

Operating and Service Manual Star Cool 1.1 Refrigeration Unit



Model SCI-Basic/CA/CR and SCU

Version 810990A June 2026

1. Preface

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This user's manual is valid for software version 0365 or newer versions.

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This manual is valid for:

Model	SCI 1.1 - 20/40/CA/CR and SCU 1.1 - 20/40
Software version	365

2. Warnings

2.1 General service and maintenance

Do not operate or maintain this refrigeration unit until you have familiarized yourself completely with the equipment and operation of this unit by reading the instructions in this manual.

Do not perform any soldering on the unit before disconnecting the power plug and having removed the refrigerant. Furthermore, disconnect the power measurement module and main controller (and modem if present).

Disconnect the main power supply to the unit before inspecting the interior of the controller box.

The unit is charged with R134a, R513A, or R1234yf and ester oil BSE 55. Do not use any other refrigerant or oil. Do not use contaminated refrigerant or oil. Never release any refrigerant into the atmosphere. Use recovery equipment according to present legislation and which has been designed for use with the three above mentioned refrigerants.

During maintenance, please observe that refrigerants operate with high and low temperatures in combination with high pressures, which may cause personal injuries if not handled properly.

During recovery and maintenance of the refrigerant, personal protection equipment (goggles and gloves suitable for working with refrigerants) must be worn.

Do not trap any liquid refrigerant inside pipes during soldering work. This may lead to an explosion of the pipes. Any brazing or soldering work must be done with an inert gas (nitrogen) flowing inside the area being worked on to prevent carbon contamination.

Any replacement or repairs to copper tubing must include repainting with black epoxy (or similar) paint to prevent corrosion.

While R134a and R513A are classified as non-flammable refrigerants (A1 according to ISO817), and R1234yf being classified as mildly flammable (A2L according to ISO817), all three refrigerants decompose to toxic hydrogen fluoride gas when ignited or when in contact with hot surfaces. Ensure that the refrigerant is removed from the system, prior to conducting hot work.

We do not recommend cleaning the inside of a reefer container with soap/chemicals with a PH value below 7. However, if this occurs, clean the evaporator coil through the inspection hatches with a soap that has a PH value between 7 and 9. This cleaning is vital to reduce the risk of copper damage in the evaporator coil.

Clean the condenser coil twice a year by backflushing it with water using medium water pressure (no more than 40 PSI/2.75 bar) and waterflow over 2.5 GPM (9LPM). This is to avoid fin corrosion and high pressures (power consumption).

SCU may be operated with R1234yf in 40' HC thermal containers. Loading is permitted to the max load line. For other applications, it is the responsibility of the responsible operator to ensure a minimum volume of 6.8 m³ of air is present*, when cargo is loaded. Local rules and regulations can also apply and need to be checked. Else, operation must be performed with R134a or R513A. For further information, scan the QR code.



* behind the backplate, above the max load line, in the T-floor, at the door end and/or in the cargo area.

2.2 Use of mildly flammable refrigerant R1234yf

2.2.1 Hardware prerequisites

When operating or replacing parts on a Star Cool 1.1 model, there are specific hardware requisites depending on whether the unit is set up as Triple Refrigerant or Triple Refrigerant Ready - see below chart.

Only use genuine OEM parts from Maersk Container Industry A/S or a certified Star Cool dealer.

Model configuration	Hardware prerequisites
Triple refrigerant	Beacon, air ex motor (factory installed on CA units), safety decals
Triple refrigerant ready	Parts are mounted from factory

When the unit is powered on after a powered off period of 60 min., the unit will run a heater detection to see if the right heater type is mounted, before being able to select R1234yf as a refrigerant. If the correct heater is not detected, the R1234yf refrigerant type will not be available in the configuration list.

Older versions of the listed hardware are not compatible with Star Cool 1.1 (i.e. CIM 6.0/6.1/6.2 controller).

2.2.2 Safety instructions

Smoking is prohibited inside and around the container.

Best practice for preventing hazards and failures:

- Check that cabling is not worn out, corroded, or damaged in any way that could cause a shortage or fire in the cable tray compartment.
- Perform regular leak tests and inspections.
- Do not charge refrigerant into the system without first checking for leaks and having repaired these if/when identified.
- Overcharging is not allowed.
- Ensure that personnel are trained in how to detect and test for leaks.
- Ensure that personnel know what actions to be taken in case of alarm.
- Ensure that personnel are trained on taking protective measures:
 - a. Elimination of ignition zone inside.
 - b. Complimentary protective mean (ventilation).
- Having first aid provisions available and having established procedures to be followed under emergency conditions (i.e. leak event - decomposition and creation of toxic atmosphere, fire and explosion).
- Charging and recovery of refrigerant handled according to correct procedures.

Handling of refrigerant and associated hazards:

- Remove refrigerant completely before opening the system or performing any hot work.
- Ensure that no air is drawn into the refrigerating unit during the pump down process - pump down only permitted when no leak is suspected or detected.
- For removal and evacuation of the refrigerant system for repairs, the conventional procedures shall be used.
 - a. Ensure parts that are to be repaired and evacuated are not blocked or closed by valves.
 - b. Use equipment, suitable to use with A2L refrigerants (such as R1234yf), for recovery and evacuation of the system.
 - c. Recover refrigerant into a cylinder suitable for this purpose - ensuring that the recovery cylinder is free of air.
 - d. Evacuate the system.
 - e. Flush the circuit with oxygen-free nitrogen. DO NOT USE COMPRESSED AIR OR OXYGEN.
 - f. Open the circuit by cutting or brazing.
 - g. Ensure that the exhaust of the vacuum pump is not near any potential ignition sources or open fire. Also ensure that the residual refrigerant is released in a well-ventilated area.
- Ensuring that disposal of flammable refrigerants is done in adherence with local laws and regulations.

- Ensuring that disposal of flammable liquid oil mixtures is done in adherence with local laws and regulations, and taking precaution for the following:
 - a. Oil in the system may contain residual refrigerant, dissolved in oil. At atmospheric pressure, the refrigerant can evaporate from the oil and potentially create a flammable atmosphere. The refrigeration oil is also flammable, requiring disposal in a responsible manner and in adherence with local laws and regulations.
 - b. When draining oil from the compressor, ensure that the pressure in the compressor is reduced to atmospheric pressure (using dry nitrogen).
 - c. Oil must not be discharged into sewers, canals, rivers, ground or seawater.

2.2.3 Maintenance and repair

While it is the owner's and operator's responsibility to ensure the personnel working with the equipment are qualified and trained, e.g. by utilizing the training offered by Maersk Container Industry, it is emphasized here that maintenance and repair shall be carried out by qualified and trained personnel only.

While the guidelines and instructions in this manual are developed considering international safety standards, it is emphasized that local occupational safety and health rules and regulations apply and supersede this guideline.

When conducting maintenance and repair on this unit, check the functioning of all control and measurement devices, the sounder beacon and automatic fresh air valve. In case of component replacement, only genuine OEM parts may be used. Component changes and/or modifications of the refrigeration system are not permitted.

The use of personal protective equipment is highly recommended. Using flammable refrigerants, improper service causes higher risk, compared to non-flammable refrigerants. It is therefore the responsibility of the operator to take care that safety procedures are in place at the repair site.

It is prohibited to use inappropriate tools for, or during opening of, the container refrigerating system.

Box repair:

Repairs are to be conducted in such a way, that no opening or damaging of the mechanical refrigeration unit occurs, especially, when performing hot works or welding.

No special requirements exist for:

- Outside repair and maintenance of the box.
- Inside box repairs, with the exception of incorporating the procedure for door opening processes.
- Tools and equipment.

2.2.4 Residual risk

While the unit has been designed in accordance with the Safety standard for refrigerating systems in Thermal Containers, using flammable refrigerants and the Operational Mode Risk Assessment has shown that all evaluated risk lies below the tolerable risk criteria defined by the standard, residual risks exist and are listed here for the responsible operator to review and include into their own risk assessment.

For a potential hazardous situation to occur, the presence of a flammable atmosphere, a potent ignition source and unfavorable conditions, e.g. space, ventilation etc. need to be present simultaneously.

Therefore it is advised that:

On the inside of the reefer:

- a. Only genuine and approved spare parts are used.
- b. No auxiliary installations are made that present a potential ignition source.
- c. Loading of self-igniting cargo is prevented or managed to ensure safe operation.

On the outside of the reefer:

- a. Hot works on the reefer shall not be performed with refrigerant remaining on the system.

2.2.5 Safe operation in suspected or noticable dangerous situations

Leak has occurred (unit powered on):

In situations, where the software has detected a refrigerant leakage, the reefer will activate the sounder beacon and display the alarm 667 "Refr Leak detected". To mitigate this potential hazardous situation, the condenser and evaporator fans of the reefer will be running on high speed and the auto air exchange valve will be fully open to ventilate any potential flammable atmosphere from the inside to the outside and further dilute the refrigerant concentration in the air to safe levels. After 20 minutes, the activation of the sounder beacon and ventilation are stopped and the compressor will perform a pump down operation moving any residual refrigerant to the refrigerant system section placed outside. It is now that the system is in a low risk situation and repair of leak shall be performed by technicians. The unit displays this state by showing Alarm 668 "Leak repair needed".

After successful repair and leak check the user is prompted to confirm that the leak was repaired on the user panel. The unit will resume normal operation once this is confirmed by the operator.

Leak has occurred (door opening without power nor back-up power and unknown conditions inside):

For cases when damage to the reefer is suspected, e.g. caused by shock, accident, pipe rupture or alike, the following measures are to be taken:

- Provide power to the unit and check alarm system. In case of a leak detected by the unit, refer to the actions described in the above section "Leak has occurred (unit powered on)".
- Open the doors if no hazardous atmosphere exists in the container.

If no power supply is available, do the following:

- Ensure no open flame or potent source of ignition is present in the vicinity of minimum 3 meter radius from the door.
- Open the doors to dilute a potential hazardous atmosphere for a minimum of 10 minutes.

Actions after accident (incl. stuffing/unstuffing operation):

The vicinity of a damaged part can be dangerous due to flammable atmosphere and shall be abandoned if possible until the potentially dangerous situation is clarified. For instance, a pipe ruptures and large leaks occur combined with a loud and clearly audible noise of flow, typically lasting a few minutes. All potential ignition sources, such as open flames or electric operated devices must be removed from the area within a minimum radius of 3 meters from the accident site.

Toxic decomposition products from burnt refrigerants, e.g. Hydrogen Fluoride, can exist for a longer period of time and can create a toxic atmosphere, with a pungent, irritating and penetrating odor which is present already at very low and relative safe levels of concentration. Surfaces may be contaminated with toxic substances and care shall be taken regarding possible physical contact with these surfaces.

When opening the refrigerating system for repair when the unit is charged with R1234yf, the following precautions should be taken before working on the refrigerant circuit:

- Ensure that maintenance staff have been properly trained.
- Ensure that no flammable materials are stored in the work area and that no ignitions sources are present anywhere in the work area.
- Ensure that suitable fire extinguishing equipment is available.
- Ensure that the work area is properly ventilated before working on the refrigerant circuit or before welding, brazing or soldering work.
- Ensure that the leak detection equipment being used is suitable for R1234yf.
- Recover refrigerant from the system.
- Flush circuit with dry nitrogen.
- Evacuate to a pressure of 30 kPa absolute.
- Flush again with dry nitrogen.
- Open the circuit.

Compressor oil may contain residual amounts of refrigerant, that can degas under atmospheric pressure and create a flammable atmosphere. Oil should therefore be stored under the oxygen excluding circumstances, e.g. stored under presence of dry nitrogen.

2.3 Operation

Special attention to local laws and regulation is needed if the reefer is used for stationary refrigerated storage.

The use of reefers for non-operating reefer (NOR) cargo is becoming more prevalent. In some cases, the reefer containers have been transporting fertilisers, chemicals, and products that release chemicals, such as textiles and garments. If the humidity is high inside the reefer, these cargoes can develop a strong concentration of acid that will damage the copper pipes in the evaporator.

With reefers that have been used for NOR shipments, or have stood empty for a period of time, it is highly recommended to ensure fresh air ventilation, either by opening the fresh air intake or container door(s), which will keep the humidity as low as possible and allow gaseous contaminants to escape.

Do not enter the container, including opening the service hatches, when the oxygen level is below 20.9%. Ventilation is necessary before entering, either for repairing the unit or unloading. Stay away from doors while venting.

Human response to low oxygen atmosphere:

Oxygen content of air	Symptoms of a person exposed
20.9%	Level in ambient air - no effect.
15% - 19%	May impair coordination and induce early symptoms in persons who have coronary, pulmonary, or circulatory problems.
12% - 15%	Respiration and pulse increase, impaired coordination, poor perception and judgement.
10% - 12%	Respiration increases further in rate and depth, poor judgement, and bluish lips.
8% - 10%	Mental failure, fainting, unconsciousness, an ash-coloured face, blue lips, nausea, and vomiting.
6% - 8%	8 minutes - 100% fatal, 4-5 minutes - recovery with treatment.
4% - 6%	Coma within 40 seconds, convulsions, respiration ceases, death.

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4. Legend

Short name	Name	Short name	Name
AAS	Alarm Action System	Mcpr	Compressor motor
Act	Actual	Mevap	Evaporator motor
ACT	Automatic Cold Treatment	Mevap1	Evaporator motor 1
AirEx	Air exchange	Mevap2	Evaporator motor 2
AL	Alarm	MOP	Maximum operating pressure
Atm	Atmosphere	Mpump	Vacuum pump motor
AV	Automatic Ventilation	MTS	Multi Temperature Setpoints program
CA	Controlled Atmosphere	NSK/DST	Saigonmya/DST P100 pressure transmitter
CalUs1	Calibration USDA sensor 1	OH	Overheat
CalUs2	Calibration USDA sensor 2	P	Pressure
CalUs3	Calibration USDA sensor 3	PCB	Printed circuit board
CapReq	Requested capacity	Pdis	Discharge pressure
Com	Communication	Pmem	Pressure membrane
Cond	Condenser	Psuc	Suction pressure
Cpr	Compressor	PTI	Pre Trip Inspection
CT	Cold treatment	PTI Short	Pre Trip Inspection Short
Cur	Current	Ptot	Power total
Err	Error	PWM	Pulse Width Modulation
Evap	Evaporator	Pwr	Power
F	Frequency	Req	Requested
Fact	Compressor actual frequency	RH	Relative humidity
FC	Frequency converter	RHset	Relative humidity setpoint
Fcpr	Compressor frequency	RMM	Remote Monitoring Modem
FcprAct	Compressor frequency actual	S	Switch contact key
FcprReq	Compressor frequency requested	SC	Star Cool
Fpower	Power supply frequency converter	Set	Setpoint
		SH	Superheat
FT	Function test	Shp	High pressure switch
FW	Firmware	Sup	Supply
H	Heater	T	Temperature
Hevap	Evaporator heater	Tact	Actual temperature
HP	High pressure	Tamb	Ambient temperature
HPS	High pressure switch	TC	Calculated condenser temperature
Hpump	Vacuum pump motor heating element	Tcargo	Cargo temperature
I	Current	TCmin	Temperature condenser minimum
I1	Current phase 1	Tevap	Evaporator temperature
I2	Current phase 2	Tfc	Frequency converter temperature
I3	Current phase 3	Tint	Temp. internal (controller board)
Ifc	Current in AC compressor motor	T0	Calculated suction temperature
Init	Initialization	Tret	Return air temperature
ITI	Intelligent Trip Inspection	Tset	Temperature setpoint
ITOT	Total current limit	Tsuc	Suction temperature
LED	Light emitting diode	Tsup	Supply air temperature average
LP	Low pressure	Tsup1	Supply air temperature 1
M	Motor	Tsup2	Supply air temperature 2
Mcond	Condenser motor		

Short name	Name
Tusda1	USDA 1 temperature
Tusda2	USDA 2 temperature
Tusda3	USDA 3 temperature
Ubat	Battery voltage
Udc	DC voltage in frequency converter
U/f	Voltage/frequency ratio
V	Valve
Veco	Economizer valve
Vexp	Expansion valve
Vhg	Hot gas valve

5. General description

The ❄️ **STAR COOL** units, models SCU-40 and SCI-40 are electric powered picture frames, cooling and heating units operating on refrigerant R134a, R513A or R1234yf.

The unit is designed to maintain cargo temperatures in a range from -30°C (-22°F) to +30°C (+86°F). The unit is designed to operate in ambient temperatures from -30°C (-22°F) to +50°C (+122°F).

The outer front frame is constructed of marine grade aluminum, 5000 and 6000 series, designed to serve adequately as the container end wall. The rear bulkhead is made of food-approved material.

The unit is designed to operate under seagoing and environmental conditions as specified below:

- Salt-laden air, sea spray, and high humidity.
- Rolling: Amplitude of 30° each side, period of 13 seconds.
- Pitching: Amplitude of 6° each side, period of 8 seconds.
- Permanent list: 15° on each side.
- Shock: 2g horizontal and 5g vertical.
- Vibrations: Of the types encountered on ships, trucks, and rail.

The unit consists of the following modules:

- Frame module
- Condenser/compressor module
- Evaporator module
- Evaporator fan module

The cooling system of the unit is equipped with a two-stage compressor, electrically driven through a frequency converter.

The cooling system is also equipped with an economizer, which performs the task of sub-cooling the liquid from receiver to evaporator, thereby increasing the cooling capacity of the cooling unit. The evaporator and economizer are controlled by electronic expansion valves.

The equipment is designed to operate on a 3 phase primary power source at 50 Hz (+/- 2.5) and 360-460 V AC (max. 465 V AC) or at 60 Hz (+/- 2.5) and 400-500 V AC (max. 535 V AC), according to ISO 1496-2. An integrated dual winding transformer supplies the control circuit voltage. One winding for 18.6-32.0 V AC (for RMM modem supply) and another for 20.5-35.7 V AC converted to DC voltage in the controller (for controller and contactor supply). The output voltage is dependent on the supply voltage. An automatic system, power supply sensing and correction, is provided to ensure the correct direction of rotation for the fan motors. This is done regardless of the incoming phase sequence from the primary power supply, provided that all fan motors are wired correctly.

An optional water-cooled condenser is mounted in series with the air-cooled condenser. This water-cooled condenser allows operation of unit below deck, where no air ventilation is possible, provided that water connections are present.

The air from the unit is delivered to the bottom of the container, with return air through the top of the evaporator coil section (bottom air delivery).

The unit is equipped with a dehumidification function controlled by the electronic controller of the unit. The humidity setpoint can be set in the range from 95 – 65% RH (or 50 % with closed ventilation). The unit can control to the lowest level. The dehumidification function is active as long as the temperature control is in setpoint range. The unit is equipped with heating elements, mounted under the evaporator coil, for the dehumidification. The dehumidification system is also active in Economy mode.

The unit is equipped with a dual system for defrosting. The refrigeration system has a hot gas valve installed, for hot gas defrosting of the evaporator coil. Furthermore, the heating elements mounted under the evaporator coil, are energized during defrost. This dual system for defrosting ensures a fast defrost sequence and thereby only a very small input of heat to the container. The dual system for defrost also ensures an even distribution of heat to the evaporator coil. The result of this is that there is no build up of ice in corners or other places of the evaporator coil. The two defrost systems, hot gas and heating elements, are independent. This ensures a defrost sequence to be carried out at any time. A demand defrost system is integrated in the software ensuring that the evaporator coil will not ice up.

The unit is controlled by an electronic controller, controlling the supply temperature probe in Chill mode (temperature setting above or equal to -5°C ($+23^{\circ}\text{F}$)) and the return temperature in Frozen mode (temperature setting below -5°C ($+23^{\circ}\text{F}$)). Controller accuracy is $\pm 0.25^{\circ}\text{C}$ ($\pm 0.45^{\circ}\text{F}$). The unit can operate the evaporator fans in low speed and high speed. From the controller display, Normal or Economy mode can be selected under the Operation menu. In Economy mode the fans always run on low speed. In Normal mode the fan speed can run in high or low speed depending on running conditions.

The unit is equipped with a datalogger incorporated into the controller. The logging interval is in predefined intervals, 15, 30, 60, 120, or 240 minutes. The logging of the USDA sensors (3 pieces) and the cargo sensor is done with an interval of one hour according to USDA requirements. With a logging interval of one hour, there is storage capacity for 365 days of temperature loggings. Datalogger accuracy is $\pm 0.25^{\circ}\text{C}$ ($\pm 0.45^{\circ}\text{F}$). The datalog can be retrieved with a PC-system Starview and Psion Logman, via high-speed serial communication port.

The controller has a battery back-up system for the datalogger, which after power down of the unit continues logging in battery mode 120 times. The battery is rechargeable.

The controller is optimized for communication with Remote Monitoring Equipment, according to ISO standard 10368. Events, alarms, and datalogs can be retrieved by various download tools such as Refcon, Logman, StarView, AM-Solution, USB etc.

6. Function description

6.1 Start-up procedure

The start-up procedure has 5 modes:

1. Initialize: Self check controller / heater version check.
2. Stabilize: The evaporator fan operates at high speed to ensure that temperature sensors are at current temperature.
3. Crank case heating: If T_{amb} is lower than 2°C (36°F) heat is applied until T_{fc} is above 12°C (54°F).
4. Ramp up.
5. Terminate: Switching to normal temperature and valve regulation.

6.2 Temperature control

This function incorporates the container temperature controller.

The function has 2 modes:

1. Chill
If T_{set} is above -5°C ($+23^{\circ}\text{F}$) Chill mode is activated.
If Standard $T_{act} = T_{sup}$ if cooling need, and $T_{act} = T_{ret}$ if heating is needed.
2. Frozen
If T_{set} is equal to or less than -5°C ($+23^{\circ}\text{F}$) Frozen mode is activated and $T_{act} = T_{ret}$.

The value of the T_{set} limit is dependent on the software version.

The temperature control is set to Cool Down or Heat Up mode depending on T_{act} being above or below T_{set} . As long as the temperature is not within $T_{set} \pm$ ranges, the function remains in Cool Down or Heat Up mode. If the temperature is within range, the green IN-RANGE indicator light starts flashing. When the temperature has been within $T_{set} \pm 1.5^{\circ}\text{C}$ ranges for 30 min. the green IN-RANGE indicator light is constantly on.

If the temperature is in out-of-range condition for more than 2 hours, the IN-RANGE indicator light start flashing. After 4 hours in out-of-range condition, an in-range alarm is set. On the basis of T_{act} and T_{set} the function calculates the requested capacity ($CapReq$) value by means of a Micro controller. $CapReq$ is the desired chilling/heating capacity. $CapReq$ value can range from -100% to $+100\%$. -100% being maximum cooling and $+100\%$ being maximum heating.

Chill mode

Defect sensor(s)	Substitution sensor/Action	Alarm
Tsup1 (2)	Tact = Tsup2 (1)	105, Tsup1 invalid
Tsup1 and Tsup2	Tact = Tret + constant	105, Tsup1 invalid 108, Tsup2 invalid
Tsup1, Tsup2, and Tret	Tact = Tevap + constant	102, Tret invalid 105, Tsup1 invalid 108, Tsup2 invalid
Tsup1, Tsup2, Tret, and Tevap	**	102, Tret invalid 105, Tsup1 invalid 108, Tsup2 invalid 123, Tevap invalid

Frozen mode

Defective sensor(s)	Substitution sensor/Action	Alarm
Tret	Tact = Tevap + constant	102, Tret invalid
Tret and Tevap	Tact = Tsup1 + constant	102, Tret invalid 123, Tevap invalid
Tret, Tevap, and Tsup1	Tact = Tsup2 + constant	102, Tret invalid 105, Tsup1 invalid 123, Tevap invalid
Tret, Tevap, Tsup1, and Tsup2	**	102, Tret invalid 105, Tsup1 invalid 108, Tsup2 invalid 123, Tevap invalid

** = No more available sensors for substitution.

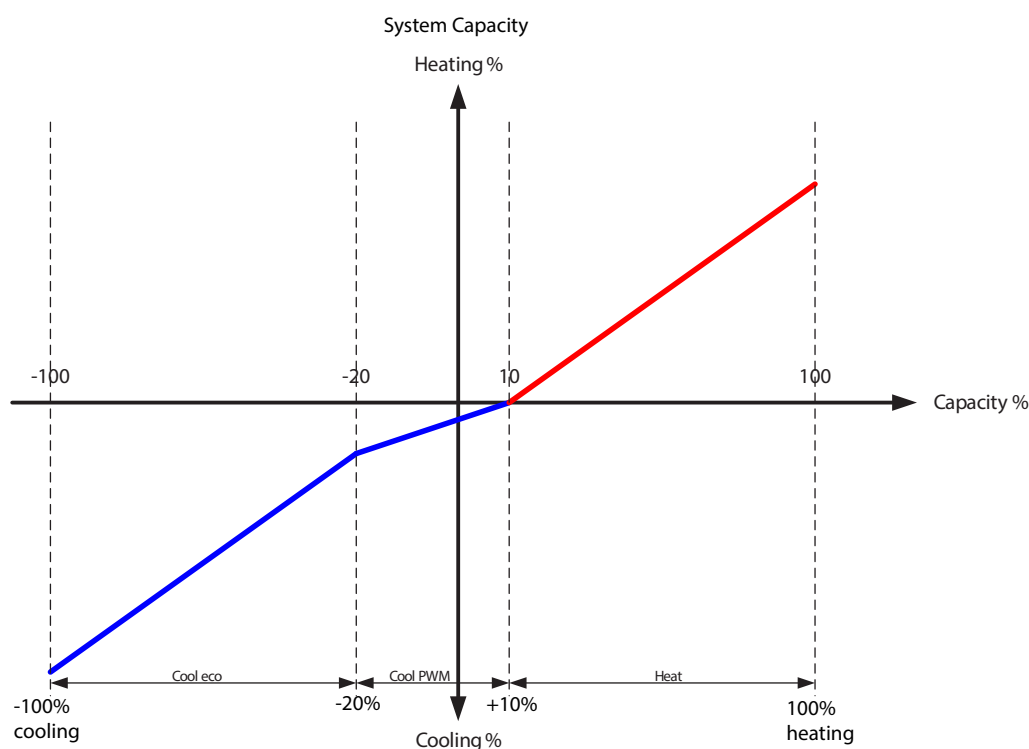
6.3 Capacity control and limiter

On the basis of requested capacity, this function determines operation mode and actions of the individual system components (compressor, valves, heating elements) and ensures that compressor minimum off time is observed. This function has 5 gears (modes). On the basis of requested capacity, the gear is determined. Compressor frequency is directly dependent upon current mode. Evaporator heater, on the other hand, is gear independent. There is overlap over the modes to maintain slow mode shifting.

Gear	Function
Off	Everything is turned off.
Start up	If cooling is required, the FC is starting at default frequency before shifting to correct cooling mode.
PWM	On/Off regulation of compressor.
CoolEco	Maximum cooling capacity with use of economizer.
Heat	Only the heaters are used.
Defrost	Heaters are always used and hot gas valve is used if ambient temperature is above 5°C (41°F).

The capacity of the unit is controlled between maximum cooling capacity (-100% capacity) and maximum heating capacity (+100% capacity). This is done by regulation of the compressor speed by means of the FC or on/off regulation. In maximum capacity (+100% capacity) the unit uses the heating elements, by means of Pulse Width Modulation, to control the capacity.

The below figure indicates the ranges for the capacity.



If there is a limiter active on the unit then the compressor speed will be slower and the unit will operate with reduced capacity. When a limiter is active, it will be shown in the status line on the main display window. The type of limiter can then be seen in the Information menu ⓘ, line I40.

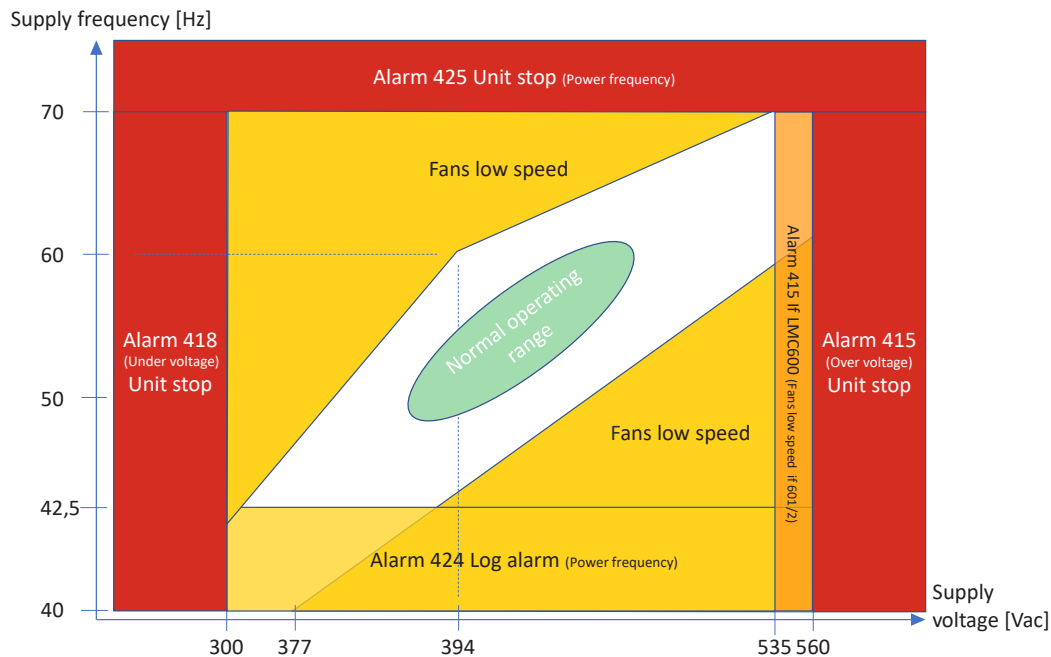
Limiter types:

- **TC**, limits the maximum condenser pressure (and temperature) and is typically active during pull down. If the unit is lacking capacity compared to other Star Cool units, clean the condenser coil, check Pdis, and check condensor fan motor for proper operation.
- **IFC**, limits the maximum current draw from the FC. Is typically active during pull down if the ambient temperature is over 25°C (77°F). If the unit is lacking capacity compared to other Star Cool units, see AL 511 for trouble shooting and check the refrigerant level (overcharged).
- **TFC**, limits the maximum internal FC temperature. Is typically active during pull down if the ambient temperature is over 40°C (104°F). If the unit is lacking capacity compared to other Star Cool units, see AL 517 for trouble shooting.
- **TO**, ensures a minimum evaporator pressure and is rarely active. If this limiter is active for more than 2 minutes, check the refrigerant level (undercharged), check Psuc and Tsuc, check Vexp and LP valve plate.
- **ITOT**, limits the current draw in the unit by reducing the compressor speed. Is typically active during pull down if the ambient temperature is over 40°C (104°F). From 13.5 A the allowed frequency raise on the compressor is reduced in steps and from 17.5 A the frequency is decreased as much as possible to avoid AL 421 from stopping the unit and the circuit breaker from being triggered.
- **Pdis**, ensures maximum discharge pressure is not exceeded. The limiter starts when the discharge pressure is 15.82 bar by controlling the FC speed.
- **UDCRipple**, reduces the frequency on the compressor if a high ripple voltage on the FC is observed. Only if FC 2.2 is mounted.

There can be multiple limiters activate simultaneously. The most critical limiter will be shown. The largest of the factors is used as the active limiter. If the limiter factor is higher than the requested capacity change, the capacity is actually reduced instead of increased. If, for example, the ambient temperature is very high, the requested capacity may increase the FC temperature over its limits and so the limiter will reduce the capacity until a safe and stable operation condition for the FC has been reached.

6.4 Electrical control

The following graphical illustration shows the accepted volt/Hz range and the set off values for the alarms AL 415, AL 418, AL 424, and AL 425.



6.5 Expansion valve

This function ensures optimum evaporator superheat (SH) and calculates the percentage of opening (SHVod) and controls the valve. This function is active during compressor operation. The valve is closed during compressor turn off. The expansion valve function includes the following three sub-functions:

1. MSS (Minimum Stable Superheat search)
This function searches for minimum stable superheat within the ranges SHmin and SHmax.
 $SH_{act} = T_{suc} - T_O (P_{suc})$
2. Superheating
Function output is the expansion valve opening rate (V_{exp}). At start-up the opening rate is 0%. The electronic expansion valve is an on/off valve controlled on the basis of opening rate with a constant cycle time.
3. MOP (Maximum Operating Pressure)
The MOP function prevents the suction pressure from getting too high.

Defective sensor(s)	Substitution sensor/Action	Alarm
Psuc	Emergency injection	206, Psuc unrealistic 207, Psuc invalid
Tsuc	Emergency injection	126, Tsuc invalid

6.6 Economizer valve

This function ensures optimum sub cooling of liquid to the evaporator and cooling of the FC. In addition, the cooling capacity is increased and compressed gas temperature is reduced. Function output is the economizer valve opening rate (V_{eco}).

The economizer control has two modes:

1. Superheat control
Valve opening rate control is based on calculations.
2. FC cooling
This function is active during compressor operation.

6.7 Dehumidification

The dehumidification function dehumidifies air in the container by means of a heater. This function can only be activated if the temperature control function is active. Dehumidification is achieved by decreasing evaporator surface temperature. This is done through activation of the heater and letting the temperature control increase cooling capacity resulting in an evaporator temperature descending.

This function has 3 modes:

1. Off
The dehumidification function is in the OFF position.
2. Active
The heater (Hevap) is activated when RH is more than RHSet and deactivated when RH is less than RHSet – 3 [%]. The humidity setpoint can be set in the range 50% to 95% relative humidity. The range 50% to 64% is only possible with fresh air closed/evaporator ventilation in low speed. The range 65% - 95% is possible to run with fresh air open/evaporator ventilation in high speed.
3. Override
Accessing override mode if:
 - Cooling demand exceeds 80% capacity
 - Large demand for heating
 - PTI
 - A fatal alarm is active
 - When operating without FC
 - Manual operation is active
 - Defrosting

Dehumidification function	
	Off
	Enabled
	Active

Other comments

The dehumidification icon  is shown in the display even if override is active.

The heat icon  follows the current state of the heater.

If dehumidification is active:

Defective sensor(s)	Substitution sensor/Action	Alarm
RH	Stop dehumidification	302, RH invalid

6.8 Condenser fan

Condenser fan control will reduce condenser pressure through condenser ventilation. The condenser pressure control also monitors the compressor outlet pressure in case of water-cooling. This function is activated when control is being in the automatic mode.

Condenser pressure control has two primary modes:

1. Air-cooled
In Air-cooled mode ventilation takes place in the following way:
Depending on the compressor outlet pressure, the fan is Off or runs in 2 different speeds: High and Low.
The fan runs in 4 modes: Off, Low-speed, High-speed and a cycle shifting between high and low-speed in two minutes intervals.
If Tamb is more than 48°C (118°F) or the compressor outlet pressure remains constantly high, the condenser fan constantly runs at high speed.
2. Water-cooled
If the condenser fan is constantly on for more than 1 hour, an alarm will be given.
The fan runs in 4 modes: Off, Low-speed, High-speed and a cycle shifting between high and low-speed in two minutes intervals.

Defective sensor(s)	Substitution sensor/Action	Alarm
Pdis	Start up: Condenser fan speed = slow <u>Chill/Frozen mode:</u> Condenser fan speed depends on ambient temperature.	203, Pdis invalid
Tamb	Tamb = Tinternal	129, Tamb invalid
Tret, Tevap and Tsup1	Tact = Tsup2 + constant	102/123/105, Tret/Tevap/Tsup 1 invalid
Tamb and Tinternal	Tc min	129, Tamb invalid

6.9 Evaporator fan

The evaporator fan function ensures correct fan speed (high or low). The function is active in the automatic mode.

This function has 2 modes:

1. Normal
Low speed in Frozen mode or if the following three conditions are set:
 - Tset is more than or equal to 0°C (32°F)
 - Dehumidification is turned off or humidity setpoint below 65%Otherwise high speed.
2. Economy
The fans run at a constant low speed. Exception: Tret > Tsup + 8°C (14°F) then high speed, until Tret > Tsup + 3°C (5°F) is reached.
Economy mode can be switched on by the operator, unless unit have StarConomy default on.

6.10 Defrost function

The defrost function ensures regular evaporator defrosting. The function is active in Automatic mode.

Defrost initiation

- On demand defrost, meaning defrost function will start when needed.

Defrosting interval

- The on demand defrost system is constantly monitoring the evaporator temperatures in order to prevent the evaporator blocking up with ice. If the system registers that the evaporator has become blocked up with ice, an on-demand defrost will be initiated.
- The minimum time between defrosts is 2½ hours depending on the operation mode.

The actual defrost execution is carried out using combinations of air defrost, hot gas, and electrical heaters and uses 4 modes:

1. Wait
In Wait mode the time is refreshed for the next defrost provided that the following conditions are satisfied:
 - Compressor is running
 - TO is less than T0min.Wait mode termination can be due to:
 - Calculated ice amount in the evaporator is above critical level (on-demand defrost)
 - Defrosting action initiated manually (manual defrost initiation)
2. Initialize
Wait until the condenser temperature is above 50°C (122°F), however no more than 300 sec.
3. Execute
In this mode the actual evaporator defrosting takes place. A defrost start event is made in the trip log. Cooling system termination results in compressor initiation, only ramp up mode is executed. Evaporator fan is stopped. Evaporator heating elements are turned on. Compressor runs at a constant frequency at 83% of full speed. Expansion valve control is deactivated. Hot gas valve is used to heat the evaporator from the inside with the hot gas from the compressor. Evaporator defrosting terminates when evaporator temperature (Tevap), is above defrost termination temperature for 2 min. or upon elapse of max. defrost time. A defrost stop event is made in the datalog with the current interval and Tevap temperature.
4. Terminate
Terminate mode is dividable into two parts:
 - Evaporator re-freezing preventing remaining water drops on evaporator from blowing into the container upon evaporator fan initiation.
 - Termination ensuring low evaporator fan speed to prevent shock boiling and to ensure that the temperature controller takes over in a controlled way. After termination, the unit continues normal operation again with the same setpoint temperature as before defrost start.

General information

If the Tevap sensor is not OK, adaptive defrosting uses a reduced defrost interval compared to normal calculated defrost intervals. Setpoint alteration leads to a new calculated defrost interval, and defrost starts when the defrost criteria is reached. With manual defrost initiation the current defrost interval is set to default defrost interval.

Manual defrost termination

Upon manual defrost termination, termination state is entered. No adaptive adjustment takes place when defrosting is manually initiated.

Regarding user interface

Defrost icon is displayed during defrost function execution.

Other comments

If service mode or PTI mode is selected during a defrost, the defrost mode is terminated and the time for the next defrosting is set to the pre-set value as if a normal defrost end had occurred.

If the unit is shut off for some reason during a defrost and the power disappears for less than 12 hours, the unit will start and try to finish the defrost again when the power returns. If the unit is shut off for more than 12 hours, the active defrost is terminated and the defrost function enters the wait state.

6.11 Alarm Action System (AAS)

This function defines what to do if a sensor is defect. The strategy is to substitute the missing sensors reading with the value from another sensor and a constant so that the unit can maintain its functionality with reduced precision.

6.12 Leak detection (units running with R1234yf only)

Precaution ventilation

In certain cases, the leak detection algorithm is disabled (can't detect a leak) e.g. when certain sensors are invalid. If this happens, the unit will ventilate as a precaution to minimize the risk of a dangerous atmosphere.

Leak detection is disabled if any of the following is true:

- Both Tsup1 and Tsup2 are invalid
- Tret is invalid
- Tsuc is invalid
- Pdis is invalid
- Psuc is invalid

If this happens the software will do as following:

- Forcefully ventilate with fully open Mair valve for 15 minutes.
- After the first 15 min. ventilation, the system will run in 30 min. intervals (normal operation for 29 minutes and ventilate for 1 minute).
- The user panel status text will display "Leak detection disabled".

Leak detection during operation while heating

Precaution ventilation procedure will be activated when specific requirements are met when SC 1.1 units are running in heating mode.

These specific requirements can only occur for CA and CA/CR configured units charged with R1234yf refrigerant and will activate when all of the below criteria are met:

- SC 1.1 units only.
- Startup/Defrost/ITI/PTI/UnitStop are all inactive.
- The actual capacity is above 3%.
- CA or CR is active, and O2 is above 10% or O2 measurements are invalid.

The ventilation will do the following:

- Air exchange valve opening shall be scheduled at xx:01 and xx:31 to not interfere with datalogging every whole hour.
- The automatic air exchange valve is open for duration of 1 minute.
- Will continue ventilating until above criteria is not fulfilled anymore.

When minor refrigerant leak is detected

During the precaution ventilation procedure, every 30 minutes, the air exchange valve is open for a specified opening time. Total procedure duration is 8 hours. The opening time can vary between 1 min. to 6 min. depending on the refrigerant leak size, and the precaution ventilation will start when:

- Minor leak is detected.
- The ventilation will start when the time is within frame of [hh:02; hh:22] or frame [hh:32; hh:52].

In case of a refrigerant leak with alarm and horns activating

When a refrigerant leak is detected, and leak detection is not disabled, the unit shall:

- Activate the sounder beacon.
- Activate alarm 667.

In case the unit is powered on, the unit shall:

- Stop unit operation (power off compressor, FC, O2, CO2, RH sensors)
- Start ventilation for 2 hours.

During the 20 minute ventilation, all alarms will be deactivated and disabled with the following exceptions:

- 203/207
- 310/313
- 4xx
- 5xx
- 9xx
- 603
- 667

When ventilation is active, the evaporator fans and condenser fan will run high speed and the automatic air exchange valve shall be opened to 100%.

In case the unit is powered off during ventilation period, the unit will keep being powered by battery and keep the sounder beacon active until the battery is drained. On the display it will say "REFR LEAK DETECTED" when refrigerant leak is detected in battery mode. When the unit is powered up again, the ventilation period will be restarted. On the display it will say "REFR LEAK VENT xxxM" with minutes counting down from when ventilation or pump down is running.

When ventilation is completed, the unit will:

- Perform a compressor pump down (Veco, Vexp, Vhg closed, compressor on until Psuc 0.3bar).
- Deactivate alarm 667 "Ref leak detected".
- Deactivate sounder beacon.
- Activate alarm 668 "Leak repair needed".
- Wait for user confirmation that leak repair was performed (Maintenance menu on user panel). Status text will inform "LEAK REPAIR NEEDED" until user confirms leak is repaired.
- Sounder beacon will be turned off when pump down is completed.
- When user has confirmed leak is repaired, alarm 668 "Leak repair needed" is deactivated.

6.13 Datalog

The controller has a datalog to record operation of the unit. The datalog includes 4 items:

- Data
- Extended data
- Alarms
- Event data

The logged data in the datalog can be seen:

- On the display menu L01, the viewable temperatures are listed.
- On the display menu L03, the logged temperatures can be viewed graphically.
- Retrieved via the program RefCon and the RMM modem and the power line.
- Retrieved via a program, LogMan, on a AMS device using the retriever socket.
- Retrieved via the StarView program using the retriever socket.

When an alarm is activated it triggers a complete log, however max. one per 15 min. The datalogger can hold approximately 10.000 logs or more than 1 year of loggings with default logging interval of one log per hour.

The following tables show retrievables with Starview software:

File download information			
F1		Signature	Header
F2		Container ID	
F3		Controller ID	
F4		Controller software	
F5		Retriever software	
F6		Extraction date	
F7		Comments	
Datalog			
D1	DT	Date	Stamp
D2		Time	
D3		Log type [Event, Data, Log]	Events + Alarms
D4		Event ID	
D5		Param. 1	
D6		Param. 2	
D7		Param. 3	
D8		Param. 4	Short Log
D9		Param. 5	
D10	Tsup	Supply air temperature [°C]	
D11	Tret	Return air temperature [°C]	
D12	Tusda1	USDA 1 temperature [°C]	
D13	Tusda2	USDA 2 temperature [°C]	
D14	Tusda3	USDA 3 temperature [°C]	
D15	Tcargo	Cargo temperature [°C]	
D16	Tset	Temperature setpoint [°C]	
D17	Humidity	Relative humidity [%]	
D18	AirEx	Air exchange [m³/h]	

D19	Psuc	Suction pressure [BarE]	Extended Log Type 1
D20	Pdis	Discharge pressure [BarE]	
D21	Fpower	Net frequency [Hz]	
D22	Upower	Highest power voltage of U1, U2, U3	
D23	I1	Current, Ph. 1 [A]	
D24	I2	Current, Ph. 2 [A]	
D25	I3	Current, Ph. 3 [A]	
D26	Ifc	FC current [A]	
D27	Fcpr	Compressor frequency [Hz]	
D28	Heater	Heating element [%]	
D29	Mevap	Evaporator motor status	
D30	Mcond	Condenser motor status	
D31	Tfc	Frequency module temperature [°C]	
D32	Tamb	Ambient temperature [°C]	
D33	Extended Log Type 2		Extended Log Type 2
D34			
D35			
D36			
D37			
D38			
D39			
D40			
D41			
D42			
D43			
D44	CA datalog		CA datalog
D45			
D46			
D47			
D48			
D49			
D50	Extended Log Type 3		Extended Log Type 3
D51			
D52			
D53			
D54			
D55			
D56			
D57	Extended Log Type 4		Extended Log Type 4
D58			
D59			
D60			
D61			
D62			
D63			
D64			
D65			

Header can be retrieved by Refcon, Logman, StarView and can be viewed in Refcon, LogView and StarView. Extended Log Type 1 can only be retrieved by Logman and StarView and shown in LogView and StarView. Extended Log Type 2 can only be retrieved by StarView and viewed in StarView. StarView is the unique program designed for communication with a Star cool unit through a serial connection to a PC.

7. Tests

The unit has 7 test functions:

1. Standard ITI (Intelligent Trip Inspection) test
2. ITI (Intelligent Trip Inspection) test
3. CA ITI (Intelligent Trip Inspection) test
4. Short PTI (Pre-Trip Inspection) test
5. Full PTI (Pre-Trip Inspection) test
6. CA PTI (Pre-Trip Inspection) test
7. Function test

ITI (Intelligent Trip Inspection) is a test function doing self-test during transport of cargo. The purpose is to eliminate the need for PTI test once the journey is finalized and the cargo unloaded. Standard ITI- and CA ITI-tests are ITI test options that can be run without cargo to finalize the necessary test to get the ITI checkmark.

The PTI test is a function test followed by a capacity test where the requested temperature must be reached within the time limit.

At test initiation, an event is generated in the log.

During function, PTI, and manually started ITI tests, the normal alarm system remains active. If an alarm is triggered during test operation, it appears in the display and will be written in the log as it is the case during normal operation. In case of a fatal alarm during testing the test is terminated and the unit remains off.

