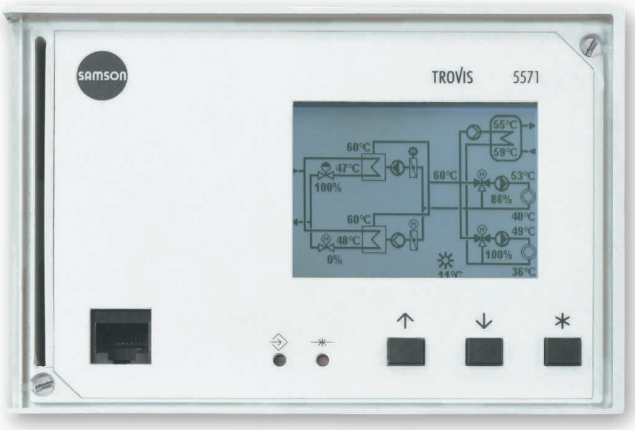
TROVIS 5500 Automation System
TROVIS 5571 Programmable Logic Controller (PLC)

Standard Application for Lag/Lead Sequence WT71



Operating Instructions

EB 5571-2 EN

Firmware version 1.50

Edition January 2014

TROVIS® Electronics from SAMSON

Safety instructions

- These operating instructions (EB 5571-2 EN) describe the standard application WT71, which can be transferred to the TROVIS 5571 Programmable Logic Controller (PLC).
  Read the Mounting and Operating Instructions EB 5571 EN for the TROVIS 5571 Programmable Logic Controller (PLC). These instructions contain important information on the installation, electrical connection, start-up and communication of the TROVIS 5571 Programmable Logic Controller.
- The device may only be assembled, started up or operated by trained and experienced personnel familiar with the product.
- Proper shipping and appropriate storage are assumed.
- The controller has been designed for use in electrical power systems. For wiring and maintenance, you are required to observe the relevant safety regulations.

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1 Operation

The application software is ready for operation with the default temperature and time schedule settings after it has been transferred to the TROVIS 5571 PLC.
On start-up, **the language as well as the current time and date** must be set in the controller. Refer to section 1.6.

1.1 Operating elements

1.1.1 Operating keys

The keys are located in the front panel of the PLC and protected by a Plexiglas door.

Changeover key
(press with pen or other pointed item)
Switch between the operating level and settings level

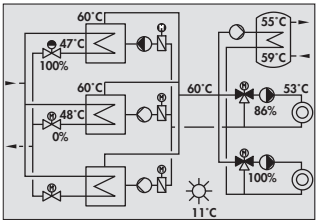
Reset key
(press with pen or other pointed item)
Resets the PLC.
NOTICE The application in the controller is deleted.

Cursor key(s)
– Navigate within levels
– Change values

Enter key
– Open levels
– Activate editing mode for parameters and function blocks
– Confirm entered settings

1.2 Display

After connecting the controller to the power supply, the current application and firmware version appear on the display. After pressing the ✳ key, the start screen appears, which also appears during operation. This start screen contains the current system scheme, time, date and information on operation.



1.3 Operating modes

The following operating modes are available:

- Stand-by: Stand-by mode
- Night: Night mode (reduced operation)
- Day: Day mode (rated operation)
- Auto (stand-by): Automatic mode with switchover between day and stand-by mode
- Auto (night): Automatic mode with switchover between day and night mode

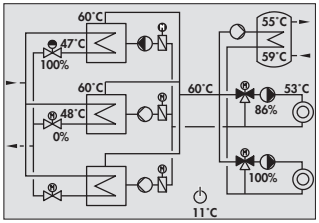
Standby mode ⏻
The heat exchanger only works when there is a demand for domestic hot water or a demand for an external set point. The protective functions remain active.

Night mode (reduced mode) ☽
Regardless of the programmed times-of-use, the set points relevant for reduced operation are used by the controller.

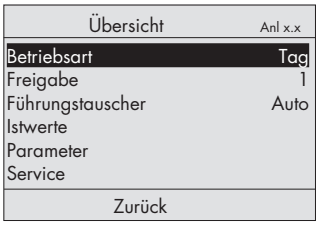
Day mode (rated operation) ☼
The set points for rated operation are used for control regardless of the entered time schedule and the summer mode.

Automatic mode 🕘
During the programmed times-of-use, the controller works in rated operation. Outside these times-of-use, the controller is in reduced operation or stand-by mode, depending on the settings. The controller switches automatically between both operating modes.

1.3.1 Setting the operating mode



The controller with start screen

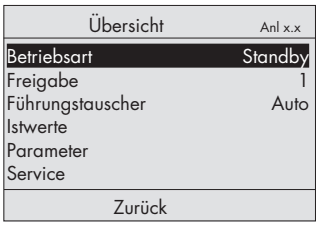


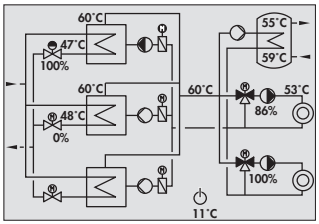
☒ Exit the start screen.
Display: Übersicht (Overview)
The 'Betriebsart' (Operating mode) menu item is highlighted.

☒ Activate the editing mode for the operating mode.
Display: The currently valid operating mode blinks.

☒ Select operating mode.

☒ Confirm selected operating mode.





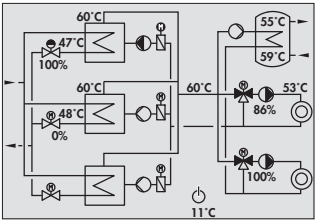
Exit setup menu

☒ Select 'Zurück' (Back).

☒ Exit overview menu.
Display: Start screen

1.4 Selecting the language

The standard application WT71 is available in German and Polish.



The controller with start screen

Übersicht	Anl x.x
Betriebsart	Tag
Freigabe	1
Führungstauscher	Auto
Istwerte	
Parameter	
Service	
Zurück	

Exit the start screen.
Display: Übersicht (Overview)
The 'Betriebsart' (Operating mode) menu item is highlighted.

Schlüsselzahleingabe
0000

Opening the service menu

Activate the controller editing mode.
Display: 'Schlüsselzahleingabe' (Key number entry)
0000 blinks.

Enter application key number .

Confirm application key number .
Display: Übersicht (Overview)

Select Service.

Service
Language
Anlage konfigurieren
Wärmetauscher 1
Wärmetauscher 2
Wärmetauscher 3
Heizkreis 1
Zurück

Open the service menu.
Display: Service
The 'Language' menu item is highlighted.

Select 'Language' menu item.

Select language.

Confirm language selected.

After selecting the language, exit the menu step-by-step and return to the start screen:

Select 'Zurück' (Back)

⊠ Exit overview menu.
Display: Start screen

1.5 Heat exchangers settings

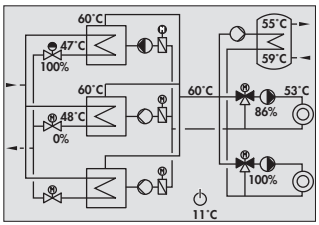
The following settings are possible:

- -: Heat exchanger 1, 2 and 3 switched off
- 1: Heat exchanger 1 running, heat exchanger 2 and 3 (if required) switched off
- 2: Heat exchanger 2 running, heat exchanger 1 and 3 (if required) switched off
- 1+2: Heat exchanger 1 and 2 running; heat exchanger 3 (if required) switched off
  Lead heat exchanger based on selection
- 3: Heat exchanger 3 running, heat exchanger 1 und 2 switched off
- 1+3: Heat exchanger 1 and 3 running, heat exchanger 2 switched off
  Lead heat exchanger based on selection
- 2+3: Heat exchanger 2 and 3 running, heat exchanger 1 switched off
  Lead heat exchanger based on selection
- 1+2+3 Heat exchanger 1, 2 and 3 running
  Lead heat exchanger based on selection

If more than one heat exchanger is enabled for operation (e.g. setting "1+2", "1+3", "2+3", "1+2+3"), the lead heat exchanger can be selected as follows:

- 1: All heat exchangers running, heat exchanger 1 as lead heat exchanger
- 2: All heat exchangers running, heat exchanger 2 as lead heat exchanger
- 3: All heat exchangers running, heat exchanger 3 as lead heat exchanger
- Auto: All heat exchangers running, automatic lag/lead sequence change, see section 4.3

1.5.1 Enabling heat exchangers and selecting lead heat exchanger



The controller with start screen

Übersicht	Anl x.x
Betriebsart	Standby
Freigabe	!
Führungstauscher	Auto
Istwerte	
Parameter	
Service	
Zurück	

✳ Exit the start screen.
Display: Übersicht (Overview)
The 'Betriebsart' (Operating mode) menu item is highlighted.

Übersicht	Anl x.x
Betriebsart	Standby
Freigabe	1
Führungstauscher	Auto
Istwerte	
Parameter	
Service	
Zurück	

Enable heat exchanger

↓ Select 'Freigabe' (Enable) menu item.

✳ Activate the controller editing mode for 'Freigabe' (Enabling).
Display: 'Freigabe' (Enabling) blinks.

↓ Enable heat exchangers as required.

Übersicht	Anl x.x
Betriebsart	Standby
Freigabe	1+2
Führungstauscher	Auto
Istwerte	
Parameter	
Service	
Zurück	

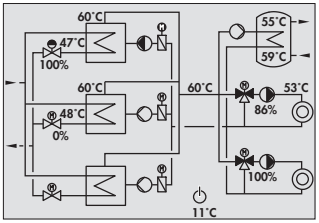
✳ Confirm enabling.

Select lead heat exchanger (Führungstauscher) (only when enable setting = "1+2", "1+3", "2+3", "1+2+3")

↓ Select 'Führungstauscher' (lead heat exchanger) menu item.

✳ Activate the controller editing mode for 'Führungstauscher' (lead heat exchanger).
Display: 'Führungstauscher' (lead heat exchanger) blinks.

↓ Set lead heat exchanger.



✳ Confirm setting.

Exit overview

↓ Select 'Zurück' (Back)

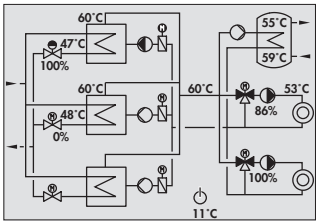
✳ Exit overview menu.
Display: Start screen

1.6 Setting the system time

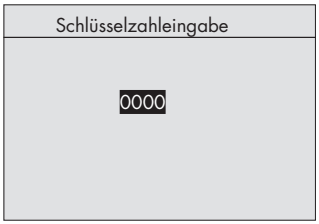
The current time and date need to be set immediately after start-up and after a power failure lasting more than 24 hours.

Set the system time in the Settings level under the menu item 'Date/Time' after pressing the changeover key and entering the system key number (see page 85). The **Automatic summer time** function can also be activated (on) or deactivated (off) in this menu item.

- **System time:** Time-dependent functions of the saved application are based on the system time set in the PLC.
- **Automatic summer time:** The summer time is automatically set on the last Sunday in March at 02:00 h and the winter time on the last Sunday in October at 03:00 h.

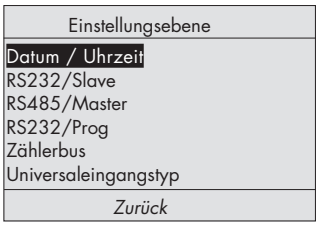


The controller with start screen



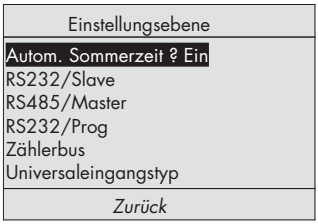
Activate the controller editing mode.
Display: 'Schlüsselzahleingabe' (Key number entry).
0000 blinks.

Enter the key number .



Confirm the entered key number.
Display: Einstellungsebene (Settings level)
The 'Datum/Uhrzeit' (Date/Time) menu item is highlighted.

- Activate the 'Datum/Uhrzeit' (Date/Time) menu item.
  Display: System time (DD.MM.YYYY HH:MM)
- Activate the editing mode for the system time.
  Display: Date (***DD***) blinks.
- Enter date.
- Confirm date entered.
  Display: Month (***MM***) blinks.
- Enter month.
- Confirm month entered.
  Display: Year (***YYYY***) blinks.
- Enter year.
- Confirm year entered.
  Display: Time (***HH***) blinks.
- Enter hour.
- Confirm hour entered.
  Display: Minutes (***MM***) blink.
- Enter minutes.



- Confirm minutes entered.
  Display: "Autom. Sommerzeit ? __"
  (Automatic summer time? __) blinks

  If required, change the current setting (on/off) of the **Automatic summer time** function.
- Activate function: Automatic summer time? Ein (On)
- Deactivate function: Automatic summer time? Aus (Off)

- Exit the 'Datum/Uhrzeit' (Date/Time) menu item.
  Display: Einstellungsebene (Settings level)

Exit the settings level

- Select 'Zurück' (Back).
- Exit overview menu.
  Display: Start screen

Note: *If no key is pressed for two minutes, the PLC automatically returns to the start screen.*

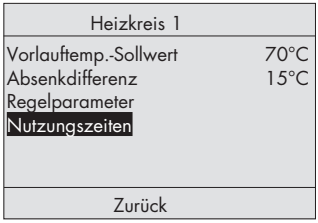
1.7 Entering time schedules

Two time schedules can be programmed for each day of the week. If only one time schedule is required, the start and stop times of the second schedule must be programmed to identical times.

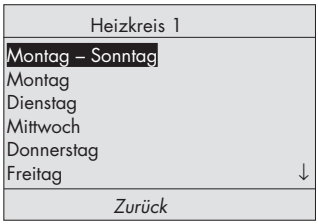
The controller is delivered with the default time schedule starting at 7:00 h and ending at 22:00 h.

The setting is performed in the menu **[Übersicht > Parameter > Allgemein > Zeitprogramme]** when just heat exchangers are to be controlled in a system (Anl x.0).
If a consumer on the secondary side exists, the setting is performed in the menu **[Übersicht > Parameter > Heizkreis 1…3]**.
The time schedules of DHW heating is programmed separately for the DHW and thermal disinfection in the menu **[Übersicht > Parameter > Warmwasserbereitung]**.

Use the arrow key ⇩ and enter key ✳ to activate the editing mode for the 'Nutzungszeiten' (Time schedule) menu item.

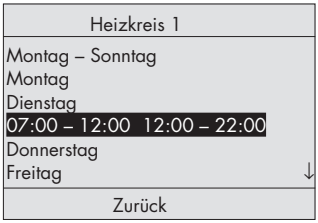


⇩ Select 'Nutzungszeiten' (Time schedule) menu item.



✳ Activate the editing mode for the time schedule. 'Montag – Sonntag' (Monday – Sunday) is highlighted.

⇩ Select time period/day.



- Activate the editing mode for the time period/day.
  Display: Current time-of-use periods
  (HH:MM – HH:MM HH:MM – HH:MM)
- Activate the editing mode of the time period.
  Display: Start time of the first time schedule blinks.
- Edit start time (steps of 30 minutes)
- Confirm start time.
  Display: Stop time of the first time schedule blinks.
- Edit stop time (steps of 30 minutes)
- Confirm stop time.
  Display: Start time of the second time schedule blinks.

The second time schedule is set like the first time schedule.

To set the time schedules for each day, repeat the instructions in the fields highlighted in gray.

After programming all the time schedules, exit the menu step-by-step and return to the start screen:

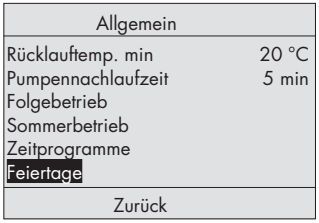
- Select 'Zurück' (Back).
- Exit overview menu.
  Display: Start screen

1.8 Entering public holidays

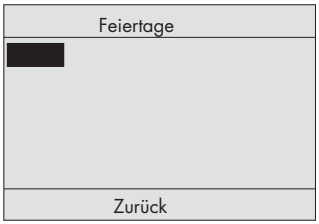
The time schedule programmed for Sunday apply on public holidays. No public holidays are ready programmed.

Public holidays must be programmed in the menu [**Übersicht > Parameter > Allgemein**].

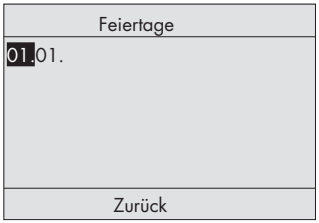
Use the arrow key ↓ and enter key ✳ to activate the 'Feiertage' (Public holidays) menu item.



↓ Select 'Feiertage' (Public holidays) menu item.



✳ Activate 'Feiertage' (Public holidays) menu item.
Display: Feiertage (Public holidays)

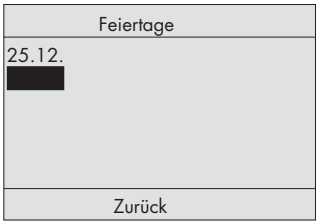


✳ Activate the editing mode for public holidays.
Display: 0 (first figure for day of month) blinks.

↑ Select date

✳ Confirm date.
Display: 01. (first figure for month) blinks.

↑ Select month.



✳ Confirm date and month.

Set other public holidays in the same manner as described above.

Deleting public holiday

⇩ Select the public holiday to be deleted.

✳ Activate the public holiday.
Display: Date blinks.

⇩ Select – – .

✳ Confirm that the public holiday is to be deleted.

After setting all public holidays, exit the menu step-by-step and return to the start screen:

⇩ Select 'Back'.

✳ Exit overview menu.
Display: Start screen

1.9 Setting parameters

Note:
- *Configure the system (see section 2.1.1) before setting any parameters as the parameters of the application are reset to the default settings on changing the system code number.*
- *Before setting the parameters in the service menu, the application key number must be entered before pressing the changeover key (⇨).*

Use the arrow key and enter key (⇩ and ✳) to select parameters in the menus (🗗) described in section 9.

✳ Activate the editing mode for the parameter

⇩ Change the parameter.

✳ Confirm parameter setting.

After setting the parameters, exit the menu step-by-step and return to the start screen:

⇩ Select 'Zurück' (Back).

