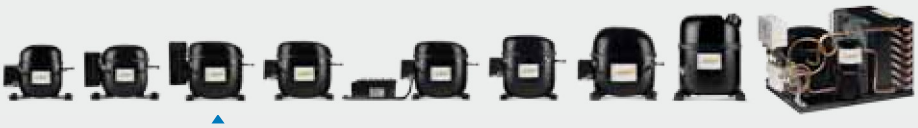
USER MANUAL
GD30FDC



Compressors for mobile applications
12 · 42V Direct Current Compressor



cubigel® compressors by HUAYI COMPRESSOR BARCELONA

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1. About the product

Many vehicles for transportation of goods or recreation, such as trucks, caravans, boats, cars, etc. are often equipped with cooling appliances. The compressors for such mobile applications must be designed to operate from a low voltage DC power supply. These compressors must also be compact in their dimensions, highly reliable and yield high performances.

GD30FDC is Cubigel's answer to the needs of users requiring comfort and reliability in their travelling, either on holidays, at work or in any other circumstance where a DC powered refrigerator is utilised. The GD30FDC is designed to operate silently, efficiently and reliably even up to angles of tilt of 30°, and works with the environmentally friendly refrigerant R134a. Its design is based on Cubigel's "D" series, which has been successfully present in the market since 1984, and has had sales of 15 million units.

GD30FDC compressor is not designed for off-road mobile applications. If you are interested in this type of mobile applications, it has to be specifically approved by Cubigel Compressors.

GD30FDC can be powered at any voltage within the 12 to 42V DC range, and is designed for capillary tube expansion. Each unit is supplied with a dedicated electronic driver (FDC1), which features all the protections for both the battery and the driver itself, including the compressor motor. The driver automatically adjusts itself to the voltage of the power supply.

Evaporation temperature range: -30°C to +10°C.
Condensation temperature range: up to 65°C. Pull-down peak: 70°C.
Ambient temperature range: -10 to 55°C (65°C at starting).

In case of ambient temperature lower than 0°C, an oil heater will be needed.

The electronic control unit FDC1 is supplied with the exclusive Serial Port Interface (SPI), featuring a RJ11 telephone type connector. SPI allows the electronic driver to be connected to a computer for programming purposes using the FxC programming package (hardware and software, provided by Cubigel under request), and allows the communication with an Electronic Integral Manager of the appliance (EIM), and making the compressor work in slave mode.

FDC1 electronic driver includes *Smart Speed*® as programming option, which is a plug-in system for automatically self-adapting compressor speed to current thermal load.

Smart Speed® reduces the number of thermostat cycles by minimizing compressor speed, enlarging on-time at every thermostat cycle, so that start/stop energy loses are substantially reduced. Lowest speed yields also highest evaporating temperature, and so highest C.O.P and lowest energy consumption. Pull-down is done at maximum programmed speed, so pull-down time is very short with respect to fixed speed systems. No design parameters neither of the compressor nor the appliance are required to be programmed, so *Smart Speed*® can be easily used in all appliances with no design efforts.

FDC1 electronic driver includes also Sleep and Sleep Energy Saving as programming option, which is a plug-in system specially conceived for mobile air conditioners avoiding any other electronic device. *Sleep and Sleep Energy Saving* makes the air conditioner work for four hours since start-up. *Sleep Energy Saving* makes the compressor run at maximum programmed speed during the first hour, when highest cooling capacity is needed, and lowers compressor speed progressively to minimum velocity three hours later. Maximum comfort and minimum energy consumption is thus achieved.

GD30FDC starting capability is as low as 10V under any balanced pressure. It also admits a certain remaining differential pressure when thermostat off-time is abnormally short. For improving even more the starting capability, FDC1 electronic driver is supplied with a 3 minutes minimum thermostat off-time. The delay is a programming option which can be easily removed if no delay is preferred for any reason.

