SIEMENS

LMU54... / LMU64...
Boiler Management Unit (BMU)
Basic Documentation

Software version 2. 08
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Siemens Building Technologies
HVAC Products

Safety notes

Caution: **The present Basic Documentation describes the broad range of applications and functions offered by the LMU... and shall serve as a guideline. The correct functioning of the unit must be checked and confirmed by functional tests on the boiler and / or on the relevant plant!**

- **Degree of protection IP 40 to EN 60 529 for burner controls must be ensured by the burner or boiler manufacturer by adequately mounting the LMU...**
- **In the geographical areas where DIN standards apply, mounting and installation must be in compliance with the relevant VDE requirements, especially DIN / VDE 0100, 0550 and DIN / VDE 0722!**
- **The electrical wiring inside the boiler must conform to country-specific and local regulations!**
- **Where (S)LTs are required, refer to the safety-related notes given in section «Electronic (S)LT»!**
- **It must be ensured that spliced individual wires cannot get in contact with adjacent terminals.**
  Use adequate ferrules!
- **Prior to commissioning, check wiring and parameterization carefully!**
  The boiler manufacturer is responsible for the correct parameterization of the LMU..., which must be in compliance with the relevant standards and regulations!
- **When commissioning the plant, check <u>all safety functions</u>!**
- **Before performing any wiring changes or other work in the connection area of the LMU…, completely isolate the unit from the mains supply!**
- **Lay high-voltage ignition cable completely separate from all other cables!**
- **Ensure protection against electric shock hazard on the LMU… and on all electrical connections through appropriate mounting!**
- **There is no absolute protection against incorrect use of the RAST5 connectors.**
  For this reason, check the correct connector assignments prior to commissioning the plant!
- **The burner manufacturer must ensure protection against electric shock hazard on all AC 230 V terminals by fitting dummy plugs!**
- **When wiring the unit, AC 230 V mains voltage and extra low-voltage must always be run strictly separate to warrant protection against electric shock hazard!**
  - **DIN EN 60335**
  - **DIN EN 60730-2-5**
- **Protect the mains-powered ionization probe against electric shock hazard!**

The LMU… is a safety device!

- **Do not open, interfere with or modify the unit!**
- **Siemens is not liable for damage resulting from unauthorized interference!**
- **In the event of blown fuses inside the LMU..., return the unit to Siemens!**
  (Customer may replace mains fuse F1 only <u>once</u>)
- **Electromagnetic emissions must be checked on an application-specific basis!**

To ensure the safety and reliability of the LMU..., the following points must also be observed:

- Condensation, formation of ice and ingress of water are not permitted!
  If such conditions have occurred, make certain the unit is completely dry before switching on!
- Static charges must be avoided as they can damage the unit's electronic components when touching them

  Recommendation: Use ESD equipment!

Contents

1 Overview

Brief description

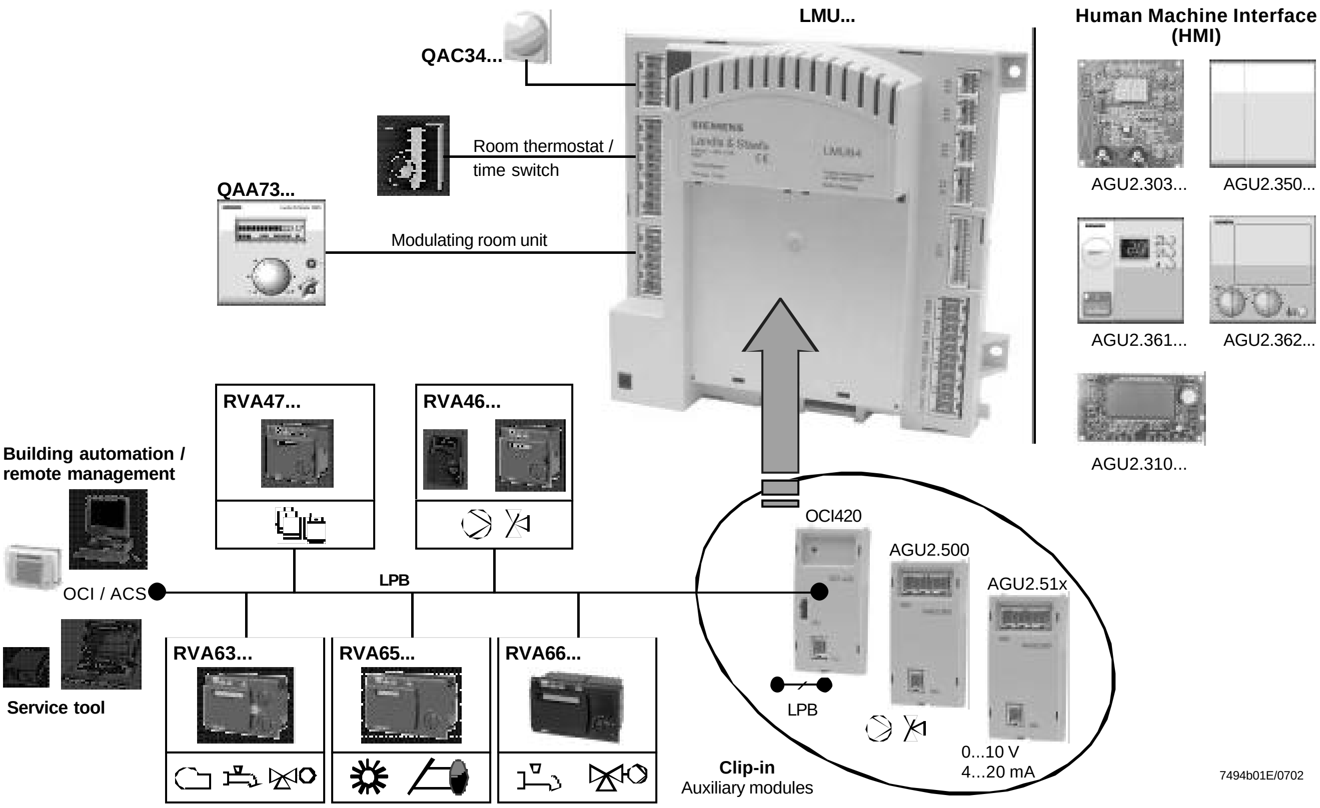
LMU... are Boiler Management Units (BMUs) of digital design for use with gas-fired appliances equipped with premix burners.

They are used for the startup, control and supervision of premix burners having the capacity ranges < 70 kW, 70 - 120 kW or > 120 kW in intermittent operation and with direct ignition of the main flame.

The LMU... provide all supervisory and control functions required for burner, heating and DHW operation and make possible modular system extensions via integrated communication interfaces.

Output modulation is accomplished via a PWM-controlled fan, and pneumatic fuel / air ratio control with the help of a gas valve.

1.1 System concept



1.2 Features

Below, the full functionality of the LMU... is described. For information on the scope of functions of a specific unit, refer to the relevant version / configuration.

Safety functions

- Gas burner control conforming to EN 298 for intermittent operation
- Integrated boiler / burner control for space heating and DHW operation
- Sequence control depending on the boiler's capacity: < 70 kW, 70 - 120 kW, or > 120 kW. Boiler capacities up to about 600 kW can be handled (depending on the type of fan / gas valve used)
- Integrated electronic (safety) limit thermostat
- Integrated limit thermostat function
- Direct ignition of the main flame by means of
  - integrated single-pole high-voltage ignition (with the choice of single-electrode operation)
  - external AC 230 V ignition control (optional)
- Continuous (analog) ionization current supervision with optional indication of flame intensity
- Gas valve control AC 230 V (RAC optional)
- Number of start repetitions can be programmed
- Quick startup (especially in connection with instantaneous DHW systems)
- Fan supervision
- Optimization of combustion (optional)

Supervision / protective functions for the plant

- Control of an AC 230 V fan (DC 24 V fan optional)
- Ignition load precontrol via speed readjustment
- Adaptive postpurge level of fan speed
- Load limitation (fan limitation by minimum / maximum speed and / or flame signal)
- Number of fan feedback pulses can be selected
- Flame stabilization time
- Boiler cycling protection via minimum boiler off time
- Dynamic switch-off differentials for space heating (Hz) and DHW (Bw) operation
- Pump and diverting valve kick
- Frost protection functions for the plant, the boiler, DHW and the room
- Water pressure supervision (pressure sensor with static and / or dynamic supervision, contact for pressure switch, flow switch)
- Flue gas temperature supervision

Auxiliary modules (clip-in)

- OCI420 clip-in for communication, LPB interface for ALBATROS system world
- AGU2.500 clip-in for additional heating circuit
- AGU2.51x clip-in function module
  - inputs: NTC, 10 kΩ
digital input
0(4)...20 mA
DC 0...10 V
  - outputs: max. 3 relays AC 230 V

DHW

- Integrated DHW systems with specific algorithms for storage tank, stratification storage tank, instantaneous and aquabooster systems
- Instantaneous DHW heating systems with optional comfort function
- DHW heating with charging pump / diverting valve
- Diverting valve control via stepper motor control, N.O. contact with continuous phase or changeover contact
- DHW control with sensor or thermostat
- Control of DHW circulating pump with QAA73...-V1.4

Heating circuit

- Integrated weather-compensated pump heating circuit
- PWM-controlled heating circuit pump with specific algorithms to ensure most effective condensation, improved overall efficiency and enhanced room comfort (optional)
- Additional weather-compensated heating circuit for single-user applications via modular clip-in add-on module AGU2.500 (pump or mixing heating circuit) with independent minimum / maximum limitation and heating curve.
  Independent time switch program in connection with the QAA73...
- Automatic summer / winter changeover
- Automatic 24-hour heating limit (with no RU connected)
- Quick setback (with no RU connected)
- Compensation variants with room thermostat / time switch (single- or dual-channel time switch)
- Compensation variants with room controls via integrated interface based on OpenTherm (QAA73... / QAA53...)

System application

- Integrated interface on OpenTherm basis
- Communication capability via the **L**ocal **P**rocess **B**us (LPB) by means of clip-in module
- Consistent system architecture of RVA… controllers
- Optional remote supervision
- Connection via LPB clip-in module to
  - RVA46... zone controllers
  - RVA47... cascade controllers
  - RVA63... boiler and heating circuit controllers
  - RVA65... energy managers for solar, wood, etc.
  - RVA66... boiler and heating circuit controllers
  - OCI6... communication interface for remote supervision (in connection with appropriate ACS… software) 1)

Operation / service

- Modular and flexible concept of operating units AGU2.3...; optionally with housings for flush panel mounting, degree of protection IPX4D (splash-proof) and LCD model with clock function and backlit display
- Chimney sweep function
- Controller stop function for output adjustment
- Error messages with lockout storage and fault history
- Display and interrogation of all relevant process parameters via operating units, QAA73... and PC tool
- Counter for the number of startups and the number of operating hours
- Maintenance functions with service message 1)
- Automatic plant configuration (identification of RU, connected HMI, sensors, etc.)

1) Planned; on request

Parameterization

- Via PC tool ACS420
- Via room unit QAA73...
- Via operating units AGU2.3...
- Via specific final production test tool ACS421

Mains transformer

- Mains transformer integrated in the unit

An additional external transformer is not absolutely required (only when using a fan operating on DC 24 V, or in the case of stepper motor control).

Other features

- Multifunctional housing with mechanical attachment facility for maximum 2 clip-in modules
  - Integrated exchangeable main fuse AC 230 V
  - Integrated installer interface via RAST5 connector
- Optional extensions with up to 2 flexible clip-in modules that can be matched to individual customer needs
- Programmable relay output (AC 230 V) for specific functions
- Programmable digital input for specific functions
- Housing / clip-in modules of advanced design made of recyclable plastic

1.3 Product range

Refer to chapter 2, «Product range overview».

1.4 Field of use

Target market

The LMU... are designed for use by OEMs. They are supplied directly to the boiler manufacturer and enhance both the functionality and the level of outfit of gas-fired boilers.

Heating plants

Suited for all types of standard heating systems such as radiator or underfloor heating systems in the residential sector (one-family houses or blocks of flats).

Heat generating equipment

Primarily for use with:

- Premixing or condensing gas-fired appliances with modulating burners using PWM DC fans and pneumatic fuel / air ratio control, in intermittent operation and with direct ignition of the main flame
- Capacity ranges < 70 kW, 70...120 kW, or > 120 kW
- Heating boilers or combi boilers with DHW storage tanks or instantaneous DHW heaters

1.5 Notes on product liability

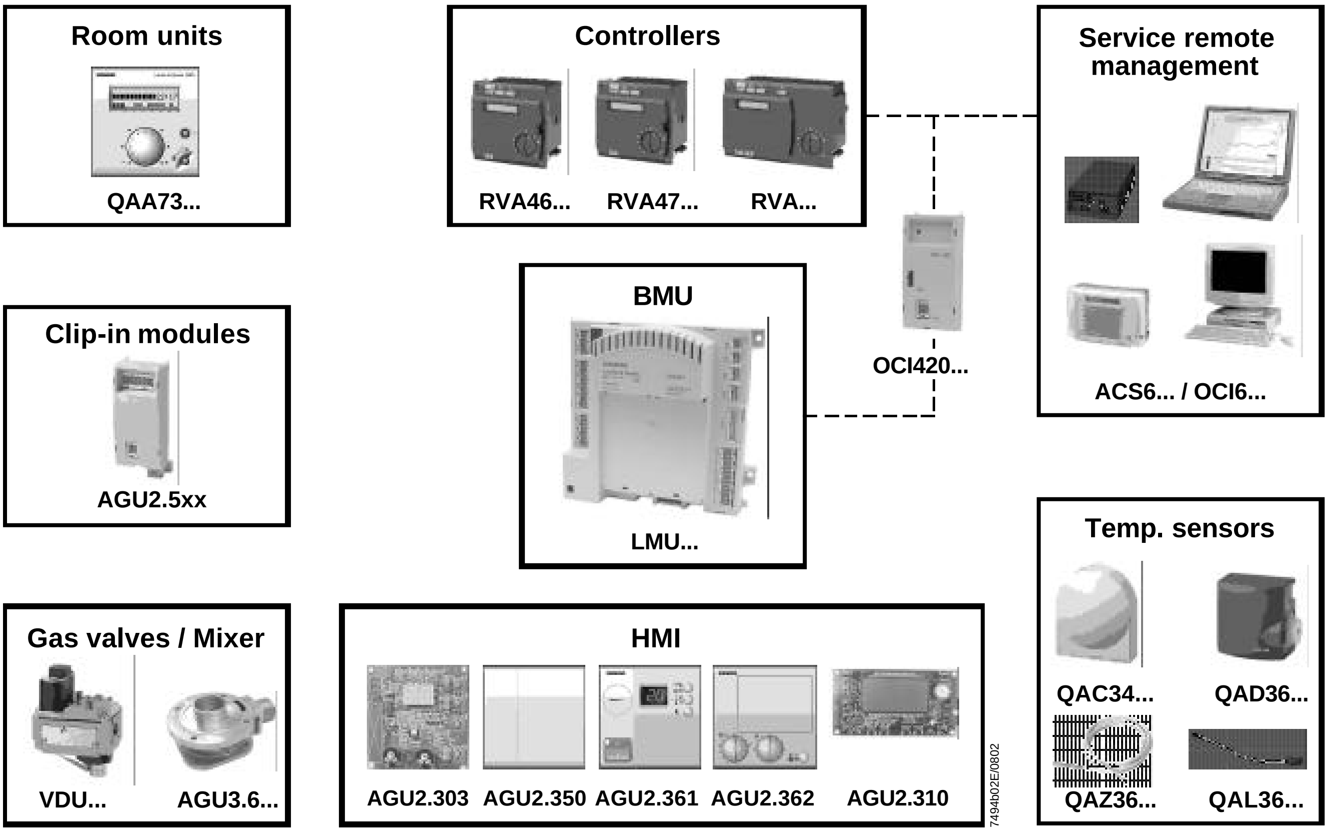
- The units may only be used in building services plant in accordance with the applications and features described above
- When using the products, all requirements specified in chapter «Technical data» must be observed
- The local safety regulations must be complied with

1.6 Notes on environmental protection

Disposal notes

The LMU... contains electrical and electronic components and may not be disposed of together with household waste. **Local and currently valid legislation must be observed!**

2 Product range overview



The following units and accessories are designed for use with the ALBATROS range:

	Type of unit	*Description*	*Documentation no.*
BMU	LMU54...	BMU (without housing, without combustion optimization)	CC1P7494 1)
	LMU64...	BMU (with housing, without combustion optimization)	CC1P7494 1)
Controller	REA02...	Room thermostat	(RAA20) CE1N3002
	REA11...	Room temperature controller	CE1P2274
	RVA46...	Heating controller	CE1P2372
	RVA47...	Cascade controller for modulating gas-fired heating boilers	CE1P2379
	RVA63...	Heating circuit controller	CE1P2373 2)
	RVA65...	Heat energy manager	CE1P2392 2)
	RVA66...	Heating circuit or primary controller with DHW control	CE1P2378 2)
Service tool	OCI490A109	PC interface for ACS42X…	--
	ACS420	Software for OCI490A109	
	ACS421	Final production test software	
Remote supervision	ACS...	Operating software	CE1B2530 2)
	OCI6...	Central communication unit	CE1N2530 / 2531 2)

Room units	QAA73...	RU for boiler control with OpenTherm interface	CE1P2284
	QAA53...	RU for boiler control with OpenTherm interface	CE1Q2282
Clip-in modules	AGU2.500A109	Clip-in for additional heating circuit	
	AGU2.500A209	Clip-in for additional heating circuit (printed circuit board version)	
	AGU2.511A109	Clip-in function module, voltage relay	
	AGU2.513A109	Clip-in function module, current relay	
	AGU2.514A109	Clip-in function module, sensor relay	
	AGU2.515A109	Clip-in function module, digital input relay	
	OCI420A109	Clip-in for communication LPB interface	
	OCI420A209	Clip-in for communication LPB interface (printed circuit board version)	
Gas valve	VDUxxx	Compact gas control loop with pneumatic fuel / air ratio control	CC1N7662
	AGU3.6...	Gas / air mixing device (pressure side)	-- 2)
Sensor	QAC34/101	Outside sensor NTC 1kΩ	CE1Q1811
	QAD36/101	Strap-on temperature sensor NTC 10 kΩ	--
	QAK36...	Screwed immersion temperature sensor NTC 10 kΩ	-- 2)
	QAL36.225	Universal temperature sensor NTC 10 kΩ	CE1Q1842
	QAZ36.522/109	Cable temperature sensor NTC 10 kΩ, cable length 2 m	CE1Q1843
	QAZ36.526/109	Cable temperature sensor NTC 10 kΩ, cable length 6 m	CE1Q1843
	AQL21.30	Holding spring for QAL36.225, 30 mm	--
	AQL21.42	Holding spring for QAL36.225, 42 mm	--
Operating section	AGU2.350A109	Dummy cover, housing for flush panel mounting, degree of protection IPx4D	1)
	AGU2.361A109	Operating section for boiler, housing for flush panel mounting, degree of protection IPx4D	1)
	AGU2.362A109	Operating section for heating circuit, housing for flush panel mounting, degree of protection IPx4D	1)
	AGU2.303B109	Operating section, type of printed circuit board	1)
	AGU2.310A109	Operating unit with LCD (printed circuit board version)	1)
Cable	AGU2.100A109	Connecting cable LMU... ⌦ AGU2.303 / AGU2.361 / AGU2.310	1) 2)
	AGU2.101A109	Connecting cable AGU2.361 ⌦ AGU2.362	1) 2)
	AGU2.102A109	Connecting cable AGU2.361 ⌦ control panel mounting QAA73...	1) 2)
	AGU2.103A109	Connecting cable service interface AGU2.361 ⌦ QAA73...	1) 2)
	AGU2.104A109	Connecting cable LMU... ⌦ Clip-in module AGU2.500 / OCI420	2)

1) Refer to Operating Instructions CC1B7494

2) On request

3 Functions

3.1 Burner control

Program selection

Parameterization enables certain parts of the burner control program to be changed, thus permitting a number of different burner control sequences.

The burner control sequences are distinguished by their capacity ranges in which the boilers shall operate.

In accordance with the standards, there are 3 different capacity ranges:

- < 70 kW
- 70...120 kW
- > 120 kW

For all capacity ranges, there are additional parameterization choices available, enabling the burner control's sequence and times to be matched to specific requirements.

EEPROM

The EEPROM of the LMU... is used to store the burner control's program sequence and lockout positions.

Also, control parameters and other setting values are filed in EEPROM.

Forced intermittent operation

Forced intermittent operation ensures that the burner control initiates shutdown after no more than 24 hours of continuous operation.

This enables the burner control to perform the internal self-tests included in the startup and shutdown sequence.

Burner control program

The burner control's program ensures orderly operation of the unit including startup and shutdown as well as flame supervision.

The sequence can be altered by changing certain parameters.

If there are deviations from the defined sequence, or in the case of a reset, the program initiates safety shutdown (home run) and then - depending on the setting made - lockout, restart or start prevention.

The program sequence is controlled in accordance with the program's phases. The individual phases are grouped and include startup, operation, shutdown and home run.

After a reset (power on), the burner starts its home run. Depending on the available (parameterized) input / output signals or program times (e.g. prepurging), the individual program phases will be either executed or skipped.

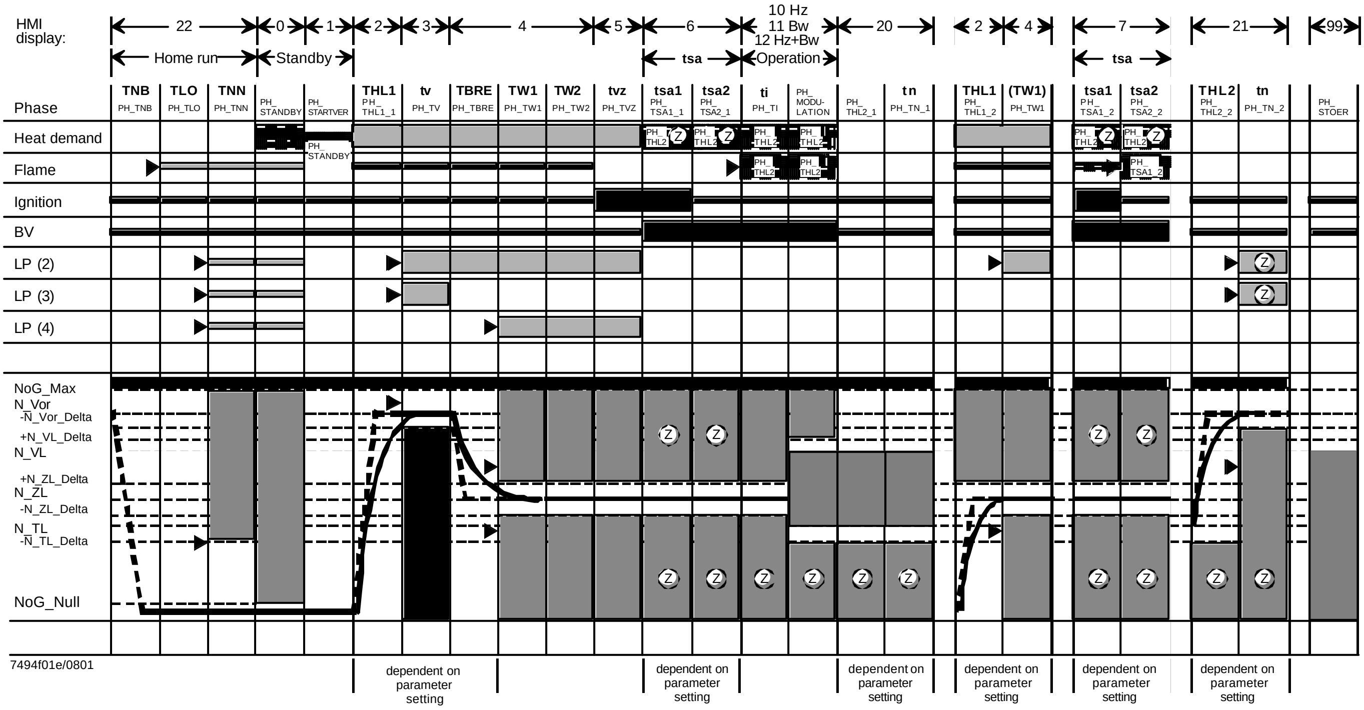
The burner control's program is designed for intermittent operation. To verify orderly functioning (detection of faults), a complete program cycle is required.

In the «Standby» position, the burner control is ready to operate and waits for a heat demand signal from the controller, or it demands start prevention (no release).

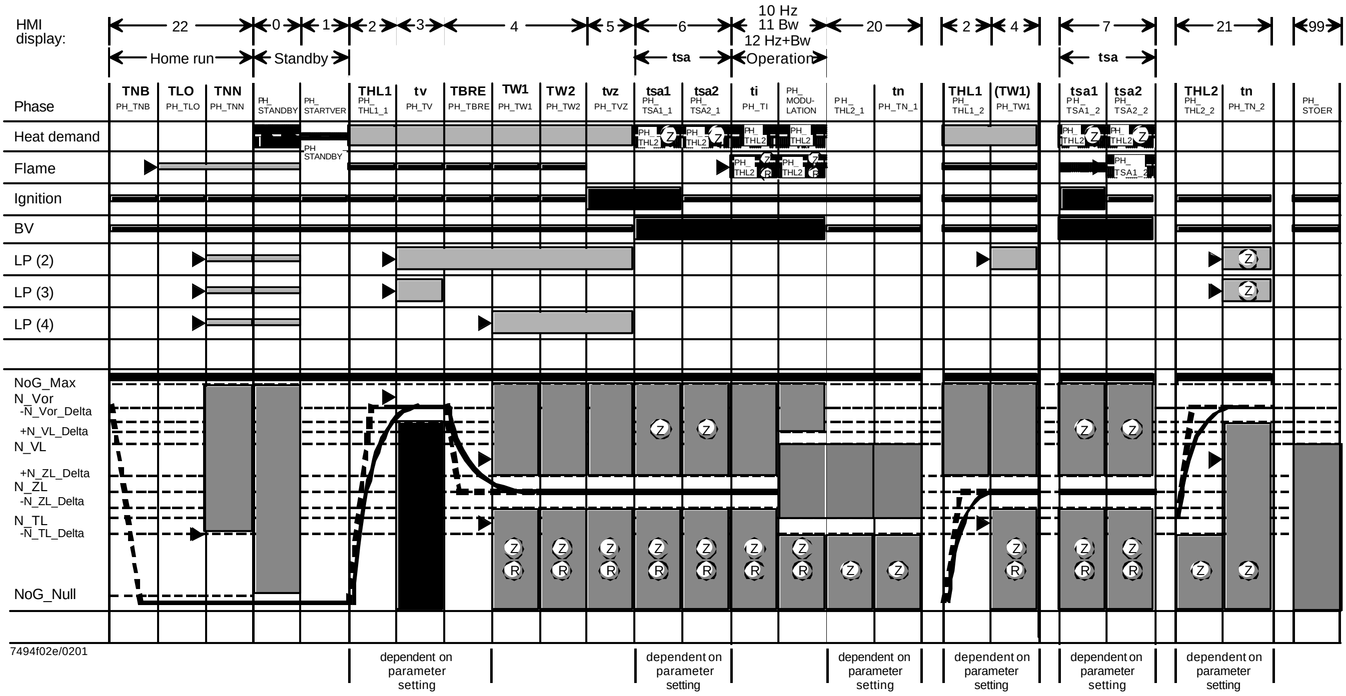
The burner control maintains the «Operation» position until no more heat is demanded by the controller - but for no more than 24 hours. On completion of that period of time, the burner control will automatically enforce intermittent operation.

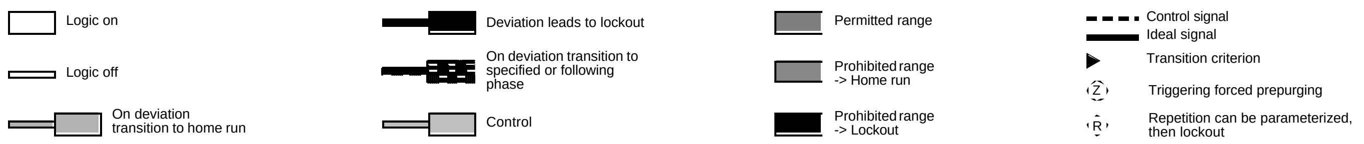
Sequence diagram

Capacity range < 70 kW



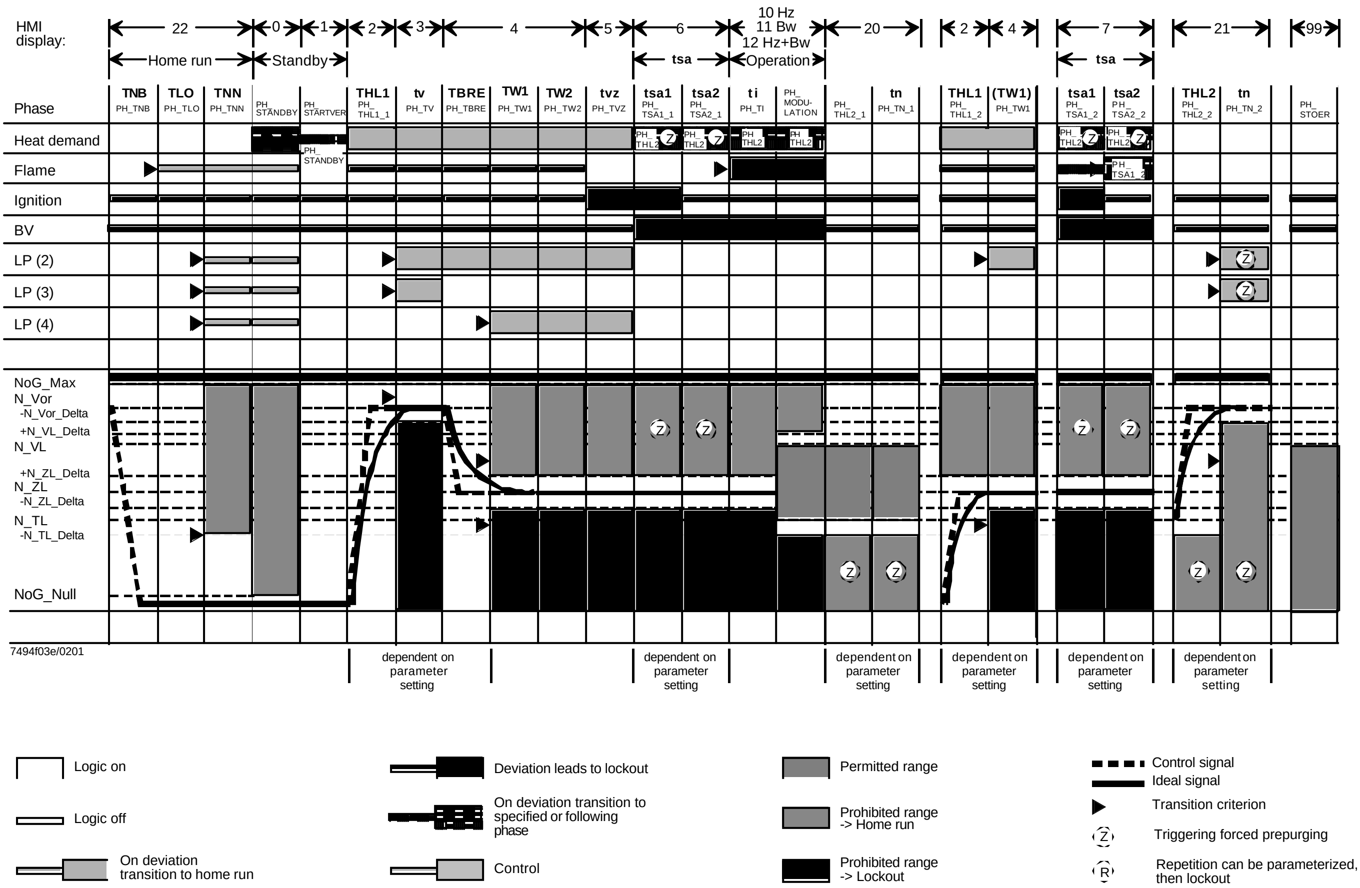
Capacity range 70...120 kW





Sequence diagram

Capacity range > 120 kW



Description of sequence diagrams

The burner control's program is subdivided into different phases. Each phase is identified by a certain output and input configuration of the burner control.

For the precise sequence of signals, refer to the sequence diagrams.

Signal sequences not shown in the sequence diagrams are summarized under «Special cases».

The times given in the sequence diagrams are distinguished as follows:

UPPERCASE LETTERS	(e.g. «THL1»)	constants stored in ROM
Lowercase letters	(e.g. «tsa»)	parameters stored in EEPROM

With regard to the speed feedback signal, the following nominal levels are used:

N_Vor,	N_VL,	N_ZL,	N_TL
Prepurging	Nominal load [1]	Ignition load	Partial load

[1] Previously «Full load» (VL)

According to the sequence diagram, there is a permitted tolerance band with an upper and a lower limit for each level (e.g. «N_ZL»), which is defined via parameter «N_XX_Delta».

The relevant sequence phases (refer to the sequence diagrams) are queried for these limits.

Example: Ignition load upper limit = «N_ZL» + «N_ZL_Delta»
lower limit = «N_ZL» - «N_ZL_Delta»

These limit values are complemented by «NoG_Null» and «NoG_Max» (refer to the sequence diagrams).

«NoG_Max» is the maximum speed that must never be reached. «NoG_Null» is the low speed that must be crossed when changing to standby.

Sequence times

Time	**Min. (s)**	**Max. (s)**	**Response at end of**	**Description**
TNB	0.2	21.0	Lockout position	Afterburn time
TLO	0.2	51.0	Lockout position	Open LP
TNN	0.2	51.0	Lockout position	Down to speed = 0
THL1	0.2	51.0	Lockout position	First fan runup time
THL2	0.2	51.0	Lockout position	Second fan runup time
tv	0	51.0	Switching	Prepurging
TBRE	0.2	51.0	Lockout position	Brake time until ignition load is reached
TW1	0.2	51.0	Lockout position	Waiting for internal sequence, speed readjustment and optimization of combustion
tvz	0.2	5.0	Switching	Preignition time
TSA	1.8	9.8	1)	Ignition safety time
tsa1	0.2	9.6 2)	1)	Ignition safety time with ignition
tsa2	0.2	TSA-tsa1 2)	1)	Ignition safety time without ignition
ti	0.2	10	Switching	Interval operation
tn	0	51.0	Switching	Postpurging

1) Lockout position or start repetition, depending on the flame signal and the parameter; various parameterization choices (refer to relevant description)

2) With parameterization with abortion of safety time in the case of flame detection, the times of «tsa1» and «tsa2» are derived from the time of establishment of flame. It should be noted, however, that «TSA» can never be exceeded

The following phases (with associated times in parentheses) are relevant with one startup / shutdown cycle:

Standby

- **PH_STANDBY** (unlimited): Burner control waits for a heat demand signal from the controller
- **PH_STARTVER**: No external or internal release, relevant diagnostic code is delivered

Startup

The change from «Standby» to «Operation» is the startup triggered by a heat demand signal from the controller.

If startup takes place with prepurging, startup will commence with the «PH_THL1_1» phase; if no prepurging is used, with the «PH_THL1_2» phase.

- **PH_THL1_1 (THL1):** Maximum fan runup time to prepurging level. With «tv» > 0 or in case of demanded forced prepurging
- **PH_THL1_2 (THL1):** Maximum fan runup time to ignition level. With «tv» = 0 and no demanded forced prepurging
- **PH_TV (tv):** Prepurging phase
- **PH_TBRE (TBRE):** Maximum period of time for reaching the ignition level after prepurging (reaching the speed band for the ignition load)
- **PH_TW1 (TW1):** Maximum waiting time until the following functions are performed:
  - Internal safety tests: These tests are started the moment the startup phase commences and already run in the background during the preceding phases
  - Combustion optimization: Optimization of combustion deactivated or stepper motor in start position
  - Speed readjustment: Checkback signal delivered when the required speed for the ignition load is reached for the first time
- **PH_TVZ (tvz):** Preignition time (can be parameterized, but minimum is 0.2 seconds)
- **PH_TSA1_1; PH_TSA2_1; PH_TSA1_2; PH_TSA2_2; (TSA):** Ignition safety time. If, on completion of this period of time, there is no flame (also after several reignition attempts), the burner control will initiate lockout or make a restart, depending on the parameter settings made.

  With parameterization with abortion of the safety time in the case of flame detection, «TSA» can be shortened via flame establishment (refer to «PH_TSA1_2», «PH_TSA2_2»).

Parameterization choice 1:

- **PH_TSA1_1 (tsa1, max. TSA):** First part of the safety time with ignition switched on. The fuel valve is open
- **PH_TSA2_1 (TSA - tsa1, max. TSA):** Second part of the safety time with ignition switched off. The fuel valve is open

Parameterization choice 2:

- **PH_TSA1_2 (max. TSA):** First part of the safety time with ignition switched on. Once a flame signal is detected, the change to the «PH_TSA2_2» phase (switching ignition off) takes place. If there is no establishment of flame, the burner control stays in the «PH_TSA1_2» phase until the end of «TSA» is reached
- **PH_TSA2_2 (0.2 seconds, can be run through several times during «TSA»):** Second part of the safety time with ignition switched off. The fuel valve is open. 0.2 seconds after the change to the «PH_TSA2_2» phase, the flame signal is checked. If, in that case, the flame has been lost, an immediate reignition attempt is made by returning to the «PH_TSA1_2» phase.

  This procedure can repeat itself until the end of «TSA» is reached.
  If the flame is still present, the change to the «PH_TI» phase takes place.

Operation:

Start of the operating position is the «PH_TI» phase. If interval «ti» is not required, it cannot be parameterized to 0 but only to a minimum of 0.2 seconds.

- **PH_TI; (ti)**, interval required for stabilization of the flame
- **PH_MODULATION;** (unlimited), controller operation. In this phase, the controller result is output

Shutdown

The change from the operating position to «Standby» is made when there is no more demand for heat and is divided into «Shutdown» and «Home run».
«Shutdown» consists of postpurging, which can be deactivated.

With postpurging, there is a choice of 2 operating modes the difference being the way the fan is controlled.

Parameterization choice 1:

- **PH_THL2_1 (0.2 s):** Change during postpurging, to the level of the last operating command
- **PH_TN1 (tn):** Postpurging to the level of the last operating command

Parameterization choice 2:

- **PH_THL2_2 (THL2):** Change during postpurging, to the level of prepurging
- **PH_TN2 (tn):** Postpurging to the level of prepurging

Home run

The home run is used to bring about the change to the «Standby» position.
Normally, the home run is made on completion of «Shutdown».

After extraordinary events (refer to the sequence diagram), or in the case of a reset, the home run brings the unit back to its basic position («Standby»).

In the case of a new demand for heat, the home run triggers a faster startup sequence. This is accomplished by a shorter «TNN» followed by a direct change from the «PH_TNN» phase to the «PH_THL1_1/2» phase. This means that the «Standby» state will be skipped.

- **PH_TNB (TNB):** Permitted afterburn time
- **PH_TLO (TLO):** Permitted period of time with «LP» closed (if present) or speed > «N_TL-N_TL_Delta»
- **PH_TNN (TNN):** Permitted period of time at speed > «NoG_Null»

Special cases (deviations)

- **Forced prepurging:** In the case of a reset after lockout and after power ON, forced prepurging with the «LmodVOr» parameter is initiated, which takes place in the «PH_TV» phase and which lasts 21 seconds, or «tv», if «tv» > 21 seconds.

  The deviations marked with «Z» in the sequence diagram cause the burner control to perform forced prepurging in the next startup phase.
- **Repetition at the end of «TSA»:** In the event no flame is established at the end of «TSA», there is a choice of lockout or repetition can be triggered by changing to the home run. The number of repetitions is limited and can be selected via the «RepZaehler» parameter.

  However, the general conditions of the different adjustable capacity ranges must be observed (refer to the table further below).
- In the event of **loss of flame during operation,** the burner control initiates lockout or changes to home run with restart, depending on the capacity range (refer to the table further below)
- **Prepurging:** Can be deactivated by using the setting 0 seconds. In that case - as shown on the sequence diagram - a change from the «PH_THL1_1» phase to the «PH_TW1» phase will take place
- **Preignition time:** If parameter «tvz» is set to 0 (no ignition prior to «TSA»), the «PH_TVZ» phase takes no more than 0.2 seconds (minimum time)
- **Forced intermittent operation:** After 24 hours of continuous operation at the latest, forced intermittent operation is triggered, which ensures a regular shutdown to the «PH_STANDBY» phase.
  The timer for forced intermittent operation is reset in the «PH_STANDBY» phase.
  Quick startup with forced intermittent operation is not possible.

- **Safety time (TSA):** As described above, the behavior of the burner control in the 2 different modes can be parameterized: Abortion of the safety time with flame detection, and evaluation of the flame at the end of the safety time.

  It must be noted that in the case of single-electrode operation, it is always «Evaluation of the flame at the end of the safety time» that must be parameterized.

- **Postpurging:** Can be parameterized in 2 different ways, namely as postpurging on the prepurging level, or as postpurging with the control used last. The duration of postpurging is adjusted via «tn» (also see above)

- **Start prevention:** Certain internal or external events can trigger start prevention. In that case, the burner control changes to the «PH_STARTVER» phase. The reason for start prevention is given via the diagnostic code

The reason can be one of the following (examples):

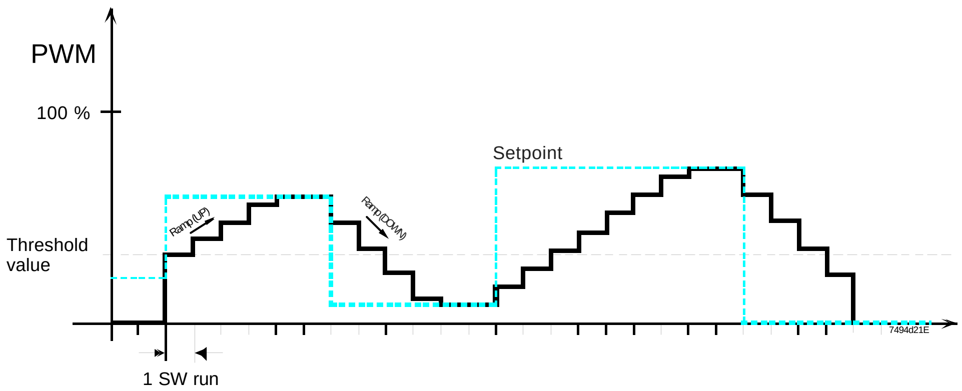
- Open-circuit or short-circuit of flame detector
- No «GP» signal (depending on the parameterization)
- Open «LP» input (depending on the parameterization)
- Temperature limiter has cut out

Some of the functions that give rise to start prevention can be deactivated via parameterization.

- **Ramps:** Fan control can be limited by a ramp. To do this, a number of parameterization choices are available.

  The rate of signal change towards a higher or lower speed is limited via parameter (VmLauf, VmLaufBetr, VmLab, VmLabBetr).

  In all phases - with the exception of «PH_MODULATION» - parameters «VmLauf» and «VmLab» apply to the rate of change of fan control up or down.



Control value following the setpoint while considering the threshold value and the ramps

In the «PH_MODULATION» phase, the increase of fan control is limited by the smaller of the 2 parameters «VmLaufBetr» and «VmLauf».

The decrease is limited by the smaller of the 2 parameters «VmLab» and «VmLabBetr».

Also, when controlling the fan, a threshold value is to be considered. It is predefined by the «LmodStart» parameter.

As long as the setpoint is lower than the threshold value, the fan will not be controlled. It is controlled only - using the threshold value - when the setpoint is at least equal to the threshold value.

If the setpoint lies above the threshold value, starting from the threshold value, the control value will approach the setpoint in accordance with the maximum slope (ramp) defined by parameters «VmLauf» and «VmLaufBetr».

If the setpoint lies below the current control value, the control value will approach the setpoint in accordance with the ramp (VmLab, VmLabBetr). This also applies in the case the setpoint is lower than the threshold value.

If the setpoint equals zero, which means that the fan shall be switched off, first the control value will be reduced in accordance with the ramp until it is smaller than or equal to the threshold value. Only then will the control value be reduced to zero.

LMU... plausibility checks of the speed parameters

Fault	**Display of fault on the PC tool**
Check PWM control values of the fan for plausibility in relation to other parameters:	
LmodZL > LmodVL	218
LmodTL > LmodZL	219
LmodNull > LmodTL	220
Check speed parameters of the fan for plausibility in relation to other parameters:	
N_TL > N_VL	221
N_VOr > NoG_Max	222
N_VL + N_VL_Delta > NoG_Max	223
N_ZL + N_ZL_Delta > N_VL + N_VL_Delta	224
N_VOr - N_VOr_Delta < NoG_Null	225
N_ZL - N_ZL_Delta < N_TL - N_TL_Delta	226
N_TL - N_TL_Delta < NoG_Null	227
N_Nachstell_Delta ≥ N_ZL_Delta or N_Nachstell_Delta ≥ N_Vor_Delta	503

Parameterization of speed feedback signal

The fan’s speed feedback signal can be parameterized.

Parameter: Fan pulses (in «FaEinstellFlags3»)

Available choices: 2, 3 or 4 pulses per revolution

Fan parameters accessible via QAA

Under certain conditions, the fan parameters for ignition load, partial load and full load can also be set via the QAA73... (parameter «FaEinstellFlags3»).

Since these fan parameters are safety-related and – as a general rule – safety-related values cannot be readjusted via the QAA73..., following applies:

- The relevant parameters will be copied and the new parameters filed in the non-safety-related range
- Changeover between the 2 parameter groups can be parameterized via a safety-related flag (FaEinstellFlags3)

Changeover to the QAA fan parameters is only permitted under certain preconditions:

1. Capacity range < 70 kW.
2. Changeover only possible on the OEM level or higher.

For the new parameters, the usual fan parameter checks are made (same as with the previous parameter group).

Listing of both parameter groups:

Parameters on QAA	**Safety-related parameters**
LmodZL_QAA	LmodZL
LmodTL_QAA	LmodTL
LmodVL_QAA	LmodVL
N_ZL_QAA	N_ZL
N_TL_QAA	N_TL
N_VL_QAA	N_VL

When setting these parameters, the following general conditions must be observed:

QAA parameters:		**CRC-protected parameter:**
LmodZL_QAA	≤	LmodZL
LmodVL_QAA	≤	LmodVL
LmodTL_QAA	≥	LmodTL
N_ZL_QAA	≤	N_ZL
N_VL_QAA	≤	N_VL
N_TL_QAA	≥	N_TL

Note

When, in the following, reference is made to one of the safety-related parameters, it is also possible that the corresponding QAA parameter is meant (depending on the parameterization).

The different capacity ranges

In compliance with the standards, a differentiation must be made with regard to the responses in the sequence diagram for the different boiler capacity ranges.

Parameter «FaProgFlags1» can be used to select the 3 following ranges:

FaProgFlags1 (Bit7)	FaProgFlags1 (Bit6)	Capacity range
0	0	< 70 kW
0	1	70...120 kW
1	0	> 120 kW

From these 3 capacity ranges, the following differences emerge:

	Capacity range		
Subject	< 70 kW	70 - 120 kW	> 120 kW
Air supply failure during prepurging, ignition or in operation: 1)	Response: Home run; during the safety time and in operation also forced prepurging. During prepurging, immediate lockout.	Response: Home run on first occurrence, one restart permitted (number 0 / 1 can be parameterized). Then lockout; also forced prepurging. During prepurging, immediate lockout. Repetition counter is reset in the «PH_TI» phase.	Response: Lockout position 4)
Failure during establishment of flame: 2)	Response: Shutdown on first occurrence, restart permitted (number of restarts can be parameterized). Then lockout; also forced prepurging. Repetition counter is reset in phase «PH_TI».	Response: Shutdown on first occurrence, one restart permitted (number 0 / 1 can be parameterized). Then lockout; also forced prepurging. Repetition counter is reset in the «PH_TI» phase.	Response: Lockout position 4)
Loss of flame during operation: 3)	Response: Shutdown	Response: Shutdown on first occurrence, one restart permitted (number 0 / 1 can be parameterized). Then lockout; also forced prepurging. Repetition counter is reset in the «PH_TI» phase.	Response: Lockout position 4)

1) With the LMU...: Failure of speed supervision or speed feedback signal below the valid range.
Relevant phases: PH_TV, PH_TW1, PH_TW2, PH_TVZ, PH_TSA1_1, PH_TSA2_1, PH_TSA1_2, PH_TSA2_2, PH_TI, PH_MODULATION

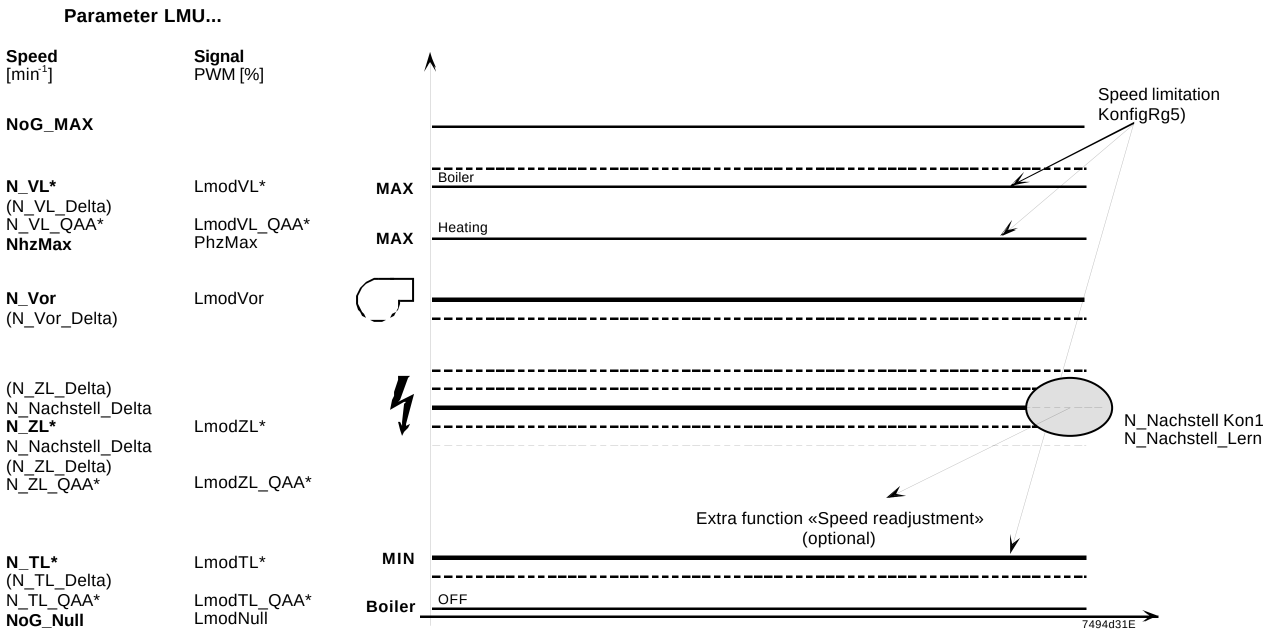
2) With the LMU...: No flame at the end of the safety time. Relevant phases: PH_TSA1_1, PH_TSA2_1, PH_TSA1_2, PH_TSA2_2

3) With the LMU...: Loss of flame during phases «PH_TI» and «PH_MODULATION»

4) Accomplished by parameterizing the specified value for the start repetitions to 0

Setting the fan parameters during startup and shutdown

To visualize the following description, also refer to the sequence diagram of the LMU… and the following graph.



* Depending on parameter «FaEinstellFlags3»

Fan control and speed parameters

First, set the speed limits while **speed readjustment is switched off**.

For that purpose, set the fan control parameters («LmodZL», «LmodVor», etc.) to the values required from the combustion point of view (with the medium flueway and at mains voltage).

Then, also determine the associated fan speeds from the fan characteristic and parameterize them accordingly («N_ZL», «N_Vor», etc.).

In a first approach, set the limit values for the permitted bands very wide («N_ZL_Delta», «N_Vor_Delta», etc.).

The values of fan control and fan speed can now be optimized.

Speed limits

First, the speed readjustment should be set to the required or parameterized speed readjustment.

When the optimization or setting is completed, proceed to the next step and determine and set the speed limits.

For that purpose, use the PC tool and record the speed (Gebl_F_Drehz) in a startup and shutdown cycle under the following boundary conditions:

1. With the minimum flueway and undervoltage (AC 195 V)
2. With the maximum flueway and overvoltage (AC 253 V)

Now, set the speed bands (speed limits about the selected speeds, that is, «N_ZLV +/- N_ZL_Delta», etc.) such that in all possible worst cases, the measured speed lies within the valid band (see above).

Faults outside these worst cases give rise to a violation of the speed limits and lead to appropriate reactions (refer to sequence diagram).

Speed readjustment

Speed readjustment is active during startup and shutdown (not during controller operation where speed limitation can be activated).

The basic task of speed readjustment is to act on the fan control in such a way that the resultant speed (after a certain settling time) will lie within an accepted speed band.

Hence, external effects (over- or undervoltage, minimum or maximum flueway, etc.) can largely be offset.

The following parameters must be considered:

- **N_NachstellKon1 (in «FaEinstellFlags2»)**

This parameter is used to activate or deactivate the function during startup.

- **N_NachstellKon2 (in «FaEinstellFlags2»)**

This parameter is used to activate or deactivate the function during shutdown.

- **N_Nachstell_lern (in «FaEinstellFlags2»)**

This parameter is used to activate or deactivate the learning function of fan control.

- **N_Nachstell_Delta**

This parameter predefines the band (+/-) to which the speed will be readjusted (neutral band).

- **Nachstell_Zaehler**

This parameter is used to define the time when ignition shall be started (depending on the fan speed settling time → more or less overshoot on ignition permitted).

Description

If the function is activated (N_NachstellKon1 + N_NachstellKon2), the fan output signal will be readjusted in order to get the speed back into the predefined band (e.g. N_ZL +/- N_Nachstell_Delta).

