

# Innovative Heating controls



**KeEnergy Heating controls**  
for heat pumps and biomass heating systems

**KEBA®**  
Automation by innovation.

## Heating controls

# KeEnergy – the best control for your heating system.

KEBA has been developing and producing innovative and high-quality solutions for more than 50 years for the industrial, banking, service and energy automation branches.

On account of the company's innovative capabilities, it was natural that KEBA became involved with forward-looking topics such as energy automation and renewable energies. The basic idea is to contribute to protecting the environment in order to reduce global warming. KeEnergy is one of the thereby created business areas that concentrates on heating controls for heat pumps and biomass boilers.





One step ahead  
with KeEnergy.





# Our goal: Satisfied customers.

Our aim is to provide a warm home, efficient heating and have a satisfied customer. This can only be achieved by perfect interaction between the control and the heat pump or biomass heating system. As a specialist for heating controls, we are the ideal partner for your heating project. A KeEnergy control keeps ahead of the competition by continuously monitoring the latest trends and innovations in the heating sector.

## Maximum ease-of-use

Intuitive operation for both end users and during commissioning is our top priority. The end user should enjoy operating the heating control using a Smartphone or tablet just as much as using the built-in AP440 touch-control operating unit. Quick commissioning of the heating is made easier for the technician by the well thought-out commissioning wizard.

## Reliability

As a manufacturer of innovative and high-quality products and solutions for industry, bank and service automation, KEBA is accustomed to the high quality requirements and industry standards. This quality and reliability is also included in the KeEnergy heating controls and is available to the end user in his heating system.

## Energy efficiency

To achieve high annual performance factors, KEBA offers hardware and software modules that are tailored to one another to increase the energy efficiency. Power costs can thereby be reduced as much as possible. The increases in energy efficiency are achieved through model-based overheat control, inverter plus compressor with characteristic field monitoring and optimized flow rate control.

## Ideal support

Through professional project management and extremely fast production of prototypes, the development time is shortened and the final heating system is on the market on time. The heating controls are optimized for the customer down to the smallest detail, thereby maximizing customer benefits and guaranteeing customer satisfaction.

# The technology expert for energy-efficient heating controls.

**The challenges of today's heating market range from energy efficiency, quality and safety to intuitive operation and rapid commissioning by the installer.**

Components with long term availability are in demand, as are quick "time-to-market", short-term trial runs, rapid service staff training and last but not least a well-balanced price-performance ratio.

**The KeEnergy system includes heat pump controls, boiler modules for biomass heating systems, touch-control operating units, heating circuit controllers and room controllers.**

In addition, thermal solar and PV systems can also be integrated to further increase their energy utilization. Via the standardized Modbus interface, simple connection to home automation systems is possible.

Complex technologies that were previously reserved for companies with large development departments are now available to smaller, medium-sized businesses. Through extensive specialized knowledge and the best project management quality, new heating projects are successfully completed in record time.



## The advantages of KeEnergy

- // Complete solutions for heat pumps and biomass heating systems
- // Components and platform for individual customer solutions
- // Specialized for heat generation, heat distribution and the system environment (remote maintenance, diagnosis tools, control units etc.)
- // Best hard- & software quality

# Maximum project support.

Optimized overall systems for the respective target market are developed in intensive cooperation with customers on the basis of a comprehensive product construction kit. The comprehensive understanding of the requirements, processes and markets down to the smallest detail has top priority at KEBA and forms the basis for a successful and long-lasting partnership.

Intense and comprehensive support over the entire project life cycle is the prerequisite for successful heating projects. Professional project management and high flexibility with prototypes shorten the time-to-market and guarantee maximum customer benefits and satisfaction during every phase of a project.

Before ordering a series, it is possible to test systems for safety and energy efficiency and optimize the heating control accordingly. An enormous competitive edge is achieved due to these quality and time benefits.

- // Professional system consultation
- // Competent application development
- // Comprehensive range of training
- // Quick support



Intense support over the  
entire project life cycle.



**Durable and safe.**  
For many years.



# High-quality hardware and software.

Thanks to a wide variety of different projects, KEBA has acquired extensive hardware and software knowledge during the course of industry-specific development of heating controls. This knowledge has flowed into the KeEnergy system in order to make it more user-friendly and energy-efficient. Due to the perfect coordination of hardware and software, the KeEnergy system has a long service life and provides reliable heating operation over many years.

## Operation

Simple and reliable operation of the heating system is possible via a permanently installed touch panel as well as via smartphone, tablet or PC. System visualization also makes it possible to check the heating at a glance.

## Remote operation and remote maintenance

When using the KeEnergy remote operation and remote service package, customers and service technicians can access the system from anywhere in the world using a reliable remote operation connection.

## Diagnostic options

With the graphical evaluation on the operating device, plots of temperatures or energy consumption are displayed in well-structured diagrams, simplifying system optimization.

## Scalable software packages

In the basis of the Linux software platform, three configuration levels (Complete, Individual and Embedded) are available which can be chosen depending on the customer's strategic alignment.

