



Frigomatic Milano 12/24V DC Fridge and Freezer Systems

INSTALLATION MANUAL



penguin
SMART REFRIGERATION SOLUTIONS

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WARRANTY

The warranty card must be filled in by your supplier, stamped and signed by an Frigoboat authorized service station (see point E). You will need to show the warranty card when you want the unit under warranty to be repaired. The authorized service station will take a note of what has been done or of what was suggested on the back of the warranty card. You better keep the card after the warranty has expired: it will help service to know more about your unit.

*** FRIGOBOAT WARRANTY ***

A) WARRANTY

The manufacturer warrants that the products listed in the warranty card are not defective from material and/or workmanship with the limitations specified in the following points. The warranty is valid in the same country where the unit has been purchased.

B) HOW TO EXTEND THE WARRANTY ABROAD

The Frigoboat warranty can be extended to all the countries where a "FRIGOBOAT" distributor is established having the unit checked by an authorized Frigoboat service dealer. The first check is free in the same country where the unit has been purchased, in the town where the service is located and during normal working time. The intervention could be charged if the first check is done abroad. The first check must be noted on the alleged warranty card. The lack of this check is not voiding the warranty but would limit the warranty if the failure or problem arose because of no check done. This check must be done within 60 (sixty) days from the delivery date to the end user. Any updating of the unit happened between the date of purchase and the date of the first check can be charged. In case of need, please apply to the national importer or to the nearest service dealer.

C) PRODUCTION CHANGES

The manufacturer will have the right to change his products without notice and without being obliged to up-date the products already sold and/or manufactured.

D) WARRANTY PERIOD

The warranty starts from the delivery date to the first owner and/or user. The delivery date has to be registered on the warranty card, which has to be completely filled. The warranty term is the minimum term prescribed by the law, if a specific law exists. Where no law on the matter was issued, or the term is a shorter one, the term is of 12 (twelve) months. All the replaced and/or repaired parts will enjoy of the residual warranty term.

E) FIRST CHECK OF THE AUTHORIZED SERVICE STATION

All the products, before being delivered are carefully checked to make sure they meet the Frigoboat specifications and quality standards. The manufacturer is not installing Frigoboat products by herself. Therefore the warranty will be valid only if the Frigoboat unit is inspected and tested by an authorized service station within 60 (sixty) days from the delivery of the unit to the owner and/or user.

F) WHAT IS THE WARRANTY COVERING

The warranty covers the cost of the defective parts or the cost for repairing them or the cost of interchangeable parts for replacement, whatever more convenient. A Frigoboat product or one component part is considered defective, and therefore included in our warranty, when it had a congenital fault existing when delivered. All the repairs under warranty when warranty must be carried out by an authorized service station during normal working hours. Time allowance tables are calculated on an average intervention on a unit installed following our specifications and leaving access for interventions. The time in excess of given time is at customer charge.

G) WHAT DOES'NT THE WARRANTY COVER

The warranty doesn't cover the products damaged because of transportation, installation or repairs or misuse, negligence, normal wear, use of not original spare parts or any other improper use or accident and/or negligence following the instruction of the use and maintenance manual or the installation instructions. The warranty is not valid also if the end user is using the product in an irresponsible way or if changes were made which the manufacturer believes may have caused or increased the damage or if safety and or regulating devices were differently adjusted and/or replaced or if the product was used infringing the law and/or for an use which wasn't foreseen. The warranty is not covering other casual or consequential or connected expenses, as for an example, custom, freight and traveling expenses, unusual expenses due to difficulties reaching the products installed, lack of use, lack of profit, lack of time or property, injuries or damages to other parts of products different from the products described in the warranty card. The manufacturer is not authorizing any third party to assume on her behalf other risks related to the sales of his products than those here expressly indicated.

H) REPORT OF THE FAULT

The owner of the unit has to report the fault of the unit to an authorized service station or to the dealer or to the Veco agent. The fault must be reported as soon as possible; at any rate not later the 14 (fourteen) days since the user has found the unit being defective. The report should include an idea of what is felt wrong. The owner should register the date of the claim.

I) RUNNING THE UNIT FOR THE FIRST TIME

Before you run the unit for the first time please make the checking suggested by the manual at Chapter "Checking and testing procedures".

CHAPTER 1

THE FRIGOMATIC MILANO 12/24V REFRIGERATION SYSTEM

The "Frigomatic Milano" system consists of the following components:

- 1) The condensing unit:
 - Milano A Air cooled
 - Milano K Keel cooled
 - Milano W Water cooled

- 2) The thermostat
 - Fridge or Freezer mechanical thermostat
 - Optional:
 - Full range mechanical Air sensing thermostat
 - Digital thermostat
 - (contact Penguin at sales@penguinfrigo.co.uk for separate manual)

- 3) The aluminium evaporator
 - Type F Plate evaporator can be bent to suit the box
(contact sales@penguinfrigo.co.uk for details on bending if required)
 - Type H Ice box
 - Type B Freezer box evaporator

- 4) The water pump and relay or ump interface (mod. Milano W only).

- 5) The keel cooler heat exchanger (mod. Milano K only)

CHAPTER 2

FRIGOMATIC MILANO AIR COOLED

12/24V DC compressor with high efficiency aluminium finned condenser with integral cooling fan.

Pre-charged with R134a refrigerant with resealing male and female quick couplings to connect to the evaporator.

Supplied as standard with both high and low pressure service valves.

2.1 - POSITION

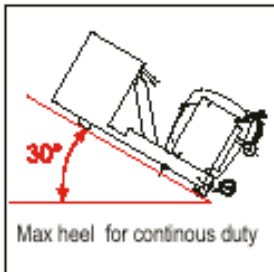
When deciding on the location of the compressor please consider the following:

A.- The compressor must be mounted horizontally on its base.

Fix with the pre-drilled holes in the stainless steel base.

Pay attention to leave enough space for the evaporator and keel cooler connections and that there is good access to the electrical connections

It can be safely angled up to 30 degrees so no problem for sailing boats



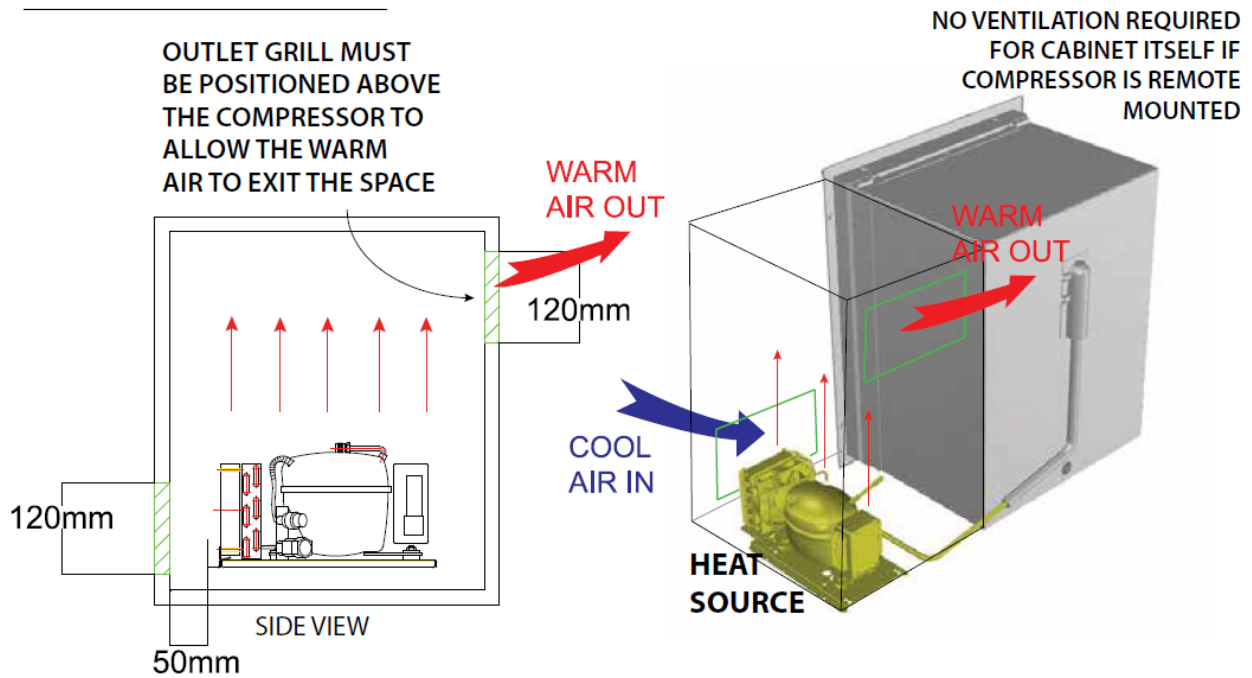
Note: Bulkhead mounting bracket also available – contact sales@penguinfrigo.co.uk for details

B.- The length of the connecting pipe is 2.8mt (8ft) without using the optional extension pipes (available from 1m to 6m see chap. 11.2).

C.- The unit must be installed with the finned condenser at least 50mm from any wall or bulkhead.

The condenser requires a minimum ventilation of 120mm x 120mm in and out of the area where the compressor is located – see below.