FDC1 also includes a 1 second filter at the thermostat input to prevent the appliance from wrong operation due to typical micro switching produced by vibrations in those appliances that fit tilt switches at the thermostat circuit. So, analogical filtering is not needed.

2. Wiring and Connections

General rules

GD30FDC must always be powered through the dedicated electronic driver FDC1, which is supplied with the compressor as a separate device.

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

DO NOT TRY TO FIT AN ELECTRONIC DRIVER OTHER THAN THE FDC1. THE COMPRESSOR WILL NOT OPERATE AND IRREVERSIBLE DAMAGE MAY OCCUR.

The FDC1 driver is directly connected to the battery poles as well as to the compressor pins. It checks battery voltage and adjusts itself to the voltage value for proper compressor operation, or switches itself off if the battery voltage is not adequate. The driver 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,. The compressor will not run correctly if it's wrongly connected.

"-" POWER INPUT TERMINAL OF THE ELECTRONIC DRIVER SHOULD BE REFERRED TO THE CHASSIS OF THE VEHICLE AS WELL AS THE APPLIANCE FRAME*

A FUSE MUST BE PLACED BETWEEN THE "+" POLE OF THE BATTERY OR DC POWER SUPPLY AND THE "+" POWER INPUT TERMINAL OF THE ELECTRONIC DRIVER*

12V SYSTEMS: 30A FUSE
24V SYSTEMS: 15A FUSE
42V SYSTEMS: 10A FUSE

In some special vehicles chassis is connected to "+" terminal of the battery instead of "-" terminal (positive reference systems). In such cases "+" should be understood as "-" and vice-versa.

In systems powered by a variable DC source, the fuse should be selected following the rules above mentioned, considering the maximum voltage at the variable DC Source.

Voltage drop in the power leads

To avoid excessive voltage drop in the leads, their length and cross section must be related to the voltage supply as indicated in Table 1.

Cross section mm²	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, its resistance should be less than 10mΩ. If the resistance is higher than 5mΩ, the maximum length of the wires indicated in Table 1 should be halved or the cross section doubled.

Wiring Diagram

The FDC1 electronic driver features a terminal board where all connections are made. The terminal lay out is described in Figure 1:

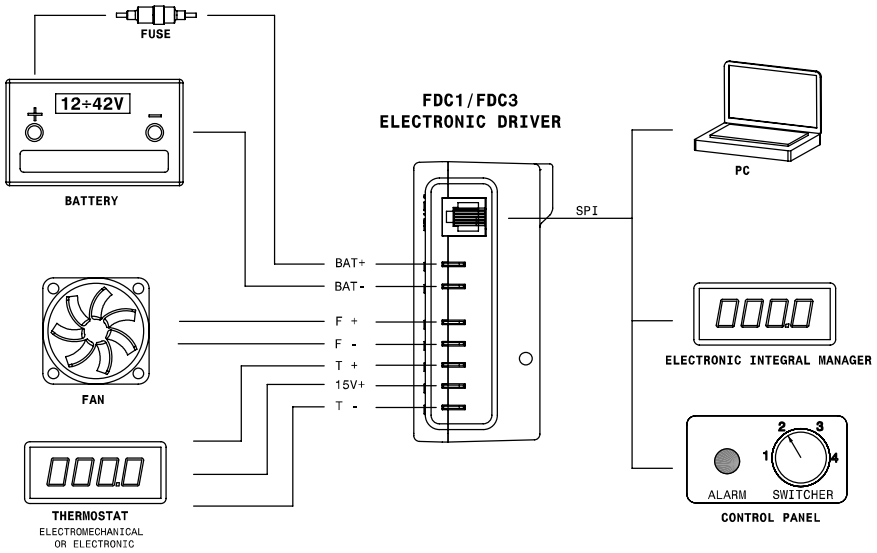


Fig. 1. FDC1 Wiring scheme

When connecting the electronic driver to the compressor, any position of the connector is possible under an electrical point of view. However, in practice, the vertical position is not possible because the electronic box cannot be assembled. The connector should be rotated 120° clockwise or counter clockwise with respect to the vertical position as shown below.

