Kemro

IM 270/W
Hybrid module
Project engineering manual V 1.04

Translation of the original instructions

KEBA®
Automation by innovation.

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Record of Revision

Version	Date	Change in chapter	Description	changed by
1.00	01-2014	-	Newly created	ekr
1.01	03-2014	Several	Safety notes adapted, description of SSI interface updated, minor corrections	ekr
1.02	12-2014	Appendix	Device only for KEBA IO system	ekr
1.03	04-2015	Connections and wiring	Added hint about wron connection of EtherCAT slave devices	swb
1.04	05-2017	Several	Several updates	swb

Table of Contents

1 Introduction

1.1 Purpose of the document

This document describes the structure of the IM 270/W.

A description of the object directory can also be found in the appendix.

Information

This manual is not adressed to end customers! Necessary safety notes for the end customer have to be taken into the customer manual in the respective national language by the machine builders and system providers.

1.2 Preconditions

This document contains information for persons with the following skills:

Target group	Knowledge and skills pre-requirement
Project engineer	Basic technical training (University of Applied Science/University level, engineering degree or corresponding professional experience). Knowledge in: ● working mode of a PLC, ● current valid safety regulations, ● the application.
Electrician	Specialized training in the electro-technical field (in accordance with industrial training guidelines). Knowledge in: ● current valid safety regulations, ● wiring guidelines, ● circuit diagrams, ● system analysis and troubleshooting, ● correct installation of electrical connections according to national and international regulations.

Target group	Knowledge and skills pre-requirement
Start-up technician	Basic technical training (Vocational high school, engineering degree or corresponding professional experience). Knowledge in: ● current valid safety regulations, ● working mode of machine or plant, ● principal functions of the application, ● system analysis and troubleshooting, ● setting options at the operating installations.
Service technician	Basic technical training (Vocational high school, engineering degree or corresponding professional experience). Knowledge in: ● working mode of a PLC, ● current valid safety regulations, ● working mode of machine or plant, ● diagnosis possibilities, ● systematic error analysis and rectification.

1.3 Intended use

The IM 270/W was developed for control applications in industrial machines. The typical applications areas include injection molding machines, robots, presses, machine tools and similar.

The IM 270/W may only be used for the types of use described in the technical descriptions and in compliance with described technical general conditions. The IM 270/W may only be used in conjunction with recommended/approved third-party equipment/installations.

The IM 270/W has been developed, manufactured, tested and documented in accordance with the appropriate guidelines and standards. Therefore, the products do not pose any danger to the health of persons or a risk of damage to other property or equipment under normal circumstances, provided that the instructions and safety precautions are properly observed.

1.4 Notes on this document

This manual is an integral part of the product. It is to be retained over the entire life cycle of the product and should be forwarded to any subsequent owners or users of the product. For enduser necessary safety information and information must be integrated in the instruction manual for endusers in the specific national language by the engine builder or the system provider.

This documentation must be legible and available to the specified persons and must be read and understood from them.

1.4.1 Contents of the document

- Description of the assembly group
- Mounting and installation instructions
- Description of interfaces including (incl. EMC measures)
- Configuration
- Operating performance
- Diagnosis
- Maintenance
- Technical data
- Information about EtherCAT and CoE
- Listing of the object directory

1.4.2 Not contained in this document

- Programming instruction
- Application diagnosis
- Firmware description

1.5 Documentation for further reading

Name	Target group
Provided system manual	• Project engineer • Electrician • Programmer • Commissioning foreman • Service technician

1.6 EtherCAT declaration

EtherCAT®	EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

2 Safety notes

2.1 Representation

At various points in this manual, you will see notes and precautionary warnings regarding possible hazards. The symbols used have the following meaning:

DANGER!

indicates an imminently hazardous situation, which will result in death or serious bodily injury if the corresponding precautions are not taken.

WARNING!

indicates a potentially hazardous situation, which can result in death or serious bodily injury if the corresponding precautions are not taken.

CAUTION!

means that if the corresponding safety measures are not taken, a potentially hazardous situation can occur that may result in slight bodily injury.

Caution

means that damage to property can occur if the corresponding safety measures are not taken.

ESD

This symbol reminds you of the possible consequences of touching electrostatically sensitive components.

Safety information

Describes important safety-related requirements or informs about essential safety-related coherences.

Information

Identifies practical tips and useful information. No information that warns about potentially dangerous or harmful functions is contained.

2.2 General safety instructions

WARNING!

It is absolutely essential that you also observe the safety instructions in the system manual for your automation system.

- The following areas of application are expressly excluded for the CPU module:
  - Use in areas where there is a risk of explosion or fire
  - Use in the mining sector
  - Use in the open air
  - Use in wet rooms or rooms with the risk of splashing water
  - Use in environments with heavily polluted air
  - Use in environments with harmful solutions, steams or radiations
  - Use in non-stationary applications
  - Other products are to be used for these applications!
- The IM 270/W is not designed for safety-relevant control tasks (e.g.: shutdown in case of an emergency). For safety-relevant control tasks and personnel security, additional external safety measures must be implemented to ensure the system remains in a safe operating condition even in the event of a fault
- At the development of the IM 270/W the standard EN ISO 13849-1 was not considered.
- The module is defined as "open type equipment" (UL 508) or as "open equipment" (EN 61010-2-201) and must therefore be installed in a control cabinet.

Caution

Improper use of the assembly or the control system leads to irreparable damage!

Turn off the power supply before inserting or removing the module. Otherwise, the module can be destroyed or undefined signal states can lead to damage of the control system.

2.3 Safety instructions for personal safety

WARNING!

Danger of personal injury due to electric shock!

- Supply the device exclusively from power sources that have an extra low voltage (e.g. SELV or PELV according to EN 61010-2-201)
- When using a SELV power source it can become PELV by reason of the module construction and the connectors (grounding!).
- Only connect voltages and circuits to connections, terminals and interfaces until 50 V nominal voltage, which are safely separated from dangerous voltages (e.g. by sufficient insulation and electric strength).

CAUTION!

Fire hazard during module failure!

Provide suitable fuses for the 24 V DC power supply of the control system for the final application! (for details, refer to the Power supply section).

2.4 Safety instructions for device maintenance

WARNING!

- If this device is damaged, the device must be taken out of commission and repaired or replaced by trained specialized personnel.
- The device must only be opened by trained specialized personnel. They must only carry out maintenance work that is explicitly permitted by KEBA (see Chapter "Maintenance").

3 Description of the assembly group

The IM 270/W is an assembly group of the KEBA automation system and is used as an independent decentralized I/O block. Furthermore, it plays the role of a bus coupler between EtherCAT and K-bus and via a K-bus interface it offers expansion options for up to 12 serial connection capable modules (I/O, technology or field bus groups) that are supplied and operated via this interface.

The IM 270/W can be connected via EtherCAT to a control unit and is thereby an EtherCAT slave. A second EtherCAT interface allows the connection of an additional EtherCAT slave.

The IM 270/W features the following inputs and outputs:

- 8 inputs for thermal elements
- 8 analog inputs, differential
- 6 analog outputs
- 32 digital inputs
- 16 digital outputs (0.5 A)
- 24 digital outputs (2 A)

The assembly group is suitable for fast control.

3.1 Front view

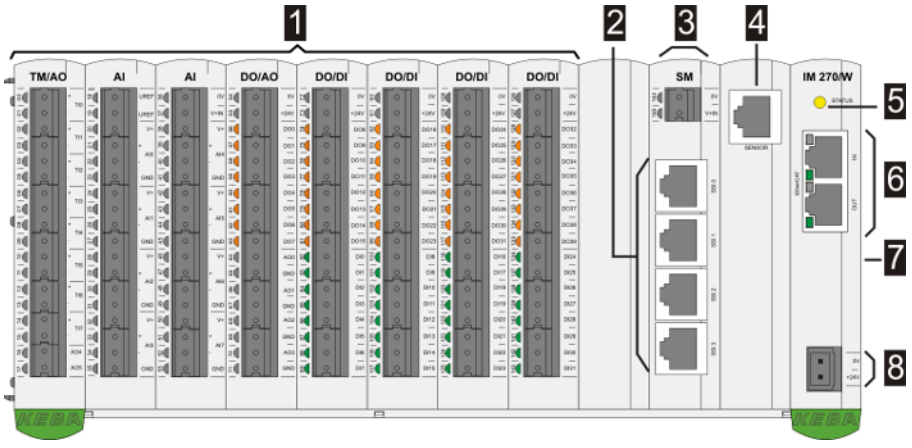


Illustration 3-1: Front view

1 ... Connections for analog and digital inputs and outputs (Onboard I/O)	2 ... SSI interfaces
3 ... Supply connection for the SSI interfaces	4 ... Interface for optional terminal temperature sensor (TE 220/A)
5 ... Status LED	6 ... EtherCAT interface with link/activity LED
7 ... Model plate	8 ... Power supply IM 270/W

Information

The electronic type plate is stored on the module in an EEPROM and can be read out by the application.

3.2 Accessories

3.2.1 Connector and connector strip

- Standard pin strips with a grid dimension of 5.08 mm are used on the IM 270/W for connections of analog and digital inputs and outputs.

  The following female connectors are required for the IM 270/W (recommended split):

Socket board	Number	Order no. Weidmüller
2-pin (gold contact)	8	BLZF 5.08/02 AU oder BLF 5.08/02 AU
3-pin	42	BLZF 5.08/03/180 SN BK BX - 1707700000
2-pin	3	BLZF 5.08/02/180 SN BK BX - 1707690000

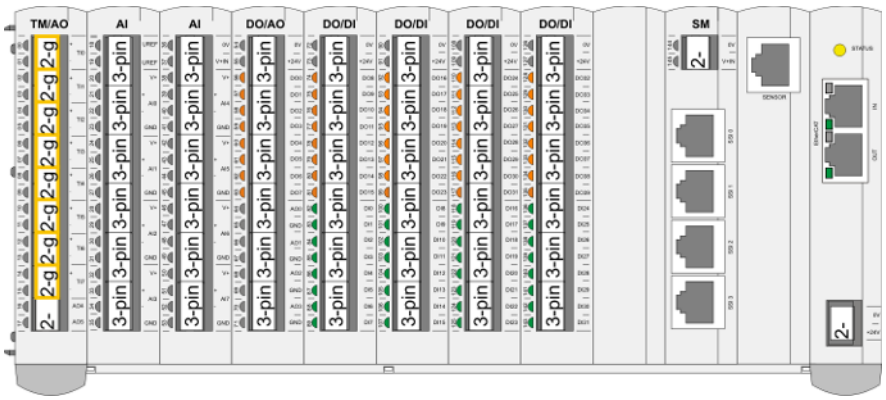


Illustration 3-2: Division example for socket board

Information

Larger terminal blocks may be used. For this purpuse also refer to the information of the terminal block manufacturer.

Information

The influence of corrosion on the input pins on the measurement accuracy for very low output voltages is very high. Therefore there are gold plated contacts used for the thermocouple input pin connectors. In any case there should be used mating connectors with gold plated contacts. Mixing the contact materials can cause an electrochemical process at ambient conditions with humidity > 50%, which may lead to contact problems.

The appropriate female connectors are not included in the delivery of KEBA, but can be purchased via KEBA

The technical data for the terminals are contained in the technical data sheet of the manufacturer of the female connectors.

3.2.2 TE 220/A terminal temperature sensor (optional)

The terminal temperature sensor TE 220/A is used for the external cold junction compensation. It must be used when the temperature lines have intermediate connections.

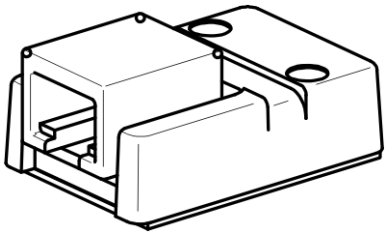


Illustration 3-3: View TE 220/A

The TE 220/A can be attached to the terminal in 2 different ways:

- Via adhesives
- Via cable binders

3.2.3 Shield rail

To connect the cable shields of the analog signals, a shield bus can be fastened directly on the IM 270/W (see 6.5 Connection of the shield bus for analog signals). A shield bus including fastening fixture is required for that.

