eBoxX plus

GB

Translation of the original operating manual

eBoxX 541 plus
eBoxX 591 plus
eBoxX 651 plus
eBoxX 721 plus
eBoxX 751 plus
eBoxX 811 plus
eBoxX 881 plus
eBoxX 911 plus
eBoxX 971 plus

Table 1: Contact details

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Introduction

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

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

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

	**Attention! An exclamation mark in a triangle indicates important information and instructions to which you must pay particular attention and must always follow.**

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

As the units of the eBoxX plus can be adapted project specifically, this document contains only information that is of general relevance for all units of the series.

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

- P&I diagram
- Circuit diagram
- All other project-specific details

Table of contents

1. Product description

Please read all the points in these operating instructions before starting up the machine. You should pay particular attention to the points on safety, commissioning/start-up and operation. Should you have any further questions concerning your machine, please contact the KKT chillers Service Team (*see Contact details*).

1.1. Intended use

The eBoxX plus is a factory-tested, fully automatic compression chiller. The machine is used exclusively for cooling liquids in accordance with EN378-1. A sufficient supply of cooling air must be provided. Only approved liquids may be used. The components of the eBoxX plus, including the switch box, meet protection class IP54. The unit is only suitable for outdoor installation (note the proportion of antifreeze mixture).

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

Table 2 contains the general safety instructions of the chiller. These instructions are attached to the machine in a clear and readily visible position. A complete description of all hazard warnings can be found in *Chapter 6.2 Hazard warnings.*

Table 2: Safety instructions

	Observe the operating instructions!
	Before opening the machine, it must be disconnected from the power supply and secured against being switched on again! The machine may only be opened 5 minutes after it has been disconnected from the power supply.
	Attention! Dangerous electrical voltage! If the machine is only turned off by means of the main switch, some of the terminals in the control cabinet will still be under dangerous voltage.
	Attention! Fire hazard! Do not store or operate the unit near sources of ignition.

1.2. Explanation of terms

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

Table 3: Explanation of terms

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

2. Function and main components

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

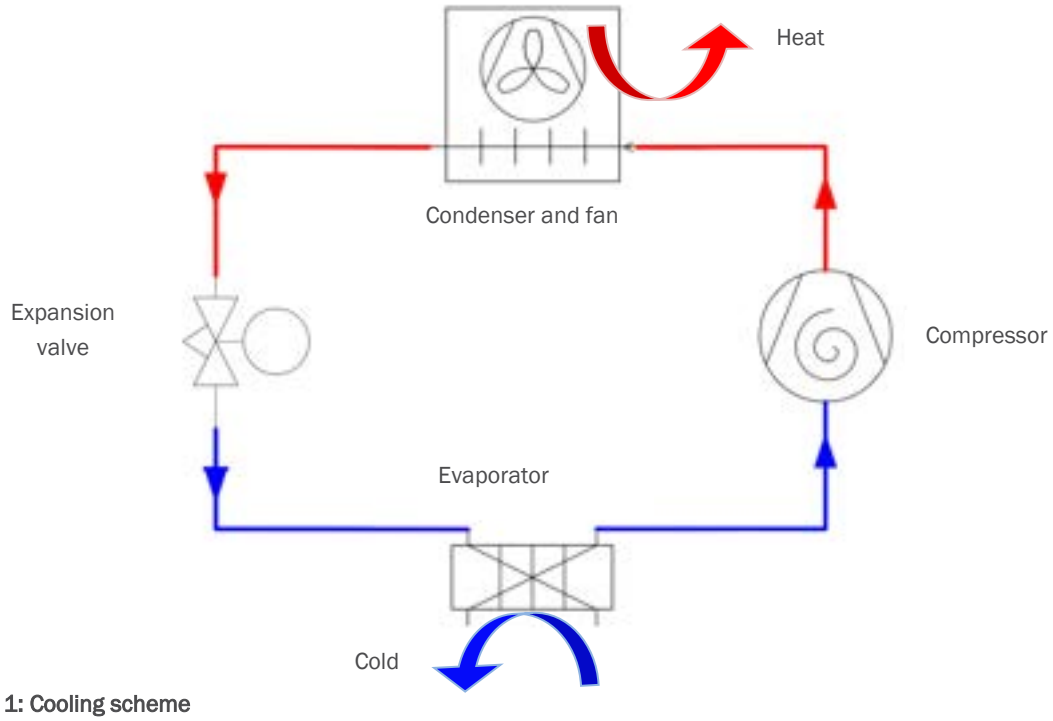


Figure 1: Cooling scheme

For the control and operation of the chiller, various sensors for pressure and temperature, a control unit, a high-pressure switch, a pump (for the hydraulic module option, see ***Chapter 5.1***) and several fans are also installed.

2.1. Compressor

The compressor generates the needed pressure difference for evaporation and condensation between heat sink and heat source in the refrigerant circuit. Vaporised refrigerant coming from the evaporator is drawn in and compressed in the compressor to the condensing pressure.

The compressors used work on the basis of the scroll principle. Scroll compressors are maintenance-free, quiet and have a very high degree of efficiency.

The flow temperature is controlled by switching one or more compressors on and off. Sequential changeover ensures that all compressors are loaded uniformly.

2.2. Evaporator

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

2.3. Condenser

The condenser is a microchannel heat exchanger that transfers heat from the refrigerant to the ambient air. In order for the transfer of heat to take place, the refrigerant in the condenser must have a higher temperature than the drawn-in ambient air changes its physical state upon heat dissipation from gaseous to liquid.
Contaminated cooling air can cause deposits to accumulate on the condenser surface. This impairs the transfer of the heat to the refrigerant. This limits the machine's operating limits and reduces the cooling capacity/energy efficiency of the machine. For this reason, always ensure a clean surface for transmission and clean the condenser in accordance with the respective kind of contamination. If you have any questions about cleaning, please contact the KKT chillers Service Team (*see: Contact Data*).

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.
The expansion valve used in the machine is regulated electronically. The electronic regulation ensures that the evaporator is constantly optimally supplied with refrigerant. This improves the efficiency of the system and reduces pressure fluctuations in the refrigeration circuit.

2.5. Refrigerant

R454B is a mixture of the refrigerants R32 and R1234yf. R32 belongs to the group of fluorocarbons. The R454B mixture is free of ozone-depleting elements, such as chlorine. Its Ozone Depletion Potential (ODP) value is therefore zero (ODP=0). The R454B mixture is classified as A2L according to ASHRAE standard 34-1997, as per ISO 817. The level of the LFL lower flammability limit (307 g/m3), low flame spread (below 6.7 cm/s), and low heat of combustion (9.5 MJ/kg) classify R32 among the A2L refrigerants with low flammability. The refrigerant also has a minimum ignition energy and a self-ignition temperature of 498°C.
A corresponding safety data sheet can be requested from our KKT chillers Service Team (*see: Contact details, page 2*).

2.6. Oil

The compressor components subject to friction are lubricated by oil that is added to the refrigerant at the factory. The oil is soluble in the refrigerant and distributes itself with it throughout the entire refrigeration circuit.

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 during which it is opened, the component must be replaced.

2.8. Pressure and temperature sensors

The sensors used continuously record the temperature or pressure at various points in the refrigerant or cold water circuit. The values are used for visualisation and for controlling the system.

2.9. 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.

2.10. 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.

2.11. Control cabinet

The control cabinet complies with the applicable IEC standards and contains the electrical and electronic components for controlling the chiller. The control cabinet can be opened via the front panel with a special tool (commercially available double-bit key).

2.12. Fan

The fan draws in the cooling air from the environment via the condenser and discharges the heated air upward from the chiller. In order to prevent injuries, the fan is protected against unintentional contact by means of a protective grille. The fan speed is variable and is essentially determined by the condensing pressure.

2.13. Cold water circuit

The cold water is conveyed through the internal piping via the evaporator of the chiller. Optionally, an integrated hydraulic module consisting of a stainless steel tank, pump and diaphragm expansion vessel can be designed as a closed system. In the process circuit, the cold water absorbs heat. The circuit closes when the cold water is conveyed back into the chiller.

2.14. PED categories of pressurized components

List of critical pressurized components (Directive 2014/68/UE):

Table 4: PED category

Component	PED category
Compressor	II
Safety valves	IV
High-pressure pressure switch	IV
Microchannel	I
Plate evaporator	II

2.15. Materials used in the water circuit

In the standard version, the material compilation is depicted as shown in Table 5 :

Table 5: Materials used

Component	Material
Unit connections	V2A 1.4305
Evaporator	V2A 1.4301 and copper (99.9%)
Water piping	V2A 1.4301
Bends, tees, couplings	V2A 1.4301
Temperature sensor	V2A 1.4301
Pressure sensor	V2A 1.4301

2.16. Water quality

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

Table 6: Water quality

Property / Constituents	Unit	Value range
pH-value (20°C)	-	7.5 - 9
Saturation index	-	-0.2 < 0 < +0.2
Conductivity	µS/cm	80-500
Water hardness	°dH	4 - 8.5
Carbonate hardness	mol/m³	<0.5
Total germ count	K/ml	<10,000
Grain size	µm	< 250
Glycol fraction (AFN / AFL)	Vol%	25 - 40
Oil fraction	Vol%	0
Chloride(Cl-)	mg/l	<50
Sulphate	mg/l	<50
Nitrate	mg/l	<100
Copper	mg/l	<0.1
Iron	mg/l	<0.2
Free carbonic acid	mg/l	<20
Manganese	mg/l	<0.05
Ammonia	mg/l	<0.5
Free chloride	mg/l	<0.5
Sulphide	mg/l	<0.03

To prevent clogging of the plate heat exchangers, the prescribed limit values must be observed.
Furthermore, any occurrence of mucilage bacteria in the cooling water must be ruled out.

Table 7: Correction factors when using glycol

% Glycol by weight	25	30	35	40
Freezing temperature	-13	-16	-20	-25
Correction factor flow rate at evaporator	1,072	1,093	1,116	1,140
Correction factor pressure losses at the evaporator	1,255	1,319	1,383	1,468
Correction factor cooling capacity	0,956	0,948	0,944	0,937
Correction factor cooling capacity	0,988	0,986	0,983	0,981

2.17. Permitted coolant media

Water and mixtures of water/Antifrogen N (AFN) or water/Antifrogen L (AFL) are permitted according to the information in chapter 2.16 Water quality

	**Attention!** **Do not use mixtures of different anti-freeze products. This can lead to undesired chemical reactions as well as silting.**
	**Attention!** **The AFN or AFL fraction in a water/glycol mixture must therefore not be less than 25 % by volume. Below this concentration, microorganisms may grow in the refrigerant and lead to organic deposits.**
	**Attention!** **Galvanised pipes are not permitted, since all glycol-water mixtures can dissolve zinc.**

Please note that Antifrogen N and Antifrogen L should always be diluted with water. In addition, glycol-water mixtures may only be used without the addition of inhibitors due to their corrosion-promoting properties, which are stronger than those of water alone.

For further information and data sheets on glycol, please visit the manufacturer's website http://www.clariant.com and http://www.antifrogen.de. Also feel free to contact our KKT chillers team (see ***Contact details, page 2***).

3. Technical data

3.1. Technical data of standard units

Table 7: Technical data Standard units

KKT chiller type	eBoxX plus	541	591	651	721	751
Cooling capacity[1)]	kW	542.2	587.4	645.8	715.7	746.6
Refrigerant	-	R454B				
Coolant	-	Correction factor cooling capacity				
Total refrigerant filling quantity	kg	41	42	43	54	55
Refrigerant GWP	-	467				
CO2 equivalent	t / kg	19.147	19.614	20.081	25.218	25.685
Total oil quantity	kg	23.9	23.9	23.9	29.9	29.9
Flow temperature	°C	-5°C bis 25°C				
Setpoint constancy	K	+/- 2				
Nominal volume flow	m³/h	93.6	101.4	111.5	123.5	128.9
Internal pressure loss, approx.	bar	0.55	0.49	0.5	0.71	0.73
Air flow rate	m³/h	152000	152000	152000	190000	190000
Sound pressure level[2)]	dB(A)	62	62.5	62.5	63.5	63.5
Ambient temperature min.	°C	-20				
Ambient temperature max.	°C	48				
Nominal water width	DN	DN80	DN80	DN80	DN100	DN100
Operating voltage	V/Ph/Hz	400-3-50				
Power consumption, approx.[3)]	kW	109.8	125.2	142.6	152.4	160.6
Current consumption, approx.[3)]	A	180.4	205.8	234.4	250.6	264.0
Pre-fuse	A	315	315.0	400.0	400.0	400.0
Protection class control cabinet	-	IP 54				
Height	mm	2490	2490	2490	2490	2490
Width	mm	2260	2260	2260	2260	2260
Length	mm	4840	4840	4840	5940	5940
Weight (net)	kg	2550	2640	2680	3180	3220

1. Cooling capacity at water supply temperature tw2 = 20°C; ambient temperature tu = 32°C; 400V/3~/50Hz
   Deviations in performance possible according to DIN14511
2. Sound pressure level in dB(A) measured at a distance of 10 metres from the unit in free field with directional factor Q=2, in compliance with UNI EN-ISO 3744 standard
3. At operating point see 1)

KKT chiller type	eBoxX plus	811	881	911	971
Cooling capacity1)	kW	805.4	876.5	911.3	969.9
Refrigerant	-	R454B			
Coolant	-	Correction factor cooling capacity			
Total refrigerant filling quantity	kg	55	65	68	68
Refrigerant GWP	-	467			
CO2 equivalent	t / kg	25.685	30.355	31.756	31.756
Total oil quantity	kg	29.9	35.9	35.9	35.9
Flow temperature	°C	-5 °C bis 25 °C			
Setpoint constancy	K	+/- 2			
Nominal volume flow	m³/h	29.9	35.9	35.9	35.9
Internal pressure loss, approx.	bar	29.9	35.9	35.9	35.9
Air flow rate	m³/h	190000	228000	228000	228000
Sound pressure level2)	dB(A)	63.5	64	64	65
Ambient temperature min.	°C	-20			
Ambient temperature max.	°C	48			
Nominal water width	DN	DN100	DN100	DN100	DN100
Operating voltage	V/Ph/Hz	400-3-50			
Power consumption, approx.3)	kW	178.4	187.6	196.2	213.8
Current consumption, approx. 3)	A	293.2	307.4	322.5	351.5
Pre-fuse	A	630	630	630	630
Protection class control cabinet	-	IP 54			
Height	mm	2490	2490	2490	2490
Width	mm	2260	2260	2260	2260
Length	mm	5940	7100	7100	7100
Weight (net)	kg	3250	3900	3940	3970

1. Cooling capacity at water supply temperature tw2 = 20 °C; ambient temperature tu = 32 °C; 400V/3~/50Hz
2. Deviations in performance possible according to DIN14511
3. Sound pressure level in dB(A) measured at a distance of 10 metres from the unit in free field with directional factor Q=2, in compliance with UNI EN-ISO 3744 standard
4. At operating point see 1)

3.2. Application limits min./max. Ambient temperatures

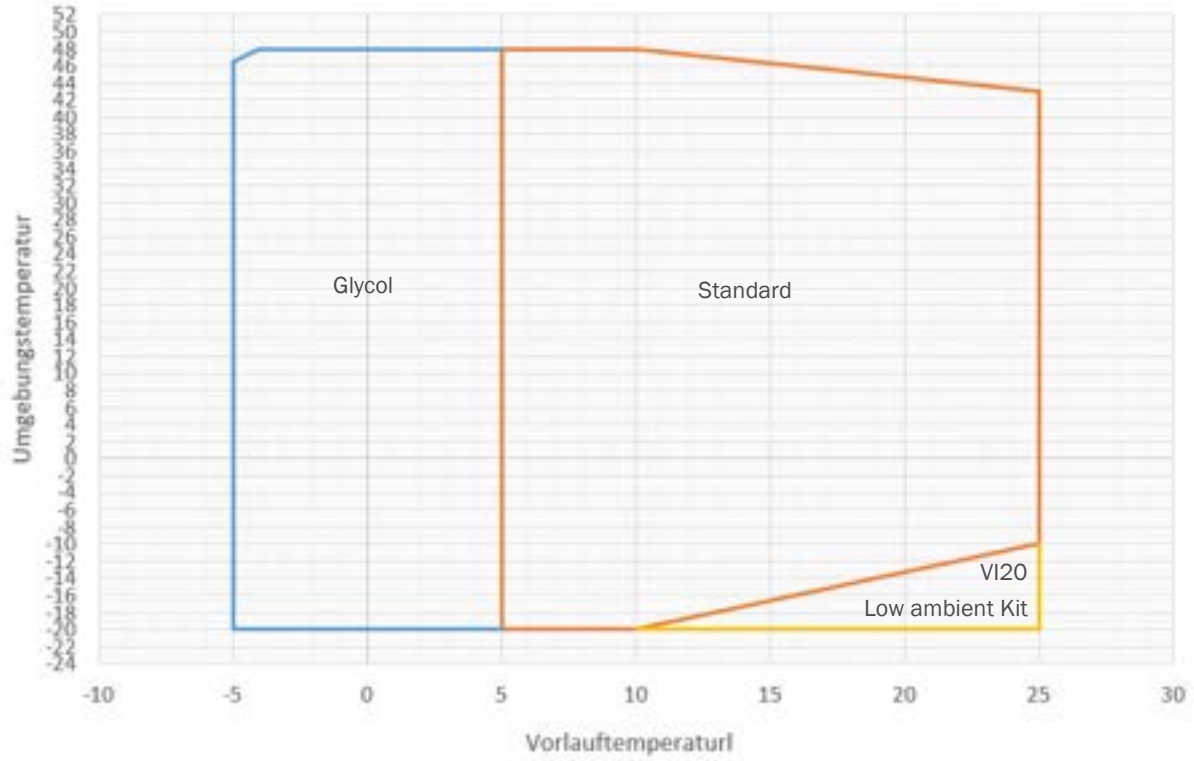


Figure 2: Limits of use

4. Standard configuration

The chiller is available in the standard version as a continuous cooler without tank and without integrated pump. This makes it possible to design an integrated system consisting of an external tank pump station, pump station or heat exchanger station. Of course, the chiller can also be integrated into an existing cold water system.

The following special features are already incorporated in the standard version:

4.1. Speed-controlled fans

These are speed-controlled fans with EC motor. Advantages are optimised partial load behaviour, noise reduction and energy savings compared to conventional fans without speed control.

Table 8: Number of fans

Cold water type	eBoxX 541 plus	eBoxX 591 plus	eBoxX 651 plus	eBoxX 721 plus	eBoxX 751 plus
Number of fans	8	8	8	10	10

Cold water type	eBoxX 811 plus	eBoxX 881 plus	eBoxX 911 plus	eBoxX 971 plus
Number of fans	10	12	12	12

4.2. Soundproof compressor housing

This is a soundproof enclosure of the compressors as standard. In addition to noise reduction, further benefits are the protection of the components.

4.3. Machine housing protection

The machine room for the chillers is the lower part of the system (beneath the condenser). It houses the refrigeration circuit with compressor, evaporator, expansion valve and the complete hydraulic system.
For the units eBoxX 541 plus to eBoxX 971 plus, the lower machine room is protected against penetration by a protective grid (see Figure 3: Display eBoxX 541plus to eBoxX 971 plus, *page 17*).

4.4. Condenser protection grille

Only available for eBoxX 541 plus to eBoxX 971 plus. These are standard side panels in RAL 9018 with aesthetic function and to protect the condenser against rough external influences.

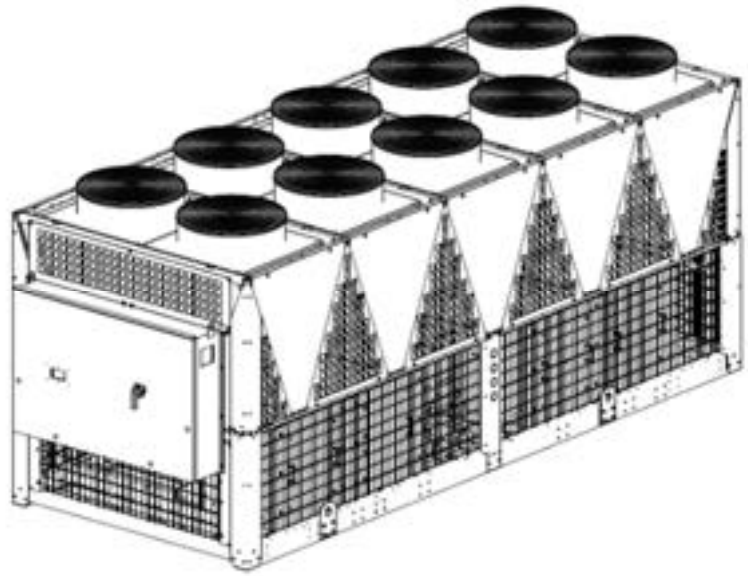


Figure 3: Display eBoxX 541plus to eBoxX 971 plus

4.5. Electronic expansion valve

This is a standard electronic expansion valve fused to maintain optimum cooling performance under partial load conditions.

4.6. Control cabinet heating

Standard built-in heater for the control box to maintain a minimum internal control cabinet temperature.

4.7. Minimum / maximum voltage control unit

This is a control unit for the minimum and maximum supply voltage which is installed as standard in the control box.

4.8. Modbus interface

This is an RS485 interface built into the control box as standard for serial data exchange with other units (Modbus TCP protocol). Should you have any further questions, please contact the KKT chillers Service Team (***see Contact details***).

4.9. Leak sensor

The leakage sensor enables the detection of possible refrigerant gas leaks. If a refrigerant leak is detected, there are two different possibilities:

1. Management of a potential-free (user usable) contact:
    - Contact open = Alarm activated
    - Contact closed = No alarm activated

2. (Factory setting) In addition to the dry contact, the management of a predefined logic that can be selected by the user from the control panel (for configuration, refer to the Commands and Controls manual) that allows the unit to perform the following:
    - Generation of an ALARM
    - Switching off the unit

NOTE

The leak sensor must only be used for checking refrigerant leaks on the unit itself.
It is not to be considered as a protective device under any circumstances. In case of rupture, the heat exchangers of the unit could release refrigerant into the water circuits. The installer must therefore design and protect the water circuits with a safety valve that must be located far from possible ignition sources.
The manifold of the safety valve drains must therefore be routed outside to a place where there are no sources of ignition and, in any case, never in adjacent rooms.

5. Options and accessories

The chiller can be equipped in the factory with the options described in the following.
The positions marked with "Accessories" are supplied separately and can be reordered at any time. 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 ***Contact details***).

5.1. Option coated Micro-Channel condensor E-coat

The eBoxX plus units are optionally available with an epoxy coated micro channel condenser. The Micro-Channel Registers made of aluminium / aluminium are treated with so-called "E-coating" to guarantee a higher wear protection against aggressive environmental conditions.
Electrofin® E-Coating is a water-based epoxy polymer coating. The formula E-coat (PPG Powercron R) was developed to optimally cover even the corners of the flaps. Electrofin® E-Coating is a UV-resistant technology and is used as corrosion protection of aluminium MCHX with 100% uninterrupted coverage. The top layer is approx. 15-30 microns and minimises the loss of performance to a minimum. The following specifications are guaranteed:

Technical capacities of e-coating	Reference standards
Coating thickness; 15-30 micron (ASTM D7091-05)	MIL-C-46168 resistance to chemical agents – DS2, HCl gas
Immersed in water: >1000 hours @ 38°C (ASTM D870-02)	MIL-P-53084 (ME) approval TACOM
Moisture resistance 1000 hours minimum (ASTM D2247-99)	ASTM B117-G85 modified salt spray (Fog) 2000 test hours
Reduction of heat exchange <1% (ARI 410)	
pH range: 3-12	
Temperature limits: -40 – 163°C	

Recommendation for the installation of the accessories:

1. Installation of the chiller in a marine environment. (Distance from the coast less than 5 km or more if the prevailing wind direction is from the sea to the interior)
2. Installation of the chiller in a rural/urban/industrial environment where pollutants or potentially corrosive substances are present. (Example: livestock breeding, hospitals, airports, volcanic areas...)

Definition coastal / marine areas::
Coastal and marine areas are characterised by the effects of the sea. Corrosion here is mainly caused by the salty sea water and potentially by the high degree of humidity. Sea salt can be blown away by the wind in the form of droplets or float in the mist and corrosion can be caused by the chlorine content many kilometres away from the sea. Marine areas are predominantly exposed to chlorine corrosion.

Definition of industrial environment:
Industrial areas are areas with industrial density. Industrial areas may differ greatly in terms of industrial typologies and the emission levels permitted in that area. There may also be different combinations of chemical substances. In industrial areas, there is generally an increasing amount of sulphur, ammonia, chlorides, NOx mixtures, metals in the air and in powder form present. These substances are known to be corrosive to metals.

Definition of urban environment:
Cities are environments with high population density. These environments are generally polluted by traffic emissions and those of heating systems in buildings. The degree of pollution of the urban environment depends to a significant extent on the traffic density.
Definition of rural environment:
Rural environments are generally not corrosive. However, some local emissions are also often generated in rural areas. For instance, ammonia as a result of animal urination, fertilisers and diesel exhaust.

Table 9: Potential emissions

Installation location close to:	Emission	Potentially aggressive substances
Power stations	Combustion products	SOx, NOx, chlorides, fluorides
Chemical sector	Emissions from industrial Processes	Ammonia, chlorides, NOx, SOx
Bio-plants	Emissions from industrial Processes	Ammonia, NOx, SOx
Petrochemical industry	Oils, fuel, emissions from Processes	Ammonia, chlorides, NOx, SOx
Petrol stations	Fuel, combustion products	Fuel leaks, chlorides, NOx, SOx
Airports	Combustion products	NOx, Sox, chlorides
Agriculture	Fertilizers	SOx, NOx, ammonia
Sea air, ships, offshore	Seawater mist	Chlorides, sulphides
Heavy industry	Pulverized coal	Sulphides, NOx, SOx
Steel plants	Pulverized coal	Sulphides, NOx, SOx
Food industry	Greases, humidity, cleaning agents	Chlorides, acids, NOx, SOx
Waste disposal	Organic particles in the air	Ammonia
Wastewater treatment plants	Organic particles in the air	Sulphides, ammonia

The polymeric treatment with ElectroFin® E-coating is resistant to the chemical agents listed below at ambient temperature. This table should be used as a general reference.

