Vario Line

EN Translation of the original operating manual

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

83000602Km

Table 1: Contact details

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Introduction

This instruction manual (operating instructions) has been prepared 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.
Allow yourself sufficient time to read through this manual carefully and to take in all the information it contains. If you have any further questions you can contact the KKT chillers service team; refer to the 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 status and to initiate corresponding countermeasures.
By complying with the servicing and maintenance programme described you ensure that the machine's reliability and safety are maintained. In addition, you keep the operating costs low and at the same time lengthen the 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. In this way you ensure the reliability and quality of the machine.

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

KKT chillers reserves the right to change technical specifications without prior announcement. The figures in this document are not to scale!

As the Vario Line units can be adapted to a specific project, this document contains only information that is of general relevance for all units in the series.

All project-specific data is enclosed with the unit in a separate quick start guide.

- Machine configuration
- Parameter list
- PI flow chart
- Pump characteristic curve(s)
- Circuit diagram
- All other project-specific details

Contents

1. Product description

Please read through all the points of this instruction manual before starting up the machine. You should pay particular attention to the points on safety, commissioning/startup and operation. Should you have any further questions concerning your machine, please contact the KKT chillers Service Team (*see Table 1: Contact details*).

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 and is not allowed to use in private households. 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 options packages).

The user (owner) is obliged to comply with the conditions specified by the manufacturer with regard to operation, maintenance and servicing in accordance to these operating instructions, as well as the locally applicable regulations (laws, standards, guidelines).
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 are attached to the outside of the machine in a clearly visible position. A complete description of all hazard warnings is given in *Chapter 4.2 Hazard warnings*.

Table 2: Safety instructions

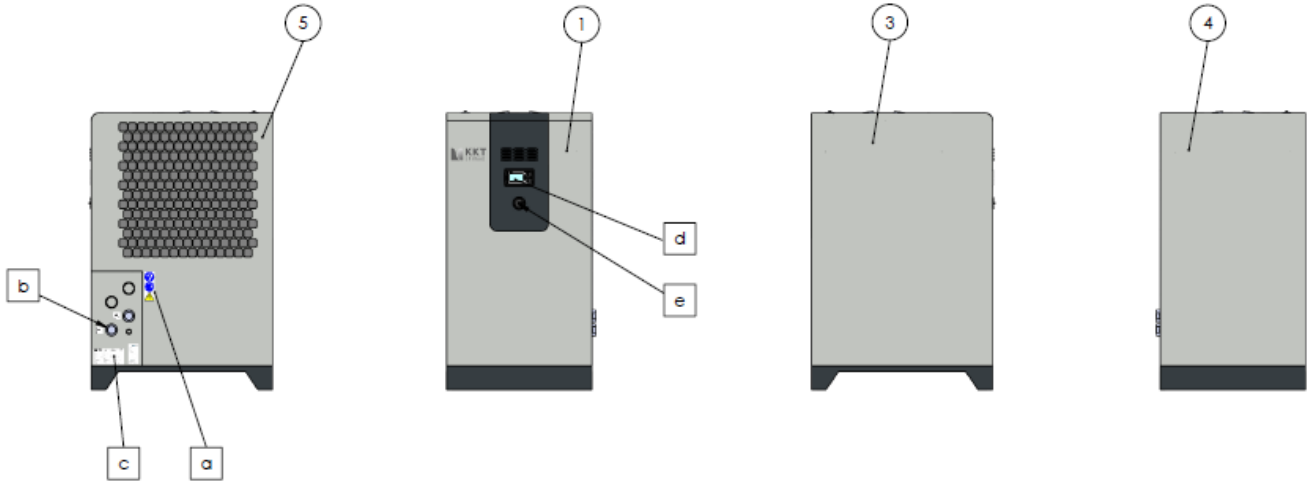
	Note and follow the instructions for use!
	The machine must be safely disconnected from the power supply before it is opened! Then wait for at least 2 minutes before opening the machine.
	Warning! Electric shock! If the machine is only switched off at its main switch, dangerous electrical voltage is still applied at several terminals in the control cabinet.

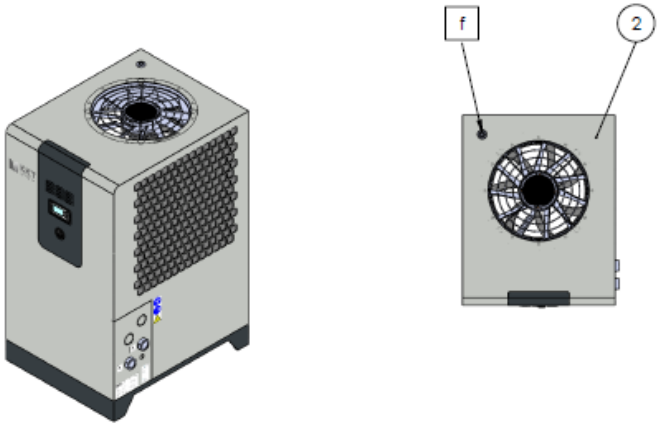
Table 3: Technical data

Vario Line	-	vBoxX 6	vBoxX 8	vBoxX 10	vBoxX 12	vBoxX 15	vBoxX 18	vBoxX 24	vBoxX 28
Cooling 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 sealed		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
Coolant	-	Water or water / glycol							
Ambient temperature range	°C	-25 to +50°C							
Refrigerant supply temperature	°C	-10 to +30°C						+5 to +30	
Setpoint consistency (basic features)	K	+/-0.5							
Tank volume	l	100				160			
Tank volume (max)	l	88				151			
Refrigerant circulating flow volume nom (dt = 5K)	m³/h	1.1	1.4	1.8	2.1	2.6	3.1	4.8	4.8
free pump pressure (basic features)	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 features)	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 apply to the units with basic features. Differences can occur, as the units are adapted to the respective customer specification from project to project. The exact, project-specific data can be found in the enclosed quick start guide.

1.2. Elements





1	Operating side	a	Safety instructions
2	Cover	b	Water connections
3	Tank, service side	c	Nameplate
4	Compressor, service side	d	Display
5	Condenser protection grille	e	Main switch
		f	Tank fill

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 compressor, condenser, expansion valve and evaporator components, 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.

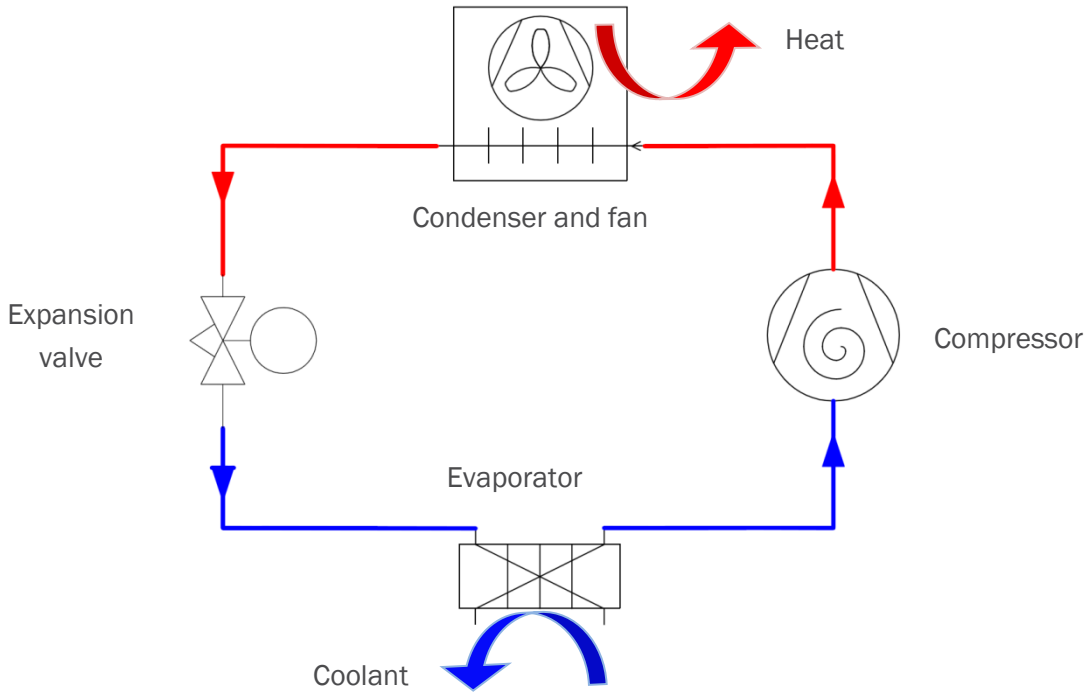


Figure 1: C6848 Refrigerating circuit diagram

In addition, diverse pressure and temperature sensors, a control unit, a high-pressure switch, one or more pumps and a fan are also installed for control and operation of the chiller.

2.1. Compressor

The compressor generates the pressure difference necessary for evaporation and condensation between the heat sink and heat source in the refrigerant circuit. Refrigerant vapour coming from the evaporator is drawn in and compressed in the compressor to the condensing pressure.
The compressors used for the Vario-Line are speed-controlled and thus automatically adapt to the required load profile – the chiller therefore 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 status 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 status 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 (see *Chapter 3.24 Air filter mat*).

If a cooling water system is available and the warm exhaust air of the chiller is to be avoided, the chiller can also be equipped 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 status in doing so.
R410A is a fluorinated greenhouse gas consisting of the zeotropic mixture of 50% each of R32 and R125 with virtually negligible temperature glide. R410A has a very high volumetric cooling 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 details*).

2.6. Oil

The compressor components subject to friction are lubricated by oil that is added in the factory by the compressor manufacturer. Polyolester (POE) oil FV505 is used for this purpose. 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 details*).

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, for which it is opened, the filter dryer must be replaced.

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 operation can be found in Chapter 8.5 Control panel*.

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 (hex socket head, 4mm). The tilt the front panel slightly towards the front 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. Optionally, the units can also be supplied as circulating coolers without tank, with pump or without tank, without pump (see *Chapter 3.1 Version without tank, with pump* and *Chapter 3.2 Version without tank, without pump*).

2.14. Ventilator

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 protected against accidental contact by wire guards 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 in from the chiller's internal tank by the internal pump and is then pumped through the process circuit. Optionally, the units can also be supplied as circulating coolers without tank with pump or without tank, 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. Then the cold water goes back to the tank. Then the cycle starts again.

2.16. Materials used in the water circuit

The basic features result from the material composition shown in Table 5:

Table 5: Materials used, basic configuration

Component	Material
Unit connections	V2A 1.4305
Evaporator	V2A 1.4301 and copper (99.9%)
Tank Tank nozzle	V2A 1.4301 V4A 1.4305
Pump Mechanical seal	V2A 1.4301 EPDM
Sealing plugs yellow	Polyamide PA 6
Sealing plugs black	Polyoxymethylene (POM)
Filling and drain valve	Brass, nickel-plated
Bends, tees, couplings	Gun metal CC499K, brass
Temperature sensor	V2A 1.4401 – AISI316
Pressure sensor	V2A 1.4301
Overflow valve (optional)	Gunmetal
Tank heater (optional)	Nickel chromium iron alloy, alloy 825
Water circuit	John Guest pipping made of polybutylene, Hose made of synthetic rubber
Push-fit fitting	Acetal copolymer, nitrile (NBR), V2A

Table 6: Materials used, non-ferrous metal free version

Component	Material
Unit connections	V2A 1.4305
Evaporator	V2A 1.4301
Tank Tank nozzle	V2A 1.4301 V4A 1.4305
Pump Mechanical seal	V2A 1.4301 EPDM
Sealing plugs yellow	Polyamide PA 6
Sealing plugs black	Polyoxymethylene (POM)
Filling and drain valve	V2A 1.4301
Bends, tees, couplings	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 chromium iron alloy, alloy 825
Water circuit	John Guest piping made of polybutylene (BGI) Hose made of synthetic rubber (BGII)
Push-fit fitting	Acetal copolymer, nitrile (NBR), V2A

2.17. Water quality

The following limit values must be complied with to ensure safe operation of the units:

Table 7: Water quality

Property / component parts	Unit	Value range Standard configuration	Value range Non-ferrous metal-free 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 bacterial count	K/ml	<10,000	<10,000
Particle size	µm	< 250	< 250
Glycol fraction (AFN)	% by vol	0, 20-40	0, 20-40
Oil fraction	% by 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 carbon dioxide	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

The specified limit values must always be complied with in order to avoid blockaging of the plate heat exchanger.

Furthermore, slime-forming bacteria must be prevented in the cooling water. If this is not possible, KKT chillers can recommend or provide an appropriate inhibitor to remove the slime forming agents on the basis of a biological water analysis carried out in advance.

2.18. Permitted coolant media

Water and mixtures of water / Antifrogen N (AFN) or water / Antifrogen L (AFL) as defined in *Chapter 2.17 Water quality* are allowed. The following table shows the requirements for the mix ration of water with antifreezes AFN and AFL. These values must be kept to as accurately as possible in order to maintain your machine's efficiency and prevent damage to components.

	**WARNING! Do not use mixtures of different anti-freezes. This can cause unwanted chemical reactions and silting-up.**

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

Setting	Frost-free at t-ambient up to	AFN mixing ratio	AFL mix ratio
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 positions marked with "accessory" are included with the unit, unattached, and can be re-ordered at any time with the respective product number. The installation of the accessory is the responsibility of the installer of the machine. You can also ask our KKT chillers Service Team to arrange for this installation (see *Table 1: Contact details*).

Information on your machine's features can be found in the separately enclosed quick start guide.

3.1. Version without tank, with pump

The Vario-Line units are optionally also available as circulating coolers. In this case, the units are delivered without an internal tank. The temperature sensor is then located in the return line of the cooler. If a tank open to the atmosphere (atmospheric tank) is integrated on site, it must be ensured that the tank is not installed at a lower geodetic level than the cooler. Additional pressure losses between the on-site tank and integrated pump must be avoided (dp_{max}=0.3bar)

3.2. Version without tank, without pump

The Vario-Line units are optionally also available as circulating coolers. In this case, the units are delivered without an internal tank and without a pump. The temperature sensor is then located in the return line of the cooler. Circulation of the cold water via the evaporator then takes place via a pump to be installed on site. This must at least be designed for the pressure loss of the overall system.

