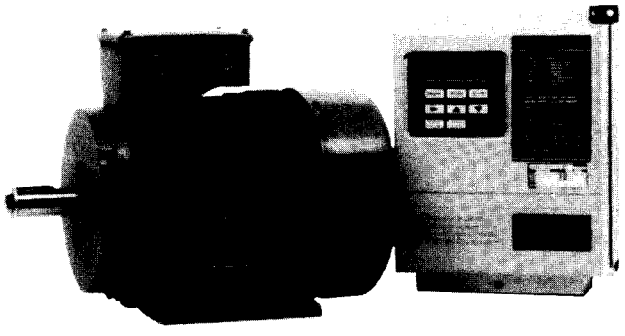
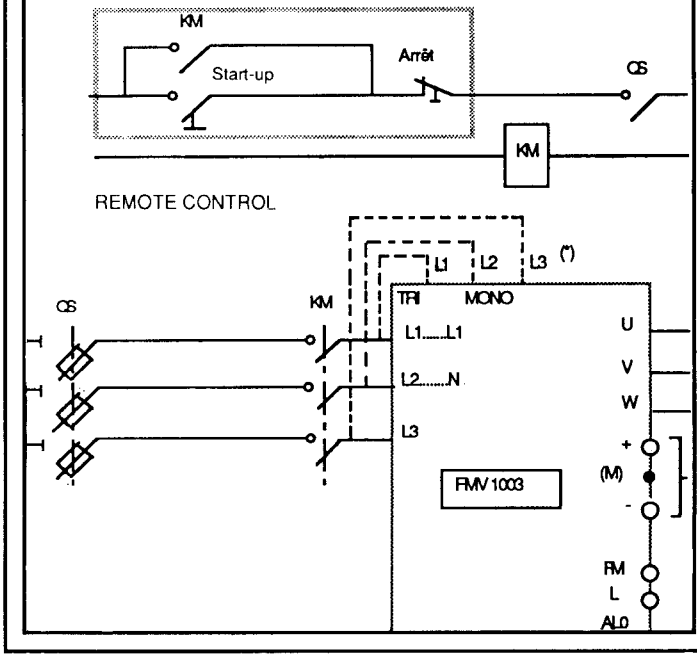
LEROY SOMER®





Réf. 47 - 033 / d - 7.89

LS FMV 1003

Asynchronous motor for speed modulation

Installation and maintenance manual

NOTE

LEROY-SOMER reserves the right to modify the specifications of its products at any time, to take advantage of the latest technical developments. The information contained in this bulletin is therefore liable to change without notice.

LEROY-SOMER gives no guarantee, whether expressed or implied, covering the information contained in this bulletin, and accepts no responsibility for any errors contained therein, nor for damage occasioned by its use.

WARNING

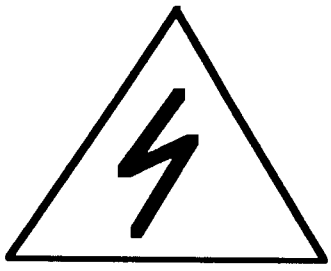
- For user safety, this controller should be earthed.(⏚)
- The controller is fitted with safety devices which can, in the case of certain faults, stop the controller and the motor. The motor itself can be jammed by mechanical means. Finally, voltage fluctuations, and particularly power cuts can also 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, particularly those complying with the decrees of 15th July 1980 concerning safety.

In these cases, therefore, it is important for the user to protect 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 accepts responsibility for carrying out the appropriate action to eliminate such interference.

AS A GENERAL RULE, ANY WORK ON THE MACHINE OR INSTALLATION, WHETHER ELECTRICAL OR MECHANICAL, SHOULD ONLY BE CARRIED OUT AFTER THE POWER SUPPLY TO THE CONTROLLER HAS BEEN SWITCHED OFF.

CONTENTS



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 disconnector or circuit-breaker) and manually locked (with key).

- Wait until the characters on the digital display have completely disappeared for a 220 V controllers, or until the capacitor discharge indicator light has gone off for 380 V controllers.

1.- DESCRIPTION

1.1 - GENERAL OPERATING PRINCIPLE

The rated speed (min-1) of a squirrel-cage motor depends on how many poles (P) it has and on the frequency (F,Hz) of the power supply. These values are linked by the following equation:

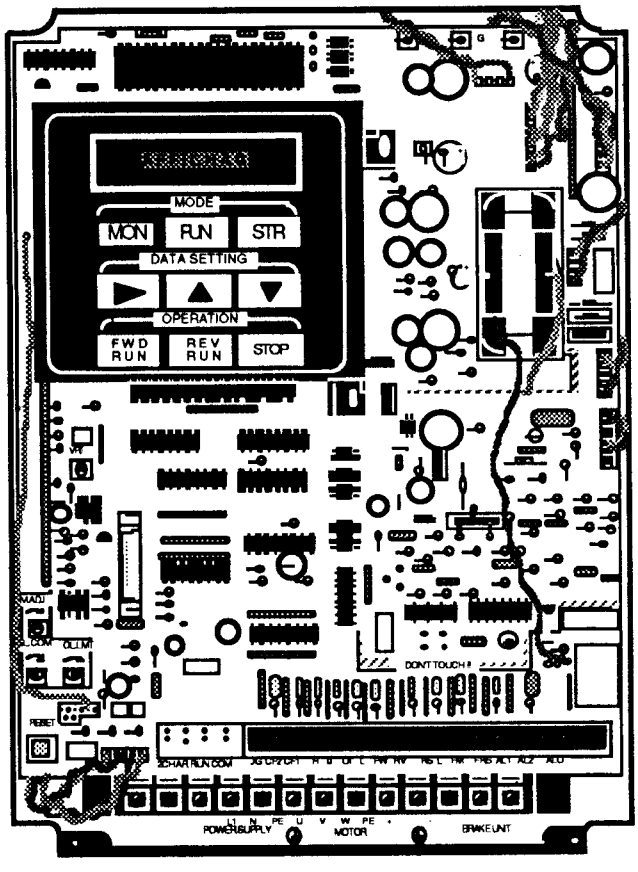
$$N = \frac{120 \times F}{P}$$

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 causes magnetic flux in the motor to vary. **FMV 1003 CONTROLLERS** therefore vary output VOLTAGE and FREQUENCY simultaneously. The motor's torque curve is thus optimized and overheating is avoided.

The **FMV 1003 CONTROLLERS** power the motor via a voltage that is generated by an internal fixed direct voltage. The voltage is modulated by pulse width modulation. This is the most advanced technique. The current supplied to the motor is virtually sinusoidal with a minimum of harmonics.

LS FMV motors are designed to perform to their best when powered by a frequency controller. Their magnetic circuits and windings have been adapted for use with **FMV 1003** controllers. The speed control gear unit thus ensures remarkable torque performances in all types of operating conditions.

A circuit diagram of the main FMV 1003 CONTROLLER



FMV 1003 - 1,5 M to 3,5 M

1.2 - FUNCTIONAL DESCRIPTION OF THE CONTROLLER

functions is given in figure 1.1.

The CONTROLLER comprises:

. A mains voltage **RECTIFIER**, linked to a **SMOOTHING CAPACITOR** that produces a direct voltage (+ and - terminals) which is set according to the mains voltage (300 V for 220 V mains and 510 V for 380 V 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 the frequency modulated. . A **CONTACTOR** (K) that short-circuits the resistor limiting the current surge when switching on.

. A current **SENSOR**.

. **AN ELECTRONIC CONTROL BOARD**

For models over 8 kVA, there is a second board comprising the basic command signal amplification circuits.

1.3 - CIRCUIT DIAGRAM

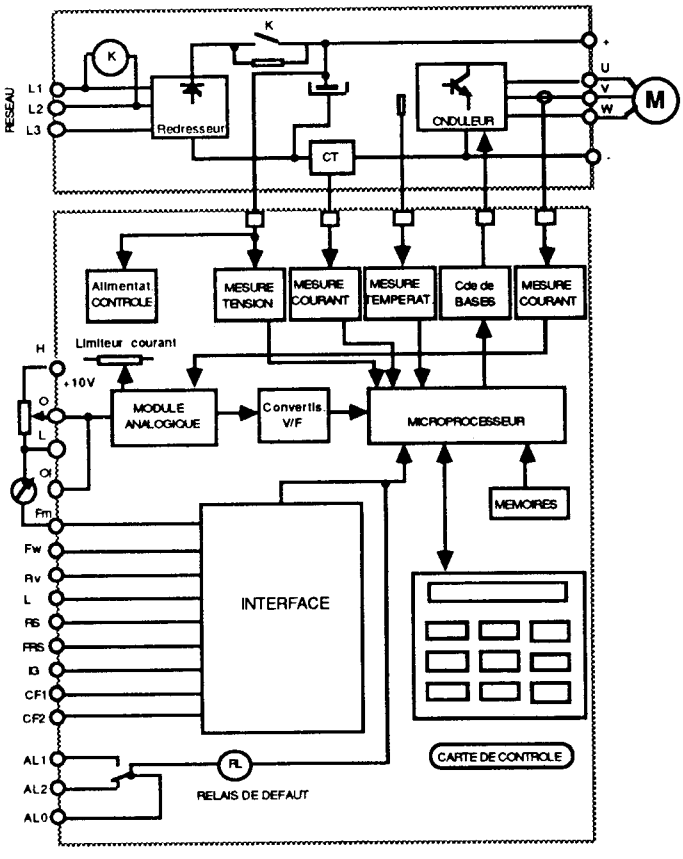
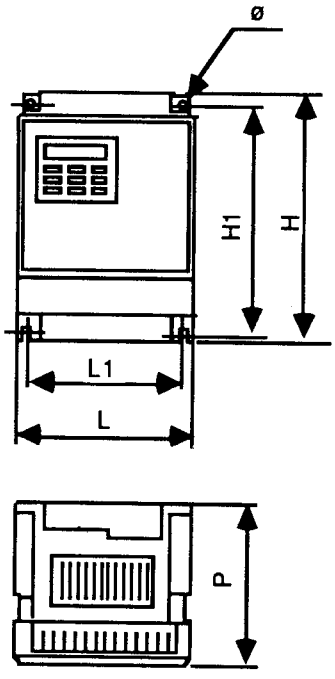
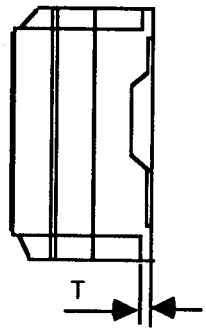


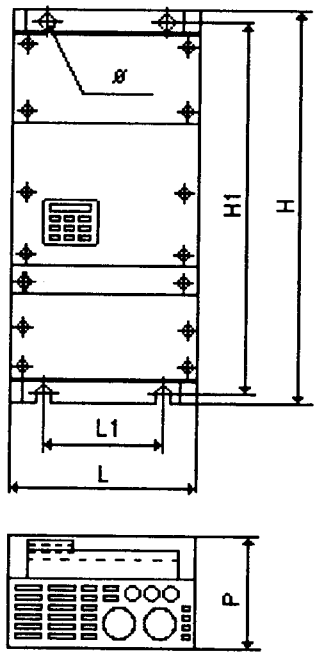
Figure 1.1 - CIRCUIT DIAGRAM

1.4 - DIMENSIONAL CHARACTERISTICS



FMV 1003
1,5 M to 75 T



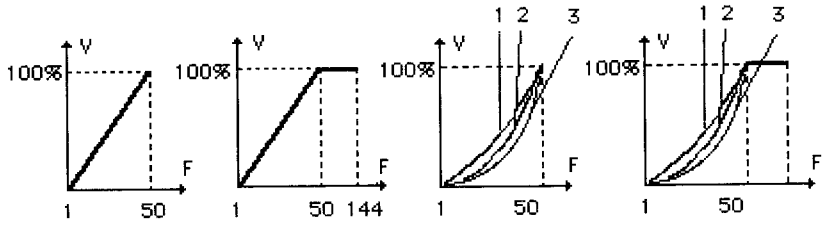


FMV 1003
100 T to 180 T

TYPES	H (mm)	H1 (mm)	L (mm)	L1 (mm)	P (mm)	ø (mm)	T (mm)	MASS (kg)
LS FMV 1003 - 1,5 M	300	280	220	200	175	7	5	5,5
LS FMV 1003 - 2,5 M	300	280	220	200	175	7	5	6,0
LS FMV 1003 - 3,5 M	300	280	220	200	175	7	5	6,5
LS FMV 1003 - 2,5 T	300	280	220	200	175	7	5	7,5
LS FMV 1003 - 3,5 T	300	280	220	200	175	7	5	7,5
LS FMV 1003 - 5,5 T	300	280	220	200	175	7	5	8,5
LS FMV 1003 - 8 T	440	420	250	230	195	7	5	14,5
LS FMV 1003 - 11 T	440	420	250	230	195	7	5	15,0
LS FMV 1003 - 16 T	450	430	325	255	240	8	1,2	22,5
LS FMV 1003 - 22 T	450	430	325	255	240	8	1,2	24,5
LS FMV 1003 - 33 T	500	480	390	300	270	12	1,2	30,0
LS FMV 1003 - 40 T	620	600	390	300	270	12	1,2	40,0
LS FMV 1003 - 50 T	700	670	480	380	270	12	1,2	58,0
LS FMV 1003 - 60 T	700	670	480	380	270	12	1,2	58,0
LS FMV 1003 - 75 T	700	670	480	380	270	12	1,2	58,0
LS FMV 1003 - 100 T	1060	1030	550	380	300	12	1,2	105
LS FMV 1003 - 120 T	1060	1030	550	380	300	12	1,2	105
LS FMV 1003 - 150 T	1300	1270	550	440	300	15	1,2	150
LS FMV 1003 - 180 T	1300	1270	550	440	300	15	1,2	160

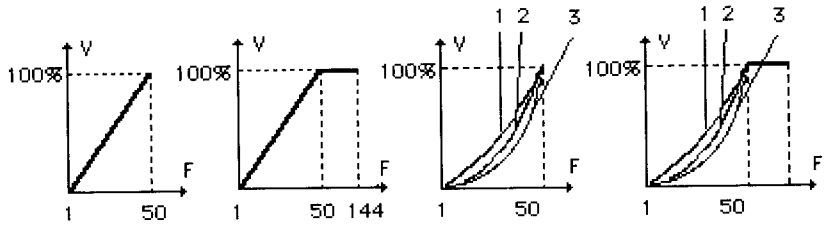
2. STANDARD SPECIFICATIONS

2.1 - CONTROLLERS FROM 1.5 M TO 22 T

INPUT VOLTAGE	220 to 240V ± 10% - SINGLE-PHASE 50/60 Hz ± 5%			380 - 415V - 50 Hz - ±10% 400 - 460V - 60 Hz - ±10% THREE-PHASE						
FMV - 1003 TYPES	1,5 M	2,5 M	3,5 M	2,5 T	3,5 T	5,5 T	8 T	11 T	16 T	22 T
CONTINUOUS OUTPOUT (kVA)	1,9	2,9	4	2,5	3,5	5,7	8,6	11	16	22
PERMANENT RATED CURRENT (A)	5	7,5	10,5	3,8	5,3	8,6	13	16	23	32
MOTOR POWER OUTPUT (kW) at 50/60 Hz	0,75	1,5	2,2	1,5	2,2	4	5,5	7,5	11	15
PROTECTION	IP 20									
OPERATING PRINCIPLE	PULSE WIDTH MODULATION (PWM) - VOLTAGE SOURCE									
STARTING FREQUENCY	0.5 Hz (settings from 0.5 to 5 Hz in steps of 0.1 Hz)									
OUTPUT FREQUENCY AND VOLTAGE	 1-50 1-60 1-87 1-104 / 1-50-144 1-60-144 1-87-144 1-104-144 / 1-50 1-60 1-87 1-104 / 1-50-144 1-60-144 1-87-144 1-104-144									
FREQUENCY ACCURACY	± 0.5% of maximum frequency (ambient temp.: 25°C ± 10°C)									
FREQUENCY RESOLUTION	0,01 Hz									
MAX/MIN FREQUENCY LIMITER	MinF: initial F - MaxF: highest F (if MaxF < MinF: error message)									
FREQUENCY JUMPING	3 settings available to avoid resonance point									
MAX.FREQUENCY SETTING	Max. frequency can be increased by O to +15Hz.									
ACCEL./DECEL.	Separate settings from 0.1 to 2999 s: linear curve - 0.1 to 230 s: S-curve									
TORQUE BOOST	Manual or automatic setting of output voltage									
BRAKING TORQUE	Regenerative braking Dynamic DC braking below frequency of 15 Hz (optional) Adjustable for braking value of 0 to 20 and braking time of 0 to 15 s									
OVERLOAD LIMITATION	150% : 60 s (every 10 min.)									
SLIP COMPENSATION	Approximately 1.5 % (at standard frequency) SL-COM									
MOTOR NOISE LEVEL	ADJUSTABLE									
OUTPUT FREQUENCY SETTING	Set point 0-10 VDC(input impedance 30 kΩ or over) 0-5 VDC (input impedance 15 kΩ or more) - potentiometer 0.47 to 2.2 kΩ. Current setting: 4-20 mA (input impedance 250 Ω) Digital setting: can be programmed on digital operation panel									
RESET	Fault reset (Reset or RS-L)									
FORWARD/REVERSE OPERATION	Forward and reverse signals can be selected individually on the digital operation panel									
MULTI-STAGE SPEED OPERATION	Four speed settings including top speed									

JOGGING OPERATION	Adjustable between 0 and 9.9 Hz (in steps of 0.1 Hz)
FREE-RUN STOP	Selected when FRS-L switch is OFF
FAULT ALARM RELAY	Activated when controller trips or powers off.
FREQUENCY MONITOR	0-10 VDC analog voltmeter or digital counter (counter impedance 10 kΩ - 22 kΩ)
AUTOMATIC RESTART	Automatic restart after instantaneous power failure. (effective from 15 to 300 ms)
OVERCURRENT	1.5 to 5.5 kVA: 220 % of nominal current. 8 to 22 kVA : 180 % of nominal current.
OVERVOLTAGE	Deceleration is too fast or mains power supply too high
UNDERVOLTAGE	1.5 to 3.5 kVA: 150 to 160 V 5.5 to 22 kVA: 280 to 320 V
INSTANTANEOUS POWER FAILURE	Displayed by controller. Operation continues for power failure of 15 ms or less Automatic restart possible for power failures of less than 300 ms
OVERLOAD	In line with electronic thermal relay setting (see 6.17)
FIN OVERHEAT	Controllers of over 8 kVA protected by thermal relays
CPU ERROR	Internal controller fault
GROUND FAULT	Monitoring at controller output up to 22 kVA (if over this level, consult us)
DC BRAKING	Available under 15 Hz. Adjustable power and duration (OPTIONAL).
CURRENT SETTING 0-20mA	0-2-mA input: input impedance 250 Ω (OPTIONAL).
OUTPUT CURRENT SIGNAL	Voltage varies between 0 and 4 V according to controller current (4V = Nom I)(Optional)
SPEED SETTING SIGNAL	Switch ON at pre-selected frequency (OPTIONAL)
CONTROLLER OPERATION RELAY	Switch ON when controller is operating (OPTIONAL)
OPERATING CONDITIONS	Operation at ambient temperature: -10 to +50°C (without cover) Relative humidity: < 90% -10 to +40°C (with cover) Altitude: < 1,000 m Storage: at temperature of -10 to +70°C

2.2 - CONTROLLERS FROM 33 TO 180 T

INPUT VOLTAGE	380 - 415V - 50 Hz - ±10% 400 - 460V - 60 Hz - ±10% THREE-PHASE								
FMV - 1003 TYPES	33 T	40 T	50 T	60 T	75 T	100T	120 T	150T	180T
CONTINUOUS OUTPOUT (kVA)	32	38	49	59	72	98	116	143	171
PERMANENT RATED CURRENT (A)	48	58	75	90	110	149	176	217	260
MOTOR POWER OUTPUT (kW) at 50/60 Hz	22	30	37	45	55	75	90	110	132
PROTECTION	IP 20								
OPERATING PRINCIPLE	PULSE WIDTH MODULATION (PWM) - VOLTAGE SOURCE								
STARTING FREQUENCY	0.5 Hz (settings from 0.5 to 5 Hz in steps of 0.1 Hz)								
OUTPUT FREQUENCY AND VOLTAGE	 1-50 1-60 1-87 1-104 1-50-144 1-60-144 1-87-144 1-104-144 1-50 1-60 1-87 1-104 1-50-144 1-60-144 1-87-144 1-104-144								
FREQUENCY ACCURACY	± 0.5% of maximum frequency (ambient temp.: 25°C ± 10°C)								
FREQUENCY RESOLUTION	0,01 Hz								
MAX/MIN FREQUENCY LIMITER	MinF: initial F - MaxF: highest F (if MaxF < MinF: error message)								
FREQUENCY JUMPING	3 settings available to avoid resonance point								
MAX.FREQUENCY SETTING	Max. frequency can be increased by O to +15Hz.								
ACCEL./DECEL.	Separate settings from 0.1 to 2999 s: linear curve - 0.1 to 230 s: S-curve								
TORQUE BOOST	Manual or automatic setting of output voltage								
BRAKING TORQUE	regenerative braking Dynamic DC braking below frequency of 15 Hz (optional) Adjustable for braking value of 0 to 20 and braking time of 0 to 15 s								
OVERLOAD LIMITATION	150% 60 s (every 10 min.)								
SLIP COMPENSATION	Approximately 1.5% (at standard frequency) SL-COM								
MOTOR NOISE LEVEL	ADJUSTABLE								
OUTPUT FREQUENCY SETTING	Set point 0-10 VDC (input impedance 30 kΩ or over) 0-5 VDC (input impedance 15 kΩ or more) - potentiometer 0.47 to 2.2 kΩ. Current setting: 4-20 mA (input impedance 250 Ω) Digital setting: can be programmed on digital operation panel								
RESET	Fault reset after RAZ (reset or RS-L)								
FORWARD/REVERSE OPERATION	Forward and reverse signals can be selected individually on the digital operation panel								
MULTI-STAGE SPEED OPERATION	Four speed settings including top speed								

JOGGING OPERATION	Adjustable between 0 and 9.9 Hz (in steps of 0.1 Hz)
FREE-RUN STOP	Selected when FRS-L switch is OFF
FAULT ALARM RELAY	Activated when there is a break in the circuit or when controller trips or power off.
FREQUENCY MONITOR	0-10 VDC analog voltmeter or digital counter (counter impedance 10 kΩ - 22 kΩ)
AUTOMATIC RESTART	Automatic restart after instantaneous power failure (effective from 15 to 300 ms)
OVERCURRENT	33 to 180 kVA : 180% of nominal current.
OVERVOLTAGE	Activated when there is a break in the circuit or when controller cuts out
UNDERVOLTAGE	33 to 75.5 kVA: 280 to 320 V 100 to 180 kVA: 320 to 360 V
INSTANTANEOUS POWER FAILURE	Automatic restart after instantaneous power failure. (effective from 15 to 300 ms)
OVERLOAD	In line with electronic thermal relay setting (see 6.17)
FIN OVERHEAT	Protected by thermal relays
CPU ERROR	Internal controller fault
GROUND FAULT	No monitoring (consult us)
DC BRAKING	Available under 15 Hz. Adjustable power and duration (OPTIONAL).
CURRENT SETTING 0-20mA	0-20 mA input: input impedance 250 Ω(OPTIONAL)
OUTPUT CURRENT SIGNAL	Voltage varies between 0 and 4 V according to controller current (4V = Nom I)(Optional)
SPEED SETTING SIGNAL	Switch ON at pre-selected frequency (OPTIONAL)
CONTROLLER OPERATION RELAY	Switch ON when controller is operating (OPTIONAL)
OPERATING CONDITIONS	peration at ambient temperature: -10 to +50°C Relative humidity: < 90% Altitude: < 1,000 m Storage: at temperature of -10 to +70°C

3.- INSTRUCTIONS FOR USE

3.1 - INSPECTION ON UNPACKING

Before installation and wiring, check that:
1 - Nothing has been damaged during transportation (otherwise inform your haulage contractor).
2 - The product is as ordered.

