

BUS HVAC UNIT OPERATOR's MANUAL

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INTRODUCTION

THERMO ASSISTANCE

Thermo Assistance is a multilingual communication tool designed to put you in direct contact with an authorized Service Dealer should you require one.

To use this system, you need the following information before you call:

- Contact Phone Number
- Type of TK Unit
- Probable Cause of Fault
- If the Unit is Under Warranty
- How You Will Pay for the Repair

Refer to the Thermo King Service Directory.

Give the Thermo Assistance Operator your name and a contact phone number and ask the operator to call you back. Thermo Assistance will then call you back, at which point you can give details of the service required and the repair will be organized.

Please note that Thermo Assistance cannot guarantee payments and that the service is designed for the exclusive use of refrigerated transporters using products manufactured by Thermo King Corporation.

DISCLAIMER

The manufacturer, Thermo King Corporation, assumes no responsibility for any act or action taken on the part of the owner or operator in the repair or operation of the products covered by this manual that are contrary to the manufacturer's printed instructions. No warranties express or implied, including warranties arising from cause of dealing or usage or trade, are made regarding the information, recommendations, and description contained herein. The manufacturer is not responsible and will not be held liable in contract or in tort (including negligence) for any special, indirect, or consequential damages, including injury or damage caused to vehicles, contents, or persons, by reason of the installation of any Thermo King product, its mechanical failure, or the failure of the owner/operator to heed caution and safety decals strategically located on the product.

INTRODUCTION

There is nothing complicated about learning to operate and maintain your new Thermo King unit, but you will find a few minutes spent studying the contents of this book will be time well spent.

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

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

1. They are equipped with the factory recommended tools to perform all service functions.
2. They have factory trained and certified technicians.
3. They are stocked with genuine Thermo King replacement parts.
4. The warranty on your new unit is valid when the repair and/or replacement of component parts is performed by an Authorized Thermo King dealer.

A closely followed maintenance program will also help keep your unit in top operating condition. If factory recommended procedures are followed, you will learn that you have purchased the most efficient and dependable device.

GENERAL OPERATION

In Air conditioning, temperature control is based on two values: The setting (Setpoint) of the electronic thermostat and the inside temperature of the cab. The difference between these two temperatures will determine the mode of operation: cool, heat, or null.

Cool: When the temperature in the cab compartment is higher than the setpoint, the unit runs in cool mode to reduce the return air temperature.

Heat: When the temperature in the cab compartment is lower than the setpoint, the unit changes to heat mode to raise the return air temperature.

Auto/Reheat: The unit cools or heats the bus compartment automatically according to the thermostat requirements.

Range of temperatures: Temperatures can be controlled from 18 °C to 27 °C (64 °F to 81 °F).

WARRANTY

Should you require warranty service or repair during the warranty period, simply present your copy of the Warranty Certificate at any of the Thermo King dealers. They will be happy to help you in accordance with the summary below.

WARRANTY SUMMARY

Full terms of the Thermo King Limited Warranty are available from your Thermo King dealer. The unit and its basic components are warranted to be free from defects in material and workmanship from the date in service for 12 months.

Note: Parts replacements or repairs under warranty must be performed by an authorized Thermo King dealer.

Note: Warranty term and times are subject to change.

SAFETY PRECAUTIONS

SAFETY PRECAUTIONS

Thermo King recommends that all services be performed by a Thermo King dealer. However, there are several general safety practices which you should be aware of:

1. When working with or around the refrigeration system, always wear goggles or safety glasses.
2. Refrigerant or battery acid can cause permanent damage if they come in contact with your eyes.
3. Never run the unit with the compressor discharge valve closed.
4. Keep your hands and loose clothing clear of fans and belts at all times when the unit is running.
5. If you need to drill holes in your unit for any reason, use extreme caution. You could be weakening structural components. Drilling into electrical wiring or refrigerant lines could cause a fire.
6. It is recommended that any service work on evaporator or condenser coils be left for the certified Thermo King technician but, should you need to work around the coils, use extreme caution as exposed coil fins can cause painful lacerations.

Automatic Start/Stop Operation

This unit may start automatically at any time when the unit ON/OFF switch is in the ON position. Be sure to switch the unit ON/OFF Key to OFF before performing any maintenance and/or inspection procedures.

REFRIGERANT

Although fluorocarbon refrigerants are classified as safe, observe caution when working with refrigerants or around areas where they are being used in the servicing of your unit.

Fluorocarbon refrigerants evaporate rapidly, freezing anything they come into contact with, if accidentally released into the atmosphere from the liquid state.

The Fluorocarbon refrigerants used in the air conditioning units may produce toxic gases which, in the presence of an open flame or electrical short, become severe respiratory irritants capable of causing death.