3.3. Version with water-cooled condenser

While the basic variant of the Vario-Line has an air-cooled condenser, it is possible to purchase the individual units of this series with water-cooled condensers too.

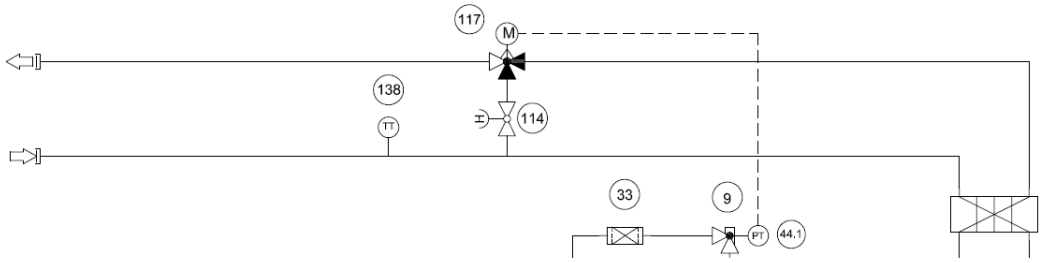


Figure 3: C6848 Refrigerating circuit diagram

The condenser used is a plate heat exchanger whose stainless steel plates are copper soldered. The 3-way valve is located in the cooling water outlet and is controlled via an actuator according to the condensation pressure. Switching from 3-way to 2-way control can be achieved by closing the additionally provided bypass valve.

The cooling water temperature is registered by an additional temperature sensor in the cooling water inlet and is displayed on the controller display.

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

The project-specific data and the adjusted PI flowchart and dimensioned diagram can be found in the enclosed quick guide.

3.4. Control cabinet heating

The control cabinet heater is thermostatically controlled and prevents moisture from the drawn-in ambient air in the event of lower ambient temperatures from condensing on electrical and electronic components of the control cabinet and hence from damaging them.

The control cabinet can only be active if the chiller is not de-energised (Main switch ON) (see *Chapter 8.1 Switching on*).

3.5. Insulation of cold lines and pump(s)

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

3.6. Tank heater with thermostatic pump start

The tank heater is used to maintain a minimum temperature in the tank. The pump circulates the cold water, while the tank heater 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 protected. In order for the heater to be active, the chiller must not be disconnected from the power supply. Even if the external release is deactivated (*Chapter 8.3 External release*), the pump stays active. The thermostatic pump start is active.

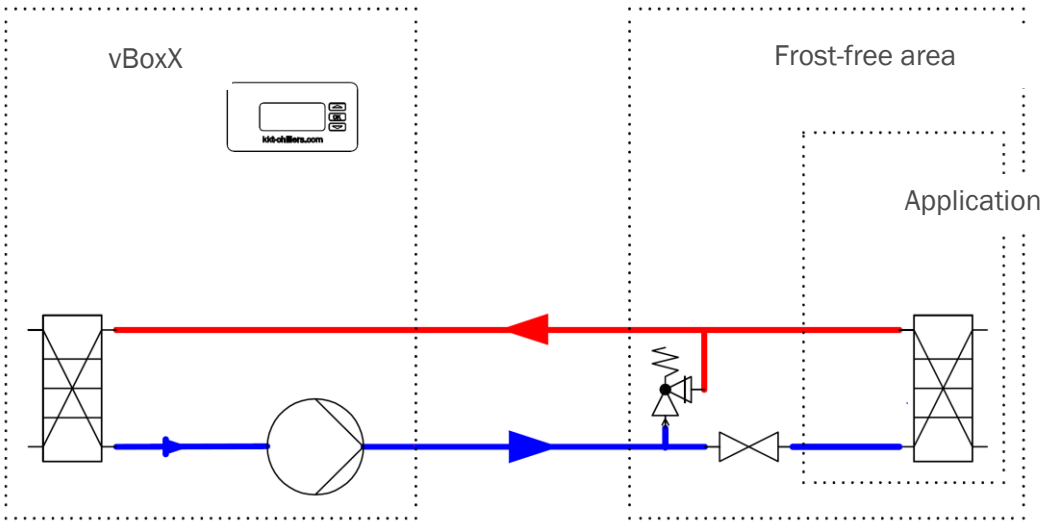


Figure 4: C6856 Thermostatic pump start with overflow valve (recommended installation)

3.7. Overflow valve for standby operation

If it is possible that the application will greatly reduce or completely prevent the flow of cold water during ongoing operation, the overflow valve option should be installed. The internal overflow valve ensures the minimum flow rate through the chiller and therefore prevents switching off of the pump. *Figure 5* shows the position of the internal overflow valve.

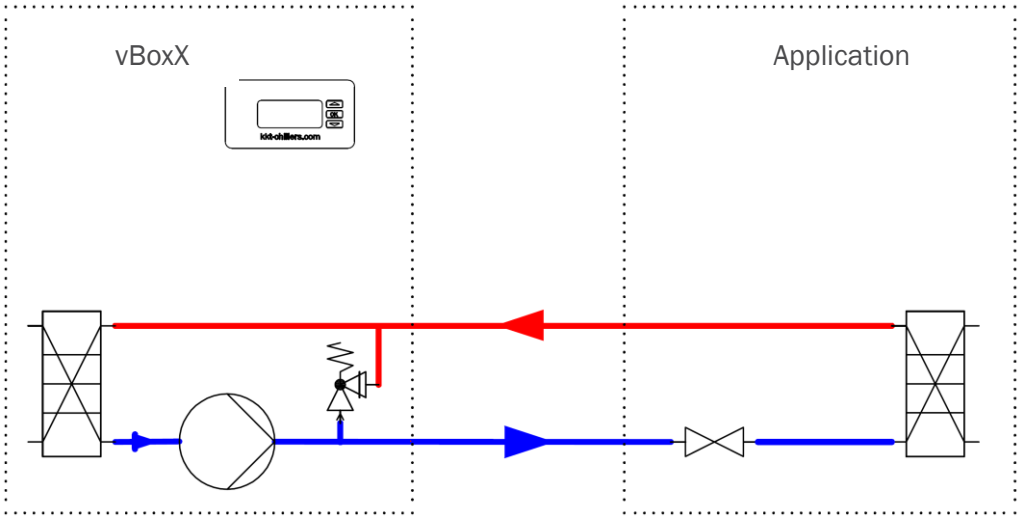


Figure 5: C6863 Overflow valve for standby operation

3.8. Higher pressure pump

The standard Vario-Line units have a 3 bar pump, which is designed for the nominal volumetric flow rate of the respective unit. Optionally, the units can also be built with higher pressure pumps, within the limits of the minimum or maximum flow rate. 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. In this case, the delivery head and the capacity are automatically adjusted to the unit characteristic of the overall system. In this way, the power of the pump 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 the cold water. The nominal flow rate is listed in *Table 3: Technical data*. If the cold water operating flow rate 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 the flow temperature. A second pump supplies the process circuit with cold water.

3.11. Second consumer pump

The standard Vario-Line units have a 3 bar pump, which is designed for the nominal volumetric flow rate of the respective unit. If a second load with the same refrigerant and the same refrigerant temperature but with different refrigerant quantity or different flow pressure is to be supplied, the unit can also be executed with an optional second load pump.

3.12. Second temperature level

If several loads are to be supplied with the same refrigerant but with different temperature level, a second setpoint can be specified for the secondary circuit. An additional temperature sensor registers the temperature in the secondary circuit. A control valve is used to add a partial volumetric flow from 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 systems. This venting process is selected automatically with the configuration of the second circuit. Each time the controller is restarted (e.g. after a power failure), on starting up pump 1, the valve for circuit 2 is also opened for 300 s. Pressure faults can occur in pump 2 if there is still air in the second circuit. This fault 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. During the venting, the temperature control is already released. Cooling by the compressor can also already take place.

3.13. Second medium

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

3.14. Automatic water feed

Any leaks and evaporation can reduce the quantity of cold water required for the function of the chiller during operation. The automatic water feed (replenish) option allows the cold water circuit to be refilled automatically. The content of the tank is monitored continuously and refilled as required until the optimum fulling level has been reached again. To this end, the operator only has to connect the chiller to the building water system via the feed connection (see *Figure 6)*. The inlet pressure must be between 1 bar and 10 bar.

Figure 6: Feed connection

If you operate your chiller with a mixture of water / glycol and only feed (replenish) pure water, you must check the glycol content of the circuit water and regular intervals and adjust it 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 is triggered if the flow reduces and falls below the switching value. The corresponding signal can be tapped potential-free at the terminal in the control panel.

3.16. Water circuit in non-ferrous metal version

If your machine has been built free from non-ferrous metals, all parts of the chiller's cold water circuit are free from non-ferrous metals. Several components such as the evaporator and pump have been adapted. The materials used for the water circuit can be found in *Table 6*.

3.17. DI package

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

	**The DI cartridge used is intended exclusively for maintaining the conductivity and not for water treatment. When using the "Automatic replenishment" option and for manual replenishment, it is important to ensure that the medium for replenishment is provided in the specified water quality.**

3.18. Conductivity monitoring

With the conductivity monitoring option, the conductivity is recorded by a measuring probe in the tank. If the specified conductance limit is exceeded, a warning and an alarm message are output (see parameter list).

3.19. Conductivity control

With the conductivity control option, the conductivity is recorded by a measuring probe in the tank. If the required conductivity is exceeded, a regulating valve opens and allows a partial volume flow of the refrigerant to flow through a DI cartridge installed in the bypass. The regulating valve closes as soon as the required conductivity is reached again.

3.20. Special voltage

If your machine is equipped for a special voltage, the electrical components have been adapted. 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 a phase monitor. This monitors the phase sequence, phase failure, undervoltage and asymmetry. It 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 UL compliant in the basic features. If your unit is ordered with the UL version option, the control cabinet is also produced according to the UL regulations. The corresponding UL certificate must then be issued as part of the official UL acceptance – ask your customer account manager.

3.23. Special paint finish

All cover panels (see *Chapter 1.2 Elements*) can be supplied with an optional special paint finish.

3.24. Air filter mat (accessories)

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 (accessories)

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

3.26. Level package (accessories)

The level package is used if the application is to be installed more than 500 mm above the chiller (see also *Chapter 6.2.7 Process level*). This option is delivered as a loose addition and consists of an electrically activated valve and a check valve. The electrically activated valve must be installed at the device inlet, and the check valve at the device outlet. The electrical installation of the valve is completed in the control cabinet according to the circuit diagram.

3.27. Filter assembly, coolant circuit (accessories)

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. Filter assembly, cooling water circuit (accessories)

The water filter protects the cooling water circuit against dirt. The set, consisting of a filter, fitting, two shut-off valves and two pointer pressure gauges for indicating the cooling water inlet and outlet pressures, is enclosed with the chiller in a separate pack. It can be installed for optional shut-off of the filter assembly or to shut-off the whole cooling water circuit.

3.29. Gateway (accessories)

The gateway is ready mounted in the control cabinet and can be used as an interface for processing all signals registered in the chiller. 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 not to be operated directly at the unit but from a different operator station, your unit can be delivered with the so-called remote control panel. Thereby the same display that is already installed in the chiller is mounted together with a rail to the operating voltage supply in one miniature housing. 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 (accessories)

These instruction manuals are provided in German, English, French and Spanish. Other languages are available on request.

3.32. Wooden crate (accessories)

While the Vario-Line units are usually delivered on wooden IPPC pallets with polystyrene corners and shrink-wrapped in foil, it is also possible to pay for delivery of the units in a wooden crate. In this case, the units are additionally protected by a solid wooden crate with IPPC label to ISPM 15 standard.

3.33. Seaworthy crate packaging (accessories)

Seaworthy crates for the Vario-Line are produced according to International Standards for Phytosanitary Measures with packaging made of solid wood (ISPM 15). This means that the crates are made of heat-treated solid wood which has been stripped of its bark. Only wood-based materials, such as OSB boards, are used. In addition, all crates are marked with the IPPC logo and registration number. The units are fixed in the crate with the help of coach bolts, ring nuts and polyester straps and are packed in a sea air consistent foil with desiccant. The components used to pack the units can be dismantled using a cross-head screwdriver. Please note the changed 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, commissioning 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 that occurs is 45 bar. Even when inactive or disconnected from the power supply the circuit is still under pressure.

4.2. Hazard warnings

A range of warnings are attached to the machine. Keep these warnings clean at all times. Damaged or missing warnings must be replaced.

Table 9: Definition of the safety symbols

	Note and follow the instructions for use!
	The machine must be safely disconnected from the power supply before it is opened! Then wait for at least 2 minutes before opening the machine.
	Warning! Electric shock! If the machine is only switched off at its main switch, dangerous electrical voltage is still applied at several terminals in the control cabinet.
	Wear safety footwear!
	Wear protective gloves!
	Wear eye protection!
	Wear protective clothing!
	Warning! Hot surface!
	Warning! Cold surface!
	WARNING!
	Contains pressurised gas!

