MOOG

DBM 033

Installation Manual

GB-4532 Rev.0 - Mar/99

DBM 033 - INSTALLATION MANUAL

Rev.	Date	Description	Updated Pages
0	Mar/99	Initial Release	

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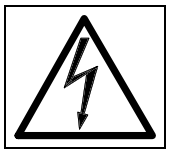
Introduction

This manual provides the necessary information for a proper installation and an effective use of DBM 033 Digital Drives in the possible different configurations.
The safety instructions provided in this Manual are included to prevent injury to personnel (WARNINGS) or damage to equipment (CAUTIONS).

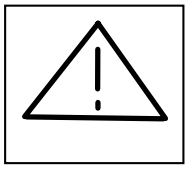
Accident Protection



***WARNING**: L+ and L- pins and Bus Bar's can have voltage ≥300Vdc even after switching off (capacitive voltage).*
High Voltage - Discharge Time approx. 6 Minutes.

***WARNING**: High Voltage. The recovery resistor is connected to the Bus Bar's and can have voltage ≥300Vdc.*

***WARNING**: do not touch recovery resistor during operation to avoid scalds.*



***CAUTION**: the drive should be located in an environment that is free from conductive pollution, dust, corroding fumes and fluids.*
In condensing atmospheres, the cabinet must be provided with an anti-condensation device.

***CAUTION**: when required for an emergency stop, opening U2-V2-W2 pins and closing motor phases to resistors, must be preceded by disabling the axis. The delay time must be at least 30 ms.*

***CAUTION**: it is recommended to disconnect the drive and the EMC filters to carry out the "AC Voltage Test" of the EN 60204-1 (par.20.4), according to the Machinery Directive (89/392/EEC) and to the Low Voltage Directive (73/23/EEC).*

***CAUTION**: the recovery resistor cable provided in kit is only for test purposes. It must be shielded to comply with the EMC Directive (89/336/EEC).*

***CAUTION**: do not exceed the tightening torque of the table (but see proper data sheets for the tightening torque of input capacitors and power modules and for the tightening torque of terminal blocks)*

Screw Thread	Tightening torque [Nm]	[lb in]
M3	1.00	8.85
M4	3.00	26.55
M5	6.00	53.10
M6	8.00	70.80

SECTION 1 - DESCRIPTION

1.1 Description

DBM033 four quadrant servodrives provide unrivaled compactness and flexibility through the integration of three axes in a single module.
A power supply is connected to 3-phase 230V and can supply up to 4 modules (12 axes).
The result is a very suitable solution for all multi-axis applications like machine tools, robotics, packaging, special material working (wood, plastics, glass, rubber, leather, paper).
A microprocessor based structure allows high servo performances with FAST, FASK and FC servomotors all equipped with a resolver feedback. Drive tuning and configuration are performed via digital parameters (not potentiometers) and stored in non-volatile memory (EEPROM).
Drive set up is possible via a keypad or PC, therefore simplifying installation and providing easy fault diagnosis.

General features:

- digital speed loop
- sinusoidal current waveform
- SMD technology with boards automatically assembled and tested
- automatic Resolver to Digital (R/D) resolution switching (from 16 to 10 bit) to achieve high motion accuracy in the whole speed range (from 0 to 10000 RPM).
- up to 99 axis system configuration
- 5/10 kHz switching frequency
- ambient temperature: 0 ÷ + 40°C
- storage temperature: -25 ÷ + 70°C
- maximum case depth of 310 mm

1.2 CE-Marking

Starting from Jan/97, DBM033 drives have CE-marking according to Low Voltage Directive.
Starting from Apr/97 the CE-marking refers also to EMC Directive (see Section 3).

A Declaration of Conformity is available.

The Low Voltage Directive (73/23/EEC) applies to all electrical equipment designed to use with a voltage rating of between 50 Vac and 1000 Vac and between 75 Vdc and 1500 Vdc.

The CE-marking states that the electrical equipment has been constructed in accordance with good engineering practice in safety matters in force in the European Community and it does not endanger the safety of persons, domestic animals or property when properly installed and maintained and used in applications for which it was made.

1.3 Electrical Data

DBM 033 Standard Power Supply

- 3-phase power input voltage: 230 Vac, ±10%, 50/60 Hz
- 1-phase auxiliary input voltage: 110/230 Vac (selectable via jumper), ±10%, 50/60 Hz

DBM 033 Module

- BUS BAR rated voltage: 300 Vdc
- three-phase output voltage: 180 Vac
- fan input voltage: 230 Vac or 110 Vac, ±10%, 50/60 Hz, 60VA for a couple of fans

STANDARD MODULES (see tab.2.16 for the other possible configurations)

Model	Output Current									Width	Weight
	Axis 1			Axis 2			Axis 3				
	Rated	Max		Rated	Max		Rated	Max			
	(Arms)	(Arms)	(A)	(Arms)	(Arms)	(A)	(Arms)	(Arms)	(A)	(mm)	(kg)
DBM 033 5-5	5	10.6	15	5	10.6	15	-	-	-	120	8
DBM 033 10-10	10	17.6	25	10	17.6	25	-	-	-	120	8
DBM 033 15-15	15	32	45	15	32	45	-	-	-	120	9
DBM 033 25-25	25	49.5	70	15	32	45	-	-	-	120	9
DBM 033 30-30	30	63.6	90	30	63.6	90				120	9
DBM 033 5-5-5	5	10.6	15	5	10.6	15	5	10.6	15	120	9
DBM 033 10-50-10	10	17.6	25	50	99	140	10	17.6	25	180	14
DBM 033 10-70-10	10	17.6	25	70	127	180	10	17.6	25	180	14

POWER SUPPLY - 230 Vac

Model	Currents			Auxiliary Input Voltage	Width	Weight
	Output Rated	Output Max	Braking			
	(A)	(A)	(A)	(Vac)	(mm)	(kg)
DBM 033 Power Supply - Standard Version	100	300	100	110/230	120	13

EXPANSIONS

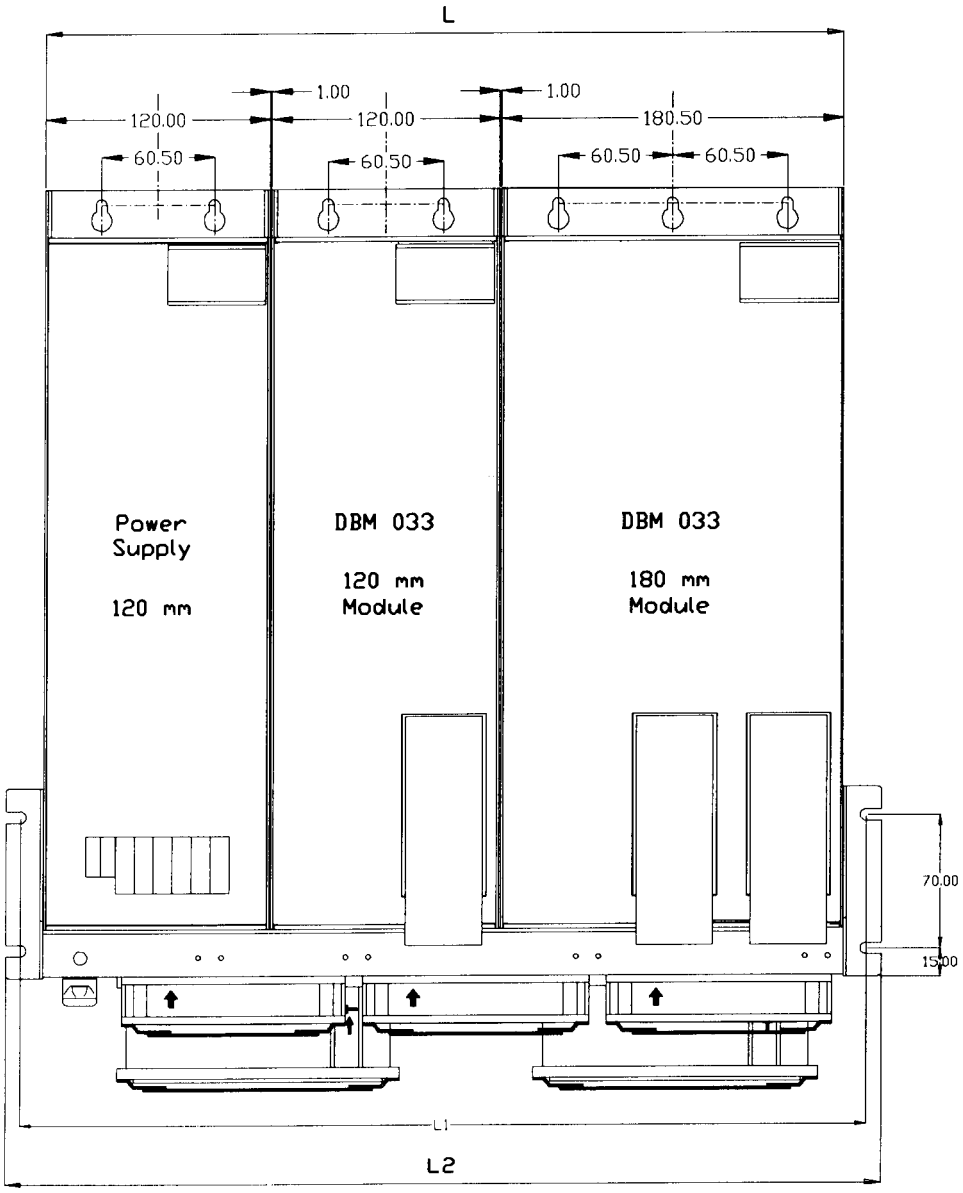
An external expansion module should be used for some configurations. Available expansions modules are shown in the table. To specify an expansion module, please replace the third axis rating number with E, this ensures that the drive is configured for use with an expansion module (e.g. DBM 033 15-15-E).

Model	Output Currents			Width	Weight
	Rated	Max			
	(Arms)	(A)	(A)	(mm)	(kg)
EBM 033 50/140	50	99	140	120	10
EBM 033 80/240	80	170	240	180	15

1.4 Dimensions

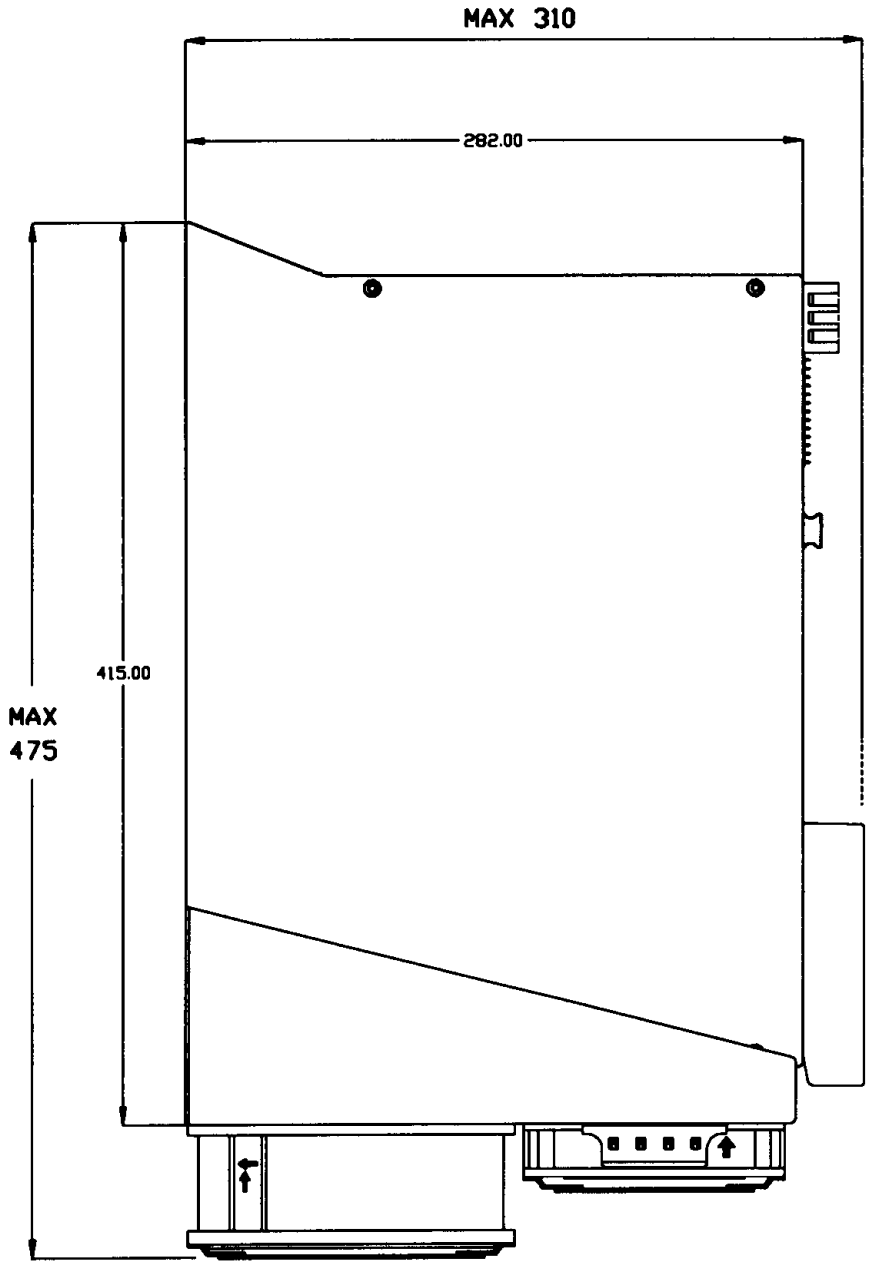
Fig. 1.1 and 1.2 (dimensions in mm) show the drilling jig between power supply and drive module. The modules must be mounted vertically, with the fan housing at the bottom. Leave a clear space of at least 50 cm (19.7 in) over and under the system for air circulation.

Fig. 1.1 Front View (Drill For M5 Screws)



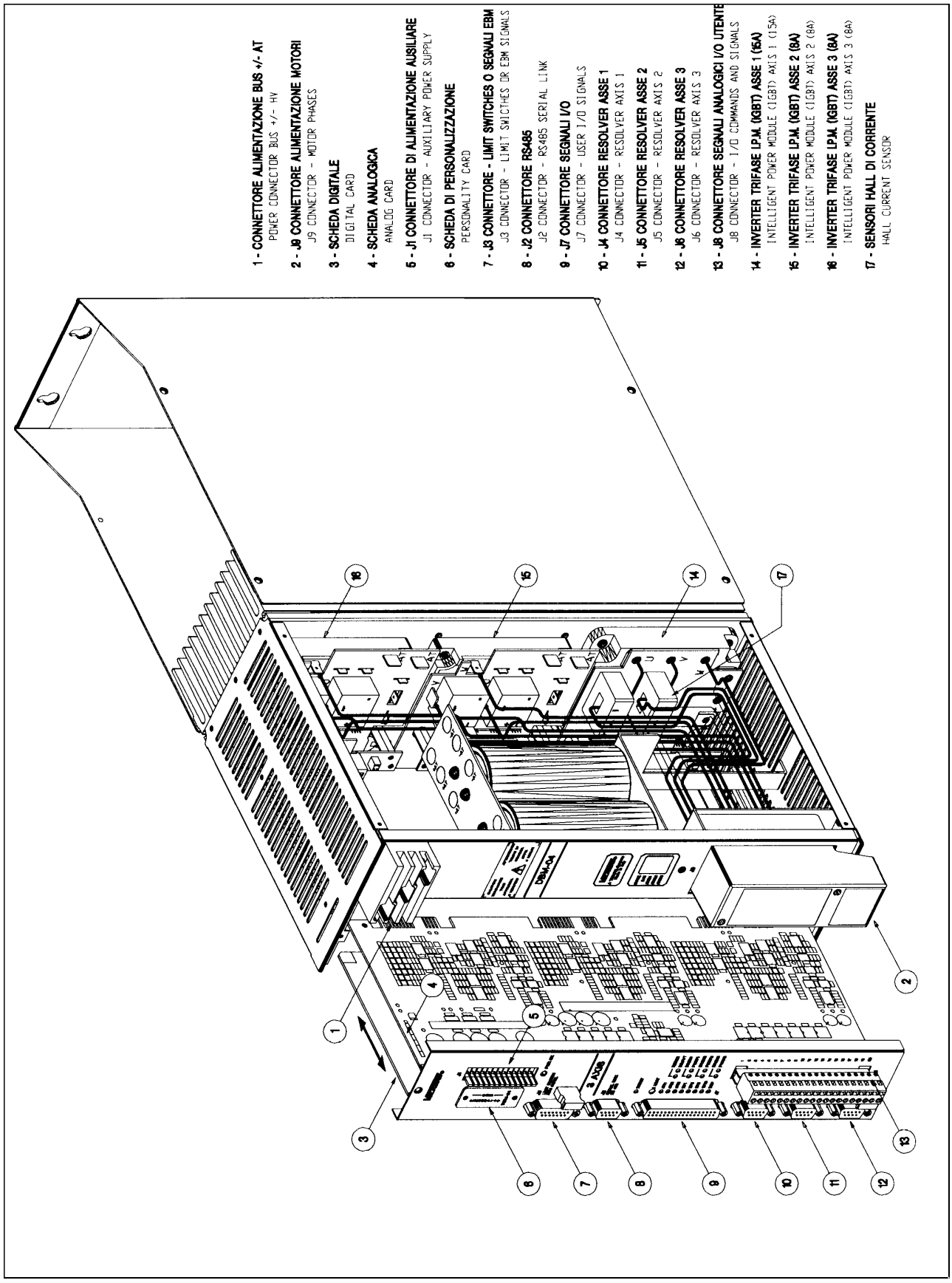
Configuration	L	L1	L2
1 DBM033 PS + 1 DBM033 120 mm	241	266	282
1 DBM033 PS + 1 DBM033 180 mm	301.5	326	342
1 DBM033 PS + 2 DBM033 120 mm	362	387	403
1 DBM033 PS + 1 DBM033 120 mm + 1 DBM033 180 mm	422.5	447	463
1 DBM033 PS + 2 DBM033 180 mm	483	508	524
1 DBM033 PS + 3 DBM033 120 mm	483	508	524
1 DBM033 PS + 2 DBM033 120 mm + 1 DBM033 180 mm	543.5	568	584
1 DBM033 PS + 1 DBM033 120 mm + 2 DBM033 180 mm	6033	629	645
1 DBM033 PS + 4 DBM033 120 mm	6033	629	645