## Energy efficiency

Thanks to a heat pump specific overheat control the KeEnergy systems ascertain the correct initial position of the electronic expansion valve for heat pumps and steadily control to an optimum annual performance factor with a adjustable low overheat.

## Technology functions

High annual performance figures are achieved by integrating photovoltaic systems and weather forecasts and having an optimized heating pump flow rate.



# Simple operation

## with graphical support.

Convenient operation of the heating system is important for both the end user and commissioning engineer. Operation of the heating system is easy and reliable with the touch operating panel and its innovative, modern operating concept. The desired room temperature or heating program can be selected using mobile end devices such as Smartphones or tablets.

### Meaningful graphical diagnosis

Using the graphical display, the technician can obtain a clear view of the temperature, power or energy consumption gradients in the form of a graph or bar chart.

Multiple parameters can be clearly displayed numerically or graphically using the specially developed diagnosis tool, Servicetool. Live recording makes it possible for the commissioning engineer to check the correctness of the chronological trend of certain heating parameters during commissioning.

### Quick and easy commissioning

Due to its simple structure, the heating control system can be commissioned with very little work. After being switched on, the heating system is configured in accordance with the respective hydraulic schematic and for the number of heating components (heating circuits, hot water tanks, PV etc.) in just a few steps using the commissioning wizard. All user input is verified. If necessary, quick support from KEBA technicians can be requested using remote maintenance.

### Remote maintenance and remote operation

Both remote maintenance and remote operation are secure from manipulation due to the use of suitable encryption algorithms. Easy to install – The remote maintenance is easy to install by connecting to the router without the need for expert knowledge of Internet connection technology.

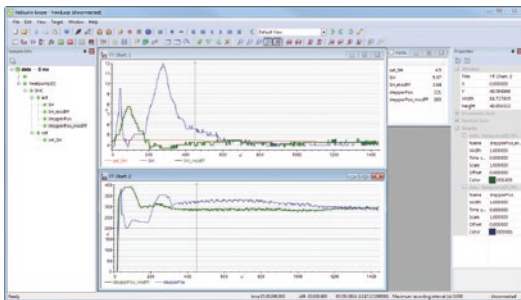
### System visualization at a glance

The web-based system visualization makes it possible to display the statuses and actual values of an individual heating hydraulic system on mobile end devices. Displaying the heating values in your own home also gives you the opportunity of controlling the functionality of the heating.

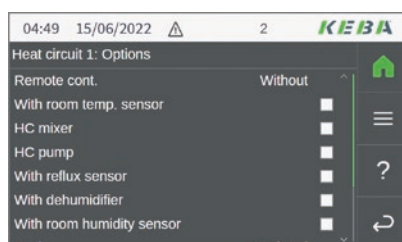
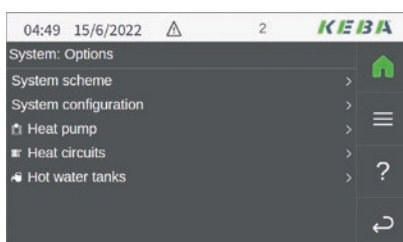


## Benefit from KeEnergy ...

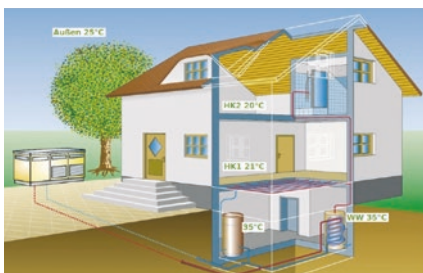
- // Maximum ease-of-use for end users and during commissioning
- // Can be used with tablet, Smartphone, PC
- // Simple remote operation and remote maintenance from any location
- // Easy to install without prior knowledge of communication technology



Diagnosis (Visualization with Servicetool)



Quick and easy commissioning



System visualization (Heating status overview)

# Optimized software packages.

The KeEnergy solution enables an individual design of the application and user interface. In addition to the complete solutions for heat pumps and biomass heating systems, the open system platform also enables an individual adaptation of the system.

This means freedom both in the programming of the heating application as well as in the customization of the user interface.

## Complete package

With the complete package, it is possible to develop turnkey solutions for heat pumps and biomass heating systems, which are ready for series production in a very short time. All components are optimally coordinated in the complete package, from the user interface as a web HMI solution to heat generation and distribution and also comprehensive services.

## Individual package

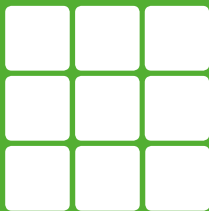
An individual package is used if only selected components are required. The heat generation and the user interface can be programmed by the heating manufacturer himself in order to safeguard the core know-how, for example.

## Embedded package

In addition to the KEBA software framework, which consists of a Linux platform and an Eclipse based programming environment, the Embedded package provides customers with the option of programming everything themselves.

# The right package

for every requirement.