The following hazard warnings apply in particular to the machine:

Table 10: Hazard warnings

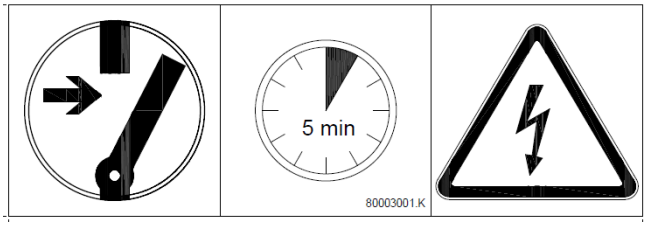
	WARNING! Work on the chiller must be carried out by properly qualified, competent personnel!
	The surfaces of pipes and components of the refrigerant and cold water circuit and electrical equipment can be very hot during operation and even for a while after.
	The surfaces of pipes and components of the refrigerant and cold water circuit and electrical equipment can be very hot during operation and even for a while after.
	WARNING! Pipes and components of the refrigerant and cold water circuit are pressurised.
	WARNING! Do not undo the system parts. Risk of injury on contact.
	WARNING! Only use the liquids specified!
	WARNING! The unit frame and housing are not designed for additional loads, which is why the components may not be walked on or subjected to extra loads!  Keep off  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 wire guard, hair or pieces of clothing can still be drawn in and caught.
- Hot surfaces on machine parts
  - Especially the compressor head, the hot gas pipe and the condenser 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 pressurise

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

Note:

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 limits the condensing pressure and switches off the compressor via its load contactor when the maximum permitted system operating pressure is reached. It is part of the safety chain. The PZH is mounted on the refrigerant receiver of the vBoxX type units (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 follow the instructions in the Troubleshooting chapter (see *Appendix* II).

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

4.4.2. High-pressure monitoring via sensor

If the high pressure in your machine's refrigeration circuit increases to a maximum value, the compressor is switched off by the high-pressure sensor . A reset is only required at the display. If the high-pressure monitor has triggered, please follow the instructions in the Troubleshooting chapter (see *Appendix* II).

4.4.3. Low-pressure monitoring

If the low-pressure in the refrigeration circuit of your system is too low for the specified cooling medium there is a risk of freezing. For this reason, the low pressure is monitored continuously and if it falls below a minimum value, the compressor is switched off. If the low pressure has increased to a minimum value, the compressor is released once more. If the low-pressure monitor has triggered, please follow the instructions in the Troubleshooting chapter (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 freezing. For this reason, the pressure at the evaporator inlet is monitored continuously. If the pressure falls below the preset value, the "Flow warning" message appears. If the value falls below the minimum value, the pump and the compressor are switched off and the "Flow stop" message appears. In this case, please follow the instructions in the Troubleshooting chapter (see *Appendix* II).

4.4.5. Oil temperature monitor

All Vario-Line units are equipped with a so-called oil temperature monitor so that the compressor starts up easily, even at low ambient temperatures. 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 inverter until the limit value is reached once more. 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. During operation of the machine its cover panels are installed, the machine is completely enclosed. No protective equipment is needed.
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 as described in *Chapter* 9 *Cleaning* and maintenance work as described in ***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/put on.

Table 11: Personal protective equipment for servicing work

	Wear safety footwear!
	Wear protective gloves!
	Wear eye protection!
	Wear protective clothing!

4.6. Airborne sound emissions

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

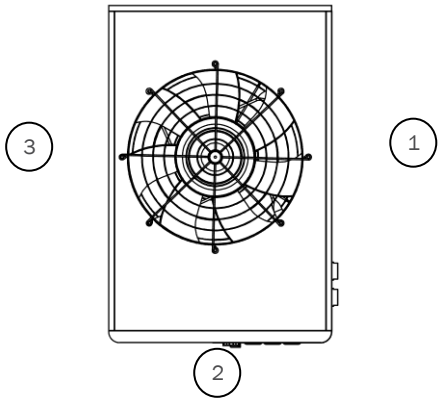


Figure 8: Airborne sound emission

In partial load mode or under favourable ambient conditions the *(see Chapter 4.7.1 Noise)* fan speed and therefore the sound emissions reduce 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 available 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 vibration still further, it is possible to install the chiller with optionally available levelling feet (*Chapter 3.25 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 risk.

4.8.2. Mechanical

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

	**WARNING! Toxic and caustic products are produced by the thermal decomposition of the R410A refrigerant.**
	**WARNING! Do not install in rooms with naked flame or smoke emissions.**

4.8.4. Other

	**WARNING! Risk of suffocation if the chiller is installed in a room that is too small. Please note and follow *Chapter 6.2.2*.**
	**WARNING! In the EU you must follow the provisions of EN 378-3. You must also comply with the local installation regulations and provisions, especially (in Germany) the VAwS and the BGR500 Chapter 2.35.**

4.9. Hazardous 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
- After skin contact: Leave clothing that has fused with the skin initially. Rinse areas damaged by cold with lukewarm water (never use hot water). Do nut rub! Cover with sterile dressing. Ensure medical treatment is provided.
- After 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 catacholamine or adrenalin ephedrine preparations.

Fire-fighting measures:

- Suitable extinguishing medium: The product itself does not burn. 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.
- After 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: Treatment of symptoms and support therapy as indicated.

Fire-fighting 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 method: Clean the contaminated area with water. Caution! Slipping hazard!
- Further information: Inform the police or competent authorities in case of penetration into 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 container: 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 any visible change to the machine’s status.
- Even if the machine has been disconnected from the power supply, the surfaces of components in the unit can still 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 connecting an incorrect source of power.

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 detect a refrigerant or oil leak, proceed as described in *Chapter 4.9 Hazardous substances*.

5. Handling and storage

The chiller is fixed on a wooden pallet in the factory for delivery. The machine is additionally protected against damage by polystyrene corner protectors and stretch film. Therefore you should remove the packaging as late as possible.

5.1. Dangerous goods

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

5.2. Transport

The chiller may only be transported using a forklift truck with sufficient load capacity. The net weight of your machine is given in the technical data. Please note that if a machine has already been in operation, it can contain residual fluids, which increase the transport weight.

	**WARNING! The chiller must not be tilted by more than 10° from the perpendicular position.**

5.2.1. Forklift truck

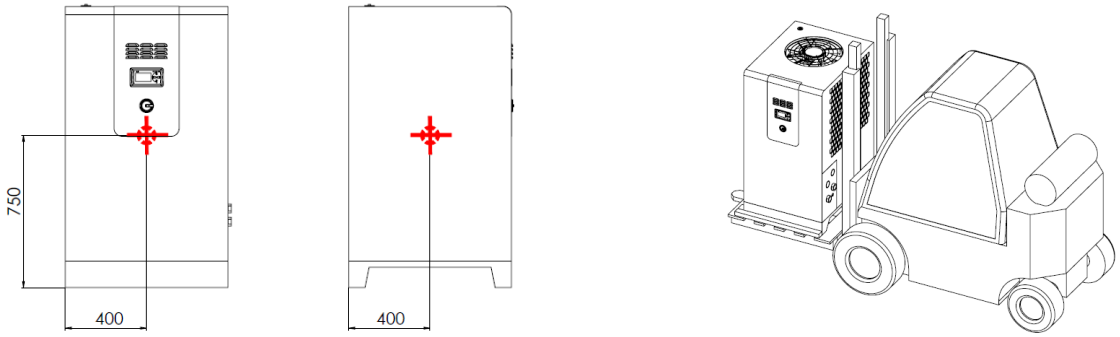


Figure 9:vBoxX 6 - 28 centre of gravity

It is possible to transport the machine both in a packed and an unpacked condition by means of fork lift truck. Please note that the centre of gravity may vary depending on the model.

5.3. Unpacking

	WARNING! Packing straps are mechanically stressed and can snap back when cut. Risk of injuries!

Remove carefully all tapes, films, protection corners and spacers. Optional accessories may also be located under the film. Ensure that these are also 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: Packaging materials

Element	Material	Recycling code
Polystyrene corners	Polystyrene	
Stretch film	Polyethylene	
Edge protection corners	Carton board	
Packaging tape	Polypropylene	
Lock bushings	Steel, zinced	
Wooden pallet	Treated raw wood to ISPM15	

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 completely drained before the chiller is placed in storage and if necessary, flushed with a mixture of water and anti-freeze (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 approved for both indoor installation *(installation site classification I)* - as well as outdoor installation *(installation site -classification III)* for the access area categories (b) “monitored access area” and (c) “access area to which only authorised persons are permitted entry” (note option packages). DIN EN 378-1
The electrical IP rating is IP54. If installed indoors, ensure sufficient air exchange. An enclosed room will steadily heat up 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 required for your machine can be found in *Table 3 Technical data.* When choosing the installation site, ensure that waste heat from other processes cannot be guided directly onto the air intake side of the chiller.
The installation of exhaust air ducts is not permitted.

	**WARNING! Do not install in rooms with naked flame or smoke emissions.**

6.2.2. Minimum room volume

The refrigerant R410A contained in the system is classified in safety group A1 in accordance with EN 378-1 Table E.2. I.e. the refrigerant is not flammable and has low toxicity. However, when installing in enclosed rooms without additional safety measures a minimum room volume is required. This is due to the fact that the maximum concentration occurring in a place occupied by people on release and depends on the quantity of refrigerant required to fill the unit. Please refer to the following table for the value to be complied with for your machine.

Table 13: Minimum volume of the installation space with regard to maximum refrigerant concentration in case of leakage if installed indoors

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

If the calculation of the minimum room volume required is only based on the respective refrigerant fill quantity, a room volume of 7 would be sufficient for size I (vBoxX 6 - vBoxX 12) or 11m³ for size II (vBoxX 15 - vBoxX 28) to rule out a risk of suffocation.

However, to ensure faultless operation and convenient servicing of the units, the clearances in the setup instructions must also be adhered to. These are 18.7m³ or 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 low that, provided the unit clearances given in the setup instructions are complied with, the risk of suffocation can be ruled out.

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 enclosed main dimensions sheets for the necessary minimum clearances.

6.2.6. Process level

The chiller may not be installed more than 500 mm below the process level, There is a risk of cold water discharging via the chiller's internal tank while the unit is not in operation. If this however is 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 feet of the machine's units must have uniform contact with the ground. Ensure that the ground/subsoil has sufficient load bearing capacity. According to the setup instructions (*Appendix III*) a continuous concrete foundation with the given minimum size is recommended. 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. The sum is 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 normal situation is for the machine and the baseplate to be stood firmly on the ground. It is not necessary to anchor the machine to the ground. However, the machine can be equipped with the optionally available levelling feet (*3.25 Vario Foot*) if necessary due to the surrounding conditions. The levelling feet provide very good resistance to slipping. If this is not sufficient for your application the machine can also be bolted to the ground. Holes are provided in the machine baseplate for precisely this purpose. The system designer is responsible for choosing suitable fixing elements.

6.2.9. Levelling

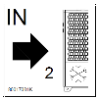
If it is necessary to level the chiller on the ground or floor, this can be done using the optionally available levelling feet.

6.2.10. Vibration isolation

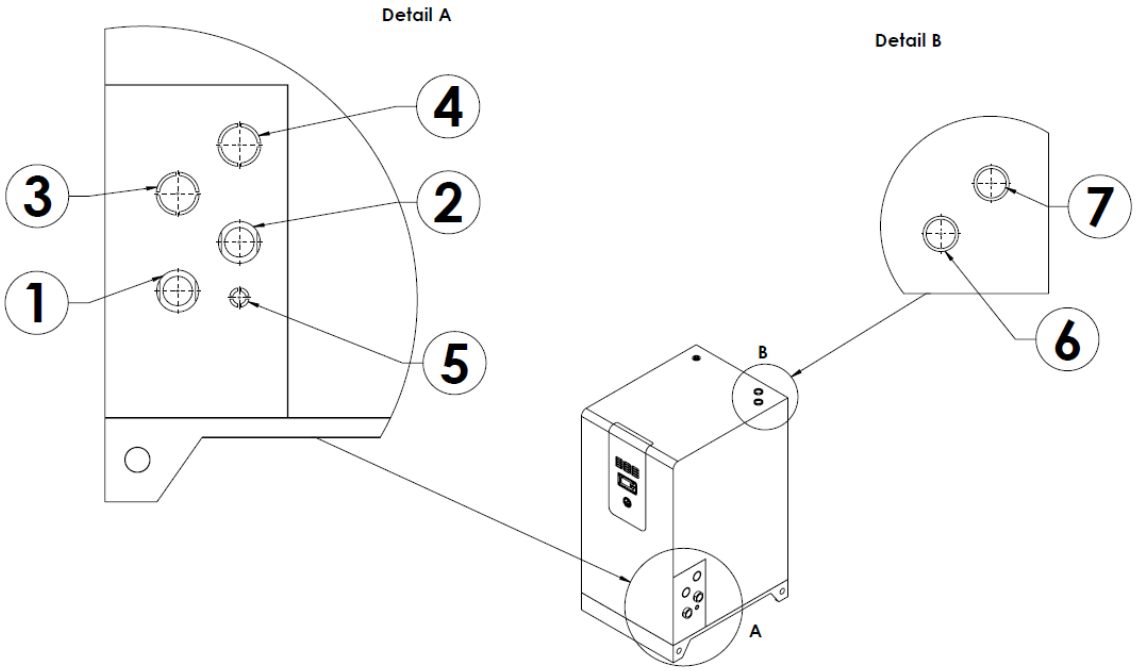
If it is necessary to isolate the chiller on the ground or floor, this can be done using the optionally available levelling feet. The levelling feet are fitted with vibration-isolating elastomers.
If there is a risk of vibration being transmitted by neighbouring machines, separate vibration decoupling must be carried out.

6.2.11. Installation

The unit-specific connection assignment is shown in the flow diagram enclosed with the chiller.

	Filling and feeding
	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 plant designer is responsible for choosing the material and cross-section of the hydraulic connections between the chiller and application. The dependencies are, among other things, the accepted pressure loss in the connection pipes and the available pump pressure. When designing the connections attention must also be paid to the minimum flow rate required and sufficient pressure resistance to the maximum pump pressure.

In the case of chillers equipped with an internal tank, the cold water circuit must be hydraulically closed.

	**WARNING! Zinced pipes may not be used with water-glycol mixtures! Formation of decomposition products which result in silting-up of the system!**

6.2.13. Frost protection measures

The chiller is exposed to a frost hazard by two different situations. Both an ambient temperature < 0 °C and a flow temperature < 8 °C entail the risk of freezing of system parts of the cold water circuit.