Function or PTI sub-test failure causes an alarm "PTI FAILURE" to be generated. In case of Function or PTI sub-test pass an event, "Test status" is displayed. For more information, please see event list.

Clear the alarm list before starting a test. If there should be any active alarms in the alarm list when a function or a PTI test is started, the test will always fail even if all the individual test steps PASS without failures.

Trip Inspection menu has a primary status and a status for each sub-test with own indexes. Only the primary status for a PTI test is memorized when supply voltage is removed.

7.1 Function test

Function test is a unit component test (non-destructive). The test is based on a GO/NO GO procedure. All tests must be executed without failure one by one for the function test result to be PASS. The tests can also be performed individually.

A full function test cannot be initiated from the Trip Inspection menu. From here the tests can only be manually initiated or as a part of the standard ITI test.

The function test can still be initiated from the PTI menu.

Note: Due to the risk of liquid in the compressor house before the compressor test (part of the function test), this liquid needs to be vaporized. Therefore, always let the compressor run for about 10-20 minutes under normal conditions before activating the PTI or function test.

Function test includes the following items:

1. PTI - init
2. Controller test
3. Power check
4. Evaporator fan (Mevap)
5. Condenser fan (Mcond)
6. Heating element (Hevap)
7. Compressor/FC/valve test (Vexp, Vhg)
8. RH sensor
9. Test completion status

For a Star Cool CA unit the following tests are added to the function test:

10. STD function test
11. CO₂ sensor test
12. O₂ sensor test
13. AirEx motor test
14. Heater in the vacuum pump
15. Test completion/status

Compressor/valve test (Vexp, Vhg)		
No	Test description (steps)	Passing conditions
80	Compressor High pressure switch test Pump down test	Max. duration 5 min Reached within max. 5 min. 20 Bar < Pdis < 24 Bar If error: AL 250 Reached within max. 5 min. Tc - T0 > 20°C If error: AL 845
81	Valve leak All valves, reed valves included	Max. duration 5 min T0diff < 25 °C If error: AL 840
83	Vexp Testing capacity	Max. duration 5 min When Pdis ≥ 5 Bar: Max. change in Pdis ± 0.75 When Pdis < 5 Bar: Max. change in Pdis ± 0.3 When Tret ≥ -15°C: Min. change in T0 + 20 °K When Tret < -15°C: Min. change in T0 + 10 °K If error: AL 842
84	Vhg (hot gas valve) Testing capacity	Max. duration 5 min When Pdis ≥ 5 Bar: Max. change in Pdis ± 0.75 When Pdis < 5 Bar: Max. change in Pdis ± 0.3 When Tret ≥ -15°C: Min. change in T0 + 20 °K When Tret < -15°C: Min. change in T0 + 10 °K If error: AL 844

NOTE: At ambient temperature above +40°C (+104°F) and below -20°C (-4°F), the unit has to be running in normal operating mode at setpoint of 0°C (32°F) for of 10 minutes with compressor running before executing a function test or PTI test. The reason for this is to ensure correct function of unit during PTI test or function test.

7.2 Full PTI

Full PTI includes the following test items:

1. Function test (see "7.1 Function test" p. 23)
2. 5°C (41°F) test + 5°C (41°F) hold test 45 min. O₂/CO₂ sensor calibration if needed
3. -18°C (-0.4°F) run test
4. Defrosting
5. Test completion/status

For units charged with R1234yf, two messages will pop up on the user panel that must be confirmed (if true) at the start of the test. The questions are to verify that the Mair Valve is operational and to verify if the beacon can be heard and beacon light is working.

If "Yes" is selected, the system will run the test as usual but if "No" is selected, the ITI will fail.

Additionally, to secure that the system is running with R1234yf, the unit will run ITI Step 10000 PTR Calibration. This step uses data from the unit to confirm the refrigerant inside of the system and should prevent any misconfiguration regarding refrigerant type.

In software ver. 361.2 and 362.0 the beacon sound during ITI Initial steps are the same as the alarm sound.

In software ver. 363.0 and onwards the beacon sound during ITI Initial steps is different from the alarm sound. It is decreased in volume and the pattern is different as well.

7.3 Short PTI

Short PTI includes the following test items:

1. Function test (see "7.1 Function test" p. 23)
2. 5°C (41°F) test + 5°C (41°F) hold test 45 min. O₂/CO₂ sensor calibration if needed
3. Defrosting
4. Test completion/status
5. Extended PTI step. Extd

7.4 CA PTI

CA PTI includes the following test items:

1. Function test (see "Function test" p. 23)
2. 5°C (41°F) run test + 5°C (41°F) hold test 45 min. O₂/CO₂ sensor calibration if needed
3. Defrosting
4. Test completion/status

Ensure a manual inspection and function test is performed before taking the Star Cool CA unit into operation. The progress of the Pre Trip Inspection can be followed in the display T04 in steps.

7.5 Finalize standard ITI

Finalize standard ITI includes the following test items:

1. Function test (see "7.1 Function test" p. 23)
2. Short PTI.
3. 5°C (41°F) test + 5°C (41°F) hold test 45 min. O₂/CO₂ sensor calibration if needed
4. Defrosting
5. Test completion/status

For units charged with R1234yf, two messages will pop up on the user panel that must be confirmed (if true) at the start of the test. The questions are to verify that the Mair Valve is operational and to verify if the beacon can be heard and beacon light is working.

If "Yes" is selected, the system will run the test as usual but if "No" is selected, the ITI will fail.

Additionally, to secure that the system is running with R1234yf, the unit will run ITI Step 10000 PTR Calibration. This step uses data from the unit to confirm the refrigerant inside of the system and should prevent any misconfiguration regarding refrigerant type.

In software ver. 361.2 and 362.0 the beacon sound during ITI Initial steps are the same as the alarm sound.

In software ver. 363.0 and onwards the beacon sound during ITI Initial steps is different from the alarm sound. It is decreased in volume and the pattern is different as well.

7.6 Finalize CA ITI

Finalize CA ITI includes the following test items:

1. Function test (see "7.1 Function test" p. 23)
2. CA PTI.
3. Air leak test (if equipment is installed).
4. 5°C (41°F) run test + 5°C (41°F) hold test 45 min. O₂/CO₂ sensor calibration if needed
5. Defrosting
6. Test completion/status

Ensure a manual inspection and function test is performed before taking the Star Cool CA unit into operation. The progress of the Pre Trip Inspection can be followed in the display T04 in steps.

8. Refrigeration system data

8.1 Refrigerant charge

4.5 kg R134a, R513A or R1234yf, with water cooled and non-water-cooled condenser.

8.2 General specification

Total unit weight	Range from 349 kg to 356 kg depending on model		
Dimensions	Height: 2235 mm	Width: 2025 mm	
Noise level	Less than 75 dB(A) in 250 Hz band. Measured 1.5 m in front of unit and 1.2 m above the ground, with the unit operating at 50 Hz.		

8.3 Compressor – motor assembly

Type	Semi-hermetic two-stage reciprocating
Number of cylinders	2 low stage cylinders 2 high stage cylinders
Speed	Variable, FC controlled
Model	S4BEF-4Y-25D
Nominal power	5.5 kW
Compressor oil type	BSE55 (item no. 818667B)
Compressor oil quantity	0.8 L in compressor and 0.4 L in system
Compressor housing	Sea water resistant aluminium, unpainted
Weight	49 kg
Conformity	EN 60034-1 EN 12693

8.4 Frequency converter (FC)

Type	FC 2.0, FC 2.1
Frequency range	20 to 90 Hz
Converter housing	Sea water resistant aluminium, unpainted
Tightness	IP 56 mounted on compressor (IP 54 stand-alone/unmounted)
Conformity	Low Voltage Directive 2014/35/EU and EMC Directive 2014/30/EU (FC 2.0)

8.5 Evaporator coil

Tube material	Copper, inner grooved, surface e-coated
Fin material	Aluminium, hydrophilic treated
Fin spacing	3.2 mm
Attitude	30° from horizontal
Conformity	PED 2014/68/EU and EC 2006/42/EC

8.6 Evaporator coil heaters

Type	ø8.5 mm in stainless steel AISI 321 fins in stainless steel AISI 304
Number	9
Rating	400 W
Conformity	EC 2014/35/EU

8.7 Evaporator fan

Material	Polyamide (PA), fibre reinforced (electrically conductive)
Type	Axial
Number of fans/blades	2 pcs
Pitch	25°
Diameter	ø315 mm
Drive	Direct on motor shaft
Conformity	International Electrotechnical Commission (IEC) 62321:2008

8.8 Evaporator fan motor

Manufacturer	Nidec motor	Zhongda motor
Type	Enclosed, non-vented	
Shaft material	Stainless steel	
No. of motors	2	
Voltage	3-phases, 400/460 V AC, 50/60 Hz	
Nominal power	0.525/0.100 kW @ 460V/60 Hz	0.305/0.060 kW @ 460V/60 Hz
Protection, electrical	Thermistors	
Speed	Dual-speed 3460/2850 rpm (60/50 Hz) 1760/1425 rpm (60/50 Hz)	Dual-speed 3430/2890 rpm (60/50 Hz) 1750/1440 rpm (60/50 Hz)
Rotation	Counter-clockwise, when viewed from shaft end	
Bearings	Permanently lubricated, sealed	
Conformity	Low Voltage Directive 2006/95/EC	

8.9 Condenser coil

Tube material	Copper, inner grooved
Fin Material	Aluminium
Fin spacing	2.0 mm
Coating, tube/fin	Cataphoresis treatment, with additional acrylic resin
Conformity	PED 2014/68/EU and EC 2006/42/EC

8.10 Condenser fan

Material	Polypropylene, glass fibre reinforced
Type	Axial
Number of fans/blades	1 pcs/4 pcs
Pitch	30°
Diameter	ø400 mm
Drive	Direct on motor shaft
Conformity	International Electrotechnical Commission (IEC) 62321:2008

8.11 Condenser fan motor

Manufacturer	Nidec motor	Zhongda dahlander motor
Type	Enclosed, non-vented	
Shaft material	Stainless steel	
No. of motors	1	
Voltage	3-phases, 400/460 V AC, 50/60 Hz	
Nominal power	0,25/0,07 kW at 460 V/60 Hz	0,30/0,08 kW at 460 V/60 Hz
Protection, electrical	Thermistors	
Speed	Dual-speed 1740/1460 rpm (60/50 Hz) 870/730 rpm (60/50 Hz)	Dual-speed 1688/1420 rpm (60/50 Hz) 750/650 rpm (60/50 Hz)
Rotation	Counter-clockwise, when viewed from shaft end	
Bearings	Permanently lubricated, sealed	
Conformity		IEC 2014/30/EU, LVD 2014/35/EU

8.12 Water cooled condenser (optional)

Operating water pressure, max.	8 BarE (115 Psi)
Water temperature, max. cooling cap.	30°C (86°F) - minimum water temperature should be higher or equal to highest actual setpoint on the containers on board
Water flow rate	22.7 to 30.2 L/min (6 to 8 gal/m)
Pressure drop	0.9 Bar to 1.2 Bar (13.05 Psi to 17.4 Psi) at above flow rate
Connections	Inlet: Hansen B-66 or equivalent. Outlet: Hansen B8-HP36-VAA or equivalent.
Condenser tubing	Cu - Ni (90/10)
Water specification	Fresh water or salt water, without free chlorine

8.13 Fresh air exchange

Fresh air exchange	Adjustable 0 to 250 m ³ /h (0 to 147 CFM) at 60 Hz adjustable by steps of 5 m ³ /h. Equivalent to 0 to 208 m ³ /h (0 to 122 CFM) at 50 Hz
AV+ controlled (optional, CO2 sensor required)	0 to 75 m ³ /h (50 Hz) controlled by the controller

8.14 Air exchange motor

Type	Gear motor
Supply	12 to 24 V DC

8.15 Economizer

Type	Brazed plate heat exchanger
Material	Stainless steel, AISI 316 L
Conformity	RoHS II 2011/65/EU

8.16 Refrigeration controls

Expansion valves	2 solenoid valves, electronically controlled by the controller
Filter drier	Danfoss DML 164 with O-ring or equivalent
Hot gas valve	Solenoid valve electronically controlled by the controller
Moisture indicator	Incorporated in receiver sight glass Material: Brass acc. to EN 12164/CW602N
Piping	Solid copper tubes according to EN 12735-1
Pipe coating	Primer: Epoxy resin zf - a120 Topcoat: Polyurethane resin Hipon - 50

8.17 Vacuum pump, including heating element

Capacity	16 m ³ /h at 50 Hz and 19 m ³ /h at 60 Hz
Supply	3 phase AC 50 Hz 340 V to 460 V and 60 Hz 400 V to 520 V
Oil (type/amount)	ISO VG 32 / 0.35 L (ver. 1) & 0.4 L (ver. 2)
Conformity	98/37/EC, 2006/95/EC, 2004/108/EC

8.18 Electrical data

Input power (operational)	3 x 360 V to 460 V 50 Hz / 3 x 400 V to 500 V 60 Hz
Control circuit voltage	12 V DC
AUX voltage AC: 19 - 30 V AC	24 V AC Nominal

8.19 Circuit breaker

Main power ampere	16 A
Conformity	Low Voltage Directive 2006/95/EC

8.20 Contactors

Nominal	9 A at 40°C (104°F) and 400 V
Max	7 A at 70°C (158°F) and 520 V
Start current	6 x nominal
Conformity	Low Voltage Directive 2014/35/EU

8.21 High pressure cut out switch

Cut out	22.5 BarE (326.3 psi) ± 0.7 Bar (10.2 Psi)
Cut in	15.9 BarE (230.6 psi) ± 0.7 Bar (10.2 Psi)
Conformity	PED 97/23/EC

8.22 Fusible plug, receiver

Blow temperature	100°C (212°F)
------------------	---------------

8.23 Fuses

Control circuit supply	0.4 A, tube fuse
------------------------	------------------

8.24 Power plug

Type	CEE 3P+E (4 pole) 32 A 400/460 V, 50/60 Hz
Protection degree	IP67
Conformity	International Electrotechnical Commission (IEC) 60309-1:1999 and 60309-2:1999

8.25 Power cable

Type	4 x 2.5 mm ² , 450/750 V, PU – sheath
Length/colour	18 m/Yellow
Temperature range	-37°C to +90°C (-34.6°F to +194°F)
Conformity	EC 2014/35/EU

8.26 USDA socket requirements

Location	Rear left side
Number	3 pcs and 1 cargo sensor
Type	Deutsch HD 10, female socket. Tin plated.

8.27 O₂ sensor

Type	Zirconium oxide
Operating range	0 to 21%
Accuracy	At O ₂ (3%) ± 0,5%, temperature ranges from -1°C to +15°C (+30°F to +59°F)
Supply	7.8 to 15 V DC
Output	RS-485

8.28 CO₂ sensor

Type	Nondispersive infrared sensor
Operating range	0 to 20%
Accuracy	CO ₂ (5%) ± 0,3% CO ₂ (0,5%) ± 0,1%
Supply	7.8 to 15 V DC
Output	RS-485

8.29 Temperature sensors, including USDA

Type	NTC, 10 kOhm at 25°C (77°F) 10K3A1
Operating temperature	-40°C to +100°C (-40°F to +212°F)
Accuracy	±0.35°C, range -40°C to -3.1°C (±0.63°F, range -40°F to +26.4°F) ±0.15°C, range -3°C to +3°C (±0.27°F, range 26.5°F to +37.4°F) ±0.25°C, range +3.1°C to +30°C (±0.45°F, range +37.4°F to +86°F) ±1.0°C, range +30.1°C to +100°C (±1.8°F, range -86.1°F to +212°F)

8.30 Relative humidity sensor

Type	Moisture capacitive element
Operating temperature	0 to 100% at -30°C to +70°C (-22°F to +158°F)
Accuracy	±0.3% at 50% and 25°C (77°F) ±0.4% at 30 to 80% and 0°C to 60°C (32°F to 140°F)
Supply	8 to 32 V DC supplied from controller at 12 V DC
Output	RS-485

8.31 CA pressure transmitter

Type	Ratiometric
Operating range	8 to 1164 mBar
Accuracy	±10 mBar
Supply	5 V DC
Output	Ratiometric

8.32 Pressure transmitters

Manufacturer		NSK	DST
Range	High pressure side	0 to 30 BarE	0 to 40 BarE
	Low pressure side	-0.69 to 9.8 BarE	-0.69 to 13.0 BarE
Conformity	High pressure side	RoHS II 2011/65/EU	RoHS 2011/65/EU EMC 2014/30/EU
	Low pressure side	RoHS II 2011/65/EU	PED 2014/68/EU
Type		Ratio metric pressure transmitter, with sealed gauge measuring principle. ¼" female flare connection with deflator.	

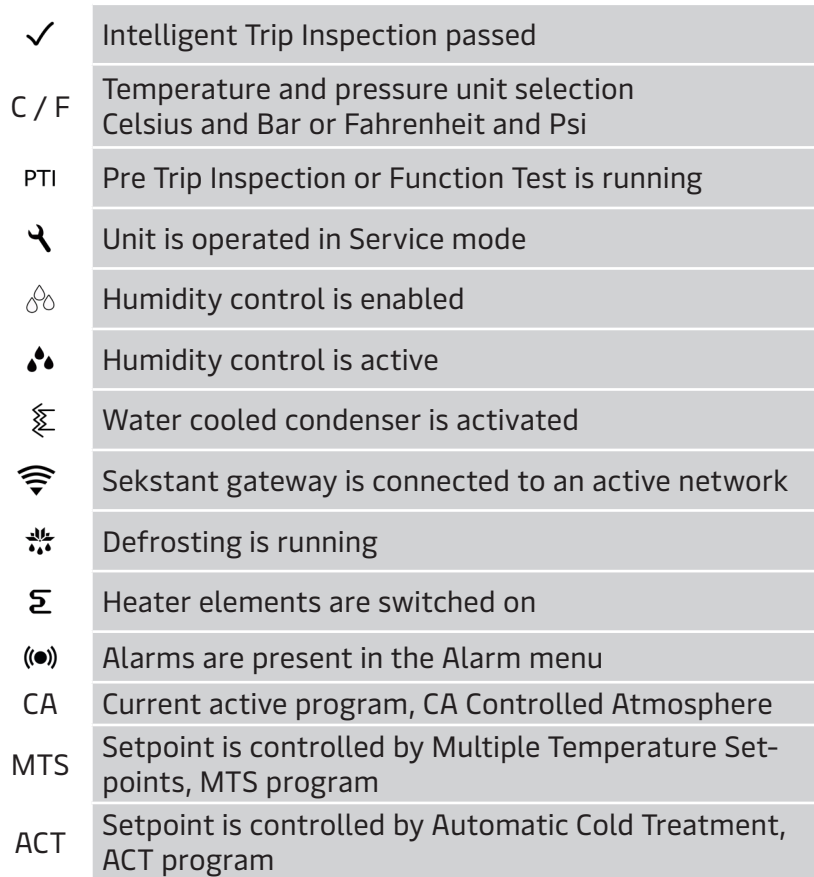
8.33 Miscellaneous

- Tin plated electrical wires
- Tin plated cables
- 2 pieces of incorporated hinges
- 2 pieces of removable evaporator hatches
- Bolts, screws and nuts in stainless steel
- Single viper peripheral seal
- Front frame is painted with polyester powder, colour RAL 9003
- Fresh air exchange is measured and logged in m³/h, definition 5 m³/h

9.1 Indicator lights

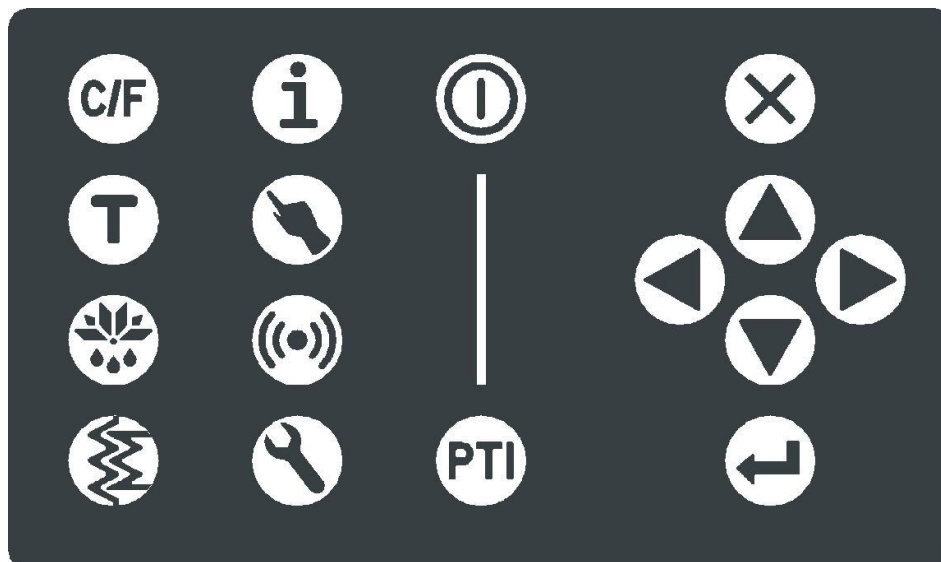
Both lights are only active when the container is connected to a power supply line. During power up, both lights are shortly illuminated to verify their function. A "Slow flash" is a short flash every 3 sec. A "Quick flash" is a flash every 1 sec. A "Normal flash" is a flash every 1½ sec.

9.2 Display



Bulb	Bulb program is running.
Range	Range program is running.
Ripe	Ripe program is running.
Durian	Durian program is running.

9.3 Keypad



Navigation keys		Use these keys to move menu display up/down and to change parameter values
	Cancel	Leave active sub menu Cancel active parameter adjustment
	Up	Move menu one line up Increment parameter value in menu Increment setpoint on main display page
	Down	Move menu one line down Decrement parameter value in menu Decrement setpoint on main display page
	Left	Move menu one line to the left
	Right	Move menu one line to the right
	Enter	Select a sub menu Activate a function (press twice) Initiate parameter adjustment Accept parameter adjustment when done
Menu keys		Press key to select menu display Press again to move menu one full page down
	Wake-up	Turn on and off battery powered display operation No display backlight will be active
	PTI	Show PRE TRIP INSPECTION menu (start/stop test and view results)
	Info	Show INFORMATION menu (actual data read out)
	Operation	Show OPERATION menu (settings)

	Alarm	Show ALARM menu (view listing of present alarms)
	Service	Show SERVICE menu (maintenance data and settings)
Function keys		Direct activation and deactivation of commonly used functions
	Unit	As long as the button is pressed, °F is shown instead of °C and Psi is shown instead of Bar in the display. Otherwise °C and Bar is shown when pressed if software is set to °F/Psi default
	Toggle	Toggles information on some sub menus.
	Defrost	010 manual defrost (see "11.14 Manual defrost" p. 60)
	Water cool	Press 3 sec. to activate and deactivate water cooled condenser

If no key is activated for a period of time, the controller will do this:

- 5 s.: Cancel active parameter adjustment
- 30 s.: Turn off battery powered display operation when not connected to a power supply line
- 5 min.: Leave service mode operation and return to automatic mode
- 10 min.: Return to main window in display

10. Menu overview

Menus are selected by pressing a menu key or by pressing the Enter key  on a sub menu line shown in the display.

10.1 General page layout

Menu title		OPERATION	
Cursor	001	Setpoint	13.0 C
	002		
	003	Control mode	STANDARD
	004	Humidity setpoint	OFF %
	005	Datalog interval	60 m
	006	PROGRAMS	>
	007		
	008		
	009	Active application	Std
Parameter ID		Parameter name	

Unit

Value

10.2 Using the cursor

The parameter ID is only used for identifying each displayed line of the menu system.

Pressing the ▲ and ▼ arrow keys will move the highlighted cursor one menu line up or down. In the upper right corner of the display is shown the actual line number of the cursor together with the total number of lines in the current menu.

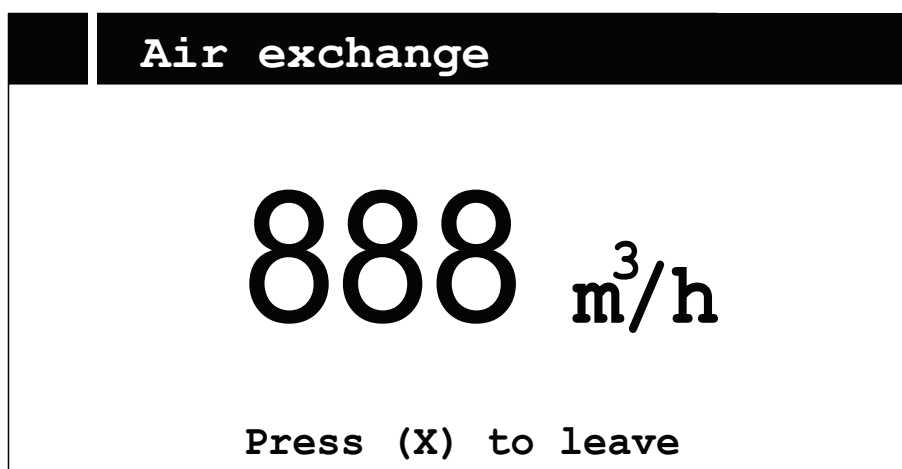
10.3 Changing a parameter value

1. First move the cursor up ▲ or down ▼ to the line of the parameter to be changed.
2. Then press the Enter key ↵. The cursor will now highlight the parameter value instead of the ID.
3. Use the up ▲ or down ▼ arrow keys to increase or decrease the displayed value.
4. Accept the new parameter value by pressing and holding the Enter key ↵ for 3 sec.
5. If not pressing any key for 5 sec. or if pressing the Cancel key ✕, the value will not be changed.
6. The cursor returns to the ID column and can now be moved to other lines.

10.4 Activating a function

1. First move the cursor up ▲ or down ▼ to the line of the function to be activated.
2. Then press the Enter key ↵. The cursor will now highlight the function value instead of the ID.
3. Do the activation by pressing the Enter key ↵ once more.
4. If not pressing any key for 5 sec. or if pressing the Cancel key ✕, no function will be activated.
5. The cursor returns to the ID column and can now be moved to other lines.

10.5 Air exchange page

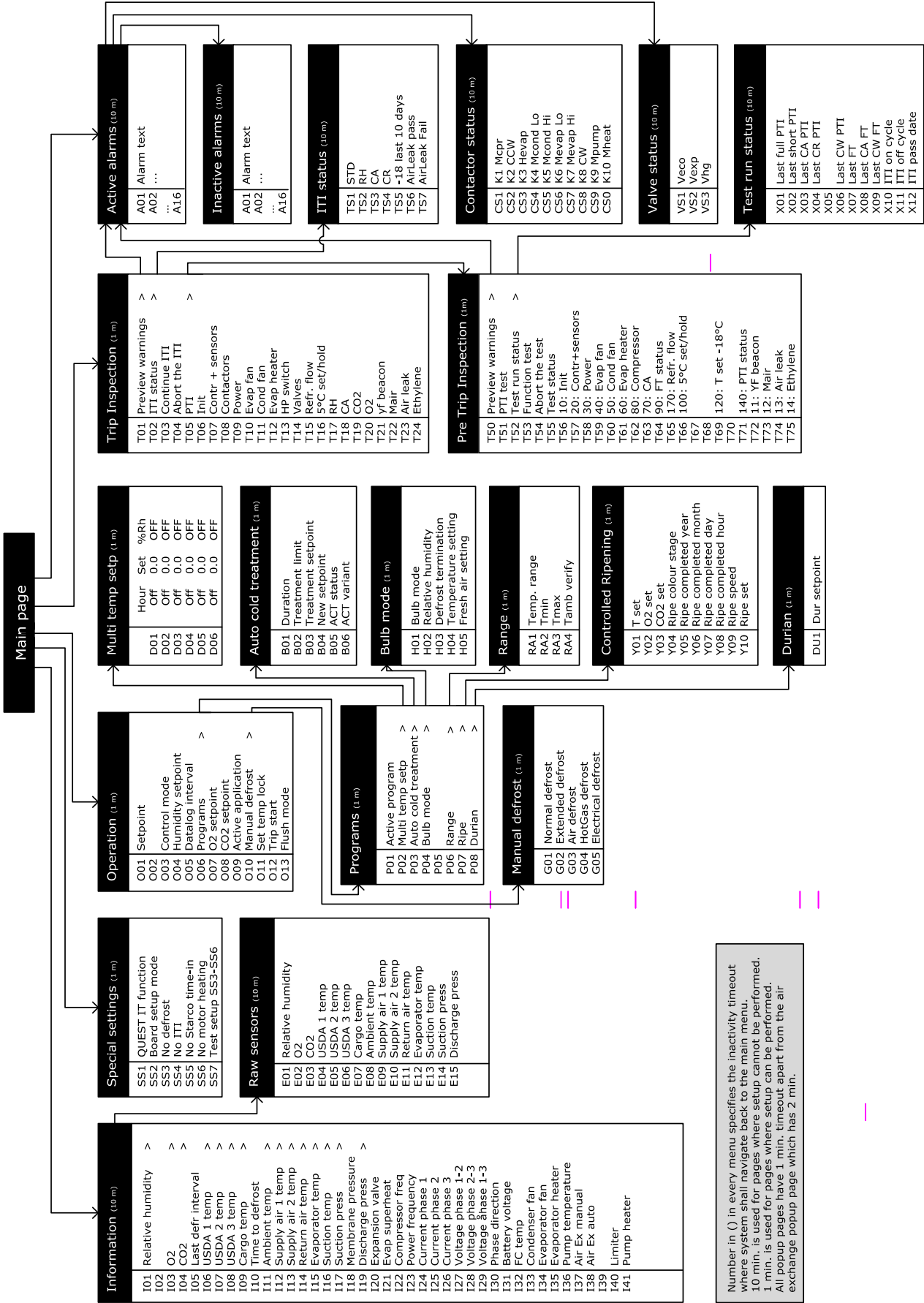


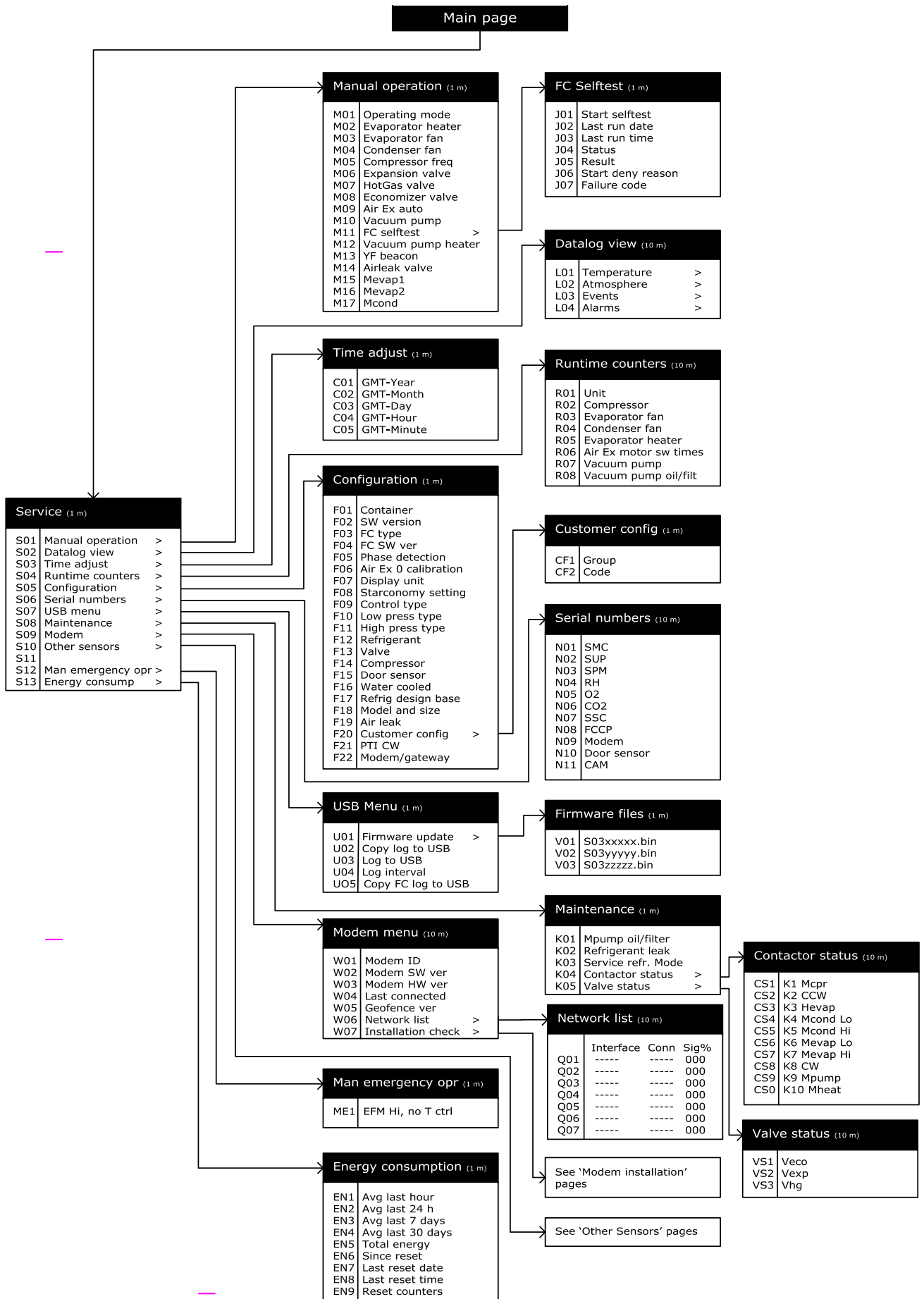
This page is automatically displayed when the user starts changing the air exchange valve position. The display returns to the main page after 10 min. or when the Cancel key ✕ is pressed.

To view actual airflow at a different time, use the Information menu ⓘ line I02.

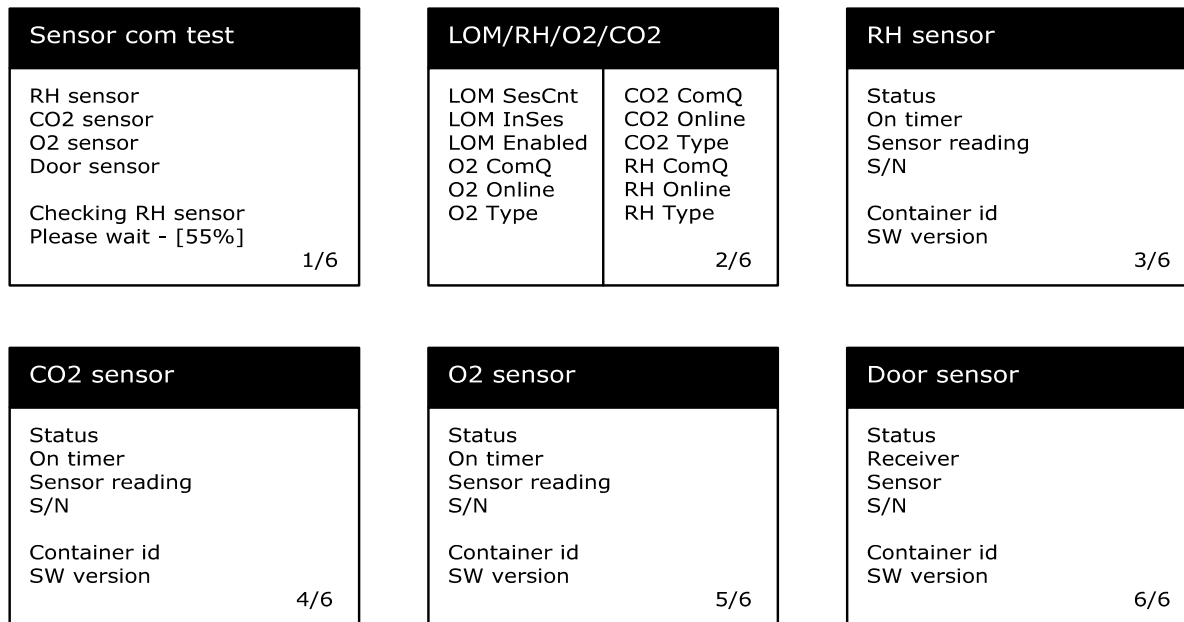
11. Operation

11.1 Menu structure

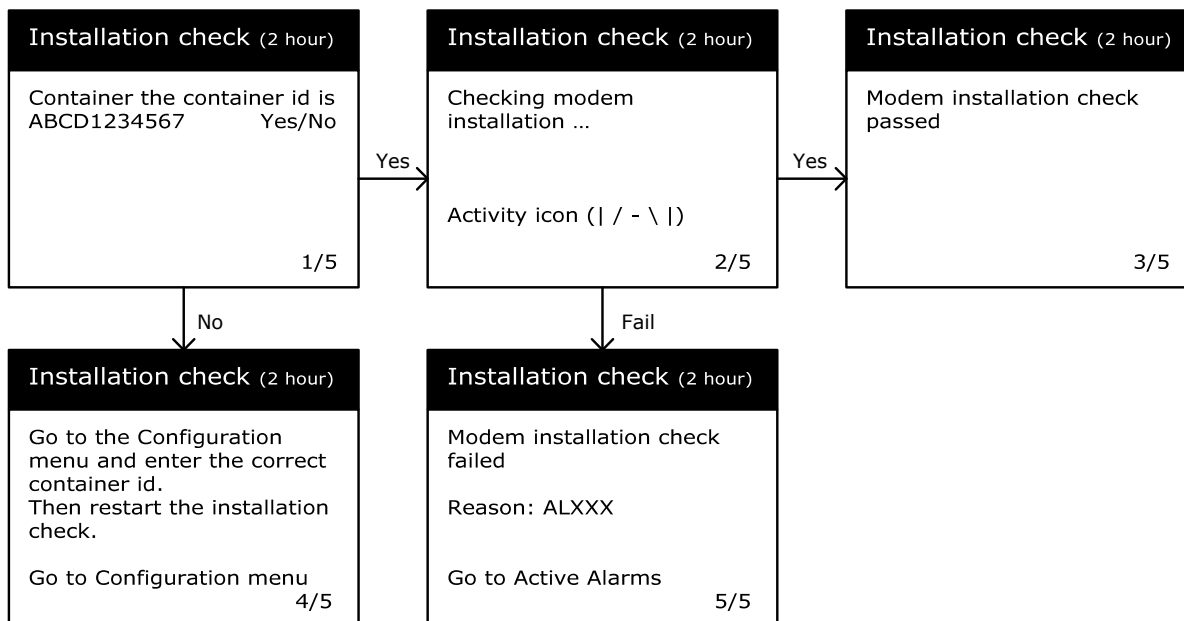




Other sensors pages



Modem installation guide



Special pages

Temperature	
RH Air	Tamb Tsup1 Tsup2 Tret Tevap Tsuc Tpump
Tusda1 Tusda2 Tusda3 Tcargo	1/15

Pressure and valve	
Pdis Psuc VexpPct VecoPct VhgPct	Tc T0 SH_act SH_ref SINJ Ver
	2/15

Motor and heater	
Mevap Mcond Mcpr HevapPct PhDir	Me1OH Me2OH McOH Shp Tevap HPumpCA MpumpCA
	3/15

Operation	
Tset CapReq Fcpr IsCountDoD Ice Type	OprMod Tact CapAct Fact LstInt LstTim Gear
	4/15

Power	
U1_2 U2_3 U1_3 Udc Umotor Power Ptot	I1 I2 I3 Idc Ifc Fpower
	5/15

Frequency converter	
Type Mode IsOnline Fset Fact Power Udc	Idc Ifc Tfc AlarmAct ComQ Alarm Status
	6/15

Calibration	
AirEx C_ID Tusda1 Tusda2 Tusda3 Tcargo	CalAex CalUs1 CalUs2 CalUs3 CalCar
	7/15

Internal reference	
U_Psuc U_Pdis U_Air U_Pmem U_Mot U5 U12	Ucom1 Ucom2 Tref1 Tref2 Tint U_Bat
	8/15

Controller	
LMC r LUP LPM LOM FWL DS CtrID	MonSt SysSta CAM (FANFC v.) Time
	9/15

Datalogger	
LogVer Lstart Lstop Lbuf Err Max LHead	LNextNb LActSec LsecCnt Lcount
	10/15

Internal Bus	
LUP SesCnt LUP InSes LUP Enabled LPM SesCnt LPM InSes LPM Enabled	LUP ComQ LPM Com
	11/15

External Bus	
LOM SesCnt LOM InSes LOM Enabled O2 ComQ O2 Online O2 Type	CO2 ComQ CO2 Online CO2 Type RH ComQ RH Online RH Type
	12/15

CO2/O2 calibration	
O2 cal stat O2 cal step O2 cal Info CO2 cal stat CO2 cal step CO2 cal info O2 cleaning	
	13/15

Module changed	
RH changed O2 changed CO2 changed LOM changed LPM changed LUP changed FC changed	
	14/15

Model code	
Model code	
	15/15

11.2 General operation

The following text is a general description of operating menus and editing parameters.

By pressing a menu key the menu is selected and its icon is illuminated. The lower part of the display shows parameter number, parameter value and a short information text in English. After 30 sec. with no keyboard activities, the display returns to the main display menu.

By pressing (X) the display returns to the previous menu level in the menu structure. If one of the other menu keys is pressed, menu selection changes.

By pressing the (▲) and (▼) keys the individual parameters are scrollable.

For parameter change, press (↔) and the parameter is highlighted in inverse writing. By pressing (▲) and (▼) keys parameter values are changeable. When desired value is set, press (↔) to accept value and parameter is shown in normal writing again. As long as the parameter value is shown in inverse writing, the setting is erasable by pressing (X) and the previous parameter value is shown again.

If the keys (▲), (▼) or (↔) are not pressed for 5 sec., the setting is cancelled and the previous parameter value is shown again.

11.3 Temperature setting

Temperature setpoint adjustment is made from the operating menu.

By pressing (▲) or (▼) the setpoint is adjusted 0.1°C (0.1°F) and the setpoint digits are highlighted in inverse writing. If the key is held, the setpoint will automatically be incremented by 0.1°C (0.1°F) until the key is no longer held. After approximately 3 sec. the setpoint will be incremented by 1°C (1°F). Upon reaching desired temperature, press (↔) and hold for 3 seconds. The setpoint will be accepted and shown in normal writing again.

During inverse writing, the new temperature setpoint is erasable by pressing (X) and the previous setpoint is shown again.

If the keys (▲), (▼) or (↔) are not pressed for 5 sec., current setting will be cancelled and previous setpoint shown again.

11.4 Wake-up mode (I)

When no main power is present the controller is switched off. The controller includes a battery for Star Cool operation when no external voltage supply is present. For battery saving in this situation, controller will turn itself off upon disappearance of external voltage supply.

By pressing (I) the controller is enabled and controller operation will be possible. In case of no keyboard activities for 30 sec., controller will be turned off again.

Controller may be manually turned off in this mode by pressing (I) again.

11.5 Contrast adjustment of the display

Press (X) and hold while pressing (▲) or (▼) to adjust contrast, and (◀) or (▶) to adjust background lighting of the display. This can be done both in battery mode and when main power is applied. After adjusting the contrast, wait for a period of 25 sec before proceeding for the new setting to be saved. Make sure contrast is properly set at all times to secure readability.

11.6 °C and °F temperature scale showing (C/F)

While button (C/F) is pressed, °F is shown instead of °C and Psi is shown instead of Bar. If software is default °F/Psi, then °C and Bar is shown instead while (C/F) is pressed.

Shown pressure is relative to atmosphere pressure.

11.6.1 Permanently change display units

The display units can be permanently changed from °C/Bar to °F/Psi, or the other way around, using StarView or via the controller menu.

Changing the display units via the controller:

1. Ensure the current software version is installed and the correct container ID is set in the Configuration menu.
2. Open the Service menu by pressing Enter .
3. Navigate to line S05 Configuration, then press Enter .
4. Go to line F07 Display Unit, press Enter , and select the desired unit scale (°F/Psi or °C/Bar).
5. Press and hold Enter  for 3 seconds until the hourglass icon appears on the display.

Some shipping lines restrict unit selection. If only one scale is allowed, the unit will default to that, and the F07 Display Unit option will not appear.

Some units go back to the default after a power cycle, a full PTI, or if the unit has been powered off for more than 96 hours.

11.7 Water-cooling activation/deactivation

The following only applies for units with water cooling (WC).

Water-cooling connecting is executed as follows:

- The container must be connected to the water-cooling system.
- Press  and hold it for 3 sec. The display shows the icon as an acceptance of water-cooling operation. The condenser fan is deactivated.

Water-cooling turn-off is executed as follows:

- Press  and hold it for 3 sec. The display turns off the  icon as an acceptance of non-operating water-cooling. The condenser fan turns on automatically.
- The container can be disconnected from the water-cooling system.

If the water supply is insufficient (the water hose is jammed, the water is not running or the water temperature is too high), the temperature in the condenser will rise and cooling capacity is decreasing and thereby threatening the cargo. If the condenser temperature rises above 58°C (136°F), the system will automatically switch to air-cooling of condenser by turning the condenser fan on. If the water flow is restored, the controller stops air-cooling of the condenser.

If the temperature stays at the high temperature for more than 1 hour, an alarm is given. The actual setting of water-cooling is remembered if the unit is switched off or there should be a power loss. Water-cooling is only turned off when the setpoint temperature is changed or when water-cooling is turned off manually.

11.8 PTI, ITI, or Function test execution

If any active warnings or alarms exist when initiating a PTI, ITI or Function test, these active alarms/warnings will be presented on display including an action selection window. Selecting "Run FT/PTI/ITI" here will enable running test though errors are detected. Pressing "Exit" will leave test menu to enable unit to be fixed before running test.

The test menu is opened by pressing . In the test menu, press keys  or  to scroll the menu. For a complete PTI test START must be highlighted by pressing  at menu item T51. Pressing  once more initiates the test. If  is not pressed within 5 sec., the controller will cancel the operation and the cursor returns to the menu item - T51.

For a short PTI test START must be highlighted by pressing  at menu item T51. Press keys  or  to scroll the menu to select SHORT. Pressing  once more initiates the test.

A complete PTI test may take several hours: First a complete function test with menu items T56 to T62 and then performance testing in menu items T63 to T75.

A short PTI takes approx. 1.5 hours.

A function test is initiated in the same way by selecting menu T53. A function test performs menu items T56 to T62, without performance testing and takes about 10 – 15 min. to complete. The function test will continue through all the steps even if failures should occur. A PTI or function test can be aborted at T54.

A single item can be tested by highlighting the item, ex. T59. When START is shown in inverse writing, pressing  again will start the test. Only the selected item is tested.

The PTI test is automatically terminated in case of no errors.

An ITI test is initiated in the same way by selecting menu T03. An ITI test performs menu items T06 to T24.. An ITI test can be aborted at T04.