The following table includes suggestions for components to connect the shield rail:

Designation	Order no. Weidmüller
Rail bar SSCH 10x3x1000 CU/SN	0348900000
Cable fastener KLBUE 3-8	1600480000
Cable fastener KLBUE 2X2-6	1675350000

The appropriate components are not included in the scope of delivery of KEBA.

3.2.4 End bracket

To secure the module on the mounting rail end bracket must be mounted.

Standard type end fixtures regularly included in the delivery program of the manufacturer can be used. They are not included in the scope of delivery.

4 Displays and operating elements

Caution

Thermical overload due to charging and discharging!

As long as one of the Status LEDs is still on after deactivation of the system, do not remove or insert modules or option modules in the system. Otherwise charging and discharging of back-up capacitors may lead to a thermal overload (electric arc) of the contacts.

4.1 Status-LED

The two colored status LED (green/red) indicates in compliance with the EtherCAT standard the current operating status of the IM 270/W.

Indication	Meaning
Dark	No supply voltage or operating state INIT
Flashing green	Firmware update
	Hardware run-up with the status: • PRE-OPERATIONAL (flashing regularly with 400 ms ON and 400 ms OFF) • SAFE-OPERATIONAL (flashing with 200 ms ON and 1000 ms OFF) See chapter "Operating status" for a description
Green	Status OPERATIONAL
Flashing red	Error on module (e.g. overload, line interruption, etc.)
Red	Fatal module error (K-Bus error, ...)

4.2 SSI status LEDs

At each respective SSI interface socket (RJ-45) there is a supply LED and a data status LED.

Power LED

Indication	Meaning
Dark	No supply of the SSI sensors
Green	Propper supply of the SSI sensors

Activity LED

Indication	Meaning
Dark	No connection

Indication	Meaning
Gelb	Reception of data

Information

In case of a not lighting supply LED, either:

- no SSI supply at the SSI feed-in terminal is available,
- or their is an overload or a short-circuit of the supply of the respective SSi sensor.

4.3 Link/activity LED

There is a link/activity LED on each EtherCAT socket (RJ 45).

Link/Activity LED

Indication	Meaning
Dark	No connection
Green flashing	Transmission of data
Green	EtherCAT connection established (100 MBit/s, Full Duplex)

4.4 Status display

LED Digital Input

Indication	Meaning
Dark	No voltage supply or indication of the state OFF
Green	Indication of the state ON

LED Digital Output

Indication	Meaning
Dark	No voltage supply or indication of state OFF
Orange	Indication of state ON

5 Mounting and installation instructions

The IM 270/W is intended for a horizontal installation on a mounting rail in a switch cabinet. The right side of the assembly group can accommodate up to 12 K-bus modules (I/O, technology or field bus assembly groups) in any order next to each other in a series. The individual devices communicate with each other via an internal system bus (K-bus).

5.1 General instructions on assembly and removal

Caution

Improper handling can damage the modules, option modules and the control system.

Switch off the operating and on-load power supply before carrying out assembly, installation or maintenance work.

Caution

Damage to components!

Handle all modules and components with care. Please ensure the following:

- Clean contact surfaces (to avoid contact faults).
- Bus plugs that are not bent.
- Ensure that no pieces of wires, fillings or swarf fall into the unit when you are drilling holes or connecting wires.

5.2 Adding modules

The IM 270/W makes the power supply available for up to 12 add-on modules. The connection between IM 270/W and the added modules is established via a parallel K-Bus. The entire package is snapped onto a mounting rail (mounting rail TS 35x7,5).

To guarantee stable functioning of the module cluster the total power demand ("Power consumption 5 V on the K-Bus" and "Power consumption 24 V on the K-Bus") on the added-on modules must not exceed the power values (Max. output power K-Bus 5 V" and "Max. output power K-Bus 24 V") of the IM 270/W specified in the technical data.

Information

For the calculation of the number of modules that can be added, the performance values specified in the technical data of the respective project engineering manual under "Power consumption 5 V on the K-Bus" and "Power consumption 24 V on the K-Bus" must be used.

To add modules, their module adress has to be set first.

5.2.1 Setting the module address

The modules in the system are addressed by means of a 16-position address switch. All modules within a device package thus can be differentiated.

A device package consists of the control and added modules.

The address switch is located on the side of the modules, underneath the KBus plug. Prior to the assembly of the package the address must be set to the position configured in the application software.

Caution

Attention must be given when setting the address switch with the screwdriver that none of the surrounding components is damaged.

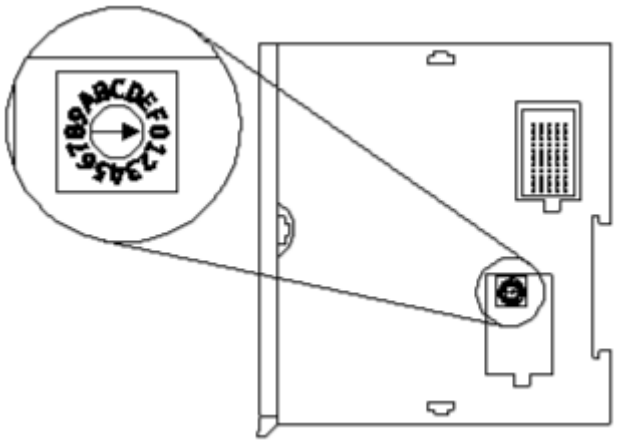


Illustration 5-4: Settings of the address switch

Information

Modules of the same type must have different address switch positions within one device package. Different modules in different device packages may have the same address switch positions.

5.2.2 Plugging modules together

Extension modules are lined up on the right side of the IM 270/W. For this purpose the side lid must be removed from the left module (IM 270/W or extension module) in each case and the extension module has to be plugged.

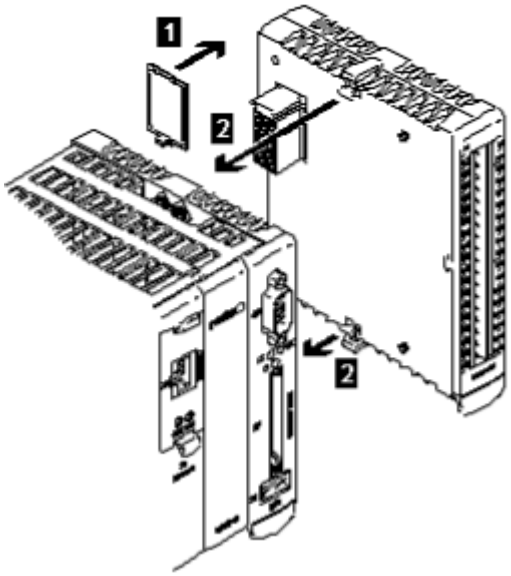


Illustration 5-5: Plugging modules together

1 ... Side lid	2 ... locking pins

Information

When adding extension modules to an already given module make sure that the locking pins are properly engaged.

Furthermore, ensure that the entire package (IM 270/W and add-on modules) is secured on either side with device end clamps to prevent it from being displaced and/or protected against vibration. At the extreme right extension module the K-Bus plug has to be covered with the side lid.

Information

If the package is not mounted properly, its function may be impaired.

5.3 Removing added modules

To remove extension modules the lockings at the top and at the bottom of the module have to be pressed first and then the module can be removed. Subsequently the connector opening for the K-Bus plug has to be covered with the side lid.

Caution

Without pressing the lockings they will break by removing the module.

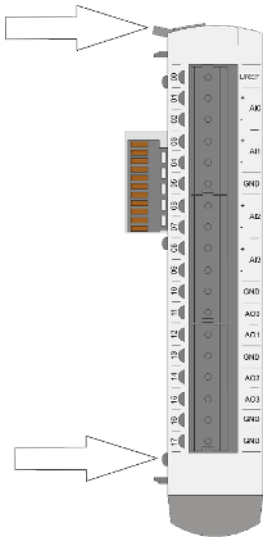


Illustration 5-6: Lockings of the module

5.4 Mounting rail

A steel rail TS 35x7.5 is to be used as mounting rail for the device. For the sake of stability the screw distance, as shown in the illustration, must not exceed 100 - 120 mm.

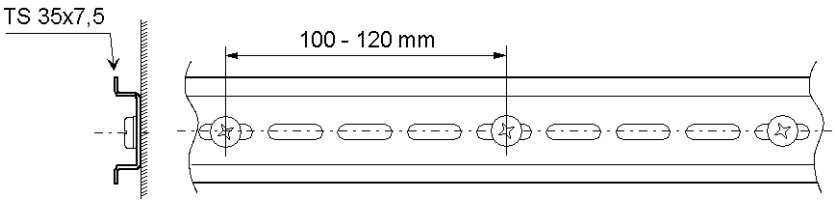


Illustration 5-7: Fixing of the mounting rail.

5.5 Required space

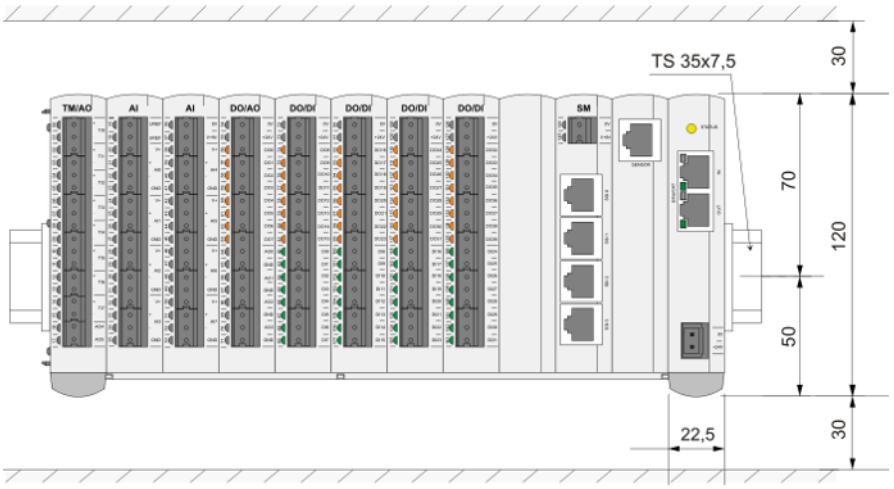


Illustration 5-8: Installation diagram

A clearance of 30 mm each must be maintained above and below the module.

5.6 Installing the module

Caution

Mounting orientation:

mounted module is directed ahead and the ventilation holes are directed upwards and downwards (see the following graphics). Otherwise defects (e.g. by means of heat accumulation) may accure (see also "Air conditioning and ventilation").

This is how the module is installed on the mounting rail:

1) Pull out (unlock) all locking levers on the mounting rail.
2) Slightly incline the module and place on the fixture of the mounting rail.
3) Press the lower half of the module onto the mounting rail.
4) Lock all locking levers on the mounting rail one after the other.
5) Secure the modules with the end brackets against slipping or loosening due to vibration (see 5.6.1 End bracket).

The module is now installed on the mounting rail. You can now wire-connect the interfaces and the inputs/outputs.

5.6.1 End bracket

To prevent the modules from slipping or loosening through vibration, an end bracket must be mounted on the left and right side of the mounting rail.

Illustration 5-9: End bracket holder

1	... End bracket		...

5.7 Removing the module

Caution

Risk of damaging components during installation work under voltage.

Therefore, switch off the power supply and remove all cable connections prior to starting dismantling work.

To remove the module proceed as follows:

1) Turn off power supply
2) Disconnect all cable connections on the module
3) Pull out (unlock) all locking levers on the mounting rail
4) Remove the module from the mounting rail.

5.8 Air conditioning and ventilation

Ventilation holes for dissipating the heat are placed at the top and underside of the module. If the permissible ambient temperature is not exceeded, no external fan will be needed. Make sure that the ventilation holes are not covered.

Caution

High temperatures may destroy the module!

