MOOG

IDBM 04

User's and Installation Manual

GB-4537 Rev.3 – Feb/03

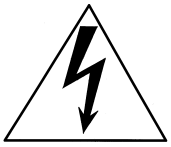
IDBM 04 - USER'S MANUAL

Rev.	Date	Description	Updated Pages
0	Jan 01	First Release	
1	Mar 01	Upgrade Section 5; correct pictures	Section 5, Various
2	July 02	Add Section 8; correct miscellaneous errors	I - all; II – 5, 7, 8, 16, 17, 18, 19, 22, 28, 29, 34, 35, 36, 39; III - 1, 2, 3, 7; IV - 1; VI - 4, 8; VIII - all
3	Feb 03	Add PS-U with oversized DBU; upgrade Section 8 according to the requests of the Competent Body; correct miscellaneous errors	I – 3, 4, 6, 9-11, 13, 19, 20; II – 5, 7, 14, 35; VIII – 1, 2, 4 to 14

TABLE OF CONTENTS

Accident Protection

The safety instructions provided in this Manual are included to prevent injury to personnel (**WARNINGS**) or damage to equipment (**CAUTIONS**).
See Section 8 for safety instructions related to the Restart Interlock Function.



***WARNING**: L+ and L- pins and Bus Bar's can have voltage ≥810Vdc 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 ≥810Vdc.*

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

***CAUTION**: make sure that the correct input voltage, 400V or 460V, has been set.*

***CAUTION**: it is recommended to disconnect the drive and the EMC filters to carry out the AC Voltage Tests of EN 60204-1 (1997), par.19.4, in order to not damage the Y-type capacitors between phases and ground. Moreover the DC voltage dielectric test required by EN 50178 (1997), product family standard, has been carried out in factory as a routine test. The DC Insulation Resistance Tests of EN 60204-1 (1997), par.19.3, may be carried out without disconnecting the drive and the EMC filters.*

***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:** in case of repetitive switching on and off, wait 1 minute between on and on.*

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

***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 see Section 2 of this Manual 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
M8	20.0	177.0

EC DECLARATION OF CONFORMITY

The undersigned, representing the following manufacturer

Moog Italiana S.r.l., Electric Division
Via Avosso 94, Casella (Genova), ITALY

herewith declares that the products

Complete Drive Modules series: BRD-4S, DBC III, DBS, DS2000, PDBS Basic Drive Modules series: BRM-4S, DBM 03, DBM 033, DBM 04, Feeding sections series: ADR, BRM-P1, BRM-P2, DBM 03-PS, DBM 033-PS, DBM 04-PS Motor groups series: FAE F/ K/ N/ T/ W, FAS F/ K/ N/ T/ W, FC

are in conformity with the provisions of the following EC directives
(including all applicable amendments)

ref. n°	title
73/23/EEC	Low Voltage Directive
89/336/EEC	EMC Directive

and that the following harmonized standards, or parts thereof, have been applied

nr	issue	title	parts
EN 60034-1	1998	Rotating electrical machines. Part 1: Rating and performance	
EN 60034-6	1993	Rotating electrical machines. Part 6: IC Code	
EN 60034-7	1993	Rotating electrical machines. Part 7: IM code	
CEI EN 60204-1	1993	Safety of Machinery. Electrical Equipment of machines. Part 1: General requirements	par. 6.2.3, 20.3, 20.4
EN 60529	1991	IP code	
CEI EN 61800-3	1996	Adjustable speed electrical power drive systems. Part 3: EMC product standard including specific test methods	par. 4, 5.3.2, 6.3.2
EN 61800-3 /A11	2000	Amendment A11	

Other references or information required by the applicable EC directives:
The conformity of products is subjected to the installation of filters and to the procedures included in the proper "Installation Manual". The user has the primary EMC responsibility in following the recommendations of the manufacturer.

Last two digits of the year in which the CE marking was affixed: 97

Casella, 2/Nov/2000

Walter Tettamanti
GENERAL MANAGER

DEC_SALE.DOC - MOD.176/PMA/4/96

CE Requirements

- **Cautionary Marking.** See Accident Protection page.

- **Protection against electric shock**. Electronic Equipment intended for installation in closed electrical operating areas kept locked. The lock shall be only opened by authorized person and the access only allowed to skilled persons whilst energized. Where the equipment requires manual intervention, 412.2.1 of HD 384.4.41 S2 shall be consulted.

- **Fixed connection for protection**. The equipment may have a continuous leakage current of more than a.c. 3.5 mA or d.c. 10 mA in normal use and a fixed ground connection is required for protection.

- **RCD**. When the protection in installations, with regard to indirect contact, is achieved by means of an RCD, their appropriate function/combination shall be verified. In any case only a residual-current-operated protective device (RCD) of Type B is allowed. In fact a d.c. component can occur in the fault current in the event of a fault connection to earth.

- **Climatic Conditions.** Equipment intended to operate within its performance specification over the range of Class 3K3, as defined in table 1 of EN 60721-3-1, EN 60721-3-2, EN 60721-3-3, EN 60721-3-4, partly modified.

- **Pollution Degree 2 Installation** - The equipment shall be placed in a pollution degree 2 environment, where normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation is to be expected, when the electronic equipment is out of operation.

- **EMC Requirements.** The installer of the equipment is responsible for ensuring compliance with the EMC standards that apply where the equipment is to be used. Product conformity is subjected to filters installation and to recommended procedures, as from Section 3 of this Manual.

- **Second Environment (EMC)**. Equipment intended to be connected to an industrial low-voltage power supply network, or public network which does not supply buildings used for domestic purposes (second environment, according to EMC Standards). It is not intended to be used on a low-voltage public network which supplies domestic premises (first environment). Radio frequency interference is expected if used on such a network.

- **Recovery Resistor Cable.** Shielding of the external recovery resistor cable, provided in kit for test purposes, is recommended for ensuring compliance with the EMC standards.

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An Affiliate of Underwriters Laboratories Inc.®

Agrate Brianza, February 5th, 2003

To
MOOG Italiana S.r.l.
Electric Division
Via Avosso, 94
I - 16015 Casella (Genova) - Italy
Attn.: Mr. Daniele Rolla

NOTICE OF AUTHORIZATION TO APPLY THE UL RECOGNITION MARK

Our Reference: **File E194181 - Vol. 2, Sec. 1** **Project 02ME19547 (02IT1420)**

Subject: **Industrial Control Equipment,**
Component - Power Conversion Equipment - (NMMS2) (NMMS8)
Open Type, Brushless Motor Servo-Drives "DBM 04 Series" and "IDBM 04 Series"

Report Revision for:

- **New alternate IPM-Power IGBT, new alternate Dynamic Brake Unit Recovery IGBT, new "Restart Interlock" boards as optional and alternate Connection PWB's, alternative components / materials, a revision of some illustrations and new drive model number to identify only accessories / expansions with Limited Voltage / Current circuitry for special customized end-use applications**

Dear Mr. Daniele Rolla,

We have completed our engineering investigation under the above project number and find the products comply with the applicable requirements.

This letter temporarily supplements the UL Follow-Up Services Inspection Procedure and serves as authorization to apply the UL and C-UL Recognition Mark, only at the factory under UL's Follow-Up Service Program, to the above products, which are constructed as described below:

- Similar to products covered in the UL Follow-Up Services Inspection Procedure, File E194181, Volume 2, Section 1.

To provide the manufacturer with the intended authorization to use the UL Recognition Mark, the addressee must send a copy of this Notice and all attached material to each manufacturing location as currently authorized in the appropriate UL File Procedure.

This authorization is effective for 90 days only from the date of this Notice and only for products at the indicated manufacturing locations. Records covering the product are now being prepared and will be sent to the indicated manufacturing locations in the near future. Please note that Follow-Up Services Procedures are sent to the manufacturers only unless the Applicant specifically requests this document.

Please note: Within Canada, there are federal and local statutes and regulations requiring the use of bilingual product markings. It is the responsibility of the manufacturer (or distributor) to comply with this law. As such, the markings provided in the UL Follow-Up Service Procedure may include only the English version. Please contact us if you need assistance with translations or in determining which markings are appropriate for your product.

Products produced, which bear the UL Recognition Mark, shall be identical to those evaluated by UL and found to comply with UL's requirements. If changes in construction are discovered, authorization to use the UL Recognition Mark may be withdrawn and products that bear the UL Recognition Mark may have to be revised (in the field or at the manufacturer's facility) to bring them into compliance with UL's requirements.

This letter is sent on behalf of Underwriters Laboratories Inc. pursuant to the Corporate Services Agreement between UL International Italia S.r.l.. and UL.

Respectfully,

Giuseppe Redaelli
Project Engineer
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UL Requirements

- These Brushless Servo-Drives shall be assembled with the guidelines specified in this Manual. Only the configurations with the components tested and described in the UL Report, file E194181, Vol.2, Sec.1, Issue date 03-28-01 and following Revisions can bear the Recognized Component (R/C) Mark. Each assembled configuration shall be evaluated in the UL Listed end-use application.

- The Component – Power Conversion Equipment "DBM 04 Series" is considered UL Recognized in the complete configurations after the assembly of the three main parts of the Drive, that is the Power Supply, the Modules and the Fan Assembly. The Marking, including the R/C Mark and the Drive Model No., shall consider the equipment in its complete configuration.

- These drives shall be used within their ratings, as specified in the marking of the equipment. In particular:
  - rated input voltage, input current, system duty cycle, auxiliary input voltage, auxiliary input power, fan input voltage, fan input power on the label affixed on the fan assembly
  - rated axis continuous output current, axis max output current, module duty cycle on the label affixed on the module

- **Cautionary Marking.** See Accident Protection page.

- **Duty Cycle**. The maximum continuous Drive output current shall be limited to 65 A and to the Maximum Module Current, due to the rated current of the Power Supply and of the Module. According to this reason, the Drive shall be used with a Duty Cycle, as specified in the marking of the equipment.

- **Surrounding Air Temperature** - *"Maximum Surrounding Air Temperature 40°C".* In the final installation considerations shall be given for the need of repeating Temperature test if the unit is mounted with a different Surrounding Air conditions.

- **Pollution degree 2 Installation** - The drive must be placed in a pollution degree 2 Environment.

- **Environmental designation** - *"Open Type Equipment"*.

- **Short Circuit Ratings**. *"Equipment suitable for use on a circuit capable of delivering not more than 5000 rms Symmetrical Amperes, 460 V ac +10% maximum"*

- **Branch Circuit Protection**. The Branch Circuit Protection for Short Circuit shall be provided in the end-use applications by external R/C Fuses (JFHR2), manufactured by Bussmann Div Cooper (UK) Ltd, Semiconductor fuse type, Mod.No. 160 FEE, rated 160 A, 660 Vac, 200 kA A.I.C.

- **Overspeed Protection**. The Power Conversion Equipment is incorporating an Overspeed Protection. See MV command in Section 6 of this Manual.

- **Overvoltage Control**. In the equipment the Overvoltage is controlled by a Transient Suppressive device, with 1500 V Clamping Voltage and min 120 J (10x1000 us or 2 ms) Energy Handling Capability. See also “Bus not normal” protection in Section 4. of this Manual

- **Overload Protection**. The equipment does not incorporate internal overload protection for the motor load. The drive is intended to be used with motors that must have integral thermal protection through a PTC. The overtemperature fault of the drive will trip when the PTC reaches 1.2 kΩ. See J4-J5-J6 connectors in Section 2 of this Manual for wiring.

- **Over-Current Protection**. The drive is provided with a current limiting circuitry. See IL and IT commands in Section 6 of this Manual.

- **Factory Wiring**. These equipments are suitable only for Factory Wiring only, that is the Terminal Blocks and the Connectors for Power Connection Wiring are not suitable for Field Wiring. In particular the DC-Bus Terminal Blocks for the Power Supply and Modules Interconnection shall be usable only with the DC-Bus Interconnection Cables provided by the manufacturer.

- **Wiring**. Wiring shall be made by stranded and/or solid, copper (Cu), 60/75°C (140/167°F) conductor only, and, for terminal blocks, the tightening torque values specified in Section 2 of this Manual shall be applied. These requirements do not pertain to control circuit terminals.

- **Wiring of Recovery Resistor**. The Dynamic Brake Unit Recovery Resistor shall have the connection wiring made with R/C (AVLV2) or insulated with R/C (YDPU2) or R/C (UZCW2) in the end-use installation.

ATTESTATO DI ESAME VOLONTARIO

VOLUNTARY EXAMINATION CERTIFICATE

05CM020301

■ Nome e indirizzo del detentore del certificato ❑ *Name and address of the holder of the certificate*	**MOOG Italiana S.r.l. Electric Division Via Avosso, 94 16015 CASELLA (GE)**
■ Costruttore ❑ *Manufacturer*	**MOOG Italiana S.r.l. Electric Division Via Avosso, 94 16015 CASELLA (GE)**
■ Genere prodotto ■ *Product designation*	**Servoazionamento digitale multiasse *Multiaxis digital servodrive***
■ Serie \ Opzione ❑ *Series \ Option*	**IDBM04 \ DRC - SRC**
■ Funzione di sicurezza ■ *Safety function*	**Interblocco al riavvio (protezione contro l'avvio inaspettato) *Restart interlock (protection against unexpected start)***
■ Direttiva(e) CE \ Norma(e) armonizzata(e) ❑ *EC - Directive(s) \ Harmonized standard*	**98/37/CE (Macchine) \ UNI EN 954-1: 1998**

■ Risultato dell'esame
■ *Examination result*

L'esame del Fascicolo Tecnico permette di dichiarare che la funzione di sicurezza "interblocco al riavvio", dopo un arresto controllato (categoria 1 CEI EN 60204-1:1998), del servoazionamento serie IDBM04, con opzione
- DRC rispetta i requisiti della categoria 3 definita nella norma armonizzata UNI EN 954-1:1998;
- SRC rispetta i requisiti della categoria 2 definita nella norma armonizzata UNI EN 954-1:1998.

I servoazionamenti devono essere installati come descritto nel Manuale Istruzioni (condizioni ambientali e interfaccia con il sistema di comando e controllo).

Following the examination of technical construction file we can declare that the safety function "restart interlock", after a controlled stop (category 1 CEI EN 60204-1: 1998), of servodrive IDBM04 series, with option
- *DRC complies with the provisions of category 3 as defined in the harmonized standard UNI EN 954-1: 1998;*
- *SRC complies with the provisions of category 2 as defined in the harmonized standard UNI EN 954-1: 1998.*

Servodrives must be installed according to the instructions (environmental and interface with control and verification circuit) of the User's Manual.

Pontenure, 12.02.2003

Il Direttore Generale
Ing. Andrea Guido Esposito

via Emilia Parmense, 11/A • 29010 Pontenure (PC) • Italy
tel.: +39 0523 517501 • fax: +39 0523 510620 • e-mail: info@icepi.com • web site: www.icepi.com

Safety (Restart Interlock Function) Requirements

- **Controlled Stop Time**. The final machine must be able to stop the motors in less than 360 ms. The hazard/risk assessment of the application must demonstrate that within this time persons cannot be injured. The drive can provide the Anti Free Wheeling function to perform the controlled stop.

- **Free-Wheeling Detection**. The external system must be able to detect free-wheeling when the axis does not stop within 360 ms after the Module Enable signal goes away. This system must have the motor velocity available.

  ***WARNING**: The designer must evaluate the machine stopping time during the risk assessment even in case of failure. The machine can present a dangerous overrun in case of failure of the drive. Other protective measure are needed to achieve a safe condition.*

- **Environmental Conditions.** Equipment intended to operate within the following environmental conditions:
  - ◊ Ambient temperature: 0 to 40°C
  - ◊ Supply voltage interruptions: 10, 20, 500 ms dip time
  - ◊ EMC immunity: according to EN 61000-6-2:1999 (Generic Standard - Immunity for industrial environment)
  - ◊ Vibration: 2 to 9Hz, 3.0 mm amplitude (peak); 9 to 200Hz, 1 g acceleration
  - ◊ Shock: 10 g, half sine, 6 ms

- **Enclosure.** Electronic Equipment intended for installation in an enclosure providing at least IP54 protection.

- **Pollution Degree 2 Installation** - The equipment shall be placed in a pollution degree 2 environment, where normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation is to be expected, when the electronic equipment is out of operation.

- ***WARNING**: When the Restart Interlock Circuit is activated, the motor can no longer generate a torque. Motors which are not automatically clamped when powered down (e.g. vertical/inclined axes), must be clamped using a mechanical brake*

SECTION 1 - DESCRIPTION

1.1 Description

IDBm, four quadrant servodrives, provide unrivaled compactness and flexibility through the integration of three axes in a single module.
A power supply is connected directly to the power distribution line at 400 or 460/480V 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 FASTACT servomotors all equipped with a resolver feedback. Drive tuning and configuration are performed via digital parameters (not potentiometers) and stored in non-volatile memory (Flash Disk).
Drive set up is possible via a 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).
- maximum case depth of 310 mm
- 10 kHz switching frequency
- operating temperature: 0 to +40°C (exceeding Class 3K3)
- relative humidity: 5% to 85% (no condensation, no formation of ice) (Class 3K3)
- air pressure: 86 kPa to 106 kPa (Class 3K3)
- storage temperature: -25 to +55°C (Class 1K4)
- transportation temperature: -25 to +70°C (Class 2K3)
- immunity to vibrations: 3.0 mm (peak) from 5 to 9 Hz, 1 g from 9 to 200 Hz (Class 3M4)
- immunity to shocks: 10 g, half-sine, 6 ms (Class 3M4)
- Fieldbus CAN OPEN

1.2 Electrical Data

PS-Standard Power Supply

- 3-phase power input voltage: 400 or 460 Vac (selectable via switch), ±10%, 50/60 Hz
- 1-phase auxiliary input voltage: 110 or 230 Vac (selectable via jumper), ±10%, 50/60 Hz, max 240 W (60 W per module)
- input current: 65 A rms
- output current: see tab 1.1
- max number of modules supplied: 4

PS-6M Power Supply (Standard Plus)

- 3-phase power input voltage: 400 or 460 Vac (selectable via switch), ±10%, 50/60 Hz
- 1-phase auxiliary input voltage: 110 or 230 Vac (selectable via jumper), ±10%, 50/60 Hz, max 360 W (60 W per module)
- input current: 65 A rms
- output current: see tab 1.1
- max number of modules supplied: 6

PS-Standalone Power Supply

- 3-phase power input voltage: 400 Vac or 460 Vac (set in factory), ±10%, 50/60 Hz
- 1-phase auxiliary input voltage (for data saving): 230 Vac, ±10%, 50/60 Hz, max 360 W (60 W per module)
- input current: 65 A rms
- output current: see tab 1.1
- max number of modules supplied: 4

PS-120 Power Supply (Powered Standalone)

- 3-phase power input voltage: 400 Vac or 460 Vac (set in factory), ±10%, 50/60 Hz
- 1-phase auxiliary input voltage (for data saving): 230 Vac, ±10%, 50/60 Hz, max 360 W (60 W per module)
- input current: 120 A rms
- output current: see tab 1.1
- max number of modules supplied: 4

PS-U Power Supply (Special Standalone)

- 3-phase power input voltage: 400 to 480 Vac, ±10 %, 50/60 Hz
- auxiliary input voltage (for data saving): 24 Vdc, ±10 %
- advanced functions for “safety requirements on IMM machine” as described in Section 7
- input current: 65 A rms
- output current: see tab 1.1
- max number of modules supplied: 4

IDBm Module

- BUS BAR rated voltage: 540 Vdc with 400 Vac or 620 Vdc with 460 Vac (set in factory)
- three-phase output voltage: 325 Vac with 400 Vac or 375 Vac with 460 Vac (set in factory)
- output current: see tab 1.1

IDBM 04 Fan Assembly

- fan input voltage: 230 Vac or 115 Vac, +0%/-10%, 50/60 Hz, or 24 Vdc, +/-4%
- input power: see tab. 2.1

Tab 1.1 Output Currents

STANDARD MODULES (see tab.2.27 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)
IDBm 3-3	3	6.4	9	3	6.4	9	-	-	-	120	8
IDBm 6-6	6	10.6	15	6	10.6	15	-	-	-	120	8
IDBm 8-8	8	15.6	22	8	15.6	22	-	-	-	120	8
IDBm 15-15	15	29.7	42	15	29.7	42	-	-	-	120	9
IDBm 25-25	25	49.5	70	25	49.5	70	-	-	-	180	13
IDBm 35-35*	35	63.6	90	35	63.6	90	-	-	-	270	18
IDBm 3-3-3	3	6.4	9	3	6.4	9	3	6.4	9	120	9
IDBm 6-6-6	6	10.6	15	6	10.6	15	6	10.6	15	120	9
IDBm 8-8-8	8	15.6	22	8	15.6	22	8	15.6	22	120	9
IDBm 15-15-15	15	29.7	42	15	29.7	42	15	29.7	42	180	14

* a duty cycle of 92 % applies.

POWER SUPPLY - 400/460 Vac

Model	Currents			Auxiliary Input Voltage	Width	Weight
	Output Rated	Output Max	Braking			
	(A)	(A)	(A)	(V)	(mm)	(kg)
PS-Standard Power Supply	65	100	100	110/230 Vac	120	13
PS-6M Power Supply (Standard Plus)	65	100	100	110/230 Vac	120	13
PS-Standalone Power Supply	65	100	100	230 Vac*	120	13
PS-120 Power Supply (Powered Standalone)	120	280	175	230 Vac*	180	20
PS-U Power Supply (Special Standalone)	65	100	100/145**	24 Vdc*	120	13

* it is not necessary for normal operations but only for data saving

** 145A with the DBM04 PS-U special version with oversized Dynamic Brake Unit.

EXPANSIONS

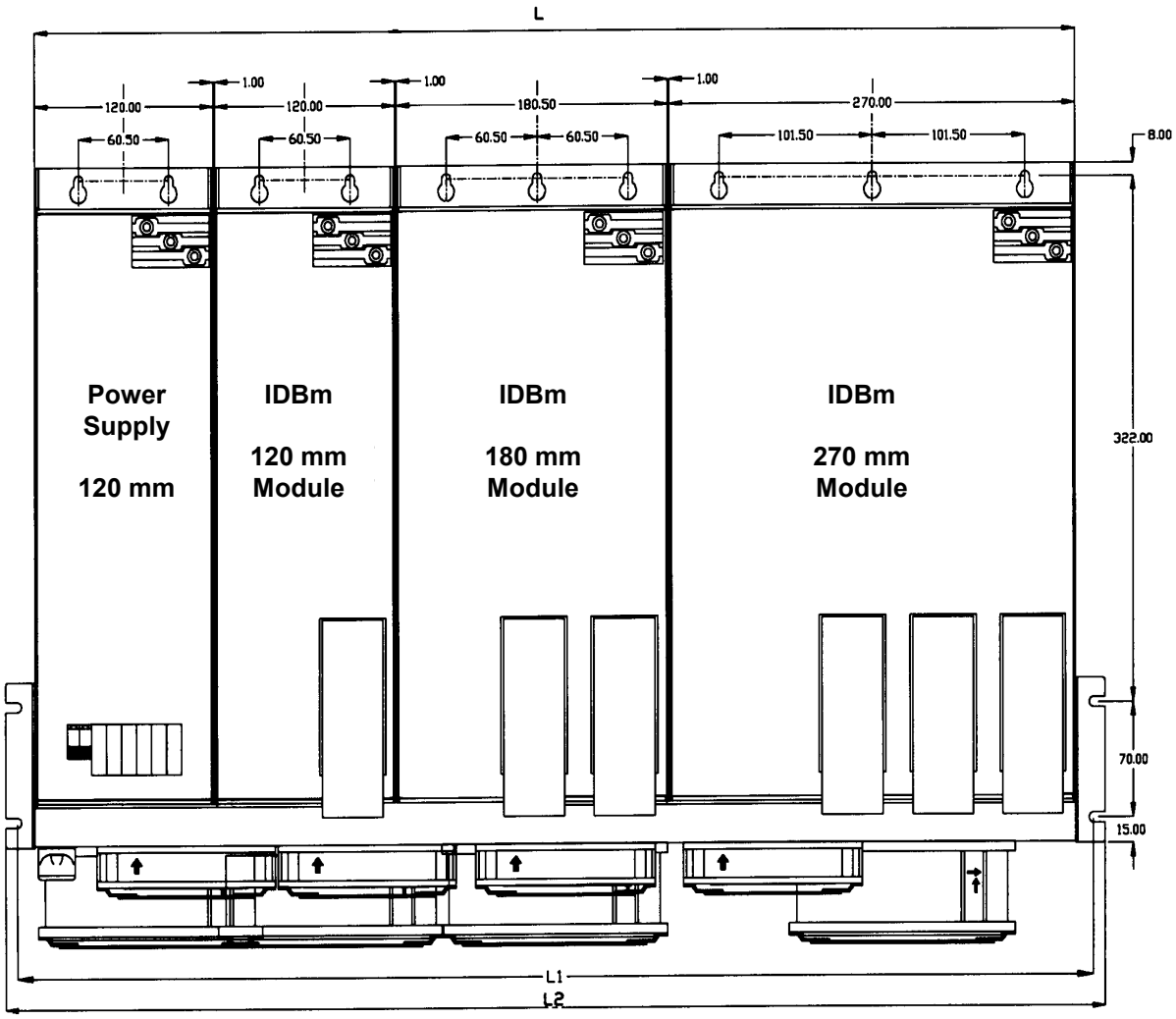
An external expansion module should be used for some configurations, including an axis rated over 35A. This is due to thermal constrictions.
Available expansions modules are shown in the table. To specify an expansion module, please replace the third axis rating number with E, this ensures that the drive is configured for use with an expansion module (e.g. IDBm 15-15-E).

Model	Output Currents			Width	Weight
	Rated	Max			
	(Arms)	(A)	(A)	(mm)	(kg)
EBM 04 50/140	50	99	140	270	18
EBM 04 60/180	60	127	180	270	18

1.3 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)

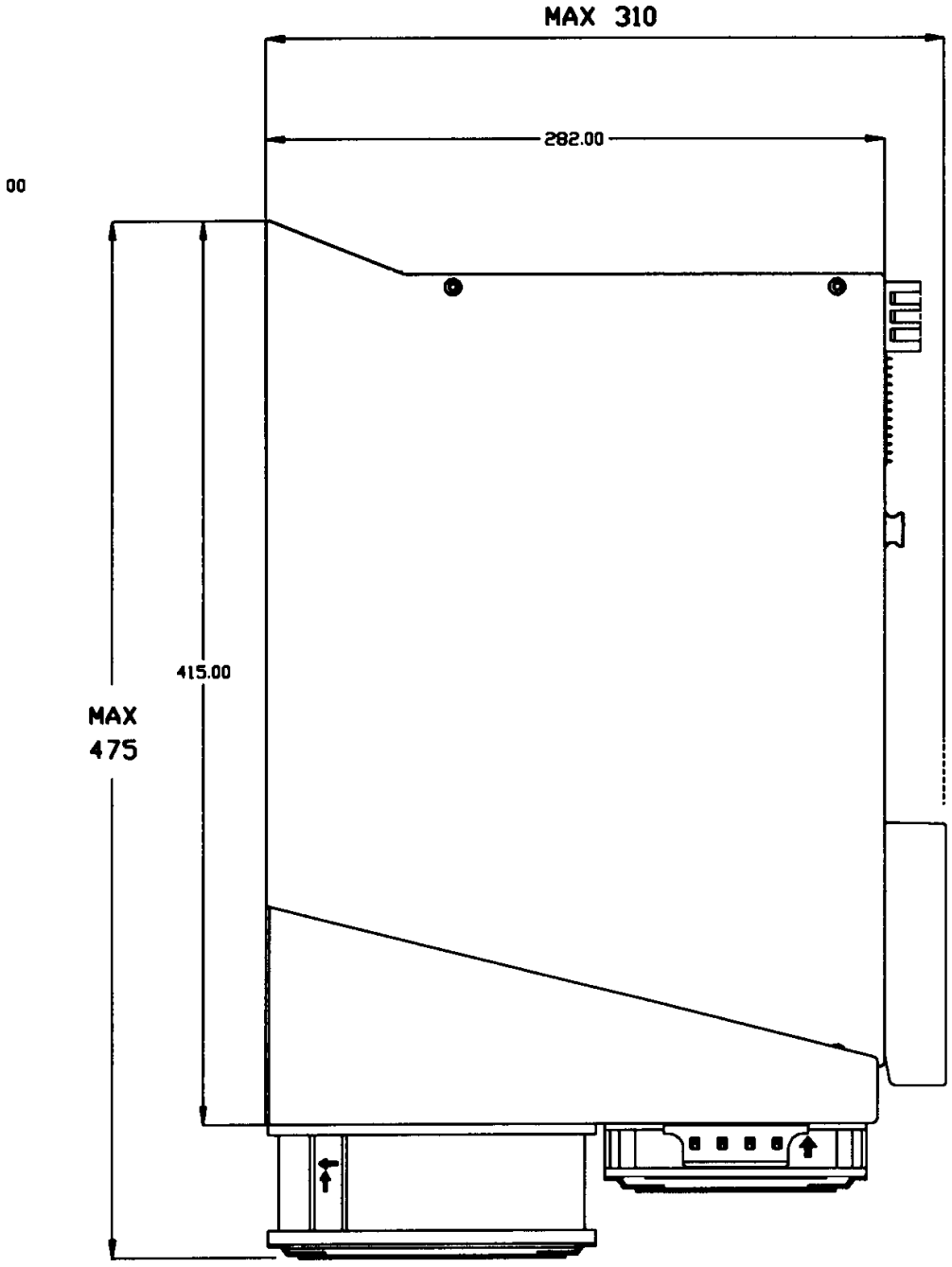


Summary Table of drive dimensions

Configuration	L	L1	L2
1 IDBm PS + 1 IDBm 120 mm	241	266	282
1 IDBm PS + 1 IDBm 180 mm	301.5	326	342
1 IDBm PS + 2 IDBm 120 mm	362	387	403
1 IDBm PS + 1 IDBm 270 mm	391	416	432
1 IDBm PS + 1 IDBm 120 mm + 1 IDBm 180 mm	422.5	447	463
1 IDBm PS + 2 IDBm 180 mm	483	508	524
1 IDBm PS + 3 IDBm 120 mm	483	508	524
1 IDBm PS + 1 IDBm 120 mm + 1 IDBm 270 mm	512	537	553
1 IDBm PS + 2 IDBm 120 mm + 1 IDBm 180 mm	543.5	568	584
1 IDBm PS + 1 IDBm 180 mm + 1 IDBm 270 mm	572.5	597	613
1 IDBm PS + 1 IDBm 120 mm + 2 IDBm 180 mm	604	629	645
1 IDBm PS + 4 IDBm 120 mm	604	629	645

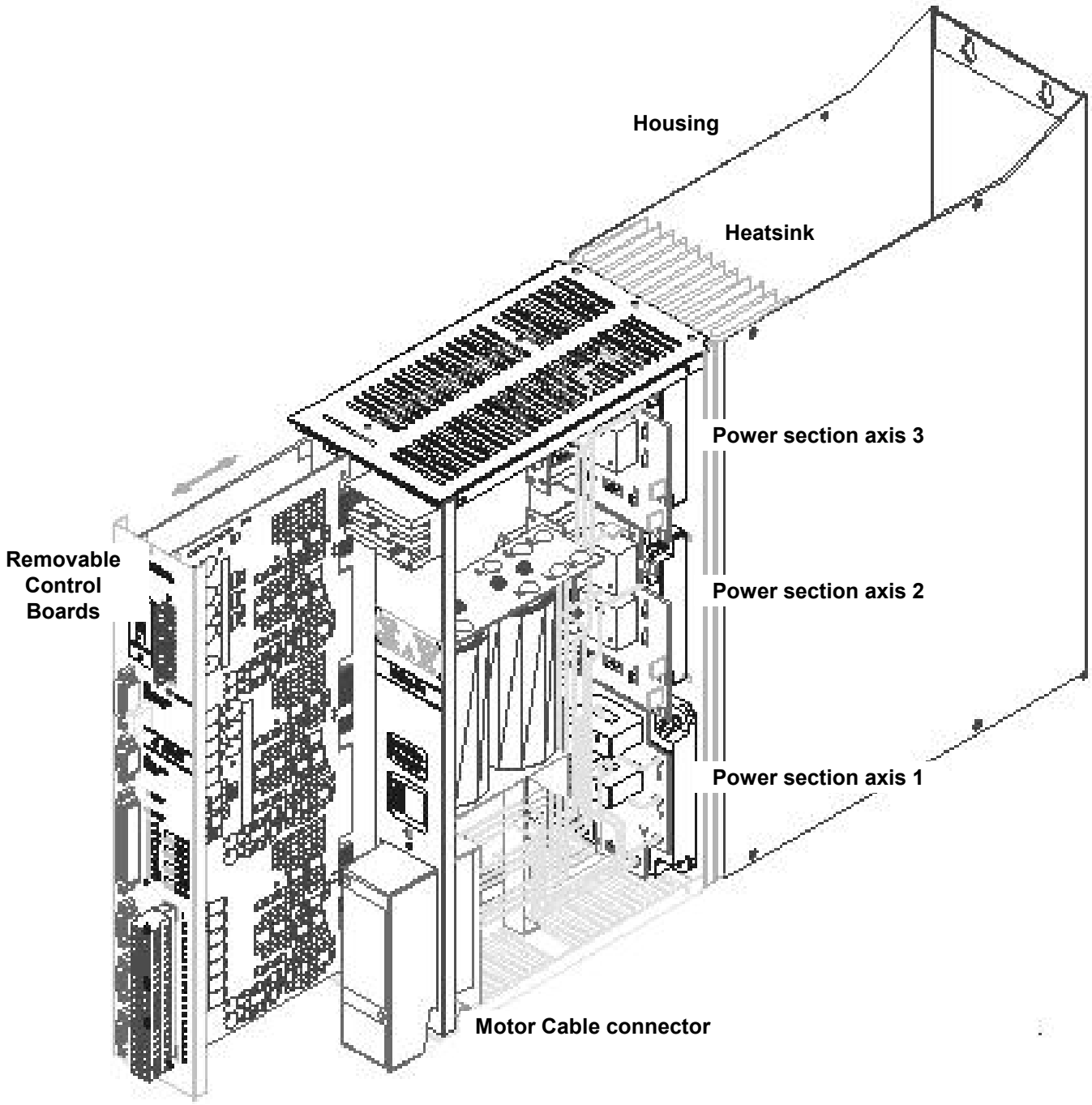
Note: the width of the Power Supply PS-120 is 180 mm.
Contact our Sales Locations or Service Centers for the available configurations and dimensions with this Power Supply.

Fig. 1.2 Side View (Drill For M5 Screws)



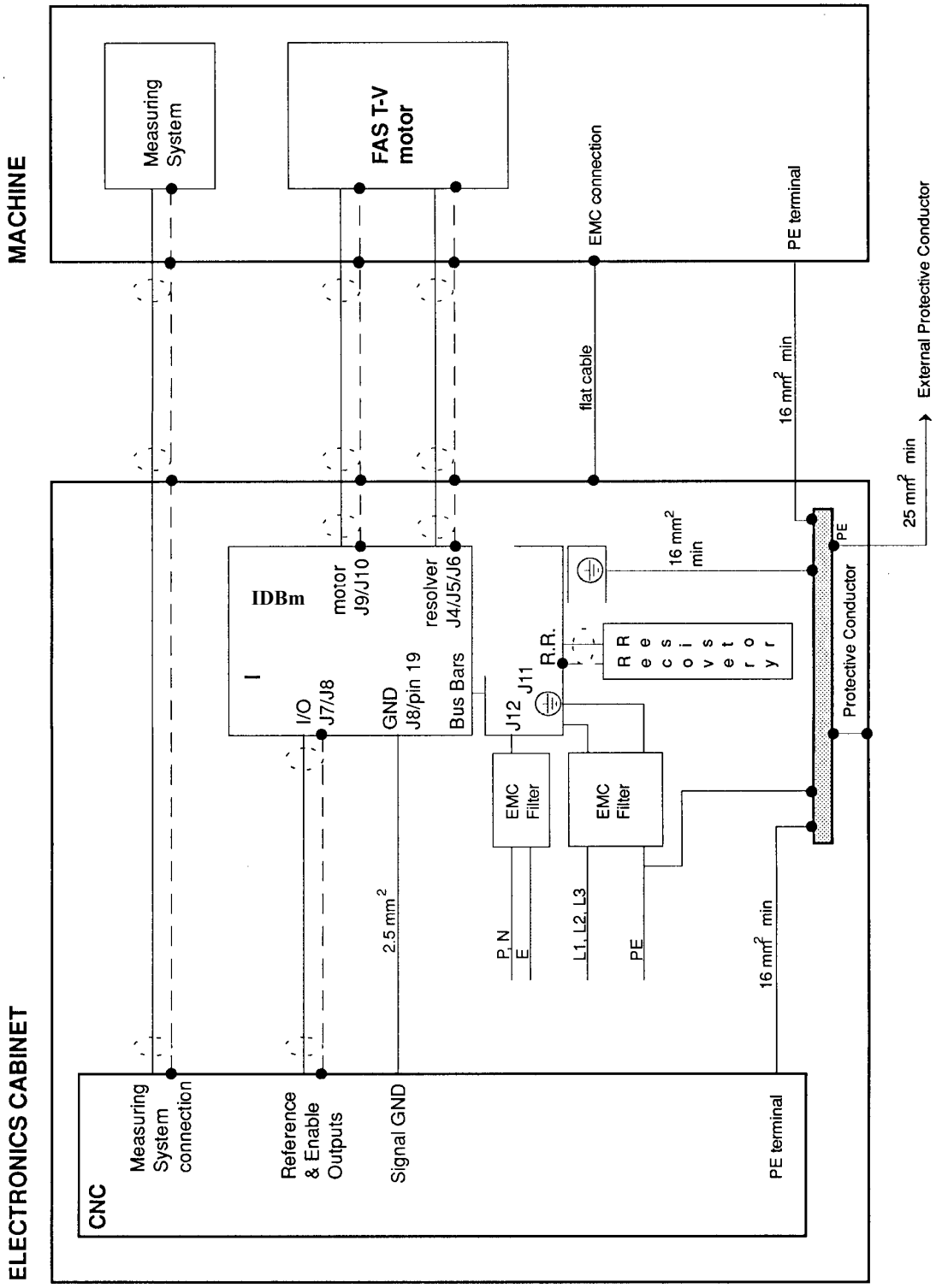
1.4 Component Identification

Fig. 1.3 Component Identification (IDBm 15-8-8)



1.5 System Grounding

Fig. 1.4 EMC/Equipotential Bonding



1.6 Options

- ADR function: external 24 Vdc UPS with added capacitance to recover braking energy. See Application Note GB-4528
- DRC (Dual-channel Restart interlock Circuit) safety function. See Section 8.
- SRC (Single-channel Restart interlock Circuit) safety function. See Section 8.

1.7 Rating Plate

The following informations are supplied on the rating plate of IDBm.

1.7.1 Power Supply

CODE:	CY2ZZZXX	where CY2ZZZ=model code, XX=option code
S/N:	AASS NNNNZZ	where AA=year, SS=week, NNNNZZ=serial number (ZZ may not be typed)
Vin:	xxx V	nominal three phase input voltage 50/60 Hz 3-phase
Iin:	xxx A_{rms}	nominal rms input current
Iout nom:	xxx A_{rms}	nominal rms output current
Iout max:	xxx A	peak output current

1.7.2 Module

Code:	CY1ZZZ XX	where 1ZZZ=model code; XX=option code
S/N:	AASS NNNNZZ	where AA=year, SS=week, NNNNZZ=serial number. ZZ may not be typed
3-phase D.C. xxx%		where xxx% =Duty Cycle
Axis 1 – BBB	$C_1C_2C_3$-C_4	code for RIC, motor, resolver, simulated encoder (see note below). BBB may not be typed
Iout nom	XX A_{rms}	nominal rms output current
Iout max	YYY A	peak output current
Axis 2 – BBB	$C_1C_2C_3$-C_4	code for RIC, motor, resolver, simulated encoder (see note below). BBB may not be typed
Iout nom	XX A_{rms}	nominal rms output current
Iout max	YYY A	peak output current
Axis 3 – BBB	$C_1C_2C_3$-C_4	code for RIC, motor, resolver, simulated encoder (see note below). BBB may not be typed
Iout nom	XX A_{rms}	nominal rms output current
Iout max	YYY A	peak output current

Note

BBB	Channels of the optional RIC (SRC=Single-channel Restart interlock Circuit, DRC=Dual-channel Restart interlock Circuit)
$C_1C_2C_3$-C_4	C_1=pulses per electrical revolution (C=64, D=128, E=256, F=512, G=1024, H=2048, I=4096, L=8192, M=16384) C_2=motor poles (A=2, B=4, C=6, D=8, E=10, F=12) C_3=resolver poles (A=2, B=4, C=6, D=8, E=10, F=12) C_4 =marker width (A=1, B=1/2, C=1/4, D=no marker)

1.7.3 UL Rating Plate

To comply with the UL requirements, the following data are shown on the rating plate of the Fan Assembly. These data are referred to the complete IDBm 04 system, UL Recognized, that is Power Supply, one or more modules, fan assembly.
The Duty Cycle is related to the max nominal current of the Power Supply (65A for PS-Standard, PS-Standalone and PS-U).
The Flow Rate (F.R.) is the sum of the fan flow rates of the fan assembly.
Power Supplies and modules intended to be part of a complete DBM 04 system, UL Recognized, are marked “Part of a Recognized System”.

