

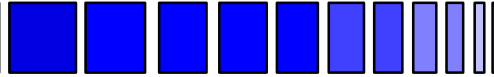
Date: June 2, 2008

# THERMO KING CORPORATION

Spec. No. 3C513 rev H



## PRODUCT SPECIFICATION



REFRIGERATION MACHINERY UNITS

**CRR-40DF**

FOR  
REFRIGERATION CONTAINERS

Conexcool

855-873-5233

[conexcool.com](http://conexcool.com)



**TABLE OF CONTENTS**

**GENERAL UNIT INFORMATION.....1**

**DESIGN STANDARD INFORMATION .....2**

**UNIT CAPACITY .....2**

**TEMPERATURE CONTROL .....3**

    FROZEN MODE .....3

    DEFROST .....3

**DETAIL INFORMATION ON UNIT .....4**

    COMPRESSOR R134A .....4

    COMPRESSOR R23 .....4

    EVAPORATOR COIL .....4

    CONDENSER COIL (AIR COOLED) .....5

    HEAT EXCHANGER .....5

    EVAPORATOR FAN .....5

    CONDENSER FAN .....5

    CONDENSER FAN MOTOR .....5

    EVAPORATOR FAN MOTORS .....6

    DEFROST / HEATERS .....6

    ELECTRICAL SAFETY CONTROLS .....6

    REFRIGERATION CONTROLS .....6

    REFRIGERATION SAFETY CONTROLS .....7

    ELECTRICAL PANEL INTERNAL COMPONENTS .....7

    ELECTRICAL PANEL EXTERNAL COMPONENTS .....7

    POWER PLUG .....7

    POWER CABLE .....7

    DOWNLOAD PLUG .....7

    BATTERY BACKUP .....8

    USDA REQUIREMENTS .....8

    PRESSURE EQUALIZATION VALVE .....8

**MISCELLANEOUS .....8**

**MICROPROCESSOR CONTROLLER MP3000 .....9**

    DATALOGGER .....10

    RETRIEVABLE DATA .....11

    CONTROLS ALARM .....11

    FUNCTION AND PTI TEST .....12

    TEMPERATURE SENSORS .....12

    REFCON REMOTE MONITORING POWER CABLE TRANSMISSION .....12

    MENU TREE .....13

**PIPING DIAGRAM .....1**



## GENERAL UNIT INFORMATION

<b>Manufacturer</b>	Thermo King Corporation.
<b>Type of System</b>	Picture frame, electric cooling and heating single piece condenser / evaporator unit.
<b>Construction</b>	<p>The refrigeration machinery is of the picture frame type. The frame is constructed of aluminum, treated to resist corrosion induced by salt spray atmosphere. The evaporator door is of the hinged removable type for easy access. The rear bulkhead panels are constructed of 3 mm aluminum with a high inherent corrosion resistance, and painted white. Panels fastness with 6 mm torc screws with insert nuts.</p> <p>Between the evaporator and condenser section the unit is insulated with fire resistant (according to ISO 3582) and CFC-free polyurethane foam. The nominal density of the foam is 32 kg/m<sup>3</sup> (2 lbs/ft<sup>3</sup>). Average thickness is 52 mm.</p> <p>All aluminum material is 5000 or 6000 series.</p> <p>All operational components except the evaporator coil are replaceable from the front of the unit.</p>
<b>Dimensions</b>	<p>Width 2025,5 mm</p> <p>Height 2235,2 mm</p> <p>Depth 420,0 mm from back of the flange</p>
<b>Weight</b>	610 Kg
<b>Electrical System Design</b>	Electrical system designed to comply with ISO 1496 Standard.
<b>Designed to operate on</b>	<p>A/C 400 to 500 Volt 3 phase 60 Hz ±2,5%</p> <p>A/C 360 to 460 Volt 3 phase 50 Hz ±2,5%</p>
<b>Control Circuit</b>	A/C 29 volt
<b>Method of Heating</b>	Electric resistance
<b>Max power Consumption in pull down</b>	19 KW
<b>Unit Air Leakage</b>	Less than 0.5 m <sup>3</sup> /h at 76 mm WG
<b>Unit Heat Leakage</b>	Less than 3.4 kcal/h/°C (3.95 W/°C)
<b>Unit test pressure R23</b>	<p>According to 746 of 26-11-1987 - (30 x 1.3 = 39 bar)</p> <p>Volume of pressure vessels 5 x 5,3 = 26,5 liter</p>
<b>Unit test pressure R134a</b>	According to TK/Arbejdstilsynet letter dated august 29 <sup>th</sup> 2002
<b>Paint Supplier</b>	Akzo Nobel
<b>Paint Color (Powder or Liquid)</b>	Off-white RAL 9016/85 (Unit) / Black (Tubing/Receiver Tank)
<b>Aluminum Corrosion Protection (Unit White 'Powder' Paint)</b>	The unit is pre-treated then painted with Infralit Polyester powder according to ISO test 7253 and 2409 classification 1. A Polyester Powder topcoat is then applied to a film thickness of 100 C meters.
<b>Refrigerant</b>	<p>R134a - 3,5 kgs</p> <p>R23 - 3,2 kgs</p>