Fig. 1.2 Side View (Drill For M5 Screws)



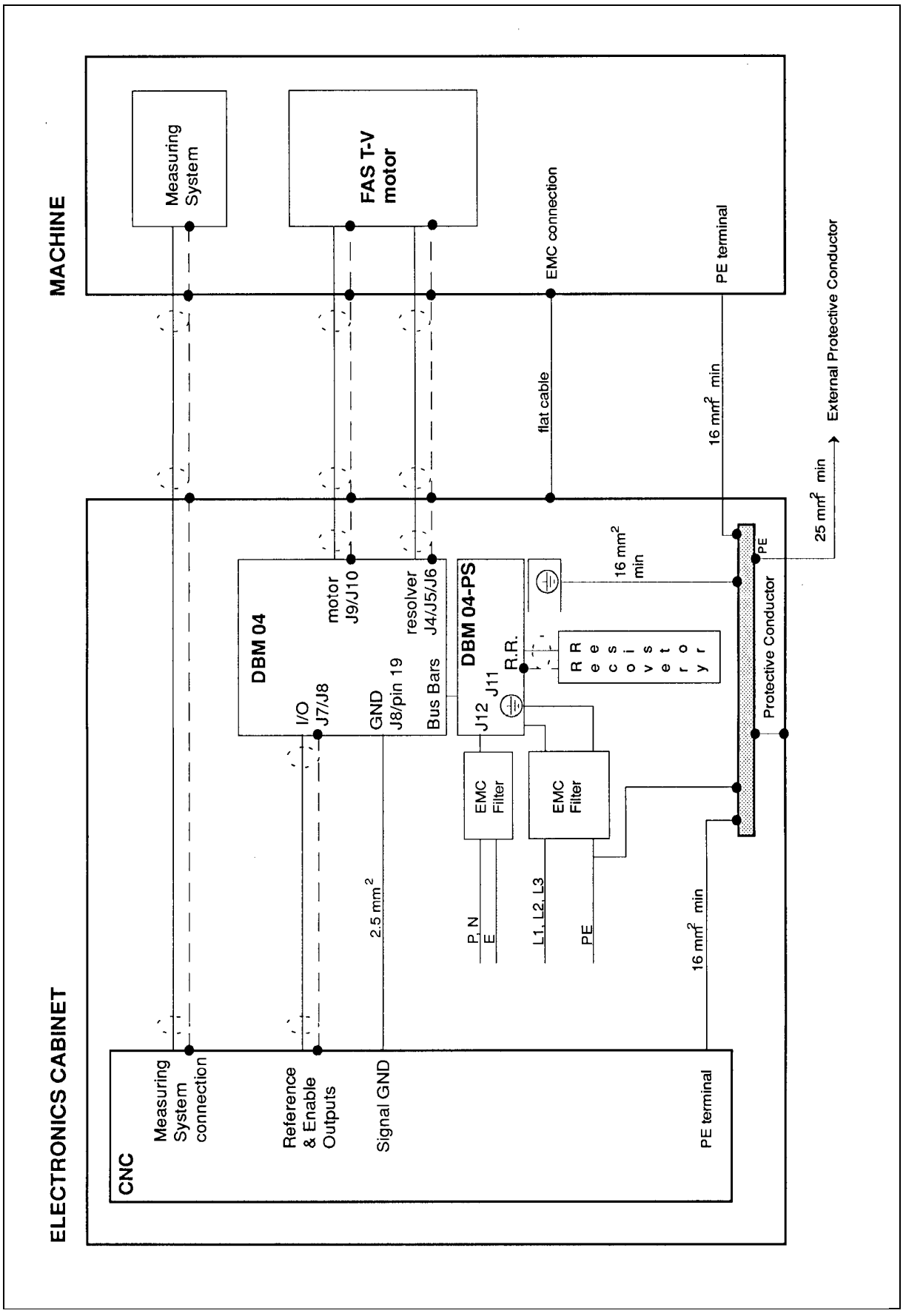
1.5 Component Identification

Fig. 1.3 Component Identification (DBM 033 15-10-10)



1.6 System Grounding

Fig. 1.4 EMC/Equipotential Bonding



1.7 Options

- software programmable (from 128 to 16384 pulses per electrical revolution) simulated encoder with marker

1.8 Rating Plate

The following informations are supplied on the rating plate of DBM 033.

1.8.1 Power Supply

CODE:	CYZZZZ XX	where ZZZZ=version code; XX=option code
S/N:	AASS NNNNNN	where AA=year, SS=week, NNNNNN=serial number
CURR:	YYY	where YYY=nominal output current

Example:

CODE:	CY2004 00
S/N:	9903 029800
CURR:	100

1.8.2 Module

CODE:	CY1ZZZ XX	where ZZZ=progressive number; XX=option code
S/N:	AASS NNNNNN	where AA=year, SS=week, NNNNNN=serial number
AXIS 1:	XX/YYY	where XX=nominal output current, YYY=peak output current
AXIS 2:	XX/YYY	where XX=nominal output current, YYY=peak output current
AXIS 3:	XX/YYY	where XX=nominal output current, YYY=peak output current

Example for a 2-axis, no options, DBM 033 10-10:

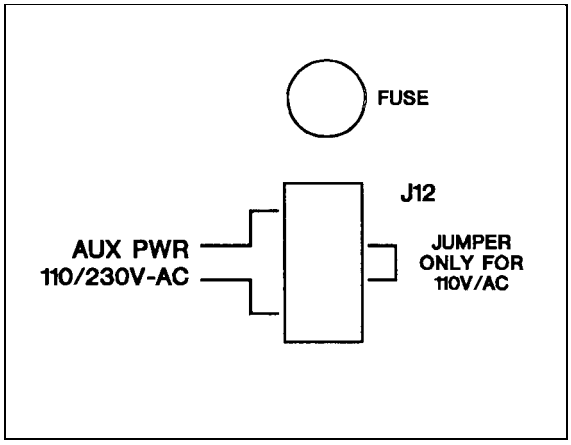
CODE:	CY1900 00
S/N:	9911 036502
AXIS 1:	10/25
AXIS 2:	10/25
AXIS 3:	

SECTION 2 - INSTALLATION

CAUTION: make sure that the correct wiring has been set for auxiliary input voltage on the DBM 033 Power Supply front panel.

- connect the jumper on J12 connector to use 110 Vac
or
- disconnect the jumper on J12 connector to use 230 Vac

Fig.2.1 110/230V Jumper



2.1 Power Transformer

A transformer or autotransformer connection from three-phase mains voltage to 230V can be used. See the end of this Section for a correct sizing.

If a transformer is used it is recommended to set the - HV to the ground, the secondary neutral remaining floating. It is recommended to use star primary winding and delta secondary winding if only one DBM PS is used. If more than one DBM PS is used the star secondary winding must be used.

If an autotrasformer is used, the -AT must not be connected to the ground.

REMARK: the auxiliary supply must be independent from the power supply, if the fault information (see FA command) is to be retained in case of a mains failure.

2.2 Fans

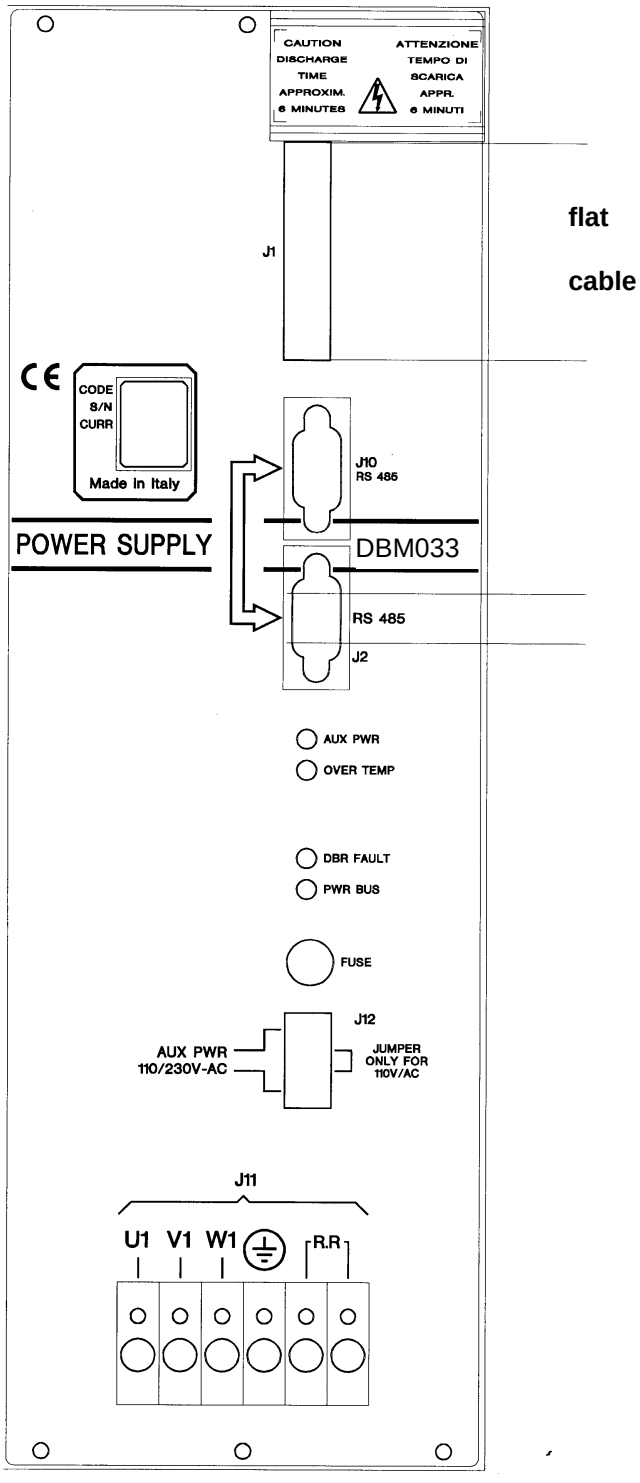
The ventilation is provided by fans mounted under the modules. The size and the number of fans are according to the system configuration. Selection of the correct Fan Assembly is due by matching Fan Assembly width to the total of the DBM drives package (i.e. Fan = Power Supply and DBM module(s) and DBM expansion module(s)).
Fan input voltage is 230 Vac (or 110 Vac). The input power is 60 W for each pair of fans.

TAB. 2.1 - FANS.

MODEL	INPUT VOLTAGE (V~)	PAIR OF FANS	WIDTH (mm)
DBM 033 F2/230	230	1	240
DBM 033 F3/230	230	1	360
DBM 033 F4/230	230	2	480
DBM 033 F5/230	230	2	600
DBM 033 F2/110	110	1	240
DBM 033 F3/110	110	1	360
DBM 033 F4/110	110	2	480
DBM 033 F5/110	110	2	600

CAUTION: a free circulation must be guaranteed for the air flow.

Fig. 2.2 Power Supply - Front Panel



2.3 Power Supply - Led's

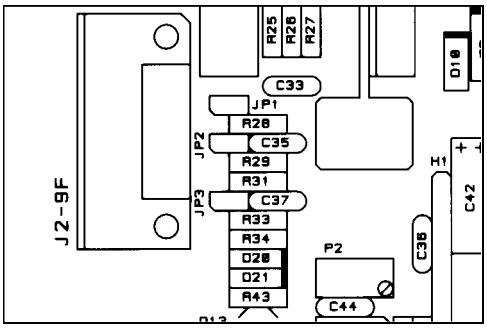
Tab. 2.2 - Power Supply - Led's

Name	Function
Yellow LED - PWR-BUS	BUS BAR voltage > 40Vdc *WARNING: active only if the aux power supply is ON*
Red LED - DBR FAULT	Recovery unit fault
Red LED - OVER TEMP	Module overtemperature via PTC (threshold 70 °C)
Green LED - AUX POWER	Auxiliary power supply OK

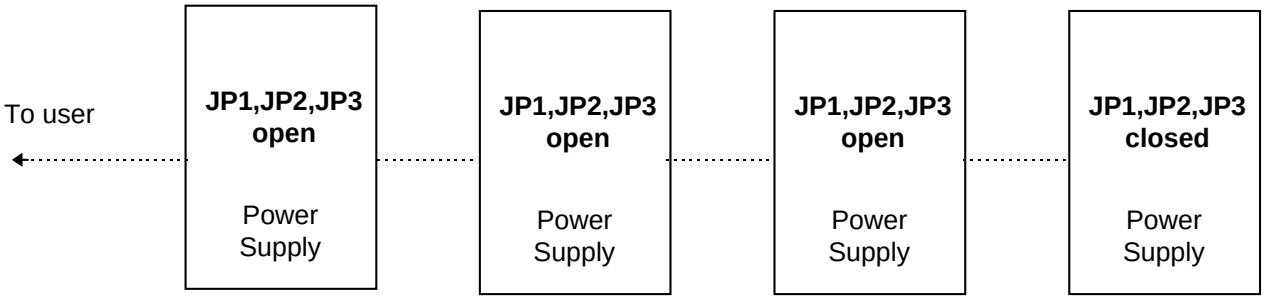
2.4 Power Supply - Internal Card Jumpers

JP1 closed (default) = connects a 120 Ω resistor between RX+ and RX- of serial link.
JP2 closed (default) = connects TX- of serial link to 0V via pull-down resistor
JP3 closed (default) = connects TX+ of serial link to +5V via pull-up resistor

Fig. 2.3 - Power Supply - Card Jumpers



In case of multidrop, the following configuration must be used.



2.5 Power Supply - Wiring

See Section 3 for shielding procedures according to EMC Directive.

Tab. 2.3 - Power Supply - J1 Connector - Auxiliary Power Supply (to Modules)
Panel side: shrouded header with 13 male contacts
Wiring side: connector with 13 female contacts (supplied in kit with cable)

Pos.	Function
1	Not connected (N.C.)
2	+18Vdc referred to -HV (540/620 Vdc)
3	-HV (540/620 Vdc)
4	158kHz square wave to high side drives
5	N.C.
6	N.C.
7	+18Vdc referred to logic 0V
8	- 18Vdc referred to logic 0V
9	+8Vdc referred to logic 0V
10	+8Vdc referred to logic 0V
11	Logic 0V
12	Resolver 0V
13	10 kHz sinusoidal wave for resolver and synchronism (carrier)

Tab. 2.4 - Power Supply - J2 Connector - RS485 Port/Fault signals (to Modules)
Panel side: Sub-D with 9 male contacts
Wiring side: Sub-D with conductive shell, 9 female contacts (supplied with cable)

Pos.	Function
1	+ Rx (RS485 serial link)
2	N.C.
3	+ Tx (RS485 serial link)
4	Power supply binary coded faults (see Tab.2.4A)
5	+ 5Vdc input referred to logic 0V
6	- Rx (RS485 serial link)
7	Logic 0V
8	- Tx (RS485 serial link)
9	Power supply binary coded faults (see Tab.2.4A)

Tab. 2.4A - Power Supply binary coded faults

J2/pos. 4	J2/pos. 9	
0	0	OK
0	1	DBR FAULT. Recovery fault
1	0	OVER TEMP. Overtemperature
1	1	Not Used.

Tab. 2.5 - Power Supply - J10 Connector - RS485 Port (to keypad or to converter)

Panel side: Sub-D with 9 female contacts

Wiring side: Sub-D with 9 male contacts (supplied with the optional RS232/485 converter kit or with the optional keypad)

Pos.	Function
1	+Rx (RS485 serial link)
2	N.C.
3	+Tx (RS485 serial link)
4	N.C.
5	+5Vdc output referred to logic 0V for power supply
6	-Rx (RS485 serial link)
7	Logic 0V
8	-Tx (RS485 serial link)
9	N.C.

Tab. 2.6 - Power Supply - J11 Connector - Power

Power: wall-through terminal block. Max wire size: 10 mm^2.

