Vario-Line

GB Translation of the original operating manual

vBoxX 6
vBoxX 8
vBoxX 10
vBoxX 12
vBoxX 15
vBoxX 18
vBoxX 24
vBoxX 28

Table 1: Contact details

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Introduction

This operating manual has been drawn up by KKT chillers on the basis of the Machinery Directive 2006/42/EC. They contain all important information and instructions for the installation and safe operation of the chiller. It also contains suggestions on how to prevent or correct faults.
Please take time to read the user manual carefully and to process all the information that it contains. For further questions, please contact the KKT chillers Service Team by means of the aforementioned contact details.

If properly used for its intended use and correctly maintained, the chiller ensures sustained, fault-free operation. The methods and procedures described in this manual were designed to help you identify problems at an early state and to initiate corresponding countermeasures.
By observing the described maintenance program, you ensure that the reliability and safety of the machine is maintained. Plus this keeps operating costs low and increases the service life of the components.

To ensure that the performance of your chiller is not impaired, we recommend that you only use original spare parts from KKT chillers. By doing so, you ensure the reliability and quality of the machine.

⚠	**ATTENTION! A black exclamation mark on a yellow background in a triangle indicates important information and instructions to which you must pay particular attention and must always follow.**

KKT chillers reserves the right to change technical data without prior announcement. Illustrations in this document are not set to scale!

As the Vario-Line units can be adapted to specific project requirements, this document only contains information that is generally important for all units in the series.

All project-specific data is enclosed with the unit in separate summary documentation.

- Machine configuration
- Parameter list
- P&I diagram
- Pump characteristic curve(s)
- Circuit diagram
- All other project-specific details

List of Contents

1. Product description

Please read all the points in these operating instructions before starting up the machine. You should pay particular attention to the points on safety, commissioning/start-up and operation. If you have any further questions about your machine, please contact the KKT chillers service team (*see Table 1: Contact Data*).

1.1. Intended use

The vBoxX is a factory-tested, fully automatic compression chiller. The machine is only used for cooling liquids in accordance with EN 378-1. A sufficient supply of cooling air must be provided. Only approved liquids may be used. The vBoxX is suitable for both indoor and outdoor installation (note the optional packages).

The operator is responsible for complying with the specified operating, servicing and maintenance conditions according to these operating instructions.
The owner of the chiller, not the manufacturer, is responsible and liable for all personal injuries and damage to property caused by improper use of the unit (misuse).

Table 2 contains the general safety instructions of the chiller. These instructions are attached to the machine in a clear and readily visible position. A complete description of all hazard warnings is given in *Chapter 4.2 Hazard warnings*.

Table 2: Safety instructions

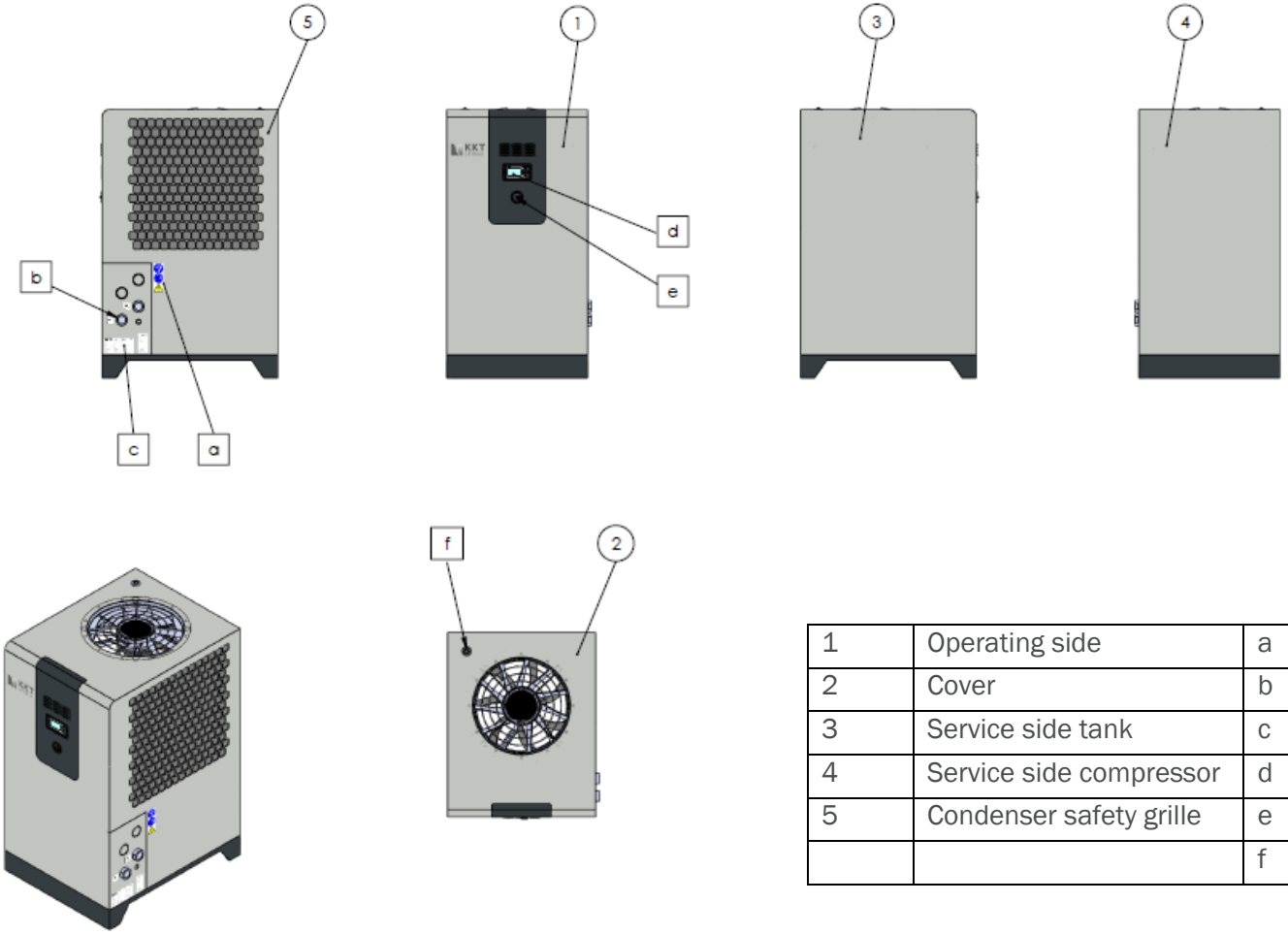
	Follow the operating instructions!
	Before opening the machine, disconnect the machine from the power supply. Then wait for at least 2 minutes before opening the machine.
	Beware of dangerous electrical voltage! If the machine is only turned off by means of the main switch, some of the terminals in the control cabinet will still be under dangerous voltage.

Table 3: Technical data

Vario-Line	-	vBoxX 6	vBoxX 8	vBoxX 10	vBoxX 12	vBoxX 15	vBoxX 18	vBoxX 24	vBoxX 28
Refrigerating capacity @ tw2=20°C / tu=32°C	kW	6.2	8.2	10.2	12.4	15.3	18.3	24.5	28.5
Refrigeration circuit hermetically tight		yes							
Refrigerant	-	R410A							
GWP		2088							
Refrigerant capacity	kg	1.6	1.6	1.8	1.8	2.5	3.2	3.4	3.4
CO2 equivalent	t CO2	3.3	3.3	3.8	3.8	5.2	6.7	7.1	7.1
Liquid	-	Water or water / glycol							
Ambient temperature range	°C	-25 to +50°C							
Coolant outlet temperature	°C	-10 to +30°C						+5 to +30°C	
Setpoint constancy (basic fitout)	K	+/-0.5							
Tank volume	l	100				160			
Tank volumen (max.)	l	88				151			
Coolant flow, nominal (dt = 5K)	m³/h	1.1	1.4	1.8	2.1	2.6	3.1	4.8	4.8
Free pump pressure (basic fitout)	bar	3							
Water connection nominal diameter	RP	1“				1 ½“			
Air flow rate (max.)	m³/h	4.400	4.400	4.400	4.400	8.200	8.200	8.200	8.200
Sound pressure level at 5m distance	dBA	54	54	54	54	59	59	59	59
Operating voltage (basic fitout)	V/Ph/Hz	400/ 3/ 50 or 480 V/3 Ph/60 Hz or 400 V/3 Ph/60 Hz							
Protection class	-	IP44							
Height	mm	1385				1500			
Width	mm	800				800			
Length	mm	800				1000			
Net weight	kg	265	265	265	265	340	340	340	340
Gross weight	kg	365	365	365	365	500	500	500	500

The data listed here applies to the units with basic fitout. As the units are adapted from project to project to the respective customer specifications, differences can occur. The precise project-specific data is given in the quick start documentation supplied with the unit.

1.2. Elements



1	Operating side	a	Safety instructions
2	Cover	b	Water connections
3	Service side tank	c	Nameplate
4	Service side compressor	d	Display
5	Condenser safety grille	e	Main switch
		f	Tank filling

1.3. Explanation of terms

For the sake of better understanding, we have listed some relevant terms that are used frequently in this document.

Table 4: Explanation of terms

Term	Explanation
Application	The source of heat hydraulically connected to the chiller.
Process circuit	Application and piping to the chiller.
Cold water circuit	Process circuit and chiller in hydraulic piping.
Cold water	Refrigerant in cold water circuit.
Cooling air	Heat absorbing ambient air drawn through the machine.
Net weight	Machine ready for operation without cooling water.
Gross weight	Machine ready for operation with cooling water.

2. Function and main components

The chiller consists of the main components: compressor, condenser, expansion valve and evaporator, which are arranged in a circuit (***Figure 1***). Refrigerant circulates in this circuit. In the evaporator, it absorbs heat from the cold water and emits it in the condenser into the drawn in air.

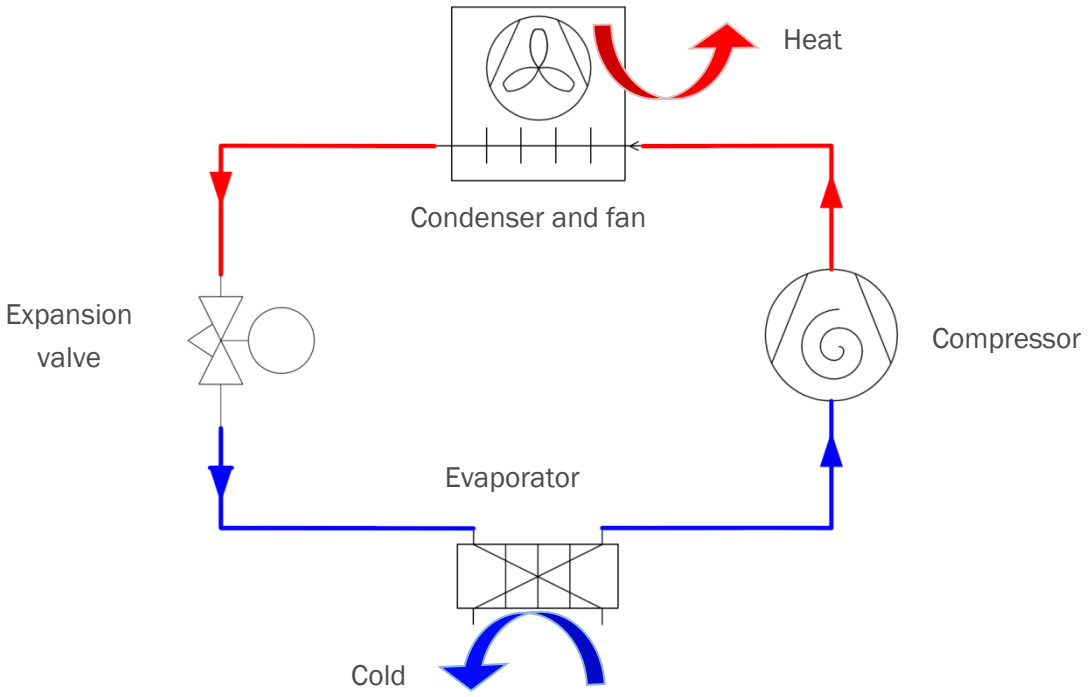


Figure 1: C6848 Refrigeration diagram

Diverse pressure and temperature sensors, a control unit, a high-pressure switch, one or several pump(s) and a fan are also installed for control and operation of the chiller.

2.1. Compressor

The compressor generates the pressure difference in the refrigerant circuit, between the heat sink and heat source, necessary for evaporation and condensing. Vaporous refrigerant from the evaporator is drawn in and is compressed to condensing pressure in the compressor.
The compressors used in the Vario-Line are speed-controlled and therefore adapt automatically to the requested load profile – and therefore the chiller always operates with maximum energy efficiency.

2.2. Evaporator

The evaporator is a plate heat exchanger that transfers heat from the cold water to the refrigerant. In order for the transfer of heat to take place, the refrigerant in the evaporator must have a lower temperature than the cold water and changes its physical state upon heat absorption from liquid to gaseous. If the cold water is polluted, deposits can accumulate on the transfer surfaces of the evaporator. This impairs the transfer of heat to the refrigerant and has negative effects on the refrigerating capacity of the machine. Therefore always make sure to use the prescribed water quality and do not make use of any other additives than prescribed.

2.3. Condenser

The condenser is a microchannel heat exchanger that transfers heat from the refrigerant to the ambient air. In order for the transfer of heat to take place, the refrigerant in the condenser must have a higher temperature than the drawn-in ambient air changes its physical state upon heat dissipation from gaseous to liquid.
Contaminated cooling air can cause deposits to accumulate on the condenser surface. This impairs the transfer of the heat to the refrigerant. This restricts the operating limit of the machine and reduces the refrigerating capacity of the machine. How to clean the condenser is described in *Chapter* 9 *Cleaning*. If you operate your chiller in an environment contaminated with dust or oil vapour, use the optionally available air filter mat (see *Chapter 3.23 Air filter mat*).

If a cooling water system is available and the hot waste air of the chiller is to be avoided, the chiller can also be designed with a water-cooled condenser (see *Chapter 3.3 Version with water-cooled condenser*).

2.4. Expansion valve

The expansion valve regulates the admission of liquid refrigerant to the evaporator and restricts the pressure of the refrigerant before entering the evaporator. In this process, the refrigerant cools down to the evaporating temperature.

2.5. Refrigerant

The refrigerant R410A circulates in the refrigeration circuit. It "transports" the heat from the evaporator the condenser and continuously changes its physical state in doing so.
R410A is a fluorinated greenhouse gas consisting of the zeotropic mixture of 50% R32 and 50% R125 with virtually negligible glide. R410A has a very high volumetric refrigerating capacity and has no ozone depletion potential (ODP=0). A corresponding safety data sheet can be requested from our KKT chillers service team (*see Table 1: Contact Data*).

2.6. Oil

The compressor components affected by friction are lubricated with oil, which is added in the factory by the compressor manufacturer. The polyolester oil FV50S is used for this. The oil is soluble in the refrigerant and distributes itself with it throughout the entire refrigeration circuit.
A corresponding safety data sheet can be requested from our KKT chillers service team (*see Table 1: Contact Data*).

2.7. Filter dryer

The task of the filter dryer is to absorb any contamination or moisture from the cooling circuit. Both refrigerant and oil are hygroscopic. When installing the refrigeration circuit, the oil may absorb moisture. This moisture can lead to corrosion and impair the cooling process. The filter dryer bonds this moisture and also has a mechanical filter effect. If work is carried out on the refrigeration circuit, in which it is opened, it is necessary to change the filter dryer.

2.8. Pressure sensors

The pressure sensors used are compact pressure transmitters with piezoresistive measurement cell. The sensors continuously record the system pressure at various locations in the refrigerant and cold water circuits. The values are used to regulate the system and for visualisation on the controller display.

2.9. Temperature sensors

The temperature sensors employed are equipped with a platinum measurement cell. The sensors continuously record the temperature at various locations in the refrigerant and cold water circuits. The values are used to control the system.

2.10. Control unit

The control unit is a control that is programmed at the factory. This is where all system-technical measurement values and information come together. In addition, the electrical components are controlled via algorithms.

2.11. Display

The display is used to visualise the necessary information and processes of the system for the user. Plus, it can be used to make entries. The display communicates with the control unit. Further information on operating the chiller is given in *Chapter 8.5 Control unit.*

2.12. Control cabinet

The control cabinet conforms to the requirements of EN 60204 and contains the electrical and electronic components for controlling the chiller. To open the control cabinet, undo the screws in the front panel first (hexagon socket, 4mm). Then tilt the front panel forward slightly and lift it out from above (see figure below). Now open the control cabinet door with the corresponding control cabinet key.

Figure 2: Opening the control cabinet

2.13. Pump

The pump of the chiller provides for the necessary circulation of the cold water. This is drawn out of the chiller's internal tank and is pumped through the process circuit. The units can also be supplied optionally as continuous flow coolers without tank, with pump or without tank and without pump (see ***Chapter 3.1 Version without tank, with pump*** and ***Chapter 3.2 Version without tank, without pump***).

2.14. Fan

The fan draws in the cooling air from the environment via the condenser and discharges the heated air upward from the chiller. To prevent injuries the fan is secured against accidental touch by means of protective grilles on the discharge side. The fan's speed is variable and is regulated from the main circuit board. The speed of the fan is essentially determined by the condensing pressure.

2.15. Cold water circuit

The cold water is drawn out of the internal tank of the chiller by the internal pump and is pumped through the process circuit. The units can also be supplied optionally as continuous flow coolers without tank, with pump or without tank and without pump (see ***Chapter 3.1 Version without tank, with pump*** and ***Chapter 3.2 Version without tank, without pump***). In the process circuit, the cold water absorbs heat. The circuit closes when the cold water is conveyed back into the chiller. It goes through the evaporator in which is discharges the heat. The cold water then returns to the tank. Then the cycle starts again.

