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Heating cascades

Mode of operation and settings

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1 General information

Copyright

Software Description

The software version described in this documentation corresponds to the version valid at the time of publication. The software version installed on your product may differ from that described in this documentation.

A software update to a more recent version can always be performed. With the appropriate authorisation, the required files can be found at "www.eta.co.at".

Subject to technical changes

We reserve the right to make technical modifications without notice. Printing and typesetting errors or changes of any kind made in the interim are not cause for claims. Individual configurations depicted or described here are only available optionally. In the event of contradictions between individual documents regarding delivery scope, the information in our current price list applies.

Explanation of symbols

Instructions and information

Layout of safety instructions

SIGNAL WORD!

Type and source of danger

Possible effects

- Measures for avoiding the danger

Types of safety instruction

CAUTION!

On non-compliance with this safety instruction, there is a risk of material damage.

WARNING!

On non-compliance with this safety instruction, there is a risk of physical injury.

DANGER!

On non-compliance with this safety instruction, there is a risk of major physical injury.

2 Description

Requirements

A heating cascade refers to having multiple boilers and/or oil/gas burners connected together. Up to 6 ETA boilers/burners can be connected together.

Permissible ETA boiler types:

- PU
- PC
- ePE-BW
- PE-K
- HACK
- ePE-K
- eHACK
- HACK VR

In addition, the following requirements must be met:

- 5 temperature sensors on buffer
- CAN-Bus connection
- Control extension TKS-W or T1-W (recommended for the fail safety)

The details in the description relate to the BufferFlex.

Output demand on buffer

When the consumer removes hot water from the buffer, the temperature in the buffer drops. When the temperature drops below the value [Buffer top target], the buffer demands output from the boiler or the heating cascade. The buffer switches off its output demand when the set values [Buffer bottom off] and [Buffer top target] are exceeded.

Division of demanded output

Within a heating cascade, the demanded output is divided proportionally among all boilers and burners that are running.

Further information for the CAN-Bus

For further information on the CAN-Bus, please refer to the separate "CAN-Bus connections" instructions.

The optional CAN router circuit board [EC-R] can be used to extend the CAN-Bus. This circuit board also serves to increase the overvoltage protection for the CAN-Bus. For further information, please refer to the accompanying circuit board instructions [EC-R].

3 Adjustable parameters

Boiler order and full load hours

All boilers have the same factory setting for the parameter [Boiler order]. This means that after every 200 full load hours, the boiler switches to the boiler with the fewest full load hours. So the overall runtime of all boilers is evenly distributed. Within a heating cascade a burner can have the same [Boiler order] setting as a boiler. The boiler that is currently in operation is called the "lead boiler". This is shown framed in the graphs below.

1 full load hour corresponds to, e.g.:

- 1 h with 100% boiler load
- 2 h with 50% boiler load
- 3 h with 33% boiler load

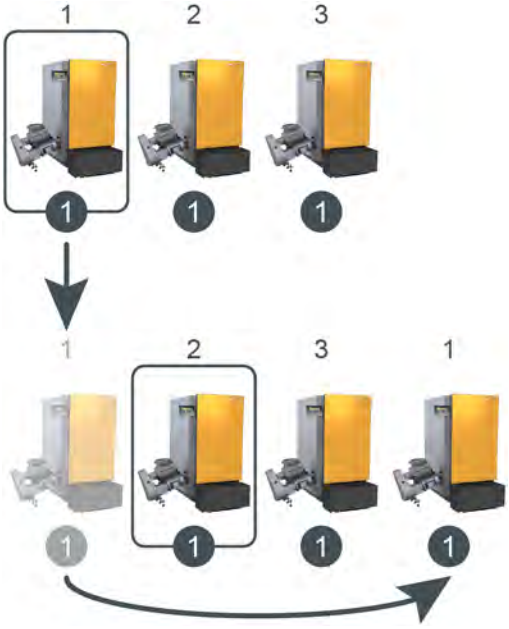


Fig. 3-1: Boiler order

1 corresponds to the boiler order [1]
2 corresponds to the boiler order [2]

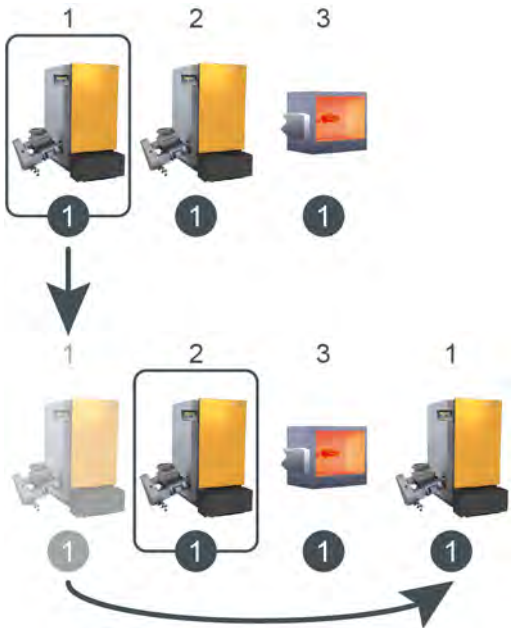


Fig. 3-2: Boiler order with burner

A boiler sequence can be defined with different values for the [Boiler order] parameter.

