



BOSCH

Operation Manual

Cascade controller
HPC 301 C

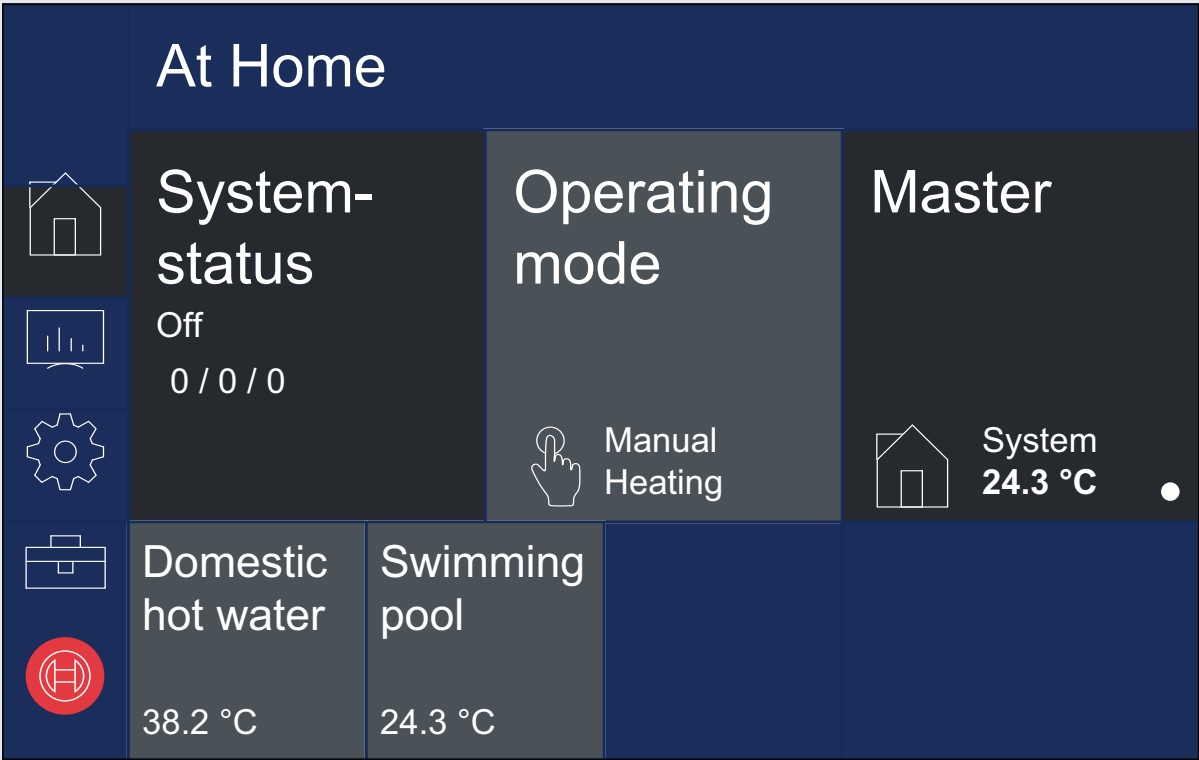


Table of contents

1	Explanation of symbols and safety instructions	3	7	Error history	16
1.1	Explanation of symbols	3	8	Block history	16
1.2	General functions	3	9	Environmental protection and disposal	17
1.3	General safety instructions	3	10	Data Protection Notice	17
2	About the product	3			
3	Operation	3			
3.1	Home screen	3			
3.1.1	Login	4			
3.2	Main menu	4			
3.2.1	At home	5			
3.2.2	Analytics	5			
3.2.3	Settings	5			
3.2.4	Installation	5			
3.3	Control elements	5			
3.3.1	+warmer/-colder buttons	6			
3.3.2	+/- buttons	6			
3.3.3	Keyboard	6			
4	Commissioning	6			
4.1	Commissioning	6			
4.2	Commissioning of the heat pump connected in parallel	7			
4.3	Cascade controller commissioning	7			
4.3.1	Number of the heat pumps connected in parallel	8			
4.3.2	Master parallel buffer cylinder	8			
4.4	Cascade and heat pump controller coupling	9			
5	Expert menu	10			
5.1	Analytics – Parallel circuit	10			
5.2	Settings	10			
5.2.1	Attachment	10			
5.2.2	System parameters Parallel circuit Heat pump	12			
5.2.3	System parameters Parallel circuit Cascade controller	12			
6	Function definition	13			
6.1	Priority assignment	13			
6.2	Heating/cooling circuits	13			
6.3	(Decentralised) water heating	13			
6.4	2. Heat source	13			
6.4.1	Control of immersion heaters	13			
6.4.2	Control of pipe heating	13			
6.4.3	Constant-controlled floor standing boiler	13			
6.4.4	Variable-controlled floor standing boiler	13			
6.4.5	Setpoint value of the 2nd Heat source	13			
6.4.6	Bivalent parallel	13			
6.4.7	Bivalent alternative	14			
6.4.8	Bivalent regenerative	14			
6.4.9	System fault	14			
6.5	Output control	14			
6.6	Building services management system	14			
6.6.1	BMS interface	15			
6.6.2	Block external	15			
6.6.3	Heating/cooling changeover	15			

1 Explanation of symbols and safety instructions

1.1 Explanation of symbols

Warnings

In warnings, signal words at the beginning of a warning are used to indicate the type and seriousness of the ensuing risk if measures for minimizing danger are not taken.

The following signal words are defined and can be used in this document:



DANGER

DANGER indicates that severe to life-threatening personal injury will occur.



WARNING

WARNING indicates a hazardous situation which, if not avoided, could result in serious personal injury or danger to life.



CAUTION

CAUTION indicates a hazardous situation which, if not avoided, could result in minor to moderate personal injury.

NOTICE

ATTENTION indicates that material damage may occur.

Important information



The info symbol indicates important information where there is no risk to people or property.

1.2 General functions

During installation, operation and maintenance, the installation instructions for the specialist must be followed.

This device must be installed and repaired only by a specialist. Improper repairs can pose a significant risk to the user. In accordance with applicable regulations, the installation instructions for specialists must be available at all times and must be provided to the specialist for their information when work is being carried out on the device.

When moving house:

- ▶ Hand these instructions over to the new tenant or owner.

If there is visible damage:

- ▶ Do not connect the device.
- ▶ Contact the supplier.

The replacement of parts must be carried out only by experts.

To avoid consequential damage:

- ▶ Only install original spare parts.
- ▶ Comply with environmental requirements relating to the recovery, reuse and disposal of operating materials and components in accordance with current standards.

1.3 General safety instructions

⚠ Notices for the target group

Any adjustment work inside the device must be carried out only by an approved contractor.

NOTICE

Improper use.

Cascade controller defect.

- ▶ Operate the Cascade controller only in dry rooms with temperatures between 0 °C and 35 °C.
- ▶ Condensation is not permitted.

NOTICE

Improper use.

Frost protection function defective.

- ▶ The heat pump must be supplied with power at all times, even in the event of active shutdowns by the electricity supplier, SG ready or §14a restrictions.
- ▶ Water must flow through the heat pump hydraulically.

2 About the product



In these instructions the name "cascade controller" is used for the physical device. The names "master controller" or "master" are used when the function of the device is involved.

3 Operation

The Cascade controller HPC 301 C is functionally necessary for the parallel actuation of up to 14 air to water heat pumps and a 2nd heat generator. With the Cascade controller both monovalent and bivalent heat pump heating systems can be actuated and system functions of the cascade system controlled.

The HPC 301 C is supplied as a wall-mounted controller as an accessory. The following information describes the operation and its features.

Further information on the settings is provided in the help section for the relevant menu item, which can be accessed via the i-icon in the top right-hand corner.