2.16. Materials used in the water circuit

The basic fitout has the material composition shown in Table 5*:*

Table 5: Materials used in the basic version

Component	Material
Unit connections	V2A 1.4305
Evaporator	V2A 1.4301 and copper (99.9%)
Tank Tank connection sockets	V2A 1.4301 V4A 1.4305
Pump Mechanical seal	V2A 1.4301 EPDM
Sealing plugs yellow	Polyamide PA 6
Sealing plugs black	Polyoxymethylene (POM)
Fill and drain tap	Nickel-plated brass
Bends, tees, sockets	Red brass CC499K, brass
Temperature sensor	V2A 1.4401 – AISI316
Pressure sensor	V2A 1.4301
Overflow valve (optional)	Red brass
Tank heater (optional)	Nickel-chrome-iron alloy - Alloy 825
Water circuit	John Guest piping made of polybutylene, Hose made of synthetic rubber
Pushfit fitting	Acetal copolymer, nitrile (NBR), V2A

Table 6: Materials used in the non-ferrous metal-free version

Component	Material
Unit connections	V2A 1.4305
Evaporator	V2A 1.4301
Tank Tank connection sockets	V2A 1.4301 V4A 1.4305
Pump Mechanical seal	V2A 1.4301 EPDM
Sealing plugs yellow	Polyamide PA 6
Sealing plugs black	Polyoxymethylene (POM)
Fill and drain tap	V2A 1.4301
Bends, tees, sockets	V2A 1.4301
Temperature sensor	V2A 1.4401 – AISI316
Pressure sensor	V2A 1.4301
Overflow valve (optional)	V2A 1.4301 / Plastic
Tank heater (optional)	Nickel-chrome-iron alloy - Alloy 825
Water circuit	John Guest piping made of polybutylene (BGI) Hose made of synthetic rubber (BGII)
Pushfit fitting	Acetal copolymer, nitrile (NBR), V2A

2.17. Water quality

The following limit values must be adhered to to ensure the safe operation of the devices:

Table 7: Water quality

Property / Constituents	Unit	Value range Standard model	Value range Non-ferrous metal version
pH-value (20°C)	-	7.5 - 9	6-10
Saturation index	-	-0.2 < 0 < +0.2	-
Conductivity	µS/cm	30-500	3-2000
Water hardness	°dH	4.5 - 8.5	<8.5
Total germ count	K/ml	<10,000	<10,000
Grain size	µm	< 250	< 250
Glycole fraction (AFN)	Vol%	0, 20-40	0, 20-40
Oil fraction	Vol%	0	0
Chloride(Cl-)	mg/l	<200	<200
Sulphate	mg/l	<70	<300
Nitrate	mg/l	<100	<100
Copper	mg/l	<0.1	<0.1
Iron	mg/l	<0.2	<0.2
Free carbonic acid	mg/l	<5	<20
Manganese	mg/l	<0.5	<0.1
Ammonia	mg/l	<0.5	<20
Free chlorine	mg/l	<0.5	<0.5
Sulphide SO3	mg/l	<1	<1
Hydrogen carbonate (alkalis) HCO3	mg/l	70-200	-
Hydrogen sulphide (H2S)	mg/l	<0.05	<0.05
Filterable substances	mg/l	<30	<30

To prevent clogging of the plate heat exchangers, the prescribed limit values must be observed.

Furthermore, any occurrence of mucilage bacteria in the cooling water must be ruled out. If this is not possible, KKT chillers can suggest or provide a suitable inhibitor on the basis of a biological water analysis to remove the mucilage agents.

2.18. Allowable liquids

Water and mixtures of water / Antifrogen N (AFN) or water / Antifrogen L (AFL) according to the details in ***Chapter 2.17 Water*** quality. The following table shows the requirements for the mix ration of water with antifreezes AFN and AFL. To maintain the performance capacity of your machine and to prevent damage to the components, these values must be complied with to the greatest extent possible.

⚠	**ATTENTION! Do not use mixtures of different anti-freeze products. This can lead to undesired chemical reactions as well as silting.**

Table 8: AFN and AFL (or equivalent) mix ratios

Setting	Frost-free at Environmental temp. up to	Mixing ratio AFN	Mixing ratio AFL
Glycol 20 - 25 %	-10 °C	20-25 %	25 - 30 %
Glycol 30 - 35 %	-15 °C	30-35 %	32-37 %
Glycol 40 %	-25 °C	40 %	42 %

3. Options and accessories

The chiller can be equipped in the factory with the options described in the following.

The items marked with "accessory" are enclosed with the unit and can also be ordered later at any time under the relevant product number. The installer of the machine is responsible for installation of the accessory. You can also ask our KKT chillers service team to carry out this installation (see *Table 1: Contact Data*).

Details of your machine fitout are given in the separate quick start documentation.

3.1. Version without tank, with pump

The Vario-Line units are optionally available as continuous flow coolers. The units are delivered without an internal tank in the unit. The temperature sensor is then located in the cooler's return line. If a tank open to the atmosphere is integrated on site, ensure that the tank is not installed at a lower geodetic level than the cooler. Additional pressure losses between the tank provided on site and the integrated pump are to be avoided (dp_{max}=0.3bar)

3.2. Version without tank, without pump

The Vario-Line units are optionally available as continuous flow coolers. The units are delivered without an internal tank in the unit and without a pump. The temperature sensor is then located in the cooler's return line. The circulation of the cold water via the evaporator is then carried out by a pump to be installed on site. This must be designed for at least the pressure loss of the entire system.

3.3. Version with water-cooled condenser

While the basic version of the Vario-Line is designed with an air-cooled condenser, it is also possible to order the individual units of this series with a water-cooled condenser.

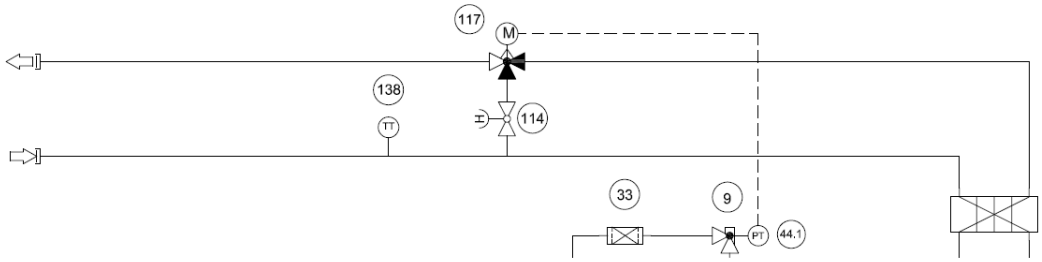


Figure 3: C6848 Refrigeration diagram

The condenser used is a plate heat exchanger with copper-brazed stainless steel plates. The 3-way valve is located in the cooling water outlet and is controlled by a servomotor according to the condensation pressure. By closing the additional bypass valve provided it is possible to switch from 3-way to 2-way control.
The cooling water temperature is recorded by an additional temperature sensor in the cooling water inlet and is displayed at the controller display.

⚠	**The water quality listed under Table 7: Water quality must be complied with – the manufacturer does not accept any liability whatsoever for damage caused by a different water specification!**

The project-specific data and adapted PI flow chart and dimensioned diagram are given in the enclosed quick-start documentation.

3.4. Control cabinet heating

The control cabinet heating is controlled thermostatically and, at lower ambient temperatures, prevents moisture from the drawn in ambient air from condensing on and damaging the electrical and electronic components of the control cabinet.

To ensure that the switch cabinet heating can be active, do not de-energise the chiller (main switch ON) (see *Chapter 8.1 Switching on*).

3.5. Insulation of the cold pipes and pump(s)

In order to prevent condensation on cold pipes of the chiller, where high temperature differences exist between the surroundings and cold water flow and taking into account the relative humidity the cold pipe insulation option must be specified.

3.6. Tank heating with thermostatic pump start

The tank heating is used to maintain a minimum temperature in the tank. The pump circulates the cold water while the tank heating controls the temperature in the system. We recommend a hydraulic installation as shown in *Figure 4*. Any bypass valves must therefore always be installed frost-free. To ensure that the heating can be active, do not de-energise the chiller. Even if the external release is deactivated (*chapter 8.3 External release*), the pump remains active. The thermostatic pump start is active.

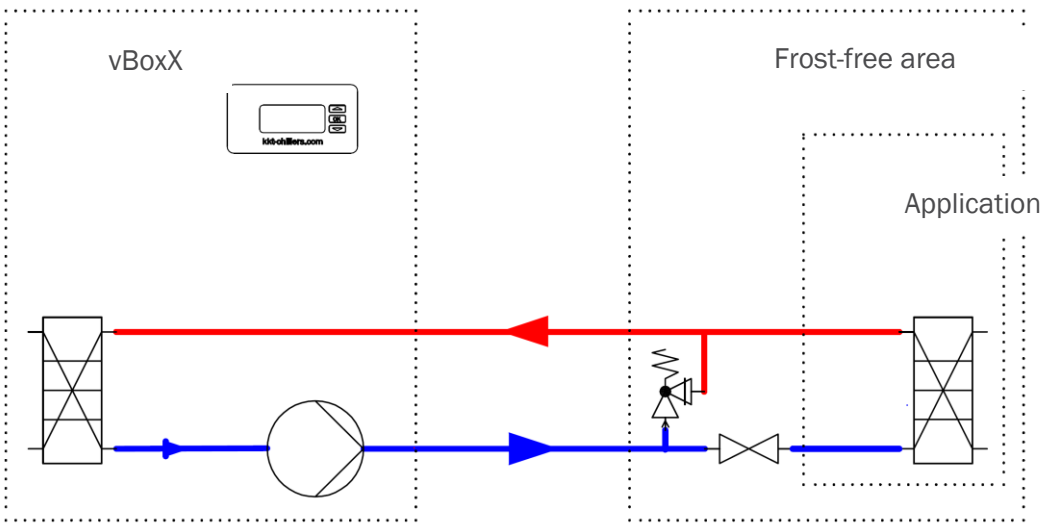


Figure 4: C6856 thermostatic pump start with overflow valve (installation recommendation)

3.7. Overflow valve for standby operation

The overflow valve option should be installed if there is a possibility of the application severely reducing or completely preventing flow of the cold water while the machine is running. The internal overflow valve ensures the minimum flow rate through the chiller and therefore prevents the pump from switching off. *Figure 5* shows the position of the internal overflow valve.

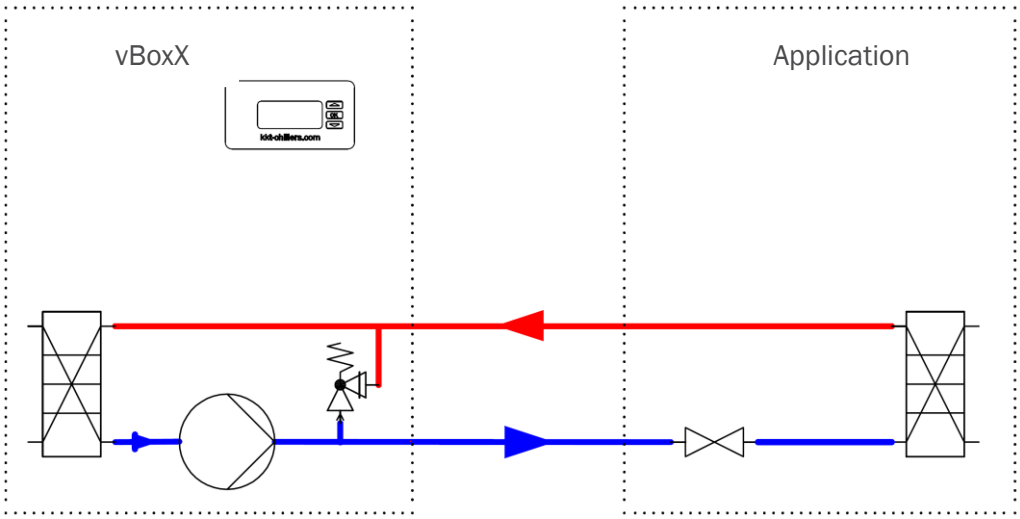


Figure 5: C6863 overflow valve for standby operation

3.8. Higher pressure pump

The standard Vario-Line units are designed with a 3 bar pump, which is designed to the nominal flow rate of the respective unit. Optionally, the units can also be supplied with higher pressure pumps within the minimum or maximum flow rate limits. The pump characteristic curve of the pump(s) used in your device are included with the device.

3.9. Speed-controlled pump

On request the Vario-Line units can also be supplied with a speed-controlled pump. The delivery head and the delivery rate are adjusted automatically to the system characteristic of the overall system. This means that the pump output can be adjusted to a minimum and the power consumption reduced.

3.10. Additional evaporator pump

The evaporator is optimised for the nominal flow rate of cold water. The nominal flow rate is listed in *Table 3: Technical specifications*. If the operating flow rate of the cold water is more than 50 % lower an evaporator pump must be installed. The evaporator pump circulates the cold water internally and keeps the stored water at flow temperature. A second pump supplies the process circuit with cold water.

3.11. Second load pump

The standard Vario-Line units are designed with a 3 bar pump, which is designed to the nominal flow rate of the respective unit. If a second load with the same liquid and same liquid temperature but different liquid quantity or different flow pressure is to be supplied, the unit can also be optionally supplied with a second load pump.

3.12. Second temperature level

If several loads with the same liquid but with different temperature levels are to be supplied, a second setpoint can be specified for the secondary circuit. In this case an additional temperature sensor records the temperature in the secondary circuit. A control valve adds a partial flow rate of the primary circuit until the required setpoint is reached in the secondary circuit.
Automatic venting of the second circuit is programmed for this type of system. This venting process is automatically selected with the configuration of the second circuit. Each time the controller is restarted (e.g. after a power failure), the valve for circuit 2 is
also opened for 300 s when pump 1 starts up. If there is still air in the second circuit, there may be a pressure fault in pump 2 two. This malfunction must be acknowledged in the alarm menu so that circuit 2 has as much flow as possible. Once the system has been vented, this pressure fault no longer occurs. The temperature control is already released during the venting. Cooling by means of a compressor can therefore already take place.

3.13. Second medium

If several loads with different liquids are to be supplied, an optional second tank, which is filled with a different medium to the primary circuit, can be provided. Both circuits are separated from each other hydraulically by an additional plate heat exchanger. Similar to the above-named option, a control valve adds a partial flow rate of the primary circuit until the required setpoint is reached in the secondary circuit.

3.14. Automatic water replenishment

Due to possible leakage and evaporation, the amount of chilled water required for the chiller to function can be reduced during operation. The automatic water replenishment option offers the possibility of automatically replenishing the chilled water circuit. The tank content is continuously monitored and refilled as needed until it is at the optimum level again. The owner (user) only has to connect the chiller to the building's water system via the feed connection (see *Figure 6)*. The inlet pressure must lie between 1 bar and 10 bar.

Figure 6: Feed water connection

If you operate your chiller with a water / glycol mixture and only feed in pure water, you must check the glycol content of the circuit water regularly and adjust if necessary.

3.15. Flow control switch

Optionally, the Vario-Line units can also be equipped with a flow control switch. The flow control switch triggers if the flow drops and falls below the switching value. The corresponding signal can be tapped, floating, at the terminal in the control cabinet.

3.16. Water circuit made free from non-ferrous metals

If your machine is made free from non-ferrous metals, all parts of the chiller's cold water circuit touched by the media are free from non-ferrous metals. Several components such as the evaporator and pump have been adjusted. The materials used for the water circuit are given in *Table 6*.

3.17. DI package

The DI package includes the water circuit option in non-ferrous metal version (see 3.7) as well as a replaceable DI cartridge with conductance monitoring and conductance control.

⚠	**The DI cartridge used is exclusively for maintaining the conductance and not for water treatment.** **When using the "Automatic refill" option and for manual refilling, it must be ensured that the medium for refilling is provided in the specified water quality.**

3.18. Conductance monitoring

With the conductance monitoring option, the conductance is detected via a measurement probe in the tank. If the stipulated limit value is exceeded, a warning and alarm message is issued (see parameter list).

3.19. Conductance control

With the conductance regulation option, the conductance is detected via a measurement probe in the tank. If the desired conductance is exceeded, a regulating value opens and allows a partial flow of refrigerant to flow through a DI cartridge installed in the bypass. The regulating valve closes as soon as the desired conductance has been reached again.

3.20. Special voltage

If your machine is equipped for a special voltage, electrical components have been adjusted. Your machine may only be operated under the voltage specified on the rating plate.

3.21. Phase monitoring

Optionally, the Vario-Line units can be equipped with so-called phase monitoring. It monitors phase sequence, phase failure, undervoltage and asymmetry and covers a voltage range of 200-690V. If the respective predefined limits are exceeded the system switches off and protects the electrical components installed in the unit.

3.22. UL version

The main components of the Vario-Line are already designed to conform to UL in the basic fitout. If your unit is ordered with the UL version option, the control cabinet is also produced in accordance with the UL regulations. The corresponding UL certificate must then be issued separately within the scope of the official UL acceptance – please ask your customer consultant.

3.23. Special paint finish

All façade panels (see ***Chapter 1.2 Elements***) can also be optionally supplied with a special paint finish.

3.24. Air filter mat (accessory)

If the chiller is operated in surroundings with dust or oil vapour the condenser should be protected with the air filter mat. The filter is fixed using the Velcro tapes attached in the condenser protective grille. The filter is cleaned by removing it and washing it with water or a slightly alkaline solution. Heavily-contaminated filters must be replaced by new ones. Please contact the KKT chillers service team (*Contact details*).

3.25. Vario Foot (accessory)

The four levelling feet of the Vario Foot can be used for rolling, vibration isolation and for height adjustment. To do this, the height of each foot can be individually adjusted up or down using a special ratchet function. If the unit is out of service, all four feet can be screwed in until the unit stands on the integrated machine rollers and can be rolled away.

3.26. Level package (accessory)

The level package is used if the application is to be installed more than 500 mm above the chiller (see also *Chapter 6.2.6 Process level*). This option is delivered separately with the unit (i.e. is not installed) and consists of an electrically activated valve and a check valve. The electrically activated valve is to be installed at the unit inlet, the check valve at the unit outlet. The valve is installed electrically in the control cabinet as shown in the electric circuit diagram.

3.27. Liquid circuit filter assembly (accessory)

The water filter protects the cold water circuit against dirt. The set, consisting of a filter, fitting and two shut off valves, is enclosed with the chiller in a separate pack and must be fitted onto the cold water inlet of the chiller from the outside when the chiller is installed.

3.28. Cooling water circuit filter assembly (accessory)

The water filter protects the chiller's cooling water circuit from dirt. The set, consisting of the filter, fitting, two shut-off devices and two indicator pressure gauges to display the cooling water inlet and outlet pressures, is supplied with the chiller in a separate package. It can be installed optionally to shut-off the filter assembly or to shut off the whole cooling water circuit.

3.29. Gateway (accessory)

The Gateway is ready-mounted in the switch cabinet and can be used as an interface for processing the chiller signals. Therefore the following processing protocols are available depending on the customer specification:

Modbus, PROFIBUS, PROFINET, DeviceNet, EtherNet,

3.30. Remote control panel (accessories)

If the chiller is to be operated from another control station instead of directly at the unit, your unit can be supplied equipped with a so-called remote control panel. In this case the same display as the one installed in the chiller is supplied in a separate miniature housing together with a top hat rail for the power supply. The remote control panel is connected to the chiller with clips and takes over the complete function of the controller in the main device. The two panels work in parallel.

3.31. Special languages (accessory)

This instruction manual is written in German, English, French and Spanish. Other optional languages are possible on request.

3.32. Wooden crate as packaging (accessory)

Although the Vario-Line devices are delivered on IPPC wooden pallets with expanded polystyrene corner pieces and wrapped in film as standard, there is also an option to receive the devices in a wooden crate. In this case the units are additionally protected by a solid wood crate with IPPC label in accordance with ISPM 15.

