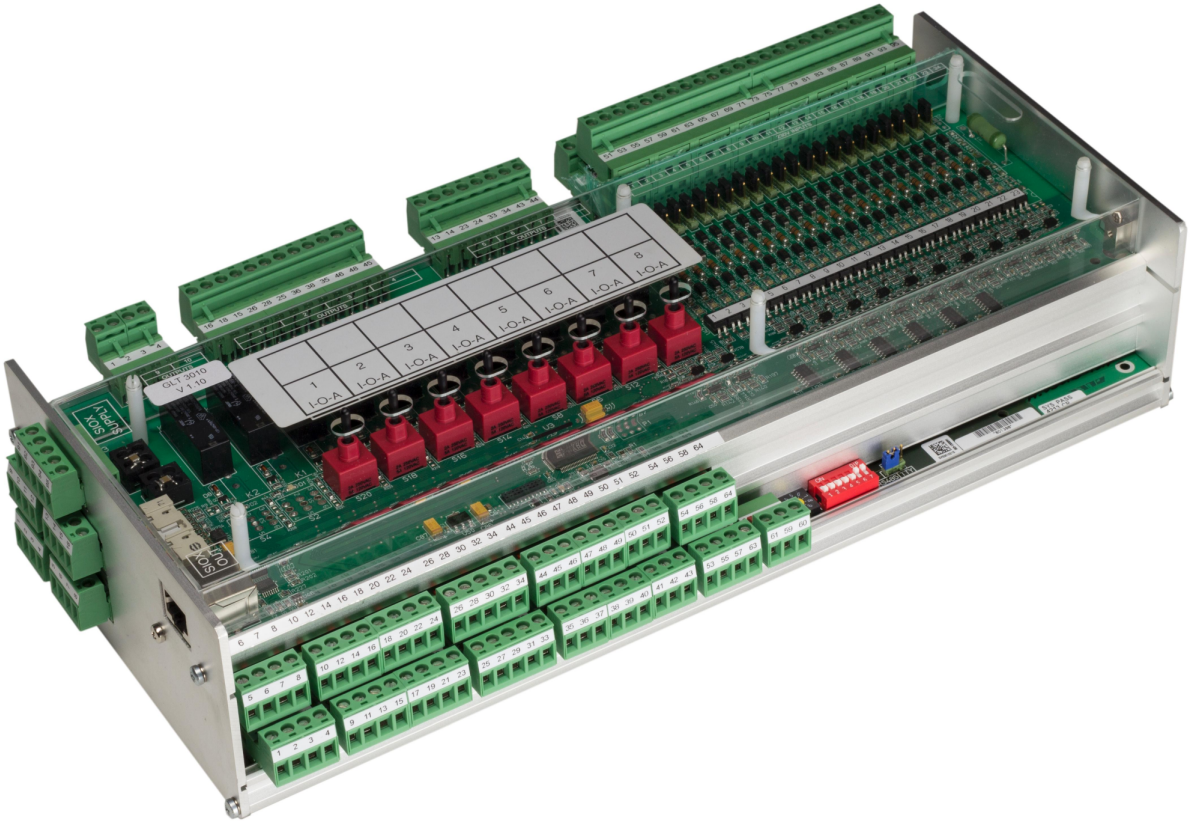
Eckelmann

Operating instruction

WRG 3010 E

Controller for heat recovery in transcritical CO2 systems



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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/_s8FYYIEckc

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

This controller has been designed exclusively for the intended use: The WRG 3010 E controller is designed for use in heat recovery , in combination with the pack controller (VS 3010 CT / VS 3015 CT / VPC 5000), in commercial and industrial refrigeration facilities in accordance with the scope of functions and in accordance with the environmental conditions described in this operating manual.

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.

2.5.1 ESD - Rules for handling and working

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:

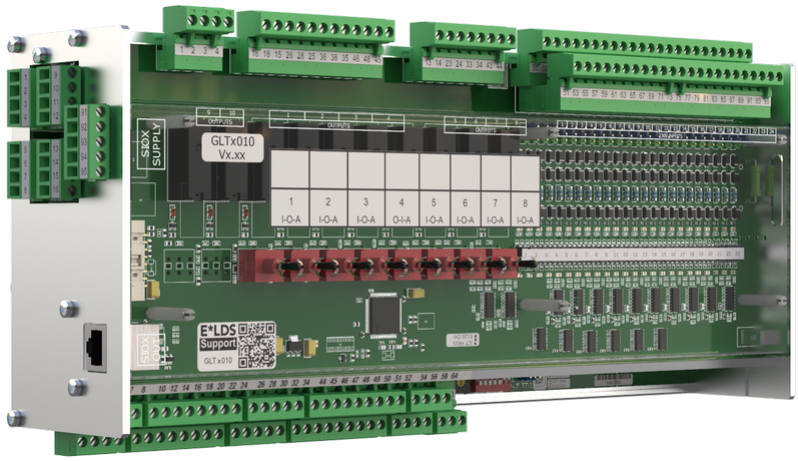
- Conductive flooring
- ESD workstations equipped with suitable tools (grounded soldering guns, antistatic wrist straps, etc.)
- Conductive ESD bags, conductive plastic containers, IC tubes or cartons lined with conductive foam
- Containers and worktops made of wood, metal or conductive plastics or paper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

2.6 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 of WRG 3010 E

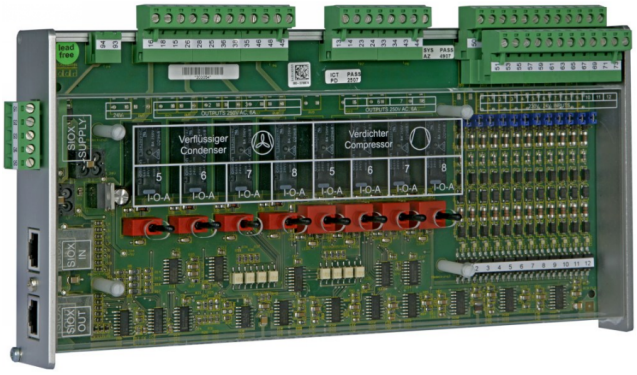
Base module WRG 3010 E



The basic module of the controller for heat recovery in transcritical CO_2 systems consists of a digital input/ output module (board above) and an analogue module (board below). An overview of the individual tasks of the functional units involved in the controller for heat recovery is given in the chapter Application of WRG 3010 E. The interfaces for communication are located on the left side, for details see chapter Connections. The controller can only be operated and parametrised with the PC software LDSWin. The controller is modularly built and can be expanded with a SIOX extension module

> **Requirement:** In order to use the full range of functions of the WRG 3010 E, one of the following interconnection controllers **must be** connected to the CAN bus:
>
> - VS 3010 CT (from version 5.34)
> - VS 3015 CT
> - VPC 5000
>
> **Practical tip:** For configuration of the interconnection controller, its operating instructions must be consulted.

SIOX extension module



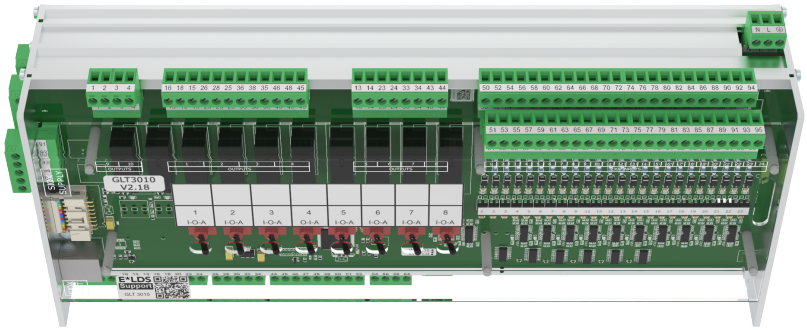
For Details see chapter Connection of the SIOX modules to the controller.

> **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

Connections basic module

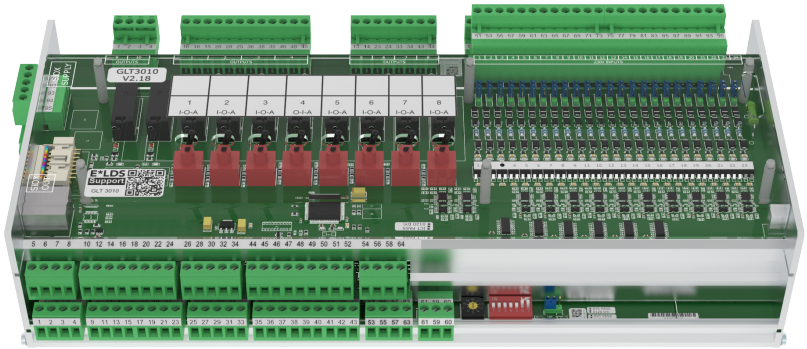
Top view - details see Connections for 230 V AC (top)



- **Digital inputs**
  23 x input 230 V AC

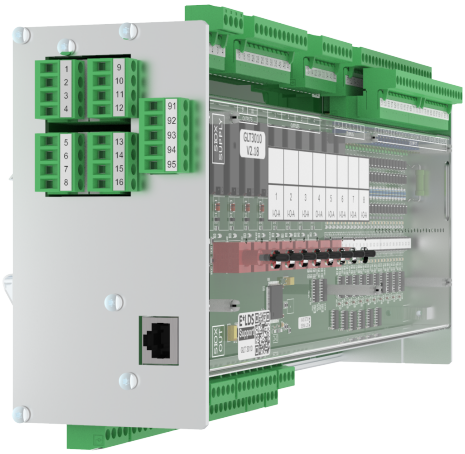
- **Relay outputs**
  6 x make contacts 230 V AC
  4 x changeover contacts 230 V AC

View from below - details see Connections for Protective Extra-Low Voltage (bottom)



- **Analogue inputs/outputs**
  2 x input Pt1000 - 4-wire connection temperature sensor Pt1000
  13 x input Pt1000 - 2-wire connection temperature sensor Pt1000
  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 drives; connection of a speed controller for speed-controlled motors

View from the side - details see Connections for Interfaces (on the side)

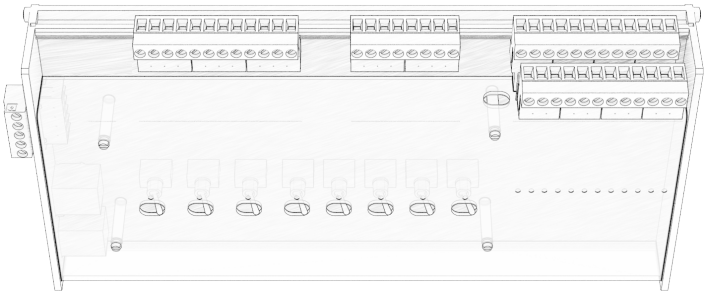


- **Interfaces**
  CAN bus: Communication in the E*LDS system
  RS232: Interface for firmware update
  RS485: Modbus-RTU
  TTY: currently without function
  SIOX OUT: Connection for data transfer to the SIOX extension modules

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

Connections extension module SIOX

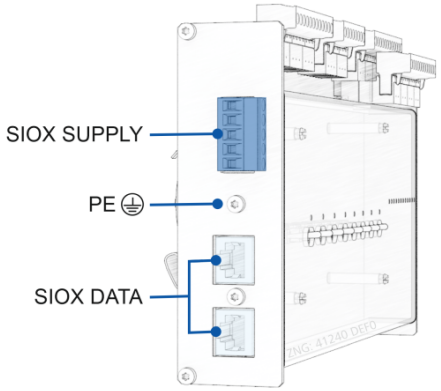
Top view - details see Connections for 230 V AC (top)



- **Digital inputs**
  12 x input 230 V AC

- **Relay outputs**
  6 x make contacts 230 V AC
  4 x changeover contacts 230 V AC

View from the side - details see Connections for Interfaces (on the side)

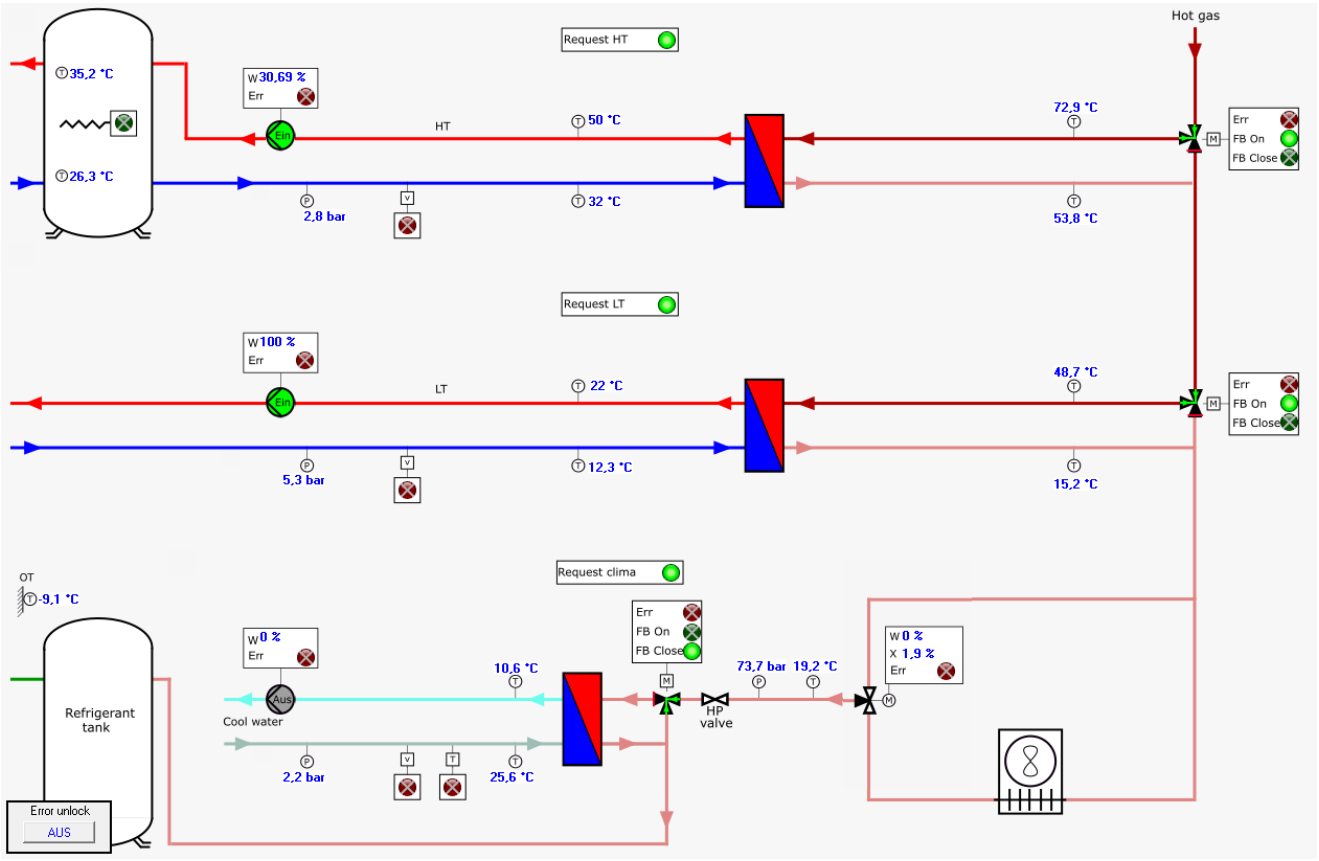


- **Interfaces**
  SIOX IN: connection for data transfer to the base module
  SIOX OUT: connection for data transfer to the SIOX extension modules
- **Protective conductor PE**
  PE must be connected!
- **SIOX Supply**
  power supply for SIOX extension modules

> The detailed device and terminal assignment of the GLT 3010 controller are listed in the chapter Pin and Terminal Assignments of WRG 3010 E.

4 Application of WRG 3010 E

The functions can be shown schematically as follows:



The heat recovery controller WRG 3010 E includes the following functions:

- Control functions*
- Regulation functions*
- Fault reporting
- Monitoring functions
- In combination with the system centre
  - Fault archiving
  - Archiving functions

The WRG 3010 E includes the following functions:

High temperature heat recovery - referred to as "HT" in the following

- Control of the hot gas valve
- Control of the water pump
- Regulation of the water pump speed
- Monitoring of the hot gas valve using end position check
- Monitoring of the water pump using fault signal contact
- Recording and archiving of the temperatures
- Power increase in multiple stages
- Gas cooler bypass
- Heat pump
- in combination with the pack controller
  - High pressure adjustment
  - Switching off the gas cooler fans

Low temperature heat recovery - referred to as "LT" in the following

- Control of the hot gas valve
- Control of the water pump
- Regulation of the water pump speed
- Monitoring of the hot gas valve using end position check
- Monitoring of the water pump using fault signal contact
- Recording and archiving of the temperatures
- Power increase in multiple stages
- Gas cooler bypass
- Heat pump
- in combination with the pack controller
  - Low pressure adjustment
  - Switching off the gas cooler fans

Gas cooler bypass - referred to as "GCBP" in the following

- Regulation of the gas cooler bypass valve
- Monitoring of the gas cooler bypass valve
- Communication via CAN with the pack controller
- Archiving of the gas cooler outlet temperature and the high pressure

Air heat pump operation - referred to as "LWP" in the following

- Enable of the air heat pump
- Control of the defrost of the air heat pump

Air conditioning operation - referred to as "AC" in the following

- Control of the refrigerant valve
- Control of the water pump
- Regulation of the water pump speed
- Monitoring of the refrigerant valve using end position check
- Monitoring of the water pump using fault signal contact
- Recording and archiving of the temperatures

Internal power calculation

- Calculation of the internal power signal via adjustable ramp and limit value monitoring
- The calculation is performed separately for the high temperature circuit and the low temperature circuit.
- Shifting for the flow/return setpoint via the outdoor temperature is selectable.

5 Function of WRG 3010 E

In installations with only one heat exchanger, the HT or LT assignment is freely selectable - it only needs to be enabled accordingly during configuration in LDSWin, see chapter Visualisation in LDSWin - HT / LT / Power Signal Setpoints. Inadvertent enabling without these system components really existing would result in the alarms being sent to the system centre.

Example: The temperature sensors, pump and valve were connected to the connections for HT and LT was enabled in LDSWin, then all alarms for LT are enabled. In the absence of signals at the input terminals, all alarms (LT) such as sensor break, pump fault and valve fault are sent to the system centre. In installations with two heat exchangers, the first one after the NT compressors is always assigned to HT. The following heat exchanger, between HT and the gas cooler, is always assigned to LT.

Unlike the other E*LDS products, the complete operation is **only** possible via LDSWin (not via the system centre); for details, see chapter Operation of WRG 3010 E.

A prerequisite for all functional units is that the *Emergency Stop* has been correctly connected:
- heat recovery at the digital input 4 (terminals 56/57) and
- air conditioning operation at the digital input 23 (terminals 94/95)
* The monitoring of these digital inputs is protected against wire break, i.e. it works inverted; for a "good" state, 230 V AC must be applied to the digital input!

5.1 High Temperature Heat Recovery HT

> The high temperature heat recovery HT is an option and does not have to be present in all systems. The prerequisite for this operating mode is that this function has been selected in the visualisation; for details see figure "HT, LT power signal setpoints".

The HT heat recovery functional unit consists of a heat exchanger, a hot gas valve, a water pump and the associated temperature sensors. There must always be 2 temperature sensors for hot gas (inlet, outlet) and 2 temperature sensors for water (inlet, outlet).

> A digital request **and** an analogue power signal are always required for operation!

When a higher-level BMS requests it via digital input 2 (terminals 52/53) and after a switch-on delay of 150 seconds has elapsed, the calculation of the internal power signal starts. An exception to this is the button "HT Off" , which is located on the "WRG 3010 E" visualisation. If this has been tapped, the internal power calculation is also suppressed. There are two ways to calculate the internal power signal; for details, see Power Signal.

If the internal, calculated power signal reaches the "Desuperheat ON" threshold, (see figure "Visualisation in LDSWin - HT / LT / Power Signal Setpoints"), the water pump starts. The speed control is activated immediately and depends on the spread between the water outlet temperature and the water inlet temperature of the heat exchanger:

- If the spread is below the setpoint, the pump delivers more slowly.
- If the spread exceeds the setpoint, the pump delivers faster.

Furthermore, a minimum speed and a maximum speed can also be set for the pump.

If there is a collective fault message from the pumps at digital input 6 (terminals 60/61: Message appears when the input is de-energised), this is forwarded to the system centre as an alarm. In this case, the pump is not switched off, as electronic pumps would otherwise not be able to be switched on again without further action.

As soon as the pump is running (and there is no fault from it), the hot gas valve is activated. The valve directs the hot gas into the heat exchanger, where it releases its energy to the water. The valve reports both end positions back to the controller, where "closed" stands for bypassing the heat exchanger and "open" for introducing the hot gas into the heat exchanger. The feedback of the valve must also always match its control. If this is not the case, an alarm is sent to the system centre. Due to different run times of the installed valve actuators, there is a waiting time of 260 seconds when switching over, during which no alarms are issued.

The following monitoring devices are available and lead to a forced closure of the hot gas valve; the pump continues to run:

- A flow monitor in the water circuit which is read via digital input 19 (terminals 86/87: "Good" state when voltage is applied). If the flow monitor trips for at least 1 minute , the hot gas valve is forcibly closed and an alarm is issued.
- An optional pressure transmitter which is read via analogue input 3 (terminals 42/43) and compared with a limit value. If the measured pressure falls below the limit value continuously for an adjustable time, it must be assumed that there is no longer sufficient water in the system. Then the hot gas valve is forcibly closed and an alarm is issued. This option must be selected and its settings configured; for detailssee picture "Setpoints HT LT power signal".
- The flow and return temperatures are monitored and if an adjustable limit value is exceeded, the hot gas valve is forcibly closed and a prio 0 message is issued. The hot gas valve is not enabled again until the value falls below the triggering limit value by 3 Kelvin.

To prevent the heat exchanger from overheating, the pump has an overrun of 150 seconds. If the HT function is deactivated, the hot gas valve is closed first, and the hot water produced in the meantime is still discharged.

In addition, the controller monitors whether sufficient heating power is available. This is assessed using two criteria:

- firstly by an adjustable spread between the CO_2 inlet temperature and the outlet temperature, and
- secondly, the water inlet temperature must be lower than the CO_2 inlet temperature. If this is not the case, the internal power signal HT is reduced to "0" after an adjustable delay and held at this value (during an adjustable lockout time), and an alarm is issued.

In addition, the HT function also has the **optional "legionella function"**:
The legionella function is intended to prevent the development of legionella by cyclically (once a week) requesting a higher temperature setpoint in the drinking water buffer. If a heat exchanger is used to heat a drinking water buffer, then the "legionella function" required for this can be activated. If the function has been activated, a separate legionella setpoint (all values can be parametrised) is transferred to the internal power calculation on Mondays at 01:00 h and the relay output 7 (terminals 33/34) on the optional SIOX extension module is set. This relay output can be used to control an additional heating rod in the drinking water buffer.
Note: The calculation of the internal power signal with the legionella setpoint can only be used if "HT" is not set to "external" power signal!
The "legionella function" remains active until the upper buffer temperature has reached the legionella setpoint or the maximum duration of the "legionella function" has expired. If the maximum duration is exceeded, a message is sent to the system centre.

The relay output 7 described in the previous paragraph is now continuously available (without legionella function). The heating rod connected there is switched on when the temperature falls below the limit temperature "HT heating rod on" and is switched off again when the temperature exceeds the limit temperature "HT heating rod off". It can thus be used as a backup heating system. There is no time-based monitoring, as is usual with the legionella function. The basic requirements for heating via heating rod are:

1. High temperature heat recovery HT is selected.
2. A request of the higher level BMS on digital input 2 (terminals 52/53).
3. A temperature sensor, mounted on top of the buffer storage tank, Pt1000 input 13 (terminals 29/30).

If any of these 3 conditions is not met, the heating rod is switched off immediately. This also applies if a temperature sensor is installed, but a sensor break is detected.

The following temperature sensors are available and must be connected correctly:

- Water inlet
- Water outlet
- Hot gas inlet
- Hot gas outlet
- Buffer top (optional)
- Buffer bottom (optional)

> All temperature sensors are monitored for wire breaks by the controller and in the event of any failure an alarm is immediately transmitted to the system centre. For details on the terminal assignment, see Terminal Assignment of the Analogue Inputs.

Setpoints

Parameter in LDSWin *	Description	Value range	Default value
Details see Visualisation in LDSWin - HT / LT / Power Signal Setpoints			
External power signal	Button for switching between external power signal and internal calculation. • EXT: external power signal. • INT: Calculation of the internal power signal based on the setpoint and the flow and return temperatures.	ON / OFF	ON
HT P calculated over buffer	Button for selection of the control variable for the return setpoint. • RL: the return temperature sensor is used for the power signal calculation. • Buffer: a buffer temperature is used for the power signal calculation. See also next line.	RL / Buffer	RL
Buffer temp. upper/lower	Button for selection of the buffer temperature which should be used as the control variable. • UPPER: the upper buffer temperature sensor is used for the power calculation • LOWER: the lower buffer temperature sensor is used for the power calculation	UPPER / LOWER	UPPER
Details see Visualisation in LDSWin - WRG 3010 E			
Spread	Spread between flow and return temperatures. • The pump adjusts its speed to this value.	2..70 K	7 K
Pump min	Minimum speed of the pump	0..100 %	20 %
Pump max	Maximum speed of the pump	0..100 %	100%
max VL temp.	Maximum flow temperature **Note:** The maximum flow temperature should be at least 5 K greater than the flow temperature setpoint. • Approaching below 5 Kelvin results in throttling of the internal power signal HT. • Exceeding this limit causes the hot gas valve to close.	0..80 °C	70 °C
max RL temp.	Maximum return temperature **Note:** The maximum return temperature should be at least 5 K greater than the return temperature setpoint. • Approaching below 5 Kelvin results in throttling of the internal power signal HT. • Exceeding this limit causes the hot gas valve to close.	0..80 °C	55 °C
HT plate active	Button for deactivating the HT heat exchanger. • OFF: heat recovery is deactivated. (pump off, hot gas valve closed) • ON: means heat recovery is activated. **The difference to the "HT present" button is that the heat recovery can be deactivated, but all monitoring functions and the visualisation are active.**	YES / NO	YES
Details see Visualisation in LDSWin - HT / LT / Power Signal Setpoints			

HT present	Button for selecting the HT heat recovery. • YES: the heat exchanger and its peripherals (pump, hot gas valve, temperature sensors) are available. • NO: the heat exchanger and its peripherals are not available. **If this button is set to "OFF", all visualisation elements concerning the HT circuit are hidden and all associated alarms are suppressed.**	YES / NO	NO
Pump controller Kp	Used for setting the Kp of the speed controller of the pump.	0,01..10	1
Pump controller Tn	Used to set the Tn of the pump's speed controller.	1..32767 s	30 s
Locking period	Specifies the lockout time for how long the heat exchanger HT remains disabled after it has been switched off due to a lack of heating power.	0..600 min	15 min
Pressure transmitter	Button for selecting the pressure transmitter in the water circuit. • YES: a pressure transmitter is available, there is monitoring for wire break. • NO: no pressure transmitter available.	YES / NO	NO
FRG Legionella fct	Button for selecting the legionella function • YES: the function is enabled. • NO: the function is not enabled.	YES / NO	NO
Legionella start day	Start day for the legionella function, where 0 means Monday and 6 means Sunday.	0..6	0
Legionella start hour	The legionella function starts at this exact hour, on the starting day.	0..24 o'clock	1 o'clock
Legionella duration	Maximum duration for the legionella function. **ATTENTION!** This value is multiplied by 6 in the controller.	1..5 h	1 h
Heater rod on	Limit temperature for switching on the heating rod.	20..80 °C	30 °C
Heater rod off	Limit temperature for switching off the heating rod.	20..80 °C	40 °C
SW RL HT at 15 °C	Setpoint for internal power calculation. **Note:** Observe the maximum return temperature, see "Maximum return temperature" above.	20..80 °C	35 °C
Setpoint VL HT	This setpoint is used at two different places. **Note:** Observe the maximum flow temperature, see "Maximum flow temperature" above. 1. For monitoring the flow temperature in the LT water circuit and, if necessary, shutting down the internal power signal. 2. Setpoint for internal power calculation	20..80 °C	55 °C
Setpoint legionella	Setpoint only for the legionella function.	20..80 °C	65 °C
min water pressure **	Minimum water pressure for monitoring the water circuit.	0..5 bar	1.2 bar
Alarm delay **	Delay until the alarm signalling of falling below the minimum water pressure.	0..3600 min	5 min
min. spread CO_2 **	Minimum spread between CO_2 - inlet temperature and outlet temperature.	5..90 K	5 K

Delay no heating power **	Delay until alarm signalling of no heating power available.	0..120 min	10 min

* The name of the parameter appears as a tooltip when the mouse is dragged over the setpoint.
** Parameter applies to heat recovery HT and LT.