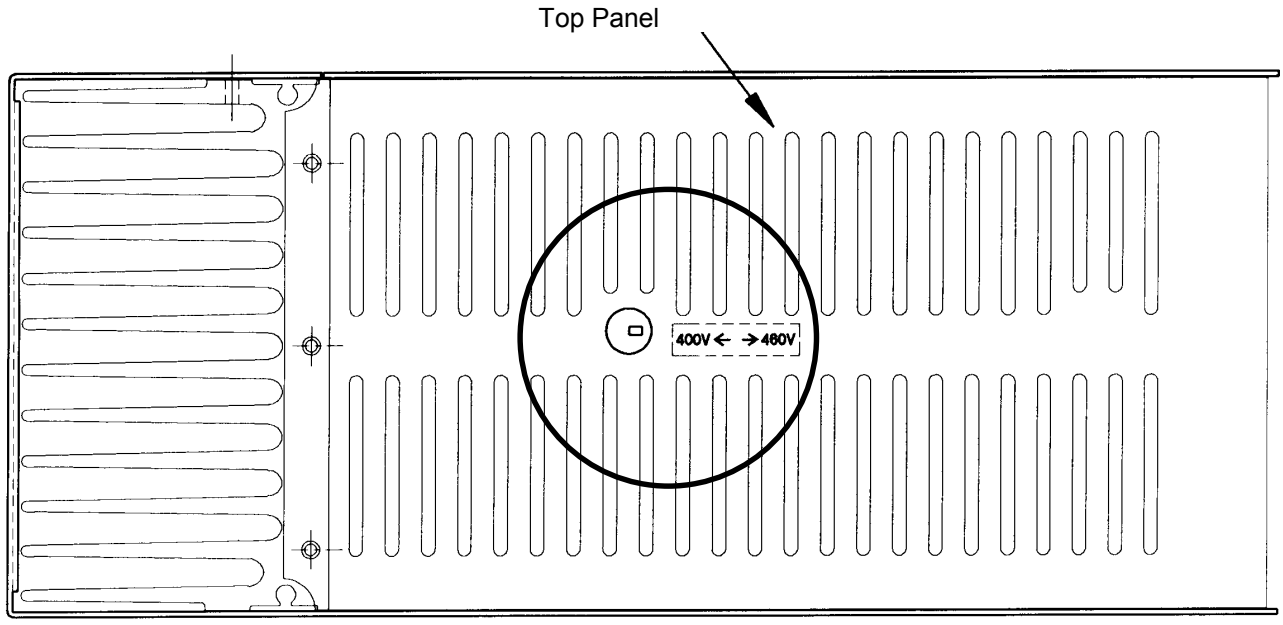
Example:

CODE	CY2000	-	CY2007 A0	-	CY1200 A2	-	CY1200 A9	-	CY1200 A9	-	CY4200
V_{in}	400	V_{ac}	3-phase		50/60Hz		I_{in}	27	A_{rms}	- Duty Cycle	100 %
Auxiliary Input			V_{in}	110/230	V_{ac}		P_{in}	240	W		
Fan Assembly			V_{in}	115	V_{ac}		P_{in}	56	W	F.R. 560	m^3/h

SECTION 2 - INSTALLATION

***CAUTION**: make sure that the correct input voltage, 400V or 460V, has been set.*

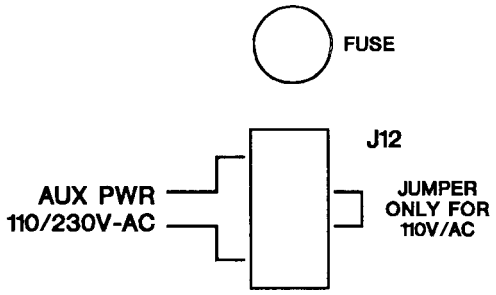
Fig.2.1 PS-Standard and PS-6M - 400/460V Setting



***CAUTION**: make sure that the correct wiring has been set for auxiliary input voltage on the PS-Standard and PS-6M front panel.*

- connect the jumper on J12 connector to use 110 Vac
<u>or</u>
- disconnect the jumper on J12 connector to use 230 Vac

Fig.2.2 PS-Standard and PS-6M - 110/230V Jumper



2.1 Fuses

2.1.1 Internal Auxiliary Fuses

2.1.1.1 PS-Standard and PS-6M

A delayed type fuse, rated 4A/250V, is provided on the front panel, to protect the auxiliary power circuit. The following types are approved:
- Mod.No.SPT 0001.2510 by Schurter AG
- Mod.No. ST520240 by Bussmann Div Cooper (UK) Ltd

2.1.1.2 PS-Standalone and PS-120

A delayed type fuse, rated 3.15A/250V, is provided on the internal base card, to protect the auxiliary power circuit. The following types are approved:
- Mod.No.SPT 0001.2509 by Schurter AG
- Mod.No. ST520231 by Bussmann Div Cooper (UK) Ltd

2.1.1.3 PS-U

A delayed type fuse, external, rated 10A/250V, have to be provided outside the power supply, to protect the auxiliary power circuit input (24VoltDC).

2.1.2 External Power Fuses (one in each phase of the power line)

2.1.2.1 PS Standard, PS-6M, PS-U and PS-Standalone

CAUTION*: equipment suitable for use on a circuit capable of delivering not more than 5000 RMS symmetrical Amperes, 460V +10% maximum, when protected by semiconductor type fuses, mod.No.160-FEE, manufactured by Bussmann Div.Cooper (UK) Ltd*

2.1.2.2 PS-120

Semiconductor type fuses, mod.No.315-FM (315A/660Vac), manufactured by Bussmann Div.Cooper (UK) Ltd, are recommended.

2.2 Soft Start

The soft start circuit (inrush current limiting) is built-in.

2.3 Transformers

2.3.1 Power Transformer

The system is designed to allow direct operation from a 400/460 Vac three phase power line, without isolation transformer. An isolation transformer may still be required to meet local safety regulations. It is the user responsibility to determine if an isolation transformer is required to meet these requirements.
To size the power transformer 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]

2.3.2 Auxiliary Power Transformer - PS-Standard and PS-6M

A transformer for the auxiliary line is not necessary.

No transformer is required for the PS-U

2.3.3 Auxiliary Power Transformer - PS-Standalone and PS-120

If data need to be saved in case of three phase power line failure, a 230 Vac single phase auxiliary line must be connected, via isolation transformer, to the PS-Standalone and PS-120 versions of Power Supply. This is not necessary for normal duty but only for data saving.

***CAUTION**: do not connect directly the auxiliary line but only through a dedicated, isolation transformer with 230Vac ±10%, 50/60 Hz secondary voltage. Rated power must be 60VA for each module (e.g. 240VA for 4 modules)*

2.4 Electrical cabinet thermal sizing

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					
PS-U	**PS-Standard, PS-6M and PS-Standalone**	**PS-120**	**Module**	**IGBT's**	**Input Bridge**
25 W	25 W	50 W	50 W	16 W/A	1 W/A

Example: with one PS-Standard, 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

Fan dissipation is not included in this table.

2.5 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 680V (for 400Vac version) or 790V (for 460/480Vac version) 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, PS-Standard, PS-6M, PS-Standalone are provided with 8.2 Ω, 750W recovery resistor, while PS-U is provided with 12 Ω, 750W recovery resistor and PS-120 with 3.9 Ω, 1000W recovery resistor. A special version PS-U with oversized Dynamic Brake Unit is provided with 8.9 Ω, 750W recovery resistor.

***WARNING**: High Voltage. The recovery resistor is connected to the Bus Bar's and can have voltage ≥810Vdc*

***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.

***CAUTION**: shielding of the recovery resistor cable, provided in kit for test purposes, is recommended for ensuring compliance with the EMC standards.*

***CAUTION:** for UL approval in the end-use installation, the Dynamic Brake Unit Recovery Resistor shall have the connection wiring made with R/C (AVLV2) or insulated with R/C (YDPU2) or R/C (UZCW2)*

2.6 Fan Assembly

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 IDBm drives package (i.e. Fan = Power Supply and IDBm module(s) and IDBm expansion module(s)).
Fan input voltage is 230 Vac or 115 Vac.

TAB. 2.1 - FAN ASSEMBLY

Model Code	Fan Assembly Width mm	Input Voltage V	Input Power W	Total Flow Rate m3/h
CY4300, CY4318, CY4359, CY4360	240	24 Vdc	23	520
CY4301, CY4323, CY4337, CY4338	300	24 Vdc	46	1040
CY4302, CY4319, CY4339, CY4340	360	24 Vdc	46	1040
CY4303, CY4341, CY4342	390	24 Vdc	46	1040
CY4304, CY4320, CY4334, CY4343, CY4344	420	24 Vdc	57	1200
CY4305, CY4321, CY4331, CY4335, CY4345, CY4346	480	24 Vdc	69	1560
CY4306, CY4316, CY4347, CY4348	510	24 Vdc	69	1560
CY4307, CY4311, CY4349, CY4350	540	24 Vdc	69	1560
CY4308, CY4351, CY4352	570	24 Vdc	69	1560
CY4309, CY4312, CY4324, CY4336, CY4353, CY4354	600	24 Vdc	92	2080
CY4310, CY4355, CY4356	750	24 Vdc	92	2080
CY4315, CY4357, CY4358	660	24 Vdc	92	2080
CY4100, CY4118, CY4159, CY4160	240	230 Vac	64	485
CY4101, CY4123, CY4137, CY4138	300	230 Vac	128	970
CY4102, CY4119, CY4139, CY4140	360	230 Vac	128	970
CY4103, CY4141, CY4142	390	230 Vac	128	970
CY4104, CY4120, CY4134, CY4143, CY4144	420	230 Vac	147	1130
CY4105, CY4121, CY4131, CY4135, CY4145, CY4146	480	230 Vac	192	1455
CY4106, CY4116, CY4147, CY4148	510	230 Vac	192	1455
CY4107, CY4111, CY4149, CY4150	540	230 Vac	192	1455
CY4108, CY4151, CY4152	570	230 Vac	192	1455
CY4109, CY4112, CY4124, CY4136, CY4153, CY4154	600	230 Vac	256	1940
CY4110, CY4155, CY4156	750	230 Vac	256	1940
CY4115, CY4157, CY4158	660	230 Vac	256	1940
CY4200, CY4213, CY4214	240	115 Vac	56	560
CY4201, CY4215, CY4216	300	115 Vac	112	1120
CY4202, CY4217, CY4218	360	115 Vac	112	1120
CY4203, CY4219, CY4220	390	115 Vac	112	1120
CY4204, CY4221, CY4222	420	115 Vac	130	1300
CY4205, CY4211, CY4223, CY4224	480	115 Vac	168	1680
CY4206, CY4225, CY4226	510	115 Vac	168	1680
CY4207, CY4227, CY4228	540	115 Vac	168	1680
CY4208, CY4229, CY4230	570	115 Vac	168	1680
CY4209, CY4212, CY4231, CY4232	600	115 Vac	224	2240
CY4210, CY4233, CY4234	750	115 Vac	224	2240
CY4235, CY4236	660	115 Vac	224	2240

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

2.7 Wire Type

2.7.1 Sizing of Wires

It is recommended to use Cu, stranded and/or solid wires, 75°C (167°F), UL approved, per the following table.

Tab. 2.2 - Sizing of Wires

	IDBm04 Model					Notes
	Power Supply		Axis			
	PS-Sandard, PS-6M, PS-U, PS-Standalone	**PS-120**	**3/9 to 15/42**	**25/70**	**35/90 to 60/180**	-
Power Line and ground wiring (No.of wires x AWG)	4 x 6 AWG	4 x 2 AWG	-	-	-	-
Auxiliary Line wiring (No. of wires x AWG)	2 x 14 AWG	2 x 10 AWG	.	.	-	-
Motor Power wiring (No.of wires x AWG)	. .	.	4 x 14 AWG	8 x 14 AWG	4 x 6 AWG	shielded
Recovery Resistor wiring (No.of wires x AWG)	2 x 10 AWG	2 x 6 AWG	.	.	.	shielded
Dc-Bus (+/-AT)	8 AWG (provided in kit)					-
Resolver wiring (No.of wires x AWG)	-		4 x 2 x 22/20 AWG			with 4 pair, each pair twisted and individually shielded with an independent overall shield

Tab. 2.3 - AWG/mm^2 Conversion Table

AWG	22	20	18	16	14	12	10	8	6	4	3	2	1	1/0
mm^2	0.3	0.5	0.8	1.3	2.1	3.3	5.3	8.4	13	21	27	34	42	54

Tab. 2.4 - Tightening torque of Power Connectors/Terminal Blocks

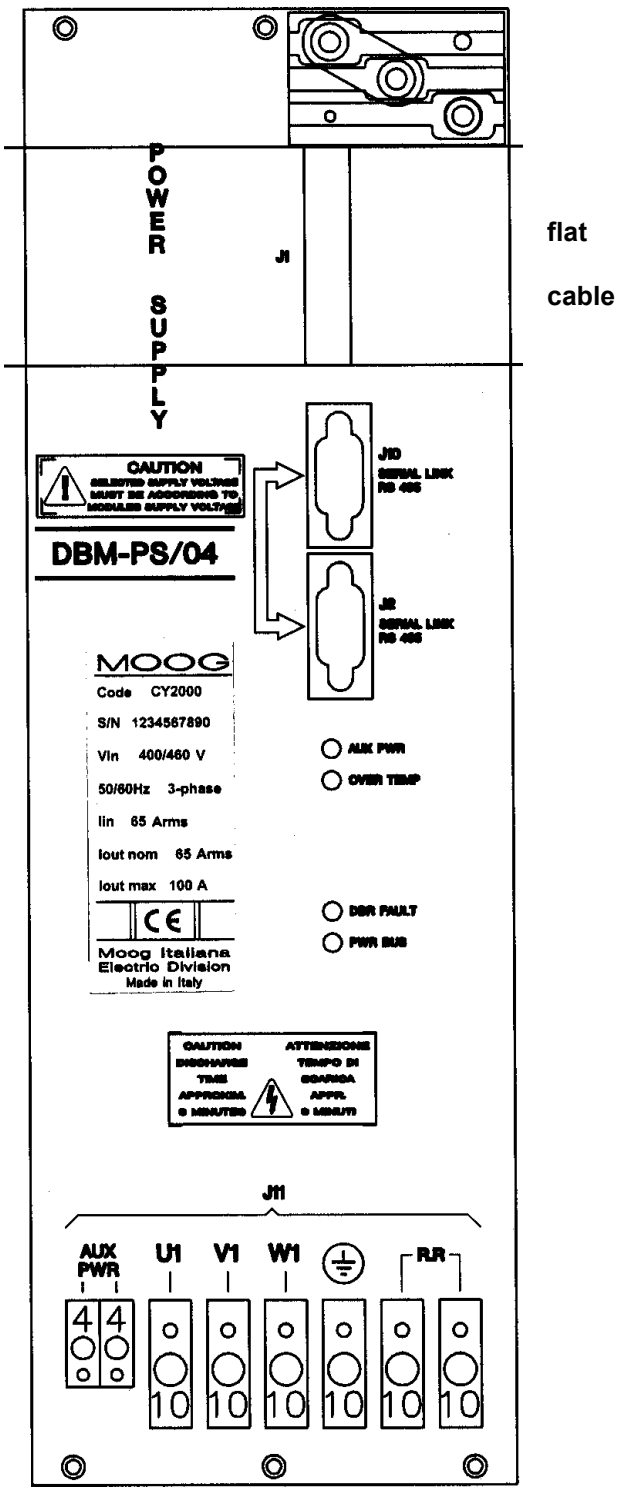
	Phoenix Contact Gmbh			Harting Kgaa		Wago Gmbh	Moog
	HDFK 4	**HDFK 10**	**HDFK 25**	**Han16E**	**HanK 4/0**	**231-104**	**DC BUS**
lb in	5-7	13.2-16	35	4.4	7	-	53
Nm	0.6-0.8	1.5-1.8	4	0.5	0.8	-	6

Tab. 2.5 - Wire stripping length for Power Connectors/Terminal Blocks

	Phoenix Contact Gmbh			Harting Kgaa		Wago Gmbh
	HDFK 4	**HDFK 10**	**HDFK 25**	**Han16E**	**HanK 4/0**	**231-104**
in	0.35	0.43	0.75	0.28	0.55	0.33
mm	9	11	19	7	14	8-9

Fig. 2.3A Power Supply - Front Panels

PS-Standalone



PS-Standard and PS-6M

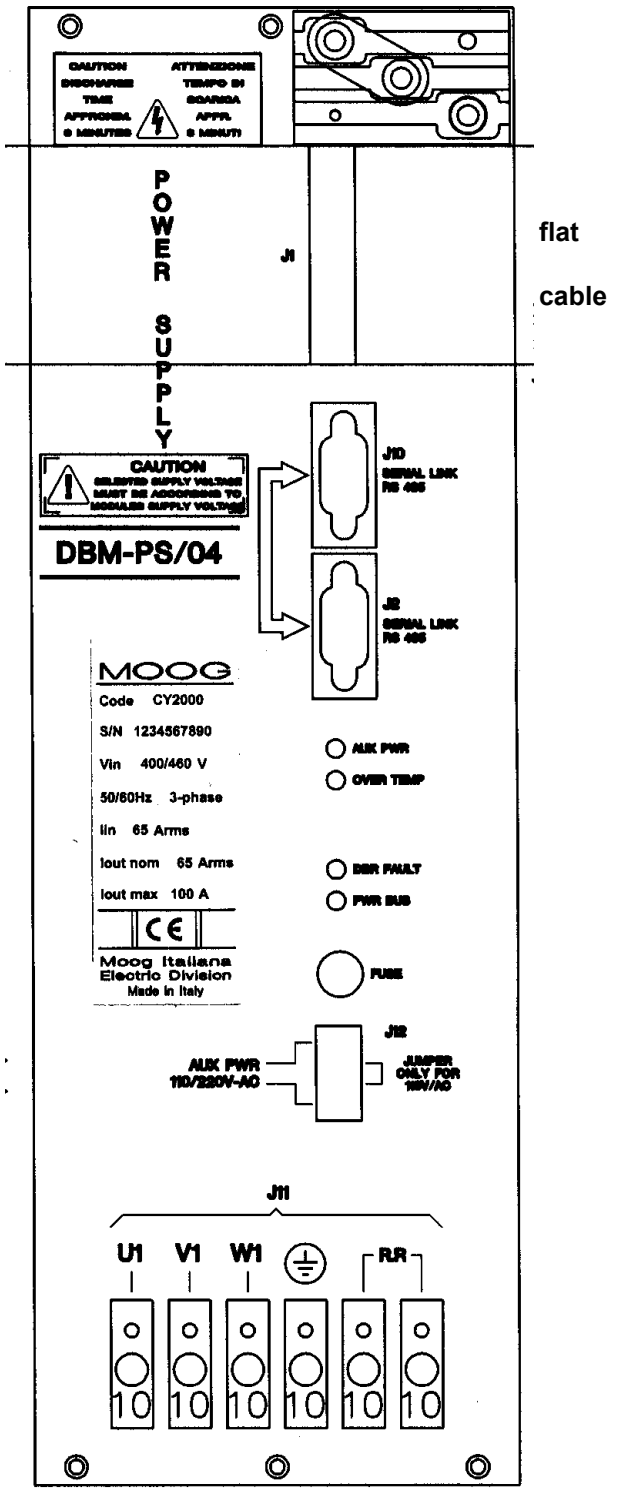


Fig. 2.3B Power Supply PS-120 - Front Panel

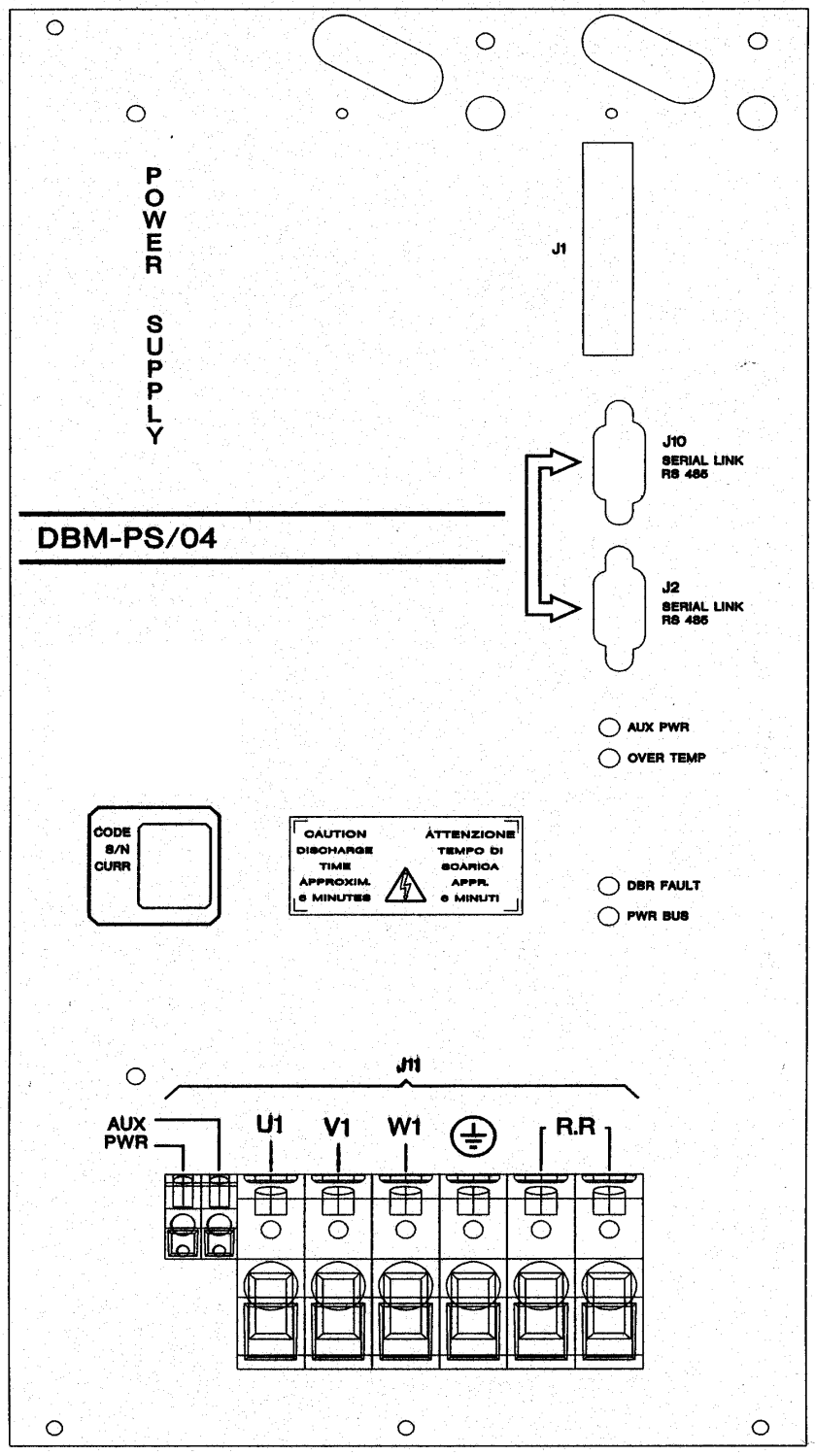
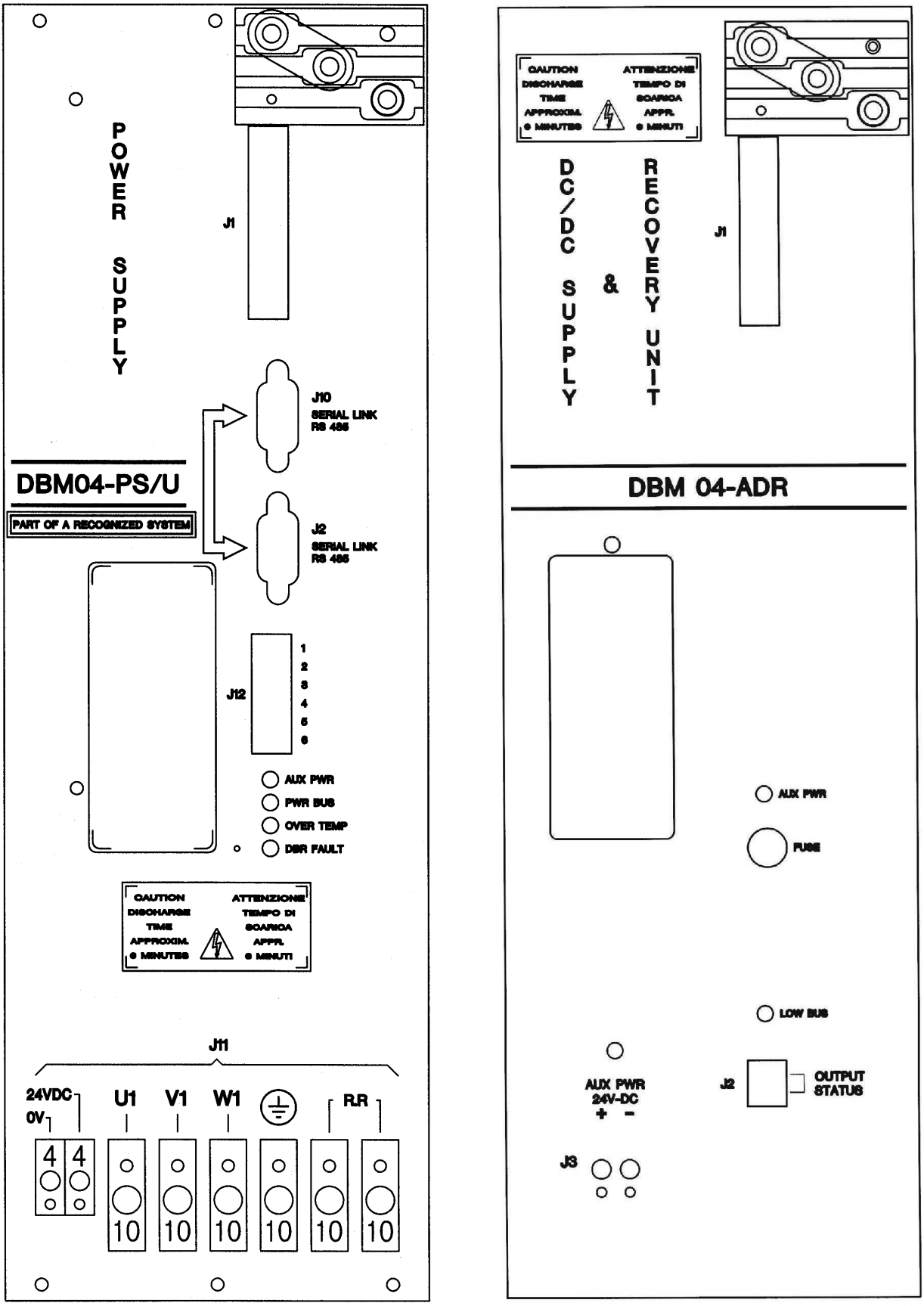


Fig. 2.3C Power Supply PS-U and ADR Unit - Front Panel



2.8 Power Supply - Wiring

See Par.2.7 for sizing of power wires, tightening torque and wire stripping length. See Section 3 for shielding procedures according to EMC Directive.

2.8.1 Signal/ Auxiliary Wiring

Tab. 2.6 - Power Supply - J1 Conn. - Auxiliary Power Supply (to Modules)
Panel side: shrouded header with 13 male contacts
Wiring side: connector with 13 female contacts (provided 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. 2.7 - Power Supply - J2 Conn. - 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.2.8)
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.2.8)

Tab. 2.8 - Power Supply binary coded faults

J2/pos. 4	J2/pos. 9	
0	0	OK
0	1	DBR FAULT. Recovery fault or VBUS Not Ok(PS-U Only)
1	0	OVER TEMP. Overtemperature
1	1	Not Used.

Tab. 2.9 - 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.

2.8.2 Power Wiring

2.8.2.1 PS-Standard and PS-6M

Tab. 2.10 - J11 Connector - Power
Power: Terminal Blocks Mod.No.HDFK 10 by Phoenix Contact Gmbh
See Par.2.7 for sizing of power wires, tightening torque and wire stripping length

Name	Function
U1	"L1" phase, three-phase input voltage 400Vac (or 460Vac)
V1	"L2" phase, three-phase input voltage 400Vac (or 460Vac)
W1	"L3" phase, three-phase input voltage 400Vac (or 460Vac)
	Ground
R.R.	Recovery resistor
R.R.	Recovery resistor

Tab. 2.11 - J12 Connector - Aux Power
Panel side: shrouded open end header with 4 male contacts
Wiring side: connector Mod.No.231-104/026-000 by Wago Gmbh (provided in kit)
See Par.2.7 for sizing of power wires, tightening torque and wire stripping length

Name	Function
AUX PWR	Auxiliary power supply 230Vac/110Vac
JUMPER	Jumper (see Fig.2.2)
JUMPER	Open=230Vac - Closed=110Vac
AUX PWR	Auxiliary power supply 230Vac/110Vac

2.8.2.2 PS-Standalone

Tab. 2.12 - J11 Connector - Power
Aux Power: Terminal Blocks Mod.No.HDFK 4 by Phoenix Contact Gmbh
Power: Terminal Blocks Mod.No.HDFK 10 by Phoenix Contact Gmbh
See Par.2.7 for sizing of power wires, tightening torque and wire stripping length

Name	Function
AUX PWR	Auxiliary power supply 230Vac
AUX PWR	Auxiliary power supply 230Vac
U1	"L1" phase, three-phase input voltage 400Vac (or 460Vac)
V1	"L2" phase, three-phase input voltage 400Vac (or 460Vac)
W1	"L3" phase, three-phase input voltage 400Vac (or 460Vac)
	Ground
R.R.	Recovery resistor
R.R.	Recovery resistor

2.8.2.3 PS-120

Tab. 2.13 - J11 Connector - Power
Aux Power: Terminal Blocks Mod.No.HDFK 4 by Phoenix Contact Gmbh
Power: Terminal Blocks Mod.No.HDFK 25 by Phoenix Contact Gmbh
See Par.2.7 for sizing of power wires, tightening torque and wire stripping length

Name	Function
AUX PWR	Auxiliary power supply 230Vac
AUX PWR	Auxiliary power supply 230Vac
U1	"L1" phase, three-phase input voltage 400Vac (or 460Vac)
V1	"L2" phase, three-phase input voltage 400Vac (or 460Vac)
W1	"L3" phase, three-phase input voltage 400Vac (or 460Vac)
	Ground
R.R.	Recovery resistor
R.R.	Recovery resistor

2.8.2.4 PS-U

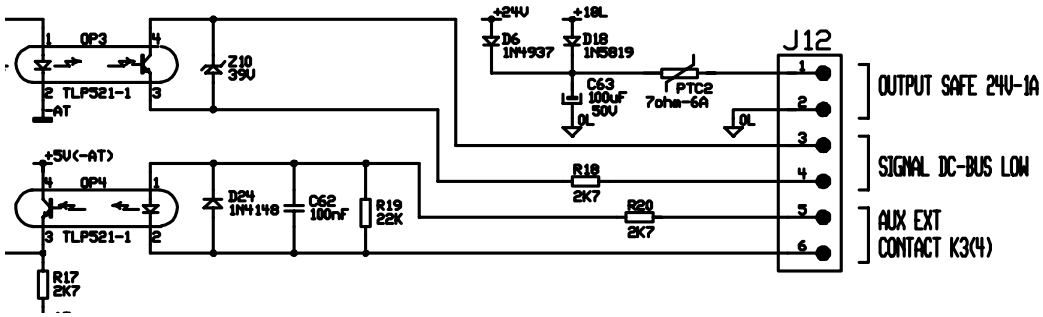
Tab. 2.14 - J11 Connector - Power
Aux Power: Terminal Blocks Mod.No.HDFK 4 by Phoenix Contact Gmbh
Power: Terminal Blocks Mod.No.HDFK 10 by Phoenix Contact Gmbh
See Par.2.7 for sizing of power wires, tightening torque and wire stripping length

Name	Function
0V	Auxiliary power supply 24Vdc, "-" input terminal
24 Vdc	Auxiliary power supply 24Vdc, "+" input terminal
U1	"L1" phase, three-phase input voltage 400Vac (or 460Vac)
V1	"L2" phase, three-phase input voltage 400Vac (or 460Vac)
W1	"L3" phase, three-phase input voltage 400Vac (or 460Vac)
⏚	Ground
R.R.	Recovery resistor
R.R.	Recovery resistor

Tab. 2.15 - J12 Connector - Safety
Panel side: shrouded open end header with 6 male contacts
Wiring side: connector Mod.No.231-106/026-000 by Wago Gmbh (provided in kit)

Pos.	Name	Function
1	OUTPUT	24Vdc (max 1A) output to feed an external relay during the anti-freewheeling. See Fig.2.4
2	SAFE 24V-1A	
3	SIGNAL	Output signal for safety. When the opto is OFF (∞ Ω) the DC-Bus is over 48V. When the opto is ON (2.7kΩ) the DC-Bus is under 48V. See Fig.2.4
4	DC-BUS LOW	
5	AUX EXT	Input signal for safety. Normally connected to 24 Vdc. When not connected to 24 Vdc, the DC-Bus is discharged via the recovery resistor. See Fig.2.4
6	CONTACT	

Fig. 2.4 J12 Connector, Internal Circuit



2.9 Power Supply - Led's

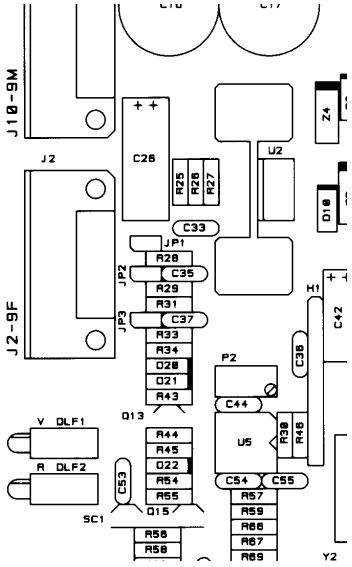
Tab. 2.16 - Power Supply - Led's

Name	Function
Yellow LED - PWR-BUS	BUS BAR voltage > 40Vdc ***WARNING**: with PS-Standard and PS-6M, active only if the aux power supply is ON*
Red LED - DBR FAULT	Recovery unit fault (or problems in the PS-U Controls)
Red LED - OVER TEMP	Module overtemperature via PTC (threshold 70 °C)
Green LED - AUX POWER	Auxiliary power supply OK

2.10 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 RS485 serial link to 0V via pull-down resistor
JP3 closed (default) = connects TX+ of RS485 serial link to +5V via pull-up resistor

Fig. 2.4 - Power Supply - Card Jumpers



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

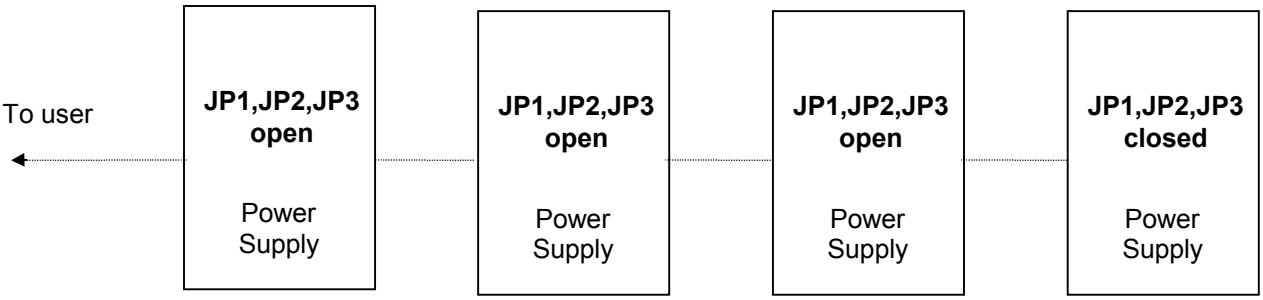


Fig. 2.5 Module - Removable Control Panels

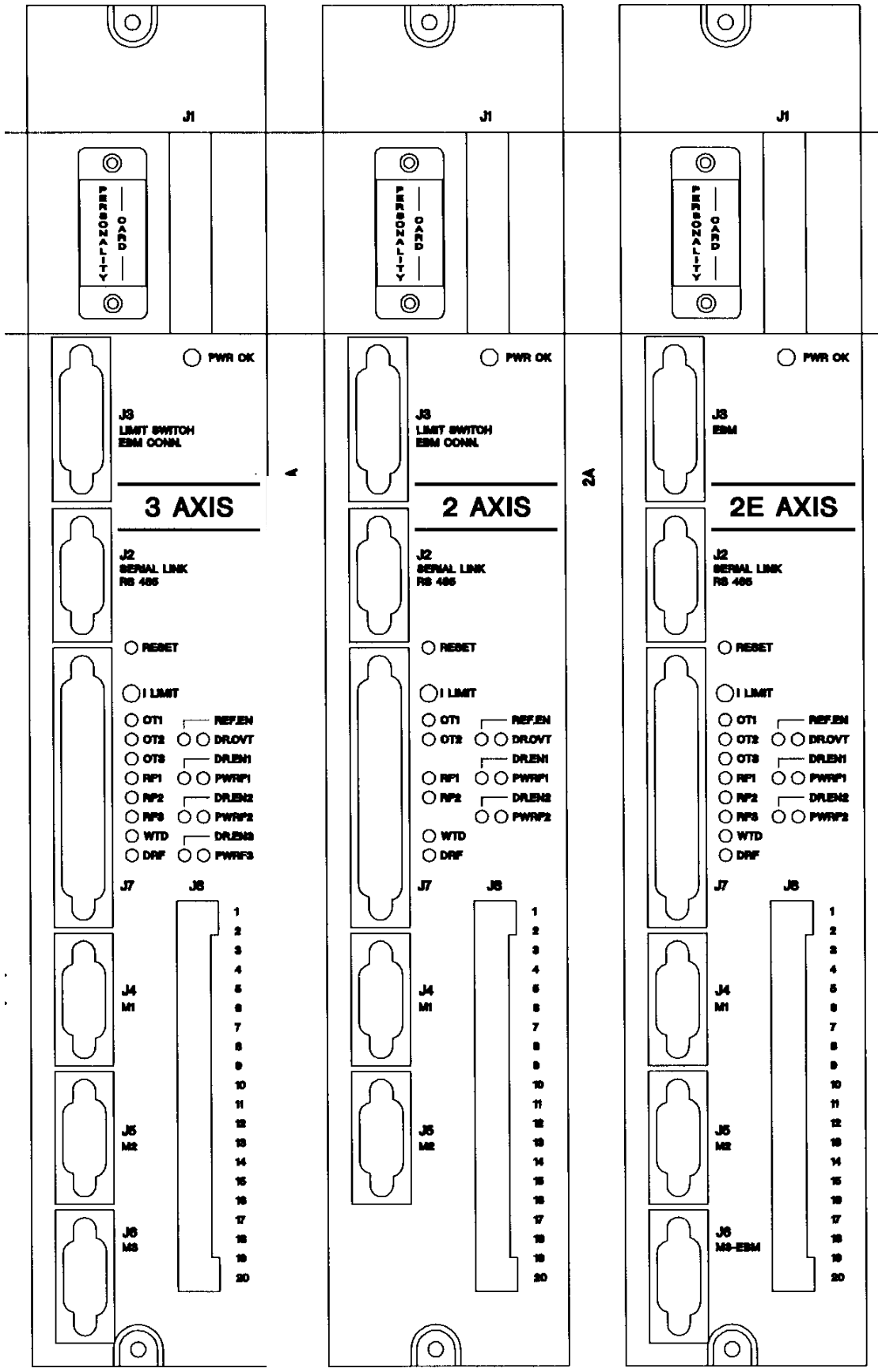


Fig. 2.6 Expansion-EBM - Removable Control Panel

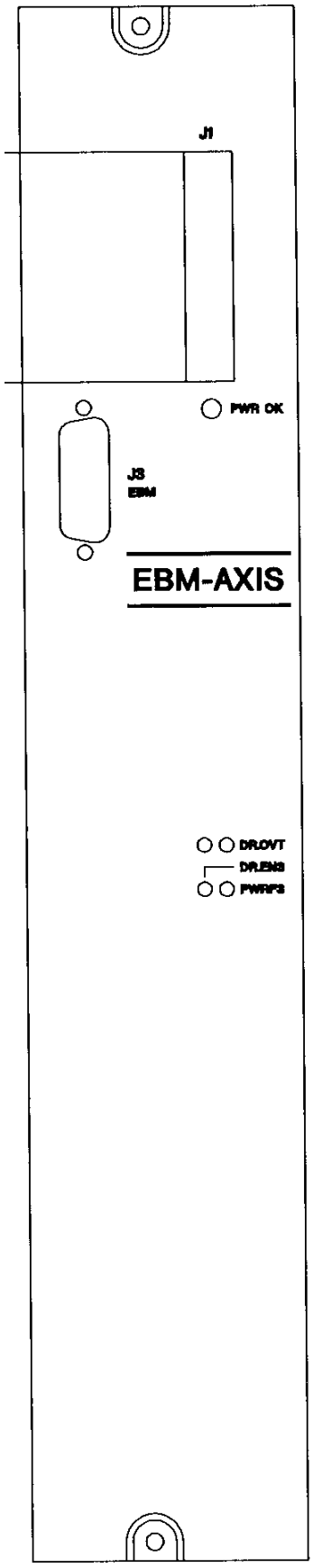


Fig. 2.7 Module (120 mm/180 mm) - Fixed Panels

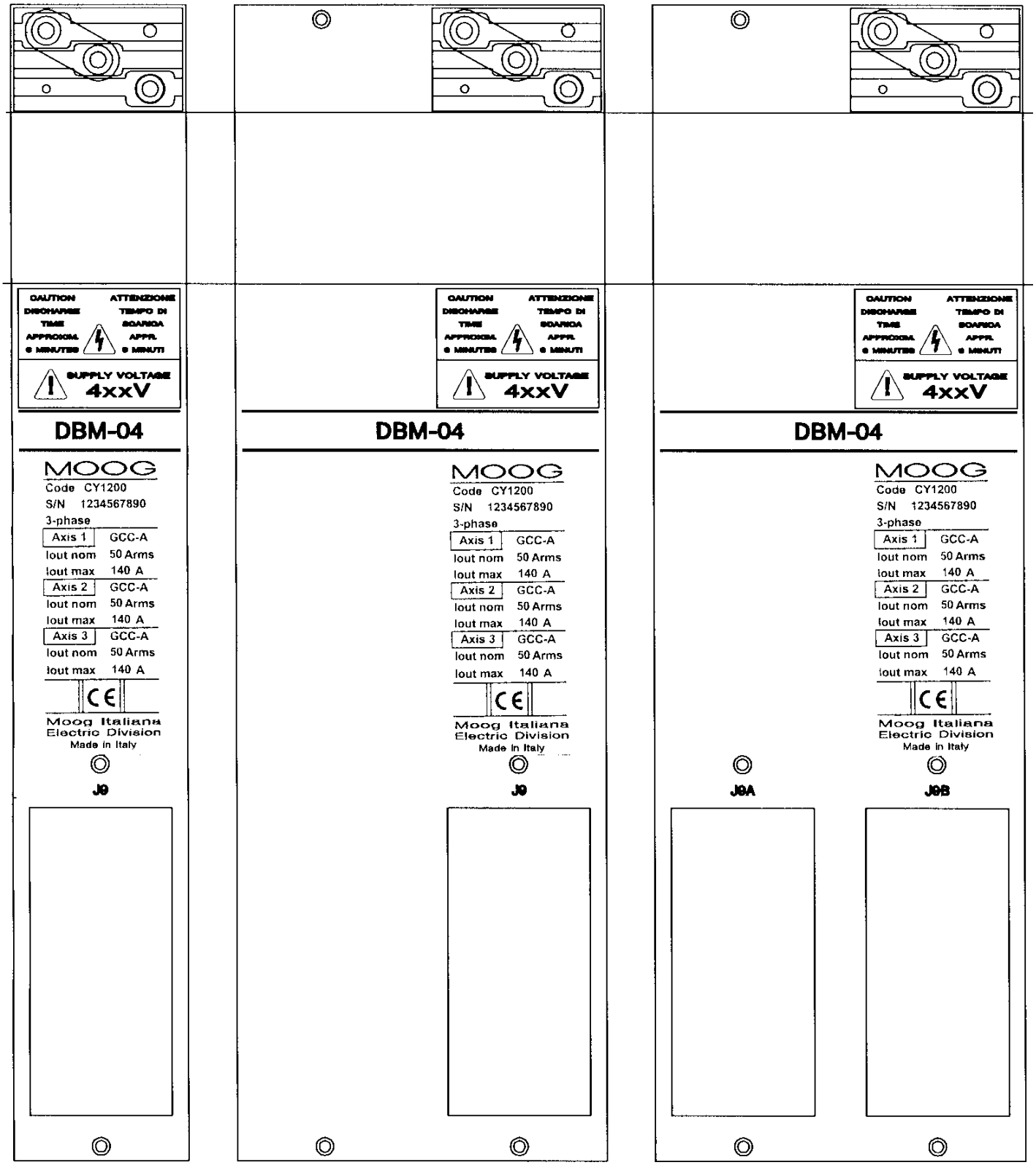
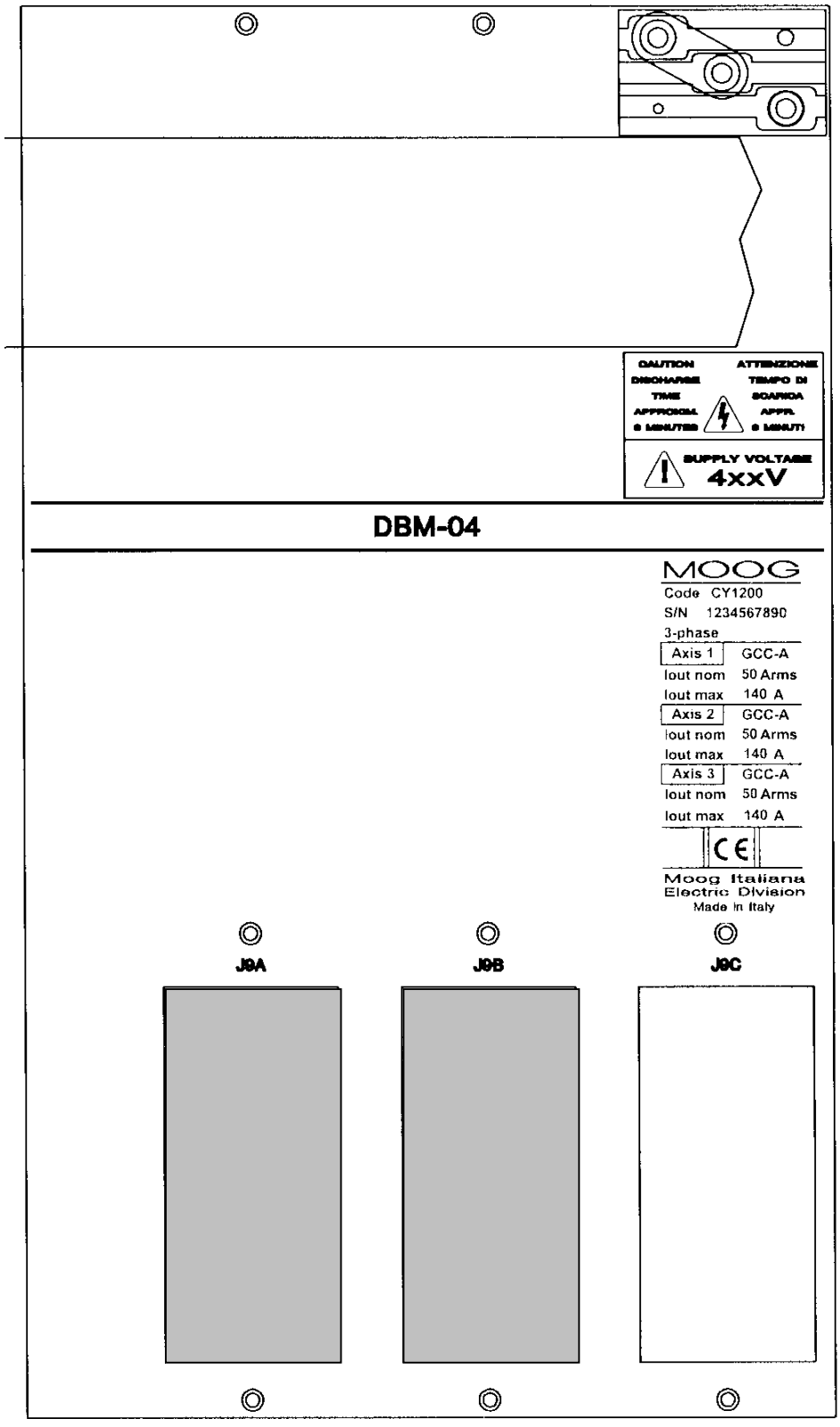


Fig. 2.8 Module/ Expansion (270 mm) - Fixed Panel



Note: the grey connectors are mounted only in some configurations (see tab.2.22)

2.11 Module Wiring

See previous paragraph for sizing of power wires, tightening torque and wire stripping length.
See Section 3 for shielding procedures according to EMC Directive.