3.33. Sea crate packaging (accessory)

Seaworthy crates for the Vario-Line are produced in accordance with phytosanitary regulations for international trade with packaging made of solid wood (ISPM 15). This means that the crate is made using heat-treated solid wood from which all bark has been removed. Only wood-based materials, such as OSB boards, are used. In addition, all crates are marked with the IPPC logo and the registration number. The units are fixed in the crate using coach bolts, ring nuts and polyester straps and are packed in sea air-resistant film together with a special desiccant. The components used to unpack the units can be dismantled using a Phillips screwdriver. Please note the altered transport dimensions.

4. Safety

The chiller, within the sense of its intentional use, is designed to operate safely, Provided the instructions described in this instruction manual are followed with regard to transport, installation, startup and servicing/maintenance. The machine conforms to the safety standards in accordance with the EC Declaration of Conformity (see appendix).

4.1. General information

The chiller contains a pressurised circuit. The maximum pressure occurring is 45 bar. Even when inactive or disconnected from the power supply the circuit is still under pressure.

4.2. Hazard warnings

A number of warning labels are applied to the machine. Keep these warnings clean at all times. Damaged or missing warnings must be replaced.

Table 9: Definition of the safety symbols

	Follow the operating instructions!
	Before opening the machine, disconnect the machine from the power supply. Then wait for at least 2 minutes before opening the machine.
	Beware of dangerous electrical voltage! If the machine is only turned off by means of the main switch, some of the terminals in the control cabinet will still be under dangerous voltage.
	Wear foot protection!
	Wear hand protection!
	Wear eye protection!
	Wear protective clothing!
	Beware of hot surface!
	Beware of cold surface!
	ATTENTION!
	Contains pressurised gas!

The following hazard warnings apply in particular to the machine:

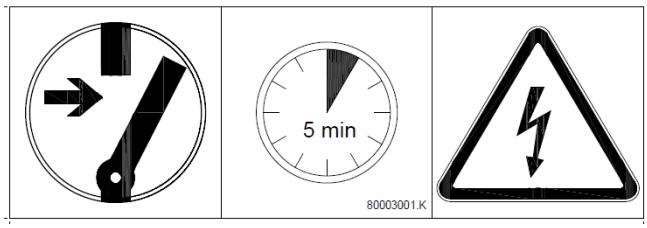
Table 10: Hazard warnings

	ATTENTION! Work on the chiller must be carried out by properly qualified, competent personnel!
	The surfaces of pipes and components of the refrigerant and cold water circuit and electrical equipment can be very hot during operation and even for a while after.
	The surfaces of pipes and components of the refrigerant and cold water circuit and electrical equipment can be very hot during operation and even for a while after.
	ATTENTION! Pipes and components of the refrigerant and cold water circuit are pressurised.
	ATTENTION! Do not undo the system parts. Risk of injury on contact.
	ATTENTION! Only use the specified liquids!
	ATTENTION! The device frame and housing are not designed for additional loads, which is why the components may not be walked on or subjected to extra loads!  Do not enter/step on  Do not load

4.3. Residual energy

Even if all the hazard warnings in Chapter 4.2 are taken into account, the following residual energy situations can result in a hazard:

- Rotational energy of the decelerating fan
  - Despite the installed protective grille, hair or pieces of clothing can still be drawn in and caught.
- Hot surfaces on machine parts
  - The compressor head, the hot gas pipe and the condenser in particular can still be very hot for some time after the machine has been switched off. Temperatures within the range from 60°C to 130°C are possible.
- Dangerous electrical voltage in the control cabinet despite the switched off main switch
  - If the machine is only switched off at its main switch, dangerous electrical voltage is nonetheless still present at several terminals in the control cabinet. In particular, these are the main supply terminal and the input terminals of the main switch.



- Refrigeration circuit is pressurised

Provided it is not damaged the refrigeration circuit is closed. Therefore, a hazard is not to be assumed.

<u>Note:</u>

After switching off the unit at the main switch, if you wait for 5 minutes before opening the unit risks due to rotational energy and electrical power can be reduced. In this case only the residual thermal energy must be considered.

4.4. Safety devices, guards and safeguards

4.4.1. High-pressure limiter

The high-pressure limiter (PZH) is a pressure switch with manual reset. The PZH restricts the condensing pressure and switches off the compressor via the load contactor when the maximum permissible system operating pressure is reached. It is part of the safety chain. The PZH is installed on the refrigerant collector for the chiller types vBoxX 200 *(see Figure 7*: *Position of the high-pressure limiter (PZH*)). If the PZH has been activated, a message is output at the operating terminal. In this case, please following the instructions in the chapter Troubleshooting (see *Appendix* II).

Figure 7: Position of the high-pressure limiter (PZH)).

4.4.2. High-pressure monitoring

If the high pressure in the refrigeration circuit of your unit rises to a maximum value, the compressor is switched off via the high pressure limiter. A manual reset at the high-pressure limiter and at the display is then required. If the high-pressure monitor has triggered, please follow the instructions in Chapter Troubleshooting (see *Appendix II*).

4.4.3. Low-pressure monitoring

If the low pressure in the refrigerating circuit of your system is too low for the specified liquid there is a risk of frost. For this reason the low pressure is monitored continuously and the compressor is switched off if the pressure falls below a minimum value. If the low pressure has increased to a minimum value the compressor is re-released. If the low-pressure monitor has triggered, please follow the instructions in Chapter Troubleshooting (see *Appendix II*).

4.4.4. Flow monitoring

If the flow rate of the cold water, which is pumped through the evaporator, is too low there is a risk of frost. For this reason the flow is monitored continuously via the evaporator. If the flow rate is only approx. 50 % of the nominal flow rate, the "Flow warning" message is output. If the flow rate falls below the minimum value of 20 % the compressor is switched off and the "Flow stop" message is output. In this case please follow the instructions in the Troubleshooting chapter (see *Appendix II*).

4.4.5. Oil temperature monitoring

In order for the compressor to start up without any problems even in low ambient temperatures, all Vario-Line units are equipped with so-called oil temperature monitoring. To this end the hot gas temperature is monitored. If the hot gas temperature is below the limit value of 6 °C the oil is heated by the frequency converter until the limit value is reached again. This function is only ensured if the main switch is switched on.

4.4.6. Personal protective equipment when operating the machine

Operating the machine involves making settings at the control panel. When operating the machine, the façade panels are mounted and the machine is completely closed. No protective equipment is required.
We recommend ear protectors be worn by persons with jobs that require them to be continuously in the immediate vicinity of the chiller. Please refer to the sound emission information included in the technical data.

4.5. Personal protective equipment for servicing work

Servicing work on the machine includes all work for which the machine is opened and one or more cover panels are dismantled. In particular, this includes cleaning work in accordance with *Chapter 9 Cleaning* and maintenance work in accordance with *Chapter 10 Service*. Before work is carried out on the chiller the protective equipment described in *Table 9: Definition of the safety symbols* must be used.

Table 11: Personal protective equipment for servicing work

	Wear foot protection!
	Wear hand protection!
	Wear eye protection!
	Wear protective clothing!

4.6. Airborne sound emissions

The airborne sound emission is given as the sound pressure level, measured at a distance of five meters without reflection. Its maximum value is given in the technical specifications. This only occurs at the highest fan speed at the air intake side of the chiller (Figure 8, measurement point [1]). The emissions in [2] to [4] are generally around 10% lower than [1].

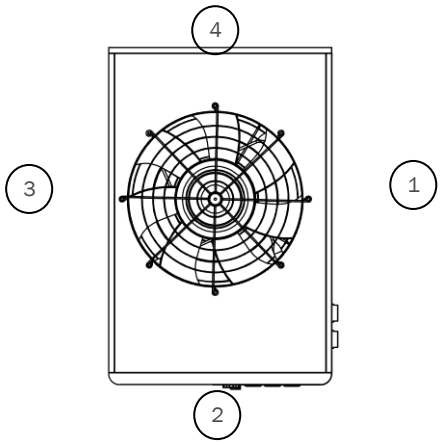


Figure 8: Airborne sound emissions

In partial load mode or under favourable ambient conditions (see *Chapter 4.7.1 Noise)* this reduces the fan speed and therefore the sound emission reduces automatically.

4.7. Notes on reducing noise and vibration

4.7.1. Noise

Details of your chiller's airborne sound emissions are given in *Chapter 4.6*.
To reduce noise pollution caused by airborne sound emissions it is advisable to install the chiller out of doors and out of the range of workplaces.
If this is not possible we recommend that when the unit is installed attention is paid to ensuring that the air intake side is not pointed directly at a workplace/workstation.
High ambient temperatures mean high fan speeds and this increases the noise levels produced. It is advisable not to expose the chiller to direct sunlight or to install it in rooms with high air temperature. Further information is given in *Chapter 6.2 Installation site*.

4.7.2. Vibration

The chiller is designed so that the vibrations caused by the compressor are largely isolated by the chiller's frame.
To minimise the effect of vibrations still further it is possible to install the chiller with the optionally available levelling feet (*Chapter 3.24 Vario Foot*). These are fitted with damping elastomers.

4.8. Residual risks

4.8.1. Electrical

If all safety provisions are complied with there is no danger.

4.8.2. Mechanical

If all safety provisions are complied with there is no danger.
Mechanical damage to components or pipes of the refrigerant circuit can cause refrigerant to leak. Leaking refrigerant can cause cold burns.

4.8.3. Chemical

	ATTENTION! Toxic and caustic products are released by the thermal decomposition of R410A.
	ATTENTION! Do not install in rooms with naked flames or smoke.

4.8.4. Other

	ATTENTION! Risk of suffocation if the chiller is installed in a room that is too small. Please note and follow Chapter 6.2.2.
	ATTENTION! In the EU you must follow the provisions of EN378-3. You must also comply with the local installation regulations and provisions, especially (in Germany) the VAwS and the BGR500 Chapter 2.35.

4.9. Dangerous substances

4.9.1. Refrigerant R410A

First-aid measures:

- After inhaling: remove victim to fresh air, ensuring your own safety, and keep the person at rest in a comfortable position. Get medical attention. If the person stops breathing, give artificial respiration
- Following skin contact: leave clothing that has fused with the skin. Rinse areas damaged by cold with lukewarm water (never use hot water). Do not rub! Cover with sterile dressing. Ensure medical treatment is provided.

- Following eye contact: rinse the eyes with clean water or eyewash solution for at least 15 minutes with the eyelids open. Consult an eye specialist.
- After swallowing: swallowing is not considered to be a likely risk as the refrigerant in the surroundings is gaseous.

Notes for the doctor: do not give the patient catecholamine or adrenalin ephedrine preparations.

Firefighting measures:

- Suitable extinguishing agents: The product itself is not flammable. Match the extinguishing measures to the surrounding fire. Cool containers with sprayed water.
- Particular hazards due to the substance, its combustion products or gases formed: forms toxic and caustic gases and fumes on decomposition.
- Special protective equipment for fire-fighting: self-contained or air-line breathing apparatus and acid-resistant protective suit for deployment in immediate vicinity.
- Further information: The effect of fire can cause bursting or explosion of the container. Ignitable gas-air mixtures possible under certain conditions.

Measures in case of accidental release:

- Environmental protection measures: where possible do not allow the product to get into the environment.
- Cleaning procedure: leave the product to evaporate.

Handling and storage:

- Handling: fire and explosion protection: heating results in increased pressure and a risk of bursting. Cool containers at risk with water. Open the containers slowly and carefully.

Personal protective equipment:

- Respiratory protection: not necessary if adequate ventilation available. Self-contained or air-line breathing apparatus within enclosed rooms, if insufficient oxygen supply available, in case of substantial or uncontrollable release. Only use breathing apparatus in accordance with the international / national standards. Only use breathing apparatus, no filtering devices.
- Hand protection: chemical-resistant protective gloves. Recommended material: Polyvinyl alcohol.
- Eye protection: close-fitting safety glasses/goggles.

General protection and hygiene measures:

- Do not inhale fumes / aerosols.
- Do not eat/drink or smoke during work.

4.9.2. Oil

First-aid measures:

- After inhaling: remove victim to fresh air, ensuring your own safety, and keep the person at rest in a comfortable position. Get medical attention.
- Following skin contact: remove soiled, soaked clothing. Wash skin with water. If symptoms develop, get medical advice.
- Following eye contact: rinse the eyes with clean water or eyewash solution for at least 10 minutes with the eyelids open. Consult an eye specialist.
- After swallowing: can cause vomiting. Have the mouth rinsed out with water and give the patient two glasses of water to drink. Get medical advice.
- Notes for the doctor: symptomatic treatment and assistive therapy as indicated.

Firefighting measures:
Low fire risk. Product only ignites in case of very large heat supply.

- Suitable extinguishing agents: match to the surroundings. Carbon dioxide, powder and foam extinguishing agents. Use water with caution to avoid possibly considerable steam generation.
- Particular hazards due to the substance, its combustion products or gases formed: irritant fumes are released during thermal decomposition.
- Special protective equipment for fire-fighting: self-contained or air-line breathing apparatus and acid-resistant protective suit for deployment in immediate vicinity.
- Further information: The effect of fire can cause bursting or explosion of the container. Ignitable gas-air mixtures possible under certain conditions.

Measures in case of accidental release:

- Environmental protection measures: do not allow the product to get into the sewers or bodies of water. Absorb with sand, soil or a similar absorbent material. Ensure proper disposal in containers.
- Cleaning procedure: Clean the contaminated area with water. Caution! Slipping hazard!
- Further information: Inform the police or competent authorities in case of penetration in the sewers or bodies of water.

Personal protective equipment:

- Respiratory protection: not necessary if adequate ventilation available. Self-contained or air-line breathing apparatus within enclosed rooms, if insufficient oxygen supply available, in case of substantial or uncontrollable release. Only use breathing apparatus in accordance with the international / national standards. Only use breathing apparatus, no filtering devices.
- Hand protection: Protective gloves. Recommended material: nitrile rubber.
- Eye protection: close-fitting safety glasses/goggles.

Handling and storage:

- Handling: avoid lengthy skin contact. Avoid inhaling high concentrations of vapour. Avoid inhaling high concentrations of fumes.
- Storage: suitable material for containers: mild steel. Tightly close unused containers to prevent the penetration of moisture. Keep away from strong oxidants.

4.10. Reasonably foreseeable misuse

Reasonably foreseeable misuse, for the users of the chiller, means foreseeable use in a way not intended according to the operating instructions. It is due to foreseeable human behaviour.
The following dangerous situations can arise due to misuse which could reasonably be expected:

- dangerous voltage of electrical components, if the machine is not disconnected from the power supply before it is opened.
- The fan and compressor can start up suddenly, without the condition of the machine changing visibly.
- Even if the machine has been disconnected from the power supply, the surfaces of components in the unit can be very hot or cold.
- risk of damage to external hydraulic components if the cold water feed is confused with the cold water return.
- danger caused by using media in the unit that have not been approved.
- Danger caused by connected an unspecified voltage source.

4.11. Information for emergencies

If an emergency occurs during operation of the chiller, the machine must be disconnected from the mains at once using the master switch. Remove people from the danger zone immediately. An emergency situation can among other things be:

- a leak and escape of refrigerant and/ or oil.
- a part of the machine becoming mechanically detached from it.
- the machine making unusual noises.
- the machine vibrating severely.

Then contact the KKT chillers Service Team. If you have noticed that refrigerant or oil has escaped, proceed as described in *Chapter 4.9 Hazardous* substances.

5. Handling and storage

The chiller is delivered from the factory fixed onto a wooden pallet. Furthermore, the machine is protected from damage by polystyrene corners and stretch film. For this reason you should remove the packaging as late as possible.

5.1. Dangerous goods

Chillers with refrigerant capacity >12 kg must be declared as dangerous goods in accordance with UN2857. The Vario-Line units have been specified so that the refrigerant charge is always <12kg.

5.2. Transport

The chiller is only allowed to be transported using a fork-lift truck with adequate load-bearing capacity. Refer to the technical specifications for details of your machine's net weight. Please note that if a machine has already been in operation, it can contain residual fluids, which increase the transport weight.

⚠	**ATTENTION! The chiller must not be tilted by more than 10° from the vertical plumb line.**

5.2.1. Fork-lift truck

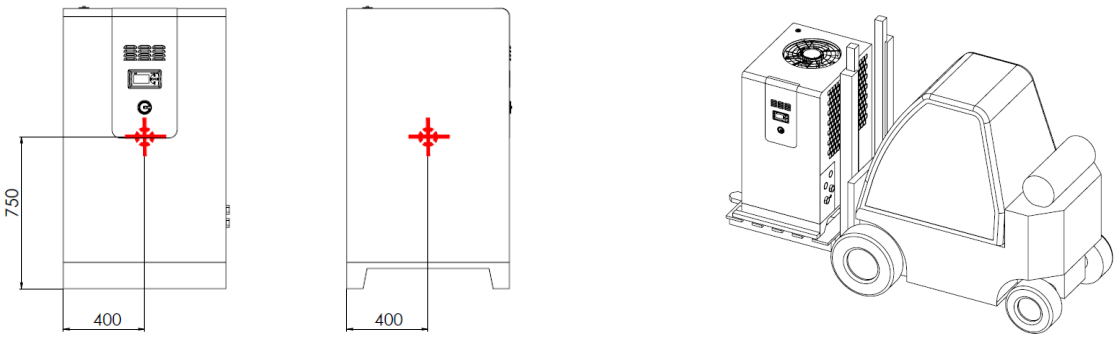


Figure 9: Centre of gravity of vBoxX 6 - 28

The machine can be transported using a fork-lift truck, both when it is packed and unpacked. Please note that the centre of gravity may vary depending on the model.

5.3. Unpacking

⚠	**ATTENTION! Packaging straps are mechanically tensioned and can recoil when cut. Risk of injuries!**

Remove all straps, films, corner protectors and spacers carefully. Optional accessories may be located under the film. Ensure that they are not damaged.

The packaging can be recycled according to the local regulations. Refer to the following table for details of the packaging materials used:

Table 12: Material of packaging

Element	Material	Recycling code
Polystyrene corner protectors	Polystyrene	06 PS
Stretch film	Polyethylene	04 PE-LD
Edge protection / corner protectors	Cardboard	21 PAP
Packaging tape	Polypropylene	05 PP
Strapping seals	Steel, galvanized	40 FE
Wooden pallet	Treated raw wood to ISPM15	50 FOR

5.4. Storage

If the chiller is stored for more than one month, it should remain in the transport packaging or be repacked.

The following conditions must be noted for storage:

- Avoid direct sunlight and moisture
- Ambient temperatures 30 °C to 50 °C

To avoid frost damage the cold water circuit must be drained completely before the chiller is placed in storage and if necessary flushed with a mixture of water and antifreeze (see *Chapter 11.1 Draining*).

