THERMO KING

Operator's Manual

Marine Reefer Units
w/ mP-4000

Revision A

May 2022

TK 61959–4–OP-EN

TRANE TECHNOLOGIES

Introduction

This manual is published for informational purposes only and the information furnished herein should not be considered as all-inclusive or meant to cover all contingencies. If more information is required, consult your Thermo King Service Directory for the location and telephone number of the local dealer.

Thermo King's warranty shall not apply to any equipment which has been "so installed, maintained, repaired or altered as, in the manufacturer's judgment, to affect its integrity."

Manufacturer shall have no liability to any person or entity for any personal injury, property damage or any other direct, indirect, special, or consequential damages whatsoever, arising out of the use of this manual or any information, recommendations or descriptions contained herein. The procedures described herein should only be undertaken by suitably qualified personnel. Failure to implement these procedures correctly may cause damage to the Thermo King unit or other property or personal injury.

There is nothing complicated about operating and maintaining your Thermo King unit, but a few minutes studying this manual will be time well spent.

Performing pre-trip checks and enroute inspections on a regular basis will minimize operating problems. A regular maintenance program will also help to keep your unit in top operating condition. If factory recommended procedures are followed, you will find that you have purchased the most efficient and dependable temperature control system available.

All service requirements, major and minor, should be handled by a Thermo King dealer for four very important reasons:

- They are equipped with the factory recommended tools to perform all service functions.
- They have factory trained and certified technicians.
- They have genuine Thermo King replacement parts.
- The warranty on your new unit is valid only when the repair and replacement of component parts is performed by an authorized Thermo King dealer.

Emergency Assistance

Thermo Assistance is a multi-lingual communication tool designed to put you in direct contact with an authorized Thermo King dealer.

Thermo Assistance should only be contacted for breakdown and repair assistance.

To use this system, you need the following information before you call: (phone charges will apply)

- Contact Phone Number
- Unit Type
- Thermostat Temperature Setting
- Ambient temperature
- Probable Cause of Fault
- Warranty Details of the Unit
- Payment Details for the Repair

Leave your name and contact number and a Thermo Assistance Operator will call you back. At this point you can give details of the service required and the repair will be organized.

No payment at point of repair for customers with a ThermoKare service contract or with a guaranty of payment from their Thermo King or FRIGOBLOCK home-dealer

THERMO KING
ThermoAssistance
00800 80 85 85 85

Belgium	+32 270 01 735
Denmark	+45 38 48 76 94
France	+33 171 23 05 03
Germany	+49 695 00 70 740
Italy	+39 02 69 63 32 13
Spain	+34 914 53 34 65
The Netherlands	+31 202 01 51 09
United Kingdom	+44 845 85 01 101
Kazakhstan	+7 7273458096
Russia	+7 4992718539
Others	+32 270 01 735

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General Inquires and Unit Maintenance

For general inquiries please contact your local Thermo King and/or FRIGOBLOCK dealer.

Go to www.europe.thermoking.com and select dealer locator for your local Thermo King/FRIGOBLOCK dealer.

Or refer to the Service Directory for contact information.

Customer Satisfaction Survey

Let your voice be heard!

Your feedback will help improve our manuals. The survey is accessible through any internet-connected device with a web browser.

Scan the Quick Response (QR) code or click Technical Publications EMEA Feedback to complete the survey.

Table of Contents

Safety Precautions

General Practices

⚠ Danger

Hazard of Explosion!

Never apply heat to a sealed refrigeration system or container. Heat increases internal pressure, which might cause an explosion resulting in death or serious injury.

⚠ Danger

Hazardous Gases - Personal Protective Equipment (PPE) Required!

Refrigerant in the presence of an open flame, spark, or electrical short produces toxic gases that are severe respiratory irritants which can cause serious injury or possible death. When working with or around hazardous chemicals, ALWAYS refer to the applicable Material Data Safety Sheets (MSDS) and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection, and handling instructions.

⚠ Danger

Risk of Injury!

Keep your hands, clothing, and tools clear of fans and/or belts when working on a unit that is running or when opening or closing compressor service valves. Loose clothing might entangle moving pulleys or belts, causing serious injury or possible death.

⚠ Danger

Refrigerant Vapor Hazard!

Do not inhale refrigerant. Use caution when working with refrigerant or a refrigeration system in any confined area with a limited air supply. Refrigerant displaces air and can cause oxygen depletion, resulting in suffocation and possible death. When working with or around hazardous chemicals, ALWAYS refer to the applicable Material Data Safety Sheets (MSDS) and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection, and handling instructions.

⚠ Warning

Hazard of Explosion!

Never close the compressor discharge service valve when the unit is operating. Never operate the unit with the discharge valve closed (front seated). This condition increases internal pressure, which can cause an explosion.

⚠ Warning

Proper Equipment Condition!

Gauge manifold hoses must be in good condition before using them. Never let them come in contact with moving belts, fans, pulleys or hot surfaces. Defective gauge equipment can damage components or cause serious injury.

⚠ Warning

Personal Protective Equipment (PPE) Required!

Always wear goggles or safety glasses and proper PPE when working on a unit. Refrigerant liquid, oil, and battery acid can permanently damage your eyes. When working with or around hazardous chemicals, ALWAYS refer to the applicable Material Data Safety Sheets (MSDS) and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection, and handling instructions.

⚠ Warning

Equipment Damage and Risk of Injury!

Never drill holes into the unit unless instructed by Thermo King. Holes drilled into high voltage cables could cause an electrical fire, severe personal injury, or even death.

⚠ Warning

Risk of Injury!

When using ladders to install or service refrigeration systems, always observe the ladder manufacturer's safety labels and warnings. A work platform or scaffolding is the recommended method for installations and servicing.

⚠ Caution

Sharp Edges!

Exposed coil fins can cause lacerations. Service work on the evaporator or condenser coils should only be accomplished by a certified Thermo King technician.

Notice

Equipment Damage!

All unit mounting bolts must be installed, be the correct length for their application, and torqued to specifications. Missing bolts, incorrect bolt lengths and improper torque specifications can damage equipment and void the warranty.

Refrigerant Hazards

⚠ Danger

Hazardous Pressures!

Always store refrigerant in proper containers, out of direct sunlight and away from intense heat. Heat increases pressure inside storage containers, which can cause them to burst and could result in severe personal injury.

⚠ Danger

Combustible Hazard!