Tab. 2.14 - 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. 2.15 - 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.2.16)
5	+5Vdc output referred to logic 0V
6	-Rx
7	logic 0V
8	-Tx
9	Power supply binary coded faults (see Tab.2.16)

Tab. 2.16 - Module - Power supply binary coded faults

J2/pos. 4	J2/pos. 9	
0	0	OK
0	1	DBR FAULT. Recovery fault or Problems in PS - U Control
1	0	OVER TEMP. Overtemperature
1	1	Not Used

2.11.1 Expansion Wiring

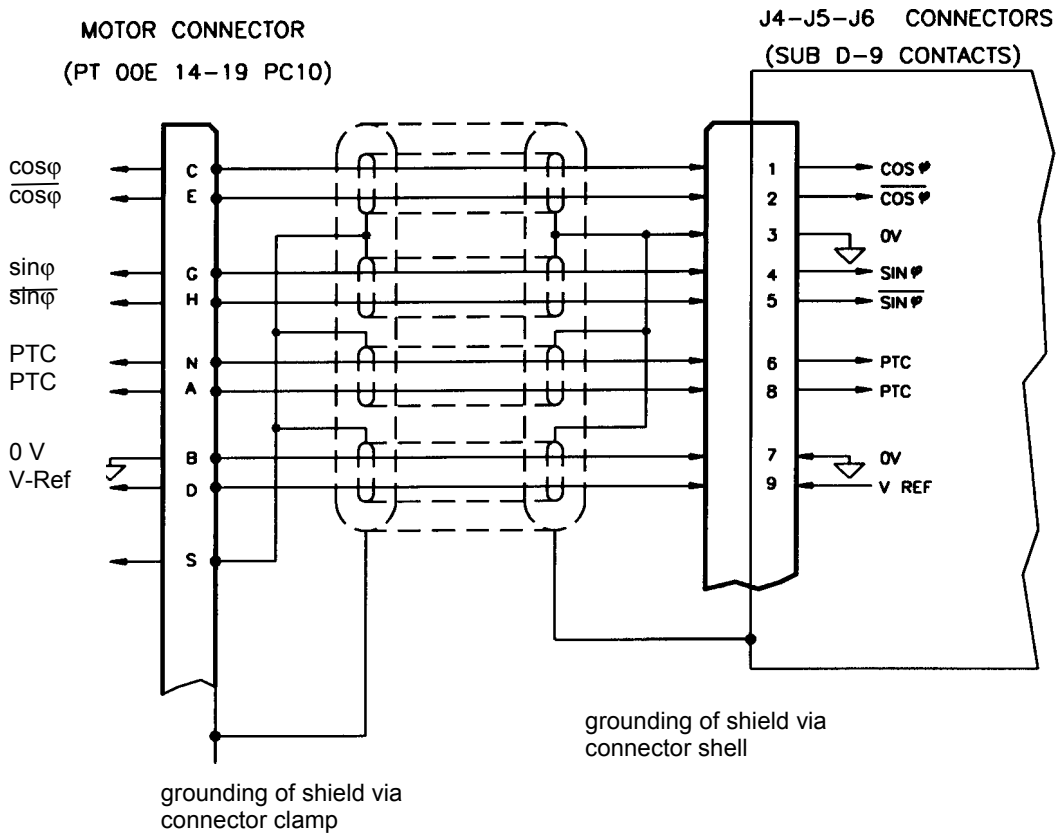
The J3 connector allows the connection of an Expansion module.

Tab. 2.18 - 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.

2.11.2 Resolver Wiring

Fig. 2.10 - Resolver Wiring



RESOLVER CONNECTOR, MOTOR SIDE		
Signal Type	FAS T/ FAS K	FAS N
	Pos.	Pos.
cosφ	C	1
$\overline{\cos\varphi}$	E	2
V-Ref	D	10
0V	B	7
PTC	N	8
PTC	A	9
sinφ	G	11
$\overline{\sin\varphi}$	H	12
shield	S	3

Note: For Other motors connectors, make reference to the motor catalogue too.

Each IDBm 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 mm^2) or 22 AWG (0.38 mm^2) wire with low capacitance can be used. We suggest to use ground connections as shown in Fig. 2.10.
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. 2.19 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)

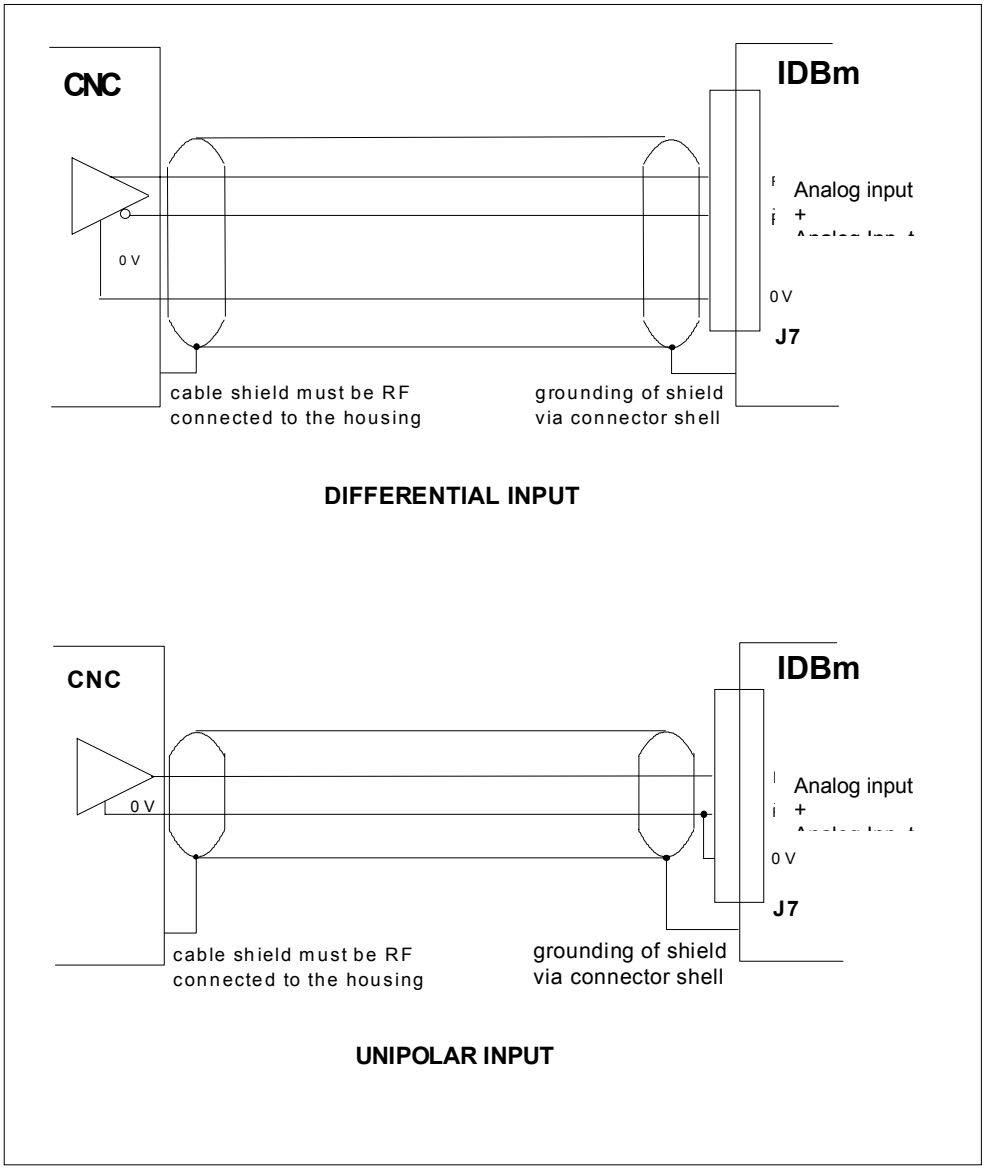
2.11.3 I/O Wiring

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.

REMARS:

- *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. 2.11 - Analog Input Wiring



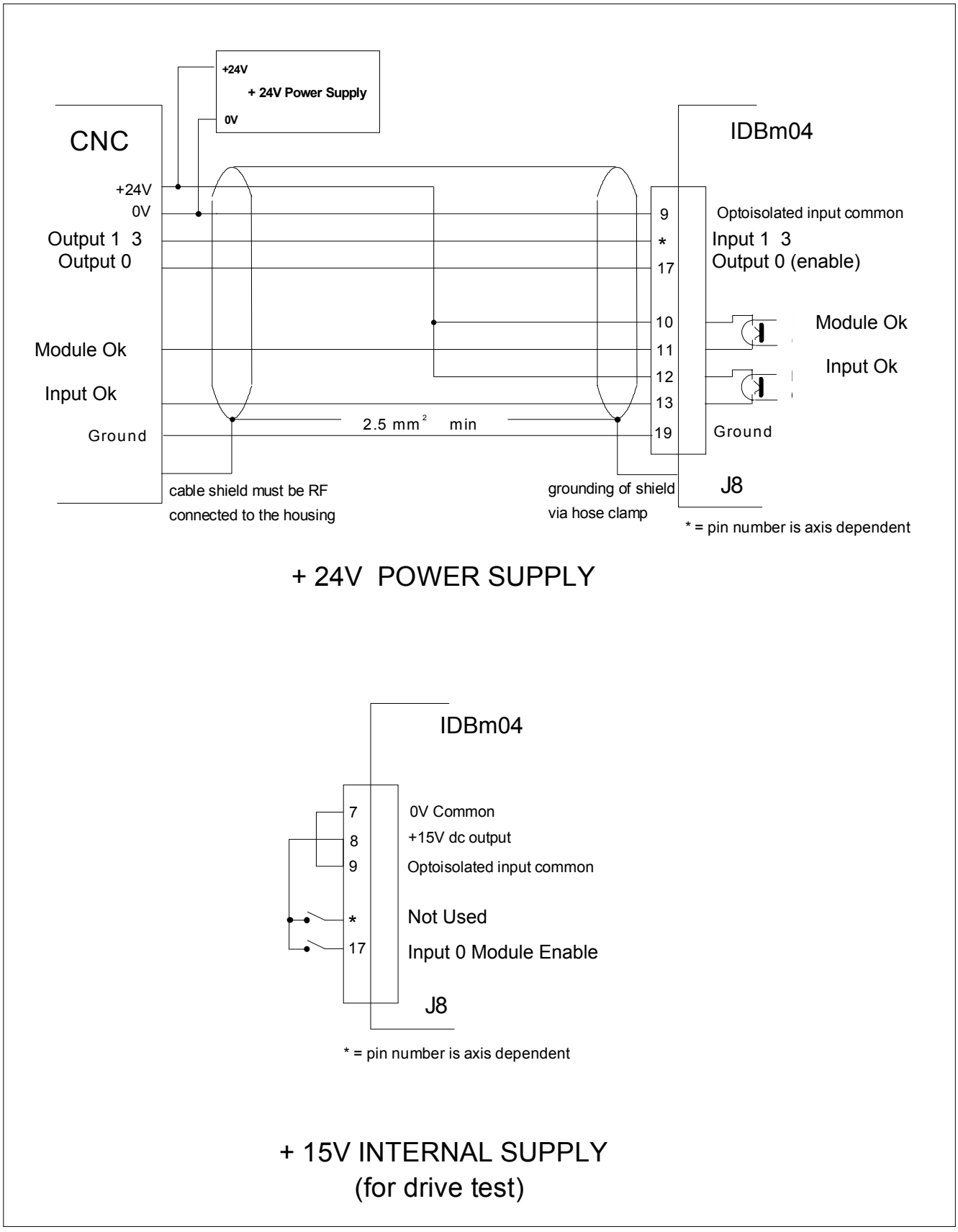
Tab. 2.20 - J7 Connector - I/O Commands, Signals and Encoder Outputs
Panel side: Sub-D with 37 female contacts
Wiring side: Sub-D with conductive shell, 37 male solder contacts

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 input input axis 3 0V = zero current +10V (or not connected) = max current
13	ILIMIT2	Analog input input axis 2 (0 to +10V)
14	ILIMIT1	Analog input input axis 1 (0 to +10V)
15		Shield. Internally connected to 0V
16	$\overline{REF3}$	Differential inverting analog input for the analog input signal axis 3, max range ±10V (see related command). See Fig. 2.11
17	$\overline{REF2}$	Differential inverting analog input for the analog input signal axis 2, max range ±10V (see related command). See Fig. 2.11
18	$\overline{REF1}$	Differential inverting analog input for the analog input signal axis 1, max range ±10V (see related command). See Fig. 2.11
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 analog input signal axis 3, max range ±10V (see related command). See Fig. 2.11
35	REF2	Differential non-inverting analog input for the analog input signal axis 2, max range ±10V (see related command). See Fig. 2.11
36	REF1	Differential non-inverting analog input for the analog input signal axis 1, max range ±10V (see related command). See Fig. 2.11
37	-15V	- 15Vdc output (I max = 30mA)

*** Note:** Differential Analog Inputs (three) available on request instead of DRIVE OK outputs

Fig. 2.12 - Input/Output Wiring

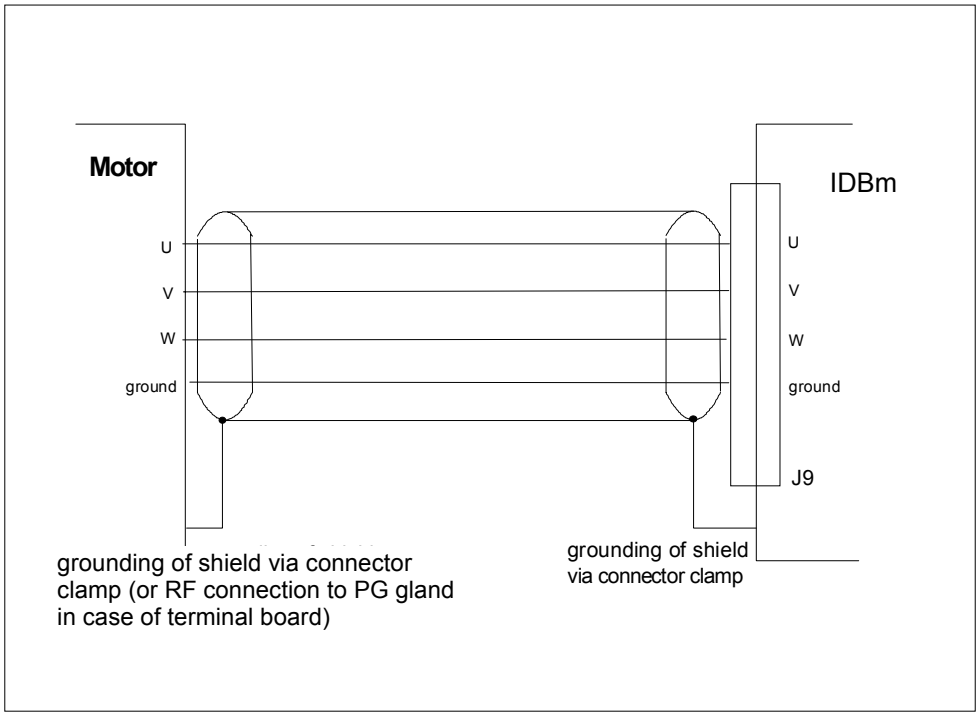


Tab. 2.21 - J8 Connector - I/O Commands and Signals
Panel side: shrouded open end header with 20 male contacts
Wiring side: connector with 20 female contacts, screw termination

Pos.	Name	
1	TACHO TEST 1	Programmable output 1, see related command
2	TACHO TEST 2	Programmable output 2, see related command
3	TACHO TEST 3	Programmable output 3, see related command
4	ANALOG OUT 1	Programmable output 4, see related command
5	ANALOG OUT 2	Programmable output 5, see related command
6	ANALOG OUT 3	Programmable output 6, see related command
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.2.12)
11	$\overline{\text{DRIVE OK}}$	Emitter of Drive OK optoisolator (see Fig.2.12)
12	MOTOR OK	Collector of Motor OK optoisolator (see Fig.2.12)
13	$\overline{\text{MOTOR OK}}$	Emitter of Motor OK optoisolator (see Fig.2.12)
14	DRIVE EN1	Input Enable 1: optoisolated programmable input. See Fig. 2.12
15	DRIVE EN2	Input Enable 2: optoisolated programmable input. See Fig. 2.12
16	DRIVE EN3	Input Enable 3: optoisolated programmable input. See Fig. 2.12
17	REF EN	PWM enable: optoisolated input for the confirmation of the common enable to the three axis
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)

2.11.4 Motor Phases Wiring

Fig. 2.13 - Motor Phases Wiring (only one axis shown)



Note: 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.2.22).
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.

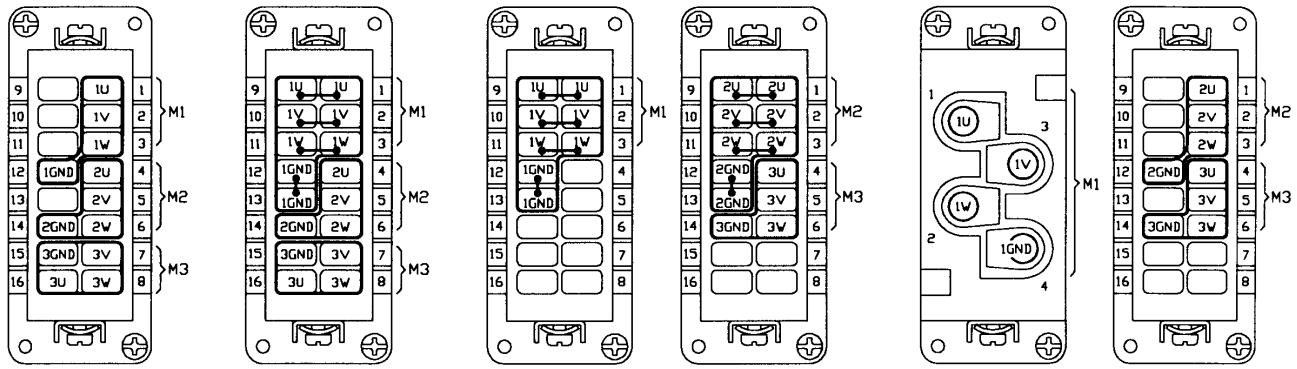
***CAUTION**: the U-V-W motor phase sequence of the connector at the drive side must match the U-V-W motor phase sequence of the connector at the motor side.*

***CAUTION**: do not parallel power connection cables to achieve requested section: this will increase the capacitance value at levels that may irreversibly damage the drive. If the value of capacitance of motor and cables, seen from drive output, exceeds 30 nF it is necessary to verify with Moog technicians the need of an adequate choke in series.*

Tab. 2.22A - J9 Connector(s) - Motor Phases (1/2)
16 pins connector: Mod.No. Han16E by Harting Kgaa
4 pins connector: Mod.No.HanK 4/0 by Harting Kgaa
See Par.2.7 for sizing of power wires, tightening torque and wire stripping length

Wiring side connector view and IDBm Configurations

J9 J9 J9A J9B J9A J9B



M1	M2	M3
3/9	3/9	3/9
6/15	3/9	3/9
8/22	3/9	3/9
15/42	3/9	3/9
6/15	6/15	3/9
8/22	6/15	3/9
15/42	6/15	3/9
8/22	8/22	3/9
15/42	8/22	3/9
15/42	15/42	3/9
6/15	6/15	6/15
8/22	6/15	6/15
15/42	6/15	6/15
8/22	8/22	6/15
15/42	8/22	6/15
8/22	8/22	8/22
15/42	8/22	8/22
15/42	15/42	6/15
15/42	15/42	8/22
15/42	15/42	15/42
3/9	3/9	
6/15	3/9	
8/22	3/9	
15/42	3/9	
6/15	6/15	
8/22	6/15	
15/42	6/15	
8/22	8/22	
15/42	8/22	
15/42	15/42	

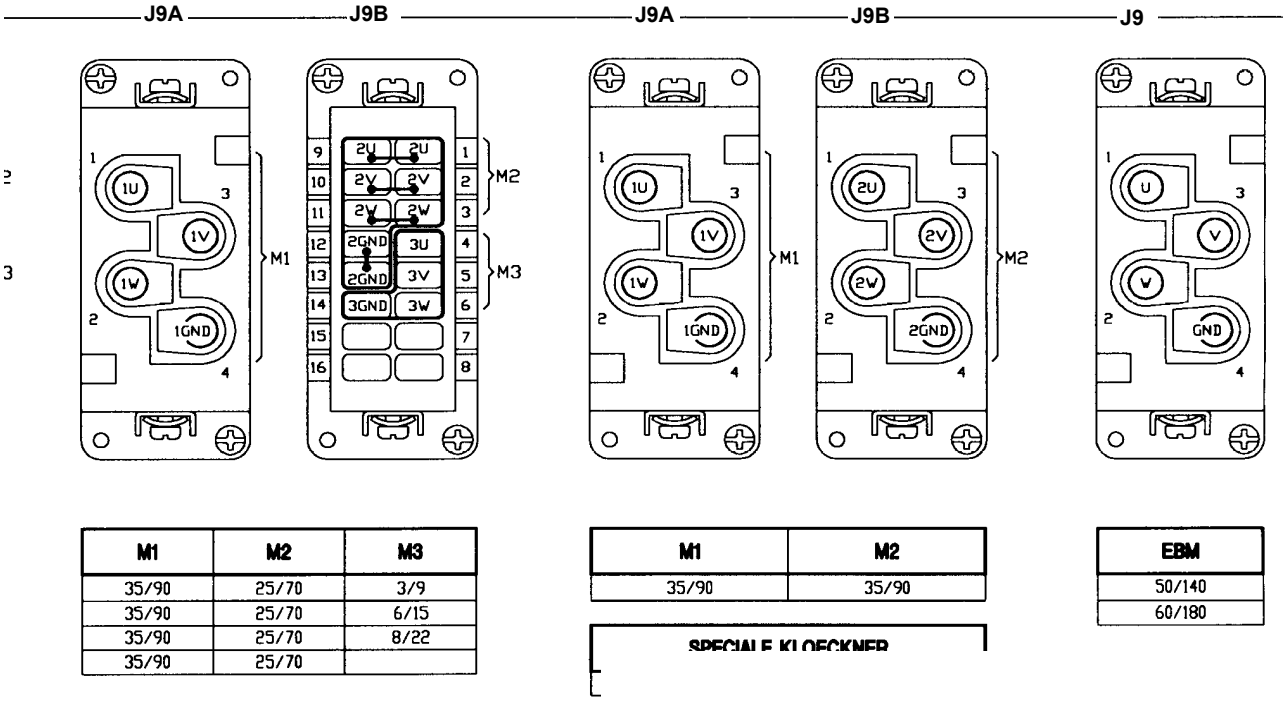
M1	M2	M3
25/70	3/9	3/9
25/70	6/15	3/9
25/70	8/22	3/9
25/70	15/42	3/9
25/70	6/15	6/15
25/70	8/22	6/15
25/70	15/42	6/15
25/70	8/22	8/22
25/70	15/42	8/22
25/70	15/42	15/42
25/70	3/9	
25/70	6/15	
25/70	8/22	
25/70	15/42	

M1	M2	M3
25/70	25/70	3/9
25/70	25/70	6/15
25/70	25/70	8/22
25/70	25/70	15/42
25/70	25/70	

M1	M2	M3
35/90	3/9	3/9
35/90	6/15	3/9
35/90	8/22	3/9
35/90	15/42	3/9
35/90	6/15	6/15
35/90	8/22	6/15
35/90	8/22	8/22
35/90	15/42	6/15
35/90	15/42	8/22
35/90	15/42	15/42
35/90	3/9	
35/90	6/15	
35/90	8/22	
35/90	15/42	

Tab.2.22B - J9 Connector(s) - Motor Phases (2/2)
16 pins connector: Mod.No. Han16E by Harting Kgaa
4 pins connector: Mod.No.HanK 4/0 by Harting Kgaa
See Par.2.7 for sizing of power wires, tightening torque and wire stripping length

Wiring side connector view and IDBm Configurations



M1	M2	M3
35/90	25/70	3/9
35/90	25/70	6/15
35/90	25/70	8/22
35/90	25/70	

M1	M2
35/90	35/90

EBM
50/140
60/180

2.12 Module - Led's

Tab. 2.23 - 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 module via MCD Commander to know the fault reason
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
Green LED DR.EN 2	Axis 2 enable
Green LED DR.EN 3	Axis 3 enable
Green LED PWR OK	Auxiliary power OK

2.14 Button

Tab. 2.24 - Button

RESET BUTTON	Digital control card reinitialization and reset of protections.

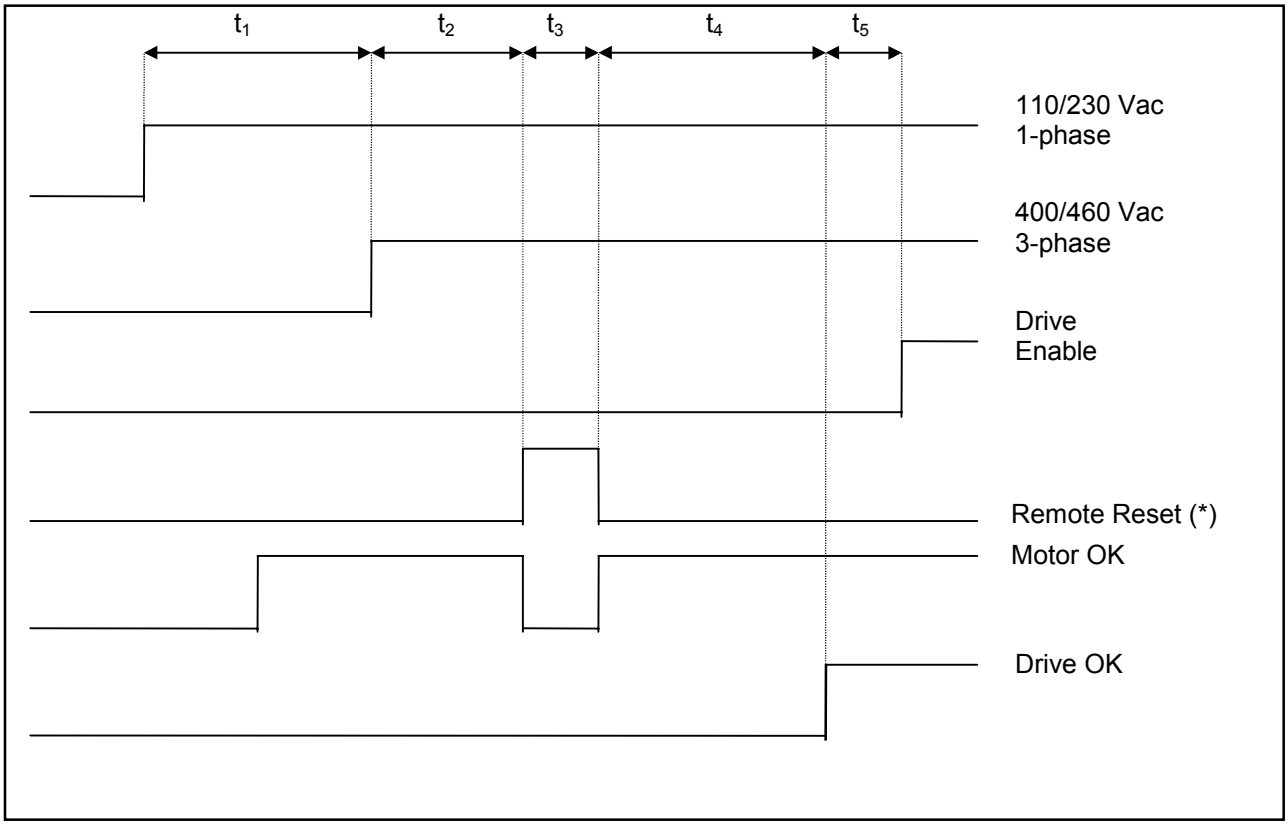
2.15 Input/Output Characteristics

Tab. 2.25 - Input/Output Characteristics

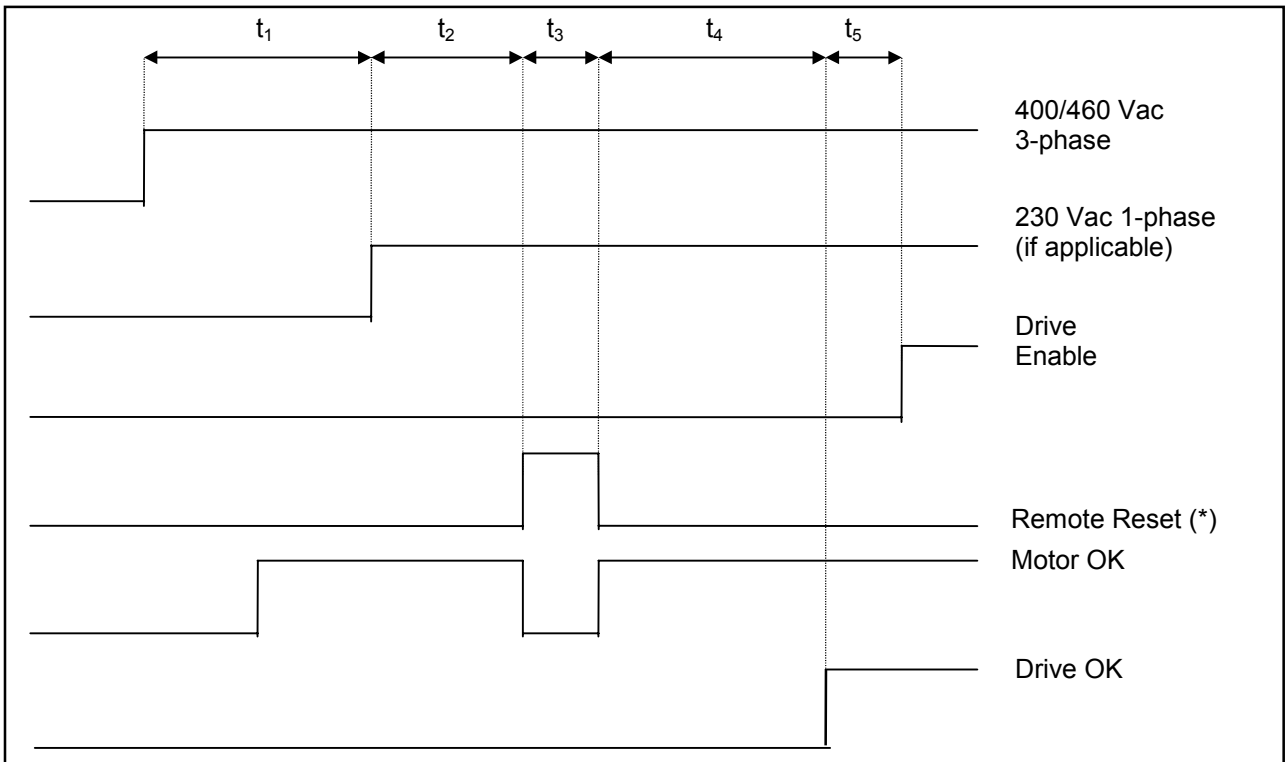
OPTOISOLATED INPUTS 0 3 Module Reset	z in =1.2 kΩ I nom = 10 mA (8 to 20 mA) Vmin = 15Vdc Vmax = 25V
OPTOISOLATED OUTPUTS 0 Motor OK	z out = 1.2 kΩ I max = 20 mA Vnom < 25 Vdc
Analog Outputs 1,2,3	z out = 100 Ω I max = 5 mA Full Scale +/- 10 Volt
Analog Outputs 4,5,6	z out = 100 Ω I max = 10 mA Full scale = ±10V
Analog differential Input 1,2,3,4,5,6	z in > 20 kΩ Full scale = ±10V
Simulated Encoder differential output signals	z out = 100 Ω Full scale = 7V (RS422/RS485 compatible)

Fig.2.15 - STARTING SEQUENCE - TIMING CHART

1. PS-Standard and PS-6M: 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



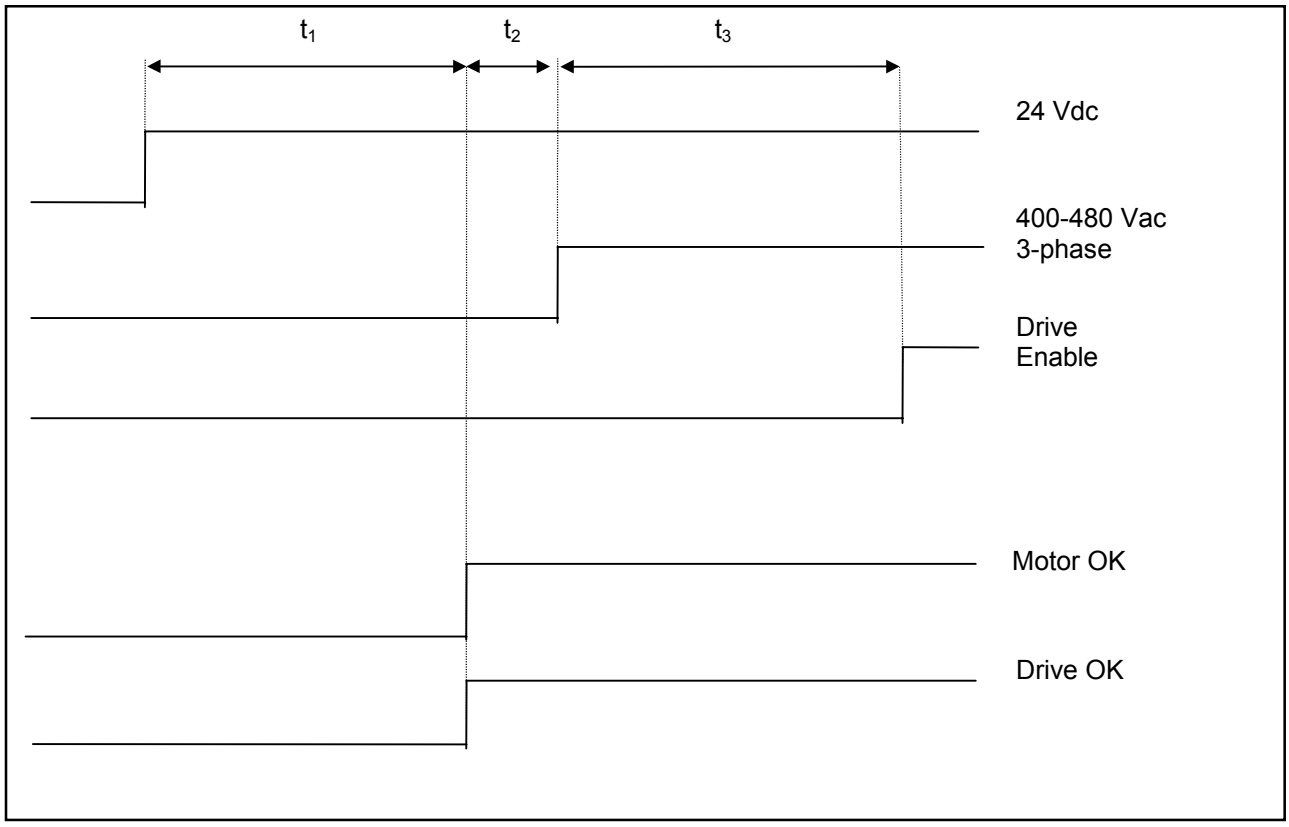
2. PS-Standalone and PS-120: $t_1 \geq 20$ ms, $t_2 \geq 1$ s, $t_3 \geq 20$ ms, $t_4 = 3$ s, $t_5 \geq 0.5$ s



*(*) **CAUTION**: the Remote Reset must be a single no repetitive signal. Otherwise it must be filtered with 500 Hz cutoff frequency.*

3. PS-U: **t_1 = 6 s, t_2 = 2 to 4 s, t_3 = 4 s**

CAUTION: *make sure that the AUX EXT CONTACT (pos.5 and 6 of J12 connector) is connected to 24Vdc before starting.*



2.17 Starting Sequence

The starting sequence depends on the type of Power Supply. See Fig.2.15 for the Timing-chart.