Table 10: Resistance e-coating

Acetone	Fructose	Ozone
Acetic Acid	Gasoline	Perchloric Acid
Acetates (ALL)	Glucose	Phenol 85%
Amines (ALL)	Glycol	Phosgene
Ammonia	Glycol Ether	Phenolphthalein
Ammonium Hydroxide	Hydrochloric Acid <10%	Phosphoric Acid
Amino Acids	Hydrofluoric Acid (NR)	Potassium Chloride
Benzene	Formaldehyde <27%	Oxalic Acid
Borax	Hydrogen Peroxide <5%	Propyl Alcohol
Boric Acid	Hydrogen Sulfide	Propylene Glycol
Butyl Alcohol	Hydrazine	Salicylic Acid
Butyl CellosolveR	Hydroxylamine	Salt Water
Butyric Acid	Iodine	Sodium Bisulfite
Calcium Chloride	Isobutyl Alcohol	Sodium Chloride
Calcium Hypochlorite	Kerosene	Sodium Hypochlorite <5%
Carbon Tetrachloride	Lactic Acid	Sodium Hydroxide <10%
Cetyl Alcohol	Lactose	
Chlorides (ALL)	Lauryl Acid	Sodium Sulfate
Chlorine Gas / Gas di Coro	Magnesium	Stearic Acid
Chrome Acid (NR)	Maleic Acid	Sucrose
Citric Acid	Methanol	Sulfuric Acid <25%
Creosol	Methylene Chloride	Sulfates (ALL)
Diesel Fuel	Methyl Ethyl Ketone	Starch
Diethanolamine	Methyl Isobutyl Ketone	Toliene
Ethyl Acetate	Mustard Gas	Triethanolarmine
Ethyl Alcohol	Naphthol	Urea
Ethyl Ether	Nitric Acid (NR)	Vinegar
Fatty Acid	Oleic Acid	Xylene
Fluorine Gas		

5.2. Accessories height-adjustable spring antivibration mountings

Height-adjustable spring vibration mountings for on-site installation (optional accessory) are supplied as an accessory pack in the unit.

Note

The spring vibration mountings must be mounted before positioning the chiller!

If the accessory If the height-adjustable spring antivibration mounting is used, it is mandatory to install expansion joints between the equipment connections and the hydraulic installation.

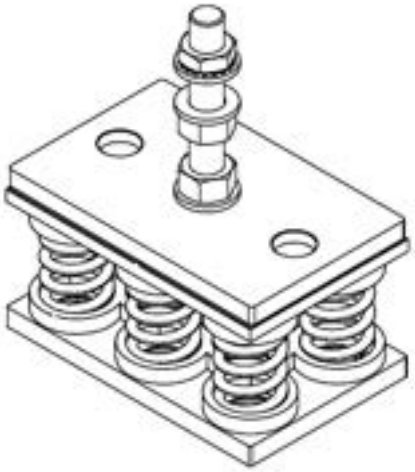


Figure 4: Height-adjustable spring antivibration mountings

5.3. Accessories for container shipment (Note 2 safety valves)

We would be pleased to offer you the dispatch of the chiller including container loading. The chiller in standard packaging (pallet & foil) is pushed into the container and can be transported in the container.
Due to the transport regulations of the refrigerant R454B, the option "double safety valves" is obligatory and is already taken into account.

Figure 5: Packing Container

5.4. Option Floating setpoint through analogue 4-20 mA signal

The control of the floating setpoint (floating setpoint) can be done by the external signal 4-20mA provided by the user. The instructions given in the wiring diagram supplied with the machine must be followed. It is also necessary to change the corresponding software parameters

5.5. Energy measurement option

The option energy quantity measurement for measuring and showing some unit characteristics in the display, such as:

- Current voltage and instantaneous total current power consumption of the unit
- Instantaneous total current power consumption of the unit
- Instantaneous power factor (cosφ) of the unit
- Current consumption (kWh)

If the unit is connected to a BMS or an external monitoring system through a serial network, it is possible to create an archive of the measured parameters and control the operating status of this unit.

	**Attention!** **To use the** energy measurement **option, the unit must be supplied with a voltage of 400V - 3ph - 50 Hz.**

5.6. Option soundproof compressor housing

This is a very strongly sound-insulated enclosure for the compressors. In addition to noise reduction, further benefits are the protection of the components.

5.7. Option service valves – shut-off valves in the intake and discharge side of the refrigeration circuit

In order not to have to drain the complete refrigerant in the refrigeration circuit during servicing, each refrigeration circuit can be shut off separately at the suction and discharge lines using the "Service valves" option.

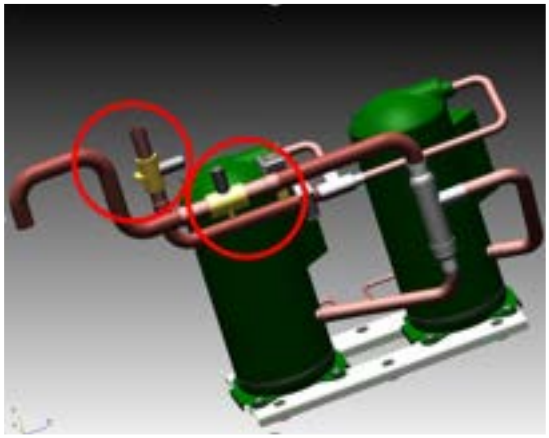


Figure 6: Option Service valves

5.8. Accessory 7“ LCD Touch Display

The 7" LCD Touch Display accessory is supplied mounted on the machine and is an alternative to the existing keypad. The accessory 7" LCD Touch Display allows, through simple and user-friendly graphic pages, the display of the operating temperature and all the process variables of the unit, the access to the setting parameters of the operating setpoints and their modification. As for the technical service, the access to the management parameters of the unit is through a password (access only for authorized personnel).

5.9. Low ambient package option

With the Low ambient Kit option, an additional condensing pressure control allows an application down to -20°C ambient temperature and flow >+10°C.

5.10. Double safety valve option

The Double safety valve option provides one double high pressure and one double low pressure safety valve.

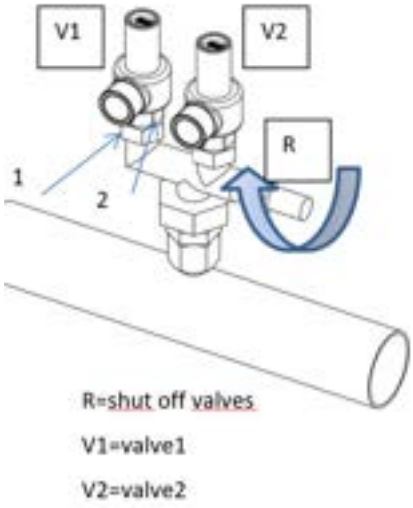


Figure 7: Double safety valve option

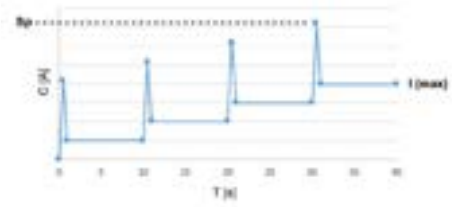
5.11. Option Interfaces (BACNET IP_MODBUS, TCP/IP) (RS485 BACNET MS/TP)

Ethernet interface for serial data exchange with other devices (protocol BACnet IP, Modbus TCP/IP). Protocol BACnet MS/TP, eBoxX = Master / Slave

5.12. Option Softstart

The soft start option makes it possible to reduce the starting current, which then gives a smooth and stepless start, which in turn is a great advantage in terms of wear of the electric motor.
The graphic shows a qualitative example of the start of the eBoxX Plus with and without soft starter.

Inrush current - without soft start
Sp Inrush current
C [A] Current intensity
T [s] Time



Starting current - with soft start
Sp Inrush current
C [A] Current intensity
T [s] Time

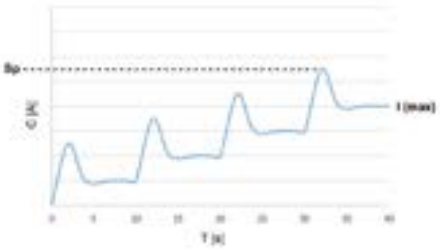


Figure 8: Option Softstart

6. Safety

The chiller, within the sense of its intentional use, is designed to operate safely. Provided also that the instructions concerning transport, installation, commissioning/start-up and maintenance given in these operating instructions are complied with. The machine complies with the safety standards of the EC Declaration of Conformity.

Table 11: Reference standards

UNI EN ISO 12100	Safety of machines. General design principles. Risk assessment and reduction.
UNI EN ISO 13857	Safety of machines. Safety distances to prevent dangerous machine areas from being reached by the upper and lower limbs.
UNI EN 563	Safety of machines. Temperatures of contact surfaces. Ergonomics data to establish temperature limit values for hot surfaces.
UNI EN 1050	Safety of machines. Principles of risk assessment.
UNI 10893	Technical product documentation. Operating instructions
EN 13133	Brazing - brazing test.
EN 378-1	Refrigerating systems and heat pumps - Safety and environmental requirements - Part 1
EN 378-2	Refrigerating systems and heat pumps - Safety and environmental requirements - Part 2
CEI EN 60204-1	Safety of machines. Electrical equipment of machines. Part 1: General requirements
UNI EN ISO 9614	Determination of sound power levels of noise sources using sound intensity
EN 50081-1:1992	Electromagnetic compatibility - Generic emission standard Part 1: Residential, commercial and light industry
EN 61000	Electromagnetic compatibility (EMC)

6.1. General information

The chiller contains a high-pressure circuit. The maximum pressure that occurs is 45 bar. Even when inactive or disconnected from the power supply the circuit is still under pressure.

The proper working order of the unit depends on the diligent observance of the instructions for use in this manual, compliance with the free areas intended for installation and the permissible area of use.

6.2. Hazard warnings

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

	General hazard Hazards that can cause death, injury, and permanent or latent disease.
	Danger of electrical voltage Danger to life from equipment components that are electrically live.
	Danger of sharp surfaces Risk of injury from sharp-edged unit components.
	Danger of hot machine components Risk of injury from potentially hot machine components.
	Danger moving machine parts Risk of injury from unit components that are in motion (e.g. fans).
 	Warning Interventions can lead to damage to the unit or individual components.
	Environmental protection Instructions for use and recycling of the unit in compliance with environmental protection.
	Fire hazard The unit contains flammable refrigerant. Keep ignition sources away. If refrigerant escapes through a leak, there is a risk of explosion. Switch off system. Notify the manufacturer's authorised customer service.

6.3. Residual energy

Even if all the hazard warnings in 6.2 are taken into account, the following residual energy situations can result in a hazard:

- Rotational energy of the decelerating fan
  - Despite the installed protective grille, hair or pieces of clothing can still be drawn in and caught.
- Hot surfaces on machine parts
  - Especially the compressor head and 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 90 °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 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.

Accordingly, self-adhesive warning signs in accordance with the "ISO 3864" standard must be affixed to the machine.

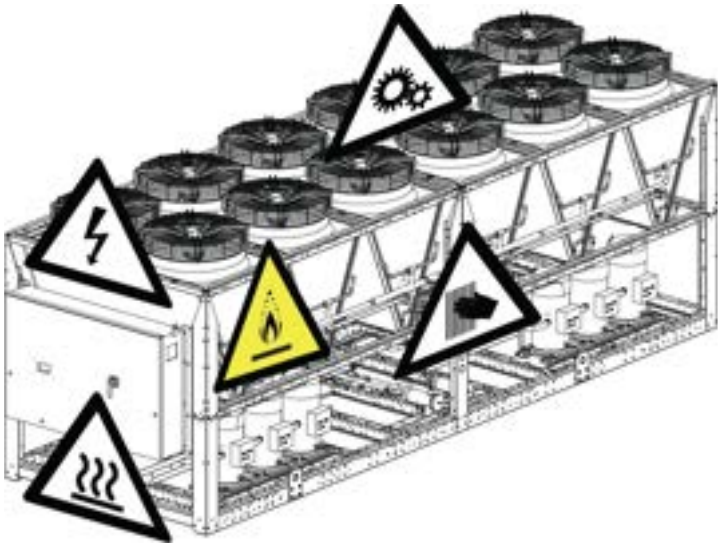


Figure 9: Warning signs for residual energy eBoxX 541 plus - eBoxX 971 plus

	**Attention!** **Observe and adhere to the symbols and notes attached to the unit.**

Note

Do not open the unit until 5 minutes after the main switch has been switched off. Dangers resulting from rotational energy and electrical energy are reduced. Residual thermal energy (risk of injury from hot components) may be present for longer than 5 minutes.

6.4. Safety devices, guards and safeguards

The unit is preset at the factory. There, the settings and the input of the standard parameters are also performed, which under normal operating conditions guarantee the faultless operation of the machine.

The following components are available for the safety of the unit:

- High-pressure pressure switch
- Water-side differential pressure switch
- High pressure safety valve
- Low pressure safety valve
- Low pressure transducer (generates low pressure alarm)

Table 12: Setting value of the safety components

Component	Tripping	Resetting
High-pressure pressure switch	42 bar	33 bar (manual)
Difference water	80 mbar	105 mbar (automatic)
High-pressure safety valve	45 bar	-

Attention!
The safety valve on the high pressure side is calibrated to 45 bar.
It may trip if the calibration value is reached during refrigerant filling.
This (as with other valves of the circuit) can lead to discharge and thus to cold burns.

Note High pressure limiter
Once the high pressure limiter has been triggered, the pressostat must be reset manually by pressing its key all the way and resetting the alarm on the control panel. To identify the cause of the intervention and the maintenance required, refer to the troubleshooting table.

6.5. Personal protective equipment when operating the machine

Operation of the unit is understood to be the execution of setting measures on the control display. When operating the unit, all façade panels or protective grids must be mounted, and the unit must be completely closed. If this is the case, no special protective equipment is required when operating the unit.
However, hearing protection is recommended for persons at workplaces that are permanently in the direct vicinity of the unit (see Sound emissions in the Technical data table).

6.6. Personal protective equipment for servicing work

Service work on the unit includes all work in which the unit is opened and one or more façade panels or protective grilles are dismantled. This applies in particular to cleaning or maintenance work.
Protective equipment must be worn before service work is performed on the unit.

Table 13: Personal protective equipment for servicing work

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

6.7. Residual risks

6.7.1. Residual electrical risks

	Attention! Based on the quality characteristics of EN 50160 and the defined standard voltages of IEC 60038, the mains voltage deviation may not exceed +/- 10% of the nominal voltage

If all safety regulations are observed, there is no danger from the unit.

6.7.2. Residual mechanical risks

If all safety regulations are observed, there is no danger from the unit.
Mechanical damage to components or pipes of the refrigerant circuit can cause refrigerant to leak. Leaking refrigerant can cause cold burns and explosion hazard.

6.7.3. Residual chemical risks

	**Attention!** **Toxic and caustic products are produced in the event of the thermal decomposition of the R454B refrigerant.**
	**Attention!** **Do not store or set up the unit in areas with naked flames or smoke.**

6.7.4. Other residual risks

	**Attention!** **In the EU you must follow the provisions of EN378-3.** **In addition, observe local installation regulations and provisions.**

6.8. Dangerous substances

	**Attention!** **Carefully read the following information about the refrigerants used.** **Conscientiously follow the following instructions and first aid measures.**

6.8.1. Characteristics of the refrigerant used.

The unit uses the refrigerant mixture R454B, consisting of:

- Difluoromethane (HFC 32) 68.9% by weight CAS no.: 000075-10-5
- 2,3,3,3-tetrafluoropropene (HFO-1234yf) 31.1% by weight CAS no: 000754-12-1

6.8.2. Characteristics of the oil used

Polyester oil is used to lubricate the unit; in any case, always follow the compressor nameplate specifications.

	**Danger!** **For more information on refrigerant and lubricating oil, refer to the safety data sheets of the respective product manufacturers.**

6.8.3. Basic eco-information about the refrigerants used

	**Environmental protection** **For more information on refrigerant and lubricating oil, refer to the safety data sheets of the respective product manufacturers.**

- Resistance, degradation and environmental impact

Refrigerant	Chemical formula	GWP (in 100 years)
R32	CH2F2	677
R1234yf	CF3-CF=CH2	<1

R454B is a mixture of the refrigerants R32 and R1234yf. R32 belongs to the group of fluorocarbons. R1234yf belongs to the group of hydrofluoroolefins. As greenhouse gases, they are subject to the Kyoto Protocol (1997 and subsequent revisions). The index that measures how much of an impact a given greenhouse gas has on global warming is the GWP (Global Warming Potential). Conventionally, the index for carbon dioxide (CO2) is GWP=1. The GWP value assigned to each refrigerant represents the same amount of CO2 in kg that must be released into the atmosphere in a 100-year time window to get the same greenhouse effect from a 1 kg refrigerant in the same time period. The R454B mixture is free of ozone-depleting elements, such as chlorine. Its Ozone Depletion Potential (ODP) value is therefore zero (ODP=0).

The R454B mixture is classified as A2L according to ASHRAE standard 34-1997, as per ISO 817. Due to the level of LFL lower flammability limit (307 g/m3), low flame spread (below 6.7 cm/s) and low heat of combustion (9.5 Mj/kg), R32 as well as R1234 is classified among A2L flame retardant refrigerants. The refrigerant also has a minimum ignition energy and a self-ignition temperature of 498°C.

Refrigerant	R454B
Safety class (ISO 817)	A2L
PED fluid group	1
ODP	0
GWP (AR5 - over 100 years)	467
Constituents	R32/R1234yf
Composition	68.9/31.1

R32 and R1234yf are derivatives of hydrocarbons that decompose rapidly in the lower atmosphere (troposphere). The decomposition products are highly volatile and are therefore present in very low concentrations. They have no effect on photochemical smog (they do not fall under volatile organic compounds VOC - according to the provisions of the agreement UNECE).

- Effects on water bodies

The substance released into the environment does not cause long-term water pollution.

- Exposure control/Personal protection equipment

Wear suitable protective clothing and gloves, protect eyes and face.

- Occupational exposure limits R454B

R32 DNEL 7035 mg/m³
R1234yf MAK 273 mg/m³

6.8.4. Important toxicological information about the refrigerant used

- Handling

	**Attention!** **All persons operating and maintaining the unit must be adequately informed of the hazards associated with handling potential toxic substances. Failure to follow the above instructions may result in personal injury and machine damage.**

Avoid inhaling high concentrations of fumes. The concentration in the ambient air must be reduced to a minimum and kept at this level; it must be lower than the occupational exposure limit. Vapours are heavier than air, so high concentrations of the substance are possible near the ground with little air exchange. In these cases, provide adequate ventilation. Avoid contact with naked flames and hot surfaces as this may produce irritating and toxic decomposition products. Avoid eye and skin contact with the refrigerant.

Measures in case of refrigerant leakage
Try to stop it from escaping. Evacuate the area. Observe the risk of explosive atmospheres. Use a respirator to enter the affected area unless it is proven that breathing in the atmosphere is safe. Remove sources of ignition. Avoid entering sewers, basements, excavations, and areas where accumulation may be hazardous. Work according to local emergency plan. Stay downwind.

Exposure to high concentrations can cause cardiac arrhythmias and be fatal.

- Inhalation of high concentrations may cause central nervous system depression causing dizziness, nausea, weakness and possibly unconsciousness, anesthetic effects, slight fainting, confusion, coordination problems, drowsiness, irregular heartbeat with a strange feeling in the chest, and fainting. In high concentrations, it can cause shortness of breath. Those affected may not be aware of the shortness of breath.
- Skin and eye contact
  Refrigerant splashes can cause cold burns. A hazard due to absorption of the substance through the skin is possible. Repeated or prolonged skin contact can destroy the skin's protective greasy film, leading to drying, cracking, and dermatitis. Refrigerant splashes can cause cold burns.
- Ingestion
  Highly unlikely; in case of ingestion, cold burns are possible.

6.8.5. First aid measures

- Inhalation

Remove casualty from exposure area and rest in a warm room wearing a respirator. Administer oxygen if necessary. If breathing stops or threatens to stop, give artificial respiration. If cardiac arrest occurs, apply external cardiac massage.

- Skin and eye contact

In case of contact with skin, wash immediately with lukewarm water for at least 15 minutes. Thaw affected skin areas with water. Contaminated clothing may cause a fire. Moisten with water before removing. The clothing may stick to the skin in case of cold burns. If skin irritation or blistering occurs, consult a physician. Immediately flush eyes with eye wash solution or clear water. While pulling eyelids apart, continue flushing for at least 15 minutes. Seek medical attention.

- Ingestion

Do not induce vomiting. If the victim is conscious, rinse his mouth with water and have him drink 200-300 ml of water. Seek medical attention.
Additional medical treatment
Symptomatic treatment and, if indicated, supportive therapy. Do not administer epinephrine or similar drugs as they may cause cardiac arrhythmias.

6.8.6. Extinguishing media

Suitable extinguishing agents:
Water spray, dry powder

Unsuitable extinguishing media:
Water jets, CO_2

6.8.7. Polyester oil

First aid measures

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

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 procedure: Clean the contaminated area with water. Caution! Slipping hazard!
- Further information: Inform the police or competent authorities in case of penetration in the sewers or bodies of water.

Personal protective equipment

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

Handling and storage

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

6.9. 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 state.
- 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.
- Danger from placing the unit in closed rooms.
- Danger from open fire

6.10. 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 (see ***Contact data***). If you have noticed any leakage of refrigerant or oil, proceed as described in the Hazardous materials section.

7. Noise emission

The airborne sound emissions data is given as the sound pressure level, measured at a distance of ten metres without reflection. Its maximum value is shown in the technical data and in the product flyer. This only occurs at the highest fan speed on the air intake side of the chiller.

7.1. Sound power and sound pressure level

Table 14: Sound power and sound pressure level

Type	Sound power level in dB per octave band (in Hz)							Mean Sound pressure level in dB (A)		
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	Lw dB(A)	Lp 10m
eBoxX 541 plus	109	105	93	89	87	82	75	65	94	62
eBoxX 591 plus	110	106	94	90	88	83	76	66	95	62.5
eBoxX 651 plus	110	106	94	90	88	83	76	66	95	62.5
eBoxX 721 plus	111	107	95	91	89	84	77	67	96	63.5
eBoxX 751 plus	111	107	95	91	89	84	77	67	96	63.5
eBoxX 811 plus	111	107	95	91	89	84	77	67	96	63.5
eBoxX 881 plus	112	108	96	92	90	85	78	68	97	64
eBoxX 911 plus	112	108	96	92	90	85	78	68	97	64
eBoxX 971 plus	113	109	97	93	91	86	79	69	98	65

The total sound power level in dB(A) is based on measurements according to UNI EN-ISO9614 and the Eurovent Sound Test 8/1
Mean sound pressure level in dB(A) in accordance with ISO 3744

Note

The Eurovent certification refers to the sound power value in dB(A) and is the only binding information on noise development. The sound pressure levels refer to the values calculated by the sound power for the installed units in free field with direction factor Q = 2 according to ISO 3744. The distance in metres is given in brackets. It is not possible to extrapolate sound pressure values for different distances.

In partial load operation or under favourable ambient conditions, the fan speed and thus also the noise emission are automatically reduced .

7.2. Notes on reducing noise and vibration

7.2.1. Noise

In the Chapter 7.1 you will find information on the airborne noise emission of your chiller. 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.

7.2.2. Vibration

The chiller is designed so that the vibrations caused by the compressor are largely isolated by the chiller's frame.
In order to further minimize the influence of vibrations, it is possible to install the chiller by means of optionally available vibration dampers (see Accessories in chapter 5.2).

8. Handling and storage

The chiller is delivered from the factory fixed in transport packaging. Remove the packaging as late in the process as possible.

8.1. Transport

8.1.1. Transport - Handling R454B

	Danger! Transport and handling may only be carried out by trained personnel qualified for this work.
	Important! Protect the machine against accidental impacts.
	UN 3358 - Refrigerating machines with flammable, with non-toxic liquefied gas

Packaging, components

	**Danger!** **Do not open and remove the packaging until at the installation site. Do not leave the packaging material within reach of children.**
	**Environmental protection** **Dispose of the packaging material in accordance with the applicable national or local environmental protection laws of the respective country.**

The documents supplied with the unit are:

- Operating instructions
- Electrical circuit diagram
- List of contractual service points
- Warranty certificates
- Certificates of the safety valves
- Operating and maintenance instructions of the safety valves
- PED certificate of the unit
- Operating and maintenance manual, fans and safety valves
- Information sheet safety measures R454B

Lifting and handling

	**Attention!** **Do not lift the unit with a forklift.**
	**Attention!** **Do not place loads on the unit as the top of the unit may be deformed or damaged.**
	**Danger!** **Always handle the unit with extreme care in order to avoid damage to the support frame and the internal mechanical and electrical components. Also, make sure there are no obstacles or people in the way to avoid the risk of collision or crushing. Make sure that the lifting equipment cannot tip over.**

After ensuring that they are suitable (load capacity and wear), the belts/chains must be passed through the appropriate hooks on the base frame. Then tighten the belts/chains and make sure they are tight against the upper edge of the outlet. Lift the unit a few centimetres and, after checking the stability of the load, carefully bring the unit up to the installation site. Gently set the machine down and secure it. During handling, be careful not to get any part of the body between them, and do not make any unintentional movements of the load.
The chiller may only be transported using a crane with sufficient rated 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.

