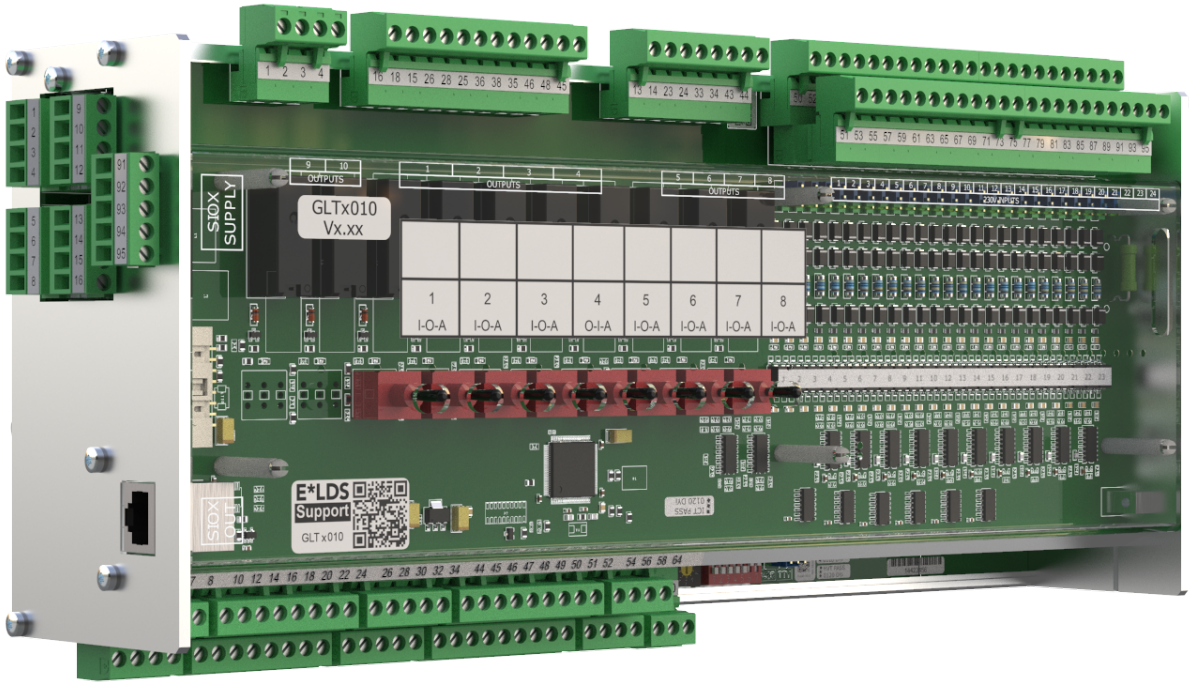
Eckelmann

Operating instruction

Compact GLT 3010 / -GLT 5010

Freely programmable control



The series includes the following expansion stages: GLT 3010 / GLT 5010

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Before commissioning and use, please check that this is the latest version of the document. With the publication of a new version of the documentation, all previous versions lose their validity. The current operating manual and information such as data sheets, more detailed documentation and FAQs are available for you online in E°EDP (Eckelmann ° Electronic Documentation Platform) at

www.eckelmann.de/elds

You reach all relevant documents for this component directly using the QR code:

https://edp.eckelmann.de/edp/lds/_RdC4ujAibE

Information on safety and connection instructions are described in detail in chapter ”Industrial safety notes”.

Table of Contents

1 Conventions

1.1 Warning signs, symbols and text formatting used in this manual

Explanation of the warning signs, symbols and text formatting used in this operating and service manual:

- **DANGER**

> **DANGER**
>
> Instructions with this symbol and/or the signal word DANGER warn the user of situations that will cause severe injury or death if the specified instructions are not observed! *

- **WARNING**

> **WARNING**
>
> Instructions with this symbol and/or the signal word WARNING warn the user of situations that may cause severe injury or death if the specified instructions are not observed! *

- **CAUTION**

> **CAUTION**
>
> Instructions with this symbol and/or the signal word CAUTION warn the user of situations that may cause moderate or minor injury if the specified instructions are not observed! *

* If any of these symbols **DANGER/WARNING/CAUTION** is recognized, the user **must** refer to the operating manual in order to understand the type of potential **HAZARD** and the required actions for avoiding the **HAZARD**. Carefully observe all health and safety instructions and use particular caution in these situations. **Failure to observe the DANGER/WARNING/CAUTION symbols will cause injury (in the worst case, severe injury or death) and/or damage to property!**

- **ATTENTION**

> **ATTENTION**
>
> Instructions with this symbol and/or the signal word ATTENTION warn the user of situations that may cause damage to property if the specified instructions are not observed! The ATTENTION symbol highlights guidelines and regulations, instructions and proper working procedures that must be particularly observed in order to prevent damage to and destruction of components or malfunctioning. **Failure to observe the ATTENTION symbol will cause damage to property!**

- **NOTICE**

> **NOTICE**
>
> Instructions with this symbol and/or the signal word NOTICE provide tips and useful additional information.

- **ELECTRIC SHOCK**

Risk of fatal electric shock!

This symbol warns of danger from **dangerous voltage** with possible consequences such as severe injury and death. If this symbol is seen, the user **must** refer to the operating manual in order to understand the type of potential **HAZARD** and the required actions for avoiding the **HAZARD**. Carefully observe all health and safety instructions and use particular caution in these situations.
Failure to observe the WARNING symbol will cause injury (in the worst case, severe injury or death) and/or damage to property!

- **ESD - Electrostatic-sensitive components and control components**

Risk of destruction of the control component / controller!
Electronic components and control components (e.g. circuit boards) are sensitive to electrostatic charges. Circuit boards may only be replaced when the **power supply is disconnected**. Always hold circuit boards by the edges. The guidelines for the handling of electrostatic-sensitive components and control components **must** be observed at all times.
Failure to observe the ESD symbol will cause damage to property!

- **DISPOSAL**

Potential negative impact on people and the environment due to non-environmentally friendly disposal.

The strike-through dustbin symbol indicates the duty to dispose of items properly. Do not dispose of this product with other domestic waste, see chapter Disposal. Please inform yourself about the local regulations for the separate disposal of electrical and electronic products. The correct disposal of your old equipment protects people and the environment from possible negative impact. **Failure to observe the DISPOSAL symbol will cause damage to people and the environment!**

1.2 Explanation of text formatting

Safety instructions or hazard warnings are composed of four elements:

1. The symbol with text (e.g. for DANGER),
2. a concise description of the hazard and
3. a description of the possible consequences.
4. Where applicable, a catalogue with measures for avoiding the hazard.

For example:

DANGER

Warning of dangerous electrical voltage! Risk of fatal electric shock!
Beware of external voltage at the digital inputs and outputs (relay/SSR)! Connections/plug connectors of the device may only be plugged in, removed and/or wired when **no voltage is present**.

A **general instruction** consists of two elements:

1. The symbol with text (including NOTICE, if applicable) and
2. the text of the instruction:

For example:

NOTICE

The current operating manual is available online from the E°EDP (Eckelmann ° Electronic Documentation Platform) at www.eckelmann.de/elds.

2 Safety instructions

This operating manual is part of the device. It **must** be kept in the vicinity of the controller as well as for future use so that it can be consulted when required. The operating manual must be available to the operating and maintenance personnel at all times in order to avoid operating errors. The safety regulations, instructions and information **must be strictly observed and complied with.** During repairs on the entire E*LDS system, the accident prevention regulations and general safety regulations must be strictly complied with. Important information (safety instructions and hazard warnings) are indicated by appropriate symbols, see chapter Conventions. Follow these instructions in order to prevent accidents and danger to life and limb, as well as damage to the E*LDS system!

Always observe the following information:

DANGER

Warning of dangerous electrical voltage! Danger of electric shock!
Beware of external voltage at the digital inputs and outputs (relay/SSR)! Connections/plug connectors of the device may only be plugged in, removed and/or wired when **no voltage is present**.

- Work on the electrical system may only be performed by **authorised, skilled personnel** (according to the definition of skilled persons in DIN/VDE 0105 and IEC364) while observing the applicable
  - VDE regulations
  - Local safety regulations
  -Intended Use
  - Five safety rules according to DGUV Regulation 3
  - ESD measures
  - Operating manuals
- For safety reasons, the equipment must not be used for any applications other than described in the operating manual and only for the intended use.
- **Before** using the device, check whether it is suitable for your application with regard to its limit values.
- The equipment **must** be installed in an electrically shielded area within the switch cabinet.
- The use of wire end ferrules with plastic collars on the COMBICON mating connectors is **mandatory** as splice protection!
- Before connecting the device, it **must** be checked whether the power supply is suitable for the device.
- Coded connectors **must** be used, as there is a possibility of plugging in non-coded connectors in such a way that there is a danger to life and limb!
- Specified ambient conditions (e.g. humidity and temperature limits, see chapter Technical Data) **must** be observed and complied with at all times to prevent malfunction.
- **Before** switching on the device, check the correct wiring of the connections.
- The device must **never be operated without** its housing. If the intended use requires opening the housing, the control unit **must** be disconnected from the power supply before opening the housing.
- Note the maximum load of the relay contacts, see chapter Technical Data.
- Note that all supply lines from and to the device, particularly those of the CAN bus and Modbus, must be shielded or installed sufficiently far away from live cables. This prevents faulty measurements and protects the device against electrical interference via the analogue inputs. Connection in parallel of RC elements is recommended for applications with critical environment.
- Contact the supplier in the case of any malfunction.

ATTENTION

Warning of damage to goods!
In our experience, the transmission of fault messages is not yet functional during the putting into service (no internet connection, no telephone line installed, etc.). It is strongly recommended in such cases to monitor the controller via the CAN bus using a system centre, a store computer or an operator terminal and to enable the transmission of fault messages, for example using a GSM modem via a mobile telephone system. In standalone operation, or as an alternative to monitoring via system centre / store computer / operator terminal, an available alarm contact on the controller must be used to enable the transmission of fault messages via a telephone network.
For more information, refer to E*LDS basics, safety instructions, CAN bus & Modbus.

2.1 Disclaimer in the event of non-compliance

These operating instructions contain information on the commissioning, function, operation and maintenance of the controls and of the associated components.

Observance of these operating instructions is a prerequisite for safe and trouble-free operation.

2.2 Requirements for the personnel

Special technical knowledge is required for planning, programming, installation, putting into service and maintenance work. This work may **only** be performed by skilled, specially trained personnel. The installation, putting into service and maintenance personnel must have training that authorises them to perform interventions in the system and the automation system. The planning and programming personnel must be familiar with the safety concepts of automation technology. Working on electrical systems **requires special technical knowledge**. Work on electrical systems may only be performed **by instructed electrically skilled persons** or under the guidance or supervision of such persons. The applicable regulations (e.g. DIN EN 60204, EN 50178, DGUV Regulation 3, DIN-VDE 0100/0113) must be observed. The operating personnel must be instructed in how to handle the system / machine and the controller and must be familiar with the operating instructions.

2.3 Intended Use

The controller GLT x010 must be used exclusively as a freely programmable controller for building automation and for the automation of commercial and industrial refrigeration systems. It is used to receive digital and analogue signals from sensors and output them to actuators, forward them to higher-level controllers and/or process the signals. The controller is designed for a working environment that is compliant with protection class IP20. There are finger protection and protection against solid foreign bodies ≥ 12.5 mm, but no protection against water.

The following use is **not permitted**:

- in wet or dusty environments
- in potentially explosive atmospheres
- in aircraft, rail vehicles and ships
- in medical devices and facilities
- in devices and systems that are used for military purposes
- for the realisation of safety functions, e.g. safe stop

Read the safety instructions and the instructions for installation and putting into service, operation and maintenance. THEN start the commissioning and/or operation of the machine / system.

The safety and functionality of the machine / system are only guaranteed for this intended application. Never use the machine / system, its components, control components or parts for any other purpose. The system must not be put into operation until conformity with the applicable EU Directives has been established for the entire system.

2.4 Five safety rules according to DGUV Regulation 3

The following rules must be strictly observed!

1. Disconnect: The entire system to be worked on must be disconnected from the power supply at all poles.

> **DANGER**
>
> **Warning of dangerous electrical voltage! Warning of dangerous electrical voltage! Danger of electric shock!**
> Beware of a possible external power supply! **BEFORE** connecting and disconnecting it must be checked that **no voltage is present** at the controller! Connections/plug connectors of the device may only be plugged in, removed and/or wired when **no voltage is present**.

2. Secure against reconnection: Attach information signs to the disconnected operating equipment stating:

- What has been disconnected.
- Reason for the disconnection.
- Name of the person who made the disconnection.
- Reconnection must be prevented using a suitable lock (e.g. padlock).

3. Prove dead (authorised skilled personnel only):

- Check voltmeter just before use.
- Prove dead on all poles at the disconnection point.
- Prove dead on all poles at the work area.

4. Ground and short-circuit: All electrical parts at the work area **must be grounded and then short-circuited**.

5. Cover or block off adjacent live parts: If there is live equipment adjacent to the work area, it must be covered using appropriate materials (e.g. insulation blankets / plates).

2.5 Electrostatic-sensitive components and control components (ESD)

All electrostatic-sensitive components and control components (referred to as "ESD" below) are labelled with the warning sign shown. Electrostatic charges arise from friction of insulating materials (e.g. floor covering, items of clothing made of synthetic fibres etc.). Even small charges can result in damage to or destruction of components. Such damage is not always immediately noticeable; in some cases, it does not lead to failure until after a certain operating time.

ATTENTION

Risk of destruction of the control component / controller! Electronic components and control components (e.g. circuit boards) are sensitive to electrostatic charges. Therefore, the guidelines for handling electrostatic-sensitive components and control components must be strictly observed.

2.6 EGB - Richtlinien zur Handhabung

Transport and store ESDs only in the protective packaging provided.
Avoid materials that may produce electrostatic discharge, for example

- Plastic containers and table tops
- Synthetic fibre clothing
- Plastic-soled shoes
- Plastic file covers
- Styrofoam packaging
- Computer monitors, etc.

Preferably wear the following:

- Cotton work clothes
- ESD shoes with conductive soles or leather soles

Use the following:

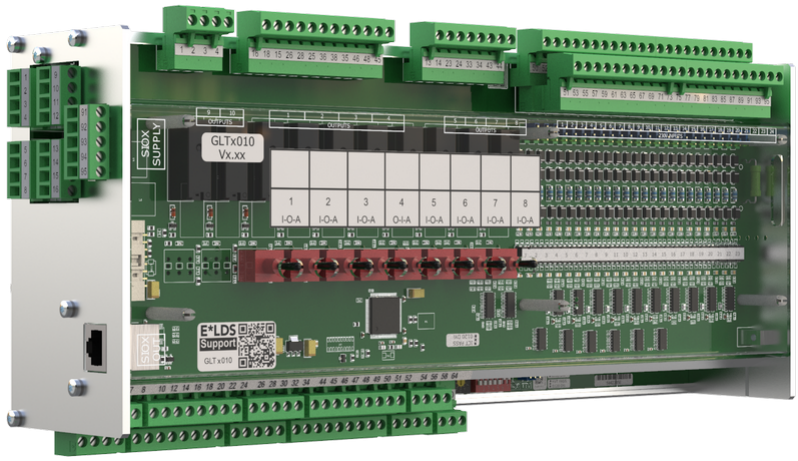
- Conductive flooring
- ESD workstations equipped with suitable tools (grounded soldering guns, antistatic wrist straps, etc.)
- Conductive ESD bags, conductive plastic containers, IC tubes or cartons lined with conductive foam
- Containers and worktops made of wood, metal or conductive plastics or paper bags

2.7 Abbreviations Used

- DGUV Regulation 3 - Accident Prevention Regulation for Electrical Systems and Equipment (previously: BGV A3 - Employer’s Liability Association Regulation for Occupational Health and Safety)
- DIN Deutsches Institut für Normung e.V. (German Standardisation Institute)
- E°EDP/EDP Electronic Documentation Platform of Eckelmann AG
- ESD Electrostatic-Sensitive Device
- ESD Electro-static discharge (Electro Sensitive Devices)
- IEC International Electric Committee
- VDE Verband der Elektrotechnik Elektronik Informationstechnik e.V. (German Association for Electrical, Electronic and Information Technologies)

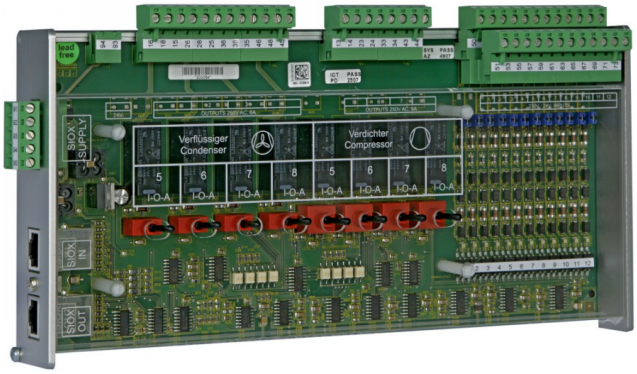
3 System design GLT x010

Base module GLT 3010 / GLT 5010



The freely programmable Compact GLT x010 is available in the GLT 3010 and GLT 5010 versions. They have the same hardware, they only differ in their firmware, see chapter GLT x010 models. The base module consists of an analogue input/output module (lower board) and a digital input/output module (upper board). The controller can be programmed with the programming system CODESYS according to IEC61131-3 and operated and parametrised with the LDSWin PC software. The interfaces for communication are located on the left side, for details see chapter Connections. The controller is a modular design and can be extended with a maximum of 3 SIOX extension modules.

SIOX Extension Module



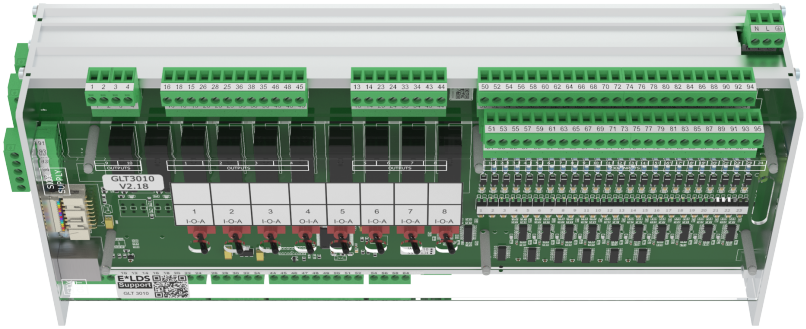
For details see chapter SIOX Extension Module.

> **SIOX operating instructions**
>
> Comprehensive details on the SIOX extension modules and their current operating instructions can be found here:
> https://edp.eckelmann.de/edp/lds/_S88KwDvR7a

3.1 Connections

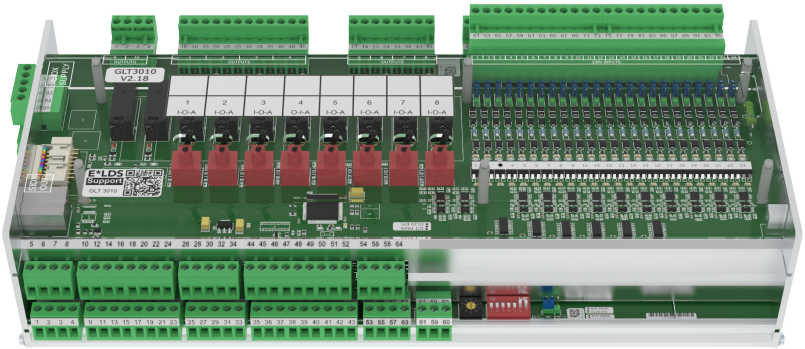
Base module connections

Top view - for details, see Connections for 230 V AC (top)



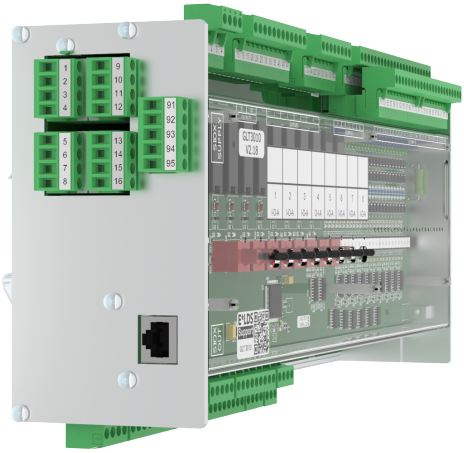
- **Digital inputs**
  23 x input 230 V AC / 24 AC/DC
- **Relay outputs**
  6 x normally open contact 230 V AC
  4 x changeover contact 230 V AC

Bottom view - for details, see Connections for safety extra-low voltage (bottom)



- **Analogue Inputs / Outputs**
  2 x Pt1000 input - 4-wire Pt1000 temperature sensor connection
  13 x Pt1000 input - 2-wire Pt1000 temperature sensor connection
  7 x input / 4-20 mA (0..10 V) - e.g. valve feedback; CO_2 sensor; flow / pressure sensor
  4 x output / 0-10 V (4..20 mA) - e.g. continuous valve actuators; connection of a speed controller for speed-controlled motors

Side view - for details, see Connections for interfaces (on the side)

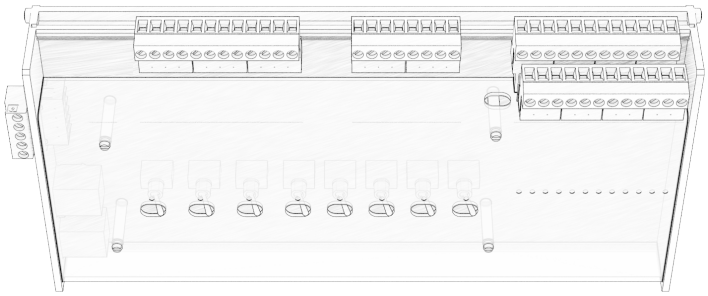


- **Interfaces**
  CAN bus: Communication in the E*LDS system
  RS232: Interface for firmware update
  RS485: Modbus RTU
  TTY: currently without function
  SIOX OUT: connection for data transfer to the SIOX extension modules

- **SIOX Supply**
  power supply for SIOX extension modules

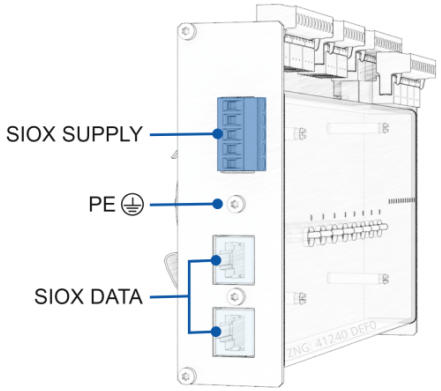
SIOX extension module connections

Top view - for details, see Connections for 230 V AC (top)



- **Digital inputs**
  12 x input 230 V AC
- **Relay outputs**
  6 x normally open contact 230 V AC
  4 x changeover contact 230 V AC

Side view - for details, see Connections for interfaces (on the side)



- **Interfaces**
  SIOX IN: connection for data transfer to the base module
  SIOX OUT: connection for data transfer to the SIOX extension modules
- **Protective conductor PE**
  PE must be connected!
- **SIOX Supply**
  power supply for SIOX extension modules

> The detailed device and terminal assignments of the controller GLT 3010 / GLT 5010 are listed in the chapter Connection and terminal assignment GLT x010 / SIOX.

3.2 GLT x010 models

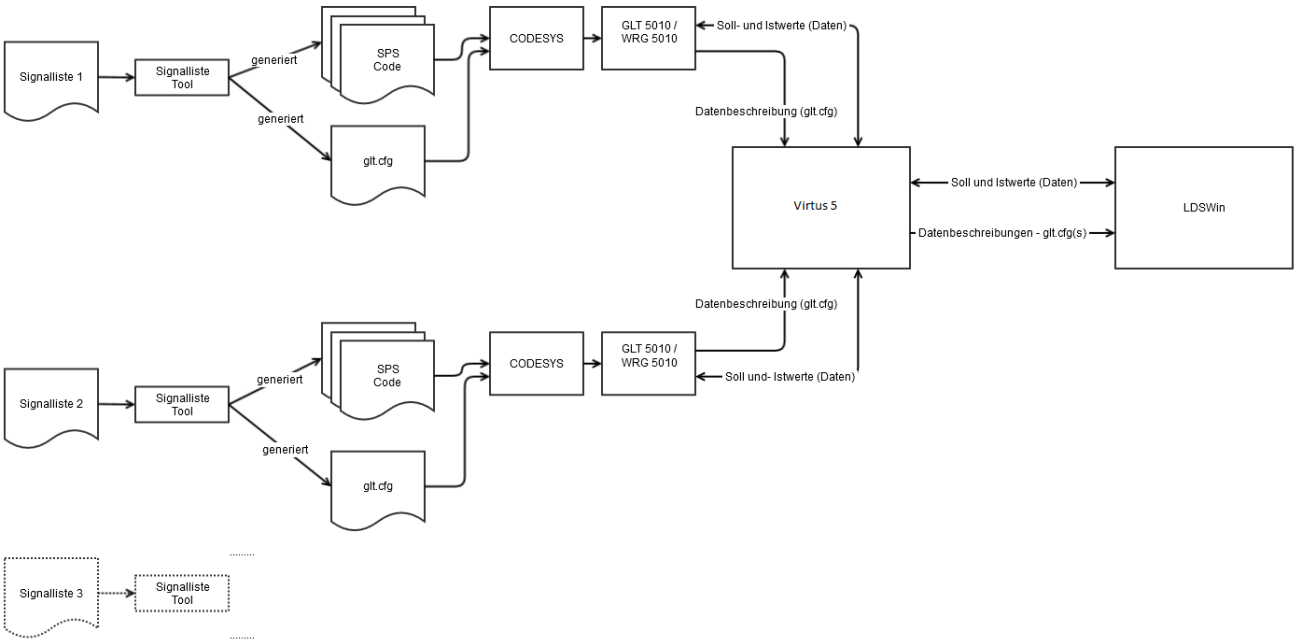
The GLT 3010 and the GLT 5010 only differ in their firmware. The main features are:

Compared to the GLT 3010, the GLT 5010 can embed the GLT channel configuration "glt.cfg" (data point description) in the user application running on it. Compared to the GLT 3010, there is **no longer** a separate "glt.cfg" file that has to be manually imported into the system centre. In addition, the Virtus 5 can then manage more data points per GLT 5010.

The current procedure for importing the GLT-3010 configuration is to import it into the system centre via LDSWin. This currently results in the following disadvantages:

- The GLT configuration "glt.cfg" contains all data points about all GLT 3010 controllers that are in the system. The GLT 3010 controllers can also be located in different maintenance groups, e.g. in the "building management system" group and in the "refrigeration" group for heat recovery. In the case of any change, it must be ensured that the corresponding Signal Lists for all maintenance groups have been merged before importing.
- In the case of any change in the CODESYS project of the GLT 3010 and the possibly resulting changes in the data points, it must currently be ensured that the corresponding GLT configuration is also available in the system centre or is imported subsequently. If this is not the case, then incorrect or implausible actual and setpoint values are displayed in LDSWin because the GLT configuration does not match the CODESYS project of the GLT 3010.

The new concept envisages that the GLT channel configuration is embedded in the CODESYS project of the controller.



The concept has been implemented in the Virtus 5 series system centre and GLT 5010, for more details about these aspects, see chapter Compatibility. The hardware of the GLT 3010 controller is not affected, i.e. a GLT 3010 controller can be transformed into a GLT 5010 controller via a firmware upgrade. The following are created from the EXCEL Signal List with the GLT channels for a DDC using the Signal List Tool

- the files of the PLC code for the CODESYS project and
- file of the GLT channel configuration (glt.cfg)

The GLT channel configuration is then integrated into the CODESYS project and is stored in the controller after import. The GLT channel configuration is then transmitted via CAN bus to the system centre and is stored there. When a connection is established, LDSWin retrieves all available GLT configurations and displays them in the usual way.

Due to the larger data volumes, the Virtus 5 series will no longer support the CAN BUS PC adapter ("*Netporty*") in the future.

3.2.1 Number of data points

- A maximum of 4 controllers of the type GLT x010 can be used system-wide in the E*LDS system.
- **GLT 3010:**
  The system centre can manage a total of **600 data points** system-wide (150 per controller) and archive a maximum of **255** data points.
- **GLT 5010:**
  The system centre can manage a total of **2000 data points** system-wide (500 per controller) and archive a maximum of **1020** data points (255 per controller).

3.2.2 Synchronisation

In this chapter, the aspects of synchronisation of the GLT channel configurations of the GLT 5010 and the system centre will be covered.

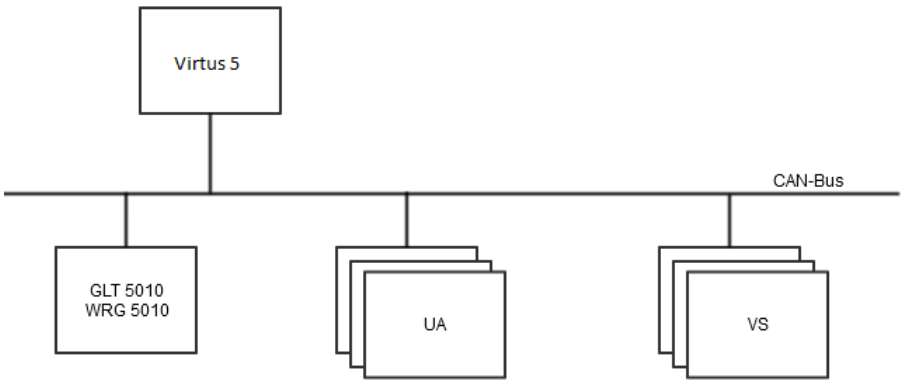
Synchronisation from the perspective of the system centre
In the case of a first start or a restart of the system centre, the system centre will query the GLT channel configuration of all existing GLT 5010 controllers in the field and persist if necessary.

Synchronisation from the perspective of the GLT 5010
In the case of a restart of the GLT 5010 or a change in the GLT channel configuration in the GLT 5010, the GLT 5010 sends its GLT channel configuration to the system centre automatically.

3.2.3 Compatibility

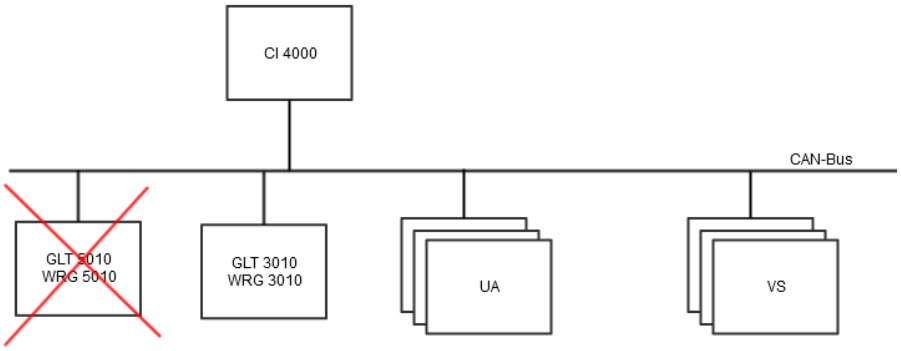
The new functionality is already integrated in the Virtus 5 series and GLT 5010. A suitable LDSWin version that supports the necessary functionalities is required for this. A system centre in the CI 4000 series can be converted into an equivalent system centre in the CI 5000 series by purchasing an upgrade.

New installation



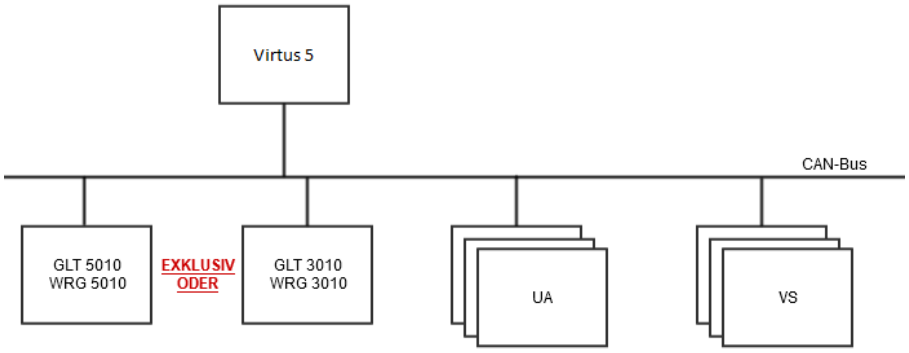
In the case of new installations with a system centre in the CI 5000 series, GLT 5010 controllers **must** be used in order to be able to use the concept with the separate GLT configurations.

Existing installations



In the case of existing installations with an installed system centre CI 4x00, it is **not** possible to use GLT 5010 controllers. The separation of GLT configurations is **not** supported in the CI 4000 series and GLT 3010. Also, in the case of replacement of a defective GLT 3010 controller, it **must** be replaced by a GLT 3010 controller again.

Backward compatibility



The two concepts are mutually interlocked in the system centre of the CI 5000 series; **mixed operation is not possible**. The support of the concept of separate GLT configurations is exclusively implemented in the system centre of the CI 5000 series, i.e. depending on the connected components, either the old previous GLT concept or the new GLT concept with separation of the GLT configurations is supported. The rules for interlocking are defined as follows:

> The rules mentioned below should be understood analogously. If other parameters or indicators are more suitable for detection, these can be selected after consultation.

- If an "old" GLT configuration is stored in the system centre, then the old, previous GLT concept is active.
- If a GLT 5010 controller is active on the CAN bus and no "old" GLT configuration has been imported into the system centre, then the new GLT concept is active.
- If a GLT 5010 controller is active on the CAN bus and the component is managed as a participant in the system centre, it is no longer possible to import the "old" GLT channel configuration into the system centre via LDSWin.

Nevertheless, if mixed operation of the GLT 5010 controller and GLT 3010 controller takes place, then this is escalated accordingly via system messages in the system centre; there is - for the components of the variant that was added later - only "node guarding" (participant monitoring on the CAN bus) of the components.

4 Tasks of the GLT x010

The controller GLT x010 is a freely programmable DDC (**D**irect **D**igital **C**ontrol) according to IEC 61131-3. IEC 61131-3 includes the following languages:

Abbreviation	Description	Note
STL	Statement List	Text: A sequence of mnemonics and operators like in assembler
LAD	Ladder Logic	Graphic: Resembles an electrical wiring diagram lying on its side
FBD	Function Block Diagram	Graphic: Reminiscent of logic plans
SFC	Sequential Function Chart	Graphic: Sequence chains comparable with Petri nets
ST	Structured Text	Text: A high level language with the syntax of *PASCAL*

The programming environment used is CODESYS from *3S*[1)] which is supplied with standard libraries. These contain ready-made modules such as PID controllers, timers, counters, triggers, flip-flops, mathematical modules, etc. With CODESYS, almost object-oriented programming with declaration of types and the use of individual types in any number of independent instances is possible.

CODESYS has yet another powerful language that complements IEC 61131-3:

Abbreviation	Description	Note
CFC	Continuous Function Chart. Free graphical function block diagram editor.	The graphical function blocks can be freely arranged in the editor as in an RI Flowchart. Feedbacks are allowed.

1): Protected trademark, see bibliography.

For individual control applications, e.g. in the field of refrigeration and building automation, the following functions can be realised with the controller in combination with Virtus 5 and LDSWin:

- Control functions
- Regulation functions
- Fault reporting
- Fault archiving
- Monitoring functions
- Archiving functions

These functions depend on the individual programming of the controller.

Applications (examples)

- Monitoring of safety equipment
- Controls and regulation of heating circuits with monitoring of pumps and valves
- Weather management
- Hot water preparation, especially via heat recovery
- Individual heat pump control systems
- Integration of third party controllers via Modbus RTU

5 Functions of the GLT x010 and set-up

5.1 Implementation

The freely programmable controller is shipped from the factory without application functions. There is **no** application loaded. All relay outputs are **switched off**. In contrast, the inputs are constantly read in even when the application is missing or stopped. The values can be visualised with LDSWin.

