MOOG

DBM 03

Installation Manual

GB-4501 Rev.4 - July/98

DBM 03 - INSTALLATION MANUAL

Rev.	Date	Description	Updated Pages
0	June/96	New Release with EMC	All
1	18/Oct/96	Add Appendix D (serial link multidrop); add Appendix E (DBTALK program); update personality card with WP jumper; update wiring drawings with shielding; correct miscellaneous errors	1, 2, 5, 11, 13, 16, 18, 19, 20, 21, 23, 24, 25, 26, 27, 32, 33, 34, 38, 44, 49, 50, 54, 55, 56
2	19/Dec/96	Add CE-marking; correct miscellaneous errors	1, 2, 19, 31, 38, 43, 51
3	23/May/97	Update standards with EN 61800-3, EMC product standard; correct fig.3.8 (EMC/Equipotential bonding); update 220Vac with 230Vac; correct the leakage current of EMC filters; correct miscellaneous errors	2, 4, 5, 8, 10, 17, 21, 26, 28, 29, 30, 34, 35, 38, 41, 42, 43, 45, 48, 49, 55, 56
4	6/July/98	Add default values for keyboard setup; add thermal sizing; correct miscellaneous errors	29, 34, 40, 43, 45, 50, 52, 53

Table of Contents

Introduction

This manual provides the necessary information for a proper installation of DBM 03 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).
To emphasize the differences between new DBM 03 User's Manual and old DBM 01 User's Manual, a vertical line in the left margin of the text indicates new items.

Accident Protection

WARNING: High Voltage. L+ and L- pins and BUS BAR can have voltage ≥300Vdc even after switching off (capacitive 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.

WARNING: when required for an emergency stop, opening motor phases must be preceded by disabling the axis. The delay time must be at least 30 ms.

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

CE-Marking

Starting from Jan/97, DBM03 drives have CE-marking according to Low Voltage Directive.
Starting from Apr/97 the CE-marking refers also to EMC Directive (see Section 6).
A Declaration of Conformity is available.

The Low Voltage Directive 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.
DBM03 drives meet the following standard related to Low Voltage Directive:

CEI EN 60204-1 (1993) par. 6.2.3, 20.3, 20.4

Component Parts

The DBM component parts are listed below.
The number of such elements depends on the system configuration.

* DBM-PS POWER SUPPLY MODULE
* DBM DRIVE MODULE
* FAN HOUSING
* RECOVERY RESISTOR
* ANCILLARY ITEMS AS FOLLOWS:

- 75 mm (2.95 in) Bus Bars (connection between DBM-PS and DBM...)
- 90 mm (3.54 in) Bus Bars (connection between DBM... and DBM... or EBM)
- flat 13-way cable for auxiliary voltage
- flat 9-way cable for serial line
- 37-contact D shell, solder type, male connector
- Cover for 37-contact D shell connector
- 9-contact D shell, solder type, male connector
- Cover for 9-contact connector
- 18-way plug in connector
- Motor connector (16-contact for DBM, 4-contact for EBM)
- Housing for motor connector
- 3.9 ohm, 370 W recovery resistor, with wiring

Assembly And Fixing

Fig. 1.10 (dimensions in mm) shows 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.

Drill for m5 screws

Note: for 180 mm module, dimensions are the same as two side by side standard modules.

Mounting Steps

REMARK: we suggest paying particular attention to the mechanical alignment of the modules, thus allowing a proper fixing of the bus-bars into the connector slots.

- fan housing
- power supply module
- drive module(s)

Note: the fan housings can be used as a support for the modules, and the modules themselves as a drilling template for their fixing.

- Connect the bus-bars between the power supply module and the drive module(s), tightening the screws at 3 Nm (26.5 lb in), to make a good electric contact.
- Connect the recovery resistor on the RR terminals of the power supply module (see Fig. 4.1). It is recommended to mount this resistor vertically and away from the heatsinks.
- Arrange the connecting cables to the other parts of the system according to the instructions given in the following sections.

Connections

Make the following connections (see Fig. 1.1)

• Flat conductor cable for auxiliary power supply (on J1)

• RS 485 serial flat conductor cable between DBM-PS (on J2) and the first DBM module (on J2)

• Keyboard or PC connection on J10 of DBM-PS

- D shell 37-contact connector on J7 of DBM module

- 18-contact connector on J8 of DBM module

- Motor connector on J9 of DBM module

- D shell 9-contact connectors on J4, J5, J6 of DBM module

REMARK: J4, J5, J6 connections must correspond to J9 connections (every resolver must correspond to his own motor, J4 to M1, J5 to M2 and J6 to M3, see Fig. 5.5, 5.6 and Fig. 6.1)

Tightening Torque

CAUTION: do not exceed the tightening torque of the table

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
M8	20.0	177.0

SECTION 1 - DESCRIPTION

1.1 Technical Data

DBM Module

Input voltage : 300Vdc, ±10%
Three-phase output voltage : 180V

DBM-PS Power Supply

Three-phase input voltage : 230Vac, ±10%, 50/60 Hz
Auxiliary power supply input voltage : 110Vac (optional) or 230Vac, ±10%, 50/60 Hz
Auxiliary input power : 55W for 3-axis module, 60W for fans pair
BUS BAR output voltage : 300Vdc

STANDARD MODULES

CODE	MODEL	TYPE	OUTPUT CURRENTS									Width A	Weight
			AXIS 1			AXIS 2			AXIS 3				
			Rated	Max		Rated	Max		Rated	Max			
			(Arms)	(Arms)	(A)	(Arms)	(Arms)	(A)	(Arms)	(Arms)	(A)	(mm)	(Kg)
CG1210-03	DBM 1.5-1.5	DBM	1.5	3.5	5	1.5	3.5	5				90	9,5
CG1212-03	DBM 2.5-2.5	DBM	2.5	5.3	7.5	2.5	5.3	7.5				90	9,5
CG1200-03	DBM 05-05	DBM	5	10.6	15	5	10.6	15				90	9,5
CG1204-03	DBM 10-10	DBM	10	18	25	10	18	25				90	9,5
CG1207-03	DBM 15-15	DBM	15	32	45	15	32	45				90	9,5
CG1209-03	DBM 25-25	DBM	25	50	70	25	50	70				90	9,5
CG1319-03	DBM 1.5-1.5-1.5	DBM	1.5	3.5	5	1.5	3.5	5	1.5	3.5	5	90	10
CG1322-03	DBM 2.5-2.5-2.5	DBM	2.5	5.3	7.5	2.5	5.3	7.5	2.5	5.3	7.5	90	10
CG1300-03	DBM 05-05-05	DBM	5	10.6	15	5	10.6	15	5	10.6	15	90	10
CG1304-03	DBM 10-10-10	DBM	10	18	25	10	18	25	10	18	25	90	11
CG1308-03	DBM 15-15-15	DBM	15	32	45	15	32	45	15	32	45	90	11
CG1314-03	DBM 25-25-15	DBM	25	50	70	25	50	70	15	32	45	90	11
CG1727-03	DBM 05-50-05	DBM-L	5	10.6	15	50	100	140	5	10.6	15	180	15
CG1743-03	DBM 05-70-05	DBM-L	5	10.6	15	70	127	180	5	10.6	15	180	15
CG1708-03	DBM 10-50-10	DBM-L	10	18	25	50	100	140	10	18	25	180	15
CG1747-03	DBM 10-70-10	DBM-L	10	18	25	70	127	180	10	18	25	180	15
CG1734-03	DBM 15-50-15	DBM-L	15	32	45	50	100	140	15	32	45	180	15
CG1774-03	DBM 15-70-15	DBM-L	15	32	45	70	127	180	15	32	45	180	16
CG1716-03	DBM 25-50-15	DBM-L	25	50	70	50	100	140	15	32	45	180	16
CG1719-03	DBM 25-25-30	DBM-L	25	50	70	25	50	70	30	64	90	180	16

Note: we recommend to contact our Sales Locations or Service Centers for guidance on selection of drives not listed above (e.g. DBM05-10-15)

POWER SUPPLY

CODE	MODEL	INPUT AUXILIARY VOLTAGE	CURRENTS			WIDTH	WEIGHT
		Rated (V)	Output Rated (A)	Output Max (A)	Braking (A)	A (mm)	(Kg)
CG2000-03	DBM PS	230	100	300	100	60	8
CG2001-03	DBM PS/110 V	110	100	300	100	60	8
CG2002-03	DBM PS/150 A	230	100	300	150	60	8

EXPANSION MODULES

CODE	MODEL	Type	OUTPUT CURRENTS			WIDTH A	WEIGHT
			Rated	Max			
			(Arms)	(Arms)	(A)	(mm)	(Kg)
CG1002-03	EBM 50/140	EBM	50	100	140	90	10
CG1003-03	EBM 70/180	EBM	70	127	180	90	10
CG1004-03	EBM 70/240	EBM	70	170	240	90	10
CG1050-03	EBM 80/240	EBM-L	80	170	240	180	15

An external expansion module should be used for some configurations including an axis rated over 25A. This is due to thermal constrictions. Available expansion modules are shown in the lefthand table.

Note: to specify an expansion module, please replace the third axis rating number with an E, this ensures that the drive is configurated for use with an expansion module (e.g. DBM 25-10-E)

1.2 Interfaces

Digital

- Output for simulated encoder (optional)
- Serial Link RS485(1200-19200 Baud) full-duplex to manage:
    - Acceleration limits
    - Autophasing
    - Control parameters
    - Monitoring of internal parameters
    - Range of analog interface
    - System status
- Output for Drive OK axis 1, axis 2, axis 3 (TTL compatible)

On-Off (Optoisolated)

- Drive OK
- Drive Enable
- Motor OK
- Reference Enable

Analog

- Input velocity (see MR command)
- Resolver differential input signals
- Peak current limit input
- Output tachometer (see ET command)
- Max current, velocity reference, velocity error outputs (see ES, SO commands)

1.3 Protection

Module

- Auxiliary voltage out of tolerance
- BUS BAR overvoltage
- BUS BAR undervoltage
- Motor phase grounded
- Motor overtemperature
- Module overtemperature
- IT protection
- Abnormal resolver signal
- Short circuit on motor phases
- Non-coherent three-phase sequence
- Actual speed versus reference error

Power Supply

- Overtemperature
- Recovery unit not OK

1.4 System Wiring

All of the analog and digital signal connectors, auxiliary power supplies and I/O interfaces are front-connected to the unit.

Connectors for auxiliary power supply are made via Molex type connectors. Motor power are connected via a Harting type connector, while I/O connectors use a Weildmuller type connector.

All other connectors are made via D-type connectors.

All signals are positive logic:
active = +15V
not active = 0V (or not connected)

1.5 DBM Configurations

Three configurations are possible for the module:

DBM-3A: 3-axis module (see Fig. 1.3)
DBM-2A: 2-axis module (see Fig. 1.4)
DBM-2E: 2-axis module with expansion (see Fig. 1.5)
DBM-L3A: 3-axis 180 mm module (see Fig. 1.6)
DBM-L2A: 2-axis 180 mm module (see Fig.1.7)

FIG. 1.1 - Inter module wiring

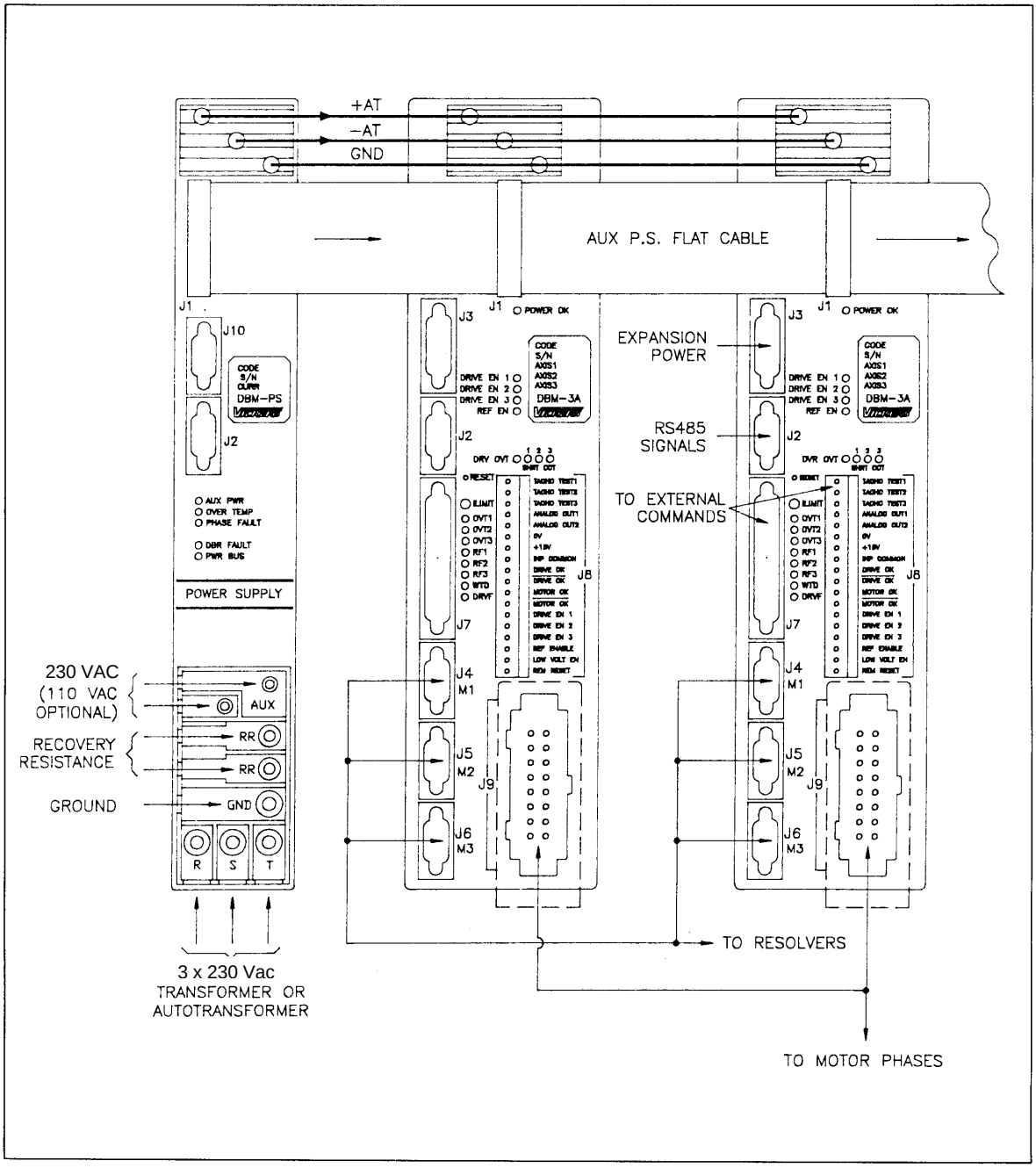
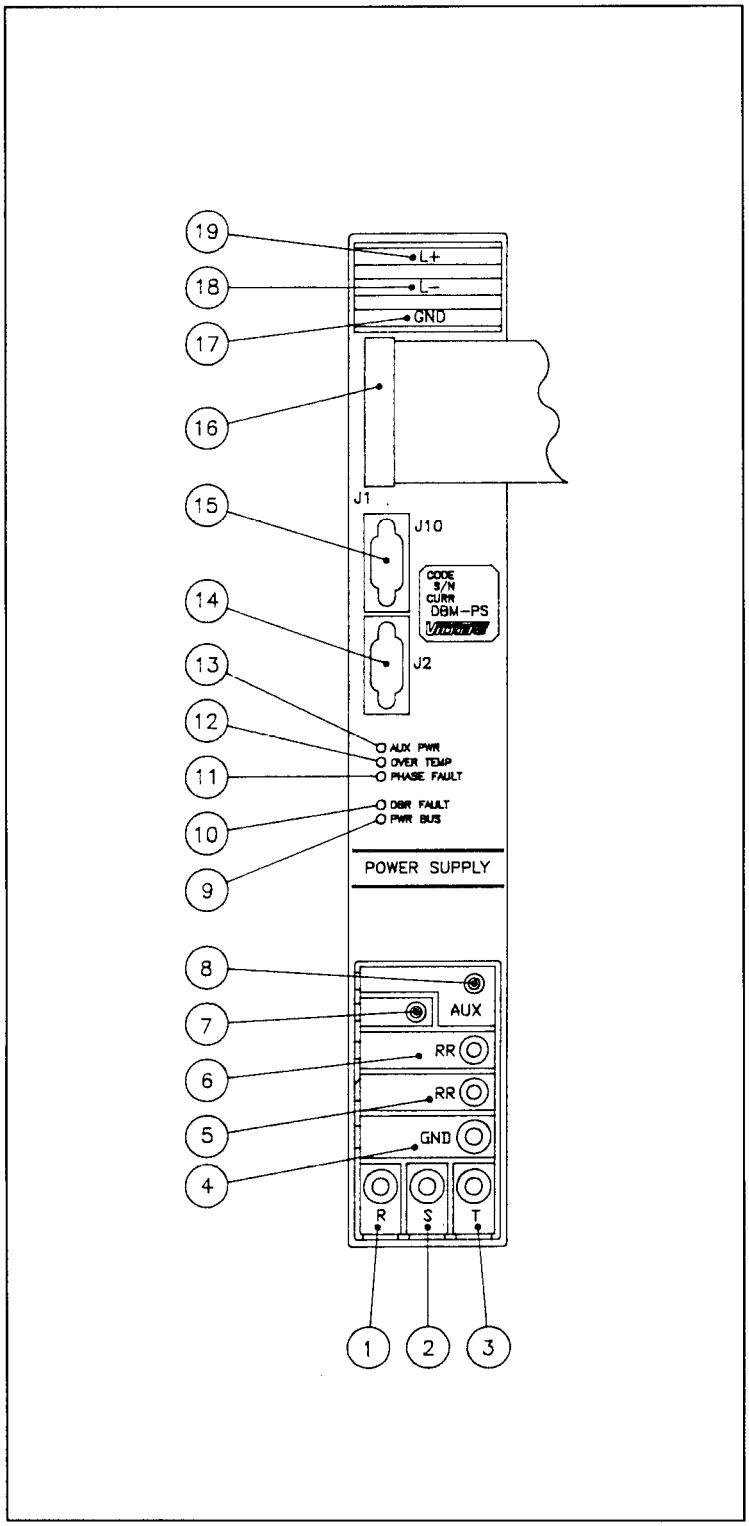


