

## **FMV 1103**

**Digital frequency controller  
for induction motors**

**Installation and maintenance**

## NOTE

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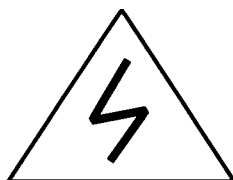
## WARNING

- For user safety, this frequency controller should be earthed (  $\pm$  ).
- The frequency controller is fitted with safety devices which can, in the case of certain faults, stop the frequency controller and the motor. The motor itself can be jammed by mechanical means. Finally, voltage fluctuations, and particularly power cuts can also cause the controller to switch off.
- The removal of the cause of the shutdown can lead to restarting, with consequent hazard for certain machines or installations.

In these cases, therefore, it is important for the user to be protected against such risks of restarting, by fitting a zero speed detector which will cut the supply to the controller, in the case of unprogrammed stoppages.

This equipment meets existing standards. Nonetheless, it may create interference and the user is responsible for carrying out the appropriate action to eliminate such interference.

- The frequency controller is designed to enable the motor to be run above its rated speed (up to 7 times for specific program settings).
- If the motor is not mechanically designed for such speeds, the user may experience serious mechanical damage to the motor.
- It is important for the user to check that the motor can withstand high speeds before programming.



**DANGER**

**IMPORTANT**

**BEFORE TOUCHING ANY PART OF THE ELECTRICAL OR MECHANICAL PARTS OF THE INSTALLATION OR MACHINE :**

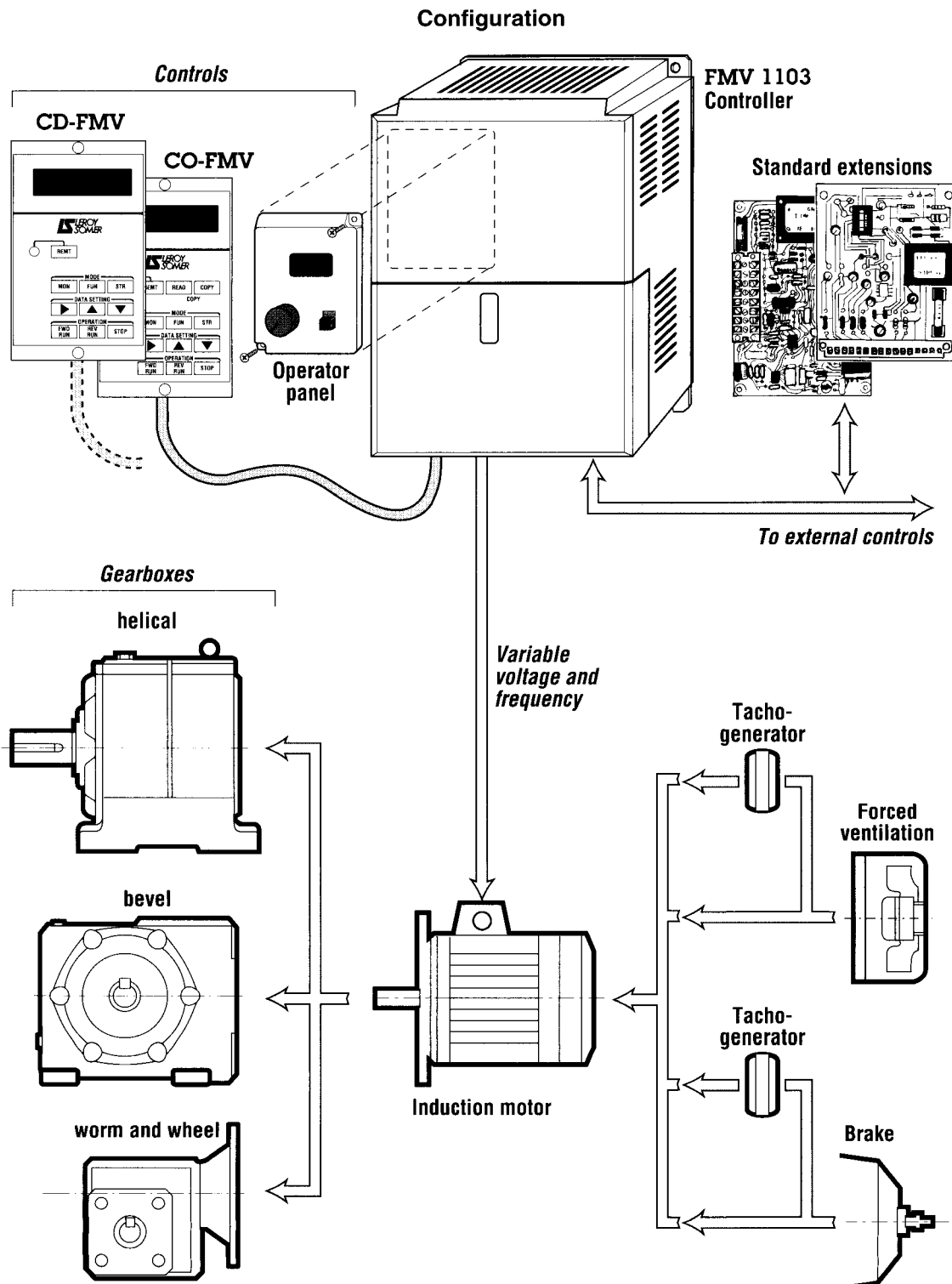
- check that the controller power supply is switched off (fuse disconnecter or circuit-breaker) and manually locked (with key),
- wait until the capacitor discharge indicator light has gone off (after approximately 30s).

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## Digital frequency controller

### FOREWORD

This technical booklet describes the installation of the **FMV 1103** Digital Frequency Controller. It describes in detail the relevant procedures required when servicing the controller and the possible peripheral devices.



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### 1 - GENERAL INFORMATION

#### 1.1 - General operating principle

The rated speed (r.p.m.) of a cage induction motor depends on the number of poles (P) and on the frequency (Hz) of the power supply. These elements are linked by the following equation :

$$N = \frac{120 \times F}{P}$$

This means that changing the frequency **F** changes the rated speed **N** of a given motor. However, changing the frequency without changing the power supply voltage varies the magnetic flux in the motor. The **FMV 1103 CONTROLLER** simultaneously varies the output VOLTAGE and FREQUENCY. This enables the motor torque curve to be optimised and avoids overheating.

