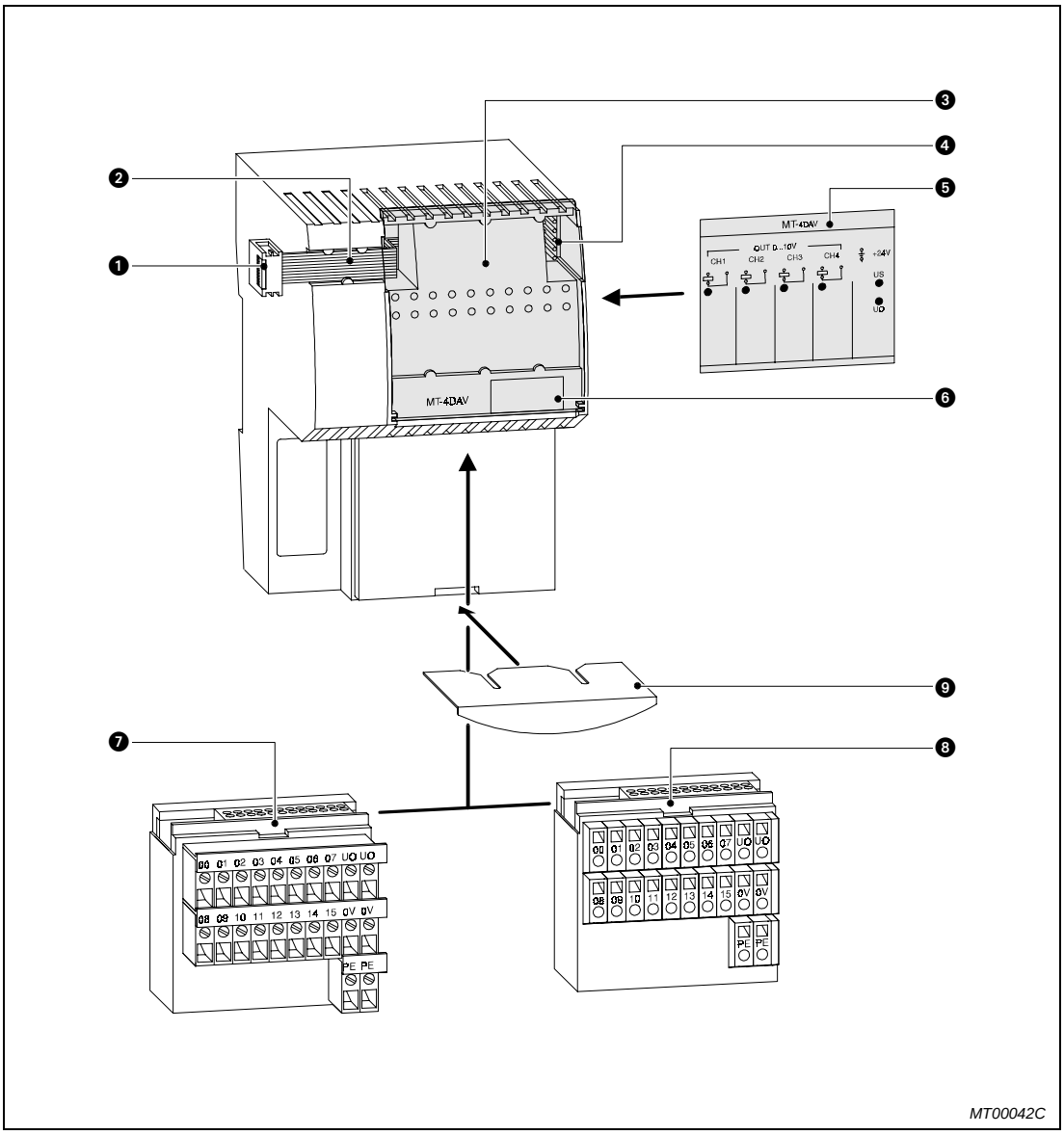


Fig. 4-44: *Analog output module MT-4DAV*

Table 4-18 describes the operating items of figure 4-44:

Position	Item	Description
❶	10-pole ribbon cable connector	Male connector for connection of the module to the basic module or to another extension module or for local extension.
❷	10-core ribbon cable	Connection cable of the modules (internal system connection).
❸	Cover of labeling strip	This cover protects the labeling strips, displays, and internal system connectors against dust and dirt.
❹	Internal system connector	Connector for the adjacent module. Here, the 10-pole ribbon cable connector plug is connected.
❺	Labeling strip	On the labeling strip the inputs and outputs can be identified. For an improved overview the fields for the signal identification align with the according terminals. In addition a status LED is integrated in each signal identification field. The right part of the labeling strip contains the diagnostic LEDs.
❻	Labeling field	In the labeling field the module can be identified.
❼	Terminal block with screw terminals (MT-DAV-TBS)	Here, the outputs, the power supply, the corresponding ground connection, and the PE connection are connected to screw terminals. The terminal block can be withdrawn towards the bottom.
❽	Terminal block with cache clamp terminals (MT-DAV-TBC)	Here, the outputs, the power supply, the corresponding ground connection, and the PE connection are connected to cache clamp terminals. The terminal block can be withdrawn towards the bottom.
❾	Locking plate	The locking plate locks the terminal blocks to the module.

Tab. 4-19: *Operating items MT-4DAV*

4.8.2 Terminal block assignment of the MT-4DAV module

The MT-4DAV module supplies 4 output channels for 0 – 10 V output. The turn-off characteristics of the outputs can be parameterized.

The terminal blocks are assigned as follows:

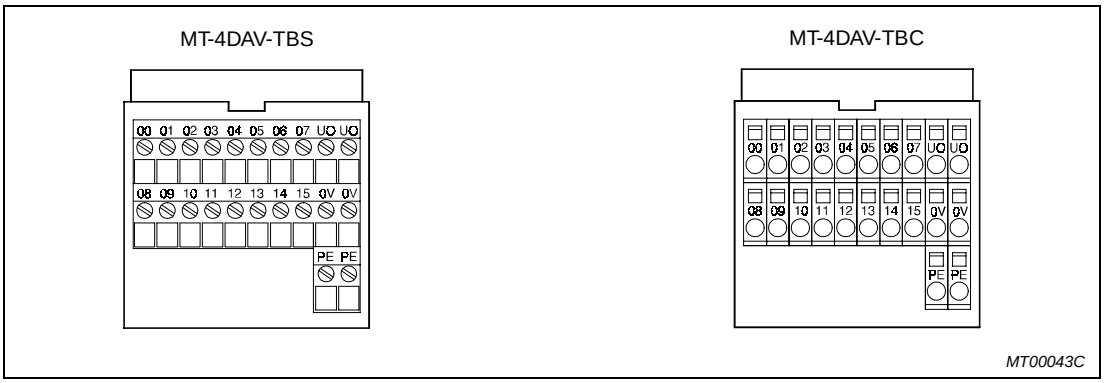


Fig. 4-45: *Terminal blocks MT-4DAV-TBS and MT-4DAV-TBC*

UO:	Power supply 24 V DC for outputs 0 - 3
0V:	Ground connection
PE:	Protective earth
00, 02, 04, 06:	Voltage outputs +
01, 03, 05, 07:	Analog ground
08, 10, 12, 14:	Bridged
09, 11, 13, 15:	Protective earth

4.8.3 Connection of actuators 0 – 10 V

The following figure shows the connection of an actuator to the terminal block for the voltage output of 0 – 10 V:

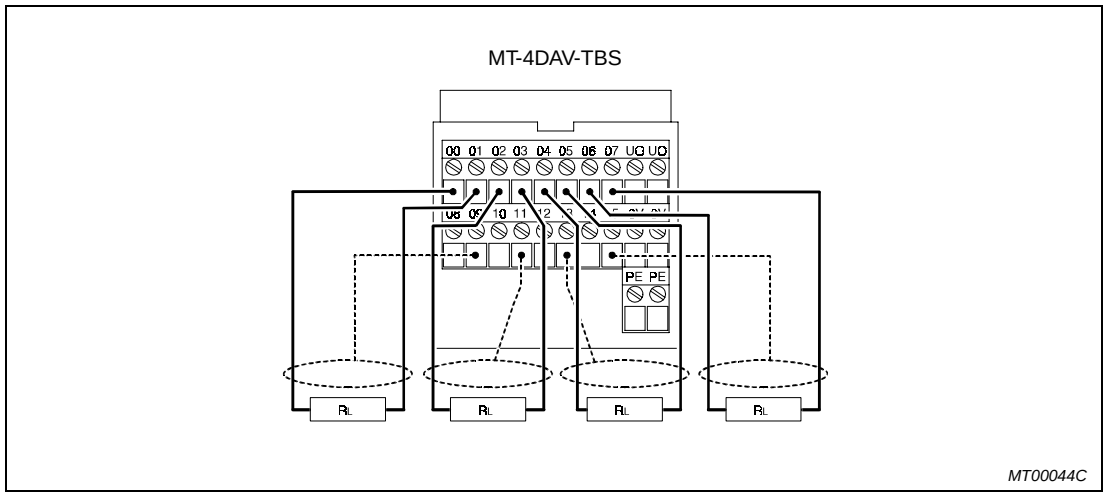


Fig. 4-46: *Sample connection for voltage output*

4.8.4 Voltage output characteristics (output range 0 – 10 V)

The figure 4-47 shows the graph of the voltage output characteristics:

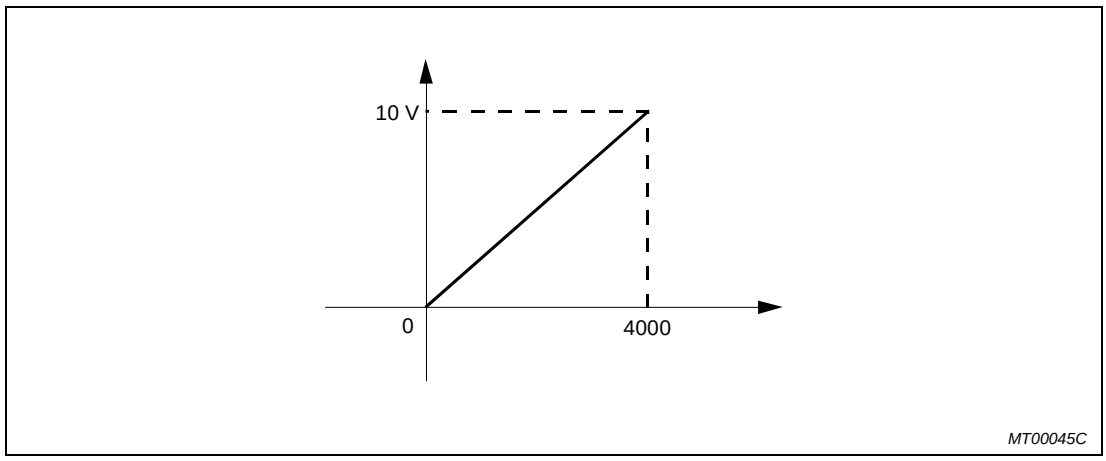


Fig. 4-47: *Voltage output characteristics*

NOTE

For a digital input, that after conversion exceeds the specified maximum value of 10 V or falls below the specified minimum value of 0 V the analog output is limited to the specified maximum value of 10,24 V or to the specified minimum value of 0 V.

4.8.5 Overall accuracy of the MT-4DAV module

The overall accuracy always refers to the entire analog output range.

The following figure shows the overall accuracy of the voltage output range.

The overall accuracy of the voltage output characteristics (0 – 10 V) is calculated as follows:

|Overall accuracy**|** = **|**main accuracy**|** + **|**conversion accuracy**|**

Here, the linearity deviation is ignored.

The main accuracy results from 0,1 % of the digital rating 4000 to ±4 LSB.

The conversion accuracy at 25 °C is specified ±4 LSB.

Therefore, the overall accuracy at 25 °C results from ±(4 LSB + 4 LSB) to ±8 LSB. This equals ±20 mV.

The measuring accuracy between 0 and 55 °C is specified ±8 LSB.

Therefore, the overall accuracy between 0 and 55 °C results from ±(4 LSB + 8 LSB) to ±12 LSB. This equals ±30 mV.

Thus, the characteristic curve of the overall accuracy of the voltage output range shown in figure 4-48 results:

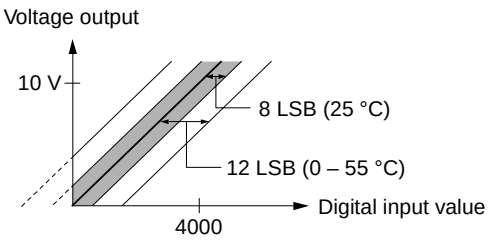


Fig. 4-48: *Overall accuracy of the voltage output characteristics*

4.8.6 Operating items of the analog output module MT-4DA

Fig. 4-49 shows the operating items and the accessories of the MT-4DA module:

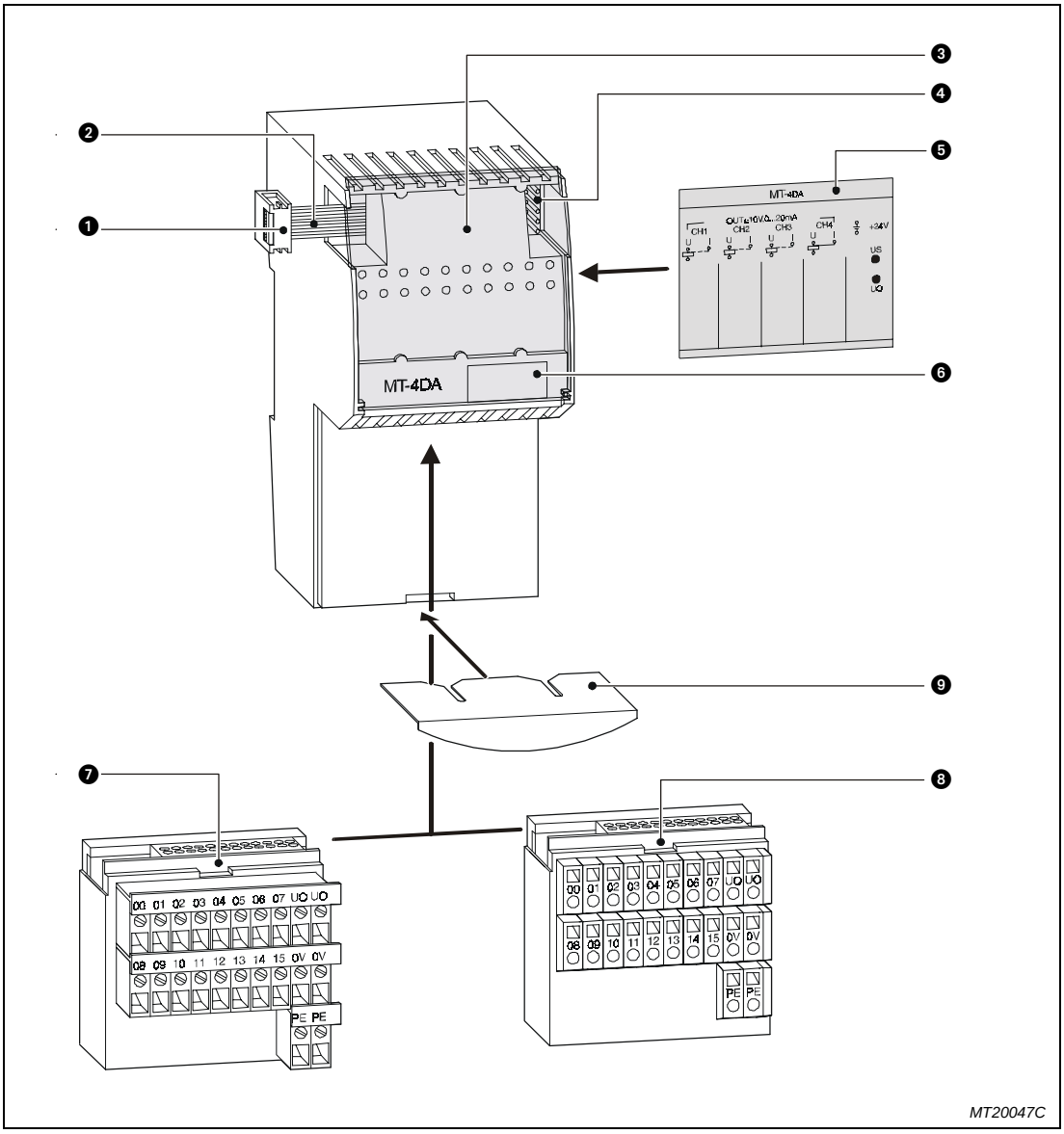


Fig. 4-49: *Analog output module MT-4DA*

Tab. 4-20 describes Fig. 4-49.

Position	Item	Description
❶	10-pole ribbon cable connector	Male connector for connection of the module to the basic module or to another extension module or for local extension.
❷	10-core ribbon cable	Connection cable of the modules (internal system connection).
❸	Cover of labeling strip	This cover protects the labeling strips, displays, and internal system connectors against dust and dirt.
❹	Internal system connector	Connector for the adjacent module. Here, the 10-pole ribbon cable connector plug is connected.
❺	Labeling strip	On the labeling strip the inputs and outputs can be identified. For an improved overview the fields for the signal identification align with the according terminals. In addition a status LED is integrated in each signal identification field. The right part of the labeling strip contains the diagnostic LEDs.
❻	Labeling field	In the labeling field the module can be identified.
❼	Terminal block with screw terminals (MT-4DA-TBS)	Here, the outputs, the power supply, the corresponding ground connection, and the PE connection are connected to screw terminals. The terminal block can be withdrawn towards the bottom.
❽	Terminal block with cache clamp terminals (MT-4DA-TBC)	Here, the outputs, the power supply, the corresponding ground connection, and the PE connection are connected to cache clamp terminals. The terminal block can be withdrawn towards the bottom.
❾	Locking plate	The locking plate locks the terminal blocks to the module.

Tab. 4-20: *Operating items MT-4DA*

4.8.7 Terminal block assignment of the MT-4DA module

The MT-4DAV module provides 4 output channels for an output of -10 – +10 V and 0 – 20 mA. The turn-off characteristics and the output range of the outputs can be parameterized.

The terminal block assignment ist listed below:

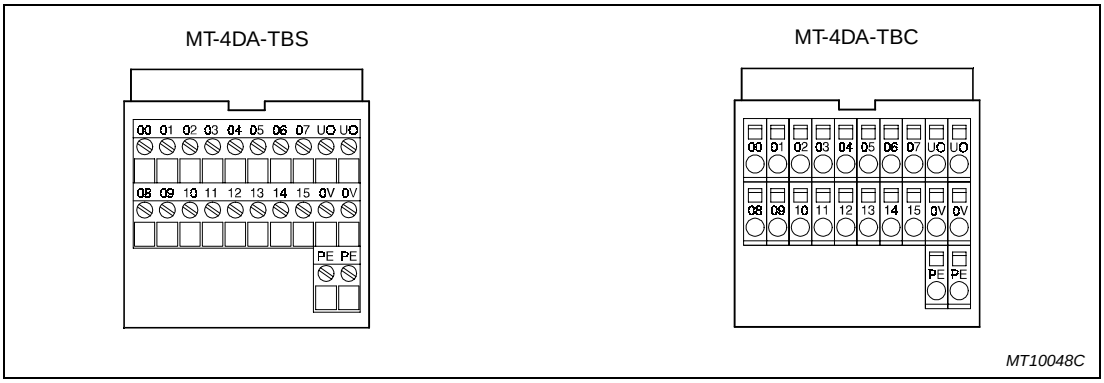


Fig. 4-50: *Terminal block assignment MT-4DAV-TBS and MT-4DAV-TBC*

UO	Power supply 24 V DC for outputs 0 - 3
0V:	Ground connection
PE:	Protective earth
00, 02, 04, 06:	Voltage outputs +
01, 03, 05, 07:	Current outputs +
08, 10, 12, 14	Analog ground
09, 11, 13, 15:	Protective earth

4.8.8 Connection of the actuators -10 V – +10 V

Fig. 4-51 shows the connection of the actuator leads to the terminal block for the ±10 V voltage output:

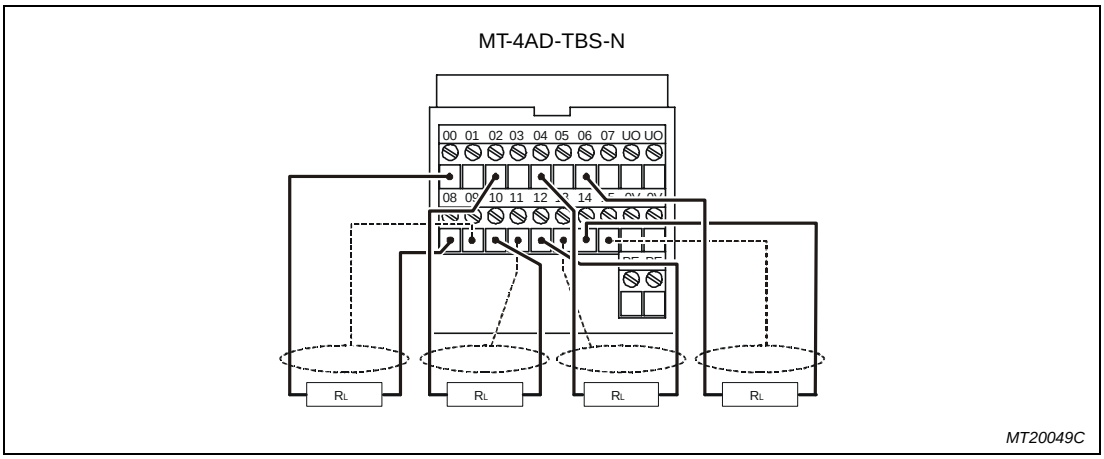


Fig. 4-51: *Sample connection for the voltage output (-10 V – +10 V)*

4.8.9 Voltage output characteristics (output range ±10 V)

Fig. 4-52 shows the graph of the voltage output characteristics:

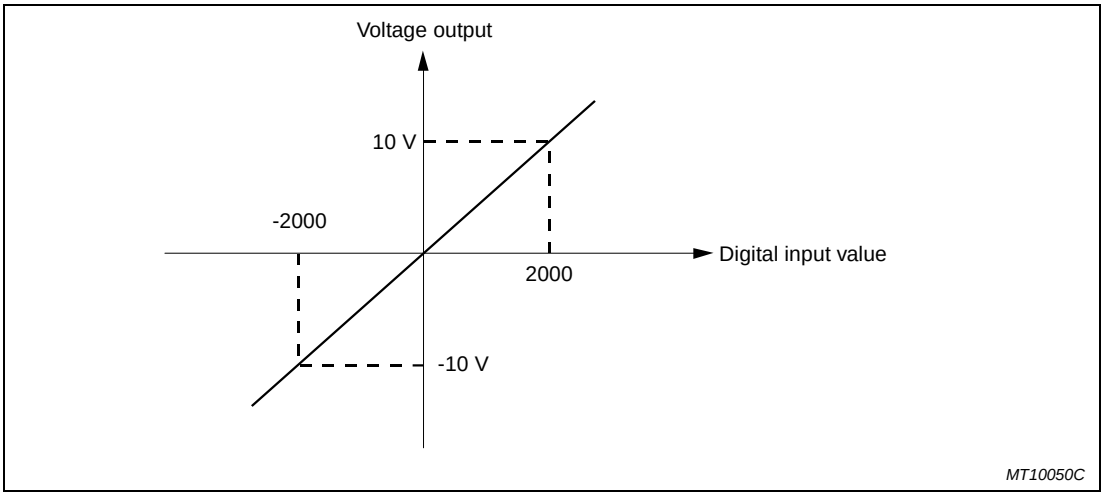


Fig. 4-52: *Voltage output characteristics (±10 V)*

NOTE

For a digital input, that after conversion exceeds the specified maximum value of 10 V or falls below the specified minimum value of 0 V the analog output is limited to the specified maximum value of 10.24 V or to the specified minimum value of 0 V.

In order to enable the voltage output characteristic for the ±10 V output range, within PROFIBUS/DP the bits 5 – 7 in the corresponding parameter byte for the according analog channel must be set as follows:

Bit	Status
5	0
6	0
7	0

Tab. 4-21:
Parameter bits output range ±10 V

4.8.10 Connection of the actuators (0 – 20 mA)

Fig. 4-53 shows the connection of the actuator leads to the terminal block for the current output:

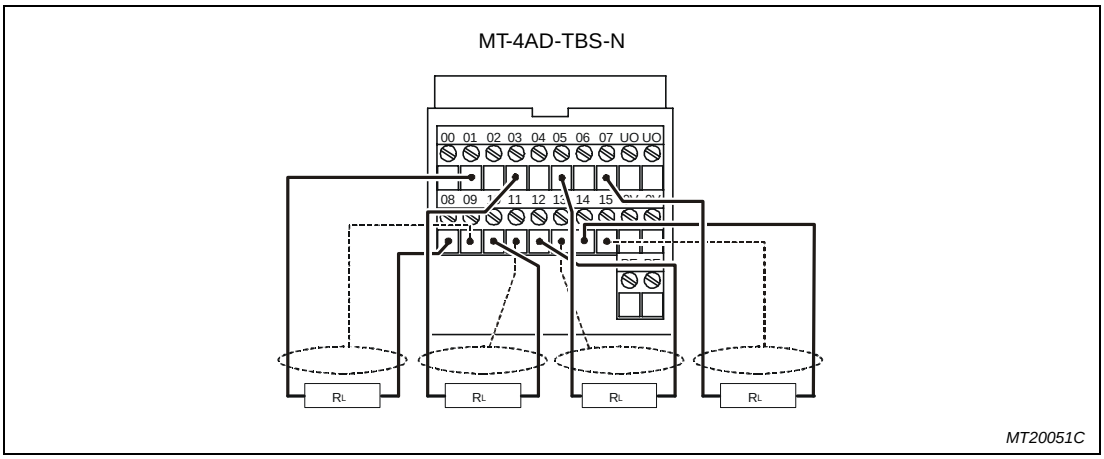


Fig. 4-53: *Sample connection for the current output*

4.8.11 Current output characteristics (output range 0 – 20 mA)

Fig. 4-54 shows the graph of the current output characteristics after changing the input range setting:

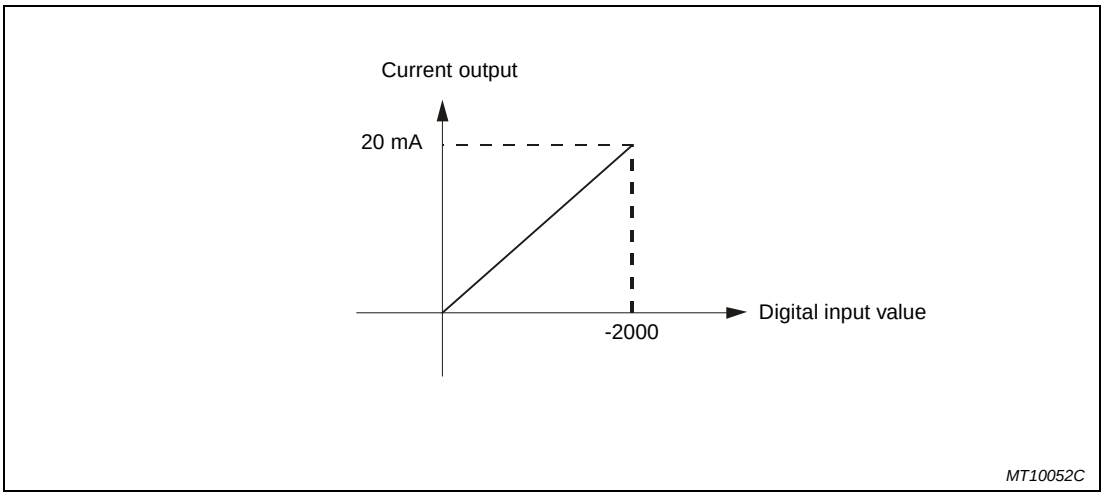


Fig. 4-54: *Current output characteristics (0 – 20 mA)*

NOTE

For a digital input, that after conversion exceeds the specified maximum value of 20 mA or falls below the specified minimum value of 0 mA the analog output is limited to the specified maximum value of 20 mA or to the specified minimum value of 0 mA.

In order to enable the current output characteristic for the 0 – 20 mA output range, within PROFIBUS/DP the bits 5 – 7 in the corresponding parameter byte for the according analog channel must be set as follows:

Bit	Status
5	1
6	0
7	0

Tab. 4-22:
Parameter bits output range 0 – 20 mA

4.8.12 Overall accuracy of the MT-4DA module

The overall accuracy always refers to the entire digital output range. The following figures show the overall accuracies of the output ranges ±10 V and 0 – 20 mA.

The overall accuracy of the voltage output characteristics is calculated as follows:

|Overall accuracy**|** = **|**main accuracy**|** + **|**measuring accuracy**|**

Here, the linearity deviation is ignored.

The main accuracy results from 0,05 % of the rating 2000 to ±1 LSB.

The conversion accuracy at 25 °C is specified ±1 LSB.

Therefore, the overall accuracy at 25 °C results from ±(1 LSB + 1 LSB) to ±2 LSB. This equals ±10 mV.

The measuring accuracy between 0 and 55 °C is specified ±3 LSB.

Therefore, the overall accuracy between 0 and 55 °C results from ±(1 LSB + 3 LSB) to ±4 LSB. This equals ±20 mV.

Thus, the characteristic curve of the overall accuracy of the voltage output range in Fig. 4-55 results:

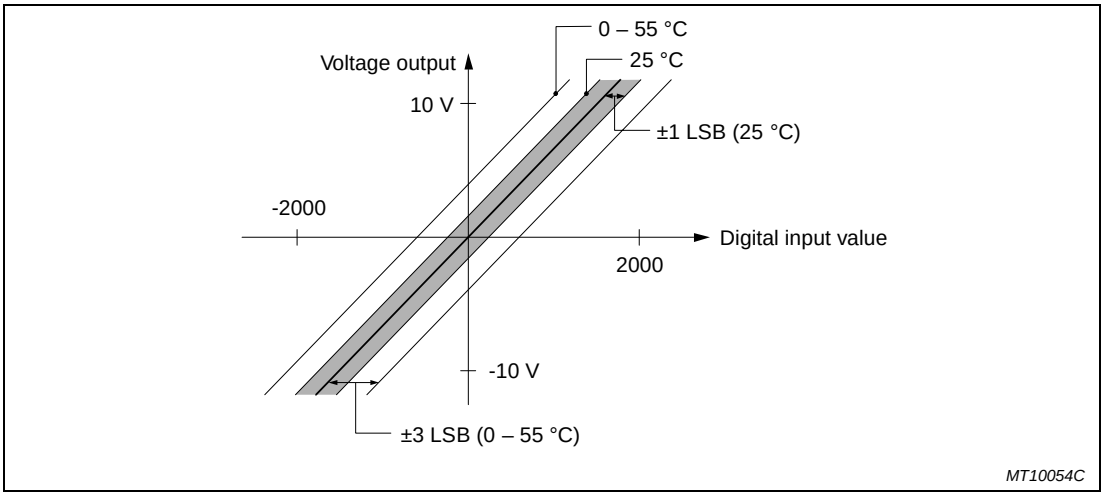


Fig. 4-55: *Overall accuracy of the voltage output characteristics*

The overall accuracy of the current output characteristics 0 – 20 mA is calculated as follows:

|Overall accuracy**|** = **|**main accuracy**|** + **|**measuring accuracy**|**

Here, the linearity deviation is ignored.

The main accuracy results from 0,05 % of the rating 2000 to ±1 LSB.

The conversion accuracy at 25 °C is specified ±1 LSB.

Therefore, the overall accuracy at 25 °C results from ±(1 LSB + 1 LSB) to ±2 LSB. This equals ±20 µA.

The measuring accuracy between 0 and 55 °C is specified ±3 LSB.

Therefore, the overall accuracy between 0 and 55 °C results from ±(1 LSB + 3 LSB) to ±4 LSB. This equals ±40 µA.

Thus, the characteristic curve of the overall accuracy of the current output range in Fig. 4-56 results:

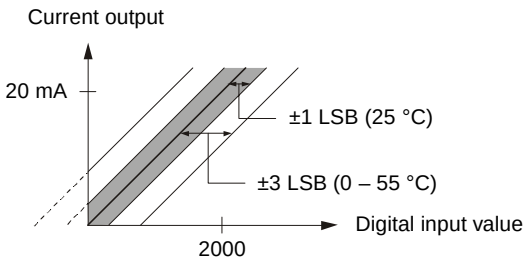


Fig. 4-56: *Overall accuracy of the current output characteristics 0 – 20 mA*

4.9 Local system extension MT-LE

The local system extension MT-LE connects the extension modules on the second level DIN rail to the modules on the first level DIN rail via the extension cable MT-LE-CBL50. It supplies power and and enables communication. The system adaptor connects-through the leads of the extension cable to the internal system connection.

4.9.1 Operating items of the local system extension

The following figure shows the operating items and accessories of the local system extension MT-LE:

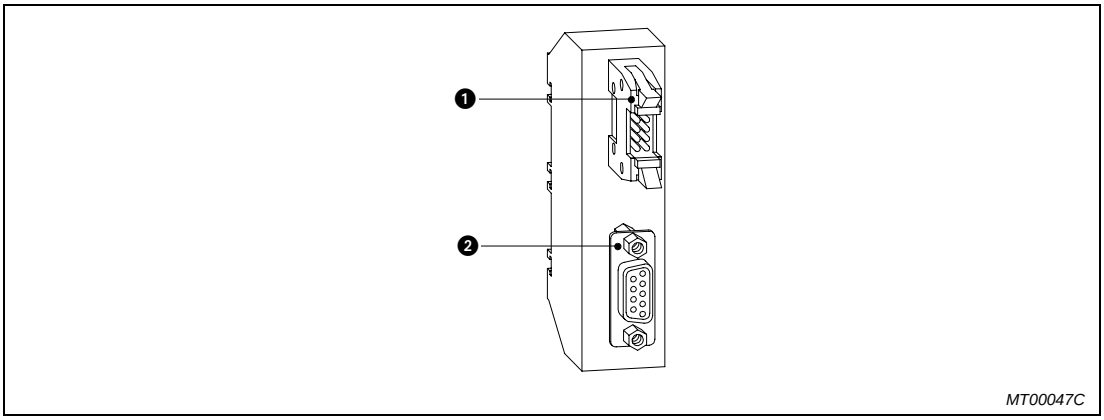


Fig. 4-57: *Local system extension MT-LE*

Table 4-22 describes the operating items of figure 4-57:

Position	Item	Description
❶	Internal system connection	Connector for the adjacent module. Here, the 10-core ribbon cable with male connector is connected.
❷	Local system connection	Connector for the extension cable MT-LE-CBL50 of the basic module.

Tab. 4-23: *Operating items of the MT-LE*

5 Installation

5.1 Safety precautions

- Voltage fluctuations and deviations in the power supply must not exceed the specifications of the modules. Otherwise malfunction and hazardous conditions on the electrical componentry may result.
- For the 24 V power supply a secure electrical isolation of the low voltage has to be ensured. Only power supply units complying with either IEC 364-4-41 or HD 384.04.41 (VDE 0100 part 410) may be used.
- Connection cables and signal lines have to be wired in a way avoiding inductive or capacitive interference that may disturb the automation functions.
- Automation facilities and their controls have to be installed in a way protected against accidental actuation.
- Anywhere in the automation installation or plant where occuring malfunctions may cause injury to persons or damage to property, additional external precautions have to be taken or safety equipment has to be installed that ensures a safe and secure operating condition even in the case of a failure (e.g. independent limit value switches, mechanical lockings etc.).

5.2 Ambience Conditions

Never expose the modules of the MT series to the following ambience conditions:

- Installation sites with ambient temperatures exceeding a range from 0 to +55 °C.
- Storage locations with ambient temperatures exceeding a range from -20 to +70 °C.
- Installation sites with a relative humidity of air exceeding a range from 10 % to 90 %.
- Installation sites where water may condensate due to sudden temperature fluctuations.
- Locations with highly inflammable gases.
- Ambience that contents a high degree of conductive dusts (metal chips, oil mist, fog, salt, and organic solvents)
- Locations exposed to direct sunlight.
- Locations where strong power and magnetic fields are generated.
- Installation sites where vibration and shock are directly transmitted to the head station.

5.3 Calculation of the produced waste heat

The operating ambient temperature of the MT system must not exceed 55 °C. The heat produced by the system has to be dissipated by ventilation.