FIG. 1.2 - DBM-PS Power Supply



Tab. 1.1 - DBM-PS Power Supply (See Fig. 1.2)

Pos.	Name	
1	R	"L1" phase, three-phase input voltage 230Vac
2	S	"L2" phase, three-phase input voltage 230Vac
3	T	"L3" phase, three-phase input voltage 230Vac
4	GND	Ground
5	RR	Recovery resistor
6	RR	Recovery resistor
7	AUX	Auxiliary power supply 230Vac (110Vac as option)
8	AUX	Auxiliary power supply 230Vac (110Vac as option)
9	Yellow LED PWR-BUS	BUS BAR voltage > 40Vdc
10	Red LED DBR FAULT	Recovery unit fault
11	N.C.	
12	Red LED OVER TEMP	Module overtemperature via PTC (threshold 80 °C)
13	Green LED AUX POWER	Auxiliary power supply OK
14	J2	RS485 output port to drives and power control fault
15	J10	RS485 input port
16	J1	Auxiliary power supply flat connector
17	GND	Ground
18	L-	BUS BAR -HV 300Vdc
19	L+	BUS BAR +HV 300Vdc

Tab. 1.2 - DBM-PS Power Supply - J1 Connector
Auxiliary Power Supply

Pos.	Name	
1		N.C. (Not connected)
2		N.C.
3		- 15Vdc referred to -HV (300Vdc)
4		+18Vdc referred to -HV (300Vdc)
5		150kHz square wave to high side drives
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. 1.3 - DBM-PS Power Supply - J2 Connector
RS485 Port Signal and PWRS Control

Pos.	Name	
1		+ Rx (RS485 serial link)
2		N.C.
3		+ Tx (RS485 serial link)
4		PWRS fault 1 - power supply binary coded faults (level 1)
5		+ 5Vdc input referred to logic 0V
6		- Rx (RS485 serial link)
7		Logic 0V
8		- Tx (RS485 serial link)
9		PWRS fault 2 - power supply binary coded faults (level 2)

Note: Rx and Tx are the receiving and transmitting signals with reference to the drive. In the rest of the manual "RS485 serial link", referring to Rx and Tx, will not be specified anymore.

In case of fault, the type of fault is as follows:

J2/pos. 4	J2/pos. 9	
0	0	OK
0	1	DBR FAULT. Recovery fault
1	0	OVER TEMP. Overtemperature
1	1	PHASE FAULT.

Tab. 1.4 - DBM-PS Power Supply - J10 Connector
RS485 Port

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

1.6 DBM-PS Internal Card Jumpers

JP1 closed (default) = connects a 120 Ω resistor between RX+ and RX-.
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. 1.A - DBM-PS Card Jumpers

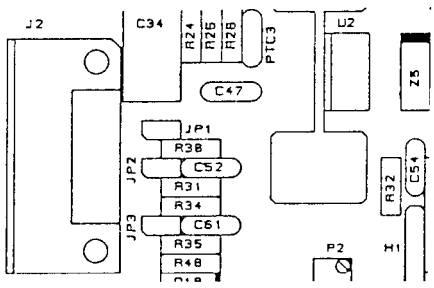


FIG. 1.3 - DBM03 - Standard 3-Axis Module

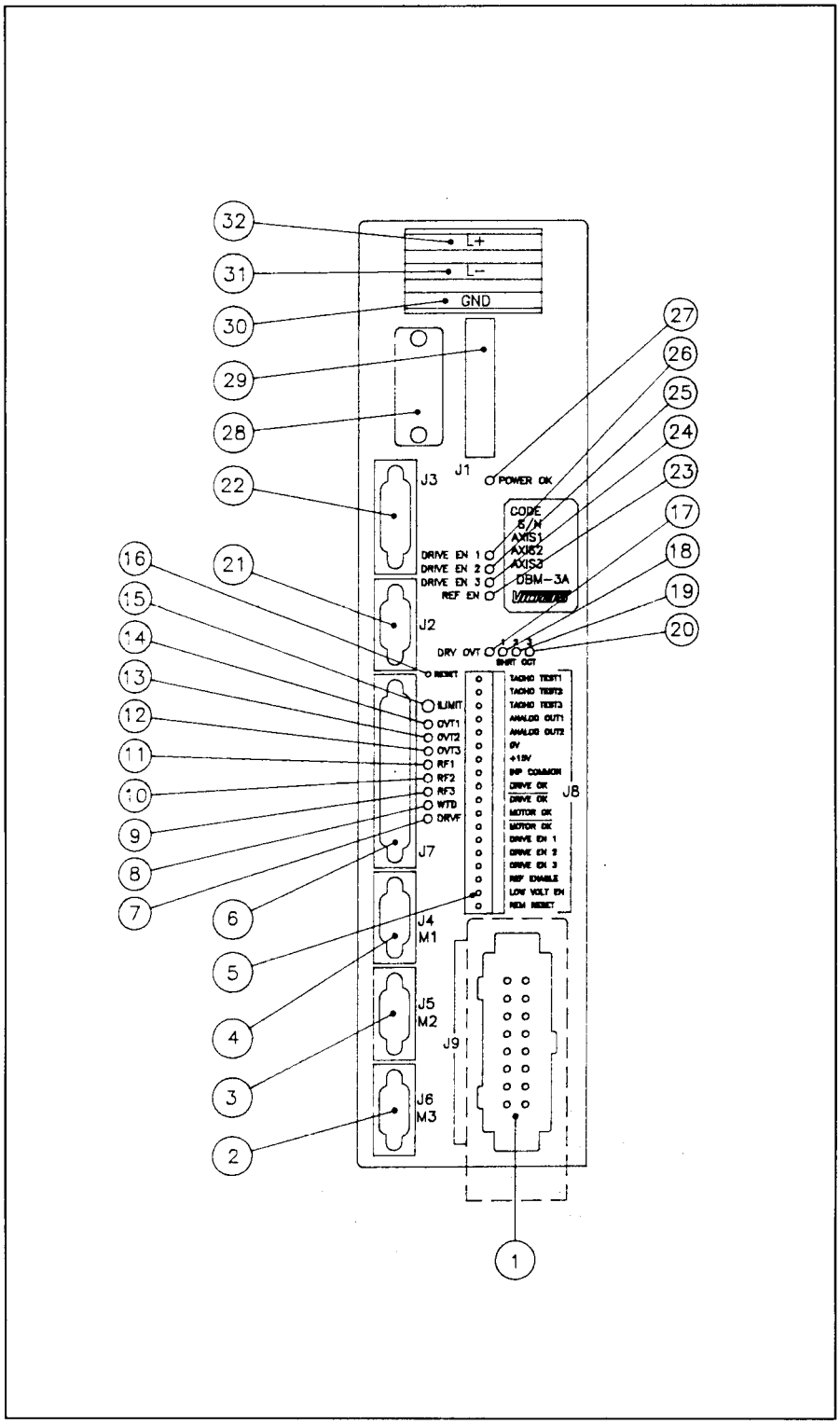
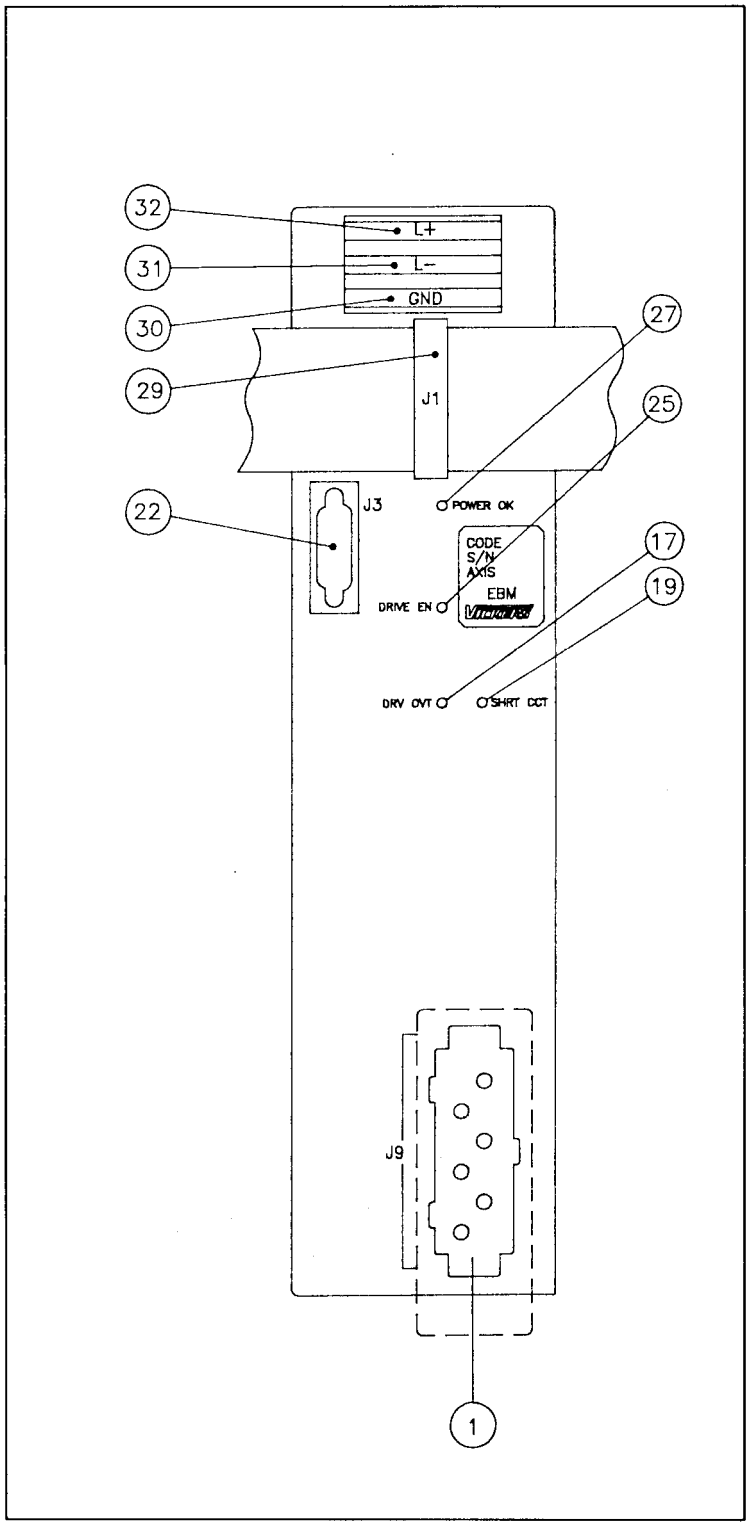


FIG. 1.4 - EBM Expansion Module (optional)



Tab. 1.5 - DBM Axis Module (See Fig. 1.3 to 1.4)

Pos.	Name	
1	J9	Motor phases (M1-M2-M3) connector
2	J6 M3	Resolver M3 connector
3	J5 M2	Resolver M2 connector
4	J4 M1	Resolver M1 connector
5	J8	I/O signals connector
6	J7	connector for analog references and simulated encoder output
7	Red LED DRFV	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)
8	Red LED WTD	Watch dog - signal; microprocessor circuit faults; this LED is on during reset
9	Red LED RF3	Resolver 3 fault - signal; resolver M3 fault, sin /cos signals interrupted, short circuit between signals or 10kHz carrier abnormal
10	Red LED RF2	Resolver 2 fault - signal; resolver M2 fault, sin /cos signals interrupted, short circuit between signals or 10kHz carrier abnormal
11	Red LED RF1	Resolver 1 fault - signal; resolver M1 fault, sin /cos signals interrupted, short circuit between signals or 10kHz carrier abnormal
12	Red LED OVT3	Motor M3 overtemperature
13	Red LED OVT2	Motor M2 overtemperature
14	Red LED OVT1	Motor M1 overtemperature
15	Trimmer ILIMIT	all axes peak current control (only for setup technicians); if current limit is required see IL, DL, AL commands
16	Push button RESET	digital control card reinitialization
17	Red LED DRV OVT	module overtemperature
18	Red LED SHRT CCT	short circuit on axis 1 (motor phases)
19	Red LED SHRT CCT	short circuit on axis 2 (motor phases)
20	Red LED SHRT CCT	short circuit on axis 3 (motor phases)
21	J2	RS485 input port and PWRS-fault signals connector
22	J3	Expansion connector for two axis module; on three axis module some pins of this connector are used as test points
23	Green LED REF EN	Reference enabled - signal: three - axis speed reference enable (see Tab. 1.12/ pos. 16)
24	Green LED DRIVE EN 1	Axis 1 enable (see also ON command)
25	Green LED DRIVE EN 2	Axis 2 enable (see also ON command)
26	Green LED DRIVE EN 3	Axis 3 enable (see also ON command)
27	Green LED POWER OK	Auxiliary power OK
28		Personality card: it contains drive setup in a non volatile memory
29	J1	Auxiliary power supply flat connector
30	GND	Ground
31	L-	BUS BAR -HV 300Vdc
32	L+	BUS BAR +HV 300Vdc
33	J10	Motor phases (M1-M2-M3) connector for DBM-L module