**FMV 1103 CONTROLLER** supplies the motor with a voltage generated from an internal fixed D.C. voltage.

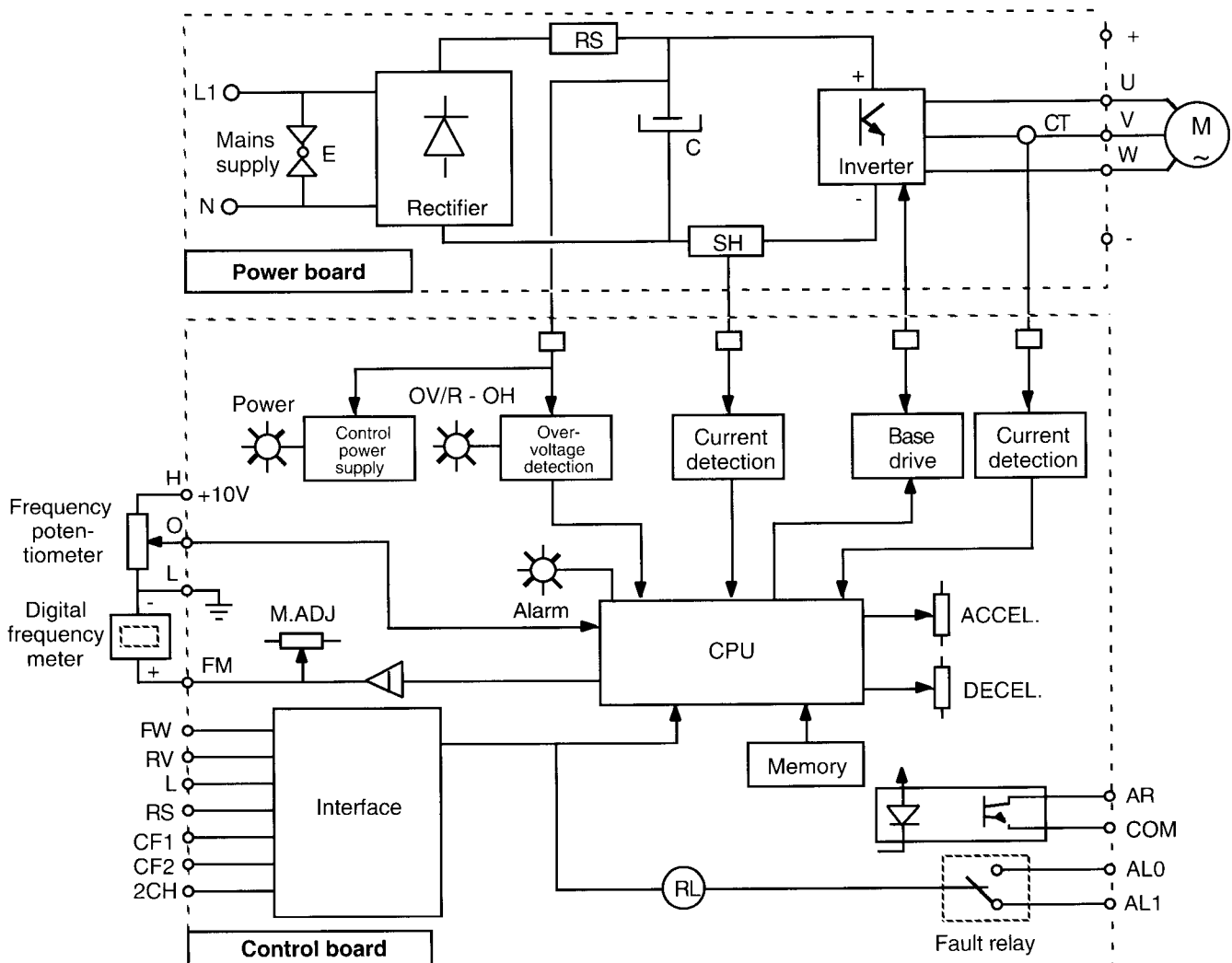
Voltage is modulated by the pulse width modulation principle. The current supplied to the motor is almost sinusoidal with a minimum of harmonic components.

#### 1.1.1 - Functional description of the controller

The controller comprises :

- A mains voltage **RECTIFIER**, linked to a **SMOOTHING CAPACITOR** that gives a direct voltage (terminals + and -) according to the mains voltage (300V for 220V mains).
- An **INVERTER** : the direct voltage powers the 6 transistor inverter. The inverter converts the direct voltage into an alternating voltage, with the voltage and frequency modulated.
- A current **SENSOR**.
- An **ELECTRONIC CONTROL BOARD** with the base drive signal amplification circuits.

#### 1.1.2 - Functional diagram



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### 1.2 - Controller setting mode

- The basic version of the **FMV 1103** is set by switches and potentiometers.

For the majority of applications, the available settings give the kind of operation required.

- 2 options (microconsole) extend these functions and transform the basic controller into a high performance controller similar to the FMV 2303.

Programming is therefore possible via clear messages, as well as fault finding : 16 digits. Control can be carried out remotely. Settings can be copied from one controller to the other.

#### 1.2.1 - CD FMV - CO FMV controller drive consoles

See chapter 4.2 for the list of available functions.

#### • Connection

Via a cable with a plug at each end.

A one meter cable is provided with every console.

#### • CD FMV remote control console

It allows :

- remote control of the controller,
- display or modification of the operating values (**MON** mode),

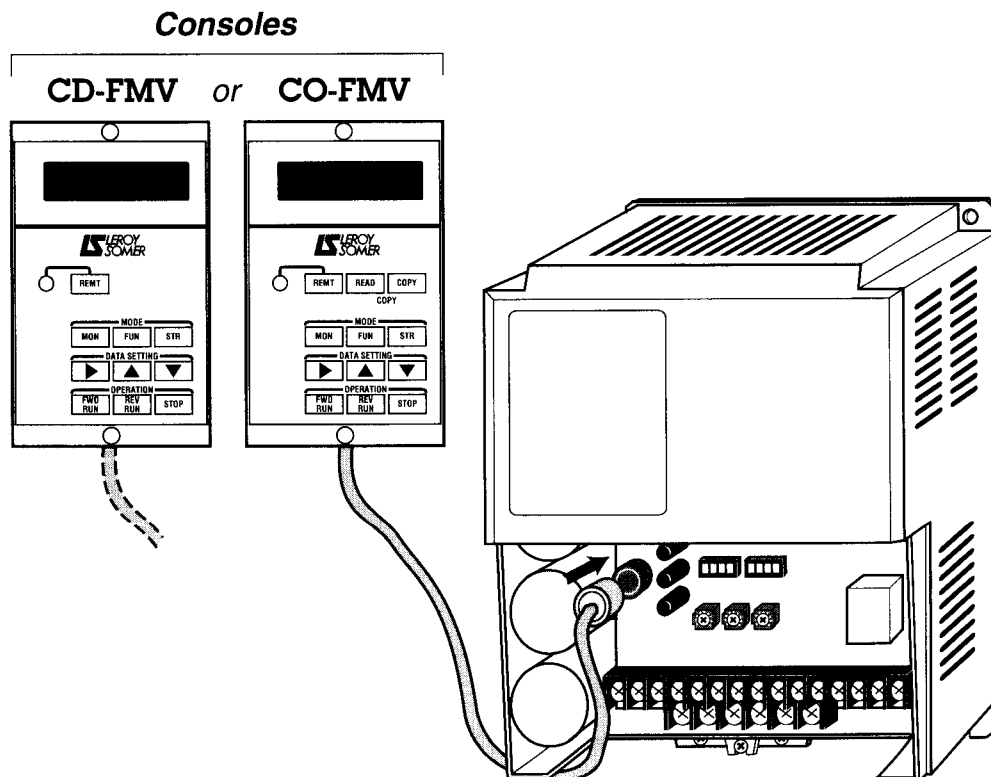
Eg. : output frequency, boost, etc...,

- access to new functions or modification of the setting range (**FUN** mode, ),

eg. : F max/F min limitation, conversion factor, setting of ramp time, etc...

#### • CO FMV remote control and copy console

Besides the **CD FMV** console functions, it enables the transfer of information from one **FMV 1103** to another or several others via the "**COPY**" function.



#### Note :

These consoles equally allow the control of the FMV 1103 or FMV 2303 controllers.

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### 1.3 - Main characteristics

|                                    |   |   |      |
|------------------------------------|---|---|------|
| Main voltage                       | 200 to 230V $\pm 10\%$ (Single phase) - 50/60 Hz $\pm 5\%$  |   |      |
| FMV 1103                           | 1.M   | 1.5M  | 2.5M |
| Controller capacity kVA at 220V AC | 1,1   | 1.9   | 2.9  |
| Permanent nominal current (A)      | 3   | 5   | 7.5  |
| Motor power (kW)                   | 0.4   | 0.75  | 1.5  |
| Protection box                     | IP00  |   |      |
| Output voltage                     | 200 - 230V threephase (according to mains voltage)  |   |      |
| Frequency resolution               | 0,2 Hz for F max 50 Hz 0,25 for F max 60 Hz<br>0,4 Hz for F max 100 Hz 0,5 Hz for F max 120 Hz  |   |      |
| Frequency accuracy                 | $\pm 0,5\%$ of the maximum frequency (ambient temperature 25°C $\pm 10^\circ\text{C}$ )   |   |      |
| Overload capacity                  | 150 % for 1 mn every 10 mn.   |   |      |
| Dynamic braking torque             | approx. 100 % (50Hz)<br>approx. 50 % (60Hz)   | approx. 70 % (50Hz)<br>approx. 30 % (60 Hz) |      |
| FW/RV terminal                     | <b>Forward</b> FW contact closed<br><b>Reverse</b> RV contact closed  |   |      |
| Controller drive :                 | Analogue reference :<br>- potentiometer or external signal,<br>- operator panel,<br>Digital reference :<br>- CD FMV or CO FMV.  |   |      |
| Frequency reference                | 0 - 20 mA by adding a resistance across terminals O - L 500 $\Omega$ ,2W.<br>0 - 10 V DC (minimum input impedance 30 k $\Omega$ ),<br>0 - 5 V DC (minimum input impedance 15 k $\Omega$ ),<br>CD FMV or CO FMV digital console. |   |      |
| Fault elimination                  | Elimination by reset (Reset or contact RS - L)  |   |      |
| Protection                         | Overcurrent, overvoltage, under voltage, micro-cutoff, overload,<br>overload limitation, short circuit across output stages.  |   |      |
| Fault relay                        | Contact closed for normal operation,<br>contact open when the controller is off or when there is a fault.   |   |      |
| Options                            | • CD FMV : remote control,<br>• CO FMV : remote and copy control,<br>• operator panel.  |   |      |