- The operating temperature inside the control cabinet must not be higher than the permissible ambient temperature of the module. If this cannot be guaranteed through natural heat dissipation, an air conditioning of the control cabinet must be provided.
- When installed in a control cabinet attention must be given that the area around the inputs for thermocouples is not exposed to any temperature changes. (e.g. no air conditioners with intermittent operating hours)
- The specified required space above and below the modules has to be guaranteed for heat dissipation reasons.

5.8.1 Use of air filters

To ensure that the contamination does not exceed contamination level 2 (according to EN 61010-2-201), the device must be installed in a dustproof, closed control cabinet. Fan openings of the control cabinet must be equipped with air filters. The filter elements must be cleaned or replaced regularly.

Information

Contamination level 2, description according to standard:

"The occurring contamination is generally not conductive. However, temporary conductivity must be expected due to condensation."

6 Connections and wiring

6.1 Power supply

To avoid problems with potential differences and compensation currents, all "0V" connections (except those of the "2A" digital outputs) must be bundled at a star point, for example with the help of a grounding bar.

In addition, a shield bus must be used for the connection of all cable shields (see 6.5 Connection of the shield bus for analog signals).

Information

In the next sub chapters, please note the differentiation between GND and 0 V.

WARNING!

Danger of personal injury due to electric shock!

- Supply the device exclusively from power sources that have an extra low voltage (e.g. SELV or PELV according to EN 61010-2-201)
- When using a SELV power source it can become PELV by reason of the module construction and the connectors (grounding!).
- Protective low voltage circuits must always be installed safely insulated separated from circuits with dangerous voltage.

CAUTION!

Fire hazard during module failure!

External line fuse with maximum 10 A must be provided in the final application.

Section

Refer to the manufacturer-specific data sheet of the of the female connectors used for type, cross-section and material. For further information: See chapter Accessories.

The actual permissible wire cross-section is specified by the electrical conditions of the connected equipment an the female connectors used:

- Max. load current and required heat dissipation through the connected wire at maximum ambient temperature.
- Permissible voltage drop for error-free operation of the connected equipment.

6.1.1 Connection examples

Separate 24 V power supply

The module itself is separated to its digital outputs. The solution with two supply units for 24 V power supply is preferred if short circuits at the I/Os are expected.

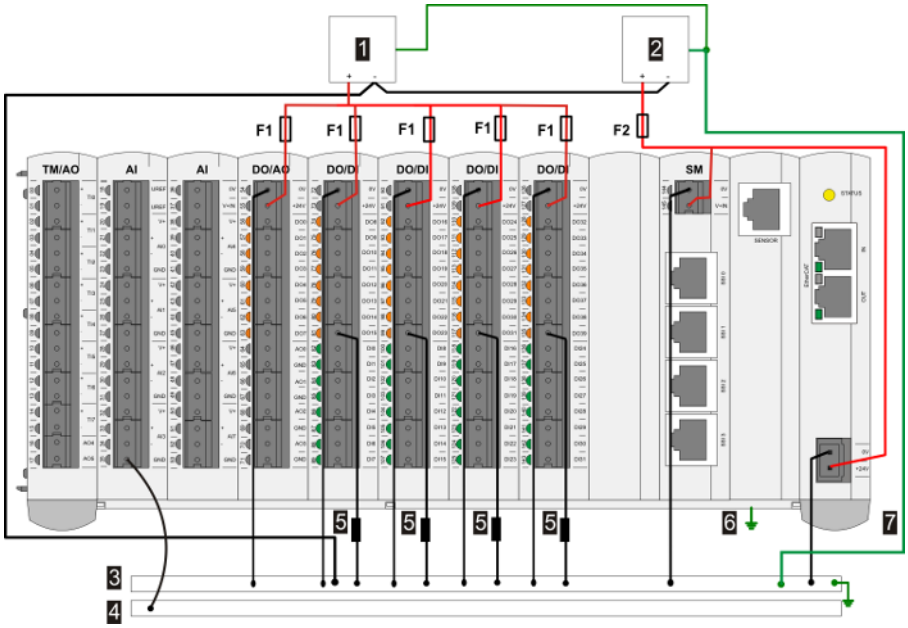


Illustration 6-10: Example: Separate power supply

1 ... 24 V supply of the DO	2 ... 24 V supply of the IM 270/W
3 ... Grounding bar	4 ... Shield rail
5 ... Load (Ohm, inductive)	6 ... Grounding point
7 ... Grounding wire (yellow/green)	

Combined 24 V power supply

The module itself such as its digital outputs are supplied with a common 24 V power supply. In this solution with one supply unit for the 24 V power supply it is necessary to use a supply unit which is strong enough.

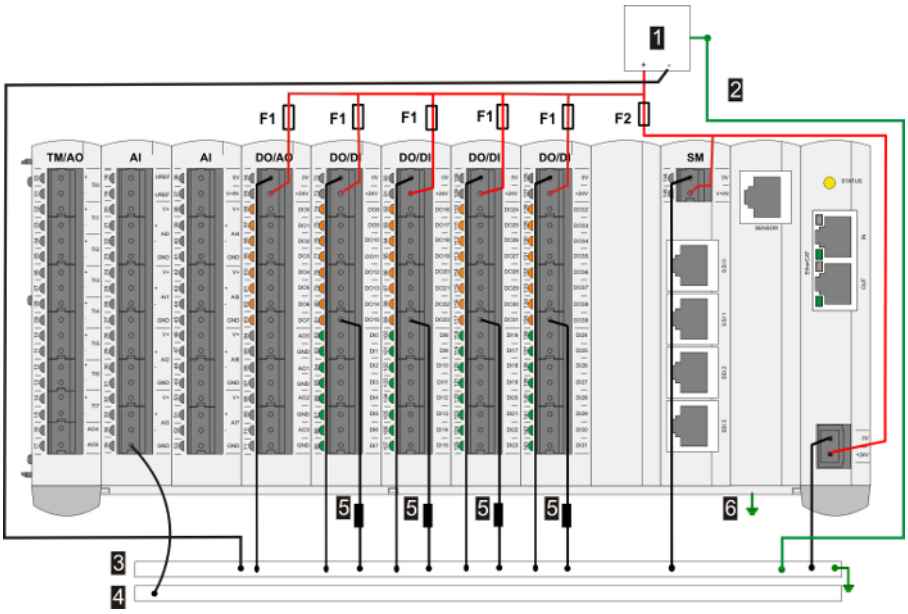


Illustration 6-11: Example: Combined power supply

1 ... 24 V supply	2 ... Grounding wire (yellow/green)
3 ... Grounding bar	4 ... Shield rail
5 ... Load (Ohm, inductive)	6 ... Grounding point

Fuse F1 (for onboard I/O)

The rated current for fuse F1 is dependent upon loads to be switched. For digital outputs the following values (each group) should be assumed:

DO0 – DO15: 0.5 A, coincidence: 100% per group

DO16 – DO39: 2 A, coincidence: 50% per group

Recommended fuse protection: Line safety swich LSS 10A – type B.

Information

Due to the switchd loads, it is possible to protect the supply for multiple groups with only one fuse.

Fuse F2 (for IM 270/W and added modules)

The rated current for fuse F2 is dependent on the own power consumption of the IM 270/W and the power consumption of the optionally added modules.

For the IM 270/W and for each added module an own fuses F2 must be used (see system manual).

Max. fuse protection: Line safety swich LSS 10A – type B.

6.2 Grounding

If required for reasons of electrical safety for the end usage, the metal parts of the module have to be grounded via the threaded bushing (M4) that is located on the bottom side of the enclosure (grounding point with ground icon).

Caution

Do not use too long screws (max. thread lenght 5 mm), because they can destroy elements within the module.

Material:

Electrolytic galvanized sheet steel, blue galvanized self-clinching standoff.

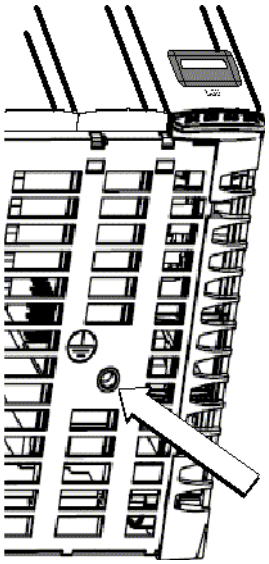


Illustration 6-12: Grounding point on the enclosure

6.3 Digital inputs

For the processing of external digital signals, 32 digital inputs of type 1 (according to EN 61131-2) are available. They have a common ground potential.

The status "ON" is indicated by illuminated green LED on the left side of the connector strip.

Reference potential for the digital inputs are only the "0V" connections for the 0.5 A outputs (the "0V" connections of the 2 A digital outputs with galvanic isolation).

6.3.1 Connection example

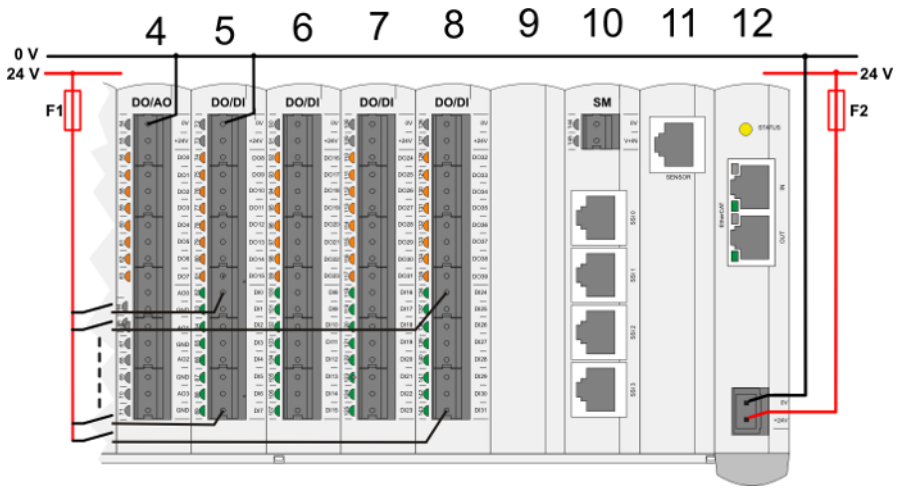


Illustration 6-13: Connection example for digital inputs

6.3.2 Connection diagram DI

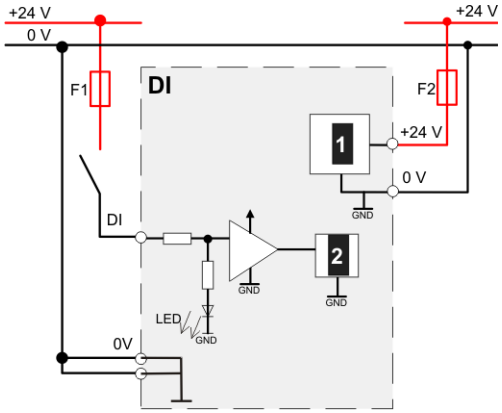


Illustration 6-14: Connection diagram for digital inputs

1 ... Power supply IM 270/W	2 ... Logic

6.4 Digital outputs

For the activation of digital actors, 40 digital outputs (5 groups to each 8 outputs) are available.

DO0 – DO15: 0.5 A, coincidence: 100%

DO16 – DO39: 2 A, coincidence: 50%

The status "ON" is indicated by illuminated orange LED on the left side of the connector strip.

The rated voltage supplying the group (for supply of a group of 8 outputs) is 24 V DC. Due to the power consumption of the switched loads, it might be necessary to split up the power supply fuse as shown in the connection example.

Information

The groups of the 2 A digital outputs feature a galvanic isolation toward each other and toward the control electronics.

