



User Instructions
12 / 24 Volt DC Refrigerators & Freezers
fitted with **DANFOSS BD35F** or
CUBIGEL GD30FDC Compressor

Issue 14: 100511

MODEL:

SERIAL No.:

PLEASE READ CAREFULLY BEFORE INSTALLING

- **THIS APPLIANCE IS INTENDED FOR USE ON BOATS OR VEHICLES ONLY. IT IS NOT DESIGNED FOR HOUSEHOLD USE.**
- **THIS APPLIANCE MUST NEVER BE LAID DOWN ON ITS BACK OR SIDE**
- **THIS APPLIANCE MUST BE ALLOWED TO RUN FOR 6 HOURS FROM NEW BEFORE LOADING WITH FOODS TO ENSURE CORRECT COOLING OPERATION.**

• **Introduction -**

Thank you for choosing SHORELINE for your mobile cooling needs. This appliance is manufactured using the very latest 'low-energy' compressor technology. To ensure that this appliance consumes the least amount of DC power, we ask you to read these instructions carefully before installing.

• **Positioning -**

To operate correctly and efficiently, your appliance must have sufficient air ventilation around the rear; sides and top, to ensure the free flow of heat generated from the compressor and condenser during the cooling operation.

Position the appliance on a level floor using the adjustable front levelling foot, and allow at least 25 mm above and to each side and to the rear to provide sufficient air gap between the appliance and the adjacent galley walls. Re-position any interior shelves or storage trays correctly to ensure vibration free operation.

Important - DO NOT OBSTRUCT the top or rear of the appliance or the condenser heat will not be able to escape and overheating could occur. This will result in excessive running periods of the compressor and reduce the life of your appliance.

**Remember - Better air flow means shorter running periods
and lower energy consumption.**

- **Connection -**

Your appliance can be powered from a 12 or 24 Volt DC supply. Once connected to the power, the compressor electronic unit will automatically calibrate to the applied voltage.

Important: Connection direct to a 240-Volt AC mains power supply will result in irreparable damage to the compressor electronic control unit.

Your DC power connection must be made to the terminals marked + and - at the top of the electronic control unit. **If the wires are incorrectly connected, the appliance will not operate**

Note - Models fitted with an internal light are supplied with short RED and BLACK cable tails ready for connection to the battery supply cable. *As most of our appliances are used on 12-volt electrical systems, models with interior lights are fitted with a 12-volt lamp. If connected to a 24-volt supply the lamp filament will 'blow'. A replacement 24-volt lamp is available on request.*

A fuse rated for 15 Amp (Max) for 12-volt installations, or 7.5 Amp (Max) for 24-volt installations, must be fitted to the POSITIVE lead from the battery to protect the installation. To allow power isolation of your appliance, a switch rated for 20 Amp (12 volt) switch, or 10 Amp (24 volt) should be fitted close to the appliance.

- **Cable Sizes -**

Connection from the battery to your appliance should be made using a cable size selected from the chart below:

CABLE SIZE		CABLE LENGTH (metres) (distance from battery to fridge)	
AWG	(MM2)	12 Volt	24 Volt
12	2.5	2.5	5
12	4	4	8
10	6	6	12
8	10	10	20

A Copy of the Danfoss & CUBIGEL/ACC Compressor Motor Data Sheet is attached for your reference.

- **Battery Protection -**

To protect your battery from any permanent damage, your appliance is fitted with an automatic low voltage protector. This will cut the power supply to the appliance if the battery voltage falls below the limit stated below:

	Cut-out	Cut-In
12 volt	10.0 volts	11.2 volts
24 volt	22.0 volts	24.4 volts

In addition, your appliance is fitted with a RED low-voltage LED alarm warning light. This is either mounted into the top front facia, the thermostat control housing, behind the lower storage container inside, or supplied on a 'flying-lead' coiled up at the rear on the Motor Electronic Unit. This indicator is continually OFF during normal operation. If the battery voltage falls below the limits stated above, this indicator will

begin to flash once every 4 or 5 seconds to warn that the battery supply is low and that the appliance is no longer running.