The equipment is designed to withstand and operate satisfactorily under sea-going and environmental conditions as follows:

<b>Ocean Environment</b>	Salt-laden air, sea spray, high humidity and severe atmospheric conditions.
<b>Rolling</b>	Amplitude of 30° on each side, periods of 13 seconds
<b>Pitching</b>	Amplitude of 6° periods of 8 seconds
<b>Permanent List</b>	10° on each side
<b>Shock</b>	Acceleration of 2g in all directions
<b>Vibrations</b>	Of the types encountered on ships, land vehicles and rails



**DESIGN STANDARD INFORMATION**

The machinery is designed for long distance transportation of deep frozen, frozen in temperature range of -65°C to -10°C.
The machinery will be fully functional and work satisfactorily, in ambient temperatures from -30°C to 50°C. Components are specified to withstand temperatures up to 70°C.
The noise level of units fitted into the container will not exceed 80db (A) in 250 Hz band. Measurement taken in front of the unit 1,5 m distance and 1,2 m above ground, with the unit operating at 50 Hz.
ARI - test method for rating refrigerated equipment.
Machinery complies with International Customs Regulations for Containers.
Machinery complies with relevant ISO recommendations.
Machinery is approved by ABS and will marked with ABS label
Unit air leakage complies with Controlled Atmosphere requirements.
Refrigeration machinery complies with the requirements of the ATP regulations.
Unit complies with Australia and New Zealand Health Requirements.
Unit control system is prepared for power management (according to customer's requirements).

**UNIT CAPACITY**

<b>Test method according to ARI standard no. 1110-69 approval</b>			
<b>Performance test result CRR40DF</b>			
<b>(Unit serial number A001018172 – MSFU 856740-4)</b>			
<b>Net cooling capacity at 37,8°C (100°F) ambient temperature at 60 Hz power</b>			
Evaporator Return Air Temperature	Fan Heat Watt	Net Capacity Watt	Power requirement Watt Power Factor
-60°C	550 W	5.850 W	13.200 W – 0.81
-30°C	550 W	8.250 W	16.300 W – 0,84
<b>System Pressure</b>			
	<b>R23</b>	<b>R134a</b>	
High Pressure	30 Bar	24.1 Bar	
Low Pressure	2 to max. 3 Bar	1 Bar	

Pull down test, lowest achievable temperature (return sensor in ambient) @ ambient 38C: -71.7°C.
Container heat leakage test. U=35.23W/°K



## **TEMPERATURE CONTROL**

### **FROZEN MODE**

The unit will function from the return air sensor. If the return air temperature fall to 1°C below setpoint, the compressor stops until the temperature has risen to 1°C above setpoint. The evaporator fans run continuously in low speed except during defrost.

ON - OFF cycling of the compressor is minimum 15 minutes on and minimum 10 minutes off.

### **DEFROST**

The defrost cycle is controlled by the defrost sensor, located in the evaporator coil. This defrost cycle will be activate when the temperature difference between return air sensor and setpoint increases to a pre-set value and 6 compressor hours time delay has elapsed since the previous defrost. The defrost sensor terminates the defrost cycle automatically when the temperature in the evaporator coil increase to 18°C or if the temperature in the evaporator coil is higher than 8°C in 35 minutes if voltage is higher than 400 and 45 minutes if voltage is less than 400. Defrost will also be terminated if the defrost cycle is activated more 90 minutes at 60 Hz or 120 minutes at 50 Hz.

