

# FRECON

FIA-L / REG 18, 37, 55, 75, 110, 150, 220, 250

PROGRAMMABLE SPEED DRIVES  
FOR  
AUTOMATIC SPEED CONTROL OF THE ROTATING  
HEAT EXCHANGER



INSTALLATION AND USER MANUAL



## 1. Introduction

- Small, light-weight and compact
- IGBT output bridge for high speed switching and low power consumption
- Heat exchanger speed continuous - controlled from 0Hz to 125Hz (option - up to 500Hz)
- Logic and analogue inputs
- Integrated measurement module, controller and special control software for autonomous speed control of the rotating heat exchanger
- FRECON MINITERMINAL - control pod : combines keypad and display, operational functions of the drive can be changed from the keypad
- External braking unit
- External RFI filter

## 2. General characteristics

Type: L/REG:	FIA-	18	37	55	75	110	150	220	250
<b>Nominal motor rating</b>	(kW)	0,18	0,37	0,55	0,75	1,1	1,5	2,2	2,5
<b>Input:</b>									
Voltage		1x 230V ± 10%							
Nominal current	(A)	2,6	4,4	6,1	7,0	9,6	12,2	17,5	20,0
Frequency		47 ÷ 63 Hz							
<b>Output:</b>									
Voltage		3 x 0 ÷ input voltage							
Frequency		0 ÷ 125Hz, (with spec. SW up to 500Hz)							
Apparent power	(kVA)	0,6	1,0	1,4	1,6	2,2	2,8	4,0	4,5
Overload		150%, 30 sec							
Nominal current	(A)	1,4	2,4	3,0	4,0	5,5	7,0	10,0	11,3
Modulation		PWM - 18kHz							
V / f - characteristic		adjustable							
<b>Control:</b>									
2x logic inputs - control switch or PLC output <i>function</i> - START/STOP, REVOLUTIONS (PULSES)									
3x analogue inputs for resistance heat sensors Pt1000 (-30 ÷ +40°C / 882,6 ÷ 1155,4 Ω) <i>function</i> - TEMPERATURE MEASUREMENT - Tp1, Tp2, To2									
<b>Protections:</b>									
low voltage, overvoltage, overcurrent, I x t, short-circuit (phase-phase, phase-earth)									
<b>Environmental conditions:</b>									
Ambient temperature / Ambient humidity		0 ÷ 40°C / max. 90% (non condensing)							
Enclosure		IP 00 or IP 20 or IP 54 (up to 0,75 kW only)							
<b>Design criteria:</b>									
Safety		EN 61 010-1 / 95							
Electromagnetic compatibility - emission:		EN 55 011/A1,B1; EN 50 081-1, 2 (with external RFI filter)							
- immunity:		EN 50 082-1, 2							
<b>Dimensions:</b>	Height	(mm)	180				200		
(IP 20)	Width	(mm)	153				160		
	Depth	(mm)	97				145		
<b>Weight:</b>		(kg)	1,3				2,5		

## 3. Description



## 4. Mechanical installation

### 4.1. Location

The installation must be located in a place free from dust; corrosive vapours; gases and all liquids. Care must also be taken to avoid condensation of vaporised liquids, including atmospheric moisture.

### 4.2. IP rating

IP 20 or IP 00 (e.g. location in a switchboard ) or IP 54

### 4.3. Mounting

- The unit must be mounted vertically, and sufficient clearance must be allowed around the unit to allow adequate flow of cooling air over the fins of the heat sink. A minimum of 50 mm is required above and below the unit, and some clear space should also be allowed at the sides and front.
- Location within the cubicle (e.g. switchboard) without any ventilation of the air inside :  
Heat can escape only by conduction through the skin of the cubicle, which is cooled by radiation to the external air.  
A minimum distance from the enclosure boundaries : 50 mm  
Heat dissipation power : approx. 4% of the real output power.