Complete package



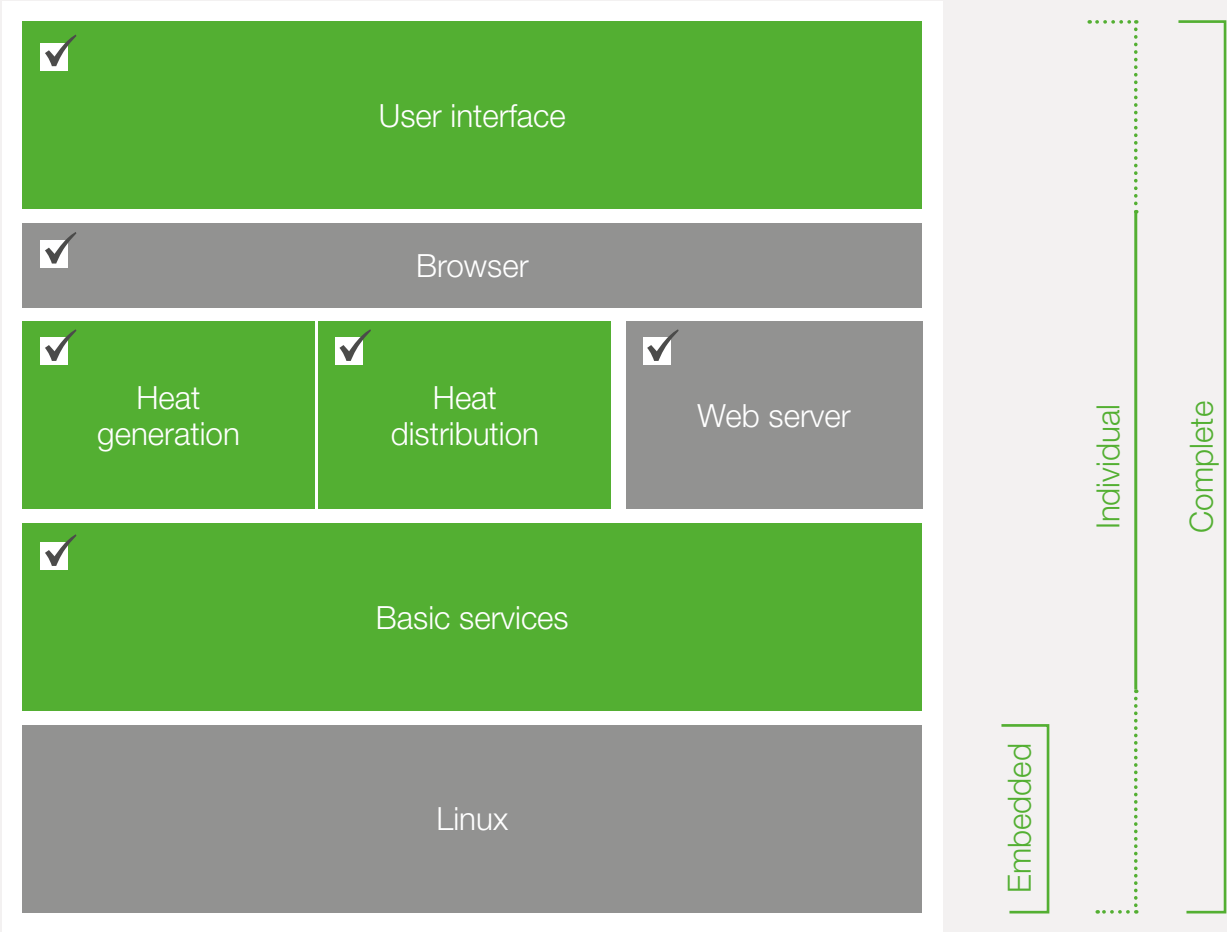
Individual package



Embedded package

The optimal type of cooperation and division of responsibility is defined, depending on the customer’s strategic alignment. The heating manufacturer has all of the options for using the KeEnergy heating control from KEBA as a complete industrial solution or as an individually configured solution.

Software system structure





# Differentiation

through open software architecture.

## Save up to 95% of development expenses

Based on the mature software, which consists of the Linux operating system and the KeEnergy applications for heat pumps and biomass, savings up to 95% of the total expense for the development of a new control software can be achieved.

## Simple integration of technology modules

Individual technology modules such as the user interface, heat generation or heat distribution can be acquired from KEBA or developed in-house.

The Linux operating system allows the use of modern programming and diagnostic tools as well as up-to-date communication standards. This enables the use of extensive software libraries for which Linux drivers are available.

The openness and expandability of the KeEnergy control system ensure investment security and fast “time-to-market” when implementing new requirements.

## Future-proof and free of charge

With Linux, a flexible and modern operating system is available which is continuously extended and updated. The heating application is programmed in C++, and the visualization is programmed in Java using the Google Web Toolkit. Both Linux and the Google Web Toolkit can be downloaded free of charge.

## Additionally available services

A comprehensive range of services and basic functions are available for the control, regulation and visualization tasks in a heating control in the Individual and Complete packages. As well as heat distribution, data recording, a diagnosis system and sophisticated online help, many other functions are available.