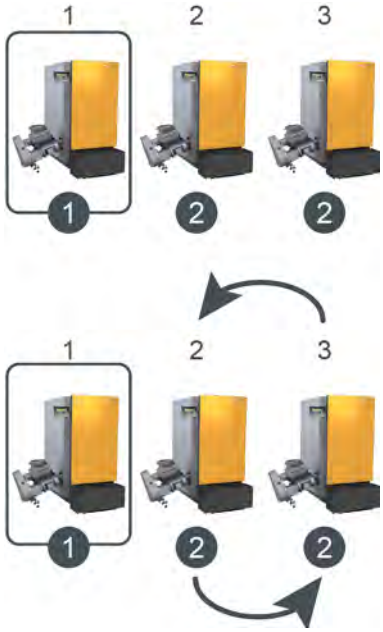


Fig. 3-3: Boiler order

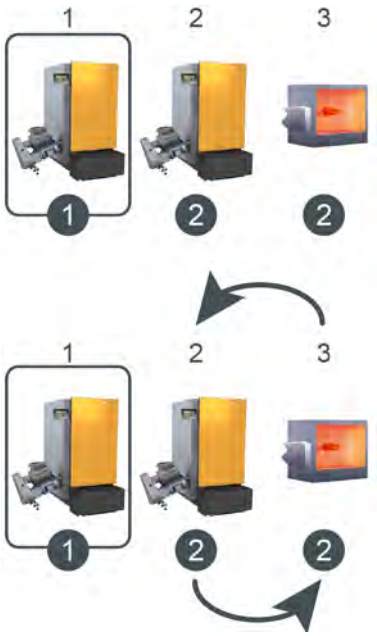
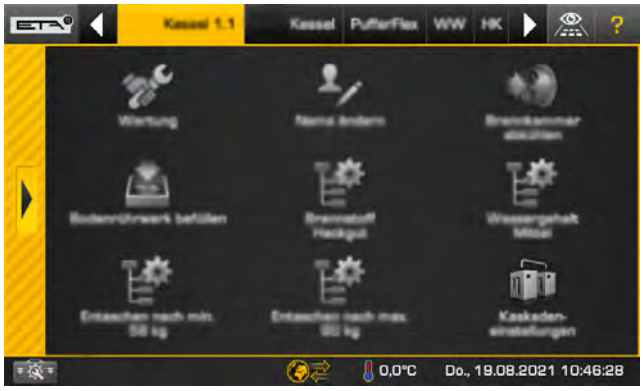


Fig. 3-4: Boiler order with burner

A boiler is automatically put back in the boiler order ranking if the boiler is in one of the following operating conditions:

- Malfunction
- Switched off
- Locked

Some parameters can also be found in the settings (button) of the boiler's function block. There, the parameters are identified by the symbol and can be adjusted by tapping. This saves you having to search through the text menu for these parameters.



Or also in the text menu under:

Boiler
↳ Settings
↳ Boiler order
↳ Failure readiness
↳ Activate?
↳ outside temperature and above

The full load hours value at which the leading boiler changes is set in the text menu of the BufferFlex function block with the [Switching at] parameter.
The threshold values for the requests of other heat producers can be changed with the additional parameters [Switch-on threshold] or [Switch-off threshold]. The desired charging duration of the buffer is set with the [Desired charging time] parameter. This parameter can be found in the BufferFlex function block under:

Buffer
↳ Boiler/buffer producer
↳ Cascade settings
↳ Switching at
↳ Switch-on threshold
↳ Switch-off threshold
↳ Output regulation
↳ Desired charging time

The individual descriptions are listed below.

Explanation of the [Switch-on threshold] function

This parameter can only be set if several heat producers charge the buffer. This parameter allows you to change the threshold for requesting another heat producer (e.g. second boiler for charging the buffer).

Example:
2 boilers with 80 kW output each charge the buffer. The parameter [Switch-on threshold] is set to 100%.
=> If more than 80 kW (e.g.: 85 kW) is requested from the buffer, the second boiler will be started in order to produce the missing thermal energy (5 kW).

However, if parameter [Switch-on threshold] is set to 110%, it is possible to request a total of 88 kW (=110% of 80 kW) from the buffer without starting the second boiler. The second boiler is only activated if more than 88 kW is requested.

Explanation of the [Switch-off threshold] function

This parameter can only be set if several heat producers charge the buffer. This parameter allows you to change the threshold for switching off the additional heat producer (e.g. second boiler for charging the buffer).

Example:
2 boilers with 80 kW output each are currently charging the buffer. The parameter [Switch-off threshold] is set to 80%.
=> If the request from the buffer falls below 64 kW (=80% of 80 kW), the last boiler started will be switched off again.

Explanation of the [Desired charging time] function

This parameter specifies the time that the boiler is allowed to take to charge the buffer to the required target temperature [Buffer top target].

In cascade systems (several boilers charge one buffer), adjusting this parameter may be helpful for faster buffer charging. Shortening this time causes other boilers to go into operation sooner to help charge the buffer. Extending the parameter would extend the runtime of an individual boiler.