Name	Function
U1	"L1" phase, three-phase input voltage 230Vac
V1	"L2" phase, three-phase input voltage 230Vac
W1	"L3" phase, three-phase input voltage 230Vac
	Ground
R.R.	Recovery resistor
R.R.	Recovery resistor

Tab. 2.7 - Power Supply - J12 Connector - Aux Power

Panel side: shrouded open end header with 4 male contacts

Wiring side: connector with 4 female contacts, screw termination

Name	Function
AUX PWR	Auxiliary power supply 230Vac/110Vac
JUMPER	Jumper (see Fig.2.1)
JUMPER	Open=230Vac - Closed=110Vac
AUX PWR	Auxiliary power supply 230Vac/110Vac

Fig. 2.4 Module - Removable Control Panels

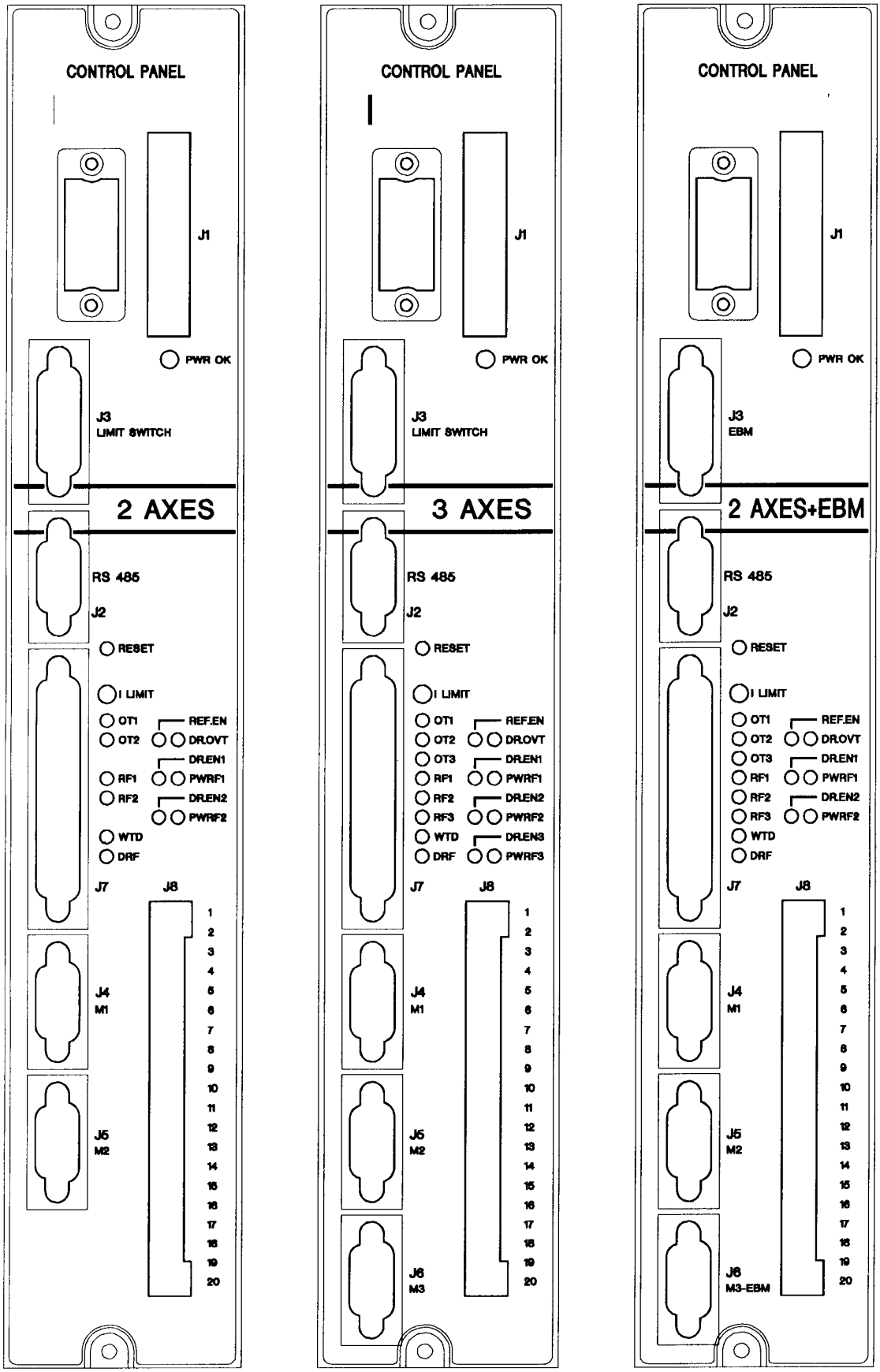


Fig. 2.5 Expansion-EBM - Removable Control Panel

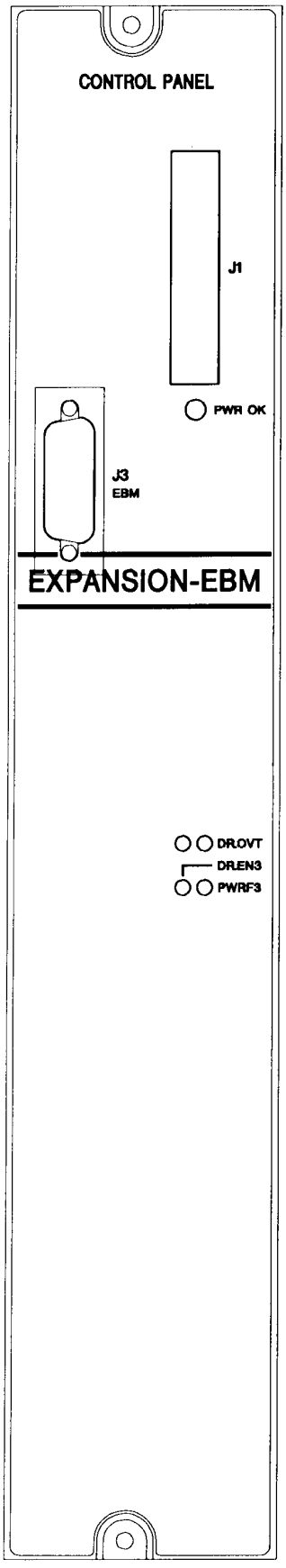
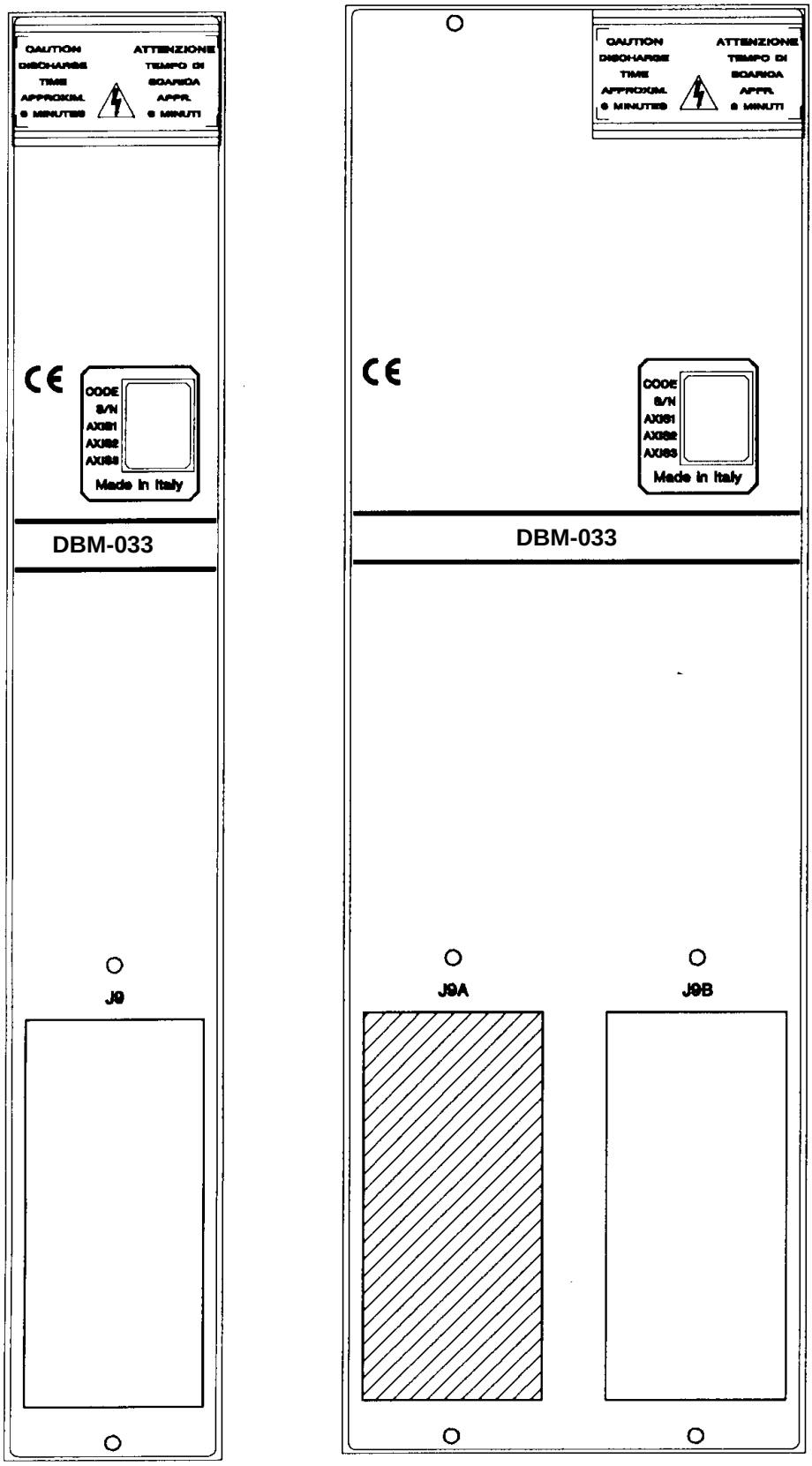


Fig. 2.6 Module (120 mm/180 mm) - Fixed Panels



Note: the dashed connector is mounted only in some configurations (see tab.2.16)

2.6 Module - Led's

Tab. 2.8 - Module - Led's

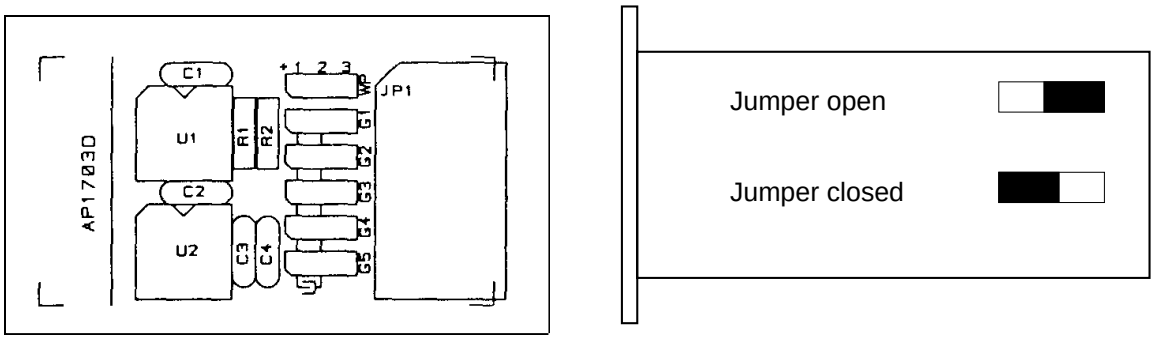
Name	Function
Red LED DRF	generic fault: the fault can correspond, according to the type, to a LED on the front end; if other red LED's are not on, out of the considered one, it is necessary to interrogate the drive via serial link to know the fault reason (see FA command)
Red LED WTD	Watch dog - signal; microprocessor circuit faults; this LED is on during reset
Red LED RF1	Resolver 1 fault - signal; resolver M1 fault, sin /cos signals interrupted, short circuit between signals or 10kHz carrier abnormal
Red LED RF2	Resolver 2 fault - signal; resolver M2 fault, sin /cos signals interrupted, short circuit between signals or 10kHz carrier abnormal
Red LED RF3	Resolver 3 fault - signal; resolver M3 fault, sin /cos signals interrupted, short circuit between signals or 10kHz carrier abnormal
Red LED OT1	Motor M1 overtemperature
Red LED OT2	Motor M2 overtemperature
Red LED OT3	Motor M3 overtemperature
Red LED DR.OVT	Module overtemperature
Red LED PWRF1	Intelligent Power Module axis 1 fault
Red LED PWRF2	Intelligent Power Module axis 2 fault
Red LED PWRF3	Intelligent Power Module axis 3 fault
Green LED REF.EN	Reference enable
Green LED DR.EN 1	Axis 1 enable (see also ON command)
Green LED DR.EN 2	Axis 2 enable (see also ON command)
Green LED DR.EN 3	Axis 3 enable (see also ON command)
Green LED PWR OK	Auxiliary power OK

2.7 Personality Card Jumpers

WP (default: open): if closed, the EEPROM is write protected and the Save (SV) command is disabled
G1 (default: open) : if closed, connects TX- of serial link to 0V via pull-down resistor
G2 : if closed, gives priority to "opto" , if open gives priority to "keypad"
G3 (default: open) : if closed, set 9600 Baud rate and basic address 1
G4 (default: open) : if closed, connects TX+ of serial link to 5V via pull-up resistor
G5 (default: open) : if closed, connects a 120 Ω resistor between RX+ and RX- of serial link

CAUTION: it is recommended to close the WP jumper at the end of installation and setup.

Fig. 2.7 - Personality Card



2.8.1 G2 Jumper: "Keypad" or "Opto" Priority

The jumper G2 on the personality card gives priority to keypad or to opto to execute "Drive Enable" command. " Drive Enable" opto isolated signals are connected to J8/ pos.13, 14, 15.

G2 open = keypad priority = the keypad (or the device connected to the serial link) is the master, i.e. it allows to enable or disable motor current, whereas the optocouplers can only disable (protection); they can enable after resetting only.

The "Drive Enable" and "Reference Enable" opto-isolated signals must be driven at +15V.

Such a procedure should be followed during installation and drive test.

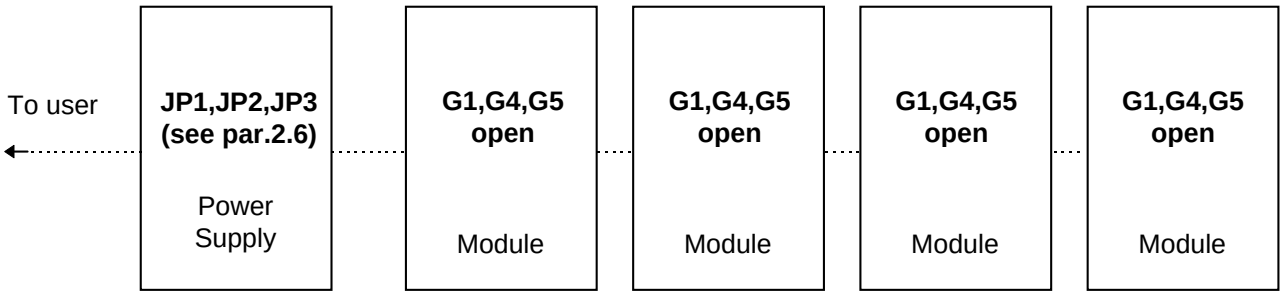
G2 closed = opto priority = the optocouplers are the master and the keypad can only be used for parameters setup.

Note:
1. See par.2.11.1 if the keypad does not communicate with the drive
2. "Drive Enable" priority is different from the use of the analog or digital reference.
You can choose an analog or digital reference by "AR" (Analog) or "DR" (Digital) commands, and save. The drives are supplied set to digital reference "DR".

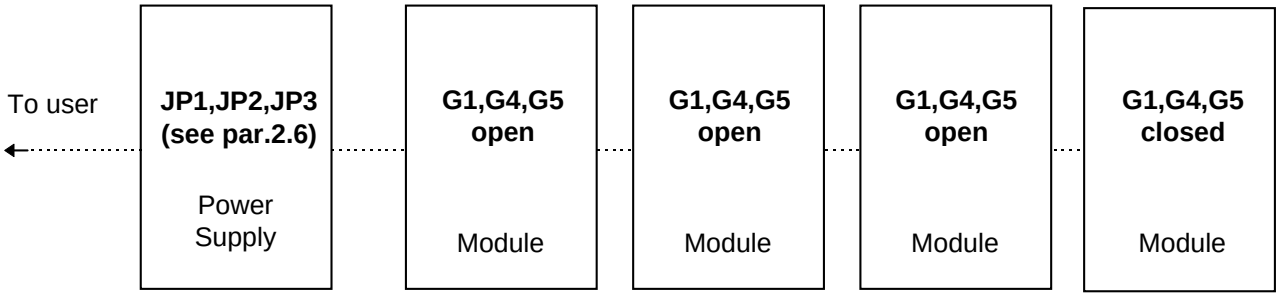
2.8.2 G1-G4-G5 Jumpers: Link Termination's

By default G1, G4 and G5 jumpers on the personality card are open (no link termination's on modules). In fact, usually, it is not necessary to close G1, G4 and G5 jumpers because the link termination's are already closed on the power supply; anyway, in specially noisy environments, could be necessary to close them also, as follows.

- **Environment without noise**



- **Specially noisy environment**



2.8.3 G3 Jumper: Basic Configuration

The jumper G3 on the personality card allows, if closed, to set 9600 Baud rate and basic address 1. This configuration can be used to restore the communication in case of fault of the serial link. When the communication has been restored, the G3 jumper must be open.

2.8.4 WP Jumper: Write Protection

The jumper WP on the personality card allows, if closed, to write protect the EEPROM. If closed, the Save (SV) command is disabled.

CAUTION: it is recommended to close the WP jumper at the end of installation and setup.

2.9 Module Wiring

See Section 3 for shielding procedures according to EMC Directive.