## 5. Electrical installation

### **SAFETY PRECAUTIONS**

**DANGER:** *The voltages present in the supply cables, the output cables and terminals, the control power supply wiring and in certain internal parts of the drive are capable of causing severe electric shock and may be lethal !*

**WARNING:** *Whenever the drive has been energised; it must be isolated before work may continue. A period of five minutes must elapse after isolation to allow the internal capacitors to discharge fully. Until the discharge period has passed dangerous voltages may be present within the drive.*

**Persons supervising and performing electrical installation must be suitably qualified and competent in these duties, and should be given the opportunity to study this manual before work is started.**

### 5.1. Power connections

#### CHECK THAT

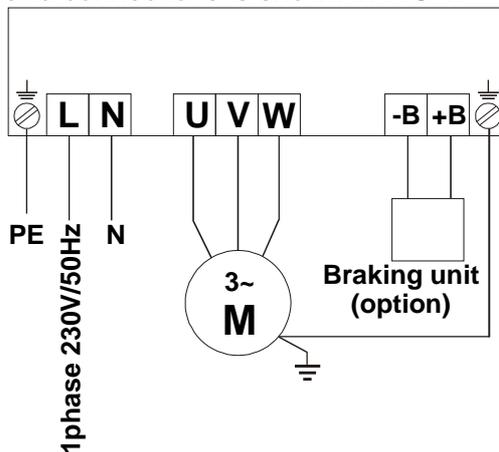
- the unit is disconnected from the input power before making connections to the terminals  
- AC input power circuit breaker, installed upstream on the low voltage switchboard, is in "off" position

#### 5.1.1. Connection procedure

- FOR PROTECTION OF LIFE AND PROPERTY, EARTH WIRES SHOULD ALWAYS BE CONNECTED FIRST !
- remove the front panel that is secured with screws
- connection cables should enter at the bottom
- connect the 1 PHASE mains supply to the terminals N; L.
- connect the motor terminals to the U, V, W terminals of the drive
- refit the front panel

**Never connect the input power to the U, V, W terminals of the drive !!!**

The layout of the power terminals and connections is shown in FIG 1.



**FIG 1**

**5.1.2. Recommended protection devices installed upstream of the drive and cabling**

Drive model	FIA-L/REG	18	37	55	75	110	150	220	250
fuse ratings*		6A		10A		16A		20A	25A
cable size (for 3-core)** mm <sup>2</sup>		1,5						2,5	4,0

\* The use of slow protection devices (curve C) is recommended because a current surge may appear at power on.

\*\*Cable sizes are recommendations only. Cabling should conform to local codes of practice and regulations.

**5.1.3. Motor connection**

- No protection devices between the drive and the motor are recommended. The power connections from the drive output to the motor may be switched, for isolation purposes; but not for control purposes.
- Connection between the drive and the motor as short as possible are recommended to prevent emissions from the motor cable.  
If it is not possible, screened or armoured cable may be used. The screen or armour should be connected in the same way as for standard cable (to both the motor earth terminal and the drive earth terminal).
- Installations with long cable runs to the motor (i.e. above approx. 30 m), may need the addition of motor line chokes to prevent nuisance tripping of the drive caused by capacitive leakage effects.

