

MEDI-KOOL™

Rx CLIMATE CONTROL UNITS

**INSTALLATION INSTRUCTIONS
AND OWNER'S MANUAL**



PRODUCED BY:

**MERMAID MANUFACTURING OF
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FOR TECHNICAL ASSISTANCE PLEASE CALL

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IMPORTANT UPDATES FOR MERMAID MANUFACTURING:

As of 09/2015 Mermaid Manufacturing no longer uses Danfoss BD35/BD50 compressors or modules. Each product as of 09/2015 uses a Masterflux Cascade compressor on each unit.

Current Cascade compressor information can be found on page 12-13.

Due to the change of our compressor, each Medi-Kool control board will now preform a 4 minute delay. When the cabinet reaches temperature, the control board will shut down the unit which will allow the compressor to sit dormant for 4 minutes. This is a requirement in order for the compressor to not overheat. No significant loss of temperature will occur. If your cabinet drops anywhere below 10° within 4 minutes of delay, please contact Mermaid. (see front page for contact information)

WARRANTY INFORMATION

Should your Medi-Kool product fail to function (due to a defect in material or workmanship) within one year from the date of manufacturing, MERMAID MANUFACTURING OF S.W. FL, INC. (hereafter "MERMAID") will replace or repair (at MERMAID'S discretion) any defective parts free of charge after written notice to MERMAID of your intent to ship the product back to our factory with transportation charges pre-paid. All units are shipped and sent via LTL Freight, in a box on a pallet for safe keeping. We will not accept any repair units via "ground" shipping!

Mermaid agrees to pay freight shipping to and from the customer within the first year. After the first year, Mermaid will not be responsible for shipping, but will still service the unit free of charge up to FIVE YEARS, as long as it's deemed a manufacturer defect. After FIVE YEARS, labor charges of \$75.00 per hour will be applicable along with parts costs. This also applies if it is not a manufacturer defect.

Mermaid is not responsible for the installation or de-installation of the unit. Mermaid is not responsible for labor reimbursement.

Control boards are covered for one-year. We do have the ability to repair control boards. After our standard one-year, if the control board fails, there is \$100.00 charge for control board repairs. Tecumseh compressors are covered for one year.

The one year provision of this limited warranty shall be void if either the circuit board or any major component has been damaged after the sale, subjected to unreasonable or abnormal use or operation, altered, repaired by anyone other than MERMAID without the company's consent, wired with undersized wire (consult factory for questions and/or see "WIRING INSTRUCTIONS" as laid out in this guide), or installed or used other than as indicated in this installation and user's guide

Limitation of Liability: Mermaid is dedicated to manufacturing quality marine and medical related products. In no event shall Mermaid be liable for any indirect, incidental or consequential damages arising out of any sale or operation of the products sold and/or installed. The purchaser or the user will hold Mermaid harmless of any incident caused by the failure of the Mermaid product up to and including injury or death. And in no event shall Mermaid's obligation exceed the value of the product(s) sold.

INSTALLATION:

- 1) Based on your MK model's dimensions, please determine the "cut out" dimensions for your cabinet. Please be sure to include enough space for the compressor.
Compressor Left, Right, Rear: 13" Wide x 7" Deep x 7 1/2" High
Compressor Top: 13" Wide x 7" Deep x 8 1/2" High
- 2) Determine how you will supply power to the location.
- 3) Based on the compressor, find a location for a "vent" to allow airflow to compressor. (see venting below) **THIS IS A CRITICAL REQUIREMENT.**
- 4) How will the unit be mounted? Each unit comes with at least a 1" flange around the cabinet for proper mounting. Ensure the location is strong enough to accommodate the weight of the unit.
(If needed, please install a support block under the body of the unit. This will alleviate the pressure on the mounting flange)
- 5) Choose a location for the Medi-Kool™ temperature control panel. Each unit is pre-wired using 5' of cable and protected using an 10 amp fuse. It is important not to damage the control panel nor disturb the wiring on the rear of the unit. If a longer cable is needed, please contact us immediately. **DO NOT SPLICE THE WIRES IN ANY SITUATION.**
Failure to follow these instructions will void all warranties on the product.

VENTING:

Venting your Medi-Kool unit is extremely important. The compressor needs proper airflow in order to maintain operation. Without airflow, the compressor will overheat; causing unit failure.