5.2 Low Temperature Heat Recovery LT

> The low-temperature heat recovery LT is an option and does not have to be present in all systems. The prerequisite for this operating mode is that this function has been selected in the visualisation; for details see figure "HT, LT Power Signal Setpoints".

The functional unit heat recovery LT consists of a heat exchanger, a hot gas valve, a water pump and the associated temperature sensors. There must always be 2 temperature sensors for hot gas (inlet, outlet) and 2 temperature sensors for water (inlet, outlet).

> A digital request **and** an analogue power signal are always required for operation!

When a higher-level BMS requests it via digital input 1 (terminals 50/51) and after a switch-on delay of 150 seconds has elapsed, the calculation of the internal power signal starts. An exception to this is the button "LT Off" , which is located on the "WRG 3010 E" visualisation. If this has been tapped, the internal power calculation is also suppressed. There are two ways to calculate the internal power signal; for details, see Power Signal.

If the internal, calculated power signal reaches the "Desuperheat ON" threshold, see "Visualisation in LDSWin - HT / LT / Power Signal Setpoints, the water pump starts. The speed control is activated immediately and is based on the spread between the water outlet temperature and the water inlet temperature of the heat exchanger:

- If the spread is below the setpoint, the pump turns slower.
- If the spread exceeds the setpoint, the pump turns faster.

Furthermore, a minimum speed and a maximum speed can also be set for the pump.

If there is a collective fault message from the pumps at digital input 5 (terminals 58/59: Message appears when the digital input is de-energised), this is forwarded as an alarm to the system centre. In this case, the pump is not switched off, as electronic pumps would otherwise not be able to be switched on again without further action.

As soon as the pump is running (and there is no fault from it), the hot gas valve is activated. This directs the hot gas into the heat exchanger, where it releases its energy to the water. The valve reports both end positions back to the controller, where "closed" stands for bypassing the heat exchanger and "open" for introducing the hot gas into the heat exchanger. The feedback of the valve must also always match its control. If this is not the case, an alarm is sent to the system centre. Due to the run times of the installed valve actuators, there is a waiting time of 260 seconds when switching over, during which no alarms are issued.

The following monitoring devices are available and lead to a forced closure of the hot gas valve, the pump continues to run:

- A flow monitor in the water circuit, which is read via digital input 18 (terminals 84/85: "Good" state when voltage is applied). If the flow monitor trips for at least 1 minute , the hot gas valve is forcibly closed and an alarm is issued.
- An optional pressure transmitter, which is read in via analogue input 4 (terminals 45/46), is compared with a limit value. If the measured pressure falls below the limit value continuously for an adjustable time, it must be assumed that there is no longer sufficient water in the system. Then the hot gas valve is forcibly closed and an alarm is issued. This option must be selected and its set values must be configured; for detailssee Figure "Setpoints HT LT power signal".
- The flow and return temperatures are monitored and if an adjustable limit value is exceeded, the hot gas valve is forcibly closed and a prio 0 message is issued. The hot gas valve is not enabled again until the value falls below the triggering limit value by 3 Kelvin.

To prevent the heat exchanger from overheating, the pump has an overrun of 150 seconds. If the LT function is deactivated, the hot gas valve is closed first, and the hot water produced in the meantime is still discharged.

In addition, the controller monitors whether sufficient heating power is available. This is assessed via two criteria:

- firstly by an adjustable spread between the CO_2 inlet temperature and the outlet temperature, and
- secondly, the water inlet temperature must be lower than the CO_2 inlet temperature. If this is not the case, the internal power signal LT is reduced to "0" after an adjustable delay and held at this value during an adjustable lockout time, and an alarm is issued.

The following temperature sensors are available and must be connected correctly:

- Water inlet
- Water outlet
- Hot gas inlet
- Hot gas outlet

> All temperature sensors are monitored for wire breaks by the controller and in the event of any failure an alarm is immediately transmitted to the system centre. For details of the terminal assignment, see Terminal Assignment of the Analogue Inputs.

Setpoints

Parameter in LDSWin *	Description	Value range	Default value
Details see Visualisation in LDSWin - HT / LT / Power Signal Setpoints			
External power signal	Button for switching between external power signal and internal calculation. • EXT: external power signal. • INT: Calculation of the internal power signal based on the setpoint and the flow and return temperatures.	ON / OFF	ON
Details see Visualisation in LDSWin - WRG 3010 E			
Spread	Spread between flow and return temperatures. • The pump adjusts its speed to this value.	2..70 K	7 K
Pump min	Minimum speed of the pump	0..100 %	20 %
Pump max	Maximum speed of the pump	0..100 %	100%
Limit temp. Flow max	Maximum flow temperature **Note:** The maximum flow temperature should be at least 5 K greater than the flow temperature setpoint. • Approaching below 5 Kelvin leads to throttling of the internal power signal LT. • Exceeding this limit causes the hot gas valve to close.	0..80 °C	40 °C
Limit temp. Return max	Maximum return temperature **Note:** The maximum return temperature should be at least 5 K greater than the return temperature setpoint. • Approaching below 5 Kelvin leads to throttling of the internal power signal LT. • Exceeding this limit causes the hot gas valve to close.	0..80 °C	30 °C
LT plate active	Button for deactivating the LT heat exchanger. • OFF: heat recovery is deactivated. (pump off, hot gas valve closed) • ON: heat recovery is activated. **The difference to the "LT present" button is that the heat recovery can be deactivated, but all monitoring functions and the visualisation are active.**	YES / NO	YES
Details see Visualisation in LDSWin - HT / LT / Power Signal Setpoints			
available	Button for selecting the LT heat recovery. • YES: the heat exchanger and its peripherals (pump, hot gas valve, temperature sensors) are available. • NO: the heat exchanger and its peripherals are not available. **If this button is set to "Off", all visualisation elements concerning the LT circuit are hidden and all associated alarms are suppressed.**	YES / NO	NO
Pump controller Kp	Used for setting the Kp of the speed controller of the pump.	0,01..10	1
Pump controller Tn	Used to set the Tn of the pump's speed controller.	1..32767 s	30 s
Locking period	Specifies the lockout time for how long the heat exchanger LT remains disabled after it has been switched off due to a lack of heating power.	0..600 min	15 min
Pressure transmitter	Button for selecting the pressure transmitter in the water circuit. • YES: a pressure transmitter is available, there is monitoring for wire break. • NO: no pressure transmitter available.	YES / NO	NO
SW return LT at 15 °C	Setpoint for internal power calculation. **Note:** Observe the maximum return temperature, see "Maximum return temperature" above.	20..80 °C	20 °C

Setpoint flow LT	This setpoint is used at two different places. **Note:** Observe the maximum flow temperature, see "Maximum flow temperature" above. 1. For monitoring the flow temperature in the LT water circuit and, if necessary, shutting down the internal power signal. 2. Setpoint for internal power calculation	20..80 °C	35 °C
min water pressure **	Minimum water pressure for monitoring the water circuit.	0..5 bar	1.2 bar
Alarm delay water **	Delay until the alarm signalling of falling below the minimum water pressure.	0..3600 min	5 min
min. spread CO_2 **	Minimum spread between CO_2 inlet temperature and outlet temperature.	5..90 K	5 K
Delay no heating power **	Delay until alarm signalling of no heating power available.	0..120 min	10 min

* The name of the parameter appears as a tooltip when the mouse is dragged over the setpoint.
** Parameter applies to heat recovery HT and LT.

5.3 Air conditioning operation

Cold water generation (Air conditioning operation) is an option and does not have to be present in all installations.
The prerequisite for this operating mode is that this function has been selected in the visualisation, for details, see figure Visualisation in LDSWin - GCBP / LWP / air conditioning operation setpoints.

The cold water generation functional unit consists of a heat exchanger, a refrigerant valve, a water pump and the two temperature sensors "water inlet" and "water outlet".

Requirements

- A functional CAN bus connection with the pack controller.
- The enable for cold water operation from the pack controller.
- The Emergency Stop, digital input 23 (terminals 94/95: "Good" state when voltage is applied), system is running without faults.

When a higher-level BCS requests it via digital input 7 (terminals 62/63) and after a switch-on delay of 150 seconds has elapsed, the water pump starts. The speed control is activated immediately and depends on the water inlet temperature in the heat exchanger. The setpoint for this is the "Klima Abschalttemperatur", which can be set in LDSWin, minus 4 Kelvin.

Example: The switch-off temperature is 25 °C; minus 4 Kelvin the setpoint for the speed controller is 21 °C. If the water inlet temperature exceeds the setpoint, the pump slows down; if it falls below the setpoint, the pump speeds up.

Furthermore, a minimum speed and a maximum speed can also be set for the pump in LDSWin.

If a collective fault signal from the pump is present at digital input 13 (terminals 74/75: signal is received when the input is de-energised), this is forwarded to the system centre as an alarm. In this case, the pump is not switched off, as electronic pumps would otherwise not be able to be switched on again without further action.

There is a flow monitor in the water circuit which is connected to digital input 22 (terminals 92/93: voltage applied means flow present). When the pump starts, the "Good" state is checked three times - each time at intervals of 30 seconds. If this does not report any flow within this time, an alarm is generated and sent to the system centre. If this alarm is present, the pump is stopped until the alarm has been acknowledged. The alarm must be acknowledged in LDSWin via the "Unlock fault" button. This button is available on all LDSWin visualisation screens.

There is also a thermostat switch in the water circuit, which should prevent the water from freezing. The switch is connected to the digital input 8 (terminals 64/65).

If the "pressure transmitter" option has been selected, the water pressure is also monitored. The threshold and the delay for the low water pressure alarm signalling are the same as in the HT and LT water circuits Visualisation in LDSWin - HT / LT / Power Signal Setpoints.

If the pump is running smoothly and the three above-mentioned monitoring devices are also free of faults and the water inlet temperature is not above the switch-off temperature for longer than 10 minutes, the refrigerant valve is opened. This feeds the refrigerant into the heat exchanger, in which the cold water for air conditioning is produced on the secondary side. The valve reports both end positions back to the controller, where "closed" stands for bypassing the heat exchanger and "open" for introducing the refrigerant into the heat exchanger. The feedback of the valve must always match its actuation. If this is not the case, an alarm is sent to the system centre. Due to the run times of the installed valve actuators, there is a waiting time of 260 seconds when switching over, during which no alarms are output.

If the frost protection thermostat is triggered (digital input 8 (terminals 64/65)), the refrigerant valve is closed and an optional hot gas injection is activated. Both valves are switched over again as soon as the frost protection thermostat signals OK. In order to prevent the cold water plate from being continuously switched on and off, it can only be switched on again after an adjustable standstill time has elapsed.

Special case: A special feature is a common water circuit of **LT and air conditioning**. A changeover valve is used to switch between the air conditioning heat exchanger and the LT heat exchanger. In this case, only **one** water pump is required.

> **Important:** In this special case, the pump used - **and only in this case** - must be connected with all connections to the terminals of the air conditioning pump.

A changeover valve is used to convey warm water from the LT heat exchanger in winter and cold water from the air conditioning heat exchanger in summer to the consumers.

The "*WRG Klima verr. Zeit*" parameter is only required in this operating mode (common water circuit). It is the lock-down time between LT and air conditioning. This should prevent switching back and forth between hot water production and cold water production.

> In all other cases, in which the two **water circuits are operated separately** from each other, this option must not be selected!

Setpoints

Parameter in LDSWin	Description	Value range	Default value
For details, see Visualisation in LDSWin - WRG 3010 E			
Klima Abschalttemp.	The switch-off temperature has 2 functions: 1. If the water inlet temperature exceeds this threshold continuously for 10 minutes, the refrigerant valve is closed. This should prevent too much flash gas being generated. 2. The switch-off temperature minus 4 Kelvin is the setpoint for the speed control of the pump.	10..40 °C	25 °C
Klima Pumpe min	Minimum speed of the pump	0..100%	20%
Klima Pumpe max	Maximum speed of the pump	0..100%	100%
For details, see Visualisation in LDSWin - GCBP / LWP / air conditioning operation setpoints			
A/C available	Button for selecting the air conditioning mode • YES: the heat exchanger and its peripherals (pump, refrigerant valve, temperature sensors) are available. • NO: the heat exchanger and its peripherals are not available.	YES / NO	NO
Klima Pumpe Kp	Used for setting the Kp of the speed controller of the pump.	0.01..10	1
Klima Pumpe Tn	Used for setting the Tn of the speed controller of the pump.	1..32767 s	30 s
WRG-Klima Verr.Zeit	This is the lock-down time between HR mode and A/C mode.	30..1440 min	30 min
Klima Standzeit	The air conditioning standstill time begins when the air conditioning is switched off. While this time is running, the air conditioning operation cannot be switched on again.	10..240 min	20 min
PV Sauggasüberhitzung	Button for selecting the "PV suction gas superheat" function. • YES: there are parallel compressors in the system, and the refrigerant line coming from the HP valve is routed through an additional heat exchanger installed in the suction line of the parallel compressors. The selection of this option also causes the GCBP to be enabled with the setpoint "Soll tg1 Klima". In this case, the GCBP is used to ensure that the temperature of the refrigerant does not drop below the setpoint. In the case that the suction gas superheat has been requested and the GCBP is also requested via the heat recovery, the setpoint "Soll tg1" from the heat recovery has priority. • NO: this configuration and this functionality are not available.	YES / NO	NO
KWS pressure transmitter	Button for selecting the pressure transmitter in the water circuit. • YES: a pressure transmitter is available, there is monitoring for wire break. • NO: no pressure transmitter available.	YES / NO	NO

gemein.W-kreislauf	Button for selecting the common water circuit option of NT and air conditioning. • YES: a common water circuit is available. • NEIN: separate water circuits for LT and air conditioning are available.	YES / NO	NO

5.4 Power Signal

The building transmits a heating power requirement separately for HT and LT to the WRG 3010 E in the form of a 0..10 V signal. This signal should be understood as a 0..100% heating power requirement. These are read at the analogue input 5 (terminals 48/49) for LT and analogue input 7 (terminals 59/60) and are designated as "external power signal". If such a signal is not available, it is possible to create this signal in the WRG 3010 E itself.

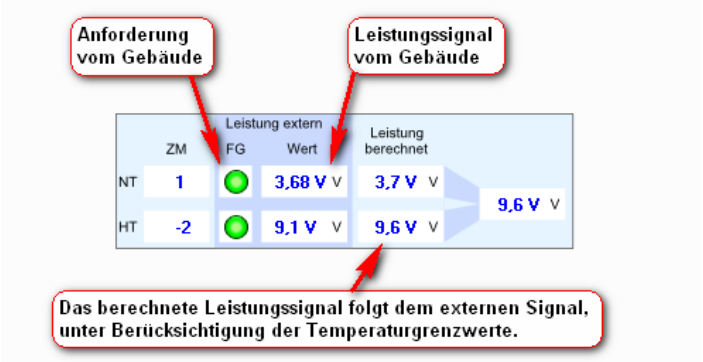
The way in which the power signal is formed must be selected during commissioning. Switching during operation is also possible. It is also possible to set HT and LT differently. For example, this can be used if HT and LT are present in the system and only one power signal is available from the building.

A ramp is built into the calculation of the internal power signal to protect the refrigeration pack system against setpoint jumps of the building. This should slowly ramp up or ramp down the system. This ramp can be adjusted in LDSWin.

The algorithms for calculating the internal power signal are the same for HT and LT. The power signal embodies the heating requirement of the building, so to speak, and the individual heating instances are activated or deactivated via the switch-on and switch-off points that can be adjusted in LDSWin; for details see Visualisation in LDSWin - HT / LT / Power Signal Setpoints. As it will almost always be the case that the two calculated power signals (HT and LT) have different levels, the highest of the two is decisive. In the event that, for example, HT continues to request power and LT no longer requires power, the power signal LT is successively lowered until it falls below the "Desuperheat" switch-off point. Then the hot gas valve is closed and the LT functional unit goes into standby. However, the heating instances requested by HT will continue to be executed.

The power calculation includes a state machine (ZM) with the following states, see Visualisation in LDSWin - HT / LT / Power Signal Setpoints lower left corner.

ZM	State	Cause	Effect
0	Off	There is no request from the building or the function (HT / LT) has been deselected.	The calculated power signal remains at 0.
1	Standby	The external power signal has been reached.	The calculated power signal can have all values between 0 V and 10 V.
2	Increase	The external power signal is higher than the calculated power signal.	The calculated power signal is increased according to the set ramp.
-2	Reduce	The external power signal is lower than the calculated power signal.	The calculated power signal is lowered according to the set ramp
-1	Shutdown	The request from the building has been removed or the function has just been deselected.	The calculated power signal immediately goes to 0. Restarting the power calculation is prevented for 5 minutes.



At this point of the visualisation, there are also feedback signals from the power signal calculation.

Formation of the internal power signal via external 0..10 V power signal using the example of LT

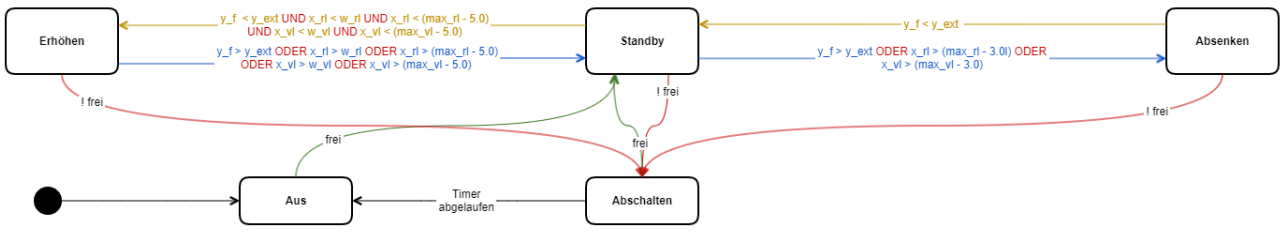
The internally calculated power signal usually follows the external signal from the building; to protect against overheating, the limit temperatures are taken into account, which can prevent the power signal from following. There are separate limit temperatures for flow and return for HT and LT. Reaching the setpoint for flow and return temperature also means that the internal power signal does not follow the external power signal. The setpoint for the flow and return temperature can also be adjusted via the outside temperature.

The calculation is started after 150 seconds from the LT request. The following diagram should show the dependencies.

- y_ext: external power request
- y_f: calculated power signal
- x_vl: Actual value flow temperature
- x_rl: Actual value return temperature
- w_vl: Setpoint flow temperature, observe outside temperature adjustment if necessary
- w_rl: Setpoint return temperature, observe outside temperature adjustment if necessary
- max_vl: maximum flow temperature
- max_rl: maximum return temperature

> **Note:** The maximum flow temperature/return temperature should be **at least 5 K** greater than the flow temperature/return temperature setpoint.

- free: request available
- ! free: request not available

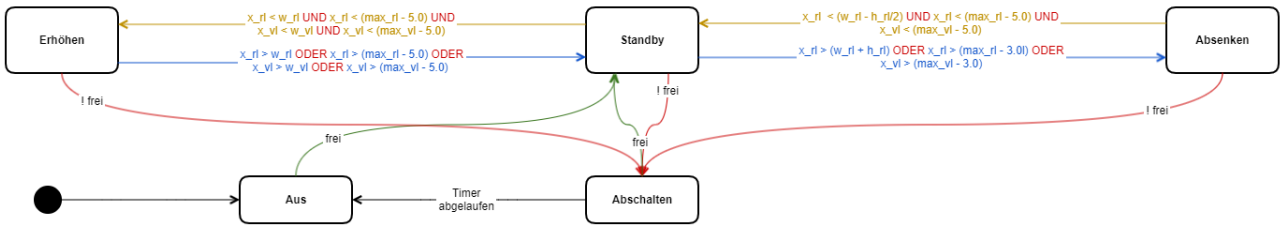


Formation of the internal power signal via the setpoint and actual temperatures

With this type of calculation of the power signal, only the temperatures in the water circuit are taken into account, any external power signal is not taken into account. There is a setpoint in each case for flow temperature and return temperature. Both setpoints are treated equally and can be adjusted via the outside temperature. They cause the power signal to be lowered or increased. The control variable for the flow setpoint is always the flow temperature. The control variable for the return setpoint for LT is always the return temperature. With HT, this can be freely selected from the following temperatures via buttons: the return temperature, the buffer top temperature or the buffer bottom temperature. The limit temperatures are monitored and exceeding them leads to a reduction of the calculated power signal. The following limit temperatures, the maximum flow and return temperatures, exist separately for HT and LT:

After 150 seconds have elapsed from the LT request, the calculation for the respective requested system part is started. The following diagram should show the dependencies.

- x_vl: Actual value flow temperature
- x_rl: Actual value return temperature
- w_vl: flow temperature setpoint
- w_rl: return temperature setpoint
- h_rl: hysteresis return temperature
- max_vl: maximum flow temperature
- max_rl: maximum return temperature
- free: request available
- ! free: request not available



The internal power signal with which all heating instances are enabled is also influenced by external factors:

1. The defrost of the air heat pump - here the calculated output signal is reduced below the switch-on threshold of the LWP and GCBP. This should ensure that the maximum amount of hot gas is available for defrosting.
2. There is a communication problem with the interconnection controller or the interconnection controller is not ready for heat recovery. In this case, the calculated power signal is limited to the level of the “desuperheat on" threshold.

These two criteria apply equally to HT and LT. If a fault occurs in the water circuit, only the calculated power signal of the relevant heat exchanger is reduced to 0. The other heat exchanger can thus continue to operate.

There are the following heating instances:

- **Desuperheating**, where HT and LT each assess their calculated power signal separately.

The respective higher calculated power signal from HT and LT then results in the currently higher heating instance:

- **Pressure boost**
- **Gas cooler fan shutdown**
- **GCBP**
- **LWP**

The pressure boost, GCBP and LWP heating instances can also be switched on with a delay. According to the parameter, the increase of the calculated power signal is then suspended.

Setpoints

Parameter in LDSWin * / **	Description	Value range	Default value
Details see Visualisation in LDSWin - HT / LT / Power Signal Setpoints			
External power signal HT	Button for switching between external power signal and internal HT calculation. • ON: external power signal. • OFF: Calculation of the internal power signal based on the setpoint and the flow and return temperatures.	ON / OFF	ON
External power signal LT	Button for switching between external power signal and internal LT calculation. • ON: external power signal. • OFF: Calculation of the internal power signal based on the setpoint and the flow and return temperatures.	ON / OFF	ON
Details see Visualisation in LDSWin - HT / LT / Power Signal Setpoints			
Signal high %	Ramp for power calculation; specifies by how many percent per time unit the signal should be increased.	0..100%	0.1%
Signal high s	Time unit for the ramp for increasing the power signal.	1..10000 s	100 s
Signal down %	Ramp for the power calculation. The value specifies by how many percent per time unit the signal should be reduced.	0..100%	0.1%
Signal down s	Time unit for the ramp for lowering the power signal.	1..10000 s	50 s
Hysteresis power calcul.	Hysteresis for the internal power calculation; details can be found in the description / diagram.	1..20 K	6 K
Delay pressure boost	Delay until the start of the pressure boost heating instance. The calculated power signal is frozen while the time elapses.	0..600 min	5 min
maximum HP	Maximum permitted high pressure. If this value is exceeded, even if only briefly, all heating instances are immediately disabled and the calculated power signal goes to 0. If the high pressure falls below this setpoint - 5 bar, the heating instances are enabled again.	60..110 bar	100 bar
min. spread CO2	Specifies the minimum spread between hot gas inlet and hot gas outlet. The value applies for HT and LT. If the minimum spread is undercut, and this for the delay time, the calculated power signal is reduced.	5..90 K	5 K
Delay no heating power	If no heating power is present, the calculated power signal for the relevant heat exchanger (HT / LT) is reduced to 0 after "Delay no heating power".	0..120 min	10 min
max. HD with WRG	Maximum HP setpoint with power signal "pressure boost up" or higher. **Note:** This parameter must be set to the same value in the interconnection controller.	40..92 bar	80 bar
min. HD with WRG	Minimum HP setpoint with power signal "pressure boost down" or lower. **Note:** This parameter must be set to the same value in the interconnection controller.	40..92 bar	50 bar
Desuperheat on	Threshold for starting the "Desuperheating" heating instance; for details, see chapter Desuperheating.	0.1..12 V	0.5 V
Desuperheat off	Threshold for stopping the "Desuperheating" heating instance.	0.1..12 V	0.3 V
Pressure boost down	Lower value for starting the "Pressure Boost" heating instance; for details, see chapter Pressure boost.	0.1..12 V	1.0 V

Pressure boost up	Upper value for "pressure boost" heating instance.	0.1..12 V	6.0 V
GC fan off	Threshold for starting the "Gas cooler fan off" heating instance; for details, see chapter Gas Cooler Fan Switch-Off.	0.1..12 V	7.0 V
GC fan on	Threshold for stopping the "Gas cooler fan switch-off" heating instance.	0.1..12 V	6.5 V
GCBP on	Threshold for starting the "GCBP" heating instance; for details, see chapter Gas Cooler Bypass GCBP.	0.1..12 V	8.5 V
GCBP off	Threshold for stopping the "GCBP" heating instance.	0.1..12 V	7.5 V
LWP on	Threshold for starting the "LWP" heating instance; for details, see chapter Air Heat Pump LWP.	0.1..12 V	9.5 V
LWP off	Threshold for stopping the "LWP" heating instance.	0.1..12 V	9.2 V
Adjustment via OT	The button activates or deactivates the setpoint adjustment via outside temperature.	YES / NO	NO
Offset heating curve	The parameter specifies the amount of the offset which is added to the setpoint of the return temperature HT and LT.	0..30 K	0 K
max. elevation	This parameter limits the increase of the return temperature setpoints HT and LT.	0..50 K	7 K
Buttons for manual override If several or all buttons for manual operation are set to "**ON**", the following priority applies in descending order: Power signal Man hold -> power signal Man down -> power signal Man up			
Signal manually high	Manual enabling of the increase of the power signal. The "power signal high / power signal low sec" parameters are active, as with automatic calculation. **ATTENTION:** If the button is permanently set to*"ON*", this will cause the power signal to rise up to 10 V, regardless of any water temperatures or external power signals! The manual override is only to be used during commissioning or short tests and then must be set back to "*OFF"*!	ON / OFF	OFF
Signal down manually	Manual enabling for reduction of the power signal. The "power signal low / power signal high sec" parameters are active, as with automatic calculation. **ATTENTION:** If the button is permanently set to "*ON*", this will cause the power signal to drop to 0 V, regardless of any water temperatures or external power signals! The manual override is only to be used during commissioning or short tests and then must be set back to "*OFF"*!	ON / OFF	OFF
Hold signal manually	Manual freezing of the power signal. **ATTENTION:** If the button is permanently set to "*ON*", the power signal is no longer increased or decreased, regardless of any water temperatures! The manual override is only to be used during commissioning or short tests and then must be set back to "*OFF"*!	ON / OFF	OFF

* The name of the parameter appears as a tooltip when the mouse is dragged over the setpoint.
** Parameters apply to heat recovery HT and LT.

5.5 Desuperheating

The first stage of heat recovery is the desuperheating heating instance. If the power signal HT or LT reaches the respective "Heat On" threshold, the HT or LT function is enabled accordingly. For details, see High temperature HT heat recovery and Low temperature LT heat recovery.

Setpoints

Parameter in LDSWin *	Description	Value range	Default value
For details, see Visualisation in LDSWin - HT / LT / Power Signal Setpoints			
Enthitzen Ein	Threshold Enthitzen Ein	0.1..12 V	0.5 V
Enthitzen Aus	Threshold Enthitzen Aus	0.1..12 V	0.3 V

* The name of the parameter is displayed as a tooltip when the mouse is moved over the setpoint.

5.6 Pressure boost

Pressure boosting is implemented by sending a new setpoint value to the pack controller via the CAN bus depending on the calculated power signal. The new setpoint is shifted linearly between "min HD bei WRG" and "max HD bei WRG", depending on the power signal.

The voltage value of the power signal can be set with the parameter "Druckanheb. unten", the associated pressure is set with the parameter "min HD bei WRG".
The voltage value of the power signal can be set with the parameter "Druckanheb. oben", the associated pressure is set with the parameter "max HD bei WRG".

Setpoints

Parameter in LDSWin *	Description	Value range	Default value
For details, see Visualisation in LDSWin - HT / LT / Power Signal Setpoints			
Druckanheb. unten	Pressure boost lower threshold	0.1..12 V	1.0 V
Druckanheb. oben	Pressure boost upper threshold	0.1..12 V	6.0 V
min HD bei WRG	Pressure value for the lower threshold of the pressure boost	40..92 bar	50 bar
max HD bei WRG	Pressure value for the upper threshold of the pressure boost	40..92 bar	80 bar

* The name of the parameter is displayed as a tooltip when the mouse is moved over the setpoint.