### 1.4 -Summary of setting options via CD FMV or CO FMV consoles

| Function  | Factory setting             | Setting range without CD FMV/CO FMV | Setting range with CD FMV/CO FMV   |
|---|-----------------------------|-------------------------------------|------------------------------------|
| Output frequency  | 000 Hz                      | 0,5 to 120 Hz                       | 0,5 - 375 Hz                       |
| Voltage/frequency curves                                    | 060 - 060 Hz                | 8 laws                              | 48 laws                            |
| ACCEL/DECEL 1 ramp  | 5 s                         | 0,2 - 30 s                          | 0,1 - 300 s                        |
| ACCEL/DECEL 2 ramp  | 1 s                         | -                                   | 0,1 - 300 s                        |
| Low speed torque : boost                                    | 55                          | -                                   | 0 - 99                             |
| Pre-set speeds (3)  | 5 Hz/20Hz/40Hz              | -                                   | 0,5 - 375 Hz                       |
| Signal  |                             |                                     |                                    |
| - Speed reached via terminals : logic signal 27V DC, 50 mA. | -                           | -                                   | 0,5 - 375 Hz                       |
| - Frequency detection                                       | For digital frequency meter | -                                   | Analogue frequency meter selection |
| DC injection braking  |                             |                                     |                                    |
| • Frequency setting   | 0,5 Hz                      | -                                   | 0,5 - 375 Hz                       |
| • Braking value   | 20                          | -                                   | 0 - 20                             |
| • Braking time  | 1 s                         | -                                   | 0 - 15 s                           |

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### 1.5 - Ambient characteristics

Storage temperature - 10°C to + 60°C.

Ambient operating temperature - 10°C to + 40°C.

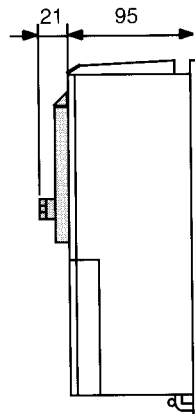
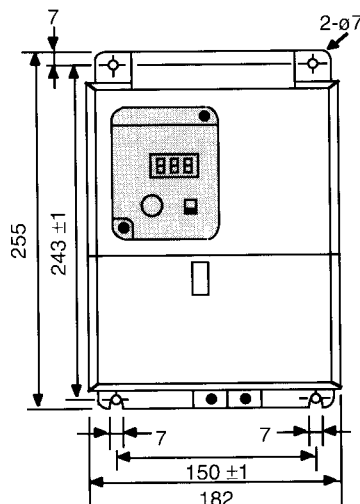
Altitude ≤ 1000m.

Humidity < 90 % of relative humidity without condensation vibration 0,5 g (10 - 55 Hz).

#### Note :

Ambient air must not contain conducting dust or corrosive gases.

### 1.6 - Dimensional characteristics



Mass :

FMV 1103 1.M = 2 kg

FMV 1103 1.5 M = 2.6 kg

FMV 1103 2.5 M = 2.7 kg

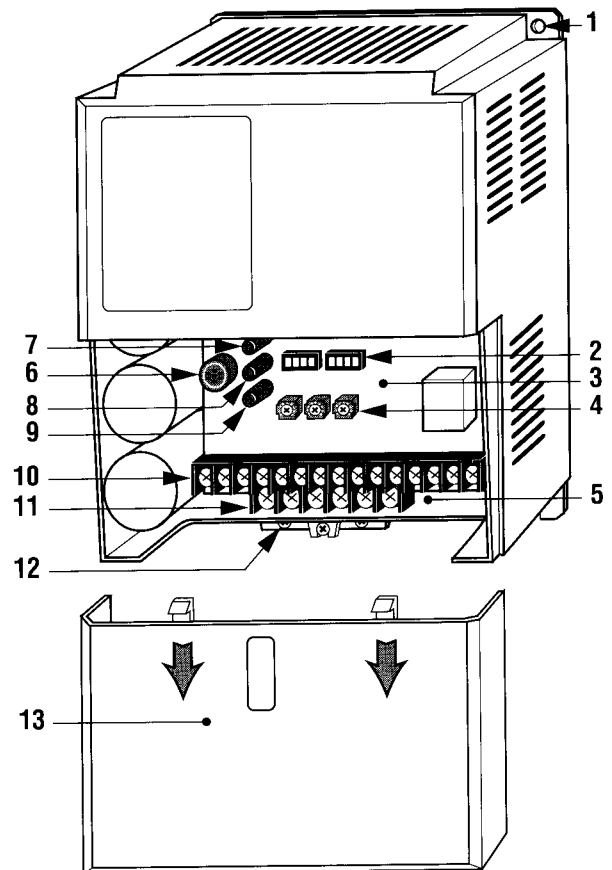
### 1.7 - Installation

#### 1.7.1 - Initial checks

Before installing the controller be sure that :

- the controller has not been damaged during transport,
- the nameplate corresponds to the mains power supply and motor.

#### 1.7.2 - Identification of the controller



- 1 : fitting holes
- 2 : programming switch
- 3 : control board
- 4 : setting potentiometers
- 5 : power board
- 6 : CD FMV or CO FMV control console socket
- 7 : Power on Led
- 8 : fault Led (Alarm)
- 9 : overvoltage/overheating Led (OV/R - OH)
- 10 : control board terminal block
- 11 : power terminal block
- 12 : ground terminal
- 13 : detachable cover

#### 1.7.3 - Mounting instructions

- Fit the controller vertically leaving a 10 cm space on the right and left sides and 15 cm space above and underneath.
- Due to thermal problems fix the controllers side by side and not one on top of the other.
- Never block the controller's ventilation air intake.
- When the controller is installed in the cabinet and the internal temperature exceeds 40 °C provide ventilation.



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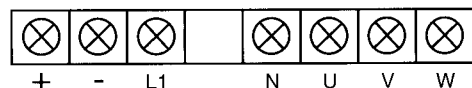
### 2 - CONNECTIONS

#### 2.1 Designation and use of terminals

To access the terminals push the 2 references "PUSH" located on the lower part, then pull downwards.

##### 2.1.1 - Power terminal block

Located on the lower board it comprises 8 screw terminals.



| Ref.      | Designation              | Function                          |
|-----------|--------------------------|-----------------------------------|
| L1 - N    | Controller input (mains) | Single-phase 200 - 230V, 50/60 Hz |
| U - V - W | Controller output        | Motor power supply                |
| +, -      | Continuous bus* output   | Connection to the braking unit    |

\* Effective november 91.

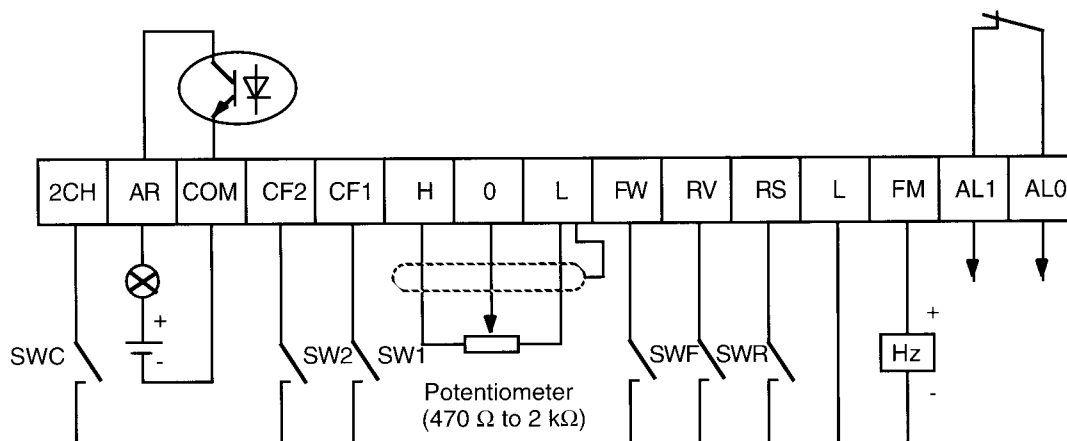
The connection should be earthed (screw  $\oplus$ ).