Do not use oxygen (O_2) or compressed air for leak testing. Oxygen mixed with refrigerant is combustible.

⚠ Warning

Hazardous Gases!

Do not use a Halide torch. When a flame comes in contact with refrigerant, toxic gases are produced. These gases can cause suffocation, even death.

⚠ Warning

Personal Protective Equipment (PPE) Required!

Refrigerant in a liquid state evaporates rapidly when exposed to the atmosphere, freezing anything it contacts. Wear butyl lined gloves and other clothing and eye wear when handling refrigerant to help prevent frostbite. When working with or around hazardous chemicals, ALWAYS refer to the applicable Material Data Safety Sheets (MSDS) and OSHA/GHS (Global Harmonized System of Classification and Labelling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection, and handling instructions.

Notice

Equipment Damage!

When being transferred, refrigerant must be in liquid state to avoid possible equipment damage.

Electrical Hazards

Electrical Precautions

- The possibility of serious or fatal injury from electrical shock exists when servicing a refrigeration unit. Extreme care must be used when working with a refrigeration unit that is connected to its power source.
- Extreme care must be used even if the unit is not running. Lethal voltage potentials can exist at the unit power cord, inside the control box, inside any high voltage junction box, at the motors and within the wiring harnesses.

- In general, disconnect the units power cord before repairing or changing any electrical components.
- Even though the controller is turned off, one of the phases is still live and represents a potential danger of electrocution.

High Voltage

⚠ Danger

Hazardous Voltage!

Lethal amounts of voltage are present in some electrical circuits. Use extreme care when working on the refrigeration unit. If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other local, state, or country-specific requirements for arc flash protection PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASHING CLOTHING. ELECTRICAL METERS AND EQUIPMENT MUST BE PROPERLY RATED FOR INTENDED VOLTAGE.

⚠ Warning

Hazardous Voltage!

Treat all wires and connections as if they were high voltage until a meter and wiring diagram indicate otherwise. Only use tools with insulated handles. Never hold uninsulated metal tools near exposed, energized conductors. If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other local, state, or country-specific requirements for arc flash protection PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASHING CLOTHING. ELECTRICAL METERS AND EQUIPMENT MUST BE PROPERLY RATED FOR INTENDED VOLTAGE.

⚠ Warning

Hazardous Voltage!

Never work alone on high voltage circuits in the refrigeration unit. Another person should be nearby to shut off the unit and provide aid in the event of an accident. If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other local, state, or country-specific requirements for arc flash protection PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASHING CLOTHING. ELECTRICAL METERS AND EQUIPMENT MUST BE PROPERLY RATED FOR INTENDED VOLTAGE.

⚠ Warning

Personal Protective Equipment (PPE) Required!

In the event of an electrical accident, all required PPE should be near the work area in accordance with OSHA, NFPE 70E, or other local, state, or country-specific requirements for a Category 3 risk.

⚠ Warning

Hazardous Voltage!

The unit On/Off switch must be turned Off before connecting or disconnecting the standby power plug. Never attempt to stop the unit by disconnecting the power plug.

⚠ Warning

Risk of Injury!

The unit power plug must be clean and dry before connecting it to a power source.

⚠ Warning

Risk of Injury!

Do not make rapid moves when working on high voltage circuits in the refrigeration unit. Do not grab for falling tools because you might accidentally touch a high voltage source.

Low Voltage

⚠ Warning

Live Electrical Components!

Control circuits are low voltage (24 Vac and 12 Vdc). This voltage potential is not considered dangerous. Large amount of current available (over 30 amperes) can cause severe burns if shorted to ground. Do not wear jewelry, watch or rings. These items can shortcut electrical circuits and cause severe burns to the wearer.

Electrostatic Discharge Precautions

Precautions must be taken to prevent electrostatic discharge while servicing the microprocessor controller and related components. The risk of significant damage to the electronic components of the unit is possible if these precautionary measures are not followed. The primary risk potential results from the failure to wear adequate electrostatic discharge preventive equipment when handling and servicing the controller. The second cause results from electric welding on the unit and container chassis without taking precautionary steps.

Electrostatic Discharge and the Controller

You must avoid electrostatic discharges when servicing the controller. Solid-state integrated circuit components can be severely damaged or destroyed with less than a small spark from a finger to metal object. You must rigidly adhere to the following statements when servicing these units. This will avoid controller damage or destruction.

- Disconnect all power to the unit.
- Avoid wearing clothing that generates static electricity (wool, nylon, polyester, etc.).
- Do wear a static discharge wrist strap (refer to Tool Catalog) with the lead end connected to the controller's ground terminal. These straps are available at most electronic equipment distributors. *Do not* wear these straps with power applied to the unit.
- Avoid contacting the electronic components on the circuit boards of the unit being serviced.
- Leave the circuit boards in their static proof packing materials until ready for installation.

- Return a defective controller for repair in the same static protective packing materials from which the replacement component was removed.
- Check the wiring after servicing the unit for possible errors. Complete this task before restoring power.

Welding on Refrigeration Units or Containers

Electric welding can cause serious damage to electronic circuits when performed on any portion of the refrigeration unit, genset, container, or container chassis with the refrigeration unit attached. It is necessary to verify that welding currents are not allowed to flow through the electronic circuits of the unit. The procedures below MUST be strictly followed when servicing units to avoid damage or destruction of the microprocessor.

1. Disconnect the battery connections (if equipped) and lock out - tag out the unit according to local regulations.
2. Disconnect all power to or from the refrigeration unit or genset.
3. Disconnect all quick-disconnect wire harnesses from the back of the controller.
4. Switch all of the electrical circuit breakers in the control box to the Off position.
5. When steps 1 through 5 are complete, weld the unit and/or container using normal welding procedures. Keep ground return electrode as close to the area to be welded as practical. This will reduce the likelihood of stray welding currents passing through any electrical or electronic circuits.
6. When welding is complete, restore the unit power cables, wiring, and circuit breakers to their normal condition.

First Aid

REFRIGERANT

- **Eyes:** For contact with liquid, immediately flush eyes with large amounts of water and get prompt medical attention.
- **Skin:** Flush area with large amounts of warm water. Do not apply heat. Remove contaminated clothing and shoes. Wrap burns with dry, sterile, bulky dressing to protect from infection. Get prompt medical attention. Wash contaminated clothing before reuse.
- **Inhalation:** Move victim to fresh air and use Cardio Pulmonary Resuscitation (CPR) or mouth-to-mouth resuscitation to restore breathing, if necessary. Stay with victim until emergency personnel arrive.
- **Frost Bite:** In the event of frost bite , the objectives of First Aid are to protect the frozen area from further injury, warm the affected area rapidly, and to maintain respiration.