- 1) Outside venting is always the preferred form of venting the compressor units on each product however, if outside ventilation is not possible ensure a **minimum** of 36 square inches of airflow reaches the compressor compartment for adequate cooling. **INLET AND OUTLET VENTS REQUIRED.**
- 2) If the 36 square inches surrounding the compressor is not able to be met, an auxiliary fan may be required to vent the compressor compartment. **PROPER VENTILATION IS REQUIRED FOR COMPRESSOR AND UNIT OPERATION.**
- 3) Should you experience the system not operating properly, verify that the venting area is not obstructed or the auxiliary fan (if installed) has not stopped performing. **Failure to vent the unit properly voids all warranties!**

WIRING:

- 1) Hard wire the Medi-Kool™ electrical connection to the 12-Volt DC power source on the vehicle. The back of each unit will have a (+) and a (-) label indicating where the power for the vehicle is to be placed. They will be near the white terminal block. If possible, use copper conductors with a minimum of #14 AWG wire. The longer the wire length from the power source to the unit, the thicker the gauge wire is needed. **IT IS RECOMMENDED NOT TO EXCEED 15 FEET OF WIRE, HOWEVER, SHOULD THE CIRCUMSTANCE ARISE, ENSURE YOU HAVE UPGRADED THE GAUGE OF YOUR 12-VOLT DC WIRE.**
- 2) Dual Temp units require a separate power supply for each compressor. You cannot run a Dual Temp unit through one power supply, this will result in failure.
- 3) A constant 12VDC power supply is recommended to ensure uninterrupted operation of the Mermaid Medi-Kool™ units. If a battery isolator is required, ensure the operator understands programming the Medi-Kool™ control board may be required on re-start.

See WIRING DIMENSIONS under TROUBLESHOOTING SECTION for additional information.

- 3) The digital control panel has quick connect fittings for ease of installation. Should the wires need to be removed for installation, ensure the proper leads are replaced in their respective points. **FAILURE TO RE-CONNECT THE WIRES PROPERLY WILL RESULT IN AN OPERATIONAL FAILURE OF THE COMPRESSOR.**
- 4) Beginning in May of 2006 we no longer put the gray thermostat cable in the quick connect harness. It is now the installer's responsibility to connect the black terminal block on the gray thermostat cable to the back of the Medi-Kool™ circuit control board. There is a white label on the cable indicating exactly where the terminal connects to the board. The connection is on the terminal on the back of the board. The black terminal block on the gray cable has a small "snap-in" connection to it. **Ensure the terminal is put on the proper way or false readings will be read on the digital display.**

DO NOT CUT OR SPLICE THE GRAY THERMOSTAT CABLE OR THE PRE-MADE WIRING HARNESS. FAILURE TO FOLLOW THIS INSTRUCTION WILL VOID ALL WARRANTY.

SETTING PARAMETERS FOR CONTROL BOARD

NOTE: Each board will perform a 4 minute delay before turning the compressor back on once the cabinet has reached temperature. This feature is necessary in order for the compressor to function.

1. Make sure ALL power, thermostat, and White Molex plug connections are made.
2. Turn the POWER/RESET SWITCH on.
 - a. Display will show set temperature (top left number), current temperature (middle number) and memory used (upper right corner - 0% on new boards).
 - b. Display will also show date (lower left) and time (lower right) TIME IS USING A 24 HOUR FORMAT. These will need to be set upon initial use of the Mermaid Medi-Kool™ board. Follow instruction below to set each prompt.
3. To Set Temperature:
 - a. Push dial once, "Set Temp" will display with an arrow pointing left and right.
 - b. Push dial again. "Set Temp" will display again with set temp now showing. Turn dial clockwise or counterclockwise to set desired cabinet temperature.
 - c. Once set, push dial again. This will lock in set temperature.
 - d. Rotate dial clockwise our counterclockwise to "Exit" prompt and push dial.
4. To Set Date:
 - a. Push dial once, rotate dial ONCE clockwise "Set Date" will display with an arrow pointing left and right.
 - b. Push dial again. "Set Year" will display again with "YY and a number. Turn dial clockwise or counterclockwise to set current year.
 - c. Once set, push dial again. "MM/DD and set date will display.
 - d. Turn dial clockwise or counterclockwise to set month. Push dial again to save and rotate dial again to set day.
 - e. Once complete, push dial again "Set Date" will display. Rotate dial to "Exit" prompt.
5. To Set Time:
 - a. Push dial once, rotate dial TWICE clockwise "Set Time" will display with an arrow pointing left and right.
 - b. Push dial again. "Set Hour" and "hh:mm" will display with default time. Turn dial clockwise or counterclockwise to set Hour.
(NOTE: time is displayed in a 24 hour format)
 - c. Once set, push dial again to set Minute.
 - d. Push dial again to finish Hour and Minute setting.
 - e. Set Time will show on the screen again.
 - f. Rotate dial clockwise our counterclockwise to "Exit" prompt and push dial.