Tab. 2.9 - Module - J1 Connector - Auxiliary Power Supply (to PS/Modules)
Panel side: shrouded header with 13 male contacts
Wiring side: connector with 13 female contacts (supplied in kit with cable)

Pos.	Function
1	Not connected (N.C.)
2	+18Vdc referred to -HV (540/620 Vdc)
3	-HV (540/620 Vdc)
4	158kHz square wave to high side drives
5	N.C.
6	N.C.
7	+18Vdc referred to logic 0V
8	- 18Vdc referred to logic 0V
9	+8Vdc referred to logic 0V
10	+8Vdc referred to logic 0V
11	Logic 0V
12	Resolver 0V
13	10 kHz sinusoidal wave for resolver and synchronism (carrier)

Tab. 2.10 - Module - J2 Connector - RS485 Port/Fault signals (to PS/Modules)
Panel side: Sub-D with 9 male contacts
Wiring side: Sub-D with conductive shell, 9 female contacts (supplied by with cable)

Pos.	
1	+Rx
2	N.C.
3	+Tx
4	Power supply binary coded faults (see Tab.2.10A)
5	+5Vdc output referred to logic 0V
6	-Rx
7	logic 0V
8	-Tx
9	Power supply binary coded faults (see Tab.2.10A)

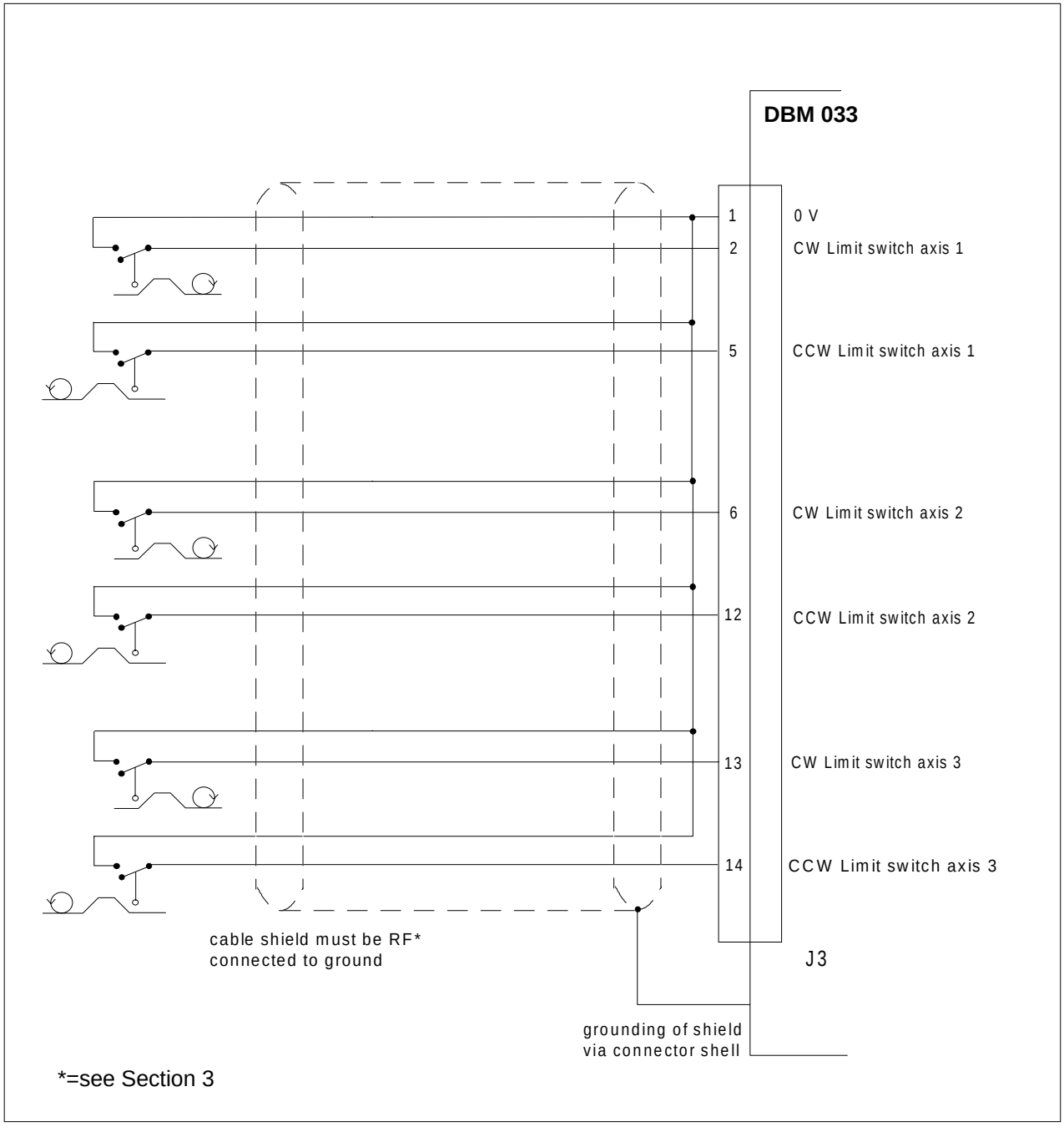
Tab. 2.10A - Module - Power supply binary coded faults

J2/pos. 4	J2/pos. 9	
0	0	OK
0	1	DBR FAULT. Recovery fault
1	0	OVER TEMP. Overtemperature
1	1	Not Used

2.9.1 Limit Switches/Expansion Wiring

The J3 connector allows, when the Expansion is not present, the availability of CW/CCW limit switches for each axis. With the input enabled (to 0V), the rotation is disabled in one direction and enabled in the other direction.
When the Expansion is present, the J3 connector is used for signal connection to the Expansion module.

Fig. 2.8 - Limit Switches Wiring



Tab. 2.11A - Module - J3 Connector - Limit Switches (When EBM Expansion Is Not Present)
Panel side: Sub-D with 15 female contacts
Wiring side: Sub-D with conductive shell, 15 male solder contacts

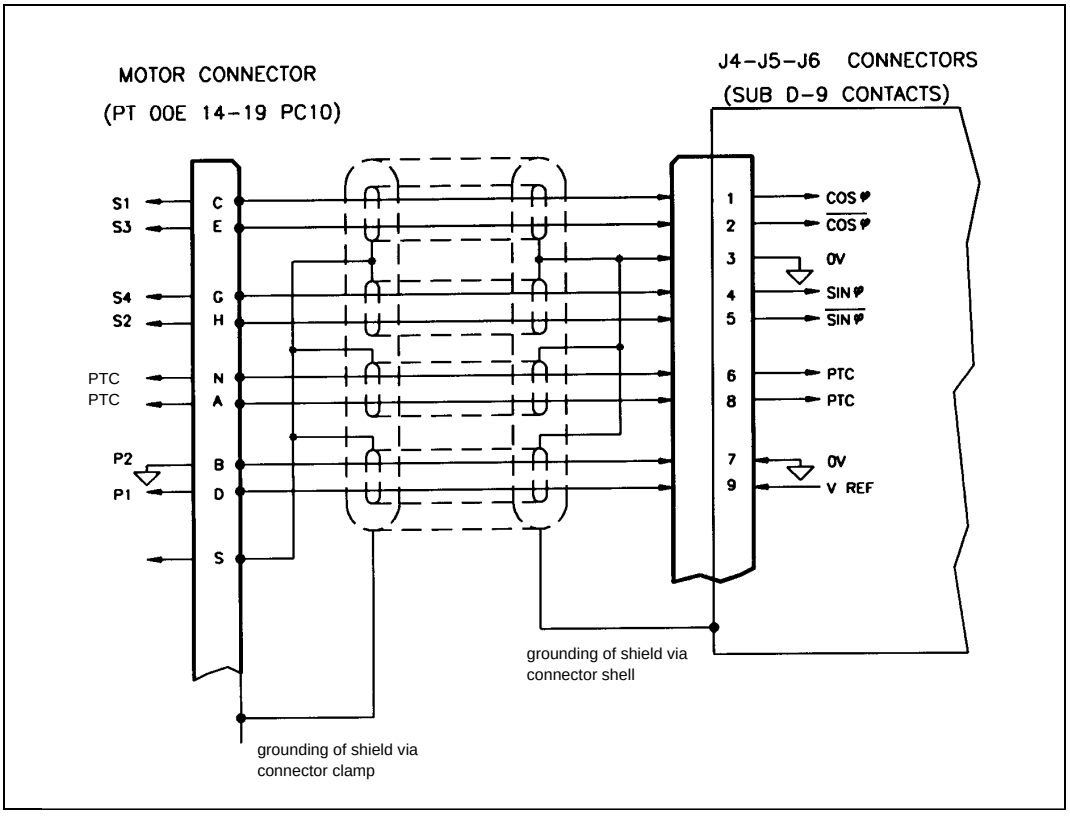
Pos.	
1	0V common
2	CW limit switch, axis 1
3	N.C.
4	N.C.
5	CCW limit switch, axis 1
6	CW limit switch, axis 2
7	N.C.
8	N.C.
9	N.C.
10	N.C.
11	N.C.
12	CCW limit switch, axis 2
13	CW limit switch, axis 3
14	CCW limit switch, axis 3
15	0V common

Tab. 2.11B - Module/Expansion - J3 Connector - Expansion Connection
Panel side: Sub-D with 15 female contacts
Wiring side: Sub-D with conductive shell, 15 male solder contacts

Pos.	
1	0V common
2	Auxiliary voltages referred to logic 0V not OK signal
3	Phase U reference current signal
4	Torque enabled signal
5	Short circuit signal
6	Overtemperature signal
7	Expansion present signal
8	Overtemperature signal
9	N.C.
10	Phase V reference current signal
11	Overtemperature signal
12	N.C.
13	BUS BAR fault signal
14	Auxiliary voltages referred to - HV (540/620 Vdc) not OK signal
15	N.C.

2.9.2 Resolver Wiring

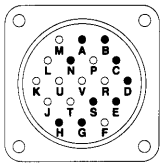
Fig. 2.9 - Resolver Wiring



RESOLVER CABLE	
OUTPUT	SIGNAL
S1	COS
S2	$\overline{\text{SIN}}$
S3	$\overline{\text{COS}}$
S4	SIN
P1	Vref
P2	0V
SHIELD	
PTC	
PTC	

Motor Signal Connector

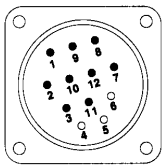
FAS T /
FAS K



C $\overline{\cos\varphi}$
E $\overline{\cos\varphi}$
D V-ref
B 0V
N PTC
A PTC

G $\underline{\sin\varphi}$
H $\overline{\sin\varphi}$
S shield

FAS N



1 $\underline{\cos\varphi}$
2 $\overline{\cos\varphi}$
3 shield
7 0V
8 PTC
9 PTC

10 V-ref
11 $\underline{\sin\varphi}$
12 $\overline{\sin\varphi}$

Each DBM module can be connected up to 3 resolvers. Axis 1 resolver must be connected to J4 M1 connector, axis 2 resolver to J5 M2 and axis 3 resolver to J6 M3.
Figure 2.11 shows the wiring lay-out of the resolver with differential output.
We recommend to use 4 pair cables, each pair twisted and individually shielded with an independent overall shield. 20 AWG (0.60 mm²) or 22 AWG (0.38 mm²) wire with low capacitance can be used. We suggest to use ground connections as shown in Fig. 2.9.
Cable length should not exceed 30 m (100 ft.). It is recommended that the signal cable and power cable be separated, if possible, through the use of independent duct (conduit) or by a distance of 12 inches (30 cm).
See Section 3 for shielding procedures according to EMC Directive.

Tab. 2.12 J4-J5-J6 Connectors - Resolvers
Panel side: Sub-D with 9 female contacts
Wiring side: Sub-D with conductive shell, 9 male solder contacts

Pos.	Name	
1	cos	Differential cos signal non-inverted input
2	$\overline{\cos}$	Differential cos signal inverted input
3	Shield	Internally connected to 0V common
4	sin	Differential sin signal non-inverted input
5	$\overline{\sin}$	Differential sin signal inverted input
6	PTC	Motor PTC input
7	0V	0V common. Special for 10kHz carrier
8	PTC	Motor PTC input
9	V ref	20 Vpp/ 10kHz sinusoidal output signal for supplying primary resolver winding (carrier)

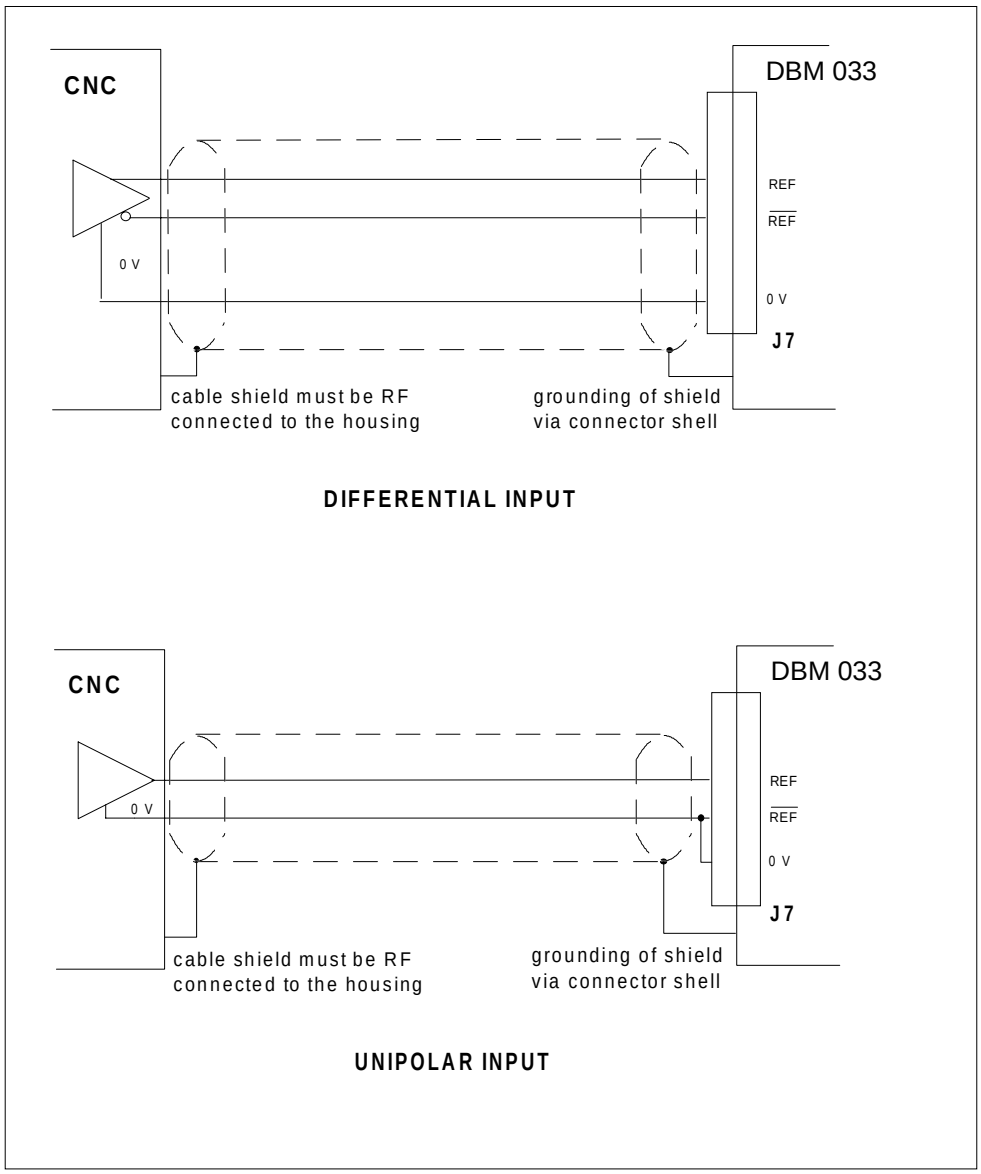
2.9.3 I/O Wiring

All the signal cables must be separated from power cables by a distance ≥30 cm.
See Section 3 for shielding procedures according to EMC Directive.

REMARKs:

- *DRIVE OK (J7 connector): it is suggested to connect the isolated output " DRIVE OK " to a remote control switch so that, if a fault occurs, the power supply is disconnected to avoid system damages.*
- *SIMULATED ENCODER SIGNALS (J7 connector):*
  - in specially noisy environments it is suggested to connect a 220 ÷ 680 Ω resistor between A and $\overline{A}$, B and $\overline{B}$, C and $\overline{C}$ at the receiver input.
  - for lengths in excess of 5 m (16 ft.) the cable must have 3 pairs, each pair twisted.

Fig. 2.10 - Speed Reference Wiring



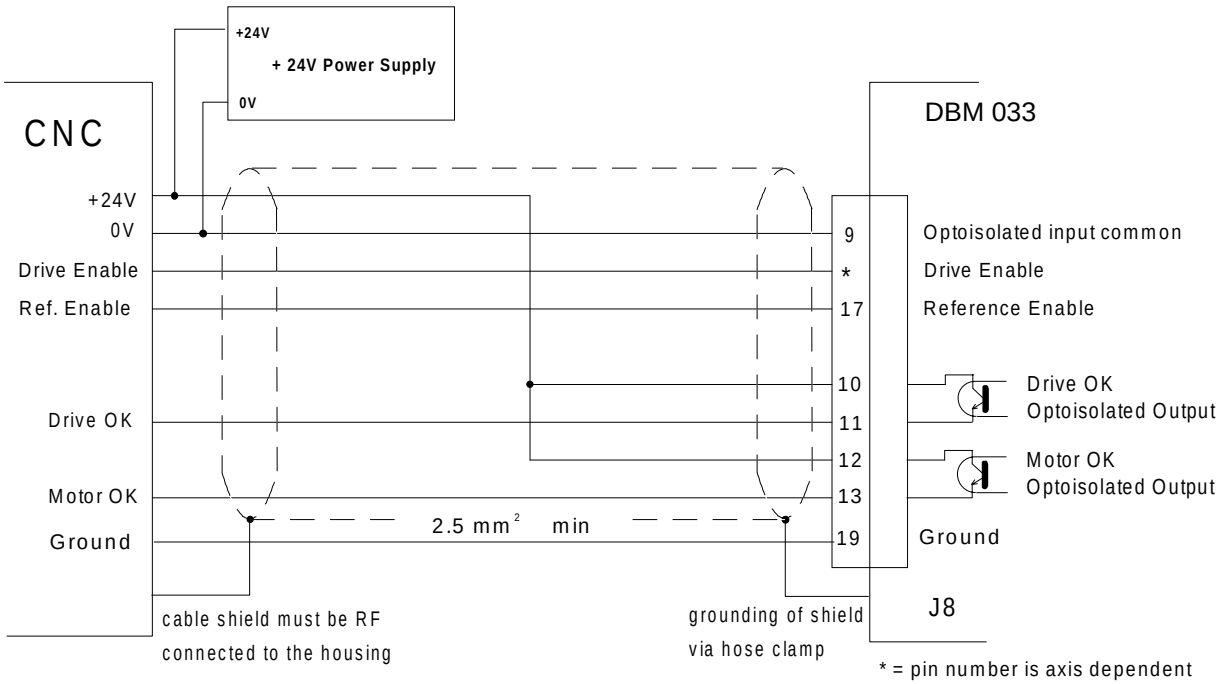
Tab. 2.13 - J7 Connector - I/O Commands, Signals and Encoder Outputs
Panel side: Sub-D with 37 female contacts
Wiring side: Sub-D with conductive shell, 37 male solder contacts