Installation at ambient temperature < 0 °C with antifreeze
The machine is protected against freezing by an antifreeze. Always comply with the requirements with regard to the operating liquid and 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 an antifreeze in accordance with the specifications. Please note that the evaporation temperature is always significantly lower than the cold water flow temperature. A risk of freezing can exist even in a supposed safe temperature range. Comply with the requirements with regard to the operating liquid and mix ratio.

6.2.14. Flushing the cold water circuit

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

6.2.15. Filling

If the hydraulic installation of the whole system has been completed, the unit can be filled. Open all the stopcocks in the cold water circuit.

	**WARNING! Only use approved refrigerants, see Chapter 2.15! If there is a risk of frost, note Chapter 6.2.14. !** **All operating liquids must be mixed before they are added to the system!**

Procedure for chillers with integrated tank:
The filling can be carried out via the tank without pressurised methods.

Procedure for chillers without integrated tank:
The standard machine without integrated tank does not have a filling connection. To fill the system you must 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 fill and make-up connections are marked with the following pictogram:

Figure 11: Fill and feed connection

	**WARNING! In the EU you must follow the provisions of EN 378-3.** **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

Vent the pump before commissioning. When doing so, open the vent screw before switching on the pump and keep it open during ongoing operation until all air has escaped from the pump body (see example *Figure 12*).

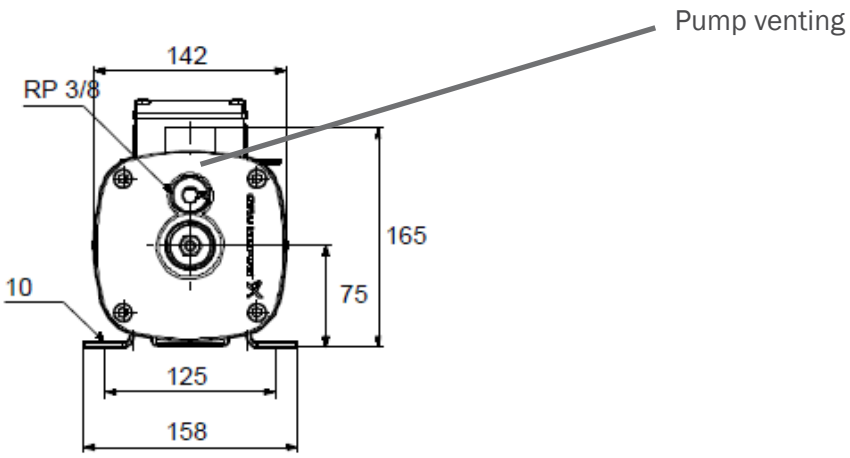


Figure 12: Position of the pump venting (horizontal type example)

If your chiller is equipped with an internal tank, the further water circulation ensures that any residual air in the overall system 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

⚠	**WARNING! The electrical installation, testing and startup may only be carried out by qualified personnel. Note and follow the local regulations.**
⚠	**WARNING! 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 can be damaged.**

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

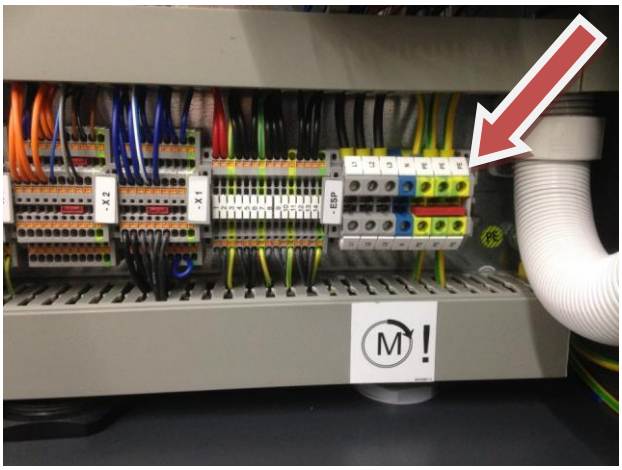


Figure 13: Main supply

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 laid into the inside of the machine. Recesses are provided in the baseplate for this purpose. Feed the supply cable, protected by rubber grommets, through these openings *(see Figure 13 Main supply*).

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. At the initial startup or if starting up after a lengthy period with no operation, all electronic components must be allowed to acclimatise.

If you use an external control cable to set the chiller's release (see *Chapter 8.3 External release*), this cable is laid parallel with the supply cable and is wired at the corresponding terminals in the control cabinet. The machine is bridged at the corresponding terminals on delivery.

Once the electrical installation has been completed the phase sequence must be tested. This is done by checking the rotational direction of the pump. This has a rotational direction arrow on it. If the rotational direction does not match the arrow, the phase sequence can be corrected by swapping two phases at the main supply.

7. Initial startup

Before commissioning the chiller, the checklist must be used to check whether all the necessary work in*Chapter*6 *Setup and installation* has been carried out properly.

All Vario-Line units are equipped with a so-called oil temperature monitor (*4.4.5 Oil temperature monitor*) so that the compressor starts up easily, even at low ambient temperatures. To ensure this function, in ambient temperatures below 5 °C it is necessary for the finished, installed machine to be switched on at the main switch without release of the cooling for at least 3 hours before the required operation is switched on.

7.1. Installation checklist

- Unit installed horizontally and stable?
- Any vibration damping and floor anchoring necessary is installed?
- The spaces around the unit are sufficient according to the specifications?
- Air intake side free from packaging material, etc.?
- Hydraulic connection OK?
- Cold water circuit filled in accordance with specification? Water quality OK?
- Whole system flushed? Dirt trap cleaned?
- Cross-sections adequately dimensioned?
- Electrical connection OK? Electrical power available?
- External pumps OK? Direction of rotation?
- Unit cover closed?
- Whole system OK and ready for startup?
- Compressor “preheated”?
- External release OK?

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

Use the enclosed **Product registration** form to register your chiller. This ensures that you receive support quickly and easily 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

Firstly, switch on the unit by flipping 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 at ambient temperatures <5 °C for longer than 6 h. In this case the compressors must be preheated for 3 h, so that the refrigerant can escape from the oil. Compressor heating and the thermostatic pump start are active.

- **Auto**: The chiller is ready for operation. Fully-automatic operation starts by external release (potential-free contact) as described in Chapter *8.3 External* release. If the contact is open, the compressor heater and the thermostatic pump start are active. If the contact is closed, fully-automatic control for the compressor and the tank heating are released. The chiller adjusts to its setpoint.

- **On:** the chiller is continuously switched on in fully-automatic mode without external release.

8.3. External release

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

8.4. Control

The system is controlled by a PLC (programmable logic controller). This communicates with an add-on module and a controller for controlling the inverter and the display. The controller for controlling the inverter includes control of the complete refrigeration circuit. The inverter itself is used for optimised speed control of the compressor All operation-relevant data are shown on the display.

8.5. Control panel

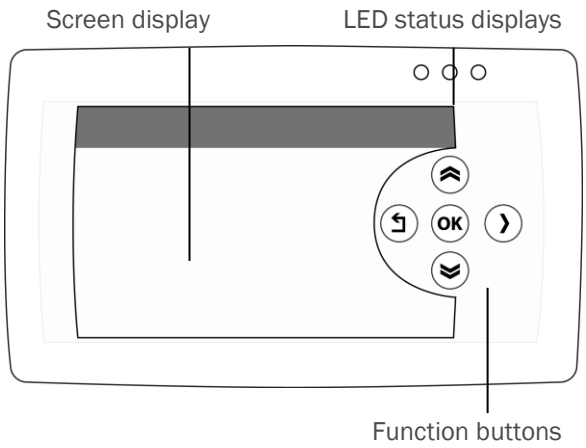


Figure 14: Chiller control panel

LED status displays:

- Left LED is lit red:
  Group fault exists
- Middle KED is lit yellow:
  Pump is running
- Right LED is lit green:
  Compressor is running

Please note:
Selected menu fields in which you can make changes (= input fields), are shown inversely on the display.

There are two types of input fields:

- Text input fields
  Setting options are displayed by default texts.
  If a text input field for changing the setting option is activated, this setting option appears positioned on the right.
- Numerical input fields
  Values can be changed within a predefined value range.
  If a numeric input field for changing the value is activated, a small flashing cursor appears at the current input position below the respective digit.

Button functions:
Pressing any button activates the display lighting.

Pressing this button allows you
- to scroll within a menu level from the currently shown display to the previous display of this menu level.
- change the values if the selected input field was released beforehand by pressing the OK button: increase a value within numerical input fields. Switch to the previous setting option within the text input fields.

Pressing this button allows you
- to activate the input fields for entering /editing values.
- to save the entered value of an input field and also block the respective input field at the same time.
- to confirm all faults in the “Alarms” menu, if the button is pressed for 5 seconds.

Pressing this button allows you
- to navigate from an upper menu level to the associated submenu level.
- to switch between the displayed input fields (if no input field has been activated for input)
- jump from one number position to another within the numeric input fields that were previously activated.

Pressing this button allows you
- to scroll within a menu level from the currently shown display to the next display of this menu level.
- change the values if the selected input field was released beforehand by pressing the OK button: lower a value within numerical input fields. Switch to the next setting option within the text input fields.

Pressing this button allows you
- navigate from a lower to the next higher menu level.
- jump from one number position to another within the numeric input fields that were previously activated.

8.5.1. Start screen

The general operating status of the system is displayed on the Start screen.

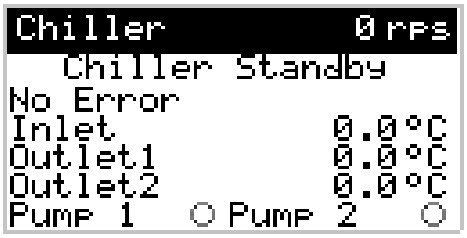


Figure 15: Start screen

① Current system operating mode
(here: System standby)
Changing the operating mode see Chapter *8.5.2 Changing the operating mode*.

The other menu fields of the Start screen are used for information. Changes to the displayed values are made automatically. Manual input is not possible here.

② Active alarm
(here: no fault)

③ Inlet = inlet temperature
process water circuit 1 in °C

④ Outlet 1 = outlet temperature
process water circuit 1 in °C

⑤ Outlet 2 = outlet temperature
process water circuit 2 in °C

⑥ Pump 1 / Pump 2. = operating status of the pumps

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

8.5.2. Change of operating mode

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

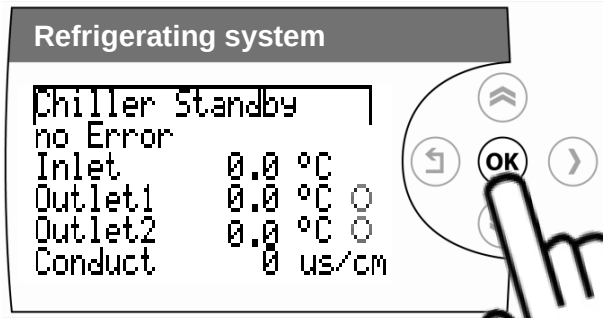


Figure 16: Activating menu bar

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 status.
(current operating status in the adjacent figure: “System standby”).

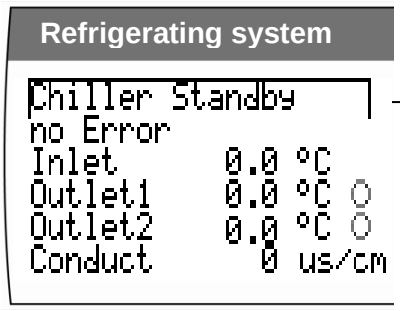


Figure 17: Menu bar is activated

By releasing the “current system operating mode” text input field the text shown in the display is right-aligned.

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 modes:

- System standby
- System auto
- System on

Press the OK button to save and activate the currently displayed mode.
This left-aligns the entry in the text input field.
At the same time, the text input field is blocked again.

8.5.3. Navigating to the menu levels

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

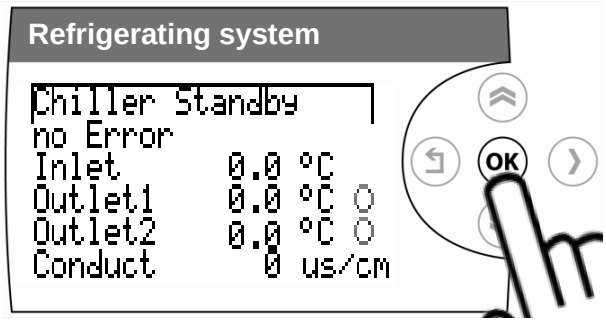


Figure 18: Navigating to the Main menu

If the lighting of the control panel is switched on, you can navigate further to the main menu.
To do this, press button ⓧ.

Please note:
No input field for changing values may be activated if you want to navigate between or within menu levels.

Press button ⓧ to navigate from a higher menu level to subordinate menu level.

Within a menu level, scroll down through the display of this menu level by pressing button ⓧ or scroll upwards by pressing the button ⓧ.

The displays of a menu level rotate, i.e.: if you scroll down, the last display of a menu level is followed by the first display of the same menu level. if you scroll up, the last display of the same menu level follows the first display of a menu level.
Press button ⓧ to navigate from a lower menu level to an overriding menu level.

8.6. Parameter

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 blocked parameters. For enquiries regarding the daily password, please contact our KKT chillers Service Team (*Contact details*). The password level of the individual parameters is given in the parameter list enclosed in the machine documentation.

8.7. Controller description

8.7.1. Electronic level monitoring

Before switching on the chiller, the electronic level monitoring becomes active.
The level is monitored for three statuses:

- Tank min level STOP; The chiller switches off immediately.
- Tank min level warning; The chiller continues to run but in case of a standstill it does not switch back on. The water feed solenoid valve (only for automatic water feed option) is opened.
- Tank max level message; The cold water feed solenoid valve (only for automatic water feed option) is closed.

The ideal status exists when the level is above the warning level and below the maximum level. In this case, no message appears.
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 in order not to initiate a cooling process that can possibly not be ended.