Example: If "*Druckanheb. unten"* is set to 1 V and "*Druckanheb. oben"* is set to 6 V, then with a calculated power signal of 5 V, an HP setpoint of 74 bar is transmitted to the pack controller if the minimum and maximum values of the HP are at the default values.
In addition, a signal is sent via the CAN bus to the Vpack controller, which confirms the validity of the HP setpoint.

The two parameters "min HD bei WRG" and "max HD bei WRG" influence the HP setpoint which is transmitted from the WRG 3010 E via the CAN bus to the pack controller. In the pack controller, the received new HP setpoint is checked for Min and Max; the two parameters are also located there. Ideally the parameters in the WRG 3010 E should be set to the same values as in the pack controller.

5.7 Gas cooler fan switch-off

If the calculated power signal rises above "*GK lüfter Aus*", the pack controller is informed via the CAN bus that it should switch off its gas cooler fans. The gas cooler fans are enabled again when the value falls below "*GK lüfter Ein*".

Setpoints

Parameter in LDSWin *	Description	Value range	Default value
For details, see Visualisation in LDSWin - HT / LT / Power Signal Setpoints			
GK lüfter Aus	Threshold Gaskühlerlüfter Aus	0.1..12 V	7.0 V
GK lüfter Ein	Threshold Gaskühlerlüfter Ein	0.1..12 V	6.5 V

* The name of the parameter is displayed as a tooltip when the mouse is moved over the setpoint.

5.8 Gas cooler bypass GCBP

> GCBP is an option and does not have to be present in all installations.
> The prerequisite for this operating mode is that this function has been selected in the visualisation, for details, see figure Visualisation in LDSWin - GCBP / LWP / air conditioning operation setpoints.

The gas cooler bypass is a valve and bypass line to bypass the gas cooler. This allows the heat generated by the refrigeration pack system to be retained in the building.

The WRG 3010 E supports both digital changeover valves and continuously regulating valves. The valve **must** be correctly parametrised (digital/continuous), otherwise fault signals will occur due to other feedback signals from the valve.

> Gas cooler bypass operation is only possible in combination with a pack controller connected to the CAN bus. The high pressure and the tg1, as well as their sensor faults are transmitted cyclically from this.

The GCBP operation is only enabled as soon as Power Signal the GCBP switch-on threshold has been reached. It is disabled again if the value falls below the GCBP switch-off threshold. There is one exception; if there are parallel compressors with a heat exchanger for suction gas superheating in the system and this function is enabled in LDSWin, the gas cooler bypass valve is also enabled. However, this only applies to the continuously regulating valve; for details, see chapter Air conditioning operation.

Gas cooler bypass with digital switching valve

If the gas cooler bypass operation is enabled and no defrosting of the LWP is active and the high pressure, the tg1 and the water return temperature are OK (see setpoints), the GCBP valve is opened. The high pressure, the tg1 temperature and the water return temperature are constantly monitored. If any of the 3 shutdown criteria is met or the request goes away, this will result in immediate closing of the GCBP valve and the lockout time will start. If a sensor break at the HP sensor or tg1 sensor is transmitted by the pack controller, this also causes the GCBP valve to close, as these are important control and monitoring variables. The GCBP valve cannot be opened again until the lockout time has expired. The valve reports both end positions back to the controller, where "open" stands for bypassing the gas cooler and "closed" for introducing the hot gas into the gas cooler. The feedback of the valve must always match its actuation. If this is not the case, an alarm is sent to the system centre. Due to the run times of the installed valve actuators, there is a waiting time of 260 seconds when switching over, during which no alarms are output.

Gas cooler bypass with continuously regulating valve

The continuously regulating valve has the same requests as the switching valve. The difference is that it can also bypass partial quantities of the hot gas and thus leave more heat energy in the building.

It receives the setpoint "GCBP Soll tg1" for regulation and the actual value tg1 comes from the pack controller. The valve must have a control range of 2-10 volts and the response must correspond to this. Due to too high a deviation between the actuation of the valve and its response, the fault message is generated and also output to the system centre with a delay of 260 seconds.

If the suction gas superheating of the parallel compressors is intended and parametrised and the air conditioning operation starts, the controller of the GCBP valve receives the setpoint "GCBP Solltg1 Klima" and regulates it in the same way. If there are separate water circuits for LT and air conditioning and if the PV suction gas superheat is parametrised, the setpoint "GCBP Soll tg1" always has priority for heat recovery.

If an air heat pump is configured and has been in operation for a configurable period of time (see chapter Airheat pump LWP), the LWP is defrosted with hot gas. The GCBP valve is closed during defrosting to ensure rapid progress. This applies both to the digital switching valve and to the continuously regulating switching valve.

Setpoints

Parameter in LDSWin *	Description	Value range	Default value
For details, see Visualisation in LDSWin - HT / LT / Power Signal Setpoints			
GCBP Ein	Threshold value of the power signal for switching on the gas cooler bypass, if Überschreitung Ein.	0.1..12 V	8.5 V
GCBP Aus	Threshold value of the power signal for switching off the gas cooler bypass, if Überschreitung Aus.	0.1..12 V	7.5 V
For details, see Visualisation in LDSWin - GCBP / LWP / air conditioning operation setpoints			
GCBP vorhanden	Button for selecting the GCBP • YES: the gas cooler bypass is available. • NO: the gas cooler bypass is not available.	YES / NO	NO
GCBP Einschaltverzug	Switch-on delay of the heating instance "GCBP".	0..600 min	5 min
GCBP Soll tg1	Setpoint for the regulation of the continuous gas cooler bypass valve for heat recovery.	0..40 °C	25 °C
GCBP Soll tg1 Klima	Setpoint for the regulation of the continuous gas cooler bypass valve for air conditioning operation; for details, see Air conditioning operation.	0..40 °C	8 °C
GCBP max HP	High pressure switch-off criterion • If this value is exceeded and taking into account the subsequent hysteresis, the gas cooler bypass is forced to shut down.	1..100 bar	95 bar
GCBP hysteresis HP	Hysteresis for high pressure switch-off criterion.	1..30 bar	10 bar
GCBP max tg1	Hot gas temperature switch-off criterion • If this value is exceeded and taking into account the subsequent hysteresis, the gas cooler bypass is forced to shut down.	0..40 °C	34 °C
GCBP hysteresis tg1	Hysteresis for hot gas temperature switch-off criterion.	1..10 K	2 K
GCBP max T H2O	Water return temperature switch-off criterion • If this value is exceeded and taking into account the subsequent hysteresis, the gas cooler bypass is forced to shut down. • This is set to 90 °C on delivery and will not result in shutdown. However, it can be activated at any time by reducing it.	20..100 °C	90 °C
GCBP hysteresis H2O	Hysteresis for water return temperature switch-off criterion.	1..10 K	2 K
GCBP Sperrzeit	After completion of the gas cooler bypass operation or a forced shutdown due to the previously mentioned criteria, there is a time-limited restart lockout.	10..240 min	20 min
GCBP Regler Kp	Parameter for the Kp of the gas cooler bypass controller.	0.01..10	0.5
GCBP Regler Tn	Parameter for the Tn of the gas cooler bypass controller.	1..32000 s	45 s
GCBP valve min	Minimum opening degree of the gas cooler bypass valve.	0..70%	0%
GCBP valve max	Maximum opening degree of the gas cooler bypass valve.	0..100%	100%

GCBP digital	Button for switching from continuously controlled gas cooler bypass to digital gas cooler bypass. • YES: Gas cooler bypass valve is controlled digitally (Open/Close). • NO: Gas cooler bypass valve is continuously controlled.	YES / NO	NO
GCBP subkrit. aktiv	Button for enabling and disabling the subcritical operation of the gas cooler bypass. • YES: Gas cooler bypass valve is enabled in the subcritical range of the refrigeration pack system. • NO: Gas cooler bypass valve is only enabled in the transcritical range.	YES / NO	YES

* The name of the parameter is displayed as a tooltip when the mouse is moved over the setpoint.

5.9 Air heat pump LWP

LWP is an option and does not have to be present in all installations.
The prerequisite for this operating mode is that this function has been selected in the visualisation, for details, see figure Visualisation in LDSWin - GCBP / LWP / air conditioning operation setpoints.

Regulation via UA 4x0 E

If the calculated power signal reaches the switch-on threshold for the LWP, an enable is given via the relay output 3 (terminals 35/36/38). The WRG 3010 E only issues the enable signal on the "*manual switch-off*" digital input of the case controller UA 4x0 E, which then takes over the control for injection valve, temperatures, etc., see details operation manual of case controller.

Defrost LWP

The defrost can be initiated in 2 ways.

1. Start after expiry of a configurable time of the LWP operation.
2. Start via a "Manual Defrost" button in LDSWin.

The enable is withdrawn from the UA 4x0 E when defrosting starts. In addition, the calculated power signal of HT **and** LT is reduced below the switch-off threshold of GCBP and LWP. The power signal calculation is enabled again after completion of defrosting.

The defrost can be ended in the following ways:

- The configurable defrost time expires or
- the defrost termination temperature is exceeded (only if a temperature sensor has been installed in the heat pump).

Hot gas can also be injected to accelerate defrosting. The hot gas valve at relay output 9 (terminals 1/2) is not enabled until the GCBP valve has an opening degree of < 10%.
Another way to accelerate defrosting would be to close the hot gas valves of HT and LT. In this way, no more heat is transferred to the building during defrosting. This can be switched on and off via a button in LDSWin.

The drip time starts after completion of the defrost. The water that has formed during defrosting should drip off during this time. The LWP is not enabled again until the calculated power signal has exceeded the LWP switch-on threshold again.

Setpoints

Parameter in LDSWin *	Description	Value range	Default value
For details, see Visualisation in LDSWin - HT / LT / Power Signal Setpoints			
LWP Ein	Threshold value of the power signal for switching on the air heat pump, if Überschreitung Ein.	0.1..12 V	9.5 V
LWP Aus	Threshold value of the power signal for switching off the air heat pump, if Überschreitung Aus.	0.1..12 V	9.2 V
For details, see Visualisation in LDSWin - GCBP / LWP / air conditioning operation setpoints			
LWP vorhanden	Button for selecting the LWP. • YES: the air heat pump is available. • NO: the air heat pump is not available.	YES / NO	NO
LWP Einschaltverzug **	Delay time for heat pump enable. • The WRG 3010 E switches to the operating mode "LWP" if the calculated power signal has reached the switch-on threshold. This parameter can then be used to delay the start of the air heat pump again.	0..600 min	60 min
LWP max HGtemperatur	Maximum outlet temperature of the hot gas from HT heat exchanger. Exceeding this temperature will cause the LWP to switch off, even if the power signal requests the LWP. The LWP is not enabled again until the hot gas outlet temperature drops 4 Kelvin below this threshold.	20.0..80.0 °C	40.0 °C
LWP defrost; for details, see Visualisation in LDSWin - GCBP / LWP / air conditioning operation setpoints			
Abtau Intervall	The defrost interval specifies the time period for which the LWP must be in operation before the next defrost is started.	60..1440 min	360 min
Abtau Endtemperatur	If the defrost termination temperature sensor in the LWP reaches this value, the defrost will be terminated.	1..25 °C	15 °C
LWP Abtauzeit	This parameter specifies the maximum defrost time, after which defrosting is ended and the drip time starts.	1..120 min	60 min
LWP Abtropfzeit	The drip time is used to drip/dry the LWP package before the LWP is put back into operation.	1..10 min	5 min
LWP Handabtauung	Button for initiating the defrost. • YES: start defrost process. • NEIN: do not start a manual defrost.	YES / NO	YES
Abtauung WRG aus	Button for switching off the heat recovery during the defrost process. • YES: the heat recovery is deactivated during defrosting in order to use all the available heat of the refrigeration pack system for defrosting. • NO: heat recovery is throttled during defrosting by the heating instances GCBP and LWP.	YES / NO	YES

* The name of the parameter is displayed as a tooltip when the mouse is moved over the setpoint.
** Parameter is applicable for heat recovery HT and LT.

5.10 Archiving of operating data

All relevant operating data of the controller for heat recovery are transmitted via the CAN bus to the system centre for later system analysis and evaluation in LDSWin and archived there.

5.11 Calibration of the Pt1000 Temperature Sensor

Due to a very long connection cable from the controller to a Pt1000 temperature sensor, the cable resistance increases, which results in a measurement error (for more details about this topic, see Determination of Measurement Uncertainty). To compensate for such measurement errors, which have an unfavourable effect on the control and accuracy of the display in the visualisation, an individual offset can be adjusted in the controller for each temperature sensor to calibrate its measured value.

Configuration

All 15 Pt1000 temperature sensors of the controller and their functions are listed in the "Service Area" visualisation. The column "Measured Value" shows the temperature (incl. the line resistance) that was measured at the corresponding terminals. If the measured value deviates from the real temperature, e.g. due to excessive resistivity, this can be corrected by activating the offset (ON/OFF); the corresponding button then shows "ON". The required offset can be set between -25 .. +25 Kelvin in steps of 0.1 Kelvin from the measured value. The performed calibration is then used for control and visualisation and displayed in the "Calibrated Value" column:

Sensor Calibration

Pt1000	Terminals	Measured Value	Offset		Calibrated Value	Description
1	1, 2, 3, 4	-9,1 °C	OFF	0 K	-9,1 °C	Outdoor temperature 2
2	5, 6, 7, 8		OFF	0 K		- -
3	9, 10	72,9 °C	OFF	0 K	72,9 °C	Temperatur CO2 Entry HT
4	11, 12	64,1 °C	ON	-15,4 K	48,7 °C	Temperatur CO2 Entry LT
5	13, 14	15,2 °C	OFF	0 K	15,2 °C	Temperatur CO2 Exit LT
6	15, 16	28,8 °C	ON	25 K	53,8 °C	Temperatur CO2 Exit HT
7	17, 18	12,3 °C	OFF	0 K	12,3 °C	Temperatur H2O Return LT
8	19, 20	22 °C	OFF	0 K	22 °C	Temperatur H2O Forward LT
9	21, 22	32 °C	OFF	0 K	32 °C	Temperatur H2O Return HT
10	23, 24	50 °C	OFF	0 K	50 °C	Temperatur H2O Forward HT
11	25, 26	25,6 °C	OFF	0 K	25,6 °C	Temperatur H2O Return Clima
12	27, 28	10,6 °C	OFF	0 K	10,6 °C	Temperatur H2O Forward Clima
13	29, 30	35,2 °C	OFF	0 K	35,2 °C	Temperatur Buffer HT top
14	31, 32	26,3 °C	OFF	0 K	26,3 °C	Temperatur Buffer HT down
15	33, 34	11,7 °C	OFF	0 K	11,7 °C	Temperatur HP Defrost Sensor

Service Mode Analogue Inputs and Outputs

	Terminals	REL	Value	Rem. time
AI 1	35, 36, 37	OFF	10 mA	0 min
AI 2	38, 39, 40	OFF	15 mA	0 min
AI 3	41, 42, 43	OFF	4 mA	0 min
AI 4	44, 45, 46	ON	15 mA	42 min

	Terminals	REL	Value	Rem. time
AI 5	47, 48, 49	OFF	3 V	0 min
AI 6	50, 51, 52	OFF	0 V	0 min
AI 7	59, 60, 61	OFF	2 V	0 min

	Terminals	REL	Value	Rem. time
AO 1	53, 54	OFF	7 V	0 min
AO 2	55, 56	OFF	2 V	0 min
AO 3	57, 58	ON	3 V	41 min
AO 4	63, 64	OFF	4 V	0 min

Example for the Pt1000 8 (temperature H_2O flow LT):

The real, measured flow temperature is 19.7 °C

1. However, the measured value of 22.0 °C is too high!
2. The difference is -2.3 Kelvin
3. Enter and activate the amount for the offset (-2.3 Kelvin) (button is set to ON):

Calibrated, adjusted value: 22.0 °C + (-2.3 Kelvin) = **19.7 °C (for regulation and visualisation)**

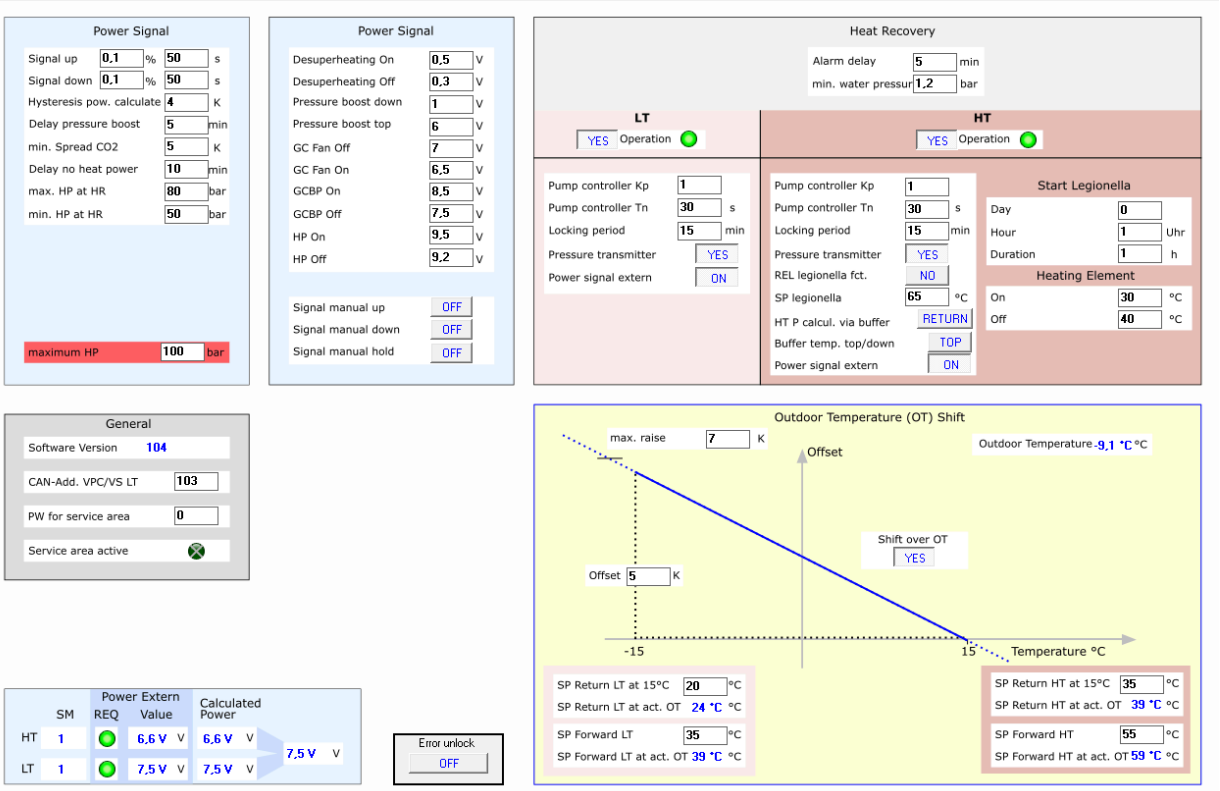
> To make it easier to locate the Pt1000 temperature sensors on the controller, their associated terminals are displayed in the "Terminals" column, see chapter Terminal Assignment of the Analogue Inputs.

5.12 Service Area Analogue Inputs and Outputs

For test and service purposes, all analogue inputs and outputs of the controller can be manually overridden in manual mode. The service area is password-protected and must be activated beforehand.

Activation of the service area via password

The password (PW) for the service area (service mode) is entered in the "General" area (grey field) on the "Setpoints HT LT power signal" page:



The password is 65205 and cannot be changed.
If the controller has accepted the password, "0" is displayed again in the input field for security reasons. The green indicator light underneath signals that the service area is active (enabled). After **10 minutes without** manual override at the analogue inputs and outputs, the service area is blocked again. For another manual override, the password must be entered again.

Service area (service mode) analogue inputs and outputs

After enabling the service area (service mode), the desired analogue signal can be entered for each analogue input (AI 1.. AI 7) and output (AO 1..AO 4). The terminal is only enabled after the relevant button (FRG ON) has been pressed. The corresponding indicator lights up green and the "remaining time" (the time the value remains active) is displayed:

Sensor Calibration

Pt1000	Terminals	Measured Value	Offset			Calibrated Value	Description
1	1, 2, 3, 4	-9,1 °C	OFF	0	K	-9,1 °C	Outdoor temperature 2
2	5, 6, 7, 8		OFF	0	K		- -
3	9, 10	72,9 °C	OFF	0	K	72,9 °C	Temperatur CO2 Entry HT
4	11, 12	64,1 °C	ON	-15,4	K	48,7 °C	Temperatur CO2 Entry LT
5	13, 14	15,2 °C	OFF	0	K	15,2 °C	Temperatur CO2 Exit LT
6	15, 16	28,8 °C	ON	25	K	53,8 °C	Temperatur CO2 Exit HT
7	17, 18	12,3 °C	OFF	0	K	12,3 °C	Temperatur H2O Return LT
8	19, 20	22 °C	OFF	0	K	22 °C	Temperatur H2O Forward LT
9	21, 22	32 °C	OFF	0	K	32 °C	Temperatur H2O Return HT
10	23, 24	50 °C	OFF	0	K	50 °C	Temperatur H2O Forward HT
11	25, 26	25,6 °C	OFF	0	K	25,6 °C	Temperatur H2O Return Clima
12	27, 28	10,6 °C	OFF	0	K	10,6 °C	Temperatur H2O Forward Clima
13	29, 30	35,2 °C	OFF	0	K	35,2 °C	Temperatur Buffer HT top
14	31, 32	26,3 °C	OFF	0	K	26,3 °C	Temperatur Buffer HT down
15	33, 34	11,7 °C	OFF	0	K	11,7 °C	Temperatur HP Defrost Sensor

Service Mode Analogue Inputs and Outputs

	Terminals	REL	Value		Rem. time
AI 1	35, 36, 37	OFF	10	mA	0 min
AI 2	38, 39, 40	OFF	15	mA	0 min
AI 3	41, 42, 43	OFF	4	mA	0 min
AI 4	44, 45, 46	ON	15	mA	42 min

	Terminals	REL	Value		Rem. time
AI 5	47, 48, 49	OFF	3	V	0 min
AI 6	50, 51, 52	OFF	0	V	0 min
AI 7	59, 60, 61	OFF	2	V	0 min

	Terminals	REL	Value		Rem. time
AO 1	53, 54	OFF	7	V	0 min
AO 2	55, 56	OFF	2	V	0 min
AO 3	57, 58	ON	3	V	41 min
AO 4	63, 64	OFF	4	V	0 min

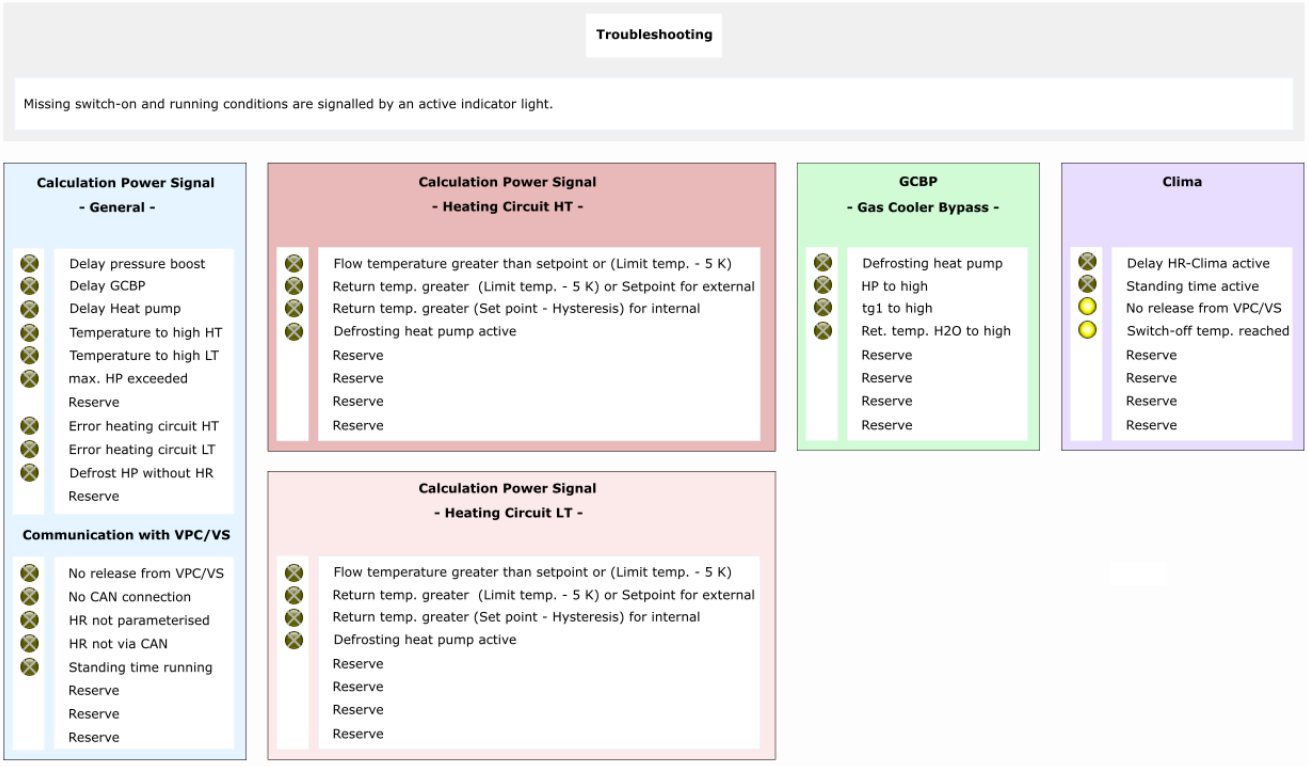
The service mode for each analogue signal is **automatically ended after 60 minutes** or it can be ended directly via the button within the 60 minutes. If the time has elapsed or if the service mode is ended directly, the controller returns to regular operation.

Both the release of the service area and the release of the service mode for each individual analogue signal (FRG ON) generates a message with prio. 23 in the alarm list.

CI-Meldung	CI-Meldungsende	Marktname	Teilnehmer	Pos	Meldetext	Prio	Adresse	Nr.
18.03.2021 12:00		Teststände\WRG3010E\EN\Teststand_WRG3	WRG3010E	KMR	Servicemode aktiv	23	122	56
18.03.2021 12:02		Teststände\WRG3010E\EN\Teststand_WRG3	WRG3010E	KMR	AO 1 Hand aktiv	23	122	64
18.03.2021 12:02		Teststände\WRG3010E\EN\Teststand_WRG3	WRG3010E	KMR	AI 3 Hand aktiv	23	122	59

5.13 Troubleshooting

The visualisation page "Troubleshooting" is available to the user for quick troubleshooting. The colour grouping of the switch-on and running conditions are arranged in the same way as the other visualisation pages, so that a quick assignment of statuses is possible. Missing switch-on or running conditions are signalled with yellow indicator lights.



Status of the indicator lights

- yellow (inactive) and marked with an X: there is no problem with this function.
- yellow (active): missing switch-on or running condition, function cannot start or the Power Signal cannot be increased.

> **Practical tip**
>
> The conditions shown are a supplement to the Alarms and Messages. Pending, active alarms can also cause a function to be switched off or prevent it from being switched on.

6 Installation and Start-Up of WRG 3010 E

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 and hazard instructions observed. Any maintenance by the user is not intended, as possible hazards from incorrect re-assembly cannot be ruled out. Opening the device is not authorised! Furthermore, it must be noted that the safety of the system or the installation in which the device is integrated is the responsibility of the creator of the system or installation. If the device is used in any way not specified by Eckelmann AG, the protection supported by the device can be compromised!

The system centre is used, among other things, for alarming and archiving operating data and is the link between the LDSWin PC software and the controller.

Parameterisation of the controller during commissioning or subsequent changes to its configuration can **only be carried out via the LDSWin PC software**. The controller should only be used with compatible versions of LDSWin; otherwise the range of functions may be limited.
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 commissioning the system, the necessary basic hardware and software settings, which are described in the following chapters, must be made on the controller.