If any error occurs during the test, alarms will be shown in the alarm list. Active alarms in the alarm list before start of the PTI/ITI test will lead to failure of the PTI/ITI test:

1. One alarm for PTI, ITI or function test failure. Status are also listed in the menu items T56 – T62(FT)/T75(PTI) or T06-T24 (ITI).
2. One or more alarms for a specific error during the test. Only listed in alarm list.

Failures found during the tests are listed in the alarm list and the results of the separate PTI test steps are in menu items T56 to T75 or T06-T24 for ITI test. Alarms found are logged in the datalog.

Description of an alarm can be found in this manual "14. Detailed alarm description" p. 80.

When the PTI/ITI test completes or is aborted, all alarms found during the test are set inactive in the alarm list. If the alarm list is empty, the unit is completely OK. If the controller is switched off, only the main status of a PTI/ITI test is remembered in menu item T55/T02.

T01 Preview warnings

Function:

See "11.15 Alarms" p. 61.

Value:

-

T02 ITI status

Function:

View status of ITI. Can view status for STD, CA, RH and CR.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user.

T03 Continue ITI

Function:

Start Intelligent Trip Inspection test to verify full functionality of the unit and performance test at different setpoint temperatures.

Value:

For starting ITI test, select either STD, CA, RH or CR via  or  and press  which initiates the test. The ITI test is automatically terminated in case of no errors.

T04 Abort the ITI

Function:

Stop the running ITI test.

Value:

To stop the running test, STOP must be highlighted by pressing . Pressing again stops the test.

T05 PTI

Function:

Open the Pre Trip Inspection menu

Value:

-

T06 Init

Function:

Shows the status of the test initialization. This test is always done.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user.

T07 Contr + Sensors**Function:**

Shows the status of the test of the controller.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user. See specific description for AL 801.

T08 Contactors**Function:**

Shows the status of the test of the contactors.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user.

T09 Power**Function:**

Shows the status of the test of power consumption/connection.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user. See specific description for AL 805.

T10 Evap fan**Function:**

Shows the status of the test of the evaporator fans.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user. See specific description for AL 810 - 813.

T11 Cond fan**Function:**

Shows the status of the test of the cond. fan.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user.

T12 Evap heater**Function:**

Shows the status of the test of the evaporator heater.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user. See specific description for AL 820 - 821.

T13 HP switch**Function:**

Shows the status of the test of the HP switch.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user.

T14 Valves**Function:**

Shows the status of the test of the valve plates.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user.

T15 Refr. flow**Function:**

Shows the result of the refrigerant flow test.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user. See specific description for AL 803.

T16 5 °C set /hold**Function:**

Shows the status of the 5 °C set/hold test.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user.

T17 RH**Function:**

Shows the status of the RH test.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user.

T18 CA**Function:**

Shows the status of the CA feature test.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user.

T19 CO2**Function:**

Shows the status of the CO2 test.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user.

T20 O2**Function:**

Shows the status of the O2 test.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user.

T21 YF Beacon (1234YF configured units only)**Function:**

Shows the status of the test of the YF beacon.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user.

T22 Mair (1234YF configured units only)**Function:**

Shows the status of the test of the Mair.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user.

T23 Air leak (1234YF configured units only)**Function:**

Shows the status of the test of the air leak.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user.

T24 Ethylene (Star Ripe only)**Function:**

Shows the status of the test of the ethylene system.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user.

T50 Preview warnings**Function:**

See "11.15 Alarms" p. 61.

Value:

-

T51 PTI test**Function:**

Start Pre Trip Inspection test run to verify full functionality of the unit and performance test at different setpoint temperatures.

Value:

For starting PTI test, select either FULL, SHORT or CA via ▲ or ▼ and press ↵ which initiates the test. The PTI test is automatically terminated in case of no errors.

T52 Test run status**Function:**

Go to test run sub menu.

Value:

None.

T53 Function test**Function:**

Start function test runs to verify full functionality of the unit without performance tests.

Value:

For starting function test, START must be highlighted by pressing ↵. Pressing ↵ once more initiates the test.

T54 Abort the test**Function:**

Stop the running PTI or function- test.

Value:

To stop the running test, STOP must be highlighted by pressing ↵. Pressing again stops the test.

T55 Test status**Function:**

Shows the status of the last/running test.

Value:

The value depends on the function running. For PTI the values can be: "RUN" for running, "PASS" for test passed successfully, "ABORT" for test aborted by a user, "FAIL" for a failing PTI test – see the alarm list for specific reason.

T56 Test result: 10 Init**Function:**

Shows the status of the test initialization. This test is always done.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user.

T57 Test result: 20 Contr+sensors**Function:**

Shows the status of the test of the controller.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user. See specific description for AL 801.

T58 Test result: 30 Power**Function:**

Shows the status of the test of power consumption/connection.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user. See specific description for AL 805.

T59 Test result: 40 Evap fan**Function:**

Shows the status of the test of the evaporator fans.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user. See specific description for AL 810 - 813.

T60 Test result: 50 Cond fan**Function:**

Shows the status of the test of the condenser fan.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user. See specific description for AL 815 - 817.

T161 Test result: 60 Evaporator heater**Function:**

Shows the status of the test of the evaporator heater.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user. See specific description for AL 820 - 821.

T62 Test result: 80 Compressor**Function:**

Shows the status of the test of the compressor.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user. See specific description for AL 845 and 846.

T63 Test result: 70 CA**Function:**

Shows the status of the CA feature test.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user.

T64 Test result: 90 FT status**Function:**

Shows the status of the function test.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user.

T65 Test result: 170 Refr. flow**Function:**

Shows the result of the refrigerant flow test.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user. See specific description for AL 803.

T66 Test result: 100 5°C set/hold**Function:**

Shows the status of the performance test with temperature setpoint of 5°C (41°F).

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user. See specific description for AL 855.

T69 Test result: 120 T set -18°C**Function:**

Shows the status of the performance test with temperature setpoint of -18°C (-0.4°F).

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user. See specific description for AL 870.

T71 Test result: 140 PTI status**Function:**

Shows the status of the PTI test.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user. See specific description for AL 850.

T72 YF Beacon (1234YF configured units only)**Function:**

Shows the status of the test of the YF beacon.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user. See specific description for AL 865.

T73 Mair (1234YF configured units only)**Function:**

Shows the status of the test of the Mair.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user. See specific description for AL 866.

T74 Air leak (1234YF configured units only)**Function:**

Shows the status of the test of the air leak.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user.

T75 Test result: 14 Ethylene (Star Ripe only)**Function:**

Shows the status of the ethylene test.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user. See specific description for AL 868.

11.8.1 Test run status

X01 Last full PTI**Function:**

Date of last full PTI.

Value:

YYYY-MM-DD or N/A.

X02 Last short PTI**Function:**

Date of last short PTI.

Value:

YYYY-MM-DD or N/A.

X03 Last CA PTI**Function:**

Date of last CA PTI.

Value:

YYYY-MM-DD or N/A.

X04 Last CR PTI**Function:**

Date of last CR PTI.

Value:

YYYY-MM-DD or N/A.

X05 Last EX PTI**Function:**

Date of last EX PTI.

Value:

YYYY-MM-DD or N/A.

X06 Last CW PTI**Function:**

Date of last CW PTI.

Value:

YYYY-MM-DD or N/A.

X07 Last FT**Function:**

Date of last FT.

Value:

YYYY-MM-DD or N/A.

X08 Last CA FT**Function:**

Date of last CA FT.

Value:

YYYY-MM-DD or N/A.

X09 Last CW FT**Function:**

Date of last CW FT.

Value:

YYYY-MM-DD or N/A.

X10 ITI on cycle**Function:**

Display remaining on time of current test interval.

Value:

Shown as hours.

X11 ITI off cycle**Function:**

Display remaining off time of current test interval.

Value:

Shown as hours.

X12 ITI pass date**Function:**

Date of last ITI pass → checkmark set.

Value:

YYYY-MM-DD or N/A.

11.8.2 ITI test status**TS1 STD****Function:**

Status for STD ITI test.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user.

TS2 RH**Function:**

Status for RH ITI test.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user.

TS3 CA**Function:**

Status for CA ITI test.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user.

TS4 CR**Function:**

Status for CR ITI test.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user.

TS5 -18C Last 10 days**Function:**

Status for -18C last 10 days test.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user.

TS6 AirLeak Pass**Function:**

Lists the date of the last AirLeak test pass date.

Value:

"-" if not done yet. "YYYY-MM-DD" if passed.

TS7 AirLeak Fail**Function:**

Lists the date of the last AirLeak test fail date.

Value:

"-" if it hasn't failed. "YYYY-MM-DD" if failed.

11.9 Information menu ⓘ

By pressing ⓘ the Information menu is selected. The ⓘ icon is displayed.

I01 Relative humidity**Function:**

Shows current relative humidity in the container.

Value:

Shown as a percent value.

I03 O₂**Function:**

Shows the O₂ level [%].

Value:

An actual value of the O₂ level inside the container.

I04 CO₂**Function:**

Shows the CO₂ level [%].

Value:

An actual value of the CO₂ level inside the container.

I05 Last defrost interval**Function:**

Show current interval between last two defrostings.

Value:

Shown in hours.

I06 USDA 1 temperature**Function:**

Shows current temperature for USDA 1 sensor.

Value:

Shown in temperature scale °C or °F. Switch by pressing .

I07 USDA 2 temperature**Function:**

Shows current temperature for USDA 2 sensor.

Value:

Shown in temperature scale °C or °F. Switch by pressing .

I08 USDA 3 temperature**Function:**

Shows current temperature for USDA 3 sensor.

Value:

Shown in temperature scale °C or °F. Switch by pressing .

I09 Cargo temperature**Function:**

Shows current temperature for cargo sensor.

Value:

Shown in temperature scale °C or °F. Switch by pressing .

I10 Time to next defrost**Function:**

Shows current time to the next defrosting.

Value:

Shown in hours and minutes.

I11 Ambient temperature**Function:**

Shows current ambient temperature.

Value:

Shown in temperature scale °C or °F. Switch by pressing .

I12 Supply air 1 temperature**Function:**

Shows current temperature for supply 1 sensor.

Value:

Shown in temperature scale °C or °F. Switch by pressing .

I13 Supply air 2 temperature**Function:**

Shows current temperature for supply 2 sensor.

Value:

Shown in temperature scale °C or °F. Switch by pressing .

I14 Return air temperature**Function:**

Shows current temperature for return sensor.

Value:

Shown in temperature scale °C or °F. Switch by pressing .

I15 Evaporator temperature**Function:**

Show current temperature for evaporator.

Value:

Shown in temperature scale °C or °F. Switch by pressing .

I16 Suction temperature**Function:**

Shows measured suction gas temperature.

Value:

Shown in temperature scale °C or °F. Switch by pressing .

I17 Suction pressure**Function:**

Shows current suction pressure for compressor.

Value:

Shown in units of Bar or Psi relative to atmosphere pressure. Switch by pressing  (at °C pressure is shown in BarE, at °F in Psi).

I18 Membrane pressure**Function:**

Membrane pressure.

Value:

Actual vacuum pressure between the vacuum pump and membrane. Under normal conditions: 20 - 79 mBar.

I19 Discharge pressure**Function:**

Shows current discharge pressure for compressor.

Value:

Shown in units of Bar or Psi relative to atmosphere pressure. Switch by pressing  (at °C pressure is shown in BarE, at °F in Psi).

I20 Expansion valve**Function:**

Shows current percentage of expansion valve opening. Pulse Width Modulation.

Value:

Shown as a percent value.

I21 Evaporator superheat**Function:**

Shows current superheat of expansion valve. $T_{suc} - T_0 = SH$.

Value:

Shown in temperature scale °K.

I22 Compressor frequency**Function:**

Shows current compressor frequency.

Value:

Shown in units of Hz.

I23 Power frequency**Function:**

Shows current power (net) frequency.

Value:

Shown in units of Hz.

I24 Current phase 1**Function:**

Shows actual current consumption on phase 1 for the unit excluding the compressor.

Value:

Shown in units of ampere.

I25 Current phase 2**Function:**

Shows actual current consumption on phase 2 for the unit excluding the compressor.

Value:

Shown in units of ampere.

I26 Current phase 3**Function:**

Shows actual current consumption on phase 3 for the unit excluding the compressor.

Value:

Shown in units of ampere.

I27 Voltage phase 1 - 2**Function:**

Shows current voltage between phase 1 and 2.

Value:

Units in volt.

I28 Voltage phase 2 - 3**Function:**

Shows current voltage between phase 2 and 3.

Value:

Shown in units of volt.

I29 Voltage phase 1 - 3**Function:**

Shows current voltage between phase 1 and 3.

Value:

Shown in units of volt.

I30 Phase direction**Function:**

Shows current phase sequence.

Value:

Shown as CW or CCW or None. Value is not user-changeable. If AL 423 "No phase direction" go to configuration F05 for settings.

I31 Battery voltage**Function:**

Shows current Battery voltage.

Value:

Shown as voltage.

I32 Frequency converter temperature**Function:**

Shows current converter temperature.

Value:

Shown in temperature scale °C or °F. Switch by pressing .

I33 Condenser fan**Function:**

Shows current speed for condenser fan.

Value:

Shown as OFF, LO, HI or OH (overheat).

I34 Evaporator fan**Function:**

Shows current speed for evaporator fan.

Value:

Shown as OFF, LO, HI or OH (overheat).

I35 Evaporator heater**Function:**

Shows current on/off-cycle of evaporator heating element. Pulse Width Modulation

Value:

Shown as a percent value "on" during runtime. Cycle duration is 50 sec.

I36 Pump temperature**Function:**

Shows current temperature of the vacuum pump.

Value:

Shown in temperature scale °C or °F. Switch by pressing .

I37 Air exchange manual**Function:**

Shows current opening of manual air exchange valve.

Value:

Shown as m³/h.

I38 Air exchange automatic**Function:**

Shows current opening of automatic air exchange valve.

Value:

Shown as m³/h.

I40 Limiter**Function:**

Shows what condition is limiting the cooling capacity.

Value:

None, T0 (suction pressure), Pdis (discharge pressure), Ifc (compressor current), Tfc (frequency converter temperature), Uni (defrost limiter), Itot (total current).

I41 Pump heater**Function:**

Shows current operation of vacuum pump heater.

Value:

OFF, ON.

11.10 Raw sensors

Shows the unfiltered and unsubstituted value of the sensors. When sensor is malfunctioning, the value of this sensor is substituted and marked with a ' (e.g. 0.7' C). By pressing the Enter key  in the Information menu, raw temperature sensor values are shown in the user panel.

E01 Relative humidity**Function:**

Shows current relative humidity in the container.

Value:

Shown as a percent value.

E02 O2**Function:**

Shows the O₂ level [%].

Value:

An actual value of the O₂ level inside the container.

E03 CO2**Function:**

Shows the CO₂ level [%].

Value:

An actual value of the CO₂ level inside the container.

E04 USDA 1 temperature**Function:**

Shows current temperature for USDA 1 sensor.

Value:

Shown in temperature scale °C or °F. Switch by pressing .

E05 USDA 2 temperature**Function:**

Shows current temperature for USDA 2 sensor.

Value:

Shown in temperature scale °C or °F. Switch by pressing .

E06 USDA 3 temperature**Function:**

Shows current temperature for USDA 3 sensor.

Value:

Shown in temperature scale °C or °F. Switch by pressing .

E07 Cargo temperature**Function:**

Shows current temperature for cargo sensor.

Value:

Shown in temperature scale °C or °F. Switch by pressing .

E08 Ambient temperature**Function:**

Shows current ambient temperature.

Value:

Shown in temperature scale °C or °F. Switch by pressing .

E09 Supply air 1 temperature**Function:**

Shows current temperature for supply 1 sensor.

Value:

Shown in temperature scale °C or °F. Switch by pressing .

E10 Supply air 2 temperature**Function:**

Shows current temperature for supply 2 sensor.

Value:

Shown in temperature scale °C or °F. Switch by pressing .

E11 Return air temperature**Function:**

Shows current temperature for return sensor.

Value:

Shown in temperature scale °C or °F. Switch by pressing .

E12 Evaporator temperature**Function:**

Show current temperature for evaporator.

Value:

Shown in temperature scale °C or °F. Switch by pressing .

E13 Suction temperature**Function:**

Shows measured suction gas temperature.

Value:

Shown in temperature scale °C or °F. Switch by pressing .

E14 Suction pressure**Function:**

Shows current suction pressure for compressor.

Value:

Shown in units of Bar or Psi relative to atmosphere pressure. Switch by pressing  (at °C pressure is shown in BarE, at °F in Psi).

E15 Discharge pressure**Function:**

Shows current discharge pressure for compressor.

Value:

Shown in units of Bar or Psi relative to atmosphere pressure. Switch by pressing  (at °C pressure is shown in BarE, at °F in Psi).

**11.11 Operation parameter settings **

By pressing  the Operation menu is selected. The  icon is displayed.
Use the arrow keys  and  to navigate and the Enter key  to select.

001 Setpoint**Function:**

The function is used for changing the setpoint.

Change the value to the desired value and press the Enter key  for 3 seconds to acknowledge.

Value:

-

003 Control mode**Function:**

Use to set the control mode.

If STANDARD mode is selected: In Chill mode, the evaporator fans run at high speed unless the set-point (Tset) $\geq -4.9^{\circ}\text{C}$ (23.2°F) and the air exchange is closed and dehumidification is off and CA/AV+ is inactive. In Frozen mode, the evaporator fans run at low speed.

If STARCON mode is selected: See "11.21 Configuration" p. 67.

Value:

STANDARD, STARCON. Default is customer dependent.

004 Humidity setpoint**Function:**

Setting of reference relative humidity. Note that container relative humidity is only reducible.

Value:

Shown as 'Off' or a percent value. Value can be set to Off or values from 50% to 95% in 1% increments. Default = Off.

005 Datalog interval**Function:**

Setting of interval between loggings in the datalog.

Setting the datalog interval to 60 min. (default value) allows logging of data for over a year.

Value:

Interval set to 15, 30, 60, 120, or 240 min. Default 60 min.

006 Programs**Function:**

Go to the programs sub menu.

Value:

None.

007 O₂ setpoint**Function:**

View the O₂ setpoint if the active application is set to CA.

Value:

Range 3 - 21% in increments of 0.1%.

008 CO₂ setpoint**Function:**

View the CO₂ setpoint if the active application is set to CA.

Value:

Range 4 - 20% in increments of 0.1%.

009 Active application**Function:**

Set the actual active application.

Value:

- Std (standard)
- AV+ (automatic ventilation +) *
- CA (controlled atmosphere) *

010 Manual defrost**Function:**

Go to manual defrost sub menu.

Value:

None.

011 Set temp lock****Function:**

Locks the temperature setpoint from being changed via the user panel.

Value:

On, off.

012 Trip start****Function:**

Turn trip start on or off.

Value:

On, off.

013 Flush mode**Function:**

Activating command will allow very high levels of CO₂ for 4 hours, then returning to normal control. Setting is only available if CO₂ is 10% or higher.

Value:

On, off.

* availability is model dependent.

** only visible if enabled for that unit.

11.12 Programs

P01 Active program**Function:**

Shows active program or activates selected program.

Attention: Program setpoints have to be set before activating the program is activated.

Value:

Shown as None, MTS, ACT, Bulb, Ripe or Durian mode. Press  for 3 seconds to activate selected program or stop an active program by selecting None.

P02 Multi temperature setpoints**Function:**

Leads to the sub menu of the program.

Value:

Go to the sub menu of the program.

P03 Auto Cold Treatment**Function:**

Leads to the sub menu of the program.

Value:

Go to the sub menu of the program.

P04 Bulb mode**Function:**

Leads to the sub menu of the program.

Value:

Go to the sub menu of the program.

P06 Range**Function:**

Leads to the sub menu of the program.

Value:

Go to the sub menu of the program.

P07 Ripe**Function:**

Leads to the sub menu of the program.

Value:

Go to the sub menu of the program.

P08 Durian**Function:**

Leads to the sub menu of the program.

Value:

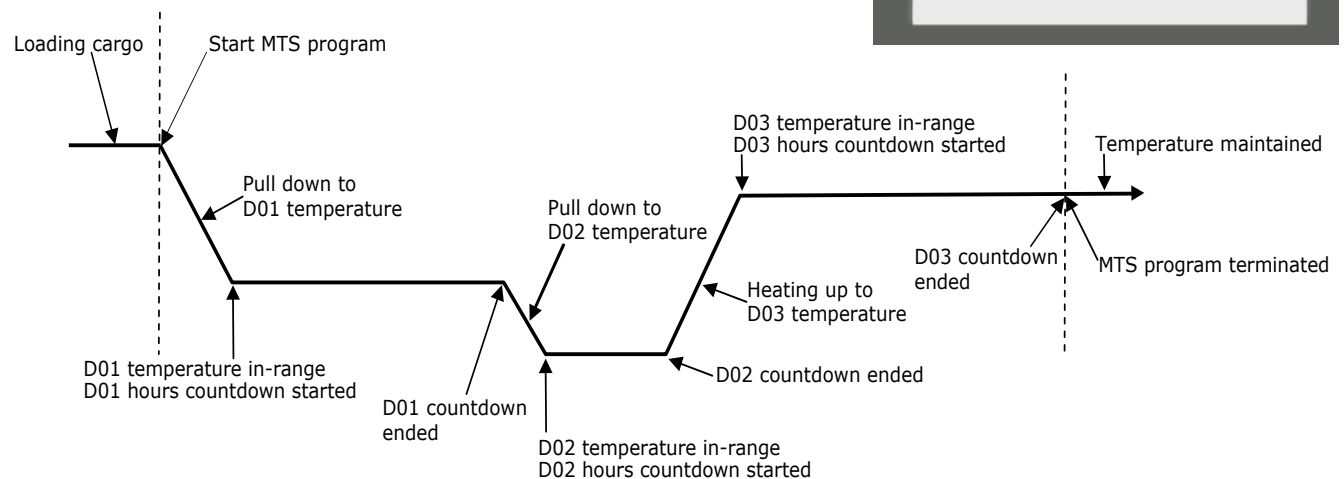
Go to the sub menu of the program.

11.12.1 Multiple Temperature Setpoints program, MTS

MTS is a program used to automatically change setpoints at specific intervals. If only one setpoint is required, set this in the Operation menu on line 001 Setpoint.

Depending on the customer configuration, the program is terminated if the user sets the active program to None, if a PTI or Automatic Cold Treatment is initiated, if the MTS program is done, if a trip start is initiated, or if the unit has been powered off for more than 48 hours.

Example:



D01-D06 Settings per step

Function:

Settings for step 1 to 6 of the Multiple Temperature Setpoints program.

Value:

D01 - D06: Step number 1 - 6:

Hours: Defines how many hours the temperature setpoint is used (from 1 to 999 hours). When setpoint from "Set" is in-range, the time starts. Setting hours to Off clears all settings in this step and the succeeding steps.

Set: The setpoint temperature to use for this step. Temperature change per hour (ramp) is fixed for cooling, and change is done with maximum cooling capacity available.

%RH: Dehumidification - humidity setpoint. Values: Off, 50% – 95%. Off means the controller maintains as high humidity as possible, at all other values the controller will use the humidity setpoint to maintain dehumidification. Dehumidification is active immediately when the step starts including under temperature ramps.

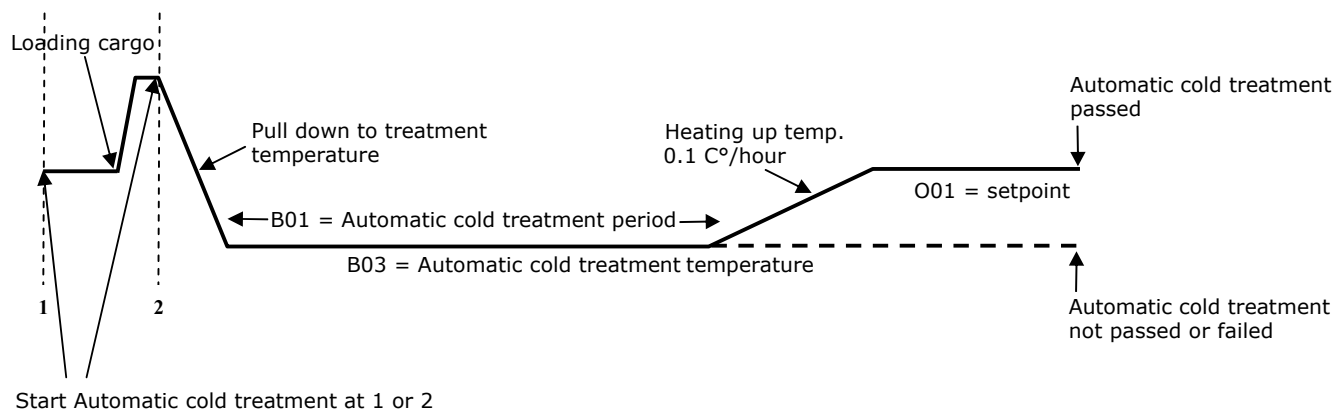
11.12.2 Automatic Cold Treatment program, ACT

Automatic Cold Treatment can only be started when all Tusda sensors are in function. If one or more Tusda sensors fail under the Automatic Cold Treatment period, the treatment temperature is kept as setpoint for the whole trip. When Automatic Cold Treatment is done without any sensor failure, ACT PASSED-PRG ACTI is written in the display status texts (see "9.2 Display" p. 32). If the USDA sensors are out of range, ACT FAILED will be written.

The ACT-status will be displayed until:

- Program status set to none
- Initiated PTI
- Power off more than 48 hours (168 hours prefix dependent)

Termination of an active ACT can only be done by manually setting active program (P01) to none or if the unit has been powered off for more than 48 hours (168 hours prefix dependent). Datalog interval during ACT is default 60 min. (cannot be changed). After ACT activation, the treatment setpoint is adjustable in the legal range.



Requirement: ACT Operation

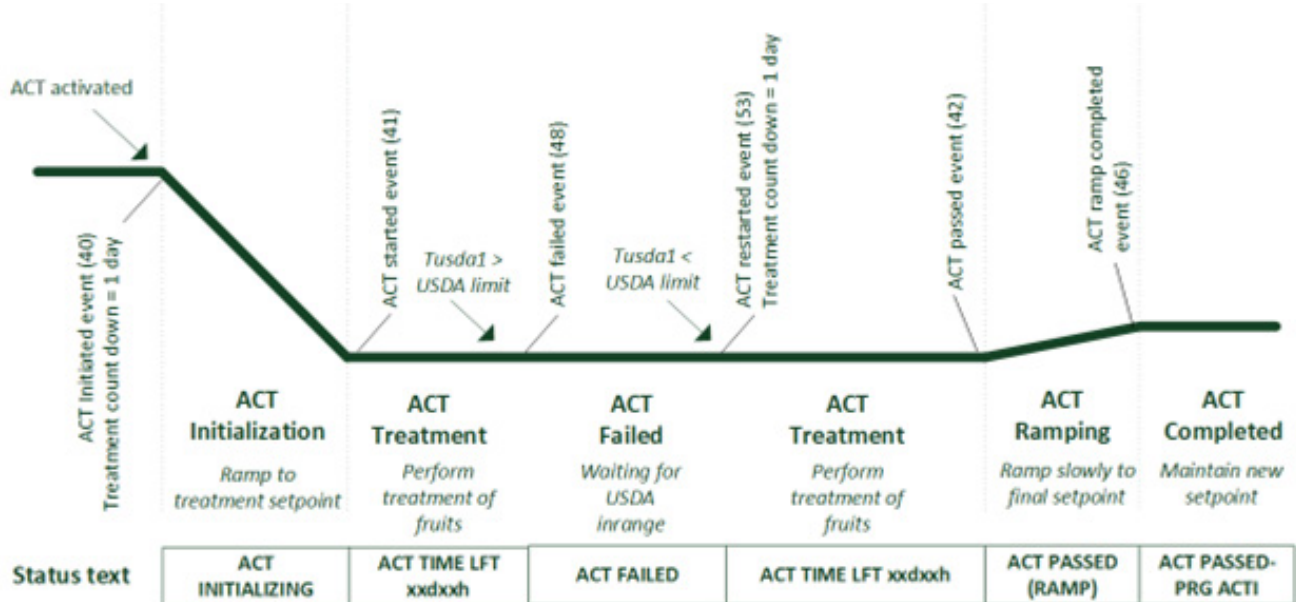
The ACT program shall perform the following steps:

- **Initialization:** Wait until all mounted USDA sensors < Treatment limit - 0.1K.
- **Treatment:** Perform treatment by keeping the USDA temperatures < Treatment limit ACT keeps Tset at treatment setpoint and monitors the USDA sensors. ACT+ controls the Tset based on the max USDA temperature.
- **Failed:** In case one of the USDA sensors violates the treatment limit, the failed state is entered. Violation shall only be checked at the whole hour. When all USDA sensors come inrange again (treatment limit - 0.1K), treatment is restarted.
- **Ramping:** Ramp the temperature to the new temperature setpoint. The slope of the ramp shall be 0.1°C per hour.

Note

The ACT can fail in case either:

1. Treatment is not completed in time e.g. in case one of the USDA sensors violate the treatment limit, the treatment is restarted and the treatment might not be completed in time.
2. The hourly USDA sensor loggings show that a USDA sensor violated the treatment limit, which means the program can't be approved.

Failure scenario:**B01 Duration****Function:**

Setting of duration in days of the Automatic Cold Treatment. There's three lines for definition of the duration.

When duration set (1) and (2) are not configured, ACT will run as a standard ACT.

Value:

Values 1 - 45 days. The number of days to use depends on the cargo and the treatment temperature. The treatment time is counted from the validity of at least 3 USDA sensors all showing a temperature below the maximum USDA temperature. If one or more USDA sensors is out of range and returns to in range again, the timer for the Automatic Cold Treatment will reset. ACT passed shows that all USDA sensors have been under maximum allowed temperature in the duration time in one period.

B02 Treatment limit / Treatment fail limit**Function:**

Setting of the maximum allowed temperature of the mounted USDA sensors. There's three lines for definition of the treatment limit. In case a USDA sensor violates the treatment limit from the first set, it will continue treatment with the treatment limit from the second or third set (if USDA sensor does not violate these treatment limits).

When treatment limit set (1) and (2) are not configured, ACT will run as a standard ACT.

Value:

-4.7°C to +30.0°C.

Shall be locked after ACT activation.

B03 Treatment setpoint / Protocol low limit**Function:**

Setting of the setpoint during the treatment.

Value:

-4.9°C to [Treatment limit - 0.2K].

After ACT activation, adjustable in the legal range.

B04 New setpoint / Final setpoint**Function:**

Setting of final setpoint.

Value:

-1.5°C to +30.0°C.

Shall be locked after ACT activation.

B05 ACT status**Function:**

Shows the status of the ACT program.

Value:

Not active, Active, Aborted, Pass, Done, Fail.

The Automatic Cold treatment program stops automatically if the unit has been powered off for more than 48 hours (168 hours prefix dependent).

USDA**Function:**

The bottom line shows the temperatures of USDA sensors 1 – 3 and the cargo sensor.

Value:

Actual temperature measured of the sensor. -70°C indicates that the sensor is not mounted!
Check alarm list to see if there should be an USDA alarm.

11.12.3 Bulb mode

The major functionality in Bulb mode is:

1. Bulb mode selection:
 - a. MevapL
 - b. MevapH
 - c. MevapL for 1 hour then MevapH for 1 hour etc.
2. The possibility to control dehumidification and termination temperature of defrosts.

Bulb mode is only available under normal operation mode. Temperature control and control of relative humidity must be as under normal operation mode conditions except for the control of the Mevap. Mevap will be controlled according to the selection of the mode as described above.

Bulb mode is NOT active in Frozen mode, StarConomy or CA/AV+. If Bulb mode compromises the temperature control, standard control will be active to correct temperature deviation. Bulb mode is OFF after PTI pass or fail and when the program is manually deactivated.

Bulb mode settings are:

1. Temperature setting from -1°C to +30°C, only Chill mode. Default 10°C.
2. RH setting from 50% to 95%. Default 95%.
3. Fresh air setting (ventilation) from 0 m³/h to 250 m³/h. Default 0 m³/h.
4. Defrost termination from +4°C to +25°C. Default 15°C.
5. Bulb mode selection:
 - a. MevapL = BulbLo
 - b. MevapH = BulbHi
 - c. BulbAlt = MevapL for 1 hour then MevapH for 1 hour etc. (Always starting with low speed, also after defrost or power on)

Fresh air setting will be done by actually adjusting the manual air vent to the desired amount of fresh air and then accepting the settings in the program menu.

In the datalog, the following will be recorded as an event:

1. Bulb mode ON
2. Bulb mode OFF

The Bulb setup parameters will be logged as parameters to the event (RHset, Ventilation, Defrost termination criteria, Type of Bulb mode (either Hi, Low or Alt)).

H01 Bulb mode**Function:**

Fan pattern when in Bulb mode.

Value:

Values: Lo, Hi or Alt.

H02 Relative humidity**Function:**

Relative humidity setpoint when in Bulb mode.

Value:

Values: Set from 50% to 95%.

H03 Defrost termination**Function:**

Evaporator temperature must be above this limit before defrost can stop.

Value:

-

H04 Temperature setting**Function:**

Temperature setpoint when in Bulb mode.

Value:

Values: Set from -1°C to +30°C (default 10°C).

H05 Fresh air setting**Function:**

When user manually adjusts the air vent, the setting will be highlighted in the display and prompt the user to press .

Value:

Values: Set from 0 to 250 m³/h.

11.12.4 Range

Range program controls the Tset based on the ambient temperature to prepare the unit for power off scenarios, where the ambient temperature could influence the cargo temperature to be outside the required operation temperature range (e.g. Chilled temperature range Tmin=2C, Tmax=8C).

The settings for Range is as following:

RA1 Temp. range**Function:**

Select range for temperature.

Value:

Chilled (2.0°C to 8.0°C), Ambient (15.00°C to 25.00°C), Other (-5.9°C to 30°C)

RA2 Tmin (if 'Other' is selected)**Function:**

Set Tmin. Range is -5.9°C to 27°C.

Value:

Shown in temperature scale °C or °F. Switch by pressing .

RA3 Tmax (if 'Other' is selected)**Function:**

Set Tmax. Range is -2.9°C to 30°C.

Value:

Shown in temperature scale °C or °F. Switch by pressing .

RA4 Tamb verify**Function:**

Shows current ambient temperature which must be verified before program start.

Value:

Shown in temperature scale °C or °F. Switch by pressing .

If Tmin is changed to a value that lies above Tmax -3, Tmax will automatically be changed to Tmin +3.
If Tmax is changed to a value that lies below Tmin +3, Tmin will automatically be changed to Tmax -3.

If program is terminated (whether manually or automatically), current calculated/filtered Tset is kept as the controlling Tset. Afterwards Tset must be configured from the Operation menu 001.

11.12.5 Controlled Ripening

The settings for controlled ripening is as following:

Y01 T set

Function:

The function is used for changing the setpoint.

Change the value to the desired value and press the Enter key  for 3 seconds to acknowledge.

Value:

-

Y02 O2 set

Function:

The function is used for changing the O2 setpoint.

Change the value to the desired value and press the Enter key  for 3 seconds to acknowledge.

Value:

-

Y03 CO2

Function:

The function is used for changing the CO2 setpoint.

Change the value to the desired value and press the Enter key  for 3 seconds to acknowledge.

Value:

-

Y04 Ripe colour stage

Function:

Select the colour stage of the cargo at the end of the ripe program.

Value:

CONFIRM

Y05 Ripe completed year

Function:

Year of completion of ripe program.

Value:

YYYY

Y06 Ripe completed month

Function:

Month of completion of ripe program.

Value:

MM

Y07 Ripe completed day

Function:

Day of completion of ripe program.

Value:

DD

Y08 Ripe completed hour

Function:

Hour of completion of ripe program.

Value:

XX:XX

Y09 Ripe speed

Function:

Select speed of ripe program

Value:

CONFIRM

Y10 Ripe set**Function:**

Confirm settings by pressing the Enter key  for 3 seconds.

Value:

-

11.12.6 Durian

The settings for durian mode is as following:

DU1 Dur setpoint**Function:**

The function is used for changing the setpoint.

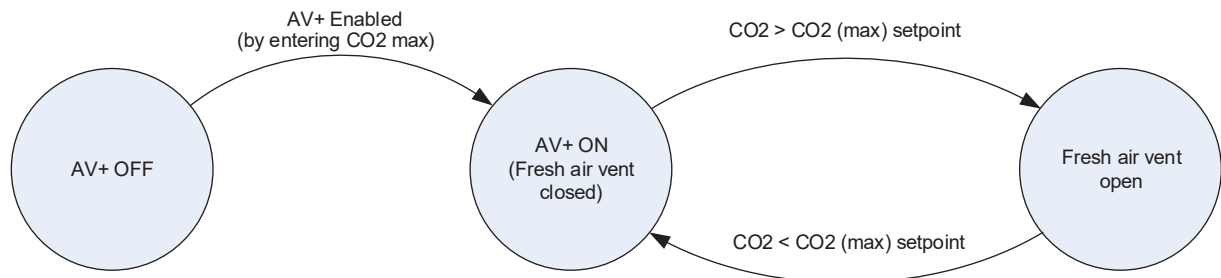
Change the value to the desired value and press the Enter key  for 3 seconds to acknowledge.

Value:

-

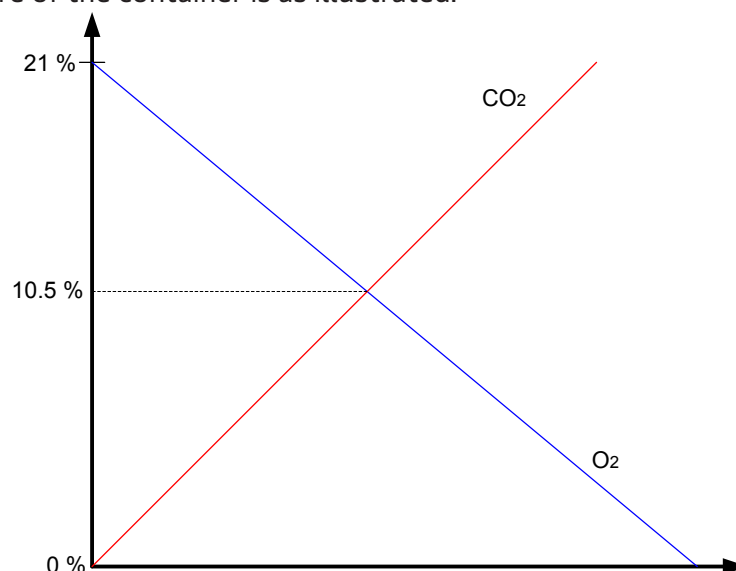
11.13 Active application settings**11.13.1 AV+**

The Star Cool AV+ is an application designed to automatically regulate the internal atmosphere of the container using greatly reduced energy consumption compared to manual or other automated fresh air systems. With a respiring cargo, the container's atmosphere attains the desired gas composition based on entered setpoints for maximum CO₂ via the controller which accurately regulates the exchange of CO₂ for O₂ using ambient air.



Perishables will generate CO₂ via respiration, leading to an increase in the CO₂ and a proportional decrease in O₂ level inside the container. If the CO₂ level in the container atmosphere reaches above the pre-set CO₂ max level, the air exchange valve will open and thereby lower the CO₂ level and raise in O₂ by diluting with ambient air.

For AV+ setpoints are entered via the display: Max CO₂ level range 1 - 19.8%. The relation between O₂ and CO₂ in the atmosphere of the container is as illustrated:

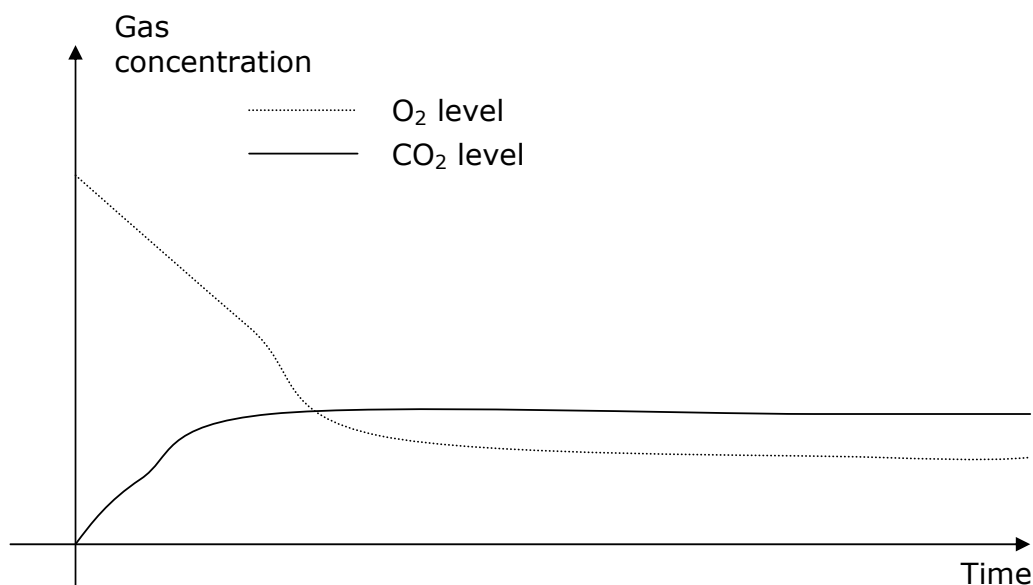


11.13.2 CA

ATTENTION! Due to regulation of the cargo atmosphere during transport, the oxygen level may be low and/or the carbon dioxide level high inside the container! Please check gas levels and flush with fresh air before entering and unloading. Exposure to low oxygen/high carbon dioxide may cause loss of consciousness and suffocation.

The Star Cool CA is a controlled atmosphere application designed to prolong the shelf life of perishables by regulating the internal atmosphere of the container. The container's atmosphere obtains the desired gas composition based on entered setpoints for O_2 and CO_2 via the controller. The desired atmospherical composition of the gas serves to lower the respiration of the perishables, and thereby providing a prolonged shelf life.

The basic principle is that the fruit will generate CO_2 from O_2 via respiration. This will increase the CO_2 level and decrease the O_2 level inside the container. When the CO_2 level reaches above the CO_2 setpoint the vacuum pump will activate and evacuate CO_2 with the selective membrane. If the O_2 level goes below the O_2 setpoint the air exchange valve will open and let in ambient air (20.9% O_2). This described mechanism will regulate the gas concentration within the container as illustrated below:



Level readings:

Actual O_2 and CO_2 concentrations can be viewed in the menu structure on line I03 and I04, and in the main display window. The membrane pressure can be viewed in the menu structure on line I18 Membrane pressure. Actual vacuum pump oil temperature can be viewed in the menu structure on line I36 Pump temperature.

If the setpoints for O_2 and CO_2 are set to Off, the CA function is turned off. If the setpoint is set to Frozen mode, the CA function is turned off.

To turn on the CA function:

1. Tset to a chill setpoint
2. Set Active application to CA
3. Scroll to an O_2 setpoint
4. Scroll to a CO_2 setpoint

All of the above needs to be set for the CA function to be activated. Please note that it will take 5 minutes before O_2 and CO_2 can be viewed in the display.

The AirEx motor can be activated in Manual mode in the menu structure on line M09 Air Ex auto.

0%: Valve closed

100%: Valve open

The vacuum pump can be activated in the menu structure on line M10 Vacuum pump. Activating the vacuum pump should result in a pressure drop which can be viewed in the menu structure on line I18 Membrane pressure when running range 20-79 mBar. Only manually activate the vacuum pump when absolutely necessary! The vacuum pump is not pre-heated if manually activated - this can cause damage to the vacuum pump over time.

11.14 Manual defrost

A manual defrost is only accepted if T_{evap} less than 15°C (59°F). Defrosting is manually initiated by pressing the  key or using the 010 Manual defrost menu, selecting specific defrost type and holding it for 3 sec. The display shows the  icon as an acceptance of defrost initiation.

G01 Normal defrost

Function:

Defrost where defrost type is selected automatically.

Value:

Default OFF. Select ON and hold for 3 seconds to start defrosting.

G02 Extended defrost

Function:

Defrost where defrost type is extended.

Value:

Default OFF. Select ON and hold for 3 seconds to start defrosting.

G03 Air defrost

Function:

Defrost using evaporator fan only.

Value:

Default OFF. Select ON and hold for 3 seconds to start defrosting.

G04 HotGas defrost

Function:

Defrost using hot gas only. Requires T_{amb} to be above +5°C (41°F).

Value:

Default OFF. Select ON and hold for 3 seconds to start defrosting.

G05 Electrical defrost

Function:

Defrost using electrical heater only.

Value:

Default OFF. Select ON and hold for 3 seconds to start defrosting.

11.15 Alarms

The alarm list holds all active and inactive alarms. By pressing  all active alarms are shown. The full list of active/inactive alarms, fatal alarms and warnings can be accessed using the T00 menu. The icon  is displayed in upper left corner of the display. With any alarms in the list the icon is displayed on the main menu.

Alarm handling is to protect the unit with cargo and inform the user in case of error conditions. The main priority is to keep cargo safe.

Alarm handling is split in 2 parts:

1. Detect an abnormal situation and report it as an alarm.
2. React on the alarms and compensate for them (AAS - Active Alarm System).

An alarm can have 4 different levels.

- Log: Information for service. Only in the datalog, not on the display.
No risk to cargo.
- Warning: Warning of an abnormal situation, but the unit continues to operate with unchanged or little change in functionality in actual running mode.
No risk to cargo.
- Alarm: The unit operates with reduced or changed functionality.
Risk to cargo.
- Fatal Alarm: The unit needs service now!
Serious risk to cargo!

All errors in the 4 levels can have two states: Active or Inactive.

- Active: The alarm is active.
- Inactive: The alarm is no longer active. The alarm can be acknowledged from the alarm list.

The 4 alarm levels will be treated by the controller in the following way:

Alarm type	Datalog	Alarm list	Red LED	Cargo risk
Log	Yes	No	OFF	No risk to cargo
Warning	Yes	Yes	OFF	No risk to cargo
Alarm	Yes	Yes	SLOW FLASH 2% ON, 98 % OFF Duty time of 3 sec	Risk to cargo
Fatal Alarm	Yes	Yes	QUICK FLASH 80% ON, 20 % OFF Duty time of 1 sec	Serious risk to cargo!

Alarm handling is made to detect abnormal situations, possibly solve problems and report the problems. The alarm types indicate for the operator how severe the problem is for the safety of the cargo. Some problems are fluctuant where the problem may be fixed if the unit restarts.

Some of the alarms are only warnings but will restart the unit to try to solve the problem. There is an individual time out period for the alarms. A warning will not stop the unit permanently! If a problem with warning type continues to be active over a period, the problem seems to be of a more stable and therefore more severe character and another alarm is triggered with alarm type Alarm.