# Your path to more energy efficiency.

Optimized software solution packages for increasing the energy efficiency are the result of years of cooperation with heat pump specialists.

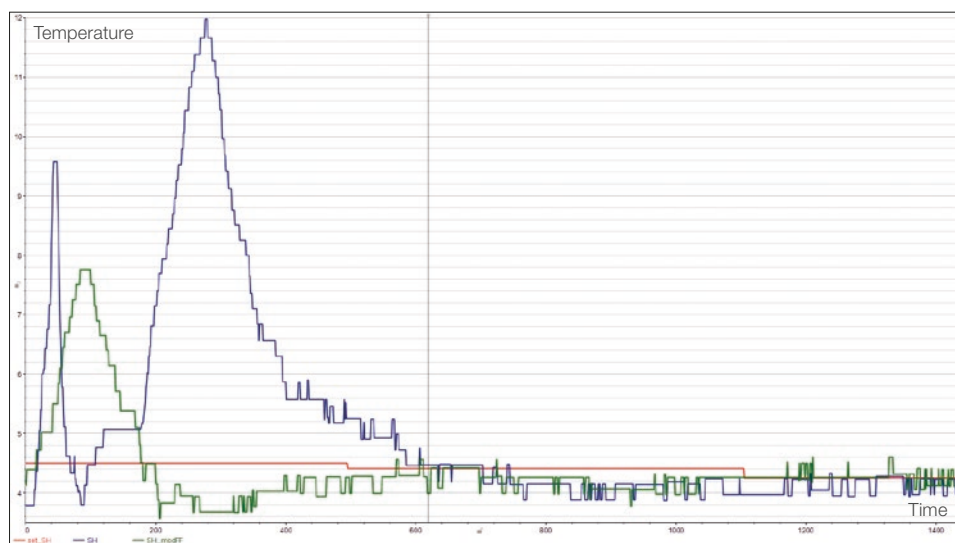
Extensive knowledge of heat pump overheating control and support for many different inverters and well-engineered characteristic field monitoring have also flowed in here.

# The easy way to optimize your heat pump.

## Energy efficiency due to optimum start valve position

The heat pump specific overheat control ascertains the correct initial position of the electronic expansion valve and steadily controls to an optimum annual performance factor with an adjustable low overheat. This particularly advantage with regard to air heating pumps, which are operated at a wide range of different outside temperatures.

Overheating control at the intake gas is used as standard.



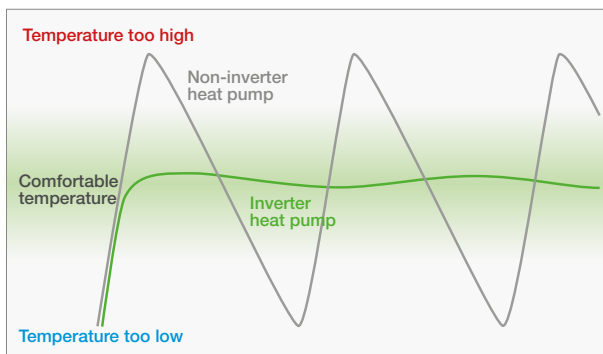
Overheating control: set value (red), without model-based overheating control (blue), with model-based overheating control (green)



## Energy savings of 25% through minimum start-up losses

Using a KEBA heat pump control, the combination of inverter and variable-speed compressor achieves energy savings of up to 25% over standard fixed-speed compressors.

The heat pump always generates the heat that is currently required with maximum energy efficiency because of this combination. Fixed-speed compressor start/stop cycles are avoided, meaning that the compressor is looked after in the best possible way.

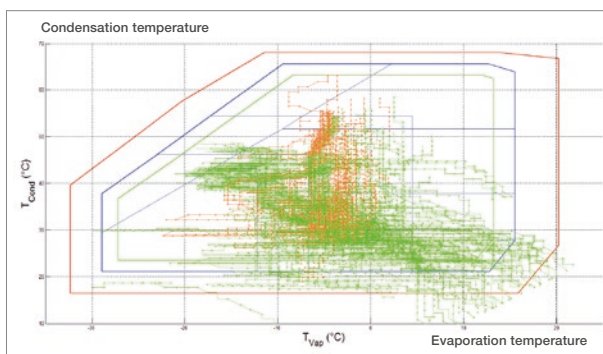


Comparison of inverter heat pumps (green) and non-inverter heat pumps (gray).