If speed readjustment is used, the actual speed will be readjusted to nearly the required speed until ignition takes place.

Since with this readjustment, the fan speed requires a certain settling time, it is **very advisable** to parameterize prepurging and ignition at the same level, so that the prepurging time can be used for settling process.

If, for example, prepurging > ignition, a second settling process will take place, that is, the deviation at the time of ignition will be greater.

In that case, the prepurging time should be changed and the level of prepurging and ignition should be the same.

Learning function

During startup, the fan output will be changed in order to readjust the resulting actual speed.

To ensure that this practically fixed offset does not need to be readjusted on each startup, the fan output signal will be acquired at the end of startup, and the value learned will be used next time the burner is started up.

This means that the settling process will be accelerated.

The learning function can be deactivated with flag «N_Nachstell_lern» (in «FaEinstellFlags2»).

Reinitialization

In the following cases, a reinitialization will be made or the parameterized control values learned:

- In the event of a fault in connection with the fan
- In the event of a reset
- After power ON

Tolerance of settling process during startup

Especially in cases where the prepurge level deviates from the ignition level, the fan speed needs a certain time to settle out just prior to ignition. Depending on the application, this speed variation can give rise to more or less disturbance.

Parameter «Nachstell_Zaehler» can be used to adjust the permitted degree of fan speed settling, or from when the change to ignition shall take place.

If a small value is parameterized (e.g. 1), ignition is effected immediately. The greater the value, the less overshoot is permitted on ignition.

It should be noted that greater values extend the startup phase.

3.2 Selection of the compensation variants

Different types of compensation are used for the heating and the DHW circuit, depending on the types of plant components. On completion of a certain startup time, during which the connected components are queried, the relevant compensation variant is selected.

If plant components are connected or removed during operation, the compensation variant changes after the new plant state is identified.

Heating circuits

The plant components decisive for the compensation variant of heating circuits 1 and 2 or the following:

- The RU
- The outside sensor
- The HMI (none / cannot be parameterized / can be parameterized)

External heat demand signals (via the RVA...) are received directly and are not included in the following table.

Without HMI

RU QAA53 / QAA73	**RU for Hk1 active**	**RU for Hk2 active**	**Outside sensor**	**Setpoint Hk1 TkSoll**	**Setpoint Hk2 TvSoll**	**Compensation variant heating circuit 1**	**Compensation variant heating circuit 2**
Not present	–	–	Not present	TvSollWf1 at TaGem = 0 °C	TvSollWf2 at TaGem = 0 °C	Emergency operation	Emergency operation
Not present	–	–	Present	TvSollWf1	TvSollWf2	Weather compen-sation LMU	Weather compen-sation LMU
Present	No	No	Not present	TvSollWf1 at TaGem = 0 °C	TvSollWf2 at TaGem = 0 °C	Emergency operation	Emergency operation
Present	No	No	Present	TvSollWf1	TvSollWf2	Weather compen-sation LMU	Weather compen-sation LMU
Present	Yes	No	Not present	Tset / Tset2	TvSollWf2 at TaGem = 0 °C	Room compen-sation RU	Emergency operation
Present	Yes	No	Present	Tset / Tset2	TvSollWf2	Weather compen-sation RU	Weather compen-sation LMU
Present	Yes	Yes	Not present	Tset / Tset2	Tset / Tset2	Room compen-sation RU	Room compen-sation RU
Present	Yes	Yes	Present	Tset / Tset2	Tset / Tset2	Weather compen-sation RU	Weather compen-sation RU
Present	No	Yes	Not present	TvSollWf1 at TaGem = 0 °C	Tset / Tset2	Emergency operation	Room compen-sation RU
Present	No	Yes	Present	TvSollWf1	Tset / Tset2	Weather compen-sation LMU	Weather compen-sation RU

Legend

TvSollWf1	Flow temperature setpoint resulting from weather compensation for heating circuit 1
TvSollWf2	Flow temperature setpoint resulting from weather compensation for heating circuit 2
TsRaumMmi	Room temperature setpoint of HMI
TSet	Flow temperature setpoint of RU for heating circuit 1
Tset2	Flow temperature setpoint of RU for heating circuit 2
TrSet	Room temperature setpoint of RU for heating circuit 1
RT / SU	Room thermostat / time switch
SU program Hz1	Time switch program on the AGU2.310 for heating circuit 1
RU1 / V	Heat demand from RU for heating circuit 1 / heating circuit 2
–	Will not be evaluated

With HMI AGU2.362 /
AGU2.362, AGU2.303

RU QAA53 / QAA73	RU for Hk1 active	RU for Hk2 active	Outside sensor	Setpoint Hk1 TkSoll	Setpoint Hk2 TvSoll	Compensation variant heating circuit 1	Compensation variant heating circuit 2
Not present	–	–	Not present	TvSollMmi (setting pot)	TvSollMmi (setting pot)	Fixed value control	Fixed value control
Not present	–	–	Present	TvSollWf1	TvSollWf2	Weather compen-sation LMU	Weather compen-sation LMU
Present	No	No	Not present	TvSollMmi (setting pot)	TvSollMmi (setting pot)	Fixed value control	Fixed value control
Present	No	No	Present	TvSollWf1	TvSollWf2	Weather compen-sation LMU	Weather compen-sation LMU
Present	Yes	No	Not present	Tset / Tset2	TvSollMmi (setting pot)	Room compen-sation RU	Fixed value control
Present	Yes	No	Present	Tset / Tset2	TvSollWf2	Weather compen-sation RU	Weather compen-sation LMU
Present	Yes	Yes	Not present	Tset / Tset2	Tset / Tset2	Room compen-sation RU	Room compen-sation RU
Present	Yes	Yes	Present	Tset / Tset2	Tset / Tset2	Weather compen-sation RU	Weather compen-sation RU
Present	No	Yes	Not present	TvSollMmi (setting pot)	Tset / Tset2	Fixed value control	Room compen-sation RU
Present	No	Yes	Present	TvSollWf1	Tset / Tset2	Weather compen-sation LMU	Weather compen-sation RU

With HMI AGU2.310

RU QAA53 / QAA73	RU for Hk1 active	RU for Hk2 active	Outside sensor	Setpoint Hk1 TkSoll	Setpoint Hk2 TvSoll	Compensation variant heating circuit 1	Compensation variant heating circuit 2
Not present	–	–	Not present	TvSollMmi acc. to SU prog. HMI Hz1	TvSollMmi	Fixed value control	Fixed value control
Not present	–	–	Present	TvSollWf1	TvSollWf2	Weather compen-sation LMU	Weather compen-sation LMU
Present	No	No	Not present	TvSollMmi acc. to SU prog. HMI Hz1	TvSollMmi	Fixed value control	Fixed value control
Present	No	No	Present	TvSollWf1	TvSollWf2	Weather compen-sation LMU	Weather compen-sation LMU
Present	Yes	No	Not present	Tset / Tset2	TvSollMmi	Room compen-sation RU	Fixed value control
Present	Yes	No	Present	Tset / Tset2	TvSollWf2	Weather compen-sation RU	Weather compen-sation LMU
Present	Yes	Yes	Not present	Tset / Tset2	Tset / Tset2	Room compen-sation RU	Room compen-sation RU
Present	Yes	Yes	Present	Tset / Tset2	Tset / Tset2	Weather compen-sation RU	Weather compen-sation RU
Present	No	Yes	Not present	TvSollMmi acc. to SU prog. HMI Hz1	Tset / Tset2	Fixed value control	Room compen-sation RU
Present	No	Yes	Present	TvSollWf1	Tset / Tset2	Weather compen-sation LMU	Weather compen-sation RU

Room setpoint

The room setpoint is obtained from the following tables:

HzA: Heating circuit of the LMU... (1 or 2) which is controlled by the main heating circuit of the RU (RU1)

HzB: Heating circuit of the LMU... (1 or 2) which is controlled by the secondary heating circuit of the RU (RU2)

Note

Refer to «Configuration of the heating circuits».

Hz1 and Hz2 can also be simultaneously assigned to the RU1 or RU2 program.

Without the RU, HzA = Hz1 and HzB = Hz2

Without HMI

RU QAA53 / QAA73	Room setpoint RU active	RU1 active for heating circuit	RU2 active for heating circuit	Outside sensor	Room setpoint HzA	Room setpoint HzB
Beliebig	No	–	–	Don't care	(TrSmin+TrSmax) / 2	(TrSmin+TrSmax) / 2
Present	Yes	No	No	Don't care	(TrSmin+TrSmax) / 2	(TrSmin+TrSmax) / 2
Present	Yes	No	Yes	Don't care	(TrSmin+TrSmax) / 2	(TrSmin+TrSmax) / 2
Present	Yes	Yes	No	Don't care	TrSet	(TrSmin+TrSmax) / 2
Present	Yes	Yes	Yes	Don't care	TrSet	(TrSmin+TrSmax) / 2

With HMI AGU2.361 / AGU2.362, AGU2.303

RU QAA53 / QAA73	Room setpoint RU active	RU1 active for heating circuit	RU2 active for heating circuit	Outside sensor	Room setpoint HzA	Room setpoint HzB
Don't care	No	–	–	Not present	(TrSmin+TrSmax) / 2	(TrSmin+TrSmax) / 2
Don't care	No	–	–	Present	TrSollMmi	TrSollMmi
Present	Yes	No	No	Not present	(TrSmin+TrSmax) / 2	(TrSmin+TrSmax) / 2
Present	Yes	No	Nein	Present	TrSollMmi	TrSollMmi
Present	Yes	No	Yes	Not present	(TrSmin+TrSmax) / 2	(TrSmin+TrSmax) / 2
Present	Yes	No	Yes	Present	TrSollMmi	(TrSmin+TrSmax) / 2
Present	Yes	Yes	No	Not present	TrSet	(TrSmin+TrSmax) / 2
Present	Yes	Yes	No	Present	TrSet	TrSollMmi
Present	Yes	Yes	Yes	Don't care	TrSet	(TrSmin+TrSmax) / 2

With HMI AGU2.310

RU QAA53 / QAA73	Room setpoint RU active	RU1 active for heating circuit	RU2 active for heating circuit	Outside sensor	Room setpoint HzA	Room setpoint HzB
Don't care	No	–	–	Not present	(TrSmin+TrSmax) / 2	(TrSmin+TrSmax) / 2
Don't care	No	–	–	Present	TrSollMmi, reduced acc. to SU program Hz1	TrSollMmi
Present	Yes	No	No	Not present	(TrSmin+TrSmax) / 2	(TrSmin+TrSmax) / 2
Present	Yes	No	No	Present	TrSollMmi, reduced acc. to SU program Hz1	TrSollMmi
Present	Yes	No	Yes	Not present	(TrSmin+TrSmax) / 2	(TrSmin+TrSmax) / 2
Present	Yes	No	Yes	Present	TrSollMmi, reduced acc. to SU program Hz1	(TrSmin+TrSmax) / 2
Present	Yes	Yes	No	Not present	TrSet	(TrSmin+TrSmax) / 2
Present	Yes	Yes	No	Present	TrSet	TrSollMmi
Present	Yes	Yes	Yes	Don't care	TrSet	(TrSmin+TrSmax) / 2

Configuration of the heating circuits

The RU is a multifunctional unit for 1 or 2 heating circuits. For that purpose, it has a main heating circuit (heating circuit 1) and - only with the QAA73... - a secondary heating circuit (heating circuit 2).

The choice which of the RU's heating circuits acts on which of the LMU's heating circuits is made with the «KonfigHks» parameter. This parameter is conceived such that it allows the RU's influence on heating circuits 1 and 2 of the LMU... to be defined separately.

For both heating circuits of the LMU..., the following choices exist:

- No RU influence (0)
- Controlled by the main heating circuit of the RU (1)
- Controlled by the secondary heating circuit of the RU (2)

When no RU is used, this parameter is of no importance.
Control of an LMU's heating circuit by the RU presupposes that the controlling heating circuit in the RU is not deactivated (the heating circuits of the RU can be deactivated by changing the slope).

If, in the RU, the heating circuit selected for the control is deactivated, the action is the same as with setting «No RU influence» using the «KonfigHks» parameter.

The following assignments can be made:

Parameter KonfigHks	RU influence on heating circuit 2 of the LMU6x	RU influence on heating circuit 1 of the LMU6x	Impact
0	**0**	**0**	Both heating circuits of the LMU... are without RU influence
1	**0**	**1**	Hz2 without RU influence, Hz1 is controlled by the main heating circuit of the RU, if RU is present
2	**0**	**2**	Hz2 without RU influence, Hz1 is controlled by the secondary heating circuit of the RU, if RU is present
10	**1**	**0**	Hz1 without RU influence, Hz2 is controlled by the main heating circuit of the RU, if RU is present
11	**1**	**1**	Both heating circuits of the LMU mare controlled by the main heating circuit of the RU, if RU is present
12	**1**	**2**	Hz1 is controlled by the secondary heating circuit of the RU, Hz2 by the main heating circuit of the RU, if RU is present
20	**2**	**0**	Hz1 without RU influence, Hz2 is controlled by the secondary heating circuit of the RU, if RU is present
21	**2**	**1**	Hz1 is controlled by the main heating circuit of the RU, Hz2 by the secondary heating circuit of the RU, if RU is present
22	**2**	**2**	Hz1 and Hz2 are controlled by the secondary heating circuit of the RU, if RU is present

DHW circuit

The plant components decisive for the DHW circuit's compensation variant are the following:

- LPB clip-in OCI420...
- The RU
- The HMI
- DHW sensor 1

Without HMI

LPB clip-in	**DHW sensor 1 TbwIst1**	**RU QAA73...**	**DHW setpoint TempAnfoVeBw**	**DHW demand**	**Compensation variant DHW circuit**
Not present or DHW locked	Not present	Don't care	TbwSmin	Locked	Locked
Not present or DHW locked	Present	Not present	(TbwSmin+ TbwSmax) / 2	Continuously or via time switch 2)	Emergency operation
Not present or DHW locked	Present	Present	TdhwSet	RU- DHW	RU-compensated
Present and DHW released 1)	Not present	Don't care	TbwSmin (DHW heated by RVA)	LMU-internal DHW heating locked	Locked
Present and DHW released 1)	Present	Not present	TbwSollRva	RVA-DHW	RVA-compensated
Present and DHW released 1)	Present	Present	TbwSollRva	RVA-DHW	RVA-compensated

With HMI AGU2.361 / AGU2.362, AGU2.303

LPB clip-in	**DHW sensor 1 TbwIst1**	**RU QAA73...**	**DHW setpoint TempAnfoVeBw**	**DHW demand**	**Compensation variant DHW circuit**
Not present or DHW locked	Not present	Don't care	TbwSmin	Locked	Locked
Not present or DHW locked	Present	Not present	TbwSollMmi	Continuously or via time switch 2)	Fixed value control
Not present or DHW locked	Present	Present	TdhwSet 3)	RU- DHW	RU-compensated
Not present or DHW locked	Present	Present	TbwSollMmi 3)	RU- DHW	RU- / HMI-compensated
Present and DHW released 1)	Not present	Don't care	TbwSmin (DHW heated by RVA)	LMU-internal DHW heating locked	Locked
Present and DHW released 1)	Present	Not present	TbwSollRva	RVA-DHW	RVA-compensated
Present and DHW released 1)	Present	Present	TbwSollRva	RVA-DHW	RVA-compensated

With HMI AGU2.310

If the DHW operating mode of the AGU2.310 is on standby, the compensation variant in the DHW circuit is generally locked, with DHW setpoint «TbwSmin» and DHW demand locked.

If the operating mode is not on standby, the following table applies:

LPB clip-in	**DHW sensor 1 TbwIst1**	**RU QAA73...**	**DHW setpoint TempAnfoVeBw**	**DHW demand**	**Compensation variant DHW circuit**
Not present or DHW locked	Not present	Don't care	TbwSmin	Locked	Locked
Not present or DHW locked	Present	Not present	TbwSollMmi	Always	Fixed value control
Not present or DHW locked	Present	Present	TdhwSet 3)	RU-DHW	RU-compensated
Not present or DHW locked	Present	Present	TbwSollMmi 3)	RU-DHW	RU- / HMI-compensated
Present and DHW released 1)	Not present	Don't care	TbwSmin (DHW heated by RVA)	LMU-internal DHW heating locked	Locked
Present and DHW released 1)	Present	Not present	TbwSollRva	RVA-DHW	RVA-compensated
Present and DHW released 1)	Present	Present	TbwSollRva	RVA-DHW	RVA-compensated

Legend

TbwSmin	Minimum DHW temperature setpoint
TbwSmax	Maximum flow temperature setpoint
TbwSollMmi	DHW temperature setpoint of the HMI
TbwSollRva	DHW setpoint of the RVA...
TdhwSet	DHW temperature setpoint of the RU
TempAnfoVeBw	Resulting DHW temperature setpoint
RU-Bw	DHW demand from the RU
RVA-Bw	DHW demand from the RVA...

1) The information «Present and DHW released» results from the following:
   - LPB clip-in is contained in the user list of the internal bus
   - The connected RVA... controller delivers a DHW setpoint

2) A time switch for the DHW demand must be released via prameterization (KonfigRg1.Schaltuhr2Bw =1 and KonfigRg1.Schaltuhr2 =1).
   It is to be connected to the RU input. This function **cannot** be used in connection with a RU

3) Can be selected via parameterization «KonfigRg6.2»

3.3 Acquisition of actual values

All actual values are read in via AD conversion. A description of the individual channels is given below.

Assignment of analog sensors

The LMU… has 6 analog read-in channels that can be configured in different ways.

Configura-tion	Analog 1 (tested)	Analog 2 (tested)	Analog 3	Analog 4	Analog 5	Analog 6
1	TkIst	TkRuec	TbwIst1	Tabgas *	TiAussen	Ph2o
2	TkIst	TkRuec	TbwIst1	Tabgas *	TbwIst2	Ph2o
3	TkIst	TbwIst2	TbwIst1	Tabgas *	TiAussen	Ph2o
4	TkIst	TkRuec	TbwIst1	TbwIst2 *	TiAussen	Ph2o

* Variant (in parameterization **and** hardware version)

The selection of AD configuration is made via parameterization (KonfigRg3.0-4).

Each sensor can be checked for open-circuit or short-circuit.

With all sensors that activate functions automatically, open-circuit error messages **cannot** be generated.

In the event of an open-circuit, it is therefore possible to select whether the sensor shall generate an error message or whether it shall be used for automatic changeover.

The selection is made via parameter «KonfigRg0.0-4». For assignment, refer to «Legend of parameters, bit fields LMU...».

Temperatures

Measuring range: Temperature range that is internally presented and evaluated

Read-in range: Temperature range in which neither short-circuits nor open-circuits may be detected

Temperature	Measuring range	Read-in range
Boiler flow temperature	0...125 °C	-5...125 °C
Boiler return temperature	0...125 °C	-5...125 °C
DHW temperature 1 / 2	0...100 °C	-5...125 °C
Outside temperature	-35...+35 °C	-50...+50 °C
Flue gas temperature type A and B	0...125 °C	-5...150 °C

Read-in tolerance (worst case device accuracy excluding sensor error).

Temperature	Range	Tolerance	Resolution
DHW temperature 1 / 2 Boiler flow / return temperature	25...75 °C 0...100 °C	± 2.3 K ± 3.4 K	0.14 K 0.3 K
Outside temperature	-25...+25 °C -35...+35 °C	± 1.6 K ± 2.0 K	0.12 K 0.16 K
Flue gas temperature type A and B	50...125 °C 50...150 °C	± 3.2 K ± 4.9 K	0.2 K 0.32 K

The flue gas sensor is used in 2 types of applications:

Type A: Flue gas systems up to 80 °C, sensor can withstand 150 °C

Type B: Flue gas systems up to 120 °C, sensor can withstand 150 °C

Sensors type A and B use the same NTC sensing element as the boiler temperature sensors, the only difference being the measuring range.

Display of ionization current

The LMU... measures the ionization current passing through the probe. It can be displayed directly in µA:

1. Via the QAA73...:
   This value can be displayed on the LMU's parameterization level. It is a data point that the QAA73... can only read. The time required for updating is about 3 seconds.
2. Via the PC tool.
3. Via the HMI (AGU2.303..., AGU2.310... or AGU2.361...)

3.4 Supervisory functions

Temperature limiter function

The temperature limiter overrides boiler control.

When a maximum boiler temperature is reached, the temperature limiter causes the boiler to shut down and delivers a forced signal to carry the heat away from the boiler. After the boiler has cooled down, the temperature limiter will again enable startup commands.

Switch-off criterion:	TkIst ≥ TkMax
Effects:	Triggering shutdown Triggering the forced signal to carry heat away from the boiler
Switch-on criterion:	TkIst < TkMax – SdHzEin
Effects:	Enabling new startup commands Disabling the forced signal (starting pump overrun if there is no demand for heat)

The temperature limiter overrides the 2-position control. The maximum boiler temperature setpoint, the switching differentials and the cutout temperature of the temperature limiter should match (also refer to section «2-position control»).

Flue gas temperature supervision

Plausibility check of sensor

If a configuration with flue gas sensor was selected (KonfigRg3) and flue gas temperature supervision was released (KonfigRg5), the LMU… must read in a valid value for the flue gas temperature.

Otherwise, there will be either start prevention with error code or the unit will initiate lockout (KonfigRg5).

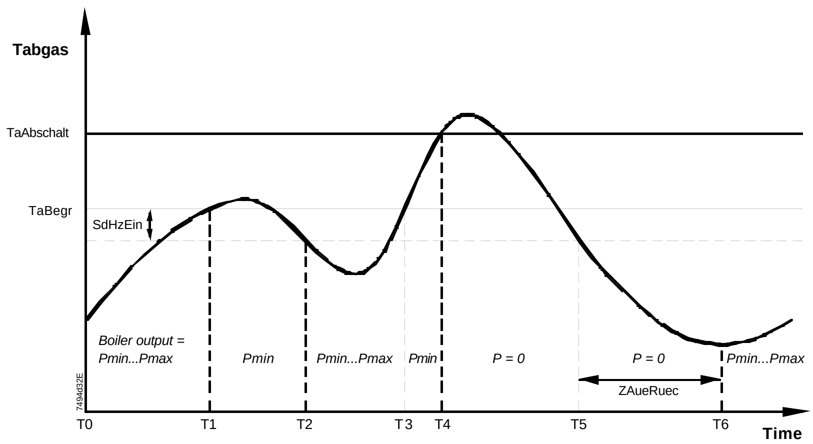
Function

Flue gas temperature supervision is classified as non-safety-related and overrides boiler control. If the first flue gas temperature threshold (TaBegr) is exceeded, the boiler's output will be reduced to its minimum.

If the second flue gas temperature threshold (TaAbschalt) is reached, the boiler will be shut down. In that case, in accordance with parameterization (KonfigRg5), either start prevention of at least 10 minutes (ZAueRuec) will be triggered or the unit will initiate lockout.

The boiler will be released again only after the flue gas temperature has dropped below a certain level.

The following graph shows the different phases of flue gas temperature supervision:



Flue gas temperature supervision with the LMU...

- Boiler output limitation will be triggered when: Tabgas ≥ TaBegr
- Boiler shutdown will be triggered when: Tabgas ≥ TaAbsch
- Boiler output limitation or shutdown will be canceled when: Tabgas < TaBegr – SdHzEin

If flue gas temperature supervision responds, an error code or lockout code will be displayed. In addition, a forced signal will be triggered.

In the case of boiler shutdown, the fan will overrun (ZGebNach).

To ensure that short-time crossings of the flue gas temperature threshold do not immediately give rise to a response, the acquired flue gas temperature will be filtered ($\tau \approx$ 2 seconds).

Electronic (S)LT

The electronic (S)LT used with the LMU... consists of the following function blocks:

- Switching off in the case of overtemperature
- Conduction of a number of plausibility tests in order to be able to interfere in the process in due time to avoid overtemperatures
- Conduction of tests in order to detect fault conditions, thus enabling the (S)LT to initiate adequate actions

Note!

The 2 (S)LT sensors (flow and return) are safety-related sensors!

They must be located and fixed in a way that constant and even heat transfer is ensured (during the entire occupancy time and also after replacement).

- The flow sensor **must** be fitted at a location that is representative of the maximum boiler temperature!
- The return sensor **must** be fitted at a location that is representative of the return temperature!

Following must be observed in connection with the flow **and** return sensors:

- Do **not** use clamping bands for fixing!
- When using a holding spring, cable strain relief must be provided!
- Screwed immersion sensors can be used without taking any extra measures

Note

Measures may be necessary to check proper heat transfer inside the boiler.

Make certain that parameterization is matched to the specific requirements of the boiler(s) and plant!

The relevant boiler and plant regulations must be complied with!

We recommend the use of an **external** safety limit thermostat (connection to LMU-X3-01) in the following cases:

- Boiler outputs > 120 kW
- Applications involving pressure class 3

Handling faults

The table below contains the faults that can occur. It also shows the related measures, that is, whether start prevention or immediate lockout shall be triggered.

Description of fault	Function	Operating state		Diagnosis / fault display	Actions			
						Lockout		
		Faulty	Unfa-vora-ble		Start prevention	Immedi-ately	After (min.)	After number of faults (in 24 h)
Short-circuit flow		X		X	X		10	
Open-circuit flow		X		X	X		10	
Measured value of flow not plausible	TkIst < 0 °C	X		X	X		10	
Measured value of flow not plausible	TkIst > 124 °C	X		X	X		10	
Short-circuit return		X		X	X		10	
Open-circuit return		X		X	X		10	
Measured value of return not plausible	TkRuec < 0 °C	X		X	X		10	
Maximum return temperature exceeded	TkRuec > TSTB	X		X	X		10	
(S)LT cutout temperature reached	TkIst > TSTB Burner is switched off		X	Over-temperature	Already activated by TW			Parameter: GrenzeNach erwaermung
Maximum temperature gradient exceeded	ΔTkIst > TempGradMax Switch burner off		X	Small heat consumption	X			Parameter: GrenzeGradi ent
Excessive ΔT	Δϑ > dTkTrSTB Reduce output by 20 %		X					
	Δϑ > dTkTrSTB + 8K Reduce output to min.		X					
	Δϑ > dTkTrSTB + 16K Burner off	X		X	X			Parameter: GrenzeDelta T
Return temperature above flow temperature	TkRuec > TkIst + Sd_RL groesser _VL	(X)	X	X	X			Parameter: GrenzeRL_gr oesserVL

Legend

Δϑ TkIst - TkRuec
ΔTkIst Gradient of actual boiler temperature

Fault handling routines

If a fault occurs and the limit thermostat’s (TW) cutout temperature is reached, the accumulated heat must be carried away from the boiler by activating the fan or the heating circuit pump (if not yet running).

Response if the cutout temperature is reached:

- **Pump and fan overrun**

In the event the above faults occur, following applies:

If the TW cutout temperature «TkMax» (parameter) is reached, the heating circuit pump will be activated to accelerate the dissipation of heat and optional heating circuits will be forced to draw off heat.

If the (S)LT’s cutout temperature is reached, the fan will **also** be activated.

Both are active until the relevant trigger criterion is no longer present, the maximum time being «ZGebNach» (parameter).

Flow switch / water pressure supervision

Input «Heating circuit monitor» permits the use of a flow switch or of water pressure supervision through connection of the relevant switch. The following functions can be parameterized:

KonfigRg5.1	KonfigRg5.0	Impact
0	0	Flow switch triggering lockout
0	1	Flow switch triggering start prevention
1	0	Pressure switch triggering lockout
1	1	Pressure switch triggering start prevention

Function of flow switch

With this function, the switch closes when adequate amounts of water pass through the boiler's heat exchanger. Hence, the heating circuit flow switch may be evaluated only if, in the case of demand for heat, water passes through the primary heat exchanger.

In the case of DHW heating, the heating circuit flow switch will **not** be evaluated with the following systems:

System 4
36
52
68

The heating circuit flow switch test is always started when demand for heat is triggered (internally or externally).

When the switch is closed, startup can immediately be initiated. When open, the LMU… will lock startup after a waiting time of 12 seconds. Then, a change to start prevention or lockout with the relevant diagnosis is made (status or error code).

If the switch closes after that period of time and start prevention was triggered, it will be canceled again and delivery of the status code is suppressed.

If there is no demand for heat, there will be no evaluation of the heating circuit flow switch during pump overrun or during a kick function.

Function of pressure switch

In that case, input «Heating circuit monitor» watches the water pressure (water shortage switch).

A closed pressure switch immediately enables the startup commands to the burner control and control of the pumps. If the pressure switch is open, start prevention or lockout will only be triggered after 12 seconds.

To ensure protection against water shortage, pump control will also be locked.
For the diagnosis, a status or error code is generated in that case.

If the water pressure rises again and there is start prevention, it will automatically be canceled again and pump control enabled.

Pressure sensor

Plausibility check of pressure sensor:

If a configuration with water pressure sensor was selected (KonfigRg3) and water pressure supervision was released (KonfigRg5), the LMU… must read in a valid value for the water pressure.

Otherwise, there will be either start prevention with error code or the unit will initiate lockout (KonfigRg5). In any case, the pump will be deactivated to prevent dry run.

Note

Only one of the 3 devices (flow switch, pressure switch or pressure sensor) can be used for supervision. Combinations are not possible.

Static supervision

Function

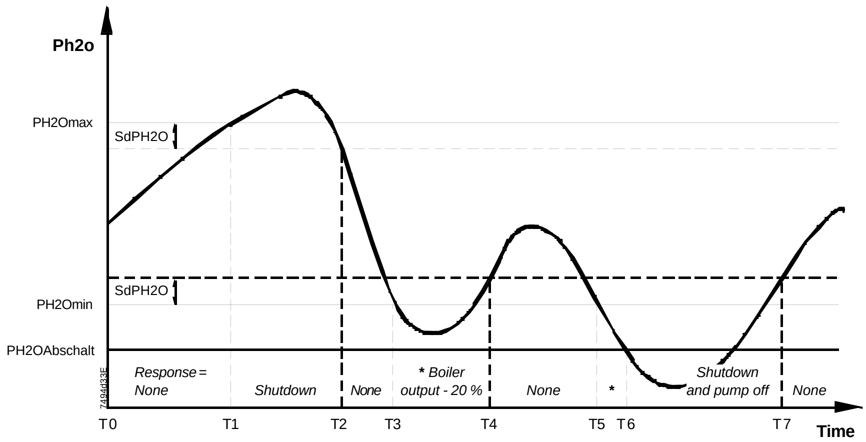
If the pressure sensor is configured, the pressure switch or flow switch will no longer be checked because water pressure supervision has the higher priority.

Water pressure supervision is overriding boiler temperature control.
When certain threshold values are crossed, the LMU… responds in one of the following ways:

- Shutdown (PH2Omax), or
- Output reduction (PH2Omin), or
- Shutting down of boiler and pump (PH2OAbschalt)

If water pressure is too high or too low, there will either be start prevention or the unit will initiate lockout, depending on the parameterization (KonfigRg5).

When water pressure returns to the permitted pressure range, the boiler will be released with no delay. The following graph shows the various phases of water pressure supervision:



Static water pressure supervision with the LMU...

• Boiler shutdown will be triggered when:	Ph2o ≥ PH2Omax
• Boiler output limitation will be triggered when:	Ph2o ≤ PH2Omin
• Boiler and pump shutdown will be triggered when:	Ph2o ≤ PH2OAbschalt
• Boiler output limitation or shutdown will be canceled when:	Ph2o < PH2Omax – SdPH2O
	Ph2o > PH2Omin + SdPH2O

If water pressure supervision responds, an error code or lockout code will be displayed.

To ensure that short-time crossings of the water pressure thresholds do not immediately give rise to a response, the acquired water pressure will be filtered ($\tau \approx 2$ seconds).

Dynamic supervision

When a heating circuit pump is activated, the pressure downstream from the pump will increase and the pressure upstream will decrease. These changes in pressure depend on the pumping power and the pump's capacity.

Function

The pressure sensor acquires the pressure before and after the pump is switched on. The pressure differential must exceed a minimum threshold (dpH2OminPuOn) to ensure proper functioning of the pump.

At the same time, the same pressure differential may not exceed a maximum threshold (dpH2OmaxPuOn), which could lead to the indication of too little circulation or no circulation at all.

If this criterion is not met, start of the pump will be prevented for 10 minutes, with indication of the relevant signal code. If start prevention takes place 6 times in successive order, lockout will be triggered if activated via parameter «KonfigRg5.7=1».

If the pump continues to run during start prevention, it will be locked for the last 10 seconds of start prevention, to be able to again acquire the pressure change caused by the reactivation of the pump, after the boiler has been released again.

The pressure thresholds can be parameterized in the range from 0 to 5 bar, the resolution being 0.02 bar. Checking of the pressure thresholds is individually switched off by selecting 0 bar as the minimum value and 5 bar as the maximum value.

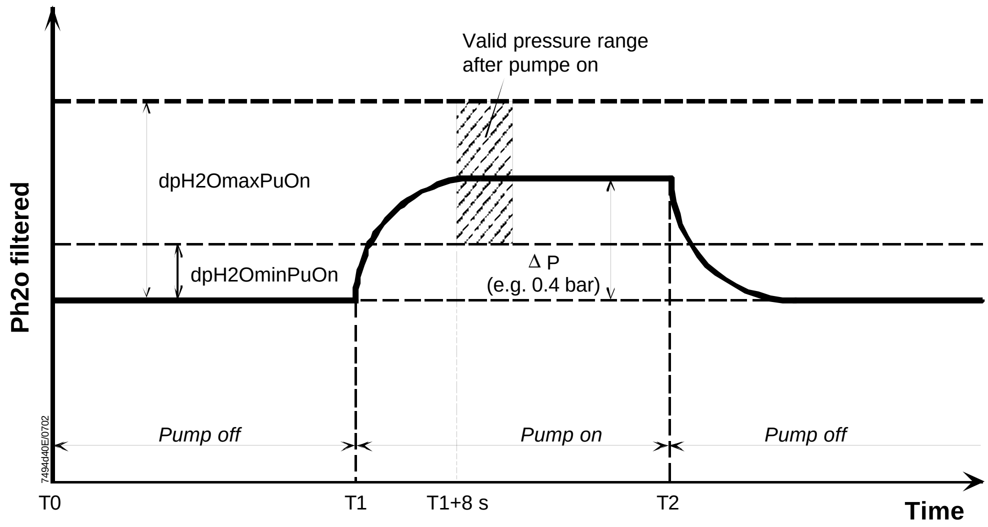
Parameter bit «KonfigRg4.3» can be used to define whether a pressure increase or decrease will be expected after the pump is switched on.

Note

If a diagram was configured without a pump Q1, the function must be deactivated.

The differential pressure is checked 8 seconds after the pump was switched on. Then, during normal pump operation, the differential pressure will no longer be checked.

If a configuration with water pressure sensor was selected (KonfigRg3) and supervision of water circulation has been released (dpH2Omin/maxPuOn), the LMU... must read a valid value for the water pressure. Otherwise, there will be start prevention with the relevant signal code or lockout will be triggered (KonfigRg5.7).



Dynamic water pressure supervision of the LMU...

Load limitation

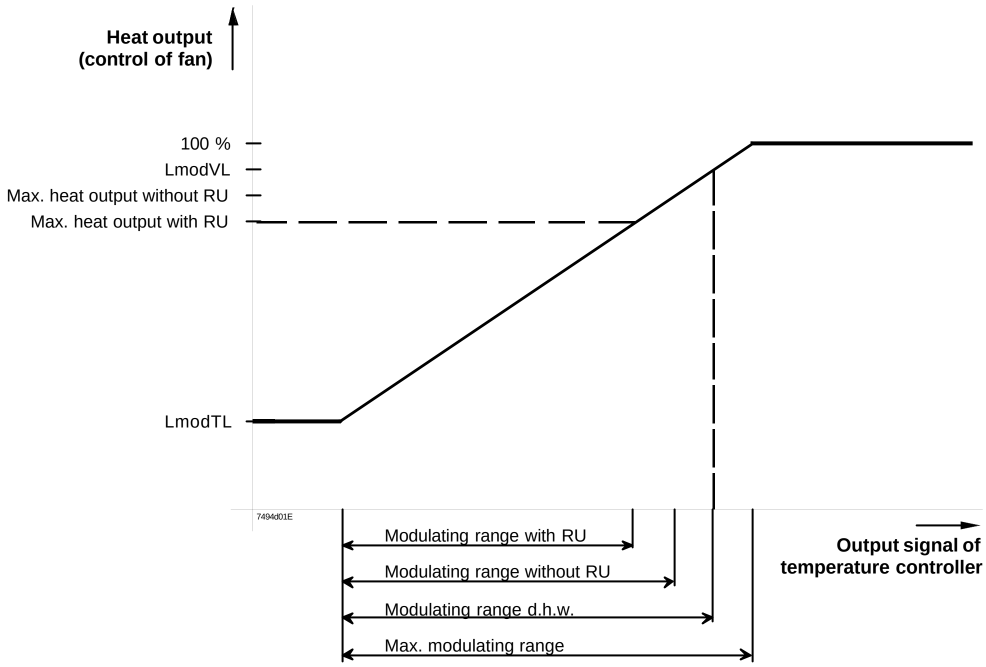
When defining the minimum and maximum heat output, the «Speed limitation» function is of importance. This function is selected via parameterization:

KonfigRg5.2 = 0: Without speed limitation
KonfigRg5.2 = 1: With speed limitation

- Without speed limitation

In that case, the limit values selected for the setting range of heat output are the PWM control values of the fan.

Supply voltage variations have an impact on the heat output and the fan will not catch up. The maximum heat output or the modulating range can be determined with the help of the following graph, depending on the type of plant components connected:



Modulating range of the LMU... without speed limitation

The output limits in the case of heat demand are dependent on the connection of a RU. The following table shows the assignment:

RU	Maximum heat output PhzMaxAkt
Present	See calculations below
Not present	PhzMax

Formula to be used for weather compensation without room influence via the RU:

$$PhzMaxAkt = \frac{RelModLevSet}{100\,\%} \cdot (PhzMax - LmodTL) + LmodTL$$

RelModLevSet: The relative modulation level setting specifies the maximum degree of modulation of the RU in % of the modulating range.

If there is demand for DHW, the maximum output is always predetermined by «LmodVL». With regard to heat demand, the following thus applies to the modulating range:

	Demand for space heating	**Demand for DHW heating**
Minimum output	LmodTL	LmodTL
Maximum output	PhzMaxAkt	LmodVL

The maximum heat output can be adjusted on the HMI, QAA73... or PC tool using the controller stop function.

The setting range is 0...100 %, whereby the following assignment applies:

0 % → LmodTL
100 % → LmodVL

When setting the maximum heat output, the following must be observed:

Maximum output in DHW mode: LmodTL ≤ LmodVL ≤ 100 %

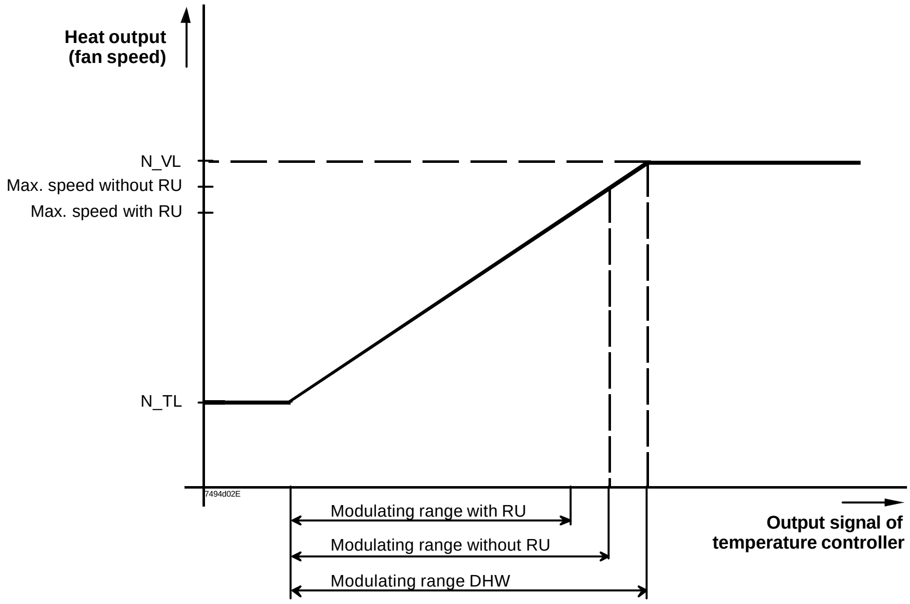
Maximum output in heating mode: LmodTL ≤ PhzMax ≤ LmodVL

Maximum output in heating mode and RU connected: LmodTL ≤ PhzMaxAkt ≤ PhzMax

- With speed limitation

When speed limitation is active, disturbing effects on the fan's speed (voltage variations, changes in resistance on the flue gas side) will be offset with regard to output limits.

For that purpose, the associated speeds must be matched to the heat output measured at the boiler. Like without speed limitation, the modulating range or the maximum heat output can be specified in the form of fan speed.



Modulating range of the LMU... with speed limitation

The output limits in the case of heat demand are dependent on the connection of an RU. The following table shows the assignment:

RU	**Maximum heat output «NhzMaxAkt»**
Present	See calculations below
Not present	NhzMax

Formula to be used for weather compensation without room influence via the RU:

$$NhzMaxAkt = \frac{RelModLevSet}{100\ \%} \bullet (NhzMax - N\_TL) + N\_TL$$

RelModLevSet: The relative modulation level setting specifies the maximum degree of modulation of the RU in % of the modulating range.

If there is demand for DHW, the maximum output is always predetermined by «N_VL». With regard to heat demand, the following thus applies to the output or speed range:

	Demand for space heating	**Demand for DHW heating**
Minimum output	N_TL	N_TL
Maximum output	NhzMaxAkt	N_VL

«NhzMax» can be readjusted during operation via the HMI. Using the controller stop function, a setting range of 0...100 % is possible on the HMI, QAA73... or PC tool, whereby the following assignment applies:

0 % → N_TL
100 % → N_VL

When setting the maximum heat output, the following must be observed:

Maximum output in DHW mode:	N_TL ≤ N_VL
Maximum output in heating mode:	N_TL ≤ NhzMax ≤ N_VL
Maximum output in heating mode and RU connected:	N_TL ≤ NhzMaxAkt ≤ NhzMax

Speed limitation

Speed limitation maintains the preselected speeds when the maximum or minimum heat output is reached. Disturbance variables with regard to fan speed are voltage variations and changes in flueway resistance (length of flueways).

In the case of crossings of the maximum or minimum speed thresholds, speed limitation acts like a one-sided speed control loop.

Depending on the demand for heat, the heat output range is thus as follows:

- With all types of heat demand: N_TL ≤ Nist ≤ NhzMaxAkt

The associated PWM setting range is: LmodTL...PhzMaxAkt

- With DHW demand: N_TL ≤ Nist ≤ N_VL

The associated PWM setting range is: LmodTL...LmodVL

LmodTL: Minimum modulation value at which the flame is not yet lost and combustion performance is still satisfactory

LmodVL: Maximum permissible PWM value (parameter)

Note

Speed limitation has 2 parameters («KpBegr» and «KpUnbegr»), which make it possible to set the dynamics of speed limitation.

The parameter value of 10 represents the default setting.

Limitation of ionization current

An additional limit is introduced for the ionization current (parameter «IonLimit»).
This limit is used to determine the minimum speed such that an ionization current fault cannot cause the burner to shut down.
For that function, speed limitation must be active.

If parameter «IonLimit» is set to 0, the function is deactivated.

If the ionization current drops below «IonLimit», the minimum speed will be set to the current speed.

When the function is activated, this speed will then define the lower limit for the speed limitation. If the ionization current drops below that limit, the lower speed limit will be raised by 100 min^{-1} every 10 seconds.

Speed limitation thus raises the PWM signal and the modulation, which leads to a higher ionization current.

When the lower speed limit reaches the maximum speed («NhzMax» or «N_VL»), the integrator will be stopped.

If the ionization current exceeds the limit, the speed limit is reduced again by 100 min^{-1} every 10 seconds until the speed limit has reached the minimum speed (N_TL).

3.5 Boiler control

Boiler control comprises all functions that convert the demand signal (boiler temperature setpoint) to the output signal (PWM fan control).

These functions include:

- The chimney sweep function (→ CC1**B**7494)
- The controller stop function (→ CC1**B**7494)
- Frost protection for the boiler
- 2-position control
- Modulating control
- Limitation and output of the manipulated variable

Frost protection for the boiler

Frost protection for the boiler is ensured independently of the demand for heat or the connected plant components. It is therefore checked autonomously in the boiler control and, if required, triggers startup with a forced signal to carry the heat away from the boiler.

- Activating frost protection for the boiler: TkIst < TkSfrostEin

When frost protection for the boiler is activated, the forced signal is delivered, thus ensuring that the necessary amounts of heat are carried away from the boiler. The boiler temperature setpoint for the PID controller used during frost protection for the boiler is the maximum boiler temperature setpoint «TkSmax»:

TkSoll = TkSmax

This gives rise to a higher heat output, which means that the switch-off criterion will be reached safely within a short period of time.

- Terminating frost protection for the boiler: TkIst > TkSfrostAus

If there is no other or no greater demand for heat, shutdown will be initiated when the switch-off criterion is reached and the forced signal canceled so that pump overrun starts.

When there is additional demand for heat, there will be no shutdown when frost protection for the boiler is terminated.

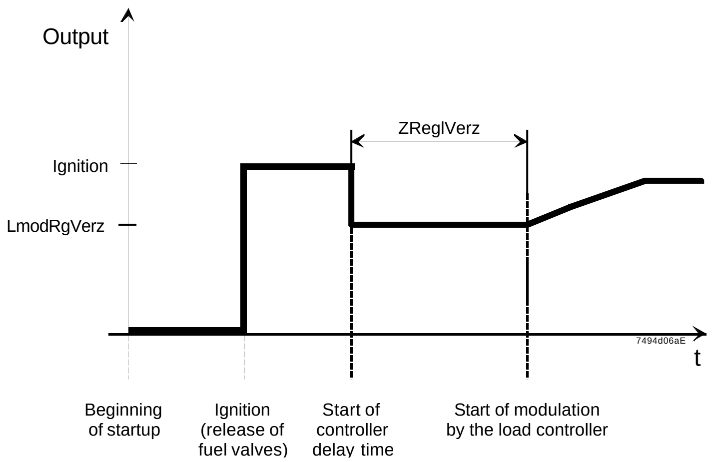
Controller delay

Controller delay due to parameterization

The controller delay serves for stabilizing the combustion conditions, especially after a cold start.

After release of the controller by the burner control, the latter maintains the parameterized heat output (parameter «LmodRgVerz») for the period of time predefined by parameter «ZReglVerz». The modulating controller and thus modulation are released only when this period of time has elapsed.

The following graph shows an example:



During the controller delay, the heat output in heating mode is limited to the heating circuit's correcting span («LmodTL...PhzMax» or «N_TL...NhzMax»).

The controller delay can also be activated via a flag (parameter «KonfigRg7» flag «BetrArtRgVerz») in the case of

- DHW demand (with the exception of instantaneous DHW heaters)

whereby the parameterized output is limited to the possible correcting span of the respective operating mode.

Controller delay due to SLT criterion

If shutdown takes place due to a criterion of the electronic SLT - caused for example by residual heat or a too rapid rise of the boiler temperature - a controller delay will be activated with the next startup.

That controller delay lasts 30 seconds and is active only in heating mode or in the DHW modes. During the time the controller delay is active, the following heat output is delivered, depending on the parameterization.

KonfigRg7 - BetrArtRgVerz = 0: Minimum heat output
KonfigRg7 - BetrArtRgVerz = 1: Heat output «LmodRgVerz», which can be parameterized

In operating modes «Chimney sweep», «Controller stop», or with the test function, the controller delay due to an SLT criterion does not exist. But these operating modes can activate the SLT criterion for the next startup.

Controller configuration

Depending on the operating mode, the boiler controller must be loaded with the relevant setpoints / actual values:

Transfer of setpoint / actual value

	Heating mode	**DHW storage tank charging**	**Instantaneous DHW heating**
Setpoint Tsoll	TkSoll	TkSoll	TempAnfoUfBw
Actual value Tist	TkIst	TkIst	TbwIst1/ TkRuec or TkIst

In heating and DHW storage tank charging mode, the ascertained boiler temperature setpoint is passed on. In the case of an instantaneous DHW heater, the DHW setpoint is used. The actual values will be loaded.

With instantaneous DHW heaters, this is dependent on the type of hydraulic system, water draw or comfort mode and the parameterization (KonfigRg2, DlhKomfReglF).

Determining the controller coefficients

Parameter selection

With fixed controller parameterization, only the relevant controller coefficients and the respective sampling times are selected here.

	Heating mode	**DHW storage tank charging**	**Instantaneous DHW heating**
Controller parameters Kp, Tn, Tv	KpHz1, TnHz1, TvHz1	KpBw, TnBw, TvBw	KpBw, TnBw, TvBw
Sampling time	ZabtastK	ZabtastK	ZabtastDlh

Heat output limits

The PWM setting range of the temperature controller depends on the speed limitation and the heat demand.

- With inactive speed limitation:

  The modulating range must be parameterized while giving consideration to voltage variations.

LmodTL:

This limit must be set such that the heat output will not fall below the minimum permissible output while taking into account voltage variations (undervoltage).

PhzMax, LmodVL:

This limit must be set such that the heat output will not exceed the maximum permissible output while taking into account voltage variations (overvoltage).

	Heating mode	**DHW mode**
Output limits with speed limitation inactive	LmodTL, PhzMax	LmodTL, LmodVL

In addition, the following requirement must be met: PhzMax ≤ LmodVL

- When speed limitation is active:

  The modulating range of the temperature controller remains as wide as possible and speed limitation limits the heat output to the required value.

  - Upper limitation: «NhzMaxAkt» in the case of heating demand, «N_VL» in the case of DHW demand
  - Lower limitation: «N_TL» in the case of heating and DHW demand

  To ensure a maximum modulating range will be reached and voltage variations in the fan's power supply can be offset, it is recommended to set the setting parameters of output adjustment as follows:

LmodTL:

Minimum PWM value at which the flame is not yet lost (while giving consideration to voltage variations).

PhzMax, LmodVL:

100 % (makes possible the maximum fan setting range).
If the associated speeds «NhzMax» and «N_VL» deviate too much from these PWM values, there will be more and more overshoot when the fan speed attempts to adjust itself on reaching the maximum heat output.

If such overshoot is not desired, the values can be reduced.

With the following operating modes, the heat output is statically predefined, that is, the boiler controller's results will be ignored and a value in accordance with the function is delivered to the burner control.

Function	**Required heat output**
Chimney sweep function	PhzMaxAkt
Controller stop function	Set on the HMI or QAA73...
Controller delay	LmodRgVerz

Boiler temperature control

2-position control

The 2-position controller generates the signal for startup or shutdown by the burner control:

Startup = «On» at	TkIst < TkSoll - SdEin
Shutdown = «Off» at	TkIst > TkSoll + SdAus

The switching differentials will be loaded depending on the compensation variant. Also, the dynamic switch-off differential has an impact on the value of «SdAus».

Minimum boiler pause time

The minimum boiler pause time locks the boiler for an adjustable period of time «ZBreMinP».

This time commences after normal shutdowns or when the temperature limiter responds in the case of heat demand, but the 2-position controller initiates a new startup only when this period of time has elapsed.

- **Release of minimum pause time:**

After the flame signal is safely detected, the minimum pause time will be released, that is, the pause time can be started by the 2-position controller with the next shutdown.

- **Start of minimum pause time:**

After release of the minimum pause time on shutdown by the 2-position controller or temperature limiter, the timer will be loaded with the time «ZBreMinP» and then started.

- **Interruption of minimum pause time:**

If, during the minimum pause time, one of the following functions is called for, it will immediately be started. In the background, the minimum pause time for the heating circuit continues to run.

- DHW demand
- Frost protection for the boiler
- Controller stop function
- Chimney sweep function

If the demand is terminated during that period of time, the demand for heating will continue to be locked until the minimum pause time has elapsed.

- **Termination of minimum pause time:**

- On completion of the minimum pause time
- When there is no more demand for heating (Hz1, Hz2 or HzZone)
- When a maximum control differential ΔT = «TkSoll – TkIst» is exceeded

If, during the boiler's minimum pause time, the boiler temperature drops excessively, the pause time will be terminated when a maximum control differential is reached and startup will be released again.

$\Delta T \geq$ dTbreMinP

The minimum pause time will be restarted with the next shutdown.

Boiler cycling protection

Boiler cycling protection is accomplished with different methods, depending on the operating mode.

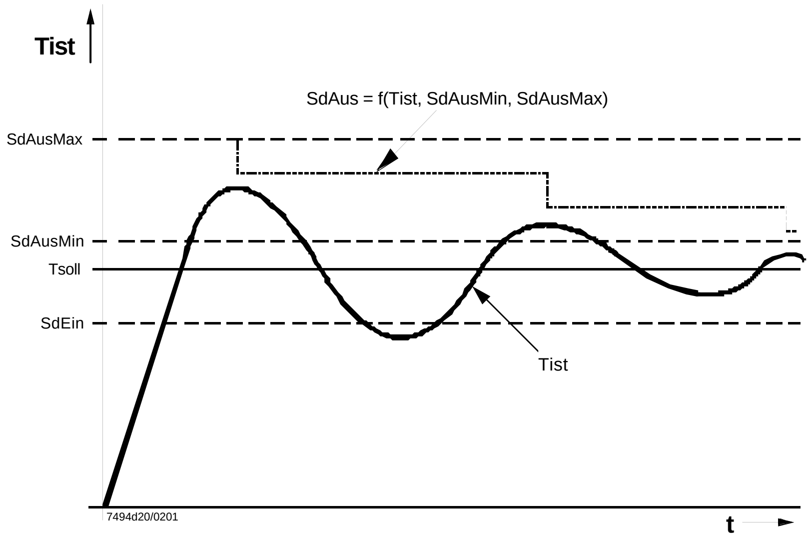
	Heating mode	DHW storage tank	Instantaneous DHW heater 1)
Dynamic switch-off differential	X	X	X
Minimum boiler pause	X		

1) = outlet temperature control

Dynamic switch-off differential

To prevent unnecessary boiler shutdowns during the settling phase, the switch-off differential is dynamically adapted depending on the temperature progression.