Explanation of the [Failure readiness] function

This parameter can only be set if several heat producers charge the buffer. If the outside temperature exceeds the value set in parameter [outside temperature and above], then the boiler will be put into [Failure readiness] operating mode. This boiler may only heat again when another boiler has a malfunction or no other boiler is ready. If the outside temperature falls below this value by 2 °C, then the cascade control of the buffer is used again based on the [Boiler order]. With the [Activate?] parameter, the boiler can be set in [Failure readiness] operating mode.

De-ashing

If a boiler is just about to de-ash, the de-ashing of the other boilers is locked. With parameter [Delay of the de-ashing lock], the de-ashing lock remains in effect longer by the amount of this value, so that premature de-ashing of another boiler is prevented. The parameter is set in the text menu of the boiler.

Boiler
↳ De-ashing
↳ Delay of the de-ashing lock

This parameter can only be viewed and changed with temporary authorisation [Service KD].
Contact customer service by phone for the password:
+43 (0) 7734 / 2288 - 700

3.1 Consumer data

M-bus heat flow meter

With a heat meter, the consumer data are transmitted directly to the control system. The configuration and commissioning for the heat meter can be found in the manual of the heat meter.

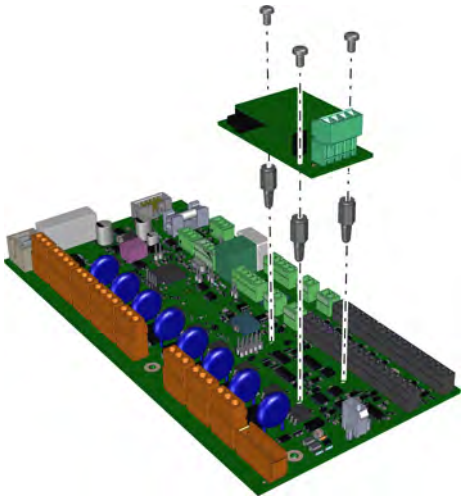


Fig. 3-5: M-bus circuit board for heat flow meter

Setting the outputs for the consumers

If the consumer's output for the buffer are known, set those parameters in the function block of each consumer (e.g.: heating circuit, hot water tank).

Heating circuit
↳ Heating load
↳ spec. heating load
↳ Total area

Tab. 3-1: Output setting at the heating circuit

Hot water tank
↳ Register performance

Tab. 3-2: Output setting on the hot water tank

Buffer
↳ Hot water area
↳ Output for hot water supply

Tab. 3-3: Output settings on the combination buffer

With [Starting after output] the boiler starts if the output of the consumers at the buffer becomes too high, regardless of the set target temperature [Buffer top target].

Buffer ↳ Boiler/buffer producer ↳ Starting after additional criteria ↳ Starting after output

Tab. 3-4: Additional criteria

If the consumer outputs are not known, the BufferFlex automatically estimates the required outputs. However, more precise control is achieved if the actual number of consumer outputs is known.

4 Examples

4.1 Ash removal

If a boiler will soon de-ash, the de-ashing of the other boilers is locked and the output of the boilers is increased proportionally. The temporary increase in output is referred to as "De-ashing lock". The de-ashing lock ensures that only one boiler is de-ashed at a time and all other boilers can continue to operate with increased output.

The previously increased output produces an surplus output, which evens out the output deficit during the de-ashing. After de-ashing the de-ashing lock still remains, so that an early de-ashing of another boiler is prevented.

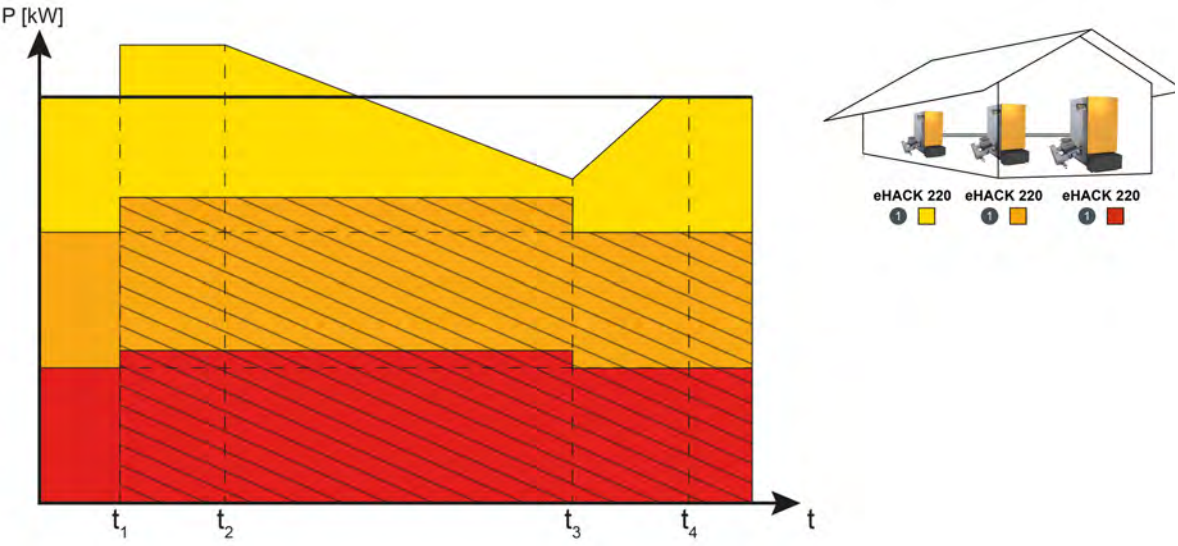


Fig. 4-1: De-ashing process with 3 boilers running

P [kW]	Output
t	Time
t_1	Start of the de-ashing lock. The output of all boilers are increased above the demanded output.
t_1 to t_2	Output surplus compared to the requested output
t_2	Start of ember burn-off and de-ashing
t_2 to t_3	Output deficit compared to the requested output
t_3	End of de-ashing
t_3 to t_4	Follow-up time of de-ashing lock