FIRST AID - REFRIGERANT

EYES: If liquid comes into contact with the eyes, flush with large amounts of water and get prompt medical attention.

SKIN: Flush affected area with large amounts of lukewarm water and keep cool. Cover burns with dry, sterile, bulky dressings to protect from infection or injury. Get medical attention.

INHALATION: Move victim to fresh air and restore breathing if necessary. Stay with victim until arrival of emergency medical personnel.

REFRIGERANT OIL

Always observe the following directions when working with refrigerant oil:

EYES: Avoid contact of refrigerant oil with eyes.

SKIN: Do not allow prolonged or repeated contact with skin or clothing.

IRRITATION: To prevent irritation, wash thoroughly immediately after handling.

FIRST AID - REFRIGERANT OIL

EYES: Immediately flush eyes with large amounts of water for at least 15 minutes while holding the eyelids open. Get prompt medical attention.

SKIN: Remove contaminated clothing. Wash thoroughly with soap and water. Get medical attention if the irritation persists.

INHALATION: Move victim to fresh air and restore breathing if necessary. Stay with victim until arrival of emergency personnel.

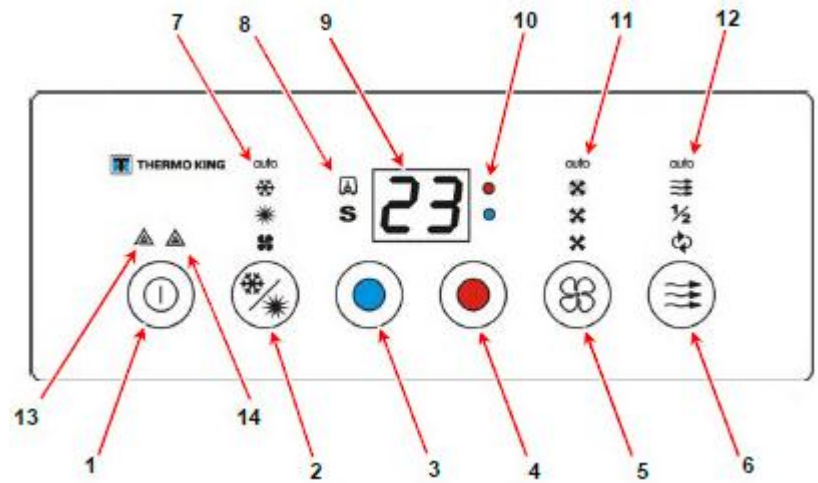
INGESTION: Do not induce vomiting. Contact local poison control center or physician immediately.

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.

CLIMAAIRE ID CONTROLLER

ClimaAire ID Controller Overview



1	ON/OFF key	8	Temperature icons
2	Mode selection key (ESCAPE)	9	Display
3	Temperature key (blue) (DOWN key)	10	Clutch & Boost pump icons
4	Temperature key (red) (UP key)	11	Blower mode icons
5	Blower speed key (ENTER)	12	Fresh air mode icons
6	Fresh air select key	13	Red alarm
7	A/C mode icons	14	Yellow alarm

Control Panel Description



ON/OFF KEY

To turn the unit **ON**, press the key.

To turn the unit **OFF**, press the key again.



MODE SELECTION KEY

auto

Reheat/Auto Mode: The unit will cool or heat the bus automatically (according to thermostat requirements).



A/C Mode: The unit will operate in cool mode.



Heat Mode: The unit will operate in heat mode.



Ventilation Mode: Only the blowers are operating.



Down Key: Decrease the temperature.



Up Key: Increase the temperature.



Blower speed key

auto

Automatic blower speed



High blower speed



Medium blower speed



Low blower speed



Fresh Air select key

auto

Automatic: Fresh air is automatically controlled in passenger compartment



Fresh Air damper is open.



Fresh air damper is open at 50%.



Recirculated Air: Fresh air damper is closed.



Red alarm indicator



Yellow alarm indicator



Display: Return air temperature icon



Setpoint icon



Red - Boost pump icon



Blue - Compressor clutch icon

ClimaAire ID Diagnostic System

After start the driver panel is in normal operating mode. In the normal operating mode is running the built-in diagnostic system.

The ClimaAIRE I D driver panel uses dual alarm system with two levels of signals:

WARNING (yellow alarm symbol)

ALARM (red alarm symbol)

When any red alarm (ALARM) appears the alarm code will be blinking on the display until some button is pushed. If any yellow alarm (WARNING) appears the alarm code will be blinking on the display for 5 sec.

The alarm codes are stored in the memory to identify possible fault conditions. Up to 40 alarms codes can be stored. The records can be displayed on the driver panel with the procedure described above. The complete history can be read by the PC only.