The AAS (Active Alarm System) will substitute a missing or malfunctioning sensor with one of the other sensors and thereby try to keep the cargo safe and well as long as absolutely possible. The substitution may lead to a deteriorated control precision, especially in Frozen mode, but the unit is not stopped fully until there are no further sensors to substitute with. The unit may try to restart to see if the malfunctioning is fluctuant. For example, if there is no substitution for a sensor or the substitute sensor is also faulty, alarm "611 Too many sensor err" is raised and the specific sensor(s) are listed separately in the alarm list.

The alarm list can include a maximum of 16 active/inactive alarms. In case of an empty alarm list,  + "No alarms" is shown.

An active alarm is shown as Acc AAnnn, where cc is the list number from 01 to 16, and nnn is the actual alarm number. An inactive alarm is shown as Acc IAnnn, where cc is the list number from 01 to 16, and nnn is the actual alarm number. An active alarm cannot be deleted from the list but may change to inactive state by eliminating the cause of the alarm. An inactive alarm can be deleted from the list by pressing  during alarm displaying.

11.16 Service function settings

By pressing  the Service menu is selected. The  icon appears in the display.

Service menu consists of various sub-menus. Use the arrow keys  and  to navigate and the Enter key  to open a sub-menu. By pressing , the display returns to Service menu.

Service menu consists of the following sub-menus:

- Manual operation (M01 - M14) Manual start/stop of motors etc.
- Datalog view (L01 - L04) View of temperature log
- Time adjust (C01 - C05) Setting of date and time
- Run time counters (R01 - R07) View of running hours for unit, compressor etc.
- Configuration (F01 - F22) Software version and various configurations
- Serial numbers (N01 - N11) Serial number for various parts
- USB menu (U01 - U05) USB functions for firmware update and logging
- Maintenance (K01 - K05) Vacuum pump oil and filter replacement acknowledgement
- Modem (W01 - W07) Modem settings and status
- Other sensors (S10) RH, CO2 and O2 sensor status
- Man emergency opr (S12) Manual emergency operation
- Energy consumption (EN01-EN09) Energy consumption statistics

11.17 Manual operation

M01 Operating mode

Function:

Start/stop of operating mode. If operating mode is MANUAL, controller stops, and by means of menu items M02 to M08 heaters, motors and valves may be manually operated. In menu item M05 compressor frequency is set. In case of no keyboard activities for 5 min., manual mode is automatically deactivated and unit starts automatically up.

Note that the unit should only be set to Manual mode by trained service personnel!

Value:

Set to MANUAL or AUTOMATIC. The bottom line on the menu shows the current consumption in the three phases (fan motor and heater) and for the frequency converter I1, I2, I3, FC.

M02 Evaporator heater

Function:

Manual heater on/off. Note that value is only accepted if control is in the manual mode (menu item M01 is MANUAL).

Value:

0 - 100 % or OFF.

M03 Evaporator fan

Function:

Manual evaporator fan on/off. Note that value is only accepted if control is in the manual mode (menu item M01 is MANUAL).

Value:

Set to OFF, LO (low speed) or HI (high speed).

M04 Condenser fan

Function:

Manual condenser fan on/off. Note that value is only accepted if control is in the manual mode (menu item M01 is MANUAL).

Value:

Set to OFF, LO (low speed) or HI (high speed).

M05 Compressor frequency

Function:

Manual setting of compressor frequency. Note that value is only accepted if control is in the manual mode (menu item M01 is MANUAL).

MANUAL: Compressor frequency is set.

Value:

MANUAL: Set to OFF (compressor stop) or value between 20 and 100 Hz.

M06 Expansion valve

Function:

Manual setting of expansion valve % opening. Note that value is only accepted if control is in the manual mode (menu item M01 is MANUAL) and compressor is not running.

Value:

Set from 0 to 100%.

M07 Hot gas valve

Function:

Manual setting of hot gas valve % opening. Note that value is only accepted if control is in the manual mode (menu item M01 is MANUAL).

Value:

Set from 0 to 100%.

M08 Economizer valve

Function:

Manual setting of economizer valve % opening. Note that value is only accepted if control is in the manual mode (menu item M01 is MANUAL).

Value:

Set from 0 to 100%.

M09 Air Ex auto**Function:**

Manual setting of external air valve % opening. Note that value is only accepted if control is in the manual mode (menu item M01 is MANUAL).

Value:

10-75m³/h.

M10 Vacuum pump**Function:**

Manual control of vacuum pump. Note that value is only accepted if control is in the manual mode (menu item M01 is MANUAL).

Value:

ON/OFF.

M11 FC selftest**Function:**

Leads to the FC self-test sub menu.

Value:

Go to the FC selftest sub menu.

M12 Vacuum pump heater**Function:**

Manual vacuum pump heater on/off. Note that value is only accepted if control is in manual mode (menu item M01 is MANUAL).

Value:

ON/OFF.

M13 YF Beacon**Function:**

Manual control of YF beacon. Note that value is only accepted if control is in the manual mode (menu item M01 is MANUAL).

Value:

ON/OFF.

M14 Airleak valve**Function:**

Manual setting of airleak valve % opening. Note that value is only accepted if control is in the manual mode (menu item M01 is MANUAL).

Value:

ON/OFF.

11.17.1 FC self-test**J01 Start self test****Function:**

Start the frequency converter built-in self-test.

Value:

Start.

J02 Last run date**Function:**

Date of the last FC self-test.

Value:

YYYY-MM-DD.

J03 Last run time**Function:**

Time of the last FC self-test.

Value:

HH:MM.

J04 Status**Function:**

Displays the current status of the frequency converter self-test.

Value:

Not run, Try to start, Running, Start denied, Finished.

J05 Result**Function:**

Displays the result of the latest frequency converter self-test.

Value:

Not run, Success, Failed.

J06 Start deny reason**Function:**

Displays the reason for the frequency converter self-test not starting.

Value:

-- : Self test is not denied (self-test can run)

Wrong FC: FC 1.0 is connected

FC offline: FC is not connected

Temp high: FC is warmer than 80°C

Cpr running: Compressor is running

Trip lock: FC has a trip lock alarm active

Motorheat: FC is running motor heat

IT grid protect: FC ITI grid protection is active

FC internal: During 'Try to start' in status the FC denied starting the self-test

Timeout: During 'Try to start' in status the FC did not respond within the timeframe

J07 Failure code**Function:**

Displays why the frequency converter self-test failed.

Value:

0001 pre-check alarm, 0002 pre-check op current, 0008 pre-check temp, 0016 pre-check storage, 0128 self-check alarm, 0256 self-check op current, 1024 self-check temp.

11.18 Datalog view

Press up  or down  to show newer or older stored set of values from the datalog.

Press  to change between the 4 zooming levels. The blank and black "bar" at the right-most edge shows a scale of 1°C per Bar.

L01 Text temperatures**Function:**

Viewing of logged temperatures. Press  on the main menu to get directly to this menu.

Value:

The following temperatures can be viewed: Setpoint temperature, supply air temperature, return air temperature, relative humidity%, air exchange m³/h, USDA 1 + 2 + 3 temperatures and cargo temperature. When entering the menu, the newest logged temperatures are always shown.

Press  to toggle between stored set of temperatures: Setpoint temperature, supply air temperature, return air temperature, relative humidity%, air exchange and the other set of temperatures: USDA 1 + 2 + 3 temperatures and cargo temperature. To move one page up, press , or down, press , to list the previous or next page of stored set of values from the datalog.

L02 Text atmosphere**Function:**

Viewing of logged atmosphere values. Press  on the main menu to get directly to this menu.

Value:

The following data can be viewed: CO2 setpoint, O2 setpoint, CO2 and O2. When entering the menu, the newest logged atmosphere values are always shown.

L03 Events**Function:**

Viewing of logged events.

Value:

-

L04 Alarms**Function:**

Viewing of logged alarms.

Value:

-

11.19 Time adjust**C01 GMT-Year****Function:**

Setting of year.

Value:

Set from 2000 to 2099.

C02 GMT-Month**Function:**

Setting of month.

Value:

Set from 1 to 12.

C03 GMT-Day**Function:**

Setting of day.

Value:

Set from 1 to 31.

C04 GMT-Hour**Function:**

Setting of hours.

Value:

Set from 0 to 23.

C05 GMT-Minute**Function:**

Setting of min. Note: when min. are set, sec. are set to 00.

Value:

Set from 0 to 59.

11.20 Run time counters**R01 Unit****Function:**

Viewing of Star Cool unit operation hours.

Value:

Shown as hours.

R02 Compressor**Function:**

Viewing of compressor operation hours.

Value:

Shown as hours.

R03 Evaporator fan**Function:**

Viewing of evaporator fan operation hours.

Value:

Shown as hours.

R04 Condenser fan**Function:**

Viewing of condenser fan operation hours.

Value:

Shown as hours.

R05 Evaporator heater**Function:**

Viewing of heater operation hours.

Value:

Shown as hours.

R06 AirEx motor sw times**Function:**

Number of times the air exchange valve is opened.

Value:

Times.

R07 Vacuum pump**Function:**

Total number of vacuum pump run time.

Value:

Hours.

R08 Vacuum pump oil/filt**Function:**

Total number since last vacuum pump oil and filter change.

Value:

Hours.

11.21 Configuration

F01 Container**Function**

Viewing and setting of container ID.

Value:

Set 4 letters followed by 7 numbers e.g. MCID 000 001 2.

F02 SW version**Function:**

Viewing of controller software version and revision.

Value:

-

F03 FC type**Function:**

Viewing and setting of actual FC type.

Value:

Set as DANFOSS or NONE for no FC mounted (see "25.1 FC 2.0/2.1 bypass" p. 116).

F04 FC SW version**Function:**

Viewing of FC software version.

Value:

-

F05 Phase detection**Function:**

Setting of phase detection.

Value:

Is only possible when AL 423 is active. Default setting is AUTO for automatic phase detection - automatically selected when the unit has been switched off for more than 30 min. before switching it on again. Can be used for manual phase setting: Setting as CW for clockwise rotation or CCW for counter-clockwise rotation. If manual phase detection is set, heat is reduced to 60% of max.

F06 Air Ex 0 calibration**Function:**

Zero adjust of air exchange sensor when the air inlet is closed.

Value:

Actual value of sensor is set to zero when Enter key  is pressed.

F07 Display unit**Function:**

Choose between temperature and pressure units.

Value:

C/bar or F/psi.

F08 Starconomy setting**Function:**

Configure if Starconomy is available as a control mode. Configure if Starconomy is as default on or off.

StarConomy is an energy saving function, which uses StarConomy for ventilation control and the Standard temperature control. Under certain conditions, StarConomy is suspended (e.g. temperature is not in range), where the Standard temperature and ventilation control is used instead.

Value:

No Starconomy, Default off, Default on.

F09 Control type**Function:**

Atmosphere control type.

Value:

None, CA, AV+, AV+O2.

F10 Low pressure type**Function:**

Set the pressure transmitter that is physically mounted for low pressure measurement. Press Enter for 3 sec. to make the selection.

Value:

NSK or DST.

F11 High pressure type**Function:**

Set the pressure transmitter that is physically mounted for high pressure measurement. Press Enter for 3 sec. to make the selection.

Value:

NSK or DST.

F12 Refrigerant**Function:**

Select the type of refrigerant mounted in the system.

When the unit is powered on after a powered off period of 60 min., the unit will run a heater detection to see if has the right heater type to be able to select R1234yf as a refrigerant. And if the correct heater is not detected the R1234yf refrigerant type will not be available to be selected in the configuration list.

Value:

R134a, R513a or R1234yf.

F13 Valve**Function:**

Set the valve version to correspond to physical mounted version.

Value:

Ver. 4

F14 Compressor**Function:**

Set the compressor type to correspond to physical mounted version.

Value:

Ver. 2

F15 Door sensor**Function:**

Enable door sensor feature.

Value:

No, Yes.

F16 Water cooled**Function:**

Enable water cooled condenser.

Value:

No, Yes.

F17 Refrig design base**Function:**

The refrigerant base design config is continuously verified up against the detected heater type. For R1234yf, the heater type is PTC. If heater type doesn't match, AL 676 will be activated, and correct settings must be verified in F17.

Value:

-

F18 Model and size**Function:**

View model and size of container.

Value:

-

F19 Air leak**Function:**

Enable air leak test during CA PTI/ITI.

Value:

No, Yes.

F20 Customer configuration**Function:**

Go to the customer configuration sub menu.

Value:

None.

F21 PTI CW**Function:**

Enable PTI CW tests. PTI CW is for reefers with reduced requirements for performance.

Value:

No, Yes

F22 Modem gateway**Function:**

Checks if modem is connected.

Value:

No, Yes

11.21.1 Customer configuration**CF1 Group****Function:**

Configuration of various features.

Value:

CF00 - CF24.

CF2 Code**Function:**

Configuration of various features.

Value:

10 digit crypted code.

11.22 Serial numbers

N01 SMC

Function:

Main controller.

Value:

Main controller serial no.

N02 SUP

Function:

User panel.

Value:

User panel serial no.

N03 SPM

Function:

Power meas.

Value:

Power meas serial no.

N04 RH

Function:

Humidity sensor.

Value:

Humidity sensor serial no.

N05 O2

Function:

O₂ sensor.

Value:

O₂ sensor serial no.

N06 CO2

Function:

CO₂ sensor.

Value:

CO₂ sensor serial no.

N07 SSC

Function:

Sub controller.

Value:

Sub controller serial no.

N08 FCCP

Function:

Frequency converter.

Value:

Frequency converter serial no.

N09 Modem

Function:

Modem.

Value:

Modem serial no.

N10 Door sensor

Function:

Door sensor.

Value:

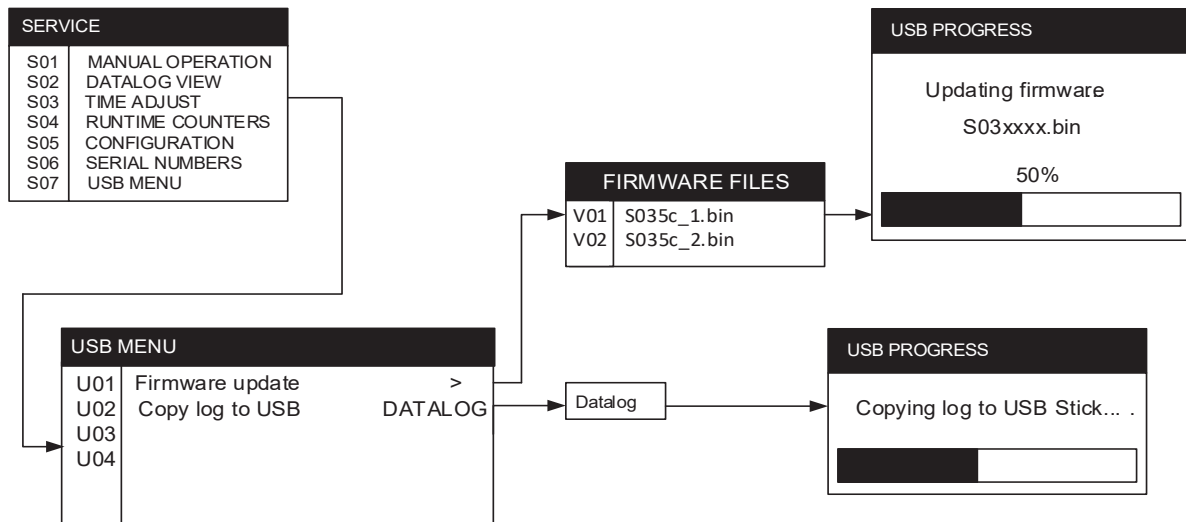
Door sensor serial no.

N11 CAM**Function:**

CAM

Value:

CAM serial no.

11.23 USB menu

The use of a USB memory stick provides easy access to the unit without need of connecting any external equipment like a PC. A service technician can, using USB, upgrade container unit firmware.

U01 Firmware update**Function:**

Container unit firmware can be upgraded from a USB memory stick. A firmware upgrade is started from the USB menu.

Value:

Depending on content of USB memory stick one out of following scenarios occurs:

1. If only one valid software file is placed in the root directory of the memory stick, the upgrade is started by selecting yes.
2. If more than one valid software files are placed in the root directory of the memory stick, user must select actual from valid software binaries filename list presented in display. The upgrade is started by selecting yes.

U02 Copy log to USB**Function:**

User selected log(s) will be stored on USB memory stick. The logs will be stored in a StarView compatible file format, enabling them to be opened here. Log file names (shown for container ID = MCIU1234567):

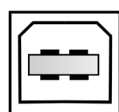
Datalog: SMCIU123.456

Fastlog: FMCIU123.456

Value:

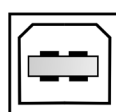
Datalog: Saving normal datalog to USB memory stick.

USB type: Inside container



PC

Inside controller box



PC



Memory Stick

U03 Log to USB**Function:**

User specified dataset will be stored on USB memory stick. The data will be stored in a StarView compatible file format, enabling them to be opened here. File names (shown for container ID = MCIU1234567):

Datalog: SMCIU123.456

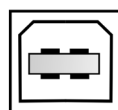
Value:

Datalog: Saving datalog to USB memory stick.

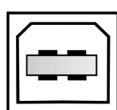
USB type:

Inside container

Inside controller box



PC



PC



Memory Stick

U04 Log interval**Function:**

Frequency of logging for U03.

Value:

Minutes.

U05 Copy FC log to USB**Function:**

Transfer a copy of the FC log to a plugged-in USB.

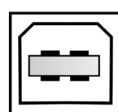
Value:

FC log: Saving FC log to USB memory stick.

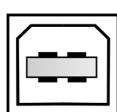
USB type:

Inside container

Inside controller box



PC



PC



Memory Stick

11.24 Maintenance**K01 Mpump oil/filter****Function:**

User acknowledgement of changing oil and filter. Will reset AL 656 Mpump service.

Value:

NONE or EXCH (when oil and filter change is required).

K02 Refrigerant leak**Function:**

Shows the status of the test of the refrigerant flow.

Value:

"-" if not done yet. "RUN" if still running test. "PASS" if test finished successfully. "FAIL" if the test failed. "ABORT" if the test was aborted by the user.

K03 Service refr. mode (R1234yf only)**Function:**

When servicing units with R1234yf refrigerant, removing refrigerant while the system is powered off triggers the standstill detection. After recharging with refrigerant and powering the system back on, the unit enters a 2-hour autoventilation phase, during which the beacon will activate. This process ensures safe operation by venting any residual gases.

Value:

Off/On

K04 Contactor status**Function:**

Shows the status of the contactors.

Value:

-

K05 Valve status**Function:**

Shows the status of the valves.

Value:

-

11.24.1 Contactor status**CS1 K1 Mcpr****Function:**

Shows the status of the Mcpr contactor.

Value:

Working/Failed

CS2 K2 CCW**Function:**

Shows the status of the CCW contactor.

Value:

Working/Failed

CS3 K3 Hevap**Function:**

Shows the status of the Hevap contactor.

Value:

Working/Failed

CS4 K4 Mcond Lo**Function:**

Shows the status of the Mcond Lo contactor.

Value:

Working/Failed

CS5 K5 Mcond Hi**Function:**

Shows the status of the Mcond Hi contactor.

Value:

Working/Failed

CS6 K6 Mevap Lo**Function:**

Shows the status of the Mevap Lo contactor.

Value:

Working/Failed

CS7 K7 Mevap Hi**Function:**

Shows the status of the Mevap Hi contactor.

Value:

Working/Failed

CS8 K8 CW**Function:**

Shows the status of the CW contactor.

Value:

Working/Failed

CS9 K9 Mpump**Function:**

Shows the status of the Mpump contactor.

Value:

Working/Failed

CS0 K10 Mheat**Function:**

Shows the status of the Mheat contactor.

Value:

Working/Failed

11.24.2 Valve status**VS1 Veco****Function:**

Shows the status of the Veco valve.

Value:

Working/Failed

VS2 Vexp**Function:**

Shows the status of the Vexp valve.

Value:

Working/Failed

VS3 Vhg**Function:**

Shows the status of the Vhg valve.

Value:

Working/Failed

11.25 Modem**W01 Modem****Function:**

Modem identification.

Value:

Modem serial number.

W02 Modem SW version**Function:**

Show modem software version and revision.

Value:

Software version and revision.

W03 Modem HW version**Function:**

Show modem hardware version and revision.

Value:

Hardware version and revision.

W04 Last connected**Function:**

Timestamp showing last time modem was connected to backend server.

Value:

Date and time YY/MM/DD HH:MM.

W05 Geofence version**Function:**

Show version of the present geofence file.

Value:

Version of the present geofence file.

W06 Network list**Function:**

Show list of active networks.

Value:

Network name - name of network type (e.g. LoRa, cellular, BLE).

Network connection - network service provider (e.g. TDC, Orange, AT&T).

Signal strength - 0-100%.

W07 Installation check**Function:**

Assistance to check if the modem has been correctly installed.

Value:

Pass/Fail

11.26 Other sensors

The other sensors sub menu is categorized in 5 pages, a test page, an overview page, and one page for each sensor.

S10 Other sensors**Function:**

RH, CO2, O2, and door sensor (optional) test and status.

Value:

	Description	Value
Test	Shows the communication status of each sensor and allows the sensor test to be run.	
Status	Overall status of the sensor. When FAIL is caused by bad communication or sensor power (e.g. low voltage).	OK/FAIL
Communication	Communication status to the sensor. Communication is kept OK until it is known that communication is not working.	OK/FAIL
Sensor power	Informs about troubles with the sensor power e.g. low or high voltages.	OK/FAIL (supply voltage shall be within 10 - 13 V).
Sensor output	The raw measurement delivered from the sensor. When communication or sensor power is FAIL, sensor output is -. When activity is restarting, sensor output is -.	Measurement (x.xx) -
Activity	What the sensor is doing. When communication or sensor power is FAIL, activity is -.	Initializing Cleaning (only O2 sensor) Standby (only O2 sensor) Calibrating (only CO2/O2 sensor) Measuring Restarting -
S/N	Serial number of the sensor. ID in serial number informs about the sensor type. Serial number is displayed until communication is lost or until a new sensor is detected.	

11.27 Man emergency opr

ME1 EFM Hi, no T ctrl**Function:**

Manually start the evaporator fans in high speed and turn all other components off.

Value:

On or Off.

11.28 Energy consumption

EN1 Avg last hour

Function:

Average power consumption the last hour.

Value:

Average in kW.

EN2 Avg last 24h

Function:

Average power consumption the last day.

Value:

Average in kW.

EN3 Avg last 7 days

Function:

Average power consumption the last week.

Value:

Average in kW.

EN4 Avg last 30 days

Function:

Average power consumption the last month (30 days).

Value:

Average in kW.

EN5 Total energy

Function:

Total Energy consumption in unit lifetime.

Value:

Accumulated consumption in kWh.

EN6 Since reset

Function:

Energy consumption since last reset of counter

Value:

Accumulated consumption in kWh.

EN7 Last reset date

Function:

Date of last reset

Value:

YYYY-MM-DD.

EN8 Last reset time

Function:

Time of last reset

Value:

HH:MM

EN9 Reset counters

Function:

Reset the counters.

Value:

-

12. External interfaces

The Star Cool controller can be accessed externally in the following ways:

Connection type	Connection method	Device
Slave modem	Powerline	Master modem
Retriever socket	RS 232	LogMan PDA Star Cool Service App StarView
USB retriever socket	USB	StarView

12.1 General requirements

1. Serial port setup is 19200, 8, N, 1
2. Unless otherwise stated, byte order is low byte first

12.2 List of terms used for external interfaces

Term	Description
LM	Local monitor serial communication port on the container unit
LogMan	Hand-held datalog retriever terminals
LogView	PC software viewer for container datalog files
RefCon	Powerline based container monitoring system and PC software
RMM	Remote monitor modem for powerline communication
SCCU6	Reefer container controller unit (Star Control)
Star Cool	Reefer container unit name
Star Cool Connect Dongle	Bluetooth dongle used to connect to controller with the Star Cool Service App (version 3.3 or higher).
Star Cool Service App	Mobile device application for iOS or Android
StarView	PC software Star Cool unit monitor

12.3 Functions overview

It is defined in the table below, which Star Cool functions each device and system will support.

Function	LogMan	LogView	RefCon	Star Cool Service App	StarView	Controller
Display basic data ¹			x		x	x
Display alarm list			x	x	x	x
Display controller information			x		x	(x)
Change container ID	x		x		x	x
Change temperature setpoint			x			x
Change humidity setpoint			x			x
Change controller date and time	x		x			x
Change units from °C/Bar to °F/Psi					x	
Calibrate USDA and cargo sensors	x				x	x
Acknowledge alarms					x	x
Initiate manual defrost			x			x
Initiate Trip Start	x		x			
Initiate Function test and PTI			x		x	x
Terminate Function test and PTI			x		x	x

Display Function test and PTI results			x		x	x
Retrieve datalog from unit	x		x	x	x	
Save datalog file (binary)	x				x	
Save datalog file (RefCon)			x			
Save datalog file (CSV text)					x	
Display datalog file (binary)		x			x	
Display datalog file (RefCon)			x			
Display datalog file (CSV text)					x	
Update controller software via bootloader	x					
Update controller software via protocol				x	x	
Operate controller in Manual mode						x

(1) Basic data: Tset, Tsup, Tret, RH, Tusda1 - 3, Tcarg, operation mode, Ubat

(x) Not all information is visible on the controller's display.

13. Events

Events, containing ID and additional run time data, are created and put into the datalog under specific occasions in order to be able to analyse the behaviour of the container unit.

No.	Name	Datalog parameter				
		Parameter 1	Parameter 2	Parameter 3	Parameter 4	Parameter 5
0	Temperature setpoint	Actual setpoint	New setpoint	n/a	n/a	SW revision
1	Humidity setpoint	Actual setpoint	New setpoint	n/a	n/a	n/a
2	Watercool deselect	n/a	n/a	n/a	n/a	n/a
3	Watercool select	n/a	n/a	n/a	n/a	n/a
4	FT start	PTI test ver	1: FT 2: CA FT	n/a	n/a	Alarm count
5*	FT step OK	Step ID	n/a	n/a	n/a	n/a
6	FT abort	Step ID	n/a	n/a	Time [sec]	Alarm count
7	ITI test failed	Step ID	n/a	n/a	n/a	n/a
8	PTI start	PTI version	1: Full PTI 2: Short PTI 3: CA PTI 4: CR PTI 5: Ext PTI 6: CW PTI 10: STD ITI 11: CA ITI 12: CR ITI	n/a	n/a	Alarm count
9*	PTI step OK	Step ID	n/a	n/a	n/a	n/a
10	PTI abort	Step ID	n/a	n/a	Time [sec]	Alarm count
12	Manual mode select	n/a	n/a	n/a	n/a	n/a
13	Manual mode deselect	n/a	n/a	n/a	n/a	n/a
14	Defrost start	Defrost activation cause: 1: Manuel start 2: Ice counter (depre- recated) 3: Demand defrost 4: Restarted 5: PTI 6: Motor overheat 7: Ice mode	DoD criteria: 0: None 1-x: One of the cur- rently defined DoD counters in RQ's	Defrost type: 0: Air 1: Hotgas 2: EI	Ice model	Actual defrost interval [minutes]
15	Defrost stop	Tevap at time of execute end	Tret at time of execute end	Time it took Tret to come from -1 °C to 1 °C [sec]	Time it took Tret to come from -2 °C to 2 °C [sec]	Defrost function: 0x8000: Standard 0x4000: Extended 0x2000: Long
16	Trip start	0: User trip-start 1: Auto trip-start	n/a	n/a	n/a	n/a

17	USDA sensor calibrated	1: USDA 1 2: USDA 2 3: USDA 3 4: CARGO	Sensor offset (reading of uncalibrated probe in ice water)	n/a	n/a	Compatibility flag 0x8000 = version 1 format
			Old calibration offset before calibration	New calibration offset after calibration		Compatibility flag 0x0000 = version 0 format
18	Extended defrost active	0: Deactivated 1: Activated				
20	Power up	Unit run time [hours]	Compr. run time [hours]	Mevap run time [hours]	Mcond run time [hours]	Hevap run time [hours]
21	User wake-up	n/a	Battery voltage	Wakeup cause	Power mode	n/a
22	Power down	SW version (Least Significant Byte)	SW version (Most Significant Byte)	Vbatt.	Power up count	SW revision
23	Software update	Current SW version (2 Least Significant Bytes)	Current SW version (2 Most Significant Bytes)	New SW version (2 Least Significant Bytes)	New SW version (2 Most Significant Bytes)	Current SW revision (8 most significant bits) New SW revision (8 least significant bits)
24	FC software update	Current SW version (2 Least Significant Bytes)	Current SW version (2 Most Significant Bytes)	New SW version (2 Least Significant Bytes)	New SW version (2 Most Significant Bytes)	
25	Real time clock	Old date	Old time	New date	New time	n/a
26	FC type	Old	New	n/a	n/a	n/a
27	Datalog interval	Old	New	n/a	n/a	n/a
28	Defrost information	Dehumi rate	Water accumulated	Ice accumulated	Refside capacity	Airside capacity
29	Gateway FW update	0 = Old version 1 = New version	Major	Minor	Patch	Delimiter
30	Container ID	Old	n/a	n/a	n/a	n/a
31	Press sensor type	Old LP	New LP	Old HP	New HP	n/a
32	Parameter change	Source: 0 = modem	Config changed Prog changed PTI/FT Ctrl Tset changed, FW update, USDA calib	Set ID, time, humi, Logint. ATMOS, O ₂ , CO ₂ , Program, CT, MTS, Reboot Std FT, Full PTI, Stop CA FT, CA PTI, Short PTI	n/a	Failure/Success
33	Sensor substituted	Substituted sensor	New sensor used	Temperature of substituted sensor	Temperature of new sensor	n/a
34	Singlestep start	n/a	n/a	n/a	n/a	n/a
35	Singlestep abort	Step ID	n/a	n/a	Time [seconds]	Alarm count
36	Singlestep ok	Step ID	n/a	n/a	n/a	n/a

50	Modem	"Reason bitword: 2 = Test passed 32 = Battery failed 64 = Wiring failed 128 = Connectivity failed"				
51	CO ₂ sensor restarted	CO ₂ value before	CO ₂ value after	Number of restarts	n/a	n/a
52	Software version	SW version (2 least significant bytes)	SW version (2 most significant bytes)	SW revision	n/a	n/a
53	ACT restarted	Treatment limit: XX.XX	Treatment setpoint: XX.XX	Probes used 1: USDA 1 2: USDA 2 4: USDA 3 8: CARGO	Duration [days]	New setpoint: XX.XX
54	ACT redefined					
55	ACT terminated defaulting					
56	Range	1 = Program started 0 = Program terminated	Temperature range 0=Chilled 1= Ambient 2= Other	Tmax	Tmin	Tset (user) Tset (filtered)
59	Modem installation	"Reason bitword: 2 = Test passed 32 = Battery failed 64 = Wiring failed 128 = Connectivity failed"	n/a	N/A	n/a	n/a
60	Durian	0=Deactivatad 1=Activated 2=Tset changed	Tset	N/A	N/A	N/A
63	GPS position	Latitude part 1	Latitude part 2	Longitude part 1	Longitude part 2	n/a
65	FC self-test	Test result: 0: Not run 1: Passed 2: Failed	Test deny reason: 0: Not denied 1: Wrong FC 2: FC offline 3: Temperature high 4: Cpr running 5: Trip lock 6: Motorheat 7: IT grid protection 8: FC internal error 9: Test timed out	Self-test status word low 16 bits	Self-test status word high 16 bits	Tfc
66	Defrost OldIceRel	Dehumi rate	Water accumulated	Ice accumulated	Old icec ounter	StarInject rev
67	Defaulting configuration	Defaulting type: 1 = A 2 = B 3 = C	n/a	n/a	n/a	n/a
68	Power spike robustness	Udc value	Udc limit	n/a	n/a	n/a
70**	Atm control start	O ₂ setpoint	CO ₂ setpoint	Type: O ₂ or CO ₂	Pump runtime	AirEx sw time
71**	Atm control stop	n/a	n/a	n/a	Pump runtime	n/a
72**	Atm setpoint	Old	New	Type: O ₂ =0 [%] CO ₂ =1 [%] AirEx exchange rate=2 [m ³ /h]	n/a	n/a
73	Module removed	1: RH 2: O ₂ 3: CO ₂ 4: SSC 5: SPM 6: SUP 8: FC 9: MCI RH 10: MCI CO ₂ 11: MCI O ₂ 12: GW 105: SPM100 205: SPM200 306: SUP300 316: SUP310	Serial no first digit after S/A/P If parameter 1 is MCI sensor, then: parameter 2 is - bit 0-6 first digit - bit 7 in parameter 2 indicates first letter: 0: P 1: A Only first byte used e.g. 137 is A9	Serial no next 4 digits	Serial no 3 digits after ID	Serial no 4 digits after W

74	Module added	1: RH 2: O ₂ 3: CO ₂ 4: SSC 5: SPM 6: SUP 8: FC 9: MCI RH 10: MCI CO ₂ 11: MCI O ₂ 12: GW 105: SPM100 205: SPM200 306: SUP300 316: SUP310	Serial no first digit after S/A/P If parameter 1 is MCI sensor, then: parameter 2 is - bit 0-6 first digit - bit 7 in parameter 2 indicates first letter: 0: P 1: A Only first byte used e.g. 137 is A9	Serial no next 4 digits	Serial no 3 digits after ID	Serial no 4 digits after W
75**	Calibration finished	2: O ₂ 3: CO ₂	0: Failed 1: Passed 2: Failed, and retry started	New O ₂ or CO ₂ measurement	Old O ₂ or CO ₂ measurement	n/a
76**	Calibration start denied	2: O ₂ 3: CO ₂	Sensor in session	O ₂ or CO ₂ measurement	Pmem	Reason for calibration deny: 1: Wrong sensor type, cal not supported 2: Measurement is good, cal not needed 3: Measurement is bad, change sensor 4: Pressure outside interval 5: No measurement possible/no sensor online
77	Controller moved	Number of changed SN's	Change bitmask	n/a	n/a	n/a
79	GE CO ₂ sensor debug values	Temperature	Voltage	Zenith	Nadir	Mode
80	FDIH data	Tsup 1, Tsup2 Active, RelState Tsup1D, Tsup2D Sensor	Tret TsupVS1, TsupVS2 TretD, TevapD Mean, Magnitude	Tsuc TretVS, TevapVS TsucD, ErrLim Limit	Tevap TsucVS, Rel IncCount, DecCount	T0 ValveModel
81	CA memb/hose leak	Rise time	Pmem ambient	Pmem current	Pmem when on	-
82	CA info	0: CO ₂ sensor 1: O ₂ sensor	Minimum measurement last 6 hours	Average measurement last 6 hours	Maximum measurement last 6 hours	Current State [4 bit]. Most used state in the last 6 hours [4 bit]. Percentage of time spend in most used state [8 bit]
85	Power consumption	Mevap avg value last 4 Hour	Mpump avg value last 4 Hour	Mcond avg value last 4 Hour	Ref side avg value last 4 Hour	Total energy avg in last 4 hours
86	FC Alarm Extra info	Status word low 16 bits	Status word high 16 bits	Alarm word low 16 bits	Alarm word high 16 bits	Internal alarm word low 16 bits
87	USB log recovered	1	Number of recoveries done	Number of loggings made up to recovery	n/a	n/a
88	Flushing mode	0: Deactivated 1: Activated	n/a	n/a	n/a	n/a
89	ITI step OK	0 = Stf group passed 1 = RH group passed 2 = CA group passed 3 = CR group passed ----- 1000-2000: Step ID	n/a	n/a	n/a	n/a
92	Database updated	ErrorFlag	ErrorIndex	n/a	n/a	n/a
93	ITI bypassed	n/a	n/a	n/a	n/a	n/a

94	UDO channel statistics	UDO channel 1: K2 CCW 2: K3 Hevap 3: K4 Mcond Low 4: K5 Mcond High 5: K6 Mevap Low 6: K7 Mevap High 7: K8 CW 9: Veco 10: Vexp 11: Vhg 14: K9 Mpump 15: K10 Mheat	Active time [minutes]	Active/failure time [minutes]	Idle time [minutes]	Idle/failure time [minutes]
95	FT/PTI skipped	Step ID	Skip reason	n/a	n/a	n/a
98	Power adjusting	0: Inactive 1: Active	n/a	Actual Fcpr	Udc	Power supply frequency

(*) Every event ID has its own set of parameters

(**) Only for some models

14. Detailed alarm description

In the following, all alarms are listed with a display text and description.

- Alarm display text is the text shown in the controller display.
- An alarm can either be only logged into the datalog or both in the datalog and shown in the controller alarm list.
- The alarm light has 3 states:
Off indicates that the alarm diodes are de-energized and there are no active alarm(s).
Slow flash indicates that the diodes are turned on shortly every 3 sec. and that there are active alarm(s).
Quick flash is when the diodes are turned on shortly every 1 sec. and that there are active fatal alarm(s).

When trouble shooting several alarms, it is generally advisable to start with the active alarm that has the lowest number and then go on to the active alarms with higher numbers. Remember that some alarms have a time-out of 30 sec. or more.

Some alarms can trigger the sounder beacon if unit is charged with R1234yf.

To be safe during an alarm, there has been introduced an extra ventilation program for the system, when running with R1234yf. It is called the precaution ventilation. This program will prevent any hazardous or flammable atmosphere and will make it safe to run with R1234yf.

14.1 Alarm list

The following list includes a view of all alarms as listed on the display and a longer text. This list is subject to constant updates.

Be sure to visit **alarm.starcool.com** or the Star Cool Service App for the latest updates.

Id	Display text	Description	Alarm type
1. Temperature sensor alarms			
102	Tret invalid	Return air temperature sensor invalid	Alarm
105	Tsup 1 invalid	Supply air temperature sensor 1 invalid	Alarm
108	Tsup 2 invalid	Supply air temperature sensor 2 invalid	Alarm
111	Tusda 1 out of range	USDA 1 temperature sensor invalid	Log
114	Tusda 2 out of range	USDA 2 temperature sensor invalid	Log
117	Tusda 3 out of range	USDA 3 temperature sensor invalid	Log
120	Tcargo out of range	Cargo temperature sensor invalid	Log
123	Tevap invalid	Evaporator temperature sensor invalid	Warning
126	Tsuc invalid	Suction temperature sensor invalid	Alarm
129	Tamb invalid	Ambient temperature sensor invalid	Alarm

130	Tamb invalid	Ambient temperature sensor invalid	Warning
132	Tpump invalid	Vacuum pump temperature sensor invalid	Alarm
148	Tsup error	Supply air temperature error	Alarm
2. Pressure transmitter alarms			
202	Pdis unrealistic	Tc value is above the limit that is realistic for the system	Alarm
203	Pdis invalid	Compressor discharge pressure transmitter invalid	Alarm
206	Psuc unrealistic	T0 value is below the limit that is realistic for the system	Alarm
207	Psuc invalid	Compressor suction pressure transmitter invalid	Alarm
214	Pmem invalid	Also activated by alarm 977, 978 (voltage reference fault)	Alarm
3. Other sensors			
302	RH invalid	Relative humidity sensor invalid	Alarm
303	AirEx invalid	Air exchange sensor short circuit	Alarm
306	HPS switch - K1	High pressure switch is active	Fatal alarm
307	HPS switch - K8	High pressure switch is active	Fatal alarm
308	Pdis high - K1	High pressure switch is not active, but pressure measurement exceeds the limit	Fatal alarm
309	HPS - K1 loose	HPS/K1 circuit is open and the pressure is low	Alarm
310	CO ₂ sensor invalid	CO ₂ sensor communication missing	Alarm
313	O ₂ sensor invalid	O ₂ sensor communication missing	Alarm
314	Replace CO ₂ sensor	Replace CO ₂ sensor	Warning
315	Replace O ₂ sensor	Replace O ₂ sensor	Warning
4. Power alarms			
400	Mevap 1 over heat	Evaporator motor 1 overheat	Fatal alarm
401	Mevap 2 over heat	Evaporator motor 2 overheat	Fatal alarm
402	Mcond over heat	Condenser motor overheat	Fatal alarm
403	Mpump over heat	Vacuum pump motor overheat	Alarm
415	Invalid power sup	U1-2 and U1-3 and U2-3 overvoltage	Fatal alarm
418	Invalid power sup	U1-2 and U1-3 and U2-3 undervoltage	Fatal alarm
421	Over current	I1-2 and I1-3 and I2-3 overcurrent	Fatal alarm
423	No phase direction	Phase direction not detectable	Fatal alarm
424	Power frequency	Phase frequency error	Log
425	Frequency too high	Power frequency too high	Fatal alarm
430	Cpr connection	Power cable from FC to compressor faulty	Alarm
5. FC alarms			
501	FC local control	FC setting in local mode	Alarm
508	Compr connection	FC short circuit	Alarm
509	FC 24 V fault	FC internal 24 V supply fault	Alarm
510	Compr connection	FC earth fault	Alarm
511	Compr over current	Compressor over current	Alarm
513	Compr overload	Compressor overload	Alarm
514	Invalid power sup	FC undervoltage fault	Alarm
515	Invalid power sup	FC overvoltage fault	Alarm
516	FC supply error	Power supply error indication	Alarm
517	FC over temp	FC over temperature fault	Alarm
518	FC inrush	FC inrush fault	Alarm
519	FC internal error	Frequency converter high voltage fault warning	Alarm
520	FC temp counter	P3000 only	Alarm
523	FC phase loss	Power supply error indication	Log
530	FC alarm undefined	Unclear error in FC	Alarm
531	PCB temperature	FC critical temperature	Alarm
532	Blocked rotor	Compressor restart fail	Alarm
595	Tfc invalid	Internal FC temperature sensor is invalid	Alarm
6. Operation alarms			
600	No control sensors	Supply air sensor 1, supply air sensor 2, return air sensor all malfunctioning	Fatal alarm
601	No watercooling	Water-cooling fault	Alarm

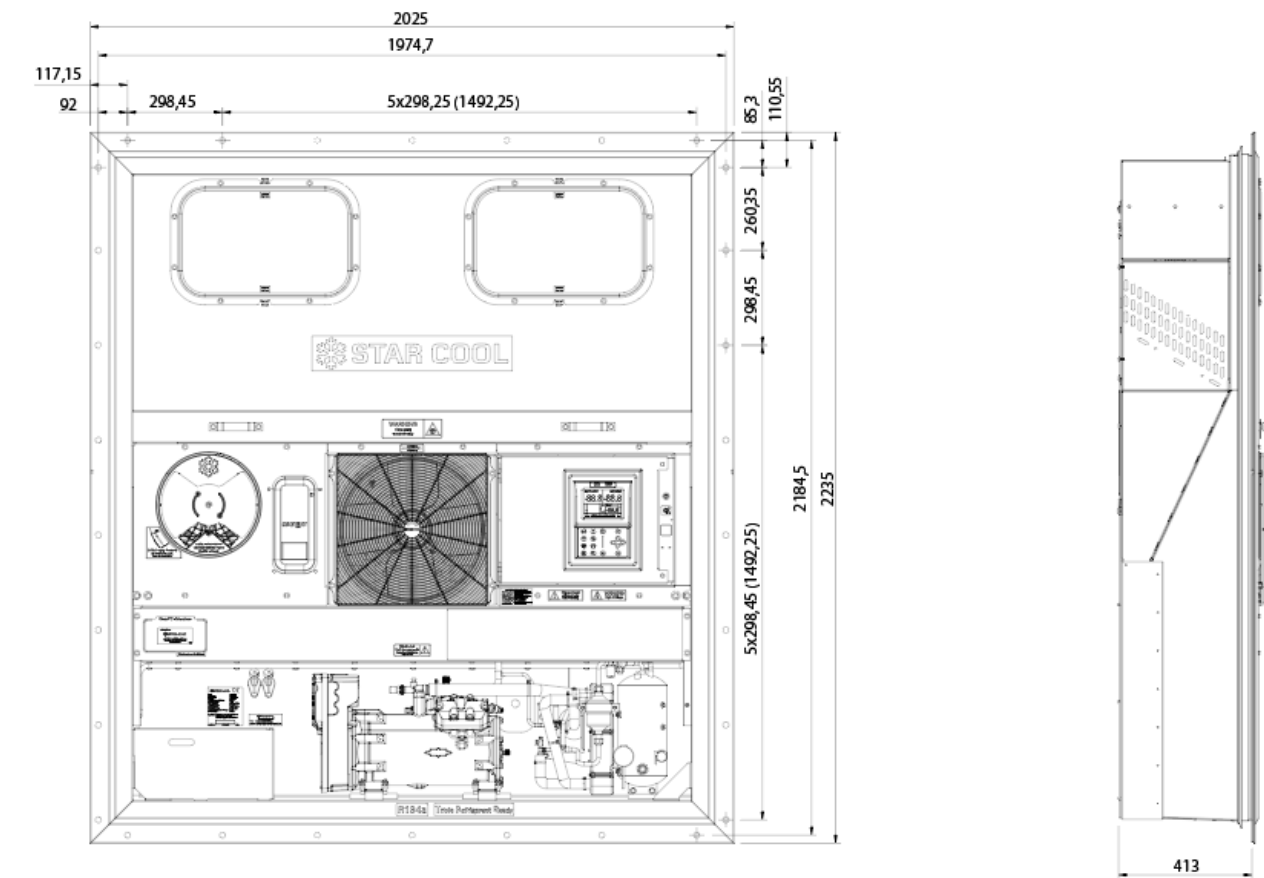
603	In range fault	In-range fault	Fatal alarm
605	Mair failure	Automatic air exchange did not open/close	Fatal alarm
607	AirEx open	Air exchange valve open in conflict with settings	Alarm
610	Defrost time exceed	Max. defrost time exceeded	Log
623	Loss of cooling	Attempts to cool down but Tsup is above Tret	Fatal alarm
624	Config valve type	System identifies controller was changed	Alarm
630	Manual phase dir	Manually selected phase direction	Warning
634	CA air filter		Warning
635	CA pump start fail	CA pump not delivering compressed air or vacuum during pump startup	Alarm
646	Low Refr. Charge	Loss of charge (LoC) detected on non-YF unit	Alarm
649	Check YF beacon	No connection to the beacon	Warning
650	O ₂ low	The O ₂ sensor measures low O ₂ levels in container	Alarm
651	CO ₂ high	The CO ₂ sensor measures high CO ₂ levels in container	Fatal alarm
652	Vacuum fault	Vacuum pump unable to reach the required pressure	Alarm
653	Mpump heat element	Vacuum pump operating temperature is low	Alarm
654	Mpump temp high	Motor for vacuum pump is overheated	Alarm
656	Mpump service	Vacuum pump needs an oil and filter change	Warning
657	Mpump start failure	Vacuum pump operating in wrong direction	Fatal alarm
658	Mpump Uf lockout	Vacuum pump cannot run due to bad U/f ratio	Alarm
660	Check coil	Coil(s) acting suspicious	Warning
661	Check contactor	Contactor(s) acting suspicious	Warning
662	Mevap lo contactor	Mevap low contactor detected to be faulty (only in heating)	Alarm
663	Mevap hi contactor	Mevap high contactor detected to be faulty (only in heating)	Alarm
664	Mevap contactors (both)	Both Mevap contactors detected to be faulty (only in heating)	Alarm
665	Hevap contactor	Hevap contactors detected to be faulty (only in heating)	Alarm
666	Reduced refr. flow	The flow of refrigerant in the system is reduced	Warning
667	Ref leak detected	R1234yf refrigerant leak has been detected	Fatal alarm
668	Leak repair needed	R1234yf refrigerant leak needs to be repaired	Fatal alarm
669	Check heater		Alarm
670	CA memb/hose leak	Vacuum pump has stopped due to leak.	Alarm
671	Mpump vacuum loss	Vacuum pump has stopped due to loss of vacuum in the system	Alarm
672	Mpump oil low	Vacuum pump oil level is detected as being low	Alarm
673	Leak Detect Disabled	Not possible to detect a leak on a unit running with R1234yf	Warning
674	Man ethylene injection	Ethylene injection did not occur	Alarm
675	Man emergency opr	User has activated manual emergency mode	Fatal alarm
676	Check refr base	User shall verify the current refrigerant type in the system, as it does not fit the current heater type detected	Warning
677	Check valve plates	Compressor valve plate(s) detected to be broken	Warning
680	RIPE Alarm		Warning
681	Phase Contactors	K2 or K8 is faulty and system is running with reversed motor direction to compensate	Alarm
683	Check coil Vexp	Check coil Vexp	Warning/ alarm
684	Check coil Veco	Check coil Veco	Warning
685	Check coil Vhg	Check coil Vhg	Warning
688	FC/Cpr incompatible		Fatal alarm
7. Communication alarms			
700	No FC/Contr com	FC missing	Fatal alarm
710	No userpanel com	(Can only be seen in StarView)	Log
720	No SPM com	Communication to power module is missing	Alarm
730	No RH sens com	RH sensor is missing	Alarm
740	No CO ₂ sens com	CO ₂ sensor is missing or communication lost	Alarm
750	No SSC com	CA module is missing or communication lost	Log
760	No O ₂ sens com	O ₂ sensor is missing or communication lost	Alarm
770	No door sens com	No communication from the door sensor	Warning

