LEROY SOMER ®

REMOTE CONTROL

KM

Start-up

Stop

SB1

SB2

K

QS

KM

L1

N

L2

L1

L3

Single-ph

Three-phase

LS FMV 2303
Asynchronous motor for speed modulation
Installation and maintenance

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

In these cases, therefore, it is important for the user to be protected against such risks of restarting, by fitting a zero speed detector which will cut the supply to the controller, in the case of unprogrammed stoppages.
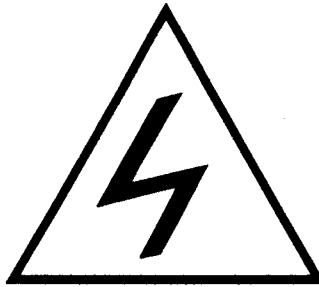
This equipment meets existing standards. Nonetheless, it may create interference and the user is responsible for carrying out the appropriate action to eliminate such interference.

- The frequency controller is designed to enable the motor to be run above its rated speed (up to 7 times for specific program settings).

- If the motor is not mechanically designed for such speeds, the user may experience serious mechanical damage to the motor.

- It is important for the user to check that the motor can withstand high speeds before programming.

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 capacitor discharge indicator light has gone off.

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 2303 controllers** therefore vary output VOLTAGE and FREQUENCY simultaneously. The motor's torque curve is thus optimized and overheating is avoided.

The **FMV 2303 controllers** power the motor with 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 designed for use with **FMV 2303** controllers. The speed control gear unit thus ensures remarkable torque performances in all types of operating conditions.

A circuit diagram of the main **FMV 2303 controller's** functions is given in figure 1.1.

FMV 2303 - 1,5 M to 3,5 M

1.2 - Functional description of the controller

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.
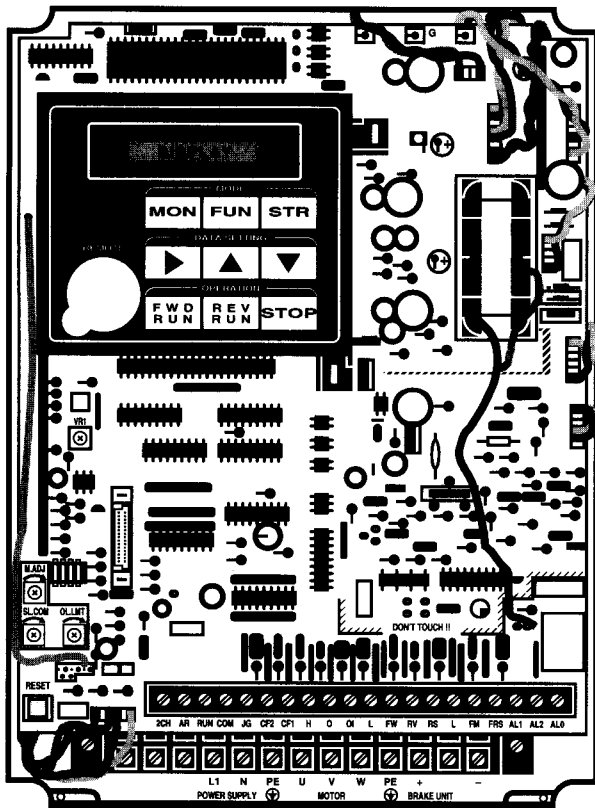
1.3 - Circuit diagram
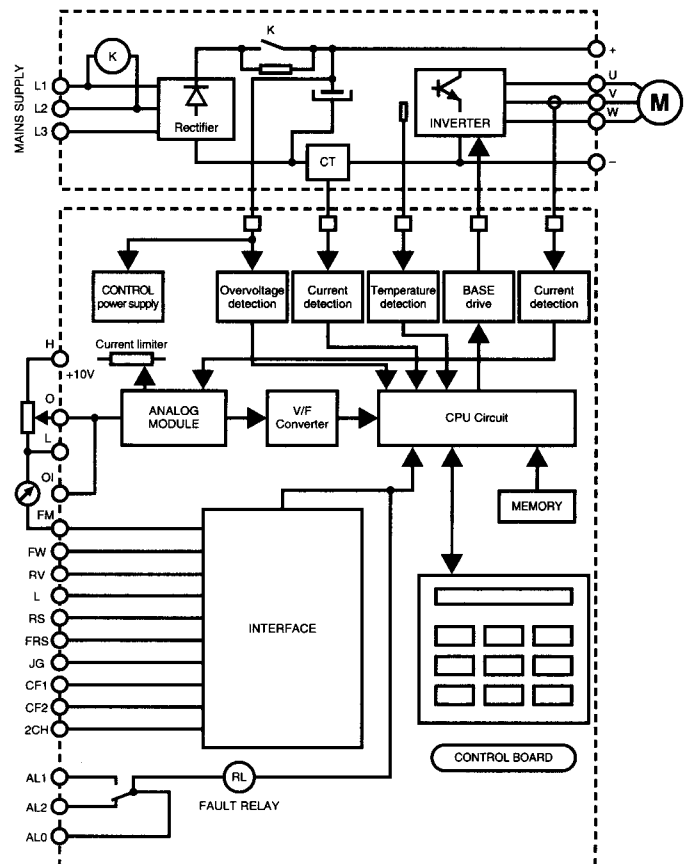
Figure 1.1 - CIRCUIT DIAGRAM

1.4 - Dimensional characteristics
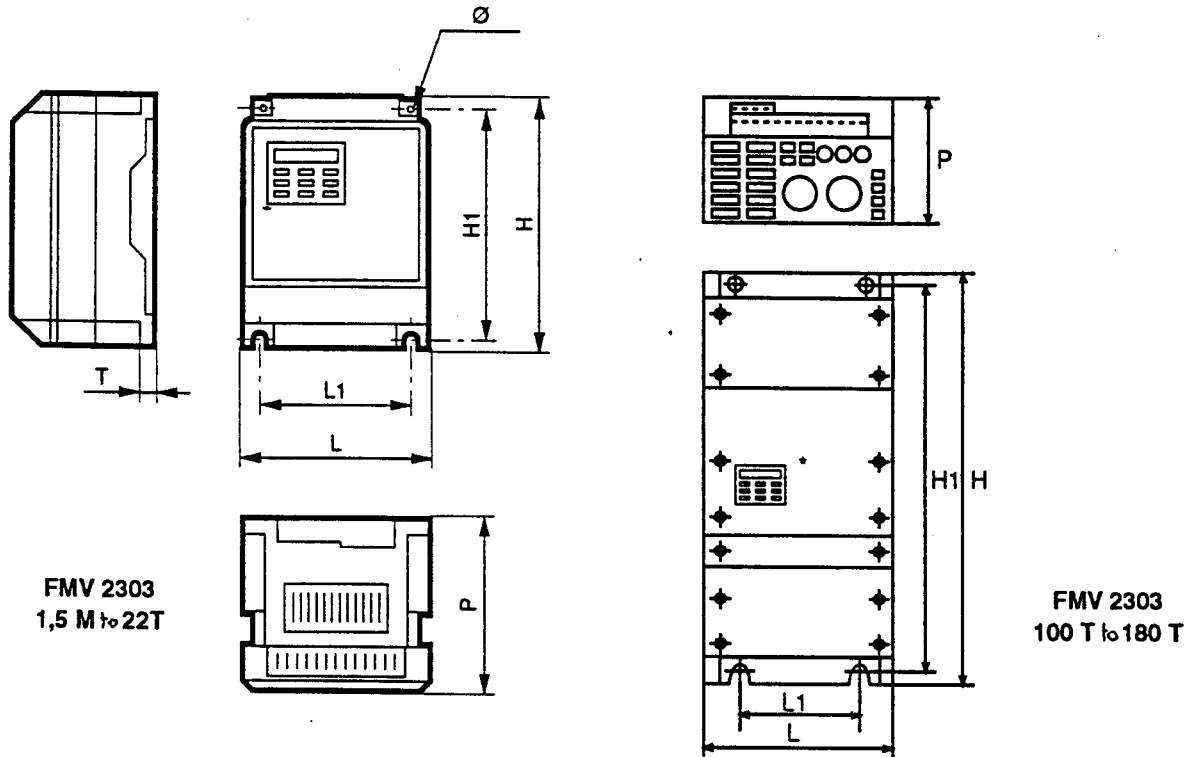
FMV 2303
1,5 M to 22T

FMV 2303
100 T to 180 T

TYPE	H (mm)	H1 (mm)	L (mm)	L1 (mm)	P (mm)	ø (mm)	T (mm)	WEIGHT (kg)
LS FMV 2303 - 1,5 M	300	280	220	200	175	7	5	5,5
LS FMV 2303 - 2,5 M	300	280	220	200	175	7	5	6,0
LS FMV 2303 - 3,5 M	300	280	220	200	175	7	5	6,5
LS FMV 2303 - 2,5 T	300	280	220	200	175	7	5	7,5
LS FMV 2303 - 3,5 T	300	280	220	200	175	7	5	7,5
LS FMV 2303 - 5,5 T	300	280	220	200	175	7	5	8,5
LS FMV 2303 - 8 T	440	420	250	230	195	7	5	14,5
LS FMV 2303 - 11 T	440	420	250	230	195	7	5	15,0
LS FMV 2303 - 16 T	450	430	325	255	240	8	1,2	22,5
LS FMV 2303 - 22 T	450	430	325	255	240	8	1,2	24,5
LS FMV 2303 - 100 T	1060	1030	550	380	300	12	1,2	105
LS FMV 2303 - 120 T	1060	1030	550	380	300	12	1,2	105
LS FMV 2303 - 150 T	1300	1270	550	440	300	15	1,2	150
LS FMV 2303 - 180 T	1300	1270	550	440	300	15	1,2	160

LEROY SOMER

2 - STANDARD SPECIFICATIONS OF CONTROLLERS FROM 1,5 M to 22 T

2.1 - Power table

FMV 2303	CONTROLLER CAPACITY (kVA)			MAXIMUM* MOTOR POWER (kW)			MAXIMUM CONTINUOUS CURRENT controller (A)
	220 or 240 V 50/60 Hz	380 to 415 V 50 Hz	400 to 460 V 60 Hz	220 to 240 V 50 or 60 Hz	380 to 415 V 50 Hz	440 to 460 V 60 Hz	
1,5 M	1,9/2,1	/	/	0,75	/	/	5
2,5 M	2,9/3,1	/	/	1,5	/	/	7,5
3,5 M	4,0/4,4	/	/	2,2	/	/	10,5
2,5 T		2,5	2,6	/	1,5	1,8	3,8
3,5 T		3,5	3,6	/	2,2	2,6	5,3
5,5 T		5,7	6	/	4	4,8	8,6
8 T		8,6	9	/	5,5	6,6	13
11 T		11	11,5	/	7,5	9	16
16 T		15	15,7	/	11	13	23
22 T		21	22	/	15	18	32
100 T		98	102	/	75	90	149
120 T		116	120	/	90	108	176
150 T		143	149	/	110	132	217
180 T		171	178	/	132	158	260

* For the LS FMV motors. Check that the rated motor current is less than the permanent rated current of the controller.

2.2 - Main specifications table

INPUT VOLTAGE	220 to 240V±10% SINGLE PHASE 50/60 Hz ±5%			380 to 415V ±10% - 50 Hz ± 5% 400 to 460V ±10% - 60 Hz ± 5% THREE PHASE						
FMV - 2303 TYPE	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
OUTPUT FREQUENCY RANGE	0,5 to 360 Hz									
VOLTAGE/FREQUENCY CHARACT.	36 types selectable									
PROTECTION BOX	IP 20									
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									
MAX.FREQUENCY SETTING	Max. frequency can be increased by 0 to +15Hz.									
ACCEL./DECEL.	Other acceleration/deceleration ramp selectable by terminal Separate settings from 0.1 to 2999 s: linear curve - or S-curve									
TORQUE BOOST	Manual or automatic setting of output voltage									
BRAKING	Regenerative braking Dynamic DC braking available for complete frequency range Adjustable braking value of 0 to 20 and braking time of 0 to 600 s									
OVERLOAD LIMITATION	150% In for 60 s (every 10 min.)									
SLIP COMPENSATION	Approximately 1.5 % (at standard frequency)									
MOTOR NOISE LEVEL	ADJUSTABLE									

OUTPUT FREQUENCY SETTING	Analogue setting	0-10 VDC (input impedance 30 kΩ or more)
		0-5 VDC (input impedance 15 kΩ or more)
		- potentiometer 0.47 to 2.2 kΩ.
		4-20 mA (input impedance 250 Ω)
		0-20 mA (optional)
	Digital setting: can be programmed on digital operation panel	
COMMAND OF CONTROLLER	Selection : by digital panel or by terminal	
RESET	Fault reset (Reset or RS-L)	
FORWARD/REVERSE OPERATION	Possibility of limiting to one direction of rotation only	
MULTI-STAGE SPEED OPERATION	Eight speed settings including output frequency setting	
JOGGING OPERATION	Adjustable between 0 and 9.9 Hz (in steps of 0.1 Hz)	
FREE-RUN STOP	Instantaneous cut off of motor voltage	
D.C. BRAKING	Adjustable power and time	
AUTOMATIC RESTART	Automatic restart after instantaneous power failure (effective from 15 to 300 ms)	

FAULTS
  OVERCURRENT
 	
  OVERVOLTAGE
  UNDERVOLTAGE
 	
  INSTANTANEOUS POWER FAILURE
 	
  OVERLOAD
  FIN OVERHEAT
  CPU ERROR
  GROUND FAULT
	1,5 to 5,5 kVA : 220 % of nominal current
	8 to 22 kVA : 180 % of nominal current
	Deceleration is too fast or mains power supply too high
	1,5 to 3,5 kVA : 150 to 160 V
	5,5 to 22 kVA : 280 to 320 V
	Displayed by controller. Operation continues for power failure of 15 ms or less.
	Automatic restart possible for power failures of less than 300 ms
	In line with electronic thermal relay setting (see F29)
	Controllers of over 5 kVA protected by thermal relays
	Internal controller fault
	Monitoring at controller output up to 22 kVA	

SIGNALISATIONS
  FAULT RELAY
  SPEED REACHED
  CONTROLLER OPERATION
  FREQUENCY MONITOR
	Activated when controller trips or power off
	Logic signal 0/27 VDC 50 mA (terminals)
	Logic signal 0/27 VDC 50 mA (terminals)
	0-10 VDC analog voltmeter or digital counter (counter impedance 10 kΩ - 22 kΩ)	

OPTION
  OUTPUT CURRENT SIGNAL
  SPEED REACHED RELAY
  CONTROLLER OPERATION RELAY
  INSTANTANEOUS BRAKING
	Voltage varies between 0 and 4 V according to controller current (4 V = Nom I)
	Switch ON at pre-selected frequency
	Switch ON when controller is operating
	Activited by terminal contact	

OPERATING CONDITIONS	Operation at ambient temperature : -10 to +50°C (without cover) -10 to +40°C (with cover) Relative humidity : < 90 % Altitude : ≤ 1000 m Storage : at temperature of -20 to + 60°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 2303 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 2303 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.
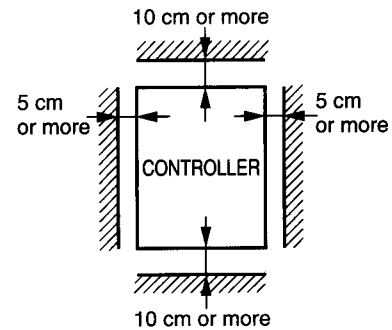
Figure 2 - Spacing around controller

3.3.3 - Sufficient space must be available to open the cover for easy access to the terminals.
3.3.4 - 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 : 50 °C
3.3.5 - Attach controllers side by side and do not stack to avoid overheating.