The different areas of power consumption are shown below:

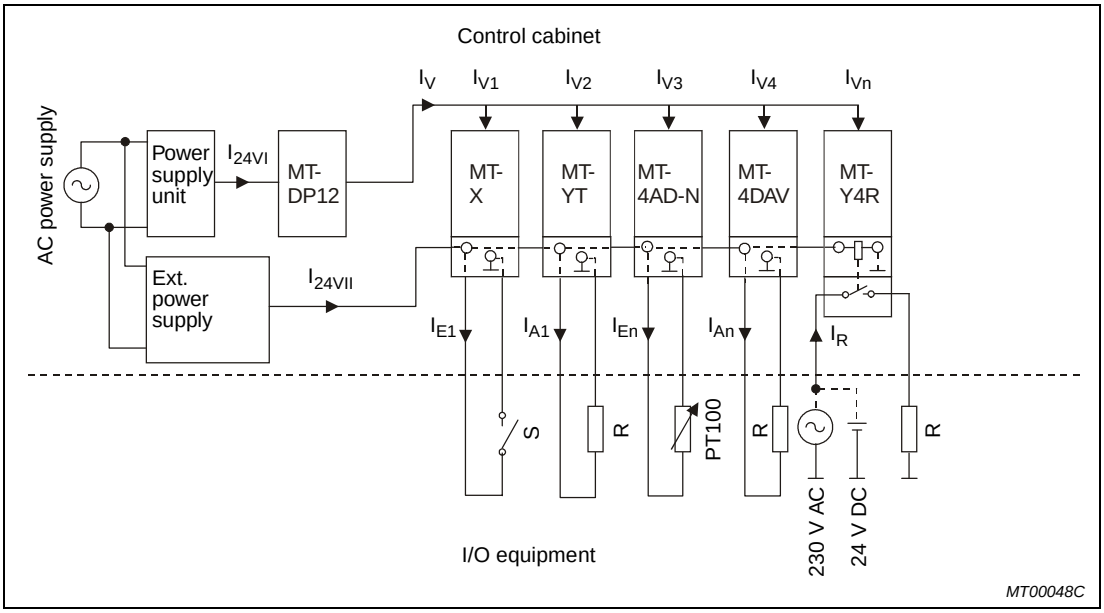


Fig. 5-1: *Determination of power consumption*

The meanings of the indications in the picture above are:

I_{24VI} =Input current of the MT-DP12 module. The consumption depends on the number of connected modules supplied via the internal system connection (max. 500 mA for maximum configuration). The current consumption of the module circuits of the MT-DP12 module is included.

I_{24VII} = Input current of the modules supplying the input and output circuits

$I_{24VII} = I_{E1} +...+ I_{En} + I_{A1} +...+ I_{An}$

I_E =Current of the input circuit (MT-Y4R module: the feed circuit for the relays).

I_A =Current of the output circuit

I_V = Current supplying the modules via the internal system connection (supplied by MT-DP12)

$I_V = I_{V1} + I_{Vn}$ *(must be* $\leq$ *900 mA)*

I_R = Load of the relay contacts of the MT-Y4R module

R =Resistor

S =Switch

NOTE

Since the integrated power supply unit of the MT-DP12 module supplies at maximum 900 mA, the total of currents of all single devices (I_V) must not exceed this value.

Power consumption of the power supply units

The efficiency of the power supply unit is approximately 0,7. From this 70% of secondary power about 30 % (3/7) is converted into heat. This has to be taken into account for the calculation produced heat.

P_{VI} = W_{NtI} = 3/7 (I_{24VI} x 24 V)

P_{VII} = W_{NtII} = 3/7 (I_{24VII} x 24 V)

Total power consumption 8 V DC

Each module is supplied with a voltage of 8 V.

$W_V = P_V$ = (Iv x 8V) x n [W]

$I_V = I_{V1} + ... + I_{Vn}$

n = number of modules

Total power consumption of the MT system

The total of the values previously calculated amounts to the total power consumption of the MT system:

$W = W_{NtI} + W_{NtII} + W_V$ [W]

Further calculations are required to determine the stray power resulting from the heat generation of the remaining devices in the control cabinet.

T = W / (U x A) [°C]

W: Power consumption of the entire MT system

A: Area of the control cabinet (m^2)

U: 6, if the air inside the cabinet is ventilated by a cooling fan

4, if the air inside the cabinet is not ventilated

NOTE

If the temperature inside the cabinet exceeds the allowable maximum ambient temperature of 55 °C permanently, a cooling fan, heat exchanger, or refridgerating set has to be installed.

In general, cooling fans should be equipped with suitable filters and adequate protection.

5.3.1 Cabling

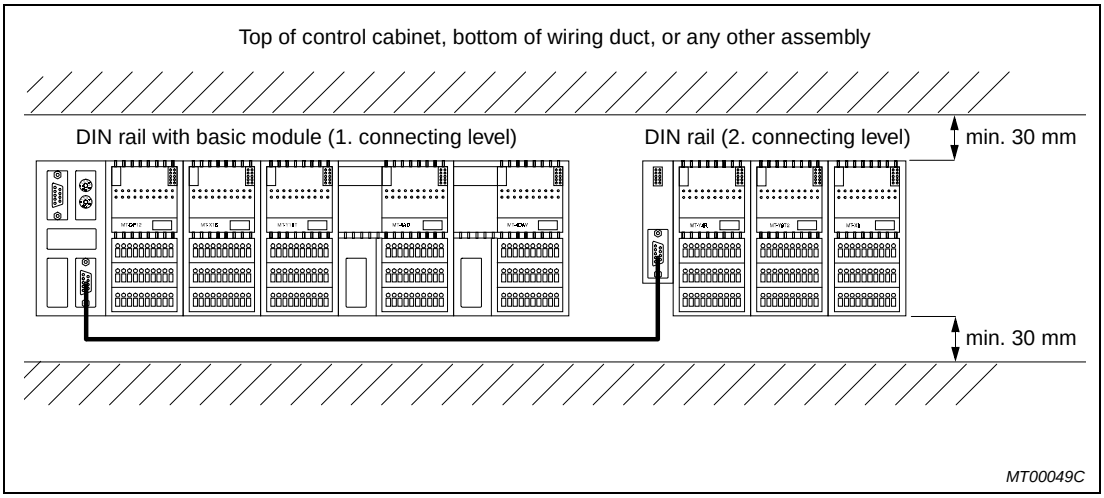


Fig. 5-2: *Parallel arrangement of the modules*

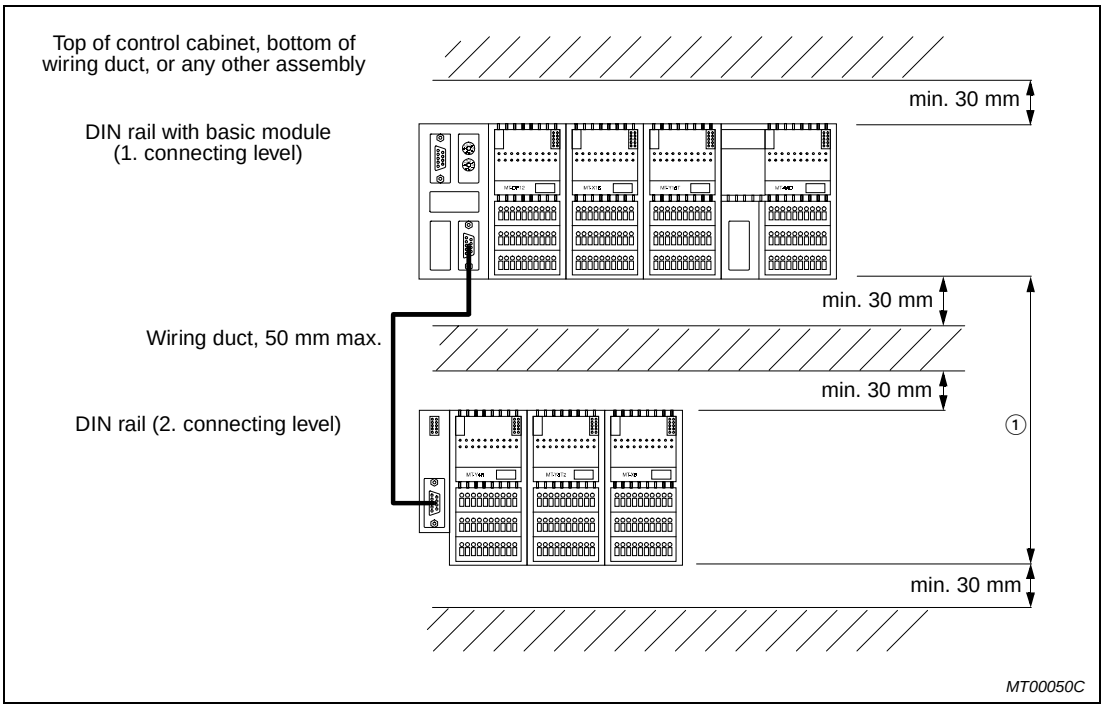


Fig. 5-3: *Serial arrangement of the modules.*

① Depending on the length of the extension cable

- In order to ensure a sufficient ventilation and to make the exchange of modules easier, a clearance of at least 30mm should be kept between the modules and the top/bottom of the cabinet.
- Never mount the devices vertically or horizontally, otherwise they are not ventilated sufficiently.

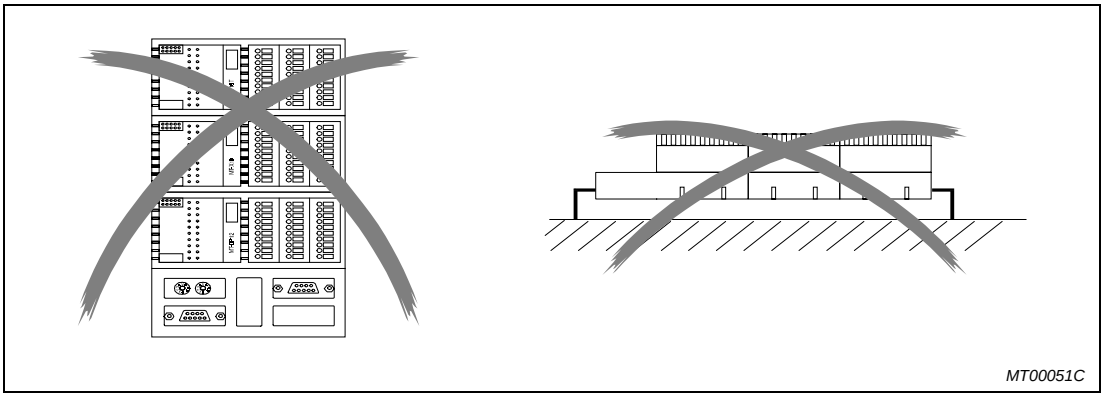


Fig. 5-4: *Vertical and horizontal mounting not allowed*

- Ensure that the DIN rail mounting surface is uniform to prevent strain. Excessive force applied to the printed circuit boards causes malfunctions. Mount the DIN rail for the modules on a flat surface.
- Mount the modules in a separate cabinet or at least distantly from electromagnetic switching devices, that may cause vibrations or disturbances.
- Provide an appropriate wiring duct.

  In case the dimensions from the top and bottom of the modules are less than those shown in figures 5-2 and 5-3 note the following points:

  – If the duct is located above the modules, the depth of the duct should be 40 mm at maximum to provide sufficient ventilation.
    The clearance of the duct to the MT series modules should provide easy access to cables and modules for later modifications.

  – If the duct is located below the modules, the clearance to the modules should provide sufficient room for the power supply leads, the 24 V DC leads, and the I/O signal lines.

- If an equipment that generates noise or heat is positioned in front of the modules (e.g, mounted on the back side of a cabinet door), allow a clearance of at least 100 mm between the modules and the equipment (see fig. 5-5).

  If the modules and such an equipment are mounted side by side, allow a clearance of at least 50 mm.

  .

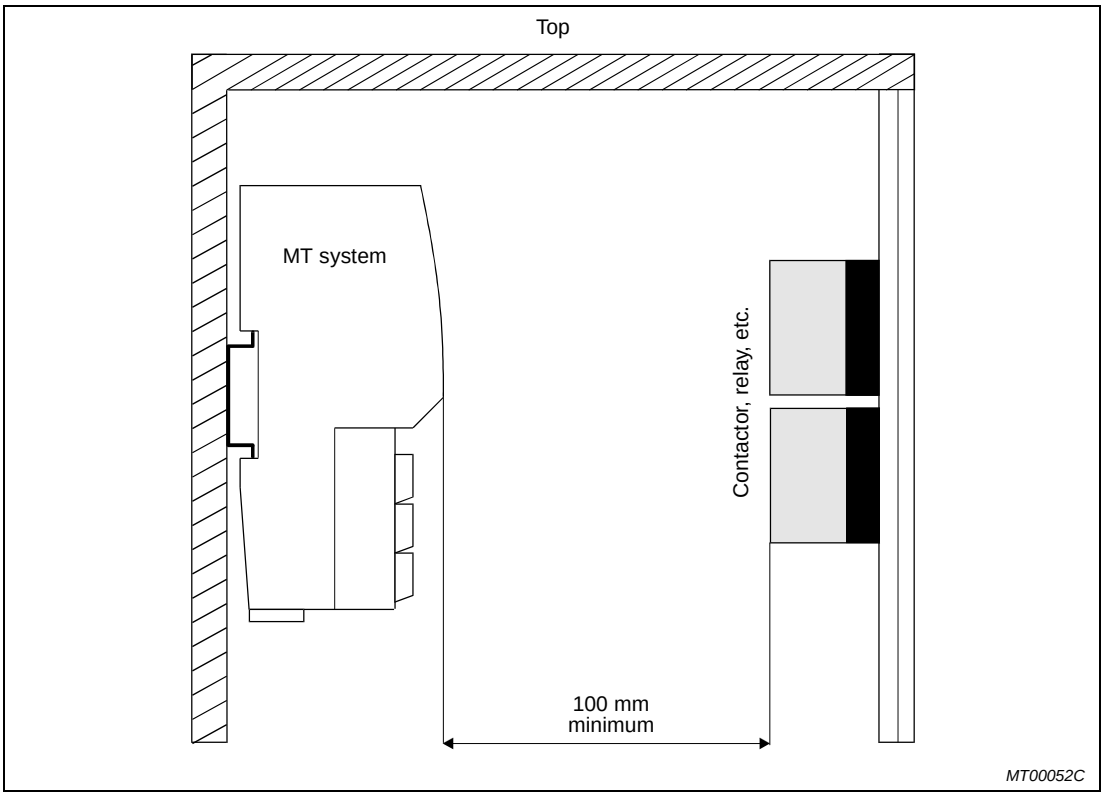


Fig. 5-5: *Opposite arrangement of modules and equipment*

5.4 Installation and Removal of Modules

E

CAUTION:

Always switch off the power supply before installing or removing a module.

Installation

① Switch off the power supply!

② Attach the module with the lower guiding groove to the DIN rail.

③ Press the module onto the DIN rail until its anchoring clip snaps in properly.

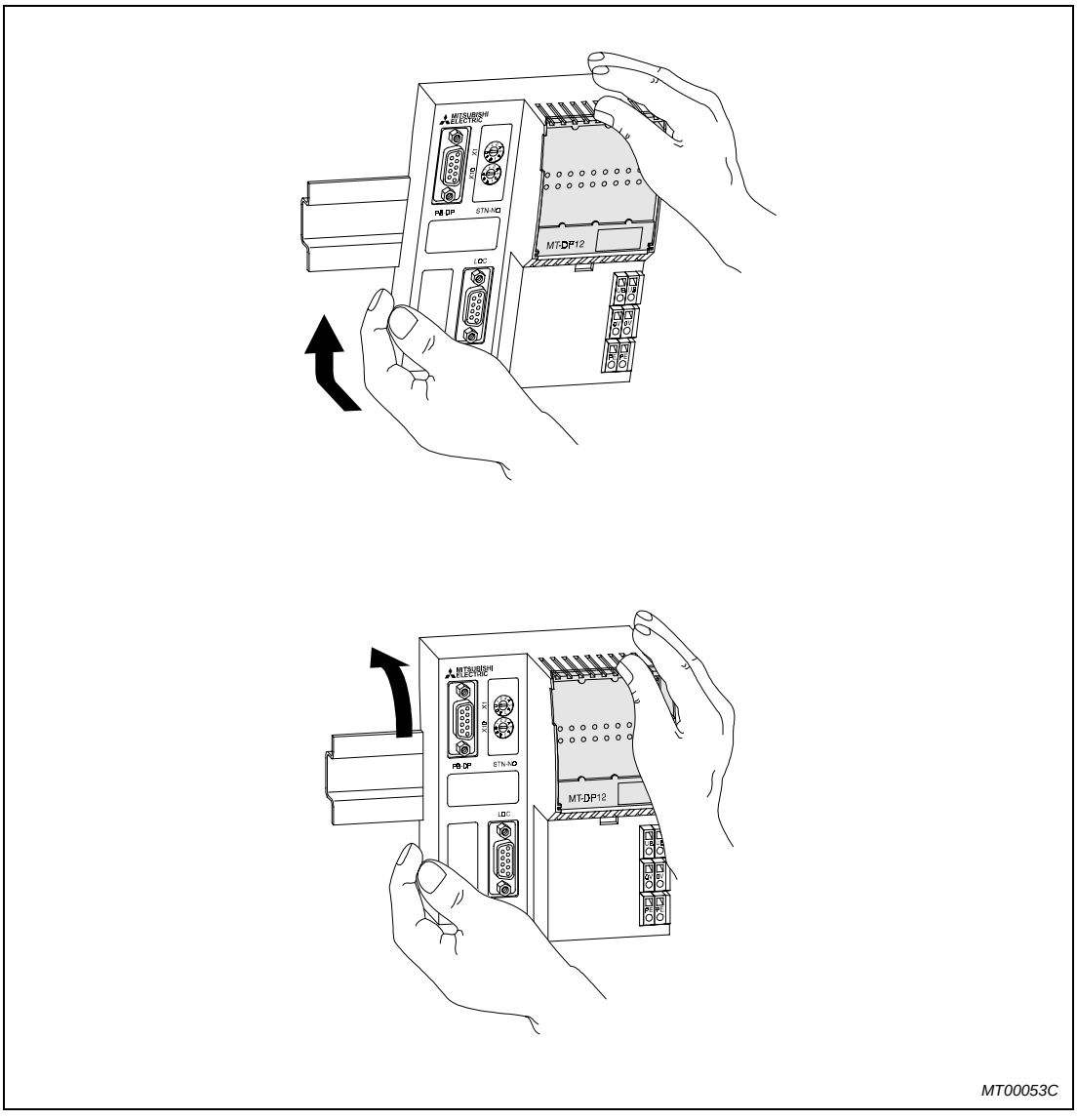


Fig. 5-6: *Installation of a module*

Removal

E

CAUTION:

Always switch off the power supply before removing or installing a module.

① Switch off the power supply!

② Hold the module with both hands. Press the module towards the top and tilt it carefully towards yourself while keeping the module in the lower guiding groove.

③ Remove the module from the guiding groove towards the bottom .

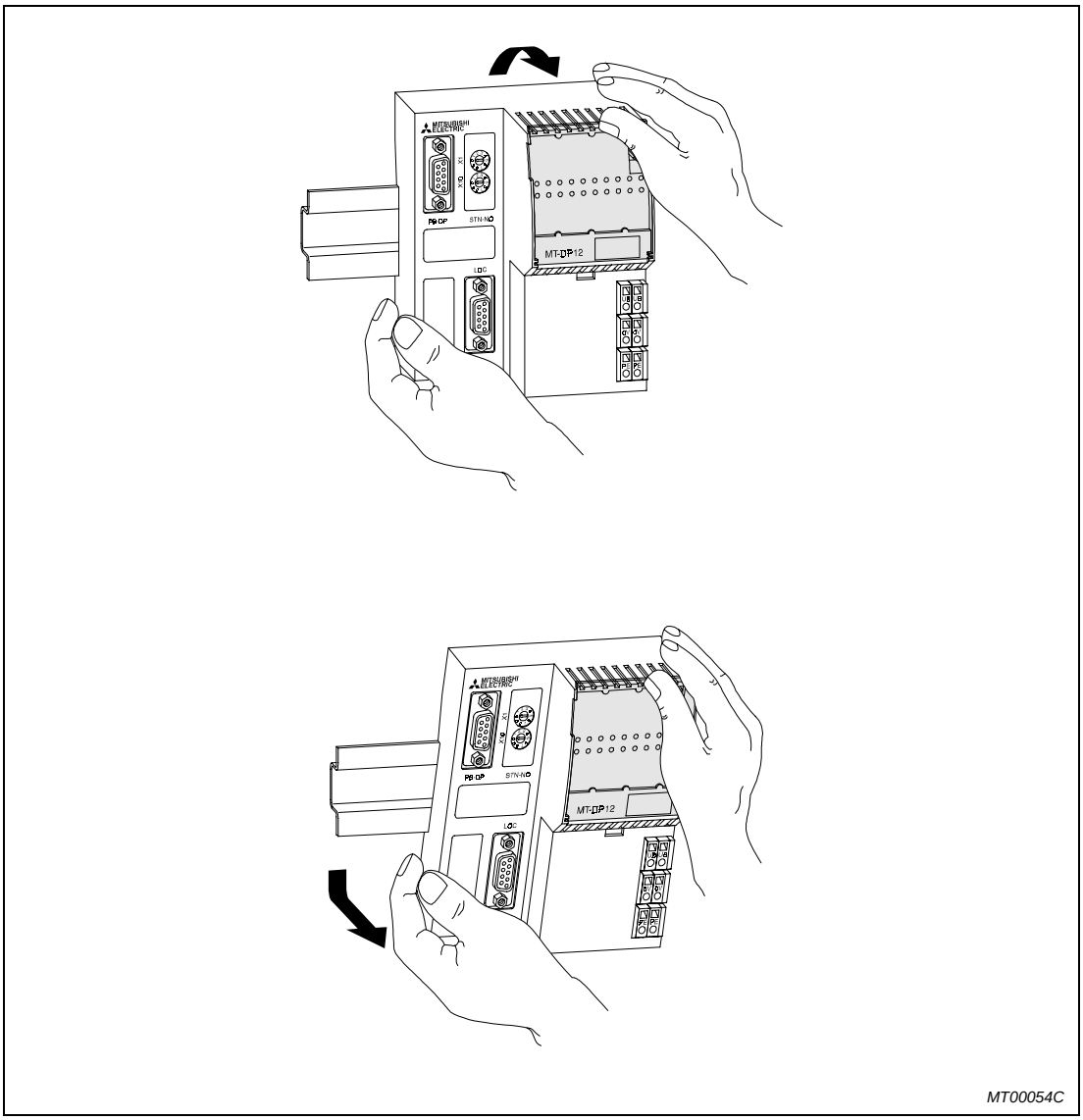


Fig. 5-7: *Removal of a module*

5.5 Mounting of the Potential Terminal Blocks

If a potential terminal block is to be used, first the MT module with a regular terminal block has to be mounted to the DIN rail. Then the potential terminal block can be engaged on the MT module (see figure 5-8).

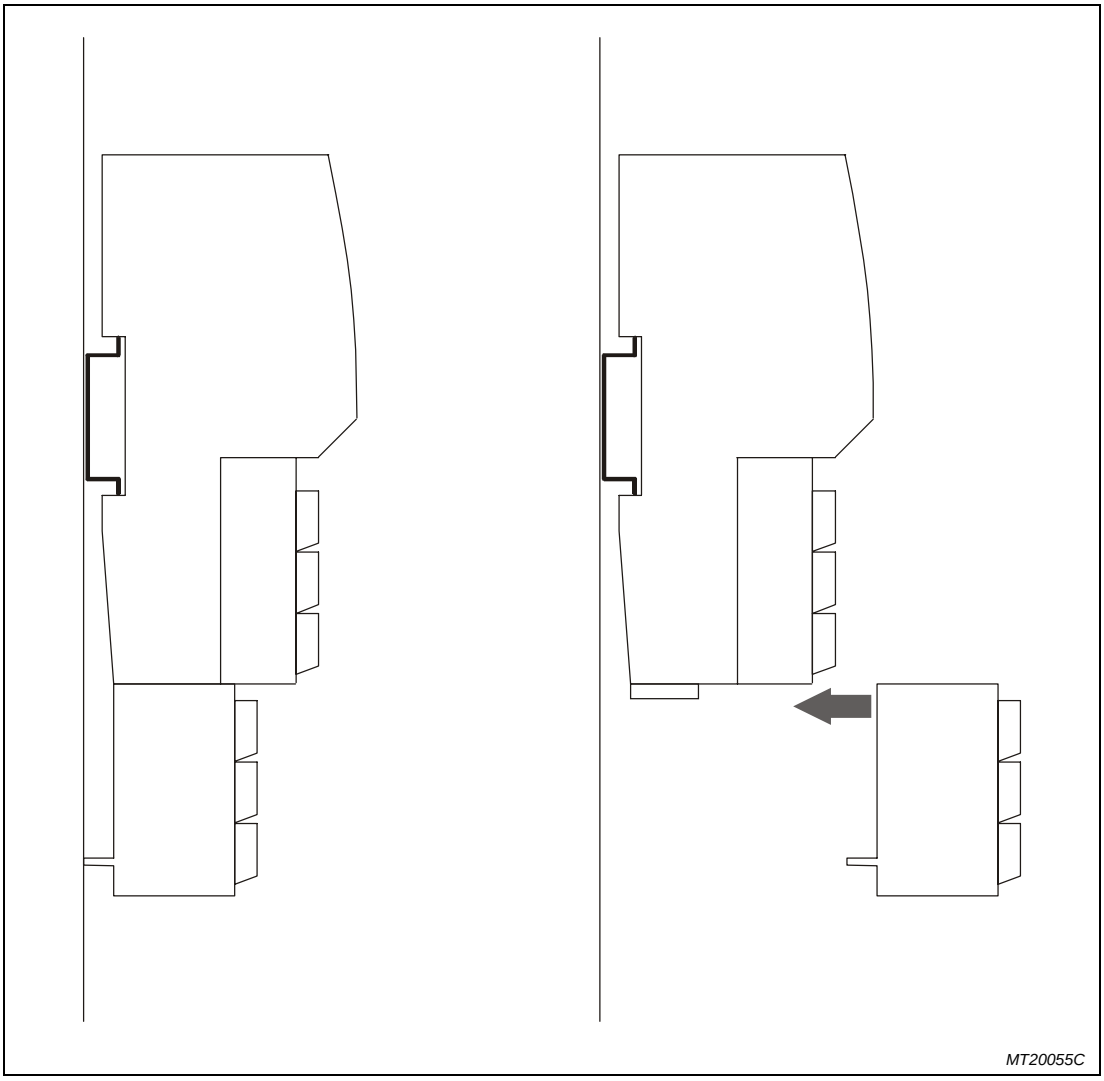


Fig. 5-8: *Mounting potential terminal block*

For mounting on deep DIN rails the potential terminal blocks have to be mounted with the enclosed snap-in pin (see figure 5-9).

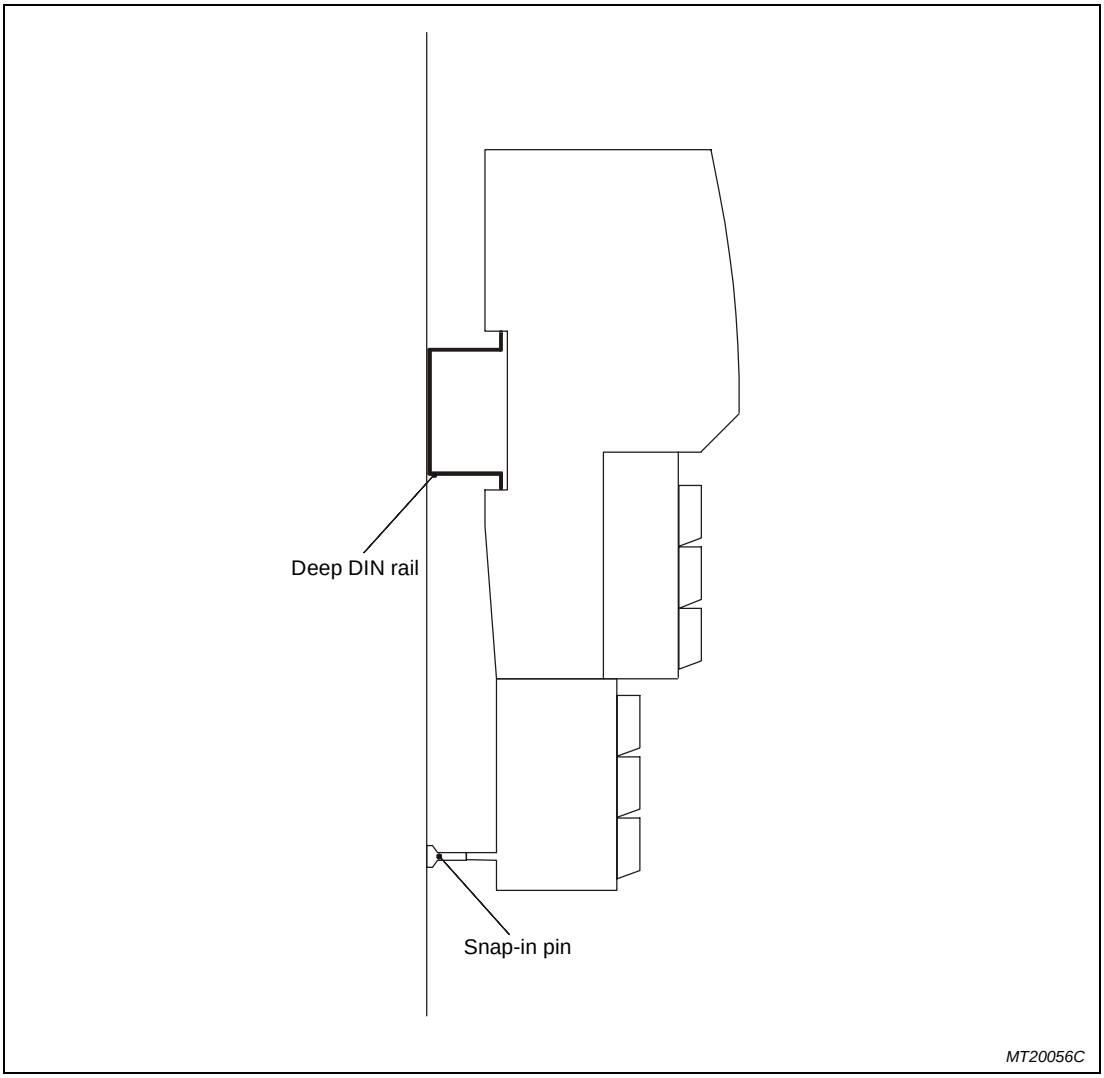


Fig. 5-9: *Mounting snap-in pin for deep DIN rail*

5.6 Wiring

E **CAUTION:**

Ensure a proper earthing. Earth all equipment before connecting the power and control circuits.

For the wiring keep the EMC directive and the European norm EN 60204.

For keeping the EMC directive there are several basic measures that are described more detailed in the following sections:

- Install equipment in a closed, earthed metal cabinet (Reduces the radiated emissions)
- Use a supply filter (Reduces the mains conducted emissions)
- Ensure good earthing (No antenna effect)
- Use shielded wire (Reduces the radiated emissions)
- Keep sensitive equipment away from sources of disturbances or install the source in a separate cabinet (Reduces coupling)

5.6.1 EMC conforming installation in cabinet

Cabinet design and layout is very important for controlling EMC. Take the following recommendations as a guideline:

- Use an earthed metal cabinet.
- Use shield gasket or other conductive material between the cabinet cover or door and cabinet. Also use short and thick wire (preferably braided) to connect the cover and cabinet.

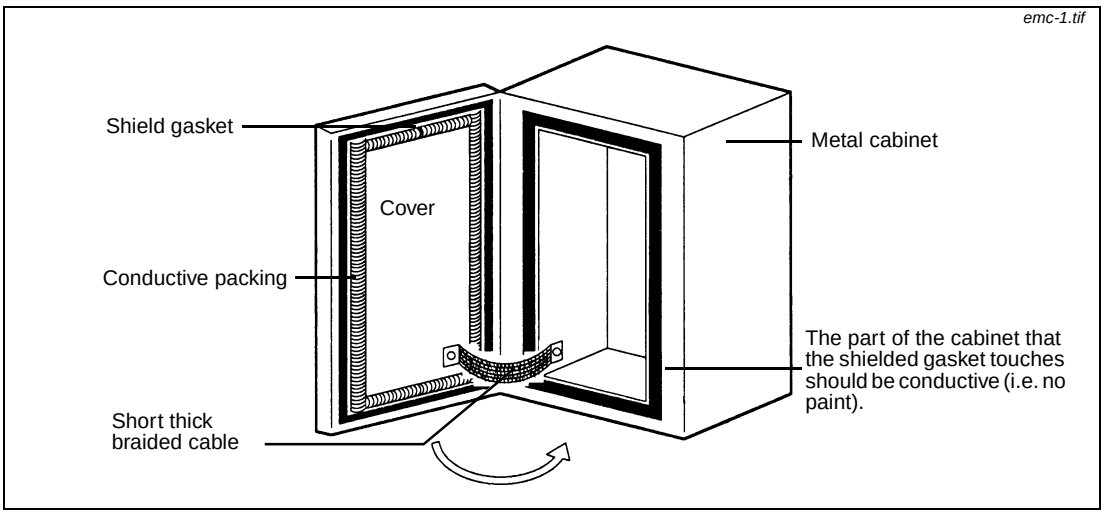


Abb. 5-10: *Recommended design of a cabinet*

- When fitting a mains filter mask or remove the paint or plating from the cabinet to make a good electrical connection between filter and cabinet. Confirm that the equipment mounting panel is also electrically earthed to the cabinet chassis.
- Weld or screw all cabinet plates at a maximum of 10 cm intervals. Also, the maximum dimension of holes in the cabinet should be should be less than 10 cm. If there is an interval (space), the shielding effect may be lost. Holes larger than this should be covered with a wire mesh, electrically connected to the cabinet. No part of the enclosure should be electrically "floating". Where insulating connections like painted metal are used, remove the paint to create good contact.

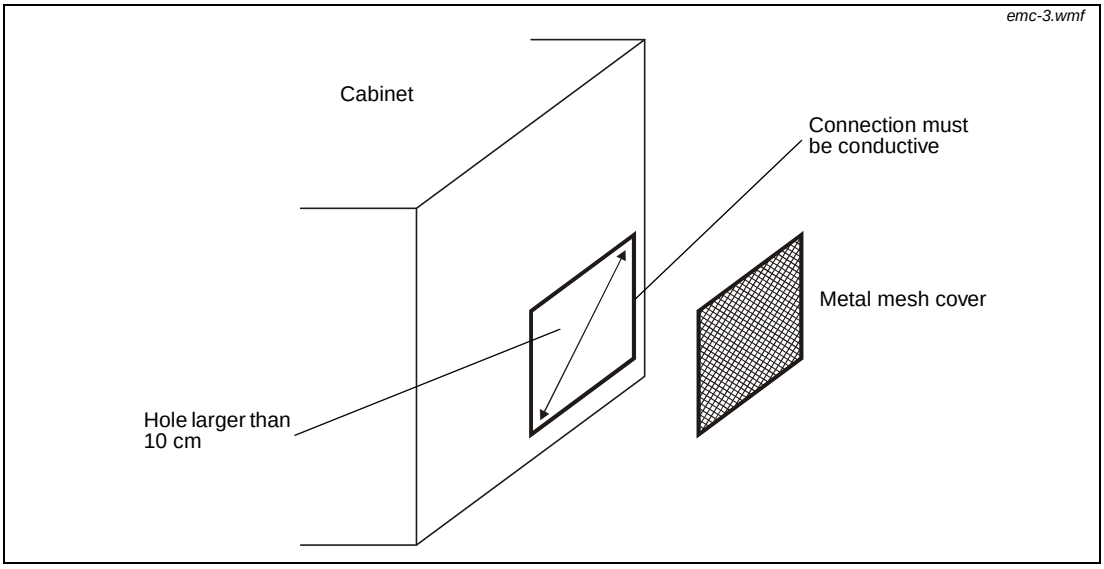


Abb. 5-11: *Example for metal mesh cover*

5.6.2 EMC conforming cable routing and shielding

- Use shielded cable or route the cable in a metal conduit.
- Connect the cable shield or conduit to the cabinet using a metal cable gland, a "P"-clip or a "U"-clip to create the shortest earth path.