If the application is missing or stopped, the life lamp (life LED) on the lower circuit board lights intermittently (periodically on for approx. 3 s and off for 0.3 s).

Only the firmware that has the following functions is installed at the factory:

1. Install firmware - with and without applications
A function that allows installing a new firmware via the serial interface RS232. There are two versions of the software installed on delivery:
a. Firmware without application
b. Firmware with application

> The procedure for installing a new firmware with or without applications is identical to that of a firmware update.

2. Provision of the interfaces for CODESYS
a. RS232 - only for the CODESYS programming system
b. RS485 - only for Modbus RTU
c. CAN bus - only for the E*LDS system
d. EEPROM - for the non-volatile saving of setpoints
e. real-time clock

3. Cycle control and management of the process image (PI)

> The following must be ensured when starting up:
> 1. The desired CODESYS application has been loaded into the controller.
> 2. All manual control switches have been set to a position that is appropriate for the process, see chapter Manual / Automatic operating modes changeover.

5.2 Starting Characteristics

The following are distinguished for any start-up of the controller:

- First start
- Restart

5.2.1 First Start

A first start is triggered when the (new) CODESYS **application** is started for the first time. This is independent from the start of the controller.
During a first start, the parameters and setpoints are set to the default values defined by the programmer if the *setpoint check* function block has been programmed accordingly.

The programmer of the application determines whether and when a first start is triggered when the application is changed and started for the first time.

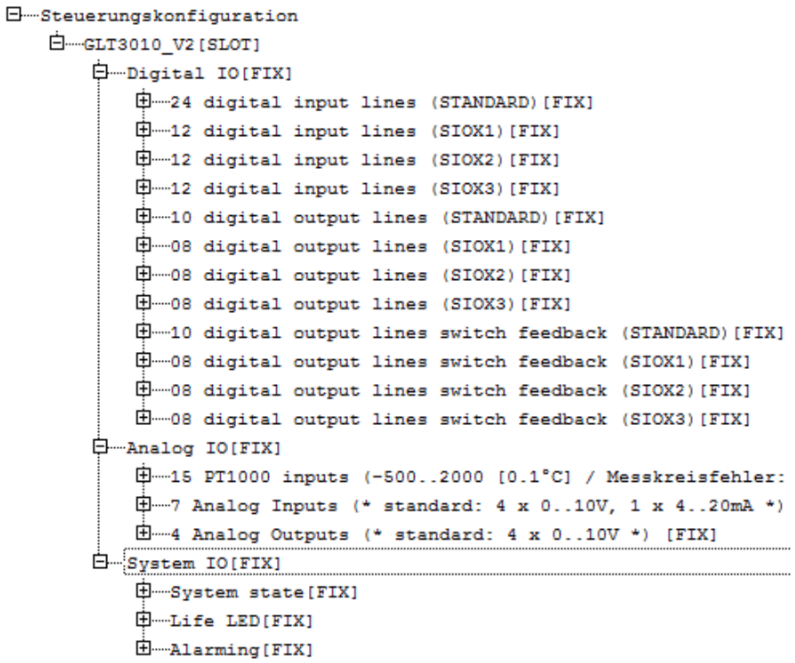
> **ATTENTION**
>
> **Before loading a new/changed application** with an expected first start, the data can be backed up previously using the LDSWin PC software. This function is available in LDSWin under the menu item "Store=> Print setpoints => GLT setpoint channels".

5.2.2 Restart

The restart takes place after restoration (switching on) of the supply voltage. If programmed accordingly, the parameters and setpoints are read from the EEPROM via the *setpoint check* function block.

5.3 Controller configuration

The controller configuration is used to establish the link between the inputs and outputs and the application, and their parametrisation. It is located in the "Resources" tab in the development system:

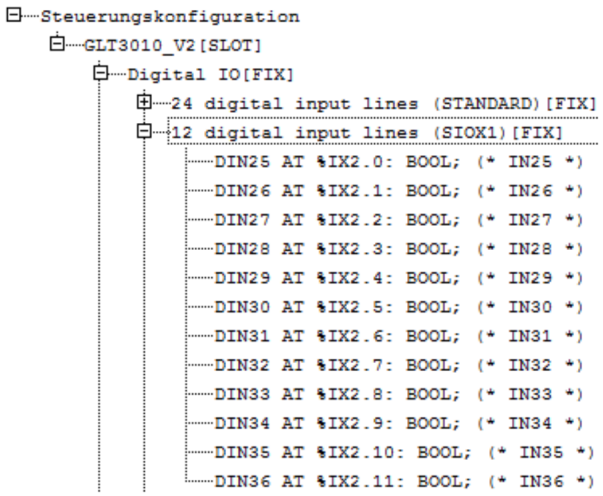


The following can generally be set in the controller configuration editor:

1. Assignment of the physical inputs and outputs to addresses in the process image of the controller
2. Setting the hardware configuration, such as number of SIOX extension modules.
3. Setting the measuring ranges
4. Prioritisation of the system alarms

The assignment of the physical inputs and outputs to the IEC addresses is predefined in the controller. This means that they are set at the factory and do not have to be configured first. The IEC addresses are needed to connect to the symbolic names in the DDC program. This is done using the *Signal List*. Such an assignment to a meaningful variable name is highly recommended, although names are already preset in the controller configuration at the factory and are marked as "Default Identifier".
The above screenshot of the controller configuration shows under "Controller GLT 3010_V2" in the section "Digital IO [FIX]" how many inputs and outputs the base module (STANDARD) and the associated SIOX1..SIOX3 extension modules have.
In addition, for each of the last four relay outputs, there is feedback for the position of the manual control switch, which is used to switch from Auto to Manual ON or OFF. This feedback is in the form of a digital input and can be retrieved by the programmer.

Example: Clicking on [+] opens the following display for the SIOX 1:

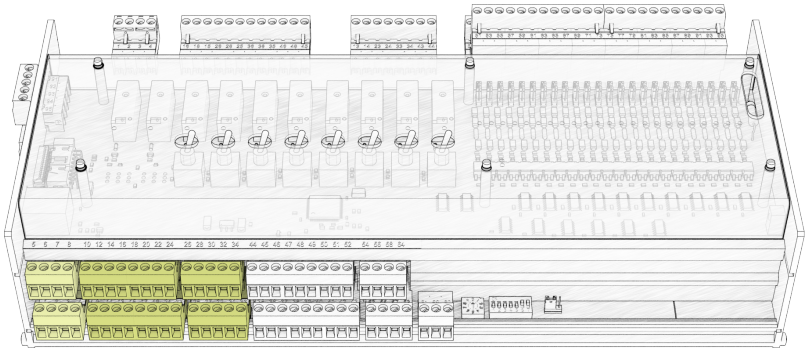


Explanation: The SIOX1 with its 12 digital inputs and the associated IEC addresses %IX2.0 .. %IX2.11.
The preset variable names DIN25 .. DIN36 can be used directly in CODESYS, e.g. for .. IF DIN34 then ...

> **Practical tip:** For better readability of the CODESYS program, meaningful process variable names should be defined via theSignalliste and then used.

5.3.1 Measuring ranges of the Pt1000 sensor inputs

The measurement inputs for the Pt1000 sensors are only available on the base module of the controller:



For details, see chapter Assignment of the analogue inputs. The Pt1000 sensors have a measuring range of -50 °C to 200 °C and a resolution of 0.1 °C. This setting is fixed from version 2.0 and does not need to be changed.

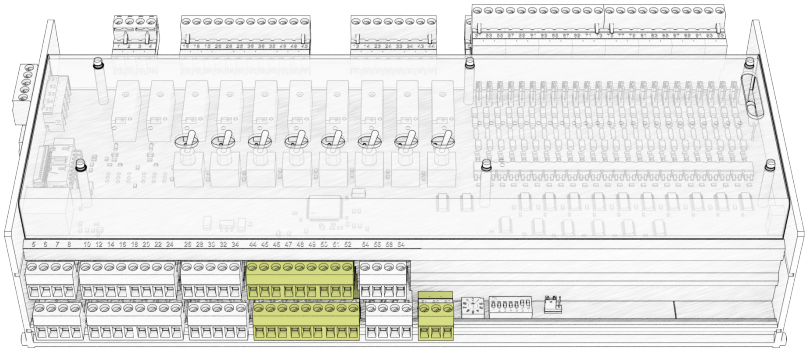
```
Analog IO[FIX]
    15 PT1000 inputs (-500..2000 [0.1°C] / Messkreisfehler: -32640 = 16#8080) (* PT1000
        PT1000_1 AT %IW26: INT; (* PT1000  1 (-500...2000 [0,1°C]) *) [CHANNEL (I)]
        PT1000_2 AT %IW27: INT; (* PT1000  2 (-500...2000 [0,1°C]) *) [CHANNEL (I)]
        PT1000_3 AT %IW28: INT; (* PT1000  3 (-500...2000 [0,1°C]) *) [CHANNEL (I)]
        PT1000_4 AT %IW29: INT; (* PT1000  4 (-500...2000 [0,1°C]) *) [CHANNEL (I)]
        PT1000_5 AT %IW30: INT; (* PT1000  5 (-500...2000 [0,1°C]) *) [CHANNEL (I)]
        PT1000_6 AT %IW31: INT; (* PT1000  6 (-500...2000 [0,1°C]) *) [CHANNEL (I)]
        PT1000_7 AT %IW32: INT; (* PT1000  7 (-500...2000 [0,1°C]) *) [CHANNEL (I)]
        PT1000_8 AT %IW33: INT; (* PT1000  8 (-500...2000 [0,1°C]) *) [CHANNEL (I)]
        PT1000_9 AT %IW34: INT; (* PT1000  9 (-500...2000 [0,1°C]) *) [CHANNEL (I)]
        PT1000_10 AT %IW35: INT; (* PT1000 10 (-500...2000 [0,1°C]) *) [CHANNEL (I)]
        PT1000_11 AT %IW36: INT; (* PT1000 11 (-500...2000 [0,1°C]) *) [CHANNEL (I)]
        PT1000_12 AT %IW37: INT; (* PT1000 12 (-500...2000 [0,1°C]) *) [CHANNEL (I)]
        PT1000_13 AT %IW38: INT; (* PT1000 13 (-500...2000 [0,1°C]) *) [CHANNEL (I)]
        PT1000_14 AT %IW39: INT; (* PT1000 14 (-500...2000 [0,1°C]) *) [CHANNEL (I)]
        PT1000_15 AT %IW40: INT; (* PT1000 15 (-500...2000 [0,1°C]) *) [CHANNEL (I)]
        PT1000_REF AT %IW41: INT; (* PT1000_REF (-500...2000 [0,1°C]) *) [CHANNEL (I)]
```

The preset process variables PT1000_1 .. PT1000_15 can be seen in the screenshot. They provide the temperature value in °C directly as an integer value with one decimal place and are increased by the factor 10 and must be converted in CODESYS with the factor 0.1.

Example:
The values "-500 .. 2000" correspond to "-50.0 °C .. 200.0 °C".

5.3.2 Measuring ranges of the analogue inputs

There are seven analogue inputs available only on the base module for any sensors or feedback signals from actuators that have a current or voltage interface:



For details, see chapter Assignment of the analogue inputs. All analogue inputs can be configured as current (4...20 mA) or voltage inputs (0...10 V), see chapter Configuration of the analogue inputs and outputs at the factory.

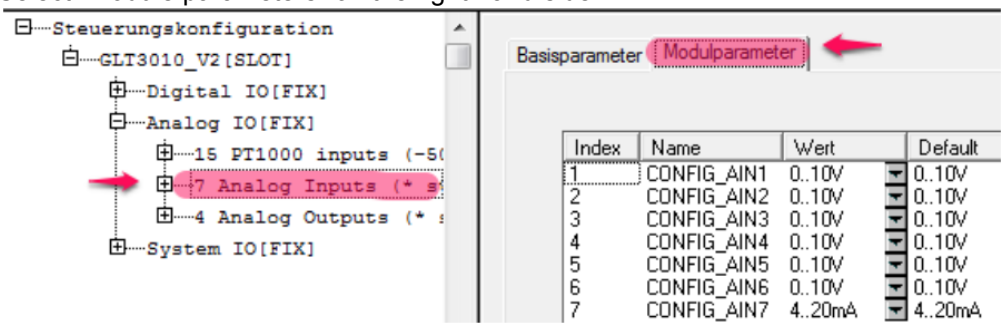
Examples of field devices for connection to the analogue inputs (e.g. ex works 4..20 mA):

- CO_2 sensor
- Pressure sensor
- Brightness sensor
- Humidity sensor
- Continuous actuators with feedback
- Temperature sensor
- Flow rate sensor

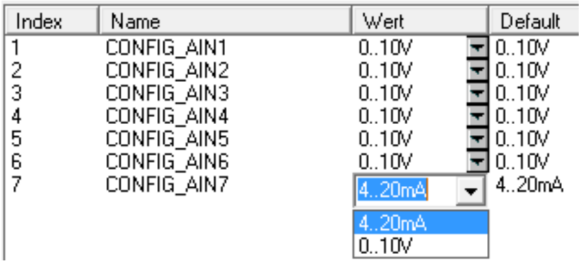
The values transferred from the controller are raw values of the analogue to digital converter (ADC), which must be converted by the CODESYS program into physical values such as temperatures in °C using a linear characteristic curve.
The current and voltage interfaces use different characteristic curves in the controller. To take this into account, the setting in the controller configuration must correspond to the field devices used, which is explained in the following example.

The analogue inputs (0..10 V / 4..20 mA) are configured in the "Module parameters" tab (see Controller configuration). The selection can be found as follows:
GLT3010_V2 → Analog IO → 7 Analog Inputs

Select "Module parameters" on the right-hand side:

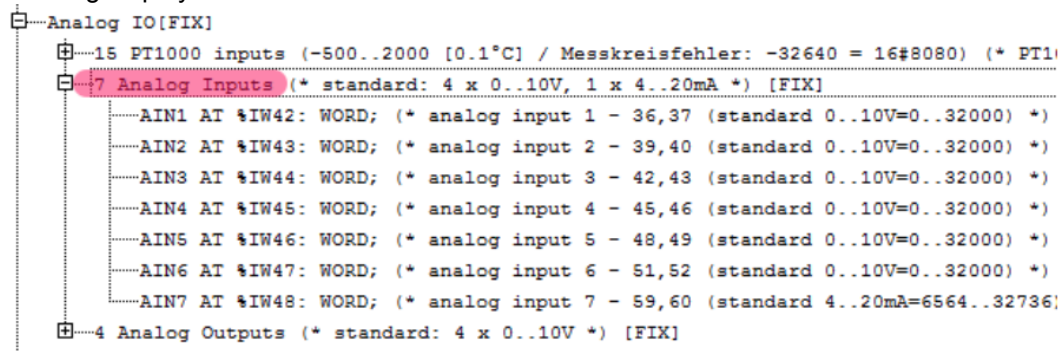


For orientation, a Default column is provided in which the factory setting is described. The Value column shows the setting currently in use. The desired behaviour of the interfaces for 0..10 V or 4..20 mA is set via the drop-down selection boxes:



> When changing the configuration of the analogue inputs, the jumpers located on the main board must be reconfigured.

The following screenshot in the controller configuration under Controller GLT 3010_V2, in the Analogue IO section, shows that the base module (called STANDARD) has 7 analogue inputs. Clicking on [+] opens the following display:

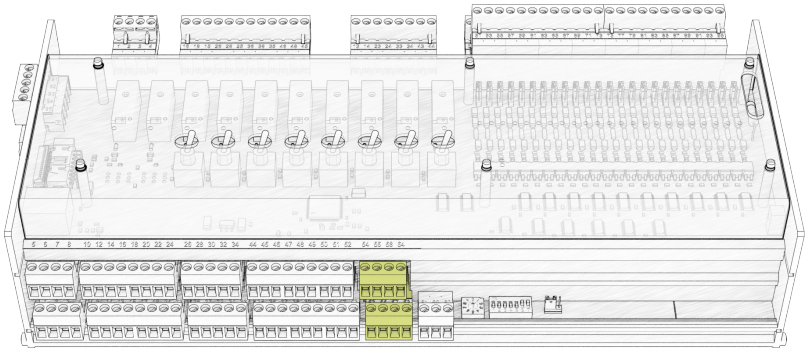


Explanation: The seven analogue inputs have the IEC addresses %IW42 .. %IW48
The preset variable names AIN1 .. AIN7 can be used directly in CODESYS, e.g. for *IF AIN7 > 16000 then*

> **Practical tip:** For better readability of the CODESYS program, meaningful process variable names should be defined via theSignal List and then used.

5.3.3 Measuring ranges of the analogue outputs

There are four analogue outputs available only on the base module for any actuators that have a current or voltage interface:



For details, see chapter Assignment of the analogue outputs. All analogue outputs can be configured as current (4...20 mA) or voltage outputs (0...10 V), see chapter Configuration of the analogue inputs and outputs.

Examples of field devices for connection to the analogue outputs 4..20 mA (e.g. ex works 0..10 V):

- Rotary actuators
- Lifting actuators
- Electronically commutated (EC) motors
- Flow rate controllers
- Frequency converters

The 16-bit number output to the output process variable in the CODESYS program is converted into a voltage or current value by the digital-to-analogue converter (DAC) of the controller and output to the field device.
The screenshot in the *controller configuration* under Controller *GLT 3010_V2*, in the *Analog IO [FIX]* section, shows that the base module (called STANDARD) has 4 analogue outputs. Clicking on [+] opens the following display:

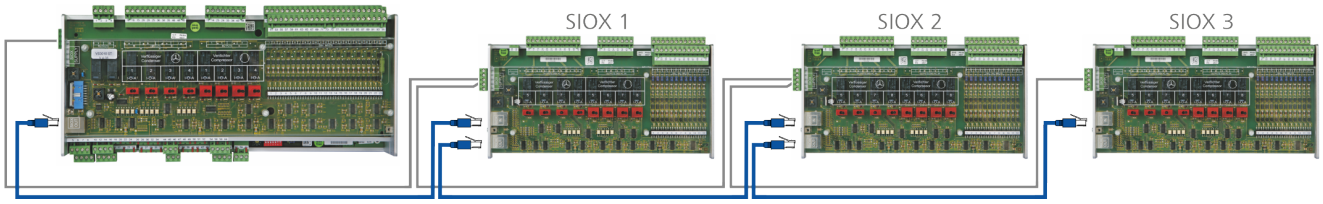
```
Analog IO[FIX]
    15 PT1000 inputs (-500..2000 [0.1°C] / Messkreisfehler: -32640 = 16#8080) (* PT1
    7 Analog Inputs (* standard: 4 x 0..10V, 1 x 4..20mA *) [FIX]
    4 Analog Outputs (* standard: 4 x 0..10V *) [FIX]
        AOUT1 AT %QW28: WORD; (* analog out 1 - 53,54 (standard 0..10V=0..32000) *)
        AOUT2 AT %QW29: WORD; (* analog out 2 - 55,56 (standard 0..10V=0..32000) *)
        AOUT3 AT %QW30: WORD; (* analog out 3 - 57,58 (standard 0..10V=0..32000) *)
        AOUT4 AT %QW31: WORD; (* analog out 4 - 59,60 (standard 0..10V=0..32000) *)
```

Explanation: The four analogue outputs have the IEC addresses %QW28 .. %QW31
The preset variable names AOUT1 .. AOUT4 can be used directly in CODESYS, for example to apply 5 V to the analogue output: AOUT1 := 16000.

> **Practical tip:** These names are not recommended due to the "poor" readability. It would be better and clearer to define meaningful process variable names via the *Signal List (*see chapter Formal structure of the Signal List) and then use them.

5.3.4 Number of SIOX extension modules

The number of SIOX extension modules connected to the controller is defined in the controller configuration. The minimum number is 0 (i.e. no SIOX) and the maximum number is 3:



Base module GLT x010 in full expansion with max. 3 SIOX extension modules, for details, see chapter SIOX Extension Module.

The number of SIOX extension modules is configured in the "Module parameters" tab (see also Controller configuration). The selection can be found as follows: *Controller configuration → GLT3010_V2 → System IO → System state [FIX]*. There, select "Module parameters" on the right-hand side and enter the desired number of SIOX extension modules in the "Value" column. The factory default value is 3, see column "Default":

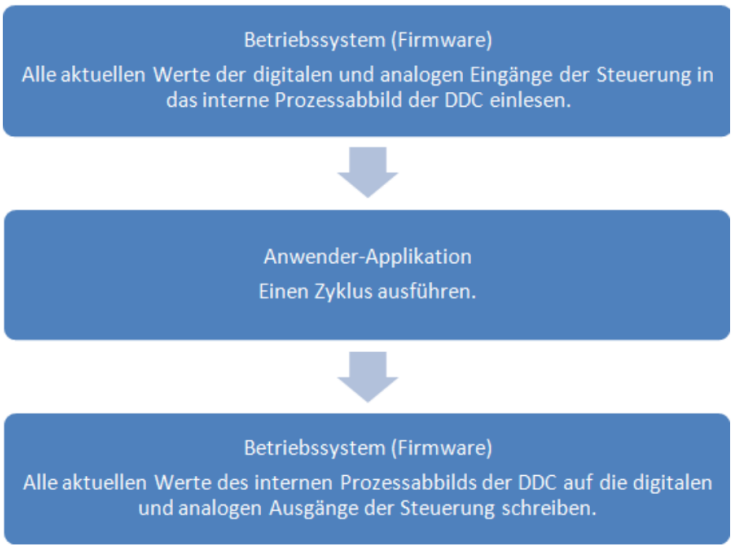
> If fewer SIOX extension modules than entered under "Value" are connected to the base module (or one of them fails during operation), the system alarm "Failure ext. SIOX x" is triggered.

5.3.5 System error messages

The system error messages are described in chapter Message system.

5.4 Process Image (PI)

The process image for the inputs and outputs is located in the memory area in the controller. The raw values of all digital and analogue inputs and outputs of the controller are stored there. The operating system, the firmware, cyclically executes the following three steps:



In the second step, the user's application is executed in the controller from start to end in the programmed sequence. Therefore, it must be ensured during programming that the individual program modules are executed quickly. This can be ensured by using state machines.

> ⓘ Actively waiting for a message or event and using large, time-consuming program loops in the range of seconds **must** be avoided, as this will also trigger the watchdog!

In CODESYS, the raw values of the analogue inputs are converted into physical values with units by the user program, the application.

Example: A room temperature sensor with a 4..20 mA interface and a measuring range of 0 °C..+50 °C provides a current value of 12 mA. This corresponds to half the measuring range, i.e. 25 °C. The analogue to digital converter of the analogue input of the controller converts this into the number 19642. If the sensor is connected to input 7 (terminals 61, 59), the value 19642 is supplied in the process variable AIN7 with the IEC address IW 48.

Analogue input: The raw values are read into the PI as a number from the analogue to digital converter ADC and represent the analogue input value of the physical interface there:
Example: U = 0..10 V [**Analog-IN**] ADU PA = 0..32000

Analogue output: The program writes a numeric value into the PI, which is converted into a voltage value by the digital to analogue converter DAC, which is then present at the output of the analogue interface.

Example: PA = 0…32000 DAU [**Analog Out**] U = 0…10 V

5.4.1 Feedback of the manual control level

The relay outputs on the base module and the SIOX extension modules have manual control switches whose switch position can be read back in two bits RM1 and RM2, see chapter Manual / Automatic operating modes changeover. It can be queried as follows whether the switch position "AUTO" is active:

IF (RM1 and not RM2) then AUTO_AKTIV := TRUE;

The following truth table shows the connections between the switch positions and the values of the two bits RM1 and RM2:

Switch position	RM1	RM1
AUTO	1	0
ON	0	1
OFF	1	1

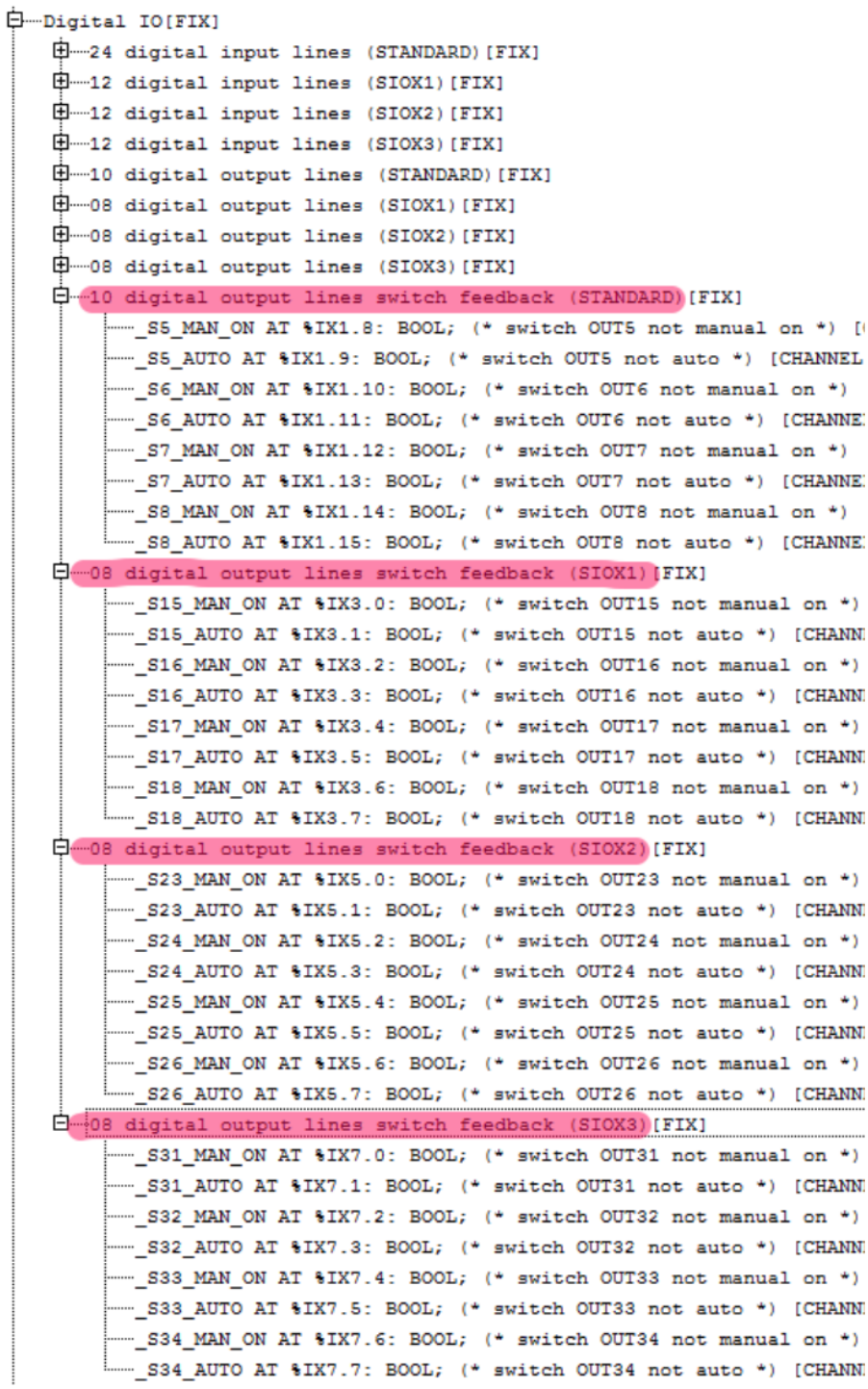
The table shows the variable names with the IEC addresses and the reference to the bits RM1 and RM2. Only the respective variable name for RM1 and RM2 must then be entered in the above table.

I/O No.	RM1		RM2		IEC address Output for AUTO
	Variable	IEC address	Variable	IEC address	
Base module GLT x010					
5	_S5_MAN_ON	IX1.8	_S5_AUTO	IX1.9	QX0.4
6	_S6_MAN_ON	IX1.10	_S6_AUTO	IX1.11	QX0.5
7	_S7_MAN_ON	IX1.12	_S7_AUTO	IX1.13	QX0.6
8	_S8_MAN_ON	IX1.14	_S8_AUTO	IX1.15	QX0.7
SIOX 1					
15	_S15_MAN_ON	IX3.0	_S15_AUTO	IX3.1	QX1.4
16	_S16_MAN_ON	IX3.2	_S16_AUTO	IX3.3	QX1.5
17	_S17_MAN_ON	IX3.4	_S17_AUTO	IX3.5	QX1.6
18	_S18_MAN_ON	IX3.6	_S18_AUTO	IX3.7	QX1.7
SIOX 2					
23	_S23_MAN_ON	IX5.0	_S23_AUTO	IX5.1	QX2.4
24	_S24_MAN_ON	IX5.2	_S24_AUTO	IX5.3	QX2.5
25	_S25_MAN_ON	IX5.4	_S25_AUTO	IX5.5	QX2.6
26	_S26_MAN_ON	IX5.6	_S26_AUTO	IX5.7	QX2.7
SIOX 3					
31	_S31_MAN_ON	IX7.0	_S31_AUTO	IX7.1	QX3.4
32	_S32_MAN_ON	IX7.2	_S32_AUTO	IX7.3	QX3.5
33	_S33_MAN_ON	IX7.4	_S33AUTO	IX7.5	QX3.6
34	_S34_MAN_ON	IX7.6	_S34_AUTO	IX7.7	QX3.7

Note: The underscore in front of the variable names signals the negation line above the variable, which is common in digital technology, if they are "Low Active" (i.e. inverted). The assignment of the variable names to the IEC addresses, divided between the controller and the three SIOX extension modules, can also be viewed in the controller configuration.

The selection can be found as follows:

Controller configuration → GLT3010_V2 → Digital IO *→ digital output lines switch feedback*



5.4.2 Pt1000 sensor inputs

The process images of the Pt1000 sensor inputs (for details, see chapter Assignment of the analogue inputs) provide a signed 16-bit integer value that is a factor of 10 higher than the measured temperature value in °C. For further use, this value is usually divided by 10 and assigned to a REAL variable.

> The 16-bit value range is: -32768 .. 32767. Therefore, in the *Signal List* for the Pt1000 sensor inputs, e.g. for the sensor Pt1000_1, the value II26 and not IW26 is entered in order to record the negative number range.

The following table shows the connections:

Measured value	Value in the process image	Meaning
< -50 °C	16#8080[1)]	Sensor fault
-50 °C	-500	
0 °C	0	
0.1 °C	1	
1.6 °C	16	
50 °C	500	
200 °C	2000	
> 200 °C	16#8080[1)]	Sensor fault

[1)] 16#8080 = 32896

5.4.3 Analogue inputs

The process image (PI) for the analogue inputs of the controller (for details see chapter Assignment of the analogue inputs) consists of unsigned 16-bit values. Different characteristic curves are implemented depending on whether current or voltage inputs are used. This also ensures compatibility with the Eckelmann controller ELC5x.

The following table shows the relationships and gives examples of values for the pairs of the measured value and the associated value in the process image:

Measuring range	Measured value	Value in the process image
0 V … 10 V	< 0	0
	0 V	0
	1 V	3200
	2 V	6400
	10 V	32000
	> 10 V	32000
4 mA .... 20 mA	< 0 mA	0
	0 mA	0
	1 mA	1637
	4 mA	6548
	20 mA	32736
	> 20 mA	32736

The characteristic curves are linear and limited to a minimum of 0 and, depending on the measuring range, a maximum of 32000 or 32736.

Examples:

1. **Voltage**: If U = 5 V is applied to the analogue voltage input, the PI value = 16000 is displayed in the process image.
2. **Current**: If a current of I = 12 mA is applied to the analogue current input, the PI value = 19644 is displayed in the process image.

5.4.4 Analogue outputs

The process image (PI) for the analogue outputs of the controller (for details see chapter Assignment of the analogue outputs) consists of unsigned 16-bit values. The characteristic curves for current and voltage are the same.
The following table shows the relationships and gives examples of values for the pairs of the output value and the associated value in the process image:

Measuring range	Output value	Value in the process image
0 V … 10 V	0 V	0
	1 V	3200
	5 V	16000
	10 V	32000
	> 10 V	> 32000
0 mA .... 20 mA	0 mA	0
	1 mA	1600
	4 mA	6400
	20 mA	32000
	> 20 mA	> 32000

The characteristic curves are linear and limited to a minimum of 0 and a maximum of 32000.

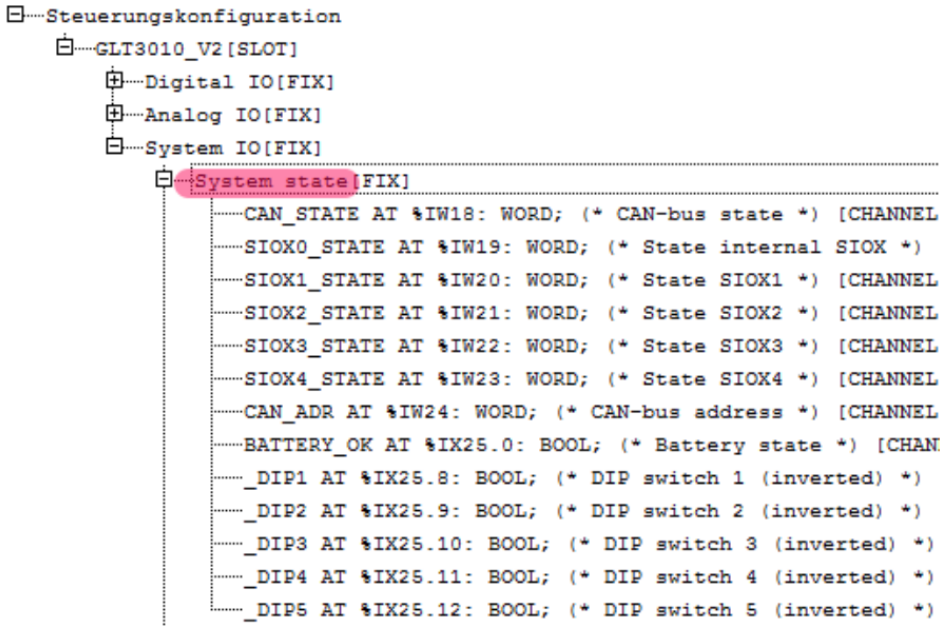
Examples:

1. **Voltage**: If the value PI = 16000 is written to the process variable, a voltage of U = 5 V is applied to the analogue voltage output by the controller.
2. **Current**: If the value PI = 19200 is written to the process variable, a current of I = 12 mA is applied to the analogue current output by the controller.

5.4.5 System Status

There are preset process variables in the controller configuration set at the factory that can be used directly for programming. In addition to the input variables for various status queries, there is also an output variable, the LIFE_LED. The selection can be found as follows:

Controller configuration → GLT3010_V2 → System → System state



The following statuses are described in detail in the following chapters:

- Status of the CAN bus
- Status of the SIOX 1..3 extension modules
- Status of the battery
- Status of the DIP switches
- Status of the Life LED

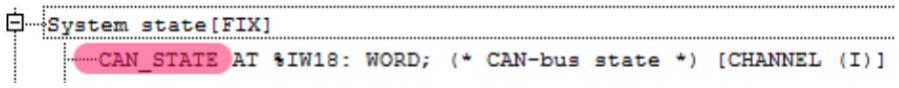
5.4.5.1 Status of the CAN bus

The CAN bus status can be read out bit by bit by the application from the variable *CAN_STATE*. The meaning of the individual bits is shown in the table.