6. **To Transmit Log: Click or go here:** http://www.mmair.com/medical_division and select the unit of choice on the left tab menu. Under each unit are the USB Download Instructions.

OR – Click here: <http://mmair.com/content/download/476/4668/file/Medi-Kool%20USB%20Download%20Instructions.pdf>

7. **To Erase Log:**

- a. Push dial once, rotate dial FOUR times clockwise “Erase Log” will display with an arrow pointing left and right.
- b. Push dial once. “Are you sure? N” will display.
- c. Turn dial clockwise to “Y” if you are sure you want to Erase Log/Memory.
- d. If “NO” simply push dial again to go back to main “Erase Log” screen.
- e. Rotate dial again to “Exit” and push the dial.
- f. If “YES” simply push the dial and the Log/Memory will permanently erase. This data **cannot** be recovered if erased.

8. **To Set Key Code:**

- a. Push dial once, rotate dial FIVE times clockwise “Set key code” will display with an arrow pointing left and right.
- b. Push dial once and “Code 00” will display.
- c. Turn dial clockwise to set desired key code. **Remember this number! It cannot be cleared without a software re-write. This is NOT a warranty issue.**
- d. Once set, push dial again. “Set key code” will display again. Rotate dial clockwise or counterclockwise to “Exit” prompt. Push dial to return to main screen. **Key code is now set and needs to be remembered!**

9. **Celsius / Fahrenheit**

- a. Push dial once, rotate dial SIX times clockwise “Set °C / °F” will display with an arrow pointing left and right.
- b. Push dial once and “Celsius” will display.
- c. Turn dial clockwise to see “Fahrenheit”.
- d. Once you choose the corresponding Temperature Scale, push dial again. “Set Temperature” will display again. Rotate dial clockwise or counterclockwise to set temp. Push dial.
- e. Rotate dial counterclockwise to see the “Exit” prompt. Push dial to return to main screen.

9. **Exit Prompt:**

- a. Exit prompt take the operator back to the main display screen. If at anytime the operator is unsure of the setting, use “Exit” to start again. No harm can be done to the board with the exception of failure to recall a previously set keycode. (please note, if the board sits with no activity while you're changing the settings, it will automatically change back to the main screen after 4 seconds.)

OPERATION AND MAINTENANCE:

Turn the unit on and let it run for several hours prior to filling the unit with its contents.

Do NOT run the unit with the door open for an extended period of time. This will only increase the frost on the evaporator, increase product temperature, and reduce the efficiency of the unit.

Your Medi-Kool™ unit automatically monitors the incoming voltage and will cycle the compressor off if the incoming voltage drops below the recommended minimum of 9.7 volts. This feature is designed to make sure your batteries will still be strong enough to start your vehicle.

As with any other 12-Volt load applied to an idle battery, the battery power will eventually begin to run down. Some form of re-charging the battery is necessary for continuous operation of the unit over extended operating periods. How long the battery, or batteries, will last on a single charge will depend on the operating time of the unit and the desired set temperature. Factors that determine operation time include; load on the cooler, ambient temperature, set temperature, and use (door open/closed) of the cooler. A key note to remember is more cycles the compressor has to take to achieve its desired set temperature = more battery life. Continuous operation of the unit as a result of any of the above = shorter battery life.

CLEANING THE MEDI-KOOL™ UNITS:

It is important to keep the interior of the unit clean and moisture free to avoid any mold or mildew growth.