* PS-Standalone and PS-120

1. Apply the 400Vac (or 460Vac) three phase power voltage
2. Apply (if applicable) the 230 Vac single phase auxiliary voltage via dedicated transformer

* PS-Standard and PS-6M

1. Apply the 230 Vac (or 110Vac) single phase auxiliary voltage
2. Apply the 400Vac (or 460Vac) three phase power voltage

* PS-U

1. Apply the 24 Vdc auxiliary voltage
2. Apply the 400Vac (or 460Vac) three phase power voltage

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

2.17.1 Autophasing

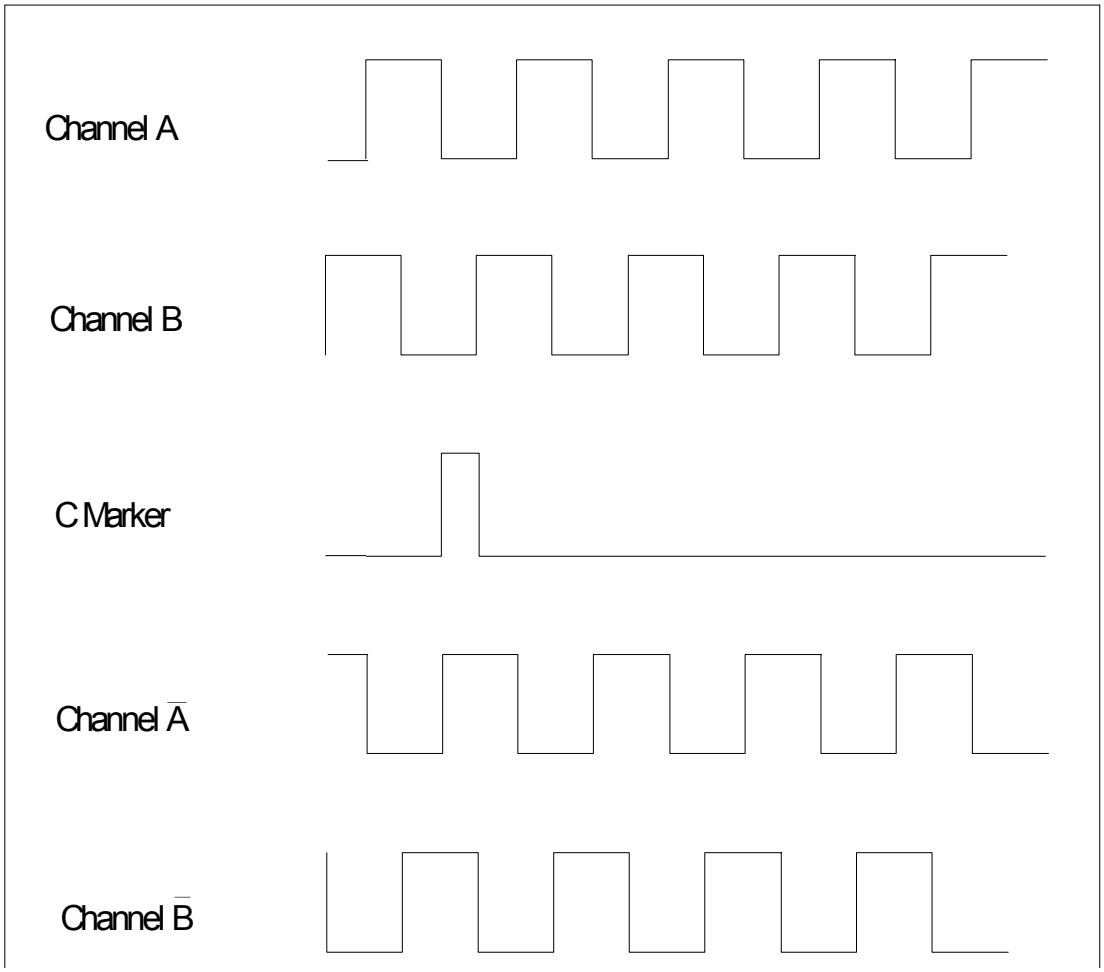
- Check that the motor is free to rotate in both directions.
- Check that no fault condition occurs (red drive-fault leds off).
- Perform AUTOPHASING routine using MCD Commander

2.18 - 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 $\bar{A}$, $\bar{B}$ and $\bar{C}$.

Fig. 2.16 - 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 $\bar{A}$ and Channel B with Channel $\bar{B}$.

2.18.1 Setup For Encoder Resolution

REMARK: the maximum number of pulses per electrical revolution depends on the R/D resolution. See Tab.2.26.

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.

2.18.2 R/D Resolution

The resolution of Resolver to Digital converter will automatically be switched according to actual speed for optimum system performance between minimum and maximum resolution (using MCD Commander).
The speed range of R/D resolution is included in the following table.

Tab. 2.26 - 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

2.19 Mechanical Brake

FASTACT servomotors have as option a 24 Vdc (24 to 26Vdc) 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. 2.17.

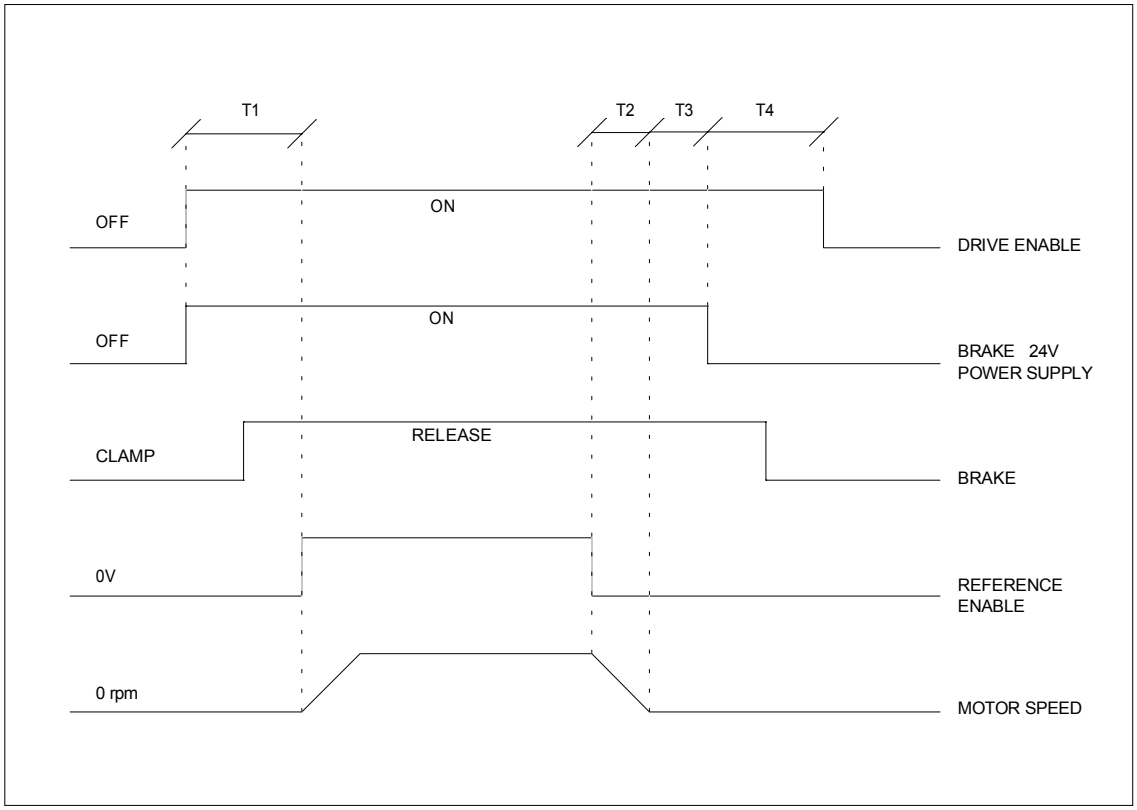
FIG. 2.17 - BRAKING SEQUENCE, TIMING CHART (for external brake control)

Notes:

1) T1 ≥ 300 ms, T2 = application depending, T3 = 100 ms, T4 ≥ 200 ms

2) T1 ≥ 1000 ms for FAS size 3 and size 4

Make reference to the MCD Manual for the Internal (module) brake control sequence.



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.
DBM04 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 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

The following filters are recommended.

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	DBM04 PS-Standard, PS-Standalone, PS-6M, PS-120 (Aux Pwr)
-	Schaffner FN 250-12/07	(12)	250	DBM04 PS-U (Aux Pwr)
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	DBM04 PS Standard, PS-6M, PS-U and PS-Standalone
AT6014	Schaffner FN 258-75/34	75 (85)	3 x 480	
AT6015	Schaffner FN 258-100/35	100 (120)	3 x 480	DBM04 PS120

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:

- IDBM04 PS-Standard + IDBM04 6-6-6 + IDBM04 6-6-6 and contemporaneity factor of 0.8.

For this application it is not necessary to use the 55A filter of the table.

The reference current is Iin = 6 ∗ 6 ∗ 0.8 = 28.8 A

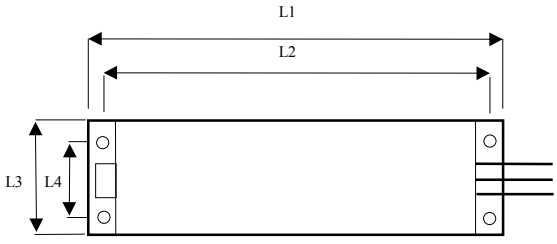
A 30A filter (FN 258-30/7) can safely be used.

3.2.3 Filter Dimensions

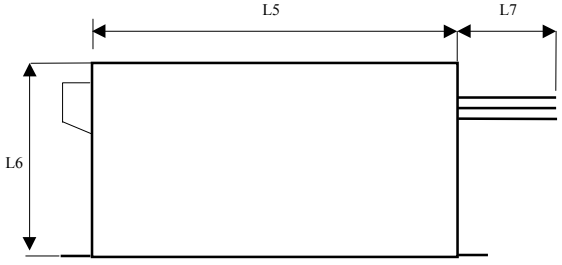
Code	Trade-mark	Dimensions [mm]							Weight
		L1	L2	L3	L4	L5	L6	l7	[kg]
AT6008	Schaffner FN 250-6/07*	85	75	54	0	65	30	300	0.24
	Schaffner FN 250-12/07*	85	75	54	0	65	40	300	0.31
AT6009	Schaffner FN 258-7/07	255	240	50	25	225±0.8	126±0.8	300	1.1
AT6010	Schaffner FN 258-16/07	305	290	55	30	275±0.8	142±0.8	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 drive panel.

***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

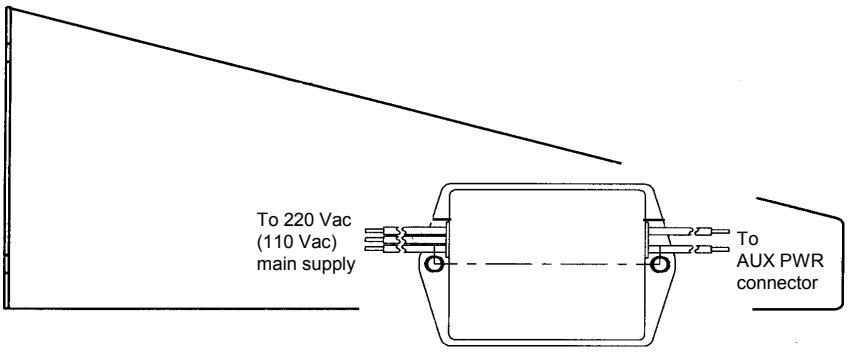
REMARK: when mounting the drive and the filter to the panel, it is essential that any paint or other covering material be removed before mounting the drive and the filter.

- The maximum torque of mounting screws is as follows:

FILTER	**Max torque**
FN 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

***CAUTION**: the filter must be connected to ground before connecting the supply*
***WARNING**: High Voltage - Discharge time approx. 10 seconds*
***WARNING**: the filter can produce high leakage currents (see Filter Data Sheets)*

- 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

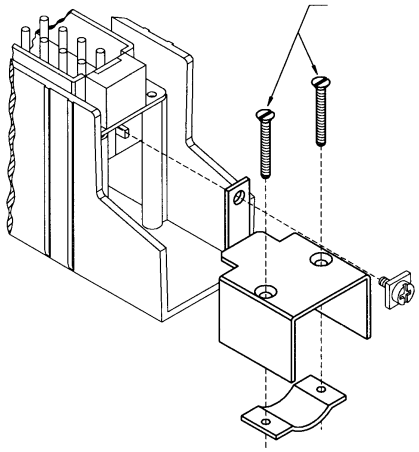
All the following cables must be shielded, with 85% minimum shielding coverage:

- 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.*

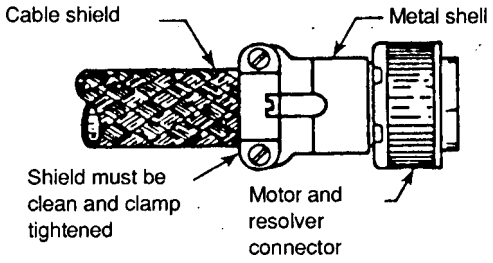
- Reference, Enable and OK cable

- 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

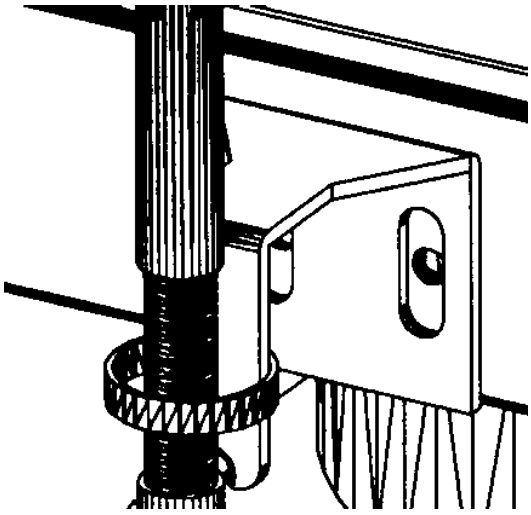
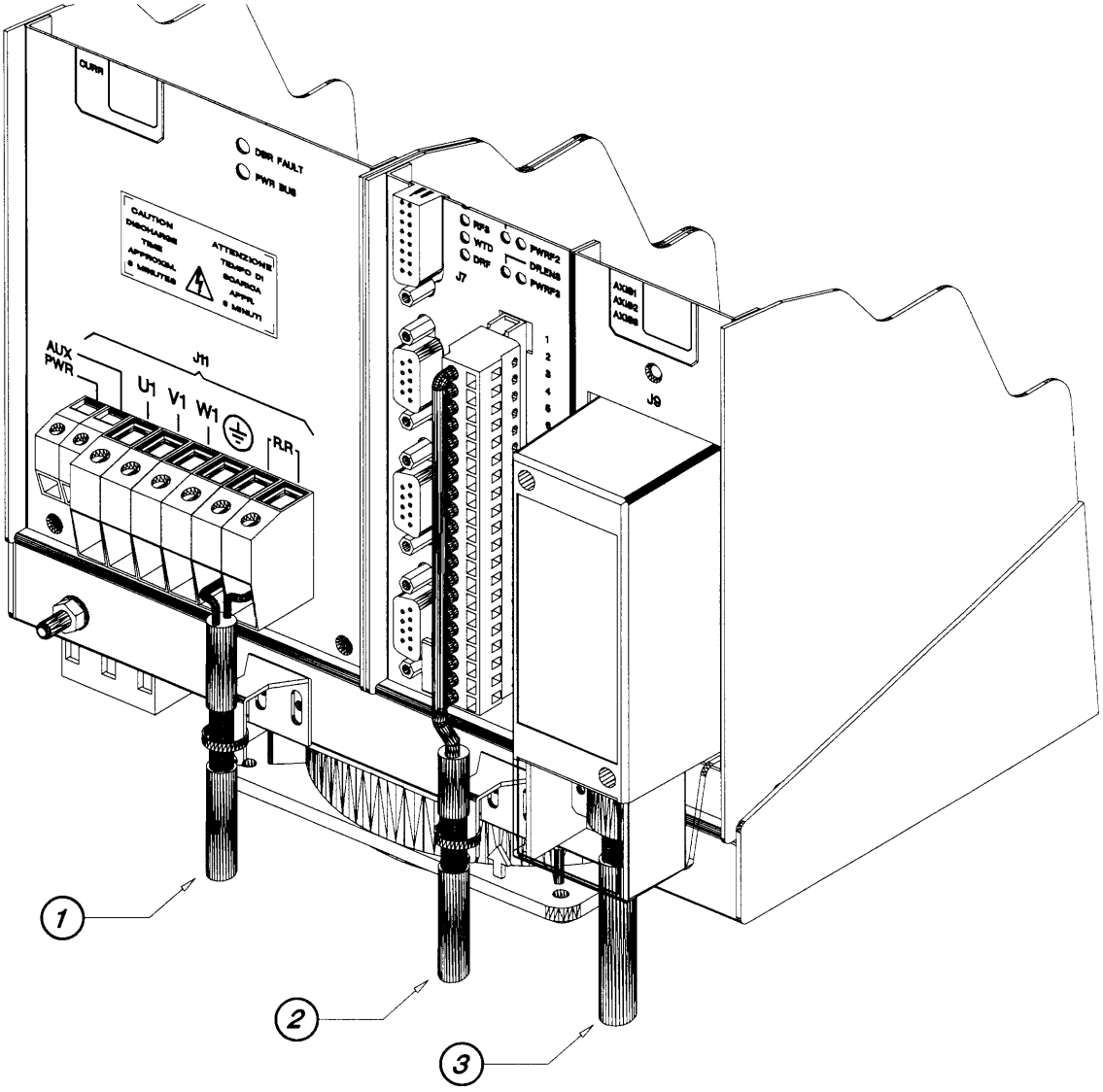


Fig. 3.4 - Cable Grounding At Drive Side



1 = Recovery resistor cable
2 = Signal Cables
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

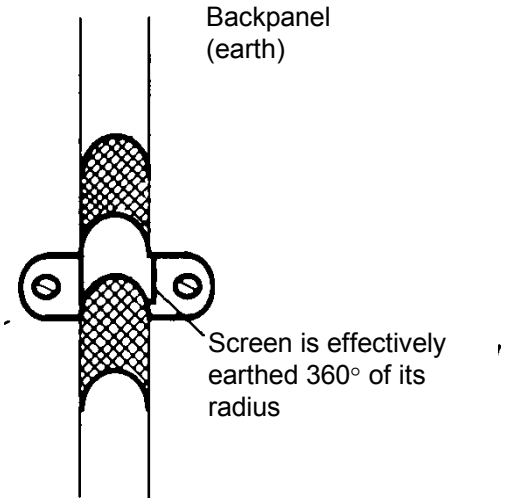
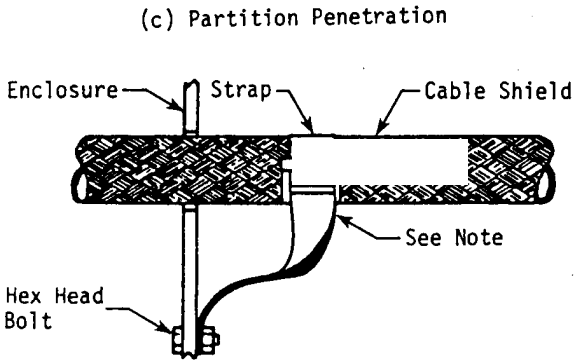


Fig. 3.6 - Partition Penetration



- 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 EMC Directive, the ventilated enclosures containing dynamic braking resistors 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.1.4).

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 04 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 Tests of EN 60204-1 (1997), par.19.4, in order to not damage the Y-type capacitors between phases and ground. Moreover the DC voltage dielectric test required by EN 50178 (1997), product family standard, has been carried out in factory as a routine test. The DC Insulation Resistance Tests of EN 60204-1 (1997), par.19.3, may be carried out without disconnecting the drive and the EMC filters.*

SECTION 4 - PROTECTIONS

4.1 Power Supply

Recovery not ok (or wrong input sequence in the PS-U).

Indicated by: LED's DRF (drive fault) on all modules, LED DBR FAULT, optoisolated output Module OK,

Set condition: when recovery circuit is active for longer than 2 s (PS-U) or broken resistance (others PS).

Effect: all drives inhibit torque

Reset condition: if the condition is not present anymore, power off and on single phase voltage (PS-Standard and PS-6M) or 24Vdc (PS-U) or 3-phase voltage (PS-Standalone and PS-120). For the PS-U, please read the Application Notes diagrams in Section 7.

Power supply overtemperature.

Indicated by: LED's DRF (drive fault) on all drives, LED OVER TEMP, optoisolated output DRIVE OK, bit I of the FA string (see FA command).

Set condition: when a limit temperature is reached.

Effect: all drives inhibit torque.

Reset condition: if the condition is not present anymore, power off and on single phase voltage (PS-Standard and PS-6M) or 3-phase voltage (PS-Standalone and PS-120) or 24 Vdc (PS-U).

4.2 Drive Module

Resolver not ok.

Indicated by: LED RF1/RF2/RF3 (Resolver Fault), optoisolated output DRIVE OK.

Set condition: when the resolver is not connected or in short circuit at the power up, when the resolver fails or is disconnected during running.

Effect: the drive inhibit torque of fault axis.

Reset condition: if the condition is not present anymore, reset button on drive or send reset commands on CAN Network (a.e. using MCD Commander)

Motor over temperature.

Indicated by: LED DRF, LED OT1/OT2/OT3, optoisolated outputs DRIVE OK and MOTOR OK.

Set condition: when a limit temperature is reached inside the motor.

Effect: the drive inhibit torque of all axes of the module.

Reset condition: if the condition is not present anymore, reset button on drive or send reset commands on CAN Network (a.e. using MCD Commander)

Notes: the fault information via LEDS and opto is reset when the motor temperature goes down the limit, while the drive is disabled until the reset condition has been met.

Power fault.

Indicated by: LED DRF, LED PWRF1/PWRF2/PWRF3, optoisolated output MODULE OK.

Set conditions:
1. When a short circuit is detected between motor phases, phase and ground, phase and HV.
2. When overcurrent is detected in motor phases.
3. Overheating of power modules (locked rotor condition).
4. Undervoltage of internal supply of power modules

Effect: the drive inhibit torque.

Reset condition: if the condition is not present anymore, power off and on the power supply. In case of condition 3. (overheating) wait at least 3 minutes before power up the drive.

Auxiliary voltages not normal

Indicated by: LED DRF, optoisolated output DRIVE OK

Set condition: when the level of +/- 15V or 5V becomes out of tolerance.

Effect: inhibit torque of all axes of the module.

Reset condition: if the condition is not present anymore, reset button on drive or send reset commands on CAN Network (a.e.using MCD Commander)

Bus not normal.

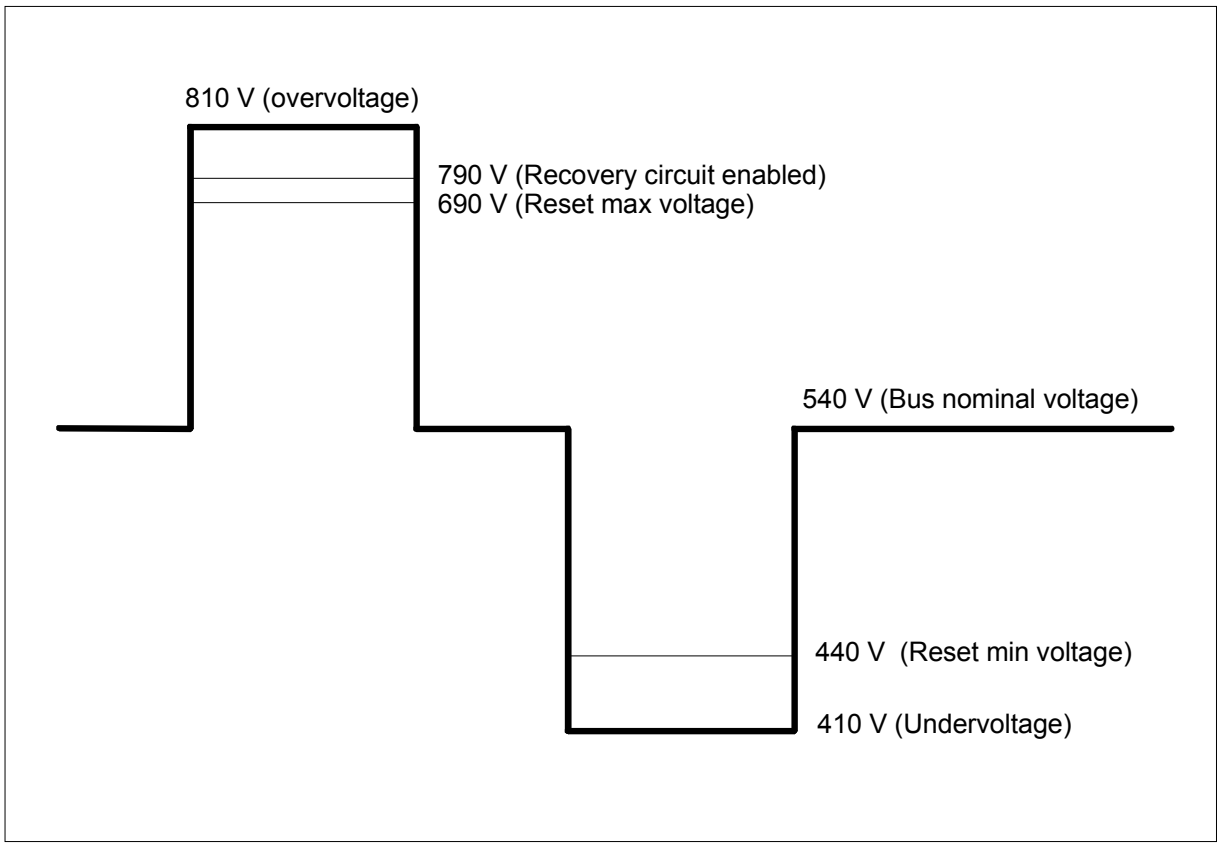
Indicated by: LED DRF, LED POWER OK, optoisolated output DRIVE OK.

Set condition: See figure 4.1.

Effect: inhibit torque of all axes of the module .

Reset condition: if the condition is not present anymore at analog level (with hysteresis), reset button on drive or send reset commands on CAN Network (a.e.using MCD Commander

FIG. 4.1 Bus Bar Voltage



Auxiliary HV referred voltages not norm.

Indicated by: LED DRF, optoisolated output MODULE OK.

Set condition: when the level of auxiliary voltages referred to power stage (-HV) becomes out of tolerance.

Effect: inhibit torque of all axes of the module.

Reset condition: if the condition is not present anymore at analog level (with hysteresis) reset button on drive or send reset commands on CAN Bus Network (a.e.using MCD Commander)
.

Module overtemperature.

Indicated by: LED's DRF and DR.OVT, optoisolated output Module OK

Set condition: when a limit temperature is reached on the heatsink.

Effect: inhibit torque of all axes of the module.

Reset condition: if the condition is not present anymore power off and on monophase voltage.

Notes: the temperature limit is detected by thermo-switch.

Overload

Check on MCD Commander specifications how could be managed this condition.

Watchdog.

Indicated by: LED DRF, LED WTD, optoisolated output DRIVE OK.

Set condition: when the micro controller or DSP fails.

Effect: inhibit torque or all axes of the module.

Reset condition: if the condition is not present anymore reset button on drive or send reset commands on CAN Network (a.e.using MCD Commander)

Section 5 MCD Commander commands and functions

Table of Contents

0 Version documentation

3.31	**RELEASED** :	Jan. 2002	Stephan Schwarz, ProControl AG
	Docu extended:		
	Changes:	Find auto. SYNC Period time	
	SDO extensions:	Set auto. micro interpolation time	
3.30	**RELEASED** :	Sep. 2001	Stephan Schwarz, ProControl AG
	Docu extended:	MCD Mode 3 (Trajectory Control)	
	SDO extensions:	0x20?1.12	Trajectory micro interpolation
3.20	**RELEASED** :	June 2001	Stephan Schwarz, ProControl AG
	SDO extensions:	0x100500	Synchronization COB-ID
		0x100600	Synchronization cycle period
		0x100700	Synchronization window length
		0x20?0.1D	Anti-Take-Off current test pulse
		0x20?1.11	Roll-Over position
3.10	**RELEASED** :	Jan. 2001	Stephan Schwarz, ProControl AG
	Docu extended:	IDBx Code Box	
		Motor safety brake	
	SDO extensions:	0x20?0.1B	KP factor during motor turn off
		0x20?0.1C	KI factor during motor turn off
		0x20?1.0E	Set input filter time constant factor
		0x20?1.0F	Shape control type
		0x20?1.10	Shape switching time period
3.08	**RELEASED** :	Feb. 2000	Stephan Schwarz, ProControl AG
	Docu extended:	Error / Warning Messages	
	SDO extensions:	0x2009.01	IDBx Module digital software input param.
		0x20?1.0E	Position interpolation time base
3.07	**RELEASED** :	Jan. 2000	Stephan Schwarz, ProControl AG

1 Communication Services

1.1 General

The MCD profile provides the following communication services according to CANopen. Some of these services are available in particular device operation modes. After power-on and startup of the application program the device is in mode „Pre-Operational“.

Services supported by the MCD devices:

Node state	Communication service provided by the IDBx devices
Disconnected	None
Connecting	Node-Guarding
Preparing	Node-Guarding, NMT, 1.SDO, 2.SDO
Prepared	Node-Guarding, NMT, 1.SDO, 2.SDO, EMERENCY
Pre-Operational	Node-Guarding, NMT, 1.SDO, 2.SDO, EMERENCY, SYNC
Operational	Node-Guarding, NMT, 1.SDO, 2.SDO, EMERENCY, SYNC, TxPDO, RxPDO

1.2 Network Management NMT

The MCD device is supporting the following NMT commands. After execution of the commands the application remains in the node state as defined to wait for other NMT commands:

NMT command	NMT command number	Node state after execution of command
Reset Communication	130	Pre-Operational
Reset Remote Node	129	Pre-Operational
Initialization Remote Node	128	Pre-Operational
Stop Remote Node	2	Prepared
Start Remote Node	1	Operational

1.3 Synchronization Object SYNC

The MCD device is supporting synchronization object. The synchronization object is broadcasted periodically by the SYNC producer. This SYNC provides the basic network clock. The time period between the SYNCs is specified by the standard parameter **communication cycle period** (see Object 1006h: Communication Cycle Period*),* which may be written by a configuration tool to the application devices during the boot-up process.

If the cycle period is set to zero the module will try to find the cycle period automatically after 5 received SYNC messages. The cycle period must by between 1..30ms

A node guarding will be active, if the cycle period is set by manually or automatically.

1.4 Node Guarding Object

The CAN bus master uses the node guard telegram to determine the current node state of the IDBx device. This is done by a periodical transmission of the Request Telegramm to the device. Based on this telegram a network timeout control for both master and slave may be implemented.
The IDBx device returns the following node state indications:.

Mode	Number
Disconnected	1
Connecting	2
Preparing	3
Prepared	4
Operational	5
Pre-Operational	127

1.5 Emergency Object

Internal error conditions (Hardware, Software) of the device are submitted to the master by the *Emergency Telegramm*.

1.6 Service Data Object SDO

The Service Data Object SDO provides access to the device's object dictionary using index and sub-index. The MCD device supports two SDO channels.

1.7 Process Data Object PDO

With the MCD device in the state *Operational,* up to 4 Receive PDO and 4 Transmit-PDO are active. These telegrams provide the exchange of process data, usually at high priority as a non confirmed service. The data structure within these PDO may vary based on the current device node state.

1.7.1 Transmission types

Type	Transmission
0	Synchronous, acyclic
1..240	Synchronous, cyclic
252	Synchronous, RTR only
253	Asynchronous, RTR only
254	Asynchronous, manufacture specific
255	Asynchronous, device specific

2 Module Identification (Node ID)

2.1 Identifier Distribution

The *CAN Communication Object Identifiers* COB-ID are usually based on the Node ID of the device. However, the COB-IDs may still be modified after device startup by SDO access. As soon as the Node ID of a IDBx device is changed, the COB-IDs are initialized as follows:

Communication Objects	COB-ID	Assignment
NMT	0x000	Module
SYNC	0x080	
EMERGENCY	0x080 + Module address	
Nodeguard	0x700 + Module address	
1. TxPDO	0x180 + Module address	Axis 1
1. RxPDO	0x200 + Module address	
2. TxPDO	0x280 + Module address	Axis 2
2. RxPDO	0x300 + Module address	
3. TxPDO	0x380 + Module address	Axis 3
3. RxPDO	0x400 + Module address	
4. TxPDO	0x480 + Module address	Reserve
4. RxPDO	0x500 + Module address	
1. TxSDO	0x580 + Module address	1. SDO-Cannel for the module
1. RxSDO	0x600 + Module address	
2. TxSDO	0x680 + Module address	2. SDO-Cannel for the module
2. RxSDO	0x780 + Module address	

2.2 Module Address (Node ID)

The MCD device node ID is to be set using the **IDBx Code-Box, MCD Commander** or **Term** (RS232 terminal program). The Node ID value must be between 1 and 127. The default value is between 57(39_h) and 63_d ($3F_h$).

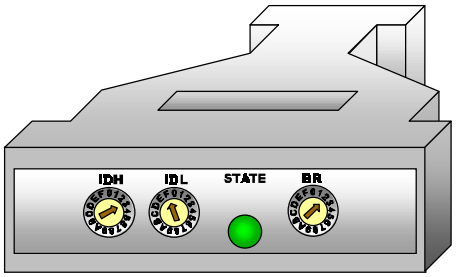
2.3 Module Baud Rate

Communication speed can be selected within the **IDBx Code-Box, MCD Commander** or **Term** (RS232 terminal program). The maximum baud rate is determined by the actual CAN bus length. The baud rate is initially set to 500 kBit/s. The following speed settings are supported by CANopen:

CANopen Index	Baud rate [kBit/s]	Max. Bus Length [m]	Bit-Time [us]
0	1000	25	1.00
1	800	50	1.25
2	**500**	100	2.00
3	250	250	4.00
4	125	500	8.00
5	50	1000	20.00
6	20	2500	50.00
7	10	5000	100.00

2.4 IDBx Code-Box

The node ID and communication baud rate will be selected by the IDH/IDL- and BR-Switch-Selector. Connect the IDBx Code-Box to the RS485 connector J2 and restart the MCD module by pressing the reset button and wait for flashing the green state LED.



Label	Assignment	Description
IDH IDL	Node ID selector (HEX switch selector)	To select the node ID 63_d, set the IDH-Switch to 3 and the IDL-Switch to F. ($63_d = 3F_h$) *2.2 Module Address (Node ID)*
STATE	Three color LED	Red: Error exist (wrong ID, BR or com.) Yellow: Wait for reposing Green: ID and BR accepted and initialized
BR	Baud rate selector (HEX switch selector)	To select the baud rate 500[kBit/s] set the BR-Switch to number *2.3 Module Baud Rate* *2.3 Module Baud Rate*

3 Object dictionary

3.1 Communication Entries

Index [h]	Nr. of Sub [h]	Deskription	
1000		Device type	
1001		Error register	Error Register :
1002		Manufacturer status register	
1003		Pre-defined error field	Pre-defined Error Field (Error History)
1004	2	Number of PDOs supported	
1005		COB-ID SYNC message	
1006		Communication cycle period	
1007		Synchronous window length	
1008		Manufacturer device name	
1009		Manufacturer hardware version	
100A		Manufacturer software version	
100B		Node-ID	
100C		Guard time	
100D		Life time factor	
100E		COB-ID Node guarding	
100F		Number of SDOs supported	
1010	7	Store parameters	
1011	7	Restore default parameters	
1014		COB-ID Emergency message	
1020	2	Verify configuration	
1021		Store EDS	
1022		Storage EDS format	
1200	2	1. Server SDO parameter	
1201	2	2. Server SDO parameter	
1400	2	1. Receive PDO communication parameter	
1401	2	2. Receive PDO communication parameter	
1402	2	3. Receive PDO communication Parameter	
1403	2	4. Receive PDO communication parameter	
1800	2	1. Transmit PDO communication parameter	
1801	2	2. Transmit PDO communication parameter	
1802	2	3. Transmit PDO communication parameter	
1803	2	4. Transmit PDO communication parameter	
1F50	14	Download program data table	

3.2 Manufacturer Specific Profile Definitions

2000	6	IDBx-Module set parameters
2001	3	IDBx-Module analog output 1. configuration parameter structure
2002	3	IDBx-Module analog output 2. configuration parameter structure
2003	3	IDBx-Module analog output 3. configuration parameter structure
2004	3	IDBx-Module analog output 4. configuration parameter structure
2005	3	IDBx-Module analog output 5. configuration parameter structure
2006	3	IDBx-Module analog output 6. configuration parameter structure
2007	4	IDBx-Module digital output configuration parameter structure
2008	6	IDBx-Module digital input configuration parameter structure
2009	1	IDBx-Module digital software input configuration parameter structure
2010	1D	IDBx-Axis 1 set parameters (e. g. resolver poles, speed gain KP ..)
2011	12	IDBx-Axis 1 motion control parameters (MotionCtrlMode,SetPos, Accel,Posgain, prof# ..)
2012	3F	IDBx-Axis 1 motion profile table (velocty profile tables: motor angle, SetRPM, Acceleration)
2020	1D	IDBx-Axis 2 set parameters
2021	12	IDBx-Axis 2 motion control parameters
2022	3F	IDBx-Axis 2 motion profile table
2030	1D	IDBx-Axis 3 set parameters
2031	12	IDBx-Axis 3 motion control parameters
2032	3F	IDBx-Axis 3 motion profile table
2100	5	IDBx-Module actual values
2101	3	IDBx-Module common values
2110	9	IDBx-Axis 1 actual values
2111	4	IDBx-Axis 1 auto phasing
2120	9	IDBx-Axis 2 actual values
2121	4	IDBx-Axis 2 auto phasing
2130	9	IDBx-Axis 3 actual values
2131	4	IDBx-Axis 3 auto phasing

3.3 IDBx-Module Set Parameters

Index [h]	Sub [h]	Description				
2000	00	IDBx-Module set parameters			7[h]	Uns8
	01	IDBx-Model description			127 Characters	Visible String
	02	IDBx-Module type			1: IDBm, 2: IDBs 3kHz, 3: IDBs 9kHz	Int32
	03	Number of axes at IDBx-Module			1..3	Int32
	04	Date and Time			sec. elapsed since midnight 00:00:00, 1. 1. 1970	Int32
	05	Hardware defintion table			HWdefine,INI	Domain
	06	Drive data base			IDBxDrv,INI	Domain
	07	Motor data base			IDBxMot,INI	Domain
2001	00	IDBx-Module analog output 1. Parameter			3[h]	Uns8
2002	00	IDBx-Module analog output 2. Parameter			3[h]	Uns8
2003	00	IDBx-Module analog output 3. Parameter			3[h]	Uns8
2004	00	IDBx-Module analog output 4. Parameter			3[h]	Uns8
2005	00	IDBx-Module analog output 5. Parameter			3[h]	Uns8
2006	00	IDBx-Module analog output 6. Parameter			3[h]	Uns8
	01	Analog output value			-32768..32767	Int32
	02	Analog output address			0x00..0x2FF	Int32
	03	Analog output gain			0..31	Int32
2007	00	IDBx-Module digital output Parameter			4[h]	Uns8
	01	Dout 0	IDBm J1pin13,	IDBs J1pin14	Bit 0..29 Matrix, Bit 30 Inverter, Bit 31 Output	Uns32
	02	Dout 1	IDBm J7pin31,	IDBs J1pin14	Bit 0..29 Matrix, Bit 30 Inverter, Bit 31 Output	Uns32
	03	Dout 2	IDBm J7pin32,	IDBs J3pin8	Bit 0..29 Matrix, Bit 30 Inverter, Bit 31 Output	Uns32
	04	Dout 3	IDBm J7pin33		Bit 0..29 Matrix, Bit 30 Inverter, Bit 31 Output	Uns32
2008	00	IDBx-Module digital input Parameter			6[h]	Uns8
	01	Dinp 0	IDBm J8pin17,	IDBs J1pin16	Bit 0..29 Matrix, Bit 30 Inverter, Bit 31 Input (RO)	Uns32
	02	Dinp 1	IDBm J8pin14,	IDBs J1pin15	Bit 0..29 Matrix, Bit 30 Inverter, Bit 31 Input (RO)	Uns32
	03	Dinp 2	IDBm J8pin15,	IDBs J1pin18	Bit 0..29 Matrix, Bit 30 Inverter, Bit 31 Input (RO)	Uns32
	04	Dinp 3	IDBm J8pin16,	IDBs J3pin1	Bit 0..29 Matrix, Bit 30 Inverter, Bit 31 Input (RO)	Uns32
	05	Dinp 4		IDBs J3pin12	Bit 0..29 Matrix, Bit 30 Inverter, Bit 31 Input (RO)	Uns32
	06	Dinp 5		IDBs J3pin7	Bit 0..29 Matrix, Bit 30 Inverter, Bit 31 Input (RO)	Uns32
2009	00	IDBx-Module digital software input Para.			1[h]	Uns8
	01	Dswi			Bit 0..29 Matrix, Bit 30 Inverter, Bit 31 Input (RO)	Uns32

3.4 IDBx-Module Actual Parameters

Index [h]	Sub [h]	Description				
2100	00	IDBx-Module actual values			5[h]	Uns8
	01	Error register			Error Messages:	Uns32
	02	Warning register			Warning Messages	Uns32
	03	DSP version number				Uns32
	04	Matrix input signals for digital outputs				Uns32
	05	Matrix output signals for digital inputs				Uns32
2101	00	IDBx-Module common values			3[h]	Uns8
	01	Start up date			40 Characters	Visible String
	02	Customer name			40 Characters	Visible String
	03	Module series number			40 Characters	Visible String

3.5 IDBx-Axes Set Parameters

Index [h]	Sub [h]	Description			
2010	00	IDBx-Axis 1 set parameters	1D[h]		Uns8
2020	00	IDBx-Axis 2 set parameters	1D[h]		Uns8
2030	00	IDBx-Axis 3 set parameters	1D[h]		Uns8
	01	Axis description	127 Characters		Visible String
	02	Drive type (3/9)	20 Characters		Visible String
	03	Motor type (FASW2-K8-031)	20 Characters		Visible String
	04	Max. Motor velocity	0..30000 [$^1/_{min}$]		Int32
	05	Error motor velocity	0..MaxVel [$^1/_{min}$]		Int32
	06	DSP command ramp up	0..3000 [$^1/_{min}$/111us] PFOC -3000..0 [$^1/_{min}$ /0.1s]		Int32
	07	DSP command ramp down	0..3000 [$^1/_{min}$/111us] PFOC -3000..0 [$^1/_{min}$ /0.1s]		Int32
	08	Motor current peak limit	0..100 [%]		Int32
	09	Drive current peak limit	0..100 [%]		Int32
	0A	Velocity filter KF1	0..30		Int32
	0B	Velocity filter KF2	0..30		Int32
	0C	Velocity control P-Gain during motor on	0..30		Int32
	0D	Velocity control I-Gain during motor on	0..30		Int32
	0E	Current control Gain	0..3		Int32
	0F	Resolver angle offset	-32768..32767		Int32
	10	Resolver poles	2, 4, 6, 8, 12		Int32
	11	Motor poles to Resolver poles	1..4		Int32
	12	Max. Resolver resolution	0: 10, 1: 12, 2: 14, 3: 16Bit		Int32
	13	Simulated Encoder output	0..7 (128, 256..16384) [counts/U]		Int32
	14	Motor turn direction	0 : clockwise, 1: counter clockwise		Int32
	15	Velocity Torque Mode	0: Velocity, 1: Torque		Int32
	16	Drive load level scale factor	600..2000 [0.1%]	(default 1000)	Int32
	17	Motor load level scale factor	600..2000 [0.1%]	(default 1000)	Int32
	18	Brake release, open time	0..1000 [ms]	0 = default value 200ms	Int32
	19	Brake nominal activation time	0..1000 [ms]	0 = default value 200ms	Int32
	1A	Brake maximal activation time	0..2000 [ms]	0 = default value 500ms	Int32
	1B	Velocity control P-Gain during motor off	0..30		Int32
	1C	Velocity control I-Gain during motor off	0..30		Int32
	1D	Anti -Take-Off current test pulse	-100..100 [%], 0=Disabled		Int32
2011	00	IDBx-Axis 1 motion control parameters	11[h]		Uns8
2021	00	IDBx-Axis 2 motion control parameters	11[h]		Uns8
2031	00	IDBx-Axis 3 motion control parameters	11[h]		Uns8
	01	Motion Control Mode	0..7		Int32
	02	Position	-PosRange..+PosRange [counts]		Int32
	03	Position tolerance window	0..PosRange [counts]		Int32
	04	Velocity, Torque command	+/-32767 [1/min, 15BitDAC]		Int32
	05	Torque limit	0..127 [7BitDAC] = 0..100%		Int32
	06	Acceleration	0..10000 [$^1/_{min}$ /ms]		Int32
	07	Deceleration	0..10000 [$^1/_{min}$ /ms]		Int32
	08	Position gain	5..1000 [1/s]		Int32
	09	Variable profile set position	0, 1		Int32
	0A	Profile number	0..3		Int32
	0B	Profile velocity scale	0..100 [%]		Int32
	0C	Profile min velocity outside profile	0..255 [$^1/_{min}$]		Int32
	0D	Profile dynamic compensation time	0..10000 [us]		Int32
	0E	Input command filter time constant for MCD mode 0 and 1	0..14: 2^x [ms]		Int32
	0F	Shape type for MCD mode 1	0 : Standard, 1 :S-, 2 :Bell-, 3 :Sin²Shape		Int32
	10	Shape switching period time for MCD mode 1	0..10000 [ms]		Int32
	11	Roll-Over position	0..PosRange [counts]		Int32
	12	Trajectory micro interpolation (linear, square) for MCD mode 3	0.. +/-32767 [ms], (+):linear (-)square		Int32

2012	00	IDBx-Axis 1 motion profile tables	0x3F: 0x01..0x0F = Profile 1 0x10..0x1F = Profile 2 0x20..0x2F = Profile 3 0x30..0x3F = Profile 4	Uns8
2022	00	IDBx-Axis 2 motion profile tables	0x3F: 0x01..0x0F = Profile 1 0x10..0x1F = Profile 2 0x20..0x2F = Profile 3 0x30..0x3F = Profile 4	Uns8
2032	00	IDBx-Axis 3 motion profile tables	0x3F: 0x01..0x0F = Profile 1 0x10..0x1F = Profile 2 0x20..0x2F = Profile 3 0x30..0x3F = Profile 4	Uns8
	01	Profile description	127 Characters	Visible String
	02	Profile size	0 = not exist, 1..	Int32
	03	Profile move direction	-1: negative, +1: positive	Int32
	04	Profile move time	[ms]	Int32
	05	Profile position gain	[1/s]	Int32
	06	Profile stroke	[counts]	Int32
	07	Profile start position	[counts]	Int32
	08	Profile end position	[counts]	Int32
	0F	Profile table		Domain

3.6 IDBx-Axes Actual Parameters

Index [h]	Sub [h]	Description		
2110	00	IDBx-Axis 1 actual values	9[h]	Uns8
2120	00	IDBx-Axis 2 actual values	9[h]	Uns8
2130	00	IDBx-Axis 3 actual values	9[h]	Uns8
	01	Error register	Error Messages	Uns32
	02	Warning register	Warning Messages	Uns32
	03	Position	[counts]	Int32
	04	Velocity	[1/min]	Int32
	05	Torque	[0.1 Nm]	Int32
	06	Motor load level	[0.1 %]	Int32
	07	Drive section load level	[0.1 %]	Int32
	08	PWM Water valve output	[0.1 %]	Int32
	09	Torque resolution	[0.1 Nm/ max Irms]	Int32
2111	00	IDBx-Axis 1 Autophasing	4[h]	Uns8
2121	00	IDBx-Axis 2 Autophasing	4[h]	Uns8
2131	00	IDBx-Axis 3 Autophasing	4[h]	Uns8
	01	Start, Finish, Abort sequence	Start = 1, Finish = 2, Abort = 0	Int32
	02	State	0..8	Int32
	03	Error	0..3	Int32
	04	Resolver offset	-32768..32767 = -180..180° electric angle	Int32

4 Motion Control Mode

4.1 Motion Control Mode 0 : Velocity / Torque Control

The RxPDO contains the set speed and the set torque of the axis. With the axis in torque mode only Motion Control Mode 0 is allowed.

