SIEMENS

Synco™ 200
Universal Controllers RLU2…
Basic Documentation

Version 2.3

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Building Technologies

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Contents

1 About this document

1.1 Revision history

Against version 2.2 of this document, the following changes have been made:

Chapter/ section	Changes
All	New template
All	Controller RLU210 no longer mentioned in this document
All	Information about paths: CHK replaced by INFO
1	New chapter
2.1	New layout
2.4	New numbers; lines deleted; lines added
3	On displays and in reference texts: • New Info symbol ⓘ • CHK is now INFO • EXP is now PASS • New arrangement of the 9 navigation fields
3.2.1	Subsection "Example of Info page..." in table for Info level: One more bullet added ("The pages are arranged…")
3.2.2	Subsection "Common properties": Last bullet: Time added
3.2.2	New: Subsection "Info pages at the service level" with examples
3.3.1	Subsection "Levels and menus" table cells for Info levels specified more precisely
3.3.2	Table revised
4	On displays and in reference texts: • New Info symbol ⓘ • CHK is now INFO • EXP is now PASS • New arrangement of the 9 navigation fields
4.3.2	Subsection Warning added
4.3.3	Note added
4.4.1	Subsection HIT tool added
6.3	Text completely revised due to revised function
7	New input identifier SAT meaning supply air temperature
7.7.2	Subsection "Fault status signals" added
7.8	New section "Supply air temperature (SAT)" due to new function
8.1.2	Sentence added to subsection "On, after outside temperature"
8.1.2	New subsection "Pump kick"
8.1.5	As fourth priority with reference to pump kick
8.1.6	Line for kick added to table "Setting values"
8.2.2	New subsection "%OPEN according to the outside temperature", with notes
8.2.3	Text relating to caution and note added
8.2.5	2 lines relating to outside temperature-dependent on and opening added to table in subsection "Setting values"
8.3.3	Note added

Chapter/ section	Changes
8.3.5	Introductory texts relating to choices 1 through 3 revised
8.3.5	Introductory text relating to special application examples 1 and 2 revised
8.3.6	New subsection "Mixed air temperature control (MAT)" due to new function
8.3.7	New subsection "Startup circuit" due to new function
8.3.8	Wording revised
8.3.11	Lines for MAT and COOLER added to "Configuration" table
8.3.11	Order and various corrections in table "Setting values"
8.4.7	Lines STEP V2 and STEP x added to tables “Display values” and “Wiring test”
8.5.7	Line ”STEP x” added to tables “Display values” and “Wiring test”
8.6.6	Line ”STEP x” added to tables “Display values” and “Wiring test”
9.1.2	Table revised
9.1.3	Subsection with 4 bullets added
9.2	Previous sections "Control strategies…", "Room temperature control", "Room-supply air temperature cascade controller" and "Supply air temperature control" now integrated in new section "Control strategies and setpoints for controller 1, basic type A"
9.2.1	Table and texts completely revised
9.2.2	Subsection "Setpoint limitations" with graph added
9.2.3	Completely revised
9.2.4	Added
9.2.5	Revised; second table added
9.2.6	Revised
9.2.7	Revised
9.2.8	Revised
9.2.9	New
9.3	New title "Control strategies and setpoints for universal controllers"
9.3	Internally restructured
9.3.1	New
9.3.2	Wording changed
9.3.4	Terms SETHEAT and SETCOOL replaced by SET MIN and SET MAX
9.3.6	New
9.3.7	New marginal heading
9.3.8	New introductory text for the 2 known examples
9.4	New title "Changeover"
9.4.1	Changes made to title, note and subsection "Room temperature controller RLU2… (A)"
9.4.2	Revised
9.4.5	New table of new path "…> PARA > MODE" added to subsection “Setting values”
9.5.2	Texts and graphs modified from subsection “RLU202, RLU220“
9.5.10	Subsection “Display values“: Sentence after table added
9.6.1	Revised
9.6.3	New

Chapter/ section	Changes
9.6.5	Subsection “Configuration” revised
9.7	SEQ is now termed SEQLIM (several times)
10	Chapter restructured
10	RELEASE is now termed ALM OFF
10.3.2	New
10.3.3	Graph in subsection "Function diagram" adapted
10.3.4	New
10.3.5	Graph in subsection "Function diagram” adapted
10.3.6	New
10.6	Legend: New device designations
11.1	Column “Effect” with page number references deleted
13.2	Operating texts adapted and reduced to texts effectively required
13.3.2	Revised
13.3.3	Graphs adapted
	Index list extended

1.2 Before you start

1.2.1 Copyright

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1.2.2 Quality assurance

This document was prepared with great care.

- The contents of all documents are checked at regular intervals
- Any corrections necessary are included in subsequent versions
- Documents are automatically amended as a consequence of modifications and corrections to the products described

Please make sure that you are aware of the latest document revision date.
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1.2.3 Document use / request to the reader

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2 Overview

2.1 Product range

Controller types and accessories

The following tables list the controller types and accessories belonging to the product range, and indicate the respective Data Sheets:

Devices

Name	*Type*	*Data Sheet*
Universal controller	**RLU202**	N3101
Universal controller	**RLU202**	N3101
Universal controller	**RLU222**	N3101
Universal controller	**RLU232**	N3101
Universal controller	**RLU236**	N3101

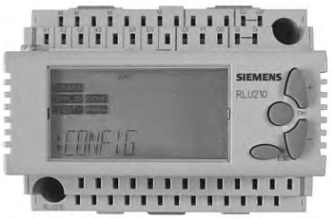
Mounting accessories

Name	*Type*	*Data Sheet*
Flush panel mounting frame	**ARG62.201**	N3101

Housing variants

The following pictures show the controller versions with large and small housing variants:

RLU202 / RLU220 / RLU222



RLU232 / RLU236

2.2 Equipment combinations

Possible combinations

The following table lists the equipment that can be combined with the controllers:

Equipment	*Type*	*Data Sheet*
Passive sensors	All types of sensors with sensing element LG-Ni1000, Pt1000, T1 (PTC)	N1721…N1846, N1713
Active sensors	All types of sensors: Operating on AC 24 V With modulating DC 0…10 V output signal	N1821, N1850…N1932
Monitors	QAF81..., QAF64..., QFA81, QFM81, QFX21, QXA2000, QBM81...	N1284, N1283, N1513, N1514, N1541, N1542 N1552
Signal converters	SEZ220	N5141
Room units	QAA25, QAA27	N1721
Passive signal sources	BSG21.1, BSG21.5, QAA25, QAA27	N1991, N1721
Active signal sources	BSG61	N1992
Actuating devices	All electromotoric and electrohydraulic actuators: Operating on AC 24 V For modulating DC 0...10 V control See:	N4000…N4999
Variable speed drives	SED2…	N5192
Time switches	Digital time switch, 1-channel SEH62.1	N5243
Transformers	Transformers complete with housing SEM62…	N5536
Service equipment	Service tool OCI700.1	N5655

2.3 Product documentation

Supplementary information

The following product documentation provides detailed information on safe and intended use and operation of Synco™ 200 products in building services plants.

Type of document	*Document no.*
Basic Documentation "Universal controllers RLU2..." (present document)	**CE1P3101en**
Application sheets "Universal controllers RLU2…"	**CE1A3101en**
Data Sheet "Universal controllers RLU2…"	**CE1N3101en**
Installation Instructions for universal controllers RLU2…	**CE1G3101x1**
Operating Instructions for universal controllers RLU2...	**CE1B3101x1**
CE Declaration of Conformity for Synco 200	**CE1T3101xx**
Environmental Declaration for universal controllers RLU202, RLU220, RLU222	**CE1E3101en01**
Environmental Declaration for universal controllers RLU232, RLU236	**CE1E3101en02**

2.4 Functions

Overview

The following table provides an overview of the functions available with the various controller types:

Function	*RLU 202*	*RLU 220*	*RLU 222*	*RLU 232*	*RLU 236*
Number of ready loaded applications	18	28	49	22	32
Basic types					
Basic type A	✓	✓	✓	✓	✓
Basic type U	✓	✓	✓	✓	✓
Selection of operation					
On / Off via digital inputs	✓	✓	✓	✓	✓
Selection of operating mode via digital inputs	✓	✓	✓	✓	✓
Changeover	✓	✓	✓	✓	✓
Interaction with heating controller	✓	✓	✓	✓	✓
Fault status messages					
Status relay, frost and main controlled variable	✓	0	✓	✓	✓
Status relay, deviation indication	✓	0	✓	✓	✓
Digital inputs	1	1	1	2	2
Universal inputs	4	4	4	5	5
Analog inputs DC 0…10 V	✓	✓	✓	✓	✓
Analog inputs LG-Ni1000	✓	✓	✓	✓	✓
Analog inputs T1	✓	✓	✓	✓	✓
Analog inputs Pt1000	✓	✓	✓	✓	✓
Digital inputs	✓	✓	✓	✓	✓
Remote setpoints (absolute and relative)	✓	✓	✓	✓	✓
Modulating outputs DC 0…10 V	0	2	2	3	3
Relay outputs	2	0	2	2	6
Pump	2	0	2	2	3
Analog output	0	2	2	3	3
Heat recovery	0	1	1	1	1
Variable step switch (1…6 steps)	0	0	0	0	1
Mixed air temperature control	0	1	1	1	1
Variable step switch (1…2 steps)	1	0	1	1	1
Linear step switch (1…6 steps)	0	0	0	0	1
Linear step switch (1…2 steps)	0	0	0	1	0
Binary step switch (1…4 steps)	0	0	0	0	1
Binary step switch (1…2 steps)	0	0	0	1	0
3-position output	1	0	1	0	0
Universal controller _//	1	1	1	1	1
Universal controller _/	0	0	1	1	1
Room-supply air cascade controller	1	1	1	1	1
Remote setpoint adjuster	1	1	1	1	1
Setpoint shift via room unit	1	1	1	1	1
Setpoint shift based on outside temperature	1	1	1	1	1
Universal setpoint shift	1	1	1	1	1
Limitation, general	1	1	1	1	1
Limitation of individual sequences	1	1	1	1	1
Locking of sequences	4	4	4	6	6
Frost protection					
Frost protection unit	✓	✓	✓	✓	✓
2-stage frost protection on the air side	✓	✓	✓	✓	✓
2-stage frost protection on the water side	✓	✓	✓	✓	✓
Fan release ALM OFF	1	0	1	1	1

2.5 Important notes

This symbol draws your attention to special safety notes and warnings. Failing to observe these notes may result in injury and / or serious damage.

Field of use

You may only use Synco™ 200 products to control and monitor heating, ventilation, air conditioning and chilled water plants.

Intended use

Safe and trouble-free operation of Synco™ 200 products presupposes transport, storage, mounting, installation and commissioning as intended as well as careful operation.

Electrical installation

Fuses, switches, wiring and earthing must comply with local safety regulations for electrical installations.

Commissioning

Only qualified staff trained by Siemens BT may prepare and commission Synco™ 200 products.

Operation

Only persons trained by Siemens BT or their representatives who are properly informed of the risks may operate Synco™ 200 products.

Wiring

When wiring, strictly separate AC 230 V mains voltage from AC 24 V safety extra-low voltage (SELV) to protect against electrical shock!

Storage and transport

For storage and transport, the limits given in the relevant Data Sheets must always be observed.

Contact your supplier or Siemens BT if you have any questions.

Maintenance

Synco™ 200 products are maintenance-free and require only cleaning at regular intervals. We recommend removing dust and dirt from system components installed in the control panels during standard service.

Faults

Should system faults occur and you are not authorized to perform diagnostics and rectify faults, call your Siemens BT service representative.

Only authorized staff are permitted to perform diagnostics, to rectify faults and to restart the plant. This applies to working within the panel as well (e.g. testing or changing fuses).

Disposal

The devices contain electrical and electronic components and must not be disposed of together with domestic waste.
Local and currently valid legislation must be observed.

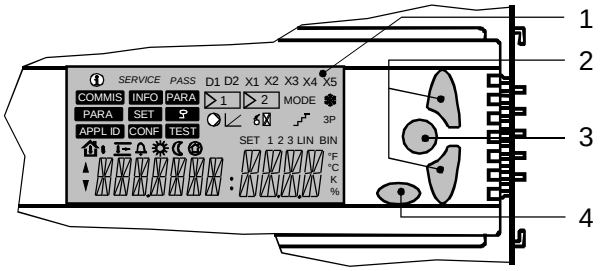
3 Operation

3.1 Operating elements and display

3.1.1 Operating elements

Front view

The following illustration shows the operating elements of the RLU2… universal controllers:



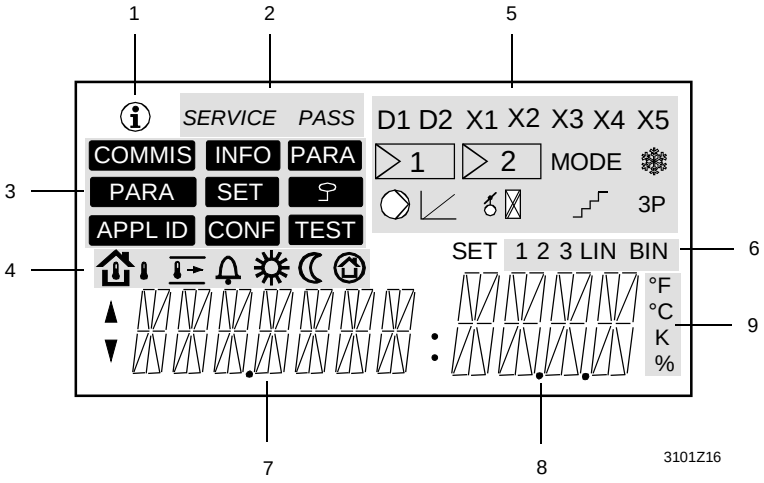
Legend

Item	*Designation*	*Properties / function*
1	Display	Backlit segment display
2	" **+** " and " **–** " buttons	Navigate and adjust values
3	**OK** button	Confirm navigation and value entries
4	**ESC** button	Return to the previous menu or abort value entries

3.1.2 Display

View / arrangement

The display is subdivided into several logical blocks.
The blocks contain symbols associated with specific operating states. They provide current information for the user.



Legend

Item	*Designation*
1	Display of Info page
2	Display of access levels
3	Menu navigation
4	Display of measured variables, operating modes
5	Function block navigation: Display corresponds to configuration diagram
6	Function block instances
7	Information segments (7 characters): Data point description (mnemonic)
8	Value segments (4 characters): Display of data point values
9	Display of units

3.1.3 Display symbols

Table of symbols

The following table lists displayed symbols and their meaning. Grouping matches the aforementioned arrangement.

Symbol	*Meaning*
Operating level	
ⓘ	Info level
None	Setting level
Access level	
SERVICE	Service level
PASS	Password level
Menus	
COMMIS	Commissioning
APPL ID	Basic configuration
TEST	Wiring test
INFO	Inputs/outputs
CONF	Extra configuration
PARA	Settings
SET	Setpoints (adjustable)
Measured variables, operating modes	
	Outside temperature
	Room temperature
	Supply air temperature
	Fault
	Room operating mode Comfort
	Room operating mode Economy
	Protection
Navigation	
▲	Navigate UP or + value
▼	Navigate DOWN or – value

Symbol	*Meaning*
Function block navigation	
D1, D2	Digital inputs D1, D2
X1…X5	Analog inputs X1…X5
▷1	Controller 1 (or controller 2)
MODE	Operating mode
	Frost protection FB
	Pump FB
	Analog output FB
	Heat recovery FB
	Step switch FB
3P	3-position output FB
Instances	
1	Instance 1
2	Instance 2
3	Instance 3
LIN	Linear step switch
BIN	Binary step switch
Units	
°F	Degrees Fahrenheit
°C	Degrees Celsius
K	Kelvin
%	Percent
Miscellaneous	
SET	Adjustable value

Note on access level

User level is active when neither service level symbol nor password level symbol is displayed.

3.2 Operating and access levels

3.2.1 Operating levels

2 operating levels

RLU2… universal controllers have 2 operating levels. They are:

- Info level
- Main menu

The following table contains their properties and identification.

Designation	*Properties*	*ID*
Info level	Use this level to display key plant data as Info pages	ⓘ
Main menu	This level is structured as a menu. It provides for reading and / or adjustment of data points	None

Note

The 2 operating levels are always available regardless of the active access level.

The term "data point" in Synco 200

In Synco 200, the term "data point" is used as a generic term that includes:

- Real data points with a physical connection to the plant, and
- Virtual data points with no direct connection to the mechanical and electrical systems (e.g. defined in the software only, e.g. setpoints)

All data points are set and read via operating lines on the menu structure. The operating elements allow you to select, display and set data points (setting parameter).
All menus are represented by mnemonics on the LCD.

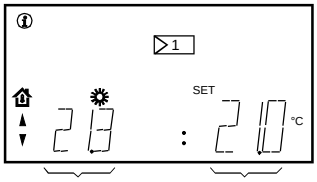
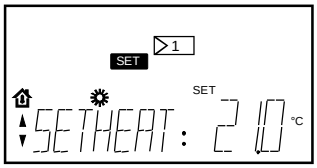
Switching between the 2 operating levels

You can switch between the 2 operating levels in the following way:

- From Info level to main menu: Press the **OK** button
- From main menu to Info level: Press the **ESC** button

Example of Info page and main menu

The following example shows the above information. The table shows an Info page for the user (top) and a main menu page (bottom):

Display	*Explanation*
 Actual value Present setpoint	Info level: • The navigation buttons " **+** " / " **–** " switch the display between the various Info pages • Number and presentation of Info pages depend on the selected application • The pages are arranged as an infinite sequence
	Main menu: • The navigation buttons switch the display between the various data points (e.g. to the SETHEAT setpoint in this example) • Change values: 1. Press the **OK** button. 2. Use the navigation buttons to change the value (e.g. to 21.0 °C in this example). 3. Press the **OK** button => the new value is adopted.

3.2.2 Access levels

3 access levels

RLU2… universal controllers have 3 access levels. They are:

- User level
- Service level
- Password level

Each data point is assigned one of these access levels.

Access

The following table contains the 3 access levels and their purpose, access and symbols:

Level	*Access*	*Symbol*
User level (for plant operator)	The user level can be accessed any time. Users can modify all data points that are visible / adjustable at this level.	None
Service level (for maintenance)	1. Simultaneously press the **OK** and **ESC** buttons. 2. Press the " **+** " / " **–** " buttons to select service level **SERV**. 3. Press the **OK** button to confirm your choice.	*SERVICE*
Password level (for commissioning)	1. Simultaneously press the **OK** and **ESC** buttons. 2. Press the " **+** " / " **–** " buttons to select password level **PASS**. 3. Press the **OK** button to confirm your choice. 4. When **PASSWRD** is displayed, press the " **+** " button to select figure **2**. 5. Press the **OK** button to confirm your choice.	*PASS*

Common properties

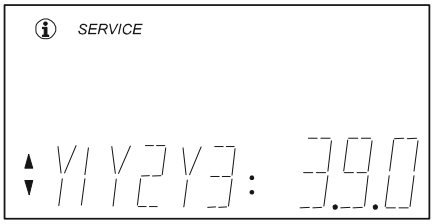
The 3 access levels share the following properties:

- The access level determines which individual menus and operating lines are activated
- A higher access level also shows the menus and operating lines for the lower access levels
- The levels use a shared menu as a basis
- The password level contains the entire menu
- After a timeout of 30 minutes (period of time during which the controller is not operated), the controller switches to the user level

Info pages at the service level

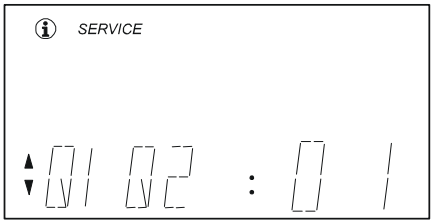
The service level displays additional Info pages for maintenance work. These show the states of the physical outputs Y1…Y3 and Q1…Q6.

Examples



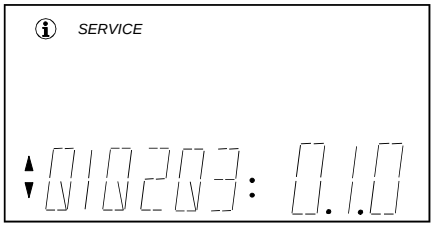
This Info page shows the voltage at terminals Y1…Y3:

- Y1 = 3.0...3.9 V
- Y2 = 9.0...10.0 V
- Y3 = 0.0...0.9 V



This Info page shows the state of relay outputs Q1…Q2:

- Q1 = 0 (open)
- Q2 = 1 (closed)



This Info page shows the state of relay outputs Q1…Q3:

- Q1 = 0 (open)
- Q2 = 1 (closed)
- Q3 = 0 (open)

3.3 Menu

3.3.1 Menu structure

Levels and menus

The submenus are shown or hidden depending on the selected access level:

User level	*Service level*	*Password level*
Info level User Info pictures 1…n	**Info level** User Info pictures 1…n Service Info pictures 1…m	**Info level** User Info pictures 1…n Service Info pictures 1…m
↓ **OK** **ESC** ↑	↓ **OK** **ESC** ↑	↓ **OK** **ESC** ↑
Main menu **SET** (Setpoints)	**Main menu** **INFO** (IInputs/outputs) **PARA** (Settings) **SET** (Setpoints)	**Main menu** **COMMIS** (Commissioning) | **PARA** (Settings) | **SET** (Setpoints) | **APPL ID** (Basic configuration) | **CONF** (Extra configuration) | **TEST** (Wiring test) **INFO** (IInputs/outputs) **PARA** (Settings) **SET** (Setpoints)

Note on user level

At the user level, the **OK** button switches the menu directly to the **SET** (setpoint) list, where you can use the " **+** " (UP) and " **–** " (DOWN) buttons to select and adjust a setpoint.

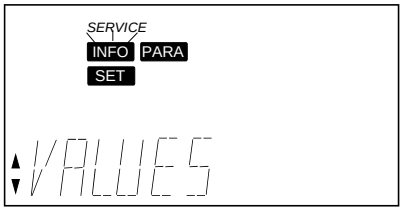
3.3.2 Menu navigation

Example

The following pictures demonstrate menu navigation with the example of adjusting proportional band Xp for sequence 1 of control loop 1. The access level is set to *SERVICE*. Starting point is the Info level.

Display

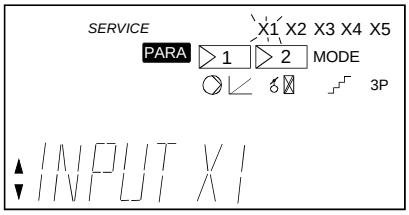
Procedure / result



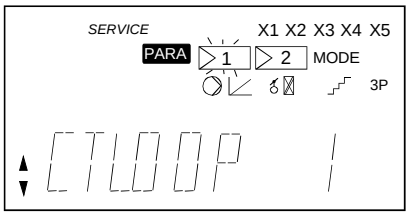
1. Press the **OK** button.
   Result: First menu entry blinks, here INFO (Inputs/outputs).

Note: Text in the information segment (here *VALUES)* explains the active menu item (here INFO).

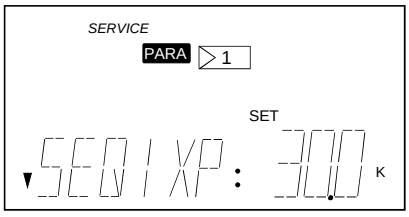
2. Press the " **–** " button to navigate to menu entry **PARA** (parameterization).
   Result: **PARA** blinks.
3. Confirm your selection by pressing the **OK** button.



Result: Function block selection appears and the first function block (X1) blinks.



4. Press the " **–** " button to navigate to menu entry **CTLOOP 1**.
5. Confirm your selection by pressing the **OK** button.
   Result: Parameter selection appears (see next picture).



6. Press the " **+** " / " **–** " buttons to navigate to the desired parameter (SEQ1 XP) and press the **OK** button.
   Result: Associated value (30.0) blinks.
7. Press the " **+** " / " **–** " buttons to adjust the value, then press the **OK** button to confirm.

4 Commissioning

4.1 Safety

Preparation for use and commissioning of Synco™ 200 controllers must only be undertaken by qualified staff who have been appropriately trained by Siemens BT.

4.2 Entering commissioning mode

4.2.1 Initial startup

Procedure

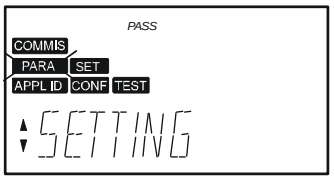
The controller automatically enters the commissioning menu when the AC 24 V power supply is applied. Note:

- The control process remains deactivated in commissioning mode – all outputs are set to a defined OFF state on controller power-up
- All of the controller's internal safety features are also deactivated!

Factory settings

The controller displays the following settings as soon as it is powered up:

- Access level **PASS** (password level)
- **COMMIS** (commissioning) menu with blinking submenu **PARA**



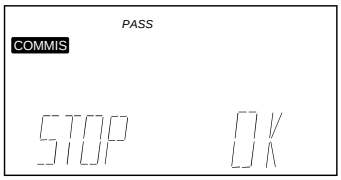
4.2.2 Start from main menu

Prerequisite

The **COMMIS** (commissioning) menu is only active at the password level (password = 2). If the password level is not already selected, simultaneously press the **ESC** and **OK** buttons to activate it.

Plant is stopped

When a user enters the commissioning menu from the main menu, the controller indicates that the plant will be stopped:



Pressing the **OK** button produces the following results:

- The controller stops the plant and deactivates the control process
- All outputs are set to a defined OFF state
- It also deactivates all of the controller's internal safety features!
- The submenus of **COMMIS** (commissioning) appear, the first menu **PARA** blinks

4.3 Selecting the basic configuration

APPL ID menu (basic configuration)

The **APPL ID** menu (basic configuration) permits the following settings:

- Choice of basic type A or U
- Choice of programmed application

4.3.1 Selecting the basic type

Distinction between basic types A and U

The basic type is the first thing you must set in every controller. The choice of basic type enables and disables certain functions. We distinguish between the following basic types:

Basic type A Deployment as a room controller	**Basic type U** Deployment as a universal controller
Key feature: Controller 1 is a room temperature controller, supply air temperature controller, or room-supply air temperature cascade controller	Key feature: Controller 1 is a universal controller

4.3.2 Selecting a programmed application

Selection

Each controller contains tested, programmed applications.

The simplest commissioning method is to activate one of the programmed applications.

The programmed applications are described in the Application Catalog and in the HIT.

Selection example

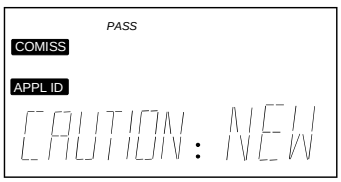
The APPL ID line displays the following: A01
Meaning:
A This standard application corresponds to basic type A.
01 First number of the internally loaded standard application

Notes

- Empty applications are displayed with A and U
- In addition, there is a data point on the **INFO** menu which indicates whether the programmed application has been modified (ADAP = adapted) or not (ORIG = original)

Warning

A newly selected application (A, A01, etc.) blinks. If an application is already loaded and the **OK** button is pressed, a warning appears (see illustration below). It says that by finally selecting (pressing **OK**) the new application, the loaded application will be overwritten. The process can be aborted by pressing the **ESC** button twice.



4.3.3 Settings

Configuration

Path: **… > COMMIS > APPL ID**

Display	*Name*	*Range / comments*
APPL ID	Plant type	Selection of basic type or application number: A, U, A01, A02, A03, A04, …, U01, U02, …

Note

If a basic type or application number has already been selected and is then changed, an asterisk ✳ appears in front of the basic type or application number.

Display values

Path: **INFO**

Display	*Name*	*Comments*
APPL ID	Plant type	Original (ORIG) Adapted (ADAP)
APPL ID	Plant type	Display of basic type or application number:

4.4 Three ways to get the right application

4.4.1 Programmed application

The easiest way

Each RLU2… controller offers a large choice of programmed and fully tested applications.

The easiest way to commission a plant is to activate one of the programmed applications and to match the parameters to the respective plant, if necessary. The programmed applications are listed in the Data Sheet (including a short description) and in the Installation Instructions.

HIT

The complete Application Catalog with all descriptions, diagrams and parts lists is contained in the HVAC Integrated Tool (HIT). For more information about the free HIT, please visit the following intranet page:
https://intranet.sbt.siemens.com/hvp/en/technical_support/hit.asp

4.4.2 Adapted application

The golden middle

The programmed application doesn't quite fit, but an adapted application is described in the Application Catalog. Make the appropriate settings on the **CONF** (additional configuration) menu to adapt the application.

4.4.3 Free configuration

The most complex way

The application you want is not described; you have to set up the configuration from scratch). Using the configuration diagrams, the controller can be matched to the type of plant (for detailed information, refer to section 13.3 "Configuration ").

4.5 Wiring test

Functions

When the peripheral equipment is connected, you can perform a wiring test in the **TEST** (wiring test) menu. We recommend testing after configuration and settings are complete. The test provides the following functions:

- Display of reading values for inputs
- Switching of aggregates connected to the outputs, such as pumps
- Preselection of a 0…100% signal for step switches, where the relays are switched

The application is deactivated during the wiring test. The outputs are in a defined OFF state, and safety-related functions (e.g. frost protection) are deactivated!

Error checks

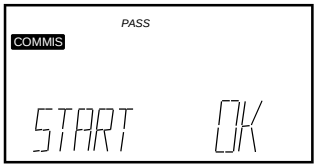
The wiring test provides checks for the following errors at the inputs and outputs:

- Connection error (mixed up wires)
- Position error (mixed up sensors or actuating devices)
- Discrepancies between connection method and controller configuration (LG-Ni1000 in place of active DC 0…10 V)

4.6 Leaving commissioning

User information

When you leave the **COMMIS** (commissioning) menu by pressing the **ESC** button, the controller displays the following information to indicate that the plant will be started:



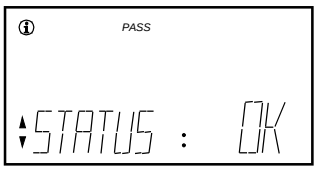
Plant is started

Pressing the **OK** button produces the following results:

- Application starts:
  - All sensors are checked, and
  - Existing sensors are marked for future fault status messages
- The display changes to the next higher menu level and the first menu symbol **COMMIS** blinks:

Exit

Now press the **ESC** button twice.
The controller will display an Info page like the following if it is in normal mode:



5 General settings

5.1 Selecting the unit

Setting values

At the service and password levels, you can switch the temperature unit between °C/K and °F:

Path: **… > PARA > MODE**

Display	*Name*	*Range*	*Factory setting*
UNIT	Unit	°C, °F	°C

5.2 Device information

Display values

You can view the SW version at the service and password levels:

Path: **INFO**

Display	*Name*	*Comments*
SW-VERS	Software version	

6 Operating modes

6.1 Basic types

Basic differentiation

We distinguish between the following 2 basic applications with the RLU2.. universal controllers:

- Basic type A => controller 1 is a room temperature controller
- Basic type U => controller 1 is a universal controller

Operating modes

In normal operation, the operating mode for basic types A and U is preselectable via digital inputs D1 / D2 (e.g. by an external time switch or manual switch).

There are the following 3 operating modes:

- Comfort
- Economy
- Protection

6.2 Room mode selection via digital inputs

Operating principle

This feature provides for intervention in the current program without having to make any changes at the controller itself. To activate this function, you have to configure the appropriate digital inputs.

Note

Mode switching via HMI (operation) is not possible.

RLU232 and RLU236

The following settings are required depending on the desired function:

Function	*Setting*	*Value*
Switching between ☼ Comfort / ⌂ Protection	Digital input D1, hard wired	Permanently configured
Switching between ☼ Comfort / ☾ Economy	Digital input D2, hard wired	Permanently configured

D1	*D2*	*Operating mode*	*Function*
0	0	☼ Comfort	Comfort is the operating mode for the occupied room. The room state is within the comfort envelope in terms of temperature, humidity, etc.
0	1	☾ Economy	Economy is an energy-saving operating mode for the room if Comfort mode is not required for a given period. In Economy mode, the control process operates with setpoints that may differ from the Comfort mode setpoints. Switching to Economy mode is usually done via an external time program
1	0	⌂ Protection	Protection is an operating mode in which a plant is only started to ensure that the building and equipment are protected against frost
1	1	⌂ Protection	See above

Notes

- If there is no wire connected to digital input D1, then D1 = 0
- If digital input D1 is set to Protection, Comfort / Economy changeover is deactivated

RLU222, RLU202 and RLU220

The following settings are required depending on the desired function:

Function	*Setting*	*Value*
Switching between ☼ Comfort / ⌂ Protection	Digital input D1, hard wired	Permanently configured
Switching between ☼ Comfort / ☾ Economy	Digital input configured for OPMODE	---, X1…X5

D1	*OP MODE*	*Operating mode*	*Function*
0	0	☼ Comfort	See "RLU232 and RLU236"
0	1	☾ Economy	See "RLU232 and RLU236"
1	0	⌂ Protection	See "RLU232 and RLU236"
1	1	⌂ Protection	See "RLU232 and RLU236"

Note

If no other digital input is configured as OPMODE (preselected operating mode), you can configure changeover between Comfort / Protection (default) or Comfort / Economy with the hard wired D1 input via parameter settings as an additional function.

Troubleshooting

Errors in operation:
The digital signals cannot be monitored. The controller interprets missing inputs as if the physical input is not connected.

We recommend configuring the control inputs to be open in the normal position (NORMPOS = OPEN).

Configuration errors:
Applying analog signals (e.g. DC 0 …10 V or LG-Ni1000) to the digital control inputs produces an incorrect response that is not monitored.

Application example

You can use the digital inputs to switch a plant to OFF.
However, all safety-related functions remain active.