In principle, the switch-off differential is reduced depending on the extent of overshoot in the settling phase. With aperiodic processes, the reduction takes place via a time criterion. The following graph shows a typical settling process:



Dynamic switch-off differential

The switch-off differential is thus a function of the maximum temperatures «Tist

SdAus» = f (Tist, SdAusMax, SdAusMin)

The switch-on differential is ready parameterized. Depending on the operating mode, the following assignments apply:

	Heating mode	**DHW storage tank**	**Instantaneous DHW**
Min. switch-off differential (parameter)	SdHzAusMin	SdHzAusMin	SdBwAus1Min
Max. switch-off differential (parameter)	SdHzAusMax	SdHzAusMax	SdBwAus1Max
Switch-off differential SdAus	=f(SdHzAusMin, SdHzAusMax, TkIst)	=f(SdHzAusMin, SdHzAusMax, TkIst)	=f(SdBwAus1Min, SdBwAus1Max, TbwIst1)
Switch-on differential SdEin (parameter)	=SdHzEin	=SdHzEin	=SdBwEin1
Time to reduction to min. switch-off differential (parameter)	ZsdHzEnde	ZsdBwEnde	ZsdBwEnde

By setting the switching differential «SdHzAusMin» equal to «SdHzAusMax», or «SdBwAus1Min» equal to «SdBwAus1Max», the dynamic switch-off differential can be deactivated. The switching differentials are then adopted as ready parameterized.

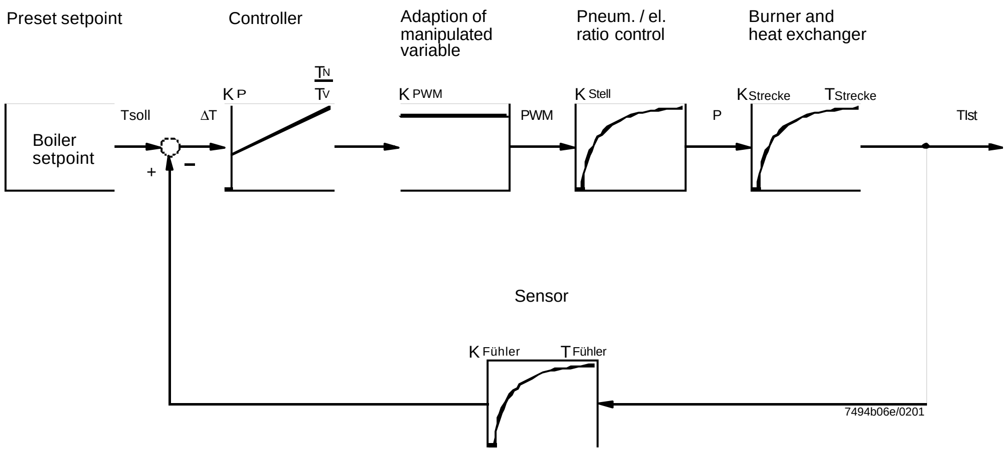
Notes

A minimum switching differential of +2 K (SdAusMin, SdEin) must be observed.

The dynamic switch-off differential only works with positive values of SdAusMin and SdAusMax!

Modulating control, conventional

The boiler circuit is a single temperature control loop:



Basic structure of boiler controller

In the boiler circuit, the boiler temperature is maintained at the predefined setpoint. The controller can be used for the heating circuit or the DHW circuit.

The overriding 2-position controller releases the above mentioned control loop and ensures that the predefined setpoint will be maintained.

The result of the temperature controller is matched to the PWM signal of the controlling element. The output is adjusted via the fan and via pneumatic or electronic ratio control.

In all cases, the temperature limiter overrides the temperature control loop. This means that the temperature limiter switches off the boiler when «TkMax» is reached (triggering safety shutdown).

Based on the control differential (ΔT = Tsoll - Tist) and the selected controller parameterization, the PID control algorithm calculates the required manipulated variable. Using the controller parameters, the relevant controller part can be activated / hidden or adapted to the controlled system.

It is also possible to set the sampling time for the boiler circuit and the DHW circuit.

The heat output determined by the PID controller is limited to the permissible output range.

3.6 Hydraulic system management (HSM)

The HSM controls the controlling elements of the gas boiler and passes the demand signal in a suitable form to the boiler control while giving consideration to boiler-specific functions.

Frost protection for the plant

Frost protection for the plant ensures protection when the outside temperature drops below a certain level. When activated, the heating circuit pumps (Q1, Q2 and Q8, if present) are directly activated so that the water in the heating circuit starts circulating.

Frost protection for the plant acts locally, that is, not on other heating zones of the RVA46… These have their own frost protection.

In the case of DHW demand with absolute priority, that demand is given priority. If there is no DHW priority, frost protection for the plant can be executed at the same time as DHW heating.

Frost protection for the plant can be parameterized:

KonfigRg1.AnlagenFrost = 0: Frost protection for the plant deactivated
KonfigRg1.AnlagenFrost = 1: Frost protection for the plant activated

Frost protection for the plant uses the actual outside temperature. The type of response depends on the outside temperature level.

If there is no outside temperature signal (LMU...-internal or external), frost protection for the plant will be locked.

Outside temperature	**Impact on the heating circuits**
TiAussen ≤ -5 °C	Pumps on
-4 °C ≤ TiAussen ≤ 1.5 °C	Pumps on for 10 minutes at 6-hour intervals
TiAussen > 1.5 °C	Pumps off (if there is no other demand for heat)

In the temperature range -4...-5 °C, there can be different responses.

Decisive is the previous outside temperature level:

- If, before, the outside temperature was higher, the pumps will cycle in that range
- If, before, the outside temperature was lower, the pumps will remain activated in that range

3.7 Consumer management (CM)

Consumer management includes the functions that relate to the interplay between the consumer groups, also including external demands.

Examples are demands for heat resulting from space heating, DHW heating, or demands resulting from operating actions.

Determining the demands for heat

Priorization of demands for heat

Consumer management collects the various demands for heat from the consumer circuits and ensures priorization. If required, several demands for heat are passed on:

- BwSpL DHW storage tank charging
- BwSpFs Frost protection for the DHW storage tank
- BwDlhA Instantaneous DHW heater, demand for outlet temperature
- BwDlhB Instantaneous DHW heater, standby demand
- BwDlhFs Instantaneous DHW heater, demand for frost protection
- BwSchS DHW stratification storage tank, quick charging
- BwSchL DHW stratification storage tank, slow charging
- BwSchFs DHW stratification storage tank, frost protection
- Hz1 Demand for heat pump circuit / boiler circuit
- HzFs1 Demand for frost protection pumps / boiler circuit
- Hz2 Demand for heat mixing circuit / pump circuit 2
- HzFs2 Demand for frost protection mixing circuit / pump circuit 2
- HzZone Demand for heat from the zone (heating circuits via LPB)
- Aus No demand for heat

Priorization of demands for heat:

Priority	Demand for heat with absolute priority	Demand for heat with no priority
1	BwDlhA	BwDlhA
	BwSpL	BwSpL
	BwSchS	BwSchS
		Hz1
		Hz2
		HzZone
2	BwDlhB	BwDlhB
	BwSchL	BwSchL
		HzFs1
		HzFs2
3	BwSpFs	BwSpFs
	BwDlhFs	BwDlhFs
	BwSchFs	BwSchFs
4	Hz1	
	Hz2	
	HzZone	
5	HzFs1	
	HzFs2	

Demands for heat of the same priority can be satisfied at the same time (if not excluded by the hydraulic system). Subordinate priorities will be locked and must wait until the higher priority is satisfied.

Determining the temperature demand

Based on the temperature demands of the connected pieces of equipment, the CM determines the resultant boiler temperature setpoint or, in the case of instantaneous DHW heating systems, the DHW temperature setpoint.

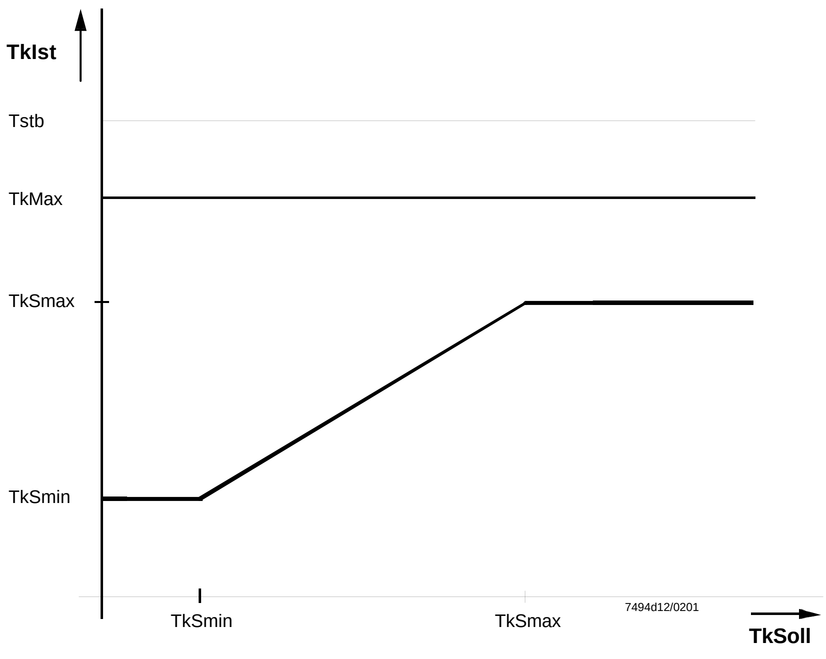
The resulting temperature demand is produced from the maximum generation of all available and released temperature demands, depending on the selected priority:

- **No priority**: Resulting temperature demand = max. (temperature demand «HC1», temperature demand «HC2», temperature demand «ext. HC», temperature demand «Bwk»)

- **Absolute priority** or all systems with instantaneous DHW heaters
  - With heating demand: Resulting temperature demand = max. (temperature demand «HC1», temperature demand «HC2», temperature demand «ext. HC»)
  - With DHW demand: Resulting temperature demand = temperature demand «Bwk»

The result obtained from the maximum generation must be restricted to the boiler's permissible temperature range. Depending on the parameterization, this may have an impact on the temperature demand from the individual circuits.

If parameterization is correct, the permissible boiler setpoint range and setting of the temperature limiter look as follows:



Correlation between 2-position control and temperature limiter

As the graph shows, the following conditions must be satisfied:

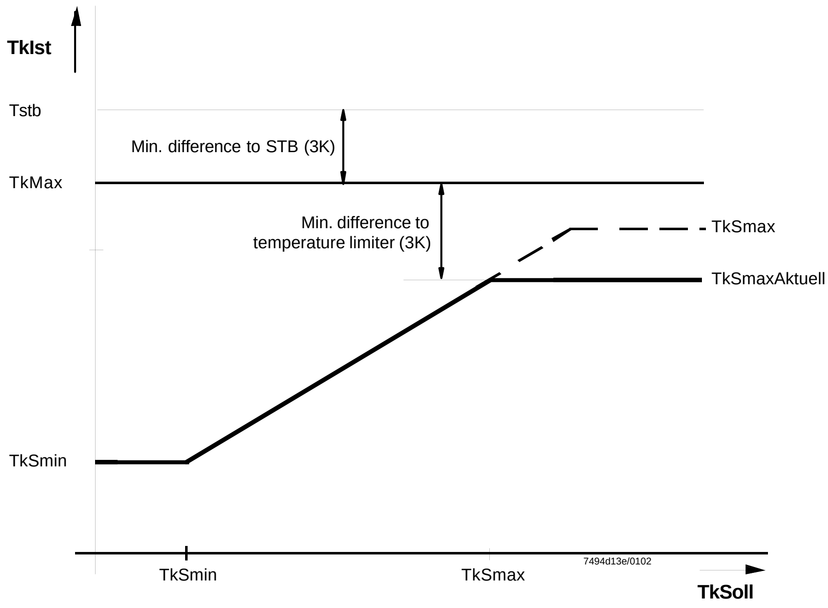
TkMax < Tstb
TkSmax < TkMax

If the selected limiter cutout temperature is too high, internal limitation will be as follows:

TkMax = Tstb – 3K

If the maximum boiler temperature setpoint is selected too high and the switch-off differential too wide (temperature limiter level reached), a minimum differential between boiler setpoint and limiter cutout temperature must be observed:

TkSmax = TkMax – 3K



Limitation of the maximum boiler temperature setpoint by the temperature limiter

In this case, the maximum boiler temperture setpoint is «TkSmaxAktuell». The greater demand from the consumer circuits cannot be satisfied. If, after use of the CM, the current switch-off differential «SdAus» is changed, the limitation is made one more time.

Temperature limitation

Heating circuit 1 can only be operated as a pump circuit. For this reason, limitation is made for the range permitted for the pump circuit.

Limitation HC1: TkSmin ≤ temperature demand HC1 ≤ TkSnorm

Exception: → Warm air curtain function

Summary / winter (S / W) changeover

S / W changeover can be accomplished in 2 different ways:

1. With the manual switch on the HMI.
2. Through automatic S / W changeover via the outside sensor.

Notes on 1.: S / W switch

Depending on the type of HMI, a S / W switch is integrated. That switch causes central locking of the heat demands of all heating circuits and a change to automatic S / W changeover. The following states are possible: 1)

- Summer operation: All heating circuits locked
- Winter operation: All heating circuits released
- Automatic operation: The heating circuits are controlled via automatic S / W changeover

1) Also refer to CC1**B**7494 / Operation / HMI

Notes on 2.: Automatic S / W changeover (can be accomplished in several ways):

a) Via the RU (refer to Basic Documentation QAA73):

When an RU is used, that RU ensures automatic S / W changeover with regard to the heating circuits connected to it (HC1 / HC2).

The LMU… has no information about the the RU's S / W changeover state. In other words, if the RU locks the heating circuits based on automatic S / W changeover, the LMU… cannot release them again.

(If this is not desired, automatic S / W changeover of the RU must be deactivated by setting a higher changeover temperature).

b) Via the LMU...:

The LMU… performs automatic S / W changeover of its active heating circuits (heating circuits not controlled via the RU).

If the system uses an outside sensor (connected to the LMU… or to the RVA...), and if a valid S / W changeover temperature was parameterized, automatic S / W changeover becomes active.

Locking the demand for heat (from winter to summer) S / Wauto = 0 at TaGed > THG + 1K

Releasing the demand for heat (from summer to winter) S / Wauto = 1 at TaGed < THG - 1K

Automatic S / W changeover of the LMU… can be locked via parameterization:

At THG = 30 °C, automatic changeover is inactive and releases the demand for heat in that case.

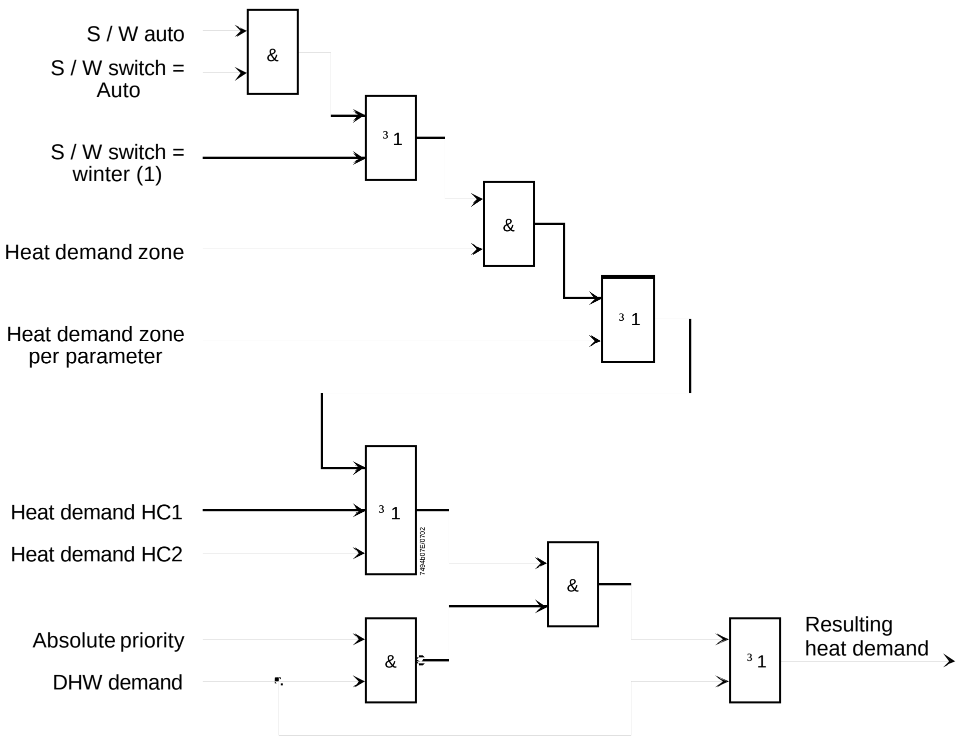
The current state of automatic LMU... S / W changeover is indicated on the HMI by an LED.

The following table shows the correlation between the 2 automatic S / W changeover facilities in the «Automatic» position of the HMI:

Automatic S / W changeover RU	Automatic S / W changeover LMU	Impact on RU HC(s)	Impact on LMU HC(s)	Impact on the zone
Summer	Summer	Locked	Locked	Locked
Winter	Summer	Locked	Locked	Locked
Summer	Winter	Locked	Released	Released
Winter	Winter	Released	Released	Released

If no HMI is connected or if the HMI has no S / W switch, the decision on locking / releasing is made exclusively via automatic S / W changeover.
If the system does not use an outside sensor either, all heating circuits will be released.

The following illustration shows the CM's demand for heat in connection with automatic S / W changeover:



Resulting heat demand of CM

Note

A description of summer / winter changeover with the AGU2.310... is given in CC1**B**7494.

3.8 Electronically controlled PWM heating circuit pump

General

In heating systems, the return temperature is the result of the

- amount of heat currently consumed,
- adjusted pump speed (multispeed pump), and
- current piping network characteristics

In the case of condensing boilers, well defined low return temperatures are required in order to improve the efficiency of condensation.

However, the temperature differential between flow and return (ΔT) should not be too great since the heat exchangers should keep the differential within given limits.

Also, the maximum pump speed is hardly ever required (saving electrical energy and reduction of noise in connection with thermostatic radiator valves).

Introduction

ΔT control acts on the PWM heating circuit pump and on the flow temperature setpoint:

1st stage: Maximum limitation of the flow temperature

2nd stage: ΔT limitation

3rd stage: ΔT supervision

A description of the control functions of stages 1, 2 and 3 is given in the following.

Notes

- A heating circuit pump with PWM is only supported in those hydraulic systems that have a PWM pump included (refer to chapter 10).

  If the selected hydraulic system that does not permit the use of a PWM pump, the connected and parameterized pump will be controlled in a correspondingly stepwise fashion via the PWM line
- Control of the PWM pump is based on weather-compensated flow temperature control according to the heating curve.

  If no weather compensation is active (no outside sensor connected), the default value used is an outside temperature Ta of 0 °C on which the calculations will be based

Task of DT control with PWM pump

If a modulating pump is used, adjustment of the pump speed alone does not suffice.

A different pump speed changes the volumetric flow through the heating plant and thus the amount of heat delivered by the heating system.

This means that when the volumetric flow changes, the flow temperature must be adjusted to the new situation.

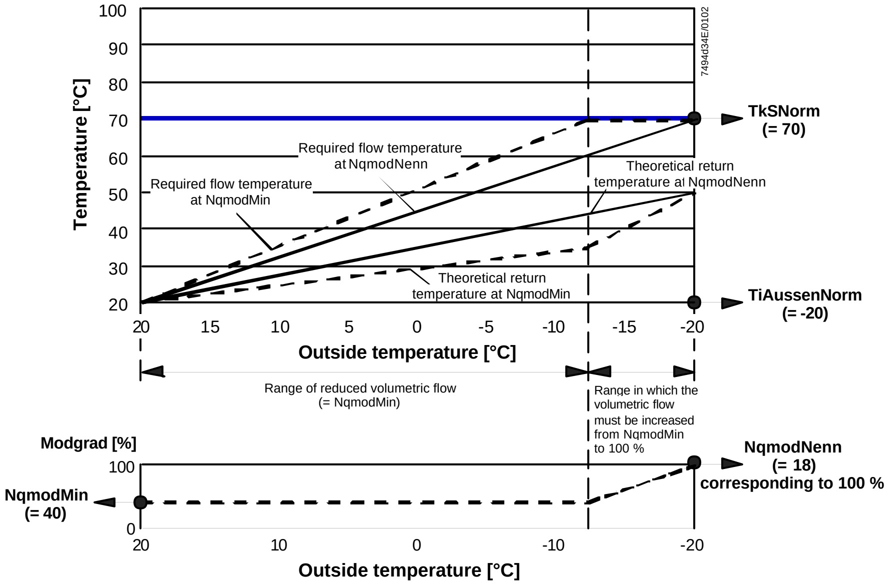
In other words, it must be ensured that, at a given operating point, the amount of heat delivered by the heating system must be the same although the volumetric flow changes.

Since in the case of weather compensation, the heating curve defines the flow temperature for a maximum volumetric flow, ΔT control should be based on that setting.

First stage
Maximum limitation of the flow temperature

Operation with the minimum volumetric flow (NqmodMin) and calculation of the associated flow tempeature boost to keep the amount of heat delivered by the heating system at a constant level.

Limitation ot the maximum flow temperature (TkSnorm) by a stepwise increase of the volumetric flow until the maximum volumetric flow is reached (NqmodNenn).



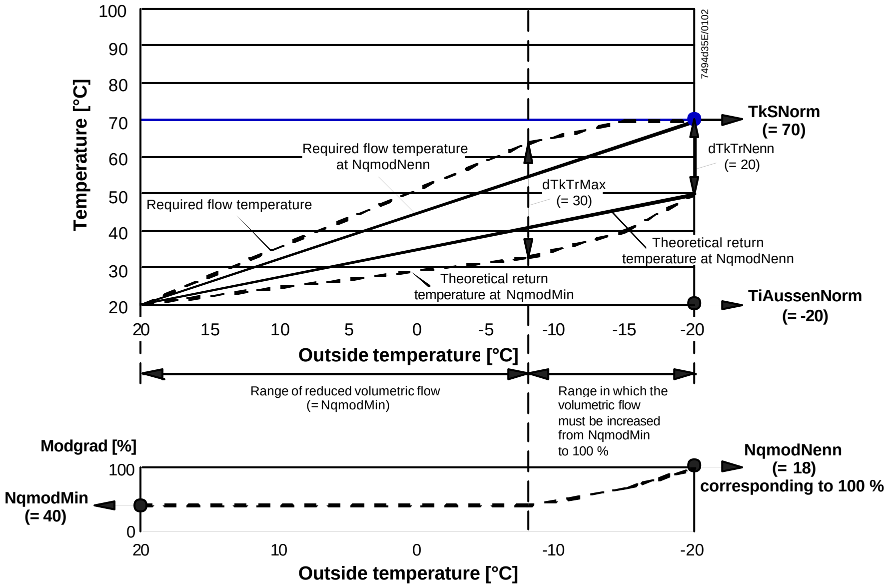
Maximum limitation of the flow temperature

Application

Condensing boilers with **no** return temperature sensor to increase the efficiency of condensation and when there are **no** limitations with regard to the heat exchanger's maximum ΔT. There should be **no bypass,** if possible.

Second stage
ΔT limitation

Like the first stage plus limitation of the minimum volumetric flow to ensure the **expected** ΔT will not exceed the adjusted ΔT (dTkTrMax)
→ Control of ΔTmax via the volumetric flow.



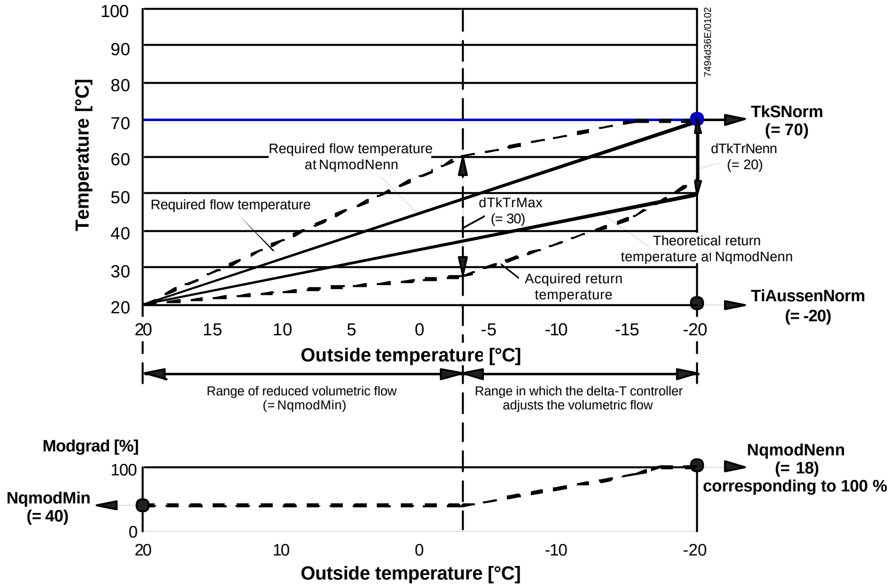
DT limitation

Application

Condensing boilers with **no** return temperature sensor to increase the efficiency of condensation and when there are limitations with regard to the heat exchanger's maximum ΔT. There should be **no bypass,** if possible.

Third stage
ΔT supervision

Like the first stage plus limitation of the minimum volumetric flow to ensure the **measured** ΔT will not exceed the adjusted ΔTmax (dTkTrMax)
→ Control of ΔTmax via the volumetric flow.



DT supervision

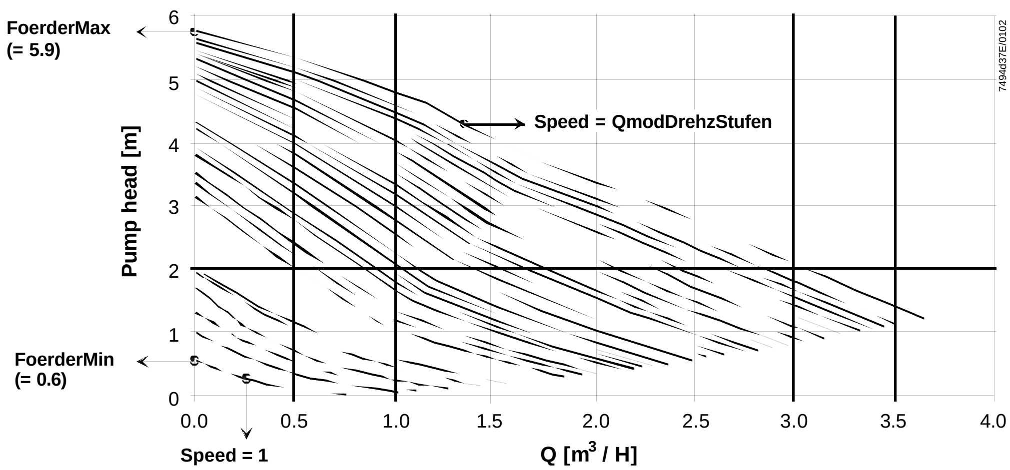
Application

Condensing boilers **with** return temperature sensor to increase the efficiency of condensation and when there are limitations with regard to the heat exchanger's maximum ΔT.
No bypass allowed.

PWM pump control

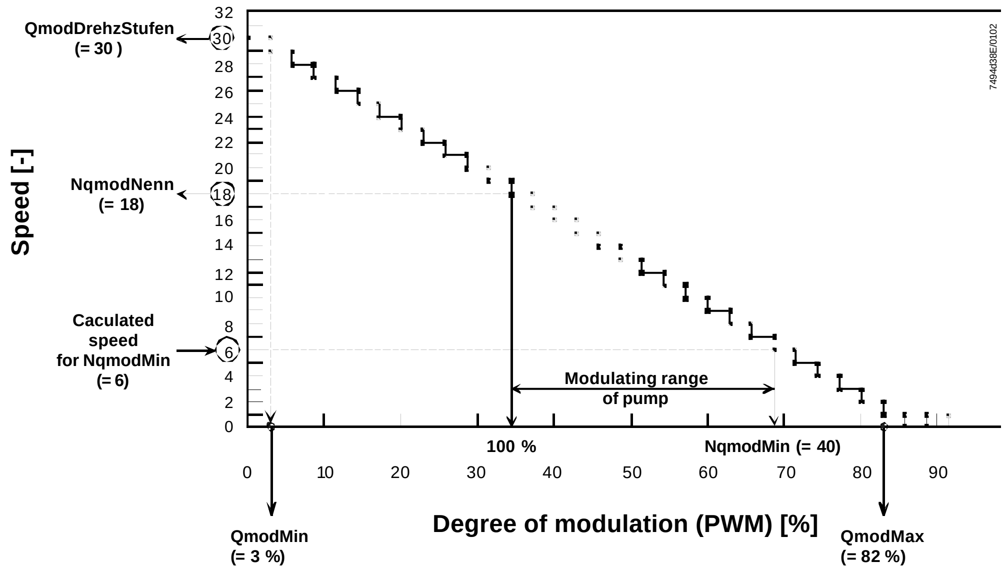
- As before, the pump is activated and deactivated via the AC 230 V line. The pump's speed is adjusted via a separate control line
- The pump is controlled by means of a pulse width-modulated DC signal (PWM = **P**ulse **W**idth **M**odulation)
- Automatic maximum operation should the control line become faulty

H-Q chart
(example)



H-Q chart of PWM pump

Adaption of modulating pump to the heating plant



Adaption of modulating pump to the heating plant

Parametes of the PWM pump (OEM)

Mandatory settings. **Parameterization to be made by the OEM!**

QmodDrehzStufen

Number of speeds supported by the PWM pump. A minimum of 2 speeds need to be set. This value can be obtained from the speed characteristic = f (PWM) or from the pump supplier's specifications.

QmodMin

Minimum degree of modulation of the PWM pump at maximum speed «QmodDrehzStufen». This value can be obtained from the speed characteristic = f (PWM) or from the pump supplier's specifications.

QmodMax

Maximum degree of modulation of the PWM pump at speed = 1.
This value can be obtained from the speed characteristic = f (PWM) or from the pump supplier's specifications.

FoerderMin

Minimum pump head of the PWM pump (zero pump head at Q = 0) at minimum speed (speed = 1) according to the supplier's specifications. This value can be obtained from the H-Q chart or from the pump supplier's specifications.

FoerderMax

Maximum pump head of the PWM pump (zero pump head at Q = 0) at maximum speed (speed = QmodDrehzStufen) according to the supplier's specifications. This value can be obtained from the H-Q chart or from the pump supplier's specifications.

Preset parameters

To be readjusted only if required or in the event of problems!

Klambda1

Filter time constant of the digital filter used for filtering the actual values of the flow and return temperatures for the ΔT supervision. This filter has a diminishing memory.
The default value of «Klambda1» is set to 0.99 ($\tau \approx 20$ seconds).

KtAbtastDt

Factor for calculating the sampling time of ΔT control. The sampling time of ΔT control is a multiple of the sampling time of boiler control (ZAbtastK).
The default value of «KtAbtastDt» is 10. If this parameter is changed, the controller parameters must be adapted also.

Activation of PWM pump via a configuration byte

Parameterization to be made by the installer

Configuration byte for setting the control strategy of the modulating pump. For the ∆T supervision, only Bits 0 through 5 are relevant.

Bit 0

Heating circuit pump or maximum limitation of the flow temperature (first stage).

XXXX XXX0: Multispeed pump is activated; the following Bits 1 through 5 have no meaning

XXXX XXX1: Modulating pump is activated and thus maximum limitation of the flow temperature also

Bit 1

∆T limitation (second stage)

XXXX XX0X: ∆T limitation is inactive

XXXX XX1X: ∆T limitation is active; maximum limitation of the flow temperature remains active also

Bit 2

∆T supervision (third stage)

XXXX X0XX: ∆T supervision is inactive

XXXX X1XX: ∆T supervision is active; maximum limitation of the flow temperature remains active also

Bit 5

∆T supervision in reduced operation

XX0X XXXX: The activated stage of ∆T supervision is inactive in reduced operation

In reduced operation, the pump will then generally operate at the minimum speed «NqmodMin». When running at minimum speed in reduced operation, the house might cool down excessively if poorly insulated.

In the case of better insulated houses, this function is an additional savings function in terms of electric pumping power, since the pump runs at a lower speed, thus saving electrical energy.

XX1X XXXX: In reduced operation (night setback), the selected ∆T supervision is active, depending on the activated stage

Bit 6 and Bit 7

Not relevant for ∆T supervision.

Parameters of the PWM pump (installer)

Mandatory settings! **Parameterization to be made by the installer.**

NqmodNenn

Speed at the design point of the heating plant. This value must be set at the time the plant is hydraulically balanced.
It corresponds to the speed of the circulating pump at the design point for reaching the nominal volumetric flow.

This parameter corresponds to the analog speed selector of the circulating pump, so to say.

For the control, setting of the «NqmodNenn» speed corresponds to the volumetric flow of 100 % (= nominal flow at the design point).

The settings for the reduced volumetric flow («NqmodMin» and «NqmodMinBw») refer to this 100 % value.

Parameters of the PWM pump

Settings to be made if required.

NqmodMin

Minimum speed of the PWM pump in heating operation that may be used so that a sufficient supply of heat to the rooms is still ensured.

The adjusted percentage value is converted to a minimum characteristic depending on the selected speed characteristic or the «NqmodNenn» speed.

This means that if «NqmodNenn» is changed, «NqmodMin» will automatically produce another minimum speed for heating operation.

NqmodMinBw

Minimum speed of the PWM pump in the case of stratification torage tank applications. This pump speed is used when the stratification storage tank is fully charged.

The adjusted percentage value is converted to a minimum characteristic depending on the selected speed characteristic or the «NqmodNenn» speed.

This means that if «NqmodNenn» is changed, «NqmodMinBw» will automatically produce another minimum speed for DHW heating.

Parameters for temperatures

Mandatory settings! **Parameterization to be made by the installer.**

TkSnorm

Maximum boiler temperature setpoint for the heating circuit. The maximum boiler temperature setpoint or the nominal design temperature of the radiator heating system refers to the design point at the design outside temperature «TiAussenNorm».

At the design outside temperature (lowest outside temperature), a 70 / 50 system is designed based on a maximum boiler temperature of 70 °C.

This means that the «TkSnorm» setting to be made for a 70 / 50 system is 70.

TiAussenNorm

Design outside temperature at the design point of a heating plant.
The design outside temperature (lowest outside temperature) for the respective geographical region can be obtained from appropriate tables (e.g. VDI-Wärmeatlas, DIN standard).

The maximum boiler temperature setpoint «TkSnorm» will then be set according to the design outside temperature.

dTkTrNenn

Mandatory setting!
Design differential (= temperature differential between flow and return) at the design point at the design outside temperature. In the case of a 70 / 50 system, the setting to be made is thus 20.

dTkTrMax

Setting to be made if required.
Maximum differential or ΔT between flow and return that shall be maintained by the ΔT supervision.

This value is used in connection with the ΔT limitation for controlling the pump's degree of modulation. With the ΔT supervision, «dTkTrMax» is the setpoint for the control of the measured temperature differential between flow and return.

«dTkTrMax» can be set independently of «dTkTrNenn» and can even be greater than «dTkTrNenn». When setting «dTkTrMax», the permissible temperature differential of the associated heat exchanger must be observed.

PID controller coefficients of delta-T supervision

If required.

KpDt — Proportional coefficient of ΔT supervision

TvDt — Derivative action time of ΔT supervision

TnDt — Integral action time of ΔT supervision

Summary of all DT parameters

No.	DPA no.	Parameter name	Function	Setting level	Mandatory settings	
					OEM	**Installer**
1	180	QmodDrehzStufen	Number of speeds of the modulating pump	OEM	**Yes**	If required
2	146	QmodMin	Minimum degree of modulation	OEM	**Yes**	If required
3	147	QmodMax	Maximum degree of modulation	OEM	**Yes**	If required
4	177	FoerderMin	Minimum pump head	OEM	**Yes**	If required
5	176	FoerderMax	Maximum pump head	OEM	**Yes**	If required
6	435	Klambda1	Filter time constant	OEM	If required	No
7	179	KtAbtastDt	Factor for sampling time	OEM	If required	No
8	182	KonfigRg7	Configuration byte			
		Bit 0	Heating circuit pump 0: Multispeed; 1: Modulating	Installer	**Yes**	No
		Bit 1	ΔT limitation 0: Inactive; 1: Active	Installer	**Yes**	No
		Bit 2	ΔT supervision 0: inactive; 1: active	Installer	**Yes**	No
		Bit 3	Plant volume	Installer	No	**Yes**
		Bit 4	1,0: medium			
		Bit 5	ΔT in reduced operation. 0: inactive; 1: active	Installer	**Yes**	No
		Bit 6	Not relevant	Installer	No	No
		Bit 7	Not relevant	Installer	No	No

Summary of all ΔT parameters (cont'd)

No.	DPA no.	Parameter name	Function	Setting level	Mandatory settings	
					OEM	Installer
9	174	NqmodNenn	Speed at the design point	Installer	No	**Yes**
10	175	NqmodMin	Minimum speed in heating operation	Installer	No	If required
11	188	NqmodMinBw	Minimum speed in DHW operation	Installer	No	If required
12	181	TkSnorm	Maximum boiler temperature setpoint	Installer	No	**Yes**
13	173	TiAussenNorm	Design outside temperature at the design point	Installer	No	**Yes**
14	172	dTkTrNenn	Design differential	Installer	No	**Yes**
15	116	dTkTrMax	Maximum temperature differential of ΔT control	OEM	**Yes**	If required
16	167	KpDt	Proportional coefficient	OEM	No	If required
	168	TvDt	Derivative action time	OEM	No	If required
	169	TnDt	Integral action time	OEM	–	If required

Behavior in different operating modes

Pump overrun

To ensure safe startup of the modulating pump, a start kick with the maximum pump speed (QmodMin) is given for 10 seconds each time the pump is activated.

On completion of the start kick, the value calculated from the heat demand will be adopted.

Normal operation (heating operation)

In normal heating operation, the pump runs at reduced speed (reduced volumetric flow) for the greatest part of the operating time and the flow temperature will be appropriately raised.

On the software side, both ΔT limitation and ΔT supervision can be switched on or off.

When the modulating pump is running, maximum limitation of the flow temperature according to the adjusted value is always active.

Reduced (setback) operation

In reduced operation, it is always the reduced (minimum) volumetric flow that is used, or the ΔT supervison is active.

If the ΔT limitation and / or the ΔT supervision are active, they also acts in this operating mode. It then works the same way as in normal operation, the only difference being the lower flow temperature level.

Shutdown mode

The modulation function of the pump is deactivated since the heating is shut down.

Heating up phase

In order not to extend the heating up phase due to the reduced volumetric flow, the plant is always heated up with the full volumetric flow «NqmodNenn» within the first 30 minutes after reduced operation (night setback) or after plant shutdown (night shutdown).

Then, a change to the volumetric flow is made that was calculated according to the current outside temperature.

DHW operation

The maximum pump speed (QmodMin) will be used (with the exception of full charging of stratification storage tank systems).

Behavior with night setback or quick setback

If the LMU... knows about the states of the switching program, it is possible to run the heating circuit pump at minimum speed during night setback or quick setback.

Decisive for this function is the compensation variant used.

In that case, it is accepted that the room temperature drops below the nominal level. Energy savings are given priority.

Parameterization offers the following choices:

KonfigRg7.DtRedBetrieb =

XX0X XXXX: ∆T control is inactive in reduced mode, which means that the pump's speed is «NqmodMin»

XX1X XXXX: ∆T control is also active in reduced mode

Information about night setback is dependent on the compensation variant of heating circuit 1. Depending on the variant, the function is either locked or released:

Compensation variant HC1	Criterion for night setback
Emergency operation, fixed value control or weather compensation LMU...	Time switch is used and has made setback: «KonfigRg1.Schaltuhr1» = 1 **and** RT = 0
Room influence RU or weather compensation RU	Switching program of HC1 is in night setback mode: «BetrNiveauRh1»= 0 er 1*

* BetrNiveauRh1 = 0 means frost protection
BetrNiveauRh1 = 1 means reduced mode (this means that the minimum pump speed is also used in frost protection mode)

If the criteria for night setback are not met, ∆T control will be calculated and the calculated pump speed delivered.

Behavior with boostheating

If the LMU... knows about active boost heating, it is possible to deliver the maximum pump speed during boost heating (thus ensuring the shortest heating up time).

Information about boost heating is only possible in connection with the QAA73...:

Condition for evaluating boost heating:

Compensation variant Hz = (room influence RU or weather compensation RU) and QAA73... present.

On completion of boost heating, the degree of modulation from the calculation of ∆T control will be delivered again.

Maximum limitation of the flow temperature in connection with ∆T control

Depending on the connected plant components, the maximum flow temperature setpoint «teta_vl_max» is generated based on the input from several sources:

	Emergency operation, fixed value control, weather compensation LMU...	Room influence RU, weather compensation RU
Compensation variant HC1	TkSnorm (setting parameter of LMU…)	MaxTSet (setting of RU)

3.9 Heating circuit control

From the entries made by the endusers, room control determines the demand signal delivered by the associated heating system. This takes place based on the results obtained from weather compensation, switching programs, ECO functions, etc.

Attenuated outside temperature

Benefit

- Consideration is given to the building's thermal storage capacity

Description

The attenuated outside temperature is the simulated room temperature of a fictive building that has no heat source and that is solely influenced by the prevailing outside temperature.

Setting

No direct setting is possible. Generation of the attenuated outside temperature cannot be influenced in any way.

Process

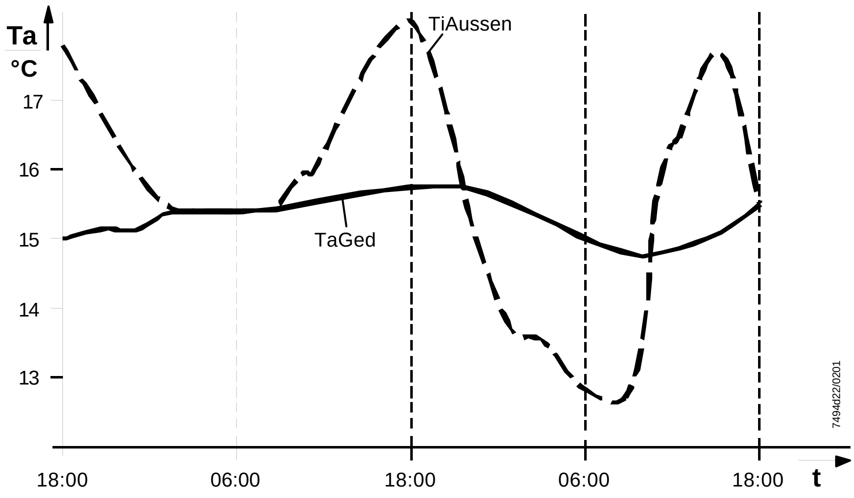
The attenuated outside temperature is generated by the controller itself. It is calculated at 10-minute intervals based on the actual outside temperature.

Effect

The attenuated outside temperature has a direct impact only on S / W changeover.

It acts indirectly on the flow temperature control via the composite outside temperature.

Example



TiAussen	Actual outside temperature
TaGed	Attenuated outside temperature

Composite outside temperature

Benefit
- Compensating variable for flow temperature control

Description
The composite outside temperature is a mixture of actual outside temperature and attenuated outside temperature as calculated by the controller.

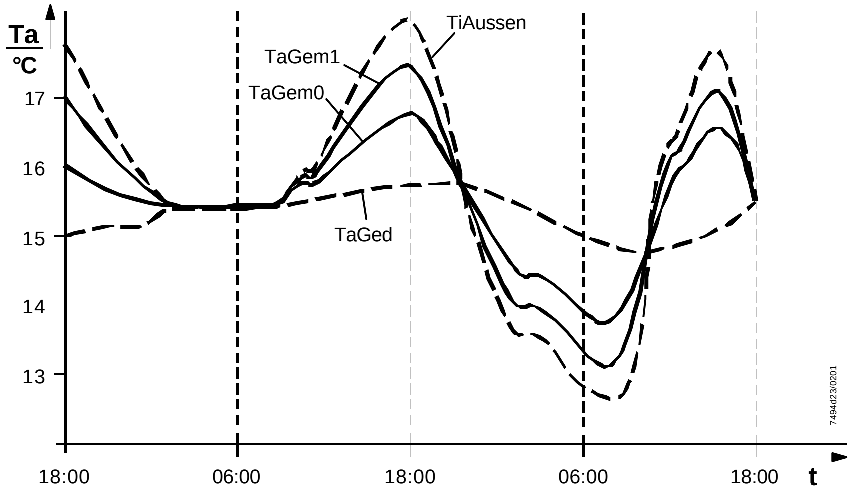
Process
The mixture of actual and attenuated outside temperature is dependent on the type of building construction and is generated as follows:

Selected type of building construction	*Composite outside temperature*
Heavy	TaGem = ½ TiAussen + ½ TaGed
Light	TaGem = ¾ TiAussen + ¼ TaGed

Impact
The composite outside temperature acts on the flow temperature control as the compensating variable, enabling the flow temperature to adapt to the prevailing weather conditions.

Also, it acts on the automatic 24-hour heating limit to switch off the heating.

Example



TiAussen	Actual outside temperature
TaGed	Attenuated outside temperature
TaGem1	Composite outside temperature of light buildings
TaGem0	Composite outside temperature of heavy buildings

Type of building construction

Benefit
- The building's thermal storage capacity is taken into account

Description
Allows the rate of control to be adapted to the type of building construction.

Impact
Depending on the thermal storage capacity of a building (type of building construction), the room temperature changes at different rates as the outside temperature varies. This setting adapts the generation of the composite outside temperature to the type of building construction (also refer to «Attenuated outside temperature»).

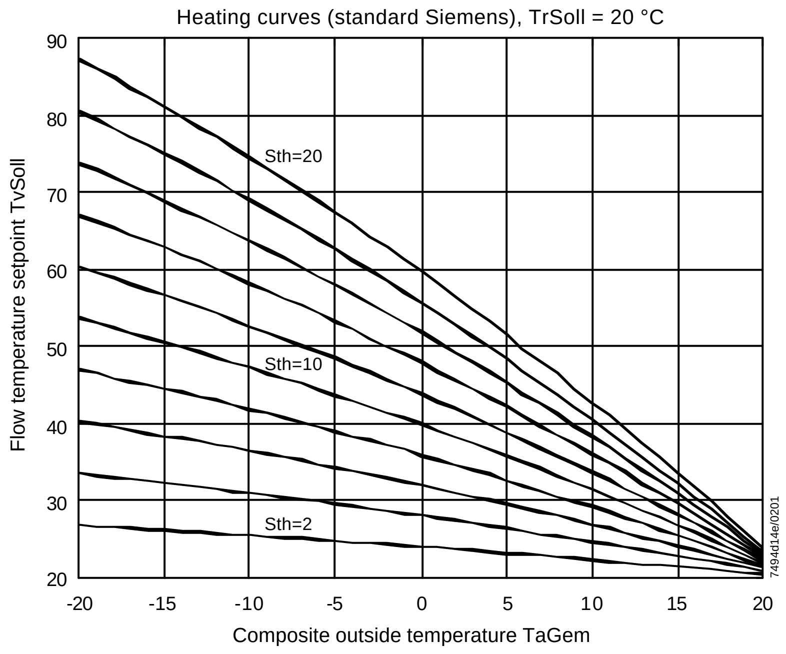
Entry («KonfigRg4»):

XXXX XX1X: **Heavy building construction.** The room temperature responds more slowly to outside temperature variations

XXXX XX0X: **Light building construction.** The room temperature responds more quickly to outside temperature variations

Type of building construction
- Heavy building construction: Houses or buildings with thick walls or walls with outside insulation
- Light building construction: Houses or buildings with thinner walls or light brickwork

Heating curves



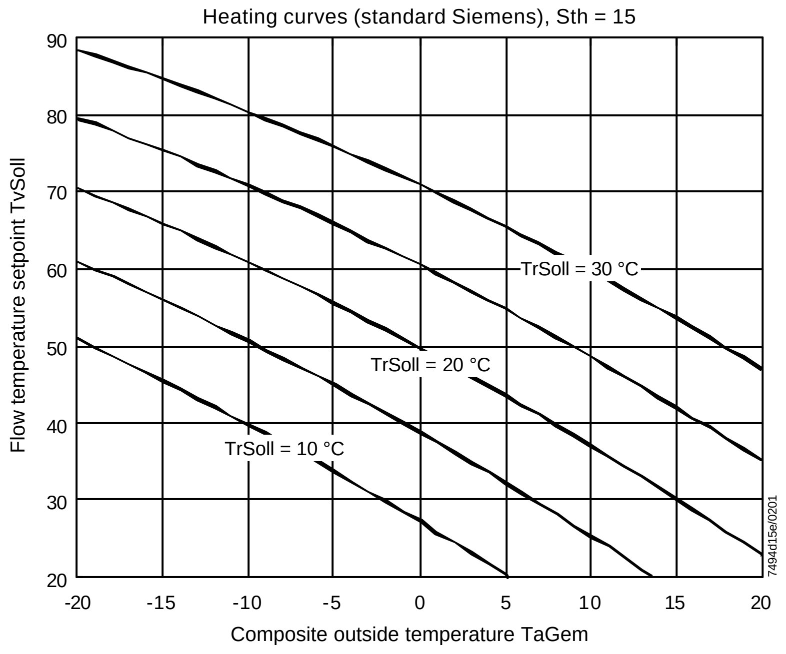
Heating curves of LMU...-internal weather compensation (impact of slope)

Legend

TvSoll:	Flow temperature
TaGem:	Composite outside temperature
Sth:	Heating curve slope (parameter)

The heating curve describes radiator systems with a radiator exponent of n =1.3 at a room temperature setpoint of 20 °C. For other systems with n = 1.1, for example, or different nominal flow / return temperatures, the slope can be appropriately adjusted.

In the case of room temperature setpoint changes, the heating curve is shifted on a 45 ° axis in relation to TvSoll = f (TaGem) graph.



Heating curves of LMU...-internal weather compensation (impact of room temperature setpoint)

Calculation of the heating curve is based on a maximum pump flow rate, which means that the pump's degree of modulation is 100 %.

When using a variable speed pump, a certain extra temperature is added.

With QAA73...

RU QAA73... calculates weather compensation completely (referred to a degree of pump modulation of 100 %). Input data from the RU's perspective are the following:

Toutside:	Actual outside temperature

As the results of weather compensation, the LMU... receives from the RU:

TSet:	Boiler temperature setpoint of HC1 of the RU
TSet2:	Boiler temperature setpoint of HC2 of the RU
CH1 enable:	Heat demand HC1 of the RU
CH1 enable:	Heat demand HC2 of the RU

To maintain the room temperature level with pump modulation, the LMU… calculates an extra temperature, which is added to the value of the RU.

Generating the demands for heat

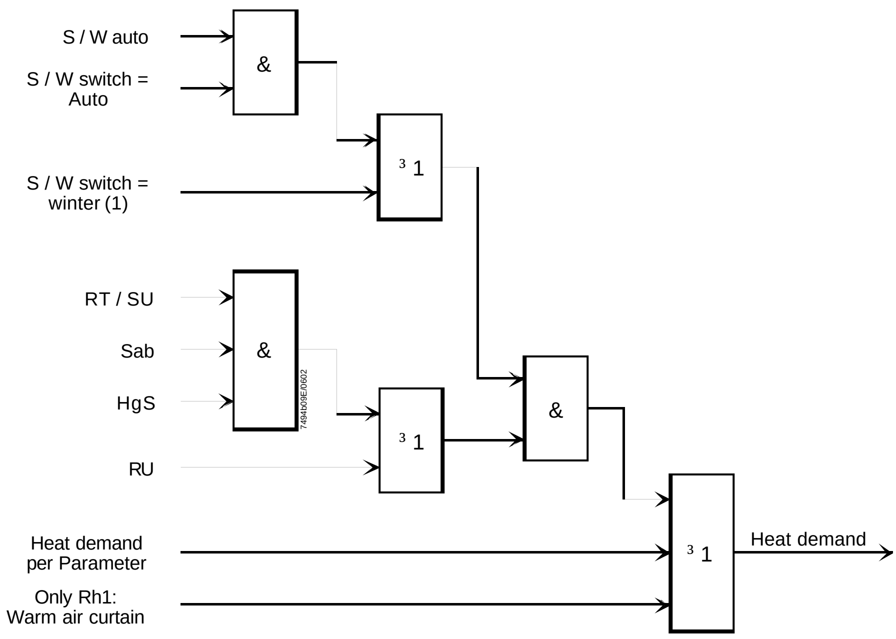
If there are several sources that call for heat, the following priorities apply:

1. Demand for heat via the RU.
2. Room thermostat or time switch with / without weather compensation.

For the different plant components that act on the demand for heat, refer to the table in chapter «Combinations of RU and room thermostat / time switch».

The → ECO functions also have an impact on the demand for heat.

In general, the heating circuits' demand for heat is that shown by the following diagram:



Generation of heat demand by heating circuits 1 and 2

Legend

RT / SU	Room thermostat / time switch
HgS	Heating limit switch
RU	Room unit
S / W auto	S / W changeover by LMU…
S / W switch	S / W changeover on HMI
Sab	Quick setback

If certain plant components are not present (e.g. no S / W changeover), the input will enable the demand for heat.

Time switch

In the case of systems using a time switch (external clock connected to the room thermostat or QAA73... input), there are 2 choices to determine the demand for heat.

