

Digital DRIVE for Brushless motor IMD Series



INSTALLATION GUIDE

Read manual before installing and respect
all indications with this icon:



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1- Introduction

1-1- Warning



Read this manual before first installing, nonobservance may result in property damages and in personal injuries.

Only suitable qualified personnel should undertake the mounting, installation, operation and maintenance of the equipment must be complied with the general setup and safety regulations for work on power installations (e.g. DIN, VDE, EN, IEC or other national and international regulations).

It is important that all safety instructions are strictly followed. Personal injury can result from a poor understanding of the safety requirements.

The following safety regulations should be followed:

• VDE 0100	Specification for the installation of power systems up to 1000 V
• VDE 0113	Electrical equipment of machines
• VDE 0160	Equipment for power systems containing electronic components.

- ***Never open the equipment.***
- ***Dangerous high voltages exist within the equipment and on the connectors. Because of this, before removing any of the connectors, it is necessary to remove the power and wait at least 5 minutes to allow the capacitors to discharge.***
- ***Never connect or disconnect the drive with power applied.***
- ***Some of the drive's surfaces can be very hot.***

Some of the drive's components are susceptible to damage from electrostatic discharges. Always handle the equipment using appropriate anti-static precautions.

We have gone to great lengths to ensure this documentation is correct and complete. However, since it is not possible to produce an absolutely error-free text. No responsibility will be assumed by SERAD for all damages caused by using this documentation and software.

We reserve the right to make changes to all or part of the specification without prior notice.

1-2- MD series drive description

Supply :	230V to 400V AC $\pm 10\%$ three phase or 230V AC $\pm 10\%$ single phase
Auxiliary supply :	24 V DC $\pm 10\%$, 0.4A typical (0,7A max if all options)
Supply filter :	Integral
Switching frequency :	6.67 kHz sine-wave PWM
DC bus voltage :	310V to 680V
Braking resistance :	Integral : 75 ohms 60W Possibility to add an external resistor : Min value Max. cont. power Imp power 60 Ω 5K Ω 10K Ω
Protection :	Short circuit between phases, phase to earth, over current, I2t Over voltage, under voltage Motor feedback fault
Motor feedback :	Resolver SinCos encoder Hiperface ^(option)
Master encoder :	Incremental encogser Absolute encoder SSI SinCos encoder Hiperface ^(option) Virtual
Encoder emulation :	Incremental : A, /A, B, /B, Z, /Z 1 to 100 000 points per rev
Diagnostic :	STATUS display
Communication :	RS 232 MODBUS RTU IMDBUS : for master/slave application CANopen ^(option) : DS 402, SDO, PDO, master or slave PROFIBUS DP* ^(option) SERCOS 16Mb* ^(option)
Digital inputs :	4 inputs (with 2 fast inputs I3 and I4) 12 additional inputs with expansion module (with 2 fast inputs I15 and I16) Type: PNP, 24V DC, 8mA per input and 15 per fast input Logic 0: Between 0 and 5 V Logic 1: Between 8 and 30 V
Digital outputs :	2 outputs as standard S1 : Relay, 48V dc / 48V ac, 3A max S2 : NPN (open collector) 24V dc, 100mA 8 additional outputs with expansion module Type : PNP 24V dc, 500mA max per output Protected against short circuit and over temperature.
Analogue inputs :	2 inputs : Input voltage : ± 10 V Maximum voltage : ± 12 V Input impedance : 20 Kohms Resolution : 16 bits for input 1 and 12 bits for input 2
Analogue output :	1 output : Output voltage : ± 10 V Maximum current : 5 mA Resolution : 8 bits

Architecture :	Processor :150 MHz DSP and 100 000 gates FPGA FLASH memory for programs and parameters RAM memory for data FRAM memory for variables Real-time, multi-tasking kernel
Control loops :	Current loop : 75 µs Speed loop : 150 µs Position loop : 150µs
Operating modes :	Torque mode Speed mode Position mode Stepper Mode (pulse input, direction) Motion functions (absolute, relative and infinite movements, S profile) Advanced motion functions (gearbox, CAM profiles, CAMBOX functions, triggered movement)
Operating temperature :	0 to 40°C
Storage temperature :	-10 to 70°C
Degree of protection :	IP 20
Weight	3,6 Kg