6.3 Fan release / ALM OFF

Function and non-switch off conditions

This function uses a free switching output of the RLU2… (e.g. Q1) for fan release ALM OFF.

The fan is released when no alarm is present, that is, with alarm OFF (when ALM OFF = YES, that is, when the switching output is energized). This is the case when:

- No frost alarm FROST is pending
- There is no fault of the main controlled variable MAINALM
- The controller is not using the **COMMIS** (commissioning) menu

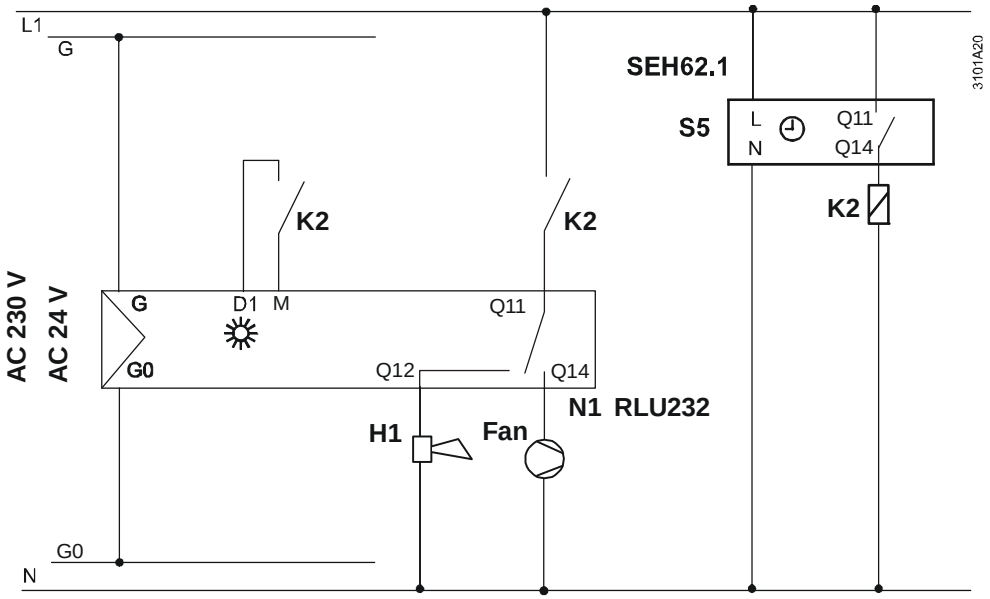
Recommendation

Use the switching output for changeover (see connection diagram below), whereby:

- Switching relay deenergized:
  Fault status message (frost or fault of main controlled variable), fan OFF
- Switching relay energized:
  Fan released

Connection diagram

This application example shows a fan controlled by a time switch (switching on / off):



- The time switch determines the controller's operating mode via relay K2 at operating mode input D1 (Comfort or Protection). The controller provides for changeover of operating mode or setpoints
- The time switch switches the fan via relay K2
- In the event of fault (frost, sensor error), the controller disconnects the fan from power and triggers an acoustic alarm (H1)

Activation of function

The fan release function is activated by assigning relay Q1 to the respective output on submenu **MODE** under **ALM OFF** (fan release relay / alarm OFF).

6.3.1 Settings

Configuration

Path: **… > COMMIS > APPL ID**

Display	*Name*	*Range / comments*
ALM OFF	Fan release relay	Activation of relay output; adjustable values: ---, Q1, Q2, … (free outputs only)

Display values

Path: **INFO**

Display	*Name*	*Comments*
ALM OFF	Fan release relay	YES = fan released / no alarm (relay energized) NO = fault status message (relay deenergized) Fan OFF

Wiring test

Pfad: **… > COMMIS > TEST**

Display	*Name*	*Positions*
ALM OFF	Fan release relay	YES = fan released / no alarm (relay energized) NO = fault status message (relay deenergized) Fan OFF

7 Inputs

7.1 Universal inputs X1…X5

7.1.1 General settings

Connectable signals

The following signals can be connected to universal inputs X1…X5:

- Digital signals
- Passive analog signals
- Active analog signals

Number of universal inputs

Depending on the type of RLU2… universal controller, the following numbers of universal inputs (Xx) are available:

Controller type	*Number of universal inputs Xx*
RLU202	4
RLU202	4
RLU222	4
RLU232	5
RLU236	5

7.1.2 Activating the function

Availability

Universal Xx inputs are always available. If not required for their functionality, they can be used for diagnostics purposes.

Assigning the identifiers

To activate, assign a LABEL (identifier) to each input used. The identifier also defines the input's physical unit. The following identifiers are available:

LABEL (identifier)	*Explanation*
ROOM	Room temperature
OUTS	Outside temperature
SAT	Supply air temperature
Temp	Temperature sensor without dedicated functionality in °C / °F
%	DC 0…10 V signal, unit %
0.0	Universal input with 1 decimal place, resolution –99.9…+999.9, increment 0.1
0000	Universal input without decimal place, resolution –999…+9999, increment 1.
REMx	Absolute setpoint adjuster
REL	Rem setp adjuster relative, in K / °F, range −3…+3 K
FRST	Frost protection
DIG	Digital

Notes on units

There are 2 special features with regard to the assignment of the physical unit:

- The unit of room temperature, supply air temperature and outside temperature is always °C (°F)
- Digital inputs do not require units

Further details

There is a more detailed description for each specific use of the universal inputs in the following sections:

- Universal inputs used as analog inputs, see 0
- Universal inputs used as digital inputs, see 7.3

7.2 Analog inputs X1…X5

7.2.1 Activation and type

Activation

To activate the analog inputs X1…X5, follow the procedure described above under "Activating the function".

Type (TYPE)

If the unit is °C / °F, the type is selectable. The following types are available:

- NI (LG-Ni1000)
- 2XNI (2 x LG-Ni1000)
- T1 (T1)
- PT (Pt1000)
- 0-10 (DC 0…10 V)

If the unit is not °C / °F, the type is always DC 0…10 V.

7.2.2 Measuring range (MIN VAL, MAX VAL)

Passive temperature signals

The following measuring ranges are defined for passive temperature signals:

Temperature signal	*Measuring range*
LG-Ni1000	–50…+250 °C (fixed)
2 x LG-Ni1000 or T1	–50…+150 °C (fixed)
Pt1000	–50…+400 °C (fixed)

Active signals

In the case of active signals, the measuring range can be entered. Both an upper and a lower measured value is required.
Active DC 0…10 V temperature signals have a default measuring range of 0…200 °C, but they are adjustable within the overall range of –50…+500 °C.

Example

Room temperature with an active DC 0…10 V signal = 0…50 °C:

- Lower measured value (MIN VAL): 0 °C
- Upper measured value (MAX VAL): 50 °C

7.2.3 Active measured value signal (SIGNALY)

Multiple use of sensors

The measured values from passive sensors can be delivered in the form of active, continuous signals. For that, you must assign an output to the input.
The settings under "Measuring range" are also used for setting up the output.

Example

You want to output the measured value from an LG-Ni1000 sensor as an active signal of DC 0…10 V = 0…50 °C:

- Lower measured value (MIN VAL): 0 °C
- Upper measured value (MAX VAL): 50 °C

Note

The active measuring signal is only usable for analog values.
Digital signals would produce an output of either DC 0 V or DC 10 V.

7.2.4 Correction (CORR)

Compensation of line resistance

A measured value correction can be entered for passive temperature sensors in order to compensate for line resistance.

This can be used to perform on site calibration with a reference measuring unit.

7.2.5 Special analog inputs

Special functions

Certain sensors are required for special functions, such as pump ON at low outside temperatures. Therefore, the following analog inputs provide additional, special functions:

- OUTS Outside temperature; see section 7.6
- ROOM Room temperature; see section 7.7
- SAT Supply air temperature; see section 7.8

Special setting values

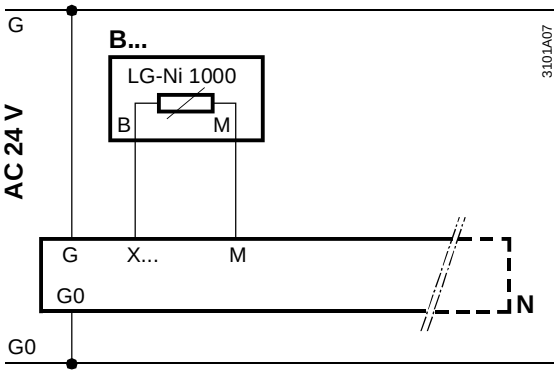
The following analog inputs provide special setting values:

- REMx Absolute setpoint adjuster; see section 7.4
- REL Relative setpoint adjuster; see section 7.5
- FRST Frost; see section 10

7.2.6 Connection diagrams (examples)

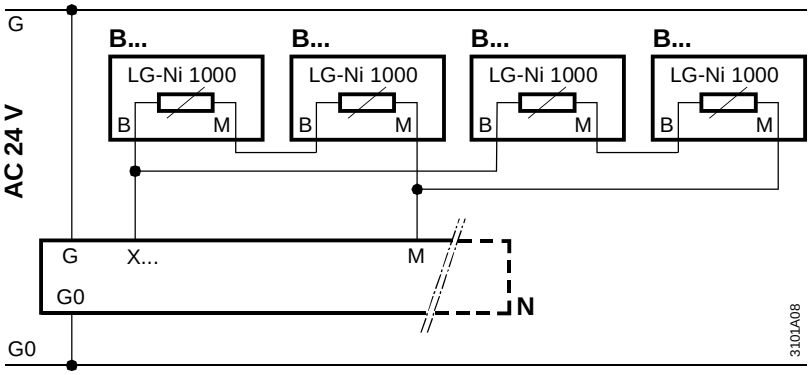
Connection diagram LG-Ni1000 sensor

You can connect a passive LG-Ni1000 temperature sensor to the input. It must be connected according to the following diagram:



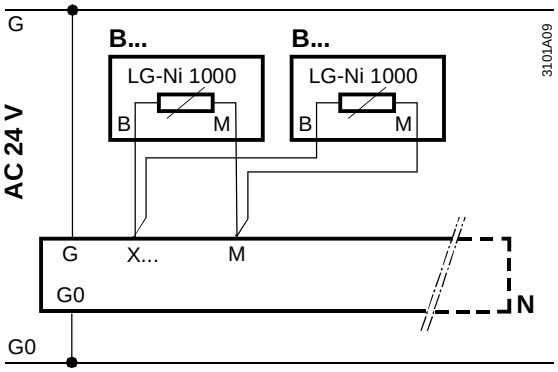
Averaging with 4 x LG-Ni1000

It is also possible to take an average temperature measurement with 4 passive sensors. In that case, the sensors must be connected according to the following diagram:



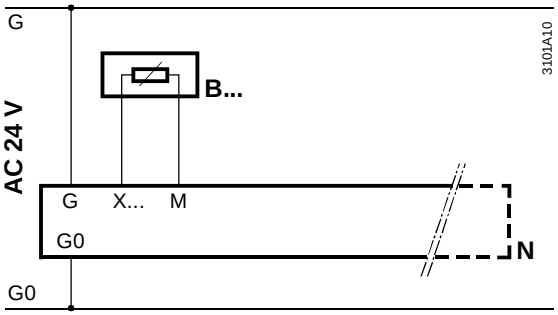
Connection diagram for 2x LG-Ni1000 sensors

2 passive LG-Ni1000 temperature sensors can be connected to the input. The control process uses them to calculate the average temperature. The sensors must be connected according to the following diagram:



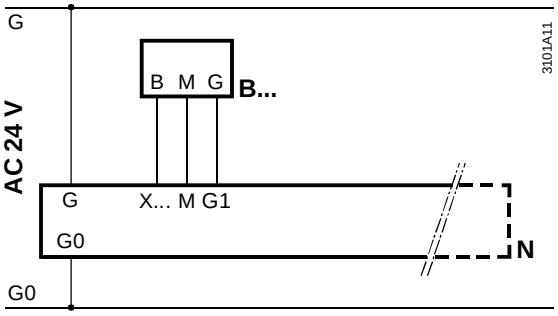
Connection diagram T1

A passive T1 temperature sensor can be connected to the input. It must be connected according to the following diagram:



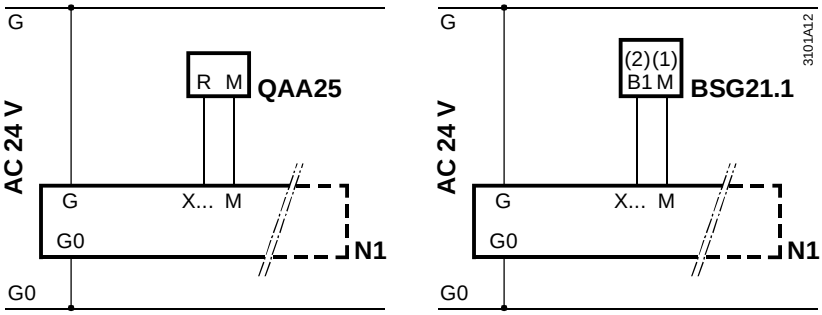
Connection diagram for DC 0…10 V

An active sensor can be connected to the input. It must be connected according to the following diagram:



Connection diagram for 0…1000 Ω

A passive setpoint adjuster (e.g. BSG21.1 or QAA25) can be connected to the input. It must be connected according to the following diagram:



7.2.7 Troubleshooting

Sensor signal monitoring

The controller monitors the active and passive signals as follows:

- When you leave the commissioning menu, the universal controller checks which sensors are connected.
  - If, at that time, one of the sensors is connected, but is missing later, a sensor error message is delivered, and the affected sensor is presented on the display as "Xx ----"
  - If the cable is short-circuited (passive sensors only), a sensor error message is also delivered, and the affected sensor is presented on the display as "Xx ooo"
- If a sensor is used for the main controlled variable and an error occurs later on during operation, the plant is shut down, that is, the outputs are set to OFF or 0%

Exercise caution when changing identifiers!

If you change an input identifier after configuration of the other blocks is completed, the controller may deactivate some functions of the other blocks, because they might otherwise have to operate with units that are invalid for the respective function block.

7.2.8 Settings

Configuration

Path: **… > COMMIS > CONF > X1…X5**

Display	*Name*	*Range / comments*
LABEL	Input identifier	Assignment of ROOM, OUTS, SAT, TEMP, %, 0.0, 0000
SIGNALY	Measured value signal output	Output of passive temperature sensor as active signal

Setting values

Path: **… > PARA > X1…X5**

Display	*Name*	*Range*	*Factory setting*
TYPE	Type	NI, 2XNI, T1, PT, 0-10	NI
MIN VAL	Value low	–50…+500 (with analog signals only)	-50
MAX VAL	Value high	–50…+500 (with analog signals only)	250
CORR	Correction	–3.0…+3.0 (with °C only)	0 K

Display values

Path: **INFO**

Display	*Name*	*Comments*
X1	X1	Display of current measured value at terminal X1
…	…	…
X5	X5	Display of current measured value at terminal X5

Wiring test

Path: **… > COMMIS > TEST**

Display	*Name*	*Positions*
X1	X1	Display of current measured value at terminal X1, non-adjustable
…	…	…
X5	X5	Display of current measured value at terminal X5, non-adjustable

Fault status messages

Display	*Name*	*Effect*
Xx --- / ooo	Sensor error Xx…	Non-urgent message; plant not stopped. However, if sensor is used for the main controlled variable: Plant stopped

7.3 Digital inputs (D1, D2, X1…X5)

Purpose and types

Signals for open-loop control functions (e.g. mode selector switch) can be connected to the digital inputs. There are 2 types of digital input:

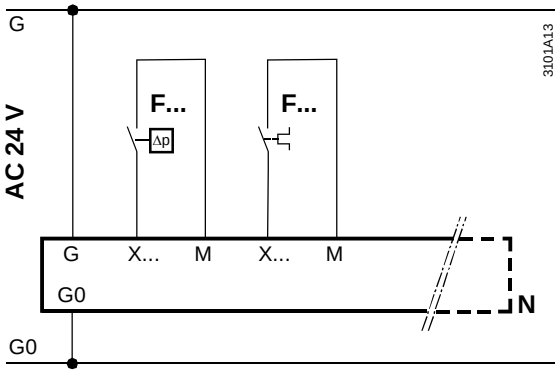
- Permanently assigned digital inputs D1 and D2
- Universal inputs X1…X5, activated as digital inputs X1…X5

Normal position

For each digital input, the normal position can be predefined.
The following positions can be selected: Open / Closed (OPEN / CLSD)

Connection diagram

Only potential-free contacts can be connected to the digital inputs.



Troubleshooting

The digital signals cannot be monitored. If an important protection function, such as a frost protection unit, is connected to this input, we recommend that you make the wiring in such a way that a frost alarm is also triggered if there is no signal (cable break). Setting value ”Normal position”: Closed

7.3.1 Settings

Configuration

Path: **… > COMMIS > CONF > X1…X5**

Display	*Name*	*Range / comments*
LABEL	Input identifier	Assignment of DIG

Setting values

Path: **… > PARA > D1**
… > PARA > D2
… > PARA > X1
… > PARA > X5

Display	*Name*	*Range*	*Factory setting*
NORMPOS	Normal position	OPEN, CLSD	OPEN

Display values

Path: **INFO**

Display	*Name*	*Comments*
D1	D1	Indication of present digital signal at terminal D1
D2	D2	Indication of present digital signal at terminal D2

Wiring test

Path: **… > COMMIS > TEST**

Display	*Name*	*Positions*
D1	D1	Indication of present digital signal at terminal D1, non-adjustable
D2	D2	Indication of present digital signal at terminal D2, non-adjustable

..

7.4 Remote setpoint, absolute (REM)

7.4.1 Basic type and suitable setpoint adjusters

Basic type

You can configure an absolute setpoint adjuster both for basic type A and basic type U.
It acts on the Comfort and Economy setpoints.

Suitable setpoint adjusters

Suitable setpoint adjusters are the QAA25 room operating unit (5…35 °C) and the BSG21.1 (0…1000 Ω) or BSG61 (DC 0…10 V) devices.

7.4.2 Activating the function

Specify identifier and controller

You can activate the function by setting the identifier of an input as a remote setpoint (REMx).
At the same time, you must specify the controller (1…2) that the remote setpoint shall act on.

7.4.3 Type and measuring range

Active or passive?

You can select whether the remote setpoint is an active signal (DC 0…10 V) or a passive signal (0…1000 Ω).

Additionally, you can set the input signal's range:

- MIN VAL: Lowest value at DC 0 V or 0 Ω
- MAX VAL: Highest value at DC 10 V or 1000 Ω

7.4.4 Setpoints for basic type A

Setpoints for Comfort

The Comfort setpoints must always be entered.

The remote setpoint always acts on the heating setpoint; the dead zone between Seq1+2 and Seq4+5 remains the same as the dead zone for the permanently preset setpoints.

- Therefore, the present Comfort heating setpoint is:
  = remote setpoint
- Therefore, the present Comfort cooling setpoint is:
  = remote setpoint + (Comfort cooling setpoint minus Comfort heating setpoint)

Setpoints for Economy

The Economy setpoints are shifted in the same way.

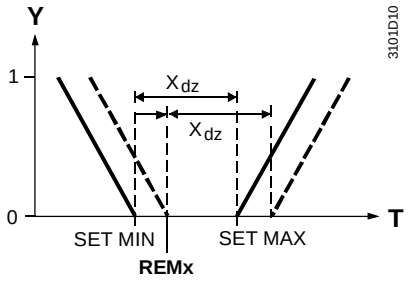
7.4.5 Setpoints for basic type U

Setpoints for Comfort

The Comfort setpoints must always be entered.

The remote setpoint always acts on the lower Comfort setpoint (SET MIN); the dead zone X_{dz} between Seq1+2 and Seq4+5 remains the same as the dead zone X_{dz} for the permanently preset setpoints.

- Therefore, the present lower Comfort setpoint (SET MIN) is:
  = remote setpoint (REMx)
- Therefore, the present upper Comfort cooling setpoint (SET MAX) is:
  = remote setpoint (REMx) + (upper Comfort setpoint minus lower Comfort setpoint)



Setpoints for Economy

The Economy setpoints are shifted in the same way.

7.4.6 Troubleshooting

Connection errors

When you leave the commissioning menu, the universal controller checks whether the setpoint adjuster is connected.

- If, at that time, the setpoint adjuster is connected, but is missing later during operation, or if there is a short-circuit in the cable, a sensor error message is delivered and presented on the display:
  - "Xx ---" => setpoint adjuster missing
  - "Xx ooo" => short-circuit
- If, at that time, there is no signal from the setpoint adjuster, the controller uses the internally adjusted setpoints

Configuration errors

If more than one input has been activated as the remote setpoint adjuster for the same controller, the controller only accepts the first input.

Note

Remote setpoint adjusters BSG21.2, BSG21.3, BSG21.4 and QAA26 are not supported.

7.4.7 Settings

Configuration

Path: **… > COMMIS > CONF > X1…X5**

Display	*Name*	*Range / comments*
LABEL	Input identifier	REMx

Setting values

Path: **… > PARA > X1…X5**

Display	*Name*	*Range*	*Factory setting*
TYPE	Type	0-10, OHM	OHM
MIN VAL	Value low	–50…+500	0
MAX VAL	Value high	–50…+500	50

Display values

Path: **INFO**

Display	*Name*	*Comments*
Xx	Xx	Indication of present remote setpoint adjuster value at terminal Xx

Wiring test

Path: **… > COMMIS > TEST**

Display	*Name*	*Positions*
Xx	Xx	Indication of present remote setpoint adjuster value at terminal Xx, non-adjustable

Fault status messages

Display	*Name*	*Effect*
Xx --- / ooo	Sensor error X…	Non-urgent alarm; plant not stopped

7.5 Remote setpoint, relative (REL)

7.5.1 Basic type and suitable setpoint adjusters

Basic type

You can only configure a relative setpoint adjuster for basic type A.
It acts on the Comfort and Economy room temperature setpoints.

Suitable setpoint adjusters

Suitable setpoint adjusters are the QAA27 room operating unit (–3…+3 K) or the BSG21.5.

7.5.2 Activating the function

Specify identifier (REL)

The function is activated by setting the identifier of an input as “Remote setpoint adjuster, relative” (REL).

The relative remote setpoint adjuster can only be activated for room temperature control, basic type A, and always acts on controller 1.

7.5.3 Measuring range

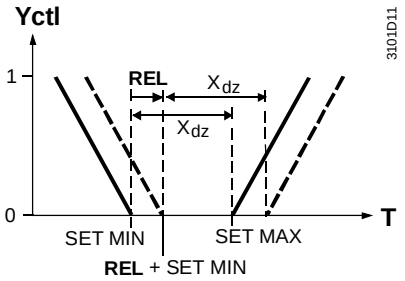
1000…1175 Ω

The setpoint adjuster's range must be 1000…1175 Ω = –3…+3 K.

7.5.4 Setpoints

Setpoints for Comfort

The relative remote setpoint adjuster acts on the lower Comfort setpoint (SET MIN) and the upper Comfort setpoint (SET MAX).
Therefore, the dead zone X_{dz} between Seq1+2 and Seq4+5 remains the same as the dead zone X_{dz} for the permanently preselected setpoints.



Setpoints for Economy

The Economy setpoints are shifted in the same way.

7.5.5 Troubleshooting

Connection errors

When you leave the commissioning menu, the universal controller checks whether the setpoint adjuster is connected.

- If, at that time, the setpoint adjuster is connected, but is missing later during operation, or if there is a short-circuit in the cable, a sensor error message is delivered and presented on the display:
  - "Xx ---" => setpoint adjuster missing
  - "Xx ooo" => short-circuit
- If, at that time, there is no signal from the setpoint adjuster at the time, the controller operates without the relative setpoint shift

Configuration errors

If you have activated more than one input as the relative remote setpoint adjuster, the controller only accepts the first input.

7.5.6 Settings

Configuration

Path: **… > COMMIS > CONF > X1…X5**

Display	*Name*	*Range / comments*
LABEL	Input identifier	REL

Display values

Path: **INFO**

Display	*Name*	*Comments*
Xx	Xx	Indication of present relative remote setpoint adjuster value at terminal Xx

Wiring test

Path: **… > COMMIS > TEST**

Display	*Name*	*Positions*
Xx	Xx	Indication of present relative remote setpoint adjuster value at terminal Xx, non-adjustable

Fault status messages

Display	*Name*	*Effect*
Xx --- / ooo	Sensor error X…	Non-urgent message; plant not stopped

7.6 Outside temperature (OUTS)

7.6.1 Activation and functionality

Activating the function

You can activate the function by setting identifier **OUTS** (outside temperature) at the respective input.

OUTS (outside temperature) is a special identifier, because it creates a large number of internal connections.

Additional functionality

The other properties, such as measuring range, troubleshooting, etc., are described in chapter 0 "Analog inputs".

7.6.2 Settings

Configuration

Path: **… > COMMIS > CONF > X1…X5**

Display	*Name*	*Range / comments*
LABEL	Input identifier	OUTS

Setting values

Path: **… > PARA > X1**
… > PARA > X5

Display	*Name*	*Range*	*Factory setting*
TYPE	Type	NI, 2XNI, T1, PT, 0-10	NI
MIN VAL	Value low	–50…+500	-50
MAX VAL	Value high	–50…+500	250
CORR	Correction	–3.0…+3.0	0 K

Display values

Path: **INFO**

Display	*Name*	*Comments*
OUTS	Outside temperature	

Wiring test

Path: **… > COMMIS > TEST**

Display	*Name*	*Positions*
OUTS	Outside temperature	Indication of outside temperature (at terminal Xx and as special data point OUTS), non-adjustable

Fault status messages

Display	*Name*	*Effect*
Xx --- / ooo	Sensor error X…	Non-urgent message; plant not stopped

7.7 Room temperature (ROOM)

7.7.1 Activation and functionality

Activating the function

You can activate the function by setting identifier **ROOM** (outside temperature) at the respective input.

ROOM (outside temperature) is a special identifier because it creates automatically a large number of “internal connections”. ROOM can only be selected in basic type A.

Additional functionality

The other properties, such as measuring range, troubleshooting, etc., are described in chapter 0 "Analog inputs".

7.7.2 Settings

Configuration

Path: **… > COMMIS > CONF > X1**
… > COMMIS > CONF > X5

Display	*Name*	*Range / comments*
LABEL	Input identifier	ROOM

Setting values

Path: **… > PARA > X1…X5**

Display	*Name*	*Range*	*Factory setting*
TYPE	Type	NI, 2XNI, T1, PT, 0-10	NI
MIN VAL	Value low	–50…+500	-50
MAX VAL	Value high	–50…+500	250
CORR	Correction	–3.0…+3.0	0 K

Display values

Path: **INFO**

Display	*Name*	*Comments*
ROOM	Room temperature	

Wiring test

Path: **… > COMMIS > TEST**

Display	*Name*	*Positions*
ROOM	Room temperature	Indication of room temperature (at terminal Xx and as display value ROOM), non-adjustable

Fault status messages

Display	*Name*	*Effect*
Xx --- / ooo	Sensor error X…	Non-urgent message; plant not stopped

7.8 Supply air temperature (SAT)

7.8.1 Activation and functionality

Activating the function

You can activate the function by setting identifier SAT (supply air temperature) at the respective input.

SAT (supply air temperature) is a special identifier because it creates automatically a large number of “internal connections”. SAT can only be selected in basic type A.

Other properties

The other properties, such as measuring range and troubleshooting, are described in section 0 "Analog inputs".

7.8.2 Settings

Configuration

Path: **… > COMMIS > CONF > X1**
… > COMMIS > CONF > X5

Display	*Name*	*Range / comments*
LABEL	Input identifier	SAT

Setting values

Path: **… > PARA > X1…X5**

Display	*Name*	*Range*	*Factory setting*
TYPE	Type	NI, 2XNI, T1, PT, 0-10	NI
MIN VAL	Value low	–50…+500	-50
MAX VAL	Value high	–50…+500	250
CORR	Correction	–3.0…+3.0	0 K

Display values

Path: **INFO**

Display	*Name*	*Comments*
SAT	Supply air temperature	

Wiring test

Path: **… > COMMIS > TEST**

Display	*Name*	*Positions*
SAT	Supply air temperature	Indication of supply air temperature (at terminal Xx and as display value SAT), non-adjustable

Fault status messages

Display	*Name*	*Effect*
Xx --- / ooo	Sensor error X…	Non-urgent message, plant not stopped

8 Aggregates

8.1 Pump (PUMP x)

8.1.1 Purpose and activation

Purpose of PUMP x

The PUMP x (pump control) function block controls load-dependent pumps.

Number

Depending on the type of controller, the following pump control choices (PUMP x) are available:

Controller type	*Number of PUMP x*
RLU202	Max. 2
RLU202	None
RLU222	Max. 2
RLU232	Max. 2
RLU236	Max. 3

Activation

For activation, you must assign a switching output (Qx) to pump control (PUMP x).

8.1.2 Switching on / off

Not possible via operating mode

The pumps cannot be switched via the operating mode (Comfort, Economy).

Load-dependent by the sequence controller

The sequence controller can switch the pump on according to load. Up to 2 connections can be wired from the sequence controllers, in which case maximum selection applies.

You can enter the switch-on and switch-off points via the ON-Y and OFF-Y settings. In normal use, we recommend switching the pump on at 5% load, and switching it off again at 0% load.

"On" according to outside temperature

To prevent freezing of water pipes, pumps can be operated permanently at low outside temperatures.
In order to be able to activate this function, an outside temperature signal must be available (refer to section.7.6, Outside temperature (OUTS)
You can deactivate this function by setting the ON-OUTS limit value to –50 °C.
The controller switches the circulating pump on if the outside temperature falls below the set limit value. It switches the pump off again when the temperature has risen by 2 K above the limit value.
This function is available with every operating mode, including Protection.

Switch-off delay

For the pumps, a switch-off delay DLY OFF can be set. The switch-off delay always acts on the switch-off command for:

- Pumps that are switched on according to load via the sequence
- "On" depending on outside temperature

The switch-off delay does not act with the following switch-off commands:

- Plant stop due to fault status messages (frost [cooling sequence], main controlled variable not available)
- Wiring test

Pump kick

To prevent the pumps from seizing during longer off periods (e.g. heating group in the summer), a periodic pump kick can be activated per every pump block. When pump kick is activated, the pumps are switched on for 30 seconds, independent of all other functions (refer to section 8.1.5 "Priorities“).

The pump kick is executed periodically every “n” hours by setting the kick period. Kick period = 0: No pump kick.

8.1.3 Troubleshooting

Errors in operation

If the outside temperature signal is not available, and the value for "On according to outside temperature" is not set to –50 °C, the pump remains permanently on.

8.1.4 Function check / wiring test

Switching on / off

During the wiring test, the pumps can be directly switched via the control switch.

Switch positions

The switch has the following positions:

- Off
- On

8.1.5 Priorities

4 priorities for pump operation

The following priorities apply to pump operation:

1 ON / OFF during the wiring test
2 ON due to frost protection function (pump on heat sequence)
3 ON due to "ON according to outside temperature"
4 ON due to pump kick
5 ON depending on demand (refer to sequence controller; subsection 9.5.6 “Pump outputs”)

8.1.6 Settings

Configuration

Path: **… > COMMIS > CONF > PUMP 1**
… > COMMIS > CONF > PUMP 2
… > COMMIS > CONF > PUMP 3

Display	*Name*	*Range / comments*
PUMP x	Output	Output of pump x (1, 2, 3) to a relay; adjustable values: ---, Q1, Q2, … (free outputs only)

Setting values

Path: **… > PARA > PUMP 1**
… > PARA > PUMP 2
… > PARA > PUMP 3

Display	*Name*	*Range*	*Factory setting*
Y ON	Load-dependent ON	0…100 %	5 %
OFF-Y	Load-dependent OFF	0…100 %	0 %
ON-OUTS	Outside temp-dependent ON	–50…+250 °C	–50 °C
DLY OFF	Switch-off delay	00.00…60.00 m.s	00.00
KICK	Kick period	0…200h	0

Display values

Path: **INFO**

Display	*Name*	*Comments*
PUMP 1	Pump 1	Indication of current state: Off, On…
PUMP 2	Pump 2	Indication of current state: Off, On…
PUMP 3	Pump 3	Indication of current state: Off, On…

Wiring test

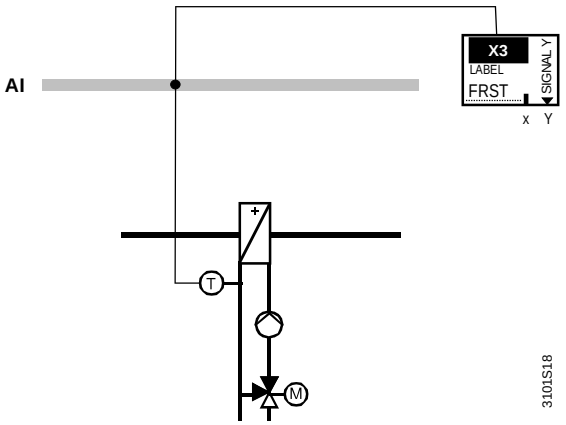
Path: **… > COMMIS > TEST**

Display	Name	Positions
PUMP 1	Pump 1	Off, On…
PUMP 2	Pump 2	Off, On…
PUMP 3	Pump 3	Off, On…

8.1.7 Application examples

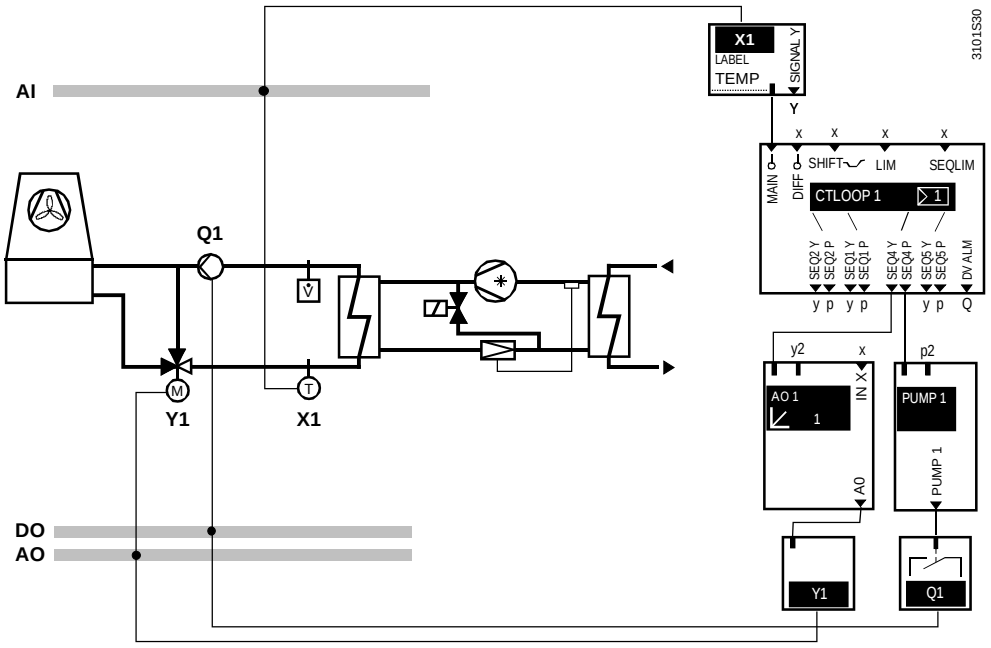
Frost protection pump

Pump used as a frost protection pump in connection with air heating coil:



Load-dependent recooling pump

Pump used as a load-dependent recooling pump on a multistage refrigeration machine:



8.2 Modulating output (AO)

8.2.1 Purpose and activation

Purpose of AO x

The AO x (modulating output) function block generates a continuous DC 0…10 V output signal for a modulating actuator with a corresponding input.