6.1 Top-Hat Rail Mounting

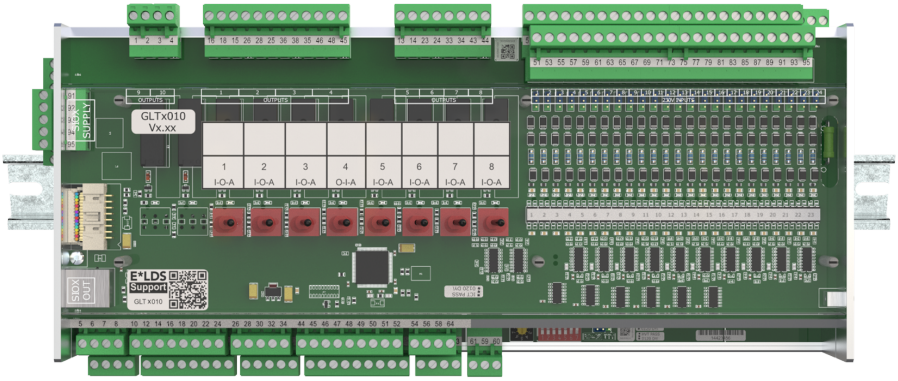
The basic module and the SIOX extension modules are snapped onto a top-hat rail by means of two claws on the back; for details see chapter Mounting on the DIN Rail.

ATTENTION

The controller may only be operated mounted on a top-hat rail as a built-in regulating and control unit (EN60730) and can be bayed without spacing. The power dissipation of the controller is 24 VA and 3.1 W per SIOX. To operate the controller, the natural convection of the circulating air with free air exchange is sufficient to avoid overheating. A sufficient air inlet under the unit (min. 30 mm) 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 applies in particular to the analogue inputs and outputs as well as to the CAN bus and Modbus wiring; see operating instructions *"Basics and General Safety and Connection Instructions*". These must also be installed with sufficiently large distance 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 ducts.

Specified mounting position

The basic module must be mounted as follows:



Protection class and dimensions see chapter Technical Data WRG 3010 E.

6.1.1 Mounting on the DIN Rail

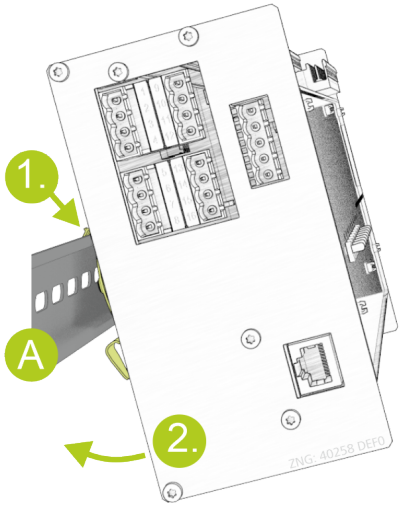
DANGER

Warning of dangerous electrical voltage! 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, see chapter Handling Wide COMBICON Plugs.

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

To ensure assembly/disassembly, a distance of at least 30 mm to the next component (e.g. cable duct) **must be** maintained below the controller.
Note: The top-hat rail (35 mm) must have a height of at least 5 mm.

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



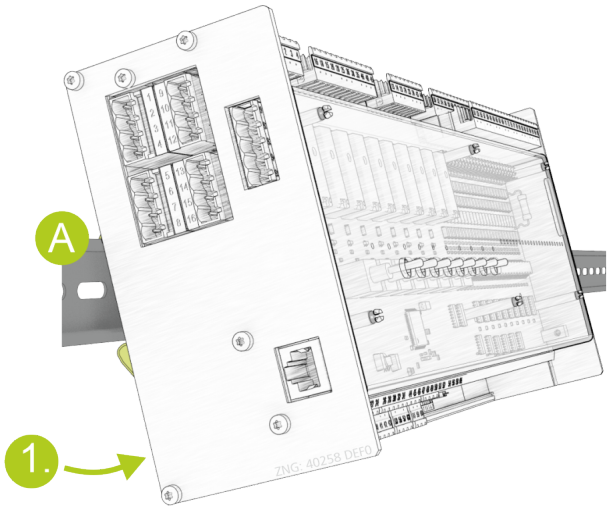
6.1.2 Removal from the DIN Rail

DANGER

Warning of dangerous electrical voltage! Danger of electric shock! For dismantling, the safety regulations as well as the work safety instructions **must be** observed. **All** plug-in connections may only be plugged and unplugged in a de-energised state, see chapter Handling Wide COMBICON Plugs.

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

Step 2: Remove the controller from the top-hat rail **(A)** with a swivelling movement **(1.)** upwards.



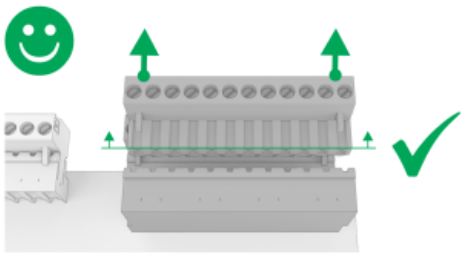
6.1.3 Handling Wide COMBICON Plugs

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**.

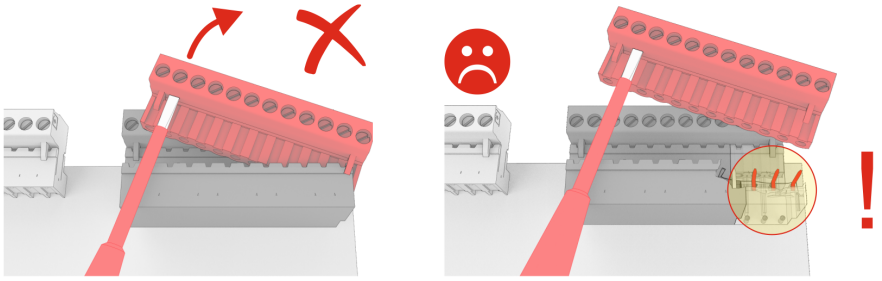


For detailed information on handling wide COMBICON connectors, see online in EDP.

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!



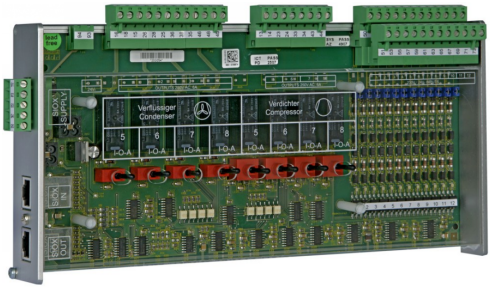
6.2 SIOX Extension Module - for Top-Hat Rail Mounting

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.

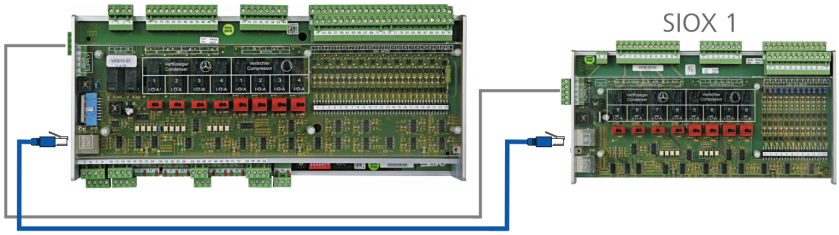
An optional extension module SIOX (Serial IO-Extension) can be connected to the controller. Whether an extension module is required depends on the functions which are controlled or read via this control component. These are the following functions:

- Hot gas injection cold water plate on frost alarm (relay output)
- Additional heating rod for legionella function (relay output)



SIOX extension module with switches

The connection to the basic module is made via SIOX power supply lines (SIOX SUPPLY) or SIOX data lines (SIOX IN / OUT):



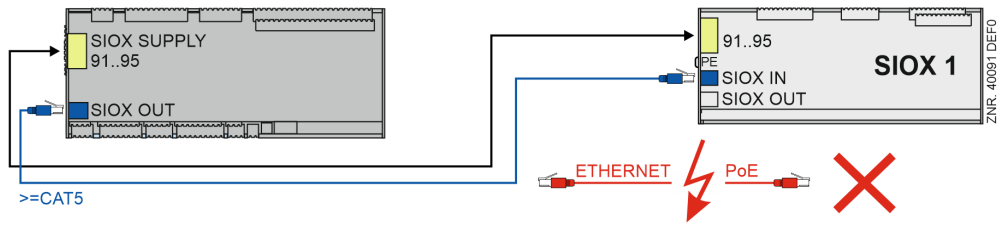
For details see chapter Connection of the SIOX modules to the controller.

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

6.2.1 Connection of the SIOX modules to the controller

The 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).



For details see chapter Terminal Assignment of SIOX.

ATTENTION

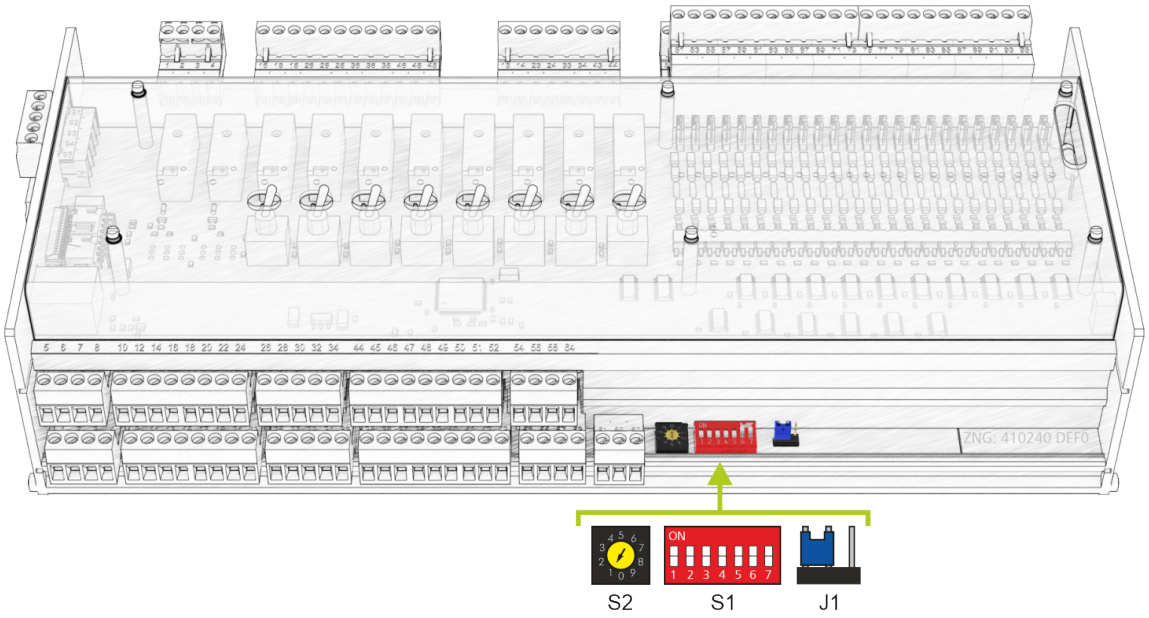
Danger of destruction of components! SIOX extension modules may **only** be connected to each other or the base module when no voltage is present! In the event of an Ethernet network cable with PoE (Power over Ethernet) being used instead of the SIOX data cable (RJ45) damage can occur to participating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

6.3 Basic Settings Hardware

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



These basic settings **must be configured before** the controller is switched on:

1. DIP switch S1 for setting the functionality

- For details see chapter Settings via DIP Switch S1

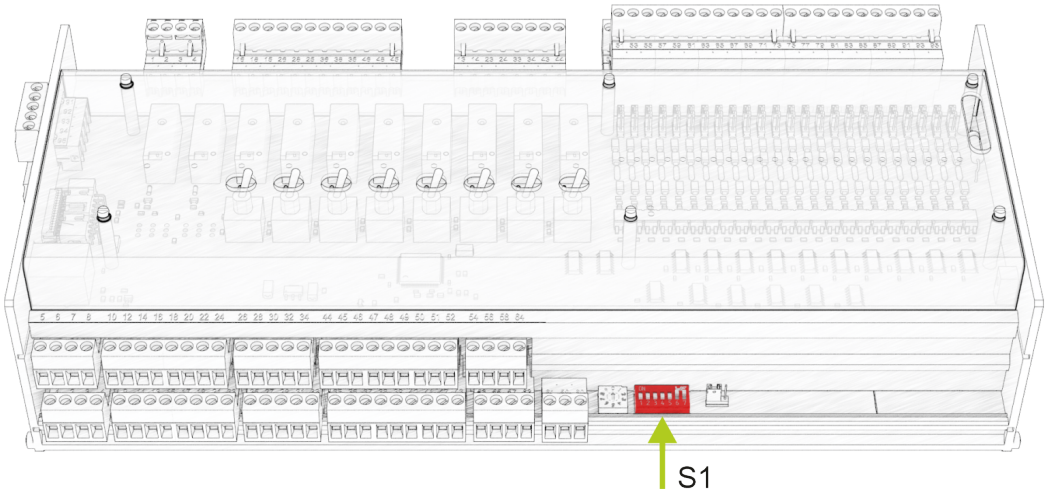
2. Decade switch S2 for activation / deactivation as CAN bus device

- For details see chapter Setting the CAN Bus Address Using Decade Switch S2

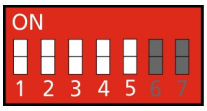
3. Jumper J1 for configuring the RS485/TTY interface

- For details see chapter Setting of the Interface RS485/TTY Using Jumper J1

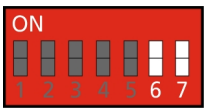
6.3.1 Settings via DIP Switch S1



S1: Coding switches 1..5
These are **read during runtime** and act on the controller immediately after adjustment. The coding switches are freely available to the programmer of the application. He defines the meaning of the coding switches, how they are to be used.

Coding switches 1..5	Switch	Function
	**1:**	ON / OFF: currently without function
	2:	ON / OFF: currently without function
	3:	ON / OFF: currently without function
	4:	Special version E-Center Gaimersheim ON: activated OFF: deactivated
	5:	ON / OFF: currently without function

S1: Coding switches 6..7
Coding switches 6 and 7 determine the operating mode of the controller:

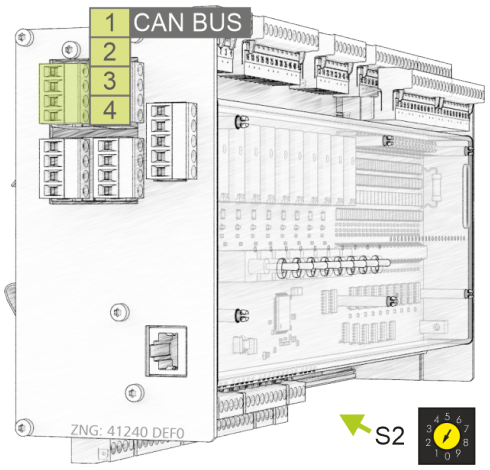
Coding switches 6..7	Switch	Function
	**6/7**	ON: Normal operation (factory setting) OFF: Firmware update mode

ATTENTION

Coding switches **6 and 7** may **only** be set to OFF for the purpose of firmware updates! 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 switch positions of S1, the controller **must** be de-energised for a short time so that the desired settings are adopted!

6.3.2 Setting the CAN Bus Address Using Decade Switch S2

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



Setting the CAN bus address (node No.) or deactivating CAN bus communication
The decade switch S2 specifies the CAN bus address.

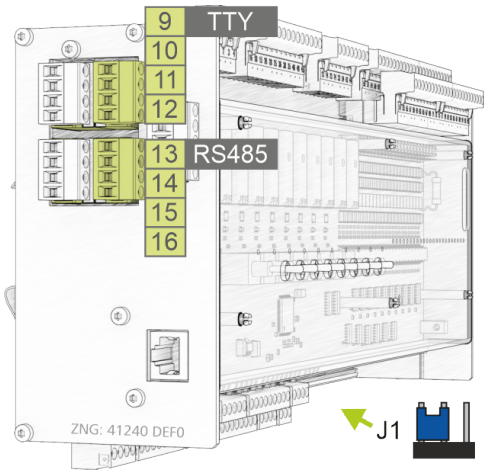
> **ATTENTION**
>
> - After changing the switch position of S2, the controller **must** be disconnected from the power supply for a short time so that the new settings will be adopted!
> - In installations with **only one WRG 3010 E,** the CAN bus address must be set to position 1 (address 122)!

Decade switch S2	Switch positions	CAN bus address / node No. (Kn.nnn)	Function
	**1..4**	122..125	Assign CAN bus address to controller
	0, 5..9	NONE	CAN bus interface deactivated (inactive, disabled) The controller is not detected as a CAN bus device!

For more details on the pin assignment, see chapter Terminal Assignment of CAN Bus.

6.3.3 Setting of the Interface RS485/TTY Using Jumper J1

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



Setting of the interface
The jumper J1 specifies the function of the interface.

Jumper J1	Jumper position	Activated interface	Function
	Left-centre **Factory setting**	RS485 Terminals 13/14/15/16	currently without function
	Centre-right	TTY Terminals 9/10/11/12	currently without function

For details see chapter Terminal Assignment of RS232 and TTY.

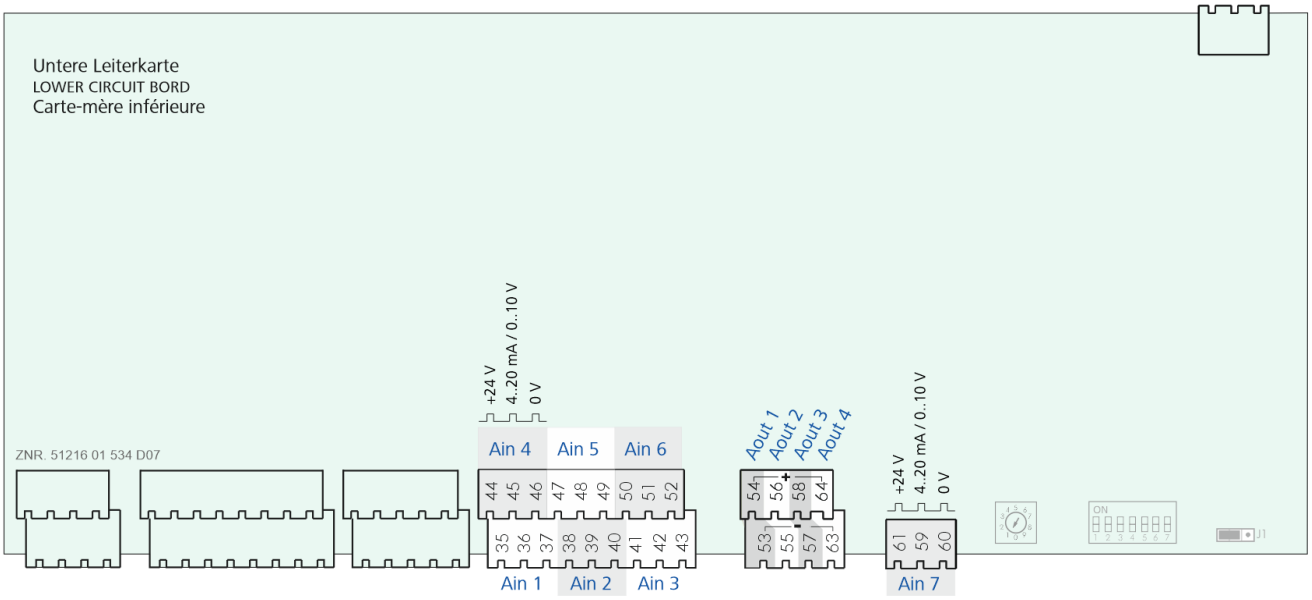
6.3.4 Configuration of the Analogue Inputs and Outputs at the Factory

DANGER

Important safety instructions! Any maintenance by the user is **not** intended, as possible hazards from incorrect re-assembly cannot be ruled out. Opening the device is **not** authorised! Reconfiguration of the analogue inputs and outputs is **not** necessary. Incorrect handling can result in damage and impairment of the controller functions! If the unit is **opened anyway, the unit must be subjected to an insulation test**!

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

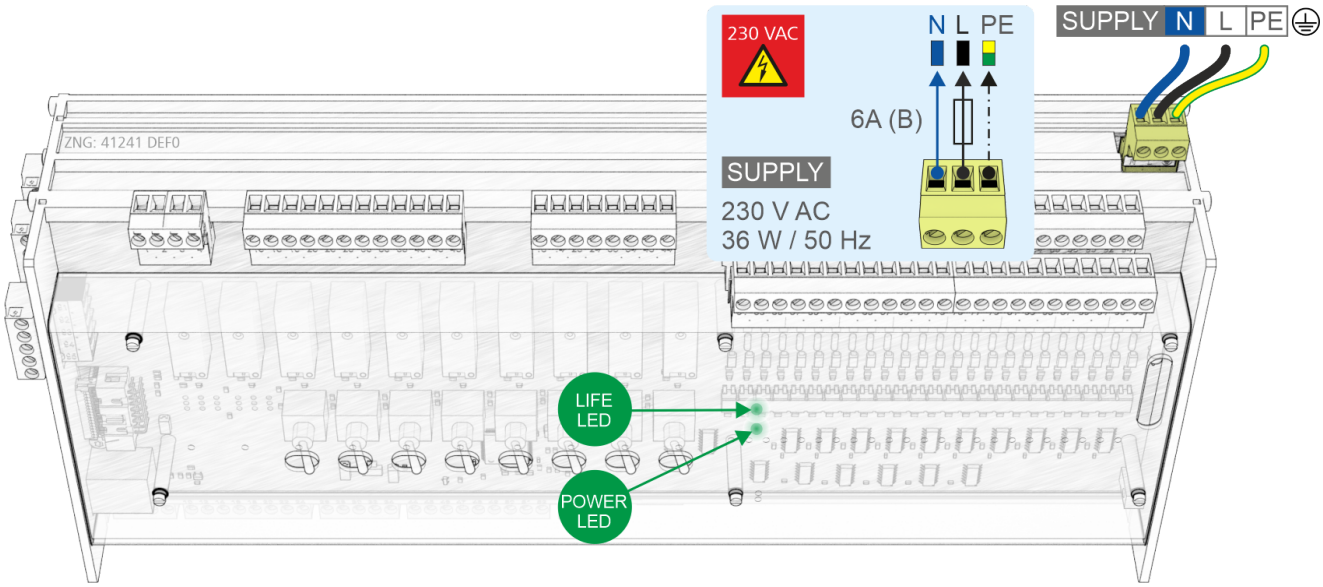
Analogue inputs 1..4	4..20 mA
Analogue inputs 5..7	0..10 V
Analogue outputs 1..4	0..10 V



6.3.5 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).



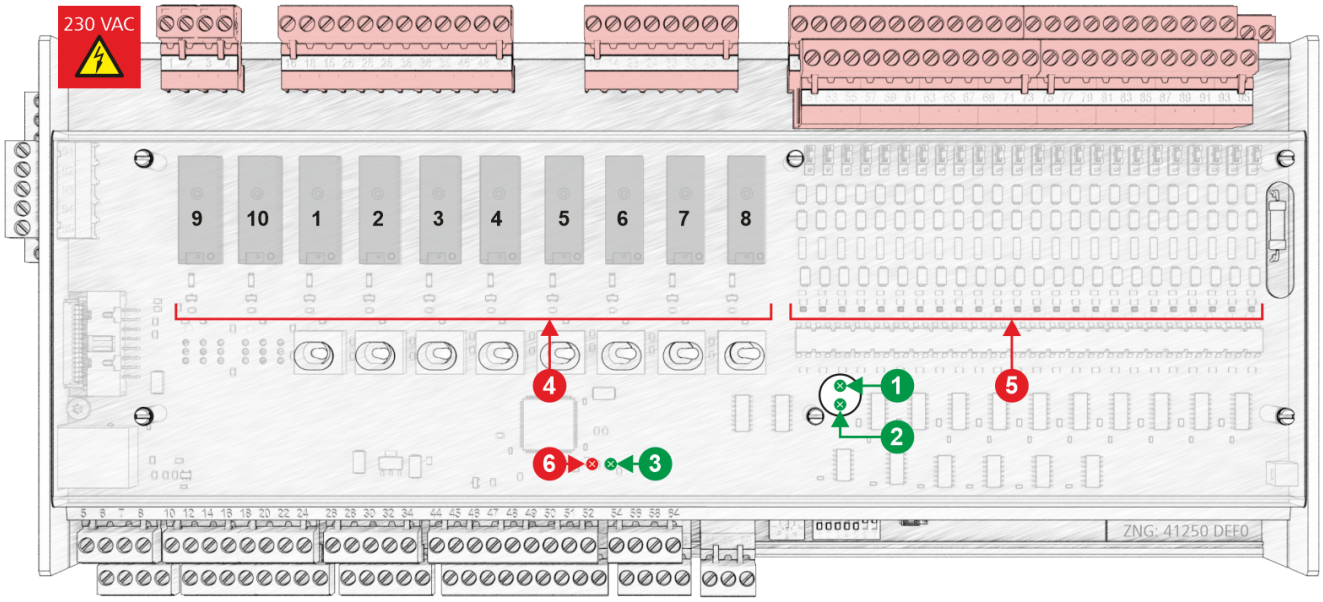
The controller can be put into operation after completion of the mechanical and electrical installation. After connecting to the power supply, the green LED (POWER) lights briefly after switching on.
Note: As the controller itself does not have a switch for switching on or off, it **must** be disconnected from the power supply for e.g. a Restart for approx. 2 seconds (switch on/off the circuit breaker).

For details see chapter Terminal Assignment of the 230 V AC Power Supply and Status LEDs.

6.3.5.1 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!



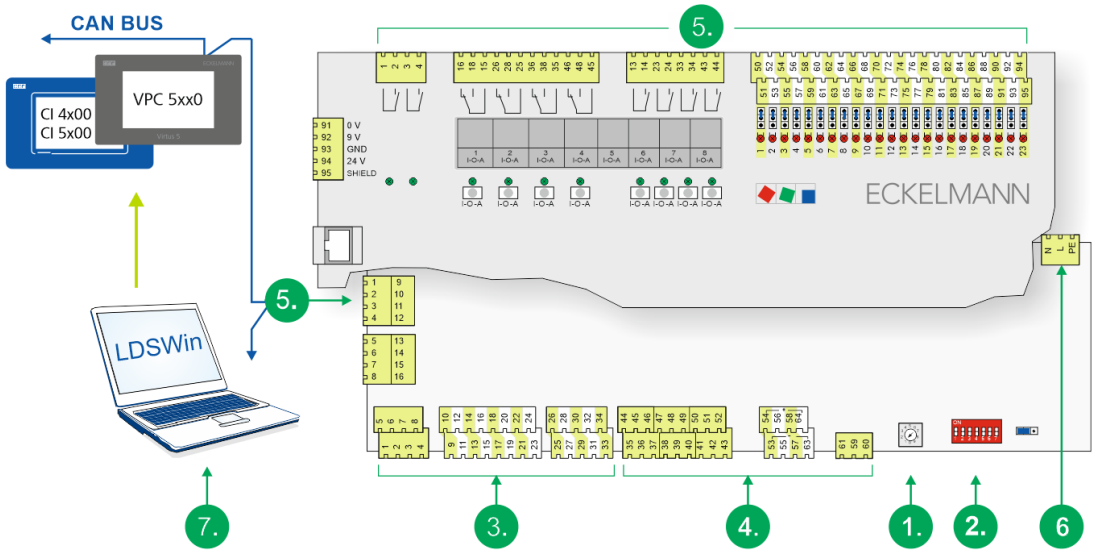
	Function	Colour	LED	Description
Lower board				
1	LIFE	green	LED	FLASHING: Active lamp, board is supplied with power, processor is running OFF: Power supply interrupted or device defective
2	POWER	green	LED	ON: Power supply OK, device is supplied with power, processor is running OFF: Power supply interrupted 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 on the exact terminal assignment can be found in the chapter Pin and Terminal Assignments of WRG 3010 E.

6.4 Quick Commissioning

This chapter is a guide for quick commissioning.

Step 1: Connect hardware completely



1. Set the CAN bus address (122..125); see chapter Setting the CAN Bus Address Using Decade Switch S2.
2. Configure the DIP switches; see chapter Einstellungen über DIP-Schalter S1.
3. Connect the temperature sensors; see chapter Terminal Assignment of the Analogue Inputs.
4. Connect the analogue inputs; see chapter Terminal Assignment of the Analogue Inputs.
5. Connect the controller completely (CAN bus, digital inputs, etc.)
6. Switch on the controller: supply with power.
7. Start LDSWin, connect to the system centre and load the configuration file (glt.cfg); for details see chapter Integration in LDSWin.

Step 2: Configure controller via LDSWin

All optional functions of the WRG 3010 E are **deselected** in the delivery condition!

> **ATTENTION**
>
> During commissioning, only those options may be selected which are actually available in the system!