	**Attention!** **Always handle the unit with extreme care in order to avoid damage to the casing and the internal mechanical and electrical components.** **Also check that there are no persons or obstacles along the route to prevent the risk of impact, crushing or tipping over of the lifting and conveying equipment.**

8.1.2. Transport eBoxX 541 plus – eBoxX 971 plus

The chiller may only be transported using a crane with sufficient rated capacity. **Fehler! Verweisquelle konnte nicht gefunden werden.** depicts the regulations for crane transport.

Please observe the following:

- Always handle the unit with extreme care in order to avoid damage to the casing and the internal mechanical and electrical components
- Do not stack the units on top of each other
- The permissible temperature range for storage is -20÷50°C
- The position of the lifting straps must be checked depending on the model and accessories installed
- During lifting and movement, make sure that the unit always remains horizontal
- Make sure that the unit remains horizontal at all times during lifting and movement!

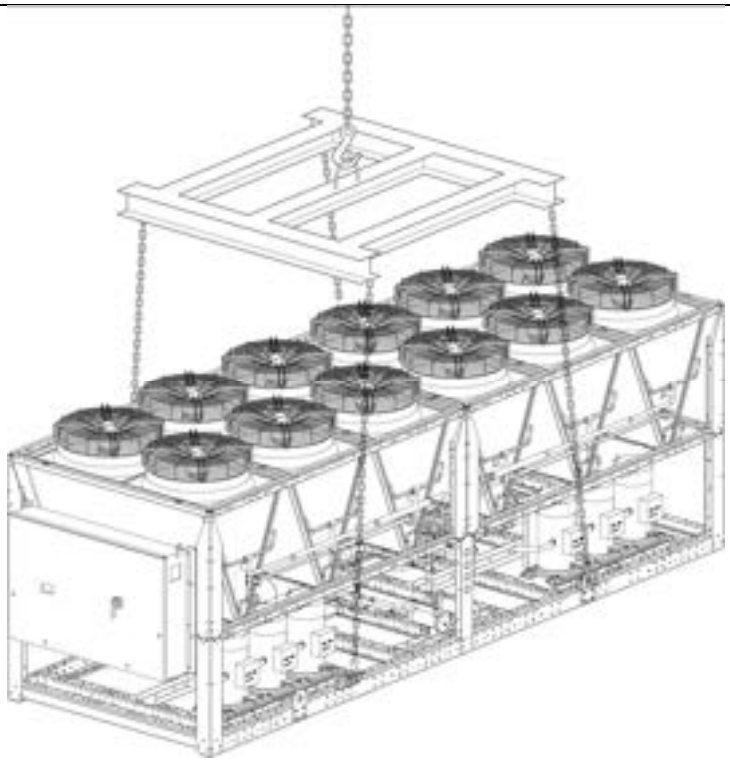
eBoxX 541 plus – eBoxX 971 plus	

Figure 10: Transport eBoxX 541 plus – eBoxX 971 plus

8.2. Unpacking

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

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

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

Table 15: Material of packaging

Element	Material	Recycling code
Polystyrene corner protectors	Polystyrene	
Stretch film	Polyethylene	
Edge protection / corner protectors	Cardboard	
Packaging tape	Polypropylene	
Strapping seals	Steel, galvanized	
Wooden pallet	Untreated raw wood, spruce or pine without bark	

8.3. 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 20 °C to 50 °C

To avoid frost damage the cold water circuit must be completely drained before the chiller is placed in storage and then flushed with a mixture of water and anti-freeze.

9. Installation

9.1. 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

9.2. Face distribution

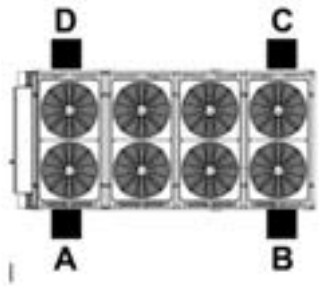
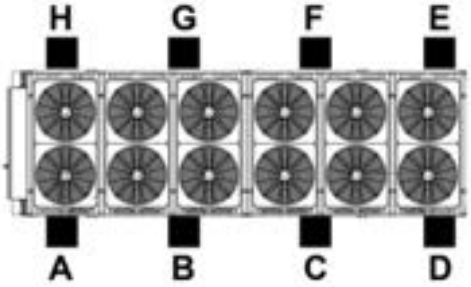
eBoxX 541 plus – eBoxX 651 plus	eBoxX 721 plus – eBoxX 971 plus
	

Figure 11: Face distribution: eBoxX 541 plus – eBoxX 651 plus

Figure 12: Face distribution: eBoxX 721 plus – eBoxX 971 plus

Table 16: Weight distribution eBoxX 541 plus – eBoxX 971 plus

Weight		eBoxX 541 plus	eBoxX 591 plus	eBoxX 651 plus	eBoxX 721 plus	eBoxX 751 plus	eBoxX 811 plus	eBoxX 881 plus	eBoxX 911 plus	eBoxX 971 plus
Standard eBoxX plus										
Empty weight	kg	3,220	3,310	3,350	3,975	4,015	4,045	4,810	4,850	4,880
Support leg										
A	kg	1,083	1,091	1,142	680	687	694	813	821	826
B	kg	823	819	865	647	654	661	774	777	784
C	kg	570	541	581	573	579	585	709	709	716
D	kg	744	719	762	495	501	507	606	602	609
E	kg	-	-	-	329	332	333	405	406	409
F	kg	-	-	-	378	382	383	468	474	476
G	kg	-	-	-	426	430	431	508	518	518
H	kg	-	-	-	451	454	455	533	549	548

Standard eBoxX plus with compressor enclosure option										
Empty weight	kg	3,470	3,560	3,600	4,270	4,310	4,340	5,150	5,190	5,220
Support leg										
A	kg	1,088	1,096	1,147	685	692	699	818	826	831
B	kg	828	824	870	652	659	666	779	782	789
C	kg	575	546	586	578	584	590	714	714	721
D	kg	749	724	767	500	506	512	611	607	614
E	kg	-	-	-	334	337	338	410	411	414
F	kg	-	-	-	383	387	388	473	479	481
G	kg	-	-	-	431	435	436	513	523	523
H	kg	-	-	-	456	459	460	538	554	553

9.3. Installation location

9.3.1. General information

The chiller is approved exclusively for outdoor installation (installation site classification III) for access area categories (b) "Monitored access area" as well as (c) "Access area to which only authorized personnel have access" (observe option packages) DIN EN 378-1. The electrical degree of protection corresponds to IP54. The air flow rate required for your machine is specified in the 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.

Attention!
Do not install in rooms or spaces with naked flames or smoke.
Maintain a safety distance of 2 m in all directions around the chiller.
It must be ensured that the installation site of the eBoxX plus is stationary outdoors without a roof.

9.3.2. 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.

9.3.3. 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.

9.3.4. Minimum distances for servicing

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.

Table 17: Minimum distances for servicing eBoxX 541 plus – eBoxX 971 plus

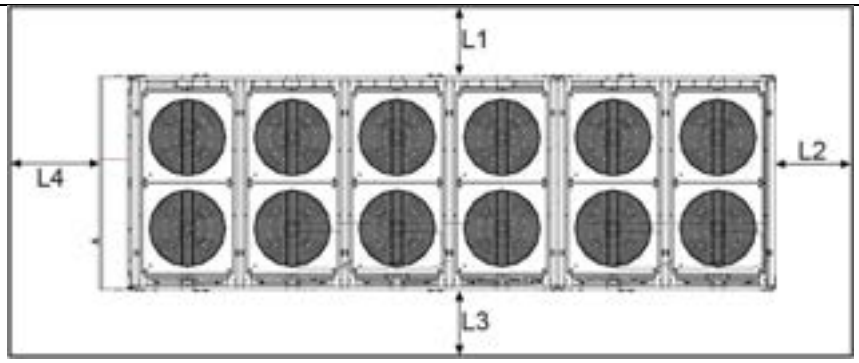
eBoxX 350 – 530	
L1 = 1,000 mm L2 = 1,000 mm L3 = 1,000 mm L4 = 1,600 mm	

Figure 13: Minimum distances for servicing eBoxX 541 plus – eBoxX 971 plus

	**Attention!** **Maintain a safety distance of 2 m in all directions around the chiller.** **It must be ensured that the installation site of the eBoxX plus is stationary outdoors without a roof.** **See information sheet: safety measures R454B**

9.3.5. Surface and foundation

The surface on which the machine is installed must be flat and horizontal. All the machine's feet must have uniform contact with the ground. Ensure that the ground/subsoil has sufficient load bearing capacity. A continuous concrete foundation is recommended according to ***(minimum requirements EN 206-1 / EN 1045-2: Cube strength fck, cube 30N/mm², concrete class C30 to 50, concrete thickness at least 20 cm)*** is recommended.

For chillers equipped with the hydraulic module option, the tank filling quantity is added to the net weight during operation. This gives the gross weight.

If it is not possible to lay a foundation, the machine can also be positioned on a baseframe made of steel sections. Please also ensure here that all the unit feet have uniform contact with the baseframe.

	**Danger!** **Installation must be carried out only by experienced technicians who are licensed to work on refrigeration and air conditioning systems. Incorrect installation may be the cause of poor operation of the unit with significant drop in efficiency.**
	**Danger!** **Personnel are required to comply with all local and national regulations in effect at the time of installation.**
	**Danger!** **Some internal parts of the unit may cause cuts. Use appropriate personal protective equipment.**
	**IMPORTANT !** **The machine is intended for outdoor installation. Positioning or improper installation of the unit may increase the operating noise and machine vibrations generated during operation.**

9.3.6. Requirements for the installation site

The choice of the installation site must be made in accordance with the EN 378-1 standard and the provisions of the EN 378-3 standard. In any case, with regard to the installation location, the risks related to accidental leakage of the refrigerant gas contained in the unit must always be taken into account.

Instructions for the installation of the units with refrigerant R454B
The eBoxX plus units contain R454B gas, classified as A2L according to EN 378-1; transport is regulated according to ADR UN 3358.

Characteristics of the refrigerant used
- Difluoromethane (HFC 32) 68.9% by weight CAS no.: 000075-10-5
- 2,3,3,3-tetrafluoropropene (HFO-1234yf) 31.1% by weight CAS no: 000754-12-1

Basic eco-information about the refrigerants used
- Resistance, degradation and environmental impact

Refrigerant	Chemical formula	GWP (in 100 years)
R32	CH2F2	675
R1234yf	CF3-CF=CH2	<1

R1234yf belongs to the group of hydrofluoroolefins. As greenhouse gases, they are subject to the Kyoto Protocol (1997 and subsequent revisions). The index that measures how much of an impact a given greenhouse gas has on global warming is the GWP (Global Warming Potential). Conventionally, the index for carbon dioxide (CO2) is GWP=1. The GWP value assigned to each refrigerant represents the same amount of CO2 in kg that must be released into the atmosphere in a 100-year time window to get the same greenhouse effect from a 1 kg refrigerant in the same time period. The R454B mixture is free of ozone-depleting elements, such as chlorine. Its Ozone Depletion Potential (ODP) value is therefore zero (ODP=0). The R454B mixture is classified as A2L according to ASHRAE standard 34-1997, as per ISO 817. The level of the LFL lower flammability limit (307 g/m3), low flame spread (below 6.7 cm/s), and low heat of combustion (9.5 MJ/kg) classify R32 among the A2L refrigerants with low flammability. The refrigerant also has a minimum ignition energy and a

self-ignition temperature of 498°C.R454B is a mixture of the refrigerants R32 and R1234yf. R32 belongs to the group of fluorocarbons

Refrigerant	R454B
Safety class (ISO 817)	A2L
PED fluid group	1
ODP	0
GWP (AR5/AR4 - over 100 years)	467/466
Constituents	R32/R1234yf
Composition (%)	68.9/31.1

The units must be installed outdoors and in accordance with the locally applicable regulations and laws and in compliance with the EN 378-3 standard. The unit must be positioned so that in the event of a leak, the refrigerant cannot enter the building and endanger people or property. In the event of a leak, the refrigerant must not enter ventilation ducts, access doors, flaps or hatches or similar openings. If roofing is provided for equipment installed outdoors, it must be provided with a system for natural or forced ventilation. For units installed outdoors but in a location where a refrigerant leak may stagnate, such as in a hole, the installation shall comply with the leak detection and ventilation requirements necessary for machinery spaces designated "machinery" space "in accordance with EN 378-1. For units filled with R454B refrigerant, the outlet of the safety valves must be relocated so that the gas is discharged further away in the event of the valves being triggered due to overpressure. The cross-section and length of the pipes used to relocate the outlet of the safety valves must comply with the laws of the country of installation and the European directives.

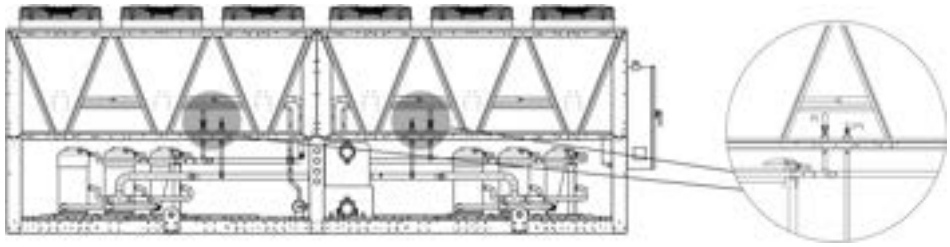


Figure 14: Requirements for the installation site

The safety valve models used depend on the size of the equipment. The safety valves used have the following characteristics:

High pressure valve		
	Outlet diameter	Trigger pressure
eBoxX 54 1plus – 591 plus	2x 1“ ISO228	45 bar
eBoxX 651 plus – 971 plus	2x 1 ¼“ ISO228	45 bar
Low pressure valve		
eBoxX 541 plus – 971 plus	2x ¾“ ISO228	28.4 bar

Note
The number of valves is doubled if the double safety valve accessory is present, as well as container shipping.
Note: The leak sensor must only be used to check for refrigerant leaks from the unit. It is not to be considered as a protective device under any circumstances.
In case of rupture, the evaporator / recovery unit could release refrigerant into the hydraulic circuits. It is the fitter's responsibility to design and protect the hydraulic circuits with safety valves, which must be placed in an area away from possible ignition sources.

The eBoxX plus units contain refrigerant R454B, which is classified in safety class A2L according to EN378-1, Appendix E and is therefore flammable. For machines operated with refrigerant R454B, a specific risk assessment has been carried out by taking appropriate measures to reduce the risk itself. In any case, the unit is not suitable for installation in areas where there is a risk of explosion.
The person responsible for the installation must prepare a risk assessment after installing the unit, taking into account the surrounding hazardous areas and the hazards generated by the unit. The risk assessment must include the analysis of any ignition sources that may be present in the vicinity of the equipment. The risk assessment and subsequent mitigation measures must be applied throughout the life of the unit, and life includes transportation, storage, installation, operation, maintenance, and ultimately disposal of the unit. The refrigerant in the unit is pressurized even when the unit is not running and is disconnected from power, in the event of a possible leak, the entire contained amount would escape. Personnel required to work near or on the unit must be adequately trained to work in safety. To reduce the risk, the instructions in the following paragraphs regarding the safety valve routing must be followed. The transport of the safety valve discharges must be carried out in the open air without ignition sources and in no case in a confined space.

The safety valves are dimensioned in such a way that it is possible to connect a section of discharge line after them. The diameter, length and number of curves of the section of the line located after the safety valves shall be selected so that the pressure losses in this section do not exceed the project values. The size of the line diameter downstream of the safety valves must be selected so that the constraints given in the table below are met. The table indicates the minimum diameter of the line depending on its length, the number of curves and the type of valves installed on the unit

Minimum distance chiller <-> discharge opening		5m		
Outlet line material		Copper pipe suitable for the corresponding sudden release pressure Recommendation: Copper pipe (in accordance with EN12735-1)		
Outlet line high pressure eBoxX 541 plus – 591 plus		Length [m]		
		up to 10	up to 20	up to 30
		free inner cross section		
No. Pipe bends	3	45mm	51mm	55mm
	6	47mm	52mm	56mm
	10	48mm	53mm	57mm
Outlet line high pressure eBoxX 651 plus – 971 plus		Length [m]		
		up to 10	up to 20	up to 30
		free inner cross section		
No. Pipe bends	3	61mm	69mm	74mm
	6	64mm	71mm	76mm
	10	67mm	73mm	78mm
Outlet line low pressure eBoxX 541 plus – 971 plus		Length [m]		
		up to 10	up to 20	up to 30
		free inner cross section		
No. Pipe bends	3	34mm	39mm	42mm
	6	35mm	39mm	42mm
	10	36mm	40mm	43mm

	ATTENTION! The outlet lines must be brazed. **Pressing as well as soft soldering of connections is not allowed**
	ATTENTION! If the safety valves are triggered, strong pressure is suddenly released. The outlet line / piping must be designed for this load.

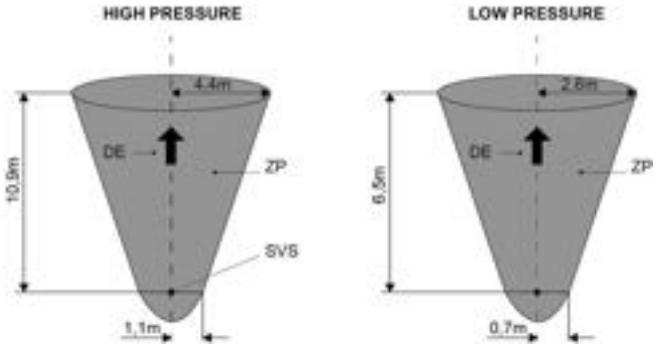
Note
The number of valves doubles if the accessory DVS - double safety valve - is present.
Note: The leak sensor (option LKD) must only be used to check for refrigerant leaks from the unit. It is not to be considered as a protective device under any circumstances.

Example:
Installed unit: eBoxX 911 plus
Type of high pressure valve: 2x 1 ¼“ ISO228
Length of line after valve: 18 m
Number of curves: 8
In the table, search for the values for length and number of curves that follow each other in size
Length of the line in the table: 20 m
Number of curves: 10
➢ The minimum inner diameter of the outlet pipe must be 45 mm

The thickness and type of material of the ductwork must be selected based on the PS and TS values indicated on the nameplate to avoid slackening and throwing away of the material. The installer must also provide suitable supports to avoid deformation or slackening, and to prevent mechanical stresses from directly loading the safety valves.

Note: Each valve must be connected independently to an outlet line.

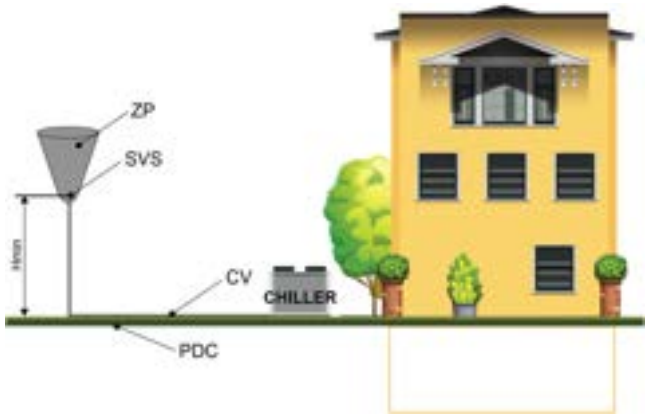
The eventual engagement of the safety valve creates a hazardous area near the outlet, within which there must be no device/support frame, because this would alter the physical distribution of the flammable gas in such a way as to make it unpredictable. The distribution cones are shown below.



DE	Output direction
ZP	Danger area
SVS	Safety valve outlet

Figure 15: Requirements for the installation site

The manifold of the safety valve outlets must therefore be routed to the outside in one place, in compliance with the following regulations. In particular, the collective outlet pipe of the safety valves must be placed at a height of at least 3 metres above the landscape surface.



Hmin	Minimum height 3 m
ZP	Danger area
SVS	Safety valve outlet
CV	Ducting valves
PDC	Landscape surface

Figure 16: Requirements for the installation site

In case of a defect, the evaporator of the unit may release refrigerant into the water circuit. Therefore, the installer must design and protect the water circuit with a safety valve located well away from possible ignition sources.

Table 18: Clearances and installation

	**IMPORTANT !** **Before installing the unit, check the permissible noise levels of the site.**
	**IMPORTANT !** **When installing the unit, respect the required clearances, taking into account the free access to the electrical and water connections.**
	**IMPORTANT !** **Installation that does not take into account the minimum technical clearances will result in poor functioning of the unit, an increase in the power absorbed and a noticeable reduction in cooling capacity.**

9.3.7. Stability

By default, the machine stands firmly on the base. It is not necessary to anchor the machine to the ground. If, however, if ambient conditions make it necessary, the machine can be connected to the ground at the base frame or optionally equipped with the available vibration dampers.

9.3.8. Vibration isolation

If it is necessary to decouple the chiller from the base, this can be done by means of the optionally available oscillating metal feet. If there is a risk of vibration being transmitted by neighbouring machines, separate vibration decoupling must be carried out.

9.3.9. Installation

OUT →	Unit outlet
IN ←	Unit inlet

Shut-off valves (ball valve, butterfly valves) should be installed externally, which can separate the chiller from the rest of the system. A dirt filter (not larger than 0.8 mm) should also be provided to protect the entire system and adapted to the pressure losses of the system. Clean this filter based on the degree of contamination.

⚠	**Attention!** **The water circuit and the connection of the unit to the system must be carried out in accordance with local and national regulations.**

9.3.10. Hydraulic installation

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

It must also be ensured during hydraulic installation that the unit connections available on the chiller do not represent a fixed point. In order to avoid damage to the pipework and chiller, support of the hydraulic connections near the unit connections must be provided by the customer.

The installation of compensators between the equipment connections and the hydraulic installation is recommended.

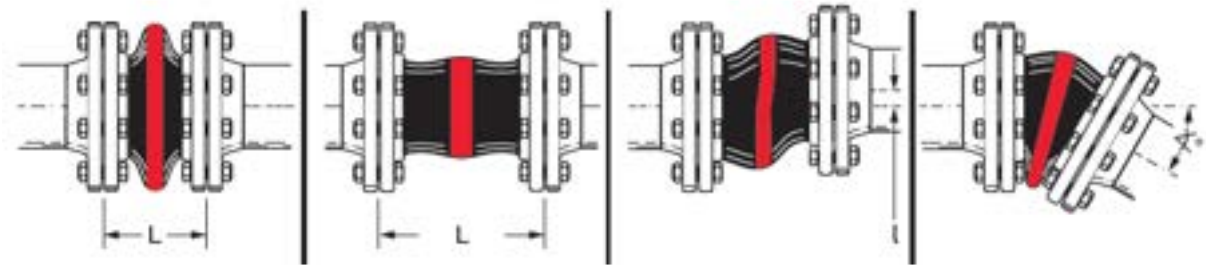


Figure 17: Hydraulic installation

9.3.11. Frost protection measures

The chiller is exposed to the risk of frost in two different situations. Both with an ambient temperature < 5 °C and a feed temperature < 5 °C there is a risk of freezing of parts of the cold water circuit system.

Installation at ambient temperature < 5 °C with anti-freeze mixture
The machine is protected against freezing by anti-freeze. Ensure that you always comply with the requirements with regard to the operating fluid and the mix ratio.

Flow temperature < 5 °C
The machine must be protected against freezing by anti-freeze in accordance with the specifications. Please note that the evaporation temperature is always significantly below the cold water feed temperature. Ensure that you comply with the requirements with regard to the operating fluid and the mix ratio.

9.3.12. Flushing the cold water circuit

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

9.3.13. Filling

Once the hydraulic installation of the overall system has been completed, the chiller can be filled. All shut-off valves in the cold water circuit must be opened. For filling, please use the internal filling connections in the unit or provide an external filling possibility for atmospherically closed systems.

	**Attention!** **Only use approved coolant media! If there is a risk of frost, please observe anti-freeze mixture! All operating liquids must be mixed before they are added to the system!**

9.3.14. Venting

Please use the internal ventilation fittings in the unit for venting. In addition, we recommend installing a suitable vent valve at the highest point in the cold water circuit. Several automatic air vents may therefore be necessary.

9.3.15. Electrical installation

	**Attention!** **The electrical installation, testing and commissioning may only be carried out by qualified personnel. Note and follow the local regulations.**
	**Attention!** **Do not switch on the chiller until the hydraulic installation is completed and the machine has been filled as specified. Otherwise the machine could be damaged.**
	**Attention!** **Make sure that the screws securing the conductors to the electrical components in the control cabinet are properly tightened. (They may have loosened during movement and transport.)**

Note

Always install a circuit-breaker with delayed characteristic, sufficient load capacity and breaking capacity and with a minimum contact opening of 3 mm at a protected location and close to the machine. (The device must be able to interrupt the assumed short-circuit current, the value of which is determined according to the characteristics of the installation.) The connection of the machine to an earthing system is required by law and serves to protect the user during machine operation.

The power supply coming from the three-phase line must go to the circuit breaker. The power supply cable (not below H05RNF) must be flexible and have a neoprene sheath: for cross section see or wiring diagram or according to local utility regulations.

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

If you use an external control cable to set the release for the chiller, this is laid parallel to the supply cable and wired to the corresponding terminals in the control cabinet. (Refer to the circuit diagram included with the unit)

Once the electrical installation has been completed the phase sequence must be tested. This can be done with a rotating field meter.

10. Commissioning

	**Attention!** **Before any maintenance work - even simple visual inspections - always disconnect the machine from the mains with the main switch first. Make sure that nobody can accidentally activate the machine; block the main switch in position "0".**

Before commissioning the chiller, use the checklist to check whether all the necessary work from the ***Setup and Installation*** chapter has been carried out correctly.