3.1 Home screen



Fig. 1 Home screen with language and user selection



During an initial commissioning of the controller or after a software update the guided EasyOn Commissioning is started automatically (→ Chapter 4, page 6).

Access to the display and control unit is obtained by selecting the desired user group and then confirming by tapping the red login icon.

- User
- Expert
- Service

Depending on the selected user group, a password is required for access (→ Chapter 3.1.1, page 4).

You can return to the language and user selection screen at any time by tapping the company logo in the bottom left-hand corner. The active user level is also indicated by a colour on the display. The specialist menu is blue and the service menu is red. After a certain period of inactivity, the heat pump controller automatically switches back to the main menu.



If language and user selection are not available, the touch screen is still in start-up mode.

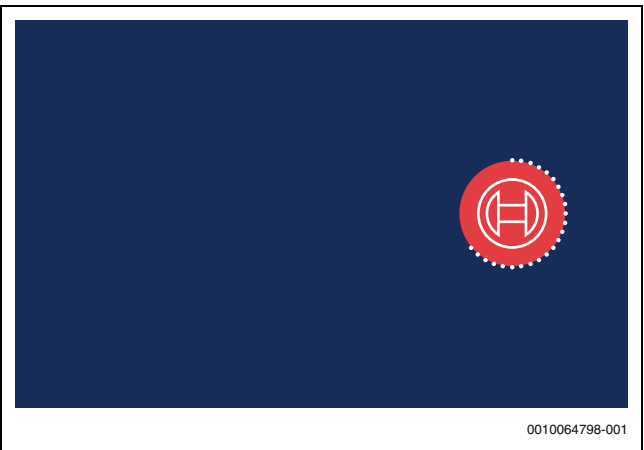


Fig. 2 Touch screen is in start-up mode



If after approximately 2 minutes a language and user selection still is not possible, there may be an address conflict in a master system. In this case the software on the display and the Cascade controller has to be reinstalled by authorised personnel.

3.1.1 Login

A password must be entered to access the specialist and service areas. You will be prompted to enter the password after selecting the user group and then confirming with the login icon.



Fig. 3 Selecting the user group

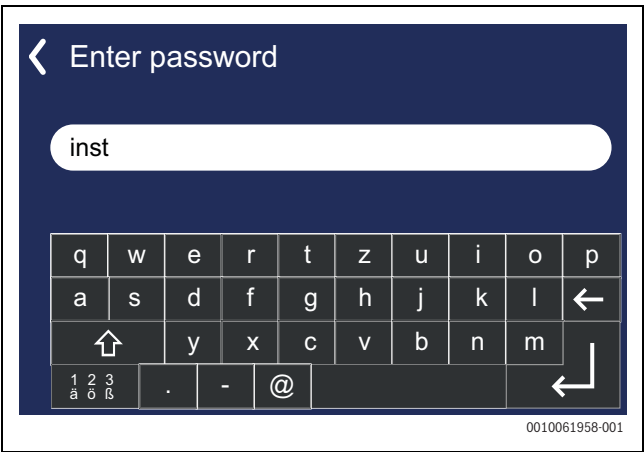


Fig. 4 Entering the password for the specialist

Once the password has been successfully entered and confirmed by pressing the Enter button, you will automatically be taken to the Expert home screen.

Settings in the expert menu may be adjusted only by the expert.

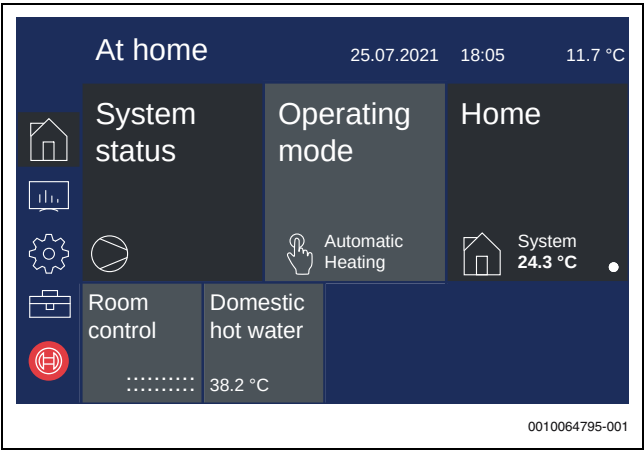


Fig. 5 Expert home screen

3.2 Main menu

The main menu comprises 5 menu levels. Access to the individual operating levels is allowed subject to the user group selected. The menu structure of the HPC 301 C is identical to that of the HPC 301. Further information about the basic structure of the menu can be found in the operating instructions for the HPC 301.

	At home	System status, operating mode, settings for the operator
	Analytics	System data, operating data, running times, heat output, inputs and outputs
	Settings	Date and time, language and region, screen, home app

	Installation ¹⁾	Heating programs, system setup, function locks, EasyOn
	Start view	Return to language and user selection

1) Only available in the specialist and service areas.

Table 1 Control buttons

3.2.1 At home

The At home menu clearly displays all the information required by the operator, the current status of the heating system and settings. In particular, the operating mode, set temperatures and weekly profiles can be easily changed via this menu.

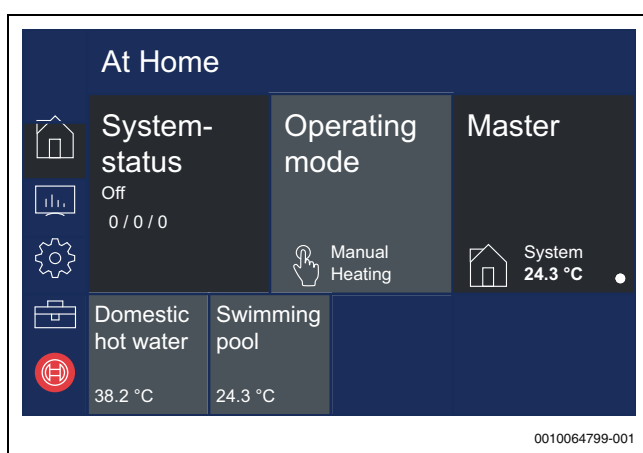


Fig. 6 View At home

3.2.2 Analytics

All current and historical quantities of heat, runtimes and operating data, as well as the input and output states, are provided in the **Analytics** menu.

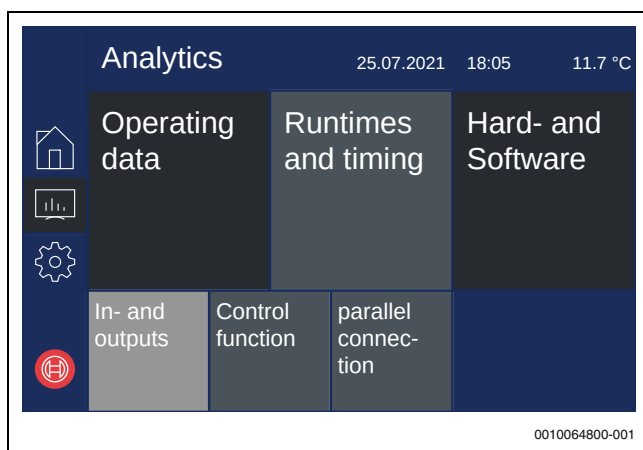


Fig. 7 Overview Analytics

3.2.3 Settings

All system parameters, as well as settings relating to the display and accessories, are configured in the **Settings** menu.



All system parameters are explained in more detail in the operating instructions for the HPC 301 heat pump, supplied.