A. On the Visualisation in LDSWin - HT / LT / Power Signal Setpoints:

1. Is an HT heat exchanger available? YES / NO
2. If yes, is a pressure transmitter available in the water circuit? YES / NO
3. - " - , should the internal power calculation be based on the return temperature or the buffer temperature? Return / Buffer
4. - " - , is the HT heat exchanger used to heat drinking water and is the legionella function required? YES / NO
5. Is an LT heat exchanger available? YES / NO
6. If yes, is a pressure transmitter available in the water circuit? YES / NO
7. Should an outside temperature adjustment be activated for the HT and LT return temperature setpoints? YES / NO
8. The setpoint for the HT return temperature and the setpoint for the LT return temperature, both at 15 °C, must be entered.
   If only one heat exchanger is available, then only for this!

B. On the Visualisation in LDSWin - GCBP / LWP / air conditioning operation setpoints:

1. Is a gas cooler bypass available? YES / NO
2. If yes, is this controlled digitally? YES / NO
3. Should the gas cooler bypass also be enabled in the subcritical range of the refrigeration pack system? YES / NO
4. Is an air heat pump available? YES / NO
5. Is a cold water plate (air conditioning) available? YES / NO
6. If yes, are there parallel compressors with a heat exchanger for suction gas superheating in the refrigeration pack system? YES / NO
7. - " - , is a pressure transmitter available in the water circuit? YES / NO
8. - " - , is a common water circuit for LT and cold water available? YES / NO
9. The setpoint for the HT flow temperature and the setpoint for the LT flow temperature. There is no outside temperature adjustment for the flow temperature.
   If only one heat exchanger is available, then only for this!

C. On the Visualisation in LDSWin - WRG 3010 E:

1. The maximum HT flow temperature.
2. The maximum HT return temperature.
3. The maximum LT flow temperature.
4. The maximum LT return temperature.
   Note for C1..C4: For all temperatures, it must be ensured that the maximum temperatures should be **at least** 5 Kelvin higher than the corresponding setpoints!

> **ATTENTION**
>
> Even if the system is operated with the external power signal, the setpoints for flow and return temperature and the maximum temperatures must be specified, as these influence the calculated power signal (keyword: overheating protection).

6.5 Battery replacement

No battery replacement for the device by the user is envisaged as the battery service life is designed for greater than 10 years. **Opening** the device is **not authorised**. If the "*battery voltage*" message is displayed, the device

must be sent to Eckelmann AG to guarantee correct replacement of the battery. Replacement of the battery after expiry of the warranty is subject to a charge.

ATTENTION

WEEE Reg. No.
DE 12052799

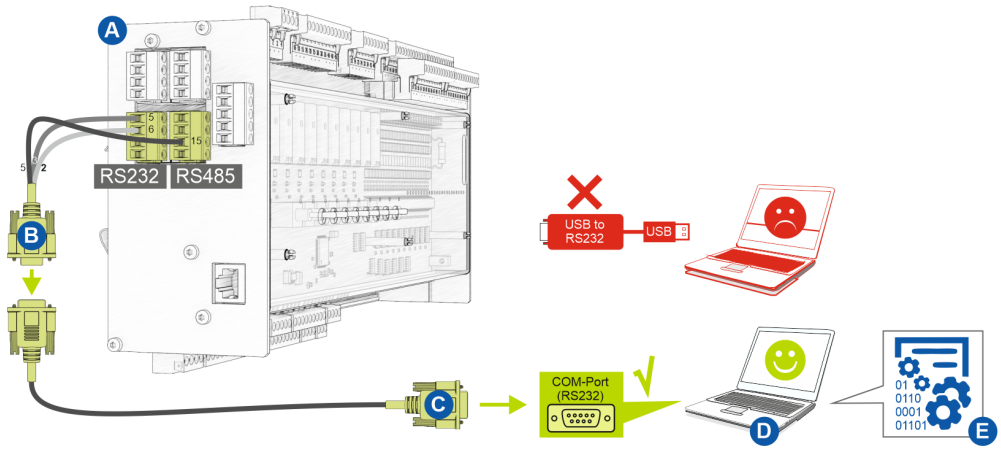
The device contains a lithium battery that must be correctly disposed of separately! Never dispose of this product with other domestic waste. Please inform yourself about the local regulations for the separated disposal of electrical and electronic products and batteries. The correct disposal of your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

6.6 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.

6.6.1 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.

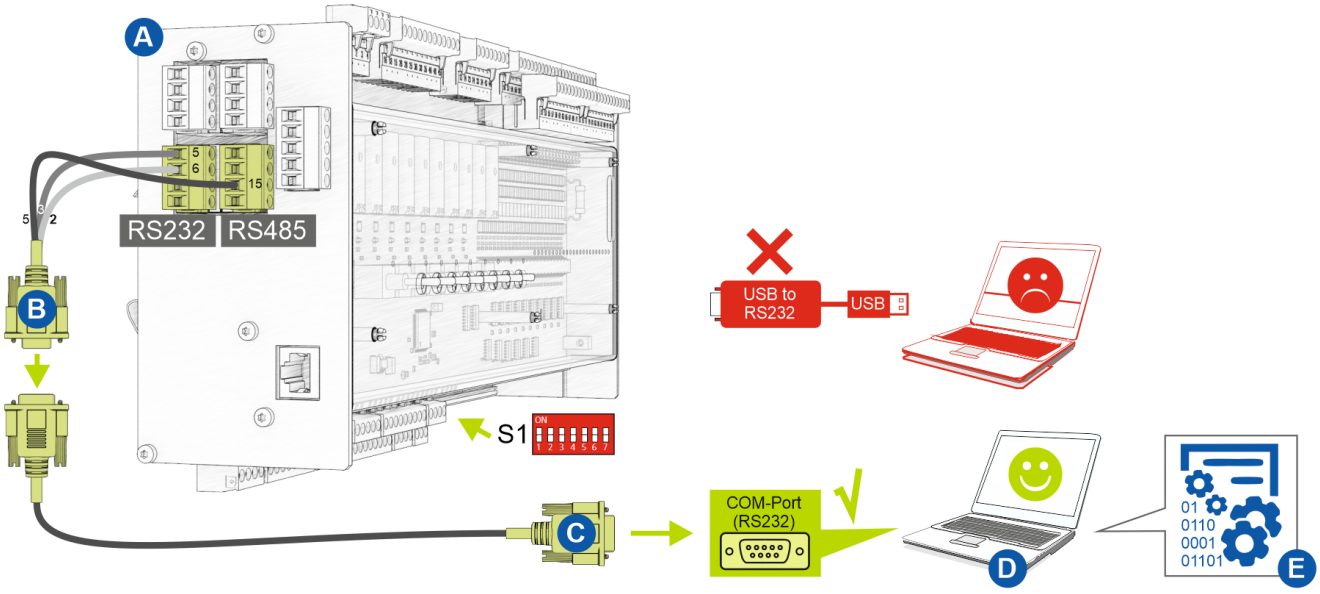
The current file for the firmware update is available in the EDP under https://edp.eckelmann.de/edp/lds/_s8FYYIEckc.

6.6.2 Update of the current firmware

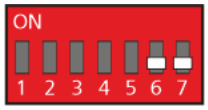
The file "**wrg3010e.exe**" (E) for the firmware update is available in the EDP at https://edp.eckelmann.de/edp/lds/_s8FYYIEckc and may have to be unpacked from the ZIP archive **before** use.

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:

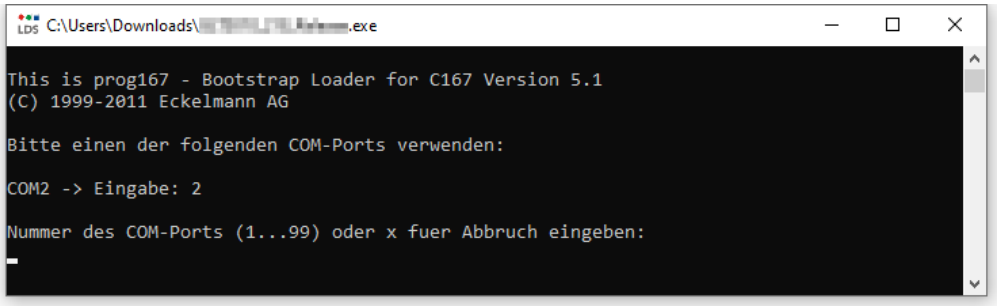
1. Strictly disconnect controller from the mains power supply (there **must** be absence of voltage) .



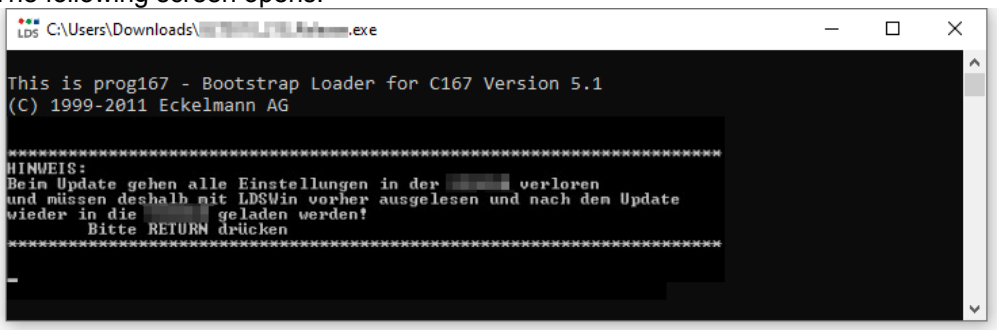
2. Set DIP switch S1 coding switches **6 and 7 to OFF**:



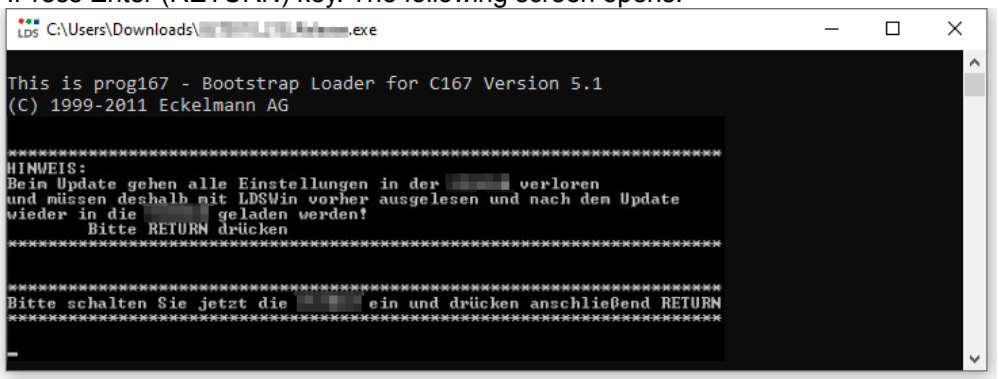
3. Connect controller (A) to flash cable (B) (connect both 4-pin plug connectors at the terminals 5/6/7/8 and 13/14//15/16).
4. Connect flash cable (B) to null modem cable (C).
5. Connect null modem cable (C) to the COM port (RS232) of the notebook (D)
6. In Windows Explorer, run the file *"GLT3010.exe"*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



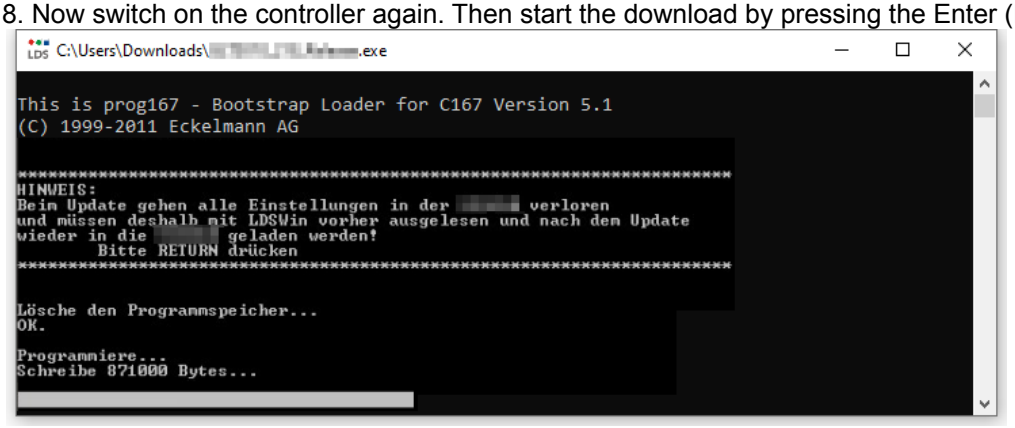
The following screen opens:



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

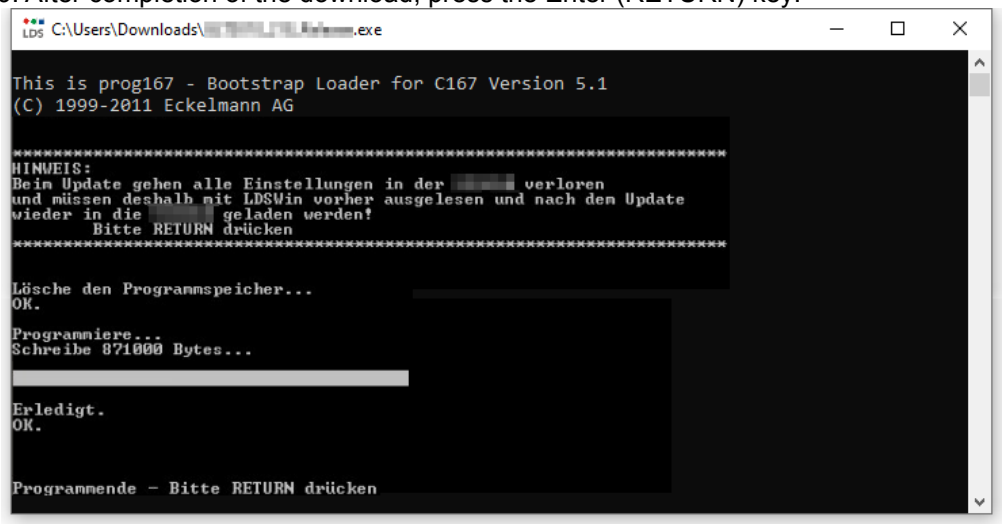


8. Now switch on the controller again. Then start the download by pressing the Enter (RETURN) key:

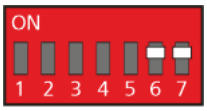


The bar at the bottom indicates the progress of the download.

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



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

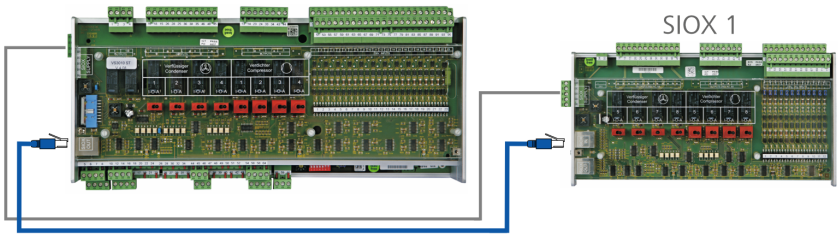


11. The controller must be disconnected from the power supply for a short time after the firmware update.

> **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!

7 Pin and Terminal Assignments of WRG 3010 E

The following figures and tables show the terminal assignments of the basic module and the SIOX extension modules.



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

- Connections for 230 V AC (top)
- Connections for Protective Extra-Low Voltage (bottom)
- Connections for Interfaces (on the side)

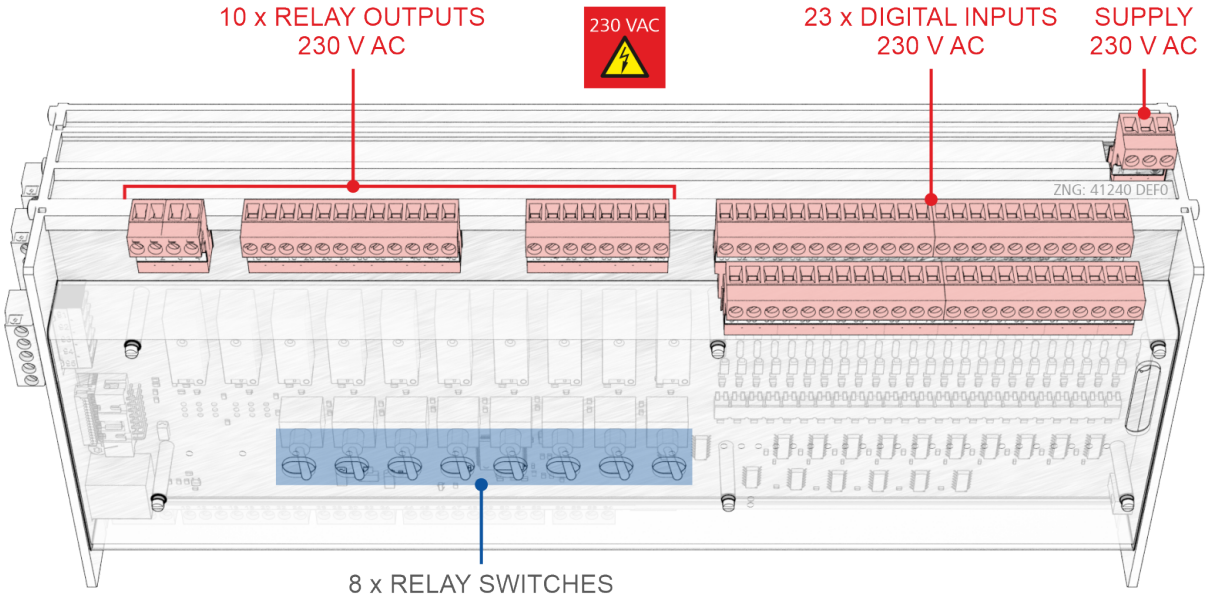
DANGER

Warning of dangerous electrical voltage! Danger to life - risk of electric shock or malfunction!
The following points must be **strictly** observed when wiring:

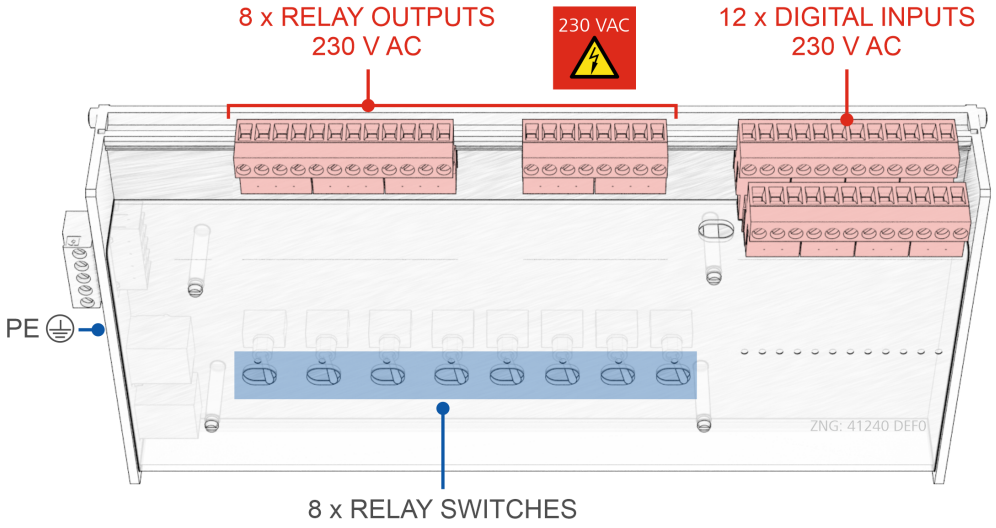
- **Before** loosening or inserting plug contacts on the controller, the system must be **disconnected from the power supply**!
- For **analogue inputs and outputs** with current or voltage interface (4..20 mA / 0..10 V), it is essential to ensure **correct polarity**. Short circuits or a faulty power 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 digital inputs - must be **shielded**. Otherwise malfunctions, e.g. faulty measurements, cannot be ruled out.

7.1 Connections for 230 V AC (top)

Basic Module



SIOX Extension Module

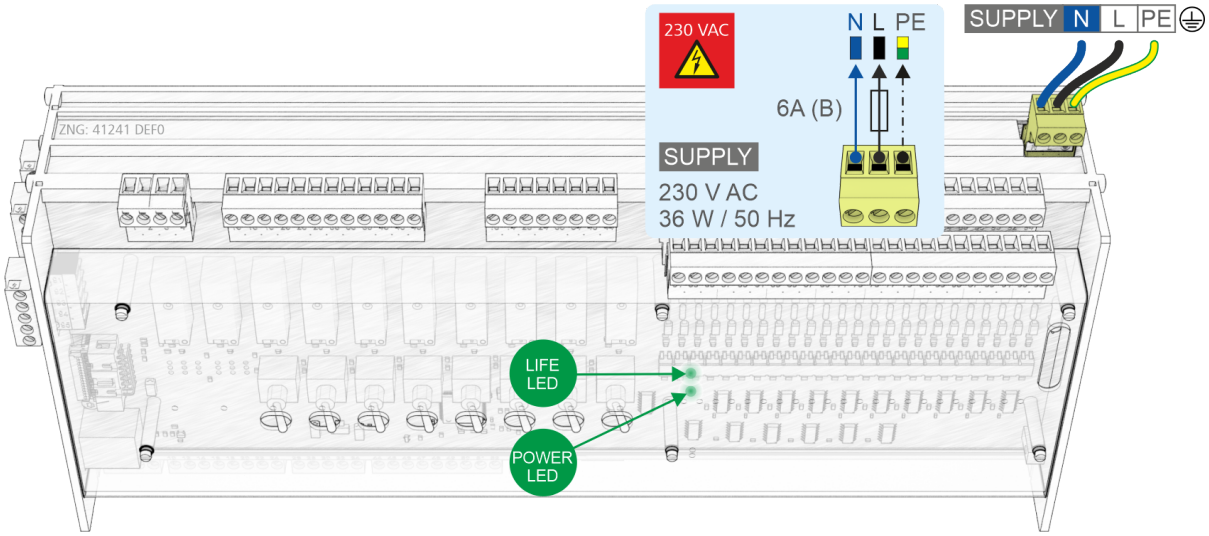


7.1.1 Terminal Assignment of the 230 V AC Power Supply

DANGER

Warning of 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			
Designation	**Terminal No.**	**Connection**	**Function**
230 V AC	N L PE	Neutral conductor Phase 230 V AC Protective 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 applying the 230 V AC power supply, the green POWER LED flashes; for details see chapter Status LEDs.

Requirements for the connecting cable

Since the controller does not have an integrated disconnecting device in the form of a mains switch,
a) a switch or circuit breaker must be present in the system or building installation,
b) this must be suitably located and easily accessible to the user, and
c) this must be marked as the disconnecting device for the unit.

7.1.2 Terminal Assignment of the Relay Outputs - 230 V AC

DANGER

Warning of 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 / pollution degree 2: All connections of the device provided for operation with 230 V AC mains voltage **must** be wired with the same phase 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!

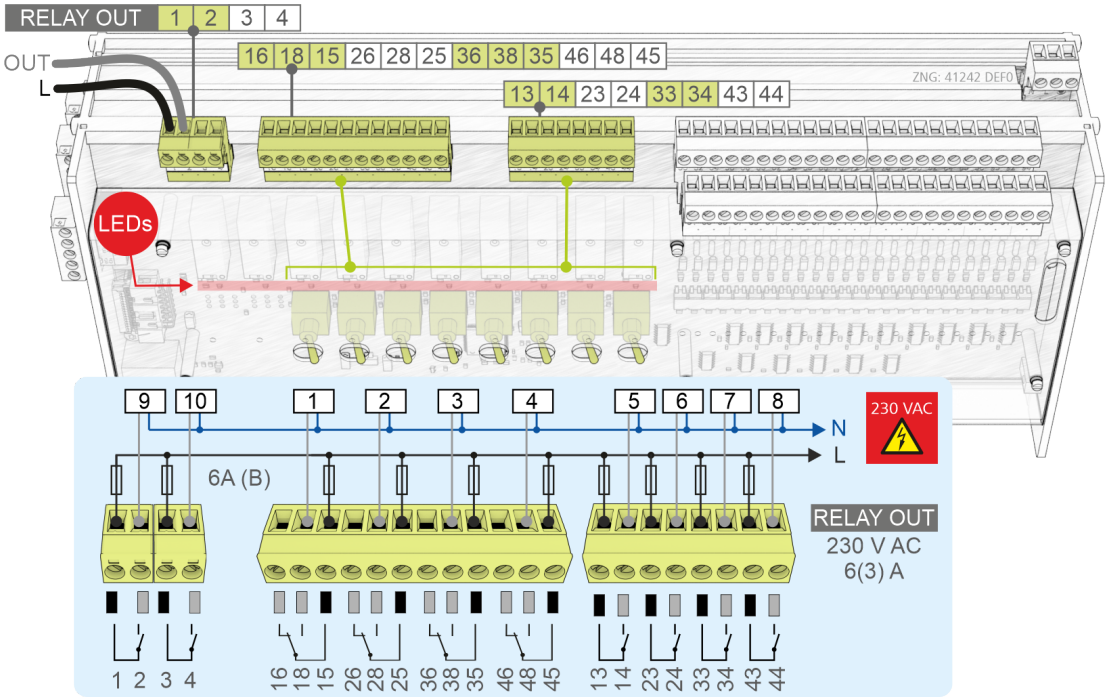
ATTENTION

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: Observe the Handling Wide COMBICON Plugs.
Manual switch on the basic and extension module: The relay outputs 1..8 (not 9 and 10) of the basic module and all relay outputs of the extension module can be manually overridden via the corresponding manual switches on the front; for details see chapter Manual/Automatic Operating Modes.
Practical tip: The configured operating mode of the relay outputs should be noted on the front in the spaces provided to facilitate subsequent manual operation.

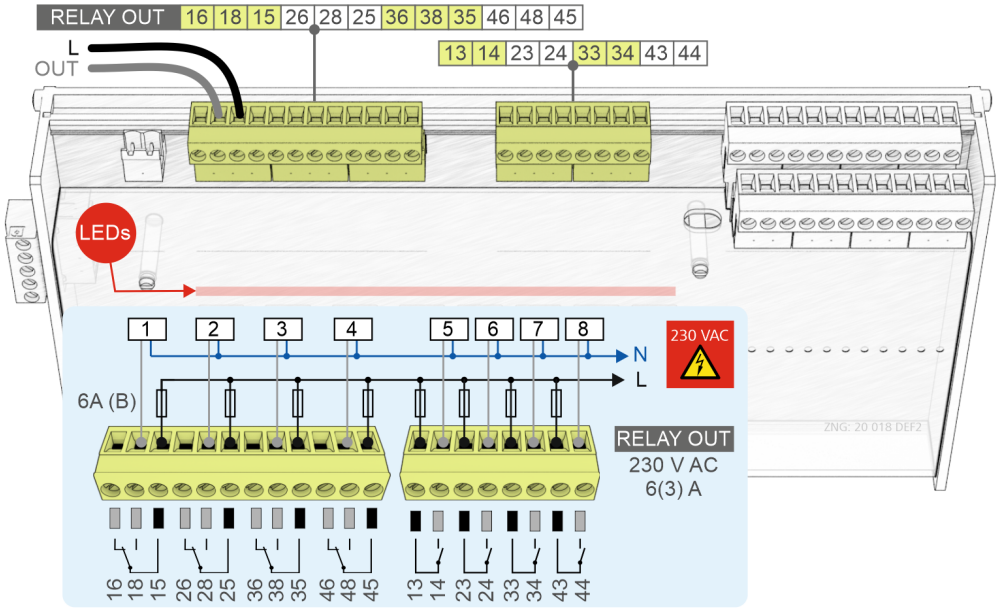
Relay outputs on the basic module



Terminal assignment of the relay outputs

Terminal No.	Function
Basic module	
1, 2	HG (hot gas) defrost valve LWP
3, 4	GCBP digital
15, 16, 18	HG valve LT
25, 26, 28	HG valve HT
35, 36, 38	FRG LWP
45, 46, 48	Air conditioning valve
13, 14	Pump LT
23, 24	Pump HT
33, 34	Pump cold water
43, 44	Valve cold water / HR

Relay outputs on the SIOX extension module



Terminal No.	Function
SIOX 1	
15, 16, 18	--
25, 26, 28	--
35, 36, 38	--
45, 46, 48	--
13, 14	--
23, 24	Air conditioning HG (hot gas) injection
33, 34	HW heating rod
43, 44	--

7.1.3 Terminal Assignment of the Digital Inputs - 230 V AC

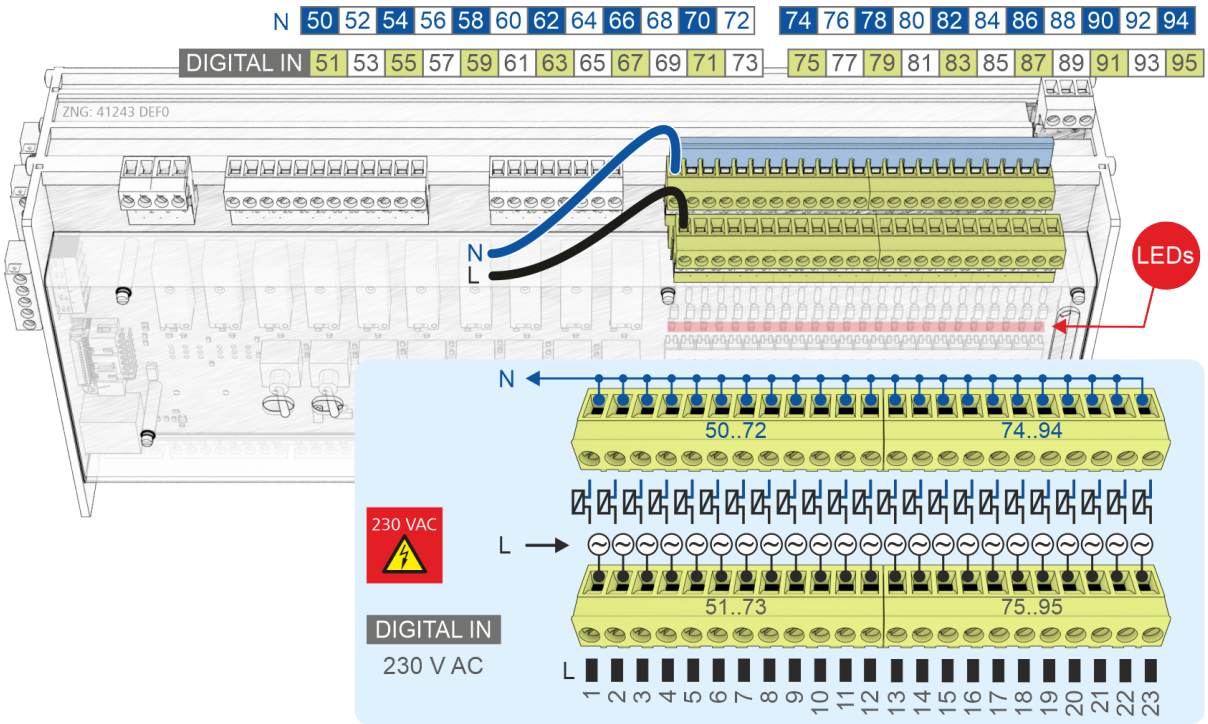
DANGER

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!
Overvoltage category II / pollution degree 2: All connections of the device provided for operation with 230 V AC mains voltage **must** be wired with the same phase 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

Damage to the connector socket: Observe the Handling Wide COMBICON Plugs.