3.2 - INSTALLATION PRECAUTIONS

Before starting up FMV 1003 controller, check the following points:
1 - That the mains supply voltage is compatible with the controller type.
2 - That the controller installation site is well ventilated.
- The FMV 1003 CONTROLLER is wall-fitted.
- Install vertically and take the precautions listed below:

3.3 - INSTALLING THE CONTROLLER

3.3.1 - Comply with the figure opposite:

3.3.2 - The controller must be installed in an environment free from dust, corrosive gases, sprays, vibrations (maximum permissible = 0.3 g) and other harmful elements.

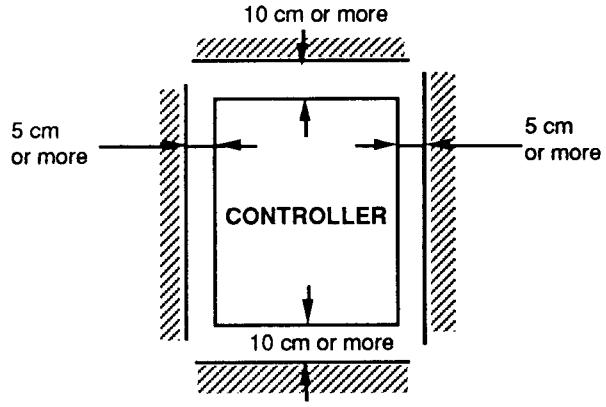


Figure 2 - SPACING AROUND CONTROLLER

3.3.3 - When installed without due care, defects may damage main circuit components.

3.3.4 - Sufficient space must be available to open the cover for easy access to the terminal.

3.3.5 - When installing the controller in a box, make sure that there is sufficient ventilation to get rid of excess heat (losses = 5% of the nominal power of the controller). Maximum ambient temperature:
see tables pages 7 and 9.

3.3.6 - Attach CONTROLLERS side by side and do not stack to avoid overheating.

3.4 - TERMINAL

3.4.1. - Description of terminals

Terminal code	TERMINAL NAME	FUNCTION
L1-N L1,L2,L3	Controller input terminal Mains power supply	SINGLE-PHASE 220 V - 240 V / 50, 60 Hz TRI - 380/415 V / 50 Hz - 400/460 V / 60 Hz
+,(M) , -	DC Voltage output terminal	Connection to braking unit
H	Power supply terminal for frequency setting potentiometer	10 V DC
O	Reference voltage for frequency setting	0 - 10 V DC or 0 - 5 V DC (switchable)
OI	Reference current for frequency setting	4 - 20 mA
L	Common control terminal (CANNOT BE USED FOR GROUNDING)	
FW	FORWARD Start/Stop terminal	Contact closed: Forward - Contact open: STOP
RV	REVERSE Start/stop terminal	Contact closed: Reverse - Contact open: STOP
RS	Reset terminal	Contact closed: fault reset
FRS	Free-run stop terminal	Contact open: Controller stop, motor free run stop.
FM	Frequency monitor terminal	Select a digital frequency counter or an analog meter (0 - 10 V)
JG	Jogging terminal	Contact closed: jogging operation
CF1, CF2	Multi-stage speed terminals	Contact closed: multi-stage speed operation
P.E	Earth terminal	Grounding
AL1 AL2 AL0	FAULT ALARM RELAY terminal	Power off or trip, AL0-AL1 open and AL0-AL2 closed
L1H-L2H L3H	ELECTRONIC CIRCUIT SUPPLY terminal	Only for 100 T or greater. - 460 V mains supply
L1M-L2M L3M	ELECTRONIC CIRCUIT SUPPLY terminal	Only for 100 T or greater. -415 to 440 V mains supply
L1L-L2L L3L	ELECTRONIC CIRCUIT SUPPLY terminal	Only for 100 T or greater. - 380 to 400V mains supply.
-1	-	DO NOT USE

3.4.2 - Terminal configuration

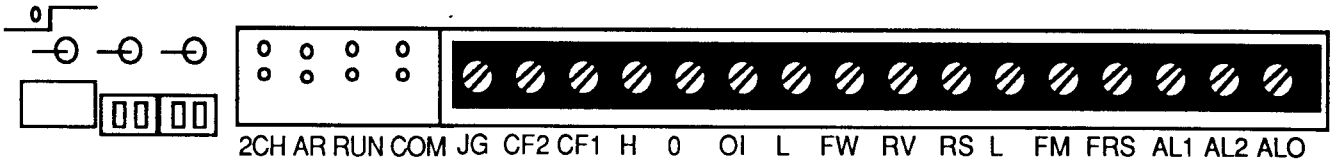


Figure 3.2 - CONTROL BOARD 1.5 M to 180 T

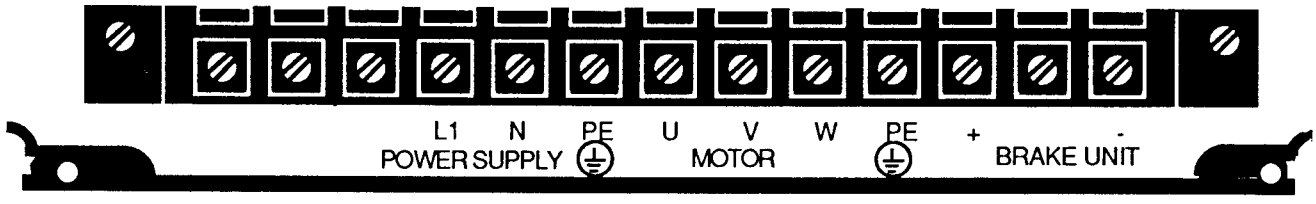


Figure 3.3 - POWER BOARD 1.5 M to 3.5 M

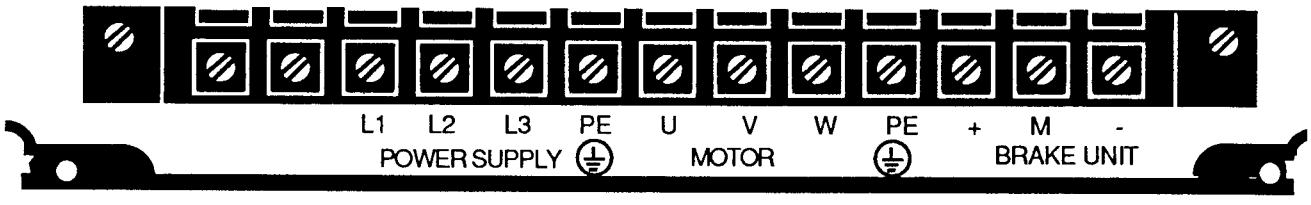


Figure 3.4 - POWER BOARD 2.5 T to 22 T

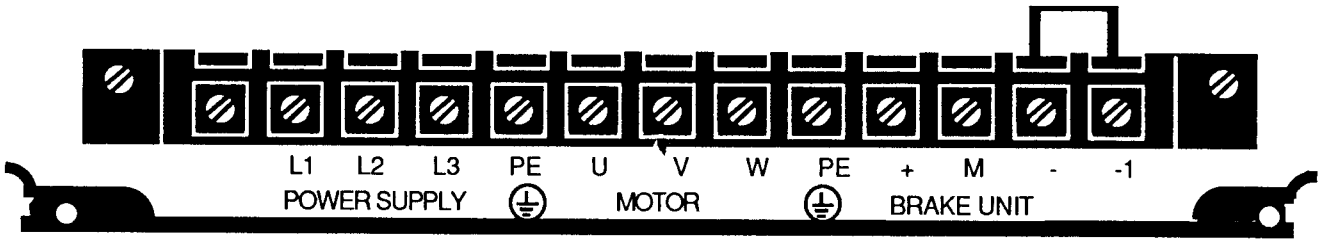


Figure 3.5 - POWER BOARD 33 T to 75 T

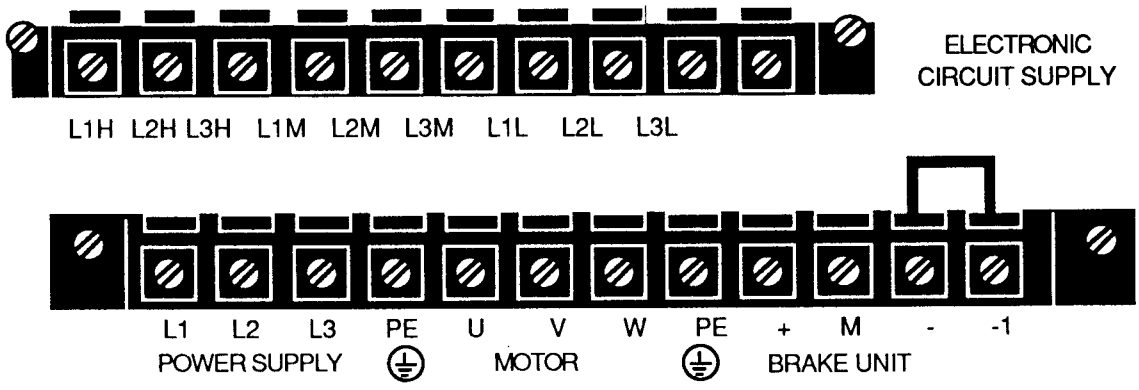


Figure 3.6 - POWER BOARD 100 T to 150 T

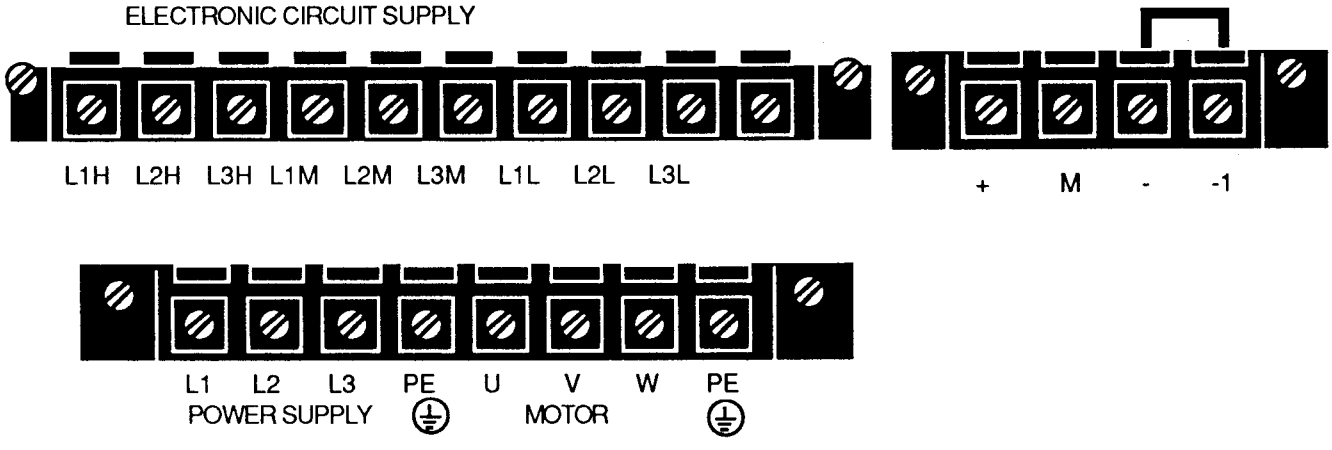


Figure 3.7 - POWER BOARD 180 T

3.5 - Connection diagrams

3.5.1 - Command through digital operation panel

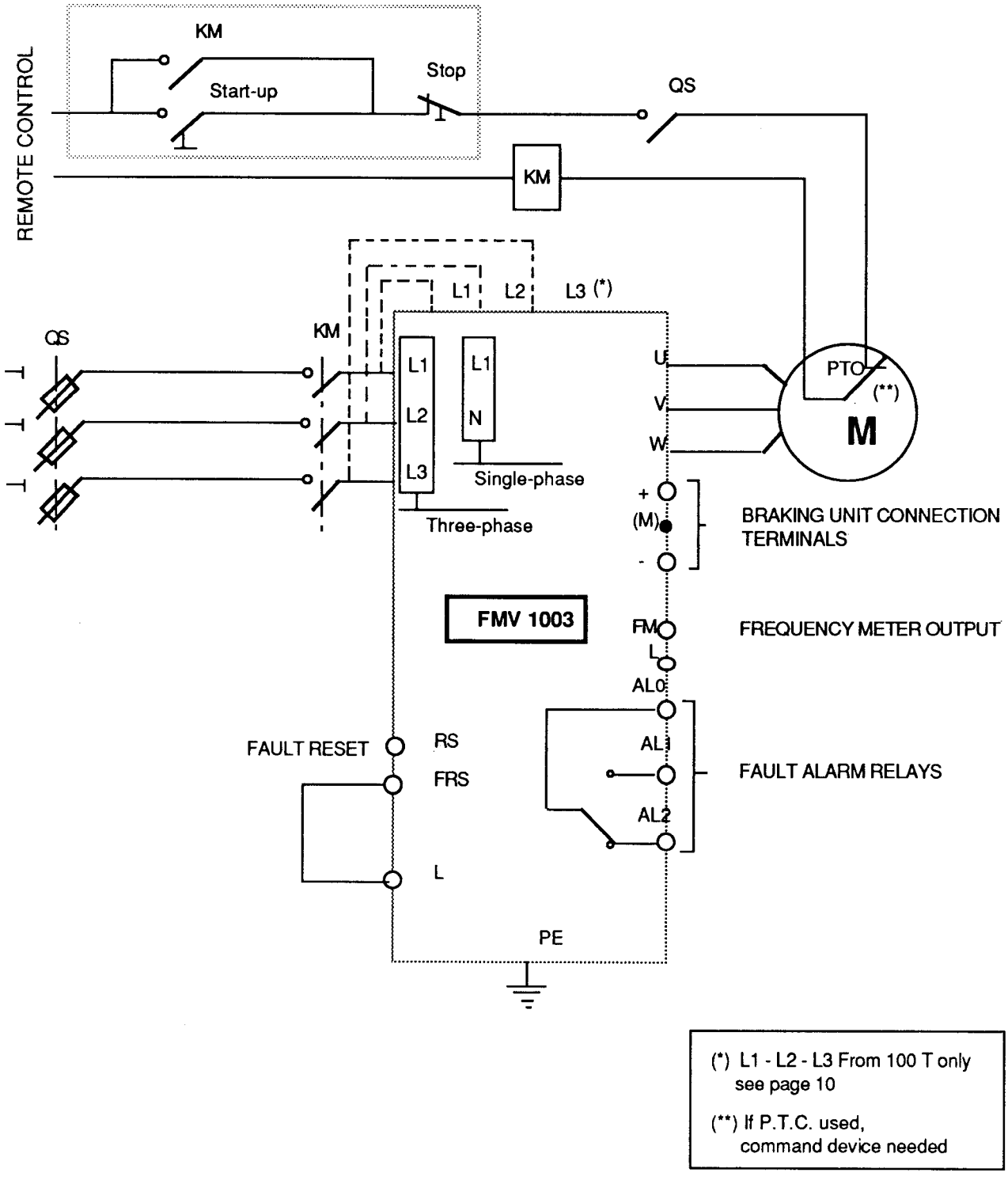


Figure 3.8 - STANDARD CONNECTION.

3.5.2 - Remote control (potentiometer)

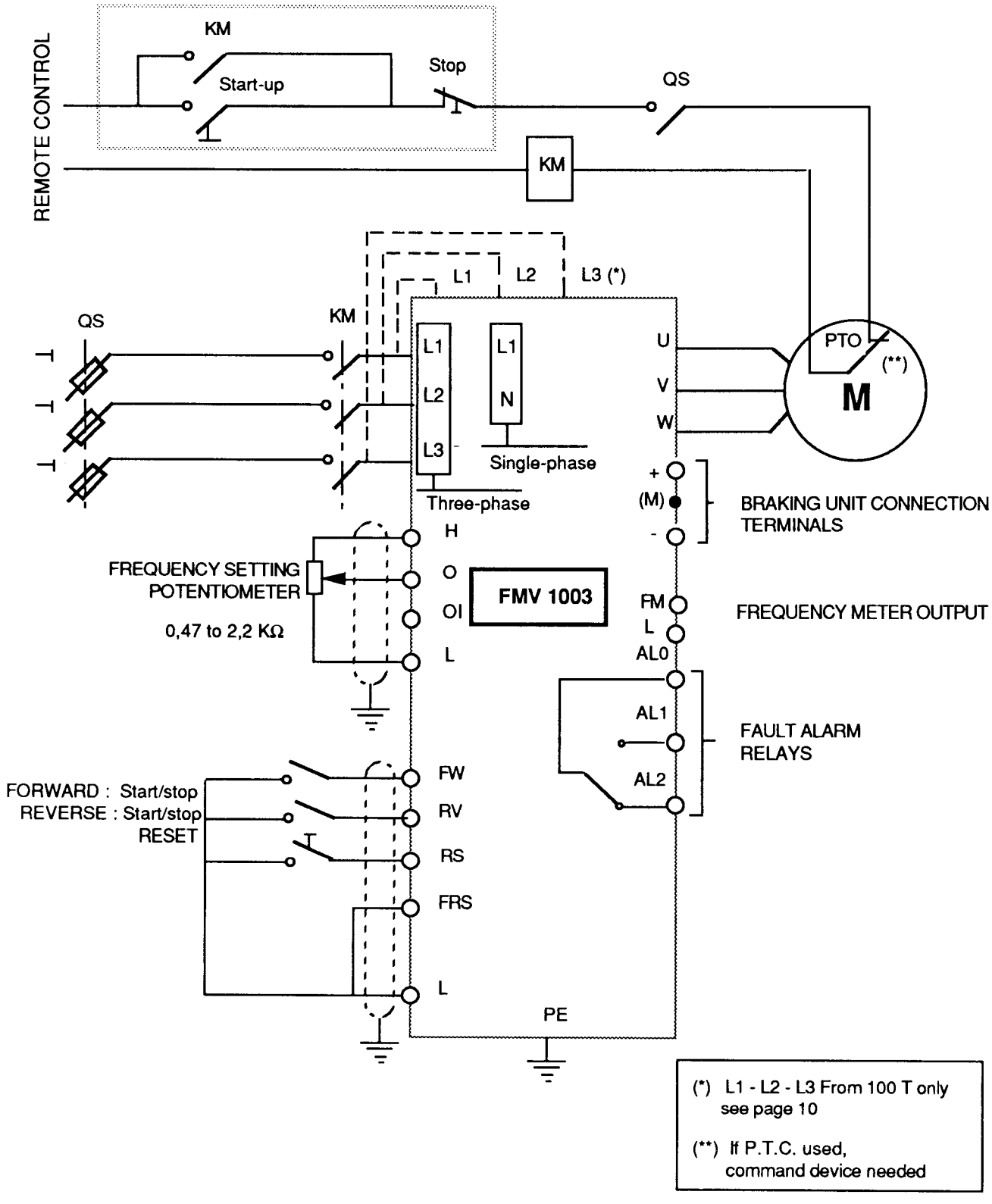


Figure 3.9 - STANDARD CONNECTION.