8.7.2. Switching the chiller on/off

The selected pumps are released if:

- It is selected in the chiller configuration of the software,
- 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 motor protection switch faults are queued.
- 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 time delay.
When the load 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 at start; the pressure or the flow monitor triggers an alarm if, after the time has expired, no pressure or no flow has developed.
- Delay during operation; in order to ignore short-term fluctuations in pressure or flow, the alarm is delayed.

The same applies to the pressure and flow monitoring of the evaporator.

On switching off the system, the temperature control is blocked immediately and thus the compressor is switched off. The pump continues to run to prevent uncontrolled continued evaporation.

8.7.3. Cold water feed temperature control

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

The following operating statuses reduce the control signal for the compressor:

- High pressure
- Low pressure
- High-low pressure difference too large

8.7.4. Compressor control

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

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

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 value is exceeded, but releases them again if the value falls below the release value. Before switching off the, high-pressure transmitter signals a warning.

Low pressure is also monitored by pressure transmitters. The compressor switches off if the value falls below the setpoint value. If the switch-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 request for the compressor. If no intake pressure has built up by the time the time expires, the low-pressure fault alarm is triggered. After the start time has expired the low pressure may exceed the switch-off value for a short time. If this occurs more than three times within an hour, the compressor is blocked. 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 at 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

To keep the superheating constant, an electronic expansion valve with PI controller is used in vBoxX 6 – 18 and a thermal expansion valve in vBoxX 24 – 28.

8.7.7. Temperature limit monitoring

The temperature of the cold water feed is monitored for a minimum and maximum limit value if the chiller is switched on (pump is running). If the limit value is exceeded or the minimum is not reached, an alarm is triggered with time delay, which switches off the compressor.

8.7.8. Group fault message + warning message

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

9. Cleaning

9.1. Air filter mat

To maintain high performance, the optional air filter mat (*3.24 Air filter mat*) must be checked for contamination at least once a month. The appropriate air filter mats can be ordered at any time as an original spare part – please contact our KKT chillers Service Team (*Contact details*).

9.2. Condenser

To maintain high performance, the microchannel heat exchanger must be cleaned if there is any visible contamination, but at least annually. To do this, disconnect the unit from the power supply and remove the service panels and the condenser protective grille (panels 3 and 5, see Chapter *1.2 Elements*). First of all, remove coarse dirt particles from the outside using a standard vacuum cleaner. 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 required water circulation quantity, the optional water filter (*Chapter 3.27 Refrigerant circuit filter assembly*) must be checked for contamination at least once a month. The appropriate filter unit can be ordered at any time as an original spare part – 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 that the complete cleaning of the cold water circuit only be carried out by qualified personnel – please contact our KKT chillers Service Team (*Contact details*).

10. Service

All service work may only be carried out by suitably qualified personnel.

10.1. Servicing/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 unexpected failures
- To plan further servicing work in order to minimise downtimes

An overview of the 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 named points describe the minimum maintenance. The system's reliability can be increased by intensifying the monitoring. You can contact our service department at any time regarding servicing and maintenance quotations / maintenance agreements.

Use the enclosed **Product registration** form to register your chiller. This ensures that you receive support quickly and easily in a service case, as KKT chillers already has all the relevant data.

10.2. Fault clearance

Troubleshooting and fault correction instructions are given in ***Appendix II***.

Our technical customer service can be reached around the clock and will assist you with all service matters (maintenance, repairs, spare parts, etc.):

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. In this way you ensure the reliability and quality of the machine. For enquiries regarding spare parts, please contact our KKT chillers Service Team (*Contact details*).

Use the enclosed **Product registration** form to register your chiller. This ensures that you receive support quickly and easily in a service case, as KKT chillers already has all the relevant data.

11. Withdrawing from service

	**WARNING! The machine must be withdrawn from service by professional and qualified technicians.** **They must also be familiar with the local regulations.**

For safety-related notes regarding any 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. If the unit is shut down for a lengthy period the complete cold water circuit must be fully drained. Proceed as follows:

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

The drain valve is identified by the symbol shown in *Figure 19*.

Figure 19: Identification of the drain cock

The position of the drain plug is shown in *Figure 20*.

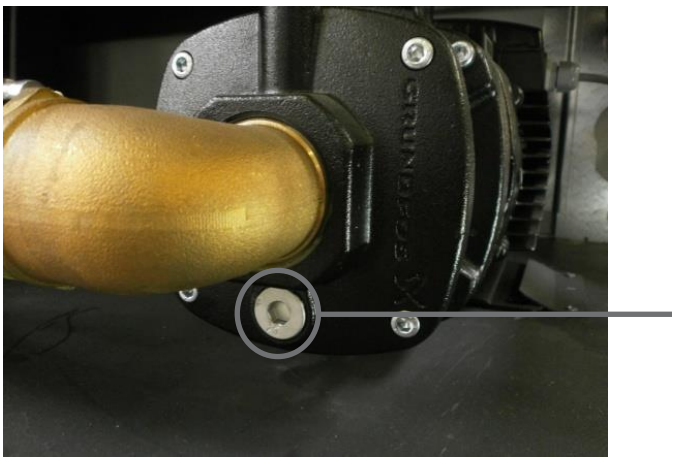


Figure 20: Position of the pump drainage (here: horizontal type)

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

	**WARNING! Any dismantling must be carried out by professional and qualified technicians.** **The 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...) must be recycled, reused or disposed of. Please note and follow all local and national regulations and if necessary contact your local waste management authority.

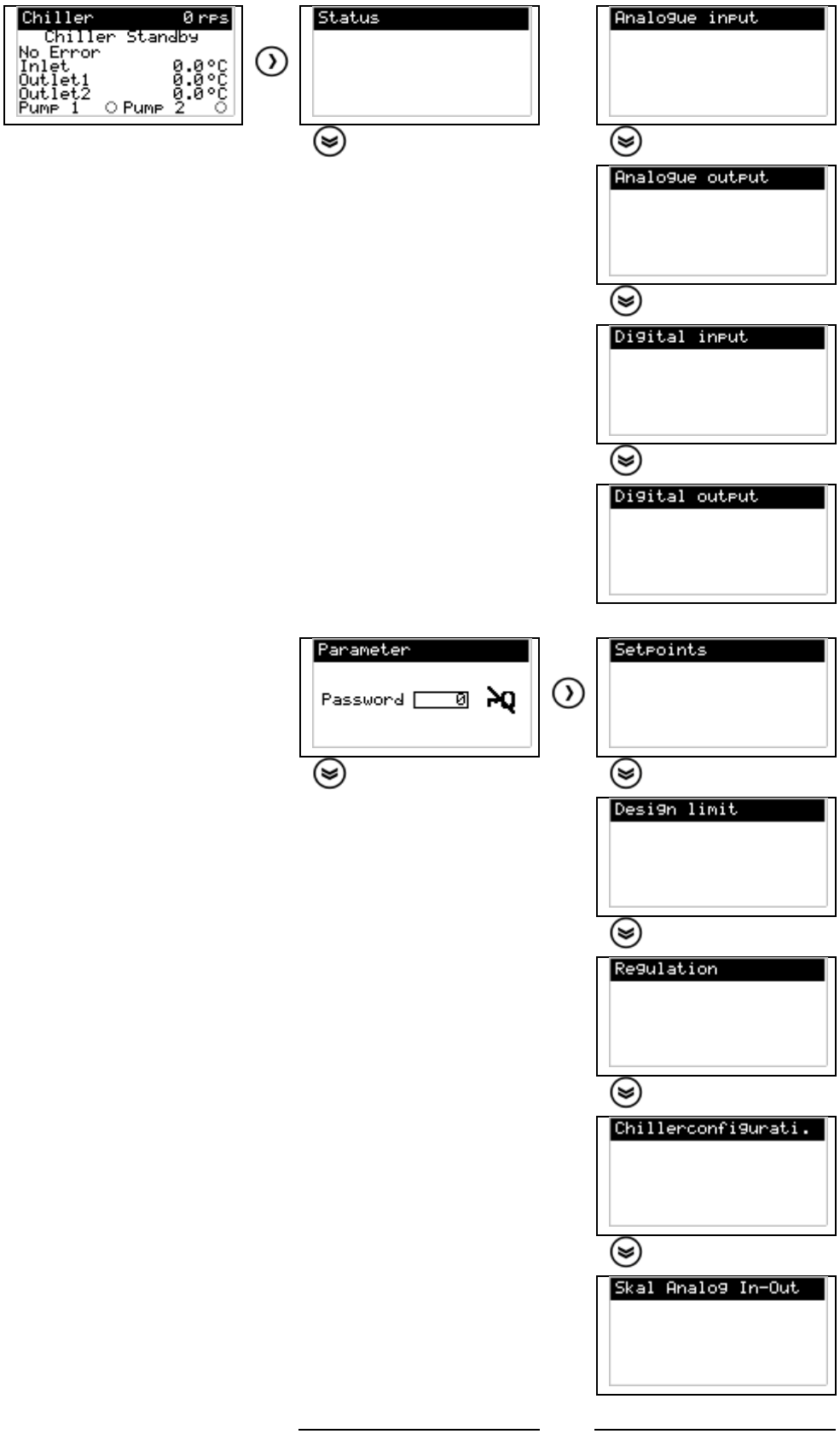
A specialised disposal company must be used for the disposal of these wastes. They will issue a proof of disposal that must be archived. The chiller can be returned to KKT chillers for disposal. Please contact our KKT chillers Service Team for details (*Contact details*).

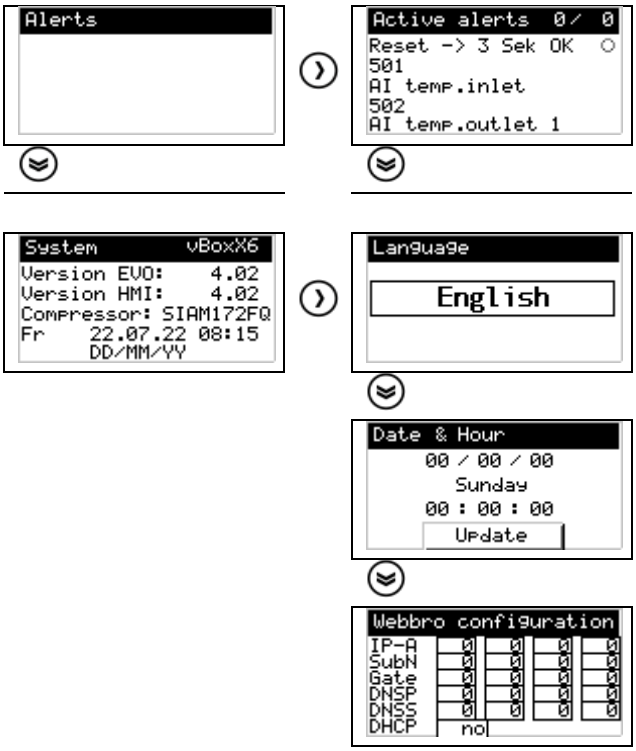
13. Products, solutions and services

Apart from the Vario-Line, KKT chillers also offers other products, solutions and services, which are not described in this document. Take a look at our website *http://www.kkt-chillers.com* or contact your KKT chillers contact (*contact details*) – we look forward to hearing from you!

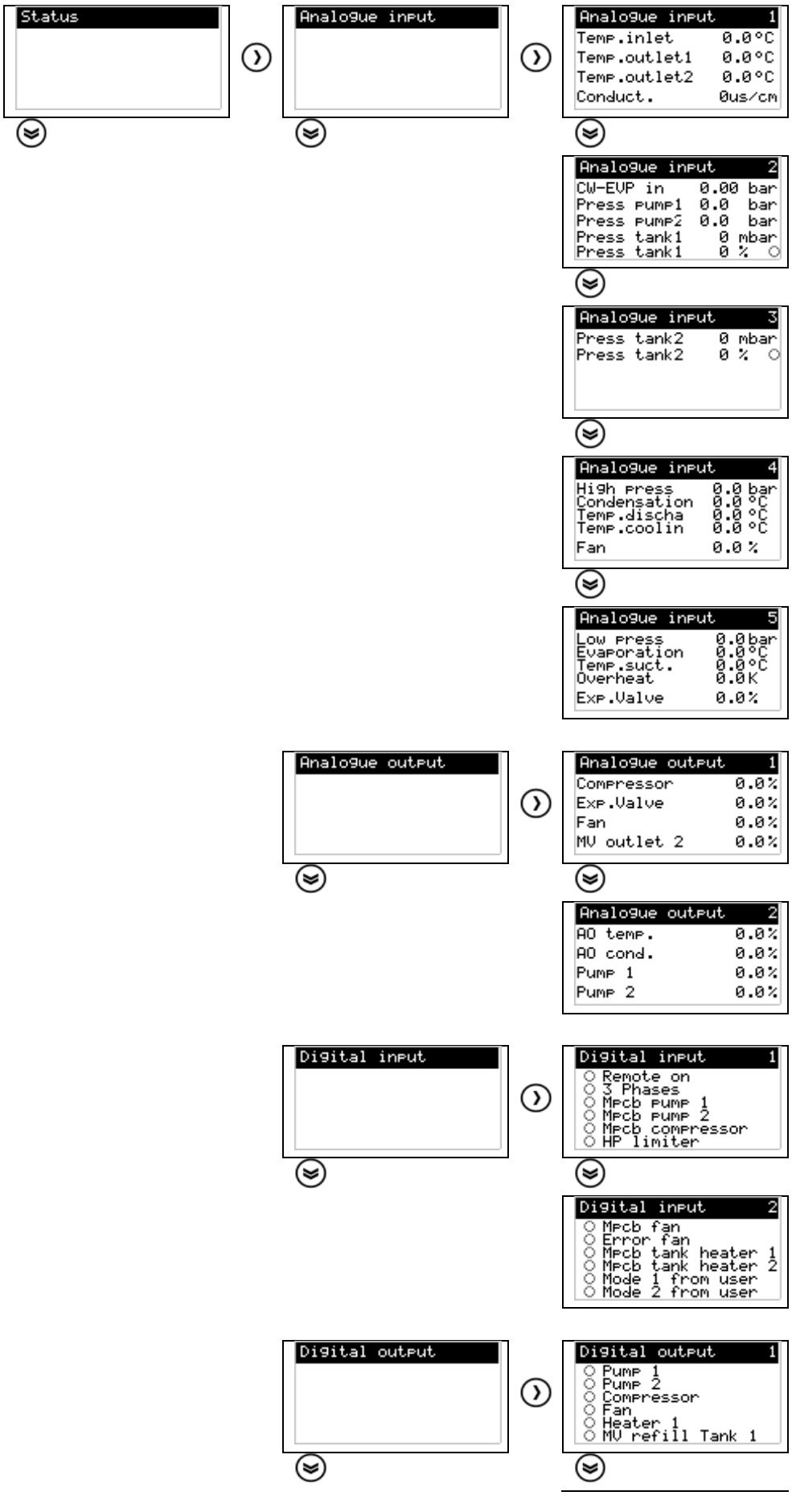
I. Overview of the menu levels

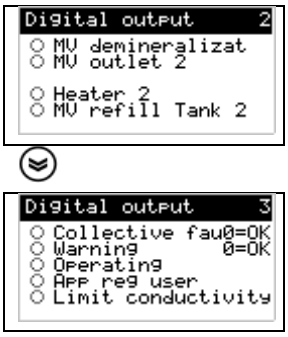
Main structure




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
SubN
Gate
DNSP
DNSS
DHCP
no