REMOTE COMPRESSOR



The vent openings should be positioned in such a way that immediate recirculation of heated air does not occur. Recirculation of heated air causes it to become progressively warmer reducing the condenser capacity, lowering the efficiency of the refrigeration plant, and resulting in an increased power consumption and/or loss of cooling capacity. Do not install the unit free standing in a small compartment and take care that where the discharge air enters a small compartment that it cannot immediately recirculate back through an outlet in the same bulkhead. Avoid also using air which is preheated as a result of being drawn from, for instance, the engine compartment.

2.2 - GRILL

If the hole and therefore the finned condenser is in a position exposed to physical damage it should be protected by a grill having at least the same cross-section of the condenser. We recommend using our grill E250115 which allows a sufficient air flow and a good protection to the unit.

CHAPTER 3

FRIGOMATIC MILANO KEEL COOLED

12/24V DC compressor

Pre-charged with R134a refrigerant with resealing male and female quick couplings to connect to the keel cooler condenser and aluminium evaporator.

Supplied as standard with both high and low pressure service valves.

3.1 - POSITION

When deciding on the location of the compressor please consider the following:

A.- The compressor can be located anywhere (within 1.5m of the keel cooler). It doesn't need air circulation but only accessibility for maintenance.

B.- The compressor must be mounted horizontally on its base.

Fix with the pre-drilled holes in the stainless steel base.

Pay attention to leave enough space for the evaporator and keel cooler connections and that there is good access to the electrical connections

It can be safely angled up to 30 degrees so no problem for sailing boats



Note: Bulkhead mounting bracket also available – contact sales@penguinfrigo.co.uk for details

C - The length of the keel cooler connecting pipes is 1.5m (3ft) **and cannot be extended**

D - The length of the connecting pipe is 2.8mt (8ft) without using the optional extension pipes (available from 1m to 6m see chap. 11.2).

3.2 - KEEL COOLER SEA WATER HEAT EXCHANGER

The keel cooler is a Cupro nickel heat exchanger moulded within a sintered bronze casting.

Supplied with 15m copper pipes pre-charged with R134a refrigerant with re-sealing male and female quick couplings to connect to the compressor and evaporator.

Available with or without protective anodes.

It can also be used as a ground plate for electronic instruments.

E50361 is the standard keel cooler suitable for hulls up to 40mm thickness

E50362 is the long stud keel cooler suitable for hulls up to 100mm thickness

Recommended Fitting Instructions

1. Decide where the keel cooler is going to be positioned (must be within 1.5m of the compressor).
2. Drill a pilot hole where the keel cooler is to be located – from the inside out to avoid hitting any stringers etc.
3. For boats with double skins, if when drilling, there is a clear gap between the inner moulding and the hull, use a 4" hole saw to cut away a large enough section of the inner moulding to fit the keel cooler directly to the outer laminate. If there is no gap between the inner moulding and the hull and the two are completely bonded together drill straight through both laminates with a 38mm hole saw.
4. Scrape away any existing antifouling so you are back to the bare hull to bond to.

Then drill an oversized hole (40mm) so the keel cooler will easily slide up through. (it is a good idea to do a dummy run on a piece of wood to confirm).
5. Once you have done your test, drill the hole in the hull, fit the O ring and insert the keel cooler from the outside.
6. To hold it in place wind the nut on a couple of turns of the thread, so the washer holds it hanging down from the hull.
7. Mask the keel cooler so just the surface to be bonded to the hull is exposed.
8. Pull the O ring up and fill the recess with your waterproof adhesive
9. Then drop the O ring onto the adhesive and add more adhesive on top of the O ring and the rest of the top surface of the keel cooler.
10. Then with someone on the outside to hold the keel cooler in the correct orientation, push the keel cooler up flush to the hull and tighten the nut inside.
11. Once in place just a 'good nip' with the spanner will hold it all in place until the adhesive has gone off and the keel cooler will then be bonded in place.

Fitting the keel cooler



The keel cooler was carefully masked around its outer edges to protect them from excess sealant. Any sealant stuck here will act as an insulator, reducing the unit's efficiency



Underwater adhesive-sealant was applied to the back of the unit to ensure a watertight fit

The keel cooler's 3.8cm hole can be made with a simple hole cutter in a GRP or wooden hull. A steel, aluminium or ferro hull would require more complex cutters, plus galvanic isolation with a neoprene backing pad and a plastic insert.

A pilot hole can be made from inside the hull first, to confirm the position, and to ensure that the final hole will be clear of any stringers, bulkheads or other in-hull obstructions.

Before drilling into the pilot hole from outside, Ian first cleaned off the antifouling, and then keyed the GRP underneath so the sealant would be able to get a good purchase.

The main hole only took a few seconds to cut through the Hunter Delta's GRP hull.



Wires and tubes are fed up through the hole so the unit can be secured. This is best achieved as a two-person job - one to hold the unit in position and one to tighten the nut from inside



Care should be taken to ensure the unit is aligned fore-and-aft to minimise drag

GROUNDING AND CLEANING THE KEEL COOLER:

Provision is provided for a grounding/bonding wire to be attached. It is very important that the Keel Cooler is electrically connected to the battery negative, with no switch in the circuit between the Keel Cooler connection and the battery negative.

If the Keel Cooler being installed is the type without zincs, it must also be connected to the vessel's bonding system and a sacrificial zinc anode. This is an important safety precaution and a connection must be made to the battery negative whether the keel cooler has zincs or not.

The keel Cooler should not be painted and must be inspected periodically for corrosion. Clean occasionally with a brush, never with a metal scraper.

For details on the recommended grounding please see the [Frigoboat Correct Bonding](#) document

CHAPTER 4

FRIGOMATIC MILANO PUMP WATER COOLED

12/24V DC compressor

Cupro nickel sea water heat exchanger with built in over heat switch

Pre-charged with R134a refrigerant with resealing male and female quick couplings to connect to the evaporator.

Supplied as standard with both high and low pressure service valves.

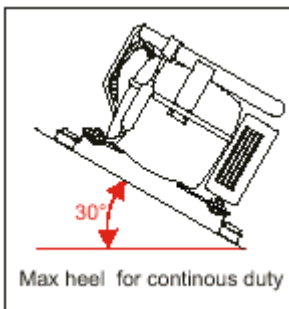
4.1 - POSITION

When deciding on the location of the compressor please consider the following:

A.- The compressor must be mounted horizontally on its base.

Fix with the pre-drilled holes in the stainless steel base.

Pay attention to leave enough space for the evaporator and sea water connections and that there is good access to the electrical connections



It can be safely angled up to 30 degrees so no problem for sailing boats

Note: Bulkhead mounting bracket also available – contact sales@penguinfrigo.co.uk for details

B.- The length of the connecting pipe is 2.8mt (8ft) without using the optional extension pipes contact sales@penguinfrigo.co.uk for details

4.2 - SEA WATER PUMP

The pump we supply is self-priming, but we recommend:

Installation

The pump is mounted as low in the boat as possible – ideally below the waterline.

Use wire reinforced hose

Ensure the pipe run from the intake and strainer to the pump is as direct as possible and the pipe run from the pump to the condenser is as direct as possible

The outlet should be just above the waterline so the flow can be confirmed

Sea Water Strainer

You must have a good intake strainer (120 Mesh) to protect the pump, pipework and condenser from sea water growth and organisms. Frigoboat part number A091508 contact sales@penguinfrigo.co.uk for details.

Water flow requirement is 4-5 litres per minute 9 (1 gal/min)

When all connections are completed, operate the water pump independently and make sure that:

A.- You have no water leaks.

B.- The water flow is at least 1/2 gall/min (2 l/min).

4.3 - PUMP SPECIFICATION

The pump we supply with the unit is A092819C or PF-1A092819C

It must have a 12V supply (see wiring diagrams for details)

For 24V applications the pump is the same but it needs a pump interface (E51385), which halves the voltage (from 24V to 12V). Note that this can also be used to run up to 3x water cooled compressors from the same pump.

4.4 ALTERNATIVE PUMPS

Any pump can be used to circulate water through the Milano water cooled condenser as long as:

A.- The water flow is at least 0,5 gal/min (2 l/min) and does not exceed 10 litres per minute

B.- A relay is always used to operate the pump.

C.- The pump is suitable for continuous duty.

CHAPTER 5

ELECTRONIC CONTROLLER FOR FRIGOMATIC MILANO

5.1 - The electronic controller can operate from either 12V or 24V D.C

- a) It automatically selects 12V or 24V supply (it chooses 24V automatically if the voltage exceeds 17V)
- b) It also allows the compressor to run at 4 different speeds according to the capacity of the fridge or freezer and corresponding size of the evaporator plate. 2,000 RPM up to 3,500 RPM set by the Speed regulator board fitted to the bottom three terminals of the controller.

(see wiring diagram for details)

The electronic controller has also the following safety features:

5.1.1.-Protection of the battery:

if the supply voltage drops below 10.6 V (23.4) it stops the compressor till the voltage rises back to 11.7 V (24 V). See note 2.

5.1.2 - Protection of the compressor: It stops the compressor, any time it doesn't start when powered; it tries again every 60 seconds. - It will also stop the compressor if its speed is too low (below 1,900 RPM).

5.1.3.- Fan motor and pump protection: if they draw more than 0.7 A, the compressor will be stopped. It tries again every 60 seconds.