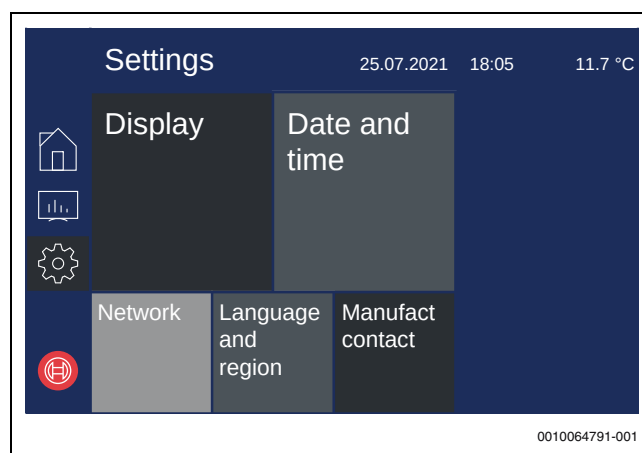


Fig. 8 Overview Settings

3.2.4 Installation

In the **Installation** menu, after a successful commissioning a heat-up program can be activated or the guided **EasyOn** Commissioning restarted.

This menu can only be found in the expert and service menu.

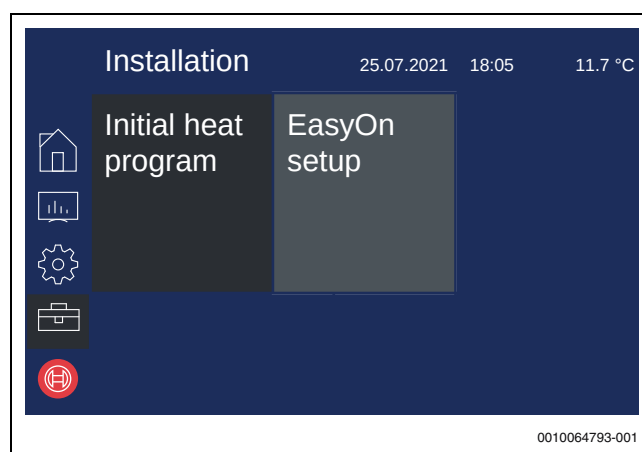


Fig. 9 Overview Installation

3.3 Control elements

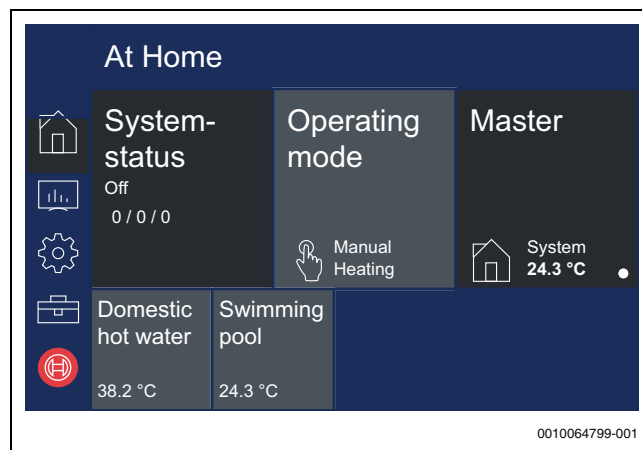


Fig. 10 Operator view

The display and control unit allows you to make the settings required for operation and view the displays.

Depending on the user group and setting value, there are different ways to change the value.

3.3.1 +warmer/-colder buttons

In a slider view, the heating curve or set temperature is adjusted using the +warmer/-colder button. **Tapping** the button once changes the value by **1** or **0.1**. If the button is kept pressed, the value changes more quickly.

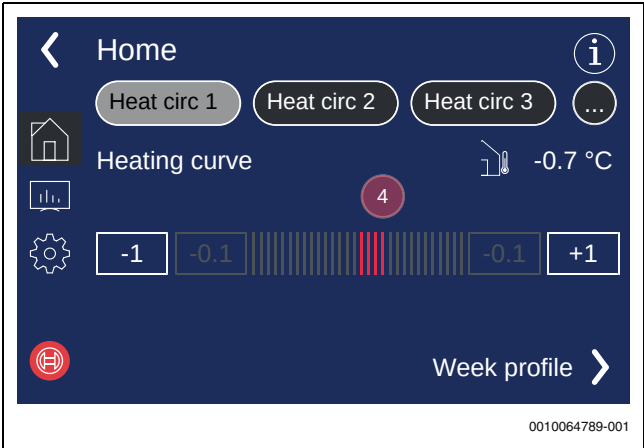


Fig. 11 Changing values using a slider

3.3.2 +/- buttons

When adjusting settings using the +/- buttons, tapping a value displays it inverted.

The value is changed using the +/- buttons. The value is confirmed after **tapping** the display area once.

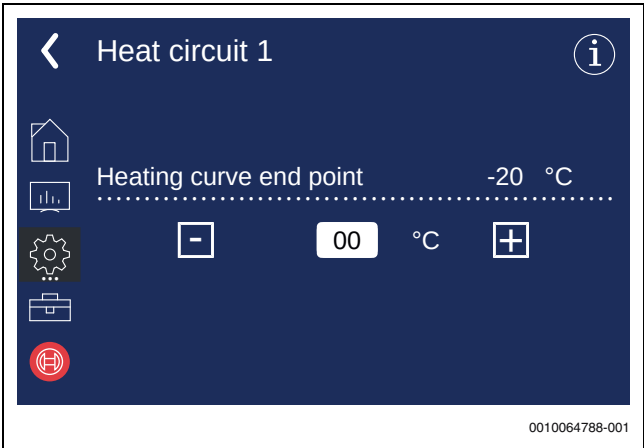


Fig. 12 Inverted setting value

3.3.3 Keyboard

The value is changed using the screen keyboard. To do this, tap the value to be changed; it will then be displayed inverted. The value is then changed using the keyboard. The change is confirmed using the angled **Confirm** button.

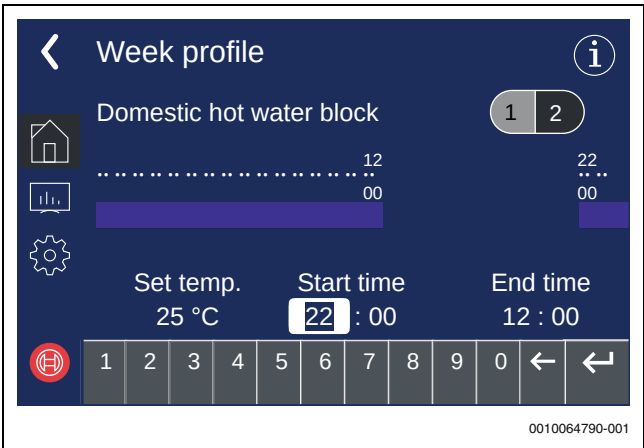


Fig. 13 Changing values using a keypad

4 Commissioning

NOTICE

A network connection (pLAN J14) cannot be established during the commissioning.

- ▶ If a network connection already exists, unplug the plug from the controller.
- ▶ Establish a network connection only after the commissioning of all heat pumps and the Cascade controllers is finished.

The heat pumps connected in parallel have to be put into operation first before the commissioning of the cascade system (→ Chapter 4.2, page 7).

The commissioning of the cascade controller follows subsequently (→ Chapter 4.3, page 7).

The network connection (pLAN J14) in the cascade cluster has to be severed during the commissioning. The point at which the connection may be re-established is described in detail in the instructions.

4.1 Commissioning

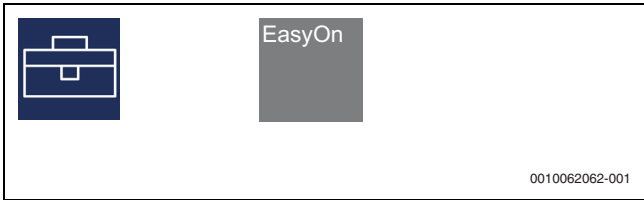


Fig. 14 EasyOn installation

The **EasyOn** Commissioning wizard for the Cascade controller is accessed via the service menu; as a result, a login with the service password is required during the initial start-up (→ Chapter 3.1.1, page 4). This is started automatically, has to run through once and manages all of the system parameters relevant to the operation via the settings. The menu options available depend on the type of controller, heat pump and hardware used.