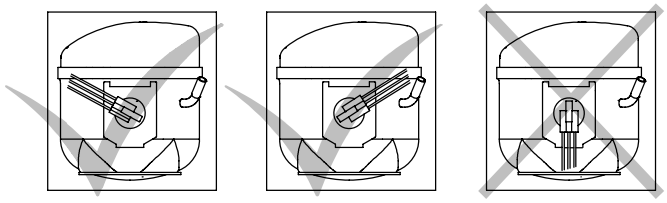


Fig. 2. Connection of the FDC1 electronic driver to the compressor

3. The serial port interface (SPI)

The electronic control unit FDC1 is supplied with the exclusive Serial Port Interface (SPI), featuring a RJ11 telephone type connector. This port allows the electronic driver to be connected to a computer for programming purposes using the FxC programming package (hardware and software) provided by Cubigel under request. Optionally, the SPI can be configured to:

• Install a LED to display the intervention of any alarm.

• Set up either the compressor speed or the battery protection level, through physical connections between IN1, IN2 and COM.

• Connect the electronic driver as slave to an Electronic Integral Manager of the appliance with serial communication capabilities (Rx, Tx and COM), to allow working with variable speed. SPI provides a 5 V output, limited to 25mA, to power up the EIM.

Figure 3 Shows the RJ11 male connector which can be plugged to the SPI and the usage of each terminal in it.

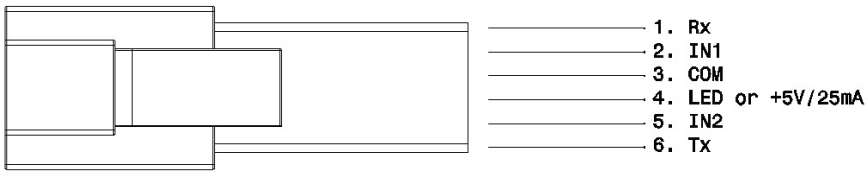


Fig. 3. SPI terminals

4. Operating voltage

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

DC VOLTAGE SUPPLY ALLOWED: 10V to 42.4V

Functional modes

• Standard (Default):

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

12 to 14V: actual voltage is below 17V
24 to 28V: actual voltage is within 17 and 33V
36 to 42V: actual voltage is within 33 and 42.4V

• Special (programming option):

The compressor can be powered by a variable DC source as, for instance, a photovoltaic panel, in which the output voltage strongly depends on the intensity of sunlight radiation. In these special cases the driver should be programmed with rated, minimum and maximum voltages. These values should be within the allowable DC voltage power supply (10 V to 42.4V).

Rated voltage and voltage limits are programmed by the appliance manufacturer by means of a PC connected through the serial port to the driver's Serial Port Interface, using the FxC programming package provided by Cubigel under request.

5. Battery protection system

There is a protection system for the battery that prevents the compressor from operating if the available voltage becomes too low. The battery protection level should be set up as following:

• By programming:

Voltage limits for battery protection can be freely set, by the customer for every system (12-14V, 24-28V, 36-42V or special) by means of the serial or USB port of a PC connected to the SPI port of the electronic driver using the FxC programming package provided by Cubigel under request. In that option cut-out and cut-in values must respect the rule defined by Table 2.

Rated voltage range (V)	Cut-out (V)		ΔV	
	min	max	min	max
12-14	9,0	12.0	1.0	1.5
24-28	20,0	26.0	2.0	3,0
36-42	34,0	40.0	2.0	3.0
Special	9,0	40.0	1.0	3.0

Table 2. Limits of battery protection parameters

In Table 2, ΔV is the difference between cut-out and cut-in, that is, the cut-in value is the result of adding ΔV to the cut-out value.