5.1.4 - Protection against too high voltage

The electronic controller, if the voltage exceeds 17V, assumes that it is connected to a 24V environment but, in this case (between 17 and 23V) the voltage is too low and the compressor will not run. For this reason with this model of electronic controller (marked as BD 35F) it must be used a stabilized mains adaptor E51305 which gives always 24V even if the battery supplies 12V.

NOTICE 1: After the electronic unit is powered you could have a waiting time up to 30 seconds, before the compressor starts.

NOTICE 2: The electronic controller, even if designed for marine installation, must be protected against drops of water and from the bilge splashing. Take care that even a single water drop can follow a wire and reach the controller. For this reason we suggest that wires are reaching the controller from a lower position.

5.2 - ALARM SIGNALS

To the electronic controller it is possible to connect a LED (terminals + and D) which emits up to 5 blinks every 5 seconds with the following meanings:

1 blink: Supply too low (below 10.4 or 22.8) Check wire size (12.2)

2 blinks: Fan (terminals C and F) draws too much (more than .7 A)

3 blinks: Compressor failed start attempt (retries every 60 s.)

4 blinks: Compressor too low RPM (below 1,900 RPM).

5 blinks: Too high temperature of the electronic controller (heat sink) It restarts when it cools down.

CHAPTER 6

ALUMINIUM EVAPORATOR

6.1 - The evaporator is the unit that is installed in the cabinet to cool it and thereby keep it at the desired temperature. Several types of evaporators are available and the choice between them depends on the size and layout of the cabinet. Before starting the installation make sure that the insulation is at least as effective as recommended.

USAGE	POLYURETHANE	POLYSTYRENE
Refrigerator	2 inches (50 mm)	3.3/4 inches (80 mm)
Deep Freeze	4.1/4 inches (100 mm)	6.1/2 inches (160 mm)

A greater thickness is not detrimental and will conserve energy.

6.2 - POSITION

Install the evaporator as high as possible as cold air falls and therefore the space above the evaporator may not be cold enough for storage. Consider carefully how you will use the cabinet, how you will for instance reach into it and whether you wish to produce ice cubes. The connecting pipe goes out of the cabinet to the condensing unit and requires a hole having a minimum diameter of 1"1/2 (30mm). This hole should be drilled as high as possible to reduce the loss of cold. When selecting the route that the pipe will take, try to choose one that will protect it from damage, by both cutting and compression, even inside lockers, and then drill the necessary holes along that route. Carefully seal the hole you drilled in your cabinet (consider also the passage of the capillary or thermostat cable).

6.3 - INSTALLATION

The assistance of another person is very useful at this point. Unroll completely the evaporator pipe and arrange the two end couplings so that they will pass one after the other through the sequence of holes that you have prepared, the male coupling (IM) proceed the female coupling (IF). Do not remove the end brass plugs at this stage, as they will provide an important protection from dirt and moisture. Take extreme care of the point where the capillary comes out of the main refrigeration pipe as it is very vulnerable at this point, feed the end of the pipe into the cabinet, out through the hole and then carefully, leading with the hand all the way, through the sequence of holes. Try to avoid inducing force at any stage and keep curves to as large a radius as possible to avoid kinking. Do not keep bending and re bending any section of the pipe as copper work hardens and each successive bend becomes more difficult until the pipe will fail. If you have an excessive length simply roll it up and fasten it to prevent vibrations.

6.4 - EVAPORATOR MODEL "H"

You can install this evaporator in any position.

Drill the four mounting holes in roof or wall of the cabinet. Use two of the four screws provided together with the two studs in the holes in the back or base of the evaporator (closed end), preposition the screws and then slide on the evaporator using the slots. Finally enter the other two stainless steel screws through the holes, then the spacers and hence into the structure of the cabinet. Tighten all screws.

6.5 - EVAPORATOR MODEL "F"

Each one has several holes available for fixing it on the wall of the cabinet lining. For the best performance on the cooling unit these evaporators should be installed with the exit pipe upwards. The evaporator can be bent using the correct tool. Contact a Frigoboat service agent for details.



6.6 - EVAPORATOR MODEL "B"

You can install this evaporator in any position

It has two holes in each corner for a vertical installation on a wall of the cabinet lining. Spacers of 5/8" (16mm) should be used to allow enough air circulation for an efficient cooling.

6.7 - EVAPORATOR PIPE EXTENSIONS

When the compressor has to be placed at a distance over the standard you should use an extension pipe available in length (1-2-3-4-5 and 6 mt long). Use the same care handling the extension pipe as recommended for the evaporator pipe. The use of long extensions is slightly affecting the unit efficiency.

6.8 - THERMOSTAT CAPILLARY

The evaporator is equipped with a small plate to be used to connect the tail of the thermostat capillary (See 8.5). We strongly suggest to keep this plate accessible and possibly swapping it from one face to the opposite, reversing also the small plastic nut.

6.9 - TOUCHING UP EVAPORATOR PAINT

If the evaporator paint gets dented because of bending or for any other reason, give additional paint touch using epoxy paint. This applies also to the drilled holes.

CHAPTER 7

MECHANICAL THERMOSTAT FOR ALUMINIUM EVAPORATORS

7.1 - The thermostat is the component that allows you to regulate the cabinet temperature according to the needs of the stored food.

NOTICE: Vary the thermostat setting when the unit is working or wait 10 minutes since the unit has stopped. If you disconnect the unit while running, wait 5/10 minutes before giving power back again.

7.2 - POSITION

You can place the thermostat either inside or outside the icebox provided you can read it and turn its knob and it is kept well clear of dripping water. The capillary cannot be extended and its end must be in touch with the evaporator (See 9.5)

7.3 - INSTALLATION

Fix the thermostat box on the wall you have chosen using two screws.

7.4 - THERMOSTAT SETTING

The thermostat has a knob graduated from 1 to 7. When the knob is rotated to 7 the temperature in the icebox will become the lowest possible.

7.4.A - THERMOSTAT FOR REFRIGERATION (WHITE BOX)

The first time you start your cooling unit you should rotate the thermostat knob in the position 3-4. You will rotate the knob later towards 7 if you want the temperature in your refrigerator colder and towards 1 if you want it warmer.

7.4.B - FREEZER THERMOSTAT (BLUE BOX)

When starting the unit rotate the thermostat knob to 4. Wait at least two cycles before adjusting the knob for lower or higher freezer temperatures.

7.5 - THERMOSTAT CAPILLARY FOR ALUMINIUM EVAPORATOR (ANY MODEL)

The tip of the capillary should be in touch with the evaporator surface for at least 3" (7.5mm). For this reason you should bend the tip to a "U" shape and place it under the special groove of the small plate on the evaporator before tightening the fixing screw.

ATTENTION : It is important that the thermostat capillary is in contact with the evaporator at its tip only as other colder contacts could affect the operational characteristics.

We strongly suggest that the small fixing plate is easily accessible in order to make future maintenance easily. If necessary the plate can be swapped from one face to the other the evaporator reversing also the plastic nut.



Fig 9.5

7.6 - DEFROST

When frost on your evaporator gets over 1/2 inch thick, switch off the fridge switch or turn the thermostat knob counter clockwise to the "OFF" position and wait till your evaporator is completely defrosted before resetting the thermostat. Open your hatch or door if you want to speed de-icing. **Never use a knife or other metal object to force ice from your evaporator or you will easily pierce the refrigerant coil sooner or later.**

7.7 - EXCESSIVELY COLD CABINET

See Troubleshooting Chap. 10

CHAPTER 8

QUICK CONNECTS

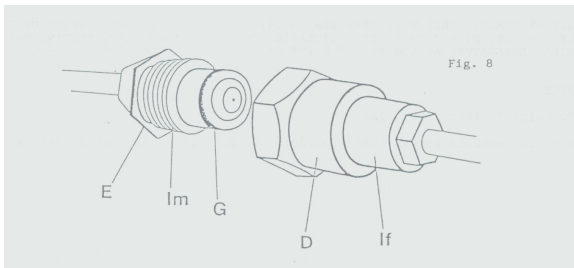
All the components of the Frigomatic unit are supplied with Frigoboat quick connects which retain the refrigeration gas that has been factory pre charged and permit quick and simple connection of the refrigeration system.

IMPORTANT

Under no circumstances run the Frigomatic compressor unless the two quick connects are fully joined.

8.1 COUPLING THE QUICK CONNECTS

The quick connects on the condensing unit are fitted with plastic dust caps. Do not remove these until the last minute when you are ready to connect the system together.



The Quick Connects seal with O rings, so they do not rely on compression and it should be possible to do the couplings up by hand without the need for spanners (subject to access). Centre the two halves precisely, align the quick connects so the nut (D) can be screwed by hand into the male half coupling (IM).

Do not let the male end of the quick connect turn.

It is important to fully make the couplings so the two nuts are touching to ensure the quick connect is fully open. Use a spanner just to nip the nuts in place and prevent them coming loose.

If after the coupling has been pushed together you get a continuous hiss take the couplings apart at once as it is possible that the 'O Ring' (G) has been damaged. Spare 'O Rings' are provided (bag taped to top of compressor).

Take care not to bend or twist the two pipes during the above operation and always use two wrenches of the correct size to nip the couplings in place. Having completed the first coupling you can then proceed with the second one but more care is required when connecting the red and yellow labelled high pressure pipes because the smaller tubes terminating in a male coupling will not tolerate abuse.