#### Caution :

- never connect a circuit such as a group of capacitors between the controller and motor output,
- never connect the alternating mains to the controller's U.V.W. terminals.

##### 2.1.2 - Control/adjustment terminal block

Located on the upper board it comprises 15 screw terminals.



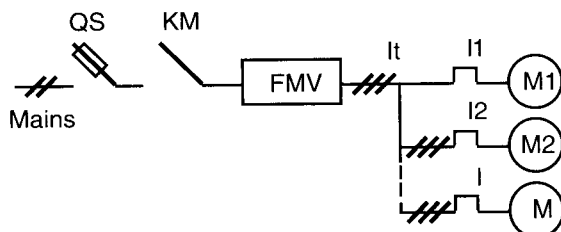
| REFERENCE | DESIGNATION  | FUNCTION  |
|-----------|--|---|
| H         | Power supply for the frequency setting potentiometer | 10V CC  |
| O         | Frequency reference instruction                      | 0-10V DC or 0-5V DC (switchable) 0 - 20 mA see § 3.3.1  |
| L         |  | OV control common terminal (DO NOT USE AS GROUND)   |
| FW        | FORWARD - Start/Stop                                 | Closed contact : forward start  |
| RV        | REVERSE - Start/Stop                                 | Closed contact : reverse start  |
| RS        | Reset  | Closed contact (not maintained) : fault reset   |
| FM        | Output frequency detection                           | Digital frequency counter signal  |
| CF1, CF2  | Preset speeds  | Speeds according to contact combinations<br>V1 = 5 Hz SW1 closed SW2 open<br>V2 = 20 Hz SW1 open SW2 closed<br>V3 = 40 Hz SW1 closed SW2 closed |
| AL1 - AL0 | Fault indication relay                               | OFF or Fault<br>AL0 - AL1 open  |
| 2CH       | 2nd ramp Accel./Decel.                               | Closed contact : selection of second ramps ACCEL/DECEL 2.   |
| AR        | Indication of the frequency reached                  | Open collector output (potential free) 0/27 VDC 50 mA   |
| COM       | Common terminal of the frequency reached             | Common point for the AR terminal do not use as earth terminal, different potential from terminal L.   |

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### 2.2 - Special connections

#### 2.2.1 - Parallel connection of motors

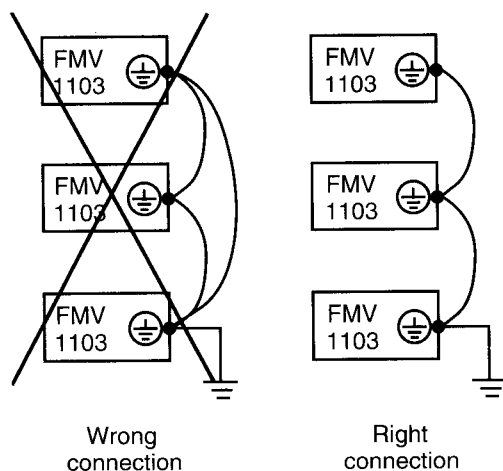


It is possible to power several different motors from only one frequency controller. Each motor must be protected by a thermal relay.

Determination of the controller size :

$$I_n \text{ Controller} > I_1 + I_2 + \dots + I$$

#### 2.2.2 - Grounding of several controllers



#### Signals and controls connections

- Wires in shielded twisted cables :
  - control/command signals : terminals H, O, L, FW, RV, RS, FM, CF1, CF2, 2CH,
  - logic signals : terminals AR, COM,
  - fault relay output : terminals AL0, AL1.

|                            |  |
|----------------------------|--|
| Control signals            | Terminals FW, RV, CF1, CF2, RS,<br>low level $\leq 0,3V$ ,<br>high level $\geq 2,4V$ ,<br>Minimum input pulse width $\geq 50$ ms.  |
| Fault relay                | Terminals AL0, AL1,<br>250V AC, 2,5A (resistive load)<br>0,2A ( $\cos \varphi = 0,4$ )<br>30V DC, 3A (resistive load)<br>0,7A ( $\cos \varphi = 0,4$ )   |
| Logic signals              | Terminals AR<br>0/27V DC, 50 mA  |
| Analogue frequency setting | Terminal O<br>Voltage input : (*)<br>0 - 10V input impedance 30 k $\Omega$<br>0 - 5V input impedance 15 k $\Omega$<br>Specification of potentiometer<br>2W : 470 $\Omega$<br>1W : 1 ou 2 k $\Omega$        |
| Frequency monitoring       | Terminal FM<br>• Digital operator panel connection<br>• Analogue voltmeter<br>(programming change needed<br>via CD FMV or CO FMV)<br>10V full scale<br>(load resistance 10 to 22 k $\Omega$ ,<br>1 mA max) |

(\*) do not apply a voltage greater than 12V across terminals O and L.

#### 2.2.3 - Cable dimensioning

According to the type of controller use the current values given in the table below.

| Controller type  | Motor Power kW | Line current Amps | KM sizing QS fuse HRC type |
|------------------|----------------|-------------------|----------------------------|
| LS FMV 1103 1.M  | 0,4            | 6,5               | 8                          |
| LS FMV 1103 1.5M | 0,75           | 11                | 12                         |
| LS FMV 1103 2.5M | 1,5            | 16                | 20                         |

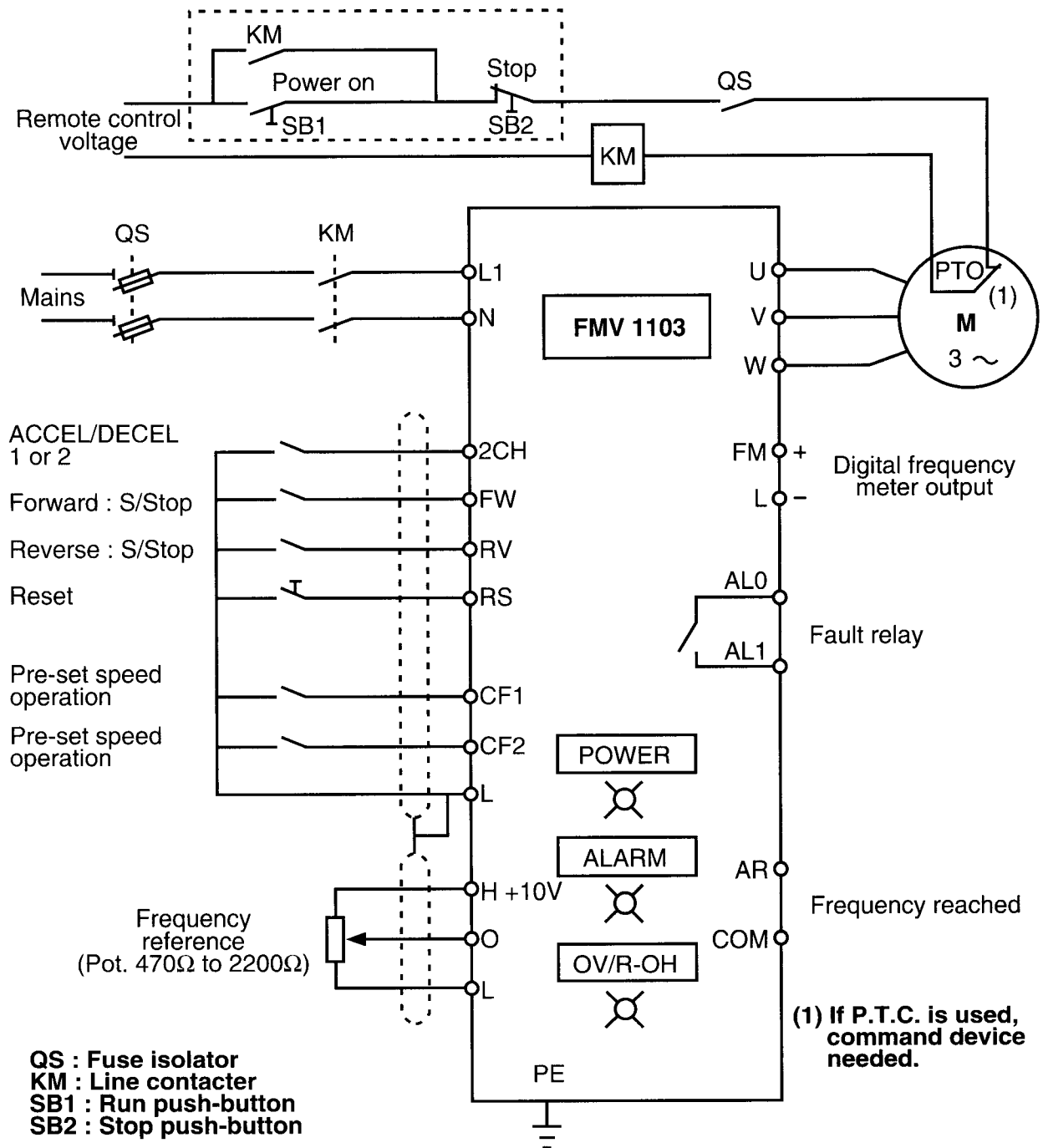
#### Note :