Changeover takes place via setting parameter «dTrAbsenk»:

dTrAbsenk = 0:	Time switch acts directly on the demand for heat
dTrAbsenk ≠ 0:	Time switch acts on the room temperature setpoint

Time switch acting directly on heat demand

In this case, the switching state of the time switch contact is directly passed on. The time switch can be connected either to the room thermostat or to the QAA73... input. The following assignment applies:

Time switch contact open:	SU = 0
Time switch contact closed:	SU = 1

If **no** time switch is connected, the demand for heat will stay locked (SU = 0)

The assignment to the heating circuits is as follows:

Time switch connected to …	Impact on …
RT input	Heating circuit 1, SU1 = RT
QAA73 input	Heating circuit 2, SU2 = OT

If a RU is connected to the QAA73... input, the following assignment applies:

Time switch connected to …	Impact on …
RT input	Heating circuit 1, SU1 = RT, if not controlled by the RU Heating circuit 2, SU2 = RT, if not controlled by the RU

If SU2 is derived from the QAA73... input (no RU connected), SU2 will act on heating circuit 2 only when parameter «KonfigRg1.Schaltuhr2Bw» = 0 and «KonfigRg1.Schaltuhr2» = 1, that is, if a change to heating circuit 2 was made. Otherwise, SU2 acts on the DHW circuit.

If, by contrast, SU2 is derived from the RT input (RU connected), the RU always acts on heating circuit 2.

When AGU2.310... is connected, following applies: Time switch is inactive. It will be replaced by the time switch program of the AGU2.310... (→ CC1**B**7494).

Time switch acting on the room temperature setpoint

In this operating mode, the time switch produces a reduction of the room temperature setpoint when the time switch contact is open. The room temperature setpoint changed in this way is included in the calculation made by the heating limit switch. Hence, in this case, the time switch only acts indirectly on the demand for heat.

If weather compensation is used, reduction of the room temperature setpoint also leads to a reduction of the boiler temperature setpoint.

TsRaumAkt:	Current room temperature setpoint
TsRaum:	Room temperature setpoint from HMI or RU
dTrAbsenk:	Temperature by which the room temperature setpoint shall be lowered in reduced mode (setting parameter)

The room temperature setpoint «TsRaumAkt» changed in this way is included in the calculation of the boiler temperature setpoint if weather compensation is used. The time switch can be connected either to the room thermostat's input or to the QAA73... inputs.

With regard to the time switch signal, the following applies, independent of the contact position:

SU = 1

With this variant, the demand for heat is generated based on S / W changeover, heating limit switch and quick setback.

Room thermostat

In the case of systems that use a room thermostat, the switching state of that contact decides on the demand for heat that shall be generated:

Input of room thermostat open: RT = 0
Input of room thermostat closed: RT = 1

If **no** room thermostat is connected, the demand for heat will stay locked (RT1 = 0).

The assignment to the heating circuits is the same as with the time switch:

Time switch connected to …	**Impact on …**
RT input	Heating circuit 1, RT1 = RT
QAA73 input	Heating circuit 2, RT2 = OT

If a RU is connected to the QAA73... input, the following assignment applies:

Time switch connected to …	**Impact on …**
RT input	Heating circuit 1, RT1 = RT, if not controlled by the RU Heating circuit 2, RTR2 = RT, if not controlled by the RU

RU

If a RU is connected, that unit decides on locking and releasing the heat demands from the heating circuits controlled by it.

It is only S / W changeover that can override this demand.

The heating circuits not controlled by the RU can be operated by a room thermostat or time switch. Both heating circuits of the LMU relate to the RT input since the QAA73... input is used by the RU.

For the assignment to the evaluation logic, following applies:

Heating circuit 1

RU1 = 0: Demand for heat locked
RU1 = 1: Demand for heat released

Heating circuit 2

RU2 = 0: Demand for heat locked
RU2 = 1: Demand for heat released

Combinations of RU and room thermostat / time switch

If, with regard to the switching program and the feedback signal from the room, different plant components are connected, the following table applies for the assignment to the heating circuits and the demands for heat.

When a RU is used, a room thermostat or time switch cannot be connected to that input. For this reason, the table does not include these combinations.

Heating circuits of the RU are interpreted as nonexisting if, via the → configuration of the heating circuits, they have not been parameterized as controlling heating circuits, or if the heating curve slope has been deactivated.

RT1 or SU1	**RT2 or SU2**	**RU**	**RU1**	**RU2**	**Heat demand HC1**	**Heat demand HC2**
Not present	Not present	–	Not present	Not present	–	–
Present	Not present	–	Not present	Not present	RT1 / SU1 1) 2)	–
Not present	Present	Not present	Not present	Not present	–	RT2 / SU2 1)
Present	Present	Not present	Not present	Not present	RT1 / SU1 1) 2)	RT2 / SU2 1)
Present	Not present	Present	Not present	Not present	RT1 / SU1 1) 2)	RT1 / SU1 1)
Not present	Not present	Present	Present	Not present	RU1	–
Present	Not present	Present	Present	Not present	RU1	RT1 / SU1 1)
Not present	Not present	Present	Not present	Present	–	RU2
Present	Not present	Present	Not present	Present	RT1 / SU1 1) 2)	RU2
Not present	Not present	Present	Present	Present	RU1	RU2
Present	Not present	Present	Present	Present	RU1	RU2

Legend

RT1 Room thermostat connected to RT input

SU1 Time switch connected to RT input

RT2 Room thermostat connected to OpenTherm input

SU2 Time switch connected to OpenTherm input and activated («KonfigRg1.Schaltuhr2Bw» = 0 and «KonfigRg1.Schaltuhr» = 1)

RU RU connected to OT input

RU1 Heating circuit of the RU, which controls heating circuit 1 of the LMU...

RU2 Heating circuit of the RU, which controls heating circuit 2 of the LMU...

– Present or not present

1) Depending on parameter «KonfigRg1», time switch 1 / 2, following applies:
If this parameter = 1, time switch 1 / 2 is used
If this parameter = 0, room thermostat 1 / 2 is used

2) If, with the AGU2.310, time switch operation is parameterized, the contact will **not** be evaluated and replaced by the switching program of the operating section

ECO functions

S / W changeover

Since S / W changeover applies to all connected heating circuits, refer to «S / W changeover».

Automatic 24-hour heating limit

Benefits

- Automatic shutdown of heating
- Saving energy without sacrificing comfort

Description

This is a fast-acting savings function since the heating will be switched off as soon as no more heat is required. This ensures efficient operation throughout the year as there is no need to switch off the heating manually – a special benefit during intermediate seasons.

Without room influence

Introduction

If **no** RU is connected, the room temperature setpoint will **not** be readjusted by the room influence.

In that case, changeover of the automatic 24-hour heating limit takes place in accordance with the adjusted setpoints.

Process

The basic values used for the process are those of the composite outside temperature and those of the current room temperature setpoint.

Switching off

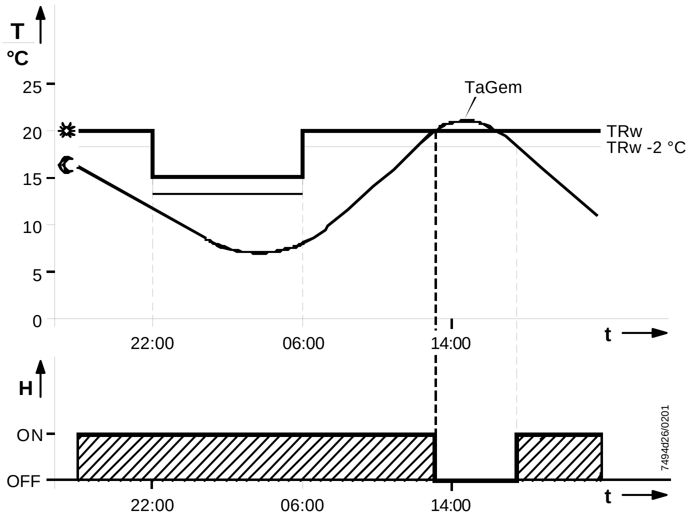
If the composite outside temperature exceeds the current room temperature setpoint, the heating will be shut down.

Switch-off point of heating: **TaGem = TRw**

Switching on

If the composite outside temperature drops by more than 2 °C below the current room temperature setpoint, the heating will be switched on.

Switch-on point of heating: **TaGem = TRw - 2 °C**



H	Automatic 24-hour heating limit
TaGem	Composite outside temperature
TRw	Room temperature setpoint

Effect

During the time the automatic 24-hour heating limit is active, the heating will automatically be off.

Quick setback constant (KON)

Benefit

- Making use of the building's ability to store heat

Impact

The duration of quick setback will be changed.

Entry:

Increase: Longer setback time;
for well insulated buildings that cool down rather slowly

Decrease: Shorter setback time;
for poorly insulated buildings that cool down quickly

Without room influence

Quick setback is started as soon as changeover to a lower room temperature setpoint takes place.

The heating circuit pump will be deactivated until the quick setback time has elapsed. That quick setback time is generated based on the setting of the composite outside temperature and the room temperature setpoint step.

The quick setback time is limited to a maximum of 15 hours.

Example

The example applies to a setpoint step of 4 K (e.g. from TRw 20 °C to 16 °C):

	KON					
TaGem	0	4	8	12	15	20
- 20	0	0	0	0	0	0
- 10	0	0.5	1	1.5	2	2.5
0	0	3	6	9	11	15
+ 10	0	5	11	15 (16.5)	15 (21)	15 (27)
	Values are given in hours					

Generating the temperature demands

Heating circuits 1 and 2 generate heat demands Hz1 and Hz2.

The heat demands are generated in different ways, depending on the configuration. Also, the temperature demands are determined. They result from the user settings and environmental conditions.

With fixed value control or emergency operation

Fixed value control

The temperature demands result from the potentiometer position of the HMI.

Emergency operation

The temperature demands result from the calculation of the heating curve based on an assumed outside temperature of 0 °C. This means that parameter «Slope» can be used to exert an influence on the temperature demand.

With weather compensation

There are different sources of weather compensation:

- LMU...-internal weather compensation:
  LMU...-internal weather compensation will be activated when the outside sensor is present, but no RU is connected. The heating curve parameters of the LMU… will be used (STH1, STH2, DTR1, DTR2)!
- Weather compensation with the QAA73...:
  The weather compensation of the QAA73... follows from the plant configuration.
  In the case of weather compensation via the QAA73 ., the heating curve parameters of the latter will be used which means those of the LMU… are not relevant!

For detailed information on the assignment of setpoints, refer to «Compensation variants heating circuits».

4 Clip-in AGU2.500... for additional heating circuit

The description below covers the full functionality of the AGU2.500... system.
For the concrete scope of functions, refer to the relevant version / configuration.

Functions

General

- Additional pump or mixing circuit for single-user applications
- Independent heating circuit with own
  - time switch program
  - heating curve
  - minimum / maximum limitation of the flow temperature
- Central operation of the 2 heating circuits via the QAA73...
- Straightforward attachment of clip-in module AGU2.500... to the housing of the LMU6...
- RAST5 connectors for all inputs and outputs

Note

Maximum one clip-in module AGU2.500... can be connected to the LMU5... / LMU6... .
A maximum of 2 clip-in modules (OCI420 / AGU2.500... / AGU2.51x) can be connected.

Hydraulic diagrams

On the LMU..., the respective hydraulic diagrams **must** be activated via parameter «HydrSystem»:

- Pump circuit extensions: Diagrams 32 ... 47
- Mixing circuit extensions: Diagrams 48 ... 63
- Zone extensions: Diagrams 64 ... 79

Note

With certain hydraulic diagrams using the AGU2.500... applications, an additional actuating device Y1 (programmable output K2 of the LMU...) in the LMU… pump circuit is used to ensure overtemperature protection.

Sensor inputs (analog inputs)

- Flow sensor

The sensor used has a sensing element NTC 10 kΩ. Its characteristic is the same as that of the NTC sensor read in by the LMU… basic unit.

Temperature	Measuring range	Read-in range	Tolerance	Resolution
Flow temperature	0...100 °C	-5...125 °C	± 3 K	0.3 K

Note

The read-in tolerance is the worst-case device accuracy excluding the sensor tolerance.

Inputs / outputs

Refer to «Connection diagrams».

Interfaces for the LMU...

- Connect X50 of the LMU... and AGU2.500... via cable AGU2.104
- Connect AGU - X52 - 01 to X1 - 02 of the LMU... (mains supply)

Sensor

If the sensor becomes faulty (open-circuit or short-circuit), it must be noted that the flow temperature will no longer be controlled. The mixing valve will be driven to the fully closed position (from V1.01).

Frost protection

The mixing valve clip-in module has its own frost protection function. This frost protection of the heating circuit **only** covers the mixing circuit.

The frost protection for the heating circuit can only become active when a flow sensor is connected to the mixing valve clip-in module.

If such a flow sensor is not present, or if it does not function correctly, the function cannot be performed.

Overtemperature protection

Mixing circuits

In mixing circuits, the maximum flow temperature that can occur will be limited:

- 55 °C	up to V1.01
TvSmax	V1.02 and higher

In the case of underfloor heating systems, a **separate** external limit thermostat must be fitted to ensure protection against overtemperatures!

Determining the flow temperature setpoint

When there is an active demand for heat, the flow temperature setpoint is generated from the temperature demand plus a boost when there is an active forced signal, or minus a reduction when there is an active locking signal.

The forced signal has priority over the locking signal.

When frost protection for the heating circuit is active, the flow temperature setpoint is generated from the switch-off threshold for frost protection.

If the heat demand for heating circuit 2 is not set, but a forced signal is present, the flow temperature setpoint will be placed in the middle between «TvSmin» and «TvSmax».

Handling the locking signal

The basic unit generates locking signals when the current heat consumption is limited by the consumers.

The purpose of these locking signals is to shut down or throttle individual load circuits to enable the boiler temperature to rise more quickly.

If the locking signal exceeds a threshold value (5 %), the heat demand of all pump heating circuits will be reset, thereby deactivating the pump of heating circuit 2.

If the second heating circuit is a mixing circuit (and is parameterized as such), any locking signal causes the flow temperature setpoint to drop.

Handling the forced signal

The basic unit generates a forced signal if there is a need for the boiler to carry surplus heat away.

With the help of the forced signal, the heat shall reach the consumers as quickly as possible.

When the forced signal is active, the basic unit sets the heat demand for all heating circuits (including that for heating circuit 2).

Flow temperature control

The control used is 3-position control with delayed checkback. In connection with the actuator, the control loop provides PI mode.

The flow temperature is controlled to the setpoint of the determined flow temperature plus the boost.

Pump control

Pump control with pump circuits

The pump is controlled via the mixing valve clip-in module. This also applies to **pump overrun** and the pump kick.

Pump control with mixing circuits

In the case of a mixing circuit, the pump can also be activated by the mixing valve clip-in module, independent of the LMU… (e.g. during frost protection for the heating circuit).

Pump overrun

During pump overrun, the controller is also active. It maintains the flow temperature setpoint that was valid prior to pump overrun. On completion of the pump overrun in the case of mixing circuits, the mixing valve will be driven to the fully closed position.

Pump kick

After the pump kick in the case of mixing circuits, a kick is given to the mixing valve actuator (pump is deactivated). The mixing valve will then be driven toward the fully open and then toward the fully closed position.

The time of control toward the fully open position corresponds to the parameterized actuator running time, and an additional 10 seconds toward the fully closed position.

Mixing valve control

The mixing valve clip-in module is suited for mixing valves equipped with a 3-position actuator. This necessitates 3 states for the control of the mixing valve:

- Toward fully open
- Toward fully closed
- Unchanged

The running time of the mixing valve is to be parameterized on the LMU...

This actuator running time will be used for both the opening and the closing command (symmetric actuator).

Position of mixing valve in the idle state

If, in the case of a system with mixing circuit, the controller of the mixing valve clip-in module is not active - which means no pump control by the LMU… either (with the exception of the pump kick) - the mixing valve will be driven to the fully closed position.

The duration of control depends on the paramererized actuator running tiem and is as follows: 2 x actuator running time

Functional test

After each reset, the mixing valve clip-in module automatically makes a functional test. In the test, the mixing valve is first driven toward the fully open position (8 seconds) and then toward the fully closed position (10 seconds).

Then, the output is used for the control of the pump (10 seconds).

5 Clip-in module OCI420... for communication via LPB

Functions

General

- Communication clip-in module for connecting LMU5... / LMU6... to the ALBATROS range of controllers via a LPB interface
- Connection of the LMU... to
  - RVA46... zone controllers
  - RVA47... cascade controllers
  - RVA63... boiler and heating circuit controllers
  - RVA65... energy managers for solar, wood, etc.
  - RVA66... boiler and heating circuit controllers
  - OCI6... communication interface for remote supervision (in connection with suitable ACS... software) 1)

1) Planned; on request

Note

Maximum one clip-in module OCI420... can be connected to the LMU5... / LMU6... .
A maximum of 2 clip-in modules (OCI420 / AGU2.500... / AGU2.51x) can be connected.

Inputs / outputs

Refer to «Connection diagrams».

Interfaces to LMU...

- Connect X40 of the LMU... and OCI420... via cable AGU2.104

5.1 Connection of LMU... to ALBATROS via OCI420 (LPB clip-in)

The connection of the LMU... to the ALBATROS system represents a functional extension which, in principle, comprises 3 applications:

1. Additional heating circuits that are controlled by an RVA46..., RVA63... or RVA66...
2. Support of external DHW heating, provided the types of RVA... controllers used offer this facility (e.g. RVA63... or RVA66...).
3. Use of the LMU... in a multiboiler plant (cascade) that is controlled by a superposed cascade controller.

5.1.1 Additional heating circuit extensions via ALBATROS controllers

ALBATROS heating circuit controllers, such as the RVA46…, make it possible to connect additional heating circuits to the LMU...

In that case, the BMU acts as the heat supplier to one or several external consumers that are controlled by the RVA…

All sensors, pumps and valves required for operating the external heating circuit will be connected to the relevant ALBATROS controller that evaluates and controls them.

It is practical to also use that controller for making all settings required in connection with the extension of the zone (setpoints, time switch programs, etc.).

For the operation of external heating circuits, an appropriate hydraulic diagram must be selected on the LMU… Suitable choices are diagram 64 through 76.

Automatic changeover of operating mode

Integration of the LMU... into the ALBATROS system includes automatic changeover of the operating mode on the RVA... .

It is activated when operating mode «Standby» or «Manually summer» was selected on the BMU or was triggered via modem.

In that case, the heating circuit operating mode on the RVA… changes automatically and is indicated by a flashing «Standby» button.

Giving consideration to heat demand from the RVA…

The LMU… always takes into account the external heat demand from an RVA... as long as internal automatic summer / winter changeover does not call for summer operation due to high outside temperatures.

This means that protective functions on the RVA..., such as frost protection for the room, can become active also when, on the LMU…, the «Standby» mode (manual summer operation) was selected.

Locking and forced signals when connecting to the LPB

Although the operating mode of RVA… controllers normally is autonomous, the LMU… can make use of locking and forced signals to influence the heat consumption of the external user.

Locking signals that reduce heat consumption of the external heating circuits are generated by the LMU... when DHW heating with absolute priority is active in the system (on the LMU… or on one of the RVA...).

In that case, the RVA... will shut down their heating circuit pumps and drive their mixing valves to the fully closed position.

If, however, the boiler temperature reaches a crucial level (e.g. temperature limiter cuts out), the LMU… will generate forced signals that force the consumers to draw more heat.

In response, ALBATROS controllers will activate the heating circuit pumps and open their mixing valves.

In addition, the LMU… uses forced signals to trigger pump overrun in external heating circuits. The duration of pump overrun is determined by LMU... parameter 130 -- (ZqNach).

5.1.2 External DHW heating by ALBATROS controllers

In principle, application «External DHW heating» by an ALBATROS controller is not much different from «Heating circuit extension». Nevertheless, a number of important points need to be considered with this application.

In an interconnected system consisting of LMU…and RVA… controllers, several plant components can manage DHW heating. At first, it does not matter whether one or several units are involved in DHW heating.

Normally, a selection is to be made when the type of DHW heating is used as a criterion. For example, ALBATROS controllers do not support instantaneous DHW heating applications, but only storage systems.

DHW sensors, pumps and valves will be connected to the device that has been selected for that function. This means that all settings required for DHW heating are to be made there (setpoints, time switch programs, etc.).

Provision of external DHW heating by ALBATROS controllers means that an adequate hydraulic diagram must have been selected on the LMU... .

Suitable choices are diagram 64 through 76.

Type of priority of DHW heating

In general, the type of priority of DHW heating is selected on the relevant unit and has an impact on all heating circuits in the system.

However, the LMU… only supports the types of priority «Absolute» and «None», which results in restrictions.

The types of priority «Shifting» and «Mixed», which can be selected on the RVA…, are treated by the LMU… like absolute priority and are passed to all heating circuits in the system.

Also, local DHW heating with absolute priority **always** prevails over external DHW heating that is active at the same time!

5.1.3 Multiboiler plants with LMU (cascade applications)

If the capacity of a single boiler is not sufficient to cover the demand of a heating plant, several boilers can be cascaded.

This type of application can be straightforwardly implemented with the ALBATROS cascade controller RVA47... and several LMU... .

The RVA47... is a cascade controller that enables a central RVA47... to control up to 15 LPB-compatible LMUs.

In that case, the BMUs are operated as pure boiler controllers without having their own consumers. This means that the only pieces of equipment to be connected are the flow and return sensors (B2 and B7) and the boiler pump (Q1).

The cascade controller evaluates the heat demand from the consumers and controls the boilers assigned to it according to a selectable strategy.

For this application, all connected LMUs must be used with hydraulic diagram no. 80.

In general, all boiler-specific configurations are to be made on the respective BMU while cascade-related values are to be set on the RVA… .

In addition to LPB-compatible BMUs, the RVA47... is capable of controlling BMUs connected via the PPS interface.

The cascade controller can easily cope with this kind of mixed operation, but there are a number of differences between the 2 types of devices in terms of operating and display values on the RVA.... .

With the LMU…, the following operating lines are not available or are deactivated:

- Enduser parameter:
  - BMU error code display (line 49)
- Heating engineer parameters:
  - Actual value of the boiler temperature BMU (line 55)
  - Boiler temperature setpoint BMU (line 65)
  - Burner hours run (lines 80 through 83)
  - Rated output BMU 1...4 (lines 91 through 94). This value is to be set directly on the respective unit (parameter 145, «PmaxHuKw»)
- OEM parameters:
  - Calibration of actual output of BMU 1...4 (lines 25 through 28). This value is to be set directly on the respective unit (parameter 440, calibration factor)

Separate DHW circuit in cascade applications

In a cascade application, a BMU can provide temporary DHW heating, in spite of an overriding controller.

In that case, the respective LMU... «disengages» itself from the cascade for the period of time DHW is heated and is then not available as a heat source.

This special case is extremely unfavorable for the RVA47… since its cascade control will be disturbed by the sudden switching actions of a boiler. But there are certain types of heating plant where this feature is required (e.g. plants with instantaneous DHW heaters).

Also, this special case can only be covered by the cascade user having device address 2.

In addition to the address, the correct hydraulic diagram must be parameterized on the LMU… that provides DHW heating. Depending on the type of DHW heating, diagrams 81 through 85 are available here.

The other cascade boilers remain set to 80. In addition, sensors, pumps and valves and an optional flow switch that are used in conjunction with DHW heating are to be connected to this special LMU... .

Although all relevant sensors and actuating devices are to be connected to a special unit from which they are also operated, the DHW setpoint is predefined by the overriding cascade controller.

In general, all settings in connection with DHW heating are to be made on the RVA47… (DHW operating mode, nominal and reduced setpoint, etc.).

Operation with the RVA65...

When using an LMU... together with an RVA65..., the same preconditions apply as with the RVA47... .

Although the LMUs are not cascaded in this case, here too, the RVA65... controls several heat sources (e.g. oil-, gas- or wood-fired boilers).

For this reason, there is no difference to cascade applications as far as the BMU is concerned. A separate DHW circuit is also supported with this type of application, provided the LMU… has been configured to device address 2!

5.1.4 System functions

In addition to the aforementioned applications, the interconnected system with ALBATROS controllers offers a number of other system-specific functions.

Uniform system time

Through appropriate configuration of each system user, a central clock time source can be selected from the interconnected system of units, which is then used for synchronization by the other units.

Special ALBATROS components, such as the AUF77 radio clock, deliver very accurate time information and can be straightforwardly integrated into an LPB system.

Clock time handling on the LPB can be defined on the LMU… with parameter «LPBKonfig0» and bitfield «ZeitSynchro».

The following settings can be made:

Autonomous (value 0)

The clock time of the LMU... will **not** be synchronized with the system time on the LPB.

This is the standard setting.

Slave without remote readjustment (value 1)

The clock time of the LMU... will be synchronized with the system time, which means that a clock time available on the LPB will be adopted.

Remote readjustment of the system time by an operating unit of the LMU... is not possible with this setting, nor is it possible otherwise!

System time master (value 2)

The clock time of the LMU... will be made available on the LPB as the system time and can be used by the other ALBATROS devices.

Remote readjustment via other RVA... controllers is not possible with this setting either.

When making the clock time configuration on the LMU..., the following rules must be observed:

- Use of the system time by the LMU… makes sense only if it can be displayed by a RU (QAA73...) or an operating unit (AGU2.310...)

  For that purpose, on the QAA73..., parameter «Uhrzeitmaster» on line 96 must be set to 1 = BMU.
  The AGU2.310... will adopt the clock time automatically.

  Operation of a QAA53... is not possible with this setting since this unit cannot handle clock time information.

- If no clock time source is connected to the LMU... (QAA73..., QAA53... or AGU2.310...), it cannot deliver any valid clock time to the system. In that case, an error message («Ungültige Uhrzeit» = 95) will be delivered

- Configuration of 2 units from the system as clock time master is not permitted and generates error message «Zwei Uhrzeitmaster» = 100.

If there are several clock time sources in the system, the source to be selected for the system time should be the one that delivers complete time **and** date information.

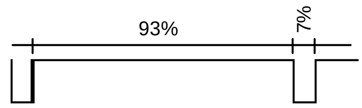
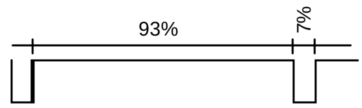
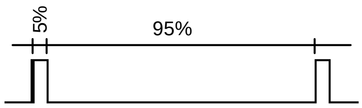
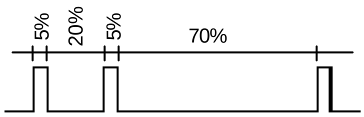
Excluded from this rule are interconnected systems using the QAA53... because that RU cannot make use of the clock time.

Error / diagnostic messages from the LMU...

Error and diagnostic messages from the LMU… are delivered via the LPB and appear on the display of the RVA... controllers.

Each message consits of an error code, which is clearly defined throughout the system, and a priority, which is used to select the highest priority should several errors occur at the same time.
In connection with the communication interface OCI6... and high-priority error messages, alarms can be sent to remote operating stations, ensuring remote supervision of heating plant.

In addition to transmitting error codes, the OCI420... features status indication by means of an LED. That LED indicates the state of the LPB and interface.

Priority	Status	OCI bus power supply	LED status indication
1	OCI not configured	Optional	ON
2	OCI and LMU incompatible	Optional	 Frequency: 1 Hz
3	OCI configured LPB short-circuit or no power	Optional	OFF
4	LPB address inadmissible	Optional	 Frequency: 1 Hz
5	OCI configured LPB ok	Off	 Frequency: 1 Hz
		On	 Frequency: 1 Hz

In addition, the interface generates the following error messages of its own:

Error code (display on the RVA or on operating section of the LMU)	Cause of error	Troubleshooting
81	➢ Physical defect of bus line (short-circuit / open-circuit) ➢ Bus power supply switched off at several units	➢ Replace bus line or search for disruptions and short-circuits ➢ Activate automatic bus power supply at all units (LMU parameter «LPBKonfig0», no. 17)
82	➢ 2 or more bus users have the same segment and device address	➢ Check the set segment and device address at all units and, if necessary, make changes according to «Setting the LPB device and segment address» **Note**: After rectification, the error can still be present for up to 11 minutes [1)]
100	➢ 2 or more units in the system are configured as time master	➢ Check the selected behavior or the clock time. Configure one single unit in the system as the clock time master. Also refer to «Uniform system time»
140	➢ The set segment and device address does not match the configured plant diagram	➢ For cascade applications, diagrams 80 through 85 apply. Segment address = 0; device address 2...16 ➢ For zone extensions, diagrams 64 through 76 apply. Segment address = 0; device address = 1

[1)] A faster response of the entire system can be obtained by cutting the power supply for a short moment

Outside sensor, outside temperature sensor

In an interconnected system consisting of LMU… and ALBATROS controllers, only one common outside temperature sensor is required. This sensor can be connected to any of the units and then passes its signal to all bus users.

It is also possible to connect outside sensors to several units (buildings using several outside sensors).

In that case, units that do not have their own outside sensor do not handle all sensor values they receive but only adopt the outside temperature signal delivered by the unit with the next lower address.

Assignment of address numbers

This means that the address numbers must be assigned such that the unit with no sensor follows with its number the unit whose signal it has to adopt.

If a unit **cannot** adopt the value of a unit with a lower address number, it will adopt the measured value of the unit with a sensor that has the highest address number.

Units with a local outside sensor are excluded from this rule. They do not give consideration to external outside temperature signals.

Setting the LPB device and segment address

When interconnecting several LPB-compatible units, address assignment to every component is mandatory.

The address of a user is like a postal address and may occur in the system only once to ensure troublefree communication.

A basic distinction is made between device address and segment address.

Device address

The device address shall be assigned from 1 to 16 in consecutive order in accordance with the connected units. The user with device address 1 is the master which should exist in every segment.

For heating circuit extensions with or without external DHW heating, the device address of the LMU... is to be set to 1 (master)!

In the case of cascade applications, the value of the device address must be greater than 1!

Segment address

The segment address enables the system to be subdivided into several segments.

Units located at the same place of application can be combined in one segment.

The segment address has a setting range from 0 to 14 and must be set to 0 for the LMU..., independent of the type of application!

6 Clip-in function module AGU2.51x

Functions

General

The clip-in function module represents an extension of the LMU... basis in terms of inputs and outputs. It has 1 input and up to 3 outputs.

All outputs are AC 230 V outputs.

The input of the clip-in function module is a digital or analog input, depending on the type of module. The analog input can be one of the following:

- Sensor input (NTC, 10 kΩ)
- Voltage input (DC 0...10 V)
- Current input (4...20 mA, 0...20 mA)

Note

Maximum one clip-in module AGU2.51x... can be connected to the LMU5... / LMU6... . A maximum of 2 clip-in modules (OCI420 / AGU2.500... / AGU2.51x) can be connected.

Outputs

The outputs of the clip-in function module are used by the LMU... as programmable outputs. For each of the maximum of 3 outputs on the clip-in module, a function can be selected via a specific parameter.

The functions are described in chapter «Programmable output of the LMU...».

Assignment of the required functions to the individual outputs of the clip-in function module is made via parameters «KonfigAusgang1R», «KonfigAusgang2R» and «KonfigAusgang3R».

Number of available outputs

The clip-in function module may not be able to handle all 3 available outputs, the reason being limited power supply.

If, in addition to the clip-in function module, no other clip-in or the mixing valve clip-in module is connected, all 3 outputs can be handled. If, in addition to the clip-in function module, an LPB clip-in module is used, only outputs 1 and 2 of the clip-in function module can be handled.

Inputs

The function of the input on the clip-in function module is defined via parameter «KonfigEingangR».

Since the function of the input depends on the version of the clip-in function module, it is checked first whether the parameterized function can be performed by the connected module version.

If that is not the case, an error message will be delivered.

Digital input

The input of the clip-in function module is used by the LMU… as another programmable input (→ Programmable input of the LMU...).

Note

The LP contact **can never** be read in via the input of the clip-in function module!

Analog input

The following functions can be selected via parameter «KonfigEingangR»:

- 4 Predefined setpoint
- 5 Predefined output
- 6 Sensor input "Pressureless header"

Predefined setpoint (temperature demand)

In that case, the heat demand (temperature demand) is predefined via an analog signal.

This can take place via a current signal (4...20 mA) or voltage signal (DC 0...10 V).

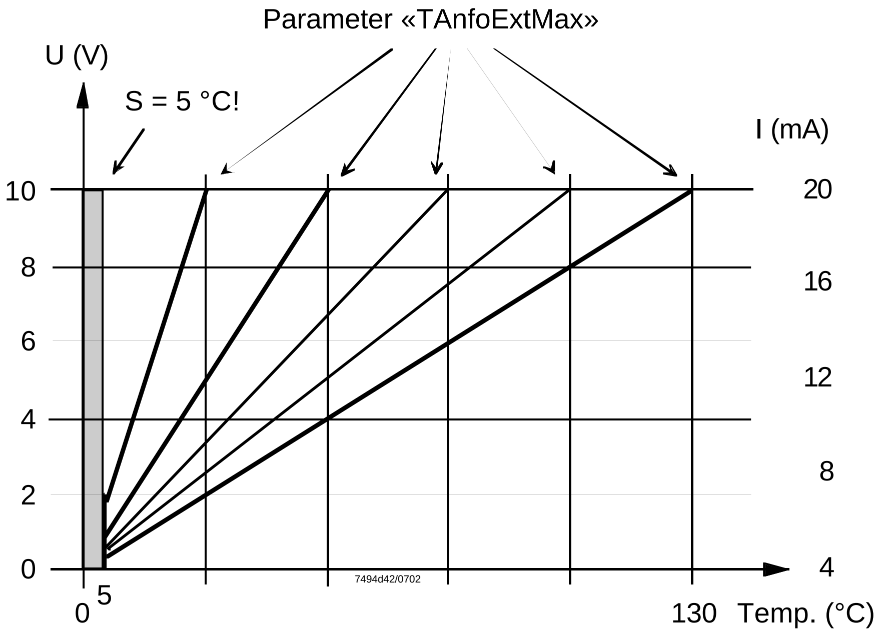
The maximum value is defined via parameter «TanfoExtMax» on the LMU... The setting range of this parameter is from 5 to 130 °C, the resolution being 1 °C.

The heat demand is derived from the the temperature demand.

For that, the threshold value is 5 °C. If the temperature demand is > (5+1) °C, the heat demand will be set. If the temperature demand is < (5-1) °C, the heat demand will be reset.

Both temperature and heat demand are assigned to heating circuit 1 of the LMU... .

Any additional heat demand that might exist at the same time will be accepted. The temperature demand is determined via the maximum value.



Predefined setpoint

Predefined output

In this case, the relative boiler output is predefined via an analog signal.

This analog signal can be a current signal (0...20 mA, 4...20 mA) or a voltage signal (DC 0...10 V).

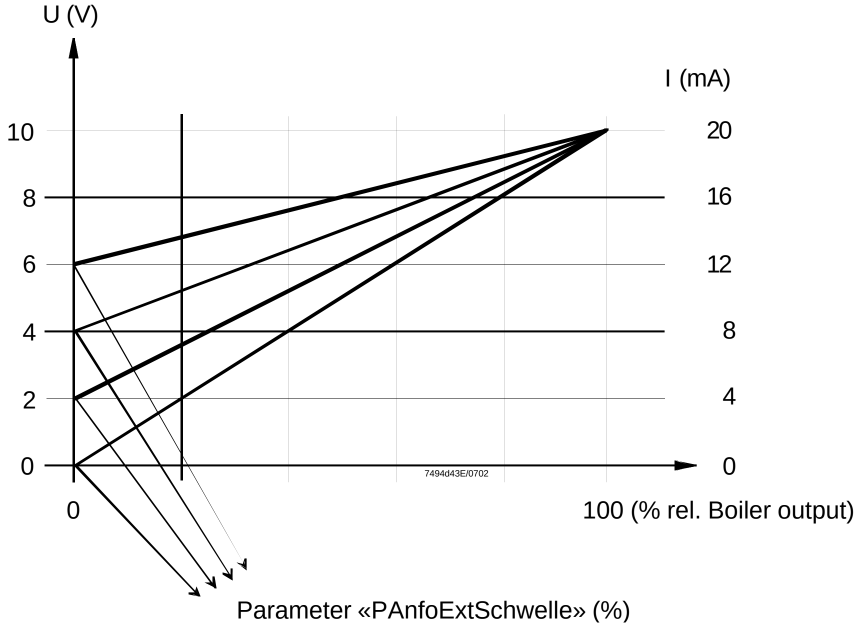
The analog signal is transmitted to the LMU… and applied to the possible output range as a percentage value.

The threshold from which the analog signal shall activate the predefined load is defined with the help of parameter «PanfoExtSchwelle». This parameter also defines the minimum value of the analog signal.

The range of the analog signal between threshold and maximum value is converted into an output signal in the range 0...100 %.

If the analog signal is near the parameterized threshold, the boiler will be operated at the minimum relative output. In the case of maximum value of the analog signal, control takes place with the maximum relative boiler output.

If the analog signal lies below the parameterized threshold, the predefined output will not be active.



Predefined output

Sensor input "Pressureless header"

This function facilitates control of the boiler to the flow temperature after the pressureless header. For that purpose, a sensor located in the flow after the pressureless header must be connected to the input of the clip-in function module.

The function is based on the following conditions:

- In addition to heating circuit 1, the hydraulic diagram contains no other heating circuits
- An operational boiler return sensor

In pure heating mode (that is, when DHW heating is not active), the boiler temperature is controlled to the value of this sensor. This means that the boiler is heated up until the flow temperature after the pressureless header has reached the required level.

If no boiler return sensor is connected, an error code will be delivered.

If the state of the boiler return sensor changes from "Present" to "Faulty", the actual boiler temperature will be maintained again and an error code delivered. ...

Control to the flow sensor after the pressureless header can work only if there is flow on the consumer side. If the flow rate approaches zero, that sensor may no longer be used for control.

For the detection of flow, the boiler return sensor is used.
As long as the consumer draws heat, the boiler return flow rate is always lower than the flow after the pressureless header.

The boiler return temperature exceeds the level acquired by the sensor at the pressureless header only when, on the consumer side, the flow rate approaches zero.

In that case, the sensor after the pressureless header is no longer used for control, but the boiler return sensor. This state is maintained until the boiler return temperature returns below the temperature level after the pressureless header.

In other words, the boiler is always controlled to the higher of the 2 temperatures.

7 DHW control (BWR)

Boiler temperature setpoint during DHW heating with storage tank systems

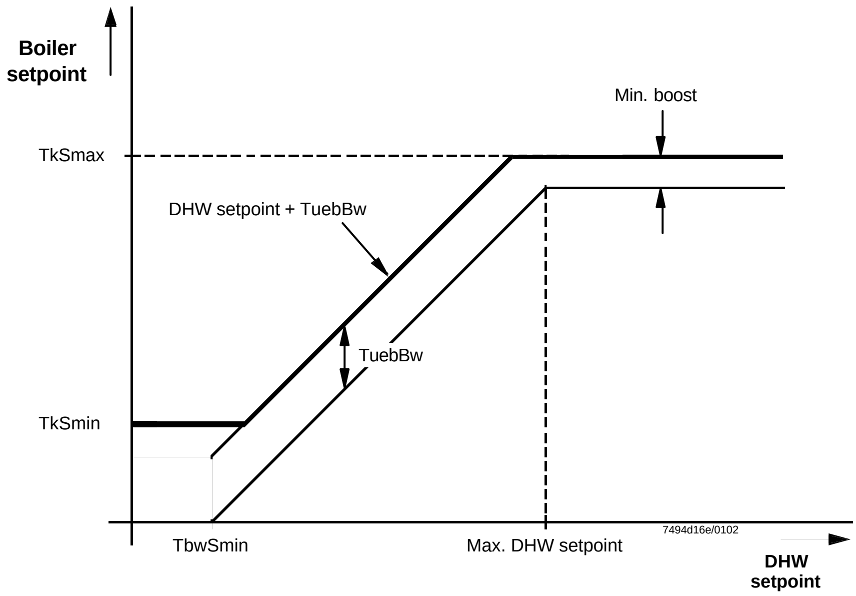
With storage tank systems, a boost is added to the DHW setpoint. This boost can be parameterized and has an impact on the charging time of the storage tank.
During DHW heating, the boiler temperature setpoint is thus as follows:

Boiler temperature setpoint = DHW temperature setpoint + «TuebBw»

Boiler temperature setpoint:	Boiler temperature setpoint during storage tank charging
DHW temperature setpoint:	Current DHW temperature setpoint
TuebBw:	Setting parameter for boiler temperature boost

As a result of the boost, the boiler temperature setpoint can reach inadmissibly high levels. When limiting the boiler temperature setpoint, it may drop below «Bw-Soll», however.

For this reason, the boost can be limited to a minimum. In that case, the DHW setpoint will be limited:



Boiler temperature setpoint during storage tank charging

TbwSmin:	Minimum DHW temperature setpoint
TkSmin:	Minimum boiler temperature setpoint
TkSmax:	Maximum boiler temperature setpoint
Max. Bw-Sollwert:	Maximum DHW temperature setpoint (TkSmax – minimum boost)
Minimum boost:	5 K

Hence, when reaching the boiler temperature limitations, the following effects will be produced:

Boiler temperature setpoint < TkSmin

Limitation to «TkSmin». The storage tank's charging time becomes shorter.

Boiler temperature setpoint > TkSmax

Limitation to «TkSmax» and reduction of boost. Limitation of the DHW temperature setpoint. This means that the storage tank's charging time becomes longer.

It is possible that only a lower DHW temperature setpoint will be reached.

DHW temperature control

Compensation variants

The compensation mode of DHW heating depends on the plant components connected to the LMU… . By evaluating the components, «Compensation variant Bw» will be generated (refer to chapter «Compensation variant Bw»).

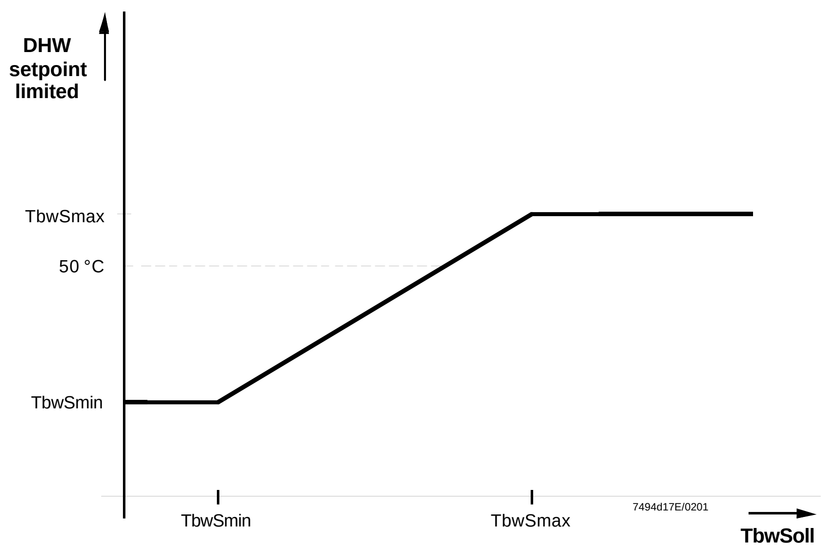
The setpoint used depends on the compensation variant:

Compensation variant DHW	DHW release	DHW setpoint	Description
Locked	0 (always locked)	TbwSmin	DHW heating is locked, the DHW setpoint is initialized with the minimum setpoint, no frost protection possible
Emergency operation	1 (always released)	(TbwSmin+ TbwSmax)/2	Since there is no facility to set the DHW temperature setpoint, the mean value of the setpoint setting range is used
Fixed value control	1 (always released)	TbwSollMmi	DHW setpoint of HMI will be adopted
AGU2.310...-dependent	DHW off	Bw_Soll_Frost	DHW heating is locked Frost protection for DHW is active
	DHW on	TbwSollMmiRed TBwSollMmi	According to the switching program of the AGU2.310...
RU-dependent	Follows from RU locked	TbwSmin	Adoption of frost protection setpoint from the LMU...
	Follows from RU released	TdhwSet	DHW setpoint of RU will be adopted
RVA-dependent	released	TbwSollRva	DHW setpoint of RVA will be adopted

The resulting DHW temperature setpoint will be limited to the permissible setting range. The important criterion here is the type of system used - storage tank or instantaneous heating system.

Limitation of the DHW temperature setpoint with storage tank systems

The setpoint setting range with storage tank systems follows from the parameterization of the boiler and the DHW heating circuit:



Boiler temperature setpoint during storage tank charging

TbwSmin: Minimum DHW temperature setpoint
TbwSmax: Maximum DHW temperature setpoint

The maximum DHW temperature setpoint «Max.Bw-Sollwert» follows from the limitation to the maximum permissible boiler temperature setpoint.

Maximum DHW temperature setpoint = Min [TbwSmax, (TkSmax – 5K)]

This ensures that the resulting DHW temperature setpoint can be handled.

In the special case «Stratification storage tank», the minimum DHW temperature setpoint is 50 °C.

If «TkSmax» was parameterized to < 50 °C, DHW charging will be locked and a status code delivered.

Position of diverting valve

When there is no more demand for heat, the diverting valve will maintain the operating position it had assumed last.

Pump / diverting valve overrun

- Relevant outputs are activated in the DHW circuit
  - If «B2 > TqNach»: As long as «B2 < TqNach»

or

  - If «B2 < TqNach»: For the fixed time of one minute

Storage tank systems

Storage tank control via sensors

In the case of DHW heating with a storage tank system, only the sensor for «TbwIst1» is required.
The sensor for «TbwIst2» can be used as an option.

If connected, the sensor for «TbwIst2» with the storage tank can only generate but not stop a demand for DHW.

The switch-on conditions for DHW demand are the following:

- If the sensor for «TbwIst1» is connected:

  TbwIst1 < DHW setpoint – SdBwEin1

- If the sensor for «TbwIst1» and the sensor for «TbwIst2» are connected, following also applies:

  TbwIst2 < DHW setpoint – SdBwEin2

and

DHW setpoint – SdBwEin1 < TbwIst1 < DHW setpoint + (SdBwAus1Max – SdBwMin)

The minimum switching differential «SdBwMin» (value: 2 K) ensures that there is a minimum interval between the switch-on and the switch-off point of the sensor for «TbwIst1».

The demand for DHW will be generated when the switch-on condition is satisfied:

The demand for DHW causes activation of the relevant pump. In the case of a modulating speed pump, DHW charging takes place with the maximum volumetric flow (minimum degree of modulation):

Degree of modulation of pump = QmodMin

The demand for DHW is stopped when at the sensor for TbwIst1:

- TbwIst1 > DHW setpoint + SdBwAus1Max

  When the demand for DHW is stopped, pump overrun starts. In the case of a modulating speed pump, pump overrun is executed with the maximum volumetric flow (minimum degree of modulation):

  Degree of modulation of pump = QmodMin

  The burner is switched on when «TkIst < (TkSoll – SdHzEin1)». (TkSoll = DHW setpoint + TuebBw).

  The output demand on the burner is controlled between «LmodTL» and «LmodVL» or, in the case of an active speed limitation, between «N_TL» and «N_VL».

Storage tank control via thermostat

Storage tank systems can also be operated with an external thermostat.
Storage tank control by a thermostat is released when a storage tank system has been parameterized (systems 2, 3, 8, 34, 35, 40, 44, 50, 51, 56, 60, 66, 67, 72, 76, and 81).

The thermostat is to be connected to the DHW flow switch or, in place of the DHW sensor 1 to the LMU… The input to be used must be selected via parameterization:

KonfigRg42 = 0: DHW thermostat to be connected to the input of the DHW flow switch

KonfigRg42 = 1: DHW thermostat to be connected to input «DHW sensor 1»

Connecting to the DHW sensor input

When connecting the thermostat to the DHW sensor input, high-quality contact material is mandatory (e.g. gold-plated contacts) since the signal voltage at that input is DC 5 V. The second DHW sensor must not be present.

If a short-circuit is detected at the input, no status code will be delivered. The signal is interpreted directly as a DHW demand signal.

Read-in value ≤ open-circuit threshold	Stopping the demand for DHW
Read-in value ≥ short-circuit threshold	Triggering the demand for DHW

Connecting to the DHW flow switch input:

When using this connection, no DHW sensor may be connected to the LMU... (neither «Bw1» nor «Bw2» sensor). Otherwise, the demand for DHW will be suppressed.

The demand for DHW follows from the state of the «Bw-Flow-Switch» input:

0: Stopping the demand for DHW
1: Triggering the demand for DHW

With both types of connection, the maximum DHW setpoint is used for calculating the boiler temperature setpoint (during storage tank charging) when there is an active demand for DHW:

DHW setpoint = TbwSmax

In that case, the DHW settings made on the HMI, RU or RVA… are of no importance. The setting value on the QAA73... will be locked.

Control of the pump is the same as with «Storage tank control by sensor».

Stratification storage tank

Stratification storage tank systems require a modulating pump in the DHW charging circuit. That pump is controlled in accordance with the criteria described below.

The following table shows when modulating control of heating circuit 1 without the clip-in module is possible with the LMU... basic unit.

Plant diagram	**Heating circuit 1**
9, 41, 43, 57, 59, 73, 75	Multispeed
10, 42, 58, 74, 83	Multispeed or modulating

In the case of the stratification storage tank, a differentiation is made between 2 types of DHW charging modes:

1. Full charging.
2. Recharging.

The criteria for these 2 operating modes are dependent on the compensation variant of DHW.

- **With compensation variant Bw = «RU-dependent»**

Full charging is released only when the switching program is in the first DHW forward shift period of the respective day.
This is transmitted from the QAA73... via bus interface.

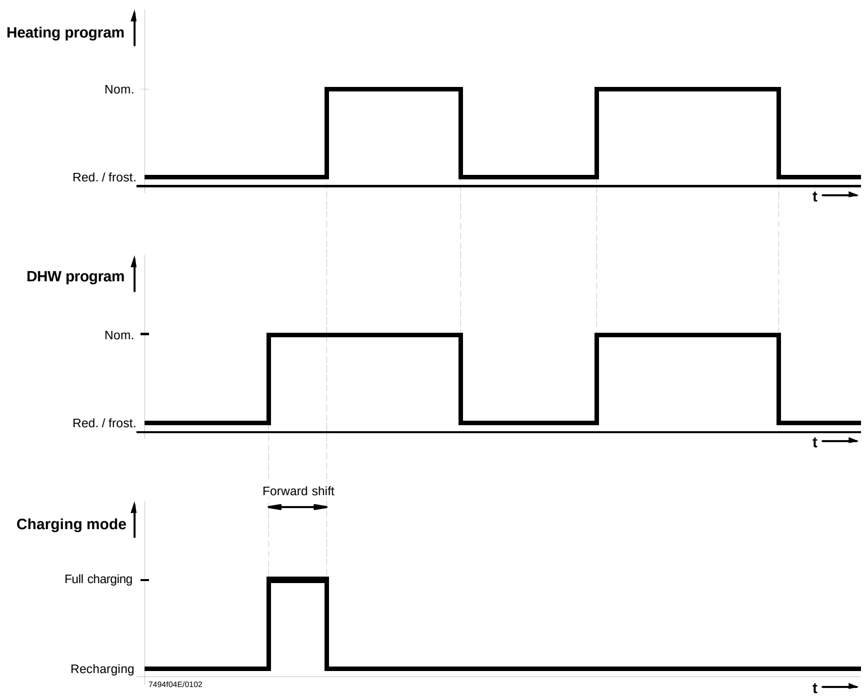
Note: Other types of OpenTherm RU do not support this function; this means that when using an RU of other manufacture, only recharging will be activated.

Release of full charging:

0: Full charging of stratification storage tank locked
1: Full charging of stratification storage tank released

Depending on the DHW mode on the RU (heating program with forward shift of DHW or own DHW program), full charging is released in 1 of 2 different ways.

1. Full charging during the DHW forward shift against the heating program:



Charging of stratification storage tank with DHW forward shift

During the DHW forward shift time, the QAA73... sends:

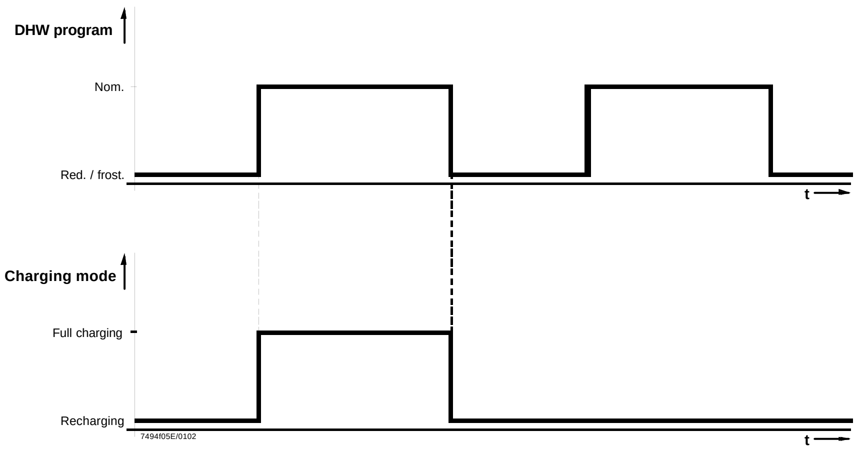
FreigabeDurchladung = 1

This gives rise to the release of the stratification storage tank's full charging. If there are further changes from «Reduced» to «Nominal level» on the same day, there will be no more forward shifts. After the first forward shift:

FreigabeDurchladung = 0

This gives rise to the release of the stratification storage tank's recharging.

2. Full charging during the first DHW phase of the day:



Charging of stratification storage tank with own DHW program

Full charging will be released during the first nominal phase of the DHW program:

Release of full charging = 1

If additional charging is required on the same day, only recharging takes place.

Release of full charging = 0

If no DHW program is selected on the QAA73... (continuously frost protection, reduced or nominal level), following applies:

Release of full charging = 0

This means that recharging is continuously used.

- **With compensation variant Bw = «RVA-dependent, fixed value control or emergency operation»**

Full charging is possible only if, for heating circuit 1, an external time switch is connected to the LMU...
This will be predefined via parameterization.

KonfigRg1.Schaltuhr1:

0: No time switch present, it is always recharging that is released
1: A time switch for heating circuit 1 is connected to the room thermostat

If a time switch is used, full charging during the setback phases is released.