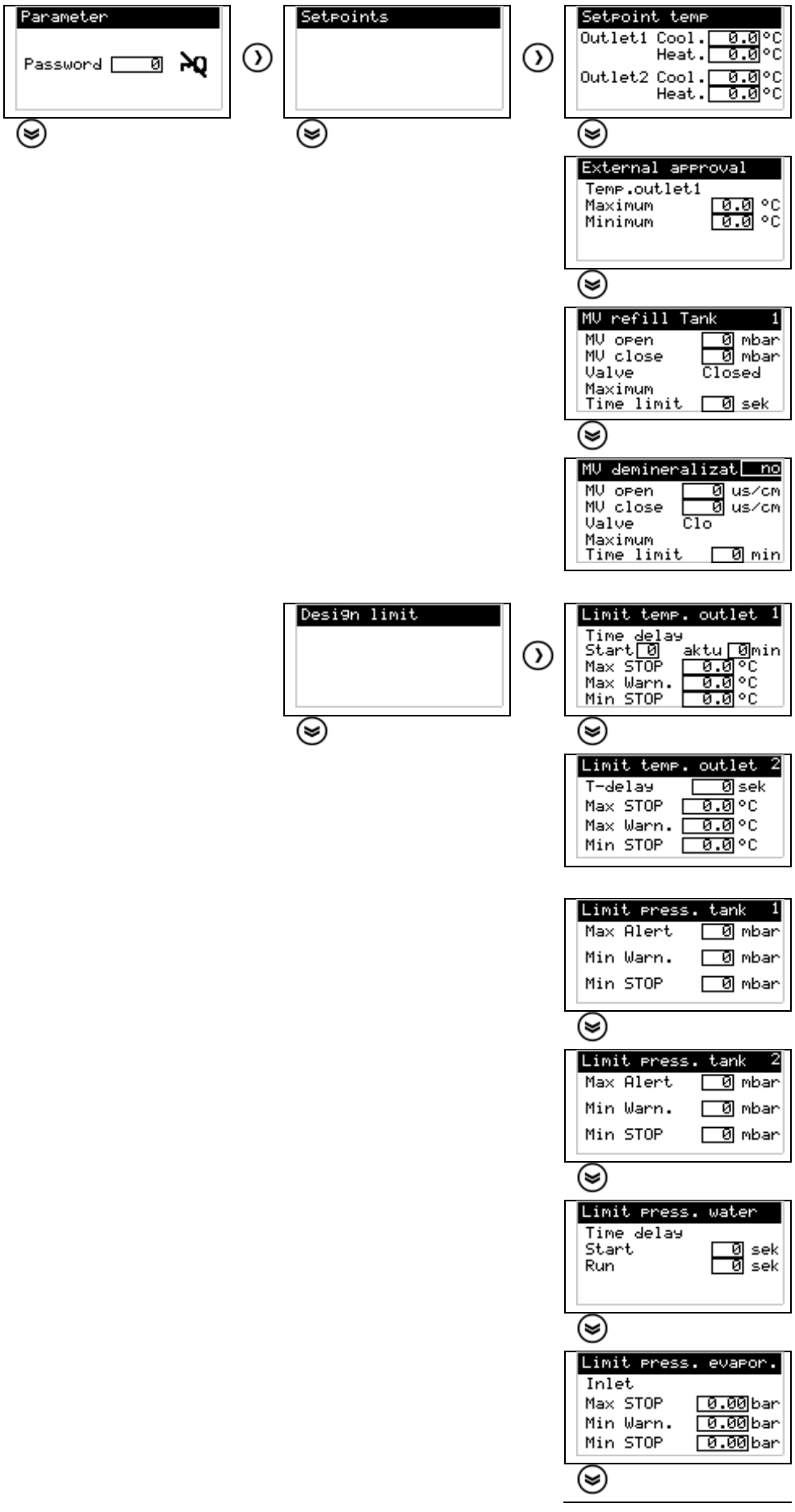
Status

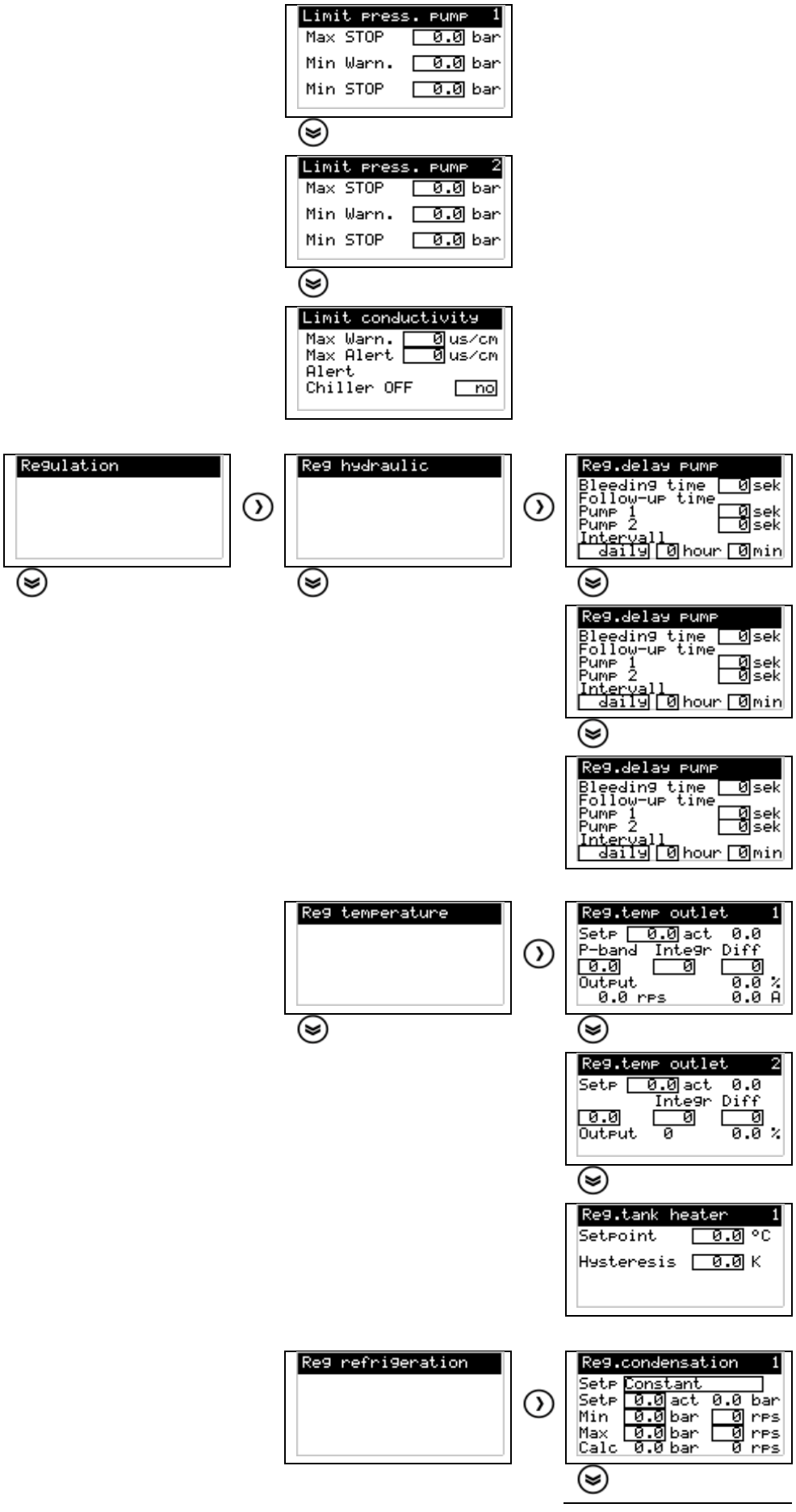

Status
Analogue input
Analogue input 1
Temp.inlet 0.0°C
Temp.outlet1 0.0°C
Temp.outlet2 0.0°C
Conduct. 0us/cm
Analogue input 2
CW-EVP in 0.00 bar
Press pump1 0.0 bar
Press pump2 0.0 bar
Press tank1 0 mbar
Press tank1 0 %
Analogue input 3
Press tank2 0 mbar
Press tank2 0 %
Analogue input 4
High press 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 0.0 bar
Evaporation 0.0 °C
Temp.suct. 0.0 °C
Overheat 0.0 K
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

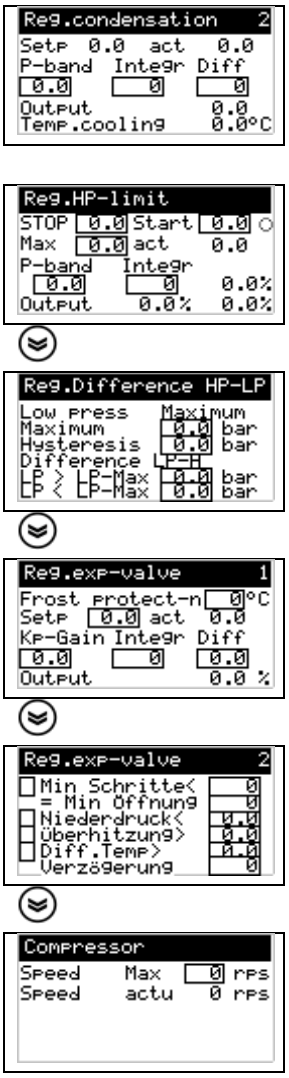

Digital output 2
MV demineralizat
MV outlet 2
Heater 2
MV refill Tank 2
Digital output 3
Collective fau0=OK
Warning 0=OK
Operating
App reg user
Limit conductivity

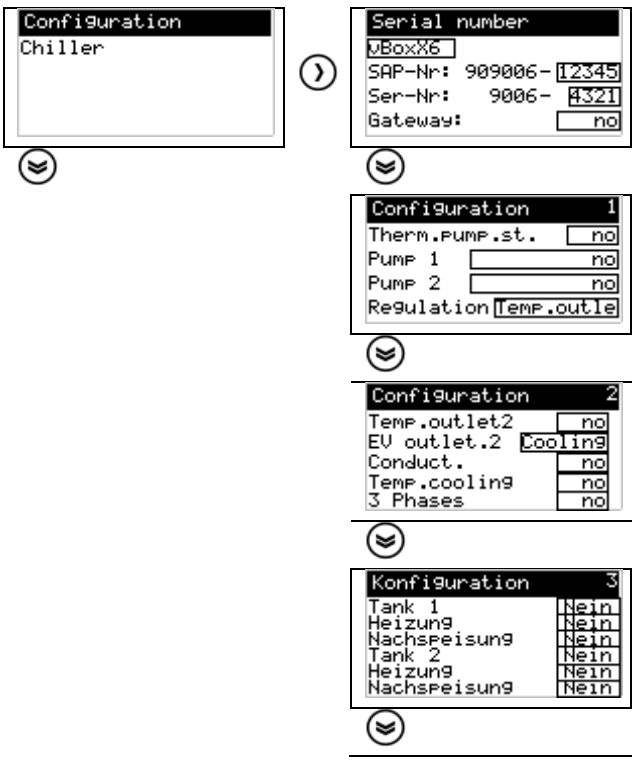

Network
Adr.1 uPC
Adr.2 FREE SMART
Adr.4 FREE ADVANCE
Adr.5 Gateway
Adr.6 EEV SANHUA
CAN 1 EVE 4200