## Many years of stable operation

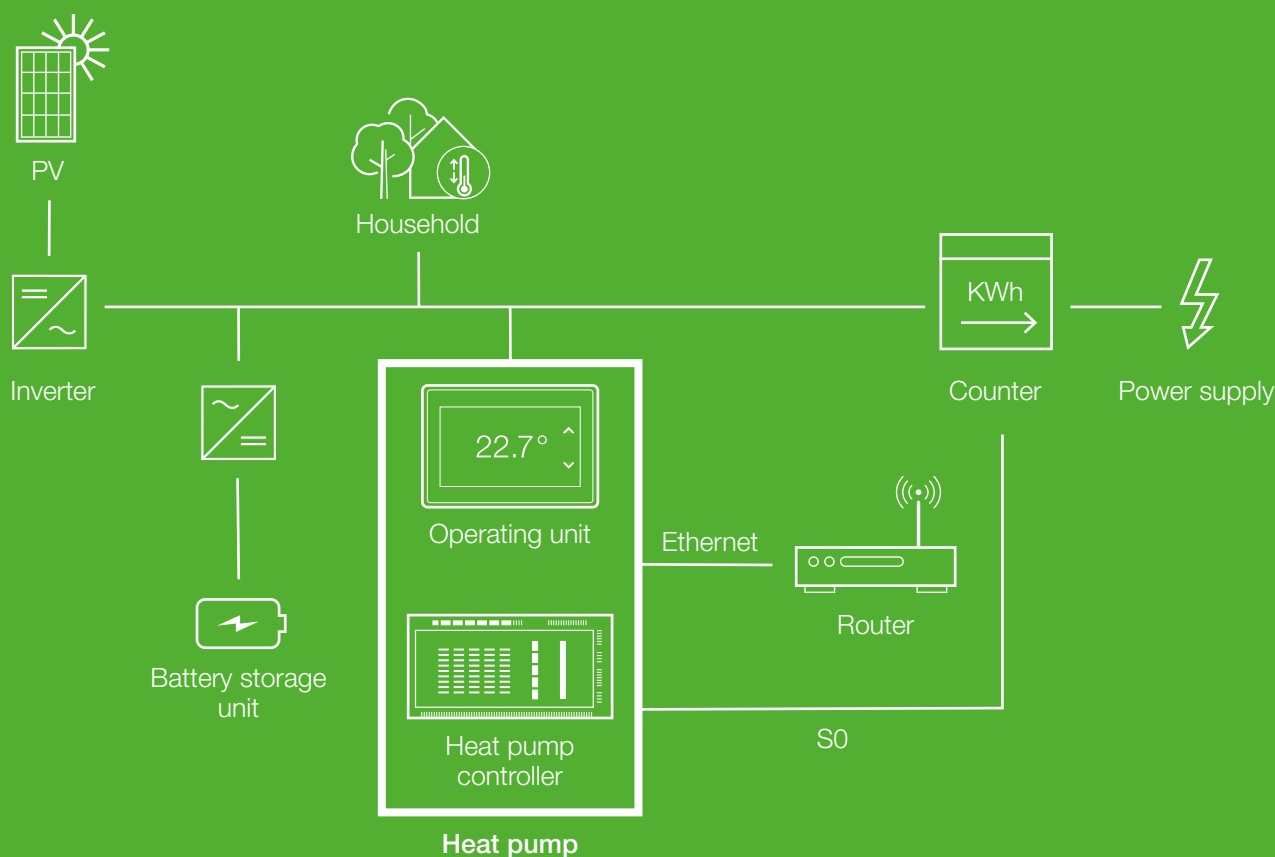
The characteristic field monitoring developed at KEBA for variable-speed compressors guarantees many years of stable compressor operation in accordance with the specifications of the compressor manufacturer.

With the KeEnergy system, it is ensured that the speed specifications are fulfilled in accordance with the specification and that the compressor is operated in the energy-optimized speed ranges.



Compressor characteristic diagram

# Added value through technology functions.



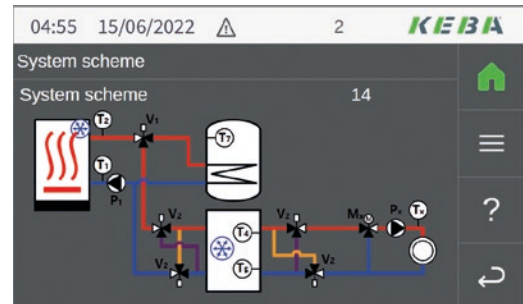
## Photovoltaic system integration

Optimum use can be made of the self-produced electricity for the heat pump by means of the combination of a heat pump and a photovoltaic system. Utilization of the locally generated regenerative energy therefore increases, and the amount of electricity drawn from the mains can be reduced.

Heat pumps are often integrated into higher-level energy management systems via Modbus TCP. This Modbus TCP interface is also available with the KeEnergy control system. The energy management system provides the information about the infeed of surplus power into the mains.

Alternatively, the heat pump can be integrated using a smart-grid-ready interface or an S0 pulse counter.

With variable-speed systems, the compressor power is controlled to the current mains surplus power, which significantly increases the utilization of the PV energy. At the same time, operation is kept within the compressor characteristic field. The energy use is also optimized by integration of weather forecasting.



Example of a selectable hydraulic schematic

## Hydraulic schematics for many use cases

A large number of tested hydraulic schematics have been developed from the demands of the heating manufacturers. The graphically represented hydraulic schematics show the design of the heating system with the different heating components. The hydraulic scheme for heating or cooling required for the given system and the corresponding description can simply be selected.

Due to the large number of hydraulic schematics for heating and cooling applications, extremely complex heating systems can be started up easily and without additional programming.