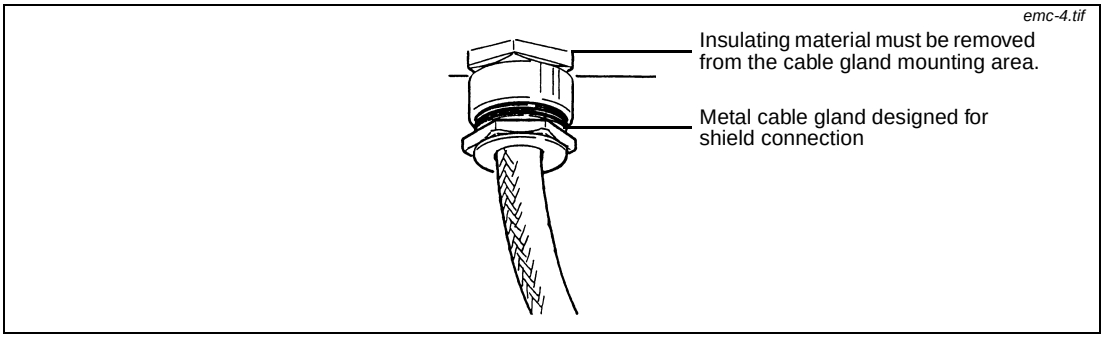


Abb. 5-12: *Cable routing and shielding via metal cable gland*

- The position of the "P"-clip or "U"-clip should be as close a possible to the cable entry point.

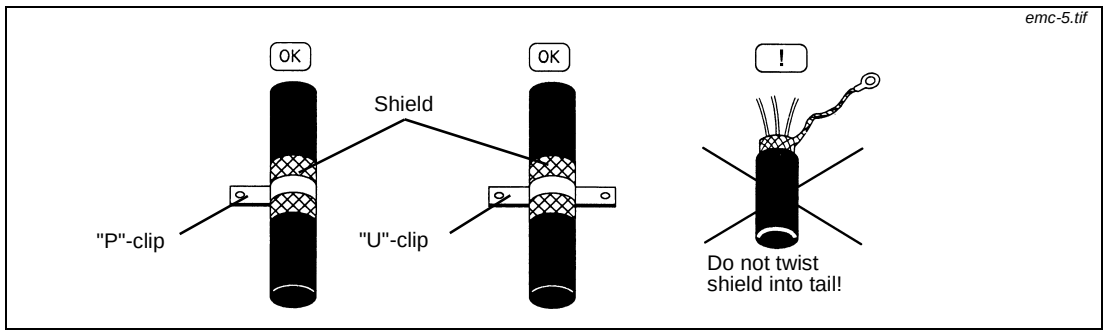


Abb. 5-13: *Cable routing and shielding via "P"-clip or "U"-clip*

- Separate control signal wires as far as possible (min. 30 cm) from all high voltage or high current cables.
- Do not route control signal wires and high voltage or high current cables in parallel.

5.6.3 Wiring instructions

Connection of the power supply

- If the voltage fluctuation are higher than the stipulated value, a constant-voltage transformer has to be installed.

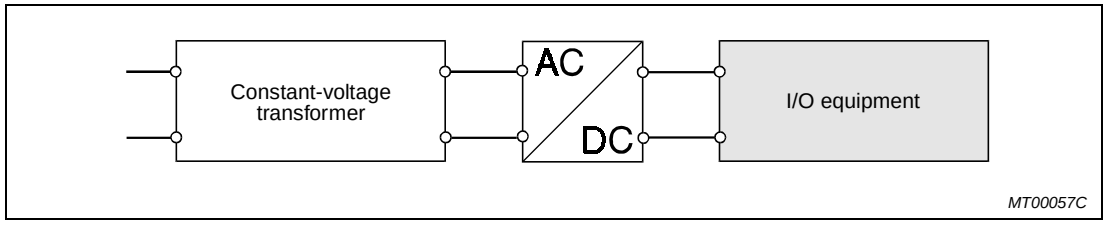


Fig. 5-14: *Connection of a voltage regulator*

- The power supply unit must not generate noise across wire, the controllers, and ground. If excessive noise is generated an isolating transformer has to be connected.

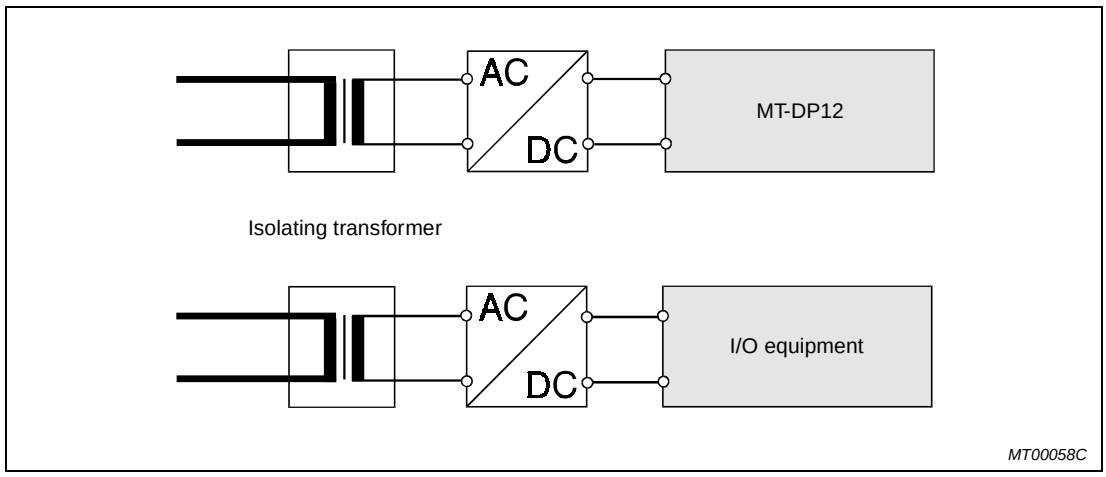


Fig. 5-15: *Connection of an isolating transformer*

- The power supply of the basic module should be separated from that of the I/O and power equipment as shown below:

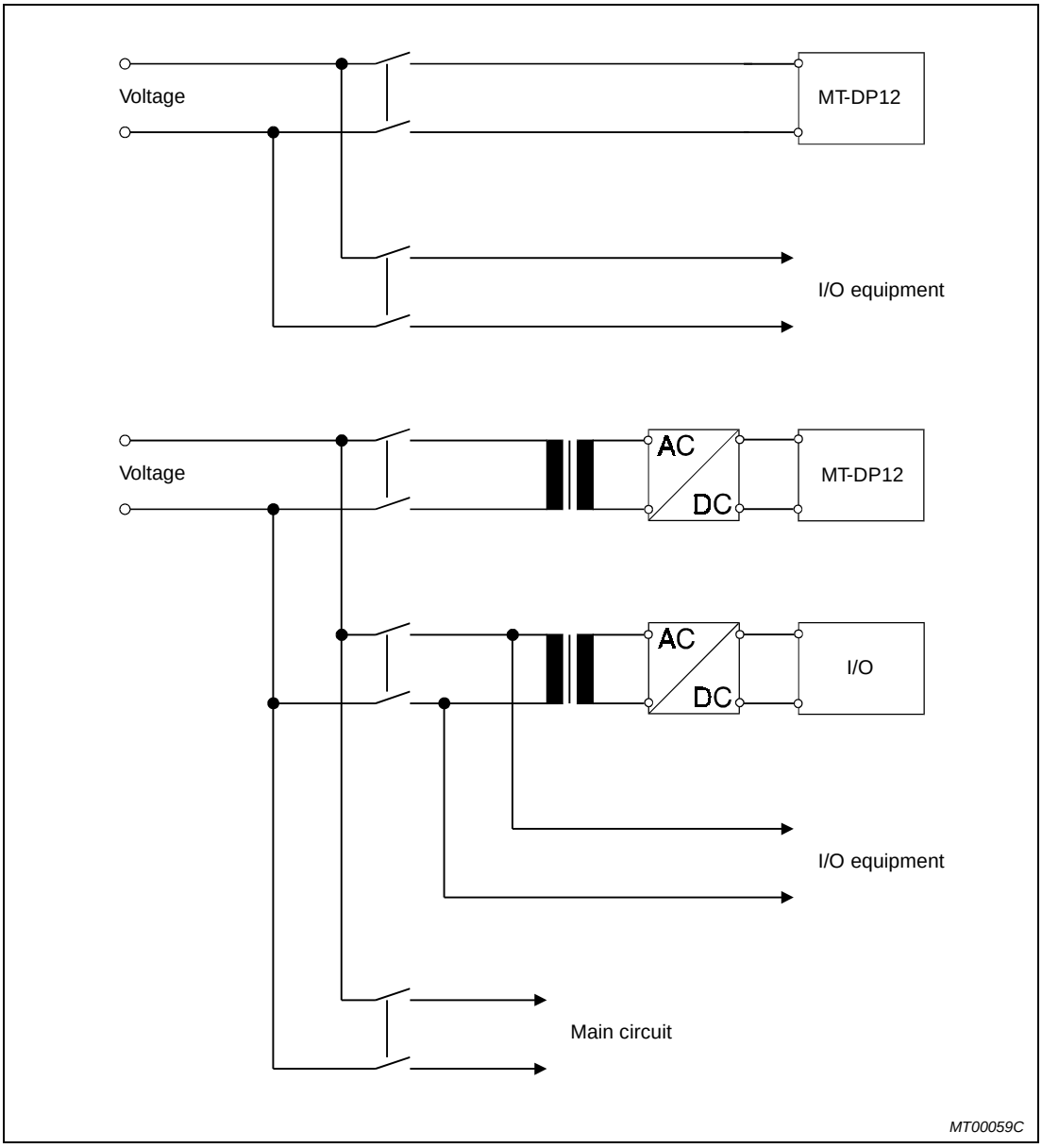


Fig. 5-16: *Separation of the mains supply circuits*

- Twist the main supply and the DC 24 V cables as closely as possible or bundle them with cable binders. Connect the modules with the shortest possible wire lengths.
- To minimize voltage drop, use wires with a maximum cross-section (2,5 mm^2) for the DC 24 V supply should be used.
- The main supply and the DC 24 V cables must not be bundled with the main-circuit wires or with the I/O signal lines (high-voltage, large-current). Also, the wires mentioned must not be laid too close together. If possible, provide more than 100 mm distance between them.

Wiring of the external equipment with the inputs and outputs.

- The cross-section of the connecting wires for the input and output terminals is 0,75 to 1,5 mm^2 with end sleeves, and 2,5 mm^2 without end sleeves. However, a cross-section of 0,75 mm^2 is recommended.
- Input and output lines should always be laid separately.
- I/O signal lines have to be laid with a minimum distance of 100 mm to high-voltage and large-current main circuit wires.
- If no sufficient distance beween the I/O signal lines and high-voltage and large-current can be kept, shielded cables have to be used. Preferably, ground the shielding at the modul side.

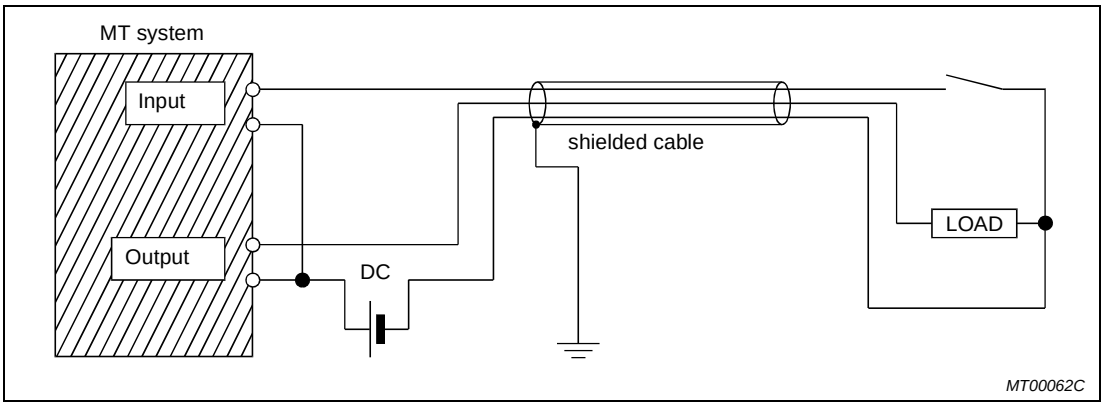


Fig. 5-17: *Wiring and grounding of the I/O signal line*

- If wiring is done with a piping, ground the piping.
- Separate the DC 24 V I/O cables from the AC cables.

Grounding

- The MT system should be grounded as independently as possible from other equipment (see figure 5-14 on the left). Apply class 3 grounding (grounding resistance 100 Ω max.).

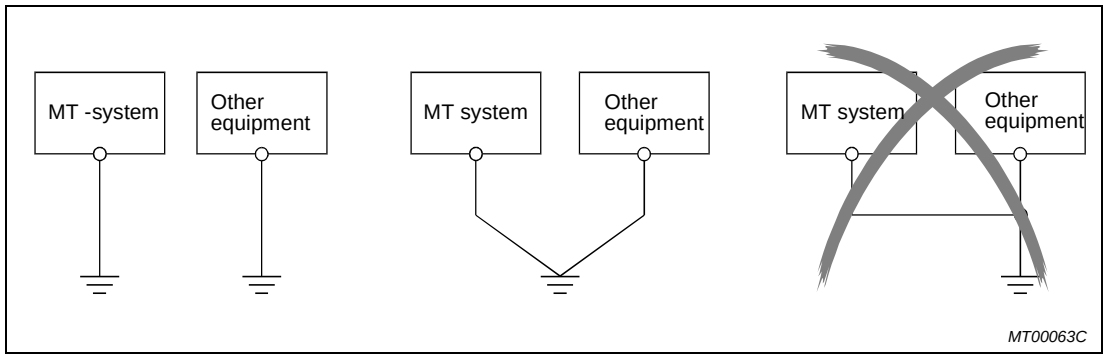


Fig. 5-18: *Grounding connection*

- If an independent grounding is not possible, use the joint grounding method as shown in the center figure above. The grounding method shown on the right is not allowed.

Shielding

For the communication of a MELSEC system with peripheral equipment shielded data lines have to be used only. At best, the shielding is made of twisted copper. The density of the braiding determines the effectiveness of the shielding. Make sure to follow the bending instructions of the cable manufacturer, otherwise the shielding might fan out. For longer distances connect the shielding each 20 m to ground.

Analog signal transmission

Transmit low frequency analog signals over short distances through 2-core shielded cable. The reference conductor potential of the sending and the receiving unit might differ, therefore potential isolating components are used (balance transformers, optocouplers, etc.).

Digital signal transmission

Follow the specifications of the interface concerning transfer rate and transfer distance, for an error free digital signal transmission.

6 Configuration

The configuration specifies the installed system components of the MT series and their mounting order in the according master. The procedures of the configuration through the software MELSOFT GX Configurator-DP and the setting of the station number are described below.

6.1 Station number

The PROFIBUS station number of the MT-DP12 module is set as decimal number with two rotary switches near the PROFIBUS connector. The switch labeled "x10" sets the digit of tens, the switch labeled "x1" sets the digit of ones. Valid station numbers range from 01 to 99.

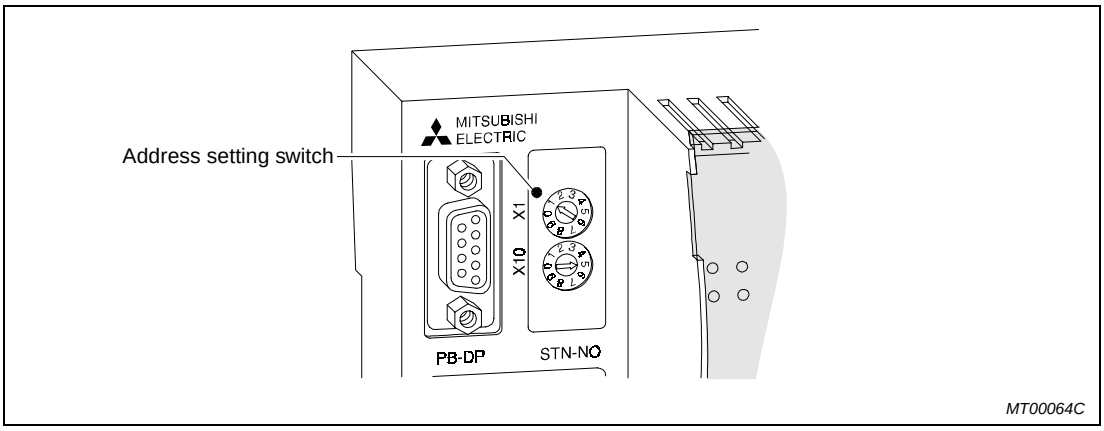


Fig. 6-1: *Address setting switch*

Figure 6-1 shows the station number set to 51.

NOTE

The module station number is only adopted by the module when the voltage supply UB is connected to it. Therefore, after having changed the station number switch OFF the voltage supply for a moment so that the new station number will be adopted.

6.2 PROFIBUS configuration

The configuration of the MT-DP12 module depends on the number and type of extension modules. For this purpose identification bytes are assigned consecutively for each module. The assignment starts with the modules that are connected to the internal system interface (see figure 6-2). These operations are not apparent with the MELSOFT GX Configurator-DP parameterizing software.

NOTE

The configuration of the system is compared to that in the PROFIBUS master. Only if the configuration data of the master corresponds to that of the slave the communication is enabled.

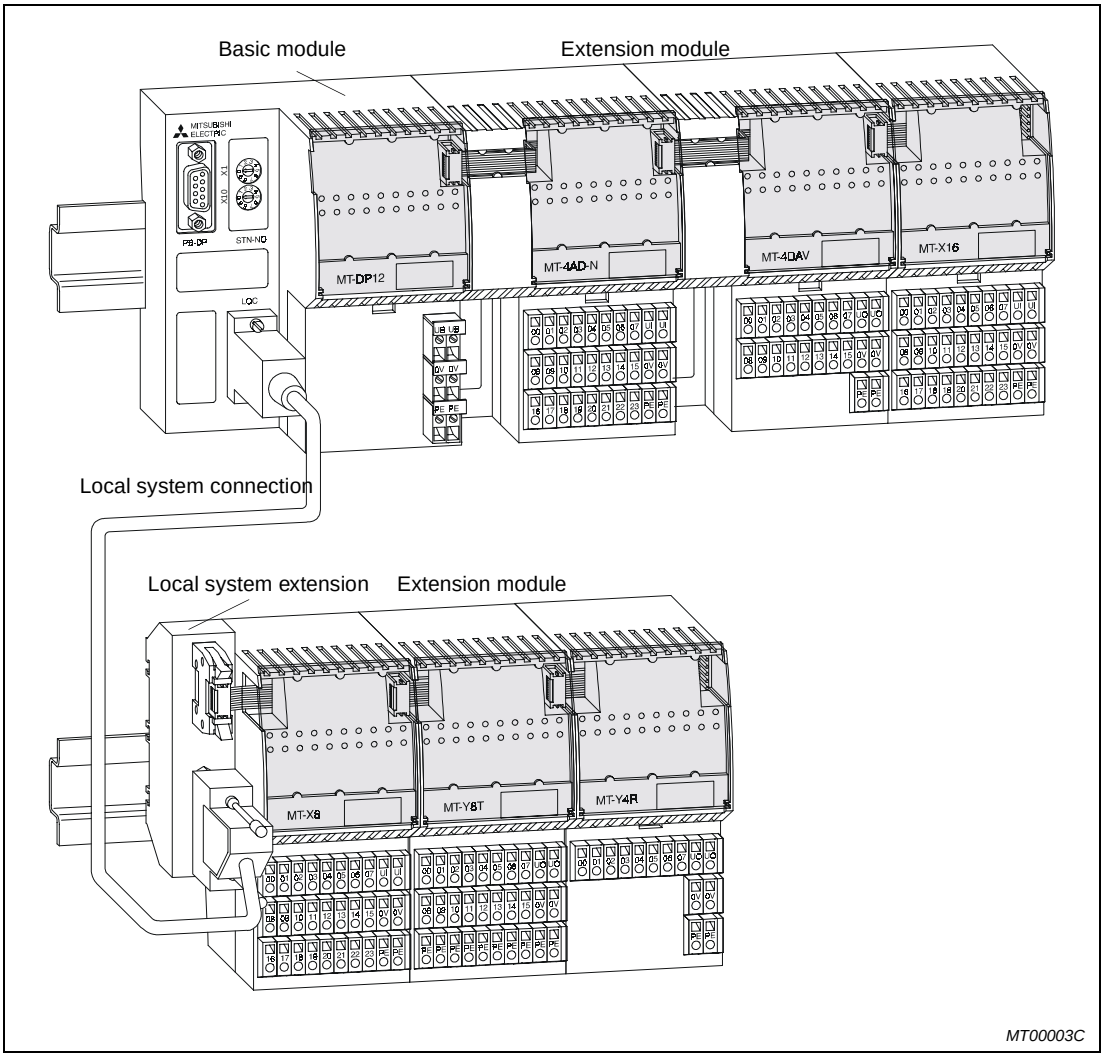


Fig. 6-2: *Sample configuration*

6.2.1 Structure of configuration data (identification bytes) of digital extension modules

Table 6-1 shows the assignment of identification bytes to the different module types:

Module	Identification		Meaning
	hexadecimal	decimal (COM ET 200)	
MT-DP12E	10H	16	1 byte input, no consistency
MT-X8	10H	16	1 byte input, no consistency
MT-X16	50H	80	1 word input, no consistency
MT-Y8T MT-Y8T2 MT-Y4R MT-Y8R5	20H	32	1 byte output, no consistency
MT-Y16T	60H	96	1 word output, no consistency
MT-X4Y4T	10H	16	1 byte input, no consistency
	20H	32	1 byte output, no consistency

Tab. 6-1: *Configuration data (identification bytes) of digital extension modules*

6.2.2 Structure of configuration data (identification bytes) of analog extension modules

For analog modules each channel is configured separately. For a fourfold module the value shown below has to be generated four times. Table 6-2 shows the assignment of identification bytes to the different module types:

Module	Identification		Meaning
	hexadecimal	decimal (COM ET 200)	
MT-4AD-N	50H, 50H, 50H, 50H	80, 80, 80, 80	1 word input, no consistency (per channel)
MT-4DAV	60H, 60H, 60H, 60H	96, 96, 96, 96	1 word output, no consistency (per channel)
MT-4DA	60H, 60H, 60H, 60H	96, 96, 96, 96	1 word output, no consistency (per channel)

Tab. 6-2: *Configuration data (identification bytes) of analog extension modules*

6.3 Configuration with MELSOFT GX Configurator-DP 4

The software MELSOFT GX Configurator-DP is designed to configure and parameterize the PROFIBUS/DP masters AJ71PB92D, A1SJ71PB92D, and QJ71PB92D. For the configuration of the master via the PROFIBUS/DP, take the steps below in the described order.

① Start GX Configurator-DP. In the menu "File" select "New" to create a new configuration project.

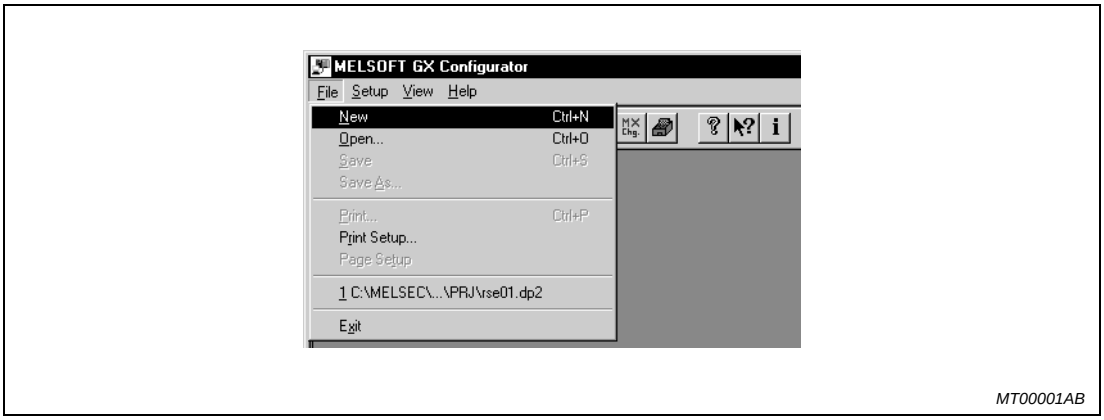


Fig. 6-3: *Creating a new configuration project*

② The following dialog appears for the selection of the desired master in the desired operation mode.
The following operation modes can be selected:
Mode "0", standard operation mode with 32 send-/receive-bytes.
Mode "E", enhanced operation mode with 244 send-/receive-bytes.

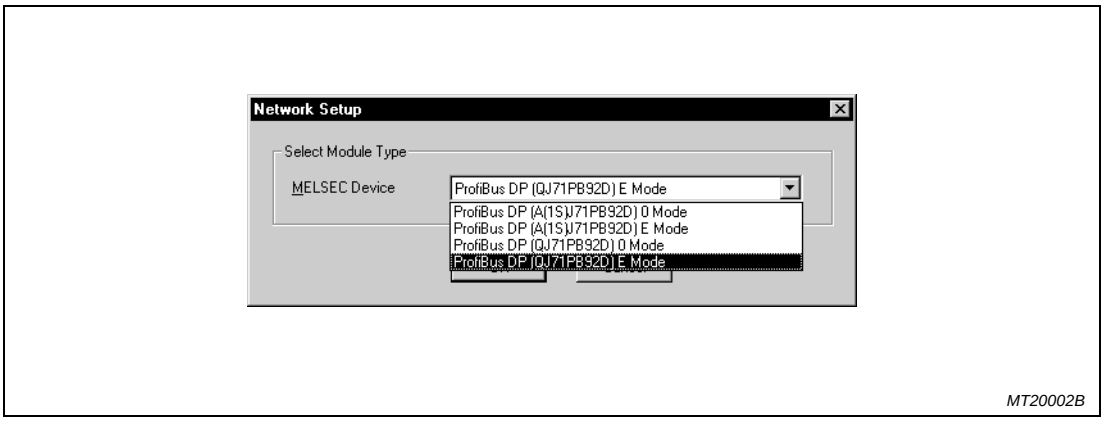


Fig. 6-4: *Selection of the PROFIBUS/DP master and operation mode*

Make your selection and confirm with the "OK" button. The graphical network editor for the Profibus configuration appears.

③ Install the GSD file for the MT series. The GSD file includes the device information of the modules.

a) In the menu "Setup" select "GSD Device Database" to open the dialog "Device Database".

b) In the dialog "Device Database" select the slave device group "I/O". To this slave device group the MT series is to be added.

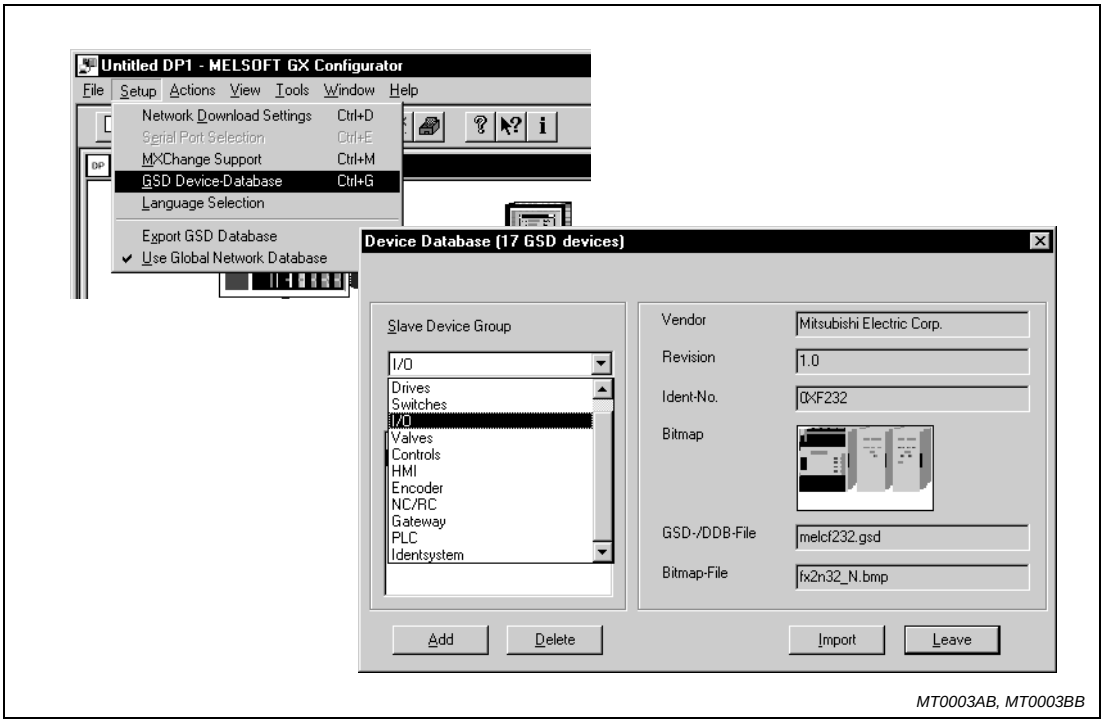


Fig. 6-5: *GSD device database*

c) Click the "Add" button to open the dialog "Load GSD-/DBB-File".

d) In the field "Look in" specifiy the path where the GSD file is saved (e.g. Diskette A:) to list the saved GSD files. Select the file "MT12F037.GSD" and confirm with the "Yes" button.

e) Confirm the following request for copying the GSD file to the database with the "OK" button.

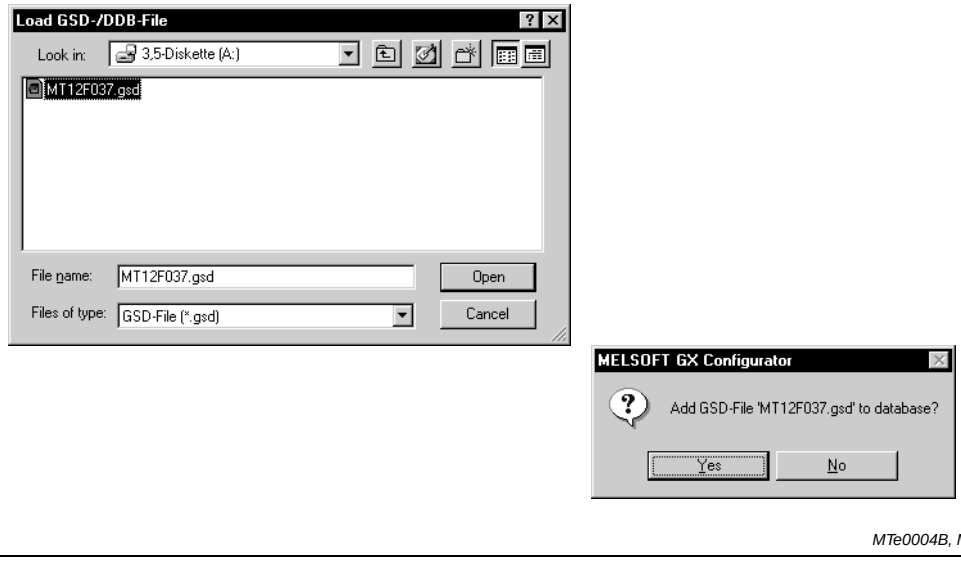


Fig. 6-6: *Loading the GSD file*

f) In the field "Look in" specify the path where the bitmap device file is saved (e.g. Diskette A:) to list the saved files. Select the file "MT12F037.BMP" and confirm with the "Yes" button.

g) Two more requests follow for optional bitmap files for diagnostics and special functions ("Bitmap_Diag" and "Bitmap_SF"). If you own these files, load them as described above. If not, cancel each request via the "Cancel" button.

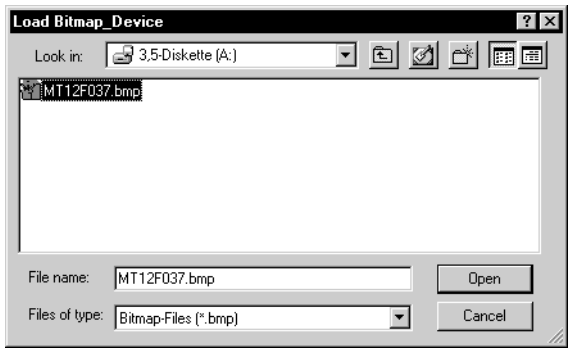


Fig. 6-7: *Loading the BMP file*

h) In the slave device group "I/O" under "Available Slave Systems" a new entry "MT-DP12" appears. The device information for the MT modules is now included in the GSD database. Close the dialog via the "Leave" button.

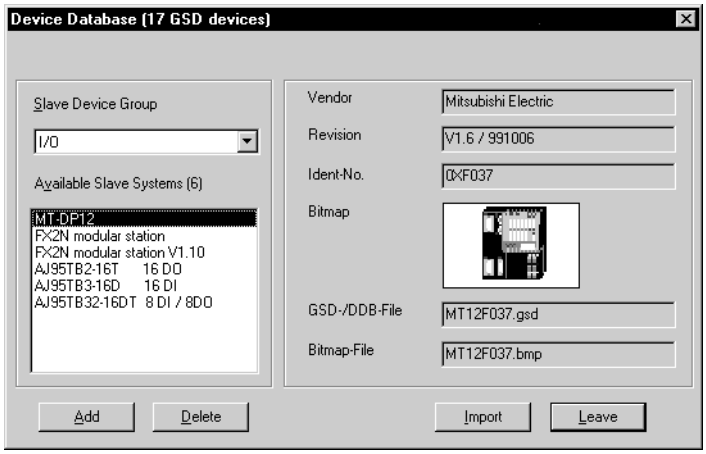
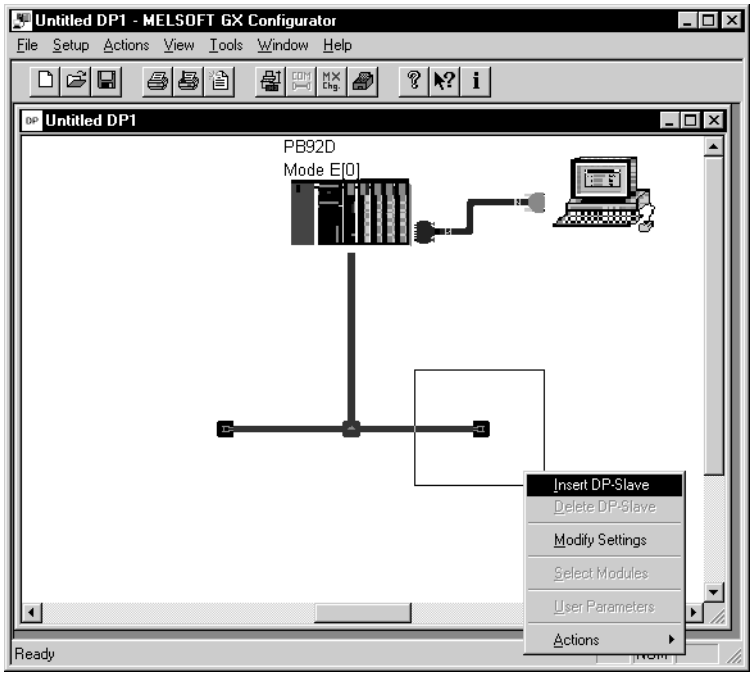


Fig. 6-8: *New entry of the MT series*

The GSD and bitmap files for the basic module MT-DP12E are installed in the same way.

NOTE These procedures are only required once to load the device information of the MT series into the GX Configurator-DP configuration software.

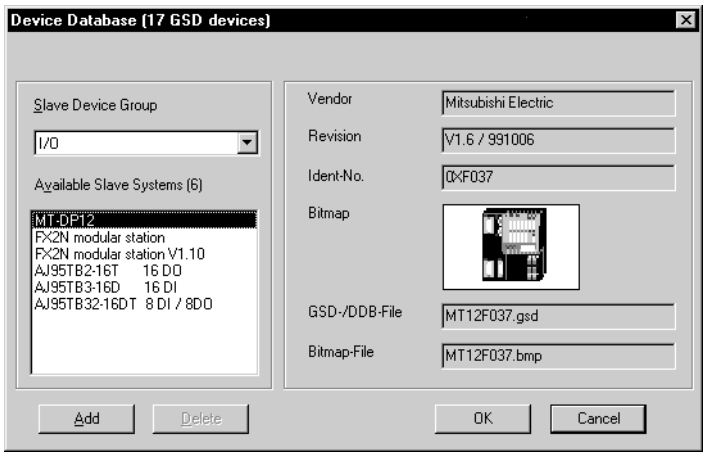
④ In order to put the MT series into operation, the configuration of the MT-System has to be acknowledged by the master module. The graphical network editor presents the master PLC with its connection to GX Configurator-DP (personal computer) and the RS485 network connection.
Right-click on a vacant node of the RS485 network connection to open the context menu. Select "Insert DP-Slave" to open the dialog "Device Database".