Drive	Rated current	Peak current (2s)	Rated power	Dimensions w x h x d
IMD / 1	1,25 Aeff	2,5 Aeff	0,7 kVA	72 x 293 x 233
IMD / 2	2,5 Aeff	5 Aeff	1,4 kVA	72 x 293 x 233
IMD / 5	5 Aeff	10 Aeff	2,8 kVA	72 x 293 x 233
IMD / 10	10 Aeff	20 Aeff	5,6 kVA	72 x 293 x 233

2- Installation

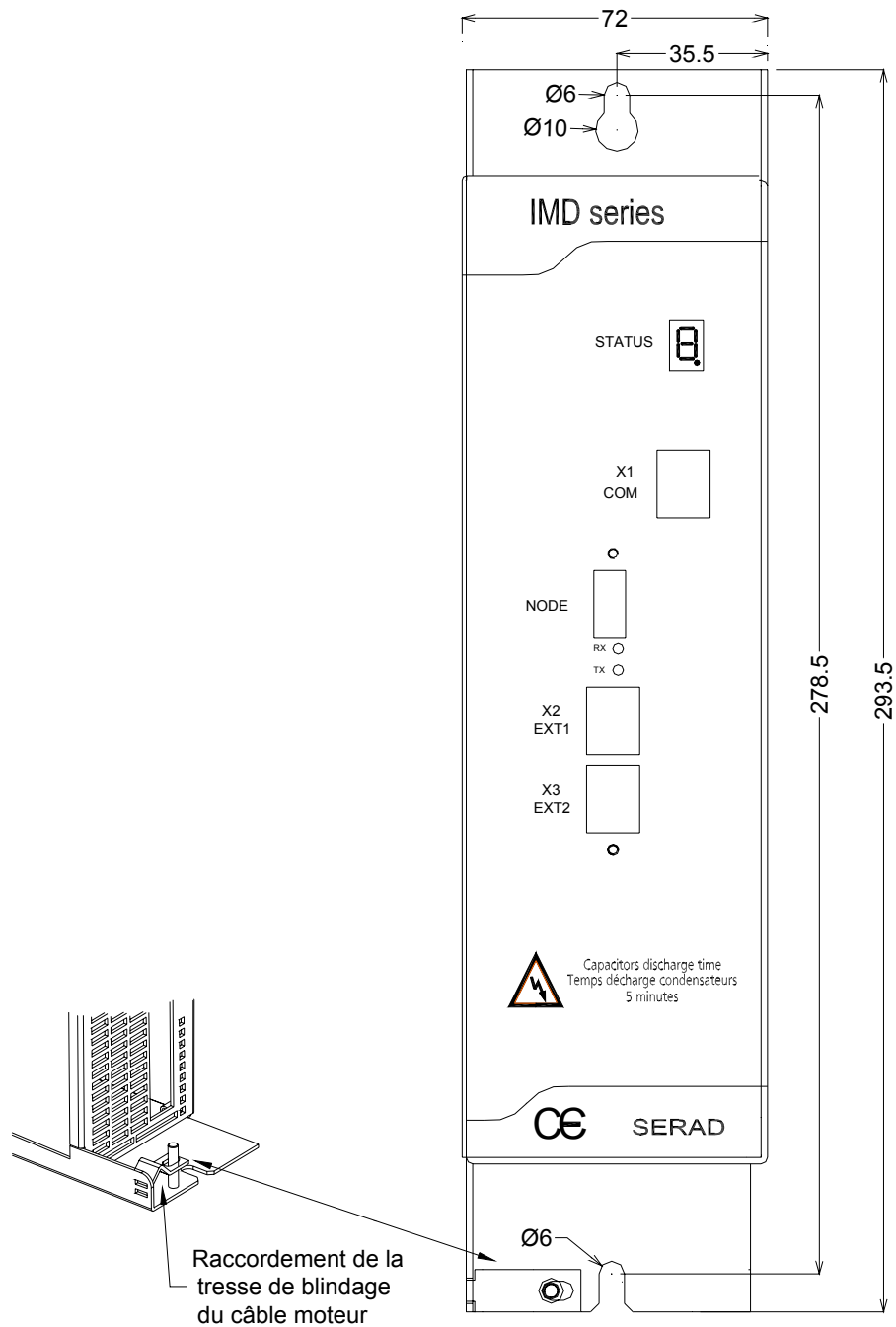
2-1- General



It is very important to adhere to the following:

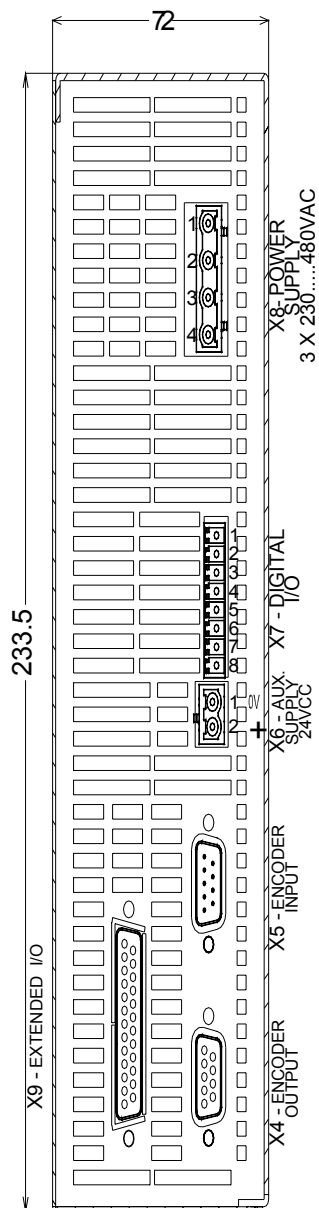
- ⚡ A badly earthed connection can damage electronic drive components.
- ⚡ The drive must be installed vertically in free air to ensure cooling by natural convection.
- ⚡ It must be protected from excess humidity, liquids, and dirt.
- ⚡ The motor, resolver and encoder cables must be screened, the screen being earthed at both ends of the cable.
- ⚡ The analogue I/O must use screened cable, the screen being earthed at one end only.
- ⚡ The cable for the RS 232 serial link between the drive and the PC must be screened, the screen being earthed at both ends of the cable. It should be disconnected from the drive when no longer in use. All of these cables, as well as the I/O cables, should be run separately from the power cables.
- ⚡ Diodes must be fitted across the loads on all static digital outputs (Q2 to Q10). These diodes must be positioned as close to the load as possible. The supply and signal cables must be free from over-voltage transients.
- ⚡ Safety standards specify a manual reset after a stop caused either by a supply interruption, or by an emergency stop or by a drive fault.
- ⚡ For all serious faults, it is obligatory to remove the high voltage supply to the drive.
- ⚡ The Drive Ready output should be connected in series in the emergency stop loop.
- ⚡ In the case of axis over-travel, the over-travel limit switches must be connected to the limit inputs or in series with the emergency stop loop. It is also recommended to use the software limits.
- ⚡ If the drive is configured in speed loop, the drive enable input should be controlled by the supervisory controller (CNC, PLC etc).
- ⚡ If the drive is configured in position loop, the parameter "Maximum following error" should be set appropriately.
- ⚡ If the drive contains an application program developed using iDPL, connect a signal 'Cabinet supplies OK' to one of the digital inputs and monitor it in a non-blocking safety task. On detection of an excess following error the drive will be put in open loop mode and the drive ready relay will be opened. If another action is required you should use the SECURITY instruction.

2-2- Front view



STATUS	7-segment diagnostic display
X1 COM	RS-232 serial port for communication with a PC
X2 EXT1	Extension: Optional communications ports
X3 EXT2	Extension: Optional communications ports

2-3- Top view

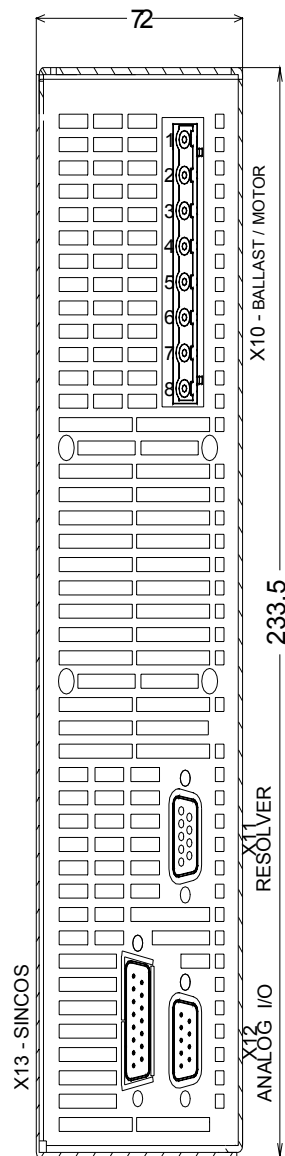


X4	ENCODER OUTPUT	Multifunction encoder output
X5	ENCODER INPUT	Multifunction encoder input
X6	24Vdc	Auxiliary 24V DC supply
X7	I/O	Digital I/O
X8	POWER SUPPLY	Single / Three-phase power supply
X9	EXT I/O	Option: I/O expansion board



The voltage on connector X8 can reach 480V!