6. Installation

6.1. Overview

Several tasks are necessary to install the chiller. The following work schedule shows the order in which they are carried out:

- Prepare the installation site
- Install the machine
- Flush the cold water circuit
- Hydraulic installation
- Fill the whole system
- Vent the whole system
- Electrical installation

6.2. Installation site

6.2.1. General information

The chiller is suitable for both indoor and outdoor installation (note the optional packages). An enclosed room would heat up steadily and the machine can switch off due to a lack of cooling. The exhaust heat from the machine can be approximately calculated as 1.3 x net refrigeration capacity. The air flow rate to be supplied to your machine is given in ***Table 3: Technical specifications.*** When choosing the installation site, ensure that waste heat is not transferred to other processes directly on the air intake side of the chiller.

⚠	ATTENTION! Do not install in rooms with naked flames or smoke.

6.2.2. Minimum room volume

The refrigerant in the unit is assigned to safety group A1 in accordance with EN 378-1 Table E.2. I.e. the refrigerant is not flammable and has low toxicity. If the chiller is installed in enclosed rooms without additional safety measures a minimum room volume is required. This is due to the maximum concentration occurring in an area occupied by persons in the event of release and depends on the refrigerant quantity in the chiller. Refer to the following tables for the value to be complied with for your machine.

Table 13: Minimum volume of the installation room with regard to maximum refrigerant concentration in case of a leak if the chiller is installed indoors

vBoxX	6	8	10	12	15	18	24	28
$V_{Rmin\ refrigerant}$ [m³]	7				11			
$V_{Rmin\ installation\ instructions}$ [m³]	18.7				21.0			

If the calculation of the minimum necessary room volume is related to the respective refrigerant fill quantity only, a room volume of 7 m³ would be sufficient for size I (vBoxX 6 - vBoxX 12) and 11m³ for size II (vBoxX 15 – vBoxX 28), in order to prevent a risk of suffocation.

However, in order to ensure fault-free operation and comfortable servicing of the units the clearances given in the installation instructions must also be maintained. These are 18.7m³ for size I (vBoxX 6 - vBoxX 12) and 21.0m³ for size II (vBoxX 15 – vBoxX 28) – see **Appendix II**.

The refrigerant fill quantity of the Vario-Line units is therefore so small that if the unit clearances given in the installation instructions are complied with it is possible to exclude the risk of suffocation.

6.2.3. Ambient temperature

The chiller is cooled by the ambient air and the lower the temperature of this cooling air the more economically the chiller works. Direct sunshine or exhaust air from other machines heats up the surrounding air and must be taken into account when installing the chiller. Preference is for a shaded installation. The maximum ambient temperature is given in the technical data.

6.2.4. Effect of surrounding air flow

The chiller emits heat to the surrounding area, the machine also draws in cooling air. The machine controls the quantity of cooling air automatically via the speed of the fan. Air currents surrounding the machine, such as the wind, can affect this control and endanger operation of the machine. If a constant direction of an air current is known at the installation site, this should not be directed at the air intake side of the chiller.

6.2.5. Minimum clearances

The minimum clearances around the machine are made up of service clearances and clearances to ensure optimum air supply. On the one hand accessibility must be ensured from all sides, in addition, an unhindered, sufficient quantity of cooling air must be able to be drawn in and blown out upwards. If the minimum clearances are not complied with there is a risk of an air short-circuit between the air intake and discharge side. Please refer to the necessary minimum clearances given in the enclosed main dimension sheets.

6.2.6. Process level

The chiller must not be installed more than 500 mm below the process level. There is a risk that if the chiller is not in use the cold water can drain via the internal tank. If this is nonetheless necessary, the Level package option (*3.26 Level package*) must be installed.

6.2.7. Surface and foundation

The surface on which the machine is installed must be flat and horizontal. All the machine's feet must have uniform contact with the ground. Ensure that the ground/subsoil has sufficient load bearing capacity. The installation instructions (*Appendix II*) recommend a continuous concrete foundation with the given minimum size. For details, the gross weight of your machine is listed in the technical data (*Table 3:* In the case of chillers equipped with a tank, the net weight in operation increases by the tank capacity. This gives the gross weight.
If it is not possible to lay a foundation, the machine can also be positioned on a baseframe made of steel sections. Please also ensure here that all the unit feet have uniform contact with the baseframe.

6.2.8. Stability

The machine usually stands firmly with its baseplate on the ground or floor. It is not necessary to fix the machine onto the floor. However, if this is not possible due to the ambient conditions, the machine can be equipped with the optionally available levelling feet (*3.24 Vario Foot*). The levelling feet provide very good resistance to slipping. If this is not sufficient for your application the machine can also be bolted onto the floor. Holes for this are provided in the machine baseplate. The system designer is responsible for choosing suitable fixing elements.

6.2.9. Levelling

If it is necessary to level the chiller on the ground, this can be done using the optionally available levelling feet.

6.2.10. Vibration isolation

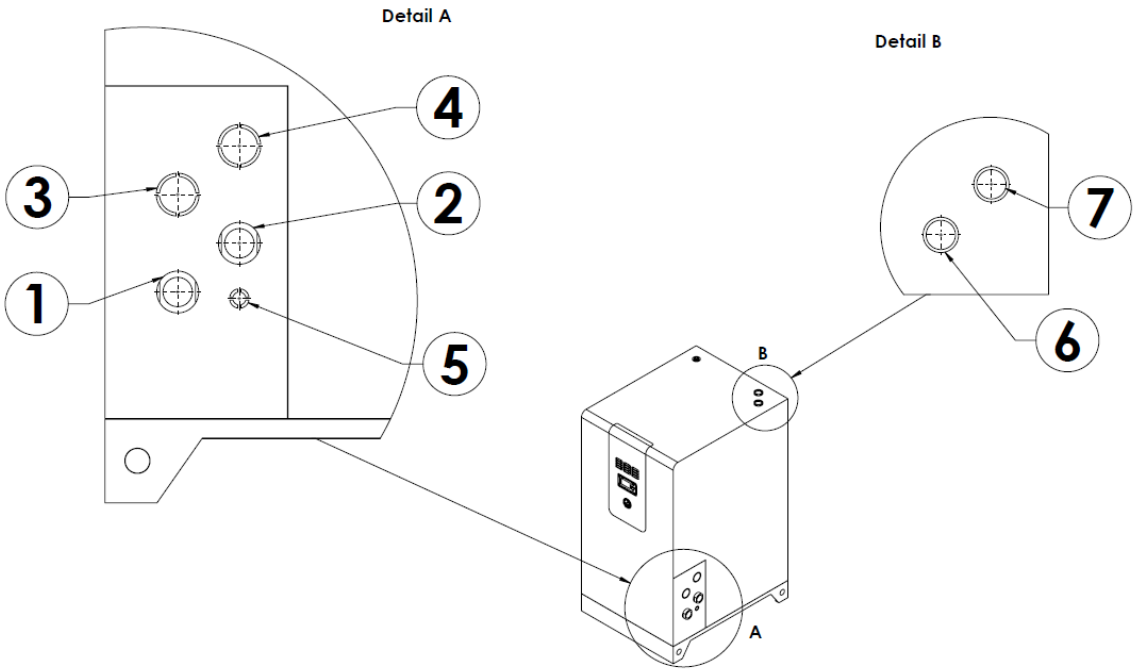
If it is necessary to isolate the chiller from the ground, this can be done using the optionally available levelling feet. The levelling feet are equipped with vibration isolating elastomers.
If there is a risk of vibration being transferred through neighbouring machinery, separate vibration decoupling must be established.

6.2.11. Installation

The device-specific connection allocation can be found in the flow diagrams that accompany the chiller.

	Filling and topping up
	Draining
	Unit outlet cold water circuit 1 (VL)
	Unit inlet cold water circuit 1 (RL)
	Unit outlet cold water circuit 2 (VL)
	Unit inlet cold water circuit 2 (RL)

vBoxX 6 - 28



6.2.12. Hydraulic installation

The system designer is responsible for choosing the material and the cross-section of the hydraulic connections between the chiller and the application. Other dependent factors include the accepted pressure loss in the connection lines and the available pump pressure. When designing the connections attention must also be paid to the minimum flow rate to be maintained and sufficient resistance to the maximum pump pressure.

The refrigerant circuit of chillers with an internal tank must be closed hydraulically.

⚠	**ATTENTION! Galvanised pipes must not be used if water-glycol mixtures are used! Formation of decomposition products, which result in silting up of the system!**

6.2.13. Frost protection measures

The chiller is exposed to the risk of frost in two different situations. Both with an ambient temperature < 0 °C and a feed temperature < 8 °C there is a risk of freezing of parts of the cold water circuit system.

Installation in ambient temperature < 0 °C with anti-freeze
The machine is protected against freezing by anti-freeze. Ensure that you always comply with the requirements with regard to the operating fluid and the mix ratio. This also applies to the version with water-cooled condenser (*Chapter 3.3 Version with water-cooled condenser*).

Flow temperature < 8°C
The machine must be protected against freezing by anti-freeze in accordance with the specifications. Please note that the evaporation temperature is always significantly below the cold water feed temperature. Even within the supposedly safe temperature range there can still be a risk of freezing. Ensure that you comply with the requirements with regard to the operating fluid and the mix ratio.

6.2.14. Flushing the cold water circuit

Contamination of external pipes and components can damage the chiller. Before the chiller is connected hydraulically with the cold water circuit this must be flushed several times. If there are dirt traps in the cold water circuit they must be cleaned after the flushing.

6.2.15. Filling

Once the hydraulic installation of the overall system has been completed, the chiller can be filled. All shut-off valves in the cold water circuit must be opened.

⚠	**ATTENTION! Use approved liquids only, see Chapter 2.15! In case of a frost risk, note and follow Chapter 6.2.13. !** **All the operating liquids must be mixed before they are added to the chiller!**

Procedure for chillers with integrated tank:
The chiller can be filled via the tank without pressure.

Procedure for chillers without an integrated tank:
In the standard version the machine without an integrated tank does not have a filling connection. To fill the system, provide a filling connection in the process circuit. If an external tank is installed in the process circuit, fill your system directly in this tank.

All filling and feed connections are labelled with the following pictogram:

Figure 11: Filling and feed connection

⚠	ATTENTION! In the EU you must follow the provisions of EN378-3. You must also comply with the local installation regulations and provisions, especially (in Germany) the VAwS and the BGR500 Chapter 2.35.

6.2.16. Venting

The pump must be vented before it is started up. To do this the vent plug must be opened before switching on the pump and kept open while the pump is running until all air has escaped from the pump body (see example *Figure 11*).

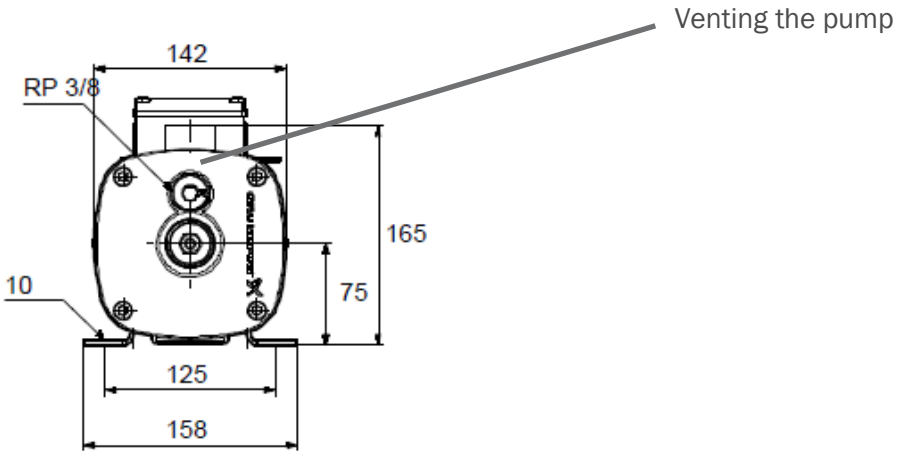


Figure 12: Position of the pump venting (example of horizontal type)

If your chiller is equipped with an internal tank, the further water circulation ensures that residual air can escape via the tank open to the atmosphere.

For machines without a tank we recommend that an automatic venting valve be installed at the highest point in the cold water circuit.

6.2.17. Electrical installation

⚠	ATTENTION! The electrical installation, testing and commissioning may only be carried out by qualified personnel. Note and follow the local regulations.
⚠	ATTENTION! Do not switch on the chiller until the hydraulic installation is completed and the machine has been filled as specified in Chapter 6.2.15. Otherwise the machine could be damaged.

The chiller is connected electrically to its main supply terminal in the control cabinet (see *Figure 13 Main infeed*). A corresponding circuit diagram is enclosed with the unit.

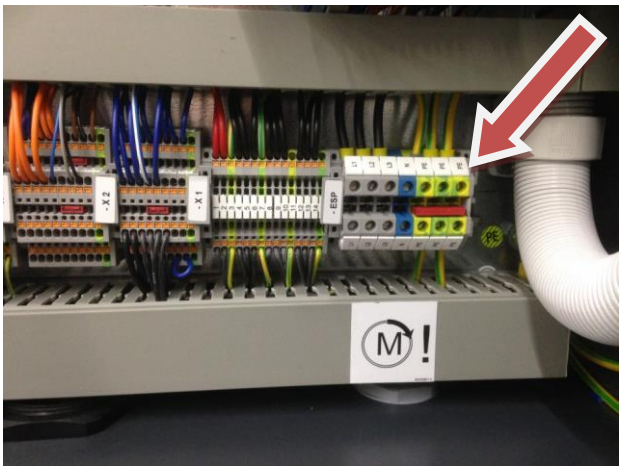


Figure 13: Main infeed

The load cable and fuses must be dimensioned according to the machine's technical specifications and the regulations of the local power supply company.

The supply cable must be routed into the machine. Cut-outs for this are provided in the baseplate. Feed the supply cable, protected by rubber grommets, through these openings (*see Figure 13 Main infeed)*.

Never switch on the chiller immediately if the machine is moved from a cold room to a warm room. The condensing moisture can damage electronic components. For the initial startup or following a lengthy period out of use all the electronic components must have become acclimatised.

Use an external control cable to set the release (see *Chapter 8.3 External release)* the chiller; this is laid parallel with the supply cable and is wired to the corresponding terminals in the control cabinet. On delivery the machine is bridged at the corresponding terminals.

If the electrical installation is completed the phase sequence must be checked. This is done by checking the rotational direction of the pump. A rotational direction arrow is given on this. If the rotational direction is not the same the phase sequence can be corrected by swapping two phases at the main infeed.

7. Initial startup

Before the initial startup, the chiller must be checked using the checklist, to ensure all necessary work described in *Chapter 6 Installation* has been carried out properly.

In order for the compressor to start up without any problems even in low ambient temperatures, all Vario-Line units are equipped with so-called oil temperature monitoring (*4.4.5 Oil temperature monitoring*). In order to ensure this function, in ambient temperatures less than 5 °C it is necessary for the fully installed machine with switched on main switch to be left switched on without cooling release for at least 3 hours before the required operation.

7.1. Installation checklist

- Unit installed horizontal and stable?
- Any vibration damping and floor anchors installed?
- Spaces / clearances around the unit are adequate according to the requirements?
- Air intake side free from packaging materials, etc.?
- Hydraulic connection OK?
- Cold water circuit filled in accordance with the specifications? Water quality OK?
- Whole system flushed? Dirt trap cleaned?
- Cross-sections adequately dimensioned?
- Electrical connection OK? Electrical power is available?
- External pumps OK? Rotational direction?
- Unit cover closed?
- Overall system OK and ready for commissioning/startup?
- Compressor "preheated" ?
- External release OK?

After checking the checklist listed above you can continue with *Chapter 8 Operation*.

Use the enclosed form to register your chiller **Product Registration**. In this way you will receive fast and uncomplicated support in a service case, as KKT chillers already has all the relevant data.

8. Operation

The chiller is designed for fully automatic operation.

8.1. Switching on

First, switch on the unit by turning the main switch. A start screen appears on the display.

8.2. Selecting the operating mode

In the Start screen you can choose between the following three operating modes:

- **Standby:** This operating mode is to be selected if the chiller was disconnected from the power supply in ambient temperatures <5°C for longer than 6 hours. In this case the compressors must be preheated for 3 h, so that the refrigerant can escape from the oil. The compressor heating and the thermostatic pump start are operational.

- **Auto**: The chiller is ready for operation. Fully automatic operation starts by means of external release (potential-free contact) per chapter ***8.3 External release***. If the contact is open, the compressor heating and the thermostatic pump start are operational. If the contact is closed, the fully automatic regulation of the compressor and the tank heating is released. The chiller regulates to its setpoint value.

- **On:** The chiller is switched on permanently in fully automatic operation, without external release.

8.3. External release

In the delivered state the contact for the external release is bridged. An external control cable can be wired up in place of the bridge. Please refer to ***chapter 6.2.17 Electrical installation*** Information on the installation of the external release. Fully automatic operation starts with this external release.

8.4. Control

The system is controlled via a PLC (programmable logic controller). This communicates with an extension module and a controller for activating the inverter and the display. The controller for activating the inverter includes the activation for the complete refrigeration circuit. The inverter itself is used for optimised speed control of the compressor. All operationally relevant data is shown on the display.

8.5. Control unit

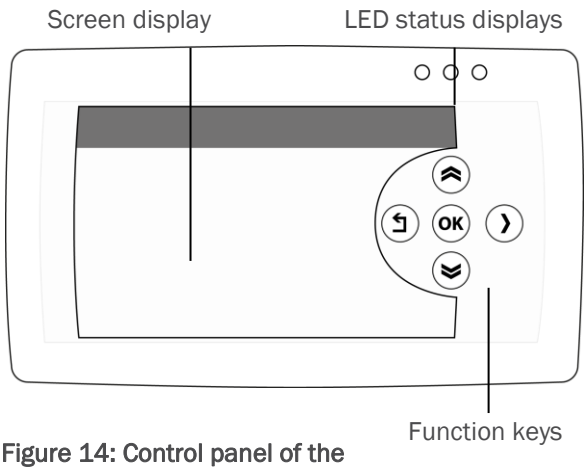


Figure 14: Control panel of the chiller

LED status displays:

- Left LED lights up red:
  Group fault is present
- Middle LED lights up yellow:
  Pump is running
- Right LED lights up green:
  Compressor is running

Please note:
Activated menu fields, in which you can make changes (= input fields), are shown on the display inversely.
There are two types of input fields:

- Text input fields
  Setting options are displayed by default texts.
  If a text input field is released for a change to the setting option, this setting option is right-aligned.
- Numerical input fields
  Values can be changed within a predefined value range.
  If a numerical input field is released for a change to the value, a small flashing cursor appears under the respective digit of the current input position.

Button functions:
Press any button to switch on the display lighting.