Note - Low voltage limits are to be measured at the compressor electronic control unit. Beware of voltage drop over long cable lengths and through any cable connections and isolation switches of insufficient rating. No other electrical equipment, i.e. water pumps, should be installed along the same cables supplying the appliance as low-voltage tripping can occur when these are switched on.

- **Appliance Operation -**

The cold control or thermostat can be manually adjusted from position 1 (WARMEST / FULLY ANTI-CLOCKWISE) to position 5 or Higher (COLDEST / FULLY CLOCKWISE). It is recommended that a position between 1 and 2 is most suitable.

Allow your fridge or freezer to operate for at least six hours from new before loading with foods to ensure its correct operation.

To achieve the optimum storage temperature for your food products, refrigerators should hold a mean internal temperature of +5°C, and freezers and freezer compartments below -12°C. If your appliance is holding temperatures colder than these recommended settings, the appliance will be running unnecessarily.

Note - These 12/24 Volt DC freezers are designed to store pre-frozen foods, not to freeze down large quantities of fresh foods. Expect the motor compressor to run for very long periods without cutting off if you attempt to freeze fresh foods.

Warning: If the room temperature drops below +16°C the freezer section in Models RR102, RR5010, RR155, RR5510, RF88 & RT143 may begin to defrost and may reduce the life of your frozen foods.

You may notice some unusual noises particularly if the fridge or freezer is placed in a quiet location. Most of these are perfectly normal, but you should be aware of them. *Gurgling, Whooshing:* these are the noises caused by the circulation of the liquid refrigerant in the cooling systems. These types of noises have become more pronounced since the introduction of CFC free gases. This is not a fault and will not affect the performance of your refrigerator or freezer. *Humming, Purring or Pulsating:* This is the compressor motor working as it pumps the refrigerant around the system.

- **Defrosting -**

It is necessary to regularly defrost your appliance in order to ensure efficient operation. The frost build up on refrigerator evaporator cooling plate should not exceed 6 mm in thickness before defrosting.

Before starting, ensure your food products are stored temporarily in an insulated container to minimise any temperature rise, particularly any frozen products. DO NOT re-freeze frozen foods if they have defrosted.

To defrost your appliance, isolate the power to your appliance. Allow the defrost water to collect in plastic tray (where fitted) beneath the ice compartment. When defrosting is completed, remove the drip tray, empty the water, and wipe dry and put back into its normal position.

Freezers should be defrosted when the ice build-up becomes greater than 10mm

Model RL5010 is a larder refrigerator and will defrost automatically, as will the fridge sections in models RR102, RR5010, RR155, RR5510, RF88 & RT143. You will notice water droplets down the inside back wall – this is normal. This water will drip out of the drain hole into the evaporation tray mounted above the motor/compressor unit at the rear. It is important to keep the drain hole clear using the pipe stick provided.

Note - Do not use sharp instruments to remove frost build-up as this could result in damage to the cooling plates or shelves.

• **AFTER SALES SERVICE -**

In the unlikely event of you experiencing problems with your appliance, please refer to the attached electrical fault analysis sheet. If you require any additional service information, please contact us at the address below, **quoting your appliance model number and serial number as displayed on the inside of your appliance.**

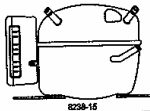


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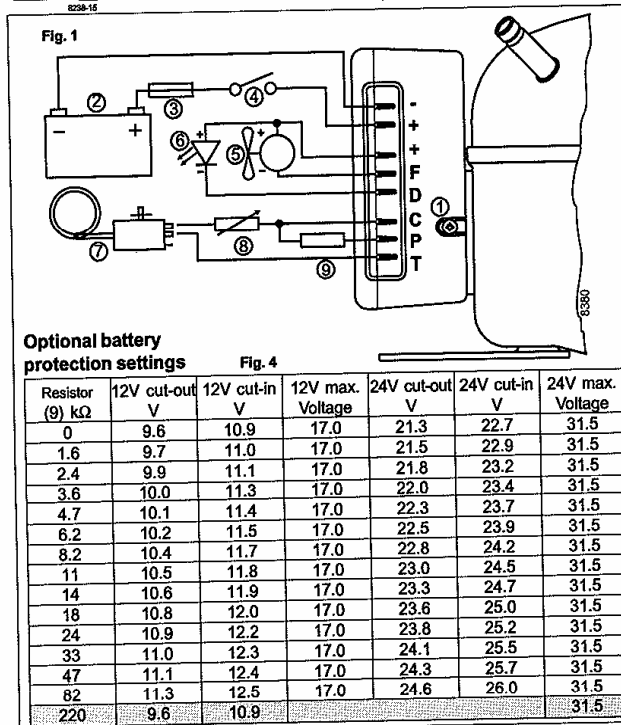
DANFOSS BD35F / ACC GD30FDC COMPRESSOR ELECTRICAL FAULT ANALYSIS