Note

The AO x function block is not available with the RLU220 controller.

Activation

To activate the AO x function block, you must assign an output (Y x) to it.

8.2.2 Function

External signal (IN X)

You can connect the load signal for the modulating output from the sequence controller to the modulating output.

Additionally, it is also possible to use an analog input (IN X) as the load signal. If one or more (maximum 2) internal load signals and the external load signal are connected at the same time, the controller uses maximum selection.

For example, this provides for combination of the air cooling coil signal from an external dehumidification controller with that from a temperature controller.

Note

The external signal is considered only if the controller operates in Comfort or Economy mode!

Output inversion (INVERS)

You can invert any output. Meaning:

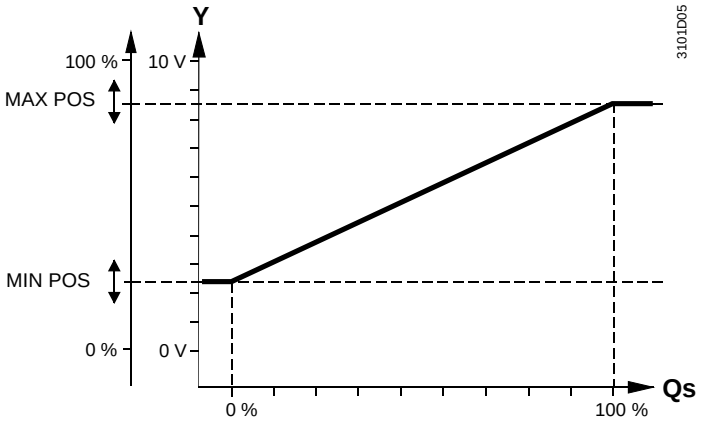
INVERS = NO: 0…100% load = 0…100% output
INVERS = YES: 0…100% load = 100…0% output

If the controller has an analog output and is switched off during operation (input D1 = Protection), the output signal behaves as follows:

INVERS = NO: 0% output
INVERS = YES: 100% output

Limitations (MIN POS, MAX POS)

You can impose upper and lower limits on the modulating output. In that case, 0…100% output means "Positioning signal min (MIN POS)…positioning signal max (MAX POS)" as shown below:



Qs = load demand from the sequence controller

Application example

You can use this feature to parameterize the output for a solenoid valve with a DC 5…7.5 V input signal, for example.

%OPEN according to the outside temperature

At low outside temperatures, air heating coils must be permanently heated; this is ensured by maintaining a (minimum) valve position (controlled by an analog output). This function prevents the air heating coils from freezing up.
Prerequisite for this function is the availability of an outside temperature signal (refer to section 7.6, Outside temperature (OUTS)

If the outside temperature falls below the adjusted limit value (ON-OUTS), the controller opens the analog output. The analog output and thus the valve opening position in percent are set to the value entered in %OPEN. The analog output is deactivated and thus the valve fully closed when the outside temperature has exceeded the limit value by 2 K.

Notes

- The connected controller sequence can override this process
- This function is available with every operating mode, including Protection

8.2.3 Troubleshooting

Signal interpretation

The controller interprets external signals IN X with input values below 0 V as 0%, and signals with values over 10 V as 100%. It performs linear interpolation on all values in between.

Caution

Observe hardware restrictions!

Note

If, with the %OPEN function activated, the outside temperature sensor is missing, the valve opens until the entered position is reached and then maintains that position.

8.2.4 Wiring test (TEST)

Switching on / off

During the wiring test, the modulating output can be directly commanded via the control switch.

Switch positions

The switch has the following positions:

- ---
- 0…100% load

Note

Settings such as INVERS, MIN POS and MAX POS are also effective during the wiring test.

8.2.5 Settings

Configuration

Path: **… > COMMIS > CONF > AO 1**
… > COMMIS > CONF > AO 2
… > COMMIS > CONF > AO 3

Display	*Name*	*Range / comments*
AO x	Modulating output	Activation of modulating output; adjustable values: ---,Y1, Y2, Y3
IN X	Preselection external	Adjustable values: ---, X1, X2, … (inputs with identifier % only)

Setting values

Path: **… > PARA > AO 1**
… > PARA > AO 2
… > PARA > AO 3

Display	*Name*	*Range*	*Factory setting*
MIN POS	Positioning signal min	0…100 %	0 %
MAX POS	Positioning signal max	0…100 %	100 %
INVERS	Inversion	NO, YES	NO
ON-OUTS	Outside temp-dependent ON	–50…+250 °C	–50 °C
%OPEN	Outside temp-dependent open	0…100 %	0 %

Display values

Path: **INFO**

Display	*Name*	*Comments*
AO 1	Modulating output 1	0…100 %
AO 2	Modulating output 2	0…100 %
AO 3	Modulating output 3	0…100 %

Wiring test

Path: **… > COMMIS > TEST**

Display	*Name*	*Positions*
AO 1	Modulating output 1	---, 0…100 %
AO 2	Modulating output 2	---, 0…100 %
AO 3	Modulating output 3	---, 0…100 %

8.3 Heat recovery (HREC)

8.3.1 Purpose and activation

Purpose of HREC

The HREC function block controls HR equipment or mixing dampers with a DC 0…10 V signal.

Note

The HREC function block is not available with the RLU220 controller.

Activation

To activate the HREC function block, you must assign an output (Y x) to it.

Notes

If you use the HREC function block to control mixing dampers, ensure that TYPE is set to DMP. This refers to the control of the outside air dampers.

8.3.2 External preselection (IN X)

Maximum selection in case of several load signals

You can connect the load signal for HR from the sequence controller to the HR equipment.

Additionally, it is also possible to use an analog input (IN X) as the load signal.

If one or a maximum of 2 internal load signals plus an external load signal are connected at the same time, the controller uses maximum selection. This provides for combination of an external load signal from another RLU2.. universal controller with the internal maximum economy changeover (MECH), for example.

Note

The external signal is considered only if the controller operates in Comfort or Economy mode!

8.3.3 Heat recovery changeover (TYPE)

Output inversion

To produce the changeover between HR equipment (wheel, glycol) and mixing dampers, you can invert the output signal using TYPE.

Settings

You have to make the following settings in normal operation to achieve the customary control response:

- HR equipment:
  _ TYPE = ERC 0…100% load = 0…100% output
- Mixing damper:
  /_ TYPE = DMP 0…100% load = 100…0% output

Note

This response applies if the HR equipment (HREC) is connected to the SEQ1 Y heating sequence of the CTLOOP controller.

Output signal behavior

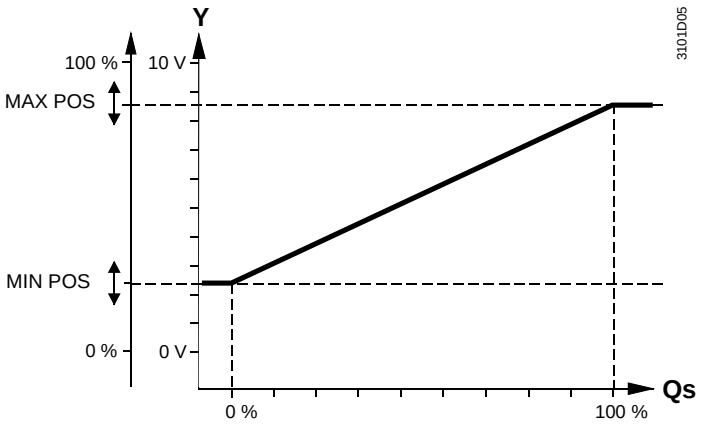
If the controller with a HR equipment / mixing damper output is switched off during operation (input D1 = Protection), the output signal behaves as follows:

- TYPE = ERC: 0% (i.e. DC 0 V)
- TYPE = DMP: 0% (i.e. DC 0 V)

8.3.4 Limitations (MIN POS, MAX POS)

Diagram

You can impose upper and lower limits on the modulating output.
In that case, the 0…100% output signal corresponds to:
Minimum positioning signal (MIN POS)…maximum positioning signal (MAX POS).



Qs = load demand from the sequence controller

Application example

You can implement a minimum air damper position using the minimum positioning signal (MIN POS).

Note

The controller does not give consideration to MIN POS and MAX POS in Protection mode.

8.3.5 Maximum economy changeover (MECH)

Purpose

The purpose of this function is to optimize the control of the HR in air conditioning systems with regard to operating costs. It compares the available energy in the outside air and exhaust air, and switches the inversion accordingly.

Activation

To activate the maximum economy changeover (MECH) function, assign the corresponding inputs during configuration:

- MECH 1 (MECH input 1)
- MECH 2 (MECH input 2)

3 changeover possibilities

The following 3 changeover possibilities are available:

- Changeover from externally via a digital signal
- Changeover at an adjustable value
- Changeover at an adjustable difference between 2 measured values

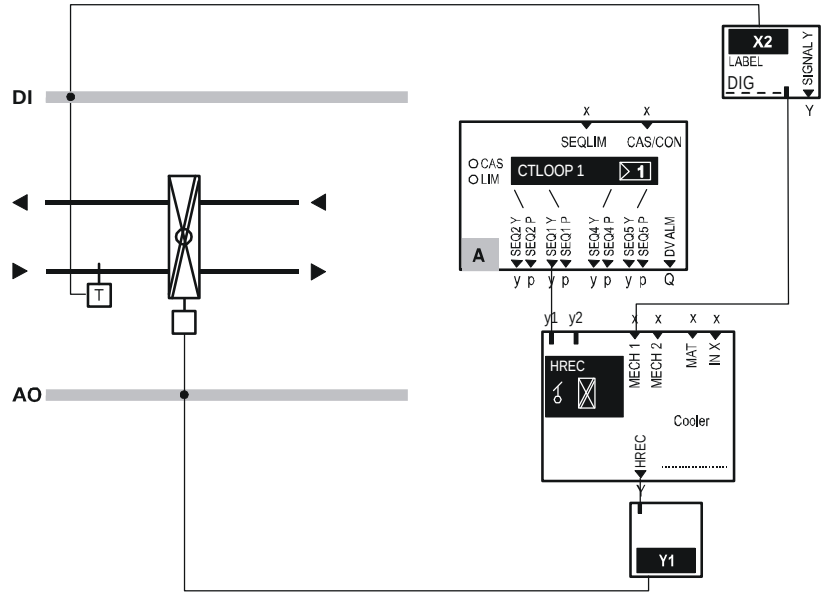
Special application examples:

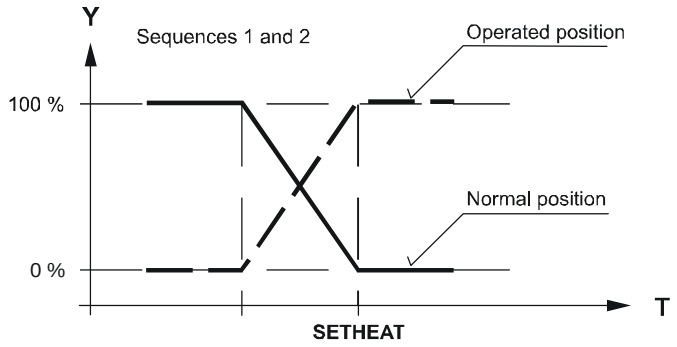
- Changeover from externally via a digital signal with air damper as first cooling sequence
- Changeover at an adjustable difference with air damper as first cooling sequence

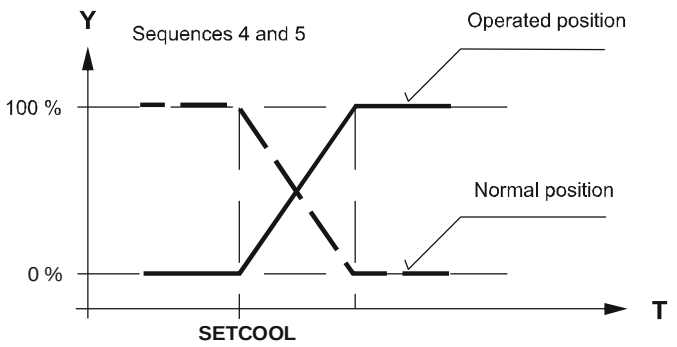
The 3 possibilities and the 2 special application examples are explained on the following pages.

Possibility 1: Changeover from externally via a digital signal

For that purpose, MECH input 1 (MECH 1) must be assigned a digital input.
Function with TYPE = ERC:
When controlled via the heating sequence:
Normal position => no inversion of HR output (HREC)
Operated position=> inversion of HR output (HREC)
When controlled via the cooling sequence:
Normal position => inversion of HR output (HREC)
Operated position=> no inversion of HR output (HREC)







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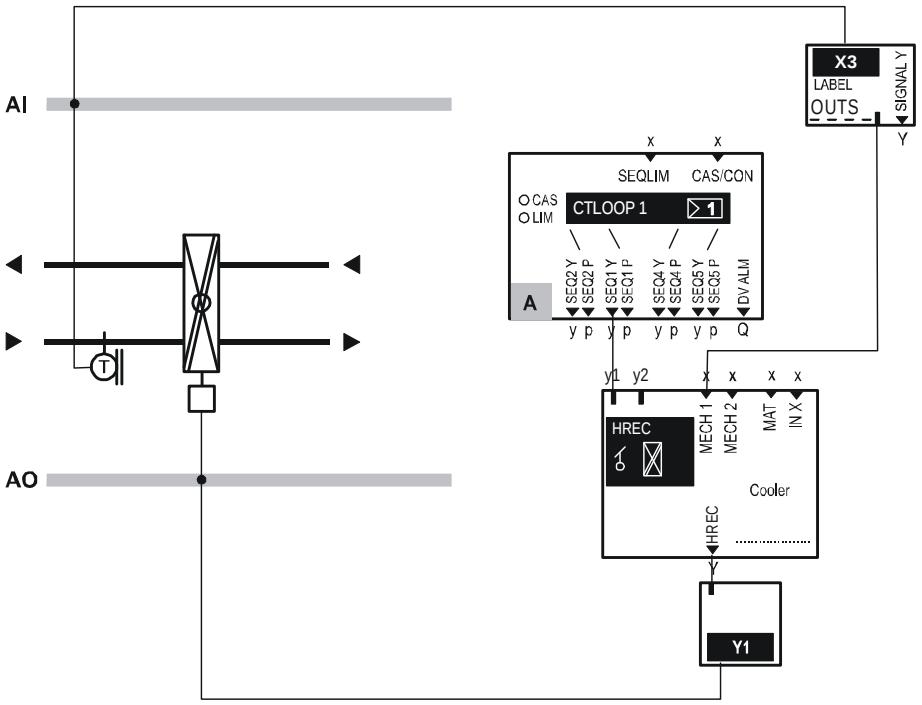
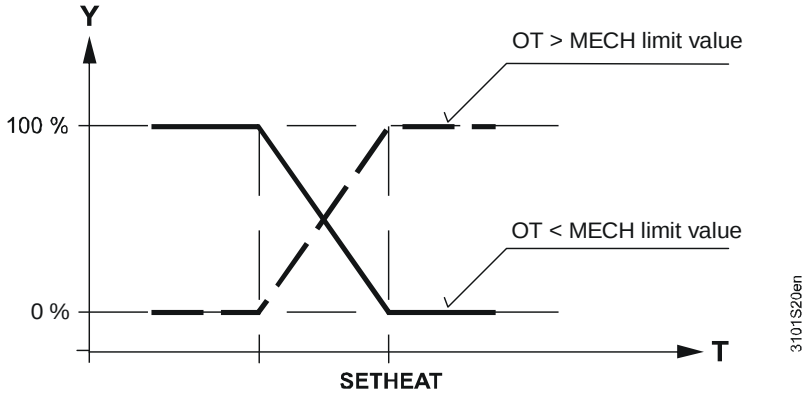
Application example

Changeover via an external actuating device (digital input).

Possibility 2: Changeover at an adjustable value
For that purpose, MECH input 1 (MECH 1) must be assigned an alalog input. Function with TYPE = ERC:

When controlled via the heating sequence:
When the set MECHU limit value (MECHSET) is exceeded, the output of the HR equipment (HREC) will be inverted.
When controlled via the cooling sequence:
When the set MECH limit value (MECHSET) is exceeded, the output of the HR equipment (HREC) will no longer be inverted.





Application examples

Examples of changeover at an adjustable value:

- Changeover at an outside temperature >25 °C
- Changeover at an outside enthalpy > 30 kJ/kg
- Changeover via an external enthalpy difference processor at an enthalpy difference ≥ 2 kJ/kg

Possibility 3: Changeover at an adjustable difference

To achieve changeover at an adjustable difference between 2 measured values, you must assign one analog input each to MECH input 1(MECH 1) and MECH input 2 (MECH 2).

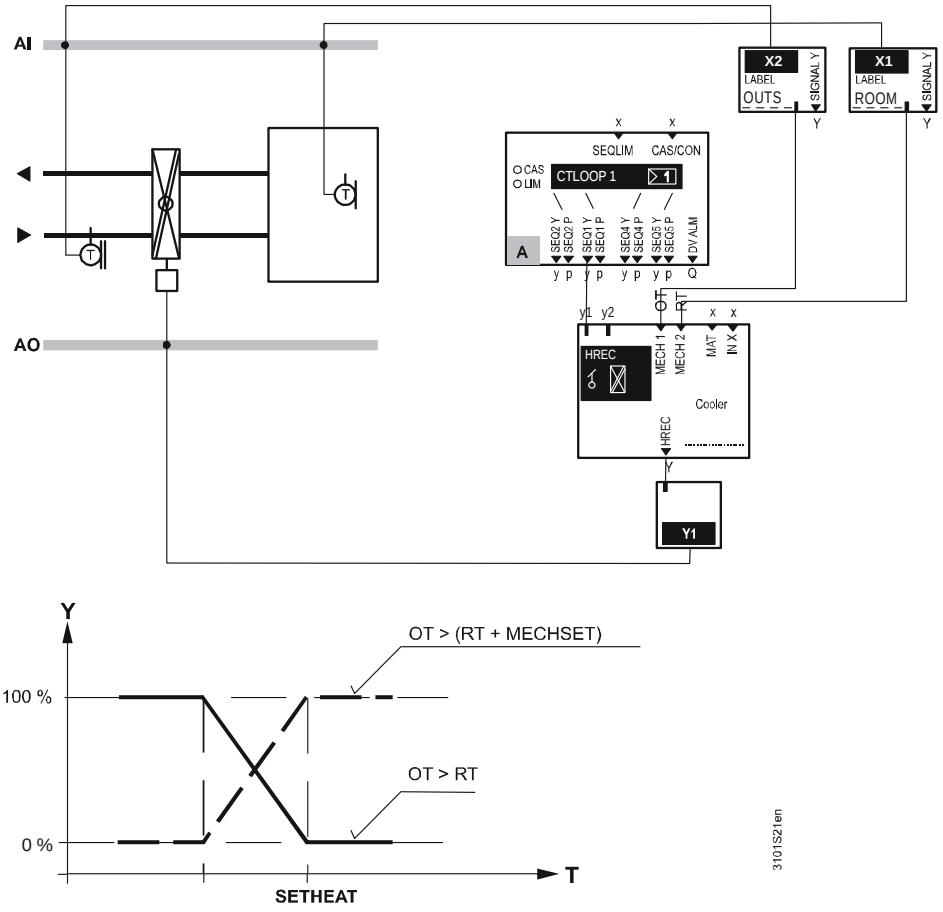
Function with TYPE = ERC:

When controlled via the heating sequence:

When the set MECH difference (MECHSET) is exceeded, the output of the HR equipment (HREC) will be inverted.

When controlled via the cooling sequence:

When the set MECH difference (MECHSET) is exceeded, the output of the HR equipment (HREC) will no longer be inverted.



Application examples

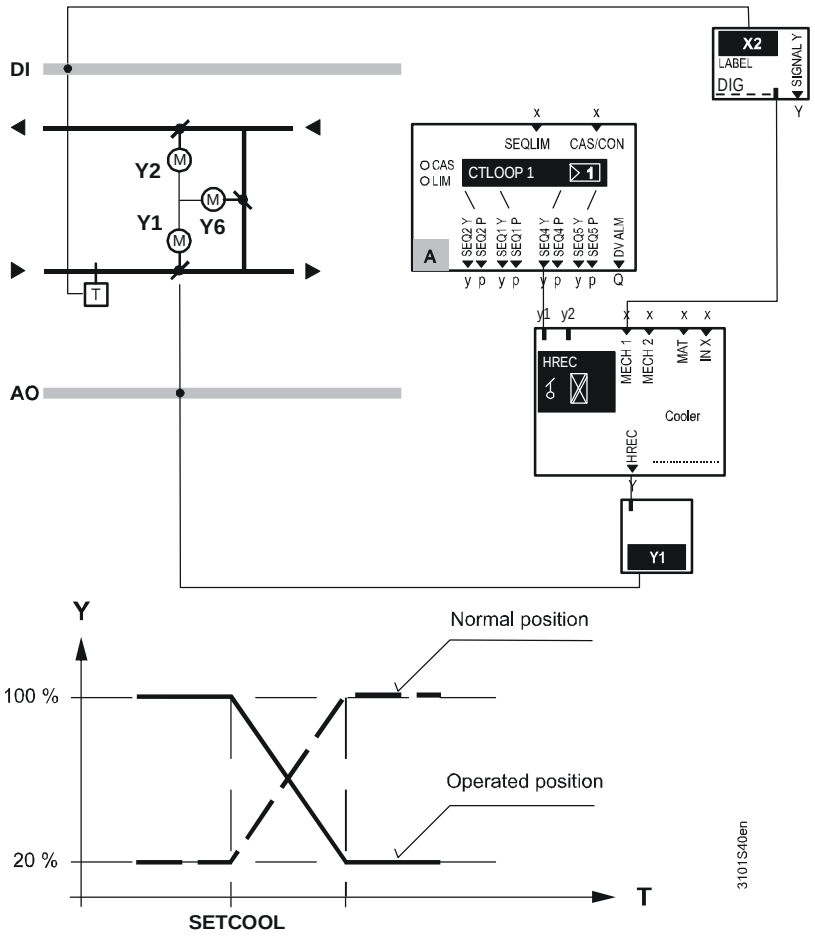
Examples of changeover at an adjustable difference:

- Changeover at a temperature difference of:
  Outside temperature minus room temperature ≥3 K
- Changeover at a temperature difference of:
  Outside temperature minus exhaust air temperature ≥2 K

Special application example 1:
Changeover from externally via digital signal with air damper as first cooling sequence

For that purpose, MECH input 1 (MECH 1) must be assigned a digital input.
Function with TYPE = DMP and control via the cooling sequence:

Normal position	=> no inversion of air damper output (HREC)
Operated position	=> inversion of air damper output (HREC)

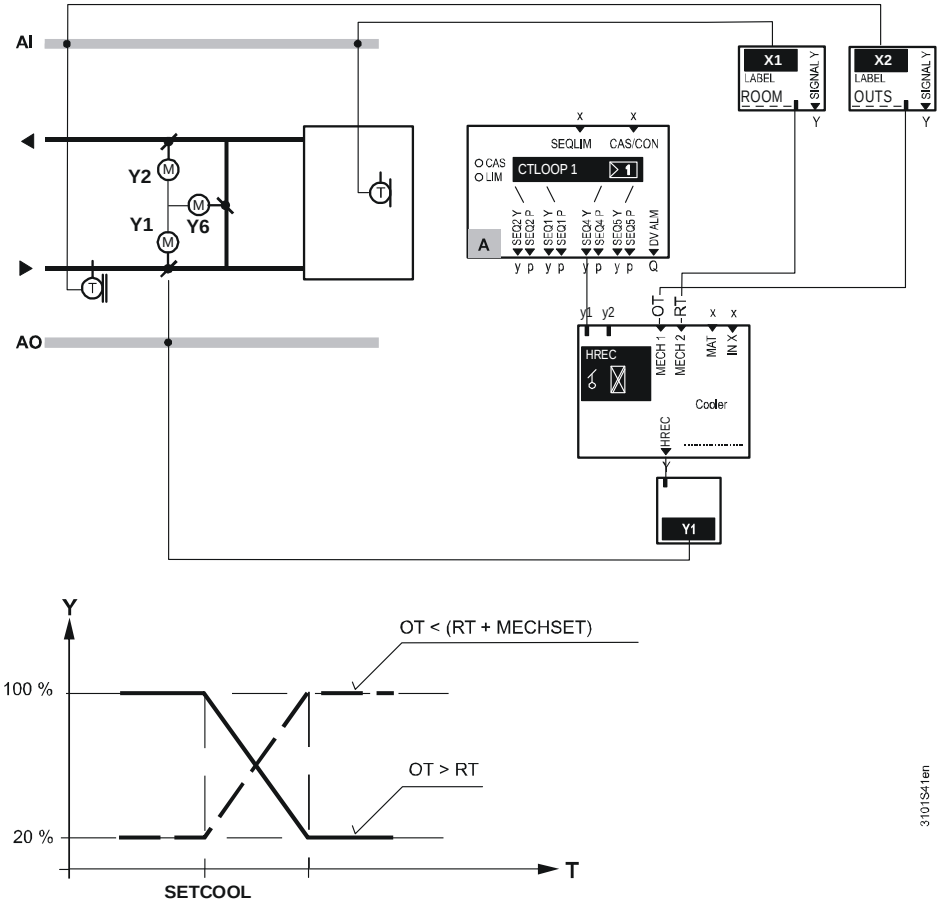


Special application example 2: Changeover at adjustable difference with air damper as first cooling sequence

To achieve changeover at an adjustable difference between 2 measured values, you must assign one analog input each to MECH input 1 (MECH 1) and MECH input 2 (MECH 2). To do this, assign the outside temperature to MECH input 1, and the room temperature to MECH input 2.

Function with TYPE = DMP and control via the cooling sequence:

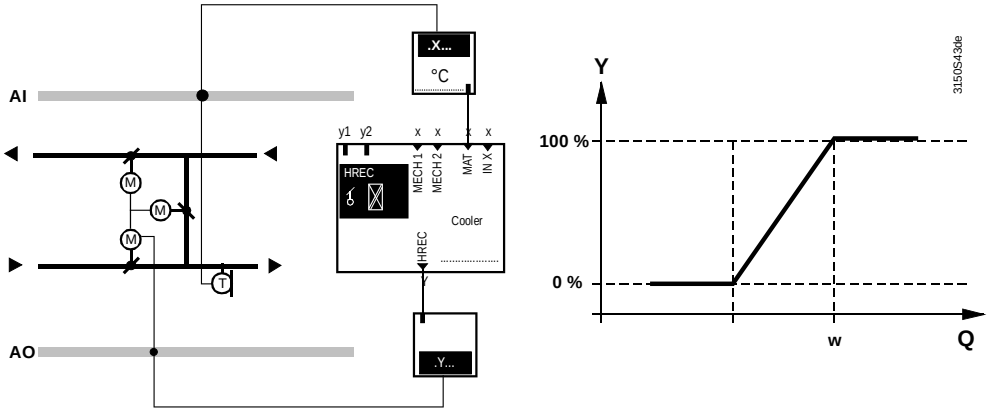
When the set MECHU limit value (MECHSET) is exceeded, the air damper output (HREC) will be inverted.



8.3.6 Mixed air temperature control (MAT)

Activation

The mixed air temperature controller is activated by feeding the mixed air temperature signal to the HR block (HREC). With the help of the mixing dampers, the mixed air temperature is controlled to an adjustable setpoint.



Note

The startup circuit or MECH, if configured, act on the controlling output with higher priority.

8.3.7 Startup circuit

Activation

The startup ciruit for air dampers is activated by entering a value >0.00 for “Startup time”.

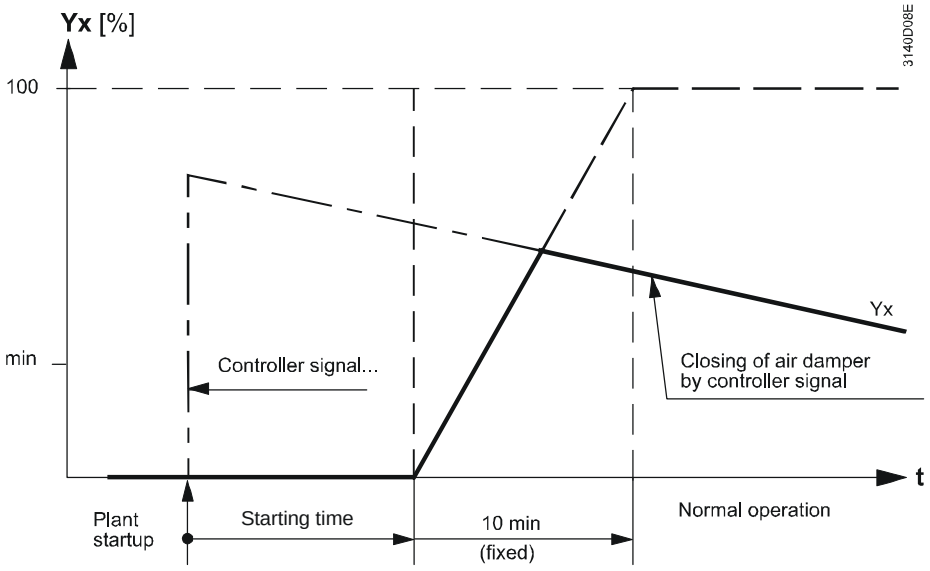
Purpose

The purpose of the startup circuit is to prevent the air heating coils from freezing up by first opening the air damper with a certain delay, then it opens steplessly.

If an outside temperature signal is available, the startup circuit is active only when the outside temperature lies below 15 °C. At outside temperatures above 15 °C, the plant is started up without making use of the startup circuit. If no outside temperature signal is available, the startup circuit is always active, provided the startup time entered is > 00.00.

When the plant is started up, the air damper operates according to the following diagram:

Function diagram



8.3.8 Permanent priority of cooling valve (COOLER)

Problem

In dehumidification mode, temperature control calls for warmer air, therefore acting on the HR system. As a result, the air cooling coil needs more energy to cool the air again.

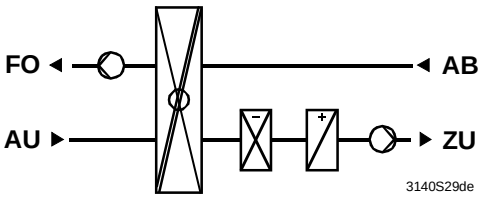
Solution

This is prevented by making use of the COOLER function: The cooling valve function block is assigned to the HR equipment. The cooling valve is given priority. When the cooling valve is open, the output signal of the HR equipment is set such that the air temperature after HR is as low as possible.

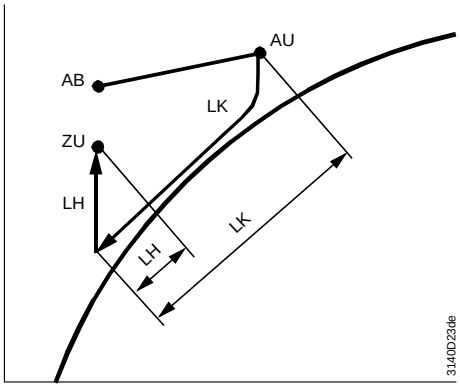
The COOLER function is also available for mixing dampers.

Example

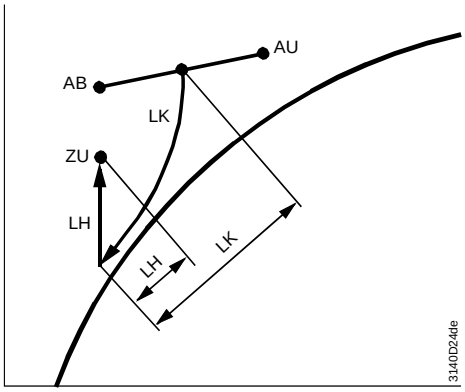
Dehumidification and heating in a partial air conditioning system



Process without cooling valve setting:



Process with cooling valve setting:



8.3.9 Wiring test (TEST)

Direct control via control switch

During the wiring test, the modulating output can be directly commanded via the control switch. Maximum economy changeover (MECH) is inactive.