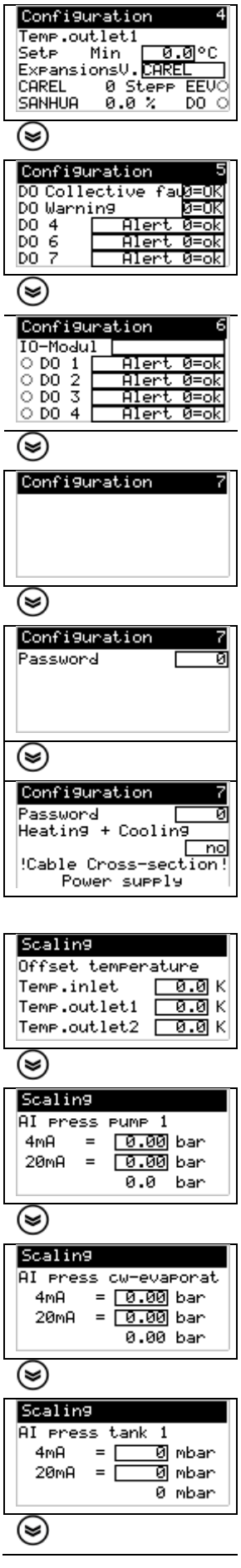
Parameter

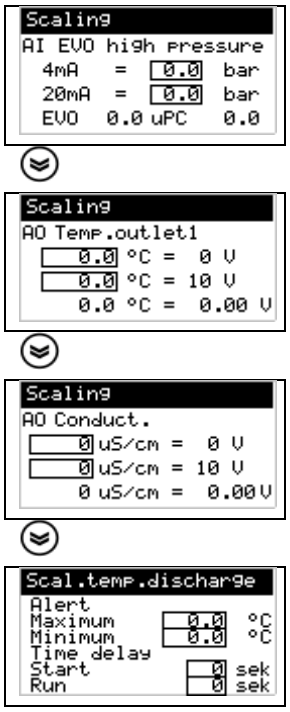

Parameter
Password 0
Setpoints
Design limit
Setpoint temp
Outlet1 Cool. 0.0 °C
Heat. 0.0 °C
Outlet2 Cool. 0.0 °C
Heat. 0.0 °C
External approval
Temp.outlet1
Maximum 0.0 °C
Minimum 0.0 °C
MV refill Tank 1
MV open 0 mbar
MV close 0 mbar
Valve Closed
Maximum
Time limit 0 sek
MV demineralizat no
MV open 0 us/cm
MV close 0 us/cm
Valve Clo
Maximum
Time limit 0 min
Limit temp. outlet 1
Time delay
Start 0 aktu 0min
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 0.00bar
Min Warn. 0.00bar
Min STOP 0.00bar


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
Interval
daily 0 hour 0 min
Reg.delay pump
Bleeding time 0 sek
Follow-up time
Pump 1 0 sek
Pump 2 0 sek
Interval
daily 0 hour 0 min
Reg.delay pump
Bleeding time 0 sek
Follow-up time
Pump 1 0 sek
Pump 2 0 sek
Interval
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 = 0.00V
Scal.temp.discharge
Alert
Maximum 0.0 °C
Minimum 0.0 °C
Time delay
Start 0 sek
Run 0 sek

II. Troubleshooting

Error code	vBoxX display	Type of message vBoxX	Message description	Cause of the message	Troubleshooting	Response of the vBoxX chiller
161	Low pressure Min.Stop Version 03.61 and higher Low pressure sensor	Group warning	Analog ow pressure input (PWM) at the µPC, has maximum measured value, although a lower value should be displayed.	Analog input is not connected or is defective.	Testing of the sensor's electrical connections, Testing of the sensor based on the characteristic curve	Switches off the compressor and fan immediately.
301	Temp.Outl.1 maxWarn	Group warning	Outlet temperature of the liquid circuit is approaching the upper limit.	Thermal overload, No cold generation.	Check refrigerating capacity, check the function of the refrigeration circuit	All components continue to run, warning is saved, manual reset.
302	Temp.Outl.2 maxWarn	Group warning	Outlet temperature of the liquid circuit is approaching the upper limit.	Thermal overload, No cold generation, Cooling valve not working; Cooling valve incorrectly configured.	Check refrigerating capacity, Check the function of the refrigeration circuit, Check cooling valve, Check the cooling valve configuration.	All components continue to run, warning is saved, manual reset.
311	Tank max pressure warn	Group warning	Level in the tank is approaching the maximum limit.	Level in the tank is too high, level sensor in the tank is defective.	Drain the tank slightly, check the function of the sensor in the tank.	All components continue to run, warning is saved, manual reset.
312	Tank press. min warn	Group 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 the tank, check the function of the sensor in the tank.	All components continue to run, warning is saved, manual reset.
313	Time limit EV1 refill	Group warning	The solenoid valve of the tank feed does not close within the specified time.	The freshwater supply is interrupted.	Check the function of the tank feed solenoid valve. Open shut-off valves integrated in the supply pipe. Check supply pipe for leakage.	Tank feed solenoid valve closes. All components continue to run, alarm is saved, manual reset.
314	Tank 2 press.max warn	Group warning	Level in the tank is approaching the maximum limit.	Level in the tank is too high, level sensor in the tank is defective.	Drain the tank slightly, check the function of the sensor in the tank.	All components continue to run, warning is saved, manual reset.
315	Tank 2 press.min warn	Group 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 the tank, check the function of the sensor in the tank.	All components continue to run, warning is saved, manual reset.
321	Coldwatpress.minwarn	Group warning	The liquid pressure at the evaporator is approaching the minimum or maximum limit	External gate valve is closed, filter is dirty, air in the system.	Open external gate valve, clean filter, vent the system.	All components continue to run, alarm is saved, manual reset.

322	KW-VD min flow warn	Group warning	The refrigerant flow through the evaporator is approaching the minimum limit.	External gate valve is closed, filter is dirty, air in the system.	Open external gate valve, clean filter, vent the system.	All components continue to run, alarm is saved, manual reset.
326	Press. P1 min warn	Group 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 is saved, manual reset.
327	Press. P2 min warn	Group 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 is saved, manual reset.
331 334	Conduct'y max alarm	Group warning	Conductivity exceeds maximum limit.	Conductivity too high.	Check limit value specification, If present: check DI cartridge, check flow through DI cartridge.	Depending on the configuration, switching off of the system or only message, alarm is saved, manual reset.
332 335	Conduct'y max warn	Group warning	Conductivity is approaching the maximum limit.	Conductivity too high.	Check the limit default. If present: Check DI cartridge, check flow through DI cartridge.	All components continue to run, alarm is saved, manual reset.
333 336	Time limit EV1 demin.	Group warning	The demineralisation solenoid valve does not close within the specified time.	DI cartridge is worn. No flow through the DI cartridge. Switching off point is set too high.	Change DI cartridge. Check flow through the DI cartridge. DI cartridge worn.	Demineralisation solenoid valve closes. All components continue to run, alarm is saved, manual reset.
351	Temp.Outl.1 maxStop	Group fault message	Maximum outlet temperature of cold water circuit 1 exceeded.	No cold generation, thermal overload.	Check the function of the refrigeration circuit, check the installed heat load.	Chiller switches off immediately. Alarm is saved, Manual reset.
352	Temp.Outl.1 minStop	Group fault message	Minimum outlet temperature of cold water circuit 1 is not reached.	Check the function of the tank heating, check the target value specification, ambient temperature too low.	Check the function of the tank heating, check the setpoint, increase the ambient temperature.	Chiller switches off immediately. Alarm is saved, Manual reset.
353	Temp.Outl.2 maxStop	Group fault message	Maximum outlet temperature of cold water circuit 2 exceeded.	No cold generation, circuit 2 valve does not open thermal overload.	Check the function of the refrigeration circuit, check the function of water circuit 2 (cooling valve), check circuit 2 configuration.	Chiller switches off immediately. Alarm is saved, Manual reset.
354	Temp.Outl.2 minStop	Group fault message	Minimum outlet temperature of cold water circuit 2 is not reached.	Check the function of the tank heating, check the target value specification, ambient temperature too low.	Check the function of the tank heating, check the setpoint, increase the ambient temperature.	Chiller switches off immediately. Alarm is saved, Manual reset.

361	Tank press. min Stop	Group fault message	Level in tank is below the minimum.	Level in the tank is too low, level sensor dirty or defective.	Fill tank, check the function of the tank sensor.	Chiller switches off immediately. Alarm is saved, Manual reset.
362	Tank 2 press.min Stop	Group fault message	Level in tank is below the minimum.	Level in the tank is too low, level sensor dirty or defective.	Fill tank, check the function of the tank sensor.	None, Alarm is saved, manual reset.
372	KW-VD max flow Stop	Group fault message	Refrigerant flow in the inlet is too high	Evaporator dirty, water quantity too high	Clean the evaporator, adjust the water quantity, test the water quality	System shuts down in controlled manner, alarm is saved, manual reset.
373	Coldwatpress.maxStop	Group fault message	Liquid pressure in the inlet is too high	Evaporator dirty, water quantity too high	Clean the evaporator, adjust the water quantity, test the water quality	System shuts down in controlled manner, alarm is saved, manual reset.
374	Coldwtpress.minStart	Group fault message	Liquid pressure at the evaporator too low after switching on.	External gate valve is closed, filter is dirty, air in the system.	Open external gate valve, clean filter, vent the system.	System shuts down in controlled manner, alarm is saved, manual reset.
375	Coldwatpress.min.Op	Group fault message	Cold water pressure at the evaporator too low during operation.	External gate valve is closed, filter is dirty, air in the system.	Open external gate valve, clean filter, vent the system.	System shuts down in controlled manner, alarm is saved, manual reset.
376	KW-VD minStart flow	Group fault message	Refrigerant flow at the evaporator too low after switching on.	External gate valve is closed, filter is dirty, air in the system.	Open external gate valve, clean filter, vent the system.	System shuts down in controlled manner, alarm is saved, manual reset.
377	KW-VD min flow op	Group fault message	Refrigerant flow at the evaporator too low during operation.	External gate valve is closed, filter is dirty, air in the system.	Open external gate valve, clean filter, vent the system.	System shuts down in controlled manner, alarm is saved, manual reset.
381	Press. P1 max Stop	Group fault message	Pressure of the liquid outlet pressure is 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 is saved, manual reset.
383	Press. P1 min Start	Group fault message	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 operates 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 is saved, Manual reset.

384	Press. P1 min oper.	Group fault message	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 operates outside the set limits	Increase external pressure loss	Fan, compressor and pump switch off immediately, pump 2 continues to run, alarm is saved, Manual reset.
385	Press. P2 max Stop	Group fault message	Pressure of the liquid outlet pressure is too high.	External gate valve closed, filter dirty.	Open external gate valve, clean filter, check overflow valve setting.	Pump switches off. Alarm is saved, Manual reset.
387	Press. P2 min Start	Group fault message	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 operates outside the set limits external pipe system not yet filled.	Fill and vent Increase external pressure loss	Pump switches off. Alarm is saved, Manual reset.
388	Press. P2 min oper.	Group fault message	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 operates outside the set limits	Increase external pressure loss	Pump switches off. Alarm is saved, Manual reset.
501	AI Temp.inlet	Group warning	Measured value of the analog input is outside the valid measurement range	Sensor is defective, sensor break or sensor short-circuit	Testing of the sensor's electrical connections, testing of the sensor based on the characteristic curve	No response if outlet control, if control sensor switches off the system. Warning is saved, manual reset.
502	AI Temp.Outlet 1	Group fault message	Measured value of the analog input is outside the valid measurement range	Sensor is defective, sensor break or sensor short-circuit	Testing of the sensor's electrical connections, testing of the sensor based on the characteristic curve	Pump continues to run controls according to inlet sensor (5K above set outlet temperature) acknowledgement is successful
503	AI Temp.Outlet 2	Group fault message	Measured value of the analog input is outside the valid measurement range	Sensor is defective, sensor break or sensor short-circuit	Testing of the sensor's electrical connections, testing of the sensor based on the characteristic curve	Cooling valve closes, Compressor shuts down in controlled manner, system shuts down after run-down time, alarm is saved, manual reset.
511	AI cold water press.	Group fault message	Measured value of the analog input is outside the valid measurement range	Sensor is defective, sensor break or sensor short-circuit	Testing of the sensor's electrical connections, testing of the sensor based on the characteristic curve	Compressor & fan switch off immediately, pump 1 continues to run, pump 2 continues to run, system switches off after run-down time, alarm is saved, manual reset.

513	AI pump pressure 1	Group fault message	Measured value of the analog input is outside the valid measurement range	Sensor is defective, sensor break or sensor short-circuit	Testing of the sensor's electrical connections, testing of the sensor based on the characteristic curve	Compressor & fan switch off immediately, pump 1 switches off immediately, pump 2 continues to run, alarm is saved, manual reset.
514	AI pump pressure 2	Group fault message	Measured value of the analog input is outside the valid measurement range	Sensor is defective, sensor break or sensor short-circuit	Testing of the sensor's electrical connections, testing of the sensor based on the characteristic curve	Compressor & fan switch off immediately, Pump 1 continues to run, Pump 2 switches off immediately, Cooling valve closes, alarm is saved, manual reset.
515	AI tank pressure 1	Group fault message	Measured value of the analog input is outside the valid measurement range	Sensor is defective, sensor break or sensor short-circuit	Testing of the sensor's electrical connections, testing of the sensor based on the characteristic curve	Chiller switches off immediately, alarm is saved, manual reset.
516	AI tank pressure 2	Group fault message	Measured value of the analog input is outside the valid measurement range	Sensor is defective, sensor break or sensor short-circuit	Testing of the sensor's electrical connections, testing of the sensor based on the characteristic curve	Pump 2 switches off. Alarm is saved, Manual reset.
517	AI KW-VD flow	Group fault message	Measured value of the analog input is outside the valid measurement range	Sensor is defective, sensor break or sensor short-circuit	Testing of the sensor's electrical connections, testing of the sensor based on the characteristic curve	Compressor & fan switch off immediately, pump 1 continues to run, pump 2 continues to run, system switches off after run-down time, alarm is saved, manual reset.
521	AI high pressure	Group fault message	Measured value of the analog input is outside the valid measurement range	Sensor is defective, sensor break or sensor short-circuit	Testing of the sensor's electrical connections, testing of the sensor based on the characteristic curve	Compressor & fan switch off immediately Check fan Pump continues to run Acknowledging is successful 2x
526	AI cool water temp.	Group warning	Measured value of the analog input is outside the valid measurement range	Sensor is defective, sensor break or sensor short-circuit	Testing of the sensor's electrical connections, testing of the sensor based on the characteristic curve	Alarm is only displayed no switching off operations are initiated acknowledgement is successful