3.4 - Terminals
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 THREE-PHASE - 380/415 V / 50 Hz - 400/460 V / 60 Hz
U, V, W	Output controller	Supply motor
P.E	Earth terminal	Grounding (connection)
+,(M) , -	DC Voltage output terminal	Connection to braking unit
H	Power supply terminal for frequency setting potentiometer	10 V DC
O	Reference frequency	Voltage signal 0 - 10 V DC or 0 - 5 V DC (switchable)
OI	Reference frequency	Current signal 4 - 20 mA
L	Common control terminal 0V (CANNOT BE USED FOR GROUNDING)	
FW	FORWARD Start/Stop terminal	Contact closed: Forward
RV	REVERSE Start/stop terminal	Contact closed: Reverse
RS	Reset terminal	Contact closed: fault reset
FRS	Free-run stop terminal	Contact open: Controller stop, motor free run stop.
FM	Output 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	7 multi-stage speed operation (following contacts)
AL1 AL2 AL0	FAULT ALARM RELAY terminal	Power off or trip, AL0-AL1 open and AL0-AL2 closed
2CH	Second stage Acceleration/Deceleration	Contact closed : second-stage ACCEL/DECEL 2
AR	Frequency reached terminal	Logic signal (open collector) 0/27 VDC 50 mA : frequency reference reached or programmable frequency reached
RUN	Running signal terminal	Logic signal (open collector) 0/27 VDC 50 mA ON when on during controller operation
COM	Common terminal	Common terminal AR and RUN only (this terminal is not a ground terminal)
-1	-	Do not use

3.4.2 - Terminal configuration

- CONTROL BOARD 1,5M 180T

2CH	AR	RUN	COM	JG	CF2	CF1	H	O	OI	L	FW	RV	RS	L	FM	FRS	AL1	AL2	AL0

- POWER BOARD 1,5M 3,5M

L1	N	PE	U	V	W	PE	+		-

Power supply ⏚ Motor ⏚ Brake unit

- POWER BOARD 2,5T 22T

L1	L2	L3	PE	U	V	W	PE	+	M	-

Power supply ⏚ Motor ⏚ Brake unit

POWER 100T 150T

L1H	L2H	L3H	L1M	L2M	L3M	L1L	L2L	L3L

L1	L2	L3	PE	U	V	W	PE	+	M	-	-1	-

Power supply ⏚ Motor ⏚ Brake unit

POWER 180T

L1H	L2H	L3H	L1M	L2M	L3M	L1L	L2L	L3L

+	M	-	-1

L1	L2	L3	PE	U	V	W	PE	L3L

Power supply ⏚ Motor ⏚
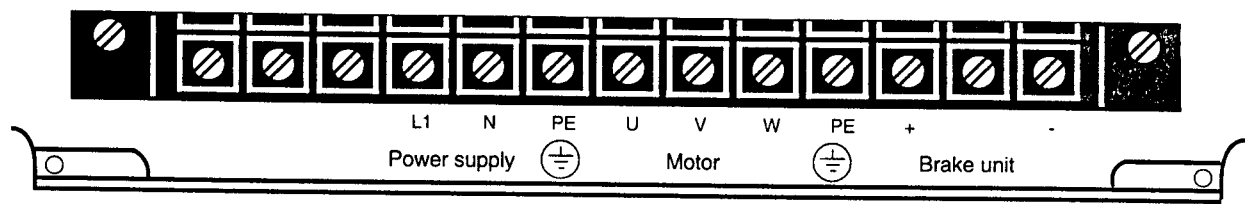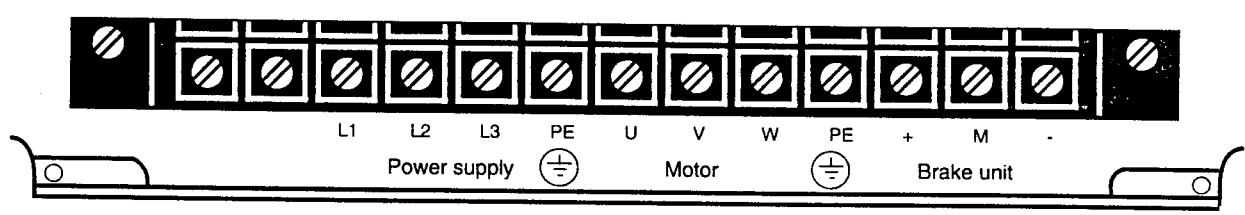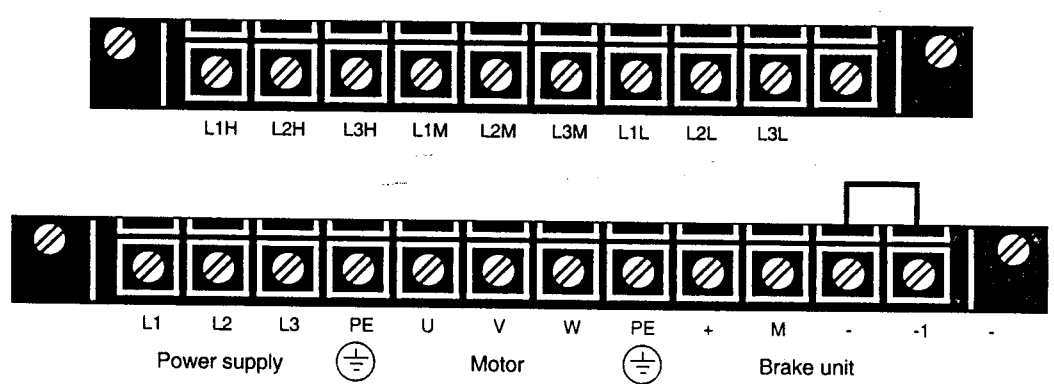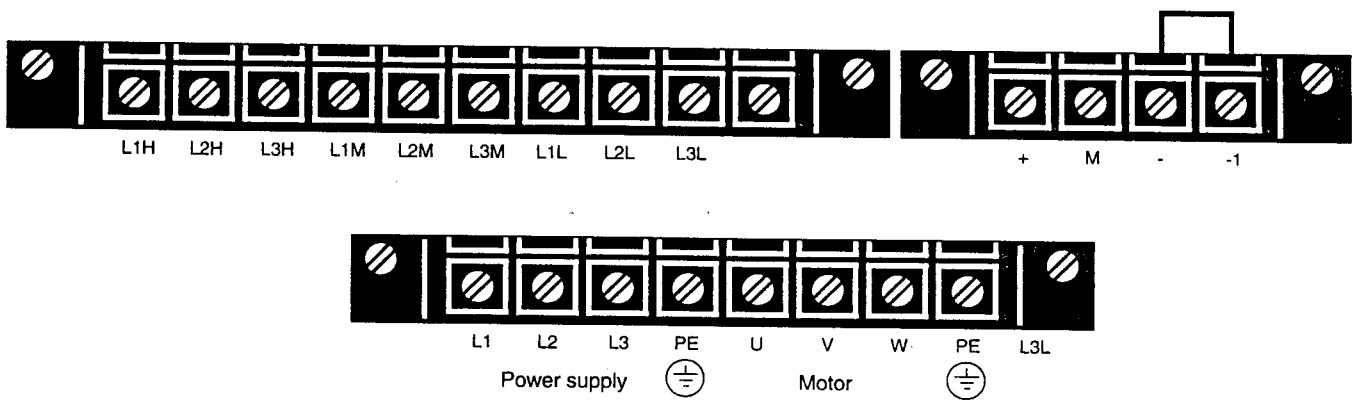
3.5 - Connection diagrams
3.5.1 - Command through digital operation panel

REMOTE CONTROL

KM

Start-up

SB1

Stop

SB2

QS

KM

QS

KM

L1

L2

L3

Three-phase

N

L1

Single-phase

FMV 2303

U

V

W

M
3 ~

PTO (*)

+

(M)

–

BRAKING UNIT CONNECTION
TERMINALS

FM

L

FREQUENCY METER OUTPUT

FAULT RESET

RS

FRS

L

AL0

AL1

AL2

FAULT ALARM RELAYS

AR

RUN

COM

LOGIC SIGNAL

PE

QS : Isolator + 3 fuses
KM : Line contactor
SB1 : Run push-button
SB2 : Stop push-button

(*) If P.T.C. used,
command device needed
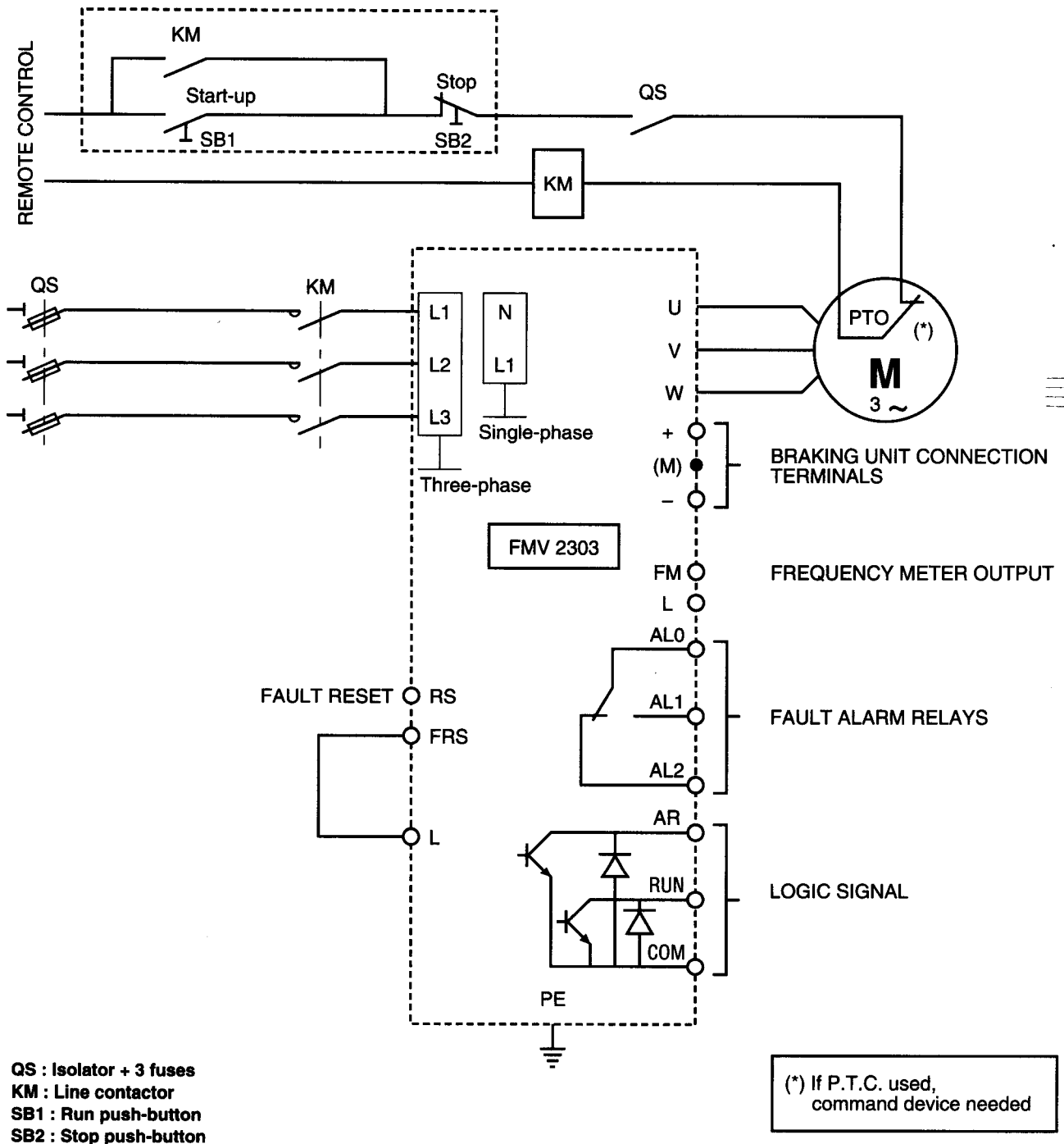
Figure 3.8 - STANDARD CONNECTION

3.5.2 - Remote control (potentiometer)

FREQUENCY SETTING POTENTIOMETER
0,47 to 2,2 KΩ

FMV 2303

BRAKING UNIT CONNECTION TERMINALS

FREQUENCY METER OUTPUT

FAULT ALARM RELAYS

LOGIC SIGNAL

ACCEL./DECEL. 1 or 2

FORWARD : Start/Stop

REVERSE : Start/Stop

RESET

(*) If P.T.C. used,
command device needed

QS : Isolator + 3 fuses
KM : Line contactor
SB1 : Run push-button
SB2 : Stop push-button

Figure 3.9 - STANDARD CONNECTION

3.5.3 - Remote control (other types)

Figure 3.10 - STANDARD CONNECTION

Labels in diagram:

REMOTE CONTROL

KM
Start-up
Stop
SB1
SB2
QS
KM

QS
KM
L1
L2
L3
N
L1
Single-phase
Three-phase

U
V
W
M
3 ~
PTO (*)

+
(M)
−
BRAKING UNIT CONNECTION TERMINALS

See §7
H
O
OI
L

FMV 2303

2CH
FM   FREQUENCY METER OUTPUT
L

ACCEL./DECEL. 1 or 2

FORWARD : Start/Stop — FW
REVERSE : Start/Stop — RV
RESET — RS

ALO
AL1   FAULT ALARM RELAYS
AL2

FREE-RUN STOP — FRS
JOGGING OPERATION OR MULTI-STAGE SPEED — JG
MULTI-STAGE SPEED OPER. — CF1
MULTI-STAGE SPEED OPER. — CF2
L

AR
RUN   LOGIC SIGNAL
COM

PE

(*) If P.T.C. used,
command device needed

QS : Isolator + 3 fuses
KM : Line contactor
SB1 : Run push-button
SB2 : Stop push-button

3.5.4.1 - Connection to different motors
Motors connected in parallel :
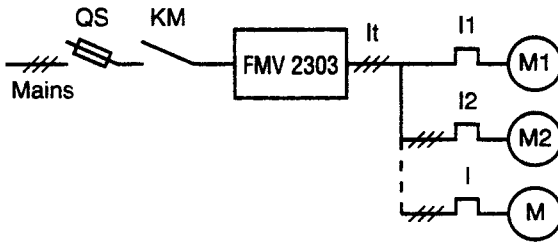
Several motors with different power ratings can be powered by the same frequency controller. Each motor must be protected by a thermal relay.

Determining controller rating :

$$I_N \text{ Controller} > I1 + I2 + ... + I$$

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.
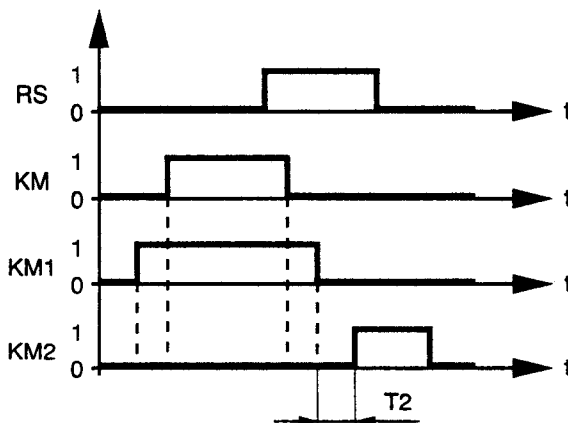
Note :
To safeguard the parameters in memory refer to §6.

3.6 - Cable dimensioning
(For three-phase controllers 2.5 T to 22 T)

3.6.1 - General
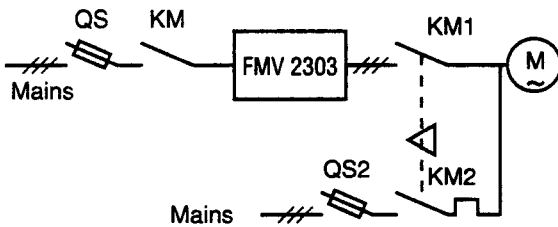The current absorbed by the controller is not sinusoidal. It includes a fundamental wave at 50 or 60 Hz, with harmonics of smaller amplitude and higher frequencies. The fundamental wave I1 determines the active power.
Pact = I1 x V x √3.
The fundamental wave added to the harmonics gives the RMS value (1) of the current and determines the apparent power **Papp = I x V x √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 mains supply, refered to the power of the controller.
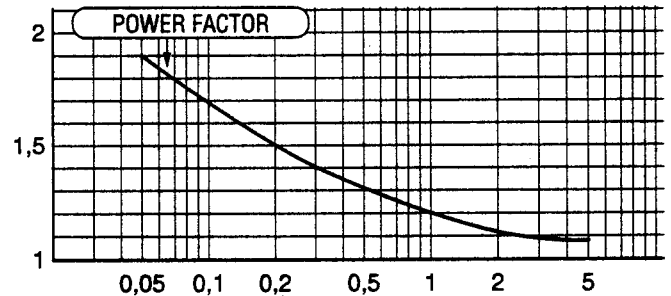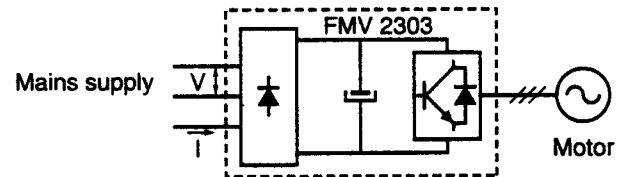
Inductive reactance of source voltage refered to the power of the controller expressed in %.

3.6.3 - Determining the value of current I

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

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

Note :
If the installed power and thus the inductive loss, is not known, take the motor current (see following table) and apply a 1.5 coefficient.

Controller type	Motor power kW	Motor current (Amps)	KM sizing QF fuse delayed action (Amps)
LS FMV 2303 2,5 T	1,5	3,8	10
LS FMV 2303 3,5 T	2,2	5,3	10
LS FMV 2303 5,5 T	4	8,6	16
LS FMV 2303 8 T	5,5	13	25
LS FMV 2303 11 T	7,5	16	32
LS FMV 2303 16T	11	23	40
LS FMV 2303 22 T	15	32	50

Examples

1 - A 15 kW motor is powered by an LS FMV 2303 - 22 T Controller. Energy is supplied by a 250 kVA transformer with an inductive reactance of 5%. The inductive reactance refered to the power of the motor is :

$$\frac{5 \times 22}{250} = 0,44\%$$

Power factor read on curve : 1.35
RMS value of current I :

$$I = \frac{15\,000 \times 1,35}{\sqrt{3} \times 380 \times 0,95 \times 0,9} = 36A$$

2 - Data identical to that in 1, except transformer power = 25 kVA. The inductive reactance brought down to the power of the motor is:

$$5 \times \frac{22}{25} = 4,4\%$$

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

$$I = \frac{15\,000 \times 1,08}{\sqrt{3} \times 380 \times 0,95 \times 0,9} = 28,7A$$

3 - LS FMV 2303 - 22 T   mot P = 15 kW
                                I motor = 32 A
RMS value of current I = 32 x 1,5 = 48A.

3.7 - Cable dimensioning
(For single-phase controllers 1,5 M to 3,5 M)
For these types use the current values given in the following table.

Controller type	Motor power kW	Line current (Amps)	KM sizing QF fuse delayed action (Amps)
LS FMV 2303 1,5 M	0,75	8	10
LS FMV 2303 2,5 M	1,5	15	16
LS FMV 2303 3,5 M	2,2	18	22

N.B. : These examples can be used to determine the minimum cross sectional diameter of a cable for a continuous operation. The resulting drop in voltage must then be checked. The above table must in no way be used to replace currently applicable standards and texts.