REFRIGERANT OIL

- **Eyes:** Immediately flush with large amounts of water for at least 15 minutes. Get prompt medical attention.
- **Skin:** Remove contaminated clothing. Wash thoroughly with soap and water. Get medical attention if irritation persists.
- **Inhalation:** Move victim to fresh air and use Cardio Pulmonary Resuscitation (CPR) or mouth-to-mouth resuscitation to restore breathing, if necessary. Stay with victim until emergency personnel arrive.
- **Ingestion:** Do not induce vomiting. Immediately contact local poison control center or physician.

ENGINE COOLANT

- **Eyes:** Immediately flush with large amounts of water for at least 15 minutes. Get prompt medical attention.
- **Skin:** Remove contaminated clothing. Wash thoroughly with soap and water. Get medical attention if irritation persists.
- **Ingestion:** Do not induce vomiting. Immediately contact local poison control center or physician.

BATTERY ACID

- **Eyes:** Immediately flush with large amounts of water for at least 15 minutes. Get prompt medical attention. Wash skin with soap and water.

- **Skin:** Immediately remove contaminated clothing. Wash skin with large volumes of water, for at least 15 minutes. Wash skin with soap and water. Do not apply fatty compounds. Seek immediate medical assistance.
- **Inhalation:** Provide fresh air. Rinse mouth and nose with water. Seek immediate medical assistance.
- **Ingestion:** If the injured person is fully conscious: make the person drink extensive amounts of milk. Do not induce vomiting. Take the injured person immediately to a hospital.

ELECTRICAL SHOCK

Take IMMEDIATE action after a person has received an electrical shock. Get quick medical assistance, if possible.

The source of the shock must be quickly stopped, by either shutting off the power or removing the victim. If the power cannot be shut off, the wire should be cut with an non-conductive tool, such as a wood-handle axe or thickly insulated cable cutters. Rescuers should wear insulated gloves and safety glasses, and avoid looking at wires being cut. The ensuing flash can cause burns and blindness.

If the victim must be removed from a live circuit, pull the victim away with a non-conductive material. Use wood, rope, a belt or coat to pull or push the victim away from the current. DO NOT TOUCH the victim. You will receive a shock from current flowing through the victim's body. After separating the victim from power source, immediately check for signs of a pulse and respiration. If no pulse is present, start Cardio Pulmonary Resuscitation (CPR). If a pulse is present, respiration might be restored by using mouth-to-mouth resuscitation. Call for emergency medical assistance.

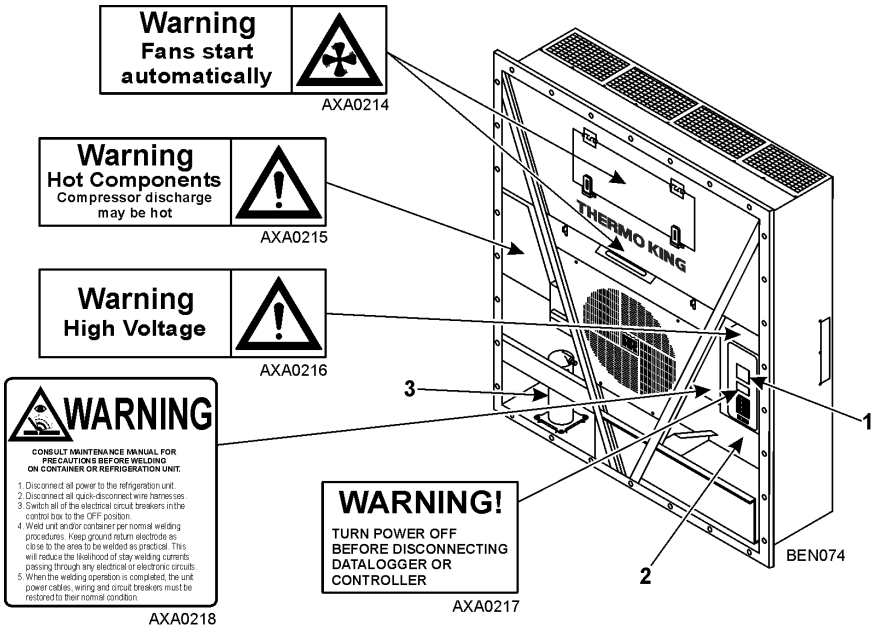
ASPHYXIATION

Move victim to fresh air and use Cardio Pulmonary Resuscitation (CPR) or mouth-to-mouth resuscitation to restore breathing, if necessary. Stay with victim until emergency personnel arrive.

Identifying Unit Safety and Warning Decals

Serial number decals, refrigerant type decals, and warning decals appear on all Thermo King® equipment. These decals provide information that may be needed to service or repair the unit. Service technicians should read and follow the instructions on all warning decals.

Figure 1. Nameplate and Warning Locations



1	Controller Nameplate
2	Unit Nameplate
3	Compressor Nameplate

Unit Description

Introduction

This chapter will briefly describe the following items:

- General Unit Description.
- Standard Component Descriptions.
- Optional Component Descriptions.

General Description

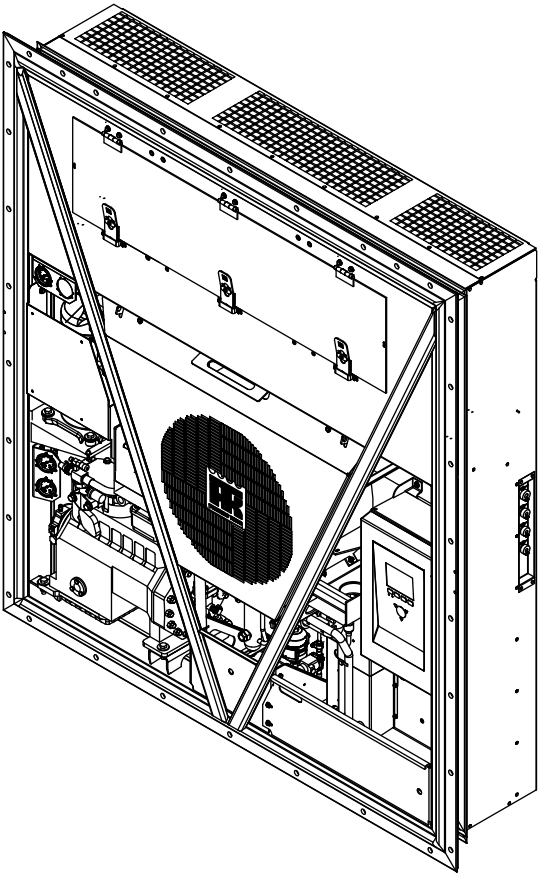
Units are all-electric, single-piece, refrigeration units with bottom air supply. The unit is designed to cool and heat ISO1496-2 refrigerated containers for shipboard or overland transit (Intermodal), as well as land based stationary storage. The unit mounts in the front wall of the container. Forklift pockets are provided for installation and removal of the unit.