For additional security defrost will be initiated by a timer.

The initial defrost timer interval will be twelve hours and increases by six hours up to a thirty-six hour interval whilst on timer activated defrosts.

If the unit has been switched off for more than twelve hours or if the setpoint has been changed more than 5°C, the timer will be reset. If not, the unit will start with the same defrost sequence.

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**DETAIL INFORMATION ON UNIT**

**COMPRESSOR R134a**

<b>Manufacturer</b>	Copeland	<b>Type</b>	D3DSTA-075E-TFD
<b>Cylinders</b>	3	<b>Bore and Stroke</b>	61.9 x63.5 mm
<b>Displacement</b>	60 m <sup>3</sup> /h	<b>Speed</b>	1750 rpm at 60 Hz
<b>Valves (all brass)</b>	Suction and discharge with connection for gauge	<b>Finish</b>	Two (2) base coats of Epoxy-Polyamide primer are applied and top coated with two (2) additional coats of Polyurethane / Isocyanat black paint from 240 to 280 micron thickness.
<b>Protection</b>	Internal thermal automatic reset	<b>Oil sight glass</b>	Electro galvanized. Painted with black PUR paint from 240 to 280 micron thickness. Meets UL Minimum Low Side Pressure of 915 PSIA
<b>Approved Oils</b>	Copeland Ultra 22CC Mobil EAL 22CC ICI Emkarate RL32CF	<b>Oil Pump</b>	Impeller Type - Positive Displacement

**COMPRESSOR R23**

<b>Manufacturer</b>	Copeland	<b>Type</b>	ZF18K4E-TFD-276 / 277
<b>Displacement</b>	20,5 m <sup>3</sup> /h	<b>Nominal HP</b>	6
<b>Valves (all brass)</b>	Suction and discharge with connection for gauges	<b>Finish</b>	<b>Pre-treatment:</b> Painted with PPG Pitthane Gray (97-148) from 5.0 - 6.0 mils, bake for 40 minutes at 250 F and "cool to touch". <b>Finish:</b> Painted with PPG Pitthane Black (97-813) from 1.0 - 2.0 mils, bake by 35 minutes by 80°C or air dry by 1 hour.
<b>Protection</b>	Internal thermal automatic reset	<b>Oil sight glass (Removed on type no. 277)</b>	Same as compressor Meets UL Minimum Low Side Pressure of 915 PSIA
<b>Locked rotor Current</b>	70 Amps 460 V- 60Hz	<b>Weight</b>	40 Kg

**EVAPORATOR COIL**

<b>Tube Material</b>	Copper	<b>Fin Material</b>	Special Aluminum DIN 1712/A199
<b>Fin Space</b>	3,17 mm	<b>Configuration</b>	Horizontal
<b>Pipe Copper</b>	According to DIN 1787 wall thickness 0,45 mm	<b>Protection</b>	Treated with hydrophilic surface to resist corrosion induced by saltspray atmosphere.
<b>Surface Area</b>	58 m <sup>2</sup>	<b>Injection</b>	10
<b>Manufacturer</b>	Dalian/ECO or equivalent		



## CONDENSER COIL (AIR COOLED)

<b>Tube Material</b>	Copper	<b>Fin Material</b>	Copper
<b>Fin Space</b>	2,00 mm	<b>Configuration</b>	Circular
<b>Pipe Copper</b>	According to DIN 1787 wall thickness 0,45 mm	<b>Protection</b>	Epoxy E-Coat with Polyurethane top coat for UV protection
<b>Surface Area</b>	34,5 m <sup>2</sup> Subcool area R-134, 4,6 m <sup>2</sup> Subcool area R23, 2,3 m <sup>2</sup>		
<b>Manufacturer</b>	Dalian/ECO or equivalent		