Bit	Mask	Status of the CAN bus
7	16#80	CAN-Bus-Off (CAN bus controller has switched off)
6	16#40	Error counter in CAN bus controller above threshold value
5	16#20	Overflow of the receive buffer in the CAN bus controller
4	16#10	Overflow of the receive buffer in the operating system
3	16#08	CAN bus address conflict
2	16#04	Controller is in alarm state
1	16#02	-
0	16#01	CAN bus enable has been granted by central control

In CODESYS, the defined variable name and the associated IEC address can be looked up using the following path:

Controller configuration → GLT3010_V2 → System → System state → CAN_STATE



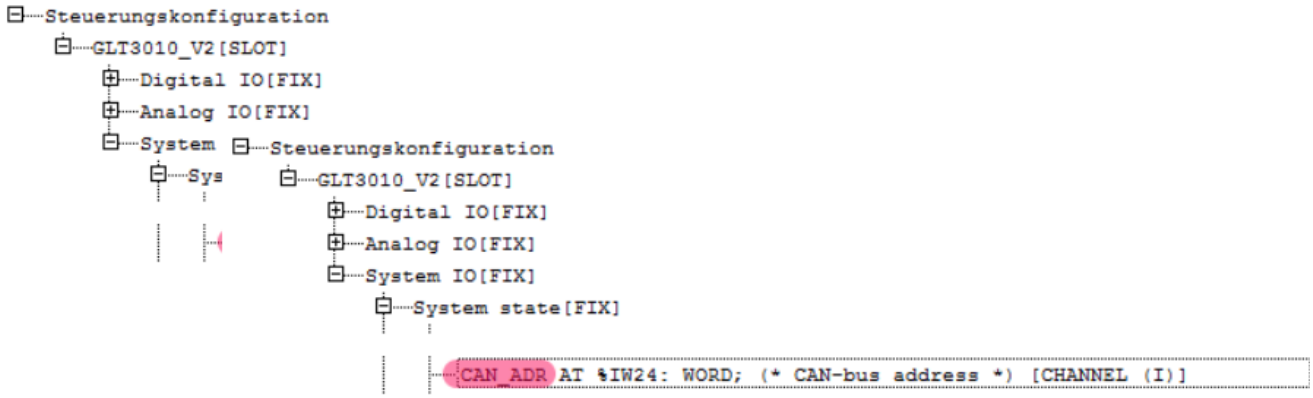
Example in STRUCTURED TEXT:
ADDR_ERR := EXTRACT(CAN_STATE, 3); (* Query the fourth bit from the bottom in the table *)

5.4.5.2 CAN bus address status

The application can query the CAN bus address of the controller that it communicates with on the bus.

CPU	CAN bus address
1	122
2	123
3	124
4	125

In CODESYS, the defined variable name *CAN_ADR* and the associated IEC address can be looked up using the following path:
Controller configuration → GLT3010_V2 → System → System state → CAN_ADR



Example in STRUCTURED TEXT:
if CAN_ADR = 122 then … ;

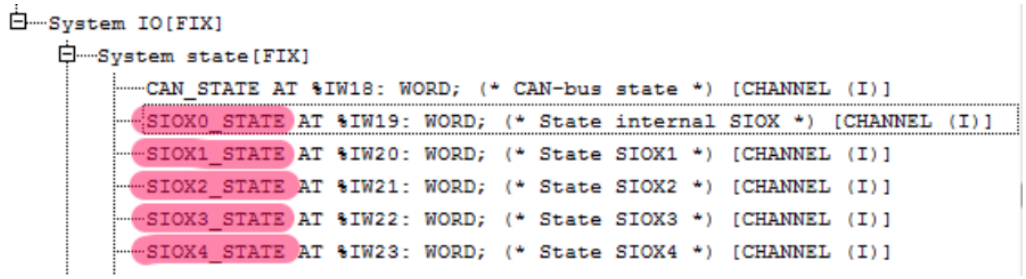
5.4.5.3 Status of the SIOX 1..3 extension modules

The status can be queried separately for each SIOX extension module by the application. The variables SIOX0_STAT represent the internal SIOX of the controller or SIOX1_STAT to SIOX3_STAT the extension modules SIOX 1..3. The statuses here are also bit by bit. The following table shows the connections:

Bit	Mask	Status of the SIOX 1..3 extension modules
7	16#80	-
6	16#40	-
5	16#20	-
4	16#10	-
3	16#08	-
2	16#04	Error read-back status of the SIOX counter (0-14)
1	16#02	SIOX watchdog failed
0	16#01	Incorrect module address read: SIOX configuration resistors read back incorrectly

In CODESYS, the defined variable name and the associated IEC address can be looked up using the following path:

Controller configuration → GLT3010_V2 → System → System state → SIOXn_STATE



Example in STRUCTURED TEXT:
SIOX_WDOG := EXTRACT(SIOX0_STATE, 1); (* Query the second bit in the table *)

5.4.5.4 Status of the battery and DIP switches

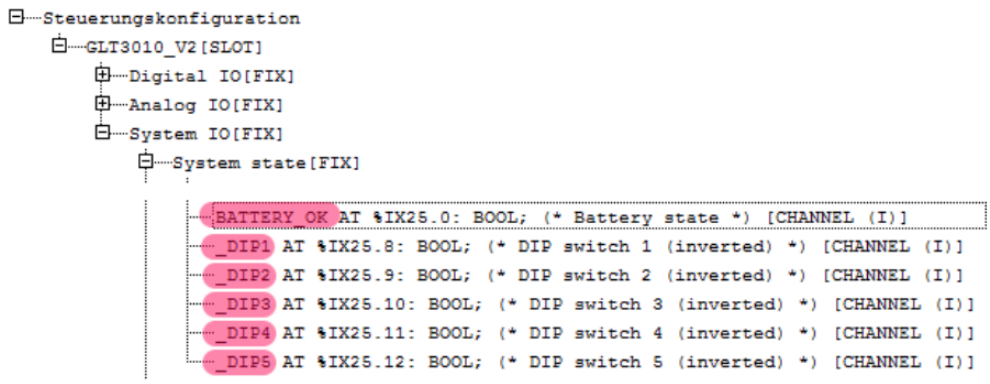
Both the battery status and the positions of the DIP switch S1 (for details see chapter Settings using DIP switch S1) can be read out by the application. It is stored in a bit-oriented status register with the IEC address %IW25. The individual bits for the query are already declared in the *controller configuration*. The variable *BATTERY_OK* indicates the status of the battery:

BATTERY_OK	**Status**
True	Battery voltage is above the limit.
False	Battery voltage is critical, battery must be replaced.

The variables _DIP1 to _DIP5 indicate the position of the coding switches 1 to 5. The underscore identifies the variables as *low active*, i.e. inverted.

_DIPn	**Status**
True	Off
False	On

In CODESYS, the defined variable name and the associated IEC address can be looked up using the following path:
Controller configuration → GLT3010_V2 → System → System state → BATTERY_OK

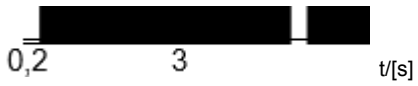
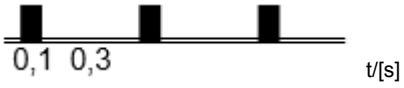


Example in STRUCTURED TEXT:

```
 IF NOT BATTERY_OK THEN
   SendLowBat();
END_IF
```

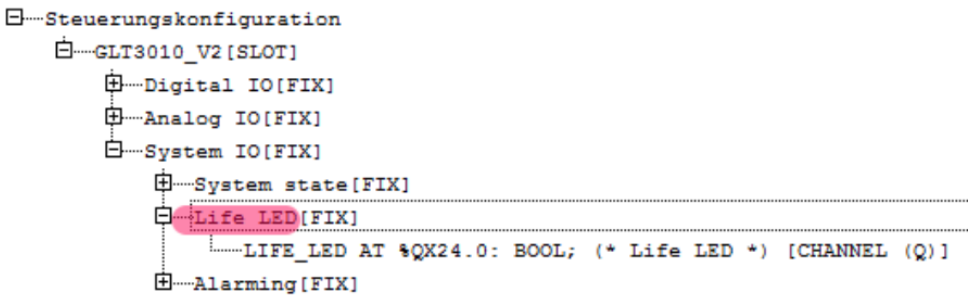
5.4.5.5 Status of the Life LED (life lamp)

The life LED is a green LED on the lower board of the controller (for details see chapter Status LEDs) and shows its status. The life LED can be directly addressed by the application in the process image and is used to distinguish between certain operating states. The following table shows the connections:

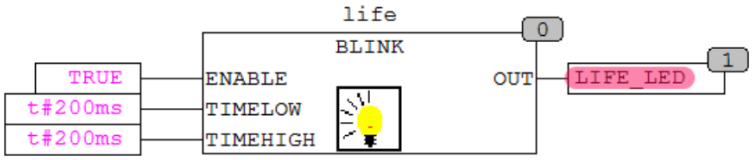
No.	Function	Signal pattern of the Life LED	Signal
1	Only firmware is in operation - without application		Periodically 0.2 s off and 3 s on.
2	Examples for Life LED in the application		
	Initialisation after switching on		Periodically 0.1 s on and 0.3 s off.
	Normal operation		Periodically 0.2 s on and 0.2 s off.

If the life LED is not programmed in the application, its status is random: It is either continuously on or off. However, in order to recognise whether the controller is working properly or whether an application is being executed, a life LED (life lamp) with a fixed periodic signal should therefore always be programmed in the application.

The process variable LIFE_LED for addressing using CODESYS and the associated IEC address in the process image can be found in the *controller configuration* using the following path:
Controller configuration → GLT3010_V2 → System → System state → Life_LED



Example "Normal Operation" in CFC:



6 Signal List

The Signal List, an Excel file, contains all data points needed for the regulation and control task. The following services are performed with your help:

1. Design guide for the switch cabinet construction
2. Cable list for the on-site electrician
3. Fault message texts for the system centre
4. Creation of the instances and scaling of the sensors in the CODESYS program
5. Interface GLT Config for visualisation in LDSWin
6. Commissioning log

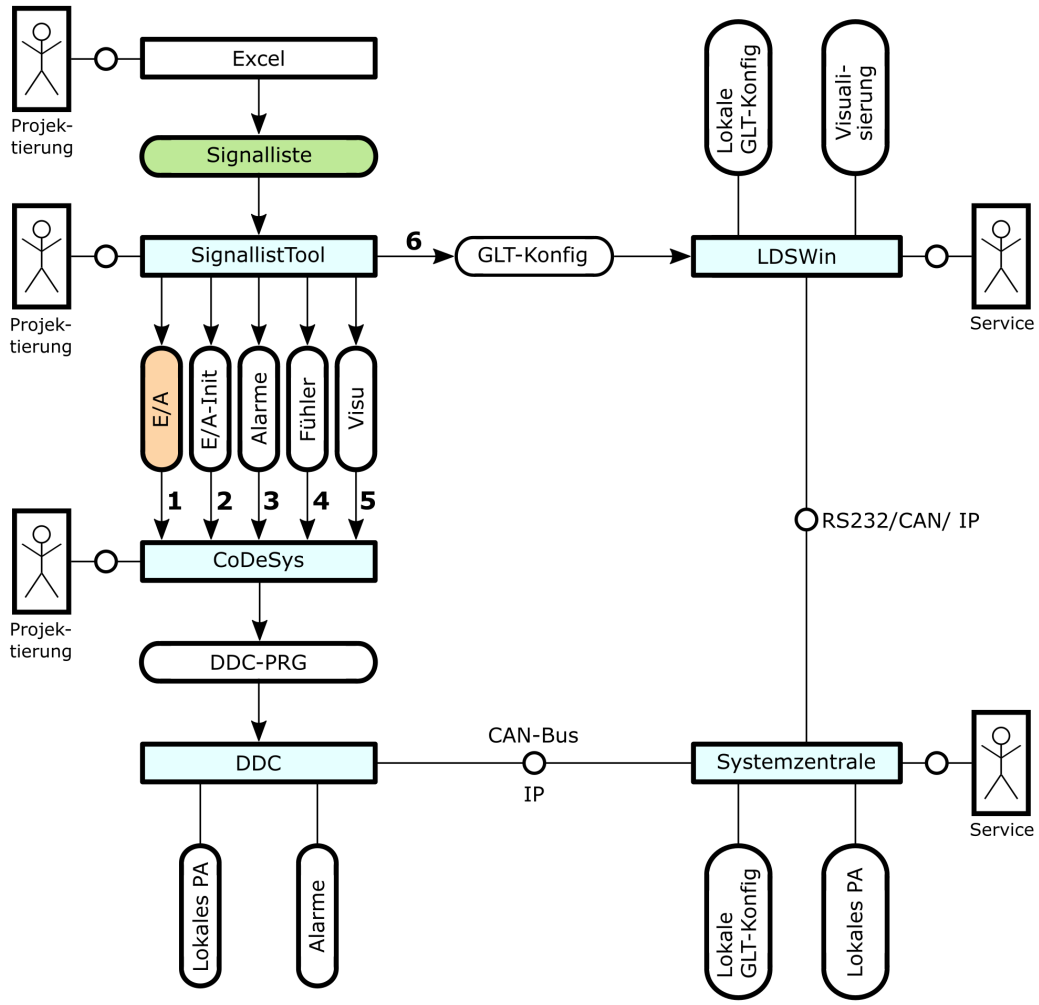
Up to 4 controllers can be manged with one Excel file. A separate worksheet is created for each controller. The Excel worksheets must be named **DDC1**...**DDC4** (for the controllers 1..4 with the CAN addresses 122..125). Using the *Signal List Tool*, various files are generated from the Signal List for use in the CODESYS program (*.exp) and LDSWin (*.cfg).

No.	Function	Name of the *source code* file
1	**E/A assignment** Contains all IO variables with assignment to the process image	EA_DDC_**n**.exp
2	**Setpoints** Sets all setpoints with the "flag input words" for controllers, control variables, ...etc. to a default value that is stored in the Signal List. These values can be adjusted for the runtime via LDSWin.	DDC_**n**_Sollwerte.exp
3	**Error texts** Outputs all fault messages defined in the Signal List with their priorities on the CAN bus.	DDC_**n**_AlarmPrepare.exp
4	**Probes and sensors** Provides the application with the instance variables of the sensors with the respective scaling. The values are output as a physical value, e.g.: 24.5 °C	DDC_**n**_Fuehler.exp
5	**Visualisation**	Visu_DDC_**n**
6	**GLT Config** Creates the GLT interface for the system centre for communication with the LDSWin system. The Signal List determines which data point is displayed in LDSWin, whether it can be changed and whether it should be archived.	<name of the Excel file>.cfg

n stands for 1..4 for the respective controller.

The files are stored in the directory in which the Signal List is located.

The following diagram shows the relationship between *Signal List Tool*, the Signal List, CODESYS, *LDSWin*, the controller, the system centre, the associated files 1 to 6 and the communication paths.



The files 1 to 5 correspond to the *source code* files from the table on the previous page. The *Signal List Tool* generates the source code files 1 to 5 from the Signal List, which are read into CODESYS using the import function and are then available to the developer for the creation of the application. The file 6 "*GLT.cfg"* is read into LDSWin and transmitted to the system centre via the serial interface, the CAN bus or TCP/IP. This allows the system centre to archive the values of selected data points and transfer them to LDSWin for visualisation.

The runtime system of the controller, that is connected to the system centre via the CAN bus, automatically sends alarms to the system centre, among other things. In the Signal List, a potential-free contact can be directly integrated as a PRIOn alarm with the corresponding message text without any programming effort. The alarms program code generated by the *Signal List Tool*, see (3) in the diagram above, is imported into CODESYS and all alarms are included in the program code.

6.1 Formal structure of the Signal List

The Signal List must have a certain formal structure so that the Signal List Tool can generate the source code files for CODESYS and the GLT Config for the system centre without errors:

1. The first cell in Excel, **A1**, must contain the marker $$ so that the following functions are available.
2. There are markers in **row 1** that indicate the function of the relevant columns. This means that the meaning of the information can be distributed to the columns as desired.
3. The area containing valid data is framed by the abbreviations $START and $ENDE.

The following screenshot shows an extract from the beginning of a Signal List:

$$	$TXT	$EA1	$EA2	$REF	$LDSW	$ARC	$ARCN	$FTYP	$FTZ	$FN	$YMIN	$YMAX	$M	$B	$DEF	$E	$PRIO	$LDSTXT	$TXT2
	Signal / Feldgerät	E/A-Bereich	Bezeichner für Ein-/Ausgang	Kanal Ref	LDSWin CFG	Archivieren	Archiv-Nr	Fühler typ	Fühler PTn Tz	Fühler PTn n	min	max	m	b	Default	Einheit	Alarmprio	Text	Kommentar
$START																			
$ENDE																			

6.2 The Column Markers

The markers in the first row in the Excel worksheet indicate the meaning of the column. They are evaluated by the *Signal List Tool* in order to be able to interpret the information of the respective column.
The following markers are defined:

Marker	Meaning	Comment
$TXT	General description of the signal	Optional
$EA1	Address according to IEC 61131	-
$EA2	Variable identifier	-
$REF	Channel reference	Unique ID for LDSWIN
$LDSW	**R** : read-only **W**: for reading and writing **X** : No visualisation	Visualisation in LDSWin
$ARC	**X**: for archiving	
$ARCNR	Archive number	*is calculated automatically and entered*
$YMIN	Minimum of the measuring / setpoint range	Visualisation in LDSWin characteristic curves e.g. for sensors
$YMAX	Maximum of the measuring / setpoint range	
$SM	Gradient m of the linear equation	*is calculated automatically and entered*
$SB	Y-axis intercept b of the linear equation	*is calculated automatically and entered*
$E	Unit	Visualisation in LDSWin
$LDSTXT	–	Visualisation in LDSWin, description of data point or fault message in plain text, maximum 19 characters
$DEF	Default value of the setpoint	Optional, missing disables [Setpoints] button
$TXT2	Comment	Optional
$PRIO	Priority of the fault message: 0 .. 99	Optional, missing disables [Error Texts] button
$KAB	Cable number Wn.m for cable list	Optional, missing disables [Cable Lists] button
$FTYP	–	Optional, missing disables [Sensor] button
$FTZ	PTn filter for sensor - Parameter Tz - Delay time	Optional
$FN	PTn filter for sensor - Parameter n - Order	Optional
$FDEF	–	Optional, missing disables [Sensor] button

The most frequently used markers are briefly explained below.

6.2.1 Marker $EA1 - Address according to IEC 61131-3

For access to the physical interfaces, the digital and analogue inputs and outputs, addressing according to IEC addresses is used, which allow direct linking of variables to the inputs and outputs of the DDC.
The structure of such an address follows the structure %(1)(2)(3)(4):
Position (1) indicates whether it is a physical input, output or a flag.
Position (2) defines the data type and can be combined with position (1) as desired.
Position (3) distinguishes whether the flag is an input or an output.
Position (4) defines the address.

Structure of the IEC addresses					**Function**
%	**(1)**	**(2)**	**(3)**	**(4)**	
	I				Physical input
	Q				Physical output
	M		**4**		Flag = virtual input (setpoint)
	M		**5**		Flag = virtual output
		X		**n.m**	Data type bit (TRUE / FALSE)
		W		**n**	Data type word (16-bit, unsigned: 0 .. 65535)
		I		**n**	Data type integer (16-bit, signed: -32768 .. 32767) [1)]
		U		**n**	Data type ULong (32-bit, unsigned) [1)]
		L		**n**	Data type Long (32-bit, signed) [1)]

[1)] is created in CODESYS as %IW but with data type INT, ULong or Long

The following table summarises the permitted combinations:

Address	**Meaning**	**Use**
%IX**n.m**	Binary input: word n, bit m	I/O
%QX**n.m**	Binary output: word n, bit m	I/O
%IWn	"Analogue" input: word n	I/O
%II**n**	"Analogue" input: integer n (signed input value)	I/O
%QW**n**	"Analogue" output: word n	I/O
%MX4.**n.m**	Flag input bit – digital (**n** = 0 - 9 = word number; **m** =0 - 15 = bit number)	Setpoint
%MW4.n	Flag input word – analogue (**n** = 0 - 9 = word number)	Setpoint
%MX5.2**n.m**	Flag output bit: - digital (**n** = 0 - 9 = word number; **m** =0 - 15 = bit number)	Error message

The following overview shows the relationship between IEC address/variable name and the generated program code.

Physical inputs and outputs and flags

Bit variable in the input image	**IX0.0**	returns: <*variable name*> AT %IX0.0 : BOOL;
Word variable in the input image	**IW1**	returns: <*variable name*> AT %IW1 : WORD;
Integer variable in the input image	**II2**	returns: <*variable name*> AT %II2 : INT;
Word variable flag as setpoint	**MW4.10**	returns: <*variable name*> AT %MW4.10 : WORD;
Word variable flag as alarm	**MW5.0.2**	returns: <*variable name*> AT %MW5.0.2: BOOL;

Dummy inputs and outputs

Bit variable general	**X**	returns: <*variable name*> : BOOL;
Word variable general	**W**	returns: <*variable name*> : WORD;
Integer variable general	**I**	returns: <*variable name*> : INT;
Real variable general	**R**	returns: <*variable name*> : REAL;

When using these characters, ordinary variables are created instead of process image variables.

Constants

Bit constant	TRUE	returns: <*variable name*> : BOOL := TRUE;
Bit constant	FALSE	returns: <*variable name*> : BOOL := FALSE;
Word constant	W(3200)	returns: <*variable name*> : WORD := 3200;
Integer constant	I(-1)	returns: <*variable name*> : INT := -1;
Real constant	R(2.5)	returns: <*variable name*> : REAL := 2.5;
Time constant	t#2s	returns: <*variable name*> : TIME := T#2S;

Physical inputs or outputs can be "overwritten" for test purposes by writing a **constant** before the address in the Signal List. This has the advantage that the information of the IEC address is retained. If the constant is removed after the test, the variable is again connected to the physical input or output.

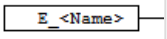
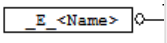
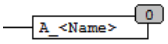
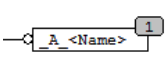
Example Overwrite physical input and output with constant TRUE and W(32000)

Address	Type	Effect
IX6.3	BOOL	Connected to IO.
TRUE IX6.3	BOOL	Fixed constant value TRUE. No connection to the IO.
IW23	WORD	Connected to IO.
W(32000) IW23	WORD	Fixed constant value 3200. No connection to the IO.

6.2.2 Marker $EA2 - Variable identifier

The following naming convention has been implemented for the variable names:
The prefix **E_** is used for inputs and the prefix **A_** for outputs. For digital inputs or outputs, there is also the special feature of providing an inverted input or output with an "inversion dash". This is necessary for the Signal List Tool so that a "**-1**" for the inverted display is entered in the column with the marker $M. In this, the (red) "indicator lamp" in the visualisation is only active when the input/output signal is off.

In general, you should only think in *positive* logic when programming and not check for each individual alarm input whether it is a *normally closed* or *normally open* contact. This would reduce the readability of the program and increase susceptibility to errors. Therefore, the following generally applies: if a digital "*connection line*" in the program is TRUE, then this function is active, regardless of whether the physical input or output is a normally closed or normally open contact. For this purpose, the digital signals of a normally closed contact are inverted directly at the beginning of the processing. The following figure shows the connections:

Variable mapped to	Variable name	Low active	Application example
Physical input			Temperature sensor
		x	Cable-break-proof fault signal, e.g. monitor
Virtual input	ME_<Name>		Setpoint input, manual operating level via LDSWin
Physical output			System centre - display - actual values
		x	Cable-break-proof lighting control
Virtual output	MA_<Name>		Status and internal operating displays, internal alarms, locked alarms, internal setpoints and actual values via LDSWin

The naming of the variables should be uniform and in capital letters. For example, a temperature sensor always starts with **E_T_**. The following table shows some examples of variable names. It can be seen there that fault messages always have the suffix **_ERR**. The frost protection thermostat has a fault message *MA_FST_ERR* with the Prio 2 message text *Frost Protection* that is locked in the controller. Locked fault messages are present until they are acknowledged via a *group acknowledgement button* on the cabinet. Furthermore, for diagnostic purposes, an internal analogue controller signal has been routed out to the virtual output *MW5.30* for monitoring.

Example: Table with IEC addresses column E/A area, variable names column identifier for input/output and texts for the visualisation *LDSWin*:

1	$TXT		$EA1	$EA2	$REF	$LDSW	$ARC	$ARCN	$FTYP	$FTZ	$FN	$YMIN	$YMAX	$M	$B	$DEF	$E	$PRIO	$LDSTXT
12	Signal / Feldgerät		E/A-Bereich	Bezeichner für Ein-/Ausgang	Kanal Ref	LDSWin CFG	Archivieren	Archiv-Nr	Fühlertyp	Fühler PTn Wert Tz	Fühler PTn Wert n	min	max	m	b	Default	Einheit	Alarmprio	Text
22																			
23	**Konstanten**																		
24			t#96h	K_PUMPEN_KICK_ZYKLUS															
25			t#10s	K_PUMPEN_KICK_DAUER															
39																			
40	**Heizlüfter**																		
41			TRUE	E_FREIGABE_LUEFTUNG															
42	Temperatur Zuluft = X (Regelgröße)	Rohranlegefühler Pt1000	IW28	E_T_ZULUFT	198	r	x	141	PT1000			0	200	0,10	0		°C		Zulufttemperatur
43	Sollwert Zulufttemperatur		MW4.30	ME_W_T_ZULUFT	199	w	x					10	50	0,10	0	30	°C		W Zulufttemperatur
45	Pumpe Heizregister ein		QX0.4	A_PUMPE_HZREG	200	r	x	10											Pumpe Heizregister
46	Pumpe Heizregister Störung	230VAC, potentialfreier Öffner-Kontakt	IX0.1	_E_PUMPE_HZREG	202	x													
47			MX5.10.1	MA_PUMPE_HZREG_ERR	204	r	x	90										2	Pumpe HzRegister Störung
49	Regelventil Heizregister	Ansteuerung stetig 0..10V	QW28	A_VENTIL_HZREG	206	r	x	142				0	100	0,00	-25		%		Regelventil Befehl
50		Rückmeldung stetig 0…10 V	IW42	E_VENTIL_HZREG_RM	208	r	x	143				0	100	0,00	-25		%		Regelventil Rückmeldung
51		DDC-Fehlermeldung - intern	MX5.30.0	MA_VENTIL_HZREG_ERR	210	r	x	130										2	Regelventil Störung
53	Frostschutzthermostat	Ppotentialfreier Öffner-Kontakt	IX0.2	_E_FST	214	r													Frostschutzthermostat
54		DDC-Fehlermeldung - intern	MX5.20.2	MA_FST_ERR	216	r	x	110										2	Frostschutz-Alarm
56	Reglerausgang		MW4.10	MA_Y_VENTIL_HZREG	218	r											%		Reglerausg
58	Lüfter Motor ein		QX0.5	A_LUEFTER	220	r	x	10											Lüfter
60	Lüfter Motor Rep/ TK		IX0.3	_E_LUEFTER_ERR	222	x													
61			MX5.20.3	MA_LUEFTER_ERR	224	r	x	110										2	Lüfter Störung
63	Aufheizphase zu lang		MX5.30.1	MA_HEIZ_DAUER	226	r	x	130										2	Alarm Dauerheizen
65	Temperatur Rücklauf Heizregister	Rohranlegefühler Pt1000	IW29	E_T_HZREG_RL	228	r	x	144	PT1000			0	200	0,10	0		°C		Rücklauftemperatur

6.2.3 Marker $REF - channel reference

A data point is uniquely identified in LDSWin via the channel reference. All properties of a data point including the variable name ($EA1) and the variable address in the process image ($EA2) can be changed without affecting an already existing visualisation in LDSWin. The channel reference must be unique within the entire system, i.e. the signal lists of two different controllers must not both contain the same channel reference.

6.2.4 Marker $LDSW, $ARC, $ARCNR - LDSWin visualisation

For the *LDSWin visualisation*, the three markers will be used to determine whether the process variables will be displayed in LDSWin and their value histories archived or not.

Marker	Possible values	Note
$LDSW	**R** : read-only (actual values) **W**: for reading and writing (setpoints) **X** : No visualisation	Visualisation in LDSWin
$ARC	**X**: for archiving	The archiving takes place in a time grid of 2 minutes over one week.
$ARCNR	-	The archive number is calculated automatically and **must not be entered manually**!

6.2.5 Marker $FTYP, $FTZ, $FN - Probes and sensors

It is possible to use the *Signal List* to automatically generate the function blocks for converting the analogue input values into the physical values. The generated CODESYS export file contains the variable declaration **All_Sensors** in *Resources → Global Variables → GLT Process* as well as the function block definition **All_Sensors**. The function block is instantiated in PLC_PRG and called before the control routines are called. The following columns are used for this:

1	$EA1	$EA2	$REF	$LDSW	$ARC	$ARCN	$FTYP	$FTZ	$FN	$YMIN	$YMAX	$M	$B
12	E/A-Bereich	Bezeichner für Ein-/Ausgang	Kanal Ref	LDSWin CFG	Archivieren	Archiv-Nr	Fühlertyp	Fühler PTn Wert Tz	Fühler PTn Wert n	min	max	m	b
42	IW28	E_T_ZULUFT	198	r	x	141	PT1000			0	200	0,10	0

$FTYP: Type of the sensor
PT1000 creates a Pt1000_T instance for the Pt1000 inputs of the controller
Sensor 20 mA creates a SENSOR_T instance for sensors with current interface 4..20 mA
Sensor 10 V creates a SENSOR_T instance for sensors with voltage interface 0..10 V

$FTZ and **$FN**: Parameters of an optional PTn link connected downstream of the characteristic curve block e.g. for averaging

$MIN and **$MAX**: Measuring range of the sensor with current / voltage interface (is ignored for Pt1000)

$M and **$B**: Gradient and Y-axis intercept of the linear equation - are calculated automatically.

The name of the instance of the characteristic curve block is derived from the identifier of the input ($EA2). The prefix **E_** of the input variables is replaced with the prefix **F_**.

The row of the Excel worksheet shown above results in the following program code in CODESYS:

Resources → Global Variables → Process → All_Sensors

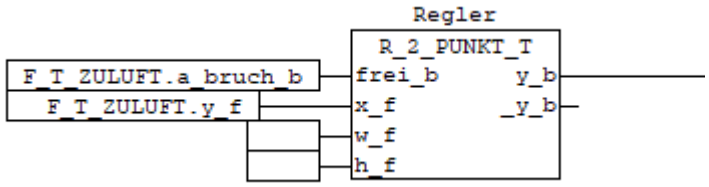
```
VAR_GLOBAL CONSTANT
...
(* 42 *) F_T_ZULUFT : SENSOR_PT1000_T;
...
END_VAR
```

Function block All_Sensors

FUNCTION_BLOCK Alle_Fuehler
...
(* 27) F_T_ZULUFT(x_i:=E_T_ZULUFT);(* PT1000 *)
...

Use in the application

The calculated results can then be used as follows:



6.2.6 Marker $YMIN, $YMAX, $SM, $B, $E, $DEF

Setpoints for the runtime can be entered directly in the *Signal List* in the LDSWin visualisation for the control and regulation of the system. The setpoints are entered in the *Default* column, e.g. 27.5 °C entered.

1	$TXT	$EA1	$EA2	$REF	$LDSW	$ARC	$ARCN	$FTYP	$FTZ	$FN	$YMIN	$YMAX	$M	$B	$DEF	$E	$PRIO	$LDSTXT
12	Signal / Feldgerät	E/A-Bereich	Bezeichner für Ein-/Ausgang	Kanal Ref	LDSWin CFG	Archivieren	Archiv-Nr	Fühlertyp	Fühler PTn Wert Tz	Fühler PTn Wert n	min	max	m	b	Default	Einheit	Alarmprio	Text
43	Sollwert Zulufttemperatur	MW4.30	ME_W_T_ZULUFT	199	w	x					10	50	0,10	0	30	°C		W Zulufttemperatur

The interface to *LDSWin* via the flag image can only show bits, bytes and words (16-bit values). In order to be able to use values with decimal places, these must be converted to integer values by appropriate multiplication by 10,100, 1000 etc. The system is informed via the increase **m** flag $M how many decimal places are desired:

Decimal places	m	Default	Transmitted value
0	0	1500	1500
1	0.1	27.5	275
2	0.01	3	300
3	0.001	1.234	1234

The input of the setpoints in LDSWin can be limited downwards with column $YMIN and upwards with column $YMAX.

Negative values are also supported for the $DEF setpoints.

The following entries can be found in the export files created from the Signal List by the Signal List Tool:
File: EA_DDC_1.EXP

```
...
(*43*) ME_W_T_ZULUFT     : REAL;   (* W supply air temperature *)
(*43*) ME_W_T_ZULUFT_raw : WORD;   (* W supply air temperature *)
...
```

File: … Sollwerte DDC 1.EXP

```
(* W supply air temperature *)
ME_W_T_ZULUFT := WORD_TO_REAL( ME_W_T_ZULUFT_raw ) * 0.1;
IF (ME_W_T_ZULUFT_raw < 100) OR (ME_W_T_ZULUFT_raw > 500) OR (set_default_b = TRUE ) THEN
   ME_W_T_ZULUFT_raw := 300;
END_IF
```

6.2.7 Marker $PRIO - Alarm priority

An IEC process variable can be directly linked to a non-locked alarm in the *Signal List*.

Example: A potential-free normally closed contact of a pump located on the variable _E_PUMPE_HZREG with the address IX0.1.

1	$TXT	$EA1	$EA2	$REF	$LDSW	$ARC	$FTYP	$YMIN	$YMAX	$M	$B	$DEF	$E	$PRIO	$LDSTXT
12	Signal / Feldgerät	E/A-Bereich	Bezeichner für Ein-/Ausgang	Kanal Ref	LDSWin CFG	Archivieren	Fühlertyp	min	max	m	b	Default	Einheit	Alarmprio	Text
46	Pump.Heizregister Stör.	IX0.1	_E_PUMPE_HZREG	202	x					-1				2	Pumpe HzRegister Störung

The value -1 should be entered in column $M for NC contacts so that the inverse logic (low active) is correctly displayed in the visualisation under LDSWin.
The desired priority = 2 is entered in column $PRIO.

Opening the contact (variable value = FALSE) will signal an alarm with priority 2 and the text "Pump Heating Coil fault".

Automatic generation of alarms for sensor faults

1	$TXT	$EA1	$EA2	$REF	$LDSW	$ARC	$FTYP	$YMIN	$YMAX	$M	$B	$DEF	$E	$PRIO	$LDSTXT
12	Signal / Feldgerät	E/A-Bereich	Bezeichner für Ein-/Ausgang	Kanal Ref	LDSWin CFG	Archivieren	Fühlertyp	min	max	m	b	Default	Einheit	Alarmprio	Text
42	Istwert Zulufttemperatur	IW28	E_T_ZULUFT	198	r	x	PT1000	0	200	0,10	0		°C	2	Zulufttemperatur

Setting a priority for rows with defined $FTYP generates the following in the **Alarm_Prepare function**:
LDS_AlmStat_ar[2].io_b := F_T_ZULUFT.a_bruch_b; LDS_AlmPrio_ar[2] := 2;

In the event of a sensor fault, the function block F_T_ZULUFT sets the output a_bruch_b. An alarm message with priority 2 is then signalled via Alarm_Prepare.