3.5.3 - Remote control (other types)

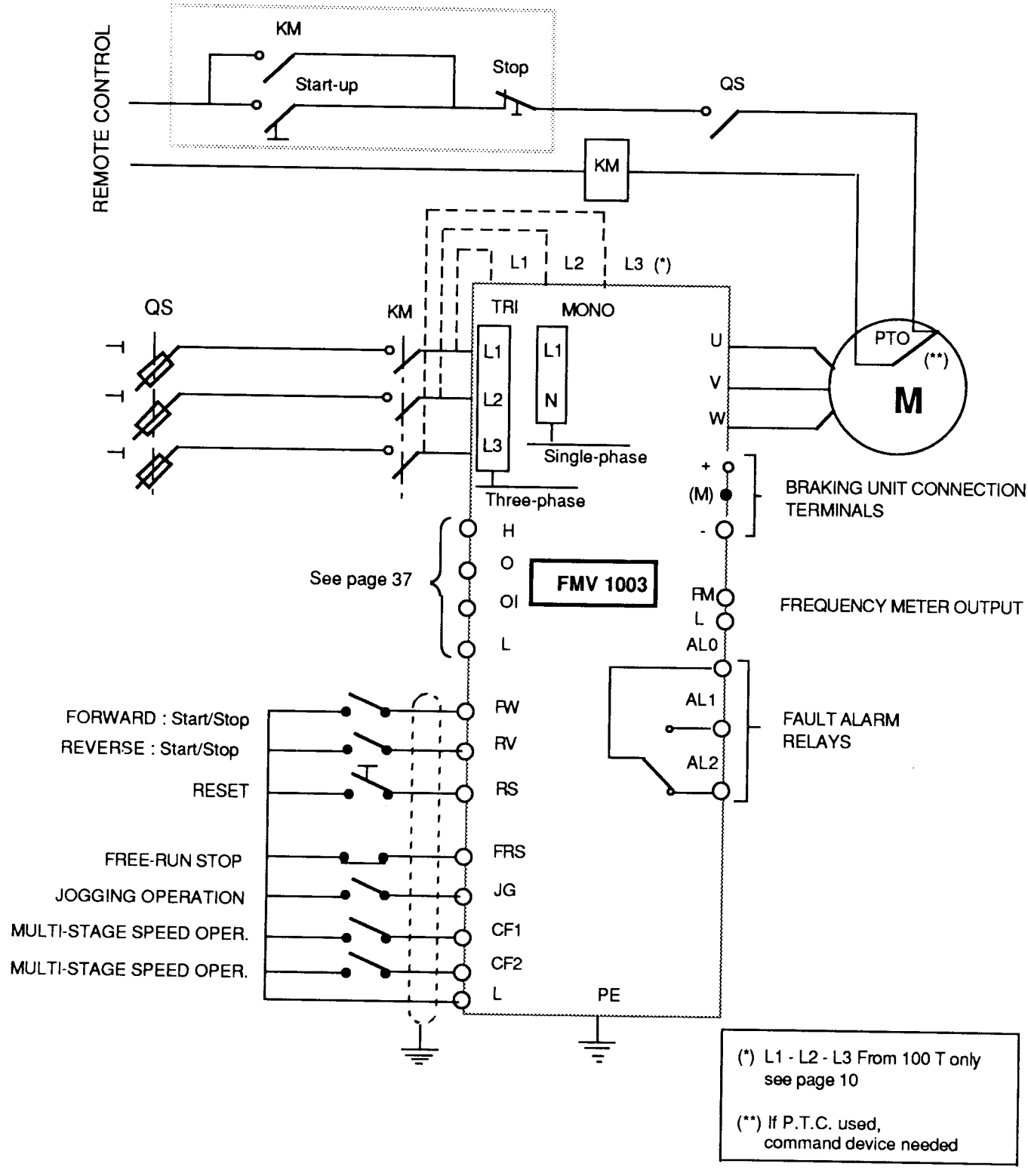
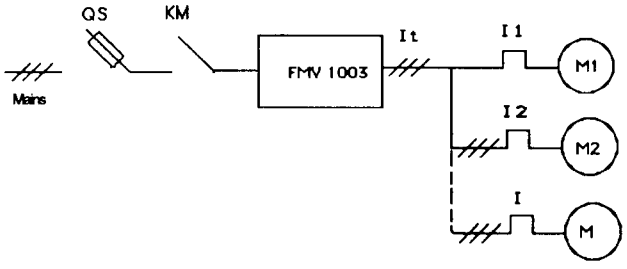


Figure 3.10 - STANDARD CONNECTION.

3.5.4.1 - Connection to different motors
Motors connected in parallel:

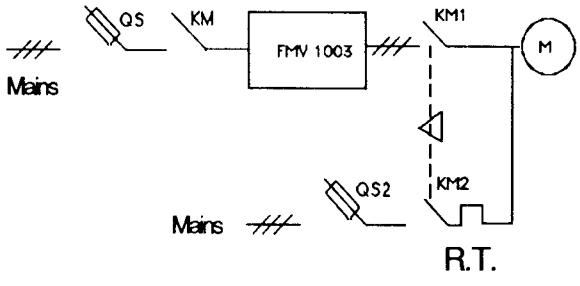


Several motors with different power ratings can be powered by the same frequency controller. Each motor must be protected by a thermal relay.

Determining controller rating:

NI Controller > I1 + I2 + ... + 1

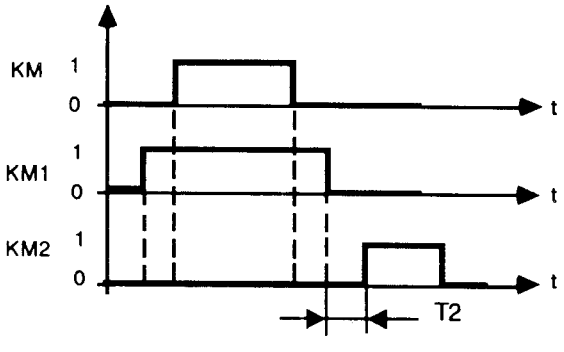
3.5.4.2 - Connecting the motor directly to mains supply (by-pass)



Sequence to be followed:

- KM1 must be activated before KM
- Mechanical locking between KM1 and KM2

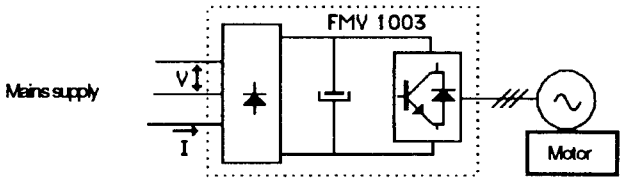
It is essential to keep within time T2 = 1.5 s
This is the time that it takes for the motor to become demagnetized.

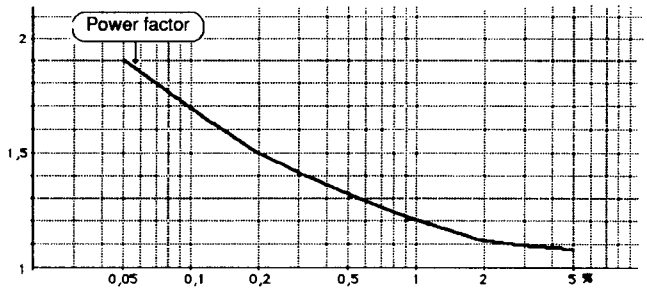


3.6 CABLE DIMENSIONING
(For three-phase controllers 2.5 T to 180 T)

3.6.1 General
The current absorbed by the controller is not sinusoidal. It includes a fundamental wave at 50 or 60 Hz, with harmonics of smaller amplitude and higher frequencies. The fundamental wave I1 determines the active power.
ActP = I1 x $\sqrt{3}$.
The fundamental wave added to the harmonics gives the RMS value (1) of the current and determines the apparent power **AppP = I x $\sqrt{3}$**

3.6.2 - The power factor K = I/I1
This determines the overdimensioning coefficient of the mains supply and the protection devices. All these parameters are mainly dependent on the impedance of the mains supply, and therefore on the inductive reactance of the the mains supply, which is brought down to the power of the controller





inductive reactance of source voltage brought down to the power of the controller.

3.6.3 - Determining the value of current I

REMARQUE :
In the case we do not know the installed power, therefore the inductive loss, consider the motor current and apply a 1,5 coefficient.

$$I = \frac{P(mot) \times K}{\sqrt{3} \times V \times \eta(mod) \times \eta(mot)}$$

I = RMS current (mains supply)
V = RMS voltage (mains supply)
K = Form factor (read on above curve)
P(mot) = motor power
(η mod) = controller efficiency (approximately 95% at nominal charge)
(η mot) = motor efficiency

EXAMPLES

1 - A 45 kW motor is powered by an LS FMV 1003-60 T Controller. Energy is supplied by a 500 kVA transformer with an inductive reactance of 5%.
The inductive reactance brought down to the power of the motor is:

$$\frac{5 \times 60}{500} = 0{,}6\%$$

Power factor read on curve: 1.3
RMS value of current I:

$$I = \frac{45000 \times 1{,}3}{\sqrt{3} \times 380 \times 0.95 \times 0.9} = 104 \text{ A}$$

2 - Data identical to that in 1, except transformer power = 60 kVA
The inductive reactance brought down to the power of the motor is:

$$5 \times \frac{60}{60} = 5\%$$

Power factor read on curve: 1.08
RMS value of current I:

$$I = \frac{45000 \times 1{,}08}{\sqrt{3} \times 380 \times 0{,}95 \times 0{,}9} = 86 \text{ A}$$

EXAMPLE :
LS FMV 1003 - 60 T motP = 45 kW
I motor = 90 A
RMS value of current I = 90 x 1.5 = 135 A

3.7 CABLE DIMENSIONING FOR SINGLE-PHASE CONTROLLERS

For these types use the current values given in the following table.

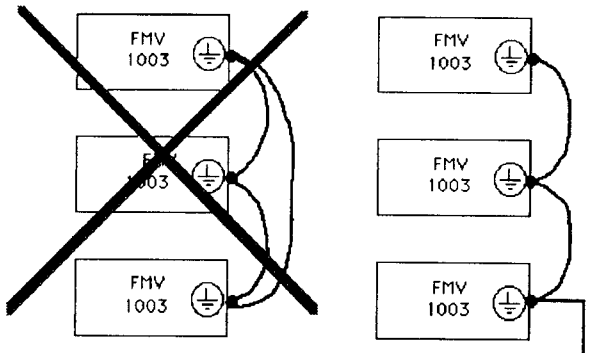
Controller type	Motor power kW	Line current (Amps)	KM sizing QS fuse delayed action (AMPS)
LS FMV 1003 1,5 M	0,75	8	10
LS FMV 1003 2,5 M	1,5	15	16
LS FMV 1003 3,5 M	2,2	18	22

N.B.
These examples can be used to determine the minimum cross sectional diameter of a cable so that it will not overheat in continuous operation. The resulting drop in voltage must then be checked. The above table must in no way be used to replace currently applicable standards and texts.

3.7.1 - Other connections

- 1.5 mm2 cross sectional dia. wires in shielded twisted cables.
- Signal line: H, OI, L, FW, RV, RS, FRS, FM, JG, CF1, CF2
- Command lines: AL0, AL1, AL2

3.7.2 - Grounding of several controllers.



Wrong connection

Right connection.

Controller type	Motor power kW	Line current (Amps.)	KM sizing QF. fuse delayed action (AMPS)	CONTROLLER type	Motor power kW	Line intensity (Amps.)	KM sizing QF. fuse delayed action (AMPS)
LS FMV 1003 2,5 T	1,5	3,8	10	**LS FMV 1003 40 T**	30	58	100
LS FMV 1003 3,5 T	2,2	5,3	10	**LS FMV 1003 50 T**	37	75	125
LS FMV 1003 5,5 T	4	8,6	16	**LS FMV 1003 60 T**	45	90	160
LS FMV 1003 8 T	5,5	13	25	**LS FMV 1003 75 T**	55	110	200
LS FMV 1003 11 T	7,5	16	32	**LS FMV 1003 100 T**	75	149	250
LS FMV 1003 16T	11	23	40	**LS FMV 1003 120T**	90	176	315
LS FMV 1003 22 T	15	32	50	**LS FMV 1003 150T**	110	217	400
LS FMV 1003 33 T	22	48	80	**LS FMV 1003 180 T**	132	260	400

4.- STARTING FROM FACTORY SETTINGS

4.1 - STARTING THE MOTOR FROM THE TERMINAL

4.1.1 - Connection diagram. See figure 3.10 on page 15.

4.1.2 - Start procedure

. Switching on: close isolating switch QS and power contactor KM.

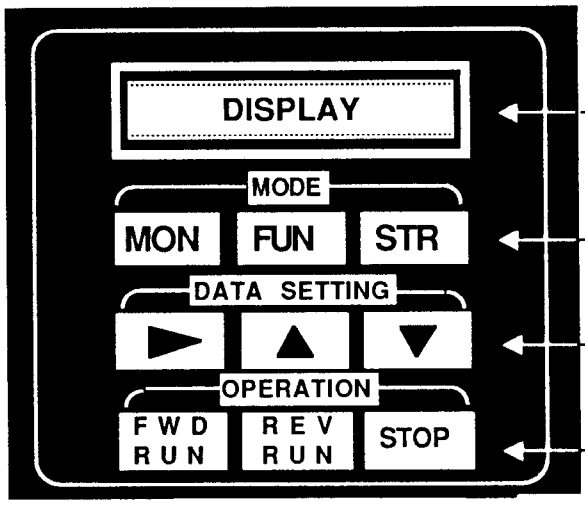
. Select Forward run (close switch FW-L) or Reverse run (close switch RV-L).

. Adjust the frequency with the potentiometer until the desired speed is obtained.

. The motor is stopped by opening switch FW-L (Forward run) or RV-L (Reverse run).

4.2 - STARTING THE MOTOR FROM THE OPERATION PANEL

4.2.1 - Digital operation panel configuration



16-character display, which automatically comes on when power is switched on

Keys used to select operating modes

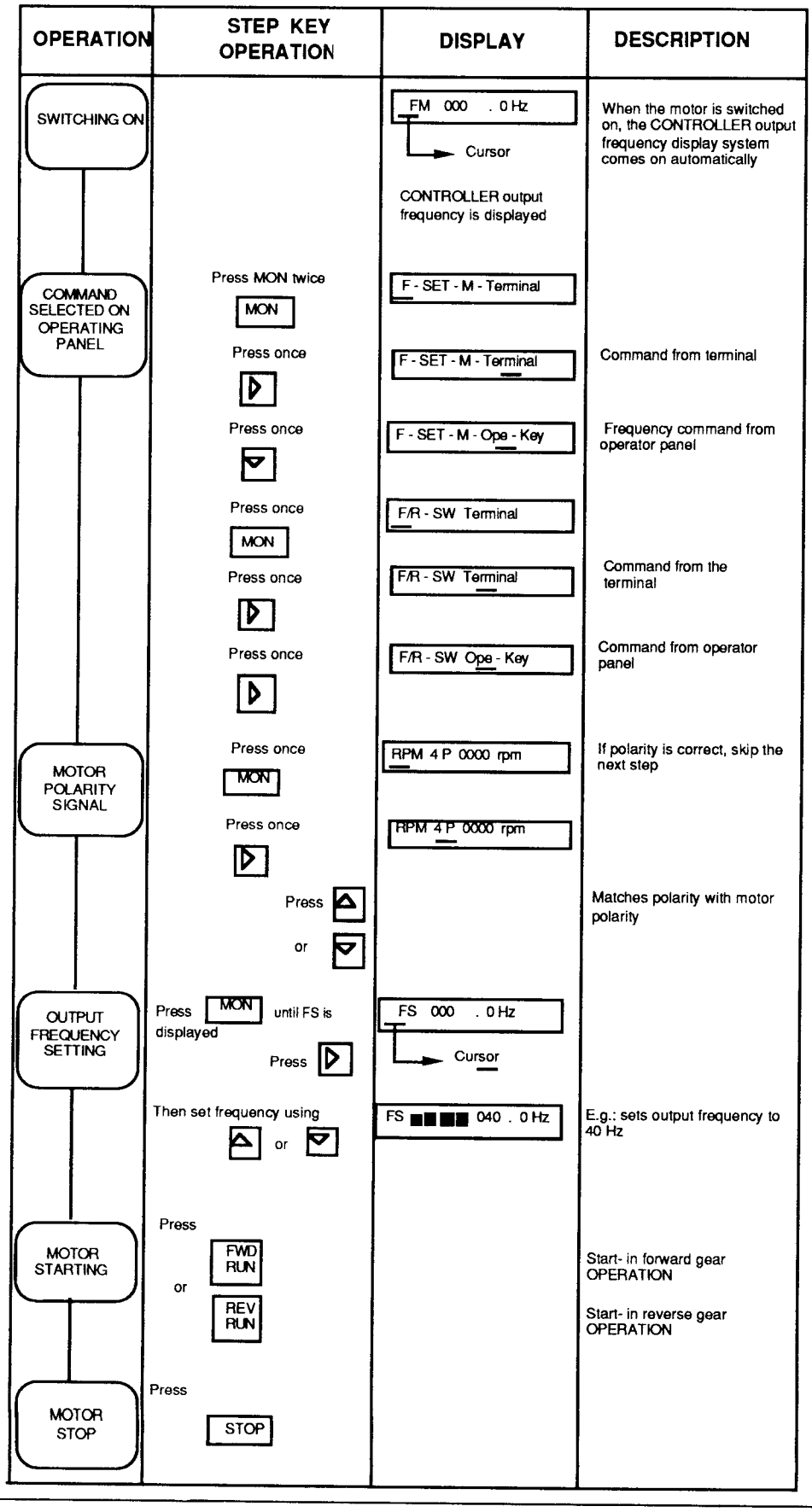
Keys used for scrolling through, setting or modifying data or parameters.

Keys used for starting the motor in forward or reverse.
Stop.

4.2.2 - Description of functions

SECTION	KEY	FUNCTION
MODE SELECTION	MON	Modifies or checks controller setting parameters
	FUN	Selects function mode for function names and setting or modification of operating parameters (modifications only possible when motor is at a standstill)
	STR	Stores data set or modified in FUN (function) mode
SCROLLING SETTING OR MODIFICATION OF DATA	▷	This key moves the cursor to the data to be modified
	△ ▽	These keys set or modify data or select functions in MON or FUN mode
MOTOR START / STOP	FW RUN	This key starts the motor in forward run
	REV RUN	This key starts the motor in reverse run
	STOP	This key stops the motor

4.2.3 - Starting procedure using the operator panel (table 4.2)



5.- IDENTIFICATION AND MODIFICATION OF PARAMETERS IN "MON" MODE

5.1 - PARAMETER IDENTIFICATION

Display the parameters one by one using the *MON* key

DISPLAY SEQUENCE AND MONITOR NAME		INITIAL DISPLAY	FACTORY SETTING	DATA MODIFICATION/SETTING RANGE	REMARKS
1	Output frequency display Function: frequency meter	F M 0 0 0 . 0 Hz	—		
2	Controller output frequency setting	F S 0 0 0 . 0 Hz	0 Hz	0 - FMax	Data can be entered or modified up to the maximum frequency of the V/F pattern selected
3	Frequency command method	F - SET - M Terminall	Terminal	Terminal or Ope-key	Ope-key = operator panel
4	Operation command method	F/R - SW Terminal	Terminal		
5	Motor speed display	RPM 4P 00000 RPM	4 p	2 - 48	Displays the polarity of the motor being powered
6	Output current display	If.....AI m 0 0 0. 0%	—	3,0 - 260	If: controller current Im: current consumed by the motor
7	Manual torque boost adjustment	V-Boost Code < 31>	31	00 - 99	Boost set between 0.5 and 20 H
8	Output voltage gain adjustment	V-Gain 100%	100	50 - 100	Setting of controller output voltage (from 50 to 100%)
9	Jogging frequency setting	Jogging 00,5 Hz	0,5	0 - 9,9	Must be connected to the terminal
10	Fault display	#	—	Table 5.1	Symbol # indicates that the controller is operating normally. If it fails, the error display takes precedence over all other displays and indicates the nature of the fault

5.2 - FAULT IDENTIFICATION

Display

DISPLAY	CAUSE
OVER - V	Overvoltage on deceleration (dynamic braking)
O C - Accel	Overcurrent on acceleration
O C - Decel	Overcurrent on deceleration
O C - Drive	Overcurrent due to motor overload
C P U	Central processing unit fault
UNDER - V	Mains power supply undervoltage
Inst. P . F	Instantaneous power failure
Over L	Motor overload
OH FIN	Controller fin overheat
G N D F l t	Ground fault
O V . S R C	Mains power supply overvoltage
N G . F R S	Power failure during motor free-run stop
NG.JOG	Mains power failure during jogging operation
N G - DB	Power failure during jogging operation
U V - WAIT	Mains power supply undervoltage: awaiting automatic re-start

NOTE : When returning the setting to its initial state (setting before shipment) for some reason, follow the steps below.