Tab. 1.6 - DBM Module, EBM Expansion - J1 Connector Auxiliary Power Supply

Pos.	Name	
1		N.C.
2		N.C.
3		- 15Vdc referred to -HV (300Vdc)
4		+ 18Vdc referred to -HV (300Vdc)
5		150kHz square wave to high side drives
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		10kHz sinusoidal wave for resolver and synchronism (carrier)

Tab. 1.7 - DBM Module - J2 Connector - Power Supply Flat and RS485 Port Signals

Pos.	Name	
1		+Rx
2		N.C.
3		+Tx
4		PWRS fault 1 - power supply binary coded faults
5		+5Vdc output referred to logic 0V
6		-Rx
7		logic 0V
8		-Tx
9		PWRS fault 2 - power supply binary coded faults

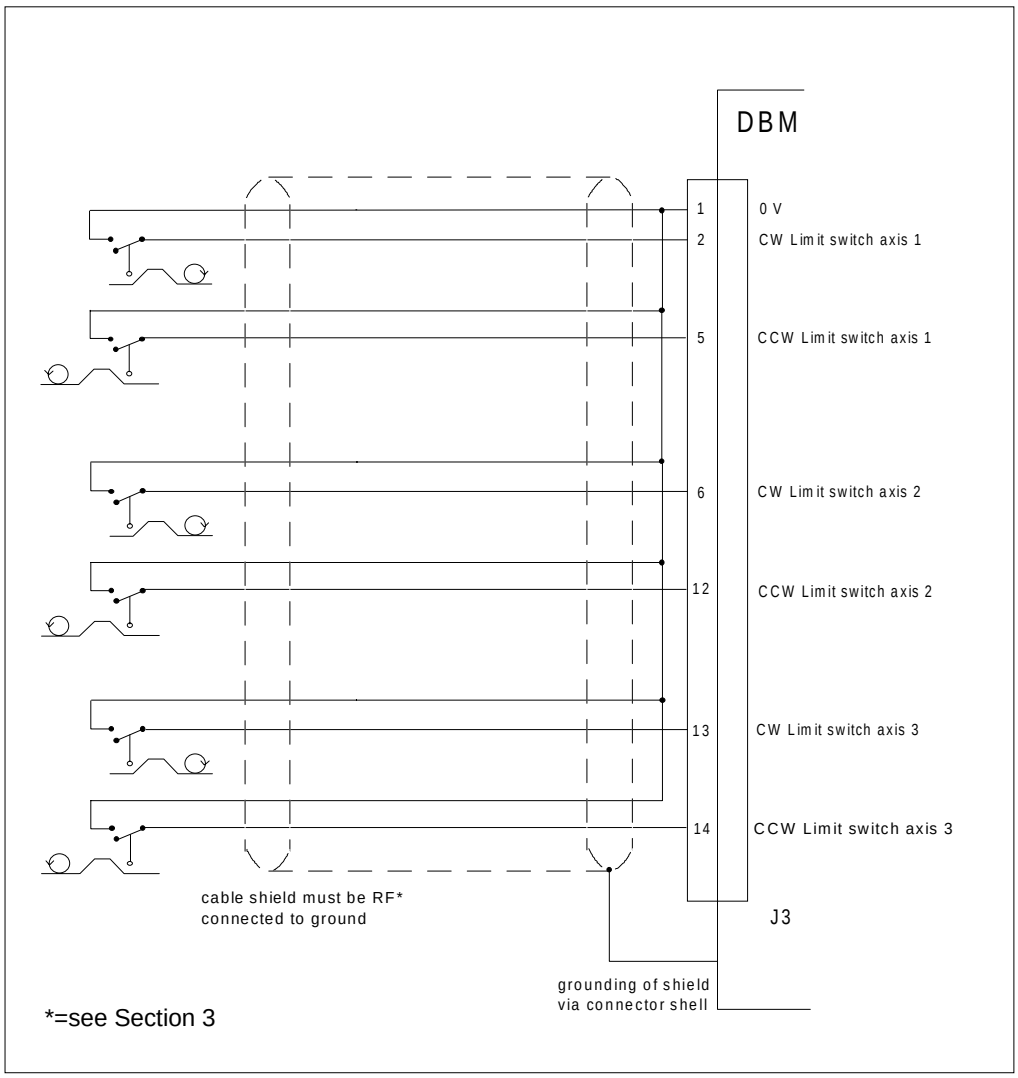
Note: In case of fault, the type of fault is as follows:

J2/pos. 4	J2/pos. 9	
0	0	OK
0	1	DBR FAULT. Recovery fault
1	0	OVER TEMP. Overtemperature
1	1	PHASE FAULT.

Tab. 1.8 - DBM Module - J3 Connector
Expansion Connection

Pos.	Name	
1		0V common
2		Auxiliary voltages referred to logic 0V not OK input signal
3		Phase U reference current output signal
4		Torque enabled output signal
5		Short circuit input signal
6		Overtemperature input signal
7		Expansion present input signal
8		Overtemperature output signal
9		N.C.
10		Phase V reference current, output signal
11		Overtemperature input signal
12		Non - coherent current input signal
13		BUS BAR fault input signal
14		Auxiliary voltages referred to - HV (300Vdc) not OK, input signal
15		N.C.

FIG. 1.5 - Limit Switches Wiring



Tab. 1.9 - DBM Module J3 Connector (when EBM Expansion is not present)
Limit Switches Connection (see Fig. 1.9)

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.

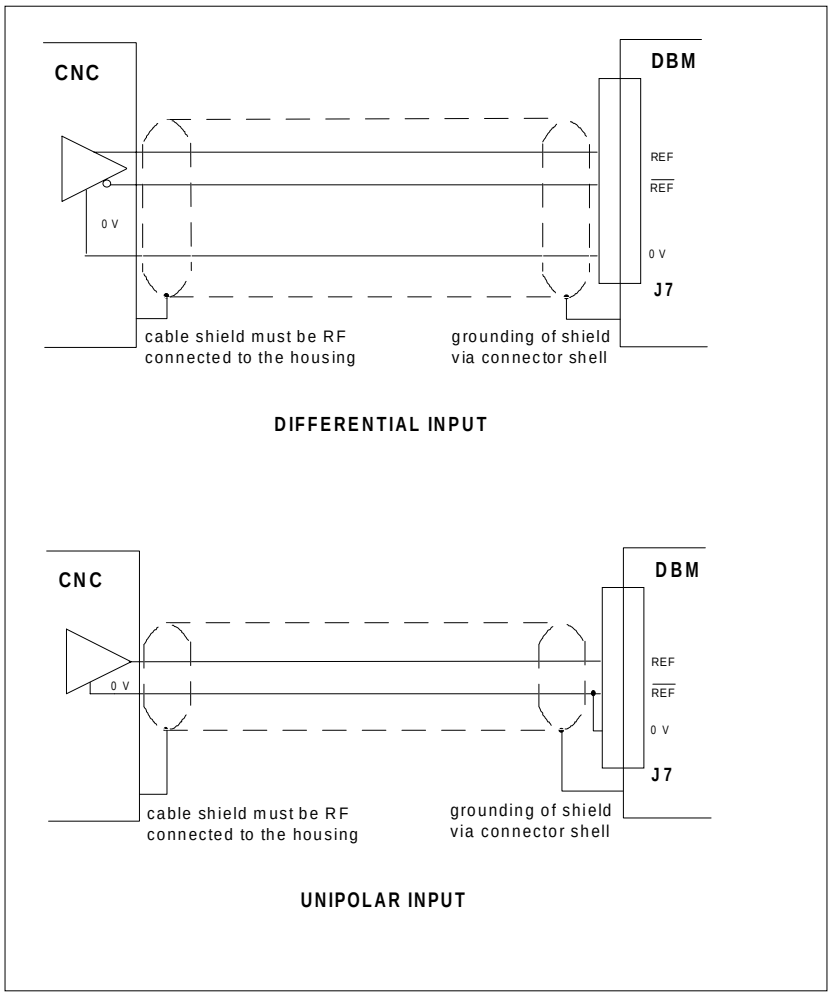
Pos.	Name	
1		0V common
2		CW limit switch, axis 1
3		N.C.
4		N.C.
5		CCW limit switch, axis 1
6		CW limit switch, axis 2
7		N.C.
8		N.C.
9		N.C.
10		N.C.
11		N.C.
12		CCW limit switch, axis 2
13		CW limit switch, axis 3
14		CCW limit switch, axis 3
15		0V common

Note: CW means clockwise rotation when viewed from shaft end, with default DI command.

Tab. 1.10 - DBM Module - J4 - J5 - J6 Connectors
Resolvers

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)

FIG. 1.6 - Speed Reference Wiring



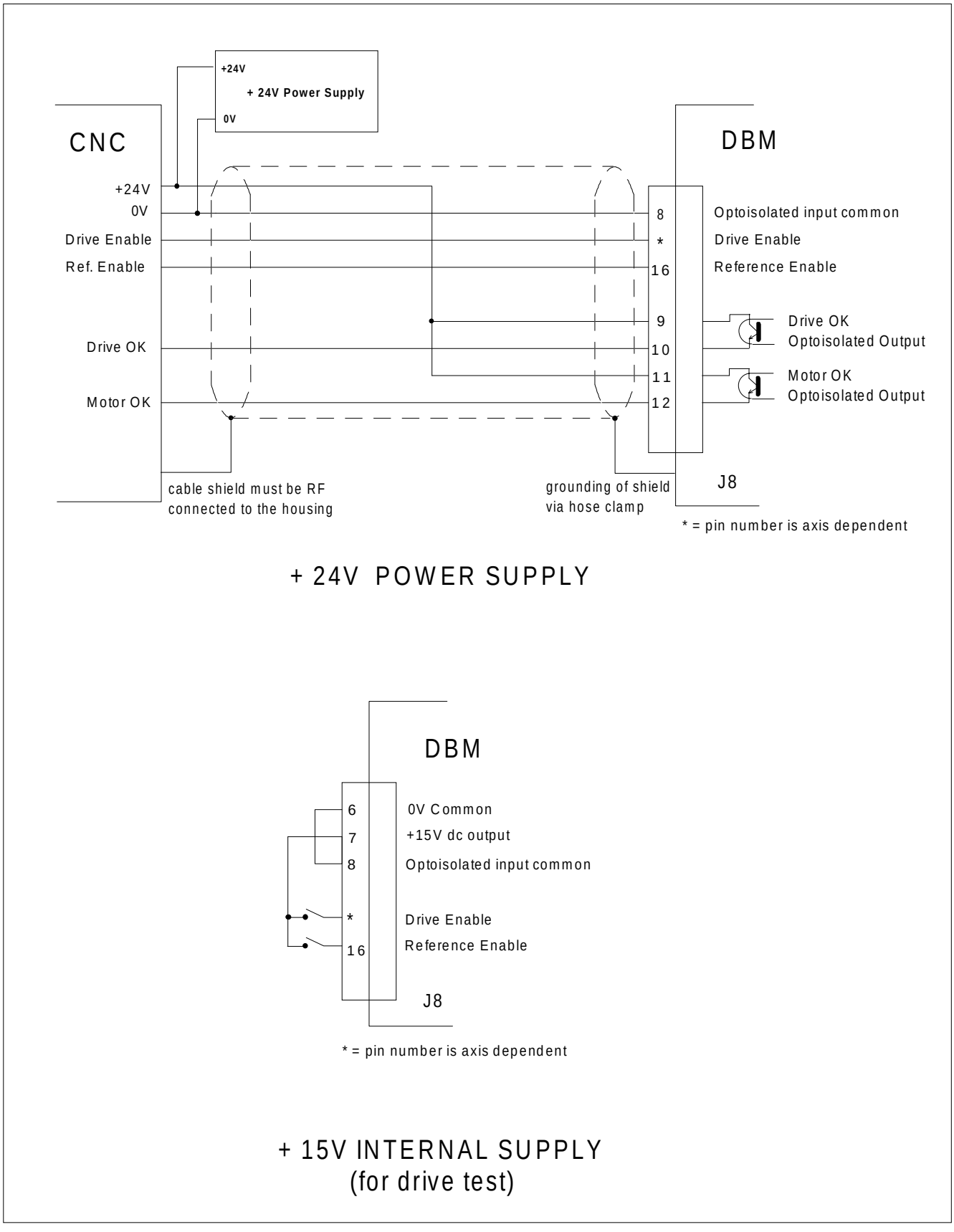
Tab. 1.11 - DBM Module - J7 Connector Analog Inputs and Simulated Encoder Outputs

Pos.	Name	
1		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 input I limit axis 3, referred to analog 0V 0V = zero current +10V (or not connected) = max current
13	ILIMIT2	Analog input I limit axis 2, referred to analog 0V (0 to +10V)
14	ILIMIT1	Analog input I limit axis 1, referred to analog 0V (0 to +10V)

15		Shield. Internally connected to 0V
16	$\overline{\text{REF3}}$	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. 1.6.
17	$\overline{\text{REF2}}$	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. 1.6.
18	$\overline{\text{REF1}}$	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. 1.6.
19		+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. 1.6.
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. 1.6.
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. 1.6.
37		- 15Vdc output (I max = 30mA)

REMARK: in DBM 01 version positions 31, 32 and 33 were assigned to differential inverting I Limit analog inputs. If this option was used, to change DBM 01 with DBM 03 it is necessary to properly specify <u>differential</u> analog I Limit input in the order.