The switch has the following positions:

- ---
- 0…100% load

Note

Settings such as TYPE, MIN POS and MAX POS are also effective during the wiring test.

8.3.10 Troubleshooting

Errors in operation

If the sensors for MECH are not available, changeover does not occur.

Configuration errors

If the second MECH input does not have the same unit as the first MECH input, only the first input is used for changeover. If no input or only the second input is configured, changeover is deactivated.

8.3.11 Settings

Configuration

Path: **… > COMMIS > CONF > HREC**

Display	*Name*	*Range / comments*
HREC	Mixing damper/HR	Activation of HR; adjustable values: ---, Y1, Y2, …
MECH 1	MECH input 1	Adjustable values: ---, X1, X2, … (only °C, 0.0, 0000, digital)
MECH 2	MECH input 2	Adjustable values: ---, X1, X2, … (only °C, 0.0, 0000)
MAT	Mixed air temperature	Adjustable values: ---, X1, X2, … (only °C, 0.0, 0000)
IN X	Preselection external	Adjustable values: ---, X1, X2, … (inputs with identifier % only)
COOLER	Cooling coil valve	---, AO1, AO2, AO3, STP1, STP2, STP3, SLIN, SBIN, 3P

Setting values

Path: **… > PARA > HREC**

Display	*Name*	*Range*	*Factory setting*
TYPE	Type	ERC, DMP	ERC
MIN POS	Positioning signal min	0…100 %	0 %
MAX POS	Positioning signal max	0…100 %	100 %
MECHSET	MECH limit value		3 K, 20 °C
STUP-TI	Startup time	00.00...60.00 m.s	00.00 m.s
MAT SP	Mixed air temperature setpoint	-50 °C … 250 °C	12 °C
MAT XP	Mixed air temp P-band Xp	0.0 ... 500 K	10 K
MAT TN	Mixed air temp int act time Tn	00.00...60.00 m.s	02.00 m.s

Display values

Path: **INFO**

Display	*Name*	*Comments*
HREC	Mixing damper/HR	0…100 %

Wiring test

Path: **… > COMMIS > TEST**

Display	*Name*	*Positions*
HREC	Mixing damper/HR	---, 0…100 %

8.4 Variable step switch (STEP Vx)

8.4.1 Purpose and activation

Purpose of STEP Vx

The STEP Vx (variable step switch) function block switches multi-stage aggregates. All outputs can be set individually.

Number

Depending on the type of controller, the following number of variable step switches are available:

Controller type	*Number of variable step switches*
RLU202	1 = with a maximum of 2 steps
RLU202	None
RLU222	1 = with a maximum of 2 steps
RLU232	1 = with a maximum of 2 steps
RLU236	1 = with a maximum of 6 steps 1 = with a maximum of 2 steps (6 relays available in total)

Activation

To activate the variable step switch, assign a relay Q… to the STEP 1 output.

Note

Additionally, you can also configure the available analog output AO with each step switch. The same settings are possible as with the modulating output, AO function block. Accordingly, a Y output can also be assigned.

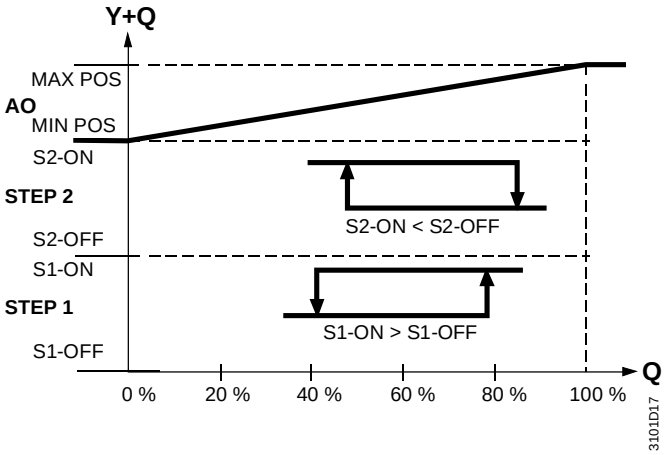
8.4.2 Operating principle

Load connection

With variable step switching, you can set the digital outputs individually according to the load.
You can define the digital output's direction of action via the switching point settings. The digital outputs can overlap each other.

Example

The following diagram shows an example of load connection.



If the step switch is controlled by 2 internal sequence controllers, the larger signal is effective (maximum selection).

Locking time (OFFTIME)

Additionally, you can enter a common locking time for the digital outputs. This ensures that a stage that has just switched off remains off for at least the set period of time.

No overrun time in the step switch

You cannot enter an overrun time for the step switches, since there are no open-loop control functions in the Synco 200 product range.

Note

If the variable step switch is controlling an electric air heater battery, you must solve the fan overrun time using external means.

8.4.3 External preselection (IN X)

Maximum selection in case of several preselections

You can configure an analog input as a preselection for the step switch. The controller performs a maximum selection together with the internal signals.

For example, you can use this feature to implement the following function: External control. The RLU236 provides the step switch function only.

Note

The external signal is considered only if the controloler is in Comfort or Economy mode!

8.4.4 Output inversion (INVERS)

Definition and behavior

You can invert the analog output. Meaning:

INVERS = NO: 0…100% load = 0…100% output
INVERS = YES: 0…100% load = 100…0% output

If the controller with a variable step switch is switched off during operation (input D1 = Protection), the output signal behaves as follows:

INVERS = NO: 0% output
INVERS = YES: 100% output

8.4.5 Function check / wiring test

Switching on / off

The step switch can be switched directly via the control switch during the wiring test.

Switch positions

The switch has the following positions:

- ---
- 0…100% load

Note

Settings such as INVERS, MIN POS and MAX POS are also effective during the wiring test.

8.4.6 Priorities

Two priorities

The following 2 priorities apply to the step switch:

1 On / Off during the wiring test
2 Demand-controlled by the sequence controller (preselection in normal operation) and the IN X external signal (maximum selection)

8.4.7 Settings

Configuration

Path: **… > COMMIS > CONF > STEP V1**
… > COMMIS > CONF > STEP V2

Display	*Name*	*Range / comments*
STEP 1	Step 1	Activation of step switch and selection of the number of steps; adjustable values: ---, Q1, Q2, … (free outputs only)
STEP 2	Step 2	---, Q1, Q2, … (free outputs only)
STEP 3	Step 3	---, Q1, Q2, … (free outputs only)
STEP 4	Step 4	---, Q1, Q2, … (free outputs only)
STEP 5	Step 5	---, Q1, Q2, … (free outputs only)
STEP 6	Step 6	---, Q1, Q2, … (free outputs only)
AO	Modulating output	---, Y1, Y2, … (free outputs only)
IN X	Preselection external	---, X1, X2, … (inputs with identifier % only)

Setting values

Path: **… > PARA > STEP V1**
… > PARA > STEP V2

Display	*Name*	*Range*	*Factory setting*
S1-ON	[Step 1] ON	0…100 %	17 %
S1-OFF	[Step 1] OFF	0…100 %	1 %
S2-ON	[Step 2] ON	0…100 %	33 %
S2-OFF	[Step 2] OFF	0…100 %	17 %
S3-ON	[Step 3] ON	0…100 %	50 %
S3-OFF	[Step 3] OFF	0…100 %	33 %
S4-ON	[Step 4] ON	0…100 %	67 %
S4-OFF	[Step 4] OFF	0…100 %	50 %
S5-ON	[Step 5] ON	0…100 %	83 %
S5-OFF	[Step 5] OFF	0…100 %	67 %
S6-ON	[Step 6] ON	0…100 %	100 %
S6-OFF	[Step 6] OFF	0…100 %	83 %
OFFTIME	Locking time	00.00…10.00 m.s	00.00 m.s
MIN POS	Positioning signal min	0…100 %	0 %
MAX POS	Positioning signal max	0…100 %	100 %
INVERS	Inversion	NO, YES	NO

Note

STEP V1 has a maximum of 2 steps.
Therefore, the setting values for S3-ON to S6-OFF are not shown.

Display values

Path: **INFO**

Display	*Name*	*Comments*
STEP V1	Variable step switch 1	0…100 %
STEP x	Variable step switch 1, step x	ON, OFF
STEP V2	Variable step switch 2	0…100 %
STEP x	Variable step switch 2, step x	ON, OFF

Wiring test

Path: **… > COMMIS > TEST**

Display	*Name*	*Positions*
STEP V1	Variable step switch 1	---, 0…100 %
STEP x	Variable step switch 1, step x	ON, OFF
STEP V2	Variable step switch 2	---, 0…100 %
STEP x	Variable step switch 2, step x	ON, OFF

8.5 Linear step switch (STEPLIN)

8.5.1 Purpose and activation

Purpose of STEPLIN

The STEPLIN (linear step switch) function block switches multistage aggregates. Load distribution to the outputs is linear.

Number

Depending on the type of controller, the following number of linear step switches are available:

Controller type	*Number of linear step switches*
RLU202	None
RLU202	None
RLU222	None
RLU232	1 linear step switch with a maximum of: – 2 relay outputs – 1 modulating output
RLU236	1 linear step switch with a maximum of: – 6 relay outputs – 1 modulating output

Activation

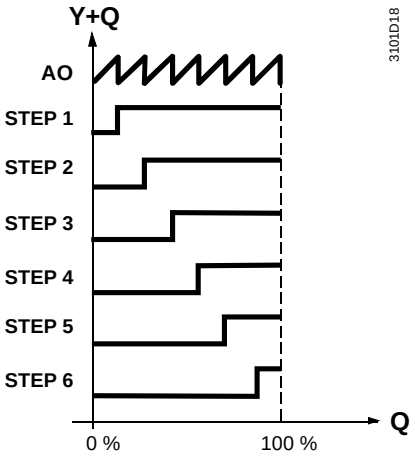
To activate the linear step switch, assign a relay Q… to the STEP 1 output.

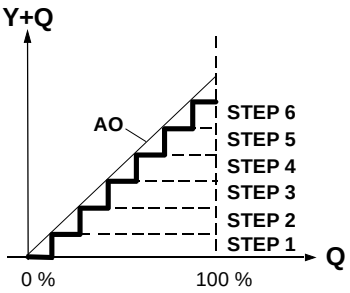
8.5.2 Operating principle

Load connection

The linear step switch connects the relay outputs in equal steps.

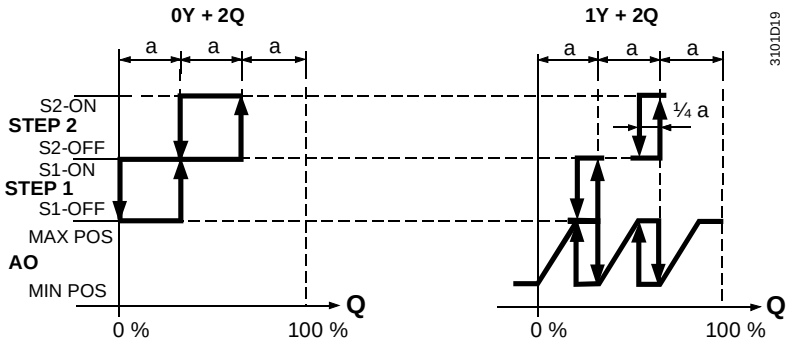
Load connection applies the following pattern:





Switching interval

Example with 2 digital outputs:



$$\text{Interval a} = \frac{100\,\%\,\text{load}}{(\text{number of steps} + 1)}$$

Locking time (OFFTIME)

Additionally, you can enter a common locking time for the relay outputs. This ensures that a step that has just switched off remains off for at least the set period of time.

Startup delay (ON DLY)

To prevent excessively quick startup, you can enter a common startup delay time. This delay makes the controller wait for the set time between the steps during startup.

Run time priority changeover (PRIO CH)

With the linear step switch, you can set a priority changeover of the outputs.

The priorities change at fixed intervals of roughly one week (always after 7 x 24 = 168 hours).

Changeover is as follows (example with 4 steps):

Week 1: 1, 2, 3, 4
Week 2: 2, 3, 4, 1
Week 3: 3, 4, 1, 2
Week 4: 4, 1, 2, 3
Week 5: 1, 2, 3, 4
Etc.

Note

In the event of a voltage drop, priority changeover is reset.

8.5.3 External preselection (IN X)

Maximum selection

You can configure an analog input (IN X) as a preselection for the step switch. The controller performs a maximum selection together with the internal signals.

Example

For example, you can use this feature to implement the following function:
DX cooling control, maximum selection between internal temperature control and dehumidification signal from an external dehumidification controller.

Note

The external signal is considered only if the controller operates in Comfort or Economy mode.

8.5.4 Output inversion (INVERS)

Definition and behavior

You can invert the step switch's analog output. Meaning:

INVERS = NO: 0…100% load = 0…100% output
INVERS = YES: 0…100% load = 100…0% output

The same settings are possible for this analog output as for the modulating output, AO function block.

If the controller has a linear step switch and is switched off during operation (input D1 = Protection), the output signal behaves as follows:

INVERS = NO: 0% output
INVERS = YES: 100% output

8.5.5 Function check / wiring test

Switching on / off

The step switch can be switched directly via the control switch during the wiring test.

Switch positions

The switch has the following positions:

- ---
- 0…100 %

Note

Settings such as INVERS, MIN POS and MAX POS are also effective during the wiring test.

8.5.6 Priorities

The following 2 priorities apply to the step switch:
1 On / Off during the wiring test.
2 Demand-controlled by the sequence controller (preselection in normal operation) and the external preselection (maximum selection)

8.5.7 Settings

Configuration

Path: **… > COMMIS > CONF > STEPLIN**

Display	*Name*	*Range / comments*
STEP 1	Step 1	Activation of step switch and selection of the number of steps; adjustable values:---, Q1, Q2, … (free outputs only)
STEP 2	Step 2	---, Q1, Q2, … (free outputs only)
STEP 3	Step 3	---, Q1, Q2, … (free outputs only)
STEP 4	Step 4	---, Q1, Q2, … (free outputs only)
STEP 5	Step 5	---, Q1, Q2, … (free outputs only)
STEP 6	Step 6	---, Q1, Q2, … (free outputs only)
AO	Modulating output	---, Y1, Y2, … (free outputs only)
IN X	Preselection external	---, X1, X2, … (inputs with identifier % only)

Setting values

Path: **… > PARA > STEPLIN**

Display	*Name*	*Range*	*Factory setting*
ON DLY	Startup delay	00.00…10.00 m.s	00.00
PRIO CH	Run priority changeover	NO, YES	NO
OFFTIME	Locking time	00.00…10.00 m.s	00.00
MIN POS	Positioning signal min	0…100 %	0 %
MAX POS	Positioning signal max	0…100 %	100 %
INVERS	Inversion	NO, YES	NO

Display values

Path: **INFO**

Display	*Name*	*Comments*
STEPLIN	Linear step switch	0…100 %
STEP x	Linear step switch, step x	ON, OFF

Wiring test

Path: **… > COMMIS > TEST**

Display	*Name*	*Positions*
STEPLIN	Linear step switch	---, 0…100 %
STEP x	Linear step switch, step x	ON, OFF

8.6 Binary step switch (STEPBIN)

8.6.1 Purpose and activation

Purpose of STEPBIN

The STEPBIN (binary step switch) function block switches multi-stage aggregates. The aggregates must be sized according to the binary load distribution.

Number

Depending on the type of controller, the following number of binary step switches are available:

Controller type	*Number of binary step switches*
RLU202	None
RLU202	None
RLU222	None
RLU232	1 binary step switch with a maximum of: – 2 relay outputs(= 3 load steps) – 1 modulating output
RLU236	1 binary step switch with a maximum of: – 4 relay outputs(= 15 load steps) – 1 modulating output

Activation

To activate the binary step switch, assign a relay Q… to the STEP 1 output.

8.6.2 Operating principle

Load distribution (demand calculation)

The binary step switch distributes the digital outputs with the number of load steps according to the following table over the total contact rating of the aggregate.

a) If configured **without** the analog output:

Configured outputs	*Load distribution*				*Number of load steps*
	Relay 1	*Relay 2*	*Relay 3*	*Relay 4*	
0Y+2Q	Q1 = 1/3	Q2 = 2/3			3
0Y+3Q	Q1 = 1/7	Q2 = 2/7	Q3 = 4/7		7
0Y+4Q	Q1 = 1/15	Q2 = 2/15	Q3 = 4/15	Q4 = 8/15	15

b) If configured **with** an analog output:

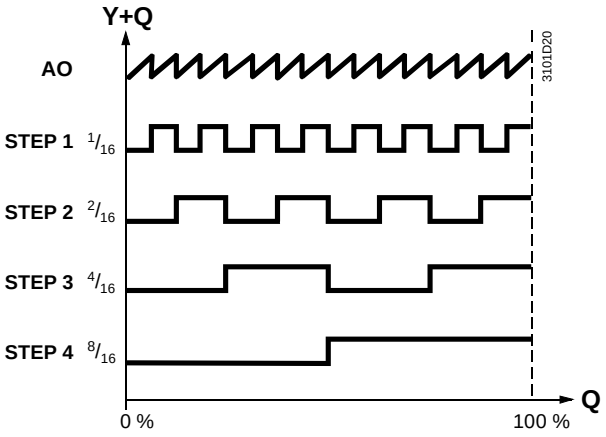
Configured outputs	*Load distribution*					*Number of load steps*
	Y	*Relay 1*	*Relay 2*	*Relay 3*	*Relay 4*	
1Y+2Q	Y= 1/4	Q1= 1/4	Q2= 2/4			4
1Y+3Q	Y= 1/8	Q1= 1/8	Q3= 2/8	Q3= 4/8		8
1Y+4Q	Y= 1/16	Q1=1/16	Q2=2/16	Q3=4/16	Q4=8/16	16

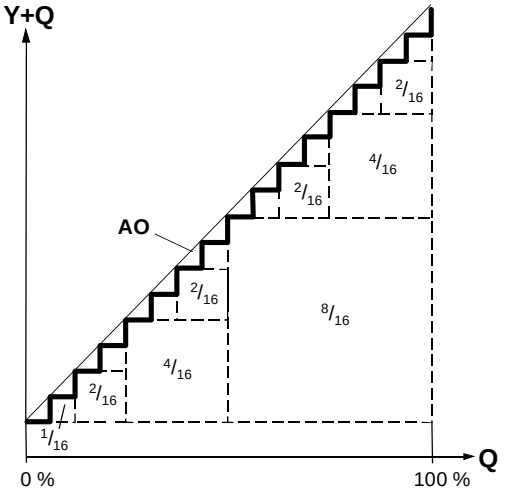
Explanation

0Y = no analog output
1Y = 1 analog output

Load connection

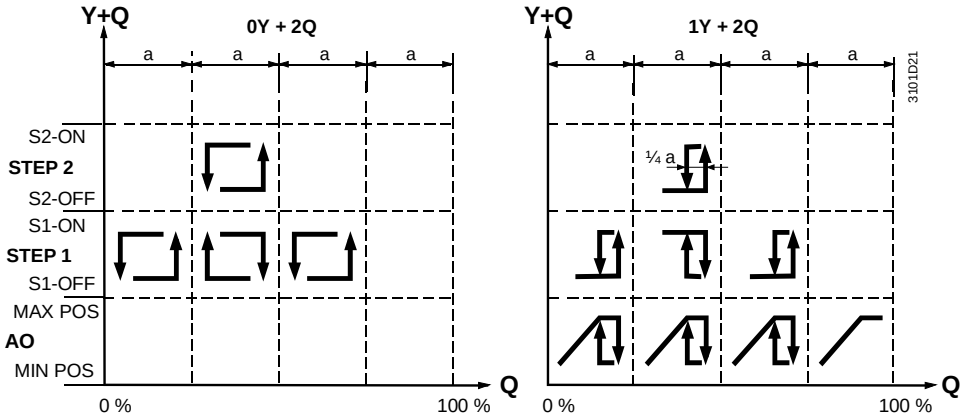
Load connection applies the following pattern:





Switching interval

Example with 2 digital outputs:



Locking time (OFFTIME)

Additionally, you can enter a common locking time for the relay outputs. This ensures that a step that has just switched off remains off for at least the set period of time.

If a relay output is locked, all relays with less power will be energized for the duration if required by the sequence controller in order to prevent a total power drop off.

Application example: Control of refrigeration machine

8.6.3 External preselection (IN X)

Maximum selection in case of several preselections

You can configure an analog input (IN X) as a preselection for the step switch. The controller performs a maximum selection together with the internal signals.

For example, you can use this feature to implement the following function: External control – the RLU236 provides the step switch function only.

Note

The external signal is considered only if the controller operates in Comfort or Economy mode.

8.6.4 Output inversion (INVERS)

Definition and behavior

You can invert the step switch's analog output. Meaning:

INVERS = NO: 0…100% load = 0…100% output
INVERS = YES: 0…100% load = 100…0% output

The same settings are possible for this analog output as for the modulating output, AO function block.

If the controller has a binary step switch and is switched off during operation (input D1 = Protection), the output signal behaves as follows:

INVERS = NO: 0% output
INVERS = YES: 100% output

8.6.5 Function check / wiring test

Switching on / off

The step switch can be switched directly via the control switch during the wiring test.

Switch positions

The switch has the following positions:

- ---
- 0…100 %

Note

Settings such as INVERS, MIN POS and MAX POS are also effective during the wiring test.

Priorities

The following priorities apply to the step switch:

1 On / Off during the wiring test
2 According to the positioning signal from the sequence controller (preselection in normal operation) or an external signal (maximum selection)

8.6.6 Settings

Configuration

Path: **… > COMMIS > CONF > STEPBIN**

Display	*Name*	*Range / comments*
STEP 1	Step 1	Activation of step switch and selection of the number of steps; adjustable values:---, Q1, Q2, … (free outputs only)
STEP 2	Step 2	---, Q1, Q2, … (free outputs only)
STEP 3	Step 3	---, Q1, Q2, … (free outputs only)
STEP 4	Speed 4.	---, Q1, Q2, … (free outputs only)
AO	Modulating output	---, Y1, Y2, … (free outputs only)
IN X	Preselection external	---, X1, X2, … (inputs with identifier % only)

Setting values

Path: **… > PARA > STEPBIN**

Display	*Name*	*Range*	*Factory setting*
OFFTIME	Locking time	00.00…10.00 m.s	00.00
MIN POS	Positioning signal min	0…100 %	0 %
MAX POS	Positioning signal max	0…100 %	100 %
INVERS	Inversion	NO, YES	NO

Display values

Path: **INFO**

Display	*Name*	*Comments*
STEPBIN	Binary step switch	0…100%
STEP x	Binary step switch, step x	ON, OFF

Wiring test

Path: **… > COMMIS > TEST**

Display	*Name*	*Positions*
STEPBIN	Binary step switch	---, 0…100 %
STEP x	Binary step switch, step x	ON, OFF

8.7 3-position output (3-POINT)

8.7.1 Purpose and activation

Purpose of 3-POINT

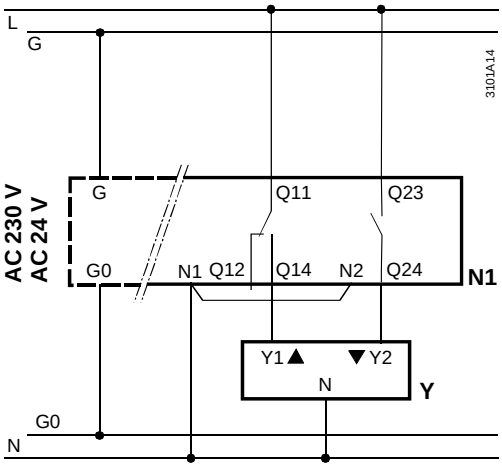
The 3-POINT (3-position output) function block controls a modulating controlling element (valve) with a 3-position actuator (open / standstill / close). This requires 2 switching outputs (open / close).

Activation

You can only activate the 3-position output in the RLU202 and RLU222 universal controllers. To do so, make setting "3P" on the configuration menu.

Relays Q1 and Q2 must not be occupied by other functions.

Connection diagram



Note

For 3-position control of a controlling element operating on AC 230 V, you must activate the interference suppression element in the controller. To do so, connect terminal N1 to the neutral conductor, and install a wire link between N1 and N2.

8.7.2 Operating principle

Calculation of positioning signal

The controller uses the duration of the open and close commands and the entered actuator running time (ACTTIME) to calculate the actuator's present position (stroke model). This is compared with the present positioning setpoint. If the result is a deviation, the controller issues an open or close command.

Synchronization

When the actuator reaches the end positions (fully closed or fully open), the controller synchronizes the actuator with the stroke model (end position synchronization). To do so, the controller issues the appropriate positioning command for a period 1.5 times the entered actuator running time (ACTTIME).

If the actuator shall maintain the end position, end position synchronization (see above) is repeased at 10-minute intervals.

8.7.3 External preselection (IN X)

Maximum selection in case of several preselections

You can configure an analog input as a preselection for the 3-position output. The controller performs a maximum selection together with the internal signals.

For example, you can use this feature to implement the following function: Use of the RLU202 / RLU222 universal controller as DC 0…10 V signal converters => 3-position.

Note

The external signal is considered only if the controller operates in Comfort or Economy mode.

8.7.4 Function check / wiring test (TEST)

Switching on / off

During the wiring test, the 3-position output can be directly commanded via the control switch.

Switch positions

The switch has the following positions:

- Standstill (----)
- Open (OPEN)
- Close (CLOS)

Notes

When you enter the commissioning menu (COMMIS) the 3-position actuator travels to the 0% position (CLOS).
When you leave the COMMIS menu, the controller does not compensate for any changes made to the 3-position output during the wiring test. This does not take place until after the first synchronization.

8.7.5 Priorities

2 priorities

The following 2 priorities apply to the 3-position output:

1 On / Off during the wiring test
2 According to the positioning signal from the sequence controller (preselection in normal operation) and external preselection (maximum selection)

8.7.6 Settings

Configuration

Path: **… > COMMIS > CONF > 3-POINT**

Display	*Name*	*Range / comments*
3P	3-position	Activation of 3-position output function; adjustable values: NO, YES
IN X	Preselection external	---, X1, X2, … (inputs with identifier % only)

Setting values

Path: **… > PARA > 3-POINT**

Display	*Name*	*Range*	*Factory setting*
ACTTIME	Actuator running time	0.10…10.00 m.s	2.00 m.s

Display values

Path: **INFO**

Display	*Name*	*Comments*
3P	3-position	0…100 %

Wiring test

Path: **… > COMMIS > TEST**

Display	*Name*	*Positions*
3P	3-position	---, OPEN, CLOSE

9 Controller (CTLOOP x)

9.1 General

9.1.1 Purpose and use

Purpose of CTLOOP x

The CTLOOP x (controller) function block generates a positioning signal based on a comparison of the controlled variable with the selected reference variable in order to control the aggregates assigned to the individual sequences.

Number of controllers

Depending on the type of RLU2… universal controller, the following numbers of controllers (CTLOOP function blocks) are available:

Controller type	*Number of controllers*
RLU202	Max. 1
RLU202	Max. 1
RLU222	Max. 2
RLU232	Max. 2
RLU236	Max. 2

Use

We distinguish between controller 1 and controller 2.

Controller 1 is used for the following depending on the basic type selected for the device:

Basic type	*Use of controller 1:*
A	Ventilation applications: – Room-supply air temperature cascade controller – Supply air temperature controller – Room or extract air temperature controller
U	Universal controller for: Humidity, dew point, indoor air quality, pressure, volumetric flow

Controller 2 is used as a universal controller with all basic types.

9.1.2 Controller configuration procedure

Major steps

The controllers are configurable for a wide variety of applications.
The following table provides an overview of the major steps with reference to the appropriate sections:

step	*Activity*	*Section*
1	Definition of control strategy: What do you want to control and how?	
	• Temperature control	9.2
	• Universal control	9.3
	• Heating / cooling changeover	9.4
2	Assignment of appropriate outputs to the individual sequences.	9.5
3	Activation of auxiliary functions:	
	• Limitation, general	9.6
	• Limitation of individual sequences	9.7
	• Locking sequences according to OT	9.8
	• Summer / winter compensation	9.9
	• Universal setpoint shift	9.10
4	Activation of deviation message	9.11

9.1.3 Limitations and setpoint influences

Influence of functions

The following functions can have an influence on setpoints:

- Summer / winter compensation
- Universal setpoint shift
- Remote setpoint, absolute
- Remote setpoint, relative

The setpoint influences differ depending on the selected type of controller.
They are described in chapters 7 and 9.

The following functions can have a limiting or activating influence on the heating or cooling sequences:

- Frost protection FROST
- Locking sequences according to the outside temperature
- Limiting an individual sequence SEQLIM
- Limitation, general, LIM

9.1.4 Function priorities

5 priorities

If different functions that act on the same controller are active at the same time, the following priorities apply:

1 Frost protection FROST
2 Locking sequences according to the outside temperature
3 Limiting an individual sequence SEQLIM
4 Limitation, general, LIM
5 Sequence controller

9.2 Control strategies and setpoints for controller 1, basic type A

9.2.1 Selecting the control strategy

Control strategies controller 1, basic type A

Controller 1 in basic type A is used for temperature control.
Different control strategies are available.
The following table shows the dependencies:

Control strategy *Explanations given in …*	*Required input identifiers* *Footnote 1*	*Connection inputs – control loop* *Footnote 2*	*Setting value STRATGY in CTLOOP 1*
Room temperature control Subsection 9.2.6 Footnote 3	ROOM	None	--- (No impact)
Supply air temperature control Subsection 9.2.8 Footnote 3	SAT	None	--- (No impact)
Changeover between room-supply air temperature cascade control and supply air temperature control via a digital input Subsection 9.2.7 Footnotes 4, 5, 6	SAT ROOM DIG	DIG -> CAS/CON	CAS
Room-supply air temperature cascade control Subsection 9.2.7 Footnotes 5, 6	SAT ROOM	None	CAS
Room temperature control with supply air temperature limitation Subsection 9.2.9 Footnotes 5, 6	SAT ROOM	None	LIM

Explanations

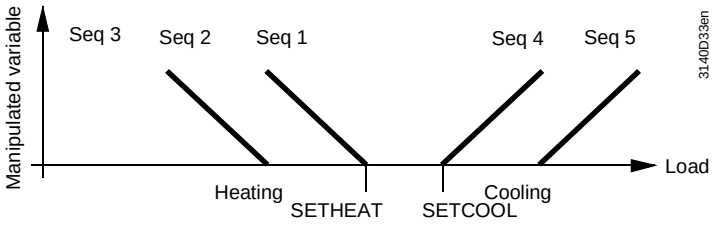
1 Any input Xx of the input block can be used.
Selection of an input identifier label requires that the respective temperature is indeed acquired (e.g. ROOM: (Room temperature must be available)
2 The "connection" is made as a setting value in controller 1 block
3 Setting value STRATGY has no impact in connection with room temperature and supply air temperature control.In these cases, the setting value is not evaluated
4 CAS/CON facilitates changeover from cascade control in the summer to supply air temperature control in the winter (when heating is ON) via a digital input
5 If both input identifiers SAT and ROOM are available, the STANDBY setting decides whether room-supply air temperature cascade control or room temperature control with supply air temperature limitation is performed
6 If selection of a control strategy is required and none is selected ("---")
- applies to room-supply air temperature cascade control and room temperature control with supply air temperature limitation – control strategy “Supply air temperature control” is automatically activated

9.2.2 Setpoints

Preselections

You can assign individual setpoints for the Comfort and Economy modes. We distinguish between the following setpoints in the 2 modes:

- SETHEAT lower setpoint "Heating" (sequence 1+2)
- SETCOOL upper setpoint "Cooling" (sequence 4+5)



Influences on the setpoints

The following functions can have an influence on setpoints:

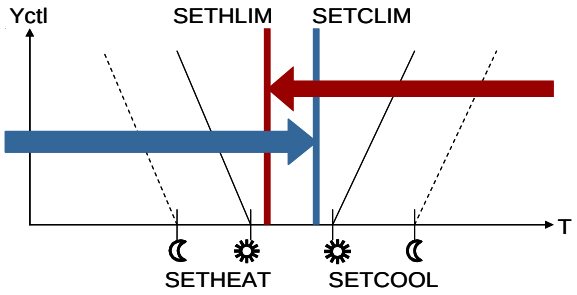
- Locking a sequence by the outside temperature OT (refer to section 9.8)
- Remote setpoint, absolute (refer to section 7.4)
- Remote setpoint, relative (refer to section 7.5)
- Summer / winter compensation (refer to section 9.9)

Setpoint limitations

To save as much energy as possible, the setpoint range adjustable by the user can be limited. This function is made available in Comfort and Precomfort modes. This setting can only be made with controller 1 in basic type A.

Using SETHLIM, the cooling setpoint can be limited to a minimum value. This means that this minimum value cannot be crossed, neither by the relative setpoint adjuster, the absolute setpoint adjuster, summer / winter compensation, nor other functions. The factory setting is 0 °C, which means that the function is deactivated.

Using SETHLIM, the heating setpoint can be limited to a maximum value. This means that this maximum value cannot be crossed, neither by the relative setpoint adjuster, the absolute setpoint adjuster, summer / winter compensation, nor other functions. The factory setting is 250 °C, whichmeans that the function is deactivated.