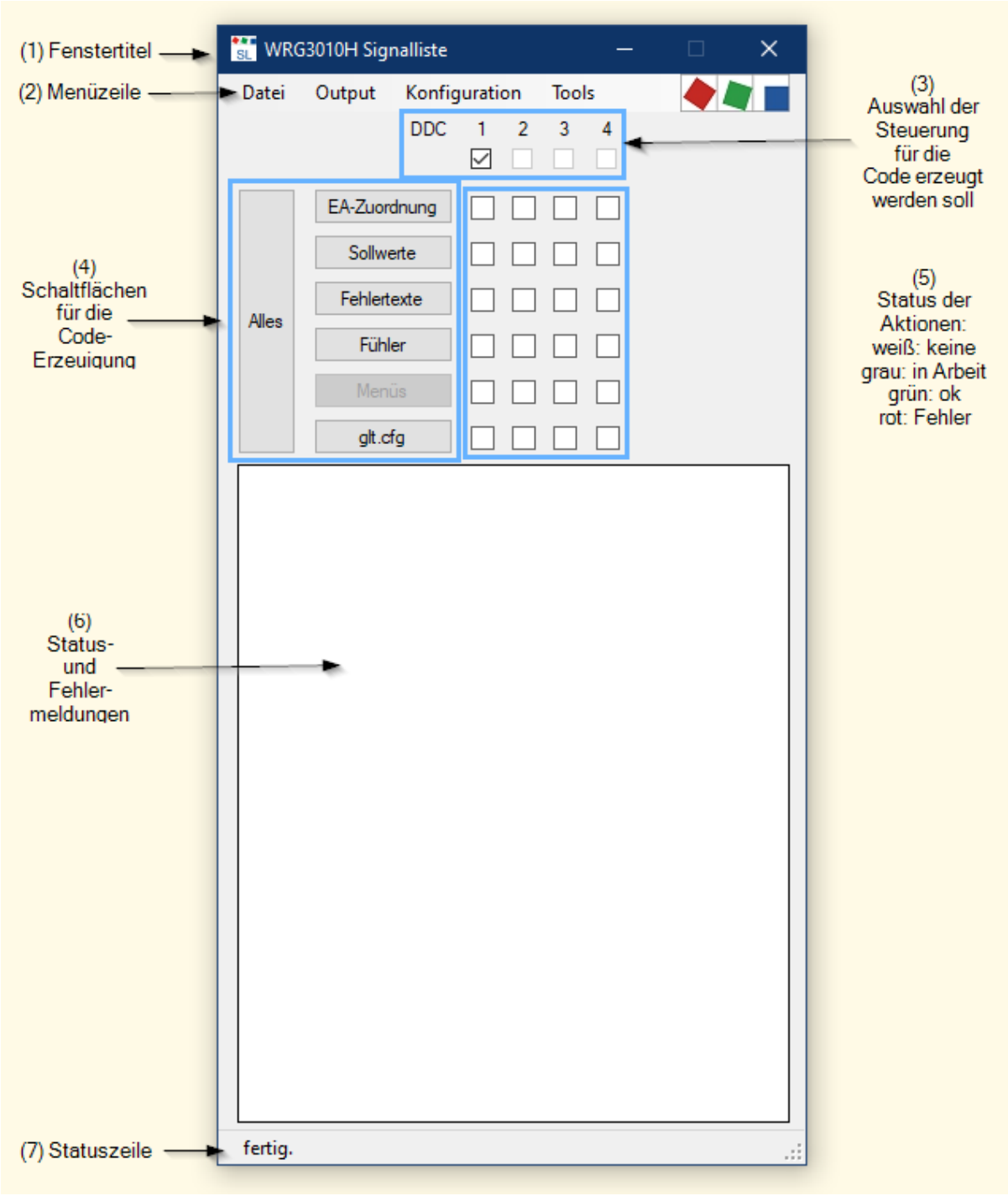
Variable alarm priorities
Using M4 flags, up to 26 priority groups can be realised. The groups are labelled 'A' to 'Z' and defined via set $DEF, $YMIN, $YMAX. In the $PRIO column, the priority is then assigned to a group via the identifier instead of being set to a constant.

1	$TXT	$EA1	$EA2	$REF	$LDSW	$ARC	$FTYP	$YMIN	$YMAX	$M	$B	$DEF	$E	$PRIO	$LDSTXT
12	Signal / Feldgerät	E/A-Bereich	Bezeichner für Ein-/Ausgang	Kanal Ref	LDSWin CFG	Archivieren	Fühlertyp	min	max	m	b	Default	Einheit	Alarmprio	Text
13		MW4.60	ME_ALARMPRIO_A	90	w			0	99			2		A	Fühlerfehler
14		MW4.61	ME_ALARMPRIO_B	91	w			0	99			1		B	Ventilfehler
15		MW4.62	ME_ALARMPRIO_C	92	w			0	99			3		C	Handbedienung
16															
42	Istwert Zulufttemperatur	IW28	E_T_ZULUFT	198	r	x	PT1000	0	200	0,10	0		°C	A	Zulufttemperatur
43	Sollwert Zulufttemperatur	MW4.30	ME_W_T_ZULUFT	199	w	x		10	50	0,10	0	30	°C		W Zulufttemperatur

7 Signal List Tool

The Signal List Tool is available online for registered customers in E°EDP. It is needed to generate the program files required by the CODESYS program and the system centre/store computer. The Signal List Tool and the files it generates from the signal list are described below.

The screenshot shows the screen which is divided into the areas (1) to (7). It shows an error-free run after generating all required data from the signal list.



Clicking on the "All" button executes all actions for all selected controllers one after the other.

The areas in detail:

<table>
<tr><th>No.</th><th>Description</th><th>Explanation</th></tr>
<tr><td>(1)</td><td>Title</td><td>Title of the opened signal list</td></tr>
<tr><td>(2)</td><td>Menu</td><td>The menu bar in the top line with the selection</td></tr>
<tr><td>(3)</td><td>DDC selection</td><td>The code for one DDC, a selection or all DDCs can be generated selectively. This can save time if only one DDC will be changed.</td></tr>
<tr><td>(4)</td><td>Code generation buttons</td><td>Here, either all or individual program files for CODESYS can be generated by clicking a button.
<table>
<tr><th>Action button</th><th>Generated CODESYS file (x = 1..4)</th></tr>
<tr><td>All</td><td>All files</td></tr>
<tr><td>EA assignment</td><td>EA_DDC_x.exp, Visu_DDC_x.exp</td></tr>
<tr><td>Setpoints</td><td>DDC_x_Sollwerte.exp</td></tr>
<tr><td>Error texts</td><td>DDC_x_AlarmPrepare.exp</td></tr>
<tr><td>Glt.cfg</td><td>~x glt.cfg (for all DDCs)</td></tr>
</table></td></tr>
<tr><td>(5)</td><td>Actions status</td><td>Status of the actions for the respective DDC.
Green: OK, code generated.
Red: error, no code generated</td></tr>
<tr><td>(6)</td><td>Status and error messages</td><td>This shows how many data points the building automation system visualises and archives and detailed error messages in the event of input errors in the signal list.</td></tr>
<tr><td>(7)</td><td>Status line</td><td>1. Progress display
2. Status message such as "Finished"
3. Error messages
Note
Simply double click on one of the error messages in the status line to display the error highlighted in colour in the Signal List.</td></tr>
</table>

7.1 Starting the tool and settings

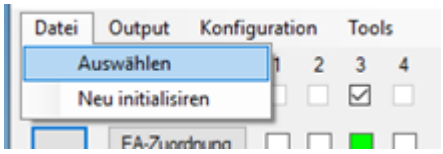
There are two ways to start the tool

1. Double click on the file with the name "~.sigcfg" (preferred method)
   The Signal List is loaded automatically.
2. Direct start of the tool
   The Signal List must be selected via the menu [File → Select].

> **Note**
>
> The Signal List must be linked to this file extension to start via the sigcfg file.
> The link is set up by calling up the menu item "Tools → Bind .sigcfg". The program must have previously been started with administrator rights.

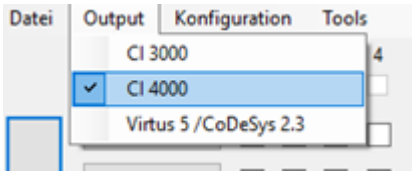
7.2 Menu functions

- **File menu**



Selection	Description
Select	Select and load a new Signal List manually.
Reinitialise	The tool must be reinitialised if new columns have been inserted in the Signal List or their sequence has been changed.

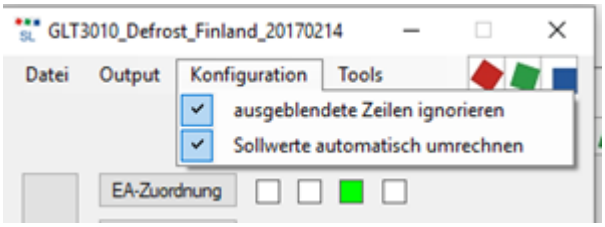
- **Output Menu**



Determines which system centre and controller are used.

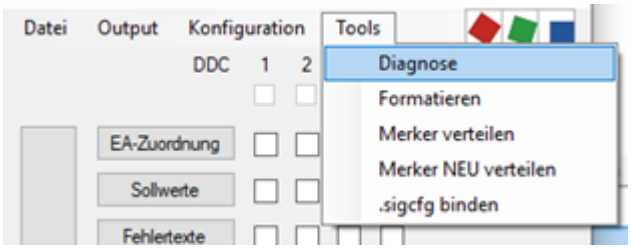
Selection	GLT type
→ CI 3000	= GLT 3010
→ CI 4000	= GLT 3010
→ Virtus 5 / CODESYS 2.3	= GLT 5010

- **Configuration menu**



Note: The settings of this menu item should not be changed, as they are only intended for special applications.

- **Tools Menu**



The "Tools" menu contains useful tools:

Selection	Description
Diagnose	Among other things, the version number and the installation directory of the Signal List Tool are displayed here.
Format	Reformats the Signal List in Excel. See Formatting Information
Distribute flags	Automatically distributes the addresses for newly added flags/setpoints in the Signal List. Flags with already assigned addresses remain unaffected.
Distribute flags NEW	Automatically distributes the addresses for newly added flags/setpoints in the Signal List. Flags with already assigned addresses remain unaffected.
Bind .sigcfg	Binds the tool to the Signal List with the ".sigcfg" extension. This means that a double click on this file is sufficient to open the Signal List and the tool.

- **Formatting**

Colour columns uniformly
Enter a colour code as a 2-digit number xy in row 1 in the respective column:
x = background colour:
- 0 = white
- 1 = off-white

y = text colour:
- 0 = black
- 1 = brown
- 2 = red
- 3 = orange
- 4 = yellow
- 5 = green
- 6 = blue
- 7 = violet
- 8 = grey
- 9 = white

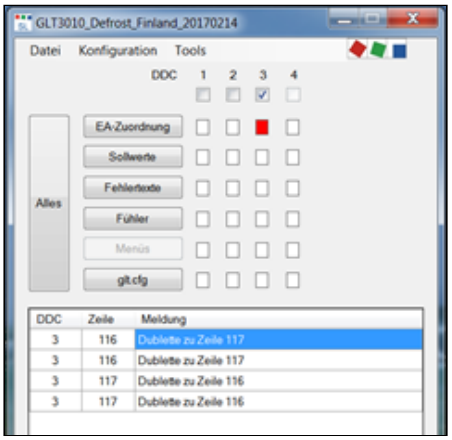
Row separators
Create a highlighted row in column A in the respective row with the following characters for visual separation:
- **#** or **$** = medium grey bar with height 26
- **=** or ***** = medium grey bar with height 13
- **-** = medium grey bar with height 3
- **!** = formatting as comment column with blue text

Duplicate recognition
The columns for **cable numbers $K**, **EA assignment $EA1, EA2**, **reference $REF** and **LDS text $LDSTXT** are provided with conditional formatting so that duplicates are automatically highlighted.

7.3 Error message examples

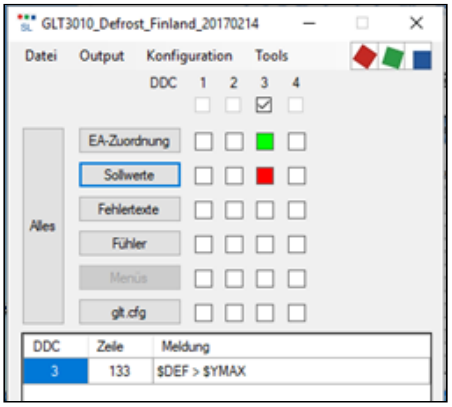
> **Note**
>
> Simply double click on one of the error messages in the status line to display the error highlighted in colour in the Signal List.

Example 1: Perform code generation for the process image [EA assignment].



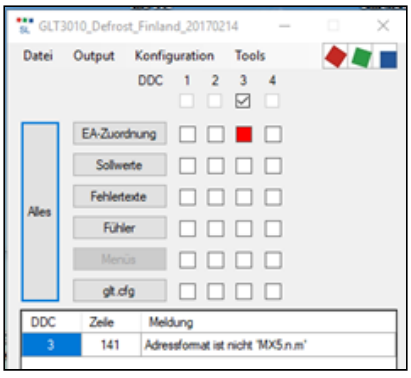
Signal List
The same EA address is entered in rows 115 and 117
.

Example 2: Perform code generation for the setpoints



Signal List
In row 133,
the setpoint 300 is above the set maximum of 45!

Example 3: Carry out code generation for the process image [IO assignment].



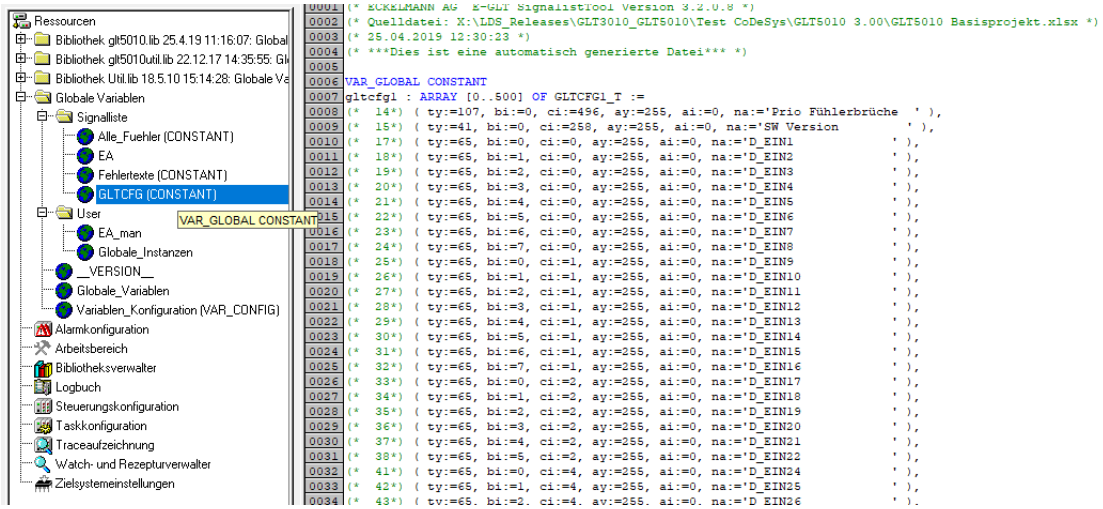
Signal List
In row 141,
"MX5.0.2 h" instead of "MX5.0.2" was entered in the E/A area!

7.4 Changes of GLT 5010 compared to GLT 3010

The data point description is embedded in the CODESYS program of the GLT 5010. The controller, together with the system centre, then takes care of the distribution in the system.

With the Signal List Tool (per controller), CODESYS export files with the name "EA_DDC_**n**_config.exp" are created.

The respective file is imported as usual.
Under "Resources → Global Variables → Signal List → GLTCFG" you will then find the two structure fields gltcfg1 and gltcfg2.



As a last step, the pointers to the structure fields must be made known **once** to the operating system of the controller via the function Set_GLTCFG(). In the example application, the module INIT_T is suitable for this purpose:

```
FUNCTION_BLOCK INIT_T
VAR_INPUT
END_VAR
VAR_OUTPUT
END_VAR
VAR
   init: BOOL;
END_VAR
```

```
IF NOT init THEN
   init := TRUE;

   MA_CI3K_W_RAL_MARKT  := 16#8080;
   MA_CI3K_W_RAL_KASSE  := 16#8080;
   MA_CI3K_RAL_MARKT    := 16#8080;
   MA_CI3K_RAL_KASSE    := 16#8080;
   MA_CI3K_CO2_MARKT    := 16#8080;
   MA_CI3K_RAL_LAGER    := 16#8080;
   MA_CI3K_ZUL          := 16#8080;
   MA_CI3K_ABL          := 16#8080;
   MA_CI3K_AUSSENTEMP   := -128;
   MA_CI3K_W_ZULUFT     := 16#8080;
   MA_CI3K_WW_OBEN      := 16#8080;
   MA_CI3K_WW_UNTEN     := 16#8080;
   MA_CI3K_BETRIEB      := 16#8080;
   MA_ZLG_DEBUG1        := 0;
   MA_ZLG_DEBUG2        := 0;

   Kaeltemittel( km := R744 );

   MA_SW_VERSION := fMake_Version( Major_b := THIS_VER_MAJOR, Minor_b := THIS_VER_MINOR );

   SetTeilnInfo( name := 'GLT 5010 Demo', pos := 'Test', typ := 'GLT5010', version_major := THIS_VER_MAJOR, version_minor := THIS_VER_MINOR, verbund := 0 );

   Set_GLTCFG( ADR( gltcfg1 ), ADR( gltcfg2 ), gltcfg_lines );

END_IF
```

When starting the controller, or more precisely: the CODESYS application, the operating system then automatically transfers the complete configuration file "GLT.CFG" to the system centre CI 5x00 or Virtus.

8 CODESYS

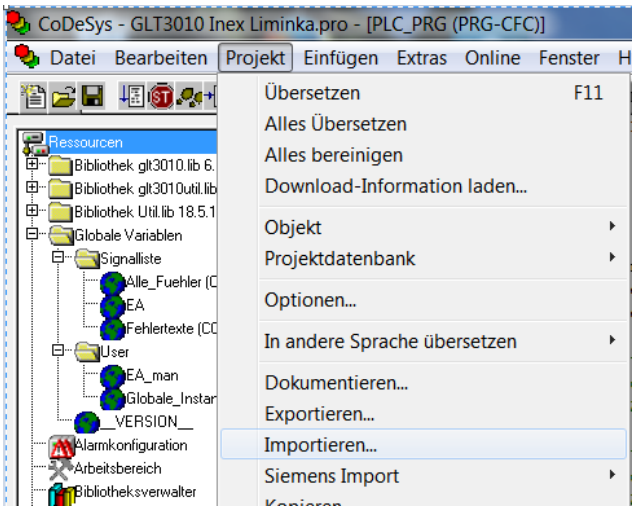
8.1 Creation of the application using CODESYS

The CODESYS development system, which is required for programming the GLT x010, can be obtained from EDP. Before creating the program, the settings of the target system and the communication parameters must be set. This is described in Target System Settings. Programming in the individual IEC 61131-3 languages is described in the relevant CODESYS documentation. There you will also find the traffic light example, which is a good introduction to the subject.

To establish a connection from the digital and analogue inputs and outputs of the controller to the sensors and actuators, the signal list must first be created. See Signal List.
In the next step, the files required for CODESYS and the store computer are generated using the Signal List Tool, for details see Signal List Tool.

Importing the machine-generated source code into CODESYS

The procedure described below must always be performed when changes have been made to the signal list with regard to the alarms, the sensors or the setpoints. In the CODESYS menu, click on Project → Import...:

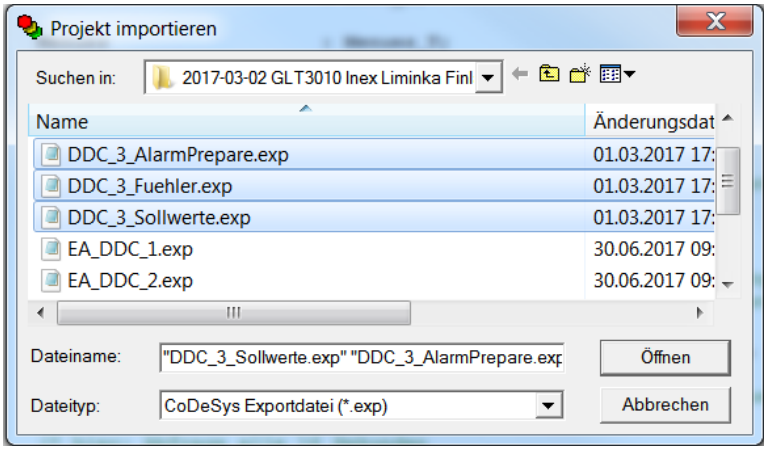


In the file selection window "Import project" that opens, select the following three files:

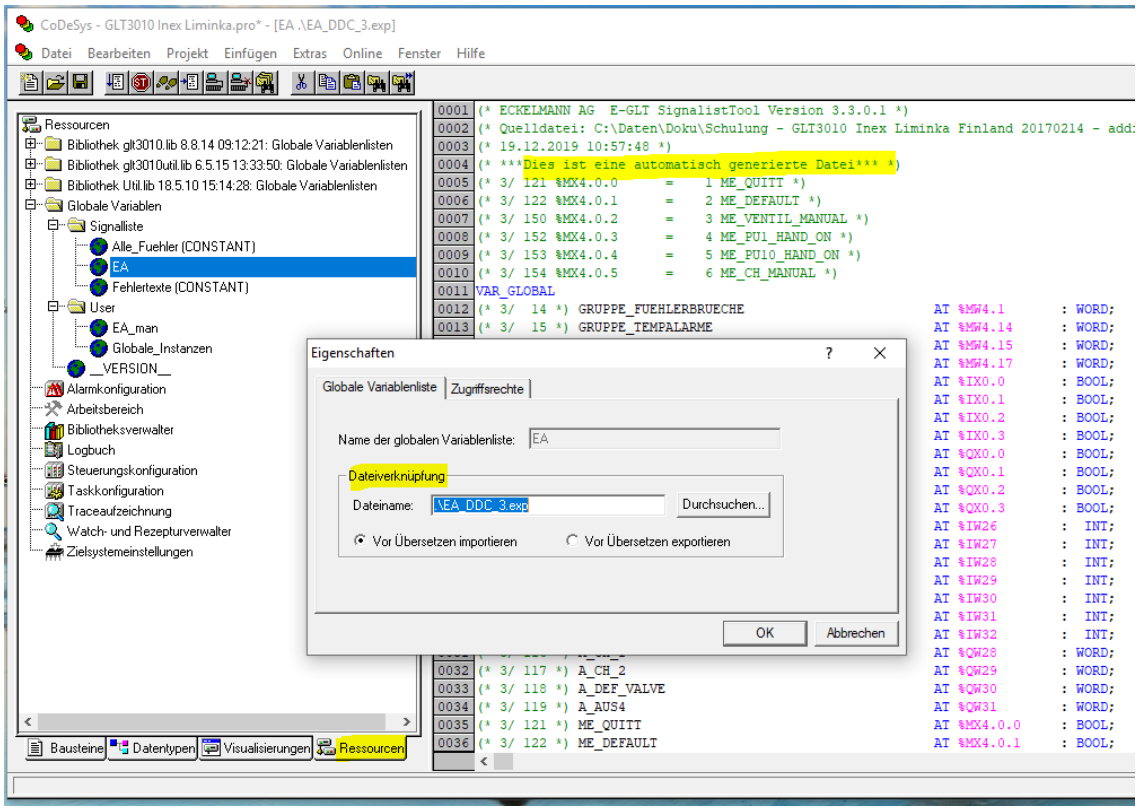
- *DDC_n_AlarmPrepare*.exp
- *DDC_n_Fuehler.exp*
- *DDC_n_Sollwerte.exp*

For **n**, enter the number of the respective controller (1...4)

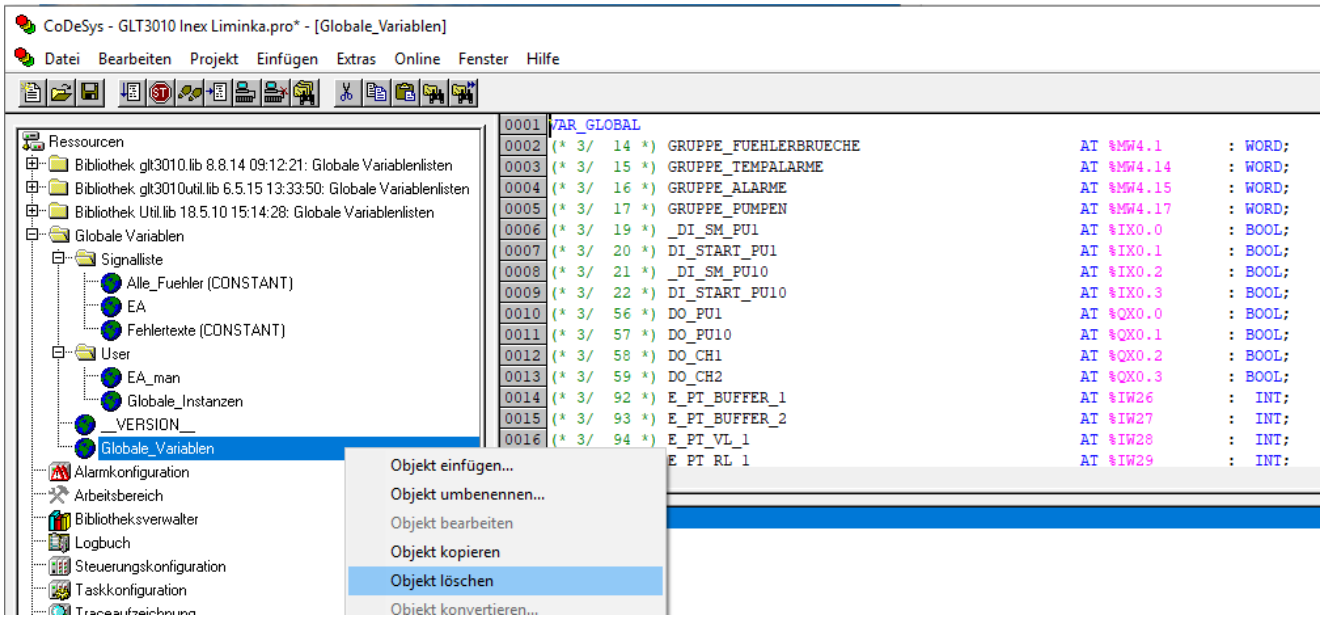
In the following example, the 3rd controller in the system (DDC3) is being processed.



The EA assignment, contained in the file *EA_DDC_n.exp*, is automatically imported during the compilation process when the CODESYS application is started on the example application.
The relevant configuration can be accessed via the menu item "Object properties..." in the context menu of the object "Resources → Global variables -> Signal list → EA".

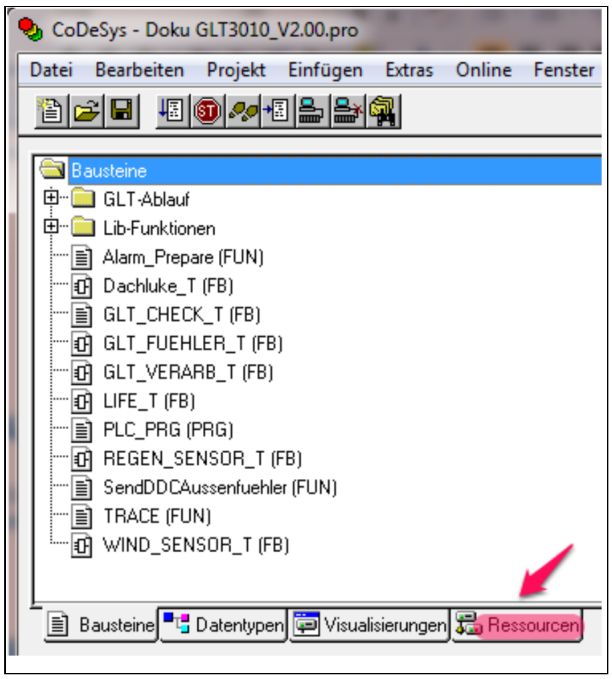


Note
If the file *EA_DDC_n.exp* is imported manually by mistake, it must be removed again under the tab Resources, there under "Global Variables → User → Global Variables" with the context menu, selection "Delete Object", see screenshot:

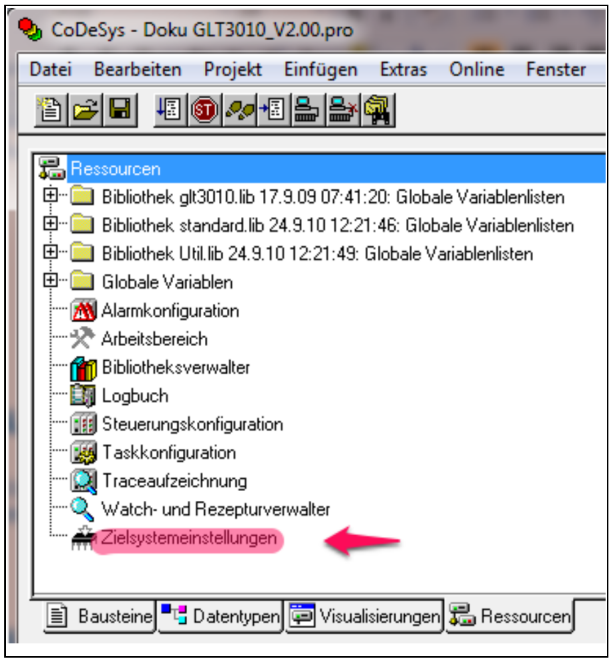


8.1.1 Target system settings

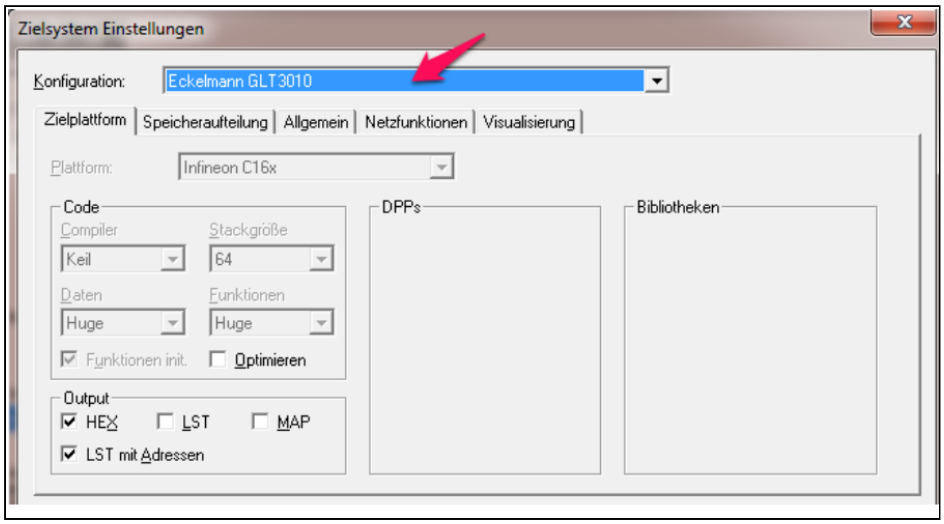
It must be communicated to the development system CODESYS for which processor the program should be compiled and is set in the target system settings.
1. Select the "Resources" tab:



2. The view of the resources opens. Double click there on "Target system settings":

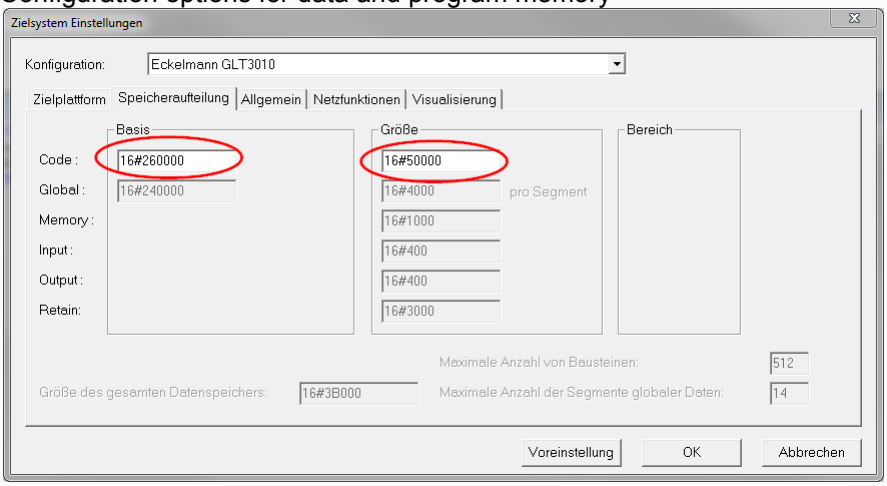


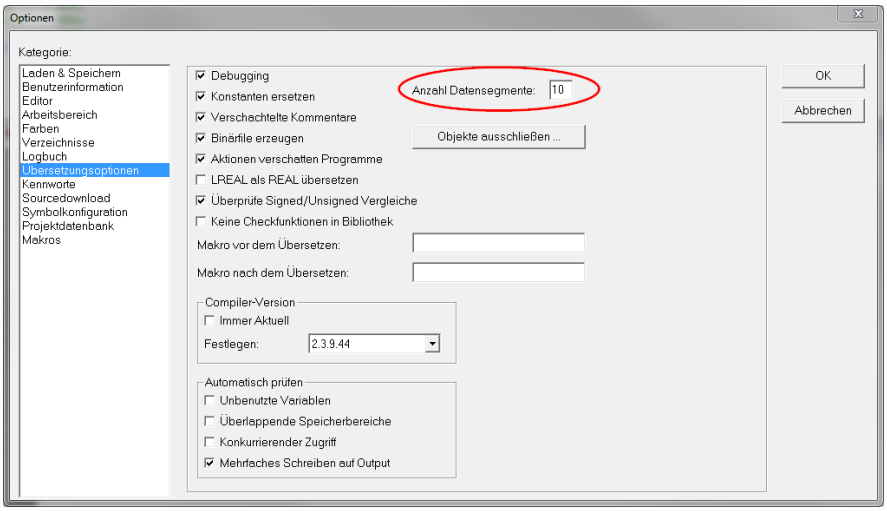
3. "Eckelmann GLT 3010" must be selected as target system in the configuration:



Advanced

Configuration options for data and program memory



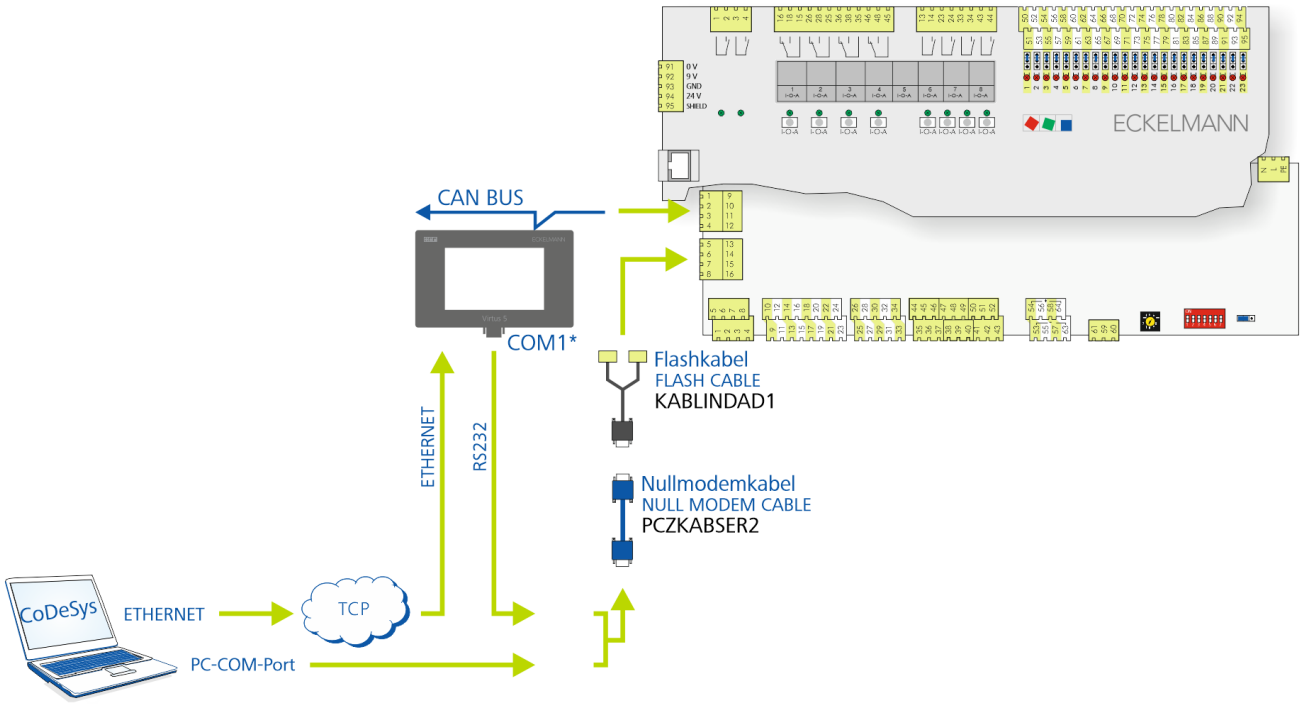


8.2 Importing the application using CODESYS

Importing the application using CODESYS is described in the following chapters. The following requirements must be met for the import:

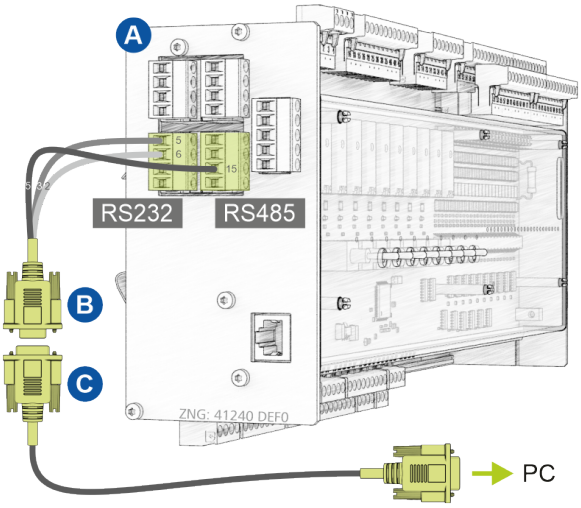
1. The controller is connected to the PC/ Notebook via the RS232 interfaces and the communications parameters are set correctly.
2. The project is compiled without errors.