4.2 Motion Control Mode 1 : Position Control

The RxPDO contains set speed, set position and the torque limit. Position control type (Standard-, S-, Bell-, Sin²-Shape), acceleration, deceleration and position gain are to be set by SDO communication. All parameters for the position control algorithm (v, s, a, kp) may modified any time, even during movement..

4.3 Motion Control Mode 2 : Profile Control

This operation mode allows to choose from four different velocity profiles for each axis. The profile data are generated from the ProControl Motion Control Analysis Program (BAP). The profile data are stored on the Flash disk using the following file names:

1. Motion Profile	AX1_PROF.I_1	AX2_PROF.I_1	AX3_PROF.I_1
2. Motion Profile	AX1_PROF.I_2	AX2_PROF.I_2	AX3_PROF.I_2
3. Motion Profile	AX1_PROF.I_3	AX2_PROF.I_3	AX3_PROF.I_3
4. Motion Profile	AX1_PROF.I_4	AX2_PROF.I_4	AX3_PROF.I_4

The RxPDO is used to select the Profile Number, Velocity Scaling Factor, Position and Torque Limit.

4.4 Motion Control Mode 3 : Trajectory Control

A master PLC must send periodical together with the SYNC-Message a new position (Trajectory Control). To get a smooth velocity between tow SYNC-Message it is possible to activate a linear or square position interpolation.

5 Special Function

5.1 Position Control Shape Type

In the Motion Control Mode 1 (Position Control Mode) are different selectable position control shape types available. The shape type for each axis is set by SDO communication (0x20?1.0F).

5.1.1 Shape Parameter

Parameters	Shape Type support	Limits, Units		SDO index, sub index
Position	0..3	-PosRange..+PosRange	[counts]	Axis 1 0x2011.02 Axis 2 0x2021.02 Axis 3 0x2031.02
Velocity	0..3	-32768..+32767	['/min]	Axis 1 0x2011.04 Axis 2 0x2021.04 Axis 3 0x2031.04
Acceleration	0..3	0..10000	['/min/ms]	Axis 1 0x2011.06 Axis 2 0x2021.06 Axis 3 0x2031.06
Deceleration	0	0..10000	['/min/ms]	Axis 1 0x2011.07 Axis 2 0x2021.07 Axis 3 0x2031.07
Switching period time	1..3	0..10000	[ms]	Axis 1 0x2011.10 Axis 2 0x2021.10 Axis 3 0x2031.10
Position gain	0..3	5..1000	['/s]	Axis 1 0x2011.08 Axis 2 0x2021.08 Axis 3 0x2031.08

5.1.2 Shape Restriction: Type 0 (Standard)

- The switching period time is not supported.
- Acceleration and deceleration parameter can be different and are maximum values

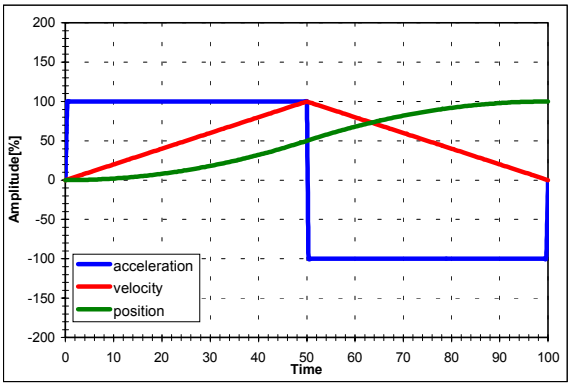
5.1.3 Shape Restriction: Type 1..3 (S-, Bell-, Sin²-Shape)

- Deceleration parameter is not supported.
- Acceleration parameter is used also for deceleration and are average values
- Switching period time = 0 and Acceleration = 0
  This settings produce no moving and are normally not used.
- Switching period time = 0 and Acceleration > 0
  The system changes the velocity with the acceleration parameter (average).
- Switching period time > 0 and Acceleration = 0
  This system changes the velocity in exactly the switch period time.
- Switching period time > 0 and Acceleration > 0
  The effective switch period time conforms with the set one or a multiple of the switch period time. The acceleration parameter (average) give a maximum limit for the acceleration.

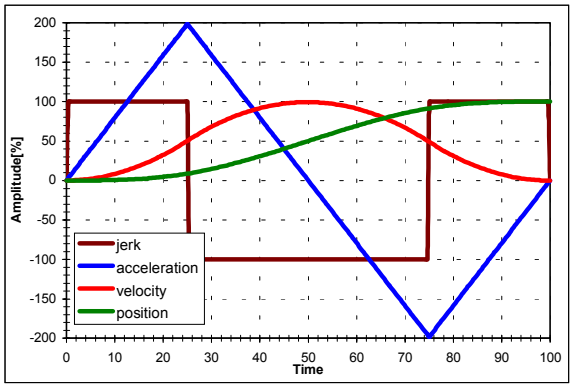
5.1.4 Shape comparison table

Shape Type	Switch period time	Maximum Jerk	Maximum Torque
0 : Standard	No	∞	100%
1 : S-Shape	Yes	100%	200%
2 : Bell-Shape	Yes	113%	150%
3 : Sin^2-Shape	Yes	123%	157%

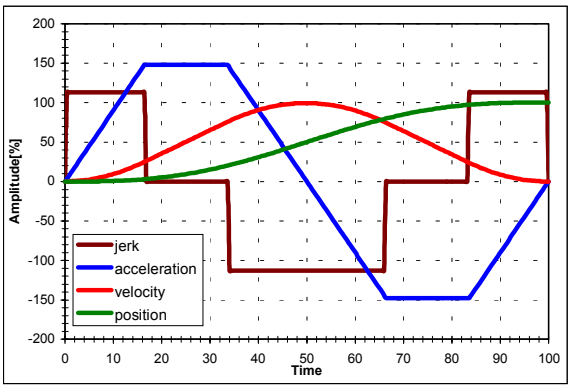
Type 0: Standard



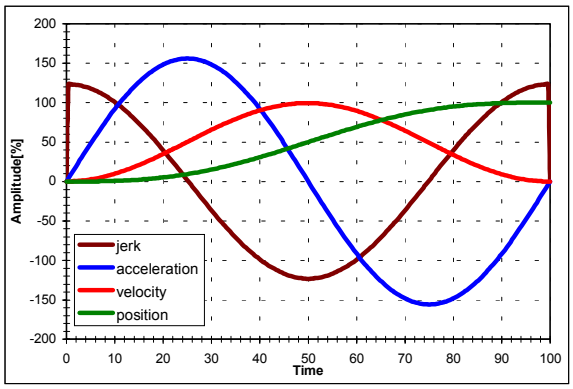
Type 1: S-Shape



Type 2: Bell-Shape



Type 3: Sin²-Shape



5.2 Position Referencing

Position Referencing is applicable in Motion Control Mode 0 and Motion Control Mode 1 only. The direction of the movement is determined by the sign of the set speed and set torque. Based on the Referencing Mode the following actions are possible:

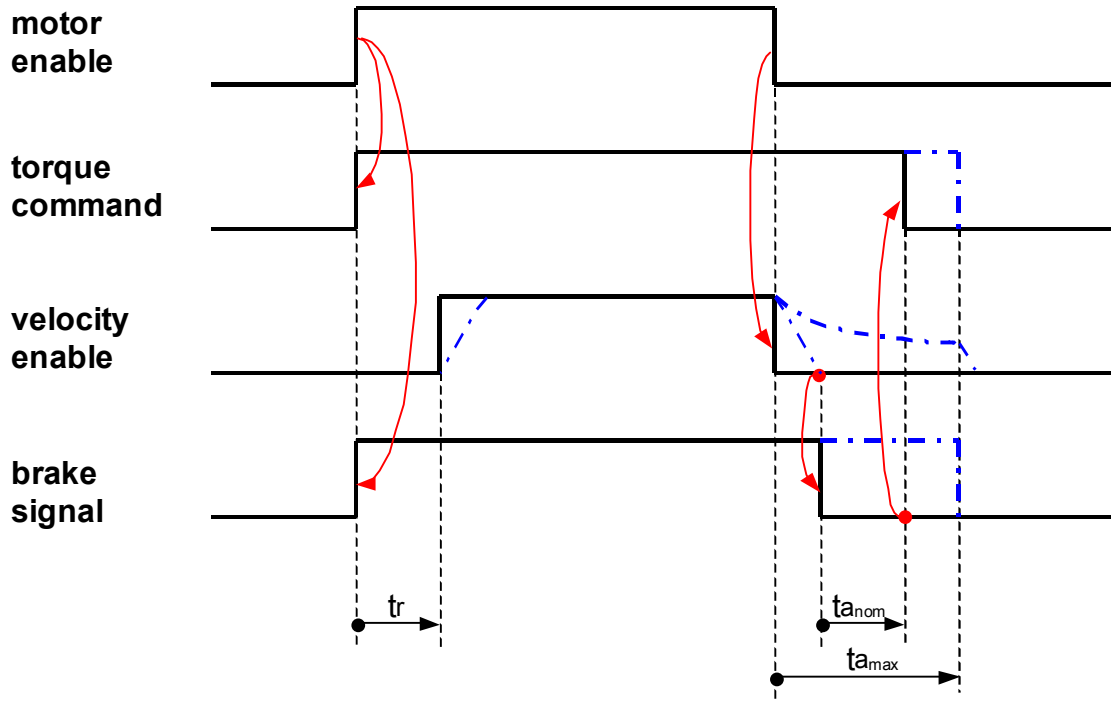
Mode	Description
0	**Referencing not active.** Axis is working in the selected Motion Control Mode.
1	**Referencing active.** Axis moves based on set velocity and torque limit.
2	**Referencing in manual mode.** Uses the actual position of the axis as reference position. Returns automatically to previously used Motion Control Mode.
3	**Referencing using Limit Switch Signal** A limit switch signal is used to define the reference position. Returns to previously used Motion Control Mode after completion.

As soon as Position Referencing is selected, the internal reference position is being erased. Therefore when activating the axis afterwards, the Referencing Mode immediately becomes active.

5.3 Motor safety brake

The motor brake signal can be mapped by Matrix-Output-Configuration table to a external periphery output. The following chart shows the MCD Standard-Profile motor safety braking sequence over the time.

5.3.1 Time chart



5.3.2 Time setting parameters

Legend	Description	SDO index, sub index
tr	Brake release, open time	Axis 1 0x2010.18 Axis 2 0x2020.18 Axis 3 0x2030.18
Ta_{nom}	Brake nominal activation time	Axis 1 0x2010.19 Axis 2 0x2020.19 Axis 3 0x2030.19
Ta_{max}	Brake maximal activation time	Axis 1 0x2010.1A Axis 2 0x2020.1A Axis 3 0x2030.1A

5.4 Autophasing

When Autophasing is being activated, Motion Control Mode 0 is selected automatically. While Autophasing is active, TxPDO.Control.Bit_3 is set. After completion, TxPDO.Control.Bit_3 is cleared and the previously used Motion Control Mode is activated again.

6 Motion-Control-Mode 0 Velocity / Torque Mode

6.1 RxPDO: Receive PDO for one axis of the MCD-Module

Byte 1	Byte 2	Byte 3,4	Byte 5..8
Control	TrqLim	Vel/Trq	Position

6.1.1 Control Command: Control

Bit 0..2 Mode 0..7 0 = Velocity / Torque mode
Bit 3 Input velocity- or torque command filter enable
Bit 4,5 Position reference mode 0..3
0: Position reference cycle disabled
1: Position reference cycle enable
2: Preset the reference position at current position immediately
3: Preset the reference position whit limit switch signal
Bit 6 Clear error messages and switch motor on if axis enabled.
Bit 7 Axis enable, if no error exist motor will switch on.

6.1.2 Torque Limitation : TrqLim

0..127 Torque PWM output limitation [torque_low_res]

6.1.3 Velocity / Torque Command: Vel/Trq

+/-32767 Velocity mode [$^1/_{min}$]
Torque mode [torque_high_res]

6.1.4 Position Value: Position

+/-PosRange Preset for the reference position [counts]

6.2 TxPDO: Transmit PDO for one axis of the MCD-Module

Byte 1	Byte 2	Byte 3,4	Byte 5..8
Status	Torque	Velocity	Position

6.2.1 Control Status: Status

Bit 0..2 Mode 0..7 0 = Velocity / Torque mode
Bit 3 Autophasing selected
Bit 4 Reference limit switch signal
Bit 5 Reference cycle done, reference position valid
Bit 6 Error exist
Bit 7 Axis enabled

6.2.2 Torque Output: Torque

+/-127 Torque PWM output [torque_low_res]

6.2.3 Actual Velocity: Velocity

+/-32767 Actuel velocity [$^1/_{min}$]

6.2.4 Position

+/- PosRange Actual position [counts]

Position Range: PosRange = 2147483647 * 2 / Resolver Pools

7 Motion-Control-Mode 1 Position Control Mode

7.1 RxPDO: Receive PDO for one axis of the MCD-Module

Byte 1	Byte 2	Byte 3,4	Byte 5..8
Control	TrqLim	Velocity	Position

7.1.1 Control Command: Control

Bit 0..2 Mode 0..7 1 = Position control mode
Bit 3 Input velocity command filter enable
Bit 4,5 Position reference mode 0..3
0: Position reference cycle disabled
1: Position reference cycle enable
2: Preset the reference position at current position immediately
3: Preset the reference position whit limit switch signal
Bit 6 Clear error messages and switch motor on if axis enabled.
Bit 7 Axis enable, if no error exist motor will switch on.

7.1.2 Torque Limitation : TrqLim

0..127 Torque PWM output limitation [torque_low_res]

7.1.3 Velocity Command: Velocity

0..32767 Reference position set : Set velocity for position control [^{1}/min]
+/-32767 Reference position not set : Set velocity and direction [^{1}/min]

7.1.4 Position Value: Position

+/-PosRange Reference position set : Set position for position control [counts]
+/-PosRange Reference position not set : Preset for the reference position [counts]

7.2 TxPDO: Transmit PDO for one axis of the MCD Module

Byte 1	Byte 2	Byte 3,4	Byte 5..8
Status	Torque	Velocity	Position

7.2.1 Control Status: Status

Bit 0..2 Mode 0..7 1 = Position control mode
Bit 3 Position tolerance window reached
Bit 4 Reference limit switch signal
Bit 5 Reference cycle done, reference position valid
Bit 6 Error exist
Bit 7 Axis enabled

7.2.2 Torque Output: Torque

+/-127 Torque PWM output [torque_low_res]

7.2.3 Actual Velocity: Velocity

+/-32767 Actuel velocity [^{1}/min]

7.2.4 Position

+/- PosRange Actual position [counts]

Position Range: PosRange = 2147483647 * 2 / Resolver Pools

8 Motion-Control-Mode 2 Profile Control Mode

8.1 RxPDO: Receive PDO for one axis of the MCD Module

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5..8
Control	TrqLim	ProfScale	ProfVel	Position

8.1.1 Control Command: Control

Bit 0..2 Mode 0..7 2 = Profile control mode
Bit 3 Variable profile set position
Bit 4, 5 Profile number 0..3
Bit 6 Clear error messages and switch motor on if axis enabled.
Bit 7 Axis enable, if no error exist motor will switch on.

8.1.2 Torque Limitation : TrqLim

0..127 Torque PWM output limitation [torque_low_res]

8.1.3 Profile Scale Factor : ProfScale

0..100 Set velocity [$^1/_{min}$] = Profile velocity * ProfScale / 100 [%]

8.1.4 Velocity outside profile range: ProfVel

0..255 Velocity command outside profile range [$^1/_{min}$]

8.1.5 Position Value: Position

+/-PosRange TxPDO.Control.Bit_3 = 0 no function
+/-PosRange TxPDO.Control.Bit_3 = 1 Variable profile set position [counts]

8.2 TxPDO: Transmit PDO for one axis of the MCD-Module

Byte 1	Byte 2	Byte 3,4	Byte 5..8
Status	Torque	Velocity	Position

8.2.1 Control Status: Status

Bit 0..2 Mode 0..7 2 = Profile control mode
Bit 3 Position tolerance window reached
Bit 4 Profile status
Bit 6 = 0: Set position outside profile table
Bit 6 = 1: Profile table not exits
Bit 5 Reference cycle done, reference position valid
Bit 6 Error exist
Bit 7 Axis enabled

8.2.2 Torque Output: Torque

+/-127 Torque PWM output [torque_low_res]

8.2.3 Actual Velocity: Velocity

+/-32767 Actuel velocity [$^1/_{min}$]

8.2.4 Position

+/- PosRange Actual position [counts]

Position Range: PosRange = 2147483647 * 2 / Resolver Pools

9 Motion-Control-Mode 3 Trajectory Control Mode

9.1 RxPDO: Receive PDO for one axis of the MCD-Module

Byte 1	Byte 2	Byte 3,4	Byte 5..8
Control	TrqLim	Velocity	Position

9.1.1 Control Command: Control

Bit 0..2 Mode 0..7 3 = Trajectory control mode
Bit 3 Micro interpolation enable
Bit 4,5 Position reference mode 0..3
0: Position reference cycle disabled
1: Position reference cycle enable
2: Preset the reference position at current position immediately
3: Preset the reference position whit limit switch signal
Bit 6 Clear error messages and switch motor on if axis enabled.
Bit 7 Axis enable, if no error exist motor will switch on.

9.1.2 Torque Limitation : TrqLim

0..127 Torque PWM output limitation [torque_low_res]

9.1.3 Velocity Limitation: Velocity

0..32767 Reference position set : Set velocity limit [^{1}/min]
+/-32767 Reference position not set : Set velocity and direction [^{1}/min]

9.1.4 Position Value: Position

+/-PosRange Reference position set : Set position for trajectory [counts]
+/-PosRange Reference position not set : Preset for the reference position [counts]

9.2 TxPDO: Transmit PDO for one axis of the MCD Module

Byte 1	Byte 2	Byte 3,4	Byte 5..8
Status	Torque	Velocity	Position

9.2.1 Control Status: Status

Bit 0..2 Mode 0..7 1 = Position control mode
Bit 3 Position tolerance window reached
Bit 4 Reference limit switch signal
Bit 5 Reference cycle done, reference position valid
Bit 6 Error exist
Bit 7 Axis enabled

9.2.2 Torque Output: Torque

+/-127 Torque PWM output [torque_low_res]

9.2.3 Actual Velocity: Velocity

+/-32767 Actuel velocity [^{1}/min]

9.2.4 Position

+/- PosRange Actual position [counts]

Position Range: PosRange = 2147483647 * 2 / Resolver Pools

10 Error / Warning Messages

10.1 Module Errors / Warnings

10.1.1 Error Messages:

Index, sub index at object dictionary 2100[h] 01[h]

Bit	Message
0	1: Recovery resister circuit error
1	2: Over temperature at power supply
2	3: Aux.low voltage not ok +/-15V(GND)
3	4: Aux.high voltage not ok +/-15V(AT)
4	5: Over temperature at module
5..7	
8	7: System observation error exist
9..14	
15	16: Wrong DSP program version

10.1.2 Warning Messages

Index, sub index at object dictionary 2100[h] 02[h]

Bit	Message
0	1: Bus voltage out of range
1..7	
8	7: Copyright verification error
9..13	
14	15: RTC not set
15	16: RTC-Battery low

10.2 Axis Errors / Warnings

10.2.1 Error Messages

Index, sub index at object dictionary 2110[h] 01[h] Axis 1
Index, sub index at object dictionary 2120[h] 01[h] Axis 2
Index, sub index at object dictionary 2130[h] 01[h] Axis 3

Bit	Message
0	1: Motor phase / IGBT power failure
1	2: Resolver not connected
2	3: Motor over temperature
3	4: Motor load level stop
4	5: Drive load level stop
5	6: Bus voltage out of range
6	7: Axis input enable interrupted
7	8: Anti Take Off stop
8..12	
13	14: Axis parameter wrong
14	15: Motor parameter wrong
15	16: Drive parameter wrong

10.2.2 Warning Messages

Index, subindex at object dictionary 2110[h] 02[h] Axis 1
Index, subindex at object dictionary 2120[h] 02[h] Axis 2
Index, subindex at object dictionary 2130[h] 02[h] Axis 3

Bit	Message
0	1: Axis enable not present
1	2: Motor off
2	3: Resolver phasing is activated
3	4: Motor velocity error limit reached
4	5: Motor load level warning
5	6: Drive load level warning
6	7: Reference position not set
7..15	

10.3 EMERGENCY Telegram

Emergency objects are triggered by the occurrence of a device internal error situation and are transmitted from an emergency producer on the device. Emergency objects are suitable for interrupt type error alerts. An emergency object is transmitted only once per 'error event'. As long as no new errors occur on a device no further emergency objects will be transmitted.

10.3.1 Transmit PDO structure :

Byte 1, 2	Byte 3	Byte 4..8
Error Code	Error Register	MCD manufacturer specific error field

10.3.2 Error Code :

[h]	Message
0000	Error reset or no error
1000	Generic module error For details see MCD manufacturer specific error field
1001	Generic axis 1 error For details see MCD manufacturer specific error field
1002	Generic axis 2 error For details see MCD manufacturer specific error field
1003	Generic axis 3 error For details see MCD manufacturer specific error field
1010	Generic user main application error For details see user application manufacturer specific error field documentation.
1011	Generic user axis 1 application error For details see user application manufacturer specific error field documentation.
1012	Generic user axis 2 application error For details see user application manufacturer specific error field documentation.
1013	Generic user axis 3 application error For details see user application manufacturer specific error field documentation.

10.3.3 Error Register :

Bit	Message
0	Generic error
1	Current
2	Voltage
3	Temperature
4	Communication error (overrun, error state)
5	Device profile specific
6	Reserved (always 0)
7	Manufacturer specific

10.3.4 MCD manufacturer specific error field :

Byte 4, 5	Byte 6	Byte 7, 8
MCD error register	MCD error additional Index	MCD error additional Value

10.3.4.1 MCD error register :

Error Code	MCD error register
1000	See Module Error Messages
1001	See Axis 1 Error Messages
1002	See Axis 2 Error Messages
1003	See Axis 3 Error Messages

10.3.4.2 MCD error additional Index, Value :

For debugging or special function it’s possible to send together with the error message a additional 16 bit value with the corresponding index number (0..255).

10.4 Pre-define Error Field (Error History)

The object at index 1003h holds the errors that have occurred on the device and have been signaled via the Emergency Object. In doing so it provides an error history.

1. The entry at sub-index 0 contains the number of actual errors that are recorded in the array starting at sub-index 1.
2. Every new error is stored at sub-index 1, the older ones move down the list.
3. Writing a “0” to sub-index 0 deletes the entire error history (empties the array).
4. The error numbers are of type UNSIGNED32 and are composed of a 16 bit error code and a 16 bit additional error information field which is manufacturer specific. The error code is contained in the lower 2 bytes (LSB) and the additional information is included in the upper 2 bytes (MSB).

10.4.1 16 bit Error Code :

See : Error Code

10.4.2 16 bit Additional error information field :

See : MCD error register

11 IDBx-Module Connectors

11.1 IDBs-Module

11.1.1 J1-Connector I/O-Signals

Connector type at panel side : WAGO 231-450
Connector type at wiring side : WAGO 231-120/026-000

Pin	Definition	Description	
1	ANALOG INP (+) 1	Differential analog input 1	±10 Voltage range
2	ANALOG INP (-) 1	Differential analog input 1	
3	ANALOG INP 2	Analog input 2 referred to ANALOG GND	±10 Voltage range
4	ANALOG OUT 1	Analog output 1 referred to ANALOG GND	±10 Voltage range
5	ANALOG OUT 2	Analog output 2 referred to ANALOG GND	±10 Voltage range
6	ANALOG GND	Analog ground for pin 3..5	
7	+15VDC OUT	Output power supply +15 Voltage (I_{max} = 100 mA)	
8	INPUT COMMON	Input power supply common for DIGITAL INPUT 0, 1, 2 signals	
9	+24VDC INPUT	Input power supply +24 Voltage to drive the MODULE OK signal	
10	MODULE OK	Digital output signal MODULE OK	+24 Voltage (optoisolated)
11	+24VDC INPUT	Input power supply +24 Voltage to drive the DIGITAL OUT 0 signal	
12	DIGITAL OUT 0	Digital output signal 0	+24 Voltage (optoisolated)
13	+24VDC INPUT	Input power supply +24 Voltage to drive the DIGITAL OUT 1 signal	
14	DIGITAL OUT 1	Digital output signal 1	+24 Voltage (optoisolate)
15	DIGITAL INP 1	Digital input signal 1	+24 Voltage (optoisolated)
16	DIGITAL INP 0	Digital input signal 0	+24 Voltage (optoisolated)
17	MODULE RESET	Digital input signal for reset module	+24 Voltage (optoisolated)
18	DIGITAL INP 2	Digital input signal 2	+24 Voltage (optoisolated)
19	GND	Connect to ground with >= 2.5 mm2	
20	GND	Connect to ground with >= 2.5 mm2	

11.1.2 J2-Connector RS485 Port Signals

Connector type at panel side : SUB-D 9 contacts, male
Connector type at wiring side : SUB-D 9 contacts, female

Pin	Definition	Description
1	(+)Rx	Differential receive single
2	n.c.	
3	(+)Tx	Differential transmit signal
4	n.c.	
5	+5VDC(0V)	+5 VDC output power supply referred to 0 V
6	(-)Rx	Differential receive single
7	0V (logic)	0 V logic circuit
8	(-)Tx	Differential transmit signal
9	n.c.	

11.1.3 J3-Connector Encoder Outputs and I/O-Signals

Connector type at panel side : SUB-D 15 contacts, female
Connector type at wiring side : SUB-D 15 contacts, male

Pin	Definition	Description	
1	DIGITAL INP 3	Digital input signal 3, referred to 0 V (logic)	+5 VDC (not opto-isolated)
2	(-) B1	Differential encoder phase B, axis 1 output signal	
3	(+) A1	Differential encoder phase A, axis 1 output signal	
4	(+) C1	Differential encoder phase C, axis 1 output signal	
5	-15VDC(0V)	-15 VDC output power supply referred to 0 V (I_{max} = 30mA)	

6	+15VDC(0V)	+15 VDC output power supply referred to 0 V (I_{max} = 30mA)	
7	DIGITAL INP 4	Digital input signal 4, referred to 0 V (logic)	+5 VDC (not opto-isolated)
8	DIGITAL OUT 2	Digital output signal 2, referred to 0 V (logic)	+5 VDC (not opto-isolated)
9	(+) B1	Differential encoder phase B, axis 1 output signal	
10	(-) A1	Differential encoder phase A, axis 1 output signal	
11	(-) C1	Differential encoder phase C, axis 1 output signal	
12	DIGITAL INP 3	Digital input signal 3, referred to 0 V (logic)	+5 VDC (not opto-isolated)
13	DIGITAL Test Pin 1	Digital test pin 1 for DSP-Processor	+5 VDC (not opto-isolated)
14	DIGITAL Test Pin 2	Digital test pin 2 for DSP-Processor	+5 VDC (not opto-isolated)
15	0V (logic)	0 V logic circuit	

11.1.4 J4-Connector Resolver

Connector type at panel side : SUB-D 9 contacts, female
Connector type at wiring side : SUB-D 9 contacts, male

Pin	Definition	Description
1	(+) cos	Differential cosine input signal
2	(-) cos	Differential cosine input signal
3	Shield	Shield of twisted cable
4	(+) sin	Differential sinus input signal
5	(-) sin	Differential sinus input signal
6	PTC	Motor winding PTC resistor
7	0V (resolver)	0 V resover circuit
8	PTC	Motor winding PTC resistor
9	10kHz (resolver)	10 kHz, 20 Vpp output sinusoidal wave for supplying primary resolver winding

11.1.5 J20-Connector I/O-Port (LPT)

Connector type at panel side : MINI-SUB-D 20 contacts, female
Connector type at wiring side : MINI-SUB-D 20 contacts, male

Pin	Definition	Description	LPT-Connector SUB-D 25 contacts	
1	0V (logic)	0 V logic circuit	LPT Ground	18..25
2	I/O 8	Bi-directional data line 8	LPT Out (-)Strobe	1
3	I/O 0	Bi-directional data line 0	LPT Data 0	2
4	I/O 9	Bi-directional data line 9	LPT Out (-)Auto Line Feed	14
5	I/O 1	Bi-directional data line 1	LPT Data 1	3
6	I/O 10	Bi-directional data line 10	LPT Out (-)Initialisation	16
7	I/O 2	Bi-directional data line 2	LPT Data 2	4
8	I/O 11	Bi-directional data line 11	LPT Out (-)Select	17
9	I/O 3	Bi-directional data line 3	LPT Data 3	5
10	I/0 Interrupt	Interrupt line	LPT Inp (-)Acknowledge	10
11	I/O 4	Bi-directional data line 4	LPT Data 4	6
12	I/O 16	Bi-directional data line 16	LPT Inp (-)Error	15
13	I/O 5	Bi-directional data line 5	LPT Data 5	7
14	I/O 12	Bi-directional data line 12	LPT Inp (+)On line	13
15	I/O 6	Bi-directional data line 6	LPT Data 6	8
16	I/O 13	Bi-directional data line 13	LPT Inp (+)Paper empty	12
17	I/O 7	Bi-directional data line 7	LPT Data 7	9
18	I/O 14	Bi-directional data line 14	LPT Inp (-)Acknowledge	10
19	0V (logic)	0 V logic circuit	LPT Ground	18..25
20	I/O 15	Bi-directional data line 15	LPT Inp (+)Busy	11

11.1.6 J21-Connector CAN 1/2

Connector type at panel side : SUB-D 9 contacts, male
Connector type at wiring side : SUB-D 9 contacts, female

Pin	Definition	Description
1	(-) can 2	Differential can 2 signal
2	(-) can 1	Differential can 1 signal
3	0V (logic)	0 V logic circuit
4	n.c.	
5	n.c.	
6	0V (logic)	0 V logic circuit
7	(+) can 1	Differential can 1 signal
8	(+) can 2	Differential can 2 signal
9	n.c.	

11.1.7 J22-Connector RS232 Port

Connector type at panel side : SUB-D 9 contacts, male
Connector type at wiring side : SUB-D 9 contacts, female

Pin	Definition	Description
1	-DCD	Data carrier dedect
2	RXD	Receive signal
3	TXD	Transmit signal
4	-DTR	Data terminal ready
5	0V (logic)	0 V logic circuit
6	-DSR	Data set ready
7	-TRS	Request to send
8	-CTS	Clear to send
9	-RI	Ring indikator

11.1.8 J24-Connector +24VDC Auxiliary Power Supply

Connector type at panel side : WAGO 231-432
Connector type at wiring side : WAGO 231-102/026-000

Pin	Definition	Description
1	+24 VDC	Input power supply +24 Voltage for drive internal auxiliary power supplies
2	-24 VDC	

11.2 IDBm-Module

11.2.1 J1-Connector Auxiliary Power Supply

Pin	Definition	Description
1	n.c.	
2	+18VDC(-HV)	+18 VDC input power supply referred to (-)High-Voltage-Bus
3	- HV	(-)High-Voltage-Bus
4	158kHz (±18V(-HV))	158 kHz square wave signal for drives IGBT-Power supply
5	n.c.	
6	n.c.	
7	+18VDC(0V)	+18 VDC input power supply referred to 0 V
8	-18VDC(0V)	-18 VDC input power supply referred to 0 V
9	+8VDC(0V)	+8 VDC input power supply referred to 0 V
10	+8VDC(0V)	+8 VDC input power supply referred to 0 V
12	0V (logic)	0 V logic circuit
13	0V (resolver)	0 V resolver circuit
13	10kHz (resover)	10 kHz input sinusoidal wave for supplying primary resolver winding

11.2.2 J2-Connector RS485 Port/Fault Signals

Connector type at panel side : SUB-D 9 contacts, male
Connector type at wiring side : SUB-D 9 contacts, female

Pin	Definition	Description
1	(+)Rx	Differential receive single
2	n.c.	
3	(+)Tx	Differential transmit signal
4	Fault signal Bit 1	Power supply binary fault code, bit 1
5	+5VDC(0V)	+5 VDC output power supply referred to 0 V
6	(-)Rx	Differential receive single
7	0V (logic)	0 V logic circuit
8	(-)Tx	Differential transmit signal
9	Fault signal Bit 0	Power supply binary fault code, bit 0

11.2.3 J3-Connector Expansion Module

Connector type at panel side : SUB-D 15 contacts, female
Connector type at wiring side : SUB-D 15 contacts, male

Pin	Definition	Description
1	0V (logic)	0 V logic circuit
2	Aux. Voltage not ok	Auxiliary voltage at expansion module not ok
3	U-Current reference	Reference signal for phase U current
4	IGBT-Enable	Enable signal for IGBT-Power module
5	IGBT-Fault	Fault exist at IGBT-Power module
6	Over temperature	Over temperature at expansion module
7	Expansion pressent	Expansion module pressent
8	LED over temp.	Over temperature LED signal
9	Current gain Bit 1	Current control gain binary selector, bit 1
10	V-Current reference	Reference signal for phase V current
11	Current gain Bit 0	Current control gain binary selector, bit 0
12	n.c.	
13	HV-Bus not ok	High voltage bus not ok, out of tolerance
14	Aux. (-HV) not ok	Auxiliary voltage (-HT) at expansion module not ok
15	0V (logic)	0 V logic circuit

11.2.4 J4/5/6-Connector Resolver

Connector type at panel side : SUB-D 9 contacts, female
Connector type at wiring side : SUB-D 9 contacts, male

Pin	Definition	Description
1	(+) cos	Differential cosine input signal
2	(-) cos	Differential cosine input signal
3	Shield	Shield of twisted cable
4	(+) sin	Differential sinus input signal
5	(-) sin	Differential sinus input signal
6	PTC	Motor winding PTC resistor
7	0V (resover)	0 V resover circuit
8	PTC	Motor winding PTC resistor
9	10kHz (resover)	10 kHz, 20 Vpp output sinusoidal wave for supplying primary resolver winding

11.2.5 J7-Connector Encoder Outputs and I/O-Signals

Connector type at panel side : SUB-D 37 contacts, female
Connector type at wiring side : SUB-D 37 contacts, male

Pin	Definition	Description	
1	0V (logic)	0 V logic circuit	
2	(-) A1	Differential encoder phase A, axis 1 output signal	
3	(-) B1	Differential encoder phase B, axis 1 output signal	
4	(-) C1	Differential encoder phase C, axis 1 output signal	
5	(-) A2	Differential encoder phase A, axis 2 output signal	
6	(-) B2	Differential encoder phase B, axis 2 output signal	
7	(-) C2	Differential encoder phase C, axis 2 output signal	
8	(-) A3	Differential encoder phase A, axis 3 output signal	
9	(-) B3	Differential encoder phase B, axis 3 output signal	
10	(-) C3	Differential encoder phase C, axis 3 output signal	
11	DIGITAL Test Pin 2	Digital input test pin 2 for DSP-Processor	+5 VDC (not optoisolated)
12	ANALOG INP 6	Analog input 6	±10 Voltage range
13	ANALOG INP 5	Analog input 5	±10 Voltage range
14	ANALOG INP 4	Analog input 6	±10 Voltage range
15			
16	ANALOG INP (-) 3	Differential analog input 3	
17	ANALOG INP (-) 2	Differential analog input 2	
18	ANALOG INP (-) 1	Differential analog input 1	
19	+15VDC(0V)	+15 VDC output power supply referred to 0 V (I_{max} = 30mA)	
20	(+) A1	Differential encoder phase A, axis 1 output signal	
21	(+) B1	Differential encoder phase B, axis 1 output signal	
22	(+) C1	Differential encoder phase C, axis 1 output signal	
23	(+) A2	Differential encoder phase A, axis 2 output signal	
24	(+) B2	Differential encoder phase B, axis 2 output signal	
25	(+) C2	Differential encoder phase C, axis 2 output signal	
26	(+) A3	Differential encoder phase A, axis 3 output signal	
27	(+) B3	Differential encoder phase B, axis 3 output signal	
28	(+) C3	Differential encoder phase C, axis 3 output signal	
29	DIGITAL Test Pin 1	Digital input test pin 1 for DSP-Processor	+5 VDC (not opto-isolated)
30	Shield		
31	DIGITAL OUT 1	Digital output signal 1	+5 VDC (not opto-isolated)
32	DIGITAL OUT 2	Digital output signal 2	+5 VDC (not opto-isolated)
33	DIGITAL OUT 3	Digital output signal 3	+5 VDC (not opto-isolated)
34	ANALOG INP (+) 3	Differential analog input 3	±10 Voltage range
35	ANALOG INP (+) 2	Differential analog input 2	±10 Voltage range
36	ANALOG INP (+) 1	Differential analog input 1	±10 Voltage range
37	-15VDC(0V)	-15 VDC output power supply referred to 0 V (I_{max} = 30mA)	

11.2.6 J8-Connector I/O-Signals

Connector type at panel side : WAGO 231-450
Connector type at wiring side : WAGO 231-120/026-000

Pin	Definition	Description	
1	ANALOG OUT 1	Analog output 1 referred to ANALOG GND	±10 Voltage range
2	ANALOG OUT 2	Analog output 2 referred to ANALOG GND	±10 Voltage range
3	ANALOG OUT 3	Analog output 3 referred to ANALOG GND	±10 Voltage range
4	ANALOG OUT 4	Analog output 4 referred to ANALOG GND	±10 Voltage range
5	ANALOG OUT 5	Analog output 5 referred to ANALOG GND	±10 Voltage range
6	ANALOG OUT 6	Analog output 6 referred to ANALOG GND	±10 Voltage range
7	ANALOG GND	Analog ground for pin 1..8	
8	+15VDC OUT	Output power supply +15 Voltage (I_{max} = 100 mA)	
9	INPUT COMMON	Input power supply common for DIGITAL INPUT 0, 1, 2, 3 signals	
10	+24VDC INPUT	Input power supply +24 Voltage to drive the MODULE OK signal	
11	MODULE OK	Digital output signal MODULE OK	+24 Voltage (opto-isolated)
12	+24VDC INPUT	Input power supply +24 Voltage to drive the DIGITAL OUT 0 signal	
13	DIGITAL OUT 0	Digital output signal 0	+24 Voltage (opto-isolated)
14	DIGITAL INP 1	Digital input signal 1	+24 Voltage (opto-isolated)
15	DIGITAL INP 2	Digital input signal 2	+24 Voltage (opto-isolated)
16	DIGITAL INP 3	Digital input signal 3	+24 Voltage (opto-isolated)
17	DIGITAL INP 0	Digital input signal 0	+24 Voltage (opto-isolated)
18	MODULE RESET	Input signal for reset module	+24 Voltage (opto-isolated)
19	GND	Connect to ground with >= 2.5 mm2	
20	GND	Connect to ground with >= 2.5 mm2	

11.2.7 J20-Connector I/O-Port (LPT)

Connector type at panel side : MINI-SUB-D 20 contacts, female
Connector type at wiring side : MINI-SUB-D 20 contacts, male

Pin	Definition	Description	LPT-Connector SUB-D 25 contacts	
1	0V (logic)	0 V logic circuit	LPT Ground	18..25
2	I/O 8	Bi-directional data line 8	LPT Out (-)Strobe	1
3	I/O 0	Bi-directional data line 0	LPT Data 0	2
4	I/O 9	Bi-directional data line 9	LPT Out (-)Auto Line Feed	14
5	I/O 1	Bi-directional data line 1	LPT Data 1	3
6	I/O 10	Bi-directional data line 10	LPT Out (-)Initialisation	16
7	I/O 2	Bi-directional data line 2	LPT Data 2	4
8	I/O 11	Bi-directional data line 11	LPT Out (-)Select	17
9	I/O 3	Bi-directional data line 3	LPT Data 3	5
10	I/0 Interrupt	Interrupt line	LPT Inp (-)Acknowledge	10
11	I/O 4	Bi-directional data line 4	LPT Data 4	6
12	I/O 16	Bi-directional data line 16	LPT Inp (-)Error	15
13	I/O 5	Bi-directional data line 5	LPT Data 5	7
14	I/O 12	Bi-directional data line 12	LPT Inp (+)On line	13
15	I/O 6	Bi-directional data line 6	LPT Data 6	8
16	I/O 13	Bi-directional data line 13	LPT Inp (+)Paper empty	12
17	I/O 7	Bi-directional data line 7	LPT Data 7	9
18	I/O 14	Bi-directional data line 14	LPT Inp (-)Acknowledge	10
19	0V (logic)	0 V logic circuit	LPT Ground	18..25
20	I/O 15	Bi-directional data line 15	LPT Inp (+)Busy	11

11.2.8 21-Connector CAN 1/2

Connector type at panel side : SUB-D 9 contacts, male
Connector type at wiring side : SUB-D 9 contacts, female

Pin	Definition	Description
1	(-) can 2	Differential can 2 signal
2	(-) can 1	Differential can 1 signal
3	0V (logic)	0 V logic circuit
4	n.c.	
5	n.c.	
6	0V (logic)	0 V logic circuit
7	(+) can 1	Differential can 1 signal
8	(+) can 2	Differential can 2 signal
9	n.c.	