- Turn power ON.
- Set the right side of DIP SW on PC board to "ON" with the [MON] [FUN] [STR] keys on the digital operation panel depressed at the sometime, turn the forced reset button ON.
- After resetting, release these 3 keys thas depressed in 1 or 2 seconds.
- Turn the forced reset button ON.
- Turn the DIP SW OFF.

5.3 - MODIFICATION OF FACTORY SETTINGS
Programming:

Press [MON] as many times as necessary to display the data to be modified, then use [▷] to place the cursor under the part to be changed.

Press [▲] or [▼] to enter the new value

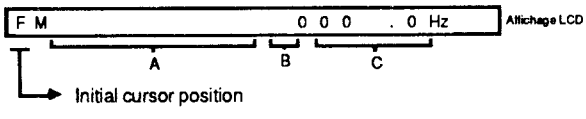
PARAMETERS THAT CAN BE MODIFIED OR DISPLAYED DURING CONTROLLER OPERATION	PARAMETERS THAT CAN ONLY BE MODIFIED WHEN THE MOTOR IS AT A STANDSTILL
Frequency setting (FS)	Method of setting frequency F-SET-M Ope-key (panel) or F-SET-M Terminal
Motor speed display (number of poles)	Selection of motor command F/R-SW Ope-key or F/R-SW Terminal
Motor current display (IF)	
Manual setting of torque (V-Boost)	
Output voltage setting (V-Gain)	
Jogging frequency setting	

After a parameter has been changed, the new setting is automatically stored in the memory.

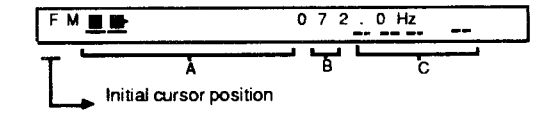
5.4 - PROCEDURE FOR SETTING PARAMETERS IN "MON" MODE

5.4.1 - Changes in controller output frequency

When the equipment is switched on, the CONTROLLER automatically goes into MONitor (MON) mode (real output frequency) and displays the output frequency received by the motor (0 Hz, motor at standstill).

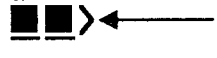


When the motor is running, the display shows



PART A

Part A shows the real output frequency to highest frequency ratio.



In the example above, part A indicates that the 72 Hz/144 Hz (Fmax) output frequency ratio is greater than 40%.

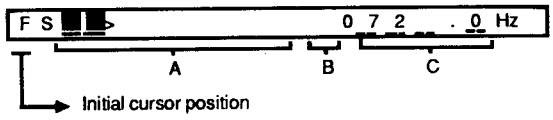
PART B Part B indicates forward or reverse run as follows:

F: forward **R**: reverse

PART C : Output frequency received by the motor.

5.4.2 - Output frequency adjustment

Used to set motor speed
- Pre-setting when motor stopped
- Adjustment of speed when motor running



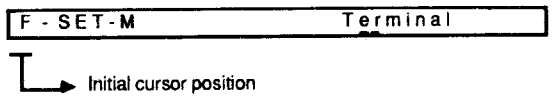
Move the cursor onto the dashes using [▷]

Set the output frequency using [▲] or [▼]

As soon as the new frequency is displayed, the motor accelerates or decelerates until the selected frequency is reached.
Parts A and B are described in paragraph 5.4.1.
Part C indicates the frequency setting.

5.4.3 - Frequency reference selection

This selection can only be made when the motor is at a standstill.
This can be done in two ways:
- Ope-key: Digital operation panel
- Terminal: Points H, O, OI amd L on the terminal



Move the cursor onto the dashes using [▷]

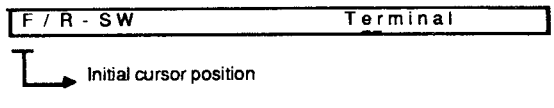
Specify code required using [▲] or [▼]

5.4.4 - Operating command selection

This selection can only be made when the motor is at a standstill

- **Ope-key:** Operation panel [FWD RUN] Forward run [REV RUN] Reverse run

- **Terminal** : FW and L terminals (Forward run)
RV and L terminals (Reverse run)

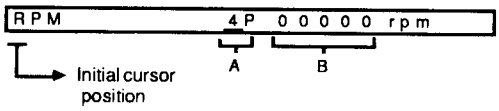


Move the cursor onto the dashes using [▷]

Specify the code required using [▲] or [▼]

5.4.5 - Motor speed display

Displays the polarity and the number of revolutions per minute.



Move the cursor onto the dashes using ▶

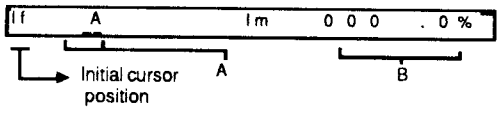
Specify the polarity required using ▲ or ▼

PART A: Select the polarity of the motor to be controlled (factory setting: 4 poles)
PART B: Displays motor speed in min-1

DISPLAY SEQUENCE	1	2	3	4	5	6	7	8	9	10	11	12	13	14
No. OF MOTOR POLES	2	4	6	8	10	12	14	16	18	20	24	32	36	48

5.4.6 - CONTROLLER output current display

Displays the controller output current (in real terms or as a %)
It can be displayed in two ways for part A:
- As a % of the controller's rated current with no value for the current in part A (factory setting)
- As a real value of the current consumed by the motor if the rated controller current is displayed in part A.



Move the cursor onto the dashes using ▶

Select the current corresponding to the controller's rating using ▲ or ▼

When the motor is started up, the real controller output current is displayed in part B as a real value.

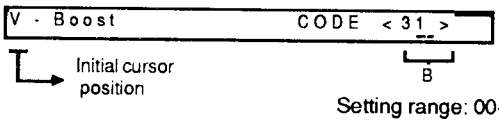
N.B.: The motor current displayed in part B is only valid if the rated current displayed in part A corresponds to that of the controller.

DISPLAY SEQUENCE	1	2	3	4	5	6	7	8	9	10	11	12	13	14
CURRENT	3	3,8	5	5,3	7,5	8,6	10,5	13	16	16,5	23	24	32	46

DISPLAY SEQUENCE	15	16	17	18	19	20	21	22	23	24	25	26	27	28
CURRENT	48	58	64	75	90	95	110	121	145	149	176	182	217	260

5.4.7 - Manual torque boost adjustment

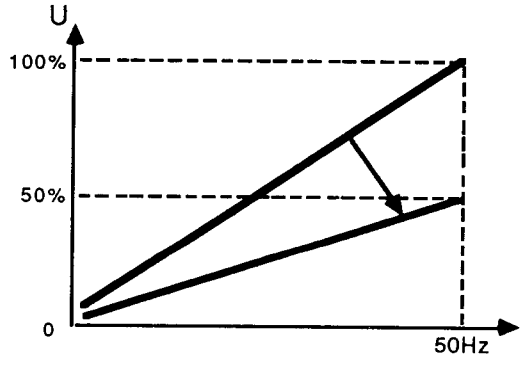
The torque boost is adjusted by setting the voltage in the low frequency range (25 Hz max.)



Setting range: 00-99

Move the cursor onto the dashes using ▶

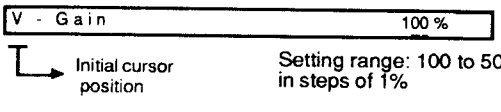
Set the voltage using ▲ or ▼



E.g.: Output frequency 1 - 50 Hz

5.4.8 - Adaptation of the output voltage

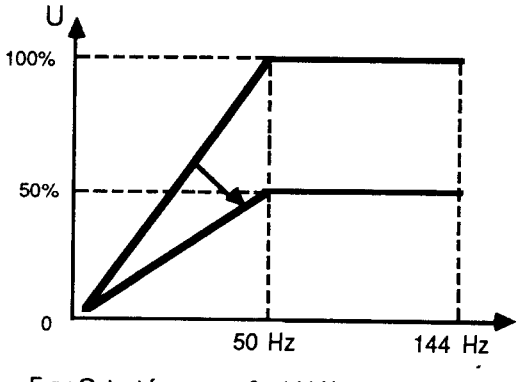
This is the ratio in % between the input voltage (mains supply) and the controller output voltage for the maximum frequency of the range selected (see pages 29 and 30).



Setting range: 100 to 50% in steps of 1%

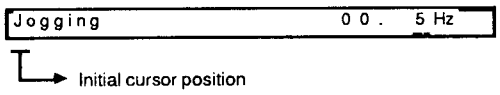
Move the cursor onto the dashes using ▶

Select the range using ▲ or ▼
See figure opposite.



E.g.: Output frequency 0 - 144 Hz

5.4.9 - Jogging output frequency setting



The output frequency is obtained as soon as the jogging command is sent.

Move the cursor onto the dashes using ▶

Set the range using ▲ or ▼

CONTROL TERMINALS OR DIGITAL OPERATION PANEL

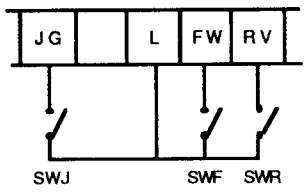


Fig. 5.1

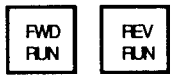
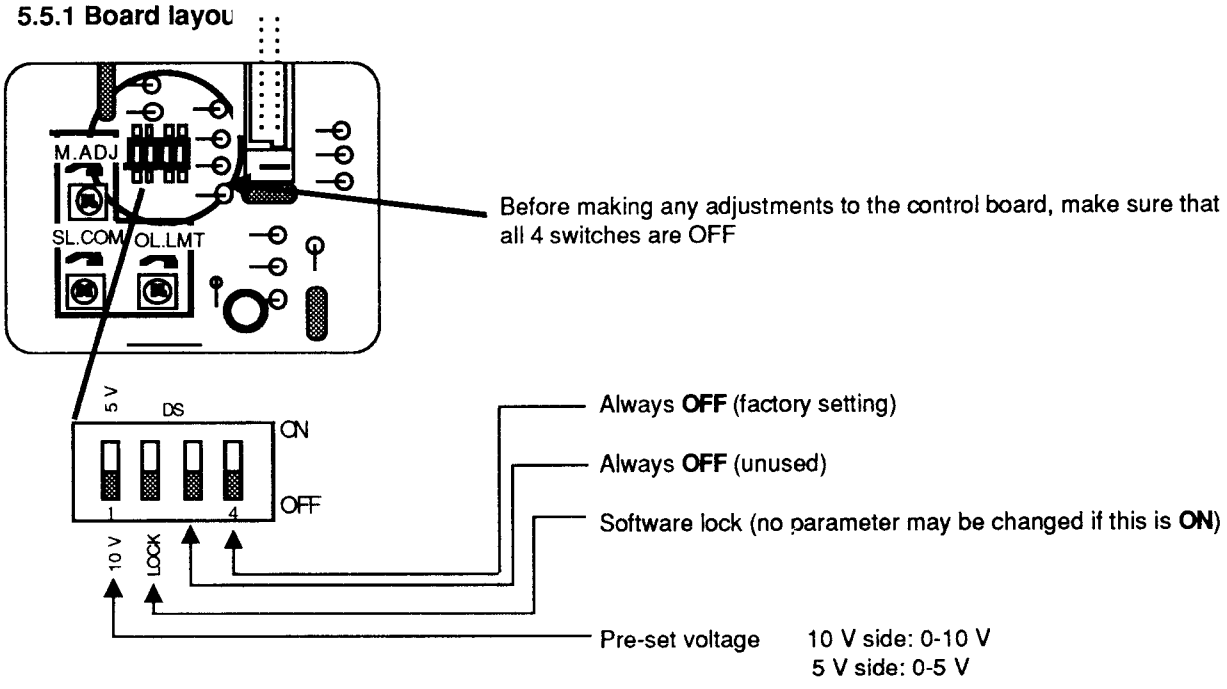


Fig. 5.2

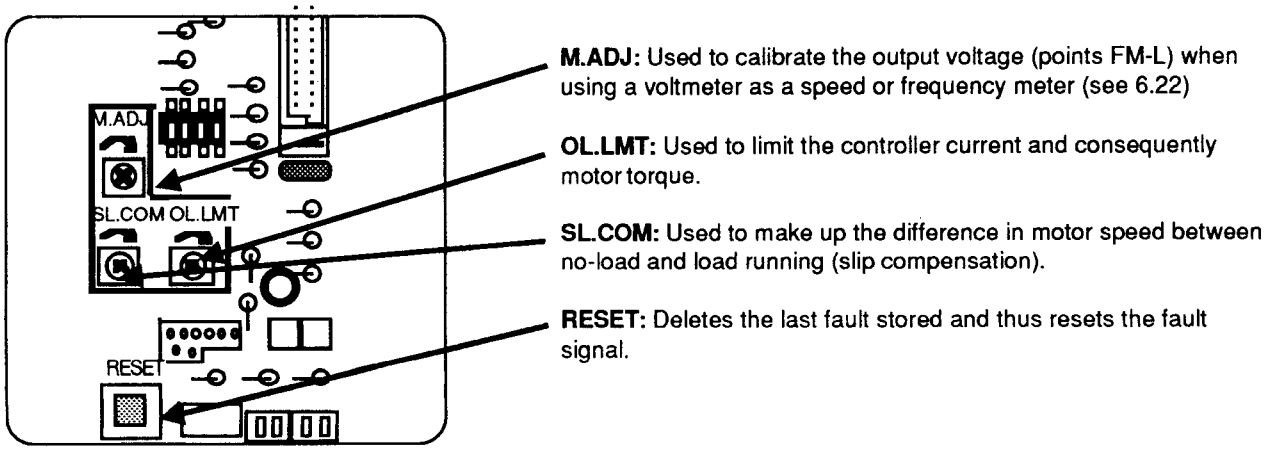
To use this function:
- Close switch SWJ
- Request jogging either:
- at the terminal (fig. 5.1) by closing SWF or SWR
- on the operator panel (fig. 5.2) by pressing FWD RUN or REV RUN

5.5 - CONTROL BOARD ADJUSTMENTS

5.5.1 Board layou



5.5.2 - Adjustments



6. IDENTIFICATION AND SETTING OF FUNCTIONS IN "FUN" MODE

The "FUN" programming mode (short for FUNCTION) is used to modify operating parameters. Parameters are modified in two stages.

6.1 - FUNCTION MODE (FUN) 1

6.1.1 - Identification

Display the parameters (see table 6.1, page 26) one by one by pressing FUN once then ▲ or ▼ to scroll through.

6.2 - FUNCTION MODE (FUN) 2

6.2.1 - Identification

Function mode 2 is used to set or modify data. Table 6.2, pages 27 and 28, indicates the initial display, factory settings and ranges within which parameters may be set or modified.

6.2.2 - Function change

The **FUN** key, used to change the function, must be pressed twice in order to modify a parameter.

- Parameters **can only be modified when the motor is at a standstill.**
- Once the parameter has been changed, check that the new setting is correct and do not forget to store it in the memory by pressing **STR** .

If **STR** is not pressed, then the old parameters remain unchanged. When a parameter is changed, an asterisk (*) appears in the middle of the digital display. When STR is pressed, the parameter is stored and the asterisk disappears.

- If the minimum or maximum value in the range is selected, an exclamation mark (!) appears in the centre of the digital display.
- When in function mode, the motor is inoperational. Before starting it up again, press **MON** to select the programming mode.

NOTE : RE-SETTING to initial setting (see page 21)

• Precautions to be taken when a new paragraph is entered in the memory:

When a parameter has been modified and stored using **STR**, make sure that it has been entered correctly by cutting off the power supply WITHOUT PRESSING RESET or POINTS RS, L ON THE TERMINAL.

Wait until the display has gone out or until the capacitors have been discharged before switching on again.

This procedure ensures that parameters are retained in the memory, whatever subsequent operations are performed.

Note :This procedure is also applicable to MON mode.

Table 6.1 FUNCTION MODE (FUN) 1

FUNCTION No.	FUNCTION NAME	DISPLAY
F 00	V/F pattern	F - 0 0 VF1 - VC
F 01	Acceleration time setting	F - 0 1 ACCEL - 1
F 02	Deceleration time setting	F - 0 2 DECEL - 1
F 03	Frequency fine adjustment range: 0.1 to 15 Hz	F - 0 3 + F . Max
F 04	Minimum starting frequency adjustment	F - 0 4 F . Min
F 05	Maximum frequency limiter setting (panel)	F - 0 5 H - LIM - F
F 06	Minimum frequency limiter setting (panel)	F - 0 6 L - LIM - F
F 07	Jump frequency 1	F - 0 7 JUMP - F1
F 08	Jump frequency 2	F - 0 8 JUMP - F2
F 09	Jump frequency 3	F - 0 9 JUMP - F3
F 10	Motor noise adjustment (carrier frequency)	F - 1 0 CF - Code
F 11	Frequency stop time at start before acceleration	F - 1 1 Fstop - T
F 12	Multistage speed setting 1	F - 1 2 Speed - 1
F 13	Multistage speed setting 2	F - 1 3 Speed - 2
F 14	Multistage speed setting 3	F - 1 4 Speed - 3
F 20	DC braking frequency adjustment	F - 2 0 F - DCB
F 21	DC braking voltage adjustment	F - 2 1 V - DCB
F 22	DC braking time adjustment	F - 2 2 T - DCB
F 23	Electronic thermal relay adjustment	F - 2 3 E - Therm
F 24	Linear or S-curve acceleration	F - 2 4 ACCLine
F 25	Linear or S-curve deceleration	F - 2 5 DE CLine
F 26	Start point frequency of external frequency setting (terminal)	F - 2 6 F - START
F 27	End point frequency of external frequency setting (terminal)	F - 2 7 F - END
F 28	Switch selection	F - 2 8 SWITCH1
F 30	Overload limit time constant setting	F - 3 0 LM - CONS
F 32	Automatic torque boost adjustment	F - 3 2 V - auto
F 36	Stand-by time setting for automatic restart after controller trip after instantaneous power failure.	F - 3 6 IPS - R - T

Table 6.2 FUNCTION MODE (FUN) 2

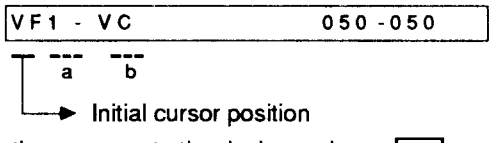
LIST OF FONCTION [FUN]		DESCRIPTION																		
		LCD DISPLAY																Min.	Max.	UNIT	FACTORY	FURTHER
N°	FUNCTION NAME	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	SETTING	SETTING		SETTING	INFORMATION
F 00	V/F pattern	F V	- F	0 1	AFTER PRESSING FUN ONCE 0 AFTER PRESSING FUN TWICE -	V	C			V	F 0	1 5	- 0	V -	C 0	5	0	–	–	–	–	Page 26 Page 28 to 30
F 01	ACCELERATION TIME	A	C	C	E	L	-	1		±	±	±	±	.	±		S	0000,1	2999,9	sec	0020,0	Page 31
F 02	DECELERATION TIME	D	E	C	E	L	-	1		±	±	±	±	.	±		S	0000,1	2999,9	sec.	0020,0	Page 31
F 03	MAXIMUM FREQUENCY ADJUSTMENT	±	F	m	a	x	.		+	+	±	±	.	±		H	z	000,0	015,0	Hz	000,0	Page 31
F 04	STARTING FREQUENCY ADJUSTMENT	±	F	m	i	n	.		+	+	±	±	.	±		H	z	000,5	005,0	Hz	000,5	Page 31
F 05	UPPER FREQUENCY LIMITER	H	-	L	I	M	-	F		±	±	±	.	±		H	z	000,5	159,0	Hz	000,0	Page 31
F 06	LOWER FREQUENCY LIMITER	L	-	L	I	M	-	F		±	±	±	.	±		H	z	000,5	159,0	Hz	000,0	Page 32
F 07	JUMP FREQUENCY 1 SETTING	J	U	M	P	-	F	1		±	±	±	.	±		H	z	000,5	159,0	Hz	000,0	Page 32
F 08	JUMP FREQUENCY 2 SETTING	J	U	M	P	-	F	2		±	±	±	.	±		H	z	000,5	159,0	Hz	000,0	Page 32
F 09	JUMP FREQUENCY 3 SETTING	J	U	M	P	-	F	3		±	±	±	.	±		H	z	000,5	159,0	Hz	000,0	Page 32
F 10	MOTOR NOISE ADJUSTMENT	C	F	-	C	o	d	e				<	U	>				C	U		U	Page 32
F 11	FREQUENCY STOP ADJUSTMENT AT START	F	S	t	o	p	-	t			+	±	±	.	±		S	000,0	015,0	sec	000,0	Page 32
F 12	MULTISTAGE SPEED 1 SETTING	S	p	e	e	d	-	1		±	±	±	.	±		H	z	000,5	159,0	Hz	000,0	Page 32
F 13	MULTISTAGE SPEED 2 SETTING	S	p	e	e	d	-	2		±	±	±	.	±		H	z	000,5	159,0	Hz	000,0	Page 32
F 14	MULTISTAGE SPEED 3 SETTING	S	p	e	e	d	-	3		±	±	±	.	±		H	z	000,5	159,0	Hz	000,0	Page 32
F 20	DC BRAKING FREQUENCY ADJUSTMENT	F	-	D	C	B				±	±	±	.	±		H	z	000,5	015,0	Hz	001,0	Page 33
F 21	DC BRAKING VOLTAGE ADJUSTMENT	V	-	D	C	B								+	±	±		000	020	V	010	Page 33
F 22	DC BRAKING TIME ADJUSTMENT	T	-	D	C	B					+	±	±	.	±		S	000,1	015,0	sec.	05,0	Page 34
F 23	ELECTRONIC THERMAL RELAY ADJUSTMENT	E	-	t	h	e	r	m						±	±	±	S	50	100	1%	100	Page 34
F 24	ACCELERATION CHARACTERISTICS	A	C	C	I	i	n	e			L	i	n	e	a	r		–	–	–	Linear	Page 34
F 25	DECELERATION CHARACTERISTICS	D	E	C	I	i	n	e			S	-	c	u	r	v	e	–	–	–	Linear	Page 34
F26	EXTERNAL FREQUENCY SETTING START (terminal)	F	-	S	T	A	R	T		±	±	±	.	±		H	z	000,5	159,0	Hz	000,0	Page 34
F 27	EXTERNAL FREQUENCY SETTING END (terminal)	F	-	E	N	D				±	±	±	.	±		H	z	000,5	159,0	Hz	000,0	Page 34

Tableau 6.2 FUNCTION MODE (FUN) 2 (suite).