MT00010B

Fig. 6-9: *Inserting the DP-slave*

⑤ From the slave device group "I/O" under "Available Slave Systems" select the slave system "MT-DP12".



MT00011B, MT0011AB

Fig. 6-10: *Selection of the MT series*

Confirm with the "OK" button. The dialog "Slave Parameter Settings" appears.

⑥ In the "Name" field you can enter a name for your module for documentation purposes.

Under "FDL Address" enter the station number you specified via the rotary switches on your basic module. Click the "Select Modules" button to specify the hardware configuration of your MT system.

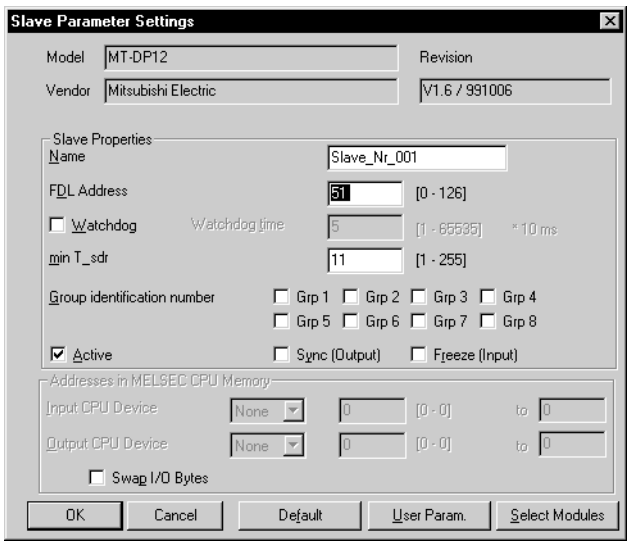


Fig. 6-11: *Specification of the station number*

The dialog "Slave Modules" appears.

⑦ The left window lists the modules of the MT series. They have to be added to the right window in the same order as the hardware is arranged. Remind to add the modules that are connected to the local extension in the same order as if they were mounted to the right of the last module on the first mounting level. Figure 6-12 refers to the sample configuration shown in figure 6-2. For the completion of the configuration confirm and close the window with "OK".

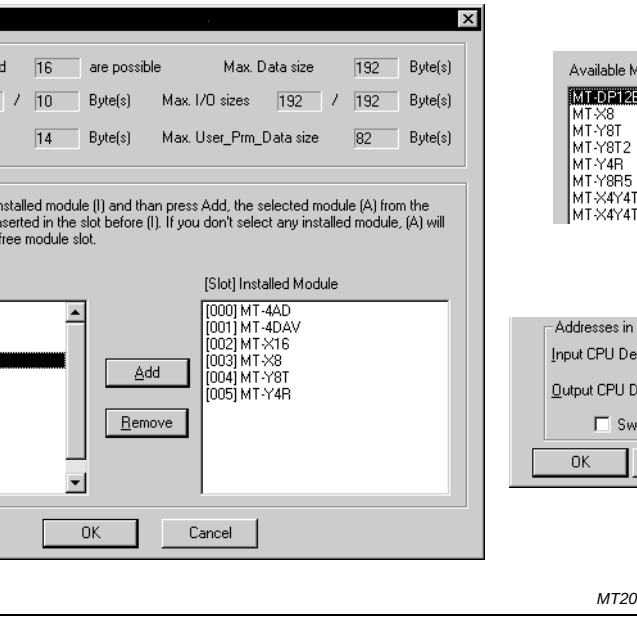


Fig. 6-12: *Configuration*

In the dialog "Slave Parameter Settings" under the entry "Adresses in MELSEC CPU Memory" you can specify the PLC device that stores the effective data. When using the basic module MT-DP12E the additional entry "MT-DP12E [X8]" is included in the list box. Select this entry to configure and parameterize the inputs of the MT-DP12E module. Confirm and close the dialog "Slave Parameter Settings" with "OK".

The graphical network editor shows the pictogram of the MT series connected to the PROFIBUS/SP line.

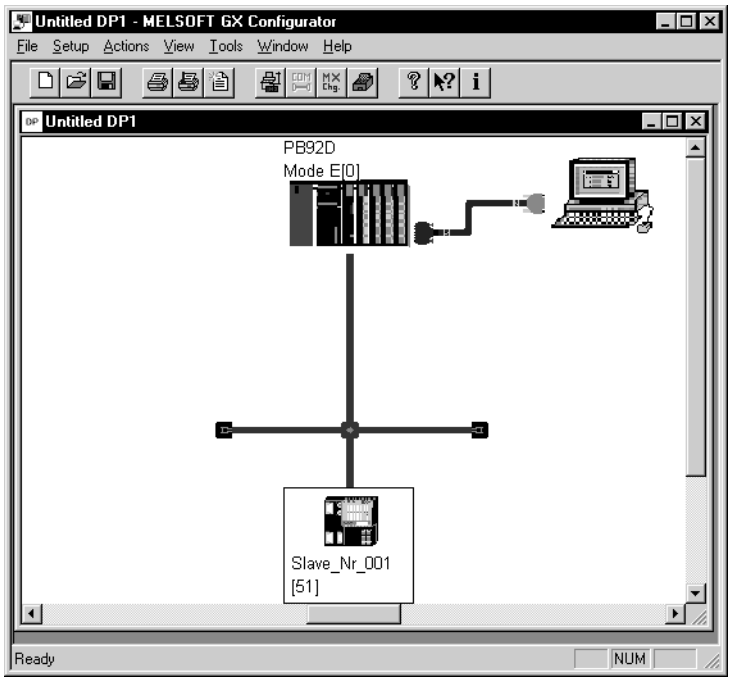
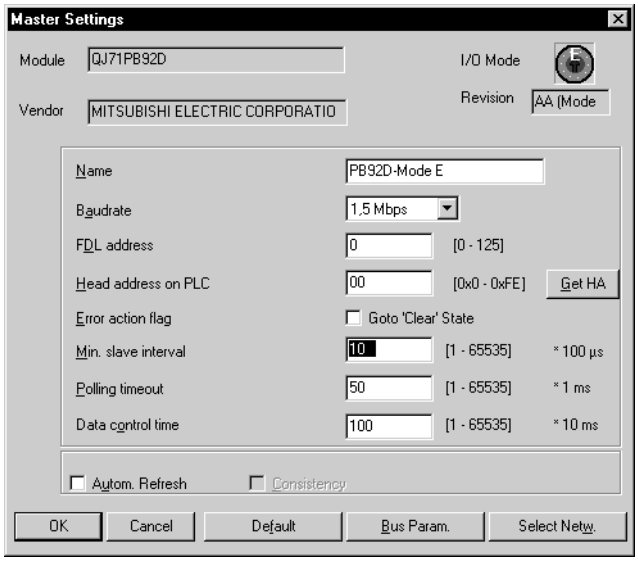


Fig. 6-13: *Represented MT slave*

NOTE

For an accurate timing of the MT series on the PROFIBUS/DP, the "Minimum slave intervall" has to be set to at least 10 x 100µs as described below (see figure 6-14):

1. Double-click on the master symbol.
2. Set the "Min. slave interval" to 10.
3. Close the dialog with "OK".



MT0017BB

Fig. 6-14: *Setting of the "Min. slave interval"*

⑧ Now your configuration can be written to the PROFIBUS/DP master. Right-click on the grafical network editor to open the context menu. Select "Actions" and "Write to PB92D".

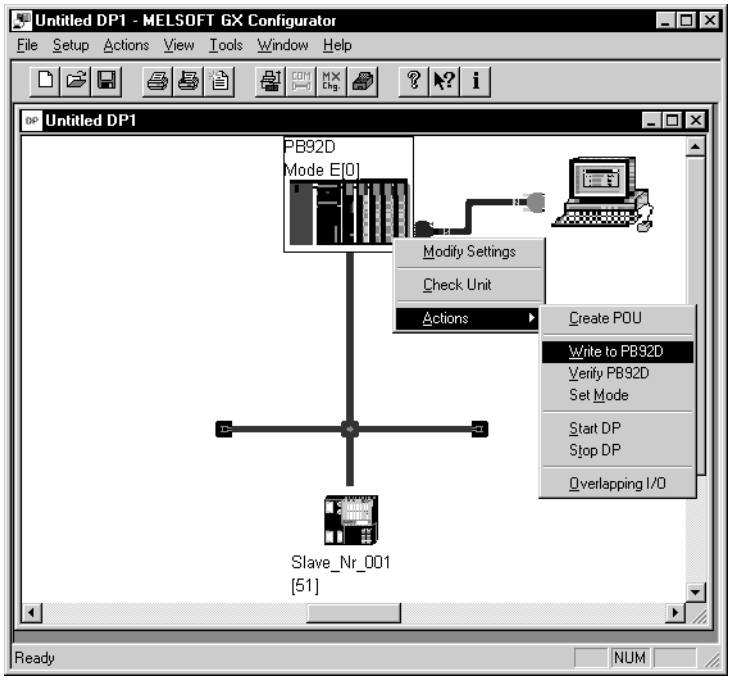


Fig. 6-15: *Writing the configuration data*

For further use save your configuration project via the menu item "File - Save".

NOTE Refer to the software manual of GX Configurator-DP for further details.

7 Parameterization

The basic module and the extension modules are parameterized over the PROFIBUS with the parameterizing software MELSOFT GX Configurator-DP. Parameterizing determines the measuring ranges of the single modules or defines the response of the devices in case of a failure.

The meaning of the single bits in the parameter bytes of the parameterizing frames and the related options of the according extension modules are described in the following chapters.

The parameterizing frame is arranged of single bytes that are required to specify the reaction of the single modules or of the basic module. For different modules, different numbers of bytes are needed for an entire parameterization.

Table 7-1 shows the assignment of modules to the according functions of the parameter bytes and refers to the chapters containing further details.

Module	Number of USER parameter bytes	Byte no.	Function		Chapter
MT-DP12	2	Byte 0	Reserved (00_H)		7.1
		Byte 1	Diagnostics setting		
MT-DP12E	3	Byte 0	Reserved (00_H)		7.2
		Byte 1	Diagnostics setting input data		
		Byte 2	Diagnostics setting output data		
MT-X8	1	Byte 0	Diagnostics setting		7.3
MT-X16	1	Byte 0	Diagnostics setting, byte swap		7.4
MT-Y8T	1	Byte 0	Response to bus errors, diagnostics setting		7.5
MT-Y16T	1	Byte 0	Response to bus errors, diagnostics setting, byte swap		7.6
MT-Y8T2	1	Byte 0	Response to bus errors, diagnostics setting		7.7
MT-Y4R	1	Byte 0	Response to bus errors, diagnostics setting		7.8
MT-Y8R5	1	Byte 0	Response to bus errors, diagnostics setting		7.9
MT-X4Y4T	2	Byte 0	Diagnostics setting input data		7.10
		Byte 1	Response to bus errors, diagnostics setting output data		
MT-4AD-N	4	Byte 0	Channel 0	Response to bus errors, diagnostics setting, data format, averaging, channel control mode	7.11
		Byte 1	Channel 1		
		Byte 2	Channel 2		
		Byte 3	Channel 3		
MT-4DAV	4	Byte 0	Channel 0	Response to bus errors, diagnostics setting, data format, channel control mode	7.12
		Byte 1	Channel 1		
		Byte 2	Channel 2		
		Byte 3	Channel 3		
MT-4DA	4	Byte 0	Channel 0	Response to bus errors, diagnostics setting, data format, channel control mode	7.13
		Byte 1	Channel 1		
		Byte 2	Channel 2		
		Byte 3	Channel 3		

Tab. 7-1: *Assignment of parameter bytes to the modules*

The master A1SJ71PB92D is capable of sending 34 parameter bytes to the MT series.

The parameterization data is stored to the internal EEPROM of the MT series and then parameterizes the extension modules.

7.1 Parameter byte MT-DP12 module

The transmission of diagnostics data can be switched off globally by setting bit 1 in the parameter byte. If the diagnostics messaging is enabled, bit 0 in the parameter byte enables or disables the static diagnosis.

Static diagnosis:

The static diagnosis is sent, if no communication between the MT-DP12 and the PROFIBUS master can be established due to a system failure. These failures might result from an interruption in the system interface or a serious malfunction of a module.

Fig. 7-1 shows the arrangement of the parameter bytes of the MT-DP12 module:

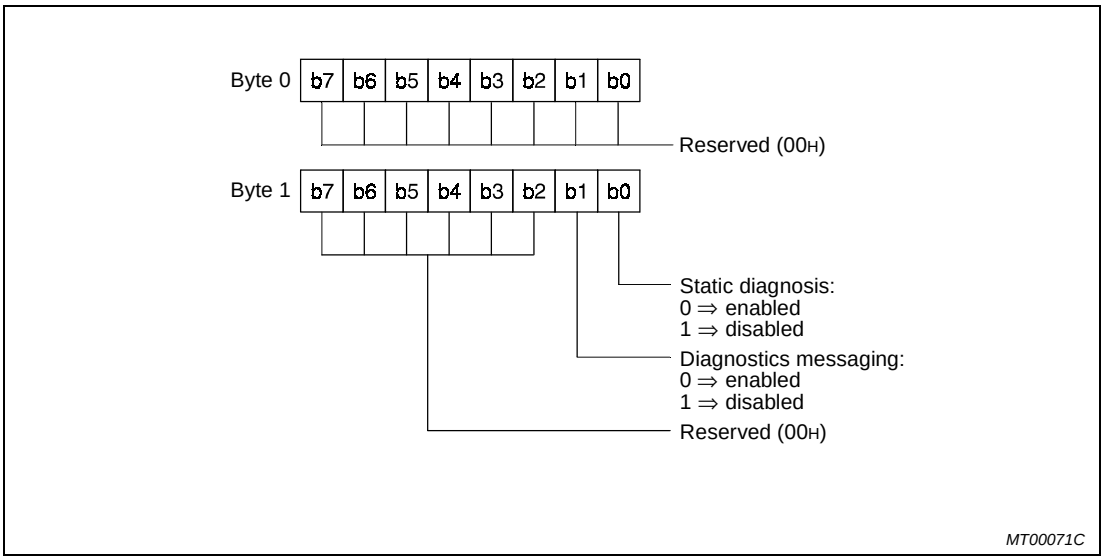


Fig. 7-1: *Parameter byte MT-DP12 module*

NOTE

All reserved parameters have to be set to the value 0 (00H). Otherwise the PROFIBUS transmission is terminated due to a parameterization error.

7.2 Parameter byte MT-DP12E module

The transmission of diagnostics data can be switched off globally by setting bit 1 in the parameter byte. If the diagnostics messaging is enabled, bit 0 in the parameter byte enables or disables the static diagnosis.

Static diagnosis:

The static diagnosis is sent, if no communication between the MT-DP12E module and the PROFIBUS master can be established due to a system failure. These failures might result from an interruption in the system interface or a serious malfunction of a module.

Additionally, the MT-DP12E module provides 8 integrated digital inputs. These inputs can be parameterized for error 0 and error 1concerning the diagnosis enabling.

If the diagnostics is enabled, Error 0 returns the value 0 if the power supply UI is connected, and the value 1 if the power supply UI is not connected. Error 1 returns the value 0 if the sensor power supply is available, and the value 1 if the sensor power supply is short-circuited.

Fg. 7-2 shows the parameter arrangement of the MT-DP12E module.

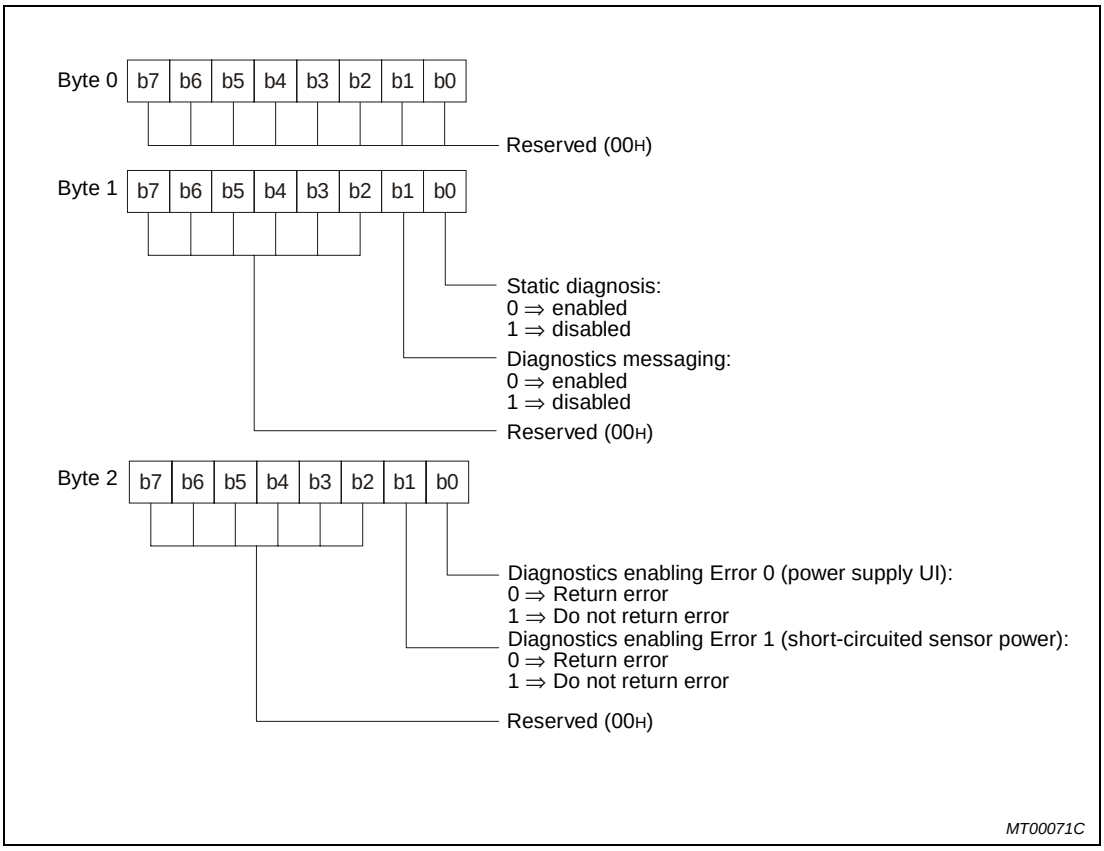


Fig. 7-2: *Parameter byte MT-DP12E module*

NOTE All reserved parameters have to be set to the value 0 (00H). Otherwise, the PROFIBUS transmission is terminated due to a parameterization error.

7.3 Parameter byte MT-X8 module

The digital input module MT-X8 can be parameterized concerning the diagnostics enabling for Error 0 and Error 1.

If the diagnostics is enabled, Error 0 returns the value 0 if the power supply UI is connected, and the value 1 if the power supply UI is not connected. Error 1 returns the value 0 if the sensor power supply is available, and the value 1 if the sensor power supply is short-circuited.

Fig. 7-3 shows the parameter arrangement of the MT-X8 module:

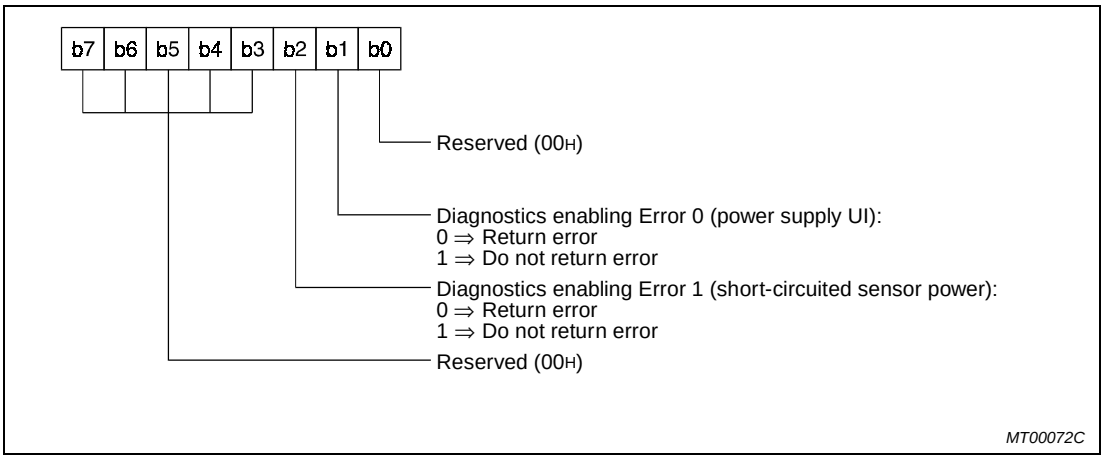


Fig. 7-3: *Parameter byte MT-X8 module*

NOTE

All reserved parameters have to be set to the value 0 (00H). Otherwise the PROFIBUS transmission is terminated due to a parameterization error.

7.4 Parameter byte MT-X16 module

The digital output module MT-X16 can be parameterized concerning the diagnostics enabling for Error 0 and Error 1, and the byte swap.

If the diagnostics is enabled, Error 0 returns the value 0 if the power supply UI is connected, and the value 1 if the power supply UI is not connected. Error 1 returns the value 0 if the sensor power supply is available, and the value 1 if the sensor power supply is short-circuited.

The byte swap has to be parameterized in cases where the sequence of data bytes in the parameterization frames of the masters and that of the MT system do not match. Consequently, the data bytes of the modules would be stored in an incorrect sequence in the buffer memory of the master, or the bytes would be output to the MT modules in an incorrect sequence. In this case, the sequence of the bytes has to be reversed.

Fig. 7-4 shows the Mitsubishi-Standard with the Low-Byte/High-Byte sequence in the parameterization frame:

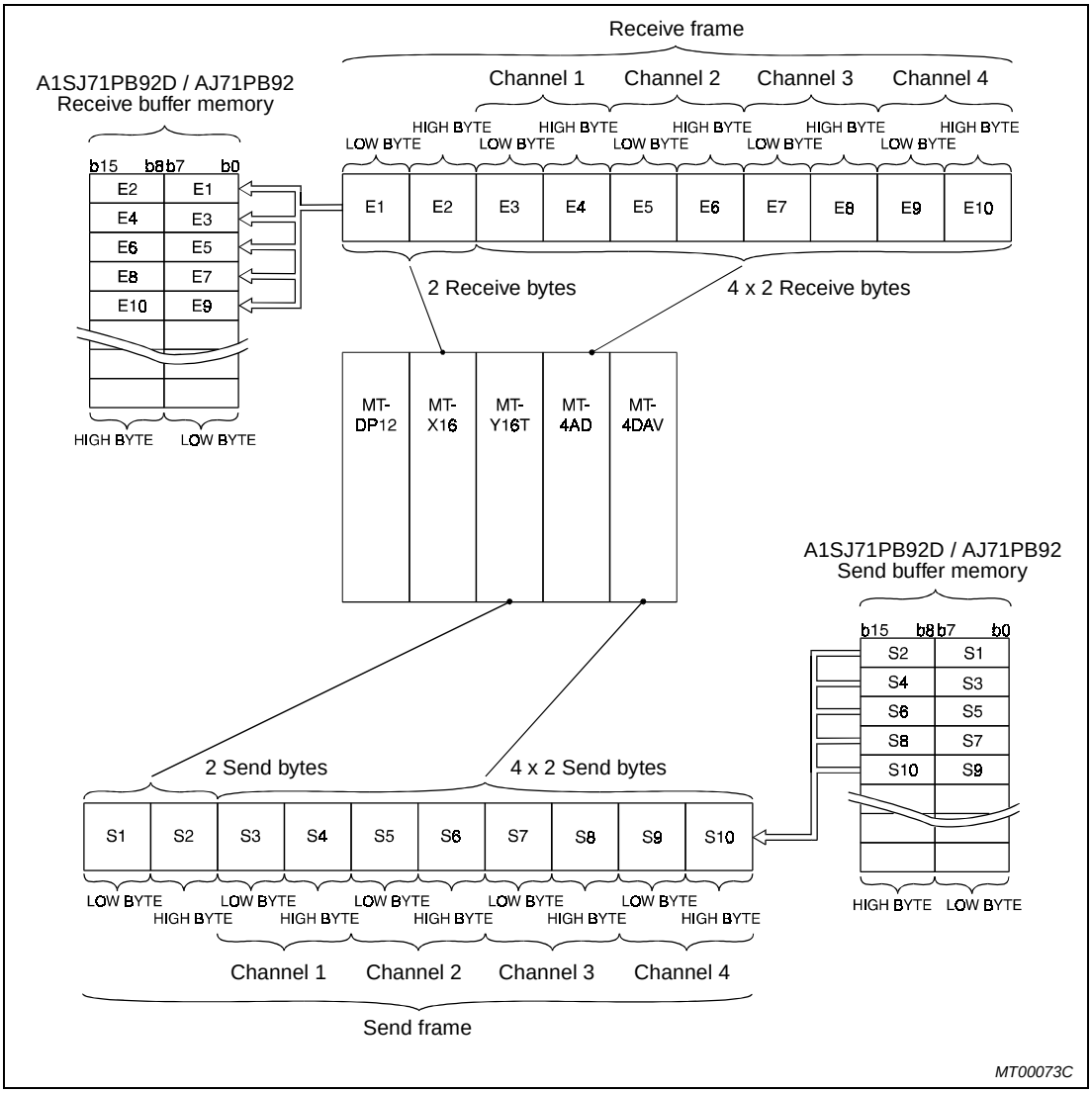


Fig. 7-4: *Receive and send sequence of the protocol frame bytes*

Fig. 7-5 shows the parameter byte arrangement of the MT-X16 module:

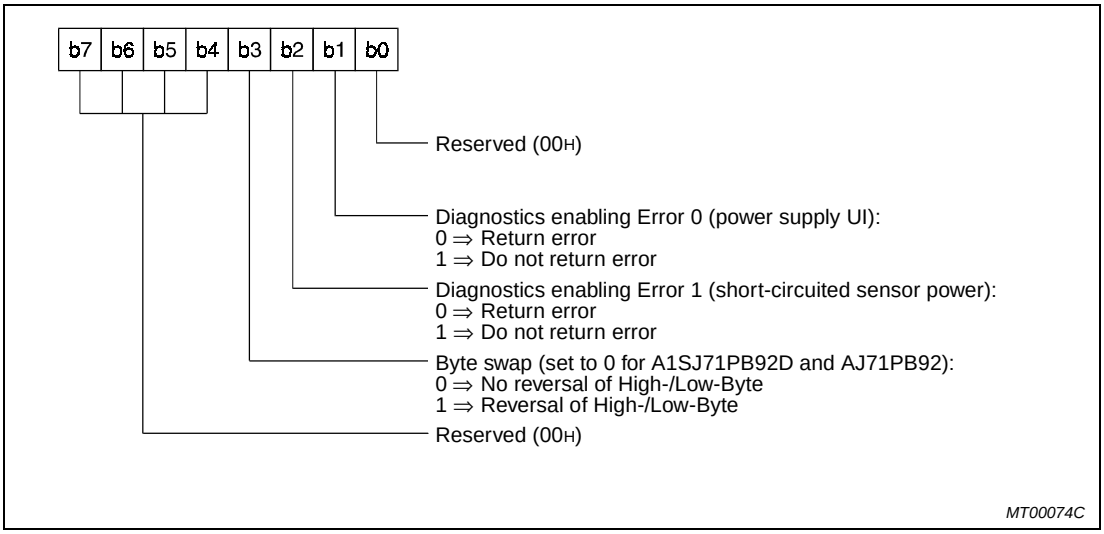


Fig. 7-5: *Parameter byte MT-X16 module*

NOTE

All reserved parameters have to be set to the value 0 (00H). Otherwise the PROFIBUS transmission is terminated due to a parameterization error.

7.5 Parameter byte MT-Y8T module

The digital output module MT-Y8T can be parameterized concerning the response to bus errors, and the diagnostics enabling for Error 0 and Error 1.

If the diagnostics is enabled, Error 0 returns the value 0 if the power supply UO is connected, and the value 1 if the power supply UO is not connected. Error 1 returns the value 0 if the sensor power supply is available, and the value 1 if the sensor power supply is short-circuited.

Fig. 7-6 shows the parameter byte arrangement of the MT-Y8T module:

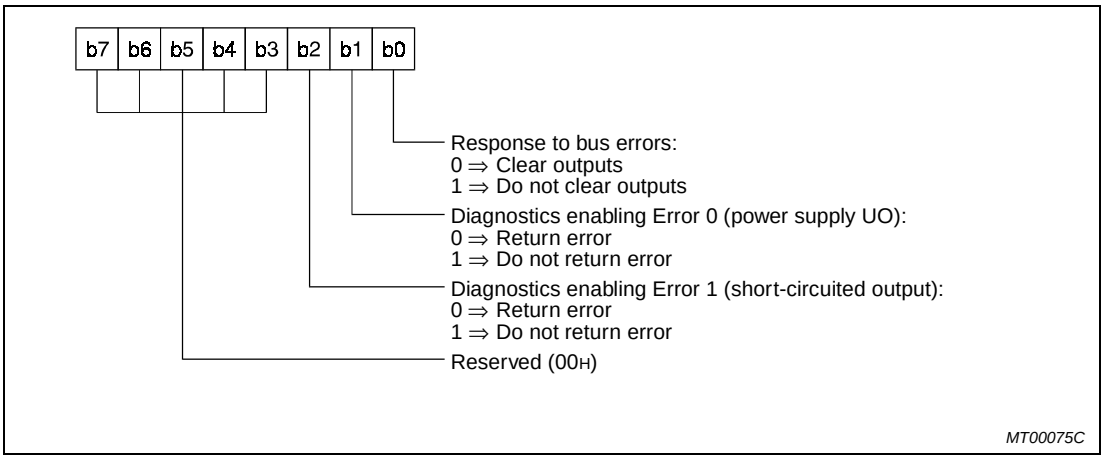


Fig. 7-6: *Parameter byte MT-Y8T module*

NOTE

All reserved parameters have to be set to the value 0 (00H). Otherwise the PROFIBUS transmission is terminated due to a parameterization error.

7.6 Parameter byte MT-Y16T module

The digital output module MT-Y16T can be parameterized concerning the response to bus errors, the diagnostics enabling for Error 0 and Error 1, and the byte swap.

If the diagnostics is enabled, Error 0 returns the value 0 if the power supply UO1/UO2 is connected, and the value 1 if the power supply UO1/UO2 is not connected where both voltages are not supplied; in case that either UO1 or UO2 is missing no error will be returned. Error 1 returns the value 0 if no output is short-circuited, and the value 1 if any output is short-circuited.

Refer to chapter 7-3 “Parameter byte MT-X16 module” for the application of a byte swap.

Fig. 7-7 shows the parameter byte arrangement of the MT-Y16T module:

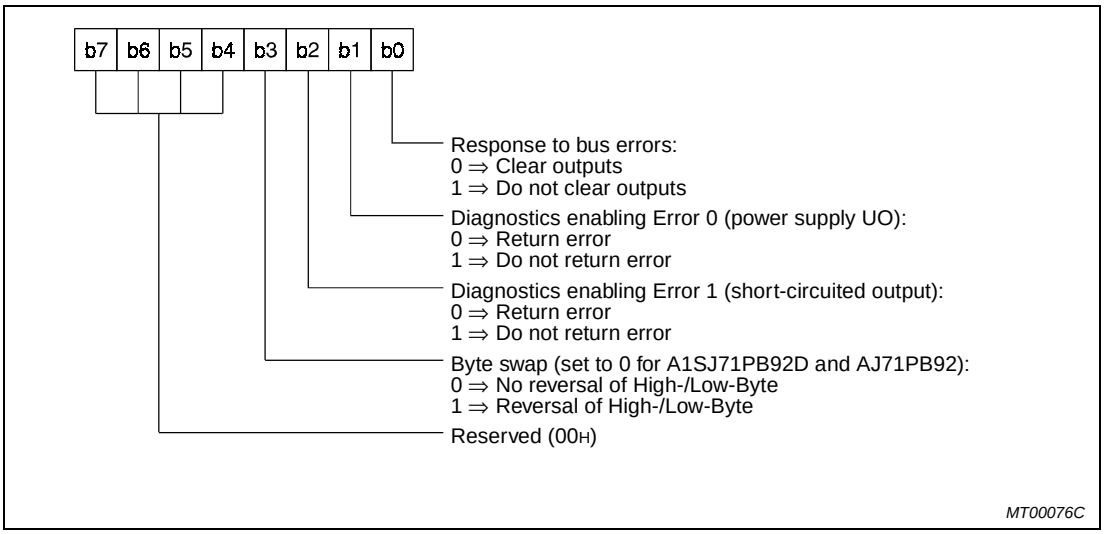


Fig. 7-7: *Parameter byte MT-Y16T module*

NOTE All reserved parameters have to be set to the value 0 (00H). Otherwise the PROFIBUS transmission is terminated due to a parameterization error.

7.7 Parameter byte MT-Y8T2 module

The digital output module MT-Y8T2 can be parameterized concerning the response to bus errors and the diagnostics enabling for Error 0.

If the diagnostics is enabled, Error 0 returns the value 0 if the power supply UO1/UO2 is connected, and the value 1 if the power supply UO1/UO2 is not connected where both voltages are not supplied; in case that either UO1 or UO2 is missing no error will be returned.

Fig. 7-8 shows the parameter byte arrangement of the MT-Y8T2 module:

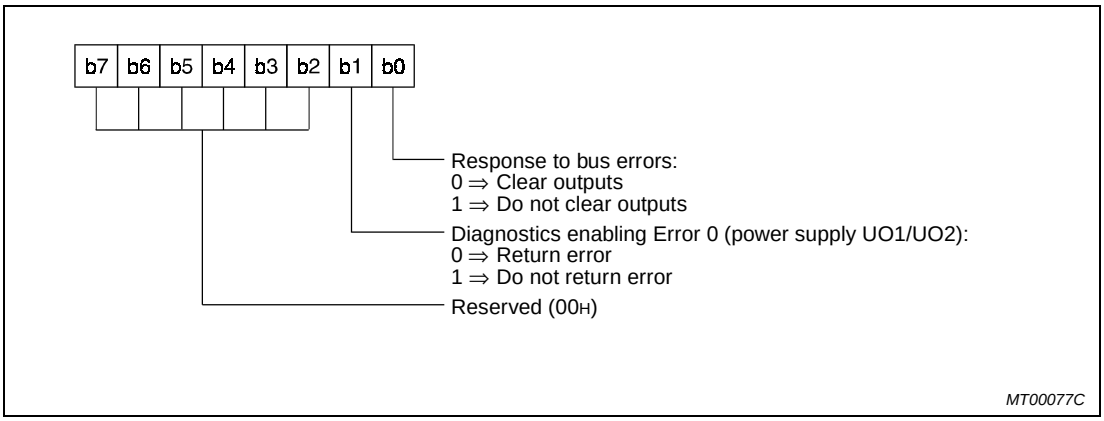


Fig. 7-8: *Parameter byte MT-Y8T2 module*

NOTE All reserved parameters have to be set to the value 0 (00_H). Otherwise the PROFIBUS transmission is terminated due to a parameterization error.

7.8 Parameter byte MT-Y4R module

The digital output module MT-Y4R can be parameterized concerning the response to bus errors and the diagnostics enabling for Error 0.

If the diagnostics is enabled, Error 0 returns the value 0 if the power supply UO (for relays) is connected, and the value 1 if the power supply UO (for relays) is not connected.