The following points must be observed before activating the chiller:

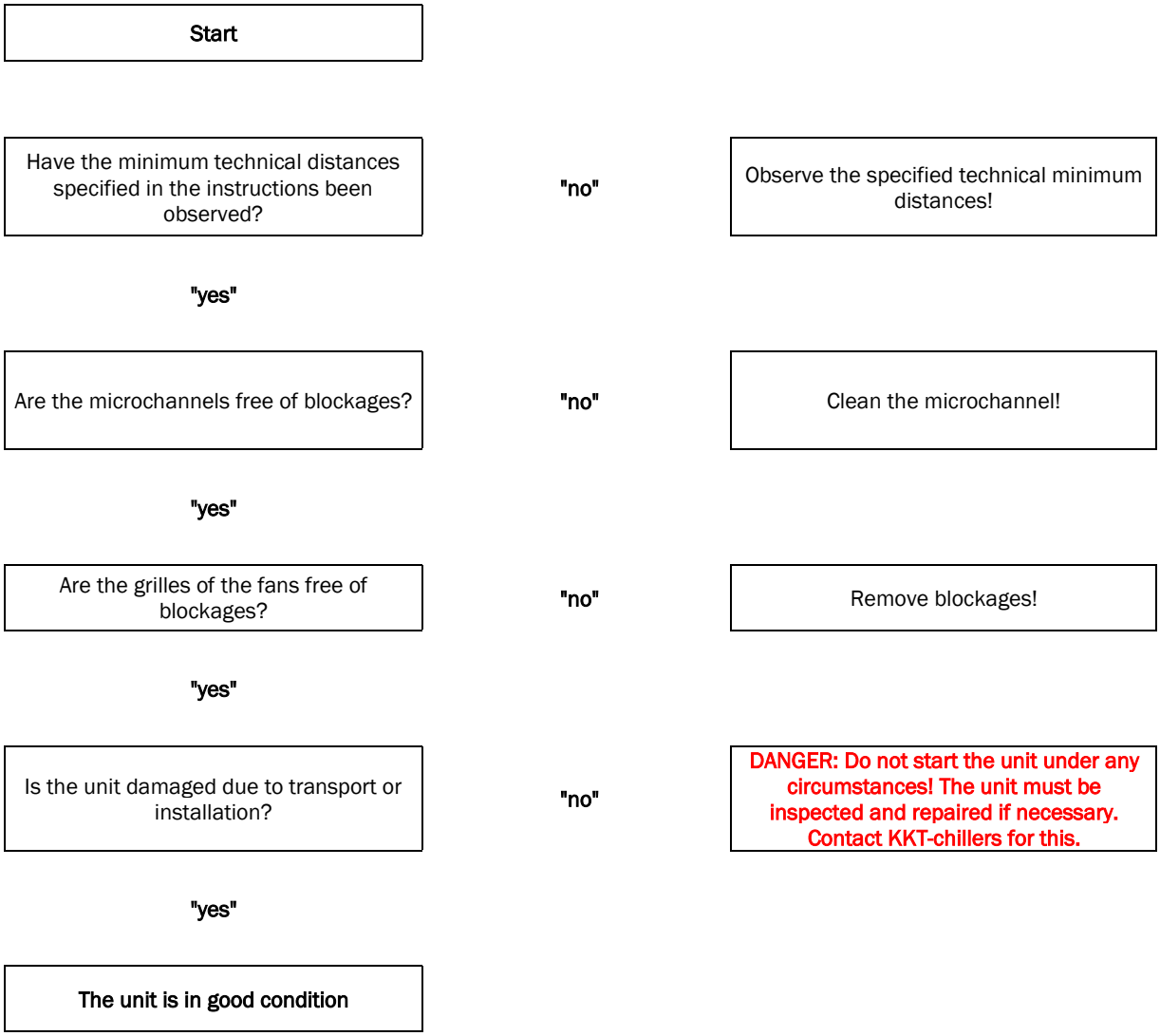
- The mains voltage must correspond to the values given on the nameplate and/or in the wiring diagram with the following tolerance range in the "Electrical connections" section
- The power supply must be dimensioned for the power consumption of the machine;
- Open the control box and ensure that the terminals and contactors are tight (they can become loose during transport, causing malfunctions);

10.1. Start the procedure

	**Attention!** **Switch on the power supply at least 12 hours prior to commissioning so that the crankcase heater of the compressor is supplied with power. These heaters are automatically switched off each time the machine is started.**
	**Attention!** **The initial commissioning of the unit may only be carried out by qualified personnel. Note and follow the local regulations.**

Once the installation and connection of the unit have been completed, the unit can be started. Strictly observe the diagrams in the following sections for correct initial commissioning of the unit.

10.1.1. General condition of the unit



10.1.2. Checking the oil level of the compressor

Start

Is the oil level sufficient?

"no" → Refill as required

"yes"

Was preheating switched on at least 12 hours before the start?

"no" → Switch on preheating and wait 12 hours

"yes"

The compressors are ready to start

	**Attention!** **The initial commissioning of the unit may only be carried out by qualified personnel. Note and follow the local regulations.**

10.1.3. Checking the water connections

Start

Were the connections made correctly?

"no" → Adjust the connections!

"yes"

Is the inlet and outlet direction of the water correct?

"no" → Adjust the inlet and outlet direction!

"yes"

Are the circuits filled with water or water-glycol (according to specification) and vented?

"no" → Filling and/or venting circuits

"yes"

Does the flow rate correspond to the information in the operating manual?

"no" → Restore the flow rate!

"yes"

Is the rotating field correct, has the phase position been checked?

"no" → Check the rotating field and, if necessary, establish the correct phase position!

"yes"

Have external flow monitors or dirt traps been connected correctly?

"no" → Correct or replace the components!

"yes"

The water connection is compliant.

10.1.4. Electrical connections

Start

Is the unit is fed according to the values indicated on the nameplate and in the circuit diagram ?

"no" → Make sure that the supply is correct!

"yes"

Is the phase sequence correct?

"no" → Make sure that the phase sequence is correct!

"yes"

Does the earth connection comply with the legal regulations?

"no" → **DANGER: Reposition the earth connection!**

"yes"

Are the conductors of the power circuit dimensioned according to the instructions?

"no" → **DANGER: Replace the cables immediately!**

"yes"

Is the circuit breaker connected upstream of the unit correctly dimensioned?

"no" → **DANGER: Replace the component immediately!**

"yes"

The electrical connection is compliant.

10.2. Initial commissioning

If the previously listed checks have been completed with a positive result, you can proceed with the initial commissioning of the machine.

Start

Activate the motor protection switches of the compressors.

"yes"

Simulate a test start to check whether the contactors.
have been fitted correctly.

"yes"

Disconnect the power supply to the auxiliary circuit again.

"no"

Check the component and replace if necessary!

"yes"

Re-activate the motor protection switches of the compressors.

"yes"

Power the auxiliary circuit again.

"yes"

Start the unit from the control panel.

"yes"

Select from the following operating modes.

"yes"

Check the correct rotation of the pumps (hydraulic module option) and flow rates.

"no"

Check the component and replace if necessary!

"yes"

Complete start procedure.

10.3. Checking while the machine is running

Start

Unauthorized persons must be sent away.

"OK"

Is the differential pressure switch on the water side triggered correctly?

"no"

Check the component and replace if necessary!

"yes"

Is the operating pressure reading correct?

"no"

Switch off unit and find the cause of this malfunction!

"yes"

Will gas leaks of > 3 grams/year be detected if the pressure on the on the high pressure side is brought to approx. 8 bar? (according to EN 378-2)

"no"

Switch off unit and find the cause of this malfunction!

"yes"

Does the display show no alarms?

"no"

Find the cause of the alarm and the cause of this malfunction!

"yes"

Check completed.

11. Operation

The chiller is designed for fully automatic operation.

11.1. Switching on / off

First switch on the unit by flipping the main switch.

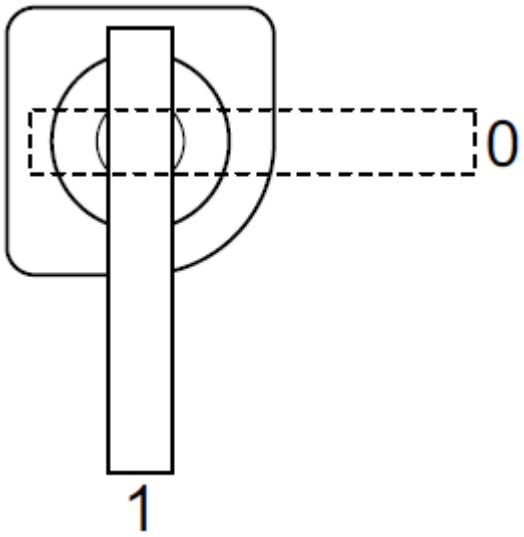
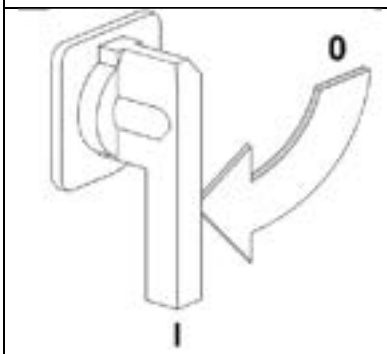
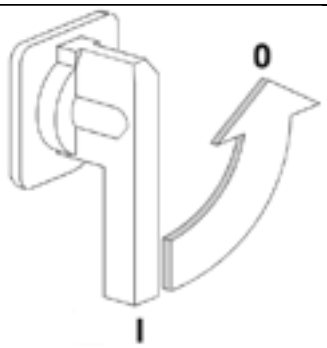


Figure 18: Main switch

Switching on the system	Switching off the system
	
Turn the circuit breaker on the handle by 90° clockwise.	Turn the circuit breaker on the handle by 90° counter-clockwise. The control panel is switched off.

11.2. Control panel / user interface

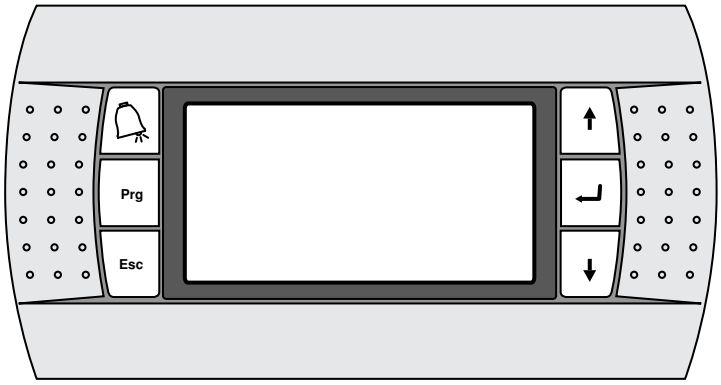
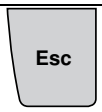
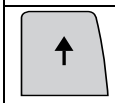
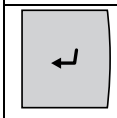
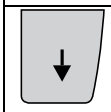


Figure 19: Control panel

Table 19: Control panel buttons

Button	Action
	**Button [ALARM]** Visualisation of the list of active alarms
	**Button [PRG]** Provides access to the programming menu for the settings.
	**Button [ESC]** Return to the upper level mask
	**Button [UP]** If the cursor is on the movement field (upper left corner), it returns to the previous screen; if it is on an editable value, it is increased
	**Button [ENTER]** To confirm the entered value and move the cursor to the following field
	**Button [DOWN]** If the cursor is on the movement field (upper left corner), it returns to the previous mask; if it is on a modifiable value, it decreases it.

With the help of the switches and the keyboard, the user can perform the following interventions:

- Power supply of the unit
- Start-up of the unit;
- Stand-by;
- Switching/selecting the operating mode;
- Adjustment of the cooling setpoint;
- Clock and time range setting;
- Local monitoring protocol setting;
- Display of alarm messages;
- Visualisation of the status of the main components via LED display or display;
- Display of the operating hours counter;
- Switching off the unit

11.3. Status after switching on and off

After switching on the system, the following screen page appears

Figure 20: Start screen

To switch on/off the unit:

1. Move the cursor to the last line while pressing the ENTER key.
2. Use the UP and DOWN buttons to change the "ON" - "OFF" setting
3. Confirm the setting by pressing the ENTER button.

Display	Comment
Setpoint	Display of the current working setpoint value
Input	Water temperature input primary side
Exit	Water temperature output primary side
REG	Displays the temperature used for control.
Status	On
	Off alarms (the machine is off because there is an alarm)
	OFF by the supervisor (the machine is in Off because of an external supervisor)
	Off from seq. (the machine is set to Off by command of step switching of the unit)
	Off due to timer (the machine is set to Off during corresponding time periods)
	Off because of SCR (the machine is set to Off from the digital input)
	Off because of display (the machine is set to Off because of manual setting)
	Disabled (the machine remains off for the time required to heat the compressor crankcase oil)
	Off from T.Est. (The machine is off due to low outside air temperature.)
[PRECIRC]	Phase of pre-circulation of the primary circuit pump
Mode	Shows the operating mode of the machine:
	Cooling
Keyboard on/off	For switching the unit on and off
	ACCESO (ON) = Unit ON
	SPENTO (OFF) = Unit OFF

11.4. Status of refrigeration circuits

By pressing the UP and DOWN keys you can scroll through some menus on the main screen page and check the status of the unit and some settings. The first screen is the status of cooling circuit 1, followed by the other circuits (if more than one).

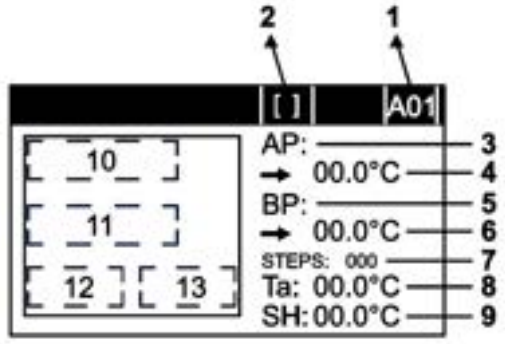


Figure 21: Status of refrigeration circuits

Display		Comment
1		Code of the mask. The letter denotes the menu, while the number is consecutive
2	[N] [F]	Circuit off Circuit generates cold
3	AP	Display high pressure [barg]
4	→	Display of the conversion of the high pressure value into temperature [°C]
5	BP	Display low pressure [barg]
6	→	Display of the conversion of low pressure into temperature [°C]
7	STEPS	Electronic thermostatic valve positioning indicator [opening level]
8	Ta	Display of the suction temperature of the compressor
9	SH	Display of the superheating value
10	80%	Fan speed regulation steps and percentage of analogue signal
11	StartStop	Compressor in Start/Stop phase
	Alarm	Compressor in alarm condition
	Off (*)	Turn compressor off and on
	Forz. Off	Unit switched off or manual compressor deactivation or switch-off
	On (**)	Compressor on
	(*)	OffT=XXXs (compressor in OFF for safety interval equal to the value visualised opposite).
	(**)	OnT= XXXs (compressor in ON for safety interval equal to the value visualised opposite).
12	[PREVENT]	Function Prevention Alarm Unit
	[FAN]	Pre-ventilation activated
	[EVOSYNC]	Synchronisation phase
13	LSH	Low superheat protection (LowSH) active
	LOP	Low operating pressure (LOP) protection active
	MOP	High operating pressure protection (MOP) active
	HIT	High condensation temperature prevention (HiTcond) active

Figure 22: Temperature

1	Outdoor air temperature (if probe is present)
2	Control setpoint active
3	Water temperature used for setting
4	[LIMIT] Unit exposed to power limitation
5	Demanded power recovery side (only versions PdC or PdC+RC100)
6	Demanded capacity primary side
7	Number of stages of active compressors

Only with energy measurement option

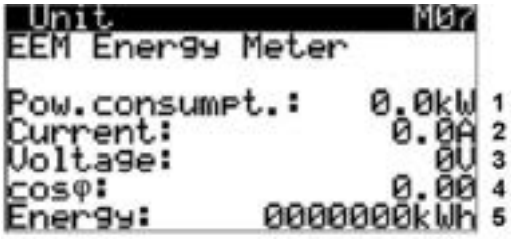


Figure 23: Energy measurement

1	Instantaneous power consumption of the unit
2	Instantaneous current consumption of the unit
3	Acquired voltage
4	Phase shift angle between phases
5	Total energy consumed by the machine

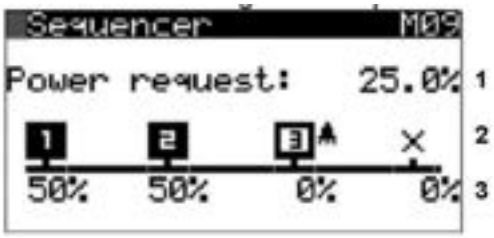


Figure 24: Integrated step switch

In the M09 screen of the master unit, the current status of the machine group can be displayed:

1	**Pot. request**	Percentage of total power requested by the group
2	3 2	Unit connected, compressor switched off (white background) or switched on (black background)
	✕	Unit not connected
	🔔	Alarm triggered on unit
3	—	No power requested (pump switched off)
	0%	No power requested (pump switched on)
	1%÷100%	Power requested by the unit

11.5. Menu navigation

If you press the PRG key, the main menu can be accessed. With the UP and DOWN keys you can select the desired menu and pressing the Enter key takes you to it. To return to the previous menu, press the Esc key.

11.5.1. Main menu

Press the Prg key to return to the main menu.

Figure 25: Main menu

Use the Up and Down keys to scroll through the following menus:

A.	Setpoint	Menu for setpoint adjustment
B.	Clock	Menu for setting the time and time spans.
C.	Limitations	Menu for setting the FDL and FNR option
D.	Input/Output	Menu for visualisation of the status of the digital/analogue inputs/outputs of the circuit board
E.	Data storage	Menu for visualisation of alarm archives
F.	Info	Info menu
G.	Language selection	Menu Language selection
H.	Operating hours	Operating hours menu
i.	Config. BMS	Menu for configuring the BMS ports

By pressing the ENTER key, the selection can be confirmed and the desired menu called up.

11.5.2. Setpoint value menu

In the Setpoint menu, in addition to the water temperature setpoint for the cooling mode, the operating mode can also be set.

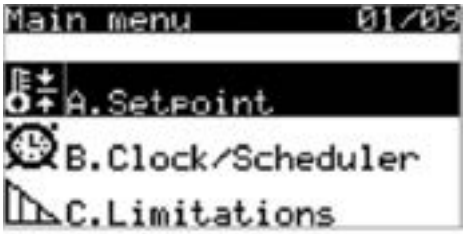


Figure 26: Setpoint value menu

11.5.3. Change of operating mode

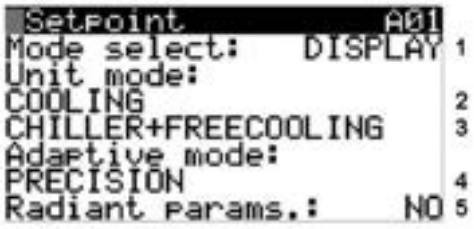


Figure 27: Change of operating mode

1	Determines whether the selection of the operating mode of the unit must be made via the display or via an external digital contact (section 12.2, Summer / Winter selector switch - SEI)
2	If the machine operating mode is selected via the display, the following can be set: **COOLING MODE**
3	Set the setting curve of the AF+ function

11.5.4. Adjustment of the setpoint

The setpoint currently used by the unit is indicated by an arrow.

Settings in Cooling mode

Figure 28: Setting in cooling mode

1	Main setpoint in COOLING MODE
3	Correction made to the setpoint with the CS setpoint shift function in offset mode (only with CS setpoint offset option)
4	Display of the current working setpoint value

11.5.5. Setpoint compensation

If the machine is set to the return temperature or to the flow temperature and AF+ is used in Precision mode, climatic compensation of the setpoint can be activated based on the outdoor temperature

The more critical the external conditions are, the greater the correction made to the setpoint. The compensation can be activated/deactivated individually for each operating mode.

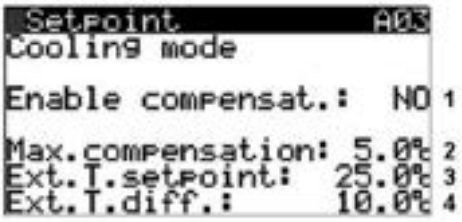
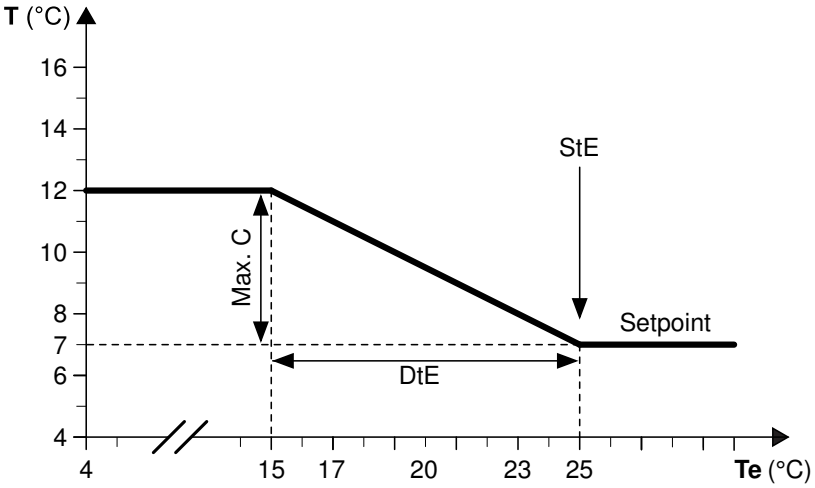


Figure 29: Setpoint compensation

1	Activation climatic compensation of the setpoint
2	Maximum compensation applied to the setpoint (*)
3	Outdoor temperature threshold, above this threshold no compensation is applied (**)
4	Outdoor temperature range in which a gradual compensation of the setpoint is performed (***)

Graph of climatic compensation of the setpoint in cooling mode



T	Setpoint
Te	Outdoor temperature
(*) Max.C	Maximum compensation
(**) DtE	Difference outdoor temperature
(***) StE	Setpoint outdoor temperature

Example: With the compensation parameters set in the mask shown in the example, the setpoint is not changed when the outdoor temperature is higher than 25 °C; at lower temperatures it is increased gradually, up to a maximum increase of 5° C in the case of outdoor temperatures up to 15 °C.

11.5.6. Option CS floating setpoint

The floating setpoint function allows to change the setpoint value through a 4÷20 mA analogue signal. The floating setpoint (CS) option is enabled at the factory.

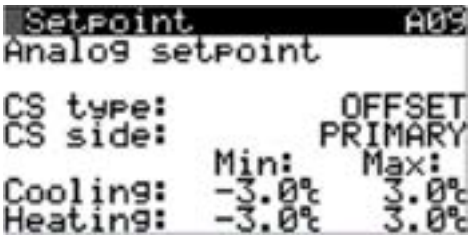


Figure 30: Option CS-floating setpoint

Setting: Tipo CS (CS type) floating setpoint

The user can choose between 2 operating logics:

OFFSET	In the Offset Set-point logic, the analogue signal (appropriately configured) corrects the Set-point value set on the control panel.
SHIFTING	In the "Floating setpoint" logic, the analogue signal adjusts the setpoint.

Type floating setpoint CS offset

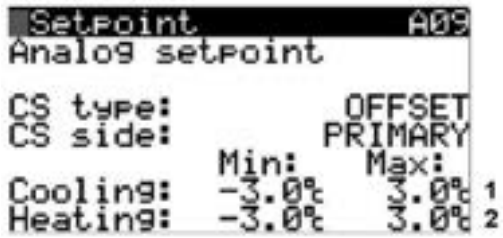
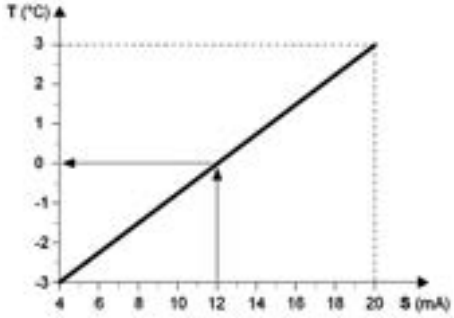


Figure 31: Floating setpoint CS offset

1	Minimum or maximum correction applied in cooling mode with OFFSET logic

Graphic Sliding setpoint CS in logic Offset cooling mode



T	Change according to the adjusted setpoint
S	External analogue signal (4÷20 mA)

Example: With a minimum offset of -3°C and a maximum offset of 3°C, with an external analogue signal of 8 mA, the setpoint adjusted is decreased by 1.5°C.

11.5.7. Clock menu

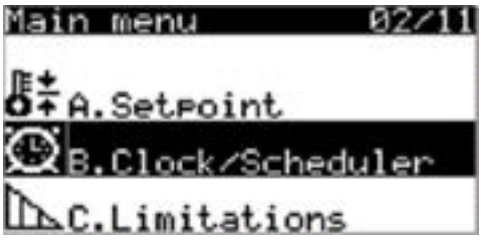


Figure 32: Clock menu

In the menu "Clock " it is possible to set the time for the automatic switch on/off of the unit for each single day of the week.

Mask B01 allows setting the clock and activating the time ranges.

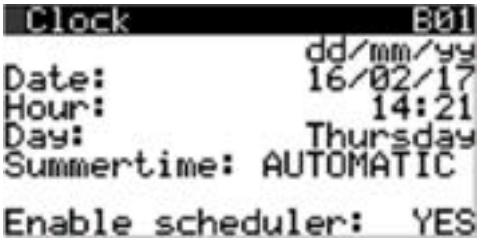


Figure 33: Setting and activating time ranges

The masks B02...B03 allow to set the daily time ranges in relation to the cooling.