9.2.3 Troubleshooting

Impact of sensor errors

The effect of sensor failures is as follows:

Control strategy	*Room sensor missing*	*Supply air sensor missing*	*Room and supply air sensor missing*
Room temperature control	Plant will be shut down (MAINALM)	No supply air sensor	No supply air sensor
Room-supply air temperature cascade control	Supply air temperature control with room setpoints	Plant will be shut down (MAINALM)	Plant will be shut down (MAINALM)
Supply air temperature control	No room sensor	Plant will be shut down (MAINALM)	No room sensor
Room temperature control with supply air temperature limitation	Plant will be shut down (MAINALM)	Room temperature control without supply air temperature limitation	

9.2.4 Configuration

Controller 1, basic type A

Path: **… > COMMIS > CONF > X1…X5**

Display	*Name*	*Adjustable values / comments*
LABEL	Input identifier	Activation of room / supply air temperature sensor. Adjustable values: ROOM, SAT

Path: **… > COMMIS > CONF > CTLOOP 1**

Display	*Name*	*Adjustable values / comments*
CAS/CON	Casc/const changeover input	Activation of control strategy changeover. Adjustable values: ---, X1, X2, … (digital values only). Meaning of input signal: 0 = room-supply air temperature cascade control 1 = supply air temperature control (constant)
STRATGY	Control strategy	Adjustable values: ---, LIM, CAS (factory setting: CAS)

9.2.5 Settings

Setting values

Path: **SET**

Display	*Name*	*Range*	*Factory setting*
SETCOOL ☾	Economy cooling setpoint	Comfort cooling setpoint to 250 °C	28 °C
SETCOOL ☼	Comfort cooling setpoint	Comfort heating setpoint to Economy cooling setpoint	24 °C
SETHEAT ☼	Comfort heating setpoint	Economy heating setpoint to Comfort cooling setpoint	21 °C
SETHEAT ☾	Economy heating setpoint	–50 °C to Comfort heating setpoint	19 °C

Path: **… > PARA > CTLOOP 1**

Display	*Name*	*Range*	*Factory setting*
SETCLIM	Cooling setpoint limitation	-50.0…250 °C	0 °C
SETHLIM	Heating setpoint limitation	-50.0…250 °C	250 °C

Note

This setting can only be made on controller 1 in basic type A.

9.2.6 Implementation: Room temperature control

9.2.6.1 Activation and setpoints

Activation

Room temperature control can only be activated for controller 1, basic type A. To activate room temperature control, assign input identifier ROOM to the room temperature.

9.2.6.2 Operating principle

PID control

PID control is used to maintain the room temperature at the adjusted setpoint.

9.2.6.3 Troubleshooting

Room temperature sensor present?

When you leave the commissioning menu, the universal controller checks whether a room temperature sensor is connected.

- If, at that time, a room temperature value is available, but is missing later, a sensor error message is delivered and presented on the display:
  "Xx ---" => sensor missing or "Xx ooo" => short-circuit
- If, at that time, there is no room temperature value (main controlled variable in this case), the plant will be shut down (MAINALM):

9.2.6.4 Settings

Configuration

Path: **… > COMMIS > CONF > CTLOOP 1**

Display	*Name*	*Setting*
STRATGY	Control strategy	---

9.2.7 Implementation: Room-supply air temperature cascade controller

9.2.7.1 Activating the cascade controller

Activation

The cascade controller can only be activated for controller 1, basic type A.
To activate room-supply air temperature cascade control, assign one input each to the room and the supply air temperature and select control strategy CAS.
Also refer to subsection 9.2.1 ”Selecting the control strategy“.

Function of CAS/CON input

If, in addition, input CAS/CON is assigned to a terminal, this input must be "0" for cascade control.

Note

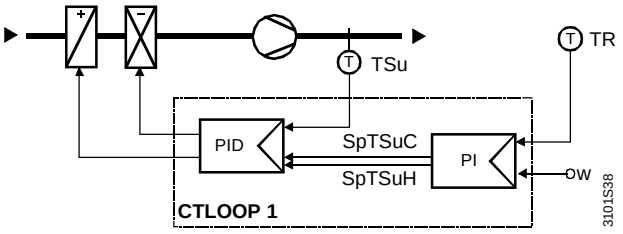
You can use this input to configure changeover of the control strategy between cascade and supply air temperature control:

- Cascade control CAS/CON = 0
- Supply air temperature control CAS/CON = 1 (for behavior, refer to subsection 0)

9.2.7.2 Operating principle

Principle

The following diagram shows the operating principle of room-supply air temperature cascade control:



The main controlled variable is the room temperature TR; the auxiliary controlled variable is the supply air temperature TSu.

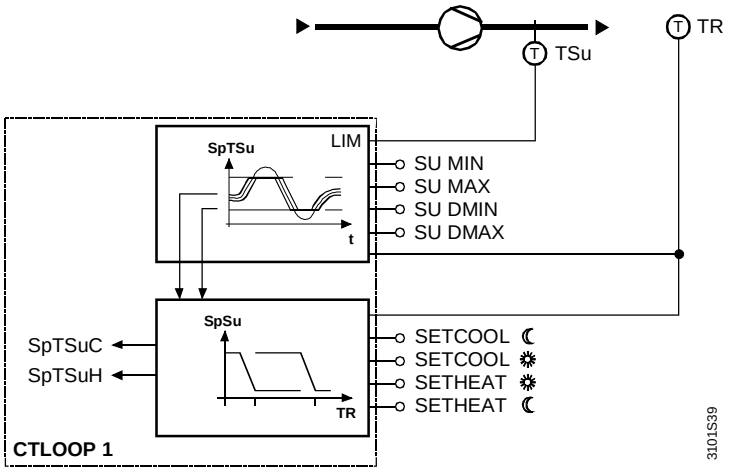
The room temperature controller provides PI control, the supply air temperature controller PID.

The result is a PI+PID room-supply air temperature cascade control process.

The room temperature controller sets the present setpoints SpTSuC and SpTSuH for the supply air temperature controller within the selected limit values.

Setpoint generation

The following diagram shows the setpoint settings for cascade control, and the principle by which the CTLOOP 1 controller block generates the supply air temperature setpoints SpTSuC and SpTSuH:



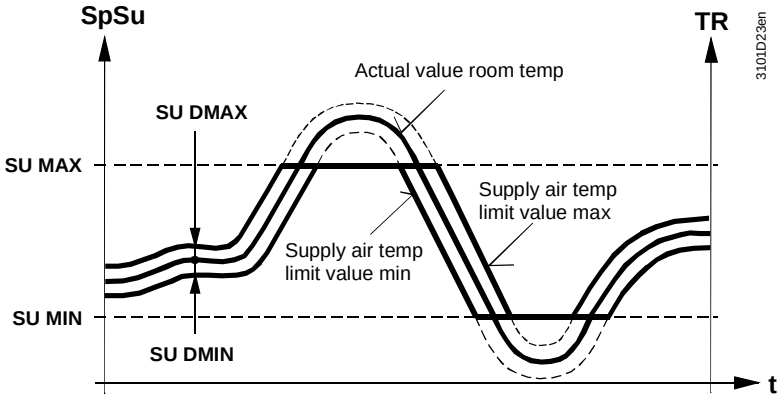
Supply air temperature limitation

The following limit values are preselectable for the supply air temperature controller:

- SU MAX and SU MIN: Absolute maximum and minimum limitation of the supply air temperature
- SU DMAX and SU DMIN: Maximum and minimum temperature difference limitation between the actual value of the room temperature and the supply air temperature

Function diagram

The following diagram illustrates the operating principle of the 2 supply air temperature limitations:



9.2.7.3 Troubleshooting

Room and supply air temperature sensor present?

When you leave the commissioning menu, the universal controller checks whether the room and the supply air temperature sensor are connected and then responds as follows:

- If, at that time, the measured values of room and supply air temperature are available, but are missing later, a sensor error message is delivered and presented on the display:
  - "Xx ---" => sensor missing
  - "Xx ooo" => short-circuit
- If, at that time, the measured value of the room temperature is missing, the supply air is controlled to the adjusted room temperature setpoints
- If, at that time, the measured value of the supply air temperature is missing, the plant will be shut down (MAINALM)

9.2.7.4 Settings

Configuration

Path: **… > COMMIS > CONF > CTLOOP 1**

Display	*Name*	*Setting*
STRATGY	Control strategy	CAS

Setting values

Path: **… > PARA > CTLOOP 1**

Display	*Name*	*Range*	*Factory setting*
ROOM XP	Room influence Xp	1…1000 K	10 K
ROOM TN	Room influence Tn	00.00…60.00 m.s	10.00 m.s
SU MAX	Supply air limit value max	–50…+250 °C	35 °C
SU MIN	Supply air limit value min	–50…+250 °C	16 °C
SU DMIN	Min limitation supply air delta	0…50 K	50 K
SU DMAX	Max limitation supply air delta	0…50 K	50 K

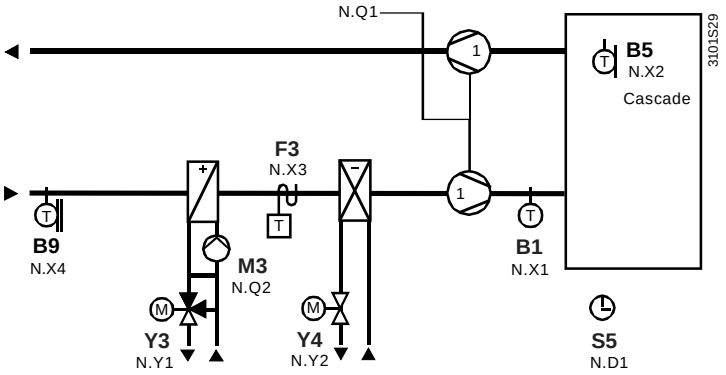
9.2.7.5 Application example “Room-supply air temperature cascade controller”

Plant diagram

The example shown in the following is the programmed standard application with controller type RLU222, basic type A16, for a plant with an air heating coil and air cooling coil.

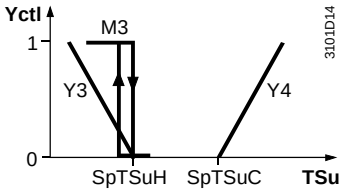
Functions:

- Room temperature cascade control
- Summer / winter compensation
- Frost protection
- Fan release

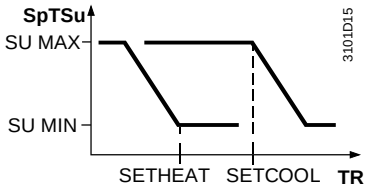


Function diagrams

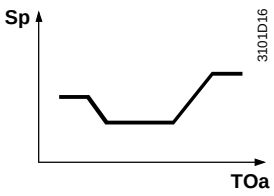
Controller sequences:



Preselected setpoints for supply air temperature control:



Summer / winter compensation:



9.2.8 Implementation: Supply air temperature control

9.2.8.1 Activating supply air temperature control

For controller 1, basic type A

Supply air temperature control is always activated for controller 1, basic type A. This control process need not be specifically activated (factory setting).

9.2.8.2 Operating principle

PID control.

PID control maintains the supply air temperature at the adjusted setpoint.

9.2.8.3 Troubleshooting

Supply air temperature sensor present?

When you leave the commissioning menu, the universal controller checks whether a supply air temperature sensor is connected and then responds as follows:

- If, at that time, the supply air temperature sensor is present but is missing later, the controller generates a sensor error message is delivered and presented on the display:
  - "Xx ---" => sensor missing
  - "Xx ooo" => short-circuit
- If there is no supply air temperature sensor (main controlled variable in this case) from the start, the plant will be shut down (MAINALM)

9.2.8.4 Settings

Configuration

Path: **… > COMMIS > CONF > CTLOOP 1**

Display	*Name*	*Setting*
STRATGY	Control strategy	---

9.2.9 Implementation: Room temperature control with supply air temperature limitation

9.2.9.1 Activating the control process

Activation for controller 1 only, basic type A

Room temperature control with supply air temperature limitation can only be activated for controller 1, basic type A.
To activate this control strategy, assign one input each to the room and the supply air temperature and select control strategy LIM.
Also refer to subsection 9.2.1 ”Selecting the control strategy“.

9.2.9.2 Operating principle

Purpose of LIM

PID control maintains the room temperature at the adjusted setpoint. The LIM function (general limitation function) overrides the sequence controller’s normal control function to keep the supply air temperature within adjusted limits.
Also refer to section 9.6 “Limitation, general (LIM)“.

If, at the same time, other influences act on the sequence controller, the priority order according to subsection 9.1.4 “Function priorities” applies.

9.2.9.3 Troubleshooting

Supply air and room temperature sensor present?

When you leave the commissioning menu, the universal controller checks whether room and supply air temperature sensor are connected and then responds as follows:

- If, at that time, the measured values of room and supply air temperature are available, but are missing later, a sensor error message is delivered and presented on the display:
  - "Xx ---" => sensor missing
  - "Xx ooo" => short-circuit
- If, at that time, no supply air temperature sensor is connected, limitation is set inactive (room temperature control without supply air temperature limitation)
- If, at that time, no room temperature sensor is connected (main controlled variable in this case), the plant will be shut down (MAINALM)

9.2.9.4 Settings

Configuration

Path: **… > COMMIS > CONF > CTLOOP 1**

Display	*Name*	*Range / comments*
STRATGY	Control strategy	LIM

Setting values

Path: **… > PARA > CTLOOP 1**

Display	*Name*	*Range*	*Factory setting*
LIM MAX	Gen limiter limit value high	Input range limit sensor	35 °C
LIM MIN	Gen limiter limit value low	Input range limit sensor	16 °C
LIM DHI	Gen limiter differential high	0…500 K	50 K
LIM DLO	Gen limiter differential low	0…500 K	50 K
LIMCOOL	Reduction min limitation cooling	0…10 K	0 K
LIM XP	Gen limiter P-band Xp	0…500 K	15 K
LIM TN	Gen limiter integr action time Tn	00.00…60.00 m.s	02.00 m.s

9.3 Control strategies and setpoints for universal controllers

The control strategies and setpoints for universal control are presented. These are controller 2 in basic type A and controllers 1 and 2 in basic type U.

9.3.1 Selecting the control strategy

Controller 2 in basic type A and controllers 1 and 2 in basic type U are intended for universal control.

You can select one of 2 control strategies. For that purpose, the following settings are required:

Control strategies controller 2, basic type A Or controllers 1 + 2, basic type U

Control strategy	*Required input identifiers Footnote 1*	*Connection inputs – control loop Footnote 2*
Control to a sensor input	Any analog input	MAIN
Differential control	Any analog input (main controlled variable) Any analog input (same unit as main controlled variable)	MAIN DIFF

Explanations

1 Any input Xx of the input block can be used.
2 The "connection" is made as a setting value in controller 1 or controller 2 block.

9.3.2 Activation

Activation

To activate the controller, assign the main controlled variable (MAIN). The choice of main controlled variable determines the physical unit.

9.3.3 Operating principle

PID control

PID control maintains the main controlled variable at the adjusted setpoint.

9.3.4 Setpoints

Preselections

The following applies to controller 2, basic type A, and controllers 1+2, basic type U:

- You can assign individual setpoints for the Comfort and Economy modes.
- We distinguish between the following setpoints:
  - SET MIN lower setpoint "Heating" (sequence 1+2)
  - SET MAX upper setpoint "Cooling" (sequence 4+5)

Influences on the setpoints

These functions can have an influence on the setpoints:

- Universal setpoint shift
- Remote setpoint, absolute

9.3.5 Troubleshooting

Effect of incorrect configuration

Incorrect configuration has the following effect:

Configuration point	*Setting*	*Effect*
Main controlled variable (MAIN) dDifferential input (DIFF)	--- (not relevant)	Controller inactive
Main controlled variable (MAIN) Differential input (DIFF)	Xx (analog) Xx (not same unit as main controlled variable)	Control to absolute value, no differential control

Main sensor present?

When you leave the commissioning menu, the universal controller checks whether a main sensor is connected.

- If, at that time, the main sensor is connected, but is missing later, or if there is a short-circuit in the cable, a sensor error message is delivered and shown on the display:
  - "Xx ---" => main sensor missing
  - "Xx ooo" => short-circuit
- If, at that time, there is no main sensor (main controlled variable in this case), the plant will be shut down (MAINALM)

9.3.6 Configuration

Controller 2, basic type A; controllers 1+2, basic type U

Path: **… > COMMIS > CONF > CTLOOP 1**
Path: **… > COMMIS > CONF > CTLOOP 2**

Display	*Name*	*Adjustable values / comments*
MAIN	Main controlled variable	Activation of main controlled variable. Adjustable values: ---, X1, X2, … (analog values only)
DIFF	Differential input	Activation of difference control Adjustable values: ---, X1, X2, … (analog values only)

9.3.7 Settings

Controller 2, basic type A; controllers 1+2, basic type U

Path: **… > SET**

Display	*Name*	*Range*	*Factory setting*
SET MAX ☾	Economy setpoint high	Main controlled variable input range	28 °C, 80 %, 100, 1000
SET MAX ☼	Comfort setpoint high	Main controlled variable input range	24 °C, 60 %, 60, 600
SET MAX ☼	Comfort setpoint low	Main controlled variable input range	21 °C, 40 %, 0, 0
SET MAX ☾	Economy setpoint low	Main controlled variable input range	19 °C, 20 %, 0, 0

9.3.8 Application examples

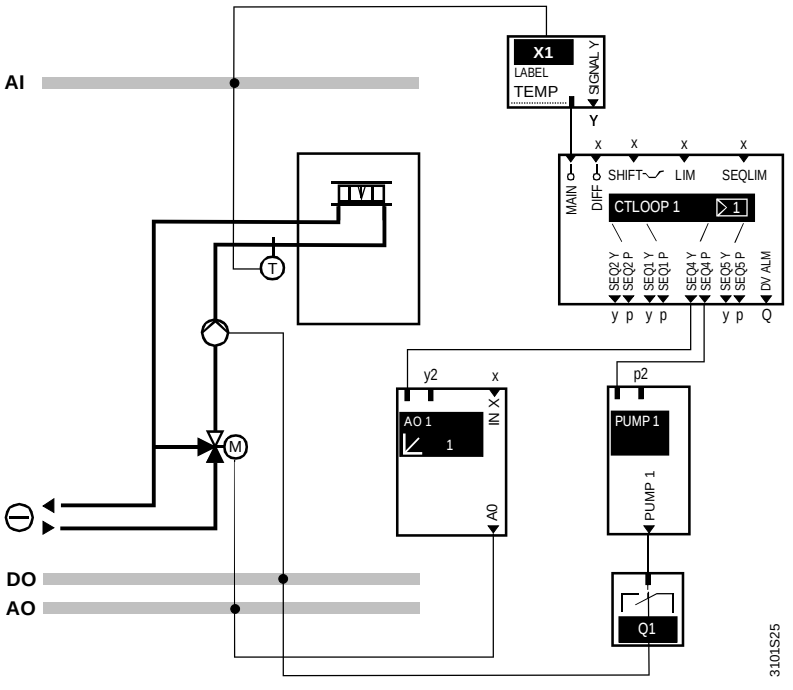
The universal controller is able to control to an absolute variable or differential variable. In the case of differential control, the variable to be controlled is the following:
Main controlled variable (MAIN) minus variable at the differential input (DIFF)

Typical application examples of both control strategies:

- Basic heating plant, outside temperature-dependent flow temperature control (without room influence), thermostatic radiator valves
- Differential pressure control

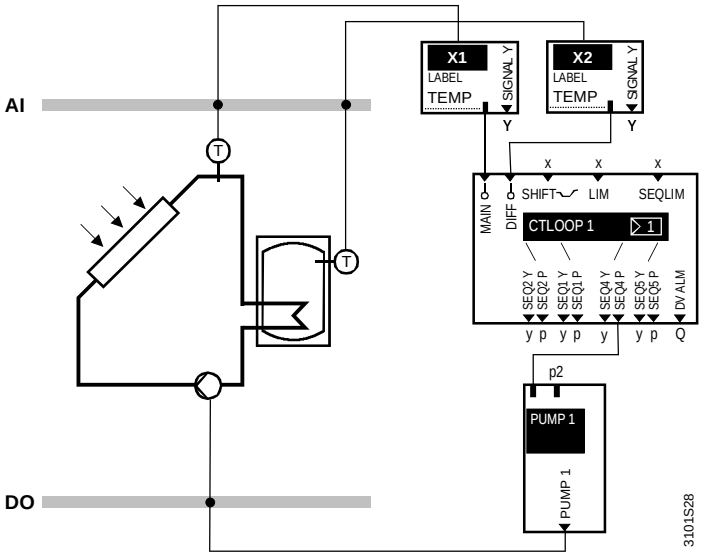
Example of chilled ceiling (absolute variable)

The chilled ceiling's flow temperature is controlled to an absolute value:



Example of solar plant (differential variable)

The solar plant switches on as soon as the temperature in the panel (main controlled variable) is 5 K above the storage tank temperature (differential controlled variable):

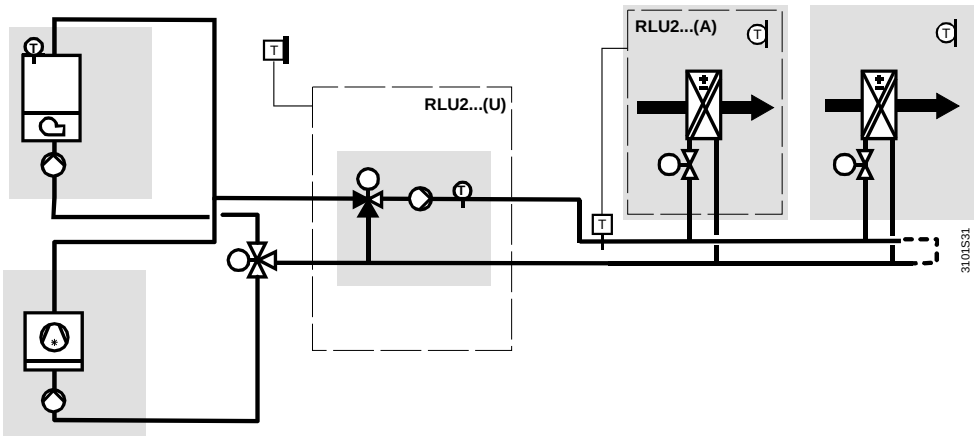


9.4 Changeover

9.4.1 Activating the controller with changeover

Plant principle

The following example shows a changeover plant with supply area, precontrol and room temperature control. The RLU2…(U) precontroller and RLU2…(A) room temperature controller are indicated.



Activating the RLU2… (U) primary pre-controller

You can activate this control function for all universal controllers, i.e. for RLU202, RLU220, RLU222, RLU232 and RLU236 in basic type U.
Apply the following procedure to activate the respective controller:

- Assign one Xx input each to the main controlled variable (MAIN) at the CTLOOPx controller block and to the CH OVER input at the MODE function block
- Set the identifier of the main controlled variable MAIN to TEMP

Note

In that case, the “Changeover” function always acts only on controller 1 and the activated sequences. The universal controller comes standard with all sequences activated.

Room temperature controller RLU2… (A)

It is also possible to activate the “Changeover” function in basic type A:
The respective controller is activated as follows:

- Assign input CH OVER at the MODE function block an input Xx

The changeover input, switched by a changeover thermostat in the flow, only releases the heating or cooling sequences. The individual sequences can be deactivated via the parameter menu so that the second heating sequence can be used separately for reheating, for example.

9.4.2 Operating principle

Control mode

PID control controls the main controlled variable according to the defined setpoint.

Enabling the sequences

The position of the CH OVER digital input determines whether the heating or cooling sequences are enabled:

- CH OVER = 0 signifies "enable cooling sequences"
- CH OVER = 1 signifies "enable heating sequences"

Note

The "analog output" aggregate must be configured for heating and cooling sequences, i.e:

- Heating (sequence 1 and / or sequence 2) and
- Cooling (sequence 4 and / or sequence 5)

For more detailed information, refer to section 9.5 “Sequence controllers, output assignments”.

9.4.3 Setpoints

Basic type U, controller 1

You can preselect individual setpoints for the Comfort and Economy modes.

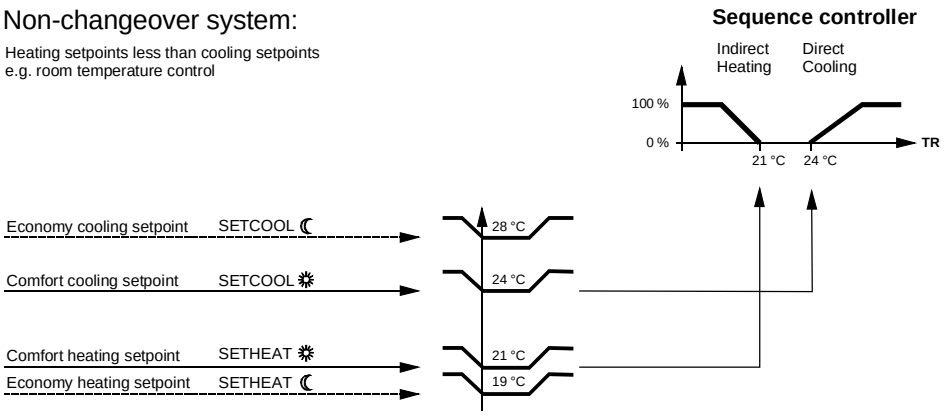
We distinguish between the setpoints for:

- Precontroller "Heating" (sequence 1)
- Precontroller "Cooling" (sequence 4)

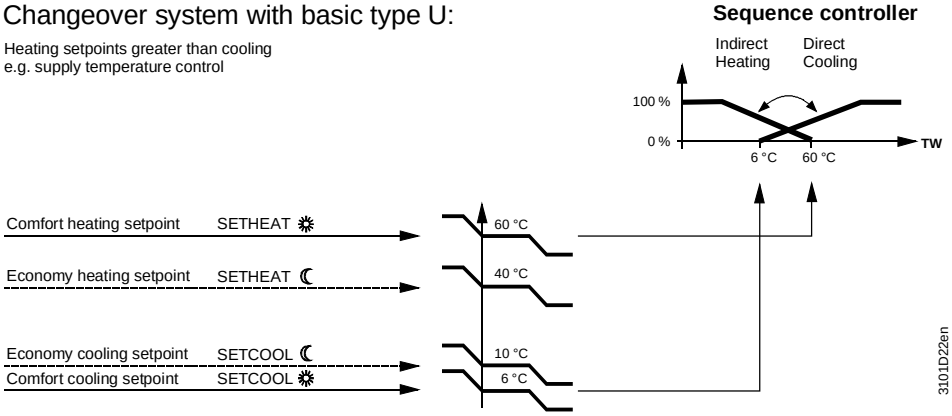
Setpoint preselection

The following diagrams illustrate the different setpoint preselections for non-changeover and changeover systems:

Non-changeover system:



Changeover system with basic type U:



Refer to the corresponding setting values on the following page (factory settings).

Note on Economy setpoints

Economy setpoints are only adjustable if an input has been defined for operating mode changeover.

Influences on the setpoints

The following functions can have an influence on setpoints:

- Universal setpoint compensation (refer to section 9.10)
- Remote setpoint, absolute (refer to section 7.4)

Basic type U, controller 2

Sequence controller 2 always operates in the same mode as sequence controller 1, but it has no changeover functionality.

9.4.4 Troubleshooting

Main sensor present?

When you leave the commissioning menu, the universal controller checks whether a main sensor is connected.

- If, at that time, the main sensor is connected, but is missing later, or if there is a short-circuit in the cable, a sensor error message is delivered and presented on the display:
  - "Xx ---" => main sensor missing
  - "Xx ooo" => short-circuit
- If, at that time, there is no main sensor (main controlled variable in this case), the plant will be shut down (MAINALM)

9.4.5 Settings

Configuration

Path: **… > COMMIS > CONF > MODE**

Display	*Name*	*Adjustable values / comments*
CH OVER	2-pipe heating/cooling system	Activation of heating/cooling changeover contact. Adjustable values: ---, X1, X2, … (digital values only)

Setting values

Path: **… > PARA > MODE**

Display	*Name*	*Range*	*Factory setting*
CO SEQ1	Change to sequence 1	YES, NO	YES
CO SEQ2	Change to sequence 2	YES, NO	YES
CO SEQ4	Change to sequence 4	YES, NO	YES
CO SEQ5	Change to sequence 5	YES, NO	YES

Path: **… > SET**

Display	*Name*	*Range*	*Factory setting*	
			Non-changeover	*Changeover*
SETCOOL ☾	Economy cooling setpoint	0…100 °C	28 °C	10 °C
SETCOOL ☼	Comfort cooling setpoint	0…100 °C	24 °C	6 °C
SETHEAT ☼	Comfort heating setpoint	0…100 °C	21 °C	60 °C
SETHEAT ☾	Economy heating setpoint	0…100 °C	19 °C	40 °C

Display values

Path: **INFO**

Display	*Name*	*Comments*
CH OVER	2-pipe heating/cooling system	Present COOL / HEAT state

9.4.6 Application examples

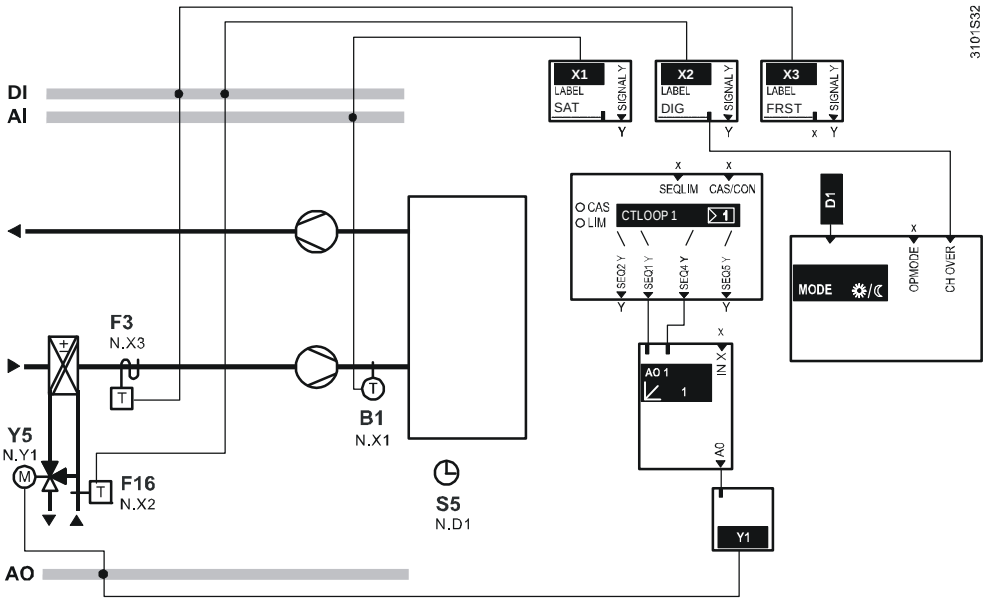
2 typical examples

Typical application examples for the changeover controller:

- Example 1: Hot / chilled flow supply temperature control (basic type U)
- Example 2: Individual room control with air heating / air cooling coil (basic type A)

Diagram for example 2, individual room control

This example corresponds to application RLU220 / A09 from the programmed standard applications:



9.5 Sequence controllers, output assignments

9.5.1 Activating the function block

Assign the main controlled variable

To activate the CTLOOPx sequence controller, assign a main controlled variable to it. The necessary settings are described in chapter 0 “Setting up the control strategy”.

9.5.2 Structure of the sequence controller

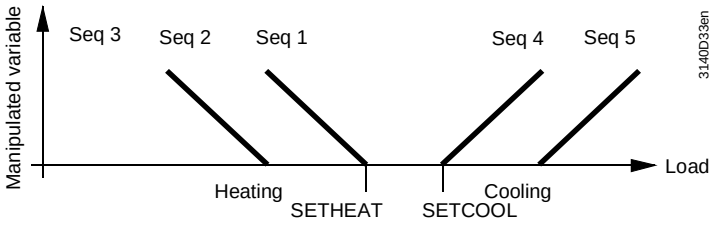
Conroller 1 RLU222, RLU232, RLU236

Controller 1 (in RLU222, RLU232 and RLU236) can contain a maximum of 4 sequences in the following combinations:

- 1 sequence: Sequence 1 or sequence 4
- 2 sequences: Sequence 1+2, or sequence 1+4, or sequence 4+5
- 3 sequences: Sequence 1+2+4, or sequence 1+4+5
- 4 sequences: Sequence 1+2+4+5

Function diagram

The following diagram shows the sequences and their directions of action:



Explanations relating to the function diagram

The SETHEAT heating setpoint is assigned to successive sequences 1 and 2. Their output signal acts in the opposite direction to the input variable T.

The SETCOOL cooling setpoint is assigned to successive sequences 4 and 5. Their output signal acts in the same direction as the input variable T.

RLU202, RLU220

Similar to the above statements, the RLU202 and RLU220 controllers contain a controller 1 with the following sequences:

- 1 sequence: Sequence 1 or 4
- 2 sequences: Sequence 1+2, or sequence 1+4, or sequence 4+5

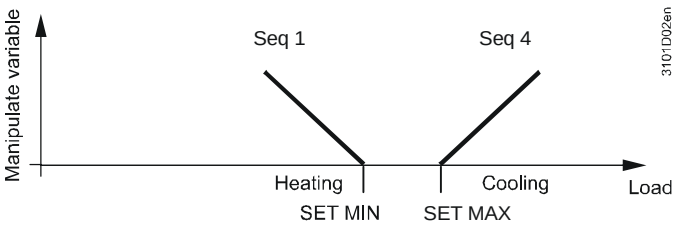
Controller 2 RLU222, RLU232, RLU236

Controller 2 (in RLU222, RLU232 and RLU236 only) can contain a maximum of 2 sequences in the following combinations:

- 1 sequence: Sequence 1 or 4
- 2 sequences: Sequence 1+4

Function diagram

The following diagram shows the sequences and their directions of action:



9.5.3 Assigning outputs to sequences

Outputs Y and P

Each sequence has 2 outputs:

- 1 load output SEQx Y
- 1 pump output SEQx P

You can occupy both.