FIG. 1.7- Input/Output Wiring



Tab. 1.12 - DBM Module J8 Connector
I/O Commands and Signals

Pos.	Name	
1	TACHO TEST 1	tachometer analog output, axis 1. Range: see ET command
2	TACHO TEST 2	tachometer analog output, axis 2. Range: see ET command
3	TACHO TEST 3	tachometer analog output, axis 3. Range: see ET command
4	ANALOG OUT 1	analog output 1. Max current, velocity reference or velocity error outputs. See ES and SO commands.
5	ANALOG OUT 2	analog output 2. Max current, velocity reference or velocity error outputs. See ES and SO commands.
6	0V	0V common
7	+15V	+15Vdc output (Imax = 30mA)
8	OPTO 0V	Optoisolated 0V
9	DRIVE OK	Collector of Drive OK optoisolator
10	$\overline{\text{DRIVE OK}}$	Emitter of Drive OK optoisolator
11	MOTOR OK	Collector of Motor OK optoisolator
12	$\overline{\text{MOTOR OK}}$	Emitter of Motor OK optoisolator
13	DRIVE EN1	Drive enable 1: optoisolated input for axis 1 torque enable. See Fig. 1.7.
14	DRIVE EN2	Drive enable 2: optoisolated input for axis 2 torque enable. See Fig. 1.7.
15	DRIVE EN3	Drive enable 3: optoisolated input for axis 3 torque enable. See Fig. 1.7.
16	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)
17		N.C.
18	REM RESET	Remote reset: optoisolated input for logic section reset, equivalent to push button on the front panel

Tab. 1.13 - EBM Expansion (optional) - J3 Connector (See Fig. 1.8)

Pos.	Name	
1		0V common
2		Auxiliary voltages referred to logic 0V not OK output signal
3		Phase U reference current input signal
4		Torque enabled input signal
5		Short circuit output signal
6		Overtemperature output signal
7		Expansion present input signal
8		Overtemperature input signal
9		NC
10		Phase V reference current, input signal
11		Overtemperature output signal
12		Non - coherent current output signal
13		BUS BAR fault output signal
14		Auxiliary voltages referred to +HV (300Vdc) not OK output signal
15		N.C.

Tab. 1.14 - Input/Output Characteristics

Optoisolated inputs Drive enable 1,2,3 Reference enable Remote reset	z in =1.2 kΩ I nom = 10 mA Imax = 20 mA Vnom = 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 outputs Analog Out1 Analog Out2	z out = 100 Ω I max = 10 mA Range: see ES command Full scale = ±10V
Velocity reference inputs 1,2,3	z in > 20 kΩ Range = see MR command Vmax = 12 V
Drive OK outputs 1, 2, 3	TTL compatible Fan-out = 5 LS-loads I max = 5 mA
Simulated Encoder differential output	z out = 100 Ω Full scale = 7V (differential)

FIG. 1.8 - Motor Phases Wiring (only one axis shown)

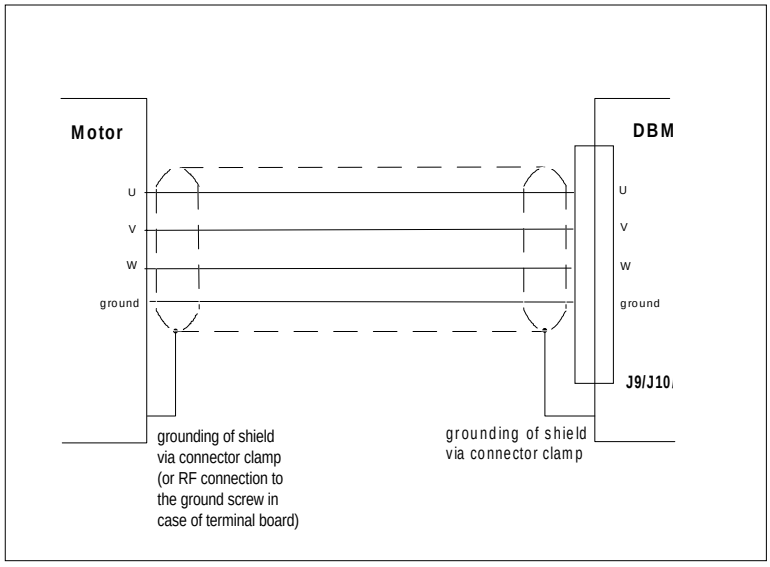
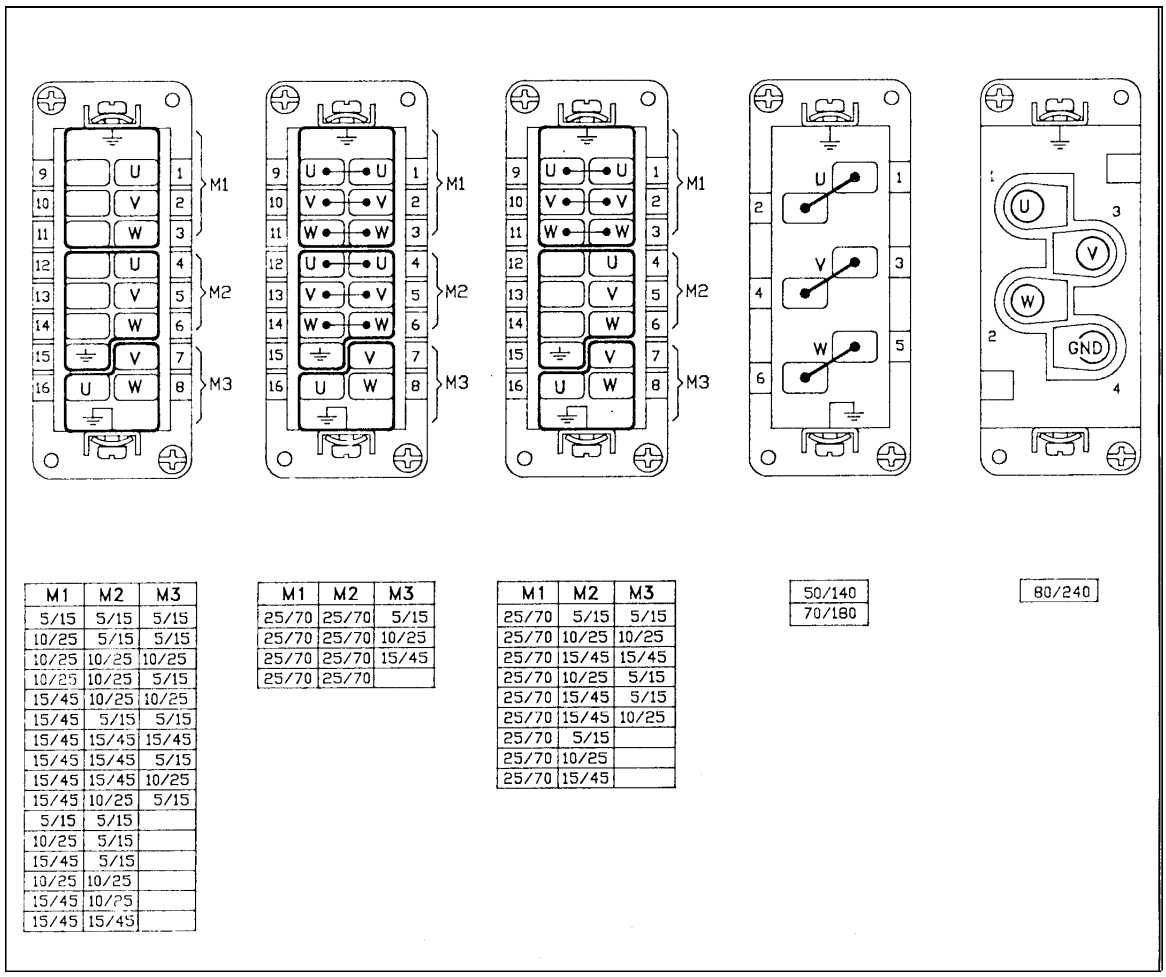


FIG. 1.9A DBM03 Module. J9 Connector. Motor Power

The configuration of this connector depends on the different combinations of sizes .
Notes: M1 always corresponds to the more powerful axis. M3 must not be connected in 2 axis configuration.



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	

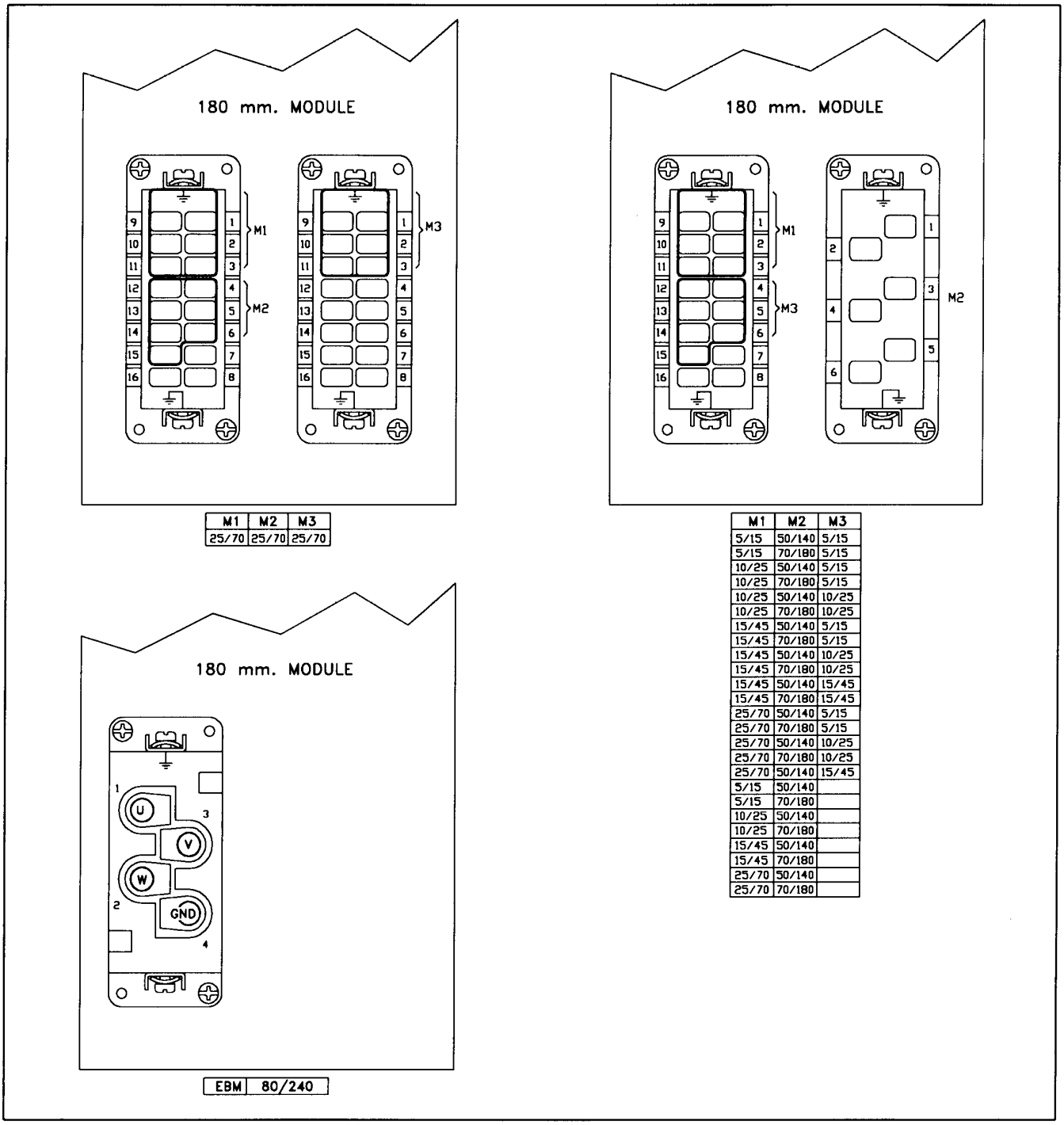
M1	M2	M3
25/70	5/15	5/15
25/70	10/25	10/25
25/70	15/45	15/45
25/70	10/25	5/15
25/70	15/45	5/15
25/70	15/45	10/25
25/70	5/15	
25/70	10/25	
25/70	15/45	

50/140
70/180

80/240

FIG. 1.9B DBM03-L (180 mm) Module. J9 and J10 connectors. Motor Power

The configuration of these connectors depend on the different combinations of sizes .
Notes: M2 always corresponds to the more powerful axis. M3 must not be connected in 2 axis configuration.
For U-V-W positions see Fig. 1.9A.



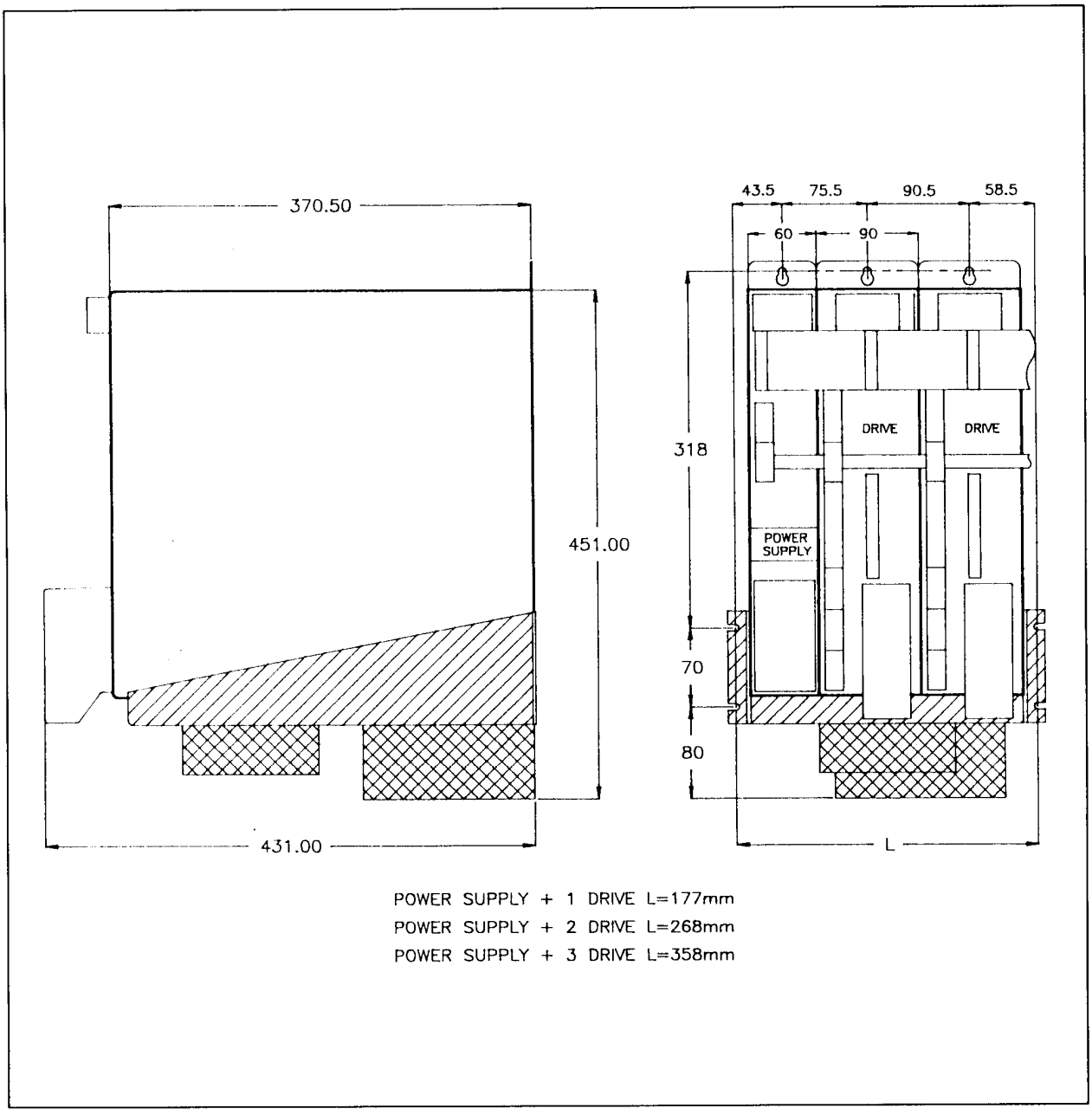
M1	M2	M3
25/70	25/70	25/70

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	

1.7 Dimensions

FIG. 1.10 - Dimensions (in mm).