State of room thermostat input:

0: Full charging released
1: Recharging released

- **With compensation variant Bw = «Locked»**

Charging of the stratification storage tank is locked.

With the stratification storage tank, both sensors (for «TbwIst1» and «TbwIst2») must be connected. If the sensor for «TbwIst1» has a short-circuit or open-circuit, the demands for recharging and full charging of the stratification storage tank will be locked and the relevant status code delivered.

If the sensor for «TbwIst2» has a short-circuit or open-circuit, full charging of the stratification storage tank will no longer be possible. To have DHW available also if the sensor for «TbwIst2» is faulty, only recharging with the help of the sensor for «TbwIst1» is provided.

The boiler temperature setpoint is determined by boiler temperature setpoint = BwSollwert + boost, whereby the minimum limitation is

boiler temperature setpoint = 50 °C + TuebBw.

Full charging of the stratification storage tank

With full charging, the temperature of the entire storage tank is raised to the setpoint temperature while the pump is running at low speed. When the temperature at the upper sensor for «TbwIst1» is too high (> TbwSmax), the demand for heat will be stopped.

Demand for DHW is stopped when, at the sensors for «TbwIst2» and «TbwIst1»:

TbwIst2 < DHW setpoint – SdBwEin2

and

TbwIst1 < TbwSmax – SdBwEin1

Demand for DHW is stopped when, at the sensor for «TbwIst2» or «TbwIst1»:

TbwIst2 > DHW setpoint + SdBwAus2Max

or

TbwIst1 > TbwSmax + SdBwAus1Max

During full charging, the charging pump runs at low speed.
This speed can be adjusted independently of heating operation, which means that it has its own parameter «NqmodMinBw».

The burner is put into operation when TkIst < (TkSoll – SdHzEin1) (TkSoll = TbwSoll + TuebBw).

The output demand on the burner will be adjusted between «LmodTL» and «LmodVL» or, with active speed limitation, between «N_TL» and «N_VL».

If, during active full charging, the release criterion for full charging becomes obsolete, the demand for DHW will be stopped based on the criteria of recharging.

Recharging of the stratification storage tank

With recharging, it is only the upper part of the storage tank that is brought to the setpoint temperature while the pump runs at full speed.

Function «Recharging of the stratification storage tank» will be activated when the conditions for full charging are not satisfied or when, in full charging mode, the sensor for «TbwIst2» is faulty.

The evaluation for DHW demand is made only based on the sensor for «TbwIst1».

Demand for DHW is stopped when, at the sensor for «TbwIst1»:

TbwIst1 < BwSoll – SdBwEin1

Demand for DHW is stopped when, at the sensor for «TbwIst1»:

TbwIst1 > BwSoll + SdBwAus1Max

In the case of DHW demand or pump overrun, the modulating pump runs at maximum speed or with the minimum degree of modulation.

QmodMin: Minimum degree of modulation, that is, maximum pump speed

The burner is put into operation when «TkIst < (TkSoll – SdHzEin1)» (TkSoll = TbwSoll + TuebBw).

The output demand on the burner will be adjusted between «LmodTL» and «LmodVL» or, with active speed limitation, between «N_TL» and «N_VL».

If, during active recharging, the release criterion for recharging becomes obsolete, the demand for DHW will be stopped based on the criteria of full charging.

Instantaneous DHW system

Notes

- If, due to the flow switch, startup is aborted before the fuel valve opens (DHW flow switch open again), no overrun will be triggered
- If DHW heating is switched off by the QAA73... or AGU2.310, no DHW heat demand will be generated, even if a flow switch signal is active
- If, in standby or reduced DHW mode, the frost protection setpoint is entered as a temperature demand, this temperature will no longer be additionally limited to «TbwSmin»
- If the DHW temperature falls below 5 °C, the frost protection function for the instantaneous DHW heater will be activated. When the DHW temperature exceeds 7 °C, the frost protection function will be deactivated.

  During the time the frost protection function for the instantaneous DHW heater is active, the heat exchanger for DHW is heated up at the minimum rate. When the flow temperature exceeds parameter «TkFrostAus», the 2-position controller will be switched off. When the flow temperature returns to a level which lies 2 °C below that value, the 2-position controller will switch the burner on again.

  The frost protection function has a higher priority than heat demand from the heating circuits, but the priority of DHW outlet temperature control is even higher
- In systems with primary heat exchangers, there is neither frost protection for DHW nor DHW comfort

Hydraulic diagram

- Instantaneous DHW heating system with plate heat exchanger for sanitary water (systems 5 / 6 and extended systems)
- DHW sensor B3 must be located at the DHW outlet. It is placed such that it can acquire both
  - the DHW outlet temperature in instantaneous DHW mode, and
  - the temperature of the plate heat exchanger in comfort mode (if comfort mode with sensor B3 was selected)

Operating mode

Outlet temperature control (FS-DHW is closed)

DHW demand

- By closing FS-DHW (external contact)

Control

- **Control sensor:** Directly via B3, PID control
- **Boiler output:** Modulating between minimum and maximum boiler output
- **Setpoint:** T_set_DHW - according to the DHW compensation variant (for ext. potentiometer HMI, QAA73..., etc.)
- **Differentials:** SdBwEin1, SdBwAus1Min, SdBwAus1Max

End of demand

- By opening FS-DHW

Pump / diverting valve overrun

- Q1 / diverting valve are always in operation (→ DHW circuit)

Comfort control (after FS-DHW opening)

DHW demand

- After outlet temperature control, comfort control will be activated for a certain period of time:

  - Without additional heat demand: [1] Time «Z_BwComfort1»
  - With additional heat demand: [1] Time «Z_BwComfort2»

Control

- **Control sensor:** The control is effected either according to boiler sensor B2, return sensor B7 or the Bw1 sensor (KonfigRg2).
  If the boiler sensor is used, parameter «TuebBw» is added to the setpoint
- **Boiler output:** Min. power (fixed value)
- **Setpoint:** Parameter «TbwBereit» or «T_set_DHW» according to outlet temperature control (can be adjusted via «KonfigRg2,Bit1»)
- **Differentials:**
  - «SdBwEin2», «SdBwAus2Max» when using sensor B3 for the control
  - «SdHzAus», «SdHzEin» when using sensor B2 for the control

End of demand

- Without additional heat demand: 1) After the time «Z_BwComfort1»
- With additional heat demand: 1) After the time «Z_BwComfort2»
  After this period of time, the LMU… switches to the heating circuit and comfort control will be terminated!

If a demand for heat is received only during comfort mode, the remaining time will be shortened to «Z_BwComfort2» (if remaining time «Z_BwComfort1 > Z_BwComfort2»).

1) Additional external heat demand via HC 1 / 2, RVA..., etc.

Pump / diverting valve overrun

During comfort control:

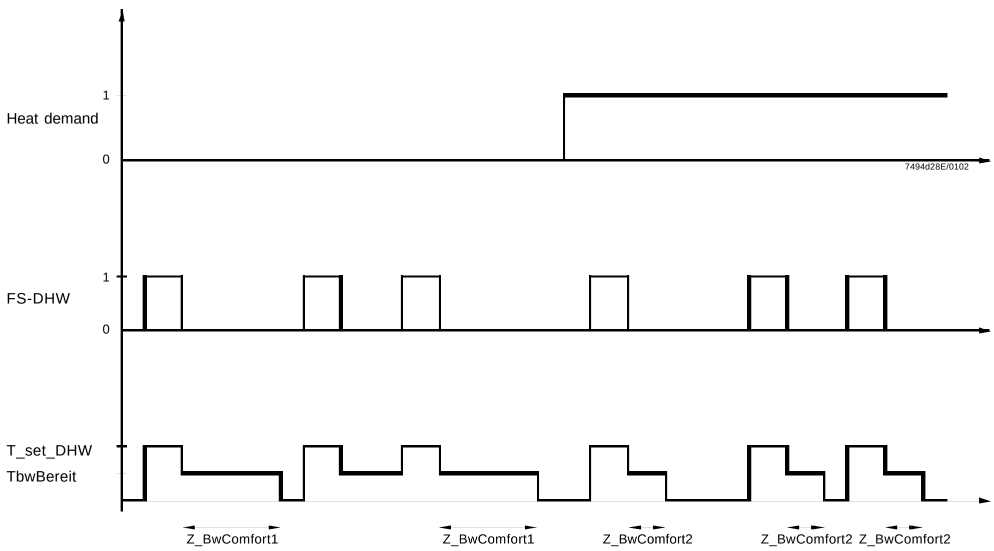
- The relevant outputs in the DHW circuit are activated

After comfort control:

- Zhe relevant outputs in the DHW circuit are activated (➔ KonfigRg2.0)
  - If «B2 > TqNach»: As long as «B2 < TqNach»

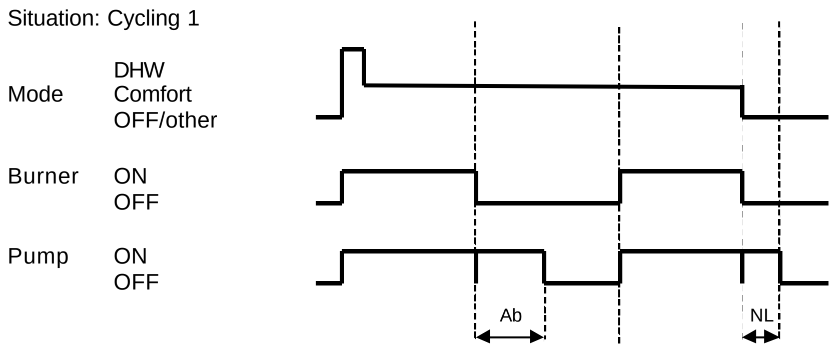
or

  - If «B2 < TqNach»: For the fixed time of one minute



Shutdown of pump

Pump shutdown is implemented in comfort mode (parameter «ZqComfortAus»).



The pump’s shutdown time starts when the burner is shut down.
The pump will be deactivated when this period of time has elapsed. It will be activated again when the burner is started up.

Ab Shutdown time comfort «ZqComfortAus»

NL Overrun time

The above graph applies to «Z_BwComfort1» and «Z_BwComfort2».

If «ZqComfortAus» is parameterized longer than the longest time of «Z_BwComfort1» and «Z_BwComfort2», the pump will run as long as comfort mode is active.

Aqua-booster system

Hydraulic diagram

- Instantaneous DHW heating system with plate heat exchanger (system 07)
- The plate heat exchanger is constantly maintained at the DHW comfort temperature
- Using comfort sensor B3, DHW demand is detected via dT supervision
- Outlet temperature control is accomplished with sensor B7

Operating mode

Outlet temperature control

DHW demand is detected via dT supervision with sensor B3. Temperature control is accomplished directly with sensor B7.

DHW demand

- With sensor B3 via dT supervision (parameter «dTzapfHz» in heating mode or standby; parameter «dTzapfKomf» in comfort mode)

Control

- **Control sensor:** Directly with return sensor B7 via PID control
- **Boiler output:** Modulating between minimum and maximum
- **Setpoint:** T_set_DHW, depending on the DHW compensation variant (e.g. potentiometer, HMI, QAA73..., etc.)
- **Differentials:** «SdBwAus1», «SdBwEin1»

End of demand

- With sensor B3 via dT supervision (parameter «dTzapfEnde»)

Pump / diverting valve overrun

- Q1 / diverting valve are always in operation (→ DHW circuit)

Comfort control

The plate heat exchanger is constantly maintained at the DHW comfort temperature using comfort sensor B3.

DHW demand

- When the DHW comfort temperature is not reached

Control

- **Control sensor:** With comfort sensor B3
- **Boiler output:** Minimum (fixed value)
- **Setpoint:** Parameter «TbwBereit» (if «KonfigRg2.1 = 1»)
- **Differentials:** SdBwEin2, SdBwAus2Max

End of demand

When the DHW comfort temperature is reached.

Pump / diverting valve overrun

During comfort control:

- Q1 / diverting valve are always in operation (→ DHW circuit)

After comfort control:

- Relevant outputs are activated in the DHW / heating circuit (➔ KonfigRg2.0)
  - If «B2 > TqNach»: As long as «B2 < TqNach»

or

  - If «B2 < TqNach»: For the fixed time of one minute

Miscellaneous

- To compensate a possible temperature offset, a setpoint readjustment for comfort and outlet temperature control mode can be implemented:
  - Parameters «dTbwKomfxx» for a setpoint of 40 °C / 60 °C in comfort mode
  - Parameters «dTbwAuslxx» for a setpoint of 40 °C / 60 °C in outlet temperature control mode
- In addition - as an option - an external DHW flow switch can be used to generate a demand (parameter «KonfigRg8»)

Legionella function

The LMU... does **not** provide legionella protection. That function is implemented in connection with the QAA73... for example.

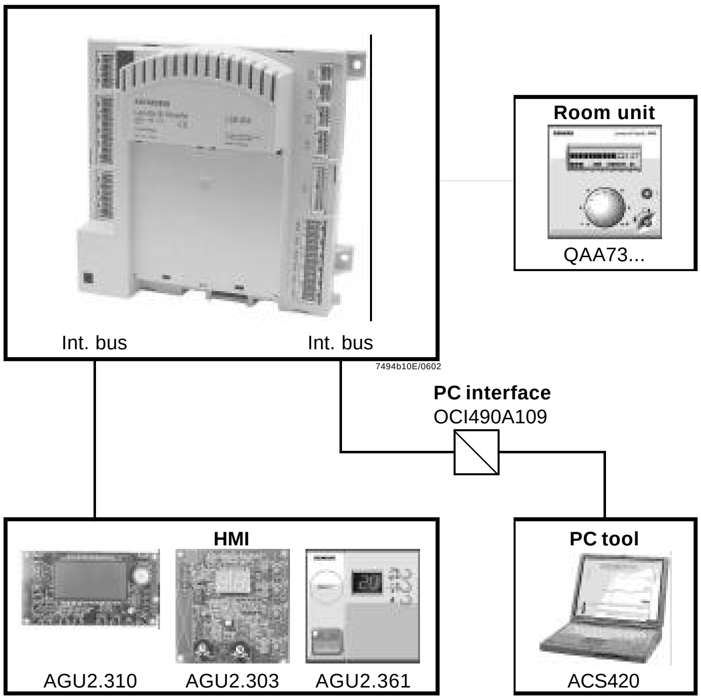
7.1 Special functions

Forced signals

Forced signals give rise to heat supply by the boiler through activation of the pumps, changeover of the diverting valve, or opening of the mixing valve. Forced signals are triggered by the

- electronic safety limit thermostat
- temperature limiter
- chimney sweep function
- controller stop function
- frost protection for the boiler

Parameterization



Choices and channels for parameterizing the BMU

Via PC tool ACS420 and OCI490...

Users	Siemens, OEM, for use in laboratories
Features	Changing individual parameters and a parameter set
Parameter types	Safety-related and non-safety-related parameters
Parameter levels	All
Connection	OCI490... to LMU...-X40 or X50

Note: If the PC tool is connected to the LMU…, only **one** clip-in module may be plugged in

Via QAA73... / AGU2.310

Users	Siemens, OEM, installer, enduser
Features	Changing individual BMU parameters
Parameter types	Non-safety-related parameters
Parameter levels	Enduser, heating engineer, OEM
Connection QAA73...*	I To LMU... plug-in space X10-01 or to
	II AGU2.361...-X2 (QAA73... as a service unit)
	III AGU2.362...-X1 (mounted in boiler control panel)
Connection AGU2.310	To LMU... plug-in space X30

* **Note:** With connection choices II and III, an RU connected to the LMU... will be switched off.

Via AGU2.361 / AGU2.303

User	Heating engineer
Features	Changing individual specific BMU parameters
Parameter types	Non-safety-related parameter (refer to CC1**B**7494)
Parameter levels	Heating engineer
Connection	To LMU...-X30

Note

For parameterization via QAA73... / AGU2.3..., refer to Operating Instructions CC1**B**7494!

When setting the parameters with the help of the LMU... PC tool, a special programming position is used. After setting the parameters, a reset must be made.

When setting the parameters via the RU, shutdown with a change to start prevention takes place. After the parameters are set, operation can be resumed without having to make a reset.

Before changed parameters are stored in EEPROM, the associated safeguarding values (CRC, test values of transmission programs, plausibility of parameters) as well as the permitted value range are checked.

Programmable input of the LMU...

The input for the air pressure switch (LP / X10-04) can also be used for other functions, provided the burner control does not evaluate this input as an LP contact!

The LP contact is **not** evaluated by the burner control if **«LPKon» = 1 («Input signal as a programmable input»)** is set in parameter «FaEinstellFlags2».

Parameter **«KonfigEingang»** determines the function to be assigned to the programmable input.

Using parameter «KonfigEingang», the following functions can be assigned to the programmable input:

- 0 Default, programmable input function is not used
- 1 Modem function active when contact is closed
- 2 Modem function active when contact is open
- 3 Warm air curtain function

Modem function

Using the modem function, the heating plant can be shut down from a central location or be brought into the «Standby» mode. All protective functions (e.g. frost protection, pump kicks) remain active.

RVA... controllers will automatically be switched to standby.

If the modem function is not active, that locking function will not be active either.

- When the modem function is active, frost protection for the room cannot be provided!
- When the modem function is active, the legionella function of the RU cannot be provided!

Warm air curtain function

The warm air curtain function raises the boiler temperature setpoint to the maximum value «TkSmax». In addition, a heat demand signal for heating circuit 1 will be delivered.

This function can be activated both in summer and winter operation.

- Modulation of burner output will be maintained
- DHW priority will be maintained
- The warm air curtain function is active when the contact is closed
- PWM pump control will not be affected

The limitation of HC1 is provided according to «TkSmin $\leq$ temperature demand HC1 $\leq$ TkSmax».

Programmable output of the LMU...

Relay K2 is used as a programmable output of the LMU… Its function will be defined via parameter «**KonfigAusgang»**.

This parameter is on the «Installer» level and can also be accessed via the QAA73... .

With a number of hydraulic systems, output K2 is already assigned a basic function.

This can be the system pump, for example, the shutoff valve, or a DHW pump.

If output K2 is assigned one of the following functions using parameter «KonfigAusgang», the basic function will **no longer** be available at this output.

If required, the basic function of output K2 can be transferred to one of the outputs of the clip-in function module.

Another alternative is offered by the hydraulic diagrams that include a diverting valve.
If the diverting valve is a stepper motor valve, the basic function of output K2 can be transferred to the relay output (AC 230 V) for the diverting valve, which is not required in that case.

For that purpose, parameter «**K2aufUV»** in «KonfigRg4» is to be set to «On».

It is always only **one** of the following functions that can be performed.

The following functions can be transferred to output K2 of the LMU... via parameter «KonfigAusgang»:

- 0 Default (function according to the hydraulic diagram)
- 1 Status output
- 2 Alarm output
- 3 Operational signal
- 4 Switching off external transformer
- 5 Pump of the second heating circuit
- 6 DHW circulating pump
- 7 Actuating device with warm air curtain activated
- 8 Pump of the pressureless header (on / off for pump on the consumer side)
- 9 Basic function of controller clip-in module (system pump Q8 with plant diagrams 67, 70, 71 and 72)
- 10 Basic function K2 (like default, function according to the hydraulic diagram)
- 11 Actuating device with full DHW charging activated, in connection with stratification storage tanks
- 12 Actuating device when analog signal (at the clip-in function module) has exceeded the threshold

Status output

Control of an additional valve when using liquefied gas.

The status output is non-safety-related and is not supervised.
It is activated when the controller passes a command to the burner control.

If there is a lockout which does not allow the burner control to be started up, the status output will be deactivated.

Exception: Lockout caused by open GP contact.

Alarm output

Output is set when there is a fault on the unit that calls for a manual lockout reset (nonvolatile lockout).

Operational status signal

Output is set when the burner is in operation.

Switching off the external transformer

This output is used for switching off the external transformer. The output is active when the external transformer is required; otherwise, it is inactive.

The objective is to switch off the external transformer as often as possible in order to minimize the system's overall energy consumption.

The external transformer is required for the DC 24 V fan and the 2 stepper motors.

There are thus 3 potential reasons for switching on the external transformer:

- Fan
- Stepper motor required for optimization of combustion
- Stepper motor of the diverting valve (if present)

If at least one of these components calls for power, the external transformer will be switched on.

The demand for power from the fan and the stepper motor for combustion optimization is met in that the external transformer is always switched on when the burner control's operating state is any but standby.

If parameter «LmodNull» is not equal to zero, the fan mut also operate in standby, that is, the external transformer always remains on.

Pump output second heating circuit

This output delivers the control signal for the pump of the LMU...'s second heating circuit. The pump of the second heating circuit is always assigned to the mixing valve clip-in module.

If the second heating circuit is a pump circuit, the pump can also be controlled via the programmable output.

DHW circulating pump

This function is used for controlling a DHW circulating pump. It necessitates a QAA73… of software version 1.4 or higher.

The criteria for switching on the DHW circulating pump (e.g. time switch program) are determined by the QAA73… .

Actuating device with warm air curtain function activated

This function is used to activate the programmable output when the input for the warm air curtain function has been set (see programmable input LMU… basic or relay clip-in function module).

If this input is not set, the output will also be reset.

Pump of pressureless header

This function is used to control the pump after the pressureless header. The function is only available with the hydraulic diagrams that, in addition to heating circuit 1 (pump heating circuit), have no other heating circuits included.

The pump after the pressureless header will always be switched on when the LMU… with pump Q1 serves heating circuit 1. In that case, pump Q1 supplies water to the pressureless header.

Like pump Q1, the pump after the pressureless header features pump overrun and pump kick).

Basic function of controller clip-in module

This function is used for controlling system pump Q8 with hydraulic diagrams 67, 70, 71 and 72. Precondition is that the system pump function has been activated via parameter «Q8Fkt» (KonfigRg4).

Actuating device with full DHW charging activated

This function is used to activate the output for the period of time full charging of the DHW stratification storage tank is activated.

This means that the function can only be activated when using hydraulic diagrams that include stratification storage tanks. Otherwise, the output remains reset.

Actuating device when analog signal exceeds threshold

This function is used to activate the output when the input signal at the clip-in function module has crossed the response threshold.

The function is only possible in connection with the → **Predefined setpoint** or → **Predefined output** via the input of the clip-in function module.

The response threshold with the predefined setpoint is reached when the input signal corresponds to a temperature level above 5 °C.

With the predefined output, the response threshold is defined by parameter «PAnfoExtSchwelle».

Power concept

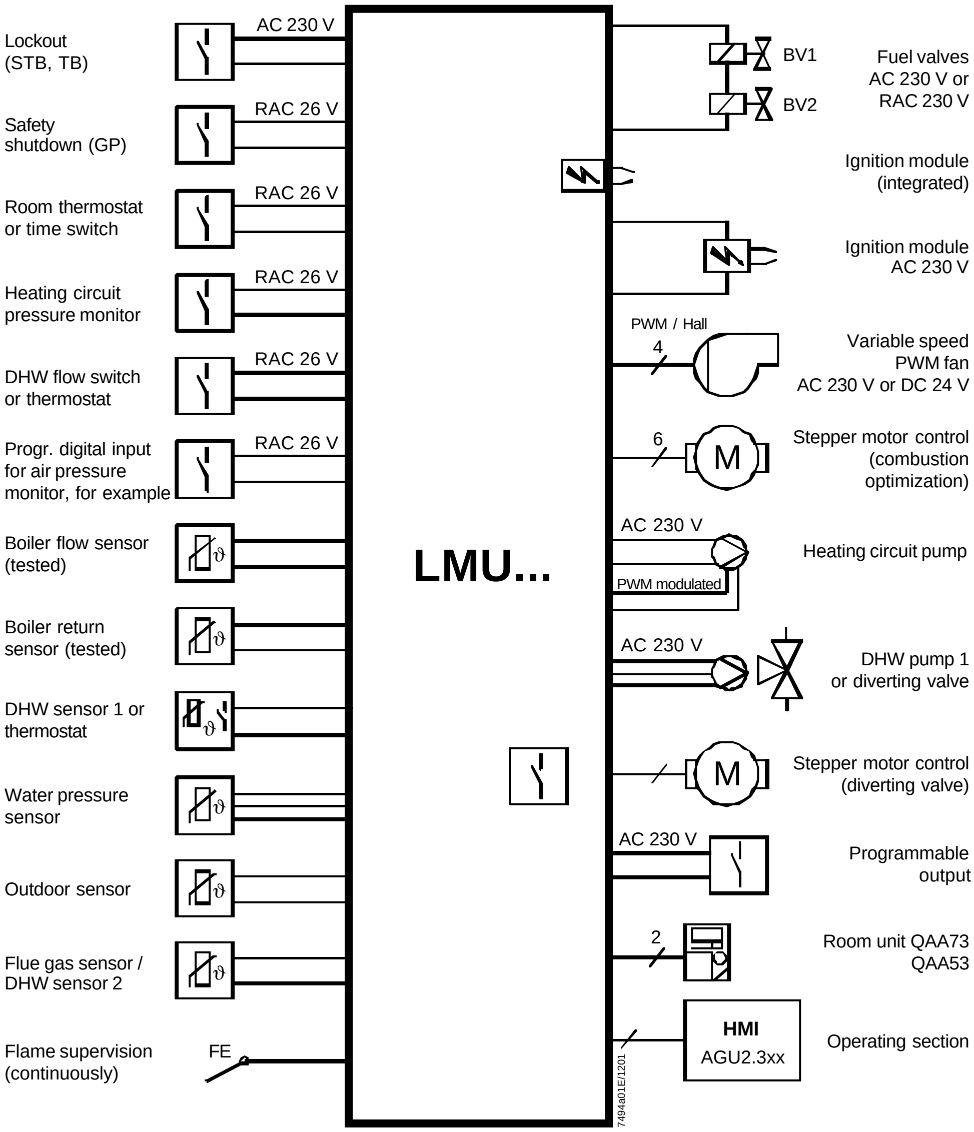
The LMU... has an integrated mains transformer to provide extra low-voltage power for

- the LMU...
- the HMI
- the RU
- maximum 2 clip-in modules (e.g. AGU2.500 / OCI420)

An additional external transformer is required only when using a DC 24 V fan or for stepper motor control.

8 Basic diagram

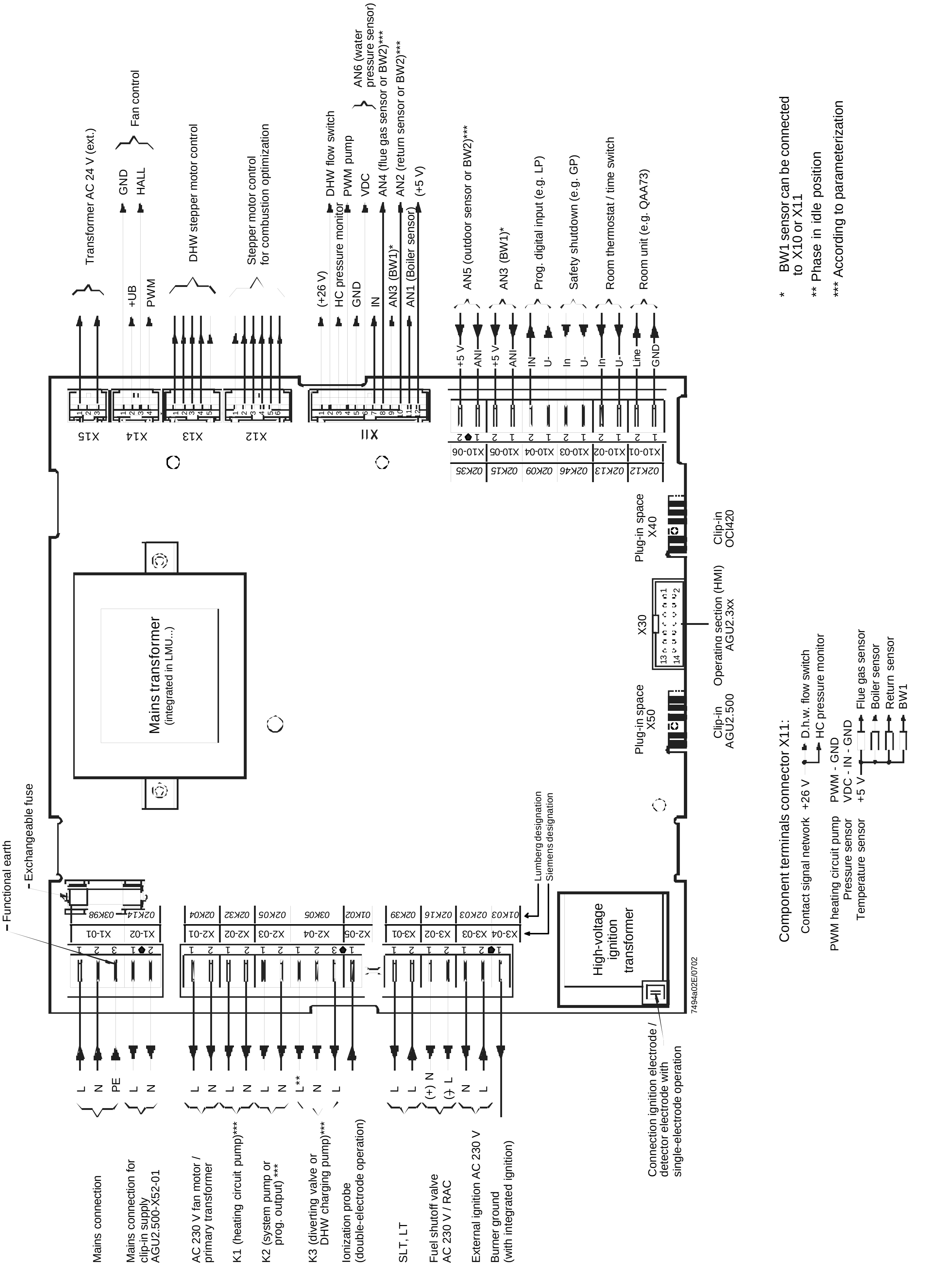
8.1 LMU...



The diagram shows the **maximum functionality** of the LMU... system. For the specific scope of functions, refer to the relevant version / configuration !

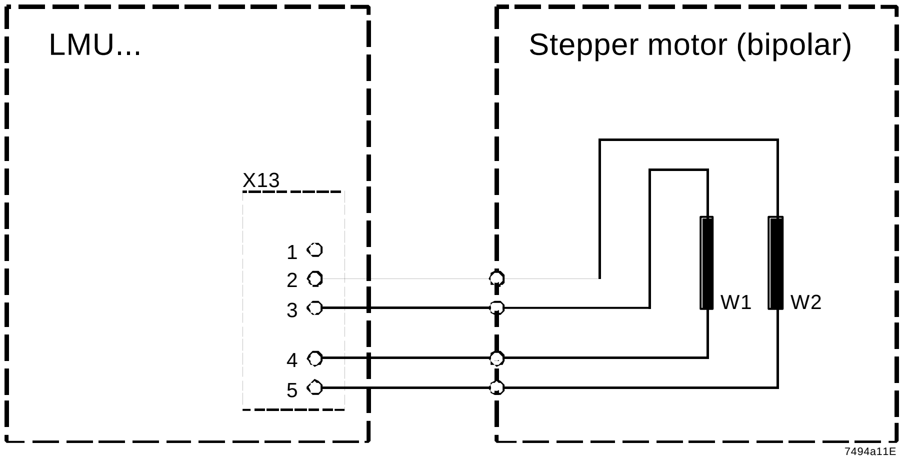
9 Connection diagrams

9.1 LMU...



The diagram shows the **maximum functionality** of the LMU... system. For the specific scope of functions, refer to the relevant version / configuration !

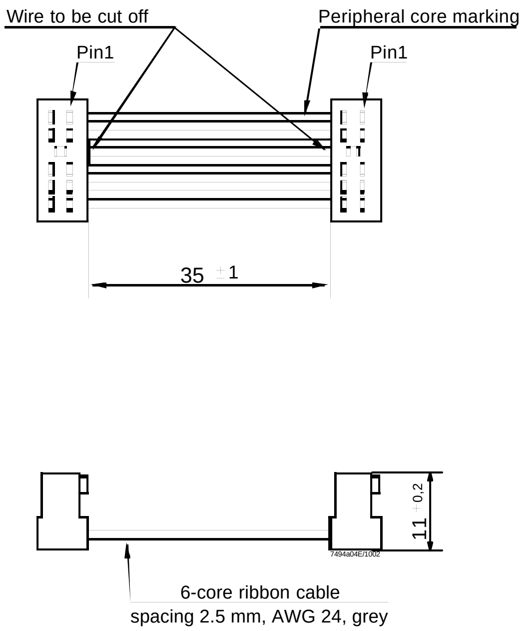
9.2 DHW stepper motor (bipolar)



Direction of rotation: Can be reversed by exchanging connections 2 and 5 **or** 3 and 4.

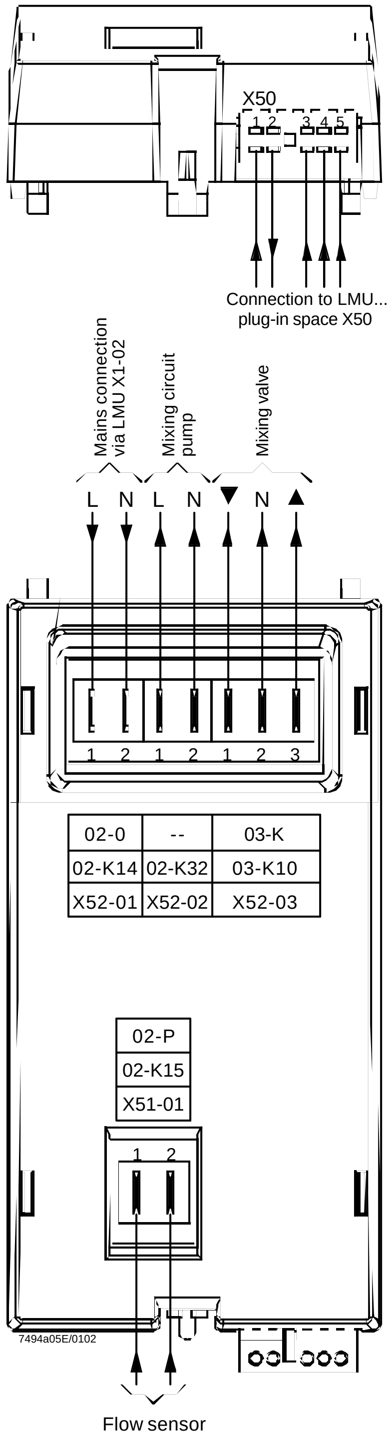
9.3 AGU2.104A109

Connecting cable LMU... ⌦ Clip-in module AGU2.5x / OCI420 via connectors X40 / X50



Connector:
Lumberg type Duomodul 3515 05 K04

9.4 AGU2.500A109

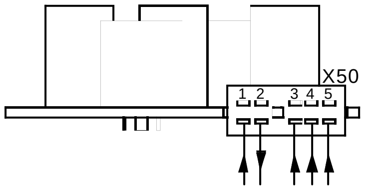


X50	Siemens designation
3515 05 K04 [1)]	Lumberg designation
3515 05 K18 [2)]	Lumberg designation

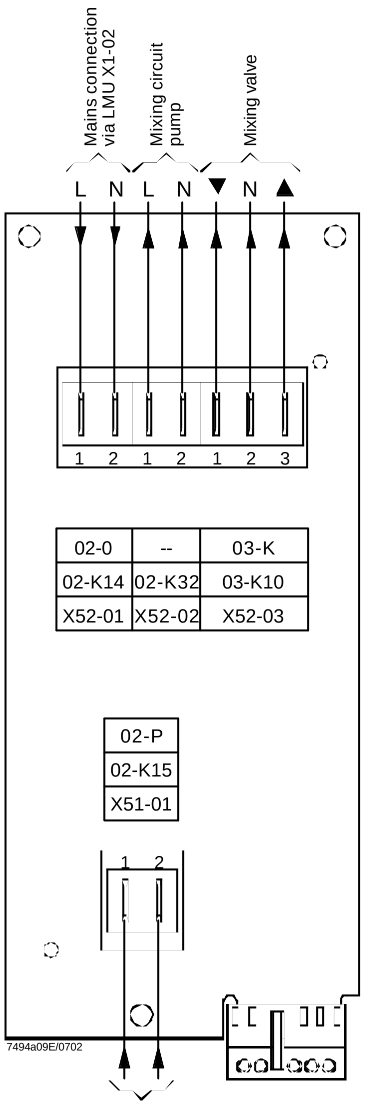
1) This connector variant is permitted only when module is plugged into the LMU6...

2) This connector variant is permitted only when printed circuit board is slotted and applies to all applications

9.5 AGU2.500A209



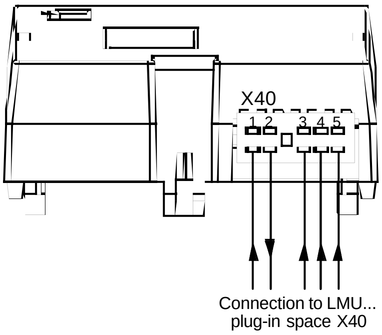
X50	Siemens designation
3515 05 K18	Lumberg designation



02-0	--	03-K	Standard short-form designation
02-K14	02-K32	03-K10	Lumberg designation (3611...)
X52-01	X52-02	X52-03	Siemens designation

02-P	Standard short-form designation
02-K15	Lumberg designation (3611...)
X51-01	Siemens designation

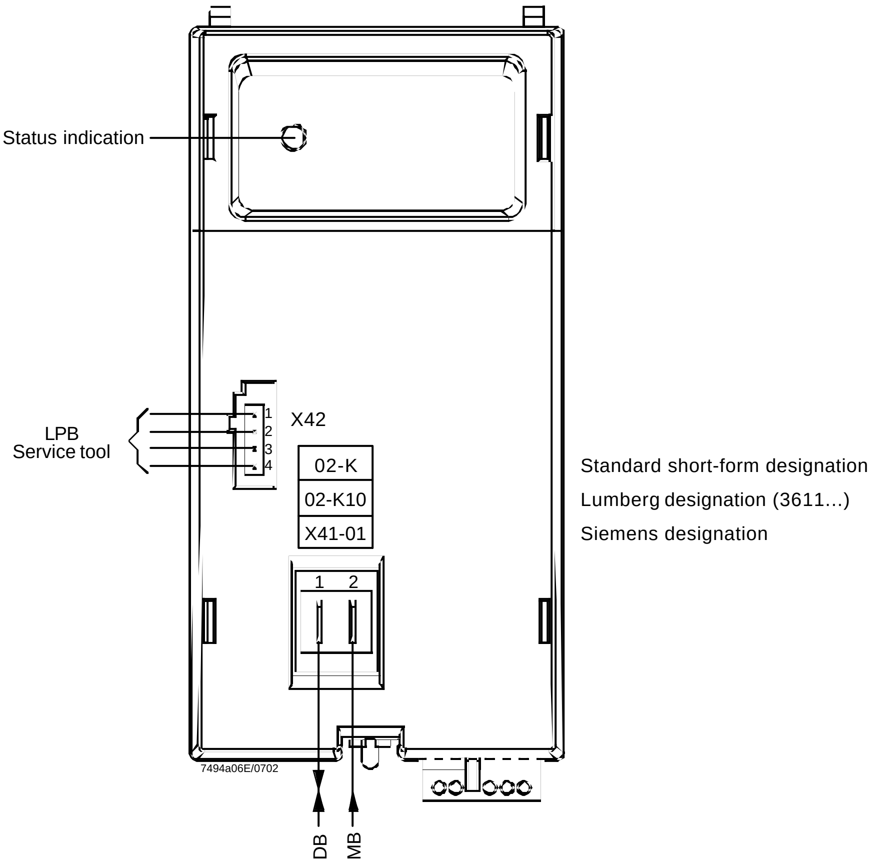
9.6 OCI420A109



X40	Siemens designation
3515 05 K04 [1)]	Lumberg designation
3515 05 K18 [2)]	Lumberg designation

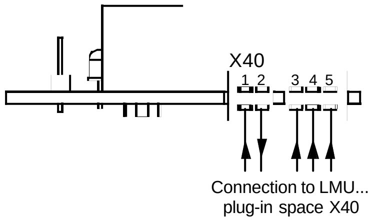
1) This connector variant is permitted only when module is plugged into the LMU6...

2) This connector variant is permitted only when printed circuit board is slotted and applies to all applications

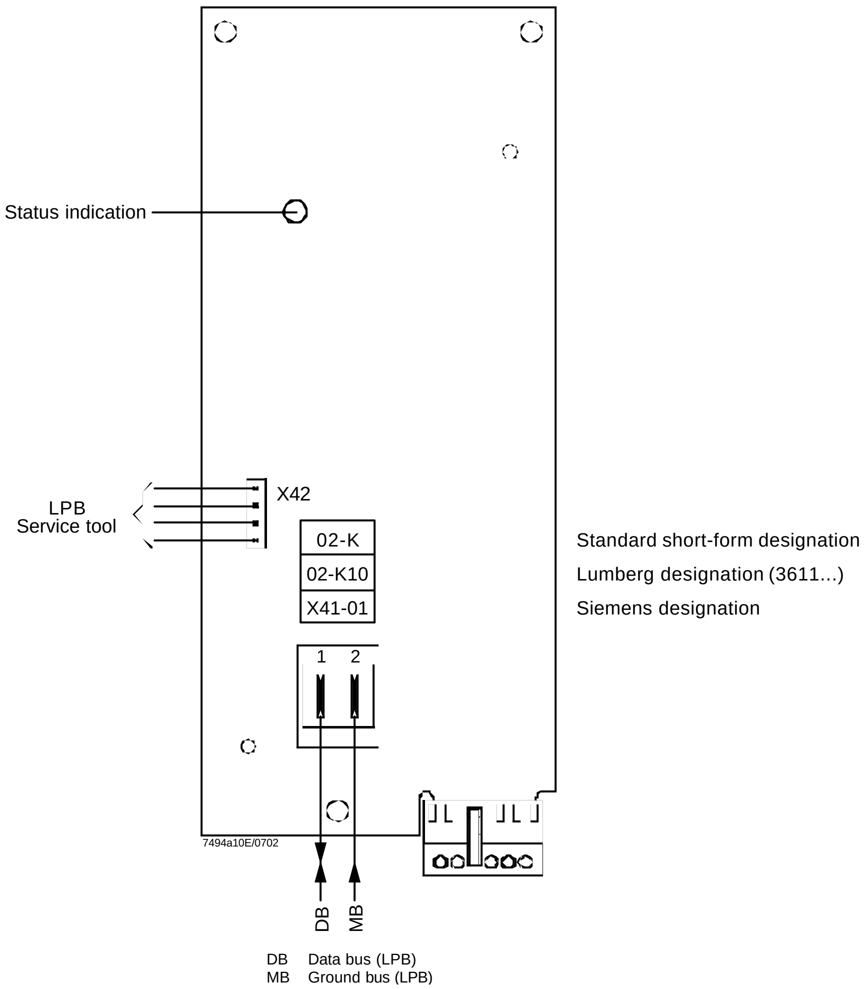


DB Data bus (LPB)
MB Ground bus (LPB)

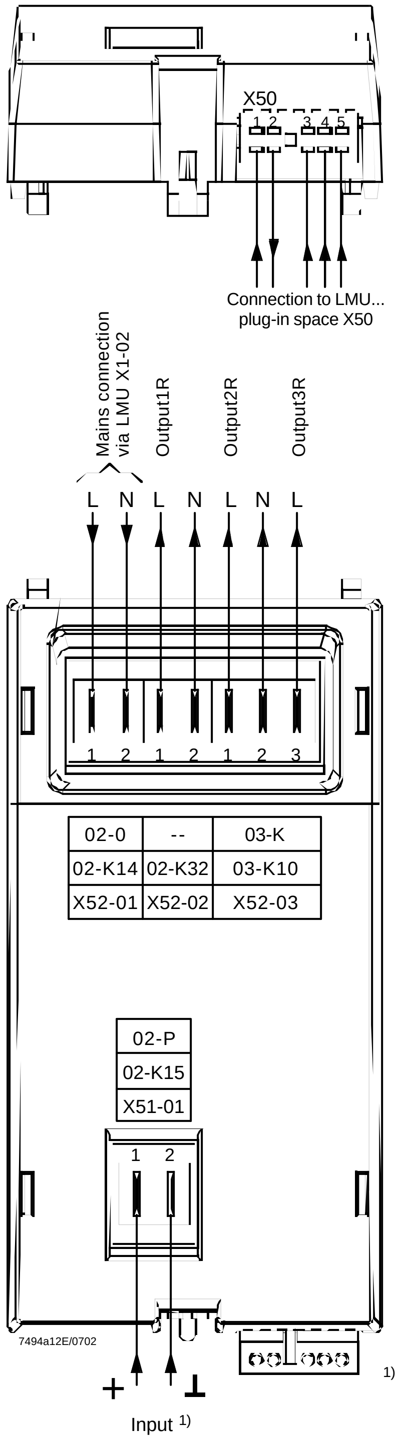
9.7 OCI420A209



X40	Siemens designation
3515 05 K18	Lumberg designation



9.8 AGU2.51x



X50	Siemens designation
3515 05 K04 1)	Lumberg designation
3515 05 K18 2)	Lumberg designation

1) This connector variant is permitted only when module is plugged into the LMU6...

2) This connector variant is permitted only when printed circuit board is slotted and applies to all applications

Standard short-form designation
Lumberg designation (3611…)
Siemens designation

Standard short-form designation
Lumberg designation (3611…)
Siemens designation

1) Observe polarity of input with:
AGU2 .511A109
AGU2.513A109

9.9 Connecting cable between OCI490... and PC

The connecting cable to be used is a 9-polar serial interface cable with a 1-to-1 connection (crossed connections **not permitted**)!

Note

The cable is **not** supplied by Siemens.

9.10 Mounting, electrical installation and service

Mounting (general)

On the boiler, the unit must be fitted in a housing ensuring degree of protection of at least IP 40.

Depending on the field of use, more stringent degrees of protection may be required, which must then be observed.

When mounted, the maximum permissible ambient temperature may not be exceeded!

**The unit is designed for mounting on the burner or in the control panel.
Protection against electric shock hazard must be ensured!**

Condensation water may not fall on or get inside the LMU..., neither in operation nor during service work!

Mounting the LMU5x...

When mounting the printed circuit board on a metal surface, the gap between the underside of the printed circuit board and the metal surface must be ^{3} 12 mm (conforming to EN 60 335 ® minimum 8 mm air path and creeping distance to the end of the wires or solder fillets).

- The spacers must be made of electrically nonconducting material!
- When using fixing screws made of metal, the diameter of the head must be ≤ 6 mm!
- If the spacers use metal fixing screws on each side, the air path between the screws must be ≥ 8 mm or solid insulation of 2 mm must be fitted (EN 60 335)!

Ignition device

Electric ignition sparks generate high-frequency energy that can adversely affect radio and television reception. In that case, the high-voltage cable running to the ignition electrode acts as a transmitter.

The ignition module integrated in the LMU… is equipped with appropriate filters which prevent high-frequency energy from being passed from the ignition cable to the other terminals.

An application-specific test is still required, however, to prove that spacing is adequate.

High-frequency energy also spreads as capacitance and inductance, which means that it is not bound to cable. This must be considered when laying cables.

The ignition cable must meet the technical specification of the integrated ignition module. It should be run to the ignition electrode as directly as possible, with no loops.

It may never be laid parallel or very close to other electrical conductors.

Terminals and wiring

The RAST 2.5 connection area on the narrow side of the unit operates on protective extra low-voltage.

When making the wiring, the extra low-voltage area must be strictly separated from other voltage areas to ensure protection against electric shock hazard!

With the RAST5 connectors, the predefined coding must be observed!

Make connections to components only when power is switched off!

Ensure protection against electric shock hazard on unused AC 230 V connection terminals (RAST5) by fitting dummy plugs!

To isolate the unit from the mains network, use a multipolar switch.

For wiring the bus users, only the cables specified by Siemens may be used!

The contact material used with external signal sources (LP, RT, DHW flow switch, etc.) should be gold-plated silver (also refer to «Technical data»).

Both the detector electrode and the ignition probe must be protected against electric shock hazard.

Since the cable to the flame detector electrode must be well insulated against ground, it must be protected against condensation, together with the detector electrode.

Input X1 for the unit's power supply must be connected to the power supply network as follows:

X1-1 to L and **X1-2 to N.**

Connection of functional earth to X1-3 must be made in compliance with regulations!

Testing by the customer

If the boiler or burner manufacturer wants to conduct additional insulation or high-voltage tests, they can only be made after prior approval by Siemens!

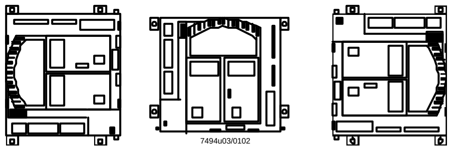
10 Technical data

10.1 LMU...

General

Mains voltage	AC 230 V +10 % -15 %
Mains voltage	50 Hz ±5 %
Power consumption (without transformer and loads)	max. 15 VA
Sizing surge voltage category	III (DIN EN 60 664)
Degree of protection (LMU5x... / LMU6x...)	IP 00
Mandatory after mounting in the boiler	min. IP 40
Safety class	areas of safety class 0 and areas of SELV
Degree of contamination	1
Mounting position	**always upright** (3 positions)

It must be ensured that the unit can dissipate sufficient heat through its ventilation slots!



Environmental conditions in operation	to DIN EN 721-3-3
- Temperature range	0 ... +60 °C
- Vibrations in operation	to EN 298
Environmental conditions during transport	to DIN EN 60 068-2-30 and DIN EN 60 730-2-5 chapter 12
- Temperature range	-20 ... +70 °C
- Vibrations	DIN EN 60 721-3-2 requirements of class 2M2

Condensation, formation of ice and ingress of water are not permitted!

Conformity with EC Directives	
- Electromagnetic compatibility (Immunity)	89 / 336 / EEC
Software classes	to DIN EN 60 730-2-5
- Controller section	class A
- Burner control	class C
Dimensions (L x W x H) (without housing)	180 x 180 x 45 mm
Dimensions (L x W x H) (with housing)	212 x 188 x 67.5 mm
Weight (without housing)	approx. 0.8 kg
Weight (with housing)	approx. 1.15 kg
Housing	
- Material	Polycarbonat
- Color	RAL 7035 (light-grey)
- Flame protection class	to UL 94: V-2
Unit fuse (to IEC 127)	T6.3 H 250
Identification code (to EN 298)	F M C L B N

Electrical connection data

- Maximum overall current of all mains components connected to the LMU… and the clip-in modules (at UN = AC 230 V; Tu = 60 °C) — 5 A

- Mains extension (X1-02)

- Current	depending on the current draw of the heating circuit pump, programmable AC 230 V output, fuel valve, DHW charging pump, external ignition module and clip-in modules used

- Primary transformer / AC 230 V fan (X2-01)

- Voltage	AC 230 V +10 % -15 %

- K1 (X2-02)

- Voltage	AC 230 V +10 % -15 %
- Current	5 mA ... 1 A, cos φ > 0.8

- K2 (X2-03)

- Voltage	AC 230 V +10 % -15 %
- Current	5 mA ... 1 A, cos φ > 0.8

- DHWK3 (X2-04)

- Voltage	AC 230 V +10 % -15 %
- Current	5 mA ... 1 A, cos φ > 0.8

- Flame supervision / ionization probe (X2-05)

- Switching threshold (required DC)	min. 0.7µA
- Current	typ. 1.4 µA max. 2.2µA
- Response time in the event of loss of flame	< 1 s
- Electric shock hazard	cannot be touched
- Flame detector cable length	≤ 1 m

Note

Conductors L and N must be correctly connected!

- Safety temperature limiter (X3-01)

- Voltage	AC 230 V +10 % -15 %
- Current	5 mA ... 1 A, cos φ > 0.8 power supply for fuel valve and ignition

- Fuel valve (X3-02)

AC output	AC 230 V +10 % -15 % valve must still open at AC 175 V
- Current	5 mA ... 0.5 A, cos φ > 0.8

Note

If a fuel valve with rectifier shall be connected to the fuel valve AC output, it can only be made with the approval of Siemens!

In that case, additional protective measures inside the LMU... will be required (optional electronic components).

RAC output	RAC 230 V +10 % -15 % 100 Hz valve must still open at RAC 175 V
- Pmax	20 W, cos φ > 0.9

General information about connection of the fuel valve:

- Max. cable length	3 m
- Max. leakage current at 1.06 x UNenn	≤ 0.5 mA
- Additional capacitive circuitry or protective elements for limiting surge voltages	not permitted

- External ignition module (X3-03)

- Voltage	AC 230 V +10 % -15 %
- Current	5 mA ... 0.5 A, cos φ > 0.8
	must still ignite at AC 175 V
- Max. cable length	3 m

With regard to switch-on and switch-off characteristics, every type of external ignition module used must be approved by Siemens !

- Integrated ignition module (X3-04)

- Min. sparking power / pulse	3 mJ at 2 kΩ
- Max. sparking power / pulse	4 mJ at 2 kΩ
	in the range of 175 V ... 253 V
- Min. pulse sequence	10 Hz at 175 V
- Max. pulse sequence	25 Hz at 253 V
- Electric shock hazard	cannot be touched
- Open-circuit voltage	20 kV
- Max. no-load operation	30 s

- Transformer connection, secondary side (X15) — refer to specification of transformer
- Fan control (X14)
  - Max. current draw when using stepper motor control for combustion optimization and DHW diverting valve — DC 1.2 A
  - Max. current draw without using stepper motor control for combustion optimization and DHW diverting valve — DC 1.5 A
  - Cable length — ≤ 3 m
- Boiler temperature sensor (X11) NTC 10 kΩ
  - Max. continuous temperature — 100 °C
  - Max. temperature short-time — 125 °C
  - Sensor tolerance — ≤ ±2 K
  - Cable length — ≤ 3 m
  - Aging — ≤ ±3 %
  - τ — ≤ 20 s
  - Other requirements — to DIN EN 60 730-2-9
  - Temperature-resistance characteristic:

Temperature [°C]	RNTC [kW]	Temperature [°C]	RNTC [kW]
-20.00	96.360	50.00	3.605
-10.00	55.047	60.00	2.490
0.00	32.555	70.00	1.753
10.00	19.873	80.00	1.256
20.00	12.488	90.00	0.915
25.00	10.000	100.00	0.677
30.00	8.059	110.00	0.508
40.00	5.330	120.00	0.387

Note

The QAx36xx must be used in compliance with their specifications.