6.4.1 Connection example

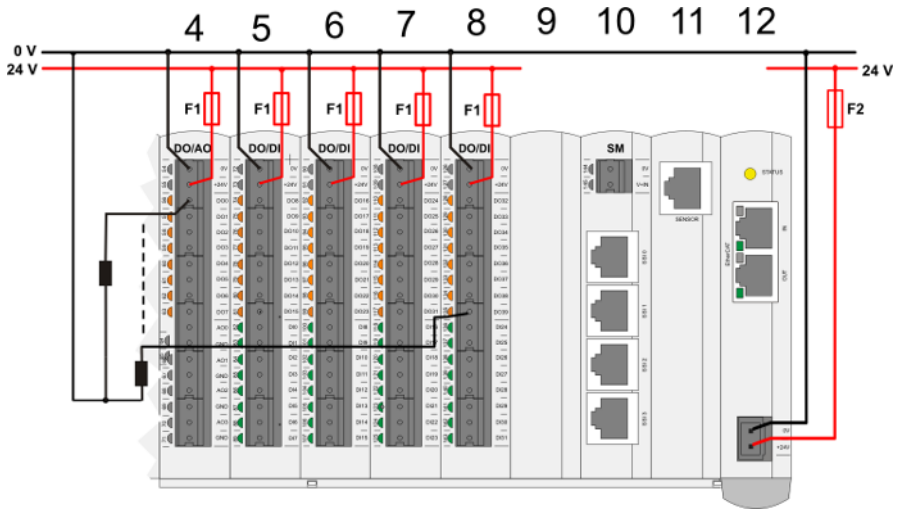


Illustration 6-15: Connection example for digital outputs

6.4.2 Connection diagram DO

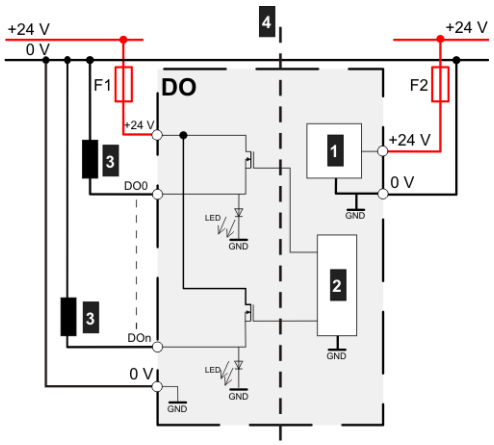


Illustration 6-16: Connection diagram for a group of digital outputs

1 ... Power supply IM 270/W	2 ... Logic
3 ... Load	4 ... Galvanic insulation (only for 2 A digital outputs)

6.5 Connection of the shield bus for analog signals

Information

All cable shields must be connected on a common shield rail. In particular this applies for analog signals. This shield rail has to be placed as close as possible to the connectors and has to be connected to GND (see graphic below).

The connection of shield buses is possible on the housing of the IM 270/W as well as on the bottom and the top (shield busses must be cut to length if necessary). In each instance, three fastening options are provided in 105 mm intervals, for:

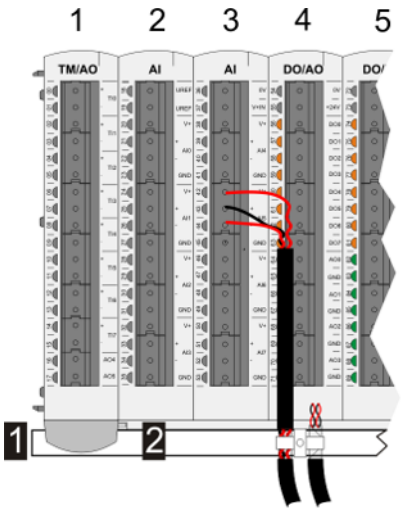
- Threaded bolts M4

If the shield bus is not installed via the threaded bolts, a connection between the shield bus and ground ("GMD" connections) is required.

Information

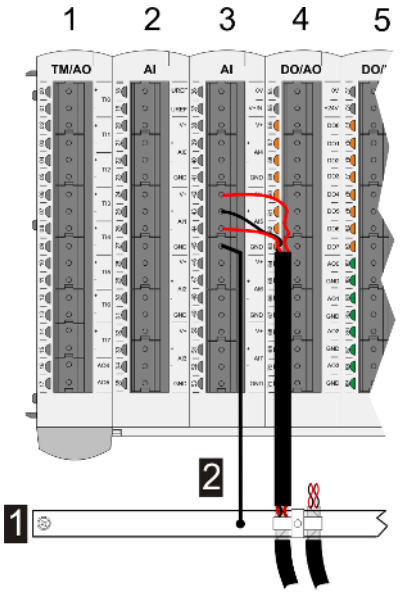
The fastening of the shield bus needs to be designed independently (based on the installation in the switch cabinet)

Principal diagram: Connection of the shield rail on the housing



1 ... Shield rail	2 ... Ground connection with threaded bolts on the housing

Principal diagram: Connection of the shield rail not on the housing



1 ... Shield rail	2 ... Ground connection to GND, length: max. 1 m

6.5.1 Notes on wiring

The following notes of wiring must be regarded:

- Analog lines must be connected with a shielded cable.

- The cable shield must be placed on the shield rail as shown in the illustration.
- In case the shield rail is not mounted on the enclosure via screwed bolts:

  The shield rail must be connected to a GND terminal at one point.
- To attain optimum interference immunity, analog lines should not be laid out parallel to strong interfering lines (e.g. lines of converters for motors).
- Analog and digital lines must not combined within one cable shield.

6.6 Analog inputs (differential or single-ended)

8 analog inputs with 15-bit resolution (at 0V/10V) or 16-bit resolution (at -10V/+10V) are available (optionally configurable via software to "single ended" or to "differential").

ended" or to "differential"). When using the analog inputs as "single ended" inputs, they are designed for a ratio-metric measurement, the measurement is standardized to U_{REF}.

Ratiometric measurement:

Always measures the ratio between input voltage and reference voltage.

During ratiometric measurements, the input voltage will also change if the reference voltage changes although the resistance potentiometer remains in the same position. Because the ADC always measures the ratio of the two voltages, the measurement value remains constant in this case. As a result, variations of the reference voltage do not change the measurement result.

For further information on wiring and shielding of the analog inputs: See system manual.

WARNING!

Unintentional switching on of a drive possible!

If the power supply for the modules is not switched on, but a voltage is applied to the analog inputs (e.g. by the external supply of an encoder), there may still be a voltage on the analog outputs. This enables drives to be switched on although they have not received an ON command.

Remedy: The drives must only switch after the activation of an enable output. This may only be switched on after startup of the system is complete (e.g. via the output of digital output module).

6.6.1 Connection example

Analog input (differential utilization)

A sensor is connected to the assembly group via two equal quality signal lines (+, -) and a differential signal is formed to regain the data signal. Common mode errors are thereby neutralized.

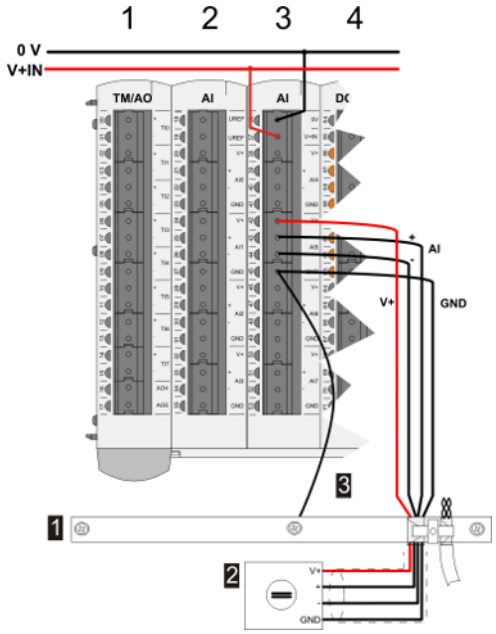


Illustration 6-17: Connection example for analog inputs (differential)

1 ... Shield rail	2 ... Sensor
3 ... Ground connection to GND, length: max. 1 m	

Analog input (utilization single ended [for ratio-metric measurement])

In this case, the sensor is connected to the assembly group via a signal line (+). The electric signal transmission takes place through a voltage that changes with respect to GND.

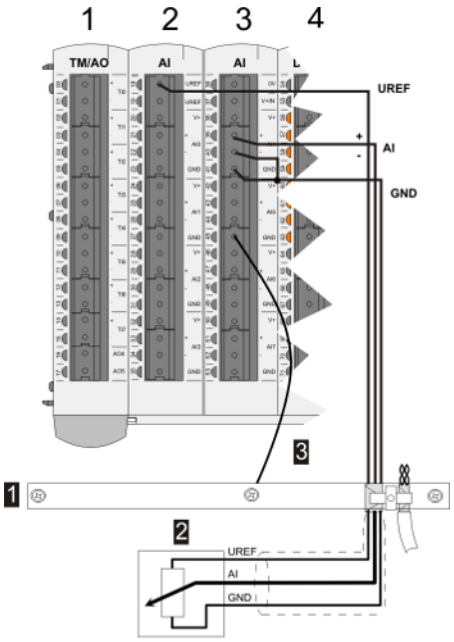


Illustration 6-18: Connection example for analog inputs (single ended, ratio-metric measurement)

1 ... Shield rail	2 ... Sensor
3 ... Ground connection to GND, length: max. 1 m	

6.6.2 Connection diagram AI (single ended)

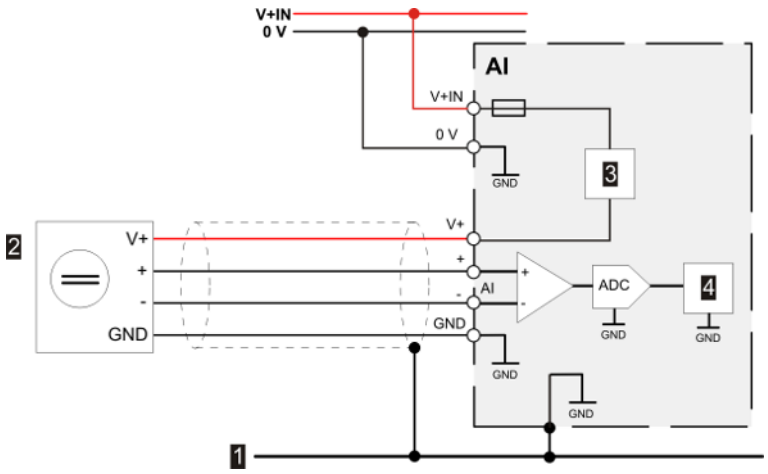


Illustration 6-19: Connection diagram for analog inputs (differential)

1 ... Shield rail	2 ... Sensor
3 ... Validity verification of voltage value	4 ... Logic

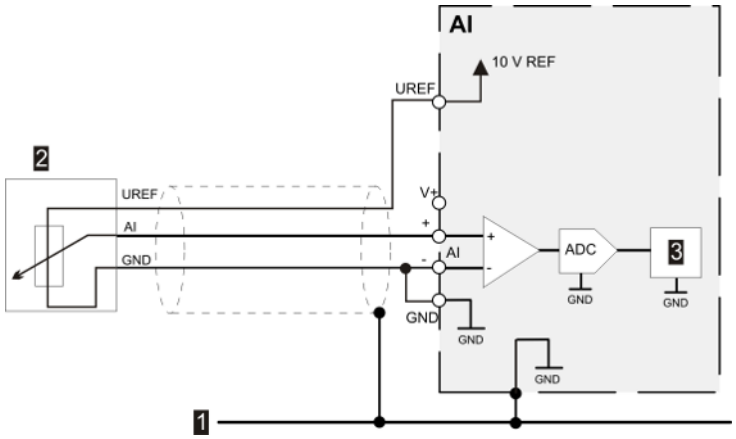


Illustration 6-20: Connection diagram for analog inputs (single ended, for ratio-metric measurement)

1 ... Shield rail	2 ... Sensor
3 ... Logic	

6.7 Analog outputs

6 analog outputs with 12-bit resolution and a voltage range of ± 10 V are available.