Pos.	Name	
1	0V	Logic 0V (it can be used as common for analog output supplies ±15V)
2	$\overline{A1}$	Encoder output: inverted phase A - motor 1
3	$\overline{B1}$	Encoder output: inverted phase B - motor 1
4	$\overline{C1}$	Encoder output: inverted phase C - motor 1
5	$\overline{A2}$	Encoder output: inverted phase A - motor 2
6	$\overline{B2}$	Encoder output: inverted phase B - motor 2
7	$\overline{C2}$	Encoder output: inverted phase C - motor 2
8	$\overline{A3}$	Encoder output: inverted phase A - motor 3
9	$\overline{B3}$	Encoder output: inverted phase B - motor 3
10	$\overline{C3}$	Encoder output: inverted phase C - motor 3
11	TP2	Testing point 2
12	ILIMIT3	Analog Current Limit input axis 3 0V = zero current +10V (or not connected) = max current
13	ILIMIT2	Analog Current Limit input axis 2 (0 to +10V)
14	ILIMIT1	Analog Current Limit input axis 1 (0 to +10V)
15		Shield. Internally connected to 0V
16	$\overline{REF3}$	Differential inverting analog input for the speed reference signal (or torque ref. signal, see TC command) axis 3, max range ±10V (see MR command). See Fig. 2.10
17	$\overline{REF2}$	Differential inverting analog input for the speed reference signal (or torque ref. signal, see TC command) axis 2, max range ±10V (see MR command). See Fig. 2.10
18	$\overline{REF1}$	Differential inverting analog input for the speed reference signal (or torque ref. signal, see TC command) axis 1, max range ±10V (see MR command). See Fig. 2.10
19	+15V	+15Vdc output (I max = 30mA)
20	A1	Encoder output: phase A - motor 1
21	B1	Encoder output: phase B - motor 1
22	C1	Encoder output: phase C - motor 1
23	A2	Encoder output: phase A - motor 2
24	B2	Encoder output: phase B - motor 2
25	C2	Encoder output: phase C - motor 2
26	A3	Encoder output: phase A - motor 3
27	B3	Encoder output: phase B - motor 3
28	C3	Encoder output: phase C - motor 3
29	TP1	Testing point 1

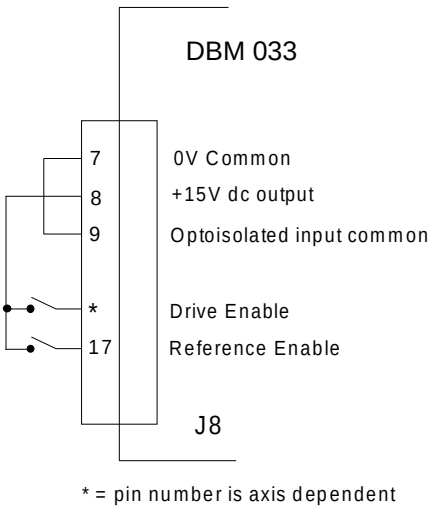
30		Shield. Internally connected to 0V
31	DRIVE OK 1 *	Drive OK output, axis 1. Imax=5mA. 0V=not OK +5V=OK
32	DRIVE OK 2 *	Drive OK output, axis 2. Imax=5mA. 0V=not OK +5V=OK
33	DRIVE OK 3 *	Drive OK output, axis 3. Imax=5mA. 0V=not OK +5V=OK
34	REF3	Differential non-inverting analog input for the speed reference signal (or torque ref. signal, see TC command) axis 3, max range ±10V (see MR command). See Fig. 2.10
35	REF2	Differential non-inverting analog input for the speed reference signal (or torque ref. signal, see TC command) axis 2, max range ±10V (see MR command). See Fig. 2.10
36	REF1	Differential non-inverting analog input for the speed reference signal (or torque ref. signal, see TC command) axis 1, max range ±10V (see MR command). See Fig. 2.10
37	-15V	- 15Vdc output (I max = 30mA)

* Note: $\overline{\text{I LIMIT}}$ inputs available on request instead of DRIVE OK outputs

Fig. 2.11 - Input/Output Wiring



+ 24V POWER SUPPLY



+ 15V INTERNAL SUPPLY
(for drive test)

Tab. 2.14 - J8 Connector - I/O Commands and Signals
Panel side: shrouded open end header with 20 male contacts
Wiring side: connector with 20 female contacts, screw termination

Pos.	Name	
1	TACHO TEST 1	tachometer output, axis 1. Range: (ET*/10)V for max speed
2	TACHO TEST 2	tachometer output, axis 2. Range: (ET*/10)V for max speed
3	TACHO TEST 3	tachometer output, axis 3. Range: (ET*/10)V for max speed
4	ANALOG OUT 1	analog output 1. See Tab. 2.15 and ES, SO commands
5	ANALOG OUT 2	analog output 2. See Tab. 2.15 and ES, SO commands
6	ANALOG OUT 3	max current output, axis 3 (100% of max current = 10V)
7	0L	logic 0V
8	+15V	+15Vdc output (Imax = 30mA)
9	OPTO 0V	Optoisolated 0V
10	DRIVE OK	Collector of Drive OK optoisolator (see Fig.2.11)
11	$\overline{\text{DRIVE OK}}$	Emitter of Drive OK optoisolator (see Fig.2.11)
12	MOTOR OK	Collector of Motor OK optoisolator (see Fig.2.11)
13	$\overline{\text{MOTOR OK}}$	Emitter of Motor OK optoisolator (see Fig.2.11)
14	DRIVE EN1	Drive enable 1: optoisolated input for axis 1 torque enable. See Fig. 2.11
15	DRIVE EN2	Drive enable 2: optoisolated input for axis 2 torque enable. See Fig. 2.11
16	DRIVE EN3	Drive enable 3: optoisolated input for axis 3 torque enable. See Fig. 2.11
17	REF EN	Reference enable: optoisolated input for the confirmation of the common reference to the three axis (REF EN not active means no speed reference or zero torque)
18	REM RESET	Remote reset: optoisolated input for logic section reset, equivalent to push button on the front panel
19	GROUND	Ground. It must be connected to CNC ground with 2.5 mm^2 wire as short as possible
20	GROUND	Ground (connected to 19)

* default ET=80

Tab. 2.15A - ANALOG OUT - ADDRESS SETTING (SO COMMAND)

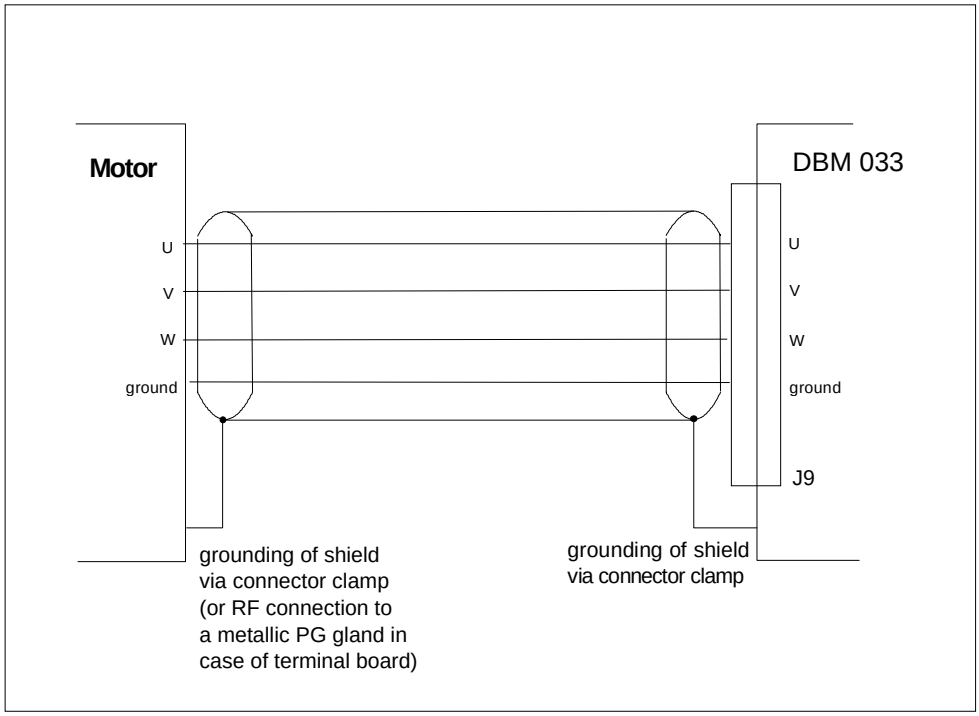
SO	Address	SO	Address	SO	Address
1SO	Analog Out 1 first module	**4SO**	Analog Out 1 second module	**7SO**	Analog Out 1 third module
2SO	Analog Out 2 first module	**5SO**	Analog Out 2 second module	**8SO**	Analog Out 2 third module

Tab. 2.15B - ANALOG OUT - OUTPUT SETTING (SO COMMAND)

SO	Max Current	SO	Velocity Reference	SO	Velocity Error
SO1	axis 1	**SO4**	axis 1	**SO7**	axis 1
SO2	axis 2	**SO5**	axis 2	**SO8**	axis 2
SO3	axis 3	**SO6**	axis 3	**SO9**	axis 3

2.9.4 Motor Phases Wiring

Fig. 2.12 - Motor Phases Wiring (only one axis shown)



All the motor phases must be connected from J9 connector(s) to motor connector(s). Note that M1 always corresponds to the more powerful axis, while M3 must not be connected in 2 axis configuration.
There several motor power connections, depending on module configuration (see Tab.2.16).
See Section 3 for shielding procedures according to EMC Directive.

CAUTION: the resolver wiring must match the motor wiring, i.e. the resolver cable running from M1 motor must be connected to J4 M1 connector, the resolver cable running from M2 motor must be connected to J5 M2 connector, the resolver cable running from M3 motor must be connected to J6 M3 connector.

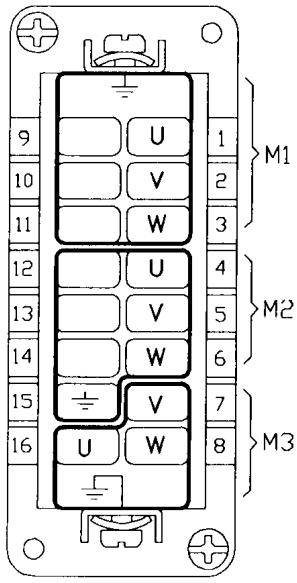
CAUTION: the U-V-W motor phase sequence of the connector at the drive side must match the U-V-W motor phase sequence of the connector at the motor side.

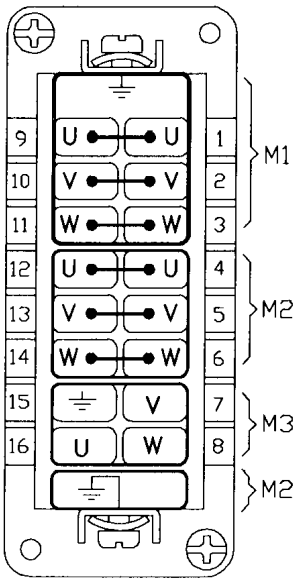
Tab. 2.16A - J9 Connector(s) - Motor Phases (120 mm module)

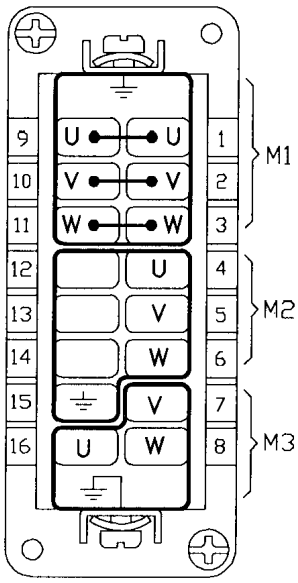
Panel side: power connector with 4, 6 or 16 female contacts

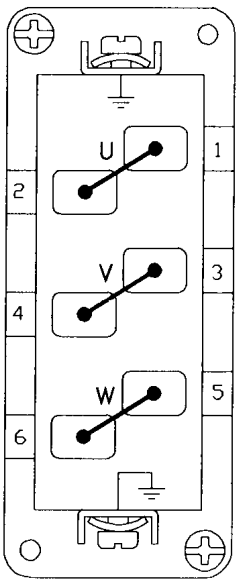
Wiring side: power connector, 4 male contacts (max wire size: 16 mm^2), 6 male contacts or 16 male contacts (max wire size: 2.5 mm^2), screw termination

Wiring side connector view and DBM033 Configurations









M1	M2	M3
5/15	5/15	5/15
10/25	5/15	5/15
10/25	10/25	10/25
10/25	10/25	5/15
15/45	10/25	10/25
15/45	5/15	5/15
15/45	15/45	15/45
15/45	15/45	5/15
15/45	15/45	10/25
15/45	10/25	5/15
5/15	5/15	
10/25	5/15	
15/45	5/15	
10/25	10/25	
15/45	10/25	
15/45	15/45	

M1	M2	M3
25/70	25/70	5/15
25/70	25/70	10/25
25/70	25/70	15/45
25/70	25/70	
30/90	30/90	5/15
30/90	30/90	10/25
30/90	30/90	
30/90	25/70	
30/90	25/70	5/15
30/90	25/70	10/25

M1	M2	M3
25/70	5/15	5/15
25/70	10/25	10/25
25/70	15/45	15/45
25/70	10/25	5/15
25/70	15/45	5/15
25/70	15/45	10/25
25/70	5/15	
25/70	10/25	
25/70	15/45	
30/90	5/15	5/15
30/90	10/25	10/25
30/90	15/45	15/45
30/90	10/25	5/15
30/90	15/45	5/15
30/90	15/45	10/25
30/90	5/15	
30/90	10/25	
30/90	15/45	

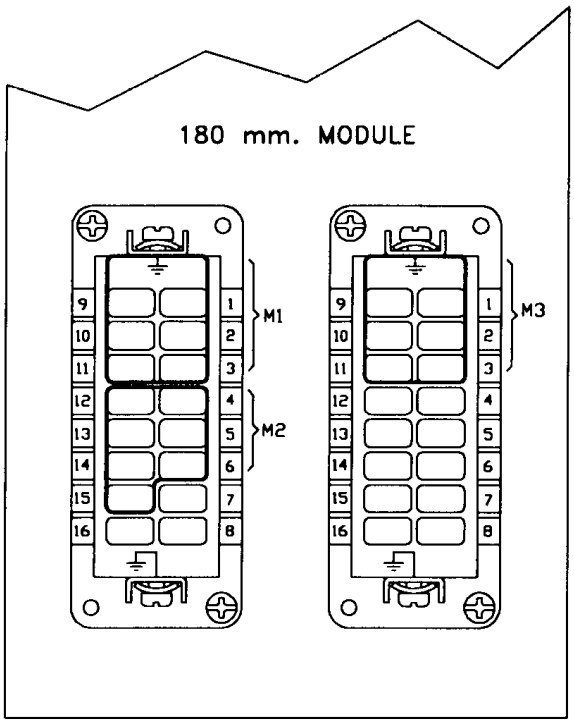
Expansion
50/140

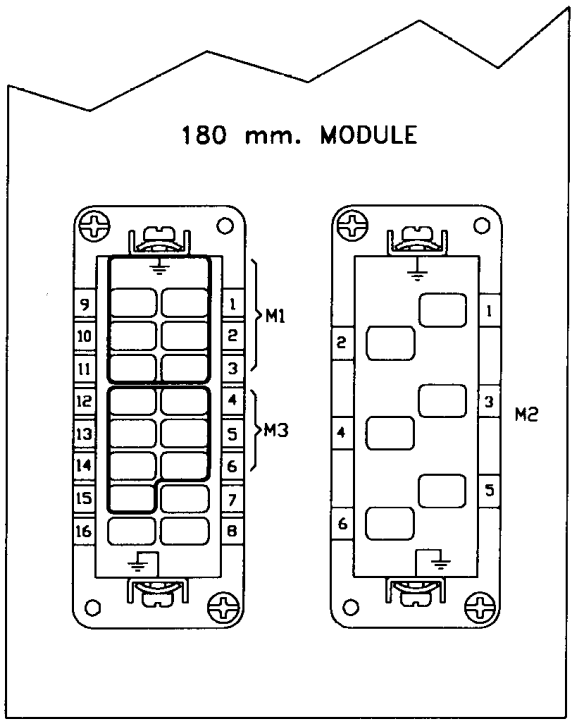
Tab.2.16B - J9 Connector(s) - Motor Phases (180 mm module)

Panel side: power connector with 4, 6 or 16 female contacts

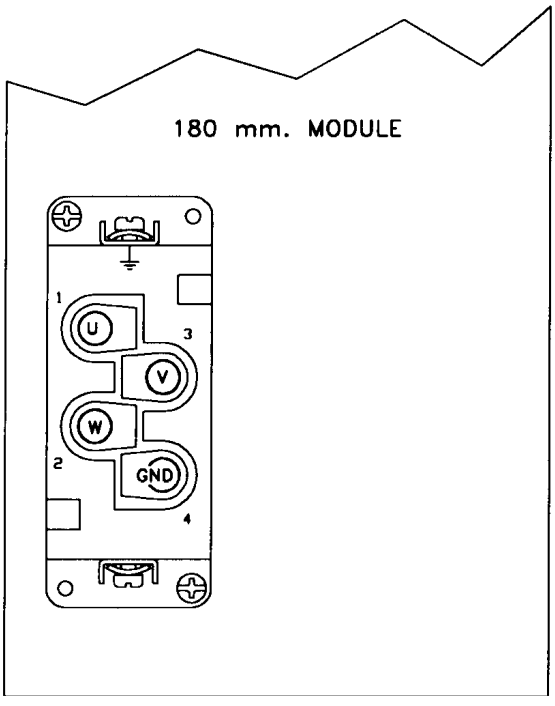
Wiring side: power connector, 4 male contacts (max wire size: 16 mm^2), 6 male contacts or 16 male contacts (max wire size: 2.5 mm^2), screw termination

Wiring side connector view and DBM033 Configurations





M1	M2	M3
25/70	25/70	25/70
30/90	30/90	30/90



Expansion
80/240

M1	M2	M3
5/15	50/140	5/15
5/15	70/180	5/15
10/25	50/140	5/15
10/25	70/180	5/15
10/25	50/140	10/25
10/25	70/180	10/25
15/45	50/140	5/15
15/45	70/180	5/15
15/45	50/140	10/25
15/45	70/180	10/25
15/45	50/140	15/45
15/45	70/180	15/45
25/70	50/140	5/15
25/70	70/180	5/15
25/70	50/140	10/25
25/70	70/180	10/25
25/70	50/140	15/45
5/15	50/140	
5/15	70/180	
10/25	50/140	
10/25	70/180	
15/45	50/140	
15/45	70/180	
25/70	50/140	
25/70	70/180	
30/90	50/140	5/15
30/90	70/180	5/15
30/90	50/140	10/25
30/90	70/180	
30/90	50/140	
30/90	50/140	15/45

2.9.5 Potentiometer/Button

Tab. 2.17 - Potentiometer/Button

I LIMIT POTENTIOMETER	Peak current control. A full CCW rotation will set the current to zero. A full CW rotation will set the current to 100%.
RESET BUTTON	Digital control card reinitialization and reset of protections.