Press this button
- to scroll within a menu level from the current display to the previous display of this menu level.
- to change the values if the input field was released for input beforehand by pressing the OK button:
  Within numerical input fields you increase a value.
  Within text input fields you switch to the previous setting option.

Press this button
- to release the input fields for entering / changing values.
- to save the value entered in an input field and at the same time to lock the respective input field.
- to acknowledge all fault messages in the "Alarms" menu if you keep the button pressed for longer than 5 seconds.

Press this button
- to navigate from a higher menu level to the corresponding submenu level.
- to switch between the displayed input fields (if no input field is released for input)
- to jump from one number digit to the next within numerical input fields previously released for input.

Press this button
- to scroll within a menu level from the current display to the next display of this menu level.
- to change the values if the input field was released for input beforehand by pressing the OK button:
  Within numerical input fields you lower a value.
  Within text input fields you switch to the next setting option.

Press this button
- to navigate from a lower to the next higher menu level.
- to jump from one number digit to the next within numerical input fields previously released for input.

8.5.1. Start screen

The general operating status of the system is shown on the start screen:

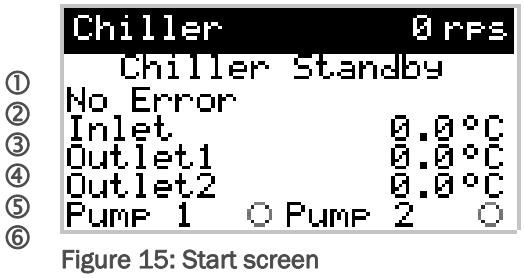


Figure 15: Start screen

① Current system operating mode (here: System standby) For details of how to change the operating mode see ***Chapter 8.5.2 Changing the operating mode.***

The other menu fields of the start screen provide information. The displayed values are changed automatically. Manual input is not possible here.

② Active alarm (here: no fault)

③ Inl. = Inlet temperature
Process water cycle 1 in °C

④ Austr.1= Outlet temperature
Process water cycle 1 in °C

⑤ Austr.2= Outlet temperature
Process water cycle 2 in °C

⑥ Pump 1 / Pump 2. = Pump operating status

O O Pump activity symbols
O O = neither of the two pumps is running
● ● = both pumps are running

8.5.2. Changing the operating mode

If the screen lighting is off (= display is at rest), press any button first to switch on the screen lighting.

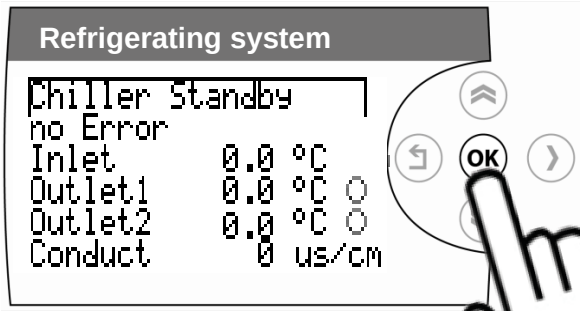


Figure 16: Activating the menu line

If the display lighting is switched on, press the OK button to release the "Current system operating mode" text input field to change the operating state.
(current operating state in the Figure to the side: "System standby").

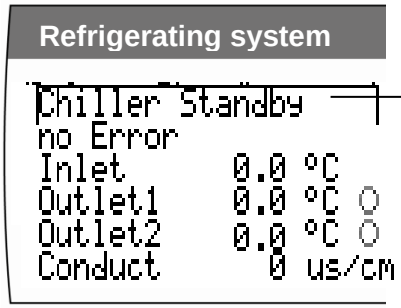
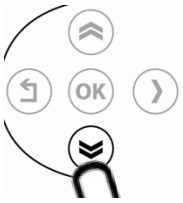


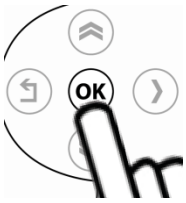
Figure 17: Menu line is activated

By releasing the text input field "Current system operating mode" the text shown in the display is aligned with right-alignment.



Press the button to jump within the released text input field to the next possible setting option.
Press the button to jump to the previous setting option.
You can select one of the following operating modes:

- System standby
- System auto
- System on



Press the OK button to save and activate the currently displayed operating mode.
The entry in the text input field is then left-aligned once again. At the same time, the text input field is locked again.

8.5.3. Navigating to the menu levels

Starting from the start screen, you can open the main menu of the setting and control software. From there you can open submenus (for an overview of the menu levels, see *Appendix I*). If the screen lighting is off (= display is at rest), press any button first to switch on the screen lighting.

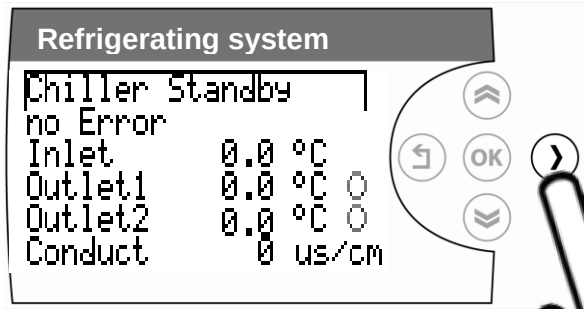


Figure 18: Navigating to the main menu

If the lighting of the control unit is switched on you can navigate back to the Main menu. To do this, press the ⟩ button.

Please note:
To navigate between or within menu levels, none of the input fields may be released for changing values.

To navigate from a higher level to a lower menu level, press the ⟩ button.

Within the menu level, press the ⌄ button to scroll down the displays of this menu level or press the ⌃ button to scroll up.

The displays of a menu level rotate through, this means: Scroll down; the last display of a menu level is followed by the first display of the same menu level. Scroll up; the first display of a menu level is followed by the last display of the same menu level.
To navigate from a lower level to a higher menu level, press the ↰ button.

8.6. Parameters

A parameter can have a lower display level than access level. I.e. not all the parameters displayed can be changed. A daily password is required to change the saved parameters. Should you have any questions about daily passwords, please contact our KKT chillers Service Team (*Contact details*). The password level for the individual parameters can be found in the parameter list that accompanies the machinery documentation.

8.7. Controller description

8.7.1. Electronic level monitoring

Before switching on the chiller the electronic level monitoring takes effect.
The level is monitored for three states:

- Tank min level STOP; The chiller switches off immediately.
- Tank min level warning; The chiller continues running, but does not switch back on if it is at a standstill. The water feed solenoid valve (only with the automatic water feed option) is opened.
- Tank max level message; The cold water feed/water feed solenoid valve (only with the automatic water feed option) is closed.

The ideal state is if the level lies above the warning level and below the maximum level. No message appears in this case.
If the chiller is switched on and the min level warning is reached, the chiller stays switched on so that a cooling process that has started is not interrupted. If the chiller is switched off, the chiller does not start, so that a cooling process is not initiated which might not be able to be ended.

8.7.2. Switching the chiller on - off

The selected pumps will be released if:

- It is selected in the system configuration on the software side,
- No motor protection switch faults are queued,
- No flow monitoring faults are queued,
- No minimum or maximum pump pressure faults are queued.

The following conditions must be fulfilled for the chiller standby status:

- The control has finished its initialisation routine
- Release of all selected pumps,
- Release of the cold water feed or return sensor,
- No exceeding of the cold water feed temperature,
- Release through tank level monitoring,
- Release through cold water pressure monitoring at the evaporator inlet.

The condenser fan is released if:

- The compressor is released
- No fault is queued at the motor protection switch.
- No fault is queued at the digital fault input (e.g. control unit group fault).

When the system is switched on, the primary pump / evaporator pump is switched on with a 3.5 s delay.
When the consumer pump is switched on a timing element starts for each pump, which activates the monitoring of the minimum and maximum cold water pressure at the pump outlet. When the pump is switched on a timing element also starts for release of the compressor's temperature control. The compressor's temperature control is released when the time of the pump has expired. This time is also used for activation of the flow monitoring.

The pressure and flow monitoring takes place with two timing elements:

- Delay on starting; the pressure or flow monitoring triggers an alarm if no pressure has built up after the time has expired
- Delay during operation, in order to ignore short-term pressure or flow fluctuations, the alarm is delayed.

On switching off the system the temperature control is locked immediately and therefore the compressor is switched off. The pump continues running to prevent uncontrolled re-evaporation.

8.7.3. Cold water flow temperature control

The sensor in the tank is usually used to control the liquid flow temperature (system with tank, with pump). If this sensor fails, the control system switches internally to the sensor in the cold water return and the setpoint is increased by a defined value.
A PI controller is used, which generates an output signal of output signal of 0% up to 100%, which activates the compressor.

The following operating states reduce the activation signal for the compressor:

- High pressure
- Low pressure
- Difference between high and low pressure too large

8.7.4. Compressor control system

The control system is designed for a refrigerating circuit with a speed-controlled compressor.

The compressor is requested depending on the controller output signal and is controlled according to the load demand. The compressor switches off if refrigerating capacity is no longer requested.

The high pressure is monitored on the hardware side by means of the high-pressure limiter. When it is triggered the compressor switches off immediately. In addition, the high pressure is controlled by means of a pressure transmitter. This also switches off the compressor if the setpoint is exceeded, but it re-releases it when the pressure falls below the release value. Before switching off, the high-pressure transmitter signals a warning message.

The low pressure is also monitored by pressure transmitters. If the value falls below the setpoint the compressor switches off. If the switching off value is exceeded by the hysteresis the compressor is released again. The triggering of the alarm is delayed by two timing elements. The first timing element is started with the compressor request. If no suction pressure has built up after the time has expired the low-pressure fault alarm is triggered. After the start time has expired the low pressure may fall below the switching off value for a short time. If this happens more often than three times within an hour, the compressor is locked. Before a low-pressure fault is triggered, a low-pressure warning is signalled.

8.7.5. Fan speed control

Due to the continuous adjustment in the number of fans, the condensing pressure is kept constant depending on the ambient temperature by means of a PI controller. As the condensing pressure at the moment in which the compressor is switched on rises very fast, the PI controller is superimposed by a P controller with limiting setpoint. This only intervenes if the PI controller is too slow.

8.7.6. Electronic expansion valve control

An electronic expansion valve with PI regulator is used with vBoxX 6 – 18 and a thermal expansion valve with vBoxX 24 – 28 to keep the superheating constant.

8.7.7. Temperature limit monitoring

The temperature of the cold water flow is monitored for a minimum and maximum limit value if the chiller is switched on (pump is running). If the temperature falls below or exceeds the limit value, after a time delay an alarm is triggered which switches off the compressor.

8.7.8. Group fault message + Warning

A group fault is triggered if an alarm occurs. All alarms are included in the group fault, however, not the warnings. The group fault alarm relay has a floating changeover contact and is pulled up in fault-free operation to ensure wire break monitoring.

9. Cleaning

9.1. Air filter mat

To maintain high performance capability the optionally available air filter mat (*Chapter 3.23 Air filter mat*) must be checked for dirt at least once a month. Suitable air filter mats can be ordered as original spare parts at any time – please contact our KKT chillers service team (*Contact details*).

9.2. Condenser

To maintain high performance capability the microchannel heat exchanger must be cleaned if visibly dirty, however, at least once a year. To do this, safely disconnect the unit from the power supply and remove the service panels and the condenser safety grille (panel 3 and 5, see *Chapter 1.2 Elements*). Use a standard vacuum cleaner to remove coarse dirt particles from the outside first. Then flush the microchannel heat exchanger carefully, in the opposite direction to the air flow, from inside with warm tap water. Then clean with a wet vacuum cleaner until the surface is dry again. For versions with water-cooled condensers see complete cleaning of the cold water circuit.

9.3. Water filters

To ensure the required water quality and the necessary circulating water quantity the optionally available water filter (*Chapter 3.26 Liquid circuit filter assembly*) must be checked for dirt at least once a month. The suitable filter unit can be ordered as an original spare part at any time – please contact our KKT chillers service team (*Contact details*).

9.4. Complete cleaning of the cold water circuit

Due to the complexity and diversity of the possible external materials we recommend complete cleaning of the cold water circuit is carried out by qualified personnel only – to this end, please contact our KKT chillers service team (*Contact details*).

10. Service

All service work may only be carried out by properly trained, competent personnel.

10.1. Maintenance

Reliable operation and a long service life for the entire system can be guaranteed by proper maintenance.

The purpose of the maintenance is:

- To ensure that the machine operates reliably and without unforeseeable failures
- To plan further servicing work in order to minimise downtimes

An overview of the servicing/maintenance intervals recommended by the VDMA is given in ***Appendix III***. In addition, the national regulations of the respective place of installation must also always be followed.

Please note that the points listed represent the minimum maintenance required. By increased monitoring, system reliability can be enhanced. Our service department will be pleased to help with any maintenance offers / contracts.

Use the enclosed form to register your chiller **Product Registration**. In this way you will receive fast and uncomplicated support in a service case, as KKT chillers already has all the relevant data.

10.2. Disposal

An introduction to troubleshooting is given in the ***Appendix II***.

Our technical customer service is available for you to contact around the clock and will provide you with support for all your servicing needs (servicing, maintenance, repairs, spare parts, ...):

Service Team Europe
T +49 9228 9977 7190
E service@kkt-chillers.com
W www.kkt-chillers.com

24/7
Customer Support

Service Team USA
TF +1 866 517 6867
E support@kkt-chillersusa.com
W www.kkt-chillersusa.com

10.3. Spare parts

To ensure that the performance of your chiller is not impaired, we recommend that you only use original spare parts from KKT chillers. By doing so, you ensure the reliability and quality of the machine. For spare parts enquiries, please contact our KKT chillers service team (*Contact details)*.

Use the enclosed form to register your chiller Product Registration. In this way you will receive fast and uncomplicated support in a service case, as KKT chillers already has all the relevant data.

11. Decommissioning/Taking out of service

⚠	**ATTENTION! Decommissioning must only be carried out by professional and qualified technicians.** **They must also be familiar with the local regulations.**

For safety-relevant information on possible residual energy, please refer to *Chapter 4.3 Residual energy.*

11.1. Draining

If the system is filled and there is a risk of frost, suitable measures must be taken to protect the liquid against frost. The complete cold water circuit must be fully drained before any lengthy stoppage of the unit. To do so, proceed as follows:

1. Drain the tank via the drain cock provided for this purpose
2. Drain the evaporator via the drain cock provided for this purpose
3. Drain the pump using the drain plug provided

The drain tap is marked in the unit by the symbol listed in *Figure 19*.

Figure 19: Labelling of the drain tap

The position of the drain tap is given in *Figure 19*.

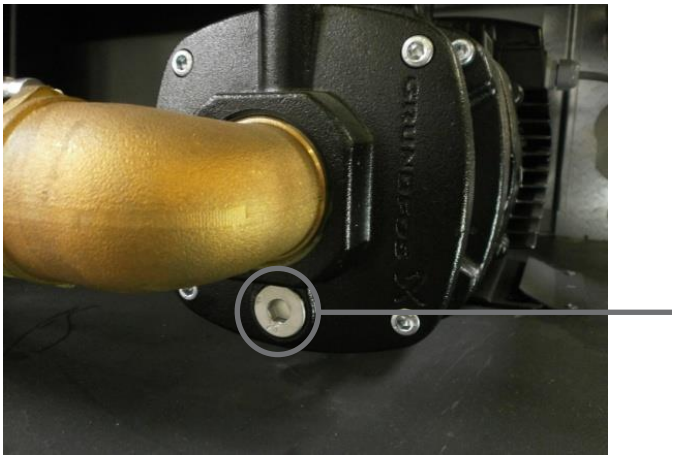


Figure 20: Position of the pump drainage (here: horizontal type)

In order to prevent damage caused by frost, the cold water circuit must then be flushed with a mixture of water and 40 % by volume Antifrogen-N (or equivalent antifreeze).

12. Recycling

⚠	**ATTENTION! Dismantling must be carried out by professional and qualified technicians.** **Water and refrigerant pipes are pressurised!** **They must also be familiar with the local regulations.**

All parts (e.g. refrigerant, oil, glycol, metal, electronics, battery etc.) must be recycled, reused or disposed of. Please note and follow all local and national regulations and if necessary contact your local waste management agency.

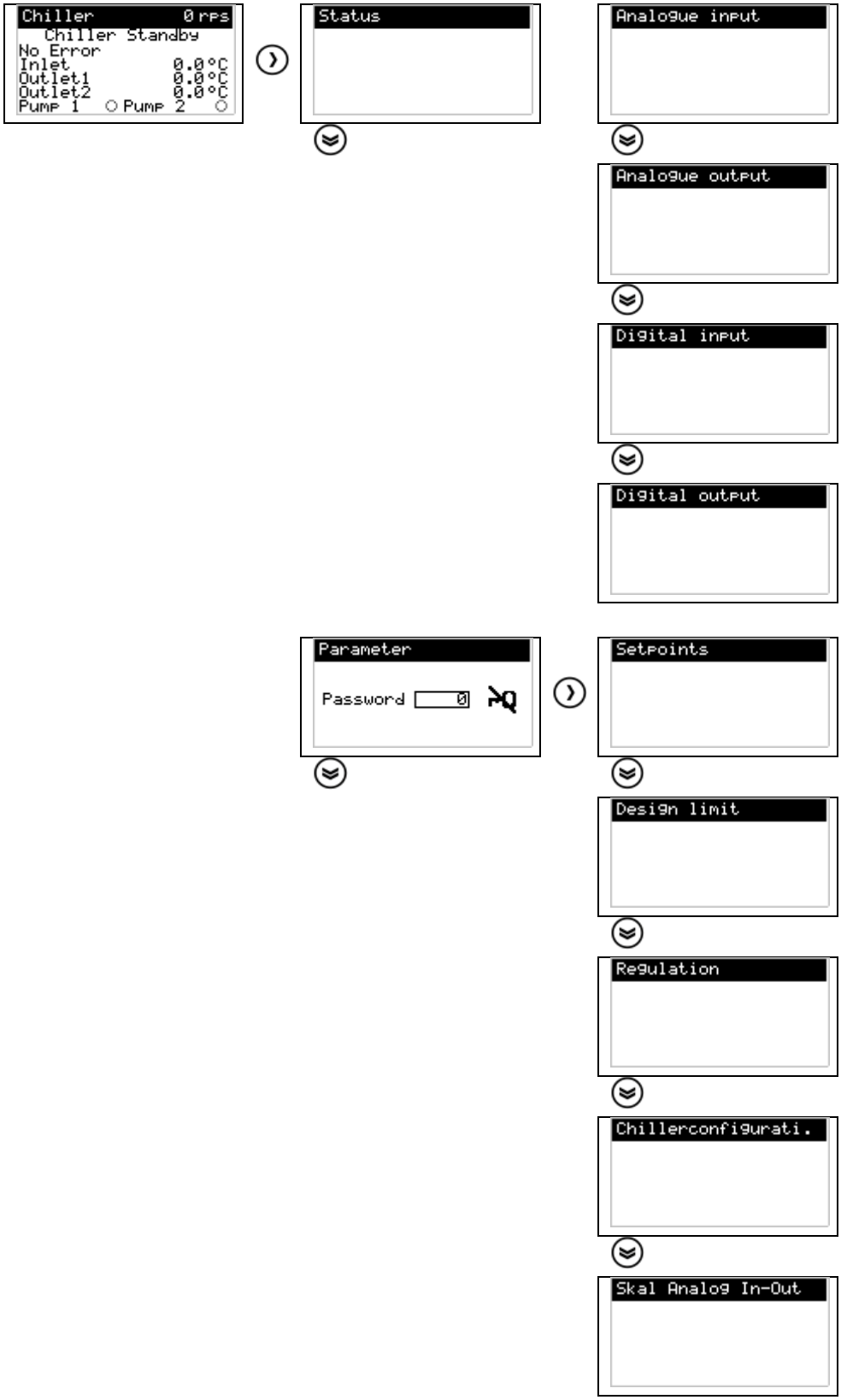
A specialised disposal company must be contracted to dispose of these wastes. They issue a proof of disposal which must be archived. The chiller can be returned to KKT chillers for disposal. In this case, please contact our KKT chillers service team (***Contact details***).