✳ Exit overview menu.
Display: Start screen

2 Start-up

2.1 System code numbers

In the service menu, the required system code number can be selected after entering the key number of the application. The application key number can be found on page 85. To avoid unauthorized use of the key number, remove the page or make the key number unreadable.

Two heat exchanger circuits and six different consumer connections are possible.

	Heat exchanger 1	Heat exchanger 2	Heat exchanger 3	Heating circuit 1	Heating circuit 2	Heating circuit 3	DHW heating
System Anl 1.x	•	•	–				
System Anl 2.x	•	•	•				
System Anl x.0				–	–	–	–
System Anl x.1				•	–	–	–
System Anl x.2				•	•	–	–
System Anl x.3				•	•	•	–
System Anl x.4				–	–	–	•
System Anl x.5				•	–	–	•
System Anl x.6				•	•	–	•

2.1.1 Configuring the system

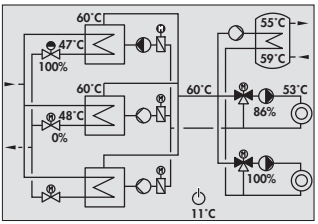
Note:

– *Perform the electrical connection described in section 7 before configuring the system.*
– *Changing the system code number (Anl x) causes the application parameters to be reset to their default settings.*

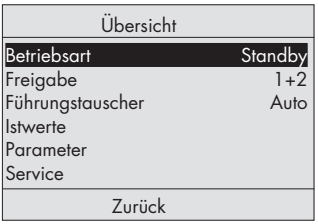
All the systems described in section 2.1.1 can be set using the system configuration. Use the arrow keys ↑ ↓ and enter key ✳ to perform the settings.

Example: System Anl 2.6 is to be configured.

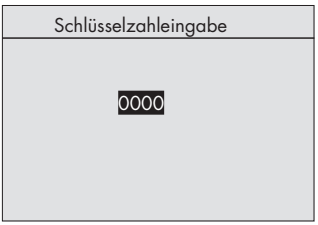
	Heat exchanger 1	Heat exchanger 2	Heat exchanger 3	Heating circuit 1	Heating circuit 2	Heating circuit 3	DHW heating
System Anl 2.x	•	•	•				
System Anl x.6				•	•	–	•



The controller with start screen



⊠ Exit the start screen.
Display: Übersicht (Overview)
The 'Betriebsart' (Operating mode) menu item is highlighted.



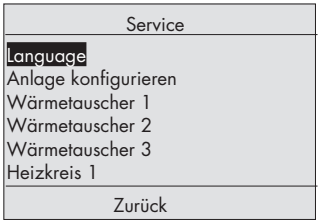
Opening the service menu

⇶ Activate the controller editing mode.
Display: 'Schlüsselzahleingabe' (Key number entry).
0000 blinks.

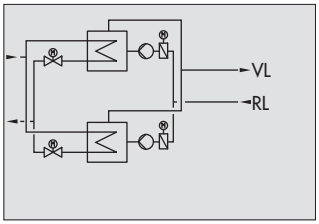
⇩ Enter application key number.

⊠ Confirm application key number.
Display: Übersicht (Overview)

⇩ Select Service.



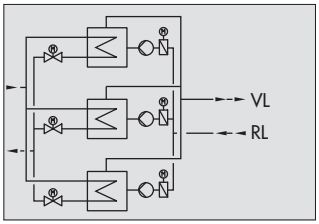
✳ Open the service menu.
Display: Service
The 'Language' menu item is highlighted.



Activating the system configuration

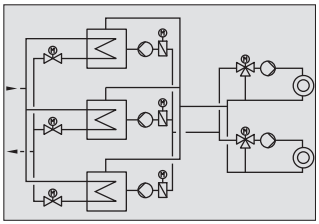
↓ Select 'Anlage konfigurieren' (Configure system) menu item.

✳ Activate the editing mode for 'Anlage konfigurieren' (Configure system).
The system configuration starts with system Anl 1.0 (two heat exchangers).



↓ Select third heat exchanger.

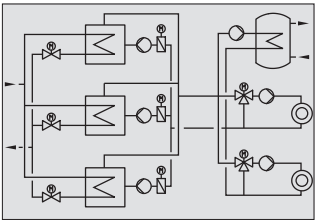
✳ Confirm selection.



✳ Select heating circuit 1.

↓ Select heating circuit 2.

✳ Confirm selection.



✳ Select DHW heating.

✳ Confirm with [Übernehmen].

If the configuration is to rejected:

↑ Select [Verwerfen] on display.

✳ Reject configuration.
The display returns to the service menu.

Setting the heat exchanger rating

It is particularly important to set the rating of a heat exchanger if the lag/lead sequence is to depend on the heat exchanger's output capacity. Refer to section 4.2. The rating of all heat exchanger is set to 70 kW by default. If the rating of one or more heat exchangers is to be changed, proceed as follows:

Service
Language
Anlage konfigurieren
Wärmetauscher 1
Wärmetauscher 2
Wärmetauscher 3
Heizkreis 1
Zurück

↓ Select required heat exchanger (Wärmetauscher 1-3).

Wärmetauscher 1	
Nennleistung	70kW
Regelkreis	3-Punkt
Freigabe	EIN
Zurück	

✳ Activate the editing mode for 'Wärmetauscher x'
Display: Wärmetauscher x (Heat exchanger x)
The menu item 'Nennleistung' (Rating) is highlighted.

✳ Activate the editing mode for rating.

↓ Set the required rating.

✳ Confirm setting.

After configuring the system, exit the menu step-by-step and return to the start screen:

↓ Select 'Zurück' (Back).

✳ Exit overview menu.
Display: Start screen

3 System

Systems Anl 1.x have two heat exchangers, where as system Anl 2.x have three heat exchangers.

The controller is used to control the sequence of one system with two or three heat exchangers.

The heat exchangers run, depending on the configuration, in parallel, in direct sequence or with automatic lag/lead sequence change (based on time, outdoor temperature or capacity). In weather-compensated control, an outdoor sensor (AF) is additionally required. All heat exchangers have a return flow sensor (RüF) on the primary side for return flow temperature limitation as well as a flow sensor (VF) on the secondary side. The control is based on cascade control. In this case, each heat exchanger uses its own flow sensor VF1, VF2 or VF3 for control. The set point is determined by the overall flow sensor VFg. Depending on the heat exchanger, a control valve (continuous or three-step), a circulation pump (Pu) and a shut-off valve (Kl) are included in the control. Heat exchangers that are not in operation are shut off hydraulically by the shut-off valve (Kl1, Kl2 or Kl3). As soon as a heat exchanger starts running after the time in *Min. deactivation time* has elapsed, the shut-off valve opens. After the time in *Shut-off valve transit time* has elapsed, the corresponding circulation pump (Pu1, Pu2 or Pu3) starts running, the control valve is opened and closed-loop control is activated.
If a heat exchanger stops running after the time in *Min. activation time* has elapsed, the shut-off valve first closes after the control valve closes and after the time in *Pump lag time* elapses. The shut-off valves are controlled using a continuous OPEN or CLOSE signal.

Note: *The pump lag time is immediately ended when the supply flow falls below the limit.*

[Übersicht > Parameter > Wärmetauscher 1…3]

Parameters	WE	Adjustment range
Einschaltzeit min (min. activation time)	0 min	0 to 90 min
Ausschaltzeit min (min. deactivation time)	0 min	0 to 90 min
Klappenlaufzeit (shut-off valve transit time)	3 min	0 to 300 min

[Übersicht > Parameter > Allgemein]

Parameters	WE	Adjustment range
Pumpennachlaufzeit (pump lag time)	5 min	0 to 90 min
Vorlaufgrenzwert (supply flow limit)	55 °C	20 to 120 °C

4 Functions of the heat exchanger

4.1 Parallel operation

This function leads to all boilers working constantly in parallel (**no lag/lead sequence control**). The boilers start operating one after the other, taking into account the programmed time schedules: *Min. deactivation time* and *Sequence delay* as well as taking into account *Temperature to enable lag/lead sequence*.

[Übersicht > Parameter > Allgemein > Folgebetrieb]

Parameters	WE	Adjustment range
Folge (sequence) = parallel	Depending on outdoor temp.	Outdoor temperature dependent, unrestricted, parallel
Folgefreigabetemp. (temperature to enable lag/lead sequence)	12 °C	–40 to 50 °C
Folgeverzögerung (sequenc delay)	10 min	0 to 90 min

[Übersicht > Parameter > Wärmetauscher 1…3]

Parameters	WE	Adjustment range
Ausschaltzeit min (min. deactivation time)	0 min	0 to 90 min

4.2 Lag/lead sequence control

The heat exchangers are enabled depending on the configuration:

- **Enabled = EIN (on)**
  The heat exchanger is only enabled by the heat exchanger enabling function (see section 1.5.1).

Enabled = BI (binary input)
The heat exchanger is only enabled if it is not locked by the heat exchanger enabling function (see section 1.5.1) and when its binary input is closed:
– UE 17 of the PLC for heat exchanger WT1
– UE 16 of the PLC for heat exchanger WT2
– BE5 at the ModBus I/O (1402-0328O (4) for heat exchanger WT3

[Übersicht > Service > Wärmetauscher 1…3]
This menu can only be activated after the application key number has been entered!

Parameter	WE	Adjustment range
Freigabe (Enabling)	EIN	EIN (on), BE (binary input)

4.2.1 Unrestricted sequence

If the flow temperature does not reach the target temperature (set point), the lead heat exchanger is activated. If the output entered in *ON switching point* is not reached to increase the flow temperature to the set point, the lag heat exchanger is activated. It supplies the remaining energy required to heat the flow temperature.

The lag heat exchanger first stops running when the total of the modulation of all the heat exchangers is smaller than the *OFF switching point* parameter.

[Übersicht > Parameter > Allgemein > Folgebetrieb]

Parameter	WE	Adjustment range
Folge (sequence) = uneingeschränkt (unrestricted)	Outdoor temperature dependent	Outdoor temperature dependent, unrestricted, parallel
EIN-Schaltpunkt (ON switching point)	90 %	0 to 100 %
AUS-Schaltpunkt (OFF switching point)	40 %	0 to 100 %

4.2.2 Outdoor-temperature-dependent sequence

The heat exchangers are enabled depending on the outdoor temperature. Above the *Temperature for enabling the sequence*, **only** the lead heat exchanger is enabled. The *Temperature for enabling the sequence* parameter must be adapted to meet the energy demand and possible output of the lead heat exchanger. A higher energy demand must be able to be achieved by longer operating times of the lead heat exchanger without loss of comfort.

This configuration prevents the start-up of the lag heat exchanger when it is foreseeable that the output of the lead heat exchanger is sufficient.

[Übersicht > Parameter > Allgemein > Folgebetrieb]

Parameter	WE	Adjustment range
Folge (sequence) = Außentemp.-abhängig (outdoor temperature dependent)	Outdoor temperature dependent	Outdoor temperature dependent, unrestricted, parallel
Folgefreigabetemp. (temperature for enabling the sequence)	12 °C	–40 to 50 °C

4.2.3 Sequence lock over the binary input

The binary input UE11 is used to lock the sequence. The input of the outdoor temperature is determined by the binary input. The outdoor sensor is not required.

[Übersicht > Parameter > Allgemein > Folgebetrieb]

Parameter	WE	Adjustment range
Folge (sequence) = Außentemp.-abhängig (outdoor temperature dependent)	Outdoor temperature dependent	Outdoor temperature dependent, unrestricted, parallel

4.2.4 Sequence delay

If the energy of one heat exchanger is insufficent to heat the flow temperature to the required set point, the next heat exchanger is first switched on when required after the time in *Sequence delay* has elapsed. This prevents the brief operation of a heat exchanger.

[Übersicht > Parameter > Allgemein > Folgebetrieb]

Parameter	WE	Adjustment range
Folgeverzögerung (sequence delay)	10 min	0 to 90 min

4.3 Change in lag/lead sequence

The lag/lead sequence can be changed depending on the outdoor temperature, operating hours or output capacity. The change in lag/lead sequence is only effective when the setting 'Führungstauscher' (lead heat exchanger) is set to 'Auto'. See section 1.5.

4.3.1 Outdoor-temperature-dependent change

The outdoor-temperature-dependent change in lag/lead sequence is only appropriate when heat exchangers with varying output capacities are used.
The lead heat exchanger is determined by the *Reverse sequence limit ta* parameter. When outdoor temperatures are above this limit, the smaller heat exchanger leads. Whereas when the outdoor temperatures are below the limit, the larger heat exchanger leads.
To prevent a lag/lead sequence change when the outdoor temperature fluctuates briefly, the mean outdoor temperature is calculated over three days.

Example:

	Rating$_{WT1}$ = 20 kW	**Rating$_{WT2}$ = 50 kW**	**Rating$_{WT3}$ = 60 kW**
Outdoor temperature < *Folgeumkehr-GW ta* (*reverse sequence limit ta)*	Lead		
Outdoor temperature > *Folgeumkehr-GW ta* (*reverse sequence limit ta)*			Lead

[Übersicht > Parameter > Allgemein > Folgebetrieb]

Parameters	**WE**	**Adjustment range**
Führungswechsel (sequence change) = Außentemp. (outdoor temp.)	AUS	Outdoor temp., rating, operating hours, OFF
Folgeumkehr-GW ta (reverse sequence limit ta*)*	15 °C	–40 to 50 °C

4.3.2 Capacity-dependent change

The lead heat exchanger is the heat exchanger which had the lowest average output capacity over the past three days.

[Übersicht > Parameter > Allgemein > Folgebetrieb]

Parameter	WE	Adjustment range
Führungswechsel (sequence change) = Leistung (rating)	AUS	Outdoor temp., rating, operating hours, OFF

4.3.3 Operating hours-dependent change

The *Time interval for lag/lead sequence change* parameter determines after how many operating hours a sequence change can take place.

Parameter	WE	Adjustment range
Führungswechsel (sequence change) = Betreib-Std (operating hours)	AUS	Outdoor temp., rating, operating hours, OFF
Folgeumkehr-Intervall (time interval for lag/lead sequence change)	168 h	1 to 999 h

4.4 Smooth start-up

The **smooth start-up** function prevents the lead heat exchanger from overheating in problematic systems by reducing the lead heat exchanger to 50 % (control output) before activating the lag heat exchanger.

Parameter	WE	Adjustment range
Sanftanlauf (smooth start-up) = EIN (on)	AUS	EIN (on), AUS (off)
Folgeumkehr-Intervall (time interval for lag/lead sequence change)	168 h	1 to 999 h

4.5 Time schedule

Two times-of-use can be programmed for each day of the week.
The times-of-use can be entered individually for each day of the week or together for all days of the week (Monday to Sunday).

Note: *The programming of times-of-use and public holidays are described in detail in section 1.7.*

Systems without consumers on the secondary side
[Übersicht > Parameter > Allgemein > Zeitprogramme]

Systems with consumers on the secondary side
[Übersicht > Parameter > Heizkreis 1…3]

Parameter	WE	Adjustment range
Nutzungszeiten (times-of-use)	7:00 to 22:00	As required

5 Functions of the heating circuit

The following function descriptions are based on systems with heating circuits on the secondary side. Refer to section 2.1.

5.1 Weather-compensated control

When weather-compensated control is used, the flow temperature is controlled according to the outdoor temperature. The heating characteristic in the controller defines the flow temperature set point as a function of the outdoor temperature (–> Fig. 1).

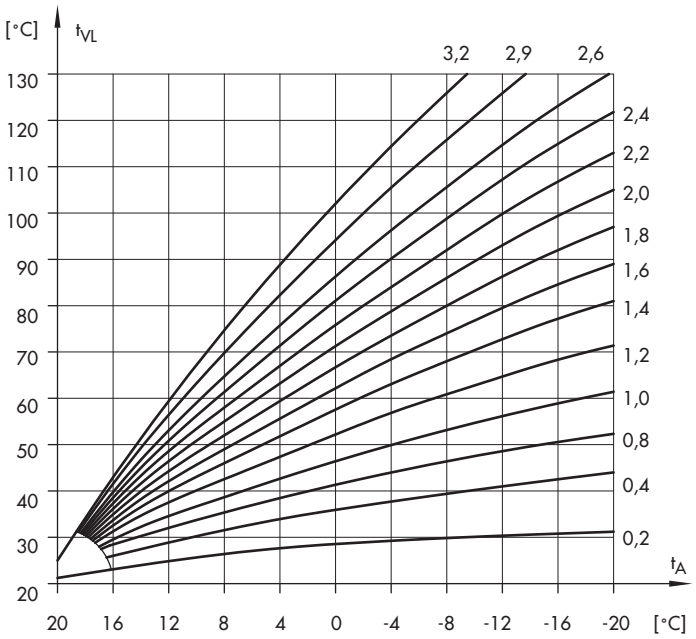


Fig. 1 Gradient characteristics

5.1.1 Gradient characteristic

Basically, the following rule applies: a decrease in the outdoor temperature causes the flow temperature to increase.
By varying the parameters *Gradient* and *Level*, you can adapt the characteristic to your individual requirements: An increased *Gradient* causes the flow temperature to increase; a lower *Gradient* causes a lower flow temperature. The *Level* parameter shifts the heating characteristic parallely up or down. Outside the times-of-use, reduced set points are used for control:
Reduced flow set point = Flow set point – *Set-back difference*
The *Max. flow temperature* and *Min. flow temperature* parameters mark the upper and lower limits of the flow temperature.

Examples for adjusting the characteristic:

- Old building, radiator design 90/70: Gradient approx. 1.8
- New building, radiator design 70/55: Gradient approx. 1.4
- New building, radiator design 55/45: Gradient approx. 1.0
- Underfloor heating depending on arrangement: Gradient smaller than 0.5

[Übersicht > Service > Heizkreis 1…3]
This menu can only be selected after the application key number has been entered!