3.7.1 - Grounding of several controllers

Wrong connection   **Right connection**
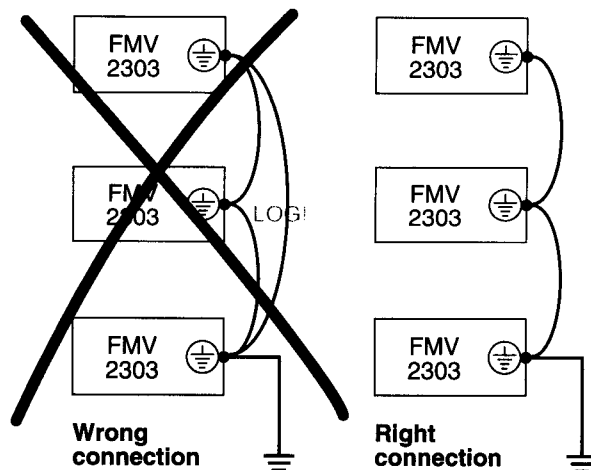
3.7.2 - Other connections (signals, commands)
- Wires in shielded twisted cables
  - Control/command signals : H, O, OI, L, FW, RV, RS, FRS, FM, JG, CF1, CF2, 2CH.
  - Logic signal : AR, RUN, COM.
  - Output relay : AL0, AL1, AL2.

Control signals	Terminals FW, RV, JG, CF1, CF2, RS, FRS Low level ≤ 0,3 V High level ≥ 2,4 V Minimum input pulse width ≥ 50 ms
Output relay	Terminals AL0, AL1, AL2 - 250 VAC, 2,5 A (resistive load) 0,2 A (cos φ = 0,4) - 30 VDC, 3 A (resistive load) 0,7 A (cos φ = 0,4)
Logic signals	Terminals AR, RUN 0/27 VDC, 50 mA
Frequency setting command (potentiometer)	Terminal 0 Specification of potentiometer 2W : 500 Ω 1W : 1 or 2 kΩ
Frequency setting command (external signal)	Terminal 0 Input voltage : (*) 0 - 10 V input impedance 30 kΩ 0 - 5 V input impedance 15 kΩ Terminals 0I Input current : Input impedance 250 Ω
Frequency monitoring	Terminals FM 0 - 10 V full-scale (Load resistance 10 to 22 kΩ 1 mA max).

(*) Do not apply a voltage of 12 VDC or more across terminals 0 and L.

4 - STARTING FROM FACTORY SETTINGS

4.1 - Starting the motor from the terminal
4.1.1 - Connection diagram (See §3.5.2 or 3.5.3)

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
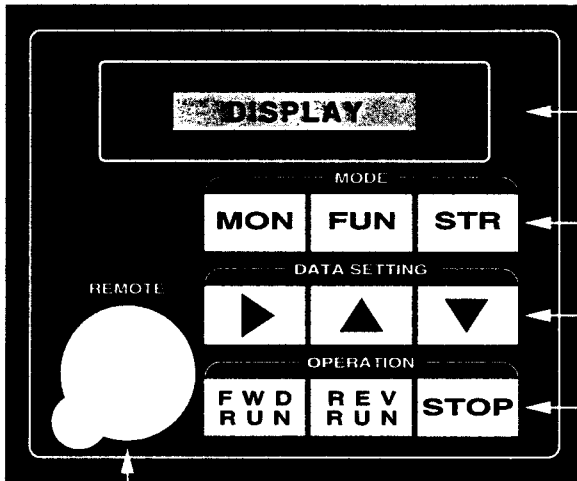
16-character display.

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.

Connections for :
• remote control,
• copy unit,
• serial communication interface.

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.

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4.2.3 - Starting procedure using the operator panel

OPERATION	MANIPULATION	DISPLAY	DESCRIPTION
SWITCHING ON		FS000.0 [ ] 000.0 Hz ► Cursor CONTROLLER output frequency is displayed	When the motor is switched on, the CONTROLLER output frequency display system comes on automatically.
COMMAND SELECTED ON OPERATING PANEL	Press MON twice M O N	F - SET - M - Terminal	
	Press once ▷	F - SET - M - Terminal	Command from terminal
	Press once ▽	F - SET - M - Ope - Key	Frequency command from operator panel
	Press once M O N	F/R - SW - Terminal	
	Press once ▷	F/R - SW - Terminal	Command from terminal
	Press once ▷	F/R - SW - Ope - Key	Command from operator panel
MOTOR POLES INDICATION	Press once M O N	RPM 4P 0000 rpm	If no of poles is correct, skip the next step
	Press once ▷	RPM 4P 0000 rpm	
	Press △ or ▽		Matches no of poles of motor
OUTPUT FREQUENCY SETTING	Press until M O N FS is displayed	FS000.0 [ ] 000.0 Hz ► Cursor	
	Press ▷ Then set frequency using △ or ▽	FS040.0 [ ] 000.0 Hz	E.g. : sets output frequency to 40 Hz
MOTOR STARTING	Press F W D R U N or		Motor starts in FORWARD run
	R E V R U N		Motor starts in REVERSE run
MOTOR STOP	Press STOP		

4.3 - Pratical guide for settings

This pratical settings guide allows you to simply carry out controller settings and lists the functions which are described in more detail by the following pages.

MAIN SETTINGS

SELECTION OF THE TYPE OF CONTROL OF THE CONTROLLER

RUN, REVERSING, STOP OF MOTOR	- Remotely : via terminals - MODE "MON" 3 (TERMINAL). - From the controller : via the keypad MODE "MON" 3 (OPE KEY).
SPEED ADJUSTMENT	- Remotely : via terminals - MODE "MON" 2 (TERMINAL). - From the controller : via the keypad MODE "MON" 2 (OPE KEY).
MOTOR STOP ON DEFAULT	- Restart automatically or manually MODE "FUN" - F28.

STARTING

ACCELERATION TIME ADJUSTMENT	- Acceleration ramp MODE "FUN" - F01.
ACCELERATION TORQUE ADJUSTMENT	- Manual boost adjustment (increased torque at low speed) : MODE "MON" 7.

RUNNING : CHOOSING THE OPERATING SPEEDS

CHOICE OF THE MOTOR IS OPERATING SPEED RANGE	- Selection of the output frequency range MODE "FUN" - F00.
CALIBRATION OF THE MIN AND MAX OPERATING SPEEDS	- Min speed (calibration of the min frequency) MODE "FUN F06". - Max speed (calibration of the max frequency) MODE "FUN F05".

RUNNING : MEASURE OF OPERATING PARAMETERS

DISPLAY OF THE CONTROLLER'S OUTPUT FREQUENCY	- Simultaneous display of the frequency reference and the actual output frequency MODE "MON" 1.
DISPLAY OF THE DIRECTION OF MOTOR ROTATION	- Forward running : F ; Reverse running : R, MODE "MON" 1.
DISPLAY OF ABSORBED MOTOR CURRENT	- Factory setting : expresses the motor current as a percentage of the controller's rated current. - Actual current can be shown by programming in the controller's rated current, MODE "MON" 6.
DISPLAY OF FAULTS	- Clear display of the last 3 faults MODE "MON" 10.

RUNNING : OPTIMISATION OF THE DRIVE SYSTEM'S QUALITY

MOTOR PROTECTION AND TORQUE LIMITATION	- Thermal protection of motor, adjustment of rated current of electronic thermal relay ; MODE "FUN" - F23. - Controller output current limitation to avoid tripping due to overloads. Potentiometer OL-LMT.

STOPPING THE MOTOR

COAST STOP	- The motor and driven machine are not controlled during the deceleration. - Switching off the controller's supply by contactor KM. - Switching off the motor's supply from the controller : (electronic stop) by opening the contact FRS-L on the controller's terminals.
CONTROLLED STOP	- The deceleration is controlled by decreasing the controller's output frequency ; - Deceleration ramp adjustment : MODE "FUN" - F02.

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SPECIFIC SETTINGS

SELECTION OF THE TYPE OF CONTROL OF THE CONTROLLER

RUN, REVERSING, STOP OF MOTOR	- Via micro-console (option) - MODE "MON" 2 : OPE - KEY + RMT key on console. - Possibility of limitation to one direction of rotation only MODE "FUN" F28.
SPEED ADJUSTMENT	- Calibration of the analogue reference : MODE "FUN" : F26 and F27. - Via micro-console (option) - MODE "MON" 3 : OPE - KEY + RMT key on console.
MOTOR STOP ON DEFAULT	- Selection of automatic restart : flying restart/start following ramp. - Delay before automatically restarting : MODE "FUN" - F36.
PROGRAMMING LOCK	- Via micro-switch DS on control board, LOCK position.

STARTING

ACCELERATION TIME ADJUSTMENT	- Second ramp, selected by terminals, (same settings as ramp "FUN" F01) MODE "FUN" F18.
SELECTION OF ACCELERATION TYPE	- Linear or "S" acceleration : MODE "FUN" F24.
ACCELERATION TORQUE ADJUSTMENT	- Automatic boost : MODE "FUN" - F32. - If the boost settings are insufficient, vary the chopping frequency setting : MODE "FUN" F10.
ELIMINATION OF "DEAD-TIME" BEFORE MOTOR STARTS	- Adjustment of the minimum starting frequency : MODE "FUN" F04.
DELAY AT LOW SPEED BEFORE ACCELERATION	- To avoid over-current at start : MODE "FUN" F11.

RUNNING : CHOOSING THE OPERATING SPEEDS

CHOICE OF THE MOTOR'S OPERATING SPEED RANGE	- Possible additive frequency value above the maximum frequency : MODE "FUN" F03.
USE OF THE MULTIPLE PRE-SET SPEEDS	- Control by terminals only : 4 speeds including the reference . pre-set speeds 1 to 3 : MODE "FUN" F12 to F14. - After selection by F29 (switch 2), 8 speeds are possible . pre-set speeds 4 to 6 : MODE "FUN" F15 to F17.
JOGGING SPEED ADJUSTMENT	- Inching speed : MODE "MON" 9.

RUNNING : MEASURE OF OPERATING PARAMETERS

DISPLAY OF THE MOTOR'S ROTATIONAL SPEED	- Display in r.p.m, after programming the number of poles of the supplied motor : MODE "MON" 4.
CUSTOMISED DISPLAY	- Motor speed multiplied by a programmable conversion factor : MODE "MON" 5.
OUTPUT SIGNAL ON DESIRED FREQUENCY	- Logic signal via terminals when a programmable value of output frequency is reached : MODE "FUN" F39.
IMAGE OF OUTPUT FREQUENCY	- Terminal FM : used for digital or analogue frequency counter.

RUNNING : OPTIMISATION OF THE DRIVE SYSTEM CONTROLLER - MOTOR

NOISE : ADJUSTMENT OF THE ACOUSTIC TIMBRE OF THE MOTOR	- Adjustment of the chopping frequency : MODE "FUN" F10.
VIBRATION : AVOID CRITICAL RUNNING SPEEDS	- JUMPING : frequency jumps 1 to 3 MODE "FUN" F07 to F09.
SPEED PRECISION FOR LOADED MOTOR	- Slip compensation : . open loop : by adjustment of SL - COM potentiometer on the controller's control board, . closed loop : motor equipped with A.C. or D.C. tachogenerator and option board LS -.1274.
MOTOR PROTECTION AND TORQUE LIMITATION	- Adjustment of current limitation sensitivity : MODE "FUN" F30. - Selection of type of thermal protection : for standard self ventilated motor/LS FMV motor or forced-ventilated motor MODE "FUN" F29.
GAIN ADJUSTMENT	- Output voltage reduction : MODE "MON" 8.

STOPPING THE MOTOR

CONTROLLED STOP	- Selection of ramp type : linear or "S" : MODE "FUN" F25. - Second ramp selected by terminals : MODE "FUN" F19.
STOP WITH DYNAMIC BRAKING	- With high inertia loads or rapid stop requirement : - options : braking unit fitted to controller's terminals.
STOP WITH BRAKING AT END OF RAMP	- Braking by direct current injection. - start of braking MODE "FUN" - F20. - braking voltage MODE "FUN" - F21. - braking time MODE "FUN" - F22. - delay before braking MODE "FUN" - F37, enable : MODE "FUN" F28.
CONTROLLED STOP WITH BRAKING	- Stop by terminal control at any moment. - Requires option board IA - TWK.
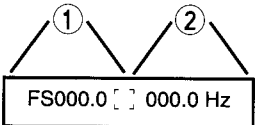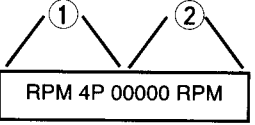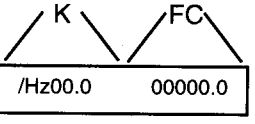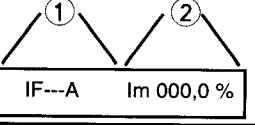
5 - IDENTIFICATION AND MODIFICATION OF PARAMETERS IN "MON" MODE.
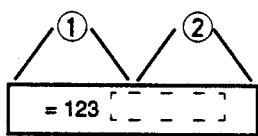
5.1 - Parameter identification

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

DISPLAY SEQUENCE		INITIAL DISPLAY	FACTORY SETTING	DATA MODIFICATION/ SETTING RANGE	REMARKS
1	Frequency setting display	① ② FS000.0 [ ] 000.0 Hz	—	Field ① 000.0 - 375.0 Hz	• Field ① reference setting. • Field ② instantaneous output frequency display.
	Multi-speed reference and output frequency display	1S000.0 [ ] 000.0 Hz 2S000.0 [ ] 000.0 Hz 3S000.0 [ ] 000.0 Hz	—		• [ ] running direction F (Forward) R (Reverse).
	Multi-speed extension	4S000.0 [ ] 000.0 Hz 5S000.0 [ ] 000.0 Hz 6S000.0 [ ] 000.0 Hz			• Multi-speed display when terminal frequency command method selected.
	Set jogging frequency and output frequency	JG001.0 [ ] 000.0 Hz	—		
2	Frequency command method	F - SET - M Terminal	Terminal	Terminal or Ope-Key	Ope-key = operator panel
3	Operation command method	F/R - SW Terminal	Terminal		
4	Motor rotationnal speed display	① ② RPM 4P 00000 RPM	4	2 - 48	① Setting the polarity of the motor being powered. ② Motor speed display.
5	Transformed frequency display	K FC /Hz00.0 00000.0	—	k : 0.1 - 99.9	The displayed frequency FC equals output frequency multiplied by programmable factor k.
6	Output current display	① ② IF---A Im 000,0 %	—	—	Field ① controller's rated current (possible adjustment during operation). Field ② output current display.

DISPLAY SEQUENCE		INITIAL DISPLAY	FACTORY SETTING	DATA MODIFICATION/ SETTING RANGE	REMARKS
7	Manual torque boost adjustment	V-Boost Code < 31>	31	00 - 99	Boost set between 0,5 Hz and 20 Hz
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	Operation by terminal
10	Faults display	① ② = 123	—	—	Field ① selection of one of the last three faults (one being the newest). Field ② fault message.

• **Precautions to be taken when a new parameter is modified :**

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

Wait until the display has gone off 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.

• **If required, all the settings can be returned to their initial state (settings before shipment). Follow the steps below :**

- Turn power on.
- Set the far right switch of DIP SW on PC board to "ON" see 5.4.2.
  With the MON   FUN   STR keys on the digital operation panel depressed at the same time, press the forced RESET button on PC board and release.
- After resetting, release these 3 keys after in 1 or 2 seconds.
- Press and release the forced RESET button again.
- Set the DIP SW to "OFF".

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5.2 - 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 (see precaution §6).

5.3 - Procedure for setting parameters in "MON" MODE

5.3.1 - 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).

| FS 000.0 ⦂⦂ 000.0 Hz | Display |

A B C
Initial cursor position
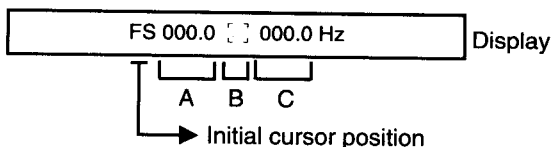
When the motor is running, the display shows :

| FS 050.0 ⦂F⦂ 032.0 Hz |

A B C
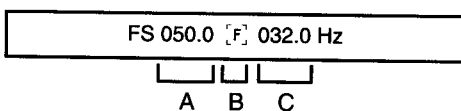
| PART A | Frequency reference display in the example F = 50 Hz. |

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

F : Forward   **R** : Reverse

| PART C | : Output frequency received by the motor. |

5.3.2 - Output frequency adjustment
Used to set motor speed
- Pre-setting when motor stopped
- Speed adjustment possible during operation.

| FS 050.0 ⦂F⦂ 032.0 Hz |

A B C
Initial cursor position
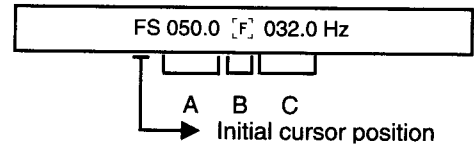
Move the cursor using ☐▷☐
Set the output frequency using ☐△☐ or ☐▽☐

As soon as the new frequency is displayed, the motor accelerates or decelerates until the selected frequency is reached.
Parts **A, B** and **C** are described in paragraph 5.3.1.