Note: for DBM-L modules (180 mm), dimensions are the same as two side by side standard modules



1.8 Fans

The ventilation is provided by fans mounted under the modules. The size and the number of fans are according to the system configuration.

Fan input voltage is 230 Vac (or 110 Vac optional). The input power is 60 W for each pair of fans.

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

TAB. 1.15 - FANS.

MODEL	INPUT VOLTAGE (V~)	PAIR OF FANS	CONFIGURATION
DBM F2	230	1	DBM-PS + 1 DBM
DBM F3	230	1	DBM-PS + 2 DBM
DBM F4	230	2	DBM-PS + 3 DBM
DBM F5	230	3	DBM-PS + 4 DBM
DBM F2 (110V)	110	1	DBM-PS + 1 DBM
DBM F3 (110V)	110	1	DBM-PS + 2 DBM
DBM F4 (110V)	110	2	DBM-PS + 3 DBM
DBM F5 (110V)	110	3	DBM-PS + 4 DBM

Note: to size the fans a DBM-L (180 mm) module counts as two DBM modules.

Example: DBM-PS, one DBM module and one DBM-L (180 mm) module, requires a DBM F4 fan type.

1.9 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).

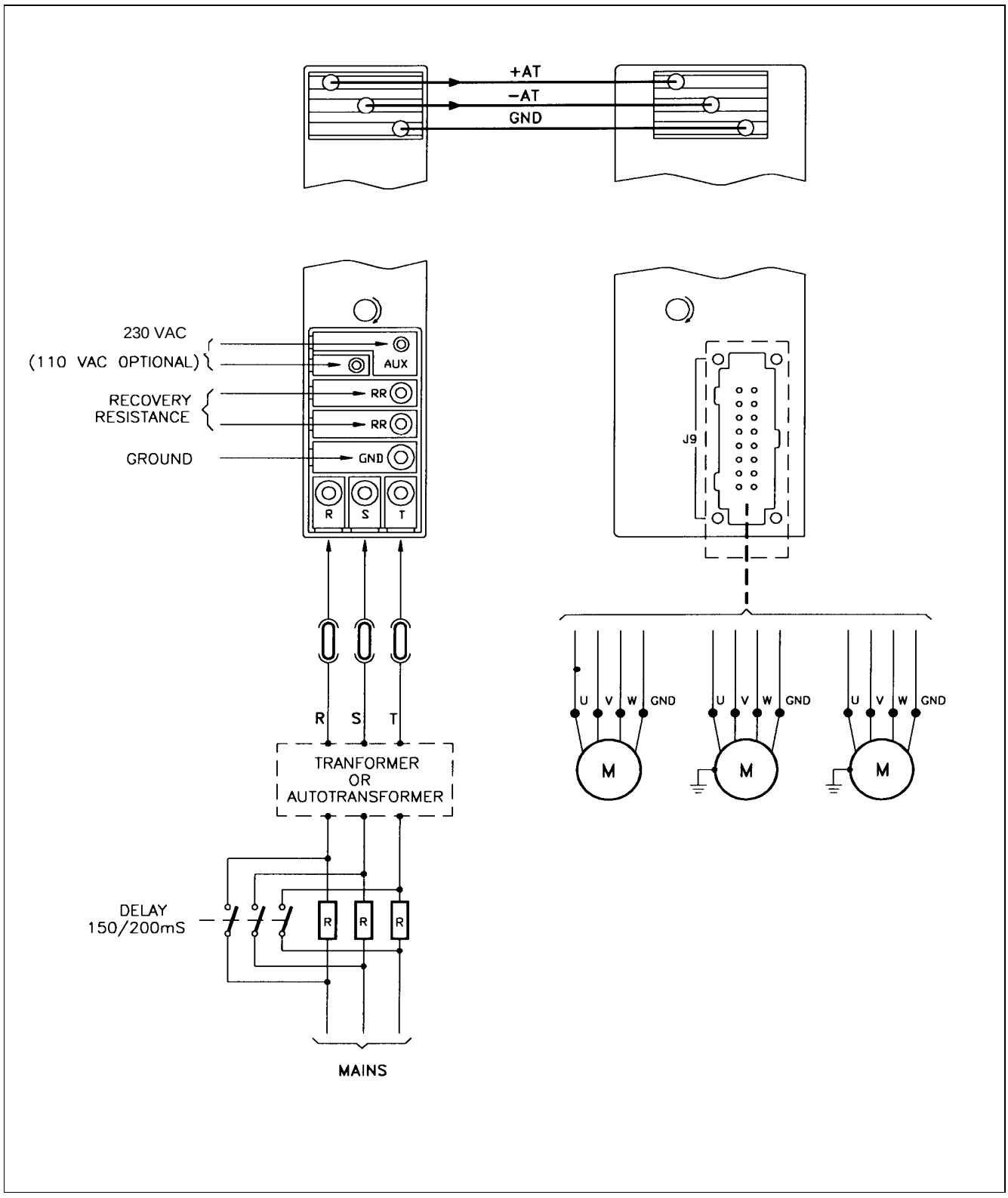
If not specifically requested, systems are provided with standard 3.9 Ω, 370W recovery resistor.
An oversized Power Supply with three 8.2 Ω, 370 W (parallel configuration) is available.

WARNING: 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 result in the explosion of the input capacitor.
It is suggested contacting our Customer Service.

WARNING: do not touch recovery resistor during operation to avoid scalds.
Ventilated enclosures containing dynamic braking resistors shall provide a degree of protection of at least IP22 (according to EN 60204-1, par. 13.3).

Section 2 - Installation

FIG. 2.1 - Transformer Connections



2.1 Wiring

This section provides the necessary information to properly wiring the digital brushless system.

1. Mains connections via transformer or autotransformer.
2. Resolver and motor power wiring.
3. Signals wiring.
4. Other wiring.

2.1.1 Transformer or Autotransformer Connection

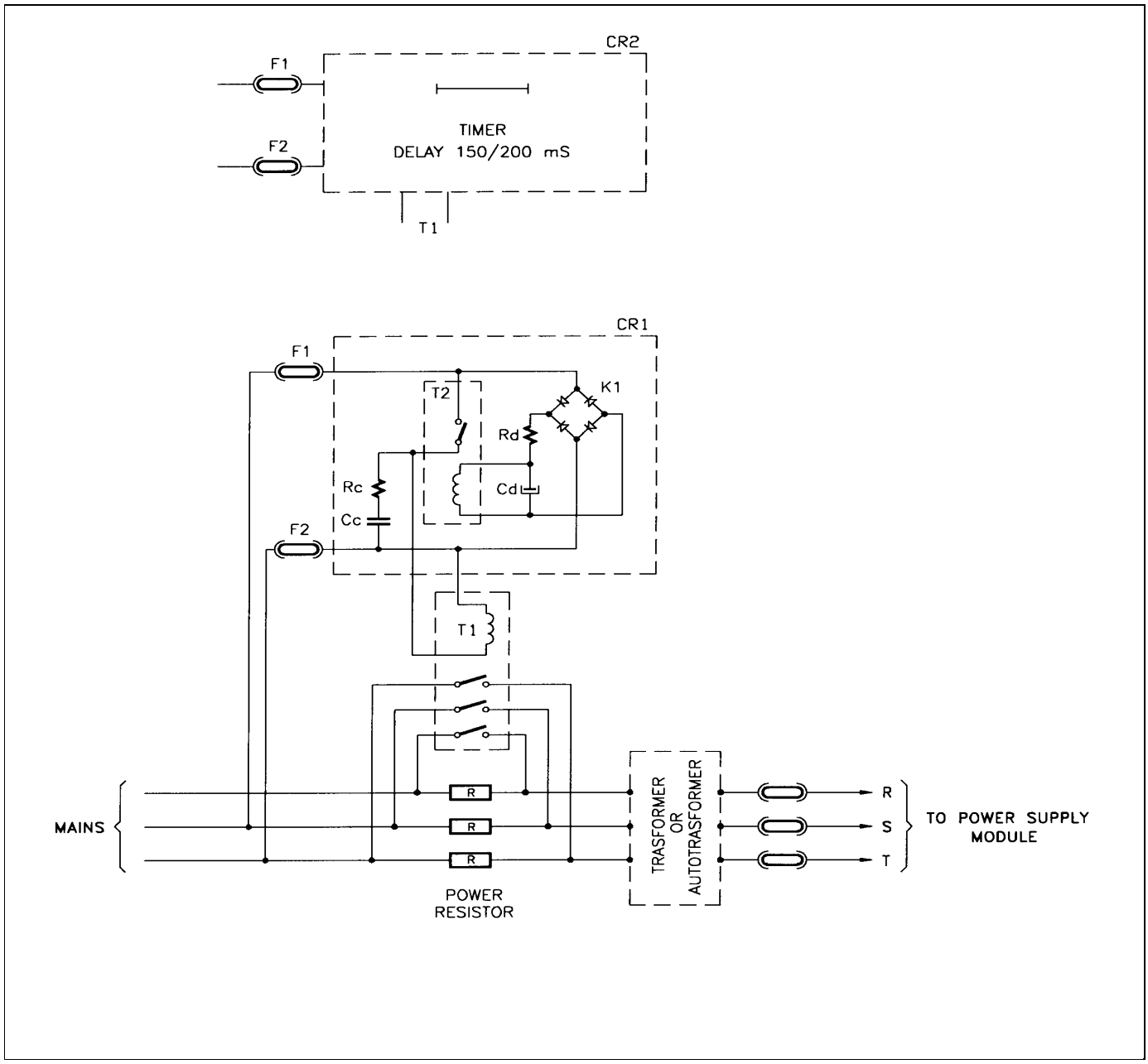
Figure 2.1 shows the electric diagram for transformer or autotransformer connection (from three-phase mains voltage to 230V). See Appendix B for a correct sizing.

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 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.

FIG. 2.2 - Soft Start



2.1.2 Soft Start

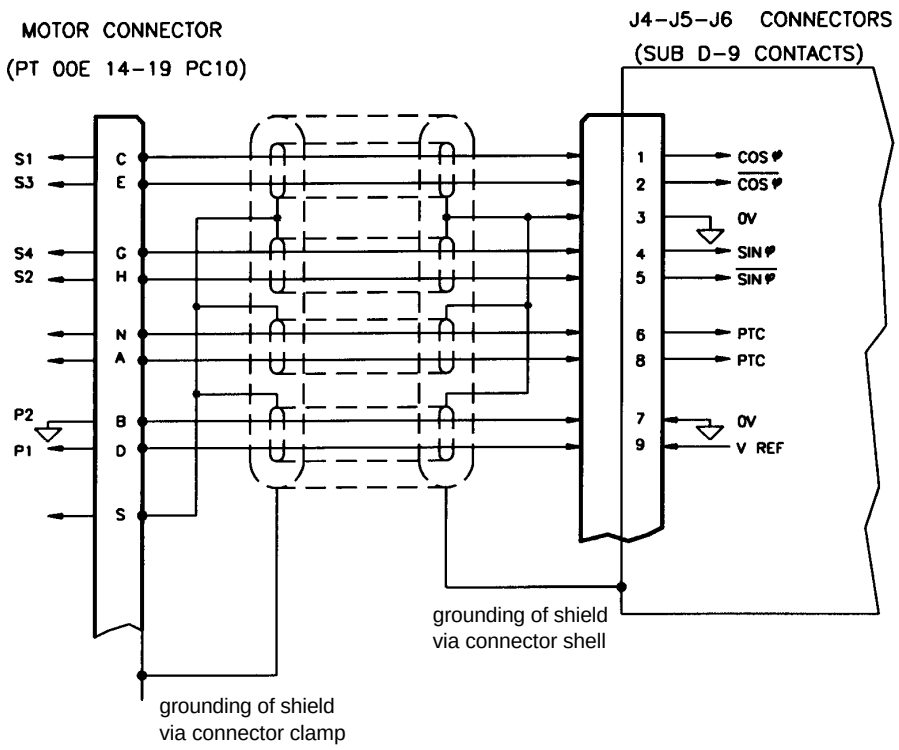
Figure 2.2 shows a current limit circuit for a standard configuration (1 Power Supply and 3 modules): it is not strictly necessary for the system operation, though it is recommended to limit the current through R-S-T phases on power up, as filter capacitors at power supply input are uncharged and can require very high instantaneous current.

The three limit resistors must be short-circuited after 150 to 200 ms. They must be of high energy type and must be rated 10 to 20 Ω, 100W.

The delay can be achieved by a timer (CR2 in Fig. 2.2) or by the circuit marked CR1 in Fig. 2.2. In this case the component list is as follows:

Cc : capacitor 0.1 μF, 250V
Cd : electrolytic capacitor 20 μF, 250V
F1, F2 : fuse 315 mA,- 250V
K1 : bridge rectifier 1A, 400V
Rc : resistor 22 Ω, 5 W
Rd : resistor 10 kΩ, 5 W
T2 : relay SPST 5A, 220V, coil 110 V, 10 kΩ

FIG. 2.3 - Resolver Wiring



RESOLVER CABLE		MOTOR CONNECTOR
OUTPUT	SIGNAL	PIN
S1	COS	C
S2	$\overline{\text{SIN}}$	H
S3	$\overline{\text{COS}}$	E
S4	SIN	G
P1	Vref	D
P2	0V	B
SHIELD		S
PTC		A
PTC		N

2.1.3 Resolver Wiring

Each DBM module can be connected up to 3 resolvers via the following connectors:

J4 M1 : axis 1 resolver
J5 M2 : axis 2 resolver
J6 M3 : axis 3 resolver

A cable with 4 pair, each pair twisted and individually shielded with an independent overall shield is recommended. 22 AWG (0.38mm^2) to 20 AWG (0.6 mm^2) can be used.

Resolver cables must be separated from power cables by a distance of 30cm (12 inches) by using a independent duct (conduit). It is recommended to avoid intermediary connections for resolver cables.

Figure 2.3 shows the wiring lay-out of the resolver with differential output.

2.1.4 Motor Power Wiring

Motor power cables must be shielded (see fig.1.8). There are seven different motor power connections, depending on module configuration (see fig. 1.9A and 1.9B).

2.1.5 Signals Wiring

Signals cable must be shielded (see fig.1.9, 1.10 and 1.11).

REMARK: 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.

2.1.5.1 Simulated Encoder Signals Wiring

For lengths in excess of 5 m (16 ft.) the cable must have 3 pairs, each pair twisted.

REMARK: in 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.

2.1.6 Serial Link Wiring

CAUTION: the serial link must be shielded and must be separated from the power cable through the use of independent duct (conduit).

2.1.7 Serial Link Connection

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

2.1.7.1 Keypad

The keypad is an optional accessory product which can be used for drive setup and monitoring. It must be connected to J10 connector.
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".

2.1.7.2 DBTALK Communication Program

See Appendix D.

2.1.8 Other Wiring

- the braking resistor
- the flat cable for auxiliary supplies
- the keyboard (or PC)
- all the analog references

2.2 Installation

2.2.1 Starting Sequence

- Connect 230 Vac (or 110 Vac) single phase power supply.
- 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 3-axis or with address 1,2 if 2-axis).