Remember again that a leak proof joint is not dependent on the tightness of the nut but that is important that the nut is screwed up to the full depth of the thread.

CHAPTER 9

ELECTRICAL CONNECTIONS

9.1 - POLARITY

Use color-coded cable to avoid reverse polarity. Reverse polarity doesn't damage the electronic controller but will not run the compressor. The main panel switch must be new and of good quality, with minimum power capacity of 20A (10 A for 24V supply). If you use a circuit breaker make sure that it doesn't cause too much voltage drop at start.

9.2 - WIRE SIZE

Measure the length the lead will have between the service control board and the electronic controller. Lead size should be no less than 0,0005 sq.in for each foot length (1 sq.mm for each mt length). We suggest installing a cable having a wire gauge as shown in the following table.

DISTANCE FROM SERVICE BATTERY TO ELECTRONIC CONTROL BOARD			WIRE GAUGE	WIRE SIZE
feet	*	mt	AWG	mm2
up to 6	*	2	14	2
7 to 10	*	2.1 - 3	12	3
11 to 17	*	3.25 - 5	10	5
18 to 27	*	5.50 - 8	8	8
28 to 42	*	8.50 - 13	6	13
43 to 64	*	13.50 - 19	4	19

9.3 - CONNECTIONS TO THE ELECTRONIC CONTROLLER

The electronic unit must be connected only to the battery through a good 15A circuit breaker or a quick acting 15a fuse. Positive (red wire) must be connected to terminal + and negative (black wire) at terminal -.

9.4 - WHAT SHOULDN' T HAPPEN

Bear in mind that the voltage drop occurs across dirty and corroded connectors; never twist wires together but only screw or solder them. A high voltage drop will prevent a compressor starting, will cause erratic running and would also damage the condensing unit if you don't eliminate the voltage drop very soon.

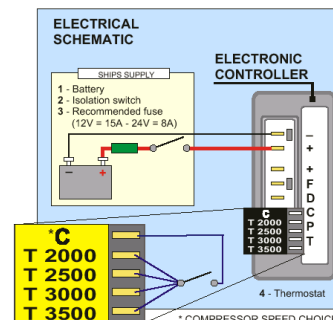
9.5 - THERMOSTAT CONNECTION AND COMPRESSOR SPEED CHOICE

These Milano is supplied with the speed regulator E51045 which allows you to set the compressor speed from 2,000 and 3,500 RPM.

Simply connect the thermostat at C & T connections (there is no polarity) then set voltage 12V or 24V and then the desired speed using the rheostat dial.

In the table below we suggest the correct speed for each evaporator model and application (fridge or freezer).

SUGGESTED COMPRESSOR SPEED		
EVAPORATORE TYPE	FRIDGE SPEED	FREEZER SPEED
EVAPORATORE 80 F	2000	-
EVAPORATORE 130H / 130F	2500	3500
EVAPORATORE 160H / 160F	2500	3500
EVAPORATORE 200H/200F/200B	3000	3500
EVAPORATORE 340 B	3500	3500



9.6 - FAN CONNECTION

Connect the fan motor to the terminals "F" (- Black) and "C" (+ Red). Do not reverse the polarity. The fan motor is electronically controlled: a short circuit between terminal "C" and "F" or the draw of more than 0.7A would immediately stop the fan motor and the compressor.

NOTICE 1: The compressor and fan could start within 30 seconds after you have powered the controller.

NOTICE 2: All the current and the fuse values must be halved for 24V supply.

9.7 - PUMP (ONLY MILANO W WATER COOLED MODEL)

For 12V installations the pump must be connected through a power relay (see schematic R1407).

For 24V installations or installations with two or more "Milano W" units operating from one pump, use the E51385 pump interface (see schematic R1374).

The Milano W is equipped with a thermal cut out safety device, which stops the system if the water circulation is not sufficient. This device is installed on the water heat exchanger and must be connected in series with the thermostat. Follow the instructions supplied with the system.

9.8 - VOLTAGE SUPPLY

It is advisable to check the value of the supply voltage at the electronic controller terminals + and - , particularly when the supply comes through the yacht panel. Switch on all loads connected to the service battery and then switch on the fridge unit, after a few seconds the fridge will start and at no time during the starting should the actual voltage have dropped below the nominal 12 or 24V.

CHAPTER 10

TROUBLE SHOOTING

10.1 - TEMPERATURE IS TOO LOW

Chap.	Cause	Diagnosis and Remedy
13.1.1	Thermostat	Turn the thermostat knob on a lower number.
13.1.2	Thermostat	The unit runs continuously without cycling : in spite of the thermostat position. If the evaporator is completely frozen replace the thermostat.
13.1.3	Holding plate is too big (Energy Saving system)	Reduce the cooling surface of the holding plate by using the Mod. A090900 ice cube kit assembly. If the temperature is too low partially cover the remaining surface with insulating material.

10.2 - TEMPERATURE IN THE COOL BOX IS NOT LOW ENOUGH

Chap.	Cause	Diagnosis and Remedy
13.2.1	Thermostat OR Frost on the evaporator	Turn the thermostat knob on a higher number. See Chap. 8.7.
13.2.2	Lack of refrigerant	Evaporator is only partially frozen and the unit runs continuously (See Point 13.5.1).
13.2.3	Cooling unit no big enough	The evaporator is completely frozen conveniently located in the upper side of the cabinet. The cooling unit is cycling also when thermostat is in the position 7 but temperature inside the cabinets is too high. It means that the cabinet is too big for the evaporator or the cabinet insulation is too poor. Should not be convenient for your to encrease the cabinet insulation and or replace the evaporator with a bigger one, you can find a remedy by moving the evaporator downwards. Doing so you reduce the refrigerated area : the cabinet size over the evaporator will not be cooled.

10.3 - COMPRESSOR DOESN'T RUN

Chap.	Cause	Diagnosis and Remedy
13.3.1	You are too anxious, not giving enough time to the unit.	Wait at least a minute without disconnecting, the main switch and with the thermostat on position 7.
13.3.2	Wrong connections.	Check connections.
13.3.3	Thermostat switched OFF. OR Wrongly connected. OR Defective.	Check thermostat knob position. Check thermostat connections. Bridge terminal "T" and "C" thermostat. If the compressor then starts, leave the bridge. Run and stop the system using the external (panel) switch (See 11.1.1). As soon as you can replace the thermostat as it is broken. If the compressor doesn't start, call the Authorized Frigoboard Service.
13.3.4	Loose fuse. OR Defective or blown fuse.	Check the fuse on the yacht panel. Check the fuse on the panel and the terminals and replace the fuse if needed. Should the new fuse blow again replace the controller. Do not connect a defective controller to a new compressor. Do not exceed the 15 AMP rated value of the fuse (normal automobile fuse).
13.3.5	Voltage too low.	Charge the battery (run the engine).
13.3.6	Defective controller	If the controller is doing its start attempt every 30 seconds and the compressor is not starting, replace the controller with a new one.
13.3.7	Defective compressor.	If a new controller is not capable to start the compressor check with a tester the electrical continuity between the compressor terminals. Ohm value should be the same for all the terminals of the compressor.
13.3.8	Compressor temperature below freezing temperature.	You have to wait till the compressor temperature rises.

10.4 - COMPRESSOR MAKES START ATTEMPTS BUT IMMEDIATELY STOPS

Chap.	Cause	Diagnosis and Remedy
		Disconnect the unit for 10 minutes
13.4.1	Self sealing coupling non screwed tight	If unit doesn't start after the rest, check the capillary quick connect is screwed correctly.
13.4.2	Voltage drops too low when the unit starts.	Check all connections if loose and/or corroded. Check cables and replace them if undersized.
13.4.3	Fan or pump relay defective. Wrongly connected.	Disconnect fan or pump relay from controller terminals "F" and "C" .If the compressor starts after disconnection, replace the fan (or the pump) motor (See 6.1.3).

WARNING: The electronic controller checks the voltage also during the compressor starting attempts. For this reason the wiring should be dimensioned to 15A draw for 12V

units (7.5A for 24V).

10.5 - THE COMPRESSOR RUNS - LOW EFFICIENCY

Temperature in the fridge is too high - the evaporator is wet and it freezes partially, close to the capillary inlet.

Chap.	Cause	Diagnosis and Remedy
13.5.1	The unit has a leak	Stop the unit and call for service (See also 15.2 and 15.3).

13.6 - COMPRESSOR TURNS - NO COOLING AT ALL

Chap.	Cause	Diagnosis and Remedy
13.6.1	The unit is empty.	Stop the unit and call for service (See also Chapp. 15.2 and 15.3).

CHAPTER 11

MAINTENANCE

11.1 - AIR COOLED UNITS

Clean the air condenser at least once a year. A condenser clogged with dust means waste of power (for "W" units see Chap. 14.5).

11.2 - RUST

Use anti-rust materials and paint to protect the components in case they have been attacked by rust.