Alarms description

The WARNING (yellow alarm) symbol will be ON in the case of:

1. Low value of any temperature sensor:
 - Temperature sensor defect
 - Short circuit of the harness to sensors
 - Temperature is lower than -35 °C (-31 °F) – resistance of the sensor or of the total circuit is lower than 1,25 KOhm
2. High value of any temperature sensor:
 - Temperature sensor defect
 - Open circuit of the harness to sensors
 - Temperature is higher than 75 °C (167 °F) – resistance of the sensor or of the total circuit is higher than 2,9 KOhm

With yellow alarm conditions the unit will continue in operation with the wrong data from the sensor.

The ALARM (red alarm) symbol will be ON or blinking in the case of:

- HPCO or LPCO switch is open longer than 10 minutes (alarm code 6)
- HPCO or LPCO switch is cycling -switched OFF 5 times per 10 minutes (alarm code 5)
- Inverter alarm (alarm code 31 - 37, special program for electric bus units only)

Any red alarm will switch the unit to the VENTILATION mode with automatic

blower speed. The driver can change the blower speed manually. The compressor and condenser fans are stopped.

The alarm symbols can be removed by restart of control system (use the ON/OFF key to switch OFF, wait for 2 seconds, switch (ON). After restart - if the reason for alarm is still in existence - the alarm symbol can appear again. If the alarm comes up again, don't restart the unit more times. In that case immediately contact the service department or Thermo King Representative.

For detail list and description of alarms refer to ClimaAIRE ID Service Manual (TK 60020-3-MM).

Alarm Code	Name	Symbol	Description
01-04	not used	-	
05	Clutch cycling	RED	HPCO or LPCO switch is switched off 5 times per 10 minutes
06	Long delay of HPCO or LPCO	RED	HPCO or LPCO switch is switched off longer than 10 minutes
07	RTS Low	YELLOW	RTS: Return Air Temperature CTS: Evaporator Coil Temperature ATS: Ambient (Fresh) Air Temperature Low = short circuit or temperature is lower than -35 °C (the limit value is -35 °C) High = open circuit (disconnected sensor) or temperature is higher than 75 °C (the limit value is 75 °C)
08	RTS High	YELLOW	
09	CTS Low	YELLOW	
10	CTS High	YELLOW	
11	ATS Low	YELLOW	
12	ATS High	YELLOW	
13 - 30	not used	-	
31 - 37	Inverter Alarms	RED	for SR10E only

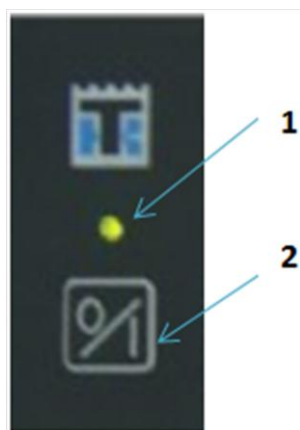
SMARTAIRE CONTROLLER

SmartAire Control System Overview



1	ON/OFF Key	10	Medium fan speed indicator
2	Mode selector	11	Low fan speed indicator
3	Auto Mode indicator	12	Air Selector Key
4	Cooling Mode indicator	13	Auto air indicator
5	Heating Mode indicator	14	Fresh air indicator
6	Ventilation Mode indicator	15	Recirculating air indicator
7	Fan Speed selection button	16	Temperature adjust key
8	Auto fan speed indicator	17 18 19	Temperature indicators
9	High fan speed indicator	20	System indicator

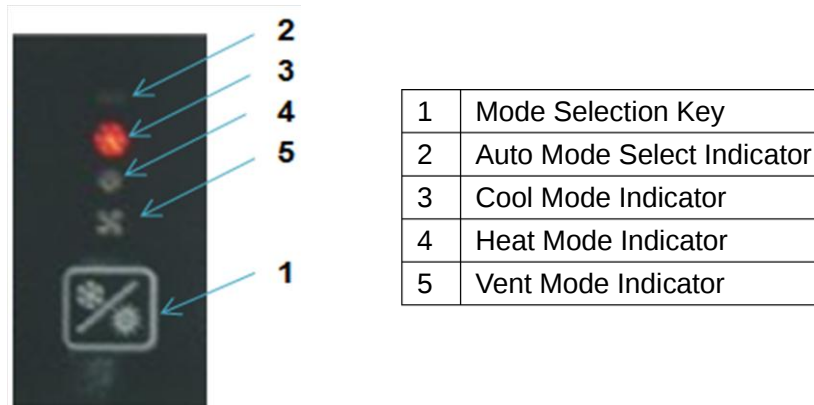
Startup / Stop the Unit



1	System Indicator
2	ON/OFF key

When the key is in the ON position, the system is powered on. The system indicator above the key is on. When the key is in of OFF position, power supply is off, the system is shut down, and the unit is not operating. The indicator above the key is off.