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

FROM KEYBOARD (see User's Manual for a detailed description of commands)

1 SA 4 <CR>	Assign basic address 4 to the second module (its primary axis)
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) and MR (max reference) 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).

- Connect 230Vac three phase power supply.

WARNING: HIGH VOLTAGE - DISCHARGE TIME APPROX. 6 MINUTES.

2.2.2 "Keyboard" or "Opto" Priority

On the personality card there is a jumper (G2) (See Fig. 2.4) which gives priority to keyboard or to opto to execute "Drive Enable" command. " Drive Enable" opto isolated signals are connected to J8/ pos.13, 14, 15.

G2 opened (position 2-3) = keyboard priority = the keyboard (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, set in factory, should be followed during installation and drive test.

G2 closed (position 1-2) =opto priority =the optocouplers are the master and the keyboard can only be used for parameters setup.

Note: "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".

2.2.3 Autophasing

Note: it is possible to limit the current in autophasing via IL command.

- Check that the motor is free to rotate in both directions.
- Check that no fault condition occurs (red DRVF leds off).
- The jumper G2 on the personality card must be opened (position 2-3, as set in factory).
- 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 KEYBOARD

4 PW91 <CR>	Enter the password for 2nd module (primary axis = 4)
PASSWORD ON	The correct answer is displayed
<CR>	Only for the 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.

2.2.4 Wiring Checks

After phasing each axis, 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 in position 2-3, for keyboard 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 KEYBOARD

5 ON <CR>	Enable digital Drive Enable for axis 5
O	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
O	Drive Enable led will be off

2.2.5 CNC Priority

With CNC, the following procedures must be followed. This way the CNC is the master and the keyboard is the slave, as follows:

- Parameters managed by CNC: Drive Enable, Reference Enable, Speed References
- Parameters managed by keyboard (or PC): all dynamic parameters (acceleration, KI, KP, etc.), Status and Fault.

2.2.5.1 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 entered 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 (not only to each axis).

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

FROM KEYBOARD

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

2.2.5.2 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, install G2 jumper in position 1-2 (closed) 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.

2.2.6 Velocity Offset

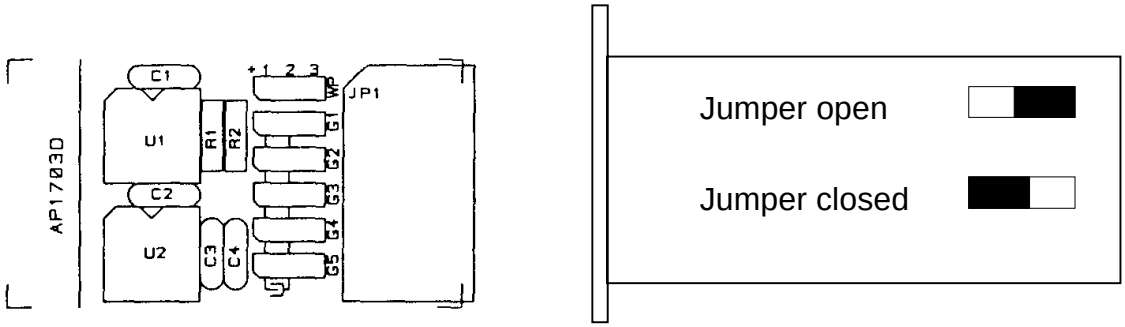
If it is necessary you can adjust the analog velocity offset by providing 0 analog speed reference and setting VO command for an automatic adjustment. A fine adjustment can be done with successive steps via OV command.
REMARK: the adjustment of the digital velocity offset must not be used to adjust the analog velocity offset and it is reserved to setup technicians.

2.2.7 Personality Card Jumpers

WP (default: open): if closed, the EEPROM is write protected and SV command 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 "keyboard"
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. 2.4 - Personality Card



REMARK: personality card of DBM 03 has a software different from DBM 01 personality card.
To change DBM 01 with DBM 03:
1. *Switch on DBM 03 with 230V mono-phase and replace the personality card with the old DBM 01 personality card with G2 and G3 jumpers closed*
2. *Reset the drive with reset button on front panel*
3. *Wait 30 sec*
4. *Switch off the drive*
5. *Restore G2 and G3 as before the removal*

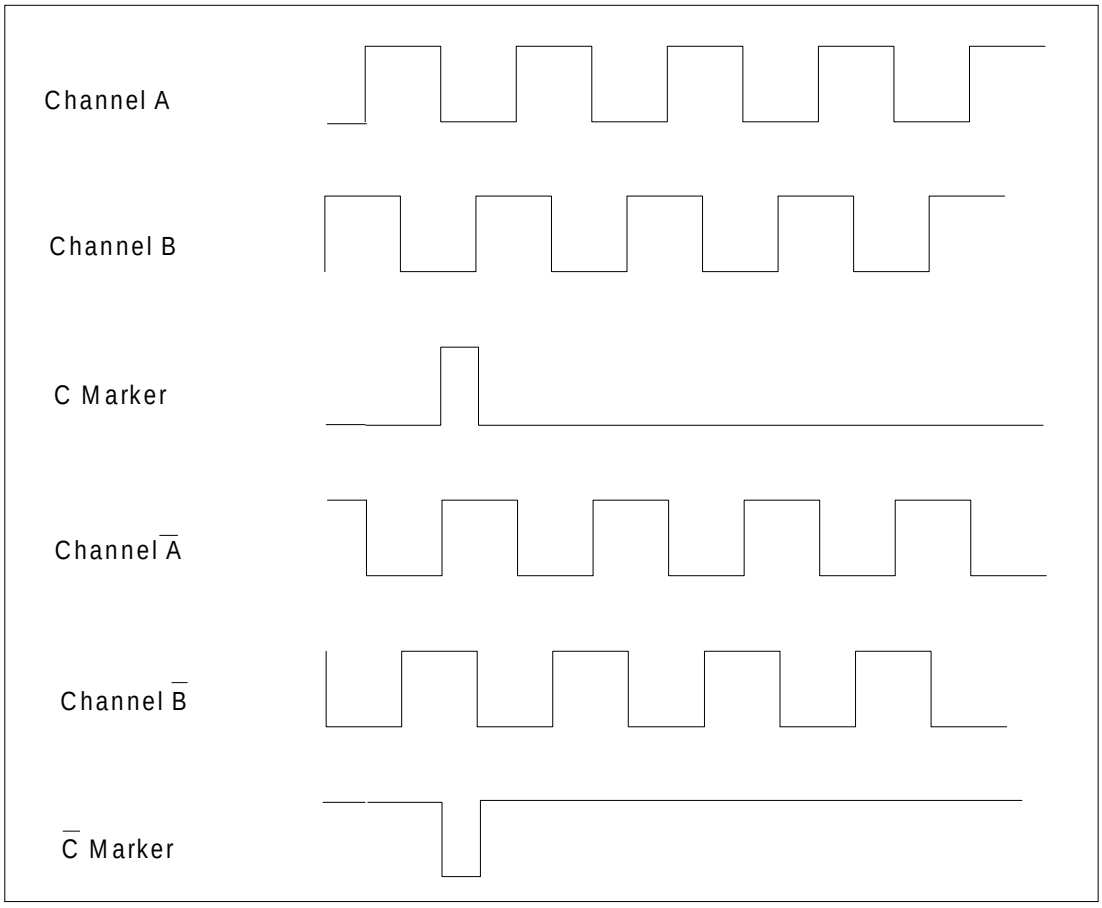
The personality card is now set to DBM 03 format. New parameters are: 1SO=1; 2SO=2; CU=128; CV=128; DF=0; ES=16; ET=80; PW=91, RN=RX=12; PR=3 and VS=0 for 2 pole resolver; PR=1 and VS=1 for 6 pole resolver; SE=1024 (if applicable).
Note: - if the number of pulses per revolution has to be different from 1024, SE parameter must be properly specified in the order
- after this setting the personality card cannot be used with DBM 01.
- with G2 and G3 closed DBM 03 does not work. The situation is as follows:
G2 open, G3 closed = keyboard priority, 9600 Baud, base address 1, password ON.
G2 and G3 closed = opto priority, reading of DBM 01 parameters (AC, AL/DL, AR/DR, BR, DE, IL, IT, KI, KP, MR, MV, NP, OC, PC, RS, SA), password OFF.

2.2.8 Resolver to Encoder (optional)

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 1024 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. 2.5 - Simulated Encoder (CW rotation when viewed from shaft end)



2.2.8.1 Setup for the Number of Steps/Revolution

From DBM 03 version the number of steps/electrical revolution of simulated encoder can be set via software (see SE commands).

REMARK: the maximum number of pulses per electrical revolution depends on the R/D resolution. See Tab.2.1.

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.

2.2.8.2 R/D Resolution

From DBM 03 version the resolution of Resolver to Digital converter will automatically be switched according to actual speed for optimum system performance between minimum (see RN command) and maximum resolution (see RX command).

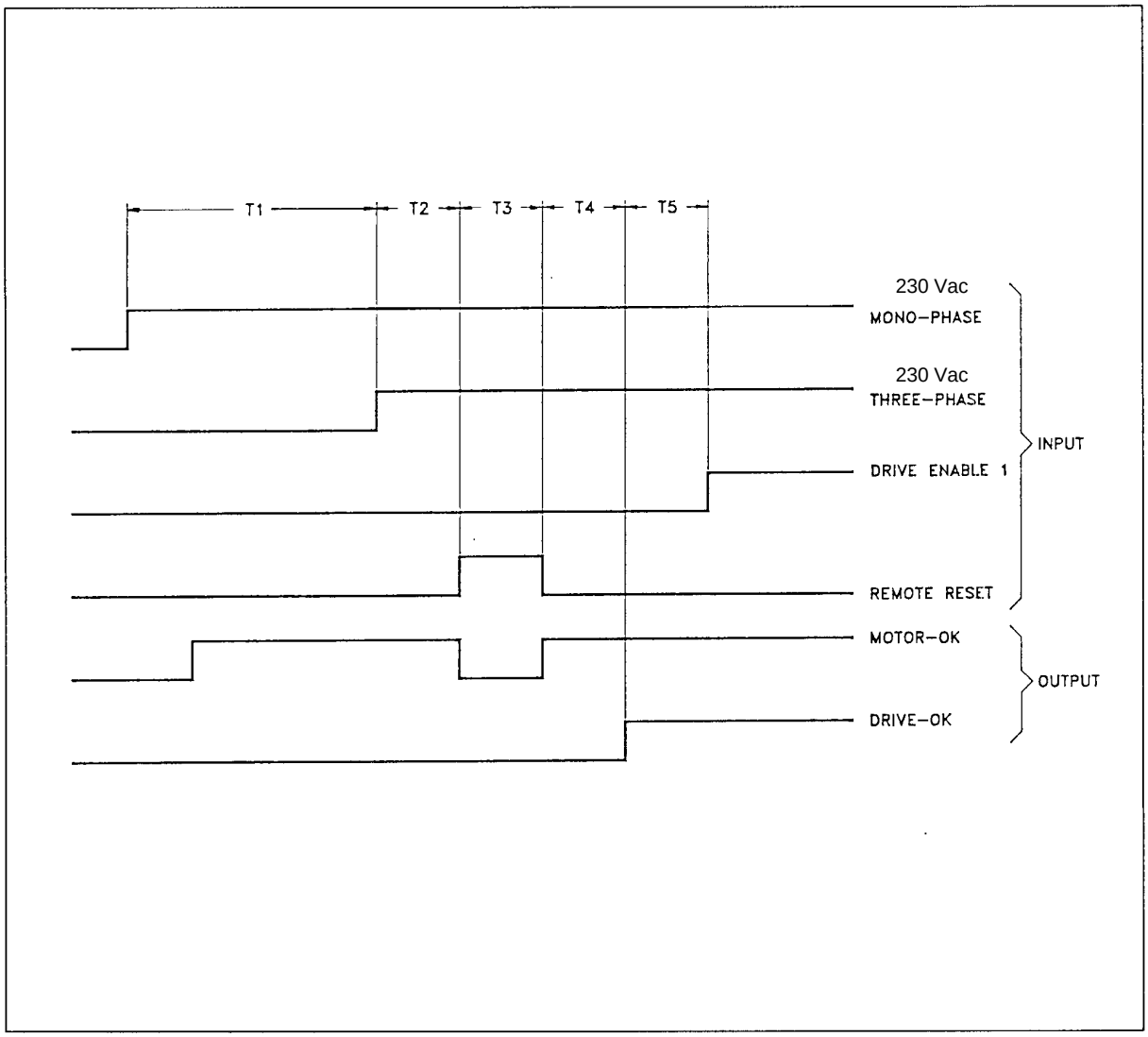
The speed range of R/D resolution is included in the following table.

Tab. 2.1 - 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

FIG. 2.6 - Starting Sequence, Timing Chart

Note: T1 = 8 to 10 s, T2 ≥ 1 s, T3 ≥ 20 ms, T4 ≈ 3 s, T5 ≥ 0.5 s.



2.3 Operation

After system wiring and installation, it is possible to start the system according to the sequence shown in figure 2.6.

Action	Effect
• Connect 230Vac single phase power supply (or 110Vac optional)	• Digital and diagnostics circuits are fed - Green LED on DBM PS, AUX PWR = ON - Opto output MOTOR OK is enabled
• Connect 230Vac three phase power supply	• 300V Bus Bars are fed - Yellow LED on DBM PS, PWR BUS = ON - Green LED on DBM, POWER OK = ON
• Reset protections by pushing the RESET button on front panel or by sending a 20ms pulse to REM RESET opto input	• Possible faults are reset - After 3s the opto output DRIVE OK is enabled
• Enable analog Drive Enable for each axis and Reference Enable via positive logic	• Green LED's on DBM, DRIVE EN = ON and REF EN = ON

WARNING: HIGH VOLTAGE - DISCHARGE TIME APPROX. 6 MINUTES.

Section 3 - Electromagnetic Compatibility (EMC)

3.1 European Directive (89/336/EC)

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.
DBM03 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)	Drive type
AT6008	Schaffner FN 250-6/07	(6)	DBM03 PS (Aux)
AT6009	Schaffner FN 258-7/07	7 (8.4)	
AT6010	Schaffner FN 258-16/07	16 (19.2)	
AT6011	Schaffner FN 258-30/07	30 (36)	
AT6012	Schaffner FN 258-42/07	42 (50.4)	
AT6013	Schaffner FN 258-55/07	55 (66)	
AT6014	Schaffner FN 258-75/34	75 (85)	
AT6015	Schaffner FN 258-100/35	100 (120)	DBM03 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 03 PS + DBM 03 5-5-5 + DBM 03 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

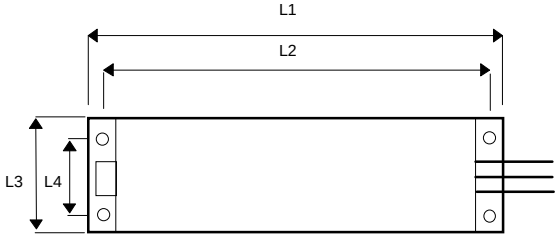
A 30A filter (FN 258-30/7) can safely be used.