11.3 - OXIDATION OF ELECTRICAL PARTS

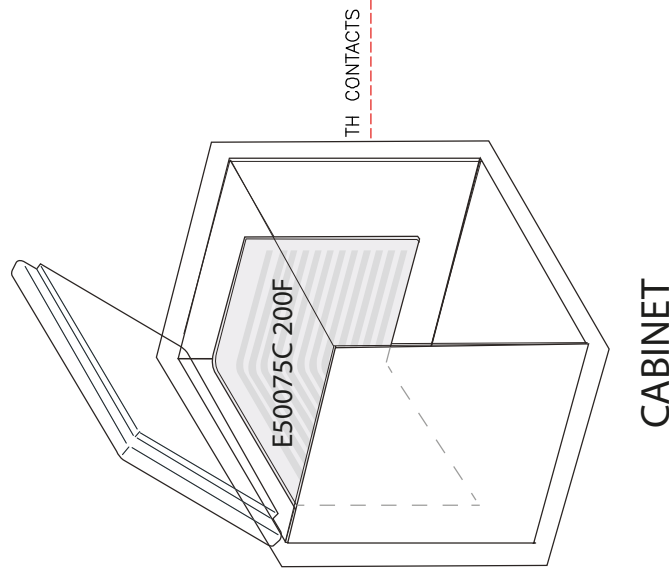
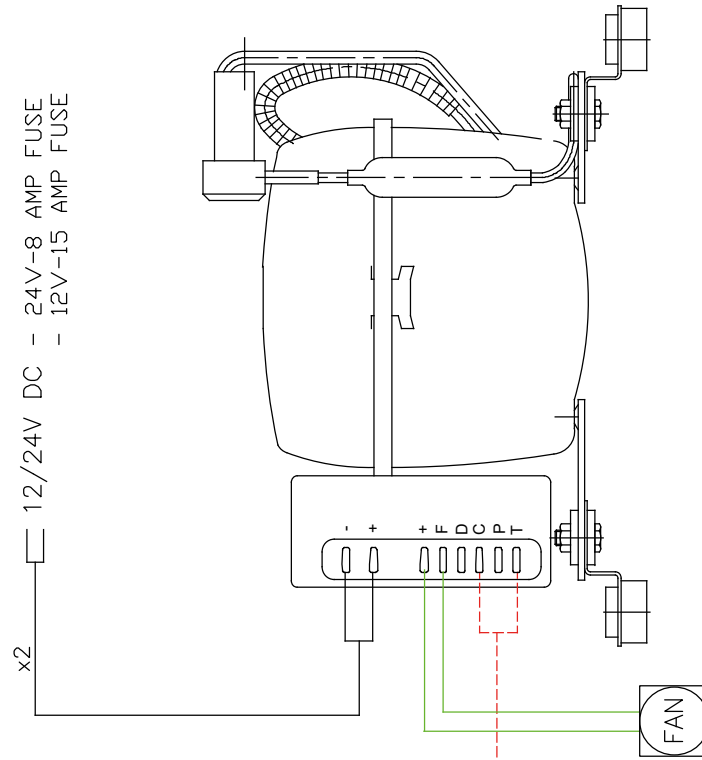
Clean the electrical terminals and contacts but **do not use any kind of spray** as it will surely damage the electronic circuit and void warranty.

11.4 - DEFROSTING (see 8.6).

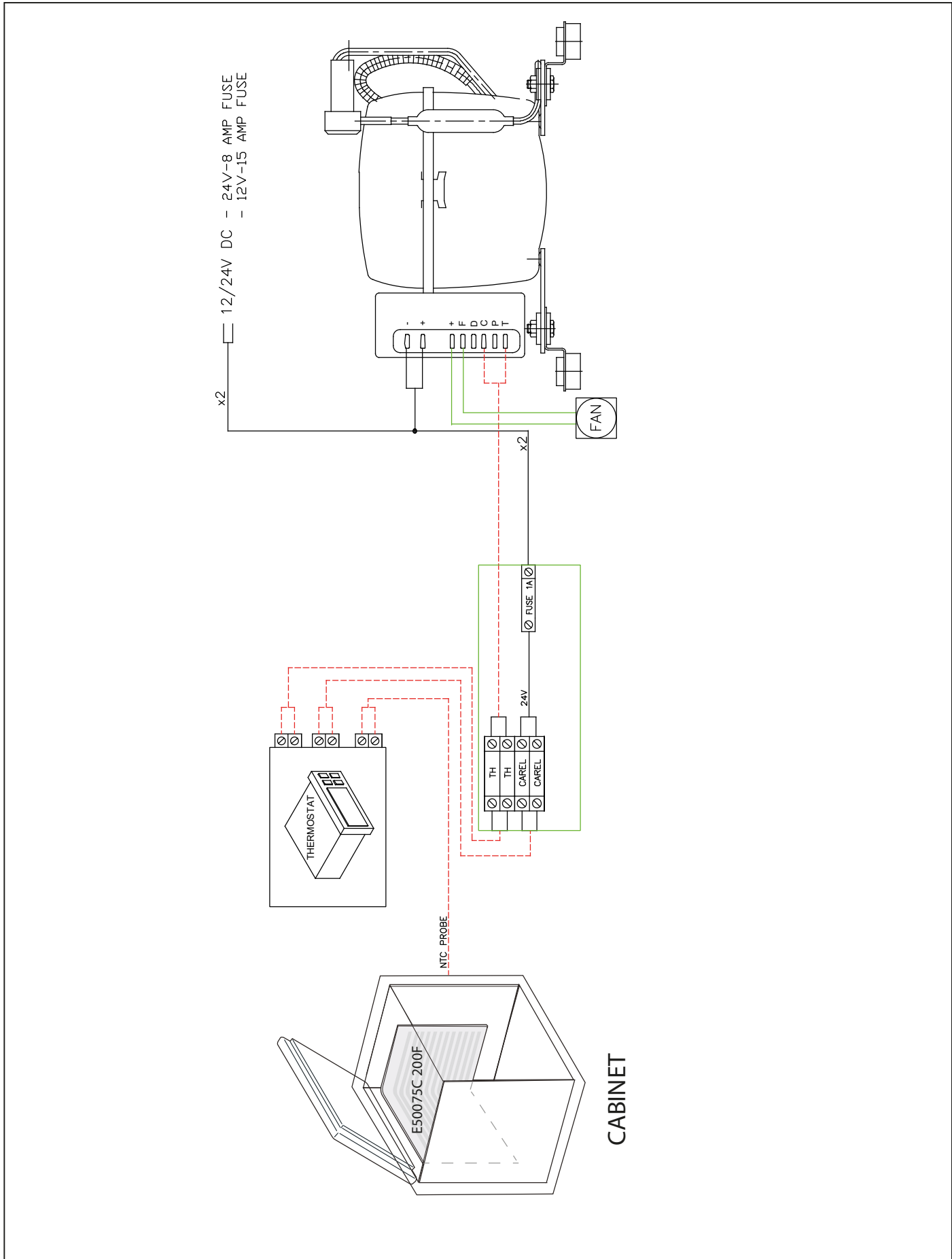
11.5 - WINTERIZING

When winterizing W units, rinse the seawater circuit with fresh water before draining it out.