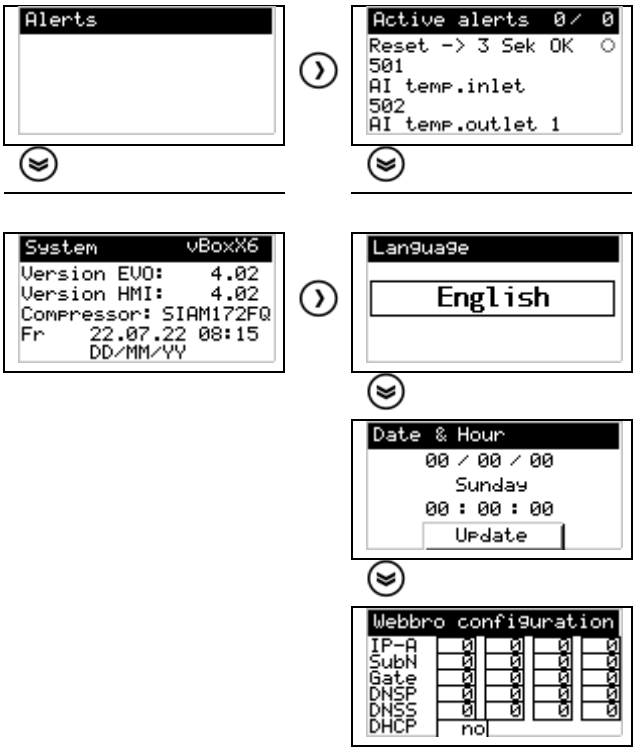
13. Products, solutions and services

Apart from the Vario-Line, KKT chillers also supplies other products, solutions and services, which are not described in this document. For more information, visit our homepage under ***http://www.kkt-chillers.com*** or contact your KKT chillers contact (***Contact details***)– we look forward to hearing from you!

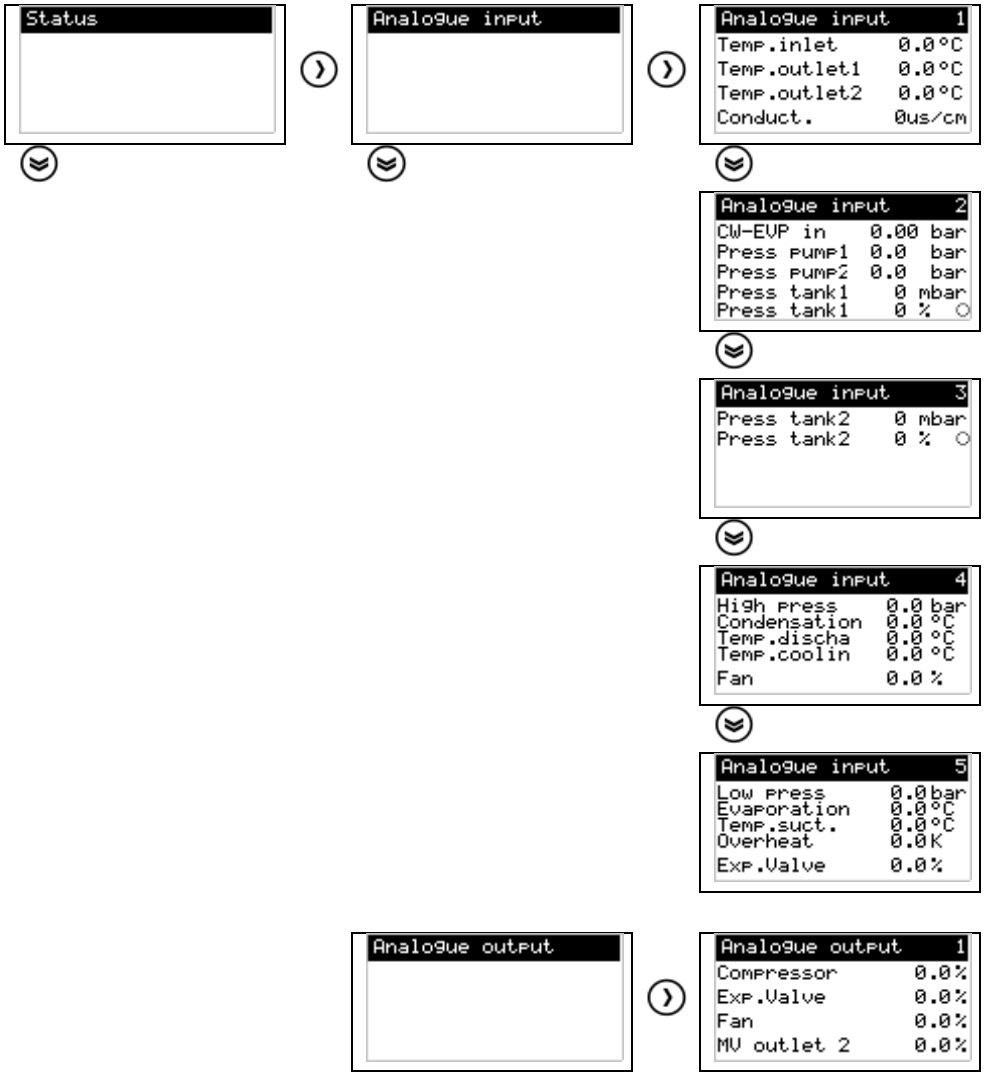
I. Overview of the menu levels

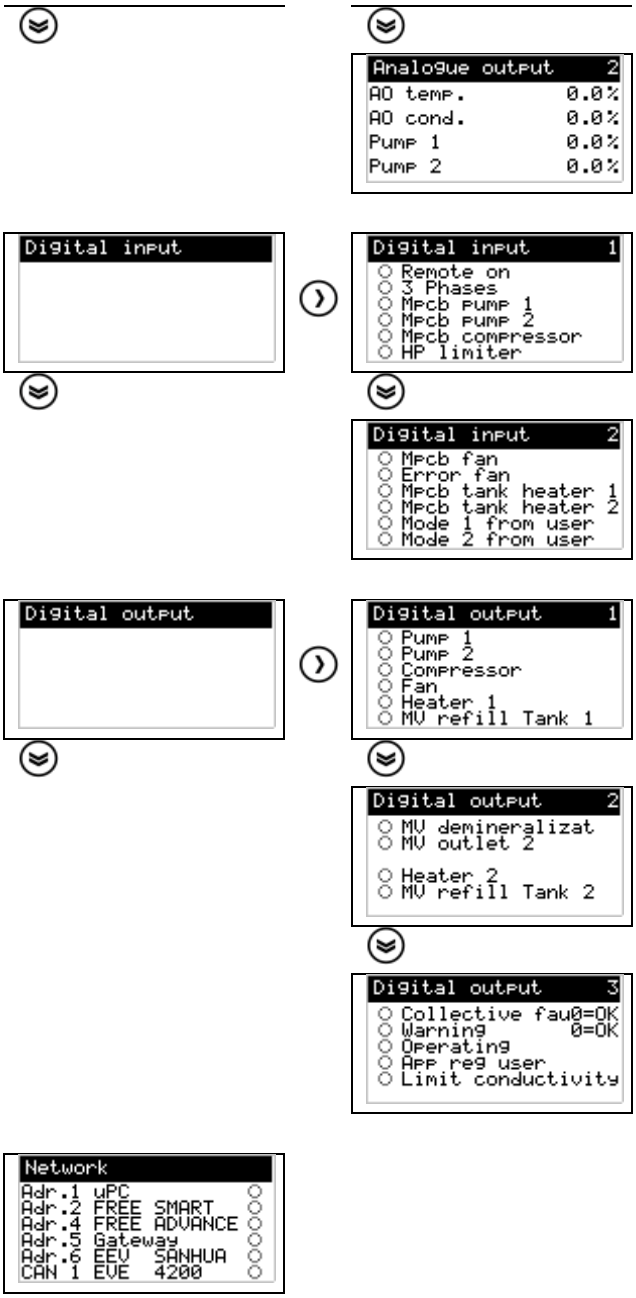
Main structure



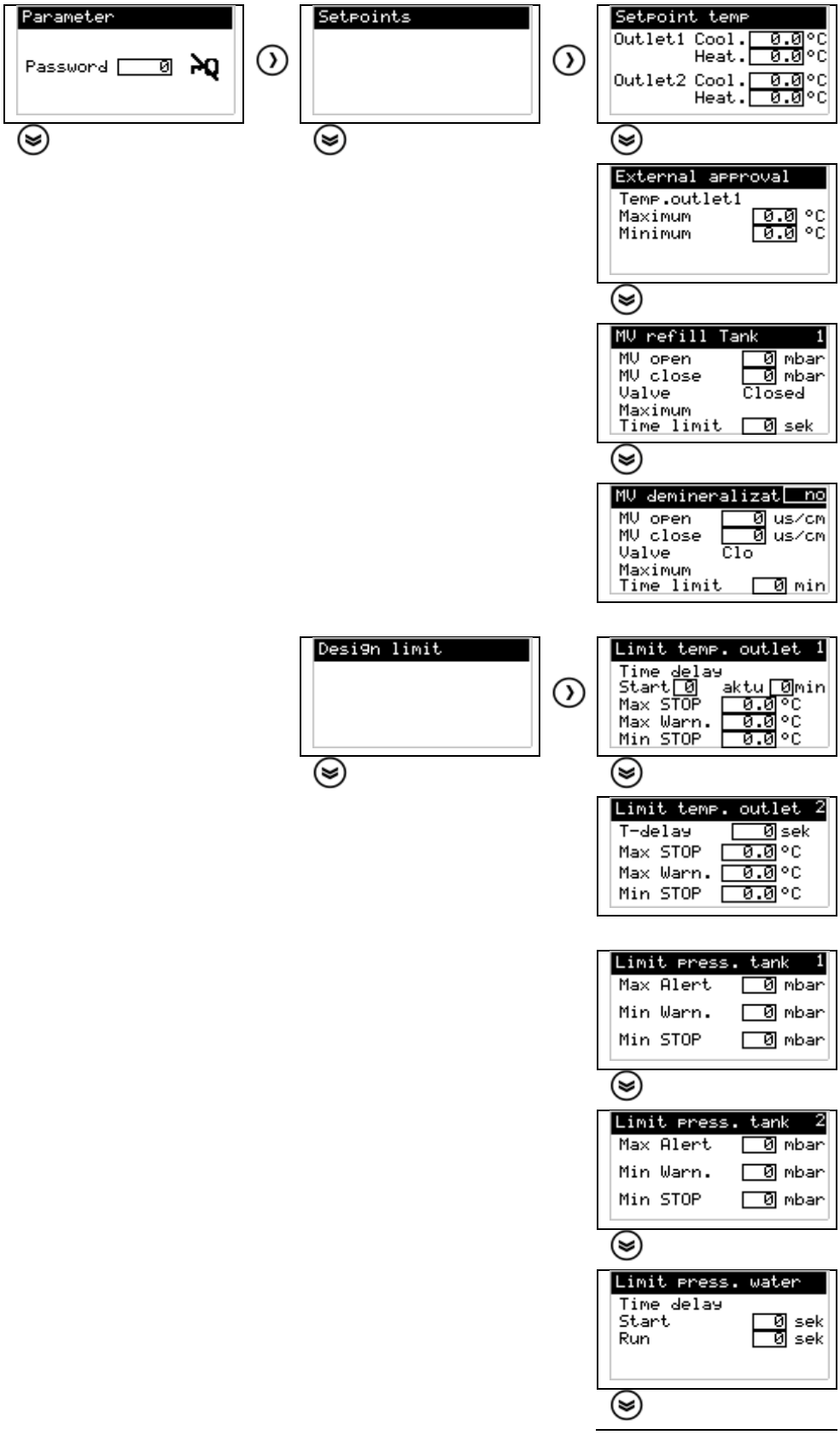

Alerts
Active alerts 0/ 0
Reset -> 3 Sek OK
501
AI temp.inlet
502
AI temp.outlet 1
System vBoxX6
Version EVO: 4.02
Version HMI: 4.02
Compressor: SIAM172FQ
Fr 22.07.22 08:15
DD/MM/YY
Language
English
Date & Hour
00 / 00 / 00
Sunday
00 : 00 : 00
Update
Webbro configuration
IP-A 0 0 0 0
SubN 0 0 0 0
Gate 0 0 0 0
DNSP 0 0 0 0
DNSS 0 0 0 0
DHCP no

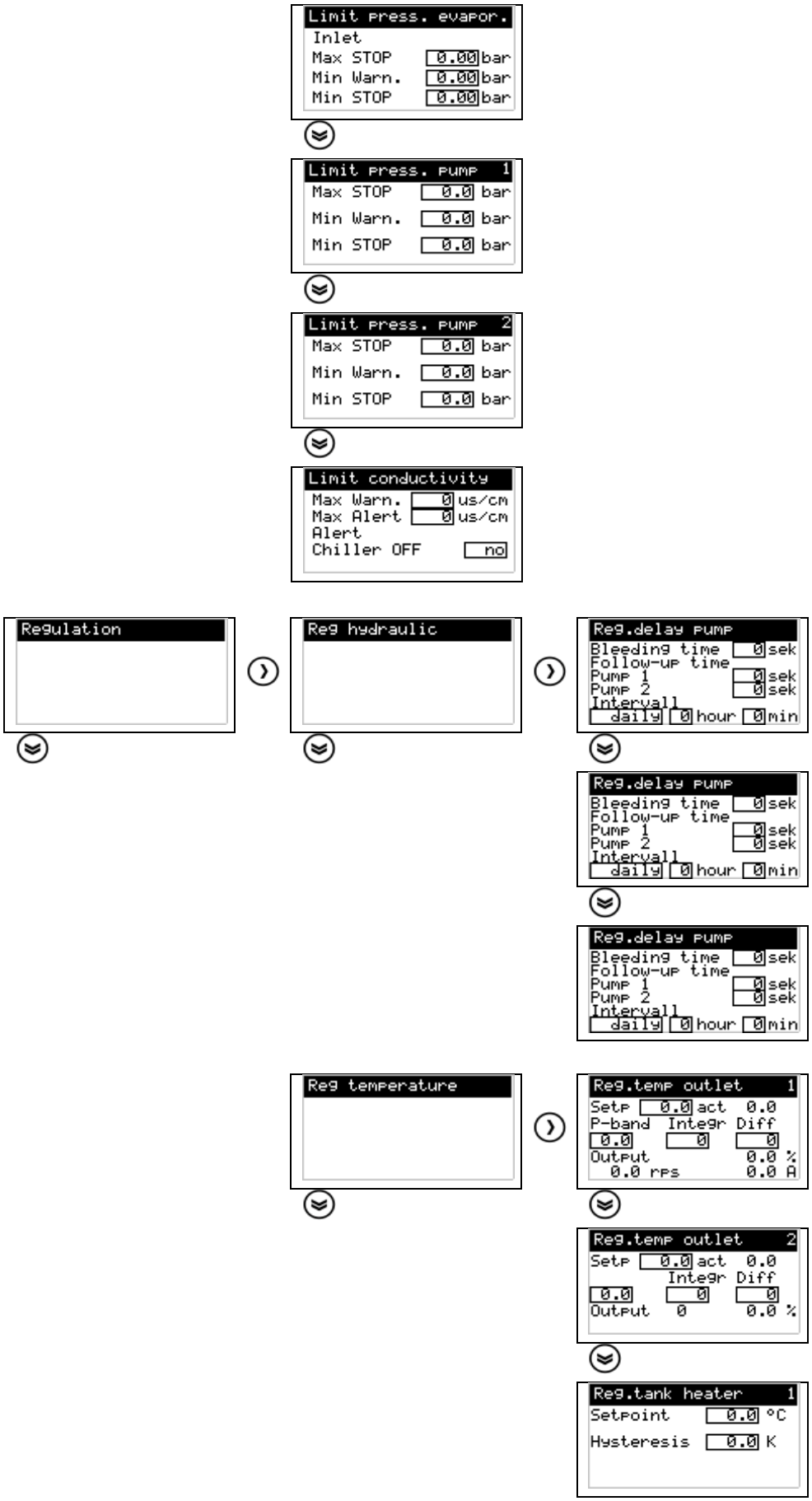
Status

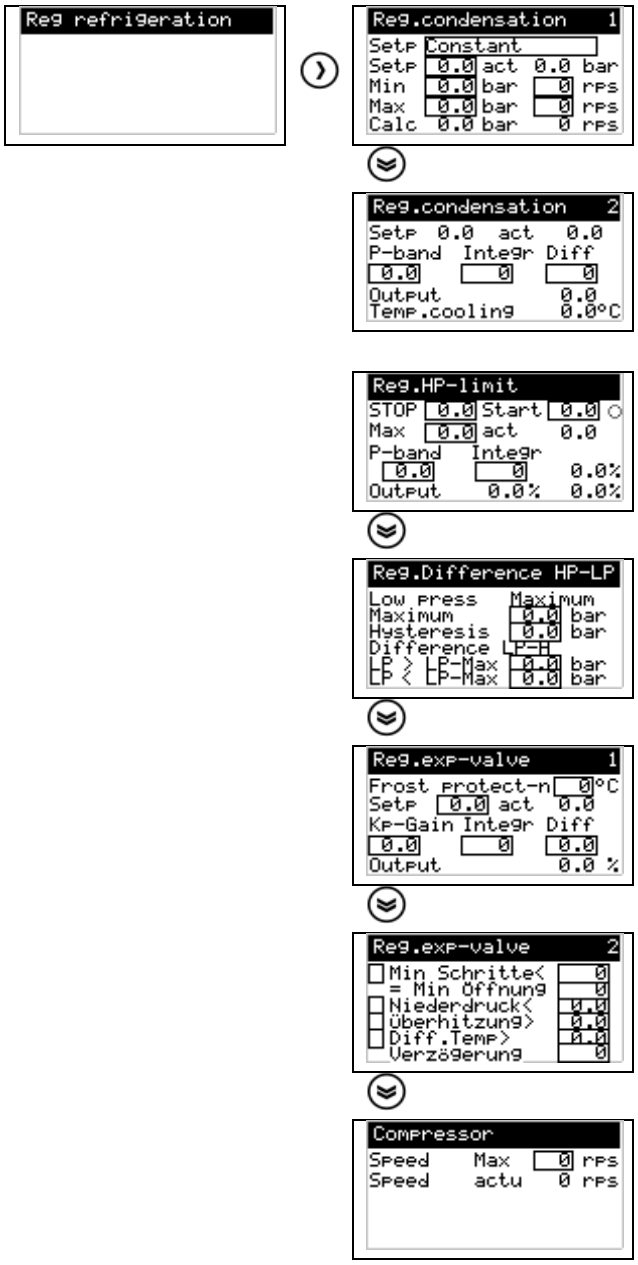

Status
Analogue input
Analogue input 1
Temp.inlet 0.0°C
Temp.outlet1 0.0°C
Temp.outlet2 0.0°C
Conduct. 0us/cm
Analogue input 2
CW-EVP in 0.00 bar
Press pump1 0.0 bar
Press pump2 0.0 bar
Press tank1 0 mbar
Press tank1 0 %
Analogue input 3
Press tank2 0 mbar
Press tank2 0 %
Analogue input 4
High press 0.0 bar
Condensation 0.0 °C
Temp.discha 0.0 °C
Temp.coolin 0.0 °C
Fan 0.0 %
Analogue input 5
Low press 0.0bar
Evaporation 0.0°C
Temp.suct. 0.0°C
Overheat 0.0K
Exp.Valve 0.0%
Analogue output
Analogue output 1
Compressor 0.0%
Exp.Valve 0.0%
Fan 0.0%
MV outlet 2 0.0%