Use a mild detergent (dish soap) and warm water to periodically wipe out the interior of the unit and the wire racks (on the 2.0 unit). Ensure the door gasket is cleaned as well and that the entire unit is dried completely before operation commences. The use of "WD40" or "Sheila Shine" is recommended to keep the stainless steel units clean.

NOTE: Do not use any abrasive cleaners, chemicals or scouring pads as this may damage your unit and transfer chemicals to the contents.

Thank you again for purchasing the Medi-Kool™ Vehicle Climate Control System. The information provided is meant to assist you during your installation and maintenance of the unit. Should you need any additional assistance, please don't hesitate to contact us!

TROUBLESHOOTING:



AS OF LATE 2015 MERMAID MANUFACTURING NO LONGER PROVIDES A DANFOSS BD35/BD50 OR ELECTRONIC MODULE

EACH MERMAID MEDI-KOOL PRODUCT UTILIZES A MASTERFLUX CASCADE COMPRESSOR AND MODULE FOR ALL UNITS.

THE FOLLOWING INFORMATION ON PAGES 8 & 9 ARE THE SAME FOR BOTH COMPRESSORS.

The compressor operates the specific climate controlled cabinet via an electronic module that is connected to the side of the compressor. Here, at the module, is where all wiring is connected in order to operate the condenser fan, the compressor, and the circuit control board. Should the unit not function, please refer to this section for assistance. Should additional information be needed, please contact the Mermaid factory.

COMPRESSOR OPERATES, NO COOLING:

1. Check that the condenser fan, located above the compressor, is in fact running.
2. If the fan is not running, check the wiring (black and red) at the module for a proper connection. Refer to Danfoss wiring schematics below.
3. If the fan is running, feel the plate inside the unit. The plate is located on the top of each unit. It is white in color and, if operating properly, will be cold to the touch.
4. If after 15 minutes, the plate is not cold and the compressor is CONFIRMED running/operating, the unit is out of refrigerant and needs to be returned to the factory for repair.

NO COMPRESSOR, NO FAN:

1. Ensure the control board is attached with 12VDC applied. The "power" light on the control board should illuminate indicating 12VDC is present.
2. Should the unit already be installed, ensure the proper 12VDC is being supplied. The Danfoss compressor will not operate below 9.7VDC and will not operate above 17.0VDC.
3. Verify the "power" light is on again. If not, check the incoming 12VDC power supply. If necessary, use a secondary 12VDC power supply (a power supply box, a 12VDC portable power supply, or any other device that will provide the necessary range of power).
4. If the "power" light is on, and the compressor and fan are not operating, check the wiring at the module. Refer to the Danfoss wiring diagram below. Keeping in mind, Mermaid utilizes our own thermostat.

COMPRESSOR OPERATES, NO FAN:

1. Verify the fan wires (Mermaid used red and black wires) are properly connected to the electronic module at the “+” and “F” terminals.
2. Verify the fan is not obstructed with a wire or other impurity.
3. If both #1 and #2 are clear, change the fan for proper operation.

FAN OPERATES, NO COMPRESSOR:

1. Verify proper 12VDC is applied to the unit. The fan will run below the necessary 9.7VDC compressor voltage.
2. Verify the compressor wires are in fact attached to the electronic compressor module. Each unit is pre-wired and pre-charged, however, the wires may have been inadvertently removed. They should be connected at the “+” and “-“at the top of the module.
3. If compressor still does not operate, provide a secondary source of power (power supply box, a 12VDC portable power supply, or any other device that will provide the necessary range of power) directly to the “+” and “-“located on the compressors electronic module. Simply remove the positive and negative wires on the module and replace with the secondary power supply. This will “jump out” the control board and provide power directly to the compressor. If the compressor starts, check wiring at the control board. If the compressor does not start, replace the electronic module.

NO POWER TO BOARD:

1. Check the 10 amp fuse that is located on the back of the board. .If the fuse is blown, Replace.
2. If board shows zero temperature, confirm that the T-stat wires are connected.

WIRING SCHEMATIC FOR *CURRENT* MASTERFLUX CASCASE COMPRESSOR

NOTE: FOR UNITS 09/2015 AND NEWER

Each Control Board will perform a 4 minute delay before turning the compressor back on once the cabinet has reached temperature. This feature is necessary in order for the compressor to function.