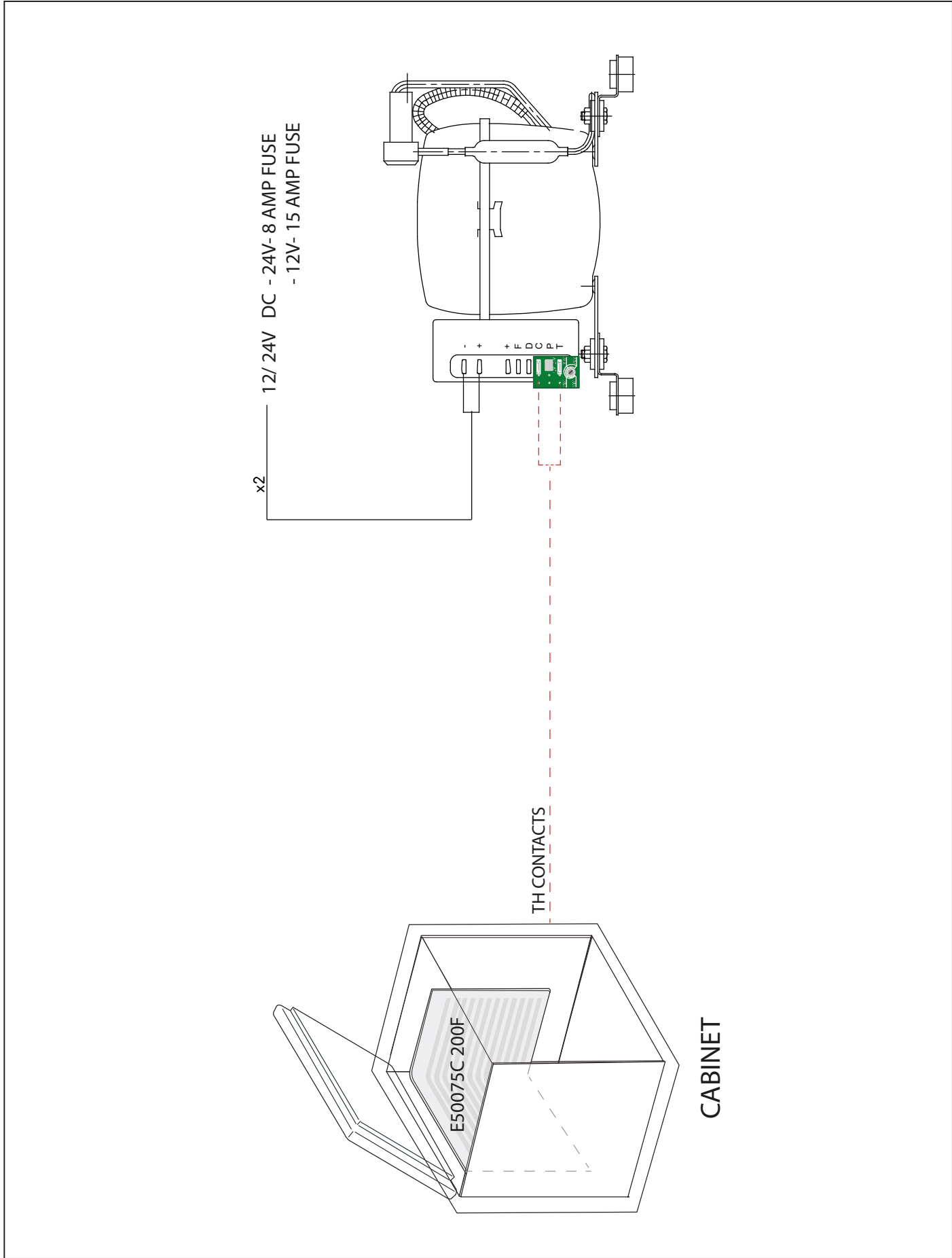
WIRING DIAGRAM - DC AIR COOLED, MECHANICAL THERMOSTAT 12/ 24V



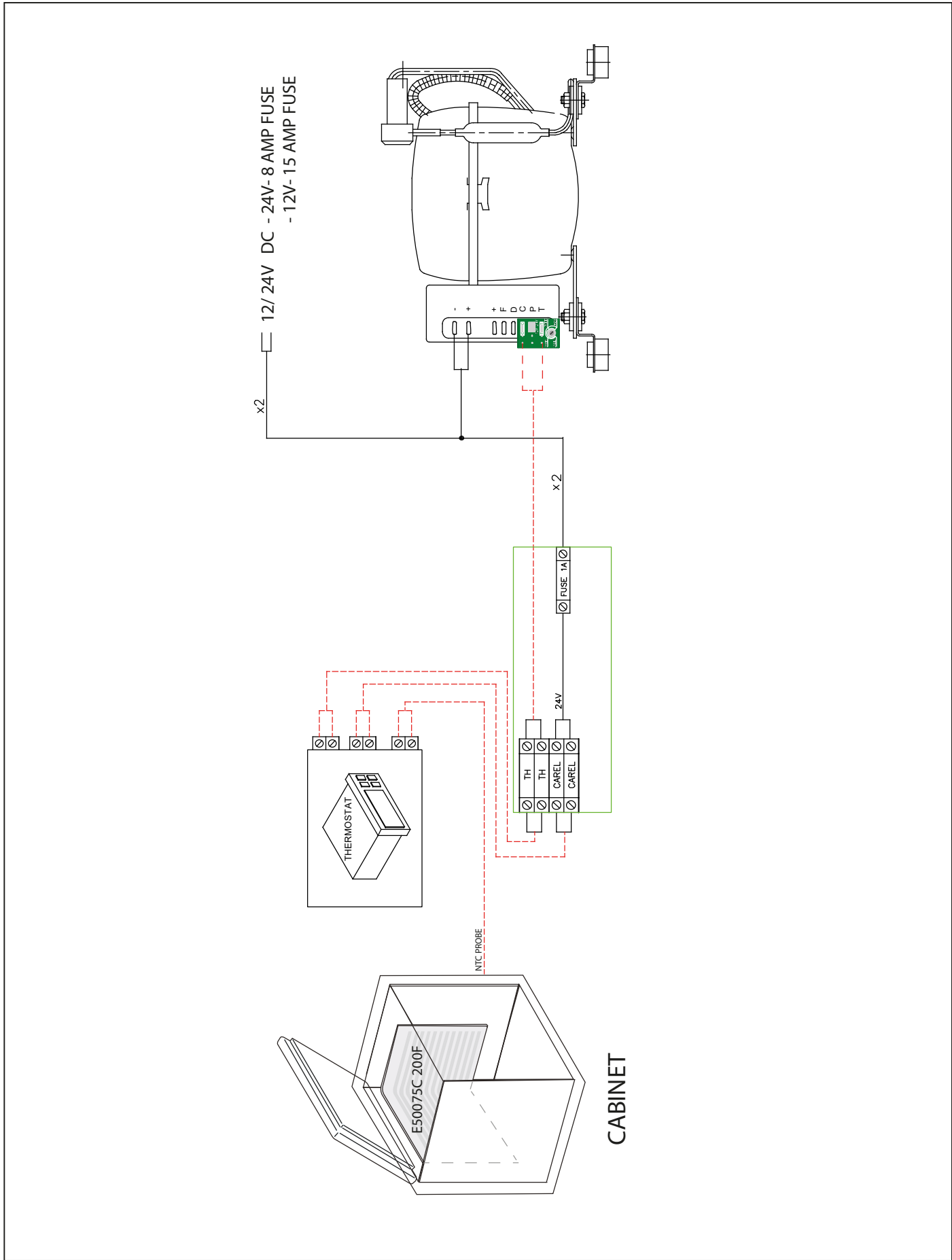
WIRING DIAGRAM - DC AIR COOLED, REMOTE CAREL 12/ 24V