5.3.3 - 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 and L on the terminal

| F - SET - M | Terminal |

Initial cursor position
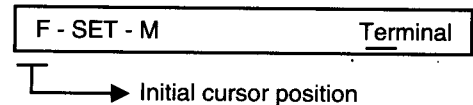
Move the cursor using ☐▷☐
Specify the code required using ☐△☐ or ☐▽☐

5.3.4 - 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)
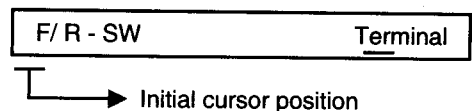
| F/ R - SW | Terminal |

Initial cursor position

Move the cursor using ☐▷☐
Specify the code required using ☐△☐ or ☐▽☐

5.3.5 - Motor speed display
Displays the No of poles and the number of revolutions per minute.

```
RPM                    4P 0 0 0 0 0 rpm
  └──▶ Initial cursor          └┘ └──┘
       position               A    B
```
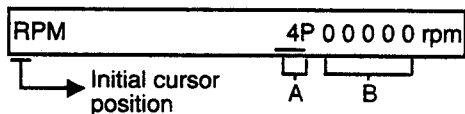
Move the cursor using ▷
Specify the polarity required using △ or ▽

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
No of MOTOR POLES	2	4	6	8	10	12	14
DISPLAY SEQUENCE	8	9	10	11	12	13	14
No of MOTOR POLES	16	18	20	24	32	36	48

5.3.6 - Frequency transformation factor
- The factor allows the frequency to be transformed into R.P.M., m/mn, etc.

```
/Hz 00.0              0 0 0 0 0 . 0 0
 └─┐└──┘              └───────────┘
   │  k                     FC
   └─▶ Initial cursor position
```
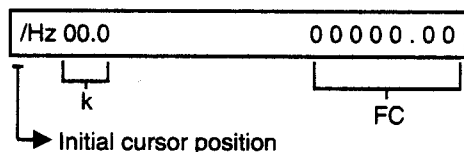
Move the cursor using ▷
Enter the factor using △ or ▽

PART A	Factor 0.1 to 99.9.
PART B	FC transformed

5.3.7 - Controller output current display
Displays the controller output current (in real terms or as a %).
It can be displayed in the two ways via 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.

```
If    A    Im    0 0 0    . 0 %
 └┐ └┘└───┘      └───────┘
  │      A            B
  └─▶ Initial cursor position
```
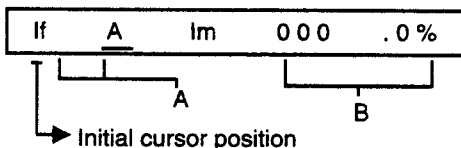
Move the cursor using ▷
Select the current corresponding to the controller's rating using △ or ▽

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

When the motor is started up, the controller's output current is then 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.

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

```
V - Boost              Code < 31 >
 └─▶ Initial cursor          └──┬──┘
      position                  B
```
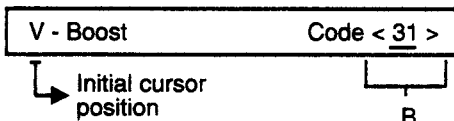
Setting range : 00-99

Move the cursor using ▷
Set the voltage using △ or ▽

5.3.9 - 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 tables §6.3.2 and 6.3.5).
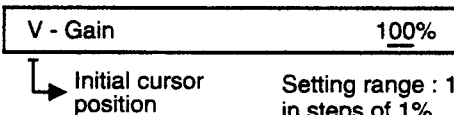
```
V - Gain                    100%
 └─▶ Initial cursor    Setting range : 100 to 50%
      position          in steps of 1%
```

Move the cursor using ▷
Select the range using △ or ▽
See following figures
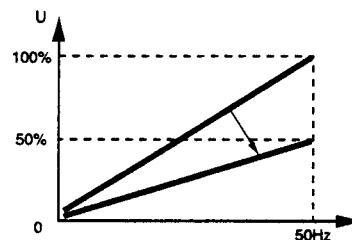
E.g. : Output frequency 1 - 50 Hz
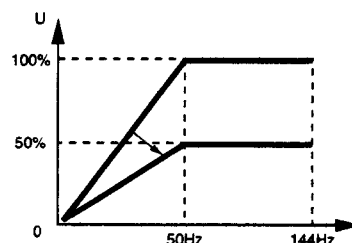
E.g. : Output frequency 0 - 144 Hz

5.3.10 - Jogging output frequency setting

```
┌─────────────────────────────────────┐
│ Jogging              0 0  .   5 Hz   │
└─────────────────────────────────────┘
  └──► Initial cursor position
```
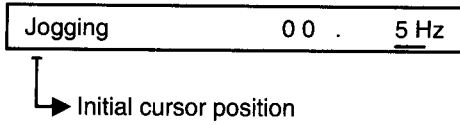
The output frequency is obtained as soon as the jogging command is sent.

Move the cursor onto the dashes using ▷
Set the range using △ or ▽

Note
If multi-speed extension F15 to F18 is used, the jogging function is disabled.

Control terminals   or   Digital operation panel
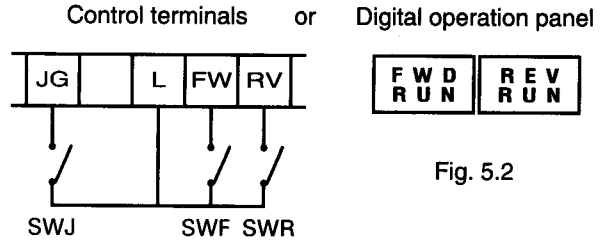
Fig. 5.2

Fig. 5.1

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]

5.4 - Control board adjustments
5.4.1 - DS Block layout (Position : lower left)
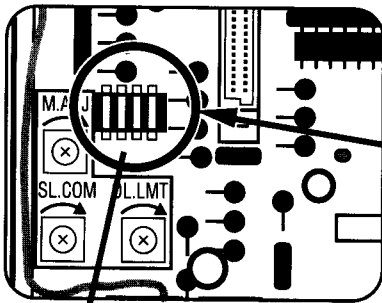
Before making any adjustments to the control board, make sure that all 4 switches are OFF

Always **OFF**

Always **OFF**

Software lock (no parameter may be changed if this is **ON**)

Pre-set voltage   10 V side: 0-10 V
                     5 V side: 0-5 V
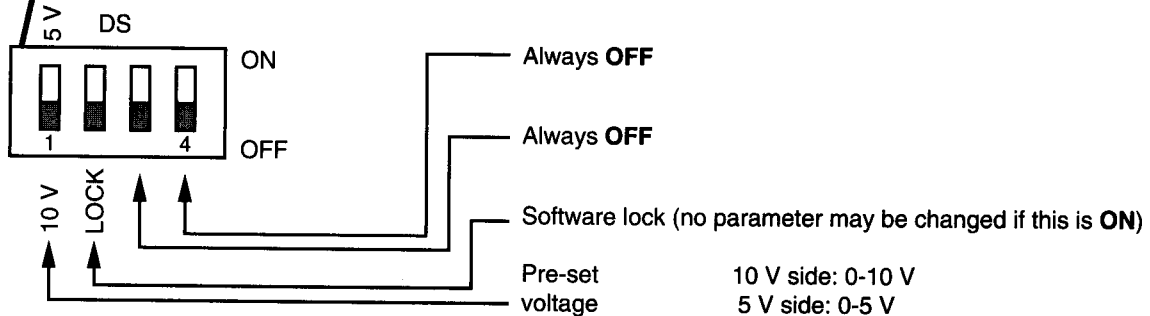
5.4.2 - Adjustments
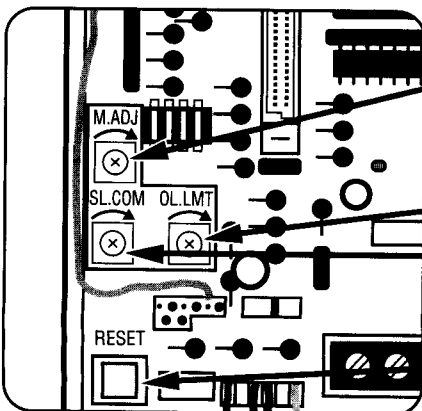
M.ADJ : Used to calibrate the output voltage (points FM-L) when using a voltmeter as a speed or frequency meter (see F28).

OL.LMT : Used to limit the controller current and consequently motor torque (see F30).

SL.COM : Used to make up the difference in motor speed between no-load and load running (slip compensation).

RESET : Deletes the last fault stored and thus resets the fault signal.

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 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 6.1 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.

• **Precautions to be taken when a new parameter 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 CONNECTING POINTS RS, L ON THE TERMINAL.
Wait until the display has gone off 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.

• **If required, all the settings can be returned to their initial state (settings before shipment). Follow the steps below :**
- Turn power on.
- Set the far right switch of DIP SW on PC board to "ON" see 5.4.2.
  With the MON FUN STR keys on the digital operation panel depressed at the same time, press the forced RESET button on PC board and release.
- After resetting, release these 3 keys after in 1 or 2 seconds.
- Press and release the forced RESET button again.
- Set the DIP SW to "OFF".

Table 6.1 FUNCTION MODE (FUN) 2.

n°	Function name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Min. Setting	Max. Setting	Unit	Factory setting
F00	V (f) Pattern	F	-	0	0							V	F	1	-	V		-	-	-	-
	(After pressing FUN once)																				
	(After pressing FUN twice)	V	F	1	-	V	C				0	5	0	-	0	5	0				
F01	Acceleration No 1	A	C	C	E	L	-	1		0	0	2	0	.	0		S	0000,1	2999,9	s	0020,0
F02	Deceleration No 1	D	E	C	E	L	-	1		0	0	2	0	.	0		S	0000,1	2999,9	s	0020,0
F03	Additive maxi. frequency adjustment : 0,1to 15 Hz	±	F	m	a	x	.			0	0	0	.	0	H	Z		0	015,0	Hz	0
F04	Starting frequency adjustment	±	F	m	i	n	.			0	0	0	.	5	H	Z		000,5	005,0	Hz	000,5
F05	Upper frequency limit setting	H	-	L	I	M	-	F		0	0	0	.	0	H	Z		000,5	375,0	Hz	0
F06	Lower frequency limit setting	L	-	L	I	M	-	F		0	0	0	.	0	H	Z		000,5	375,0	Hz	0
F07	Jump frequency 1 setting	J	U	M	P	-	F	1		0	0	0	.	0	H	Z		000,5	375,0	Hz	0
F08	Jump frequency 2 setting	J	U	M	P	-	F	2		0	0	0	.	0	H	Z		000,5	375,0	Hz	0
F09	Jump frequency 3 setting	J	U	M	P	-	F	3		0	0	0	.	0	H	Z		000,5	375,0	Hz	0
F10	Motor noise chopping frequency adjustment	C	F	-	C	o	d	e				<	U	>				C	U		U
F11	Frequency delay time at start	F	S	t	o	p	-	T		0	0	0	.	0			S	000,0	015,0	s	0
F12	Multistage speed 1 setting	S	p	e	e	d	-	1		0	0	0	.	0	H	Z		000,5	375,0	Hz	0
F13	Multistage speed 2 setting	S	p	e	e	d	-	2		0	0	0	.	0	H	Z		000,5	375,0	Hz	0
F14	Multistage speed 3 setting	S	p	e	e	d	-	3		0	0	0	.	0	H	Z		000,5	375,0	Hz	0
F15	Multistage speed 4 setting	S	p	e	e	d	-	4		0	0	0	.	0	H	Z		000,5	375,0	Hz	0
F16	Multistage speed 5 setting	S	p	e	e	d	-	5		0	0	0	.	0	H	Z		000,5	375,0	Hz	0
F17	Multistage speed 6 setting	S	p	e	e	d	-	6		0	0	0	.	0	H	Z		000,5	375,0	Hz	0
F18	Acceleration No 2	A	C	C	E	L	-	2		0	0	2	0	.	0		S	0000,1	2999,9	s	0020,0
F19	Deceleration No 2	D	E	C	E	L	-	2		0	0	2	0	.	0		S	0000,1	2999,9	s	0020,0
F20	DC Braking frequency adjustment	F	-	D	C	B				0	0	1	.	0	H	Z		0,5	375,0	Hz	001,0
F21	DC Braking voltage adjustment	V	-	D	C	B						0	1	0				0	020	V	010
F22	DC Braking time adjustment	T	-	D	C	B				0	0	5	.	0			S	000,1	600,0	s	005,0
F23	Electronic thermal relay adjustment	E	-	t	h	e	r	m					1	0	0		S	50	100	%	100
F24	Linear or S curve acceleration selection	A	C	C	l	i	n	e			L	i	n	e	a	r		-	-	-	Linear
F25	Linear or S curve deceleration selection	D	E	C	l	i	n	e			S	-	c	u	r	v	e	-	-	-	Linear
F26	External frequency setting start	F	-	S	T	A	R	T		0	0	0	.	0	H	Z		000,5	375,0	Hz	0
F27	External frequency setting end	F	-	E	N	D				0	0	0	.	0	H	Z		000,5	375,0	Hz	0
F28	Switch 1 selection	S	W	I	T	C	H	1		0	0	0	0	0	1	0	1	-	-	-	-
F29	Switch 2 selection	S	W	I	T	C	H	2		0	0	1	1	1	0	0	0	-	-	-	-
F30	Overload limit sensitivity setting	L	M	.	C	O	N	S		0	0	0	1	.	0		S	0000,3	0030,0	-	001,0
F32	Automatic torque boost adjustment	V	-	a	u	t	o							+	0	0	S	0	20	-	0

Table 6.1 FUNCTION MODE (FUN) 2 (continued).

F36	Delay time setting for automatic after controller trip restart	I	P	S	-	R	-	T		0	0	0	1	.	0		0000,3	0060,0	S	0001,0
F37	DC Braking delay time adjustment	W	-	T	-	D	C	B		0	0	0	0	.	0		0	5	s	0
F39	Frequency reached signal	S	P	D	-	A	R	V		0	0	0	.	0	H	z	000,5	375,0	Hz	0

6.3 - Function FUN (2) description

(F00) - VOLTAGE/OUTPUT FREQUENCY CURVE CHARACTERISTICS
Modifies V/F characteristics

```
VF1 - VC          050 - 050
    --- ---
     a   b
        Initial cursor position
```
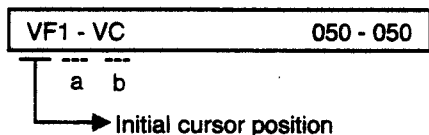
Move the cursor onto the dashes using ▷

Set part **a** with codes 1 to 8 and part **b** with codes VC, VP1, VP2 and VP3 using △ ou ▽

The table below summarizes the options for running the motor with a constant torque (also see following pages).

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
on application

To run the motor at anything other than a constant torque, move the cursor to part **b** and enter VP1, VP2 or VP3 (see following tables).

Table 6.3.1

LEROY SOMER

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

Table 6.3.2

50 Hz - 380-415V or 220-240V mains power supply					
B / A	VC	VP1	VP2	VP3	MOTOR CONNECTION
					Single phase / Three phase
1					Δ / Y
2					Δ / Y

Table 6.3.3

60 Hz - 400-460V or 220-240V mains power supply					
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, according to the power supply characteristics and those of the motor, the following choices are recommended for the "voltage/frequency" curves.

Table 6.3.4

50 Hz - 380-415V or 220-240V mains power supply					MOTOR CONNECTION	
A \ B	VC	VP1	VP2	VP3	Single phase	Three phase
* 5						Δ
* 6						Δ

Table 6.3.5

60 Hz - 400-460V or 220-240V mains power supply					MOTOR CONNECTION	
A \ B	VC	VP1	VP2	VP3	Single phase	Three phase
* 7						Δ
* 8						Δ

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

6.3.6 - V/F programmable curves extension

When bit A of switch 1 (F28) is set to 0, special V/F curves can be programmed.

```
┌─────────────────────────────────┐
│ V F Z - VC          060 - 060   │
└─────────────────────────────────┘
    └┘ └─┘             └─┘ └─┘
    a   b               c   d
    └─> Initial cursor  └───────┘
        position            z
```
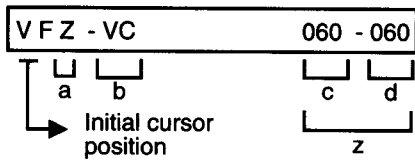
Move the cursor using $\boxed{\triangleright}$ to change Z in field **a**.

Set the part **b** to select the curve shape VC - VP1 - VP2 - VP3 using keys $\boxed{\triangle}$ or $\boxed{\triangledown}$

Set the part (Z) using keys $\boxed{\triangle}$ or $\boxed{\triangledown}$

c = 30 to 240 Hz
d = 30 to 360 Hz. with c ≤ d
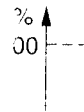
B A (Z)	VC	VP1	VP2	VP3

IMPORTANT

This characteristic (Z) imposes the use of a motor with particular electrical and mechanical characteristics (consult LEROY-SOMER).

1) Modification of the base frequency (c) causes a considerable variation in flux in the motor which can be over-saturated (value of (c) too small) or under-saturated (value of (c) too big).

2) The maximum frequency (d) can be adjusted up to 360 Hz which corresponds to more than 7 times the speed of a standard motor.
Ensure that mechanically the motor can withstand this value.

(F01) - ACCELERATION TIME No 1

Time necessary for frequency to increase from 0 to the maximum frequency of V/F curve when the 2 CH contact is open.

```
ACCEL - 1   0   0 2 0 . 0 S
```

└──► Initial cursor position
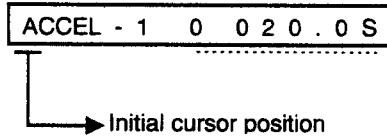
- Setting range from 0.1 to 2999.9 s
- In steps of 0,1 s

Move the cursor onto the dashes using [▷]
Set the acceleration time using [△] or [▽]

Other possibility see **(F18)**.