This table can be used to determine the minimum cross sectional diameter of a cable for a continuous operation. The resulting drop in voltage must then be checked. Under no circumstances is the above table to be used to replace applicable standards and texts.

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### 2.3 - Standard connection diagram



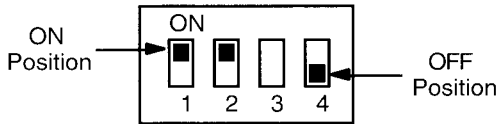
# FMV 1103

## Digital frequency controller

### 3 - SETTING UP (Basic version)

#### 3.1 - Programming (POWER OFF)

##### • Convention



In the example above, switch 1 (and 2) is ON, the black square corresponds to the position of the movable pin. This applies to all programmable switches descriptions.

##### 3.1.1 - DS1 (V/F) switch

##### • Voltage/frequency curve

Using switch DS1 select V/F pattern corresponding to your application. With switch 4 you pass from permanent torque to reduced torque.

- **Never modify V/F pattern during operation.**

- Maximum frequency can be set up to 120Hz (375Hz with console), make sure that mechanically the motor used will accept this value.

##### • Constant torque V/F pattern

| F max | Switch DS1 (V/F) | V/F curve |
|-------|------------------|-----------|
| 50    |                  |           |
| *     |                  |           |
| 100   |                  |           |
| 120   |                  |           |

\* Factory setting

**Note :** Switch 3 is not used.

##### • Reduced torque V/F pattern

| F max | Switch DS1 (V/F) | V/F curve |
|-------|------------------|-----------|
| 50    |                  |           |
| 60    |                  |           |
| 100   |                  |           |
| 120   |                  |           |

##### 3.1.2 - DS2 switch

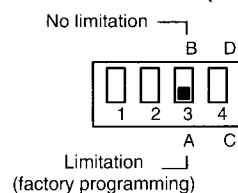
##### • Frequency reference

Select part 1 as indicated according to the reference signal :

| Reference    | Switch DS2 |
|--------------|------------|
| *<br>0 ~ 10V |            |
| 0 ~ 5V       |            |

\* Factory setting

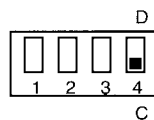
##### • Overload limiter (current)



When overload limitation is selected, the **FMV 1103** is self regulating (current) to avoid any untimely trips particularly during acceleration or deceleration.

##### • Initializing controller

The switch should be set on C position. When the settings are malfunctioning, follow the steps below.



- Set the switch 4 on D position
- Reset by terminals RS-L of the control board
- Set the switch 4 on C position

##### • Summary of the factory programmings of switch DS2

| DS2 |   |   |  |
|-----|---|---|--|
| 5V  | B | D |  |
|     |   |   |  |
| 10V | A | C |  |

**Note :** Switch 2 is not used.

# FMV 1103

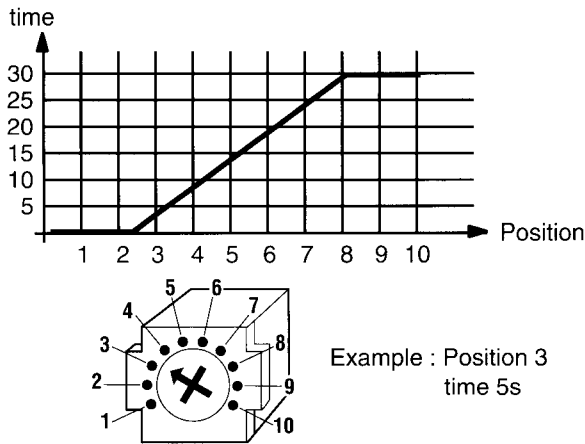
## Digital frequency controller

### 3.2 - Identification of setting potentiometers

#### 3.2.1 - Acceleration/Deceleration 1

Setting range 0.2 to 30 s (separated settings).

- According to the setting position, the time can be obtained from the graph.



#### 3.2.2 - Acceleration/Deceleration 2

Preset to 1s, activated by closing the switch connected to terminal 2 CH. Using a CD FMV or CO FMV console allows an adjustment range of 0,1 to 300s.

#### 3.2.3 - Frequency signal

Potentiometer M.ADJ adjusts the calibration of the frequency monitoring when using an analogue device. Using an analogue frequency meter will only be possible after programming with console CD FMV or CO FMV.

Connection : terminals FM - L.

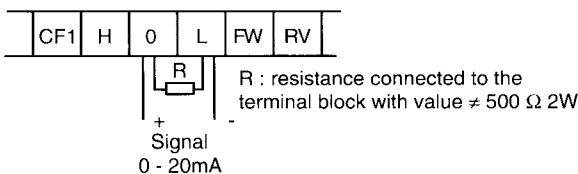
Output : Full scale 0 - 10V - 1 mA.

### 3.3 - Other operations

#### 3.3.1 - Frequency reference via current signal

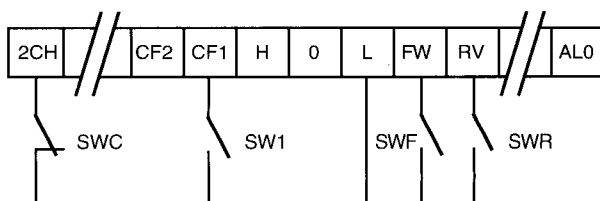
##### 0 - 20 mA

The **FMV 1103 controller** can be controlled from a current signal 0 - 20 mA by the following modification to the adjustment board terminal block.



#### 3.3.2 - " JOGGING " pulse operation

JOOGING operation (factory setting 5Hz) is set by using the wiring below. The choice of rotating direction is carried out by closing contact SWF or SWR.

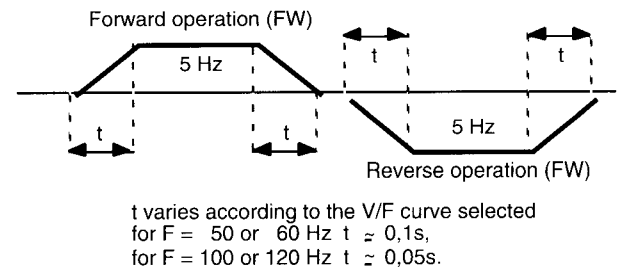


JOOGING operation requires the use of the second ACCEL/DECEL (contact SWC always closed) set at 1 s as standard.

Operation cycle :

- 1) close contact SWC,
- 2) close contact SWF or SWR,
- 3) close contact SW1 to obtain the JOOGING operation.