3.2.3. Filter Dimensions

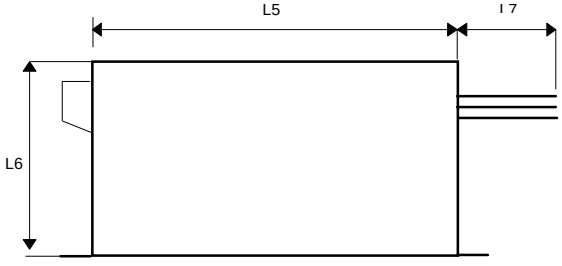
Code	Trade-mark	Dimensions [mm]							Weight
		L1	L2	L3	L4	L5	L6	l7	[kg]
AT6008	Schaffner FN 250-6/07*	85	75	54	0	65	30	300	0.24
AT6009	Schaffner FN 258-7/07	255	240	50	25	225±0.8	126±0.8	300	1.1
AT6010	Schaffner FN 258-16/07	305	290	55	30	275±0.8	142±0.8	300	1.7
AT6011	Schaffner FN 258-30/07	335	320	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

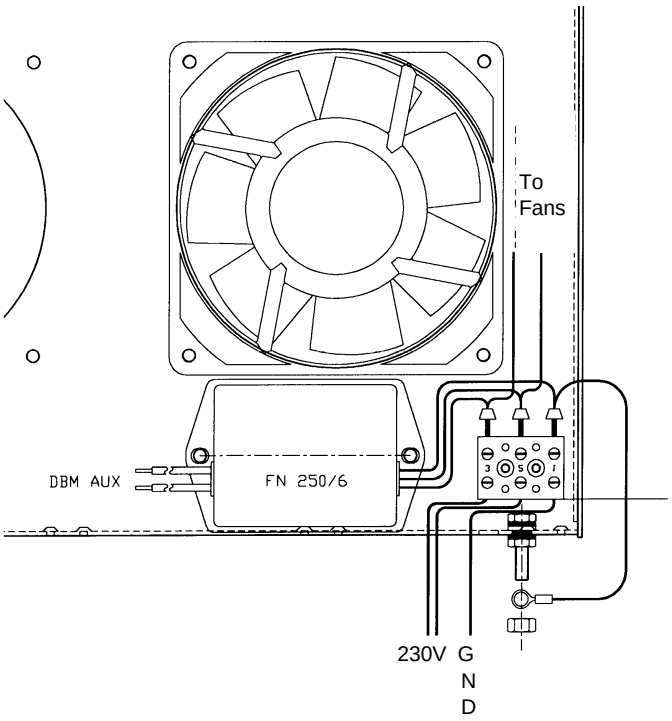
- The capacitors within the filters have discharge resistors.

CAUTION: the filter must be connected to ground before connecting the supply

WARNING: HIGH VOLTAGE - DISCHARGE TIME APPROX. 10 seconds

- Where single phase power supply is needed, the single phase filter can be installed on the fan housing.
Figure 3.1 shows installation and wiring of FN 250 6/07 filter on fan housing of DBM 03 drive.

Fig. 3.1 - FN 250-6/07 Filter Installation on DBM 03 Drive



3.3 Wiring And Grounding

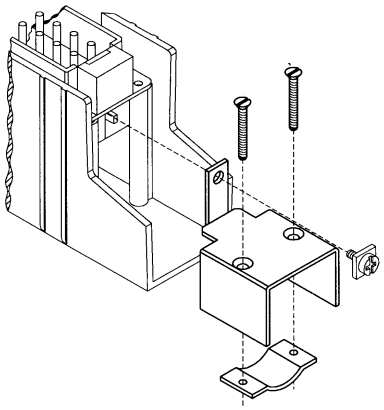
All the following cables must be shielded, with 85% minimum shielding coverage:

- power motor cable (see Fig.3.2 and 3.3)

NOTES: if a power terminal board is used at motor side, the shield must be RF connected to the ground screw via the proper clip.
- connectors at motor side can have a threaded clamp. Cable shield must be grounded in the same way as in Fig.3.3.

- resolver cable (see Fig.2.3 and 3.3 motor side)

Fig. 3.2 - Grounding of Shield to Motor Connector at Drive Side



- recovery resistor cable (BRD drive excluded)

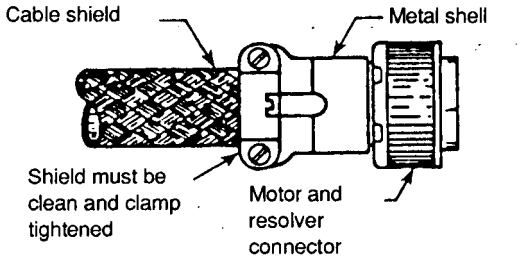
- Reference, Enable and OK cable

- 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. 3.3 - 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.3.4.

Fig. 3.4 - Grounding of Shield without Connector

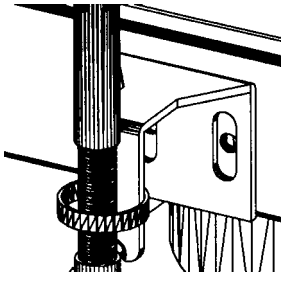
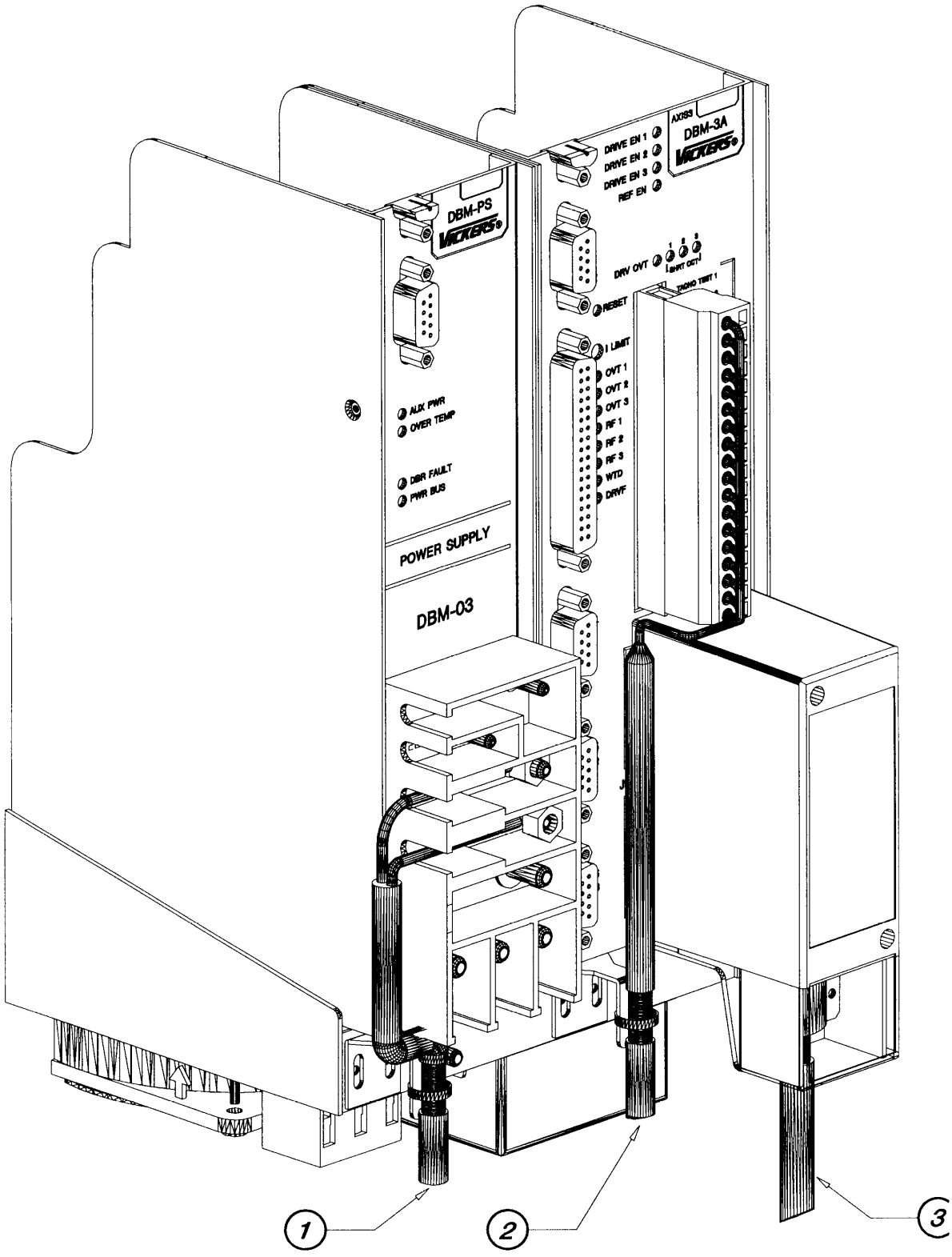


Fig. 3.5 - Cable Grounding at Drive Side



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. 3.6).
- "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. 3.6 - Backpanel Connection

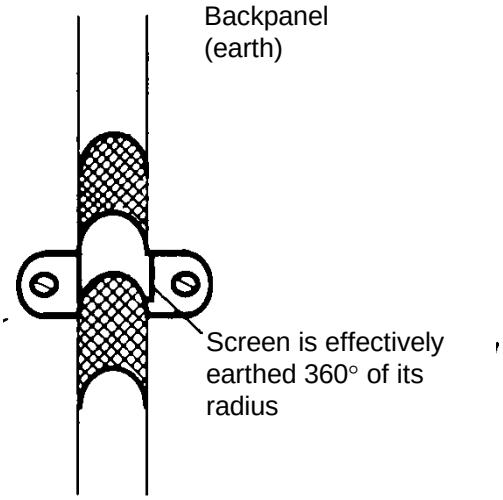
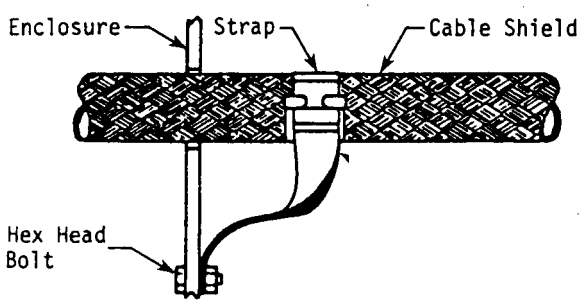


Fig. 3.7 - Partition Penetration



- 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.3.7).

3.4 Recovery Resistor / Motor Choke

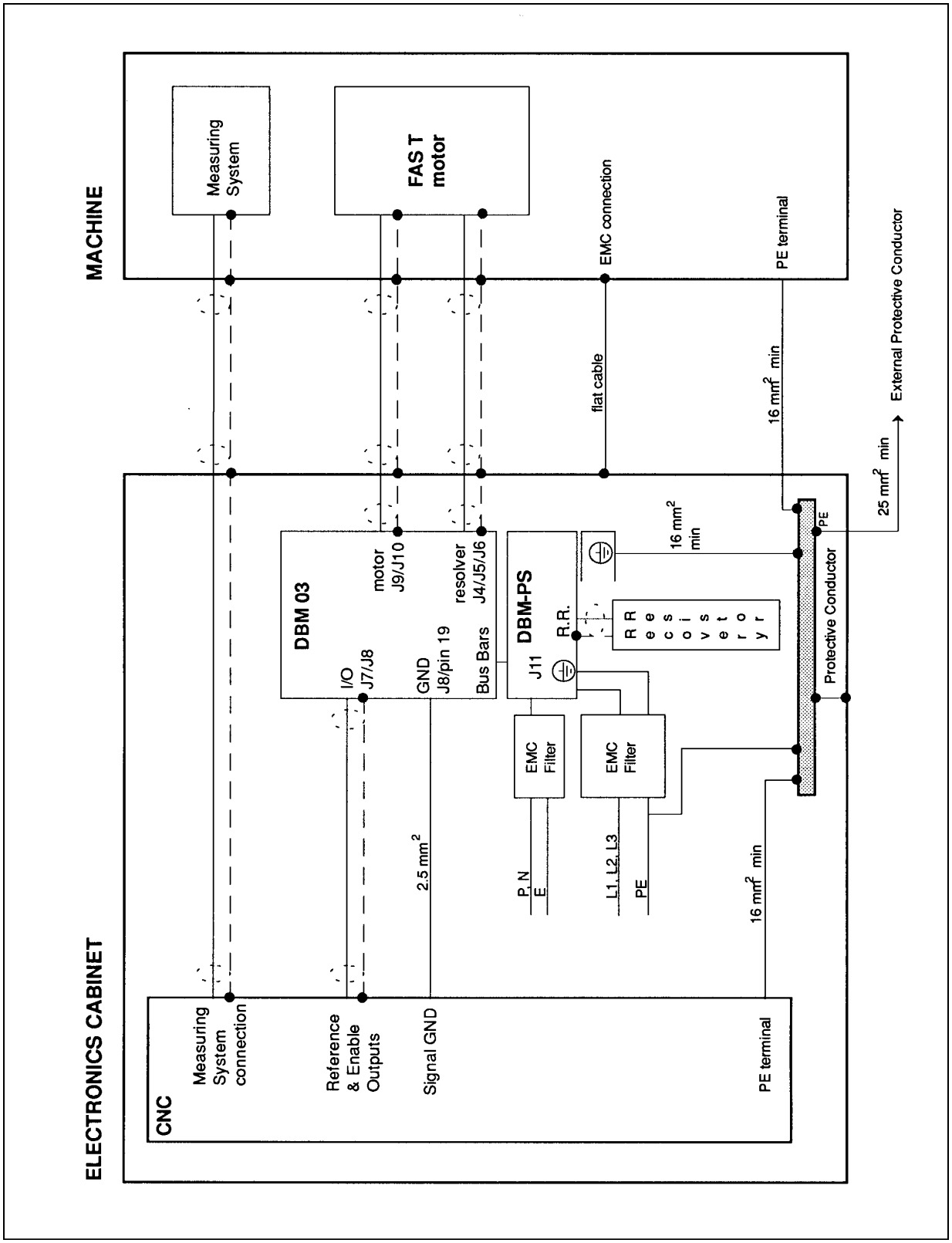
To meet the Machinery Directive "the ventilated enclosures containing dynamic braking resistors shall provide a degree of protection of at least IP22" (EN 60204-1, par. 13.3).
To meet the EMC Directive, these enclosures must be conductive. The cable of recovery resistor must be shielded and the shield 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.

Fig. 3.8 - EMC/Equipotential Bonding



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 DBM03 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.

APPENDIX A - 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 (+AT, -AT and GND) and disconnect all connectors and flat cables (see Fig. 1.1).
- Unscrew the anchor screw on the top of the module and remove the module.
- Only for same DBM versions:
  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.

CAUTION: personality card of DBM 03 has a software different from DBM 01 personality card. Do not swap personality cards between the two versions.
To change DBM 01 with DBM 03 see Par.2.2.7.

APPENDIX B - INPUT SIZING

B.1 Sizing of Power Transformer/Autotransformer

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]

B.2 Sizing of Fuses

It is necessary to divide the above calculated power by the 300 V DC Bus.

$I_f = P / 300$ [A; W, V]

Fuses must be the delay type because of high peak current inrush of the internal capacitors.

B.3 Auxiliary Power Transformer

Auxiliary power (55 W for each 3-axis module) and fan power (60 W for each pair of fans) must be added.

B.4 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 uncalculated braking, the dissipated power is as follows.