12/24 VDC Controller Features

- 4 pole sensor-less variable speed BLDC motor controller
- 180W maximum output power
- 10 - 31 VDC input range
- 48V motor supply (voltage boost)
- 12V or 24V operation (auto detect on power up)
- 1800 – 4200 rpm speed
- 0.5 - 4.75V analog speed set input (resistor programmable for fixed speed)
- 0°C to 45°C operating temperature
- Under/Over voltage shutdown (resistor programmable under voltage thresholds)
- Locked rotor detection
- Thermal shutdown – for power devices
- Over current shutdown – for power devices
- Low speed shutdown
- TTL Fault output
- Pulsed Fault output (030F0182 only)
- LED fault indicator
- Fan output, +12VDC @ 0.5A with voltage detection
- Reverse polarity protection

Optional Fixed Resistor Speed Chart

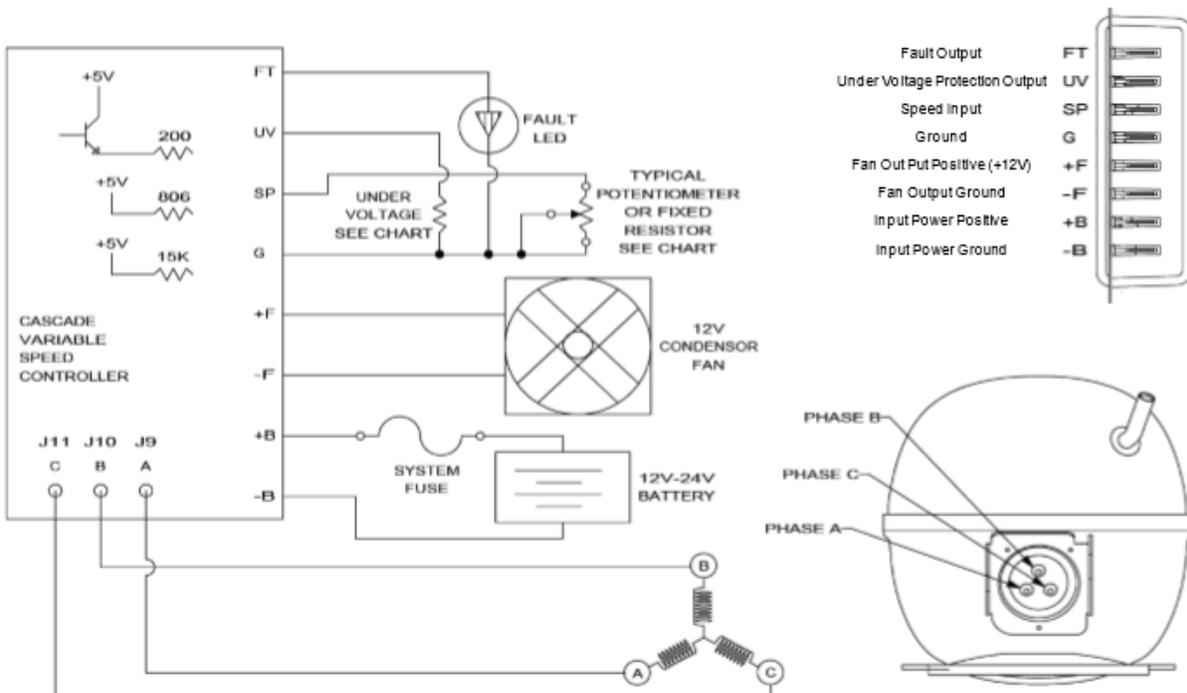
| Resistor Value | Motor Speed |
|----------------|-------------|
| OHMS | [RPM] |
| 200 | 1800 |
| 242 | 1900 |
| 287 | 2000 |
| 388 | 2200 |
| 510 | 2400 |
| 659 | 2600 |
| 847 | 2800 |
| 1090 | 3000 |
| 1.4k | 3200 |
| 1.88k | 3400 |
| 2.58k | 3600 |
| 3.8k | 3800 |
| 6.36k | 4000 |
| 15.3k | 4200 |

Use the formula below to find the resistor value needed to achieve a specific speed for the controller.