**Output voltage of the drive FRECON FIA-L/REG : 3 x 230 V !**

*MOTOR WINDING CONNECTION MUST BE COMPATIBLE WITH THIS VOLTAGE !  
IN THE MOST CASES : DELTA CONNECTION*

**5.2. Motor speed**

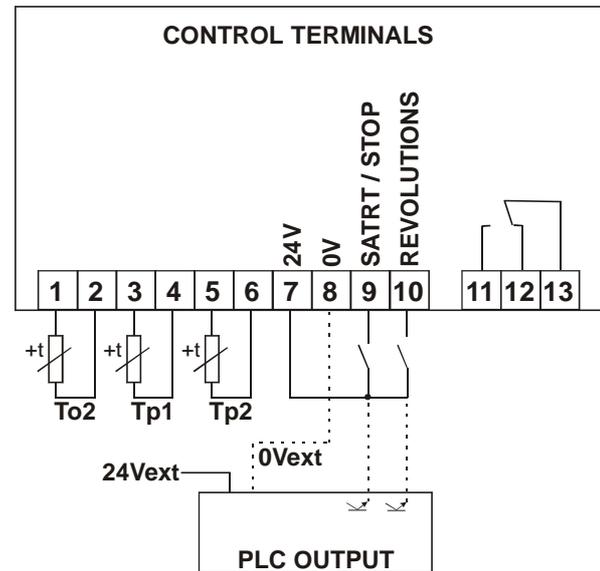
- Standard squirrel-cage ac induction motors are designed as single speed machines. If it is intended to use the capability of the drive to run the motor at speeds above its designed maximum, it is strongly recommended that the motor manufacturer is consulted first.
- The principal risks due to overspeeding are the destruction of the rotor by centrifugal force, or of the bearings by vibration or heat.
- Low speed is liable to result in overheating of the motor because the effectiveness of the internal cooling fan reduces in proportion to the square of the reduction of speed. Motors should be equipped with thermistor protection, and if full benefit of the use of low speeds is to be gained from a variable speed drive it may be necessary to arrange additional cooling for the motor.

## 5.3. Control connections

### 5.3.1. Connection procedure

- remove the front panel that is secured with screws.
- for control connections use cable of 0,5 mm<sup>2</sup> screened
- connection cable should enter at bottom.
- connect screen to earth at the drive only .
- connect control cable to terminals (connections are shown in FIG 2).
- refit the front panel

**NOTE : always segregate control and power cabling !**



**FIG. 2**

### 5.3.2. Specifications of control inputs and outputs

Complete isolation between control and power electronic circuits.

- 3x Analogue inputs Tp1, Tp2, To2
  - for resistance heat sensors Pt1000
  - Measuring range: -30 ÷ +40°C (882,2 ÷ 1155,4Ω)
  - Resolution : 0,1 °C
  - Max. error (including sensor non-linearity): max. 0,5 °C

- Logic inputs

- run/stop : control switch or PLC output
- revolutions : control switch or PLC output

Input voltage : min : 15 V<sub>DC</sub>                      Input current : approx. 8,5 mA (24 V<sub>DC</sub>)  
                           nominal : 24 V<sub>DC</sub>  
                           max : 30 V<sub>DC</sub>

- Logic output

- drive status : volt-free change-over relay contact - 250 V<sub>AC</sub> ; 8 A

## 6. Drive status indication

### 6.1. On the front panel of the drive

- LED "POWER" (red) : input voltage is present, all internal voltage levels are correct
- LED "FAILURE" (red) : internal or external trip (e.g. overvoltage, overcurrent, short-circuit ...) the drive is stopped (disconnected from the load)

### 6.2. Remote indication

- Volt-free change-over relay contact
- Control terminals : **11** - normally open  
                           **13** - common  
                           **12** - normally closed

Relay energised when : drive healthy

Relay de - energised when : power off or drive tripped (disconnected from the load)