• Externally, using COM, IN1 and IN2 of SPI:

· This option prevents from the possibility of setting up the speed externally using COM, IN1 and IN2 of SPI as defined in point 6.

· The external battery protection set up option must be previously programmed for external adjustment of the protection limits.

· Voltage limits are set up by means of a PC through its serial or USB port connected to the electronic driver SPI. It can be done by the customer itself using the FxC programming package.

· The cut-out (battery voltage at which the driver stops operating) and the cut-in (battery voltage at which driver re-starts operation after a cut-off) values are set up by connecting the SPI connector terminals IN1 and IN2 to COM. According to the connection made, four protection levels can be selected as shown in Table 3.

Protection limits (V)			Rated operating voltage range					
Protection level	Connection to COM		12-14 V		24-28 V		36-42 V	
	IN1	IN2	cut-out	cut-in	cut-out	cut-in	cut-out	cut-in
Standard	0	0	10.0	11.5	22.0	24.5	36.0	38.5
Low	1	0	9.0	10.5	20.0	22.5	34.0	36.5
High	0	1	11.0	12.5	24.0	26.5	38.0	40.5
Very high	1	1	12.0	13.5	26.0	28.5	40.0	42.5

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

6. Setting up the speed

It is possible to operate the compressor at fixed or variable speed under different running modes, options and parameters. The electronic driver is supplied by Cubigel with standard running mode and external control of the speed, with minimum speed of 1,500 rpm and maximum speed 3,500 rpm. Default running mode, options and parameters can be changed to optimize compressor performance for a given appliance, by programming, connecting a PC to the SPI by means of the FxC programming package provided by Cubigel under request. Running modes and options are:

• Standard mode:

Compressor speed is a fixed programmed value or switched externally from programmed minimum and maximum value in four steps. The switch should be connected to the SPI and should remain plugged during compressor operation.

When setting up a fixed speed, maximum speed can be limited by the available battery voltage in the following way, maximum speed would be:

· 1,500 rpm when the battery voltage is equal to the cut-in voltage.
· Programmed fixed speed when the battery voltage is equal to or greater than the maximum nominal voltage (14V, 28V and 42V for 12V, 24V and 42V systems respectively).
· A linear function of the battery voltage in the range between the cut-in and the maximum nominal voltages.

This option is particularly useful for eutectic plates systems.

If external switching is programmed, the speed is set up by the connection of the SPI terminals IN1 and IN2 to COM for minimum and maximum speeds, and two intermediate velocities according to Table 4:

Connection to COM		Speed of the motors (rpm)
IN1	IN2	
0	0	S_{min}
1	0	S_{min} + 1/3 (S_{max}-S_{min})
0	1	S_{min} + 2/3 (S_{max}-S_{min})
1	1	S_{max}

Table 4. External selection of the velocity 0=Open connection; 1=Shortened

External speed set up option must be previously programmed for external adjustment of its minimum (Smin) and maximum (Smax) limits.

External switching prevents from the possibility of setting up the battery protection externally using COM, IN1 and IN2 of SPI as defined in point 5.

• Smart Speed® mode:

Compressor will run at variable speed at its highest performance depending of the actual thermal load. The speed can be limited by a fixed programmed value and even more by the available battery voltage as described in standard mode. The speed can also be limited by external switching in the same way as described in standard mode.

NO SWITCH (MANUAL I/O, TILT, ETC.) IS ALLOWED TO BE CONNECTED IN SERIES WITH THE THERMOSTAT.

IF ELECTRONIC THERMOSTATS ARE TO BE FIT, AVOID THOSE THAT INCORPORATE MANUAL I/O SWITCH AND/OR STARTING DELAY.