8.2.1 Connection to development PC



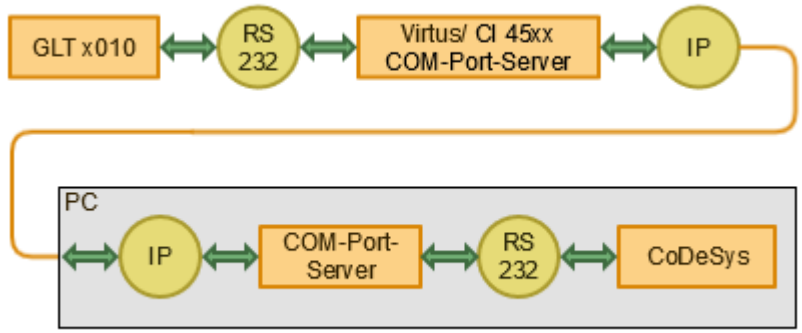
The controller must be connected to the development PC / notebook via the RS232 interface for application programming with CODESYS. This requires:

- Flash cable (B), part number KABLINDAD1
- Null modem cable (C), 2 female connectors 9-pin Sub-D, part number PCZKABSER2
- Notebook with COM port interface (RS232)

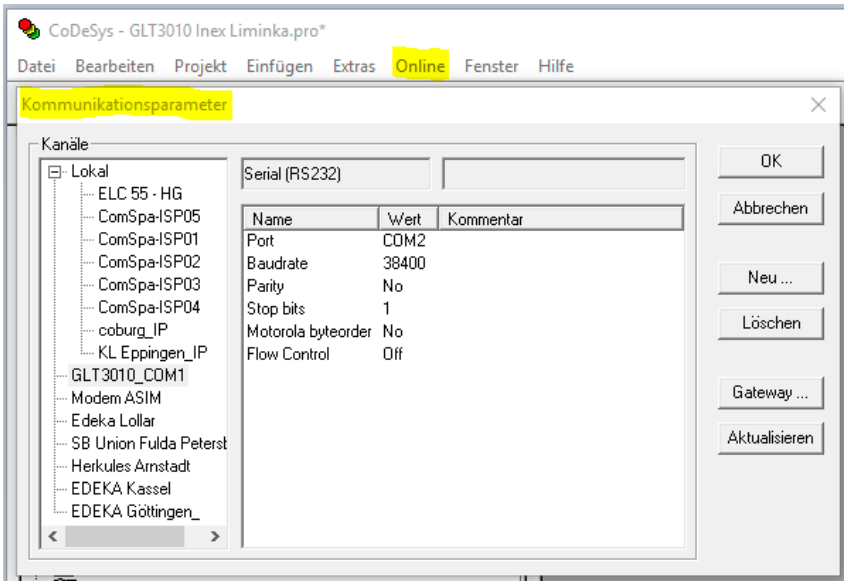


For details about the connection and the procedure, see chapter Update of the current firmware.

Another possibility is to use the Com Port Server integrated in the system centre. This enables remote access over IP with the CODESYS development system to the controller.
For configuration of the COM port server, see the operating manual of the system centre Virtus 5 (menu 4-1-5).
The COM port server driver must also be installed on the PC / notebook. The data flow between the GLT x010 and the PC/notebook as well as the implementation of the communication protocol TCP/IP ↔ RS 232 is shown below:



The corresponding settings must be made in CODESYS in the *Online* menu, under *Communication Parameters*:



On the left under "Channels", an existing configuration for RS232 can be selected or a new channel can be created with the *New* button on the right (see screenshot for details).

- Under *Port*, enter the COM port that the GLT 0x10 is connected to on the PC/notebook (here in the example "COM2").
- For communication via TCP/IP, the COM port of the COM port server must be set on the notebook, for details see Windows Device Manager, there under "Serial interfaces (RS 232)".

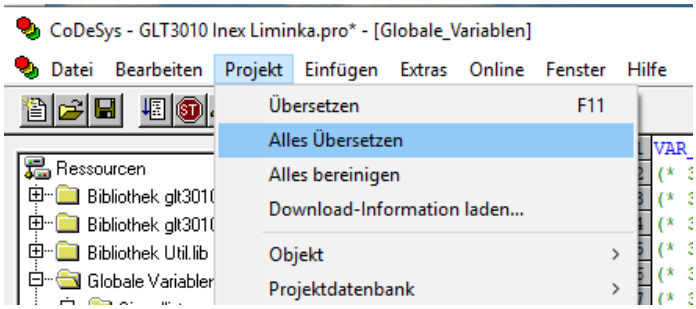
Cable length

The RS232 connection cable between GLT x010 and system centre (Virtus 5, CI 45xx) in the switch cabinet must not exceed a maximum length of 2 m and should be laid separately from low-voltage cables in order to avoid interference coupling.

8.2.2 Compile project and load into DDC

Compile project

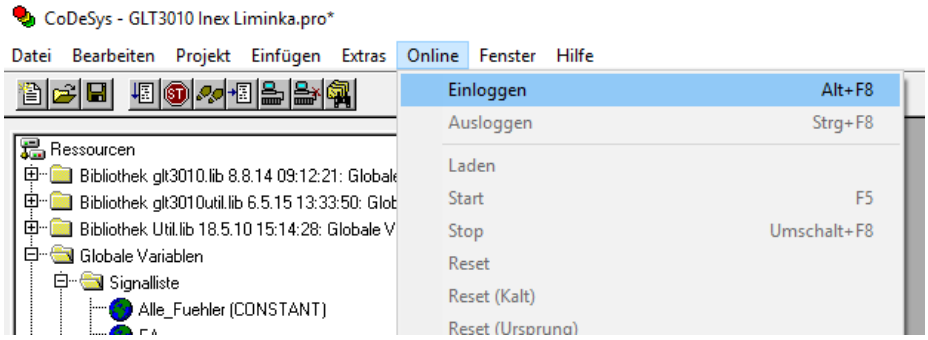
The project is completely compiled via the menu item "Project → Compile all":



> **Practical tip**
> When creating the final program code, it has proven useful to use the ***"Clean up all" selection before executing " Compile all"***!

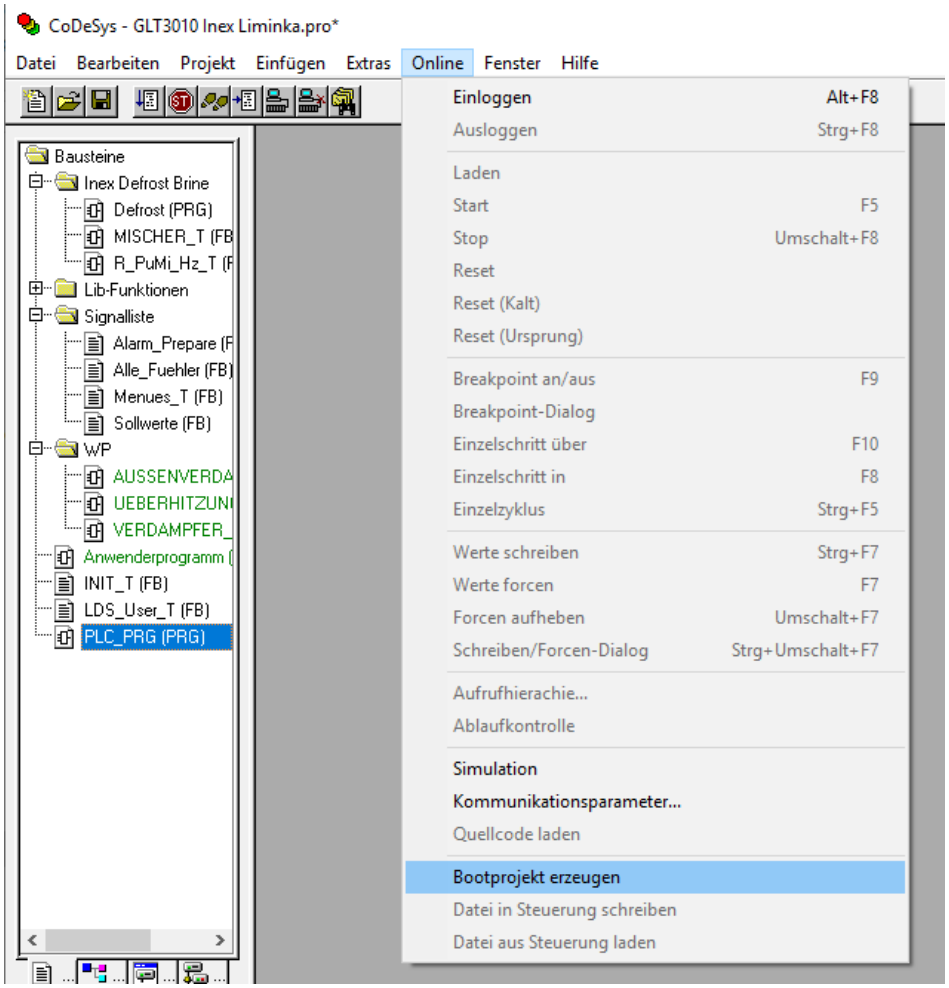
Load project into DDC

The project is transferred to the GLT x010 via the menu item "Online → Log in":



> **ATTENTION**
>
> The program is now only stored in the volatile memory of the controller. It is lost when the power supply is switched off.

8.2.3 Create boot project and start application



Create boot project

After loading the project, the boot project is created and written (flashed) to the controller.

> **ATTENTION**
>
> The changes are **only** remanent if the boot project is created during an **existing connection** (menu selection "*Online → Create boot project"*) and are also still available after a restart (e.g. after a power failure)!

Start application

The application is started in the controller via the menu selection "*Online → Start" (*or by pressing the *F5* key).

9 Installation and start-up GLT x010 / SIOX

IMPORTANT SAFETY INSTRUCTIONS!

Before the installation and start-up of the controller, the chapter Safety instructions must be carefully read in its entirety and all safety instructions and hazard warnings observed.

Among other things, the system centre is used for alarm signalling and operating data archiving and is the link between the LDSWin PC software and the controller.

The controller can only be parametrised during start-up or later changes to its configuration via the **LDSWin PC software**. The controller should only be used with compatible versions of LDSWin, otherwise the scope of functions can be restricted.
Tip: The latest LDSWin version should always be used. Among other things, setpoints, actual values and archived long-term data can also be visualised and evaluated in LDSWin.
Before the start-up of the system, the necessary hardware and software default settings which are described in the following chapters must be made on the controller.

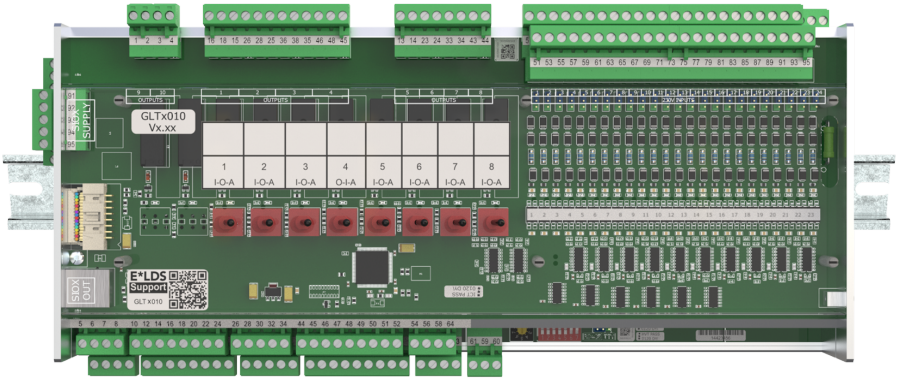
9.1 DIN rail mounting

The base module and the SIOX extension modules are snapped onto a DIN rail using two claws on the rear side, for details see chapter Mounting on the DIN rail.

> **ATTENTION**
>
> The controller may only be operated when mounted on a DIN rail as a built-in regulating and control device (EN 60730) and can be mounted in a row without spacing. The power loss of the controller is 24 VA and 3.1 W per SIOX. The natural convection of the circulating air with free air exchange is sufficient for the operation of the controller to prevent overheating. A sufficiently large air inlet (min. 30 mm) under the device and an unobstructed air outlet above it **must** always be ensured. If this cannot be guaranteed, forced ventilation is required!
> All supply lines from and to the device (with the exception of the 230 V power supply and signal lines) must be shielded! This particularly applies to the analogue inputs and outputs as well as to the CAN bus and Modbus cabling; see operating manual *"Basics and General Safety and Connection Instructions*". These must also be installed with sufficient clearance from live cables. As a general rule, care should be taken to ensure that signal cables and cables carrying mains voltage are routed in separate cable channels

Specified mounting position

The base module must be mounted as follows:



For details about protection rating and dimensions, see chapterTechnical Data GLT x010 / SIOX.

9.1.1 Mounting on the DIN rail

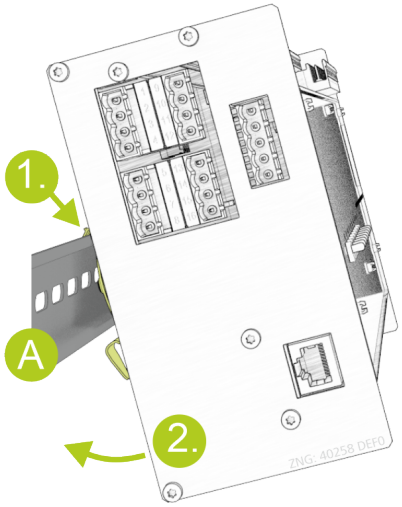
DANGER

Warning about dangerous electrical voltage! Danger of electric shock! The safety regulations and work safety instructions **must** be observed for the mounting. **All** plug connectors may only be inserted and removed when the power supply is disconnected, see chapter Handling Wide COMBICON Plugs.

Step 1: Underside of the controller (with mating connectors removed) with the two claws for mounting:

In order to ensure mounting / removal, a clearance of at least 30 mm to the next component (e.g. cable duct) **must** be maintained underneath the controller.
Note: The DIN rail (35 mm) must have a height of at least 5 mm.

Step 2: Place the controller on the upper edge **(1.)** of the DIN rail **(A)** and swivel it downwards **(2.)** until the controller snaps firmly onto the DIN rail.



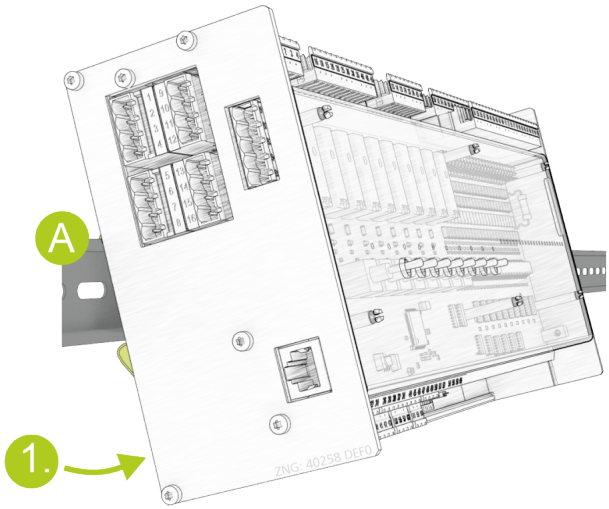
9.1.2 Removal from the DIN rail

DANGER

Warning about dangerous electrical voltage! Danger of electric shock! The safety regulations and work safety instructions **must** be observed for the mounting. **All** plug connectors may only be inserted and removed in a de-energised state, see chapter Handling Wide COMBICON Plugs.

Step 1: Detach all mating connectors with cables from the controller.

Step 2: Remove the device from the DIN rail **(A)** by swivelling**(1.)** upwards.



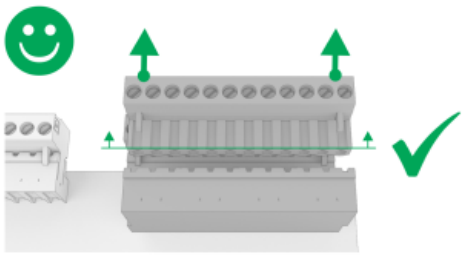
9.1.3 Handling Wide COMBICON Plugs

DANGER

Warning of dangerous electrical voltage! Danger to life - Danger of electric shock! For assembly, the safety regulations and the work safety instructions **must be** observed. **All** plug-in connections may only be plugged and unplugged in a de-energised state.

Correct handling

Mating connectors **must** be plugged or **unplugged vertically and without canting**.

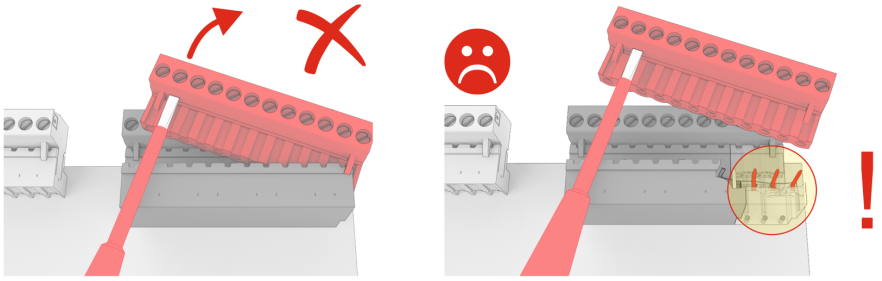


For detailed information on handling wide COMBICON connectors, see online in EDP.

Incorrect handling

ATTENTION

Incorrect handling leads to damage to the plug socket! Never detach the mating connector on one side, as this will damage the pins of the plug socket!

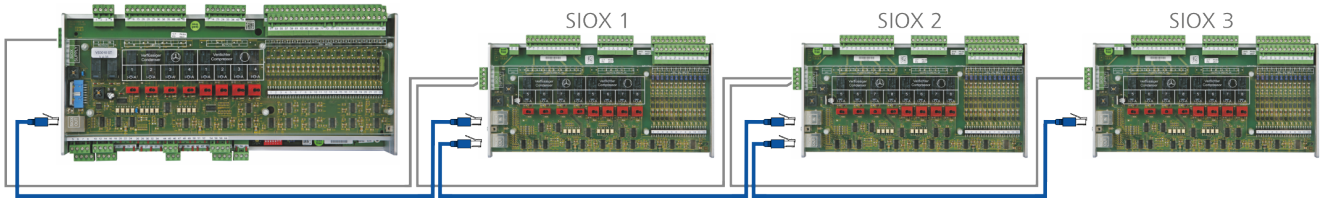


9.2 SIOX Extension Module

DANGER

Warning of dangerous electrical voltage! Danger to life - Danger of electric shock! BEFORE connecting and disconnecting, it must be ensured that **no voltage** is present at all connections of the controller.

Up to a maximum of 3 SIOX (**S**erial **IO** E**x**tension) extension modules can be connected to the controller for DIN rail mounting. Each SIOX extension module extends the controller by an additional 12 digital inputs and 8 relay outputs. The number (1..3) of required SIOX extension modules is configured in the controller configuration under CODESYS. The connection to the base module is made via SIOX power supply cables (SIOX SUPPLY) or SIOX data cables (SIOX IN / OUT):



For details, see chapter Connection of the SIOX modules to the base module.

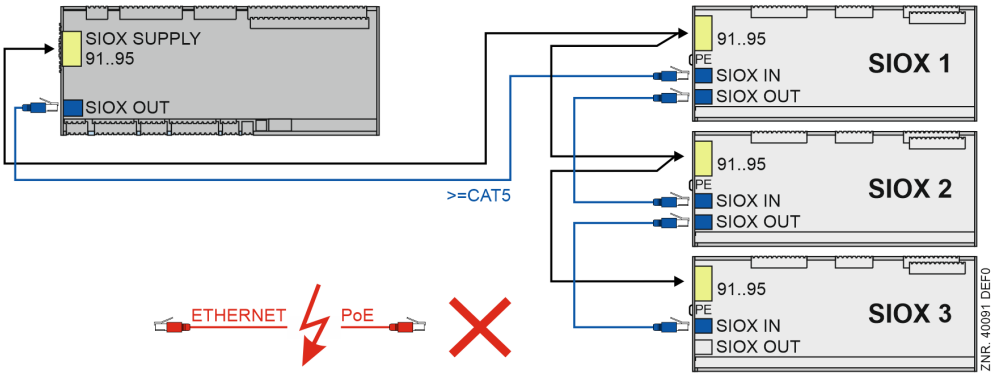
SIOX operating instructions

Comprehensive details on the SIOX extension modules and their current operating instructions can be found here:
https://edp.eckelmann.de/edp/lds/_S88KwDvR7a

9.2.1 Connection of the SIOX modules to the base module

The individual SIOX extension modules are supplied with power from the controller via SIOX-SUPPLY (terminals 91/92/93/94/95) and connected to each other in series via SIOX data cables (SIOX OUT and SIOX IN using RJ45).

Example configuration: base module with two SIOX extension modules:



For details, see chapter Assignment SIOX.

ATTENTION

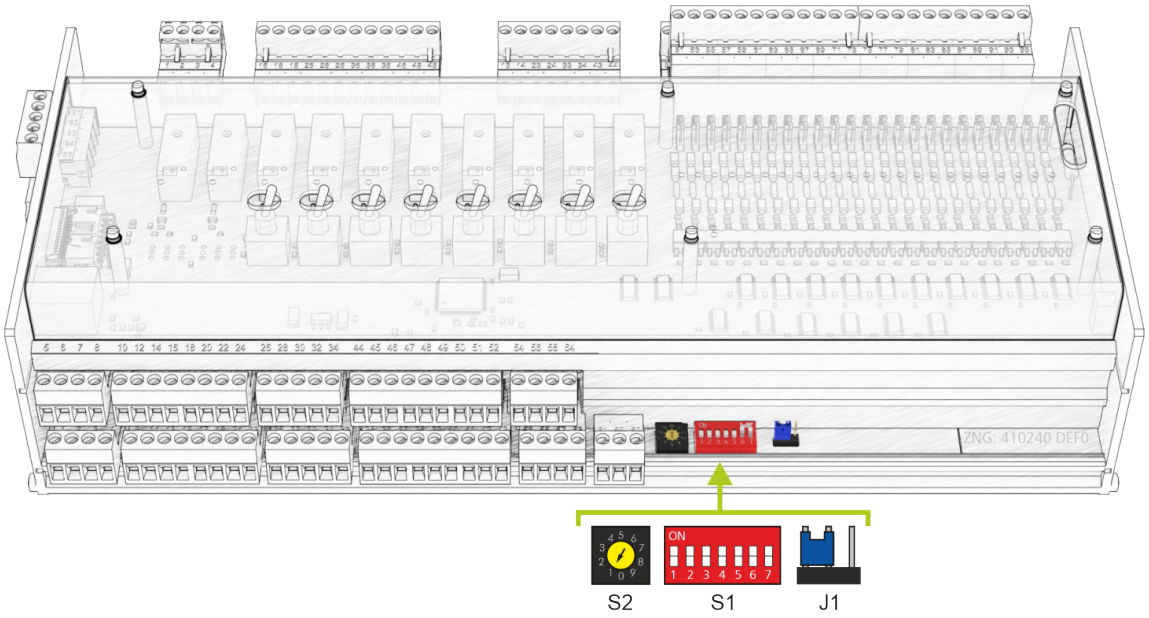
Danger of destruction of components! SIOX extension modules may **only** be connected to each other or the base module when no voltage is present! In the event of an Ethernet network cable with PoE (Power over Ethernet) being used instead of the SIOX data cable (RJ45) damage can occur to participating network devices!

SIOX operating instructions

Comprehensive details on the SIOX extension modules and their current operating instructions can be found here:
https://edp.eckelmann.de/edp/lds/_S88KwDvR7a

9.3 Default hardware settings

The default parameter settings can be configured using the **decade switch S2**, the **DIP switch S1** and the **jumper J1**.



These default settings **must be configured before** switching on the controller:

1. DIP switch S1 for setting the functionality

- For details, see chapter Default settings using DIP switch S1

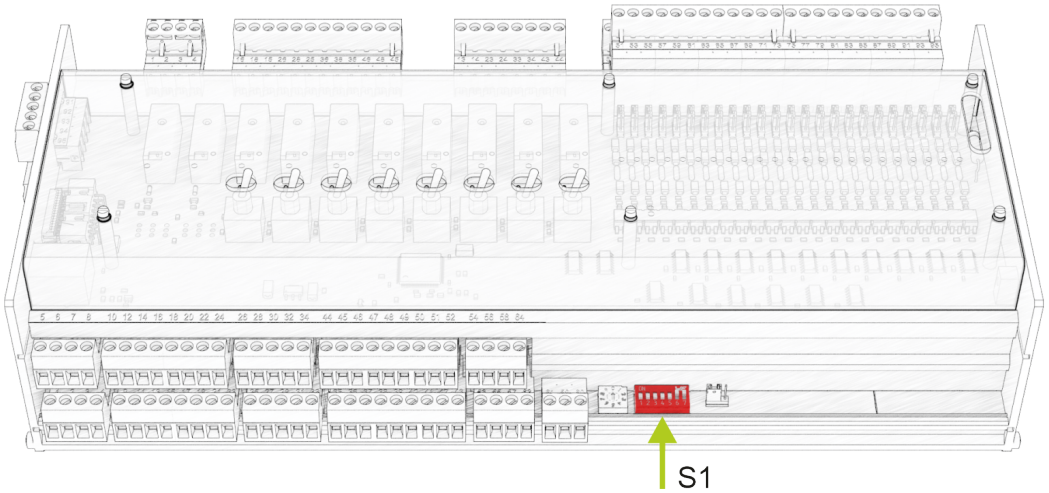
2. Decade switch S2 for activation / deactivation as CAN bus node

- For details, see chapter Setting the CAN bus address using S2

3. Jumper J1 for configuration of the RS485-/TTY interface

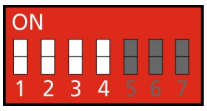
- For details, see chapter Setting of the interface RS485/TTY using jumper J1.

9.3.1 Settings using DIP switch S1



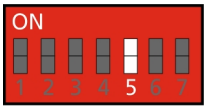
There are two types of coding switches on **DIP switch S1**:

1. Coding switches 1..4 - Freely programmable in CODESYS.
These are read in **during the runtime** and act on the controller immediately after adjustment. The coding switches are freely available to the programmer of the application. The programmer defines the meaning of the coding switches, how they should be used.

Coding switches 1..4	Switch position	Function
	**ON**	Freely programmable
	OFF	

2. Coding switches 5..7 - Hard-coded into the firmware of the controller.
These do not take effect **until after restart**, i.e. not until after a short interruption of the power supply of the controller.

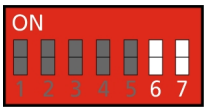
Coding switch 5
Coding switch 5 sets the transfer rate on the CAN bus. Up to now, a transmission rate of only 50 kbit/s was possible on the CAN bus (factory setting). By flipping the coding switch to "ON" you get 5 times the transfer rate (250 kbit/s). The High Speed mode of the Combi Gateway provides this transfer rate

Coding switch 5	Switch position	Function
	**ON**	250 kbit/s (High Speed)
	OFF	50 kbit/s (factory setting)

ATTENTION - ONLY CI 3x00

If the setting is incorrect, no communication can be established with the CAN bus. When using the high speed mode, the store computer CI 3x00 must be configured accordingly. The following requirements must be met:
The store computer **must** have the firmware V5.0 or higher and the parameter *"CAN Bus Fast"* (menu 6-1-1) must be set to *Yes*.

Coding switches 6..7
Coding switches 6 and 7 determine the operating mode of the controller:

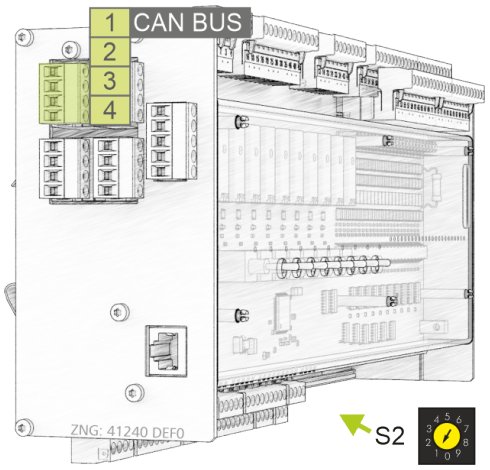
Coding switches 6..7	Switch position for 6 and 7	Function
	**ON**	Normal operation (factory setting)
	OFF	Firmware update mode

ATTENTION

The coding switches **6 and 7** may **only** be set to OFF for the purpose of the firmware update! In this state, the controller waits for the firmware update via a connected service PC. It is strictly required for the normal operation of the system that the **firmware update mode** is deactivated - DIP switch S1 coding switches 6 and 7 **must** be in the ON position!
After changing the switch positions of the coding switches **6 and 7**, the controller **must** be disconnected from the power supply for a short time so that the desired settings will be adopted!

9.3.2 Setting the CAN bus address using decade switch S2

Connection to the CAN bus
The connection to the CAN bus is made using the terminals 1-4 installed on the left side:



Setting of the CAN bus address (node number) / deactivation of the CAN bus communication
The decade switch S2 specifies the CAN bus address.

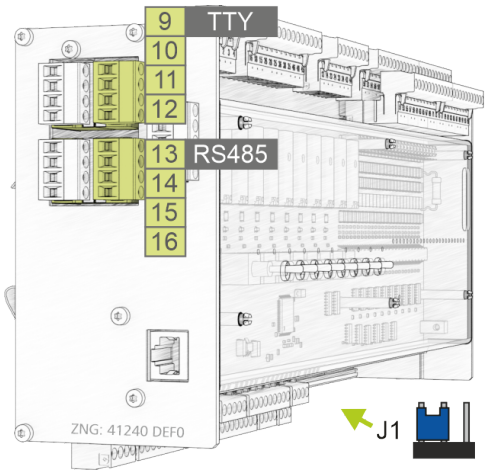
> **ATTENTION**
>
> After changing the switch position of S2, the controller **must** be disconnected from the power supply for a short time so that the new settings will be adopted!

Decade switch S2	Switch position	CAN bus address / node number (Kn.nnn)	Function
	**1..4**	122..125	Assign CAN bus address 122..125 to the controller
	0, 5..9	NONE	CAN bus interface deactivated (inactive, disabled) The controller is not detected as a CAN bus node!

For further details about pin assignments, see chapter CAN Bus Assignment.

9.3.3 Setting of the interfaces RS485/TTY using jumper J1

Connections TTY/RS485
The connections are made via the terminals 9..12 and/or 13..16 on the left front side::



Setting of the interfaces TTY/RS485
The jumper J1 determines which of the two interfaces is activated.

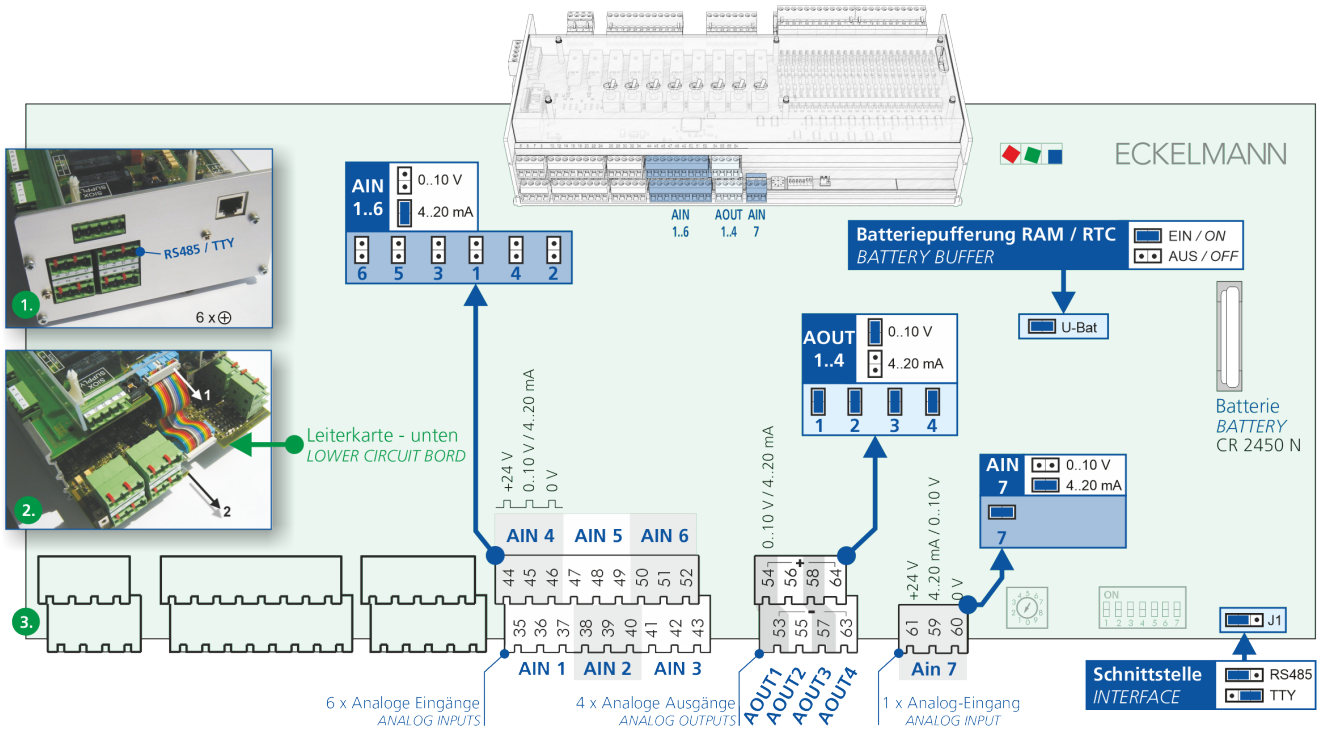
Jumper J1	Jumper position	Activated interface	Function
	Left-Middle **factory setting**	RS485 terminals 13, 14, 15, 16	Connection for third party controllers, protocol: Modbus-RTU For details, see chapter Assignment Modbus Modules.
	Middle-Right	TTY terminals 9, 10, 11, 12	Currently without function For details, see chapter Assignment RS232 and TTY.

9.3.4 Configuration of the analogue inputs and outputs at the factory

DANGER

Warning about dangerous electrical voltage! Danger to life - Danger of electric shock!
Before opening the case, it is essential to disconnect the device from the power supply! All plug connectors may only be inserted and removed when the power supply is disconnected. For details about opening the case, see chapter Replacing the battery.
Reconfiguration of the analogue inputs and outputs is **only** necessary if settings different from the delivered condition have to be made, e.g. if analogue signals with 4..20 mA signal existing in the system should be used. A reconfiguration or any opening of the controller must only be performed by trained personnel or at the factory by the manufacturer. Incorrect handling can result in damage and impairment of the controller functions!
After opening, the device **must** be subjected to an **insulation test**!