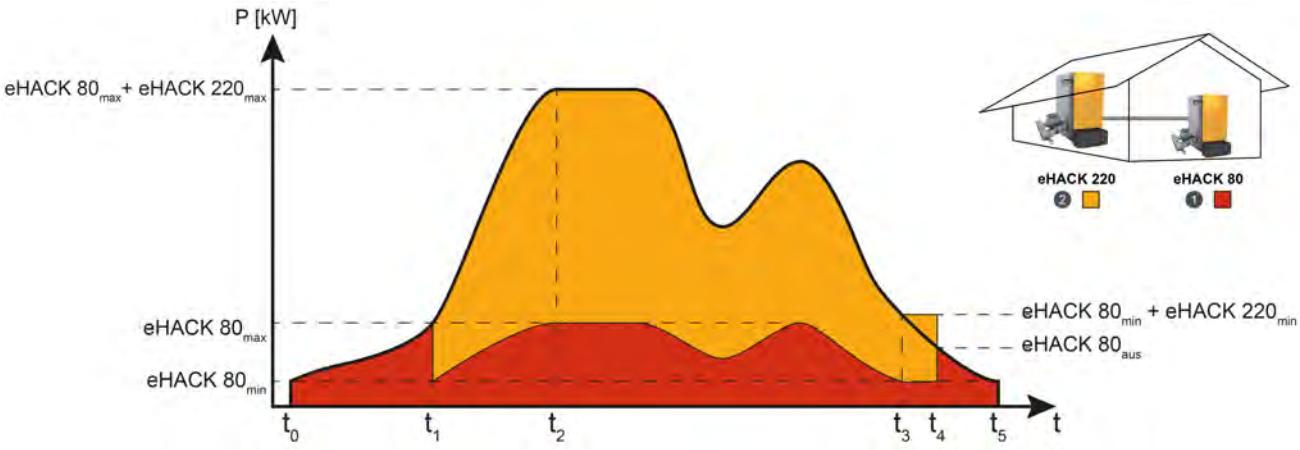
4.2 Two different boilers

In this example, two different boilers are operated:

- eHACK 80 (rated output: 23 – 80 kW, boiler order 1)
- eHACK 220 (rated output: 66 – 220 kW, boiler order 2)

In times when less heat is needed (e.g. in summer and in transitional periods), the output of the eHACK 80 is sufficient, which is why the boiler order [1] is only set for it. For the second eHACK 220 boiler, the boiler order is set to [2], so that it switches on when more output is needed (e.g. in winter).

With the eHACK 220, the fail safety can be activated for the same boiler order at times when less heat is required (e.g. in summer), so that it switches on if the eHACK 80 has a fault/malfunction or is not ready.



P [kW]	Output
t	Time
$eHACK_{max}$	Rated output
$eHACK_{min}$	minimal output
$eHACK_{off}$	Switch-off threshold
t_0	The first boiler (eHACK 80) starts with the demanded output: eHACK $80_{min-max}$
t_1	The first boiler (eHACK 80) reaches its maximum heat capacity: eHACK 80_{max} The second boiler (HACK 220) starts and the demanded output is distributed evenly between both boilers proportionally.
t_2	Both boilers reach their maximum heat capacity: eHACK 80_{max}+ eHACK 220_{max} Between the times t_2 and t_3 the demanded output from the buffer drops/increases. This is distributed evenly between both boilers.
t_3	Both boilers reach their minimum heat capacity: eHACK 80_{min}+ eHACK 220_{min} Since the requested output cannot be produced by the first boiler (eHACK 80) alone, the second boiler (eHACK 220) continues to run at its minimum heat capacity eHACK 220_{min}.
t_4	If the requested output falls below eHACK 80_{off}, the second boiler (eHACK 220) switches off. The first boiler (eHACK 80) continues to run.
t_5	If the buffer no longer requests any output, this boiler also switches itself off.

4.3 Boilers and burners

In this example, one boiler is operated with one burner:

- eHACK 80 (rated output: 23 - 80 kW)
- Burner (optional: controllable burner)