The **EasyOn** Commissioning wizard must be carried out in full and completed. It is not possible to cancel the process during commissioning!



A login with the service password is required for the advanced **parallel operation** settings. If the commissioning is started without the service menu, a standard commissioning of the heat pump is carried out. If the settings from Chapter 4.2, page 7 and 4.3, page 7 required here for the parallel operation are bypassed, the configuration of the cascade function is not possible in this case.

The commissioning can be restarted via the service menu at any time. All of the settings required here for the parallel operation can be made later.

4.2 Commissioning of the heat pump connected in parallel

Every heat pump connected in parallel is put into operation separately. During the commissioning, the heat pump is assigned a unique network address from 1 to 14 in ascending order.

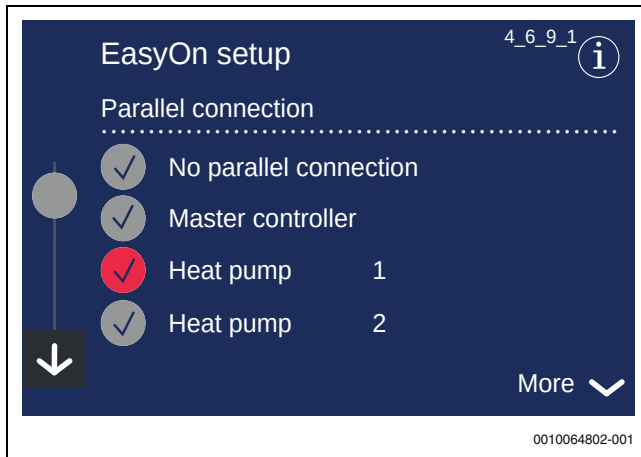


Fig. 15 Selection of the heat pump

After the selection of the heat pump, the controller has to be restarted with the next query (→ fig. 16).

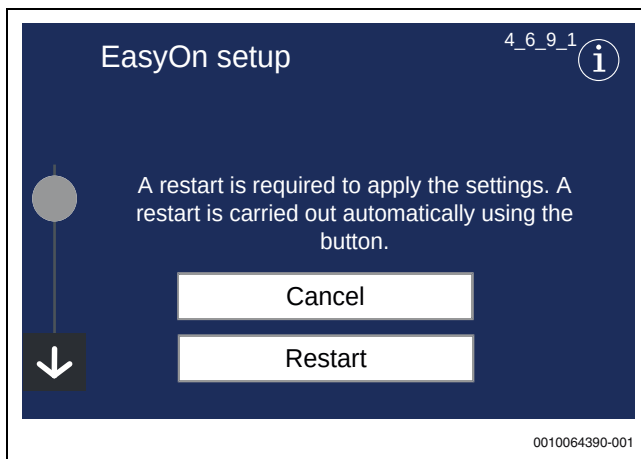


Fig. 16 Selection for the restart

During the starting procedure the display and the controller are set to the requisite network address (→ fig. 17).

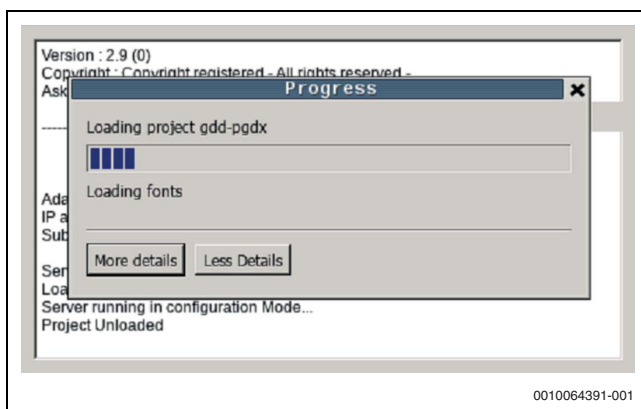


Fig. 17 Restart is carried out

After a successful restart the commissioning is continued as described in the operating instructions for the HPC 301 supplied for the heat pump. After completion of the guided EasyOn Commissioning, the name of the selected heat pump connected in parallel appears in the start view (→ fig. 18).



Fig. 18 Heat pump start screen



Unlike the Cascade controller the machine code continues to be displayed as the heat pump code for the heat pump connected in parallel.



The controller for the particular heat pump receives the outside temperature from the Cascade controller. So long as the network connection (pLAN J14) does not yet exist, the outside temperature is displayed at 0.0 °C. In this case an outside temperature sensor that is not connected is not recognised as a fault.



For the commissioning, each HPC 301 and the HPC 301 C needs an R2.2 demand sensor of its own; this has to be taken into account during the installation.

4.3 Cascade controller commissioning

The commissioning of the Cascade controller is analogous to the heat pump connected in parallel. The Cascade controller has to be selected during the commissioning (→ fig. 19). A network address is automatically assigned to the Cascade controller in the process.

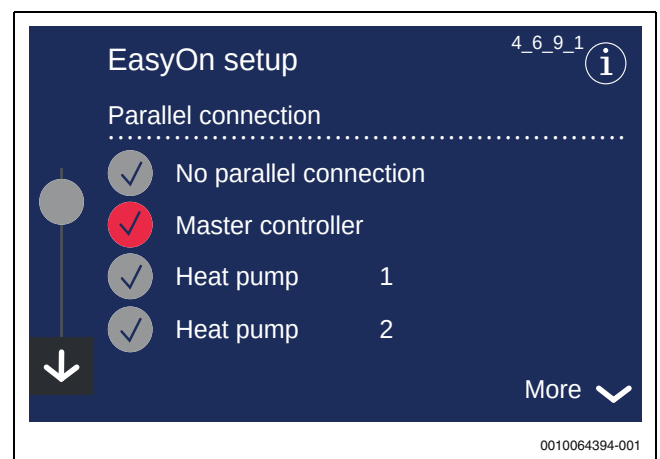


Fig. 19 Selection of the Cascade controller

After the selection of the Cascade controller, the controller has to be restarted with the next query (→ fig. 20).

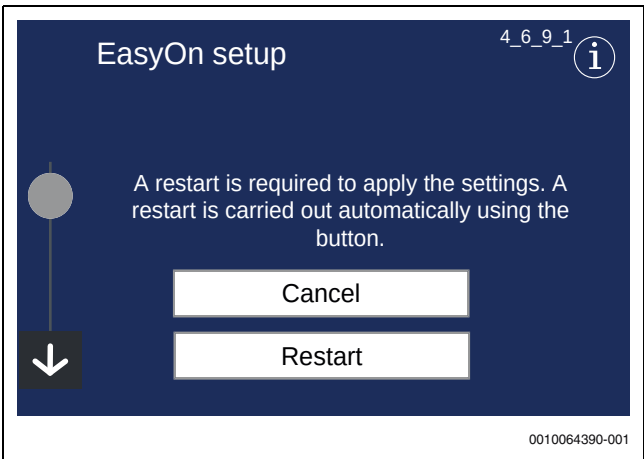


Fig. 20 Selection for the restart

During the starting procedure the display and the controller are set to the requisite network address (→ fig. 20).

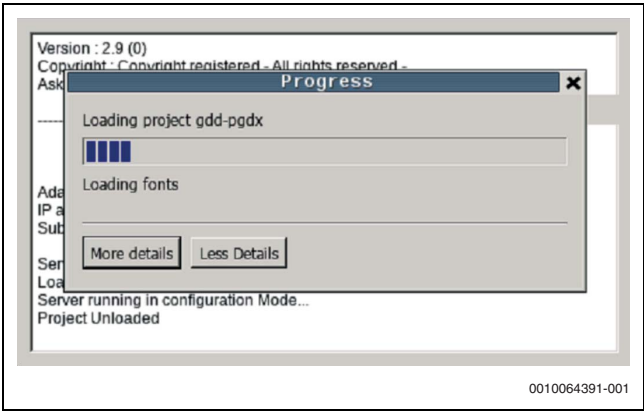


Fig. 21 Restart is carried out

i With a successful commissioning of a Cascade controller the machine code is displayed as 11111. Unlike the Cascade controller the machine code for heat pumps connected in parallel continues to be displayed as the heat pump code.