## HEAT EXCHANGER

<b>Manufacturer</b>	SWEP	<b>Type</b>	B27
<b>Number of plates</b>	34	<b>Capacity</b>	12 KW
<b>Material</b>	Stainless steel	<b>Max. pressure</b>	30 bar

## EVAPORATOR FAN

<b>Type</b>	Propeller	<b>Diameter</b>	Ø355 mm
<b>Number of Fans</b>	3	<b>Low Speed</b>	1725 rpm at 60 Hz
<b>Blade Material</b>	Glass reinforced polyamide	<b>Drive</b>	Direct on motor shaft
<b>Hubs Material</b>	Glass reinforced PBT and stainless steel ring	<b>Number of Blades</b>	8
<b>Air Flows</b>	see graph	<b>Pitch</b>	22 degree

## CONDENSER FAN

<b>Type</b>	Propeller	<b>Diameter</b>	Ø550 mm
<b>Number of Fans</b>	1	<b>Speed</b>	1750 rpm at 60 Hz
<b>Blade Material</b>	Glass reinforced polyamide	<b>Drive</b>	Direct on motor shaft
<b>Air Flow</b>	6000 m <sup>3</sup> /h	<b>Number of Blades</b>	8
<b>Hubs Material</b>	Glass reinforced PBT, and stainless steel ring	<b>Pitch</b>	35 degree

## CONDENSER FAN MOTOR

<b>Nominal KW</b>	1,5 KW	<b>Type</b>	Completely enclosed non- ventilated
<b>Speed</b>	1750 rpm	<b>Bearing</b>	Ball sealed
<b>Shaft Material</b>	Stainless steel	<b>Protection</b>	Internal thermal auto. reset
<b>Class</b>	F non-hygroscopic	<b>IP</b>	56
<b>Finish</b>	Zinc plated, coated with 50 µ marine duty Epoxy paint	<b>No. of Motors</b>	1



## EVAPORATOR FAN MOTORS

<b>Nominal KW</b>	0,75 KW	<b>Type</b>	Completely enclosed with separate windings for high speed, low speed, and non-ventilated
<b>High Speed</b>	1725 rpm	<b>Bearing Grease</b>	Front bearing size : 6205 Rear bearing size : 6203 Grease Mobil 28 Temperature range standard/deep freeze units -65°C to 65°C.
<b>Shaft Material</b>	Stainless steel	<b>Protection</b>	Internal thermal automatic reset (each winding)
<b>Class</b>	F non-hygroscopic	<b>IP</b>	56
<b>Finish</b>	Ion phosphate with power polyester top-coat to 50 micron.	<b>No. of Motors</b>	3

## DEFROST / HEATERS

Defrost drain pan with high edges, 2 drains and plastic hose. Drain complies with TIR requirements. Drains are located in close proximity to condenser coil and compressor to prevent icing in cold ambient.

<b>Defrost Heater</b>	680 W each	<b>No. of Defrost Heaters</b>	12
<b>Defrost heating capacity</b>	8160 W 460V/60 Hz 6000 W 380V/50 Hz		

## ELECTRICAL SAFETY CONTROLS

<b>Overheat Klixon</b>	Cut-out: 54°C Cut-in: 32°C	<b>Compressor Motor Condenser Motor Evaporator Motor</b>	Internal thermal automatic reset
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## REFRIGERATION CONTROLS

<b>TX Valve</b>	Danfoss	<b>Evaporator Pressure</b>	Danfoss
<b>Drier R23 &amp; R134a</b>	R134a O-ring version R23 Solder version	<b>Moisture Indicator</b>	Danfoss incorporated in receiver
<b>Receiver R23</b>	Stainless steel with sight glass	<b>Receiver R134a</b>	All copper construction with sight glass
<b>Shut-Off Valve</b>	Superior	<b>Liquid Injection Valve</b>	Danfoss
<b>Non Return Valve</b>	Danfoss	<b>Liquid Solenoid Valve</b>	Danfoss
<b>Coating</b>	All components, including pipe are Epoxy painted to resist corrosion	<b>Pipes</b>	Copper, Standard dimensions and quality tolerances per ASTM B-280
<b>Gauge for low pressure (1 pcs)</b>	Marsh Bellofram Corp.	<b>Range Max working pressure</b>	-30 - 160 Psig 240 Psig
<b>Gauge for High Pressure (3 pcs)</b>	Marsh Bellofram Corp.	<b>Range Max working pressure</b>	0 - 400 Psig 600 Psig
<b>Sightglass R134a</b>	Solder version		