## Optimized efficiency flow rate

Other energy efficiency improvements are made possible by speed control of heating circuit pumps and source pumps. By evaluating the difference between the flow and return temperature, the pumps are always controlled exactly to the required flow rate.

The pump power consumption is reduced and the precisely required flow rate is provided hydraulically. The compressor can therefore always be operated within the optimum operating range.

## Cost saving by using compressor polynomial

The electrical energy consumption of the compressor and the amount of heat that is given off can be mathematically determined using compressor polynomials with the KeEnergy heat control system.

In this way, the annual performance factor that is relevant for promotions can be determined without using an energy meter or a heat meter. This makes it possible to reduce the series production cost of the heat pump.

## Technical system description

# Heat pump control

## KeEnergy h1000

### System components:

The KeEnergy h1000 industrial solution consists of the following system components:

- // AP440 operating unit
- // CP022 heat pump controller

#### Optional:

- // Extension modules IX011 / IX012 for CP022
- // IM110 heating circuit controller
- // OI420 or AP415 room control unit



The KeEnergy h1000 industrial solution consists of the AP440 operating unit and the CP022 heat pump controller. The AP440 operating unit with integrated control makes it possible to conveniently operate the heating either from the living room or directly at the heating system. The heat pump controller operates all heat pump sensors and actuators in an optimum way.

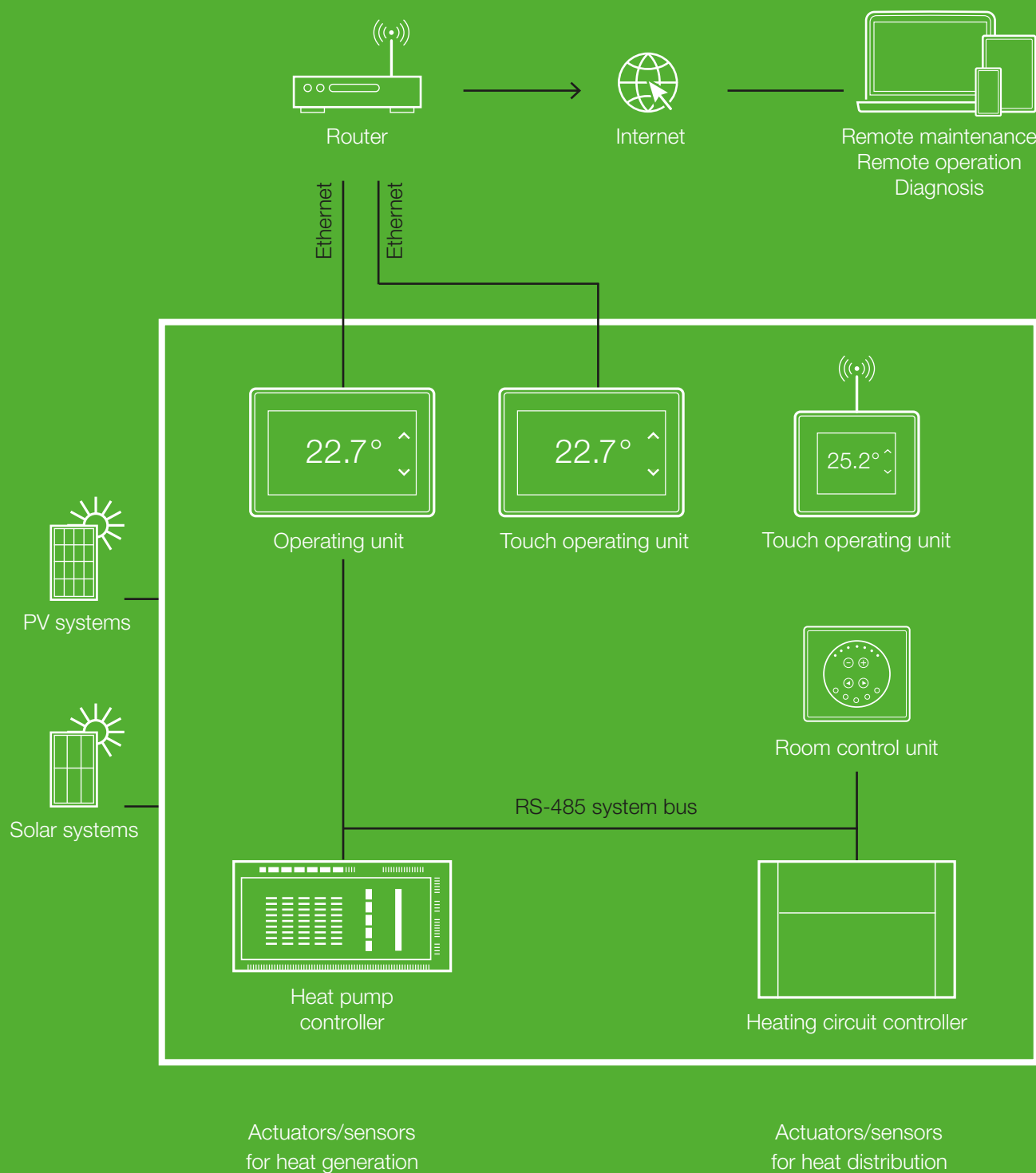
The heat pump controller can be upgraded to the IX011 extension module for one mixed heating circuit and up to 2 electronic expansion valves. An IX012 extension module makes it possible to connect two mixed heating circuits.