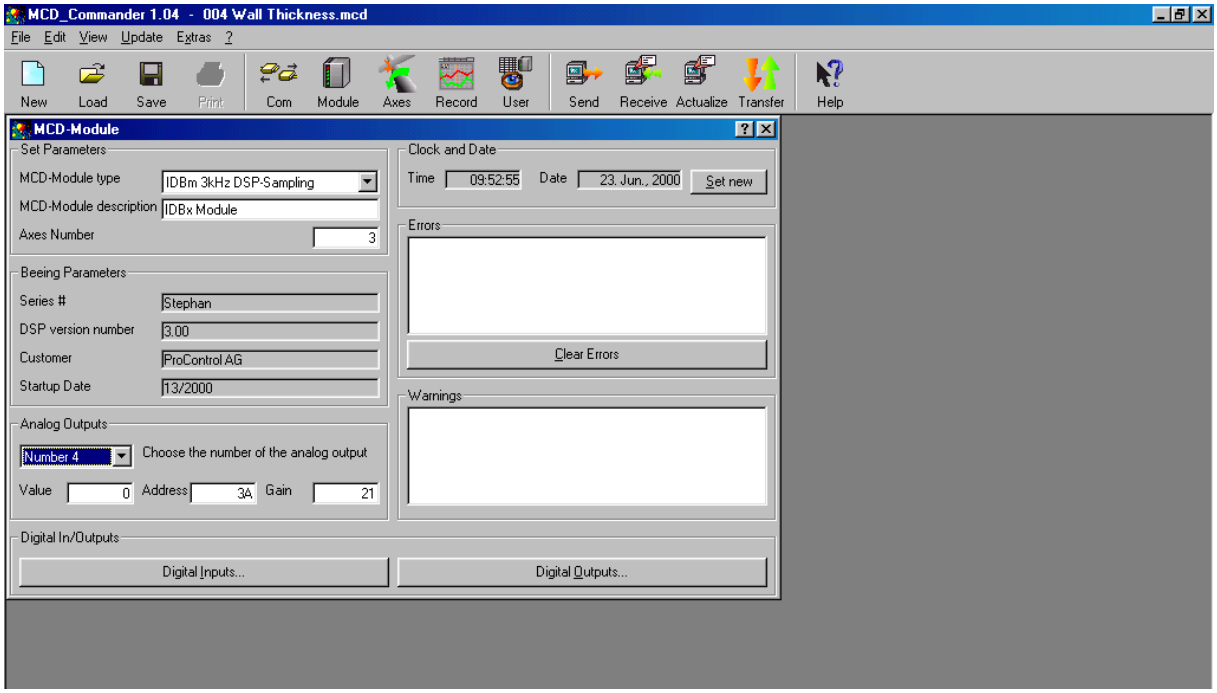
11.2.9 J22-Connector RS232 Port

Connector type at panel side : SUB-D 9 contacts, male
Connector type at wiring side : SUB-D 9 contacts, female

Pin	Definition	Description
1	-DCD	Data carrier dedect
2	RXD	Receive signal
3	TXD	Transmit signal
4	-DTR	Data terminal ready
5	0V (logic)	0 V logic circuit
6	-DSR	Data set ready
7	-TRS	Request to send
8	-CTS	Clear to send
9	-RI	Ring indikator

12 IDBx-Module Configuration

12.1 Analog Outputs



12.1.1 Configuration table

The analog outputs are configured by an address and a gain value. The gain value is a power number with the following effect. The actual value is multiplied by $2^{((Gain-16) / 2)}$ and will be written to the specified output.
Address 0 ..4 allows to manually write to the outputs.

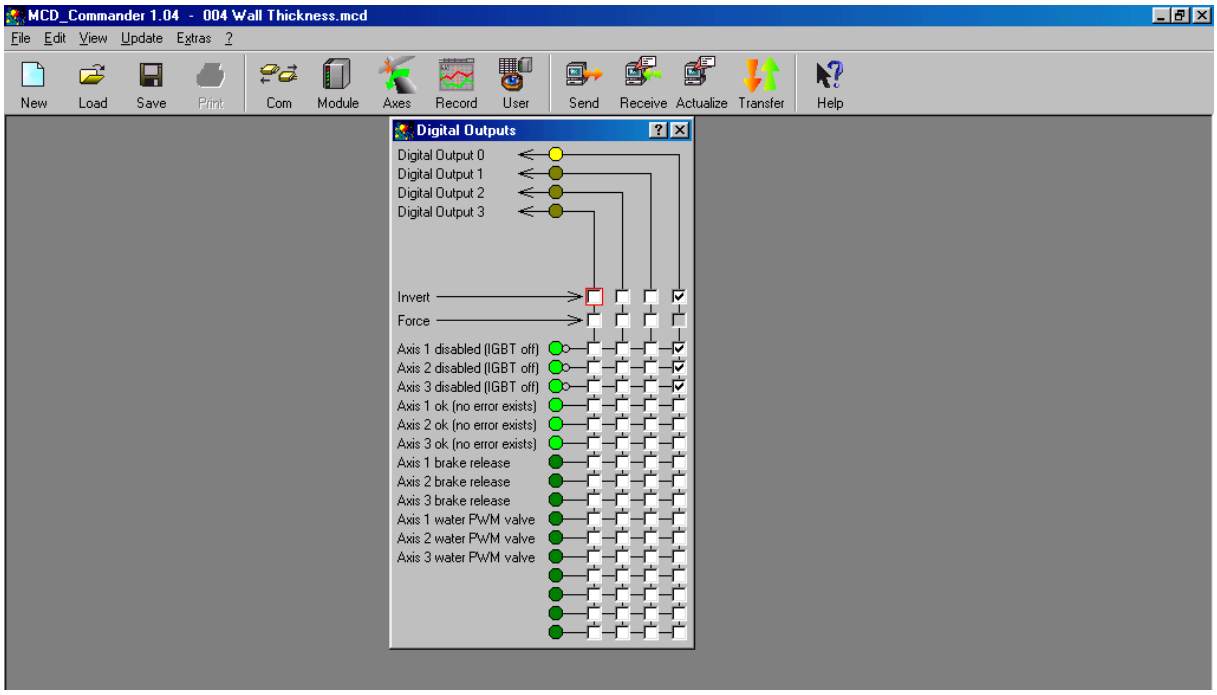
Address	Gain	Description
0x3A 0x3B 0x3C	21 21 21	**Axis 1: Filtered actual velocity** **Axis 2: Filtered actual velocity** **Axis 3: Filtered actual velocity** 2pol Resolver : 10 Volt = 15'910 [rpm] 4pol Resolver : 10 Volt = 7'955 [rpm] 6pol Resolver : 10 Volt = 5'303 [rpm] 8pol Resolver : 10 Volt = 3'977 [rpm]
0x37 0x38 0x39	16 16 16	**Axis 1: Output current command** **Axis 2: Output current command** **Axis 3: Output current command** 10 Volt = 100% of maximum drive current
0x00 0x01 0x02 0x03 0x04	 15 16 17	**User output value** Value : 23169 = 10 Volts Value : 32767 = 10 Volts Value : 46339 = 10 Volts

12.1.2 IDBx-Modules and DSP-Versions specific definition

The following analog outputs are exist at different IDBx modules and will be supported at different DSP-Versions.

Modul	DSP-Version	Description
IDBs		ANALOG OUT 1, 2
IDBm	bis 02.99	ANALOG OUT 4, 5
	ab 03.00	ANALOG OUT 1..6

12.2 Digital Outputs



12.2.1 Matrix-Output-Configuration table

The physical digital outputs are configured by a matrix table. There are internal matrix input signals which can be selected to the matrix outputs. If the inverter function is selected the matrix output will be inverted written to the physical output.
If no matrix mask for a digital output selected, it is allows to manually write to the output.

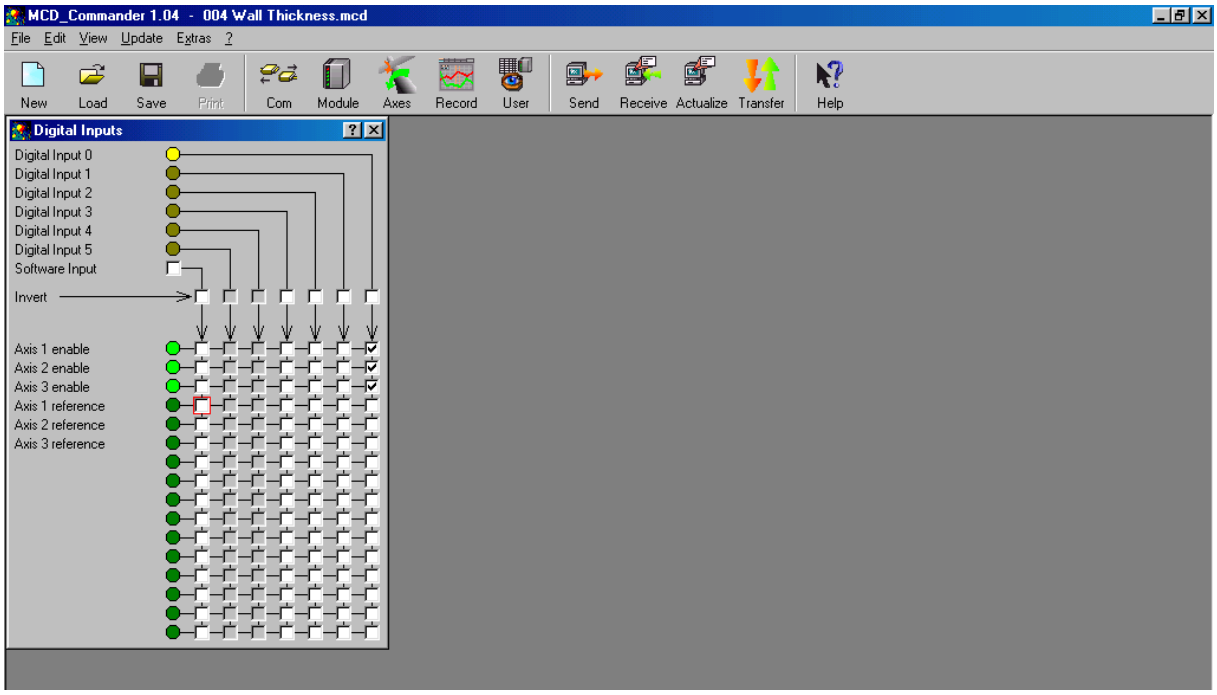
Matrix-Inputs	Matrix-Bit-Mask	Description
Ax_1 disabled	0000'0000'0000'0001	Axis 1: disabled, IGBT off
Ax_2 disabled	0000'0000'0000'0010	Axis 2: disabled, IGBT off
Ax_3 disabled	0000'0000'0000'0100	Axis 3: disabled, IGBT off
Ax_1 ok	0000'0000'0000'1000	Axis 1: No error exist at axis
Ax_2 ok	0000'0000'0001'0000	Axis 2: No error exist at axis
Ax_3 ok	0000'0000'0010'0000	Axis 3: No error exist at axis
Ax_1 brake	0000'0000'0100'0000	Axis 1: Motor safety brake open signal
Ax_2 brake	0000'0000'1000'0000	Axis 2: Motor safety brake open signal
Ax_3 brake	0000'0001'0000'0000	Axis 3: Motor safety brake open signal
Ax_1 water valve	0000'0010'0000'0000	Axis 1: PWM output for water motor cooling valve
Ax_2 water valve	0000'0100'0000'0000	Axis 2: PWM output for water motor cooling valve
Ax_3 water valve	0000'1000'0000'0000	Axis 3: PWM output for water motor cooling valve

12.2.2 IDBx-Modules specific definition

The following physical digital outputs are exist at different IDBx modules.

Modul	Connecter	Description		
IDBs	J1 Pin 12	DIGITAL OUT 0	+24 VDC (optoisolated)	default:: AXIS DISABLED
	J1 Pin 14	DIGITAL OUT 1	+24 VDC (optoisolated)	
	J3 Pin 8	DIGITAL OUT 2	+5 VDC (not optoisolated)	
IDBm	J7 Pin 13	DIGITAL OUT 0	+24 VDC (optoisolated)	default:: AXES DISABLED
	J7 Pin 31	DIGITAL OUT 1	+5 VDC (not optoisolated)	
	J7 Pin 32	DIGITAL OUT 2	+5 VDC (not optoisolated)	
	J7 Pin 33	DIGITAL OUT 3	+5 VDC (not optoisolated)	

12.3 Digital Inputs



12.3.1 Matrix-Input-Configuration table

The physical digital inputs are configured by a matrix table. There are internal matrix output signals which can be selected to the matrix inputs. If the inverter function is selected the physical input will be inverted written to the matrix table.

Matrix-Outputs	Matrix-Bit-Mask	Description
Ax_1 enable	0000'0000'0000'0001	Axis 1: Enable for switch axis on
Ax_2 enable	0000'0000'0000'0010	Axis 2: Enable for switch axis on
Ax_3 enable	0000'0000'0000'0100	Axis 3: Enable for switch axis on
Ax_1 reference	0000'0000'0000'1000	Axis 1: Reference limit switch signal
Ax_2 reference	0000'0000'0001'0000	Axis 2: Reference limit switch signal
Ax_3 reference	0000'0000'0010'0000	Axis 3: Reference limit switch signal

12.3.2 IDBx-Modules specific definition

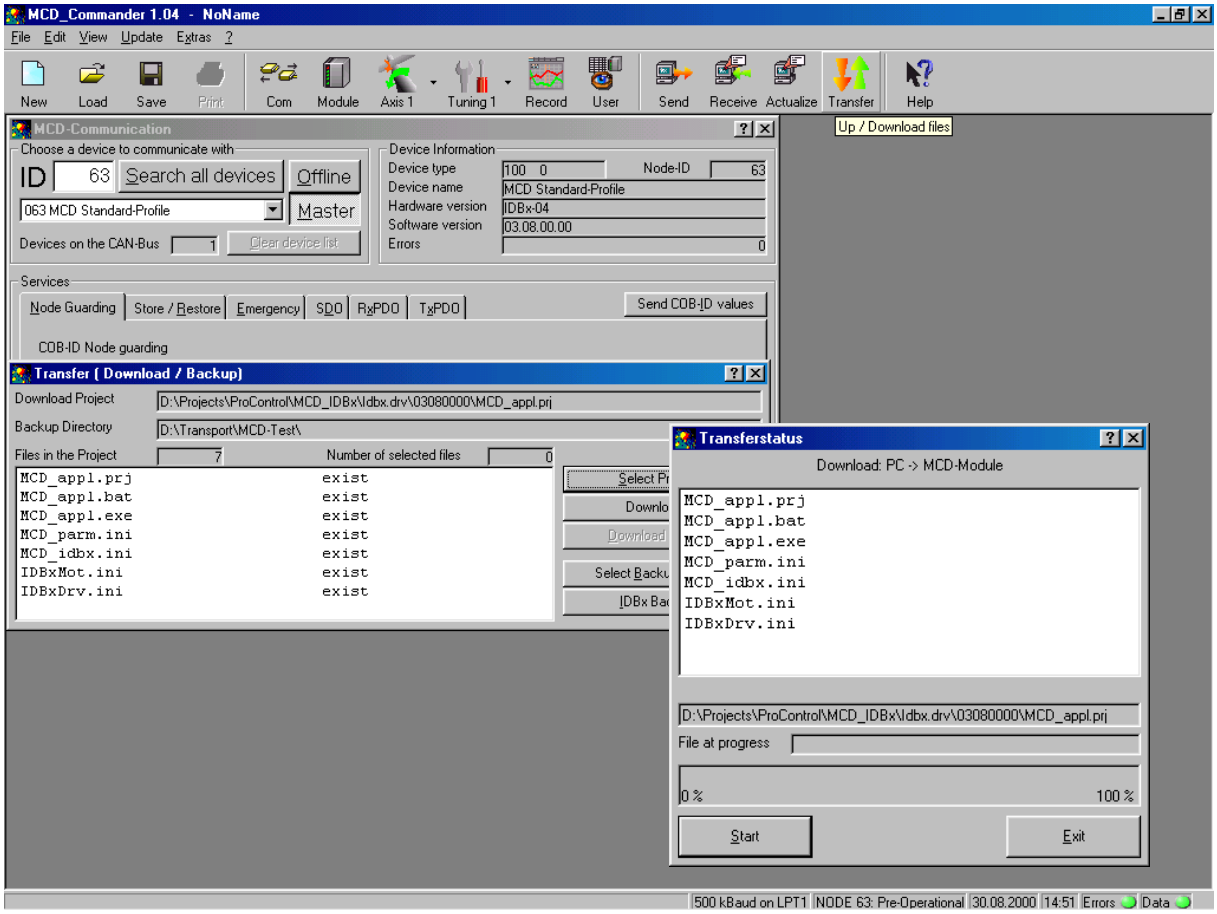
The following physical digital inputs are exist at different IDBx modules.

Modul	Connecter	Description		
IDBs	J1 Pin 16	DIGITAL INP 0	+24 VDC (optoisolated)	default:: AXIS 1 ENABLE
	J1 Pin 15	DIGITAL INP 1	+24 VDC (optoisolated)	
	J1 Pin 18	DIGITAL INP 1	+24 VDC (optoisolated)	
	J3 Pin 1	DIGITAL INP 2	+5 VDC (not optoisolated)	
	J3 Pin 12	DIGITAL INP 3	+5 VDC (not optoisolated)	
	J3 Pin 7	DIGITAL INP 4	+5 VDC (not optoisolated)	
IDBm	J8 Pin 17	DIGITAL INP 0	+24 VDC (optoisolated)	default: AXIS 1..3 ENABLE
	J8 Pin 14	DIGITAL INP 1	+24 VDC (optoisolated)	
	J8 Pin 15	DIGITAL INP 2	+24 VDC (optoisolated)	
	J8 Pin 16	DIGITAL INP 3	+24 VDC (optoisolated)	

13 Project Up- / Download

Following the step by step instructions for project up- or download.

13.1 MCD-Commander



13.1.1 Upload/Backup

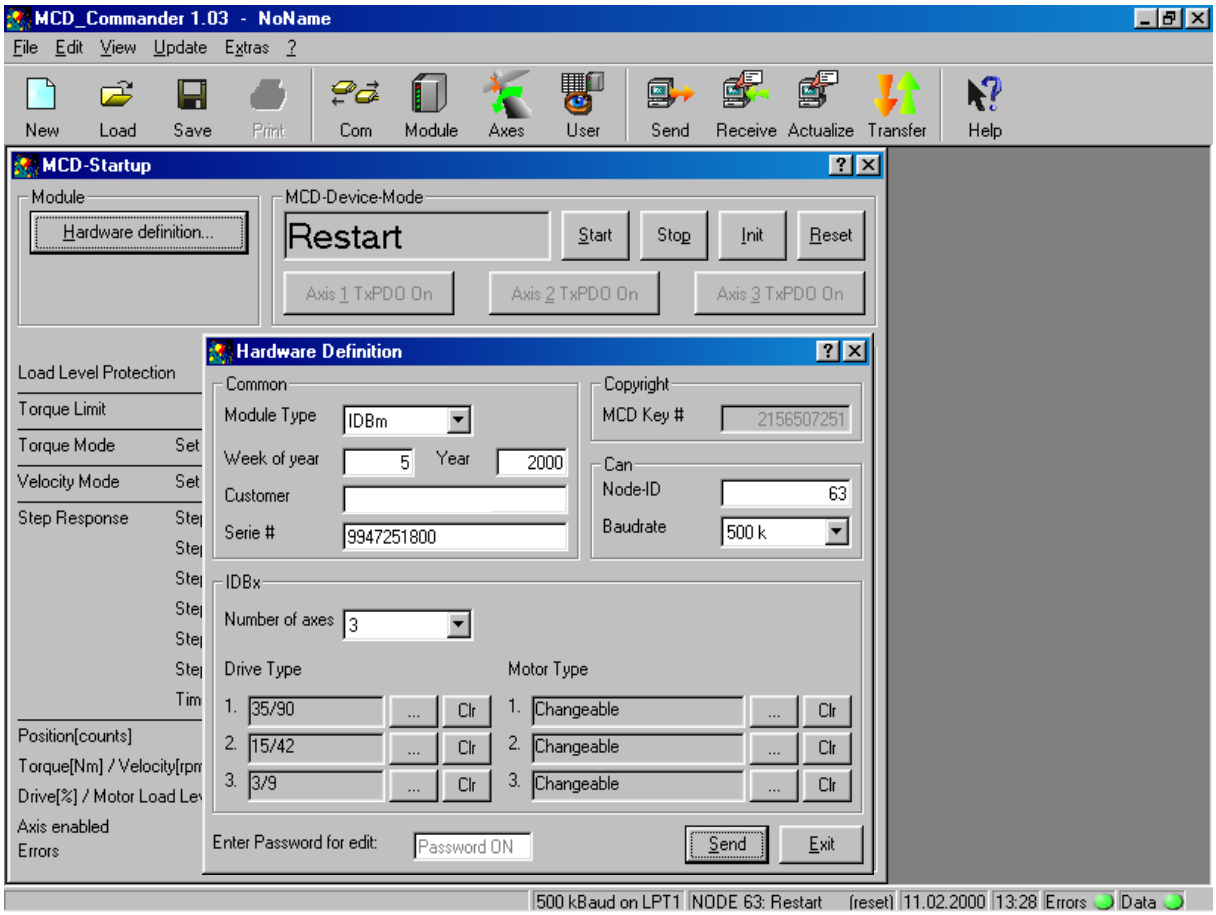
- Start the MCD-Commander and select the IDBx-Module with the right ID number (default 63)
- Select Transfer-Popup (Ctrl & F4) and press ***Select Backup Directory*** to select the directory to store the project files.
- Press ***IDBx Backup*** to activate project upload.
- Press ***Start*** to start the project upload transferring.

13.1.2 Download

- Start the MCD-Commander and select the IDBx-Module with the right ID number (default 63)
- Select Transfer-Popup (Ctrl & F4) and press ***Select Project…*** to select the project directory where the right project is stored with the existing ????.PRJ file.
- Press ***Download All*** to select all project files download.
- Press ***Start*** to start the project download transferring.
- After completely download press ***Reset*** for restart the IDBx-Module. If was't before a MCD-Profile compatible project installed, press the reset button at IDBx-Module.

14 Hardware-Definition

On the MCD-Startup side (MCD-Commander) there is the button to define the hardware. To change the hardware parameter the Device must be in the Restart, Pre-Operational or Preparing mode. For edit the hardware the password must be set. If all hardware parameter defined press the button ***send*** for download the new definition. The new definition will be valid after a IDBx-Module reset.



SECTION 6 - TROUBLESHOOTING

FIG. 6.1 - IDBM-PS Power Supply - OVER TEMP red LED on Overtemperature

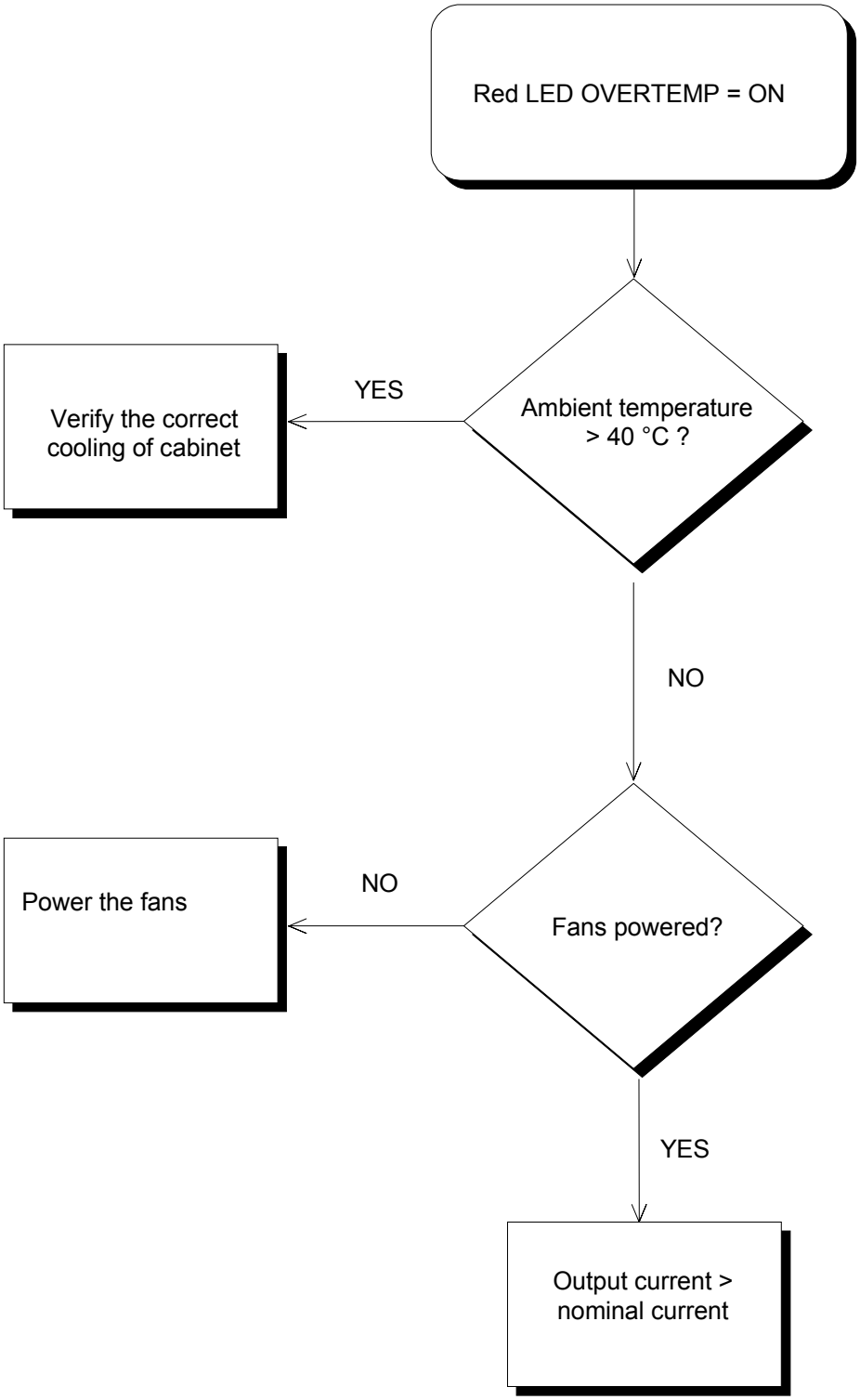


FIG. 6.2 - IDBM-PS Power Supply - DBR FAULT red LED on Recovery Fault

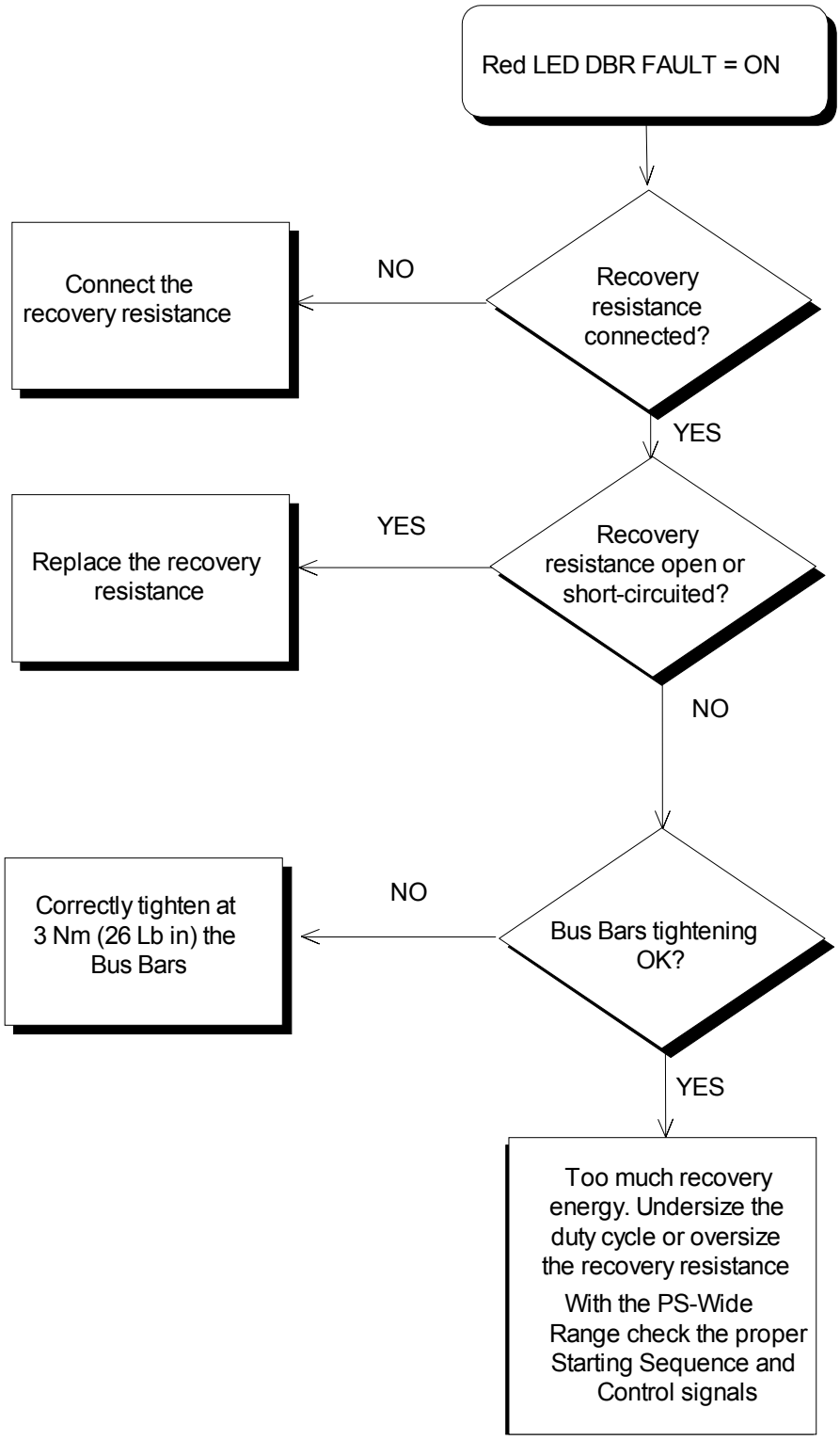


FIG. 6.3 - IDBM-PS Power Supply - PWR BUS yellow LED off

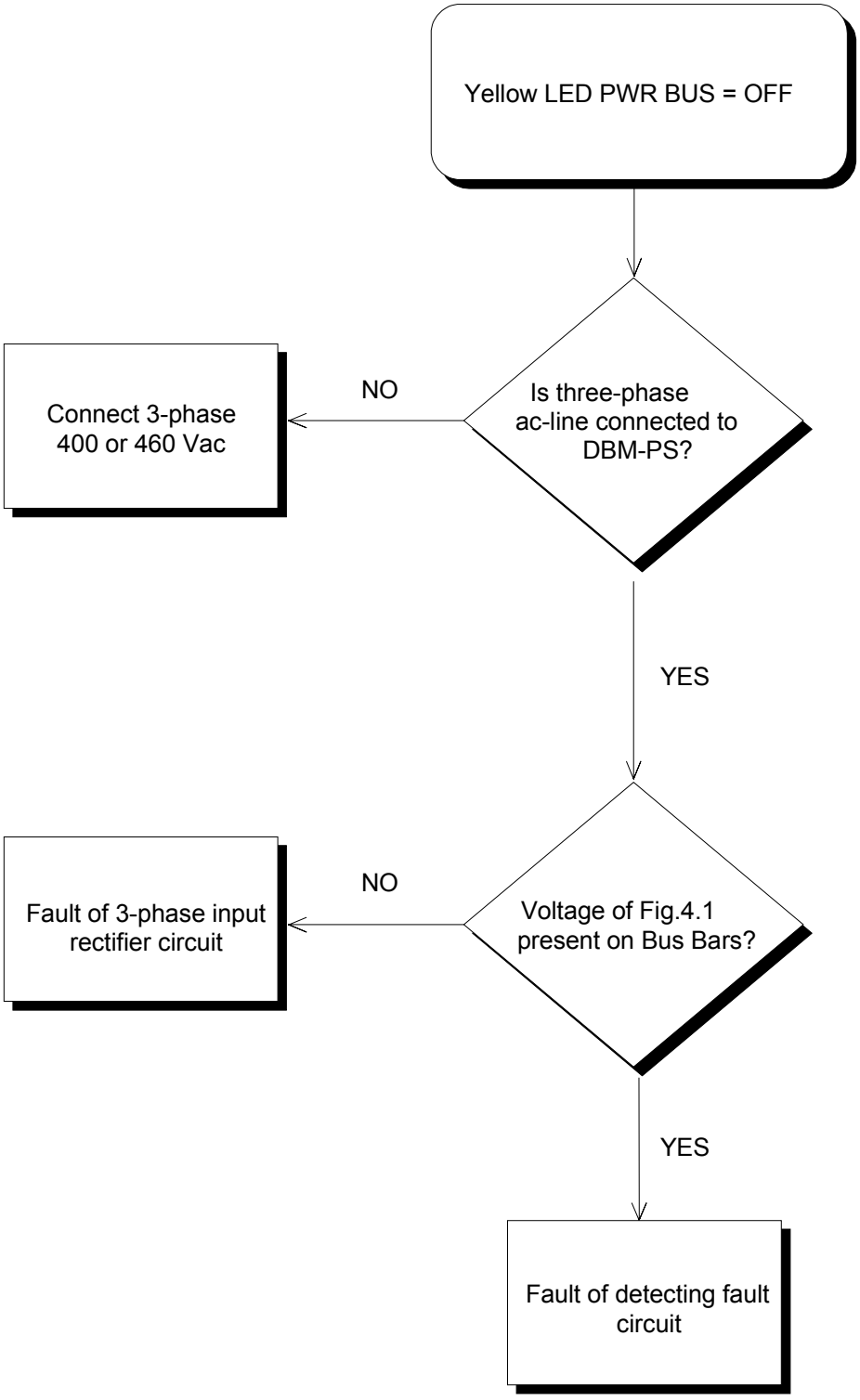


FIG. 6.4 - IDBM PS-Standard and PS-6M Power Supply - AUX PWR green LED off

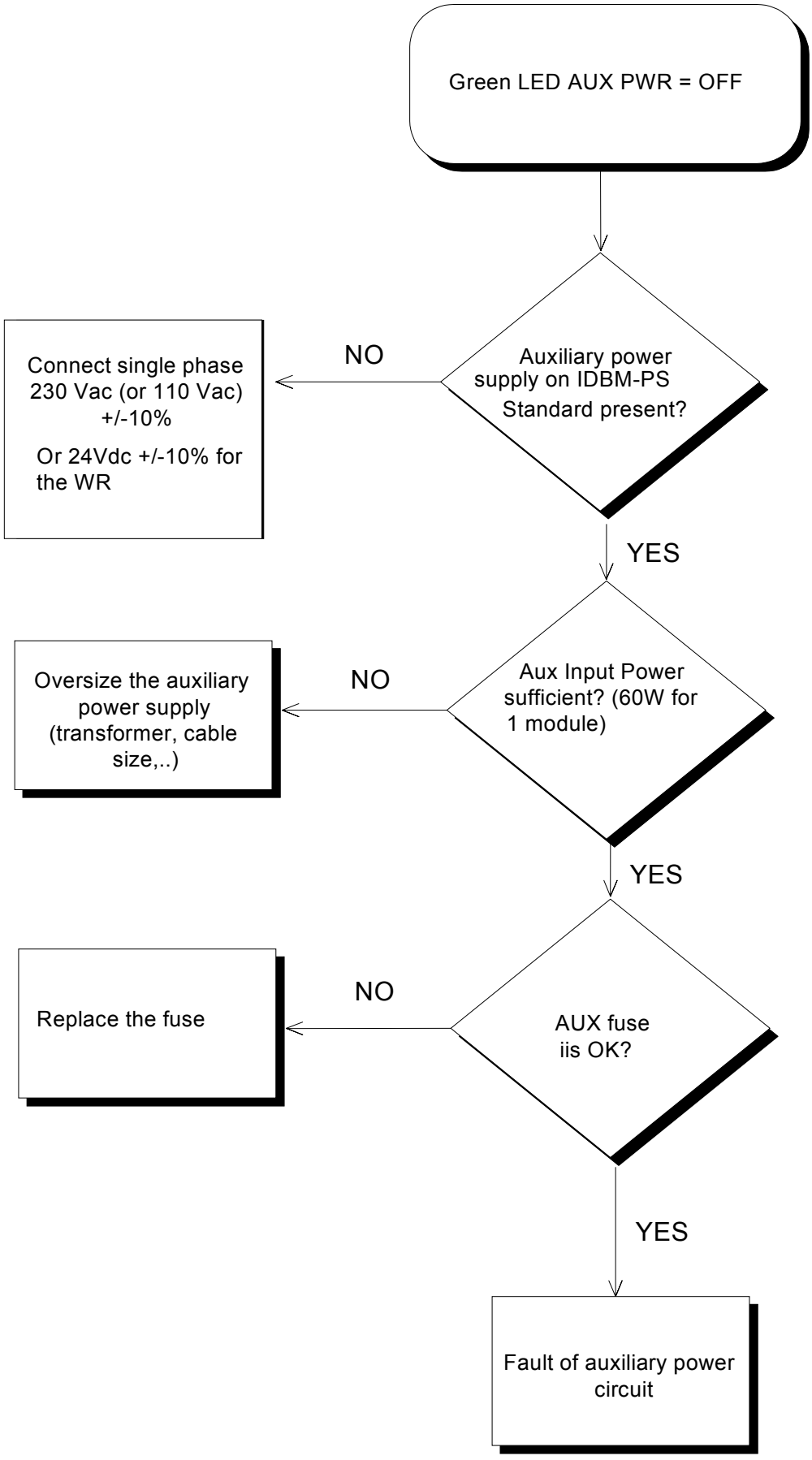


FIG. 6.5 - IDBM Module - POWER OK green LED off

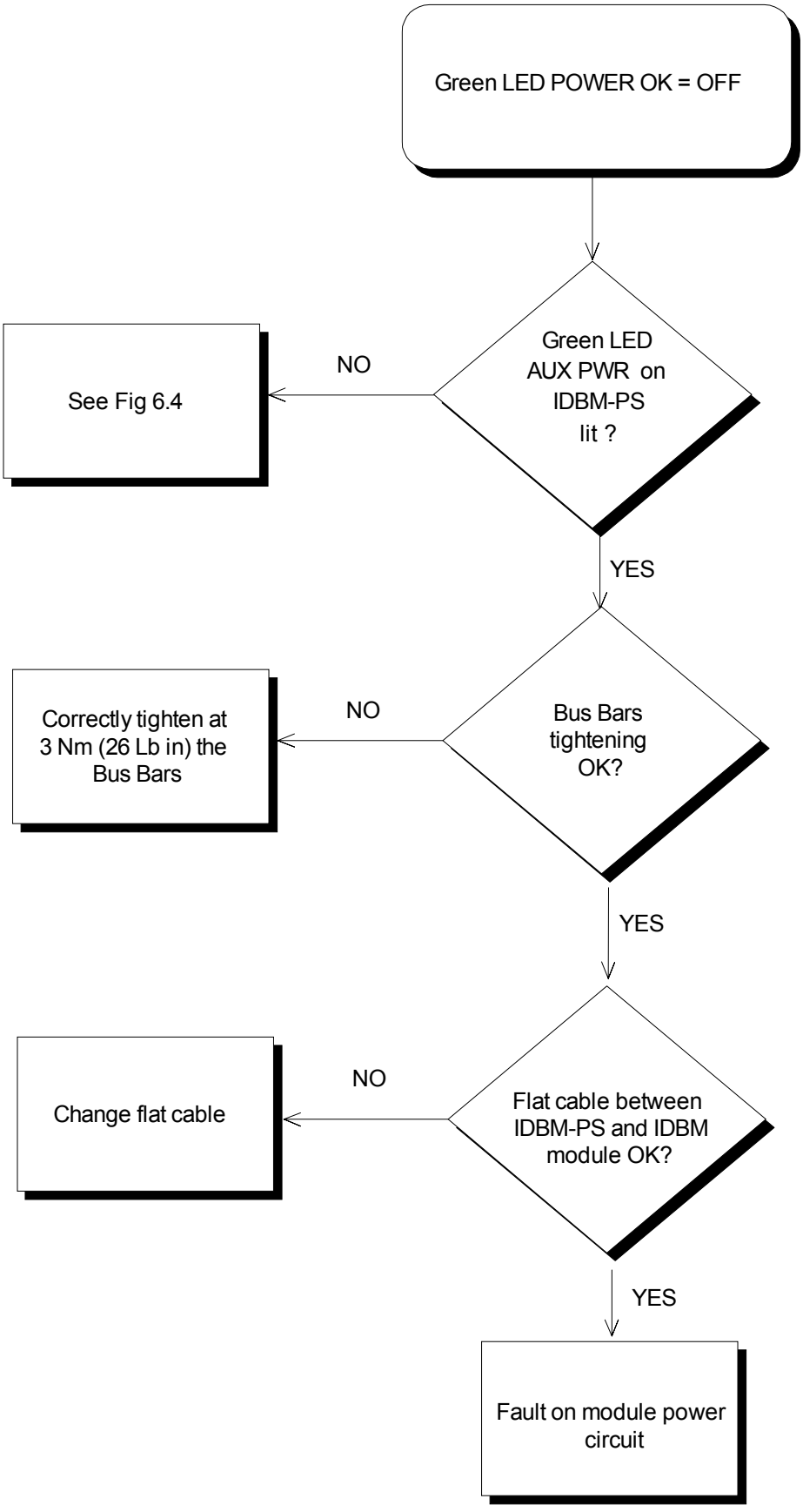


FIG. 6.6 - IDBM Module - DR.EN1/DR.EN2/DR.EN3 green LED off
Digital Input Axis 1/Axis 2/Axis 3