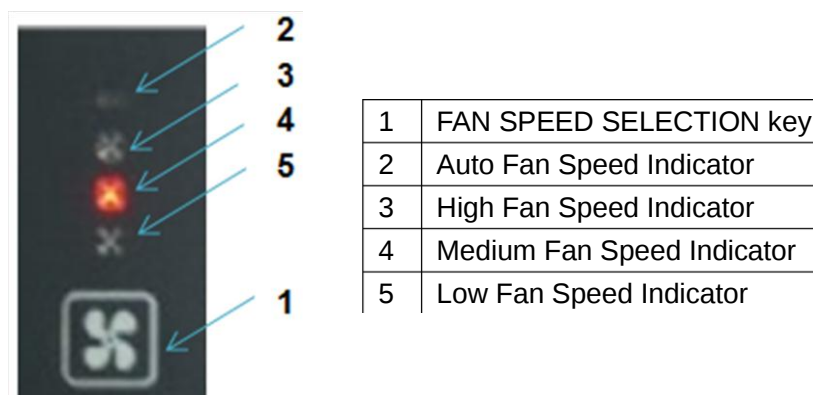
Selecting Operating Mode



Press the **MODE SELECTION** key until the desired mode LED is illuminated.

- Auto Mode: In Auto Mode, the unit cools or heats the passenger compartment as per set point temperature (for the unit with heating capability only).
- Cool Mode: In Cool Mode, the unit cools the passenger compartment as per set point temperature
- Heating Mode: In Heating Mode, the unit heats the passenger compartment as per set point temperature (for the unit with heating capability only).
- Vent Mode: In this mode, only the Evaporator blowers run to make the air circulate through the passenger compartment.

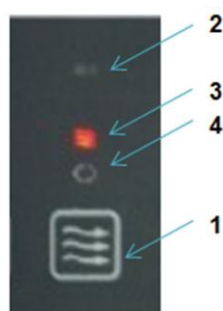
Selecting Fan Speed



Press the **FAN SPEED SELECTION** key until the desired speed LED is illuminated.

- **Auto Fan Speed Indicator:** this indicator is illuminated when this speed is selected with Fan Speed Select Key. The Evaporator fans are controlled automatically.
- **High Fan Speed Indicator:** this indicator is illuminated when this speed is selected with Fan Speed Select Key. The Evaporator fan runs at high speed.
- **Medium Fan Speed Indicator:** this indicator is illuminated when this speed is selected with Fan Speed Select Key. The Evaporator fan runs at medium speed.
- **Low Fan Speed:** this indicator is illuminated when this speed is selected with Fan Speed Select Key. The Evaporator fan runs at low speed.

Selecting Fresh/Recirculated Air

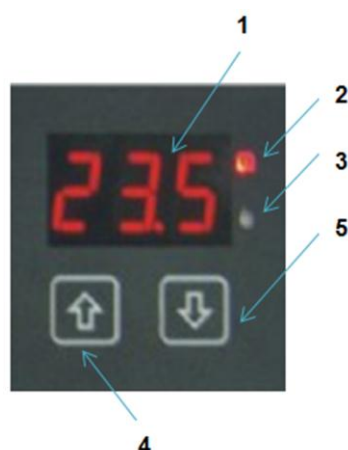


1	Air Selection Key
2	Auto Air Indicator
3	Fresh Air Indicator
4	Recirculated Air Indicator

Press the **AIR SELECTION** key until the desired air selection LED is illuminated.

- **Auto Air Indicator:** this indicator is illuminated when Auto Air is selected with Air Select Key. The internal air motion is in automatic control as per the passenger compartment condition.
- **Fresh Air Indicator:** this indicator is illuminated when Fresh Air is selected with Air Select Key. The outside air is brought into the passenger compartment.
- **Re-circulate Air Indicator:** this indicator is illuminated when Re-circulate Air is selected with Air Select Key. The air is recycled within the passenger compartment.

Setup of Bus Temperature



1	Digital display
2	Bus Temperature Indicator
3	Setpoint Temperature Indicator
4	UP Key
5	DOWN Key

Set up of temperature in the compartment. Temperature setup range is between 17°C and 27°C (unable to set up under Vent Mode).

Up Key increases the setpoint temperature.

DOWN Key reduces the setpoint temperature.

When operating the above said two keys, setpoint temperature indicator is illuminated automatically. The digital display shows the preset temperature. After operation, the passenger compartment temperature is showed automatically.