Parameter	WE	Adjustment range
Kennlinienart (type of characteristic) = Steigung (gradient)	Steigung	Four-point, gradient, fixed set point

[Übersicht > Parameter > Heizkreis 1…3]

Parameter	WE	Adjustment range
Steigung (gradient)	1.8	0.4 to 3.2
Niveau (level)	0 °C	–30 to 30 °C
Absenkdifferenz (set-back difference)	15 °C	0 to 30 °C
Vorlauftemp. max. (max. flow temperature)	90 °C	20 to 120 °C
Vorlauftemp. min. (min. flow temperature)	20 °C	20 to 120 °C

5.1.2 Four-point characteristic

The four-point characteristic allows you to define your own heating characteristic.
The four-point characteristic is defined by four points for *Outdoor temperature* and for *Flow temperature*. The set-back difference is entered for points 1 and 2 as well as points 3 and 4. This results in the dashed line in Fig. 2.

The *Max. flow temperature* and *Min. flow temperature* parameters mark the upper and lower limits of the flow temperature.

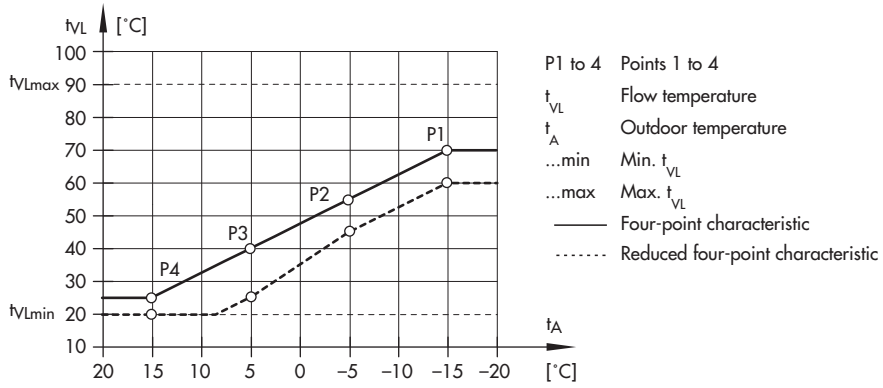


Fig. 2 · Four-point characteristic

[Übersicht > Service > Heizkreis 1…3]
This menu can only be selected after the application key number has been entered!

Parameter	WE	Adjustment range
Kennlinienart (type of characteristic) = 4-Punkte (four-point)	Steigung	Four-point, gradient, fixed set point

[Übersicht > Parameter > Heizkreis 1…3 > Kennlinie]

Parameters	WE	Adjustment range
Außentemp. Punkt1 (outdoor temp. for point 1)	–10 °C	–20 to 50 °C
Vorlauftemp. Punkt1 (flow temp. for point 1)	90 °C	20 to 160 °C

Parameters	WE	Adjustment range
Außentemp. Punkt2 (outdoor temp. for point 2)	–5 °C	–20 to 50 °C
Vorlauftemp. Punkt2 (flow temp. for point 2)	80 °C	20 to 160 °C
Absenkdiff. Punkt2 (set-back difference for point 2)	15 °C	0 to 30 °C
Außentemp. Punkt3 (outdoor temp. for point 3)	5 °C	–20 to 50 °C
Vorlauftemp. Punkt3 (flow temp. for point 3)	68 °C	20 to 160 °C
Absenkdiff. Punkt3 (set-back difference for point 4)	20 °C	0 to 30 °C
Außentemp. Punkt4 (outdoor temp. for point 4)	10 °C	–20 to 50 °C
Vorlauftemp. Punkt4 (flow temp. for point 4)	50 °C	20 to 160 °C
Vorlauftemp. max. (max. flow temperature)	90 °C	20 to 120 °C
Vorlauftemp. min. (min. flow temperature)	20 °C	20 to 120 °C

5.1.3 Fixed set point control

The flow temperature can be regulated to a fixed set point during the times-of-use. Outside the times-of-use, this set point is reduced by the amount in *Set-back difference*.

Note: *The outdoor temperature has no effect on the closed-loop control.*

[Übersicht > Service > Heizkreis 1…3]
This menu can only be selected after the application key number has been entered!

Parameter	WE	Adjustment range
Kennlinienart (type of characteristic) = Festwert (fixed set point)	Steigung	Four-point, gradient, fixed set point

Systems without consumers on the secondary side
[Übersicht > Parameter > Allgemein]

Systems with consumers on the secondary side
[Übersicht > Parameter > Heizkreis 1…3]

Parameters	WE	Adjustment range
Vorlauftemp.-Sollwert (flow temperature set point)	70 °C	20 to 160 °C
Absenkdifferenz (set-back difference)	15 °C	0 to 30 °C

6 Functions of DHW heating

6.1 DHW heating in the storage tank system

Operation with a storage tank sensor SF1 (BE3 to ModBus I/O 1402-0328 (3))
The controller begins charging the storage tank when the water temperature measured at sensor SF1 falls below *Min. storage tank*. The storage tank charging finishes when the water temperature measured at the sensor SF1 has reached the limit in *Max. storage tank*.
The *Flow temperature set point* defines the set point at the flow sensor VFg.

Operation with two storage tank sensors SF1 (BE3 to ModBus I/O 1402-0328 (3)) and SF2 (BE4 an ModBus I/O 1402-0328 (3))
The controller begins charging the storage tank when the water temperature measured at sensor SF1 falls below *Min. storage tank*. The storage tank charging finishes when the water temperature measured at the sensor SF2 has reached the limit in *Max. storage tank*.
The *Flow temperature set point* defines the set point at the flow sensor VFg.

Operation with storage tank thermostat (BE3 to ModBus I/O 1402-0328 (3))
The storage tank thermostat is connected at SF1 and switches the storage tank charging on and off. The *Flow temperature set point* must still be defined.

[Übersicht > Parameter > Warmwasserbereitung]

Parameters	WE	Adjustment range
Vorlauftemp.-Sollwert (flow temperature set point)	65 °C	20 to 120 °C
Speicher min (min. storage tank)	40 °C	20 to 90 °C
Speicher max (max. storage tank)	45 °C	20 to 90 °C

6.1.1 Priority operation

In many systems, the allotted amount of water cannot meet DHW heating and heating operation demands when they are required at the same time. As a result, the capacity required for DHW heating needs to be taken from the heating system when great heating loads occur; and this, until DHW heating has been concluded. For this purpose, the DHW heating can be given priority by the set-back operation function. This is achieved by monitoring the temperature at storage tank sensor SF1.

[Übersicht > Parameter > Warmwasserbereitung]

Parameter	WE	Adjustment range
Vorrangschaltung (priority operation) = EIN (on)	AUS	AUS (off), EIN (on)

6.2 Thermal disinfection

In all systems with DHW heating, the DHW storage tank is thermally disinfected on a selected day of the week or every day. The storage tank is heated up to the adjusted *Disinfection temperature*. The load set point is always 5 °C higher than the disinfection temperature. The process starts at the beginning of the time-of-use and ends at the lastest when the time-of-use ends.
Thermal disinfection for preventing legionella infection causes:

- excessively high return flow temperatures during the disinfection cycle (return flow temperature limitation suspended)
- excessively high storage temperatures after thermal disinfection has been concluded,
- lime scale (possibly), which can have a negative effect on heat exchanger performance.

Note: *The programming of the times-of-use is described in detail in section 1.7.*

[Übersicht > Parameter > Warmwasserbereitung]

Parameter	WE	Adjustment range
Desinfektionstemperatur (disinfection temperature)	70 °C	50 to 80 °C
NZ therm. Desinfektion (times-of-use for thermal disinfection)	7:00 to 22:00	As required

6.3 External demand for DHW

This function causes the controller to switch to DHW demand when the binary input WWA (UE2) is closed. If an external demand for DHW and thermal disinfection occur at the same time, thermal disinfection has priority.

[Übersicht > Parameter > Warmwasserbereitung]

Parameter	WE	Adjustment range
Vorlauftemp.-Sollwert (flow temp. set point)	65 °C	20 to 120 °C

6.4 Time schedules

Two times-of-use can be programmed for each day of the week.
The times-of-use can be entered individually for each day of the week or together for all days of the week (Monday to Sunday).

Note: *The programming of times-of-use and public holidays are described in detail in section 1.7.*

[Übersicht > Parameter > Warmwasserbereitung]

Parameter	WE	Adjustment range
Nutzungszeiten (times-of-use)	7:00 to 22:00	As required

7 General functions

7.1 Outdoor-temperature-dependent deactivation

The controllers switches to the stand-by mode when the outdoor temperature exceeds the *Temperature-dependent limit for summer mode* parameter. When the outdoor temperature falls below the limit, heating starts again. This function is activated by default.

[Übersicht > Parameter > Allgemein > Sommerbetrieb]

Parameter	WE	Adjustment range
ta-GW unm. Sommerbetri (temperature-dependent limit for summer mode)	22 °C	0 to 50 °C

Note: *The outdoor-temperature-dependent deactivation works separately from the summer mode function.*

7.2 Summer mode

Summer mode is activated depending on the mean daytime temperature (measured between 7.00h and 22.00h) during the desired period. If the mean daytime temperature exceeds the *Outdoor temperature limit* on two successive days within the active time period, summer mode is activated on the following day.

If the mean daytime temperature remains below the *Outdoor temperature limit* on one day, summer mode is deactivated on the following day.

[Übersicht > Parameter > Allgemien > Sommerbetrieb]

Parameters	WE	Adjustment range
Zeitraum (time period)	01.06 to 30.09	As required
Außentemp. Grenzwert (outdoor temperature limit)	18 °C	0 to 40 °C

7.3 Forced operation of the pumps

When the pumps (Pu1, Pu2, Pu3 and Pu4) have not been activated for 24 hours, forced operation of the pumps is started between 12:00 and 12:01 h. The storage tank charging pump SLP is started between 12:01 and 12:02 h.

7.4 Flow temperature limitation

The flow temperature limitation is performed separately for each heat exchanger.
If the temperature at the flow sensor VF1, VF2 or VF3 exceeds the maximum flow temperature, the corresponding heat exchanger is limited to the *Max. flow temperature*.

[Übersicht > Parameter > Wärmetauscher 1…3]

Parameters	WE	Adjustment range
Vorlauftemp. max (max. flow temperature)	90 °C	20 to 120 °C
Vorlauftemp. min (min. flow temperature)	20 °C	20 to 120 °C

Note: *The controller does not replace the function of a safety temperature limiter.*

7.5 Return flow temperature limitation

The return flow temperature limitation is performed separately for each heat exchanger.
If the temperature at the return flow sensor RüF1, RüF2 or RüF3 exceeds the maximum permissible temperature, the output of the corresponding heat exchanger 1, 2 or 3 is restrained while the other heat exchangers continue to work normally. In firmware version 1.50 and higher, the restraint is determined by the *Return flow limitation* factor (P algorithm).

Note:
- *The current return flow temperature set points, even for restrained heat exchangers, can be read in the set point menu [Übersicht > Sollwerte].*
- *Using weather-compensated control with gradient characteristic, the return flow temperature is limited to a fixed value by equating the* Return flow temperature foot *and* Max. return flow temperature *parameters.*

[Übersicht > Parameter > Allgemein]

Parameters	WE	Adjustment range
Rücklauftemp. max (max. return flow temperature)	65 °C	20 to 120 °C
Rücklaufbegrenzung (mit P-Algorithmus) (return flow limitation with P algorithm)	0.1	0.1 to 2.0
Steigung, Rücklauf (gradient, return flow)	1.2	0.2 to 3.2
Niveau, Rücklauf (level, return flow)	0.0 °C	–30 to 30 °C
Fußpunkt Rücklauftemperatur (return flow temperature foot)	65 °C	5 to 90 °C

The return flow temperature can also be monitored by a thermostat. The input of the return flow sensor is defined as the binary input:
– UE9 of the controller for RüF1 (heat exchanger WT1)
– UE8 of the controller for RüF2 (heat exchanger WT2)
– UE1 of the controller for RüF3 (heat exchanger WT3)

Note: *To be able to keep to the defined return flow temperature limit, make sure that the heating characteristic is not selected too steep and the speed of the circulation pumps is not too high.*

7.6 Condensate accumulation control

To start up condensate accumulation plants, in particular to avoid problematic excess temperature, the condensate accumulation control can be activated by setting an attenuation intensity (between 2 and 10 °C). The controller response to set point deviations which cause the primary valve to open is attenuated. The controller response to set point deviations which cause the control valve to close remains unaffected.

[Übersicht > Parameter > Allgemein]

Parameter	WE	Adjustment range
Begrenzung Xw Auf (°C) (limit Xw OPEN)	AUS	AUS (off), 2 to 10 °C

7.7 Three-step control

The control algorithm is adjusted separately for the control valves Rk1 to Rk3 of the heat exchangers and for the heating circuit mixing valves HK1 to HK3.

The flow temperature can be controlled using a PI algorithm. The valve reacts to pulses that the controller sends when a system deviation occurs. The length of the first pulse, in particular, depends on the extent of the system deviation and the selected *Proportional gain* K_P (the pulse length increases as K_P increases). The pulse and pause lengths change continuously until the system deviation has been eliminated. The pause length between the single pulses is greatly influenced by the *Reset time* T_N (the pause length increases as T_N increases).
The *Transit time* T_Y specifies the time required by the valve to travel through the range of 0 to 100 %.

Heat exchanger control circuit Rk1 to Rk3

The control valves are connected to the binary outputs listed below:
- BA3 and BA4 of the controller for heat exchanger control circuit Rk1
- BA5 and BA6 of the controller for heat exchanger control circuit Rk2
- BA1 and BA2 at ModBus I/O 1402-0328 (4) for heat exchanger control circuit Rk3

Note: *Alternative assignment is shown in section 8.1.*

[Übersicht > Service > Wärmetauscher 1…3]
This menu can only be selected after the application key number has been entered!

Parameter	WE	Adjustment range
Regelkreis (control circuit) = 3-Punkt (three-step)	3-Punkt	Continuous, three-step

[Übersicht > Parameter > Wärmetauscher 1…3]

Parameters	WE	Adjustment range
Kp	1.0	0.1 to 99.9
Tn	30 s	0 to 999 s
Ty	45 s	15 to 600 s

Heating circuits HK1 to HK3

The control valves are connected to the binary outputs listed below:
- BA1 and BA2 to ModBus I/O 1402-0328 (1) for heating circuit HK1

- BA1 and BA2 to ModBus I/O 1402-0328 (2) for heating circuit HK2
- BA1 and BA2 to ModBus I/O 1402-0328 (3) for heating circuit HK3

[Übersicht > Service > Heizkreis 1…3]
This menu can only be selected after the application key number has been entered!

Parameter	WE	Adjustment range
Regelkreis (control circuit) = 3-Punkt (three-step)	3-Punkt	Continuous, three-step

[Übersicht > Parameter > Heizkreis 1…3]

Parameters	WE	Adjustment range
Kp	6.0	0.1 to 99.9
Tn	120 s	0 to 999 s
Ty	120 s	5 to 600 s

7.8 Continuous control

The control algorithm is adjusted separately for the control valves Rk1 to Rk3 of the heat exchangers and for the heating circuit mixing valves HK1 to HK3.

The flow temperature can be controlled using a PID algorithm. The valve receives an analog 0 to 10 V signal. When a system deviation occurs, the proportional component immediately causes the 0 to 10 V signal to change (the greater K_P, the greater the change). The integral components becomes effective with time: T_N represents the time which elapses until the integral component has changed the output signal to the same extent as the immediate change performed by the proportional component (the greater T_N, the slower the rate of change). Due to the derivative component, any change of the system deviation is incorporated into the output signal with a certain gain (the greater T_V, the stronger the change).

Heat exchanger control circuit Rk1 to Rk3

The continuous signal is issued by the following binary outputs:
- AA1 of the controller for heat exchanger control circuit Rk1
- AA2 of the controller for heat exchanger control circuit Rk2
- AA3 of the controller for heat exchanger control circuit Rk3

[Übersicht > Service > Wärmetauscher 1…3]
This menu can only be selected after the application key number has been entered!

Parameter	WE	Adjustment range
Regelkreis (control circuit) = stetig (continuous)	3-Punkt	Continuous, three-step

[Übersicht > Parameter > Wärmetauscher 1…3]

Parameters	WE	Adjustment range
Kp	1.0	0.1 bis 99.9
Tn	30 s	0 bis 999 s
Tv	0 s	0 bis 999 s
Ty	45 s	15 bis 600 s

Heating circuits HK1 to HK3

The continuous signal is issued by the following binary outputs:
- AA6 at ModBus I/O 1402-0328 (1) for heating circuit HK1
- AA6 at ModBus I/O 1402-0328 (2) for heating circuit HK2
- AA6 at ModBus I/O 1402-0328 (3) for heating circuit HK3

Note: *Alternative assignment is shown in section 8.1.*

[Übersicht > Service > Heizkreis 1…3]
This menu can only be selected after the application key number has been entered!

Parameter	WE	Adjustment range
Regelkreis (control circuit) = stetig (continuous)	3-Punkt	Continuous, three-step

[Übersicht > Parameter > Heizkreis 1…3]

Parameters	WE	Adjustment range
Kp	6.0	0.1 to 99.9
Tn	120 s	0 to 999 s
Tv	0 s	0 to 999 s
Ty	120 s	5 to 600 s

7.9 Processing an external demand

An external set point can be transferred using this function. The set point can be transferred over Modbus and/or over an analog signal at UE2.

The external demand works according to the maximum principle: If the internal set point is larger than the transferred external set point, then the internal set point has priority.

Transfer over Modbus

[Übersicht > Parameter > Allgemein]

Parameter	WE	Adjustment range
St.-Nr. (ext. Bedarf) (st. no. - external demand)	AUS	AUS (off), 5 to 999

Transfer over an analog signal at UE2

0 to 10 V correspond to the range *External demand (0V)* to *External demand (10V)*.