2-4- Bottom view



X10	RB / MOTOR	External braking resistor and motor supply
X11	FEEDBACK	Motor position feedback (resolver / encoder)
X12	ANALOG	Analogues I/O
X 13	SINCOS	Motor position feedbacks (if SINCOS encoder is used)

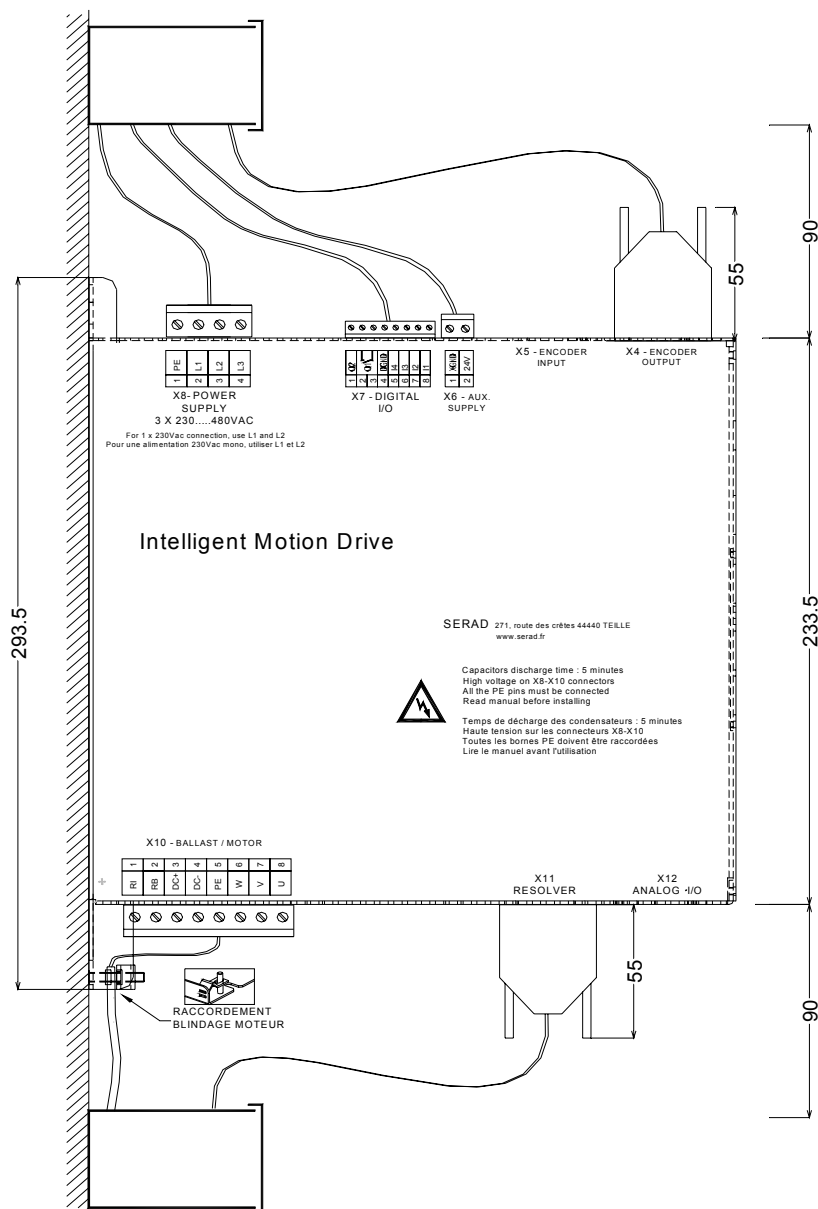


Care must be taken when making connection to connector X10. An incorrect connection can seriously damage the drive. Dangerous voltages are present on X10 (900V).

Wait at least 5 minutes to allow the capacitors to discharge before remove connector.