	FAULT	POSSIBLE REASON	CORRECTIVE ACTION
1	Compressor does not run - LED flashes <u>once</u> every few seconds	Voltage/Current supply too low to electronic unit terminals. Bad wiring connections.	Check cable size is correct. Check rating of isolation switches or for loose battery or wiring connections.
		Battery voltage too low.	Charge battery
2	Compressor does not run - LED flashes <u>three times</u> every few seconds THIS IS A SAFETY MOTOR PROTECTION FEATURE AND SHOULD AUTOMATICALLY RE-SET ITSELF AFTER 15 MINUTES	System pressures unequal before thermostat re-connects	If problem persists: Switch off power for 10 minutes, and then switch back on.
			Suspect Electronic Unit or Thermostat.
3	Compressor does not run	No power to unit	a) Check power at terminals on electronic unit. b) Check correct Polarity of <u>your</u> wiring.
		Defective line fuse or electronic unit	Replace fuse.
		Thermostat not making contact. Check by short-circuiting terminals T & C (Danfoss) or terminals T+ & T- (ACC) on electronic unit – compressor should then run continuously	Turn thermostat on or up to colder position
			Replace thermostat
			Replace electronic unit
4	Compressor runs but no refrigeration cooling	Appliance blocked in with no air flow at rear or sides	Refer to user instruction for correct installation guidance
		Refrigerator system fault: Leak or Blockage	Contact refrigeration engineer



Instructions

Electronic Unit for BD35/50F Compressors,
101N0210, 101N0220 and 101N0300, 12-24V



Optional battery protection settings

Fig. 4

Resistor (9) kΩ	12V cut-out V	12V cut-in V	12V max. Voltage	24V cut-out V	24V cut-in V	24V max. Voltage
0	9.6	10.9	17.0	21.3	22.7	31.5
1.6	9.7	11.0	17.0	21.5	22.9	31.5
2.4	9.9	11.1	17.0	21.8	23.2	31.5
3.6	10.0	11.3	17.0	22.0	23.4	31.5
4.7	10.1	11.4	17.0	22.3	23.7	31.5
6.2	10.2	11.5	17.0	22.5	23.9	31.5
8.2	10.4	11.7	17.0	22.8	24.2	31.5
11	10.5	11.8	17.0	23.0	24.5	31.5
14	10.6	11.9	17.0	23.3	24.7	31.5
18	10.8	12.0	17.0	23.6	25.0	31.5
24	10.9	12.2	17.0	23.8	25.2	31.5
33	11.0	12.3	17.0	24.1	25.5	31.5
47	11.1	12.4	17.0	24.3	25.7	31.5
82	11.3	12.5	17.0	24.6	26.0	31.5
220	9.6	10.9				31.5

Wire dimensions

Cross section mm ²	Max length* m	Max length* m
	12V operation	24V operation
2.5	2.5	5
4	4	8
6	6	12
10	10	20

Fig. 2 *Length between battery and electronic unit

Standard battery protection settings

12V cut-out V	12V cut-in V	24V cut-out V	24V cut-in V
10.4	11.7	22.8	24.2

Fig. 3

Compressor speed

Electronic unit	Resistor (8) Ω	Motor speed rpm	Contr.circ. current mA
101N0210 101N0220	0	2,000	5
	277	2,500	4
	692	3,000	3
	1523	3,500	2
101N0300 with AEO	0	AEO	6
	173	2,000	5
	450	2,500	4
	865	3,000	3
	1696	3,500	2

Fig. 5

ENGLISH

The electronic unit is a dual voltage device. This means that the same unit can be used in both 12V and 24V power supply systems. Maximum voltage is 17V for a 12V system and 31.5V for a 24V power supply system. Max. ambient temperature is 55°C. The electronic unit has a built-in thermal protection which is actuated and stops compressor operation if the electronic unit temperature gets too high.