[Übersicht > Parameter > Allgemein]

Parameter	WE	Adjustment range
Externer Bedarf (0V) (external demand)	0 °C	0 to 150 °C
Externer Bedarf (10V) (external demand)	120 °C	0 to 150 °C

Note:

- *The external demand and the external demand for DHW share the input UE2. An analog signal is used for external demand and is switched to the flow temperature set point for the external demand for DHW when a binary signal is applied. Refer to section 6.3.*
- *The* External demand (0V) *and* External demand (10V) *parameters are available in firmware version 1.50 and higher. In the previous firmware versions, the range is fixed to 0 to 10 V which corresponds to 0 to 120 °C.*

7.10 Separate set point

The universal input UE2 is configured automatically as a binary input when the *Separate set point* parameter is activated. When the binary input is activated, the controller uses the separate set point for control. The controller uses the *Set point demand* for closed-loop control.

Note: *When the separate set point is deactivated, the universal input UE2 is configured for the external demand as a 0-10-V input. Refer to section 7.9.*

[Übersicht > Parameter > Allgemein]

Parameters	WE	Adjustment range
Separater Sollwert (separate set point)	AUS	EIN (on), AUS (off)
Sollwert Anf. (set point demand)	65 °C	20 to 120 °C

7.11 Position feedback

When this function is active, the valve position of each control valve is issued as a signal:

- Position feedback SRM1 at UE5 (heat exchanger WT1):
  0 to 10 V or 1 to 2 kΩ
- Position feedback SRM2 at UE4 (heat exchanger WT2):
  0 to 10 V or 1 to 2 kΩ
- Position feedback SRM3 at ModBus I/O 1402-0328 (4), UE2 (heat exchanger WT3):
  0 to 1 kΩ

The exact values must be adjusted on start-up by calibrating the measuring range to the potentiometer installed in the actuator. The controller assigns the bottom end position to the 0 % value and the top end position to the 100 % value.

The analog 0 bis 10 V signal corresponds to the range between 0 and 100 % in a linear manner.

Note:
– *The values for position feedback are changed in the menu of the WT71 application and saved in a non-volatile memory. The values write over the universal input values of the PLC after a power supply failure.*
– *If no position feedback is connected, the issued value is displayed in the system scheme.*

[Übersicht > Service > Wärmetauscher WT1 … WT3]
This menu can only be selected after the application key number has been entered!

Parameters	WE	Adjustment range
SR-Eingang (position feedback input)	1000–2000 Ohm	1000–2000 Ohm/0–10 V
Ventil-Messbereich min (min. valve measuring range)	1000 Ohm	1000 to 2000 Ohm or 0 to 10 V
Ventil-Messbereich max (max. valve measuring range)	2000 Ohm	1000 to 2000 Ohm or 0 to 10 V

7.12 Forwarding the measured outdoor temperature

The controller can forward its measured outdoor temperature to another controller over Modbus.

[Übersicht > Parameter > Allgemein]

Parameter	WE	Adjustment range
Außentemp senden St.-Nr. (send outdoor temp. to st. no.)	AUS	AUS (off), *5* to *255*

Note: *This function is available in firmware version 1.50 and higher.*

7.13 Fail-safe behavior

The heat exchangers stop running immediately after a pump malfunction.

A heat exchanger malfunction causes it to stop running. The shut-off valve closes after the control valve closes and the *Pump lag time* has elapsed. The *Pump lag time* is immediately stop if the supply fall falls below the *Supply flow limit.*

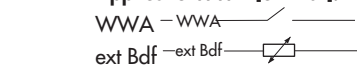
Parameter	WE	Adjustment range
Pumpennachlaufzeit (pump lag time)	*5* min	0 to 90 min
Vorlaufgrenzwert (supply flow limit)	*55* °C	20 to 120 °C

8 Terminal assignment

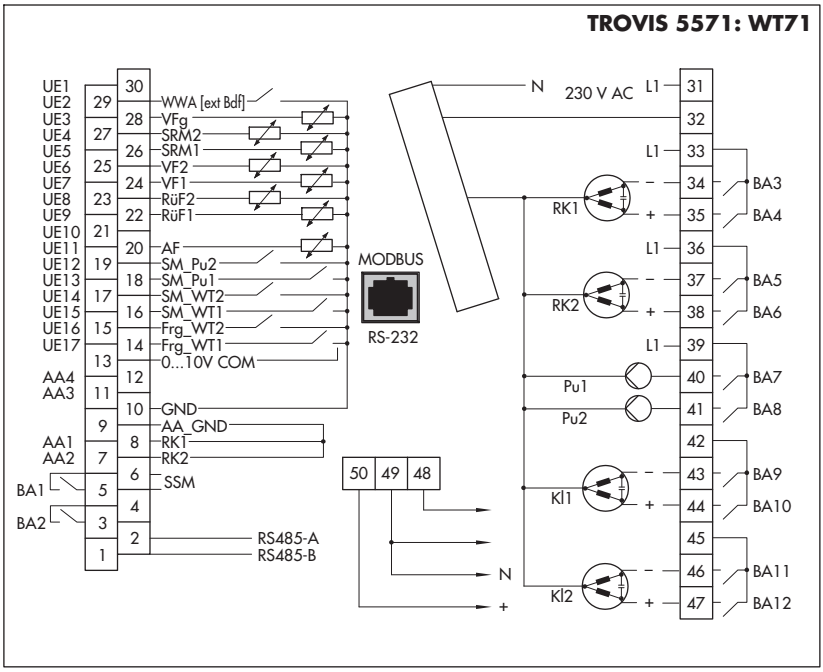
Legend

AA	Analog output (0 to 10 V)
AE	Analog input
BA	Binary output
BE	Binary input
HK	Heating circuit mixing valve
RK	Heat exchanger control valve
Kl	Shut-off valve
Pu	Heat exchanger circulation pump
Pu (HK)	Heating circuit pump
SLP	Storage tank charging pump
AF	Outdoor sensor
RüF1…3	Heat exchanger return flow sensor
RüF4…6	Heating circuit return flow sensor
SF	Storage tank sensor
VF1…3	Heat exchanger flow sensor
VF4…6	Heating circuit flow sensor
VFg	Overall flow sensor
Frg_WT	Heat exchanger enabled
SM_Pu	Pump fault alarm
SM_WT	Heat exchanger fault alarm
SSM	Collective fault alarm
WWA	External set point demands
[ ]	Alternative assignment depending on connections (alternative assignments for continuous-action control circuits RK1, RK2 and RK3 as well as for the continuous-action heating circuit HK1. Refer to section 8.1)

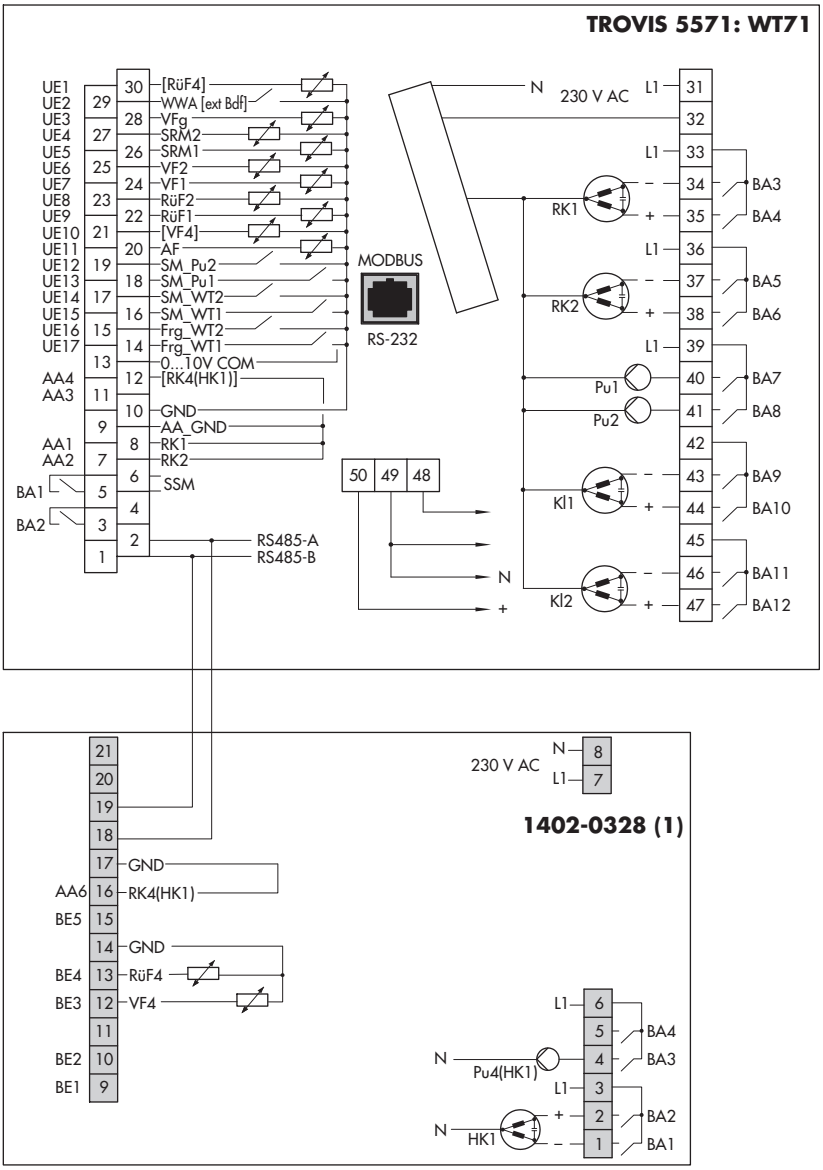
Applies to WWA [ext Bdf]:



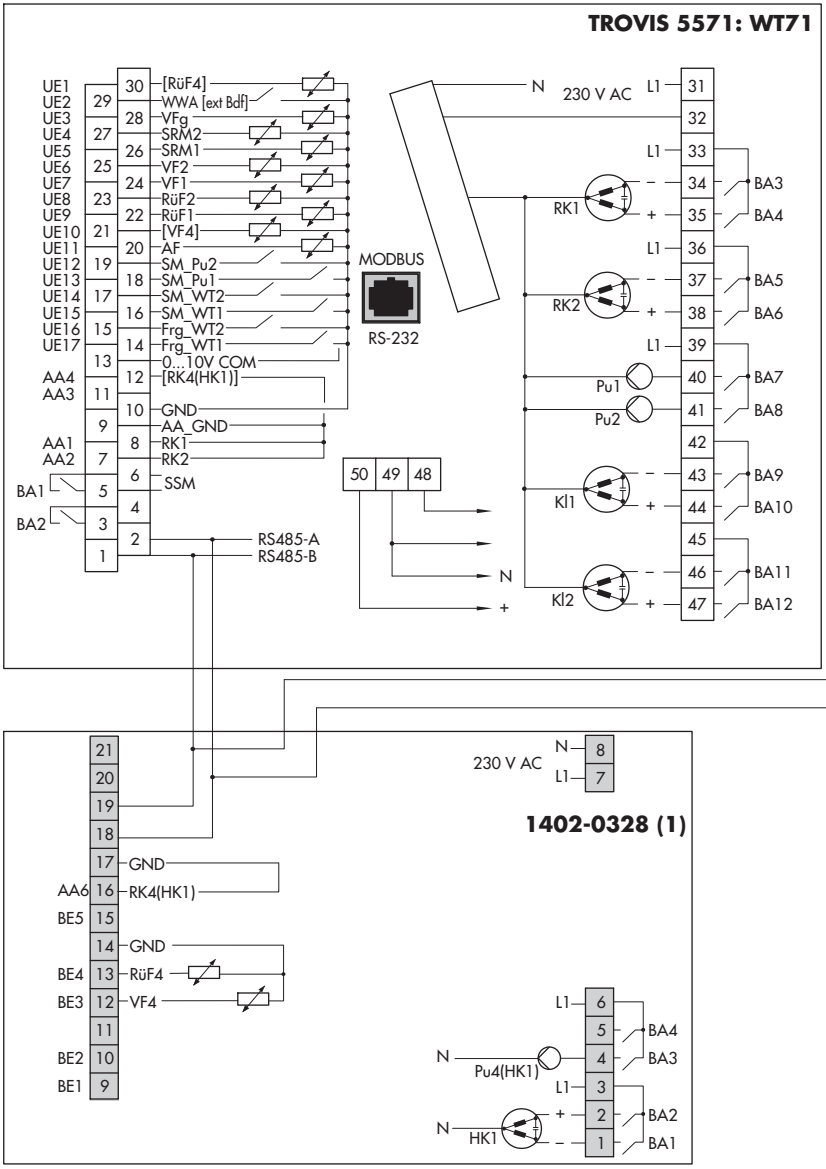
The gray-shaded terminals belong to the ModBus I/O (1402-0328). Refer to the Mounting and Operating Instructions EB 5571 EN for more details.



System Anl 1.0



System Anl 1.1



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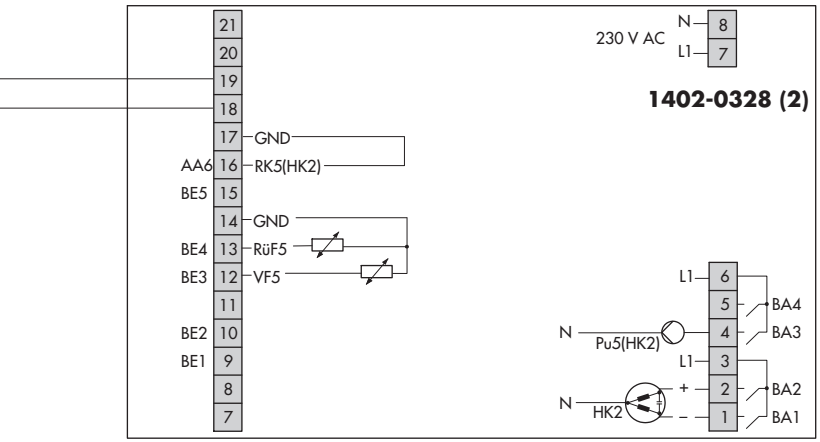
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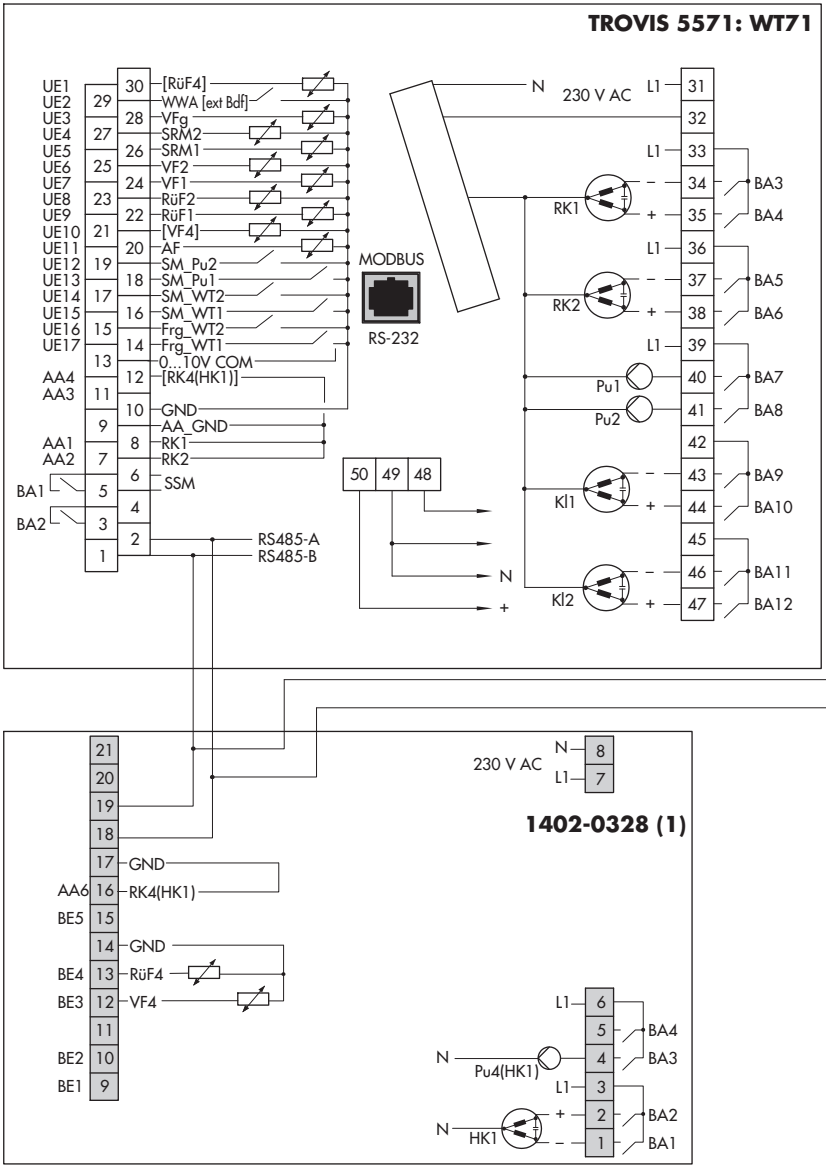
19
18
17
GND
AA6
16
RK5(HK2)
BE5
15
14
GND
BE4
13
RüF5
BE3
12
VF5
11
BE2
10
BE1
9
8
7
230 V AC
N
8
L1
7
1402-0328 (2)
L1
6
5
BA4
N
4
BA3
Pu5(HK2)
L1
3
+
2
BA2
N
HK2
–
1
BA1