Another IM110 heating circuit controller can also be used for two mixed heating circuits, a hot water tank and a thermal solar system. By using multiple IM110's, systems with up to 8 heating circuits and 4 hot water tanks can be implemented.

Room temperature and humidity can be measured either with the OI420 room control unit (with film keyboard and bus connection) or with the AP415 room control unit (with touch display). The end customer can adjust the room temperature to his individual requirements. The type of heating circuit can also be chosen by the customer.

The KeEnergy h1000 solution can be configured as a tandem system with 2 compressors on 1 control. A maximum of 4 compressors, each with a heat pump controller and a shared operating unit, can be controlled with a cascade.





## Technical description

# Operating unit

## KeEnergy AP440

## Product features

The AP440 operating unit with integrated control is installed either directly in the boiler or in a living room. It is used, on the one hand, for visualization and operation and, on the other hand, for the control and regulation of the entire heating system. The high-resolution, graphics-capable 5" color display with intuitive touch operation offers convenient operation for the end customer and the service technician.

The operating unit has an Ethernet interface for connecting the home network router. One or more room control units can be connected to this router for operating the heating system from the living room.



### Display

Size	5" (16:9), TFT, color
Resolution	800 x 480
Touchscreen	Resistive

### Computer core

CPU	ATMEL SAMA5D26 (ARM V7 architecture)
Memory	512 MB flash, 256 MB DRAM
RTC Real Time	Yes, battery buffered

### Interfaces

Communication	1 x 10 / 100 MHz Ethernet LAN interface
Communication	2 x USB, 1 x RS485 115 kbit/s Optional: 1 x RS232 or RS485
Sensor system	1 digital room temperature sensor, 1 room humidity sensor

### General

Connection option	KTY external temperature sensor
Operating temperature	5 °C ... +40 °C
Power supply	24 V DC
Protection rating	IP20
Heating system installation protecting rating	IP41
Living room installation protection rating	IP30
Standard declaration	CE conformity declaration
Dimensions	155 x 105 x 30 mm (W x H x D)

## Technical description

# Heating circuit module

## KeEnergy IM110

### Product features

The heating circuit module is used for the realization of the heat distribution and supports a large selection of hydraulic schemes. It includes actuators and sensors for two heating circuits, a hot water tank, a buffer, a thermal solar system as well as a control for external boilers.

An especially simple connection technology, a convenient wiring compartment and many cable entries facilitate fast and simple installation of the heating circuit controller.

The standard size in the safety low voltage range and in the low-voltage range is implemented using plastic strips. Production in industrial quality provides high temperature resistance, a long service life and protection against overloads.



Heating circuit module	
CPU	100 MHz Arm core
Interfaces	RS485
Inputs	14 x temperature input KTY / PT1000 / NTC 1 x meter 1 x analog input 0-10 V / 4-20 mA
Outputs	1 x analog output 0-10 V or PWM 2 x potential-free contact 2 x mixed output relay 230 V 5 x output relay 230 V 2 x output triac 230 V
Power supply	115-240 V AC / 50-60 Hz 24 V via bus system Optional power supply for stand-alone operation 115-240 V / 24 V / 30 W
Protection class	IP31 with splash water protection from above
Dimensions	280 x 200 x 53 mm (W x H x D)

## Technical description

# Heat pump controller

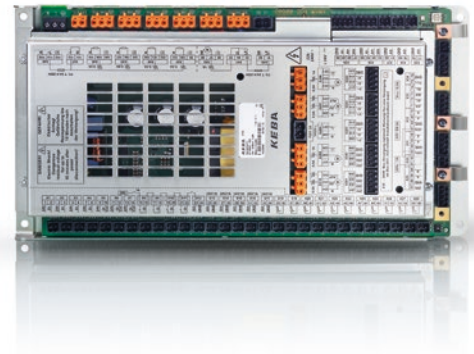
## KeEnergy CP022

### Product features

The heat pump control fulfills all of the required hardware interfaces for operating air, brine and direct evaporation heat pumps. The CP022 heat pump controller is provided with a robust metal housing for the protection of the electronics. If necessary, this CP022 can also be delivered without metal housing.

Because of the high demands that are made of the control speed, overheating control has been implemented for actuating from 1 to 3 electronic expansion valves at the heat pump controller.

Because there are a sufficient number of TRIACs, additional relays can be avoided in many cases and high-efficiency heating pumps can be reliably actuated. This saves considerable hardware and wiring costs.