771	Missing door sensor	Door sensor is missing	Warning
775	No CAM com		Alarm
780	Modem Installation	Sekstant gateway cannot send data	Warning
781	Modem CloudCon Alarm	Sekstant gateway cannot send data	Warning
8. Test alarms			
800	Func test failed	Function test fault	Warning
801	Controller	Controller internal voltage reference fault	Warning
802	AirEx Open	Manual air exchange is opened preventing other function tests to succeed	Warning
803	Reduced refr. flow	The flow of refrigerant in the system is reduced	Warning
805	Idle current	Unit idle overcurrent fault	Warning
810	Mevap cur LO speed	Evaporator motor low speed current fault	Warning
811	Mevap cur HI speed	Evaporator motor high speed current fault	Warning
812	Mevap current OFF	Evaporator motor off current fault	Warning
815	Mcond cur LO speed	Condenser motor low speed current fault	Warning
816	Mcond cur HI speed	Condenser motor high speed current fault	Warning
817	Mcond current OFF	Condenser motor off current fault	Warning
819	Contactor error	Contactor(s) acting suspicious.	Warning
820	Hevap current ON	Evaporator heater on current fault	Warning
821	Hevap current OFF	Evaporator heater off current fault	Warning
822	Hevap current error	Hevap current failure	Warning
823	Hevap current drop	The controller config for refr design base does not match current heater type	Warning
824	K2/K8 contactor error	Contactor(s) acting suspicious	Warning
826	Hpump current ON	Heat vacuum pump too high or too low	Warning
827	Hpump current OFF	Measured current is too high when heater is turned off	Warning
830	Mpump current error	Mpump current failure	Warning
831	Pmem sensor	Pmem above or below 1000 mBar (± 60 mBar) after Mpump off for 300 sec.	Warning
832	CO ₂ sensor	No reading or value above 1%	Warning
833	O ₂ sensor	No reading or value out of range	Warning
836	Pmem vacuum	Unable to create vacuum	Warning
837	Pmem ambient	Not measuring Pmem pressure 1000 mBar (± 60 mBar)	Warning
838	Mpump ON current	Current failure	Warning
839	Mpump OFF current	Current in off position is too high	Warning
840	Valve leaks	Valve leak fault	Warning
841	K1 contactor welded	Contactor damaged (always drawn) making FC always powered	Warning
842	Expansion valve	Expansion valve fault	Warning
844	Hot gas valve	Hot gas valve fault	Warning
846	FC check	FC internal fault	Warning
847	High press switch	High pressure switch fault	Warning
848	Temp sensors invalid	Temperature and pressure sensor malfunctioning	Warning
849	Valve error	Check that compressor can operate valves failed	Warning
850	PTI test failed	PTI test fault	Warning
851	Alarm is active	Active alarms turning ITI checkmark off	Warning
854	Air leakage	Vacuum pump temperature not archived or pump down failed	Warning
855	PTI Tset 5	PTI 5°C set fault	Warning
857	CA curtain	No CA curtain is mounted	Warning
858	Gateway	The test failed indicating a problem with the Sekstant gateway installation	Warning
859	Low refr. charge (PTI)	Loss of charge detected on non-YF unit during PTI	Warning
860	PTI Tset 0	PTI 0°C set fault	Warning
865	yf Beacon	Manual beacon test failed	Warning
866	Mair	Automatic air exchange did not open/close.	Warning
868	Ethylen injection	Manual ethylene injection test failed	Warning
870	PTI defrost	PTI defrost fault	Warning
879	PTI check cont/valve	Evaporator and/or economizer valve error	Warning
880	PTI Tset -18	PTI -18°C set fault	Warning

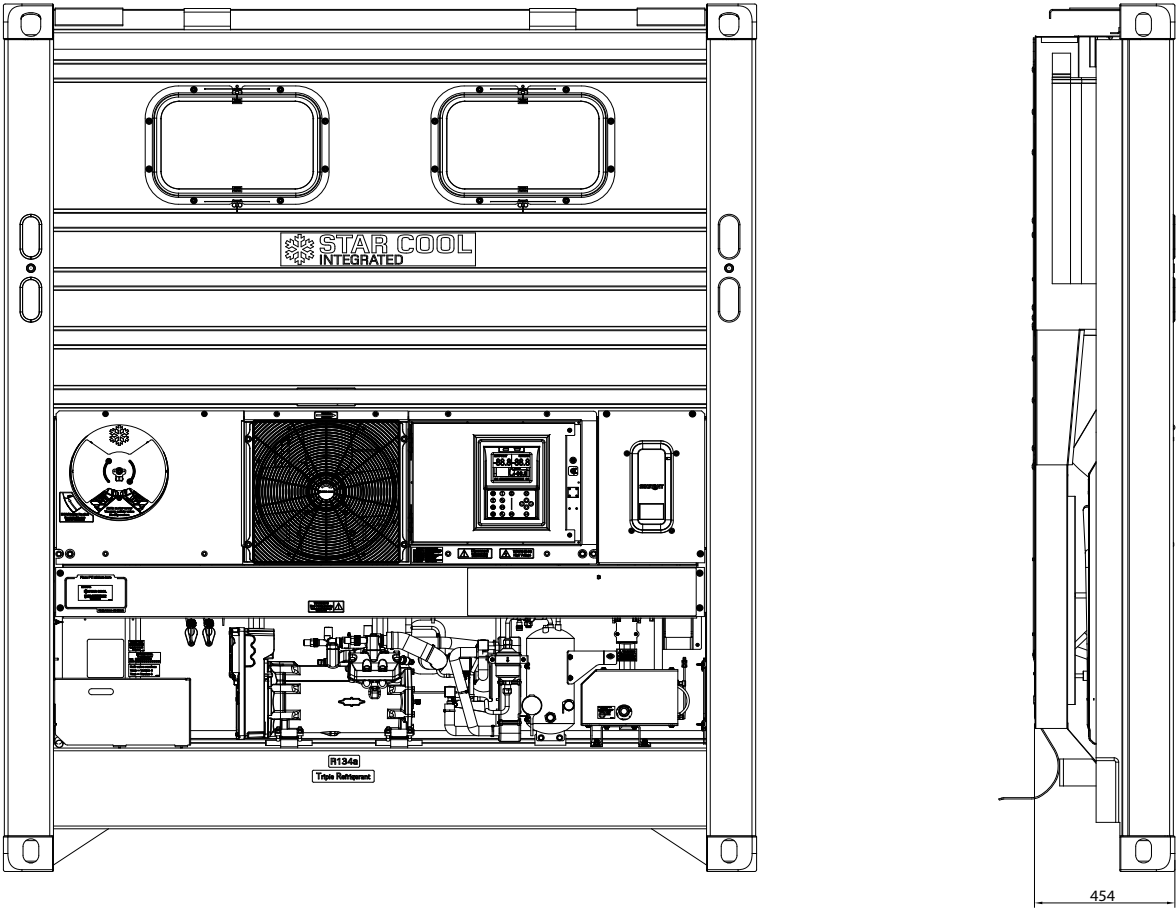
884	Psuc invalid	Compressor suction pressure transmitter invalid	Warning
885	Tsup1 invalid	Supply air temperature sensor 1 invalid	Warning
886	Tsup2 invalid	Supply air temperature sensor 2 invalid	Warning
887	Tevap invalid	Evaporator temperature sensor invalid	Warning
888	Tsuc invalid	Suction temperature sensor invalid	Warning
889	Tret invalid	Return air temperature sensor invalid	Warning
890	PTI Tset 13	PTI test fault	Warning
891	Hpump current	Vacuum pump heater fault	Warning
892	O2/CO2 sensor	Failing O2/CO2 sensor when running FT CA/ITI CA/PTI CA	Warning
894	RH sensor	RH sensor communication missing	Warning
895	CO ₂ sensor	The CO ₂ sensor communication and CO ₂ level are tested	Warning
896	O ₂ sensor	The O ₂ sensor communication and O ₂ level are tested	Warning
897	Hpump broken	Vacuum pump could not be heated	Warning
899	ITI failed	ITI test fault	Log
9. Controller alarms			
902	Battery malfunction	Battery malfunctioning	Alarm
904	Datalog error	SCCU6 datalog fault	Alarm
905	Database corrupt	SCCU6 database fault	Log
907	Realtime error	Real-time clock needs checking	Alarm
913	Geteway voltage	Battery and/or battery power measurement module is defective	Warning
950	CAM sup		Fatal Alarm
953	Temp ref 1 LO	Controller internal voltage reference fault	Warning
954	Temp ref 1 HI	Controller internal voltage reference fault	Warning
955	Temp ref 2 LO	Controller internal voltage reference fault	Warning
956	Temp ref 2 HI	Controller internal voltage reference fault	Warning
961	Pdis sens sup LO	Controller internal voltage reference fault	Log
962	Pdis sens sup HI	Controller internal voltage reference fault	Log
963	Psuc sens sup LO	Controller internal voltage reference fault	Log
964	Psuc sens sup HI	Controller internal voltage reference fault	Log
965	Controller sup LO	Controller internal voltage reference fault	Log
966	Controller sup HI	Controller internal voltage reference fault	Log
967	AirExMot sup LO	Controller internal voltage reference fault	Log
968	AirExMot sup HI	Controller internal voltage reference fault	Log
969	AirEx sens sup LO	Controller internal voltage reference fault	Log
970	AirEx sens sup HI	Controller internal voltage reference fault	Log
971	Sensor bus sup LO	Controller internal voltage reference fault	Log
972	Sensor bus sup HI	Controller internal voltage reference fault	Log
973	SUP6 SPM6 sup LO	Supply voltage SUP6 SPM6 low	Log
974	SUP6 SPM6 sup HI	Supply voltage SUP6 SPM6 high	Log
975	Internal sup LO	12 V supply voltage low on SMC6	Log
976	Internal sup HI	12 V supply voltage high on SMC6	Log
977	Pmem sens sup LOW	Controller internal voltage reference fault	Log
978	Pmem sens sup HIGH	Controller internal voltage reference fault	Log
982	CA P1 sens sup LO		Log
983	CA P1 sens sup HI		Log
984	CA P2 sens sup LO		Log
985	CA P2 sens sup HI		Log
990	Firmware update fail	Failed to activate firmware	Alarm
994	Req min SW352-11	The software which has been uploaded to the controller is not compatible with the current hardware version, please use software 0352 rev. 11 or newer	Alarm
995	Contr internal error	Controller module must be replaced	Alarm
996	SW incompatible	Prom CRC fault	Warning
998	Could not detect CA	Unable to detect CA	Alarm
999	Keyboard failure	Indication of defective keyboard or connection	Warning

15. Star Cool unit installation dimensions

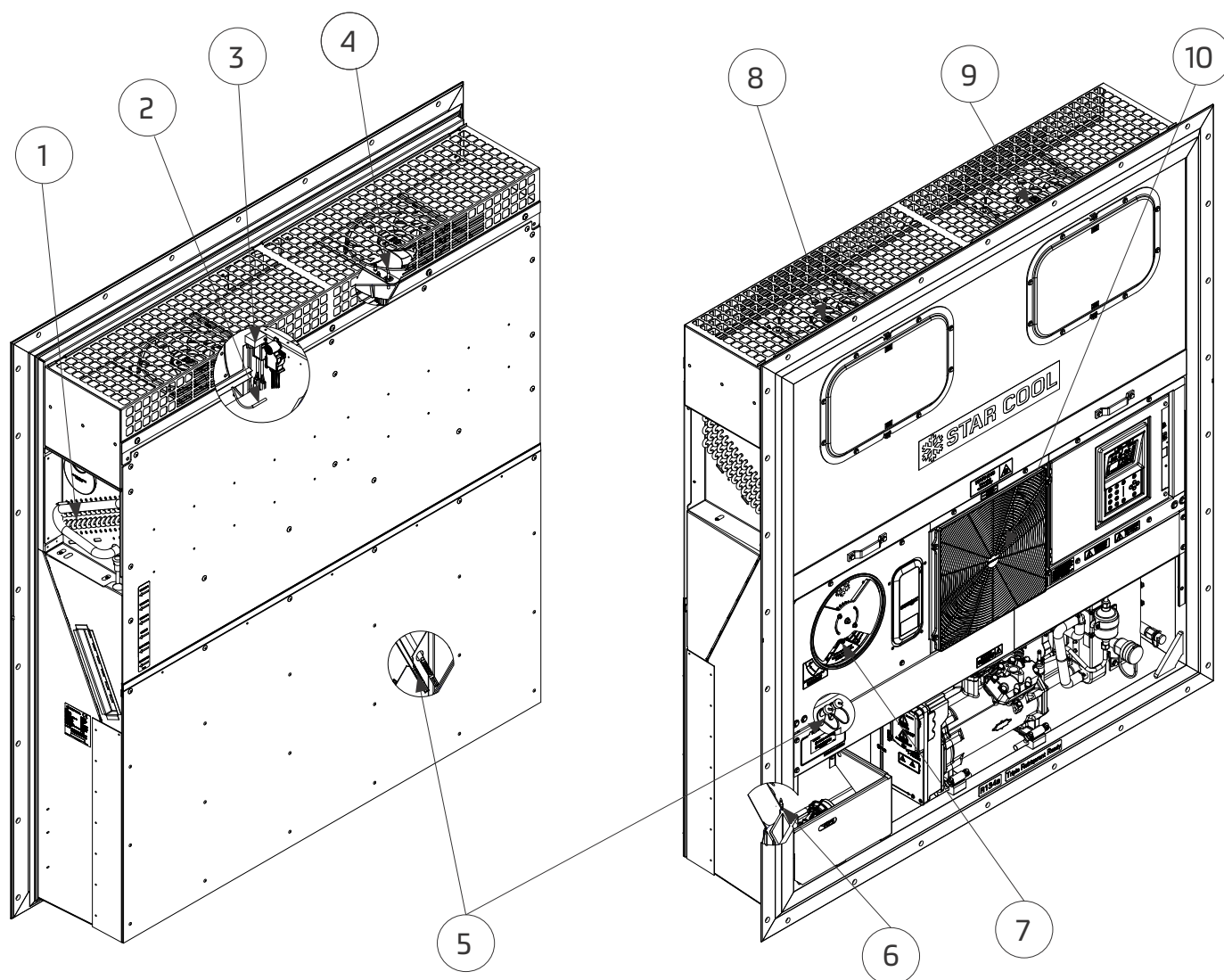
Type: SCU



Type: SCI

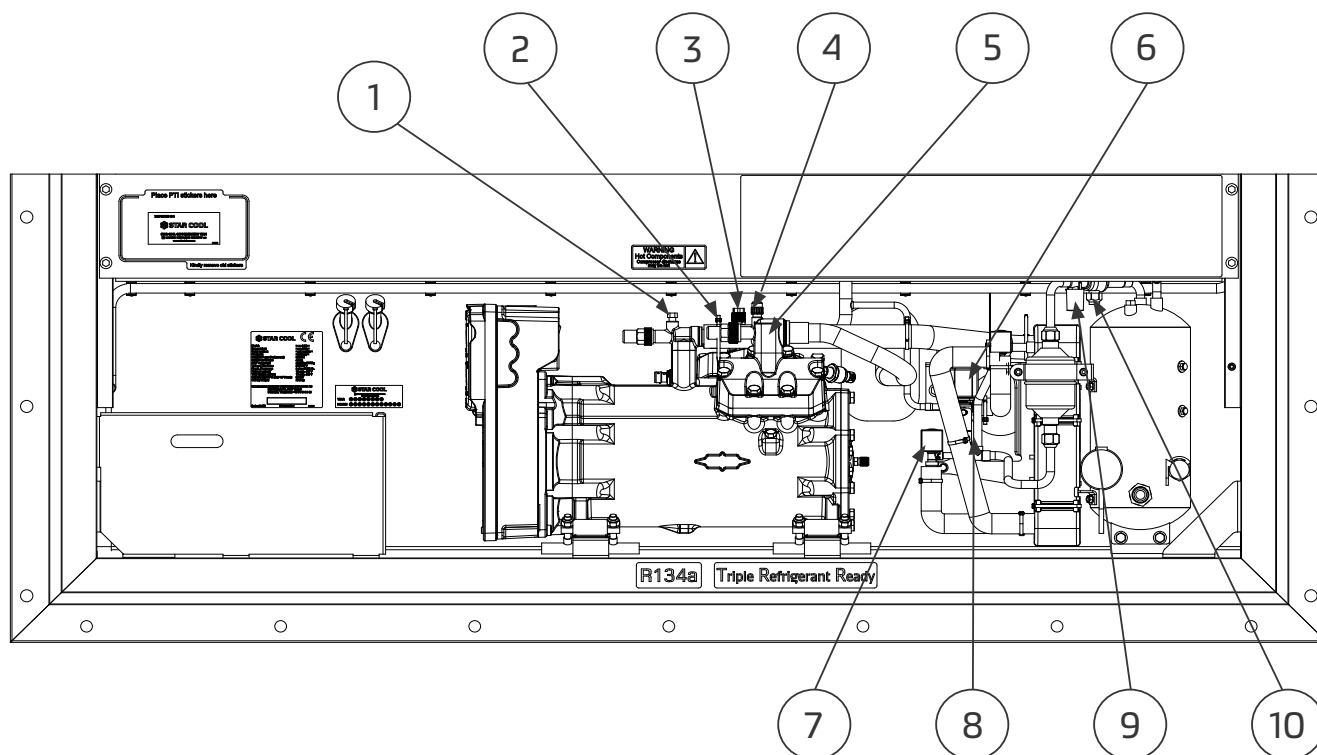


16. Location of motors, temperature sensors, humidity sensor and air exchange potentiometer



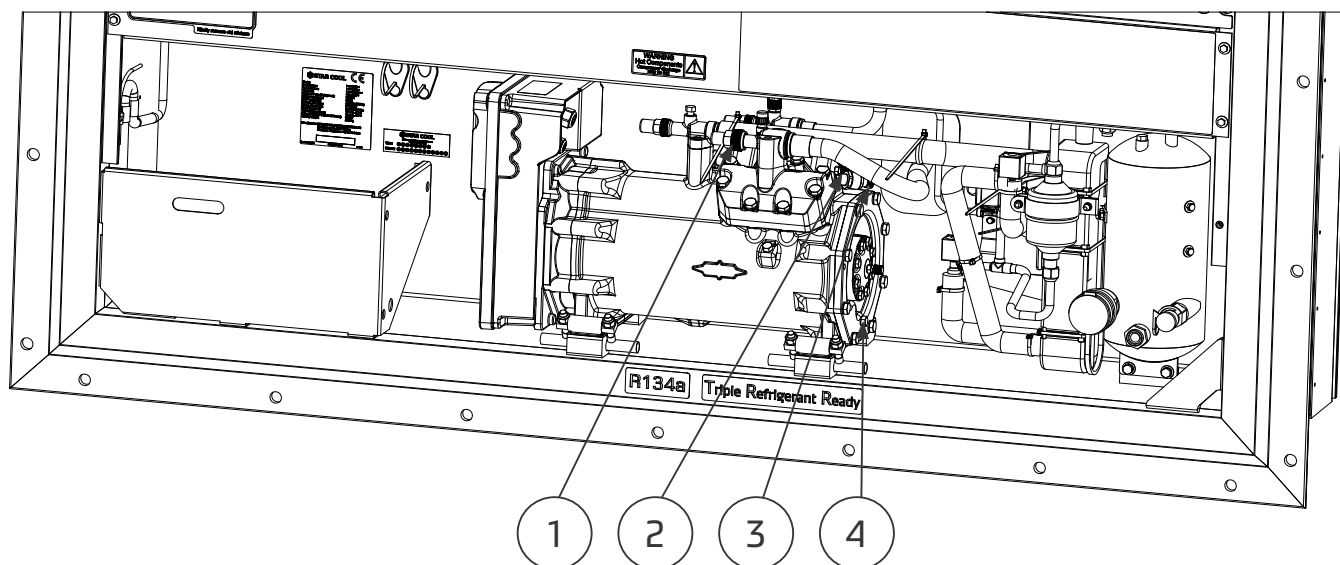
Pos	Description	Short name	Quantity	Location	Accessibility
1	Suction temperature sensor	Tsuc	1	Inside	Through inspection hatch
2	Evaporator temperature sensor	Tevap	1	Inside	Through inspection hatch
3	Relative humidity sensor	RH	1	Inside	Through inspection hatch
4	Return temperature sensor	Tret	1	Inside	Through inspection hatch
5	Supply temperature sensor	Tsup	2	Outside	
6	Ambient temperature sensor	Tamb	1	Outside	
7	Air exchange potentiometer	AirEx	1	Outside	Behind fresh air cover panel
8	Evaporator motor no. 1	Mevap1	1	Inside	Through inspection hatch
9	Evaporator motor no. 2	Me-vap2	1	Inside	Through inspection hatch
10	Condenser motor	Mcond	1	Inside	Through fan grille

17. Location of valves



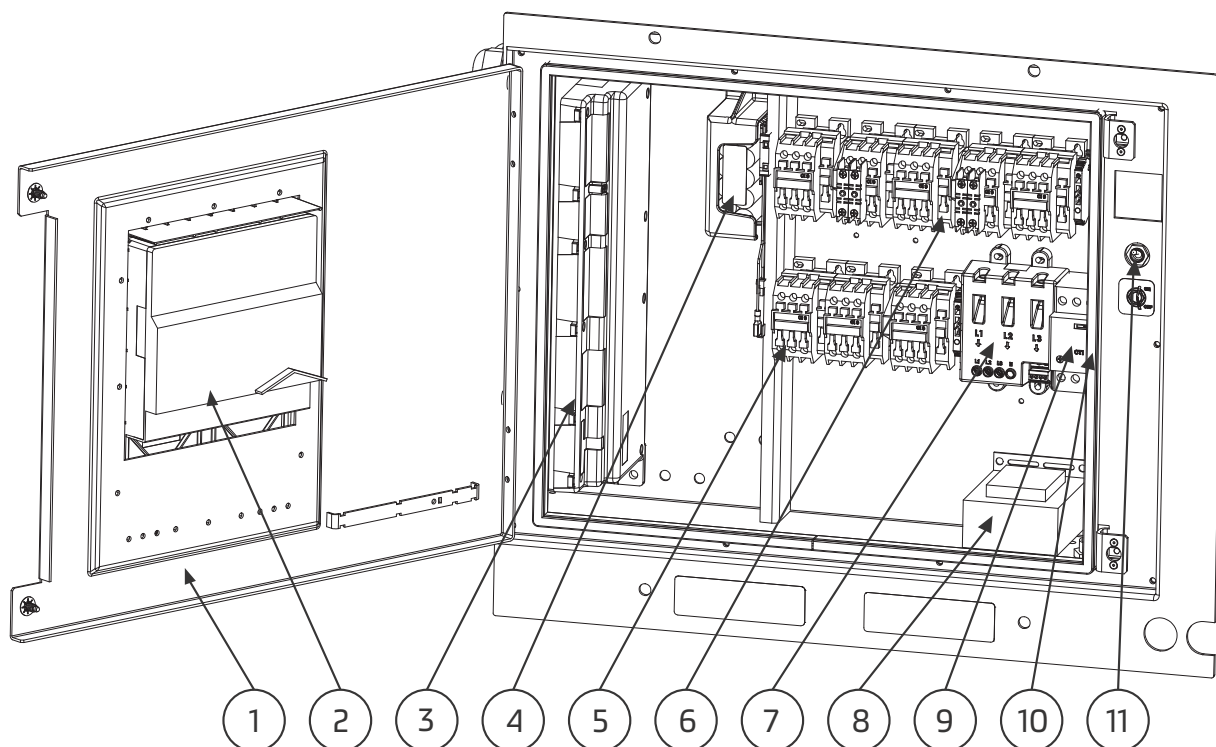
Position	Description
1	Economizer service valve
2	Discharge service valve
3	Evacuation valve
4	Evacuation valve
5	Suction service valve
6	Hot gas valve
7	Expansion valve, economizer
8	Expansion valve, evaporator
9	Liquid charging valve
10	Manual stop valve

18. Location of pressure transmitters, high pressure switch and oil outlet port

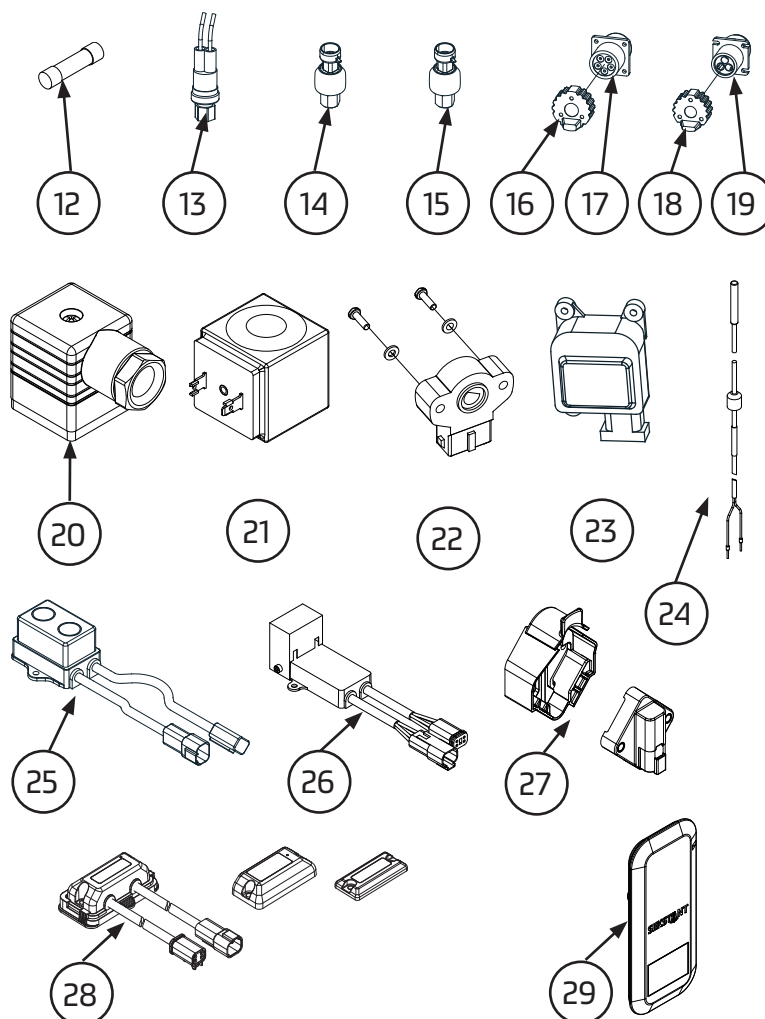


Position	Description	Short name	Quantity	Location
1	Discharge pressure transmitter	Pdis	1	Outside
2	High pressure switch	Shp	1	Outside
3	Suction pressure transmitter	Psuc	1	Outside
4	Oil outlet port		1	Outside

19. Controller unit illustration

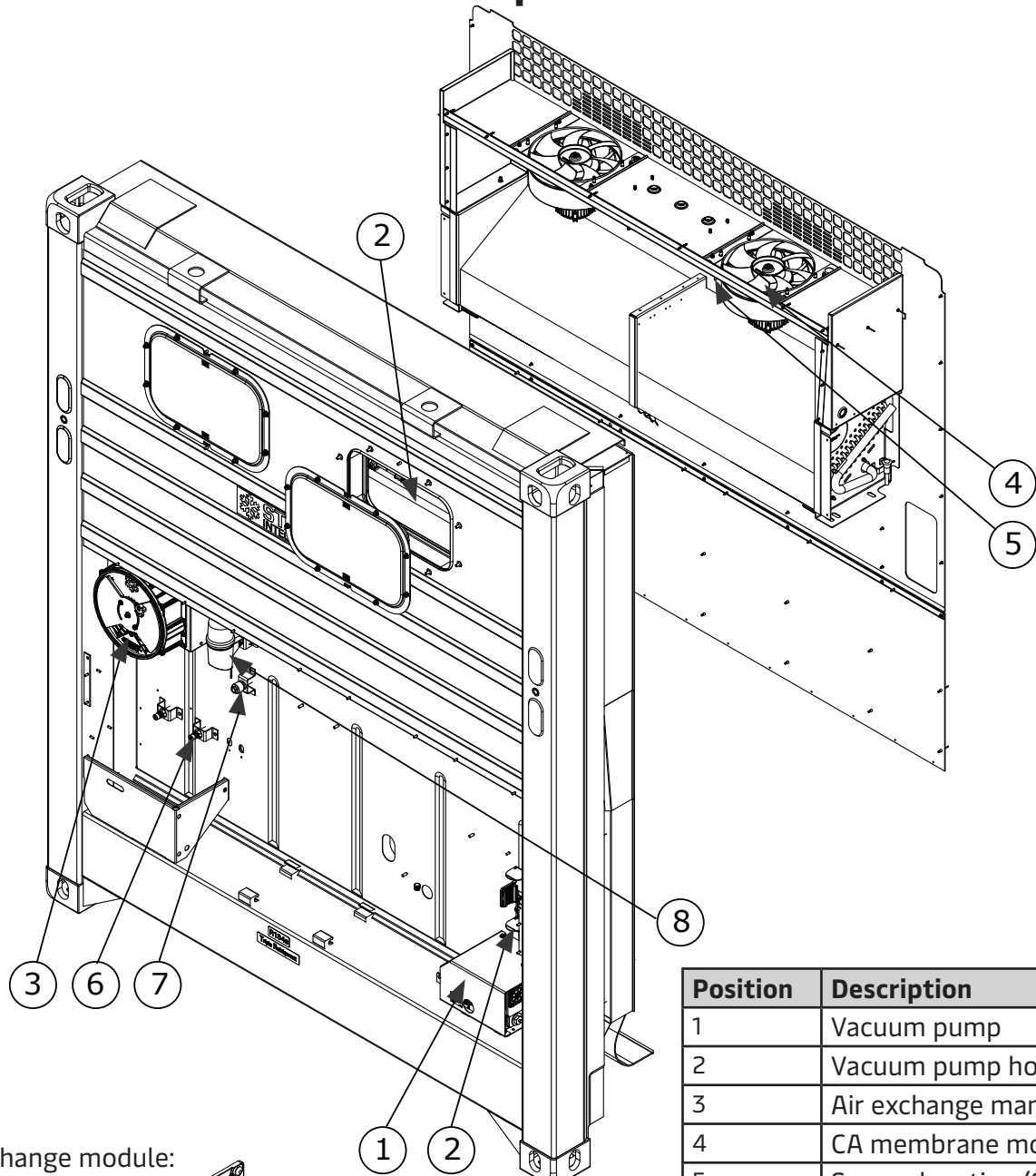


Position	Description
1	Controller door
2	User panel (SUP6)
3	Controller module (SMC6)
4	Sekstant battery
5	Contactor
6	Auxiliary contact
7	Power measurement module (SPM6)
8	Transformer, 105VA
9	Main circuit breaker, 17A
10	Fuse holder for 0.4A fuse
11	On/Off switch
12	Fuse, 400mA
13	High pressure switch
14	Pressure transmitter -0.69-9.8 Bar
15	Pressure transmitter 0-30 Bar
16	Retriever socket cap
17	Retriever socket
18	USDA socket cap
19	USDA socket
20	Connector plug
21	Solenoid coil, 11W, 24V AC
22	Air exchange potentiometer
23	Motor, fresh air
24	Temperature sensor, 3 m
25	Sensor, CO2
26	Sensor, O2
27	Humidity sensor
28	Door sensor
29	Sekstant gateway

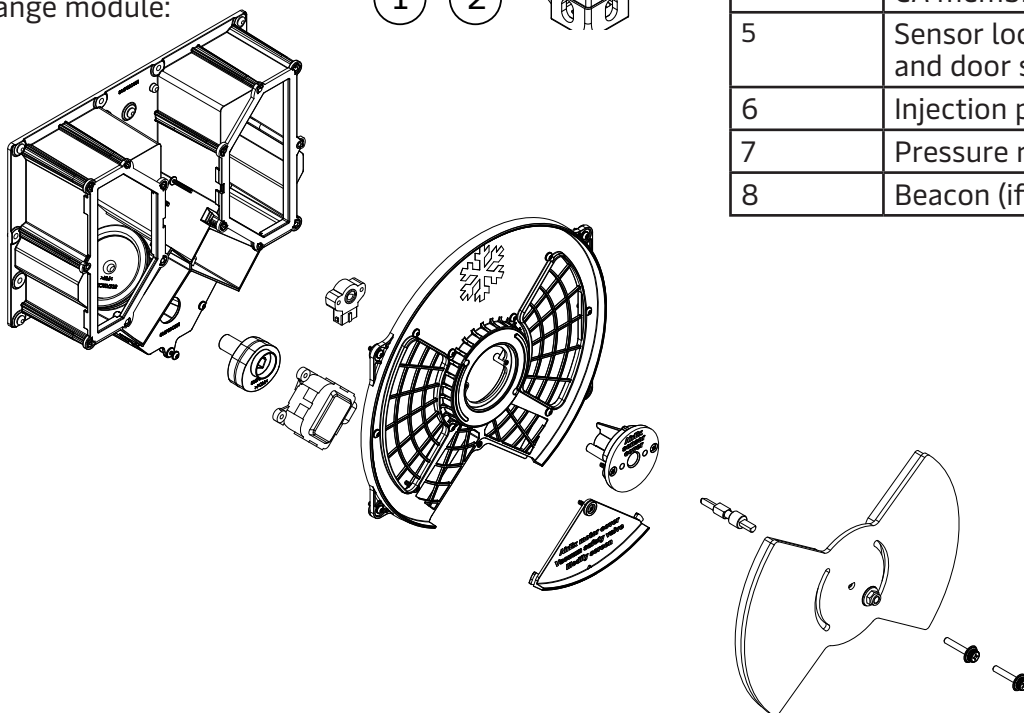


Setup may vary depending on model

20. Locations of AV and CA components



Air exchange module:



Position	Description
1	Vacuum pump
2	Vacuum pump hose
3	Air exchange manual
4	CA membrane module
5	Sensor location (O ₂ , CO ₂ and door sensor)
6	Injection ports
7	Pressure release valve
8	Beacon (if installed)

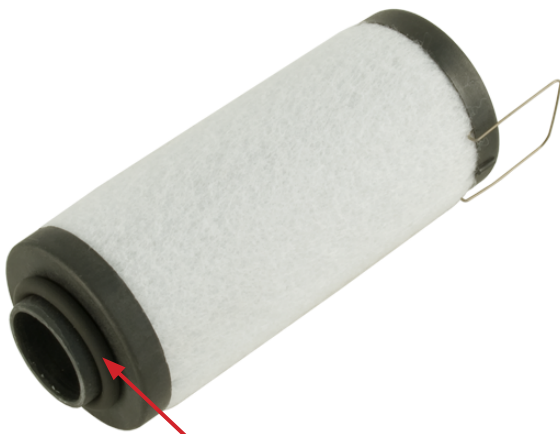
CA membrane module



Pressure transmitter



Oil filter ver. 1



Oil filter ver. 2



Note: O-ring has to be in place

CO₂ sensor

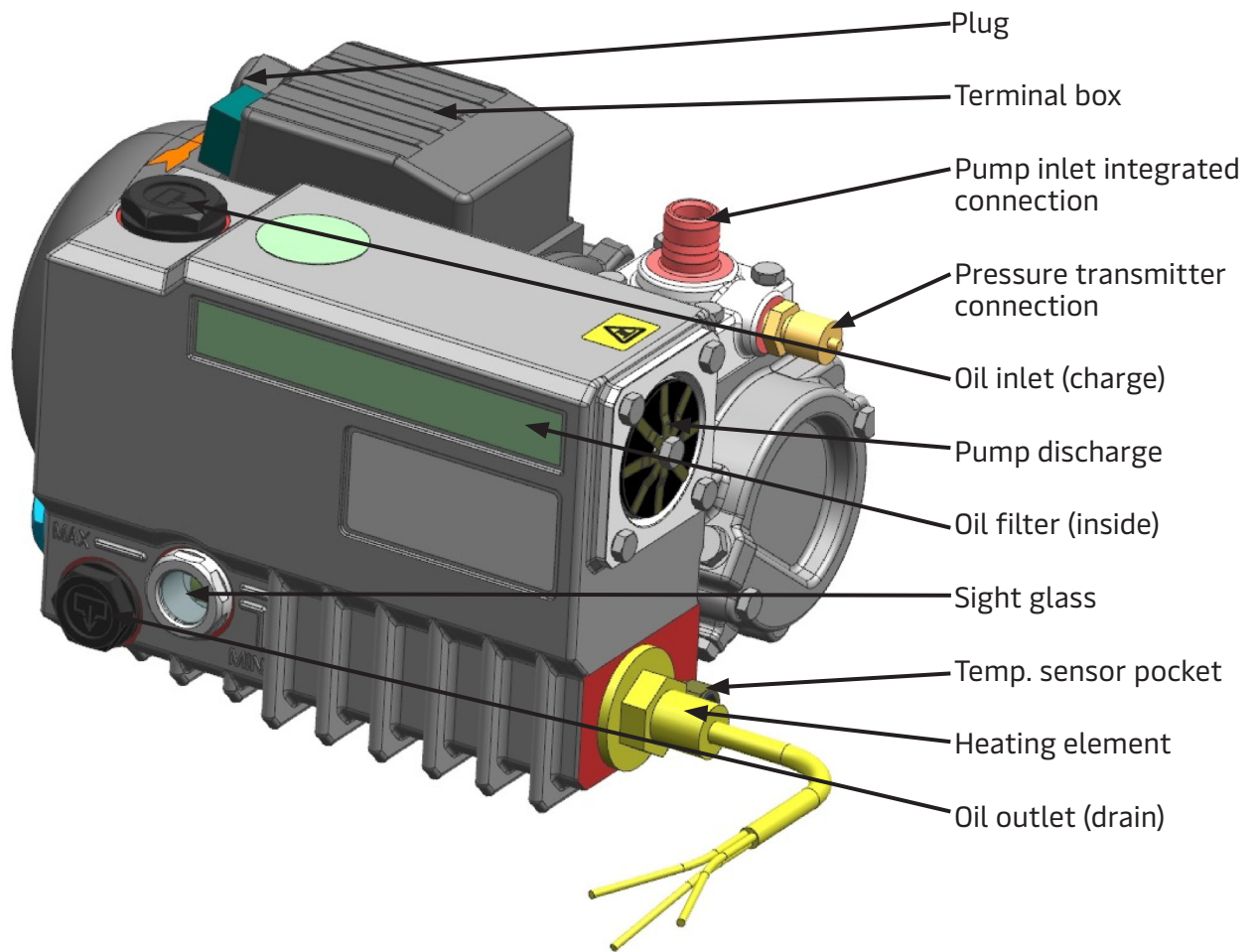


O₂ sensor



Displayed sensors may vary from currently used models

Vacuum pump



Tightening torques for M6 screws on vacuum pump cover shield: 6 Nm
Tightening torques for plugs, heating element, and sight glass: 15 Nm

21. Replacements

21.1 Replacement of controller module, CIM 6.4

If charged with R1234yf, only CIM 6.4 must be installed in place of the defective controller.

Keep in mind that the white cable is ground, and the black is signal. If in doubt, always refer to the controller wiring decal.

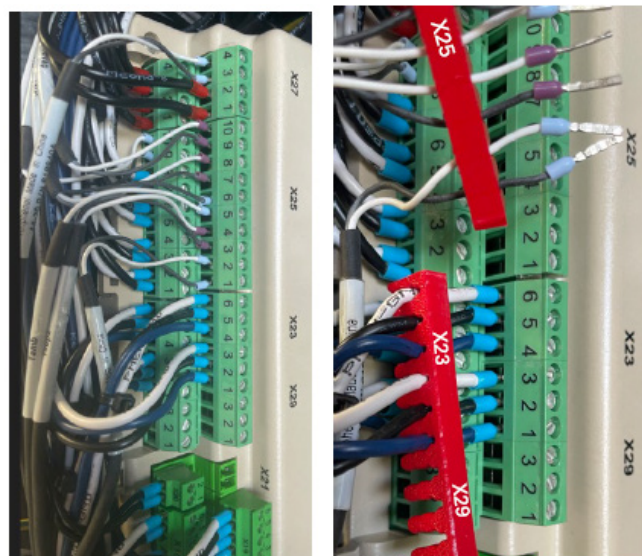
Combs must be used. Each comb has been marked indicating which connector set it belongs to. The combs can be broken into 3 pieces at the designated breaking points to make the mounting easier.



If you're replacing a 6.1/6.2 controller with a 6.4 controller, the green controller plugs (X23 to X27) must be removed after you have installed the comb.

To ensure a firm seating, and that the wires don't fall out during the rework operation, it is crucial that the wires are fully pressed into the comb. As the distance between the teeth of the comb varies, it is important to use the correct section of the comb (see labelling on the comb edge), otherwise it doesn't fixate the wires correctly.

1. Start by removing the auxiliary contactor from contactor K5 by pressing the grey tap (optional). All wires must stay mounted, it's only the auxiliary contactor which must be dismantled from the main contactor to ensure space for the screwdriver.
2. Cut and remove the big cable ties across the controller. **Note: only the wide cable ties, which locks the cables to the controller.** The smaller ones are used to hold the wiring together. **Take special care to not damage any wires doing this.**
3. Start with the odd numbered connectors first. Mount the comb and loosen screws 4 & 3 in X27. The placement of the comb must match the original placement in the controller.



4. Continue with screw 2 & 1 and placement of the comb.
5. Continue the procedure until all wires from the odd connectors (from X27 to X23) are in the combs.

6. Repeat step 1 with the inner row of even numbered connectors; start by mounting the comb and then loosening X26 controller screws 4 & 3. Optional: Take wires out one-by-one and place into the comb.
7. For X24 it is easier to remove the wire first and then clip into the comb. Continue by placing each wire in the red comb.
8. When all wires from both screw terminal rows are loosened, the inner cable tie at X26 can be cut and removed.
9. Remove all the green connector plugs from the connector sockets (X1 to X21).
10. Remove the ground connector from the controller.
11. Loosen the 4 controller nuts (2 in each side with a 10 mm hex socket). To avoid dropping the nut inside the cabinet, insert tape inside of the hex socket. This holds the nut firmly inside the socket and it won't fall out during this procedure.
12. Carefully take out the controller, by first lifting it up and out of the threaded rod, and then turning the bottom out.
13. Install the new controller and tighten the 4 nuts to 6 Nm (replace the tape inside of the hex socket if needed so that the nut is firmly held in place).
14. Install the ground connector.
15. Mount all the green connector plugs in the correct connector socket, ensuring firm mounting and that it is fully inserted and aligned. Even numbers at the back, odd numbers at the front.
16. **It is important to start with even numbered connectors. Ensure that every wire goes back into the correct socket controlled by the comb.** Mount one wire from the comb in the matching connector and tighten the screw to 0.5 Nm. The ferrule must be fully inserted. Check that the ferrule is locked in place in the connector by pulling slightly on the ferrule. Continue until all wires from the red combs are mounted.
17. Continue with the front row and install all wires from the combs. Do it one by one to ensure all cables are correctly mounted. **Note that no wires should be connected to X29, so installation starts from X23.**
18. Install cable ties and cut the cable tie end, ensuring that cut end is placed towards the contactors to avoid damaging the electrical decal when the door is closed. Check that the height of the cable set is below the gasket height and that the door closes properly without the display cable interrupting operation.