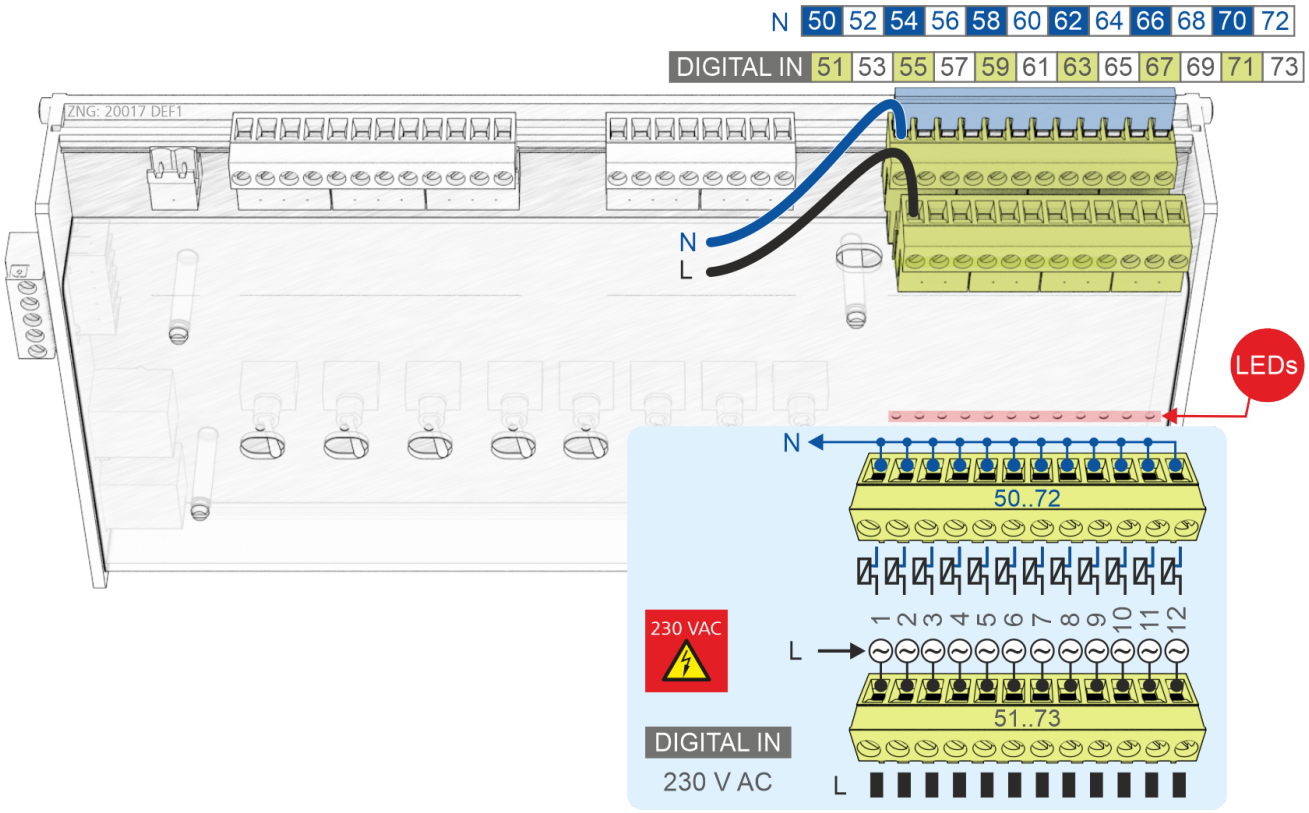
Digital inputs on the basic module



Terminal No.	Function
Basic module	
50, 51	Request LT
52, 53	Request HT
54, 55	--
56, 57	Emergency stop heat recovery *
58, 59	SSM (collective fault message) pump LT *
60, 61	SSM (collective fault message) pump HT *
62, 63	Air conditioning request
64, 65	FST cold water
66, 67	Valve CW (cold water) open
68, 69	Valve CW (cold water) closed
70, 71	U.valve = HR
72, 73	U.valve = cold water (cold water)
74, 75	SSM (collective fault message) pump air conditioning
76, 77	Valve LT open
78, 79	Valve LT closed
80, 81	Valve HT open
82, 83	Valve HT closed
84, 85	Flow LT *
86, 87	Flow HT *
88, 89	GCBP digital open
90, 91	GCBP digital closed
92, 93	Flow cold water *
94, 95	Emergency stop cold water *

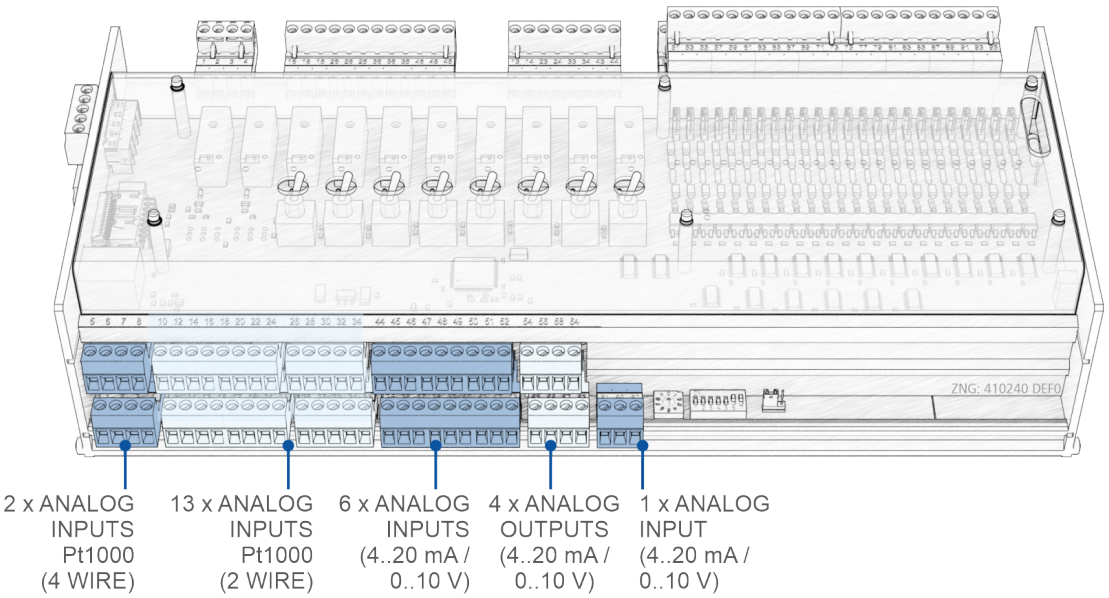
* The monitoring of the digital input is protected against wire break, i.e. it works inverted; for a "good" state 230 V AC must be applied to the digital input!

Terminal assignment of the digital inputs on the SIOX extension module



Terminal No.	Function
SIOX 1	
50, 51	--
52, 53	--
54, 55	--
56, 57	--
58, 59	--
60, 61	--
62, 63	--
64, 65	--
66, 67	--
68, 69	--
70, 71	--
72, 73	--

7.2 Connections for Protective Extra-Low Voltage (bottom)

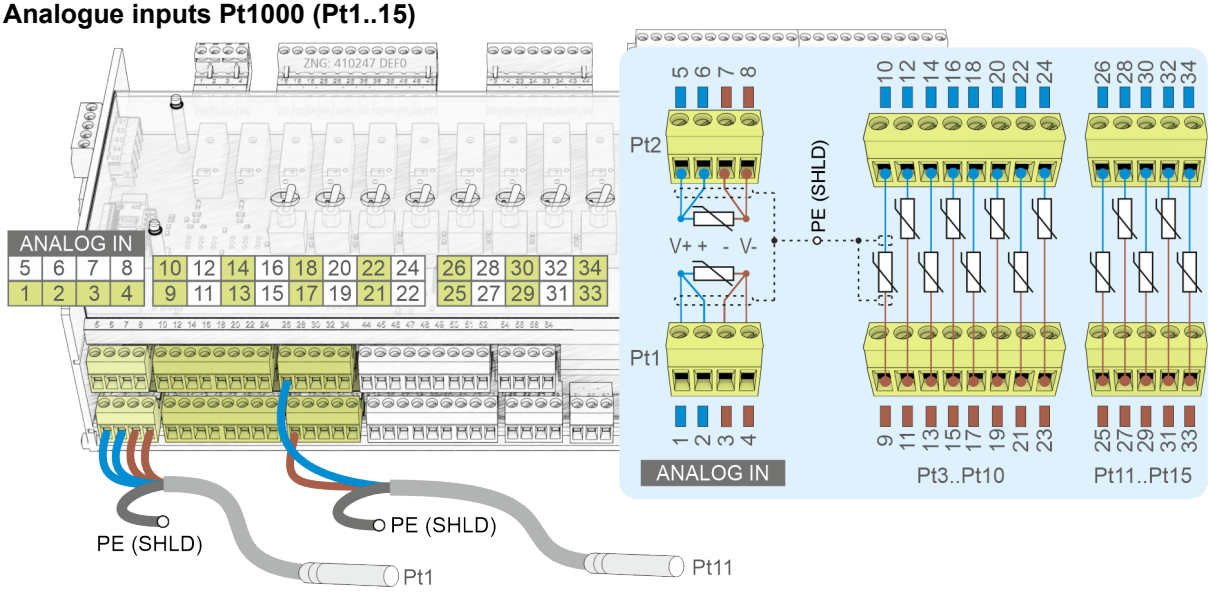


7.2.1 Terminal Assignment of the Analogue Inputs

DANGER

Warning of 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!

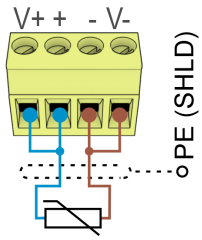
Analogue inputs Pt1000 (Pt1..15)



ATTENTION

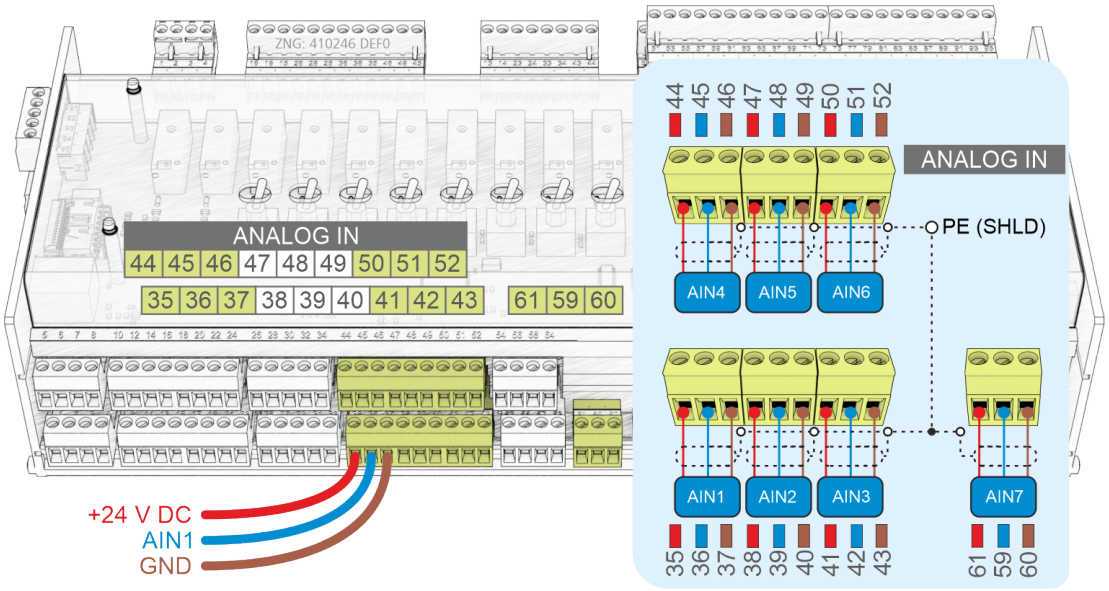
Malfunction due to interference! All supply lines from and to the controller (with the exception of the 230 V supply and signal lines) must be shielded (cable type: LiYCY)! This particularly applies for the analogue inputs and outputs (e.g. sensor supply lines). As a general rule, care should be taken to ensure that signal cables and cables carrying mains voltage are routed in separate cable ducts. Furthermore, the following must be observed when installing 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 Terminal No.	Function
4-wire technology * - calibratable	
1, 2, 3, 4	AT (outside temperature)
5, 6, 7, 8	--
* The analogue inputs can also be used in 2-wire technology by bridging the terminals V+ with + or - with -V:  	
2-wire technology - calibratable	
9, 10	T CO2 on HT
11, 12	T CO2 on LT
13, 14	T CO2 off LT
15, 16	T CO2 off HT
17, 18	T H2O Backl. LT
19, 20	T H2O flow LT
21, 22	T H2O return HT
23, 24	T H2O flow HT
25, 26	T H2O return Air conditioning
27, 28	T H2O flow Air conditioning
29, 30	T Buffer HT upper
31, 32	T Buffer HT lower
33, 34	LWP defrost sensor

Note: The use of temperature sensors in 2-wire technology leads to large measuring errors at long distances, which can be compensated if necessary; for details see calibration of Pt1000 temperature sensors.

Analogue inputs (AIN1..7)



AIN Terminal No.	Function
Analogue inputs	
35 36 37	-- -- --
38 39 40	+24 V 0..10 V - Pressure H2O air conditioning 0 V **Sensor type: 4..20 mA, -0.5..8 bar ***
41 42 43	+24 V 0..10 V - Pressure H2O HT 0 V **Sensor type: 4..20 mA, -0.5..8 bar ***
44 45 46	+24 V 0..10 V - Pressure H2O LT 0 V **Sensor type: 4..20 mA, -0.5..8 bar ***
47 48 49	+24 V 0..10 V - Power signal LT 0 V
50 51 52	+24 V 2..10 V - RM gas cooler bypass 0 V
59 60 61	0..10 V - Power signal HT 0 V +24 V

ATTENTION

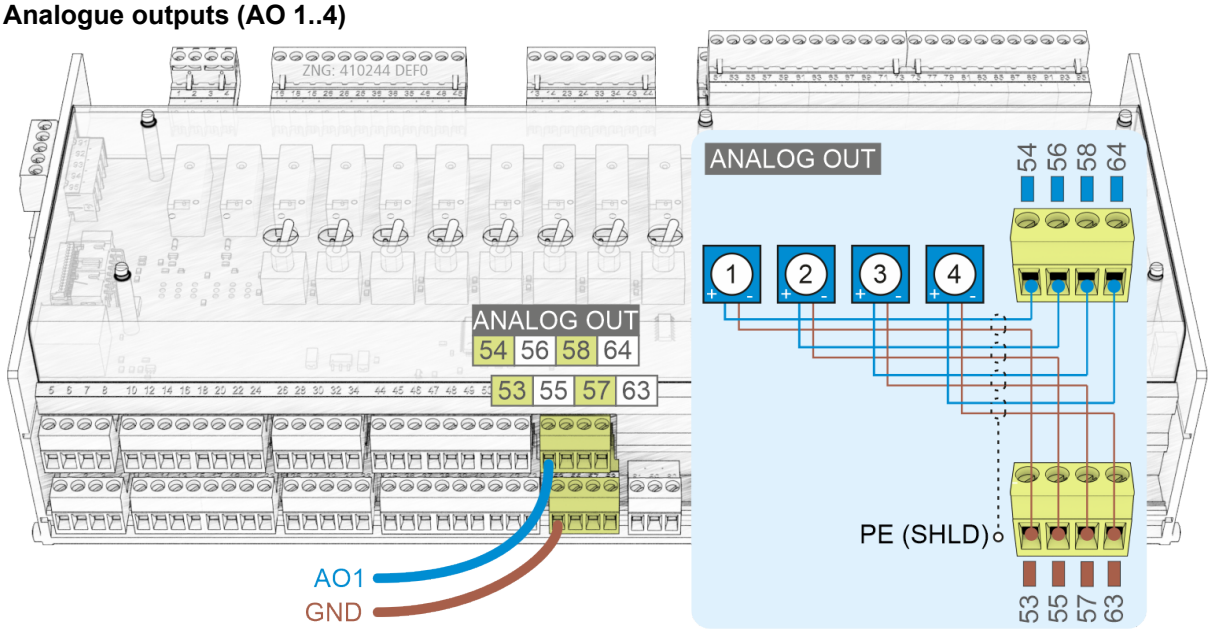
* These sensors **must** be used! A sensor with other characteristics can cause the controller to malfunction as the physical parameters are then interpreted incorrectly!

7.2.2 Terminal Assignment of the Analogue Outputs

DANGER

Warning about dangerous electrical voltage! 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 transducers). Furthermore, this will destroy the controller!

Analogue outputs (AO 1..4)



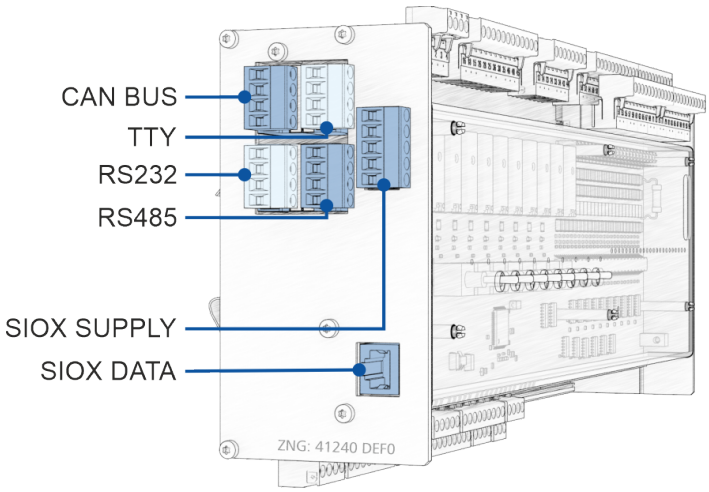
ATTENTION

Malfunction due to interference sources! All supply lines from and to the WRG 3010 E (with the exception of the 230 V power supply and signal cables) must be shielded (cable type: LiYCY)! This particularly applies for the analogue inputs and outputs (e.g. sensor supply cables) as well as the CAN bus cabling (see Basics and General Safety and Connection Instructions). As a general rule, care should be taken to ensure that signal cables and cables carrying mains voltage are routed in separate cable channels.

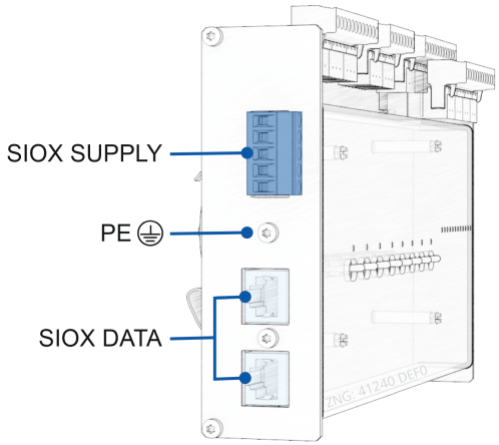
Terminal No.	Function
Base module	
53 54	GND 0..10 V - Gaskühl.byp.ventil
55 56	GND 0..10 V - Pumpe NT Drehzahl
57 58	GND 0..10 V - Pumpe HT Drehzahl
63 64	GND 0..10 V - Pumpe Klima Drehzahl

7.3 Connections for Interfaces (on the side)

Basic Module



SIOX Extension Module



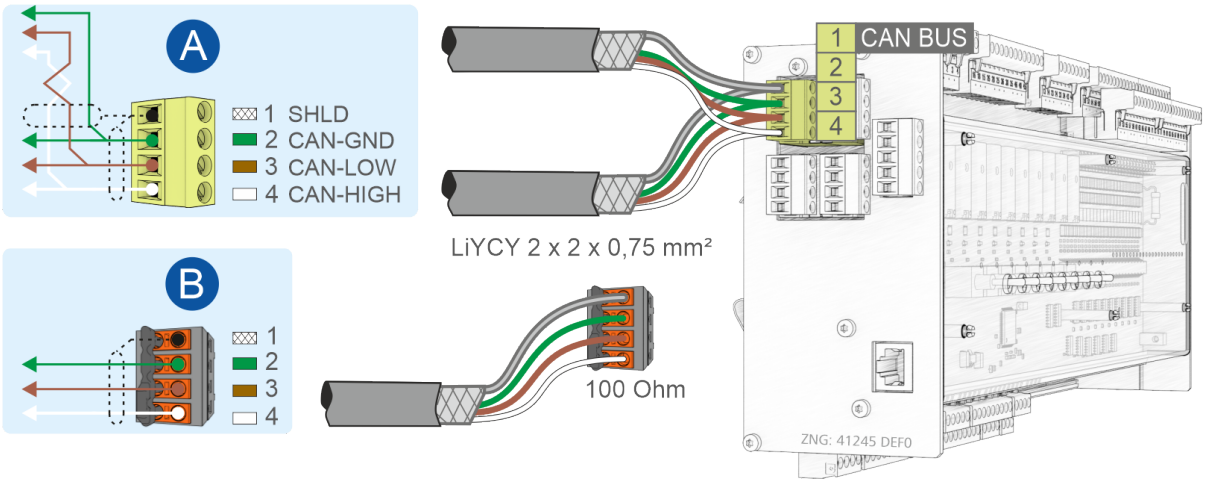
7.3.1 Terminal Assignment of CAN Bus

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.

ATTENTION

All CAN bus supply cables 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 ducts. Maximum length of the cable: 500 m.
Wiring variant A: Unit is a device in a CAN bus segment with other devices before and after this, **no terminating resistor** required.
Wiring variant B: Unit is at the beginning / end of a CAN bus segment, **a terminating resistor 100 Ohm is required** (item number KGLCANTERM).
For further details on the CAN bus, see the operating instructions"E*LDS Basics, Safety Instructions, CAN Bus & Modbus".



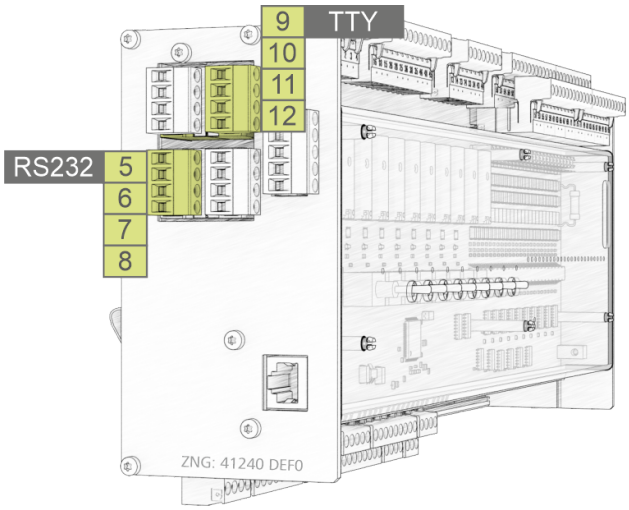
CAN BUS on the basic module			
Designation	**Terminal No.**	**Connection**	**Wire colour**
Standard, for connection to the E*LDS system			
CAN BUS	1 2 3 4	SHIELD CAN-GND (Ground) CAN-LOW CAN-HIGH	Shielding green brown white

For details, see chapter Setting the CAN Bus Address via Thumb Wheel Switch S2.

7.3.2 Terminal Assignment of RS232 and TTY

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!



RS232 and TTY on the basic module			
Designation	**Terminal No.**	**Connection**	**Function**
RS232	5, 6, 7, 8	TxD, RxD, RTS, CTS	currently without function
TTY	9, 10, 11, 12	TxD+, TxD-, RxD+, RxD-	currently without function

For details see chapter Setting the RS485/TTY Interface via Jumper J1.

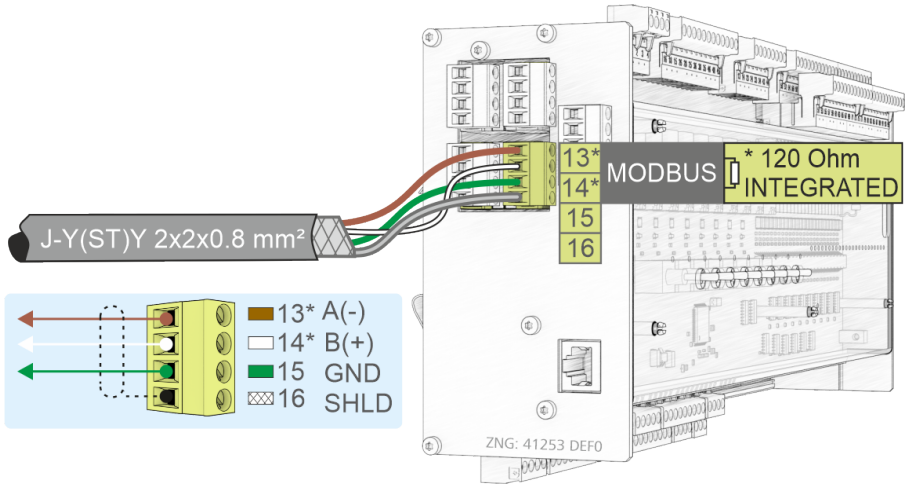
7.3.3 Terminal Assignment of RS485

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.

ATTENTION

All supply cables of the Modbus 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 ducts.
For further details on the CAN bus, see the operating instructions "E*LDS Basics, Safety Instructions, CAN Bus & Modbus".



RS485 on the basic module				
Designation	**Terminal No.**	**Connection**	**Wire colour**	**Function**
RS485	13* 14*	RS485 A(-) RS485 B(+)	brown white	currently without function
	15 16	GND SHIELD	green shielding	currently without function

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

For details see chapter Setting the RS485/TTY Interface via Jumper J1

7.3.4 Terminal Assignment of SIOX

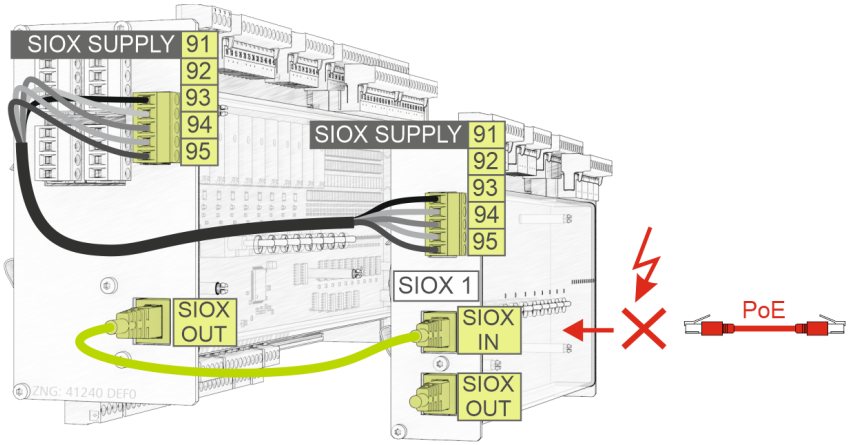
DANGER

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.