After a successful restart the commissioning is continued. Specific settings for the Cascade controller can be found in Chapter 4.3.1 and 4.3.2. Otherwise the commissioning of the HPC 301 C behaves identically to the HPC 301. You can find details in the operating instructions for the HPC 301.

4.3.1 Number of the heat pumps connected in parallel

During the commissioning the number of the heat pumps connected in parallel has to be specified in the Cascade controller in order to be able to activate the pumps in the network.

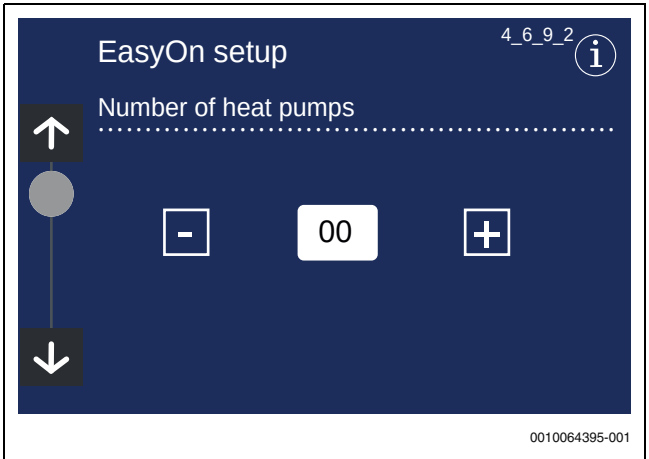


Fig. 22 Number of the heat pump connected in parallel

Parameters	Description	Adjustment range
Number of heat pumps	Setting for the number of heat pumps connected in parallel which are integrated in the network operation.	0 ... 14

Table 2 Number of heat pumps

4.3.2 Master parallel buffer cylinder

The master parallel buffer function can only be stored in the Cascade controller as a function. This is necessary for mapping system hydraulics with parallel buffer memory. Details can be found in System hydraulics.

For this function the master return temperature sensor R2.5 and the master flow temperature sensor R9.5 still need to be installed for the requisite demand sensor R2.2.

Parameters	Description	Adjustment range
Functions	The desired function must be selected based on the system hydraulics. Notice: The function Direct Circuit and Mixer Circuit 1 cancel each other out. The maximum number of available functions depends on the hardware used. (Three other functions can be added to the HPC 301 and the HPC 301 C in addition to the unmixed heating circuit, as standard. With the use of function extension module FEM2 2 more functions can be assigned.)	- DHW 1st unmixed circuit 1st mixed circuit 2nd mixed circuit 3rd mixed circuit - Dual mode - Regenerative - Swim. pool - Cooling actively - Master parallel buffer cylinder

Table 3 Master functions

i Further information and setting options for the system functions can be found in the installation and operating instructions for the heat pump manager of the master controller.

After completion of the guided EasyOn Commissioning, the start screen appears with the name Master controller (→ fig. 23).



Fig. 23 Start screen Cascade controller

4.4 Cascade and heat pump controller coupling

After all of the heat pumps connected in parallel and the Cascade controller have been put into operation, the coupling of the system occurs. For the purpose, the pLAN J14 connection needs to be re-established. Then a restart of every controller is recommended.

After a successful integration the following screen should be visible in the "At Home" menu of the Cascade controller.

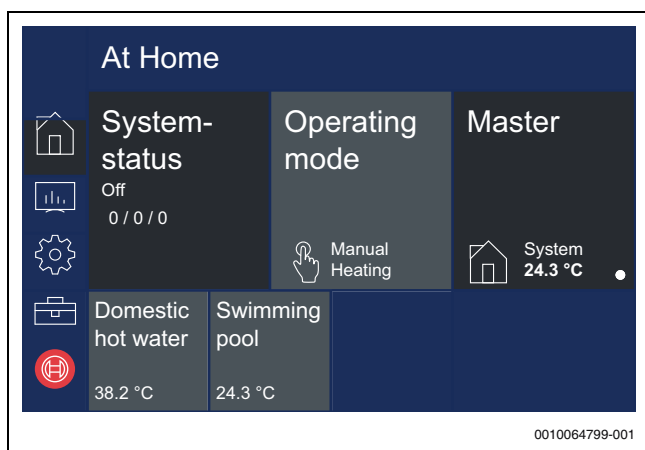


Fig. 24 Screen following successful integration

The current status of the cascade system can be accessed via System status. The number of the currently operating output stages, the number of the requested output stages and the total number of output stages present can be learned from the status 0/0/0.

For example, the display 1/2/6:6 means that a total of six output stages are present, two output stages are requested and one output stage is currently in operation.

Detailed information about the heat pumps connected in parallel and their connection to the Cascade controller can be viewed under Analytics.

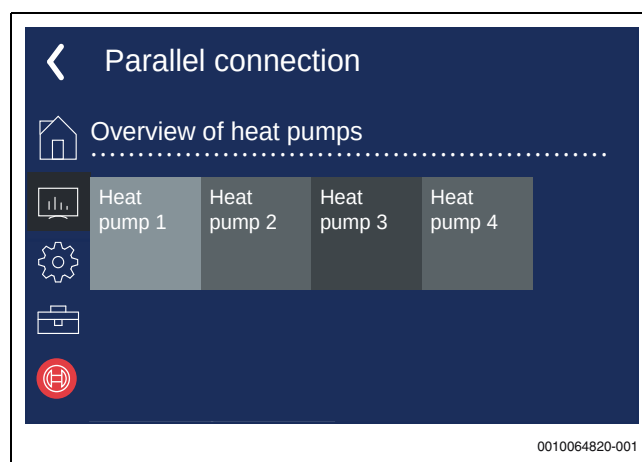


Fig. 25 Overview of the heat pumps connected in parallel

5 Expert menu

The following settings can only be made in the expert menu. This can be accessed as described in → Chapter 3.1.1, page 4.

In general, every section of the expert menu of the HPC 301, in HPC 301 C too, can be viewed. You can find details in the operating instructions for the HPC 301.

Cascade-specific subjects are described in the following.

5.1 Analytics – Parallel circuit

A status overview of all heat pumps connected in parallel can be seen under **Analytics > Parallel circuit**. The various possible statuses are displayed in the table.

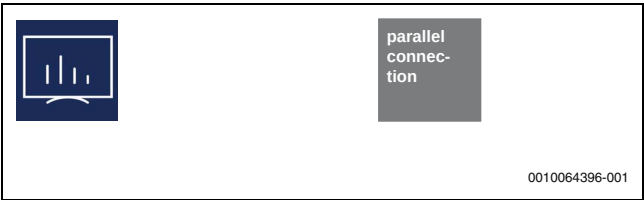


Fig. 26 Analytics Parallel circuit

Parameters	Meaning
Heat pump 1 - 14 	There is a fault on the connected heat pump.
Heat pump 1 - 14 	Everything is OK on the connected heat pump.
Heat pump 1 - 14 	The heat pump to be connected has yet to be connected to the parallel circuit.
Heat pump 1 - 14 	There is a block on the connected heat pump.
Heat pump 1 - 14 	The connected heat pump is recognised by the Cascade controller but is still not programmed for the parallel circuit.

Table 4 Status overview of the heat pumps on the Cascade controller

Parameters	Meaning
Heat pump 1 - 14 	The heat pump is configured and programmed for the parallel operation.
Heat pump 1 - 14 	The heat pump is configured for the parallel operation but is still not programmed.