9.5.4 Activating the sequences

Activation rules

To activate a sequence, assign either a load output or a pump output to it.

When neither a load output nor a pump output is assigned to a sequence, this sequence and all subsequent sequences (within heating or cooling) will be deactivated.

9.5.5 Load outputs

Available load outputs

The following load outputs are available for the sequence controllers:

- Modulating output
- Heat recovery
- Variable step switch
- Linear step switch
- Binary step switch
- 3-position output (with RLU222 and RLU202 only)

Load output rules

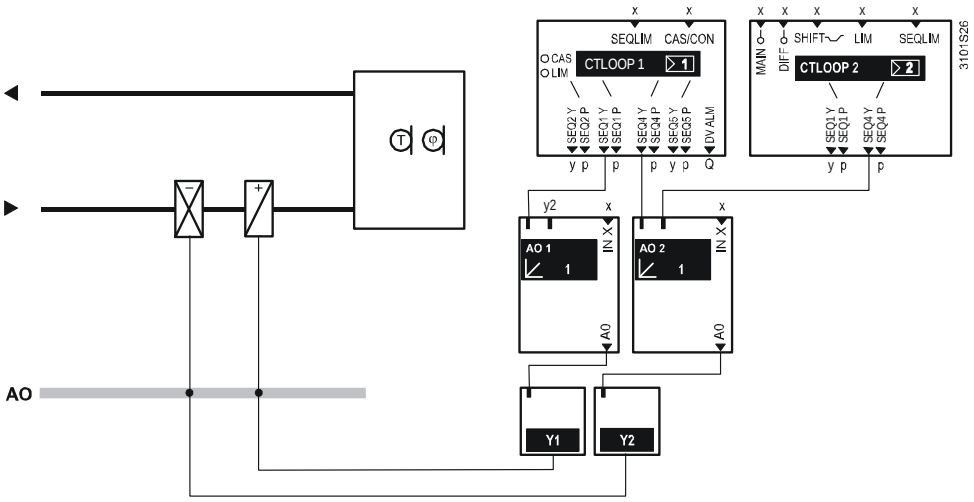
Only **one** load output can be assigned to each sequence.
However, each load output can be commanded by up to 2 sequences (from the same or different control loops).

Application example

This example shows a plant with the heating, cooling and dehumidification functions.

Assignments:

- Control loop 1 (room temperature) with sequence 1 (heating) and sequence 4 (cooling)
- Control loop 2 (room humidity) with sequence 4 (dehumidification)
- Both controllers (sequences 4) command load output AO2, which transmits the resultant signal to the air cooling valve via output Y2.



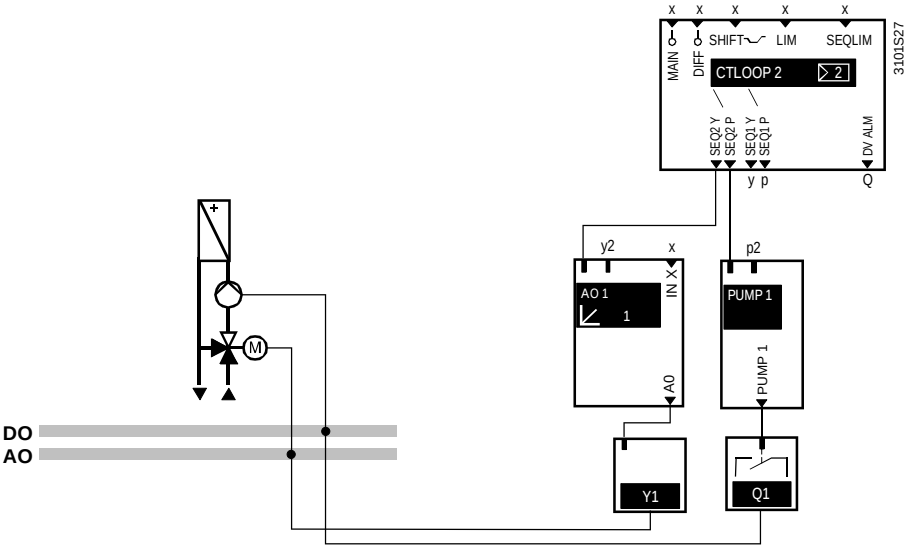
9.5.6 Pump outputs

Possibilities

Only one pump can be assigned to each sequence. However, each pump can be controlled by up to 2 sequences.

Application example

This example shows an air heating coil with a valve and pump. Both are controlled by sequence 2; the pump is controlled via pump output SEQ2 P:



9.5.7 Control parameters (Xp, Tn, Tv)

Setting possibilities

You can set the following control parameters for each configured sequence:

- SEQx XP (P-band Xp)
- SEQx TN (integral action time Tn)
- SEQx TV (derivative action time Tv)

If you use all parameters, the result is a PID control loop.
If you want P, PI or PD control action, make the following settings:

Setting	*Result*
SEQx TN = 00:00; SEQx TV = 00:00	P-control
SEQx TV = 00:00	PI-control
SEQx TN = 00:00	PD-control

Recommendations for commissioning

We recommend the following standard values for quick controller commissioning:

- P-band Xp of the controller:
  Room and extract air control loops 1…2 K / 2…4% r.h., supply air control loops 5 K / 10% r.h.
- Set the integral action time Tn equal to the greatest time constant of the controlled system
- Set the derivative action time Tv equal to the time constant of the sensor

Apply the following procedure if the control loop is hunting:

1. Set Tn and Tv to 00:00.
2. Increase Xp (e.g. double it)
3. Add Tn again, starting with the value shown above.
   Increase Tn if the control loop starts hunting again.
4. Add Tv again, starting with the value shown above.
   Reduce Tv if the control loop starts hunting again.

9.5.8 Control timeout

Delays the integral action component

In order, for example, to prevent the cooling valve from opening immediately the moment the heating valve has closed, you can enter a control timeout period (TIMEOUT). The controller does not add the integral action component during that period of time.

9.5.9 Troubleshooting

Errors in operation

If the main controlled variable is not available to the controller (e.g. in case of cable rupture), the plant will be shut down and a sensor error message "Xx --- " or "Xx ooo" delivered.

Configuration errors

The major configuration errors and their consequences are the following:

- The sequence controller only operates if a terminal with an analog value is assigned to its main controlled variable
- If individual sequences do not have outputs assigned to them, they and all subsequent sequences are inactive The possible combinations are described in subsection 9.5.2 “Structure of the sequence controller”

9.5.10 Settings

Configuration

Path: **… > COMMIS > CONF > CTLOOP 1**
… > COMMIS > CONF > CTLOOP 2

Display	*Name*	*Range / comments*
SEQ1 Y	[Sequence 1] load	---, modulating output 1…3, HR, variable step switch 1…2, linear step switch, binary step switch
SEQ1 P	[Sequence 1] pump	---, pump 1…3

Path: **… > COMMIS > CONF > CTLOOP 1**

Display	*Name*	*Range / comments*
SEQ2 Y	[Sequence 2] load	---, modulating output 1…3, HR, variable step switch 1…2, linear step switch, binary step switch
SEQ2 P	[Sequence 2] pump	---, pump 1…3

Path: **… > COMMIS > CONF > CTLOOP 1**
… > COMMIS > CONF > CTLOOP 2

Display	*Name*	*Range / comments*
SEQ4 Y	[Sequence 4] load	---, modulating output 1…3, variable step switch 1…2, linear step switch, binary step switch
SEQ4 P	[Sequence 4] pump	---, pump 1…3

Path: **… > COMMIS > CONF > CTLOOP 1**

Display	*Name*	*Range / comments*
SEQ5 Y	[Sequence 5] load	---, modulating output 1…3, variable step switch 1…2, linear step switch, binary step switch
SEQ5 P	[Sequence 5] pump	---, pump 1…3

Configuration note

The configuration shown above is designed for a RLU236 controller, but different aggregates are available with each type; refer to section 2.4 “Functions".

Setting values

Path: **… > PARA > CTLOOP 1**
… > PARA > CTLOOP 2

Display	*Name*	*Range*	*Factory setting*
SEQ1 XP	[Sequence 1 _] Xp	0…500 K	30 K
SEQ1 TN	[Sequence 1 _] Tn	00.00…60.00 m.s	03.00 m.s
SEQ1 TV	[Sequence 1 _] Tv	00.00…60.00 m.s	00.00 m.s
SEQ2 XP	[Sequence 2 \ .._] Xp	0…500 K	30 K
SEQ2 TN	[Sequence 2 \ .._] Tn	00.00…60.00 m.s	03.00 m.s
SEQ2 TV	[Sequence 2 \ .._] Tv	00.00…60.00 m.s	00.00 m.s
SEQ4 XP	[Sequence 4 _/] Xp	0…500 K	30 K
SEQ4 TN	[Sequence 4 _/] Tn	00.00…60.00 m.s	03.00 m.s
SEQ4 TV	[Sequence 4 _/] Tv	00.00…60.00 m.s	00.00 m.s
SEQ5 XP	[Sequence 5 _.. /] Xp	0…500 K	30 K
SEQ5 TN	[Sequence 5 _.. /] Tn	00.00…60.00 m.s	03.00 m.s
SEQ5 TV	[Sequence 5 _.. /] Tv	00.00…60.00 m.s	00.00 m.s
TIMEOUT	Control timeout	00.00…60.00 m.s	00.00 m.s

Display values

Path: **INFO**

Display	*Name*	*Comments*
_	[Sequence 1] load output	Indication of sequence controller's present output as 0…100% with a sequence diagram and controller icon
\ _	[Sequence 2] load output	See comment above
_/	[Sequence 4] load output	See comment above
_/ /	[Sequence 5] load output	See comment above

Inverted sequences are also shown inverted, e.g. [Sequence 1] load output analog output is inverted: /_

9.6 Limitation, general (LIM)

9.6.1 Purpose and activation

Purpose of LIM

The LIM function (general limiting function) overrides the sequence controller's normal control function.

Activation:
Controller 1, type A

To activate the function, select input identifier SAT for the room and the supply air temperature and, in the configuration, in setting value STRATGY, control strategy LIM for controller 1 (also refer to subsection 9.2.1 “Selecting the control strategy”).

Activation:
Controller 2, type A
controllers 1+2, type U

To activate the function, assign an input Xx to the LIM label at the controller 2 function block.

If other influences act on the sequence controller at the same time, the order of priorities applies as shown in subsection 9.1.4 “Function priorities”.

9.6.2 Operating principle

Limitation with PI control

If the controlled variable crosses one of the limit setpoints, the limitation function with PI control (LIM XP, LIM TN) overrides the normal control function to maintain the limit setpoint. We distinguish between:

- Absolute limitation
- Relative limitation

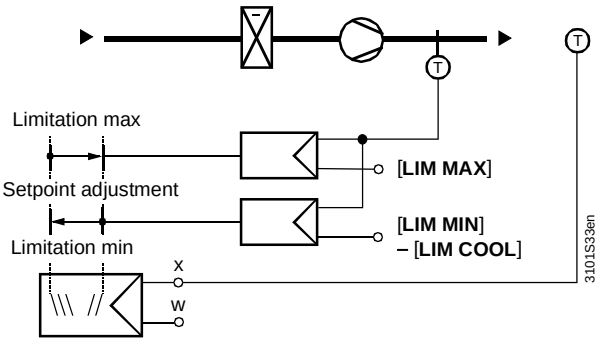
If you only want one of these functions, you can disable the other by setting the setpoints a long way out of range.

Absolute limitation

You can define one setpoint each for maximum and minimum limitation (LIM MAX, LIM MIN).

Application example

Supply air temperature or supply air humidity limitation:



Acts an all sequences

!! Not meaningful with cascade control !!

Special case:

Cooling sequence 4+5 active

If cooling sequence 4+5 is enabled, minimum limitation can be set lower by an adjustable value (LIMCOOL).

This feature prevents the refrigeration machine from switching off again shortly after switching on in case of multistage (DX) cooling.

This function is only active if the main controlled variable and the input for general limitation have the unit °C.

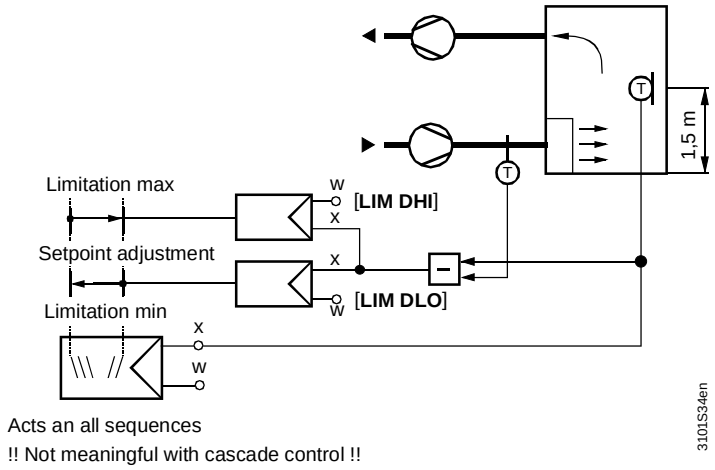
Relative limitation

The following applies to relative limitation:

- You can only activate maximum and minimum differential limitation (LIM DHI, LIM DLO) if the main controlled variable and the limit sensor are configured with the same physical unit
- The adjusted limit setpoints refer to the temperature difference between the main controlled variable and the limit sensor
- You can enter one setpoint each for maximum and minimum differential temperature limitation

Application example

Supply air temperature limitation for a displacement ventilation outlet:



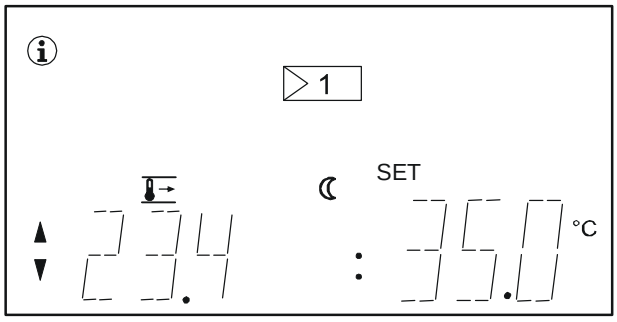
Acts an all sequences

!! Not meaningful with cascade control !!

9.6.3 Info pages

With controller 1, type A, “General limitation“ is also displayed on an Info page. The value displayed at right is not the setpoint, but the limit value currently active.

This Info page shows 23.4 °C as the actual value of the supply air temperature at left, and the relevant limit temperature of 35 °C at right.



9.6.4 Troubleshooting

Limit sensor connected?

When you leave the commissioning menu, the universal controller checks whether a sensor is connected to the LIM input.

- If, at that time, a sensor is connected, but is missing later, a sensor error message is delivered and presented on the display:
  - "Xx ---" => sensor missing
  - "Xx ooo" => short-circuit
- If, at that time, no sensor is connected, limitation will be deactivated

9.6.5 Settings

Configuration

Path: **… > COMMIS > CONF > CTLOOP 1 (type A)**

Display	*Name*	*Range / comments*
STRATGY	Control strategy	LIM (only type A)

Path: **… > COMMIS > CONF > CTLOOP 1 (type U)**

Display	*Name*	*Range / comments*
LIM	General limit controller	Activation of general limitation; adjustable values: ---, X1, X2, … (nur analoge Werte) (nur Typ U)

Path: **… > COMMIS > CONF > CTLOOP 2**

Display	*Name*	*Range / comments*
LIM	General limit controller	Activation of general limitation; adjustable values: ---, X1, X2, … (analog values only)

Setting values

Path: **… > PARA > CTLOOP 1**
… > PARA > CTLOOP 2

Display	*Name*	*Range*	*Factory setting*
LIM MAX	Gen limiter limit value high	Limit sensor input range	35 °C
LIM MIN	Gen limiter limit value low	Limit sensor input range	16 °C
LIM DHI	Gen limiter differential high	0…500 K	50 K
LIM DLO	Gen limiter differential low	0…500 K	50 K
LIMCOOL	Reduction min limitation cooling	0…10 K	0 K
LIM XP	Gen limiter P-band Xp	0…500 K	15 K
LIM TN	Gen limiter integr action time Tn	00.00…60.00 m.s	02.00 m.s

9.7 Limitation of individual sequences (SEQLIM)

9.7.1 Purpose and activation

Purpose of SEQLIM

The SEQLIM function provides limitation for individual sequences.

Activation

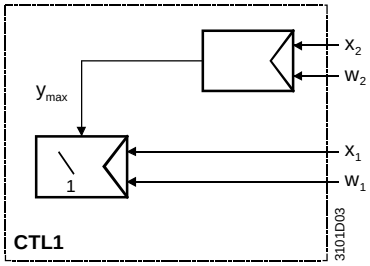
To activate this function, configure the SEQLIM input of the CTLOOP controller.
Where:

- You can only assign analog inputs
- You can only activate this function once per controller
- If, at the same time, other influences act on the sequence controller, the priority order according to subsection 9.1.4 “Function priorities” applies

9.7.2 Operating principle

General function

This function is configurable either for minimum or maximum limitation. You can assign its action to one of the sequences (Seq 1, Seq 2, … Seq 5):



Legend:

x_2	Limit controlled variable
w_2	Limit setpoint (min/max)
y_{max}	Limit signal, always acting as a closing signal on 1 sequence (Seq1, Seq2…Seq5)
x_1	Main controlled variable
w_1	Main setpoint
CTL1	Controller 1 (CTLOOP1)

Minimum limitation

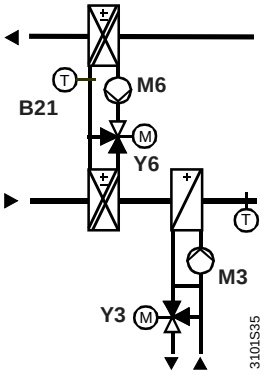
If the controlled variable drops below the limit setpoint (SEQ SET), the limit function with PI control (SEQ XP, SEQ TN) overrides the normal control function to maintain the limit setpoint.
Minimum limitation causes the relevant sequence to close; the other sequences are not affected.

Application example, HR

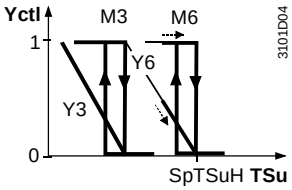
Anti-icing protection for the HR unit, acting on sequence 1 (Y6), closing.

The temperature at limit sensor B21 must, for example, be at least 0 °C (SEQ SET), otherwise throughput will be steplessly limited by Y6.

Basic diagram

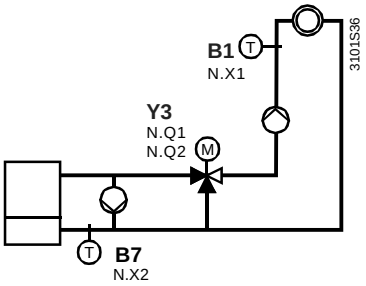


Function diagram



Application example, boiler

In a boiler with risk of corrosion, the return temperature (water inlet temperature at B7) is prevented from falling below a certain level, acting on sequence 1 (Y3):



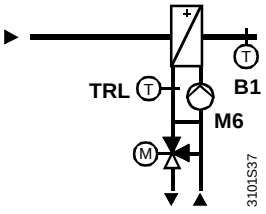
Maximum limitation

If the controlled variable exceeds the limit setpoint (SEQ SET), the limit function with PI control (SEQ XP, SEQ TN) overrides the normal control function to maintain the limit setpoint.
Maximum limitation causes the sequence to close.

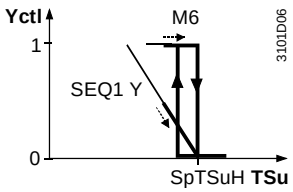
Application example, air heater

Maximum limitation of the return temperature (TRL), acting on sequence 1 / valve M:

Basic diagram



Function diagram



9.7.3 Troubleshooting

Sensor connected?

When you leave the commissioning menu, the universal controller checks whether a sensor is connected.

- If, at that time, the sensor is connected, but is missing later, or if there is a short-circuit in the cable, a sensor error message is delivered and presented on the display:
  - "Xx ---" => sensor missing
  - "Xx ooo" => short-circuit
- If, at that time, the sensor is not connected, limitation will be deactivated

9.7.4 Settings

Configuration

Path: **… > COMMIS > CONF > CTLOOP 1**
… > COMMIS > CONF > CTLOOP 2

Display	*Name*	*Range / comments*
SEQLIM	Sequence limit controller	Activation of limitation of individual sequence; adjustable values: ---, X1, X2, … (analog values only)

Setting values

Path: **… > PARA > CTLOOP 1**
… > PARA > CTLOOP 2

Display	*Name*	*Range*	*Factory setting*
SEQ MOD	Type of limitation	Min, max	Min
SEQ SEL	Sequence selection	Seq1, Seq2, Seq4, Seq5	Seq1
SEQ SET	Limit value	Input signal range	1 °C
SEQ XP	Seq limiter P-band Xp	Input signal range	10 K
SEQ TN	Seq limiter integr action time Tn	00.00…60.00 m.s	01.00 m.s

9.8 Locking sequences according to the outside temperature

9.8.1 Purpose and activation

Purpose

This function locks individual sequences depending on the outside temperature.

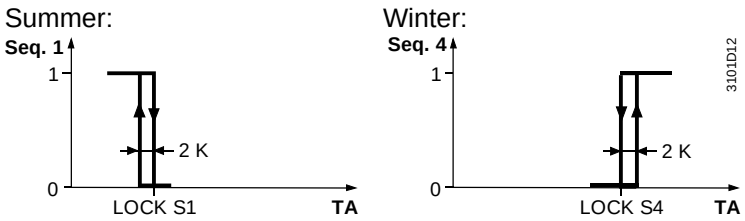
Activation

This function is always active if an outside temperature value is available.
If other influences act on the sequence controller at the same time, the order of priorities applies as shown in subsection 9.1.4 “Function priorities”.

9.8.2 Operating principle

Summer and winter cases

You can lock heating sequences at high outside temperatures and cooling sequences at low outside temperatures. This ensures that heating is deactivated in summer and cooling is deactivated in winter. The switching differential is fixed at 2 K.



Explanation

1 = sequence enabled
0 = sequence disabled

Response if individual sequences are disabled

If individual sequences are locked, the controller continues its action with the other sequences without a transition.

If, for example, sequence 1 is locked, the controller uses sequence 2 for heating (sequence 1 does not delay the control process).

9.8.3 Troubleshooting

OT sensor signal available?

If there is no outside temperature sensor signal, the controller does not disable the sequences.

9.8.4 Settings

Setting values

Path: **… > PARA > CTLOOP 1**
… > PARA > CTLOOP 2

Display	*Name*	*Range*	*Factory setting*
LOCK S1	[Sequence 1] outside temp >	–50…+250 °C	250 °C
LOCK S2	[Sequence 2] outside temp >	–50…+250 °C	250 °C
LOCK S4	[Sequence 4] outside temp <	–50…+250 °C	–50 °C
LOCK S5	[Sequence 5] outside temp <	–50…+250 °C	–50 °C

9.8.5 Application example

Preheater

Disabling a preheater on sequence 2 at temperatures above 10 °C.
Function: Valve fully closed, pump off.

9.9 Summer / winter compensation

9.9.1 Activation

Controller 1, basic type A

Summer / winter compensation is only activated for controller 1, basic type A.
It is always active if an outside temperature signal is available.

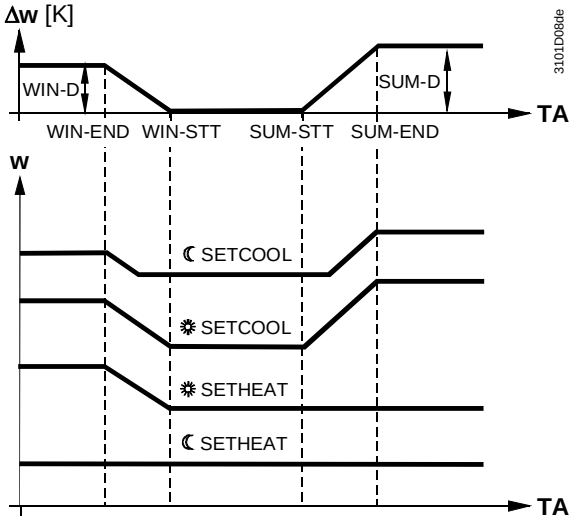
9.9.2 Operating principle

Function

This function shifts the room temperature controller's setpoint as a function of the outside temperature.

Diagram

This setpoint shift acts on the Comfort and Economy modes according to the following diagram:



Legend:

WIN-D	Winter comp. delta
SUM-D	Summer comp. delta
WIN-END	Winter comp. end point
WIN-STT	Winter comp. starting point
SUM-STT	Summer comp. starting point
SUM-END	Summer comp. end point
OT	Outside temperature
w	Setpoint
Δw	Setpoint shift

Explanations for the diagram

- Upward shift at low outside temperatures acts on heating and cooling
- Downward shift at low outside temperatures acts on heating
- Upward shift at high outside temperatures acts on cooling
- Downward shift at high outside temperatures acts on heating and cooling

Application

The purpose of summer / winter compensation is as follows:

- Summer compensation to compensate for the lighter clothing worn by building occupants
- Winter compensation to compensate for cold surfaces in the room, such as the windows

9.9.3 Troubleshooting

OT sensor signal available?

If there is no outside temperature sensor signal, the controller does not shift the setpoint.

9.9.4 Settings

Setting values

Path: **… > PARA > CTLOOP 1**

Display	*Name*	*Range*	*Factory setting*
SUM-D	Summer compensation delta	0…+50 K	0 K
SUM-END	Summer compensation end	SUM-STT…50 °C	30 °C
SUM-STT	Summer compensation start	WIN-STT…SUM-END	20 °C
WIN-STT	Winter compensation start	WIN-END...SUM-STT	0 °C
WIN-END	Winter compensation end	–50 °C…WIN-STT	–10 °C
WIN-D	Winter compensation delta	–50…+50 K	0 K

9.10 Universal setpoint shift

9.10.1 Activation

Controller 1, basic type U, controller 2

Universal setpoint shift is available with:

- Controller 1, basic type U only
- Controller 2

To activate the function, configure an appropriate input. You can only assign analog inputs.

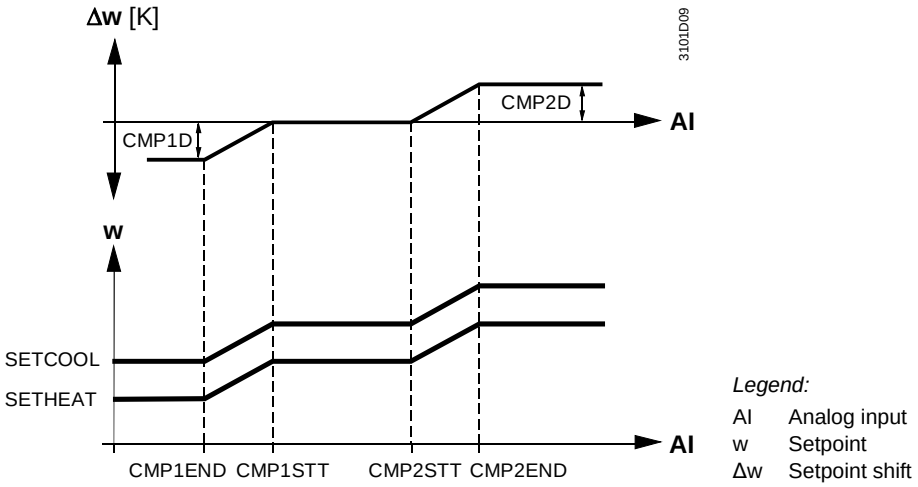
9.10.2 Operating principle

Function

You can use a universal input to shift the controller's setpoint.

Diagram

Setpoint shift acts on the Comfort and Economy modes according to the following diagram:



Application

Typical applications for universal setpoint shift are:

- Refrigeration: Shifting the flow temperature setpoint for the chilled ceiling according to room enthalpy or surface temperature
- Ventilation: Shifting according to room humidity or surface temperature

9.10.3 Troubleshooting

Sensor connected?

When you leave the commissioning menu, the universal controller checks whether a sensor is connected.

- If, at that time, a sensor is connected, but is missing later, a sensor error message is delivered and presented on the display:
  - "Xx ---" => sensor missing
  - "Xx ooo" => short-circuit
- If, at that time, the sensor is not connected, setpoint compensation will be deactivated

9.10.4 Settings

Configuration

Path: **… > COMMIS > CONFIG > CTLOOP 1**
… > COMMIS > CONFIG > CTLOOP 2

Display	*Name*	*Range / comments*
SHIFT	Universal shift	Adjustable values: ---, X1, X2, … (analog values only)

Setting values

Path: **… > PARA > CTLOOP 1**
… > PARA > CTLOOP 2

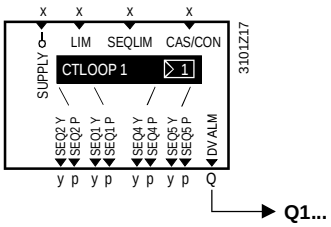
Display	*Name*	*Range*	*Factory setting*
CMP2D	[Setp compensation 2] delta	–50…+500 K	0 K
CMP2END	[Setp compensation 2] end	CMP2STT…500 °C	30 °C
CMP2STT	[Setp compensation 2] start	CMP1STT …CMP2END	20 °C
CMP1STT	[Setp compensation 1] start	CMP1END... CMP2STT	0 °C
CMP1END ...	[Setp compensation 1] end	–50 °C… CMP1STT	–10 °C
CMP1D	[Setp compensation 1] delta	–50…+500 K	0 K

9.11 Deviation message (DV ALM)

9.11.1 Activation

Deviation message relay of universal controller

For the main controlled variable of an RLU2… universal controller, a deviation message can be generated.
To activate the function, connect the DV ALM output of the controller block to any Q… switching output of the RLU2… controller.



Notes

The universal controllers RLU232 and RLU236 also only have one deviation message relay. Both the CTLOOP 1 and CTLOOP 2 sequence controllers always act on the same relay.

The "Deviation message" function is not available with the RLU220 controller.

9.11.2 Operating principle

Monitored values

The deviation message monitors the following values:

- Difference between actual value and setpoint
- Sequence controller at limit
- Message delay time

Trigger

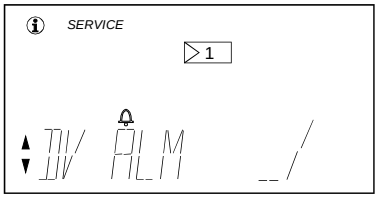
If a control loop is operating at the limit (all heating sequences fully open and all cooling sequences fully closed, or vice versa) and the set difference between actual value and setpoint is exceeded, the controller triggers a fault status message after an adjustable period of time.

You can set individual message delay times for the upper and lower limits (DV DLYH, DV DLYL). This also allows for monitoring plants that provide heating only or cooling only.

Presentation

The controller presents the deviation message as a fault status message at the Info level like this:

- Bell icon blinks
- Sequence controller 1 icon is visible
- Indication whether the deviation occurred in the heating or cooling sequences



Notes on use and configuration

Note the following points with regard to the deviation message:

- Set the message delay time long enough so that the plant does not trigger a fault status message on startup
- The deviation message always refers to the sequence controller. Therefore, in the case of room-supply air temperature cascade control, it monitors the supply air. Set the values accordingly
- The deviation message only works when the control process is active
- If a sequence is limited by a general or sequence limiter, it will not generate a deviation message
- The assignment is made in the configuration diagram, always at sequence controller 1
- If you set both the deviation message and the timeout period for the sequence controller, ensure that the message delay time for the deviation message is longer than the timeout period
  If you fail to do so, there will be a deviation message every time the timeout acts on the sequence controller

9.11.3 Settings

Configuration

Path: **… > COMMIS > CONF > CTLOOP 1**

Display	*Name*	*Range / comments*
DV ALM	Deviation message	Activation of “Deviation message” function, adjustable values: ---, Q1, Q2, … (relays only)

Setting values

Path: **… > PARA > CTLOOP 1**
… > PARA > CTLOOP 2

Display	*Name*	*Range*	*Factory setting*
DV ALM	Deviation message	Main controlled variable input signal range	100 K, 100 %, 900.0, 9000
DV DLYH	Deviation message delay high	00.00…6.00 h.m	00.30 h.m
DV DLYL	Deviation message delay low	00.00…6.00 h.m	00.30 h.m

Display values

Path: **INFO**

Display	*Name*	*Comments*
DV ALM	Deviation message	Indication of current state: Off, On

Wiring test

Path: **… > COMMIS > TEST**

Display	*Name*	*Positions*
DV ALM	Deviation message	Off, On

9.11.4 Application example

Chilled water flow temperature control	Basic type U / flow temperature control for chilled water: With an upward adjustment of the setpoint, the water can take a very long time to warm up if the valves are closed and the pipe is well insulated.
Necessary delay time	The upper message delay time (DV DLYH) is set to 6 h in this case to avoid unnecessary fault status messages.
Note	If the setpoint deviation is still present after 6 hours, you can assume that the valves do not close properly.

10 Frost protection (FROST)

10.1 Purpose and types of monitoring

Purpose of FROST

The FROST (frost protection) function block protects air heating coils against freezing.

Types of frost protection monitoring

This function is available only once in all devices. It provides for the following types of frost protection monitoring:

- Frost protection unit (DIG)
- 2-stage frost protection on the air side (DC 0…10 V)
- 2-stage frost protection on the water side (NI)

Note

Please note that the frost protection function cannot protect the plant against frost damage if there is insufficient heat output (e.g. no heating water)!