## 7. Operating procedures

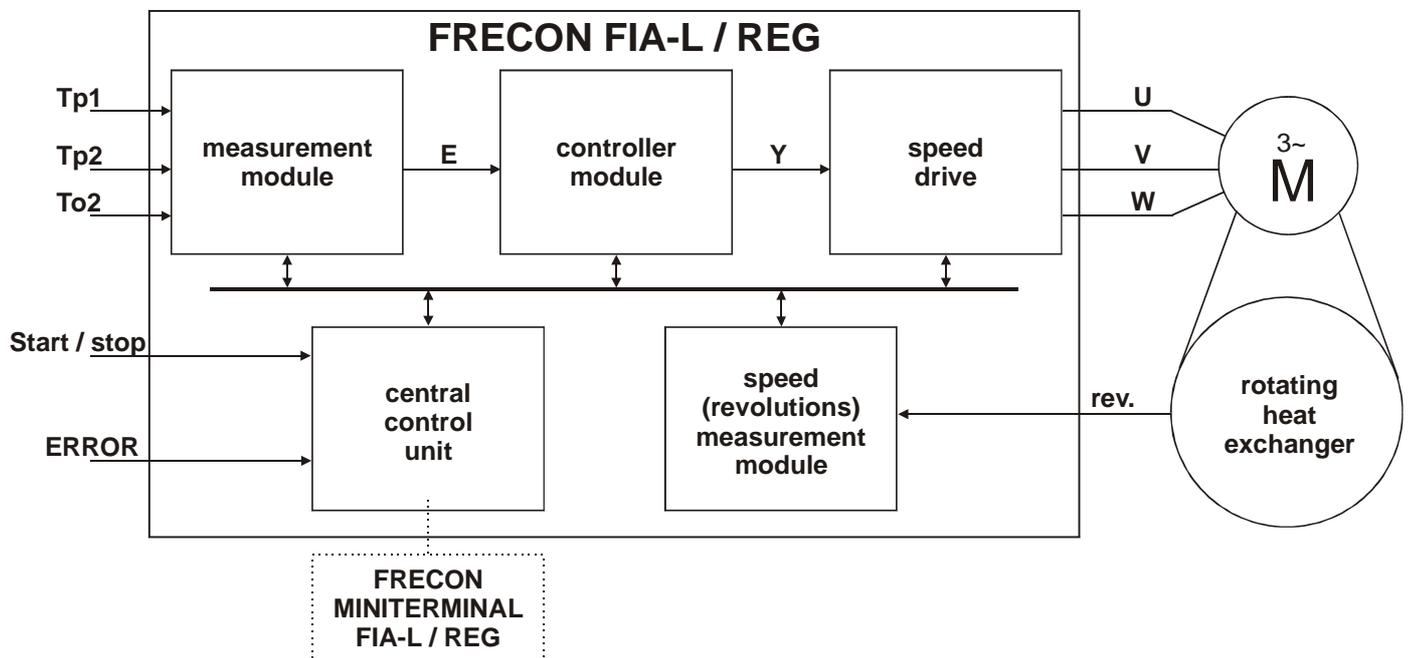
CHECK THAT :

- The motor rating is compatible with the drive rating
- The motor winding connection is compatible with the drive output voltage (refer to chapter 5; section 1.3.)
- AC input power circuit breaker of the correct rating is installed upstream on the low voltage switch - board (refer to chapter 5, section 1.2.)
- the drive is firmly attached in an upright position and is properly ventilated

### 7.1. Procedure I - remote (external) control, without using MINITERMINAL (control pod) - automatic control

- connect the control cable to terminal board (shown in FIG 2)
- put the AC input power circuit breaker in "ON" position - the red "POWER" light goes on. In the event of a fault, the red "FAILURE" light goes on.

When the remote control mode is set and START signal is activated, the automatic speed control occurs according to the following diagram:



Measurement module is equipped with 3 inputs for resistance heat sensors Pt1000 to outdoor input air temperature - Tp1 scanning, indoor input air controlled temperature – Tp2 scanning and indoor exhausted air temperature - To2 scanning. Module converts measured values to digital form and from set (required) value is calculated the control deviation, which is led to the controller input. Module also compares measured values and evaluates if input air heating or cooling occurs. These information are sent to the central control unit, which controls other modules function.

Controller module contains digital PI – controller with adjustable gain and integral action time constant. Controller module output represents control variable for speed drive.

Speed drive calculates from controller module output value and other set parameters required output frequency and voltage, on the basis of these values, output 3 phase voltage for heat exchanger motor is modulated.

Speed measurement module contains input for pulse reading from rotating heat exchanger speed sensor. If the speed monitoring function is activated and no pulse from speed sensor was evaluated during approx. 4 min. when motor running, then the speed drive is tripped and fault is signalled. If speed sensor is disconnected, speed monitoring function is necessary to deactivate.

Central control unit receives information from all modules and controls their operation. Unit are equipped with START/STOP logic control input and summary error signalisation output.

NOTE: In the remote control the control keys on the MINITERMINAL FIA-L/REG (control pod) are ignored.