- Return sensor (X11) NTC 10 kΩ — as under boiler sensor
- DHW sensor (X11) [1)] NTC 10 kΩ — refer to Data Sheet QALx6xx
  - Cable length — ≤ 3 m
- Flue gas sensor (X11) NTC 10 kΩ — refer to Data Sheet QAx3x...
  - Cable length — ≤ 3 m
- Outside sensor (X10-06) NTC 1 kΩ — refer to Data Sheet QAC34...
  - Cable length — ≤ 40 m
- Pressure sensor (X11)
  - Min. output voltage LMU — DC 9 V at 5 mA
  - Typical output voltage LMU — DC 14 V at 5 mA
  - Max. output voltage LMU — DC 19 V at 5 mA; DC 20 V at 0 mA
  - Input voltage LMU — DC 0.5 V ... 4.5 V with a dummy load of 12 kΩ
  - Cable length — ≤ 3 m
- Pressure sensor (X11)
  - Huba Control, type 502 — 0 ... 4 bar
  - Imit — on request

• Heating circuit flow switch / pressure monitor (X11)	
- Min. output voltage LMU…	RAC 19 V at 7 mA
- Typical output voltage LMU…	RAC 26 V at 10 mA
- Max. output voltage LMU…	RAC 31.5 V at 12 mA 50 Hz single-path rectified
- Max. contact resistance	300 Ω
- Cable length	≤ 3 m
• DHW flow switch (X11)	
- Min. output voltage LMU…	RAC 19 V at 7 mA
- Typical output voltage LMU…	RAC 26 V at 10 mA
- Max. output voltage LMU…	RAC 31.5 V at 12 mA 50 Hz single-path rectified
- Max. contact resistance	300 Ω
- Cable length	≤ 3 m
• Safety shutdown / gas pressure switch (X10-03)	
- Min. output voltage LMU…	RAC 19 V at 7 mA
- Typical output voltage LMU…	RAC 26 V at 10 mA
- Max. output voltage LMU…	RAC 31.5 V at 12 mA 50 Hz single-path rectified
- Max. contact resistance	300 Ω
- Cable length	≤ 5 m
• Programmable digital input / air pressure switch (X10-04)	
- Min. output voltage LMU…	RAC 19 V at 7 mA
- Typical output voltage LMU…	RAC 26 V at 10 mA
- Max. output voltage LMU…	RAC 31.5 V at 12 mA 50 Hz single-path rectified
- Max. contact resistance	300 Ω
- Cable length	≤ 5 m
• Room thermostat / time switch (X10-02)	
- Min. output voltage LMU…	RAC 19 V at 7 mA
- Typical output voltage LMU…	RAC 26 V at 10 mA
- Max. output voltage LMU…	RAC 31.5 V at 12 mA 50 Hz single-path rectified
- Max. contact resistance	300 Ω
- Cable length	≤ 40 m
• Stepper motor control for combustion optimization (X12)	refer to Data Sheet VDUx
- Cable length	≤ 1 m
• DHW stepper motor control (X13)	Sonceboz 7217R030 bipolar control
- Min. output voltage LMU…	DC 22 V at 228 mA
- Typical output voltage LMU…	DC 28.5 V at 176 mA
- Max. output Voltage LMU…	DC 41 V at 122 mA
- Cable length	≤ 1 m

Note: The currents specified are average motor currents

- RU (X10-01) — QAA73, QAA53
  - Connection: 2-wire interchangeable
  - Cable length: max. 50 m
  - Cable resistance: max. 2 x 5 Ω
  - Power consumption: 30 mW (typically)
- PWM control for heating circuit pump (X11)
  - PWM frequency: 1.536 kHz ± 2 %
  - Min. output voltage LMU...: DC 5 V at 5 mA
  - Typical output voltage LMU...: DC 10 V at 7 mA
  - Max. output voltage LMU...: DC 15 V at 10 mA; DC 20 V at 0 mA
  - Cable length: ≤ 3 m

[1)] When connecting a thermostat to the DHW sensor input, appropriate contact material is mandatory (e.g. gold-plated contacts) since the signal voltage at that input is DC 5 V.

- DHW thermostat connected to DHW sensor input
  - Voltage: DC 5 V
  - Current: ≥ 1.5 mA

Cable lengths (LMU... ⌦ HMI and LMU... ⌦ Clip-in)

- Connection LMU... ⌦ HMI (X30) — total
- Connection LMU... ⌦ Clip-in module (OCI420... / AGU2.500...) — max. 1 m

Connectors

Connector space	Component	Type of connector *
X11	LMU...	Connector (RAST 2.5) 12-pole Supplier, e.g. Lumberg Duomodul 3521 12 K00
X12	LMU...	Connector (RAST 2.5) 6-pole Supplier, e.g. Lumberg Duomodul 3521 06 K00
X13	LMU...	Connector (RAST 2.5) 5-pole Supplier, e.g. Lumberg Duomodul 3521 05 K00
X14	LMU...	Connector (RAST 2.5) 4-pole Supplier, e.g. Lumberg Duomodul 3521 04 K00
X15	LMU...	Connector (RAST 2.5) 3-pole Supplier, e.g. Lumberg Duomodul 3521 03 K00
X30	LMU... for AGU2.361	Connector to DIN 41651, 14-pole, 1.27 mm spacing, AWG28, Supplier, e.g. FCI Quickie III 71600-014
X40	LMU... for OCI420	Connector (RAST 2.5) 5-pole Supplier, e.g. Lumberg Duomodul 3515 05 K04
X50	LMU... for AGU2.500	Connector (RAST 2.5) 5-pole Supplier, e.g. Lumberg Duomodul 3515 05 K04
High-voltage ignition transformer integrated in the LMU...		Quick connector 2.8 x 0.8 mm

* Connector to be fitted to the component (to be provided by OEM)
Recommended cross-sectional area of cable for X11...X15: 0.38 mm^2

10.2 Clip-in

10.2.1 AGU2.500...

Outputs

Mixing circuit pump and mixing valve

Electrical connections

- Voltage: AC 230 V +10 % -15 %
- Current: 5 mA ... 1 A, cos φ > 0.8

Note

When assigning loads to the outputs, the **total current draw** of the LMU… system must be taken into consideration!

Input

Flow sensor NTC 10 kΩ — like boiler sensor

10.2.2 AGU2.51x

Outputs

Up to 3 outputs (K1...K3)
When using 2 clip-in modules with the LMU…, only 2 outputs possible

Electrical connections

- Voltage: AC 230 V +10 % -15 %
- Current: 5 mA ... 1 A, cos φ > 0.8

Note

When assigning loads to outputs K1...K3, the **total** current draw of the LMU… system must be taken into consideration!

Input

Version	Input	Remarks
AGU2.511A109	0...10 V	Note polarity
AGU2.513A109	(0)4...20 mA	Note polarity
AGU2.514A109	NTC 10 kΩ	Like boiler sensor
AGU2.515A109	 1)	

1) Contact rating: Nom. DC 34 V / 5 mA

Note

The inputs may only be used with safety extra low-voltage (SELV) and may not be connected to protective earth (PE)!

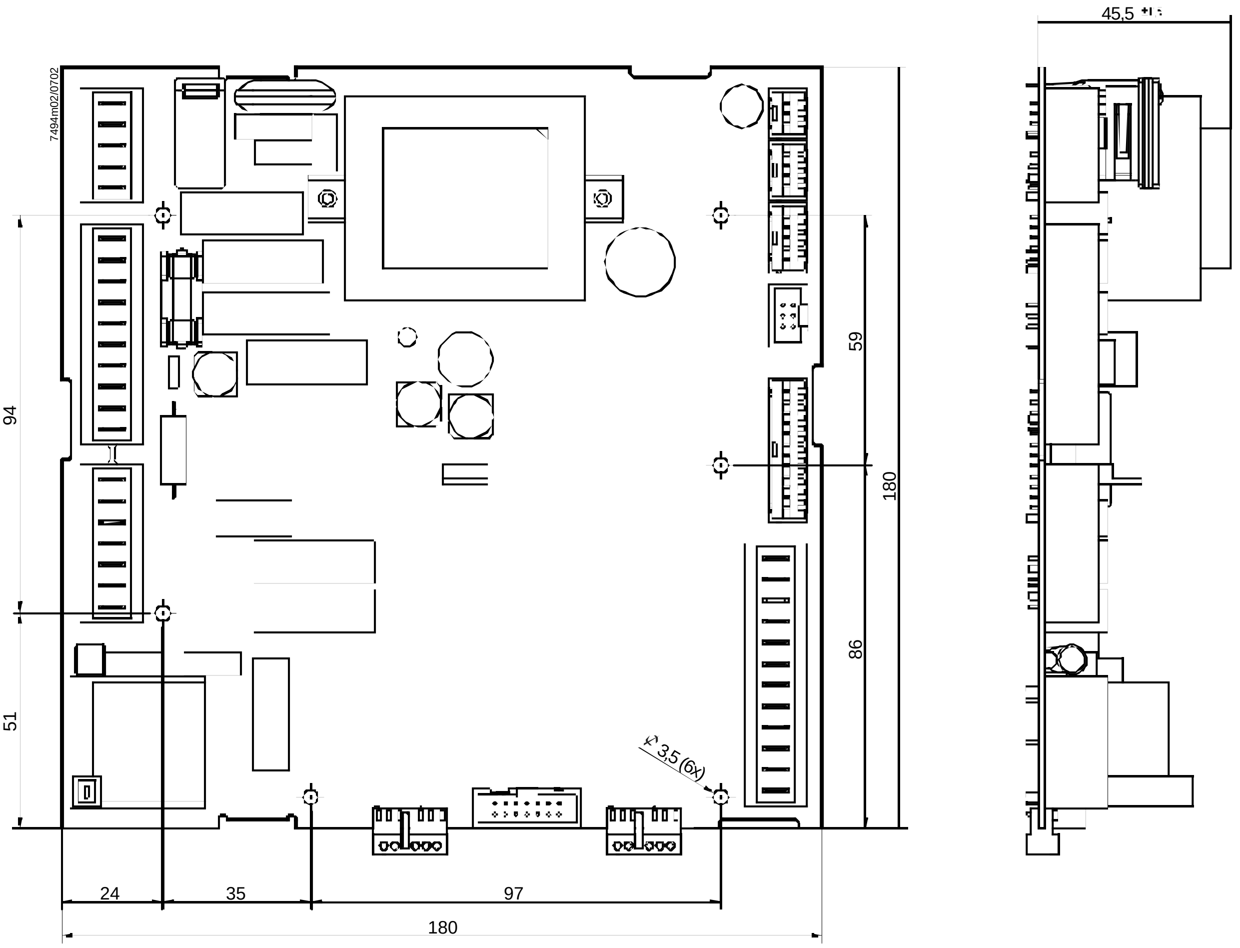
10.3 External components

RAST5 connectors	Insulation displacement connectors	e.g. Lumberg type 3625 (suitable stranded wires 1.0...1.5 mm^2)
	or	
	Connectors with screw terminals	e.g. Lumberg type 3611 (suitable stranded wires 2.5 mm^2)
Mains transformer	• Safety transformer to EN 61 558-2-6	refer to separate Siemens specification_LMU5x_transformer and fan_de_VX.Y.doc specification (mandatory)
Fan with DC 24 V motor	• Rated data	refer to separate Siemens specification_LMU5x_transformer and fan_de_VX.Y.doc specification (mandatory)
Fan with DC motor operating on mains voltage	• Rated data	refer to separate Siemens specification_LMU5x_transformer and fan_de_VX.Y.doc specification (mandatory)

11 Dimensions

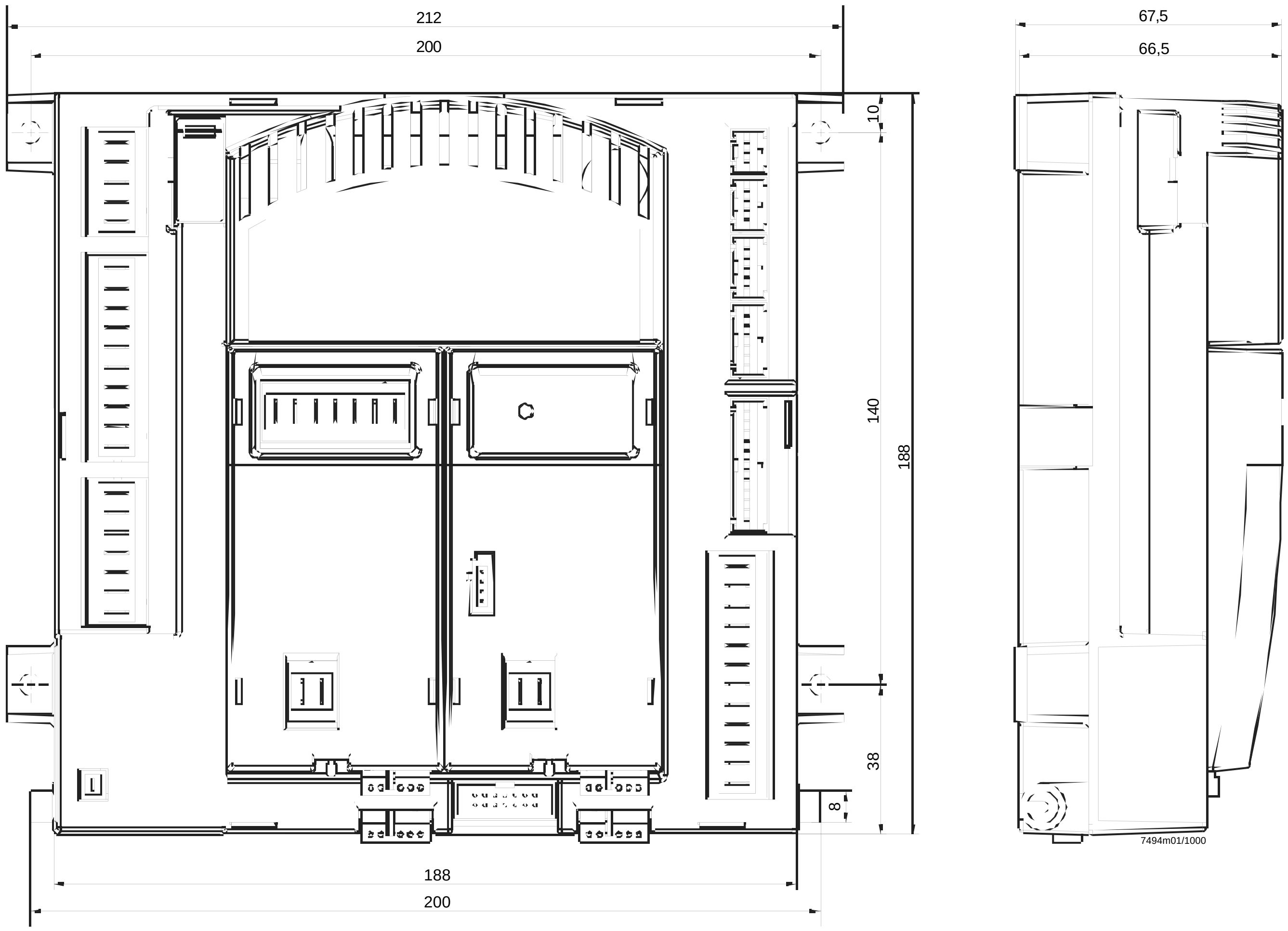
11.1 LMU5x...

Dimensions in mm



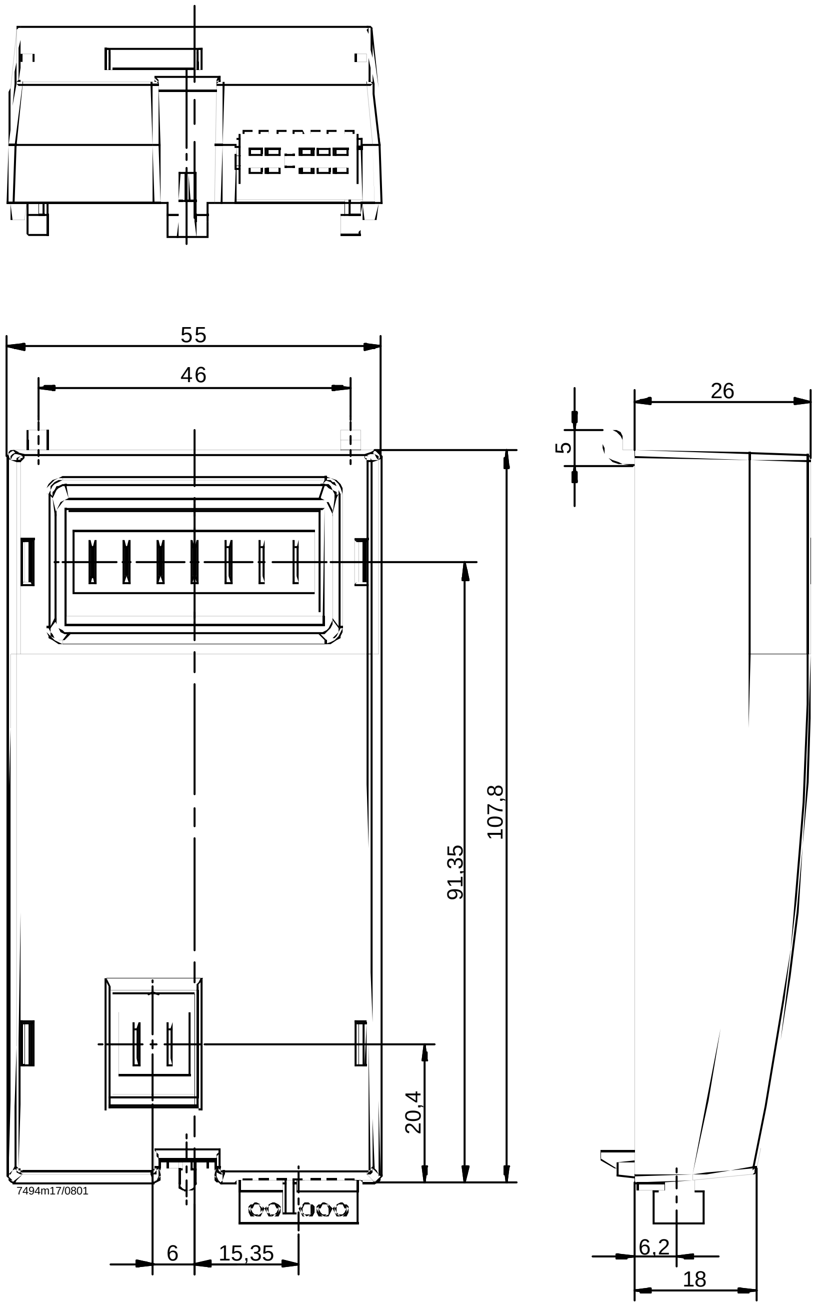
11.2 LMU6x...

Dimensions in mm



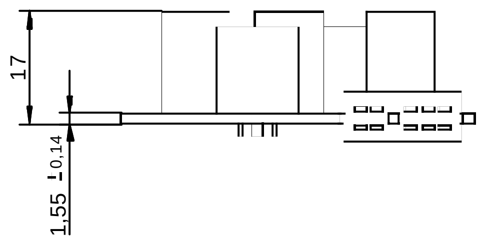
11.3 AGU2.500A109 / AGU2.51xA109

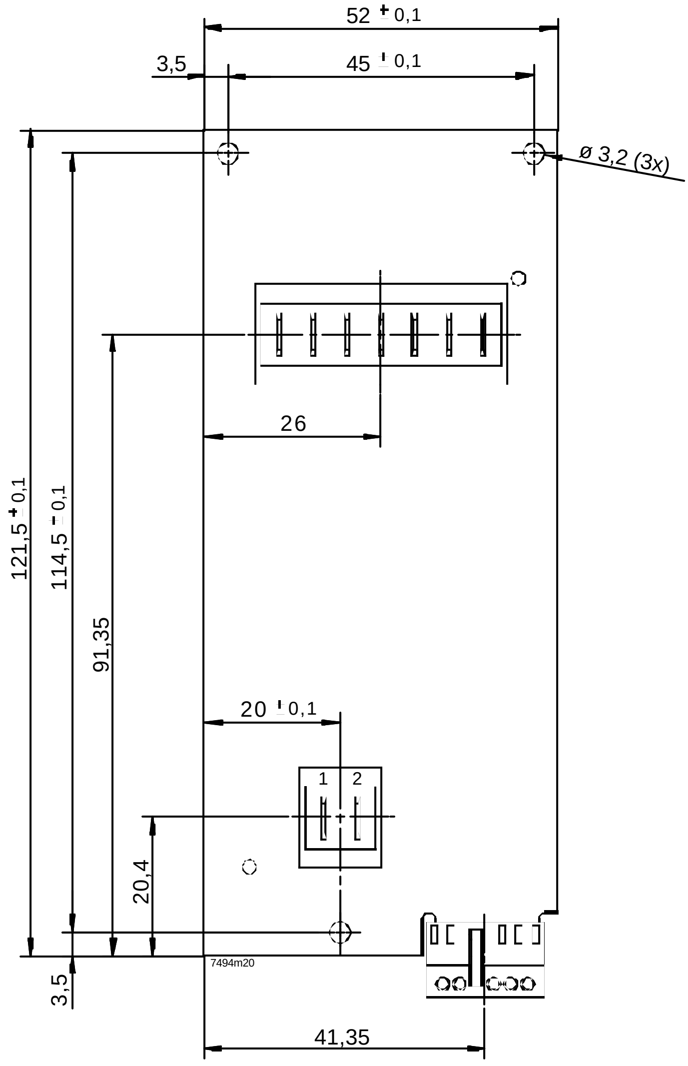
Dimensions in mm



11.4 AGU2.500A209

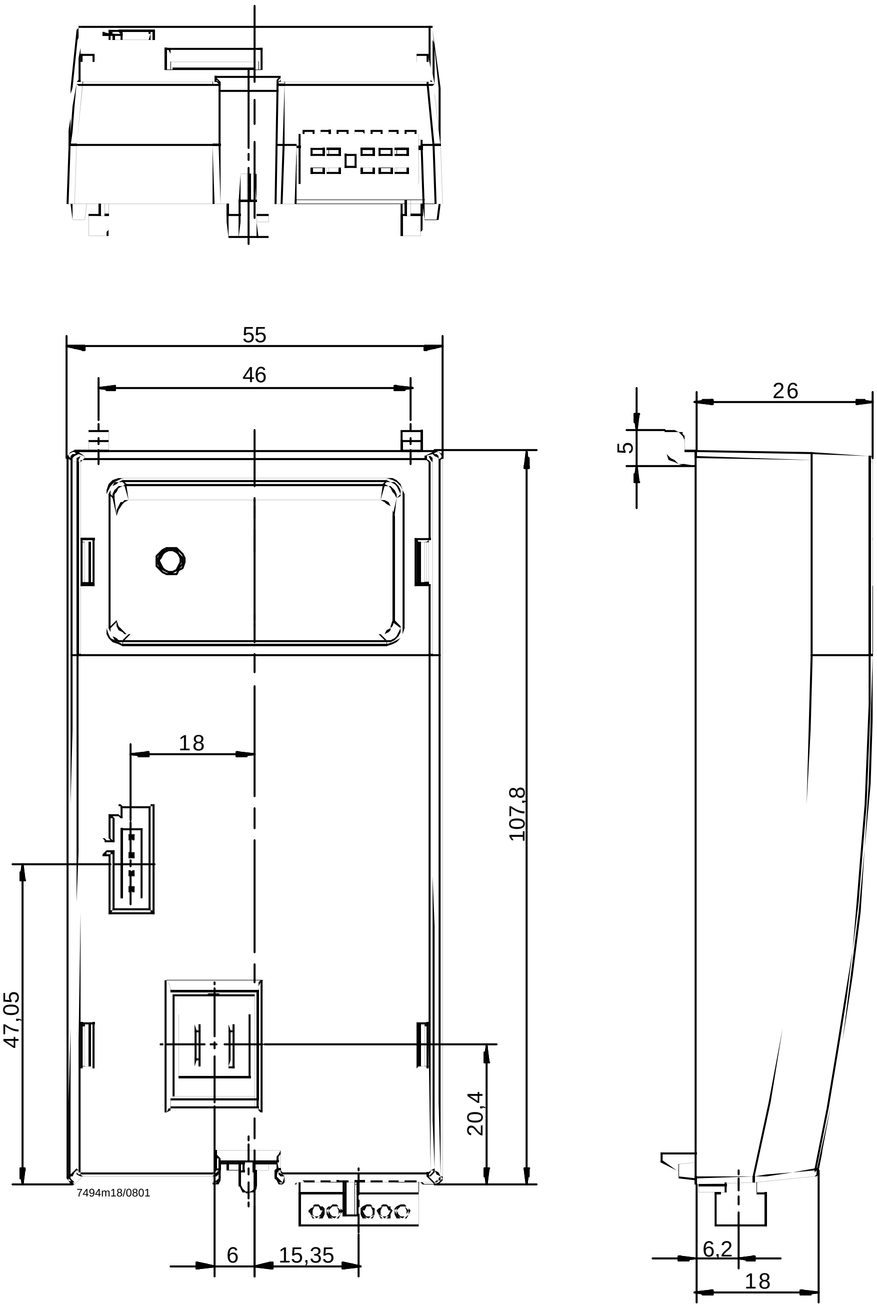
Dimensions in mm





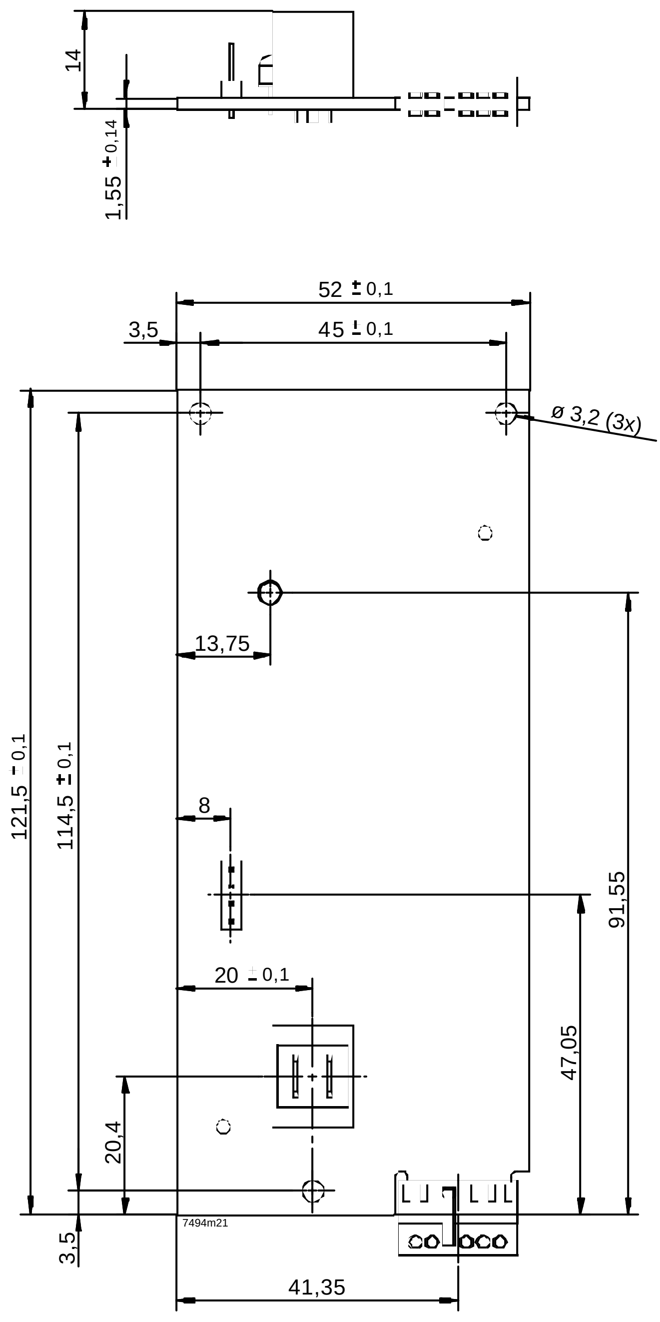
11.5 OCI420A109

Dimensions in mm



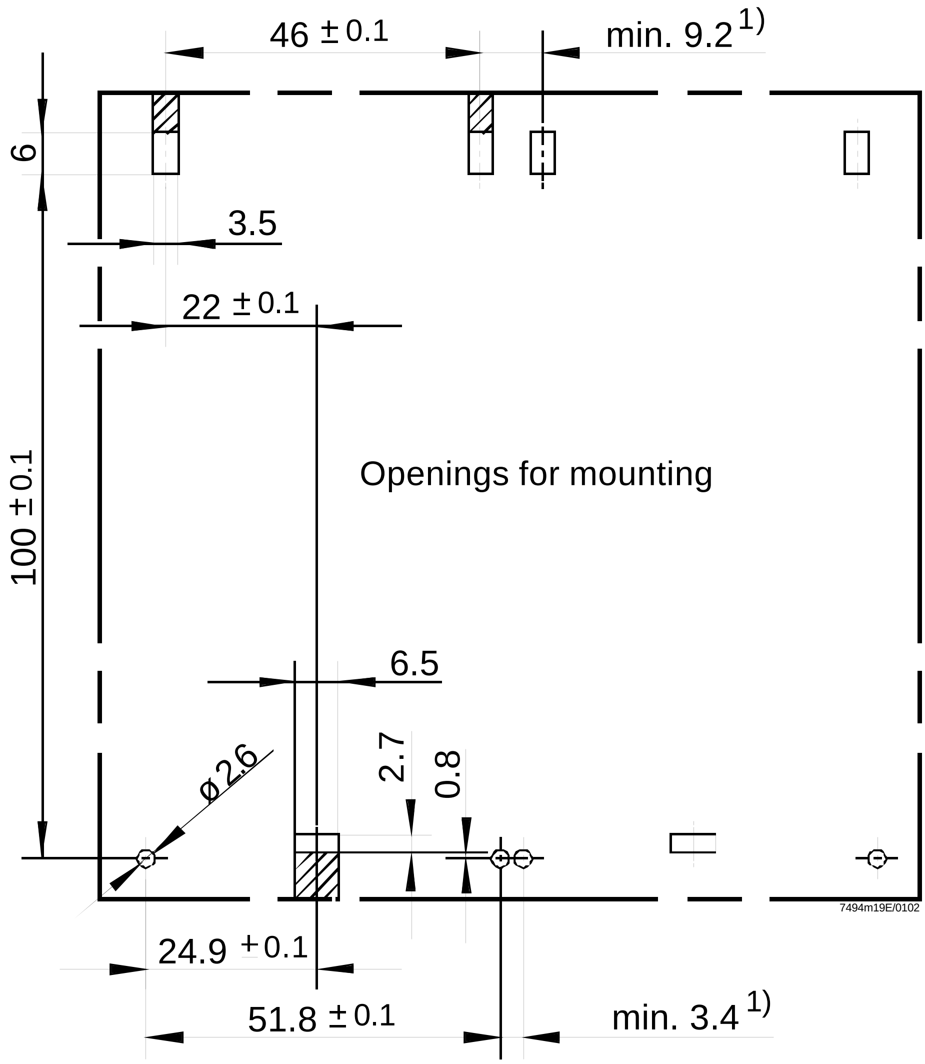
11.6 OCI420A209

Dimensions in mm



11.7 Mounting plate for clip-in module

Dimensions in mm



Material thickness in these areas
1.5 ± 0.1

1) Distance between 2 modules

12 Parameter list / legend of parameter bit fields LMU...

12.1 Parameter list

Parameter list LMU...

Temperatures

No	Name	Group	Function	Range	No QAA73 AGU2.310	Level QAA73 AGU2.310	LevelNo PC_Tool	Level PC_Tool
			Setpoints, actual values and limit values					
96	TkSmin	Boiler	Minimum boiler setpoint temperature (20 °C<=TkSmin<=TkSmax)	20 ... 90 °C	503	Engineer	5	Installer
97	TkSmax	Boiler	Maximum boiler setpoint temperature (TkSmin<=TkSmax<=90 °C)	20 ... 90 °C	504	Engineer	5	Installer
181	TkSnorm	Heating mode HC1	Boiler setpoint at design outside temperature	20 ... 90 °C	505	Engineer	5	Installer
98	TvSmin	Heating mode AGU2.500	Minimum flow setpoint temperature (20 °C<=TvSmin<=TvSmax)	20 ... 90 °C	506	Engineer	5	Installer
99	TvSmax	Heating mode AGU2.500	Maximum flow setpoint temperature (TvSmin<=TvSmax<=90 °C)	20 ... 90 °C	507	Engineer	5	Installer
100	TbwSmin	DHW	Minimum DHW setpoint temperature (10 °C<=TbwSmin<=TbwSmax)	10 ... 80 °C	508	OEM	4	OEM service
101	TbwSmax	DHW	Maximum DHW setpoint temperature (TbwSmin<=TbwSmax<=80 °C)	10 ... 80 °C	509	OEM	4	OEM service
250	dTbwKomf40	DHW-inst DHW heater	Setpoint readjustment in Comfort mode and setpoint of 40 °C	-20 ... 20 K	580	Engineer	5	Installer
251	dTbwKomf60	DHW-inst DHW heater	Setpoint readjustment in Comfort mode and setpoint of 60 °C	-20 ... 20 K	581	Engineer	5	Installer
252	dTbwAusl40	DHW-inst DHW heater	Setpoint readjustment with outlet temperature control and setpoint of 40 °C	-20 ... 20 K	582	Engineer	5	Installer
253	dTbwAusl60	DHW-inst DHW heater	Setpoint readjustment with outlet temperature control and setpoint of 60 °C	-20 ... 20 K	583	Engineer	5	Installer
94	TrSmin	Weather compens	Minimum room setpoint (10 °C<=TrSmin<=TrSmax)	10 ... 30 °C	501	Engineer	6	Enduser
95	TrSmax	Weather compens	Maximum room setpoint (TrSmin<=TrSmax<=30 °C)	10 ... 30 °C	502	Engineer	6	Enduser
103	TkSfrostEin	Boiler	Boiler frost protection switch-on temperature (5 °C<=TkSfrostEin<TkSfrostAus)	5 ... 50 °C	511	Engineer	5	Installer
104	TkSfrostAus	Boiler	Boiler frost protection switch-off temperature (TkSfrostEin<TkSfrostAus<=50 °C)	5 ... 50 °C	512	Engineer	5	Installer
105	TqNach	DHW	Switch-off temperature for pump overrun (after DHW heating)	20 ... 90 °C	513	OEM	4	OEM service
114	TgradMax	No meaning	Maximum temperature gradient of boiler setpoint ramp in heating mode (0: no setpoint ramp)	0 ... 255 K/min	518	OEM	4	OEM service
112	THG	Heating mode	Summer / winter changeover temperature (30 °C: S / W changeover deactivated)	8 ... 30 °C	516	Enduser	6	Enduser
113	dTbreMinP	Boiler	Maximum control differential; when exceeded, minimum pause time will be aborted	0 ... 90 K	517	Engineer	5	Installer
108	TuebVor	Heating mode AGU2.500	Boiler temperature setpoint boost with mixing circuit	0 ... 30 °C	514	Engineer	5	Installer
106	TbwBereit	DHW-ins DHW heater	Setpoint for readiness temperature	10 ... 60 °C	607	Engineer	6	Enduser
102	TuebBw	DHW	Flow temperature setpoint boost with DHW heating	0 ... 30 °C	510	Engineer	5	Installer
107	TkBegr	No meaning	Boiler temperature limitation with instantaneous DHW heater	60 ... 95 °C			4	OEM service
115	dTrAbsenk	Heating mode time switch	Reduction of room setpoint when using time switch (dTrAbsenk=0: acting on heat demand)	0 ... 10 K	520	Enduser	6	Enduser
173	TiAussenNorm	Weather compens	Design outside temperature (for sizing heating plant)	-50 ... 20 °C	519	Engineer	5	Installer
172	dTkTrNenn	PWM pump	Delta flow / return temperature at TiAussenNorm, 2. 5 <=...<= dTkTrMax	2.5 ... 20 K	521	Engineer	5	Installer
116	dTkTrMax	PWM pump	Maximum dT of boiler flow and return for dT supervision	2.5 ... 35 K	522	OEM	3	OEM (production)
462	dTkTrSTB	Boiler (S) LT	Maximum dT of boiler flow and return above which the electronic SLT cuts out	2.5 ... 50 K			3	OEM (production)
111	TaBegr	Boiler flue gas supervision	Triggering threshold for output reduction at high flue gas temperatures (limitation)	0 ... 255 °C	593	OEM*	3	OEM (production)
438	TaAbschalt	Boiler flue gas supervision	Triggering threshold for boiler shutdown at high flue gas temperatures	0 ... 255 °C	592	OEM*	3	OEM (production)
109	TkMax	Boiler TL	Maximum limitation of boiler temperature (TL function 1)	0 ... 100 °C	515	OEM*	3	OEM (production)
110	Tstb	Boiler (S) LT	Cutout temperature of SLT	0 ... 110 °C			3	OEM (production)
389	TempGradMax	Boiler (S) LT	Maximum rate of flow temperature rise	0 ... 20 K/s			3	OEM (production)
528	TAnfoExtMax	AGU2.51x	Maximum value of heat demand with external predefined temperature setpoint (5 °C< = TAnfoExtMax< = 130 °C)	5 ... 130 °C	622	Engineer	5	Installer

7494t01E_Param_List.xls

* Read only

Switching differentials

No	Name	Group	Function	Range	No QAA73 AGU2.310	Level QAA73 AGU2.310	LevelNo PC_Tool	Level PC_Tool
			Switch-on / -off thresholds					
117	SdHzEin	Boiler	Switch-on differential of burner in heating mode	0.5 ... 32 K	523	Engineer	5	Installer
118	SdHzAusMin	Boiler	Minimum switch-off differential of burner in heating mode	0.5 ... 32 K	524	Engineer	5	Installer
119	SdHzAusMax	Boiler	Maximum switch-off differential of burner in heating mode	0.5 ... 32 K	525	Engineer	5	Installer
120	SdBwEin1	DHW	Switch-on differential of burner in DHW heating mode (sensor 1)	0.5 ... 32 K	526	Engineer	5	Installer
121	SdBwAus1Min	DHW	Minimum switch-off differential of burner in DHW heating mode (sensor 1)	-32 ... 32 K	527	Engineer	5	Installer
122	SdBwAus1Max	DHW	Maximum switch-off differential of burner in DHW heating mode (sensor 1)	-32 ... 32 K	528	Engineer	5	Installer
123	SdBwEin2	DHW	Switch-on differential of burner in DHW heating mode (sensor 2)	0.5 ... 32 K	529	Engineer	5	Installer
125	SdBwAus2Max	DHW	Maximum switch-off differential of burner in DHW heating mode (sensor 2)	-32 ... 32 K	531	Engineer	5	Installer
323	Sd_RL_groesser_VL	Boiler (S) LT	Threshold switch-off temperature when comparing boiler flow / return temperature (el. LT)	5 ... 20 K			3	OEM (production)

Controller functions

No	Name	Group	Function	Range	No QAA73 AGU2.310	Level QAA73 AGU2.310	LevelNo PC_Tool	Level PC_Tool
			Configuration					
126	Sth1	Weather compens HC1	Heating curve slope heating circuit 1	1 ... 40	532	Enduser	6	Enduser
127	Sth2	Weather compens AGU2.500	Heating curve slope heating circuit 2	1 ... 40	533	Enduser	6	Enduser
128	DtR1	Weather compens HC1	Room setpoint readjustment heating circuit 1	-31 ... 31 K	534	Enduser	5	Installer
129	DtR2	Weather compens AGU2.500	Room setpoint readjustment heating circuit 2	-31 ... 31 K	535	Enduser	5	Installer
135	PhzMax	Heating mode	Maximum degree of modulation in heating mode (LmodTL <= PhzMax <= LmodVL)	0 ... 100 %	541	Engineer	4	OEM service
137	NhzMax	Heating mode	Maximum speed at maximum output in heating mode (maximum speed limitation)	0 ... 12750 rpm	536	Engineer	4	OEM service
144	PminHuKw	Boiler INFO value	Minimum boiler output in kW (Hu)	0 ... 65535 kW	542	Engineer	5	Installer
145	PmaxHuKw	Boiler INFO value	Maximum boiler output in kW (Hu)	0 ... 65535 kW	543	Engineer	5	Installer
175	NqmodMin	PWM pump	Minimum pump speed permitted for the heating plant	10 ... 100 %	538	Engineer	5	Installer
188	NqmodMinBw	PWM pump	Minimum pump speed for full charging of stratification storage tank	10 ... 100 %	539	Engineer	5	Installer
174	NqmodNenn	PWM pump	Pump speed at the heating plant's design point	1 ... 50	537	Engineer	5	Installer
180	QmodDrehzStufen	PWM pump	Number of speeds of modulating pump (supplier specification)	2 ... 50	540	OEM	4	OEM service
146	QmodMin	PWM pump	Minimum degree of modulation of modulating pump (supplier specification)	0 ... 70 %	548	OEM	4	OEM service
147	QmodMax	PWM pump	Maximum degree of modulation of modulating pump (supplier specification)	10 ... 100 %	549	OEM	4	OEM service
435	Klambda1	PWM pump	Filter time constant of actual values of flow / return temperature of dT control	0 ... 1	586	OEM	4	OEM service
148	Kon	Heating mode	Constant for quick setback without room influence	0 ... 20	551	Engineer	5	Installer
179	KtAbtastDt	PWM pump	Sampling factor of dT control (as a factor for TabtastK)	0 ... 50	550	OEM	4	OEM service
149	HydrSystem	Boiler	Hydraulic system adjustment	0 ... 255	552	Engineer	5	Installer
193	KonfigHks	Heating mode	Configuration of heating circuits	0 ... 255	553	Engineer	5	Installer
194	KonfigRg0	Boiler	Setting flags: status code open-circuit sensor for Anx channel suppressed / not suppressed	0 ... 255	554	Engineer	4	OEM service
150	KonfigRg1	Boiler	Setting flags	0 ... 255	555	Engineer	6	Enduser
151	KonfigRg2	DHW-inst DHW heater	Instantaneous DHW heater setting flags	0 ... 255	556	Engineer	5	Installer
152	KonfigRg3	Boiler	AD converter configuration and heating demand	0 ... 255	557	Engineer	5	Installer
153	KonfigRg4	Boiler	Setting flags	0 ... 255	558	Engineer	5	Installer
154	KonfigRg5	Boiler	Setting flags	0 ... 255	559	OEM	4	OEM service
155	KonfigRg6	Boiler	Setting flags	0 ... 255	560	OEM	4	OEM service
182	KonfigRg7	Boiler	Setting flags	0 ... 255	561	Engineer	5	Installer
328	KonfigRg8	DHW-inst DHW heater	Setting flags for instantaneous DHW heater	0 ... 255	587	Engineer	5	Installer
427	dTzapfEnde	DHW-inst DHW heater	Response threshold for detection of DHW consumption with instantaneous DHW heater	-2 ... 1,984375 K/s	599	Engineer	5	Installer
428	dTzapfKomf	DHW-inst DHW heater	Response threshold for detection of DHW consumption with instantaneous DHW heater in Comfort mode	-2 ... 1,984375 K/s	600	Engineer	5	Installer
429	dTzapfHz	DHW-inst DHW heater	Response threshold for detection of DHW consumption with instantaneous DHW heater in heating mode	-2 ... 1,984375 K/s	601	Engineer	5	Installer
433	LmodRgVerz	Boiler	Output during controller delay time (LmodTL <= LmodRgVerz <= LmodVL)	0 ... 100 %	598	Engineer	5	Installer
439	ZeitKoLrelGedStand	Boiler OCI420	Time constant for filtering the relative burner output delivered via LPB bus	0 ... 2550 s			3	OEM (production)
440	Kalibrationsfaktor	Boiler OCI420	Calibration of LMU for load signal delivered via LPB to match effective output	-128 ... 127			3	OEM (production)
470	KonfigEingang	Boiler	Progr input LMU basis	0 ... 255	614	Engineer	5	Installer

Controller functions (cont'd

No	Name	Group	Function	Range	No QAA73 AGU2.310	Level QAA73 AGU2.310	LevelNo PC_Tool	Level PC_Tool
526	KonfigEingangR	AGU2.51x	Progr input on clip-in function module	0 ... 255	618	Engineer	5	Installer
471	KonfigAusgang	Boiler	Function programmable output K2 LMU	0 ... 255	615	Engineer	5	Installer
523	KonfigAusgang1R	AGU2.51x	Function output1 clip-in function module	0 ... 255	619	Engineer	5	Installer
524	KonfigAusgang2R	AGU2.51x	Function output2 clip-in function module	0 ... 255	620	Engineer	5	Installer
525	KonfigAusgang3R	AGU2.51x	Function output3 clip-in function module	0 ... 255	621	Engineer	5	Installer
529	PAnfoExtSchwelle	AGU2.51x	Threshold of analog signal from which the external demand for output will be accepted (percentage of maximum value of analog signal)	5 ... 95 %	623	Engineer	5	Installer

Controller times

			All non-safety-related time parameters					
130	ZqNach	Heating mode	Overrun time of pumps, max. 210 min (setting 255: continuous operation of Q1)	0 ... 255 min	544	Engineer	5	Installer
134	ZkickFkt	Boiler	Time for kick function of pump / diverting valve outputs	0 ... 51 s	584	Engineer	5	Installer
139	ZBreMinP	Boiler	Minimum burner pause time (heat demand-dependent switching hysteresis)	0 ... 3600 s	545	Engineer	5	Installer
140	ZBreMinL	No meaning	Minimum burner running time (heat demand-dependent switching hysteresis)	0 ... 255 s	546	Engineer	5	Installer
141	ZReglVerz	Boiler	Controller delay after burner is started up	0 ... 255 s	547	Engineer	5	Installer
136	ZAueRuec	Boiler flue gas supervision	Reset time of flue gas supervision equipment	10 ... 218 min			3	OEM (production)
329	ZsdHzEnde	Boiler	Time until switch-off differential is reduced to SdHzAusMin	0 ... 210 min	588	OEM	4	OEM service
330	ZsdBwEnde	DHW	Time until switch-off differential is reduced to SdBwAusMin	0 ... 210 min	589	OEM	4	OEM service
331	ZSperrDynAusSd	Boiler	Locking time of dynamic switch-off differential after a change of heating<->DHW	0 ... 51 s	590	OEM	4	OEM service
430	Z_BwComfort1	DHW-inst DHW heater	Time for instantaneous DHW heater Comfort function after consumption (when there is no demand for heat) (0 = deactivated; 1440 = continuously)	0 ... 1440 min	602	Engineer	5	Installer
460	Z_BwComfort2	DHW-inst DHW heater	Time for instantaneous DHW Comfort function after consumption (when there is demand for heat) (0 = deactivated; 255 = 4h15min)	0 ... 255 min	603	Engineer	5	Installer
475	ZqComfortAus	DHW-DLH	Time for pump overrun in Dlh Comfort function with burner off (0 = pump off with burner off; 255 = pump always on)	0 ... 255 min			5	Installer

Controller coefficients

			Setting the controller's dynamics					
158	KpBw	DHW	Proportional coefficient of DHW controller	0 ... 15.9375	566	OEM	4	OEM service
159	TvBw	DHW	Derivative action time of DHW controller	0 ... 15.9375 s	567	OEM	4	OEM service
160	TnBw	DHW	Integral action time of DHW controller	0 ... 4000 s	568	OEM	4	OEM service
161	KpHz1	Heating mode HC1	Proportional coefficient of heating circuit controller	0 ... 15.9375	569	OEM	4	OEM service
162	TvHz1	Heating mode HC1	Derivative action time of heating circuit controller	0 ... 15.9375 s	570	OEM	4	OEM service
163	TnHz1	Heating mode HC1	Integral action time of heating circuit 1 controller	0 ... 4000 s	571	OEM	4	OEM service
167	KpDt	PWM pump	Proportional coefficient of dT control	0 ... 15.9375	575	OEM	4	OEM service
168	TvDt	PWM pump	Derivative action time of dT control	0 ... 15.9375 s	576	OEM	4	OEM service
169	TnDt	PWM pump	Integral action time of dT control	0 ... 4000 s	577	OEM	4	OEM service
170	ZAbtastK	Boiler	Sampling time of temperature control loop in heating mode and with storage tank charging	1 ... 4 s	578	OEM	4	OEM service
171	ZAbtastDlh	DHW-inst DHW heater	Sampling time of temperature control loop with instantaneous DHW heater	1 ... 4 s	579	OEM	4	OEM service

Pressures

			Setpoints, actual values and limit values					
436	pH2OAbschalt	Boiler water pressure supervision	Water pressure above which boiler and pump will be shut down	0 ... 25.5 bar	594	Engineer	5	Installer
156	pH2Omin	Boiler water pressure supervision	Minimum boiler water pressure	0 ... 25.5 bar	562	Engineer	5	Installer
157	pH2Omax	Boiler water pressure supervision	Maximum boiler water pressure	0 ... 25.5 bar	563	Engineer	5	Installer
437	SdpH2O	Boiler water pressure supervision	Switching differential of water pressure	0 ... 25.5 bar	595	Engineer	5	Installer
177	FoerderMin	PWM pump	Min head of modulating pump (supplier specification)	0 ... 25.5 m	565	OEM	4	OEM service
176	FoerderMax	PWM pump	Max head of modulating pump (supplier specification)	0.5 ... 25.5 m	564	OEM	4	OEM service
479	dpH2OminPuOn	Boiler water pressure supervision	Min pressure differential to be reached after the pump was switched on	0 ... 5 bar	616	Engineer	5	Installer
480	dpH2OmaxPuOn	Boiler water pressure supervision	Max pressure differential that can occur when pump is switched on	0 ... 5 bar	617	Engineer	5	Installer

Burner control fan

No	Name	Group	Function	Range	No QAA73 AGU2.310	Level QAA73 AGU2.310	LevelNo PC_Tool	Level PC_Tool
			Burner control parameters in connection with the fan					
37	LmodVor	Boiler	Modulation air during prepurging	0 ... 100 %			4	OEM service
38	LmodZL	Boiler	Modulation air at ignition load	0 ... 100 %			4	OEM service
464	LmodZL_QAA	Boiler	Setting value QAA73: modulation air at ignition load	0 ... 100 %	608	OEM	5	Installer
39	LmodTL	Boiler	Modulation air low-fire, lower limit of modulating range	0 ... 100 %			4	OEM service
465	LmodTL_QAA	Boiler	Setting value QAA73: modulation air at low-fire; lower limit modulating range	0 ... 100 %	609	OEM	5	Installer
40	LmodVL	Boiler	Modulation air high-fire, upper limit modulating range	0 ... 100 %			4	OEM service
466	LmodVL_QAA	Boiler	Setting value QAA73: modulation air at high-fire; upper limit modulation range	0 ... 100 %	610	OEM	5	Installer
41	LmodNull	Boiler	Modulation air when burner control is not in operation	0 ... 100 %			4	OEM service
42	LmodStart	Boiler	Threshold value modulation air for start / stop	0 ... 100 %			4	OEM service
43	NoG_Max	Boiler	Maximum speed	0 ... 12750 rpm			4	OEM service
44	N_Vor	Boiler	Speed required during prepurging	0 ... 12750 rpm			4	OEM service
45	N_Vor_Delta	Boiler	Tolerance band for N_Vor	0 ... 12750 rpm			4	OEM service
46	N_VL	Boiler	Speed required at high-fire	0 ... 12750 rpm			4	OEM service
469	N_VL_QAA	Boiler	Setting value QAA73: speed required at high-fire	0 ... 12750 rpm	613	Engineer	5	Installer
47	N_VL_Delta	Boiler	Tolerance band for N_VL	0 ... 12750 rpm			4	OEM service
48	N_ZL	Boiler	Speed required at ignition load	0 ... 12750 rpm			4	OEM service
467	N_ZL_QAA	Boiler	Setting value QAA73: speed required at ignition load	0 ... 12750 rpm	611	Engineer	5	Installer
49	N_ZL_Delta	Boiler	Tolerance band for N_ZL	0 ... 12750 rpm			4	OEM service
434	Nachstell_Zaehler	Boiler	Counter for speed readjustment on startup (tolerance limit of speed overshoot)	1 ... 50			3	OEM (production)
390	N_Nachstell_Delta	Boiler	Speed readjustment on startup and shutdown: band within which the speed should be	50 ... 12750 rpm			4	OEM service
50	N_TL	Boiler	Speed required at low-fire	0 ... 12750 rpm			4	OEM service
468	N_TL_QAA	Boiler	Setting value QAA73: speed required at low-fire	0 ... 12750 rpm	612	Engineer	5	Installer
51	N_TL_Delta	Boiler	Tolerance band for N_TL	0 ... 12750 rpm			4	OEM service
52	NoG_Null	Boiler	Maximum fan speed on standstill	0 ... 12750 rpm			4	OEM service
53	VmLauf	Boiler	Rate of change of fan control (PWM) rising	0 ... 100 % / s			4	OEM service
54	VmLab	Boiler	Rate of change of fan control (PWM) falling	0 ... 100 % / s			4	OEM service
55	VmLaufBetr	Boiler	Speed mod air rising in operation	0 ... 100 % / s			4	OEM service
56	VmLabBetr	Boiler	Speed mod air falling in operation	0 ... 100 % / s			4	OEM service
138	ZGebNach	Boiler (S) LT	Maximum overrun time when TL / LT cuts out	0 ... 10 min	585	OEM	4	OEM service
546	KpBegr	Boiler	Parameter for dynamics of speed limitation. Action in the direction of limitation	1 ... 40			4	OEM Service
547	KpUnbegr	Boiler	Parameter for the dynamics of speed limitation. Action against the direction of limitation	1 ... 40			4	OEM Service

Burner control sequence

			Parameters for configuring the burner control					
58	Ti	Boiler	Interval ignition load; transition time operation with ignition load	0 ... 10 s			3	OEM (production)
59	Tvz	Boiler	Preignition time	0 ... 25 s			3	OEM (production)
60	Tn	Boiler	Postpurge time	0 ... 51 s			3	OEM (production)
61	Tv	Boiler	Prepurge time	0 ... 51 s			3	OEM (production)
62	Tsa	Boiler	Satety time total	1.8 ... 9.8 s			2	L&S temp
63	Tsa1	Boiler	Safety time	0.2 ... 9.6 s			2	L&S temp
64	FaProgFlags1	Boiler	Setting flags of burner control section internally (control sequence)	0 ... 255			1	L&S service (Development)
65	FaEinstellFlags1	Boiler	Setting flags of burner control section external components1	0 ... 255			2	L&S temp
66	FaEinstellFlags2	Boiler	Setting flags of burner control section external components2	0 ... 255			4	OEM service
463	FaEinstellFlags3	Boiler	Setting flags of burner control section	0 ... 255			4	OEM service
67	RepZaehler	Boiler	Number of permitted repetitions for restart	0 ... 15			2	L&S temp
317	TB_Konfig	Boiler (S) LT	Flags for configuring the LT functions	0 ... 255			2	L&S temp
319	GrenzeNacherwaermung	Boiler (S) LT	Counter limit for triggering lockout in the event of faulty postheating	0 ... 50			3	OEM (production)
320	GrenzeGradient	Boiler (S) LT	Counter limit for triggering lockout in the event of faulty gradient	0 ... 50			3	OEM (production)
321	GrenzeDeltaT	Boiler (S) LT	Counter limit for triggering lockout in the event of faulty dT	0 ... 50			3	OEM (production)
322	GrenzeRL_groesserVL	Boiler (S) LT	Counter limit for triggering lockout in the event the return is higher than the flow	0 ... 50			3	OEM (production)
476	IonLimit	Boiler	Limit value for limiting the ionization current. 0 = function inactive	0 ... 25 µA			4	OEM Service

Burner control identification

No	Name	Group	Function	Range	No QAA73 AGU2.310	Level QAA73 AGU2.310	LevelNo PC_Tool	Level PC_Tool
			Production data and version					
289	KundeNr	INFO values	Official L & S customer number	0 ... 255			1	L&S service (Development)
5	ParaVersNr	INFO values	Parameter set version number	0 ... 65535			1	L&S service (Development)
6	ParaSatzNr	INFO values	Parameter set number	0 ... 65535			1	L&S service (Development)
527	P_Kenn	Parameterization	Identification of parameter set. PC tool programmed from OEM level only when this parameter is identical	0 ... 255			2	L&S temp
7	FabJahr	INFO values	Production year	0 ... 255			0	L&S production
8	FabMonat	INFO values	Production month	0 ... 255			0	L&S production
9	FabTag	INFO values	Production day	0 ... 255			0	L&S production
10	FabNr	INFO values	Production number	0 ... 2147483647			0	L&S production
11	Pruefer	INFO values	Inspector code	0 ... 255			0	L&S production
348	GerFam	INFO values	Device family	0 ... 255			5	Installer

Operating data

			Operating data, learn adaption range					
68	BetrStd	INFO values	Hours run burner	0 ... 131070 hrs	718	Engineer*	1	L&S service (Development)
69	BetrStdHz	INFO values	Hours run heating mode	0 ... 131070 hrs	719	Engineer*	1	L&S service (Development)
70	BetrStdBw	INFO values	Hours run DHW heating	0 ... 131070 hrs	720	Engineer*	1	L&S service (Development)
71	BetrStdZone	INFO values	Hours run zone	0 ... 131070 hrs	721	Engineer*	1	L&S service (Development)
72	InbetrSetz	INFO values	Start counter	0 ... 327675	722	Engineer*	1	L&S service (Development)
246	TvSollMmiEeprom	INFO values	Initialization value of boiler setpoint potentiometer	20 ... 90 °C			1	L&S service (Development)
511	TvSollRedMmiEeprom	Initialization	Initialization value of boiler setpoint potentiometer reduced	5 ... 90 °C			1	L&S service (Development)
247	TrSollMmiEeprom	INFO values	Initialization value of room setpoint potentiometer	10 ... 30 °C			1	L&S service (Development)
512	TrSollRedMmiEeprom	Initialization	Initialization value of room setpoint potentiometer reduced	10 ... 30 °C			1	L&S service (Development)
248	TbwSollMmiEeprom	INFO values	Initialization value of DHW setpoint potentiometer	10 ... 80 °C			1	L&S service (Development)
513	TbwSollRedMmiEeprom	Initialization	Initialization of DHW setpoint potentiometer reduced	10 ... 80 °C			1	L&S service (Development)
74	MmiStatus	HMI	Selection of summer / winter operating modes	0 ... 255	724	Engineer*	1	L&S service (Development)
73	Pmittel	No meaning	Mean boiler output	-	723	Engineer*	-	-
474	SwVersion_LMU	INFO values	SW version of LMU for presentation on the OT parameter setting level	-	725	Engineer*	-	-
240	IonStrom	INFO values	Measured value of ionization current	-	755	Engineer*	-	-

* Read only

MCI

			Mixing valve clip-in					
441	XpHz2	Heating mode AGU2.500	P-band of heating circuit 2 controller	1 ... 100 K	597	OEM	4	OEM service
166	TnHz2	Heating mode AGU2.500	Integral action time of heating circuit 2 controller	10 ... 873 s	574	OEM	4	OEM service
442	ZeitAufZu	Heating mode AGU2.500	Running time of actuator in heating circuit 2 (TimeOpening / TimeClosing)	30 ... 873 s	596	Engineer	4	OEM service
443	SdHz2	Heating mode AGU2.500	Switching differential of 3-position controller in heating circuit 2 (<= neutral zone (2K))	0 ... 2 K			4	OEM service
445	KoeffSperr	Heating mode AGU2.500	Weighting factor for locking signal in heating circuit 2	0 ... 200 %			1	L&S service (Development)

LPB

			LPB clip-in					
17	LPBKonfig0	Boiler OCI420	Setting flags for time synchronization and power supply on LPB	0 ... 255	604	Engineer	5	Installer
380	LPBAdrSegNr	Boiler OCI420	LPB segment number of LMU	0 ... 14	606	Engineer	5	Installer
381	LPBAdrGerNr	Boiler OCI420	LPB device number of LMU	0 ... 16	605	Engineer	5	Installer
416	LPBGeraeteVariante	Boiler OCI420	Device variant within the LMU6x family	0 ... 255			1	L&S service (Development)
415	LPBErrorGerAlarm	Boiler OCI420	Setting flags for configuring the device alarm on LPB	0 ... 255			1	L&S service (Development)

12.2 Lockout position storage

No QAA73... AGU2.310	Name	Function	Level QAA73... AGU2.310
700	Stoer1	1st past value of lockout code counter	Engineer *
701	StrPn1	1st past value of lockout phase	Engineer *
702	StrDia1	1st past value of internal diagnostic code	Engineer *
703	Stoer2	2nd past value of lockout code counter	Engineer *
704	StrPn2	2nd past value of lockout phase	Engineer *
705	StrDia2	2nd past value of internal diagnostic code	Engineer *
706	Stoer3	3rd past value of lockout code counter	Engineer *
707	StrPn3	3rd past value of lockout phase	Engineer *
708	StrDia3	3rd past value of internal diagnostic code	Engineer *
709	Stoer4	4th past value of lockout code counter	Engineer *
710	StrPn4	4th past value of lockout phase	Engineer *
711	StrDia4	4th past value of internal diagnostic code	Engineer *
712	Stoer5	5th past value of lockout code counter	Engineer *
713	StrPn5	5th past value of lockout phase	Engineer *
714	StrDia5	5th past value of internal diagnostic code	Engineer *
715	Stoer_akt	Current value of lockout code counter	Engineer *
716	StrPn_akt	Current value of lockout phase	Engineer *
717	StrDia_akt	Current value internal diagnostic code	Engineer *

* Read only

With the ACS420, the lockout position storage is accessed via a specific menu.