Alarm code

In alarm status, System Indicator flashes while the digital display shows failure codes:

E01	High / Low Pressure off long time
E02	Clutch Turns on and off frequently
E04	Abnormal Returned Air Temperature Sensor
E05	Abnormal Evaporator Temperature Sensor

1. High / Low Pressure Off long time (E01)

Failure cause: High and Low Pressure Valve off over 10 minutes.

Remedy: Automatically switch to ventilation mode. Failure code is displayed. Alarm cancelled after shutting off.

2. Clutch Turns on and off Frequently (E02)

Failure cause: Clutch turns on and off more than 5 times within 10 minutes.

Remedy: Automatically switch to ventilation mode. Failure code is displayed. Alarm cancelled after shutting off.

3. Abnormal Returned Air Temperature Sensor (E04)

Failure cause: The value of Returned air sensor is lower than 1.25 k ohm (RTS <-35 °C or sensor is in short-circuit) or higher than 2.9 k ohm (RTS >75 °C or sensor is in open-circuit).

Remedy: Operation continues with failure code displayed.

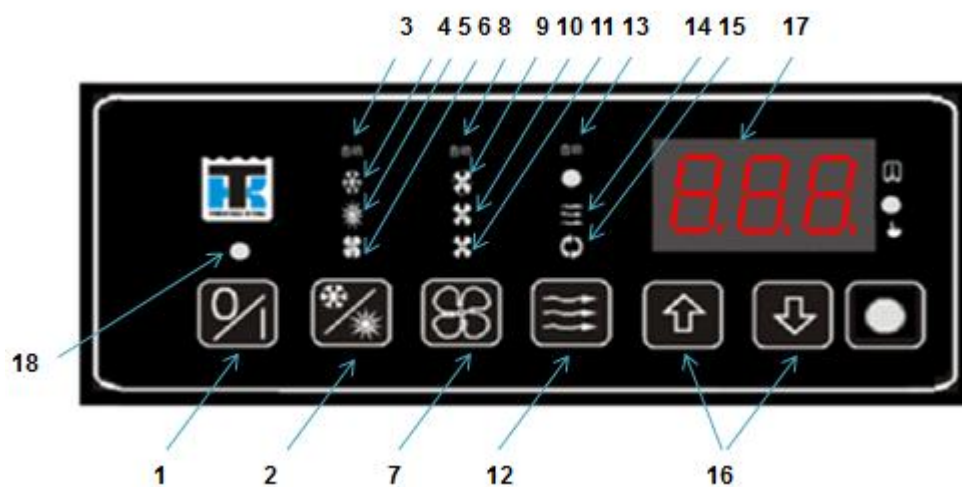
4. Abnormal Evaporator Temperature Sensor (E05)

Failure cause: Evaporator sensor value lower than 1.25 k ohm (CTS <-35°C or sensor short-circuit) or higher than 2.9 k ohm (CTS >75°C or sensor Open-circuit).

Remedy: Operation continues with failure code displayed. Occurs, the unit switches to vent mode. To restart the unit in normal operating mode, press the ON / OFF key. If the unit will not start, consult an authorized Thermo King technician.