Fig. 7-9 shows the parameter byte arrangement of the MT-Y4R module:

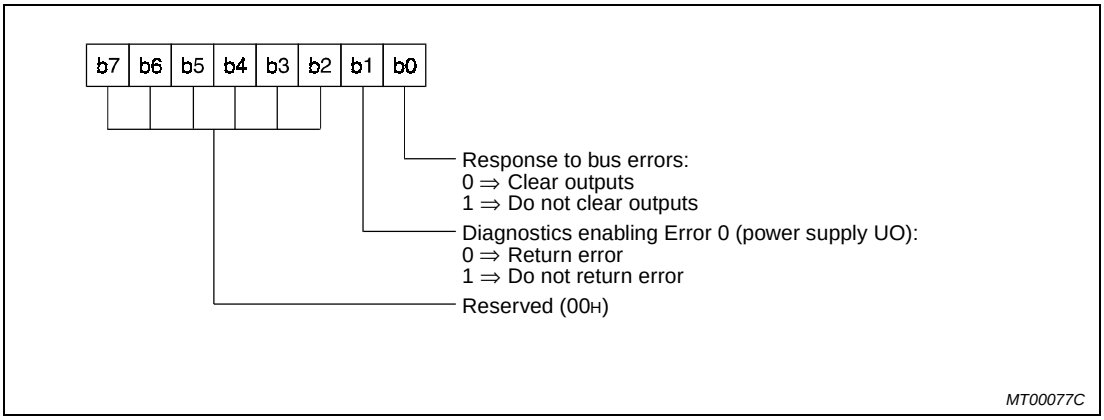


Fig. 7-9: *Parameter byte MT-Y4R module*

NOTE All reserved parameters have to be set to the value 0 (00H). Otherwise the PROFIBUS transmission is terminated due to a parameterization error.

7.9 Parameter byte MT-Y8R5 module

The digital output module MT-Y8R5 can be parameterized concerning the response to bus errors and the diagnostics enabling for Error 0.

If the diagnostics is enabled, Error 0 returns the value 0 if the power supply UI isconnected, and the value 1 if the power supply UI is not connected.

Fg. 7-10 shows the parameter byte arrangement of the MT-Y8R5 module.

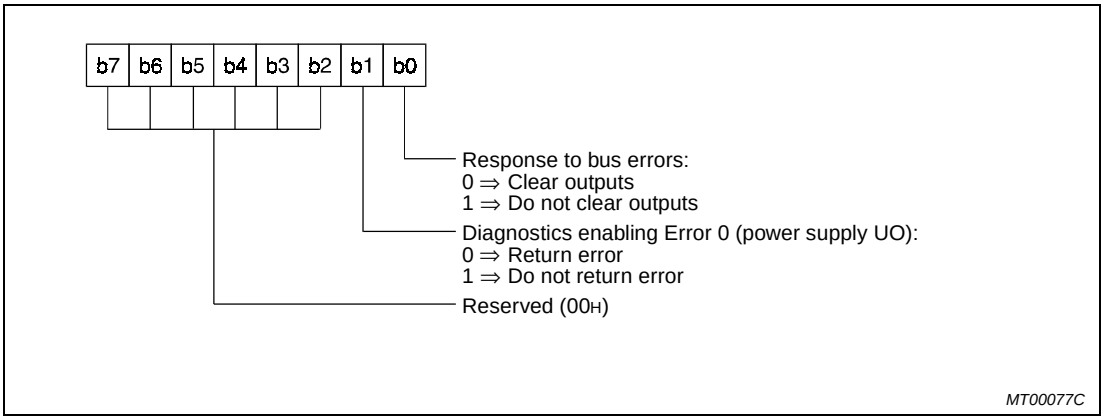


Fig. 7-10: *Parameter byte MT-Y8R5 module*

NOTE All reserved parameters have to be set to the value 0 (00H). Otherwise the PROFIBUS transmission is terminated due to a parameterization error.

7.10 Parameter byte MT-X4Y4T module

The digital module MT-X4Y4T is a combined input/output module with 4 digital inputs and 4 transistor outputs. The inputs and outputs are parameterized separately.

The inputs are parameterized concerning the diagnostics enabling for Error 0 and Error 1.

If the diagnostics is enabled, Error 0 returns the value 0 if the power supply UI is connected, and the value 1 if the power supply UI is not connected. Error 1 returns the value 0 if the sensor power supply is available, and the value 1 if the sensor power supply is short-circuited.

The outputs can be parameterized concerning the response to bus errors and the diagnostics enabling for Error 0.

If the diagnostics is enabled, Error 0 returns the value 0 if the power supply UO (for relays) is connected, and the value 1 if the power supply UO (for relays) is not connected.

Fig. 7-11 shows the parameter byte arrangement of the MT-X4Y4T module.

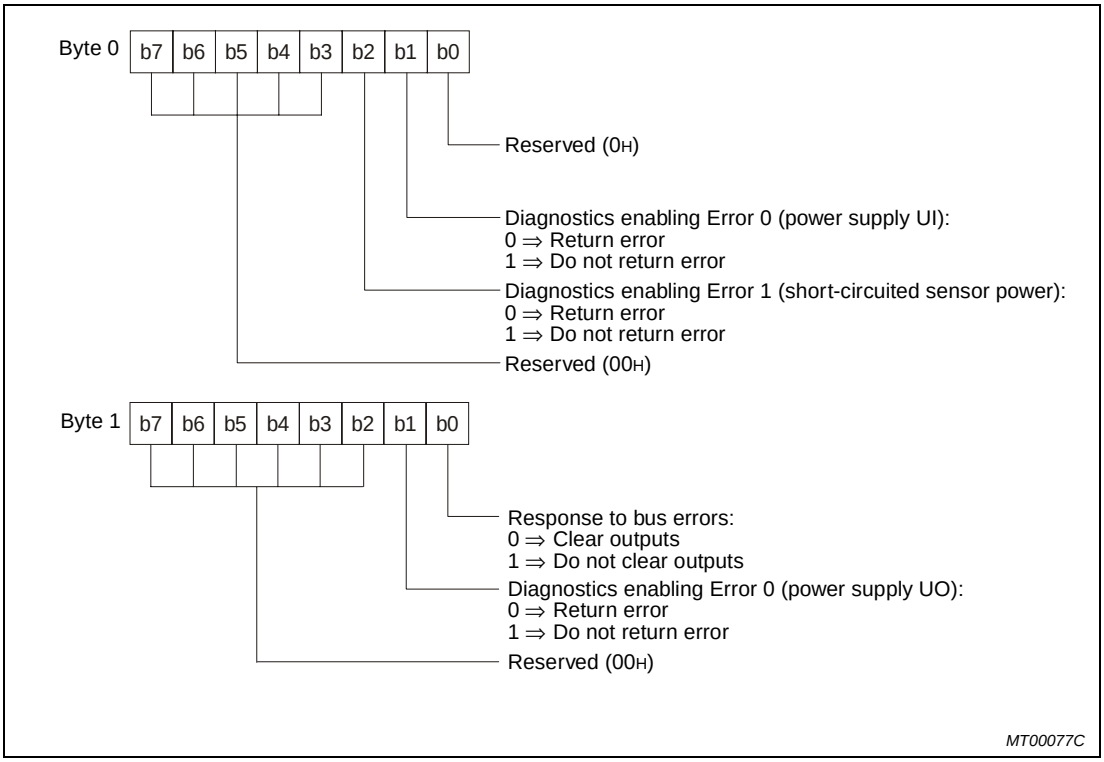


Fig. 7-11: *Parameter byte MT-X4Y4T module*

NOTE

All reserved parameters have to be set to the value 0 (00H). Otherwise the PROFIBUS transmission is terminated due to a parameterization error.

7.11 Parameter byte MT-4AD-N module

The analog input module can be parameterized with one parameter byte for each analog channel (4 channels ⇒ 4 parameter bytes) concerning the response to bus errors, the diagnostics enabling for Error 0 and Error 1, the data format, the averaging, and the channel control mode (measuring range).

If the diagnostics isenabled, Error 0 returns the value 0 if the power supply UI isconnected, and the value 1 if the power supply UI isnot connected. Error 1 returns the value 0 for an intact module, and the value 1 for internal malfunction of the module.

Fig. 7-4 on page 7-5 shows the data format and the High-/Low-Byte sequence according to the status of bit 3 of the parameter byte.

Fig. 7-12 shows the parameter byte arrangement of the MT-4AD-N module:

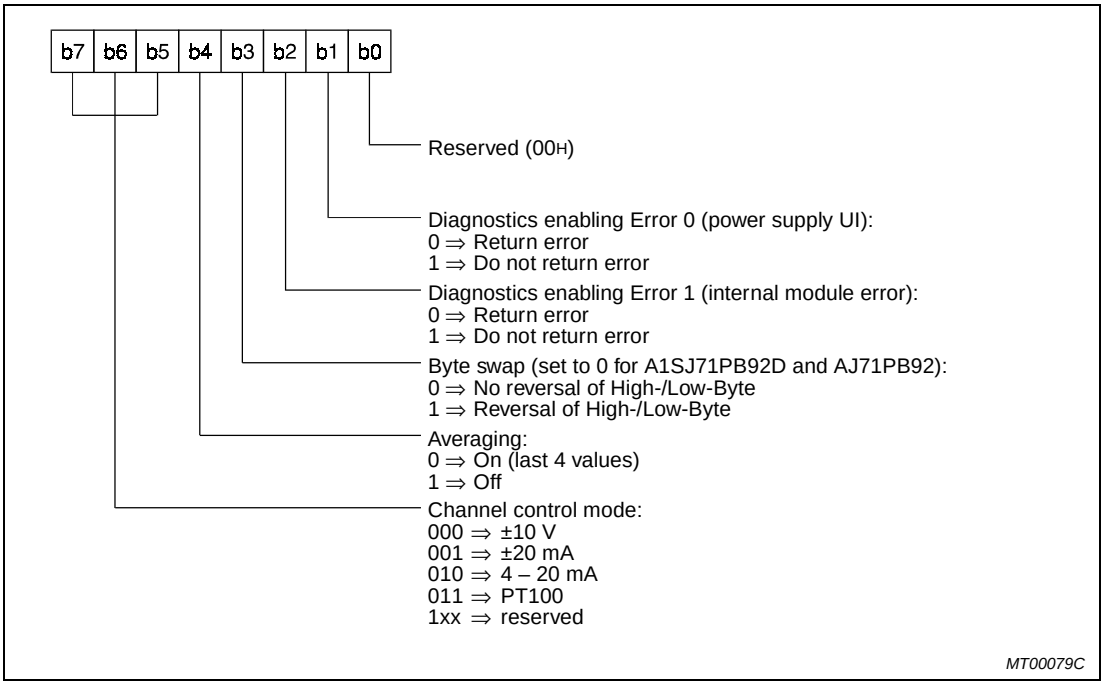


Fig. 7-12: *Parameter byte MT-4AD-N module*

NOTE All reserved parameters have to be set to the value 0 (00H). Otherwise the PROFIBUS transmission is terminated due to a parameterization error.

7.12 Parameter byte MT-4DAV module

The analog output module can be parameterized with one parameter byte for each analog channel (4 channels ⇒ 4 parameter bytes) concerning the response to bus errors, the diagnostics enabling for Error 0 and Error 1, the data format, and the channel control mode (output range).

If the diagnostics is enabled, Error 0 returns the value 0 if the power supply UO isconnected, and the value 1 if the power supply UO is not connected. Error 1 returns the value 0 for an intact module, and the value 1 for internal malfunction of the module.

Fig. 7-13 shows the parameterizing data arrangement of the MT-4DAV module:

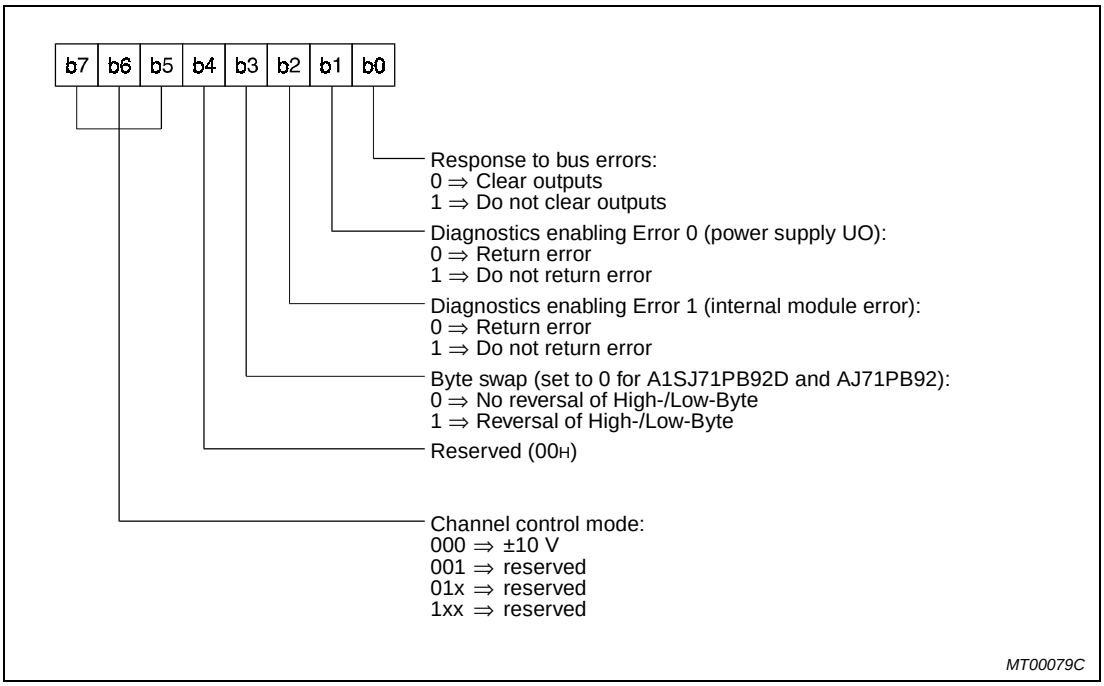


Fig. 7-13: *Parameter byte MT-4DAV module*

NOTE All reserved parameters have to be set to the value 0 (00H). Otherwise the PROFIBUS transmission is terminated due to a parameterization error.

7.13 Parameter byte MT-4DA module

The analog output module can be parameterized with one parameter byte for each analog channel (4 channels ⇒ 4 parameter bytes) concerning the response to bus errors, the diagnostics enabling for Error 0 and Error 1, the data format, and the channel control mode (output range).

If the diagnostics is enabled, Error 0 returns the value 0 if the power supply UO is connected, and the value 1 if the power supply UO is not connected. Error 1 returns the value 0 for an intact module, and the value 1 for internal malfunction of the module.

Fg. 7-14 shows the parameterizing data arrangement of the MT-4DA module.

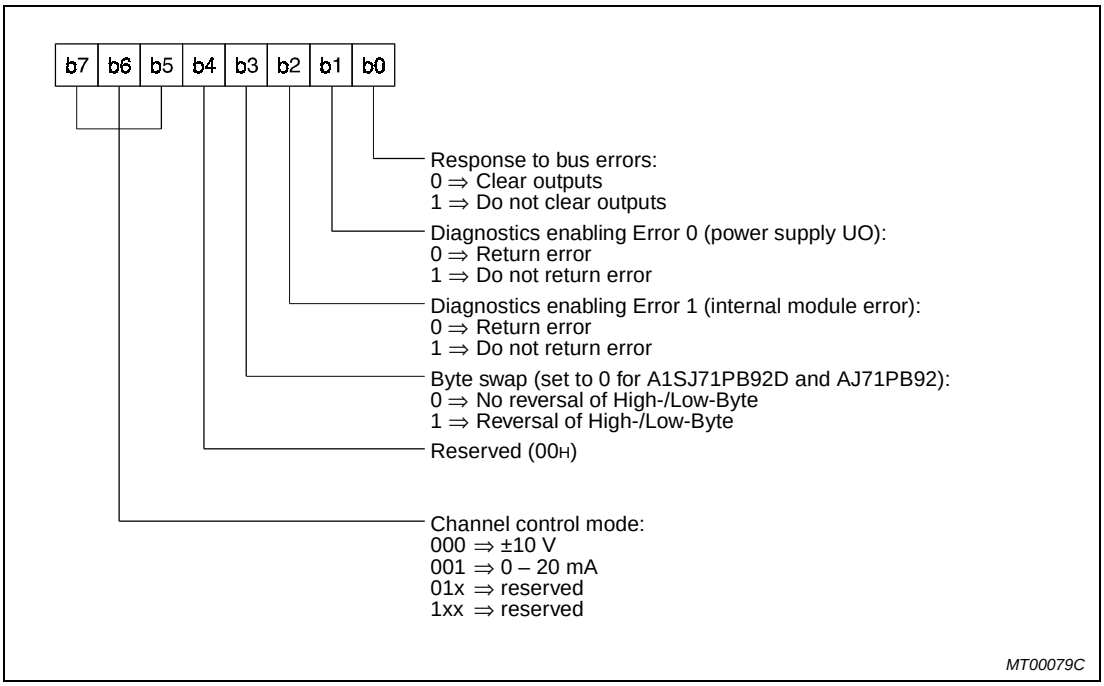


Fig. 7-14: *Parameter byte MT-4DA module*

NOTE All reserved parameters have to be set to the value 0 (00H). Otherwise the PROFIBUS transmission is terminated due to a parameterization error.

7.14 Parameterization with MELSOFT GX Configurator-DP 4

When initializing of the PROFIBUS/DP network, the master (A(1S)J71PB92D or QJ71PB92D) sends the stored slave configuration to the according slave. If the configuration sent corresponds to the actual slave configuration, the slave returns a positive confirmation. Then, the master sends initial values for the measuring range, failure diagnosis etc. as parameterization frame (“User Parameter”) to the slave.

The length of the parameterization frame depends on the number of installed modules (refer to Chapter 7.1). The software GX Configurator-DP determines this frame length automatically. In order to parameterize the modules via the PROFIBUS/DP proceed as follows:

① First configure your master (refer to Chapter 6.3).
The graphical network editor presents the master PLC with its connection to GX Configurator-DP (personal computer), the RS485 network connection, and the slave system.

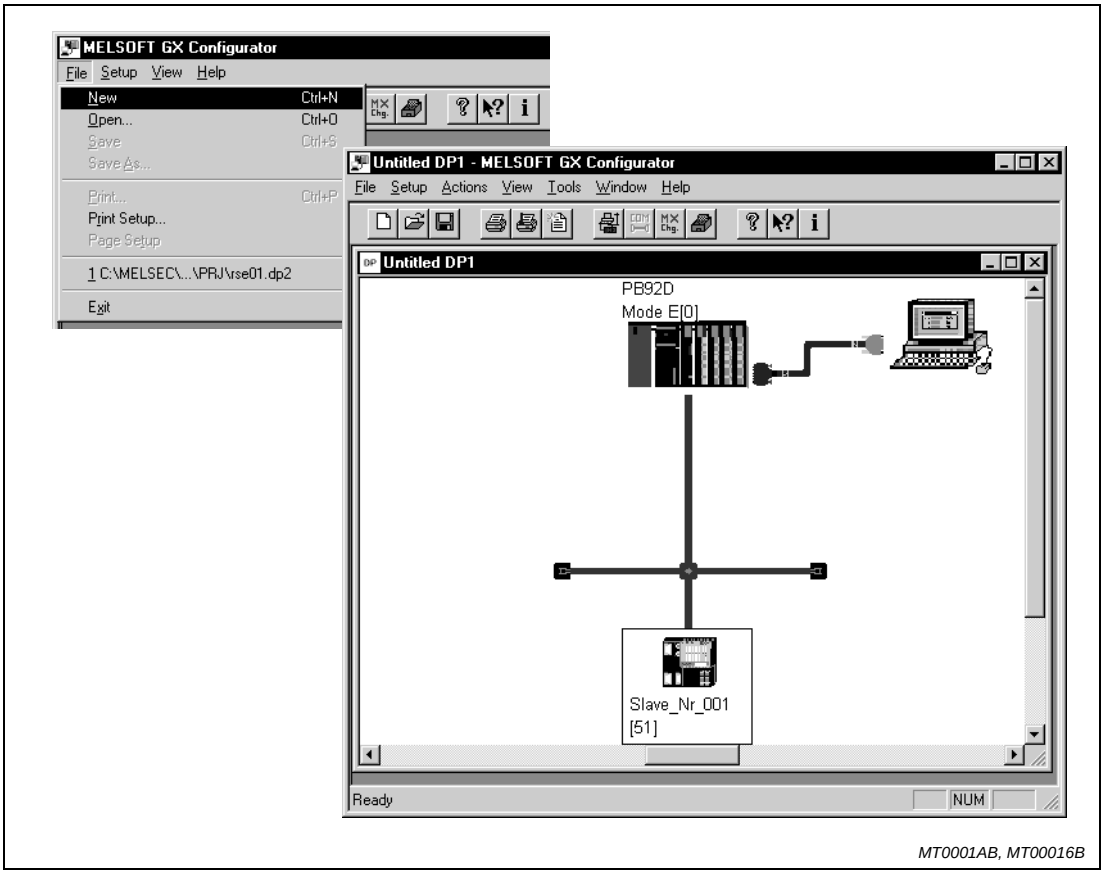


Fig. 7-15: *System configuration in the graphical network editor*

② In the graphical network editor right-click on the slave system to open the context menu. Select „User Parameters“ to open the dialog „Extended User Parameters“.
In this dialog you can parameterize the configured slaves directly after selecting them with the mouse. Left-click on the desired module tab. A dialog box opens including the parameters in clear. Left-click on the parameter to be edited. A drop-down list opens for the selection of the setting. The dialog can as be operated as well via the keyboard (refer to GX Configurator-DP manual).

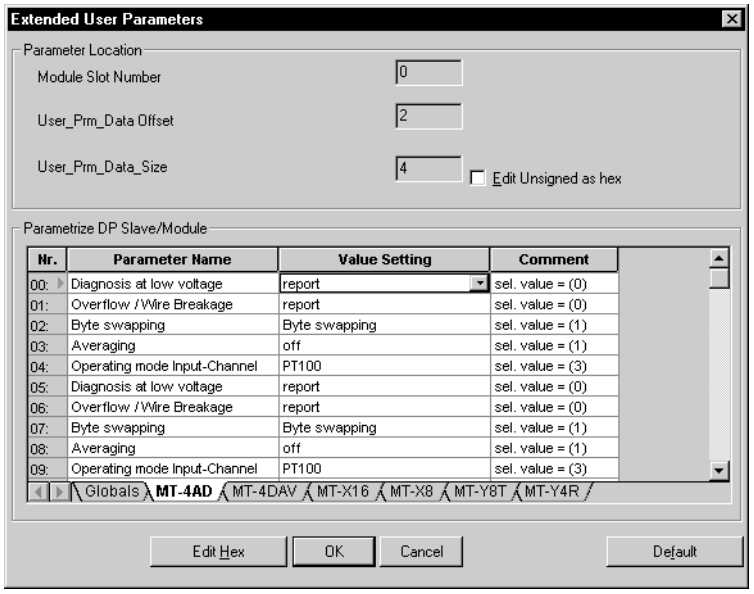


Fig. 7-16: *Parameter entry and editing in clear*

③ Click on the "Edit Hex" button. The Hex Editor for the slave user parameters opens. Alternatively to the dialog „Extended User Parameters“ in the grid of the Hex Editor the parameter data of the individual modules has to be entered corresponding to the descriptions of the parameterization frames and parameterizing data arrangements (refer to Chapter 7.1 to 7.13).
Fig. 7-17 shows the data corresponding to the sample configuration (fig. 6-2). The decimal values of the binary encoding of the set bits of the parameter bytes in hexadecimal format are to be entered. Table 7-2 shows the assignment of entries to the according parameter data. The entries begin at the 0th parameter byte.

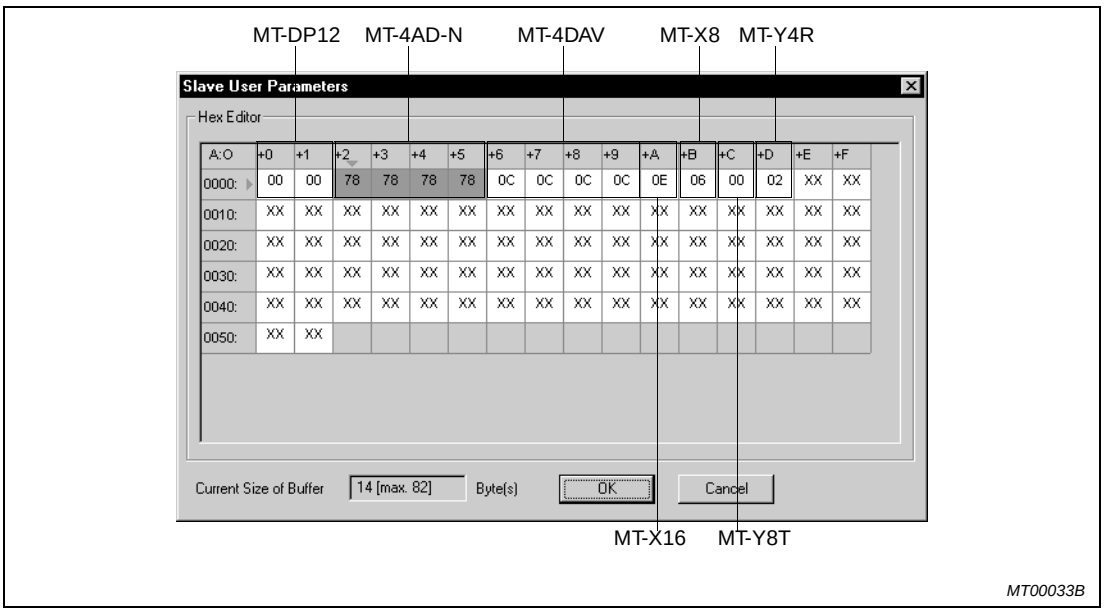


Fig. 7-17: *Hexadecimal parameter entry and editing*

Confirm the entries and close this dialog with “OK”. You are back in the dialog „Extended User Parameters“. Close and confirm this dialog with „OK“.

The table below shows the entries corresponding to the parameterizing frame and parameter byte arrangement (Chapter 7-1 to 7-13):

Byte	Module	Parameterization		Binary value b7 – b0	Decimal value	Hexadec. value
00 (00H)	MT-DP12	Reserved		00000000	0	00H
01 (01H)		Static diagnosis enabled. b0 = 0 Diagnostics messaging enabled. b1 = 1		00000000	0	00H
02 (02H)	MT-4AD-N	Channel 1	Error 0 return enabled. b1 = 0 Error 1 return enabled. b2 = 0 Byte swap enabled. b3 = 1 Averaging off. b4 = 1 Channel control mode PT100. b7–b5 = 011	01111000	120	78H
03 (03H)		Channel 2	Error 0 return enabled. b1 = 0 Error 1 return enabled. b2 = 0 Byte swap enabled. b3 = 1 Averaging off. b4 = 1 Channel control mode PT100. b7–b5 = 011	01111000	120	78H
04 (04H)		Channel 3	Error 0 return enabled. b1 = 0 Error 1 return enabled. b2 = 0 Byte swap enabled. b3 = 1 Averaging off. b4 = 1 Channel control mode PT100. b7–b5 = 011	01111000	120	78H
05 (05H)		Channel 4	Error 0 return enabled. b1 = 0 Error 1 return enabled. b2 = 0 Byte swap enabled. b3 = 1 Averaging off. b4 = 1 Channel control mode PT100. b7–b5 = 011	01111000	120	78H
06 (06H)	MT-4DAV	Channel 1	Clear outputs on bus errors. b0 = 0 Error 0 return enabled. b1 = 0 Error 1 return disabled. b2 = 1 Byte swap enabled. b3 = 1 Channel control mode 0 – 10V. b7–b5 = 000	00001100	12	0CH
07 (07H)		Channel 2	Clear outputs on bus errors. b0 = 0 Error 0 return enabled. b1 = 0 Error 1 return disabled. b2 = 1 Byte swap enabled. b3 = 1 Channel control mode 0 – 10V. b7–b5 = 000	00001100	12	0CH
08 (08H)		Channel 3	Clear outputs on bus errors. b0 = 0 Error 0 return enabled. b1 = 0 Error 1 return disabled. b2 = 1 Byte swap enabled. b3 = 1 Channel control mode 0 – 10V. b7–b5 = 000	00001100	12	0CH
09 (09H)		Channel 4	Clear outputs on bus errors. b0 = 0 Error 0 return enabled. b1 = 0 Error 1 return disabled. b2 = 1 Byte swap enabled. b3 = 1 Channel control mode 0 – 10V. b7–b5 = 000	00001100	12	0CH
10 (0AH)	MT-X16	Error 0 return disabled. b1 = 1 Error 1 return disabled. b2 = 1 High- / Low-Byte swap. b3 = 1		00001110	14	0EH
11 (0BH)	MT-X8	Error 0 return disabled. b1 = 1 Error 1 return disabled. b2 = 1		00000110	6	06H
12 (0CH)	MT-Y8T	Clear outputs on bus errors. b0 = 0 Error 0 return enabled. b1 = 0 Error 1 return disabled. b2 = 0		00000000	0	00H
13 (0DH)	MT-Y4R	Clear outputs on bus errors. b0 = 0 Error 0 return disabled. b1 = 1		00000010	2	02H

Tab. 7-2: *Listing of the entries in the parameterizing matrix*

④ Now your configuration can be written to the PROFIBUS/DP master. Right-click on the grafical network editor to open the context menu. Select „Actions“ and “Write to PB92D”.

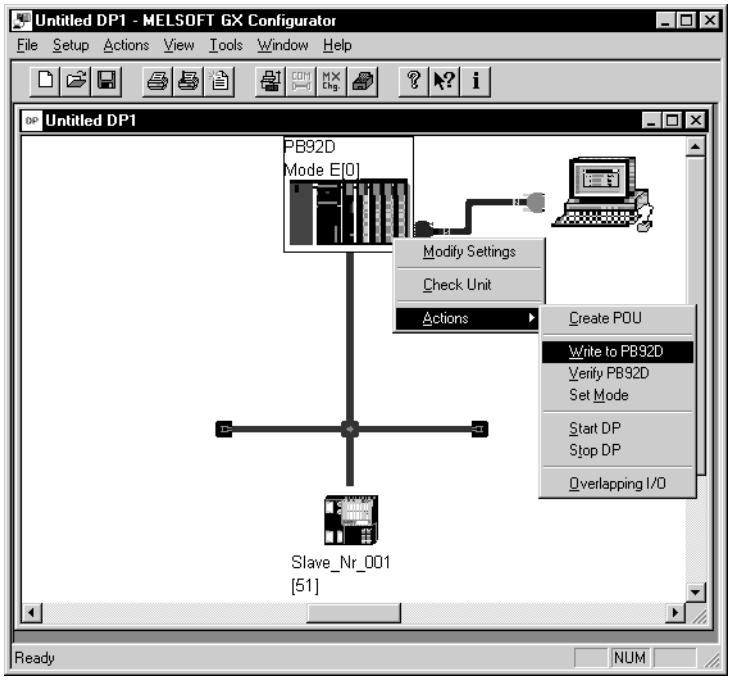


Fig. 7-18: *Writing the parameterizing data*

For further use save your configuration project via the menu item „File - Save“.

NOTE Refer to the software manual of GX Configurator-DP for further details.

8 Maintenance and Inspection

This chapter describes items for daily and periodic maintenance and inspection to maintain the MT system in errorfree and best condition.

8.1 Daily inspection

The table below gives an overview of inspections to be checked daily:

No.	Check Item		Check Point	Judgement	Corrective Action
1	DIN rail		Check for loose mounting screws.	Mounting screws of the DIN rail must not be loose.	Retighten mounting screws.
2	Modules		Check proper seating of the modules on the DIN rail.	The modules must be mounted properly to the DIN rail.	Attach modules properly.
3	Cable connections		Check for loose terminal screws.	Terminal screws must not be loose.	Retighten terminal screws.
			Check clearance between solderless terminals.	Proper clearance must be provided between solderless terminals.	Correct clearance.
			Check connectors of extension cable.	Connectors should not be loose.	Retighten connector mounting screws.
4	LEDs on the modules	US LED	Check that the LED is ON after switching on.	LED is ON (OFF indicates an error).	Refer to Chapter 9-2
		RUN LED	Check that the LED is ON during RUN.	LED is ON. (OFF or flashing indicates an error)	Refer to Chapter 9-2
		ERROR-LED	Check that the LED is ON, only if an error occurs.	LED is OFF. (Constantly ON indicates an error)	Refer to Chapter 9-2
		Input LED	Check that the LED turns ON and OFF.	LED is ON when input is ON. LED is OFF when input is OFF. (Deviation indicates an error)	Check sensors and sensor leads for breaks.
		Output LED	Check that the LED turns ON and OFF.	LED is ON when output is ON. LED is OFF when output is OFF. (Deviation indicates an error)	Check actuators and actuator leads for breaks.

Tab. 8-1: *Daily inspection*

8.2 Periodic inspection

This section describes the inspection items to be checked every six to twelve months. Also check these items, if the system configuration or wiring was changed.

No.	Check Item		Checking Method	Judgment	Corrective Action
1	Ambient conditions	Ambient temperature	Measure with thermometer and hygrometer. Measure corrosive gas.	0 – 55 °C	If the MT system is installed inside a cabinet, the conditions inside the cabinet are relevant.
		Ambient humidity		10 – 90 % RH	
		Ambience		There must not be corrosive gases.	
2	Line voltages of the modules		Check the line voltages UB, UI, and UO across the terminals.	24 V: 18 – 30 V DC	Change input voltages or renew power supply.
3	Condition of modules	Loose seating of the modules on the DIN rail	Check proper seating of the modules on the DIN rail.	The modules must be mounted properly to the DIN rail.	Attach modules properly.
		Dirt, dust, or foreign matters	Visual check.	There must not be dirt, dust or foreign matters in the vicinity of the modules.	Remove and clean.
4	Connecting conditions	Loose terminal screws	Check for loose terminal screws.	Terminal screws must not be loose.	Retighten terminal screws.
		Clearance between solderless terminals.	Visual check.	Proper clearance must be provided between solderless terminals.	Correct clearance.
		Loose connectors	Visual check.	Connectors should not be loose.	Retighten connector mounting screws.

Tab. 8-2: *Periodic inspection*

9 Troubleshooting

This chapter describes various procedures for troubleshooting, as well as corrective actions.

9.1 Basic troubleshooting

System reliability not only depends on reliable equipment but also on short down-times in the event of faults. The three basic points to be kept in mind in troubleshooting are:

Visual checks

- How does the controlled periphery operate (in STOP and operating mode)?
- Is the power ON or OFF?
- Status of inputs and outputs?
- Condition of wiring (I/O lines, cables)?
- Status of LED indicators (US, RUN, ERROR LED, I/O LEDs)?

Trouble check

Observe any changes in the error condition during

- short switch OFF and ON

Narrow down the possible causes of the trouble

Deduce where the fault lies

- inside or outside the head station
- in an I/O module

The flow chart on the next page provides further help for failure narrowing.