LIST OF FUNCTIONS [FUN]		DESCRIPTION																			
N°	FUNCTION NAME	LCD DISPLAY																Min. SETTING	Max. SETTING	UNIT	FACTORY SETTING	FURTHER INFORMATION
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16					
F 28	SWITCH SELECTION	S	W	I	T	C	H	1		0	0	0	0	0	1	0	1	See options on Page 35			00000101	Page 35
F 30	OVERLOAD LIMIT SETTING	L	M	.	C	O	N	S		.	.	±	±	.	±			0000,3	0030,0	-	001,0	Page 35
F 32	AUTOMATIC TORQUE BOOST ADJUSTMENT	V	-	a	u	t	o							+	±	±		00	20	-	00	Page 35
F 36	STANDBY TIME SETTING FOR RESTART AFTER INSTANTANEOUS POWER FAILURE.	I	P	S	-	R	-	T		.	±	±	±	.	±		S	0000,3	0003,0	-	0001,0	Page 36

6.3 - VOLTAGE/OUTPUT FREQUENCY LAW CHARACTERISTICS (F00)

Modifies V/F characteristics



Move the cursor onto the dashes using [▶]

Fill in part a with codes 1 to 8 and part b with codes VC, VP1, VP2 and VP3 using [▲] or [▼]

The table below summarizes the options for running the motor with a constant torque.

LCD DIGITAL DISPLAY															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
		a		**b**											
V	F	1	-	V	C				0	5	0	-	0	5	0
V	F	2	-	V	C				0	5	0	-	1	4	4
V	F	3	-	V	C				0	6	0	-	0	6	0
V	F	4	-	V	C				0	6	0	-	1	4	4
V	F	5	-	V	C				0	8	7	-	0	8	7
V	F	6	-	V	C				0	8	7	-	1	4	4
V	F	7	-	V	C				1	0	4	-	1	0	4
V	F	8	-	V	C				1	0	4	-	1	4	4

Consult us for advice on use

To run the motor at anything other than a constant torque, move the cursor to part B and enter VP1, VP2 or VP3 (see table 6.4 on pages 29 and 30).

Table 6.3

The output frequency of the controller is independant of the input frequency.However, in function of the power supply characteristics and those of the motor, the following choices are recommended for the "voltage frequency" curves.

Table 6.4.1

50 Hz - 380-415 V or 220-240 V mains power supply

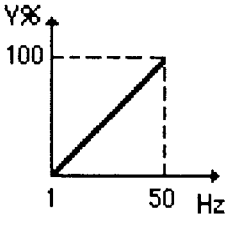
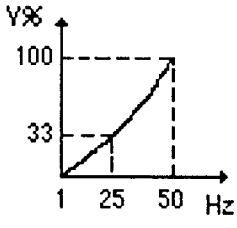
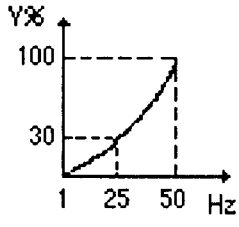
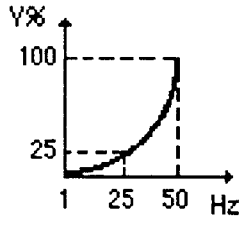
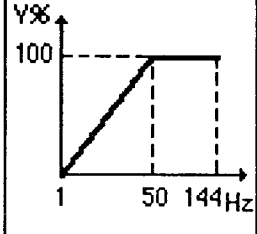
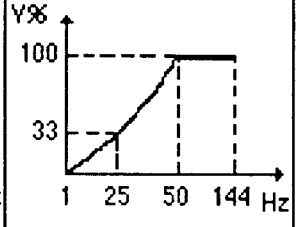
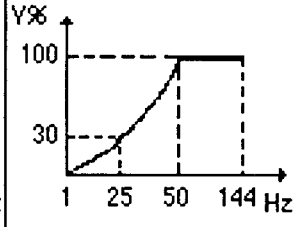
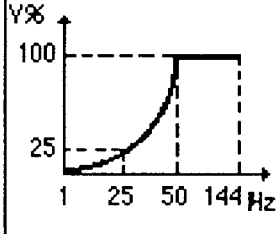
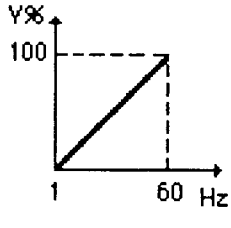
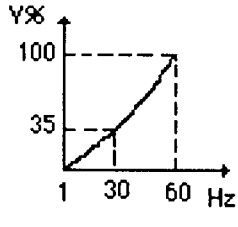
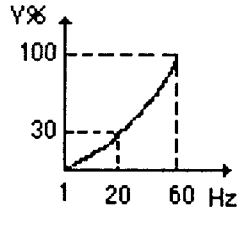
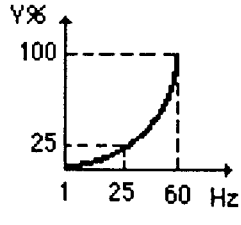
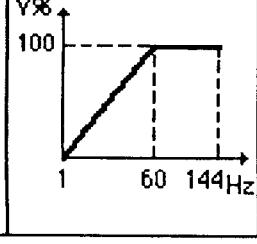
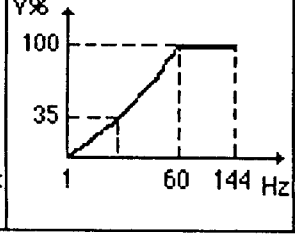
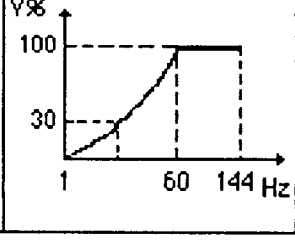
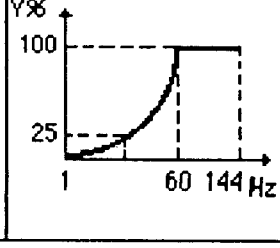
B / A	VC	VP1	VP2	VP3	MOTOR CONNECTION	
					Single phase	Three phase
1					Δ	Y
2					Δ	Y

Table 6.4.2

60 Hz - 400-460 V or 220-240 V

B / A	VC	VP1	VP2	VP3	MOTOR CONNECTION	
					Single phase	Three phase
3					Δ	Y
4					Δ	Y

The output frequency of the controller is independant of the input frequency. However, in function of the power supply characteristics and those of the motor, the following choices are recommended for the "voltage frequency" curves.

Table 6.4.3

50 Hz - 380-415 V or 220-240 V mains power supply

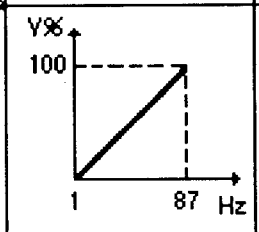
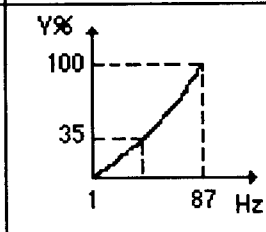
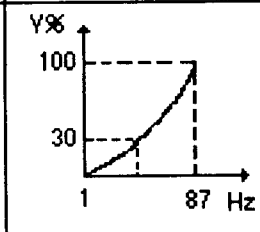
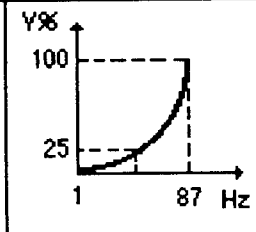
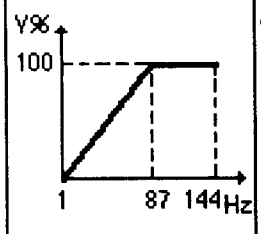
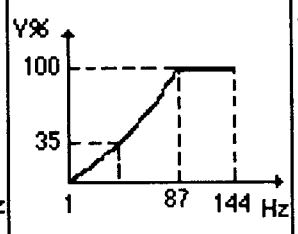
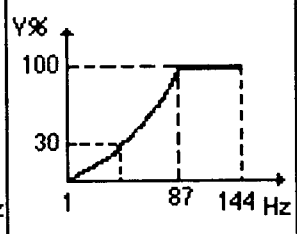
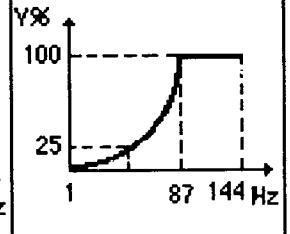
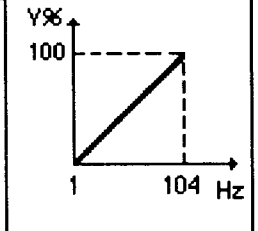
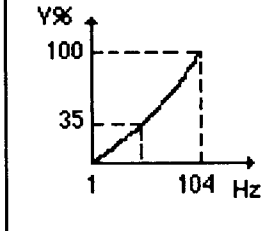
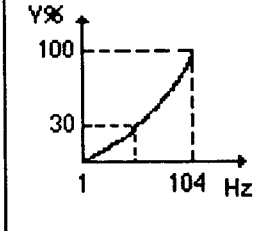
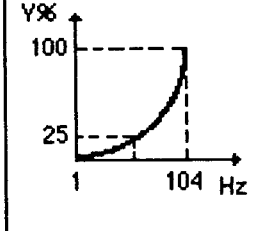
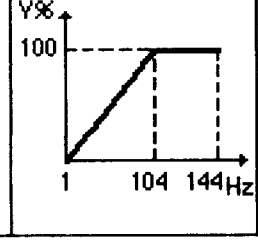
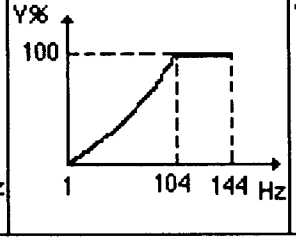
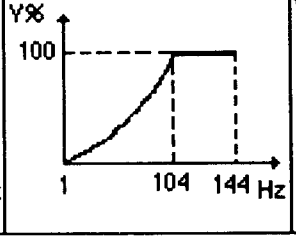
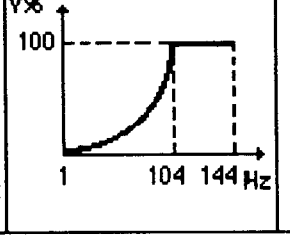
B / A	VC	VP1	VP2	VP3	MOTOR CONNECTION	
					Single phase	Three phase
(*) 5						Δ
(*) 6						Δ

Table 6.4.4

60 Hz - 400-460 V or 220-240 V

B / A	VC	VP1	VP2	VP3	MOTOR CONNECTION	
					Single phase	Three phase
(*) 7						Δ
(*) 8						Δ

** Contact us for special motor connections and special controller requirements*

6.4 - ACCELERATION TIME (F01)

Sets the time required to obtain the frequency programmed from the start of operation.

ACCEL - 1	0	0 2 0 . 0	S

Initial cursor position

- Setting range from 0.1 to 2999.9 s
- In steps of 0.1 s
- 0.1 to 230 s for the S-curve.

Move the cursor onto the dashes using ▶

Set the acceleration time using ▲ or ▼

6.5 - DECELERATION TIME

Time taken by the motor to decelerate from its operating frequency to a complete standstill.

DECEL -1	0 0	2 0 . 0	S

Initial cursor position

- Setting range from 0.1 to 2999.9 s
- In steps of 0.1 s
- 0.1 to 230 s for the S-curve.

Move the cursor onto the dashes using ▶

Set the deceleration time using ▲ or ▼

6.6 - MAXIMUM FREQUENCY ADJUSTMENT (F03)

Used to increase the frequency range selected.

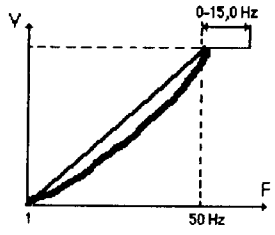
F max.	0 0 0 . 0	Hz

Initial cursor position

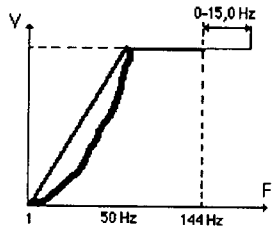
- Setting range from 0.00 to 15.0 Hz.
- In steps of 0.1 Hz

Move the cursor onto the dashes using ▶

Set the frequency range using ▲ or ▼



E.g.: Range of 1 to 50 Hz



E.g.: Range of 1-50-144 Hz

6.7 STARTING FREQUENCY ADJUSTMENT (F04)

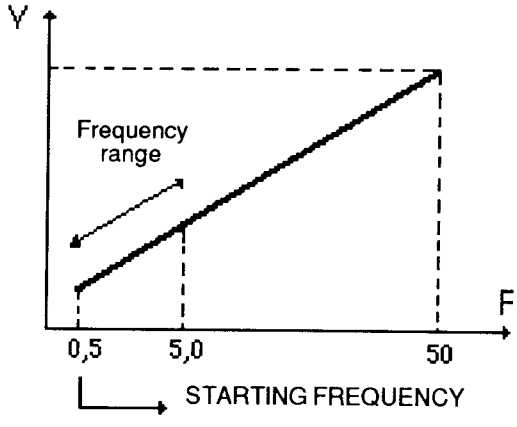
F min.	0 0 0 . 5	Hz

Initial cursor position

- Setting range from 0,5 to 5,0 Hz.
- In steps of 0,1 Hz.

Move the cursor onto the dashes using ▶

Set the frequency using ▲ or ▼



6.8 - UPPER FREQUENCY LIMITER (F05)

Limits the highest frequency for an operator command using the panel.

H - LIM - F	0 0 0 . 0	Hz

Initial cursor position

- Setting range from F min to F max.
- In steps of 0.1 Hz

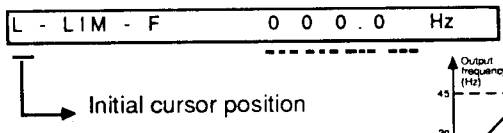
Move the cursor onto the dashes using ▶

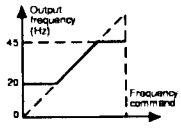
Set the frequency using ▲ or ▼

* Setting value 000.0 Hz indicates that the upper frequency limiter is not used.

6.9 - LOWER FREQUENCY LIMITER (F06)

Limits the lowest frequency for a command made on the operator panel.





- Setting range from F min to F max.
- In steps of 0.1 Hz

Move the cursor onto the dashes using ▶

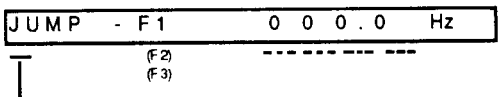
Set the frequency using ▲ or ▼

* Setting value 000.0 Hz indicates that the lower frequency limiter is not used

N.B.:
This adjustment can only be made if the upper frequency limit has been set.
If Fmax. < Fmin, a setting error message is displayed.

6.10 - JUMP FREQUENCY SETTINGS 1, 2 & 3 (F07, F08 & F09)

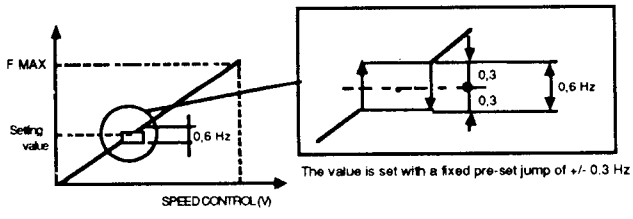
Used to jump 3 frequencies likely to have negative effects on motor operation (noise, vibration, resonance etc.). Only the point from which the jump is made can be set, the size of the jump being pre-set and unchangeable.



- Setting range from F min to F max.
- In steps of 0.1 Hz.

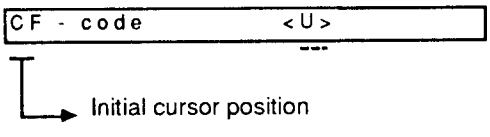
Move the cursor onto the dashes using ▶

Set the frequency using ▲ or ▼



6.11 - MOTOR NOISE ADJUSTMENT (F10)

Alters the motor noise by changing the carrier frequency.



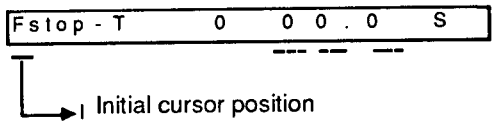
Move the cursor onto the dashes using ▶

Set the frequency using ▲ or ▼

Code	C D E F G H I J K L M N O P Q R S T U
Noise	LOW-PITCH → HIGH-PITCH

6.12 - FREQUENCY STOP TIME ADJUSTMENT AT START (F11)

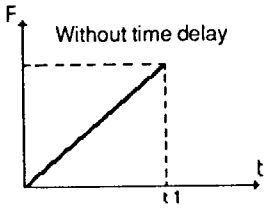
Time delay from 0 to 15 seconds at 4.4 Hz. to avoid over current at start.

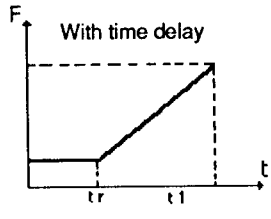


- Setting range from 0.00 to 15 seconds
- In steps of 0.1 s.

Move the cursor onto the dashes using ▶

Set the delay using ▲ or ▼

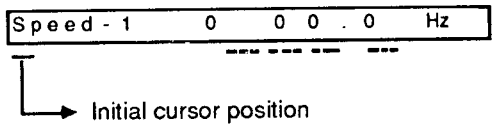




tr: programmable from 0 to 15 s

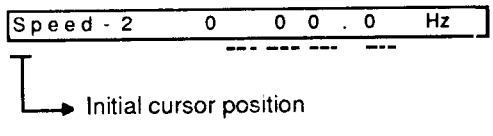
6.13 - MULTISTAGE SPEED SETTINGS

6.13.1 - Speed 1 (F12)

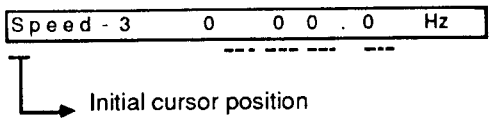


- Setting range from F min to F max.
- In steps of 0.1 Hz.

6.13.2 Speed 2 (F13)

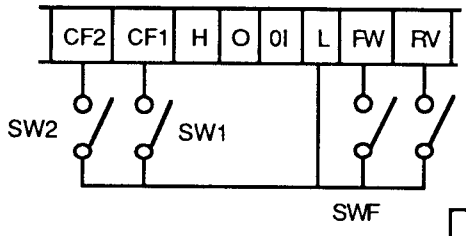


6.13.3 - Speed 3 (F14)



Move the cursor onto the dashes using ▶

Set the frequency using ▲ or ▼



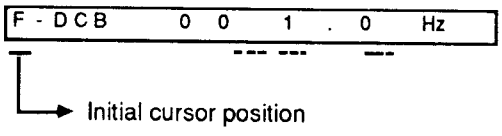
Remark : to have the speed 4 :
- by operator panel command, enter in MON mode a frequency in FS.
- by terminal command, connect terminals H and O and use a potentiometer.