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 of a basic module with one SIOX extension module:



Designation and terminal No.		Function - details see chapter Connection of the SIOX modules to the controller
Basic module	**SIOX 1..3**	
91 92 93 94 95	91 92 93 94 95	**SIOX SUPPLY** - Power supply for SIOX modules GROUND from 9 V +9 V DC GROUND from 24 V +24 V DC SHIELD (shielding)
SIOX OUT	SIOX OUT	**SIOX data line** - output for communication with SIOX(en)
-	SIOX IN	**SIOX data line** - input for communication with basic 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

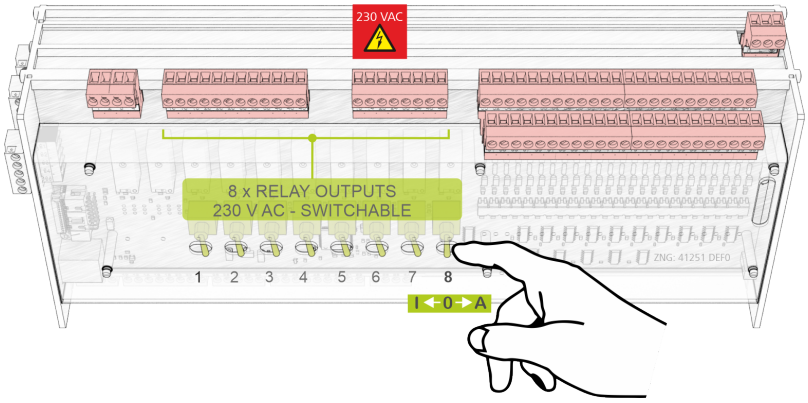
8 Manual/Automatic Operating Modes

The manual/off/automatic mode selection is available in the same way on the basic module and on the SIOX extension module. These can be used for the following purposes:

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

Manual mode enables fixed switching from automatic mode to manual ON (I) or to manual OFF (O). The programme controller for each selected field device is inoperative in manual mode. Manual/automatic switching of the respective field device, which depends on the application, is carried out via the switches located on the front.

Example on the basic module (S8 on O = manual OFF)



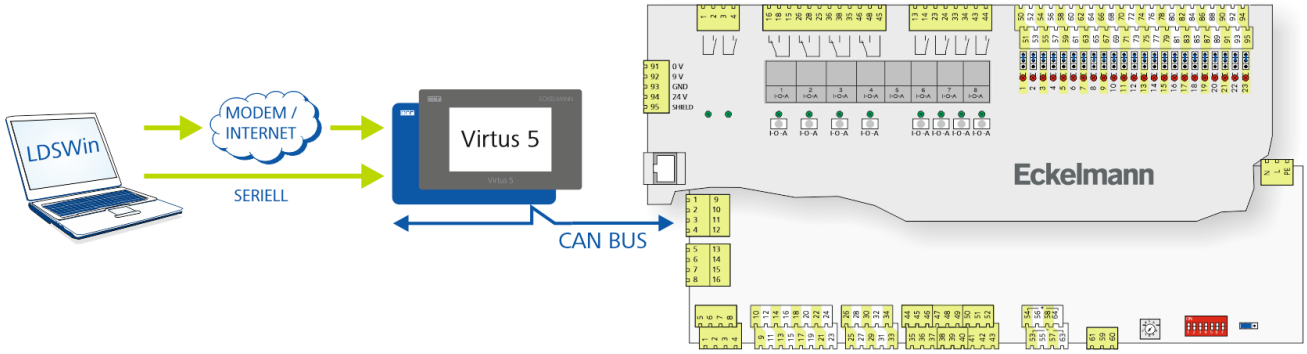
The following switch positions are possible:

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

> ⓘ The manual ON (I) and manual OFF (O) positions override the state desired by the software! The automatic mode (A) by the programme in the controller is out of operation until the respective switch is set to *AUTO* again.

9 Operation of WRG 3010 E

The WRG 3010 E controller for heat recovery can **only** be operated and parametrised with the PC software LDSWin. The connection of LDSWin to the system centre (that functions as gateway for the controller) can either be made remotely (via modem or via the network) or directly on-site (via a serial connection):



> Details for the connection of LDSWin to the E*LDS system can be found in the LDSWin operating manual.

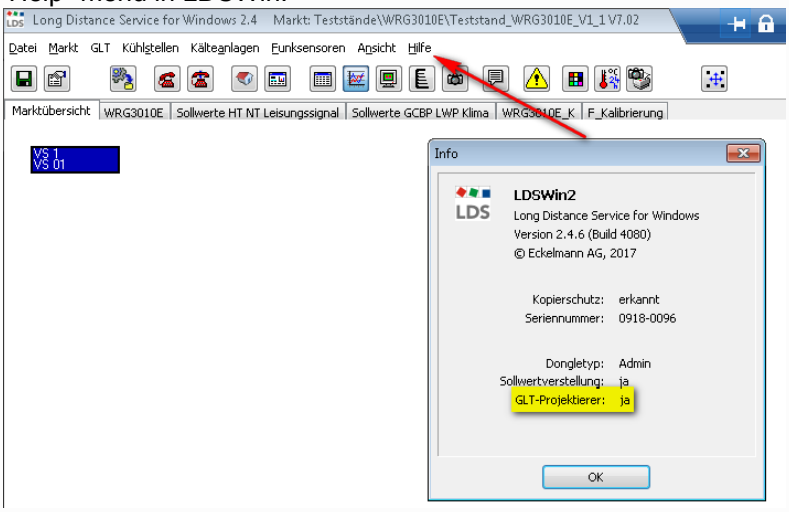
Once the connection has been established, the controller can be operated and parametrised via LDSWin.

> All selectable functions of the controller are deactivated in the delivery condition. The individual modules must be selected using the corresponding button during the commissioning.

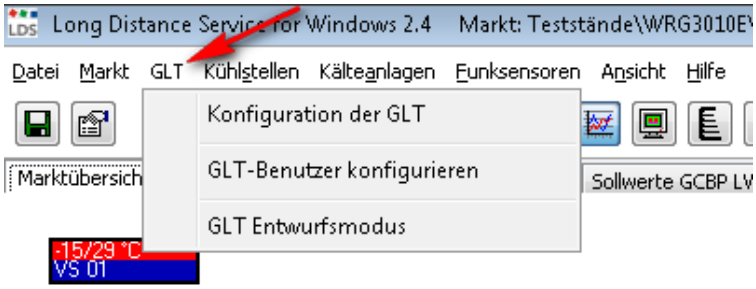
9.1 Integration in LDSWin

For parameterisation and operation of an WRG 3010 x or GLT x010, the visualisation pages must first be imported into LDSWin, here using an WRG 3010 E as an example:

> **Requirement:** A dongle with rights as "BMS project engineer" is required to import visualisation pages into LDSWin.
> In order to check whether the used dongle has these rights, this information can be retrieved in the "Help" menu in LDSWin:



If a WRG 3010 x or GLT x010 has been connected in the E*LDS system via the CAN bus, the entry "BMS" is displayed in the menu bar in LDSWin:

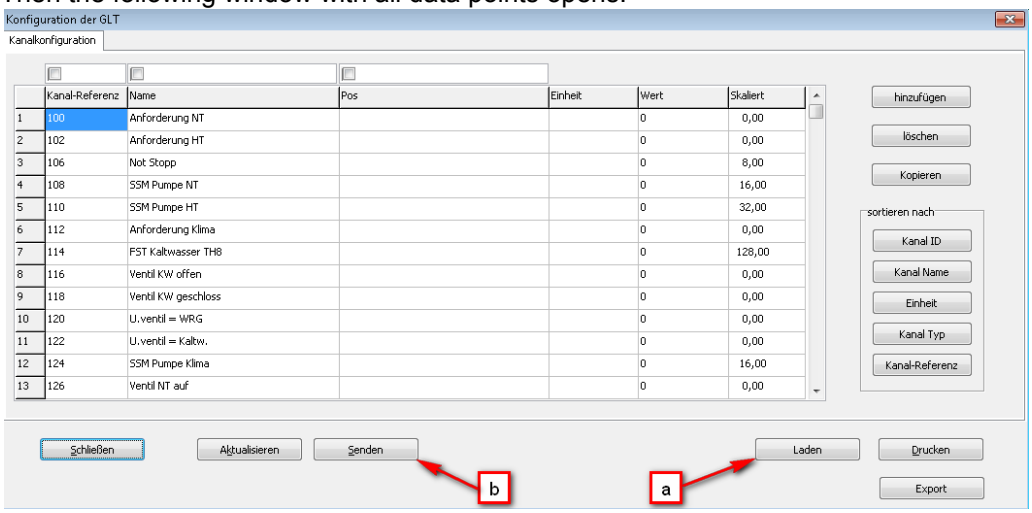


If this entry is missing, then either the controller has not been detected by the system centre or the dongle does not have rights as "BMS project engineer".

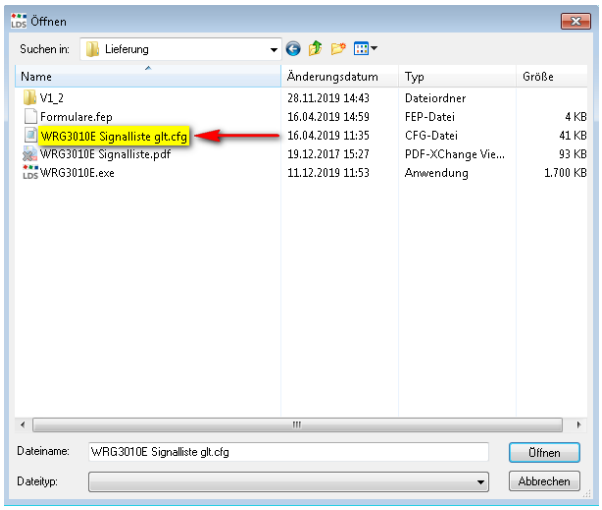
The following order in the procedure must be **strictly observed** for the import:

1. Open the menu "BMS" and select the submenu "Configuration of the BMS".

2. Then the following window with all data points opens:



Note: This list is empty if the store is being created for the first time. To import the "glt.cfg" (configuration file with all data points), click on the "Load" button **(a)** and the following window will open:

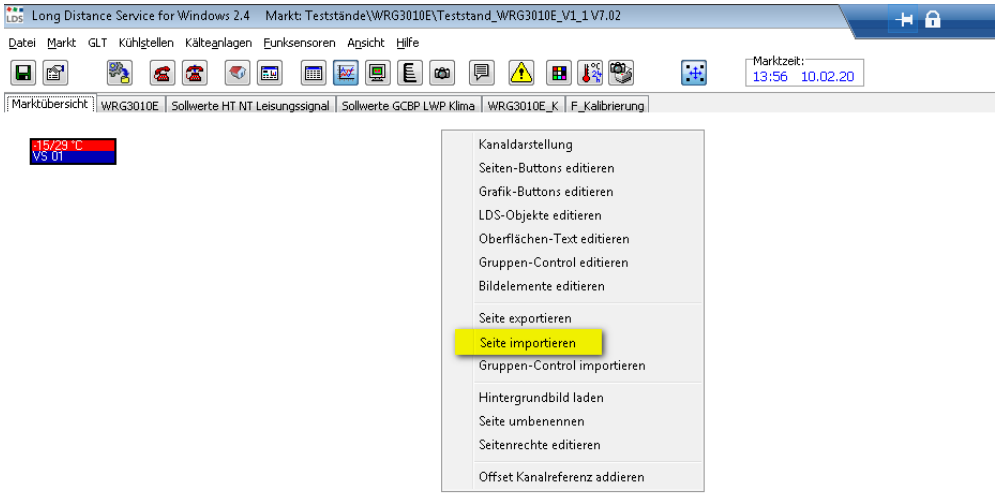


There, the file "WRG3010 Signalliste glt.cfg" or "GLTx010 Signalliste glt.cfg" must be selected and loaded into LDSWin by clicking the button "Open".
Subsequently, the "glt.cfg" must be sent to the system centre by clicking the button "Send" **(b)**

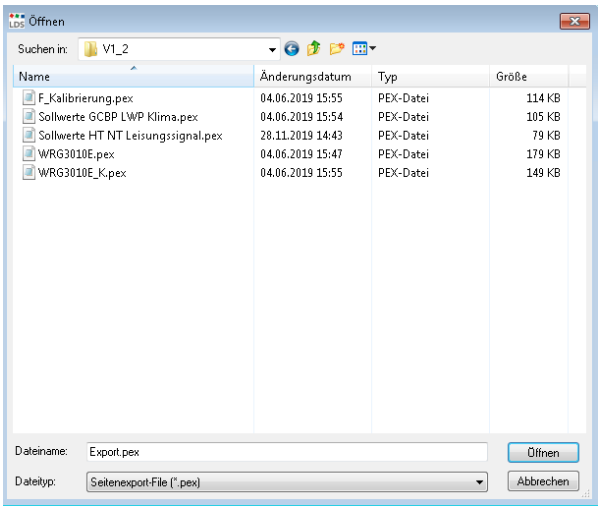
3. The individual visualisation pages can be imported if the data points have been loaded both in LDSWin and in the system centre.
   For this, change mode must be activated in LDSWin:

   Tip: Pressing the button again deactivates the change mode.

4. In the next step, please move the mouse pointer to any position on the current page (outside the menu bar) and press the right mouse button and select "import page" in the menu that opens:

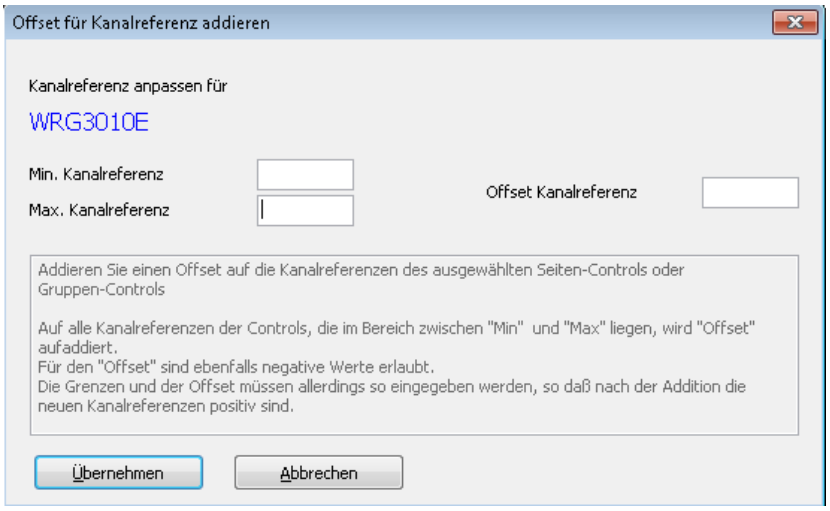


5. In the mask, navigate to the directory in which the folder with the supplied visualisation pages is located:



Note: All visualisation pages are of the file type "PEX" (Page EXport).

6. Select the required visualisation pages and click on "Open". The following mask then appears, here using the example of an WRG 3010 E:



If this is an installation with **only one WRG 3010 E**, this window can be closed by clicking the "cancel" button and the page is completely imported.
Repeat the steps 4. to 6. until all pages have been imported.

> **ATTENTION**
>
> In installations with **only one controller,** the CAN bus address must be set to position 1 (address 122)! For details, see chapter Setting the CAN Bus Address Using Decade Switch S2.

7. **SPECIAL CASE for systems in which up to a maximum of four WRG 3010 E are installed!**
   On request, the user will receive a separate "glt.cfg" from Eckelmann AG. This contains all data points for the visualisation of the controllers.
   In this case, the mask (see point 6) must be completed in full; the corresponding details will be provided separately by Eckelmann AG.

> The pages can be moved and changed in their arrangement in LDSWin at any time as long as the change mode is activated.
> **Practical tip:** If all pages have been completely imported, the change mode (see point 3) **must** be deactivated again.

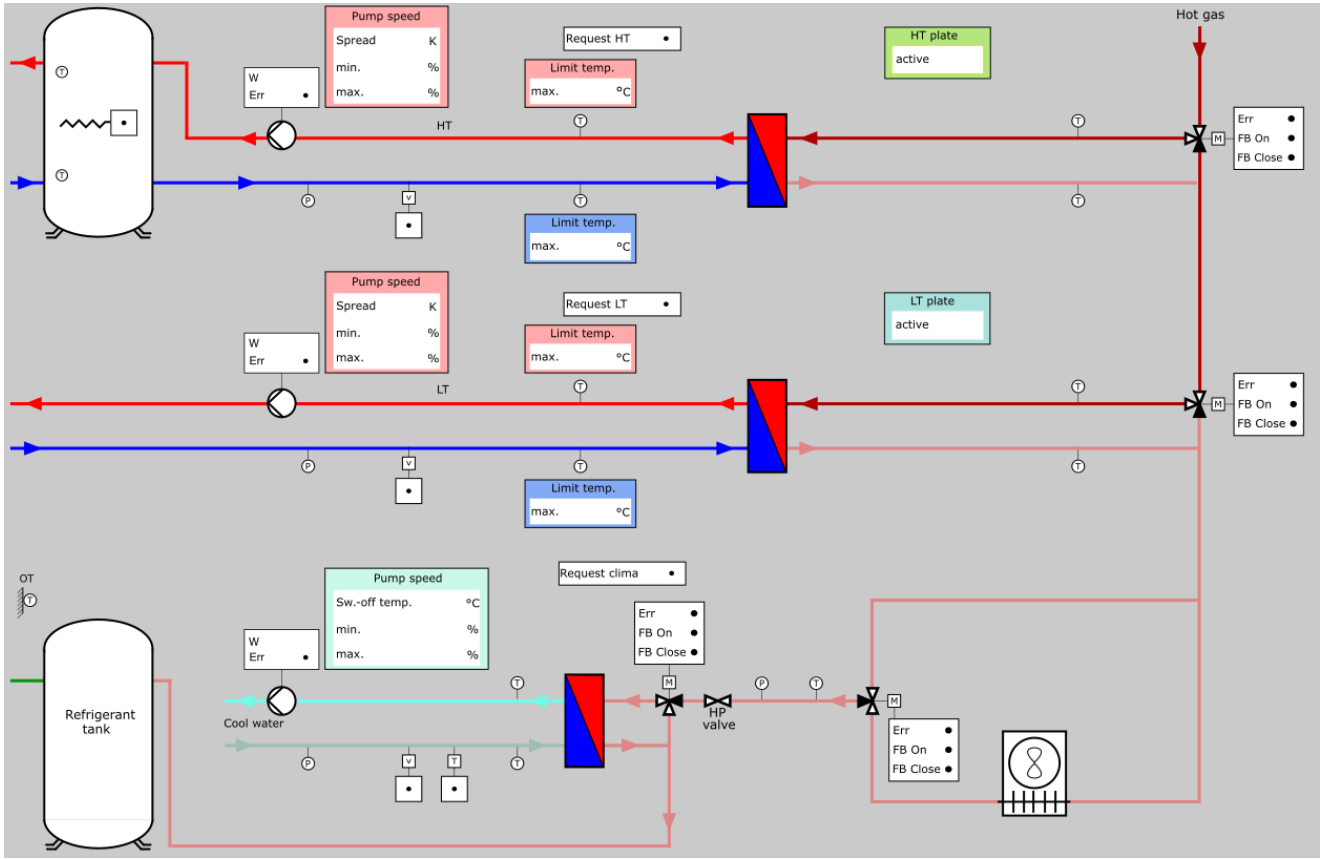
9.2 Visualisation in LDSWin - WRG 3010 E

The "WRG 3010 E" visualisation page shows the schematic flow chart of the installation, with CO_2 and water circuit. All actual values are visualised on this page and some setpoints can be adjusted here.

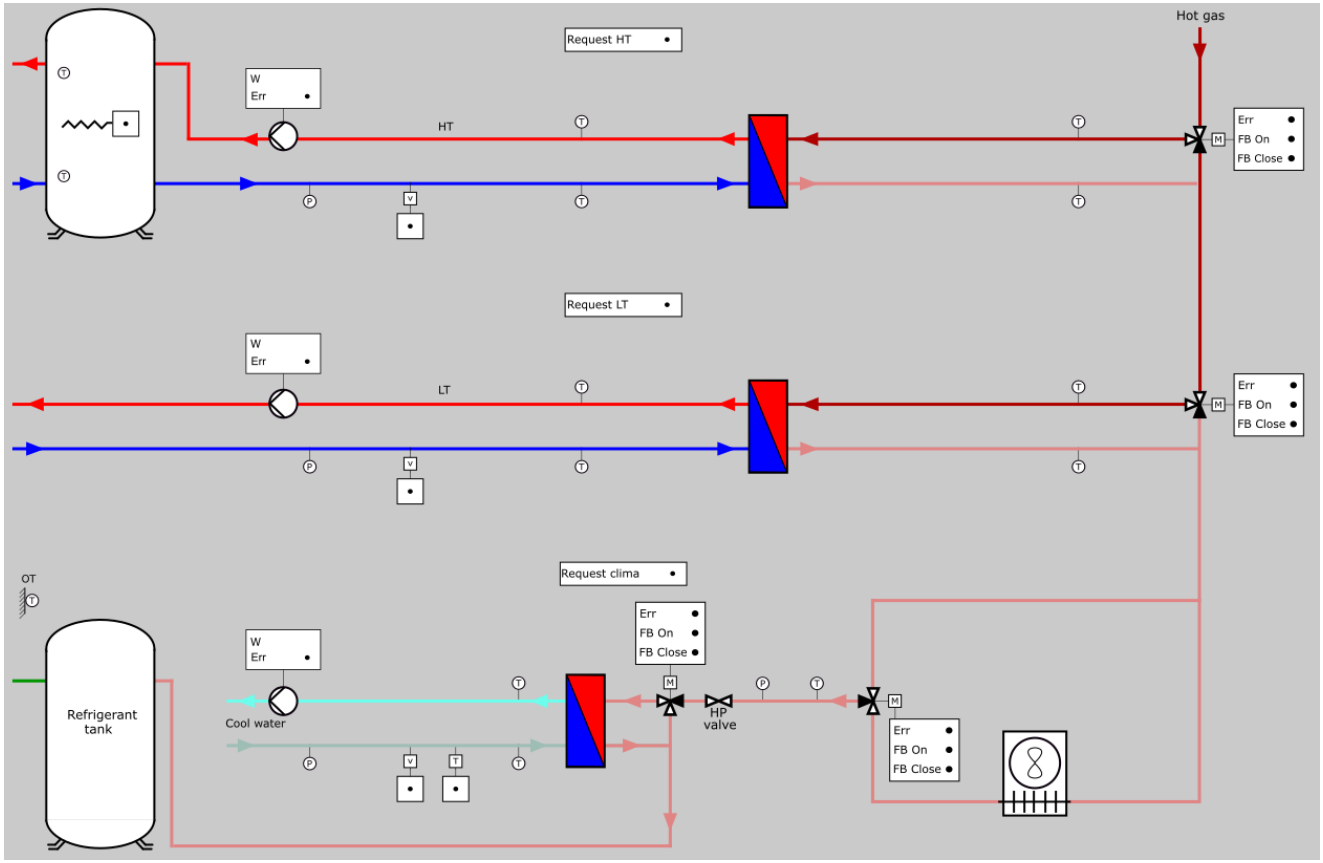
The following elements are available for the operation:

1. The setpoint for the speed control of the pumps. For HT and LT this is the spread in each case between flow (red) and return (blue). When producing cold water, it is the switch-off temperature, which is also used to monitor the inlet temperature of the water.
2. Setting the minimum and maximum speed of each pump.
3. For HT and NT the maximum permissible temperature in the flow and return, both can be set separately.
4. One button each to deactivate the HT and LT heat exchanger:
   Button not activated: System component in function.
   Button activated: System component in function - however, alarms are still active!

Example 1: "WRG 3010 E" visualisation page in LDSWin. The picture shows the **complete design** of the installation with all connected, optional system components and continuously controlled GCBP:



Example 2: "WRG 3010 E" visualisation page in LDSWin, here in configuration with **not** selected HT heat exchanger and digital GCBP. Due to the deselection of the optional system components (HT has been deselected), these are no longer displayed and their alarms are suppressed:



9.3 Visualisation in LDSWin - HT / LT / Power Signal Setpoints

This visualisation page is used for the parametrisation of HT, LT and the generation of the internal power signal. The individual areas are subdivided by colour.

General (grey)

The current software version is shown in the grey area. This is always displayed as a three-digit integer and is to be interpreted as follows, as here in the example of "104": *V1.04*. For various functions, communication with the interconnection controller is required. The CAN bus address of the NK pack must be entered so that both can communicate. In the next line, the password for activating the service area can be entered. The green indicator light underneath signals an active service area; see chapter Service Area Analogue Inputs and Outputs.

Power signal **(blue)**

The blue area shows the setpoints of the power signal processing; for details, see Power Signal. The setpoints include the following information:

- Information for increasing and reducing the internal power signal.
- The delay to the next heating instance (pressure increase).
- The determination whether heating power is available and the delay until the hot gas valve closes.
- Maximum high pressure with HR. This parameter also exists in the interconnection controller and should be set to the same value.
- Minimum high pressure with HR. This parameter also exists in the interconnection controller and should be set to the same value.
- Maximum high pressure (coloured red); exceeding this leads to all heating instances being switched off.
- Thresholds of the internal power signal for starting and stopping the individual heating instances.
- A manual override of the state machine.

In the lower left corner, information about the state machine, the request from the building, the level of the external power signal and the calculated power signal are displayed, in each case for HT and LT. The higher power signal (from HT and LT) then determines the heating level for the entire system.

Heat recovery HT and LT (pink)

The pink area contains the required setpoints for HT (see chapter High Temperature Heat Recovery HT) and LT (see chapter Low Temperature Heat Recovery LTI). In detail, these are:

- The button for activation of the option HT and/or LT.
- The required Kp and Tn (each separately adjustable for HT and LT) for the speed control of the pumps.
- A possibility to enter the lockout time, after HT or LT has been switched off (due to the absence of heat output).
- A button to specify whether a pressure transmitter is installed in the water circuit (separate for HT and LT).
- The minimum water pressure, including the delay time until alarm signalling. The parameters are only important if the button "pressure transmitter" has been set to "yes" (and thus the actual pressure can be recorded).
- The button for selecting whether the external power signal is used or a separate power signal is calculated based on the water temperatures.