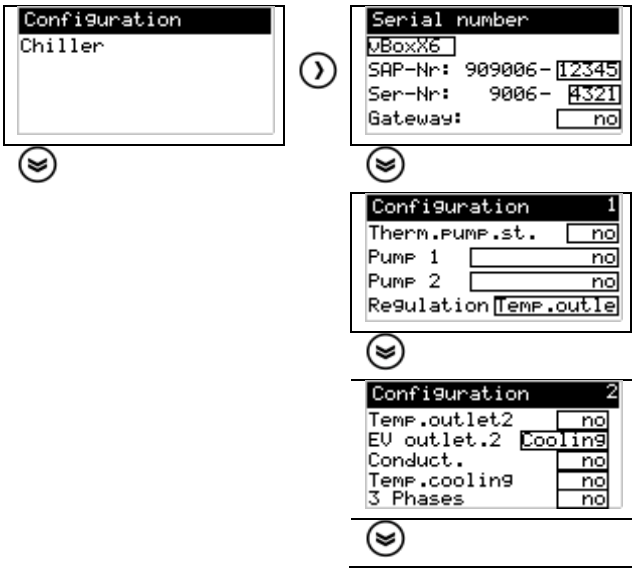

Analogue output 2
AO temp. 0.0%
AO cond. 0.0%
Pump 1 0.0%
Pump 2 0.0%
Digital input
Digital input 1
Remote on
3 Phases
Mpcb pump 1
Mpcb pump 2
Mpcb compressor
HP limiter
Digital input 2
Mpcb fan
Error fan
Mpcb tank heater 1
Mpcb tank heater 2
Mode 1 from user
Mode 2 from user
Digital output
Digital output 1
Pump 1
Pump 2
Compressor
Fan
Heater 1
MV refill Tank 1
Digital output 2
MV demineralizat
MV outlet 2
Heater 2
MV refill Tank 2
Digital output 3
Collective fau0=OK
Warning 0=OK
Operating
App reg user
Limit conductivity
Network
Adr.1 uPC
Adr.2 FREE SMART
Adr.4 FREE ADVANCE
Adr.5 Gateway
Adr.6 EEV SANHUA
CAN 1 EVE 4200

Parameters


Parameter
Password 0
Setpoints
Setpoint temp
Outlet1 Cool. 0.0 °C
Heat. 0.0 °C
Outlet2 Cool. 0.0 °C
Heat. 0.0 °C
External approval
Temp.outlet1
Maximum 0.0 °C
Minimum 0.0 °C
MV refill Tank 1
MV open 0 mbar
MV close 0 mbar
Valve Closed
Maximum
Time limit 0 sek
MV demineralizat no
MV open 0 us/cm
MV close 0 us/cm
Valve Clo
Maximum
Time limit 0 min
Design limit
Limit temp. outlet 1
Time delay
Start 0 aktu 0 min
Max STOP 0.0 °C
Max Warn. 0.0 °C
Min STOP 0.0 °C
Limit temp. outlet 2
T-delay 0 sek
Max STOP 0.0 °C
Max Warn. 0.0 °C
Min STOP 0.0 °C
Limit press. tank 1
Max Alert 0 mbar
Min Warn. 0 mbar
Min STOP 0 mbar
Limit press. tank 2
Max Alert 0 mbar
Min Warn. 0 mbar
Min STOP 0 mbar
Limit press. water
Time delay
Start 0 sek
Run 0 sek


Limit press. evapor.
Inlet
Max STOP 0.00 bar
Min Warn. 0.00 bar
Min STOP 0.00 bar
Limit press. pump 1
Max STOP 0.0 bar
Min Warn. 0.0 bar
Min STOP 0.0 bar
Limit press. pump 2
Max STOP 0.0 bar
Min Warn. 0.0 bar
Min STOP 0.0 bar
Limit conductivity
Max Warn. 0 us/cm
Max Alert 0 us/cm
Alert
Chiller OFF no
Regulation
Reg hydraulic
Reg.delay pump
Bleeding time 0 sek
Follow-up time
Pump 1 0 sek
Pump 2 0 sek
Intervall
daily 0 hour 0 min
Reg.delay pump
Bleeding time 0 sek
Follow-up time
Pump 1 0 sek
Pump 2 0 sek
Intervall
daily 0 hour 0 min
Reg.delay pump
Bleeding time 0 sek
Follow-up time
Pump 1 0 sek
Pump 2 0 sek
Intervall
daily 0 hour 0 min
Reg temperature
Reg.temp outlet 1
Setp 0.0 act 0.0
P-band Integr Diff
0.0 0 0
Output 0.0 %
0.0 rps 0.0 A
Reg.temp outlet 2
Setp 0.0 act 0.0
Integr Diff
0.0 0 0
Output 0 0.0 %
Reg.tank heater 1
Setpoint 0.0 °C
Hysteresis 0.0 K


Reg refrigeration
Reg.condensation 1
Setp Constant
Setp 0.0 act 0.0 bar
Min 0.0 bar 0 rps
Max 0.0 bar 0 rps
Calc 0.0 bar 0 rps
Reg.condensation 2
Setp 0.0 act 0.0
P-band Integr Diff
0.0 0 0
Output 0.0
Temp.cooling 0.0°C
Reg.HP-limit
STOP 0.0 Start 0.0
Max 0.0 act 0.0
P-band Integr
0.0 0 0.0%
Output 0.0% 0.0%
Reg.Difference HP-LP
Low press Maximum
Maximum 0.0 bar
Hysteresis 0.0 bar
Difference LP-H
LP > LP-Max 0.0 bar
LP < LP-Max 0.0 bar
Reg.exp-valve 1
Frost protect-n 0°C
Setp 0.0 act 0.0
Kp-Gain Integr Diff
0.0 0 0.0
Output 0.0 %
Reg.exp-valve 2
Min Schritte< 0
= Min Öffnung 0
Niederdruck< 0.0
Überhitzung> 0.0
Diff.Temp> 0.0
Verzögerung 0
Compressor
Speed Max 0 rps
Speed actu 0 rps


Configuration
Chiller
Serial number
vBoxX6
SAP-Nr: 909006- 12345
Ser-Nr: 9006- 4321
Gateway: no
Configuration 1
Therm.pump.st. no
Pump 1 no
Pump 2 no
Regulation Temp.outle
Configuration 2
Temp.outlet2 no
EV outlet.2 Cooling
Conduct. no
Temp.cooling no
3 Phases no

```
Konfiguration        3
Tank 1               Nein
Heizung              Nein
Nachspeisung         Nein
Tank 2               Nein
Heizung              Nein
Nachspeisung         Nein
```

```
Configuration        4
Temp.outlet1
Setp    Min    0.0 °C
ExpansionsV. CAREL
CAREL    0 Stepp EEV
SANHUA   0.0 %   DO
```

```
Configuration        5
DO Collective fau 0=OK
DO Warning        0=OK
DO 4     Alert 0=ok
DO 6     Alert 0=ok
DO 7     Alert 0=ok
```

```
Configuration        6
IO-Modul
DO 1     Alert 0=ok
DO 2     Alert 0=ok
DO 3     Alert 0=ok
DO 4     Alert 0=ok
```

```
Configuration        7
```

```
Configuration        7
Password             0
```

```
Configuration        7
Password             0
Heating + Cooling
                    no
!Cable Cross-section!
    Power supply
```

```
Scaling
Analogue input
Analogue output
```

```
Scaling
Offset temperature
Temp.inlet      0.0 K
Temp.outlet1    0.0 K
Temp.outlet2    0.0 K
```

```
Scaling
AI press pump 1
 4mA   =  0.00 bar
 20mA  =  0.00 bar
          0.0  bar
```

```
Scaling
AI press cw-evaporat
  4mA   =  0.00 bar
  20mA  =  0.00 bar
           0.00 bar
```

```
Scaling
AI press tank 1
  4mA    =      0 mbar
  20mA   =      0 mbar
                0 mbar
```

```
Scaling
AI EVO high pressure
  4mA    =    0.0  bar
  20mA   =    0.0  bar
  EVO   0.0 uPC   0.0
```

```
Scaling
AO Temp.outlet1
    0.0 °C =  0 V
    0.0 °C = 10 V
    0.0 °C =  0.00 V
```

```
Scaling
AO Conduct.
    0 uS/cm =  0 V
    0 uS/cm = 10 V
    0 uS/cm =  0.00 V
```

```
Scal.temp.discharge
 Alert
 Maximum        0.0  °C
 Minimum        0.0  °C
 Time delay
 Start            0  sek
 Run              0  sek
```

II. Troubleshooting

Fault code	Display	Type of message	Message description	Cause of the message	Troubleshooting	Reaction of the chiller
161	Low press. min. Stop From version 03.61, low-pressure sensor	Group fault alarm	Analogue low pressure input (PWM) at the µPC, has maximum measured value although a lower value must be displayed.	Analogue input not connected or faulty.	Check liquid flow. Check the refrigerant level. Check the function of the expansion valve.	Switches compressor and fan off immediately.
301	Temp.Outl.1 maxWarn	Warning	Outlet temperature of the liquid circuit is approaching the upper limit.	Thermal overload, No cold production (refrigeration).	Check refrigerating capacity, check the function of the refrigeration circuit	All components continue to run, Warning will be saved, Manual reset.
302	Temp.Outl.2 maxWarn	Warning	Outlet temperature of the liquid circuit is approaching the upper limit.	Thermal overload, No refrigeration effect, Cooling valve not working; Cooling valve incorrectly configured.	Check refrigerating capacity, Check the function of the refrigeration circuit, Check cooling valve, Check configuration of cooling valve.	All components continue to run, Warning will be saved, Manual reset.
311	Tank press. max warn	Warning	Level in the tank is approaching the maximum limit.	Level in the tank is too high, level sensor in the tank is defective.	Empty the tank a little, Check the function of the tank sensor.	All components continue to run, Warning will be saved, Manual reset.
314	Tank 2 press.max warn	Warning	Level in the tank is approaching the maximum limit.	Level in the tank is too high, level sensor in the tank is defective.	Empty the tank a little, Check the function of the tank sensor.	All components continue to run, Warning will be saved, Manual reset.
312	Tank press. min warn	Warning	Level in the tank is approaching the minimum limit.	Level in the tank is too low, level sensor in the tank is defective.	Fill tank, Check the function of the tank sensor in the tank.	All components continue to run, Warning will be saved, Manual reset.
315	Tank2 press.min warn	Warning	Level in the tank is approaching the minimum limit.	Level in the tank is too low, level sensor in the tank is defective.	Fill tank, Check the function of the tank sensor in the tank.	All components continue to run, Warning will be saved, Manual reset.
313	Timelimit EV1 refill	Warning	The tank refilling solenoid valve does not close within the specified time.	The freshwater supply is interrupted.	Check the function of the tank refilling solenoid valve. Open the shut-off devices integrated into the supply line. Check supply pipe for leakage.	Tank refilling solenoid valve closes. All other components continue to run, Alarm will be saved, Manual reset.
317	Time limit MV2 demin.	Not present in hardware	The tank refilling solenoid valve does not close within the specified time.	The freshwater supply is interrupted.	Check the function of the tank refilling solenoid valve. Open the shut-off devices integrated into the supply line. Check supply pipe for leakage.	Tank refilling solenoid valve closes. All other components continue to run, Alarm will be saved, Manual reset.

321	Coldwatpress.minwarn	Warning	The liquid pressure at the evaporator is approaching the minimum or maximum limit	External gate valve closed, Filter dirty, Air in the system.	Open the external gate valve, Clean the filter, Vent the system.	All components continue to run, Alarm will be saved, Manual reset.
326	Press. P1 min warn	Warning	The pump's pressure is approaching the minimum limit	Flow rate too high, chiller resistance too low, air in the system	Reduce flow rate, increase chiller resistance, Vent the system.	All components continue to run, Alarm will be saved, Manual reset.
327	Press. P2 min warn	Warning	The pump's pressure is approaching the minimum limit	Flow rate too high, chiller resistance too low, air in the system	Reduce flow rate, increase chiller resistance, Vent the system.	All components continue to run, Alarm will be saved, Manual reset.
331	Conduct'y max alarm	Warning	Conductivity exceeds maximum limit.	Conductivity too high.	Check the limit default, If installed: Check DI cartridge, Check flow through the DI cartridge.	Depending on configuration, system shutdown or only message, Alarm will be saved, Manual reset.
332	Conduct'y max warn	Warning	Conductivity is approaching the maximum limit.	Conductivity too high.	Check the limit default. If installed: Check DI cartridge, Check flow through the DI cartridge.	All components continue to run, Alarm will be saved, Manual reset.
333	Timelimit EV1 demin.	Warning	The demineralisation solenoid valve does not close within the specified time.	DI cartridge worn out. No flow through the DI cartridge. Switch-off point set too high.	Replace DI cartridge. Check flow through the DI cartridge. DI cartridge worn out.	Desalination solenoid valve closes. All other components continue to run, Alarm will be saved, Manual reset.
351	Temp.Outl.1 maxStop	Group fault alarm	Maximum outlet temperature water circuit 1 exceeded.	No refrigeration effect, Thermal overload.	Check the function of the refrigerant circuit, Check thermal load installed.	Chiller switches off immediately. Alarm will be saved, Manual reset.
353	Temp.Outl.2 maxStop	Group fault alarm	Maximum outlet temperature water circuit 2 exceeded.	No refrigeration effect, Circuit 2 valve does not open Thermal overload.	Check the function of the refrigerant circuit, Check the function of water circuit 2 (cooling valve), Check the configuration of circuit 2, Check thermal load installed.	Chiller switches off immediately. Alarm will be saved, Manual reset.
352	Temp.Outl.1 minStop	Group fault alarm	Outlet temperature is below the minimum.	Check the function of the tank heating, Check setpoint specifications, ambient temperature too low.	Check the function of the tank heating, check the setpoint, increase the ambient temperature.	Chiller switches off immediately. Alarm will be saved, Manual reset.
354	Temp.Outl.2 minStop	Group fault alarm	Outlet temperature is below the minimum.	Check the function of the tank heating, Check setpoint specifications, ambient temperature too low.	Check the function of the tank heating, check the setpoint, increase the ambient temperature.	Chiller switches off immediately. Alarm will be saved, Manual reset.

361	Tank press. min Stop	Group fault alarm	Level in tank is below the minimum.	Level in the tank too low, Level sensor in the tank contaminated or defective.	Fill tank, Check the function of the tank sensor.	Chiller switches off immediately. Alarm will be saved, Manual reset.
362	Tank 2 press.min Stop	Group fault alarm	Level in tank is below the minimum.	Level in the tank too low, Level sensor in the tank contaminated or defective.	Fill tank, Check the function of the tank sensor.	None, Alarm will be saved, Manual reset.
373	Coldwatpress.maxStop	Group fault alarm	Liquid pressure in the inlet is too high	Evaporator dirty, water quantity too high	Clean evaporator, Adjust the water quantity, check the water quality	System shuts down in a controlled manner, Alarm will be saved, Manual reset.
374	Coldwtpress.minStart	Group fault alarm	Liquid pressure at the evaporator too low after switching on.	External gate valve closed, Filter dirty, Air in the system.	Open external gate valve, clean filter, vent the system.	System shuts down in a controlled manner, Alarm will be saved, Manual reset.
375	Coldwatpress.min.Op	Group fault alarm	Cold water pressure at the evaporator too low during operation.	External gate valve closed, Filter dirty, Air in the system.	Open external gate valve, clean filter, vent the system.	System shuts down in a controlled manner, Alarm will be saved, Manual reset.
381	Press. P1 max Stop	Group fault alarm	Refrigerant output pressure too high	External gate valve closed, Filter dirty	Open external gate valve, clean filter, check overflow valve setting	Fan, compressor and pump switch off immediately, Pump 2 continues to run, Alarm will be saved, Manual reset.
385	Press. P2 max Stop	Group fault alarm	Refrigerant output pressure too high	External gate valve closed, Filter dirty	Open external gate valve, clean filter, check overflow valve setting	Pump switches off. Alarm will be saved, Manual reset.
383	Press. P1 min Start	Group fault alarm	Cold water pressure at the pump outlet too low after switching on. Flow rate too high, Air in the system.	External pressure loss too low Pump is operating outside the set limits External pipe system not yet filled	Fill and vent Increase external pressure loss	Fan, compressor and pump switch off immediately, Pump 2 continues to run, Alarm will be saved, Manual reset.
387	Press. P1 min oper.	Group fault alarm	Cold water pressure at the pump outlet too low after switching on. Flow rate too high, Air in the system.	External pressure loss too low Pump is operating outside the set limits External pipe system not yet filled	Fill and vent Increase external pressure loss	Fan, compressor and pump switch off immediately, Pump 2 continues to run, Alarm will be saved, Manual reset.
384	Press. P2 min Start	Group fault alarm	Cold water pressure at the pump outlet too low during operation. Flow rate too high, Air in the system.	External pressure loss too low Pump is operating outside the set limits	Increase external pressure loss	Pump switches off. Alarm will be saved, Manual reset.