Installation (Fig. 1)

Connect the terminal plug from the electronic unit to the compressor terminal. Mount the electronic unit on the compressor by snapping the cover over the screw head (1).

Power supply (Fig. 1)

The electronic unit must always be connected directly to the battery poles (2). Connect the plus to + and the minus to -, otherwise the electronic unit will not work. The electronic unit is protected against reverse battery connection.

For protection of the installation, a fuse (3) must be mounted in the + cable as close to the battery as possible. 15A fuse for 12V and 7.5A fuse for 24V circuits are recommended.

If a main switch (4) is used, it should be rated to a current of min. 20A.

The wire dimensions in Fig. 2 must be observed. Avoid extra junctions in the power supply system to prevent voltage drop from affecting the battery protection setting.

Battery protection (Fig. 1)

The compressor is stopped and re-started again

according to the decided voltage limits measured on the + and - terminals of the electronic unit. The standard settings for 12V and 24V power supply systems appear from Fig. 3.

Other settings (Fig. 4) are optional if a connection which includes a resistor (9) is established between terminals C and P.

In solar applications without a battery a 220 kΩ resistor is recommended. In AEO (Adaptive Energy Optimizing) speed mode the BD compressor will always adapt its speed to the actual cooling demand within a random operation voltage of 9.6 to 31.5V.

Thermostat (Fig. 1)

The thermostat (7) is connected between the terminals C and T. Without any resistor in the control circuit, the compressor with electronic unit 101N0210 or 101N0220 will run with a fixed speed of 2,000 rpm when the thermostat is switched on. With the thermostat directly connected to terminal C the electronic unit 101N0300 will adjust its speed to the actual cooling demand.

Other fixed compressor speeds in the range between 2,000 and 3,500 rpm can be obtained when a resistor (8) is installed to adjust the current (mA) of the control circuit. Resistor values for various motor speeds appear from Fig. 5.

Fan (optional, Fig. 1)

A fan (5) can be connected between the terminals + and F. Connect the plus to + and the minus to F. Since the output voltage between the terminals + and F is always regulated to 12V, a 12V fan must be used for both 12V and 24V power supply systems.

The fan output can supply a continuous current of 0.5A_{nom}. A higher current draw is allowed for 2 seconds during start.

LED (optional, Fig. 1)

A 10mA light emitting diode (LED) (6) can be connected between the terminals + and D. In case the electronic unit records an operational error, the diode will flash a number of times. The number of flashes depends on what kind of operational error was recorded. Each flash will last ¼ second. After the actual number of flashes there will be a delay with no flashes, so that the sequence for each error recording is repeated every 4 seconds.

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 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 _{nom}).
1	Battery protection cut-out (The voltage is outside the cut-out setting).



GD30FDC

Compressor for R134a
12V – 42V Direct Current

1. WIRING AND CONNECTIONS

General rules

GD30FDC must always be powered on through the dedicated electronic driver FDC1 that is a separate device from the compressor.

NEVER DIRECTLY CONNECT COMPRESSOR HERMETIC PINS (FUSITE) TO THE TERMINALS OF A BATTERY OR ANY OTHER DC OR AC SOURCE.

DO NOT TRY TO FIT AN ELECTRONIC DRIVER DIFFERENT THAN FDC1. THE COMPRESSOR WILL NOT OPERATE AND IRREVERSIBLE DAMAGE CAN BE PRODUCED.

The driver is directly connected to the battery poles as well as to compressor pins. It checks battery voltage and stabilises it to the right value for proper compressor operation or switches it off if battery voltage is not adequate. It also controls the compressor speed.

ALWAYS RESPECT THE POLARITY OF THE BATTERY WITH THE POWER INPUT TERMINALS OF THE ELECTRONIC DRIVER

The unit is protected against damage caused by wrong polarity of the supply but the compressor would not operate.