The analogue inputs and outputs can be configured using jumpers on the **bottom** circuit board of the controller.



Practical tip: For better interference immunity, the analogue inputs should be configured for 4..20 mA current for long cable lengths.

The analogue inputs and outputs are configured at the factory as follows:

Analogue inputs **(AIN)**	1..6 7	0..10 V 4..20 mA
Analogue outputs **(AOUT)**	1..4	0..10 V

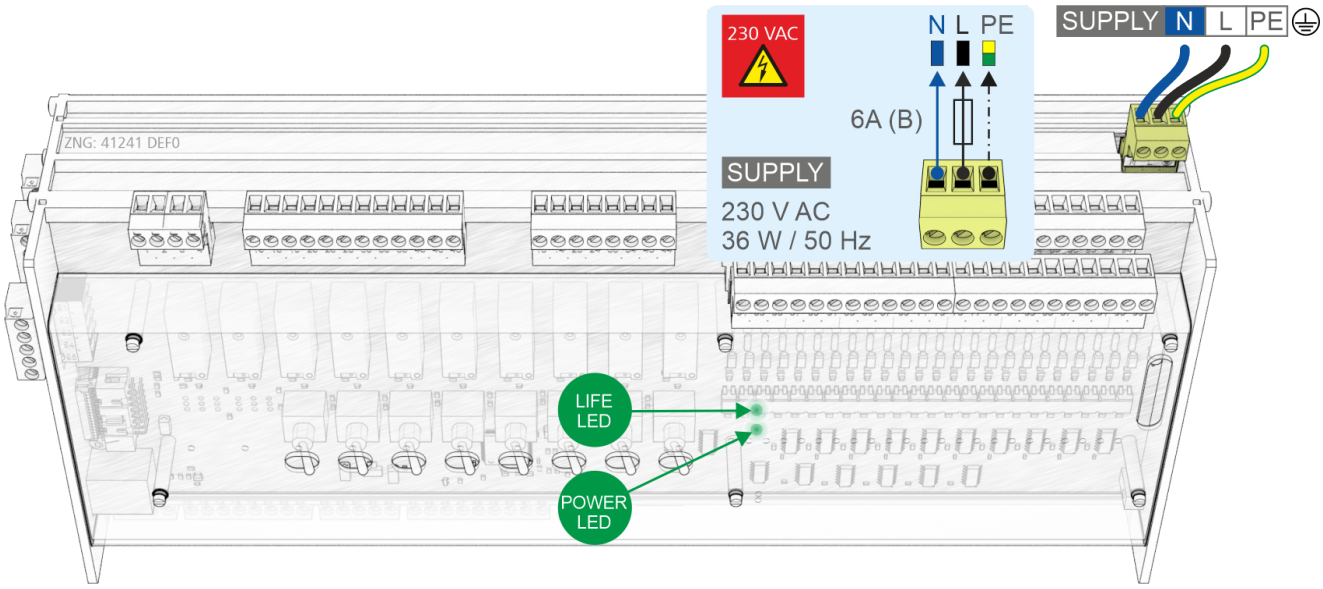
9.3.5 Power supply

DANGER

Warning about dangerous electrical voltage! Danger to life - Danger of electric shock! BEFORE connection and disconnection, it **must** be checked that the 230 V AC power supply cable is **disconnected from the power supply**! The controller is only permitted to be connected to the intended operating voltage of 230 V AC!

ATTENTION

A circuit breaker **must** be used to protect the mains cable and must not interrupt the earth conductor (PE). For details, see chapter Assignment of the 230 V AC power supply.



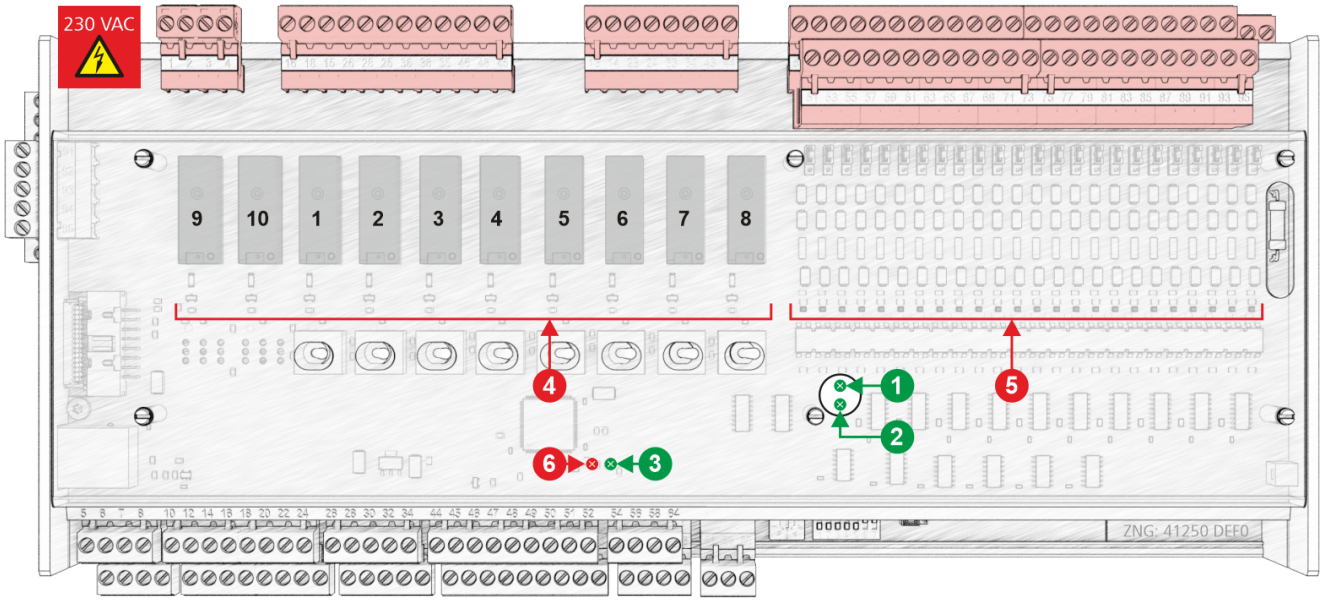
The controller can be put into operation after completion of the mechanical and electrical installation. After connecting to the power supply, the green LED (POWER) lights briefly after switching on, see chapter Status LEDs.

Note: As the controller itself does not have a switch for switching on or off, it **must** be disconnected from the power supply for e.g. a Restart for approx. 2 seconds (switch on/off the circuit breaker).

9.3.5.1 Status LEDs

DANGER

Warning of dangerous electrical voltage! Danger to life - Danger of electric shock! BEFORE connecting and disconnecting, it must be checked that the terminals are **disconnected from the 230 V AC**! External voltage 230 V AC may be present at these terminals!



	Function	Colour	LED	Description
Lower board				
1	LIFE	green	LED	FLASHING: Active lamp, board is supplied with power, processor is running OFF: Power supply interrupted or device defective
2	POWER	green	LED	ON: Power supply OK, device is supplied with power, processor is running OFF: Power supply interrupted or device defective
Upper board (internal SIOX)				
3	LIFE	green	LED	FLASHING: Active lamp, board is supplied with power, processor is running OFF: Power supply interrupted or device defective
4	Relay outputs	green	LED1 .. LED10	ON: Relay is activated **ATTENTION:** External voltage can be present at these terminals!
5	Digital inputs	red	LED1 .. LED23	ON: Digital input is activated, voltage is present! **ATTENTION:** External voltage can be present at these terminals!
6	For future functions	red	LED	---

Information for the precise terminal assignment can be found in chapter Connection and terminal assignment GLT x010 / SIOX.

9.4 Replacing the battery

The controller has a lithium buffer battery of the **type CR 2450 N, 3 V**. In order to change the battery, it is necessary to remove the controller from the system. In this case, the system is **not** controlled and monitored!

DANGER

- **Warning about dangerous electrical voltage! Danger of electric shock!** The safety regulations and work safety instructions in the chapter Conventions must be observed for the battery replacement.
  A battery replacement may **only** be performed by trained personnel or at the factory by the manufacturer! After opening, the device **must** be subjected to an **insulation test**!
- **All** plug connectors may only be inserted and removed when the **power supply is disconnected**. Label connector if necessary before the removal and then detach.
- Circuit boards may only be replaced when the **power supply is disconnected**. Always hold circuit boards at the edge.
  
  Observe ESD (Electrostatic Discharge) regulations!
- After opening, the device **must** be subjected to an **insulation test**!

ATTENTION

Risk of false alarm! The removal of the controller from the CAN bus generates an error message in the higher level controller (system centre / store computer / operator terminal). Therefore, in addition to the precautionary measures that directly concern the controller, consequences in the higher level controllers / systems must also be taken into account.

Performing the battery replacement

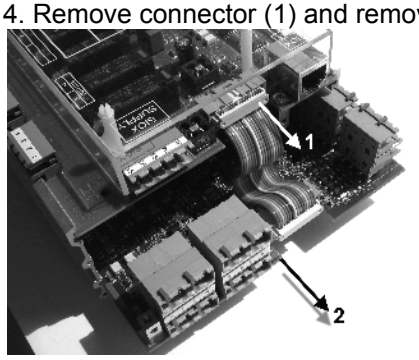
1. Disconnect controller from the power supply. Acknowledge alarm in the higher level controller if necessary.
2. Disconnect all plug connectors, remove controller from the mounting.

DANGER

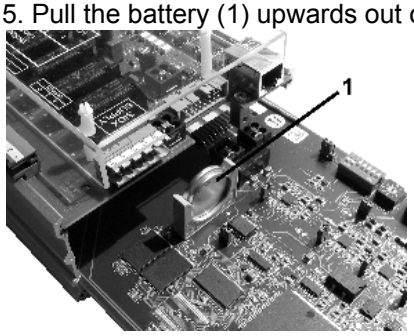
Warning about dangerous electrical voltage! Danger of electric shock! A voltage of 230 V AC can be present on some connectors.

3. Undo six screws of the side panel.

4. Remove connector (1) and remove bottom circuit board (2).



5. Pull the battery (1) upwards out of the battery holder and dispose of correctly.



ATTENTION

WEEE Reg. No.
DE 12052799

The device contains a lithium battery that must be correctly disposed of separately! Never dispose of this product with other domestic waste. Please inform yourself about the local regulations for the separated disposal of electrical and electronic products and batteries. The correct disposal of your old equipment protects the environment and people against possible negative consequences.

6. Pick up the new battery with a cloth and push it into the battery holder.

ATTENTION

Do **not** handle the new battery with metal pliers as the battery can be destroyed by the resulting short circuit:

- wipe with a clean and dry cloth.
- do **not** hold on the edge contact areas.

7. Assembly is performed in reverse order. Reconnect all connectors.

Warning about dangerous electrical voltage! Danger of electric shock! A voltage of 230 V AC can be present on some connectors.

8. Supply the controller with power again. The application works again.

9. In the case of unchanged configuration, the controller will be automatically detected again via the CAN bus. Date, time and automatic switching between summer / winter time are performed automatically via the central time synchronisation by the higher level controller.

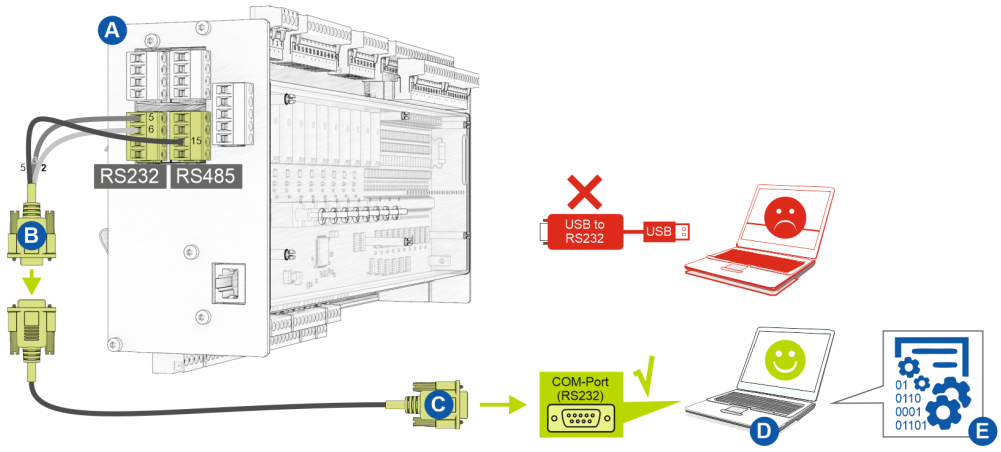
(Error) messages are output during restart of the controller. These must be checked / acknowledged in the higher level controller (system centre / store computer / operator terminal)
It is recommended to perform a first start after the battery replacement!

9.5 Firmware Update

The controller is delivered with the current firmware, ready for operation. Future software releases (e.g. with extended range of functions) can be loaded via a firmware update to update the controller.

> **ATTENTION**
>
> **Damage to the installation and stock loss! Before** the firmware update, the affected system component or the system must be brought into a safe state as the shutdown of the controller during the firmware update can have undesired effects on the system component and/or the system.
> **Caution: data loss!** When changing the firmware version, all adjusted setpoint values are lost. As a precaution, the settings **should** therefore be backed up by saving them using the LDSWin PC software **before** the firmware update. After the firmware update, the saved settings can be reloaded into the controller from LDSWin.

9.5.1 Requirements for firmware update



The following requirements are necessary for a firmware update:

(A) Controller
(B) Flash cable, part number KABLINDAD1
(C) Null modem cable, part number PCZKABSER2
(D) Notebook with COM port interface (RS232)

> If no RS232 interface is available on the notebook (or PC), this must be equipped with an **RS232 interface**:
> **Notebook**: PCMCIA COM port adapter
> **PC**: PCI COM port card
> **IMPORTANT:** A USB COM port adapter is expressly **not** recommended!

(E) File for the firmware update.

> **ATTENTION**
>
> It must **strictly** be ensured that the appropriate firmware update version for the controller is used!
> **Note:** If necessary, it must be unpacked from the ZIP archive **before** use.

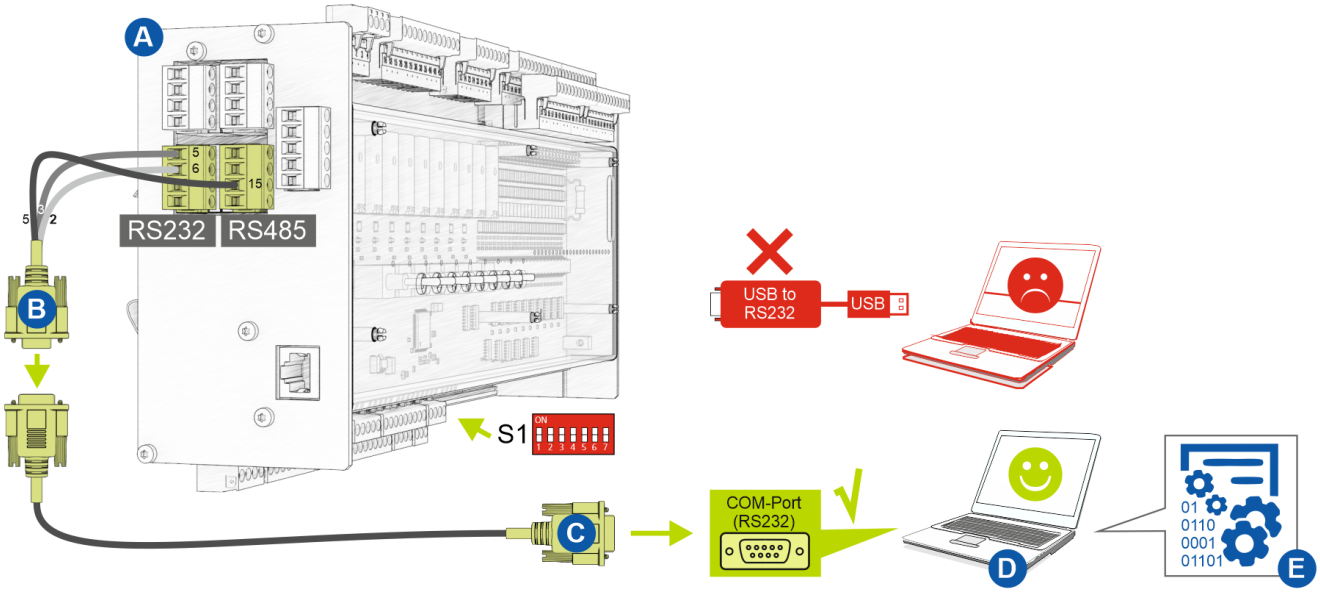
The current file for the firmware update is available in the EDP under https://edp.eckelmann.de/edp/lds/_RdC4ujAibE.

9.5.2 Update der aktuellen Firmware

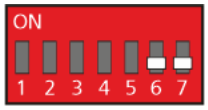
The file "**GLT3010_xxx_Release.exe**" (E) for the firmware update is available in the EDP at https://edp.eckelmann.de/edp/lds/_RdC4ujAibE and may have to be unpacked from the ZIP archive **before** use.

The firmware update is performed using a notebook (or PC) that is connected to the controller via the COM port interface (RS232). The following steps must be **strictly** performed and observed during the firmware update:

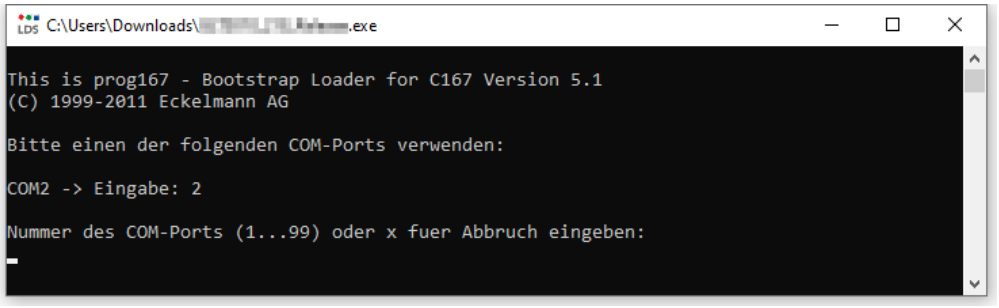
1. Strictly disconnect controller from the mains power supply (there **must** be absence of voltage) .



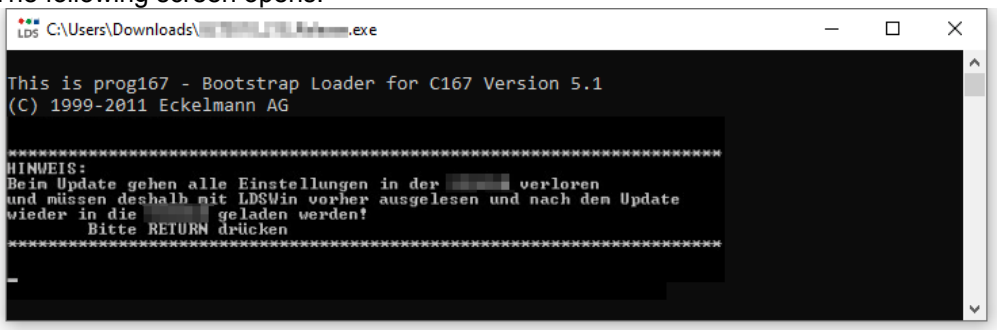
2. Set DIP switch S1 coding switches **6 and 7 to OFF**:



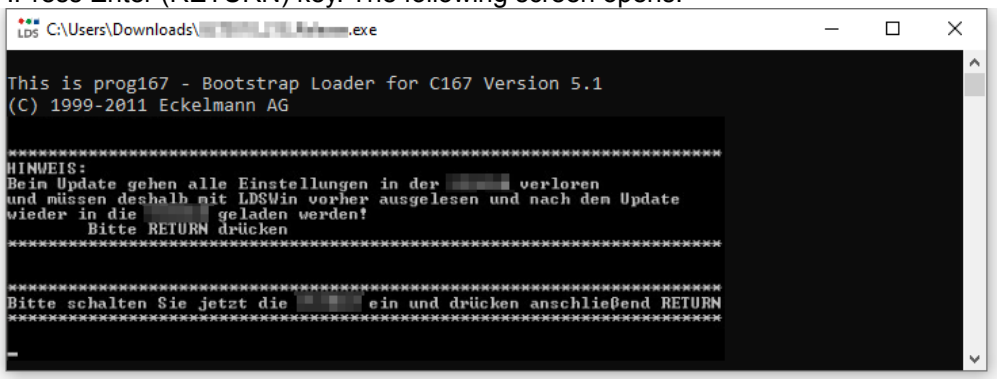
3. Connect controller (A) to flash cable (B) (connect both 4-pin plug connectors at the terminals 5/6/7/8 and 13/14//15/16).
4. Connect flash cable (B) to null modem cable (C).
5. Connect null modem cable (C) to the COM port (RS232) of the notebook (D)
6. In Windows Explorer, run the file *"GLT3010.exe"* by double clicking on it and select the used COM port on the screen.



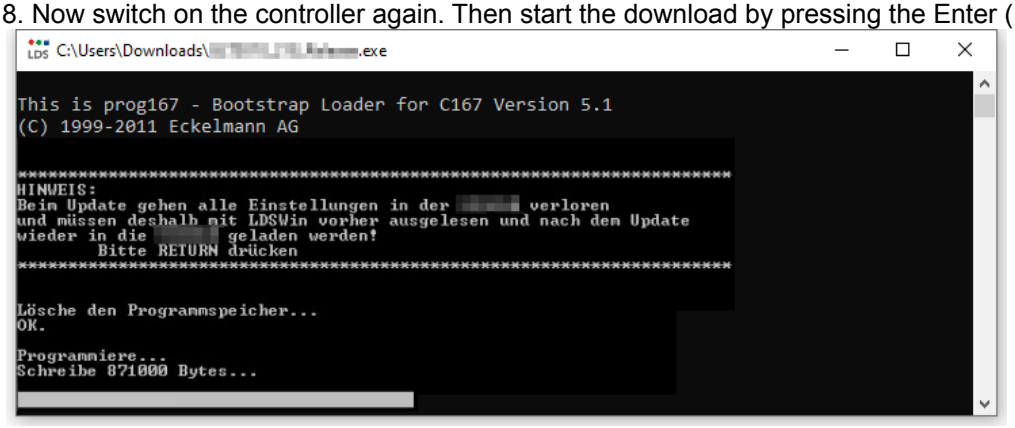
The following screen opens:



7.Press Enter (RETURN) key. The following screen opens:

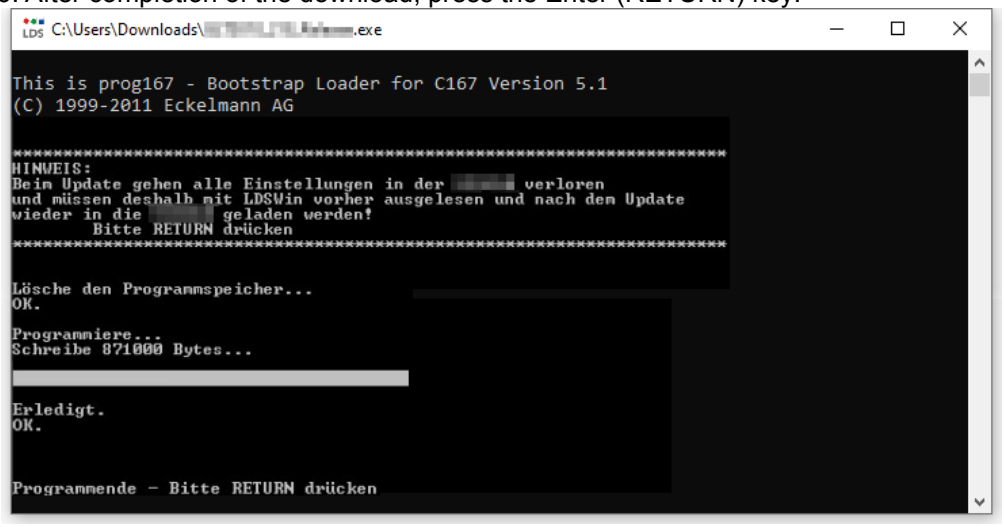


8. Now switch on the controller again. Then start the download by pressing the Enter (RETURN) key:

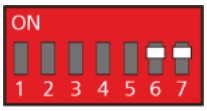


The bar at the bottom indicates the progress of the download.

9. After completion of the download, press the Enter (RETURN) key:



10. Set DIP switch S1 coding switches **6 and 7 to ON again:**

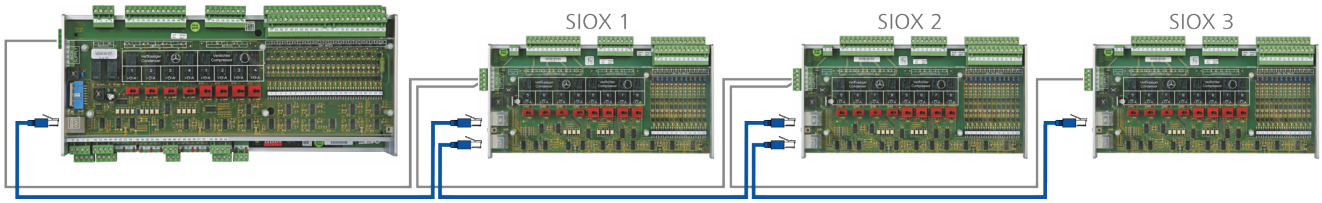


11. The controller must be disconnected from the power supply for a short time after the firmware update.

> **ATTENTION**
>
> In normal operation, the coding switches **6 and 7 of the DIP switch S1 are always in the ON position**!
> After changing the switch positions of both S1 and S2, the controller must be disconnected from the power supply for a short time so that the new settings will be adopted!

10 Connection and terminal assignment GLT x010 / SIOX

The following illustrations and tables show the terminal assignments of the base module and of the SIOX extension modules.



Base module GLT x010 in full expansion with max. 3 SIOX extension modules For more details, see the chapters

- Connections for 230 V AC (top)
- Connections for safety extra-low voltage (bottom)
- Connections for interfaces (on the side)

DANGER

Warning about dangerous electrical voltage! Danger to life - Danger of electric shock or malfunction! The following points must be **strictly** observed for the cabling:

- The system must be **disconnected from the power supply before** detaching or inserting plug contacts on the controller.
- For **analogue inputs and outputs** with current or voltage interface (4..20 mA / 0..10 V), it is essential to ensure **correct polarity**. Short circuits or a faulty power supply can result in impairments of the function or even destruction of components of the controller.
- **All connection cables** from and to the controller - with the exception of the relay outputs and the digital inputs – must be **shielded**. Otherwise malfunctions, e.g. faulty measurements, cannot be ruled out.
- It must also be strictly ensured that the inputs / outputs are correctly configured using the jumpers provided for this (current or voltage interface, see chapter Configuration of the analogue inputs and outputs at the factory).
- **Base module:** For the digital inputs, ensure the correct jumper setting for 24 V AC/DC or 230 V AC, see chapter Configuration of the digital inputs 230 V AC / 24 V AC/DC.
  ATTENTION: If 230 V AC is applied to a digital input that has been configured for 24 V AC, this results in destruction of the digital inputs!

10.1 Assignment of all inputs and outputs

The assignment of **all** digital and analogue inputs and outputs is defined by the programmer of the application and determines which functionality each of the individual inputs and outputs has.

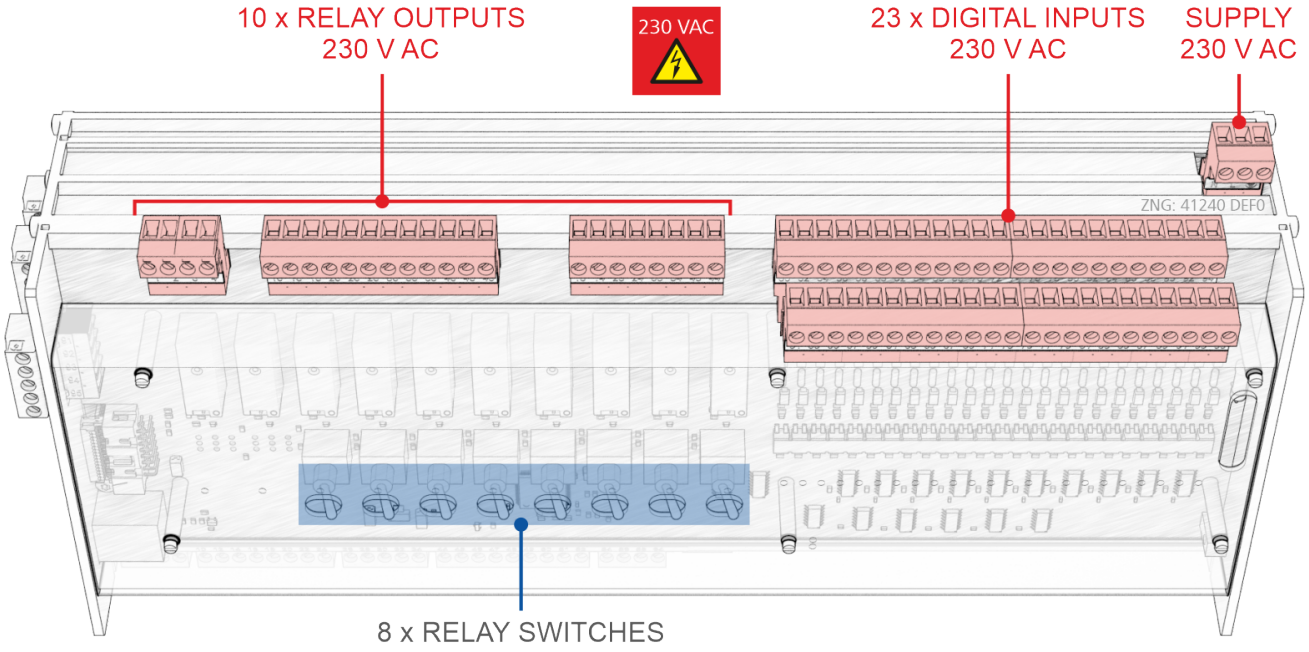
The hardware inputs and outputs are accessed in the software via the respective assigned address of the process variables. In the controller, all addresses of all process variables are preset to fixed values at the factory and cannot be changed. They can be viewed in the programming environmentCODESYS in the controller configuration. The assignment of the permanently configured addresses in the GLT x010 hardware is explained in more detail in the following chapters. These addresses are needed for the creation of the Signal List which is the basis for the creation of the application.

Practical tip

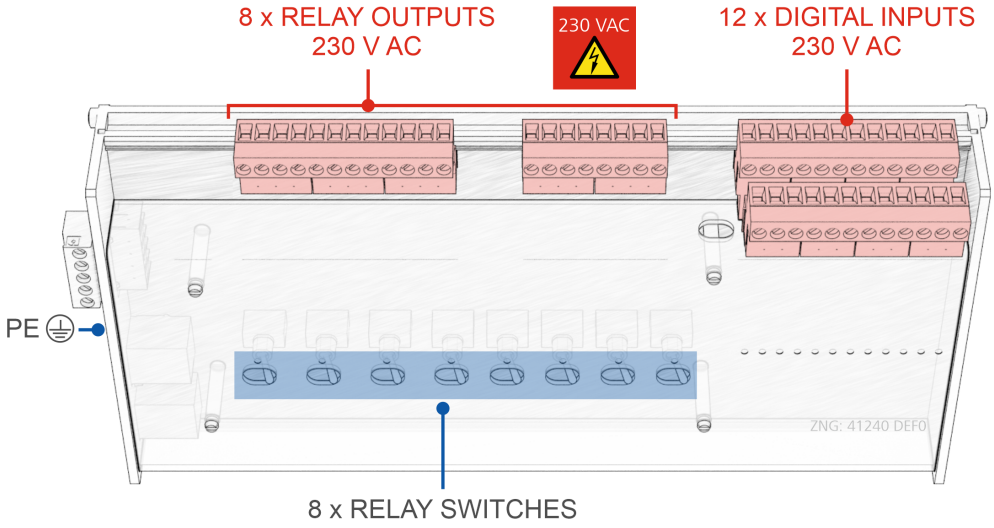
In order to establish a better reference to the controller configuration in CODESYS, the columns "I/O no." which indicate the numbers of the inputs and outputs in the controller configuration are shown in the tables of the connection assignment.

10.2 Connections for 230 V AC (top)

Base module



SIOX Extension Module

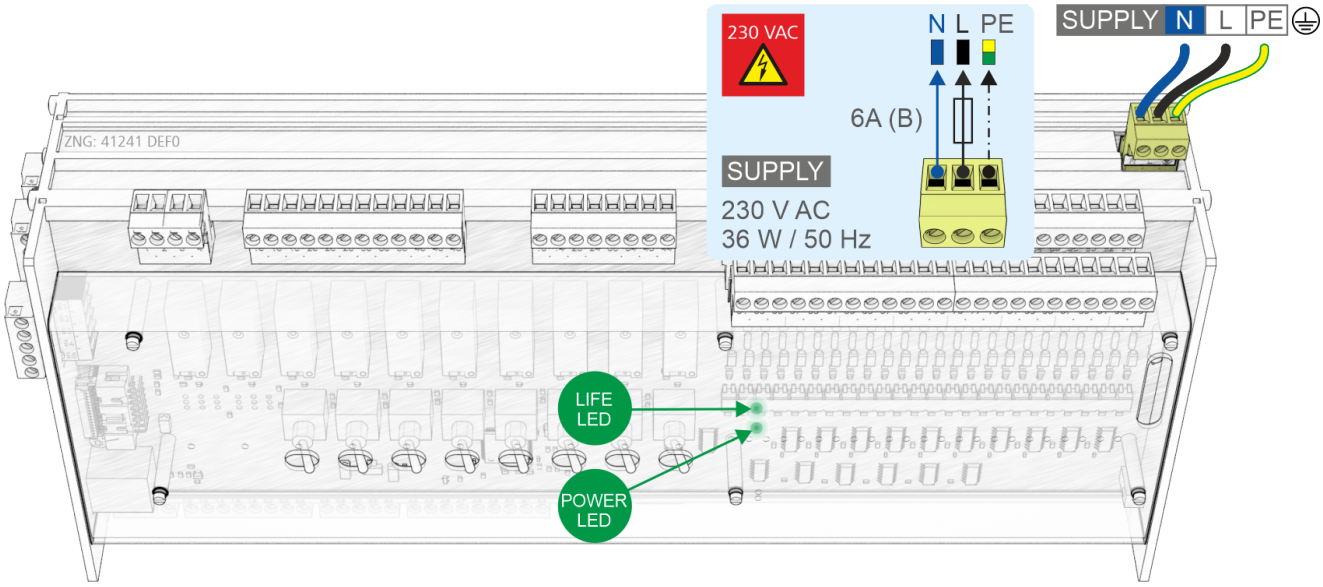


10.2.1 Assignment of the 230 V AC power supply

DANGER

Warning about dangerous electrical voltage! Danger to life - Danger of electric shock! BEFORE connecting and disconnecting, it must be checked that the 230 V AC power supply cable is **disconnected from the power supply**! The controller is only permitted to be connected to the intended mains power supply!

Connection: Only on base module – terminal block, upper right at the back



SUPPLY			
Description	**Terminal No.**	**Connection**	**Function**
230 V AC	N L PE	Neutral conductor Phase 230 V AC Earth conductor	Power supply

Connection to the power supply

In order to fuse the mains power line, a circuit breaker with the following characteristics **must** be used:

- Rated current for 230 V AC: 6 A
- Tripping characteristic (type): B

After connection of the 230 V AC power supply, the green POWER LED flashes, for details see chapter Status LEDs

Requirements for the connection cable

As the controller does not have an integrated disconnecting device in the form of a power switch, the following must be implemented:
a) a switch or circuit breaker must be installed in the system or building installation,
b) this must be suitably positioned and easily accessible for the user and
c) this must be labelled as disconnecting device for the device.