9.2 Troubleshooting

9.2.1 Troubleshooting flowchart

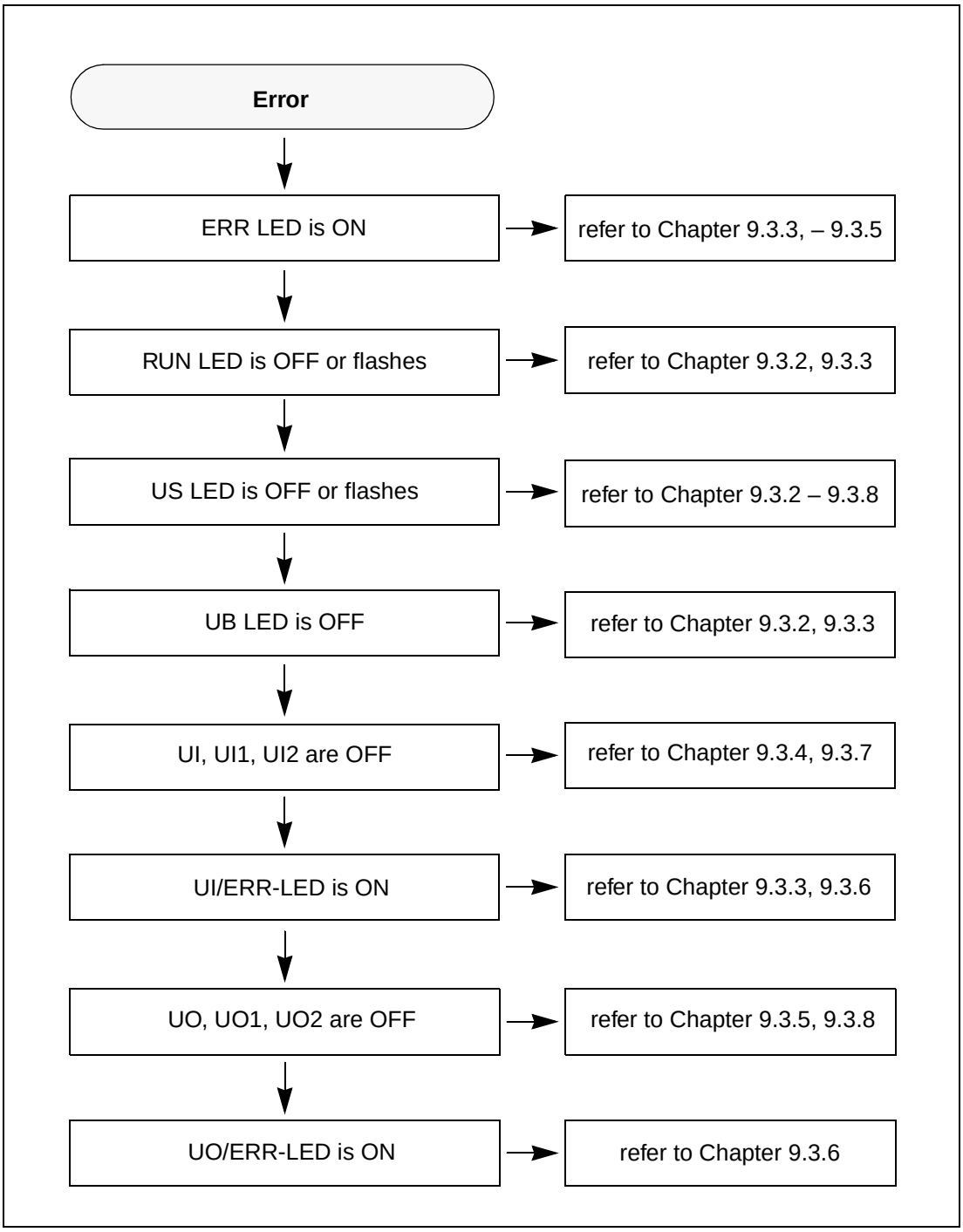


Fig. 9-1: *Troubleshooting flowchart*

9.3 Troubleshooting by LED indicators

Troubleshooting is supported by the LED indicators on the single modules. The status of the LEDs and corresponding diagnostics are described in the following chapters.

9.3.1 Putting the module into operation and cyclic operation

Prior to the initial operation the operating parameters have to be downloaded from the masters A1SJ71PB92D, AJ71PB92, and QJ71PB92D to the slave station (MT system). The output Y0 of the master module has to be set for this operation.

After switching on the RUN LED flashes at low frequency (1 Hz). At this stage the master-slave configuration is compared and the system interface configured.

If the comparison result is positive, the RUN LED remains ON. If the LED indication differs an error occured (refer to Chapter 9.3.2).

9.3.2 LED troubleshooting of the MT-DP12 module

For troubleshooting, judge the LED indications illustrated in fig. 9-2 according to tab. 9-1 and perform the corresponding corrective actions.

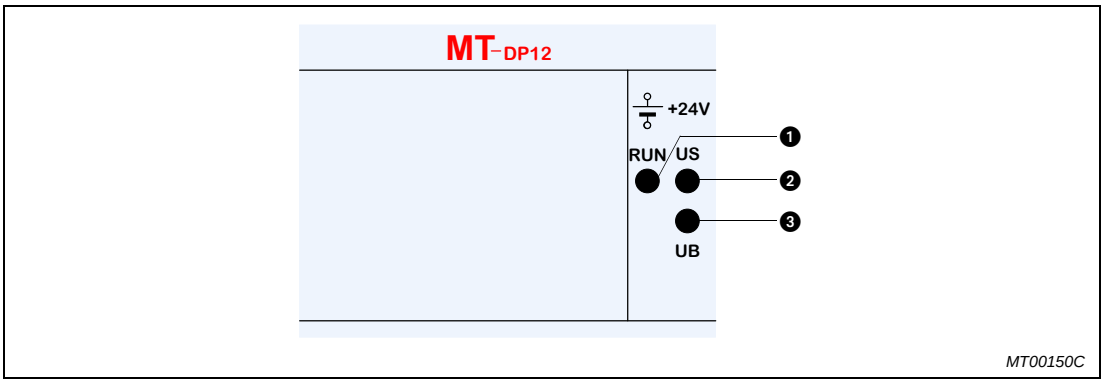


Fig. 9-2: *Diagnostics indicators on the MT-DP12 module*

Position	LED	Status	Diagnosis	Corrective Action
❶	RUN LED (green)	ON	Cyclic data communication with the master	—
		Flashes slowly (1 Hz)	Comparison master-slave configuration/system interface configuration	—
		Flashes quickly (5 Hz)	No extension modules connected or failure in system interface	Check the connections of the extension modules (int. system connection), customer service.
		OFF	Module failure	Customer service
❷	US LED (green)	ON	Voltage supply applied	—
		OFF	Voltage supply of the modules not applied, MT-DP12 module is not power supplied, module failure	Check voltage supply UB, customer service.
❸	UB LED (green)	ON	Voltage supply of the MT-DP 12 module applied	—
		OFF	Voltage supply of the MT-DP 12 module not applied	Check voltage supply UB.

Tab. 9-1: *LED diagnostics of the MT-DP12 module*

9.3.3 LED troubleshooting of the MT-DP12E module

For troubleshooting, judge the LED indications illustrated in fig. 9-3 according to tab. 9-2 and perform the corresponding corrective actions.

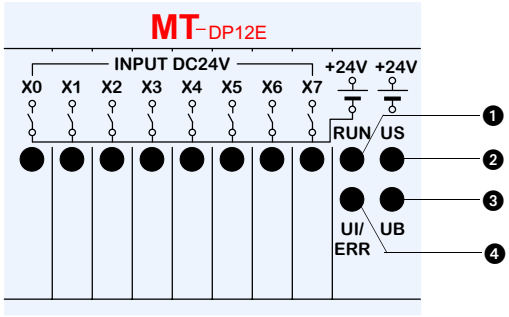


Fig. 9-3: *Diagnostics indicators on the MT-DP12E module*

Position	LED	Status	Diagnosis	Corrective Action
❶	RUN LED (green)	ON	Cyclic data communication with the master	—
		Flashes slowly (1 Hz)	Comparison master-slave configuration/system interface configuration	—
		Flashes quickly (5 Hz)	No extension modules connected or failure in system interface	Check the connections of the extension modules (int. system connection), customer service.
		OFF	Module failure	Customer service
❷	US LED (green)	ON	Voltage supply applied	—
		OFF	Voltage supply of the modules not applied, MT-DP12 module is not power supplied, module failure	Check voltage supply UB, customer service.
❸	UB LED (green)	ON	Voltage supply of the MT-DP 12 module applied	—
		OFF	Voltage supply of the MT-DP 12 module not applied	Check voltage supply UB.
❹	UI/ERR-LED (green/red)	Green	Voltage for the sensors supplied/normal operation	—
		Red	Voltage for the sensors not supplied/group error message sensor supply	Check voltage supply UI, check sensors and wires for short circuits.

Tab. 9-2: *LED diagnostics of the MT-DP12E module*

9.3.4 LED troubleshooting of the digital input modules

For troubleshooting of the MT-X8 and MT-X16 modules, judge the LED indications illustrated in fig. 9-4 according to table 9-3 and perform the corresponding corrective actions.

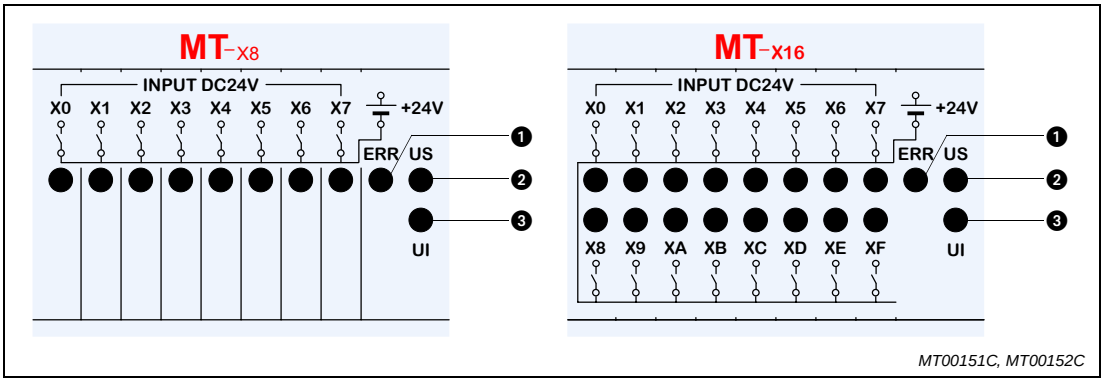


Fig. 9-4: *Diagnostics indicators on digital input modules*

Position	LED	Status	Diagnosis	Corrective Action
❶	ERR LED (red)	OFF	Normal operation.	—
		ON	Group error message sensor power supply	Check the voltage supply UI, check the sensors and leads for short-circuits.
❷	US LED (green)	ON	Voltage supply of the system interface applied	—
		OFF	Voltage not supplied, failure in internal system connection, failure in MT-DP 12 module, voltage UB of the MT-DP12 module not supplied	Check internal system connection (connectors), check voltage UB of the MT-DP12 module, customer service.
❸	UI LED (green)	ON	Voltage supply of the sensors applied	—
		OFF	Voltage supply of the sensors not applied	Check voltage supply UI.

Tab. 9-3: *LED diagnostics of the digital input modules*

9.3.5 LED troubleshooting of the digital output modules

For troubleshooting of the MT-Y8T, MT-Y16T, MT-Y8T2, and MT-Y4R modules, judge the LED indications illustrated in fig. 9-5 according to table 9-4 and perform the corresponding corrective actions.

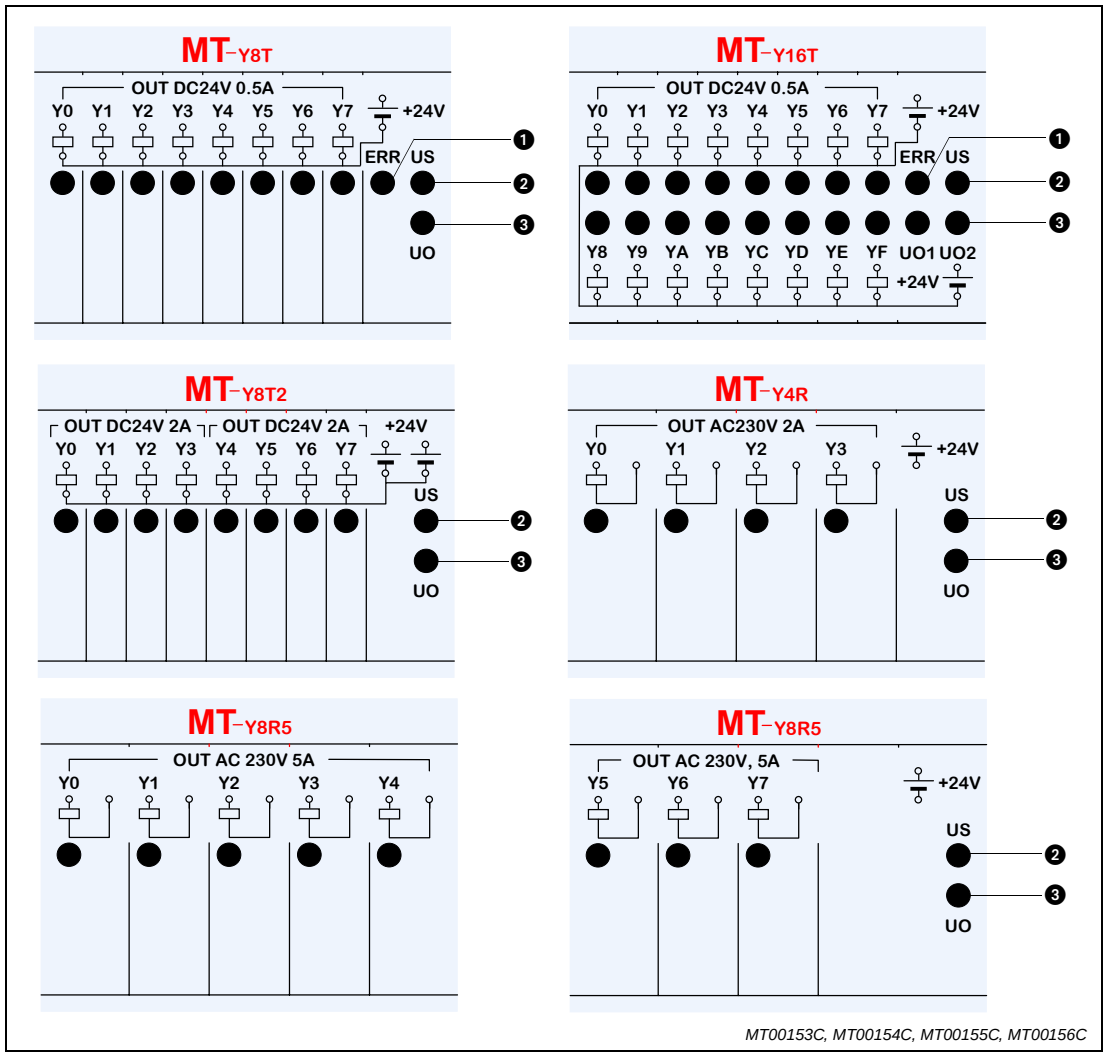


Fig. 9-5: *Diagnostics indicators on digital output modules*

Position	LED	Status	Diagnosis	Corrective Action
❶	ERR LED (red)	OFF	Normal operation	—
		ON	Group error message actuator short-circuited	Check the actuators and actuator leads for short-circuits.
❷	US LED (green)	ON	Voltage supply of the system interface applied	—
		OFF	Voltage not supplied, failure in internal system connection, failure in MT-DP 12 module, voltage UB of the MT-DP12 module not supplied	Check internal system connection (connectors), check voltage UB of the MT-DP12 module, customer service.
❸	UO LED (green) UO1 LED (green) UO2 LED (green)	ON	Voltage supply of the actuators applied	—
		OFF	Voltage supply of the actuators not applied	Check voltage supply UO, UO1 and UO2.

Tab. 9-4: *LED diagnostics of the digital input modules*

9.3.6 LED troubleshooting of the digital input/output modules

For troubleshooting of the MT-X4Y4T module, judge the LED indications illustrated in fig. 9-6 according to table 9-5 and perform the corresponding corrective actions.

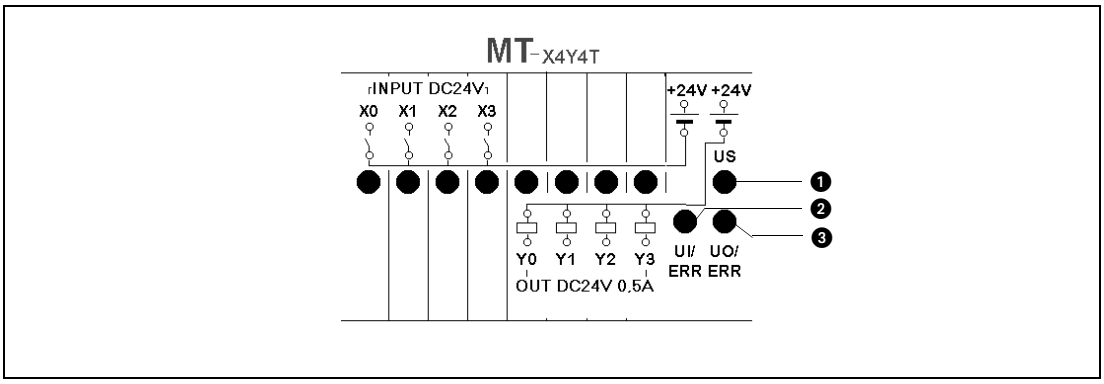


Fig. 9-6: *Diagnostics indicators on digital input/output modules*

Position	LED	Status	Diagnosis	Corrective Action
❶	US LED (green)	ON	Voltage supply of the system interface applied	—
		OFF	Voltage not supplied, failure in internal system connection, failure in MT-DP12(E) module, voltage UB of the MT-DP12(E) module not supplied	Check internal system connection (connectors), check voltage UB of the MT-DP12(E) module, customer service.
❷	UI/ERR LED (green/red)	Green	Voltage for the sensors supplied/normal operation	—
		Red	Voltage for the sensors not supplied/group error message sensor supply, short-circuit	Check voltage supply UI, check the sensors and wires for short-circuits.
❸	UO/ERR-LED (green/red)	Green	Voltage supply of the actuators applied/normal operation	—
		Red	Voltage supply not applied/ group error message actor supply, short-circuit	Check voltage supply UO, check the actors and wires for short-circuits.

Tab. 9-5: *LED diagnostics of the digital input/output modules*

9.3.7 LED troubleshooting of the analog input modules

For troubleshooting of the MT-4AD-N module, judge the LED indications illustrated in fig. 9-7 according to table 9-6 and perform the corresponding corrective actions.

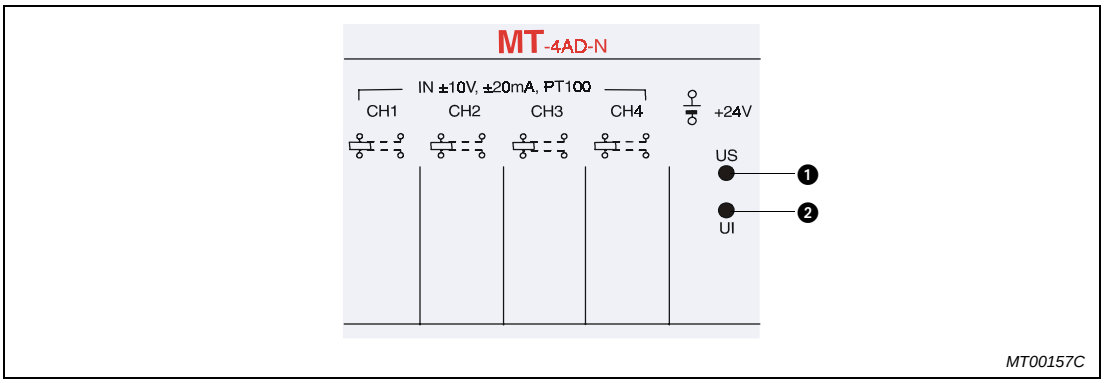


Fig. 9-7: *Diagnostics indicators on MT-4AD-N module*

Position	LED	Status	Diagnosis	Corrective Action
❶	US LED (green)	ON	Voltage supply of the system interface applied.	—
		Flashes slowly (1 Hz)	Internal module failure	Customer service
		Flashes quickly (5 Hz)	Failure in the internal system connection to the MT-DP12 module.	Check internal system connection (connectors)
		OFF	Voltage not supplied, failure in internal system connection, failure in MT-DP 12 module, voltage UB of the MT-DP12 module not supplied.	Check internal system connection (connectors), check voltage UB of the MT-DP12 module, customer service.
❷	UI LED (green)	ON	Voltage for the sensors supplied.	—
		OFF	Voltage for the sensors not supplied.	Check voltage supply UI of the sensors

Tab. 9-6: *LED diagnostics of the MT-4AD-N module*

9.3.8 LED troubleshooting of the analog output modules

For troubleshooting of the MT-4DAV module, judge the LED indications illustrated in fig. 9-8 according to table 9-7 and perform the corresponding corrective actions.

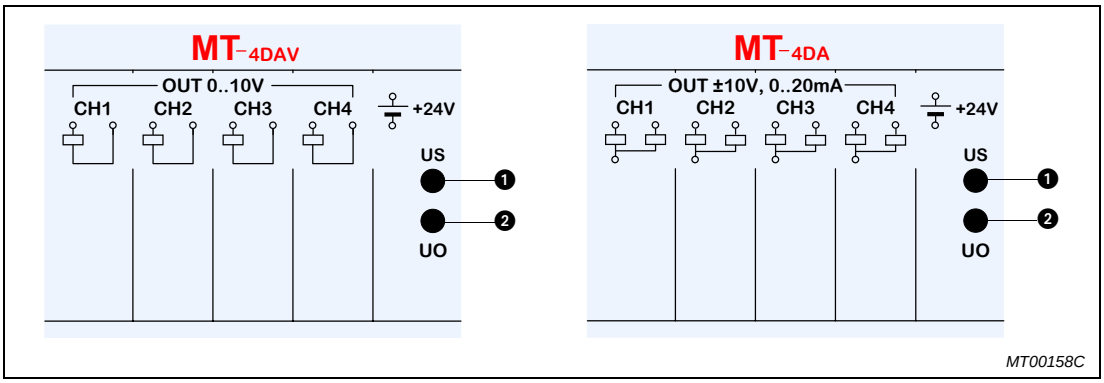


Fig. 9-8: *Diagnostics indicators on MT-4DAV module*

Position	LED	Status	Diagnosis	Corrective Action
❶	US LED (green)	ON	Voltage supply of the system interface applied.	—
		Flashes slowly (1 Hz)	Internal module failure	Customer service
		Flashes quickly (5 Hz)	Failure in the internal system connection to the MT-DP12 module.	Check internal system connection (connectors)
		OFF	Voltage not supplied, failure in internal system connection, failure in MT-DP 12 module, voltage UB of the MT-DP12 module not supplied.	Check internal system connection (connectors), check voltage UB of the MT-DP12 module, customer service.
❷	UO LED (green)	ON	Voltage for the actuators supplied.	—
		OFF	Voltage for the actuators not supplied.	Check voltage supply UO of the actuators.

Tab. 9-7: *LED diagnostics of the MT-4DAV module*

9.4 Failure diagnosis via PROFIBUS/DP

The failure diagnosis via the PROFIBUS/DP is supported by the masters A1SJ71PB92D and QJ71PB92D only. For the failure diagnosis the diagnostics frame written to the buffer memory has to be read-out. The reception of the diagnostics frame by the master is indicated by the master by setting X1. The diagnostics frame is sent to the master by the MT-DP12(E) module.

The MT-DP12(E) module supports the device and identification related diagnosis. A channel related diagnosis is not supported. The identification related (location related) diagnosis for the extension modules applies to one channel. In this respect one channel represents one digital extension module or the analog channel of an analog module.

The diagnostics data is sent on each occurrence and remedy of a failure in one channel. If for one channel an error was returned (e.g, Error 0) and another error (e.g, Error 1) occurs in the same channel, no further diagnostics data is transferred. All errors are recognized and stored but only the first error per channel will be returned through transmission of diagnostics data.

9.4.1 Arrangement of the diagnostics frame

Table 9-8 describes the arrangement of the diagnostics frame:

<table>
<tr><th rowspan="2">Byte no.</th><th colspan="3">Diagnostics data</th></tr>
<tr><th>Description</th><th colspan="2">Explanation</th></tr>
<tr><td>0</td><td>Status 1 of station</td><td colspan="2" rowspan="6">Fixed header, according to
Profibus User Club guideline</td></tr>
<tr><td>1</td><td>Status 2 of station</td></tr>
<tr><td>2</td><td>Status 3 of station</td></tr>
<tr><td>3</td><td>Diagnostics master_add</td></tr>
<tr><td>4</td><td>Ident number_high</td></tr>
<tr><td>5</td><td>Ident number_low</td></tr>
<tr><td>6</td><td>Header byte of the device related diagnosis</td><td>02H</td><td rowspan="2">Device related diagnosis,
2 bytes long (incl. header)</td></tr>
<tr><td>7</td><td>Data byte of the device related diagnosis</td><td></td></tr>
<tr><td>8</td><td>Header byte of the identification related diagnosis</td><td colspan="2">Length of identification related diagnosis</td></tr>
<tr><td>9</td><td>1. Data byte of the identification related diagnosis</td><td>Channel 0 to 7</td><td rowspan="10">Each bit in the data range corresponds to one channel of a extension module.</td></tr>
<tr><td>10</td><td>2. Data byte of the identification related diagnosis</td><td>Channel 8 to 15</td></tr>
<tr><td>11</td><td>3. Data byte of the identification related diagnosis</td><td>Channel 16 to 23</td></tr>
<tr><td>12</td><td>4. Data byte of the identification related diagnosis</td><td>Channel 24 to 31</td></tr>
<tr><td>13</td><td>5. Data byte of the identification related diagnosis</td><td>Channel 32 to 39</td></tr>
<tr><td>14</td><td>6. Data byte of the identification related diagnosis</td><td>Channel 40 to 47</td></tr>
<tr><td>15</td><td>7. Data byte of the identification related diagnosis</td><td>Channel 48 to 55</td></tr>
<tr><td>16</td><td>8. Data byte of the identification related diagnosis</td><td>Channel 56 to 63</td></tr>
<tr><td>17</td><td>9. Data byte of the identification related diagnosis</td><td>Channel 64 to 71</td></tr>
<tr><td>18</td><td>10. Data byte of the identification related diagnosis</td><td>Channel 72 to 79</td></tr>
</table>

Tab. 9-8: *Diagnostics frame*

That means that byte 7 contains the reason why the MT-DP12 module has sent a diagnostics frame to the master. Since the MT system consists of several modules in which a failure might have occurred, the bytes 9 through 18 of the diagnostics frame determine the digital module or analog channel respectively in which the failure occured.

9.4.2 Description of the diagnostics bytes

The first 6 bytes (byte 0 - byte 5) of the diagnostics frame form a fixed header conforming to the Profibus User Club guideline.

Byte 6 determines the device related diagnostics bytes. For the MT-DP12 module, two device related diagnostics bytes are determined. Figure 9-9 shows the arrangement of byte 6 of the diagnostics frame.

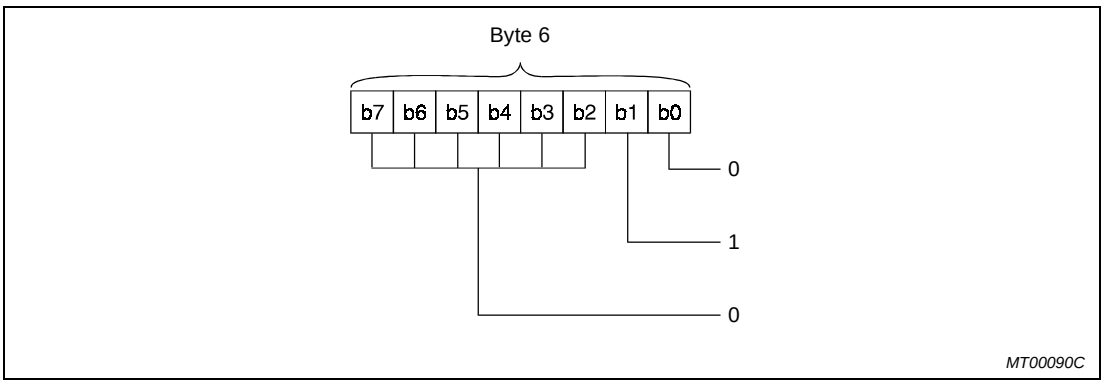


Fig. 9-9: *Byte 6 of the diagnostics frame*

Byte 7 contains the error code of the occurred errors. Table 9-9 gives an overview of possible errors.

Error	Description
Error 0	Internal system error
Error 1	Voltage for sensors/actuators not supplied
Error 2	Short-circuit in sensor/actuator supply
Error 3	Range overflow or underflow of analog values
Error 4	Wire break PT100

Tab. 9-9: Error codes

Figure 9-10 shows the assignment of bits to the according error codes:

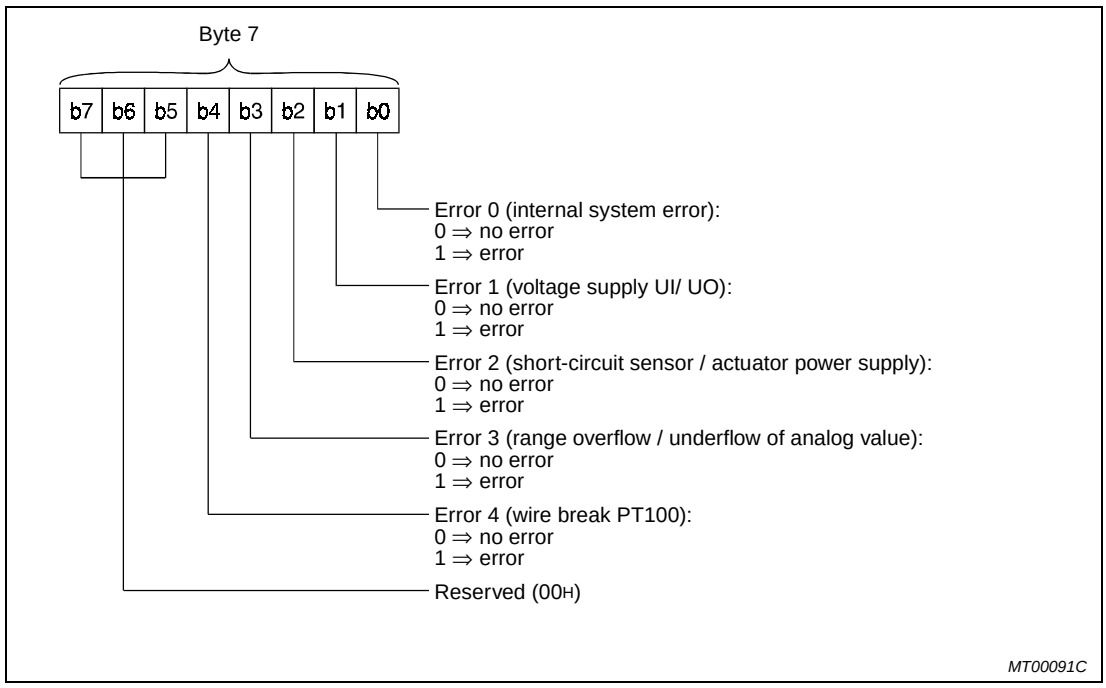


Fig. 9-10: *Byte 7 of the diagnostics frame*

Byte 8 of the diagnostics frame determines the number (incl. byte 8) of the identification related diagnostics bytes (bytes locating the error). In this respect one channel represents one digital input / output module or the channel of an analog module. The frame length varies between 2 and 10 bytes depending on the number of channels. Figure 9-11 shows the arrangement of byte 8 of the diagnostics frame. Conforming to the PROFIBUS/DP standard bit 7 always retains the status 0 and bit 6 the status 1.

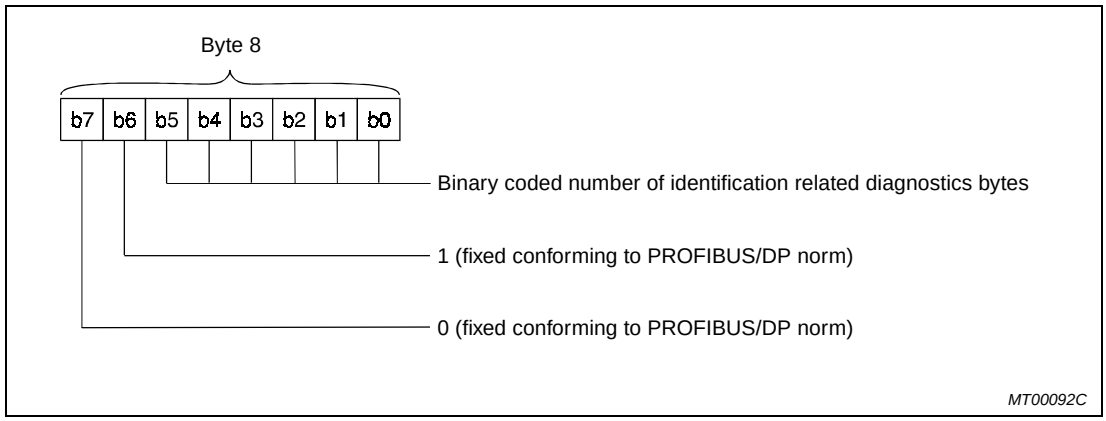


Fig. 9-11: *Byte 8 of the diagnostics frame*

The bytes 9 through 18 of the diagnostics diagram specify the location (channel) where error 0 through error 4 occurred. Figure 9-10 shows the bytes 9 and 18 of the diagnostics frame.

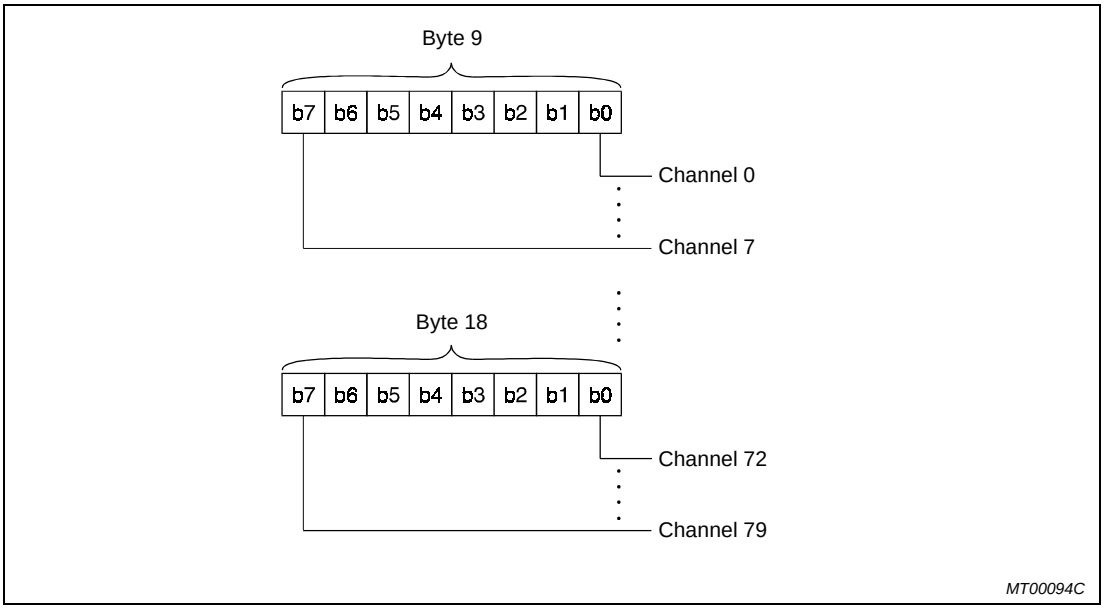


Fig. 9-12: *1st and 10th data byte of the identification related diagnostics*

10 Specifications

10.1 General specifications

Operating conditions	Specifications		
Operating ambient temperature	0 to +55 °C		
Storage ambient temperature	-25 to +75 °C		
Operating ambient humidity	10 % – 90 % RH (non-condensing)		
Vibration resistance DIN IEC 68 part 2-6 compliant	Frequency	Acceleration	Amplitude
	10 – 58 Hz	—	0,15 mm
	58 – 150 Hz	2 G	
Shock resistance DIN IEC 68 part 2-27 compliant	Amplitude 15 G, 11 ms duration		
Noise immunity EN 61000-4-3 compliant	HF-field conforming to ENV 50140, field strength 10 V/m, 10 – 1000 kHz		
Withstand strength (Burst) EN 61000-4-4 compliant	2000 V for the power supply 2000 V for the bus lines 2000 V for the input / output lines		
Dielectric strength EN 61000-4-2 compliant	Air stroke: 8 kV Contact stroke: 4 kV Coupling plate (hor./vert.): 4 kV		
Isolation	MT-Y4R module conforms to DIN VDE 0160		
Grounding	PE connections of the terminal blocks are connected-through to the DIN rail. PE terminals must be connected.		
Noise radiation conforming to EN 55011	Group 1, Class A		
Operating ambience	Free of corrossive gases and minimum of dust.		
Cooling method	Self-cooling		
System of protection	IP 20		
Approvals	CE①		

Tab. 10-1: *General specifications*

① The CE certificate is approved for the following modules provided they are installed inside a metal cabinet:

MT-DP12(E)
MT-X8
MT-X16
MT-Y8T
MT-Y16T
MT-Y8T2
MT-Y4R
MT-Y8R5
MT-X4Y4T
MT-4AD-N
MT-4DA(V)

10.2 Interfaces

10.2.1 PROFIBUS/DP interface

This interface is only supplied on the MT-DP12 module. Table 10-2 describes the specifications of the PROFIBUS/DP interface:

Item	Description
Communications protocol	PROFIBUS/DP conforms to DIN 19245-3
Data transfer rates	9,6/19,2/93,75/187,5/500 kBaud/ 1,5/3/6/12 MBaud (automatic detection)①
Potential isolation	Optocoupler between interface and system
Operating modes	Sync mode und freeze mode support
Address setting	Adresses 1 – 99 via BCD rotary switch
Ident-number	F037H
Parameterization data	Depending on the configuration of the MT Series the maximum length of the parameterization frame is 82 bytes. The length of the parameterization frame of the A1SJ71PB92D master is limited by the system to 34 bytes (1 MT-DP12 module, 4 analog input modules, 4 analog output modules). The length of the parameterization frame of the AJ71PB92 master is limited by the software to 25 bytes.
Diagnostics data	6-byte system diagnostics conforming to the standard, 2-byte device related diagnostics, 2-10 bytes identification related diagnostics②.
Expansibility	16 extension modules max., 192 digital inputs and outputs, 4 analog input or output modules (limited by 32 send- and receive-bytes of the master buffer memory).