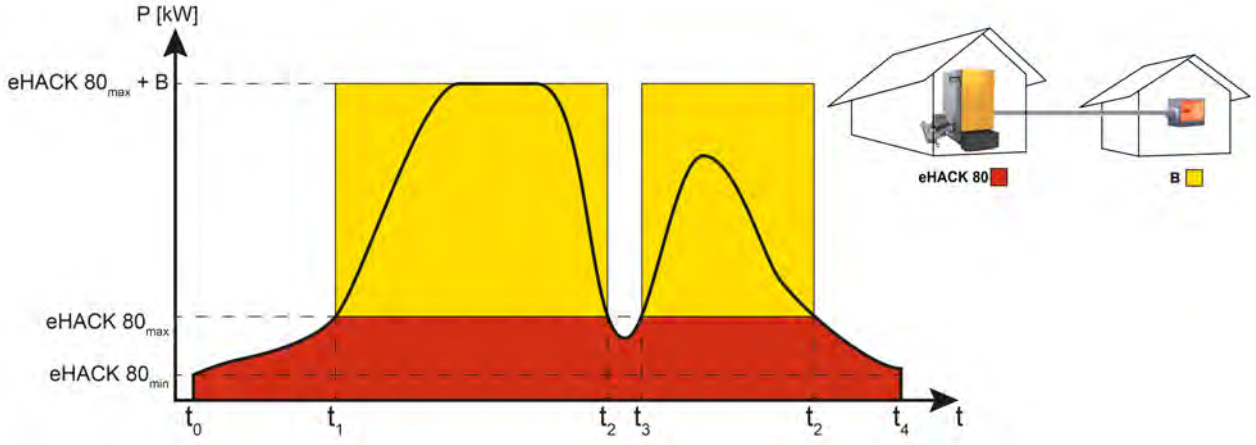


Fig. 4-2: Boilers with burner

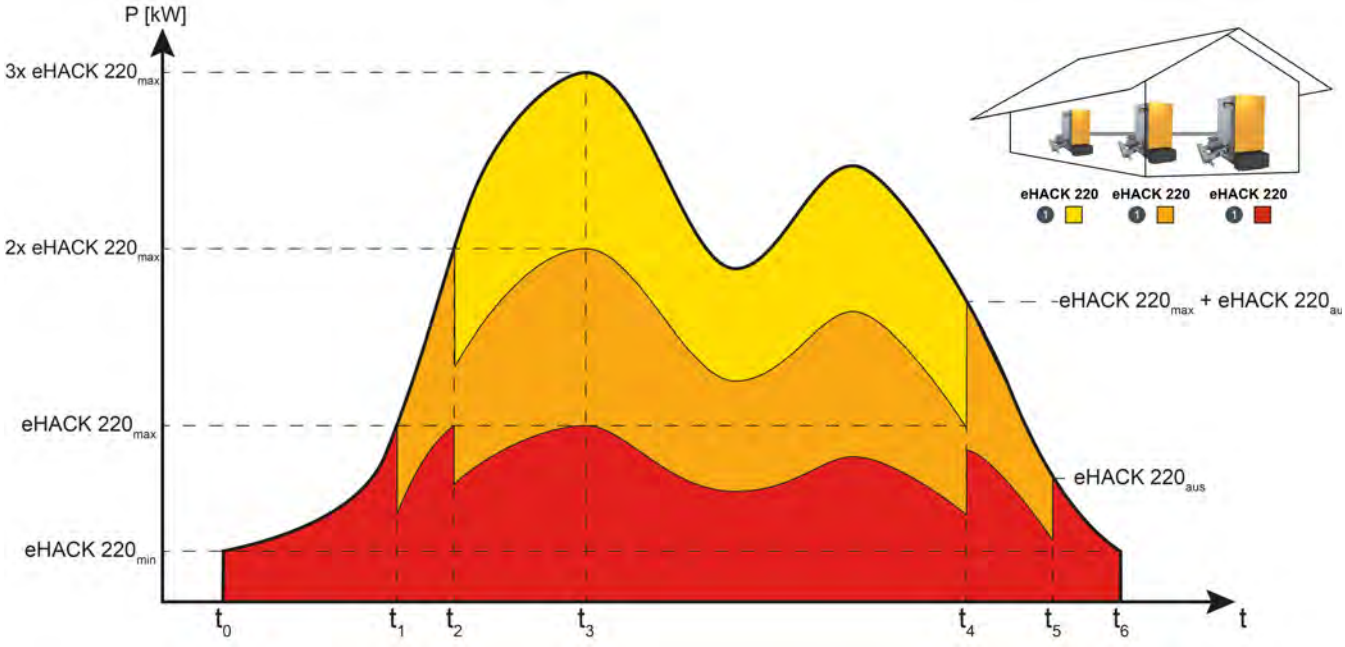
Fig. 4-3: Boiler with controllable burner

P [kW]	Output
t	Time
$eHACK_{max}$	Rated output of the boiler
$eHACK_{min}$	minimal output of the boiler
B_{max}	maximum rated output of the burner
t_0	The boiler eHACK 80 starts with the demanded output: eHACK $80_{min-max}$
t_1	The boiler eHACK 80 reaches its maximum heat capacity: eHACK 80_{max} The burner starts.
t_2	If the requested output falls below the maximum heat capacity of the eHACK 80_{max} boiler, the burner is switched off.
t_3	If the demanded output exceeds the maximum heat capacity of the eHACK 80_{max} boiler, the burner is switched back on.
t_4	If the buffer no longer requests any output, this boiler also switches itself off.