6.7.1 Connection example

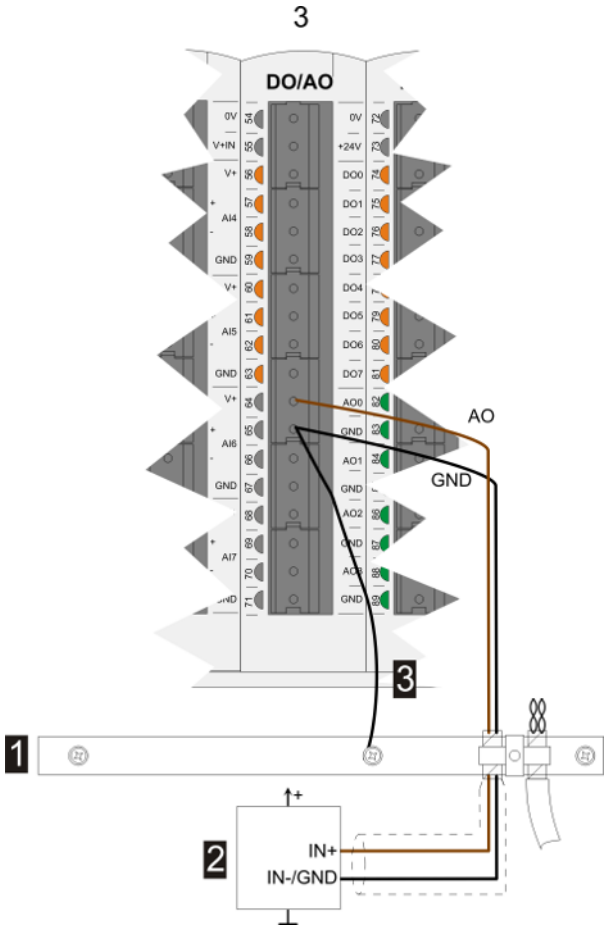


Illustration 6-21: Connection example for analog outputs

1 ... Shield rail	2 ... Actor
3 ... Ground connection to GND, length: max. 1 m	

Information

For the two outputs AO4 and AO5, a ground pin of the other analog outputs can be used as a reference point.

6.7.2 Connection diagram

6.8 Inputs for thermal elements

There are 8 isolated measuring inputs available for thermal elements.

Information

Thermal elements must be insulated from live parts.

Information

The influence of corrosion on the input pins on the measurement accuracy for very low output voltages is very high. Therefore there are gold plated contacts used for the thermocouple input pin connectors. In any case there should be used mating connectors with gold plated contacts. Mixing the contact materials can cause an electrochemical process at ambient conditions with humidity > 50%, which may lead to contact problems.

Information

To prevent measurement errors at the inputs for thermocouples, the thermocouples may be (if necessary) wired using thermo-compensatingcables.

Very long and/or thin thermo-compensating-cables cause measurement error due to their ohmic resistance. To minimize this measurement error it is recommended to hold the total resistance of the sensor (thermocouple, thermo-compensating-cables) down as much as possible.

For example a sensor resistance of 50 Ω causes a measurement error of about 12µV.

The following thermocouples can be connected to these inputs in both isolated and in non-isolated configurations (The thermocouple type must be software configured):

- Typ J (Fe-CuNi) according to IEC 60584
- Typ K (NiCr-Ni) according to IEC 60584
- Typ L (FeCu-Ni) according to DIN 43710
- Typ N (NiCrSi-NiSi) according to IEC 60584

The measurement time is configurable, whereupon a faster measurement time results in a reduction in resolution. The resolution of the measurement method on the inputs corresponds to 16 bits at a measurement time of 100 ms.

Each of these inputs is equipped with a sensor failure monitoring. In case of falling below the measuring range, a sensor failure is set.

For cold-junction compensation the temperature of the clamps has to be determined. When connecting the sensors directly with on IM 270/W an internal measuring of the temperature of the clamps will be used. If an external clamping unit (transition thermocouple line to copper line) is used the temperature of the clamp can be measured with the external optional sensor TE 220/A.

The connectors of the inputs for thermocouples of the IM 270/W are standard male connectors with gold contacts. Therefore also the female connectors must have gold contacts.

6.8.1 Connection example

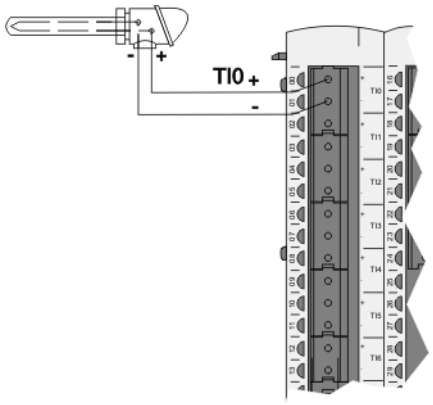


Illustration 6-22: Connection example measurement input (TI0)

6.8.2 Connection diagram thermocouples

IM 270/WConnection diagram

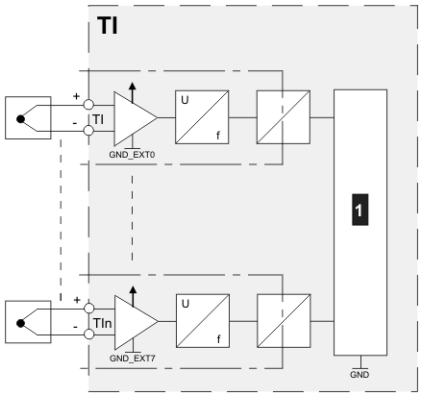


Illustration 6-23: Connection diagram for inputs for thermocouples

1 ... Counter + Logic

Further information to hardware endpoints: See system manual.

6.9 Interface for terminal temperature sensor (SENSOR)

6.9.1 Connection example

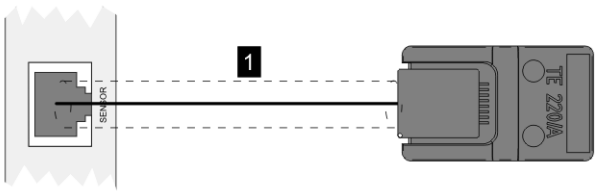


Illustration 6-24: Connecting terminal temperature sensor TE 220/A

1	... Data cable CAT7 or CAT5

6.9.2 Cable specification

To connect the terminal temperature sensor with the IM 270/W, a 8-pin shielded data cable must be used (1:1 connection). Up to a length of 10 m the cable must comply at least CAT5. Up to a length of 60 m the cable must comply CAT7.

6.9.3 Plug specification

RJ45 connector: Modular 8-pole plug, shielded

The cable shielding must be connected plane with the shield cover of the plug. An additional connection of the shield and the ground is not necessary.

6.10 SSI interface

A Synchronous Serial Interface (SSI) (**S**ynchronous **S**erial **I**nterface) is an interface for absolute stroke measuring systems.

Each SSI interface offers a 24 V supply for the SSI sensor which is secured with a self-resetting safety fuse. Furthermore the SSI interface is galvanic insulationed, according SSI standards.

Galvanic insulation in accordance with the proposal of the SSI standard means that only the SSI data signal (reception signal from sensor) features a galvanic insulation. The power supply, the cable shield, and also the SSI clock signal feature a galvanic insulation.

On sensor break a message is sent to the application. Furthermore, an errorbit mask can be defined via software to determine a sensor error.

Each SSI interface can be configured as an input for the hardware comparator (see online help of the configuration tool).

6.10.1 Connection example

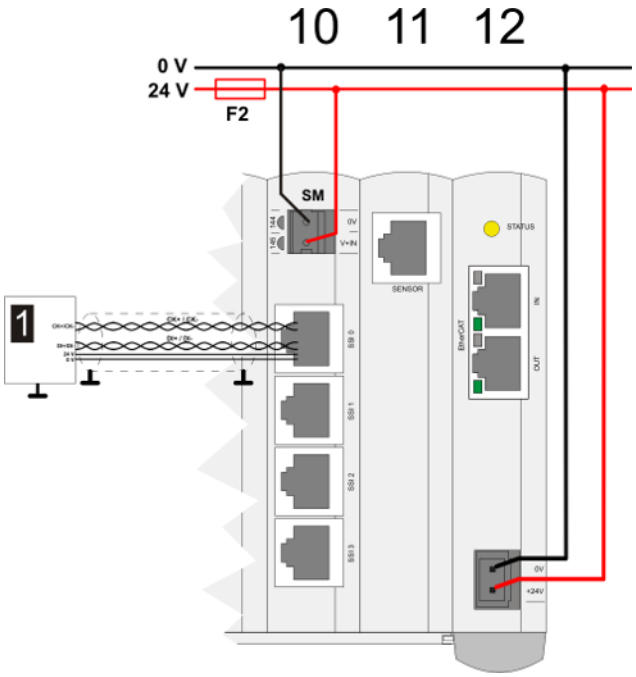


Illustration 6-25: Connection example for transducer on SSI0

1 ... Transducer	

The connected SSI supply is internally forwarded to the SSI interfaces in the following way: Each with a via self-resetting fuse, filtered, checked for correct voltage level and the result will be made available to the application.

6.10.2 Pin assignment

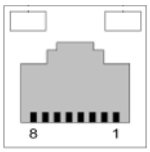


Illustration 6-26: RJ45 Plug

Pin- No.	Designation	
01	n.c.	
02	n.c.	
03	DI+	Data input +
04	CK-	Clock output -
05	CK+	Clock output +
06	DI-	Data input -

Pin- No.	Designation	
07	24 V	Transducer supply voltage
08	0 V	Transducer supply voltage

6.10.3 Cable and plug specification

Further information: See system manual.

6.11 EtherCAT interface

Specification: RJ45, 100Base-TX, Full Duplex, Autonegotiation

Information

EtherCAT slave devices must not be connected to the IN input of the IM 270/W because of runtime errors.

6.11.1 Pin assignment

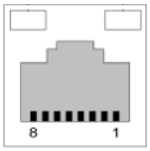


Illustration 6-27: RJ45 plug socket

Pin no.	Signal designation		Input / Output
1	Tr. Data+	Transmit Data +	Output
2	Tr. Data-	Transmit Data -	Output
3	Re. Data+	Receive Data +	Input
4	n.c.	n.c.	---
5	n.c.	n.c.	---
6	Re. Data-	Receive Data -	Input
7	n.c.	n.c.	---
8	n.c.	n.c.	---

6.11.2 Cable and plug specification

Further information: See system manual.

6.12 EMC and wiring guidelines

Pay attention from the outset to careful wiring and shielding according to the given guidelines.

Further information: See system manual.

7 Configuration

A KEBA automation system needs data for the configuration of system performance, its I/O-devices and interfaces. The system reads this data during the start-up operation and allocates them to its components and devices.

Configuration data is created by included configuration tools or by editing configuration files.

For further information about the configuration see the documentation of the included configuration tool.

Modules added-on to the IM 270/W are supported on the K-Bus, as well as moduls added-on to a control. When using the KEBA IO system a manual evaluation and configuration of the PDOs (process data objects) and SDOs (service data objects) are not required (merely the module address of the K-Bus modules must be adapted).

7.1 EtherCAT configuration tool

By means of this software an EtherCAT network can be configured. This contains the definition of the network topology and the parameter defintion of the network participants (EtherCAT master and EtherCAT slaves). The configurator uses device description files (ESI files = EtherCAT Slave Information Files) of the EtherCAT slaves, which provide correct interaction between the devices and full access to the respective functionality. The description files are stored in a library that can expand and update itself.

7.2 Address settings

EtherCAT station address

The EtherCAT station address is allocated automatically by the configuration tool.

Information

If the address setting is invalid, no communication with the IM 270/W is possible.

The address is set once during the startup of the IM 270/W. It is not possible to change the address during operation.

K-Bus address

On the one hand the K-Bus address setting of the modules must take place on the modules themselves via address switches and on the other hand also via the IM 270/W by amending a "CoE Init command” of the “CANOpen startup entry” by means of the Ether- CAT configuration tool.

Information

The default address of each module is 0.

7.3 Module mapping

The modules connected to the device must be added on to the virtual slots in the EtherCAT configuration tool to enable the exchange of the data objects.