(F02) - DECELERATION TIME No 1

Time necessary for frequency to decrease from max frequency of V/F curve to 0 when the 2 CH contact is open.

```
DECEL - 1   0 0 2 0 . 0   S
```

└──► Initial cursor position
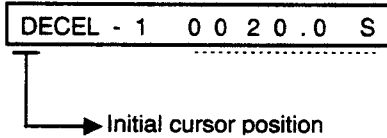
- Setting range from 0.1 to 2999.9 s
- In steps of 0,1 s

Move the cursor onto the dashes using [▷]
Set the deceleration time using [△] or [▽]

Other possibility see **(F19)**.

(F03) - MAXIMUM FREQUENCY ADJUSTMENT

Used to increase the frequency range selected.

```
F max -     0 0 0 . 0   Hz
```

└──► Initial cursor position
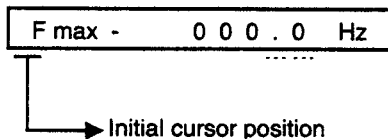
- Setting range from 0.00 to 15.0 Hz
- In steps of 0.1 Hz

Move the cursor onto the dashes using [▷]
Set the frequency range using [△] or [▽]
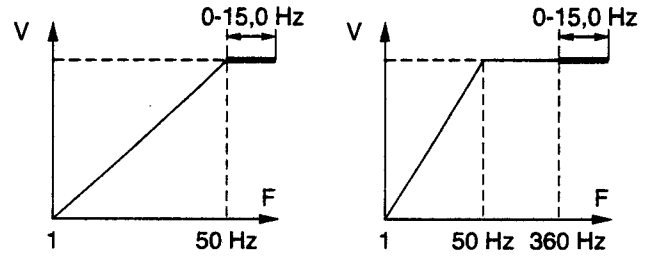
E.g. : Range of 1 to 50 Hz

E.g. : Range of 1-50-360 Hz

(F04) - STARTING FREQUENCY ADJUSTMENT

Allows setting of the minimum starting frequency between 0.5 and 5 Hz.

```
F min       0 0 0 . 5   Hz
```

└──► Initial cursor position
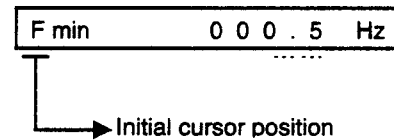
- Setting range from 0.5 to 5.0 Hz
- In steps of 0.1 Hz

Move the cursor onto the dashes using [▷]
Set the frequency using [△] or [▽]
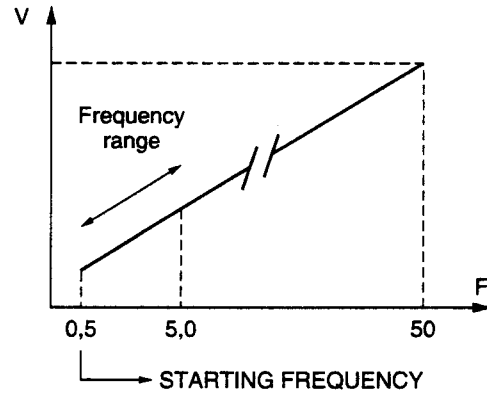
(F05) - UPPER FREQUENCY LIMITER

Limits the highest frequency during operation.

```
H - LIM - F    0 0 0 . 0 HZ
```

└──► Initial cursor position
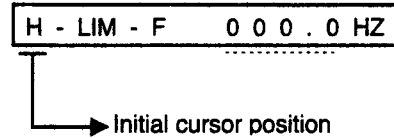
- Setting range : from lower frequency limiter **(F06)** to the maximum frequency V/F curve.
- In steps of 0.1 Hz

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.

LS *LEROY SOMER*

(F06) - LOWER FREQUENCY LIMITER

Limits the lowest frequency during operation.

```
L - LIM - F    0 0 0 . 0 HZ
```

➤ Initial cursor position

Setting range : from 0.5 Hz to upper frequency limiter (F05).
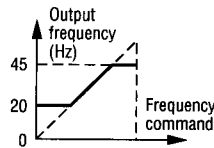
Move the cursor onto the dashes using ▷
Set the frequency using △ or ▽

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

(F07, F08, F09) - JUMP FREQUENCY

SETTINGS 1, 2 & 3

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.

```
JUMP - F1   0 0 0 . 0  Hz
        (F2)
        (F3)
```

➤ Initial cursor position

- Setting range : from lower to upper frequency limiters
- In steps of 0.1 Hz

Move the cursor onto the dashes using ▷
Set the frequency using △ or ▽

The value is set with a fixed pre-set jump of ±0,3 Hz.
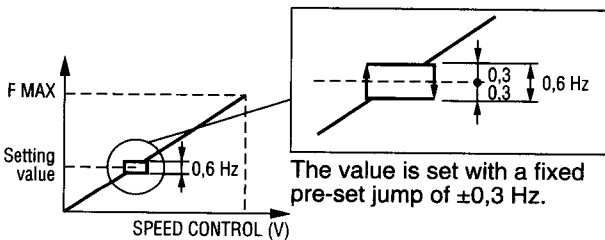
(F10) - MOTOR NOISE ADJUSTMENT

Alters the motor noise by changing the chopping frequency.

```
CF - code     <U>
```

➤ Initial cursor position

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

(F11) - FREQUENCY STOP TIME ADJUSTMENT AT START

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

```
Fstop - t    0  0 0 . 0  S
```

➤ Initial cursor position

- 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
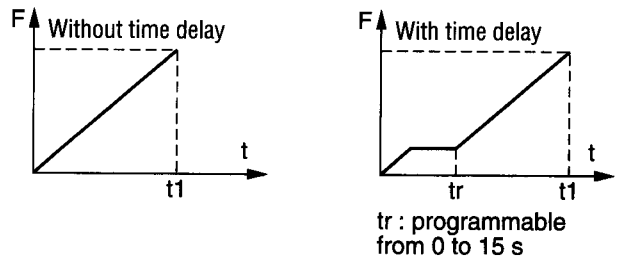
(F12, F13, F14) - MULTISTAGE SPEED SETTINGS

Gives choice of running speeds which are selected by terminals CF1, CF2, see page below.

(F12) - Speed 1

```
Speed - 1   0  0 0 . 0   Hz
```

➤ Initial cursor position

- Setting range : from (F06) to (F05)
- In steps of 0.1 Hz

(F13) - Speed 2

```
Speed - 2   0  0 0 . 0   Hz
```

➤ Initial cursor position

(F14) - Speed 3

```
Speed - 3   0  0 0 . 0   Hz
```

➤ Initial cursor position

Move the cursor onto the dashes using ▷
Set the frequency using △ or ▽

CF1	CF2	H	O	OI	L	FW	RV

SW2 SW1   SWF SWR
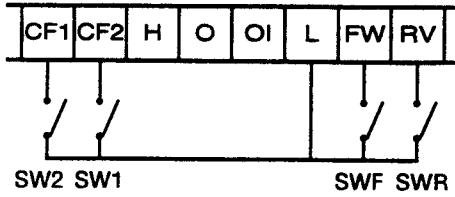
Note :

To obtain speed 4 :
- using operator panel command, enter in MON mode a frequency in FS.
- using terminal command, connect terminals H and O and use a potentiometer. (See §7).
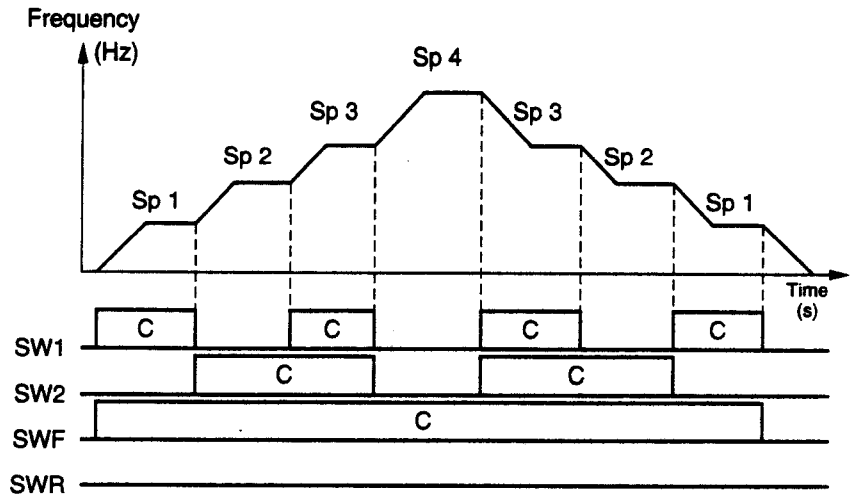
(F15, F16, F17) - MULTISTAGE SPEED EXTENSION

• When using the extra 3 speeds ; the jogging function cannot be used.

• To use extra speeds 4-5-6 bit B of switch 2 **(F29)** must be set to 1.

JG	CF1	CF2	H	O	OI	L	FW	RV

(setting : FS)

SWJ SW1 SW2   SWF SWR
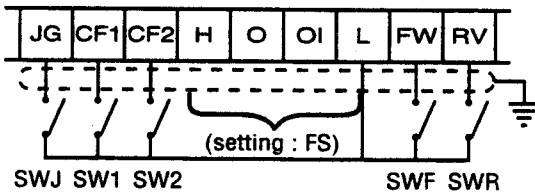
	Terminal			Frequency setting
Speed	CF1 / SW1	CF2 / SW2	JG / SWJ	
Sp 1	C	-		Speed setting 1 (1S)
Sp 2	-	C	-	Speed setting 2 (2S)
Sp 3	C	C		Speed setting 3 (3S)
Sp 4	C	-		Speed setting 4 (4S)
Sp 5	~~-~~	~~C~~		~~Speed setting 5 (5S)~~
Sp 6	C	C	C	Speed setting 6 (6S)
Sp 7	-	-		Jog speed setting Mode MON 9
Sp 8	-	-		Frequency reference from terminal or operation panel according to F.SET - M MON mode
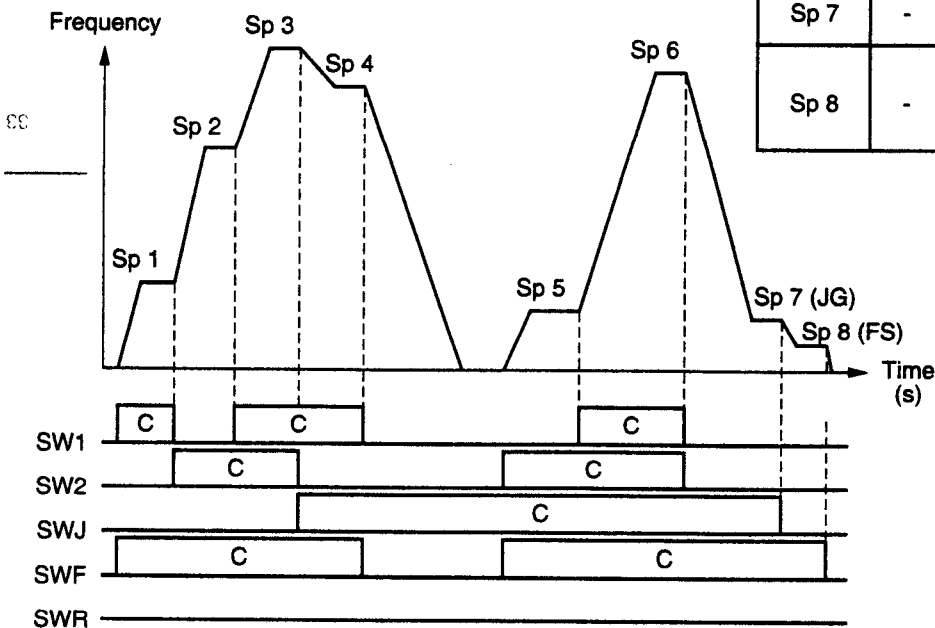
C = Closed

LEROY SOMER

(F18) - ACCELERATION TIME No 2

Time necessary for frequency to increase from 0 to the maximum frequency of V/F curve when the 2 CH contact is closed.

```
ACCEL - 2        0020.0S
```
└──▶ Initial cursor position
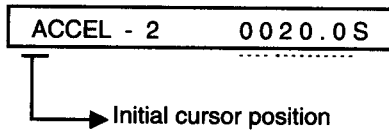
- Setting range from 0.1 to 2999.9 s.
- In steps of 0.1 s.

Move the cursor onto the dashes using ▷
Set the acceleration time using △ or ▽

Other possibility see (F01).

(F19) - DECELERATION TIME No 2

Time necessary for frequency to decrease from max frequency of V/F curve to 0 when the 2 CH contact is closed.

```
DECEL - 2        0020.0S
```
└──▶ Initial cursor position
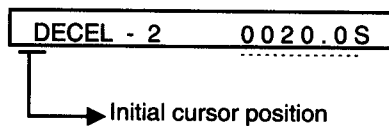
- Setting range from 0.1 to 2999.9 s.
- In steps of 0.1 s.

Move the cursor onto the dashes using ▷
Set the deceleration time using △ or ▽

Other possibility see (F02).
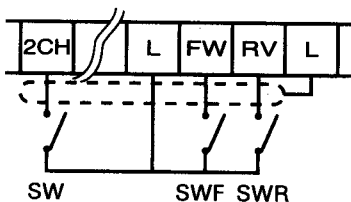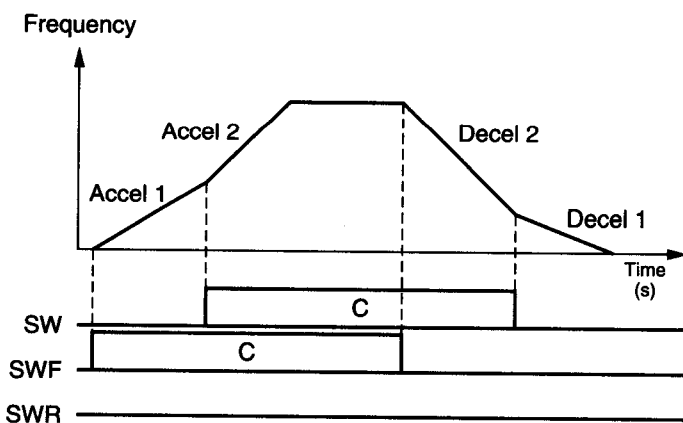
Contact 2CH - L

Open	ACCEL 1 - DECEL 1 Time
Closed	ACCEL 2 - DECEL 2 Time

(F20) - AUTOMATIC DC BRAKING FREQUENCY ADJUSTMENT

After stop command controller follows deceleration ramp until frequency (F20) this sets the output frequency at which DC braking then automatically starts.

Automatic braking is enabled when the bit B of switch 1 (F28) is set to 1.

```
F - DCB        00 1 . 0 Hz
```
└──▶ Initial cursor position
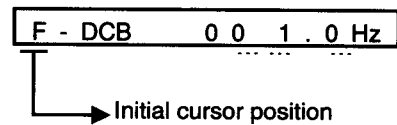
Setting range 0.5 to 375 Hz
In steps of 0.1 Hz

Move the cursor onto the dashes using ▷
Set the frequency using △ or ▽

(F21) - DC BRAKING VOLTAGE ADJUSTMENT

Sets the DC braking voltage and thus the braking torque.

```
V - DCB        0 1 0 .
```
└──▶ Initial cursor position
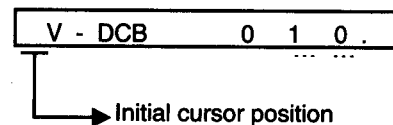
Setting range 0 to 20
In steps of 1

Move the cursor onto the dashes using ▷
Set the braking voltage using △ or ▽

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

(F22) - DC BRAKING TIME ADJUSTMENT

Allows programming of the duration of the injection of DC current after the end of the deceleration ramp.

```
T - DCB        0 0 5 . 0 S
      └──────► Initial cursor position
```

- Setting range from 0.1 to 600 s.
- In steps of 0.1 s.

Move the cursor onto the dashes using ▷
Set the braking time using △ or ▽
(*) When 000.0 s is set, DC braking operation is disabled.

DC Braking table

	End of ramp braking	Stop command braking
Settings	F - DCB (F20) V - DCB (F21) T - DCB (F22) WT - DCB (F37)	V- DCB (F21) T - DCB (F22) WT - DCB (F37)
Enabling	Set part B of switch 1 to 1 (F28)	Option board IA - TW - K
Start of DC Braking	When output frequency reaches (F20) F-DCB setting	When DB-L contact is closed at any time

Caution

DC current induces a temperature rise of the motor windings. Do not set a braking time larger than 15s before checking that the motor can withstand it.
(We recommend use of the FMV motor protected with a thermal sensor).