$$934960 - 806 \cdot \text{Speed_Desired} = \text{Speed_Desired} - 4360$$

LED Fault Indicator Output

| | |
|------------------------|-----------|
| Motor Fault | 1 Flash |
| Under Voltage | 2 Flashes |
| Over Voltage | 3 Flashes |
| Over Temperature | 4 Flashes |
| Over Current/Power | 5 Flashes |
| Fan Voltage Error | 6 Flashes |
| General Hardware Error | 7 Flashes |
| System Integrity Fault | 8 Flashes |



ELECTRONIC MODULE WIRING FROM PRE-WIRED MEDI-KOOL™ CONTROL BOARD TO COMPRESSOR MODULE:

MODULE:

(FT) FAULT OUTPUT

(UV) UNDER VOLTAGE
PROTECTION OUTPUT

(SP) SPEED INPUT

(G) GROUND

(+F) FAN OUTPUT POSITIVE

(-F) FAN OUTPUT GROUND

(+B) INPUT POWER POSITIVE

(-B) INPUT POWER GROUND

WIRES:

GREEN—FAULT LIGHT

OPEN—NO WIRE

BLACK—(RESISTOR CONNECTING TO BLUE)

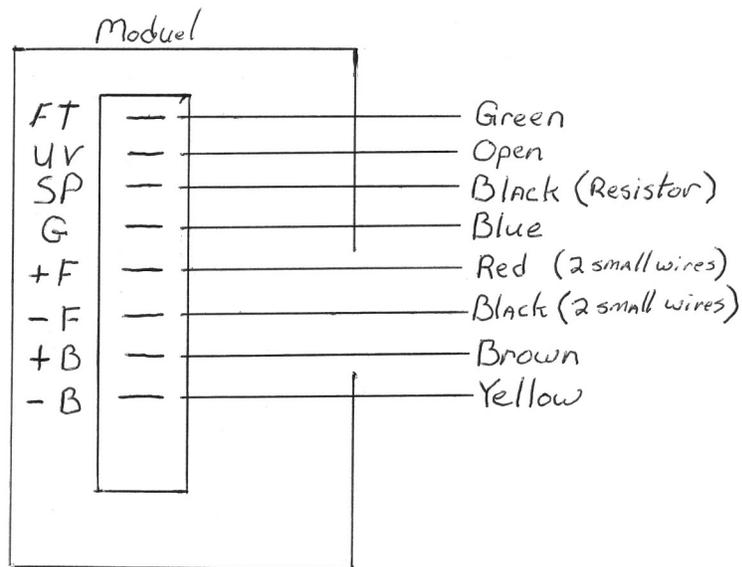
BLUE COMPRESSOR WIRE

THIN RED—POSITIVE FAN

THIN BLACK—NEGATIVE TO FAN

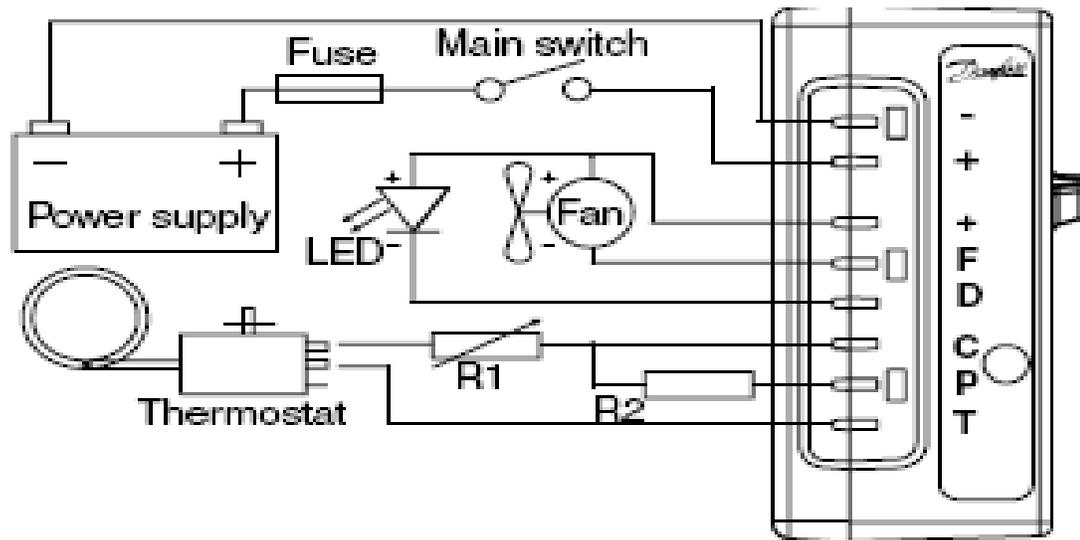
BROWN— INCOMING 12/24V POWER

YELLOW—NEGATIVE 12/24V POWER



WIRING SCHEMATIC FOR DANFOSS BD35/BD50 ELECTRONIC MODULE

NOTE: FOR UNITS 09/2015 AND OLDER



ELECTRONIC MODULE WIRING FROM PRE-WIRED MEDI-KOOL™ CONTROL BOARD TO COMPRESSOR MODULE:

MODULE:

- (-) NEGATIVE LEAD =
- (+) POSITIVE LEAD =
- (+) POSITIVE LEAD =
BACKED
- (F) NEGATIVE LEAD =
- (D) FAULT LIGHT =
LIGHT)
- (C) SPEED CONTROL =
- (P) OPEN TERMINAL =
- (T) SPEED CONTROL =

WIRES:

- BLACK WIRE** (NEGATIVE 12/24V) FROM WHITE TERMINAL BLOCK PRE-WIRED FROM THE MERMAID FACTORY.
- RED WIRE** (INCOMING 12/24V POWER) FROM WHITE TERMINAL BLOCK PRE-WIRED FROM THE MERMAID FACTORY.
- THIN RED WIRE (FAN) + **BLUE WIRE** PIGGY
- THIN BLACK WIRE (FAN)
- GREEN WIRE** (**BLUE** ABOVE IS ALSO FAULT
- BLACK JUMPER WIRE** (C-T TERMINAL)
- NO WIRE
- BLACK JUMPER WIRE** (C-T TERMINAL)

Wire dimensions

| Size AWG Gauge | Cross section mm ² | Max length* 12V operation | | Max length* 24V operation | |
|----------------------|-------------------------------------|------------------------------|-----|------------------------------|----|