Phase designations / numbers

PH_TNB	0
PH_TLO	1
PH_TNN	2
PH_STANDBY	3
PH_STARTVER	4
PH_THL1_1	5
PH_THL1_2	6
PH_TV	7
PH_TBRE	8
PH_TW1	9
PH_TW2	10
PH_TVZ	11
PH_TSA1_1	12
PH_TSA1_2	13
PH_TSA2_1	14
PH_TSA2_2	15
PH_TI	16
PH_MODULATION	17
PH_THL2_1	18
PH_THL2_2	19
PH_TN_1	20
PH_TN_2	21
PH_STOER	22

Note

For meaning of the phase numbers, refer to the → Sequence diagrams

12.3 Legend of parameter bit fields LMU...

Controller functions

KonfigRg0	**Setting flags:**	**Status code open-circuit sensor channel Anx suppressed / not suppressed**
	MeldAN2	Status code open-circuit sensor channel AN2 XXXX XXX0 suppress XXXX XXX1 deliver
	MeldAN3	Status code open-circuit sensor channel AN3 XXXX XX0X suppress XXXX XX1X deliver
	MeldAN4	Status code open-circuit sensor channel AN4 XXXX X0XX suppress XXXX X1XX deliver
	MeldAN5	Status code open-circuit sensor channel AN5 XXXX 0XXX suppress XXXX 1XXX deliver
	MeldAN6	Status code open-circuit sensor channel AN6 XXX0 XXXX suppress XXX1 XXXX deliver
	MeldVLHz2	Status code open-circuit flow sensor HC2 XX1X XXXX deliver
	MeldFueRelCl	Status code open-circuit sensor on clip-in function module X0XX XXXX suppress X1XX XXXX deliver
KonfigRg1	**Setting flags**	
	BwVor	DHW priority XXXX XX00 absolute XXXX XX10 no priority
	Schaltuhr1	Terminal assignment RT (X10-02; can also act on heating circuit 2, if RU is connected) XXXX X0XX RT XXXX X1XX time switch
	Schaltuhr2	Terminal assignment OT (X10-01; if RU is connected, terminal RT can also act on heating circuit 2->time switch) XXXX 0XXX RT XXXX 1XXX time switch
	AnlagenFrost	Frost protection for the plant XXX0 XXXX OFF XXX1 XXXX ON
	Schaltuhr2Bw	Assignment of second time switch to OT terminals (X10-01) XX0X XXXX time switch acts on HC XX1X XXXX time switch acts on DHW

KonfigRg2	**Instantaneous DHW heater setting flags**		
	DlhNachlInBw	Pump overrun into the heating circuit or into the inst. DHW heat exchanger	
		XXXX XXX0	overrun into the heating circuit
		XXXX XXX1	overrun into the inst. DHW heat exchanger
	DlhKomfTemp	Definition of comfort temperature level	
		XXXX XX0X	same level as outlet temperature
		XXXX XX1X	parameter «TbwBereit
	DlhKomfReglF	Comfort PID control sensor	
		XXXX 00XX	boiler sensor (flow)
		XXXX 01XX	DHW1 sensor (abortion criterion: time)
		XXXX 10XX	return sensor (B7)
KonfigRg3	**AD converter and HC demand**		
	ADkon0	Configuration AD converter inputs	
		XXX0 0001	configuration 1
		XXX0 0010	configuration 2
		XXX0 0011	configuration 3
		XXX0 0100	configuration 4
	Hz1set	Heat demand 1	
		XX0X XXXX	internal
	Hz2set	Heat demand 2	
		X0XX XXXX	internal
	HzZoSet	Heat demand zone	
		0XXX XXXX	internal
KonfigRg4	**Setting flags**		
	Q8Fkt	System function	
		XXXX XXX0	OFF
		XXXX XXX1	ON
	GebBauweise	Type of building construction	
		XXXX XX0X	light
		XXXX XX1X	heavy
	Bw-Thermostat	Selection of terminals on DHW thermostat	
		XXXX X0XX	DHW thermostat connected to X11 (digital input)
		XXXX X1XX	DHW thermostat connected to X10-05 (analog input)
	H2OUmlaufVor	Location of water pressure sensor in relation to the pump	
		XXXX 0XXX	pressure increase due to pump on
		XXXX 1XXX	pressure decrease due to pump on
	K2aufUV	Transfer of basic function from K2 to K3 (only with stepper motor diverting valve)	
		XXX0 XXXX	default (K3 unchanged)
		XXX1 XXXX	transfer of basic function from K2 to K3,
	UvKon	Configuration of diverting valve	
		000X XXXX	no diverting valve
		001X XXXX	magnetic valve (0 = HC; 1 = DHW)
		010X XXXX	motorized valve (0 = HC; 1 = DHW)
		011X XXXX	mototized valve (1 = HC; 0 = DHW)
		100X XXXX	stepper motor valve, unipolar
		101X XXXX	stepper motor valve, bipolar

KonfigRg5	**Setting flags**		
	H2Oueb	Water shortage switch (input X11-3)	
		XXXX XX00	flow switch -> lockout
		XXXX XX01	flow switch -> start prevention
		XXXX XX10	pressure switch -> lockout
		XXXX XX11	pressure switch -> start prevention
	DrehBegr	Speed limitation	
		XXXX X0XX	OFF
		XXXX X1XX	ON
	H2OUebSens	Water pressure supervision with pressure sensor	
		XXX0 0XXX	deactivated
		XXX0 1XXX	activated with start prevention
		XXX1 0XXX	activated with lockout
	AbgasUeb	Flue gas temperature supervision	
		X00X XXXX	deactivated
		X01X XXXX	activated with start prevention
		X10X XXXX	activated with lockout
	H2OUmlauf	Water flow supervision with pressure sensor	
		0XXX XXXX	error leads to start prevention
		1XXX XXXX	error leads to a lockout position
KonfigRg6	**Setting flags**		
	PIDinit		
		XXXX XXX0	internal
	KundenRU	Locking RU of other manufacture	
		XXXX XX0X	OFF
		XXXX XX1X	ON
	BwSoll	Source of DHW setpoint	
		XXXX X0XX	RU (if connected)
		XXXX X1XX	MMI (also when a RU is connected)
	Sperrsignal	Calculation of locking signal	
		XXXX 0XXX	calculation of locking signal deactivated
		XXXX 1XXX	calculation of locking signal active
	ReglStopSave	Output can be stored at end of controller stop function	
		XXX0 XXXX	output cannot be stored
		XXX1 XXXX	output can be stored
	DrehGrWechsel	Activation of fast speed limit changes	
		XX0X XXXX	normal handling
		XX1X XXXX	accelerated handling of fast changes
KonfigRg7	**Setting flags**		
	ModQ1	Heating circuit pump	
		XXXX XXX0	multispeed
		XXXX XXX1	modulating
	DtBegr	dt limitation	
		XXXX XX0X	OFF
		XXXX XX1X	ON
	DtRegelung	dt control	
		XXXX X0XX	OFF
		XXXX X1XX	ON

AnlVol	Plant volume	
	XXX0 1XXX	medium
DtRedBetrieb	dT control in reduced mode	
	XX0X XXXX	OFF
	XX1X XXXX	ON
BetrArtRgVerz	Operating modes with active controller delay: Heating mode or all modes (except inst. DHW heater)	
	X0XX XXXX	controller delay only active in heating mode
	X1XX XXXX	controller delay active in all modes

KonfigRg8 **Setting flags for instantaneous DHW heater**

Wärmetauscher	Type of heat exchanger on the secondary side	
	XXXX 0000	plate heat exchanger
	XXXX 0001	coil heat exchanger on the primary side
	XXXX 0010	coil heat exchanger on the secondary side
SmaxIgnor	Suppression of first maximum for control of the inst. DHW heater	
	XXX0 XXXX	first maximum after startup will be evaluated
	XXX1 XXXX	first maximum after startup will be ignored
DlhAuslAnfo	Inst DHW heat demand with aqua-booster systems	
	XX0X XXXX	demand via DHW1 sensor or flow switch
	XX1X XXXX	demand via flow switch only

KonfigRg9

XXXX XX01 internal

Burner control program

FaProgFlags1 **Setting flags of burner control section internal (sequence)**

TsaKon	Duration of safety time (tsa)	
	XXXX XXX0	end of flame detection
	XXXX XXX1	fixed sequence time
Lber	Boiler output	
	00XX XXXX	≤ 70 kW
	01XX XXXX	70...120 kW
	10XX XXXX	≥ 120 kW

FaEinstellFlags1 **Setting flags of burner control section external components1**

Zdg_dyn	Feedback signal from ignition	
	XXXX XXX0	static (internally)
	XXXX XXX1	dynamic (externally)
VO_Aktiv		
	XXXX XX0X	internal
Vcc_3V3		
	XXXX 0XXX	internal

FaEinstellFlags2	**Setting flags of burner control section external components2**		
	LPKon	Function of free contact input (APS)	
		XXXX X000	not permitted
		XXXX X001	input s ignal as a programmable input
		XXXX X010	APS configuration2 (sequence diagram)
		XXXX X011	APS configuration3 (sequence diagram)
		XXXX X100	APS configuration4 (sequence diagram)
		XXXX X101	contact open -> start prevention
	GPKon	Function of contact input GP	
		XXXX 0XXX	no GP connected
		XXXX 1XXX	GP open -> start prevention
	NLKon	Level of postpurging	
		XXX0 XXXX	prepurge level
		XXX1 XXXX	after the last operation control command
	N_NachstellKon1	Speed readjustment on startup	
		XX0X XXXX	OFF
		XX1X XXXX	ON
	N_NachstellKon2	Speed readjustment on shutdown	
		X0XX XXXX	OFF
		X1XX XXXX	ON
	N_Nachstell_lern	Learning function with speed readjustment	
		0XXX XXXX	OFF
		1XXX XXXX	ON
FaEinstellFlags3	**Setting flags of burner control section**		
	Gebl_QAA	Release or use of fan parameters of QAA73...	
		XXXX XXX0	no use of QAA fan parameters
		XXXX XXX1	use of QAA fan parameters
	Gebl_Impulse	Number of pulses of fan's Hall feedback signal per revolution	
		XXXX X00X	2 pulses per revolution
		XXXX X01X	3 pulses per revolution
		XXXX X10X	4 pulses per revolution
	CheckAnzAusg	Number of outputs on clip-in function module for adaption to current balance	
		XXXX 1XXX	internally
TB_Konfig	**Flags for configuring the TL functions**		
	TW_EIN	TW ON / OFF	
		XXXX XXX0	TW OFF
		XXXX XXX1	TW ON
	Gradient_EIN	Test exceeding temperature gradient ON / OFF	
		XXXX XX0X	test exceeding temperature gradient OFF
		XXXX XX1X	test exceeding temperature gradient ON
	DeltaT_1_EIN	Checking excessive dT (> dTkTrSTB) ON / OFF	
		XXXX X0XX	checking OFF
		XXXX X1XX	checking ON
	DeltaT_2_EIN	Checking excessive dT (> dTkTrSTB + 8K) ON / OFF	
		XXXX 0XXX	checking OFF
		XXXX 1XXX	checking ON

DeltaT_3_EIN	Checking excessive dT (> dTkTrSTB + 16K) ON / OFF	
	XXX0 XXXX	checking OFF
	XXX1 XXXX	checking ON
RL_groesser_ VL_EIN	Checking return temperature > boiler / flow temperature ON / OFF	
	XX0X XXXX	checking OFF
	XX1X XXXX	checking ON
TW_Check_EIN	Checking TW ON / OFF	
	X0XX XXXX	checking TW OFF
	X1XX XXXX	checking TW ON
el_STB_EIN	Electronic SLT ON / OFF	
	0XXX XXXX	electronic SLT OFF
	1XXX XXXX	electronic SLT ON

Note: If the electronic (S)LT is parameterized as active, all checks must be switched active!

Operating modes

MmiStatus **Selection of S / W operating modes** (after startup)

S_W_Einst	Summer / winter selection	
	XXXX XX00	manually summer
	XXXX XX01	manually winter
	XXXX XX10	automatically summer
	XXXX XX11	automatically winter

LPB

LPBKonfig0 **Setting flags for LPB connection**

ZeitSynchro	Response of LMU... with regard to local time / system time	
	XXXX XX00	autonomous
	XXXX XX01	slave without remote adjustment
	XXXX XX10	system time master
	XXXX XX11	free
ParLPBSpeisung	Operating mode distributed bus power supply on LPB	
	XXXX X0XX	distributed bus power supply OFF
StatLPBSpeisung	Status distributed bus power supply on LPB	
	XXXX 0XXX	distributed bus power supply OFF
	XXXX 1XXX	distributed bus power supply ON
EventControl	Flag for nonvolatile storage of event behavior of LMU... on LPB	
	XXX0 XXXX	events disable, not permitted
	XXX1 XXXX	events enable, permitted
ParBwZuordnung	DHW heating for own HC, own segment, all	
	X00X XXXX	locally
	X01X XXXX	segment
	X10X XXXX	system

LPBErrorGerAlarm **Setting flags for configuring the device alarm on LPB**

LPBAlarm Acknowledge		
	XXXX XXX0	alarm acknowlegdement OFF
LPBAlarmEvent		
	XXXX XX0X	event capability OFF (as supplied)

13 Glossary of abbreviations

Constants

PkesselMax	Constant for maximum boiler output (100 %)
PkesselMin	Constant for minimum boiler output (0 %)
SdBwMin	Minimum switching differential with 2-sensor storage tank systems
TqModAnlauf	Duration of startup kick for the modulating pumps (10 seconds)

Variables

AlbaCode	ALBATROS error code, standardized error code between RVA... controllers and LMU…
dTbwKomf	DHW setpoint readjustment in comfort mode
dTbwAusl	DHW setpoint readjustment with outlet temperature control
ek0	Current control differential in the boiler circuit (TkSoll – TkIst)
FreigabeDurchladung	Identification of first DHW nominal level on the current day
Gebl_Drehz	Current fan speed
Gebl_PWM	Current fan control
IonStrom	Ionization current (measured value)
MaxBoilerCapacity	Maximum boiler capacity in kW
RelModLevSet	Relative maximum heat output as predefined by the QAA73...
MinModulationLevel	Minimum boiler output in %
modRegler	Heat demand of the controller on the burner control
OT	OpenTherm interface
NhzMaxAkt	Resulting maximum heat output when speed limitation is active
PhzMaxAkt	Resulting maximum heat output when speed limitation is inactive
PhzRelMmi	Relative heat output as predefined by the HMI
PhzRelPc	Relative heat output as predefined by the PC
Pumpe_PWM	Current degree of modulation of the modulating boiler pump
QmodMinBw	Degree of modulation during full charging of the stratification storage tank
RelativeModLevel	Current heat output for the RU
SdAus	Current switching differential off
SdEin	Current switching differential on
TaGed	Attenuated outside temperature
TaGem	Composite outside temperature
TbwIst1	Actual value of the DHW temperature at sensor B3
TbwIst2	Actual value of the DHW temperature at sensor B4
TbwSoll	Current DHW temperature setpoint
TbwSollMmi	DHW temperature setpoint of the HMI
TbwSollRva	DHW temperature setpoint of the RVA... controller
TdhwSet	DHW temperature setpoint of the RU
teta_vl_max	Current maximum flow temperature in heating circuit 1
TiAussen	Actual outside temperature
TkIst	Actual value of the boiler flow temperature
TkRuec	Actual value of the boiler return temperature
TkSoll	Boiler temperature setpoint
TrSoll	Current room temperature setpoint
TrSet	Room temperature setpoint of the HMI
TsRaum	Room temperature setpoint resulting from the compensation variant
TsRaumAkt	Current room temperature setpoint (incl. setback phases)
TsRaumMmi	Room temperature setpoint of the HMI
TvIst	Actual value of the flow temperature (second heating circuit)
TvSollMmi	Flow temperature setpoint of the HMI

14 Addendum: Hydraulic diagrams BMU

14.1 Hydraulic diagrams

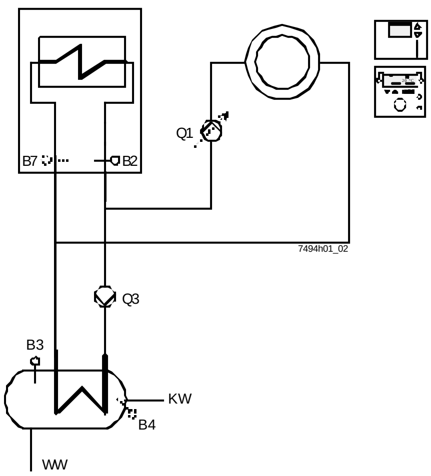
Selection of hydraulic diagrams via parameter 149 (HydrSystem) is mandatory.

For assignment of the diagrams to the outputs of the LMU…, refer to the table in section 14.2.

Subdivision	Basic diagrams:	Diagrams 01 through 31
	Pump circuit extensions via AGU2.500...:	Diagrams 32 through 47
	Mixing circuit extensions via AGU2.500...:	Diagrams 48 through 63
	Zone extensions (e.g. RVA46...):	Diagrams 64 through 79
	Heat generation manager (e.g. RVA47..., RVA65...):	Diagrams 80 through 95

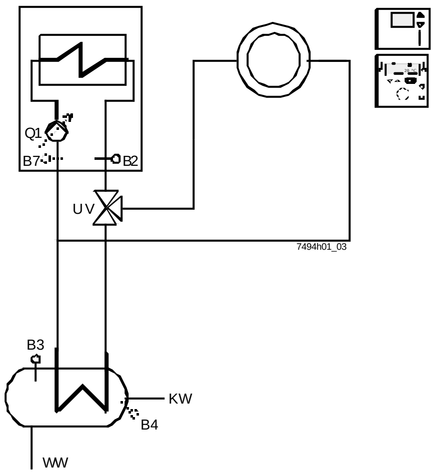
Basic diagrams

Diagram 02



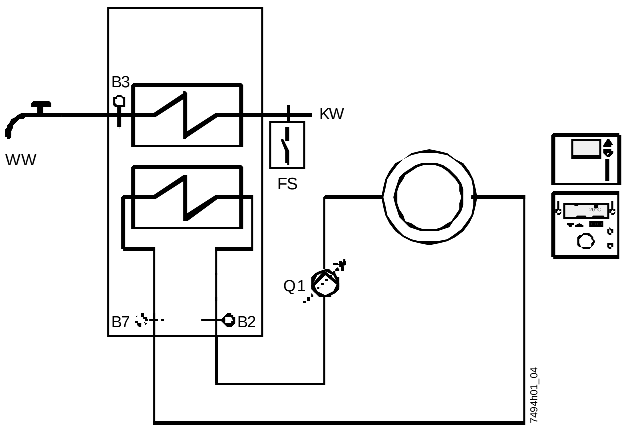
Storage tank system with pump circuit

Diagram 03



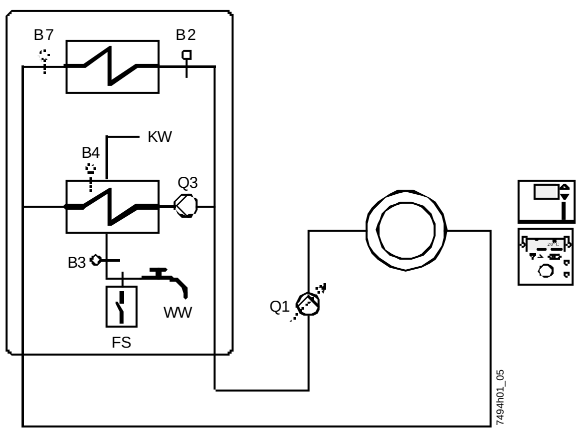
Storage tank system with diverting valve (electromotoric or electrohydraulic) and pump circuit

Diagram 04



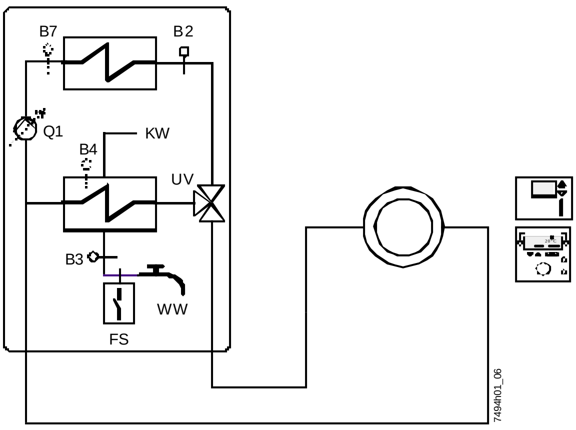
Instantaneous DHW heater with primary heat exchanger and pump circuit

Diagram 05



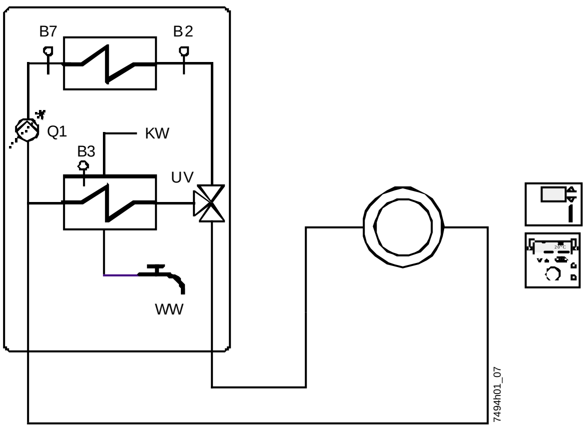
Instantaneous DHW heater with secondary heat exchanger and DHW pump and pump circuit

Diagram 06



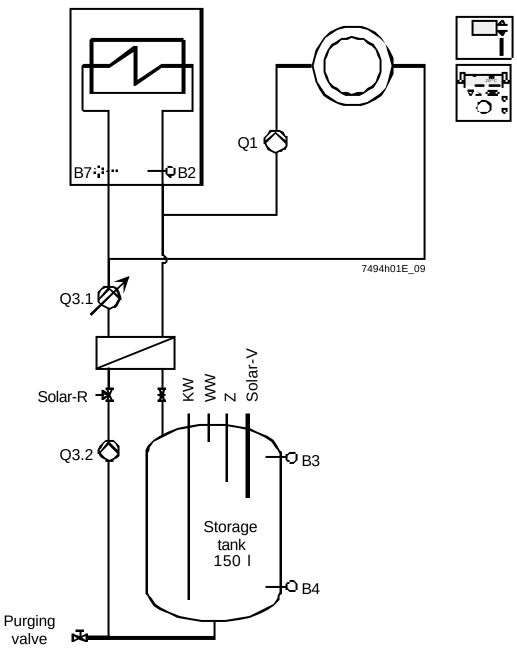
Instantaneous DHW heater with secondary heat exchanger and diverting valve (electromotoric or electrohydraulic) and pump circuit

Diagram 07



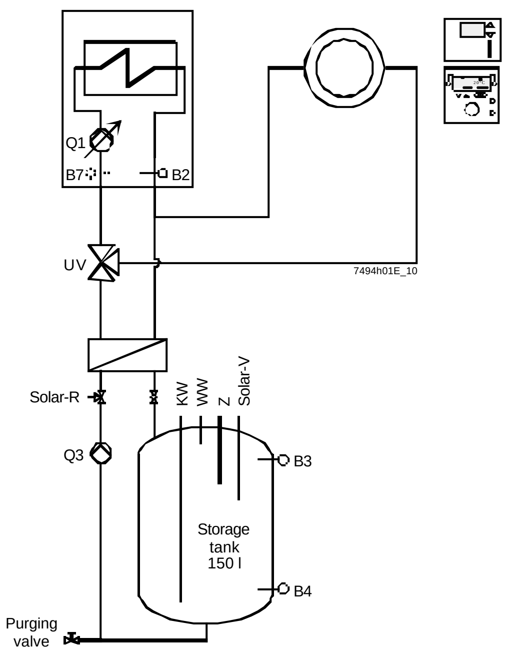
Aqua-booster and pump circuit

Diagram 09



Stratification storage tank with charging pump and pump circuit

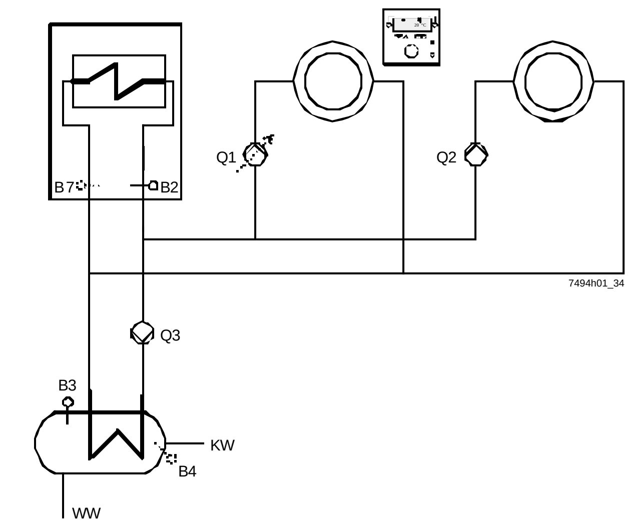
Diagram 10



Stratification storage tank with diverting valve and pump circuit

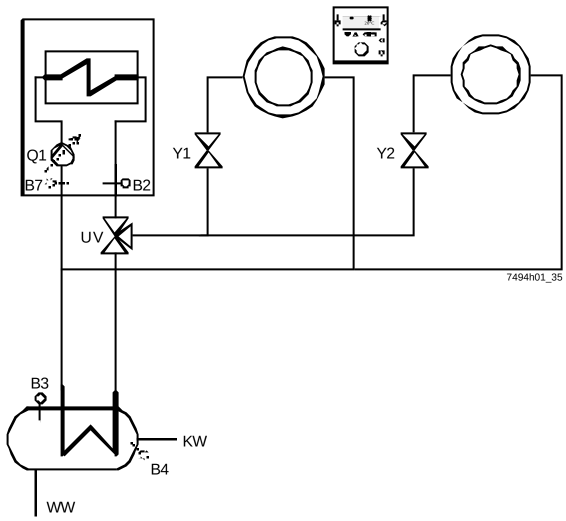
Pump circuit extensions via AGU2.500...

Diagram 34



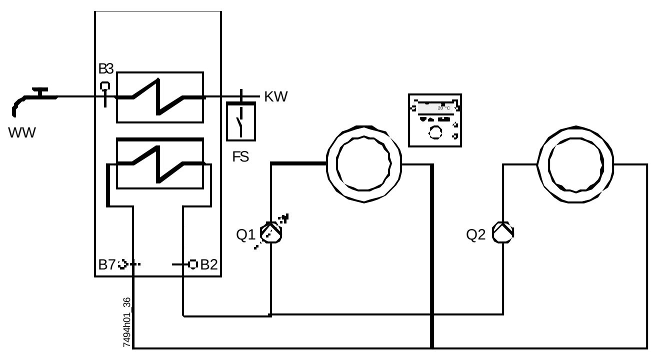
Storage tank system with 2 pump circuits

Diagram 35



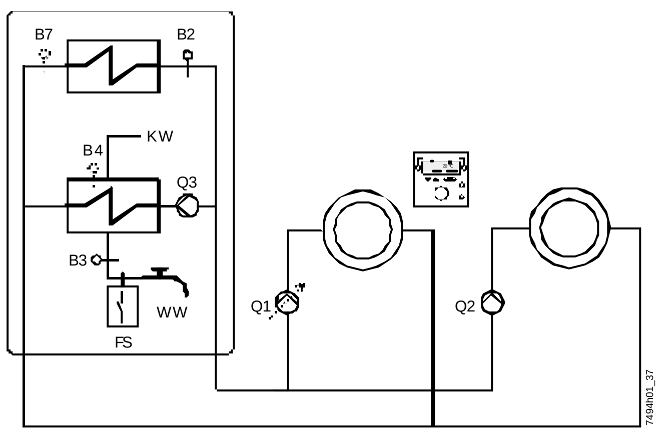
Storage tank system with diverting valve (electromotoric or electrohydraulic) and 2 pump circuits

Diagram 36



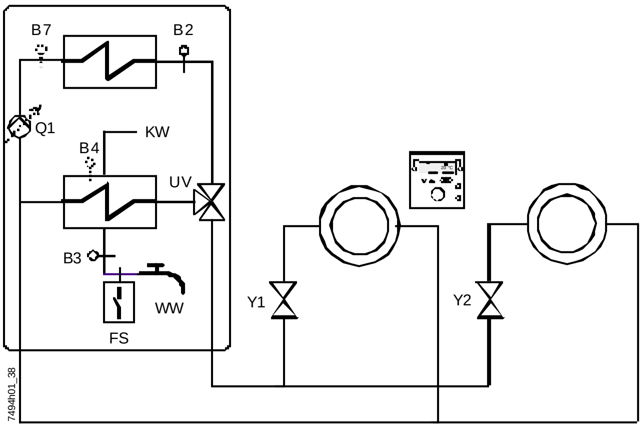
Instantaneous DHW heater with primary heat exchanger and 2 pump circuits

Diagram 37



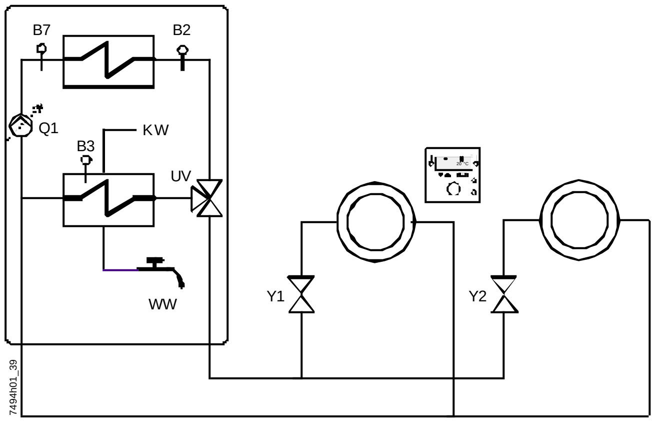
Instantaneous DHW heater with secondary heat exchanger, DHW pump and 2 pump circuits

Diagram 38



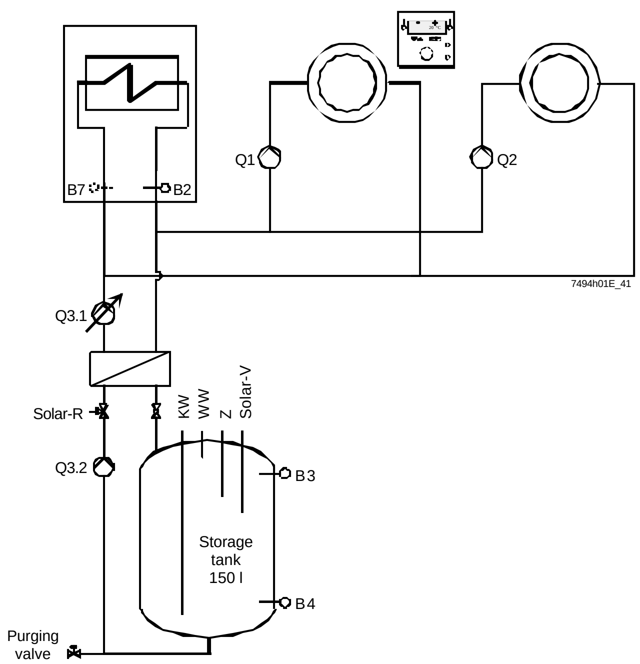
Instantaneous DHW heater with secondary heat exchanger, diverting valve (electromotoric or electrohydraulic) and 2 heating circuits

Diagram 39



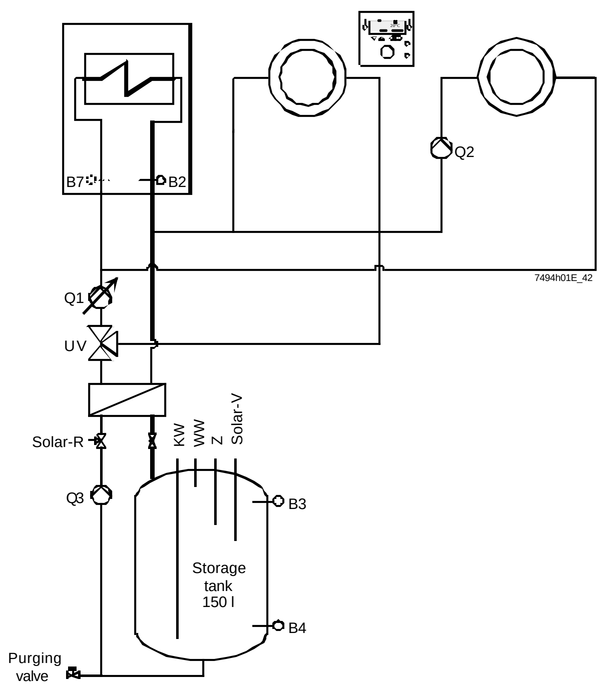
Aqua-booster with 2 pump circuits

Diagram 41 1)



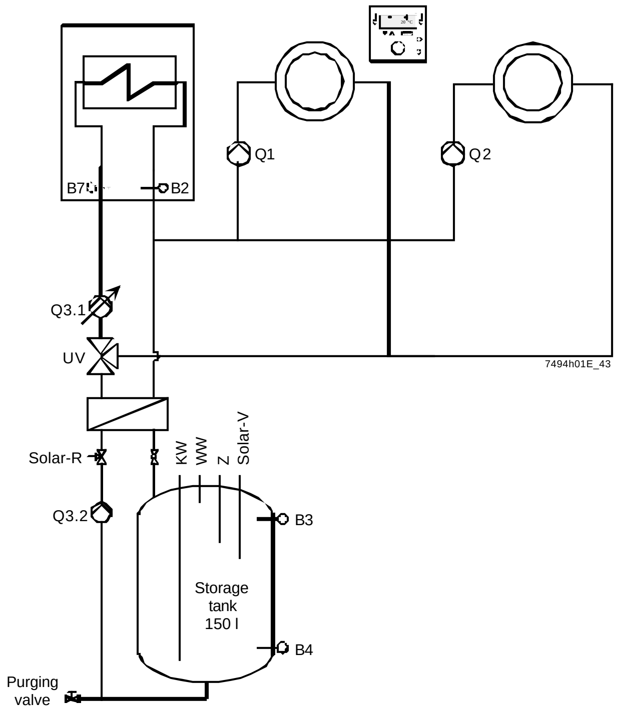
Stratification storage tank with charging pump and 2 pump circuits

Diagram 42



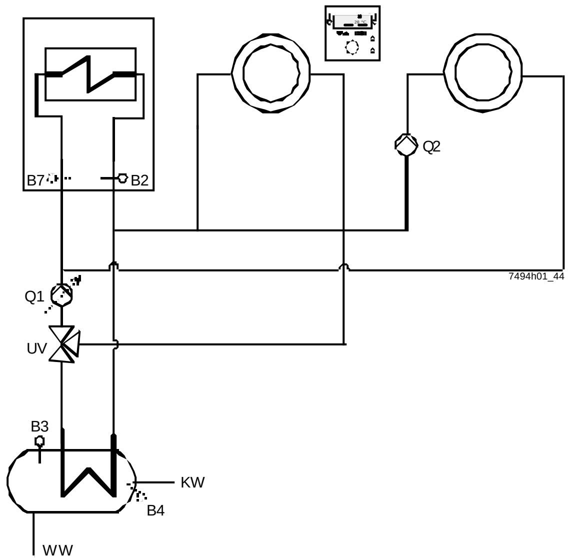
Stratification storage tank with diverting valve and 2 pump circuits

Diagram 43 1)



Stratification storage tank with diverting valve and 2 pump circuits

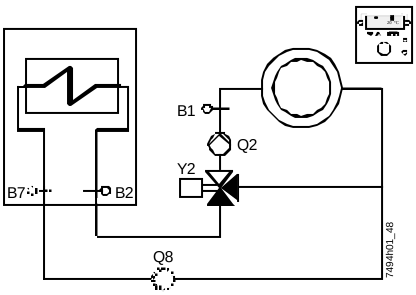
Diagram 44



Storage tank system with diverting valve and 2 pump circuits

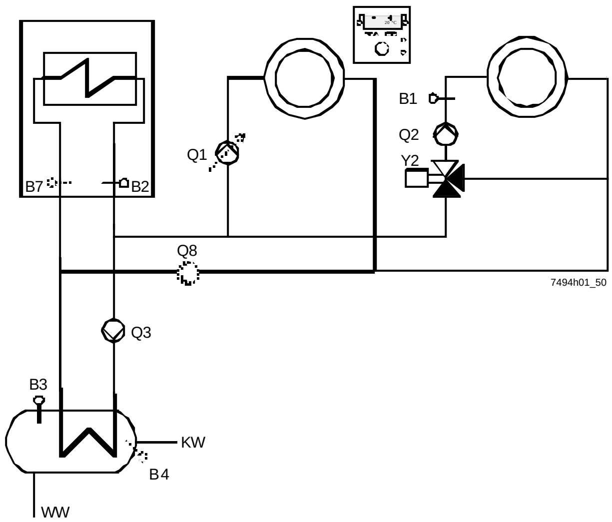
Mixing circuit extensions via AGU2.500...

Diagram 48



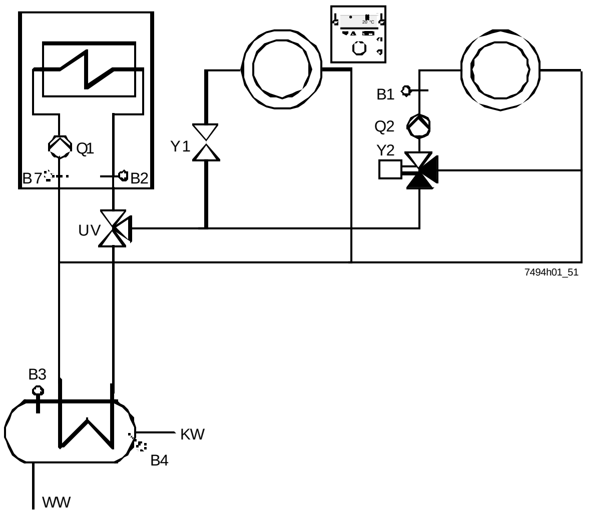
Mixing circuit

Diagram 50



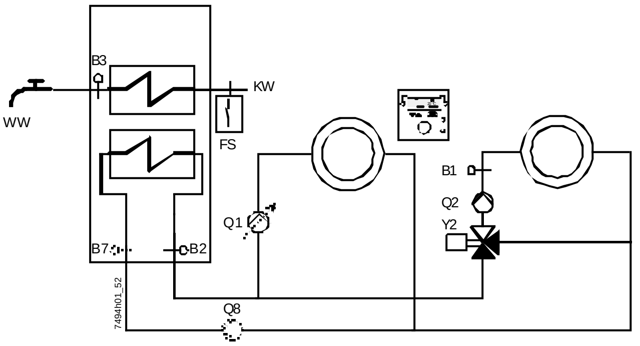
Storage tank system with one pump circuit and one mixing circuit

Diagram 51



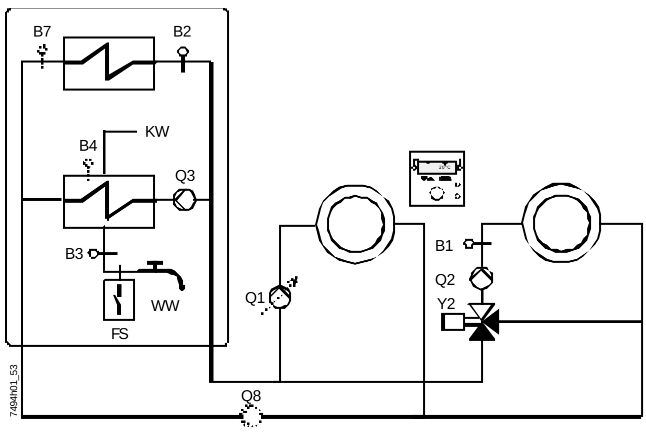
Storage tank system with diverting valve (electromotoric or electrohydraulic), pump circuit and mixing circuit

Diagram 52



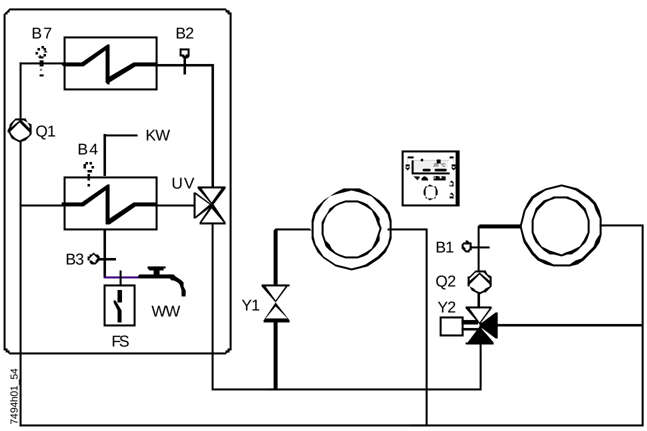
Instantaneous DHW heater with primary heat exchanger, pump circuit and mixing circuit

Diagram 53



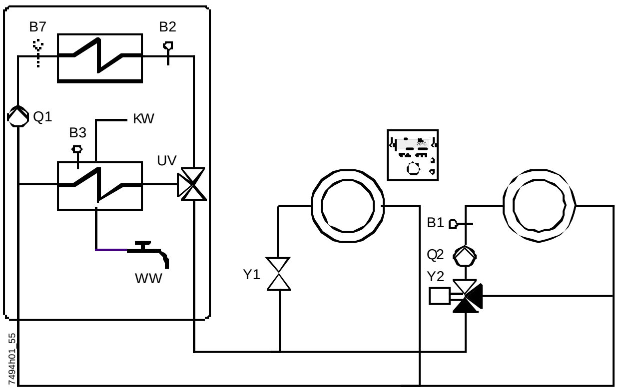
Instantaneous DHW heater with secondary heat exchanger, DHW pump, pump circuit and mixing circuit

Diagram 54



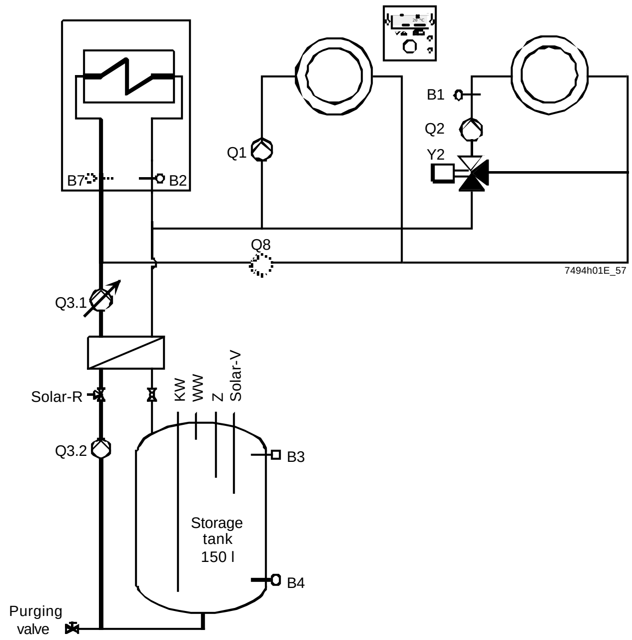
Instantaneous DHW heater with secondary heat exchanger, diverting valve (electromotoric or electrohydraulic), pump circuit and mixing circuit

Diagram 55



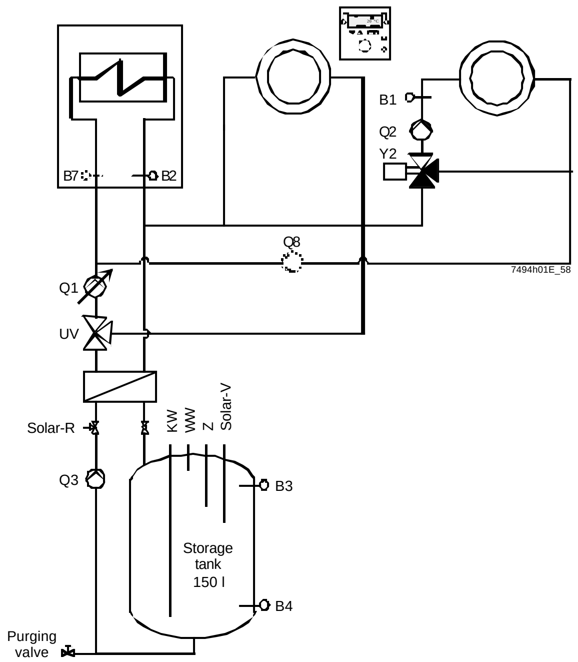
Aqua-booster with diverting valve, one pump circuit and one mixing circuit

Diagram 57 1)



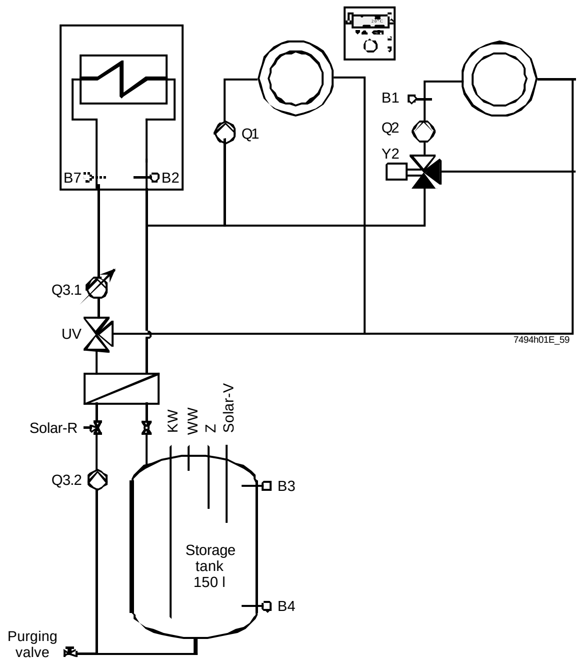
Stratification storage tank system with charging pump, one pump circuit and one mixing circuit

Diagram 58 1)



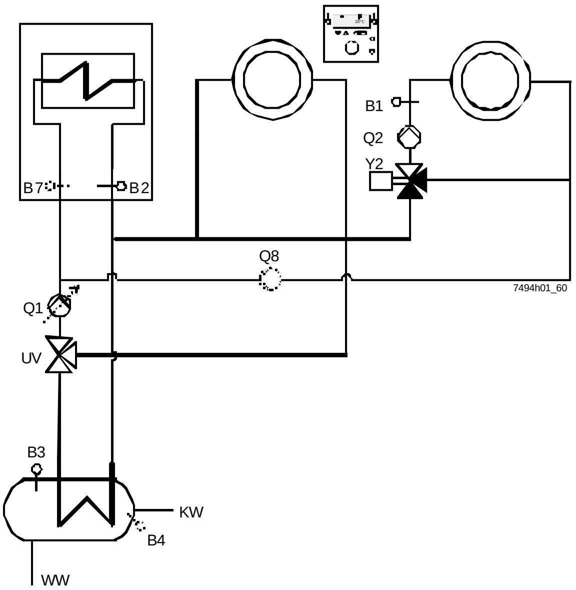
Stratification storage tank with diverting valve, pump circuit and one mixing circuit with system pump

Diagram 59 1)



Stratification storage tank with diverting valve, pump circuit and one mixing circuit

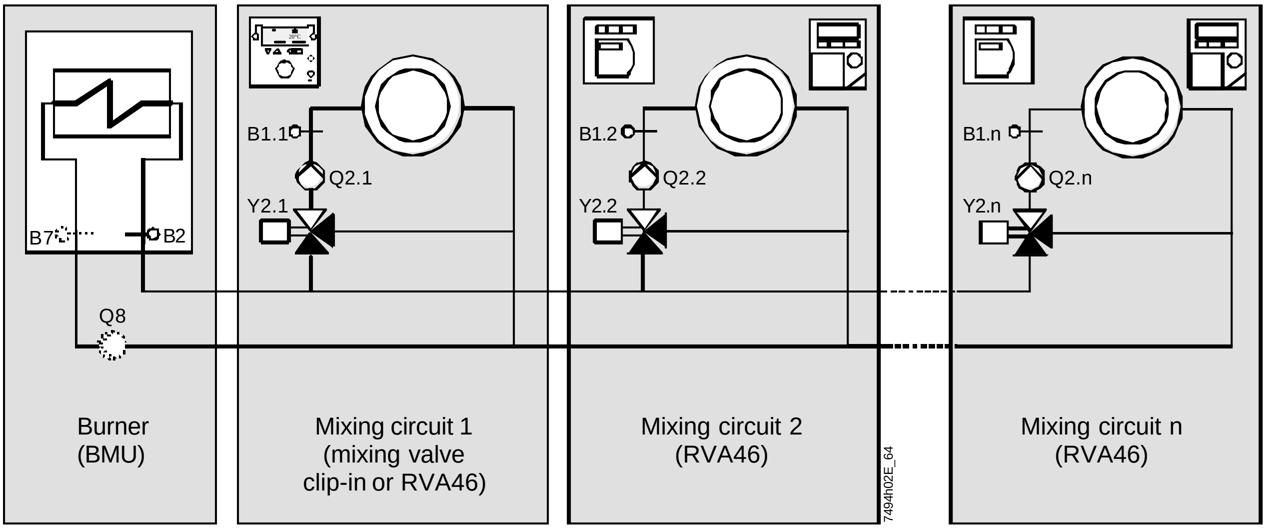
Diagram 60



Storage tank system with diverting valve, pump circuit and one mixing circuit with system pump

Zone extensions

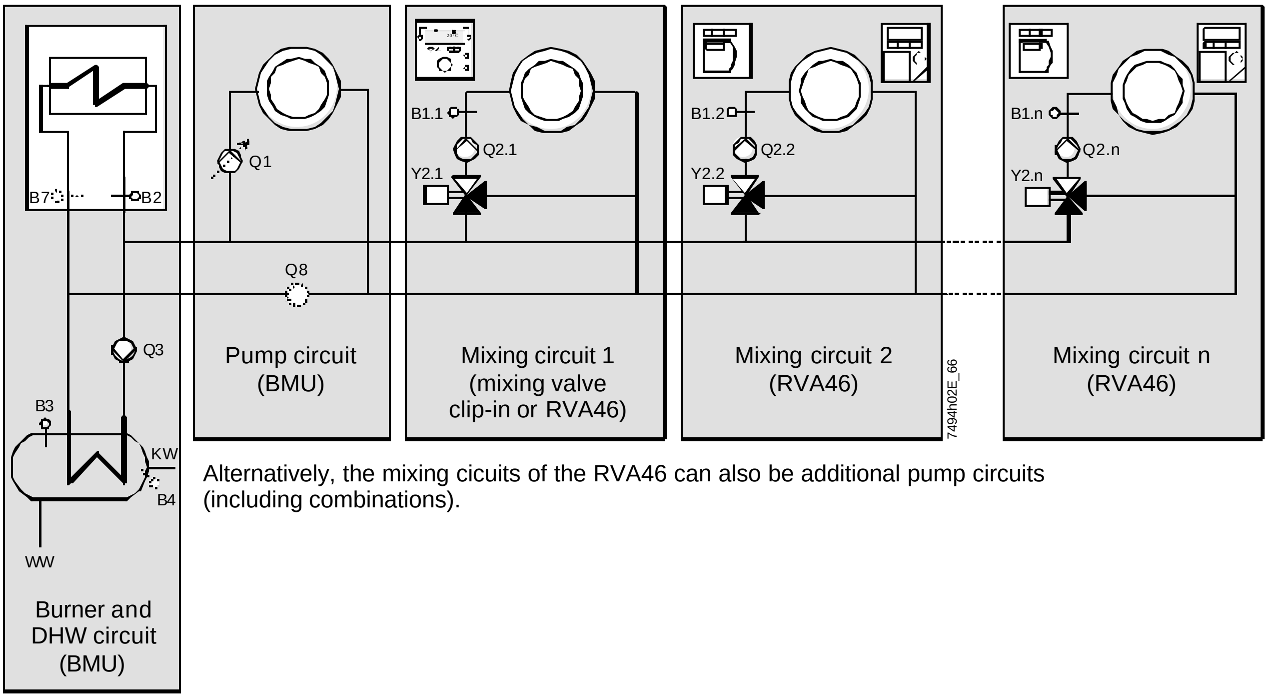
Diagram 64



Alternatively, the mixing cicuits of the RVA46 can also be additional pump circuits (including combinations).