2.9.6 Fuse (Power Supply)

A delayed type fuse, rated 4A/250V, is provided on the front panel of DBM 033 Power Supply, to protect the auxiliary power circuit.

2.9.7 Input/Output Characteristics

Tab. 2.18 - Input/Output Characteristics

OPTOISOLATED INPUTS Drive enable 1,2,3 Reference enable Remote reset	z in =1.2 kΩ I nom = 10 mA (8 to 20 mA) Vmin = 15Vdc Vmax = 25V
OPTOISOLATED OUTPUTS Drive OK/ Motor OK	z out = 1.2 kΩ I max = 20 mA Vnom < 25 Vdc
Analog tacho outputs 1,2,3	z out = 100 Ω I max = 5 mA Range: see ET command Gain error = ±10% over production spread Max linearity error: ±2% over full range
Analog Out1 Analog Out2	z out = 100 Ω I max = 10 mA Full scale = ±10V
Velocity differential Reference Signals 1,2,3	z in > 20 kΩ Full scale = ±10V
Simulated Encoder differential output signals	z out = 100 Ω Full scale = 7V (RS422/RS485 compatible)

2.10 Serial Link Connection

REMARK: for the first installation it is strongly recommended to use either the optional keypad or the DBTALK communication program.

2.10.1 Keypad

The keypad is an optional accessory product which can be used for drive setup and monitoring. The keypad must be connected to J10 connector of Power Supply.
If problems occur when attempting to communicate, the keypad is most likely set incorrectly. To start the setup procedure press <CTRL>, then <CR>. For each parameter the current setting is displayed, together with a question asking if you want to change it.
The correct setting is:

BAUD = 9600
WORD = 8D+E+1 STOP
BLOCK MODE
SINGLE LINE MODE
FLASHING OFF
KEY REPEAT ON SLOW

Be sure to save at the end of the procedure by pressing <Y> when the display shows: "Make changes permanent Y/N".

2.10.2 Connection to Personal Computer

2.10.2.1 RS232/RS485 Full-duplex Converter

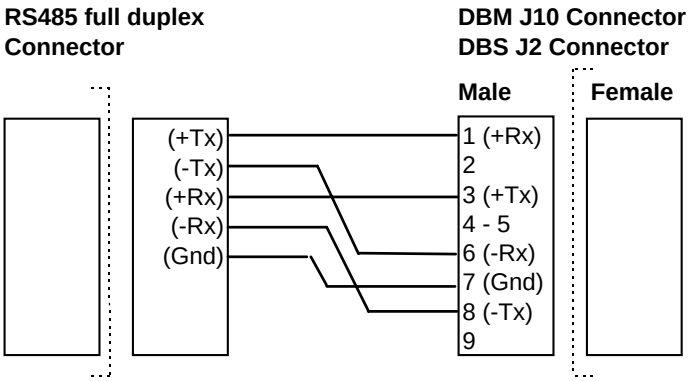
The RS422 interface wiring is based on one-to-one, no multidrop, principle. Four wires are used. With RS422, you can transmit and receive data simultaneously (full-duplex).
The RS485 half-duplex uses only two wires. It allows multidrop communication. With RS485 half-duplex, you cannot transmit and receive simultaneously.
DBM033 supports RS485 full-duplex with four wires (RS422 compatible). Up to 99 DBM and up to 15 DBS drives can be connected in multidrop configuration.

- **RS232/485 CONVERTER KIT**

This very small external converter provides a full-duplex interface between PC and DBM. The converter must be fit directly into a COM port (RS232) of a PC. This way the link becomes purely RS485, less susceptible to noise and able to transmit over much longer distances than RS232.

The kit includes:
- the converter to fit into DB25-S connector of the PC (COM port)
  The DTE/DCE switch of the converter must be set to DCE (Data Communications Equipment)
- a DB25 to DB9 interface (to be used if the PC COM port is DB9-S)
- a 2 m cable to connect the converter to DBM J10 connector

- An optoisolated PC board RS 485 full-duplex driver can also be used. The following wiring must be used.



2.10.2.2 DBTALK Program

- **PC REQUIREMENTS**

- 80286, 80386, 803386 microprocessor or better
- Hard disk and one diskette drive. You need 2 Mbytes of disk space and 512 kbytes of RAM
- CGA, EGA, VGA, MCGA graphics card (color VGA recommended)
- MS-DOS 6.2 or later
- ANSI.SYS in CONFIG.SYS

- **DBTALK PROGRAM**

The DBTALK program is available on floppy disk

- **INSTALL PROGRAM**

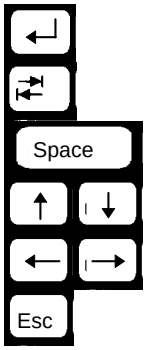
- Insert diskette into drive A or drive B
- Type <a:install> (or <b:install>)

The installation program will create the Directory C:\DBTALK, will copy all the files in this new directory and will start the program

- **START PROGRAM** (after the first installation)

- Type <cd dbtalk>
- Type <start>

- **MOVE IN THE PROGRAM**



Start the selected procedure

Select the field

Reread parameters

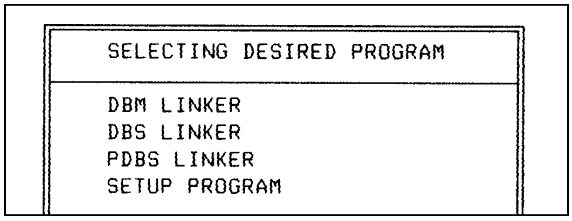
Move up/down

Go to previous/next screen

Exit/Go to previous menu

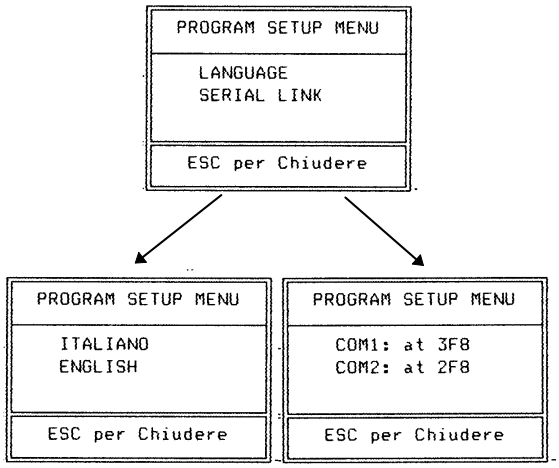
- **SELECT PROGRAM**

⇒ DBM linker
⇒ DBS linker
⇒ PDBS Linker (see PDBS Application Manual)
⇒ Setup



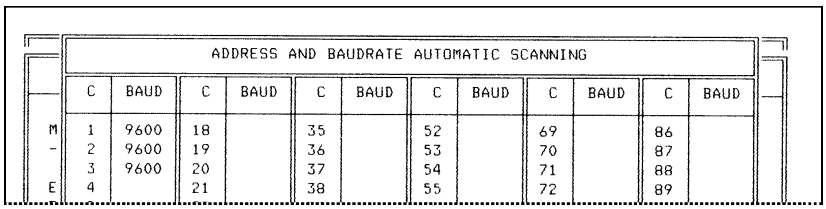
- **SETUP** to choose

⇒ Language: Italian or English
⇒ Serial link : COM1 or COM2

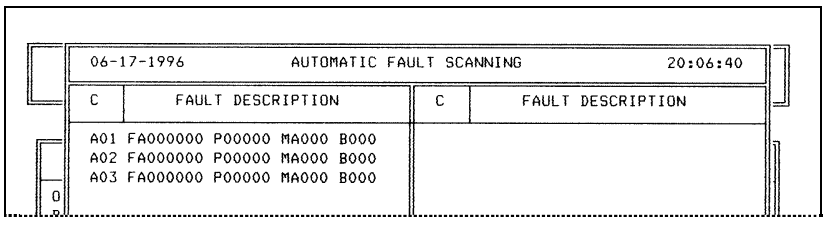


- **UTILITY** to

⇒ Scan Baud rates

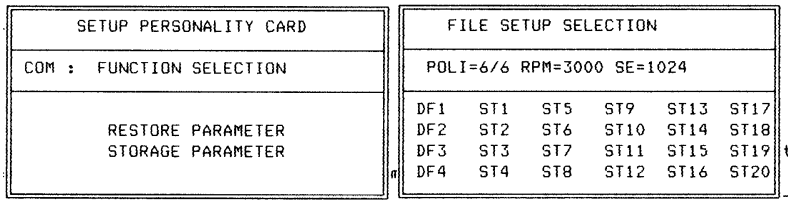


⇒ Scan Faults



⇒ Restore/store Personality Card parameters

To save the actual parameter set, select STORAGE PARAMETER, select the file (e.g. ST1), press <TAB> to change the description and press <CR>



⇒ Set Baud rates

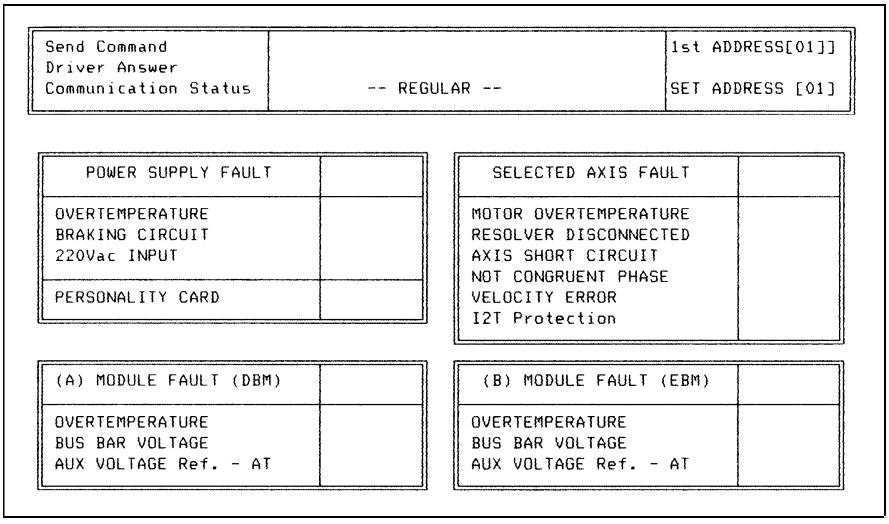
⇒ Start the Autophasing procedure

⇒ Set the "Adjustment of Torque/Speed curve" procedure

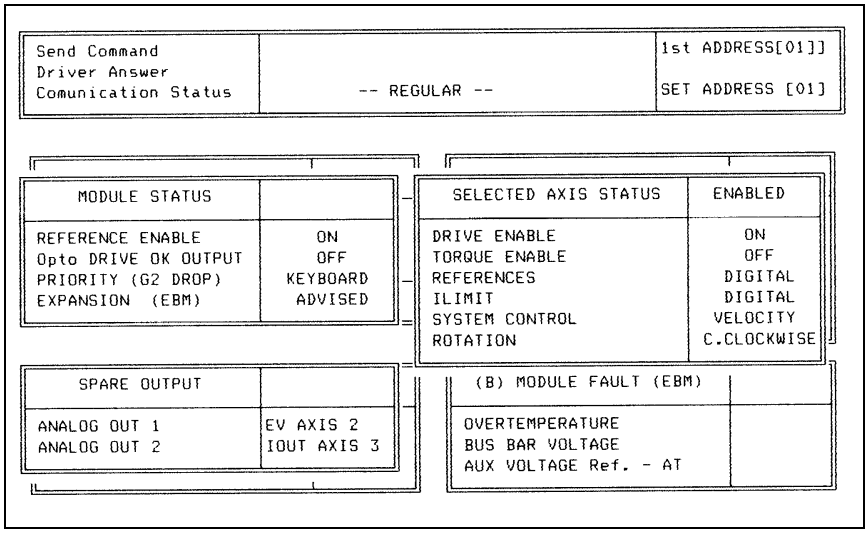
- **MANUAL** to

⇒ See/Reset Faults

If the fault condition is not present anymore, the fault will be reset automatically. To reset the fault on the screen, go to the next screen with the arrow keys

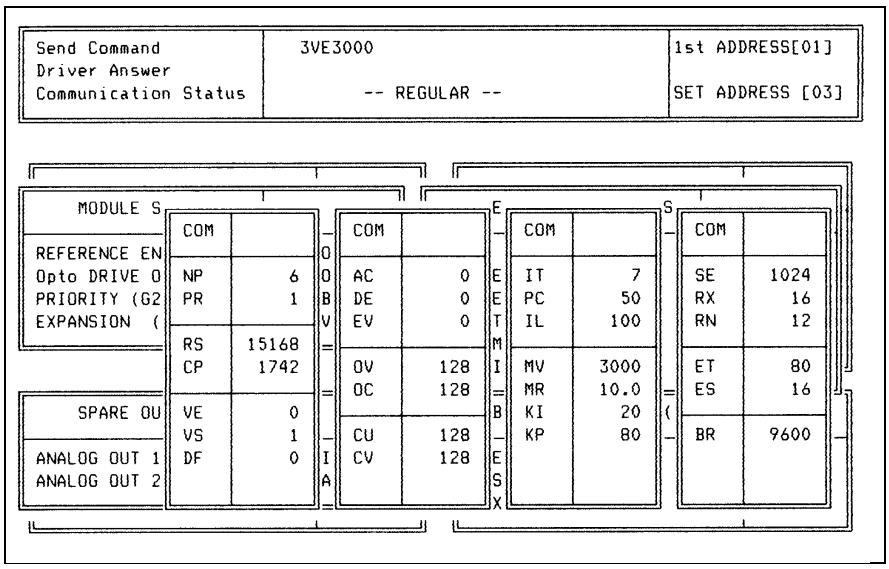


⇒ Display the Status



⇒ See/Change parameters

To change one parameter type the command string on the PC keyboard. Example: 3VE3000



2.11 Recovery Circuit

The recovery circuit is formed by a switching regulator, a recovery transistor and a recovery resistance. While braking the motor returns energy which cannot be sent to the line since the rectifier circuit is not regenerative. Returned energy tends to increase the BUS BAR DC voltage. When HV reaches 375V the switching regulator brings the recovery transistor into conduction, thus connecting the recovery resistance in parallel with filter capacitors. The recovery resistance is formed by enameled wire fixed resistor(s).

If the recovery resistance works for intervals shorter than the time necessary to reach thermal equilibrium, the resistor can temporarily handle power levels up to 10 times the nominal power rating of the resistor (short time overload).

If not specifically requested, systems are provided with standard 3.9 Ω, 370W recovery resistor.

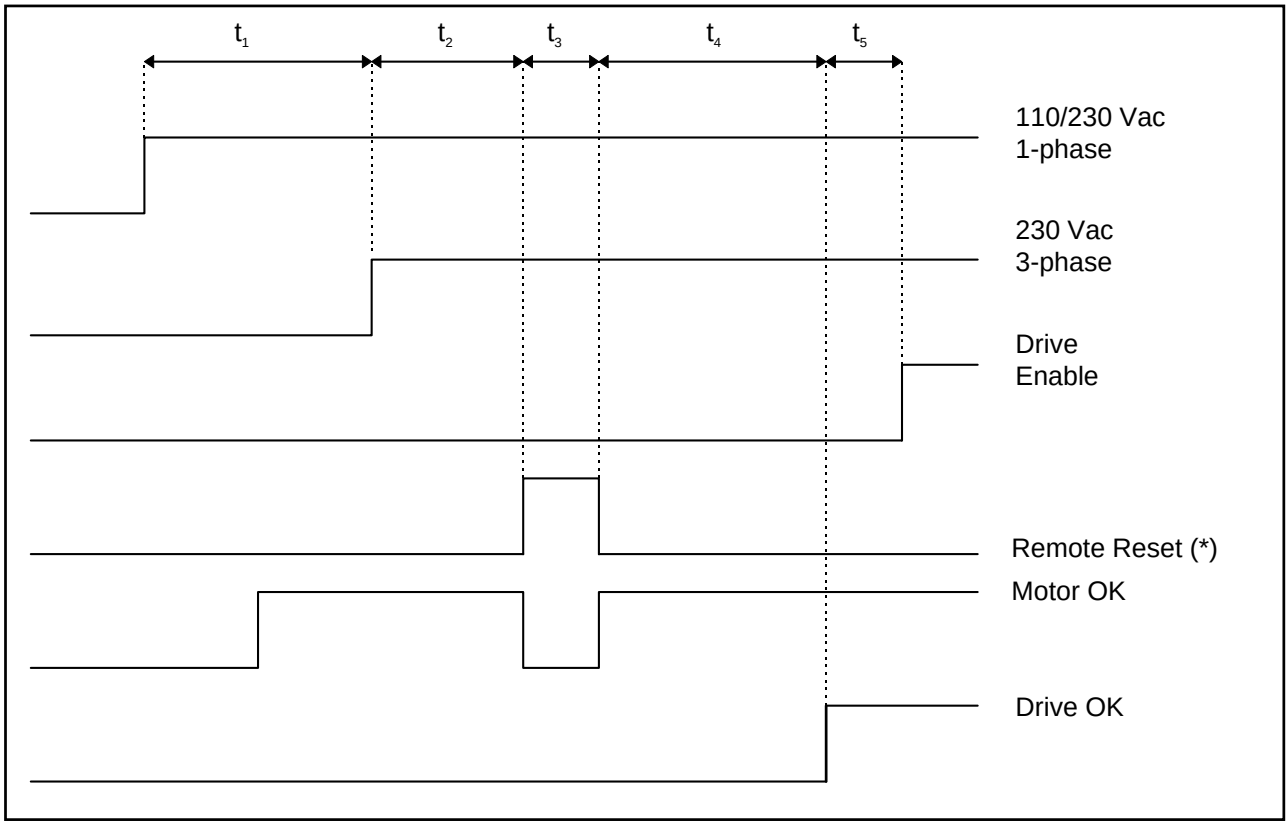
WARNING: High Voltage. The recovery resistor is connected to the Bus Bar's and can have voltage ≥300Vdc

WARNING: do not touch recovery resistor during operation to avoid scalds.