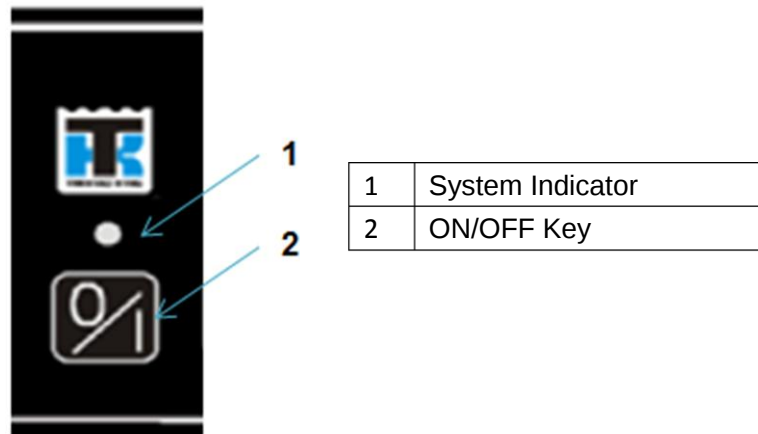
SMARTAIRE II CONTROLLER

SmartAire II Controller Overview



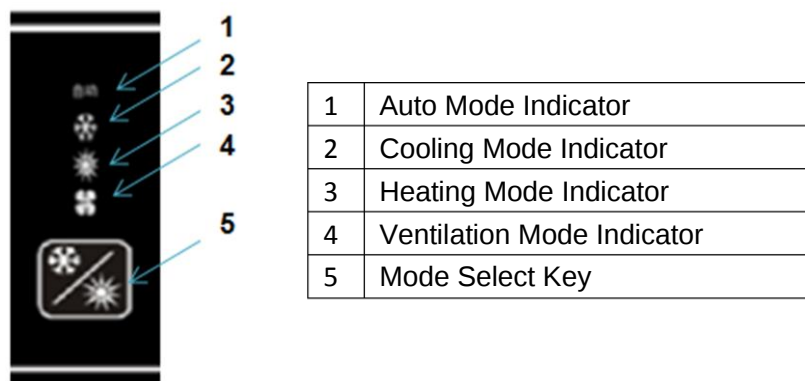
1	ON/OFF Key	10	Medium Fan Speed Indicator
2	Mode Select Key	11	Low Fan Speed Indicator
3	Auto Mode Indicator	12	Air Select Key
4	Cooling Mode Indicator	13	Auto Air Indicator
5	Heating Mode Indicator	14	Fresh Air Indicator
6	Ventilation Mode Indicator	15	Recirculated Air Indicator
7	Fan Speed Select Key	16	Temperature Adjust Keys
8	Auto Fan Speed Indicator	17	Temperature Indicators
9	High Fan Speed Indicator	18	System Indicator

Startup / Stop the Unit



ON/OFF Key: when the key is in the ON position, the system is powered on. The system indicator above the key is on. When the key is in of OFF position, power supply is off, the system is shut down, and the unit is not operating. The indicator above the key is off.

Selecting Operating Mode

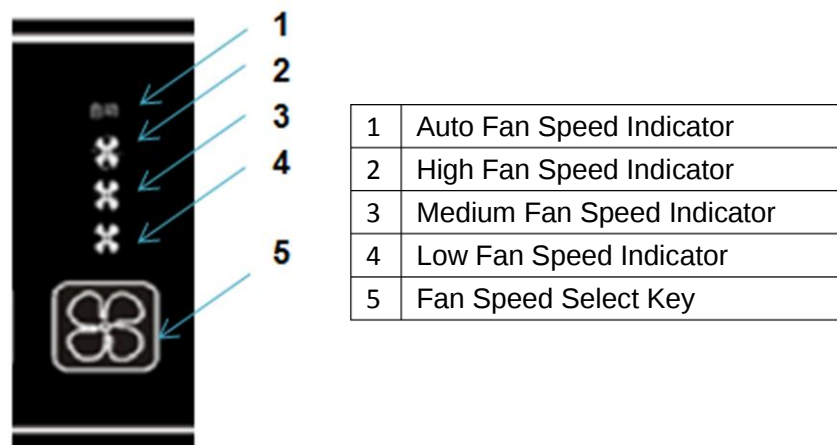


Mode Select Key: for mode selection of auto, cooling, heating or ventilation.3.

Auto Mode Indicator: this indicator is illuminated when the desired mode is selected with Mode Select Key. In this mode, unit is automatically controlled as per thermostat setting.

- **Cooling Mode Indicator:** this indicator is illuminated when the desired mode is selected with Mode Select Key. In this mode, the unit cools the bus as per the setting.
- **Heating Mode Indicator:** this indicator is illuminated when the desired mode is selected with Mode Select Key. In this mode, the unit heats the bus as per the setting.
- **Ventilation Mode Indicator:** this indicator is illuminated when the desired mode is selected with Mode Select Key. In this mode, only the evaporator fan is working for air circulation within the bus compartment.

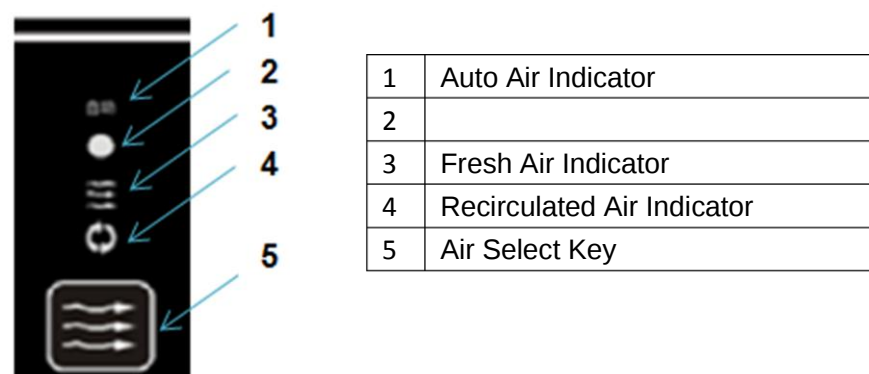
Selecting Fan Speed



Fan Speed Select Key: select evaporator fan speed in the modes of auto, high, medium or low.