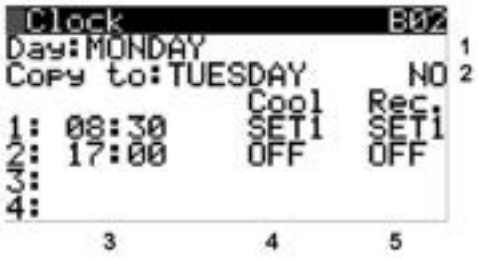


Figure 34: Setting daily time ranges

1	Day to be programmed. Changing the day loads the time ranges of the selected day on the display.
2	The value of the displayed day can be copied to another day, which can be freely selected. Select the target day and set YES.
3	Setting the start time of the timer. The time range ends with the beginning of the following time range or at the end of the day. Attention: For correct operation of the time ranges, the clock times must be set to increase.
4	Settings command page primary circuit. An OFF command can be set for each range, for switching on with SET1 or switching on with SET2 (only with option SDP).
5	Settings command page recovery. An OFF command can be set for each range, for switching on with SET1 or switching on with SET2 (only with option SDP). (EXP or PdC+RC100 versions only)

With the parameters entered in the example mask:
Time range 1 starts at 8:30 and ends at 17:00; Time range 2 starts at 17:00 and ends at 23:59. Before 08:30, since there are no specifications, the control present at the end of the day is used (in this case OFF). The mask B03 makes it possible to set the "special periods" whose control commands have priority in relation to the daily time periods. In these periods the settings of the daily time ranges do not apply.

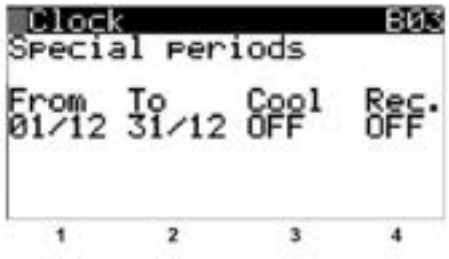


Figure 35: Special periods

1	Special start date
2	Special end date Period
3	Settings command page primary circuit. An OFF command can be set for each range, for switching on with SET1 or switching on with SET2 (only with option SDP).
4	Settings command page recovery. An OFF command can be set for each range, for switching on with SET1 or switching on with SET2 (only with option SDP). (EXP or PdC+RC100 versions only)

With the parameters set in the sample screen, the unit will remain off from December 1 to December 31 regardless of the control commands issued previously.

The B04 mask allows to set the "special days" whose control commands have priority in relation to the special periods. In these periods the settings of the special periods do not apply.

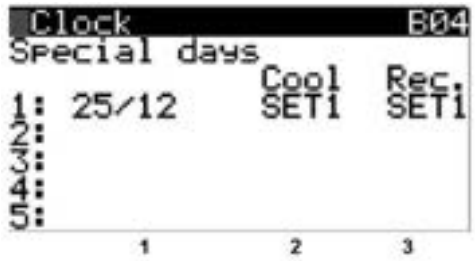


Figure 36: Special days

1	Special day
2	Settings command page primary circuit.

11.5.8. Menu Input/Output

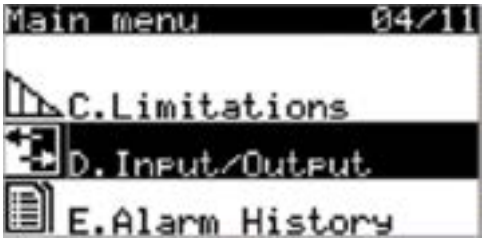


Figure 37: Main menu: Input / Output

The inputs / outputs menu is displayed one after the other via the current status.

Analogue inputs (water temperature probes, pressure transducers)

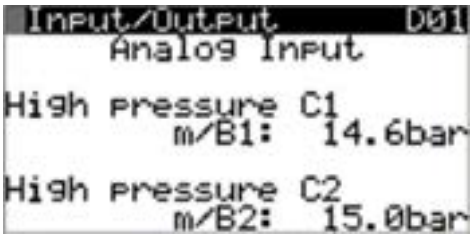


Figure 38: Analogue inputs (water temperature probes, pressure transducers)

Digital inputs (alarms, releases)

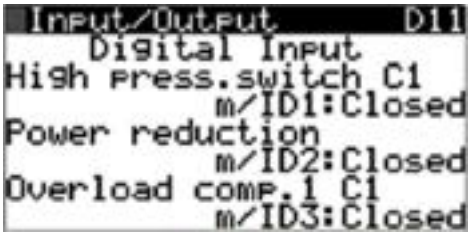


Figure 39: Digital inputs (alarms, releases)

Digital outputs (switching on units)

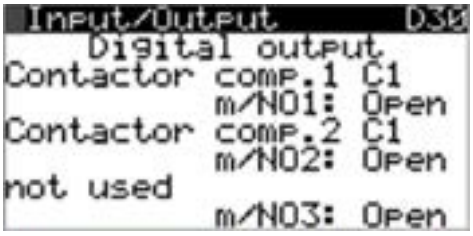


Figure 40: Digital outputs (switching on units)

Analogue outputs (modulation liquefaction)

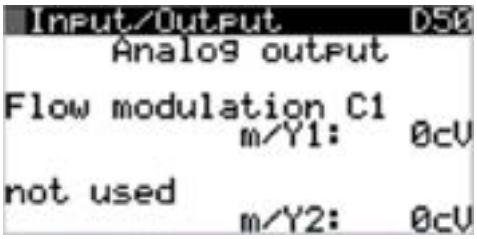


Figure 41: Analogue outputs (modulation liquefaction)

11.5.9. Data memory menu

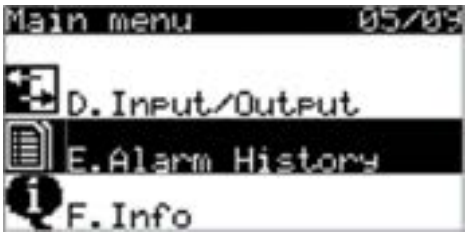


Figure 42: Menu Data memory

In the data memory menu you can view the information related to the machine status at the time the alarms occurred. Note: this menu can only be accessed if at least one alarm has occurred on the unit. The main mask shows the description of the triggered alarm, date/time of the alarm and the status in which the unit is. The UP and DOWN keys can be used to scroll through previous alarms.

Figure 43: Alarm history

Press the ENTER key to display the details of the displayed alarm

.

Use the UP and DOWN keys to scroll through the detail views.

Figure 44: Detailed views of the UP and DOWN buttons

11.5.10. Info menu

Figure 45: Main menu

In the Info menu it is possible to view the main information related to the software version and the type of card installed.

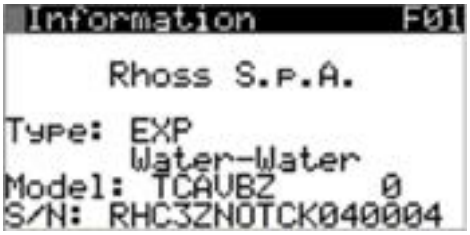


Figure 46: Info menu – Air-Water

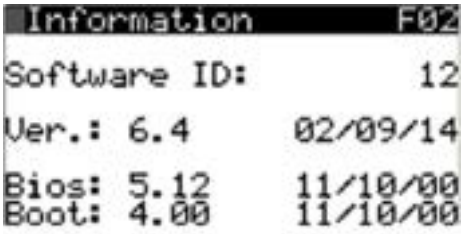


Figure 47: Software

General description of the hardware and software of the unit

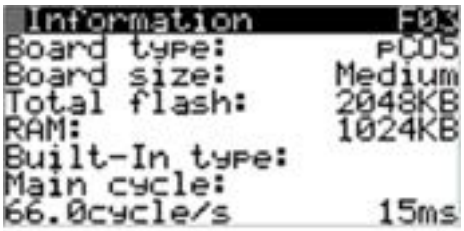


Figure 48: Mask configuration

General description of the machine configuration

11.5.11. Menu language selection

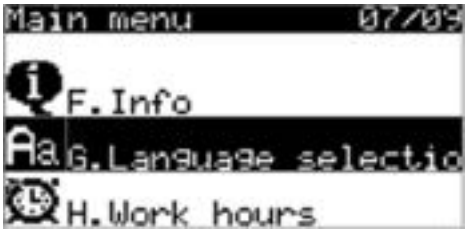


Figure 49: Language selection

The language used in all software masks can be selected in the Language change menu.

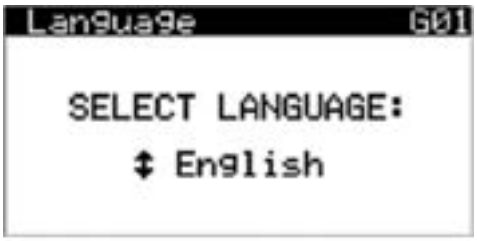


Figure 50: Arrow key UP and DOWN

Select the desired language with the UP and DOWN arrow keys, then press ESC to exit.

11.5.12. Operating hours menu

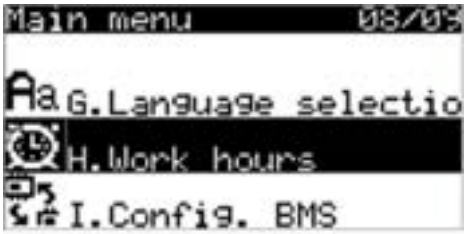


Figure 51: Operating hours

In the operating hours menu, it is possible to display the total hours worked and the number of compressor starts for each compressor.

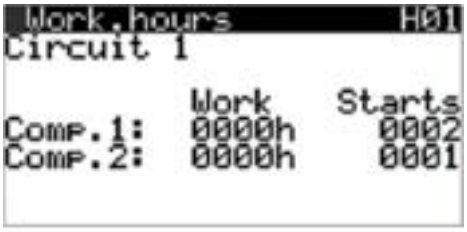


Figure 52: Compressor operating hours

Compressor operating hours

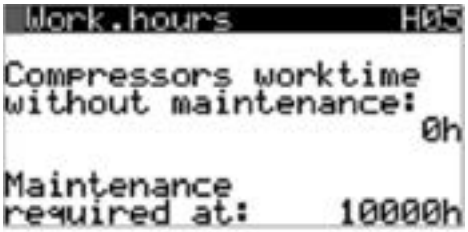


Figure 53: Hour counter

Operating hours from the last maintenance and limit value of the operating hours for the request of maintenance

When a compressor exceeds the maximum threshold of operating hours, a non-blocking alarm request for maintenance is generated, which can only be reset when maintenance has been performed by a technical customer service team member of KKT .

11.5.13. Config. menu GLT

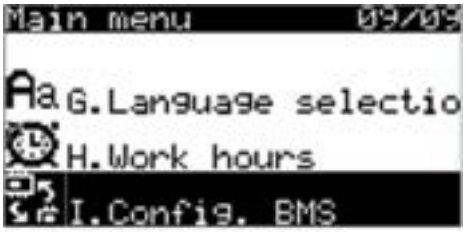


Figure 54: Configuration GLT

In the GLT configuration menu, all settings relating to a supervisor possibly connected to the unit can be set to control operation.

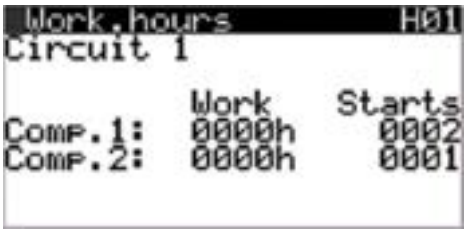


Figure 55: Configuration GLT I01a

1	Support type:
	NONE (Monitoring system by the customer. The machine is monitored, but the supervisor cannot be on or off)
	SUPERV.GENERICO (Monitoring system by the customer. The machine can be monitored and the supervisor can be on / off)
	(SIR - integrated step switch)
2	Action to be taken in case of disconnection of monitoring/timer switching **KRAFT OFF (the unit turns off)** **KRAFT ON (the unit excludes monitoring and observes only the setting on the display)** **NONE (the unit ignores the disconnection and continues with the last received control command)**
3	Activates conversion in case of LonWorks® communication (can only be activated with KFTT10 board)
4	Activates the conversion in case of Bacnet® communication (to be activated only with board KBE and KBM)
5	Selection of the list of variables to be displayed in monitoring **Note:** Set for SIR table #1

Setting of the BMS port of the MASTER card

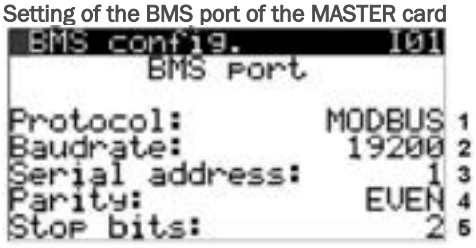


Figure 56: Setting of the BMS port

Setting of the Fieldbus port of the MASTER card

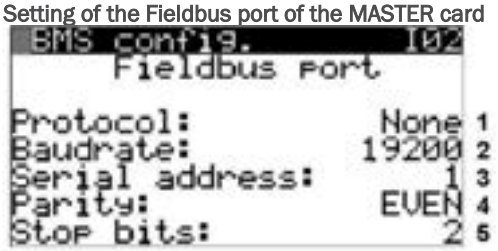


Figure 57: Setting of the Fieldbus port

Setting of the BMS2 port of the MASTER card

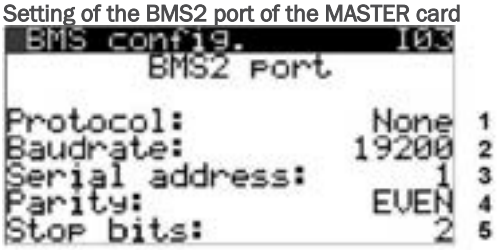


Figure 58: Setting of the BMS2 port

Setting of the BMS port of the SLAVE card

Figure 59: Setting of the BMS port

Setting of the Fieldbus port of the SLAVE card

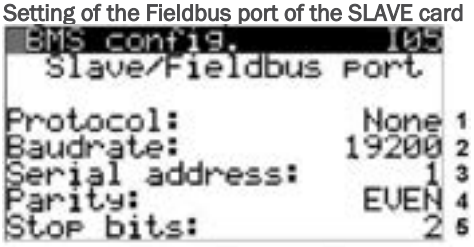


Figure 60: Setting of the Fieldbus port

1	None / RHOSS / MODBUS / WINLOAD / MODBUS EXT
2	1200 / 2400 / 4800 / 9600 / 19200
3	1÷207
4	NONE / EVEN / ODD
5	1 / 2

11.6. Alarm display

IMPORTANT !	
	**Always check the origin of the alarms displayed by the unit. Do not use the unit until the cause of the alarm has been found and eliminated.**

☐ In the event of a malfunction, the corresponding LED switches on the ALARM button is red and a beep sounds.

The alarms are visualised with the following logic:

There are active alarms that have not yet been viewed	Acoustic signal + flashing LeED display
There are active alarms that have already been viewed	Permanently on LED display
There are old alarms that have not yet been viewed	Flashing LED display

The detection of an alarm can lead to an automatic shutdown of the unit.
To display the mask indicating the type of alarm that has occurred, press the ALARM button once.

The alarms behave according to the following logic:

Severe machine alarms	are blocking the machine
Severe machine alarms or circuit alarms	are blocking the circuit
Severe alarms of the machine or the circuit or the compressor	blocking the compressor
Severe machine or circuit alarms or other alarms	switch on the LED indicator on the display

The display will then show one or more of the following screen pages:

Figure 61: Alarm display

Type of alarms:

ALXxx	Alarms Non-connection control cards
ALBxx	Alarms Sensor faulty/not connected
ALCxx	Alarms blocking the circuit/compressor
ALUxx	Alarms blocking the unit
ALDxx	Alarms Drive electronic thermostatic valve
ALVxx	Notes
ALGxx	Other general alarms

Type of alarms:

c	The alarm is automatically reset when the alarm conditions disappear
SEMIAUTO	The alarm is automatically reset for a maximum number of times per hour and per day
MAN	To reset the alarm, the user must intervene
SVC	Alarm and reset by installer. Only carried out in the Service menu

To reset a semi-automatic alarm that has already reached the maximum number of reset attempts, or a manual alarm, press and hold the ALARM button for 5 seconds.

Code	Description	Reset	Action
ALB01	High pressure probe circuit 1 damaged or disconnected	AUTO	Circuit.1 OFF
ALB02	High pressure probe circuit 2 damaged or disconnected	AUTO	Circuit.2 OFF
ALB03	High pressure probe circuit 3 damaged or disconnected	AUTO	Circuit.3 OFF
ALB05	Low pressure probe circuit 1 damaged or disconnected	AUTO	Circuit.1 OFF
ALB06	Low pressure probe circuit 2 damaged or disconnected	AUTO	Circuit.2 OFF
ALB07	Low pressure probe circuit 3 damaged or disconnected	AUTO	Circuit.3 OFF
ALB09	Temperature sensor input primary circuit* damaged or disconnected	AUTO	Primary circuit OFF
ALB10	Temperature sensor output primary circuit* damaged or disconnected	AUTO	Primary circuit OFF
ALB11	Temperature sensor input arrester** damaged or disconnected	AUTO	Unit OFF
ALB12	Temperature sensor output arrester** damaged or disconnected	AUTO	Unit OFF
ALB13	Temperature sensor input recovery damaged or disconnected	AUTO	Recovery OFF
ALB14	Temperature sensor output recovery damaged or disconnected	AUTO	Recovery OFF
ALB17	Outdoor temperature sensor damaged or disconnected	AUTO	Deact. functions
ALB18	Setpoint analogue damaged or disconnected	AUTO	Deact. functions
ALB20	Differential pressure sensor primary circuit damaged or disconnected	AUTO	Primary circuit OFF
ALB21	Temperature sensor input DS damaged or disconnected	AUTO	DS OFF
ALB22	Sensor input storage tank damaged or disconnected	AUTO	Unit OFF
ALB23	Level sensor liquid of flooded heat exchanger circuit 1 defective or not connected	AUTO	Circuit.1 OFF

ALB24	Level sensor liquid of flooded heat exchanger circuit 2 defective or not connected	AUTO	Circuit.2 OFF
ALB25	Power demand sensor defective or disconnected	AUTO	Unit OFF
ALB26	Temperature sensor system damaged or disconnected	AUTO	Deact. functions
ALB27	Pressure sensor system damaged or disconnected	AUTO	Deact. functions
ALB28	Discharge temperature sensor circuit 1 defective or not connected	AUTO	Circuit.1 OFF
ALB29	Discharge temperature sensor circuit 2 defective or not connected	AUTO	Circuit.2 OFF
ALB30	Temperature sensor regenerative recovery circuit 1 defective or not connected	AUTO	Circuit.1 OFF
ALB31	Temperature sensor regenerative recovery circuit 2 defective or not connected	AUTO	Circuit.2 OFF
ALC01	Note: Compressor maintenance N Circuit M	SVC	Comp.N/M OFF
ALC02	Compressor overload protection N Circuit M	MAN	Comp.N/M OFF
ALC03	Compressor N circuit M offline	AUTO	Comp.N/M OFF
ALC04	Circuit N Low pressure of pressure switch	SEMIAUTO	Circuit.N OFF
ALC05	Circuit N Low pressure of transmitter	SEMIAUTO	Circuit.N OFF
ALC06	Circuit N High pressure from pressure switch	MAN	Circuit.N OFF
ALC07	Circuit N High pressure of transmitter	SEMIAUTO	Circuit.N OFF
ALC09	Differential pressure switch oil circuit N	MAN	Circuit.N OFF
ALC10	Low pressure relationship HP/LP	SEMIAUTO	Circuit.N OFF
ALC11	LowSH circuit N	SEMIAUTO	Circuit.N OFF
ALC12	LOP circuit N	SEMIAUTO	Circuit.N OFF
ALC13	MOP circuit N	SEMIAUTO	Circuit.N OFF
ALC14	Low suction temperature circuit N	AUTO	Circuit.N OFF
ALC15	Autotune circuit N	AUTO	Circuit.N OFF
ALC16	Alarm compressor Turbocor 1 circuit 1	AUTO	Comp. Off
ALC17	Alarm compressor Turbocor 2 circuit 1	AUTO	Comp. Off
ALC18	Alarm compressor Turbocor 1 circuit 2	AUTO	Comp. Off
ALC19	Alarm compressor Turbocor 2 circuit 2	AUTO	Comp. Off
ALC20	Low condensing pressure	SEMIAUTO	Circuit.N OFF
ALC21	Allgemeiner Alarm EEV Freecooling	AUTO	Freecooling OFF

ALC22	Low liquid level circuit N	AUTO	Circuit.N OFF
ALC23	High level liquid circuit N	AUTO	Circuit.N OFF
ALC24	Overload protection fans circuit N	MAN	Circuit.N OFF
ALC25	Low superheat outlet circuit N	AUTO	Circuit.N OFF
ALD01	Driver EVD Master sensor broken or not connected	AUTO	Circ.master OFF
ALD02	Driver EVD Master incomplete closing	AUTO	Circ.master OFF
ALD03	Close Driver EVD master emergency	AUTO	Circ.master OFF
ALD06	Driver EVD Master Alarm EEPROM	AUTO	Circ.master OFF
ALD07	Driver EVD master engine malfunction	AUTO	Circ.master OFF
ALD08	Driver EVD Master offline	AUTO	Circ.master OFF
ALD10	Driver EVD master battery faulty	AUTO	Circ.master OFF
ALD12	Driver EVD Slave sensor broken or not connected	AUTO	Circ.slave OFF
ALD13	Driver EVD slave closes incompletely	AUTO	Circ.slave OFF
ALD14	Driver EVD slave emergency close	AUTO	Circ.slave OFF
ALD17	Driver EVD slave alarm EEPROM	AUTO	Circ.slave OFF
ALD18	Driver EVD slave motor fault	AUTO	Circ.slave OFF
ALD19	Driver EVD slave offline	AUTO	Circ.slave OFF
ALD21	Driver EVD slave battery defective	AUTO	Circ.slave OFF
ALD22	Driver EVD2 master not complete closing	AUTO	Circ.master OFF
ALD23	Driver EVD2 master emergency	AUTO	Circ.master OFF
ALD26	Driver EVD2 Master Alarm EEPROM	AUTO	Circ.master OFF
ALD27	Driver EVD2 master engine fault	AUTO	Circ.master OFF
ALD28	Driver EVD2 master offline	AUTO	Circ.master OFF
ALD29	Driver EVD2 master battery defective	AUTO	Circ.master OFF
ALD32	Driver EVD2 slave not complete closing	AUTO	Circ.slave OFF
ALD33	Closing of EVD2 driver slave	AUTO	Circ.slave OFF

ALD36	Driver EVD2 slave EEPROM alarm	AUTO	Circ.slave OFF
ALD37	Driver EVD2 slave motor fault	AUTO	Circ.slave OFF
ALD38	Driver EVD2 slave offline	AUTO	Circ.slave OFF
ALD39	Driver EVD2 slave battery defective	AUTO	Circ.slave OFF
ALG01	Clock card not	MAN	Unit OFF
ALG02	Extended memory failed	MAN	Unit OFF
ALU02	Note: Lack of flow primary circuit with pump 1	AUTO	Primary circuit OFF
ALU03	Note: Lack of flow primary circuit with pump 2	AUTO	Primary circuit OFF
ALU04	Lack of flow primary circuit with pump 1	MAN	Primary circuit OFF
ALU05	Lack of flow primary circuit with pump 2	MAN	Primary circuit OFF
ALU06	Note: Lack of flow arrester with pump 1	AUTO	Unit OFF
ALU07	Note: Lack of flow arrester with pump 2	AUTO	Unit OFF
ALU08	Lack of flow arrester with pump 1	MAN	Unit OFF
ALU09	Lack of flow arrester with pump 2	MAN	Unit OFF
ALU10	Note: Lack of flow recovery with pump 1	AUTO	Recovery OFF
ALU11	Note: Lack of flow recovery with pump 2	AUTO	Recovery OFF
ALU12	Lack of flow recovery with pump 1	MAN	Recovery OFF
ALU13	Lack of flow recovery with pump 2	MAN	Recovery OFF
ALU14	Severe alarm from digital input	MAN	Unit OFF
ALU15	Alarm wrong phase sequence	MAN	Unit OFF
ALU16	Water temperature primary circuit below limit value for operation	SEMIAUTO	Primary circuit OFF
ALU17	Water temperature recovery below limit value for operation	SEMIAUTO	Recovery OFF
ALU18	Water temperature arrester below limit value for operation	SEMIAUTO	Unit OFF
ALU19	Additional heating resistors recovery activated	AUTO	
ALU20	Alarm for low outdoor temperature	AUTO	Unit OFF
ALU21	Alarm for anti-freeze mixture primary circuit	SEMIAUTO	Primary circuit OFF
ALU22	Alarm for anti-freeze mixture arrester	SEMIAUTO	Unit OFF
ALU23	Alarm for anti-freeze mixture recovery	SEMIAUTO	Recovery OFF
ALU24	Water temperature desuperheater below limit value for operation	MAN	DS OFF
ALU25	Alarm anti-freeze desuperheater	SEMIAUTO	DS OFF
ALU26	Note: Lack of air flow secondary circuit	AUTO	Unit OFF
ALU27	Lack of air flow secondary circuit	MAN	Unit OFF
ALU28	Overload protection pump secondary circuit	MAN	Unit OFF
ALU29	Water temperature primary circuit above limit value for operation	SEMIAUTO	Primary circuit OFF
ALU30	Water temperature arrester above limit value for operation	SEMIAUTO	Unit OFF

ALU31	Detected refrigerant gas leak	AUTO	Setting mask
ALU32	Inverter pump primary circuit alarm	AUTO	Unit OFF
ALX01	Slave circuit board disconnected	AUTO	Unit OFF
ALX02	pCOe 1 offline	AUTO	Unit OFF
ALX03	pCOe 2 offline	AUTO	Unit OFF
ALX04	Energy Meter offline	AUTO	Deact. functions
ALX06	N-unit offline	AUTO	
ALX07	Inverter pump primary circuit offline	AUTO	Unit OFF

*	if HPH: Evaporator
**	if HPH: Condenser

11.6.1. Alarms menu

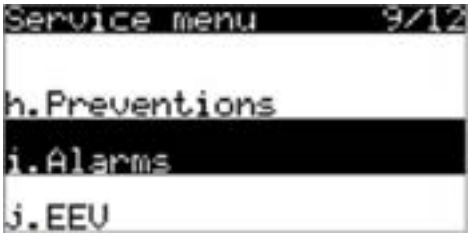


Figure 62: Alarms menu

In the Alarms menu, it is possible to modify the parameters relating to the limit values of the machine operating conditions above which the compressors are forced to switch off. The alarms cannot disappear until the conditions that triggered them are no longer present. As described in section I.1, the alarms can be reset automatically when the conditions return, manually by long pressing the alarm button or semi-automatically. In this case, it is possible to set a maximum number of automatic upgrades that can be performed in a time window of 60 minutes and for some 24 hours. This ensures that the unit can be automatically restarted after some alarm situations, but they cannot occur in this way frequently, in order to jeopardize the long-term reliability.I.4

11.6.1.1. Low pressure alarm

The low pressure alarm of the converter has no fixed threshold in cooling mode, which is variable due to the output temperature from the primary heat exchanger. The colder the water, the lower the alarm threshold. The alarm threshold is calculated on a straight line defined by 2 values: the first point is given by the alarm threshold when the temperature is -8°C; the second point is given by the alarm threshold when the temperature is +7°C. The threshold is set upwards to the value calculated at +15 °C and downward to the value calculated at -10 °C.