CAUTION: an unusual application with motor driven by the load, a large portion of the time, could result in overheating of the recovery resistor.
An unusual application with motor driven by high inertial load from high velocity in very short deceleration time could require a non standard recovery resistor.
It is suggested contacting our Service Centers.

Fig.2.13 - STARTING SEQUENCE - TIMING CHART

t_1 = 8 to 10 s, $t_2 \geq 1$ s, $t_3 \geq 20$ ms, t_4 = 3 s, $t_5 \geq 0.5$ s



(*) CAUTION: the Remote Reset must be a single nonrepetitive signal. Otherwise it must be filtered with 1 Hz cutoff frequency.

2.12 Starting Sequence

The starting sequence depends on the type of Power Supply. See Fig.2.13 for the Timing-chart.

1. Apply the 230 Vac (or 110Vac) single phase auxiliary voltage
2. Apply the 230Vac three phase power voltage

WARNING: High Voltage - Discharge time approx. 6 minutes.

- Multimodule configuration only. Disconnect the first module from the serial link and assign basic address to the second module and so on for the next modules (all the modules from factory being usually configured with address 1,2,3 if triple-axis or with address 1,2 if double-axis).

Example of basic address assignment for the 2nd module, if the first module is triple-axis:

FROM KEYPAD

1 SA 4 <CR>	Assign basic address 4 to the second module
4 SV <CR>	Save the address configuration

Note: A module programmed as "address 4" will automatically assign for the other axes the following addresses, i.e. 5 - 6 (if triple-axis) or 5 (if double-axis); and so on for the next basic addresses.

- Check if NP (pole number), MV (max velocity), MR (max reference) and other required parameters are OK for the application.

- Make a hardware reset via button on drive or via positive logic on pin 18 of J8 connector (software reset via FA command being useless for digital control card reinitialization).

2.12.1 Autophasing

- Check that the motor is free to rotate in both directions.
- Check that no fault condition occurs (red drive-fault leds off).
- The jumper G2 on the personality card must be open.
- Check that all module axes have analog drive enable on via positive logic and digital drive enable off.
- Send the password command for the module.
- Send the autophasing command for every axis of the module and save.

Example for a double module with axis 4 and axis 5:

FROM KEYPAD	
4 PW91 <CR>	Give the password for the 2nd module
PASSWORD ON	The correct answer is displayed
<CR>	Only for optional keypad.
4 AP <CR>	Allow axis 4 autophasing.
AUTOPHASING IN PROGRESS	
AXIS PHASED	
5 AP <CR>	Allow axis 5 autophasing.
AUTOPHASING IN PROGRESS	
AXIS PHASED	
4 SV <CR>	Save module 4 phasing.

- Repeat the password and autophasing procedures for subsequent modules (if applicable).
- Make a hardware reset via button on drive or via positive logic on pin 18 of J8 connector.

2.12.2 Wiring Check

Axes being phased it is possible to check the wiring by rotating the motor via its digital reference.

- Enable analog drive-enable and reference-enable via positive logic.
- Check that G2 is open for keypad priority.
- Send to every axis the ON command (to enable digital drive-enable) , the VE command (for CW slow rotation), the VE- command (for CCW slow rotation), the OF command (to disable the digital drive-enable).

Example of checking axis 5 rotation:

FROM KEYPAD	
5 ON <CR>	Enable digital drive-enable for axis 5
○	Drive enable led will be on
5 VE 50 <CR>	Set CW rotation at 50 rpm
5 VE-50 <CR>	Set CCW rotation at 50 rpm
5 OF <CR>	Disable digital drive-enable for axis 5
●	Drive enable led will be off

2.12.3 CNC Priority

With CNC, the following procedures must be followed.

2.12.3.1 Setting Of Analog References

To set the modules to use the analog references from the CNC, it is necessary to enter the password, to send the AR command to every axis and to save. ST command can be sent to check if the commands have been accepted.

Note that:
- AR command can be sent via global address (*).
- If there are two or more modules, PW (password) and SV (save) commands can be sent to each module.

Example of enabling all the analog references for two modules with axes 1,2,3 and 4,5:

FROM KEYPAD

1 PW91 <CR>	Give the password for the 1st module
PASSWORD ON	The correct answer is displayed
4 PW91 <CR>	Give the password for the 2nd module
PASSWORD ON	The correct answer is displayed
* AR <CR>	Enable analog reference for all axes
1 SV <CR>	Save the configuration for the 1st module
4 SV <CR>	Save the configuration for the 2nd module
1 ST <CR>	Ask the status for axis 1
A1 ST___ E___ I_0___	Displays the axis 1 status. Check the 0 in the 2nd bit after I
...	Repeat ST command and check other axes

2.12.3.2 Drive Enable With CNC Priority

To give the priority for enabling and disabling the drive from the CNC, it is necessary to pull out the personality card from the module, to solder G2 jumper and to pull in the card.

REMARK: if there are more than one module, do not swap the personality cards, this will swap the module data.

When the above procedure is completed, the CNC is the master and the keypad is the slave, as follows:
PARAMETERS MANAGED BY CNC: drive enable, reference enable, speed references.
PARAMETERS MANAGED BY KEYPAD: all dynamic parameters (acceleration, deceleration, KI, KP, etc.), status and fault.

2.12.4 Velocity Offset

If it is necessary you can adjust the analog velocity offset by providing 0 analog speed reference and setting VO command for an automatic adjustment. A fine adjustment can be done with successive steps via OV command.

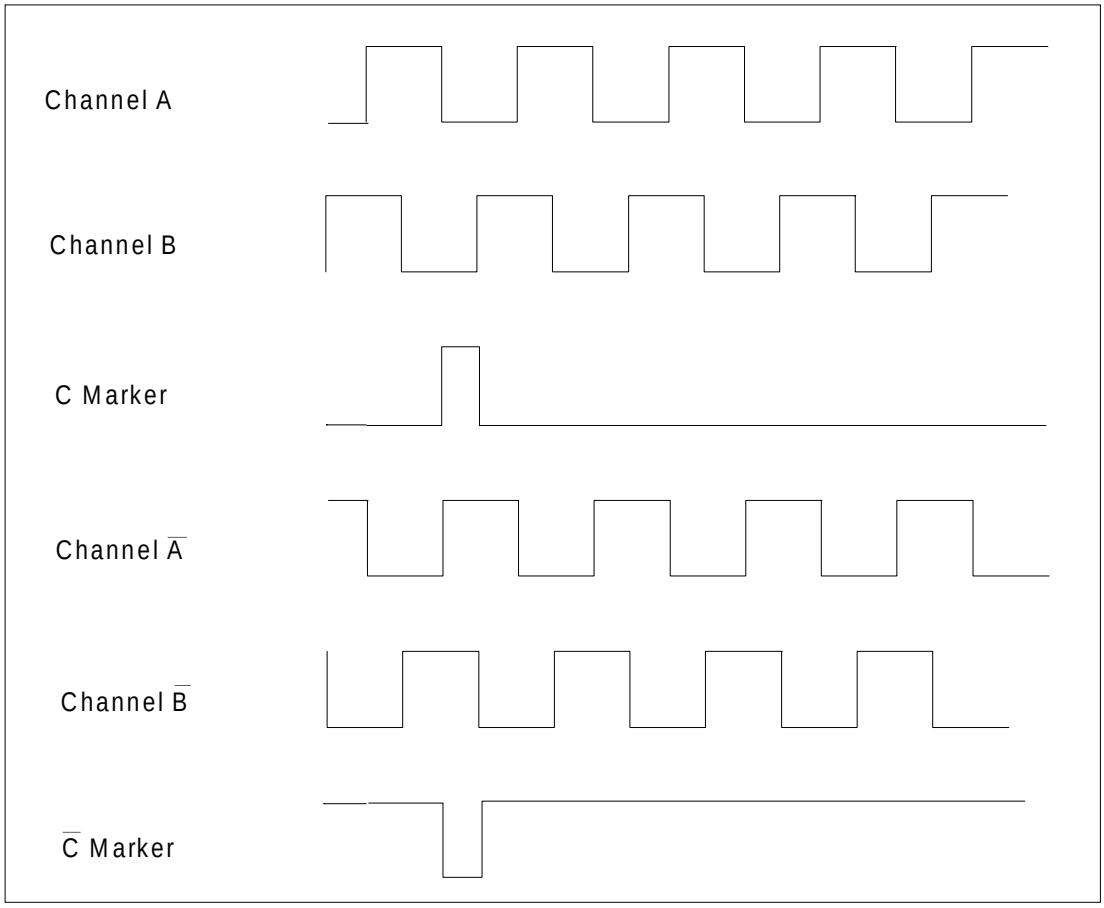
REMARK: the adjustment of the digital velocity offset must not be used to adjust the analog velocity offset and it is reserved to setup technicians. It can be made by providing 0 digital speed reference (VE=0) and setting OC command. The opto Drive Enable must be high.

2.13 - Resolver To Encoder Option

For position sensing a resolver to encoder option (simulated encoder) is available.
Encoder signals are 7V, 100 Ω impedance, as follows:

- 2 channels of square wave output with a resolution from 128 to 16384 pulses per electrical revolution. Channel B leads channel A by 90° for clockwise rotation when viewed from shaft end.
- 1 marker pulse per electrical revolution (i.e. 1∗ 3 = 3 marker pulses per mechanical revolution with a 6 pole resolver).
- . complementary outputs $\overline{A}$, $\overline{B}$ and $\overline{C}$.

Fig. 2.14 - Simulated Encoder (CW Rotation When Viewed From Shaft End)



Note: to make C Marker high when Channel A and Channel B are high (like Siemens), swap Channel A with Channel $\overline{A}$ and Channel B with Channel $\overline{B}$.

2.13.1 Setup For Encoder Resolution

The number of pulses per electrical revolution of simulated encoder can be set via SE software command.

Example of a setup for axis 1.

FROM KEYPAD

1 PW91 <CR>	Give the standard password for axis 1
PASSWORD ON	The correct answer is displayed
<CR>	Only for optional keypad
1 SE 4096 <CR>	Set 4096 ppr to axis 1
1 SE <CR>	Ask the number of ppr for axis 1
A01 SIMULATED ENCODER = 4096	
1 SV <CR>	Save

REMARK: the maximum number of pulses per electrical revolution depends on the R/D resolution. See Tab.2.19.

The width of C marker can be A (360°), A/2 (180°) or A/4 (90°); it must be specified in the order. This parameter does not depend on the software commands.

Note: to obtain the resolution per mechanical revolution it is necessary to multiply the pole pairs by the electrical resolution.

Example: if a FAS T motor with 6 pole resolver is used, 1024 pulses per electrical revolution mean 1024 ∗ 3 = 3072 pulses per mechanical revolution.

2.13.2 R/D Resolution

The resolution of Resolver to Digital converter will automatically be switched according to actual speed for optimum system performance between minimum (see RN command in the User's Manual) and maximum resolution (see RX command).
The speed range of R/D resolution is included in the following table.

Tab. 2.19 - Max speed and max ppr versus R/D resolution

	Resolution (bit)			
	10	**12**	**14**	**16**
Max number of pulses per electrical revolution	256	1024	4096	16384
Max speed with 2 pole resolver (rpm)	24000	12000	3510	877
Max speed with 6 pole resolver (rpm)	8000	4600	1170	292
Max speed with 8 pole resolver (rpm)	6000	3510	877	219

2.14 Mechanical Brake

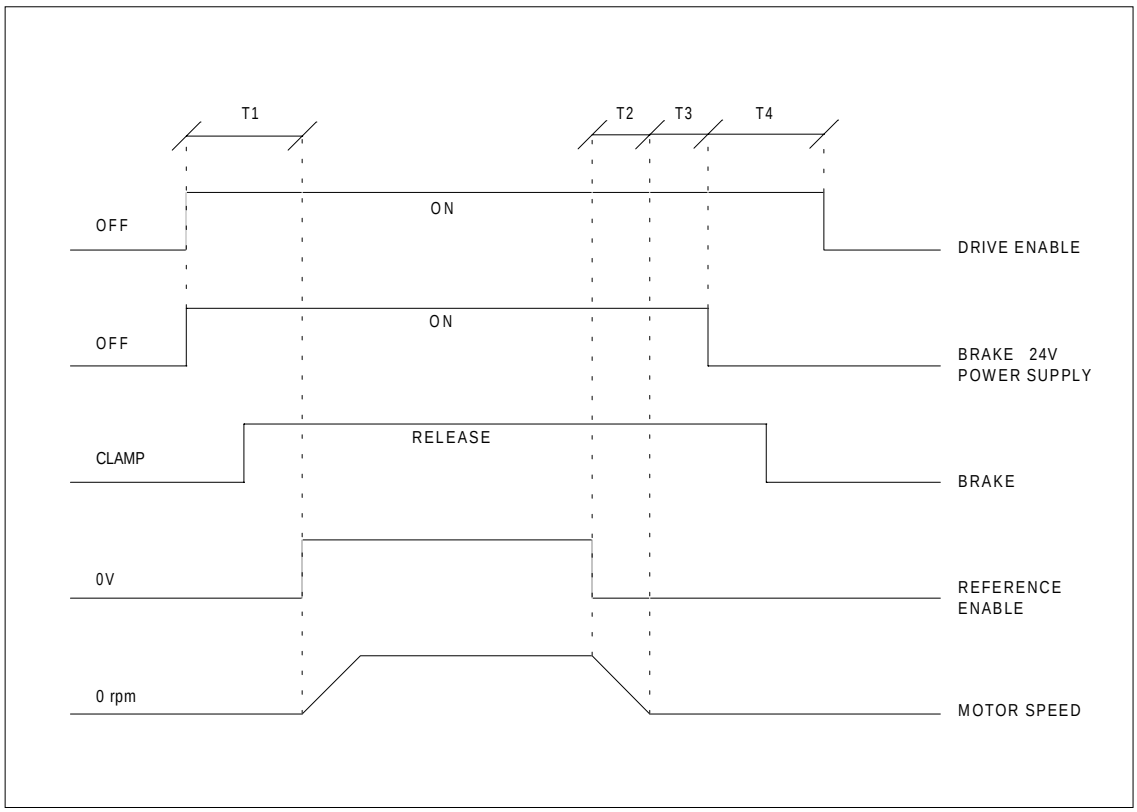
FAS series servomotors have as option a 24 Vdc electromagnetic safety brake.

CAUTION: safety brake must be clamped and released with motor at standstill. Premature failure of the brake will result if brake is used for dynamic stopping of the motor.

The release of the brake (from 0V to +24V) and the clamp (from +24V to 0V) must follow the sequence in Fig. 2.15.

FIG. 2.15 - BRAKING SEQUENCE, TIMING CHART

Note: T1 ≥ 200 ms, T2 = application dependent, T3 = 100 ms, T4 ≥ 200 ms



2.15 Module Replacement

Once DBM module to be replaced has been identified, it is necessary to follow this procedure:

- Disconnect the power.
- Remove the Bus Bars (+HV, -HV and GND) and disconnect all connectors and flat cables.
- Unscrew the anchor screw on the top of the module and remove the module.
  Remove the Personality Card, at the left of J1 connector, by loosening the two screws. After removing the card, disconnect the flat cable.

REMARK: on the personality card a EEPROM is mounted. All dynamic parameters (dynamic settings, autophasing, analog interfaces, ...) are stored in this EEPROM after every reset.
In case of module replacement, it is recommended to save all parameters with the save (SV) command before removing the Personality Card ready for installation in the replacement module. This retains and transfers all the previous module information's.

Remove the Personality Card from the new module and replace with the old one.

- Mount the new module and tighten the anchor screw at the top.
- Reassemble the Bus Bars, all the connectors and flat cables.
- Check all connections.
- Enable the auxiliary voltage and check by the optional keypad or PC all application dependent parameters. In particular: pole number, max velocity, max reference voltage, Ilimit, internal ramp generator.

2.16 Sizing Of Power Supply Circuit

2.16.1 Sizing of Input Power Supply Circuit

It is necessary to refer to the rated output power of the motors (the output power with 65K winding overtemperature is included in the Technical Data table of catalogs of servomotors), to sum the power of single axes, to multiply the sum by the contemporaneity factor (factors often utilized are K_c=0.63 for 2 axes, K_c=0.5 for 3 axes, K_c=0.38 for 4 axes, K_c=0.33 for 5 axes, K_c=0.28 for 6 axes), and by a correction coefficient (=1.2), accounting for the losses of the motor/drive system.

$P = \Sigma P_{im} * K_c * 1.2$ [W]

2.16.2 Sizing of Fuses

It is necessary to divide the above calculated power by the DC Bus voltage:

$I_f = P / V_{DCBus}$ [A; W, V]

Where:

$V_{DCBusmin}$ = 190 V

2.17 Thermal sizing of cabinet

To calculate cabinet cooling requirements, table below provides estimated equipment power dissipation values. If the application employs continuous braking, it is necessary to include the recovery resistor power dissipation (use the nominal power of recovery resistor if actual application recovery dissipation is unknown).

Power Dissipation			
Power Supply	**Module**	**IGBT's**	**Input Bridge**
25 W	50 W	16 W/A	1 W/A

Example: with one Power Supply, two modules, a total output current of 60 Arms and continuous unknown braking, the dissipated power is as follows.

Pd = 25 + (2 * 50) + (16 * 60[A]) + (1 * 60[A]) + 750 [recovery resistor power] = 1895 W

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SECTION 3 - ELECTROMAGNETIC COMPATIBILITY (EMC)

3.1 European Directive (89/336/EEC)

Compliance with the European Directive 89/336/EEC is required for all electric and electronic products brought onto the European market after December 31st, 1995.
DBM033 drives with FASTACT motors meet the following EMC product standard related to the Directive:

EN 61800-3 (1996) and EN 61800-3/A11 (2000): "Adjustable speed electrical power drive systems. Part 3: EMC product standard including specific test methods".
Second environment (industrial) compatibility levels.