**REFRIGERATION SAFETY CONTROLS**

<b>High Pressure Switch R134a</b>	Cut-out: 24.1 bar (±0,68 bar) Cut-in: 16.4 bar (±0,68 bar)	<b>Fusible Plug (Receiver)</b>	Blow temperature 100°C
<b>High Pressure Switch R23</b>	Cut-out: 30 bar (±0,68 bar) Cut-in: 22 bar (±0,68 bar)	<b>Low Pressure Switch R-23</b>	Cut-out: 0 bar (± 0,2 bar) Cut-in: 0.65 bar (±0,68 bar)
<b>High-pressure safety valve, incorporated in receiver.</b>	Mercury	<b>Cut out pressure</b>	34 bar (+3.4 bar –1.0 bar)

**ELECTRICAL PANEL INTERNAL COMPONENTS**

<b>Contactors (4 pcs)</b>	Compressors, Heater Danfoss CI25	<b>Main Circuit Breaker</b>	32 amp.
<b>Relays</b>	Condenser fan, Evaporator fan (2 pcs.) and Phase Selection (2 pcs.)	<b>Phase Sensor</b>	Automatic selection
<b>Transformer</b>	Primary 500 VAC Secondary 29/28/40 VAC	<b>Fuse</b>	3 x 20 amp on MRB 1 x 7,5 amp control circuit

**ELECTRICAL PANEL EXTERNAL COMPONENTS**

<b>Switch</b>	Unit "ON / OFF"		
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**POWER PLUG**

<b>Type CEE 17 (ISO 1496-2, Annex 0 0,1)</b>	4 pole 400 / 460 Volt 50/60 Hz	<b>Amps</b>	32	Earth	3h pos.
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**POWER CABLE**

Storage for power cable provided in condenser section

<b>Length</b>	18.3 m (60ft)	<b>Cable</b>	Containerflex 4G6mm2 FR0H
<b>Color</b>	Yellow		

**DOWNLOAD PLUG**

<b>Location</b>	On the electrical box, and container side rear unit	<b>Type</b>	5 Pole Cannon Plug 3102-E 145-5
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## BATTERY BACKUP

<b>Type</b>	12 Volt service free	<b>Capacity</b>	1.9 A
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## USDA REQUIRMENTS

<b>Receptacle type 4 pole</b>	Cannon CA 3102E-14S-2S-B-A176	<b>Quantity</b>	3 pcs.
<b>Receptacle</b>	Female socket	<b>Location</b>	Rear left side

## PRESSURE EQUALIZATION VALVE

The unit is fitted with a pressure equalization valve to avoid excessive vacuum in the container. The valve is located below the condenser motor. The opening pressure is governed a spring loaded valve.

<b>Opening pressure</b>	1250 Pascal	<b>Valve internal Diameter</b>	48 mm.
<b>Body Material</b>	Stainless steel		
<b>Airflow at 400 mm WG</b>	Approx 9m3/hour	<b>Manufacturer</b>	Gustav Fagerberg P/N 2666DN50

## MISCELLANEOUS

Auto PTI Includes function tests and fault diagnostics
One piece hinged and removable evaporator access door with quick release stainless steel latches
Sequential component start to minimize peak amp draw
Random time delays during first time start up to minimize peak amp draw.
Safety harness hooks and grab-handle integrated into heater access door
Power saving "on demand" automatic defrost system
Tin-plated and numbered wires according to UL1647
Light weight composite condenser and evaporator fans.
Only 420 mm deep from back of flange
Manual operated control by-pass mode
Quick connectors for R134a mounted on suction- discharge service valves and service valve at receiver
Included in order is 3 pcs PT100 sensor, with a length of 15 meters Teflon cable
Two added Z-profile on rear wall.



## MICROPROCESSOR CONTROLLER MP3000

The MP3000 is an advanced microprocessor temperature controller based on the latest computer technology, and is developed especially for reefer control and monitoring. The controller is design with an integrated datalogger with a link to an optional power cable transmission module.