Sequence of assembly groups suitable for serial connection

The IM 270/W sorts the assembly groups on the bus into a certain order, which looks as follows:

1	AM 299/A	2	AM 299/B	3	MM 280/A
4	TM 220/A	5	TM 240/A	6	AM 280/A
7	AM 280/B	8	AM 282/A	9	AI 240/A
10	AO 240/A	11	DI 260/A	12	DI 260/A, interrupt
13	DO 272/A	14	DM 272/A	15	DM 272/A, interrupt
16	DO 276/A	17	DM 276/A, interrupt	18	MM 240/A
19	SM 250/A	20	DO 242/B	21	DI 240/B
22	DI 240/B, interrupt	23	TM 225/A	24	SM 210/A, 4 Byte
25	SM 210/A, 18 Byte	26	SM 210/A, 36 Byte	27	SM 220/A, 4 Byte
28	SM 230/A, 4 Byte	29	SM 230/A, 18 Byte	30	SM 230/A, 36 Byte
31	FM 200/A, 4 msg	32	FM 200/A, 8 msg		

Information

When using an external control:

- If the IM 270/Wre added modules on in the configuration tool, this must take place subject to compliance with the above sequence. Thus, for example a DO 272/A is not allowed to be placed before a TM 240/A (virtual). The actual (physical) sequence can be selected randomly.
  When using KeStudio U2 a manual sequencing is not necessary.

- A maximum of 4 modules can be operated with an interrupt on the KBus. For this reason the interruptable modules DI 260/A, DM 272/A, DM 276/A and DI 240/Bare offerd as two versions in the configuration tool (e.g DI 260/A and DI 260/A, interrupt). So in the configuration tool the appropriate variante can be added, depending on whether interrupts are required at one of this modules or not.

Information

- The FM 200/A always uses interrupts to operate the CAN interfaces
- Likewise, modules of the SM 2x0/A series use interrupts to operate the serial interfaces.

Module mapping

The module mapping contains a description of the modules based on their objects (it specifies which objects a specific module offers). It is for the purpose of accessing module data via PDO or SDO data transfer.

In the standard application case, the application programmer does not need this information since the IO system makes all process data available via endpoints of the application. However, of access to special objects (data) of a module is necessary, this can take place via the interfaces provided by the library functions. The index and the sub-index of the data object are required for unique identification of a data object. Please refer to the object description for information about which objects are available.

Feldbusmodule

The IM 270/W supports the following field bus modules on the K-Bus:

Module	max. addable	Bus	max. Baud rate
FM 200/A	2	2x CAN	2x 512 kBit/s or 1x 1 Mbit/s
SM 210/A	4	2x RS-232	2x 115200 Bit/s
SM 220/A	4	1x Current Loop	9600 Bit/s
SM 230/A	4	2x RS-485/422	2x 115200 Bit/s

Independent of the type of the added modules a maximum of 4 field bus modules can be added to the IM 270/W.

Information

If fast control should be used field bus modules can not be used on the K-Bus.

8 Operating behaviour

The IM 270/W supports cycle times of under 1 ms.Such cycle times are possible in the automation system, if the appended KBus modules also support this.

The minimum cycle time for the IM 270/W is:

- without appended fieldbus modules: 100 µs.
- with appended fieldbus modules: 1 ms.

If cycle times drop below the minimum cycle time, the AL status code 0x0035 (DC Invalid Sync Cycle Time) is set, see "Response in the event of module errors".

8.1 Fast control

Integrated fast control is an innovative concept to minimize dead times and therefore also optimize the system response time. The input data are read at the latest possible point in time, transmitted to the application, processed and after that immediately written back to the output. For that, the cyclical EtherCAT communication is split in three phases. In the 1st phase the input data is read - for that the dead time within the EtherCAT frame can be minimized via Sync impulse. In the medium phase, the application processes the input data and makes the updated output data available. Output data are written in the last phase and taken over by the EtherCAT slave. The data flow therefore takes place in an optimal time frame (in contrast to this, normally input and output data are transmitted as a mix during the cyclical communication and the application runs parallel to this transmission, which can lead to dead times of several cycle times).

Information

When using K-bus modules and the fast control KEBA needs to be consulted.

8.2 Operating status

The EtherCAT slave is in the status INIT after switching on. No communication is possible yet.

In the status pre-operational mailbox communication (CoE) is possible but no process data communication. Furthermore, the settings for the process data and, if necessary, module-specific parameters that deviate from the default settings are transferred in this status.

Mailbox and process data communication is possible in the status safe operational, though the slave keeps its outputs in a secure status. The input data are updated cyclically.

Before the EtherCAT master switches the EtherCAT slave from safe-operational status to operational status it must already be transferring valid output data. In operational status the slave transfers in addition the output data of the master to its outputs. Process data and mailbox communication are possible.

Status LED Indication	Meaning
flashing green (regularly with 400 ms ON and 400 ms OFF)	Pre-Operational
flashing green (with 200 ms ON and 1000 ms OFF)	Safe-Operational
green	Operational

8.3 Module behaviour

8.3.1 Failure of the module supply

In case of a power supply failure a Reset is triggered. All lined-up assembly groups are also set into reset-status and all outputs are switched off.

8.3.2 Failure of DO-supply

In case of failure of the power supply of the digital output group, the respective groups switch into OFF-status.

8.3.3 Watchdog

- The IO watchdog checks if the CPU executes the data transfer with the IOs regularly and will be triggered in case of an error on the connectors for analog and digital inputs and outputs. In this case all digital outputs will be immediately switched off and all analog outputs are set to 0 V.
- The K-Bus watchdog causes a K-Bus reset and the outputs of the K-Bus module will be disabled.

8.3.4 Comparator functionality

A comparator serves primarily to detect when a predefined threshold value is exceeded or fallen below at an input signal and to provide the application with data on the time of the event after the comparator event occurred.

Further general information: See online help of configuration tool.

In addition to the general comparator functions described in the online help, the following inputs or outputs can be assigned one of eight comparator groups (configuration parameters `groupId`):

- Digital inputs
- Analog inputs
- SSI interfaces

Comparator groups are independent to each other, i.e. there is no influence to inputs or outputs of another comparator group. A total of eight comparator events can thus be reacted to.

8.4 Response in the event of module errors

If a module error occurs, a changeover to pre-operational status is performed. The status LED signals this by flashing red/green or in case of a serious error by lighting up red.

A reset is effected for all modules, whereby the outputs are also switched off and a status message is sent to the bus master. Once the module error has been removed the system must be reinitialized (restart).

8.5 Interrupt Timestamps

Some addable K-Bus modules produce interrupts upon status changes of the digital inputs. The time points (time stamps) of these interrupts are transferred to the process data and thereby have the following properties:

- An own time stamp is transferred to the process data for each of the 4 interrupt lines.
- A maximum of one time stamp per cycle is transferred per interrupt line.
- Only the time stamp of the first interrupt of an interrupt line is ever transferred in a cycle, the ensuing interrupts of the interrupt line in the same cycle are lost.
- The time stamp is synchronized with the fieldbus and uses the system time of the Distributed Clocks (DC) as a time basis.

8.6 Behavior of the digital outputs 0,5 A

8.6.1 Short-circuit of the outputs 0,5 A

If there is a short circuit, the affected output is switched off, the system variables `system.DOx_stat` are set to TRUE and an error message is generated.

If the device continues to signal a logical 1 (output switched off) there is a cyclical test to see whether the blocked outputs are still short circuited. The timed interval of the switch-on attempts can be adjusted using the configuration entry "Error acknowledgement cycle time" in the Kemro.manager or by specification of the parameter `cycleTimeQuitErrorTask` in the cfg file.

After the short-circuit has been rectified, the system `system.Dox_stat` flags are reset, information about the rectification of the error is generated, and the outputs become available again.

If after a short circuit another short circuit occurs on a further output, the same procedure as for existing faulty outputs applies.

8.6.2 Switching inductive loads 0,5 A

The device contains **no internal free-wheeling diodes** to take up the inductive energy when switching off the inductive loads.

The inductive load capability for each output is 100 mJ at 1 Hz.

The inductive energy is transformed into heat by the switching transistor. It sets itself a voltage of approx. - 45 V at the switching transistor. This allows for a swifter breakdown of the energy than would be possible when using the freewheeling diode.

Information

The load capacity of the outputs for inductive loads can be raised by adding an external freewheeling diode, which will, however, significantly increase the switch-off time.

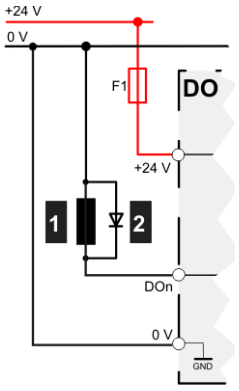


Illustration 8-28: Schematic diagram for the use of a freewheeling diode

1 ... Load	2 ... free-wheeling diode

8.7 Parallel arrangement of digital outputs

Two digital outputs can be switched parallel. This doubles the nominal current. The inductive load capacity of the outputs, however, is not increased.

Requirement:

- Outputs belong to the same output group
- Both outputs are triggered at the same time by the application

8.8 Switching inductive loads 2 A

The device contains **no internal free-wheeling diodes** to take up the inductive energy when switching off the inductive loads.

The inductive load capability for each output is 1 J at 0.2 Hz.

The inductive energy is transformed into heat by the switching transistor. It sets itself a voltage of approx. - 60 V at the switching transistor. This allows for a swifter breakdown of the energy than would be possible when using the freewheeling diode.

Information

The load capacity of the outputs for inductive loads can be raised by adding an external freewheeling diode, which will, however, significantly increase the switch-off time.

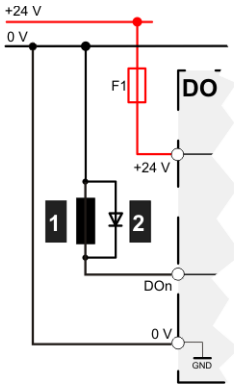
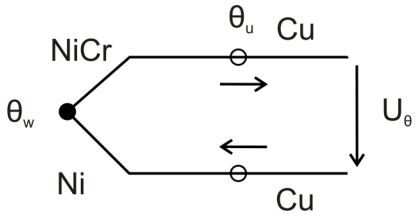


Illustration 8-29: Schematic diagram for the use of a freewheeling diode

1 ... Load	2 ... free-wheeling diode

8.9 Response of the inputs for thermocouples

8.9.1 Measurement principle, temperature measurement



$$U_\theta = (\theta_w - \theta_u) * k$$

k... [µV/K]

Illustration 8-30: Temperature measurement

The thermocouple supplies (active) a voltage Uθ, which depends on the temperature difference between the measuring point (w) and the comparison point (u, terminal). k is the temperature coefficient of the thermocouple. It is dependent on the material and the temperature. Therefore a change in the thermo-voltage is not proportional to the temperature change. The software executes the linearization.

To enable evaluation of the temperature at the measuring point, the temperature of the comparison point must be known. The latter is measured by a terminal temperature sensor that is integrated into the module. This principle is called cold-junction compensation or external temperature compensation.

When using the external temperature sensor TE 220/A he terminal point (transition from thermocouple wire to Cu-wire) can be located outside the IM 270/W.

8.9.2 Temperature data sampling

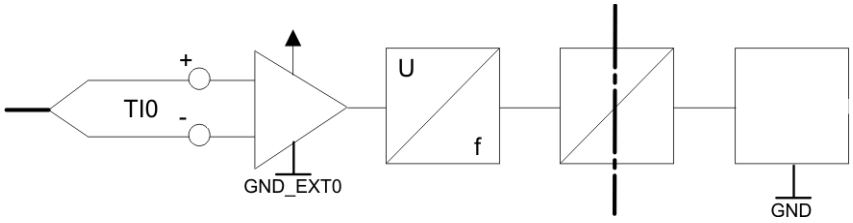


Illustration 8-31: Block diagram

The thermo voltage at the input terminals is amplified and converted into a proportional frequency in the voltage-to-frequency converter.

The measurement period may be configured to 20, 40 or 100 ms (depending on configuration a resolution of 14 - 16 bit results).

Due to the integrating measurement procedure used, any interference that occurs at the AC line frequency (50 Hz, 60 Hz) is filtered.

For effectual ripple voltage elimination an adequate configuration of the AC line frequency is necessary in fact of the different configurable measurement period, e.g. 50 Hz for short measurement period like 20 ms or 40 ms.