(F23) - ELECTRONIC THERMAL RELAY ADJUSTMENT

Modifies the output current permitted by the controller in continuous operation. See part E of switch 2 (F29).

```
E - Therm        1 0 0 %
      └──────► Initial cursor position
```

- Setting range from 100 to 50 %
- In steps of 1 %

Move the cursor onto the dashes using ▷
Set the current using △ or ▽

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

(F24) - LINEAR OR S-CURVE ACCELERATION

```
ACCline              Linear
   └──────► Initial cursor position
```

Move the cursor onto the dashes using ▷
Set the linear or "S" code using △ or ▽

LINEAR ACCELERATION   S-CURVE ACCELERATION
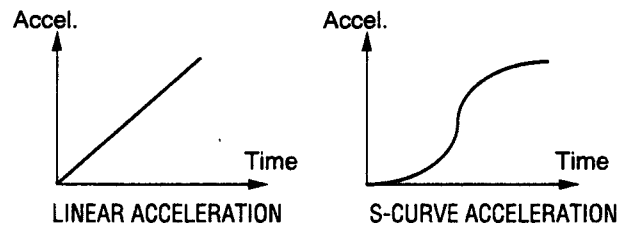
(F25) - LINEAR OR S-CURVE DECELERATION

```
DECline              Linear
   └──────► Initial cursor position
```

Move the cursor onto the dashes using ▷
Set the linear or "S" code using △ or ▽

LINEAR DECELERATION   S-CURVE DECELERATION

LEROY SOMER
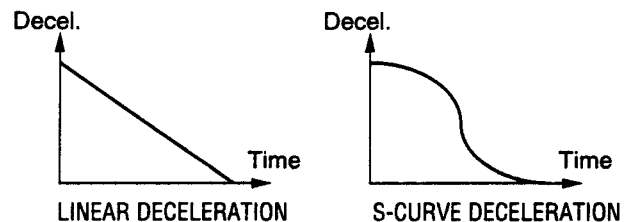
(F26, F27) - EXTERNAL FREQUENCY SETTING START AND END

For a command from the terminal.

F26 F Start

F START	00	0.0 Hz

F27 F End

F END	00	0.0 Hz

└──➤ Initial cursor position
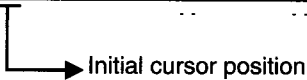
- Setting range from 000.5 to the maximum frequency of V/F pattern.

Move the cursor onto the dashes using ▷
Set the frequency using △ or ▽


```
Frequency
  (Hz)

Start                              End

Start                              End
                          Frequency
                          command

0 ------------------ 10 V
0 ------------------ 5 V
4 ------------------ 20 mA
```
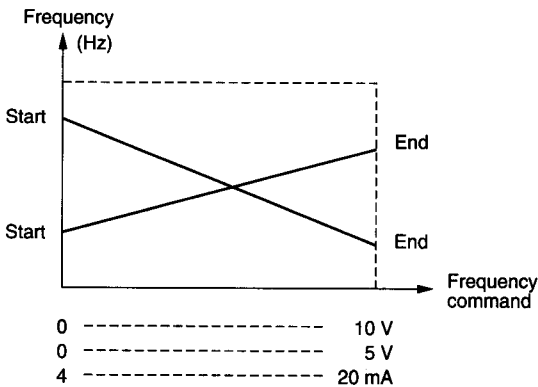
(F28) - SWITCH (1) SELECTION

SWITCH 1	0000 0 1 0 1

F E D C B A
Initial cursor position

Move the cursor onto the dashes using ▷
Select "0" or "1" using △ or ▽

Part A : 0...V/F (Z) characteristic see (F00).
: 1...Other pre-set V/F characteristics

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

Part C : 0...When using a digital frequencymeter.
: 1...When using a full-scale 0 - 10 VDC voltmeter.

Part D : 0...Overload is limited over the entire operating cycle.
: 1...Overload is not limited during acceleration.

Part E :	Restart after default trip (*)	Automatic restart after instantaneous power failure
00	NO	NO
01	NOT USED	
10	YES Flying start	YES Flying start
11	YES Flying restart	YES without flying restart (following ramp)

(*) Defaults : - Over-current
- Under-voltage
- Over-voltage

NOTES :

(1) Maximum of 3 automatic restarts every 10 mins.

(2) Delay of restart after default trip, see IP.s - RT (F36).

(3) Whilst waiting for an automatic restart, the main contactor must not be opened.

Part F : Selection of direction of rotation

	Forward(F)	Reverse (R)
00 or 11	possible	possible
01	possible	not possible
10	not possible	possible

(F29) - SWITCH (2) SELECTION

SWITCH 2	0 0 1 1 1 0 0 0

H G F E D C B A
Initial cursor position

Part A : "RUN" command during braking
: 0...The braking continues for the duration of T-DCB before the motor is restarted.
: 1...The braking is interrupted and the motor restarts.

Part B : Pre-set speeds
: 0...4 pre-set speeds [(F12) to (F14) + (reference)] and inching function (JOGGING) are possible.
: 1...8 pre-set speeds [(F12) to (F17) + reference + inching function (JOGGING)]
The inching function as a separate function is no longer useable.

Part C : When the method of control (MON 3) is via the terminals (Terminal).
: 0...STOP key on keypad is active.
: 1...STOP key on keypad is inactive.

Part D : Set to 1 (do not modify).

Part E : Adaptation of electronic thermal relay to the motor.

Output current

100 %
80 % Part E = 1
50 % Part E = 0

20 Hz   60 Hz   120 Hz   Output frequency
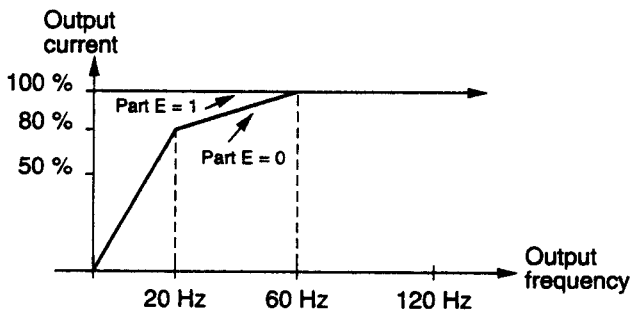
USE
Part E : 0...for a standard, self-ventilated motor (poor cooling at low speed).
: 1...for a motor :
- which is standard with forced-ventilation or LS FMV motor which is adapted for variable frequency applications.

Part F : Selection of torque amplification at low speed (BOOST - MON 7).
• 0...Boost reduced by about 30%
• 1...Boost normal.

Note : Above 10 kW, it is preferable to select 0.

Part G : Selection of restart mode after a reset (RESET).
0...restart at the beginning of the acceleration ramp.
1...restart at the speed of the motor (flying start). Do not open the line contactor for this operation.

Part H : Validation of frequency adjustment via the keypad (FS MON 1) when the cursor is locked (micro-switch LOCK-ON).
0...Adjustment impossible.
1...Adjustment possible.

(F30) - OVERLOAD LIMIT SENSITIVITY SETTING

LM. CONS   0 0 0 1 . 0

→ Initial cursor position

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 § 5.4.2).

- To the left   : 50 to 80%
- In the middle   : 100%
- To the right   : 150%
(*) The limit is set on the basis of a rated controller current of 100 %.

I Motor (A)   Limit set using potentiometer
OL-LMT
Time

F
High const. LM (30)
Low const. LM (0.3)
Time
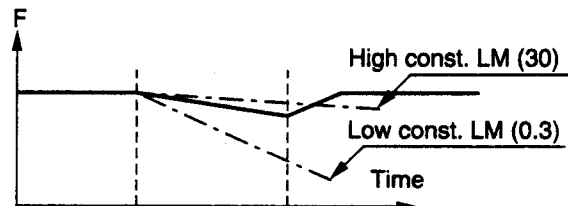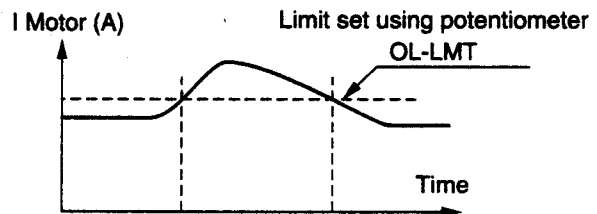
(F32) - AUTOMATIC TORQUE BOOST ADJUSTMENT
- Automatically increases the output voltage and thus motor torque during the acceleration phase.

V - auto   + 0 0

→ Initial cursor position

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.

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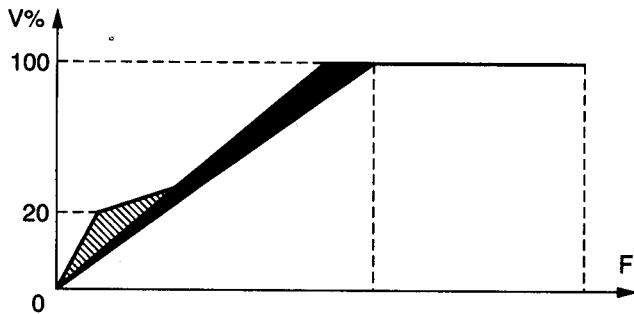
When automatic boost is used, voltage increases as shown by : ▬▬▬

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

(F36) - DELAY TIME SETTING FOR RESTART

Delay time setting for automatic motor restart after fault trip.

IP s - RT   0 0 0 0 . 3 S

└──► Initial cursor position
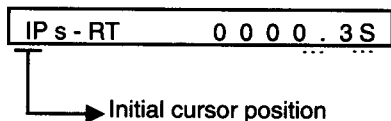
Setting range from 0.3 to 60s.
In steps of 0.1s.

Move the cursor onto the dashes using ▷
Set the time using △ or ▽

(F37) - DELAY BEFORE BRAKING

Delay the actual braking action. This function applies to both automatic braking and controlled braking and is used to avoid tripping due to over-current when the motor is running at high frequency.

W - T - DCB   0 0

└──► Initial cursor position
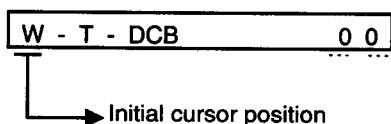
Setting range from 0 to 5s.
In steps of 0.1s.

Move the cursor onto the dashes using ▷
Set the time using △ or ▽

(F39) - ADJUSTMENT OF THE FREQUENCY REACHED THRESHOLD

This adjustment is for the logic signal available from the terminal AR (or the free voltage contact on the option board).
- For a 0 Hz setting, the AR signal becomes 27 VDC when the reference is reached.
- For a setting other than 0 Hz the AR signal becomes 27 VDC when the output frequency is greater than the programmed threshold.

SPD - ARV   0 0 0 . 0 Hz

└──► Initial cursor position
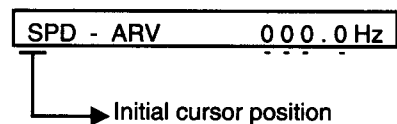
Setting range from 0.5 to 375 Hz.
In steps of 0.1Hz.

Move the cursor onto the dashes using ▷
Set the threshold using △ or ▽

7 - REMOTE INPUT/OUTPUT CONTROL SIGNALS

7.1 - Frequency setting signals
7.1.1 - Potentiometer

(10 V DC)

H   O   L

Shielded wire
L ≤ 20 m
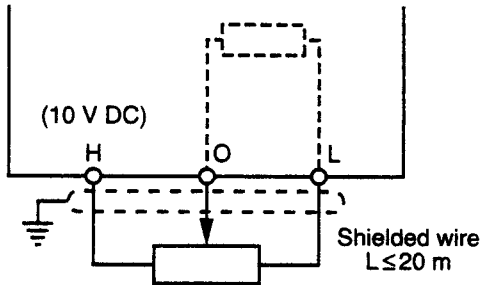
Linear potentiometer 0.47 to 2.2 kΩ

7.1.2 - Voltage signal

H   O   L

(+)   (−)

5 V / 10 V — 0-5 V DC : set 5 V by DIP SW
(*) Ze : 15 kΩ

5 V / 10 V — 0-10 V DC : set 10 V by DIP SW
(*) Ze : 30 kΩ

Shielded wire
L ≤ 20 m
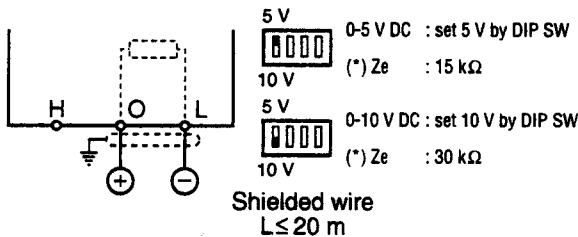
Note : Do not apply 12 VDC or more across terminals O and L.

(*) Ze = Input impedance

7.1.3 - Current signal

Ze = 250 Ω

OI   L

(+)   (−)

4 - 20 mA

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. Avoid opening SWRS while the motor is running freely (fault signal may be tripped).

RS   L
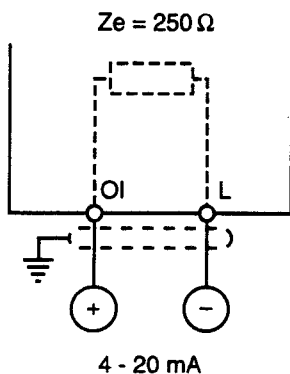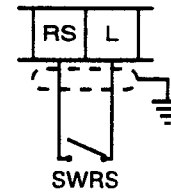
SWRS

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

When the SWRS contactor is opened :
the motor is restarted depending on the selection of Switch 2 **(F29)** part G.

G.... 0 the motor starts at the beginning of the ramp. If it was not at standstill, the controller brakes the motor before picking up the ramp.

G.... 1 the motor is restarted by a flying start.

7.3 - Jogging signal
Connection and sequencing diagram

COMMAND TERMINALS   OPERATION PANEL

JG | L |FW|RV   or   JG | L   +   FWD RUN | REV RUN

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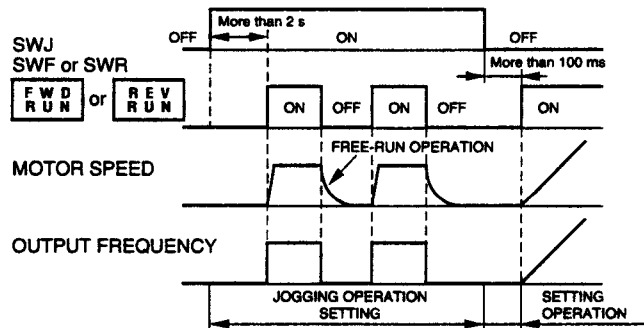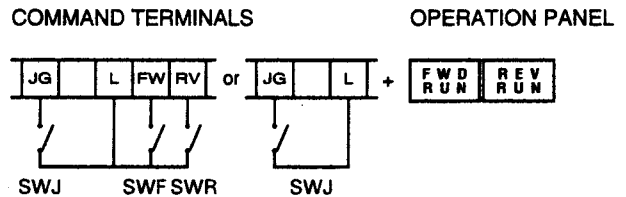
NOTE
Make sure that there is an interval of 100 ms or more when changing from jogging to normal operation.

LEROY SOMER

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.

COMMAND TERMINAL

7.5 - Frequency image signal (FM and L)
7.5.1 - Frequency signal for digital display unit

Input level : approximately 10 V
(F28) part C = 0
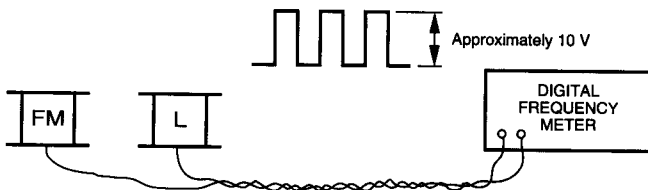
7.5.2 - Frequency signal for analogue voltmeter

(F28) part C = 1
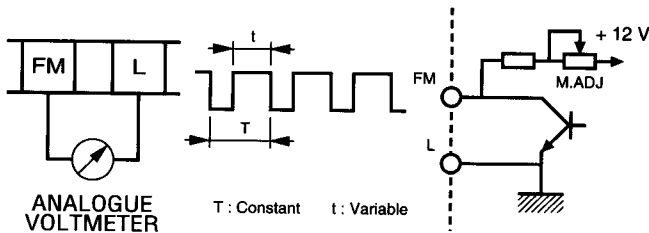
Full range : 0-10V, Ze : 10 to 22kΩ, 1mA max

* Set full scale measurement using M.ADJ.
(see paragr. 5.4.2)

Conditions of use of analogue signal
- Internal resistance (Ri) of voltmeter.
  Ri should be between 10 and 22 kΩ, if Ri is greater, put a 22 kΩ resistance in parallel with terminals FM and L.
- The connection of a filter on terminals FM and L is often needed when using the analogue signal. The filter values for a voltmeter with external resistance
  Ri ≥ 20 kΩ are :
- R1 22 kΩ
- R2 2,2 kΩ
- C1 4,7μF to 10μF.

Filter

7.6 - Fault alarm relay (AL0, AL1, AL2)

POWER SUPPLY	COMMAND	AL0 - AL1	AL0 - AL2
ON	NORMAL	ON	OFF
ON	FAULT	OFF	ON
OFF	-	OFF	ON
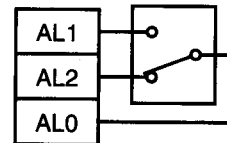
7.7 - Logic output signals AR and RUN

Signals 0/27 VDC - 50 mA, compatible with most PLCs.
This information is available on the option board IA-TWK via free voltage contacts see §8.

8 - OPTION BOARD LS FMV 2303 IA TW K

8.1 - Presentation

Option board IA TWK used in conjunction with controller LS FMV 2303 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 reached signal (relay output).