Tab. 10-2: *Specifications of the PROFIBUS/DP interface*

① The automatic baud rate detection is executed every time the voltage of MT Series is turned on. If the watchdog timer of the MT system was activated via GX Configurator-DP, the baud rate is detected once again after the watchdog timer has expired.

② This diagnosis is not supported by the master AJ71PB92.

10.2.2 System interface

This interface is supplied on all modules. Table 10-3 describes the specifications of the system interface:

Item	Description
Internal extension	10-core ribbon cable with socket connector conforming to DIN 41651
Local extension	System cable with 9-pin D-SUB male connector

Tab. 10-3: *Specifications of the system interface*

10.2.3 Local system connection

This interface is only supplied on the MT-DP12 and MT-LE modules. Table 10-4 describes the specifications of the local system connection:

Item	Description
Local system connection	9-pin D-SUB female socket
Application	Connection of the 1st connecting level (DIN rail with basic module) to 2nd connecting level (DIN rail with local system extenion)

Tab. 10-4: *Specifications of the local system connection*

10.3 Specifications of the modules

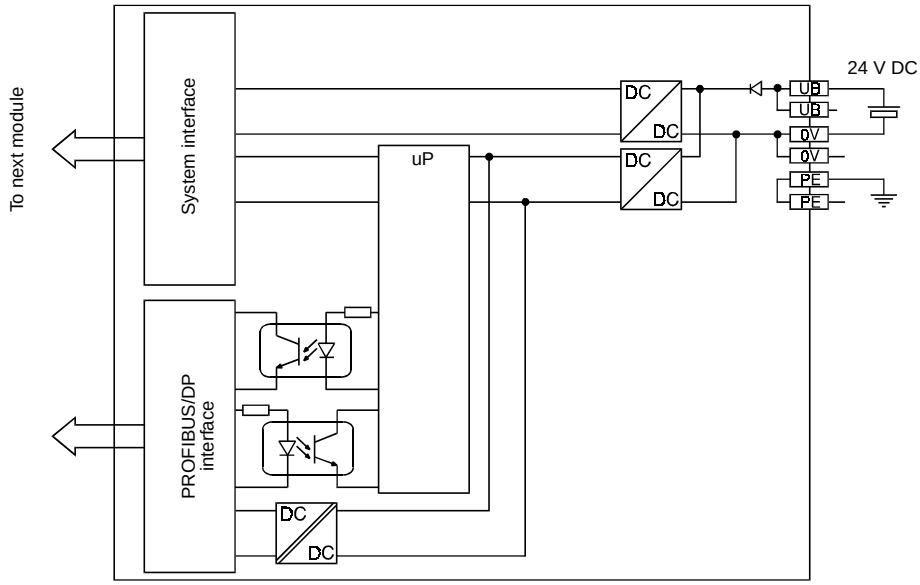
10.3.1 Basic module MT-DP12

Tables 10-5 and 10-6 describe the specifications and the external connections of the MT-DP12 module.

Item	MT-DP12	
Communications protocol	PROFIBUS/DP conforms to DIN 19245-3	
Data transfer rates	9,6/19,2/93,75/187,5/500 kBaud/ 1,5/3/6/12 MBaud (automatic detection)①	
Baud rate setting	Automatic detection①	
Potential isolation	Optocoupler between interface and system	
Operating modes	Sync mode und freeze mode support	
Address setting	Adresses 1 – 99 via BCD rotary switch	
Ident-number	F037H	
Number of extension modules	16 extension modules max., 192 digital inputs and outputs max., 4 analog input and output modules (limited by 32 send and receive bytes of the master buffer memory.	
Status indicators	RUN LED (green): PROFIBUS transmission	
	UB LED (green): Voltage supply	
	US LED (green): Voltage supply for the extension modules	
Nominal voltage	24 V DC	
Nominal input current	≤ 100 mA (without extension module)	
	≤ 500 mA (with maximum configuration)	
Supply voltage range	18 – 30 V DC	
Connecting terminals	Terminal block with screw terminal	
	Terminal block with cache clamp terminal	
Applicable wire size	Terminal block with screw terminal	0,75 – 2,5 mm^2
	Terminal block with cache clamp terminal	0,75 – 2,5 mm^2
Weight	0,28 kg	

Tab. 10-5: *Basic module MT-DP12*

① The automatic baud rate detection is executed every time voltage of the MT Series is turned on. If the watchdog timer of the MT system was activated via GX Configurator-DP, the baud rate is detected once again after the watchdog timer has expired.

External connection	Terminal block MT-DP12-TBS (TBC)	
	Terminal	Signal
	UB	Power supply
	0V	Ground
	PE	Prot. Earth①

Tab. 10-6: *External connection of the MT-DP12 module*

① The PE is connected-through to the backward metal plate internally.

10.3.2 Basic Module MT-DP12E

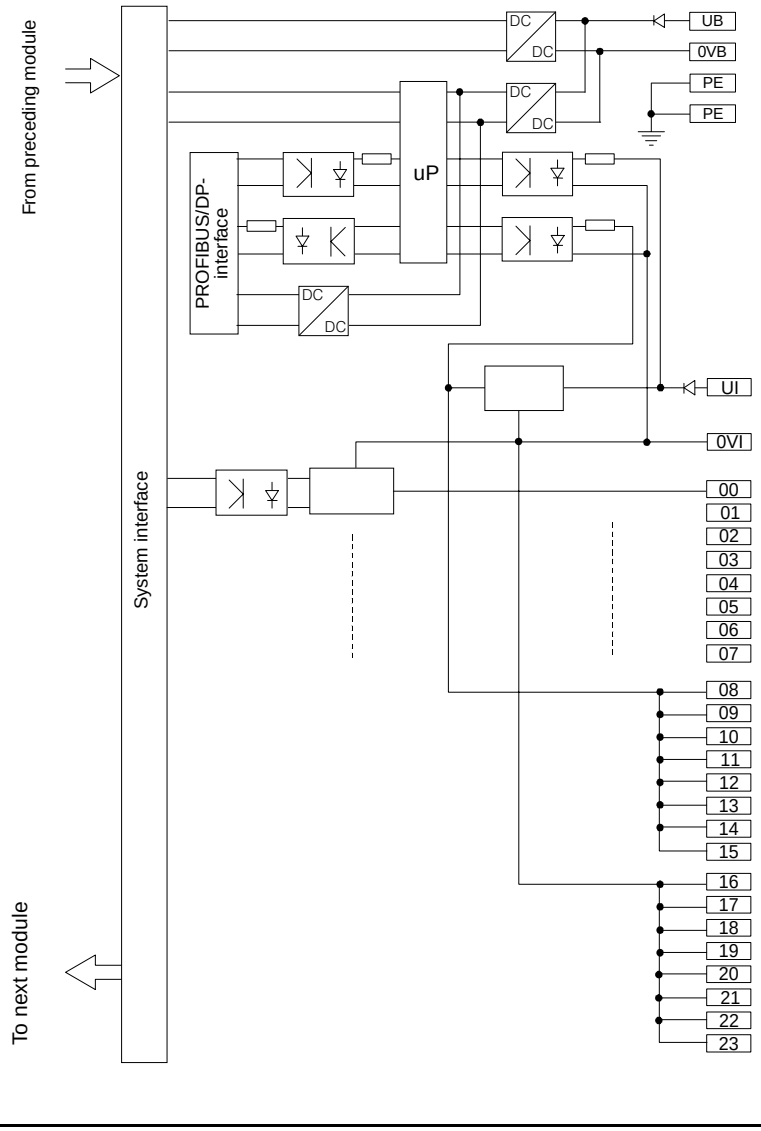
Tab. 10-7 and Tab. 10-8 describe the specifications and external connections of the MT-DP12 module.

Item		MT-DP12E	
Communications protocol		PROFIBUS/DP conforms to DIN 19245-3	
Data transfer rates		9,6/19,2/93,75/187,5/500 kBaud; 1,5/3/6/12 MBaud (automatic detection)	
Baud rate setting		Automatic detection①	
Potential isolation		Optocoupler between interface and system	
Operating modes		Sync mode and freeze mode support	
Address setting		Addresses 1 – 99 via BCD rotary switch	
Ident-number		F037H	
Number of extension modules		4 extension modules max., 72 digital inputs and outputs max. or 8 analog channels + 8 digital inputs	
Inputs			
Number of inputs		8	
Isolation		Optocoupler	
Voltage UI (sensor supply)		24 V DC	
Voltage range UI		18 – 30 V DC (ripple ratio: < 5 %)	
Input current sensor		0,7 A, electronic short-circuit protection	
Response time	OFF → ON	approx. 1 ms	
	ON → OFF	approx. 1 ms	
Input groupings		8 inputs per grouping Ground terminals: 16 – 23 (common potential)	
Status indicators		RUN-LED (green): PROFIBUS transmission	
		UB-LED (green):Voltage supply	
		US-LED (green):System voltage for the extension modules	
		Inputs (yellow):Input status	
Rated voltage		24 V DC	
Rated input current		≤ 150 mA (without extension modules)	
		≤ 560 mA (at maximum configuration)	
Voltage range		18 – 30 V DC	
Connecting terminals		Terminal block with screw terminals	
		Terminal block with cache clamp terminals	
Applicable wire size		Screw terminals	0,75 – 2,5 mm^2
		Cache clamp terminals	0,75 – 2,5 mm^2
Weight		approx. 0,28 kg	

Tab. 10-7: *Basic module MT-DP12E*

① The automatic baud rate detection is executed every time the voltage of MT Series is turned on. If the watchdog timer of the MT system was activated via GX Configurator-DP, the baud rate is detected once again after the watchdog timer has expired.

External connection



Terminal block MT-DP12E-TBS (TBC)	
Terminal	**Signal**
UB	Power supply
0V	Ground
PE	Prot. Earth②
UI	Sensor supply
00	X00
01	X01
02	X02
03	X03
04	X04
05	X05
06	X06
07	X07
08 – 15	Sensor supply
16 – 23	Ground

Tab. 10-8: *External connection of the MT-DP12E module*

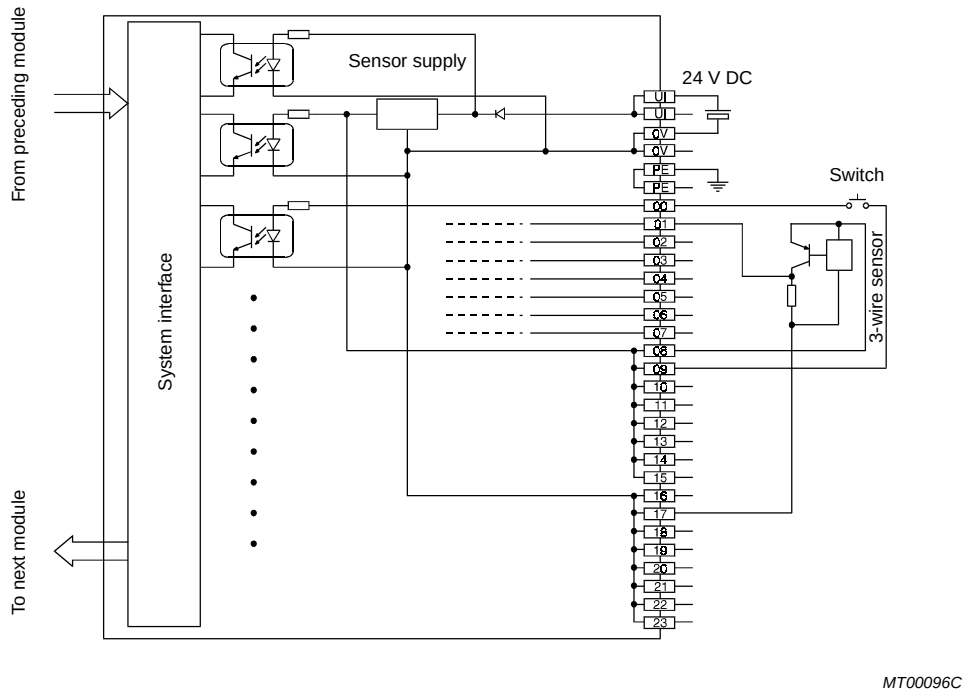
② The PE is connected-through to the backward plate internally.

10.3.3 Digital input module MT-X8

Tables 10-9 and 10-10 describe the specifications and the external connections of the MT-X8 module.

Item		MT-X8	
Number of inputs		8	
Simultaneously ON inputs		70 %	
Isolation		Optocoupler	
Voltage UI (sensor supply)		24 V DC	
Voltage range UI		18 – 30 V DC (ripple ratio: < 5 %)	
Input current (sensor supply)		≤ 30 mA (without sensor supply)	
Input current sensor		0,7 A, electronic short-circuit protection	
Polarity reversal protection		yes	
Input characteristic curve		conforms to IEC 1131-2, type 2; 7,5 mA at 24 VDC	
Max. inputs simultaneous on		8 points	
Inrush current		—	
Switch ON voltage / current		conforms to characteristic curve IEC 1131-2, type 2	
Switch OFF voltage / current			
Input resistance		not linear (see fig. 10-1, p. 10-18)	
Response time	OFF → ON	approx. 1 ms	
	ON → OFF	approx. 1 ms	
Input groupings		8 inputs per grouping Ground terminals: 16 – 23 (common potential)	
Status indicators		US LED (green): voltage supply of system interface US	
		UI LED (green): voltage supply UI for sensors	
		ERR LED (red): group error message of sensor supply	
		Inputs (yellow): status of inputs	
Connecting terminals		Terminal block with screw terminals	
		Terminal block with cache clamp terminals	
Applicable wire size		Screw terminals	0,75 – 2,5 mm^2
		Cache clamp terminals	0,75 – 2,5 mm^2
Internal power supply (8 V DC)		≤ 25 mA	
Weight		approx. 0,16 kg	

Tab. 10-9: *Digital input module MT-X8*

External connection	Terminal block MT-X8-TBS (TBC)	
	Terminal	Signal
	UI	Sensor supply
	0V	Ground
	PE	Prot. Earth①
	00	X00
	01	X01
	02	X02
	03	X03
	04	X04
	05	X05
	06	X06
	07	X07
	08 – 15	Sensor supply
	16 – 23	Ground

Tab. 10-10: *External connection of the MT-X8 module*

① The PE is connected-through to the backward metal plate internally.

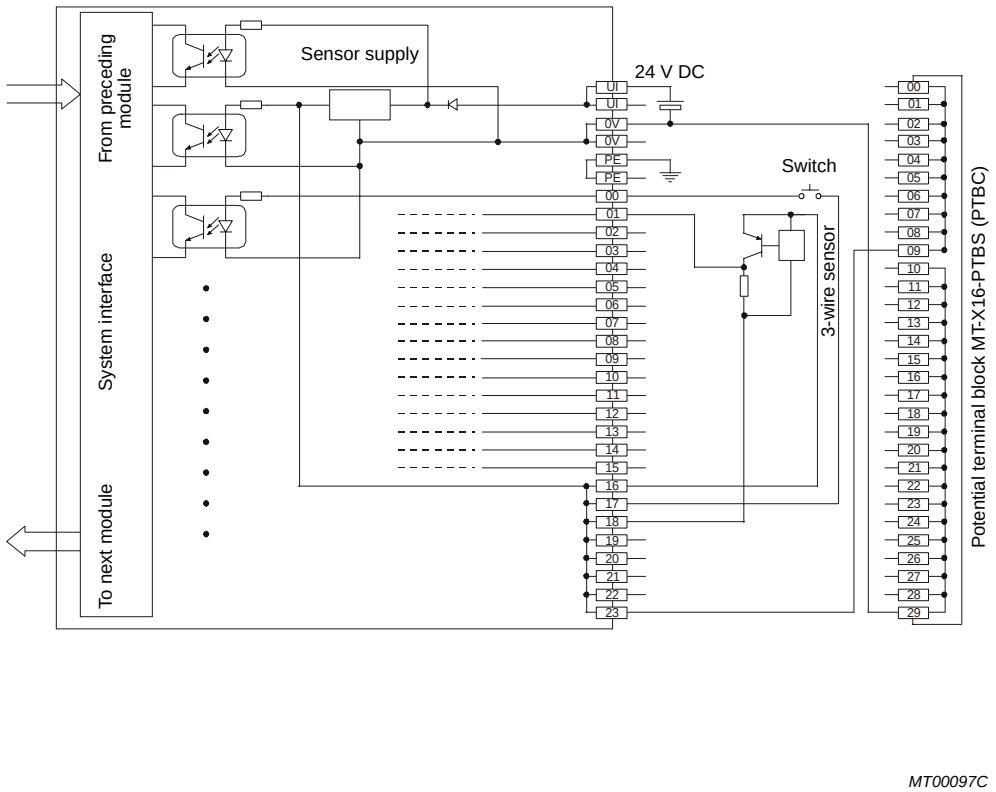
10.3.4 Digital input module MT-X16

Tables 10-11 and 10-12 describe the specifications and the external connections of the MT-X16 module.

Item		MT-X16	
Number of inputs		16	
Simultaneously ON inputs		70 %	
Isolation		Optocoupler	
Voltage UI (sensor supply)		24 V DC	
Voltage range UI		18 – 30 V DC (ripple ratio: < 5 %)	
Input current (sensor supply)		≤ 30 mA (without sensor supply)	
Input current sensor		0,7 A, electronic short-circuit protection	
Polarity reversal protection		yes	
Input characteristic curve		conforms to IEC 1131-2, type 2; 11 mA at 24 VDC	
Max. inputs simultaneous on		16 points	
Inrush current		—	
Switch ON voltage / current		conforms to characteristic curve IEC 1131-2, type 2	
Switch OFF voltage / current			
Input resistance		not linear (see fig. 10-1, p. 10-18)	
Response time	OFF → ON	approx. 1 ms	
	ON → OFF	approx. 1 ms	
Input groupings		16 inputs per grouping Ground terminals: 10 – 29 (common potential)	
Status indicators		US LED (green): voltage supply of system interface US	
		UI LED (green): voltage supply UI for sensors	
		ERR LED (red): group error message of sensor supply	
		Inputs (yellow): status of inputs	
Connecting terminals		Terminal block with screw terminals	
		Terminal block with cache clamp terminals	
Applicable wire size		Screw terminals	0,75 – 2,5 mm^2
		Cache clamp terminals	0,75 – 2,5 mm^2
Internal power supply (8 V DC)		≤ 30 mA	
Weight		approx. 0,17 kg	

Tab. 10-11:*Digital input module MT-X16*

External connection



Terminal block MT-X16-TBS (TBC)	
Terminal	**Signal**
UI	Sensor supply
0V	Ground
PE	Prot. Earth①
00	X00
01	X01
02	X02
03	X03
04	X04
05	X05
06	X06
07	X07
08	X08
09	X09
10	X0A
11	X0B
12	X0C
13	X0D
14	X0E
15	X0F
16 – 23	Sensor supply
Potential terminal block MT-X16-PTBS (PTBC)	
Terminal	**Signal**
00 – 09	Sensor supply
10 – 19	Sensor ground
20 – 29	Sensor ground

Tab. 10-12: *External connection of the MT-X16 module*

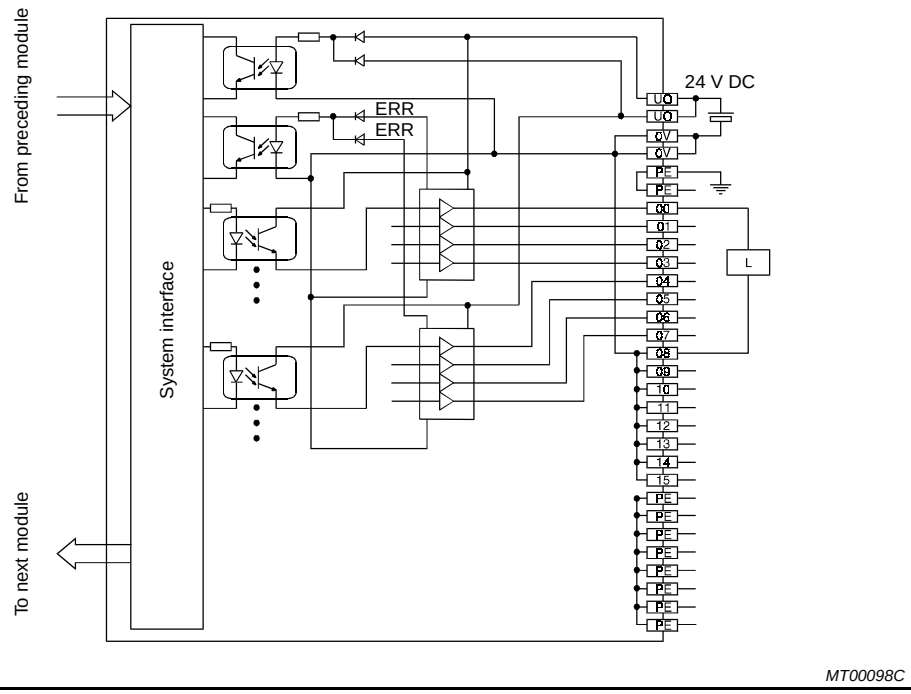
① The PE is connected-through to the backward metal plate internally.

10.3.5 Digital output module MT-Y8T

Tables 10-13 and 10-14 describe the specifications and the external connections of the MT-Y8T module.

Item		MT-Y8T	
Number of outputs		8	
Isolation		Optocoupler	
Voltage range UO (output supply)		18 – 30 V DC (ripple ratio: < 5 %)	
Input current (output supply)		≤ 20 mA (outputs switched OFF)	
Polarity reversal protection		no	
Nominal output voltage		≥ UO - 0,2 V	
Switching current per output		0,5 A (continuous duty)	
Max. switching current		2,5 A	
Leakage current (output switched OFF)		< 50 µA	
Max. voltage drop with output switched ON		200 mV	
Response time	OFF → ON	140 µs	
	ON → OFF	50 µs	
Switching frequency		≤ 100 Hz resistive load	
		≤ 10 Hz lamp load	
		≤ 0,2 Hz inductive load	
Lamp load		5 W	
Mains filter		no	
Short-circuit and overload protection		electronic	
Switched-off time after short-circuit		≤ 150 µs	
Resume after short-circuit		yes	
Output groupings		8 outputs per grouping Ground terminals: 08 – 15 (common potential)	
Status indicators		US LED (green): Voltage supply of system interface US	
		UO LED (green): Voltage supply of outputs	
		ERR LED (red): Group error message short-circuit actuator	
		Outputs (yellow): Output status	
Connecting terminals		Terminal block with screw terminals	
		Terminal block with cache clamp terminals	
Applicable wire size		Screw terminals	0,75 – 2,5 mm^2
		Cache clamp terminals	0,75 – 2,5 mm^2
Internal power supply (8V DC)		≤ 35 mA	
Weight		approx. 0,16 kg	

Tab. 10-13: *Digital output module MT-Y8T*

External connection	Terminal block MT-Y8T-TBS (TBC)	
	Terminal	Signal
	UO	Output supply
	0V	Ground
	PE	Prot. Earth①
	00	Y00
	01	Y01
	02	Y02
	03	Y03
	04	Y04
	05	Y05
	06	Y06
	07	Y07
	08 – 15	Ground

Tab. 10-14: *External connection of the MT-Y8T -module*

① The PE is connected-through to the backward metal plate internally.

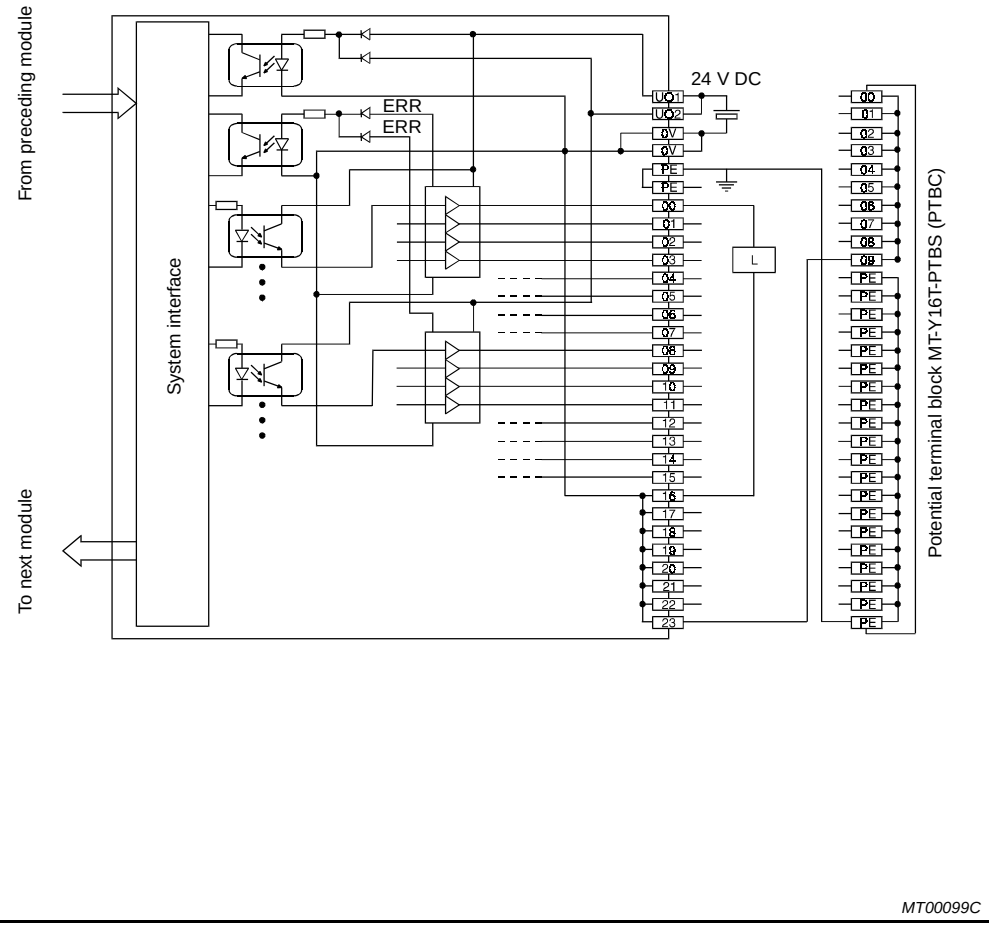
10.3.6 Digital output module MT-Y16T

Tables 10-15 and 10-16 describe the specifications and the external connections of the MT-Y16T module.

Item		MT-Y16T	
Number of outputs		16	
Isolation		Optocoupler	
Voltage range UO (output supply)		18 – 30 V DC (ripple ratio: < 5 %)	
Input current (output supply)		≤ 20 mA (outputs switched OFF)	
Polarity reversal protection		no	
Nominal output voltage		≥ UO - 0,2 V	
Switching current per output		0,5 A (continuous duty)	
Switching current of all outputs		≤ 4 A (Tu ≤ 55 °C)	
		≤ 8 A (Tu ≤ 35 °C)	
Max. switching current		2,5 A	
Leakage current (output switched OFF)		< 50 µA	
Max. voltage drop with output switched ON		200 mV	
Response time	OFF → ON	140 µs	
	ON → OFF	50 µs	
Switching frequency		≤ 100 Hz resistive load	
		≤ 10 Hz lamp load	
		≤ 0,2 Hz inductive load	
Lamp load		5 W	
Mains filter		no	
Short-circuit and overload protection		electronic	
Switched-off time after short-circuit		≤ 150 µs	
Resume after short-circuit		yes	
Output groupings		8 outputs per grouping (UO1 and UO2) Ground terminals: 16 – 23 (common potential)	
Status indicators		US LED (green): Voltage supply of system interface US	
		UO1 LED (green):Voltage supply of outputs 0 – 7	
		UO2 LED (green):Voltage supply of outputs 8 – 15	
		ERR LED (red): Group error message short-circuit actuator	
		Outputs (yellow): Output status	
Connecting terminals		Terminal block with screw terminals	
		Terminal block with cache clamp terminals	
Applicable wire size		Screw terminals	0,75 – 2,5 mm^2
		Cache clamp terminals	0,75 – 2,5 mm^2
Internal power supply (8V DC)		≤ 60 mA	
Weight		approx. 0,16 kg	

Tab. 10-15: *Digital output module MT-Y16T*

External connection



Terminal block MT-Y16T-TBS (TBC)	
Terminal	**Signal**
UO1	Output supply Y00 – Y07
UO2	Output supply Y08 – Y0F
0V	Ground
PE	Prot. Earth①
00	Y00
01	Y01
02	Y02
03	Y03
04	Y04
05	Y05
06	Y06
07	Y07
08	Y08
09	Y09
10	Y0A
11	Y0B
12	Y0C
13	Y0D
14	Y0E
15	Y0F
16 – 23	Ground
Potential terminal block MT-Y16T-PTBS (PTBC)	
Terminal	**Signal**
PE	Prot. Earth
00 – 09	Ground of actuators

Tab. 10-16: *External connection of the MT-Y16T module*

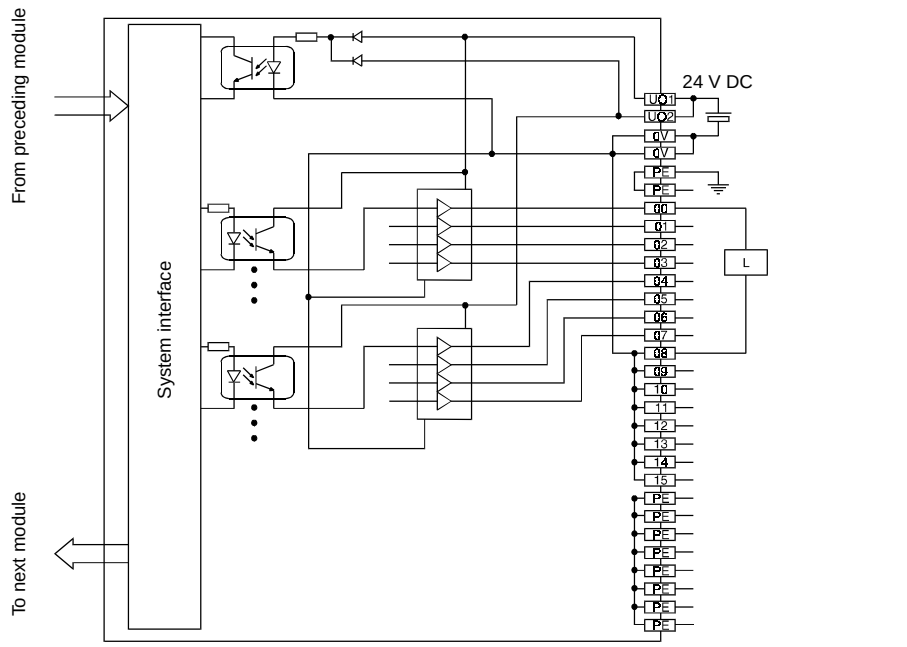
① The PE is connected-through to the backward metal plate internally.

10.3.7 Digital output module MT-Y8T2

Tables 10-17 and 10-18 describe the specifications and the external connections of the MT-Y16T2 module.

Item		MT-Y8T2	
Number of outputs		8	
Isolation		Optocoupler	
Voltage range UO (output supply)		18 – 30 V DC (ripple ratio: < 5 %)	
Input current (output supply)		≤ 20 mA (outputs switched OFF)	
Polarity reversal protection		no	
Nominal output voltage		≥ UO - 0,14 V	
Switching current per output		2 A (continuous duty)	
Switching current of all outputs		10 A	
Max. switching current		6 A	
Leakage current (output switched OFF)		6 µA	
Max. voltage drop with output switched ON		140 mV	
Response time	OFF → ON	300 µs	
	ON → OFF	80 µs	
Switching frequency		≤ 100 Hz resistive load	
		≤ 10 Hz lamp load	
		≤ 1 Hz inductive load	
Lamp load		max. 10 W	
Mains filter		no	
Short-circuit and overload protection		electronic (output remains switched OFF)	
Short-circuit current		7 A (typical)	
Resume after short-circuit		no	
Output groupings		4 outputs per grouping (UO1 and UO2); Ground terminals: 08 – 15 (common potential); with the terminal block MT-Y8T-TBS (TBC): 8 outputs per grouping.	
Status indicators		US LED (green): Voltage supply of system interface US	
		UO LED (green): Voltage supply of outputs (logical-or indication of the supply voltages UO1 or UO2)	
		Outputs (yellow): Output status	
Connecting terminals		Terminal block with screw terminals	
		Terminal block with cache clamp terminals	
Applicable wire size		Screw terminals	0,75 – 2,5 mm^2
		Cache clamp terminals	0,75 – 2,5 mm^2
Internal power supply (8V DC)		≤ 35 mA	
Weight		approx. 0,18 kg	

Tab. 10-17: *Digital output module MT-Y8T2*

External connection	Terminal block MT-Y8T2-TBS (TBC)	
	Terminal	Signal
	UO1	Output supply Y00 – Y03
	UO2	Output supply Y04 – Y07
	0V	Ground
	PE	Prot. Earth①
	00	Y00
	01	Y01
	02	Y02
	03	Y03
	04	Y04
	05	Y05
	06	Y06
	07	Y07
	08 – 15	Ground

Tab. 10-18: *External connection of the MT-Y8T2 module*

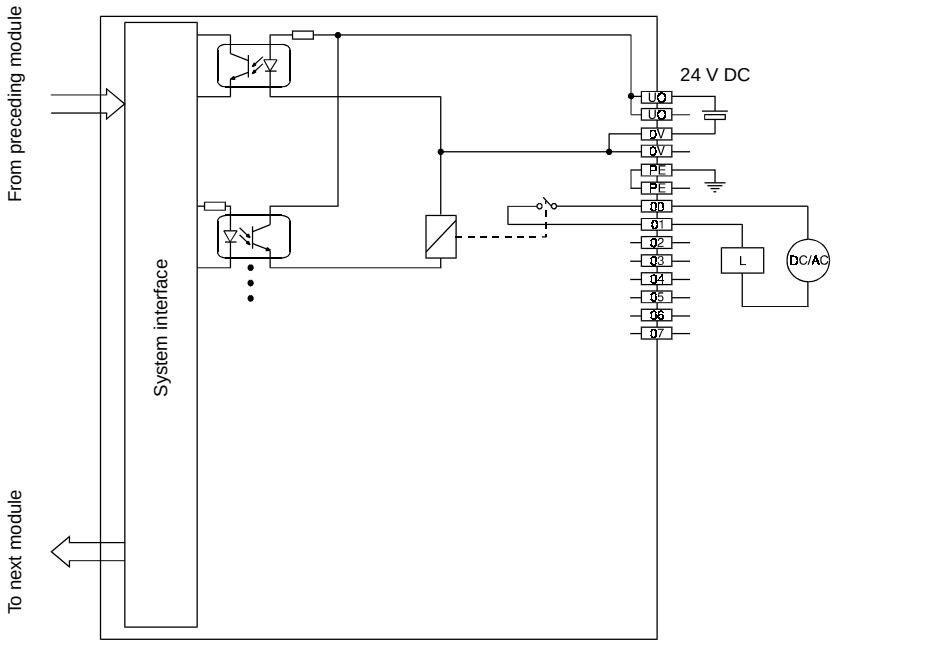
① The PE is connected-through to the backward metal plate internally.

10.3.8 Digital output module MT-Y4R

Tables 10-19 and 10-20 describe the specifications and the external connections of the MT-Y4R module.