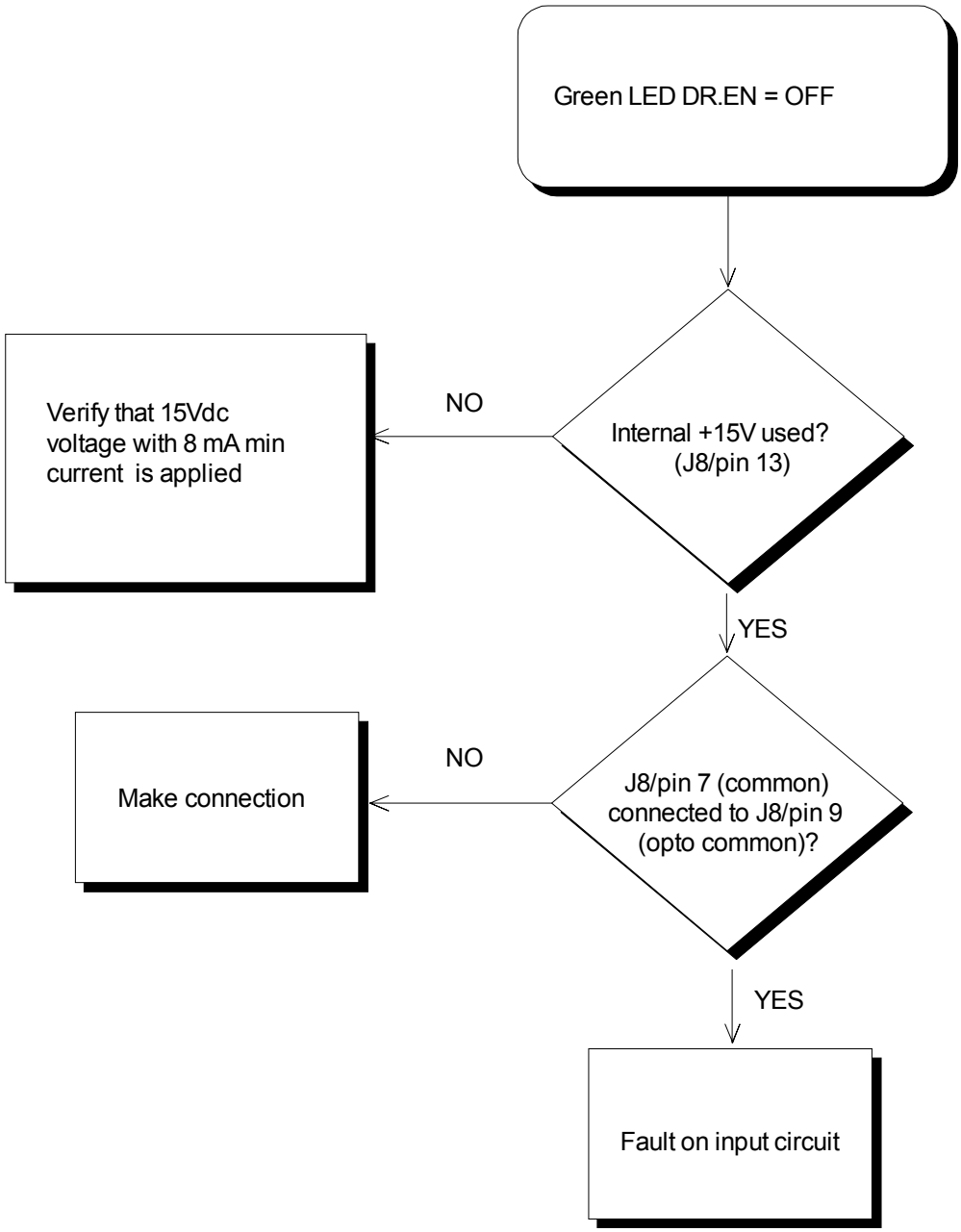


FIG. 6.7 - IDBM Module - REF.EN green LED off
Module Enable

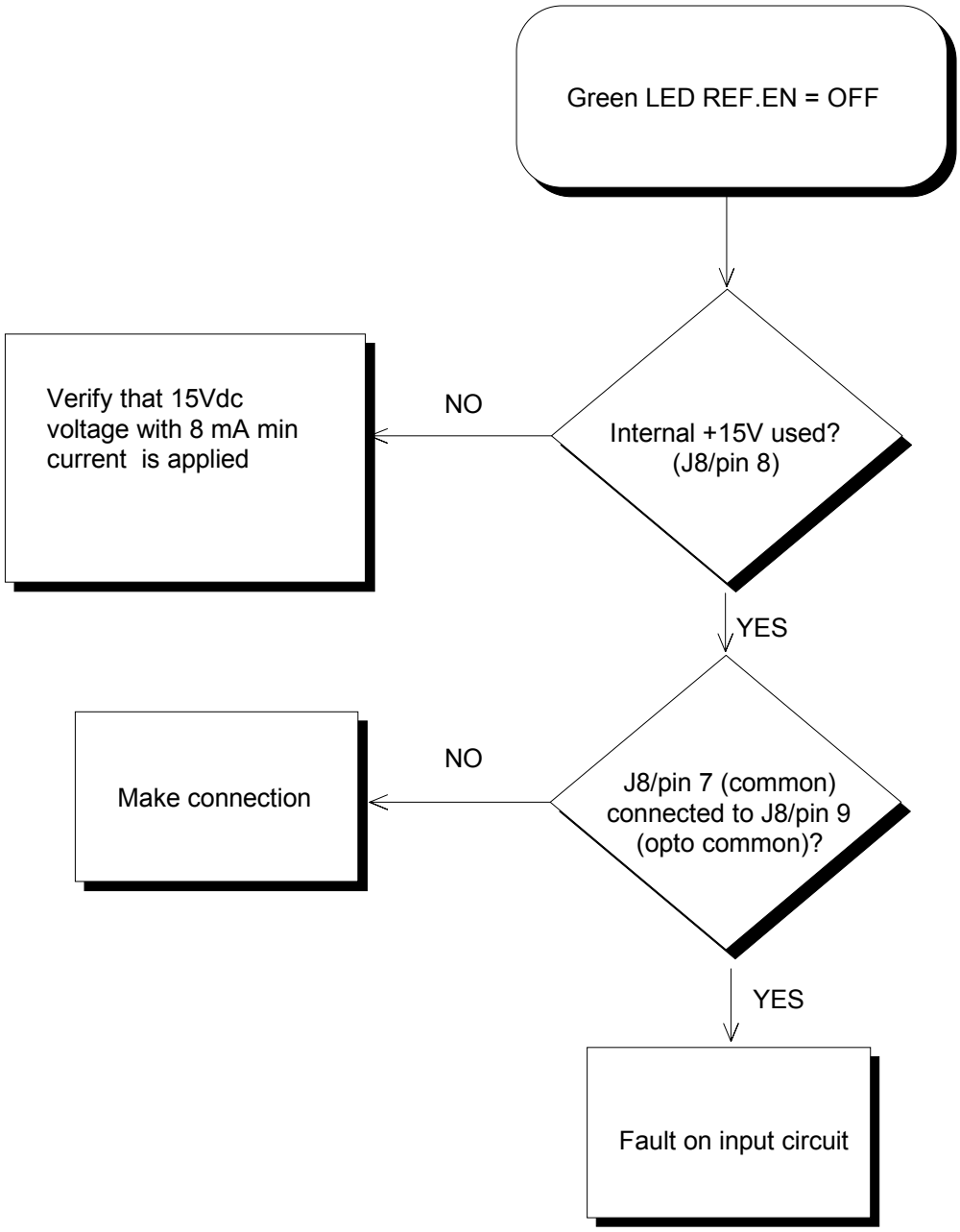


FIG. 6.8 - IDBM Module - DR.OVT red LED on
IDBM Overtemperature

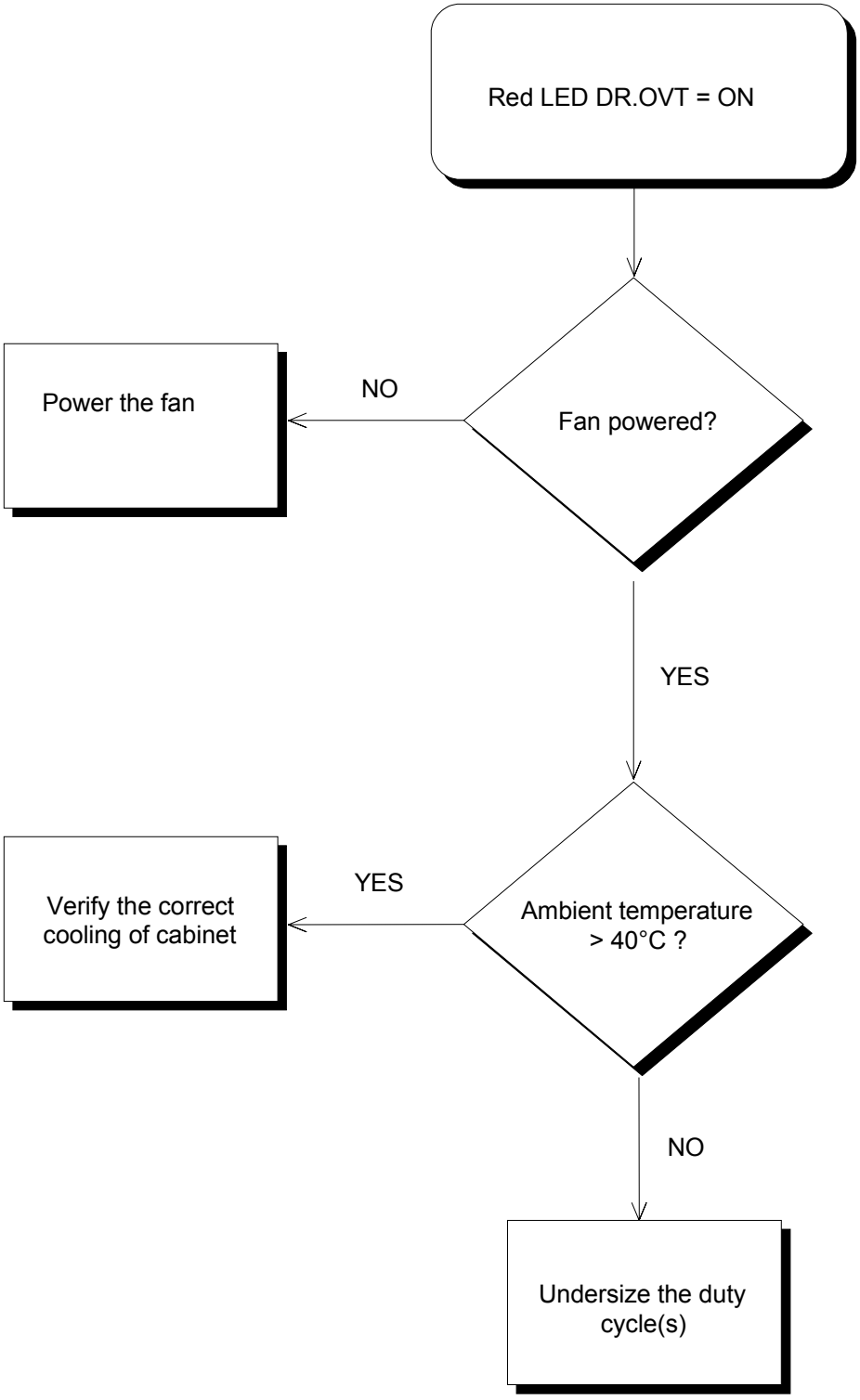


FIG. 6.9 - IDBM Module - PWRF1/PWRF2/PWRF3 red LED on Power Circuit Fault Axis 1/Axis 2/Axis 3

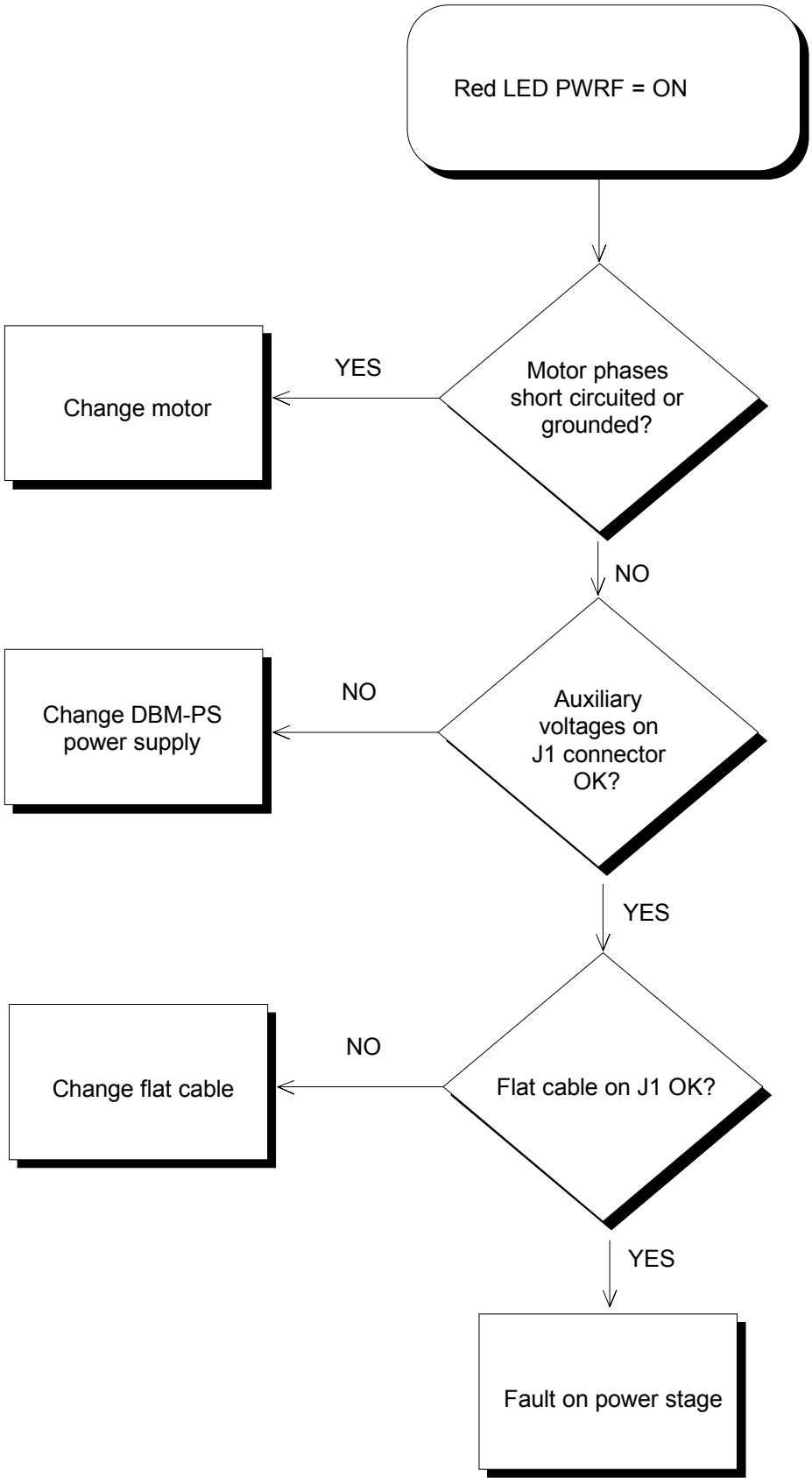


FIG. 6.10 - IDBM Module - OT1/OT2/OT3 red LED on
Motor Overtemperature Axis 1/Axis 2/Axis 3

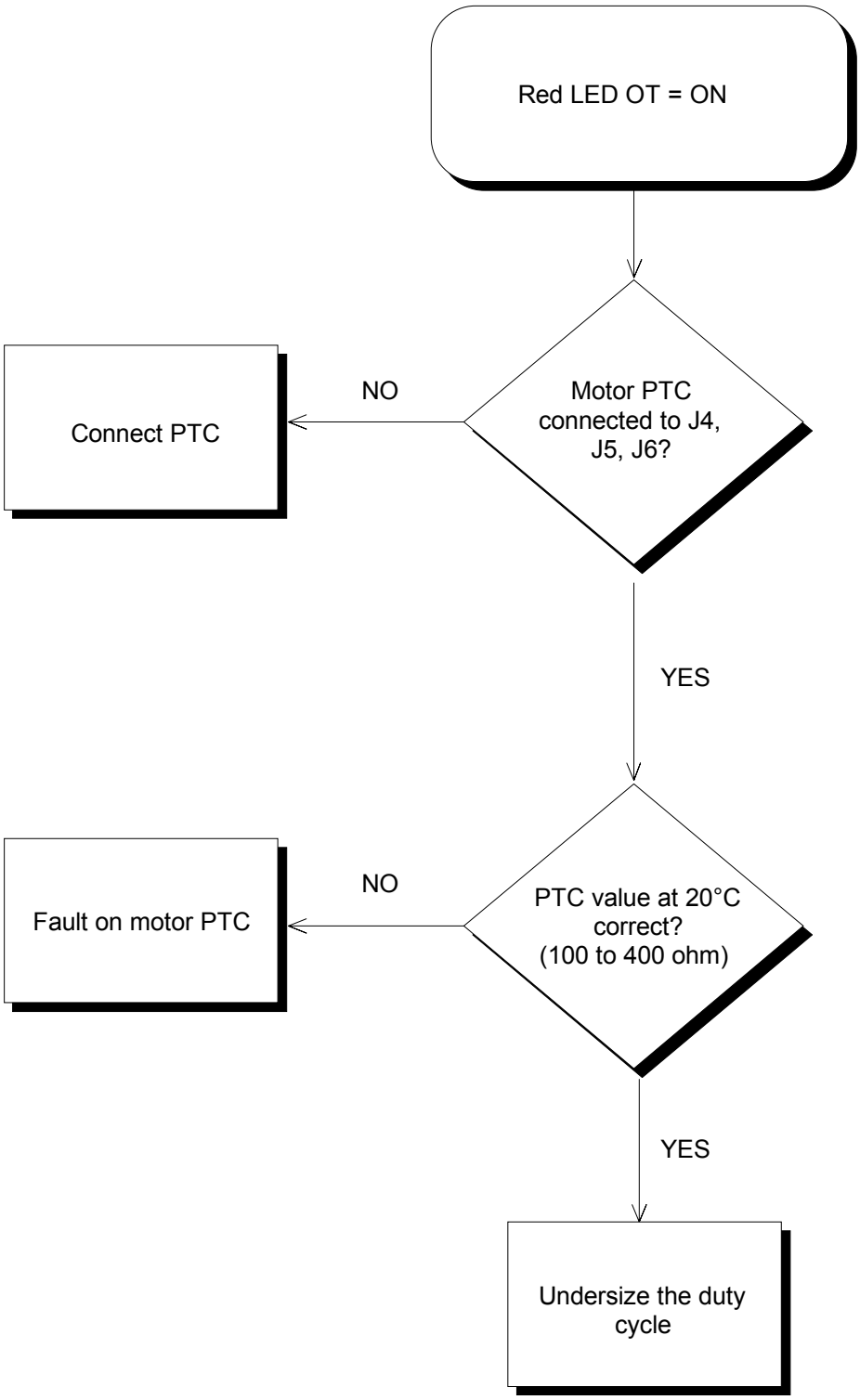


FIG. 6.11 - IDBM Module - RF1/RF2/RF3 red LED on
Resolver Fault Axis 1/Axis 2/Axis 3

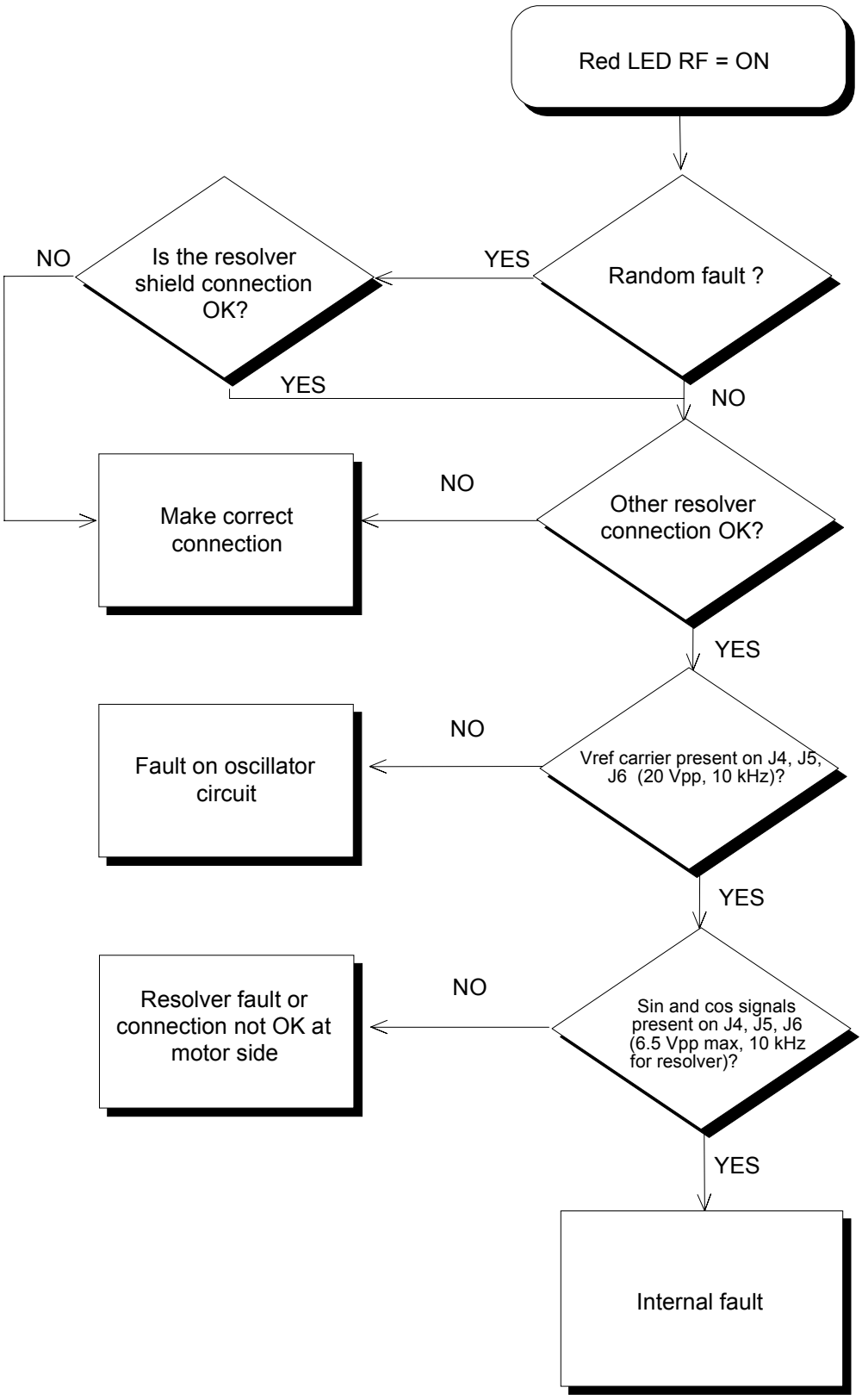


FIG. 6.12 - IDBM Module - WTD red LED on Watch Dog

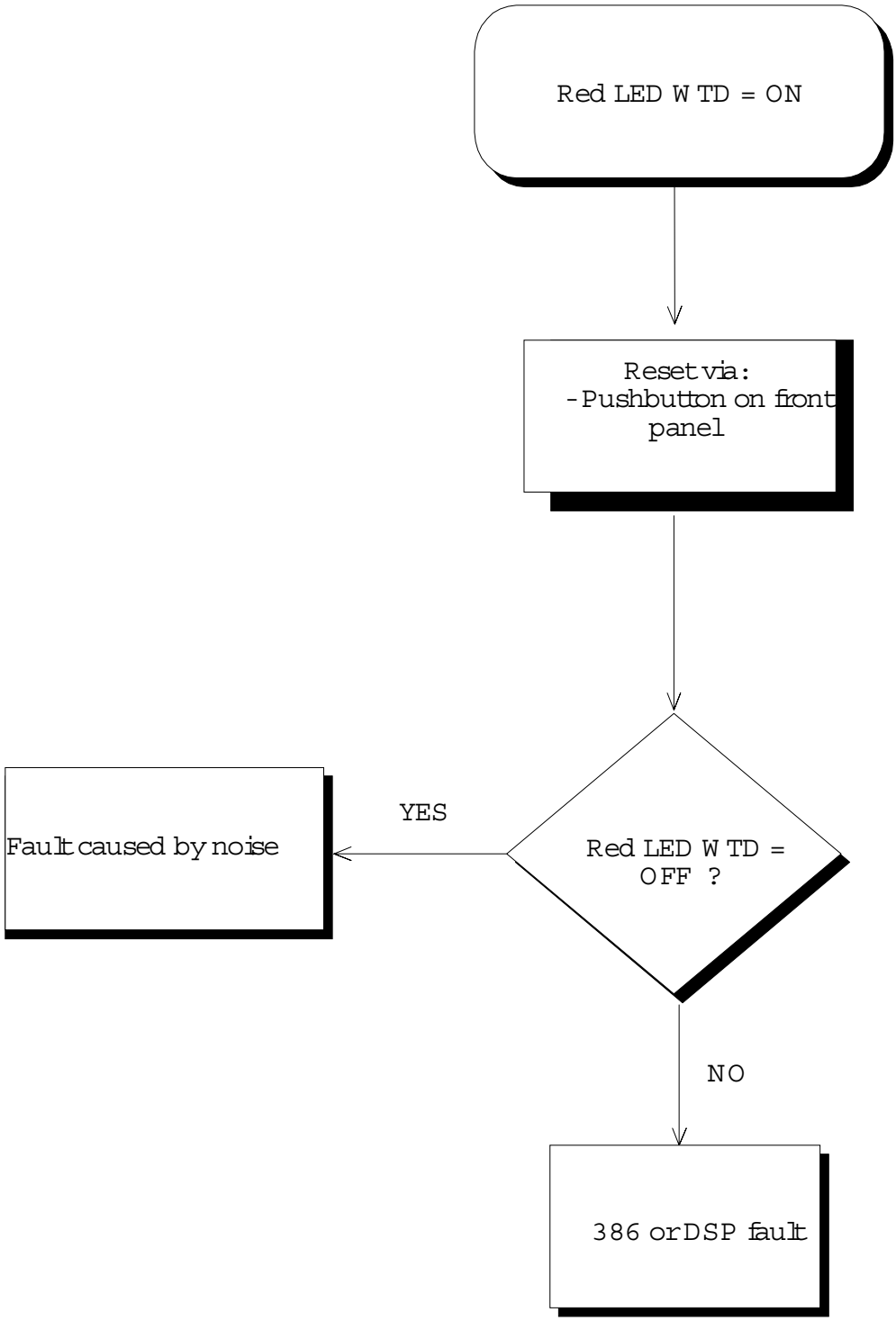


FIG. 6.13 - IDBM Module - DRF red LED on Module Fault

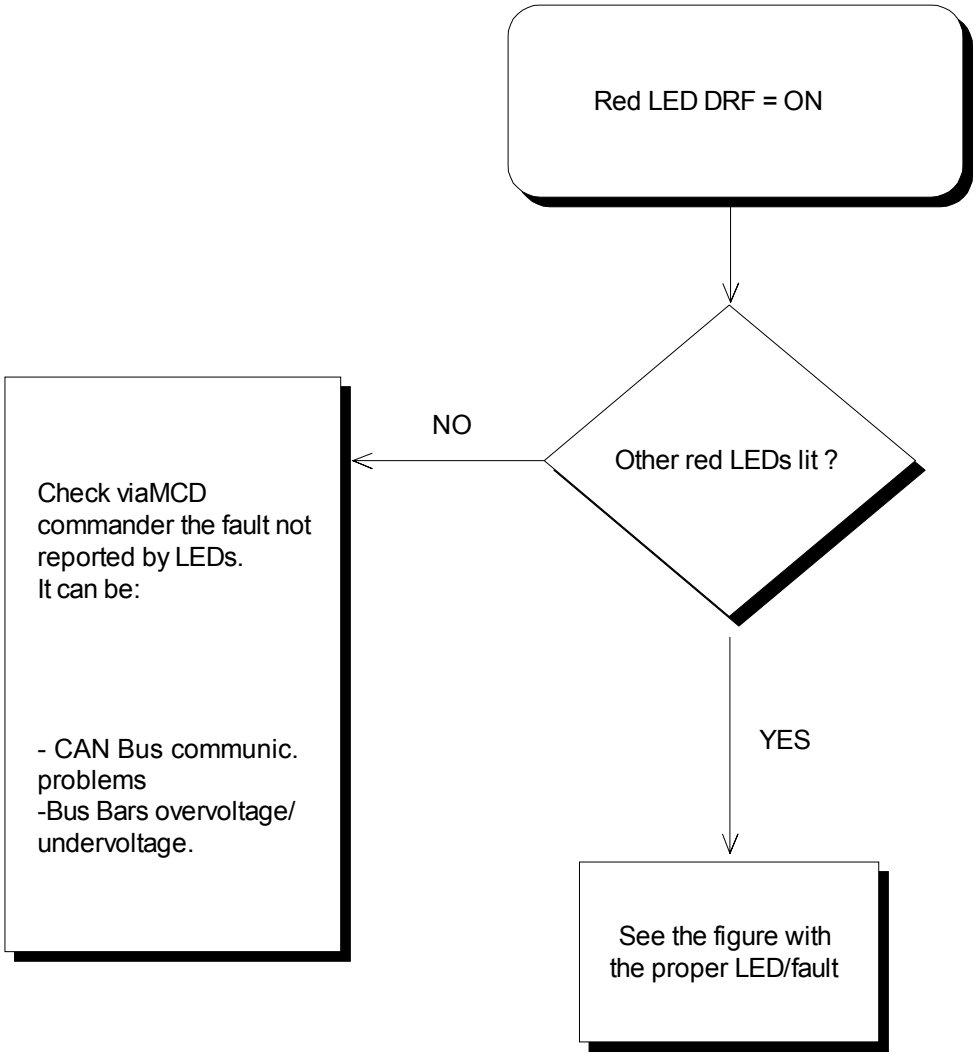


FIG. 6.14 - Motor vibrates

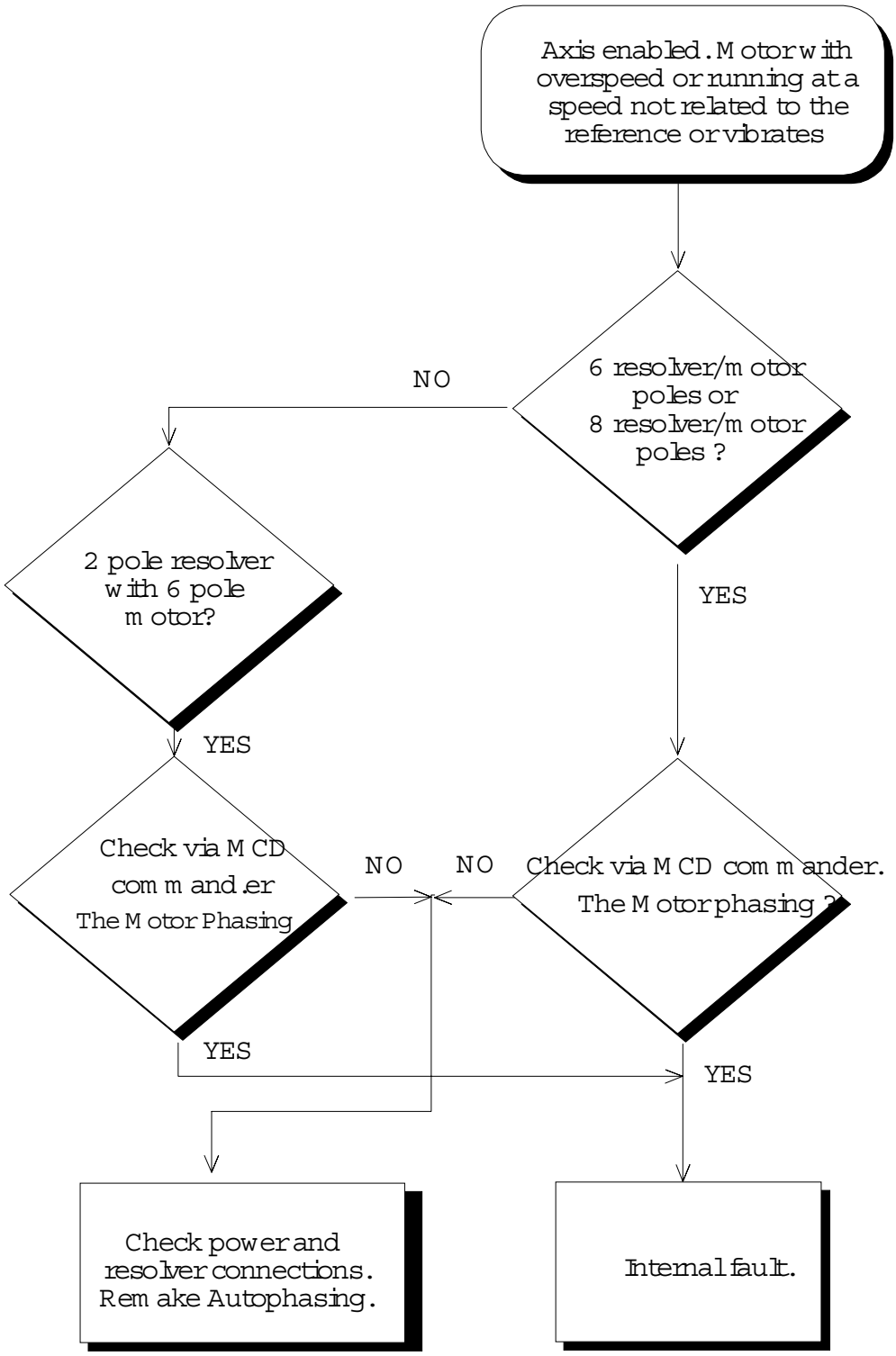


FIG. 6.15 – MCD Commander Fault

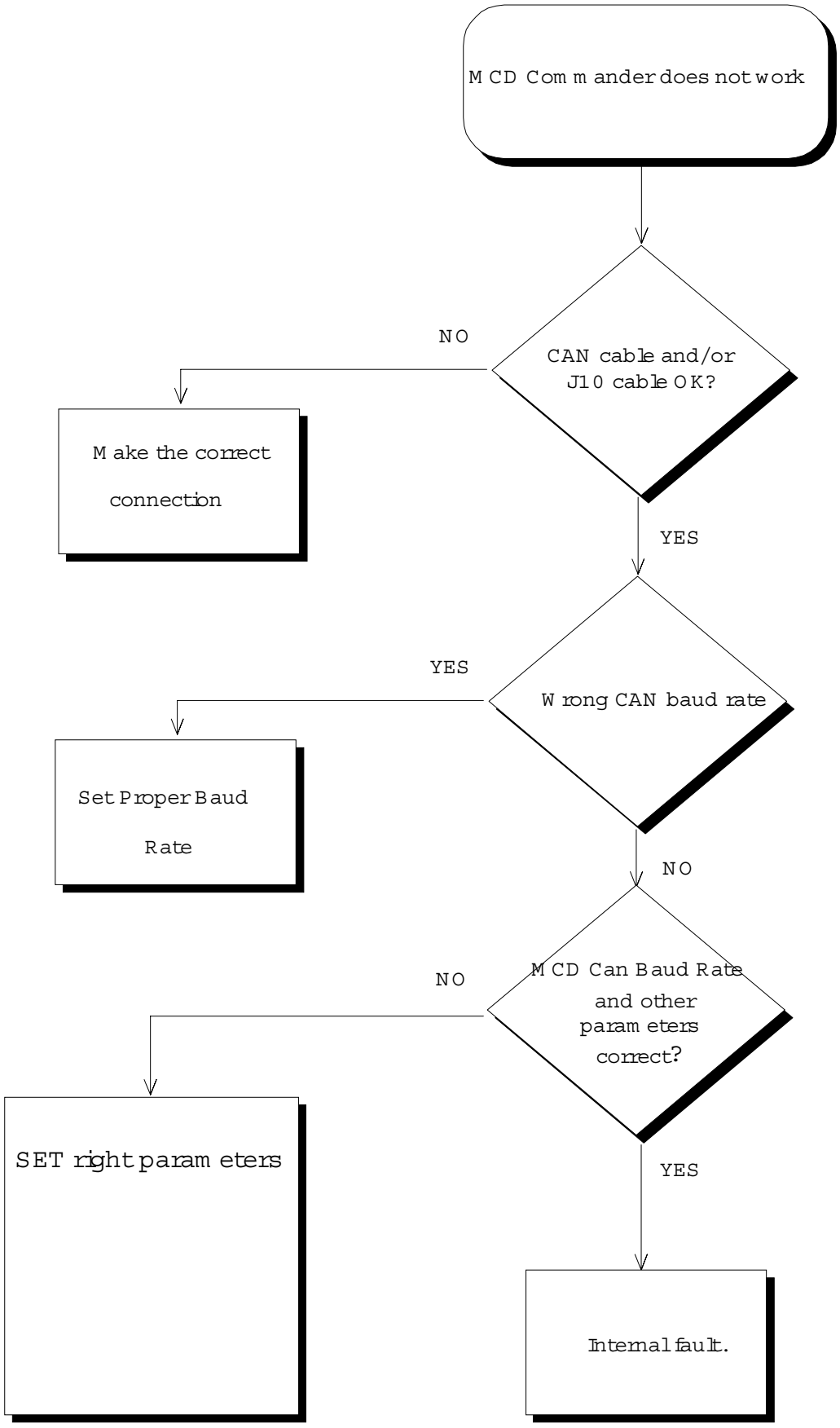
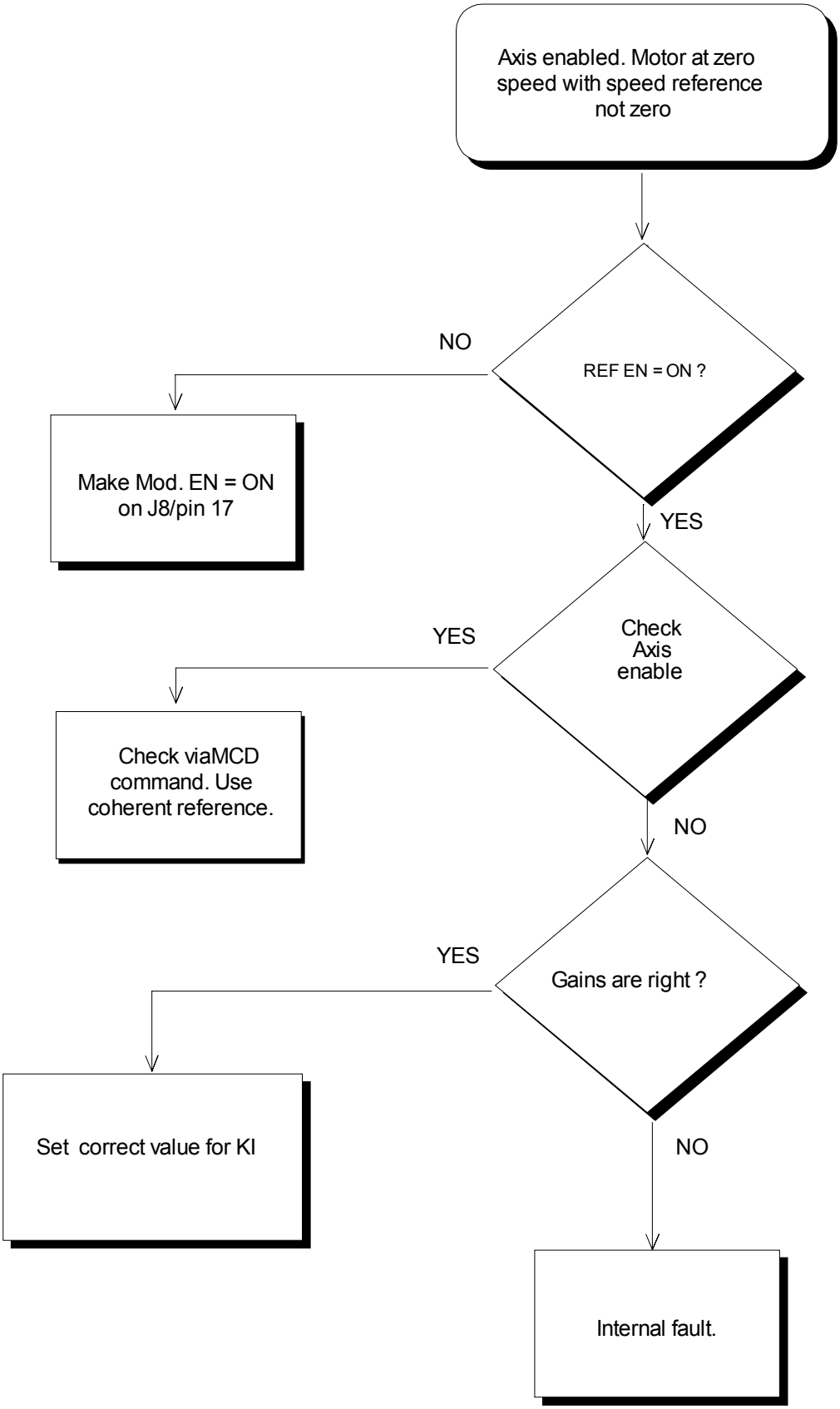


FIG. 6.16 - Motor at zero speed



SECTION 7 – APPLICATION NOTES

7.1 PS-U: Auxiliary Functions Descriptions

7.1.1 DC BUS Discharge

As safety function, it is possible to have a controlled discharge of the DC Bus, using as inputs the K3+ and common.
With the internal jumper J4 it is possible to select between a delay of 300ms (opened) or 1 s. (closed) from the opening of the Aux. Contact.
For the connection, make reference to the next page diagrams

7.1.2 DC BUS LOW

It is available on N.A. contact an output on pins DC-Bus Low. (50 ma and 30 Vdc max).
If the voltage value of the DC Bus is lower than 50 Vdc, the contact is closed to allow the operations inside than machine in safe conditions
For the connection, make reference to the next page diagrams

Wide-Range Power Supply DC-bus discharge function

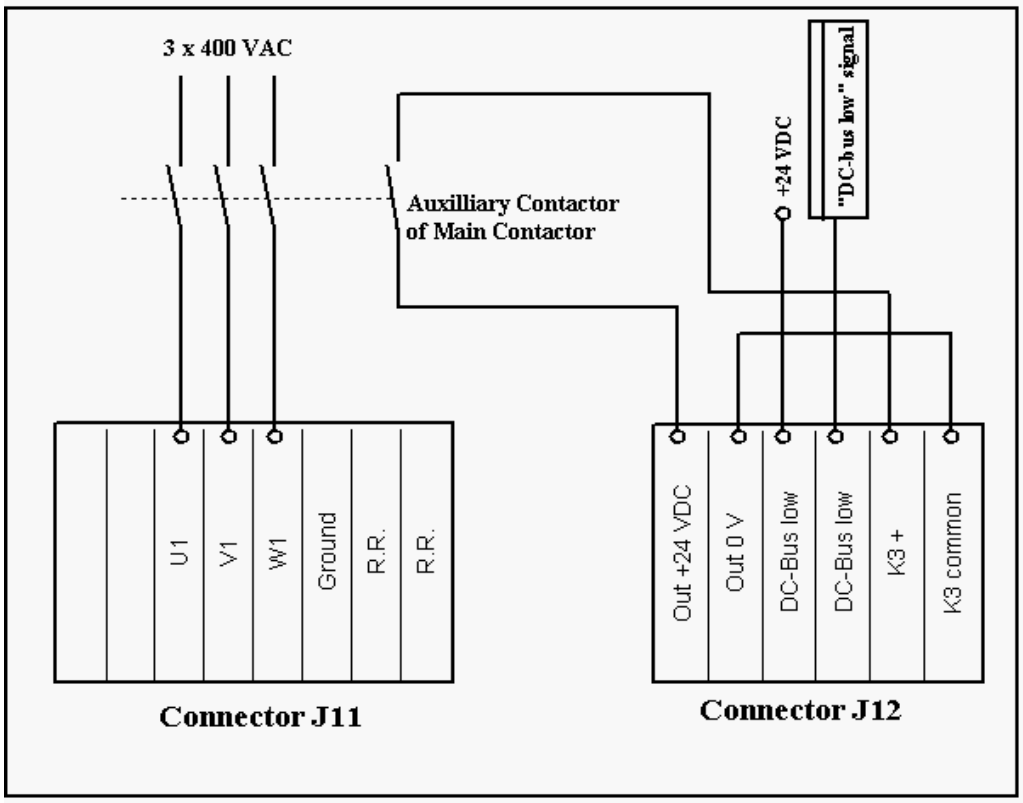


Fig. 1: Wiring Sample to discharge the DC-bus when powercontactor is disengaged

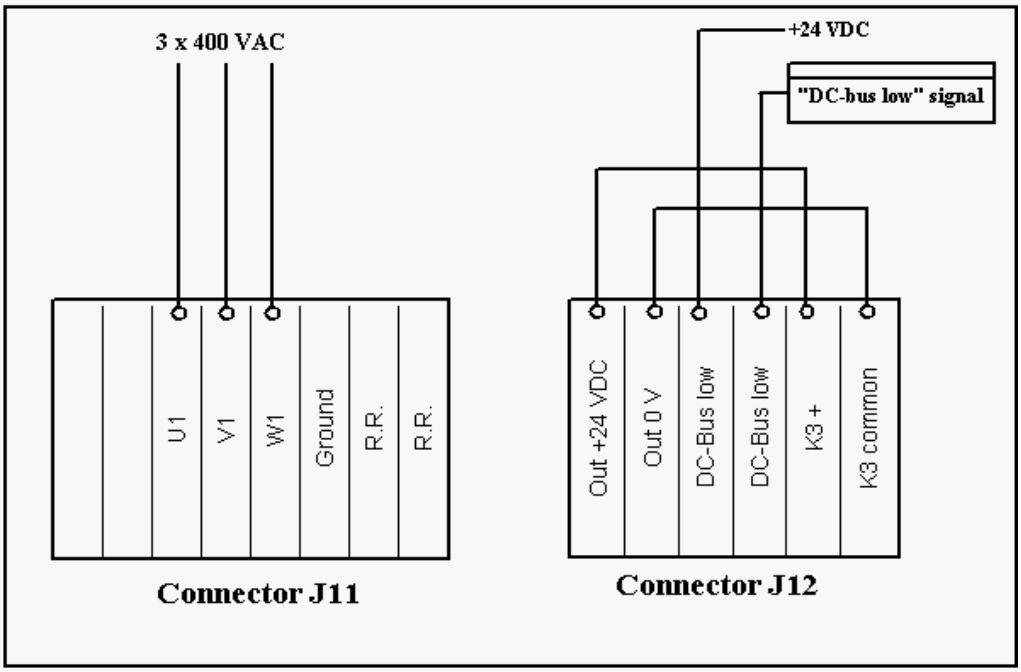


Fig. 2: Wiring Sample if no DC-bus discharge function is required

SECTION 8 - RESTART INTERLOCK CIRCUIT (Optional)

8.1 Safety Requirements

- **Controlled Stop Time**. The final machine must be able to stop the motors in less than 360 ms. The hazard/risk assessment of the application must demonstrate that within this time persons cannot be injured. The drive can provide the Anti Free Wheeling function to perform the controlled stop.