#### Operating diagram

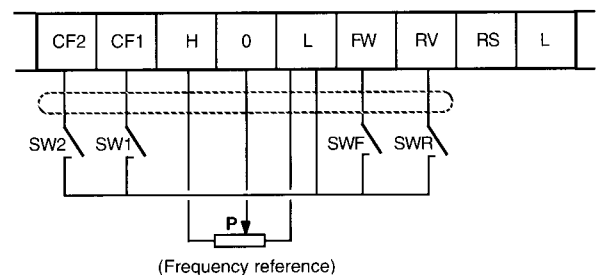


Note :

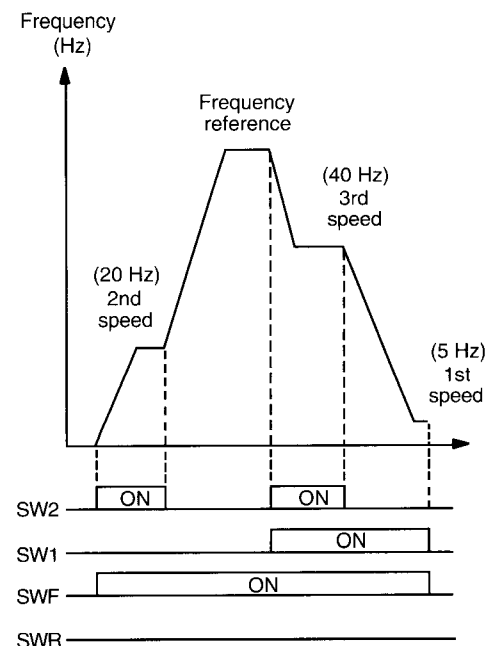
When contact SWF or SWR is open, the motor stops.

#### 3.3.3 - Pre-set speed operation

To obtain 3 operating speeds, carry out wiring below :



#### Operating diagram



Specific speeds 1 - 2 and 3 can be chosen using console CD FMV or CO FMV.



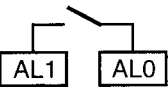

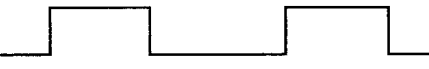








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## Digital frequency controller

### 3.4 - Protection/Signals

Protections ensured by the controller : overvoltage, undervoltage, overcurrent, overload limitation, instantaneous power failure, short-circuit across output stages.

When one of these protections comes into effect, the controller goes into security mode and interrupts the motor power supply (stop under free-wheel). The restart of the controller can only be carried out after a RESET or after switching off the mains supply.

| FAULT        | LED   | LED OPERATION  |                                     | FAULT RELAY   |
|--------------|---|--|-------------------------------------|---|
| Overcurrent  | ALARM      |    | Always ON                           |  |
| Overvoltage  | ALARM      |    | Flashing :<br>ON 5 s*<br>OFF 5 s    |   |
|              | OV / R-OH  |    | Always ON                           |   |
| Undervoltage | ALARM      |    | Flashing :<br>ON 1.5 s<br>OFF 1.5 s |   |
| Overload     | ALARM    |  | Flashing :<br>ON 0.3 s<br>OFF 0.3 s |   |
| Memory error | ALARM    |  | Flashing :<br>ON 5s<br>OFF 0.3s     |   |

\* When an overcurrent or an overvoltage fault occurs during deceleration the "ALARM" indicator is ON all the time.

### 3.5 - Power on

#### 3.5.1 - Checks

Before switching on, check :

- The connection and tightening of terminals L1/N and U.V.W.
- Connection of the frequency reference.
- Grounding (–) of the controller box.
- That there is no short-circuit or ground fault in the wiring.
- Programming complies with the application.
- Mains supply complies with the name-plate.

#### 3.5.2 - Procedure

Caution :

Before touching any part of the controller, switch off the power supply and wait until the "Power" indicator light is off (after approximately 30 s).

- Switch on the controller, the "Power" indicator light on the main board comes on.
- Select the rotating direction, FW (forward) or RV (reverse).
- Slightly turn the frequency control potentiometer clockwise and check the direction of rotation.
- Stop motor by controlled braking.
- Turn the frequency potentiometer to zero or open contact FW or RV
- Below 0.5 Hz motor stops under its own inertia (free rotation).

Carry out several Start/Stop and change of direction tests and make sure that :

- motor runs in the required direction of rotation,
- no controller fault occurs during acceleration or deceleration.

In case of starting problems, please check the troubleshooting table, chapter 5.

# FMV 1103

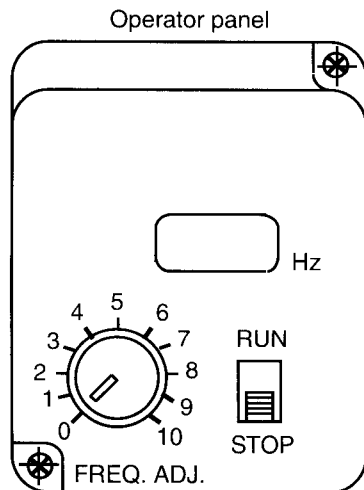
## Digital frequency controller

### 4 - CONTROLLER EXTENSION

#### 4.1 - Operator panel

It is installed directly on the controller's front side, giving access to, via connector

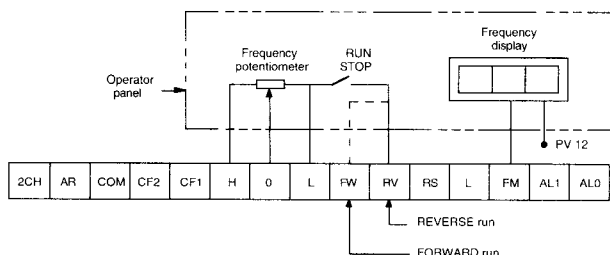
- the control potentiometer,
- the Start/Stop push-button,
- 3 digit frequency display.



#### • Connection

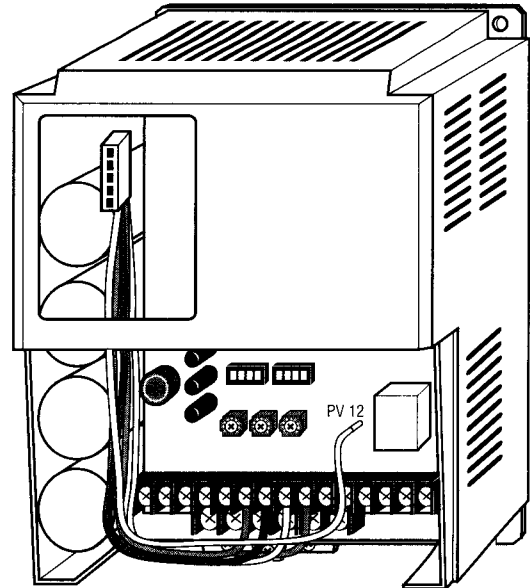
After removing the lower cover, giving access to the terminal block and the mask allowing mounting of the operator panel, connect as follows :

- a) Blue cable ---> to screw terminal FM.
- b) White cable ---> to screw terminal FW or RV according to direction of rotation.
- c) Green cable ---> to screw terminal L.
- d) Yellow cable ---> to screw terminal O.
- e) Red cable ---> to screw terminal H.
- f) Orange cable ---> to pin **PV 12** located on the control board.



If both rotating directions are used, a reverser is needed across FW and RV.

- g) Install the connector in the space between the control board and the capacitors to line up with the window provided for the operator panel. See figure below.



- h) Connect the operator panel via the connector.

- i) Fix the operator panel to the controller box using 2 screws.

#### Notes :

- Never connect an external frequency signal when the operator panel is installed.
- An external frequency control signal can be used provided that the wire connected to terminal 0 (from the potentiometer's cursor) is disconnected and isolated.

#### 4.2 - CD FMV or CO FMV consoles

These two consoles extend the basic functions of the **FMV 1103**. Programming is carried out via (16 digits) messages exactly as the troubleshooting. CD FMV console enables the use of remote control for the controller's commands and the modification of the functions' values.

CO FMV console includes CD FMV console's functions and also enables the information transfer from an **FMV 1103** to another or to several others using the "COPY" function.