10.2 Activating the function block

Configuration

To activate this function, configure the identifier (LABEL) of an input as frost (FRST).

Setting

The TYPE (identification) setting defines the type of monitor or sensor used for frost detection. One of the following frost protection functions becomes active depending on the setting:

Setting	*Frost protection function*
DIG	Frost protection unit
0-10	2-stage frost protection on the air side, frost protection sensor with active signal DC 0…10 V = 0…15 °C.
NI	2-stage frost protection on the water side, frost protection sensor with passive signal LG-Ni1000

Notes

Note the following points with regard to planning and activation of the frost protection function:

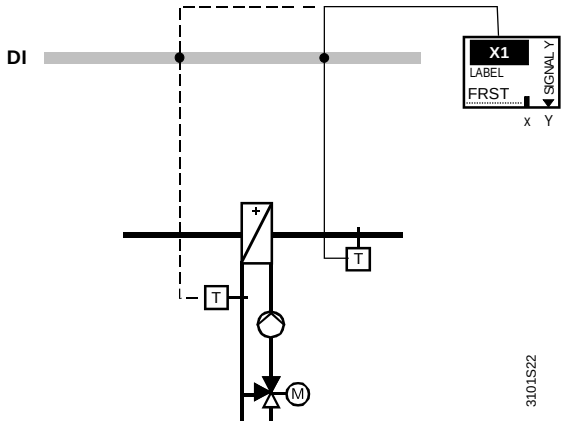
- It must be possible to switch off the fans in case of frost hazard. For that purpose, the fan release relay (ALM OFF) can be configured (refer to section 6.3 “Fan release”). We recommend configuring function block output Q to controller output Q1 with:
  - Changeover contact Q11-Q14 closed => fan release
  - Changeover contact Q11-Q14 open => frost hazard
- For proper functioning of the 2-stage, water-side prost protection function, there must be an air heating coil pump. If you want to switch it on via the controller, the outside temperature signal must be available
- Additionally, the controller assigned to the frost protection function must be the one to which the air heating coil at risk from frost is connected
- If, at the same time, other influences act on the sequence controller, the priority order according to subsection 9.1.4 “Function priorities” applies

10.3 Operating principles and settings

10.3.1 Frost protection unit (DIG)

Application example

This picture shows an application with an air- or water-side frost protection unit:



Note

Reliable frost protection depends on correct sensor placement.

Frost protection control functions

If the temperature falls below the set limit value, the frost protection unit sends a signal to the controller. Meaning:

- Contact (Q11 - Q14 / terminals 1-3) closed: No frost hazard
- Contact (Q11 - Q14 / terminals 1-3) open: Frost hazard

A frost hazard signal triggers the following actions:

- The fan release relay is deenergized (no release of fan)
- The control loop configured with the air heating coil at risk from frost switches off all cooling sequences, and opens all heating sequences to 100%. It also switches on the air heating coil pump.
  => Important: Step switches are also switched on in the process!
- If 2 controllers are configured in the RLU2…, the second (other) control loop is switched off as well
- The outside air dampers are closed

Note

The frost protection function with frost protection unit is activated in all operating modes (Comfort, Economy, Protection). Therefore, it also overrides limitations and disabling as a function of the outside temperature!

10.3.2 Settings for the frost protection unit

Configuration

Path: **… > COMMIS > CONF > X..**

Display	*Name*	*Range / comments*
LABEL	Input identifier	Activation of function with assignment of the FRST value (frost protection) to the input.

Setting values

Path: **… > PARA > FROST**

Display	*Name*	*Range*	*Factory setting*
TYPE	Identification	DIG (frost protection unit)	DIG
ACK	Fault acknowledgement	Manual acknowledgement (YES) 3x automatic acknowledgement (YES3) NO	NO
ACTING	Control loop with risk of frost	CTL1, CTL2	CTL1

Display values

Path: **INFO**

Display	*Name*	*Comments*
FROST	Actual value frost protection	

Wiring test

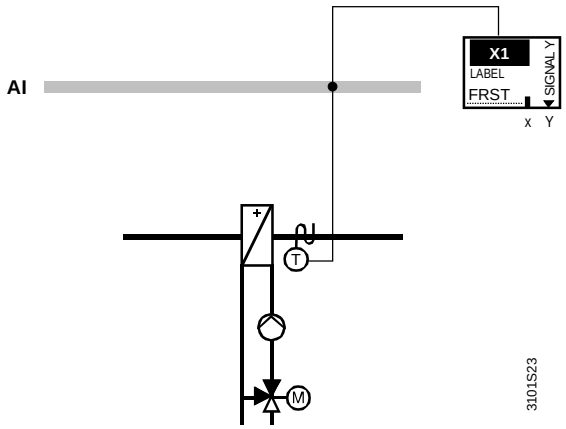
Path: **… > COMMIS > TEST**

Display	*Name*	*Positions*
FROST	Actual value frost protection	

10.3.3 2-stage frost protection on the air side (DC 0…10 V)

Application example

This picture shows an application with 2-stage, air-side frost protection:



Note

Reliable frost protection depends on correct sensor placement!

Temperature drops below starting point

If the temperature falls below the set starting point (= limit value + 2 K + P-band), the following actions are triggered:

- All heating sequences are steplessly opened and all cooling sequences are steplessly closed
- The air heating coil pump is switched on

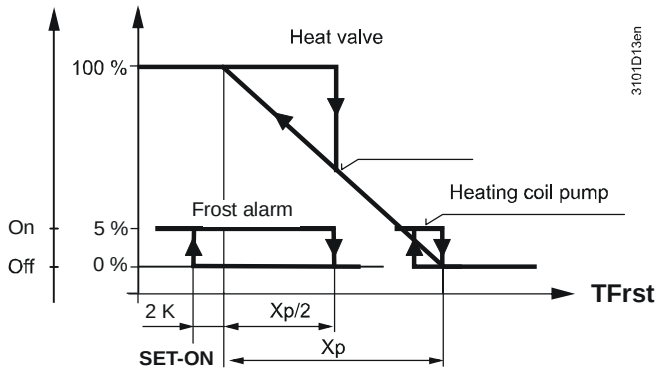
The purpose is to prevent the temperature from falling below the "frost hazard" limit value (SET-ON).

Actions if temperature drops below limit value

If the temperature still drops below the above limit value, the following actions are triggered:

- The fan release relay is deenergized (no release of fan)
- The control loop configured with the air heating coil at risk from frost switches off all cooling sequences, and opens all heating sequences to 100%. It also switches the air heating coil pump on.
  => Important: Step switches are switched on as well!
- If 2 controllers are configured in the RLU2…, the second (other) control loop is switched off as well
- The outside air dampers are closed

Function diagram This diagram illustrates the above statements:



Legend

SET-ON	Frost hazard limit value
TFrst	Frost temperature
Xp	P-band

Note The frost protection function also remains active when the plant is off.

10.3.4 Settings for 2-stage frost protection on the air side

Configuration

Path: **… > COMMIS > CONF > X..**

Display	*Name*	*Range / comments*
LABEL	Input identifier	Activation of function with assignment of the FRST value (frost protection) to the input.

Setting values

Path: **… > PARA > D2**

Display	*Name*	*Range*	*Factory setting*
TYPE	Identification	0-10 (air side, active DC 0…10 V = 0…15 °C)	DIG
SET-ON	Risk of frost limit	−50…+50 °C	5 °C
XP	P-band Xp	1…1000 K	5 K
ACK	Fault acknowledgement	YES (manual acknowlegement) YES3 (3x automatic acknowledgement) NO	NO
ACTING	Control loop with risk of frost	CTL1, CTL2	CTL1

Display values

Path: **INFO**

Display	*Name*	*Comments*
FROST	Actual value frost protection	

Wiring test

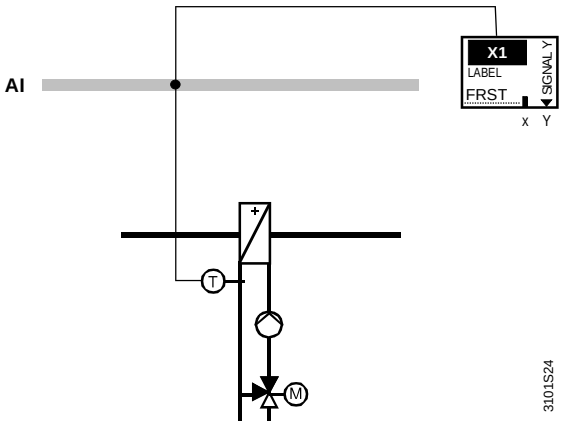
Path: **… > COMMIS > TEST**

Display	*Name*	*Positions*
FROST	Actual value frost protection	

10.3.5 2-stage frost protection on the water side (NI)

Application example

This picture shows an application with 2-stage, water-side frost protection:



Notes on engineering

Observe the following points with regard to sensor placement and the heating circuit pump:

- Reliable frost protection depends on correct sensor placement!
  Position the sensor in or on the water-side outlet of the air heating coil within the air duct
- As an additional protection function, the heating circuit pump must switch on automatically at outside temperatures below 5 °C (setting value "On according to outside temperature", refer to chapter 8 “Pump (PUMP x)”

Temperature drops below starting point

If the temperature falls below the set starting point (= limit value + 2 K + P-band), the heating sequences are steplessly opened and the cooling sequences are steplessly closed. The purpose is to prevent the temperature from falling below the "frost hazard" limit value (SET-ON).

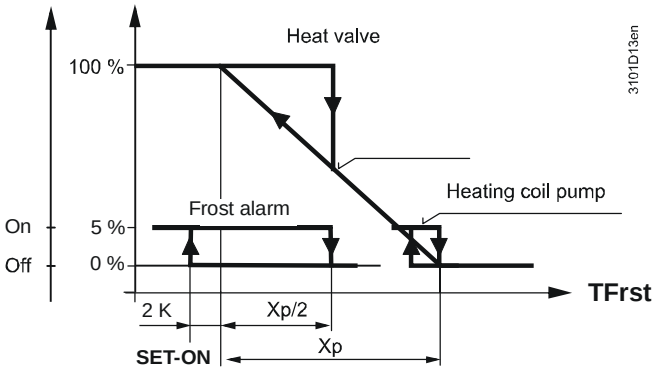
Actions if temperature drops below limit value

If the temperature still drops below the above limit value, the following reactions are triggered:

- The fan release relay is deenergized (no release of fan)
- The control loop configured with the air heating coil at risk from frost switches off all cooling sequences and opens all heating sequences to 100% It also switches on the air heating coil pump.
  => Important: Step switches are also switched on in the process!
- If 2 controllers are configured in the RLU2…, the second (other) control loop is switched off as well
- The outside air dampers are closed

Function diagram

This diagram illustrates the above statements:



Legend

SET-ON	Frost hazard limit value
TFrst	Frost temperature
Xp	P-band

Behavior if the plant is off

If the plant is off, the controller controls the air heating coil temperature to an adjustable plant OFF frost protection (SET-OFF) value with PI control (OFF XP, OFF TN) so that the air heating coil already has stored heat on startup.

This function acts on all heating sequences of the configured control loop (including step switches but:

The outside air damper remains closed (refer to section 8.3 "Heat recovery (HREC)")

10.3.6 Settings for 2-stage frost protection on the water side

Configuration

Path: **… > COMMIS > CONF > X..**

Display	*Name*	*Range / comments*
LABEL	Input identifier	Activation of function with assignment of the FRST value (frost protection) to the input.

Setting values

Path: **… > PARA > FROST**

Display	*Name*	*Range*	*Factory setting*
TYPE	Identification	NI (water side, passive Ni1000)	DIG
SET-ON	Risk of frost limit	–50…+50 °C	5 °C
XP	P-band Xp	1…1000 K	5 K
SET-OFF	Plant OFF frost protection setp	–50…+50 °C	20 °C
OFF XP	Plant OFF Xp	1…1000 K	7 K
OFF TN	Plant OFF Tn	00.00…60.00 m.s	00.30 m.s
ACK	Fault acknowledgement	YES (manual acknowlegement) YES3 (3x automatic acknowledgement) NO	NO
ACTING	Control loop with risk of frost	CTL1, CTL2	CTL1

Display values

Path: **INFO**

Display	*Name*	*Comments*
FROST	Actual value frost protection	

Wiring test

Path: **… > COMMIS > TEST**

Display	*Name*	*Positions*
FROST	Actual value frost protection	

10.4 Acknowledgement / reset (AKN)

Release conditions

The frost protection relay does not release the fan again until frost alarm is no longer pending and the signal has been reset.
You can choose between the following alarm reset alternatives:

- 3x automatic acknowledgement (YES3): Only the third frost alarm occurring within half an hour needs to be acknowledged and reset
- Manual acknowledgement (YES): All frost alarms have to be acknowledged and reset

Note

If the frost protection unit has an alarm latch of its own, you have to reset the frost alarm at the frost protection unit. The plant will not restart until you have reset the frost alarm at the frost protection unit and acknowledged and reset it at the controller.

Procedure for a pending frost alarm

Apply the following procedure in case of a pending frost alarm:

1. Press the **ESC** button once => acknowledges the fault
2. Press the **ESC** button again => resets the fault

See also subsection 11.2.2 “Fault acknowledgement”.

10.5 Display

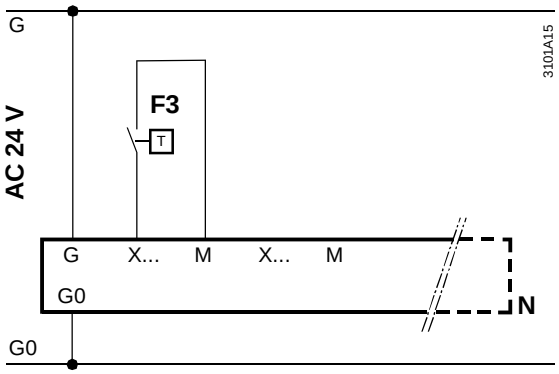
Pending frost alarm

The controller displays a pending frost alarm as follows:

10.6 Connection diagrams

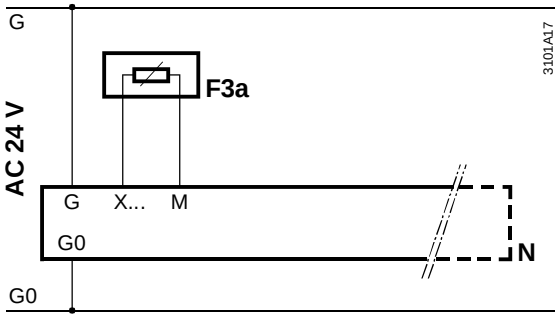
Connection diagram, frost protection unit

You can connect a frost protection unit to the input. It must be connected according to the following diagram:



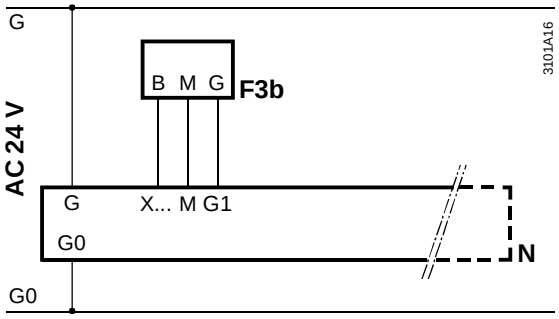
Connection diagram, water

You can connect a passive LG-Ni1000 temperature sensor to the input. It must be connected according to the following diagram:



Connection diagram, air

You can connect an active temperature sensor with a DC 0…10 V = 0…15 °C signal to the input. It must be connected according to the following diagram:



Legend for the connection diagrams

F3	QAF63.2 frost protection unit with capillary (air)
F3a	QAE2120.010 immersion temperature sensor (water)
F3b	QAM2161.040 frost sensor (air)
N	RLU2… universal controller

10.7 Troubleshooting

Frost protection unit

Digital signals cannot be monitored.
A missing signal (= contact open) is interpreted as a frost alarm, which activates the frost protection function.

2-stage frost protection on the air side

A missing signal from the frost sensor is interpreted as a frost alarm, which activates the frost protection function.

2-stage frost protection on the water side

A missing signal from the frost sensor is interpreted as a frost alarm, which activates the frost protection function.
If there is no outside temperature signal, the pump is permanently on. Setting value “On according to outside temperature" must be set to 5 °C; refer to chapter 8 “Pump (PUMP x)”.

Response with several inputs

If more than one input is configured as a frost protection input, the controller accepts the first configured input as the frost protection input.

11 Help in the case of faults

11.1 Fault list

Causes for faults

The following list contains all possible causes for faults, their display and priority.

Display	*Error / fault cause*	*Priority*
FROST	Frost hazard. Type: Simple alarm, frost with frost protection unit (parameter: NO) Type: Extended alarm, frost with sensor (parameter: YES or YES3)	1
MAINALM ▷1	Main controlled variable missing Sequence controller 1 Type: Simple alarm	2
MAINALM	Main controlled variable missing Sequence controller 2 Type: Simple alarm	3
DV ALM ▷1	Deviation message, sequence controller 1 **_** : Lower deviation **_/** : Upper deviation Type: Simple alarm	4
DV ALM ▷2	Deviation message, sequence controller 2 **_** : Lower deviation **_/** : Upper deviation Type: Simple alarm	5
X1 - - - / ooo	Sensor error X1 Type: Simple alarm	6
X2 - - - / ooo	Sensor error X2 Type: Simple alarm	7
X3 - - - / ooo	Sensor error X3 Type: Simple alarm	8
X4 - - - / ooo	Sensor error X4 Type: Simple alarm	9
X5 - - - / ooo	Sensor error X5 Type: Simple alarm	10
STATUS OK	Display in normal operation	11

Legend

Display	*Meaning*
- - -	Open circuit
ooo	Short-circuit

11.2 Rectification of faults

11.2.1 Fault indication

Indications and corrective actions

The controller presents alarms from the plant with the 🔔 icon on the display.

If 🔔 is blinking:

1. Press the **ESC** button to acknowledge the fault status message.

If 🔔 is lit:

1. Remove fault.
2. When you have rectified the fault, press the **ESC** button again to reset the fault status message.

If the plant is functioning normally again, STATUS: OK will appear on the display.

11.2.2 Fault acknowledgement

No acknowledgement needed (simple alarm)

This applies to all fault status messages that you do not have to acknowledge or reset.

Example:
If there is a deviation message, the controller delivers a fault status message. When the main controlled variable returns to the optimal range, the fault status message disappears automatically and the plant continues to operate normally.

Acknowledgement and reset (extended alarm)

This applies to all fault status messages that you have to acknowledge and reset. After acknowledgement, the fault status message is maintained until the fault is no longer present. Only then can you reset the fault status message. The fault icon disappears when you make the reset.

Example:
A frost protection sensor is installed in the plant. In case of a fault, you have to acknowledge and reset it via the user interface. Only then will the plant restart.

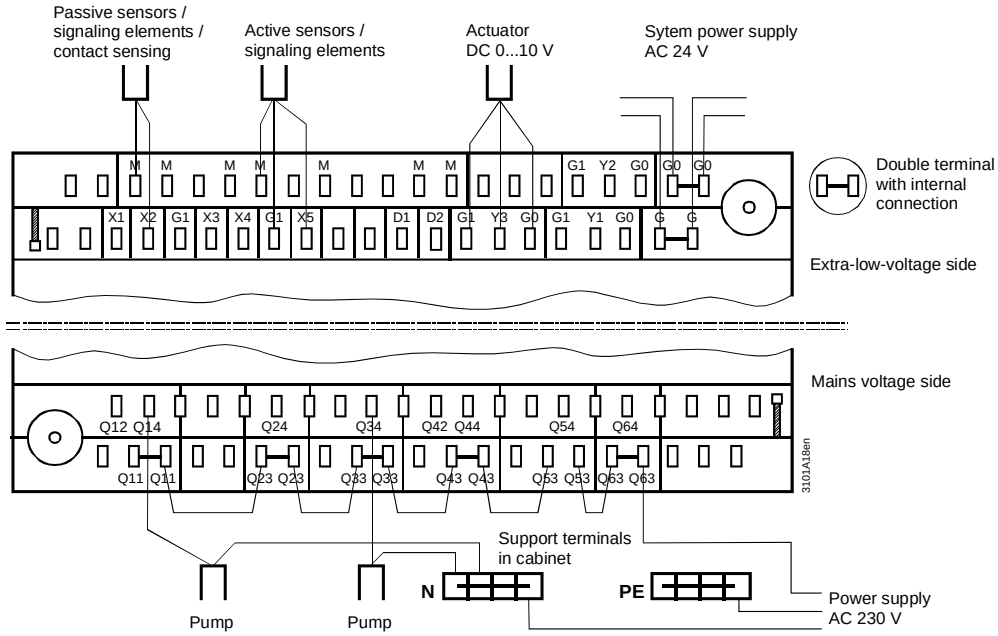
12 Electrical connections

12.1 Connection rules

Terminal connection concept

The following picture shows the terminal base of the RLU236 controller with its connections:

- Extra-low-voltage side at the top
- Mains voltage side at the bottom



Terminal assignment

Terminal	*Intended for …*
Xx, M	Passive sensors and signal sources, potential-free contacts (contact sensing)
G1, Xx , M	Active sensors and signal sources.
G1, Yx, M	Actuators
G and G0	AC 24 V system power supply

Note

Only one solid or one stranded wire can be connected per terminal.

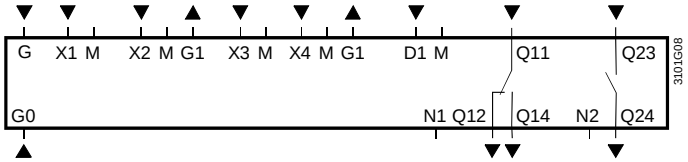
Connection procedure with spring cage terminals

Steps

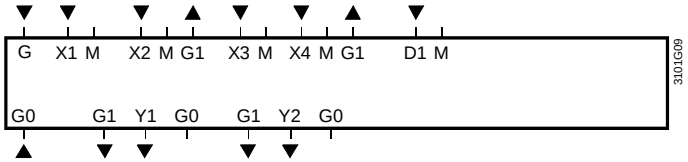
1. Strip the wire over a length of 7…8 mm
2. Position the wire and screwdriver (size 0 to 1)
3. Apply pressure with the screwdriver while inserting the wire
4. Remove screwdriver

12.2 Connection terminals of RLU2… universal controllers

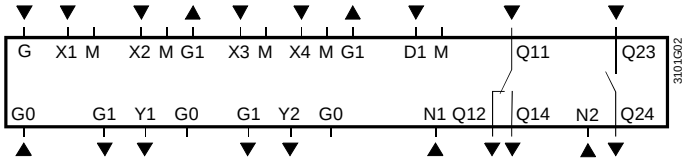
RLU202



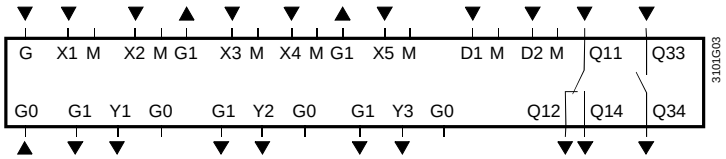
RLU220



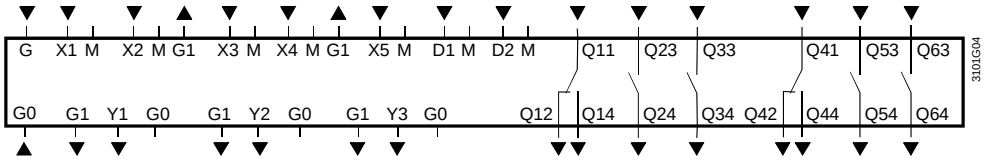
RLU222



RLU232



RLU236



Legend

G, G0	AC 24 V rated voltage
G1	AC 24 V power supply for active sensors, signal sources or limiters
M	Measuring neutral for signal input
G0	System neutral for signal output
N.X1…X6	Universal signal inpus for LG-Ni1000, 2x LG-Ni1000 (averaging), T1, Pt1000, DC 0…10 V, 0…1000 Ω (setpoint), 1000…1175 Ω (relative setpoint), potential-free contacts (contact sensing)
D1…D2	Digital signal inputs for potential-free contacts (contact sensing)
Y1…3	Control and status signal outputs, analog DC 0…10 V
Q…	Potential-free relay outputs (NO / changeover) for AC 24…230 V

13 Appendix

13.1 Abbreviations used

To facilitate reading, the most common abbreviations are listed below in alphabetical order.

Abbreviation	*Meaning*
⊕	Heating
⊖	Cooling
∆w	Setpoint shift
EA	Extract air
AC	Alternating current
AI	Analog input
AO	Analog output
OA	Outside air
CMP	Setpoint compensation
DC	Direct current
DI	Digital input
DO	Digital output
DX	Direct expansion cooling
EHA	Exhaust air
I	I-control
LCD	Liquid crystal display
AHC	Air heating coil
ACC	Air cooling coil
MECH	Maximum economy changeover (MECH)
P	P-control
PI	PI control
Q	Load output
SpTSu	Supply air temperature setpoint
SpTSuH	Supply air temperature setpoint heating
SpTSuC	Supply air temperature setpoint cooling
t	Time
TA, TOa	Outside temperature (OT)
Text	Extract air temperature
TFrst	Frost temperature
Tn	Integral action time
TR	Room or extract air temperature
t_{RL}	Return temperature
Tsu	Supply air temperature
TW	Water temperature
w	Setpoint
x	Actual value
X_{dz}	Dead zone
Xp	P-band
Y, Yctl	Controller output
SA	Supply air

13.2 Operating texts Synco 200

Operating text	*Explanation*
°C	Degrees Celsius
°F	Degrees Fahrenheit
%OPEN	Outside temp-dependent open
0.0	Universal 000.0
0000	Universal 0000
0-10	DC 0...10 V
2xNI	
3P	3-position
3-POINT	3-position output
A	Basic type A room temp
ACCESS	Access levels
ACK	Fault acknowledgement
ACTING	Control loop with risk of frost
ACTTIME	Actuator running time
ADAP	Plant type adapted
ALM OFF	Fan release relay
AO	Modulating output
APPL ID	Basic configuration
CAS/CON	Casc/const changeover input
CASC	Cascade
CAUTION NEW	Caution! New configuration
CH OVER	2-pipe heating/cooling system
CLOS	Closing
CLSD	Closed
CMF	Comfort
CMP1D	[Setp compensation 1] delta
CMP1END	[Setp compensation 1] end
CMP1STT	[Setp compensation 1] start
CMP2D	[Setp compensation 2] delta
CMP2END	[Setp compensation 2] end
CMP2STT	[Setp compensation 2] start
CNST	Constant
CO SEQ1	Change to sequence 1
CO SEQ2	Change to sequence 2
CO SEQ4	Change to sequence 4
CO SEQ5	Change to sequence 5
COMMIS	Commissioning
CONFIG	Extra configuration
COOL	Cooling
COOLER	Cooling coil valve
CORR	Correction
CTL1	Controller 1
CTL2	Controller 2
CTLOOP 1	Controller 1
CTLOOP 2	Controller 2
DIFF	Differential input
DIG	Frost protection unit
DIG	Digital
DLY OFF	Switch-off delay
DMP	Mixing damper
DV ALM	Deviation message
DV DLYH	Deviation message delay high
DV DLYL	Deviation message delay low
ECO	Economy
ERC	Heat recovery equipment
FROST	Frost protection
FRST	Frost protection
HEAT	Heating
HREC	Mixing damper/HR
INFO	
IN X	Preselection external
INVALID	Caution! Invalid settings

Operating texts Synco 200 (*cont'd)*

INVERS	Inversion
KICK	Kick period
LABEL	Input identifier
LIM	General limit controller
LIM DHI	Gen limiter differential high
LIM DLO	Gen limiter differential low
LIM MAX	Gen limiter limit value high
LIM MIN	Gen limiter limit value low
LIM TN	Gen limiter integr action time Tn
LIM XP	Mixing valve P-band Xp
LOCK S1	[Sequence 1] outside temp >
LOCK S2	[Sequence 2] outside temp >
LOCK S4	[Sequence 4] outside temp >
LOCK S5	[Sequence 5] outside temp >
MAIN	Main controlled variable
MAINALM	Main contr var sensor error
MAT	Mixed air temperature
MAT XP	Mixed air temp P-band Xp
MAT TN	Mixed air temp int act time Tn
MAX	Limitation max
MAX	Maximum
MAX POS	Positioning signal max
MAX VAL	Value high
MECH 1	MECH input 1
MECH 2	MECH input 2
MECHSET	MECH limit value
MIN	Limitation min
MIN	Minimum
MIN POS	Positioning signal min
MIN VAL	Value low
MODE	Operating mode
NI	Passive Ni1000
NO	No
NO	None
NORMPOS	Normal position
OFF	Off
OFF TN	Plant OFF Tn
OFF XP	P-band Xp
OFFTIME	Locking time
OFF-Y	Load-dependent OFF
OHM	
OK	
ON	On
ON DLY	Startup delay
ON-OUTS	Outside temp-dependent ON
ON-Y	Load-dependent ON
OPEN	Opening
OPEN	Open
OPMODE	Preselected optg mode input
ORIG	Plant type original (not adapted)
OUTS	Outside temperature
OUTSIDE	Actual value outside temp
PASS	Password level
PASSWRD	Enter password
PASSWRD	Password
PRIO CH	Run priority changeover
PRT	Protection
PT	
PUMP 1	Pump 1
PUMP 2	Pump 2
PUMP 3	Pump 3
REM1	[Controller 1] rem setp adj
REM2	[Controller 2] rem setp adj

Operating texts Synco 200 (*cont'd)*

ROOM	Room temperature
ROOM	Actual value room temp
ROOM TN	Room influence Tn
ROOM XP	Room influence Xp
S V1	Variable step switch 1
S V2	Variable step switch 2
S1-OFF	[Step 1] OFF
S1-ON	[Step 1] ON
S2-OFF	[Step 2] OFF
S2-ON	[Step 2] ON
S3-OFF	[Step 3] OFF
S3-ON	[Step 3] ON
S4-OFF	[Step 4] OFF
S4-ON	[Step 4] ON
S5-OFF	[Step 5] OFF
S5-ON	[Step 5] ON
S6-OFF	[Step 6] OFF
S6-ON	[Step 6] ON
SAT	Supply air temperature
SBIN	Binary step switch
SEQ	Sequence limit controller
SEQ MOD	Type of limitation
SEQ SEL	Sequence selection
SEQ SET	Seq limiter limit value
SEQ XP	Seq limiter P-band Xp
SEQ TN	Integral action time Tn
Seq1	Sequence 1
SEQ1 P	[Sequence 1] pump
SEQ1 TN	[Sequence 1 _] Tn
SEQ1 TV	[Sequence 1 _] Tv
SEQ1 XP	[Sequence 1 _] Xp
SEQ1 Y	[Sequence 1] load
SEQ2	Sequence 2
SEQ2 P	[Sequence 2] pump
SEQ2 TN	[Sequence 2 \ .._] Tn
SEQ2 TV	[Sequence 2 \ .._] Tv
SEQ2 XP	[Sequence 2 \ .._] Xp
SEQ2 Y	[Sequence 2] load
SEQ4	Sequence 4
SEQ4 P	[Sequence 4] pump
SEQ4 TN	[Sequence 4 _/] Tn
SEQ4 TV	[Sequence 4 _/] Tv
SEQ4 XP	[Sequence 4 _/] Xp
SEQ4 Y	[Sequence 4] load
SEQ5	Sequence 5
SEQ5 P	[Sequence 5] pump
SEQ5 TN	[Sequence 5 _.. /] Tn
SEQ5 TV	[Sequence 5 _.. /] Tv
SEQ5 XP	[Sequence 5 _.. Xp
SEQ5 Y	[Sequence 5] load
SERV	Service level
SET MAX ☼	Comfort setpoint high
SET MAX ☾	Economy setpoint high
SET MIN ☼	Comfort setpoint low
SET MIN ☾	Economy setpoint low
SETCLIM	Cooling setpoint limitation
SETCOOL ☼	Comfort cooling setpoint
SETCOOL ☾	Economy cooling setpoint

Operating texts Synco 200 (*cont'd)*

SETHEAT ☼	Comfort heating setpoint
SETHEAT ☾	Economy heating setpoint
SETHLIM	Heating setpoint limitation
SET-OFF	Plant OFF frost protection setp
SET-ON	Risk of frost limit
SETPOINT	Setpoints
SETTING	Settings
SHIFT	Universal shift
SIGNALY	Measured value signal output
SLIN	Linear step switch
START OK	Caution! Plant starts
STATUS	Device state
STEP 1	Step 1
STEP 2	Step 2
STEP 3	Step 3
STEP 4	Step 4
STEP 5	Step 5
STEP 6	Step 6
STEP V1	Variable step switch 1
STEP V2	Variable step switch 2
STEPBIN	Binary step switch
STEPLIN	Binary step switch
STOP OK	Caution! Plant stops
STRATGY	Control strategy
STUP-TI	Startup time
SU DMAX	Max limitation supply air delta
SU DMIN	Min limitation supply air delta
SU MAX	Supply air limit value max
SU MIN	Supply air limit value min
SUM-D	Summer compensation delta
SUM-END	Summer compensation end
SUM-STT	Summer compensation start
SW-VERS	Software version
TIMEOUT	Control timeout
TOOLING	Operation locked
TYPE	Type
TYPE	Identification
U	Basic type U univ controller
UNIT	Unit
USER	User level
VALUES	Inputs/outputs
WIN-D	Winter compensation delta
WIN-END	Winter compensation end
WIN-STT	Winter compensation start
WIRING TEST	Wiring test
XP	P-band Xp
YES	Yes
YES	Acknowledgement manual
YES3	Acknowledgement autom 3x

13.3 Configuration

13.3.1 Explanation of configuration principle

Configuration diagrams, contents

The controller includes a large number of preconfigured function blocks. The function blocks available for the various RLU2… universal controllers are shown in the respective configuration diagrams. They include:

- Input identifiers (inputs, input functions)
- Function blocks for open and closed-loop control functions
- Aggregates (outputs, output functions)

Configuration diagrams, contents

Project engineers can add connections from the individual input and output functions (i.e. their internal signals) to the assigned terminals.