10.2.2 Assignment of the relay outputs - 230 V AC / 24 V AC/DC

DANGER

Warning about dangerous electrical voltage! Danger to life - Danger of electric shock!
BEFORE connecting and disconnecting, it must be checked that **no voltage is present** at the 230 V AC relay outputs!
Overvoltage category II / contamination degree 2: All connections of the device provided for operation with 230 V AC supply voltage **must** be wired with the same outer conductor (L). 400 V AC between neighbouring connection terminals is **not** permitted!
No mixed operation of the voltage levels! Low voltage (230 V AC) **and** safety extra-low voltage (24 V AC/DC) must **not be connected together** at the relay outputs!

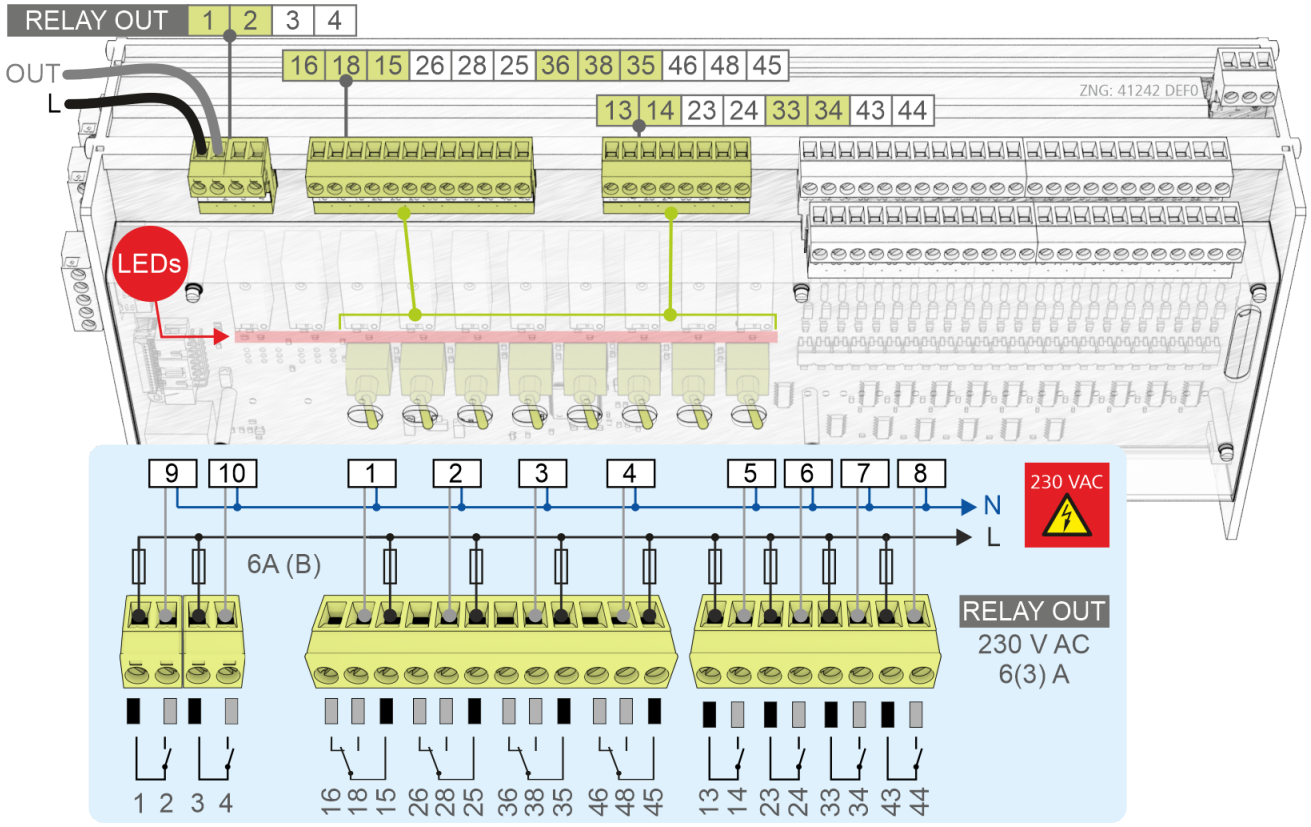
ATTENTION

Fuse protection for the supply line of the relay outputs: A circuit breaker with the following characteristics **must** be used per relay output:

- Rated current for 230 V AC: 6(3) A
- Tripping characteristic (type): B

Damage to the connector socket: Note the handling of wide COMBICON plugs.
Manual control switch on the base and extension module: The relay outputs 1..8 (not 9 and 10) of the base module and all relay outputs of the extension module can be manually overridden via the associated manual control switches on the front, for details see chapter Operating modes manual/ automatic GLT..
Practical tip: The configured functionality of the relay outputs should be noted on the front in the spaces provided to make it later manual operation easier.

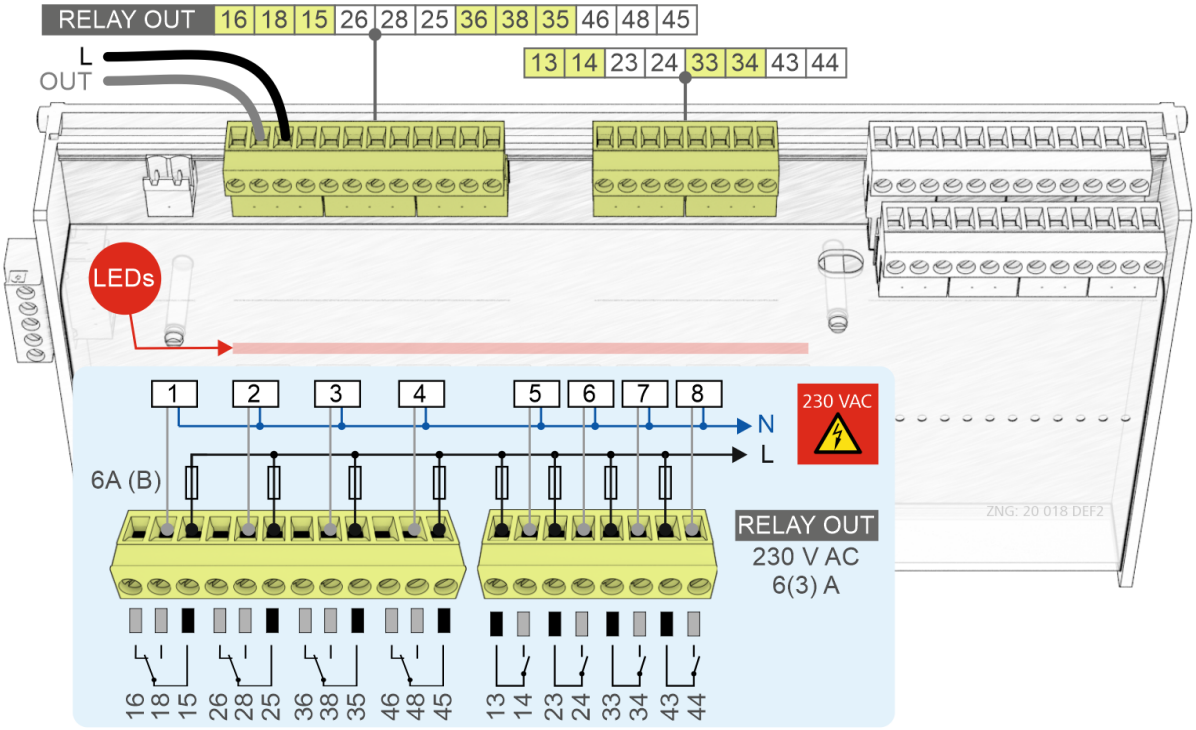
Relay outputs on the base module



Terminal assignment of the relay outputs

Terminal No.	I/O No.	Address in the process image	Function
Base module			
16, 18, 15	1	QX0.0	Freely programmable
26, 28, 25	2	QX0.1	
36, 38, 35	3	QX0.2	
46, 48, 45	4	QX0.3	
13, 14	5	QX0.4	
23, 24	6	QX0.5	
33, 34	7	QX0.6	
43, 44	8	QX0.7	
1, 2	9	QX0.8	
3, 4	10	QX0.9	

Relay outputs on the SIOX Extension Module



Relay outputs Terminal No.	I/O No.			Address in the process image			Function
SIOX 1..3	**SIOX 1**	**SIOX 2**	**SIOX 3**	**SIOX 1**	**SIOX 2**	**SIOX 3**	
16, 18, 15	11	19	27	QX1.0	QX2.0	QX3.0	Freely programmable
26, 28, 25	12	20	28	QX1.1	QX2.1	QX3.1	
36, 38, 35	13	21	29	QX1.2	QX2.2	QX3.2	
46, 48, 45	14	22	30	QX1.3	QX2.3	QX3.3	
13, 14	15	23	31	QX1.4	QX2.4	QX3.4	
23, 24	16	24	32	QX1.5	QX2.5	QX3.5	
33, 34	17	25	33	QX1.6	QX2.6	QX3.6	
43, 44	18	26	34	QX1.7	QX2.7	QX3.7	

10.2.3 Assignment of the digital inputs - 230 V AC / 24 V AC/DC

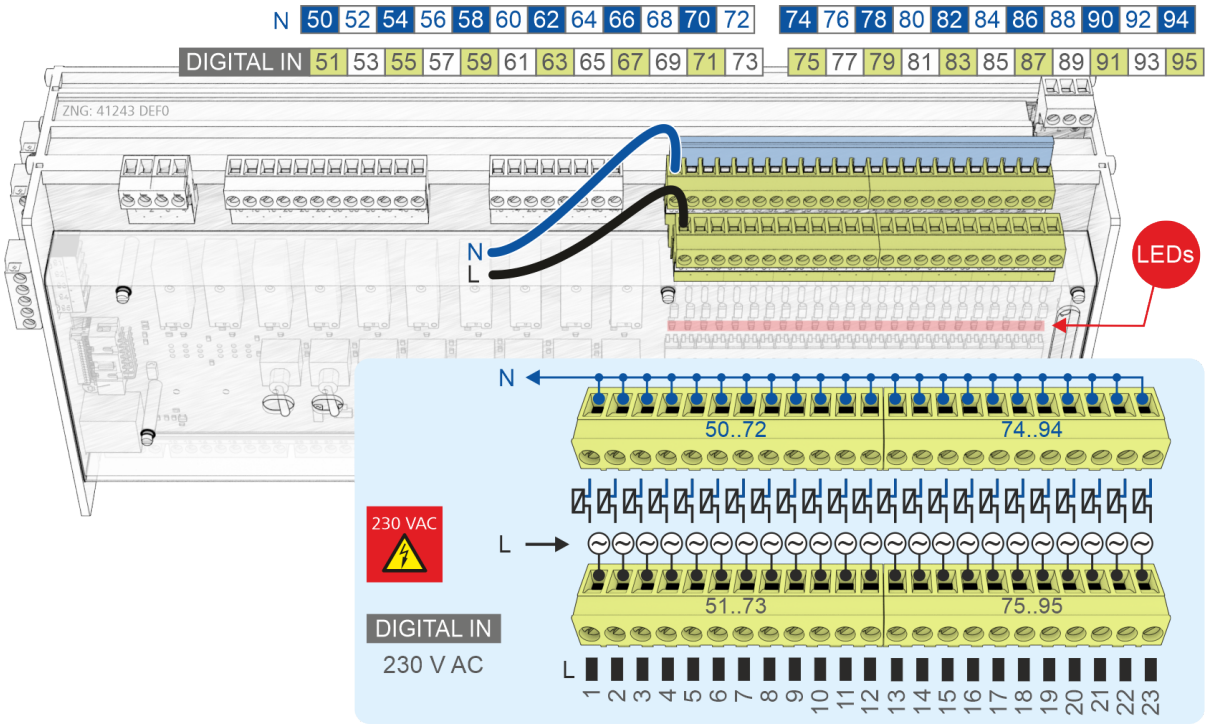
DANGER

Warning about dangerous electrical voltage! Danger to life - Danger of electric shock!
BEFORE connecting and disconnecting, it must be ensured that **no voltage** is present at all connections of the controller.
Overvoltage category II / contamination degree 2: All connections of the device provided for operation with 230 V AC supply voltage **must** be wired with the same outer conductor (L). 400 V AC between neighbouring connection terminals is **not** permitted!
NO mixed operation of the voltage levels! Low voltage (230 V AC) **and** protective extra-low voltage (24 V AC/DC) **must not be connected together** at the digital inputs, **mixed operation is NOT permitted**!

ATTENTION

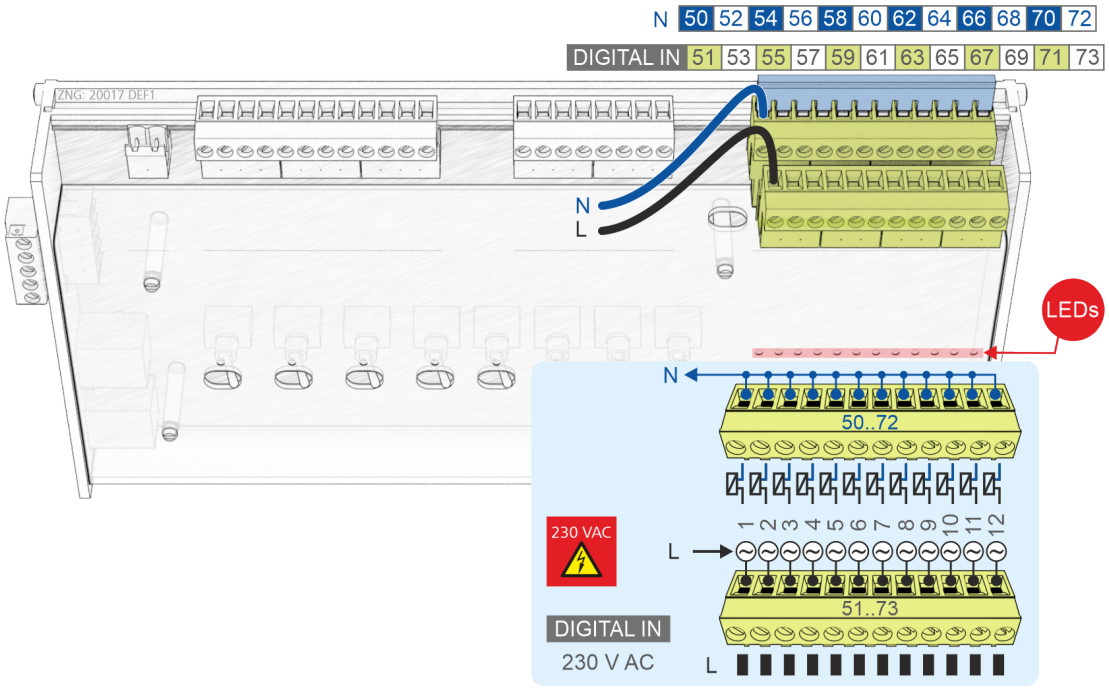
- **Base Module only - Configuration of the digital inputs:** For the digital inputs, ensure that the jumper position is correctly configured for 230 V AC or 24 V AC/DC. If 230 V AC is applied to a digital input that has been configured for 24 V AC, this results in destruction of the digital inputs! For details, see chapter Configuration of the digital inputs 230 V AC / 24 V AC/DC.
- **SIOX:** The **digital inputs** of all expansion modules are **designed for 230 V AC**. A reconfiguration of the digital inputs to 24 V AC/DC by the user is no longer provided for.
  Practical tip: Use coupling relays if necessary.
- **Damage to the connector socket:** Observe the Handling Wide COMBICON Plugs!

Digital inputs on the base module



Terminal No.	I/O No.	Address in the process image	Function
Base module			
50, 51	1	IX0.0	Freely programmable
52, 53	2	IX0.1	
54, 55	3	IX0.2	
56, 57	4	IX0.3	
58, 59	5	IX0.4	
60, 61	6	IX0.5	
62, 63	7	IX0.6	
64, 65	8	IX0.7	
66, 67	9	IX0.8	
68, 69	10	IX0.9	
70, 71	11	IX0.10	
72, 73	12	IX0.11	
74, 75	13	IX0.12	
76, 77	14	IX0.13	
78, 79	15	IX0.14	
80, 81	16	IX0.15	
82, 83	17	IX1.0	
84, 85	18	IX1.1	
86, 87	19	IX1.2	
88, 89	20	IX1.3	
90, 91	21	IX1.4	
92, 93	22	IX1.5	
94, 95	23	IX1.6	

Assignment of the digital inputs on the SIOX extension module



Digital input Terminal No.	I/O No.			Address in the process image			Function
SIOX 1..3	SIOX 1	SIOX 2	SIOX 3	SIOX 1	SIOX 2	SIOX 3	
50, 51	25	37	49	IX2.0	IX4.0	IX6.0	Freely programmable
52, 53	26	38	50	IX2.1	IX4.1	IX6.1	
54, 55	27	39	51	IX2.2	IX4.2	IX6.2	
56, 57	28	40	52	IX2.3	IX4.3	IX6.3	
58, 59	29	41	53	IX2.4	IX4.4	IX6.4	
60, 61	30	42	54	IX2.5	IX4.5	IX6.5	
62, 63	31	43	55	IX2.6	IX4.6	IX6.6	
64, 65	32	44	56	IX2.7	IX4.7	IX6.7	
66, 67	33	45	57	IX2.8	IX4.8	IX6.8	
68, 69	34	46	58	IX2.9	IX4.9	IX6.9	
70, 71	35	47	59	IX2.10	IX4.10	IX6.10	
72, 73	36	48	60	IX2.11	IX4.11	IX6.11	

10.2.3.1 Configuration of the digital inputs 230 V AC / 24 V AC/DC

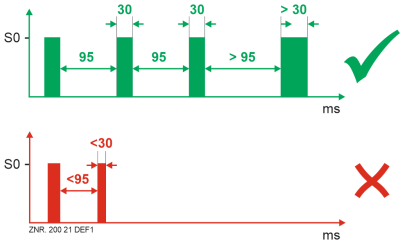
Base module ONLY - No SIOX

All digital inputs of the base module can be configured

- to 230 V AC (factory setting)
  or
- to 24 V AC/DC using jumpers.

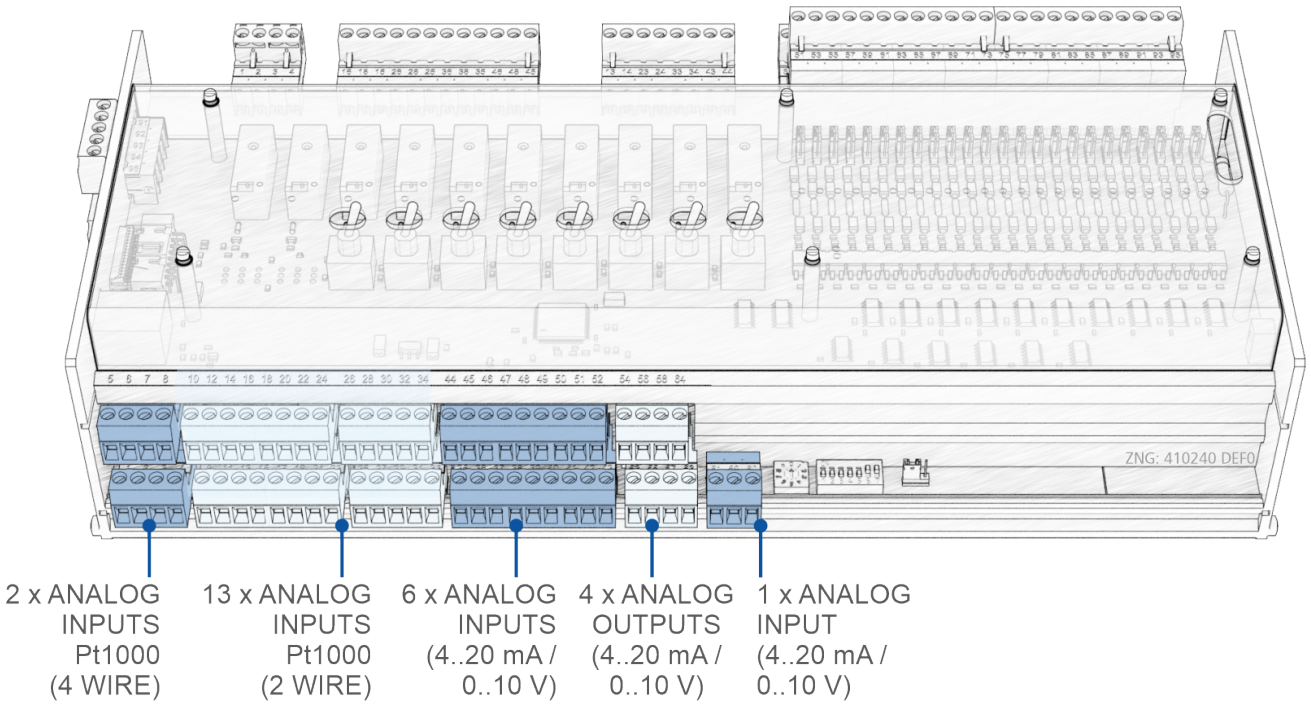
Warning about dangerous electrical voltage! Danger to life - Danger of electric shock!
BEFORE connecting and disconnecting, it must be ensured that **no voltage** is present at all connections of the controller.
Configuration of the jumpers: Always carry out the work in a de-energised state and with the connectors at the digital inputs disconnected!
Wiring of the digital inputs: If 230 V AC is connected to an input that has been configured for 24 V AC, this results in destruction of the control component!
NO mixed operation of the voltage levels! Low voltage (230 V AC) **and** protective extra-low voltage (24 V AC/DC) **must not be connected together** at the relay outputs, **mixed operation is NOT permitted**!

Configuration of the digital inputs

Jumper	Voltage	Function / conditions	Diagram
	230 V AC (factory setting)	• Only AC voltage signals are supported. • The N conductor **must** be connected on the terminal level (50..72), here using the example of terminals 50..62 with jumper.	-
	24 V AC/ DC	• AC and DC low voltage signals are detected and evaluated. **Exception:** acquisition of 24 V **DC** counter pulses (S0 interface) To count S0 pulses, these must be at least 95 ms apart, otherwise faster pulse sequences will not be detected. The pulse width must be at least 30 ms. • GND of 24 V **DC must** be connected on the terminal level (50..72), here using the example of terminals 66..72 with jumper.	

For details about the assignment, see chapter Assignment of the digital inputs - 230 V AC / 24 V AC/DC.

10.3 Connections for safety extra-low voltage (bottom)

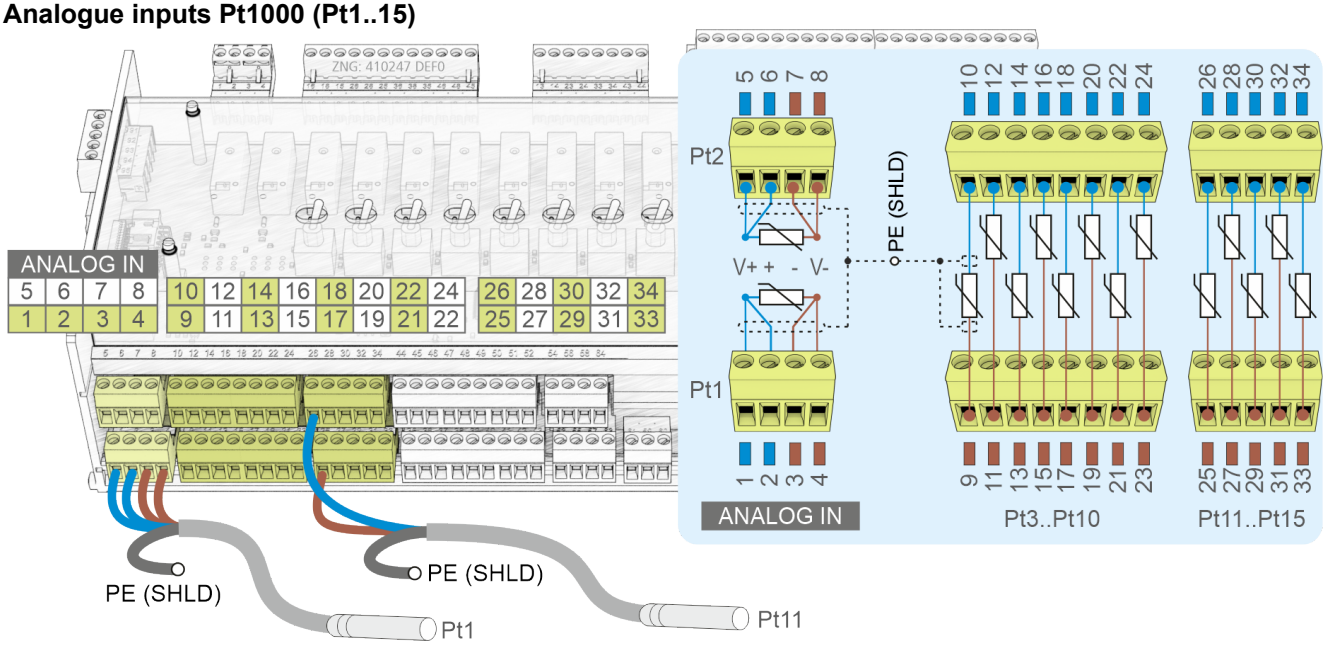


10.3.1 Assignment of the analogue inputs

DANGER

Warning about dangerous electrical voltage! Danger to life - Danger of electric shock! If supply voltage is connected to the analogue inputs, there is a risk of personal injury as the analogue inputs are not galvanically isolated from other system components (e.g. pressure transmitters). Furthermore this will destroy the controller!

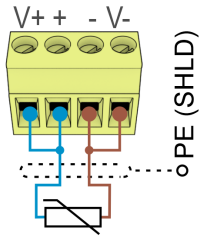
Analogue inputs Pt1000 (Pt1..15)



ATTENTION

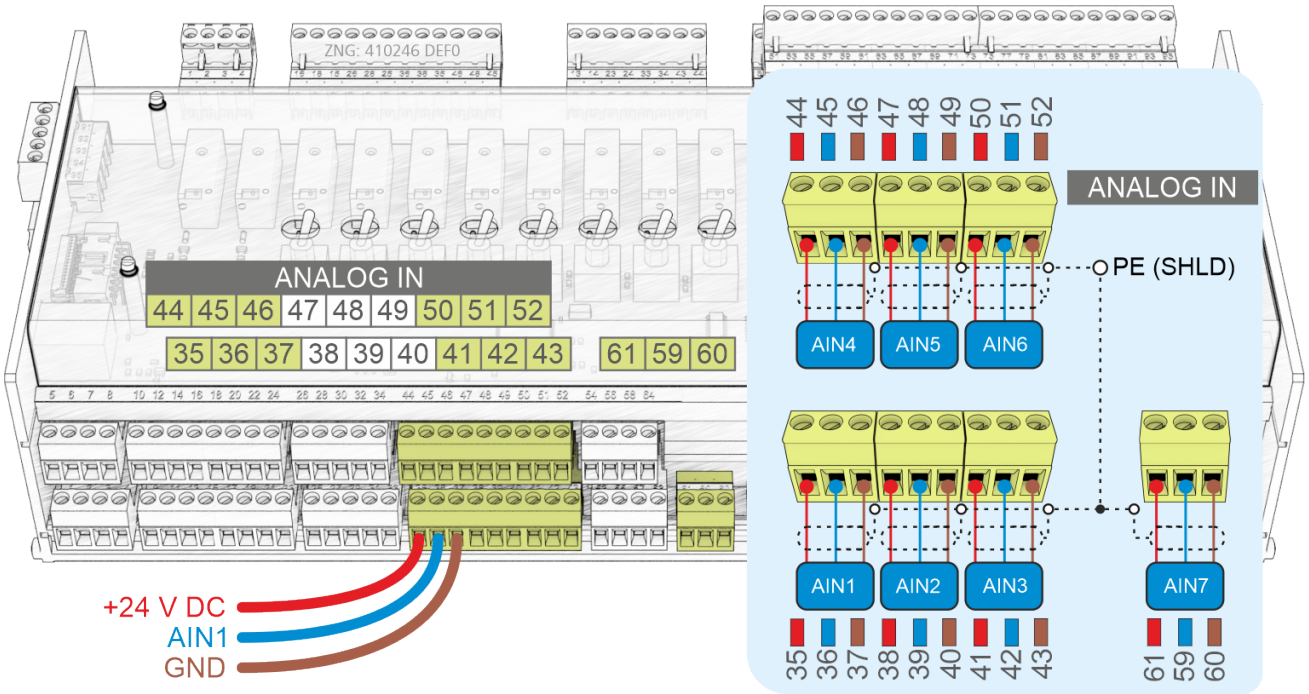
Malfunction due to interference! All supply lines from and to the controller (with the exception of the 230 V power supply and signal lines) must be shielded (cable type LiYCY)! This particularly applies for the analogue inputs and outputs (e.g. sensor supply lines). As a general rule, care should be taken to ensure that signal cables and cables carrying mains voltage are routed in separate cable channels The following must also be observed for the installation of the analogue inputs:

- Correct sensor positioning
- Correct fixing of the sensors by using metal clamps and thermally conductive paste
- Insulation of the sensors (e.g. protect sensors against direct exposure to sunlight)

Pt1000 (Pt) Terminal No.	I/O No.	Address in the process image	Assignment	Function
4-wire technology *				
1, 2, 3, 4	1	II26	V+, +,-, -V	Freely programmable
5, 6, 7, 8	2	II27	V+, +,-, -V	
* The analogue inputs can also be used in 2-wire technology by bridging the terminals V+ with + and - with -V: 				
2-wire technology				
9, 10	3	II28		Freely programmable
11, 12	4	II29		
13, 14	5	II30		
15, 16	6	II31		
17, 18	7	II32		
19, 20	8	II33		
21, 22	9	II34		
23, 24	10	II35		
25, 26	11	II36		
27, 28	12	II37		
29, 30	13	II38		
31, 32	14	II39		
33, 34	15	II40		

Note: The use of temperature sensors in 2-wire technology results in large measurement errors over long distances! For further details, see EDP.

Analogue inputs (AIN1..7)



AIN Terminal No.	I/O No.	Address in the process image	Assignment at the factory	Function
35 36 37	1	IW42	+24 V 0..10 V GND	Freely programmable
38 39 40	2	IW43	+24 V 0..10 V GND	
41 42 43	3	IW44	+24 V 0..10 V GND	
44 45 46	4	IW45	+24 V 0..10 V GND	
47 48 49	5	IW46	+24 V 0..10 V GND	
50 51 52	6	IW47	+24 V 0..10 V GND	
61 59 60	7	IW48	+24 V 4..20 mA GND	

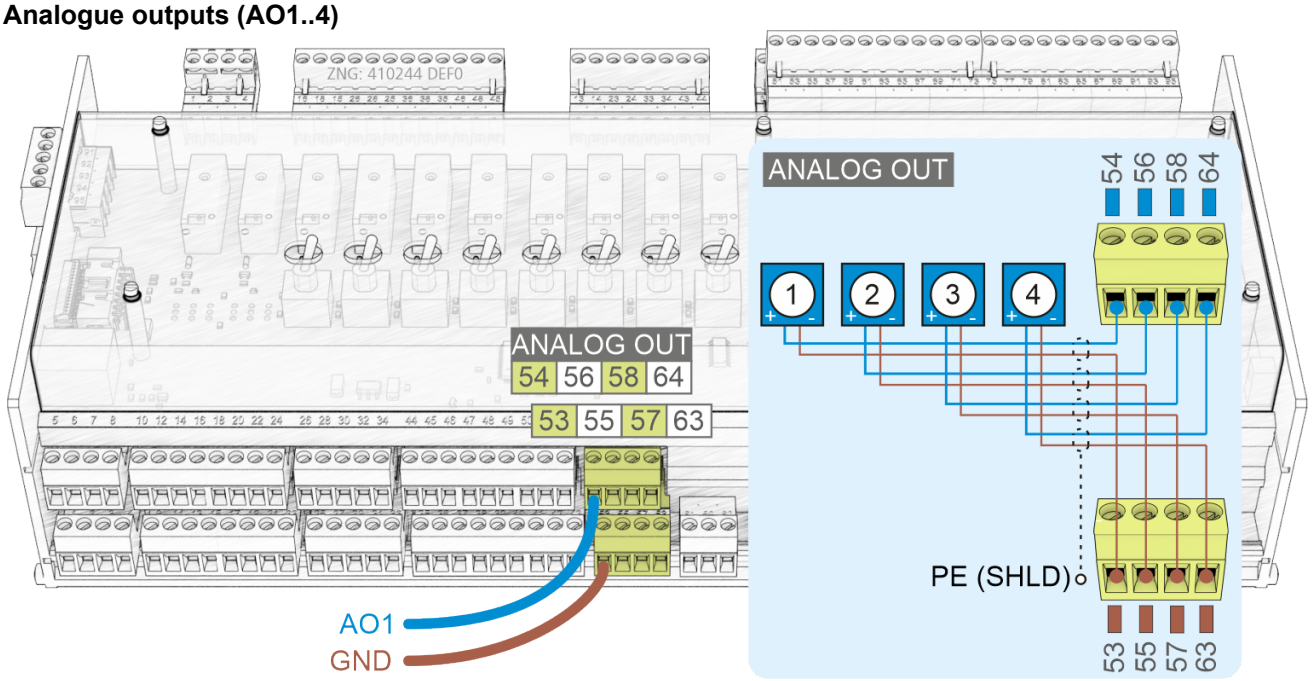
For details, see chapter Configuration of the analogue inputs and outputs at the factory.

10.3.2 Assignment of the analogue outputs

DANGER

Warning about dangerous electrical voltage! Danger to life - Danger of electric shock! If supply voltage is connected to the analogue outputs, there is a risk of personal injury as the analogue outputs are not galvanically isolated from other system components (e.g. pressure transmitters). Furthermore this will destroy the controller!

Analogue outputs (AO1..4)



ATTENTION

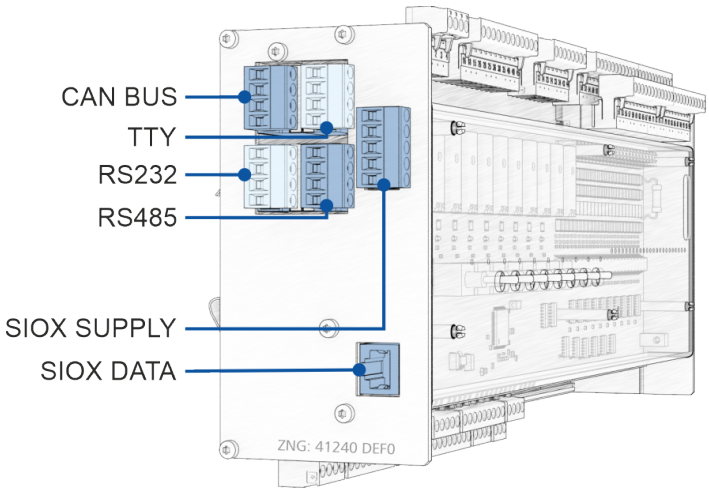
Malfunction due to interference! All supply lines from and to the controller (with the exception of the 230 V power supply and signal lines) must be shielded (cable type LiYCY)! This particularly applies for the analogue inputs and outputs (e.g. sensor supply lines). As a general rule, care should be taken to ensure that signal cables and cables carrying mains voltage are routed in separate cable channels

AO Terminal No.	I/O No.	Address process image	Assignment at the factory	Function
53 54	1	QW28	0..10 V GND	Freely programmable
55 56	2	QW29	0..10 V GND	
57 58	3	QW30	0..10 V GND	
63 64	4	QW31	0..10 V GND	

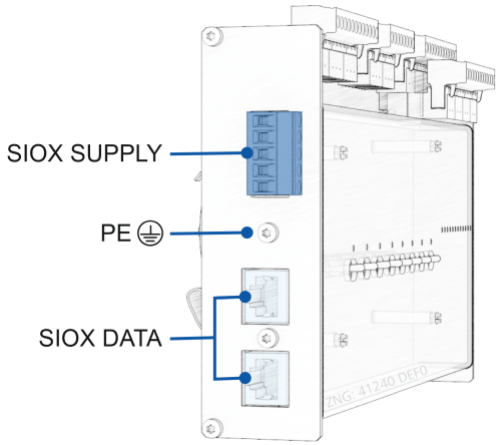
For details, see chapter Configuration of the analogue inputs and outputs at the factory.