CP022/Z-000 HEAT PUMP MODULE without extension modules	
CPU	100 MHz Arm core
Interfaces	2 x RS485 1 x 24 V / 12 V bipolar / unipolar stepper motor controller
Inputs	11 x temperature input KTY / PT1000 / NTC 11 x digital input 24 V 2 x digital input 230 V 3 x analog input 0-10 V / 4-20 mA
Outputs	6 x digital output 230 V 3 x analog output 0-10 V or PWM
Power supply	230 V AC
Switching power supply	24 V / 100 W
Protection class	IP20
Dimensions	158 x 310 x 81.2 mm (W x H x D)

## Technical description

# Heat pump controller

## KeEnergy CP022 with extension modules

### Product features

The CP022 heat pump controller is available with three different extension modules which are factory installed. These modules can be programmed to execute a wide range of hydraulic heating and cooling schemes.

#### CP022/Z-101 with IX011/A extension module

The IX011/A extension module features a mixed heating circuit and **an electronic expansion valve connection in addition to the CP022 interfaces.**

IX011/A extension module for CP022 heat pump controller	
Interfaces	1 x 24 V / 12 V bipolar / unipolar stepper motor controller
Inputs	3 x KTY / PT1000 / NTC temperature inputs 3 x 24 V digital input / 24 V digital output or PWM 1 x 4-20 mA analog input 2 x 0-10 V analog inputs 1 x 230 V digital input
Outputs	4 x 230 V Triac digital output
Power supply	230 V AC

#### CP022/Z-102 with IX011/B extension module

The IX011/B extension module features a mixed heating circuit and **two electronic expansion valve connections in addition to the CP022 interfaces.**

IX011/B extension module for CP022 heat pump controller	
Interfaces	2 x 24 V / 12 V bipolar / unipolar stepper motor controller
Inputs	3 x KTY / PT1000 / NTC temperature inputs 1 x 4-20 mA analog input 2 x 0-10 V analog inputs 1 x 230 V digital input
Outputs	4 x 230 V Triac digital output
Power supply	230 V AC

#### CP022/Z-201 with IX012/A extension module

The IX012/A extension module features **two mixed heating circuits in addition to the CP022 interfaces.**

IX012/A extension module for CP022 heat pump controller	
Inputs	4 x KTY / PT1000 / NTC temperature inputs 4 x 24 V digital input / 24 V digital output or PWM 2 x 0-10 V analog inputs
Outputs	6 x 230 V Triac digital output
Power supply	230 V AC



## Technical description

### Room controllers

#### KeEnergy AP415



#### KeEnergy OI420



### Product features

The room control units OI420 and AP415 enable convenient adjustment of the desired room temperature and the operating mode of the heater right from the living room. Both the room target temperature as well as the operating mode are set up easily: for OI420 with a keyboard and for AP415 with an intuitive touch display. The digital remote operation also acts as a room thermostat and makes the current actual values available to the heating control via a temperature sensor and humidity sensor.

Also The AP415 room control unit is connected to the system via WLAN stick, OI420 via cable.

Digital remote operation		
	AP415/T	OI420
CPU	500 MHZ ARM V7	100 MHz Arm-Core
Interfaces	WLAN	RS485
Power supply	24V	24 V via bus system
Displays	KeEnergy HMI	Selected target room temperature, operating mode
Buttons	Touch-Display	4 (temperature plus, temperature minus, heating circuit mode)
Dimensions	112 x 94 x 21 mm (W x H x D)	94 x 88 x (2 x 13) mm (W x H x D)
Protection class	IP30	IP30
Keyboard	Touch	Film

## Technical system description

# Biomass control

## KeEnergy p1000



## System features

The KeEnergy p1000 industrial solution consists of the AP440 control unit, the CP021 boiler module and the IM110 heating circuit controller. The OI420 room control unit can also be installed. Thanks to the UL compliant development, the heating control is designed for international markets.

## Boiler module for biomass CP021

The boiler module contains all the required hardware interfaces for operating biomass boilers. The boiler module CP021 is provided with a robust metal housing for the protection of the electronics. If necessary, this CP021 can also be delivered without metal housing.

The module satisfies the common legal standards and directives and is designed for the implementation of safety standard EN303-5/2012 for central heating boilers. All 230 V outputs of the module are current-controlled. Integrated motor protection and precise self-diagnosis of the heating are possible. The boiler module is connected to the rest of the system components via a bus system, and supplies them with 24 V supply voltage at the same time. Up to 4 boilers can be cascaded via the bus system using a shared operating unit.

KBoiler module	
CPU	100 MHz Arm core
Memory	32 kB flash (optional upgrade), 32 kB RAM (optional upgrade)
Interfaces	RS485
Inputs	4 x temperature input KTY / PT1000 2 x temperature input PT1000 / thermoelement 9 x digital input 24 V 3 x analog input 0-10 V / 4-20 mA 1 x switching type lambda sensor with heating 4 x digital input 230 V
Outputs	6 x output relay 230 V 7 x output triac 230 V 1 x potential-free contact 1 x digital output 24 V
Power supply	115-240 V AC / 50-60 Hz
Switching power supply	24 V / 100 W
Protection class	IP20
Dimensions	159 x 395 x 70 mm (W x H x D)

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