Designations used

Physical inputs:

- D digital
- X universal

Physical outputs:

- Q relay
- Y DC 0…10 V

Use of inputs Xx

The following rules and properties apply to inputs:

- The input identifier can be a device or a special sensor:
  Room temperature (ROOM), outside temperature (OUTS), frost protection (FRST), remote setpoint adjuster, absolute (REL) or relative (REL)
- Multiple use of inputs is possible without limitation (e.g. room temperature as the main controlled variable and as the maximum economy changeover criterion for the air damper)
- When an input is connected, the controller presents only the possible units on the display
- The error message for inputs is only active if the input is connected before completion of commissioning
- If you change an input identifier (LABEL), all of the settings associated with it also change (e.g. Xp used to be 28 K, and now it is 10 Pa)

Configuration procedure

Order:

- Basic configuration (APPL ID) first, then extra configuration (CONFIG)
- First the input identifiers (LABEL), then the control functions, then the aggregates

Wiring choices:

- Always from the arrow to the line
- From function to input: "x" to "x"
- From output block to output terminal: Analog "Y" to "Y"
- Relay "Q" to "Q"
- From the controller: Load "y" to "y", pumps "p" to "p"

Use of outputs Yx

The following applies to outputs:

- Connect the output functions to the respective terminals. Each output terminal can only be used once (e.g. Q1 for pump 1)
- Each output function has no more than 2 load signal inputs with maximum selection. Example: The air cooling coil valve opens if the room temperature or room air humidity is too high

13.3.2 Overview of function blocks

Introduction

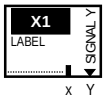
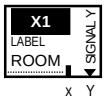
The following pages provide an overview of the function blocks for the RLU2… universal controllers, including a brief description.

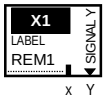
The configuration diagrams for the specific device type indicate how many of each function block are available.

Basic configuration

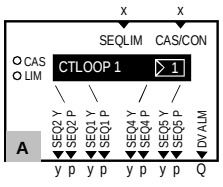
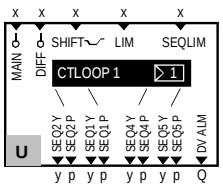
Configuration	Function
APPL ID (Anlagentyp)	• **Basic type A: Room temperature ventilation controller** (sequence controller 1 is a room temperature controller, room-supply air temperature cascade controller or supply air temperature controller) • **Basic type U: Universal controller** (sequence controller 1 is a universal controller) • **A01 … , U01 ..: Selection of a programmed application** (activation of a configuration stored in the controller)

Input identifiers

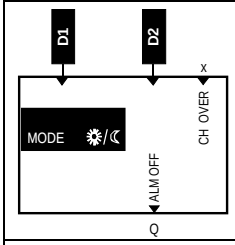
LABEL (identifier)	Configuration	Functions
	X1…X5 SIGNAL Y:	Input of input identifier (LABEL) • Physical units: TEMP (°C, °F),%, Universal 0.0 (display with one decimal place), Universal 0000 (display with no decimal places). The unit is only required for presentation on the display. The controller presents all settings that depend on the unit (e.g. P-bands) in the unit. Sensor for TEMP: Ni1000, 2x LG-Ni1000 (averaging), T1, Pt1000, DC 0…10 V, all other units DC 0…10 V, adjustable range • Digital (input for potential-free contacts) • Special identifiers: Room temperature (ROOM), outside temperature (OUTS), frost protection (FRST), remote setpoint adjuster, absolute (REM) or relative (REL). The controller itself makes internal connections for the special identifiers • SIGNAL Y provides for delivery of the passive sensor value as a DC 0…10 V signal via the Yx terminal of your choice
	Room temperature	Sensor as described under "Sensors for TEMP"
	Supply air temperature	Sensor as specified under "Sensors for TEMP"
	Outside temperature	Sensor as specified under "Sensors for TEMP" for the following functions: • Summer / winter compensation • Sequence locking according to the outside temperature • Pump ON at low outside temperatures • Maximum economy changeover of air dampers

Input identifiers *(cont'd)*		
	Frost protection	Frost protection function optionally for sequence controller 1 or 2: • 2-stage frost protection on the water side (input LG-Ni1000), PI control when plant is off • 2-stage frost protection on the air side (input DC 0…10 V = 0…15 °C) • Frost protection unit
	[Controller 1] remote setpoint adjuster [Controller 2] remote setpoint adjuster Remote setpoint adjuster, relative	• REM 1: Absolute for sequence controllers 1 to 2 (0…1000 Ω or DC 0…10 V) • REL: Relative for room temperature in basic type A, sequence controller 1 (1000…1175 Ω = -3…+3 K)

Control functions

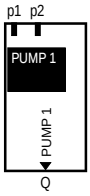
CTLOOP x (controller)	Configuration	Functions
	Controller 1, basic type A: • General limiter (LIM) • Sequence limiter (SEQLIM) • Cascade / constant changeover input (CAS/CON) • Sequence S1…S5 load (y) • Sequence S1…S5 pump (p) • Deviation message output (DV ALM) • Strategy CAS/LIM	Sequence controller, can be used as a P-, PI or PID controller. If supply air temperature (casc.) configured, can be used as: • Room-supply air cascade controller with supply air high/low limit control • Supply air temperature controller • Room temperature controller (supply air configured but not connected) If supply air temp. (casc.) not configured, can be used as: • Room temperature actual value controller Controller functions: • Assignment of sequences can be configured, a load output (modulating output, variable step switch, linear step switch, binary step switch) and a pump can be connected) • Heating sequence S1 and S2 (_) • Cooling sequence S4 and S5 (_//) • General limiter acts on all sequences. • Sequence limiter, adjustable as min. or max. limiter, acts on a settable sequence (closing) • Summer / winter compensation with outside temperature • Sequence locking according to the outside temperature • Fault status message for inadmissible control deviation can be activated
	Controller 1, basic type U; Controller 2, basic types A and U: • Main controlled variable • Differential input (DIFF) • Universal shift (⌒) • General limiter (LIM) • Sequence limiter (SEQLIM) • Sequence S1…S5 load (y) • Sequence S1…S5 pump (p) • Deviation message output (DV ALM)	Universally usable sequence controller, as a P-, PI or PID controller. • Assignment of sequences can be configured, a load output (modulating output, variable step switch, linear step switch, binary step switch) and a pump can be connected) • Heating sequence S1 and S2 (_) • Cooling sequence S4 and S5 (_//) • Simple controller or differential controller (setpoint linkable to sequence controller 1) • General limiter acts on all sequences • Sequence limiter, adjustable as min. or max. limiter, acts on a settable sequence (closing) • Universal shift • Locking the sequence according to the outside temperature • Fault status message for inadmissible control deviation can be activated

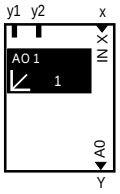
Control functions *(cont'd)*

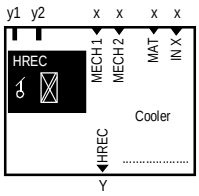
MODE (operating mode)	Configuration	Functions
	Basic types A and U: • Input for preselected operating mode (OPMODE) • H/C changeover (CH OVER) • Fan release relay output (ALM OFF)	Room operating modes. • Operating mode input (OPMODE) for changeover between Comfort and Economy setpoints • Changeover input (CH OVER) for 2-pipe heating / cooling system • Fan release relay output / No alarm output (ALM OFF) Output for switching off the fan in case of frost and external fault status message

FROST (frost protection)	Configuration	Functions
		• 2-stage frost protection on the air side (active input signal DC 0…10 V = 0…15 °C) • 2-stage frost protection on the water side (passive input signal LG-Ni1000) • Frost protection unit (digital input signal)

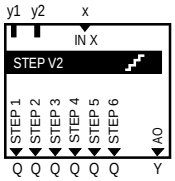
Aggregates

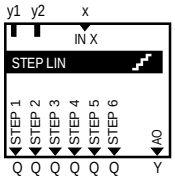
PUMP x (pump)	Configuration	Functions
	• Output (PUMP x)	• Can be used as an auxiliary pump (e.g. air heating coil pump) or main pump (e.g. in connection with chilled water precontroller) • ON via sequence controller's load signal (from up to 2 sequences with maximum selection, adjustable switching points), outside temperature-dependent ON (adjustable) • Adjustable switch-off delay • Pump kick

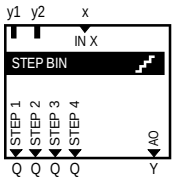
AO x (modulating outputs)	Configuration	Functions
	• Modulating output … (AO)	For modulating DC 0..10 V signals, e.g. for fan control. • Load signal from sequence controller (from up to 2 sequences with maximum selection) • "Positioning signal min“ and "Positioning signal max" adjustable • Settable inversion • Valve opens according to the outside temperature

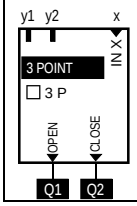
HREC (HR / mixed air damper)	Configuration	Functions
	• Output (HREC) • MECH input 1 (MECH 1) • MECH input 2 (MECH 2) • Air cooling valve (COOLER) • External signal (IN X) • Mixed air temperature (MAT)	For controlling HR equipment or mixing damper. • Configuration with load signal “Heating” or “Cooling” from the sequence controller (from max. 2 sequences with maximum selection) • Maximum economy changeover, optionally with 1 input (digital or analog) or 2 inputs (differential measurement) • HR supports cooling when cooling valve opens (also in case of dehumidification) • Adjustable "Positioning signal min“ and "Positioning signal max" • Settable inversion • External load signal can be applied • Mixed air temperature control • Startup function according to the outside temperature

Aggregates *(cont'd)*

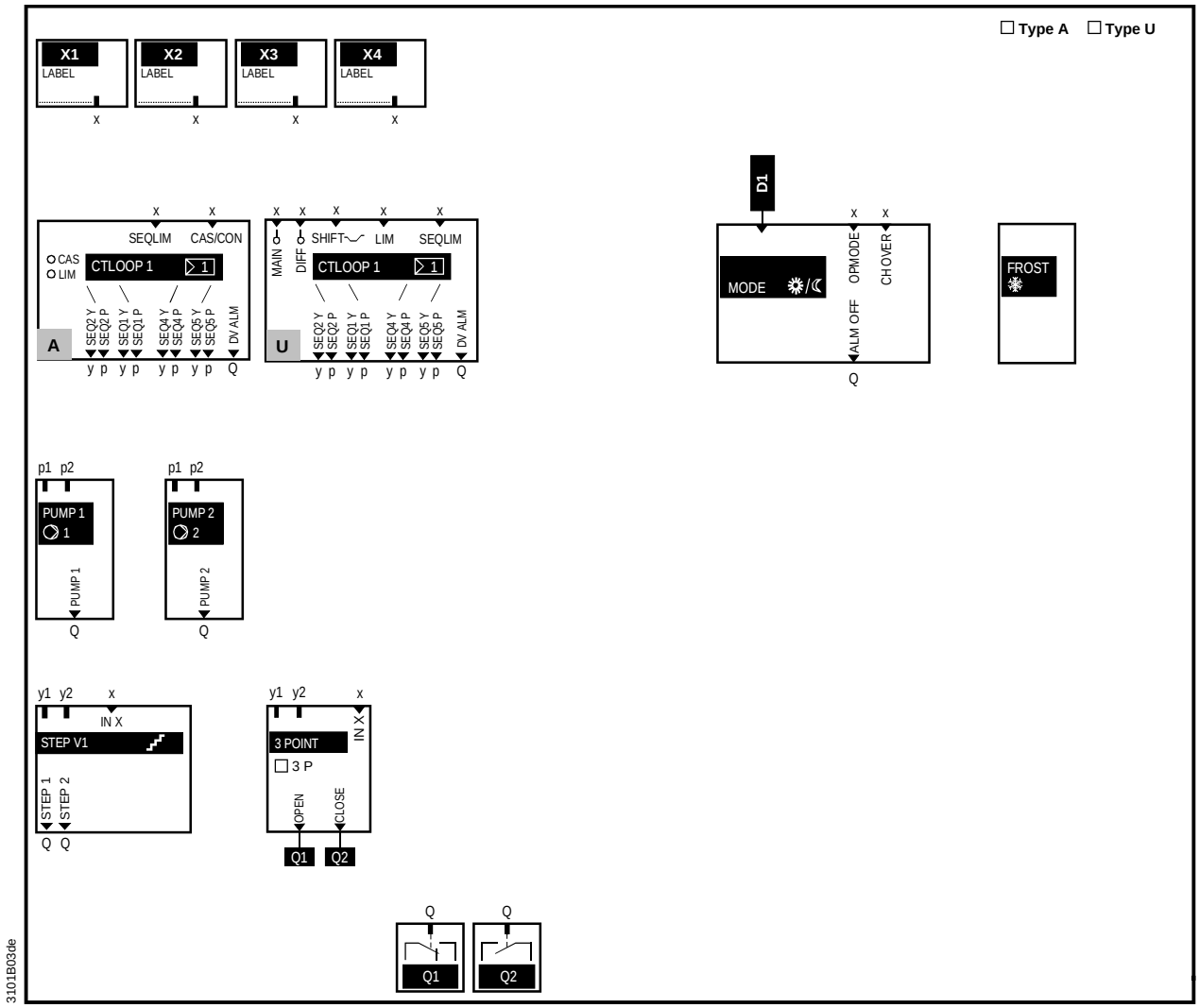
STEP Vx (variable step switch)	Configuration	Functions
	• Step 1 to … (STEP x) • Modulating output (AO) • External signal (IN X)	For controlling a multistage aggregate. • A switch-on and switch-off point can be assigned to each step according to the load signal from the sequence controller (from up to 2 sequences with maximum selection) The switching points can overlap and can be inverted (ON < OFF) • External load signal can be applied • Configurable modulating output. Same function as modulating outputs AO x • Locking time (restart delay) is adjustable (time applies to all steps)

STEP LIN (linear step switch)	Configuration	Functions
	• Step 1 to … (STEP x) • Modulating output (AO) • "External preselection" input (IN X)	For controlling a multistage aggregate. • Linear distribution of the steps over the load signal range according to the number of outputs assigned • External load signal can be applied • Modulating output can be configured, same function as modulating outputs AO x • Locking time (restart delay) and startup delay time are adjustable (time applies to all steps) • Weekly priority changeover of the steps

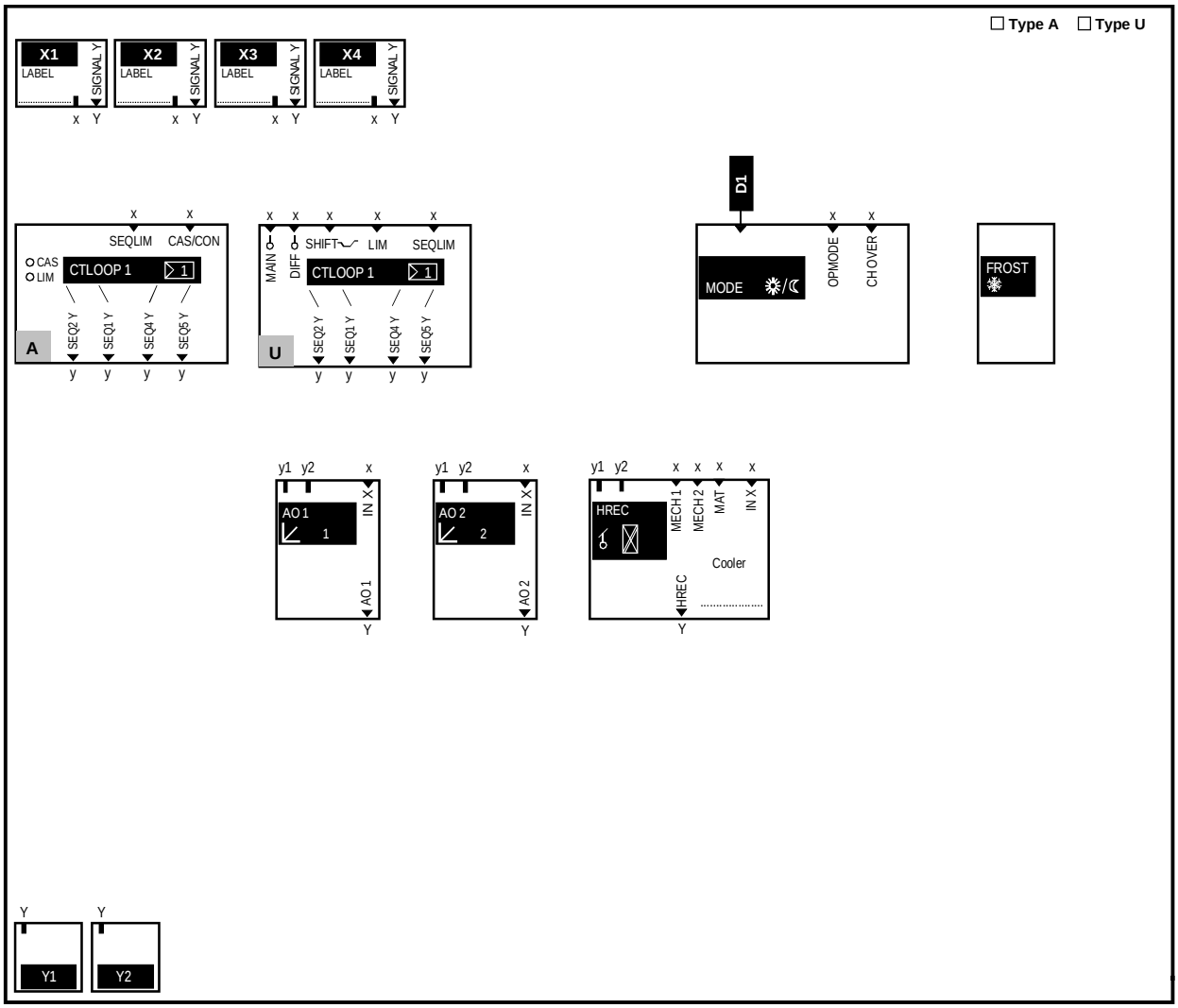
STEB BIN (binary step switch)	Configuration	Functions
	• Step 1 to … (STEP x) • Modulating output (AO) • "External preselection" input (IN X)	For controlling a multistage aggregate. • Binary distribution of the steps over the load signal range according to the number of outputs assigned • External load signal can be applied • Modulating output can be configured, same function as modulating outputs AO x • Locking time (restart delay) is adjustable (time applies to all steps)

3P (3-position)	Configuration	Functions
	• 3-position output (3-POINT) • "External preselection" input (IN X)	For controlling a 3-position actuator. • End stop synchronization • External load signal can be applied • Actuator running time adjustable

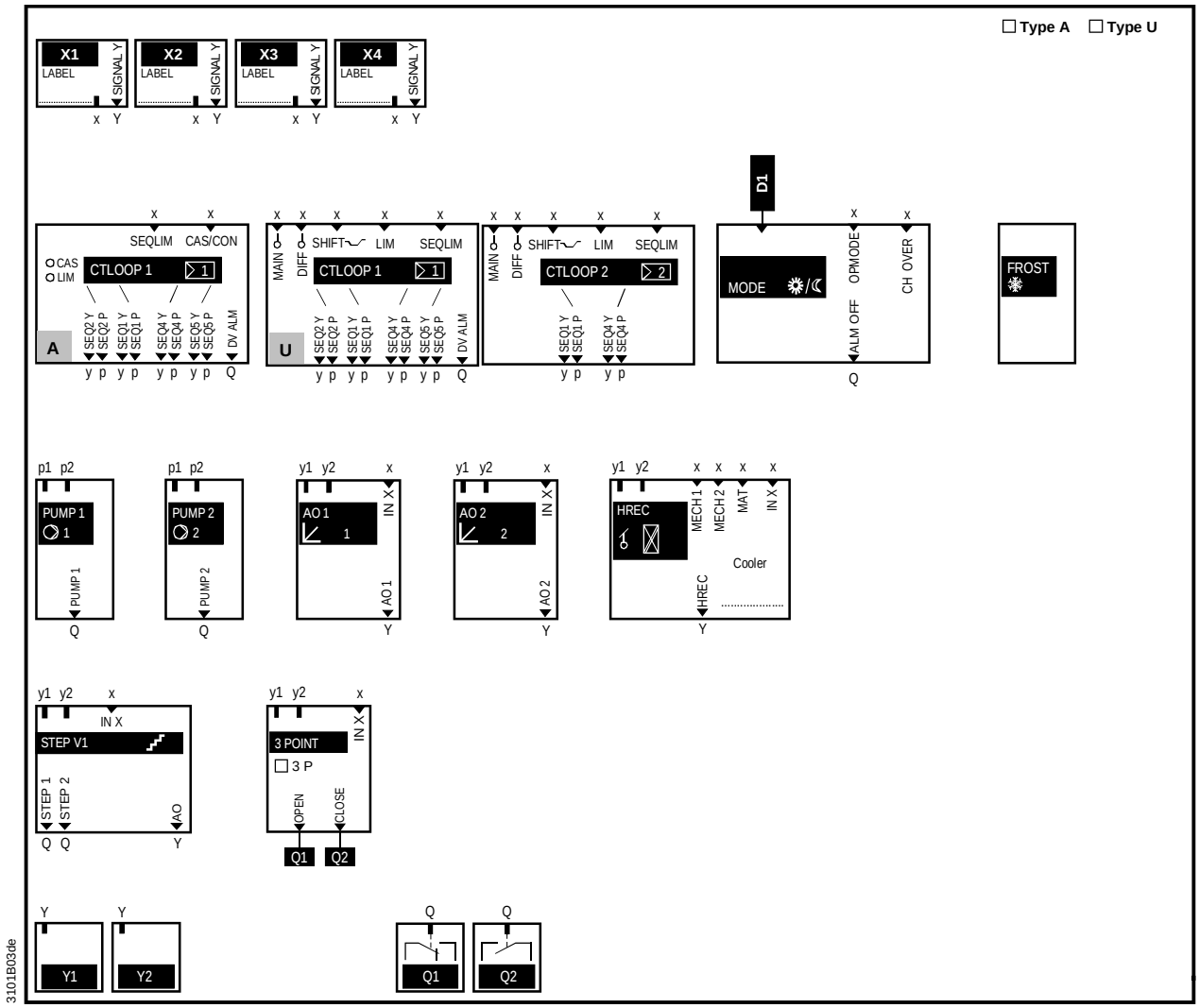
13.3.3 RLU202 configuration diagram



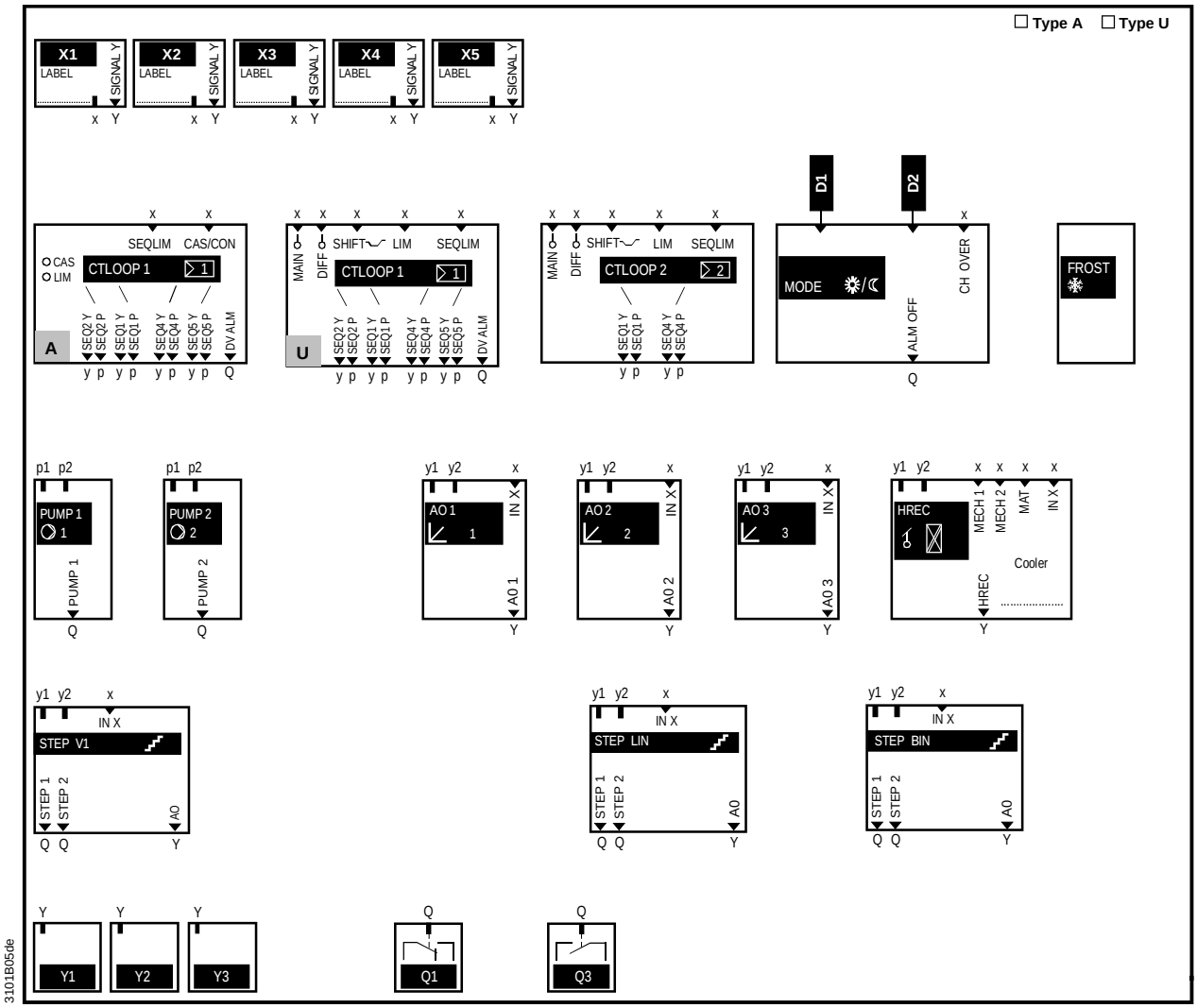
13.3.4 RLU220 configuration diagram



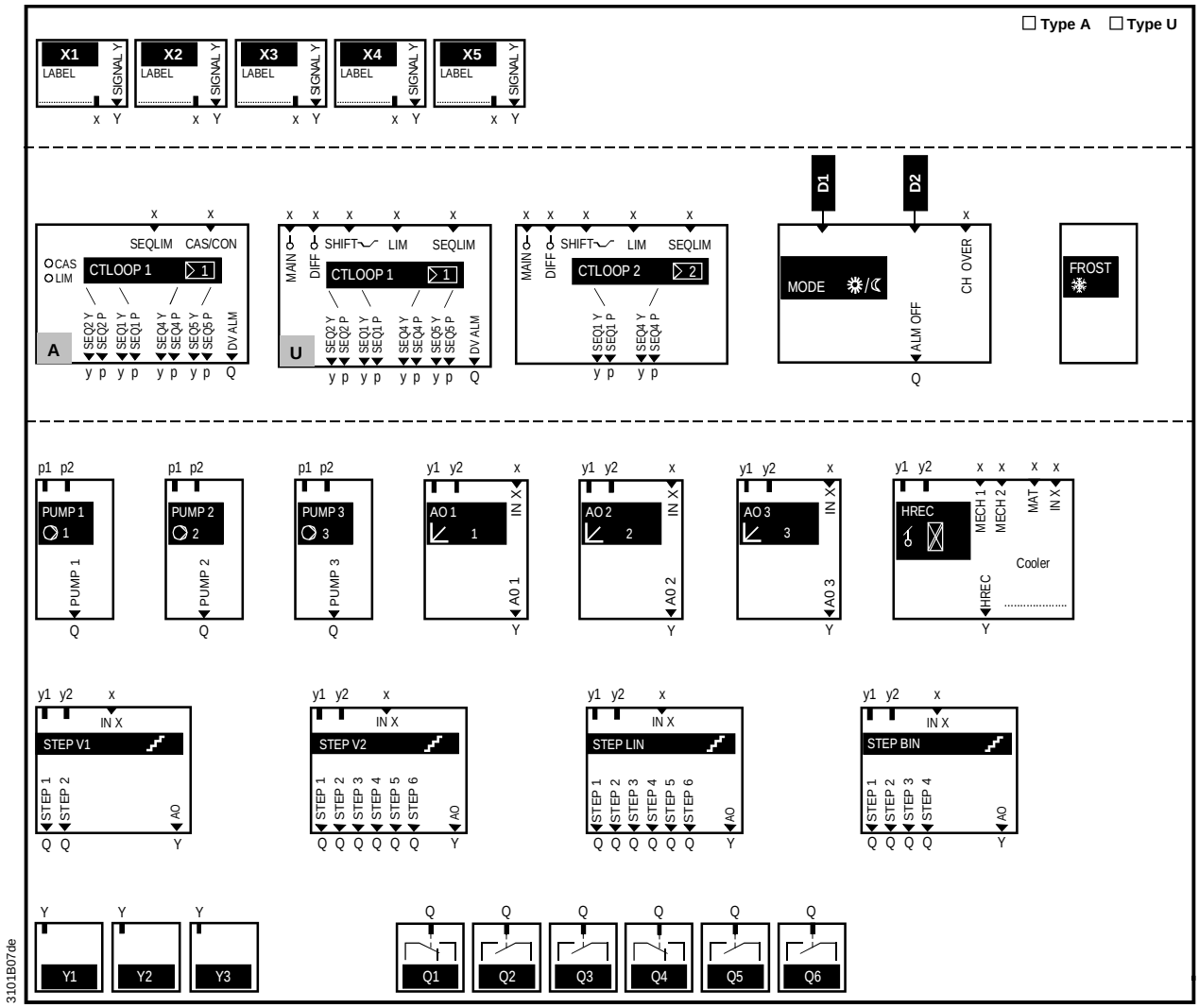
13.3.5 RLU222 configuration diagram



13.3.6 RLU232 configuration diagram



13.3.7 RLU236 configuration diagram



14 Application examples

Introduction

The configurations and setting values for a number of typical, simple functions are listed in the following.

Note

If a sufficient number of inputs and outputs are available, and the functions are switched on or off at the same time, you can also combine these functions.

14.1 Multiple use of sensors

Purpose

Passive temperature sensor LG-Ni1000 (connected to X1).
You want to convert the signal to DC 0…10 V = 0…50 °C (at Y1) for further handling.

Configuration

CONF / X1 / LABEL	TEMP	
CONF / X1 / SIGNALY	Y1	

Setting values

PARA / X1 / TYPE	NI	
PARA / X1 / MIN VAL	0	°C
PARA / X1 / MAX VAL	50	°C
PARA / X1 / CORR	0	K

14.2 Signal inversion

Purpose

You want to invert a DC 0…10 V signal (X1 to Y1).

Configuration

CONF / X1 / LABEL	%
CONF / X1 / SIGNALY	---
CONF / AO 1 / AO	Y1
CONF / AO 1 / IN X	X1

Setting values

PARA / D1 / NORMPOS	OPEN	
PARA / AO 1 / MIN POS	0	%
PARA / AO 1 / MAX POS	100	%
PARA / AO 1 / INVERS	YES	

14.3 Signal adaptation

Purpose

You want to adapt a DC 0…10 V signal (at X1) to DC 5…7.5 V (at Y1).

Configuration

CONF / X1 / LABEL	%
CONF / X1 / SIGNALY	---
CONF / AO 1 / AO	Y1
CONF / AO 1 / IN X	X1

Setting values

PARA / D1 / NORMPOS	OPEN	
PARA / AO 1 / MIN POS	50	%
PARA / AO 1 / MAX POS	75	%
PARA / AO 1 / INVERS	NO	

14.4 Step switch

Purpose

You want to convert a DC 0…10 V signal (at X1) and an enable signal (at D1) to a binary step switch signal with 2 steps (at Q1+Q2).

Configuration

CONF / X1 / LABEL	%
CONF / X1 / SIGNALY	---
CONF / STEPBIN / STEP 1	Q1
CONF / STEPBIN / STEP2	Q2
CONF / STEPBIN / IN X	X1

Setting values

PARA / D1 / NORMPOS	CLSD
PARA / STEPBIN / OFFTIME	00.00

14.5 Modulating / 2-position converter

Purpose

Switch-on and switch-off command (at Q1) according to the resistance signal from an LG-Ni1000 passive temperature sensor (at X1): ON at 28 °C, OFF at 25 °C.

Configuration

CONF / X1 / LABEL	%
CONF / X1 / SIGNALY	---
CONF / STEP V1 / STEP 1	Q1
CONF / STEP V1 / IN X	X1

Setting values

PARA / D1 / NORMPOS	OPEN	
PARA / X1 / MIN VAL	0	%
PARA / X1 / MIN VAL	100	%
PARA / STEP V1 / OFFTIME	00.00	
PARA / STEP V1 / S1-ON	28	%
PARA / STEP V1 / S1-OFF	25	%

14.6 Signal doubler

Purpose

You want to transmit a DC 0…10 V signal (at X1) as an active output (at Y1).

Configuration

CONF / X1 / LABEL	%
CONF / X1 / SIGNALY	Y1

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