## 7.2. Procedure II - local control, using MINITERMINAL FIA-L/REG (control pod)

- remove the connector cover on the front panel of the drive
- connect the control cable from the control pod to the connector on the front panel of the drive
- put the AC input power circuit breaker in "ON" position - the red "POWER" light goes on.  
In the event of a fault; the red "FAILURE" light goes on.
- press the CONTROL MODE SELECTION key (LOC/REM) on the control pod - select local (keypad) control.  
The red "LOC" light on the control pod goes on.

In the local control mode the drive is fully operated by the control pod FRECON MINITERMINAL. The local control keys (RUN and STOP) enable to start and to stop the drive.

Speed control is enabled by using keys UP/DOWN (YOUT parameter value is changed). One single keystroke on UP/DOWN keys changes the value of YOUT parameter by one step, longer pressing causes faster continuous changing of the value.

In the local control mode the remote control signals START/STOP are ignored.

## 8. Reset of the drive after a trip signal (overcurrent, overvoltage, short-circuit)

Two ways are available :

- short time disconnecting of the drive from the supply and reconnecting  
or
- STOP signal activation (START signal deactivation)

**NOTE** : restart of the drive ("START" signal activation) is recommended when the motor is stopped !

## 9. Options

### 9.1. FRECON MINITERMINAL FIA-L/REG (control pod)

Combines keypad and display functions :

- local /remote control selection
- local control (run/stop, output frequency control)
- drive parameter values adjustment and display (LCD screen)
- user sets programming possibility (i.e. storing all functional parameters into EEPROM for automatic or manual restore)
- operational status LED indication : run, local (keypad) control
- fault codes display
- MOUNTING : externally anywhere convenient at a distance permitted by a maximum cable length of 6 m from the drive to the pod.

Displayed values and adjustable drive parameters.

Menu	Display / Adjustment range	Factory setting	Description
<b>FOUT</b>	0.00 ... 125.0 Hz	-	output frequency
<b>OT</b>	0.0 ... 60.0 rev/min	-	heat exchanger revolutions
<b>TP1</b>	-30,0 ... 40.0 °C	-	outdoor input air temperature
<b>TO2</b>	-30,0 ... 40.0 °C	-	indoor exhausted air temperature
<b>TP2</b>	-30,0 ... 40.0 °C	-	indoor input air controlled temperature
<b>TSET</b>	-30,0 ... 40.0 °C	22.0	controlled temperature required value
<b>E</b>	+/- 0.00 ... 99.99 %	-	control deviation (TSET – Tp2)
<b>YP</b>	+/- 0.00 ... 99.99 %	-	controller proportional component
<b>YI</b>	0.00 ... 99.99 %	-	controller integral component
<b>YOUT</b>	0.00 ... 99.99 %	-	controller output
<b>P</b>	+/- 0.00 ... 32.00	1.00	controller proportional gain
<b>TI</b>	2.00 ... 512 sec, OFF	16.0	integral action time constant
<b>F0</b>	0,0 ... 125.0 Hz	8.0	minimum output frequency (for YOUT=0%)
<b>F100</b>	0,0 ... 125.0 Hz	52.0	maximum output frequency (for YOUT=100%)
<b>ACC</b>	0,2 ... 62.5 Hz/sec	5.0	FOUT acceleration
<b>FBAS</b>	25.0 ... 241.0 Hz	50.0	base frequency (U/f curve knee frequency)
<b>U0 + U7</b>	0,0 ... 100% Umax	10.0,...,89.5	output voltage form setting according to the load
<b>DTR</b>	0.00 ... 32.0 °C	4.4	To2-Tp1 minimum value (for recuperation sensuality)
<b>COT</b>	0 / 1	1	speed monitoring function selection
<b>SET</b>	support parameter for user set programming		

For more information: refer to user manual for the MINITERMINAL FIA-L/REG.

## 9.2. Braking unit

A decelerating AC motor regenerates energy into the inverter drive. This energy can only be dissipated within the drive, it cannot be returned to the AC supply by the FRECON unit. If the regenerated power is less than approx. 4% of rated drive power, the braking unit is not necessary to use.

Connection: terminals -B, +B (FIG. 1)

## 9.3. External RFI filter

To conform to EMC standards, external RFI-filter is necessary to use.