# FMV 1103

## Digital frequency controller

### 4.2.1 - Parameter identification and modification in mode " MON "

| DISPLAY ORDER |  | INITIAL DISPLAY          | FACTORY SETTING | MODIF. RANGE/<br>DATA SETTING | ADJUSTMENT DURING OPERATION | REMARKS  |
|---------------|--|--------------------------|-----------------|-------------------------------|-----------------------------|--|
| 1             | Frequency setting display                          | <br>FS000.0 [ ] 000.0 Hz | 0               | Field ① 000.0<br>375.0Hz      | YES                         | • Field ① frequency reference setting when MON MODE F - SET - M is on REMOTE.  |
|               | Multi-speed reference and output frequency display | 1S000.0 [ ] 005.0 Hz     | 005.0           | 0 - 375 Hz                    | YES                         | • Field ② gives the controller's instantaneous output frequency.<br>• The symbol [ ] states the rotation direction.<br>• Multi-speed is displayed when the terminal input command is used. |
|               |  | 2S000.0 [ ] 020.0 Hz     | 020.0           |                               |                             |  |
|               |  | 3S000.0 [ ] 040.0 Hz     | 040.0           |                               |                             |  |
| 2             | Frequency command method                           | F - SET - M Terminal     | Terminal        | Terminal or Remote            | NO                          | Terminal = terminal block<br>Remote = console<br>CD FMV or CO FMV  |
| 3             | Operation command method                           | F/R - SW Terminal        | Terminal        |                               |                             |  |
| 4             | V/f pattern selection : voltage-frequency          | U/F - SET Inverter       | Inverter        | Inverter or Remote            | NO                          | Inverter : setting by DIP switches.<br>Remote : setting by CD FMV or CO FMV console.   |
| 5             | Accel/Decel setting choice                         | TIME Inverter            | Inverter        | Inverter or Remote            | NO                          | Inverter : setting by potentiometers.<br>Remote : setting by CD FMV or CO FMV.   |
| 6             | Motor rotational speed display                     | <br>RPM 4P 00000 RPM     | 4               | 2 - 48                        | YES                         | ① Setting of the motor polarity.<br>② Display of the motor speed.  |
| 7             | Transformed frequency display                      | <br>/Hz00.0 00000.0      | 0               | K : 0,1 - 99,9                | YES                         | FC = FM x K<br>The value FC displayed, is the frequency received by the motor multiplied by the factor K.  |
| 8             | Output current display                             | <br>IF---A Im 000.0 %    | -               | 3,0 - 16,5                    | YES                         | Field ① current allowed by the controller (it can be changed during operation).<br>Field ② output current.   |
| 9             | Manual torque boost adjustment                     | V-Boost Code <55>        | 55              | 00 - 99                       | YES                         | Torque setting at low speed.   |
| 10            | Output voltage gain adjustment                     | V-Gain 100 %             | 100             | 50 - 100                      | YES                         | Controller output voltage setting (50 to 100 % range).   |
| 11            | Faults display                                     | <br>= 123 [ ]            | -               | -                             | YES                         | ① Selection of one of the last 3 faults (1 corresponds to the last found).<br>② Display field of the fault.  |



# FMV 1103

## Digital frequency controller

### 4.2.2 - Parameter identification and modification in MODE " FUN "

| List of functions |   | DESCRIPTION                   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |   |        |        | Min.<br>setting | Max.<br>setting | Units |
|-------------------|---|-------------------------------|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|---|--------|--------|-----------------|-----------------|-------|
| n°                | Function name   | LCD Display (factory setting) |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |   |        |        |                 |                 |       |
|                   |   | 1                             | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |   |        |        |                 |                 |       |
| F00               | V(f) pattern  | After pressing FUN once       |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    | - | -      | -      |                 |                 |       |
|                   |   | F                             | - | 0 | 0 |   |   |   |   |   | V  | F  | 1  | -  | V  |    |    |   |        |        |                 |                 |       |
|                   |   | After pressing FUN twice      |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |   |        |        |                 |                 |       |
|                   |   | V                             | F | E | - | V | C |   |   |   |    | 0  | 6  | 0  | -  | 0  | 6  |   |        |        | 0               |                 |       |
| F01               | Acceleration n° 1   | A                             | C | C | E | L | - | 1 |   |   | 0  | 0  | 0  | 5  | -  | 0  |    | S | 0000,1 | 300    | s               |                 |       |
| F02               | Deceleration n° 1   | D                             | E | C | E | L | - | 1 |   |   | 0  | 0  | 0  | 5  | -  | 0  |    | Q | 0000,1 | 300    | s               |                 |       |
| F03               | Additive to max. frequency 0.1 to 15 Hz   | ±                             | F | m | a | x |   |   |   |   | 0  | 0  | 0  | -  | 0  |    | H  | Z | 0      | 015,0  | Hz              |                 |       |
| F04               | Minimum starting frequency  | ±                             | F | m | i | n |   |   |   |   | 0  | 0  | 0  | -  | 5  |    | H  | Z | 000,5  | 005,0  | Hz              |                 |       |
| F05               | Upper frequency limit setting   | H                             | - | L | I | M | - | F |   |   | 0  | 0  | 0  | -  | 0  |    | H  | Z | 000    | 375,0  | Hz              |                 |       |
| F06               | Lower frequency limit setting   | L                             | - | L | I | M | - | F |   |   | 0  | 0  | 0  | -  | 0  |    | H  | Z | 000    | 375,0  | Hz              |                 |       |
| F10               | Motor noise adjustment (chopping frequency)   | C                             | F | - | C | o | d | e |   |   |    |    | <  | N  | >  |    |    |   | C      | U      |                 |                 |       |
| F11               | Delay time at start before acceleration   | F                             | S | t | o | p | - | T |   |   |    | 0  | 0  | 0  | -  | 0  |    | S | 000,0  | 015,0  | s               |                 |       |
| F12               | Preset speed 1  | S                             | p | e | e | d | - | 1 |   |   | 0  | 0  | 5  | -  | 0  |    | H  | Z | 000,5  | 375,0  | Hz              |                 |       |
| F13               | Preset speed 2  | S                             | p | e | e | d | - | 2 |   |   | 0  | 2  | 0  | -  | 0  |    | H  | Z | 000,5  | 375,0  | Hz              |                 |       |
| F14               | Preset speed 3  | S                             | p | e | e | d | - | 3 |   |   | 0  | 4  | 0  | -  | 0  |    | H  | Z | 000,5  | 375,0  | Hz              |                 |       |
| F18               | Acceleration n° 2   | A                             | C | C | E | L | - | 2 |   |   | 0  | 0  | 0  | 1  | -  | 0  |    | S | 0000,1 | 300    | s               |                 |       |
| F19               | Deceleration n° 2   | D                             | E | C | E | L | - | 2 |   |   | 0  | 0  | 0  | 1  | -  | 0  |    | S | 0000,1 | 300    | s               |                 |       |
| F20               | Start of DC braking   | F                             | - | D | C | B |   |   |   |   | 0  | 0  | 0  | -  | 5  |    | H  | Z | 0,5    | 375,0  | Hz              |                 |       |
| F21               | DC braking voltage  | V                             | - | D | C | B |   |   |   |   |    |    |    | 0  | 2  | 0  |    |   | 0      | 020    | V               |                 |       |
| F22               | DC braking time   | T                             | - | D | C | B |   |   |   |   |    | 0  | 0  | 1  | -  | 0  |    | S | 000,1  | 015,0  | s               |                 |       |
| F23               | Electronic thermal relay  | E                             | - | t | h | e | r | m |   |   |    |    |    |    | 0  | 9  | 0  | % | 50     | 100    | %               |                 |       |
| F26               | External frequency setting start  | F                             | - | S | T | A | R | T |   |   | 0  | 0  | 0  | -  | 0  |    | H  | Z | 000,5  | 375,0  | Hz              |                 |       |
| F27               | External frequency setting end  | F                             | - | E | N | D |   |   |   |   | 0  | 0  | 0  | -  | 0  |    | H  | Z | 000,5  | 375,0  | Hz              |                 |       |
| F28               | Switch 1 selection  | S                             | W | I | T | C | H | 1 |   |   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1 | -      | -      | -               |                 |       |
| F29               | Switch 2 selection  | S                             | W | I | T | C | H | 2 |   |   | 0  | 0  | 0  | 1  | 1  | 0  | 0  | 0 | -      | -      | -               |                 |       |
| F30               | Overload limit sensitivity  | L                             | M | - | C | O | N | S |   |   | 0  | 0  | 0  | 0  | -  | 3  |    | S | 0000,1 | 0030,0 | -               |                 |       |
| F32               | Automatic torque boost adjustment   | V                             | - | a | u | t | o |   |   |   |    |    |    |    | +  | 0  | 0  | S | 0      | 20     | -               |                 |       |
| F36               | Delay time setting for automatic restart after controller trip (instantaneous power failure). | I                             | P | S | - | R | - | T |   |   | 0  | 0  | 0  | 1  | -  | 0  |    |   | 0000,3 | 0015,0 | s               |                 |       |
| F39               | Frequency reached signal  | S                             | P | D | - | A | R | V |   |   | 0  | 0  | 0  | -  | 0  |    | H  | Z | 000,5  | 375,0  | Hz              |                 |       |

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## Digital frequency controller

### 4.3 - Extension boards

For more specific applications, LEROY-SOMER offer extension boards which encompass complex applications while being part of a standard range.