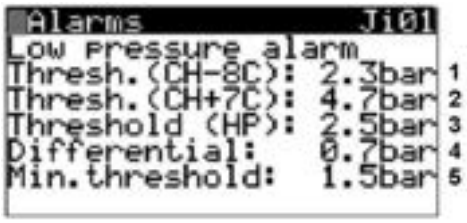


Figure 63: Low pressure alarm threshold

1	Threshold low pressure alarm with circuit in cooling mode and temperature output primary circuit equal to -8 °C
2	Threshold low pressure alarm with circuit in cooling mode and temperature output primary circuit equal to 7 °C
4	Difference for resetting the alarm
5	Threshold immediate intervention

In mask Ji02, depending on the operating mode of the unit, it is possible to set the bypass of the low pressure transmitter alarm.

Figure 64: Low pressure alarm bypass

1	Bypass of the low pressure alarm after a cycle change
3	Alarm bypass in relation to circuit activation
4	Alarm bypass during operation
5	Alarm reset delay

In the Ji03 mask, the possible number of resets for the low pressure alarm from the transducer can be set for the cooling mode. However, the low pressure alarm from the pressure switch must be reset manually.

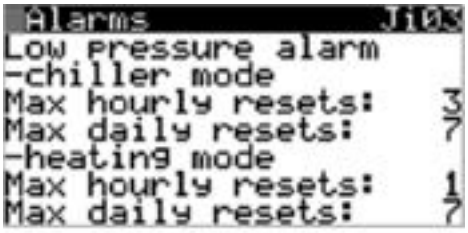


Figure 65: Low pressure alarm reset

The following graph shows the progression of the low pressure (LP) alarm threshold in cooling and the progression of the LP prevention threshold. Reference is made to the points set in the example mask on the Cartesian plane.

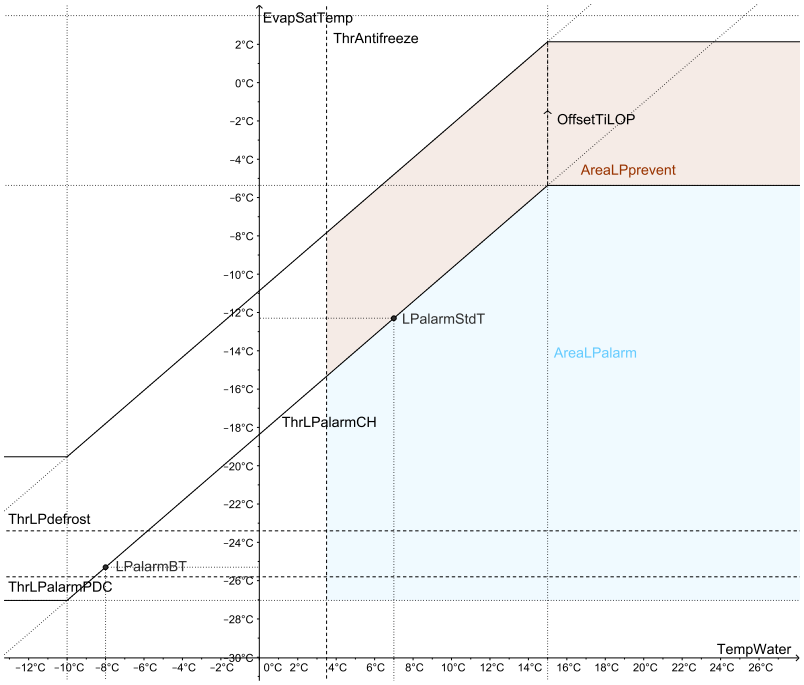


Figure 66: Low pressure alarm

ThrLPalarmCH	Low pressure alarm threshold in cooling [°C]
AreaLPprevent	Low pressure prevention intervention range in cooling mode
AreaLPalarm	Low pressure alarm and prevention intervention range
LPalarmStdT	Low pressure alarm threshold at +7 °C
LPalarmBT	Low pressure alarm threshold at -8 °C

OffsetTiLOP	Differential for the calculation of the low pressure threshold
WaterTemp	Water temperature [°C]
EvapSatTemp	Saturated evaporating temperature [°C]

11.6.1.2. High pressure alarm

In mask Ji04 you can set the threshold that determines the high pressure alarm of the converter (which is triggered without delay), as well as the number of automatic resets allowed. The high pressure alarm from the pressure switch, on the other hand, must be reset manually, and apart from pressing the alarm button for a longer time, it is necessary to manually unlock the mechanical pressure switch.

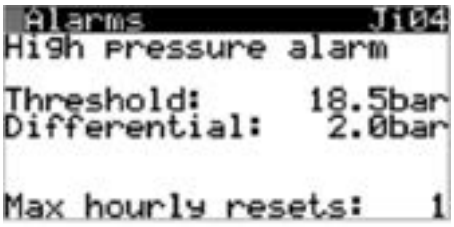


Figure 67: High pressure alarm threshold

11.6.1.3. LOP alarm (operational low pressure)

The LOP alarm does not have a fixed threshold, this is variable due to the output temperature from the primary heat exchanger. The colder the water, the higher the alarm threshold. The alarm threshold is calculated on a straight line defined by 2 values: The first point is given by the frost protection threshold minus a first offset, which can be set as a parameter for the temperature at which the frost protection threshold is fixed; the second point is defined by the frost protection threshold minus a second offset, which can be set as a parameter for the temperature at which the frost protection threshold is +10 °C. The bypass of the LOP alarm is variable depending on the condensing temperature of the refrigerant. The lower the temperature, the lower the alarm bypass. At the alarm threshold, the bypass assumes the largest value; at the alarm threshold minus a differential, the bypass assumes the smallest value. At intermediate points, the bypass varies linearly.

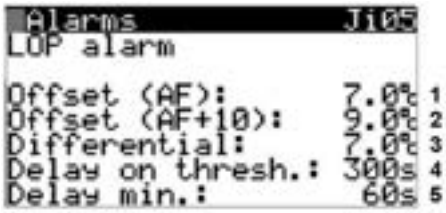


Figure 68: LOP alarm

1	Offset from the frost protection threshold when the water temperature is equal to the frost protection threshold
2	Offset from the frost protection threshold when the water temperature is equal to the frost protection threshold + 10°C
3	Differential for alarm bypass calculation
4	Alarm bypass applied to the threshold
5	Alarm bypass applied to the threshold - differential

The following graph shows the progression of the alarm threshold for low pressure (LP), LOP alarm and LP and LOP prevention. Reference is made to the points set in the example mask on the Cartesian plane.

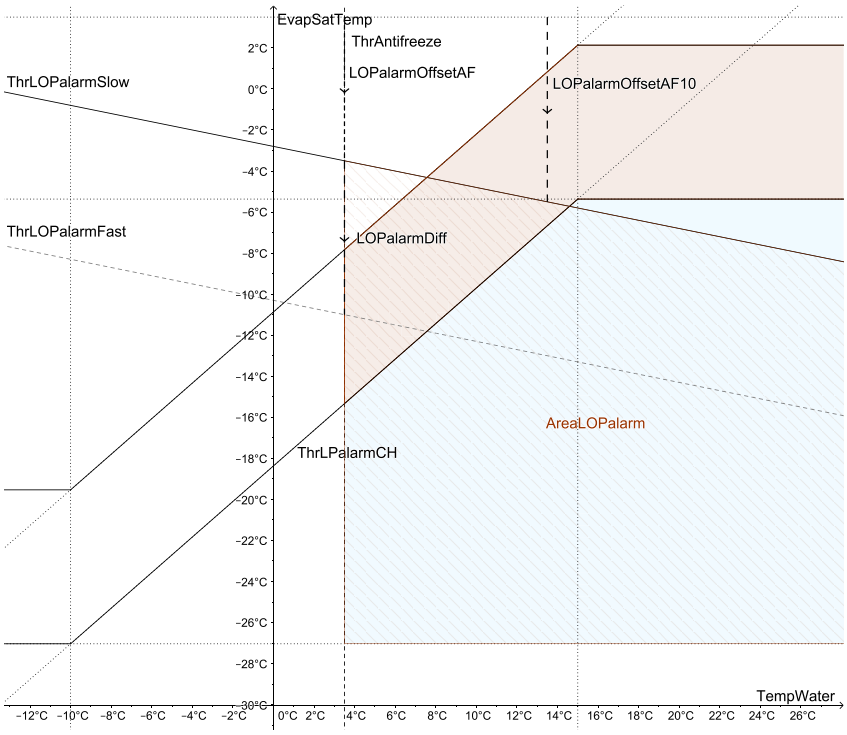


Figure 69: Low pressure alarm

ThrLOPalarmSlow	Threshold alarm and prevention LOP [°C] - acts on the threshold delay
ThrLOPalarmFast	Threshold alarm and prevention LOP [°C] - acts on the delay of the minimum value
AreaLOPalarm	Alarm and prevention LOP intervention range
ThrAntifreeze	Frost protection threshold [°C]
LOPalarmOffsetAF	Alarm LOP - offset (AF)
LOPalarmOffsetAF10	Alarm LOP - offset (AF+10)
LOPalarmDiff	Alarm LOP - Differential
WaterTemp	Water temperature [°C]
EvapSatTemp	Saturated evaporating temperature [°C]

11.6.1.4. Alarm for anti-freeze mixture

For each heat exchanger, the output temperature threshold below which the alarm is generated can be set. The electrical resistance, which prevents the formation of ice on the heat exchanger, is activated when the compressors are switched off on the basis of the setpoint, before the alarm threshold is reached. The following can be selected if together with the resistor it is necessary to activate the pump, whether it is off or not.

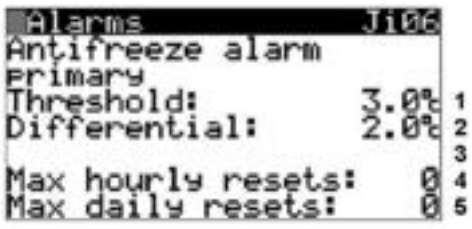


Figure 70: Antifreeze alarm primary

1	Antifreeze alarm threshold
2	Differential reset
3	Frost protection threshold with active cold setpoint2 (only with DSP option)
4	Number of times in an hour for which the alarm is reset. After this number the reset becomes manual.
5	Number of times in a day for which the alarm is reset. After this number the reset becomes manual.

Figure 71: Antifreeze heater primary

1	Difference from the frost protection threshold for the activation of the resistor
2	Difference for shutdown
3	Activates starting the pump when the resistor is active

With the parameters given in the example masks, the electrical resistor is activated together with the circulation pump at 4 °C, then the antifreeze mixture alarm is triggered at 3 °C.

Figure 72: Antifreeze example parameters

Figure 73: Antifreeze example masks

11.6.1.5. Cold/hot water alarm

In order to use the machine with respect to the operating ranges of the compressors, the water supplied to the unit must not have too high temperatures (in cooling mode).

If these limits for water are not respected, the unit may go into alarm mode (usually low evaporating pressure or high/low condensing pressure). If such alarms occur while the leaking water is not within the set limits, a message will appear on the display and the alarm "Water temperature outside operating limits" will be added to the alarm log

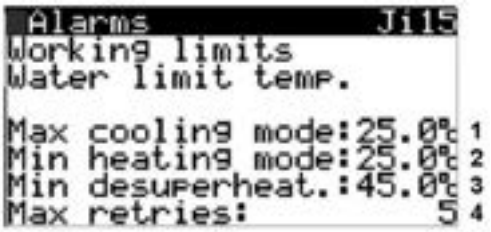


Figure 74: Cold/hot water alarm

1	Water temperature of the primary heat exchanger / disposer / recovery, above which a blockage alarm in cooling also triggers a hot water alarm.
4	Number of times in an hour for which the alarm is reset. After this number the reset becomes manual.

11.6.1.6. Low pressure value relationship

In the Ji18 and Ji19 masks it is possible to activate the low pressure ratio alarm and also set the parameters for the trigger threshold, intervention bypass and the number of allowed automatic resets per hour and per day.

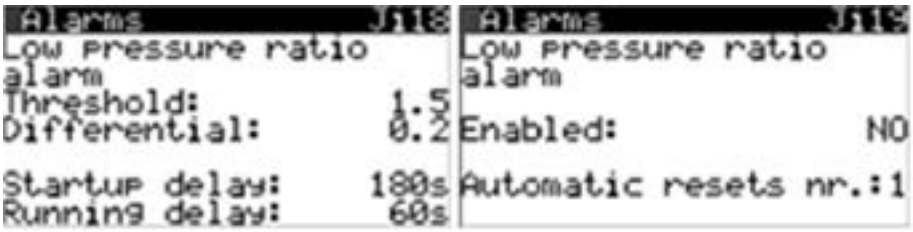


Figure 75: Low pressure ratio alarm

11.6.1.7. Low condensing pressure alarm

In the masks Ji20 and Ji21, the condensing low pressure alarm can be activated and the parameters for the trip threshold, the intervention bypass and the number of automatic resets allowed per hour and per day can also be set.

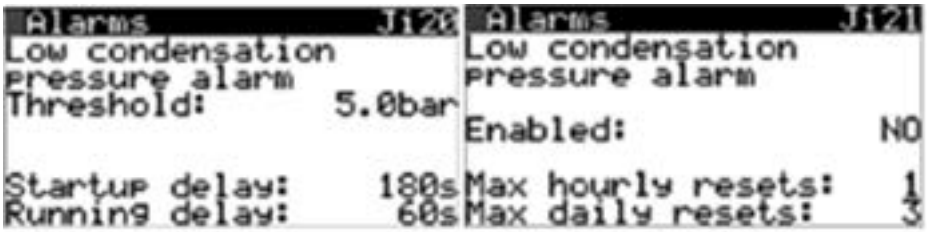


Figure 76: Low condensing pressure alarm

11.6.1.8. Alarm outdoor temperature below the limit

The outdoor environment must not be too cold in order to maintain the operating range of the compressors of the water-air units.

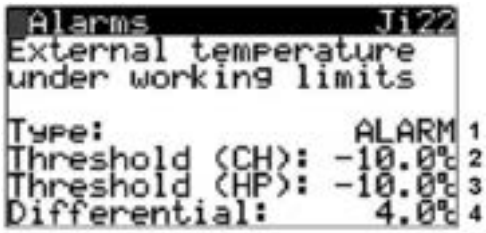


Figure 77: Low outdoor temperature alarm

1	Selection of the action to be performed when the outdoor air temperature falls below the set threshold: - DISABLED: no action - ALARM: Unit switched off due to an alarm - UNIT OFF: Unit off - OFF + PUMP ON: Unit off and pump on
2	Minimum outdoor air temperature threshold in cooling mode
4	Differential reset

11.6.1.9. Phase sequence alarm

Phase monitoring cuts off power to unit components when phases are interchanged to prevent compressors and fans from rotating in the wrong direction. Can be automatically reset for a maximum number of times per hour.

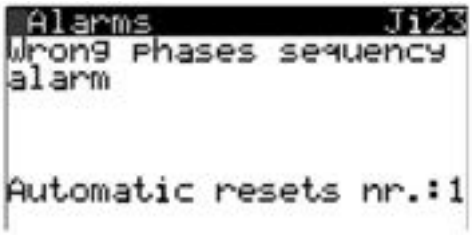


Figure 78: Phase sequence alarm

11.6.1.10. Level alarm

In the Ji26 and 27 screens it is possible to activate the level alarm and set the parameters relative to the intervention thresholds, the intervention bypasses and the number of automatic reset times.

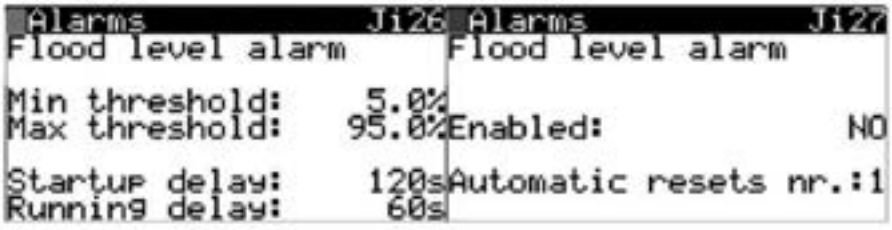


Figure 79: Level alarm

11.6.1.11. Alarm offline

In mask Ji28, you can set how long any disconnections or communication problems with the serial devices should be ignored (EVD driver, inverter, EnergyMeter, etc.). The bypass at startup is applied when the circuit board is turned on and is usually longer than the bypass taken into account during operation.

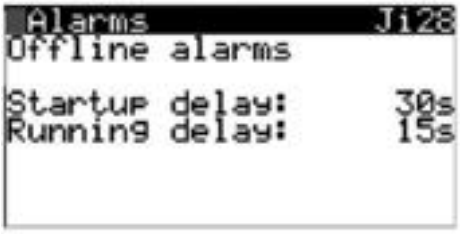


Figure 80: Alarm offline

11.6.1.12. Alarm gas leakage sensor

The Leakage Sensor can be used to detect any coolant leaks in order to take the necessary action. The Leakage Sensor can be set for the following behaviours:

- NO ACTION: The Leakage Sensor opens the contact to detect the coolant, but the electronic board does nothing;
- ALARM ONLY: When the contact is opened by the leakage sensor, the electronic board generates the alarm and blocks all the circuits;
- STOP WITH PUMPDOWN: If the circuits are running in cooling mode when the contact is opened, they are stopped by a pumpdown (period of time when operating with the thermostatic valve closed) to direct the coolant to the registers.
- STOP/RESTART WITH PUMPDOWN: When the contact is opened, the circuits that are on in cooling mode are switched off with the pumpdown procedure.

Figure 81: Alarm gas leakage sensor

1	Action to be performed when a coolant leakage is detected
2	Pressure threshold at which the pumpdown is interrupted and the compressors switch off
3	Time to remain in compressor off mode when the compressors are switched off and then switched on again in cooling mode
4	Minimum operating time of the compressors after which the pumpdown takes place, If the compressors are switched on again due to the change of operating mode with a time equal to 0, the circuit switches on without opening the thermostatic valve.

11.6.1.13. LowSH/LOP/MOP alarm

In masks Ji31 and Ji32, the number of resets per hour and per day can be set for alarms LowSH (low superheat), LOP (low operating pressure) and MOP (high operating pressure). The threshold and delay parameters are included in the menu III.1.10 EEV.

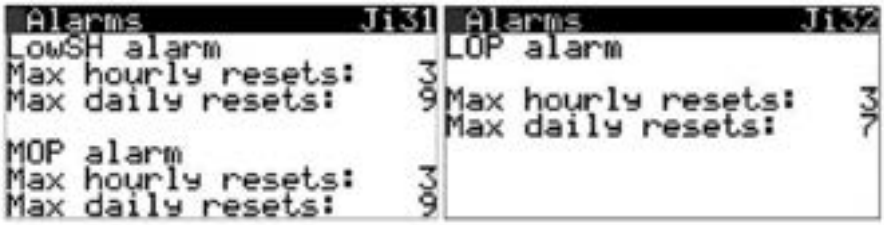


Figure 82: Low SH/LOP/MOP alarm

11.6.1.14. Alarm oil heating duty

If the unit remains off for longer than the time set in screen Ji33, the next time the unit is turned on, a warning will alert you that the oil in the compressor housing must be heated and you must wait the time indicated before the unit can be started. The waiting time is calculated linearly depending on the outside air temperature by 2 points. For temperature values below point 1, the time specified for point 1 applies. For outdoor air temperatures above point 2, the time specified for point 2 applies.

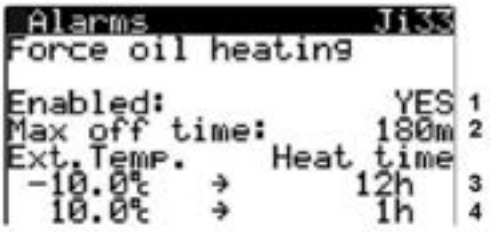


Figure 83: Alarm oil heating duty - screen

1	Activation oil heating duty
2	Time period when the unit is not supplied, after which it is necessary to wait for the oil to heat up
3	Outside temperature and prescribed heating time, defined for point 1
4	Outside temperature and prescribed heating time, defined for point 2

For example, with the parameters defined in the example screen, if the unit remains off for 180 minutes and the board is powered, the following must be waited for based on the outside air temperature:

- 12 hours if the outside air temperature is below -10 ° C;
- 1 hour if the outside air temperature is higher than + 10 ° C;
- A value calculated on the straight line given by these points when the outdoor air temperature is between -10 ° C and + 10 ° C.

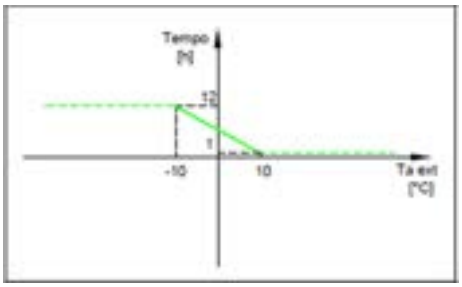


Figure 84: Alarm oil heating duty - diagram

When the function is active, the following warning is displayed, indicating how much time is needed to start the unit

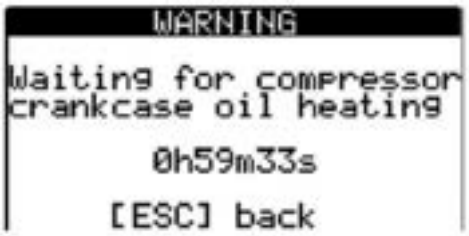


Figure 85: Alarm oil heating duty - timer

11.6.1.15. Alarm relay management

Form Ji36 allows you to select the type of alarms for which the general alarm relay is activated. Based on the following settings, you can select whether the alarm relay should be activated for:

- ANY ALARM - any random alarm
- MINOR ALARMS - alarms that affect the functionality of the machine
- BLOCKING ALARMS - alarms that block machine parts
- MANUAL ALARMS - blocking alarms that must be reset manually

This selection also applies to the general alarm variable displayed during monitoring.

Figure 86: Alarm relay management

11.7. Control of the unit with remote control

11.7.1. Remote control by means of pre-equipment for an automated and centralized control system

The connections between the board and the external switch or luminaire must be made with a shielded cable consisting of two interwoven conductors of 0.5 mm² each and interference protection. Make sure that the shielding covers the entire length of the cable. The shielding must be connected to the grounding strip in the switch cabinet (only on one side). The maximum permissible distance is 30 m. Do not lay the cables near power cables, cables with a different voltage or cables that cause electromagnetic interference. Do not lay the cables near devices that can cause electromagnetic interference.

SCR	Selector switch remote control	(control with potential-free contact)
LBG	Warning light general fault shutdown	potential-free contact
LFC1	Compressor 1 / circuit 1 operating light (as specified in the wiring diagram supplied with the machine);	(230 Vac)
LFC2	Compressor 2 / circuit 2 operating light (as specified in the wiring diagram supplied with the machine);	(230 Vac)
CS	4÷20 mA analogue signal for the adjustment of the floating set point (CS accessory)	

11.7.2. On/Off activation remote control (SCR)

IMPORTANT !

	When the unit is set to OFF by the selector switch of the remote control, the report "OFF from SCR" appears on the display of the machine.

Remove the jumper from the terminals and connect the cables coming from the ON/OFF selector switch of the remote control (selector switch must be installed by the installer).

ATTENTION!	Contact opened:	Unit in OFF
	Contact closed	Unit in ON

11.8. Sequenced unit management

11.8.1. Coordinated management of multiple identical units connected to each other (SIR:step circuit built in)

Up to 4 units of the same model/size can be used, hydraulically connected in parallel and electrically connected to the RS485 serial bus (Note: For this purpose the additional communication card KRS485 is necessary). On a unit with the designation Master and with the serial address = 1, the integrated arrester SIR is activated. This algorithm deals with the analysis of the power demand of the annex and the activation of a sufficient number of machines to satisfy it; it is also used to balance the load among the units and to balance the operating hours among the units and compressors. The other units, labelled slave and having serial addresses = 2, 3 and 4, are set to receive the control commands of the step circuit. If it is not necessary, the corresponding pumps will remain switched off; in case of lack of connection with the master, the units can be set to work separately, ignoring the lack of data exchange.

Diagram of RS485 serial bus connection

DANGER!	
	Before performing any work, make sure that the power supply to the machine has been disconnected.

Each unit is connected to terminal J25 - BMS2.

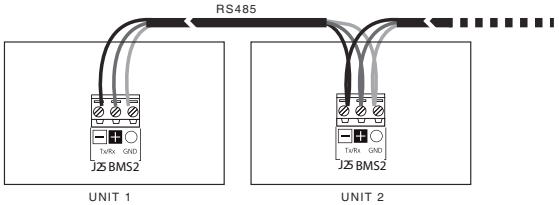


Figure 87: Terminal J25 - - BMS2

For more information on creating the RS-485 network, refer to the RHOSS document "Instructions for creating an RS-485 bus" (document code H58565).

To configure a unit as a master

Call up the Thermoregulation Help menu and access the Jc03 screen.