- **Auto Fan Speed Indicator:** this indicator is illuminated when this speed is selected with
- Fan Speed Select Key. The evaporator fans are controlled automatically depending on the thermostat setpoint and bus condition.
- **High Fan Speed Indicator:** this indicator is illuminated when this speed is selected with Fan Speed Select Key. The evaporator fans run at high speed.
- **Medium Fan Speed Indicator:** this indicator is illuminated when this speed is selected with Fan Speed Select Key. The evaporator fans run at medium speed.
- **Low Fan Speed Indicator:** this indicator is illuminated when this speed is selected with Fan Speed Select Key. The evaporator fans run at low speed.

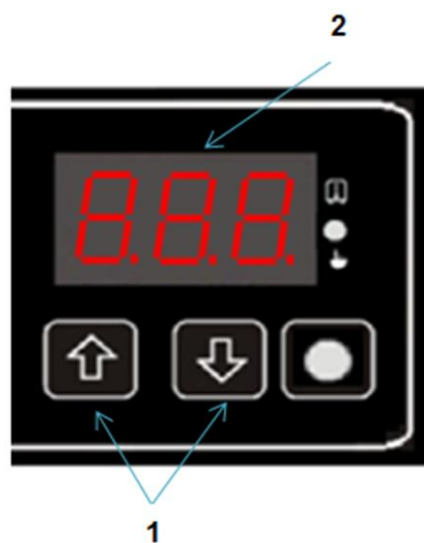
Selecting Fresh/Recirculated Air



Air Select Key: select modes for auto, fresh air or Recirculated Air.

- **Auto Air Indicator:** this indicator is illuminated when Auto Air is selected with Air Select Key. The internal air movement is in automatic control as per the bus condition.
- **Fresh Air Indicator:** this indicator is illuminated when Fresh Air is selected with Air Select Key. The outside air is brought into the bus.
- **Recirculated Air Indicator:** this indicator is illuminated when Recirculated Air is selected with Air Select Key. The air is recirculated within the bus.

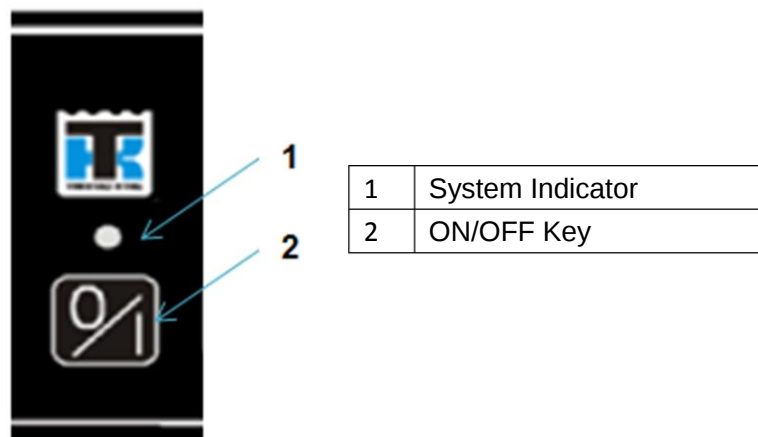
Setup of Bus Temperature



1	Temperature Adjust Keys
2	Temperature Indicators

- **Temperature Setup Key:** set temperature inside of the compartment. UP key increases temperature, DOWN key decreases temperature. Temperature setup range is between 17°C and 27°C. For articulate unit, default display is for the front zone. Click DOWN key for 3 seconds, it will display the temperature of rear zone.
- **Temperature Indicators:** when the system is working normally, the actual temperature inside of the compartment or setpoint temperature is shown.

System Indicator



System Indicator: the indicator for the system operation. When system is on, this indicator light; when system is off, this indicator turns off; when there is failure with the system, this indicator flashes. Meanwhile indicator 17 displays error code “EXX” (XX means an integer. Refer to the alarm status).

Alarm Status

In alarm status, system indicator flashes while the digital display shows error codes:

E01	High/Low Pressure Switch Shutdown
E02	Clutch Cycles Frequently
E04	Abnormal Return Air Temperature Sensor 1
E05	Abnormal Evaporator Temperature Sensor
E06	Abnormal Ambient Temperature Sensor
E07	Abnormal Return Air Temperature Sensor 2
E08	Over voltage of Alternator

1. High/Low Pressure Switch Shutdown (E01)

Failure cause: High and Low pressure Value off over 10 minutes.

Remedy: Automatically switch to ventilation mode. Error code is displayed.
Alarm cancelled after shutting off.

2. Clutch Cycles on and off frequently (E02)

Failure cause: Clutch cycles on and off more than 5 times within 10 minutes.