19. Reinstall the auxiliary contactor on contactor K5 (if removed at the beginning).

Installation check

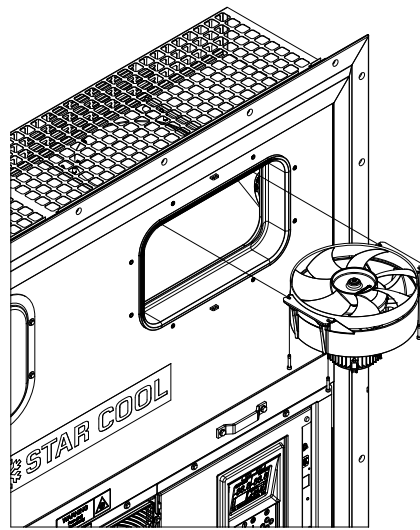
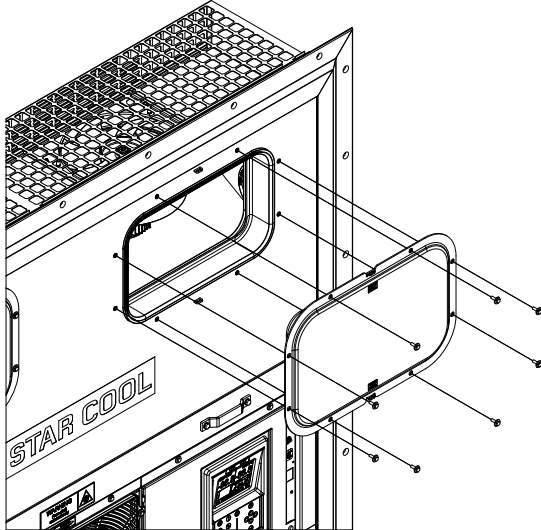
- Push contactor K5 and check that the orange part of the AUX contactor follows the movement of K5 to ensure proper installation.
- Check that all wires are installed in the correct screw terminals.
- Ferrules must be fully inserted into the green plug.
- Mount rail and bracket.
- **Power on the unit, update the configuration settings, ensure it is running with the latest software and verify that there are no active alarms. If possible, run a Function Test.**

21.2 Replacement of evaporator motor and fan

Note: Turn off main power supply to the unit before replacing evaporator motor and fan.

Note: Beware of sharp edges located in this area!

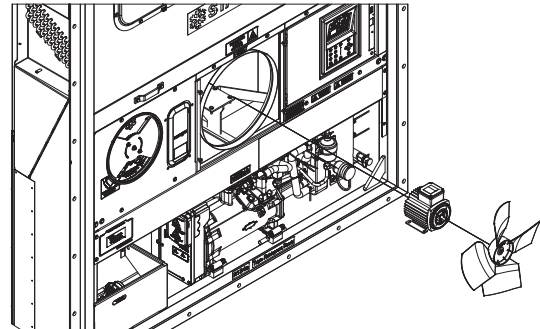
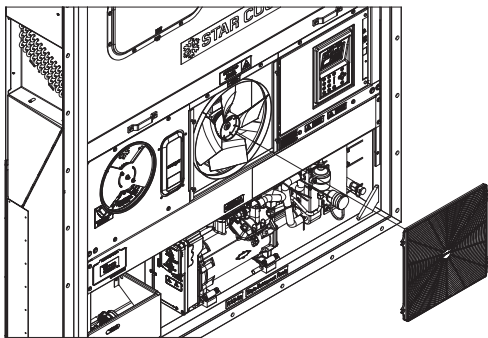
Dismount the inspection cover and disconnect the power supply to the motor by unplugging the square connector plug on the motor connection box. Do NOT open the connector box. Loosen the evaporator bracket and slide the motor and fan towards you and through the inspection cover opening. Replace the fan and/or motor and check the fan blade is aligned so it can turn freely. Mount the motor and fan back into the unit mounting plate and reconnect the power to the motor. If one or more of the bracket threads are damaged, use fan bracket repair kit. Mount the inspection cover again.



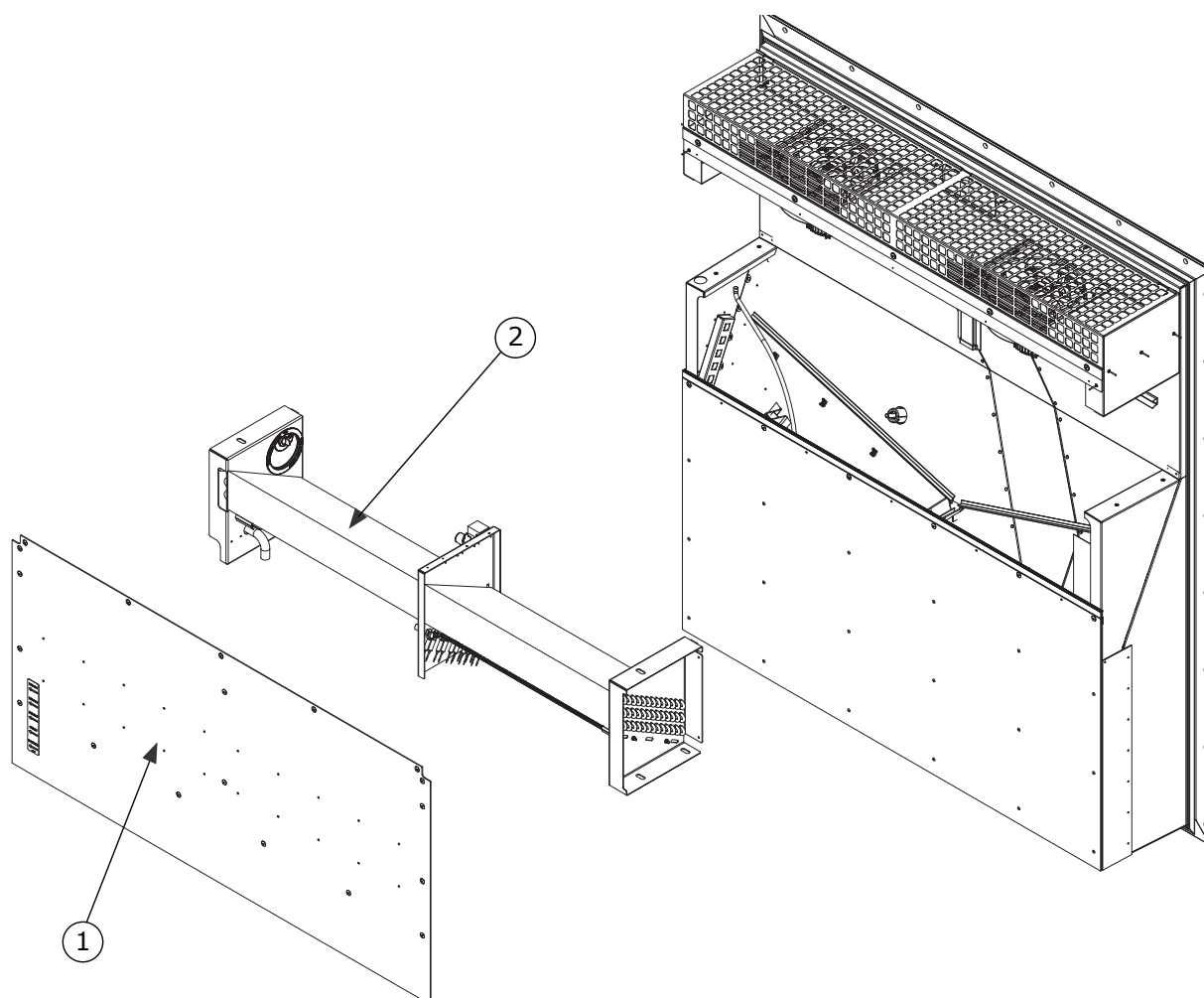
21.3 Replacement of condenser motor and fan

Note: Turn off main power supply for unit before replacing condenser motor and fan.

Remove the condenser grille and disconnect the power supply to the motor by unplugging the square connector plug on the motor connection box. Do NOT open the connection box. Replace the motor and check the fan blade is aligned so it can turn freely. Reconnect the power to the motor. Mount the condenser fan grille.



21.4 Replacement of evaporator



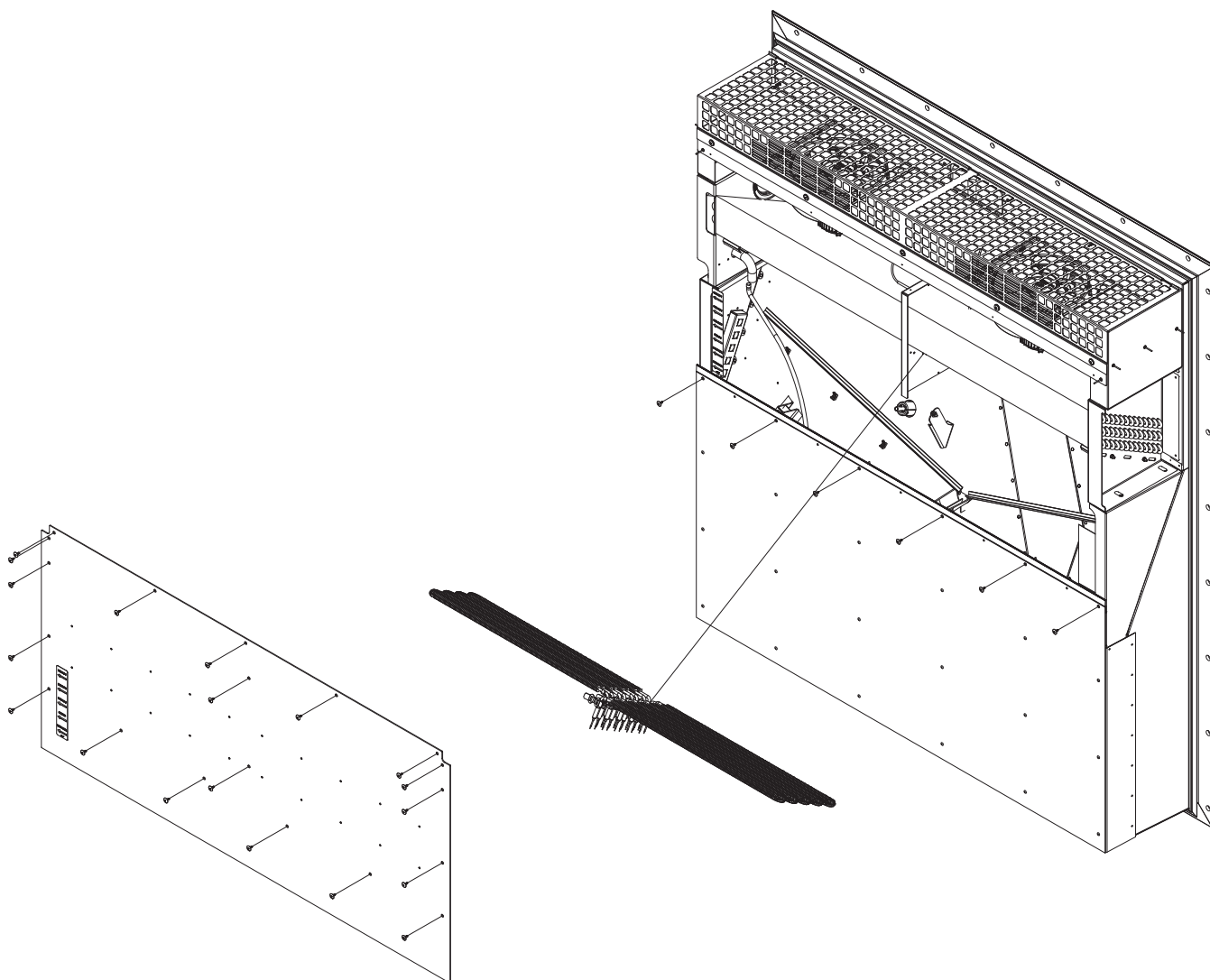
Position	Description
1	Back plate, evaporator
2	Evaporator

The replacing of evaporator is done in the following steps:

1. Evacuate refrigerant as described in this manual (see "22.1 Evacuation of refrigerant" p. 99).
2. Remove the evaporator back plate (pos. 1).
3. Remove the 9 heating elements below the evaporator (pos. 2).
4. Remove the sensors for evaporator temperature, suction temperature, and humidity.
5. Dismount or cut the suction and liquid pipes for the evaporator (pos. 2) in the correct place.
6. Remove the bolts and dismount the evaporator (pos. 2).
7. Mount new evaporator on chassis with appropriate bolts.
8. Connect the suction and liquid pipe to the new evaporator.
9. Reinstall the heating elements (see "21.4 Replacement of heating elements" p. 95).
10. Reinstall the sensors for evaporator temperature suction temperature humidity.
11. Reinstall the evaporator back plate (pos. 1).
12. Pump down the unit (see "22.4 Pump down of unit" p. 101).
13. Charge unit as described in this Manual (see "22.6 Charging of refrigerant" p. 102).

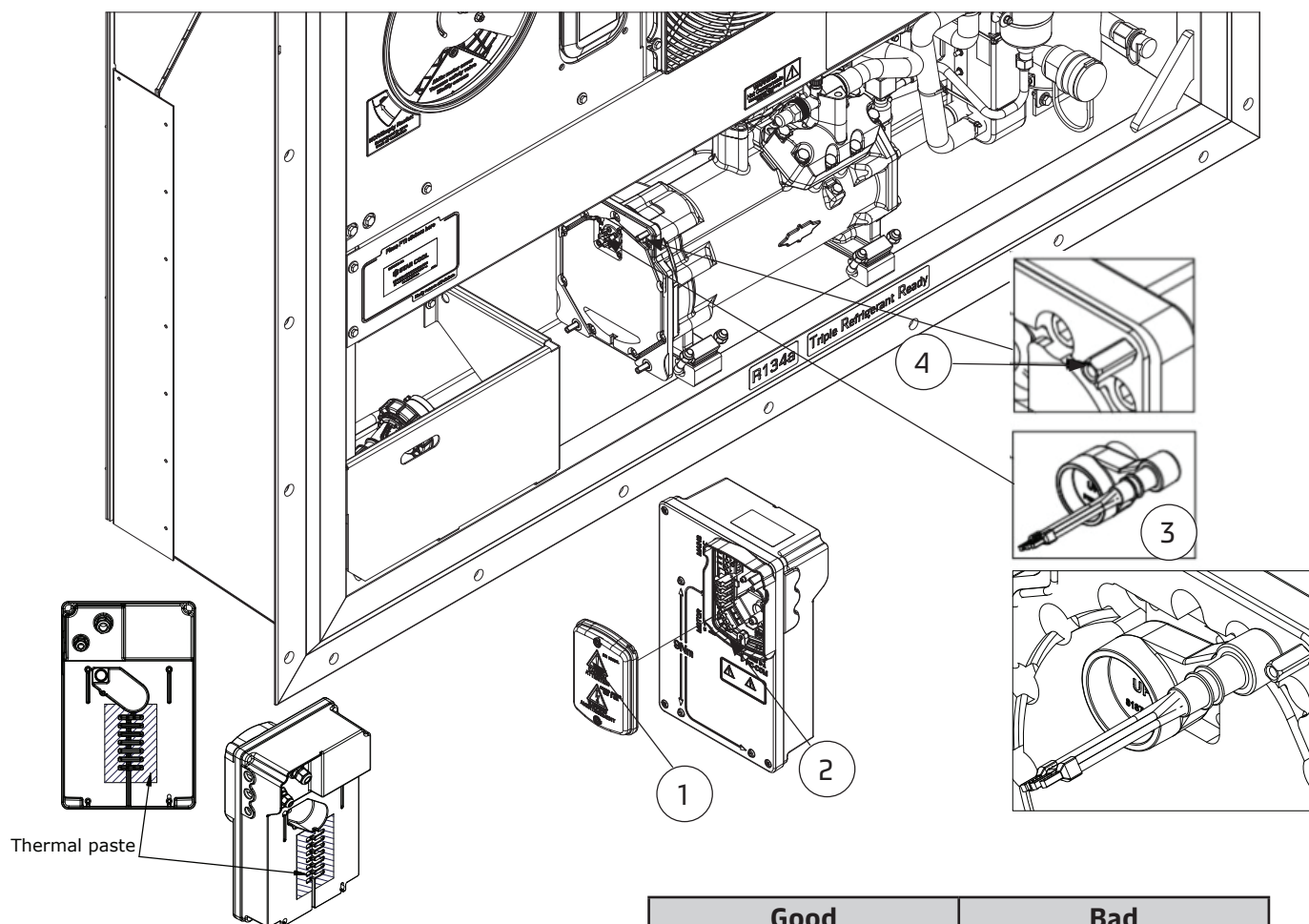
21.5 Replacement of heating elements

1. Dismount the upper back panel of the unit and dismount the defective heating element.

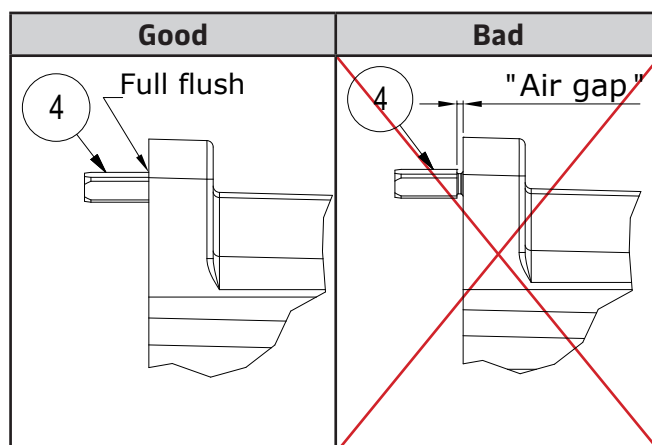


2. Mount the new heater onto the pin bolt and click into the bracket if installed.
3. Mount and tighten the M6 hex nut and washer. Use a crimp tool and heat shrink the connectors. If charged with R1234yf, a heating gun should be used on max. temperature (200-300°C / 392-572°F).
4. Secure the heater cables with cable ties.
5. Mount the upper back panel on the unit and ensure all screws are fully secured.

21.6 Replacement of FC



Position	Description
1	Black cover, FC 2.0/FC 2.1
2	Frequency converter 2.0/2.1
3	Cable, FC 2.0/FC 2.1 to compressor
4	Threaded bushing, FC mounting

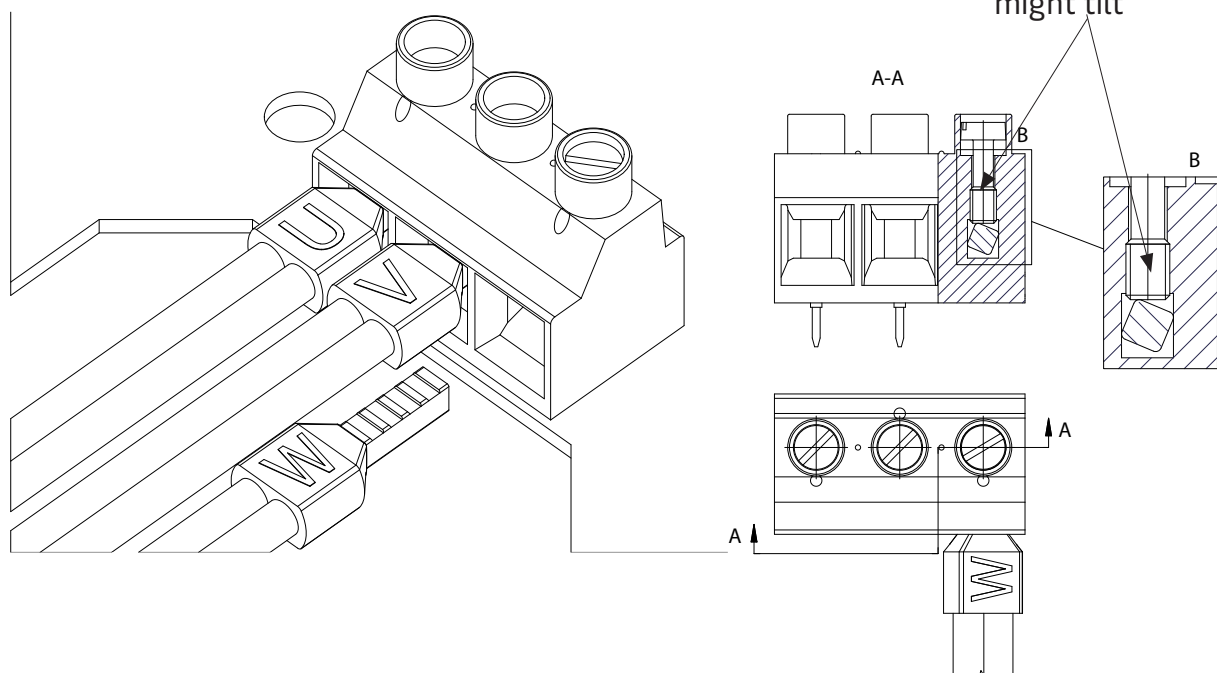


The procedure for replacing the FC is as follows (please ensure correct tightening torque is used throughout replacement):

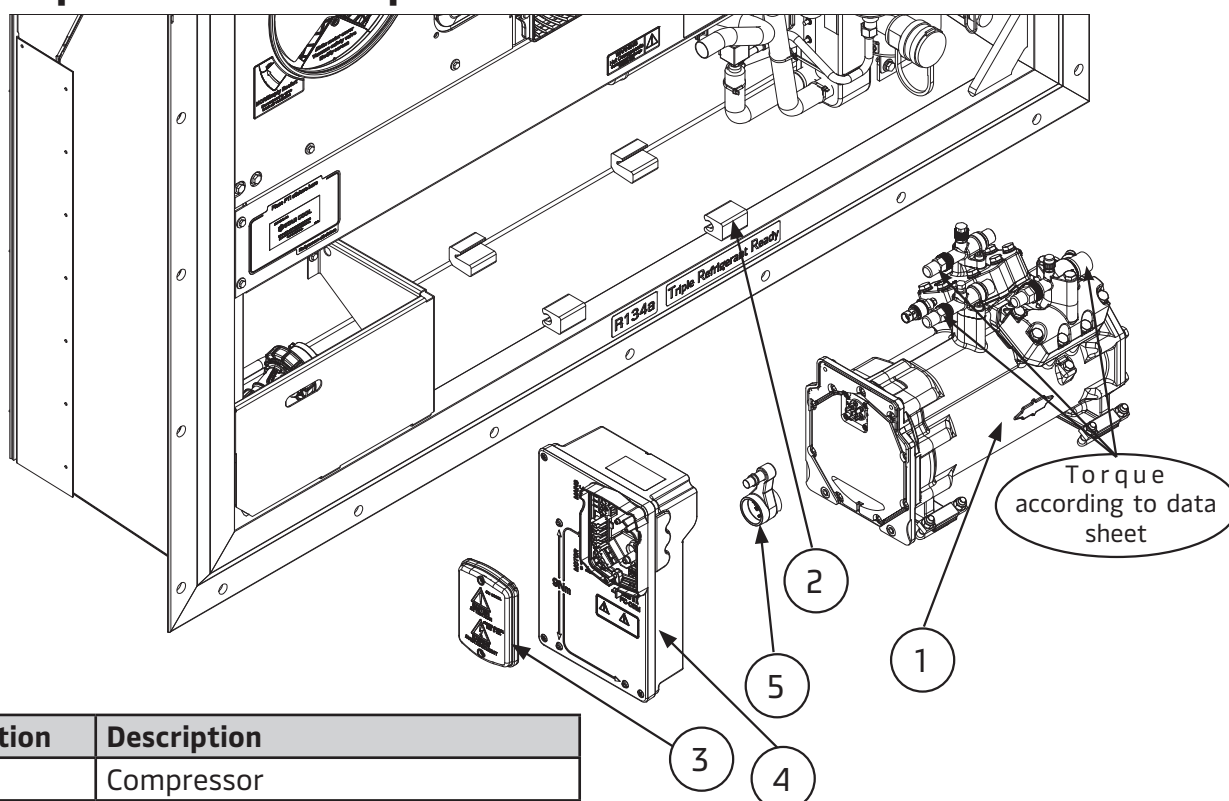
IMPORTANT! Opening the FC will void its warranty – only the black cover may be opened.

1. Remove the FC (pos. 2) and the cable (pos.3).
2. Make sure that all 4 studs (pos. 4) on the compressor are straight and tightened correctly before mounting the FC. All 4 studs must be flush to the surface of the compressor.
3. Clean the compressor end shield and the FC cooling surface of old thermal paste. Then apply new thermal paste on the FC cooling surface.
4. Mount the cable (pos. 3) on the compressor before the FC is installed.
5. Apply thermo paste before mounting the FC. Observe that the cable is not squeezed between the compressor and FC. Make sure that there is absolutely no air gap between the FC and the compressor.
6. Remove the black cover (pos. 1). When mounting the cables into the terminal, the cables will level into position during mounting. Be aware that cables may tilt. Fasten with the recommended torque.
7. Start up the unit and verify that it is running as normal.

Be aware that cables might tilt



21.7 Replacement of compressor



Position	Description
1	Compressor
2	Bracket, compressor
3	Black cover, FC 2.0/FC 2.1
4	Frequency converter 2.0/2.1
5	Cable, FC 2.0/2.1 to compressor

The procedure for replacing the compressor is as follows (please ensure correct tightening torque is used throughout replacement):

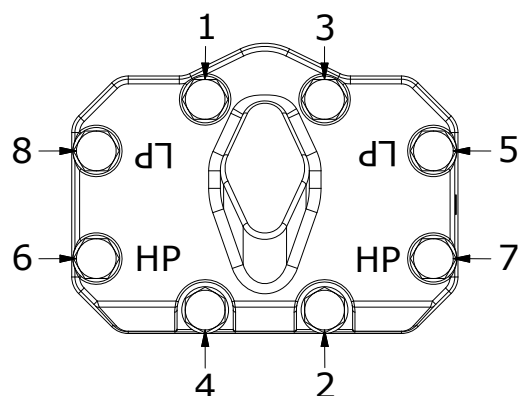
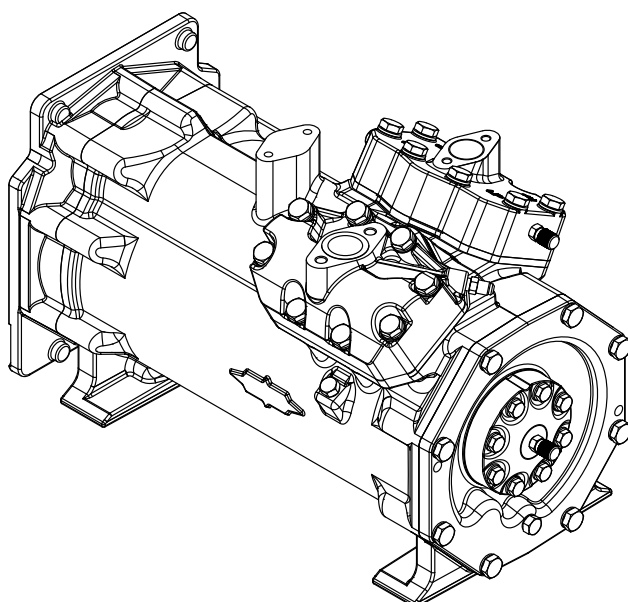
If the compressor is NOT running, close all 3 stop valves and evacuate refrigerant, and proceed from point 1. Before operating the suction service valve, loosen the gland seal by $\frac{1}{4}$ turn before you move the spindle. Once finished, tighten the gland seal and put on the protective spindle cap.

If the compressor IS running but needs replacement, complete the following before going to point 1.

- a. Close Veco and Vsuc.
 - b. Go to the Service menu  and select Manual operation and set the compressor frequency to 20 Hz.
 - c. Let the pressure drop to vacuum.
 - d. Stop the compressor by pressing Off on the controller and closing discharge stop valve.
 - e. Press wake up on the controller and read pressure in the corner of the display. Ensure it is 0 Bar.
1. Remove the FC (pos. 4) and the motor cable (pos. 5).
 2. Dismount all pressure transmitters and high pressure switch.
 3. Loosen all bolts for compressor stop valves.
 4. Loosen bracket for compressor and turn it downwards.
 5. Slide compressor out.
 6. Slide new compressor in place. Observe that the rear compressor foot is inserted firmly into the bracket slot.
 7. Reinstall the compressor brackets (but do not tighten).
 8. Reinstall all pressure transmitters and high pressure switch.
 9. Fasten all bolts for all 3 compressor stop valves. Fasten the compressor brackets!
 10. Mount the cable (pos. 5) on the compressor before the FC is installed.
 11. Apply thermo paste before mounting the FC. Observe that the cable is not squeezed between the compressor and FC. Make sure that there is absolutely no air gap between the FC and the compressor.
 12. Remove the black cover (pos. 3). When mounting the cables into the terminal, the cables will level into position during mounting. Be aware that cables may tilt. Fasten with the recommended torque.
 13. Evacuate the compressor before starting up, as described in this manual.

21.8 Replacement of compressor valve plate/cylinder head gasket

1. Depressurize the compressor.
2. Dismount cylinder head and valve plate using a rubber mallet if necessary. Carefully clean all sealing surfaces.
3. Check the valve plate and exchange the entire valve plate if damaged. Determine the cause and eliminate it.
4. Mount the cylinder head, valve plate and new gaskets correctly. Gaskets not made of rubber must be soaked in oil prior to mounting. If located in an inconvenient mounting position, use mounting pins.
5. Tighten the bolts in sequence (1 through 8) to 28 Nm. Then repeat the sequence, tightening each bolt to 70 Nm. See the numbers of the bolts in the figure below.



21.9 Replacement of filter dryer

Before replacing the drying filter, the power plug to the unit has to be disconnected.

The drying filter has to be changed every time the refrigerant system has been opened or if the moisture indicators indicate too much moisture in the refrigerant circuit. To change the drying filter, please follow the procedure below:

1. Start the unit in Manual operation.
2. Close the stop valve, pos. 14 (P & I diagram).
3. Select compressor frequency to 20 Hz.
4. Observe the suction pressure (P_{suc}). When $P_{suc} = 0 \text{ BarE}$, power off the unit.
5. Carefully loosen the two union nuts for the drying filter. Beware of pressurized escaping refrigerant. **Always wear protective goggles and gloves.**
6. Replace the drying filter with a new one supplied from Star Cool. Before mounting of the filter, put some drops of compressor ester oil on the flare in order to ensure correct tightness.
7. Tighten the two union nuts for the drying filter. (see "26.11 Tightening torques" p. 127). Use two spanners (on the nut and flare) to avoid putting pressure on the pipe.
8. Connect vacuum pump, pos. 11 (P & I diagram). Run for 2 minutes and then disconnect.
9. Open the stop-valve, pos. 14 (P & I diagram).
10. Power up the unit.

22. Service and maintenance

22.1 Evacuation of refrigerant

Evacuation of refrigerant from the unit is done by the following procedure:

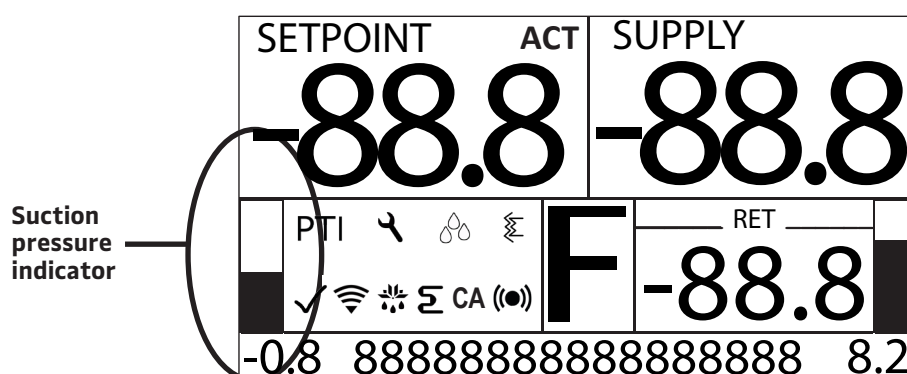
1. In cold ambient temperatures, connect power to the unit and turn it on. Allow the unit to run until the compressor is warm to the touch. Turn the unit off and disconnect the power.
2. Dismount the condenser cover plate to give yourself easier access to the compressor valves.
3. Remove the black caps from the compressor suction valve and discharge valve.
4. Connect the blue hose from the service manifold to the suction service valve port which is on the low-pressure side of the compressor.
5. Connect the red hose from the service manifold to the discharge service valve port which is on the high-pressure side of the compressor.
6. Connect the yellow hose from the service manifold to the vacuum pump.
7. Connect the black hose from the service manifold to the recovery machine.
8. Connect the black hose from the recovery machine to the empty bottle.
9. Dismount the solenoid coils from the evaporator expansion valve and the economizer expansion valve and mount permanent magnets on the valve stems.
10. To vacuum your hoses, open all the valves on the service manifold. Turn the vacuum pump on and run it until -0.99 bar is reached, usually after just a couple of minutes.
11. Turn the vacuum pump off and close the yellow hose on the service manifold. If the hose to the bottle is not already in vacuum, you will need to vacuum this hose too.
12. If a leak is suspected, a bottle to dispose of the refrigerant should be used as the refrigerant will be contaminated and must not be reused. If no leak is suspected, and the refrigerant recovery is to replace a part in the system, a recycling bottle can be prepared so that the same refrigerant can be charged to the system again.
13. Place the bottle on the scales and record the weight.
14. Open the valve on the end of the red and blue hoses.
15. Loosen the suction service valve gland seal $\frac{1}{4}$ turn so you do not damage the gasket before opening the valve using a ratchet spanner. Repeat this for the discharge service valve.
16. Open the bottle hand valve and hose valve.
17. Check the recovery machine is set for vapour recovery and turn it on.
18. Refrigerant will now begin to leave the system and move into the recycling bottle. Run the recovery machine until approximately 4.5 kg of refrigerant has been recovered (if no leak is suspected). If a leak is suspected, run the recovery machine until -0.1 bar is reached.
19. Close the black hose on the service manifold, the hand valve on the bottle and the hose valve and turn the recovery machine off.
20. Check the compressor oil level and add oil if necessary.

Note: Refer to operating and service manuals for the recovery equipment.

22.2 Compressor pump down and operation

Pump down of the compressor is done by the following procedure:

1. Connect a service gauge manifold to the two evacuation points, pos. 6 and 27 (P & I diagram) on the compressor.
2. Connect a recovery unit to the gauge manifold.
 - a. Connect a recycling bottle to the recovery unit.
 - b. Use a scale underneath the bottle, for measuring the amount of recycled refrigerant.
3. Close the suction service valve and economizer suction service valve, pos. 26 and 30 (P & I diagram). Before operating the suction service valve, loosen the gland seal by ¼ turn before you move the spindle. Once finished, tighten the gland seal and put on the protective spindle cap.
4. Close the discharge service valve, pos. 5 (P & I diagram), approx. 4 turns.
5. Run the compressor in Manual operation on 25 Hz, (see "11.17 Manual operation" p. 63).
6. Observe the LP indication until a vacuum of -0.5 Bar/E (-7.3 Psi) has been reached.
7. Turn off the compressor.
8. Close the discharge service valve pos. 5 (P & I diagram).
 - a. The evacuation points, pos. 6 and 27 (P & I diagram), are open, when the service valves, pos. 5 and 26 (P & I diagram), are closed.
9. Open the HP valve on the service gauge manifold.
10. Check that the recovery unit is set for vapour recovery.
11. Start and operate the recovery unit as long as necessary to evacuate the remaining pressure.
12. Check the service gauge manifold, should be in a slight vacuum.
13. After disconnecting the evacuation unit, the compressor is now ready to be replaced.



22.3 Compressor pump down (replaced)

Pump down of a new/replaced compressor is done by the following procedure:

1. Connect a vacuum pump with a service gauge manifold to the two evacuation points, pos. 6 and 27 (P & I diagram).
2. Check that all service valves are still closed, pos. 5, 26, and 30 (P & I diagram). Before operating the suction service valve, loosen the gland seal by ¼ turn before you move the spindle. Once finished, tighten the gland seal and put on the protective spindle cap.
3. Pump down the ambient pressure in the compressor to a vacuum, indicated on the gauges of the service gauge manifold.
4. Continue vacuum – pumping for at least 20 minutes (removing possible moisture in the oil).
5. Close the service gauge manifold LP/HP valves.
6. Switch off the vacuum pump. Write down the vacuum reading, from the service gauge manifold.
7. Observe the vacuum for minimum 0.5 hour.
8. If there has been no change in the vacuum, open all service valves, pos. 5, 26, and 30 (P & I diagram). Before operating the suction service valve, loosen the gland seal by ¼ turn before you move the spindle. Once finished, tighten the gland seal and put on the protective spindle cap.
9. If the vacuum is not maintained, there is a possible leak somewhere. Check all service gauge manifold hoses and connections, between the compressor and vacuum pump. If these are OK, check the compressor and valves for leaks.
10. Disconnect the service gauge manifold and operate the unit as normal.

22.4 Pump down of unit

Main power supply to unit shall be switched off during pump down of unit.

Pump down of unit is done by the following procedure:

1. Connect a service gauge manifold to the evacuation points, pos. 6 and 27 (P & I diagram) on the compressor.
2. Connect a recovery unit to the gauge manifold.
 - a. Connect a recycling bottle to the recovery unit.
 - b. Use a scale underneath the bottle, for measuring the amount of recycled refrigerant.
3. Close (4 turns only), service valves, pos. 5 and 26 (P & I diagram). (Pos. 30 still full open). Before operating the suction service valve, loosen the gland seal by ¼ turn before you move the spindle. Once finished, tighten the gland seal and put on the protective spindle cap.
4. Replace the electrical coils with permanent magnet on pos. 16 and 18 (P & I diagram).
5. Check that the recovery unit is set for vapour recovery.
6. Open both service gauge manifold valves (LP and HP).
7. Start and operate the recovery unit as long as necessary to evacuate desired amount of
8. refrigerant from the unit, until there is no pressure left (slight vacuum).
9. Close the service gauge manifold LP/HP valves.
10. Connect and start a vacuum pump.
11. Open the service gauge manifold LP/HP valves.
12. Continue vacuum pumping for at least 2 hours.
13. Switch off the vacuum pump and close all service gauge manifold valves,
14. Observe the vacuum level for minimum 0.5 hour.
15. If the vacuum level is maintained, then the unit can be charged as described in this manual.
16. If the vacuum level is not maintained, there is a possible leak somewhere. Perform leak check on vacuum pump & gauge manifold:
 - a. Open all service valves complete pos. 5, 26, and 30 (P & I diagram). Before operating the suction service valve, loosen the gland seal by ¼ turn before you move the spindle. Once finished, tighten the gland seal and put on the protective spindle cap.
 - b. Start the vacuum pump, open all service gauge manifold valves run to max. vacuum (there is no connection to the unit, only your tools are checked).
 - c. Close only the service gauge manifold valve which connects the vacuum pump.
 - d. Switch off the vacuum pump.
 - e. Observe the vacuum level for minimum 0.5 hour, if the vacuum level is OK for vacuum pump and gauge manifold, then the unit has a leak!
 - f. Check for leaks (see "22.5 Pressure test" p. 101).

22.5 Pressure test and vacuuming the system

After performing a major repair to the unit piping system, it is recommended to perform a pressure test. A pressure test has the purpose of checking the piping system for leakages. The pressure test is done by means of a high pressurized gas, e.g. N₂, which is let into the piping system through the two evacuation points. The procedure for this is as follows:

Note: Do not use oxygen (O₂) for a pressure test, but only nitrogen (N₂).

1. Dismount the condenser cover plate to give yourself easier access to the compressor valves.
2. Remove the black caps from the compressor suction valve and discharge valve.
3. Connect the blue hose from the service manifold to the suction service valve port which is on the low-pressure side of the compressor.
4. Connect the red hose from the service manifold to the discharge service valve port which is on the high-pressure side of the compressor.
5. Connect the yellow hose from the service manifold to the vacuum pump.
6. Connect a nitrogen bottle to the service manifold and open the nitrogen bottle hand valve and hose valve. Open the black hose on the service manifold.
7. Charge nitrogen until the manifold gauges read 4 bar. Close the hand valve on the bottle and the black hose on the service manifold.
8. Use a leak detector or spray soap water on any expected leak points. If new bubbles are formed, there is a leak. Repair the system as necessary.
9. If no leak is found, charge nitrogen again up to 8 bar and close the hand valve on the nitrogen bottle. Identify any leaks. Repair the system as necessary.
10. If still no leaks are found, charge nitrogen again to 12 bar and close the hand valve on the nitrogen bottle. Identify any leaks. Repair the system as necessary.

11. If no leaks are found, leave the unit charged with nitrogen for at least 2 hours (longer is preferred if no digital gauge is being used). If the pressure gauge still shows 12 after 2 hours, the unit has no leaks. Otherwise repair the system as necessary.
12. Disconnect the nitrogen bottle from the service manifold. Open the black hose valve and slowly open the black hose on the service manifold to release the nitrogen from the system into the air.
13. Open the yellow hose on the service manifold and start the vacuum pump. Run it until a pressure of 2.7 mbar.
14. Close all the hoses on the service manifold and turn the vacuum pump off.
15. If the vacuum remains under 2.7 mbar over a duration of at least 1 hour (or according to local regulations), then the system is ready to be charged with refrigerant.

22.6 Charging of refrigerant

Always charge refrigerant according to name plate on unit (R134a, R513A or R1234yf). You must NOT mix any of the refrigerants; avoid it at all times.

22.6.1 Charging of an empty unit

The power to the unit must be off. Before powering off unit, it might be helpful to use/run the condenser fan motor for fast dilution of any refrigeration leak.

The charging of an empty unit is done by weight, by the following procedure:

1. Open the black hose on the service manifold.
2. Run the vacuum pump to vacuum the hose usually for a couple minutes. Turn the vacuum pump off and close the yellow hose on the service manifold
3. Open the refrigerant bottle hand valve and hose valve.
4. Depending on the bottle type (if it has a tube or not), turn the bottle upside down so the liquid in the bottle will be used first.
5. Place the refrigerant bottle on the scales. Connect it to the service manifold and record the weight of the bottle.
6. Open the red hose on the service manifold.
7. Refrigerant will now begin to move into the discharge side of the system from the refrigerant bottle.
8. When the bottle weighs 4.5 kg less, close the black hose on the service manifold. If 4.5 kg cannot be reached, jump to step 16.
9. Turn the bottle upright and close the bottle hand valve and hose.
10. Remove the permanent magnets and mount the solenoid coils again.
11. Connect AC power to the unit and turn it on.
12. Back seat the discharge service valve to close the port and fully open the valve.
13. When the compressor starts running, dismount the solenoid coils and open the blue hose on the service manifold to allow the refrigerant in the hoses to be transferred to the system.
14. When the gauge reads 0 bar, back seat the suction service valve to close the port and fully open valve.
15. Mount the solenoid coils again and disconnect your gauge and hoses. Move on to the completion section.
16. If 4.5 kg cannot be reached, back seat the discharge service valve to close the port and fully open the valve. Close the hose valve on the compressor.
17. Remove the permanent magnets and mount the solenoid coils again.
18. Connect AC power to the unit and turn it on.
19. After unit has finished starting up, ensure the setpoint is lower than ambient so that the compressor and fans are running.
20. Turn the bottle upright again so the gas refrigerant will now be released. Place the bottle back on the scales.
21. Open the blue hose on the service manifold. The unit will start to draw the remaining refrigerant into the system.
22. Check the scales and when 4.5 kg has been reached, close the hand valve and hose on the refrigerant bottle.
23. Dismount the solenoid coils and then the refrigerant in the hoses to be transferred to the system.
24. When the gauge reads 0 bar, back seat the suction service valve to close the port and fully open valve. Close the hose valve on the compressor.
25. Mount the solenoid coils and disconnect your gauge and hoses.

26. Mount the service valve caps and the condenser cover plate if you removed it, ensuring to secure the metal hose clamp to the discharge pipe again.
27. Check any repairs made have been done successfully.
28. Register refrigerant handling according to local rules and regulations.
29. Ensure that the refrigerant type configured in the controller and the decal on the front of the unit matches the refrigerant you have charged.

22.7 Leakage detection

Leakage detection is done under pressure test, as described in this manual. While the unit is pressurized it is possible to check all soldered and screwed joints of the piping system. This is done with a leakage detection agent or with a solution with high foam building soap. The agent or water/soap solution is sprayed upon the joints. If there is a leakage bubbling, foam will occur. This leakage detection test can also be done while the unit is running charged with refrigerant by means of a refrigerant detector or soap solution. Leakage detection is also done during pump down of unit or compressor, as described in this manual.

For units charged with R1234yf, some alarms can trigger the sounder beacon.

22.8 Compressor



22.8.1 Check of oil level

1. Oil level can only be checked with an oil dipstick when the system is empty of refrigerant.
2. Use the compressor oil dipstick to check the oil level. It must be within the marking on the dipstick.

Note: Do not overfill the compressor with oil.

22.8.2 Draining of oil from compressor

If the compressor has been overcharged with oil, the procedure for drainage is as follows:

1. The two oil outlets are placed on a tee-piece located on the compressor end opposite of the FC end. Please observe that only one of the oil outlet ports is equipped with a schrader valve.
2. Connect a service gauge manifold to the outlet port with schrader valve of the oil pump.
3. Only connect the discharge hose to the outlet port of the oil pump.
Make sure that all stop valves on the service gauge manifold are closed.
4. Open the discharge gauge stop valve on the service gauge manifold.
5. Insert the hose from the suction gauge on the service gauge manifold into a small measuring cup.
6. Run the compressor in manual operation on 25 Hz.
7. Carefully open the suction gauge stop valve on the service gauge manifold.
8. While observing the oil level using the dipstick in the compressor, carefully let out oil, until the oil level on the dipstick has reached a mid - level.
9. Close the suction gauge stop valve and discharge gauge stop valve on the service gauge manifold.
10. Disconnect the service gauge manifold.
11. Cap the oil outlet from the oil pump.
12. Set the unit to Automatic operation mode by choosing the Service menu , line S01 Manual operation and changing MANUAL to AUTO.
13. Run the unit in normal operation.

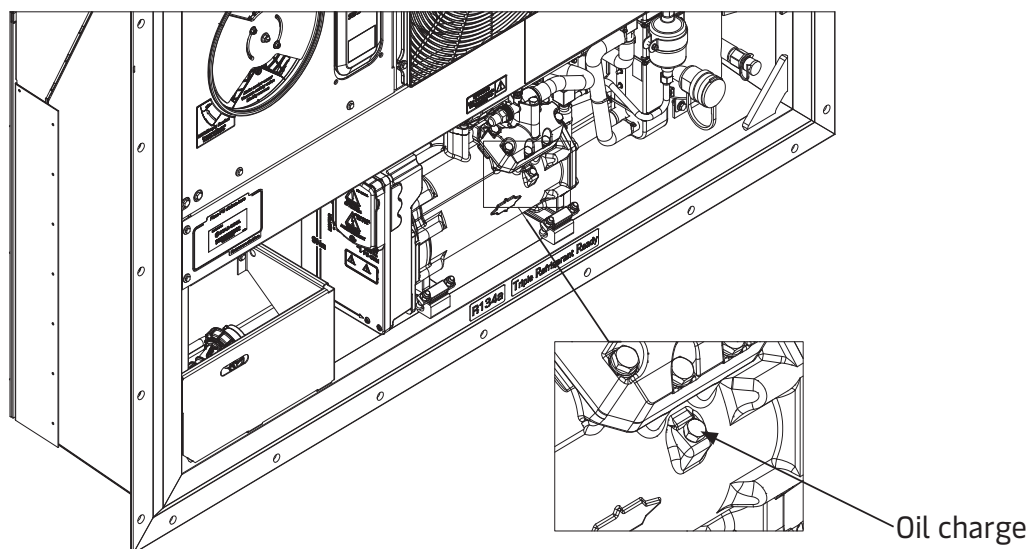
Observe the oil level when the unit is running minimum 6 hours in a stable condition.