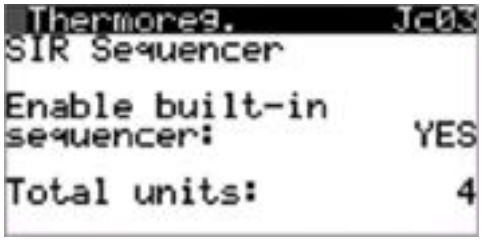


Figure 88: Configuring a unit as a master

Set:

- Activate integrated step switch SIR
- Total Units: Number of units present in the system (up to a maximum of 4).

Call up the BMS Configuration User menu and access the I01a form.

Figure 89: Configuring a unit as a master - BMS Configuration

Set:

- Type: NONE (or SUPERV.GENERICO if there is an external BMS)
- If offline: FORCE OFF / FORCE ON / NO ACTION
- Enable conv.LON: NO / SI, depending on the presence of the optional KFTT10 card
- Enable conv. BAC: NO / YES, depending on the presence of the optional KBE or KBM card
- BMS table: #1

To configure a unit as a slave

Call up the BMS configuration menu and access the I01a form.

Figure 90: Configuring a unit as a slave

Set:

- Type: SIR
- If offline: Select the intervention to be performed when the data exchange with the master is interrupted (FORCE OFF / FORCE ON / NO ACTION)
- Enable conv.LON: NO / SI, depending on the presence of the optional KFTT10 card
- Enable conv. BAC: NO / YES, depending on the presence of the optional KBE or KBM card
- BMS table: #1

Then access the mask I03.

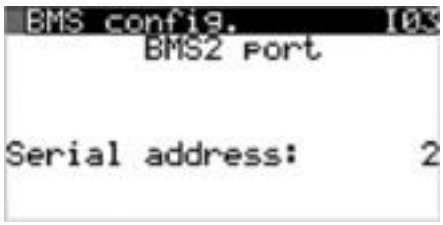


Figure 91: Configuring a unit as a slave - Serial address

Enter the serial address of the slave unit. The first slave unit has address 2, the following ones 3 and 4 (no addresses can be skipped).

Check connection/settings

If the settings and the connections are correct, an overview of the network with the communicating machines is displayed in the M09 screen of the master unit. If a unit is not accessible, it is marked with the "X" symbol.

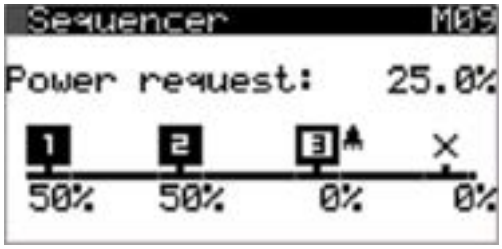


Figure 92: Network overview

Besides, the stylized symbol of a computer appears on the main mask of the slave unit in the top right corner to indicate the correct data exchange with the master.

Figure 93: Data exchange

11.9. Customer Services

IMPORTANT !	
	This menu may only be used by qualified personnel by entering the correct password.

Figure 94: Main Screen

Press the Prg key on the main screen to display the password entry screen and access the screens reserved for the installer.

Figure 95: Restricted access

For the fitter password, please contact your KKT Service.

11.9.1. Menu navigation

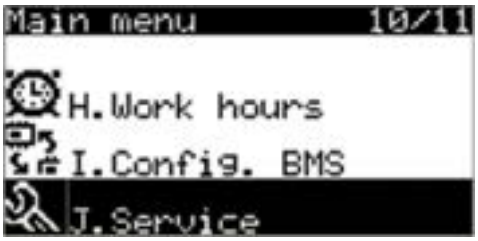


Figure 96: Service menu

In the Service menu, you can change the sensitive parameters that determine the behaviour of the unit and control the functions of the software. The Service menu is divided into submenus. If you press the PRG key, the main menu can be accessed. With the UP and DOWN keys you can select the desired menu and pressing the Enter key takes you to it. To return to the previous menu, press the Esc key.

11.9.1.1. Reset counter menu

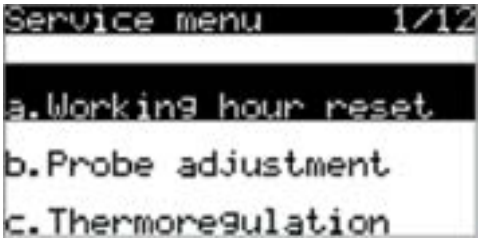


Figure 97: Reset counter menu

In the Reset counter menu, it is possible to modify the counters of the operating hours and starts carried out by each compressor and also to manage the requested maintenance alarm.

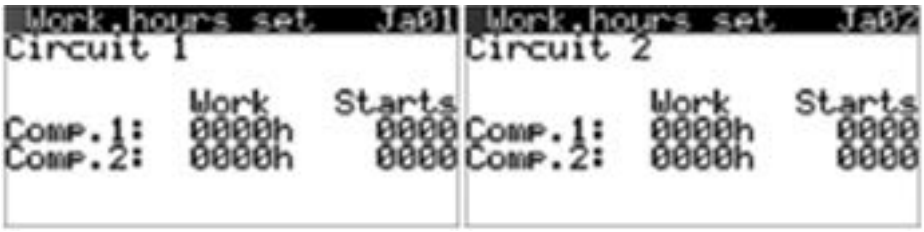


Figure 98: Operating hours overview

In the Ja01 mask as well as the following masks, the total number of operating hours performed by each compressor and the total number of starts can be changed.

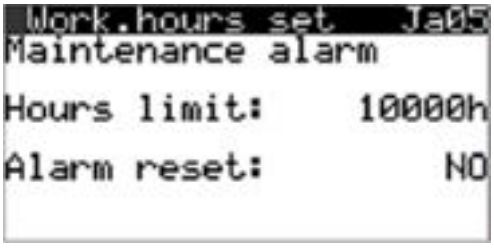


Figure 99: Setting the operating hours

In menu Ja05, it is possible to modify the threshold of operating hours that causes the "Maintenance request" alarm to appear. It is also possible to reset the alarm that has been triggered and to reset the hour counter that causes the alarm.

11.9.1.2. Sensor calibration menu

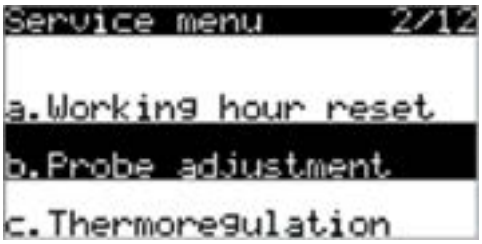


Figure 100: Sensor calibration menu

In the Sensor calibration menu, corrections can be made to the values read by the sensors.

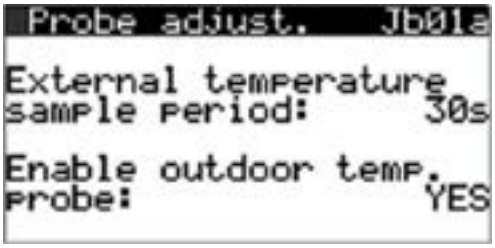


Figure 101: Setting the values

1	Sampling interval for calculating the mean outdoor air temperature (moving average on 10 samples)
2	Activate external air temperature probe

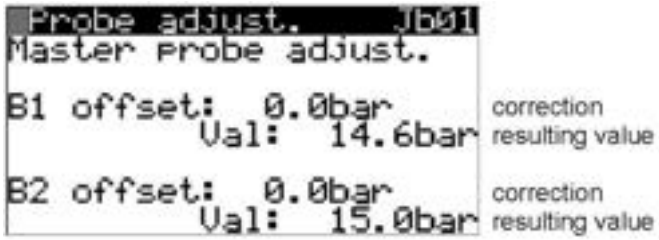


Figure 102: Acquisition correction

In the masks Jb01 and the following masks, the acquisition correction for each individual sensor can be set and the resulting value can be read off

11.9.1.2.1. Control on the return temperature

With the parameters set in the mask, a demand of 100% is generated when the temperature in the return is 4.0 °C higher in relation to the set point, while the demand is equal to 0% when the set point is reached.

Figure 103: Summer regulation

Figure 104: Winter regulation

With the settings in the example masks, a demand of 100% is generated when the temperature in the return is 4.0 °C lower in relation to the setpoint, while the demand is equal to 0% when the setpoint is reached.

11.9.1.2.2. Control at the outlet temperature

If in mask Jc02 the use of the control at the outlet of the primary circuit has been set, the masks Jc13..Jc15 appear. The control of the outlet is based on the time for which the temperature is removed from the setpoint to generate the percentage of the power demand. The further away it is from the setpoint, the faster the action of increasing or decreasing the requirement will be.

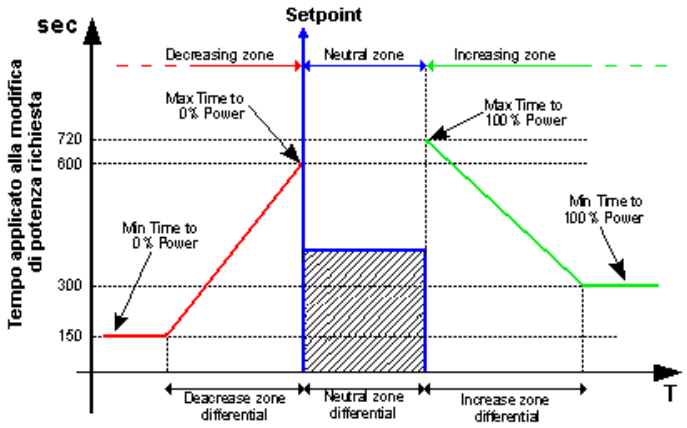


Figure 105: Example of control at the outlet (cooling mode)

Three action zones are established:

- The requirement is not changed in the neutral area
- In the increase zone, the power demand undergoes stepwise increases, the speed of which is determined by the distance from the setpoint.
- In the decrease zone, the power demand is gradually reduced, the speed of which is determined by the distance from the setpoint.

Figure 106: Neutral zone

1	Value of the size of the neutral zone currently used
2	Set value for the size of the neutral range
3	Activation of the automatic change in the size of the neutral range based on the valuation of the system load
4	Activation of the automatic change of the size of the neutral range due to the ΔT exhaust / inlet unit
5	Recorded percentage of ΔT to be used as the minimum value for the size of the neutral range
6	Waiting time for operating conditions after switching on the compressors

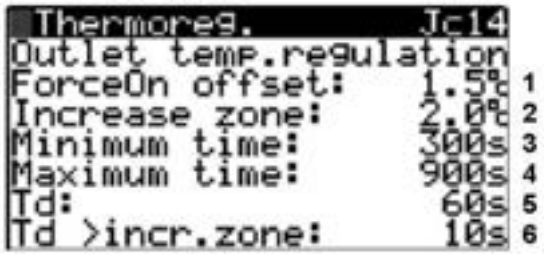


Figure 107: Increase zone

The rate of increase to be used is determined by the position of the temperature and the set minimum and maximum times. To determine the increase time to be used, set the times necessary to increase the power requirement from 0% to 100% when the temperature is at the edge of the neutral zone (maximum time) and when the temperature is outside the increase zone (minimum time).

1	Offset with respect to the beginning of the increase band that leads to switching on a compressor.
2	Size of the increase zone
3	Time required to increase the power requirement from 0 % to 100 % if the temperature is outside the increase zone
4	Time required to increase the power requirement from 0% to 100% when the temperature is at the edge of the neutral range
5	Pause time of the increase when a temperature change in the direction of the setpoint is detected
6	Pause time of the increase when a temperature change in the direction of the setpoint outside the increase area is detected

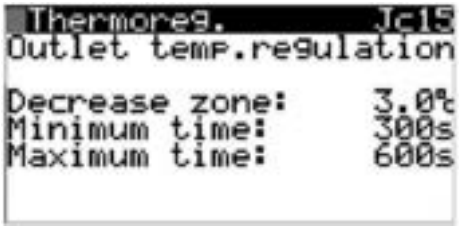


Figure 108: Decrease zone

The parameters for the decrease zone are also set.

1	Size of the decrease zone
2	Time required to reduce the power requirement from 100% to 0% if the temperature is outside the increase zone.
3	Time required to reduce the power requirement from 100% to 0% when the temperature is at the edge of the neutral range

11.9.1.3. Compressor times

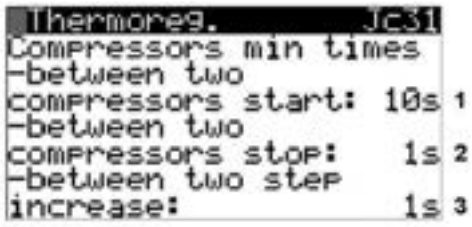


Figure 109: Compressor times

A minimum time interval can be set to avoid switching on and off too brusquely and stressing the electrics.

1	Minimum time between switching on two different compressors
2	Minimum time between switching off two different compressors
3	Minimum time between the request of a step of throttling and the subsequent increase (only for screw compressors)

11.9.1.4. Condensing pressure control

Condensing control is performed by activating the fans and modulating the speed with a signal 0 V – 10 V, following one of the adjustable algorithms.

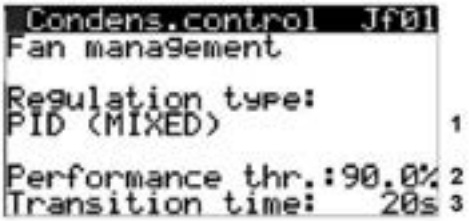


Figure 110: Condensing pressure control

1	Algorithm to be used for condensing pressure control - PROPORTIONAL: The fans follow the pressure value and switch on according to successive thresholds with differential and modulate the analogue signal based on a set point with control range and cut-off for switching off. - PID (PRESSURE): the fans modulate to maintain a set pressure value (points to the cooling capacity) - PID (PRESSURE RELATIONSHIP): The fans modulate to maintain a set value of high pressure / low pressure relationship (pointing to cooling efficiency) - PID (MIXED): The fans modulate as in "PID pressure relationship", but return to "PID pressure" when the requested power exceeds the set percentage.
2	Percentage requested cooling power beyond which in mixed PID to pressure relationship control is switched to pressure control
3	Delay of the PID in the pressure relationship or in case of polynomial control after the start phase of the circuit (at the beginning the control always follows the PID on the pressures)

The following masks Jf02..Jf07 look different depending on the algorithm used

Proportional control

For units with modulating condensation control (FI10), the condensation control is performed by modulating the fan speed with a 0-10V signal based on the condensation pressure. In the units where the fan control is actuated, the fans are switched on sequentially according to the condensation pressure.

Figure 111: Condensation control

1	Hysteresis and differential pressure for ignition step 1
2	Hysteresis and differential pressure for ignition step 2
3	Hysteresis and differential pressure for ignition step 3
4	Hysteresis and differential pressure for ignition step 4

With normal control, the fans switch on at the minimum speed when the pressure exceeds the set point and then accelerate to the maximum control speed when the set difference is exceeded. To avoid excessive noise from the fans, this is the maximum speed at which they can run until a maximum threshold for forcing is exceeded, which then brings them to the maximum possible speed.

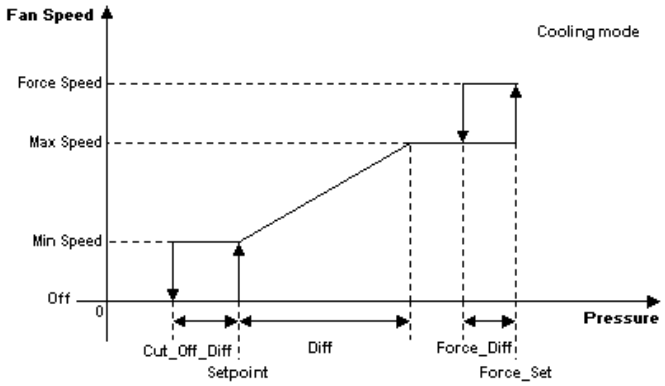


Figure 112: Proportional control

Both the control setpoint and that for forcing have hysteresis for turning off the fans and disabling forcing.

Figure 113: Hysteresis

1	Pressure setpoint for the delivery of the minimum voltage
2	Scope of the control range from minimum speed to maximum speed
3	Cut-off for switching off the modulation

PID control (any type)

With PID control, the fans modulate to maintain the set reference, whether it is a pressure value or a pressure ratio. Switching on is determined on the basis of the single step set in the Jf02-03 mask. Modulation, on the other hand, follows the setpoint set in masks Jf04-05.

In case of PID pressure or mixed, the set point of the pressure relationship is also set, which is used only after the start-up phase, but occurs by following the pressure value. As for the previous algorithm, the parameters for condensing and evaporating control are different, also a parameter set point is available for the production of domestic hot water at high outdoor temperature.

Figure 114: PID control

In the Jf05b mask for condensing control and in the Jf07b mask for evaporating control, pressure setpoints other than the main setpoints used at high and low outdoor air temperature can be set. It is necessary to set four outdoor air temperature points. The set point used varies depending on the outdoor air temperature: Between the first and the second point, the setpoint is calculated by interpolation between the setpoint defined for the lowest and the main temperature and the main temperature defined in mask Jf04. Between the second and the third point, the setpoint used is the main setpoint; between the third and the fourth point, the setpoint is calculated by interpolation between the main setpoint and the one defined for the highest temperature.

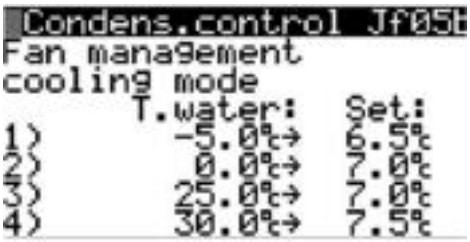


Figure 115: Outdoor air temperature points

In the Jf07c mask it is possible to set the proportional, integral and derivative parameters that determine the reactivity of the PID controller.

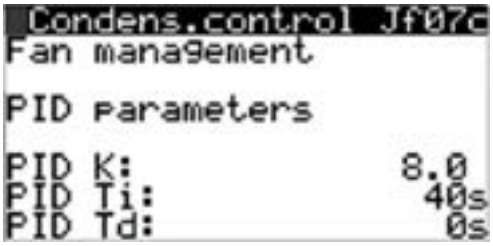


Figure 116: PID parameters

11.9.1.5. Prevention menu

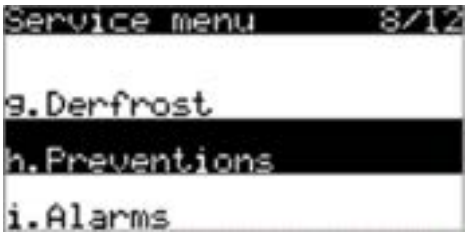


Figure 117: Prevention menu

In the Prevention menu it is possible to modify the parameters of the functions that limit the power delivered to the circuits in order to avoid alarm situations. The prevention measure differs according to the type of compressor present: For units with scroll compressors, prevention reduces by 1 the maximum number of compressors that can be operated in the circuit; For units with screw compressors, the maximum power supplied is limited. For units with inverter compressors or linear screw or Turbocor, the power is gradually limited.

Prevention high pressure

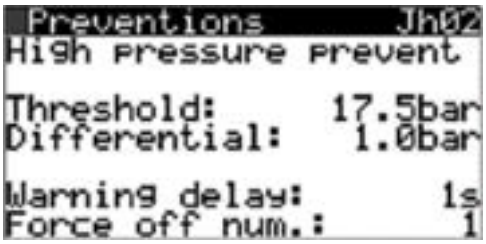


Figure 118: Prevention high pressure

1	High pressure threshold in relation to the threshold above which the performance of the circuit is reduced
2	Difference in relation to exceeding the threshold after which the performance of the circuit is reduced
3	Delay in relation to exceeding the threshold after which the performance of the circuit is reduced
4	Maximum number of forced compressor shutdowns with remaining minimum On time in a timeframe of 60 minutes.

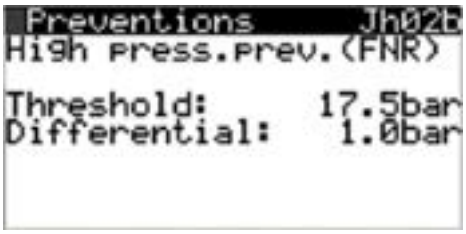


Figure 119: Prevention high pressure (FNR)

During the FNR2 function, the high pressure parameters of the Jh02b mask are used

Prevention low pressure

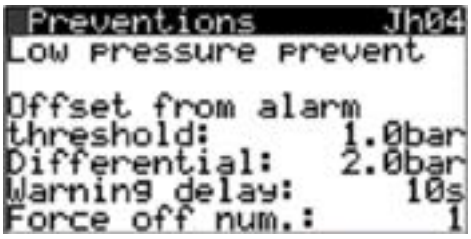


Figure 120: Prevention low pressure

When activated, low pressure prevention behaves in the same way as high pressure prevention by reducing the performance of the circuit when the low pressure drops below the set threshold. Note: It is generally disabled and is replaced in the functions by the negative pressure / LOP protection of the thermostatic valve.

Prevention low pressure/LOP

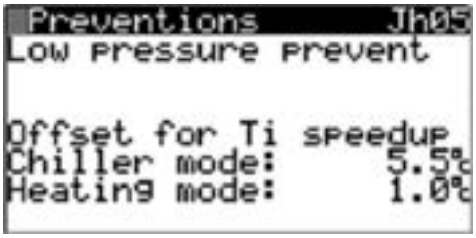


Figure 121: Prevention low pressure/LOP

When enabled, the negative pressure / LOP prevention action of the thermostatic valve consists in changing the value of the integration time applied to the thermostatic valve control. The prevention is carried out below a threshold resulting from the addition of an offset with the alarm limit value for the low pressure. A different offset can be set in the mask, depending on the operating mode of the machine.

Prevention frost protection

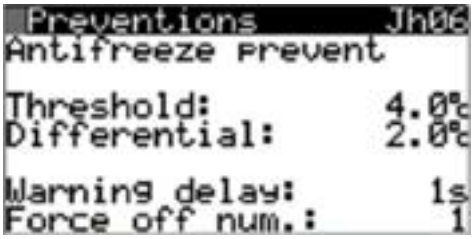


Figure 122: Prevention frost protection

When activated, antifreeze prevention behaves in the same way as for high pressure, reducing the performance of all circuits when the output temperature of the primary circuit drops below the set threshold. Note: Usually deactivated and replaced by the temperature control action in relation to the functions.

Prevention low pressure relationship

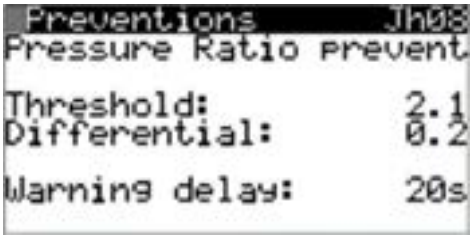


Figure 123: Prevention low pressure relationship

When activated, the low pressure relatonship prevention behaves the same as the high pressure one, reducing the power of all the circuits when the relationship between the high and low pressure values falls below the set threshold.

Prevention low superheat

Figure 124: Prevention low superheat

When enabled, the low superheat prevention (LowSH) operation is extended for the time set in the mask, even if the low superheat conditions are no longer present.

11.9.1.6. EEV menu - Electronic expansion valve

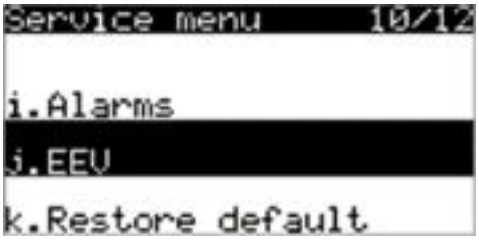


Figure 125: EEV menu

11.9.1.6.1. EEV superheat control

For all units with electronic expansion thermostatic valve, in the EEV menu it is possible to modify the parameters that control the operation of the expansion valve and the related alarms. When the circuit is started, the electronic thermostatic valve opens to a percentage proportional to the power to be switched on and to the EEV ratio parameter described in mask Jj31 before the compressors are activated. The opening obtained in this way is maintained even after switching on (repositioning time), then the valve regulates with a PID algorithm to maintain the set superheat setpoint on the circuit. The valve positions itself on openings with fixed percentages, even after other compressors have been switched on/off.

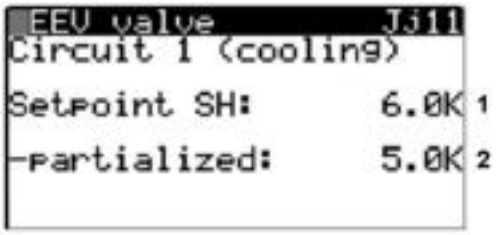


Figure 126: EEV Superheat setpoints

1	Superheat setpoint to be maintained for operation
2	Superheat setpoint to be maintained at a power output of 50 % or less of the total power output

During operation, the EVD driver is instructed to avoid superheating or pressure exceeding the set limits. When one of these thresholds is exceeded, a different integral time is first used on the control PID to make it more responsive, and after a maximum time the alarm is generated. It should be noted that due to the correspondence between pressure and temperature of a gas, the LOP and MOP thresholds are set in °C instead of bar.

In the mask Jj21..Jj24 it is possible to set the alarm thresholds for low superheat (LowSH) and high operating pressure (MOP).

Figure 127: EEV Alarm thresholds

1	Threshold value alarm low superheat (LowSH). When the superheat drops below the set threshold, the integral time of the PID is changed to make it more responsive and after a maximum time the low superheat alarm is generated.
2	High operating pressure alarm threshold (MOP)
3	Bypass of the high operating pressure (MOP) alarm in relation to the activation of the circuit

In mask Jj31.Jj34 the parameter of the percentage of valve opening at start can be set (EVV Ratio). Please note that this parameter is used together with the power percentage to be switched on to determine the opening position of the valve. For example: In a circuit with two compressors and parameters of EEV Ratio equal to 50% and with a valve that regulates from 50 to 480 steps, the first compressor (50% of the capacity of the circuit) switches with an opening equal to [minimum opening] + [50% x 50% = 25% of the operating range]. The percentage of EEV ratio to be used in cooling mode has no fixed value, this is variable due to the output temperature from the heat exchanger primary circuit. The colder the water, the lower the EEV percentage. To obtain this sliding value, the threshold of the EEV ratio is defined when the temperature is equal to -8°C and +7°C; the percentage is then calculated by interpolating the line passing through these two points until the limit of -10°C and +15°C.