• Sleep mode:

Compressor will run during four hours after start-up. The speed can be limited by a fixed programmed value and even more by the available battery voltage as described in standard mode. The speed can also be limited by external switching in a similar way as described in standard mode, Cubigel Compressorsording to table 5:

Connection to COM		Speed of the motors (rpm)	Sleep mode
IN1	IN2		
0	0	S_{min}	off
1	0	S_{min}	on
0	1	S_{max}	off
1	1	S_{max}	on

Table 5. External selection of the velocity 0=Open connection; 1=Shortened

If off sleep mode is selected, the appliance will run continuously at selected fixed speed S_{min} or S_{max}.

• Sleep Energy Saving mode:

Compressor will run during four hours. During first hour compressor will run at selected speed. During next three hours speed will decrease up to 1,500 r.p.m. Programming Sleep Energy Saving is done in the same way as Sleep.

• Slave mode:

Under this mode, variable speed is controlled by an Electronic Integral Manager of the appliance (EIM) permanently connected to the electronic driver FDC1 through the SPI, using its serial communication capabilities. The EIM reads the actual temperature inside the appliance, compares it with the set point temperature, and decides if the compressor should operate or not, and if so, at which speed. The EIM communicates how the compressor should operate and, eventually, records any abnormal circumstance that might occur. For details about the communication protocol, please, contact Cubigel.

IF ANY VARIABLE SPEED MODE IS TO BE PROGRAMMED, CHECK CAREFULLY FOR TUBE, CONDENSER AND EVAPORATOR RESONANCES. NATURAL FREQUENCIES SHOULD BE 75 Hz UP TO AVOID VIBRATIONS.

7. Programming the electronic driver

In order to program the electronic driver FDC1, a personal computer together with the FxC programming package are required (provided by Cubigel under request). To this purpose, perform the following steps:

1. Install the programming software, following the instructions of the wizard.

2. Connect the programming interface to a PC using a serial/serial or USB/serial cable supplied with the hardware.

3. Power on the programming interface using the AC/DC adapter supplied with the hardware.

4. Connect the FDC1 electronic driver to the programming interface using the double RJ11 cable supplied with the hardware.

5. Run the programming file FDC.exe.

6. From the top menu, load an existing configuration and go to step 9, or go through step 7.

7. Select the running mode, options and parameters, between:

7.1 Standard mode.

7.1.1 Select maximum fixed speed and enter a value within 1,500 and 3,500 r.p.m. as described in point 6, if desired select speed limited by available battery voltage, or

7.1.2 Select external switcher connected to SPI and enter low and high speed values within 1,500 and 3600 r.p.m. as described in point 6. External speed selection is incompatible with external battery protection (step 8.2).

7.2 *Smart Speed*® mode. Select maximum fixed speed or external switcher connected to SPI and proceed as described in 7.1.1 or 7.1.2 respectively.

7.3 Sleep and Sleep Energy saving modes. Select maximum fixed speed or external switcher connected to SPI and proceed as described in 7.1.1 or

7.4 Slave mode

8. Select the battery protection mode and the protection parameters from:

8.1 Internal protection: choose between normal and special voltage systems.

8.1.1 For normal voltage systems, enter cut-out, cut-in and maximum voltage values for every voltage system, accounting for the limits shown in Table 2 of point 5.

8.1.2 For special voltage systems, enter cut-out, cut-in and nominal and maximum voltage values accounting for the limits shown in Table 2 of point 5.

8.2 External protection. Protection values are shown in Table 3 of point 5. External protection is incompatible with external speed selection (step 7.2).

9. Select thermostat delay 3 minutes for improved starting.

10. Click “Apply”. The FDC1 electronic driver is now programmed and ready to drive the compressor.

11. From the top menu, save the current configuration if desired.

12. To program another FDC1 unit, plug it in, apply current configuration or return to step 6 to change configuration.

13. Click exit to finish.

8. Protections and alarms

GD30FDC is electronically protected against a number of possible malfunctions and failures:

• Battery discharge: refer to point 5 for details.

• Fan over current: protects the compressor and the electronic driver against fan over current due to start or running overload, or short-circuit.