These boards are programmed to accurately solve a given drive problem. They are in the form of electronic boards that can be connected to the controller.

They need to be ordered separately.

#### 4.3.1 - List of extension boards

**1 - 1126 Board** : Slave servo-control system (potentiometer sensor).

**2 - 1274 Board** : Speed regulation by a.c. or d.c. tachogenerator.

NOTE : The following **FMV 1103** functions cannot be used with the 1274 board :

- Frequency command from the panel or consoles.
- Preset speed settings and jogging operation.
- Upper and lower frequency limiter (use the settings on the 1274 board).

**3 - 1275 Board** : Automatic electromechanical brake control.

**4 - 1276 Board** : Conversion voltage/voltage signal or current/voltage signal with galvanic insulation.

**5 - 1278 Board** : Voltage to current conversion.

**6 - 1415 Board** : Automatic current-controlled speed setting.

**7 - 1333 Board** : Simultaneous control of several controllers.

**8 - 1364 Board** : Remote speed control by electronic servo-motor.

**9 - 1368 Board** : Reversal of direction of rotation by  $\pm 10V$  signal.

#### 10 - Interference filters for controller :

When interference filters are used with a differential circuit-breaker, the breaker must be equipped with a delayed tripping device.

**11 - Chokes.**

# FMV 1103

## Digital frequency controller

### 5 - MAINTENANCE

#### 5.1 - Troubleshooting

| Symptom  |  | Possible cause   | Remedy   |
|--|--|--|--|
| <b>The motor does not start</b>                              | No voltage at controller's terminals U.V.W | - No power supply to the controller on L1/N (POWER Led OFF).   | - Check the power supply line, isolator's mains, contactor up to L1/N (POWER Led must be ON).  |
|  |  | - ALARM Led ON<br>• Is RUN/STOP switch in STOP position ?<br>• FW (or RV) is not connected to terminal L ?<br>• The frequency potentiometer is at the counterclockwise end-stop position ?<br>• Are the potentiometer terminals H.O.L. wrongly connected ? | - RESET controller.<br>- Put switch in RUN position.<br>- Check and, if necessary, connect FW (or RV) to terminal L.<br>- Turn the potentiometer clockwise.<br>- Check connections.  |
|  |  |  |  |
|  | Voltage at controller's terminals U.V.W.   | - Is motor size appropriate for the controller ?<br>- Is load too big ?  | - Install correct motor.<br>- Reduce the load.   |
|  | Operator panel used                        | - Are the connections and settings between controller and operator panel correct ?   | - Check connections and settings.  |
| <b>Motor rotation reversed with respect to the command</b>   |  | - Are controller/motor U.V.W connections correct ?<br>- Are connections FW and RV on controller's terminal block correct ?   | - Check and reconnect if necessary.<br>- FORWARD run <b>FW</b> .<br>- REVERSE run <b>RV</b> .  |
| <b>Motor speed does not increase</b>                         |  | - Motor speed does not correspond to the frequency potentiometer command ?<br>- Contacts CF1-L and CF2-L are closed.   | - Check the wiring of the potentiometer ; if it is correct change the potentiometer.   |
|  |  | - Is motor load too big ?  | - Open CF1 and CF2 (when CF1 and CF2 are used with preset speeds, the frequency command is not valid)..<br>- Reduce load. When load is too big, current limit will be activated and motor speed will be lower than required. |
| <b>Motor rotation unstable</b>                               |  | - Large load variation ?   | - Use a bigger rating of controller (or change motor and controller).  |
|  |  | - Main voltage highly variable.  | - Connect the controller to a steady mains or improve supply stability.  |
| <b>Motor is not at the speed displayed by the controller</b> |  | - Maximum frequency required is not reached.   | - Check and change the V/F curve if necessary.   |
|  |  | - Does the number of motor poles correspond to the frequency wanted ?  | - Check the possible speed of the motor installed.   |

# FMV 1103

## Digital frequency controller

### 5.2 - Maintenance and cheking of controller

#### 5.2.1 - Introduction et avertissement

##### Caution :

Before any servicing of the controller, make sure that the output stages power supply is manually switched off (fuse disconnecter or circuit-breaker) or open the KM input isolator and manually lock (with key) the KM remote control.

Before touching the controller wait 30 seconds after the Power LED goes off.

The maintenance and service operations on the **FMV 1103** to be carried out by the user are very few. The current maintenance operations and the methods used to check the correct operation of the controller's output stages are described below :

### 5.3 - Maintenance

For the controller, as for any electronic device problems can occur due to high temperature, humidity, oil, dust exposure, or after any introduction of material inside. Periodically clean the motor ventilation orifices and follow bearing lubrication instructions given on the name-plate. The printed circuits and components do not normally need maintenance. Contact your supplier or the nearest service agent if there is any problem.

**Do not disassemble the printed circuits during the guarantee period. This will invalidate the guarantee.**

Do not touch the integrated circuits or the CPU unit with your fingers or with materials which have potential. For any service to the circuits, ground yourself and ground the bench and the soldering iron.

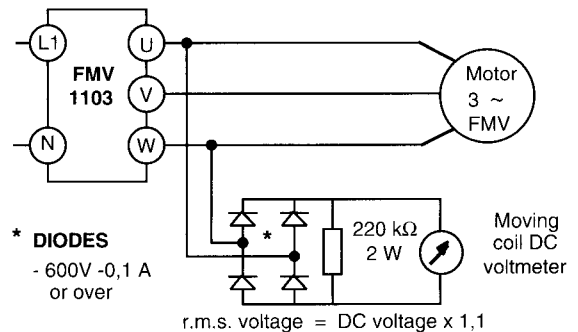
Don not handle the integrated circuits on pillars located on the control printed circuit (they can easily be damaged).

### 5.4 - Measurements

#### 5.4.1 - Measurement of the controller output voltage, under load.

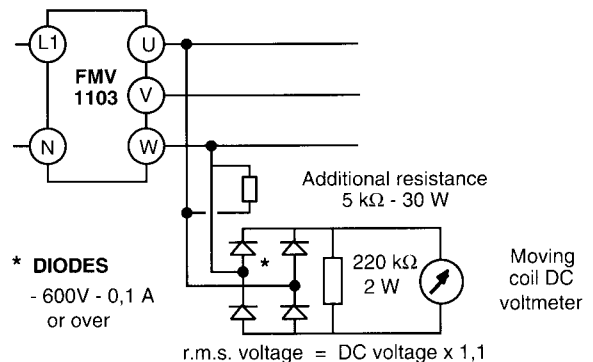
The harmonics due to the controller do not allow a correct measurement of the motor input voltage with a conventional voltmeter.

However, a value close to the r.m.s. voltage value of the fundamental wave (the wave which influences the torque) can be obtained using a conventional DC moving coil voltmeter. The required installation is described below :



#### 5.4.2 - Measurement of the controller output voltage, no load

The low value of the power semi-conductor's (2 mA) leakage current would make the previous arrangement inaccurate for measurement of the controller's output voltage, under no-load. Use the arrangement described below :



#### 5.4.3 - Measurement of the motor current

The current absorbed by the motor and the controller's input current can be measured with a conventional moving coil ammeter or with the CD FMV or CO FMV consoles.

#### 5.4.4 - Measurement of the controller's input and output power

The input and output power of the controller can be measured using an electrodynamic device.

## NOTES

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## NOTES

## NOTES

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