Table 5 Status overview of the heat pump connected in parallel

5.2 Settings

The following settings are specific to the Cascade controller and can only be made on it.

5.2.1 Attachment

System settings that apply to the entire cascade system can be made under Settings > System. Blocks or a reduction are forwarded by the Cascade controller to the heat pumps connected in parallel.

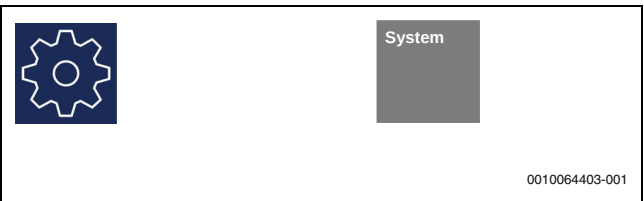


Fig. 27 Settings System

Parameters	Adjustment	Adjustment range
External inhibiting input	Is the external block input being used? What function should be performed when this input is opened?	• Frost protection • Holiday • Block hot water • Summer operating mode
Network-oriented control	How does network-oriented control work (→ Chapter , page 11)?	• EVU • Direct • EMS (Energy Management System)
Maximum power consumption	If the network-oriented control "Direct" was selected, the maximum possible percent value for the power consumption of the entire system has to be entered here. In the case of a request from the network-oriented control this value has to be transmitted from the Cascade controller to each heat pump connected in parallel. Then each individual heat pump is reduced to this value automatically. With single energy source systems if a signal is present for the control "Direct", the second electric heat generator is not released.	0 ... 100 %
Operating mode of 2nd Heat source	How should the 2nd heat generator behave in the event of a partial or total system fault? Minimal: A release occurs if all heat pumps connected in parallel report a failure or communication fault. Nominal: A release occurs if 50% of the heat pumps connected in parallel report a failure or communication fault. Maximal: A release occurs immediately a heat pump connected in parallel reports a failure or communication fault.	• Minimum • Nominal • Maximum

Table 6 System parameters

Network-oriented control

Network-oriented control means that, in the event of an imminent network overload, the network operator temporarily reduces the electricity consumption of a heat pump in order to ensure stability of the

network. Until 2023, this was primarily achieved via the energy supplier block and has been regulated since 2024 under § 14a of the German Energy Industry Act (EnWG). If the heat pump can be controlled, the system operator benefits from a reduced network fees.

Time period	Control via	Action	Setting value
Up to 2023 (classic energy supplier block)	Energy supplier (EVU), traditionally via a timer or ripple control receiver	Complete shutdown	EVU
From 2024 (§14a EnWG)	Network operator via smart meter and control box	Power reduction in accordance with § 14a EnWG	Direct
	Via an energy management system capable of controlling multiple loads (heat pump, wallbox, battery, etc.)		(EMS) Energy Management System

Table 7 Network-oriented control

Energy Management System (EMS)

If the option to control via an energy management system (EMS) has been selected, the maximum power consumption value can be adjusted dynamically using the various communication protocols (Modbus, KNX). This may be necessary and recommended when several consumers are

controlled via an EMS. If the value is > 0 (Register 265), the power consumption is reduced to this value. If the value is 0, no output reduction takes place (→ Table 8).

Further details can be found in the BMS interface. For information about this → Chapter 6.6.1, page 15.

ID	Register	Name	Value	Description	R/W
193	264	Output reduction function			R/W
193			0	EVS contact → energy supplier block	
193			1	EVS contact → §14a	
193			2	Energy Management System output reduction	
193	263	Register 264 = 1: reduced electrical output			R/W
193	265	Register 264 = 2: reduced electrical output			R/W
193			0	no output reduction	
193			>0	reduced electrical output	

Table 8 Section from the BMS data point list

5.2.2 System parameters Parallel circuit Heat pump

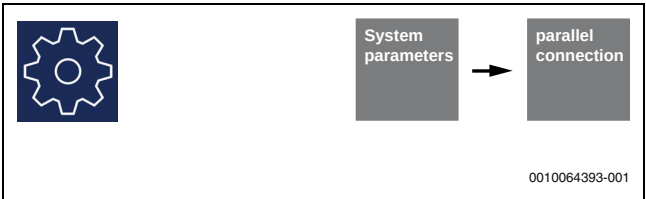


Fig. 28 Settings System parameters Parallel circuit

After the successful commissioning of the heat pumps connected in parallel these need to be activated for the cascade cluster. This setting has to be made in each HPC 301 in **Settings > System parameters > Parallel circuit**.

Parameters	Description	Adjustment range
Heat pump	Yes: The heat pump connected in parallel should be used in the network group and requested by the Cascade controller. No: The heat pump connected in parallel must not be requested by the Cascade controller.	No / Yes
Outside temperature	The outside temperature is recorded centrally via an outside temperature sensor on the Cascade controller and forwarded to the heat pump connected in parallel. Yes: The outside temperature is transferred from the Cascade controller. No: The outside temperature from the in-built outside temperature sensor should be used. A separate R1 outside temperature sensor has to be connected to the HPC 301 for this purpose.	No / Yes

Table 9 System parameter

5.2.3 System parameters Parallel circuit Cascade controller

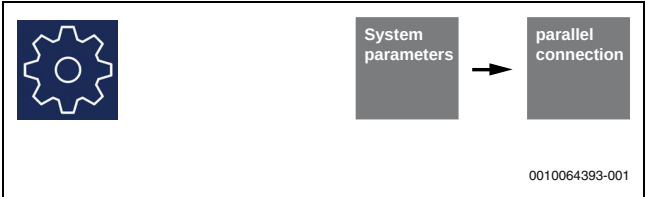


Fig. 29 Settings System parameters Parallel circuit

After a successful commissioning of the Cascade controller additional settings for increasing and reducing the output need to be made (→ Chapter 6.5, p. 14).

Parameters	Description	Adjustment range
Delay of heating output increase	Delay time for a heating request until a next higher output stage is switched to.	1 ... 20 minutes ... 60
Delay of heating output reduction	Delay time after cancelling a heating request until the next lower output stage is switched to.	1 ... 15 minutes ... 60
Delay of cooling output increase	Delay time for a cooling request until a next higher output stage is switched to.	1 ... 20 minutes ... 60
Delay of cooling output reduction	Delay time after cancelling a cooling request until the next lower output stage is switched to.	1 ... 15 minutes ... 60
Delay of DHW output increase	Delay time for a DHW request until a next higher output stage is switched to.	1 ... 20 minutes ... 60
Delay of DHW output reduction	Delay time after cancelling a DHW request until the next lower output stage is switched to.	1 ... 15 minutes ... 60
Delay of pool output increase	Delay time for a pool request until a next higher output stage is switched to.	1 ... 20 minutes ... 60
Delay of pool output reduction	Delay time after cancelling a pool request until the next lower output stage is switched to.	1 ... 15 minutes ... 60

Table 10 System parameters Parallel circuit

6 Function definition

The Cascade controller takes on the switching on and off of up to 14 separate heat pumps via heat pump manager, the control of up to 3 heating/cooling circuits, as well as decentralised DHW and pool heating. With single energy source or bivalent systems the Cascade controller controls the request from the compressors in addition to also switching on the second heat generator. The request from the compressors and switching on the 2nd heat generator is carried out via an output stage circuit. There are just as many output stages present here as compressors in the parallel operation. With another heat generator for the bivalent or single energy source operation an additional output stage is available. The heat pump manager for the individual heat pumps takes on the actuation of the compressors, the fans and the circulation pumps. Likewise the control and actuation of the primary circuit pump which ensures the heating water throughput via the particular heat pump.

6.1 Priority assignment

For a most efficient operation of the heat pump heating system possible the heat pump managers of the respective heat pumps are controlled by the Cascade controller with different priorities:

- To achieve a most uniform distribution of runtimes possible, the compressor is preferably started by the Cascade controller with the lowest runtime. The Cascade controller receives feedback from the individual heat pumps, recognises a request from blocked heat pumps and shifts the priorities for optimum utilisation.