• Starting failure: if the running speed is not achieved during the starting sequence, the unit stops and retries the start up after one minute.

• Compressor overload: This protection operates when the compressor speed drops below the set up speed, or when the current drawn in is excessive, thus preventing the appliance from operating under overload conditions, causing refrigerating overload or compressor failure.

• Electronic driver overheat: In case the temperature of the electronic components of the control becomes too high, an internal sensor will stop the unit.

When the alarm is on, ten automatic attempts to restart the compressor will be available. In case of battery protection, the number of automatic attempts to restart is unlimited. Once the sequence of automatic attempts to restart the compressor is finished, the unit will remain permanently unable to operate until it is switched off and on again from the power supply. The intervention of the thermostat during the sequence of automatic restart attempts interrupts and resets the sequence.

The SPI can be configured in a way that a LED can be connected between terminals 3 and 4 (see Fig. 2 in point 3) in order to display the intervention of any alarm, and to identify its cause. The visualisation consists of a sequence of flashes of the LED repeating every 5 seconds, until the cause of the alarm disappears. The code of the flashing sequence corresponding to each alarm is indicated in Table 6:

No. of flashes	Type of fallure
1	battery protection
2	fan over current
3	starting failure
4	compressor overload
5	electronic driver overheat
6	internal error

Table 5. Alarm codification

If the FDC1 electronic driver is connected to an Electronic Integral Manager (EIM) of the appliance as a slave through the SPI, in case of an alarm intervention, a digital alarm code will be transmitted to the EIM, which in turn will manage the information for displaying and acting purposes.

9. Compressor Cooling

An adequate heat removal mechanism from both the electronic driver and the compressor is fundamental for an optimal performance and reliability of the unit. The cooling method should be selected depending on the working conditions of the appliance, with major factors being the compressor's velocity and the evaporation temperature, and also, but secondary, the condensation temperature.

FREE AIR CIRCULATION OVER THE COMPRESSOR AND THE ELECTRONIC DRIVER MUST ALWAYS BE GUARANTEED.

Table 6 shows the recommended cooling method for a standard condensation temperature of 55ºC. The table should be taken as a recommendation, as the only way to validate a design is testing the appliance at the highest evaporation, condensation and ambient temperature, verifying that the electronic driver overheat protection does not act.

r.p.m.	Evaporation Temperature								
	-30	-25	-20	-15	-10	-5	0	5	10
1500	Static	Static	Static	Static	Static	Static	Static	Fan	Fan
2000	Static	Static	Static	Static	Static	Static	Fan	Fan	Fan
2500	Static	Static	Static	Static	Static	Fan	Fan	Fan	Fan
3000	Static	Static	Static	Static	Fan	Fan	Fan	Fan	N/A
3500	Static	Static	Static	Fan	Fan	Fan	Fan	N/A	N/A

Recommended cooling method. Condensation temperature: 55ºC.
N/A: not allowed

The electronic driver features two contacts where to connect the fan in case of compressor fan cooling as described in point 2.

10. Supply

• GD30FDC compressor including FDC1 electronic driver delivered in pallets of 144 units.

• Pack of GD30FDC compressor including: FDC1 electronic driver, set of connectors for external speed selection and spare part guide.

• Pack of FDC1 electronic driver, set of connectors for external speed selection and spare part guide.