Remark: equipments not intended to be used on a low-voltage public network which supplies domestic premises. May cause radio frequency interference.

Tests have been made in an independent, competent body, test house.

The installer of the drive is responsible for ensuring compliance with the EMC regulations that apply where the drive is to be used. We recommend filtering as per par.3.2 and wiring, grounding and screening as per par.3.3 and 3.4.

3.2 Filtering

3.2.1 Filter Types

Code	**Trade-mark**	**Rated Current [A] at 50°C (40°C)**	**Max Voltage [Vac] at 50°C**	**Drive type**
AT6008	Schaffner FN 250-6/07	(6)	250	DBM033 PS (Aux)
AT6009	Schaffner FN 258-7/07	7 (8.4)	3 x 480	
AT6010	Schaffner FN 258-16/07	16 (19.2)	3 x 480	
AT6011	Schaffner FN 258-30/07	30 (36)	3 x 480	
AT6012	Schaffner FN 258-42/07	42 (50.4)	3 x 480	
AT6013	Schaffner FN 258-55/07	55 (66)	3 x 480	
AT6014	Schaffner FN 258-75/34	75 (85)	3 x 480	
AT6015	Schaffner FN 258-100/35	100 (120)	3 x 480	DBM033 PS

3.2.2 Filter Sizing

The filter/drive coupling in the previous table is a standard coupling. The filter can be undersized according to the rms input current of the actual application. This should be done not only because, as a matter of fact, undersizing the filter means less money, but because the undersized filter provides better performance to EMC.

Example:

- **DBM PS/033 + DBM 033 5-5-5 + DBM 033 5-5-5** and contemporaneity factor of 0.8.

For this application it is not necessary to use the 100A filter of the table.

The reference current is $Iin = 6 * 5 * 0.8 = 24$ A

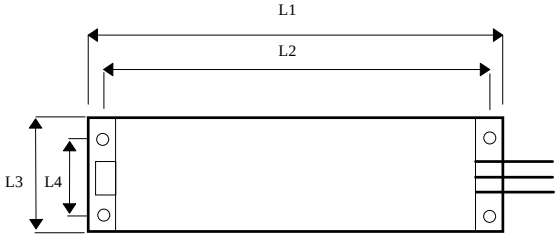
A 30A filter (FN 258-30/7) can safely be used.

3.2.3 Filter Dimensions

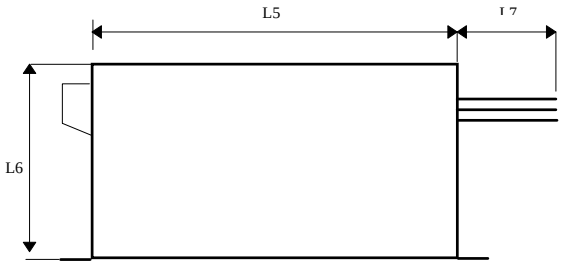
Code	Trade-mark	Dimensions [mm]							Weight
		L1	L2	L3	L4	L5	L6	l7	[kg]
AT6008	Schaffner FN 250-6/07*	85	75	54	0	65	30	300	0.24
AT6009	Schaffner FN 258-7/07	255	240	50	25	225±0.8	126±0.8	300	1.1
AT6010	Schaffner FN 258-16/07	305	290	55	30	275±0.8	142±0.8	300	1.7
AT6011	Schaffner FN 258-30/07	335	320	60	35	305	150	400	1.8
AT6012	Schaffner FN 258-42/07	329	314	70	45	300	185	500	2.8
AT6013	Schaffner FN 258-55/07	329	314	80	55	300	185	500	3.1
AT6014	Schaffner FN 258-75/34	329	314	80	55	300	220	terminal block	4
AT6015	Schaffner FN 258-100/35	379±1.5	364	90±0.8	65	350±1.2	220±1.5	terminal block	5.5

*= the FN250-6/07 filter has wiring leads (length=300mm) at both sides.

TOP VIEW



SIDE VIEW



3.2.4 Filter Installation

- The filter must be mounted on the same panel as the drive.

CAUTION: leave a clear space of at least 60mm around the filter for air circulation when the cabinet does not have forced ventilation.

- The filter must be connected as close as possible to the drive input. If the separation between filter and drive exceeds around 30 cm (1 ft.) then a flat cable should be used for the RF connection between filter and drive

REMARK: when mounting the drive and the filter to the panel, it is essential that any paint or other covering material be removed before mounting the drive and the filter.

- The maximum torque of mounting screws is as follows:

FILTER	Max torque
FN 250 - 6/07	0.8 Nm
FN 258 - 7/07	0.8 Nm
FN 258 - 16/07	0.8 Nm
FN 258 - 30/07	1.8 Nm
FN 258 - 42/07	1.8 Nm
FN 258 - 55/07	3.0 Nm
FN 258 - 75/34	3.0 Nm
FN 258 - 100/35	4.0 Nm

- The filter can produce high leakage currents (see Table)

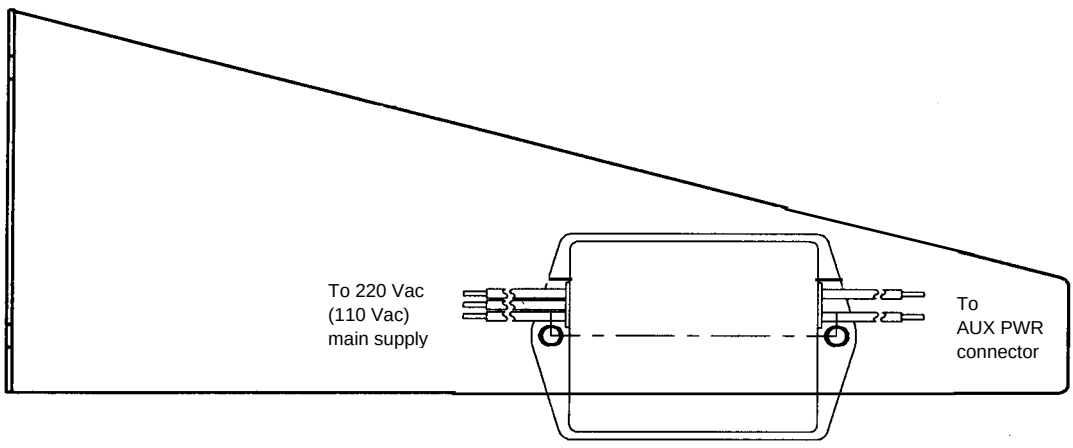
FILTER	Leakage current *
FN 250 - 6/07	1.3 mA
FN 258 - 7/07	17 mA
FN 258 - 16/07	19 mA
FN 258 - 30/07	25 mA
FN 258 - 42/07	26 mA
FN 258 - 55/07	26 mA
FN 258 - 75/34	26 mA
FN 258 - 100/35	26 mA

* Note: if two phases are interrupted, worst case leakage current could reach 6 times higher levels

- The capacitors within the filters have discharge resistors.

CAUTION: the filter must be connected to ground before connecting the supply
WARNING: High Voltage - Discharge time approx. 10 seconds

- The single phase filter can be installed on the left shoulder of the fan housing (Power Supply side), as in the following figure:



3.3 Wiring And Grounding

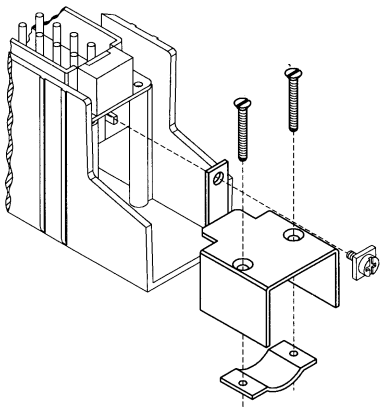
All the following cables must be shielded, with 85% minimum shielding coverage:

- power motor cable (see Fig.3.1 and 3.2)

NOTES: if a power terminal board is used at motor side, the shield must be RF connected to a metallic PG gland.
- connectors at motor side can have a threaded clamp. Cable shield must be grounded in the same way as in Fig.3.2.

- resolver cable (see Fig.2.11 and Fig.3.2 motor side)

Fig. 3.1 - Grounding Of Shield To Motor Connector At Drive Side



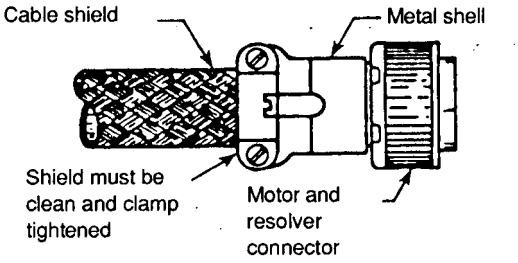
- recovery resistor cable

CAUTION*: the recovery resistor cable provided in kit is only for test purposes and not EMC compliant.*

- Reference, Enable and OK cable
- RS485 cable (flat cable between modules excluded)
- simulated encoder cable (if applicable)

The shields of the cables must be connected at both ends to the proper housing via full circumferential bond to metallic connectors or hose clamps.

Fig. 3.2 - Grounding Of Shield To Connectors At Motor Side



In case of Sub-D connector, cable shield must be grounded to the metallic hood.

When there is not connector at drive side, a kit with stand-off, screws and hose clamps is provided.

The shield of the cable must be uncovered from insulation coating and RF connected to the stand-off through the hose clamp, as in Fig.3.3.

Fig. 3.3 - Grounding Of Shield Without Connector

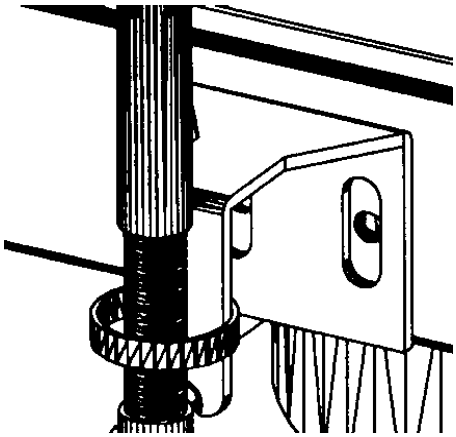
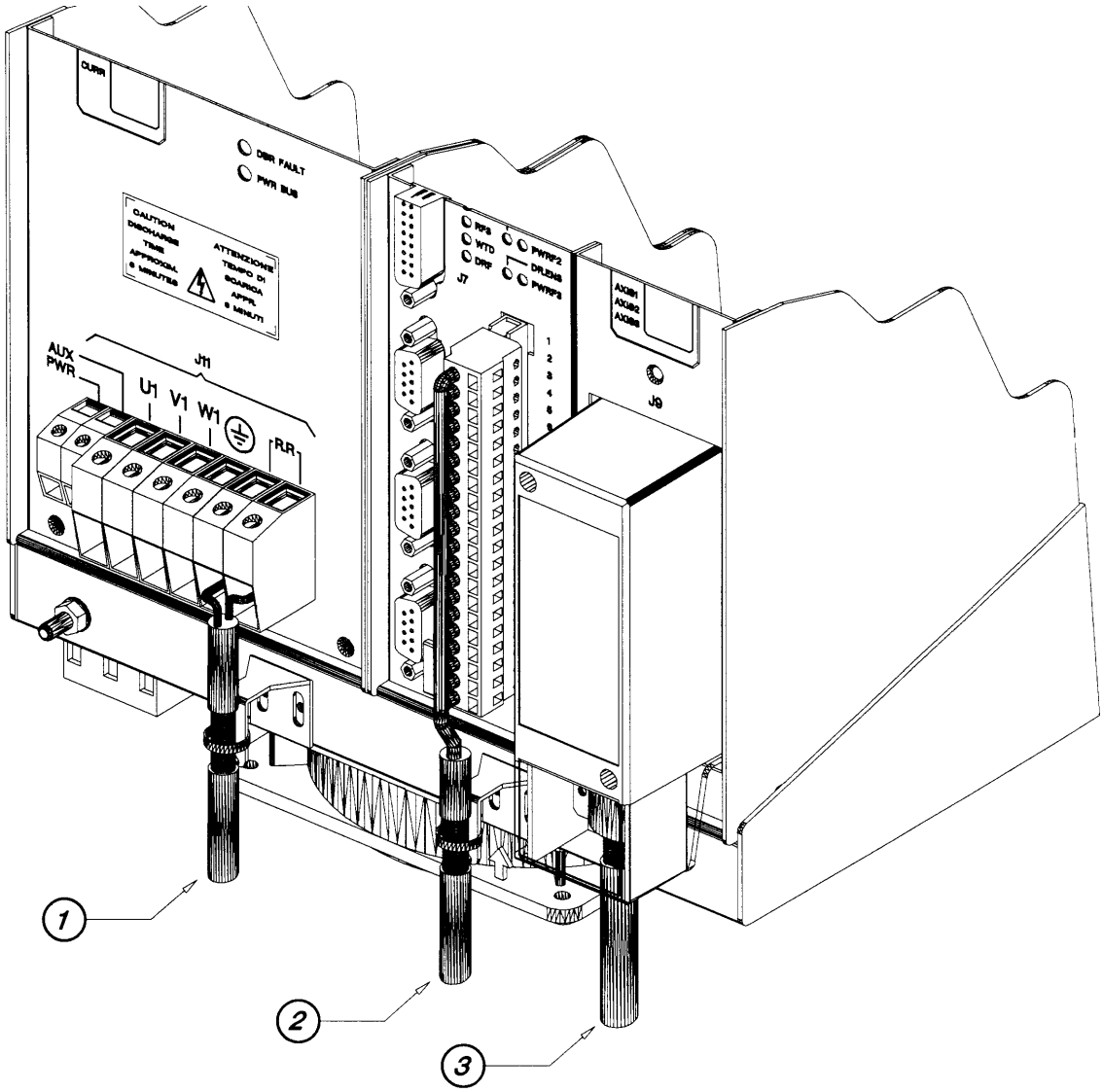


Fig. 3.4 - Cable Grounding At Drive Side



1 = Recovery resistor cable
2 = Reference, Enable, OK cable
3 = Motor power cable

Sub-D and unshielded cables not shown

It is not necessary to shield the input power wires, the bus bars, the flat cables between the modules.

REMARKs:
- the shields of cables inside the cabinet must be 360° clamped to the cabinet wall (see Fig. 3.5).
- "noisy" cables must be kept away from "sensitive" cables by at least 30 cm (12 in). Noisy cables include input-power wires, motor power and brake wiring. Sensitive cables include analog or digital signal cables: resolver cable; reference, enable and OK cable; RS485 serial link; simulated encoder wiring.
- where noisy cables must cross power cables, this must be done with angles as near to 90° as possible.

Fig. 3.5 - Clamping To Cabinet

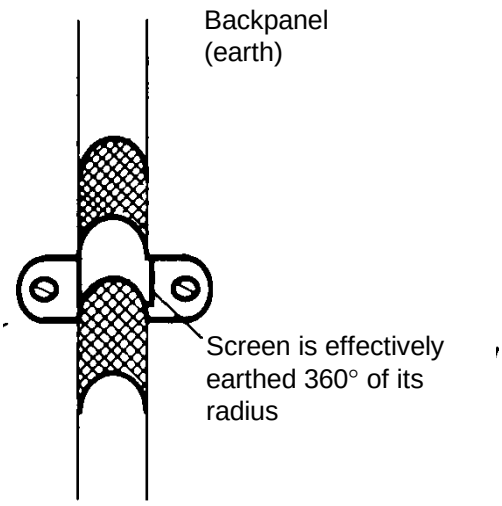
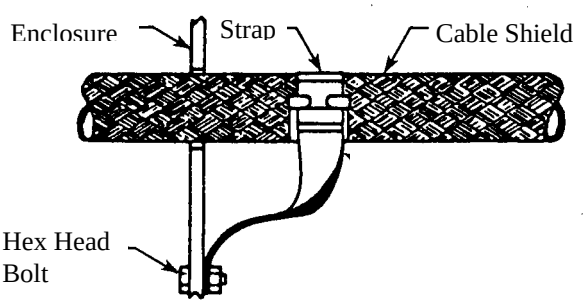


Fig. 3.6 - Partition Penetration



- the crossing of the cabinet should be accomplished with a low impedance connection between cable shield and enclosure. If a connector is not involved, the shortest practical lengths of connecting strap should be used (see Fig.3.6).

3.4 Recovery Resistor/ Motor Choke

To meet the Machinery Directive "the ventilated enclosures containing dynamic braking resistors shall provide a degree of protection of at least IP22" (EN 602033-1, par. 13.3).
To meet the EMC Directive, these enclosures must be conductive. The cable of recovery resistor must be shielded and the shield must be 360° clamped at both sides.
In some applications (e.g. some size 3 FAS T motors) a choke in series for each motor phase has to be added. This choke must be shielded.

REMARK: when mounting the enclosure of recovery resistor or motor choke to the panel, it is essential that any paint or other covering material be removed before mounting the enclosure of recovery resistor or motor choke.

3.5 Screening

To effectively screening the system all the single screens (CNC, electronic cabinet, machine, motor housing, cables) must be connected together to effectively form one screen (see Fig.1.5).

3.6 Safety Aspects

Noise suppression of Motor and Drive systems involves consideration of the earthing system, and its effectiveness at high frequencies. It should not be forgotten that is the safety system too and that the safety must take priority over EMC.
To reduce the radiated emissions, the use of capacitance to earth is very effective. In fact DBM 033 drives have Y-type capacitors near the input power supply connector and Schaffner filters also include them. These capacitors conduct current from phase to earth; this can be in the order of hundreds of milliamperes.

WARNING: appropriate safety measures should be taken to ensure that this potentially dangerous current flows to earth.

CAUTION: it is recommended to disconnect the drive and the EMC filters to carry out the "AC Voltage Test" of the EN 60204-1 (par.20.4), according to the Machinery Directive (89/392/EEC) and to the Low Voltage Directive (73/23/EEC) in order not to damage the Y-type capacitors between phases and ground while parts of circuits can be floating and possibly damaged during the test.
To make anyway this test it is recommended contacting our Service Centers.

Moog Italiana S.r.l.
Electric Division
Via Avosso, 94
16015 Casella GE
Italy
Phone: (+39) 010 9671
Fax: (+39) 010 9671 280

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