The frame and bulkhead panels are constructed of aluminum and are treated to resist corrosion. A removable evaporator compartment door provides service access. All components except the evaporator coil and electric heaters can be replaced from the front of the unit.

Each unit is equipped with an 18.3 m (60 ft.) power cable for operation on 460-400V/3 Ph/ 60-50 Hz power. The unit power cable is stored below the control box in the condenser section.

Each unit is equipped with 460-400V/3 Ph/ 60-50 Hz electric motors. An automatic phase correction system provides the proper electrical phase sequence for condenser fan, evaporator fan and compressor operation.

Figure 2. Reefer Units



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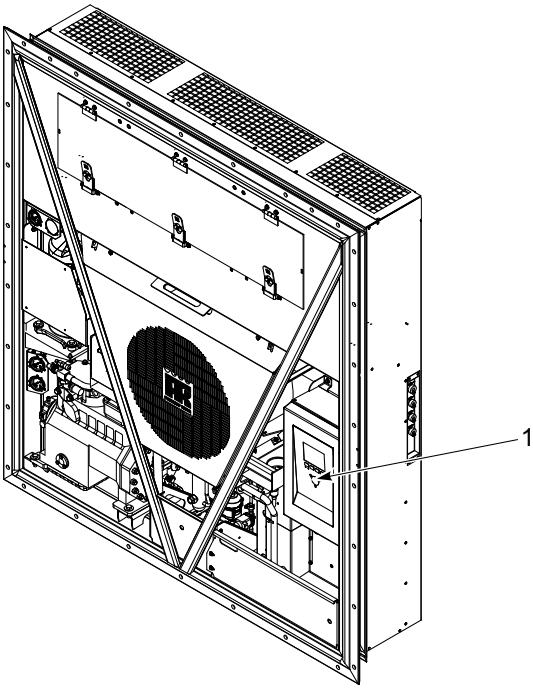
The Magnum+ and CFF container units feature the following components:

- Scroll Compressor
- Compressor Digital Control Valve
- Economizer Heat Exchange System
- Temperature Sensors
- Fresh Air Exchange System
- Receiver Tank Sight Glass
- Evaporator Fans
- Condenser Fan Control
- Suction/Discharge Pressure Sensor (Optional)
- Remote Monitoring Receptacle Option (4-pin) (optional)
- Remote Monitoring Modem (RMM, RMM+) (Optional)
- USDA Cold Treatment Temperature Recording (Optional)
- Advanced Fresh Air Management (AFAM) and Advanced Fresh Air Management Plus (AFAM+) (Optional)
- R23 Scroll Compressor
- R134a Reciprocating Compressor
- Temperature Sensors
- Evaporator Fans
- Condenser Fans
- Suction/Discharge Pressure Sensor (Optional)
- Controller
- Remote Monitoring Modem (RMM, RMM-W) (Optional)
- USDA Cold Treatment Temperature Recording (Optional)

MP4000 Controller

The MP4000 is an advanced microprocessor controller that has been specially developed for the control and monitoring of refrigeration units. See "Controller Description," p. 23 for more detailed information.

Figure 3. MP4000 Controller



1	MP4000 Controller

Controller Description

MP4000 Controller

The MP4000 is an advanced microprocessor controller. It has been specially developed for the control and monitoring of refrigeration units. The controller contains the following basic features:

- Temperature/Message Status Display
  - Temperature area: Displays return air sensor, supply air sensor, and setpoint.
  - Message area: Displays alarms, message, and controller menu.
- Keypad
  - F1 - F4 Function keys navigate within the Status Display.
  - Two Status LED indicators.
  - Special function keys: ON/OFF, PTI, Defrost.

Back-up Battery

Every Controller has a Back-up Battery. This will allow the controller to be energized if the unit is not connected to shore power. The technician can change settings in the controller - Setpoint, etc.

Press the ON/OFF key, the controller will energize and stay energized for 25 sec, by pressing any of the Menu keys the 25 sec timer will reset to 20 sec.

Input and Output Signals

The MP4000 microprocessor controls all unit functions to maintain the cargo at the proper temperature. The controller also monitors and records system faults and performs pretrip.

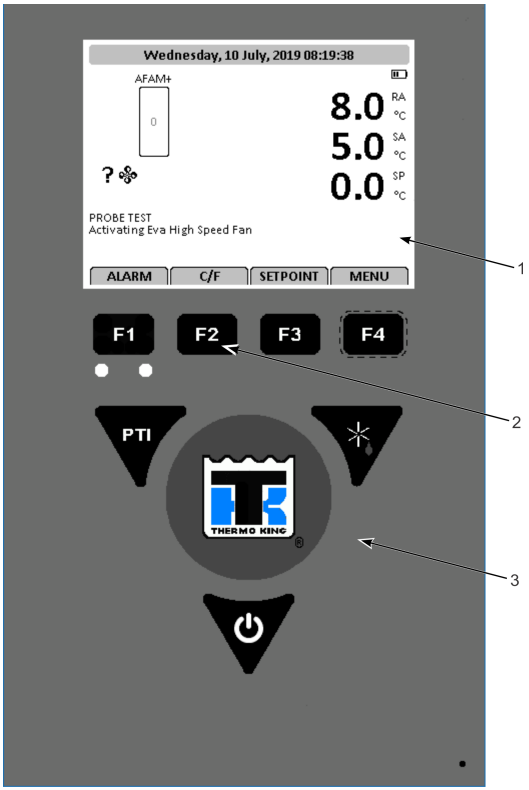
The MP4000 controller uses advanced solid-state integrated circuits to monitor and control unit functions. The controller monitors inputs from:

- Return Air Sensor
- Ambient Sensor
- High Pressure Cutout Switch/ Discharge Pressure Sensor
- Voltage measuring circuits
- Supply Air Sensor
- Humidity Sensor
- Low Pressure Cutout Switch/ Suction Pressure Sensor

- Evaporator Coil Sensor
- USDA (Spare) Sensors 1, 2, and 3
- Phase measuring circuits
- Condenser Coil Sensor
- Compressor Discharge Line Temperature Sensor
- Current measuring circuits

Output signals from the controller automatically regulate all unit functions including:

- Compressor operation
- Compressor digital valve
- Electric heaters
- Condenser fan operation
- Vapor injection valve
- Phase selection
- Evaporator fan motor operation
- Dehumidify valve



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1	Standard Display
2	Function Keys
3	Special Function Keys

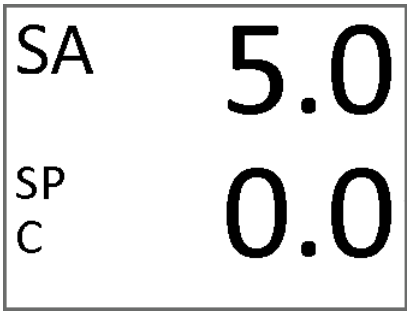
Standard Display

The Standard Display is a ¼ VGA graphical type display. The temperature can be displayed in Celsius or Fahrenheit.

The Standard Display will display the controlling sensor and Setpoint. The Setpoint will be the low reading with the C or F.

Once a key is pressed, the Standard Display will change to the Unit Status Display. After two minutes of no key activity, the display will return to the Standard Display.

Figure 4. Standard Display



Idle Screen and Check Symbol

After approximately 30 seconds of inactivity, the display will go into hibernation and one of the following symbols will be displayed. Display alternates between the idle screen and the standard display during this time.

Happy face = everything is OK

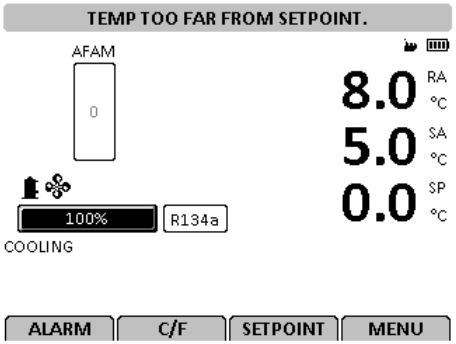
Disgruntled face = there is a message

Unhappy face = there is an alarm

The check symbol indicates that a Smart PTI has recently been running and no problems were found. The checkmark will only be shown in the normal operation state. This symbol will appear at the left hand corner of the idle screen display.

Unit Status Display

The Unit Status Display will show the following (looking from top to bottom):



- Date and Time / Alarm Warning
- rH Relative Humidity sensor
- AVL Door Position/AFAM+
- LoPrs Low Pressure Transducer
- HiPrs High Pressure Transducer
- RA Return air sensor
- SA Supply air sensor
- SP Setpoint
- Mode Icons Compressor ON, Heater ON, Evap Fan ON
- Capacity Bar Graph Percentage of mode (100% is full on)
- Mode Description unit operation
- F1 - F4 Key Functions ALARM C/F SETPOINT MENU

Display Icons

⚠	Alarm	✓	SmartPTI has recently been running and no problems found
?	Pretrip Inspection / Test in Progress	OPT	Controlling Mode Optimized
≋	Heating	ECO	Controlling Mode Economy

	Evaporator Fan High Speed		Bluetooth®
	Evaporator Fan Low Speed		Cell Phone
	Condenser Fan On		GPS Signal
	Watercooled		RMM
	Dehumidification		Battery Full (Datalogger Battery)
	Defrost		Battery Charging (Datalogger Battery)
	Compressor On Unloaded		Battery state not known. Temperature to low or high, charger suspended. (Datalogger Battery)
	Compressor On Loaded without Vapour Injection		Battery Error (Datalogger Battery)
	Compressor On Loaded with Vapour Injection		Refrigerant Type

Mode Descriptions

Chilled/Cooling (Magnum+ and CFF only)

Chilled cooling is a mode where the unit setpoint is set to above -10C. The function here is to maintain setpoint temperature by controlling the temperature on the supply air.

The supply air is not allowed to be lower than the setpoint. Chilled/cooling mode can operate the unit in different modes where the compressor can run loaded, unloaded/loaded and vapor injection depending on the need for

cooling capacity. The condenser fan will operate in an on/off algoritim depending on the temperature on the condenser. The evaporator fans will operate in either high or low speed mode depending on the need for capacity.

Chilled/Heating (Magnum+ and CFF only)

Chilled heating is a mode the unit setpoint is set to above -10C. The function here is to maintain setpoint temperature by controlling the temperature on the supply air.

The supply air is not allowed to be lower than the setpoint. Chilled heating mode can operate the unit where only the evaporator fan low speed is running, evaporator high speed is running or evaporator high speed and heat is on.

Frozen/Cooling Down

Frozen/cooling down mode where the unit setpoint is set to below -10C. The function here is to maintain setpoint temperature by controlling the temperature on the return air.

Frozen/cooling down mode can operate the unit in different modes where the compressor is loaded and vapor injection is on/off. The condenser fan will operate in an on/off algorithm depending on the temperature on the condenser. The evaporator fans will operate in low speed mode or off.

Defrost

Defrost is a situation where the unit either on demand or timing is defrosting the evaporator coil. The unit is heating with the heating elements awaiting 18C on the evaporator sensor.

When the set Defrost termination temperature is reached, the unit will return to the operation mode depending on the setpoint.

PTI

PTI is a pretrip inspection and is used to diagnose the condition of the unit. There are a possibility to chose between several type of PTI´s depending on the test needed to secure the functionality of the unit.

Silent mode

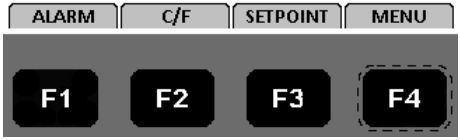
Silent mode is a way to make the reefer unit silent without manual switching it OFF and ON.

Keys and Indicator LEDs

Function Keys

The function keys are the F1 - F4 keys located below the display. They allow the operator to move quickly to a specific area of the information or into the controller menu.