11. Dimensions

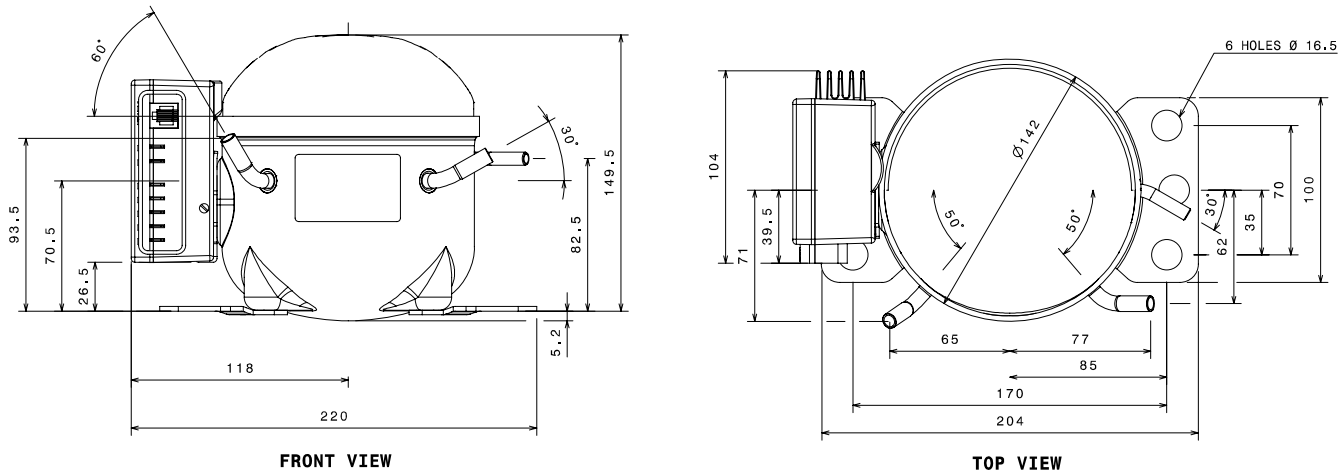


Fig. 4. GD30FDC outline drawing

12. Technical Data

Compressor		
Displacement	cm^3	3.00
Diameter	mm	18.00
Stroke	mm	12.10
Net weight	kg	5.4
Oil type		ISO VG 22 ESTER
Oil charge	cm^3	240

Approvals GD30FDC is in compliance with the following directives and approvals:
• Low Voltage Directive 73/23/EEC (CE-marking)
• Electromagnetic Compatibility Directive for Automotive Industry 95/54/EC (e-marking: e9 6013)
• VDE approval
• CCC approval
• UL approval
• Cubigel Compressors declares that production starting January 2006 is RoHS compliant

Reliability GD30FDC pass following reliability tests:
• High Temperature: according with CECOMAF GT-4002 standard
• Wear: according with CECOMAF GT-4003 standard
• ON/OFF: according with CECOMAF GT-4004 standard
• Vibrations: according with ASTM 5728 Level I standard

Application		
Application		LBP - MBP - HBP
Refrigerant		R134a
Evaporation temp. range	°C	-30 to +10
Expansion system		CAPILLARY
Compressor cooling		Static or fan depending on working conditions
Max. ambient temperature	°C	43

Electrical		
Voltage	V DC	12 to 42
Voltage range	V DC	10 to 42.4

Motor		
Type		Brush-less, Sensor-less, PMM
Phase number		3
Pole number		6
Locked rotor current (12, 24, 42 V)	A	11, 6, 4
Resistance at 25°C (R-S/R-T/S-T)	Ω	0.80

Electronic driver	
Model	FDC1
Type	Fully digital & programmable µP based
Supported devices	12V/0.5A Fan Compressor speed or battery protection level switcher Alarm LED 15V/25mA electronic thermostat 5V/25mA Electronic Integral Manager
Communication port	Serial Port Interface (SPI)
Communication capabilities	RS-232 serial port 2-digit, 4-level switcher Alarm LED
Compressor speed selection	By programming or switching*
Battery protection level selection	By Programming or switching* *only one at a time
Protections	Battery protection Fan over current Starting failure Compressor overload Electronic driver overheat Fan over current Starting failure Compressor overload
Programmable running modes	Standard Smart Speed Sleep Sleep Energy Saving Slave
Setup by default	Running mode: Standard Speed selection: external switcher Lower/higher speed: 1500/3500 r.p.m. Battery protection: fixed voltage level; standard system Cut-out (12/24/42 V systems): 11.5/24.5/38,5 V Cut- in (12/24/42 V systems): 10.0/22.0/36.0 V 3 minutes thermostat delay: on