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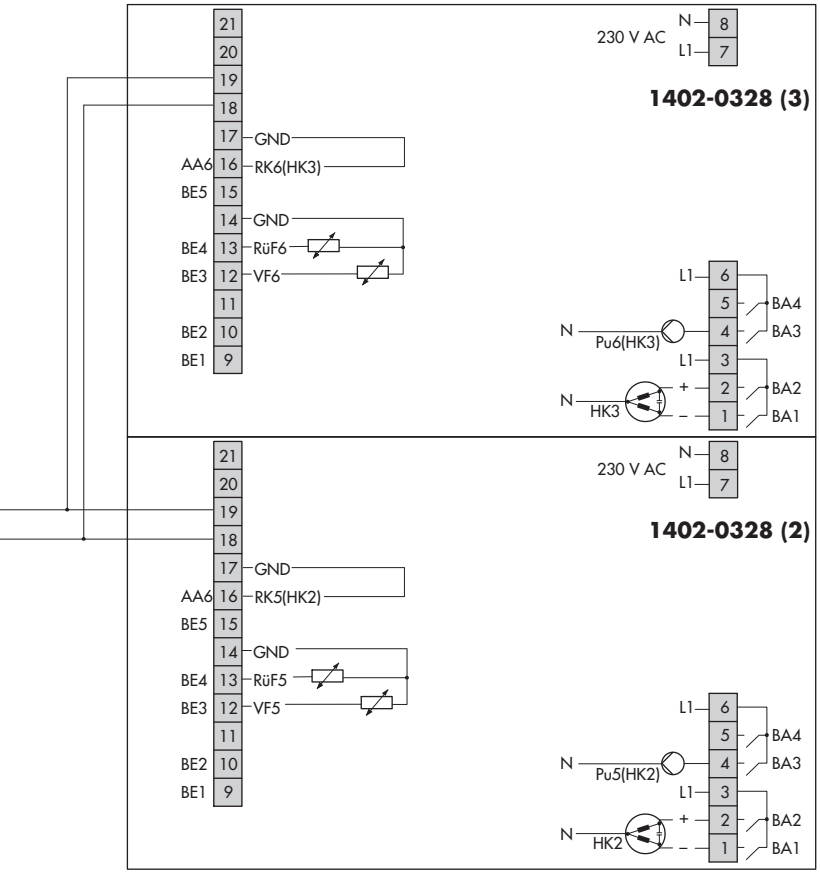
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AA6 16 RK6(HK3)
BE5 15
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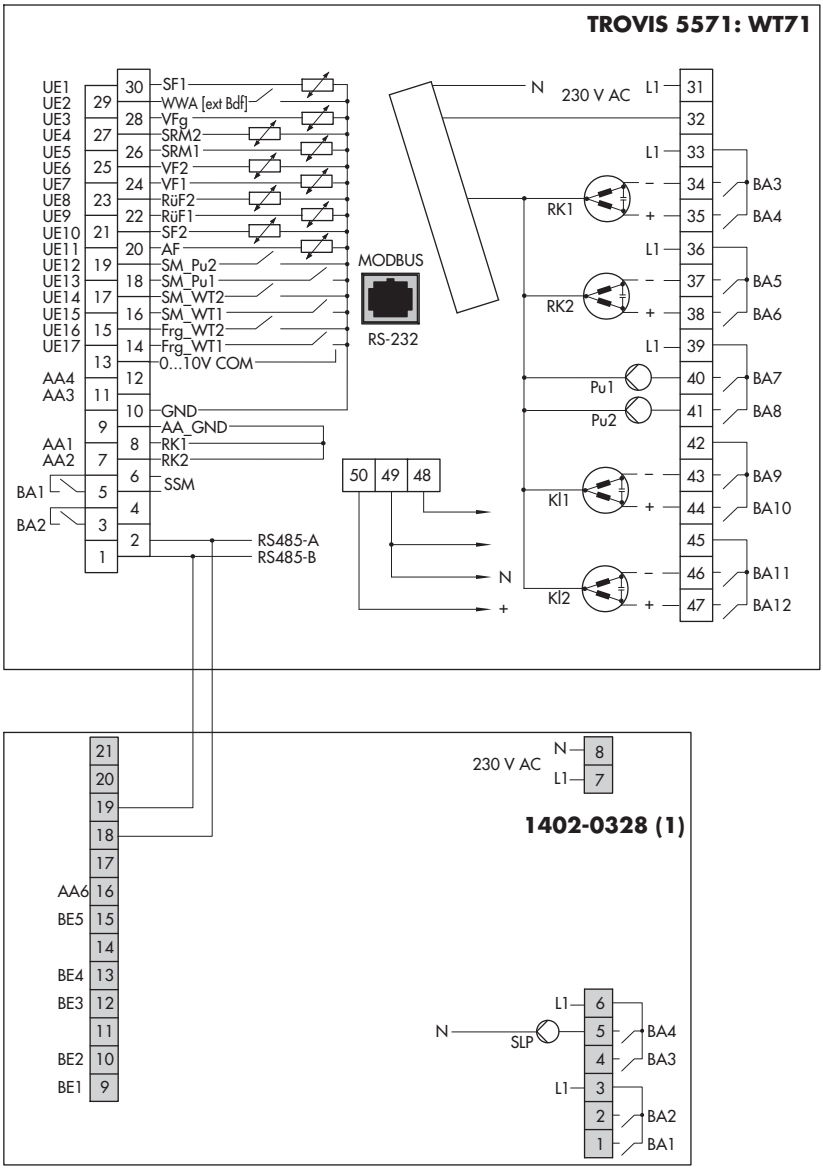
BE3 12 VF6
11
BE2 10
BE1 9
230 V AC
N 8
L1 7
1402-0328 (3)
L1 6
5 BA4
N 4 BA3
Pu6(HK3)
L1 3
+ 2 BA2
N HK3
– 1 BA1
21
20
19
18
17 GND
AA6 16 RK5(HK2)
BE5 15
14 GND
BE4 13 RüF5
BE3 12 VF5
11
BE2 10
BE1 9
230 V AC
N 8
L1 7
1402-0328 (2)
L1 6
5 BA4
N 4 BA3
Pu5(HK2)
L1 3
+ 2 BA2
N HK2
– 1 BA1



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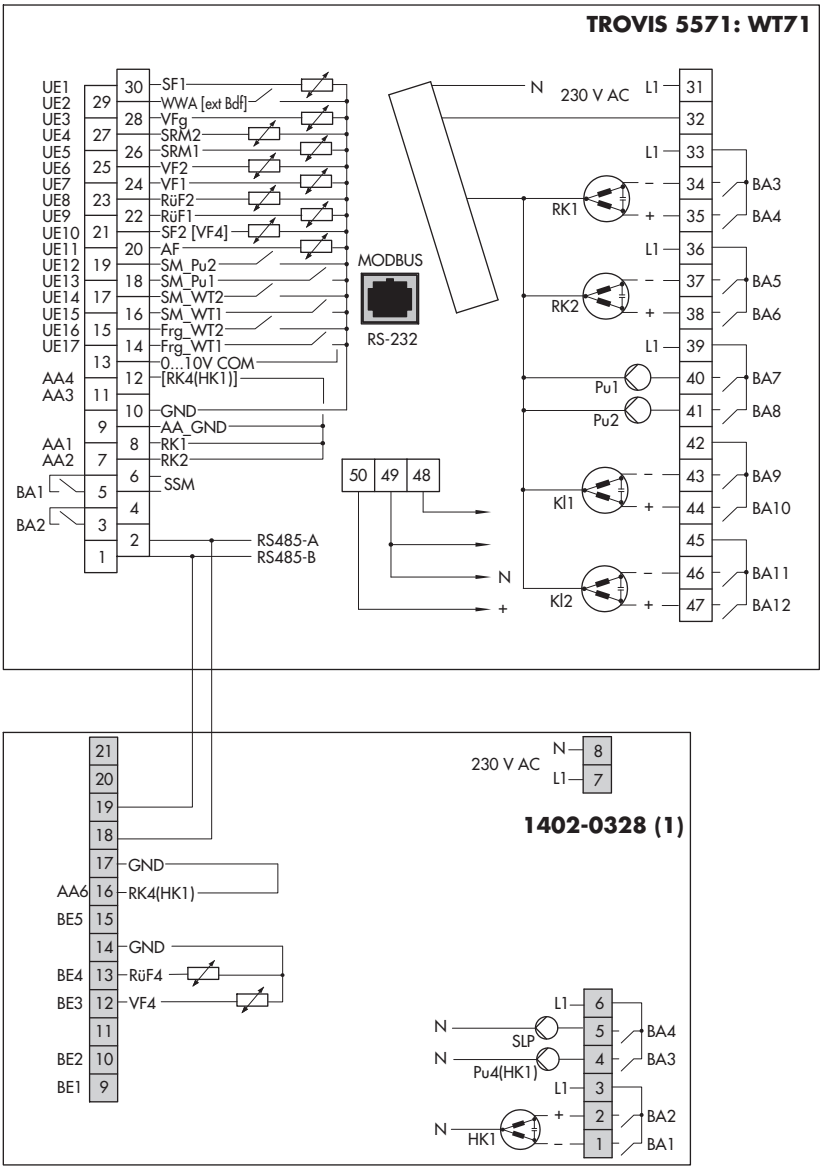

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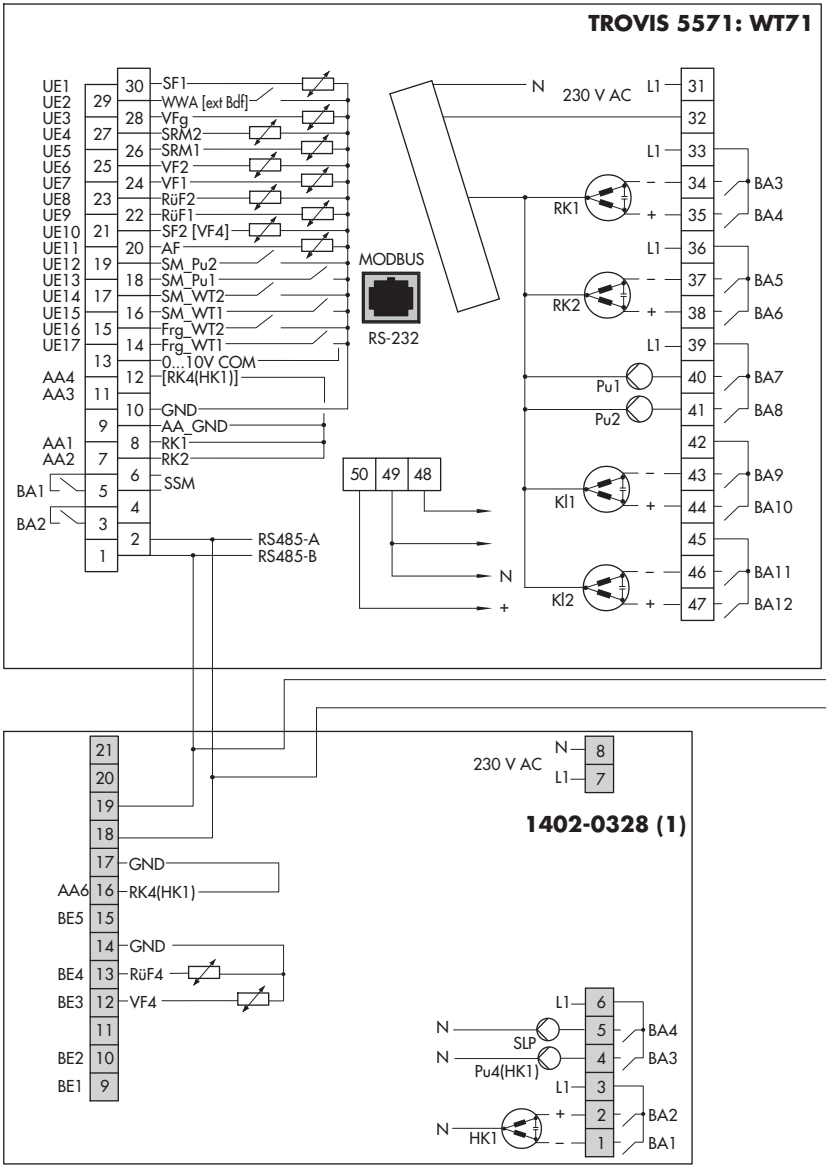

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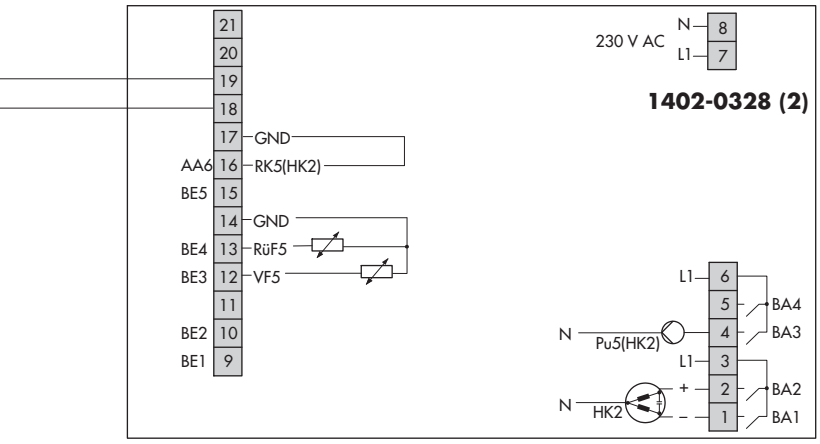
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AA6 16 RK5(HK2)
BE5 15
14 GND
BE4 13 RüF5
BE3 12 VF5
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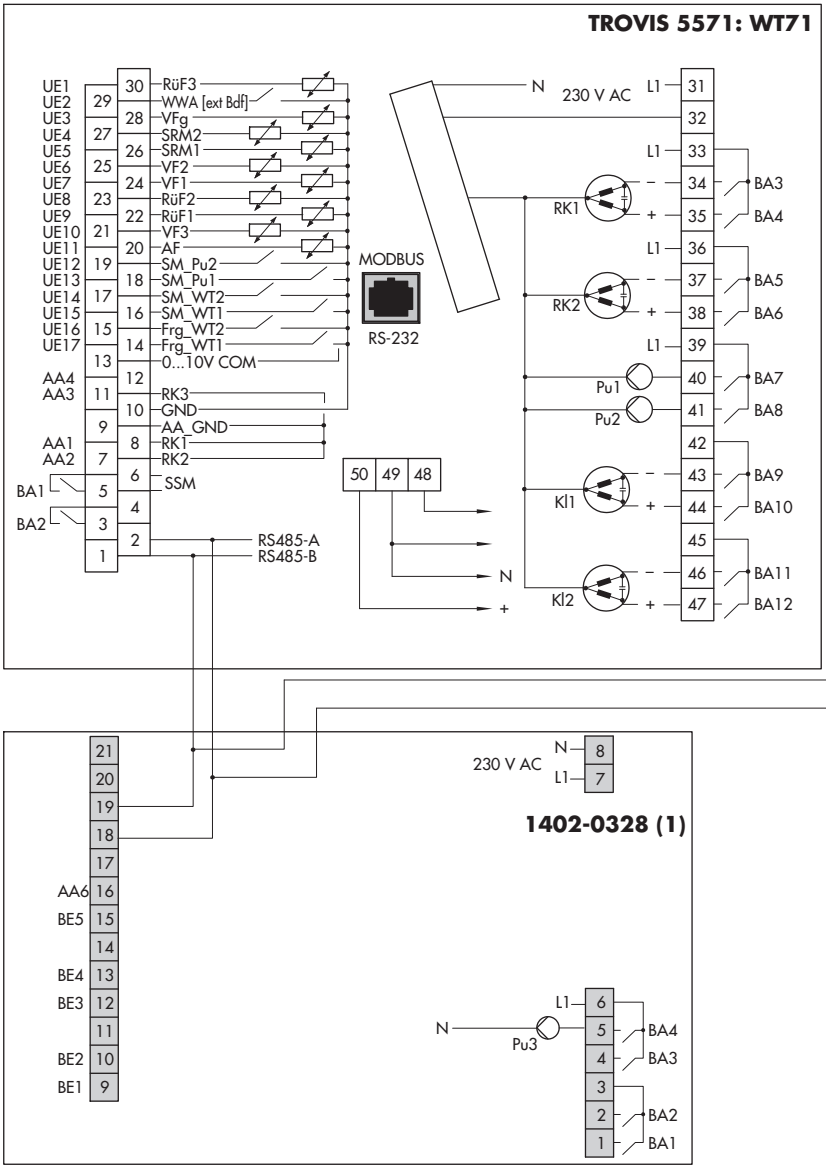
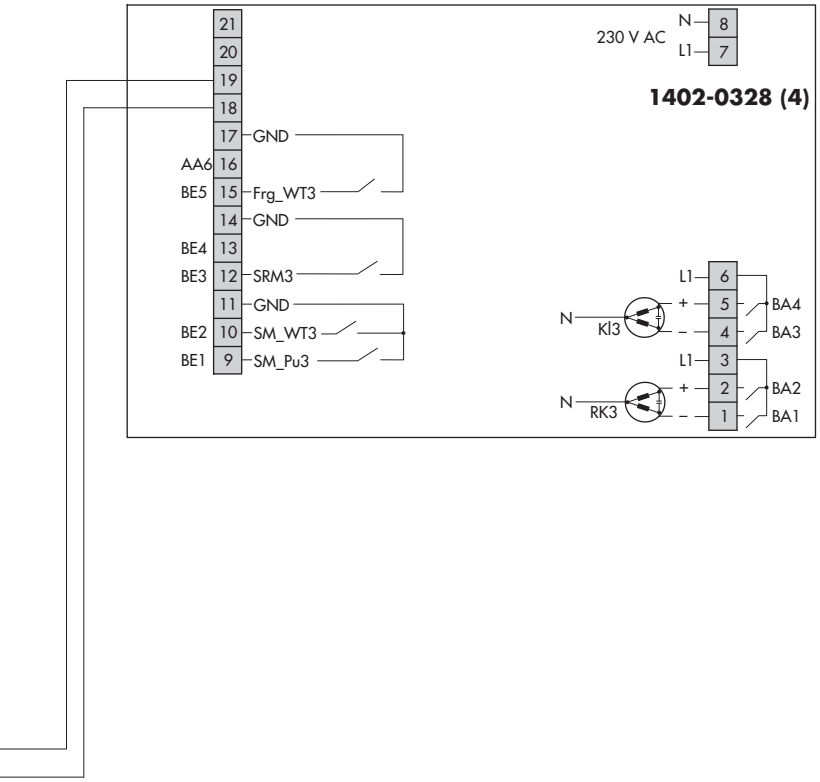
BE2 10
BE1 9
230 V AC
N 8
L1 7
1402-0328 (2)
L1 6
5 BA4
N 4 BA3
Pu5(HK2)
L1 3
+ 2 BA2
N HK2
– 1 BA1