4.4 Several similar boilers

In this example, three similar boilers are operated:

- 3x eHACK 220 (rated output: 66 – 220 kW, boiler order 1)



P [kW]	Output
t	Time
$eHACK_{max}$	Rated output
$eHACK_{min}$	minimal output
$eHACK_{off}$	Switch-off threshold
t_0	The first boiler (eHACK 220) starts with the demanded output: eHACK $220_{min-max}$
t_1	The first boiler (eHACK 220) reaches its maximum heat capacity: eHACK 220_{max} The second boiler (HACK 220) starts and the demanded output is distributed evenly between both boilers proportionally.
t_2	Both boilers reach their maximum heat capacity: 2x eHACK 220_{max} The third boiler (eHACK 220) starts and the demanded output is distributed evenly between all boilers proportionally.
t_3	All boilers reach their maximum heat capacity: 3x eHACK 220_{max} Between the times t_3 and t_4 the demanded output from the buffer drops/increases. This is distributed evenly between all boilers.
t_4	As soon as (eHACK 220_{max}+ eHACK 220_{off}) is fallen short of, the last boiler is switched off. The requested output is evenly distributed to the other two boilers.
t_5	If the requested output falls below eHACK 220_{off}, the second boiler (eHACK 220) switches off. The first boiler (eHACK 220) continues to run.
t_6	If the buffer no longer requests any output, this boiler also switches itself off.

5 CAN bus installation

Example of a heating cascade with two boilers, cascade control TKS-W and a control extension T2-BT in the adjoining building

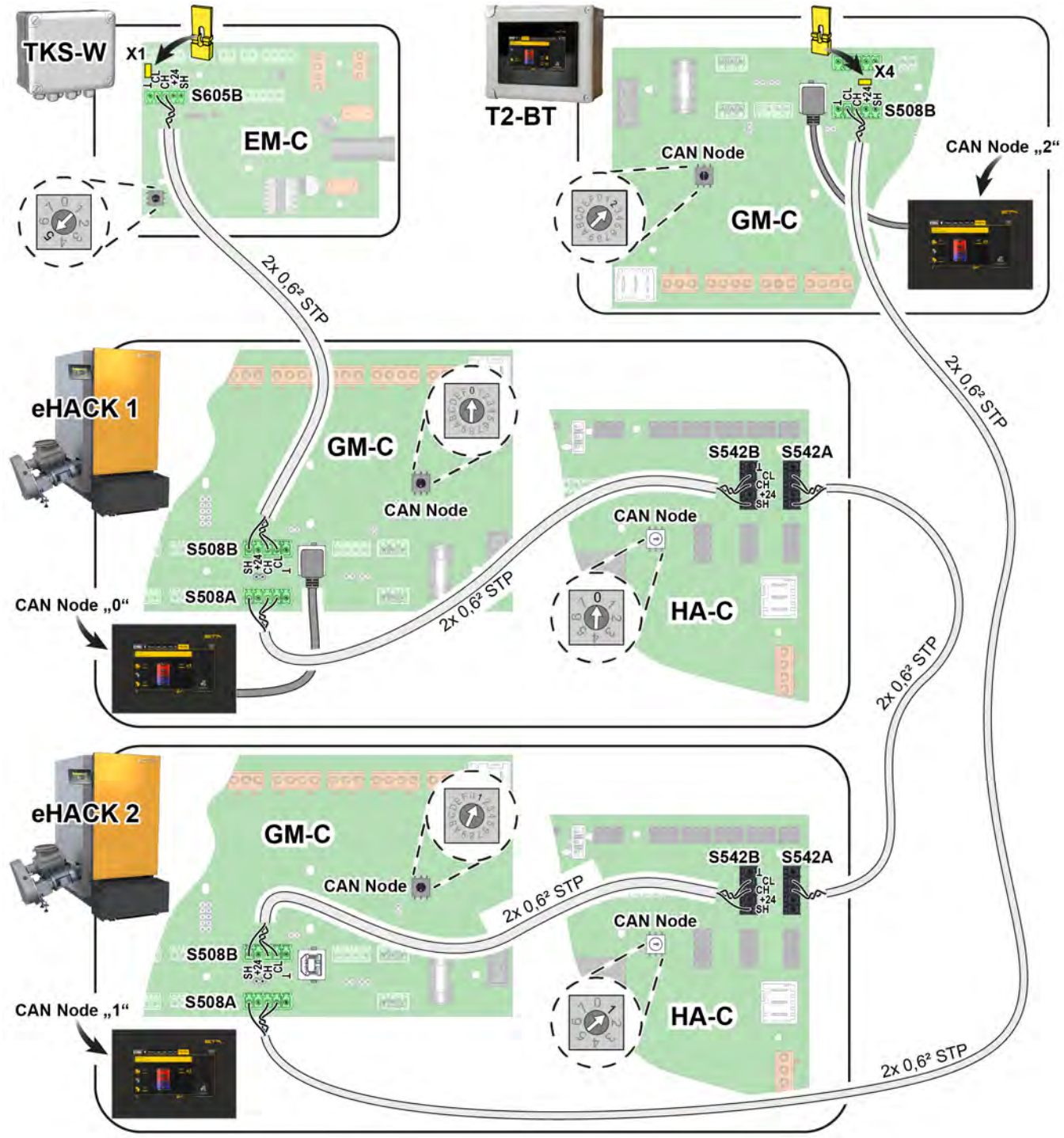


Fig. 5-1: CAN bus wiring

In order to distinguish between the identical circuit boards ([HA-C] and [GM-C]) and the control units ([BE-P]) in the control system, they must have different node numbers.