Frequently used functions such as temperature setpoint and defrost have been given separate access keys for ease of operation.

Vital data are/can be shown on an LED-display with 20.32 mm high characters, ensuring easy viewing even from a long distance. The controller is equipped with the following parts:

- 1 pcs. 4 line, 20 character LCD display
- 1 pcs. 5 segment LED display
- 8 pcs. LED's
- 1 pcs. 16 keys general-purpose keyboard plus 4 hot keys for easy operation.

The controller system consists of the following :

**MP3000 Microprocessor Controller Integrated Datalogger**  
**Main Relay Print Board (PCB)**  
**Temperature Sensors (6 pcs.)**

With exception of the sensors all components are mounted in the control enclosure. The design of the microprocessor provides permanent accuracy, reliability, and increased flexibility.

In case the return air sensor fails, the controller will automatically initiate full cooling.

A permanent base program is built into the controller, and a non-volatile memory for additions or changes in software is available.

Cooling regulation is "ON - OFF"-controlled as follows: When return air temperature is 1°C below setpoint, both systems will stop. Minimum stop time 10 minutes.

When temperature is 1°C higher than setpoint R134a system will start and after 30 seconds R23 system will start. Minimum runtime 15 minutes.

Overall accuracy is  $\pm 1^\circ\text{C}$  and checking of temperatures should be done, using an instrument with equal or better performance.

As new the MP3000 controller can be used for initial start up for both Moduload and KVQ control without downloading of specific operation software.

### LCD DISPLAY

The LCD display is used for all purposes in the man/machine interface showing menu information, data fields, etc. For further information on the LCD display see menu tree.

### LED DISPLAY

The main purpose of the LED display is to show the temperature currently used in the control algorithm. This temperature can either be return or supply. The LED's signals the one used. If a temperature is out of range the display will show "Err". The sign will indicate if the out of range value is positive or negative. The first 10 seconds after power on the LED display will show the current setpoint. The setpoint will also be shown 5 seconds in the LED display after a new setpoint has been accepted.

Further, the LED display is used during PTI to show the current stage of the PTI.



## LED DEFINITION

The use of the LED's is defined as follows:

1. Red FLASHING if error
2. Green ON if temperature is in range
3. Yellow ON if defrost is active
4. Yellow ON if heater is activated
5. Yellow ON if compressor is running
6. Yellow ON if humidity control is selected
7. Yellow ON if supply temp. is shown on LED display.
8. Yellow ON if return temp. is shown on LED display.

If both, LED 7 and LED 8 (return and supply LED's) are ON, the setpoint is shown in the LED display.

The setpoint can be set from -65°C to -10°C.

All settings are stored in a non-volatile memory and will always be intact - even in event of power failure.

## DATALOGGER

The incorporated datalogger is a microprocessor-based recorder especially developed for refrigerated containers. The datalogger type Sabroe Controls contains one memory area for storing temperatures.

All registrations are stored in the Flash memory, which contains temperatures logged at pre-defined intervals of ½, 1, 2 or 4 hours. The temperatures logged are the three USDA sensors, the controller supply- and return air sensors and the setpoint. With the one hour logging interval temperature information about the last preceding 625 days is available. The logging of the 3 USDA, Pt 100 sensors are fixed at one-hour intervals in order to comply with the USDA requirements.

One-minute log is only for calibration of USDA sensors. Maximum 72 min.

All loggings are stored with time and date of occurrence. The clock is pre-set at UTC time at the factory and operates for at least 10 years, backed up by a built-in Lithium battery. The datalogger is equipped with high-speed serial communication port. The logging can be inspected on the LCD display at the refrigerated container.

Retrieving from the datalogger can either be done by use of Sabroe Controls, DRU II/PC (or shown by Log View) handheld data retriever equipment or via REFCON power line remote monitoring system. Retrieving by the REFCON system requires that the containers are equipped with ISO standard 10368 high data rate, wide band, and power cable communication modems.

The datalogger will continue to log 120 temperature logs after the container has been disconnected from power.

All logs will be maintained until the unit is connected to power again and the battery will automatically be re-charged.