Key	SPEED 1	SPEED 2	SPEED 3	SPEED 4	SPEED 3	SPEED 2	SPEED 1
SW1	Closed	Open	Closed	Open	Closed	Open	Closed
SW2	Open	Closed	Closed	Open	Closed	Closed	Open
SWF	Closed						
SWR	Open						

GEAR	SWF	SWR
Forward	Closed	Open
Reverse	Open	Closed

6.14 - DC BRAKING FREQUENCY ADJUSTMENT (F20)

Sets the output frequency at which DC braking starts
(with extension: see page 52)



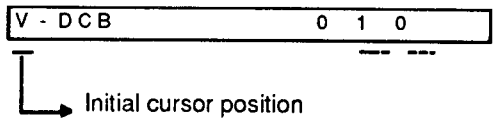
Setting range 0.5 to 15 Hz
In steps of 0.1 Hz

Move the cursor onto the dashes using ▶

Set the frequency using ▲ or ▼

6.15 - DC BRAKING VOLTAGE ADJUSTMENT (F21)

Sets the DC braking voltage and thus the braking torque.



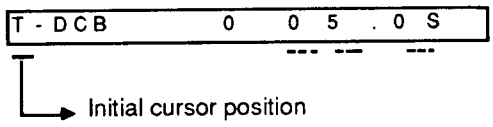
Setting range 0 to 20
In steps of 1

Move the cursor onto the dashes using ▶

Set the braking voltage using ▲ or ▼

(*) 000 indicates that there is no DC braking.

6.16 - DC BRAKING TIME ADJUSTMENT (F22)



Setting range from 0.1 to 15 s.
In steps of 0.1 s.

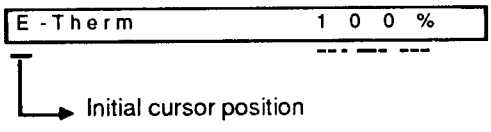
Move the cursor onto the dashes using ▶

Set the braking time using ▲ or ▼

(*) 000.0 S indicates the state or that there is no DC braking

6.17 - ELECTRONIC THERMAL RELAY ADJUSTMENT (F23)

Modifies the output current permitted by the controller in continuous operation.



Setting range from 100 to 150%
In steps of 1%

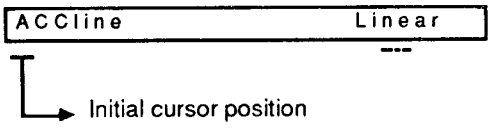
Move the cursor onto the dashes using ▶

Set the current using ▲ or ▼

$$\text{Setting value} = \frac{\text{Rated motor current}}{\text{rated controller current}} \times 100\ (\%)$$

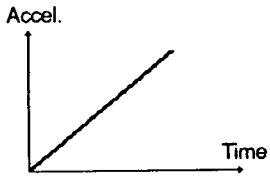
6.18 - LINEAR OR S-CURVE ACCELERATION (F24)

3. Initial cursor position

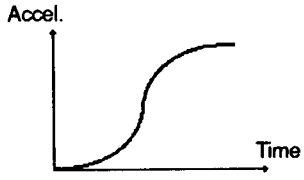


Move the cursor onto the dashes using ▶

Set the linear or "S" code using ▲ or ▼



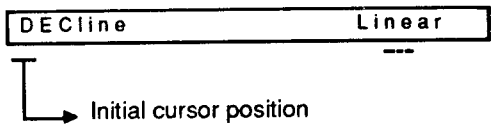
LINEAR ACCELERATION



S-CURVE ACCELERATION

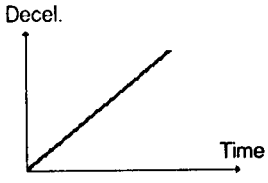
N.B.: Selecting S-curve acceleration limits the gradient time to 230 s.

6.19 - LINEAR OR S-CURVE DECELERATION (F25)

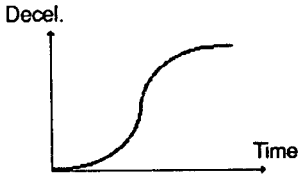


Move the cursor onto the dashes using

Set the current using



LINEAR DECELERATION

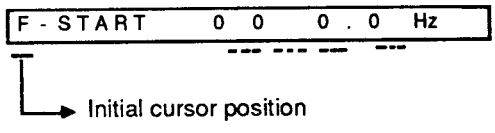


S-CURVE DECELERATION

N.B.: Selecting S-curve deceleration limits the gradient time to 230 s.

6.20 - LOWER FREQUENCY LIMITER (F26)

For a command from the terminal.



Setting range from 000.5 to F max.
In steps of 0.1 Hz.

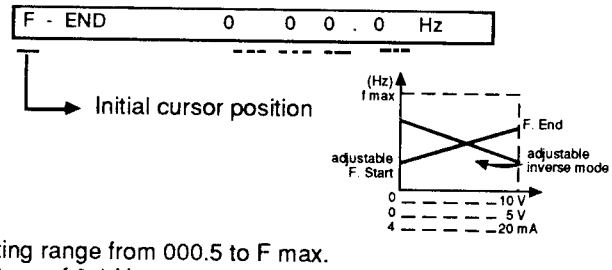
Move the cursor onto the dashes using ▶

Set the frequency using ▲ or ▼

N.B.: Before entering this setting, make sure that function F06 (lower frequency limiter for a command from the panel) has not already been programmed.

6.21 - UPPER FREQUENCY LIMITER (F27)

For a command from the terminal.



Setting range from 000.5 to F max.
In steps of 0.1 Hz.

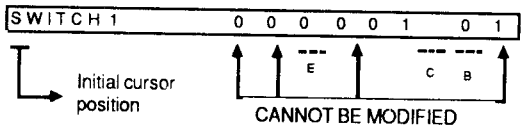
Move the cursor onto the dashes using ▶

Set the frequency using ▲ or ▼

N.B.: The value chosen for this function (F27) must be less than that of F05.

6.22 - SWITCH SELECTION (F28)

- Analog or digital frequency meter
- With or without automatic restart.



Move the cursor onto the dashes using ▶

Select "0" or "1" using ▲ or ▼

Part B : 0 ... Without DC braking, 1 ... With DC braking

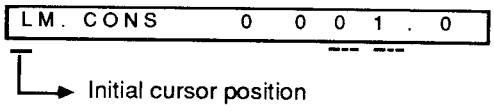
Part C : 0 ... Select "0" when using a digital frequency meter

1 ... Select "1" when using a full-scale 0-10 V DC voltmeter

Part E : 0 ... Restart function unused. When power supply is abnormal, this trips the motor and generates an alarm signal.

1 ... Restart function at the frequency set after a trip signal (input cut-off, overcurrent, over - or undervoltage). Maximum of 3 restarts every 10 minutes.

6.23 - OVERLOAD LIMIT SETTING (F30)



Setting range from 0.3 to 30
In steps of 0.1.

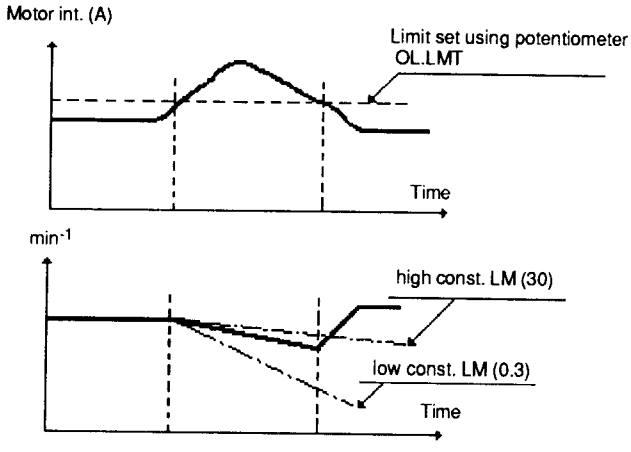
Move the cursor onto the dashes using ▶

Set the time using ▲ or ▼

The overload limit can be modified by the potentiometer (OL. LMT).(see 5.5.2 page 24) Potentiometer OL.LMT is used to change the overload limit (see 5.5.2, page 24)

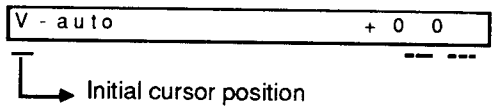
- To left: 50 to 80%
- To middle: 100%
- To right: 150%

(*) The limit is set on the basis of a rated controller current of 100%.



6.24 - AUTOMATIC TORQUE BOOST ADJUSTMENT (F32)

- Automatically sets the output voltage and thus the motor torque.
- Adjusts the voltage during acceleration.

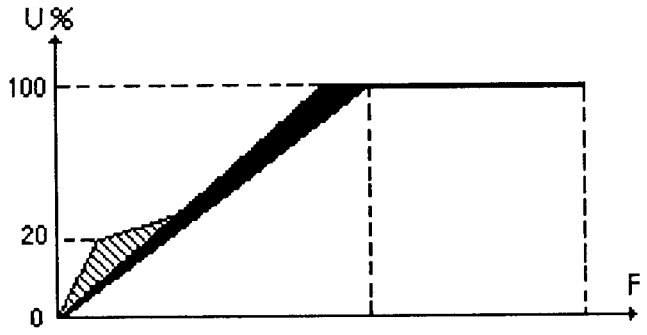


Setting range from 00 to 20.

Move the cursor onto the dashes using ▶

Set the voltage using ▲ or ▼

(*) Setting value 00% indicates that there is no automatic boost.

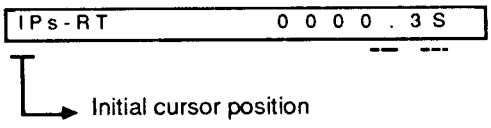


When automatic boost is used, voltage increases as shown by : ▬▬

When automatic boost is combined with manual boost, voltage increases as shown by : ▨▨

6.25 - STANDBY TIME SETTING FOR RESTART AFTER INSTANTANEOUS POWER FAILURE (F36)

Standby time setting for automatic motor restart after an instantaneous mains supply failure.



Setting value from 0.3 to 3 s.
In steps of 0.1 s.

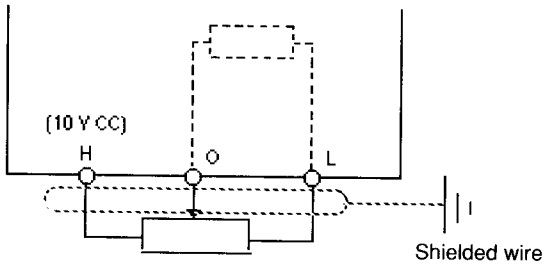
Move the cursor onto the dashes using ▶

Set the time using ▲ or ▼

7 - REMOTE INPUT / OUTPUT CONTROL SIGNALS

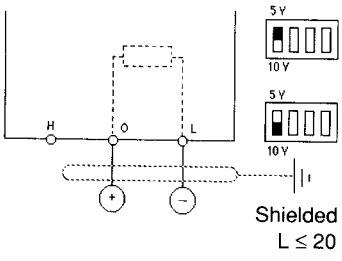
7.1 - FREQUENCY SETTING SIGNALS

7.1.1 - Potentiometer



Linear potentiometer 0.47 at 2.2k Ω

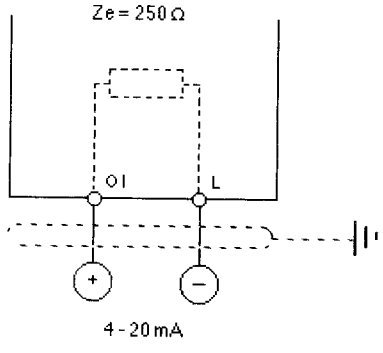
7.1.2 - Voltage signal



Note: Do not apply 12 VDC or more across terminals O and L

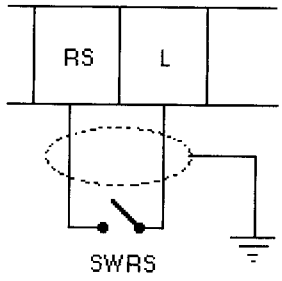
(*)Ze=Input impedance

7.1.3 - Current signal

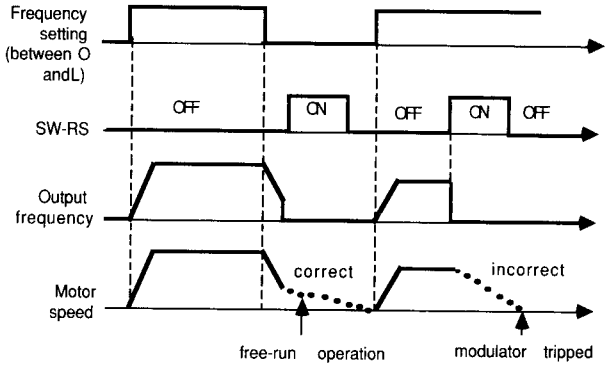


7.2 - RESET SIGNAL

This function resets the fault signal by deleting the last fault stored in the memory. When SWRS is closed the output frequency is immediately cut off. The motor runs freely, then stops. The electromagnetic brake must be activated immediately after closing SWRS. Avoid opening SWRS while the motor is running freely (fault signal may be tripped).

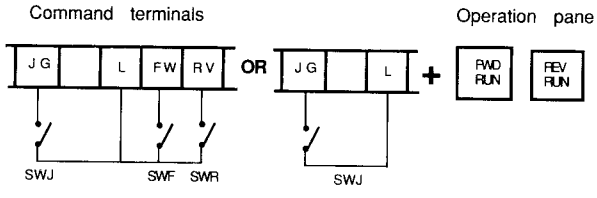


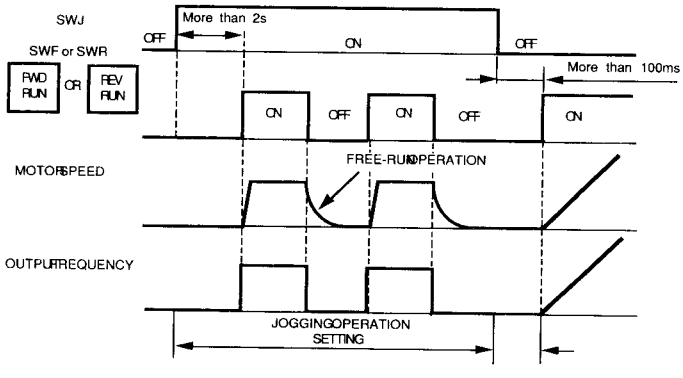
NOTE: When SWRS or RESET button is closed, the operation panel is de-activated and no characters will appear on the display



7.3 - JOGGING SIGNAL

Connection and sequencing diagram



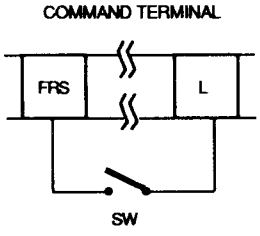


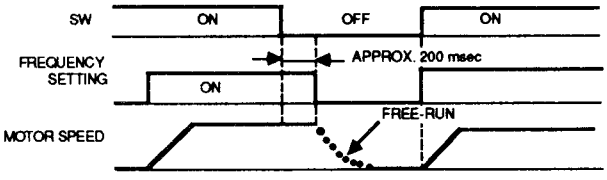
NOTE

Make sure that there is an interval of 100ms or more when changing from jogging to normal operation.

7.4 - FREE-RUN STOP SIGNAL

When the FRS-L circuit is opened, the controller output frequency is cut off and the motor runs freely.

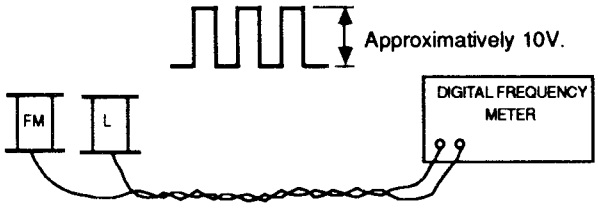




NOTE
Make sure that SW is ON when restarting after free-run. Do not use for braking. When necessary, use the reset signal to stop the motor by means of its electromagnetic brake. Otherwise, a braking time of 200ms or more is necessary.

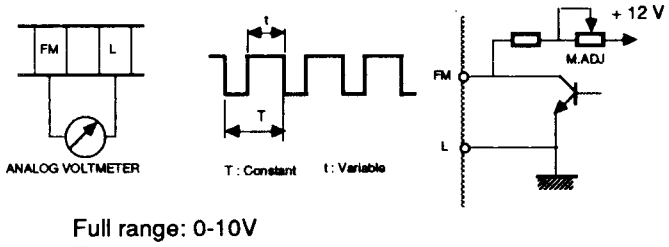
7.5 - FREQUENCY (FM AND L) IMAGE SIGNAL

7.5.1 - Frequency signal for digital display unit



7.5.2 - Frequency signal for analog voltmeter

(setting stepped on request)

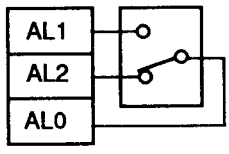


Full range: 0-10V
Ze:10-22 kΩ
1mA max

* Set full scale measurement using M.ADJ. (see paragr.5.5.2 page 24)

7.6 - FAULT ALARM RELAYS (AL0,AL1,AL2)

POWER SUPPLY	COMMAND	ALO - AL1	ALO - AL2
ON	NORMAL	ON	OFF
ON	FAULT	OFF	ON
OFF	-	OFF	ON



7.7 - RELAY SWITCH CUT-OUT POWER

CA - 250 V	Cos Ø 1 = 2,5 A Cos Ø 0,4 = 0,2 A
CC - 30 V	3 A

Table 7.1

8 - CONTROLLER MAINTENANCE AND CHECKING

8.1 - INTRODUCTION AND WARNING

Caution
The power printed circuit (lower circuit) is directly linked to the mains supply.
Do not modify the controller in any way without first manually disconnecting power stage supply (fuse isolator or circuit- breaker) or opening input contactor KM and manually locking the KM telecommand (with key).

Moreover, the smoothing capacitor can be subjected to very high voltages. Do not touch controller terminals without having performed or verified one of the following four operations a,b,c or d.
a) Once the controller power supply has been disconnected, wait until characters on the display have completely disappeared for a 220V controller. For the 380V controller, wait until capacitor discharge indicator light has gone off.
b) Check with a meter that the voltage between the positive and negative poles of the power terminal strip (smoothing capacitor terminals) does not exceed 15V.
c) If there is not enough time to perform either of the above operations, carefully (High voltage!!!) place a discharging resistor (30W-500 Ω) across the + and - power terminals for at least 15 seconds.
d) Check that terminal connections are correct.
Maintenance and repair operations to be performed on the FMV 1003 controller by the user are kept to a minimum. Standard maintenance operations and simple ways of checking that the controller is in correct working order and making an initial diagnostic of power stage functioning are listed below.

8.2 - STANDARD MAINTENANCE

Bear in mind that, like all electronic equipment, the controller can suffer from exposure to high temperatures, humidity, oil, dust, or as a result of the presence of foreign bodies.
Clean the motor ventilation ducts periodically and, where indicated, follow all bearing lubrication instructions on the instruction plate.
Printed circuits and their components normally do not require any maintenance. Switch your sales representative or your nearest service department if problems occur.

DO NOT REMOVE PRINTED CIRCUITS DURING THE PERIOD OF GUARANTEE, AS THIS IMMEDIATELY INVALIDATES THE TERMS OF GUARANTEE.

Do not ,touch printed circuits or the microprocessor with your fingers or with electrically charged or powered objects. The engineer, bench or soldering iron must be earthed before any operation is performed on the circuits.
Do not handle the socket-mounted printed circuits on the control printed circuit (risk of damage).
Replacement of the smoothing capacitor and cooling ventilator is recommended every 5 years (these components' normal lifetime).
Note that this lifetime is considerably reduced if heavy loads are applied at high temperatures. When a capacitor more than three years old is to be replaced, the new one must be aged in the stages given below:

1 - Apply 80% of rated capacitor voltage at normal temperature for one hour.
2 - Apply 90% of rated capacitor voltage at normal temperature for one hour.
3 - Finally, apply the rated capacitor voltage at normal temperature for five hours.

8.3 - MEASUREMENT OF MOTOR VOLTAGE AND CURRENT

8.3.1 - Measurement of controller output voltage under load

Harmonics caused by the controller make it impossible to measure motor input voltage with a conventional-type voltmeter. However, a value approaching the RMS voltage of the fundamental wave (that which affects the torque) can

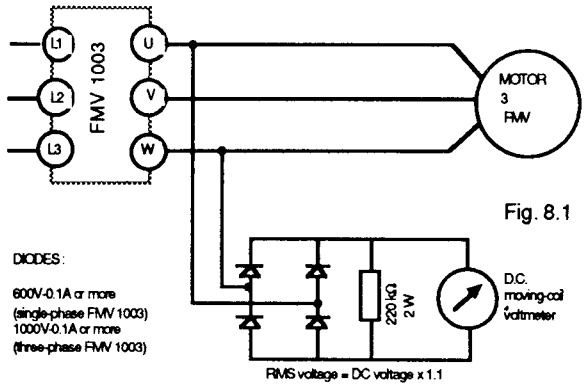


Fig. 8.1

be obtained using a conventional DC moving-coil voltmeter in the configuration shown below.