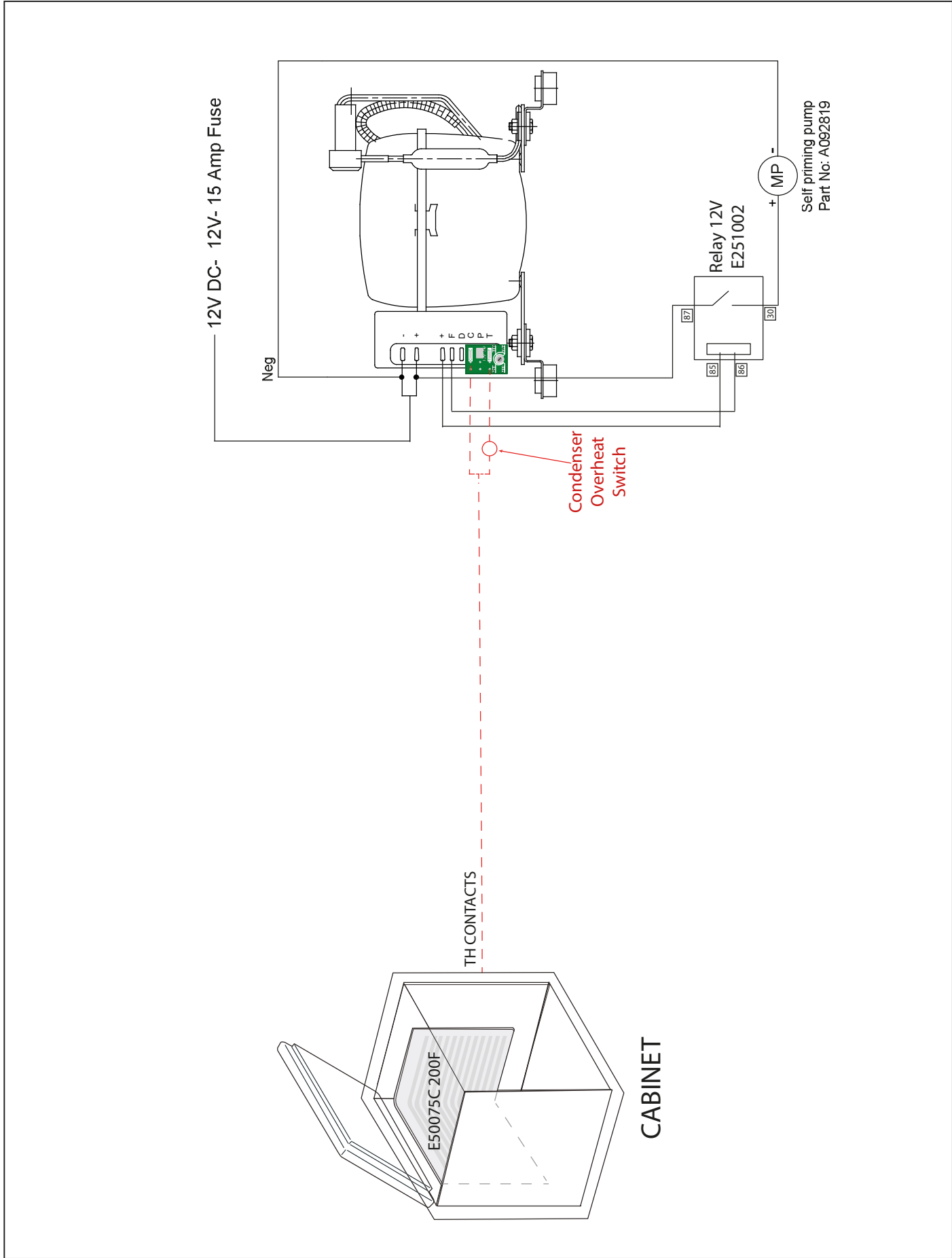
WIRING DIAGRAM - DC KEEL COOLED, MECHANICAL THERMOSTAT 12/ 24V



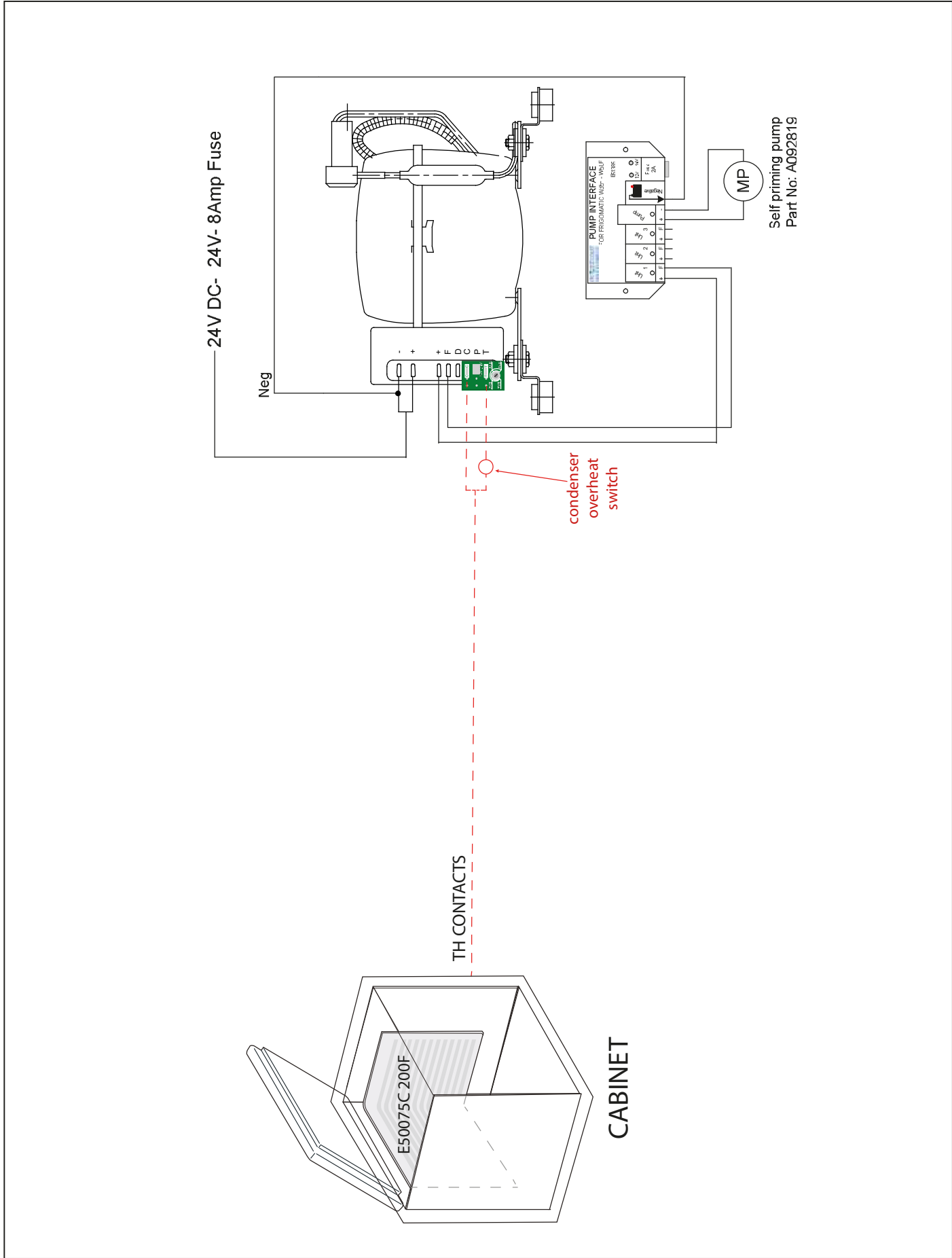
WIRING DIAGRAM - DC KEEL COOLED, REMOTE CAREL 12/ 24V