RFI - filter is located in the separate cubicle with enclosure IP 44 or IP00 (on request) or IP20

### Dimensions:

- EMC emission according to EN 50 081-1, ČSN EN 55 011/B1:
  - FIA-L18 ÷ 75 : - enclosure IP00: 92 x 60 x 49 mm
  - FIA-L18 ÷ 75 : - enclosure IP44: 160 x 90 x 70 mm
  - FIA-L110 ÷ 220 : - enclosure IP00: 92 x 60 x 56 mm
  - FIA-L110 ÷ 220 : - enclosure IP44: 160 x 90 x 70 mm
  - FIA-L250 : - enclosure IP20: 92 x 60 x 56 mm
- EMC emission according to EN 50 081-2, ČSN EN 55 011/A1:
  - FIA-L250 : - enclosure IP20: 138 x 56 x 50 mm

### 9.3.1. Installation

To install the filter, follow the instructions in FIG 4

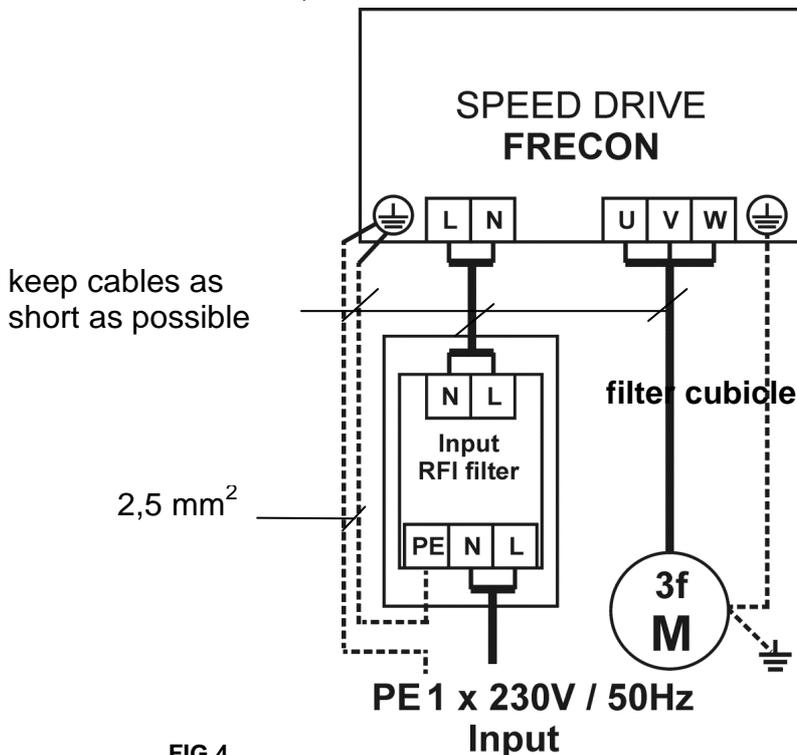


FIG 4

The filter cubicle is necessary to install near of the drive.

**NOTE:** Connections must be made with the short length of screened cables. If these cables are altered in any way the filter will operate, but compliance with any emission standard is no longer assured.

Input cable into the filter (filtered cable) and no control circuit should be run parallel to an unscreened motor cable or unfiltered supply cable with a spacing less than 0,3 m and over a distance exceeding 1m.

## 9.4. Motor line choke

*Dear user,*

*This manual has been designed to provide you with all the information you need to install and use your FRECON SPEED DRIVE. Feel free to contact us for any further information you may require concerning special applications beyond the scope of this manual.*

*Please keep this manual in a safe place for future reference.*

**FRECON**

## **SAFETY PRECAUTIONS**

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*Persons supervising and performing electrical installation must be suitably qualified and competent in these duties, and should be given the opportunity to study this manual before work is started.*

## **TESTED**

Committed to quality, FRECON individually test each FRECON SPEED DRIVE to ensure reliable performance for the user. All units have passed FRECON'S quality control standards and conform within tolerance to the enclosed specifications.