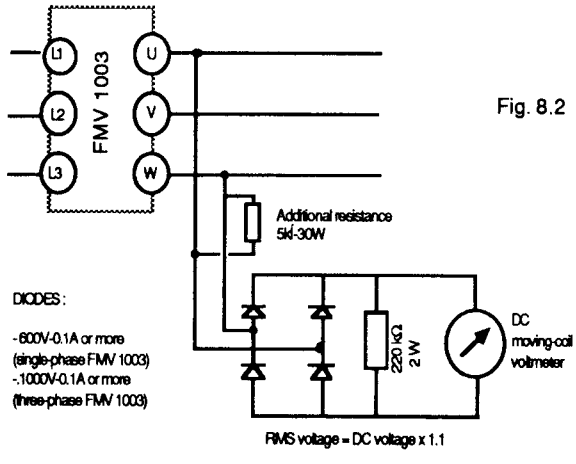


Fig. 8.2

8.3.3 - Motor current measurement

Current consumed by the motor and controller input current can be measured approximately using a conventional moving-coil ammeter.

8.3.4 - Controller input and output power measurement

Controller input and output power can be measured using an electrodynamic meter.

8.4 - CONTROLLER POWER STAGE TESTS

Preliminary remarks:

The following tests are designed to perform a qualitative test on the state of power stages. Use an ohmmeter set to 1Ω scale after switching off controller and waiting until the smoothing capacitor is completely discharged. Each measurement should be made for at least 10 seconds to avoid false readings due to charge still present on controller circuits. If in doubt about power stages, make a visual check of the status of the basic command modules, which may have been damaged as a result of damage to power stages.

Figure 8.3 below shows a general circuit diagram of the controller's transistorized inverter.

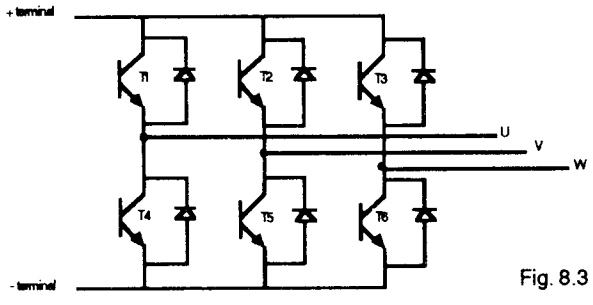


Fig. 8.3

Testing can be performed at two levels :

84.1 - Test via terminal strip

This test is fairly rudimentary. A positive response does not necessarily imply that power stages are correct. However, a negative response does generally imply that they are faulty.

Use terminals V,W,+,and - on the power circuit terminal strip.

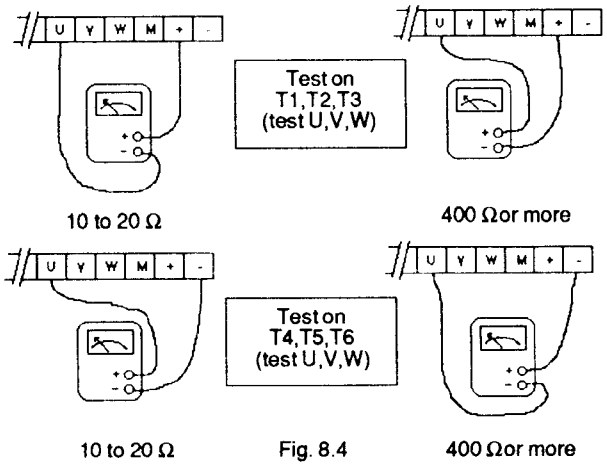


Fig. 8.4

8.4.2 - Individual power module test

This test is much more comprehensive. It is a fault-finding test like the preceding one, but it does not guarantee that the hardware is fault-free.

Warning
Controller printed circuits must be removed for this test. Do not remove if the equipment is still under guarantee, as this invalidates the terms of guarantee immediately.

To perform the test, check each of the six power modules following the instructions given in figure 8.5 below.

When replacing power modules, apply silicon grease to improve thermal conduction on module cooling surfaces.

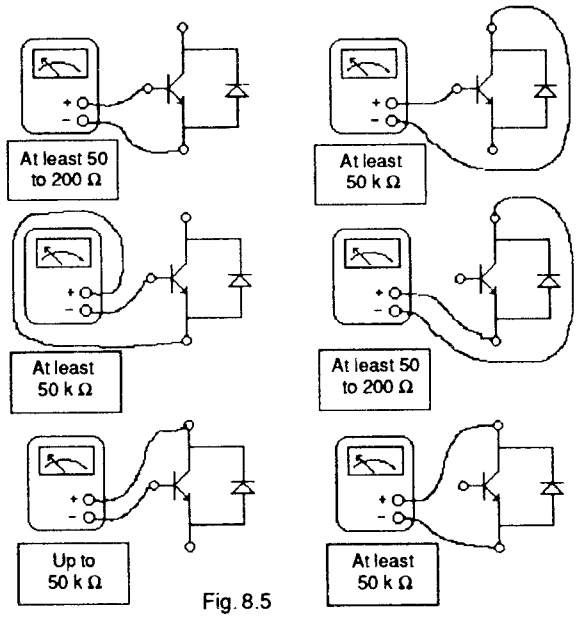


Fig. 8.5

8.5 - CONTROLLER INSULATION AND WITHSTAND VOLTAGE TESTS

8.5.1 - Introduction

Warning:
The following tests are to be performed with care. If power stages are destroyed due to handling errors or failure to comply with instructions, the guarantee is invalidated.

8.5.2 - Controller insulation tests

Short-circuit all power terminals on strip except terminal PE (ground), as indicated in figure 8.6 below. Use a megohmmeter to measure resistance between these terminals and ground. This resistance should be at least 5MΩ

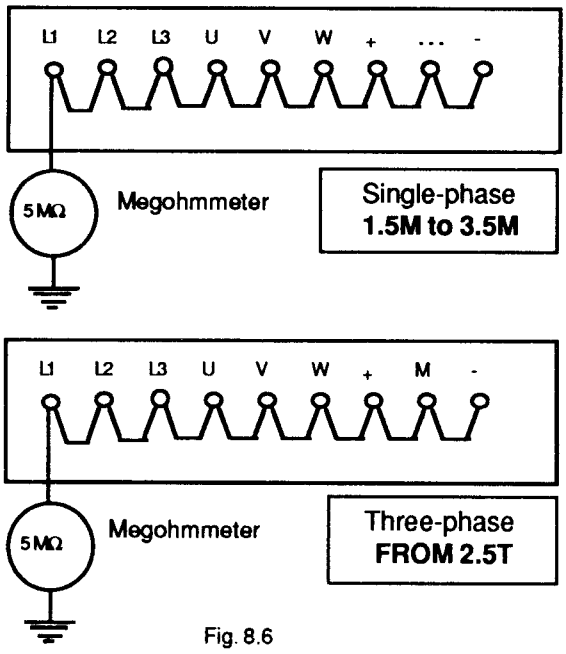


Fig. 8.6

DO NOT PERFORM INSULATION OR WITHSTAND VOLTAGE TESTS ON TERMINALS OTHER THAN THOSE INDICATED OPPOSITE.

8.5.3 - Controller withstand voltage tests

Apply an AC voltage between earth and the power terminal strip short-circuited as in figure 8.6 for one minute.

. 208,220,230,240V SINGLE-PHASE CONTROLLERS: Apply 1500V AC

. 380,400,415,440V THREE-PHASE CONTROLLERS: Apply 2000V AC

Check that nothing abnormal happens during the test.

WARNING:
Never perform withstand voltage tests on terminals other than those indicated above. Such action will damage the controller and invalidate the guarantee.

9 - TROUBLE SHOOTING

9.1 - CONTROLLER FAULT MESSAGES AND SYMPTOMS

All controller faults belong to one or other of the categories listed below in tables 9.1.1 to 9.1.5. Locate the cause and take the necessary action.

FAULT MESSAGES AND SYMPTOMS					CAUSE OF FAULT	RESET	CHECK POINTS	SUGGESTED REMEDY
QS CIRCUIT-BREAKER	Electromagnetic Contactor KM	MOTOR PTO	LCD DISPLAY ERROR ▨	Fault alarm relay	(MESSAGE CONTENTS)			
			OVER V.	○	DC smoothing circuit overvoltage	A	Check for sudden deceleration	Program a longer deceleration time
							Check that motor is not rotated from load side	It is impossible to use this application without the braking unit
			OV. SRC	○	Mains supply overvoltage	A	Check that input voltage is not too high	Check mains supply
			O.C Accel	○	Overcurrent during acceleration	A	Check for sudden acceleration	Program a longer acceleration time
							Check for short-circuit between defective phases or ground	Check output wiring. Eliminate short-circuit
							Check that torque boost is not too high	Program a lower torque boost value
							Check that motor is not jammed	Eliminate blockage
							Motor uncoupled from the machine or very small load	If motor to run under very light load, decrease the value of V- GAIN (mode MON)

Table 9.1.1

FAULT MESSAGES AND SYMPTOMS					CAUSE OF FAULT	RESET	CHECK POINTS	SUGGESTED REMEDY
QS CIRCUIT-BREAKER	Electromagnetic Contactor KM	MOTOR PTO	LCD DISPLAY ERROR ▨	Fault alarm relay	(MESSAGE CONTENTS)			
			O.C Decel	○	Overcurrent during deceleration	A	Check for sudden deceleration	Program a longer deceleration time
							Check for short-circuit between defective phases or ground	Check output wiring Eliminate short-circuit.
							Check for short-circuit in power module	Return controller for repair
			O.C Drive	○	Overcurrent during continuous motor operation	A	Check for excessive changes in load	Eliminate changes
							Check for short-circuit between defective phases or ground	Check output wiring. Eliminate short-circuit
							Check for short-circuit in power module	Return controller for repair
			OVER L.	○	Controller overload	A	Check for excess load	Reduce load factor
							Check that electronic thermal relay level is correct	Program correct level
			OH Fin	○	Controller overload	A	Check rotating cooling ventilator	Check cooling vent. Replace cooling ventilator
							Check that ambient temperature is not too high	Apply usual norms

Table 9.1.2

FAULT MESSAGES AND SYMPTOMS					CAUSE OF FAULT	RESET	CHECK POINTS	SUGGESTED REMEDY
QS CIRCUIT-BREAKER	Electromagnetic Contactor KM	MOTOR PTO	LCD DISPLAY ERROR ▨	Fault alarm relay	(MESSAGE CONTENTS)			
			Under V.	○	Under-voltage	A	Check that input voltage is not too low	Apply usual norms
							Check for poor QS-KM contacts	Replace QS and KM
							Check for instantaneous power failure or power source cut-off during jogging operation	Do not cut off power source during jogging operation
			Inst. P-F	○	Instantaneous power failure	A	Check for input voltage drop	Check power supply
							Check for poor QS-KM contacts	Remplace QS and KM
			CPU	○	CPU error	A	Check that are no sources of interference near controller	Remove all sources of interference away from controller
							Is controller unit defective ?	Replace board
			GND Fit	○	Ground fault (NOTE 2)	A	Check that ground at output is not defective	Repair defective ground
							Start operation during free-run operation of motor	Do not operate transmission mode when motor is rotating freely. Reset and restart once motor has come to a standstill

Table 9.1.3

FAULT MESSAGES AND SYMPTOMS					CAUSE OF FAULT	RESET	CHECK POINTS	SUGGESTED REMEDY
QS CIRCUIT-BREAKER	Electromagnetic Contactor KM	MOTOR PTO	LCD DISPLAY ERROR ▨	Fault alarm relay	(MESSAGE CONTENTS)			
			NG-FRS	○	FRS malfunction (FRS: Free-run stop)	A	Check for power source cut-off during restart mode (NOTE 1) and FRS operation	Do not cut off power source during FRS operation
							Check for instantaneous power failure during restart mode and FRS operation	
							Check for under-voltage during restart mode and FRS operation	
							Check for start or reset during FRS operation	
			NG-JOG	○	Jogging mode used inadvertently	A	Check to see if power has been switched ON or for reset during jogging operation	Do not turn power ON or reset during jogging operation

Table 9.1.4

FAULT MESSAGES AND SYMPTOMS					CAUSE OF FAULT	RESET	CHECK POINTS	SUGGESTED REMEDY
QS CIRCUIT-BREAKER	Electromagnetic Contactor KM	MOTOR PTO	LCD DISPLAY ERROR ▨	Fault alarm relay	(MESSAGE CONTENTS)			
			NG-DB (NOTE 3)	○	DB signal used inadvertently (DC braking)	A	Check to see if power has been switched ON or for reset during DB controller	Do not turn power ON or reset during DB operation
			UV-WAIT	○	Under-voltage (supply voltage abnormal)	A	Input voltage below 100V	Check power source
○			—	—	—	B	Check for short-circuit between defective phases or ground at input	Repair input cable
							Check that controller is not defective	Repair controller
	○		POWER OFF (NOTE 4)	—	Power failure	B	Check for power failure	Repair power source
							Check for poor continuity within KM command	Check KM continuity and coil
		○	—	—	—	C	Check for motor overload Check that ambient temperature is not too high (over 50°)	Reduce motor load Wait for motor to cool

Table 9.1.5

9.2 - MEANING OF SYMBOLS

O: Indicates which device can function.
A: Restart after closing RS and L on the logic terminal or pressing forced reset on the lower left hand side of PCB (when motor is at a standstill).
B: Activate isolator switch QS or contactor KM
C: Wait until windings are cool enough for PTO probes to close.

NOTE 1

F28 SWITCH < 00 000 101

{ 1 : 1: Automatic restart validated
{ 0 : 0: Automatic restart not validated

If a different fault symptom is displayed, cut off the power supply immediately.

NOTE 2 : Effective up to power of 22kVA - Ground protection option beyond this value.

NOTE 3 : Effective when OPTION board has been installed.

NOTE 4 : POWER OFF - indication is displayed for a few seconds after a power failure then disappears.

9.3 - TROUBLESHOOTING FLOWCHARTS

9.3.1 The motor does not function. SEE TABLE 9.2

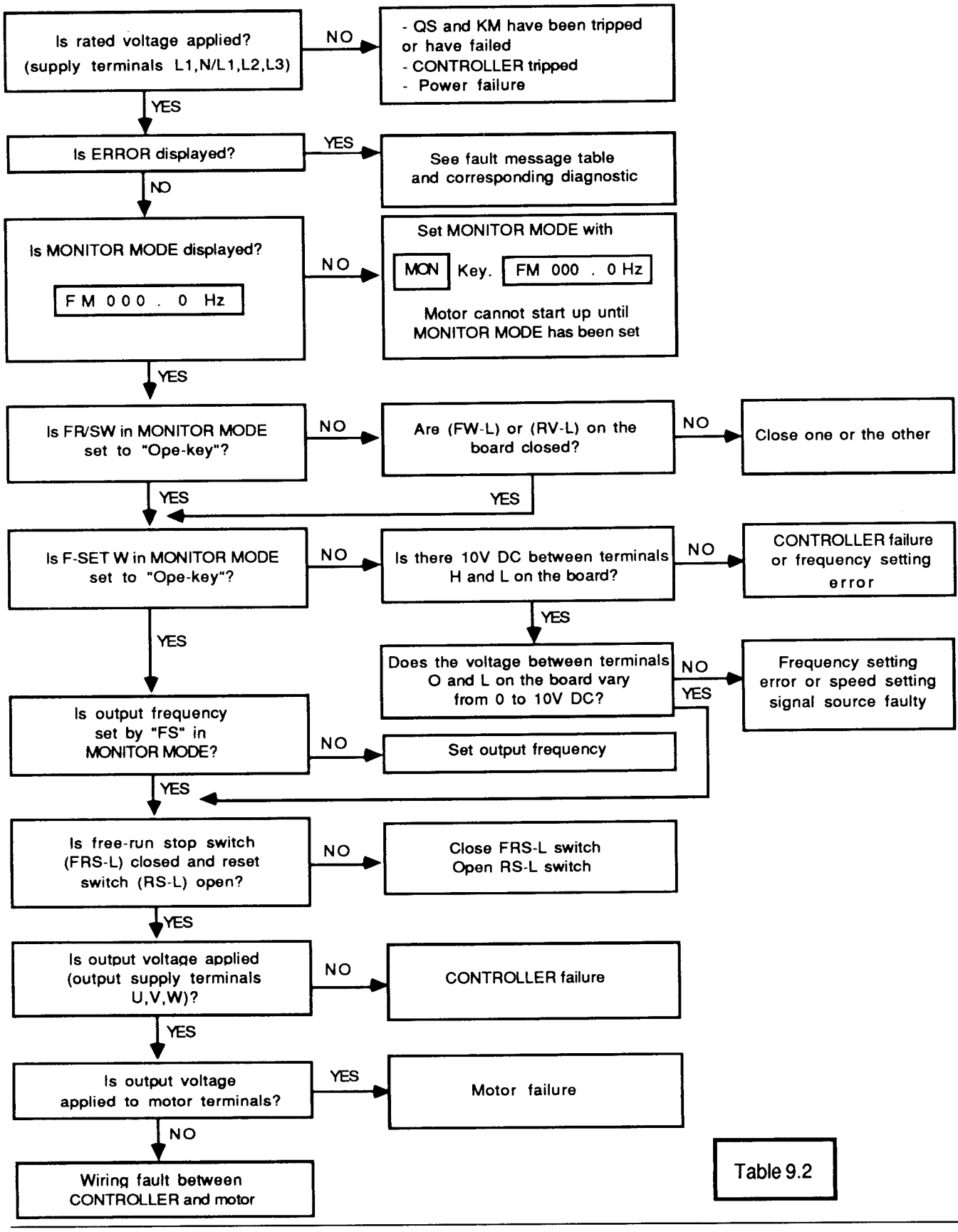


Table 9.2

9.3.2 - Motor does not accelerate

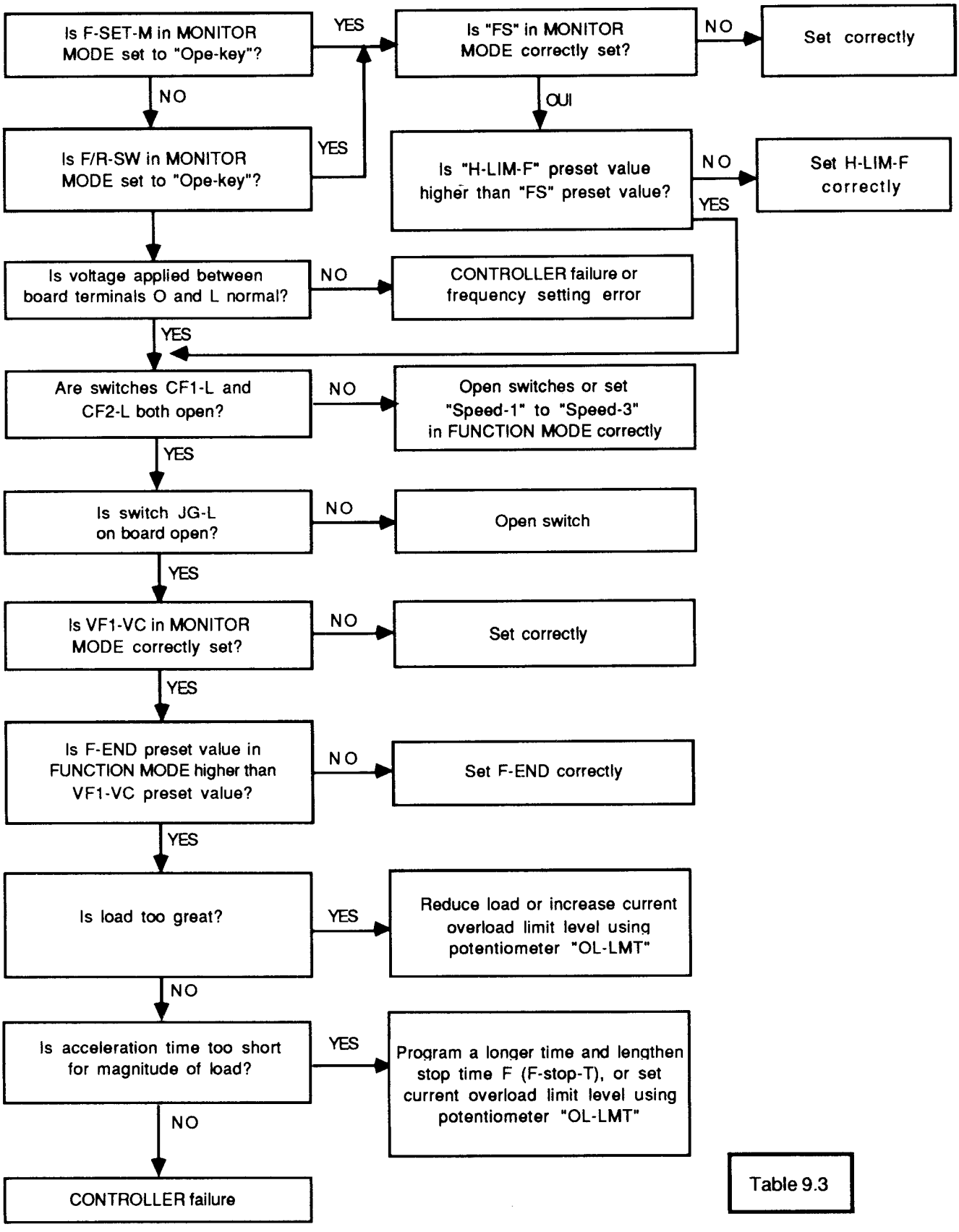


Table 9.3

9.3.3 - Motor speed too high

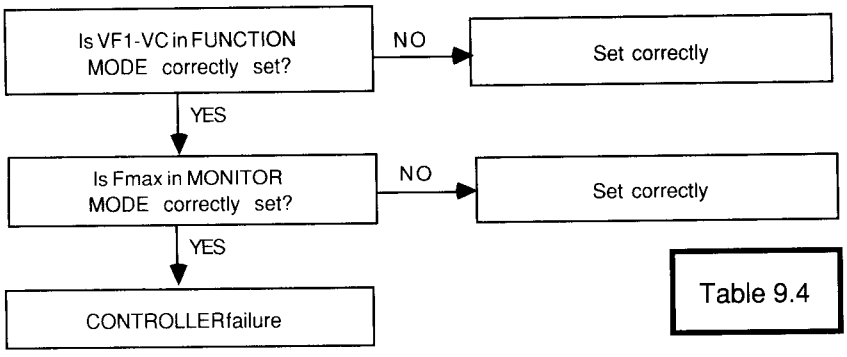


Table 9.4

9.4 - LOCATING CAUSES OF TRIPPING

9.4.1 Overcurrent trip

(OC.Accel,OC.Decel,OC.Drive)