Especially only for heat recovery HT:

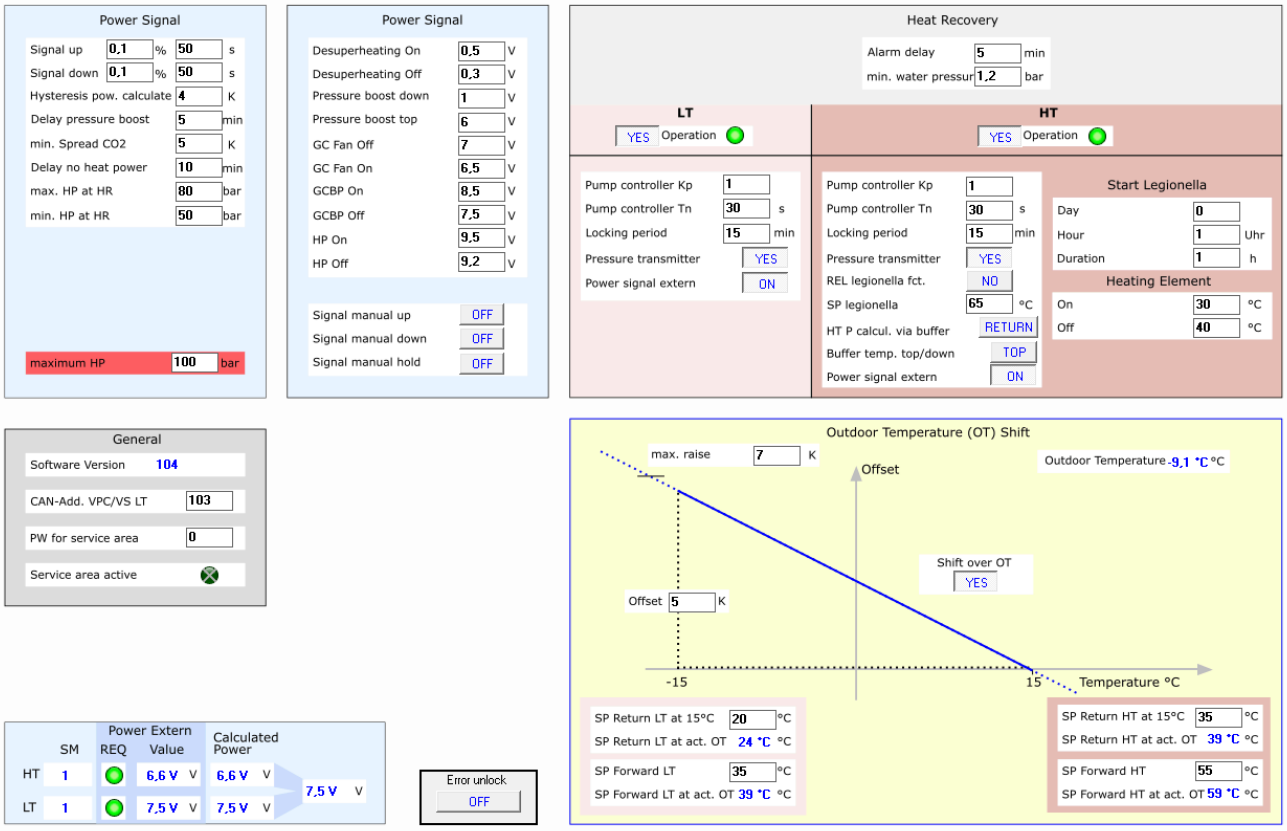
- The release of the legionella function.
- The increased setpoint for the legionella function.
- The selection of the power calculation for HT via return or buffer temperature.
- The input for the start of the legionella function.
- The switch-on threshold for starting the electric heating rod.
- The switch-off threshold for stopping the electric heating rod.
- A button for selection of the upper or lower buffer sensor as control sensor. This selection is only necessary if the power signal is calculated separately and the buffer temperature is to be used for the calculation.

Outside temperature adjustment (yellow)

The WRG 3010 E has the possibility of outside temperature adjustment. The desired setpoint for HT and LT at a outside temperature of +15 °C is set in this field. The setpoint is entered separately for the flow and return temperature of the respective heat exchanger. The current outside temperature (analogue input Pt1000, terminals 1, 2, 3, 4) is located in the yellow field at the top right. If no outside temperature sensor has been connected to the input or if there is a sensor break, the outside temperature from the interconnection controller which is transmitted from it via the CAN bus is used.

The function is activated if the button "adjustment via outside temperature" has been operated. In this case, the gradient is determined with the "offset heating curve" parameter, whereby the entered offset applies to an outside temperature of -15 °C. The gradient applies equally to HT and LT. The setpoint is then adjusted depending on the outside temperature and the gradient. To prevent possible overheating, e.g. during very low night frosts, a maximum increase can still be set. The resulting setpoint for HT and LT is located directly below the respective setpoint.

Example: The setpoint HT flow is set to 55 °C, the parameter "offset heating curve" is set to 5 Kelvin, the parameter "max increase heating" is set to 7 Kelvin and the outside temperature is -9.1 °C. In this case, the calculated new setpoint would be 59 °C.



9.4 Visualisation in LDSWin - GCBP / LWP / air conditioning operation setpoints

The setpoints for the 2 heating instances GCBP, LWP as well as for the air conditioning operation, separated by colour, are shown on this screen. These functions are switchable options that can be activated here and then adjusted. If the upper button of a function is activated ("Yes Operation"), then this function is activated and the corresponding part for visualisation, monitoring and alarm signalling is enabled.

Gaskühlerbypass (GCBP)**(green)**

The first button in the field is used for activating the GCBP function. The gas cooler bypass valve can be controlled both continuously and digitally (OPEN/CLOSED).

- The switch-on delay specifies how long this heating instance is switched on with a delay. The time runs from the start of the gas cooler bypass valve request, which depends on the internal power signal.
- The parameter "tg1" specifies the temperature of the refrigerant to be regulated in heating mode. This is only necessary for a continuously operating gas cooler bypass valve.
- The parameter "tg1 Klima" is also only applicable for a continuously operating gas cooler bypass valve. It is only required in air conditioning mode and when parallel compressors are available.
- The parameters "max HP" and "Hysteresis HP" are used to monitor the high pressure and are required for continuous and digital gas cooler bypass valves.
- The parameters "max tg1" and "Hysteresis tg1" are used to monitor the refrigerant temperature between the gas cooler bypass valve and HP valve. They are also required for continuous and digital control.
- The parameters "max T H2O" and "Hysteresis H2O" are used to monitor the water inlet temperature in the LT heat exchanger. If this is not selected, then HT heat exchanger. They are also required for continuous and ON/OFF control.
- The locking time for lock-down to prevent the gas cooler bypass valve from being switched on again.
- The Kp and Tn required for the PI controller, which controls the opening degree of the gas cooler bypass valve, and the minimum and maximum opening degree of the gas cooler bypass valve are the next setpoints.
- The "GCBP digital" button is used to select whether a continuously controlled gas cooler bypass valve or a valve (OPEN/CLOSED) is used.
- The "subcritical active" button activates or deactivates the subcritical operation of the gas cooler bypass.

Luftwärmepumpe (LWP) **(yellow)**

The top button in the field is used for activating the LWP function. The air heat pump is controlled by a downstream case controller (e.g. UA 4x0 E).

The following parameters are available:

- The "Einschaltverzug" parameter is the delay for starting the LWP heating instance.
- The "LWP max HGtemperatur" parameter monitors the hot gas outlet temperature HT and if this is exceeded, the LWP is switched off. The LWP is not enabled again until the hot gas outlet temperature drops 4 Kelvin below this threshold.

The following parameters are available for the defrosting of the LWP:

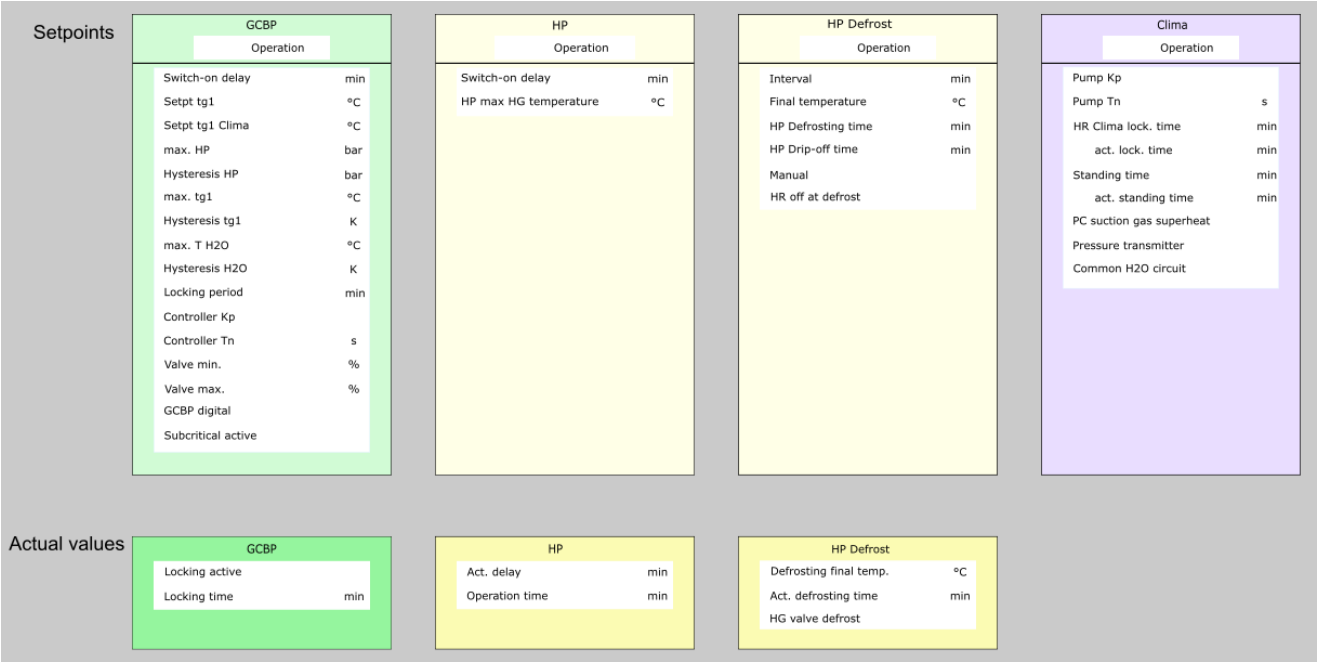
- The "Interval" parameter is the operating time of the LWP; the defrost will start after this time has elapsed.
- When the "termination temperature" is reached, defrosting is stopped and the drip time starts.
- The "LWP Abtauzeit" parameter specifies the maximum defrost duration.
- The "LWP Abtropfzeit" parameter defines the time between the end of defrosting and the restart of the LWP.
- A manual defrost can be initiated with the "Manual" button.
- All heating instances can be disabled during defrost with the "HR off at defrost" button".

Air conditioning operation **(purple)**

The top button in the field is used for activating the air conditioning function. For details about the function of the air conditioning.

- The "Pumpe Kp" and "Pumpe Tn" parameters are for the speed controller of the pump.
- The "WRG-Klima verr. Zeit" parameter specifies the time for the mutual interlocking of the heat recovery LT and air-conditioning functions, in the case of a jointly used water circuit. The remaining time is displayed immediately below.

- The "standstill time" parameter specifies how long the air-conditioning function remains disabled. The remaining time is displayed immediately below. The time runs from the time the air conditioning function is deactivated.
- A new setpoint for the GCBP is enabled with the "PV suction gas superheat" button.
- Button to indicate whether a pressure transmitter is installed in the water circuit.
- Button for activation of the common water circuit subfunction.



9.5 Visualisation in LDSWin - Service Area

The visualisation page “service area" is divided into two areas.

Upper range - sensor calibration

Overview of all Pt1000 temperature sensors with terminal number, current actual value (measured value) and a brief description of the function. In addition, it is possible to calibrate each sensor individually in order to compensate for any measurement errors that may occur due to very long connection cables by means of an offset, for details see Calibration of the Pt1000 Temperature Sensors.

Lower area - service mode (password protected)

For test and service purposes, all analogue inputs and outputs of the controller can be manually overridden in manual mode. The service mode is password protected and is only visible **after** entering a password, for details see chapter Service Area Analogue Inputs and Outputs.

Sensor Calibration

Pt1000	Terminals	Measured Value	Offset			Calibrated Value	Description
1	1, 2, 3, 4	-9,1 °C	OFF	0	K	-9,1 °C	Outdoor temperature 2
2	5, 6, 7, 8		OFF	0	K		- -
3	9, 10	72,9 °C	OFF	0	K	72,9 °C	Temperatur CO2 Entry HT
4	11, 12	64,1 °C	ON	-15,4	K	48,7 °C	Temperatur CO2 Entry LT
5	13, 14	15,2 °C	OFF	0	K	15,2 °C	Temperatur CO2 Exit LT
6	15, 16	28,8 °C	ON	25	K	53,8 °C	Temperatur CO2 Exit HT
7	17, 18	12,3 °C	OFF	0	K	12,3 °C	Temperatur H2O Return LT
8	19, 20	22 °C	OFF	0	K	22 °C	Temperatur H2O Forward LT
9	21, 22	32 °C	OFF	0	K	32 °C	Temperatur H2O Return HT
10	23, 24	50 °C	OFF	0	K	50 °C	Temperatur H2O Forward HT
11	25, 26	25,6 °C	OFF	0	K	25,6 °C	Temperatur H2O Return Clima
12	27, 28	10,6 °C	OFF	0	K	10,6 °C	Temperatur H2O Forward Clima
13	29, 30	35,2 °C	OFF	0	K	35,2 °C	Temperatur Buffer HT top
14	31, 32	26,3 °C	OFF	0	K	26,3 °C	Temperatur Buffer HT down
15	33, 34	11,7 °C	OFF	0	K	11,7 °C	Temperatur HP Defrost Sensor

Service Mode Analogue Inputs and Outputs

	Terminals	REL	Value		Rem. time	
AI 1	35, 36, 37	OFF	10	mA	0 min	
AI 2	38, 39, 40	OFF	15	mA	0 min	
AI 3	41, 42, 43	OFF	4	mA	0 min	
AI 4	44, 45, 46	ON	15	mA	42 min	

	Terminals	REL	Value		Rem. time	
AI 5	47, 48, 49	OFF	3	V	0 min	
AI 6	50, 51, 52	OFF	0	V	0 min	
AI 7	59, 60, 61	OFF	2	V	0 min	

	Terminals	REL	Value		Rem. time	
AO 1	53, 54	OFF	7	V	0 min	
AO 2	55, 56	OFF	2	V	0 min	
AO 3	57, 58	ON	3	V	41 min	
AO 4	63, 64	OFF	4	V	0 min	

10 Decommissioning and disposal

10.1 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.

10.2 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.

11 Alarms and messages of WRG 3010 E

11.1 Message system

Messages such as "*Pump collective fault*" are detected by the heat recovery controller via digital inputs or are generated by the controller itself, e.g. "*Valve fault*". These messages are then sent to the system centre via the CAN bus and archived there with date, time and message priority. All messages thus receive an "incoming" and an "outgoing" time stamp.

> Some messages must be acknowledged by the user, which is only possible with the LDSWin PC software.

11.2 Display of the Messages and Alarms in the System Centre

	Receive time stamp	Send time stamp	Controller	Position	Address	Message	Priority
Date **Time**	18.05.17 12:37:26	18.05.17 12:45:17	WRG3010E	KMR	CAN bus 122	*22 - LT valve malfunction*	22

Note about the message priorities

Only the last digit of the priority, in the example above x**2**, is decisive for the message / alarm allocation. The first digit is only used for the allocation to a maintenance group, in this case **2**x to WRG 3010 E. Thus, messages with PRIO "20" and alarms with PRIO "21" and PRIO "22" are available. The alarms with the priorities "21" and "22" act directly on the alarm relays "PRIO1" and "PRIO2" of the system centre. For more information about the priority concept, see "System Centre Operating Manual".

> **Practical tip**
>
> Since many messages and alarms are based on digital and analogue input signals, the wiring should always be checked in the event of a fault and for remedial action! In addition, the visualisation page "Troubleshooting" is available to quickly detect and eliminate possible causes for missing switch-on or running conditions.

List of alarms and messages

Priority	Message	Cause	Remedy
High temperature heat recovery HT			
20	HT temp return too high	The return temperature in the high temperature water circuit is higher than the configured maximum return temperature. Results in immediate closing of the hot gas valve and reduction of the calculated power signal for HT. The pump continues to run until the power signal is lower than the switch-off threshold of the desuperheat heating instance.	Check the configured maximum return temperature HT.
	HT temp flow too high	The flow temperature in the high temperature water circuit is higher than the configured maximum flow temperature. Results in immediate closing of the hot gas valve and reduction of the calculated power signal for HT. The pump continues to run until the power signal is lower than the switch-off threshold of the desuperheat heating instance.	Check the parameterised, maximum flow temperature HT.
22	HT FB H2O outlet	Sensor break temperature sensor water outlet (flow) from heat exchanger HT.	Check temperature sensor and replace if necessary.
	HT FB H2O inlet	Sensor break temperature sensor water inlet (return) in heat exchanger HT.	Check temperature sensor and replace if necessary.
	HT FB HG Outlet	Sensor break temperature sensor hot gas outlet from heat exchanger HT.	Check temperature sensor and replace if necessary.
	HT FB HG Inlet	Sensor break temperature sensor hot gas inlet in heat exchanger HT.	Check temperature sensor and replace if necessary.
	HT FB buffer top	Sensor break temperature sensor buffer top.	Check temperature sensor and replace if necessary.
	HT FB buffer below	Sensor break temperature sensor buffer below.	Check temperature sensor and replace if necessary.
	HT no water	The value of the pressure transmitter in the water circuit HT is lower than the parameter "minimum water pressure". Results in immediate closing of the hot gas valve and reduction of the calculated power signal for HT. The pump continues to run until the power signal is lower than the switch-off threshold of the desuperheat heating instance.	• Refill water. • Check pressure transmitter and replace if necessary. • If no pressure transmitter is connected in the HT water circuit, activate the "pressure transmitter" button. Then it must show "NO".
	HT no heating power	No heat output is detected at the HT heat exchanger. The water inlet temperature is higher than the hot gas inlet temperature or the spread between hot gas inlet and hot gas outlet is less than the value specified in the parameter "min. spread CO2". Results in a reduction of the calculated power signal for HT. The pump continues to run until the power signal is lower than the switch-off threshold of the desuperheat heating instance. The hot gas valve closes when the desuperheat heating instance is switched off.	• Check the parameter "min. spread CO2". • Check / make plausible all temperatures at the heat exchanger. • Check correct seating and correct position of the temperature sensor.
	HT no flow	No flow in the HT water circuit. The pump is activated, but the flow monitor does not switch within 1 minute. Results in immediate closing of the hot gas valve and reduction of the calculated power signal for HT. The pump continues to run until the power signal is lower than the switch-off threshold of the desuperheat heating instance.	Check flow monitor.
	HT pump fault	Collective fault of the pump in the water circuit. Results in immediate closing of the hot gas valve.	Check the collective fault signal of the pump.

	HT valve fault	Hot gas valve fault. The hot gas valve reads both end positions "open" and "closed". These must match for the actuation. If this is not the case, the alarm is issued after 300 seconds. (valve running time)	Check both end position feedback signals of the hot gas valve. OPEN: Hot gas goes into the heat exchanger. CLOSED: Hot gas bypasses the heat exchanger.
Heat recovery low temperature LT			
20	LT temp return too high	The return temperature in the low temperature water circuit is higher than the configured maximum return temperature. Results in immediate closing of the hot gas valve and reduction of the calculated power signal for LT. The pump continues to run until the power signal is lower than the switch-off threshold of the desuperheat heating instance.	Check the parameterised, maximum return temperature LT.
	LT temp flow too high	The flow temperature in the low temperature water circuit is higher than the configured maximum flow temperature. Results in immediate closing of the hot gas valve and reduction of the calculated power signal for LT. The pump continues to run until the power signal is lower than the switch-off threshold of the desuperheat heating instance.	Check the parameterised, maximum flow temperature LT.
22	NT FB H2O outlet	Sensor break temperature sensor water outlet (flow) from heat exchanger LT.	Check temperature sensor and replace if necessary.
	LT FB H2O inlet	Sensor break temperature sensor water inlet (return) in heat exchanger LT.	Check temperature sensor and replace if necessary.
	LT FB HG outlet	Sensor break temperature sensor hot gas outlet from heat exchanger LT.	Check temperature sensor and replace if necessary.
	LT FB HG inlet	Sensor break temperature sensor hot gas inlet in heat exchanger LT.	Check temperature sensor and replace if necessary.
	LT no water	The value of the pressure transmitter in the water circuit LT is lower than the parameter "minimum water pressure". Results in immediate closing of the hot gas valve and reduction of the calculated power signal for LT. The pump continues to run until the power signal is lower than the switch-off threshold of the desuperheat heating instance.	• Refill water. • Check pressure transmitter and replace if necessary. • If no pressure transmitter is connected in the HT water circuit, activate the "pressure transmitter" button. Then it must show "NO".
	LT no heating power	No heat output is detected at the LT heat exchanger. The water inlet temperature is higher than the hot gas inlet temperature or the spread between hot gas inlet and hot gas outlet is less than the value specified in the parameter "min. spread CO2". Results in a reduction of the calculated power signal for LT. The pump continues to run until the power signal is lower than the switch-off threshold of the desuperheat heating instance. The hot gas valve closes when the desuperheat heating instance is switched off.	• Check the parameter "min. spread CO2". • Check / make plausible all temperatures at the heat exchanger. • Check correct seating and correct position of the temperature sensor.
	LT no flow	No flow in the LT water circuit. The pump is activated, but the flow monitor does not switch within 1 minute. Results in immediate closing of the hot gas valve and reduction of the calculated power signal for LT. The pump continues to run until the power signal is lower than the switch-off threshold of the desuperheat heating instance.	Check the flow monitor.
	LT pump fault	Collective fault of the pump in the LT water circuit. Results in immediate closing of the hot gas valve.	Check the collective fault signal of the pump.
	LT valve fault	Hot gas valve fault. The hot gas valve reads both end positions "open" and "closed". These must match for the actuation. If this is not the case, the alarm is issued after 300 seconds. (valve running time)	Check both end position feedback signals of the hot gas valve. OPEN: Hot gas goes into the heat exchanger. CLOSED: Hot gas bypasses the heat exchanger.

Air conditioning operation			
22	Air conditioning FB H2O outlet	Sensor break temperature sensor water outlet (flow) from cold water plate.	Check temperature sensor and replace if necessary.
	Air conditioning FB H2O inlet	Sensor break temperature sensor water inlet (return) in cold water plate.	Check temperature sensor and replace if necessary.
	Air conditioning frost alarm	Frost protection thermostat cold water circuit has triggered. Causes the refrigerant valve to close immediately. Here "closed" means bypassing the heat exchanger and "open" means feeding the refrigerant into the heat exchanger. The pump continues to run.	Check the frost protection thermostat and, if necessary, set it to a different value or replace it.
	Air conditioning no water	The value of the pressure transmitter in the cold water circuit is lower than the parameter "minimum water pressure". Results in immediate closing of the refrigerant valve. The pump continues to run.	• Refill water. • Check pressure transmitter and replace if necessary. • If no pressure transmitter is connected in the HT water circuit, activate the "pressure transmitter" button. Then it must show "NO".
	Air conditioning no flow	No flow in the cold water circuit. The pump is activated, the flow monitor is interrogated 3 times at intervals of 30 seconds. If the flow monitor then still reports no flow, the alarm is triggered. Results in immediate closing of the refrigerant valve. The pump continues to run.	Check the flow monitor.
	Air conditioning malfunction Pump	Collective fault of the pump in the cold water circuit. Results in immediate closing of the refrigerant valve.	Check the collective fault signal of the pump.
	Air conditioning malfunction Switching valve	Fault switching valve LT / air conditioning. The switching valve reads both "LT" and "air conditioning" end positions. These must match for the actuation. If this is not the case, the alarm is issued after 300 seconds. (valve running time)	Check both end position feedback signals of the switching valve. OPEN: Hot gas goes into the heat exchanger. CLOSED: Hot gas bypasses the heat exchanger.
	Air conditioning malfunction Valve	Malfunction valve refrigerant air conditioning. The refrigerant valve reads both end positions "OPEN" and "CLOSED". These must match for the actuation. If this is not the case, the alarm is issued after 300 seconds. (valve running time)	Check both end position feedback signals of the refrigerant valve. OPEN: Refrigerant goes into the heat exchanger. CLOSED: Refrigerant bypasses the heat exchanger.
	Emergency stop air conditioning	Emergency stop air conditioning (message comes when digital input is de-energised). Results in shutdown of the air conditioning operation.	Check whether 230 V is applied to the terminals 94/95.
Gas cooler bypass (GCBP)			
20	GCBP disabled	The gas cooler bypass has been blocked due to a parameter violation.	Wait for time and check the parameters under "GCBP" if necessary.
21	GCBP valve fault	Fault gas cooler bypass valve. (D) The digital gas cooler bypass valve reads the two end positions "OPEN" and "CLOSED". These must match for the actuation. If this is not the case, the alarm is issued after 300 seconds. (valve running time) (A) The continuous gas cooler bypass valve reads the analogue feedback of the valve. Apart from a small tolerance, the read-back signal must correspond to the control signal (2..10 V)	• (D) Check both end position feedbacks of the refrigerant valve. OPEN: Hot gas goes into the heat exchanger. CLOSED: Hot gas bypasses the heat exchanger. • (A) Check the voltages at the terminals of the analogue output (53/54) and analogue input (50/51). NOTE: the deviation may only be < 1.8 V! • (A) Check the actuator on the gas cooler bypass valve.
Diverse			

20	Alarm legion. duration	This message only occurs if the legionella function has been activated for the HT heat exchanger. It only indicates that the legionella setpoint has not been reached within the permitted time (6x "duration legionella function") and that the function has been cancelled.	Activate the "Unlock fault" button, which can be found on almost all LDSWin visualisation screens.
21	Emergency stop	Emergency stop heat recovery (message comes when digital input is de-energised). Results in the shutdown of all heating instances and the calculated power signal HT and LT is set to "0".	Check whether 230 V is applied to the terminals 56/57.
Communication with interconnection controller			
20	IC: no release CW	No release of cold water generation from the interconnection controller.	For details, see the operating instructions of the interconnection controller.
	IC: waiting time running	The parameterised idle time in the interconnection controller runs.	
	IC: HR n.parameter.	HR mode in the interconnection controller has not been activated.	
	VS: HR n.via CAN	High pressure adjustment (in the interconnection controller) not set to CAN bus.	
22	IC: CAN connection	No connection to the parameterised (participating) interconnection controller. If the WRG 3010 E loses contact via CAN bus to the interconnection controller and this for more than 30 seconds, this alarm is triggered, the air conditioning operation is disabled and all heating instances except desuperheating are disabled.	Check the CAN bus connection.
Service area analogue inputs and outputs			
23	Service mode active	Service mode is active	For information
	AI 1..7 manual active	Override of analogue input 1..7 is active	
	AO 1..4 manual active	Override of analogue output 1..4 is active	

12 Technical Data WRG 3010 E

12.1 Electrical data

DANGER

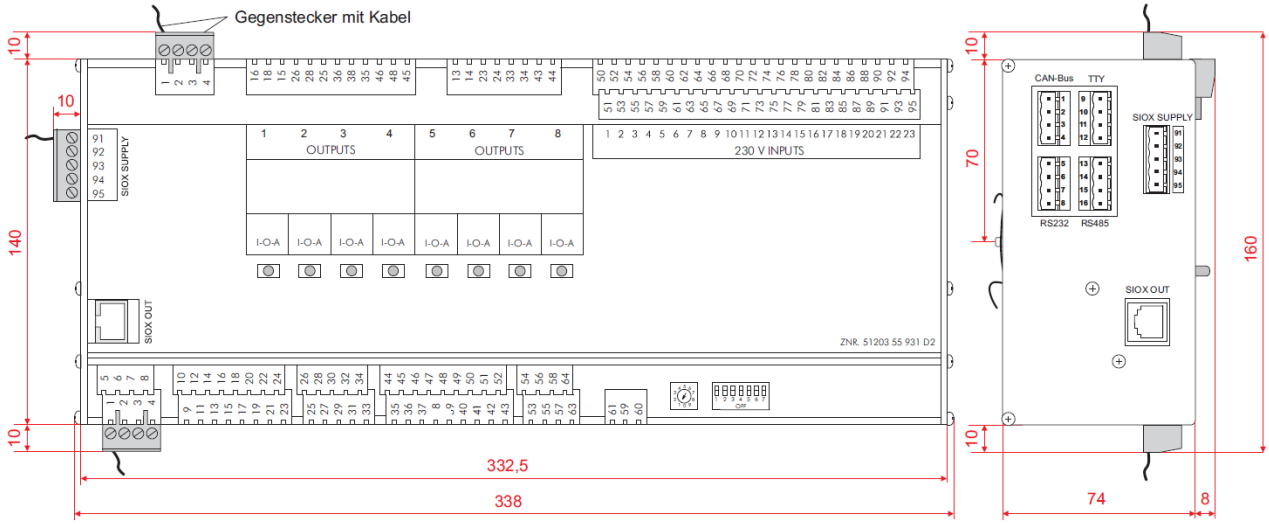
Overvoltage category III / contamination degree 2:
All connections of the device provided for operation with 230 V AC supply voltage **must** be wired with the same phase conductor. 400 V AC between neighbouring connection terminals is **not** permitted!
Overvoltage category II / contamination degree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

12.2 Mechanical Data WRG 3010 E



Basic module with manual control switch, all dimensions in mm.

13 Order numbers and accessories of WRG 3010 E

13.1 Controller for heat recovery WRG 3010 E

Part	Description	Part number
WRG 3010 E	Controller WRG 3010 E for heat recovery in transcritical CO_2 systems	WRG3010E00

13.2 Accessories for WRG 3010 E

Accessory part	Description	Part number
Temperature sensor	Pipe-mounted sensor temperature sensor (2-wire Pt1000)	KGLZPT1KTH
Flash cable	For performing a firmware update on a pack controller in the VS 3010 series	KABLINDAD1
Null modem cable	For connecting the flash cable to the serial interface of PCs / laptops, length 3.0 m	PCZKABSER2
Extension for null modem cable	Extension for null modem cable, length 1.8 m	PCZKABSER3