<b>Ambient Temperature</b>	-20°C to +70°C	<b>Humidity</b>	5% rH Non-condensing
<b>Sensor Accuracy</b>	±0.15°C (PT100 sensors)	<b>Capacity</b>	15000 Logs equal to 625 days continues logging of all sensors



## RETRIEVABLE DATA

The controller contains three memory areas, one for storing alarms/events, one for storing comments and one for PTI log.

1. Alarm and Event recording:

This record contains the last 1024 events, such as information on alarms, power on/off, defrost start/end, etc.

2. Comments recording:

Either by using the keyboard on the refrigerated container or by downloading the information from the handheld DRU II/III retriever and programming device, comments can be entered to the controller memory.

3. Recordings of the last two PTI's are stored in the PTI log.

All loggings are stored with time and data of occurrences. The clock is pre set at UTC time at factory and operates for at least 10 years, backed up by a build-in Lithium battery.

The loggings can be inspected on the LCD display on the controller.

Retrieving from the controller can either be done by use of DRU II or PC data retriever equipment or via REFCON power line remote monitoring system. Retrieving by REFCON system requires that the containers are equipped with ISO standard high data rate, broad band, power cable communication slave modems.

Data transfer time for the PTI log is approx. 3 seconds using DRU2 retriever.

Data transfer time for the Eventlog is approx. 20 seconds using DRU2 retriever.

Data transfer time for the Datalog is approx. 15 seconds per month using DRU2 retriever.

## CONTROLS ALARM

If the alarm LED light flashes on the display panel, go to alarm list in order to check the alarm system. The alarm code will be shown automatically on the LCD display.

*Sensor Alarm:*

If any sensor is defect (defrost-, return-, supply or compressor sensor).

*Temperature Alarm Freezing:*

After 1 hour running time, if temperature is not in range  $\pm 1,5^{\circ}\text{C}$  from the setpoint at settings  $-10^{\circ}\text{C}$  or below. This in-range temperature tolerance is adjustable.

The alarm is blocked if the temperature is going in the direction of the setpoint with  $0.1^{\circ}\text{C}$  per hour.

*Defrost Alarm:*

If defrost takes more than 90 minutes at 60 Hz (120 minutes at 50 Hz) or if return temperature too high  $> 35^{\circ}\text{C}$  under defrost

*If compressor high-pressure temperature is too high on compressors  $> 130^{\circ}\text{C}$  with R134a or  $138^{\circ}\text{C}$  for the Scroll compressor with R23.I*

*No LED flash:*

Alarm list (level 3) error.

Sensor: Ambient,

Power: Voltage, Amp. Hz., Delta amp., phase sensor.

*Low Pressure Switch (R23 only)*

The Low Pressure switch will stop both compressors if the pressure is lower LP settings. An alarm message will be shown in the LCD display as: "R23 Low Pressure Switch Cut-out".



## **FUNCTION AND PTI TEST**

Three automatic tests are built into the microprocessor thermostat.

### *Test No. 1:*

Function test that energizes compressor, fan motors and heating elements step by step tests the power consumption and compares to the calculated power. This program also tests the controller, temperature sensors (open/short circuit), and all contactors.

### *Test No. 2:*

PTI test that automatically tests the units' cool downs at -60°C and defrosts operation. This program also tests the controller, all contactors and their operation, temperature sensors, and finally performs a high-pressure test. Further, the current power consumption is compared to the expected.

This PTI generates a logfile, which can be retrieved with DRU II/PC. Data from the two latest PTIs will be available.

### *Test No. 3:*

Manual function test that allows switching of individual components to check power consumption and relevant performance.

## **TEMPERATURE SENSORS**

The temperature-sensing sensor is a thermistor, which is linked to a two-conductor cable via an electrical connector.

Temperature signals from the sensor are relayed to the controller through this cable.

One sensor is mounted in the center of the evaporator for measurement of the coil temperature.

Sensors no. two and three are mounted in the return and supply air duct measuring the air temperature returning from the container or the air temperature entering into the container from the refrigeration unit.