22.8.3 Charging of oil

If during normal operation it has been observed that there is too little oil charge on the compressor, additional oil may be charged. The compressor must be filled with oil type BSE 55 (item no. 818667B). The procedure for adding oil is as follows:

1. Pump down the compressor, as described in this manual.
2. Remove the plug on top of the stop valve for the intermediate pressure.
3. Start by adding 0.25 L of compressor oil.
4. Reinstall the plug on top of the stop valve for the intermediate pressure.

5. Evacuate the compressor as described in this manual.
6. Open the compressor stop valves, pos. 5, 26, and 30 (P & I diagram). Before operating the suction service valve, loosen the gland seal by ¼ turn before you move the spindle. Once finished, tighten the gland seal and put on the protective spindle cap.
7. Disconnect the vacuum pump.
8. Start up the unit and check the oil level during start up and after 20 minutes in normal stable operation. If oil is still missing, check for oil leaks or spills both inside and outside the container. If no leaks found, repeat the above.



22.9 Soldering

Warning: Any soldering or de-brazing must ONLY be carried out after recovery of any excess gas/refrigerant in the system. Also make sure to expel oxygen from system to prevent flash-ignition of hot oil. Make sure to comply to local safety regulations and government environmental laws whenever soldering on refrigeration systems.

WARNING: Do not trap any liquid refrigerant inside pipes during soldering work. This may lead to an explosion of the pipes. Any brazing or soldering work must be done with an inert gas (nitrogen) flowing inside the area being worked on to prevent carbon contamination. Any replacement or repairs to copper tubing must include repainting with black epoxy (or similar) paint to prevent corrosion.

When soldering and de-brazing components on the unit, please observe the following. Use the following material for soldering copper - copper (all pipes):

Soldering rod: L - Ag15P according to DIN 8513 or B - CuP5 according to AWS A 5.8.

Example for product name: Chem - weld product 550 or Castolin RB 5283

Soldering flux: Due to the high content of Phosphor in the soldering rod no flux is needed.

For soldering copper - stainless (connections for water cooled condenser and economizer):

Soldering rod: L - Ag40Cd according to DIN 8513 or B - Ag 1 according to AWS A 5.8.

Example for product name: Chem - weld product 511B or Castolin 1802 or 1802 F.

Soldering flux: F - SH 1 according to DIN 8511 or FB 3A according to AWS A 5.31.

Example for product name: Chem - weld product 110 or Castolin 1802 N - Atmosin.

Use wet cloths to protect sensitive valves and other equipment against heat input during soldering and de-brazing.

Use nitrogen (N₂) as inert backing gas during soldering and de-brazing.

22.9.1 Welding

Do not perform welding on the unit before disconnecting the power plug. Furthermore, disconnect the power measurement module, the main controller (and modem if present), and the following connectors:

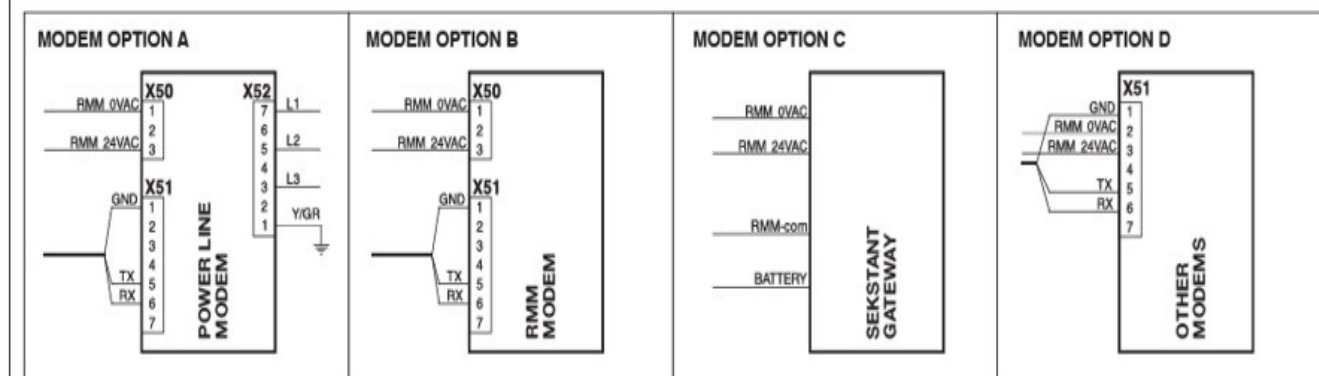
Controller: X0, X1, X10 and X8.

SPM Power Meas Module: X41.

User Panel: X80.

Modems:

- Option A (RMM): X50, X51 and X52
- Option B (RMM+, ML RCM, Orbcm): X50 and X51
- Option C (Sekstant): All connectors
- Option D (Other, f.x. Globe Tracker, ArrowSpot): X51

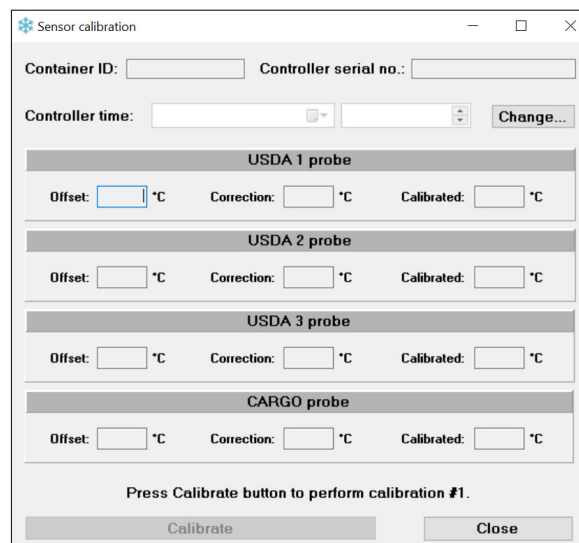
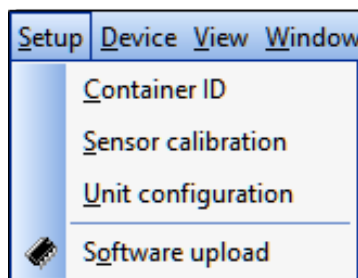


22.10 Calibration of air exchange sensor

Air exchange sensor calibration:

1. Close the air exchange cover plate.
2. In the Service menu (🔧) S05 Configuration, line F06 Air exchange calibration, select START and press the Enter key (↵).
3. Calibration is done.

22.11 Sensor calibration using StarView



When placing the USDA and cargo probes in ice water, they should display 0°C. If any reading deviates from this value the probe requires calibration. Calibration is simply done by looking at the reading for the USDA sensor and then double clicks in e.g. CalUs1. In the popup window enter the calibration value required in order for the sensor to reach 0°C. Then press Calibrate.

Do this calibration for each of the USDA and cargo sensors. Max. offset calibration is 3K. If more is required, the probe must be replaced.

23. CA service and trouble shooting

23.1 Container venting procedure

To be performed before entering a Star Cool CA unit/container.

1. Press  for the Operation menu and select line 003. Set the Control mode to Normal.
2. Manually open the fresh air vent of the CA container. Alarm AL 607 will activate as the vent is required to be closed for normal CA operation.
3. Wait for the O₂ level to reach 19-21%.
4. Once safe, the O₂ level is displayed as "O2 Act". The container doors are now safe to open.

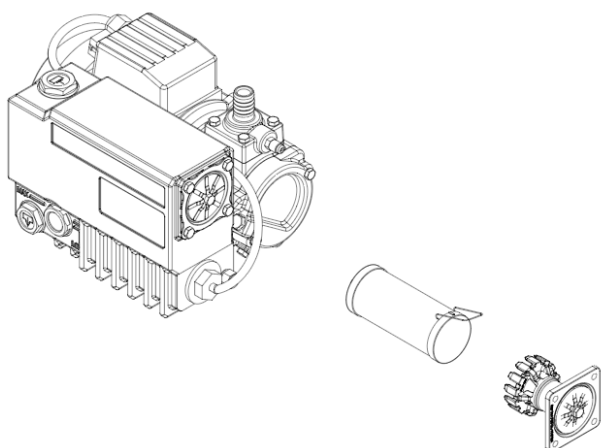
When finished, close the fresh air vent and clear AL 607.

23.2 Vacuum pump service

Every 2000 running hours the vacuum pump filter and oil must be replaced. The number of running hours can be viewed in the Service menu , S04 Runtime counters, line R08 Vacuum pump oil/filt. When activating a CA PTI, alarm 656 will become active and the vacuum pump service screen will be displayed.

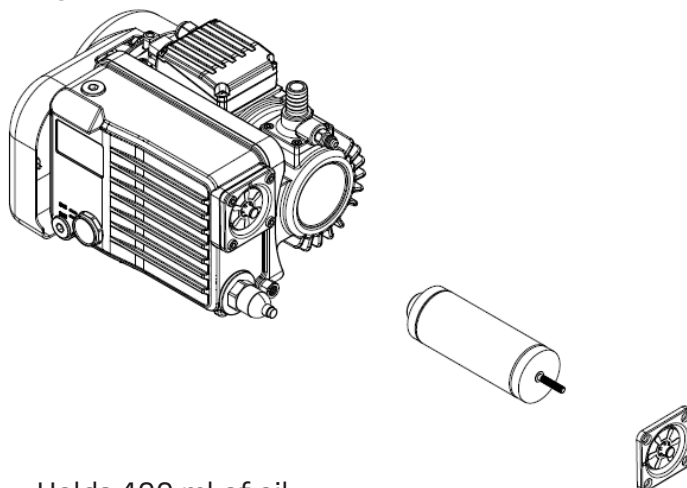
There are two versions of the vacuum pump, filter and cover shield.

Ver. 1:



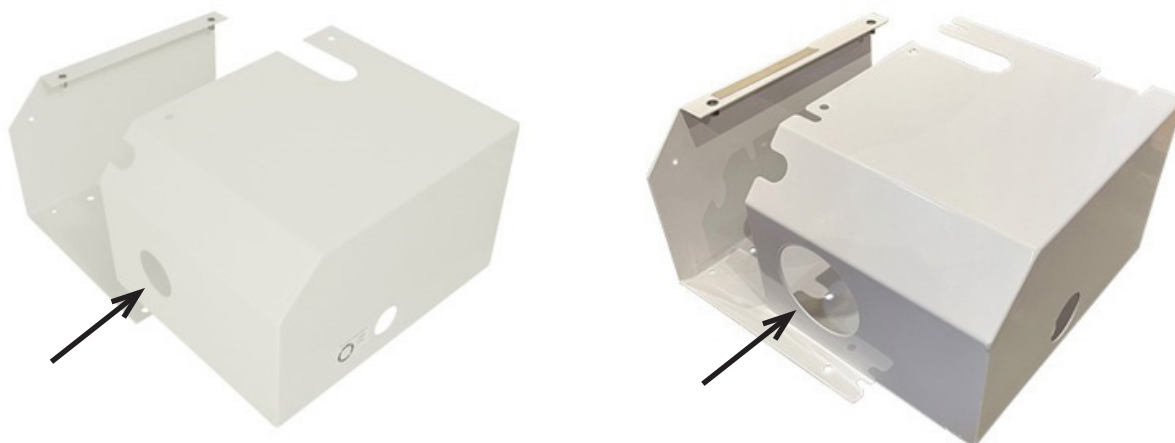
Holds 350 ml of oil.

Ver. 2



Holds 400 ml of oil.

The two cover shield versions are distinguishable by the size of the hole. Ver. 2's is much larger as shown below:



350/400 ml of oil must be filled when filter and oil change is performed. Stop when the maximum indicator on the sight glass has been reached.

A new filter will absorb oil during the initial running hours and once saturated will hold 50 ml of oil.

The difference between minimum and maximum on the sight glass is 80 ml.

While the pump is running normally, approx. 70 - 80 ml are in constant flow circulating around in the system.

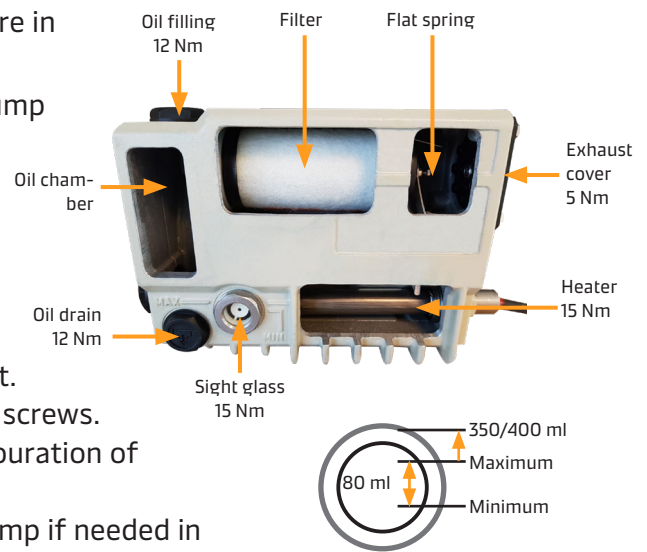
When servicing the vacuum pump, ensure to clean the pump housing and cover panels.

Pictured on the right is ver. 1, but the principle is the same for ver.2.

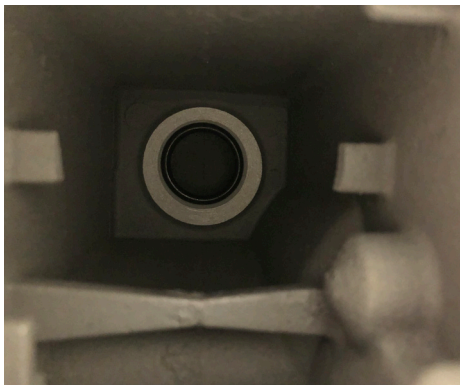
The same oil type is used on both versions.

Sightglass and heater is unchanged between versions.

1. Upload the latest software version to the controller.
2. Turn the unit off and disconnect the power to the unit.
3. Dismount the vacuum pump cover by removing the 4 screws.
4. Visually inspect if there are any oil leakages or discolouration of the pump.
5. Use a mirror, mobile phone camera, or remove the pump if needed in order to replace the filter best possible.
6. Dismount the black exhaust cover or filter adapter by removing the 4 screws.
7. If a filter adapter is not installed, loosen the screw (7 mm) that holds the flat spring and filter in place. Turn the flat spring counter clockwise and remove it.



8. Remove the filter. Check that the filter o-ring is not left behind. If so, remove it with a hook.



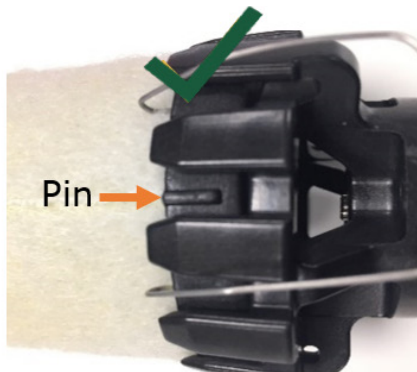
9. Clean the end of the vacuum pump housing.

10. Insert the new filter with o-ring attached ensuring that it is positioned correctly in the housing with the wire bow at the top.

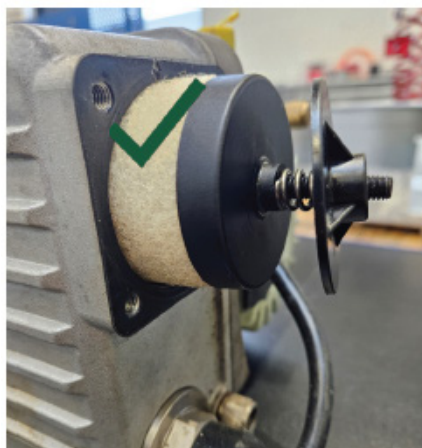


11. Attach the adaptor to the filter. Check that the pin of the filter end cap is between 2 fingers and be careful not to get the wire bow between the adaptor and the filter. Gently position the end piece and tighten the 4 screws first with 1 Nm and then with 3 Nm.

Ver. 1 adapter and filter:



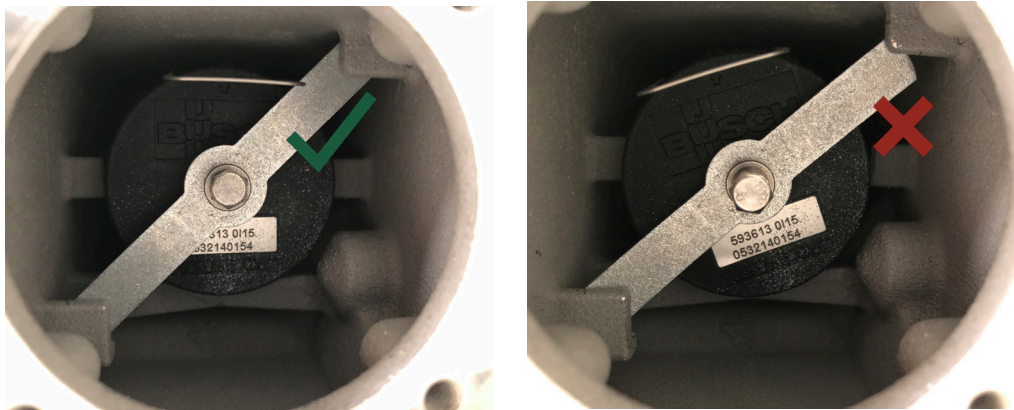
Ver. 2 adapter and filter:



12. If no filter adapter is available, loosen the screw on the flat spring and align the flat spring into its position by turning it clockwise. Tighten the screw (7 mm) to apply adequate force on the spring but do not over tighten, to prevent puncturing the filter end cap.



13. Check the position of the flat spring. It should be perfectly aligned with the housing and should not be able to move when being rotated with your fingers. If it is misaligned, adjust it into the correct position.



14. Mount the black exhaust cover with its 4 screws and tighten to 3 Nm.
15. Drain oil from the vacuum pump by removing the lower black plug next to the sight glass. If the sight glass is dirty, remove and clean it ensuring the o-ring is intact and seated correctly before tightening with a 30 mm socket to 15 Nm.
16. Mount the black plug again and via the top black plug, fill up with 350/400 ml oil. Stop when reaching the maximum indicator on the sight glass.
17. Reconnect power to the unit and turn it on.
18. Go to the Service menu (⚙️) and select line S01 Manual operation.
19. Change the value of line M01 from Auto to Manual.
20. Go down to line M10 and change the value from Off to On.
21. Let the vacuum pump run for 5 minutes.
22. Go to the Information menu (ℹ️) and view line I18 Membrane pressure. The value should be between 20 mbar and 79 mbar.
23. If not within specified range, proceed with trouble shooting according to this manual.
24. Mount the vacuum pump cover and its 4 screws.
25. Active the CA PTI and confirm the change of filter and oil in the alarm 656 message screen. Alternatively, go to the Service menu (⚙️), S08 Maintenance, select line K01 Mpump oil/filter and confirm the oil and filter change.

23.3 Trouble shooting the vacuum system

Note: Be aware of hot surfaces when handling the vacuum pump.

Note: Do not enter the container, including opening the inspection hatches, when the oxygen level is below 20.9%.

The vacuum system consists of a membrane connected with a hose to a vacuum pump. Below you will find a step-by-step method to determine the root cause of a vacuum fault. Please be aware that there can be more than one problem in a vacuum system, and you might need to go through the steps several times to eliminate the problem.

A vacuum fault can be caused by a single or combination of the following points:

- Insufficient amount of oil in the vacuum pump
- Overdue vacuum pump service
- Defective pressure transmitter (Pmem)
- Defect or leakage in the vacuum pump/filter
- Leak in hose, fittings, or connections
- Leak in membrane

Method to determine the cause:

1. Clear any active alarms before continuing with these steps.
2. Check the vacuum pump running hours in the Service menu (⚙️), S04 Runtime counters, line R08 Vacuum pump oil/filt. If the number of running hours is above or approaching 2000 and will most likely reach 2000 during the next trip, perform a mandatory vacuum pump oil and filter change.
3. If the vacuum pump oil and filter has not been changed, check that the vacuum pump oil level is above minimum. Fill with the correct oil type (as specified in this Manual) until maximum level is reached.

4. Go to the Service menu  and select line S01 Manual Operation. Change the value of line M01 from Auto to Manual. Go down to line M10 and change the value from Off to On.
5. If the vacuum pump starts go to point 13.
6. Check the resistance on contactor coil K9 and K10 between A1 and A2 (Schneider grey type: 6-8Ω, Schneider green type: 8-10 Ω, Danfoss: 5-6Ω). If the resistance is outside the specified ranges, replace the contactor.
7. Activate the contactor K9 as point 4.
8. Measure the voltage output to K9 on the controller X12 or X78 (depending on the controller version). The voltage should be between 2.5 and 6.5 VDC.
9. If not between the specified range, check the power supply.
10. If between the specified range but the vacuum pump does not start, pull the K9 contactor manually. If the pump still does not start, check the cable and connector into the pump for damages and replace as necessary.
11. If the cable and connector are ok, replace the vacuum pump.
12. If no voltage, replace the controller.
13. Go to the Information menu  and check line I18 Membrane pressure. After 7 seconds the value should be below 600 mBar.
14. If not, power off the unit and check the wiring of the K9 contactor is according to the wiring diagram.
15. Power on the unit and start the pump manually as point 4. Confirm that the vacuum pump fan can rotate freely and is rotating according to the arrow on the left side of the pump.
16. Disconnect the vacuum hose at the vacuum pump and plug the vacuum pump inlet. Go to the Information menu  and view the membrane pressure on line I18. If the pressure is below 30 mBar, connect the hose back onto the vacuum pump and ensure the connection is tight and go to 18.
17. If the pressure is above 30 mBar, install a manometer at the transmitter inlet and check the reading is similar to the display reading. If not, replace the pressure transmitter. If the manometer is showing the same "high" pressure (above 30 mBar) as the display, replace the vacuum pump.
18. If the vacuum fault is still present, disconnect the vacuum hose at the membrane and plug or seal it. Start the pump manually as point 4.
19. If the membrane pressure on line I18 is below 30 mBar, the membrane connection or the membrane itself is leaking. Replace the membrane. If the unit is in operation with cargo, be aware of possible high CO2 level and low O2 level. Check this on the controller main display. Vent the container according to this manual before removing the right hand inspection cover.
20. If the membrane pressure on line I18 is above 30 mBar, check the hose for leaks and repair or replace it. Ensure it is connected correctly. After repair or replacement of the vacuum hose, conduct a container leak test according to this Manual. This is not possible on units in operation with cargo.

23.4 Replacement of the vacuum pump heating element

1. Power off the unit.
2. **Be aware of hot surfaces.**
3. Remove the cover shield from the vacuum pump by the 4 bolts. Dismantle the vacuum pump from its socket. Disconnect the heating element in the terminal box.
4. Tilt the vacuum pump to avoid spilling oil when replacing the heating element.
5. Attach the cables to the terminal box on top of the vacuum pump according to the wiring diagram.
6. Reinstall the vacuum pump and turn the power on.
7. Test performance of the heating element by running a CA PTI.

23.5 CA preparation

The following procedure must be carried out on all Star Cool CA models prior to loading cargo.

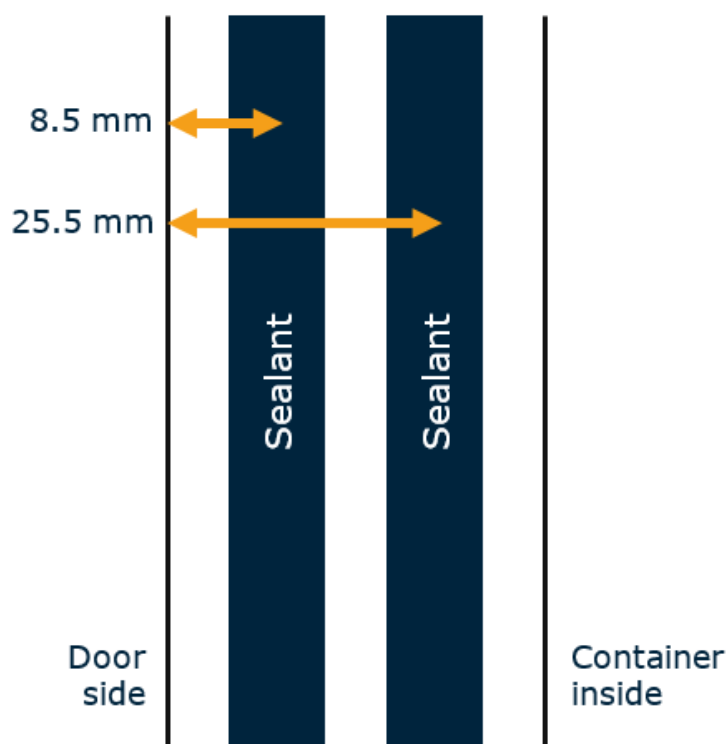
1. Ensure that all customer specified checks have been completed.
2. Make sure the inspection covers are in perfect condition and installed correctly.
3. Secure tightly the drain plugs placed near the corners of the container floor.
4. Install the CA curtain according to the Operating and Service Manual.
5. Ensure the container has passed air leak test according to the Operating and Service Manual.
6. Check and secure the vacuum pump hose connection to the vacuum pump and replace if damaged.
7. Connect power to the unit and turn it on.

8. Go to the Service menu  and select line S05 Configuration. Check the container ID on line F01 is correct. Go to line F02 and check that the software is at least version 356.
9. Go to the Service menu  and select line S03 Time adjust. Check that the controller date and time is correct and in GMT.
10. Go to the Service menu  and select line S04 Runtime counters. View the number of vacuum pump running hours on line R08.
11. If the number of running hours is above or approaching 2000 and will most likely reach 2000 during the next trip, perform a mandatory vacuum pump oil and filter change according to the Operating and Service Manual.
12. Once the oil and filter have been changed, go to the Service menu  and select line S08 Maintenance. Confirm the oil and filter change on line K01 Mpump oil/filter.
13. If the vacuum pump oil and filter has not been changed, check that the vacuum pump oil level is above minimum.
14. If not, fill with the correct oil type (as specified in this Manual) until maximum level is reached.
15. Go to the Service menu  and select line S01 Manual Operation. Change the value of line M01 from Auto to Manual.
16. Go down to line M10 and change the value from Off to On.
17. Let the vacuum pump run for 5 minutes.
18. If the exhaust from the vacuum pump is emitting a constant cloud of cold white smoke, check if the vacuum pump filter is damaged and replace if necessary.
19. Before activating the CA PTI, check the alarm history and clear any active alarms.
20. Activate the CA PTI by pressing  and selecting CA on line T01.
21. Once the CA PTI is completed, the status of the test will be shown in the main display.
22. Install 2 ethylene filters on the return air grille inside the container.
23. Load the cargo and install the CA curtain.

23.6 Curtain track installation

The procedure is to be carried out in accordance with local safety regulations and by using adequate personal protective equipment.

1. Remove the loose CA curtain track from the aluminium track.
2. Check the CA curtain track for damages especially the extruded profile edge. If damaged, use a new CA curtain track.
3. Clean the CA curtain track for sealant and dirt. New CA curtain tracks must also be cleaned prior to use. Use Sika Aktivator 205 or Acetone and a clean cloth.
4. Remove old sealant and dirt from the aluminium track. Use a powered stainless-steel brush or fine sandpaper to remove the oxidized aluminium.
5. Clean the aluminium track with Sika Aktivator 205 or Acetone and a clean cloth.
6. Remove additional dirt and dry the aluminium track with an air gun.
7. Apply sealant to the aluminium track. Use Bostik Simson ISR 70-03 or an equivalent sealant.
8. Starting with the corners, apply two lines of sealant about 5 mm thick. One line of sealant 8.5 mm from the edge of the track measured from the door side and the other 25.5 mm. The two lines of sealant should go about 20 cm from the corners.



9. Then apply a single line of sealant about 3 mm thick to the rest of the aluminium track about a quarter of the way into the track.
10. Starting with the corners, use a rubber hammer or similar to push the clean CA curtain track fully into the aluminium track. Make sure the CA curtain track is correctly oriented as shown.

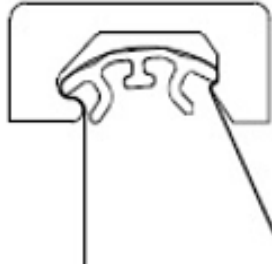


11. Add sealant to all 4 corners sealing off both sides of the CA curtain track.
12. After allowing the sealant to dry for 48 hours, perform a container leak test.
13. Install the container floor drain plugs.
14. Install the CA curtain.
15. Install the Star Cool CA test damper and manometer.
16. Apply compressed air until the manometer displays a pressure of 500 Pa/2" water gauge.
17. Close off the compressed air supply and after 8 minutes read the manometer. The pressure should be above 250 Pa/1" water gauge.
18. If the pressure is below, use soap water to check for leaks around the CA curtain track and the container doors.
19. Fix any leaks and repeat the container leak test until all leaks are fixed and the pressure is above 250 Pa/1" water gauge after 8 minutes.

23.7 Curtain installation

Warning: Knives and blades should not be used for trimming the excess curtain ribbon as this could damage the curtain.

1. Unfold the curtain and locate the midpoint fold mark.
2. Be sure to install the curtain so the warning print faces outwards.
3. Using the CA curtain holding clips, position the curtain into the curtain rail.
4. Start at the midpoint fold at the top of the curtain.
5. Using approx. 80-100 mm of material from the outside edge of the curtain, insert the clips.
6. Starting at the top center, use the tool to press the ribbon into the curtain track.
7. Make sure the flat side of the ribbon is pointing into the CA curtain track.



8. Fit the remaining ribbon by pressing and sliding the tool, removing the clips as you work your way around.
9. To install the ribbon in the corners, use the tool to push the ribbon into the rail. Use small pushing motions to work the ribbon and curtain securely in to the curtain track corners.
10. Use the same procedure to install the second half of the ribbon.
11. Check that the ribbon makes a complete seal between the curtain and the rail.
12. Pay special attention to the top center (starting point) and the four corners.
13. The curtain must not be fitted taught and there must be free material to allow for movement of the container such as racking.
14. The two remaining curtain ribbon ends must be removed by overlapping them ensuring they are fully secured into the rail, with any excess ribbon cut away using a pair of side cutters.

23.8 Container leak test

When using the CA system, the box must conform to leak rates in order to maintain control of the O₂ and CO₂ setpoints. The minimum box requirement is a pressure of 500Pa/2" to 250 Pa/1" for 8 minutes or more. It is recommended that it is checked prior to the stuffing.

A container leak test also needs to be performed:

- After replacing wiring going through the unit
- After replacing hoses and/or piping going through the unit
- After repairing structural damage on the unit and/or container
- After replacing air exchange valve and/or module
- When a container is suspected of leakage

Method:

1. Ensure floor drain plugs are installed and sealed correctly.
2. Install CA curtain properly.
3. Install Star Cool test damper.
4. Connect test manometer.
5. Apply air pressure 500 Pa/2" water column.
6. The air pressure shall remain above 250 Pa/1" water column for minimum 8 min.
7. Close air supply and perform leak search (with soap water) at the container front and end.

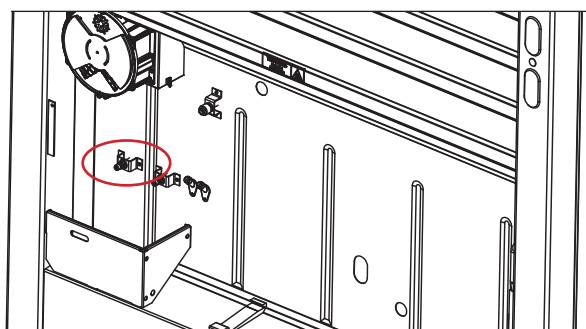
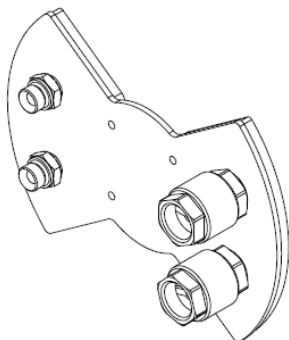
23.9 CA+ flushing

For cargo with low respiration rates, the container must be flushed with nitrogen and carbon dioxide after stuffing.

Flush mode is only available once CO₂ is 10% or higher.

Liquid or dry nitrogen can be used for this process. However, when using liquid nitrogen, it is vital to use an evaporator between the nitrogen tanks/bottle and the container inlet in order to avoid freezing damage to the cargo.

1. Check that a CA flushing damper is available. If the damper is not available, it is possible to use the injection ports found on some unit models. Skip to step 6 if using the injection ports.



2. Press  to enter the Service menu. Select line S01 Manual operation. Then change line M01 Operating mode to MANUAL.
3. Remove the original air ventilation damper from the unit.
4. Install the damper for CA flushing.
5. Return the unit to Automatic mode. Press  to enter the Service menu. Select line S01 Manual operation. Then change line M01 Operating mode to AUTO.
6. Press  to enter the Operation menu and change line O13 to ON. This overrides any automatic vent opening in case of out of range gas levels for 4 hours. A countdown clock will be visible in the main display. The unit will automatically go into Normal mode when the time limit is reached.
7. Check that the gas injection tanks/bottle have proper operation handles and pressure gauges in order to control the gas flow correctly.
8. Connect both the N₂ and CO₂ gas tanks/bottles to the damper or injection ports.
9. Monitor the supply temperature throughout the process. It should not be too much below the setpoint (each shipping line has an allowance during the flushing process, however generally the supply setpoint should never be undershot without approval).
10. Inject N₂ until the O₂ level has reached the O₂ setpoint plus 1%. The O₂ level will drop further during CO₂ injection. Note the sensors need some stabilization time. During injection, ensure that the pressure is not too high. The recommended pressure is 120 PSI. If water comes out the drain hose, then the gas injection pressure is too high.
11. Inject CO₂ until the CO₂ level has reached the CO₂ setpoint minus 3%. Note the sensors need some stabilization time. During injection, ensure that the pressure is not too high. The recommended pressure here is 100 PSI.
12. Once the CO₂ level has been reached, stop flushing. Wait for 8 minutes whilst monitoring the gas levels as they stabilize. This is to ensure that the gases are thoroughly mixed and that the controller readings are accurate.
13. If more CO₂ is needed, inject a little more gas.
14. Ensure that there is water in the defrost drain hose.
15. The flushing is now completed. Disconnect the N₂ and CO₂ gas tanks/bottles. If using the CA flushing damper, continue to step 16.
16. When the O₂ and CO₂ setpoints are reached, set the unit to Manual mode. Press  to enter the Service menu. Select line S01 Manual operation. Then change line M01 Operating mode to MANUAL.
17. Replace the original air exchange damper so it is fully closed and secured.
18. Return the unit to Automatic mode. Press  to enter the Service menu. Select line S01 Manual operation. Then change line M01 Operating mode to AUTO.

24. General trouble shooting

Tips for general trouble shooting.

1. Unit will not start up.
Check that power is applied to the unit.
Check that fuses at QS1, F1 and or F2 are not blown.
Check the alarm list. Clear all alarms and the causes.
The unit is wired for emergency operation but the parameter F03 FC type under S05 Configuration in the Service menu  is not set to NONE.
The line F03 under the Service menu  is set to NONE for emergency operation but the wires have not been correctly mounted for emergency operation.
2. Unit starts but stops shortly after. Check that the condenser motor is rotating and that the air is blowing away from the unit. Check if the high pressure switch alarm is active in the alarm list. Temperature sensors not working properly. Check that they are placed on the pipes and are inside the isolation.
3. Unit is running but is not bringing the temperature down to temperature setpoint. The cargo is very warm – it takes a long time to cool it down. The ambient temperature is very high – the condenser can only cool a little so the cooling capacity is small and the cool down process takes longer time. The hot gas valve may be leaking so that the hot gas is by-passing the condenser and is pumped into the evaporator and heating it up. The expansion valve is not opening and no cooling refrigerant is pumped into the evaporator. The condenser pressure will be very high. The unit has been put in manual phase detecting mode and all motors are running the wrong way. The compressor will pump correctly but there is very little cooling capacity in the condenser and the air flow is wrong inside in the box. One of the motors (condenser or evaporator) is running in the opposite direction.
4. Liquid refrigerant is entering the compressor through the evaporator. The temperature sensor, Tsuc is not working properly. Check that the sensor is mounted close to the pipe and is placed beneath the isolation. The pressure transmitter, Psuc is not working properly. The evaporator sensor, Tevap is not working properly.
5. Display is blank. Adjust contrast ("11.5 Contrast adjustment of the display" p. 39).

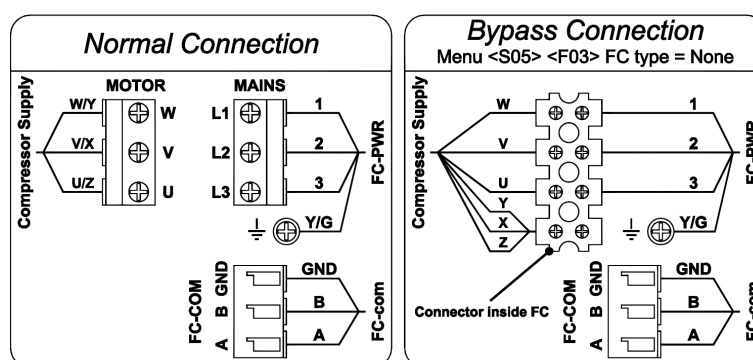
25. Emergency operation



Warning: High voltage. Unit must be disconnected from power. Only to be done by trained personnel.

25.1 FC 2.0/2.1 bypass

1. Dismount the 2 screws and remove the black plastic cover.
2. Dismount the cables on terminals U, V, and W. Cut one of the two cables on U, V, and W.
3. Strip the 3 cut cables and mount them together in one slot of the by-pass connector (found inside the black plastic cover).
4. Mount the 3 cables, marked U, V, and W into the bypass connector, according to the wiring diagram.
5. Dismount the 3 mains cables L1, L2, and L3 and mount them into the bypass connector, according to the wiring diagram.
6. Carefully place the by-pass connector inside the compartment and ensure that no cables are squeezed.
7. Mount the black plastic cover and tighten the 2 screws with 4 Nm.
8. Configure the FC for emergency operation in the Service menu (🔧), line F03 (FC type). Select NONE as the parameter.



25.2 Controller bypass

If the controller of the unit is malfunctioning or defective and no replacement is available, the unit can be run in an Emergency mode with deteriorated temperature controlling performance. This operation is only recommended for cargo being transported in Frozen mode with a setpoint below -10°C (14°F). If the cargo is transported in Chilled mode, it is recommended that the defective controller is replaced with one from a unit operating in Frozen mode.

The emergency procedure for a unit with a defective controller, running in Frozen mode, is as follows:

1. Dismount the frequency converter and connect the compressor directly to the power supply. Use the contactor in the controller as a main switch for the compressor.
2. Connect the evaporator fans in low speed and the condenser fan in high speed directly to the power supply.
3. Mount a permanent magnet on the electronic expansion valve, pos. 18 (P & I diagram).
4. Install a service gauge manifold on the unit to the two evacuation points, pos. 6 and 27 (P & I diagram).
5. Close the stop valve, pos. 14 (P & I diagram).
6. Energize the fans and the compressor.
7. Carefully open the stop valve pos. 14 (P & I diagram), observing the pressure readings on the service gauge manifold as this is done.
8. For a setpoint temperature of -20°C ($-4,0^{\circ}\text{F}$) a suction pressure of -24°C ($-11,2^{\circ}\text{F}$) is to be maintained. In general, the suction pressure (temperature) is to be 5°C (7°F) below the set point temperature. In general, the discharge pressure (temperature) is to be 10°C (18°F) above ambient temperature.
9. If there is ice building up on the compressor, it indicates that there is coming too much liquid back from the evaporator. Close the stop valve, pos. 14 (P & I diagram) slightly.

25.3 Evaporator fan motor bypass

If one of the evaporator fan motors is defective and no replacement part is available, the defective motor can be bypassed.

1. Turn off the unit via the on/off switch and unplug the unit from the main power.
2. Dismount the inspection cover.
3. Unplug (or disconnect at terminal box) the faulty evaporator fan motor.
4. Using a plastic bag of a suitable size, cover the fan propeller and secure the bag around the shaft of the faulty motor. This is to prevent air short cycling by the remaining working evaporator fan motor.
5. Protect the defective evaporator fan motor loose plug from humidity and water ingresses by securing it with a smaller plastic bag.
6. Bypass the faulty motor IP connection on the microprocessor. Both evaporator fan motor IP's are connected at plug X26 terminals 1 and 2 (Mevap1) and 3 and 4 (Mevap2) on the microprocessor.
7. Determine which motor was removed in step 2. As you face the reefer unit, motor 1 is on the left hand side of the reefer. Replace the IP connection with a jumper cable at X26.
8. Mount the inspection cover, connect power to the unit and turn it on.

25.4 Power measurement module bypass

After troubleshooting in accordance with any active alarms and identifying that the power measurement module needs to be replaced, if no replacement part is available, the power measurement module can be bypassed.

1. Turn the unit off and disconnect the power.
2. Open the controller cabinet and disconnect the X41 communication cable from the power measurement module.
3. Close the controller cabinet.
4. Connect power to the unit and turn it on.
5. Go to the Service menu line S05 Configuration.
6. Go down to line F05 Phase detection and change the value to CW.
7. Check that the condenser fan is rotating in the right direction in accordance with the arrow on the unit.
8. If the condenser fan is rotating in the wrong direction, change the value of line F05 Phase detection to CCW.
9. **IMPORTANT: This action is to be performed at every unit start up.**

26. Tables

26.1 Datalog description

Explanations of datalog loggings:

Values are stored in °C/BarE and are converted to °F/Psi on retrieval or listing on the display.

The logged data in the datalog can be seen:

- On the display menu L01, the viewable temperatures are listed.
- On the display menu L03, the logged temperatures can be viewed graphically.
- Retrieved via the program RefCon and the RMM modem and the powerline.
- Retrieved via a program, LogMan, on a PSION pda using the retriever socket.
- Retrieved via the StarView program using the retriever socket.
- Retrieved via a USB stick using the USB connection port in the controller box.

Data:

No.	Name	Value	Unit
1	Tsupply temperature	Temperature from supply sensor	°C
2	Treturn temperature	Temperature from return sensor	°C
3	Tusda 1 temperature	Temperature from USDA sensor 1	°C
4	Tusda 2 temperature	Temperature from USDA sensor 2	°C
5	Tusda 3 temperature	Temperature from USDA sensor 3	°C
6	Tcargo temperature	Temperature from cargo sensor	°C
7	Tset temperature	Setpoint temperature	°C
8	Humidity %	Humidity from humidity sensor	%
9	AirEx airflow	Airflow from air exchange sensor	m ³ /h

Extended data:

No.	Name	Value	Unit
1	Psuc pressure	Suction pressure (effective)	BarE
2	Pdis pressure	Discharge pressure (effective)	BarE
3	Fpower frequency	Power frequency	Hz
4	(Reserved)	--	--
5	Upower voltage	Highest power voltage of U1, U2, U3	V
No.	Name	Value	Unit
6	I1 current	Current I1	A
7	I2 current	Current I2	A
8	I3 current	Current I3	A
9	Ifc current	Current FC	A
10	Fcpr frequency	Compressor frequency	Hz
11	Heater status	Heater on-time	%
12	(Reserved)		--
13	Mevap status	Evaporator motor [OFF, LO, HI, ERR]	--
14	Mcond status	Condenser motor [OFF, LO, HI, ERR]	--
No.	Name	Value	Unit
15	Tfc temperature	Temperature of frequency controller	°C
16	Tambient temperature	Ambient temperature [-30/+96]	°C

Extended data 2 (only retrievable by StarView):

No.	Name	Value	Unit
1	Tsup1	Supply air temperature	°C
2	Tsup2	Supply air temperature	°C
3	Tevap	Evaporator temperature	°C
4	Tsuc	Suction temperature	°C
5	Vhg	Hot gas valve opening	%
6	Vexp	Expansion valve opening	%
7	Veco	Economizer valve opening	%
8	SHref	Superheat reference	°C
9	Tint	Internal temperature	°C

Alarms:

Alarms which may occur and a description can be found in section 14 of this manual.