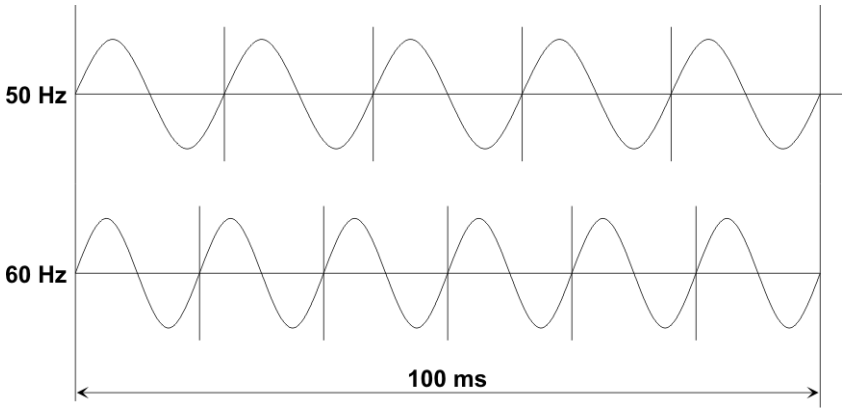


Illustration 8-32: 100 ms measurement period for the filtering of 50 Hz and 60 Hz noise

8.9.3 Operating modes

It is possible to select between 3 operating modes, which are configured via the software.

- Thermocouple measurement with internal terminal temperature compensation.
- Thermocouple measurement with external terminal temperature compensation.
- External thermocouple measurement by connecting the IM 270/W to another module.

8.9.4 Measurements with internal compensation

As the thermocouple measurement with internal cold junction compensation constitutes the standard application it is set as default.

- With this measuring process the thermocouple is directly or indirectly via a thermo-compensation line connected to the IM 270/W angeschlossen.
- The compensation of the terminal temperature is achieved with internal temperature measurement sensors.
- No temperature measurement sensor TE 220/A may be connected to the sensor interface.

Information

To ensure highest precision it is recommended to mount the IM 270/W in a calm air environment and away from power electronics, heating and ventilation elements.

8.9.5 Measurements with external compensation

In case the thermocouple lines shall be extended with CU-wires, the temperature of the terminal point (point of comparison) must be recorded with the temperature measurement sensor TE 220/A.

All **inputs for thermocouples of the device must be connected on one terminal point** since all channels are operated with external cold junction compensation when aTE 220/A.

Functionality

Illustration 8-33: Detailed diagram: Extension of the thermocouple lines

1 ... Thermocouple wire	2 ... Terminal point
3 ... Cu-wire	4 ... attached via adherents; attached via cable binders
5 ... temperature measurement sensor	

- The thermocouple lines have the interim terminal attached at a suitable position (transition from thermocouple wire to Cu-wire).
- The terminal temperature at the terminal point is measured with the help of the temperature measurement sensor TE 220/A. Hereto the temperature measurement sensor TE 220/A is directly attached to the terminal block for the interim terminal or its immediate vicinity. See above graphic.

Information

- UTo ensure highest precision it is recommended to install the terminal point and thus the TE 220/A in a calm air environment and away from power electronics, heating and ventilation elements.
- If the TE 220/A is used, then **all channels** of the device are operated with external compensation.

8.9.6 Response to sensor failure

The sensor failure is recognized by the firmware. An appropriate message is issued to the application.

Information

The sensor failure is either triggered by a cable break in the thermocouple line or by a violation of the upper range or by range undercut (TI0 – T23).

In the case of configured thermocouples that are not connected, a sensor failure is indicated at these inputs.

8.9.7 Response in connection with TE 220/A sensor

An error is issued if the configuration of the operating mode does not conform to the actual installation of a TE 220/A during start-up or during the operation.

9 Diagnosis

9.1 Error codes

The following table shows the reports that are sent in the event of an error.

Error Code (hex)	Meaning	Reaction
0x5001	Device hardware (K-Bus)	Change to PRE_OPERATIONAL
0x5002	Device hardware (K-Bus): Error on the power-down line	Change to PRE_OPERATIONAL
0x5003	Device hardware (K-Bus): Error on down line	Change to PRE_OPERATIONAL
0x5004	There are more than the allowed number of modules on the K-Bus	Change to PRE_OPERATIONAL
0x5005	K-Bus WAIT-Line is blocked by a device	Change to PRE_OPERATIONAL
0x5007	A K-Bus module has been unplugged from the K-Bus	Change to PRE_OPERATIONAL
0x5008	SERR-Line (System error) active	Change to PRE_OPERATIONAL
0x5009	There are one or several unknown modules on the K-Bus	Change to PRE_OPERATIONAL
0x500A	Several modules of the same type with the same address detected	Change to PRE_OPERATIONAL
0x500B	K-Bus watchdog	Change to PRE_OPERATIONAL
0x500C	K-Bus DMA error	Change to PRE_OPERATIONAL
0x5010	RX-FIFO overflow of one channel of an SM 2x0/A in the K-Bus module (source = 0x00) or in the UART (source = 0x01)	-

9.2 AL status codes

Both AL status codes from the EtherCAT specification and manufacturer-specific AL status codes are used:

In accordance with EtherCAT standard as per specification

AL status code	Meaning
0x0000	No error
0x0001	Unspecified error
0x0011	Invalid requested state change
0x0012	Unknown requested state
0x0013	Bootstrap not supported
0x0014	No valid firmware

AL status code	Meaning
0x0015	Invalid mailbox configuration
0x0016	Invalid mailbox configuration
0x0017	Invalid sync manager configuration
0x0018	No valid inputs available
0x0019	No valid outputs available
0x001A	Synchronization error
0x001B	Sync manager watchdog
0x001C	Invalid sync manager types
0x001D	Invalid output configuration
0x001E	Invalid input configuration
0x001F	Invalid watchdog configuration
0x0020	Slave needs cold start
0x0021	Slave needs INIT
0x0022	Slave needs PREOP
0x0023	Slave needs SAFEOP
0x0024	Invalid input mapping
0x0025	Invalid output mapping
0x0026	Inconsistent settings
0x0027	FreeRun not supported
0x0028	SyncMode not supported
0x0029	FreeRun needs 3Buffer mode
0x002A	Background watchdog
0x002B	No valid inputs ans outputs
0x002C	Fatal sync error
0x002D	No sync error
0x0030	Invalid DC SYNCH configuration
0x0031	Invalid DC latch configuration
0x0032	PLL error
0x0033	DC sync IO error
0x0034	DC sync timeout error
0x0035	DC invalid sync cycle time
0x0036	DC sync0 cycle time
0x0037	DC sync1 cycle time
0x0041	MBX_AOE
0x0042	MBX_EOE
0x0043	MBX_COE
0x0044	MBX_FOE
0x0045	MBX_SOE

AL status code	Meaning
0x004F	MBX_VOE
0x0050	EEPROM no access
0x0051	EEPROM error
0x0060	Slave restarted locally

Manufacturer specific

AL status code	Meaning
0x8001	fatal K-Bus error
0x8002	K-Bus error: Power down
0x8003	K-Bus error: Down
0x8004	more than 12 K-Bus modules present
0x8005	K-Bus error timeout
0x8007	K-Bus module has been removed
0x8008	K-Bus error SERR (System Error)
0x8009	unknown K-Bus module present
0x800A	Address conflict between two equal K-Bus modules
0x800B	K- Bus watchdog
0x800C	K- Bus DMA error

10 Maintenance

This chapter contains information for the performance of a firmware update.

10.1 Firmware update

The automation system enables centralized, automatic updating of the firmware running on the IM 270/W. Current firmware versions can be transferred from the central processor module to the module specified for the update via USB-stick.

There are two different versions of updates:

- Updating of all devices of a type
- Selection of specific devices for an update

Further information: See system manual.

During a firmware update the status LED flashes green.

Information

A manual reset must be performed upon completion of the firmware update of the IM 270/W.

Caution

Interrupting the voltage supply during the firmware update can render the IM 270/W unusable (then necessary to send the module in to KEBA).

Information

Before starting a firmware update of the IM 270/W it is checked if the new firmware is compatible to the present hardware and the update is only performed in case of successful check.

11 Disposal

11.1 Disposal of the module

Caution

Please observe the regulations regarding disposal of electric appliances and electronic devices!

- The symbol with the crossed-out waste container means that electrical and electronic devices including their accessories must not be disposed of in the household garbage.
- The materials are recyclable in accordance with their labeling. You can make an important contribution to protecting our environment by reusing, renewing and recycling materials and old appliances.

12 Technical data

12.1 General

Nominal voltage:	24 V DC from the front (rated voltage tolerance 19.2 V DC to 30 V DC, in acc. with EN 61131-2) *)
Max. switch-on current:	5 A
Max. total power consumption:	62,5 W
- Power consumption own consumption:	9 W
- Max. output power K-Bus 5 V:	8,5 W
- Max. output power K-Bus 24 V	45 W
Protection measures against:	Verpolung
Supply connection terminals:	Open terminals, grid dimensions 5.08 mm
Surge category:	II
Protection rating:	III according to EN 61131-2:2007
Protection class:	IP20

Information

**) for the power supply voltage: Chapter 5.1.1.3 of the EN61131-2 2007 is fulfilled to the severity level PS1. To achieve the severity level PS2, a power supply unit must be selected that fulfills the necessary requirements.*

12.2 Environmental conditions

Operating temperature:	+5 °C to +55 °C
Storage temperature:	-40 °C to +70 °C
Relative humidity of air:	10 % to 95 % (not condensing)
Vibration resistance:	According to EN 61131-2:2007
Shock resistance:	According to EN 61131-2:2007

12.3 Digital inputs

Number of inputs:	32
Input type:	Type 1 (according to EN 61131-2)
Voltage range for "1":	15 V ≤ U ≤ 30 V
Voltage range for "0":	-3 V≤ U ≤ 5 V
Status display:	Green LED
Min. update cycle:	200 µs
Usable as interrupt inputs:	No

Galvanic insulation:	No
Debouncing:	Configurable (via software)

12.4 Digital outputs 0.5 A

Number of outputs:	16 (DO0 - DO15) (2 groups to every 8 outputs with own supply)
Type:	Semi-conductor output
Nominal voltage:	24 V DC
Nominal current:	0.5 A with 100% simultaneity per group
Status display::	Orange LED (on the load side)
Galvanic isolation of the output groups:	No
Galvanic isolation toward the control electronics:	No
Inductive load (energy):	max. 100 mJ at 0.2 Hz
Overload-proof:	Yes
Sustained short-circuit proof:	Yes
Short-circuit diagnostics:	Yes
Reverse voltage-protected	No, defect possible

12.5 Digital outputs 2 A

Number of outputs:	24 (DO16-DO39) (3 groups to every 8 outputs with own supply)
Type:	Semi-conductor output
Nominal voltage:	24 V DC
Nominal current:	2 A with 50 % simultaneity per group
Status display::	Orange LED (on the load side)
Galvanic isolation of the output groups:	Yes
Galvanic isolation toward the control electronics:	Yes; electric strength 500 V AC
Inductive load (energy):	max. 1 J bei 0,2 Hz
Overload-proof:	No
Sustained short-circuit proof:	Yes
Short-circuit diagnostics:	Yes
Reverse voltage-protected	Yes