Item	MT-Y4R		
Number of outputs	4		
Isolation	Optocoupler		
Voltage range UO (output supply)	20,4 – 30 V DC (ripple ratio: < 5 %)		
Input current (output supply)	≤ 20 mA (outputs switched OFF)		
Polarity reversal protection	yes		
Load current conforming to EN 60947-5-1 AC15 after VDE 0660 part 20, DC13 after VDE 0660 part 300		AC 15	DC 13
	24 V	2 A	1,3 A
	110 V	2 A	0,25 A
	220 V	2 A	0,1 A
Min. load current	100 mA		
Contact material	AgCdO		
Rated isolation voltage after DIN VDE 0160	250 V, contamination level 3, overvoltage category III		
Mains filter	no		
Fuse	none		
Output groupings	4 outputs per group		
Status indicators	US LED (green): Voltage supply of system interface US		
	UO LED (green): Voltage supply of relays		
	Outputs (yellow): Output status		
Connecting terminals	Terminal block with screw terminals		
	Terminal block with cache clamp terminals		
Applicable wire size	Screw terminals	0,75 – 2,5 mm^2	
	Cache clamp terminals	0,75 – 2,5 mm^2	
Internal power supply (8V DC)	≤ 45 mA		
Weight	approx. 0,175 kg		

Tab. 10-19: *Digital output module MT-Y4R*

External connection	Terminal block MT-Y4R-TBS (TBC)	
	Terminal	Signal
	UO	Supply relay
	0V	Ground
	PE	Prot. Earth①
	00 – 01	Contact 1
	02 – 03	Contact 2
	04 – 05	Contact 3
	06 – 07	Contact 4

Tab. 10-20: *External connection of the MT-Y4R module*

① The PE is connected-through to the backward metal plate internally.

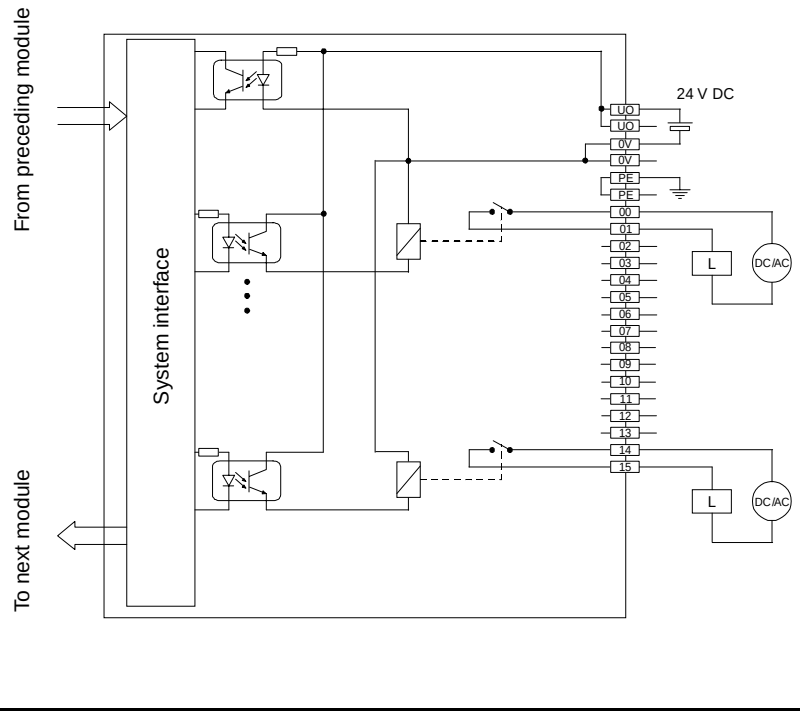
10.3.9 Digital output module MT-Y8R5

Tab. 10-21 and Tab. 10-22 describe the specifications and the external connections of the MT-Y8R5 module.

Item		MT-Y8R5			
Number of outputs		8			
Isolation		Optocoupler			
Voltage range UO (output supply)		20,4 – 30 V DC (ripple ratio: < 5 %)			
Input current (output supply)		≤ 120 mA (all outputs switched ON)			
Polarity reversal protection		yes			
Breaking capacity acc. to EN 60947-5-1 AC15 acc. to VDE 0660 part 20, DC13 acc. to VDE 0660 part 300			AC12	AC 15	DC 13
		24 V	5 A	3 A	1,0 A
		110 V	5 A	3 A	0,2 A
		220 V	5 A	3 A	0,1 A
Response time	OFF → ON	≤ 5 ms			
	ON → OFF	≤ 6 ms			
Contact material		AgCdO			
Rated isolation voltage after DIN VDE 0160		250 V, contamination level 3, overvoltage category III			
Mains filter		no			
Short-circuit and overload protection		electronic			
Switched-off time after short-circuit		≤ 150 ms			
Resume after short-circuit		yes			
Output groupings		4 outputs per grouping			
Status indicators		US-LED (green):Voltage supply of system interface US			
		UO-LED (green):Voltage supply of relays			
		Ausgänge (yellow):Output status			
Connecting terminals		Terminal block with screw terminals			
		Terminal block with cache clamp terminals			
Applicable wire size		Screw terminals			0,75 – 2,5 mm^2
		Cache clamp terminals			0,75 – 2,5 mm^2
Internal power supply (8 V DC)		≤ 80 mA			
Weight		approx. 0,325 kg			

Tab. 10-21: *Digital output module MT-Y8R5*

External connection



Terminal block left MT-Y8R5-TBSL (TBCL)	
Terminal	**Signal**
00 – 01	Contact 1
02 – 03	Contact 2
04 – 05	Contact 3
06 – 07	Contact 4
08 – 09	Contact 5
Terminal block right MT-Y8R5-TBSR (TBCR)	
Terminal	**Signal**
UO	Relay supply
0V	Ground
PE	Prot. Earth①
10 – 11	Contact 6
12 – 13	Contact 7
14 – 15	Contact 8

Tab. 10-22: *External connection of the MT-Y8R5 module*

① The PE is connected-through to the backward metal plate internally.

10.3.10 Digital input/output module MT-X4Y4T

Tab. 10-23 and Tab. 10-24 describe the specifications and the external connections of the MT-X4Y4T-Moduls.

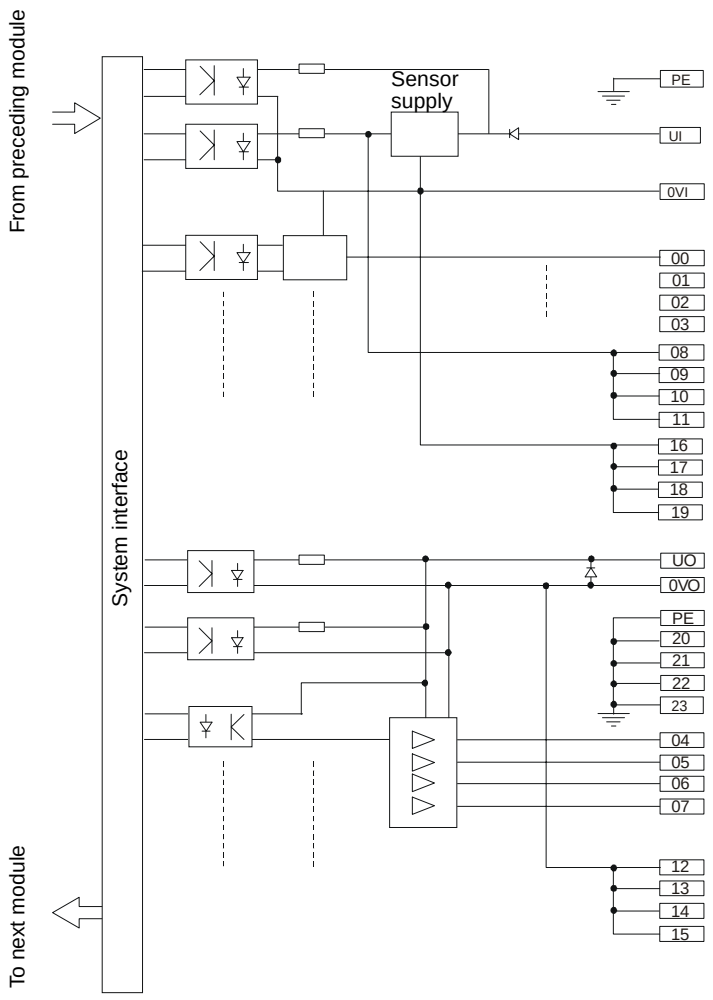
Item		MT-X4Y4T
Inputs		
Number of inputs		4
Simultaneously ON inputs		100 %
Isolation		Optocoupler
Voltage UI (sensor supply)		24 V DC
Voltage range UI		18 – 30 V DC (ripple ratio: < 5 %)
Input current (sensor supply)		≤ 500 mA
Input current sensor		0,7 A, electronic short-circuit protection
Polarity reversal protection		yes
Input characteristc curve		acc. to IEC 1131-2, type 2
Max. inputs simultaneous on		4
Inrush current		—
Switch ON voltage/current		acc. to characteristic curve IEC 1131-2, type 2
Switch OFF voltage/current		
Input resistance		not linear (siehe Abb. 10-1, S. 10-18)
Response time	OFF → ON	approx. 1 ms
	ON → OFF	approx. 1 ms
Input groupings		8 inputs per grouping Ground terminals: 16 – 23 (common potential)
Outputs		
Number of outputs		4
Isolation		Optocoupler
Voltage range UO (output supply)		18 – 30 V DC (ripple ratio: < 5 %)
Input current (output supply)		≤ 2 A
Polarity reversal protection		no
Nominal output voltage		24 V DC
Switching current per output		0,5 A (continous duty)
Max. switching current		2,5 A
Leakage current (output switched OFF)		≤ 50 mA
Max. voltage drop with output switched ON		≤ 250 mV
Response time	OFF → ON	≤ 120 µs
	ON → OFF	≤ 140 µs
Switching frequency		≤ 100 Hz resistive load
		≤ 10 Hz lamp load
		≤ 0,2 Hz inductive load
Lamp load		5 W
Mains filter		no
Short-circuit and overload protection		electronic
Switched-off time after short-circuit		≤ 150 µs
Resume after short-circuit		yes
Output groupings		4 outputs per grouping Ground terminals: 08 – 15 (common potential)
Status indicators		US-LED (green):Voltage supply of system interface US
		UI-LED (green):Voltage supply UI
		ERR-LED (red):Group error message sensor supply
		Inputs/outputs (yellow):Input/output status

Tab. 10-23:*Digital input/output module MT-X4Y4T*

Item	MT-X4Y4T	
Connecting terminals	Terminal block with screw terminals	
	Terminal block with cache clamp terminals	
Applicable wire size	Screw terminal	0,75 – 2,5 mm^2
	Cache clamp terminals	0,75 – 2,5 mm^2
Internal power supply (8 V DC)	≤35 mA	
Weight	approx. 0,16 kg	

Tab. 10-23: *Digital input/output module MT-X4Y4T*

External connection



Terminal block MT-X4X4T-TBS (TBC)	
Terminal	**Signal**
UI	Sensor supply
0VI	Ground reference inputs
UO	Actuator supply
0VO	Ground reference outputs
0V	Ground
PE	Prot. Earth①
00	X00
01	X01
02	X02
03	X03
04	Y01
05	Y02
06	Y03
07	Y04
08 — 11	Sensor supply
12 – 15	Ground actuators
16 – 19	Ground sensors
20 – 23	Prot. Earth①

Tab. 10-24: *External connection of the MT-X4Y4T module*

① The PE is connected-through to the backward plate internally

10.3.11 Characteristic curve areas IEC 1131-2, type 2

Figure 10-1 defines the input characteristic curve conforming to IEC standard.

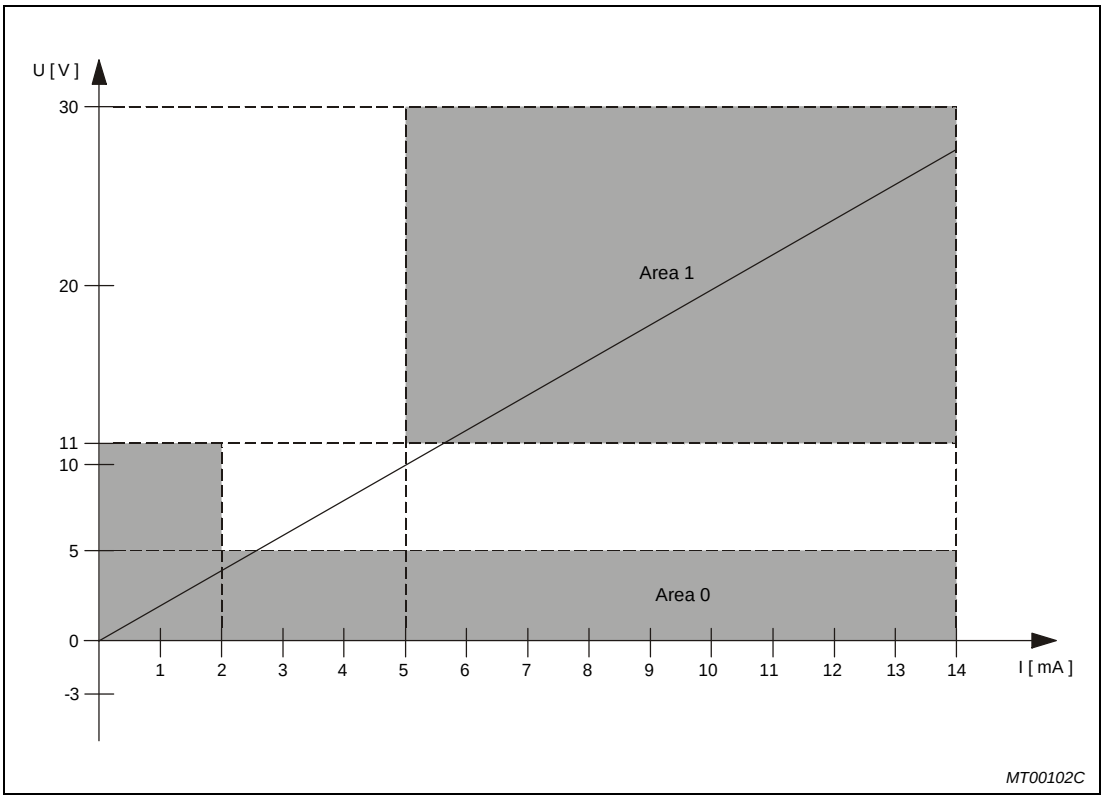


Fig. 10-1: *Characteristic curve areas IEC 1131-2, type 2*

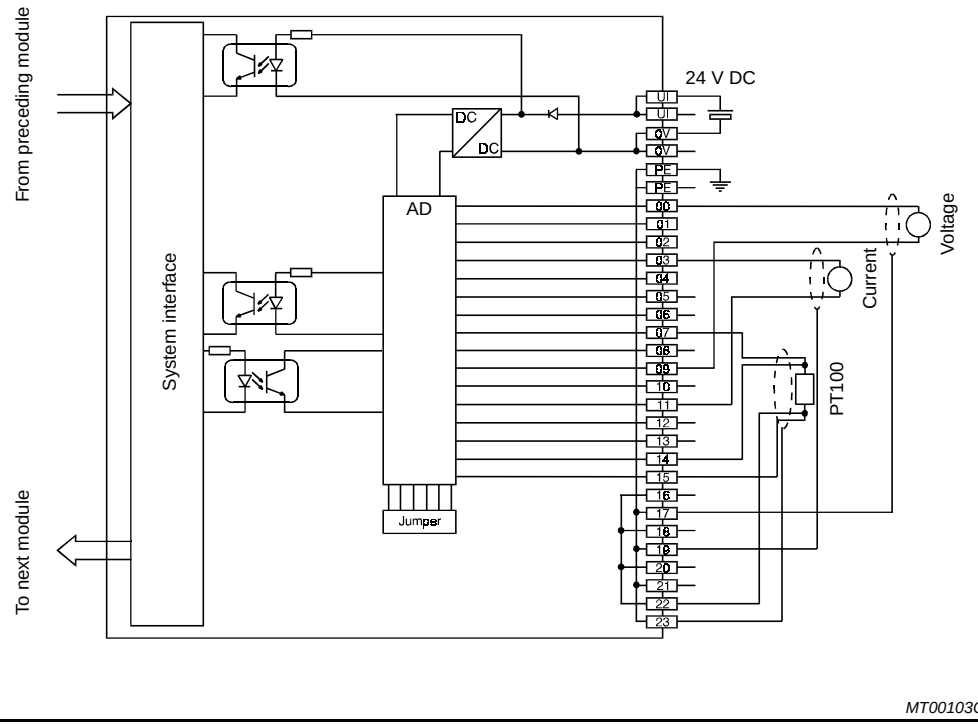
10.3.12 Analog input module MT-4AD-N

Tables 10-25 and 10-26 describe the specifications and the external connections of the module MT-4AD-N.

Item	MT-4AD-N	
Number of input channels	4	
Isolation	Optocoupler	
Voltage UI (sensor supply)	24 V DC	
Voltage range UI	18 – 30 V DC (ripple ratio: < 5 %)	
Input current (sensor supply)	≤ 50 mA	
Polarity reversal protection	yes	
Analog input	Voltage: -10 to +10 V DC (input resistance 176 kΩ) Current: -20 to +20 mA (input resistance approx. 50 Ω) Current: 4 to 20 mA (input resistance approx. 50 Ω) PT100: -180 to +600 °C (input resistance >1 MΩ) Selection through parameterization and jumpers	
Digital output	16-bit	
Converter characteristics	Analog input	Digital output
	-10 to +10 V -20 to +20 mA 4 to 20 mA -180 to 600 °C	-4000 to 4000 -4000 to 4000 0 to 4000 -1800 to 6000
Max. resolution	-10 to +10 V -20 to +20 mA 4 to 20 mA -180 to 600 °C	approx. 2,5 mV approx. 5 µA approx. 4 µA approx. 0,125 °C
Basic accuracy	Voltage measurement: ±0,15% Current meas. (±20 mA): ±0,15% Current meas. (4 – 20 mA): ±0,15% Temperature measurement: ±0,25%	
Measuring accuracy at 25 °C	Voltage measurement: ±2 LSB Current meas. (±20 mA): ±2 LSB Current meas. (4 – 20 mA): ±3 LSB Temperature measurement: ±10 LSB	1 LSB = 2,5 mV 1 LSB = 5 µA 1 LSB = 4 µA 1 LSB = 0,1 °C
Measuring accuracy at 0 – 55 °C	Voltage measurement: ±10 LSB Current meas. (±20 mA): ±10 LSB Current meas. (4 – 20 mA): ±13 LSB Temperature measurement: ±27 LSB	1 LSB = 2,5 mV 1 LSB = 5 µA 1 LSB = 4 µA 1 LSB = 0,1 °C
Overall accuracy at 25 °C (main accuracy + measuring accuracy)	Voltage measurement: ±8 LSB Current meas. (±20 mA): ±8 LSB Current meas. (4 – 20 mA): ±9 LSB Temperature measurement: ±25 LSB	±20 mV ±40 µA ±36 µA ±2,5 °C
Overall accuracy at 0 – 55 °C (main accuracy + measuring accuracy)	Voltage measurement: ±16 LSB Current meas. (±20 mA): ±16 LSB Current meas. (4 – 20 mA): ±19 LSB Temperature measurement: ±42 LSB	±40 mV ±80 µA ±76 µA ±4.2 °C
Measuring leads	≤ 200 m, shielded	
Max. converting time	50 ms per channel	
Status indicators	US LED (green): Voltage supply of system interface US	
	UI LED (green): Voltage supply UI	
Connecting terminals	Terminal block with screw terminals	
	Terminal block with cache clamp terminals	
Applicable wire size	Screw terminals	0,75 – 2,5 mm^2
	Cache clamp terminals	0,75 – 2,5 mm^2
Internal power supply (8V DC)	≤ 80 mA	
Weight	approx. 0,225 kg	

Tab. 10-25: *Analog input module MT-4AD-N*

External connection



Terminal block MT-4AD-TBS-N (TBC-N)	
Terminal	**Signal**
UI	Sensor supply
0V	Ground
PE	Prot. Earth①
00, 02, 04, 06	Voltage input +
01, 03, 05, 07	Current input +
09, 11, 13, 15	Common ground (U/I)
08, 10, 12, 14	Current driver PT100
16, 18, 20, 22	Analog Ground
17, 19, 21, 23	Prot. Earth

Tab. 10-26: *External connection of the MT-4AD-N module*

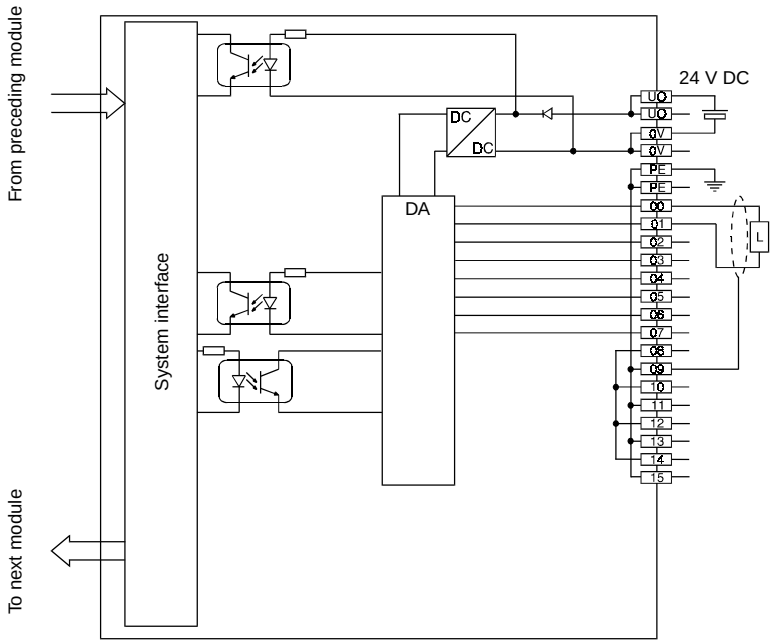
① The PE is connected-through to the backward metal plate internally.

10.3.13 Analog output module MT-4DAV

Tables 10-27 and 10-28 describe the specifications and the external connections of the MT-4DAV module.

Item	MT-4DAV	
Number of output channels	4	
Isolation	Optocoupler outputs / system, no potitial isolation between inputs and power supply	
Voltage UO (actuator supply)	24 V DC	
Voltage range UO	18 – 30 V DC (ripple ratio: < 5 %)	
Input current (sensor supply)	≤ 120 mA	
Polarity reversal protection	yes	
Digital input	16-bit	
Analog output	Voltage: 0 – 10 V DC	
Converter characteristics	Digital input	Analog output
	0 – 4000	0 – 10 V
Max. resolution	0 – 4000	approx. 2,5 mV
Main accuracy	±0,1 %	
Converter accuracy at 25 °C	±4 LSB	1 LSB = 2,5 mV
Converter accuracy at 0 – 55 °C	±8 LSB	1 LSB = 2,5 mV
Overall accuracy at 25 °C (main accuracy + converter accuracy)	±8 LSB	±20 mV
Overall accuracy at 0 – 55 °C (main accuracy + converter accuracy)	±12 LSB	±30 mV
Linearity	±0,1 %	
Actuator line	≤ 2 m, shielded	
Output load	≥ 750 Ω	
Short-circuit and overload protection	yes	
Max. converting time	≤ 1 ms per channel	
Status indicators	US LED (green): Voltage supply system interface US	
	UO LED (green): Voltage supply UO	
Connecting terminals	Terminal block with screw terminals	
	Terminal block with cache clamp terminals	
Applicable wire size	Screw terminals	0,75 – 2,5 mm^2
	Cache clamp terminals	0,75 – 2,5 mm^2
Internal power supply (8V DC)	≤ 60 mA	
Weight	approx. 0,22 kg	

Tab. 10-27: *Analog output module MT-4DAV*

External connection	Terminal block MT-4DAV-TBS (TBC)	
	Terminal	Signal
 MT00104C	UO	Actuator supply
	0V	Ground
	PE	Prot. Earth①
	00, 02, 04, 06	Voltage output +
	01, 03, 05, 07	Analog Ground
	08, 10, 12, 14	Bridged
	09, 11, 13, 15	Prot. Earth

Tab. 10-28: *External connection of the MT-4DAV module*

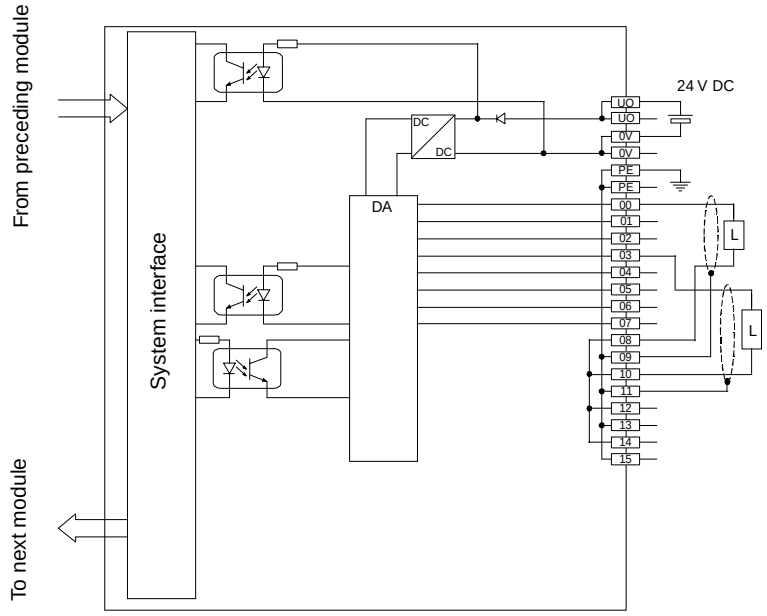
① The PE is connected-through to the backward metal plate internally.

10.3.14 Analog output module MT-4DA

Tab. 10-29 and Tab. 10-30 describe the specifications and the external connections of the MT-4DA module.

item	MT-4DA	
Number of output channels	4	
Isolation	Optocoupler outputs/system, no potential isolation of inputs from power supply	
Voltage UO (actuator supply)	24 V DC	
Voltage range UO	18 – 30 V DC (ripple ratio: < 5 %)	
Input current (sensor supply)	≤ 120 mA	
Polarity reversal protection	yes	
Digital input	16-bit	
Analog output	Voltage: -10 – 10 V DC Current: 0 – 20 mA DC	
Converter characteristics	Digital input	Analog output
	-2000 – 2000	-10 – +10 V
	0 – 2000	0 – 20 mA
Max. resolution	-10 – +10 V	5 µV
	0 – 20 mA	10 µA
Main accuracy	0,05 %	
Converter accuracy at 25 °C	±1 LSB	
Converter accuracy at 0 – 55 °C	±3 LSB	
Overall accuracy at 25 °C (main accuracy + converter accuracy)	±2 LSB	
Overall accuracy at 0 – 55 °C (main accuracy + converter accuracy)	±4 LSB	
Linearity	—	
Actuator line	≤ 2 m, shielded	
Output load (voltage)	≥ 750 Ω	
Output load (current)	≤ 500 Ω	
Short-circuit and overload protection	yes	
Max. converting time	≤ 1 ms per channel	
Status indicators	US-LED (green):Voltage supply system interface US	
	UO-LED (green):Voltage supply UO	
Connecting terminals	Terminal block with screw terminal	
	Terminal block with cache clamp terminals	
Applicable wire size	Screw terminals	0,75 – 2,5 mm^2
	Cache clamp terminals	0,75 – 2,5 mm^2
Internal power supply (8 V DC)	≤ 75 mA	
Weight	approx. 0,22 kg	

Tab. 10-29: *Analog output module MT-4DA*

External connection	Terminal block MT-4DA-TBS (TBC)	
	Terminal	Signal
	UO	Actuator supply
	0V	Ground
	PE	Prot. Earth①
	00, 02, 04, 06	Voltage output +
	01, 03, 05, 07	Current output +
	08, 10, 12, 14	Analog Ground
	09, 11, 13, 15	Prot. Earth
MT30104C		

Tab. 10-30: *External connection of the MT-4DA module*

① The PE is connected-through to the backward metal plate internally.

A Appendix

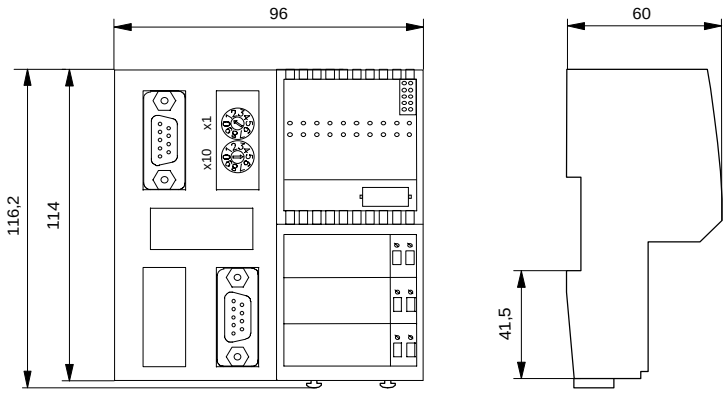
A.1 Listing of the Modules and Accessories

Type of Module	Module	Description
Network interfaces	MT-DP12	Basic module, linking the modules to the PROFIBUS/DP and supplying the system power US (8 V) to the modules
	MT-DP12-TBS	Connecting terminal block of the basic module with screw terminals
	MT-DP12-TBC	Connecting terminal block of the basic module with cache clamp terminals
	MT-DP12E	Basic module with 8 integrated digital inputs, linking of the modules to the PROFIBUS/DP and supply of the modules with the system voltage US (8 V)
	MT-DP12E-TBS	Terminal block of the basic module with screw terminals
	MT-DP12E-TBC	Terminal block of the basic module with cache clamp terminals
	MT-LE	Local system extension for the extension of the MT Series to a second connecting level
	MT-LE-CBL50	Extension cable (0,5 m) for the connection of the local system extension to the basic module
Digital input modules	MT-X8	Digital input module with 8 inputs
	MT-X8-TBS	Connecting terminal block of the MT-X8 module with screw terminals
	MT-X8-TBC	Connecting terminal block of the MT-X8 module with cache clamp terminals
	MT-X16	Digital input module with 16 inputs
	MT-X16-TBS	Connecting terminal block of the MT-X16 module with screw terminals
	MT-X16-TBC	Connecting terminal block of the MT-X16 module with cache clamp terminals
	MT-X16-PTBS	Potential terminal block of the MT-X16 module with screw terminals
	MT-X16-PTBC	Potential terminal block of the MT-X16 module with cache clamp terminals
Digital output modules	MT-Y8T	Digital output module with 8 transistor outputs, 0,5 A
	MT-Y8T-TBS	Connecting terminal block of the MT-Y8T module with screw terminals
	MT-Y8T-TBC	Connecting terminal block of the MT-Y8T module with cache clamp terminals
	MT-Y16T	Digital output module with 16 transistor outputs, 0,5 A
	MT-Y16T-TBS	Connecting terminal block of the MT-Y16T module with screw terminals
	MT-Y16T-TBC	Connecting terminal block of the MT-Y16T module with cache clamp terminals
	MT-Y16T-PTBS	Potential terminal block of the MT-Y16T module with screw terminals
	MT-Y16T-PTBC	Potential terminal block of the MT-Y16T module with cache clamp terminals
	MT-Y8T2	Digital output module with 8 transistor outputs, 2 A
	MT-Y8T2-TBS	Connecting terminal block of the MT-Y8T2 module with screw terminals
	MT-Y8T2-TBC	Connecting terminal block of the MT-Y8T2 module with cache clamp terminals
	MT-Y4R	Digital output module with 4 relay outputs, 250 V, 2 A
	MT-Y4R-TBS	Connecting terminal block of the MT-Y4R module with screw terminals
	MT-Y4R-TBC	Connecting terminal block of the MT-Y4R module with cache clamp terminals

Type of Module	Module	Description
Digital output modules	MT-Y8R5	Digital output module with 8 relay outputs, 250 V, 5 A
	MT-Y8R5-TBSL	Left terminal block of the MT-Y8R5 module with screw terminals
	MT-Y8R5-TBCL	Left terminal block of the MT-Y8R5 module with cache clamp terminals
	MT-Y8R5-TBSR	Right terminal block of the MT-Y8R5 module with screw terminals
	MT-Y8R5-TBCR	Right terminal block of the MT-Y8R5 module with cache clamp terminals
Digital input/output modules	MT-X4Y4T	Input/Output module with 4 digital inputs and 4 transistor outputs
	MT-X4Y4T-TBS	Terminal block of the MT-X4Y4T module with screw terminals
	MT-X4Y4T-TBC	Terminal block of the MT-X4Y4T module with cache clamp terminals
Analog input module	MT-4AD-N	Analog input module with 4 analog inputs (channels)
	MT-4AD-TBS-N	Connecting terminal block of the MT-4AD-N module with screw terminals
	MT-4AD-TBC-N	Connecting terminal block of the MT-4AD-N module with cache clamp terminals
Analog output module	MT-4DAV	Analog output module with 4 analog outputs (channels)
	MT-4DAV-TBS	Connecting terminal block of the MT-4DAV module with screw terminals
	MT-4DAV-TBC	Connecting terminal block of the MT-Y4DAV module with cache clamp terminals
	MT-4DA	Analog output module with 4 analog outputs (channels) for voltage and current output
	MT-4DA-TBS	Terminal block of the MT-4DA module with screw terminals
	MT-4DA-TBC	Terminal block of the MT-4DA module with cache clamp terminals

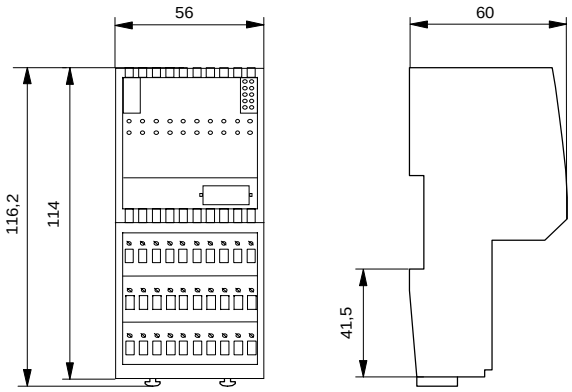
A.2 Dimensions

A.2.1 MT-DP12(E) Module



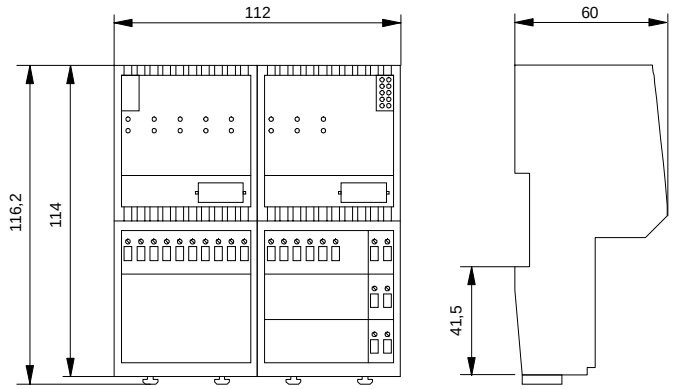
All specifications in mm

A.2.2 Digital Extension Modules (without MT-Y8R5) and MT-4DA



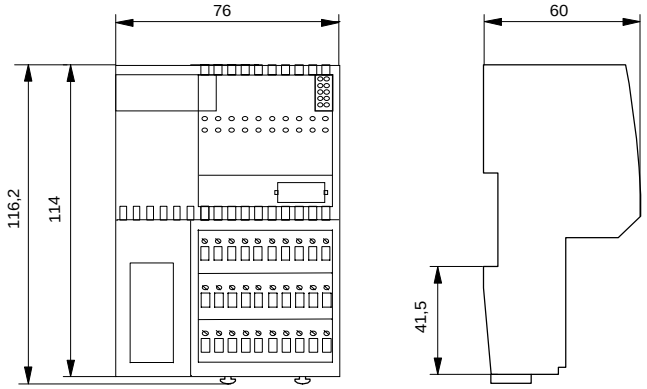
All specifications in mm

A.2.3 Digital Extension Modul MT-Y8R5



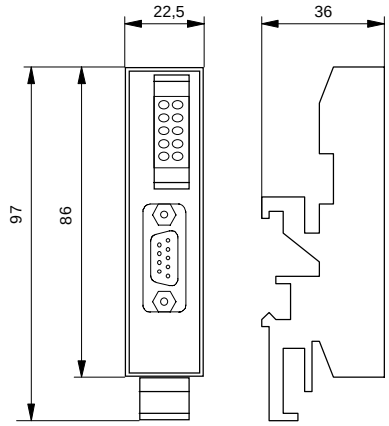
All specifications in mm

A.2.4 Analog Extension Modules (without MT-4DA)



All specifications in mm

A.2.5 MT-LE Module



All specifications in mm

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