The fourth sensor, mounted on the front wall, measures the ambient temperature and sensor number fifth and six is located on the compressor discharge head (R134a and R23) to measure the high-pressure temperature. The wire cable for the Supply, Return and Defrost are Silicone cables.

## **REFCON REMOTE MONITORING POWER CABLE TRANSMISSION**

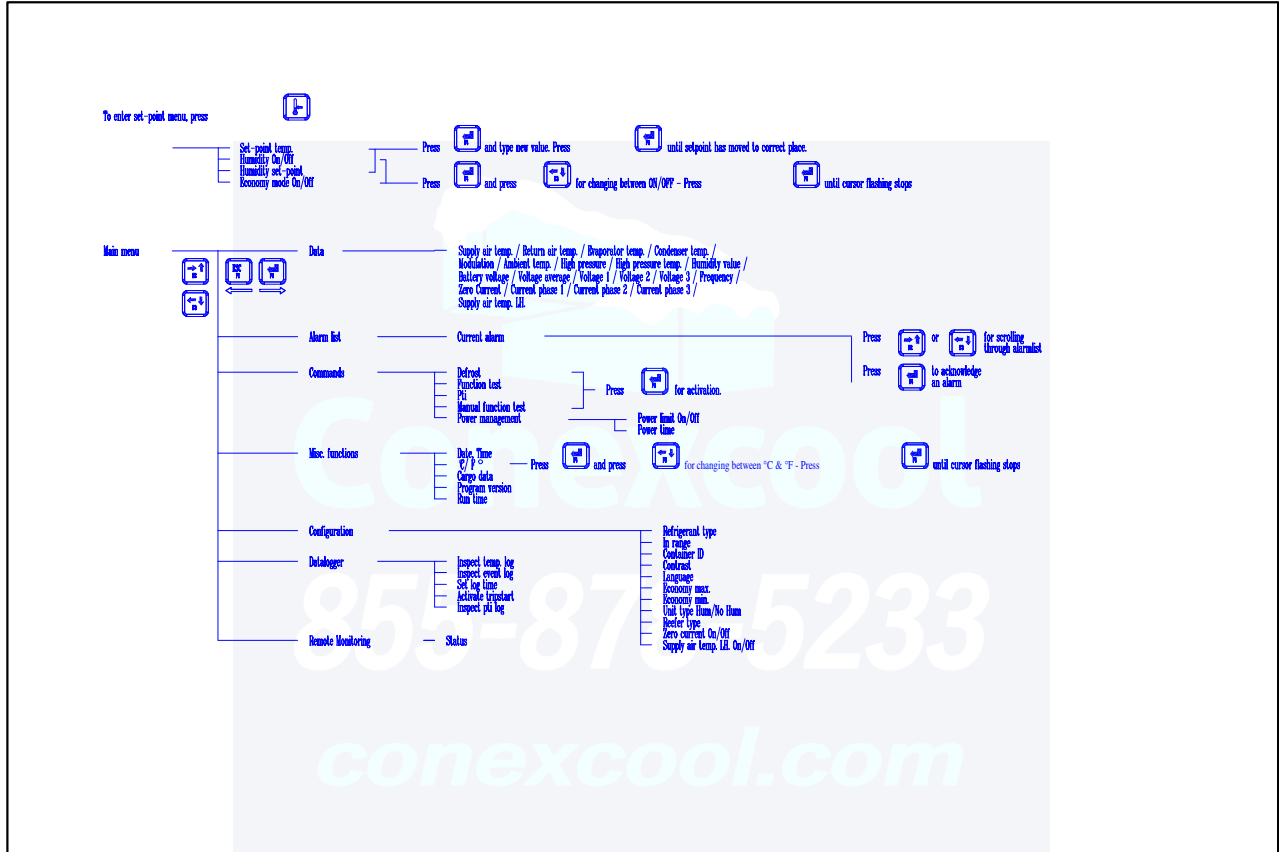
The monitoring system currently used on most ships can be applied in connection with this controller. The remote monitoring is via a power cable, high data transmission in accordance with ISO 10368. The power cable

transmission module is reading all information, which are available at the operator's panel at a remote terminal.

The system is capable of creating disc-files comp. with MS-DOS (IBMPC).



Menu Tree



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## PIPING DIAGRAM