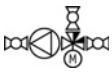
6 Hydraulic schematics

Information for the schematics

The examples listed provide non-binding information on possible hydraulic schematics, without claim of completeness.

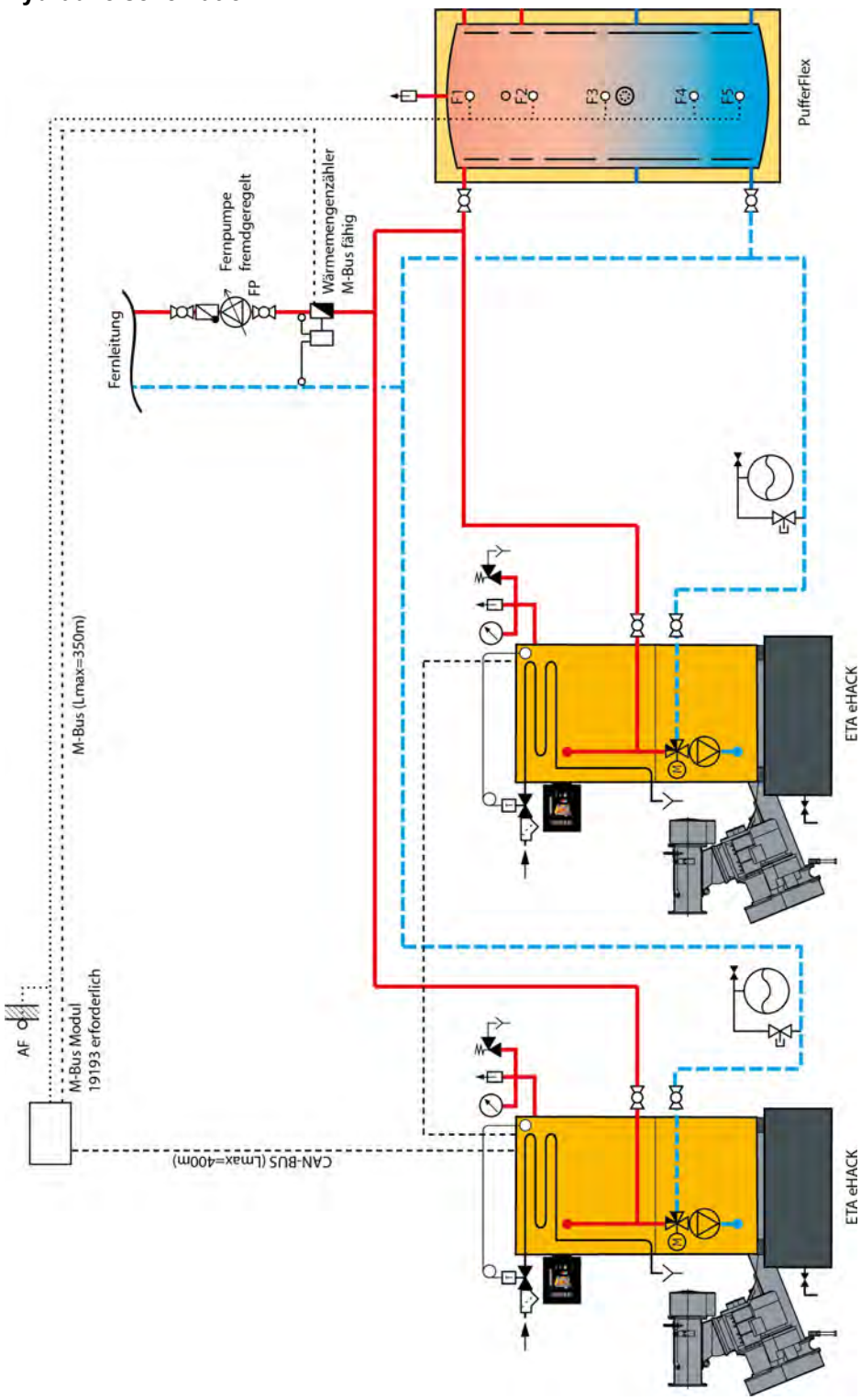
The applicable rules of engineering apply for practical implementation. The safety installations are to be implemented according to local regulations. No liability is provided.

Description of the symbols in the schematics

Description		Description	
	Heating circuit		Mixer with electrical actuator
	Heating circuit with radiators, High temperature heating circuit		Mixer with thermal actuator
	Heating circuit as underfloor heating, Low temperature heating circuit		Boiler pump with return riser
	Air heater		Thermostatic hot water mixer
	Heat exchanger		Flow control valve with electrical actuator
	Shut-off valve		Flow control valve with thermal actuator
	Ball valve		Changeover valve with electrical actuator
	Shut-off valve with cap		Changeover valve with electrical actuator
	Electrical zone valve		Differential pressure control valve
	Strand regulating valve		Temperature sensor
	Shut-off valve		Pressure sensor
	Safety valve		Room sensor
	Thermal emergency cooling valve		Contact thermostat
	Pressure gauge		Immersion thermostat
	Thermometer		Safety temperature limiter
	Emptying valve		Maximum pressure switch
	Air trap		Maximum pressure limiter
	Strainer		Minimum pressure switch
	Expansion tank		Minimum pressure limiter
	Pump		Control extension in wall box
	Pump group		Control extension in wall box with ETAtouch screen
	Oil or gas auxiliary boiler		Heat meter

6.1 Sample

Hydraulic schematic



The thermal emergency cooling valve is only prescribed for eHACK boilers over 80 kW.