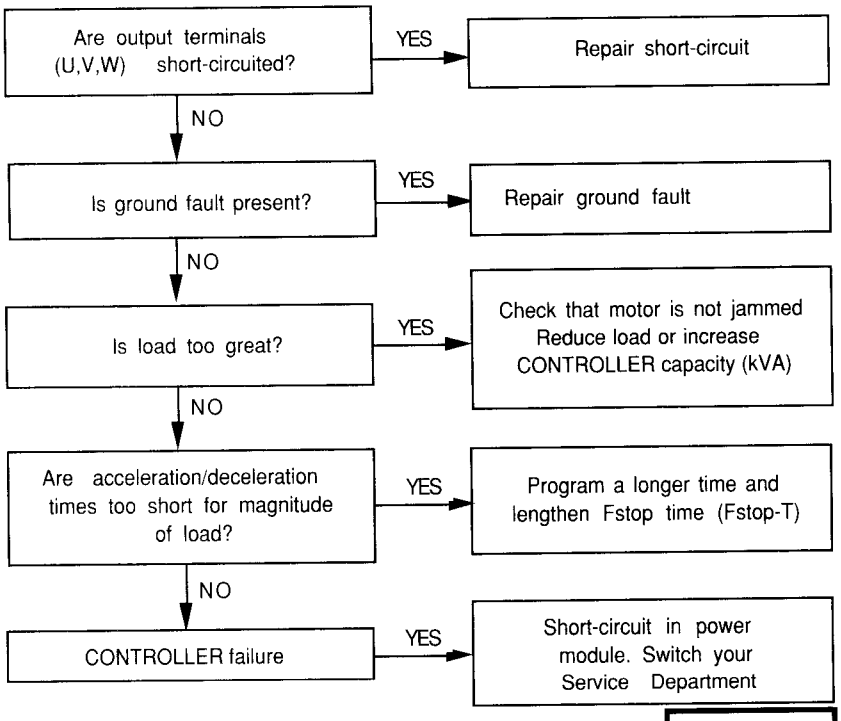


Table 9.5

9.4.2 - Overload trip (Over.L)

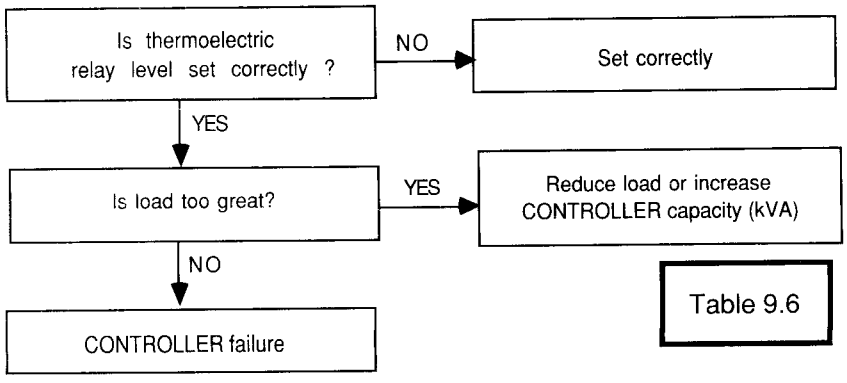


Table 9.6

9.4.3 -overvoltage trip (Over. V)

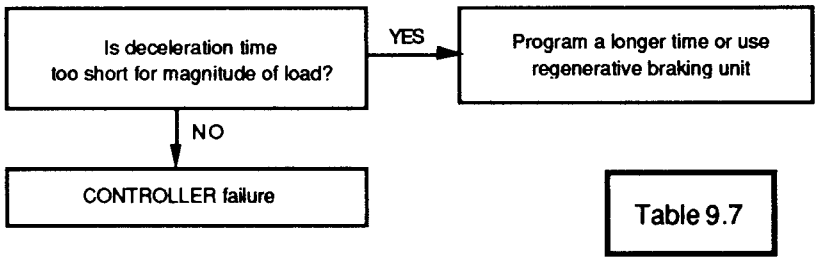


Table 9.7

9.4.4 - Undervoltage trip (Under.V)

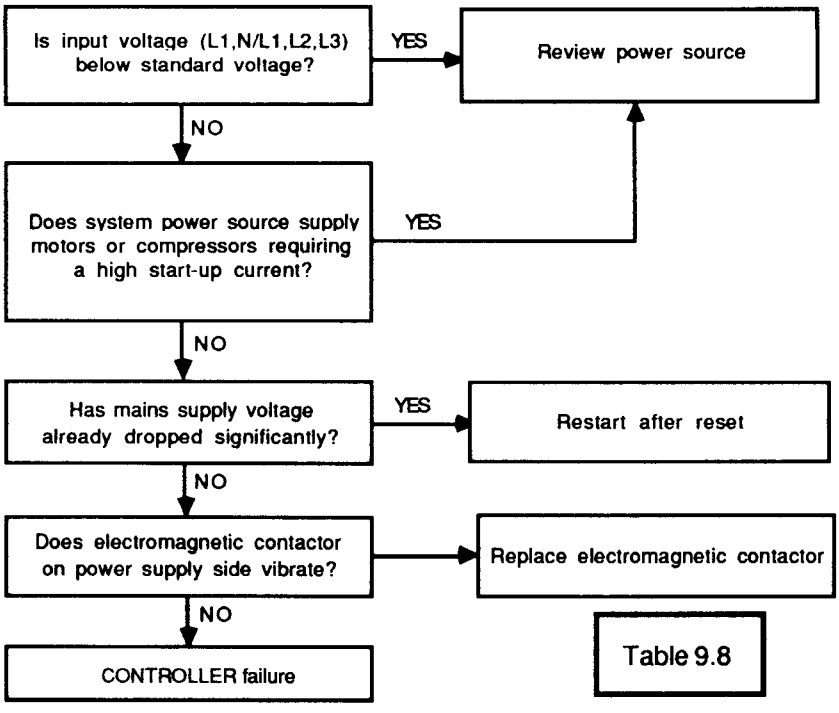


Table 9.8

9.4.5 - Instantaneous power failure trip (Under.V)

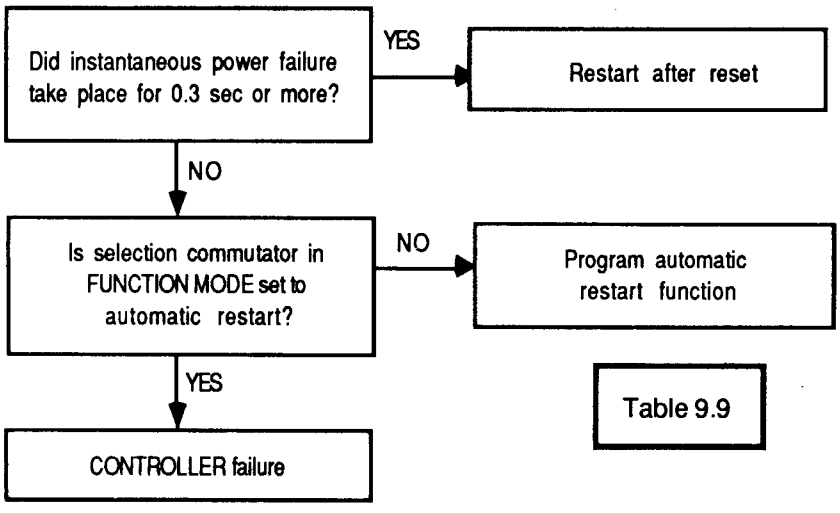


Table 9.9

9.4.6 - Fin Overheat trip (OH.Fin)(3.5 kVA or more)

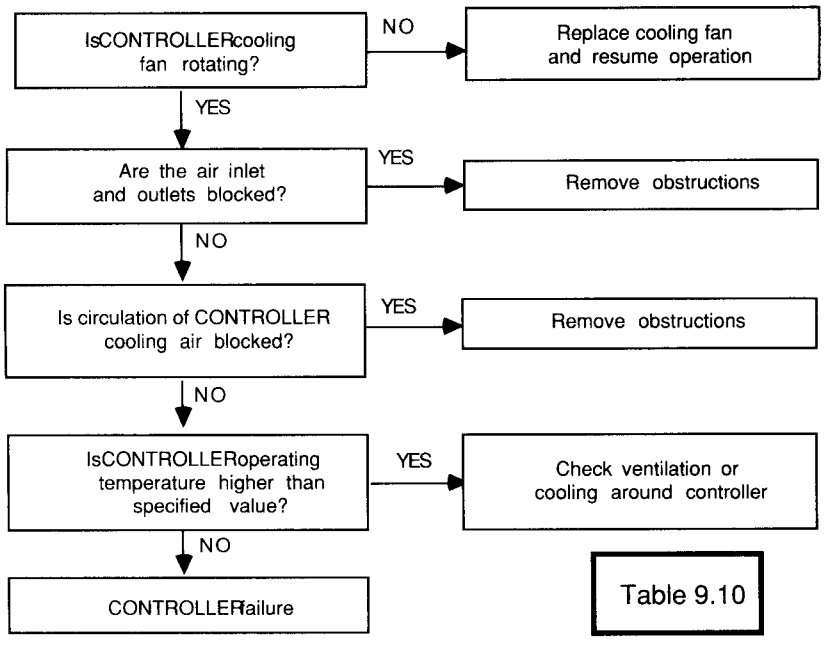


Table 9.10

10 - OPERATING EXTENSIONS

For more specific applications, extension boards that can be installed with the **CONTROLLER** are available from **LEROY-SOMER.**

These boards are to be ordered separately.

10.1 - LIST OF EXTENSION BOARDS

1 - Boards that can be incorporated in the CONTROLLER combining 5 functions

. REFERENCE LS FMV 1003 - I A TWK
. REFERENCE CURRENT SIGNAL: 0-20mA
. DC BRAKE (positioning)
. CONTROLLER OUTPUT CURRENT SIGNAL: signal 0 - 4V
. CONTROLLER OPERATION SIGNAL
. SPEED ARRIVAL SIGNAL

2 - Dynamic braking units with resistors

. R 100 M
. R 200 T
. R 400 T
. R 800 T

3 - Board 1126 : slave servo-control system (potentiometer sensor)

4 - Board 1274 : Speed setting by tachogenerator (dynamo or alternator)

Do not use with board 1274.
- Frequency command from the panel (only terminal)
- Multistage speed settings (F12 - F13 - F14)
- Jump frequency settings (F07 - F 08 - F09)
- Upper and lower frequency limiter F05 - F06 (using the settings board 1274)

5 - Board 1275 : Automatic electromechanical brake control

6 - Board 1276 : Galvanic insulation module

7 - Board 1278: Voltage to current conversion

8 - Board 1415 : Automatic current-controlled speed setting

9 - Board 1333 : Simultaneous control of several controllers

10 - Board 1364 : Remote speed control by electronic servo-motor

11 - Board 1368 : Reverse rotation through +/-10V signal when interference fillers are used with a differentiel circuit-braker, the braker must be equipped with a delayed tripping device

12 - interference filters

13 - Filter chokes

11 - OPTION BOARD LS FMV 1003 IA TW K

11.1 - PRESENTATION

Option board LS FMV 1003 IA TWK used in conjunction with controller FMV 1003 provides the following functions:
- Frequency setting via 0-20mA current signal.
- Remote DC braking control.
- Controller output current signal.
- Motor operation signal (relay output).
- Controller output frequency setting signal (relay output).

11.2 - INSTALLATION

Option board LS FMV 1003 IA TWK is mounted directly on the main controller board via the connector and the two spacers (Fig.11.1)

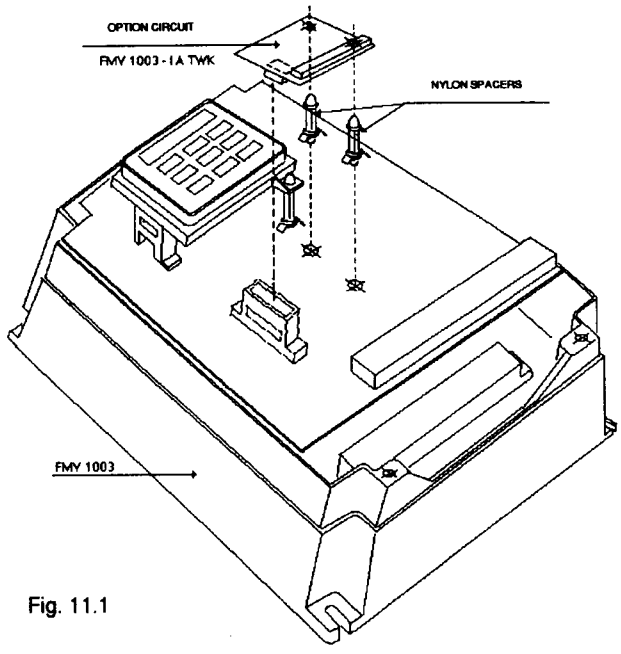
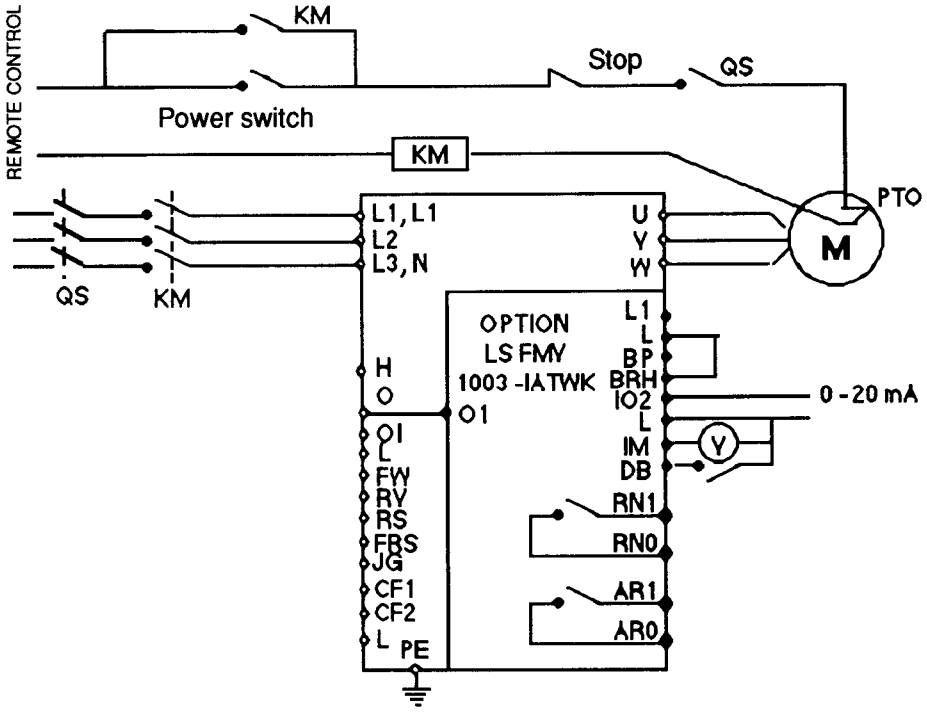


Fig. 11.1

11.3 - CONNECTIONS



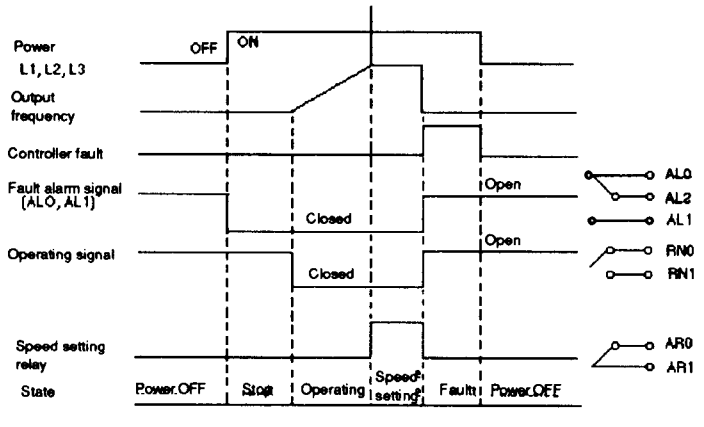
11.4 - TERMINAL FUNCTIONS

<table>
<tr><th>FUNCTION</th><th>TERMINALS</th><th>USE</th></tr>
<tr><td>Frequency setting via 0-20mA current signal</td><td>IO2 - L
O1 - O</td><td>• Connect option board terminal O1 to terminal O on LS FMV 1003 main board.
• Apply current setting of 0-20mA across IO2 (+ terminal) and L (- terminal)</td></tr>
<tr><td>External DC braking control

Set part 2 of function F28 to 1 on controller

0 0 0 0 0 1 1 1
(2)</td><td>DB - L</td><td>• DC braking is applied during deceleration if switch DB-L is closed on option board.
• The following adjustments can be made using the digital operation panel.
<table>
<tr><th>Function N°</th><th>Function name</th><th>Setting Range</th><th>Factory setting</th></tr>
<tr><td>F 20</td><td>Frequency of DC braking operation</td><td>0,5 Hz à 15 Hz</td><td>1 Hz</td></tr>
<tr><td>F 21</td><td>DC braking power</td><td>0 à 20 V</td><td>0</td></tr>
<tr><td>F 22</td><td>Duration of DC braking after stop</td><td>0 à 15 s</td><td>0</td></tr>
</table></td></tr>
<tr><td>Controller output current signal</td><td>IM - L</td><td>• Output voltage proportional to controller output current.
• Reading 0 to 4V DC (5mA max 4Vdc) corresponds to NI of controller
• Accuracy +/-10%</td></tr>
<tr><td>Motor operation signal</td><td>RNO - RN1</td><td>Switch is closed when controller is running. Switch N-O.</td></tr>
<tr><td>Frequency setting signal</td><td>ARO - AR1</td><td>Switch is open when max. frequency is attained. Switch N-C</td></tr>
</table>

11.5 - STATE DIAGRAM



Switch specification :
250V AC : 2.5A (on R)
2.2A (cos=0.4)
30V DC : 3A

12 - GUARANTEE

• LEROY-SOMER equipment, produced by the **Industrial Electronics Department**, is guaranteed for 1 year from the date stamped on the guarantee by the distributor.

• The guarantee covers replacement or repair of parts recognised as defective by:

S.A.V-D.E.I. - LEROY-SOMER - Usine des AGRIERS or by a
"SERVICE COMPANY APPROVED BY LEROY-SOMER"

• No compensation or damages may be claimed under the terms of the guarantee for any direct or indirect losses.

• The guarantee only covers the unit; it does not cover expenses incurred by removal, re-installation, handling, or carriage, packaging, or transportation costs.

• Damage caused by natural phenomena such as lightning and flooding or by accidents such as jolts, fire, chemicals or by using the unit under unsuitable conditions is not covered by the guarantee.

• The guarantee immediately becomes null and void if the customer modifies or has the equipment supplied by us repaired without our consent.

• The guarantee is not extended as a result of parts repaired, modified or replaced by us during the period covered by the guarantee.