System Anl 2.0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BE5 15 Frg_WT3
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BE4 13
BE3 12 SRM3
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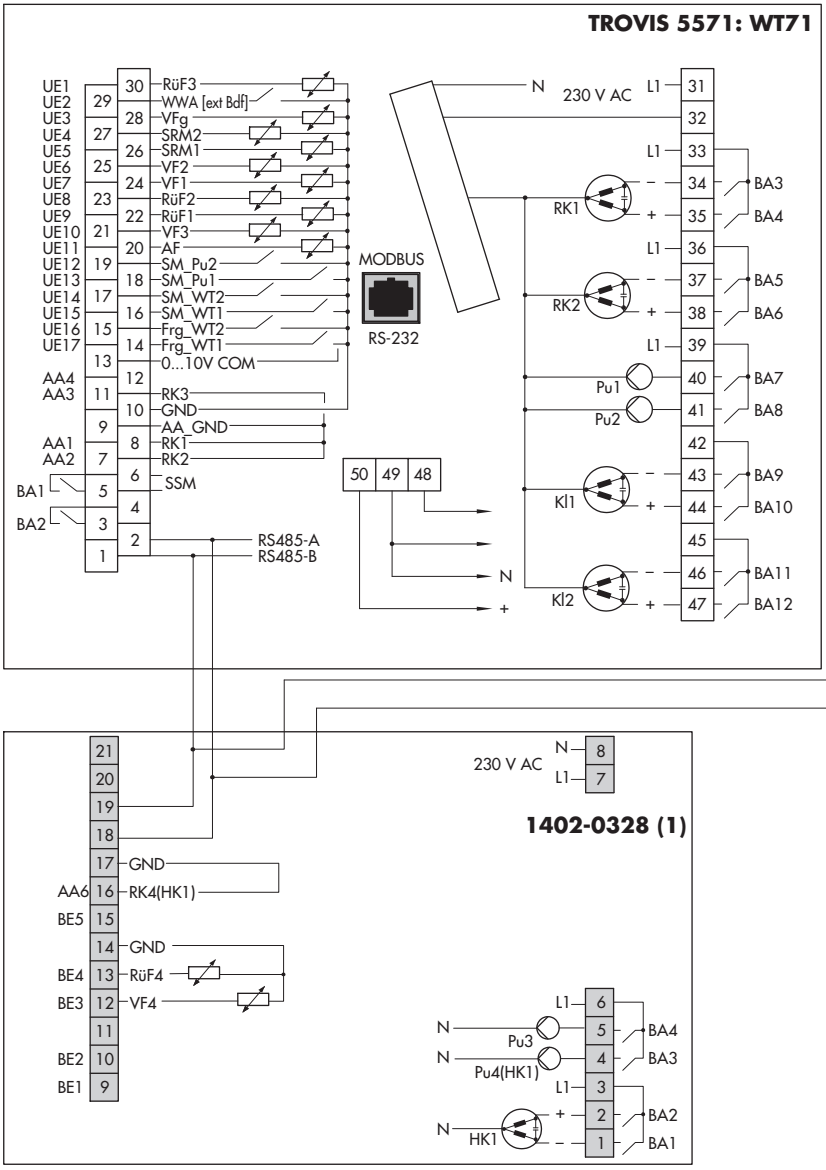
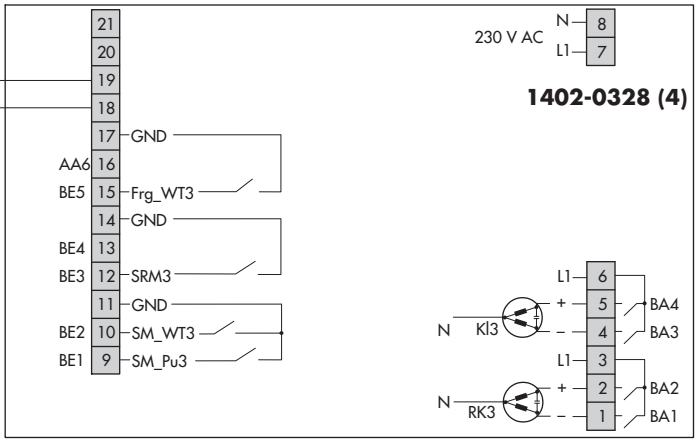
BE2 10 SM_WT3
BE1 9 SM_Pu3
230 V AC
N 8
L1 7
1402-0328 (4)
L1 6
+ 5 BA4
N Kl3
– 4 BA3
L1 3
+ 2 BA2
N RK3
– 1 BA1



System Anl 2.1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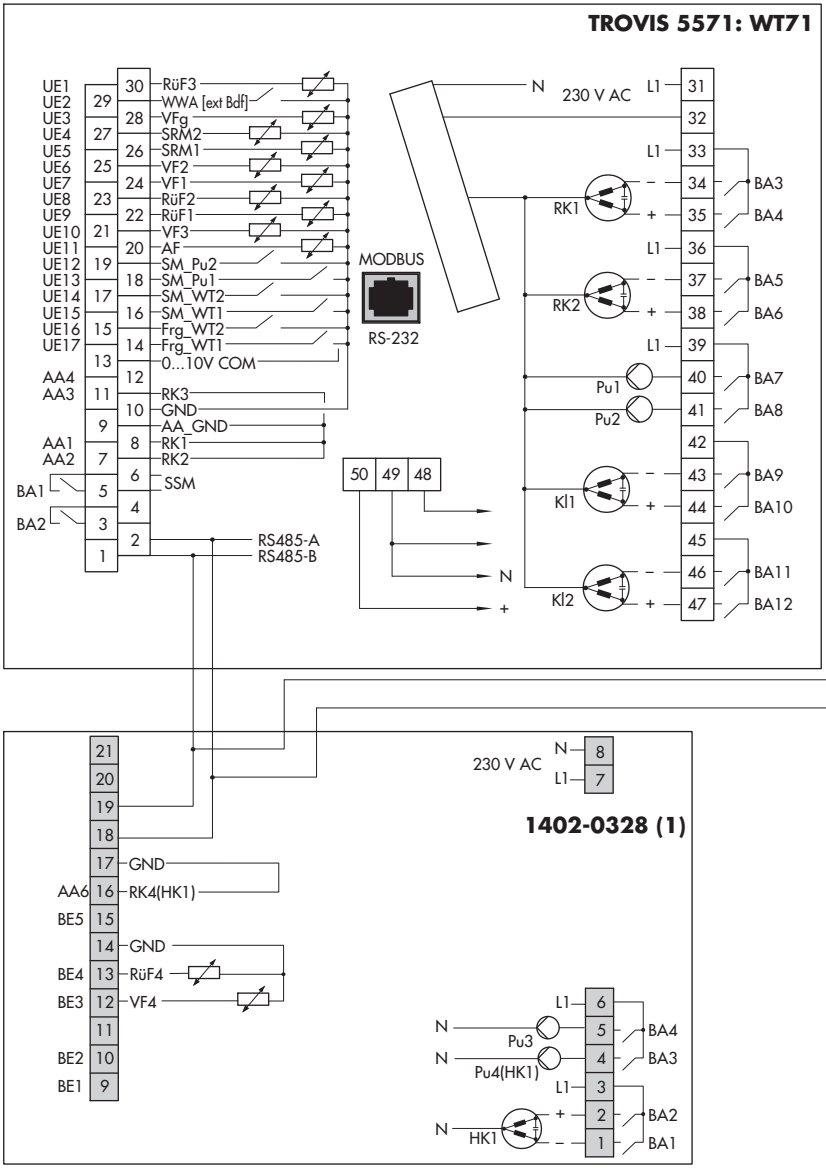
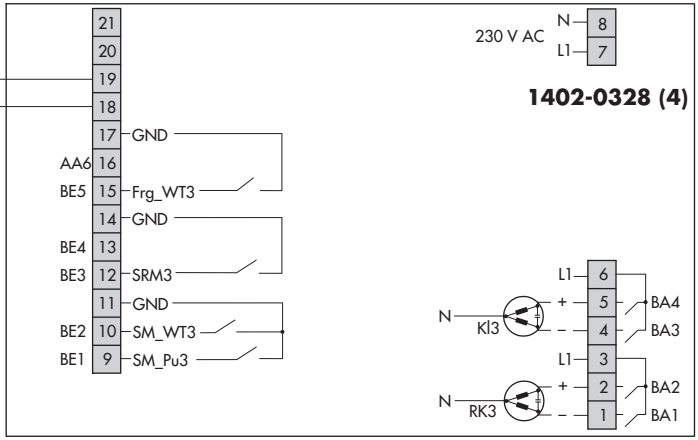
BE4 13
BE3 12 SRM3
11 GND
BE2 10 SM_WT3
BE1 9 SM_Pu3
230 V AC
N 8
L1 7
1402-0328 (4)
L1 6
+ 5 BA4
N Kl3 – 4 BA3
L1 3
+ 2 BA2
N RK3 – 1 BA1



System Anl 2.2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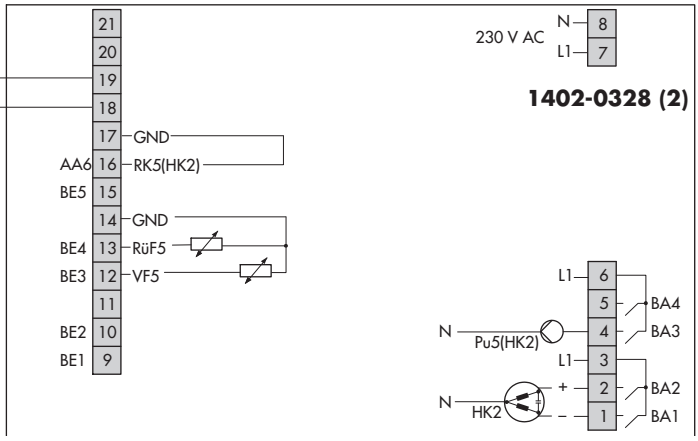
14 GND
BE4 13
BE3 12 SRM3
11 GND
BE2 10 SM_WT3
BE1 9 SM_Pu3
230 V AC
N 8
L1 7
1402-0328 (4)
L1 6
N + 5 BA4
Kl3 – 4 BA3
L1 3
N + 2 BA2
RK3 – 1 BA1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BE3 12 VF5
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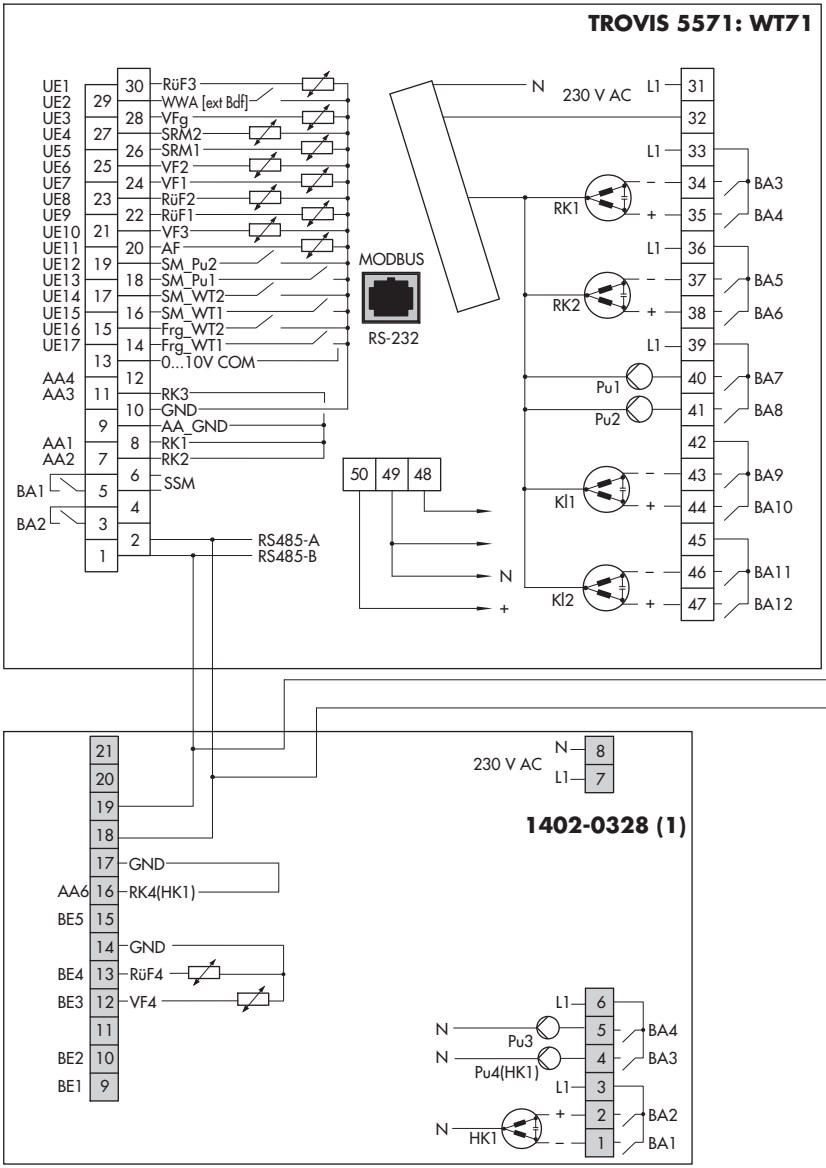
BE1 9
230 V AC
N 8
L1 7
1402-0328 (2)
L1 6
5 BA4
N 4 BA3
Pu5(HK2)
L1 3
N + 2 BA2
HK2 – 1 BA1



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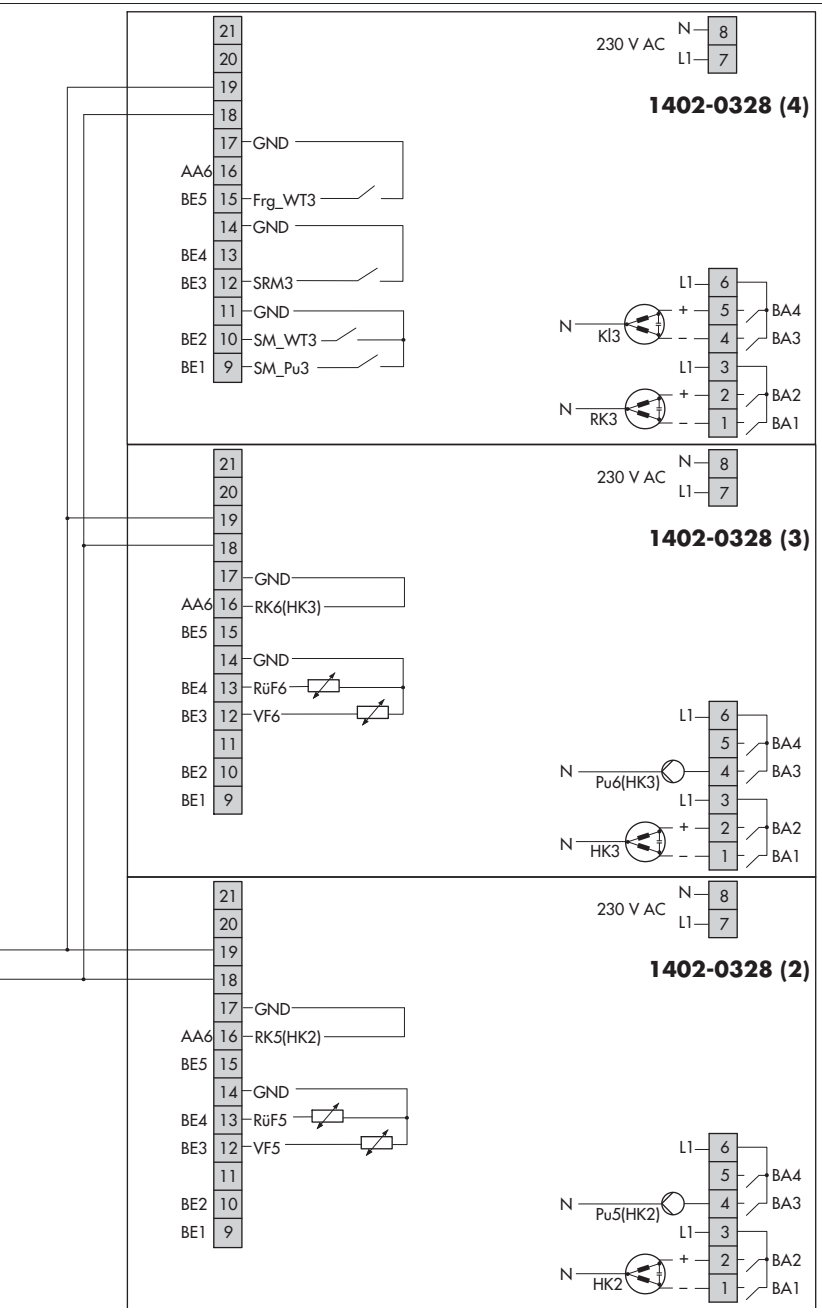
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BE4 13
BE3 12 SRM3
11 GND
BE2 10 SM_WT3
BE1 9 SM_Pu3
230 V AC
N 8
L1 7
1402-0328 (4)
L1 6
+ 5 BA4
N Kl3 – 4 BA3
L1 3
+ 2 BA2
N RK3 – 1 BA1
21
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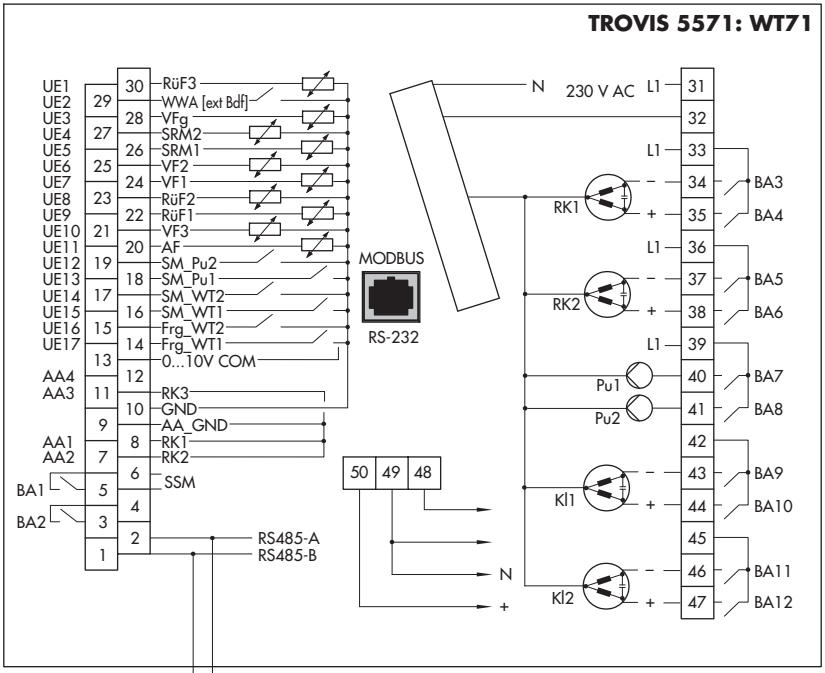
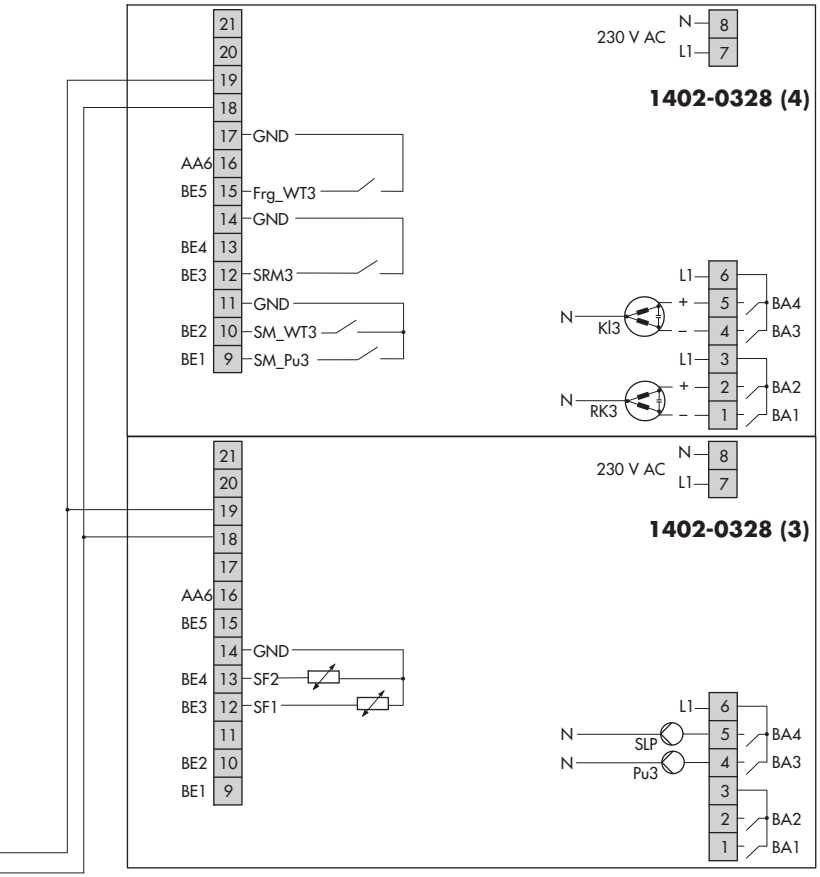
17 GND
AA6 16 RK6(HK3)
BE5 15
14 GND
BE4 13 RüF6
BE3 12 VF6
11
BE2 10
BE1 9
230 V AC
N 8
L1 7
1402-0328 (3)
L1 6
5 BA4
N Pu6(HK3) 4 BA3
L1 3
+ 2 BA2
N HK3 – 1 BA1
21
20
19
18
17 GND
AA6 16 RK5(HK2)
BE5 15
14 GND
BE4 13 RüF5
BE3 12 VF5
11
BE2 10
BE1 9
230 V AC
N 8
L1 7
1402-0328 (2)
L1 6
5 BA4
N Pu5(HK2) 4 BA3
L1 3
+ 2 BA2
N HK2 – 1 BA1