2-5- Mounting

Several drives can be mounted side-by-side provided that enough space (at least 20 mm) is left to ensure good natural convection. Let a space greater than 90 cm over and under drives to allow for the various connectors and cables to be fitted

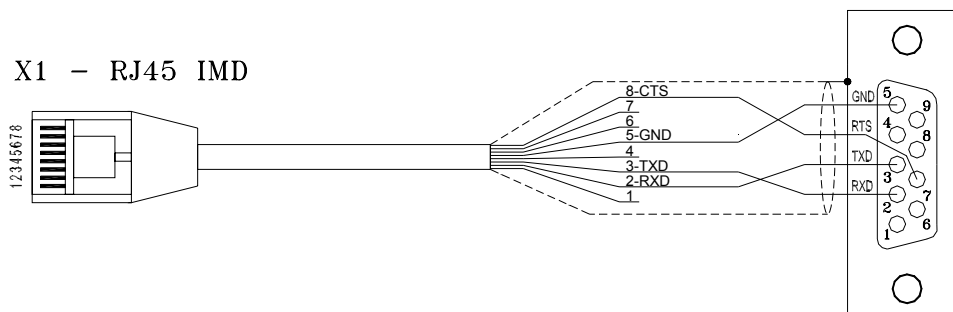


2-6- Connector pin assignments

X1: RJ45 serial port for downloading programs and parameters.

N°	Name	Type	Description
1			
2	RXD	Inp	Receive data
3	TXD	Out	Transmit data
4			
5	GND		0V
6			
7			
8	CTS	Inp	Clear to send
	SHIELD		Connect the shield to the shell of the connector

SUB D 9pts FEMELLE COM PC



X2 & X3: Extension: Optional communications port

N°	Module RS 232	Module RS 422	Module RS 485	Module CANopen
1				
2	RXD	RX+		
3	TXD	RX-		
4				
5	GND	GND	GND	GND
6				
7		TX-	TRX-	CAN_L
8		TX+	TRX+	CAN_H
	Connect the shield to the shell of the connector			

- X2 and X3 are identical and have the same connection. They make easier drive network connection.
- Node Address : For RS422, RS485 and CANopen, the NodeID corresponds to the five firstly dipswitchs + 1

Ex: dipswitchs: 1 -> ON, 2 -> OFF, 3 -> ON, 4 -> OFF, 5 -> OFF

Dipswitchs value = 1 + 4 = 5

NodeID = 5 + 1 = 6

- Put on Dipswitch 6 to activate terminal resistor (120Ω).



RS232 communication allows communication with only 1 device (ex: 1 PLC and 1 IMD drive).

X4: Multifunction encoder output:

- Encoder emulation output
- IMDbus output

The choice of the output is made in iDPL software in the Multifunction encoder output windows

Connector : SUBD 9 way female

N°	Name	Type	Encoder emulation	IMDbus
1	A	Out	Channel A	Data
2	/A	Out	Channel A inverted	/Data
3	B	Out	Channel B	Clock
4	/B	Out	Channel B inverted	/Clock
5	Z	Out	Zero marker	NC
6	/Z	Out	Zero marker inverted	NC
7				
8	GND		0V	0V
9				
	SHIELD		Connect the shield to the shell of the connector	

NC (Not connected): It is forbidden to connect this pins.

X5: Multifunction encoder input:

- Incremental encoder input
- SSI encoder input
- Stepper input
- IMDbus input

The choice of the input is made in iDPL software in the Multifunction encoder input windows

TTL 5V encoder (0-5V, differential)

Connector : SUBD 9 way male

N°	Name	Type	Incremental encoder	Codeur SSI	Stepper	IMDbus
1	A	Inp	Channel A	Data	Direction	Data
2	/A	Inp	Channel A inverted	/Data	/Direction	/Data
3	B	Inp	Channel B	NC	Pulse	Clock
4	/B	Inp	Channel B inverted	NC	/Pulse	/Clock
5	Z	I/O	Zero marker	Clock	NC	NC
6	/Z	I/O	Zero marker inverted	/Clock	NC	NC
7	+5Vdc	Out	Supply for external encoder, 100 mA max.*	NC	NC	NC
8	GND		0V	0V	0V	0V
9		Inp	NC	SSI selection : Connect pins 8 and 9	NC	NC
	SHIELD		Connect the shield to the shell of the connector			

* If the feedback is SINCOS then don't use 5V powersupply (pin 7 of connector X5) but an external powersupply.



NC (Not connected): It is forbidden to connect this pins.