Nominal performance at	rpm	1500	2000	2500	3000	3500
Cooling capacity	W	32	46	58	67	74
Cooling capacity	kCal/h	28	40	50	58	64
Input power	W	26	36	46	54	61
EER	kCal/(Wh)	1.07	1.11	1.09	1.07	1.05
COP	W/W	1.24	1.28	1.26	1.24	1.22
Current	A	2.19	3.03	3.85	4.53	5.08

Test Conditions		
Evaporating temperature	°C	-23.3
Condensing temperature	°C	55
Liquid temp. entering expansion	°C	32
Ambient and return temp.	°C	32
Voltage	V DC	12

Performance data

rpm	-30	-25	-23,3	-20	-15	-10	-5	0	5	10
Cooling Capacity ASHRAE (kCal/h)										
1500	19	25	28	33	43	60	78	100	126	160
2000	26	36	40	49	64	87	112	142	179	223
2500	32	45	50	62	82	110	142	180	227	281
3000	37	52	58	72	97	129	168	214	270	-
3500	41	57	64	79	109	144	190	244	-	-
Cooling Capacity CECOMAF (W)										
1500	18	24	26	31	41	57	73	94	119	150
2000	25	34	38	46	60	82	106	134	169	210
2500	30	42	47	58	77	104	134	170	214	264
3000	35	49	55	68	91	122	158	202	254	-
3500	39	54	60	74	103	136	179	230	-	-
Input Power (W)										
1500	23	25	26	29	34	41	47	52	57	63
2000	30	35	36	40	47	56	64	71	78	86
2500	38	44	46	53	63	73	83	92	101	110
3000	44	52	54	63	77	88	100	112	122	-
3500	50	58	61	71	89	102	116	130	-	-
C.O.P. ASHRAE (W/W)										
1500	0.97	1.17	1.24	1.33	1.47	1.70	1.95	2.23	2.58	2.94
2000	1.01	1.21	1.28	1.41	1.57	1.82	2.05	2.33	2.66	3.02
2500	0.99	1.19	1.26	1.37	1.52	1.76	2.00	2.28	2.62	2.98
3000	0.97	1.17	1.24	1.33	1.47	1.70	1.95	2.23	2.58	-
3500	0.95	1.15	1.22	1.29	1.42	1.64	1.90	2.18	-	-
C.O.P. CECOMAF (W/W)										
1500	0.79	0.97	1.03	1.07	1.21	1.39	1.57	1.80	2.10	2.37
2000	0.84	0.98	1.05	1.14	1.27	1.48	1.67	1.89	2.16	2.45
2500	0.80	0.96	1.02	1.12	1.23	1.43	1.62	1.85	2.12	241
3000	0.79	0.95	1.01	1.08	1.19	1.38	1.59	1.81	2.09	-
3500	0.78	0.94	0.98	1.04	1.15	1.33	1.54	1.77	-	-
Current (A)										
1500	1.90	2.07	2.19	2.40	2.83	3.42	3.88	4.35	4.73	5.27
2000	2.49	2.88	3.03	3.37	3.95	4.63	5.29	5.91	6.52	7.16
2500	3.13	3.66	3.85	4.39	5.23	6.06	6.88	7.65	8.40	9.1
3000	3.70	4.31	4.53	5.25	6.39	7.35	8.35	9.3	10.1	-
3500	4.18	4.80	5.08	5.93	7.44	8.51	9.7	10.8	-	-

	ASHRAE	CECOMAF
Condensation temperature:	55°C	55°C
Liquid temperature entering expansion:	32°C	55°C
Ambient and return temperature:	32°C	32°C

Voltage: 12 V DC

HUAYI
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