6.2 Heating/cooling circuits

The Cascade controller can take on the actuation of the mixer for the 2nd and 3rd heating/cooling circuit or in the bivalent operation the bivalent mixer. Additional mixed heating circuits (maximum 28) can be integrated via the respective heat pump managers of the individual heat pumps. A setpoint value is, therefore, set on the heat pump manager of the respective heat pump and is not possible by means of the Cascade controller.

6.3 (Decentralised) water heating

The water heating can be configured decentrally. This setting needs to be attuned to the hydraulic integration and affects both the actuation of the circulation pumps and the evaluation of the temperature sensors.

With a decentralised configuration the water heating and the actuation of the circulation pumps is executed via the heat pump manager of the respective heat pumps. The heat pumps are blocked from the time of a DHW request for a heating and cooling request via the Cascade controller. In order to be able to carry out the decentralised water heating function the DHW temperature sensor needs to be installed on the heat pump manager.

If the water heating is configured on the Cascade controller, central water heating is involved. The hydraulic structure has to be attuned to the system for this purpose, as well as the closing-off of the actuators and the sensors. It is important to bear in mind that a parallel heating and DHW operation is not possible until a central water heating occurs.

6.4 2. Heat source

The Cascade controller can integrate different types of 2nd heat generators whose control is subject to the type and interface. The actuation of various types of 2nd heat generators is summarised in the following. In general, this also applies to heat pump controllers.

6.4.1 Control of immersion heaters

In single energy source systems, electric immersion heaters are used. These are switched on or off based on heat demand, when a set limit temperature is exceeded or undercut and the heat pump does not reach its set temperatures. Prerequisite for the use of the immersion heater is the hydraulics attuned as E10.1, as well as activation during the guided EasyOn Commissioning.

6.4.2 Control of pipe heating

An electric pipe heater can be used in single energy source systems. The electric pipe heater is selected in the EasyOn "Heating" of the immersion heater and switched on or off based on demand. These are switched on or off based on heat demand, when a set limit temperature is exceeded or undercut and the heat pump does not reach its set temperatures. Prerequisite for the use of the pipe heater is the hydraulics attuned as E10.1, as well as activation during the guided EasyOn Commissioning.

6.4.3 Constant-controlled floor standing boiler

With this type of boiler, when released by the HPC 301/ HPC 301 C, the boiler water is always heated to a fixed temperature (e. g. 70 °C) . The set temperature must be high enough to ensure that DHW heating can also be carried out by the boiler if required. Control of the mixer is handled by HPC 301/ HPC 301 C, which activates the boiler when necessary and mixes in enough hot boiler water to achieve the desired set return or DHW temperature. The boiler is requested via the 2nd heat generator of the HPC 301/ HPC 301 C. The operating mode of the 2nd heat generator must be set to "constant".

6.4.4 Variable-controlled floor standing boiler

Contrary to a boiler with constant control, a boiler with variable control directly delivers a DHW temperature that corresponds to the outside temperature. The 3-way diverter valve has no control function; its sole purpose is to direct the flow of heating water either past the boiler circuit or through the boiler, depending on the operating mode.

In pure heat pump mode, the heating water is routed past the boiler to avoid losses due to heat radiation from the boiler. If a weather-compensated burner output control is already present, the power supply to the burner output control must be disconnected during exclusive heat pump operation. For this purpose, connect the floor standing boiler control to the output of the 2nd heat generator of the HPC 301/ HPC 301 C and the operating mode of the 2nd heat generator to "variable". The curve of the burner output control is adjusted according to the HPC 301/ HPC 301 C.

6.4.5 Setpoint value of the 2nd Heat source

If the bivalent heat generator has a 0–10 V interface for the setpoint value, then the Cascade controller supplies the control signal via an output. For this purpose, 5 corner points must be adjusted to the specifications of the bivalent heat generator. The voltage output for the set value corresponds to the calculated set temperature of the heat pump. For DHW heating and/or reheating the maximum set set value is used. You can find details in the operating instructions for the HPC 301.

6.4.6 Bivalent parallel

The "limit temperature parallel" is set in **"Settings - System parameters - 2nd heat generator"**. If the limit temperature parallel is undercut, the heat pump and the 2nd heat generator are requested when necessary.

6.4.7 Bivalent alternative

The "limit temperature alternative" is set in **"Settings - System parameters - 2nd heat generator"**. If the limit temperature alternative is undercut, the heat pump is blocked and the 2nd heat generator for the heating and DWH heating is released.



If not a parallel, but rather an alternative operation is required, then the limit temperatures alternative and parallel have to receive the same value.

6.4.8 Bivalent regenerative

When integrating a regenerative heat source (e.g. solar, wood), this must be given priority over the operation of the heat pump. To do this, select the **"Regenerative"** function in EasyOn during the selection process. As long as the regenerative storage cylinder is cold, the system behaves like a single-energy system.

The sensor for the regenerative storage cylinder is connected to the analogue input (3) of the **"Regenerative"** function block. Details can be found in the installation instructions for the controller. The mixer outputs of the dual fuel mixer are active.



With a regenerative operating mode a parallel operation of the heat pumps with a regenerative storage cylinder is not possible.

Basic function:

The temperature in the regenerative storage cylinder is measured and compared with the flow temperature for the relevant demand (DHW, heating or pool). If the temperature is higher than the limit values (Details → Operating instructions HPC 301), the heat pump is blocked, the regenerative storage cylinder as 2nd heat generator, and the dual fuel mixer is controlled accordingly.

Block due to heating request:

If the temperature in the storage cylinder is 2-20 K higher than the current flow temperature, the heat pump is blocked when a heating request is present. Operation is resumed only after the difference between the regenerative storage cylinder and the flow temperature is less than half the switching value.



For solar integration, the adjustable overtemperature should be set to the maximum value to prevent the heat pump from cycling.

Blocking due to DHW demand

If the temperature in the storage cylinder is 2-5 K higher than the current DHW temperature, the heat pump is blocked when a DHW request is present. Operation is resumed only after the difference between the regenerative storage cylinder and the DHW is less than half the switching value.

Blocking due to pool demand

If the temperature in the storage cylinder is 35 °C (adjustable value - Details → Operating instructions HPC 301), when a pool request from the heat pump is present. The release only occurs when the temperature in the parallel buffer cylinder is again 5 K below the switching temperature.

Mixer activation

If there is no bivalent regenerative block, the mixer is controlled continuously **CLOSED**.

If there is a bivalent regenerative block due to DHW or the pool, the mixer is controlled continuously **OPEN**.

If there is a bivalent regenerative block due to the heating, the mixer control is activated.

6.4.9 System fault

In the event of a partial or total system fault of the heat pumps connected in parallel the behaviour of the 2nd heat generator can be freely selected. There is no difference here between an oil/gas boiler or electric 2nd heat generators. It is possible to select between the Minimal, Nominal and Maximal settings (→ Chapter 5.2.1, page 10).



Blocks S38 and S39 are shown in the display immediately a heat pump connected in parallel reports a problem. Faults F38 and F39 are shown in the display immediately all heat pump connected in parallel report a problem.

6.5 Output control

The Cascade controller defines the switching on and off of individual output ranges of the compressors via output stages. In this connection, each compressor has an optimum range and a maximum range.

The output stage is increased when there is high heat energy demand (→ Chapter 5.2.3, page 12). Specific times can be freely selected for reducing and increasing the output stages, subject to the operation mode.

The maximum output stage corresponds with the release of the 2nd heat generator and is locked by setting a limit temperature, with the result that only when this temperature is undercut will a oil/gas heater or electric heat generator be released.

6.6 Building services management system

NOTICE

Improper operation of the heat pump due to building management systems, e.g. as a result of runtimes that are unacceptably short.