In this example, the pipe pump is controlled by a superordinate control system, to which the additional consumers are also connected. If the consumers are connected to the ETAtouch control system, the pipe pump can also be controlled via the ETAtouch control system.

For cascade systems, each boiler and each control extension should be connected to a separate power supply, fuse and a ground fault interrupter (GFI). So in the event of a fault, only the respective boiler fails (or control extension) and not the entire system.

The control extension in the wall mounted box with the [EM-C] circuit board and 5 temperature sensors is available as a set with the designation "Cascade controller TKS-W" (item no: 19114). Buffer temperature sensors are connected to it so that the remaining consumers can still demand heat in the event of a fault.

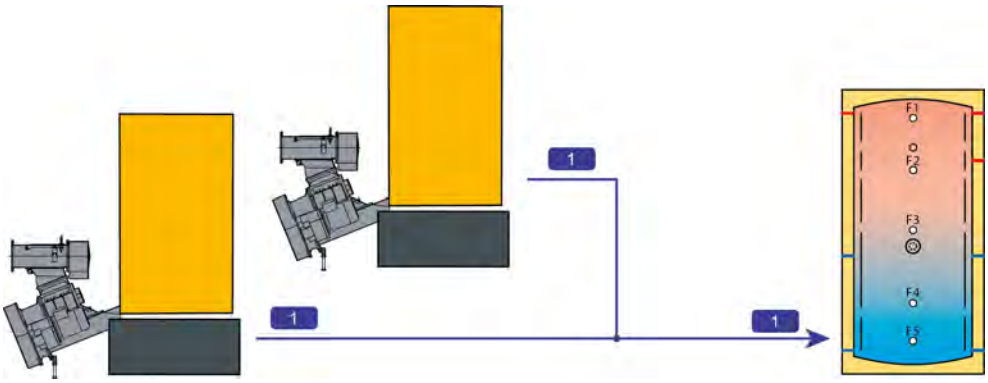
Circuit board	Function blocks		Description
HA-C 0		Boiler	Wood chip boiler Set the fuel used and the design of the fuel discharge in the boiler settings (e.g.:[Agitator from 4.5 m]).

Circuit board	Function blocks		Description
HA-C 1		Boiler	Wood chip boiler Set the fuel used and the design of the fuel discharge in the boiler settings (e.g.:[Agitator from 4.5 m]).

Circuit board	Function blocks		Description
GM-C 0		Sys	System
		Settings:	
		Outside temperature sensor	via board input

Circuit board	Function blocks		Description
EM-C 5		BufferFlex	Buffer storage tank
		Settings:	
		Temperature sensor number	For cascading systems, always install at least 5 temperature sensors.
		Combination tank	No
		Consumer levels	1
		Solar heating system	not present
		Start relief for log boiler	No
		Options:	
		☑ M-bus heat meter	

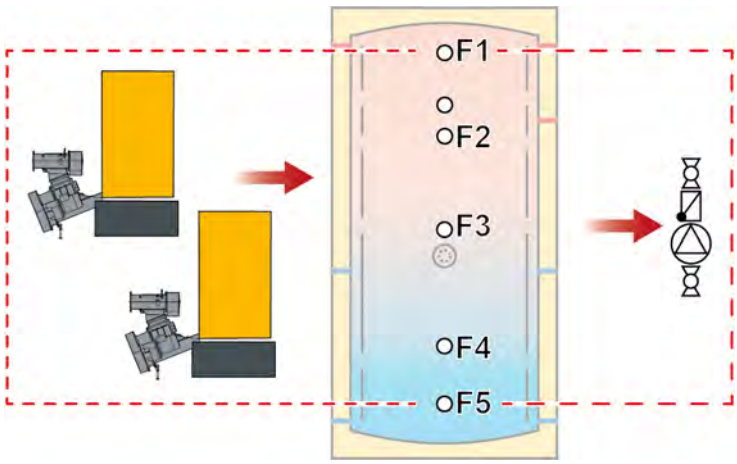
Connections



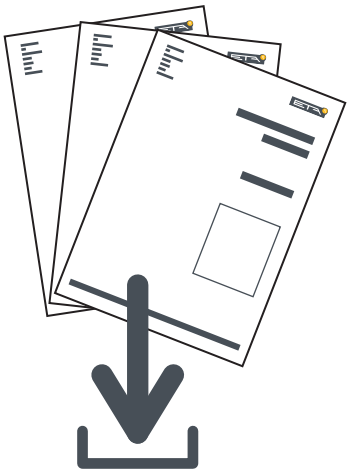
= type [Heating water]

Producers	Consumers
1 HA-C 0: Boiler: Flow	1 EM-C 5: BufferFlex: .
1 HA-C 1: Boiler1.1: Flow	

Levels in buffer



Levels in buffer	Sensor assignment in buffer (from - to)
Boiler/buffer producer	
Buffer top	Sensor 1 (top)
Buffer bottom	Sensor 5
Consumers	
Buffer top	Sensor 1 (top)
Buffer off	Sensor 5



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