8.2 - Installation

Option board IA TWK is mounted directly on the main controller board via the connector and the two spacers (Fig. 8.1).
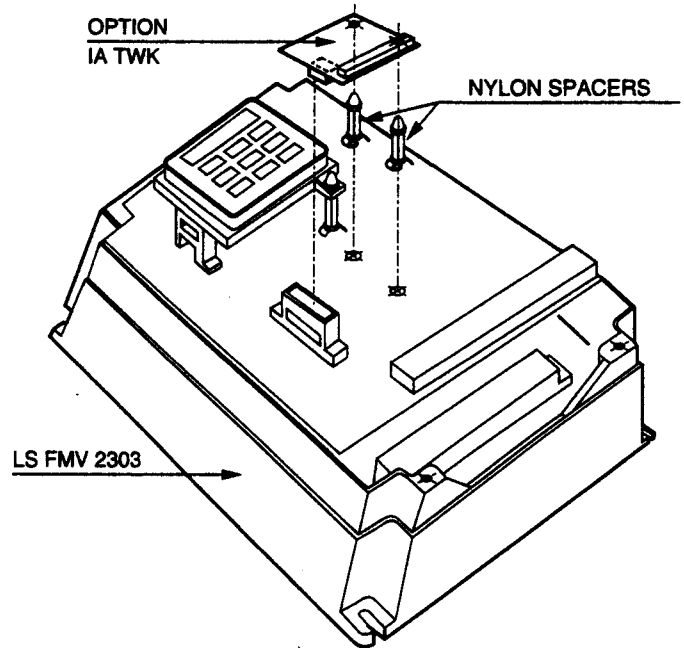
Fig. 8.1

8.3 - Connections
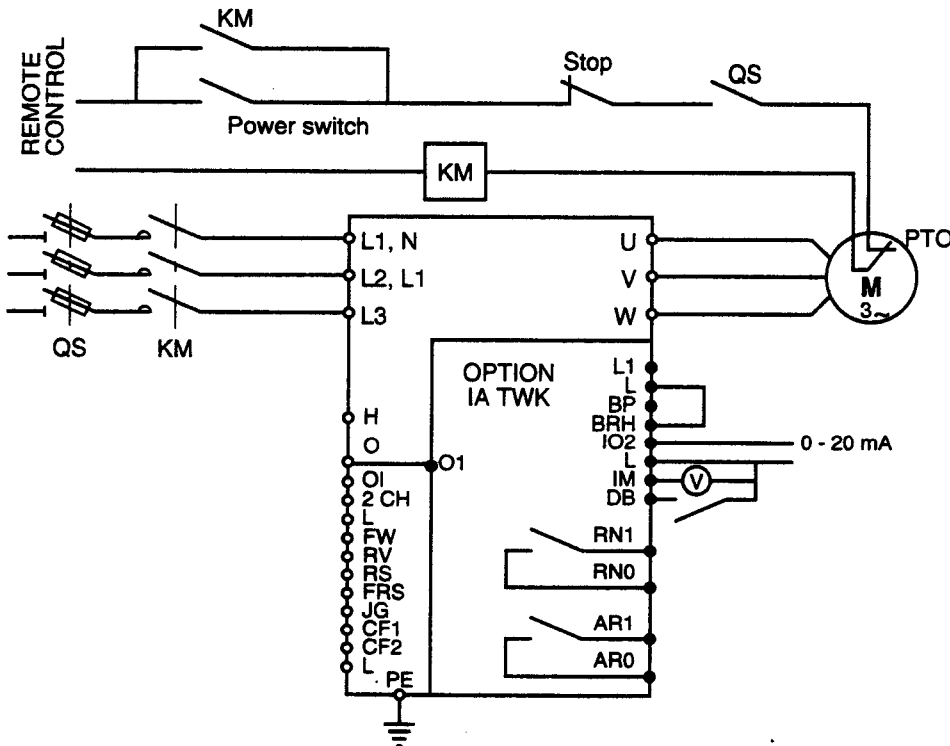
8.4 - Terminal functions

FUNCTION	TERMINALS	USE
Frequency setting via 0 - 20 mA current signal	IO2 - L 01 - 0	• Connect option board terminal 01 to terminal 0 on LS FMV 2303 main board. • Apply current setting of 0 - 20 mA across IO2 • (+ terminal) and L (- terminal)
External DC braking control Set part B of function (F28) to 1 on controller 00 000 1 1 1 (B)	DB- L	• 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.

Function N°	Function name	Setting range	Factory setting
F20	Frequency of DC braking operation	0,5 Hz to 15 Hz	1 Hz
F21	DC braking power	0 to 20	0
F22	Duration of DC braking after stop	0 to 600 s	0

FUNCTION	TERMINALS	USE
Controller output current signal	IM-L	• Output voltage proportional to controller output current. • Reading 0 to 4 V DC (5mA max 4V DC) corresponds to I_N of controller. • Accuracy ± 10 %.
Motor operation signal	RNO-RN1	Switch is closed when controller is running.
Frequency reached signal	ARO-AR1	Contact is open when frequency reference or programmed frequency is reached, see (F39).

8.5 - State diagram
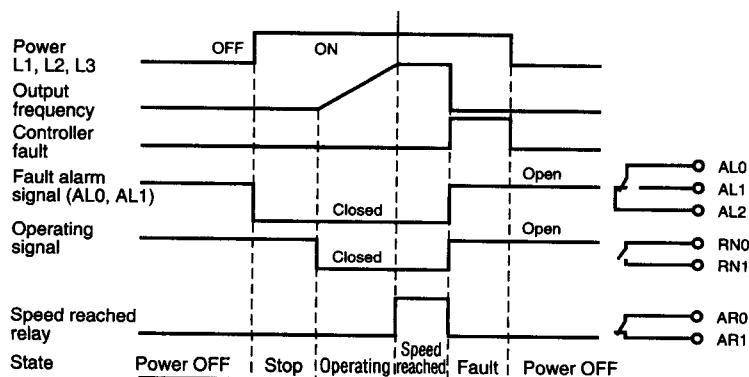
Switch specification : see § 3.7.2

9 - OPERATING EXTENSIONS

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

These boards are optional and need to be ordered separately.

9.1 - List of extension boards

1 - The IA TWK board that can be incorporated in the controller itself combines 5 functions.

2 - Dynamic braking units with resistors
- R 100 M
- R 200 T
- R 400 T
- R 800 T

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

4 - 1274 Board : Speed regulation by a.c. or d.c. tachogenerator.
The following FMV 2303 functions cannot be used with the 1274 board :
- Frequency command from the panel (terminal only).
- Multistage speed settings.
- Jogging operation.
- Jump frequency settings.
- Upper and lower frequency limiter (use the settings on the 1274 board).

5 - 1275 Board : Automatic electromechanical brake control.

6 - 1276 Board : Galvanic insulation module.

7 - 1278 Board : Voltage to current conversion.

8 - 1415 Board : Automatic current-controlled speed setting.

9 - 1333 Board : Simultaneous control of several controllers.

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

11 - 1368 Board : Reversal of direction of rotation by ± 10V signal.

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

13 - Chokes

14 - CD - FMV Remote control console
Allows all the keypad operations of the FMV 2303 to be carried out remotely (via cable link).

15 - CO - FMV Remote control and copy console
As well as the CD. FMV console functions, it is possible to transfer program information from one FMV 2303 to another or several other FMV 2303 via the "COPY" function.

16 - CS - FMV Serial communication console
Allows communication between the FMV 2303 and most computer or logic systems via RS 232 or RS 485 serial links.

10 - CONTROLLER MAINTENANCE AND CHECKING

10.1 - 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 remote control** (with key).

Furthermore, 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 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 2303 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.

10.2 - 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 name plate.
Printed circuits and their components normally do not require any maintenance. Contact 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 normal lifetime of components).
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.

10.3 - Measurement of motor voltage and current
10.3.1 - 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 be obtained using a conventional DC moving-coil voltmeter in the configuration shown below.

DIODES
- 600 V - 0.1 A or more (single-phase FMV 2303)
- 1000 V - 0,1 A or more (three-phase FMV 2303)

RMS voltage = DC voltage x 1,1

Fig. 10.1
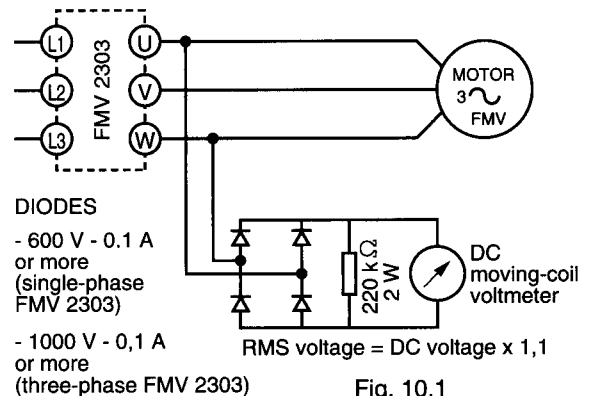
10.3.2 - Measurement of controller output voltage without load
Under no load conditions, DC voltage will develop on terminals U.V.W. due to the leak current (approx. 2 mA) of a semi-conductor even when the output frequency command is set to 0. Make connections as shown in fig. 10.2 to prevent meter indication errors.

DIODES
- 600 V - 0,1 A or more (single-phase FMV 2303)
- 1000 V - 0,1 A or more (three-phase FMV 2303)

RMS voltage = DC voltage x 1,1

Fig. 10.2
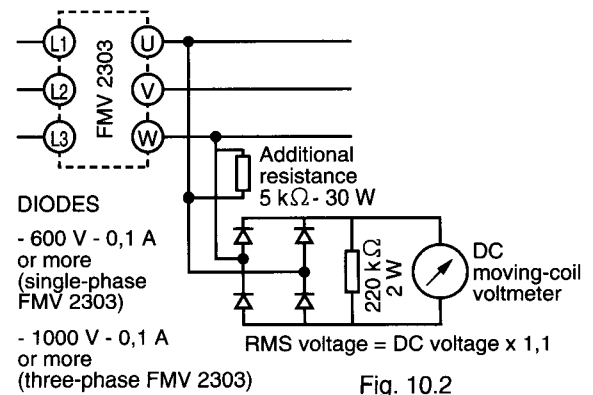
10.3.3 - Motor current measurement

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

10.3.4 - Controller input and output power measurement

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

10.4 - 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 condition of the basic command modules, which may have been damaged as a result of damage to power stages.

Figure 10.3 below shows a general circuit diagram of the controller's transistorized inverter.
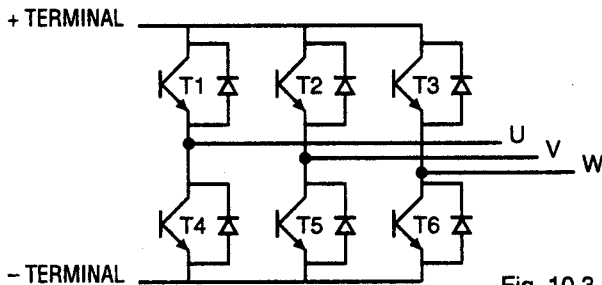
Fig. 10.3

Testing can be performed at two levels :

10.4.1 - 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 U, V, W, +, and - on the power circuit terminal strip.
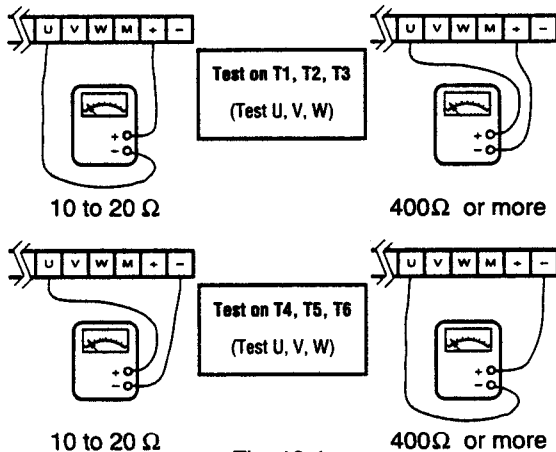
Fig. 10.4

10.4.2 - 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 10.5 below.

When replacing power modules, apply silicon grease to improve thermal conduction on module cooling surfaces.
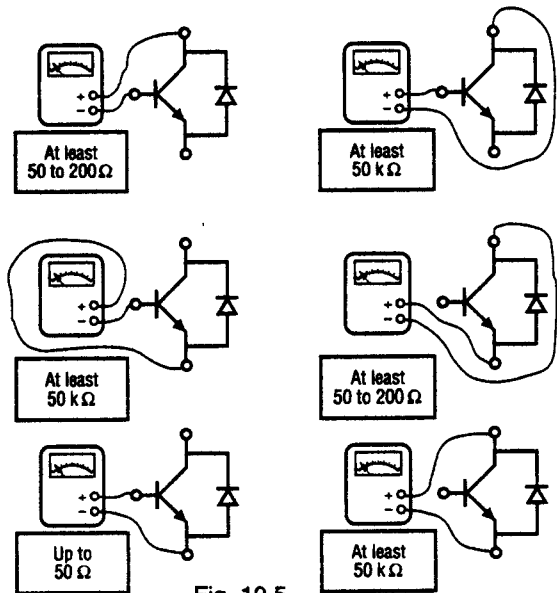
Fig. 10.5

10.5 - Controller insulation and withstand voltage tests

10.5.1 - 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.

10.5.2 - Controller insulation tests

Short-circuit all power terminals on strip except terminal PE (ground), as indicated in figure 10.6 below. Use a megohmmeter to measure resistance between these terminals and ground. This resistance should be at least 5M Ω.

LEROY SOMER

L1 L2 L3 U V W + ... −

5 MΩ Megohmeter

Single-phase
1,5 M to 3,5 M

L1 L2 L3 U V W + M −

5 MΩ Megohmeter

Three-phase
FROM 2,5 T
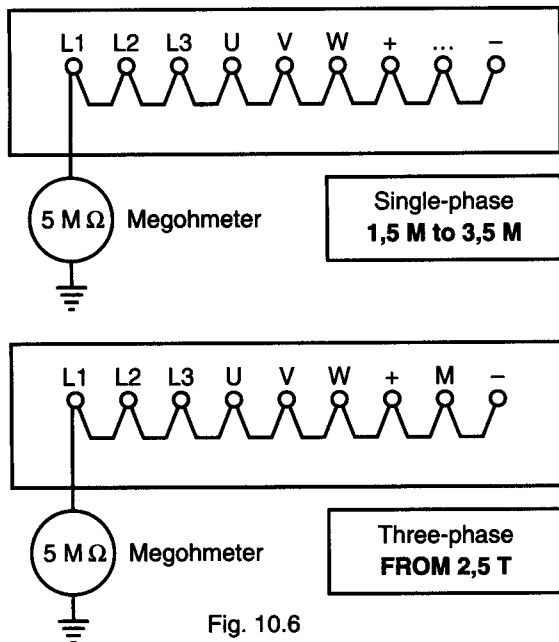
Fig. 10.6

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

10.5.3 - Controller withstand voltage tests

Apply an AC voltage between earth and the power terminal strip short-circuited as in figure 10.6 for one minute.

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

• 380, 400, 415, 440, 460V 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.

11 - TROUBLE SHOOTING

11.1 - Controller fault messages and symptoms

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

FAULT MESSAGES AND SYMPTOMS					CAUSE OF FAULT (MESSAGE CONTENTS)	RESET	CHECK POINTS	SUGGESTED REMEDY
QS Circuit-breaker	Electromagnetic Contactor KM	Motor PTO	LCD DISPLAY ERROR ▨	Fault alarm relay				
			OVER V. ○		DC smoothing circuit overvoltage	A	Check for sudden deceleration	Program a longer deceleration time
							Check that motor is not driven 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 phases or defective 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 is to run under very light load, decrease the value of V. GAIN (mode MON)

Table 11.1.1

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FAULT MESSAGES AND SYMPTOMS					CAUSE OF FAULT (MESSAGE CONTENTS)	RESET	CHECK POINTS	SUGGESTED REMEDY
QS Circuit-breaker	Electromagnetic Contactor KM	Motor PTO	LCD DISPLAY ERROR ▨	Fault alarm relay				
			O.C. Decel	◯	Overcurrent during deceleration	A	Check for sudden deceleration	Program a longer deceleration time
							Check for short-circuit between phases or defective 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 phases or defective 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
			OVER C	◯	Overcurrent just after power on	A	Current detector fault ?	Return controller for repair

Table 11.1.2

FAULT MESSAGES AND SYMPTOMS					CAUSE OF FAULT (MESSAGE CONTENTS)	RESET	CHECK POINTS	SUGGESTED REMEDY
QS Circuit-breaker	Electromagnetic Contactor KM	Motor PTO	LCD DISPLAY ERROR	Fault alarm relay				
			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	Replace QS and KM
			CPU	○	CPU error	A	Check that there are no sources of interference near controller	Remove all sources of interference from controller
							Is controller unit defective ?	Replace board
6▽			GND - FLT	○	Ground fault (NOTE 1)	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
			BOO number	○	Invalid data in soft memory	-	Check the number of times daily new data is stored (limit 10 000)	Replace the memory
			Adjust ⌐ ⌐ ⌐ S ↑number	- ∶ ●	The display does not indicate a fault	-	-	-

. Table 11.1.3

FAULT MESSAGES AND SYMPTOMS					CAUSE OF FAULT (MESSAGE CONTENTS)	RESET	CHECK POINTS	SUGGESTED REMEDY
QS Circuit-breaker	Electromagnetic Contactor KM	Motor PTO	LCD DISPLAY ERROR ▨	Fault alarm relay				
			UV-WAIT	O	Under-voltage	B	Input voltage below 100 V	Check power source
O			—	—	—	B	Check for short-circuit between phases or defective ground at input	Repair input cable
							Check that controller is not defective	Repair controller
	O		POWER OFF (NOTE 2)	—	Power failure	B	Check for power failure	Repair power source
							Check for poor continuity within KM command	Check KM continuity and coil
		O	—	—	—	C	Check for motor overload Check that ambient temperature is not too high (over 50°)	Reduce motor load. Wait for motor to cool

Table 11.1.4

11.2 - 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 sensors to close.

NOTE 1 : Effective up to power of 22 kVA.

NOTE 2 : POWER OFF - indication is displayed for a few seconds after a power failure then disappears.