- **Free-Wheeling Detection**. The external system must be able to detect free-wheeling when the axis does not stop within 360 ms after the Module Enable signal goes away. This system must have the motor velocity available.

  WARNING*: The designer must evaluate the machine stopping time during the risk assessment even in case of failure. The machine can present a dangerous overrun in case of failure of the drive. Other protective measure are needed to achieve a safe condition.*

- **Environmental Conditions.** Equipment intended to operate within the following environmental conditions:
  - ◊ Ambient temperature: 0 to 40°C
  - ◊ Supply voltage interruptions: 10, 20, 500 ms dip time
  - ◊ EMC immunity: according to EN 61000-6-2:1999 (Generic Standard - Immunity for industrial environment)
  - ◊ Vibration: 5 to 9Hz, 3.0 mm amplitude (peak); 9 to 200Hz, 1 g acceleration
  - ◊ Shock: 10 g, half sine, 6 ms

- **Enclosure.** Electronic Equipment intended for installation in an enclosure providing at least IP54 protection.

- **Pollution Degree 2 Installation** - The equipment shall be placed in a pollution degree 2 environment, where normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation is to be expected, when the electronic equipment is out of operation.

- ***WARNING****: When the Restart Interlock Circuit is activated, the motor can no longer generate a torque. Motors which are not automatically clamped when powered down (e.g. vertical/inclined axes), must be clamped using a mechanical brake*

8.2 Restart Interlock Function

The "Restart Interlock" function is included in the drive modules as an option.

The power feed from the converter to the motor is interrupted with the restart interlock (motor rotation). This is based on standard EN 60204-1:1997.

The restart interlock prevents motor unexpectedly starting from standstill. This circuit macro can be used in the "Safe stand-still" machine function. However, beforehand, a complete standstill must be achieved and ensured using the external machine control.

This is especially valid for vertical axes without any self-locking mechanical system or without weight equalization.

The dual-channel restart interlock circuit has been validated by demonstrating that a single fault does not lead to the loss of the safety function (Category 3 according to EN 954-1:1996). The remaining risk is in this case, if two errors/faults occur simultaneously in the power section; the motor briefly rotates through a small angle (Fastact motors: 6-pole 60°, 8-pole 45°, 12-pole 30°, 16-pole 22.5°).
The marking DRC identifies the dual-channel restart interlock circuit.

A single-channel restart interlock circuit is also available as an option when only Category 2, according to EN-954-1:1996, is required. With this circuit a single fault can lead to the loss of the safety function. The marking SRC identifies the single-channel restart interlock circuit.

The restart interlock function does not provide electrical isolation. It does not provide protection against "electric shock".

The complete machine or system must always be electrically isolated from the line supply through the main disconnection device (main switch) before any work is carried out on the machine or system, e.g. maintenance, service or cleaning work (refer to EN 60204-1:1997, par. 5.3).

When correctly used, the restart interlock function must be looped in in the line contactor circuit or EMERGENCY STOP circuit. The associated drive must be electrically isolated from the supply if the restart interlock relay function is not plausible, referred to the machine operating mode. The restart interlock and the associated operating mode may only be used again after the fault has been removed.

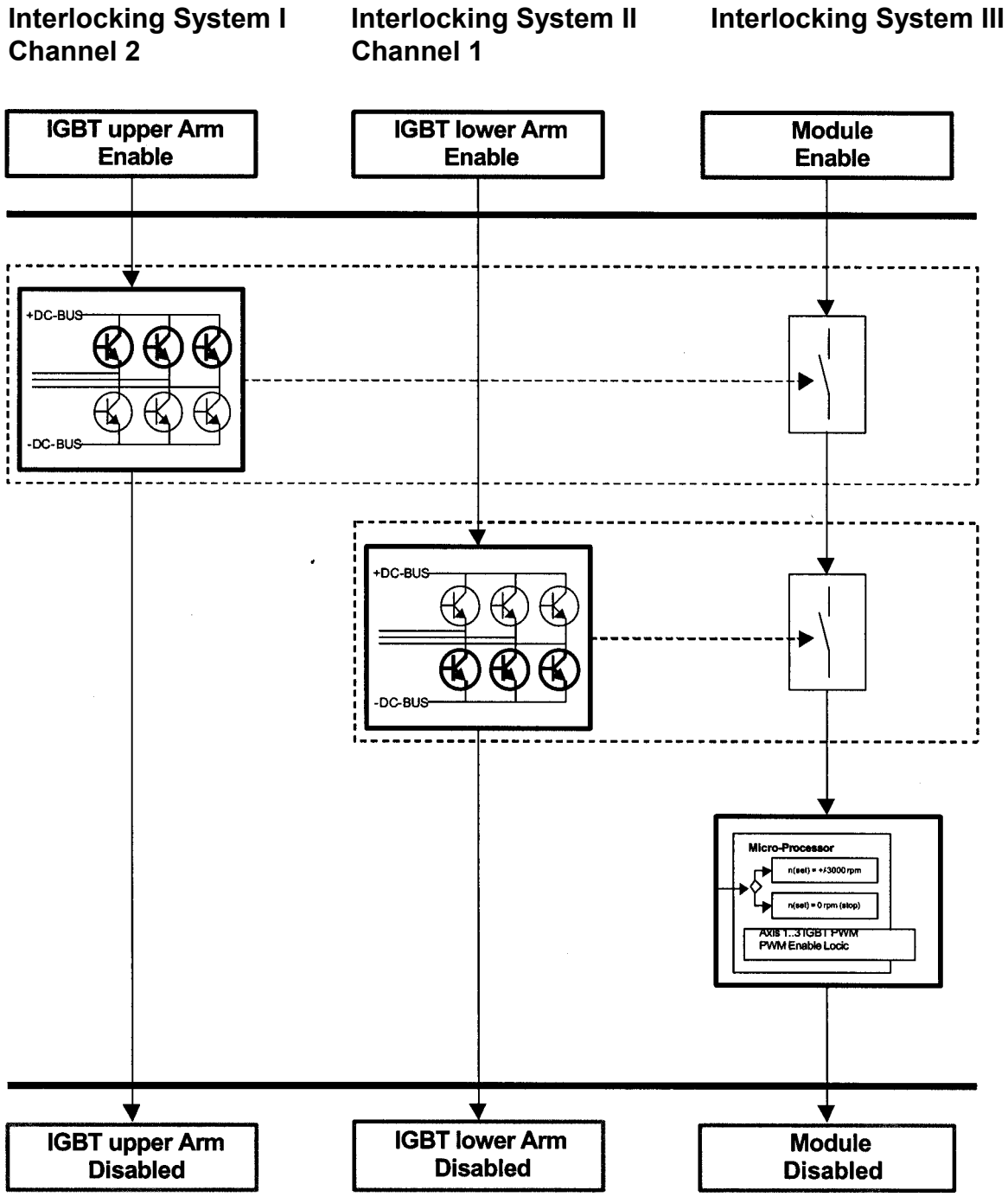
As a result of a hazard analysis/risk analysis which must be carried out according to the Machinery Directive 98/37/EC modified and referring to standards EN 292 1/2; EN 954-1; and EN 1050, the machinery manufacturer must configure the safety circuit for the complete machine taking into account all of the integrated components for his machine types and versions of them. This also includes the electric drives.

8.3 Dual-Channel Restart Interlock Circuit

***WARNING**: When the Dual-Channel Restart Interlock Circuit is activated, the motor can no longer generate a torque. Motors which are not automatically clamped when powered down (e.g. vertical/inclined axes), must be clamped using a mechanical brake*

Three redundant interlocking devices with mutual observation acting on the input power as well as on the signal path to the power control devices.

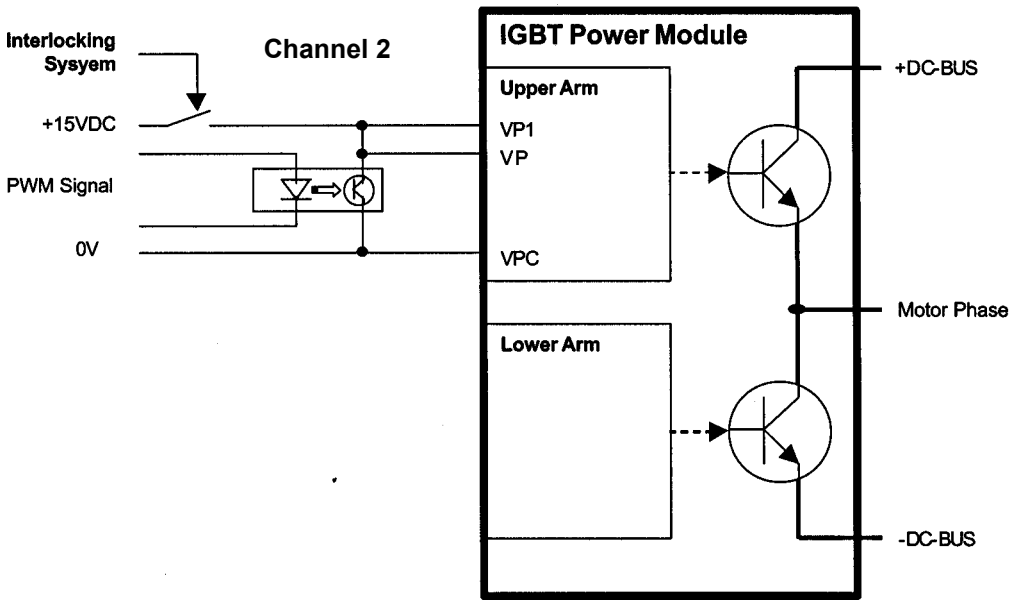
Fig. 8.1 Block Diagram of Dual-Channel Restart Interlock Circuit



8.3.1 Interlocking System I

Interlocking System I disconnects the power supply for **Channel 2** (Upper Arm IGBT). A self contained auxiliary contactor disconnects the **Module Enable** signal when Interlocking System I becomes active.

Fig. 8.2 Interlocking System I



For observing Interlocking System I the input signal Channel 2 door (Upper Arm IGBT Enable) and the output signal Channel 2 verification (Upper Arm IGBT disabled) must be checked to have the appropriate status under the following conditions:

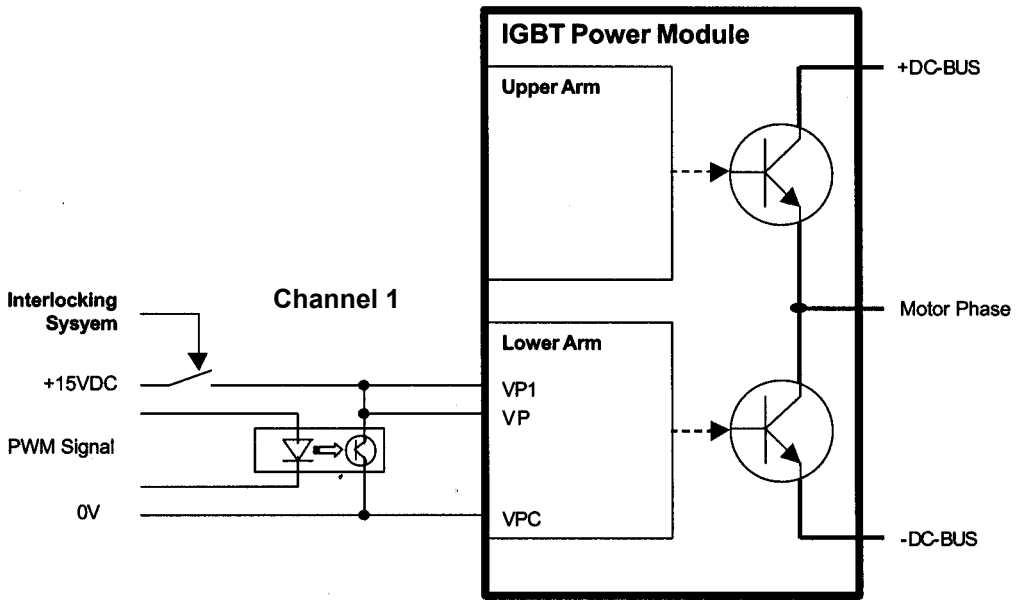
Channel 2 door = 0	Channel 2 verification = 1
Channel 2 door = 0->1	Channel 2 verification (after a delay of max 100 ms) = 0
Channel 2 door = 1	Channel 2 verification = 0
Channel 2 door = 1->0	Channel 2 verification (after a delay of 600 ms ± 100 ms) = 1

When monitoring a wrong signal status, the line contactor must disconnect the drive supply (see par.8.5). An error message must be available to make the malfunction of the safety circuit visible.

8.3.2 Interlocking System II

Interlocking System II disconnects the power supply for **Channel 1** (Lower Arm IGBT). A self contained auxiliary contactor disconnects the **Module Enable** signal when Interlocking System II becomes active.

Fig. 8.3 Interlocking System II



For observing Interlocking System II the input signal Channel 1 door (Lower Arm IGBT Enable) and the output signal Channel 1 verification (Lower Arm IGBT disabled) must be checked to have the appropriate status under the following conditions:

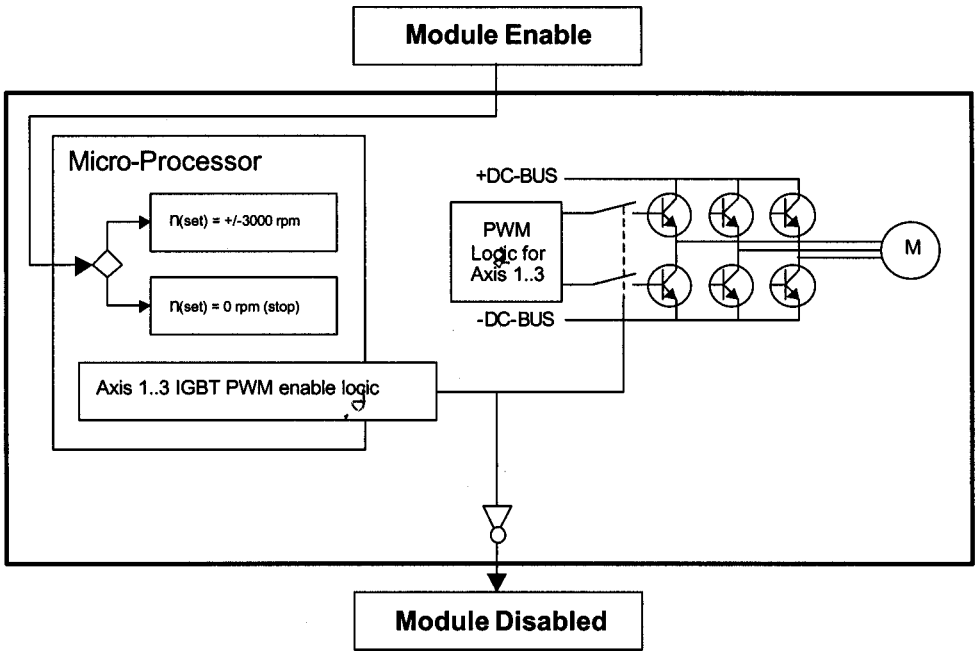
Channel 1 door = 0	Channel 1 verification = 1
Channel 1 door = 0->1	Channel 1 verification (after a delay of max 100 ms) = 0
Channel 1 door = 1	Channel 1 verification = 0
Channel 1 door = 1->0	Channel 1 verification (after a delay of 600 ms ± 100 ms) = 1

When monitoring a wrong signal status, the line contactor must disconnect the drive supply (see par.8.5). An error message must be available to make the malfunction of the safety circuit visible.

8.3.3 Interlocking System III

Interlocking System III interrupts the signal path based on the Module Enable signal. The control changes automatically to velocity control, whereas the set velocity becomes zero.As soon that all axes are at complete stop and all IGBT PWM Enable signals are switched off, the signal Module Disabled becomes active.
The Module Disabled signal is available at pos.13 of J7 connector.

Fig. 8.4 Interlocking System III



For observing Interlocking System III the input signal Module Enable and the output signal Module Disabled must be checked to have the appropriate status under the following conditions:

Module Enable = 0	Module Disabled = 1
Module Enable = 0->1	Module Disabled (after a delay of max 50 ms) = 0
Module Enable = 1	Module Disabled = 0
Module Enable = 1->0	Module Disabled (after a delay of 380 ± 20 ms) = 1

When monitoring a wrong signal status, the line contactor must disconnect the drive supply (see par.8.5). An error message must be available to make the malfunction of the safety circuit visible.

8.4 Restart Interlock Connections

The restart interlock circuit is controlled using the JS1 connector on the front panel.

Tab. 8.1 - Module - JS1 Connector - RIC (Restart Interlock Circuit)
Panel side: male socket, 12 contacts, series 581 by Binder (Moog code AK5500)
Wiring side: female cable connector, 12 contacts, series 680 by Binder (Moog code AK4500)

Pos.	Name	Function
A	+ Channel 2 door	Input to bobbin of the first relay of Channel 2 from door/gate. With the door closed, this input is high (+24Vdc). When the door is opened this input changes to low (0V). The switch off time delay for the safety relay of Channel 2 is invoked. Additionally this opens the module enable contact
B	+ Channel 1 door	Input to bobbin of the first relay of Channel 1 from door/gate. With the door closed, this input is high (+24Vdc). When the door is opened this input changes to low (0V). The switch off time delay for the safety relay of Channel 1 is invoked. Additionally this opens the module enable contact
C	GND	Ground common to the above mentioned bobbins. This ground must be referred to 0V(logic) or floating
D	Module Enable	Series of NO contacts of Channel 1 and Channel 2. These contacts must be connected in series to the Module Enable input wiring. This way, when a door is opened, also the Interlock System III is activated.
E		
F	Channel 1 Verification	NC contact of the safety relay of Channel 1. Feedback of RIC. When closed (high), the Restart Interlock function is active. The external verification system must monitor this output signal for plausibility with its input signal and for comparison with the status of Channel 2 and Module Disabled signal (redundancy verification)
G		
H	Channel 2 Verification	NC contact of the safety relay of Channel 2. Feedback of RIC. When closed (high), the Restart Interlock function is active. The external verification system must monitor this output signal for plausibility with its input signal and for comparison with the status of Channel 1 and Module Disabled signal (redundancy verification)
J		
K	N.C.	
L	N.C.	
M	N.C.	

Note: with the single-channel RIC, only Channel 1 is active. The positions related only to Channel 2 are not connected.

The external cable to JS1 connector must be fail-safe according to prEN 954-2.
The Restart Interlock relays are controlled using the external +24Vdc (pos.A + terminal for Channel 2, pos.B + terminal for Channel 1, pos.C - terminal for both Channels).
When the Channel 2 relays are de-energized, the H-J terminals are closed-circuit and the Restart Interlock Channel 2 is activated. When the Channel 1 relays are de-energized, the F-G terminals are closed-circuit and the Restart Interlock Channel 1 is activated.
The D-E signal contact actives the “Interlock System III”.

***WARNING**: this circuit must be protected against overload and short-circuit using a fuse rated max 2A.*

8.5 Sequence and Procedure using the Restart Interlock

The motor must be stopped before “+Channel 1 door” and/or “+Channel 2 door” are inhibited and the Restart Interlock is activated.

***WARNING**: If a fault occurs when actuating the Restart Interlock, then this fault must be removed before the mechanically isolating protective guards to the working zone of the machine or plant are opened. After the fault has been removed, this procedure must be repeated for the Restart Interlock. Under fault conditions, all of the drives, machine and plant must be shut down.*

If one of the following faults should occur with “+Channel 1 door” or “+Channel 2 door” de-energized and the protective guards withdrawn, then the EMERGENCY STOP must be immediately initiated:

- The acknowledgement contacts “Channel 1 verification” or “Channel 2 verification” remains open, the Restart Interlock is not activated.
- There is wrong Module Disabled signal status.
- There is a fault in the external control circuit itself.
- There is a fault in the signal lines of the acknowledge contacts.

All of the drives associated with the machine/plant must be disconnected and isolated from the line supply through the line contactor. The de-energized status of the contactor must be monitored.

***WARNING**: the line contactor must have a NC contact linked to safety NO contacts.*

If the Restart Interlock control has been correctly integrated into the external safety-related drive control and has been checked to ensure correct functioning, then the drives in the separate working zone of the machine are protected against undesirable starting, and personnel can enter or operate in the hazardous zone which has been defined.

***CAUTION:** where the equipment requires manual intervention the relevant regulations must be taken into account*

8.6 Anti Freewheeling Stop Function

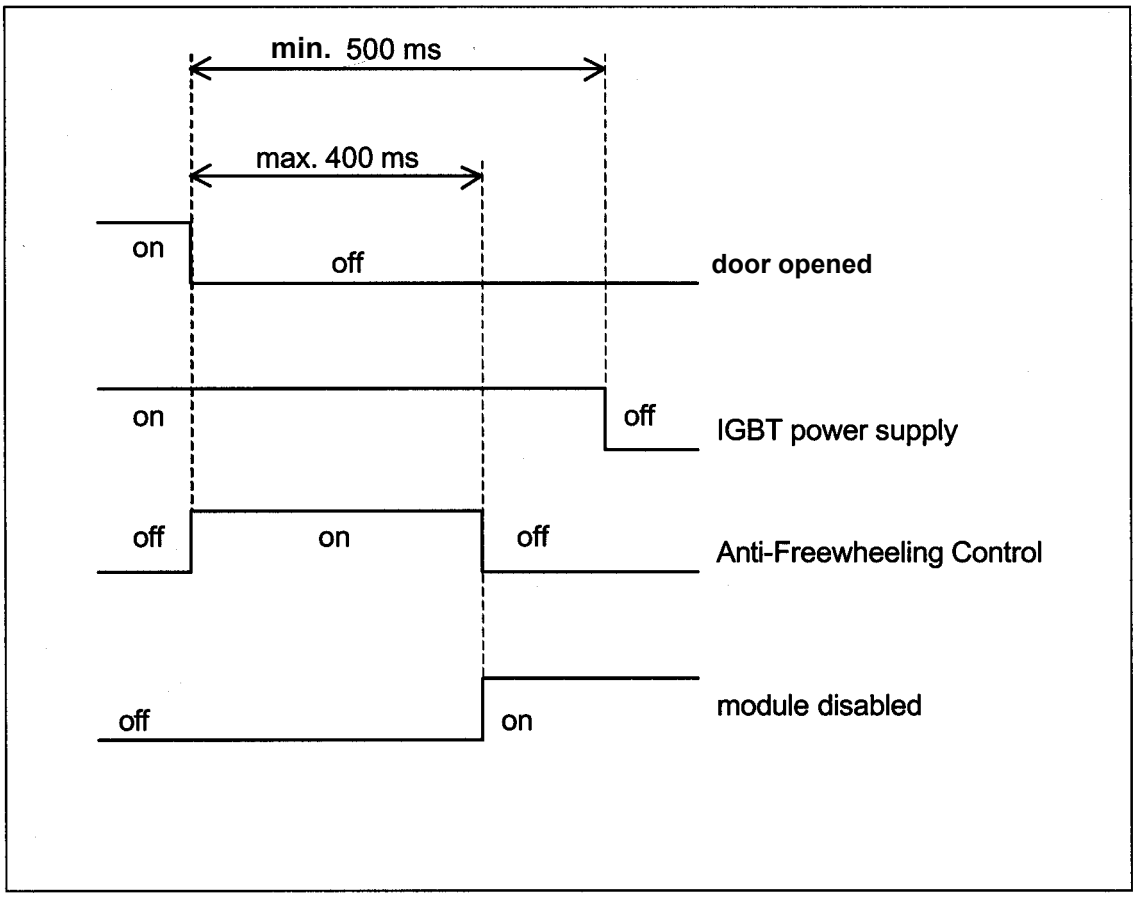
The Anti Freewheeling Stop Function is integrated in the RIC function. This means that, when this function is activated, a motor in movement performs a controlled stop. This function is still alive also in case of power shut down.

***WARNING**: The designer must evaluate the machine stopping time during the risk assessment even in case of failure. The machine can present a dangerous overrun in case of failure of the drive. Other protective measure are needed to achieve a safe condition.*

Integrated in the Restart Interlock function, the Anti Freewheeling Stop Sequence is:

- The closed safety gate is opened while the motor is stili moving
- The Module Enable signal is then switched off via the axis enable signals (D-E contacts of connector JS1)
- The microprocessor (Iatches the stop request and) performs a controlled antifreewheeling stop
- Aiso the hardware timer starts to provide the extra (min) 500 ms to allow the braking
- The IGBT are turned off via software (Interlocking System III) when the motion has stopped (but at the latest within 360 ms) to allow the switching off of PWM logic for the IGBTs
- The output signal Module Disabled switches on
- The hardware timer elapses and the power supply to the IGBT is turned off on both the Channel 1 and Channel 2 (Interlocking System I and II)
- The outputs “Channel 2 verification” and “Channel 1 verification” switch on

Fig. 8.4 Anti Freewheeling Timing Chart



8.7 Checking the Restart Interlock

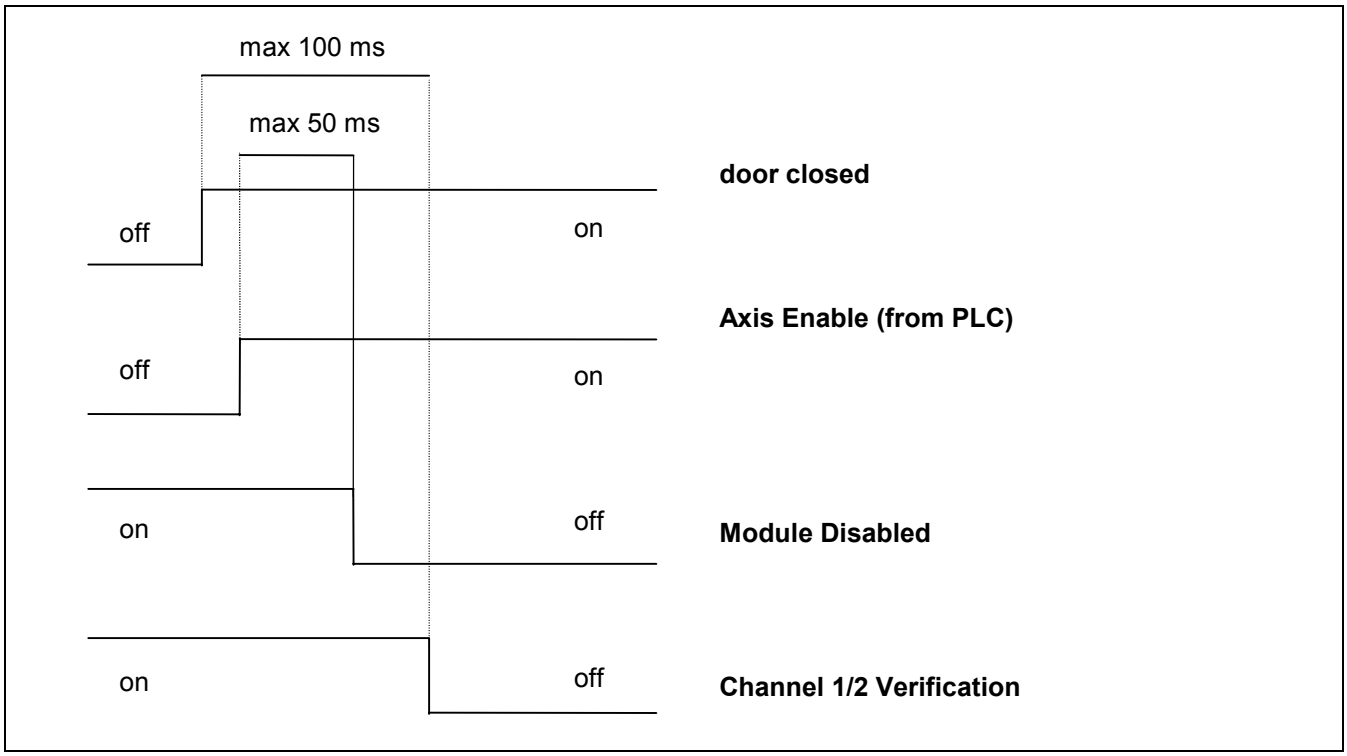
The following checks must always be made at the first start-up and when possible must be repeated at certain intervals during the operating lifetime.
A check should also be made after longer production standstills. Each individuai module must be checked.
The check must be made by qualified personnel taking into account the necessary safety measures:

- The IGBT drivers must be inhibited by withdrawing the voltage at positions A-C (Channel 2 door) and B-C (Channel 1 door) of JS1 connector. Furthermore, the acknowledge contacts J-H (Channel 2 verification) and F-G (Channel 1 verification) of JS1 connector of the Restart Interlock must close after a delay of 600 ± 100 ms. The drive then does not provide output current.
- Disabling the protective devices, e.g. opening the protective doors while the drive is running. The motor must be braked in a time < 360 ms and then powered down. This must not result in a hazardous condition.
- All possible fault situations, which could occur, must be individually simulated in the signal lines between the verification contacts and the external control as well as the signal plausibility functions of this control e.g. by disconnecting the Restart Interlock monitoring circuit at positions J-H and F-G of JS1 connector.
- The timing chart of the antifreewheeling function must be verified (see fig.8.4)

For all of the simulated fault situations, the line contactor must disconnect all of the machine or plant drives from the line supply.

The correct starting sequence shown in Fig.8.5 must be checked to verify external faults (e.g. wiring short circuit at terminals Channel Verification F-G and H-J).

Fig. 8.5 Starting Sequence Timing Chart



8.8 External Plausibility Tests

The following tests of plausibility must be made outside of the drive (e.g. by a PLC).

- The external system must be able to detect free-wheeling when the axis does not stop within 360 ms after the Module Enable signal goes away. The information about the motor velocity is available at J21 connector CAN 1/2

- Channel 1 verification. The external system must monitor this output signal for plausibility with its input signal (see par.8.3.2) and for comparison with the status of Channel 2 and with the status of Module Disabled (redundancy verification)

- Channel 2 verification. The external system must monitor this output signal for plausibility with its input signal (see par.8.3.1) and for comparison with the status of Channel 1 and with the status of Module Disabled (redundancy verification)

- Module Disabled. The external system must monitor this output signal for plausibility with its input signal (see par.8.3.3) and for comparison with the status of Channel 1 and with the status of Channel 2 (redundancy verification)

- **Monitoring by a standard Programmable Electronic System**

- Minimum functional requirements
  - The automatic monitoring shall, at discovered fault, disconnect the line contactor and prevent a new start until fault has been removed
  - The change of the monitoring signal shall be checked automatically:
    - at the start up and
    - during each stopping (Fig. 8.4) and starting (Fig. 8.5) sequence.

- Wiring requirements to avoid common mode failures
  - Each signal shall be connected to its own input module or
  - If a single input module is used the signals of antivalent logic from different position switches shall be inputted as well.

- Software verification
  - Following safety related principles, it is necessary to verify the software and give instructions on periodic maintenance

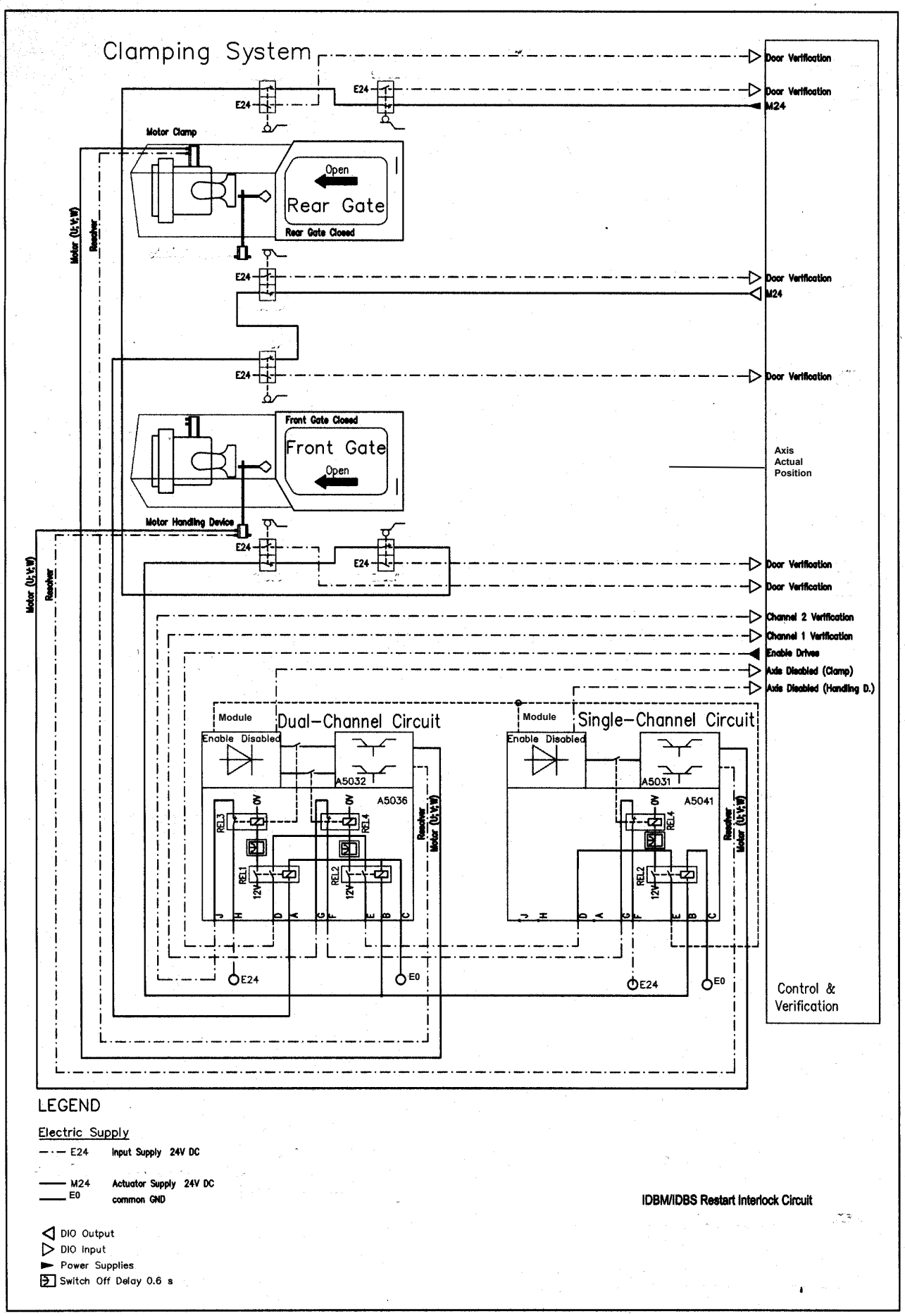
- Modification of software
  - The manufacturer shall write a warning in the software close to the part of program concerning the monitoring that this part must not be deactivated or modified for safety reasons (see also clause 3.7.7 of EN 292-2)

- Other requirements
  - The output of the PLC to the line contactor shall be periodically tested by monitoring the plausibility of the NC contact of the line contactor

- Protection of program
  - The program shall be monitored by e.g. a watchdog
  - The program shall be in permanent memory protected against electrical interference and shall be equipped with a start-up test procedure

8.9 Application Example

Fig. 8.5 Block Diagram, Application Example



8.9.1 Description of Application Example

The application of Fig.8.5 uses both the dual-channel and the single-channel Restart Interlock circuits. This choice has been done after a hazard/risk assessment of the application, which requires Category 3 (dual-channel) restart interlock function according to EN 954-1:1996 for the motor clamp axis and Category 2 (single-channel) for the motor handling axis.
The Category 3 according to EN 954-1:1996 requires that a single fault does not lead to the loss of the safety function. The Category 2 requires well-tried safety principles but a single fault can lead to the loss of the safety function
The PLC (Control & Verification in Fig.8.5) handles the coordinated drive control using logical interlocking functions.

8.9.2 Functions of Application Example

Referring to dual-channel circuit of Fig.8.5, the two channel system structure is achieved:

First shutdown path: the energy from the drive to the motors is disconnected via Channel 2.

Shutdown is realized via REL1 (A-C pos. of JS1 connector) and REL3. The contact of the Restart Interlock relay via D-E pos. of JS1 switches off the Module Enable input signal. The antifreewheeling stop function is activated and both the software (Interlock System III) and hardware (Interlock System I) timer start. When the motion has stopped (after max 360 ms) the IGBT are turned off. This must be cyclically monitored.
Refer to par.8.6 and 8.7 for the detailed timing chart.

Second shutdown path: the energy from to the motors is disconnected via Channel 1.

Shutdown is realized via REL2 (B-C pos. of JS1 connector) and REL4. The contact of the Restart Interlock relay via D-E pos. of JS1 switches off the Module Enable input signal. The antifreewheeling stop function is activated and both the software (Interlock System III) and hardware (Interlock System II) timer start. When the motion has stopped (after max 360 ms) the IGBT are turned off. This must be cyclically monitored.
Refer to par.8.6 and 8.7 for the detailed timing chart.

The drive is shutdown, e.g. when stopping in an emergency, as a result of fault messages/ signals from the drive system or the Restart Interlock monitoring when a fault condition develops.

For an EMERGENCY STOP, the drives are stopped in Stop Category 1 according to EN 60204-1:1997, 9.2.2: "Controlled stopping", the energy feed is interrupted when the drive has come to a standstill.

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