System Anl 2.4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GND
AA6 16
BE5 15
Frg_WT3
14
GND
BE4 13
BE3 12
SRM3
11
GND
BE2 10
SM_WT3
BE1 9
SM_Pu3
230 V AC
N
L1
8
7
1402-0328 (4)
L1
6
+
5
BA4
N
KI3
–
4
BA3
L1
3
+
2
BA2
N
RK3
–
1
BA1
21
20
19
18
17
AA6 16
BE5 15
14
GND
BE4 13
SF2
BE3 12
SF1
11
BE2 10
BE1 9
230 V AC
N
L1
8
7
1402-0328 (3)
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6
N
SLP
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BA4
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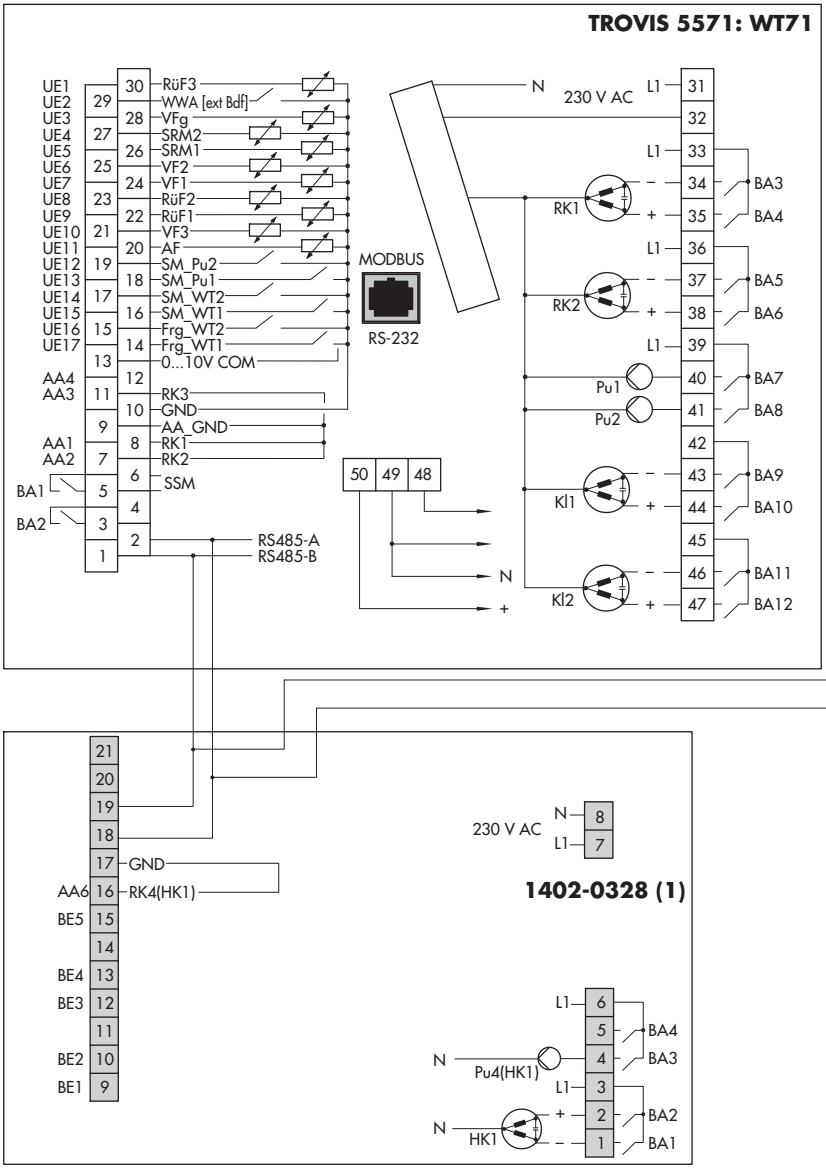
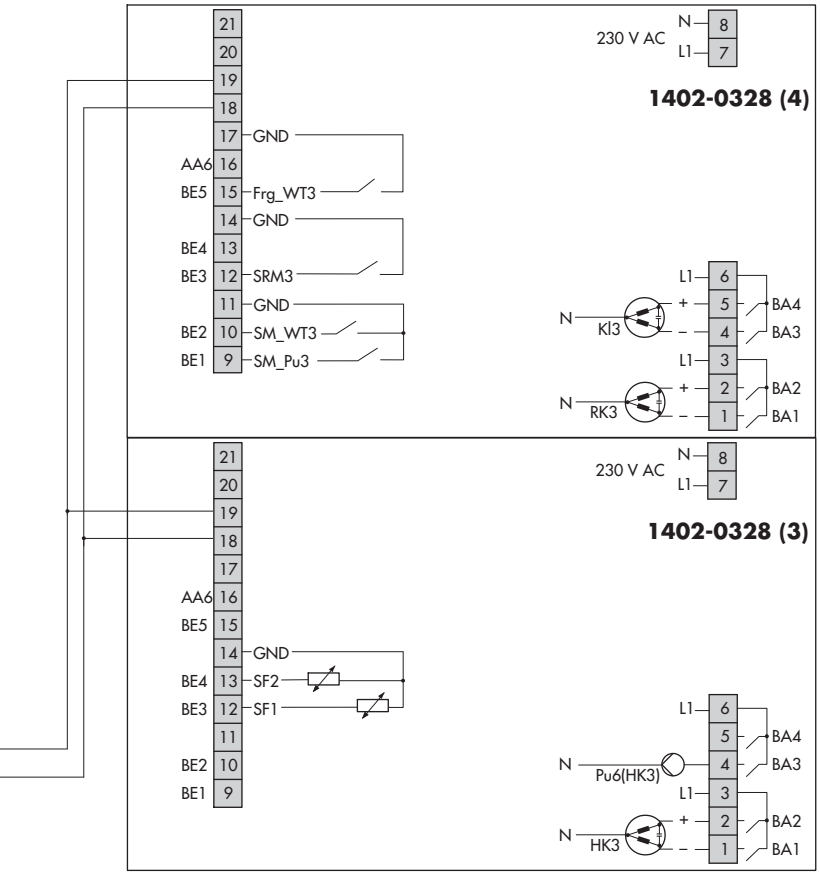
Pu3
4
BA3
3
2
BA2
1
BA1



System Anl 2.5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20
19
18
17
GND
AA6 16
BE5 15
Frg_WT3
14
GND
BE4 13
BE3 12
SRM3
11
GND
BE2 10
SM_WT3
BE1 9
SM_Pu3
230 V AC
N
L1
8
7
1402-0328 (4)
L1
6
+
5
BA4
N
Kl3
–
4
BA3
L1
3
+
2
BA2
N
RK3
–
1
BA1
21
20
19
18
17
AA6 16
BE5 15
14
GND
BE4 13
SF2
BE3 12
SF1
11
BE2 10
BE1 9
230 V AC
N
L1
8
7
1402-0328 (3)
L1
6
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BA4
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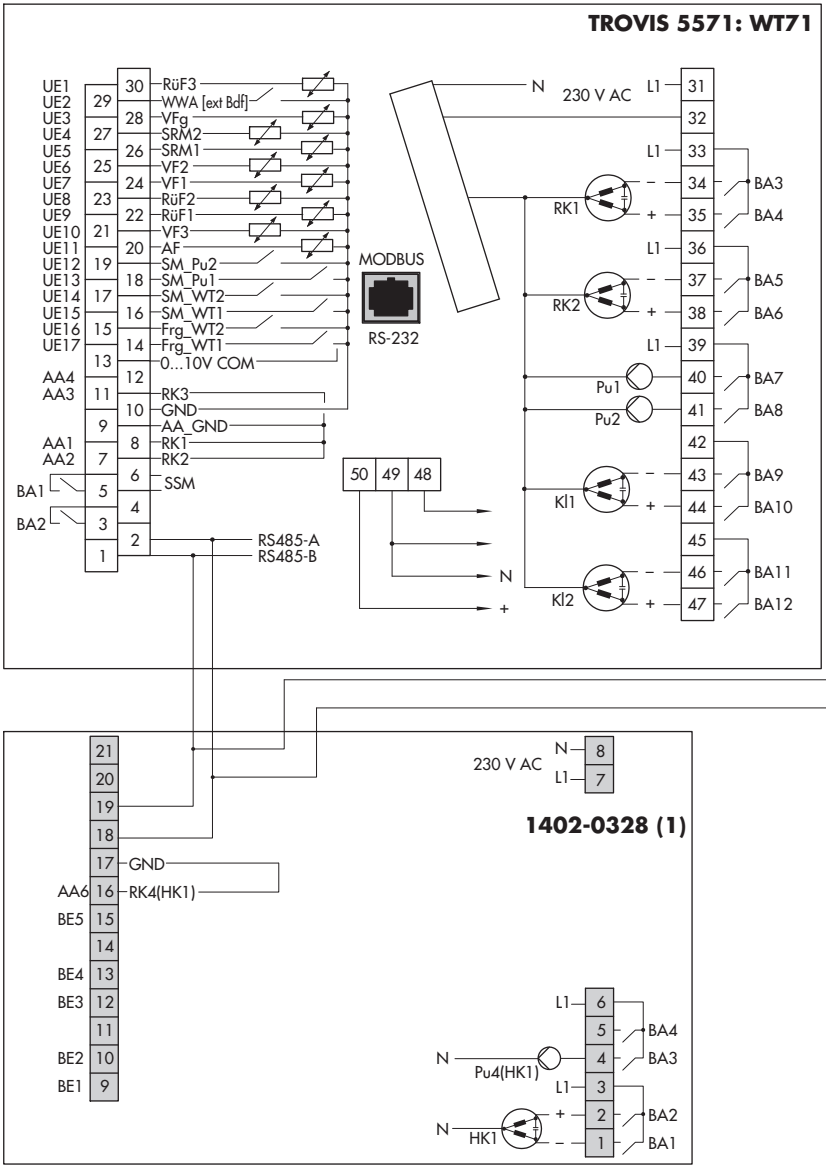
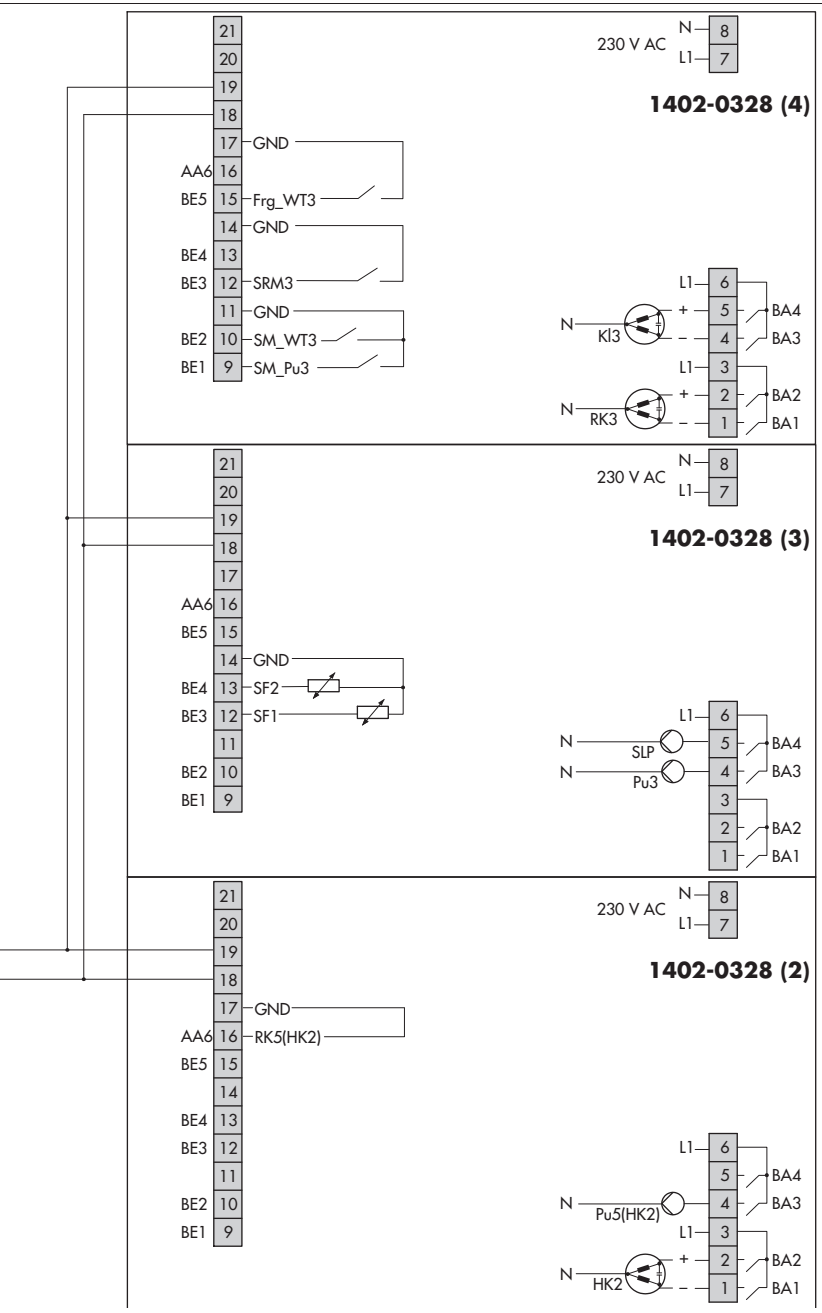
Pu6(HK3)
4
BA3
L1
3
+
2
BA2
N
HK3
–
1
BA1