"-" POWER INPUT TERMINAL OF THE ELECTRONIC DRIVER SHOULD BE REFERRED TO THE CHASSIS OF THE VEHICLE AS WELL AS THE APPLIANCE FRAME ("+" TERMINAL FOR POSITIVE REFERENCE SYSTEMS)

A FUSE MUST BE PLACED BETWEEN THE "+" POLE OF THE BATTERY OR DC POWER SUPPLY AND THE "+" POWER INPUT TERMINAL OF THE ELECTRONIC DRIVER ("-" POLE AND TERMINAL FOR POSITIVE REFERENCE SYSTEMS).

12 V SYSTEMS: 30 A FUSE.

24 V SYSTEMS: 15 A FUSE

42 V SYSTEMS: 10 A FUSE

Voltage drop in the power leads

To avoid excessive voltage drop in the leads, its length and cross section must be in relationship with the voltage supply as indicated in Table 1.

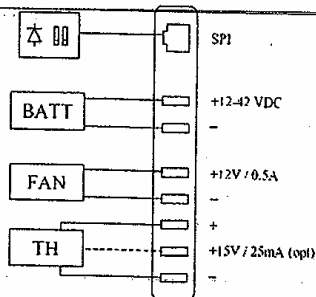
Cross section mm ²	Rated Operating Range		
	12-14 V	24-28 V	36-42 V
2.5	1.5	3	4.5
4	2.5	5	7.5
6	4	8	12
10	6	12	18

Table 1. Maximum length of leads (m)

If any kind of connector or switch is placed between the battery poles and the power terminals of the electronic driver, the resistance should be less than 10 mΩ. If the resistance is higher than 5 mΩ, the maximum length of the wires indicated in table 1 should be shortened to the half or the cross section should be increased to the double.

Wiring Diagram

FDC1 electronic driver features a terminal board where to make all the connections. The terminal lay out is described in figure 1:



2. SERIAL PORT INTERFACE

The electronic control unit FDC1 is provided with the exclusive Serial Port Interface (SPI), an RJ11 telephone type connector. This port allows the electronic driver to be connected to a computer for programming purposes. Optionally the SPI can be used for setting up either the compressor speed or the battery protection level, through physical connections between the terminals of the connector, and for installing a LED to display the intervention of any alarm. Also the SPI can be used to connect the electronic driver as slave to an Electronic Integral Manager of the appliance, with serial communication capabilities, in order to able the compressor working with variable speed.

3. OPERATING VOLTAGE

GD30FDC is designed to operate in a wide range of DC voltage supplied either by a battery or by any other kind of DC power supply.

ALLOWABLE DC VOLTAGE SUPPLY: 10 V TO 42.4 V

Functional modes

• Standard (Default):

From the actual value of applied voltage, the electronic driver automatically decides the rated voltage range of the supply. Three possible ranges are considered:

12 to 14 V: actual voltage is below 17 V.

24 to 28 V: actual voltage is within 17 and 33 V.

36 to 42 V: actual voltage is within 33 and 42.4 V.

4. BATTERY PROTECTION SYSTEM

There is a protection system of the battery preventing from compressor operation in case of available voltage becomes too low. The battery protection level should be set up as following:

Protection level	PROTECTION LIMITS (V)		Rated operating voltage range					
	Connection to COM		12-14V		24-28V		36-42V	
	IN1	IN2	cut-out	cut-in	cut-out	cut-in	cut-out	cut-in
Standard	0	0	10,0	11,2	22,0	24,4	36,0	38,4
Low	1	0	9,0	10,2	20,0	22,4	34,0	36,4
High	0	1	11,0	12,2	24,0	26,4	38,0	40,4
Very high	1	1	12,0	13,2	26,0	28,4	40,0	42,4

Table 3. IN1, IN2 and COM connection for battery protection set up. 0=open connection; 1=shortened.

5. SETTING UP THE SPEED

It is possible to operate the compressor under a different speed modes, either of fixed or variable values. The battery protection level should be set up as following:

• By programming:

The electronic driver is supplied by ACC for an already pre-fixed, unchangeable speed at any value within 1.500 r.p.m. and 3.500 r.p.m. depending on customer (the appliance producer) requirement.



Commercial Cold Business

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