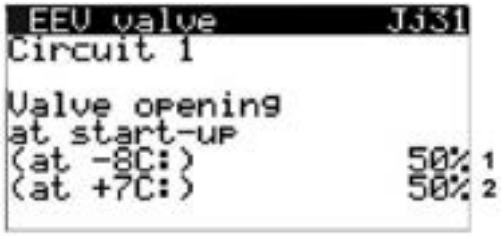


Figure 128: EEV valve opening

In mask Ji41..Jj44 it is possible to set the proportional, the integrative and the derived parameter of the PID algorithm, which regulates the opening of the valve at normal control. To make the valve more responsive, increase the proportional gain and the derivative time or decrease the integral time. To make the valve more stable, the parameters must be changed in the opposite direction.

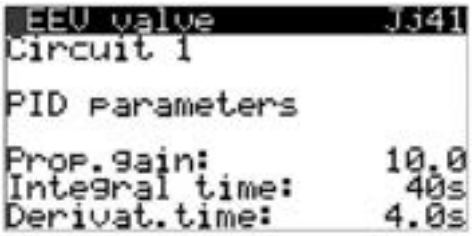


Figure 129: EEV PID parameters

Mask Jj51..Jj54 is used to set the delays related to the persistence of superheating and pressure above the alarm thresholds for generating an alarm.

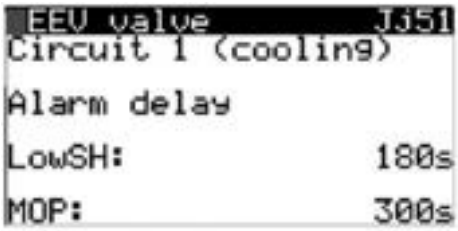


Figure 130: EEV alarm delay

The threshold and the delay of the low suction temperature alarm are set in mask Jj61..Jj64.

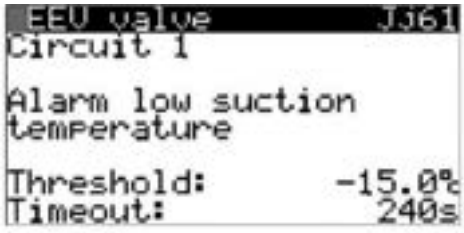


Figure 131: EEV low suction temperature alarm

11.9.1.7. Standard recovery menu

Figure 132: Restore default menu

In the Restore default values menu, all parameters of the Customer service menu can be reset and brought to the original factory values.

Figure 133: Restore all parameters

1	Select YES and confirm with Enter to start the reset.
2	Date Parameter storage (coincides with the date of the first activation of the unit)

11.9.1.8. Manual mode menu

Figure 134: Manual mode menu

In the Manual operation menu, the manual procedures such as de-icing on demand, deactivating compressors and manually changing the status of relay outputs and analogue outputs can be performed. It is recommended not to use these functions too often, but only when absolutely necessary.

The use of some compressors can be activated/deactivated in mask JI02 as well as the following masks. If a compressor is deactivated, its activation is never requested.

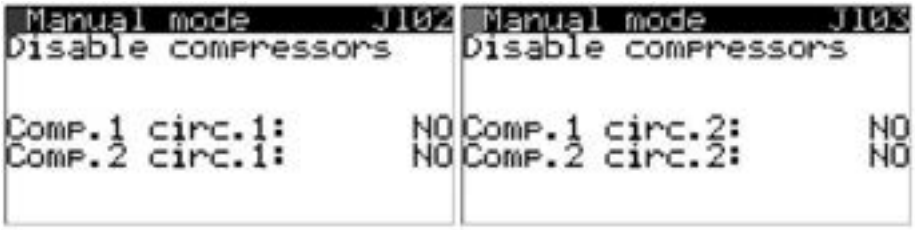


Figure 135: Activating/Deactivating compressors

In the mask JI06 and following it is possible to force the status of the digital relay outputs of the electronic board. To do this, go to the AUTO field and change it to MAN with the UP / Down keys, then confirm with Enter. In this way the status of the output becomes editable and it is possible to change it from OPEN to CLOSED at will using the Up /Down keys.

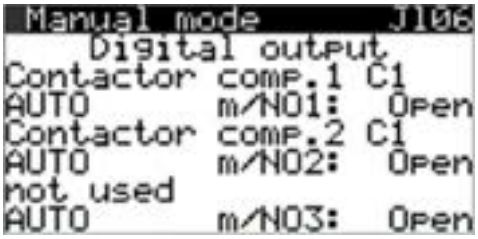


Figure 136: Digital outputs

In the mask JI20 and following the status of the analogue outputs of the board can be forced. To do this, go to the AUTO field and change it to MAN with the UP / Down keys, confirm with Enter, then it is possible to set the voltage value to be output, expressed in hundredths of a volt (0 = 0 V, 1000 = 10 V).

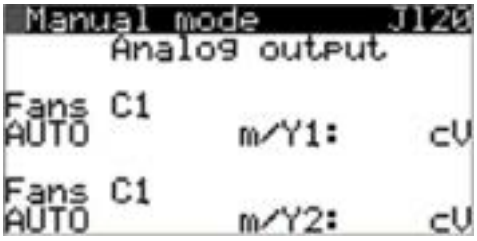


Figure 137: Analogue outputs

In the mask JI24 and following it is possible to manually force the opening, expressed in number of steps of the stepping motor, of the electronic thermostatic valves, of the valves for level or of the LBV valves

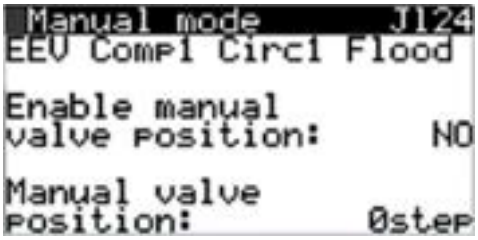


Figure 138: Manual valve position

12. Hardware – Configuration

12.1. Description of the card / circuit board

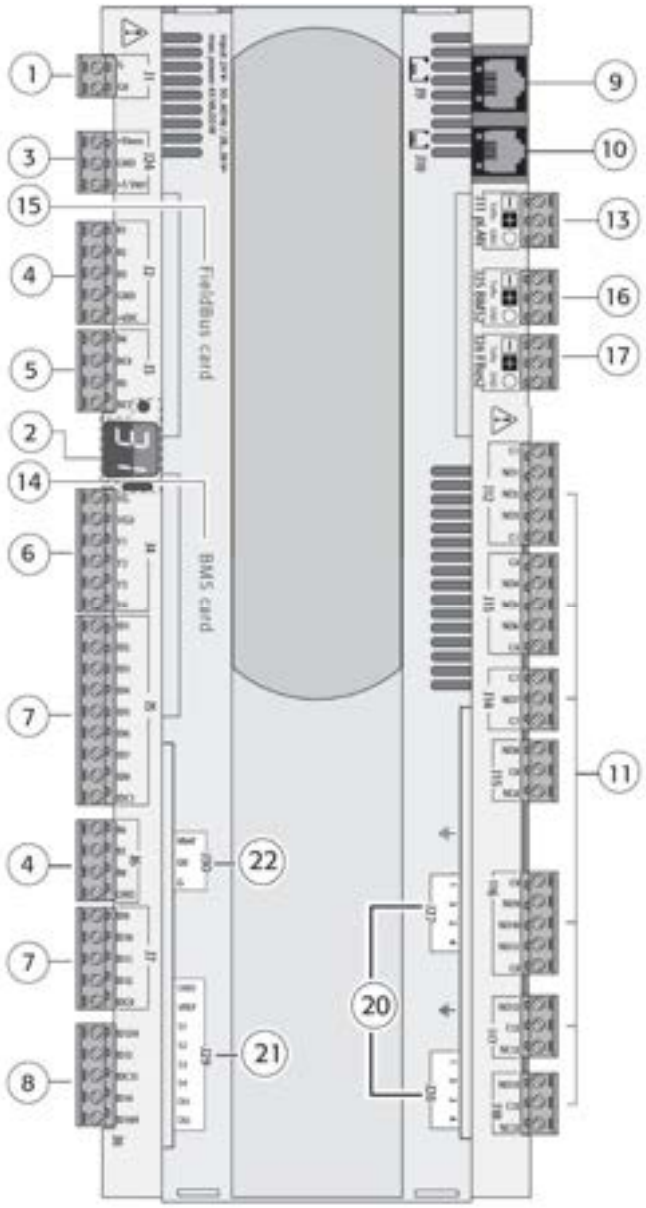


Figure 139: Description of the card / circuit board

1	Connector for power supply [G (+), G0 (-)]
2	Push button address pLAN, display 7 segments and LED indicator (power on and overload terminal +Vdc)
3	Additional supply for terminal and ratiometric probes 0...5 V
4	Universal analogue inputs NTC, 0...0 V, 1...10 V ratiometric, 0...0 V, 5...20 mA, 20...4 mA
5	Passive analogue inputs NTC, PT1000, ON/OFF
6	Analogue outputs 0...10 V
7	Digital inputs 24 Vac/Vdc
8	Digital inputs 230 Vac o 24 Vac/Vdc
9	Connector for synoptic terminal (external panel with direct signal)
10	Connector for all standard terminals of the pCO series and for downloading the application programs
11	Relay digital outputs
13	Connector local network pLAN
14	Flap for inserting the Serial Card for Supervisor option (BMS1)
15	Flap for inserting the Field Card option (Fieldbus1)
16	Connector for BMS2
17	Connector Fieldbus2
18	Terminal built-in (LCD, push buttons and LED)
19	Connector USB host and slave
20	Connector electronic valve (only on MASTER board)
21	Analogue and digital inputs Driver valve (only on MASTER board)
22	External power supply from EVbat module (only on MASTER board)

12.2. Configuration of inputs and outputs

MASTER board

ANALOG INPUTS		
Pin	**Tipo**	**Description**
B1	4÷20 mA	High pressure converter circuit 1
B2	4÷20 mA	High pressure converter circuit 2
B3	NTC	Water temperature input primary side
B4	NTC	Water temperature output primary side
B5	NTC	-
B6	-	-
B7	NTC	Temp. water input Recovery/reheater (opz. RC100/DS)
B8	NTC	Water temperature at the recovery output (option RC100)

DIGITAL INPUTS		
Pin	**Tipo**	**Description**
ID1	24 Vac	General serious alarm
ID2	24 Vac	Primary differential pressure switch
ID3	-	-
ID4	24 Vac	Phase monitor
ID5	24 Vac	Overload protection compressor 1 circuit 1
ID6	24 Vac	High-pressure pressure switch circuit 1
ID7	24 Vac	Low pressure monitor circuit 1
ID8	24 Vac	Overload protection compressor 2 circuit 1
ID9	24 Vac	Overload protection compressor 3 circuit 1
ID10	24 Vac	Overload protection compressor 1 circuit 2
ID11	24 Vac	High-pressure pressure switch circuit 2
ID12	24 Vac	Low pressure monitor circuit 2
ID13	24 Vac	Overload protection compressor 2 circuit 2
ID14	24 Vac	Overload protection compressor 3 circuit 2

DIGITAL OUTPUTS		
Pin	**Tipo**	**Description**
NO1	230 Vac	Contactor compressor 1 circuit 1
NO2	230 Vac	Contactor compressor 2 circuit 1
NO3	230 Vac	Contactor compressor 3 circuit 1
NO4	230 Vac	Changeover valves circuit 1
NO5	230 Vac	Fan Circuit 1
NO6	230 Vac	Solenoid valve recovery circuit 1 (option RC100)
NO7	230 Vac	Contactor compressor 1 circuit 2
NO8	230 Vac	Contactor compressor 2 circuit 2
NO9	230 Vac	Contactor compressor 3 circuit 2
NO10	230 Vac	Changeover valves circuit 2
NO11	230 Vac	Fan Circuit 2
NO12	230 Vac	Solenoid valve recovery circuit 2 (option RC100)
NO13	230 Vac	General alarm

Analogue outputs		
Pin	**Tipo**	**Description**
Y1	0÷10 Vdc	Fan speed circuit 1
Y2	0÷10 Vdc	Fan speed circuit 1
Y3	0÷10 Vdc	Fan speed circuit 2
Y4	0÷10 Vdc	Fan speed circuit 2

SLAVE board

ANALOG INPUTS		
Pin	**Tipo**	**Description**
B1	-	-
B2	NTC	Outdoor air temperature
B3	4÷20 mA	Offset Set-point (Signal 4-20mA) (Option CS)
B4	NTC	Inlet temperature storage tank (option VPF)
B5	NTC	Water temperature return annex (option VPF)
B6	-	-
B7	NTC	Diff. Press. Annex / Pump alarm (option VP F)
B8	-	-

DIGITAL INPUTS		
Pin	**Tipo**	**Description**
ID1	24 Vac	On/Off remote control
ID2	24 Vac	Selector switch summer/winter with remote control
ID3	24 Vac	Double setpoint (option DSP)
ID4	24 Vac	Activation of power reduction (option FDL)
ID5	24 Vac	Water-side differential pressure switch recovery (option RC100)
ID6	24 Vac	Pressure switch emptying recovery C1
ID7	24 Vac	Pressure switch emptying recovery C2
ID8	24 Vac	Release recovery (option RC100)
ID9	24 Vac	Contact FNR1 (Option FNR)
ID10	24 Vac	Contact FNR2 (Option FNR)
ID11	24 Vac	Detection device for cooling gas leakage (option LDK)
ID12	-	-
ID13	-	-
ID14	-	-

DIGITAL OUTPUTS		
Pin	**Tipo**	**Description**
NO1	-	-
NO2	-	-
NO3	-	-
NO4	-	-
NO5	-	-
NO6	230 Vac	Pump 2 recovery /DS (option RC100)
NO7	-	-
NO8	-	-
NO9	230 Vac	Antifreeze heating primary circuit
NO10	230 Vac	Primary pump 1
NO11	230 Vac	Pump 2 primary circuit (option DP)
NO12	230 Vac	Pump 1 recovery /DS (option RC100)
NO13	230 Vac	Frost protection heating recovery (option RC100)

Analogue outputs		
Pin	**Tipo**	**Description**
Y1	0÷10 Vdc	Modulation primary pump
Y2	0÷10 Vdc	Modulation system pump (option VPF)
Y3	0÷10 Vdc	Pump recovery /desuperheater (option RC100/DS)
Y4	0÷10 Vdc	Speed fans circuit 1 + circuit 2

13. 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 service work in order to minimise downtimes

An overview of the recommended maintenance intervals can be found in the following table. In addition, the national regulations of the respective installation site must be followed.

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

Table 20: Maintenance intervals

	Components	Time interval	Comments
1.	Cleaning and general control of the unit	Perform a general cleaning of the machine every 6 months and check the condition of the machine	Any existing rust spots should be painted with protective lacquer.
10.	**Compressor**		
11.	Check externally for dirt, damage and corrosion	When needed – at least every 6 months.	
12.	Check fixing, check running noises	At least every 6 months.	
13.	Measure the intake pressure	At least every 6 months.	
14.	Measure the suction gas temperature upstream of the compressor	At least every 6 months.	
15.	Measure the compression end temperature at the discharge port	At least every 6 months.	
16.	Check oil level	At least every 6 months.	The lubricating oil level in the compressor can be checked via the sight glasses.
17.	Check the acid content of the oil (acid test)	When needed	
18.	Oil change	When needed	
19.	Check that the crankcase heater is working	At least every 6 months.	
20.	Check that the output control is working	At least every 6 months.	
21.	Check the refrigerant side for leaks	At least every 6 months.	
22.	Check high/low pressure switching equipment	At least every 6 months.	
30.	**Air-cooled condenser**		
31.	Fin-packed heat exchanger	When needed – at least every 6 months.	The heat exchangers must be kept free of blockages. If necessary, they must be washed with detergents and water. Brush the heat exchangers carefully without damaging

			them. Always use personal protective equipment as required by law (goggles, ear protection, etc.).
32.	Fans	When needed – at least every 6 months.	The grilles of the fans must be kept free of blockages.
33.	Check electrical connection of fan	When needed – at least every 6 months.	The engine must be kept clean and must not show any traces of dust, dirt, oil or other impurities. This can lead to superheating due to insufficient heat dissipation The bearings are generally watertight, permanently lubricated and designed for a service life of approximately 20,000 hours under normal operating and environmental conditions.
34.	Measure the condensing temperature	At least every 6 months.	
35.	Measure the refrigerant side supercooling temperature at the condenser outlet	At least every 6 months.	
36.	Measure the medium temperature at condenser inlet and outlet	At least every 6 months.	
37.	Check that the condensation pressure control is functioning properly	At least every 6 months.	
38.	Check the refrigerant side for leaks	At least every 6 months.	
40.	**Evaporator**		
41.	Check externally for dirt, damage and corrosion	At least every 12 months	
42.	Check pressure loss	At least every 6 months.	Any incrustation of the heat exchangers can be detected by measuring the pressure loss with a differential pressure gauge between the inlet pipes and the outlet of the unit.
43.	Measure refrigerant superheat temperature	At least every 6 months.	
44.	Measure the medium temperature at the evaporator inlet and outlet	At least every 6 months.	
45.	Measure the anti-freeze temperature (freezing point) of the heat transfer media	At least every 6 months.	
46.	Check the water and refrigerant side for leaks	At least every 6 months.	
50.	**Refrigeration circuit**		
51.	Check externally for dirt, damage and corrosion	When needed – at least every 6 months.	

52.	Check insulation for damage	When needed – at least every 6 months.	
53.	Check filter dryer for blockage	When needed – at least every 6 months.	
54.	Replace filter dryer	When needed	When components in the refrigeration circuit are replaced
60.	Coolant circuit		
61.	Check externally for dirt, damage and corrosion	When needed – at least every 6 months.	
62.	Check the safety function of the safety switching	When needed – at least every 6 months.	
63.	Check pump/mechanical seal for leaks	When needed – at least every 6 months.	
64.	Check filling level / standstill pressure	When needed – at least every 6 months.	
65.	Check diaphragm expansion vessel	When needed – at least every 6 months.	
66.	Water filter (if available - external)	at least every 6 months.	This filter must be cleaned regularly.
67.	Plastic plug outlet line	When needed – at least every 12 months.	
68.	Safety valves	When needed – at least every 5 years	
70.	Control cabinet		
71.	Check externally for dirt, damage and corrosion	When needed – at least every 6 months.	In addition to checking the various electrical components, check the insulation of all cables and their tight fit on the terminal strips, paying particular attention to the earthing connections.
72.	Check fastening	At least every 6 months.	
73.	Check all threaded connections	At least every 6 months.	
74.	Check all indicator lights and error messages	At least every 6 months.	
75.	Check that the temperature and pressure sensors are functioning properly	At least every 6 months.	
76.	Check the function of the motor protection switches	At least every 6 months.	
77.	Check control cabinet heater	At least every 6 months.	
80.	Documents and labelling		
81.	All documents such as operating instructions, diagrams, circuit plans, system log are present	At least every 12 months.	
82.	Nameplate and labels are clearly legible	At least every 12 months.	

14. Cleaning and general inspection of the unit

14.1. Condenser

In order to maintain high performance, the microchannel heat exchanger must be cleaned annually when visibly contaminated, but at least once a year at ½. To do this, disconnect the unit from the power supply and remove any condenser protection grilles. 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.

14.2. Condenser with ElecroFin® coating (option)

The following cleaning procedures are recommended as part of the regular maintenance of ElectroFin®-coated condensers. To maintain warranty coverage, ElectroFin®-coated condensers must be regularly serviced and registered.

It is recommended that water chillers used in coastal or industrial areas are rinsed monthly with water to remove chlorides, dirt and deposits. It is essential that the water used for rinsing has a maximum temperature of 54°C and a maximum pressure of 62 barg to prevent damage to the fin edges. A high water temperature (max. 54 °C) reduces the surface tension, which makes it easier to remove chlorides and dirt.

Quarterly cleaning is essential to extend the life of ElectroFin®-coated condensers and maintain the warranty. Cleaning the coated condenser must be part of the unit's regularly scheduled maintenance activities. Failure to clean the ElectroFin®-coated condenser will void the warranty and could reduce both performance and life of the unit. Before regular quarterly cleaning, the condenser must be cleaned with the approved special cleaner (see list of approved products). After cleaning with the approved special cleaner, the approved chloride remover must be used (see Recommended Chloride Removers) to remove soluble salts and revitalize the unit.

The following detergent has been approved for cleaning condensers with ElectroFin® e-coating to remove mould, dust, soot, greasy residues, lint and other particles, provided it is used in accordance with the preparation and cleaning instructions on the packaging:

Product	Dealer	Product code
Enviro-Coil Concentrate	HYDRO-BALANCE CORPORATION TELEPHONE: 800 527-5166 FAX: 972394-6755 Box 730 Prosper, Texas 75078	H-EC01
Enviro-Coil Concentrate	Home Depot Supply	H-EC01

Recommended chloride remover

CHLOR*RID International, Inc PO Box 908 Chandler, Arizona 85244 / Tel.:(800) 422-3217 Fax: (480) 821-0364

CHLOR*RID DTS™ is recommended for the removal of soluble salts from ElectroFin®-coated condensers, strictly following the instructions for use. This product is not suitable for use as a degreaser. Grease or oil films must always be removed beforehand with a suitable cleaning agent.

1. **Barrier removal** - The soluble salts adhere to the substrate. For effective use of this product, it must come into contact with the salts. To use this product effectively, it must come into contact with the salts. These salts can be under any type of dirt, grease or contamination. For this reason, these barriers must be removed before the product is applied. As with all surface preparation activities, the best results are achieved through optimal work.

2. **Application of CHLOR*RID** Apply a sufficient amount of the product evenly onto the surface so that the entire surface is wetted and no areas are left out. This can be done by using a spray pump or a conventional spray gun. The method is not relevant as long as the entire surface to be cleaned is wetted. Once the condenser is completely wetted, the salts begin to dissolve and can now simply be rinsed off. Rinsing - It is strongly recommended to use a water hose
3. **Rinsing** It is strongly recommended to use a water hose and not a pressure washer as this could damage the blades. The use of drinking water is recommended for rinsing.

ATTENTION:
Aggressive chemical and acidic detergents, aggressive chemicals, household bleach or acidic detergents must not be used to clean ElectroFin®-coated condensers. These detergents are difficult to rinse, accelerate corrosion and attack the ElectroFin® coating. If the dirt is under the surface of the condenser, use the recommended special cleaners described above.

ATTENTION:
Water at high speed or compressed air water at high speed from a pressure washer or compressed air may only be used at very low pressure to prevent damage to the fins. The force of the water or air jet can bend the edges of the blades and increase the pressure drop of the air. This can lead to a reduction in performance and undesirable shutdowns of the unit.

14.3. Cleaning the fans

⚠	**Attention!** **Risk of injury – Pay attention to the fans! Do not remove the protective grilles under any circumstances!**

Check that the protective grilles of the fans are free of objects and/or impurities. The latter can considerably impair the overall performance of the machine, which in some cases can even lead to damage to the fans.

14.4. Checking the oil level in the compressor

⚠	**Attention!** **Do not use the units if the oil level in the compressor is low.**

The lubricating oil level in the compressor can be checked via the sight glasses. The oil level must be checked when all compressors are in operation.

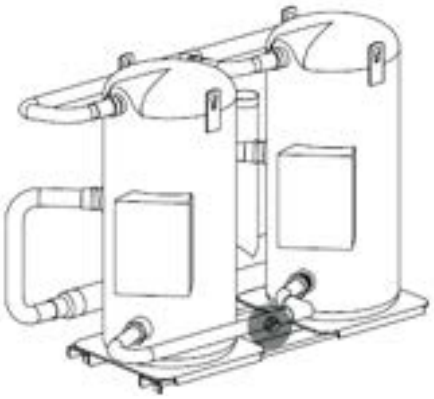


Figure 140: Example Compressor assembly – oil sight glass

In some cases, the oil may migrate towards the cooling circuit and cause slight fluctuations in level, so they should be considered normal. Fluctuations in level are also possible when the power control is activated; the oil level must always be visible through the sight glass. The formation of foam at start-up is considered normal. A prolonged and excessive presence of foam during operation, on the other hand, indicates that the coolant has diluted in the oil.

14.5. Water filter (external if present)

In order to ensure the desired water quality as well as the required water circulation quantity, external water filters are recommended. This must be checked for contamination approx. every 6 months, depending on the extent of contamination. A filter unit can be ordered at any time as an original spare part - please contact our KKT chillers team (*contact details*).

14.6. 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*).

15. Service

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

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

15.1. Repair and replacement of components

- Always observe the wiring diagrams supplied with the machine when replacing an electrically powered component, ensure that each conductor is properly disconnected to avoid reconnection errors.
- When restarting the machine, the steps of the starting phase must always be repeated.
- After maintenance work on the unit, the level and humidity indicator must be monitored. After a maximum of 12 operating hours of the machine, the cooling circuit must be completely dry and the level and humidity indicator must be green. Otherwise the filter cartridges must be replaced.

15.2. Spare parts

To ensure that the performance of your chiller is not impaired, we recommend that you only use original spare parts from KKT chillers. By doing so, you ensure the reliability and quality of the machine. For inquiries regarding spare parts, please contact our KKT chillers Service Team ***spareparts@kkt-chillers.com*** or (***contact data***).

16. Decommissioning/Taking out of service

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

For safety-relevant information regarding any residual energy, please refer to ***Residual energy.***

17. Recycling

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

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

A specialised disposal company must be contracted to dispose of these wastes. They issue a proof of disposal which must be archived.

18. Products, solutions and services

Apart from the eBoxX plus, KKT chillers also offers other products, solutions and services which are not described in this document. Please have a look at our website ***http://www.kkt-chillers.com*** or contact your KKT chillers contact person - we look forward to hearing from you!