388	Press. P2 min oper.	Group fault alarm	Cold water pressure at the pump outlet too low during operation. Flow rate too high, Air in the system.	External pressure loss too low Pump is operating outside the set limits	Increase external pressure loss	Pump switches off. Alarm will be saved, Manual reset.
501	AI Temp.inlet	Warning	Measured value of the analogue input outside the valid measurement range	Sensor defective, Sensor break or sensor short-circuit	Check the electrical connections of the sensor, Check the sensor by means of the sensor's characteristic curve	No reaction if the outlet regulation, if the regulating sensor, switches the system off. Warning will be saved, Manual reset.
502	AI Temp.Outlet 1	Group fault alarm	Measured value of the analogue input outside the valid measurement range	Sensor defective, Sensor break or sensor short-circuit	Check the electrical connections of the sensor, Check the sensor by means of the sensor's characteristic curve	Pump continues to run Regulates based on the inlet sensor (5k over outlet setpoint temperature) Acknowledgement successful
503	AI Temp.Outlet 2	Group fault alarm	Measured value of the analogue input outside the valid measurement range	Sensor defective, Sensor break or sensor short-circuit	Check the electrical connections of the sensor, Check the sensor by means of the sensor's characteristic curve	Cooling valve closes, Compressor shuts down in a controlled manner, System shuts down after the run-on time, Alarm will be saved, Manual reset.
511	AI cold water press.	Group fault alarm	Measured value of the analogue input outside the valid measurement range	Sensor defective, Sensor break or sensor short-circuit	Check the electrical connections of the sensor, Check the sensor by means of the sensor's characteristic curve	Compressor and fan off immediately, Pump 1 continues to run, Pump 2 continues to run, System shuts down after the run-on time, Alarm will be saved, Manual reset.
513	AI pump pressure 1	Group fault alarm	Measured value of the analogue input outside the valid measurement range	Sensor defective, Sensor break or sensor short-circuit	Check the electrical connections of the sensor, Check the sensor by means of the sensor's characteristic curve	Compressor and fan off immediately, Pump 1 off immediately, Pump 2 continues to run, Alarm will be saved, Manual reset.
514	AI pump pressure 2	Group fault alarm	Measured value of the analogue input outside the valid measurement range	Sensor defective, Sensor break or sensor short-circuit	Check the electrical connections of the sensor, Check the sensor by means of the sensor's characteristic curve	Compressor and fan off immediately, Pump 1 continues to run, Pump 2 off immediately, Cooling valve closes, Alarm will be saved, Manual reset.
515	AI tank pressure 1	Group fault alarm	Measured value of the analogue input outside the valid measurement range	Sensor defective, Sensor break or sensor short-circuit	Check the electrical connections of the sensor, Check the sensor by means of the sensor's characteristic curve	Chiller switches off immediately, Alarm will be saved, Manual reset.

516	AI tank pressure 2	Group fault alarm	Measured value of the analogue input outside the valid measurement range	Sensor defective, Sensor break or sensor short-circuit	Check the electrical connections of the sensor, Check the sensor by means of the sensor's characteristic curve	Pump 2 switches off. Alarm will be saved, Manual reset.
521	AI high pressure	Group fault alarm	Measured value of the analogue input outside the valid measurement range	Sensor defective, Sensor break or sensor short-circuit	Check the electrical connections of the sensor, Check the sensor by means of the sensor's characteristic curve	Compressor and fan off immediately Check fan Pump continues to run Acknowledgement successful 2x
526	AI cool water temp.	Warning	Measured value of the analogue input outside the valid measurement range	Sensor defective, Sensor break or sensor short-circuit	Check the electrical connections of the sensor, Check the sensor by means of the sensor's characteristic curve	Alarm will only be displayed No shutdown initiated, acknowledgement successful
531	AI conductivity	Group fault alarm	Measured value of the analogue input outside the valid measurement range	Sensor defective, Sensor break or sensor short-circuit	Check the electrical connections of the sensor, Check the sensor by means of the sensor's characteristic curve	Compressor off immediately Fan is shut down in a controlled manner Pumps continue to run Can be acknowledged with delay
532	AI flow Term.1	Warning	Measured value of the analogue input outside the valid measurement range	Sensor defective, Sensor break or sensor short-circuit	Check the electrical connections of the sensor, Check the sensor by means of the sensor's characteristic curve	Aftercooler valve closes
533	AI flow Term.2	Warning	Measured value of the analogue input outside the valid measurement range	Sensor defective, Sensor break or sensor short-circuit	Check the electrical connections of the sensor, Check the sensor by means of the sensor's characteristic curve	Aftercooler valve closes
535	AI Temp. heat exchanger 1	Warning	Measured value of the analogue input outside the valid measurement range	Sensor defective, Sensor short-circuit or sensor break	Check the electrical connections of the sensor, Check the sensor by means of the sensor's characteristic curve	None, as only display value
581	Network uPC					
582	Network FREEESMART1					
583	Network FREEESMART2					
585	Network Gateway					
602	DI phase monitoring	Group fault alarm	Phase monitoring has tripped	Error in relation to phase sequence, phase failure, undervoltage and asymmetry	Check supply feed	Chiller off immediately.

611	DI mpcb Pump 1	Group fault alarm	Motor protection switch has tripped	Motor current above the allowable range, Motor is running in two phases only, incorrect rotational direction, Poor contact at terminal connections, Interturn short-circuit, earth fault, rotor blocked.	Check the motor current draw, Check the operating point, Check the electrical connection of the components.	Pump 1 switches off immediately. Compressor switches off immediately.
615	DI mpcb Pump 2	Group fault alarm	Motor protection switch has tripped.	Motor current above the allowable range, Motor is running in two phases only, incorrect rotational direction, Poor contact at terminal connections, Interturn short-circuit, earth fault, rotor blocked.	Check the motor current draw, Check the operating point, Check the electrical connection of the components.	Pump 2 switches off immediately, Pump 1 switches off via max. output temperature, water circuit 1.
621	DI mpcb compressor	Group fault alarm	Motor protection switch has tripped.	Motor current above the allowable range, Motor is running in two phases only, incorrect rotational direction, Poor contact at terminal connections, Interturn short-circuit, earth fault, rotor blocked.	Check the motor current draw, Check the operating point, Check the electrical connection of the components.	Compressor and fan switch off immediately.
627	DI high-pr. limiter	Group fault alarm	High pressure limiter has tripped.	Unable to remove the waste heat of the refrigeration circuit.	Clean the condenser and filter, check the function of the fan, check cooling water circuit, fit cover panels, Press the Reset button and acknowledge at the display.	High pressure limiter tripped Compressor switches off Acknowledgement successful
631	DI mpcb fan	Group fault alarm	Motor protection switch has tripped	Motor current above the allowable range, Motor is running in two phases only, rotational direction, Poor contact at terminal connections, Interturn short-circuit, earth fault, rotor blocked.	Check the motor current consumption, check the operating point, Check the electrical connection of the components	

632	DI fan fault	Group fault alarm	Internal monitoring of the fan has tripped.	Motor is running in two phases only, rotational direction, Poor contact at terminal connections, Interturn short-circuit, earth fault, rotor blocked.	Check the motor power consumption, check the electrical connection of the components, check for mechanical blocking.	
641	DI mpcb tank heating	Group fault alarm	Circuit breaker has tripped.	Current above the allowable range, Poor contact at terminal connections due to dirt or corrosion, Short-circuit between the heating elements, earth fault.	Check the current draw, Check the electrical connection to the components, Check the earth connection	All components continue to run Tank heating will be deactivated Alarm will be saved. Manual reset,
811	µPC DI ext.release		Internal release of the "Evolution" controller unit is not applied at the "µPC" control module	Faulty contact	Check contact 4N1 and control relay 7Q1	Compressor switches off
821	AI µPC high press.	Group fault alarm	Measured value of the sensor outside the measurement range	Sensor defective, Sensor short-circuit or sensor break	Check the electrical connections of the sensor, Check the sensor by means of the characteristic curve	Compressor off immediately Fan is shut down in a controlled manner Check Pumps continue to run Can be acknowledged with delay
822	AI µPC low press.	Group fault alarm	Measured value of the sensor outside the measurement range	Sensor defective, Sensor short-circuit or sensor break	Check the electrical connections of the sensor, Check the sensor by means of the characteristic curve	MOP error Envelope superheating fault Compressor continues to run Pump continues to run No alarm to be acknowledged
823	AI µPC suct.gastemp.	Group fault alarm	Measured value of the sensor outside the measurement range	Sensor defective, Sensor short-circuit or sensor break	Check the electrical connections of the sensor, Check the sensor by means of the characteristic curve	Compressor and fan off immediately Pump continues to run Acknowledgement successful 2x
824	AI µPC hot gas temp.	Group fault alarm	Measured value of the sensor outside the measurement range	Sensor defective, Sensor short-circuit or sensor break	Check the electrical connections of the sensor, Check the sensor by means of the characteristic curve	Compressor and fan off immediately Pump continues to run Acknowledgement successful 2x

829	AI µPC Sen.Anst. B7	Group fault alarm	Measured value of the sensor outside the measurement range	Connection FreeEvolutio AO 3 to µPC AI B7 incl. GND, or Modbus communication µPC FreeEvolution	Check the electrical connection between µPC and FreeEvolution; Communication parameter in the µPC M04 other Parameter Oth02 Serial Port = 0 Serial Address = 1 Baudrate = 19200 Baud	Compressor shuts down in a controlled manner Acknowledgement successful
831	µPC high-press. max		Condensation pressure is outside the allowable range.	Unable to remove the waste heat of the refrigeration circuit.	Clean the condenser and filter. Check the function of the fan. Check the cooling water circuit. Install the cover panels. Press the Reset button and acknowledge at the display.	
832	µPC low-press. min		Low pressure sensor has tripped. Pressure has fallen below the minimum allowable pressure on the intake side of the compressor (low pressure side).	Liquid flow through the evaporator is too low. Refrigerant loss. Faulty function of the expansion valve. Faulty function of the LP sensor.	Check liquid flow. Check the function of the expansion valve.	
833	µPC hot gas temp.		Hot gas temperature is outside the allowable range.	Difference between the low pressure and high-pressure side is too large. Superheating too high. Refrigerant quantity too small.	Clean the condenser and filter. Check the function of the fan. Check the cooling water circuit. Install the cover panels. Press the Reset button and acknowledge at the display.	
834	µPC press. diff. min		The pressure difference is smaller than that needed for lubrication of the compressor.	Compressor does not develop any pressure	Contact KKT chillers service department.	
835	µPC comp. Fr.start		Compressor has attempted to start, but could not start up.	One or several of the above-named alarms has/have occurred.	Manual reset in the Error menu	
836	µPC comp. envelope		Compressor exceeds the allowed time of 60s, for running outside the envelope.	impermissible operating state	Manual reset in the Error menu	
841	Exp.vlve superht.min		The superheating value has fallen below the minimum limit.	Superheating too low	Automatic reset	

842	Exp. valve MOP		The maximum allowable evaporation pressure (MOP) has been exceeded.	Evaporation temperature too high	Automatic reset	
843	EEV suct.gastemp.min		The suction gas temperature has fallen below the minimum allowable value.	Suction gas temperature too low	Automatic reset	
845	EEV group fault		An error has occurred at the expansion valve.	one or several of the above 3 messages in relation to the expansion valve (EEV) has/have occurred	Automatic reset	
851	Inverter communic.		Communication with the inverter is disrupted.	The power supply has been interrupted. Interface cable not connected.	Check the power supply of the inverter. Check whether data LED flashes yellow. Check the wiring.	
852	Group inverter fault		Group inverter fault	One or several of the INV messages listed below is/are present.	see below	
901	INV overcurrent Overcurrent		Max. power consumption exceeded	Sudden load increase, acceleration during start-up phase too high, deceleration too fast	Contact KKT chillers service department.	
902	INV motor overload Overcurrent		Motor overload	Max. motor current exceeded beyond the allowed period	Contact KKT chillers service department.	
903	INV overvoltage Overvoltage		Max. DC voltage of the intermediate circuit exceeded	excessive speed reduction, current surges in the voltage supply	Contact KKT chillers service department.	
904	INV undervoltage Undervoltage		DC voltage of the intermediate circuit has fallen below the minimum	insufficient power supply, internal inverter error	Contact KKT chillers service department.	
905	INV Drive over T Drive overT.		Max. temperature of the inverter exceeded	cooling air supply to the inverter is too low, temperature in the control cabinet is too high	Contact KKT chillers service department.	
906	INV Drive under T Drive underT		Inverter temperature has fallen below the min. temperature	temperature in the control cabinet too low	Contact KKT chillers service department.	
907	INV overcurrent HW Overcurrent HW		Max. power consumption of the inverter exceeded	Sudden load increase, motor short-circuit	Contact KKT chillers service department.	

908	INV motor overtemp. Motor overtemp.		Max. temperature of the compressor motor exceeded	The temperature registered by the PTC thermistor is above the allowable resistance of 2600 ohm	Contact KKT chillers service department.	
909	INV Reserve		Reserve	Reserve	Contact KKT chillers service department.	
910	INV CPU error CPU error		Error in the inverter's CPU	Data loss in the memory	Contact KKT chillers service department.	
911	INV param. default Param. Default		Faulty inverter parameter	Factory settings have been restored	Contact KKT chillers service department.	
912	INV DC BUS ripple DC bus ripple		Residual ripple of the direct voltage is too high	Missing phase	Contact KKT chillers service department.	
913	INV Data comms fault Data comms fault		Communication with the inverter disrupted	Data connection between the inverter and µPC interrupted	Contact KKT chillers service department.	
914	INV Drive Thermistor Drive thermistor		Internal thermistor fault	Thermistors in the inverter are faulty	Contact KKT chillers service department.	
915	INV autotune fault Autotune fault		Automatic setting incorrect	Incorrect inverter parameterisation	Contact KKT chillers service department.	
916	INV Drive no release Drive disabled		Inverter has no release	24V voltage supply inadequate. Bridge between terminal 9 and 10 missing	Contact KKT chillers service department.	
917	INV Motor Phase Motor phase		Wiring from the inverter to the compressor is faulty	Compressor incorrectly wired or not wired at all	Contact KKT chillers service department.	
918	INV fan error Fan fault		Fan error	Cooling air fan at the inverter is defective	Contact KKT chillers service department.	
919	INV speed alarm Speed fault		Speed alarm	Sudden load increase, motor short-circuit	Contact KKT chillers service department.	
920	INV PFC Failure PFC Failure		PFC error	Overvoltage in the PFC circuit	Contact KKT chillers service department.	
921	INV Reserve		Reserve	Reserve	Contact KKT chillers service department.	
922	INV PFC undervoltage PFC Undervoltage		PFC undervoltage	AC input voltage too low	Contact KKT chillers service department.	
923	INV STO survey		Inverter checking faulty	Internal inverter error	Contact KKT chillers service department.	
924	INV STO survey		Inverter checking faulty	Internal inverter error	Contact KKT chillers service department.	
999	INV unexpected inverter stop Unexpected inverter stop			Outdated firmware version in the inverter, EMC problems	Updating the firmware, Lay control line with shielding	

Attention: Before resetting fault messages, ensure that the cause of the fault has been rectified! Frequent resetting of fault messages without having rectified the cause of the fault can result in permanent damage to the system!

III. Maintenance intervals in accordance with the VDMA

	Explanation	Annual	½ - yearly	As required	Comment
	Compressor				
1	Visual inspection for dirt, damage and corrosion	x		x	
2	Check fixing, check running noises	x			
3	Measure the intake pressure	x			
4	Measure the suction gas temperature upstream of the compressor	x			
5	Measure the compression end temperature at the discharge port	x			
6	Check oil level	x			
7	Check oil for acid content (acid test)			x	
8	Oil change			x	
9	Check that the crankcase heater is working	x			
10	Check that the output control is working	x			
11	Check the refrigerant side for leaks.	x			
12	Check high/low pressure switching equipment	x			
	Air-cooled condenser				
20	Visual inspection for dirt, damage and corrosion	x		x	
21	Measure the condensing temperature	x			
22	Measure the refrigerant side supercooling temperature at the condenser outlet	x			
23	Measure the medium temperature at condenser inlet and outlet	x			
24	Check that the condensation pressure control is functioning properly	x			
25	Check the refrigerant side for leaks.	x			
	Evaporator				
30	Visual inspection for dirt, damage and corrosion	x			
31	Measure refrigerant overheating temperature	x			
32	Measure the medium temperature at the evaporator inlet and outlet	x			
33	Measure the anti-freeze temperature (freezing point) of the heat transfer media	x			
34	Check the water and refrigerant side for leaks	x			

	Explanation	Annual	½ - yearly	As required	Comment
	Parts in the refrigerating circuit/water circuit				
40	Visual inspection for dirt, damage and corrosion	x			
41	Check insulation for damage	x			
42	Check filter dryer for blockage	x			
43	Replace filter dryer			X	If components in the refrigerating circuit are replaced
45	Check all pipes carrying refrigerant for corrosion and damage	x			
	Fans				
50	Visual inspection for dirt, damage and corrosion	x		x	
51	Check fixing parts and bearings	x			
52	Check the flexible connection for leaks (electrical connection)	x			
	Pump and piping				
60	Visual inspection for dirt, damage and corrosion	x			
61	Check fixing parts and bearings	x			
62	Check the safety function of the safety switching	x			
63	Check pump/mechanical seal for leaks	x		x	
	Water filters				
70	Visual inspection for dirt, damage and corrosion	x		x	
71	Clean filters	x		x	
72	Check filters for damage	x			

No.:	Explanation	Annual	½ - yearly	As required	Comment
	Tank / Water tank				
80	Visual inspection for dirt, damage and corrosion	x			
81	Check fastening	x			
82	Check level	x			
	Control cabinet				
90	Visual inspection for dirt, damage and corrosion	x		x	
91	Check fastening	x			
92	Check all threaded connections	x			
93	Check all indicator lights and error messages	x			
94	Check that the temperature and pressure sensors are functioning properly	x			
95	Check the function of the motor protection switches	x			
96	Check the 24VDC and infeed voltage	x		x	
97	Check control cabinet heater	x			
99	Check the control cabinet filters and if necessary clean and change/clean if necessary	x			
	Documents and Signage				
110	All documents such as operating instructions, diagrams, circuit plans, system log are present	x		x	
111	Nameplate and signage are easy to read	x		x	
	Battery - time/date				
120	Battery			x	Every 5 years
	Refrigeration circuit leak check			x	in a service case

IV. Product registration

https://www.kkt-chillers-service.de/produktregistrierung.html