Note: *Function keys will change based on what menu is active in the display.*



- F1 ALARM Key: Press to view an explanation for the current alarms present.
- F2 C/F Key: Press to view alternate temperature scale Celsius or Fahrenheit in display.
- F3 SETPOINT Key: Press to enter Setpoint menu. Press F2 Up or F3 Down keys to increase or decrease the Setpoint. Press and Hold F4 until you are returned back to the main menu.
- F4 MENU Key: Press to view the extended Menu for the MP4000.

Special Function Keys

The Special Function keys are located around the Thermo King logo. These special function key allow the operator to move quickly to perform a specific function

- Pre-Trip Inspection
- Defrost
- Unit On/Off Control

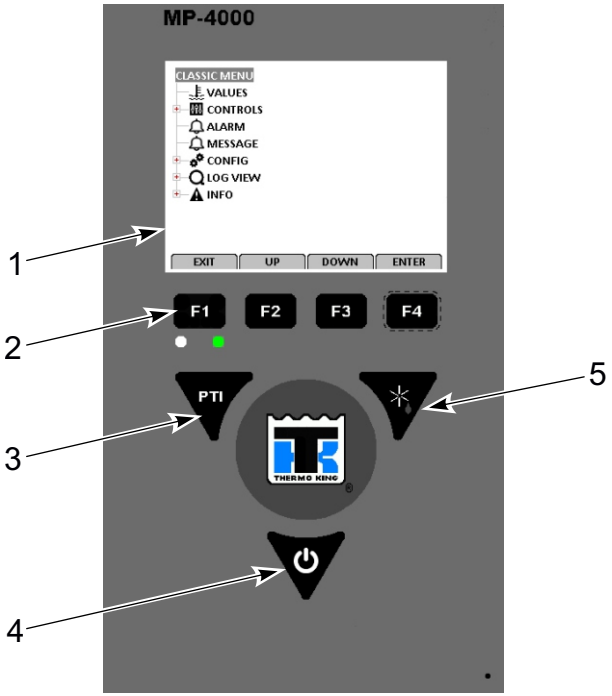
Indicator LEDs

Two status indicator LEDs are located just under the F1 - F4 function keys.

Green LED	Flashing	Temperature approaching in-range.
	Solid	Temperature in-range.
Red LED	Flashing	Alarm present and has not been acknowledged.
	Solid	Alarm present and has been acknowledged.

Navigating Controller Operating Menu

Figure 5. MP4000 Control Panel Display



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1	Classic Main Menu
2	Menu Scrolling Keys
3	PTI - Pre-trip Inspection
4	ON/OFF Key
5	Defrost Key

Menu Scrolling Keys

Moving through these seven menus, their submenus, and entering commands requires the use of four keys:

F1 — EXIT - Press the F1 key each time you want to exit a submenu shown in the message display.

F2 — UP/ DOWN - Press the F2 or F3 key each time you want to scroll up or down in a menu or submenu shown in the Message Display; or scroll forward or backward in a menu line.

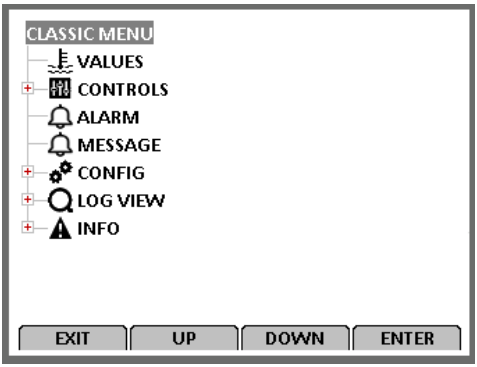
F3

F4 — ENTER - Press the F4 key to enter a new menu or submenu.

The MP-4000 contains an extensive operating menu. The menu is navigated via the controller keypad. There are 2 types of menu's that can be displayed.

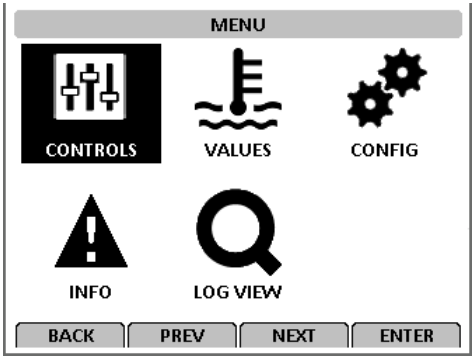
1. The Classic Main menu is divided into seven major areas that can be navigated via keypad.

Figure 6. Classic Menu



BEF590

2. The icon Main menu is divided into 5 icons (Alarms and warnings appear under “Info” icon)



Lock Padlock

If PADLOCK is active, contact technicaian, the technician must enter correct key (number) to unlock display. PADLOCK OPTION must be selected ON under the CONFIGURATION/ UNIT SETTING for it to be active or visible.

Figure 7. Lock Padlock

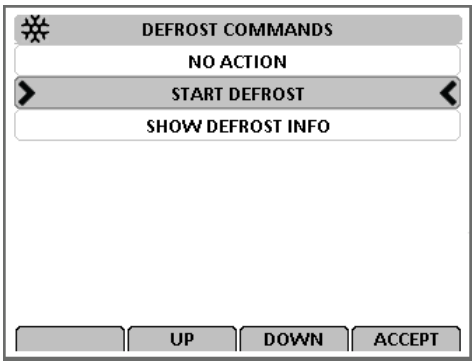
BEF591

Initiating a Manual Defrost

Turn the **UNIT ON**. Allow Unit to start and stabilise.

Complete the following steps:

Figure 8. Defrost Menu



1. Press the DEFROST Special Function key.

- If the unit operating conditions allow a manual defrost (e.g. evaporator coil temperature is less than 18 C [56 F]), the unit enters Defrost.
- Select Start Defrost.

2. The defrost cycle automatically terminates and returns the unit to normal operation.

PTI

Turn the **UNIT ON**. Allow Unit to start and stabilise.

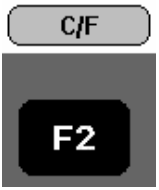
Complete the following steps:

Viewing Alarms/ Warnings

To view the alarms that are present, turn the **UNIT ON**. Allow Unit to start and stabilise.

1. Press the **F1/ALARM KEY**. The Alarm List appears.
2. Press the **F2/F3** keys to scroll between Alarms that are present.
3. Press the **F4** key to acknowledge the Alarm. Press F1 again to exit.