12.6 Analog inputs (differential or single-ended)

Number of inputs:	8

Type:	Voltage input
Input type:	Differential (standard setting) or single-ended Freely allocatable via software
Signal range:	• Differential: ±10 V • Single ended: 0 - U_{ref}
Maximum measurement signal:	-10,4 V to +10,4 V
Galvanic isolation of the output groups:	No
Galvanic isolation toward the control electronics:	No
Reference voltage output:	10 V ±2,5%, max. 20 mA
Sensor failure detection:	Yes
Scan repeat cycle:	100 µs
Input impedance in signal range:	5 MΩ
Input filter characteristic (hardware):	
• Order:	Second order
• Transition frequency:	2500 Hz
Digital filter:	Configurable for: no filter, 500 µs, 1ms, 5 ms For additional data and diagrams for the digital filters, see 15 Appendix: Digital filter of the analog inputs
Resolution:	16 Bit (±10 V), 15 Bit (0 V – U_{ref})
Transformation method:	Successive approximation
Monotonicity without error codes:	Yes
Common-mode characteristics:	
• Common-mode control:	±13,5 V
• Common-mode suppression:	> 80 dB
Value of the lowest-value bit (LSB):	0,325 mV
Maximum permitted continuous load (without damage):	±30 V
Measurement error:	
• Temperature coefficient, typical:	±5 ppm from FSV* / °C
• Temperature coefficient, max:	±20 ppm from FSV* / °C
• Largest error at 25° C:	± 0,02 % from FSV*

* FSV … Full-scale value

12.7 Analog outputs

Number of outputs:	6
Type:	Voltage output
Signal range:	± 10 V
Galvanic isolation of the output groups:	No

Galvanic isolation toward the control electronics:	No
Sustained short-circuit proof:	Ja
Conversion cycle:	100 µs
Digital resolution:	12 Bit
Value of the lowest-value bit (LSB):	5,22 mV
Monotonicity:	Yes
Load resistance:	≥ 1000 Ω
Highest capacitive load:	≤ 10 nF
Differential non-linearity:	≤ ± 1 LSB
Transient time for switch to full range:	≤ 100 µs
Analog output error:	
● Temperature coefficient, typical:	± 20 ppm from FSV* / °C
● Temperature coefficient, max:	± 30 ppm from FSV* / °C
● Largest error at 25° C:	± 0,15 % from FSV*

* FSV ... Scale end value

12.8 Inputs for thermal elements

Number of inputs:	8
Galvanic isolation:	Yes, for control electronics and between inputs electric strength: 500 V AC
Sensor failure detection:	Yes, range not met
Thermocouple types:	J, K, L, N
Measurement ranges:	
● Typ J (Fe-CuNi):	-100 °C bis +700 °C
● Typ K (NiCr-Ni):	-100 °C bis +1000 °C
● Typ L (FeCu-Ni):	-100 °C bis +700 °C
● Typ N (NiCrSi-NiSi):	-100 °C bis +1000 °C
Measurement principle:	Integrating
Measuring interval:	Configurable: 20 / 40 / 100 ms
Update interval:	Correlates to measuring interval
Mains frequency:	Configurable: 50 / 60 Hz
Input resistance:	10 MΩ
Maximum resistance value of the thermal element::	50 Ω
Resolution of the measurement process:	16 Bit
Connections:	Plug-in connection terminals RM 5.08, gold-plated contacts.

Intrinsic deviation:	± 2.5 °C max. absolute measurement deviation over the entire measuring range (± 0.5 °C typical), at 25 °C ambient temperature at the assembly group.
Operational deviation:	± 1 % of measurement, or ± 2.5 °C absolute. The higher value applies in each case. Absolute measurement deviations under reference conditions: Ambient temperature of the assembly group between 0 °C and 55 °C, temperature measurement range between 0 °C and 500 °C.
Precision of terminal temperature sensor:	± 1 °C max. absolute measurement deviation at 0 °C to 70 °C ambient temperature (± 0.5 °C typical).
Precision at internal terminal temperature compensation:	± 2 °C after 30 minutes with natural convection
Accuracy for external compensation with TE 220/A:	With the optimized positioning of the external sensor (TE 220/A, the error can be minimized by the terminal temperature compensation to ± 0.5 °C (typical).
Thermal settling time:	The measurement result is stable after 15 - 30 minutes and is within the specified tolerances.

12.9 Interfaces

EtherCAT:	2
● Data transfer rate:	100 MBit/s
SSI:	4
● Data transfer rate:	125 kBit/s, 250 kBit/s, 500 kBit/s and 1 MBit/s
● Galvanic isolation:	According SSI standards
● Resolution:	Max. 32 bit (bit number configurable)
● Supported data code:	Binary code, gray code
● Output voltage for transmitter supply:	+24 V DC
● Max. current for transmitter supply:	250 mA per channel
● Line breakage monitoring:	Yes
● Short circuit protection:	Via self-resetting fuse
K-Bus:	laterally: used for serial connection of K-bus modules.

12.10 Dimensions, weight

Height:	120 mm
Width:	270 mm
Depth:	100 mm
Weight:	880 g

13 EC directives and standards

13.1 EC directives

Guideline 2014/30/EU	EC guideline on electromagnetic compatibility
Guideline 2011/65/EU	RoHS guideline

13.2 Standards

To check the conformity of the system with the directives, the following non-binding legal European standards were applied:

13.2.1 General procedures and safety principles

EN 61131-1:2003	Programmable controllers - Part 1

Information

This product was developed for the use in industrial areas and can cause radio interference when used in residential areas.

13.2.2 EMC guideline

EN 61131-2:2007	Programmable controllers - Part 2

13.2.3 Electrical safety and fire protection

EN 61131-2:2007	Programmable controllers - Part 2

13.2.4 Environmental and surrounding conditions

EN 61131-2:2007	Programmable controllers - Part 2

13.3 Standards for the American market

13.3.1 UL test for industrial control equipment

UL 508, 2005	Industrial Control Equipment

14 Declaration of conformity

EC Declaration of conformity	
CE	KEBA AG Gewerbepark Urfahr 4041 Linz AUSTRIA

We declare that the following product(s) is/are in conformity with the essential requirements of the following European Council Directive(s).

Conformity to the directive(s) is/are assured by the compliance with the applicable parts of the described harmonized European standards.

Product group	Product	RL 2014/30/EU	EN 61131-2:2007	RL 2006/42/EG	EN ISO 13850:2008	EN 60204-1:2006	EN ISO 13849-1:2008	RL 2014/53/EU	RL 2011/65/EU
Modules	AI 240/x	X	X						X
	AM 28x/x	X	X						X
	AO 240/x	X	X						X
	BL 210/x	X	X						X
	BL 250/x	X	X						X
	BL 27x/x	X	X						X
	BX 25x/x	X	X						X
	DI 2x0/x	X	X						X
	DM 27x/x	X	X						X
	DO 2x2/x	X	X						X
	FM 2xx/x	X	X						X
	FX 2xx/x	X	X						X
	MM 2x0/x	X	X						X
	NX 25x/x	X	X						X
	SM 2xx/x	X	X						X
	SX 2x0/x	X	X						X
	TE 220/x	X	X						X
	TM 2xx/x	X	X						X

x .... Variant suffix

Important notes:

This document is only an overview and not the original declaration of conformity. The original declarations of conformity can be requested from KEBA.

Any modification on the product(s), that is performed without [Firma] consent will render this declaration invalid. The safety instructions contained in the documentation supplied with the product(s) must implicitly be followed!

15 Appendix: Digital filter of the analog inputs

The analog inputs of the IM 270/W feature digital filters, with the configurable filter modi:

- No filter
- 500 µs
- 1 ms
- 5 ms

Information about the cut-off frequency at 3 dB and 20 dB dampening are stated in the following table.

Filter modus	3dB cut-off frequency	20dB dampening at frequency
Without digital filter	2660 Hz	7500 Hz
500 µs	460 Hz	1000 Hz
1 ms	240 Hz	500 Hz
5 ms	56 Hz	130 Hz

The following illustrations contain the Bode diagram as well as the step responses for the different filter modi:

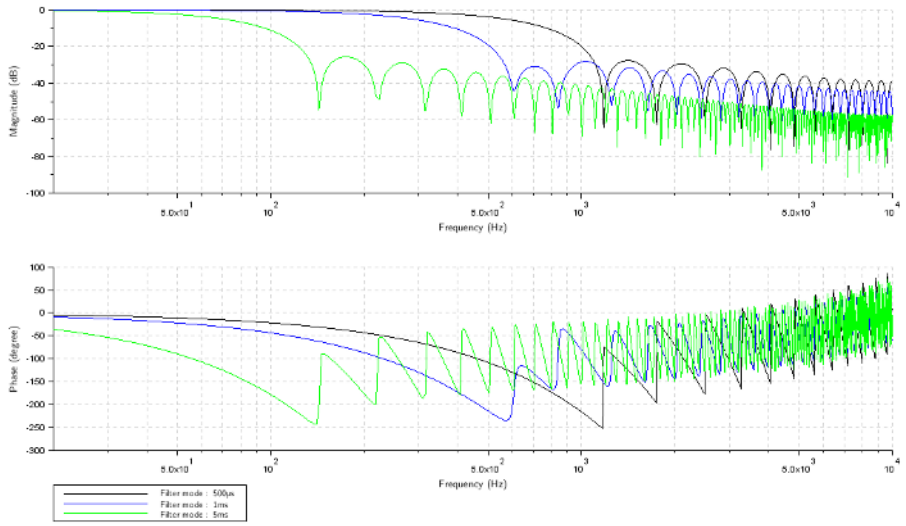


Illustration 15-34: Bode diagram for the different filter modi

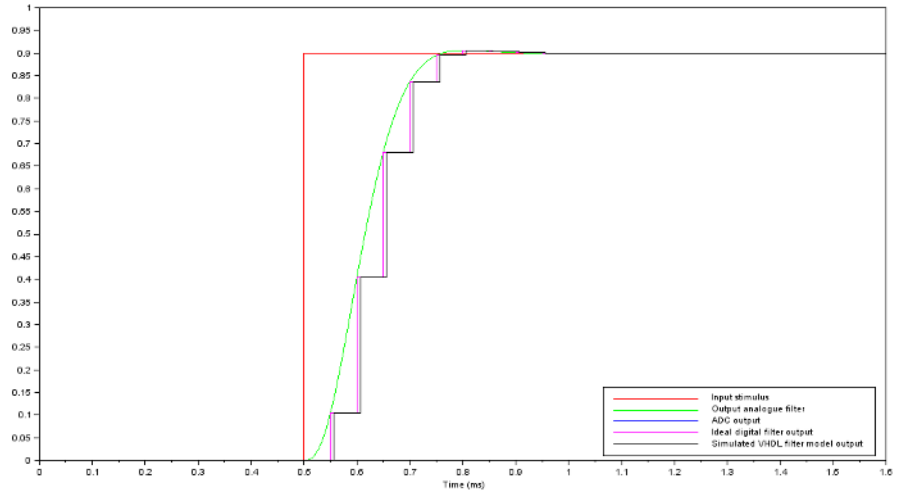


Illustration 15-35: Step responses without digital filter

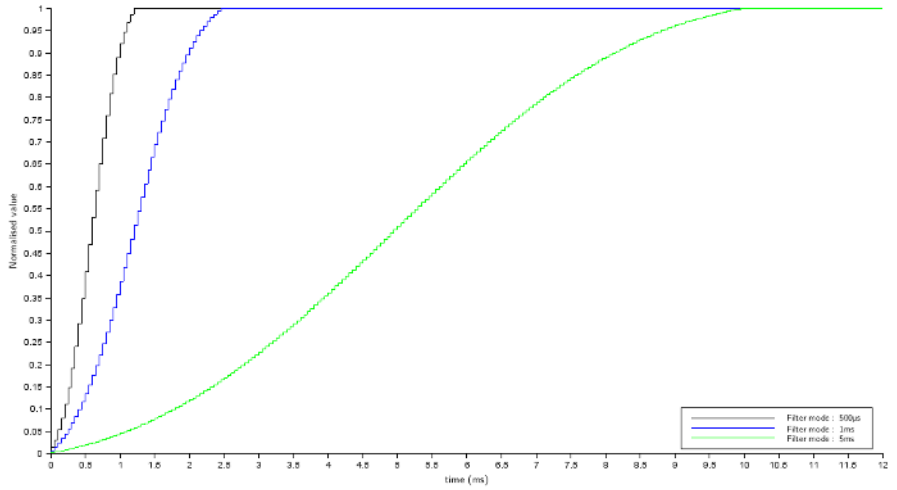


Illustration 15-36: Step responses for the different filter modi

Glossar

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