- ▶ No liability is accepted for damage caused by connecting third-party components to the heat pump.

There are two options available for connecting the Cascade controller to a building management system.

- Transfer of the default value by way of digital interface via the BMS (Building Management System). There are various protocols and interfaces available for this purpose (→ Chapter 6.6.1, page 15).
- Wiring digital inputs with the possibility of influencing the control of the heat pump on the HPC 301/ HPC 301 C. Using digital inputs it is possible here to be switched between heating and cooling (→ Chapter 6.6.3, page 15) and to have influenced the operating mode via the parameterisable block external (frost protection/DHW/ holiday/summer) (→ Chapter 6.6.2, page 15).

NOTICE

Safety functions may be compromised when the requisite pump foreruns and afterruns are not adhered.

- ▶ Always connect primary circuit pumps (M16) or – depending on the hydraulic integration – the heating pump (M13) to the HPC 301 of the heat pumps connected in parallel.

6.6.1 BMS interface

The BMS interface provides connectivity to Modbus RTU or KNX via the extensions available as optional accessories.

These extensions can be used, among other things, to read out operating data and history, and to configure settings such as mode or setpoint values. It is possible to query different values of the heat pump connected in parallel via the BMS interface of the Cascade controller.

NOTICE

Malfunction due to improper use.

- Immediately a Cascade controller is provided with an LWPM Modbus RTU network card and this is actuated by a BMS, the separate control of the heat pump via BMS has to be ceased.

Unlike the HPC 301 there is no Modbus RTU network card installed in the HPC 301 C, as standard. In order to equip the HPC 301 C with a Modbus RTU network card one of the network cards from an HPC 301 of the heat pumps connected in parallel has to be removed. Please refer to the installation instructions for the network card for further details. Please take into account that a parallel actuation of the Cascade controller and heat pump connected in parallel via a BMS has to be discontinued and proper function cannot be guaranteed.

In general, a request from the heat pump in conjunction with a building management system via an interface should be given preference.

Further information on these options can be found in the description of the relevant product, accessories and interface specifications.



6.6.2 Block external

The Cascade controller can be blocked or released via a digital input (DI2 – grey block – details can be found in the wiring diagram) for one of the following functions:

- Frost protection
 - The heat pump maintains minimum system temperatures; DHW heating and pool heating are blocked
- Block hot water
 - The heat pump is enabled; the minimum DHW temperature is maintained
- Operating mode **holiday**
 - The heat pump maintains the reduction value; DHW is blocked
- Operating mode **summer**
 - The heat pump maintains the minimum system temperature; DHW heating is released

Block external	State
active	open
inactive	closed

Table 11 Block function overview

In All case, frost protection is guaranteed.

If the "block external" function is to be used, it must be activated by the customer service team when the heat pump is commissioned.

6.6.3 Heating/cooling changeover

For parallel circuits designed for both heating and cooling, the operating mode can be changed via a digital input (K28 - cooling function - Details → Electrical plan) on the Cascade controller.

Operating mode	State
Heating	open
Cooling	closed

Table 12 Heating/cooling changeover

7 Error history

In the event of a fault of a heat pump connected in parallel, this is detected by the HPC 301 C. This heat pump is not available for the Cascade controller. If every heat pump connected in parallel is malfunctioning, this is recognised by the Cascade controller. In a bivalent system, the second heat generator takes on the heating and the DHW heating. In single energy source systems, the DHW heating is stopped. The immersion heater maintains the minimum permissible return temperature.

Once the fault has been rectified, the heat pump connected in parallel can be put back into operation. The Cascade controller recognises this and holds the heat pump in a request pending queue.



In single energy source systems, the heating can be taken on by the immersion heater and the DHW heating by the flange heater by converting to the 2nd heat generator operating mode.

Diagnosis, Fault – Alarm – Block

The last 10 causes of a fault and a block that occurred are documented in the "Information - fault history/block history" menu. The documentation includes the date, time, heat source temperature, flow temperature, return temperature as well as the status message.

Fault code	Fault	Message	Action
F5	Expansion N17	The "Cooling" expansion module is not being recognised.	► Check the connecting cable. – Cable broken? – Plug loose? – Are individual wires swapped? ► Check the power supply
F6	0Electronic expansion valve	The electronic expansion valve is not being recognised.	
F15	Sensor technology	A fault has occurred in the relevant sensor system; the exact cause is displayed in plain text.	► Check the connecting cable. – Cable broken? – Plug loose? – Are individual wires swapped?
F38	Heat pump communication	The Cascade controller is no longer connected to a heat pump. All heat pumps are offline	
F39	Heat pump fault	Every heat pump connected to the Cascade controller has a fault.	

Table 13 Error history

8 Block history

In the event of a block of a heat pump connected in parallel, this is detected by the HPC 301 C. This heat pump is not available for the Cascade controller.

Block code	Lock	Brief description
S2	Vol. flow rate	The volumetric flow rate is outside the specified limits.
S3	Heat pump	The heat pump is reporting an unknown block.
S5	Function check	The function check has been activated by a user.
S7	System check	The system check has been activated by a user for approx. 24 hours.
S8	Delay on operating mode changeover	The delay time protects the heat pump from a rapid change in temperature caused by a cooling and DHW request.
S11	Mains load	The heat pump starts up once the mains load has elapsed in order to fulfil a pending demand. The mains load is a requirement imposed by energy suppliers and can last up to 200 seconds after power is restored or following a supplier-imposed block.
S13	DHW reheating	DHW reheating via the flange or pipe heater is active.
S14	Regenerative	When the "Bivalent-Regenerative" operating mode is selected, the temperature in the storage tank is high enough to meet the current demand.
S15	Energy supplier block	An energy supplier block is present.
S25	Block external	The system has been placed in block mode by an external block signal at input ID4. This function can be configured in the menu.
S34	2. Heat source	The 2nd heat generator operation mode was selected. The heat pump is switched off. Heat is generated exclusively by the 2nd heat generator.
S38	Heat pump communication	The Cascade controller is no longer connected to a heat pump. One or more connected heat pumps is offline.
S39	Heat pump fault	One or more heat pumps connected to the Cascade controller has a fault.

Table 14 Block codes

9 Environmental protection and disposal

Environmental protection is a fundamental corporate strategy of the Bosch Group.

The quality of our products, their economy and environmental safety are all of equal importance to us and all environmental protection legislation and regulations are strictly observed.

We use the best possible technology and materials for protecting the environment taking account of economic considerations.

Packaging

Where packaging is concerned, we participate in country-specific recycling processes that ensure optimum recycling.

All of our packaging materials are environmentally compatible and can be recycled.

Used appliances

Used appliances contain valuable materials that can be recycled.

The various assemblies can be easily dismantled. Synthetic materials are marked accordingly. Assemblies can therefore be sorted by composition and passed on for recycling or disposal.

Old electrical and electronic devices



This symbol means that the product cannot be disposed of with other waste, but must be taken to waste collection points for treatment, collection, recycling and disposal.

The symbol is valid for countries that have directives on electronic waste, e.g. "European Union Directive 2012/19/EC on end-of-life electrical and electronic appliances". These provisions define the regulatory framework of the directive valid for the return and recycling of used electronic appliances in each country.

Electronic appliances that may contain hazardous substances must be recycled responsibly in order to minimise possible damage to the environment and dangers to people's health. To this end, the recycling of electronic waste contributes to the preservation of natural resources.

For more information on the environmentally safe disposal of used electrical and electronic appliances, please contact the local authorities, waste disposal company or distributor from which you purchased the product.

You can find more information here:

www.bosch-homecomfortgroup.com/en/company/legal-topics/weee/

Batteries

Batteries must not be disposed together with your household waste.

Used batteries must be disposed of in local collection systems.

10 Data Protection Notice



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