11.3 - Troubleshooting flowcharts
11.3.1 - The motor does not function

```
┌─────────────────────────┐           ┌──────────────────────────────────┐
│ Is rated voltage        │    NO      │ - QS and KM have been tripped    │
│ applied ?               │──────────▶ │   or have failed.                │
│ (supply terminals       │            │ - CONTROLLER tripped             │
│ L1, N/L1, L2, L3)       │            │ - Power failure                  │
└─────────────────────────┘           └──────────────────────────────────┘
            │ YES
            ▼
┌─────────────────────────┐    YES     ┌──────────────────────────────────┐
│ Is ERROR displayed ?    │──────────▶ │ See fault message table          │
└─────────────────────────┘            │ and corresponding                │
            │                          │ diagnostic.                      │
            │ NO                       └──────────────────────────────────┘
            ▼
┌─────────────────────────┐            ┌──────────────────────────────────┐
│ Is MONITOR MODE         │            │ Set MONITOR MODE with            │
│ displayed ?             │    NO       │ ┌─────┐      ┌──────────────────┐│
│                         │──────────▶ │ │ MON │ Key. │ FS000.0[ ]000.0Hz││
│ ┌─────────────────────┐ │            │ └─────┘      └──────────────────┘│
│ │ FS000.0[ ]000.0Hz   │ │            │ Motor cannot start up until      │
│ └─────────────────────┘ │            │ MONITOR MODE has been set        │
└─────────────────────────┘            └──────────────────────────────────┘
            │ YES
            ▼
┌─────────────────────────┐    NO      ┌──────────────────────┐   NO    ┌──────────────────────┐
│ Is FR/SW in MONITOR MODE│──────────▶ │ Are (FW-L) or (RV-L) │───────▶ │ Close one or the other│
│ set to "Ope-key" ?      │            │ on the board closed ?│         └──────────────────────┘
└─────────────────────────┘            └──────────────────────┘
            │ YES             YES              │ YES
            │◀──────────────────────────────────┘
            ▼
┌─────────────────────────┐    NO      ┌──────────────────────┐   NO    ┌──────────────────────┐
│ Is F-SET M in MONITOR   │──────────▶ │ Is there 10 V DC     │───────▶ │ CONTROLLER           │
│ MODE set to "Ope-key" ? │            │ between terminals H  │         │ failure or frequency │
└─────────────────────────┘            │ and L on the board ? │         │ setting error        │
            │                          └──────────────────────┘         └──────────────────────┘
            │ YES                              │ YES
            │                                  ▼
            │                       ┌──────────────────────┐   NO    ┌──────────────────────┐
            │                       │ Does the voltage     │───────▶ │ Frequency setting    │
            ▼                       │ between terminals H  │         │ error or speed       │
┌─────────────────────────┐        │ and L on the board   │  YES    │ setting signal       │
│ Is ouput frequency      │        │ vary from 0 to 10V DC?│◀────────│ source faulty        │
│ set by "FS" in          │   NO    └──────────────────────┘         └──────────────────────┘
│ MONITOR MODE ?          │──────▶ ┌──────────────────────┐
└─────────────────────────┘        │ Set output frequency.│
            │ YES                  └──────────────────────┘
            │◀───────────────────────────┘
            ▼
┌─────────────────────────┐    NO      ┌──────────────────────┐
│ Is free-run stop switch │──────────▶ │ Close FRS-L switch.  │
│ (FRS-L) closed and reset│            │ Open RS-L switch.    │
│ switch (RS-L) open ?    │            └──────────────────────┘
└─────────────────────────┘
            │ YES
            ▼
┌─────────────────────────┐    NO      ┌──────────────────────┐
│ Is output voltage       │──────────▶ │ CONTROLLER failure.  │
│ applied to output supply│            └──────────────────────┘
│ terminals (U, V, W) ?   │
└─────────────────────────┘
            │ YES
            ▼
┌─────────────────────────┐    YES     ┌──────────────────────┐
│ Is output voltage       │──────────▶ │ Motor failure.       │
│ applied to motor        │            └──────────────────────┘
│ terminals ?             │
└─────────────────────────┘
            │ NO
            ▼
┌─────────────────────────┐
│ Wiring fault between    │
│ CONTROLLER and motor.   │
└─────────────────────────┘
```

Table 11.3.1

11.3.2 - Motor does not accelerate

```
Is F-SET-M in MONITOR MODE          YES      Is "FS" in MONITOR MODE         NO
set to "Ope-key" ?         ────────────►     correctly set ?       ──────────────►    Set correctly.
        │
        │ NO                                          │
        ▼                                             ▼
Is F/R-SW in MONITOR MODE                    Is "H-LIM-F" preset value         NO
set to "Ope-key" ?         ─────YES───►      higher than "FS" preset value ?  ─────►   Set H-LIM-F
                                                                                       correctly.
        │                                                               YES
        │ NO
        ▼
Is voltage applied between          NO       CONTROLLER failure or
board terminals O and L normal ?  ────────►  frequency setting error.
        │
        │ YES
        ▼
Are switches CF1-L and CF2-L        NO       Open switches or set
both open ?                       ────────►  "Speed-1" to "Speed-3
                                             in FUNCTION MODE correctly.
        │
        │ YES
        ▼
Is switch JG-L on board open ?      NO       Open switch.
                                  ────────►
        │
        │ YES
        ▼
Is VF1-VC in MONITOR MODE           NO       Set correctly.
correctly set ?                   ────────►
        │
        │ YES
        ▼
Is F-END preset value in            NO       Set F-END correctly.
FUNCTION MODE  higher than        ────────►
VF1-VC preset value ?
        │
        │ YES
        ▼
                                    YES      Reduce load or increase
Is load too great  ?              ────────►  current overload limit
                                             level using potentiometer
                                             "OL-LMT".
        │
        │ NO
        ▼
Is acceleration time                YES      Program a longer time and lengthen
too short for magnitude           ────────►  stop time F (F-stop-T),
of load ?                                    or set current overload limit level
                                             using potentiometer "OL-LMT".
        │
        │ NO
        ▼
CONTROLLER failure.
```

Table 11.3.2

11.3.3 - Motor speed too high

```
┌─────────────────────────┐  NO   ┌─────────────────────────┐
│ Is VF1-VC in FUNCTION   │ ────► │ Set correctly.          │
│ MODE correctly set ?    │       │                         │
└─────────────────────────┘       └─────────────────────────┘
           │ YES
           ▼
┌─────────────────────────┐  NO   ┌─────────────────────────┐
│ Is Fmax in MONITOR MODE │ ────► │ Set correctly.          │
│ correctly set ?         │       │                         │
└─────────────────────────┘       └─────────────────────────┘
           │ YES
           ▼
┌─────────────────────────┐       ┌─────────────────────────┐
│ CONTROLLER failure.     │       │ Table 11.3.3            │
└─────────────────────────┘       └─────────────────────────┘
```

11.4 - Locating causes of tripping
11.4.1 - Overcurrent trip
(OC.Accel, OC.Decel, OC.Drive)

```
┌─────────────────────────┐  YES  ┌─────────────────────────┐
│ Are output terminals    │ ────► │ Repair short-circuit.   │
│ (U, V, W) short-circuited ?     │                         │
└─────────────────────────┘       └─────────────────────────┘
           │ NO
           ▼
┌─────────────────────────┐  YES  ┌─────────────────────────┐
│ Is ground fault present ?│ ────► │ Repair ground fault.    │
└─────────────────────────┘       └─────────────────────────┘
           │ NO
           ▼
┌─────────────────────────┐  YES  ┌─────────────────────────┐
│ Is load too great ?     │ ────► │ Check that motor is not │
│                         │       │ jammed.                 │
│                         │       │ Reduce load or increase │
│                         │       │ CONTROLLER capacity(KVA)│
└─────────────────────────┘       └─────────────────────────┘
           │ NO
           ▼
┌─────────────────────────┐  YES  ┌─────────────────────────┐
│ Are acceleration/       │ ────► │ Program a longer time   │
│ deceleration times too  │       │ and lengthen Fstop time │
│ short for magnitude of  │       │ (Fstop-T).              │
│ load ?                  │       │                         │
└─────────────────────────┘       └─────────────────────────┘
           │ NO
           ▼
┌─────────────────────────┐  YES  ┌─────────────────────────┐
│ CONTROLLER failure.     │ ────► │ Short-circuit in power  │
│                         │       │ module. Contact your    │
│                         │       │ Service Department.     │
└─────────────────────────┘       └─────────────────────────┘
                                  ┌─────────────────────────┐
                                  │ Table 11.4.1            │
                                  └─────────────────────────┘
```

11.4.2 - Overload trip (Over. L)

```
┌─────────────────────────┐  NO   ┌─────────────────────────┐
│ Is thermoelectric       │ ────► │ Set correctly.          │
│ relay level set correctly ?     │                         │
└─────────────────────────┘       └─────────────────────────┘
           │ YES
           ▼
┌─────────────────────────┐  NO   ┌─────────────────────────┐
│ Is load too great ?     │ ────► │ Reduce load or increase │
│                         │       │ CONTROLLER capacity(KVA)│
└─────────────────────────┘       └─────────────────────────┘
           │ NO
           ▼
┌─────────────────────────┐       ┌─────────────────────────┐
│ CONTROLLER failure.     │       │ Table 11.4.2            │
└─────────────────────────┘       └─────────────────────────┘
```

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11.4.3 - Overvoltage trip (Over. V)

```
┌─────────────────────────┐  YES  ┌─────────────────────────┐
│ Is deceleration time too │──────▶│ Program a longer time or │
│ short for magnitude of   │       │ use regenerative braking │
│ load ?                   │       │ unit.                    │
└─────────────────────────┘       └─────────────────────────┘
            │ NO
            ▼
┌─────────────────────────┐
│ CONTROLLER failure.     │        ┌─────────────────┐
└─────────────────────────┘        │  Table 11.4.3   │
                                   └─────────────────┘
```

11.4.4 - Undervoltage trip (Under. V)

```
┌───────────────────────────────┐ YES ┌─────────────────────────┐
│ Is input voltage (L1, N/L1,    │────▶│ Review power source.    │
│ L2, L3) below standard voltage?│     │                         │
└───────────────────────────────┘     └─────────────────────────┘
            │ NO                                    ▲
            ▼                                       │
┌───────────────────────────────┐ YES              │
│ Does system power source supply│──────────────────┘
│ motors or compressors          │
│ requiring a high               │
│ start-up current ?             │
└───────────────────────────────┘
            │ NO
            ▼
┌───────────────────────────────┐ YES ┌─────────────────────────┐
│ Has mains supply voltage       │────▶│ Restart after reset.    │
│ already dropped significantly ?│     │                         │
└───────────────────────────────┘     └─────────────────────────┘
            │ NO
            ▼
┌───────────────────────────────┐ YES ┌─────────────────────────┐
│ Does electromagnetic contactor │────▶│ Replace electromagnetic │
│ on power supply side vibrate ? │     │ contactor.              │
└───────────────────────────────┘     └─────────────────────────┘
            │ NO
            ▼
┌───────────────────────────────┐
│ CONTROLLER failure.           │      ┌─────────────────┐
└───────────────────────────────┘      │  Table 11.4.4   │
                                       └─────────────────┘
```

11.4.5 - Instantaneous power failure trip (Under. V)

```
┌───────────────────────────────┐ NO  ┌─────────────────────────┐
│ Did instantaneous power failure│────▶│ Restart after reset.    │
│ take place for 0.3 sec or more?│     │                         │
└───────────────────────────────┘     └─────────────────────────┘
            │ NO
            ▼
┌───────────────────────────────┐ NO  ┌─────────────────────────┐
│ Is selection commutator        │────▶│ Program automatic       │
│ in FUNCTION MODE               │     │ restart function.       │
│ set to automatic restart ?    │     │                         │
└───────────────────────────────┘     └─────────────────────────┘
            │ YES
            ▼
┌───────────────────────────────┐
│ CONTROLLER failure.           │      ┌─────────────────┐
└───────────────────────────────┘      │  Table 11.4.5   │
                                       └─────────────────┘
```

11.4.6 - Fin overheat trip (OH. Fin) (3,5 kVA or more)

```
┌─────────────────────┐         ┌─────────────────────┐
│  Is CONTROLLER      │   NO    │  Replace cooling fan │
│  cooling fan         │ ──────▶ │  and resume operation.│
│  rotating ?          │         │                      │
└─────────────────────┘         └─────────────────────┘
         │ YES
         ▼
┌─────────────────────┐         ┌─────────────────────┐
│  Are the air inlet   │   YES   │  Remove obstructions.│
│  and outlets blocked ?│ ──────▶ │                      │
└─────────────────────┘         └─────────────────────┘
         │ NO
         ▼
┌─────────────────────┐         ┌─────────────────────┐
│  Is circulation of   │   YES   │  Remove obstructions.│
│  CONTROLLER          │ ──────▶ │                      │
│  cooling air blocked ?│         │                      │
└─────────────────────┘         └─────────────────────┘
         │ NO
         ▼
┌─────────────────────┐         ┌─────────────────────┐
│  Is ambient          │   YES   │  Check ventilation or│
│  temperature around  │ ──────▶ │  cooling around       │
│  the CONTROLLER higher│        │  controller.         │
│  than specified value ?│        │                      │
└─────────────────────┘         └─────────────────────┘
         │ NO
         ▼
┌─────────────────────┐              ┌──────────────────┐
│  CONTROLLER failure. │              │   Table 11.4.6   │
│                      │              │                  │
└─────────────────────┘              └──────────────────┘
```

LEROY-SOMER
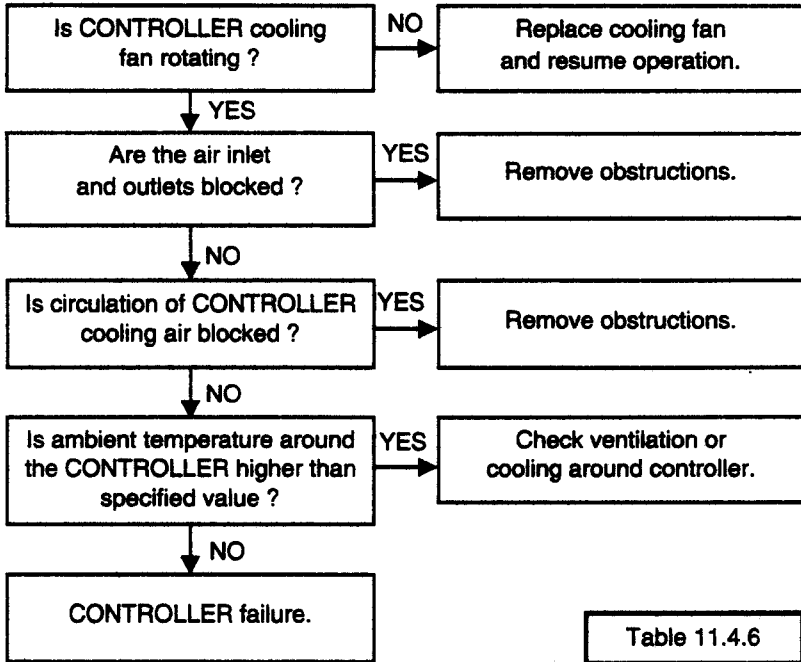
ANNEX

- Complete the last column of the table with your own settings, then detach this page to keep as a record.

FUNCTIONS			FACTORY SETTING	USER'S SETTINGS Date ....
DISPLAY		NAME		
F-00	VF1-VC	V/F pattern	-	
F-01	ACCEL-1	Acceleration time No 1	0020,0	
F-02	DECEL-1	Deceleration time No 1	0020,0	
F-03	+ F. Max	Additive maximum frequency adjustment	0	
F-04	F. Min	Starting frequency adjustment	000,5	
F-05	H-LIM-F	Upper frequency limiter	0	
F-06	L-LIM-F	Lower frequency limiter	0	
F-07	JUMP - F1	Jump frequency 1 setting	0	
F-08	JUMP - F2	Jump frequency 2 setting	0	
F-09	JUMP - F3	Jump frequency 3 setting	0	
F-10	CF - Code	Motor noise adjustment	U	
F-11	F stop - T	Frequency delay time adjustment at start	0	
F-12	Speed-1	Multistage speed 1 setting	0	
F-13	Speed-2	Multistage speed 2 setting	0	
F-14	Speed-3	Multistage speed 3 setting	0	
F-15	Speed-4	Multistage speed 4 setting	0	
F-16	Speed-5	Multistage speed 5 setting	0	
F-17	Speed-6	Multistage speed 6 setting	0	
F-18	ACCEL-2	Acceleration time No 2	0020,0	
F-19	DECEL-2	Deceleration time No 2	0020,0	
F-20	F-DCB	DC Braking frequency adjustment	001,0	
F-21	V-DCB	DC Braking voltage adjustment	010	
F-22	T-DCB	DC Braking time adjustment	005,0	
F-23	E-Therm	Electronic thermal relay adjustment	100	
F-24	ACCline	Linear or S curve acceleration	Linear	
F-25	DECline	Linear or S curve deceleration	Linear	
F-26	F-START	External frequency setting START	0	
F-27	F-END	External frequency setting END	0	
F-28	SWITCH 1	Switch 1 selection	-	
F-29	SWITCH 2	Switch 2 selection	-	
F-30	LM - CONS	Overload limit sensitivity setting	001,0	
F-32	V - auto	Automatic torque boost adjustment	0	
F-36	IPS - R - T	Delay time setting for restart	0001,0	
F-37	W - T - DCB	DC Braking delay time adjustment	0	
F-39	SPD - ARV	Frequency reached signal	0	