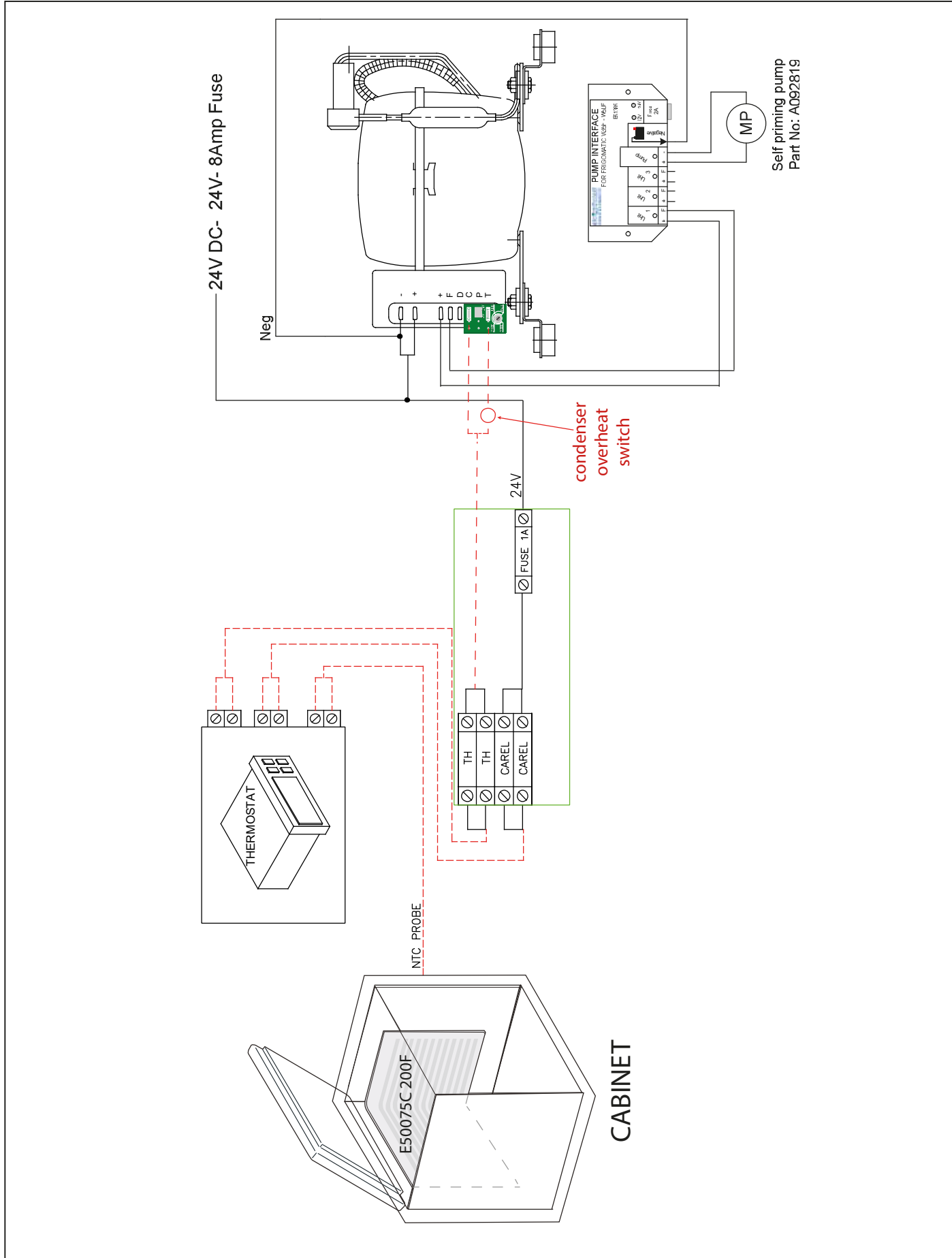
WIRING DIAGRAM - DC WATER PUMP COOLED, MECHANICAL THERMOSTAT 12V



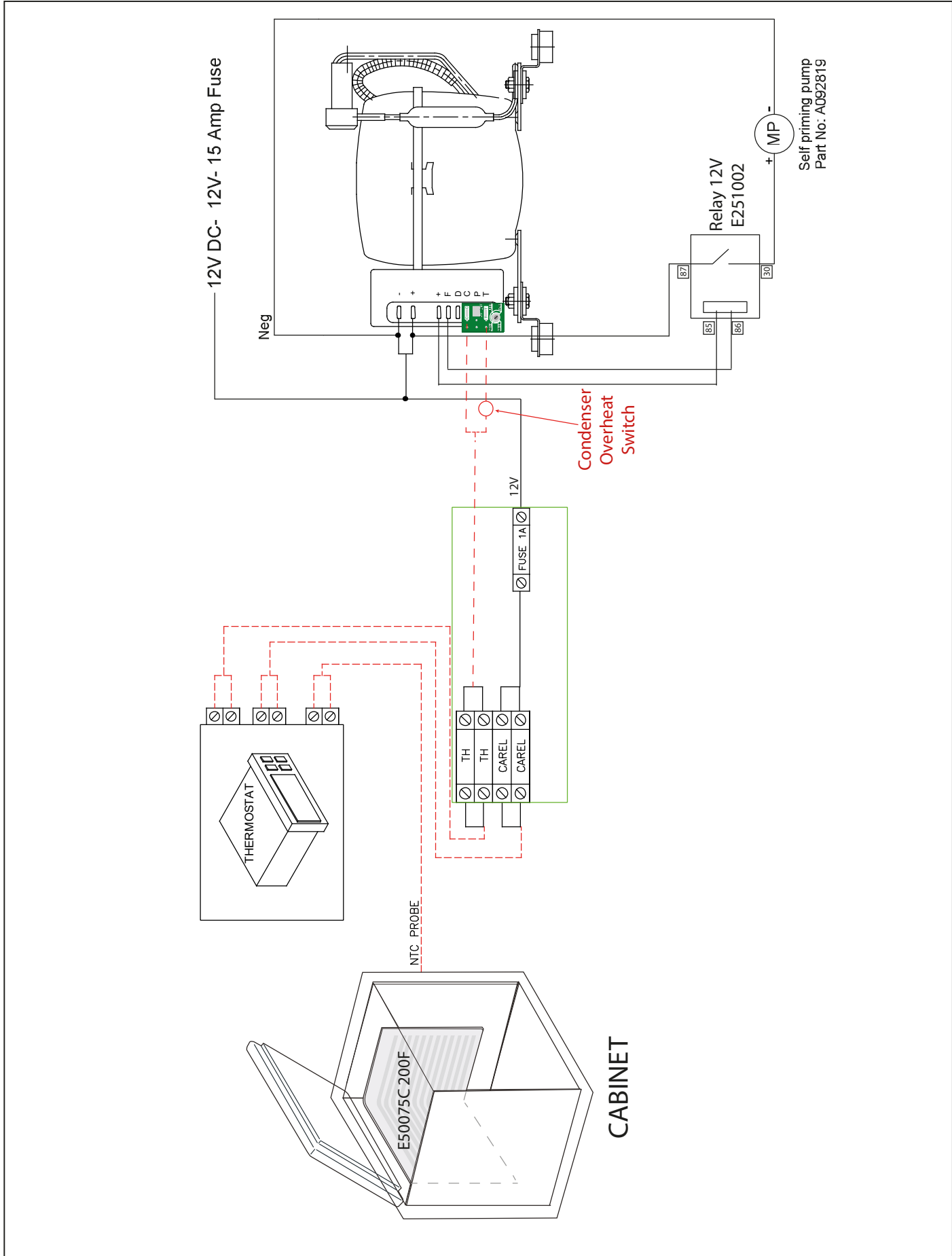
WIRING DIAGRAM - DC WATER PUMP COOLED, MECHANICAL THERMOSTAT 24V



WIRING DIAGRAM - DC WATER PUMP COOLED, REMOTE CAREL 24V



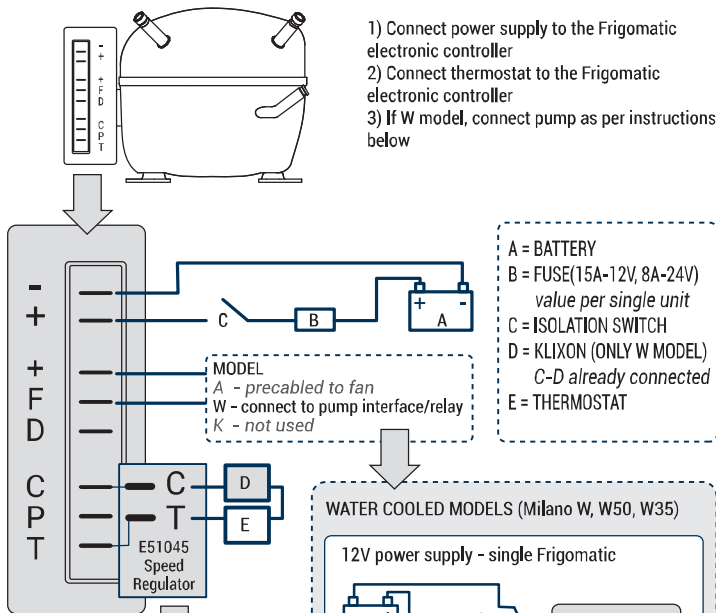
WIRING DIAGRAM - DC WATER PUMP COOLED, REMOTE CAREL 12V



FRIGOMATIC 12/24V

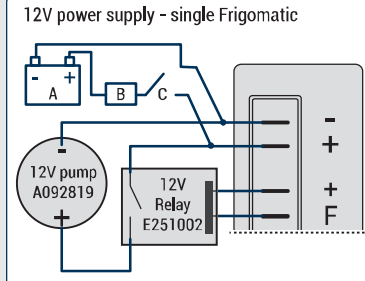
ELECTRIC CONNECTIONS

- 1) Connect power supply to the Frigomatic electronic controller
- 2) Connect thermostat to the Frigomatic electronic controller
- 3) If W model, connect pump as per instructions below

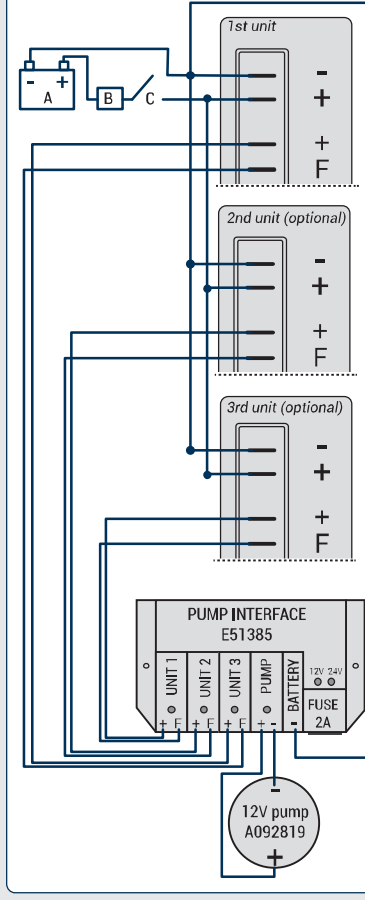


Speed regulator is available on Frigomatic Milano, plus few other models, when not available connect the thermostat to the equivalent electronic controller terminals.

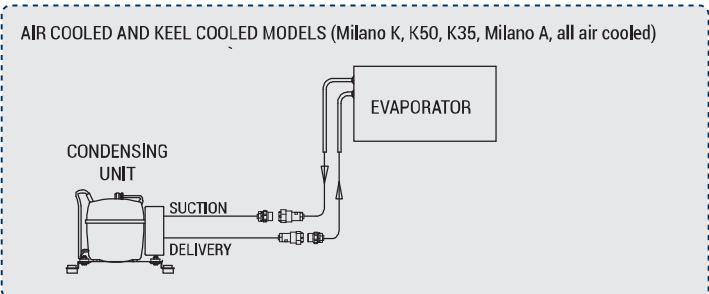
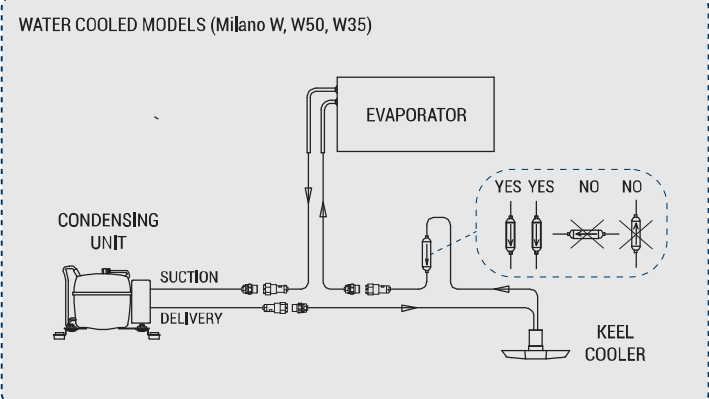
WATER COOLED MODELS (Milano W, W50, W35)



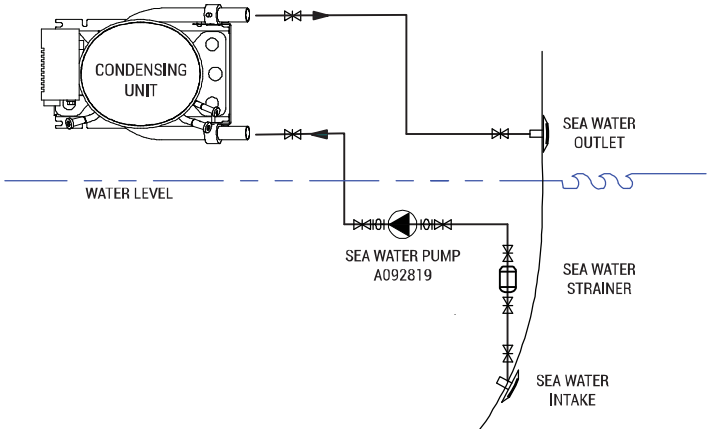
12-24V power supply - multiple Frigomatic



REFRIGERANT CONNECTIONS

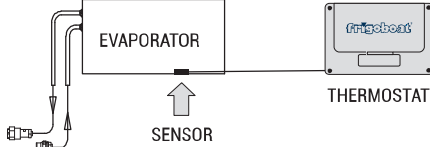


WATER CONNECTIONS (only W models)



THERMOSTAT SENSOR

The thermostat is provided with a temperature probe that needs to be installed on the evaporator plate itself, on the plastic support; make sure it does not touch the aluminium of the evaporator,



! THESE ARE ONLY PARTIAL INFORMATION, PLEASE CHECK THE FRIGOMATIC MANUAL FOR MORE INSTALLATION AND USAGE INSTRUCTIONS!