531	AI conductivity	Group fault message	Measured value of the analog input is outside the valid measurement range	Sensor is defective, sensor break or sensor short-circuit	Testing of the sensor's electrical connections, testing of the sensor based on the characteristic curve	Compressor switches off immediately fan is shut down in controlled manner pumps continue to run can be acknowledged after delay
532	AI flow Term.1	Group warning	Measured value of the analog input is outside the valid measurement range	Sensor is defective, sensor break or sensor short-circuit	Testing of the sensor's electrical connections, testing of the sensor based on the characteristic curve	Aftercooler valve closes
533	AI flow Term.2	Group warning	Measured value of the analog input is outside the valid measurement range	Sensor is defective, sensor break or sensor short-circuit	Testing of the sensor's electrical connections, testing of the sensor based on the characteristic curve	Aftercooler valve closes
535	AI temp. recooler 1	Group warning	Measured value of the analog input is outside the valid measurement range	Sensor is defective, sensor short-circuit or sensor break	Testing of the sensor's electrical connections, testing of the sensor based on the characteristic curve	None, as only display value
536	AI temp. recooler 2	Group warning	Measured value of the analog input is outside the valid measurement range	Sensor is defective, sensor short-circuit or sensor break	Testing of the sensor's electrical connections, testing of the sensor based on the characteristic curve	None, as only display value
581	µPC network	Notification	No network connection with µPC	Network connection is faulty. Network component is de-energised. Network component is defective.	Check the wiring. Check the power supply. Check component.	none, only display
582	FREEESMART1 network	Notification	No network connection with FREE SMART 1	Network connection is faulty. Network component is de-energised. Network component is defective. Wrong components configured.	Check the wiring. Check the power supply. Check component. Check configuration.	none, only display
583	FREEESMART2 network	Notification	No network connection with FREE SMART 2	Network connection is faulty. Network component is de-energised. Network component is defective. Wrong components configured.	Check the wiring. Check the power supply. Check component. Check configuration.	none, only display

584	FREEADVANCED network	Notification	No network connection with FREE ADVANCED	Network connection is faulty. Network component is de-energised. Network component is defective. Wrong components configured.	Check the wiring. Check the power supply. Check component. Check configuration.	none, only display
585	Network gateway	Notification	No network connection with gateway	Network connection is faulty. Network component is de-energised. Network component is defective. Wrong components configured.	Check the wiring. Check the power supply. Check component. Check configuration.	none, only display
586	Sanhua network	Notification	No network connection with Sanhua expansion valve driver	Network connection is faulty. Network component is de-energised. Network component is defective. Wrong components configured.	Check the wiring. Check the power supply. Check component. Check configuration.	none, only display
587	EVE 4200 network	Notification	No network connection with EVE 4200 expansion module	Network connection is faulty. Network component is de-energised. Network component is defective. Wrong components configured.	Check the wiring. Check the power supply. Check component. Check configuration.	none, only display
602	DI phase monitoring	Group fault message	Phase monitoring has tripped	Error in relation to phase sequence, phase failure, undervoltage and asymmetry	Check supply	Chiller switches off immediately.
611	DI mpcb Pump 1	Group fault message	Motor protection switch has tripped	Motor current above the allowable range, Motor only runs on two phases, wrong direction of rotation, poor contact at terminals, winding short-circuit, earth fault, rotor is blocked.	Checking of the motor power consumption, checking of the operating point, checking of the electrical connection of the components.	Pump 1 switches off immediately. Compressor switches off immediately.

612	0	0	Internal monitoring of the pump has triggered.	Motor only runs on two phases, wrong direction of rotation, poor contact at terminals, winding short-circuit, earth fault, rotor is blocked.	Check the motor power consumption, check the electrical connection of the components, check for mechanical blocking,	0
613	Flow Pump 1 start	Group fault message	Flow switch did not switch through after the pump start-up phase.	Flow too low	Check flow, check shut-off valves, check pump, check the setting of the reed contact at the flow monitor.	Pump 1 & 2 = load pump - Pump 1 switches off, - Pump 2 and compressor continue to run. Pump 1 = load pump Pump 2 = evaporator pump Chiller switches off. Pump 1 = load pump Pump 2 = redundant - Pump 1 switches off, - Pump 2 switches on. Alarm is saved. Manual reset,
614	Flow Pump 1 op.	Group fault message	Flow switch did not switch through during the pump operating phase.	Flow too low	Check flow, check shut-off valves, check pump, check the setting of the reed contact at the flow monitor.	Pump 1 & 2 = load pump - Pump 1 switches off, - Pump 2 and compressor continue to run. Pump 1 = load pump Pump 2 = evaporator pump Chiller switches off. Pump 1 = load pump Pump 2 = redundant - Pump 1 switches off, - Pump 2 switches on. Alarm is saved. Manual reset,

615	DI mpcb Pump 2	Group fault message	Motor protection switch has tripped.	Motor current above the allowable range, Motor only runs on two phases, wrong direction of rotation, poor contact at terminals, winding short-circuit, earth fault, rotor is blocked.	Checking of the motor power consumption, checking of the operating point, checking of the electrical connection of the components.	Pump 1 & 2 = load pump - Pump 2 switches off, - Pump 1 and compressor continue to run. Pump 1 = load pump Pump 2 = evaporator pump - Pump 2 and compressor switch off, - Pump 1 continues to run until outlet temp. max stop. Pump 2 = load pump Pump 1 = redundant - Pump 2 switches off, - Pump 1 switches on. Manual reset, alarm is saved.
617	Flow Pump 2 start	Group fault message	Flow switch did not switch through after the pump start-up phase	Flow too low	Check flow, check shut-off valves, check pump, check the setting of the reed contact at the flow monitor.	Pump 1 & 2 = load pump - Pump 2 switches off, - Pump 1 and compressor continue to run. Pump 1 = load pump Pump 2 = evaporator pump - Pump 2 and compressor switch off, - Pump 1 continues to run until outlet temp. max stop. Pump 2 = load pump Pump 1 = redundant - Pump 2 switches off, - Pump 1 switches on. Alarm is saved. Manual reset,

618	Flow Pump 2 op.	Group fault message	Flow switch did not switch through during the pump operating phase	Flow too low	Check flow, check shut-off valves, check pump, check the setting of the reed contact at the flow monitor.	Pump 1 & 2 = load pump - Pump 2 switches off, - Pump 1 and compressor continue to run. Pump 1 = load pump Pump 2 = evaporator pump - Pump 2 and compressor switch off, - Pump 1 continues to run until outlet temp. max stop. Pump 1 = load pump Pump 2 = redundant - Pump 2 switches off, - Pump 1 switches on. Alarm is saved. Manual reset,
621	DI mpcb compressor	Group fault message	Motor protection switch has tripped.	Motor current above the allowable range, Motor only runs on two phases, wrong direction of rotation, poor contact at terminals, winding short-circuit, earth fault, rotor is blocked.	Checking of the motor power consumption, checking of the operating point, checking of the electrical connection of the components.	Compressor and fan switch off immediately.
627	DI high-pr. limiter	Group fault message	High-pressure limiter has triggered.	Unable to remove the waste heat from the refrigeration circuit.	Clean the condenser and filter, check the function of the fan, check cooling water circuit, fit the cover panels, press the reset button and acknowledge on the display.	Triggering of the high-pressure limiter compressor switches off acknowledgement is successful
631	DI mpcb fan	Group fault message	Motor protection switch has tripped	Motor current above the allowable range, motor only runs on two phases, direction of rotation, poor contact at terminals, winding short-circuit, earth fault, rotor is blocked.	Check the motor power consumption, check the operating point, check the electrical connection of the components	None
632	DI fan fault	Group fault message	Internal monitoring of the fan has tripped.	Motor only runs on two phases, direction of rotation, poor contact at terminals, winding short-circuit, earth fault, rotor is blocked.	Check the motor power consumption, check the electrical connection of the components, check for mechanical blocking,	None

641	DI mpcb tank heating	Group fault message	Circuit breaker has tripped.	Current above the allowable range, poor contact at terminals due to dirt or corrosion, short-circuit between the heating rods, earth fault.	Check the power consumption, check the electrical connection with the components, test for short to earth	all components continue to run tank heater is deactivated alarm is saved. Manual reset,
821	AI µPC high press.	Group fault message	Measured value of the sensor is outside the measurement range	Sensor is defective, sensor short-circuit or sensor break	Testing of the sensor's electrical connections, Testing of the sensor based on the characteristic curve	Compressor switches off immediately fan is shut down in controlled manner check pumps continue to run can be acknowledged after delay
822	AI µPC low press.	Group fault message	Measured value of the sensor is outside the measurement range	Sensor is defective, sensor short-circuit or sensor break	Testing of the sensor's electrical connections, Testing of the sensor based on the characteristic curve	MOP error superheating envelope error compressor continues to run pump continues to run no alarm to acknowledge
823	AI µPC suct.gastemp.	Group fault message	Measured value of the sensor is outside the measurement range	Sensor is defective, sensor short-circuit or sensor break	Testing of the sensor's electrical connections, Testing of the sensor based on the characteristic curve	Compressor & fan off immediately Pump continues to run Acknowledging is successful 2x
824	AI µPC hot gas temp.	Group fault message	Measured value of the sensor is outside the measurement range	Sensor is defective, sensor short-circuit or sensor break	Testing of the sensor's electrical connections, Testing of the sensor based on the characteristic curve	Compressor & fan off immediately Pump continues to run Acknowledging is successful 2x
829	AI µPC Sen.Cont. B7	Group fault message	Measured value of the sensor is outside the measurement range	FreeEvolution AO 3 connection with µPC AI B7 including GND, or modbus communication µPC FreeEvolution	Check the electrical connections between µPC and FreeEvolution; communication parameters in the µPC M04 other parameters 0th02 Serial port = 0 Serial address = 1 Baud rate = 19200 baud	Compressor shuts down in controlled manner acknowledging is successful
831	µPC high-press. max	Message on the display	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	Message on the display	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.	Message on the display	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	Message on the display	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	Message on the display	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	Message on the display	Compressor exceeds the allowed time of 60s, for running outside the envelope.	impermissible operating status	manual reset in the Error menu	
841	Exp.vlve superht.min	Message on the display	The superheating value has fallen below the minimum limit.	Superheating too low	automatic reset	
842	Exp. valve MOP	Message on the display	The maximum allowable evaporation pressure (MOP) has been exceeded.	Evaporation temperature too high	automatic reset	
843	EEV suct.gastemp.min	Message on the display	The suction gas temperature has fallen below the minimum allowable value.	Suction gas temperature too low	automatic reset	
845	EEV group fault	Message on the display	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	Group inverter fault	Message on the display	Group inverter fault	One or several of the INV messages listed below is/are queued.	see below	
852	Inverter communic.	Message on the display	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.	

901	INV overcurrent Overcurrent	Message on the display	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	Message on the display	Motor overload	max. motor current exceeded beyond the allowed period	Contact KKT chillers service department.	
903	INV overvoltage Overvoltage	Message on the display	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	Message on the display	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.	Message on the display	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	Message on the display	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	Message on the display	max. power consumption of the inverter exceeded	sudden load increase, motor short-circuit	Contact KKT chillers service department.	
908	INV motor overtemp. Motor overtemp.	Message on the display	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	Message on the display	Reserve	Reserve	Contact KKT chillers service department.	
910	INV CPU error Cpu error	Message on the display	Error in the inverter's CPU	Data loss in the memory	Contact KKT chillers service department.	
911	INV Parameter default Param. Default	Message on the display	Faulty inverter parameter	Factory settings have been restored	Contact KKT chillers service department.	
912	INV DC BUS ripple DC bus ripple	Message on the display	Residual ripple of the direct voltage is too high	Missing phase	Contact KKT chillers service department.	
913	INV Data comms fault Data comms fault	Message on the display	Communication with the inverter disrupted	Data connection between the inverter and µPC interrupted	Contact KKT chillers service department.	
914	INV drive thermistor Drive thermistor	Message on the display	Internal thermistor fault	Thermistors in the inverter are faulty	Contact KKT chillers service department.	
915	INV autotune fault Autotune fault	Message on the display	Automatic setting incorrect	Incorrect inverter parameterisation	Contact KKT chillers service department.	
916	INV Drive no release Drive disabled	Message on the display	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	Message on the display	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 fault Fan fault	Message on the display	Fan error	Cooling air fan at the inverter is defective	Contact KKT chillers service department.	
919	INV speed alarm Speed fault	Message on the display	Speed alarm	sudden load increase, motor short-circuit	Contact KKT chillers service department.	
920	INV PFC failure PFC failure	Message on the display	PFC error	Overvoltage in the PFC circuit	Contact KKT chillers service department.	
921	INV Reserve	Message on the display	Reserve	Reserve	Contact KKT chillers service department.	
922	INV PFC undervoltage PFC undervoltage	Message on the display	PFC undervoltage	AC input voltage too low	Contact KKT chillers service department.	
923	INV STO survey	Message on the display	Inverter checking faulty	Internal inverter error	Contact KKT chillers service department.	
924	INV STO survey	Message on the display	Inverter checking faulty	Internal inverter error	Contact KKT chillers service department.	

Attention: Make sure that the cause of the fault has been eliminated before resetting fault messages! Frequent resetting of fault messages without rectifying the cause can cause permanent damage to the system!

III. Maintenance intervals in accordance with the VDMA

	Explanation	Annual	Six-monthly	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 the acid content of the oil (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	Six-monthly	as required	Comment
	Parts in the refrigeration 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	When components in the refrigeration 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 fixings and bearings	x			
52	Check flexible connection for tightness (electrical connection)	x			
	Pump and piping				
60	Visual inspection for dirt, damage and corrosion	x			
61	Check fixings 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	Six-monthly	as required	Comment
	Tank / Water tank				
80	Visual inspection for dirt, damage and corrosion	x			
81	Check fixing	x			
82	Check filling level	x			
	Control cabinet				
90	Visual inspection for dirt, damage and corrosion	x		x	
91	Check fixing	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 24VDC and supply voltage	x		x	
97	Check control cabinet heater	x			
99	Check control cabinet filter and if necessary replace/clean	x			
	Documents and labelling				
110	All documents such as operating instructions, diagrams, circuit plans, system log are present	x		x	
111	Rating plate and labels are clearly legible	x		x	
	Battery - time/date				
120	Battery			x	Every 5 years
	Refrigeration circuit leak check			x	in service case

IV. Product registration

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