System Anl 2.6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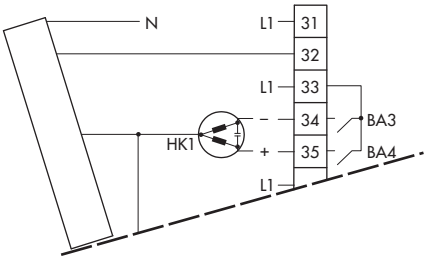
20
19
18
17 GND
AA6 16
BE5 15 Frg_WT3
14 GND
BE4 13
BE3 12 SRM3
11 GND
BE2 10 SM_WT3
BE1 9 SM_Pu3
N 8
230 V AC
L1 7
1402-0328 (4)
L1 6
+ 5 BA4
N Kl3 – 4 BA3
L1 3
+ 2 BA2
N RK3 – 1 BA1
21
20
19
18
17
AA6 16
BE5 15
14 GND
BE4 13 SF2
BE3 12 SF1
11
BE2 10
BE1 9
N 8
230 V AC
L1 7
1402-0328 (3)
L1 6
N SLP 5 BA4
N Pu3 4 BA3
3
2 BA2
1 BA1
21
20
19
18
17 GND
AA6 16 RK5(HK2)
BE5 15
14
BE4 13
BE3 12
11
BE2 10
BE1 9
N 8
230 V AC
L1 7
1402-0328 (2)
L1 6
5 BA4
N Pu5(HK2) 4 BA3
L1 3
+ 2 BA2
N HK2 – 1 BA1

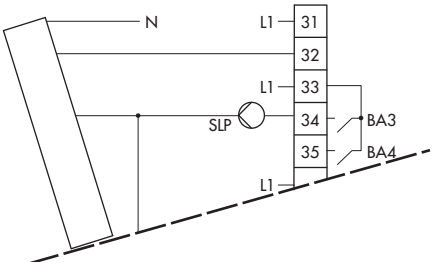
8.1 Alternative assignment

RK1 stetig (TROVIS 5571: WT71)

Anl 1.1, 1.2, 1.3, 1.5, 1.6

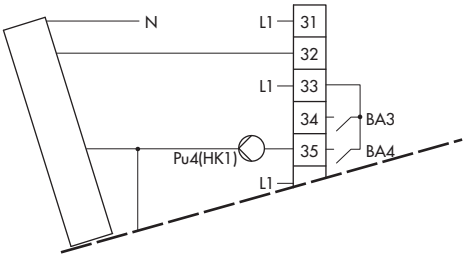


Anl 1.4



RK1 and HK1 stetig (TROVIS 5571: WT71)

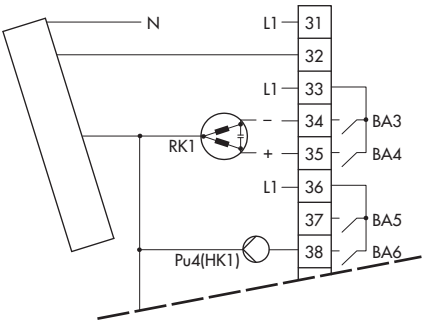
Anl 1.1, 1.2, 1.3, 1.5, 1.6



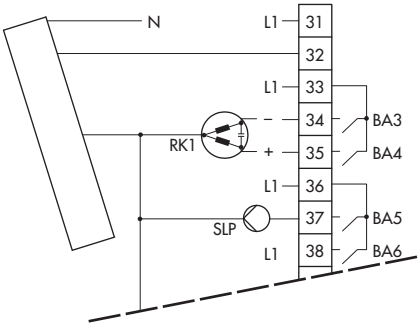
Systems Anl 1.x

RK2 stetig (TROVIS 5571: WT71)

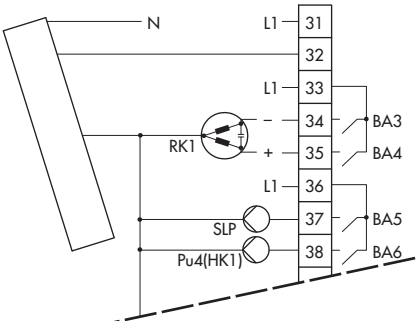
Anl 1.1, 1.2, 1.3



Anl 1.4

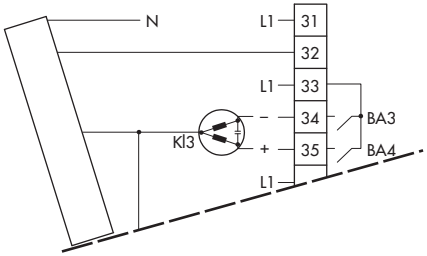


Anl 1.5, 1.6



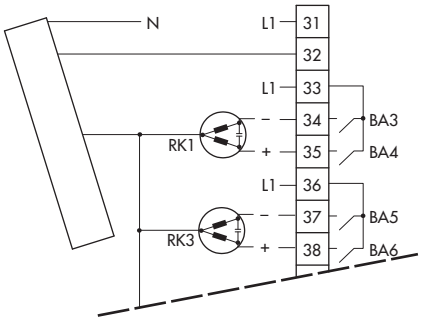
RK1 stetig (TROVIS 5571: WT71)

Anl 2.0, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6



RK2 (TROVIS 5571: WT71)

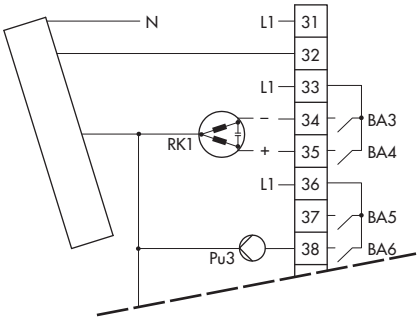
Anl 2.0, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6



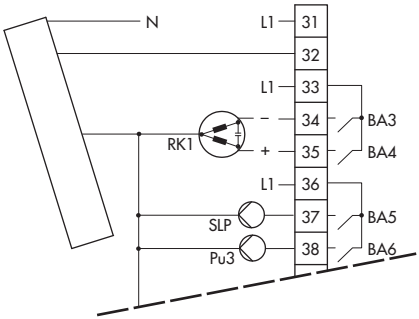
Systems Anl 2.x

RK2 und RK3 stetig (TROVIS 5571: WT71)

Anl 2.0, 2.1, 2.2, 2.3

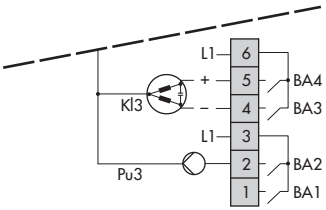


Anl 2.4, 2.5, 2.6

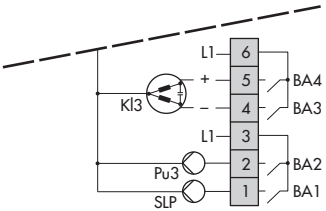


RK3 stetig (ModBus I/O 1402-0328 (4))

Anl 2.0, 2.1, 2.2, 2.3



Anl 2.4, 2.5, 2.6



9 Appendix

9.1 Menu structure

9.1.1 Heat exchangers WT1, WT2 and WT3

[Übersicht > Service > Wärmetauscher WT1 … WT3]
This menu can only be selected after the application key number has been entered!

Parameters	Adjustment range	WE	Comments
Nennleistung (rating)	5 to 5000 kW	70 kW	Rating of heat exchanger; reference value for **Unrestricted sequence**
Regelkreis (control circuit)	3-Punkt (three-step), stetig (continuous)	3-Punkt	Control algorithm of heat exchanger control circuit
Freigabe (enabling)	EIN (on), BE (binary input)	EIN	Condition for sequence operation
SR-Eingang (position feedback input)	1000–2000 Ohm, 0–10 V	1000–2000 Ohm	Signal for position feedback
Ventil-Messbereich min (min. valve measuring range)	1000 to 2000 Ohm or 0 to 10 V	1000 Ohm	Lower measuring range value
Ventil-Messbereich max (max. valve measuring range)		2000 Ohm	Upper measuring range value

[Übersicht > Parameter > Wärmetauscher WT1 … WT3]

Parameters	Adjustment range	WE	Comments
Vorlauftemp. max (max. flow temperature)	20 to 120 °C	90 °C	Upper limit for flow temperature
Einschaltzeit min (min. activation time)	0 to 90 min	0 min	Time waited until heat exchanger deactivated
Ausschaltzeit min (max. activation time)	0 to 90 min	0 min	Time waited until heat exchanger activated

Parameters	Adjustment range	WE	Comments
Klappenlaufzeit (shut-off valve transit time)	0 to 300 min	3 min	Time waited until circulation pump activated
Control parameters			
Kp	0.1 to 99.9	1.0	Gain factor of heat exchanger control circuit
Tn	0 to 999 s	30 s	Reset time of heat exchanger control circuit
Tv	0 to 999 s	0 s	Derivative-action time of heat exchanger control circuit
Ty	15 to 600 s	45 s	Valve transit time of heat exchanger control circuit

9.1.2 Heating circuits HK1, HK2 and HK3

[Übersicht > Service > Heizkreis HK1 … HK3]
This menu can only be selected after the application key number has been entered!

Parameters	Adjustment range	WE	Comments
Kennlinienart (type of characteristic)	Four-point, gradient, fixed set point	Steigung	Condition for controlling the flow temperature
Regelkreis (control circuit)	Continuous, three-step	3-Punkt	Control algorithm of heating circuit

[Übersicht > Parameter > Heizkreis HK1 … HK3]

Parameters	Adjustment range	WE	Comments
Kennlinie (characteristic)			Definition of four-point characteristic (only with type of charateristic = four-point)
Außentemp. Punkt1 (outdoor point 1)	–20 to 50 °C	–10 °C	
Vorlauftemp. Punkt1 (flow point 1)	20 to 160 °C	90 °C	
Außentemp. Punkt2 (outdoor point 2)	–20 to 50 °C	–5 °C	
Vorlauftemp. Punkt2 (flow point 2)	20 to 160 °C	80 °C	
Absenkdiff. Punkt2 (set-back diff. pt 2)	0 to 30 °C	15 °C	
Außentemp. Punkt3 (outdoor point 3)	–20 to 50 °C	5 °C	
Vorlauftemp. Punkt3 (flow point 3)	20 to 160 °C	68 °C	
Absenkdiff. Punkt3 (set-back diff. pt 3)	0 to 30 °C	20 °C	

Parameters	Adjustment range	WE	Comments
Außentemp. Punkt4 (outdoor point 4)	–20 to 50 °C	10 °C	Definition of four-point characteristic (only with type of charateristic = four-point)
Vorlauftemp. Punkt4 (flow point 4)	20 to 160 °C	50 °C	
Steigung (gradient)	0.4 to 3.2	1.8	Gradient of heating characteristic (only with type of charateristic = gradient)
Niveau (level)	–30 to 30 °C	0 °C	Level shift of heating characteristic (only with type of charateristic = gradient)
Vorlauftemp.-Sollwert (flow temp. set point)	20 to 160 °C	70 °C	Set point in fixed set point control (only with type of charateristic = fixed set point)
Absenkdifferenz (set-back difference)	0 to 30 °C	15 °C	Set-back of flow temperature set point during unoccupied time (only with type of charateristic = gradient or fixed set point)
Vorlauftemp. max (max. flow temp.)	20 to 120 °C	90 °C	Flow temperature limitation (only with type of charateristic = four-point or gradient)
Vorlauftemp. min (min. flow temp.)	20 to 120 °C	20 °C	
Control parameters			
Kp	0.1 to 99.9	6.0	Gain factor of heating circuit
Tn	0 to 999 s	120 s	Reset time of heating circuit
Tv	0 to 999 s	0 s	Derivative-action time of heating circuit
Ty	5 to 600 s	120 s	Valve transit time of heating circuit
Nutzungszeiten (times-of-use)			

Parameters	Adjustment range	WE	Comments
Montag - Sonntag (Mon - Sun)	As required	7.00 to 22.00 h	Block entry for all days of the week
Montag (Mon)			Separate entry for each day of the week **NOTE!** The block entry writes over all times-of-use programmed separately for a day of week.
Dienstag (Tue)			
Mittwoch (Wed)			
Donnerstag (Thurs)			
Freitag (Fri)			
Samstag (Sat)			
Sonntag (Sun)			

9.1.3 DHW heating

[Übersicht > Parameter > Warmwasserbereitung]

Parameters	Adjustment range	WE	Comments
Vorlauftemp.-Sollwert (flow temp. set point)	20 to 120 °C	65 °C	Flow temperature set point for DHW demand
Speicher min (min. storage tank)	20 to 90 °C	40 °C	Activation value for storage tank charging
Speicher max (max. storage tank)	20 to 90 °C	45 °C	Dectivation value for storage tank charging
Desinfektionstemp. (disinfection temp.)	50 to 80 °C	70 °C	Storage tank temperature set point for thermal disinfectio
NZ therm. Desinfektion (times-of-use for thermal disinfection)	**Note:** Only with active storage tank sensors!		
Montag - Sonntag (Mon - Sun)	As required	7.00 to 22.00 h	Block entry for all days of the week
Montag (Mon)			Separate entry for each day of the week **NOTE!** The block entry writes over all times-of-use programmed separately for a day of week.
Dienstag (Tue)			
Mittwoch (Wed)			
Donnerstag (Thurs)			
Freitag (Fri)			
Samstag (Sat)			
Sonntag (Sun)			
Vorrangschaltung (priority operation)	EIN (on), AUS (off)	AUS	Priority of DHW heating
Nutzungszeiten (times-of-use)			
Montag - Sonntag (Mon - Sun)	As required	7.00 to 22.00 h	Block entry for all days of the week
Montag (Mon)			Separate entry for each day of the week **NOTE!** The block entry writes over all times-of-use programmed separately for a day of week.
Dienstag (Tue)			
Mittwoch (Wed)			

Donnerstag (Thurs)	As required	7.00 to 22.00 h	Separate entry for each day of the week **NOTE!** The block entry writes over all times-of-use programmed separately for a day of week.
Freitag (Fri)			
Samstag (Sat)			
Sonntag (Sun)			

9.1.4 General

[Übersicht > Parameter > Allgemein]

Parameters	Adjustment range	WE	Comments
Vorlauftemp.-Sollwert (flow temp. set point)	20 to 160 °C	70 °C	Set point for fixed set point control
Absenkdifferenz (set-back difference)	0 to 30 °C	15 °C	Set-back of flow temperature set point during unoccupied time (fixed set point control)
Vorlauftemp. max (max. flow temp.)	20 to 120 °C	90 °C	Flow temperature limitation of entire system
Vorlauftemp. min (min. flow temp.)	20 to 120 °C	20 °C	
Rücklauftemp. max (max. return flow temp.)	20 to 120 °C	65 °C	Return flow temperature limitation of entire system
Rücklauftemp. min (min. return flow temp.)	20 to 120 °C	20 °C	
Pumpennachlaufzeit (pump lag time)	0 to 90 min	5 min	Time waited until shut-off valves close
Folgebetrieb (sequence operation)			

Parameters	Adjustment range	WE	Comments
Folge (sequence)	Outdoor temperature dependent, unrestricted, parallel	Outdoor temperature dependent	Condition for sequence operation
EIN-Schaltpunkt (ON switching point)	0 to 100 %	90 %	Unrestricted sequence: Limits of heat exchanger output
AUS-Schaltpunkt (OFF switching point)	0 to 100 %	40 %	
Folgefreigabetemp. (temperature for enabling the sequence)	–40 to 50 °C	12 °C	Outdoor-temperature-dependent sequence: Outdoor temperature limit
Folgeverzögerung (sequence delay)	0 to 90 min	10 min	Time waited until sequence is enabled
Führungswechsel (sequence change)	Outdoor temp., rating, operating hours, OFF	AUS	Condition for lead/lag change
Folgeumkehr-GW ta (reverse sequence limit ta)	–40 to 50 °C	15 °C	Outdoor-temperature-dependent lead/lag change: Outdoor temperature limit
Folgeumkehr-Intervall (time interval for lag/lead sequence change)	1 to 999 h	168 h	Operating hours-dependent lead/lag change: Operating hours limit
Sanftanlauf (smooth start-up)	EIN (on), AUS (off)	AUS	Prevent the lead heat exchanger from overheating
Sommerbetrieb			
tA-GW unm. Sommerbetri (temperature-dependent limit for summer mode)	0 to 50 °C	22 °C	Limit for outdoor-temperature-dependent deactivation
Zeitraum (time period)	As required	01.06 to 30.09	Application period for summer mode
Außentemp. Grenzwert (outdoor temperature limit)	0 to 40 °C	18 °C	Outdoor temperature limit (daily mean): Summer mode started when the temperature exceeds the limit
Nutzungszeiten (times-of-use)			

Parameters	Adjustment range	WE	Comments
Montag - Sonntag (Mon - Sun)	As required	7.00 to 22.00 h	Block entry for all days of the week
Montag (Mon)			Separate entry for each day of the week **NOTE!** The block entry writes over all times-of-use programmed separately for a day of week.
Dienstag (Tues)			
Mittwoch (Wed)			
Donnerstag (Thurs)			
Freitag (Fri)			
Samstag (Sat)			
Sonntag (Sun)			
Feiertage (public holidays)	As required	–	
St.-Nr. (ext. Bedarf) St. no. (external demand)	AUS, 5 to 999	AUS	Address of station, from which the external set point for transfer over Modbus is given
Begrenzung Xw Auf (°C) (limit Xw OPEN)	AUS, 2 to 10 °C	AUS	Attenuation intensity for the condensate accumulation control
Separater Sollwert (separate set point)	EIN (on), AUS (off)	AUS	Activation/input of the fixed set point *Sollwert Anf.*
Sollwert Anf. (set point demand)	20 to 120 °C	65 °C	
Vorlaufgrenzwert (flow limit)	20 to 120 °C	55 °C	Flow temperature limit under which pump lag time is ended.
Außentemperatur senden St.-Nr. (send outdoor temp.) [1]	AUS, 5 to 255	AUS	
Rücklaufbegrenzung (return flow limit) [1]	0.1 to 2.0	0.1	
Externer Bedarf (0V) (external demand) [1]	0 to 150 °C	0 °C	Range for external demand during transfer over an analog signal to UE2
Externer Bedarf (10V) (external demand) [1]	0 to 150 °C	120 °C	

[1] Firmware version 1.50 and higher

System key number	1732
Application key number	1952

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EB 5571-2 EN 2014-08