| | | ft. | m | ft. | m |
| 12 | 2.5 | 8 | 2.5 | 16 | 5 |
| 12 | 4 | 13 | 4 | 26 | 8 |
| 10 | 6 | 19.5 | 6 | 39 | 12 |
| 8 | 10 | 32.8 | 10 | 65.6 | 20 |

*Length between battery and electronic unit

It is imperative that properly sized wire is used to operate the Mermaid Medi-Kool™ climate controlled cabinet. Failure to follow the specifications listed in this manual can potentially cause damage to the circuit control board, the electronic module, and the compressor. These items are NOT covered under warranty if undersized wire is used. Warranties will also NOT apply if the gray thermostat cable or the wiring harness has been cut or spliced. Contact the Mermaid factory for harness extensions.

Operational errors shown by LED (optional):

BD35F / BD50F / BD35K Solar / BD35F Solar

| Number of flashes | Error type |
|-------------------|--|
| 5 | Thermal cut-out of electronic unit (If the refrigeration system has been too heavily loaded, or if the ambient temperature is high, the electronic unit will run too hot). |
| 4 | Minimum motor speed error (If the refrigeration system is too heavily loaded, the motor cannot maintain minimum speed at approximately 1,850 rpm). |
| 3 | Motor start error (The rotor is blocked or the differential pressure in the refrigeration system is too high (>5 bar)). |
| 2 | Fan over-current cut-out (The fan loads the electronic unit with more than 1A _{peak}). |
| 1 | Battery protection cut-out (The voltage is outside the cut-out setting). |

FAULT LIGHT INDICATORS AS SHOWN ON MEDI-KOOL™ CONTROL BOARD AND WIRING

EACH MERMAID UNIT ALSO HAS A HEATER(S) INTALLED. THERE ARE TWO RED OR BLACK WIRES EXITING THE CASE NEAR THE INSULATED EVAPORATOR LINE. THESE WIRES OPERATE THE HEATER AND ARE CONNECTED DIRECTLY TO THE MEDI-KOOL™ CONTROL BOARD.

We thank you for your business and trust that you will have many years of successful operation with the Mermaid Medi-Kool™ Climate Controlled Rx units.