Remedy: Automatically switch to ventilation mode.

Error code is displayed. Alarm cancelled after shutting off.

3. Abnormal Evaporator Coil for freezing (E03)

Failure cause: Evaporator coil temperature is lower than minus 3°C .

Remedy: The compressor clutch and condenser fans will be automatically switched off.
Evaporator speed and fresh air will not change.
Error code won't display.

4. Abnormal Return Temperature Sensor 1 (E04)

Failure cause: The value of return air sensor is lower than 1.25k ohm (RTS1<-35°C or sensor is in short-circuit) or higher than 2.9k ohm (RTS1>75°C or sensor is in open-circuit)

Remedy: operation continues with error code displayed.

5. Abnormal Evaporator Temperature Sensor (E05)

Failure cause: Evaporator sensor value lower than 1.25k ohm (CTS<-35 °C or sensor is in short-circuit) or higher than 2.9k ohm (RTS>75°C or sensor is in Open-circuit)

Remedy: Operation continues with error code displayed.

6. Abnormal Ambient Temperature Sensor (E06)

Failure cause: Ambient sensor value lower than 1.25k ohm (ATS<-35°C or sensor is in short-circuit) or higher than 2.9k ohm (ATS>75°C or sensor is in open-circuit)

Remedy: Operation continues with error code displayed. If the ambient temperature is lower than 7°C , the compressor clutch will not start.

7. Abnormal Return Temperature Sensor 2 (E07)

Failure cause: The value of return air sensor is lower than 1.25k ohm (RTS2<-35°C or sensor is in short-circuit) or higher than 2.9k ohm (RTS2>75°C or sensor is in open-circuit)

Remedy: Operation continues with error code displayed.

8. Over Voltage of alternator (E08)

Failure cause: Output is higher than 33V for 5 seconds, it will be high voltage protection.
Output is higher than 40V for 0.3 seconds, it will be over voltage protection.

Remedy: Automatically switch to low speed. Error code will display.

INSPECTION RECOMMENDATIONS

To keep the correct functions of the A/C unit you must periodically execute the following maintenance procedures. The schedules should be used during the initial service periods (at least during warranty period).

Off Season Operation of Bus Air Conditioning System

In order for the A/C system to be ready for operation, normal preventive maintenance is necessary operate all systems periodically, especially during the off season. By operating the system weekly for short intervals (5 to 10 minutes) year round, the internal parts of the compressor will remain lubricated. Offseason operation also helps to reduce compressor shaft seal leakage and allows early detection of refrigerant loss.

MAINTENANCE INSPECTION SCHEDULE

Intervals

The following intervals are just a recommendation. The periods may vary - this depends on ambient conditions, pollution or local transportation laws. Please use common sense then judging replacement of filters and cleanliness based on first four months of service.

If you need any help please contact Thermo King Representative or Service.

Refrigeration System

Monthly 10,000 km	Quarterly 30,000 km	Annually	Procedure - Required Activity - Corrective Action
			• Check refrigerant charge. Make sure discharge pressure is • Under 430 psig (2964 KPa) on R-407c systems. NOTE: This should be done twice monthly during air conditioning season. • Visually inspect condition of refrigerant hoses and tubing. • Visually inspect for leaks of refrigerant and oil. • Check dry eye in the liquid line sight glass for moisture content. • Install service gauge manifold set and check system operating pressures, temperatures and suction line conditions. • Replace filter-drier (liquid line dehydrator). NOTE: The filter-drier should be changed anytime the system is opened.

Electrical and Control System

Monthly 10,000 km	Quarterly 30,000 km	Annually	Procedure - Required Activity - Corrective Action
	Semi-annually Semi-annually		• Check evaporator blower motors speed, voltage and amperes (all motors). • Check condenser fan motor speed, voltage and amperes (all motors). • Inspect all wires and terminals for damage or corrosion. If corrosion is present, clean terminals with electrical contact cleaner. • Check condenser pressure switch/condenser motor high and low speed operation. • Check HPCO and LPCO pressure switches.

Structural - Mechanical Parts

Monthly 10,000 km	Quarterly 30,000 km	Annually	Procedure - Required Activity - Corrective Action
			• Inspect condenser coils for cleanliness. • Inspect all evaporator coils for cleanliness. • Visually inspect unit for loose, damaged or broken part, bolts and rivets. • Clean or replace air filters (more frequently if necessary). Clean condenser and evaporator drains. Make sure the evaporator drain hose check valves (kazoos) are in place and in good condition. • Clean condenser and evaporator coils. • Tighten all compressor, blowers, fans motor, covers and unit mounting bolts and brackets (more frequently if necessary).