10.4 Connections for interfaces (on the side)

Base module



SIOX Extension Module



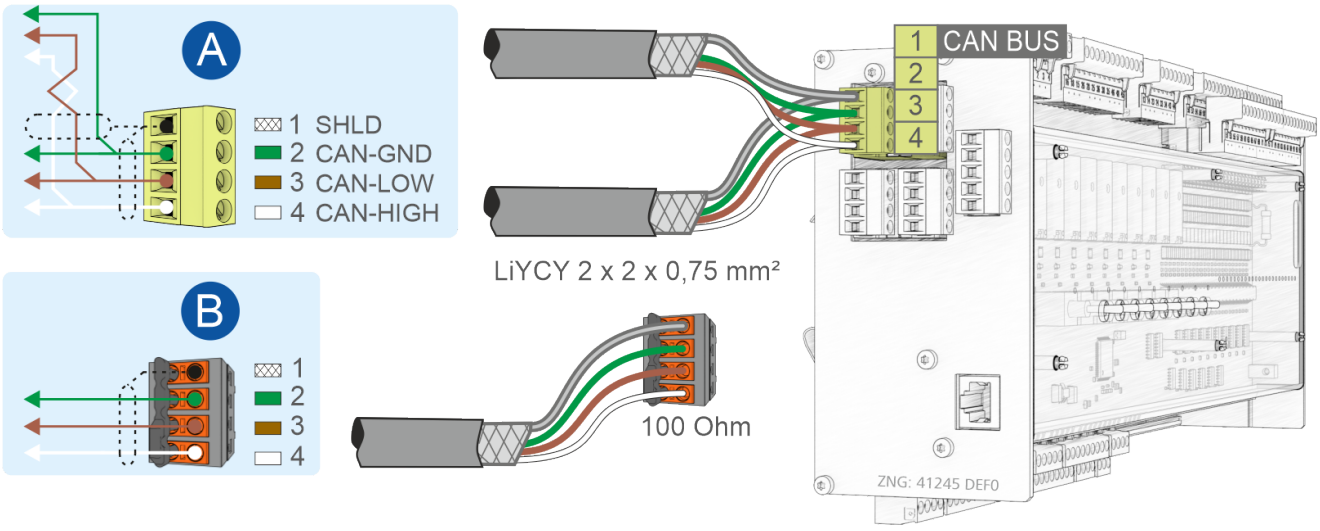
10.4.1 CAN Bus Assignment

DANGER

Warning about dangerous electrical voltage! Danger to life - Danger of electric shock! BEFORE connecting and disconnecting, it must be ensured that **no voltage** is present at all connections of the controller.

ATTENTION

All CAN bus supply lines must be shielded (cable type: **LiYCY 2x2x0.75 mm²**). As a general rule, care should be taken to ensure that signal cables and cables carrying mains voltage are routed in separate cable channels Maximum length of the cable: 500 m.
Wiring Variant A: Device is a node in a CAN bus segment with other nodes before and after this, **no terminating resistor** required.
Wiring Variant B: Device is at the start / end of a CAN bus segment, **a 100 Ohm terminating resistor is required** (part number KGLCANTERM).
For further details about the CAN bus, see operating manual "E*LDS Basics, Safety Instructions, CAN Bus & Modbus".



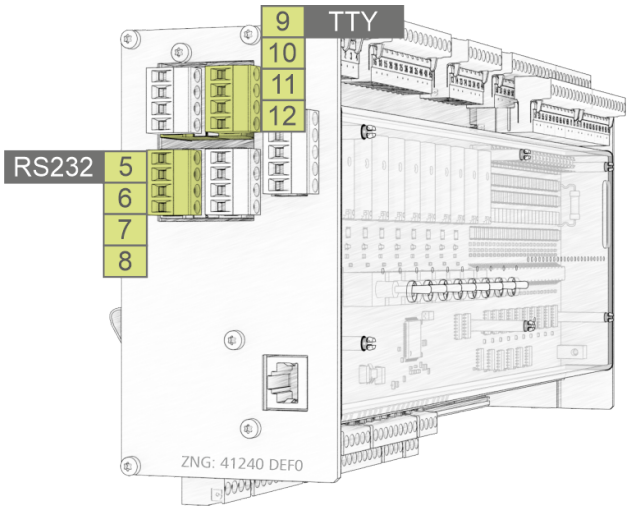
CAN BUS on the base module			
Description	**Terminal No.**	**Connection**	**Wire colour**
Standard, for connection to the E*LDS system			
CAN BUS	1 2 3 4	SHIELD CAN-GND (Ground) CAN-LOW CAN-HIGH	shield green brown white

For details, see chapter Setting the CAN bus address using decade switch S2.

10.4.2 Assignment RS232 and TTY

DANGER

Warning about dangerous electrical voltage! Danger to life - Danger of electric shock! BEFORE connecting and disconnecting, it must be ensured that **no voltage** is present at all connections of the controller.



RS232 and TTY on the base module			
Description	**Terminal No.**	**Connection**	**Function**
RS232	5, 6, 7, 8	TxD, RxD, RTS, CTS	• TxD, RxD: Coupling with notebook or PC (CODESYS), for details about connecting the controller see chapter Requirements for firmware update • RTS, CTS: not used
TTY	9, 10, 11, 12	TxD+, TxD-, RxD+, RxD-	• not used

For details, see chapter Setting of the interfaces RS485/TTY using jumper J1.

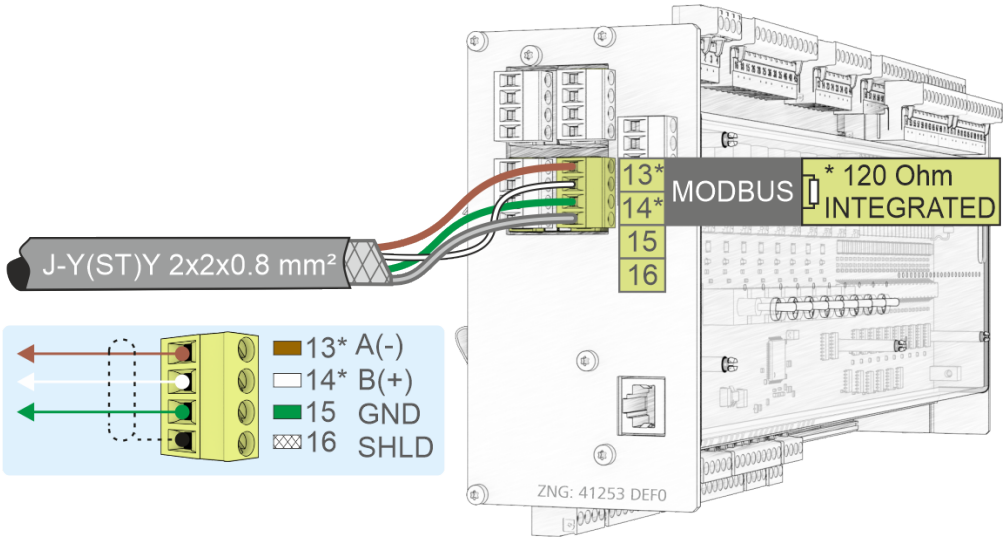
10.4.3 Assignment RS485

DANGER

Warning about dangerous electrical voltage! Danger to life - Danger of electric shock! BEFORE connecting and disconnecting, it must be ensured that **no voltage** is present at all connections of the controller.

ATTENTION

All Modbus supply lines must be shielded (cable type **J-Y(ST)Y 2x2x0.8 mm²**), the maximum length of the cable is 1000 m! As a general rule, care should be taken to ensure that signal cables and cables carrying mains voltage are routed in separate cable channels
For further details about the CAN bus, see operating manual "E*LDS Basics, Safety Instructions, CAN Bus & Modbus".



RS485 on the base module				
Description	**Terminal No.**	**Connection**	**Wire colour**	**Function**
RS485	13* 14*	RS485 A(-) RS485 B(+)	brown white	For coupling third party controllers to the Modbus, see chapter Assignment Modbus Modules Assignment Modbus Modules
	15 16	GND SHIELD	green shield	Connection for RS485 **and** RS232 interface Shield

*** Special feature:**
A terminating resistor of **120 Ohm is already permanently installed** (integrated) in the controller between the terminals **13 A(-)** and **14 B(+)**. Thus this interface represents the beginning of the Modbus, a termination at these terminals is **not** required and must **not** be done! A terminating resistor of 100 Ohm **must** only be installed **at the end of the line (at the last Modbus module)**.
Note: From serial number "*14xxxxx*" onwards, a 120 Ohm terminating resistor is permanently integrated in the controller between terminals 13/14.
The interface must be configured via jumper J1 before use.

For details, see chapter Setting of the interfaces TTY/RS485 using jumper J1.

10.4.3.1 Assignment Modbus Modules

Warning about dangerous electrical voltage! Danger to life - Danger of electric shock! If supply voltage is connected to the analogue outputs, there is a risk of personal injury as the RS485 interface is **not** galvanically isolated from other system components (e.g. pressure transmitters). Furthermore this will destroy the controller!
BEFORE connecting and disconnecting, it must be checked that no voltage is present at the 230 V AC relay outputs! Low voltage **and** safety extra-low voltage must not be applied together at the relay outputs!

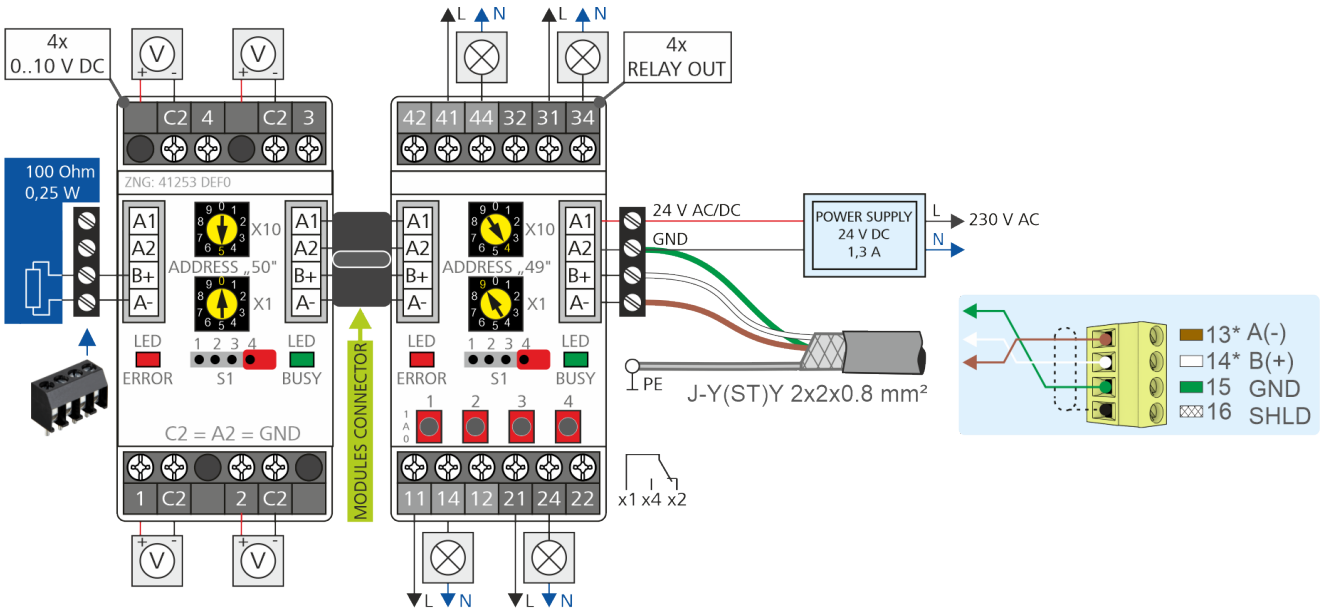
ATTENTION

Malfunction due to interference! All supply lines from and to the controller (with the exception of the 230 V power supply and signal lines) must be shielded (cable type LiYCY)! This particularly applies for the analogue inputs and outputs (e.g. sensor supply lines). As a general rule, care should be taken to ensure that signal cables and cables carrying mains voltage are routed in separate cable channels

The controller can be extended in each case by 4 relay outputs (4 x 230 V AC) and 4 analogue outputs (4 x 0..10 V DC) with the Modbus modules from Metz.

Type	Photo	Function	Part number
Modbus analogue module		4 analogue outputs 0..10 V DC	MODBAOUT02
Modbus relay module		4 relay outputs with manual control switches 230 V AC	MODBDOUT04
Power supply	-	230 V AC / 24 V DC, 1.25 A	KGLNT24V1P

Connection of the Modbus modules to the base module and the power supply
Modbus modules can be connected via the RS485 interface on the base module to expand the I/Os.



*** Note: A terminating resistor of 100 Ohm must** be installed at the end of the Modbus cable (drawing on the left, part number W100R00004), for details see EDP.

Configuration of the Modbus modules

The Modbus modules are set with *parity = even* and *bit rate of 19200 bit/s* at the factory. Further details can be found in the description of the Modbus modules.

Setting of the Modbus address

1. Disconnect module from the power supply.
2. Set Modbus address "**1..99**" (address selector switches X10 and X1).
   Example:
   X10 = 4 = 4 x 10 = 40 and
   X1 = 9 = 9 x 1 = 9
   Modbus address = X10 + X1 = 40 + 9 = 49
3. Connect 100 Ohm terminating resistor to the last Modbus module (drawing on the left).
4. Supply power to module.

The communication parameters of the Modbus interface are configured in CODESYS.

10.4.4 Assignment SIOX

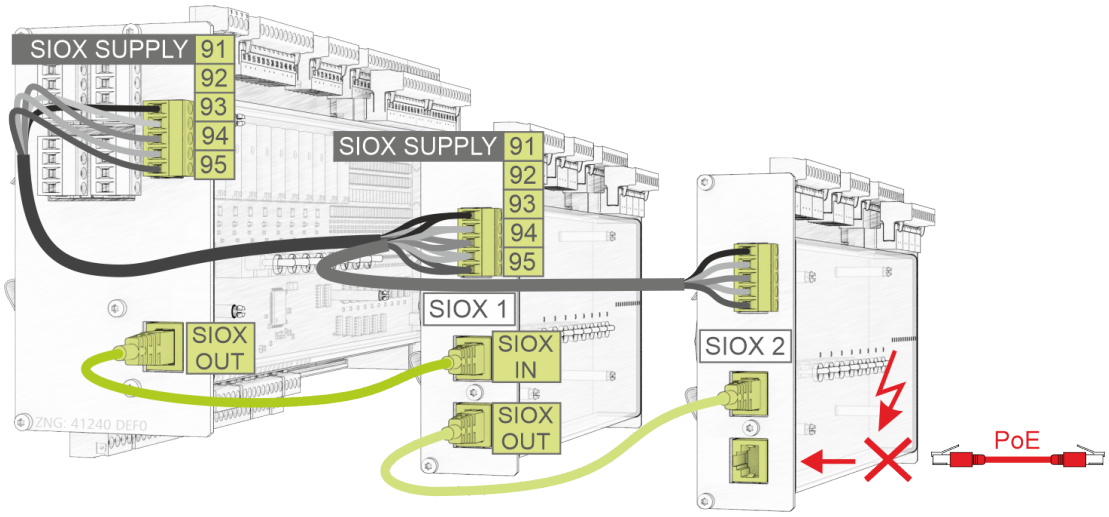
DANGER

Warning about dangerous electrical voltage! Danger to life - Danger of electric shock! BEFORE connecting and disconnecting, it must be ensured that **no voltage** is present at all connections of the controller.

ATTENTION

Danger of destruction of components! SIOX extension modules may only be connected to each other or the controller when no voltage is present! In the event of an Ethernet network cable with PoE (Power over Ethernet) being used instead of the SIOX data cable (RJ45) damage can occur to participating network devices!
Malfunctions due to interference! All supply lines from and to the controller (with the exception of the 230 V power supply and signal lines) must be shielded! As a general rule, care should be taken to ensure that signal cables and cables carrying mains voltage are routed in separate cable channels.

Example configuration: base module with two SIOX extension modules:



Designation and terminal no.		Function - For details, see chapter SIOX Extension Module.
Base module	**SIOX 1..3**	
91 92 93 94 95	91 92 93 94 95	**SIOX SUPPLY** - power supply for SIOX modules GROUND of 9 V +9 V DC GROUND of 24 V +24 V DC SHIELD
SIOX OUT	SIOX OUT	**SIOX data cable** - output for communication with SIOX module(s)
-	SIOX IN	**SIOX data cable** - input for communication with base module

SIOX operating instructions

Comprehensive details on the SIOX extension modules and their current operating instructions can be found here:
https://edp.eckelmann.de/edp/lds/_S88KwDvR7a

11 Manual / Automatic operating modes changeover

The Manual / Off /Automatic selection is available in the same way for the base module and the SIOX extension module. These can be used for the following purposes:

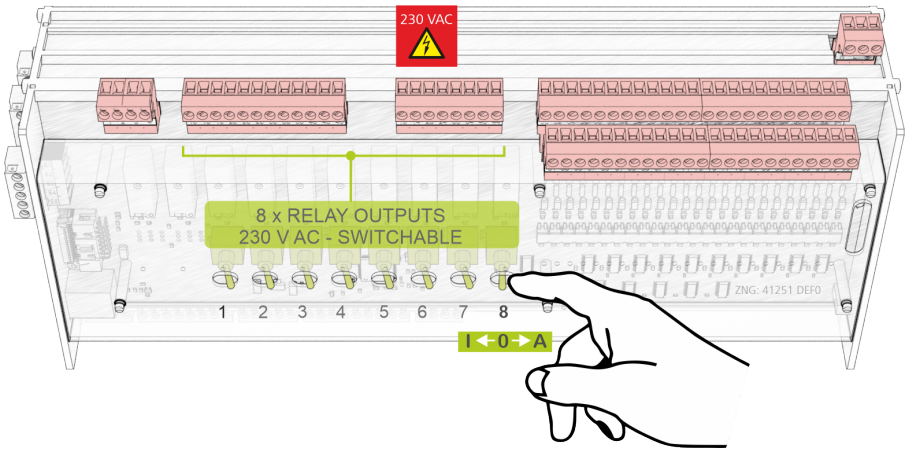
1. Service, commissioning or TÜV acceptance
2. Emergency operation

Other operating modes are possible, but must be programmed by the developer of the planned application. The coding switches 1..4 of DIP switch S1 can also be used for this purpose, see chapter Default settings using DIP switch S1. Possible applications are:

- **Service mode** - to disable certain predefined functions, for example so that the acceptance of an expert can be supported
- **Expansion stages** - for the programs e.g. one or two desuperheaters

Manual mode enables permanent switching from Automatic mode to Manual ON (I) or to Manual OFF (O). The program control for the respective selected field device has no function in manual mode. Manual/automatic switching of the respective field device, which depends on the application, is performed via the switches located on the front.

Example on the base module (S8 on O = Manual OFF)



The following switch positions are possible:

- **Automatic ON (A) - switch position for "normal operation "**
  If any switch is in the A position, the controller registers the logical state AUTOMATIC OPERATION:
  The connected equipment is **controlled as the software envisages**.
- **Manual OFF (O)**
  If any switch is in the 0 position, the controller registers the logical state MANUAL OPERATION OFF:
  The connected equipment is **not controlled** - even if the software envisages this
  , e.g. pump remains off continuously! Or it could be, for example, a " Manual active" indicator lamp on the switch cabinet door or a priority message via the CAN bus.
- **Manual ON (I)**
  If any switch is in the I position, the controller registers the logical state MANUAL OPERATION ON:
  The connected equipment is **always controlled** - even if the software does not envisage this
  , e.g. pump remains on continuously!

> The Manual ON (I) and Manual OFF (O) positions override the state desired by the software! The Automatic Operation (A) by the program in the controller is inoperative until the respective switch is set to *AUTO* again.

12 Decommissioning and Disposal

12.1 Decommissioning / Dismantling

The dismantling of the equipment may only be performed by authorised and trained personnel.

DANGER

Warning of dangerous electrical voltage! Danger to life - danger of electric shock!
During dismantling, the same safety instructions and hazard warnings must be observed as for installation, putting into service and maintenance, see chapter Safety instructions.

ATTENTION

For dismantlement, follow the steps for assembly in reverse order, see chapter Installation and Start-Up.

12.2 Disposal

NOTICE

WEEE Reg. No.
DE 12052799

Negative consequences for humans and the environment possible through environmentally unfriendly disposal!
The symbol for the separate disposal of electrical and electronic equipment represents a crossed-out wheeled trash bin and indicates that an electrical or electronic equipment marked with this symbol may not be disposed of with household waste at the end of its service life, but must be taken for separate disposal by the end user.

- In accordance with the contractual agreement, the customer is obliged to dispose of electrical and electronic waste in compliance with the statutory regulations based on the „Directive 2012/19/EU of the European Parliament on waste electrical and electronic equipment“.
- This device contains a lithium battery (for details see chapter Electrical data), which must be disposed separately!
    - **Devices with battery holder:** The battery **must** be removed from the device by the end user and **must** be disposed separately, for details see chapter Battery replacement.
    - **Devices without battery holder:** The battery contained in the device **cannot** be removed by the end user, as it is permanently installed in the device and there is no provision for battery replacement.
- Dispose the packaging, the product and its components in an environmentally friendly manner at the end of their service life. Follow the national guidelines and laws that apply to you.

Users have the option of returning a B2B device distributed by us to us at the end of its service life. Please contact your customer service representative at Eckelmann AG to arrange for the device to be taken back and disposed of properly. Please inform yourself about the local regulations for the separate disposal of electrical and electronic products and batteries. Further information on the Electrical and Electronic Equipment Act can be found at www.elektrogesetz.de.

13 Alarms and Messages GLT x010

13.1 Message system

The messages and alarms to be reported by the controller are defined in the CODESYS application, and the controller can also generate a number of internal alarms. The messages and alarms are transmitted from the controller via the CAN bus to the system centre, which then stores, manages and, if necessary, forwards them.

A priority is assigned to each alarm/message. The priorities can be logically grouped using decades, which enables maintenance group oriented alarm management.

13.2 Structure of the messages

Messages consist of date, time, the priority and message-specific plain text. They are shown on the display of the operator terminal in 3 lines of 20 characters each. One line is used for the display of the active controller.

Line	Example	Data
1	Messages ID: xxxxx	Active controller
2	Motor overload cut-out C1	Message text
3	20/05/17 10:20 IN	Date (DD/MM/YY) and time of the message
4	20/05/17 10:25 OUT	Date (DD/MM/YY) and time of clearance of the fault

Up to 100 alarm priorities are provided. The possible priorities for alarms and messages have now been increased from the previous "---", 0, 1 and 2 to 99. This priority range is divided into 10 alarm groups (decades).

- The 1 and 2 priorities (1,11,21,...91 and 2,12,22,...92) are reserved for high priority alarms that activate the alarm relays “PRIO1” and “PRIO2” as well as the LEDs “PRIO1” and “PRIO2” on the front of the system centre.
- The highest priority number in each group (9,19,29,...99) is reserved for low priority alarms which should only generate local alarm signalling (e.g. open cold room door).
- All other priority numbers are intended for low priority alarms.
- The lowest priority number in each group (0,10,20,..90) is reserved for messages that are only recorded in the message list.
- If the priority is set to "–", no message is generated.

ONLY CI 3x00 with firmware version < 5.0.
The store computer versions do not support alarm priorities > 2 until version 5.0 and higher.
If priorities of 3..99 are configured in the controller, the store computer may have to be updated to version 5.0 or higher via a firmware update. For more information about the store computer (e.g. firmware and operating manual), see EDP.

13.3 Message types

The message types are basically differentiated into:

- Process error messages
- System error messages

Process error messages
The programmer determines the repertoire of messages in the *Signal List* (see chapter Message types) and defines there the priority with which the respective messages should alert.

$TXT	$EA1	$EA2	$REF	$PRIO	$LDSTXT
Signal / Feldgerät	E/A-Bereich	Bezeichner für Ein-/Ausgang	Kanal Ref	Alarmprio	Text
Pump.Heizregister Stör.	IX0.1	_E_PUMPE_HZREG	202	2	Pumpe HzRegister Störung
	MX5.10.1	MA_PUMPE_HZREG_	204	2	Pumpe HzRegister Störung
Regelventil Heizregister	QW28	A_VENTIL_HZREG	206		Regelventil Befehl
	IW42	E_VENTIL_HZREG_RI	208		Regelventil Rückmeldung
	MX5.30.0	MA_VENTIL_HZREG_	210	2	Regelventil Störung
Frostschutzthermostat	IX0.2	_E_FST	214	0	Frostschutzthermostat
	MX5.20.2	MA_FST_ERR	216	2	Frostschutz-Alarm
Reglerausgang	MW4.10	MA_Y_VENTIL_HZRE(	218		Reglerausg
Lüfter Motor ein	QX0.5	A_LUEFTER	220		Lüfter
Lüfter Motor Rep/ TK	IX0.3	_E_LUEFTER_ERR	222		
	MX5.20.3	MA_LUEFTER_ERR	224	2	Lüfter Störung
Aufheizphase zu lang	MX5.30.1	MA_HEIZ_DAUER	226	2	Alarm Dauerheizen
Temperatur Rücklauf Hei	IW29	E_T_HZREG_RL	228		Rücklauftemperatur

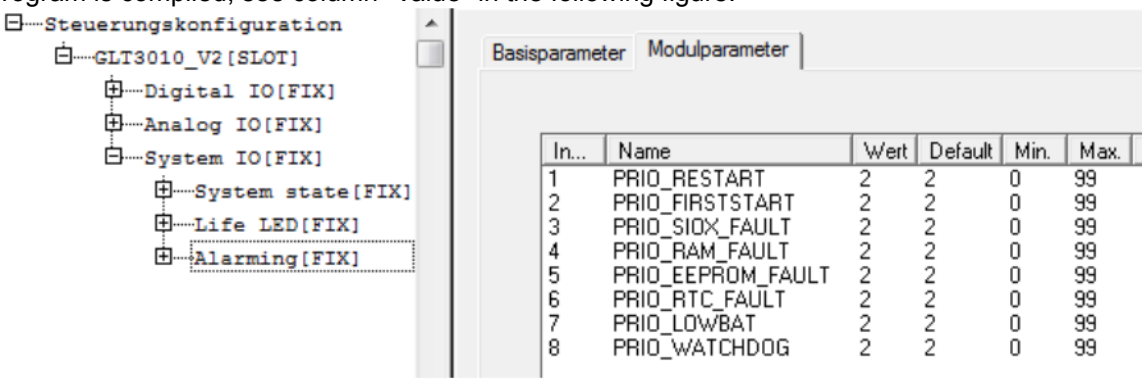
The example shows that when the potential-free *NC contact* IX0.2 opens (terminals 54/55), i.e. the process variable "_E_FST" changes from High to Low, a "*frost protection thermostat*" alarm is sent with priority 0. Assuming that the contact is processed further in the application by a function block and this sets the variable MA_FST_ERR, a "frost protection alarm" is then sent with priority 2.

System error messages
The system error messages refer to the hardware of the controller including the connected SIOX Extension Modules. The following system error messages are permanently stored in the firmware of the controller and cannot be influenced by programming the CODESYS application, only their prioritisation.

No.	Message text	System error message
2	RAM Fault	The internal data memory has a fault
4	EEPROM Fault	The internal EEPROM (parameters memory) has a fault
8	RTC Fault	Error in the real-time clock of the controller
9	Failure int SIOX Failure ext. SIOX x	Internal SIOX extension module has failed External SIOX extension module No. x (1..3) has failed
10	Battery Voltage	Internal battery fault
16	Watchdog	Internal watchdog of the pack controller deactivated (DIP switch S1 coding switch 6 = OFF, see chapter Installation and start-up GLT x010 / SIOX)
50	First Start	First start of the controller with loading of default parameters
51	Power Failure	Restart of the controller after a power failure

13.4 Setting the priorities

The alarm and message priorities can be changed in the Controller configuration with CODESYS **before** the program is compiled, see column "Value" in the following figure:



At program runtime, it is **no longer possible** to change these alarm and message priorities!

14 Technical Data GLT x010 / SIOX

14.1 Electrical Data GLT x010 / SIOX

DANGER

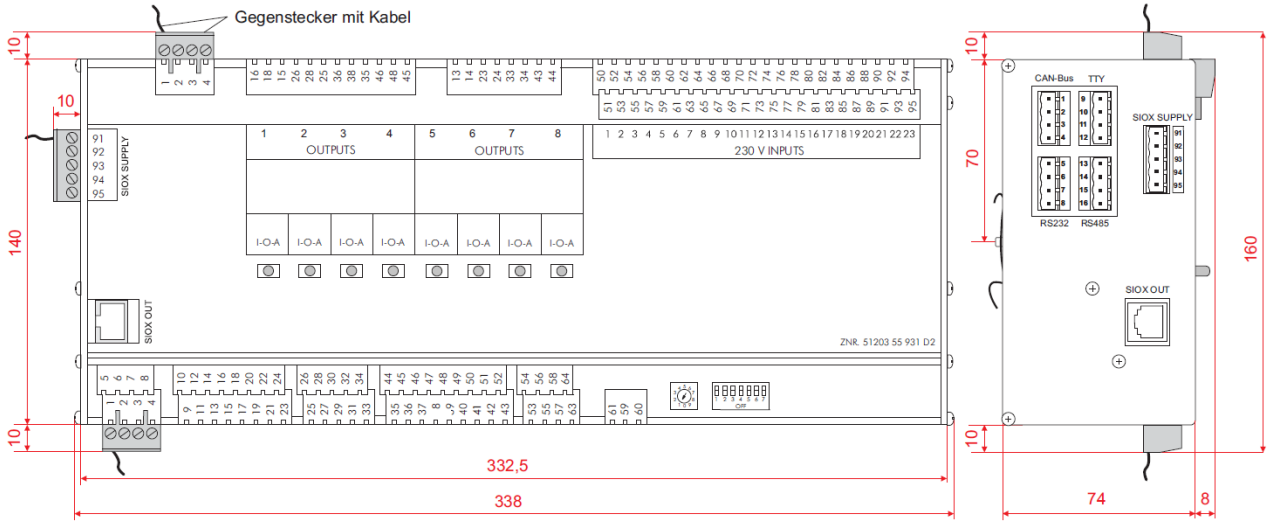
Overvoltage category III / contamination degree 2:
All connections of the device provided for operation with 230 V AC supply voltage **must** be wired with the same phase conductor. 400 V AC between neighbouring connection terminals is **not** permitted!
Overvoltage category II / contamination degree 2 or
overvoltage category II / contamination degree 1:
Different phase conductors may be used. 400 V AC between neighbouring connection terminals is permitted!

	Basic module
Operating voltage	230 V AC, 200 ... 265 V AC, 50/60 Hz
Rated power	24 VA
Leakage current over PE (protective earth)	max 1 mA
Digital inputs	23 x optionally 230 V AC or 24 V AC/DC, floating
Relay outputs	10 x 230 V AC, max. 6 A / min. 10 mA (6 NO contacts, 4 changeover contacts), floating
Manual control switch	The pack controller as well as the extension modules have manual control switches so that the regulation can be manually overridden in emergency operation.
Analogue inputs [1)]	13 x Pt1000 2-wire temperature sensor 2 x Pt1000 4-wire temperature sensor
	7 x 4..20 mA (resistance 400 ohm) / 0..10 V
Analogue outputs [1)]	4 x 0..10 V (load min. 1 kΩ) / 4..20 mA (resistance max. 800 ohm)

[1)] Supply cables to analogue inputs / outputs must be shielded. The number of analogue inputs/outputs depends on the factory setting, see chapter Configuration of the analogue inputs and outputs at the factory.

	Basic module
Field bus interface	CAN bus, zero potential
Data interfaces	SIOX OUT: Data interface for SIOX
	2 x serial RS232/RS485 1 x TTY (passive)
Other interfaces	SUPPLY: Power supply for SIOX
Real-time clock	With power reserve, lithium cell Type CRC 2450 N / 3 V Lithium Battery life 10 years Accuracy typically 12 minutes / year at 25 °C
Archive memory	Compressor run times, switching pulses, quotas, messages
Monitoring function	Watchdog
Environmental conditions	
Temperature range	Transport: -20 °C ... +80 °C Operation: 0 °C ... +50 °C
Temperature change	Transport: max. 20 K/h Operation: max. 10 K/h
Relative humidity (non-condensing)	Transport: 8% ... 80% Operation: 20% ... 80%
Shock according to DIN EN 60068-2-27	Transport and operation: 30 g
Vibration 10-150 Hz according to DIN EN 60068-2-6	Transport and operation: 2 g
Atmospheric pressure	Transport: 660 hPa ... 1060 hPa Operation: 860 hPa ... 1060 hPa
Weight	approx. 1600 g
Standards and Directives	
Protection rating	IP20
CE conformity	• Low Voltage Directive 2014/35/EU; Official Journal of the EU L96, 29/03/2014, pages 357-374 • EMC Directive 2014/30/EU; Official Journal of the EU L96, 29/03/2014, pages 79-106 • RoHS Directive 2011/65/EU; Official Journal of the EU L174, 01/07/2011, pages 88-110

14.2 Mechanische Daten GLT x010



Basic module with manual switch, all dimensions in mm.

15 Part numbers and accessories GLT x010

Product	Description	Part number
GLT 3010	Compact GLT 3010, freely programmable controller for individual solutions	GLT301011
GLT 5010	Compact GLT 5010, freely programmable controller for individual solutions	GLT5010111
SIOX	SIOX extension module (230 V AC) with switches	LISIOX0012
Accessories		
SIOX power supply cable	Power cable for the power supply of the SIOX, length 2 m	KABLIND006
SIOX data cable	Data cable from GLT x010/SIOX to SIOX in the lengths: 0.4 m 0.7 m 2.0 m 5.0 m	 KABLIND001 KABLIND002 KABLIND003 KABLIND007
Terminal set for CAN bus termination	Terminal set for CAN bus with terminating resistor 100 Ohm, 2 pieces.	KGLCANTERM
Terminating resistor 100 Ohm	Terminating resistor 100 Ohm for CAN bus	W100R00004
Flash cable	For performing a firmware update	KABLINDAD1
Null modem cable	For connecting the flash cable to the serial interface of the PC / notebook Length 3.0 m	PCZKABSER2
Extension for null modem cable	Extension for null modem cable Length 1.8 m	PCZKABSER3
Cylinder head sensor	Cylinder head sensor (2-wire Pt1000), brass	KGLZPTZYLM
Temperature sensor	Temperature sensor for connection to tube 2-wire Pt1000	KGLZPT1KTH
Humidity and temperature sensor	Combined humidity sensor (4..20 mA) and temperature sensor (4-wire Pt1000) for wall mounting	KGLZPTHYGR
Outdoor and store sensor	Temperature sensor (4-wire Pt1000) for wall mounting	KGLZPT1000
CO_2 and temperature sensor	CO_2 & temperature sensor 0-2000 ppm	KGLZTEMP72
Outdoor temperature sensor	Room temperature sensor -50..+50 °C	KGLZATFI01
Pressure transmitter	0..10 bar 1..26 bar 1..61 bar 1..161 bar	KGLZDRUCK3 KGLZDRUCK4 KGLZDRUCK5 KGLZDRUCK6
Modbus analogue module	Modbus analogue module 0..10 V DC with 4 analogue outputs	MODBAOUT02
Modbus relay module	Modbus relay module 230 V AC with 4 relay outputs (changeover contacts) and 4 manual control switches	MODBDOUT04
Terminal	4-pole terminal for Modbus modules	MODBAKLEM4
Power supply	Power supply 110 - 240 V AC / 24 V DC / 1.25 A	KGLNT24V1P
Mating connector set	Mating connector set for GLT 3010 / GLT 5010	STVSETVS20