Display Alternate Fahrenheit (F) or Celsius (C) Temperatures



To view the alarms that are present, turn the **UNIT ON**. Allow Unit to start and stabilise.

Complete the following step:

The controller can display temperatures in Celsius or Fahrenheit. Press the **F2** function key display will change to C or F To change the display to C or F permanently, press and hold the F2 C/F key, then confirm “ARE YOU SURE YES or NO. Some customers do notallow the display to be change permanently.

Changing Setpoint

To change the controller setpoint, turn the **UNIT ON**. Allow Unit to start and stabilise.

Complete the following steps:

1. Press the **F3** key at the main screen. The Setpoint Change menu appears.
2. Press the **F2/F3** keys to scroll the Setpoint Up or down - depending on your required Temperature.
3. Press and hold the **F4** key until you are returned to the main Screen. The new setpoint is recorded in the controller and appears in the display.

Controller Back-up Battery

Every Controller has a Back-up Battery. This will allow the controller to be energized if the unit is not connected to shore power. The technician can change settings in the controller - Setpoint, etc.

Press the ON/OFF key, the controller will energize and stay energized for 25 sec, by pressing any of the Menu keys the 25 sec timer will reset to 20 sec.

Operating Theory

Table 1. Magnum+ and CFF Operating Mode Function Chart

Chill Loads Setpoints at -9.9 C (14.4 F) and Above			Frozen Loads Setpoints at -10 C (14 F) and Below			
Cool w/Mod	**Heat**	**Defrost**	**Cool**	**Null**	**Defrost**	**Unit Function**
•[1]	•					Evaporator Fans High Speed[1]
•[1]			•	•[1]		Evaporator Fans Low Speed[1]
		•		•[1]	•	Evaporator Fans Off[1]
•	•					Proportional-integral Derivative (Supply Air) Control
			•	•		Return Air Sensor Control
		•			•	Evaporator Coil Sensor Control
•			•			Compressor On
•			•			Compressor Vapor Injection On (valve energized)[2]
•			•			Condenser Fan On[3]
•			•[4]			Digital Control Valve Modulating (energized)[4]
•[5]	•	•			•	Electric Heaters Pulsing or On (energized)[5]

Table 2. SF Operating Mode Function Chart

Super Freezer Setpoints at -10 C (14 F) and Below			
Cool	**Null**	**Defrost**	**Unit Function**
			Evaporator Fans High Speed[1]
•	•		Evaporator Fans Low Speed[1]
		•	Evaporator Fans Off[1]
			Proportional-integral Derivative (Supply Air) Control
•	•		Return Air Sensor Control
		•	Evaporator Coil Sensor Control
•			Compressors On (Compressor High T and Compressor LowT)
			Compressor Vapor Injection On (valve energized)[2]
•			Condenser Fan On[3]
			Digital Control Valve Modulating (energized)[4]
•			Liquid Injection Valve (energized)
		•	Electric Heaters Pulsing or On (energized)[5]

[1]Setpoint temperature and controlling mode setting determine the evaporator fan speed:

- Normal Operation: Chill Loads - High or low speed fans; Frozen Loads - Low speed fans or no fans.

[2]Vapor injection valve:

- Chill, Frozen, or Power Limit Mode: When the cool capacity is 100 percent.
- Compressor High Temperature Protection: When the compressor discharge temperature exceeds 138 C (280 F).

[3]Condenser fan pulses on and off on a 30 second duty cycle to maintain a minimum condenser temperature:

- Chill Loads: Controller maintains a minimum 30 C (86 F) condenser temperature.

- Frozen Loads: Controller maintains a minimum 20 C (68 F) condenser temperature.

[4]Digital Control valve modulates:

- Chill Loads - whenever the unit is in a Cooling mode; Power Limit - whenever the unit is in Power Limit mode.
- Dehumidification: When the Dehumidify mode is set to On, the supply air temperature must be In-range to energize the electric heaters.
  - When the humidity is two percent or more above humidity setpoint, the controller (energizes) the heaters.

[5]Controller energizes electric heaters for heat, defrost and dehumidification:

- Heat mode (compressor off): If supply air temperature is too low, heaters pulse on and off on a 60 second duty cycle.
- Defrost mode: Heaters are on until evaporator coil temperature increases to terminate defrost.

Specifications

System Net Cooling Capacity – Full Cool

Table 3. MAGNUM+ Model – Air Cooled Condensing*

Net cooling capacity at 37.8 C (100 F) ambient temperature at 60 Hz power				
Evaporator Return Air Temperature	**Power requirement Watt**	**Watts**	**KCal/hr**	**BTU/hr**
21.1 C (70 F)	11,500	16,500	13,608	56,700
1.7 C (35 F)	11,000	11,900	10,584	40,945
-17.8 C (0 F)	7,500	7,200	6,300	24,785
-29 C (-20 F)	6,600	5,000	4,360	17,251
-35 C (-31 F)	6,000	4,100	3,528	14,000
-40 C (-40 F)	3,650	3,700	3,184	12,636

*System net cooling capacity with a 38 C (100 F) ambient air temperature.

Table 4. CFF Model – Air Cooled Condensing*

Net cooling capacity at 37.8 C (100 F) ambient temperature at 60 Hz power					
Evaporator Return Air Tempera-ture	**Power require-ment Watt**	**Watts**	**COP**	**KCal/hr**	**BTU/hr**
21.1 C (70 F)	10,650	15,700	1.47	13,500	53,618
1.7 C (35 F)	8,800	11,375	1.29	9,781	38,847
-17.8 C (0 F)	5,690	6,250	1.10	5,374	21,345
-29 C (-20 F)	4,570	4,035	0.88	3,469	13,780

*System net cooling capacity with a 38 C (100 F) ambient air temperature.

System Net Heating Capacity

	60 Hz Power		
	Heating Capacity		
	Watts	Kcal/hr	BTU/hr
MAGNUM+	5,250	4,515	17,914
CFF	5,250	4,515	17,914

*System net heating capacity includes electric resistance rods and fan heat.