Zone control with RVA46

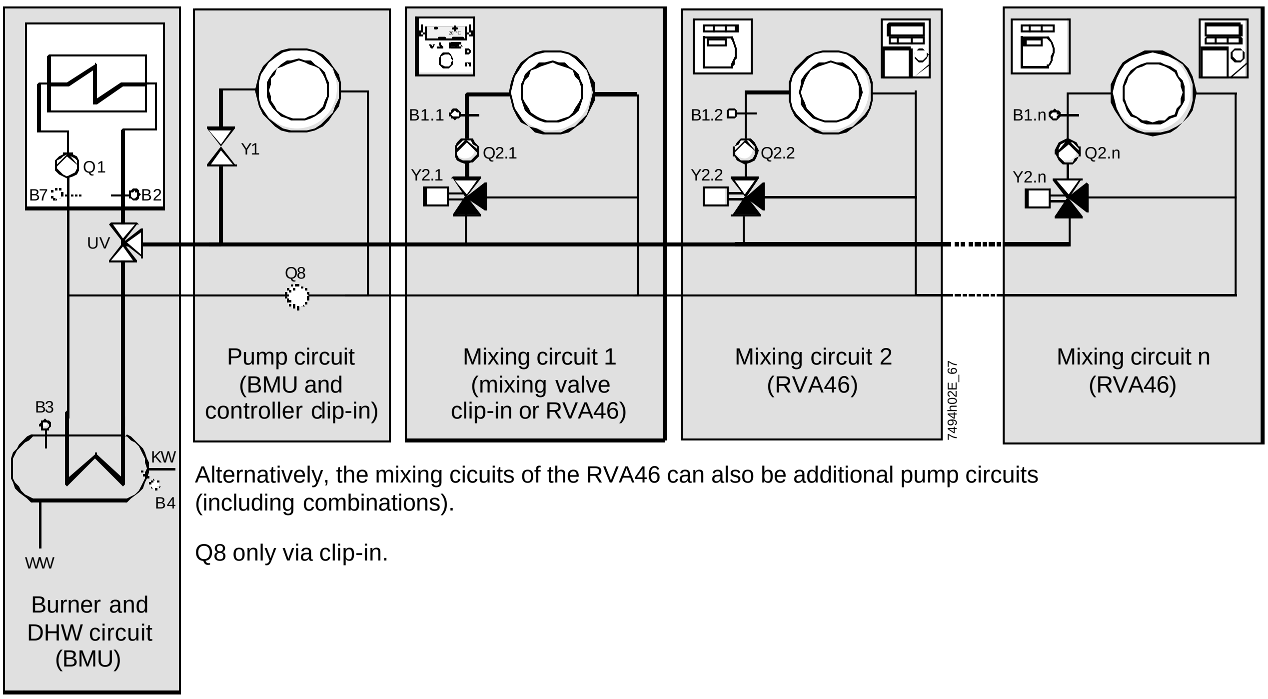
Diagram 66



Alternatively, the mixing cicuits of the RVA46 can also be additional pump circuits (including combinations).

Storage tank system with pump and zone control with RVA46...

Diagram 67

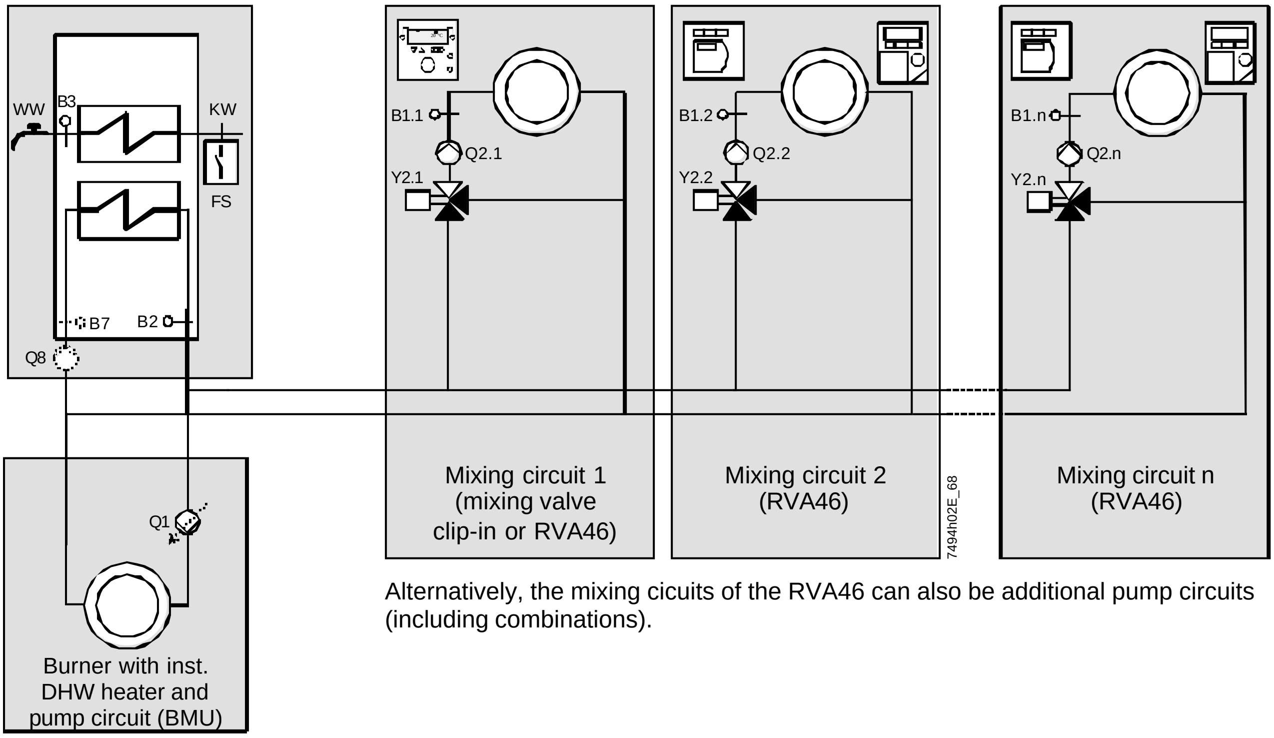


Alternatively, the mixing cicuits of the RVA46 can also be additional pump circuits (including combinations).

Q8 only via clip-in.

Storage tank system with diverting valve and zone control with RVA46...

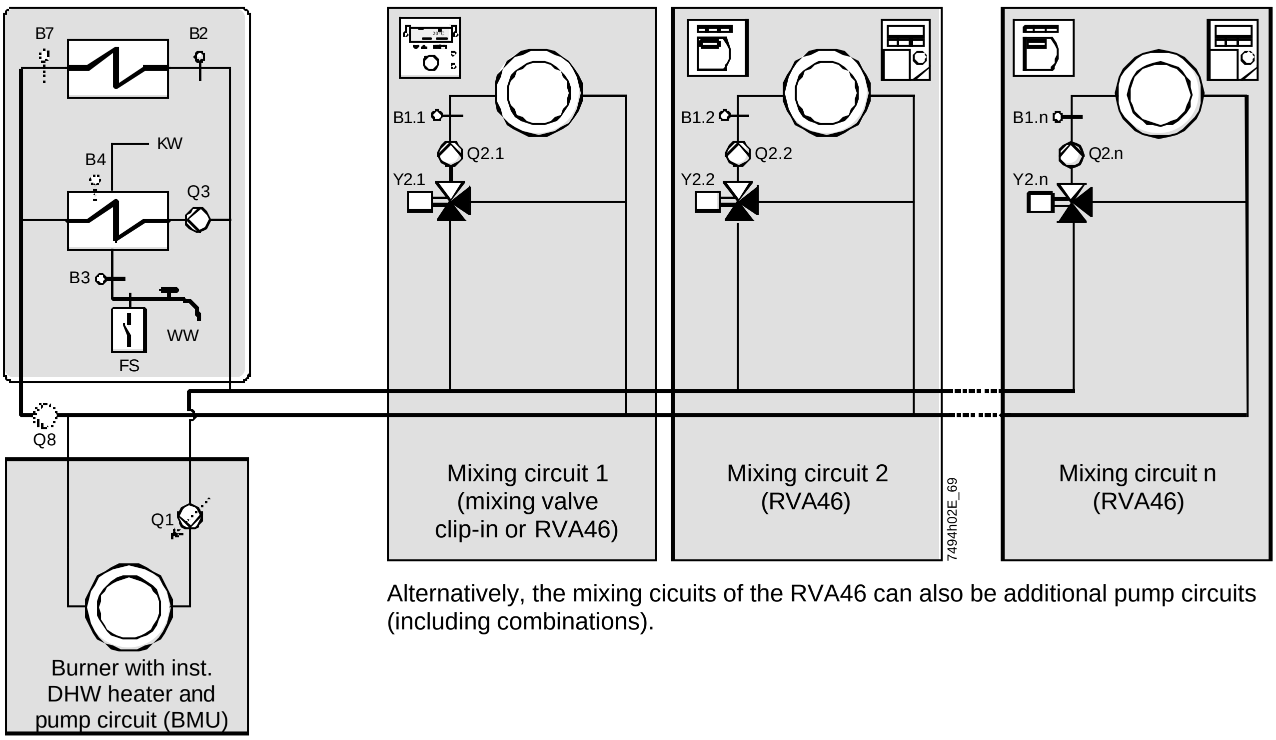
Diagram 68



Alternatively, the mixing cicuits of the RVA46 can also be additional pump circuits (including combinations).

Instantaneous DHW heater with primary heat exchanger and zone control with the RVA46...

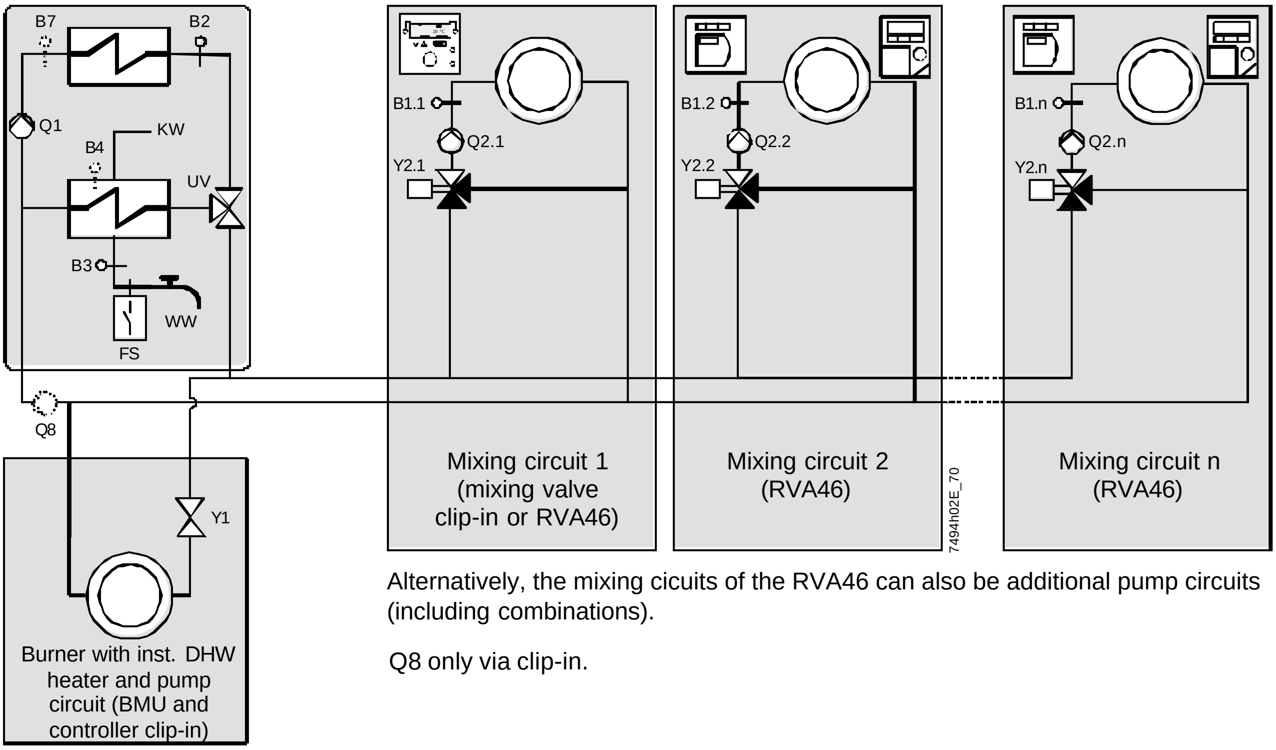
Diagram 69



Alternatively, the mixing cicuits of the RVA46 can also be additional pump circuits (including combinations).

Instantaneous DHW heater with secondary heat exchanger and zone control with the RVA46...

Diagram 70

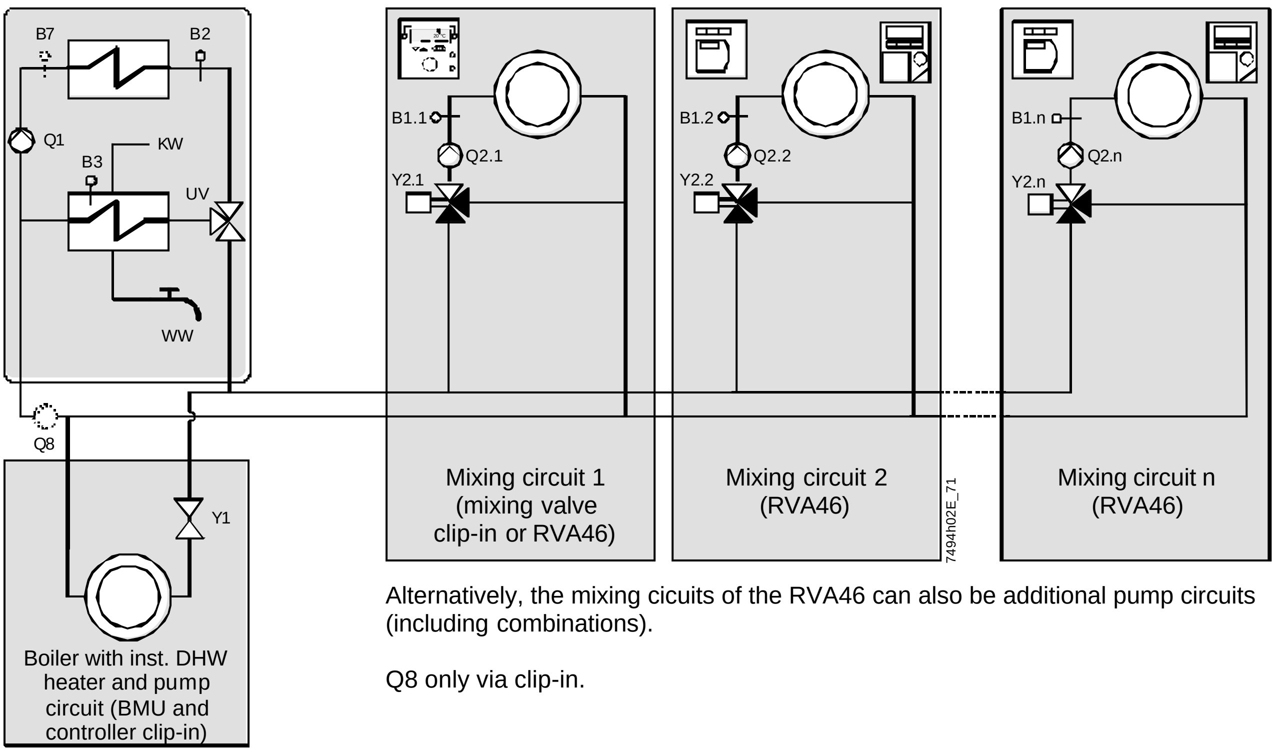


Alternatively, the mixing cicuits of the RVA46 can also be additional pump circuits (including combinations).

Q8 only via clip-in.

Instantaneous DHW heater with secondary heat exchanger, diverting valve and zone control with the RVA46...

Diagram 71

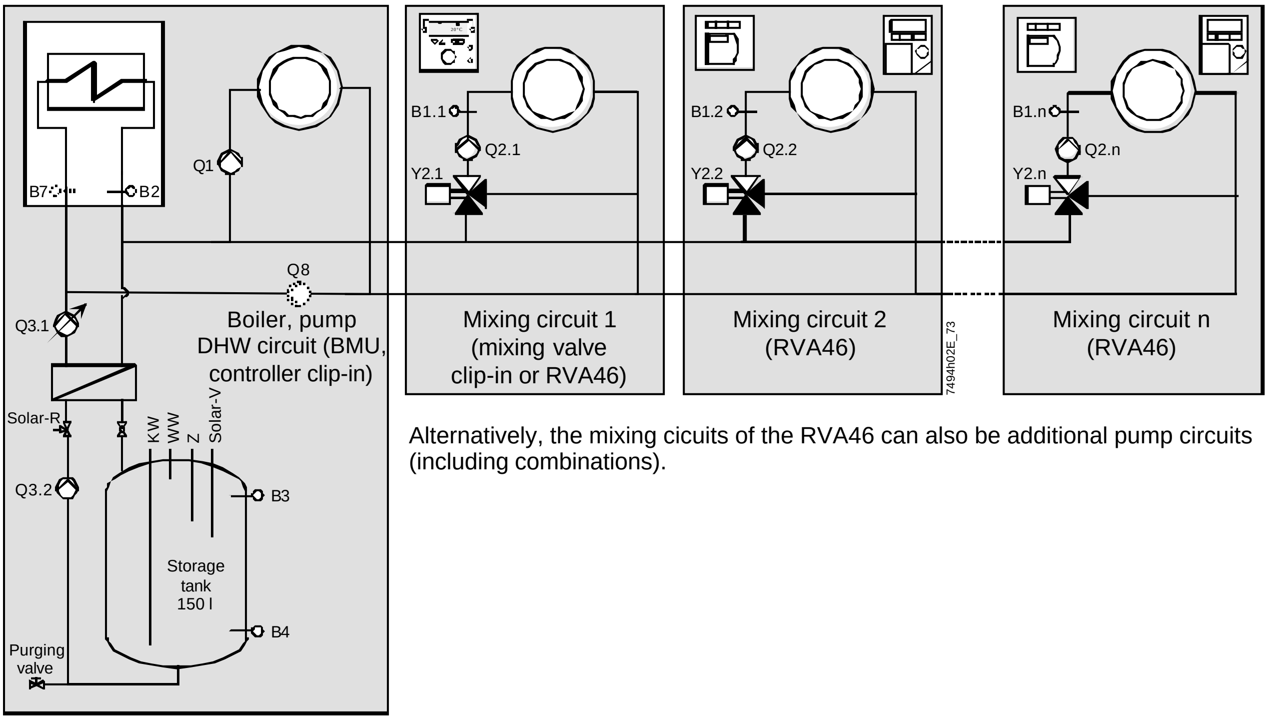


Alternatively, the mixing cicuits of the RVA46 can also be additional pump circuits (including combinations).

Q8 only via clip-in.

Aqua-booster with zone control with the RVA46...

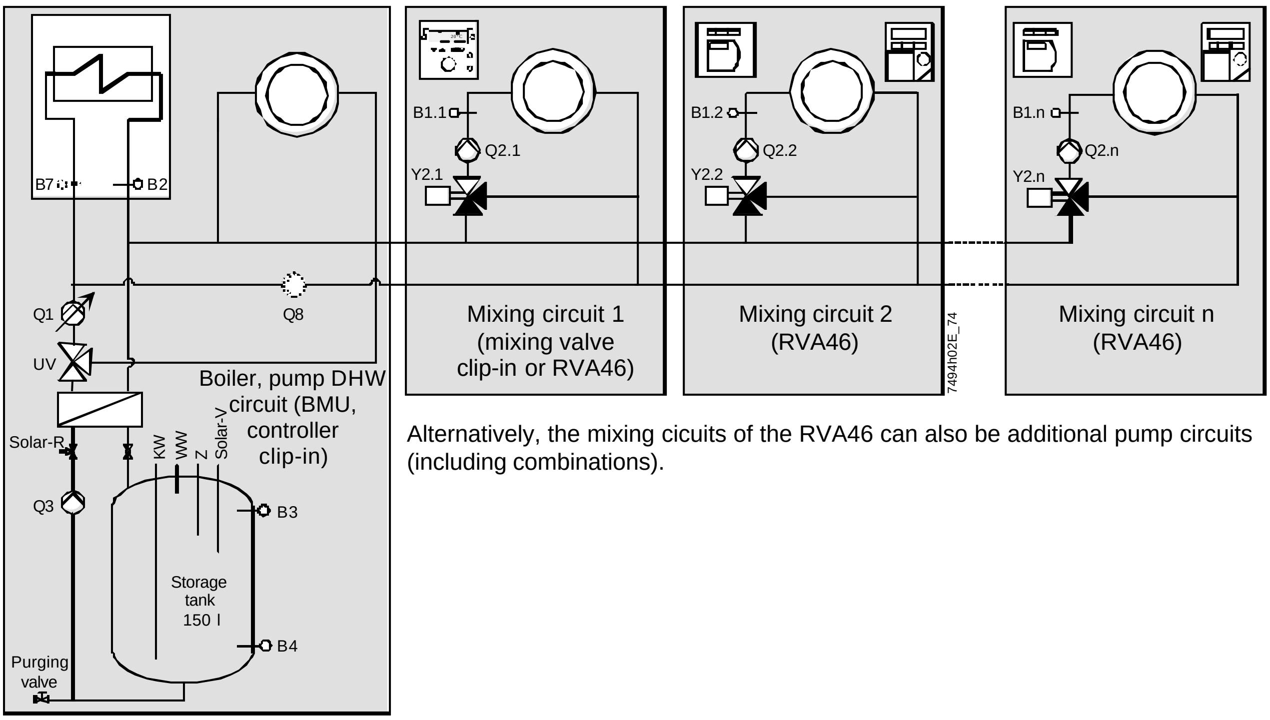
Diagram 73 1)



Alternatively, the mixing cicuits of the RVA46 can also be additional pump circuits (including combinations).

Stratification storage tank system with pump and zone control with the RVA46...

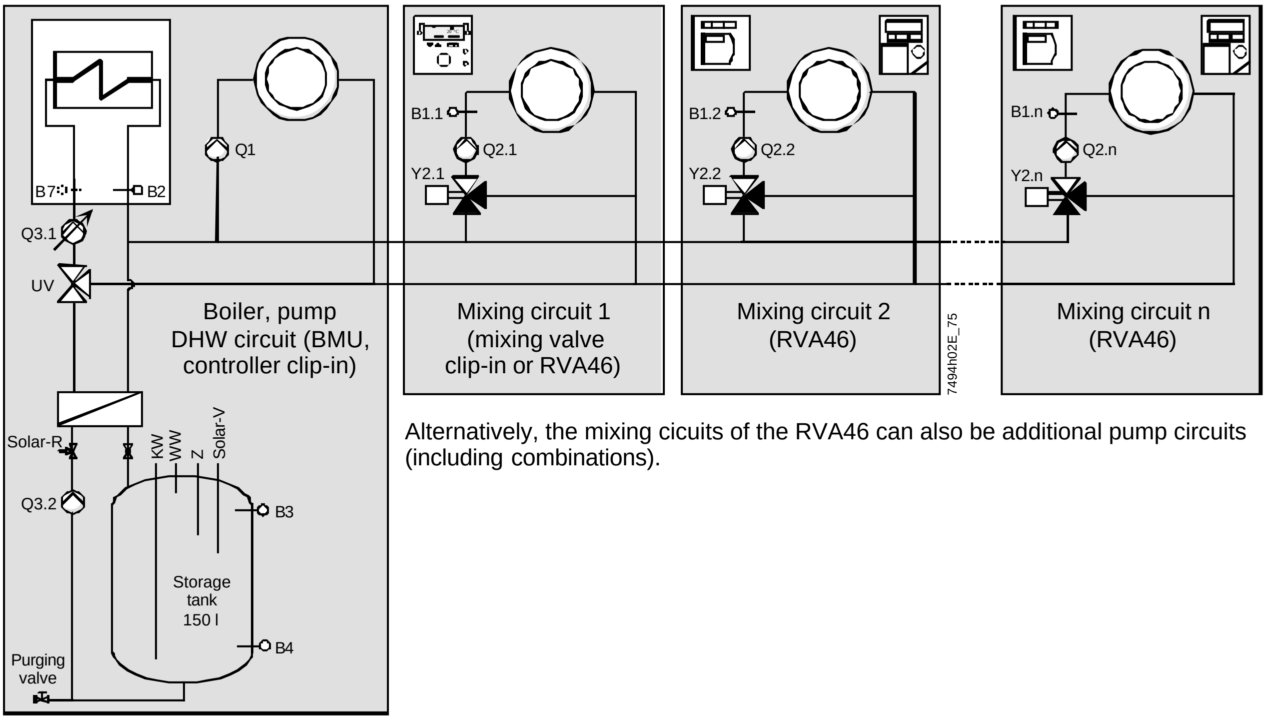
Diagram 74 1)



Alternatively, the mixing cicuits of the RVA46 can also be additional pump circuits (including combinations).

Stratification storage tank system with diverting valve and zone control with the RVA46...

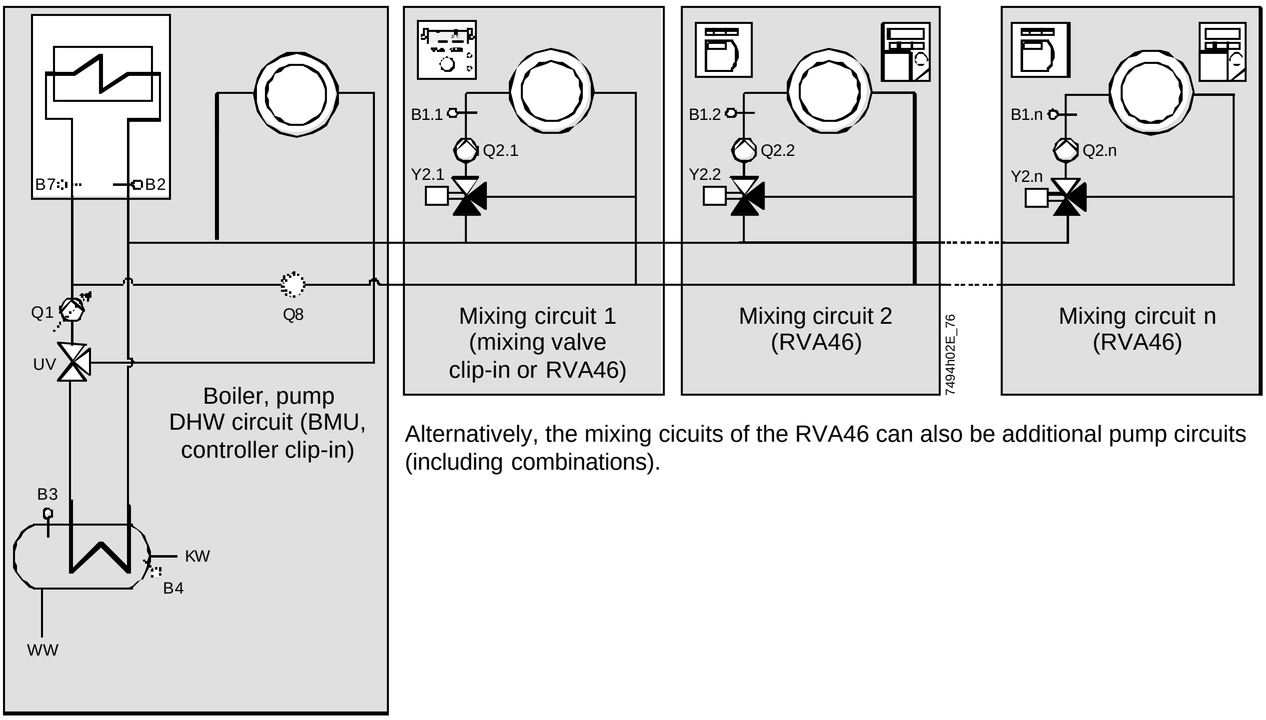
Diagram 75 1)



Alternatively, the mixing cicuits of the RVA46 can also be additional pump circuits (including combinations).

Stratification storage tank with diverting valve and primary supply function, zone control with the RVA46...

Diagram 76

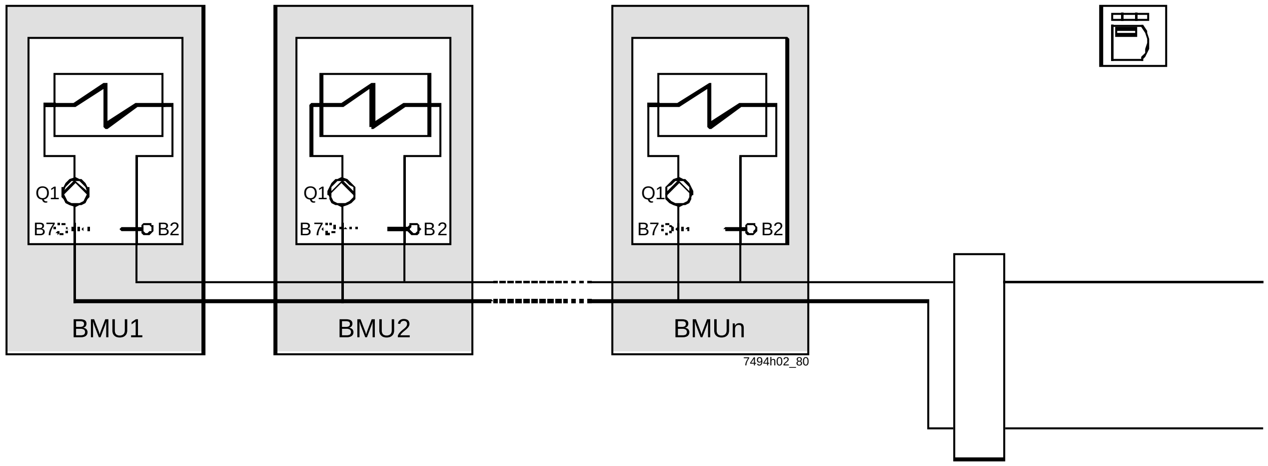


Alternatively, the mixing cicuits of the RVA46 can also be additional pump circuits (including combinations).

Stratification storage tank system with diverting valve and zone control with the RVA46...

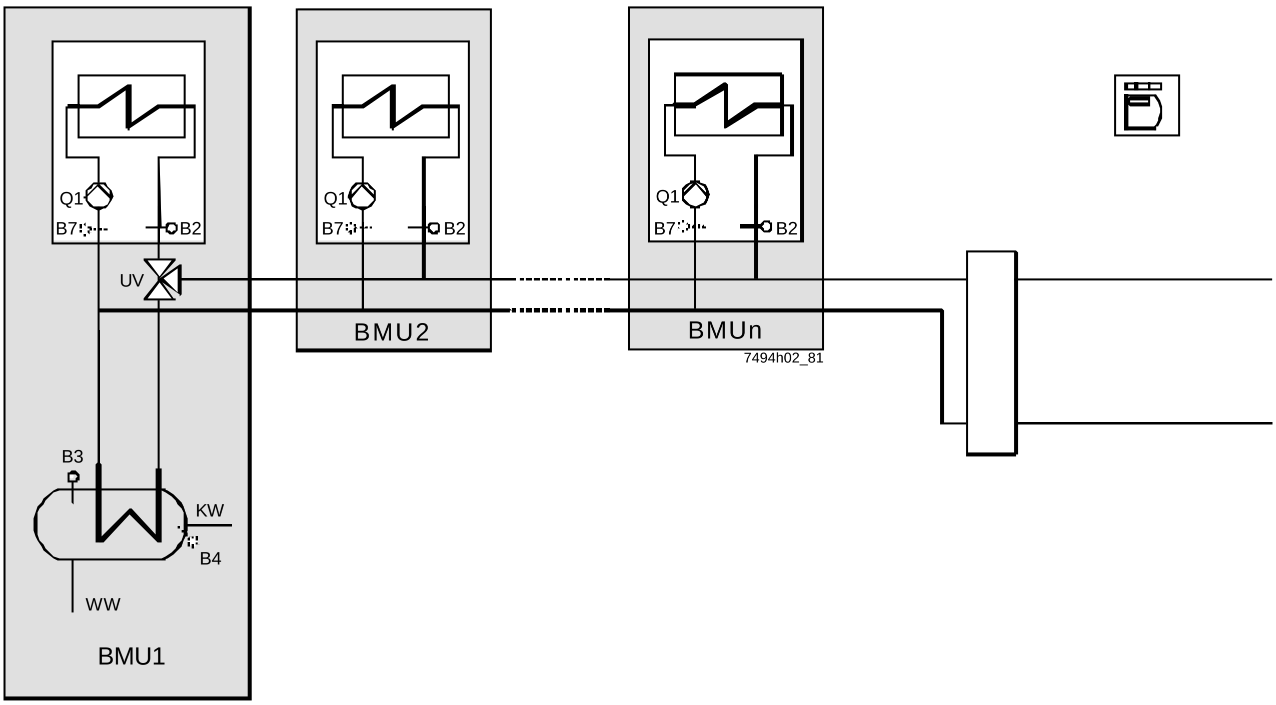
Heat generation manager

Diagram 80



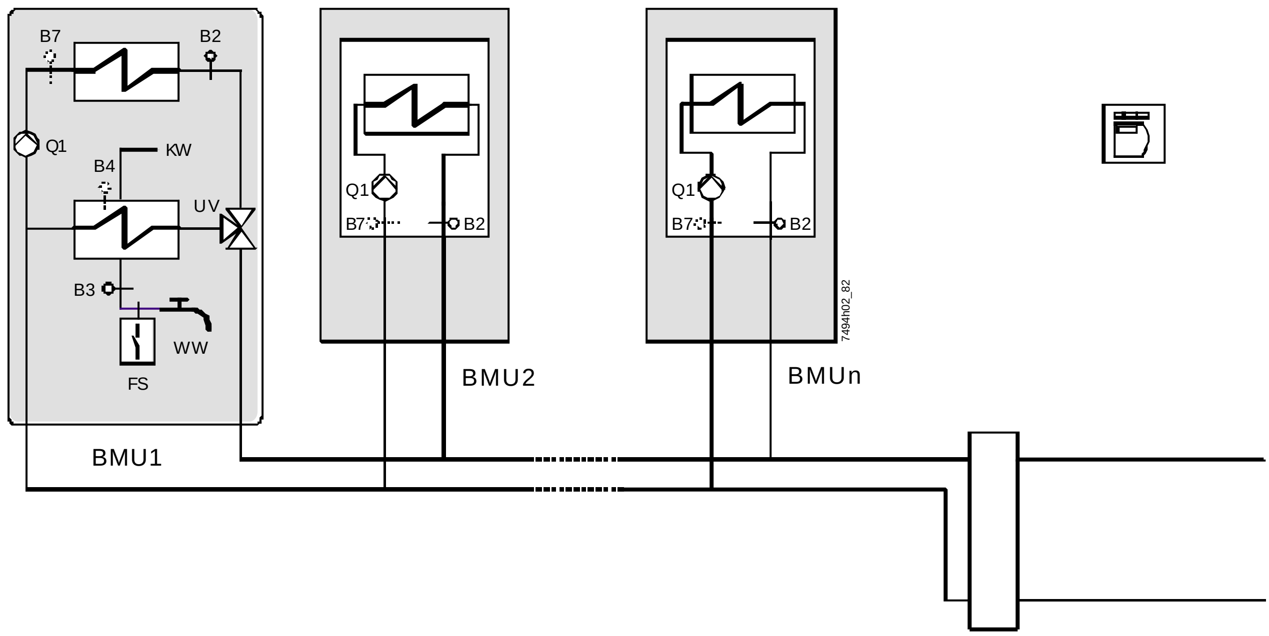
Without DHW heating

Diagram 81



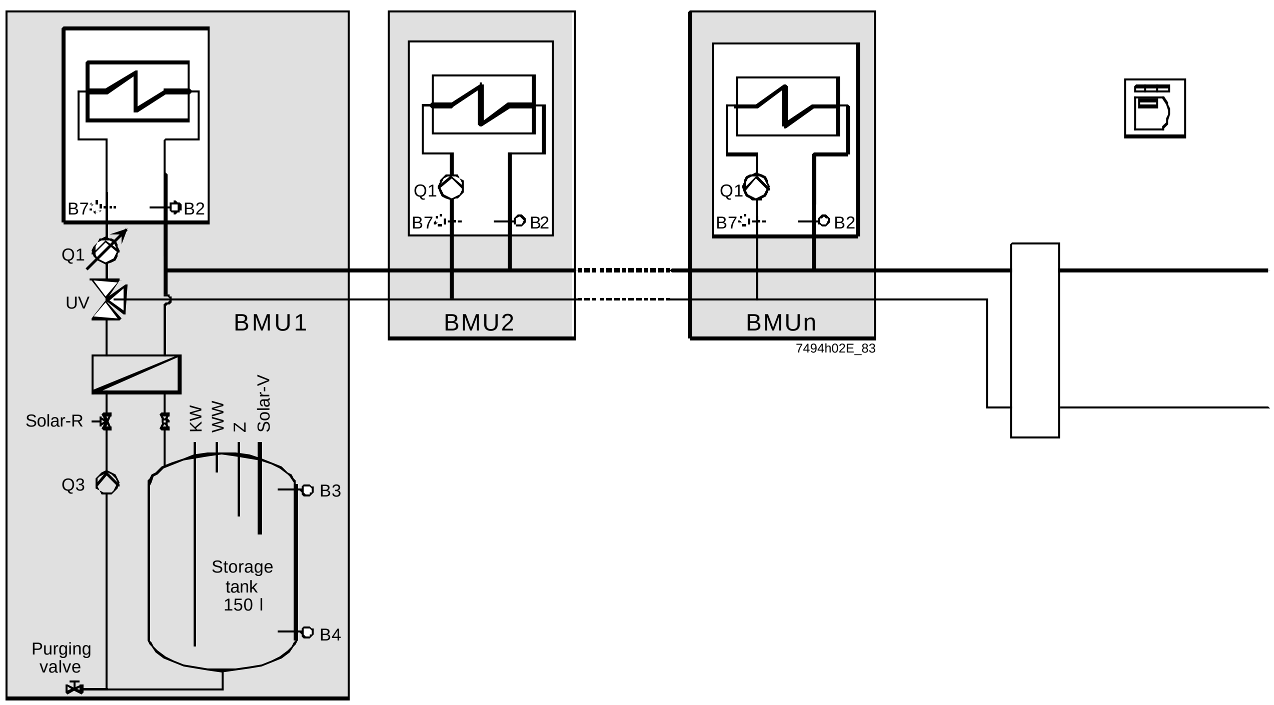
With DHW heating by a storage tank system

Diagram 82



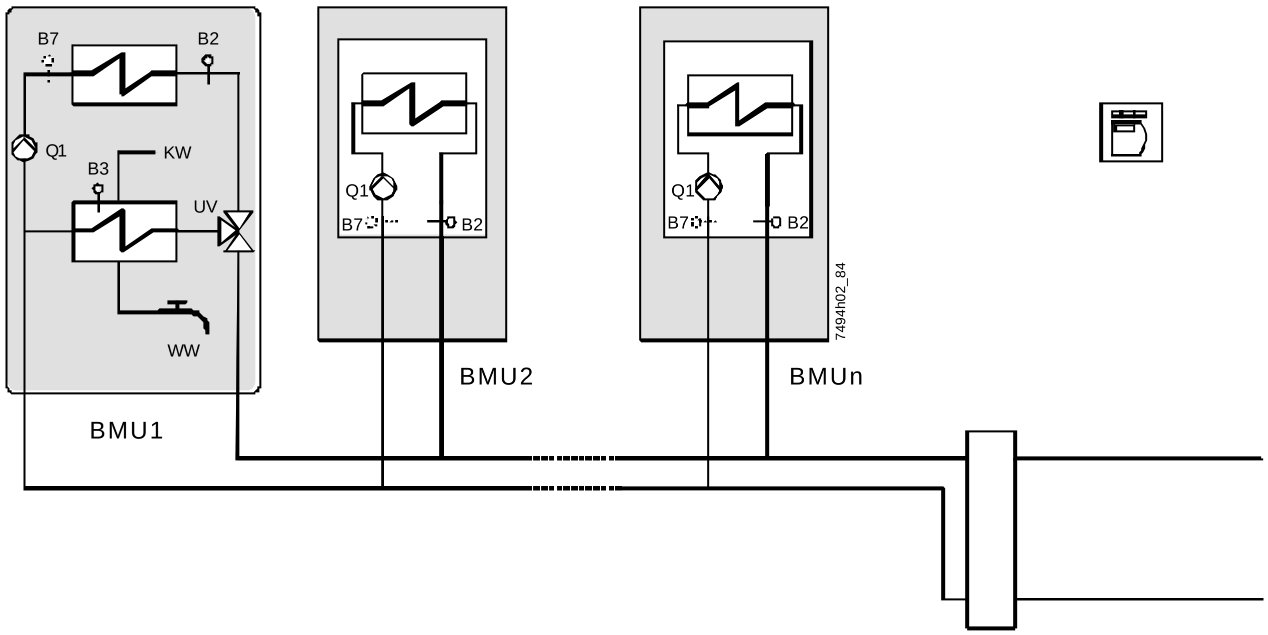
With DHW heating by an instantaneous DHW heater with diverting valve and secondary heat exchanger

Diagram 83



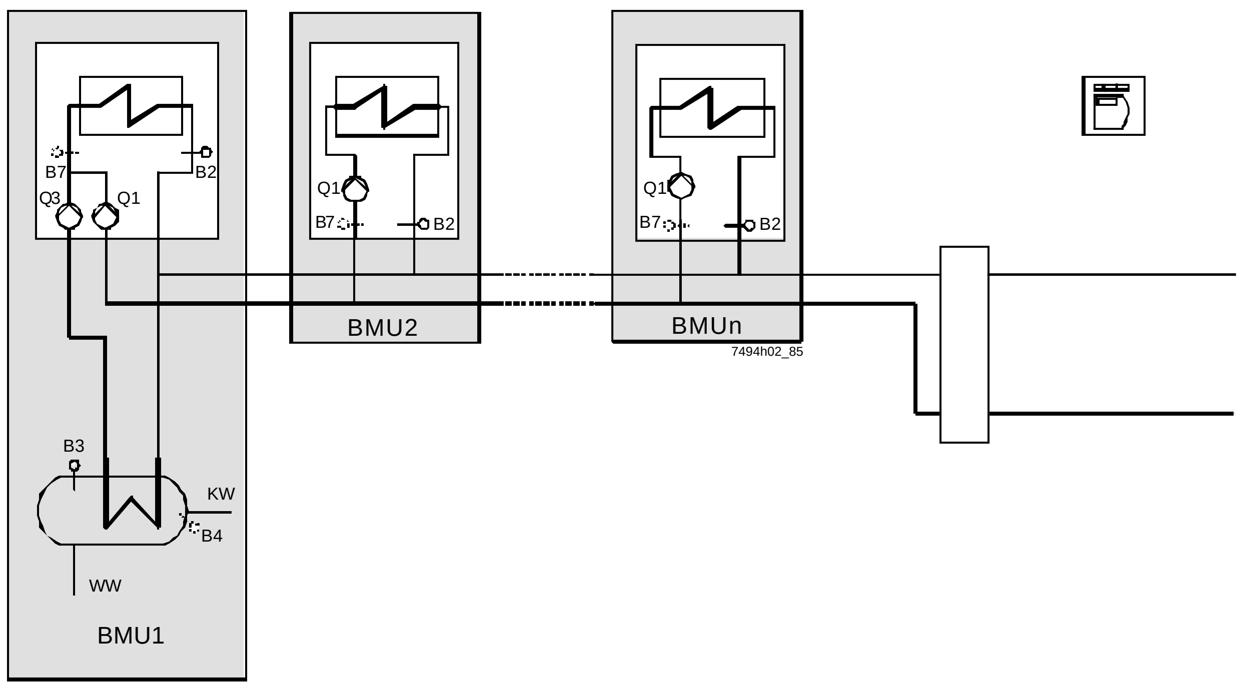
With DHW heating by a stratification storage tank system

Diagram 84



With DHW heating by an instantaneous DHW heater (aqua-booster)

Diagram 85



With DHW heating by a storage system with DHW charging pump

Note

1) Following applies to these diagrams:

- The PWM pump must be powered by the continuous live wire (refer to section14.2)
- The multispeed pump must be connected according to the table in section 14.2

Legend

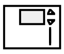
B1 Flow sensor
B2 Boiler flow sensor
B3 DHW sensor 1
B4 DHW sensor 2
B5 Room sensor HC1
B6 Room sensor HC2
B7 Boiler return sensor
B8 Flue gas sensor
B9 Outdoor sensor

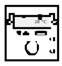
 PWM pump, mandatory

 PWM pump, optional

 Multispeed pump, single-speed (**no** PWM pump)

7494h01legE

 Room thermostat e.g. REV

 Room controller e.g. QAA73...

 Room unit (QAA70)

 Heating controller (RVA)

14.2 Assignment of hydraulic diagrams to the outputs of the LMU…

The LMU… has 3 relay outputs (K1- K3) for pumps and valves.

In addition, a pump can be modulated via the PWM output (if required, a pump can be connected externally to AC 230 V mains voltage).

Additional outputs are provided by the mixing valve clip-in module. The outputs are assigned depending on the hydraulic system used:

Hydraulic system	K1	K2	K3	PWM pump	AGU2.500 (mixing valve clip-in module) X52-02
Diagram 4	Q1	–	–	Q1	–
Diagrams 2, 5	Q1	–	Q3	Q1	–
Diagrams 3, 6, 7	Q1	–	UV	Q1	–
Diagram 9	Q1 4)	Q3.2	Q3.1	Q3.1	–
Diagram 10	Q1	Q3	UV	Q1	–
Diagram 36	Q1	–	–	Q1	Q2
Diagrams 34, 37	Q1	–	Q3	Q1	Q2
Diagram 35	Q1	Y1	UV	Q1	Y2
Diagrams 38, 39	Q1	Y1	UV	Q1	Y2
Diagram 41	Q1 4)	Q3.2	Q3.1	Q3.1	Q2
Diagram 42	Q1	Q3	UV	Q1	Q2
Diagram 44	Q1	–	UV	Q1	Q2
Diagram 48	–	Q8 1)	–	–	Q2
Diagrams 52, 68	Q1	Q8 1)	–	Q1	Q2
Diagrams 50, 53, 66, 69	Q1	Q8 1)	Q3	Q1	Q2
Diagrams 51, 54, 55	Q1	Y1	UV	–	Q2
Diagrams 57, 73	Q1 4)	Q3.2	Q8	Q3.1 2)	Q2
Diagrams 58, 74	Q8 3)	Q3	UV	Q1 2)	Q2
Diagrams 43, 59, 75	Q1 4)	Q3.2	UV	Q3.1 2)	Q2
Diagrams 60, 76	Q1	Q8	UV	Q1	Q2
Diagram 64	–	Q8 1)	–	–	Q2
Diagrams 67, 70, 71	Q1	Y1	UV	–	Q2
Diagram 80	Q1	–	–	–	–
Diagrams 81, 82, 84	Q1	–	UV	–	–
Diagram 83	Q1	Q3	UV	Q1	–
Diagram 85	Q1	–	Q3	–	–

Legend

Q1	Heating circuit pump	UV	Diverting valve
Q2	Flow pump	Y1	Shutoff valve first heating circuit
Q3	DHW pump	Y2	Shutoff valve second heating circuit
Q8	System pump		

1) System pump Q8 is controlled only if parameterized (Q8Fkt = 1)

2) Pump is only switched off via PWM control, AC 230 V connection externally

3) If Q8Fkt = 0: Control of Q1 (AC 230 V)
If Q8Fkt = 1: Control of Q8

4) Q1 cannot be modulated

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