Pd = 25 + (2 * 50) + (16 * 60[A]) + (1 * 60[A]) + 370 [recovery resistor power] = 1515 W

APPENDIX C - MECHANICAL BRAKE

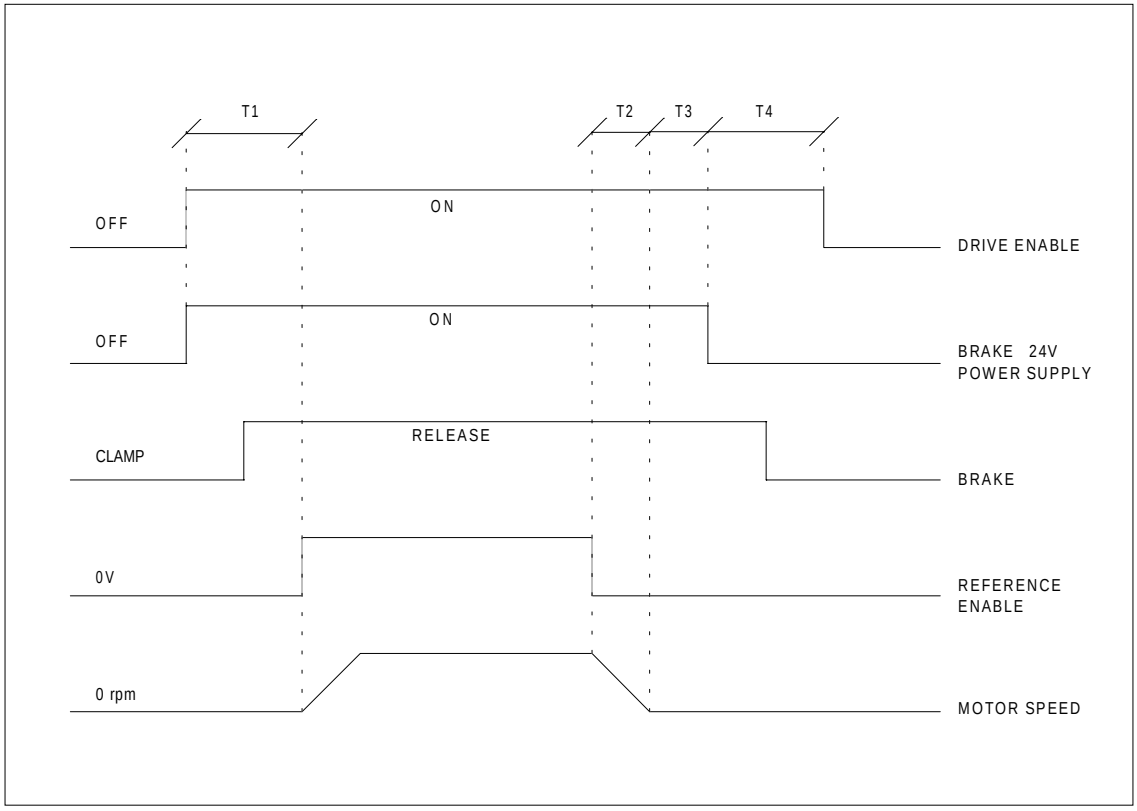
FAS series servomotors have as option a 24 Vdc electromagnetic safety brake.

CAUTION: safety brake must be clamped and released with motor at standstill. Dynamic brakings can seriously damage the brake and reduce the braking torque.

The release of the brake (from 0V to +24V) and the clamp (from +24V to 0V) must follow the sequence in Fig. C.1.

FIG. C.1 - Braking Sequence, Timing Chart

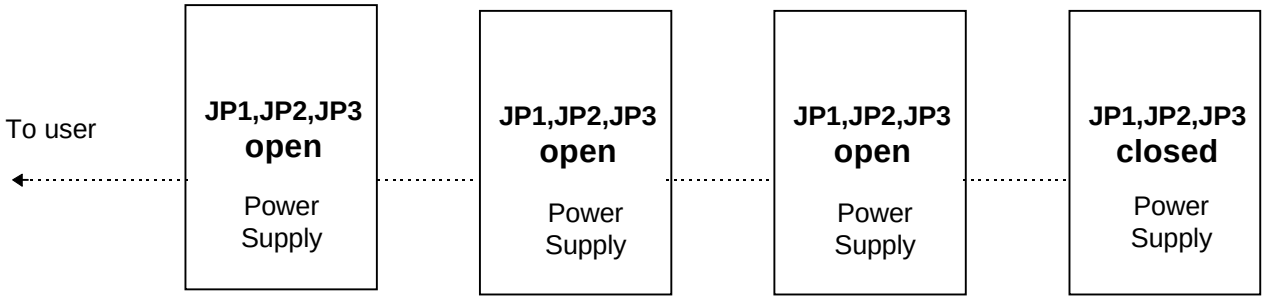
Note: T1 ≥ 200 ms, T2 = application dependent, T3 = 100 ms, T4 ≥ 200 ms



APPENDIX D - SERIAL LINK MULTIDROP

D.1 DBM-PS Internal Jumpers (see par. 1.6)

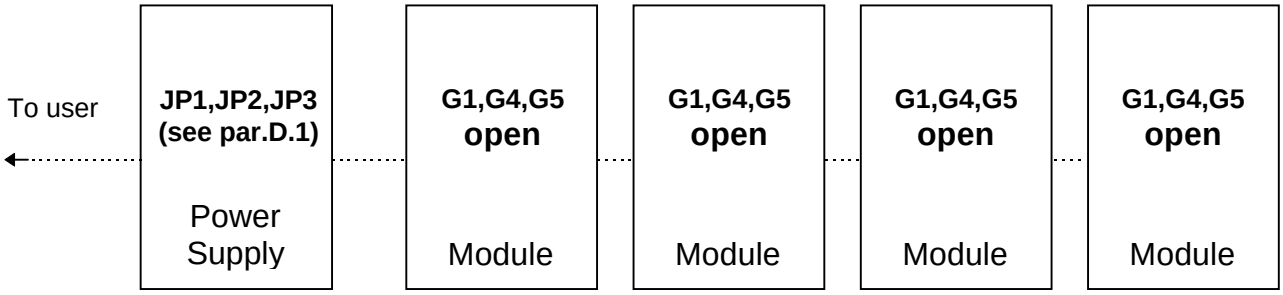
In case of multidrop, the following configuration must be used.



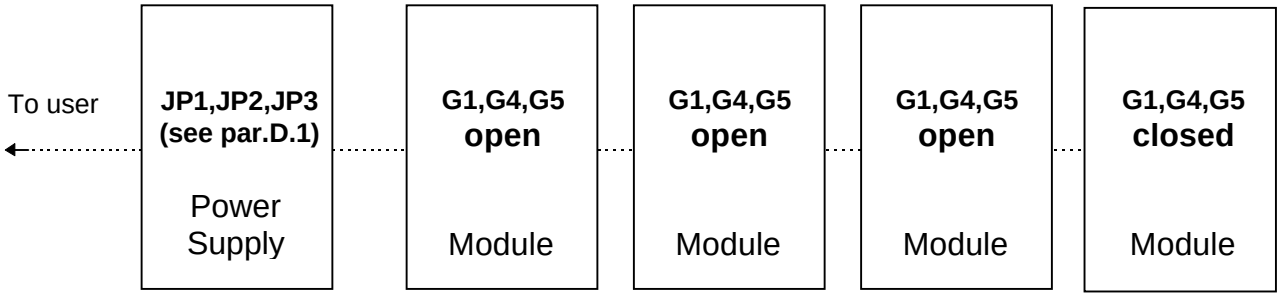
D.2 Personality Card Jumpers (see par.2.2.7.1)

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**



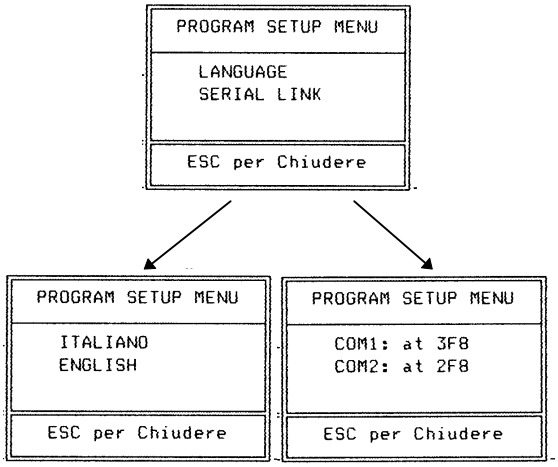
APPENDIX E - DBTALK PROGRAM

To help you communicate with DBM/DBS drives quickly and easily, DBTALK provides several features:

- **SETUP** to choose

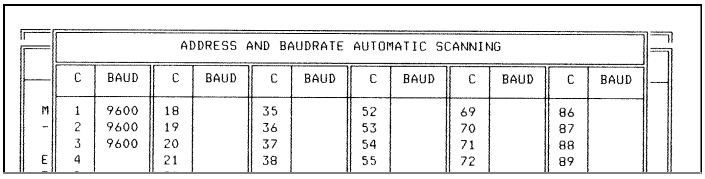
⇒ Language: Italian or English

⇒ Serial link : COM1 or COM2

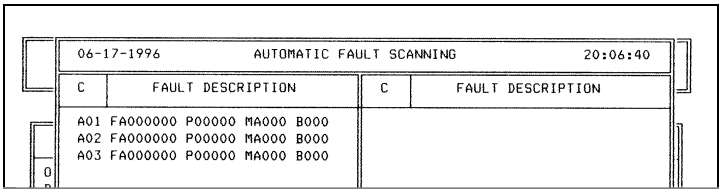


- **UTILITY** to

⇒ Scan Baud rates

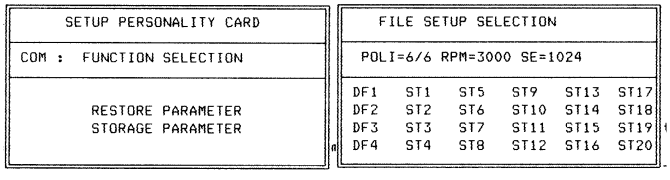


⇒ Scan Faults



⇒ 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

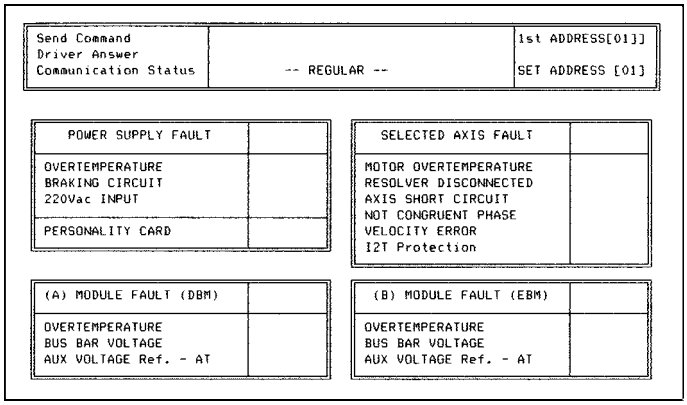
⇒ Start the Autophasing procedure

⇒ Set Defluxing (see DBS User's Manual)

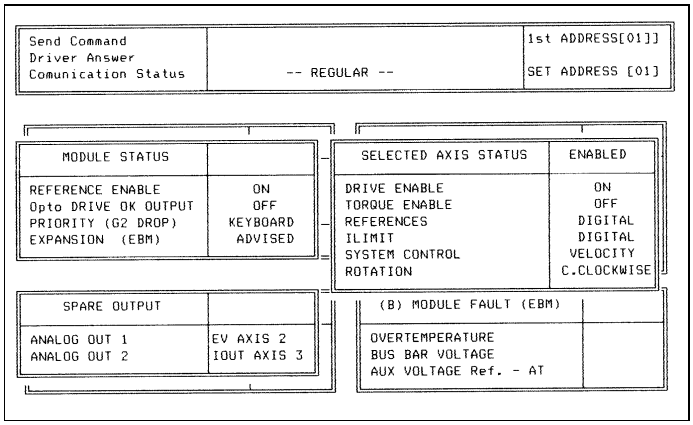
- **MANUAL** to

⇒ 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

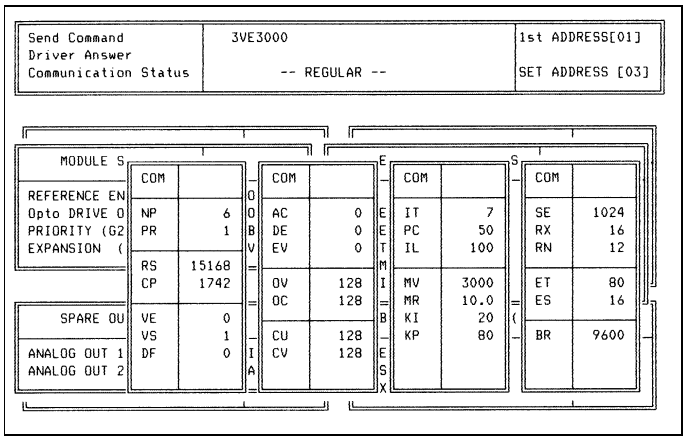


⇒ Display the Status



⇒ See/Change parameters

To change one parameter type the command string (see Drive Manual) on the PC keyboard. Example: 3VE3000



- **INTERFACE REQUIREMENTS**

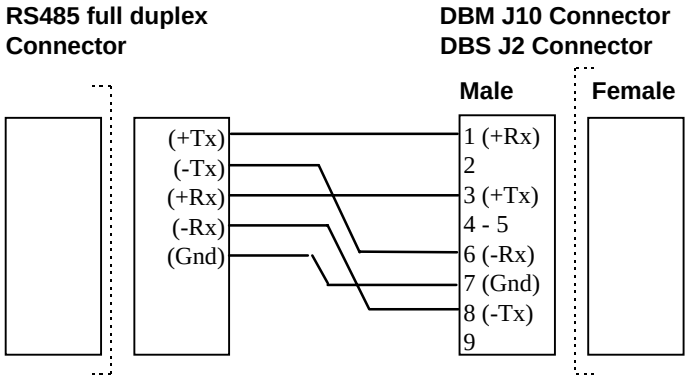
The RS422 interface wiring is based on one-to-one, no multidrop, principle. Four wires are used. With RS422, you can transmit and receive data simultaneously (full-duplex).
The RS485 half-duplex uses only two wires. It allows multidrop communication. With RS485 half-duplex, you cannot transmit and receive simultaneously.
DBM03 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/DBS.
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 or DBS J2 connector

⇒ An opto-isolated PC card RS 485 full-duplex is also available. The following wiring must be used.



- **PC REQUIREMENTS**

- 80286, 80386, 80486 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

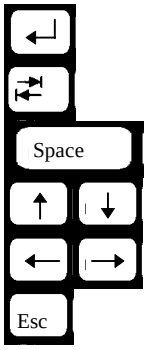
- **INSTALL PROGRAM**

- 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

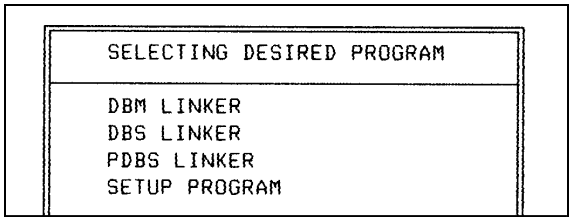
Move up/down

Go to previous/next screen

Exit/Go to previous menu

- **SELECT PROGRAM**

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



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