MP4000 Controller Specification

Temperature Controller:	
Type	MP-4000 is a controller module for the Thermo King Reefer Units. Additional requirements can be met by means of expansion modules. The MP4000 is solely responsible for temperature regulation of the reefer container, but other monitoring equipment can be used in conjunction with the MP 4000.
Setpoint Range	-40.0 to +30.0 C (-40.0 to +86.0 F) — Magnum+ -30.0 to +30.0 C (-22.0 to +86.0 F) — CFF
Temperature Display Range	-70.0 to +80.0 C (-94.0 to +176.0 F)
Controller Software	
Version	See controller display
Defrost Initiation:	
Evaporator Coil Sensor	**Manual Switch or Demand Defrost Initiation:** Coil must be below 18 C (65 F). Defrost cycle starts when technician or controller requests defrost initiation. **Timed Defrost Initiation:** Coil must be below 4 C (41 F). Defrost cycle starts 1 minute after the hour immediately following a defrost timer request for defrost initiation. For example, if the defrost timer requests a defrost cycle at 7:35, the defrost cycle will start at 8:01. Datalogger will record a Defrost event for each interval in which a Defrost cycle is pending or active (i.e. both the 8:00 and 9:00 data logs).
Demand Defrost	Demand defrost function initiates defrost when: Temperature difference between the return air sensor and defrost (evaporator coil) sensor is too large for 90 minutes Temperature difference between the supply air sensors and return air sensor is too large
Defrost Timer:	
Chilled mode	Evaporator Coil Temperature must be below 5C (41 F) to activate the defrost compressor hour timer.
Chilled Mode (continued)	There is an interval set for defrosting, however, the defrost timer is built intelligent - it detects whether or not there is ice building up on the coil. If there is no ice building up on the coil, it extends the defrost interval, and if there is Ice building up earlier on the coil it reduces the defrost interval. The maximum interval is 48 hours.

Frozen mode	Every 8 hours of compressor operation. Defrost interval increases 2 hours each timed defrost interval. Maximum time interval in Frozen mode is 24 hours.
Reset to Base Time	Defrost timer resets if the unit is off more than 12 hours, setpoint is changed more than 5 C (9 F) or PTI pretrip test occurs.
Defrost Termination:	
Defrost (Coil) Sensor	Chilled mode: Terminates defrost when coil sensor temperature rises to 18 C (65 F). Frozen mode: Terminates defrost when coil sensor temperature rises to 18 C (65 F).
Termination Timer	Terminates defrost after 90 minutes at 60 HZ operation if coil sensor has not terminated defrost (120 minutes at 50 Hz operation)
Power Off	Turning Unit On/Off switch Off terminates defrost
Compressor Shutdown Protection (Auto Reset):	
Stops Compressor	148 C (298 F)
Allows Compressor Start	90 C (194 F)
Bulb Mode:	
Evaporator Fan Speed Settings	**Flow High:** High speed only **Flow Low:** Low speed only **Flow Cycle:** Fans will cycle between low and high speed every 60 minutes
Defrost Termination Temperature Setting	4 to 30 C (40 to 86 F)

Physical Specification

Fresh Air Exchange Venting System (Adjustable):	
MAGNUM+, CFF	0 to 225 m^3/hr (0 to 168 ft^3/min.) @ 60 Hz
Weight (net):	
MAGNUM+, CFF Base Unit	360 Kg (793 lb.)
Water-cooled Condenser-Receiver Option, MAGNUM + and CFF only	13.6 Kg (30 lb.)

Unit Noise and Vibration

Conformity assessment procedure followed	Machinery	Frequency	Sound power level (Sound Power, dB(A))	
ISO 3744:2010			Measured	Guaranteed
	MAGNUM +, CFF	50 Hz	90 dB(A)	91 dB(A)
		60 Hz	95 dB(A)	96 dB(A)

Generated vibration to operator: Negligible

Warranty

Terms of the Thermo King Generator Set Unit warranty are available on request from your local Thermo King dealer.

Maintenance Inspection Schedule

Inspection and Service Intervals

A closely followed maintenance program will help to keep your Thermo King unit in top operating condition.

The following service guide table should be used as a guide when inspecting or servicing components on this unit.

Pretrip	Inspect These Items
	Electrical
•	Perform a controller pretrip inspection (PTI) check.
•	Visually check condenser fan and evaporator fan.
•	Visually inspect electrical contacts for damage or loose connections.
•	Visually inspect wire harnesses for damage or loose connections.
	Refrigeration
•	Check refrigerant charge.
	Structural
•	Visually inspect unit for damaged, loose or broken parts.
•	Tighten unit, compressor and fan motor mounting bolts.

If a unit has been carrying cargo which contains a high level of sulphor or phosphorous (e.g. garlic, salted fish etc.), it is recommended that clean evaporator coil after each trip.

Serial Number Location

Serial numbers can be found on the component's nameplate.

- Electric Motor: Attached to the motor housing.
- Compressor: On front of the compressor.
- Unit: On unit frame in power cord storage compartment.
- Controller: On top of controller.

Component Serial Number Identification

To better identify the different electronic components, our supplier has changed their serial number labeling on the MP4000 controller and power module. The label will show part number, date, and sequence.

MP4000 Controller: New label shows controller ID ABS782800212245390

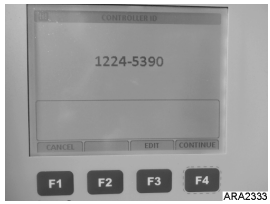
Part number: ABS7828002; Date: 2012 24 wk 1224; Sequence 5390

ID in controller would show 1224-5390

Label on Controller

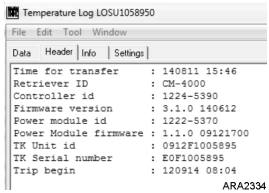
ARA2332

ID in Controller



ARA2333

Controller ID Shown in Datalogger



ARA2334

Recover Refrigerant

At Thermo King®, we recognize the need to preserve the environment and limit the potential harm to the ozone layer that can result from allowing refrigerant to escape into the atmosphere.

We strictly adhere to a policy that promotes the recovery and limits the loss of refrigerant into the atmosphere.

In addition, service personnel must be aware of Federal regulations concerning the use of refrigerants and the certification of technicians. For additional information on regulations and technician certification programs, contact your local THERMO KING dealer.

Notes

Thermo King – by Trane Technologies (NYSE: TT), a global climate innovator – is a worldwide leader in sustainable transport temperature control solutions. Thermo King has been providing transport temperature control solutions for a variety of applications, including trailers, truck bodies, buses, air, shipboard containers and railway cars since 1938. For more information, visit www.thermoking.com or www.tranetechnologies.com.

TK 61959–4–OP-EN 02 May 2022
Supersedes TK 61959–4–OP-EN ((no date found))