26.2 Temperature sensor - resistance table

Resistance [Ω]	Temp		Resistance [Ω]	Temp		Resistance [Ω]	Temp		Resistance [Ω]	Temp		Resistance [Ω]	Temp	
	[°C]	[°F]		[°C]	[°F]		[°C]	[°F]		[°C]	[°F]		[°C]	[°F]
3,095,611.00	-70	-94	138,322.00	-26	-15	13,682.60	18	64	2,315.20	62	144	570.82	106	223
2,851,363.00	-69	-92	130,243.00	-25	-13	13,052.80	19	66	2,234.70	63	145	554.86	107	225
2,627,981.00	-68	-90	122,687.00	-24	-11	12,493.70	20	68	2,156.70	64	147	539.44	108	226
2,423,519.00	-67	-89	115,613.00	-23	-9	11,943.30	21	70	2,082.30	65	149	524.51	109	228
2,236,398.00	-66	-87	108,991.00	-22	-8	11,420.00	22	72	2,010.80	66	151	510.06	110	230
2,064,919.00	-65	-85	102,787.00	-21	-6	10,922.70	23	73	1,942.10	67	153	496.08	111	232
1,907,728.00	-64	-83	96,974.00	-20	-4	10,449.90	24	75	1,876.00	68	154	482.55	112	234
1,763,539.00	-63	-81	91,525.00	-19	-2	10,000.00	25	77	1,812.60	69	156	469.45	113	235
1,631,173.00	-62	-80	86,415.00	-18	0	9,572.00	26	79	1,751.60	70	158	456.76	114	237
1,509,639.00	-61	-78	81,621.00	-17	1	9,164.70	27	81	1,693.00	71	160	444.48	115	239
1,397,935.00	-60	-76	77,121.00	-16	3	8,777.00	28	82	1,636.63	72	162	432.58	116	241
1,295,239.00	-59	-74	72,895.00	-15	5	8,407.70	29	84	1,582.41	73	163	421.06	117	243
1,200,732.00	-58	-72	68,927.00	-14	7	8,056.00	30	86	1,530.28	74	165	409.90	118	244
1,113,744.00	-57	-71	65,198.00	-13	9	7,720.90	31	88	1,480.12	75	167	399.08	119	246
1,033,619.00	-56	-69	61,693.00	-12	10	7,401.70	32	90	1,431.87	76	169	388.59	120	248
959,789.00	-55	-67	58,397.00	-11	12	7,097.20	33	91	1,385.37	77	171	378.44	121	250
891,689.00	-54	-65	55,298.00	-10	14	6,807.00	34	93	1,340.68	78	172	368.59	122	252
828,865.00	-53	-63	52,380.00	-9	16	6,530.10	35	95	1,297.64	79	174	359.05	123	253
770,880.00	-52	-62	49,663.00	-8	18	6,266.10	36	97	1,256.17	80	176	349.79	124	255
717,310.00	-51	-60	47,047.00	-7	19	6,014.20	37	99	1,216.23	81	178	340.82	125	257
667,828.00	-50	-58	44,610.00	-6	21	5,773.70	38	100	1,177.75	82	180	332.11	126	259
622,055.00	-49	-56	42,314.60	-5	23	5,544.10	39	102	1,140.71	83	181	323.67	127	261
579,718.00	-48	-54	40,149.50	-4	25	5,324.90	40	104	1,104.99	84	183	315.48	128	262
540,530.00	-47	-53	38,108.50	-3	27	5,115.60	41	106	1,070.58	85	185	307.53	129	264
504,230.00	-46	-51	36,182.80	-2	28	4,915.50	42	108	1,037.40	86	187	299.82	130	266
470,609.00	-45	-49	34,366.10	-1	30	4,724.30	43	109	1,005.40	87	189	292.34	131	268
439,445.00	-44	-47	32,650.80	0	32	4,541.60	44	111	974.56	88	190	285.08	132	270
410,532.00	-43	-45	31,030.40	1	34	4,366.90	45	113	944.81	89	192	278.03	133	271
383,712.00	-42	-44	29,500.10	2	36	4,199.90	46	115	916.11	90	194	271.19	134	273
358,806.00	-41	-42	28,054.20	3	37	4,040.10	47	117	888.41	91	196	264.54	135	275
335,671.00	-40	-40	26,687.60	4	39	3,887.20	48	118	861.70	92	198	258.09	136	277
314,179.00	-39	-38	25,395.50	5	41	3,741.10	49	120	835.93	93	199	251.82	137	279
294,193.00	-38	-36	24,172.70	6	43	3,601.00	50	122	811.03	94	201	245.74	138	280
275,605.00	-37	-35	23,016.00	7	45	3,466.90	51	124	786.99	95	203	239.82	139	282
258,307.00	-36	-33	21,921.70	8	46	3,338.60	52	126	763.79	96	205	234.08	140	284
242,195.00	-35	-31	20,885.20	9	48	3,215.60	53	127	741.38	97	207	228.50	141	286
227,196.00	-34	-29	19,903.50	10	50	3,097.90	54	129	719.74	98	208	223.08	142	288
213,219.00	-33	-27	18,973.60	11	52	2,985.10	55	131	698.82	99	210	217.80	143	289
200,184.00	-32	-26	18,092.60	12	54	2,876.90	56	133	678.63	100	212	212.68	144	291
188,026.00	-31	-24	17,257.40	13	55	2,773.20	57	135	659.10	101	214	207.70	145	293
176,683.00	-30	-22	16,465.10	14	57	2,673.90	58	136	640.23	102	216	202.86	146	295
166,091.00	-29	-20	15,714.00	15	59	2,578.50	59	138	622.00	103	217	198.15	147	297
156,199.00	-28	-18	15,001.20	16	61	2,487.10	60	140	604.36	104	219	193.57	148	298
146,959.00	-27	-17	14,324.60	17	63	2,399.40	61	142	587.31	105	221	189.12	149	300

26.3 Temperature sensor - voltage table

Temperature sensors except for reference temperature sensor.

V_{CC} = 3 V

Voltage [V]	Temp [°C]	Temp [°F]	Voltage [V]	Temp [°C]	Temp [°F]	Voltage [V]	Temp [°C]	Temp [°F]
3.00	-40	-40.0	2.03	-9	15.8	0.85	22	71.6
2.98	-39	-38.2	1.98	-8	17.6	0.82	23	73.4
2.97	-38	-36.4	1.94	-7	19.4	0.79	24	75.2
2.95	-37	-34.6	1.89	-6	21.2	0.77	25	77.0
2.92	-36	-32.8	1.85	-5	23.0	0.74	26	78.8
2.90	-35	-31.0	1.81	-4	24.8	0.72	27	80.6
2.88	-34	-29.2	1.77	-3	26.6	0.69	28	82.4
2.86	-33	-27.4	1.73	-2	28.4	0.67	29	84.2
2.83	-32	-25.6	1.68	-1	30.2	0.65	30	86.0
2.81	-31	-23.8	1.64	0	32.0	0.63	31	87.8
2.78	-30	-22.0	1.60	1	33.8	0.61	32	89.6
2.75	-29	-20.2	1.56	2	35.6	0.58	33	91.4
2.73	-28	-18.4	1.52	3	37.4	0.57	34	93.2
2.69	-27	-16.6	1.48	4	39.2	0.55	35	95.0
2.67	-26	-14.8	1.43	5	41.0	0.53	36	96.8
2.63	-25	-13.0	1.39	6	42.8	0.51	37	98.6
2.60	-24	-11.2	1.35	7	44.6	0.49	38	100.4
2.57	-23	-9.4	1.32	8	46.4	0.48	39	102.2
2.53	-22	-7.6	1.28	9	48.2	0.46	40	104.0
2.49	-21	-5.8	1.24	10	50.0	0.44	41	105.8
2.46	-20	-4.0	1.21	11	51.8	0.43	42	107.6
2.42	-19	-2.2	1.17	12	53.6	0.42	43	109.4
2.39	-18	-0.4	1.14	13	55.4	0.40	44	111.2
2.35	-17	1.4	1.10	14	57.2	0.38	45	113.0
2.31	-16	3.2	1.06	15	59.0	0.37	46	114.8
2.27	-15	5.0	1.03	16	60.8	0.36	47	116.6
2.23	-14	6.8	1.00	17	62.6	0.35	48	118.4
2.19	-13	8.6	0.97	18	64.4	0.34	49	120.2
2.15	-12	10.4	0.94	19	66.2	0.32	50	122.0
2.11	-11	12.2	0.90	20	68.0			
2.07	-10	14.0	0.88	21	69.8			

26.4 Air exchange sensor table voltage - m³/h for 75 CMH

There is an offset of 0.2 V due to mechanical design. The air exchange must be properly calibrated before measuring.

Voltage [V]	Air exchange [m ³ /h]	Voltage [V]	Air exchange [m ³ /h]	Voltage [V]	Air exchange [m ³ /h]	Voltage [V]	Air exchange [m ³ /h]
0.20	10	1.23	75	2.26	140	3.29	205
0.28	15	1.31	80	2.34	145	3.37	210
0.36	20	1.39	85	2.42	150	3.45	215
0.44	25	1.47	90	2.50	155	3.53	220
0.52	30	1.55	95	2.58	160	3.60	225
0.60	35	1.63	100	2.65	165	3.68	230
0.68	40	1.70	105	2.73	170	3.76	235
0.75	45	1.78	110	2.81	175	3.84	240
0.83	50	1.86	115	2.89	180	3.92	245
0.91	55	1.94	120	2.97	185	4.00	250
0.99	60	2.02	125	3.05	190		
1.07	65	2.10	130	3.13	195		
1.15	70	2.18	135	3.21	200		

26.5 Voltage – pressure table, LP transmitter (NSK) + DST

V_{cc} = 5 V. Pressure is relative.

Voltage [V]	Pressure [BarE]	Pressure [Psi]	Voltage [V]	Pressure [BarE]	Pressure [Psi]	Voltage [V]	Pressure [BarE]	Pressure [Psi]
	-0.69	-10.01	1.70	3.92	56.87	3.15	8.66	125.59
0.30	-0.65	-9.49	1.75	4.08	59.24	3.20	8.82	127.96
0.35	-0.49	-7.12	1.80	4.25	61.61	3.25	8.98	130.33
0.40	-0.33	-4.75	1.85	4.41	63.97	3.30	9.15	132.70
0.45	-0.16	-2.38	1.90	4.57	66.34	3.35	9.31	135.07
0.50	0.00	-0.01	1.95	4.74	68.71	3.40	9.47	137.44
0.55	0.16	2.36	2.00	4.90	71.08	3.45	9.64	139.81
0.60	0.33	4.73	2.05	5.06	73.45	3.50	9.80	142.18
0.65	0.49	7.10	2.10	5.23	75.82	3.55**	9.97	144.66
0.70	0.65	9.47	2.15	5.39	78.19	3.60**	10.14	147.03
0.75	0.82	11.84	2.20	5.55	80.56	3.65**	10.30	149.40
0.80	0.98	14.21	2.25	5.72	82.93	3.70**	10.46	151.77
0.85	1.14	16.58	2.30	5.88	85.30	3.75**	10.63	154.14
0.90	1.31	18.95	2.35	6.04	87.67	3.80**	10.79	156.51
0.95	1.47	21.32	2.40	6.21	90.04	3.85**	10.95	158.89
1.00	1.63	23.69	2.45	6.37	92.41	3.90**	11.12	161.26
1.05	1.80	26.06	2.50	6.53	94.78	3.95**	11.28	163.63
1.10	1.96	28.43	2.55	6.70	97.15	4.00**	11.45	166.00
1.15	2.12	30.80	2.60	6.86	99.52	4.05**	11.61	168.37
1.20	2.29	33.17	2.65	7.02	101.89	4.10**	11.77	170.74
1.25	2.45	35.54	2.70	7.19	104.26	4.15**	11.94	173.11
1.30	2.61	37.91	2.75	7.35	106.63	4.20**	12.10	175.49
1.35	2.78	40.28	2.80	7.51	109.00	4.25**	12.26	177.86
1.40	2.94	42.65	2.85	7.68	111.37	4.30**	12.43	180.23
1.45	3.10	45.02	2.90	7.84	113.74	4.35**	12.59	182.60
1.50	3.27	47.39	2.95	8.00	116.11	4.40**	12.75	184.97
1.55	3.43	49.76	3.00	8.17	118.48	4.45**	12.92	187.34
1.60	3.59	52.13	3.05	8.33	120.85	4.50**	13.08	189.71
1.65	3.76	54.50	3.10	8.49	123.22			

** DST P100 only

26.6 Voltage – pressure table, HP transmitter (NSK) + DST

Vcc = 5 V. Pressure is relative.

Voltage [V]	Pressure [BarE]	Pressure [Psi]	Voltage [V]	Pressure [BarE]	Pressure [Psi]	Voltage [V]	Pressure [BarE]	Pressure [Psi]
0.50	0.00	0.00	1.85	13.50	195.86	3.20	27.00	391.72
0.55	0.50	7.25	1.90	14.00	203.11	3.25	27.50	398.97
0.60	1.00	14.51	1.95	14.50	210.37	3.30	28.00	406.23
0.65	1.50	21.76	2.00	15.00	217.62	3.35	28.50	413.48
0.70	2.00	29.02	2.05	15.50	224.87	3.40	29.00	420.73
0.75	2.50	36.27	2.10	16.00	232.13	3.45	29.50	427.99
0.80	3.00	43.52	2.15	16.50	239.38	3.50	30.00	435.24
0.85	3.50	50.78	2.20	17.00	246.64	3.55**	30.50	442.25
0.90	4.00	58.03	2.25	17.50	253.89	3.60**	31.00	449.50
0.95	4.50	65.29	2.30	18.00	261.14	3.65**	31.50	456.75
1.00	5.00	72.54	2.35	18.50	268.40	3.70**	32.00	464.00
1.05	5.50	79.79	2.40	19.00	275.65	3.75**	32.50	471.25
1.10	6.00	87.05	2.45	19.50	282.91	3.80**	33.00	478.50
1.15	6.50	94.30	2.50	20.00	290.16	3.85**	33.50	485.75
1.20	7.00	101.56	2.55	20.50	297.42	3.90**	34.00	493.00
1.25	7.50	108.81	2.60	21.00	304.67	3.95**	34.50	500.25
1.30	8.00	116.06	2.65	21.50	311.92	4.00**	35.00	507.50
1.35	8.50	123.32	2.70	22.00	319.18	4.05**	35.50	514.75
1.40	9.00	130.57	2.75	22.50	326.43	4.10**	36.00	522.00
1.45	9.50	137.83	2.80	23.00	333.68	4.15**	36.50	529.25
1.50	10.00	145.08	2.85	23.50	340.94	4.20**	37.00	536.50
1.55	10.50	152.33	2.90	24.00	348.19	4.25**	37.50	543.75
1.60	11.00	159.59	2.95	24.50	355.45	4.30**	38.00	551.00
1.65	11.50	166.84	3.00	25.00	362.70	4.35**	38.50	558.25
1.70	12.00	174.10	3.05	25.50	369.95	4.40**	39.00	565.50
1.75	12.50	181.35	3.10	26.00	377.21	4.45**	39.50	572.75
1.80	13.00	188.60	3.15	26.50	384.46	4.50**	40.00	580.00

** DST P100 only

26.7 Pressure - temperature table for R134a

Temp [°C]	Temp [°F]	Pressure [Barg]	Pressure [Psig]	Temp [°C]	Temp [°F]	Pressure [Barg]	Pressure [Psig]	Temp [°C]	Temp [°F]	Pressure [Barg]	Pressure [Psig]
-40	-40	-0.5	-7.0	2	36	2.1	31.5	44	111	10.4	150.0
-38	-36	-0.4	-6.1	4	39	2.4	34.3	46	115	11.0	159.7
-36	-33	-0.4	-5.4	6	43	2.6	38.3	48	118	11.6	167.3
-34	-29	-0.3	-4.3	8	46	2.9	41.6	50	122	12.3	177.8
-32	-26	-0.2	-3.5	10	50	3.2	45.7	52	126	12.9	188.8
-30	-22	-0.2	-2.2	12	54	3.4	50.4	54	129	13.6	197.3
-28	-18	-0.1	-0.9	14	57	3.7	54.0	56	133	14.4	209.0
-26	-15	0.0	0.2	16	61	4.1	59.1	58	136	15.1	218.1
-24	-11	0.1	1.7	18	64	4.4	63.1	60	140	15.9	230.7
-22	-8	0.2	3.0	20	68	4.7	68.7	62	144	16.7	243.7
-20	-4	0.3	4.7	22	72	5.1	74.6	64	147	17.5	253.8
-18	0	0.4	6.7	24	75	5.5	79.3	66	151	18.4	267.7
-16	3	0.6	8.2	26	79	5.9	85.7	68	154	19.3	278.4
-14	7	0.7	10.4	28	82	6.3	90.8	70	158	20.2	293.2
-12	10	0.9	12.1	30	86	6.7	97.8	72	162	21.2	308.5
-10	14	1.0	14.6	32	90	7.2	105.2	74	165	22.1	320.3
-8	18	1.2	17.2	34	93	7.7	110.9	76	169	23.2	336.6
-6	21	1.3	19.3	36	97	8.2	118.9	78	172	24.2	349.1
-4	25	1.5	22.3	38	100	8.7	125.2	80	176	25.3	366.4
-2	28	1.7	24.7	40	104	9.2	133.9				
0	32	1.9	28.0	42	108	9.8	142.9				

26.8 Pressure - temperature table for R513A

Temp [°C]	Temp [°F]	Pres-sure [Barg]	Pres-sure [Psig]	Temp [°C]	Temp [°F]	Pres-sure [Barg]	Pres-sure [Psig]	Temp [°C]	Temp [°F]	Pres-sure [Barg]	Pres-sure [Psig]
-40	-40	-0.4	-5.6	2	36	2.5	36.1	44	111	10.9	157.5
-38	-36	-0.3	-4.6	4	39	2.7	39.0	46	115	11.5	167.3
-36	-33	-0.3	-3.7	6	43	3.0	43.2	48	118	12.1	174.9
-34	-29	-0.2	-2.5	8	46	3.2	46.4	50	122	12.8	185.5
-32	-26	-0.1	-1.6	10	50	3.5	51.0	52	126	13.5	196.4
-30	-22	0.0	-0.2	12	54	3.8	55.8	54	129	14.2	205.0
-28	-18	0.1	1.3	14	57	4.1	59.6	56	133	14.9	216.7
-26	-15	0.2	2.5	16	61	4.5	64.9	58	136	15.6	225.7
-24	-11	0.3	4.2	18	64	4.8	69.0	60	140	16.4	238.2
-22	-8	0.4	5.5	20	68	5.2	74.8	62	144	17.2	251.2
-20	-4	0.5	7.5	22	72	5.5	80.9	64	147	18.1	261.2
-18	0	0.6	9.6	24	75	5.9	85.6	66	151	18.9	275.0
-16	3	0.8	11.2	26	79	6.3	92.2	68	154	19.8	285.7
-14	7	0.9	13.6	28	82	6.8	97.4	70	158	20.7	300.3
-12	10	1.1	15.4	30	86	7.2	104.6	72	162	21.6	315.4
-10	14	1.2	18.1	32	90	7.7	112.1	74	165	22.6	327.1
-8	18	1.4	20.9	34	93	8.2	118.0	76	169	23.6	343.1
-6	21	1.6	23.2	36	97	8.7	126.1	78	172	24.6	355.5
-4	25	1.8	26.3	38	100	9.2	132.4	80	176	25.7	372.4
-2	28	2.0	28.8	40	104	9.7	141.2				
0	32	2.2	32.3	42	108	10.3	150.4				

26.9 Pressure - temperature table for R1234yf

Temp [°C]	Temp [°F]	Pres-sure [Barg]	Pres-sure [Psig]	Temp [°C]	Temp [°F]	Pres-sure [Barg]	Pres-sure [Psig]	Temp [°C]	Temp [°F]	Pres-sure [Barg]	Pres-sure [Psig]
-40	-40	-0.4	-5.4	2	36	2.4	34.8	44	111	10.3	149.2
-38	-36	-0.3	-4.4	4	39	2.6	37.6	46	115	10.9	158.4
-36	-33	-0.2	-3.6	6	43	2.9	41.6	48	118	11.5	165.6
-34	-29	-0.2	-2.4	8	46	3.1	44.7	50	122	12.1	175.4
-32	-26	-0.1	-1.5	10	50	3.4	49.0	52	126	12.7	185.7
-30	-22	0.0	-0.1	12	54	3.7	53.6	54	129	13.4	193.6
-28	-18	0.1	1.3	14	57	4.0	57.2	56	133	14.1	204.5
-26	-15	0.2	2.5	16	61	4.3	62.2	58	136	14.8	213.0
-24	-11	0.3	4.1	18	64	4.6	66.1	60	140	15.5	224.6
-22	-8	0.4	5.5	20	68	4.9	71.6	62	144	16.2	236.7
-20	-4	0.5	7.4	22	72	5.3	77.3	64	147	17.0	246.0
-18	0	0.6	9.4	24	75	5.7	81.8	66	151	17.8	258.8
-16	3	0.8	11.0	26	79	6.0	88.0	68	154	18.6	268.7
-14	7	0.9	13.2	28	82	6.4	92.9	70	158	19.5	282.3
-12	10	1.1	15.1	30	86	6.9	99.6	72	162	20.3	296.4
-10	14	1.2	17.6	32	90	7.3	106.7	74	165	21.2	307.2
-8	18	1.4	20.3	34	93	7.8	112.2	76	169	22.2	322.1
-6	21	1.6	22.5	36	97	8.2	119.8	78	172	23.1	333.5
-4	25	1.7	25.5	38	100	8.7	125.8	80	176	24.1	349.2
-2	28	1.9	27.9	40	104	9.2	134.0				
0	32	2.2	31.2	42	108	9.8	142.6				

26.10 Voltage - pressure table for Pmem

V_{CC} = 5V

Voltage [V]	Pressure [Bar]	Pressure [PsiA]	Voltage [V]	Pressure [Bar]	Pressure [PsiA]
0.00*	0.009	0.13	2.55	0.598	8.67
0.05*	0.021	0.30	2.60	0.610	8.84
0.10*	0.032	0.47	2.65	0.621	9.01
0.15*	0.044	0.63	2.70	0.633	9.18
0.20*	0.055	0.80	2.75	0.644	9.34
0.25*	0.067	0.97	2.80	0.656	9.51
0.30*	0.078	1.14	2.85	0.667	9.68
0.35*	0.090	1.30	2.90	0.679	9.85
0.40*	0.101	1.47	2.95	0.690	10.01
0.45*	0.113	1.64	3.00	0.702	10.18
0.50	0.125	1.81	3.05	0.714	10.35
0.55	0.136	1.97	3.10	0.725	10.52
0.60	0.148	2.14	3.15	0.737	10.68
0.65	0.159	2.31	3.20	0.748	10.85
0.70	0.171	2.48	3.25	0.760	11.02
0.75	0.182	2.64	3.30	0.771	11.19
0.80	0.194	2.81	3.35	0.783	11.35
0.85	0.205	2.98	3.40	0.794	11.52
0.90	0.217	3.15	3.45	0.806	11.69
0.95	0.228	3.31	3.50	0.818	11.86
1.00	0.240	3.48	3.55	0.829	12.02
1.05	0.252	3.65	3.60	0.841	12.19
1.10	0.263	3.82	3.65	0.852	12.36
1.15	0.275	3.98	3.70	0.864	12.53
1.20	0.286	4.15	3.75	0.875	12.69
1.25	0.298	4.32	3.80	0.887	12.86
1.30	0.309	4.49	3.85	0.898	13.03
1.35	0.321	4.65	3.90	0.910	13.20
1.40	0.332	4.82	3.95	0.921	13.36
1.45	0.344	4.99	4.00	0.933	13.53
1.50	0.356	5.16	4.05	0.945	13.70
1.55	0.367	5.32	4.10	0.956	13.87
1.60	0.379	5.49	4.15	0.968	14.03
1.65	0.390	5.66	4.20	0.979	14.20
1.70	0.402	5.83	4.25	0.991	14.37
1.75	0.413	5.99	4.30	1.002	14.54
1.80	0.425	6.16	4.35	1.014	14.70
1.85	0.436	6.33	4.40	1.025	14.87
1.90	0.448	6.50	4.45	1.037	15.04
1.95	0.459	6.66	4.50	1.049	15.21
2.00	0.471	6.83	4.55*	1.060	15.37
2.05	0.483	7.00	4.60*	1.072	15.54
2.10	0.494	7.17	4.65*	1.083	15.71
2.15	0.506	7.33	4.70*	1.095	15.88
2.20	0.517	7.50	4.75*	1.106	16.04
2.25	0.529	7.67	4.80*	1.118	16.21
2.30	0.540	7.84	4.85*	1.129	16.38
2.35	0.552	8.00	4.90*	1.141	16.55
2.40	0.563	8.17	4.95*	1.152	16.71
2.45	0.575	8.34	5.00*	1.164	16.88
2.5	0.587	8.51			

*Range with non-reliable readings

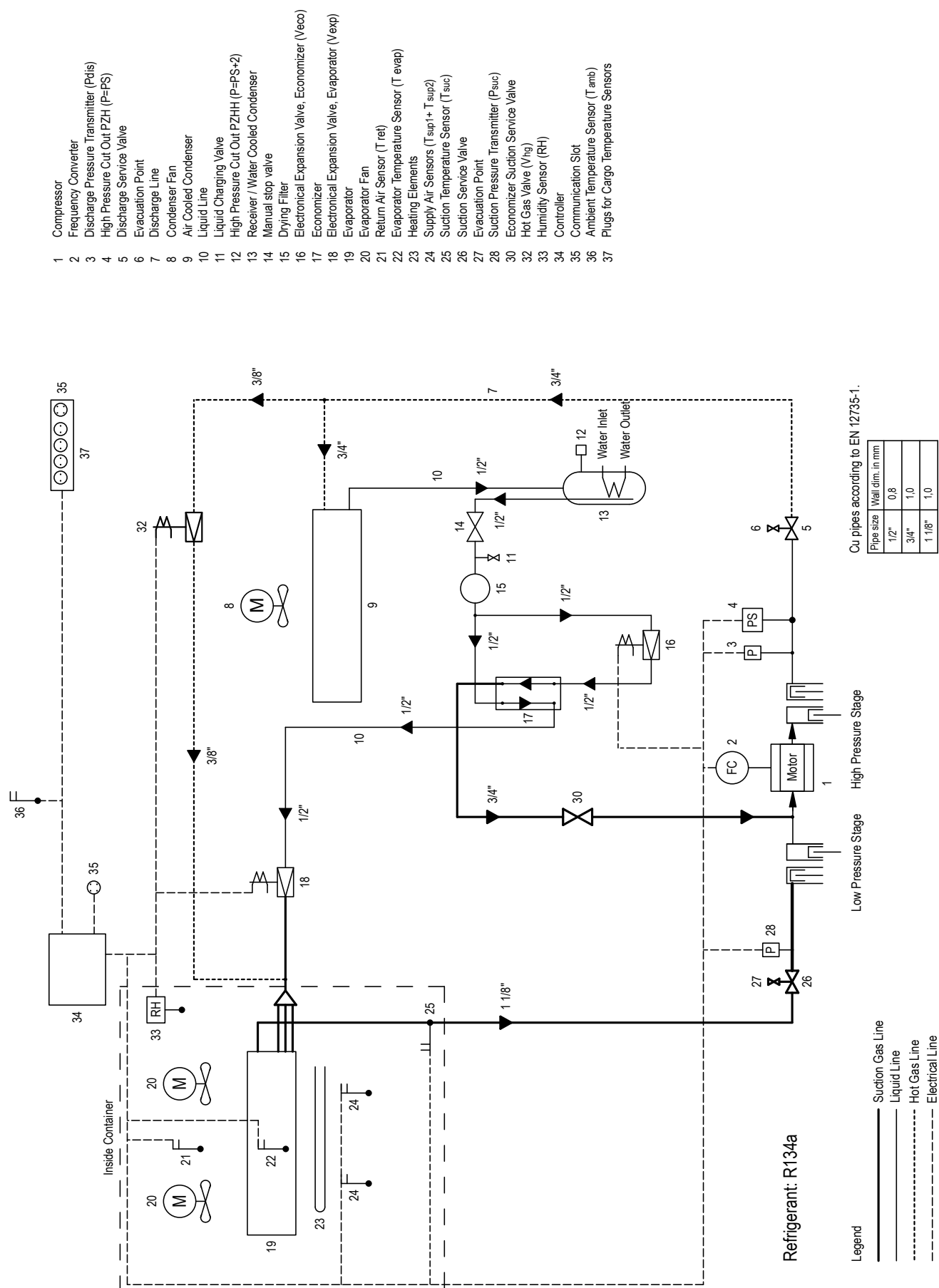
26.11 Tightening torques

Description	Type	Torque [Nm] ± 5%
General		
Hex Head Bolt + Nut, M5		4.5
Hex Head Bolt + Nut, M6		5.5
Hex Head Bolt + Nut, M8		10
Hex Head Bolt + Nut, M10		25
Hex Socket Counters. Head Bolt, M6		5.5
Hex Socket Counters. Head Bolt, M8		10
Flare Nut ½", Brass	Hex Head	35
Schröder Valve, 1/8"	Hex Head	24
Cable Gland, M12	Lock Nut	1.5
	Cap Nut	1
Cable Gland, M16	Gland	3.5
	Cap Nut	2
Cable Gland, M20	Gland	4
	Lock Nut	4
	Cap Nut	2
Cable Gland, M25	Lock Nut	6
	Cap Nut	4
Fresh Air Module		
Air Exchange Potentiometer	Slotted Cheese Head Screw, M3	0.8
Damper for Fresh Air	Hex Head/Phillips Recess, M6	2
Insect Net and AirEx Motor	Screw, ø4.0x16	0.8
AirEx Potentiometer	Screw, ø4.0x25	1.5
Frequency Converter (FC)		
FC Mounting	Hex Socket Counters. Head Bolt, M6	9
	Threaded Bushing, sq. 8 mm	10
FC Terminal Connector 'MOTOR'/'MAINS'	Slotted Cheese Head Screw, M4	1.3
FC Earth Wire	Hex Socket Counters. Head Bolt, M4	1.8
FC Connection Box Cover	Hex Socket Counters. Head Bolt, M5	4.5
Compressor		
Cylinder Head	Hex Head, M10	70
Bearing Cover	Hex Socket Counters. Head Bolt, M10	70
Oil Pump Cover	Hex Head Bolt, M8	10
Oil Filter Plug	Hex Socket	23.5
Terminal Block	Hex Socket Counters. Head Bolt, M6	14
Pressure Transmitter, AKS	Hex Head	15
Pressure Transmitter, NSK	Hex Head	15
High Pressure Switch	Hex Head	15
Receiver		
Water Outlet Coupling, Female (brass/alu)		50
Water Inlet Coupling, Male (brass/alu)	Hex Head	50
Sight Glass	Hex Head	60
Melt Fuse Valve	Hex Head	65
Valves		
Suction Gas Valve	Hex Head Bolt, M10	54
Suction Gas Valve Flange	Hex Socket Counters. Head Bolt, M10	54
Discharge and Intermediate Valve	Hex Head Bolt, M8	30
Evacuation Valve	Hex Head	18
Unit Backside		
Evaporator Cover Panels	Hex Lobular Tapping Screw, ø4.8	3
Sensors		
Humidity Sensor, O ₂ Sensor and CO ₂ Sensor	Hex Lobular Tapping Screw, ø4.8	3

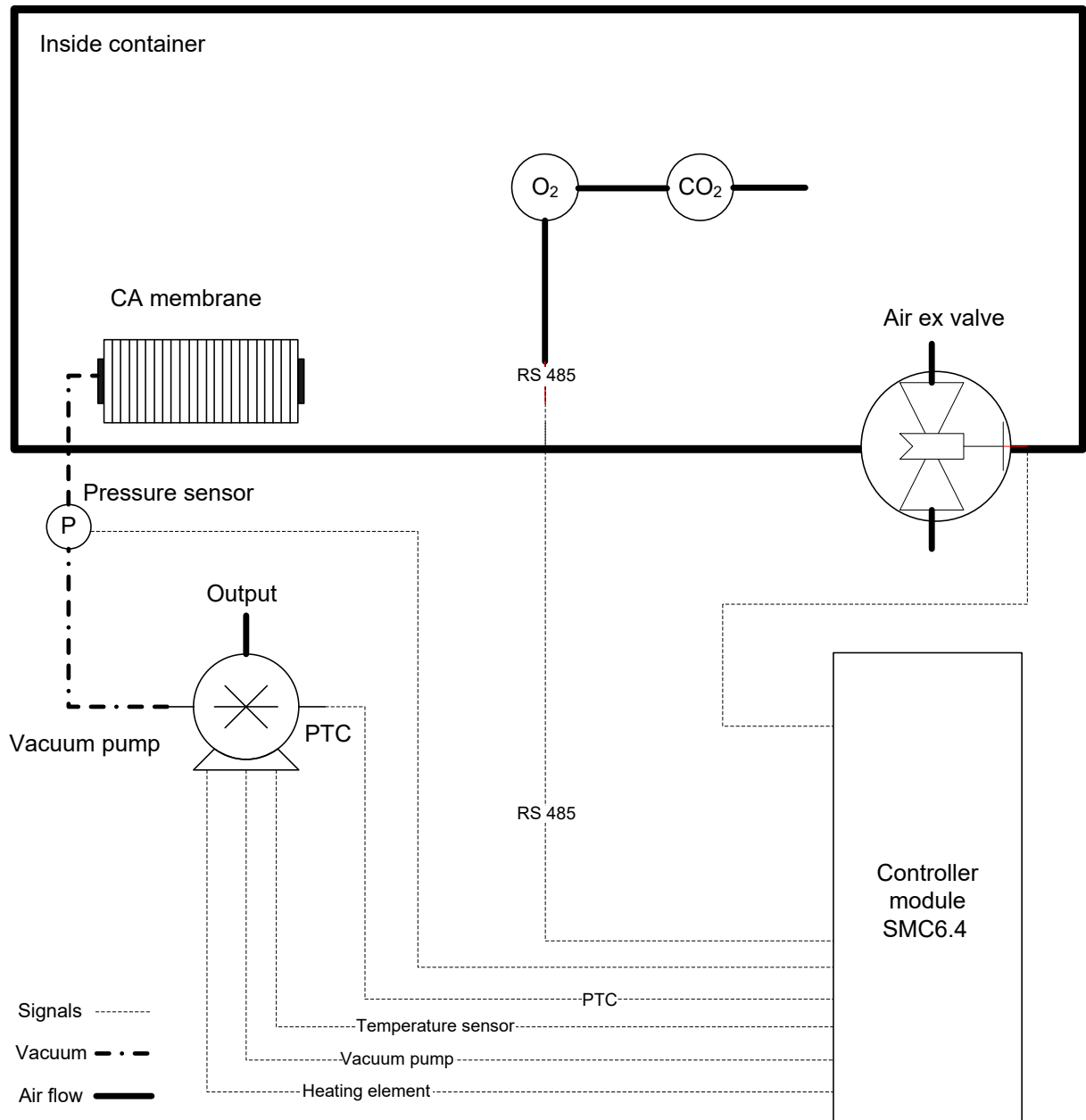
Controller Cabinet		
Controller Cabinet Door½	Screw, Phillips PH 2	1.5
Controller Plug Terminal Screws	Flat Head, 2.5 mm	0.25
Controller Terminal Screws X23-X29 (CIM 6.4 Controller)	Flat Head, 3.5 mm	0.5
Contactor, power circuit	Screw, Phillips PH 2	1.5
Contactor, control circuit	Screw, Phillips PH 2	1.5
SCU		
Hex Head Bolt	Hex Head	150-170

27. Diagrams

27.1 P & I diagram



27.2 CA function overview



28. EC Declaration of Conformity



MAERSK
CONTAINER INDUSTRY

EC DECLARATION OF CONFORMITY

2006/42/EC Annex II A

Manufacturer and compiler of the technical file:

Name	Maersk Container Industry AS
Address	Bjerndrupvej 47
Postal code and city	6360 Tinglev

Declares herby that machine type:

- **Star Cool refrigeration equipment* Model SCU-40 Triple Refrigerant and Triple Refrigerant Ready**

Is produced in accordance with the following EU directives:

- 2006/42/EC Machinery Directive
- 2014/30/EU EMC Directive
- 2014/68/EU Pressure Equipment Directive
- 2014/35/EU Low Voltage Directive

with the employment of the following harmonized standard:

- EN 378-2:2016 Refrigerating systems and heat pumps. Safety and environmental requirements. Design, construction, testing, marking and documentation
- ISO 20854:2019 Standard for thermal containers using flammable refrigerants.

* The declaration does only cover the refrigeration system, and not the container.



Signatory

General Manager

Occupation

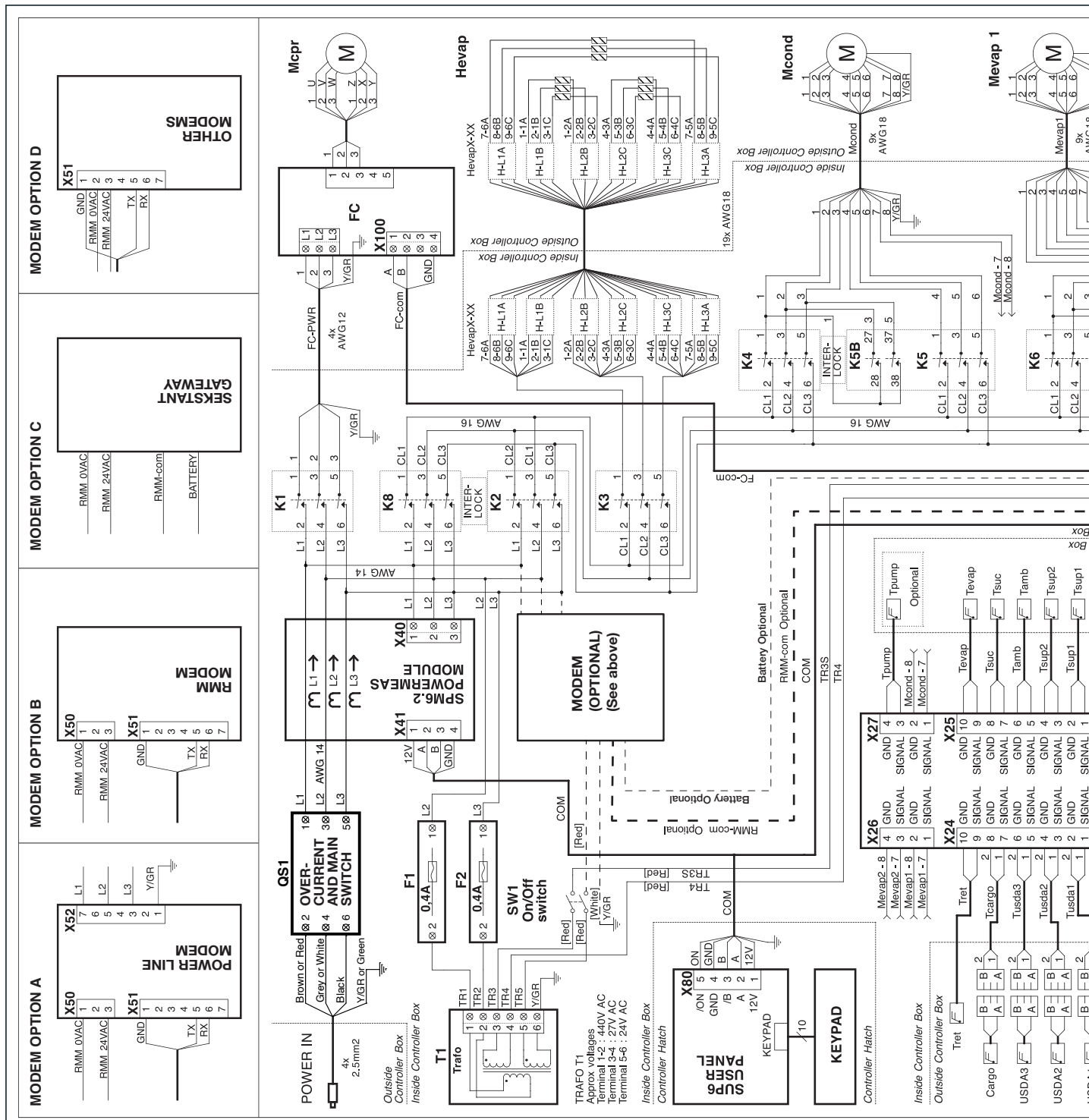
Tinglev

Place

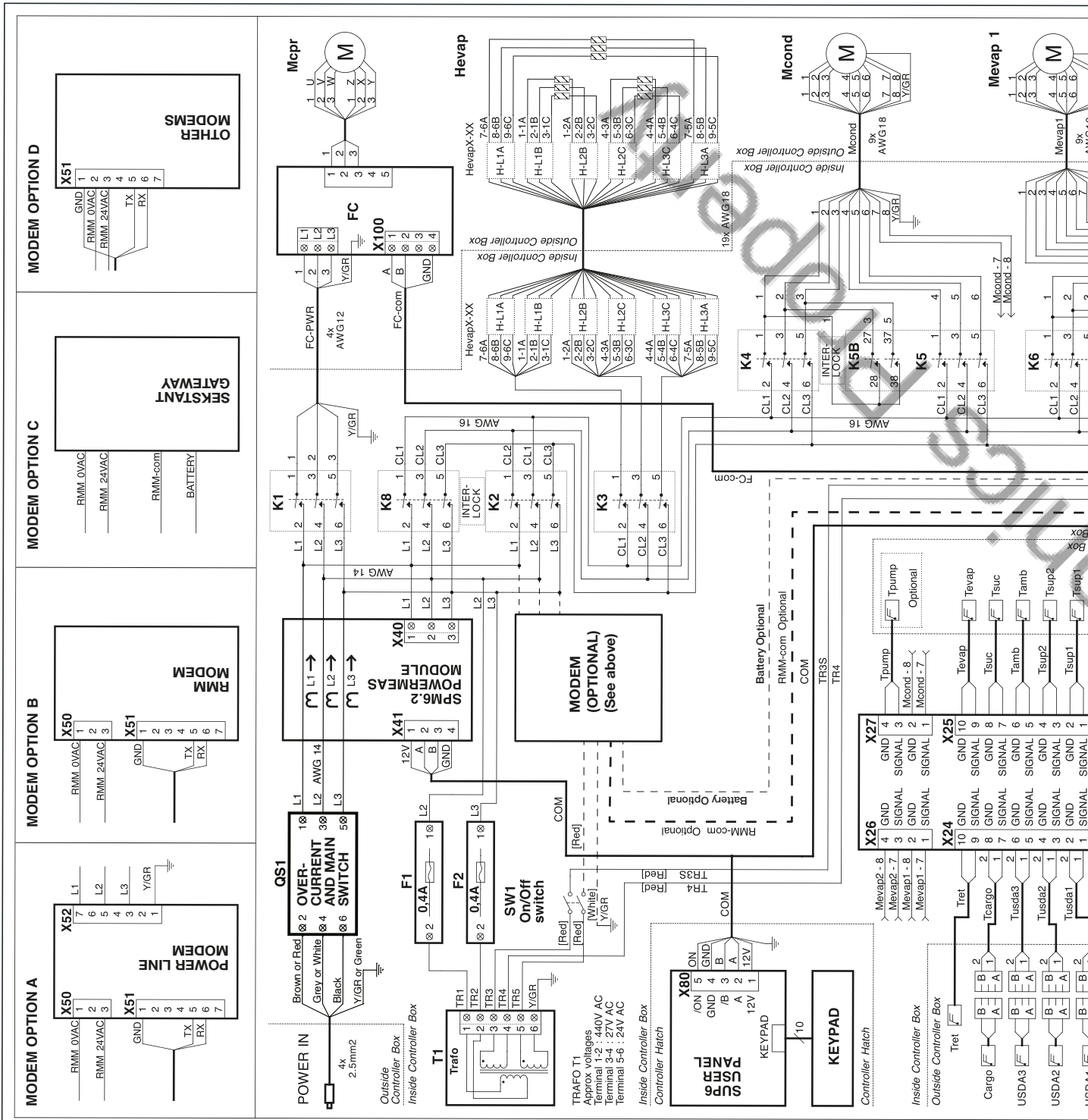
28-11-2024

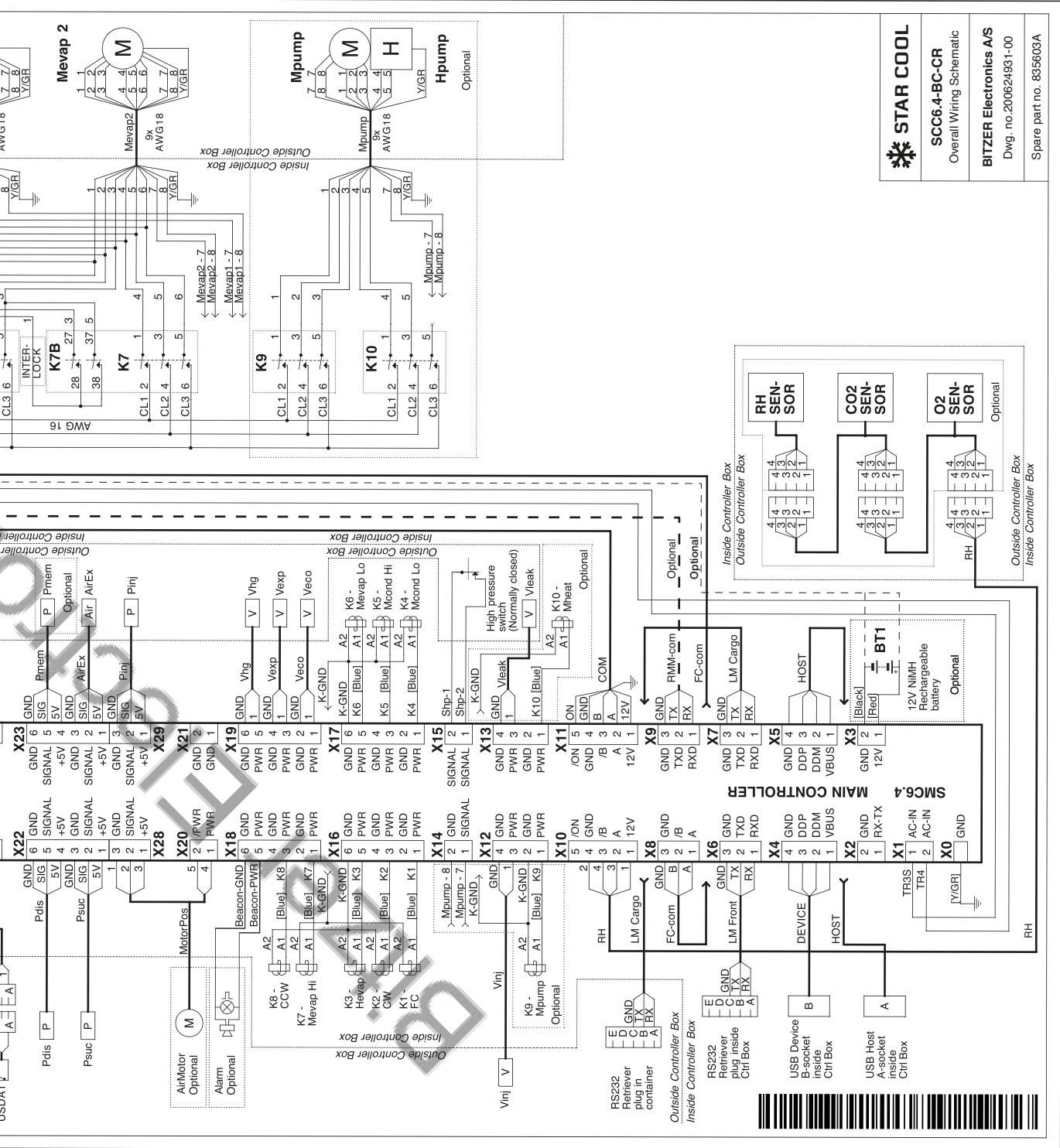
Date

29. Overall wiring schematic - CIM 6.4 controller



30. Overall wiring schematic - CIM 6.4 controller with Controlled Ripening





SCC6.4-BC-CR
Overall Wiring Schematic

BITZER Electronics AS
Dwg. no. 200624931-00

Spare part no. 835603A

Star Cool Service



The app

For trouble shooting help, manuals, alarm codes and more, download our free Star Cool Service app by simply scanning the QR code with your smart device.

See more at **apps.starcool.com**



Training

Our expert service team offer a variety of comprehensive seminars and hands-on instruction all around the world. From basic knowledge to advanced trouble shooting, we tailor courses to meet your needs.

Also, our online e-learning portal provides interactive modules, videos, and quizzes.

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Spare parts

By using only genuine Star Cool spare parts and consumables, you ensure a long and reliable life time of your reefer machines.

Purchase parts quickly and reliably on our website and choose the preferred delivery option to suit you.

Ordering support at **sales@starcool.com**

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24-hour hotline support

Call us on +45 73 64 35 00 or send an e-mail to service@starcool.com. Our service department is available 24 hours a day, 7 days a week - providing easy access to the answers you need.