X6: 24V dc supply

Connector: Removable 2 ways, 5.08mm pitch

N°	Name	Type	Description
1	XGND		0V
2	24Vdc	Inp	Control card supply, backup motor position

X7: Digital I/O

Connector: Removable 8 ways, 3.81mm pitch

N°	Name	Type	Description
1	Q2	Out	Output 2, programmable : type NPN, 24 Vdc, 100mA
2	Q1	Out	Output 1, programmable : standard function DRIVE READY
3	Q1		Relay contact, N/O between terminals 2 and 3
4	DGND		0V digital I/O
5	I4	Inp	Input 4, programmable
6	I3	Inp	Input 3, programmable
7	I2	Inp	Input 2, programmable
8	I1	Inp	Input 1, programmable:standard function ENABLE



The output Q2 is NPN open collector: the load must be connected between Q2 and +24V DC.

X8: High voltage supply

Connector: Removable 4 ways, 7.62mm pitch

N°	Name	Type	Description
1	PE		Supply earth
2	L1	Inp	Supply L1 for 230V and 400V
3	L2	Inp	Neutral for 230V or supply L2 for 400V
4	L3	Inp	Supply L3 for 400V



Care must be taken when making connection to connector X8.

Wait at least 5 minutes to allow the capacitors to discharge before remove connector.

The armoured motor cable must arrive directly on the terminals of the drive.

Connect the shield (on drive side) to the screw provided (see Front view of the drive).

X9: Option: Expansion module, 12 inputs / 8 outputs

Connector: SUBD 25 way female

N°	Name	Type	Description
1	I5	Inp	Input 5, programmable
2	I6	Inp	Input 6, programmable
3	I7	Inp	Input 7, programmable
4	I8	Inp	Input 8, programmable
5	I9	Inp	Input 9, programmable
6	I10	Inp	Input 10, programmable
7	IOGND*		0V digital I/O
8	Q3	Out	Output 3, programmable
9	Q4	Out	Output 4, programmable
10	Q5	Out	Output 5, programmable
11	Q6	Out	Output 6, programmable
12	IO 24Vdc**	Inp	External supply, 24 V dc
13	IO 24Vdc**	Inp	External supply, 24 V dc
14	I11	Inp	Input 11, programmable
15	I12	Inp	Input 12, programmable
16	I13	Inp	Input 13, programmable
17	I14	Inp	Input 14, programmable
18	I15	Inp	Input 15, programmable
19	I16	Inp	Input 16, programmable
20	Q7	Out	Output 7, programmable
21	Q8	Out	Output 8, programmable
22	Q9	Out	Output 9, programmable
23	Q10	Out	Output 10, programmable
24	IOGND*		0V digital I/O
25	IOGND*		0V digital I/O
	SHIELD		Connect the shield to the shell of the connector

* Pins 7, 24, 25: internal connection

** Pins 12, 13: internal connection

X10: Motor armature

Connector: Removable 8 ways, 7.62mm pitch

N°	Name	Type	Description
1	RI		Internal braking resistor *
2	RB		Braking resistor *
3	DC Bus +	Out	DC bus +
4	DC Bus -	Out	DC bus -
5	PE		Motor earth
6	W	Out	Motor phase W
7	V	Out	Motor phase V
8	U	Out	Motor phase U

The armoured motor cable must arrive directly on the terminals of the drive.

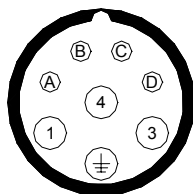
Connect the shield (on drive side) to the screw provided (see Front view of the drive).

*Selection of the braking resistor:

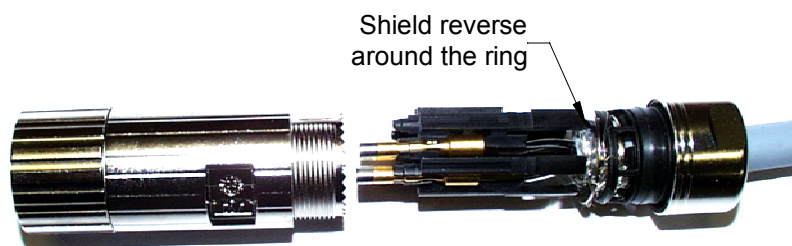
- Internal resistor: Fit a link between terminals 1 and 2
 - External resistor: Remove the link between terminals 1 and 2
- Connect the external resistor between terminals 2 and 3



Care must be taken when making connection to connector X10. An incorrect connection can seriously damage the drive. Dangerous voltages are present on X10.

SERAD MOTOR

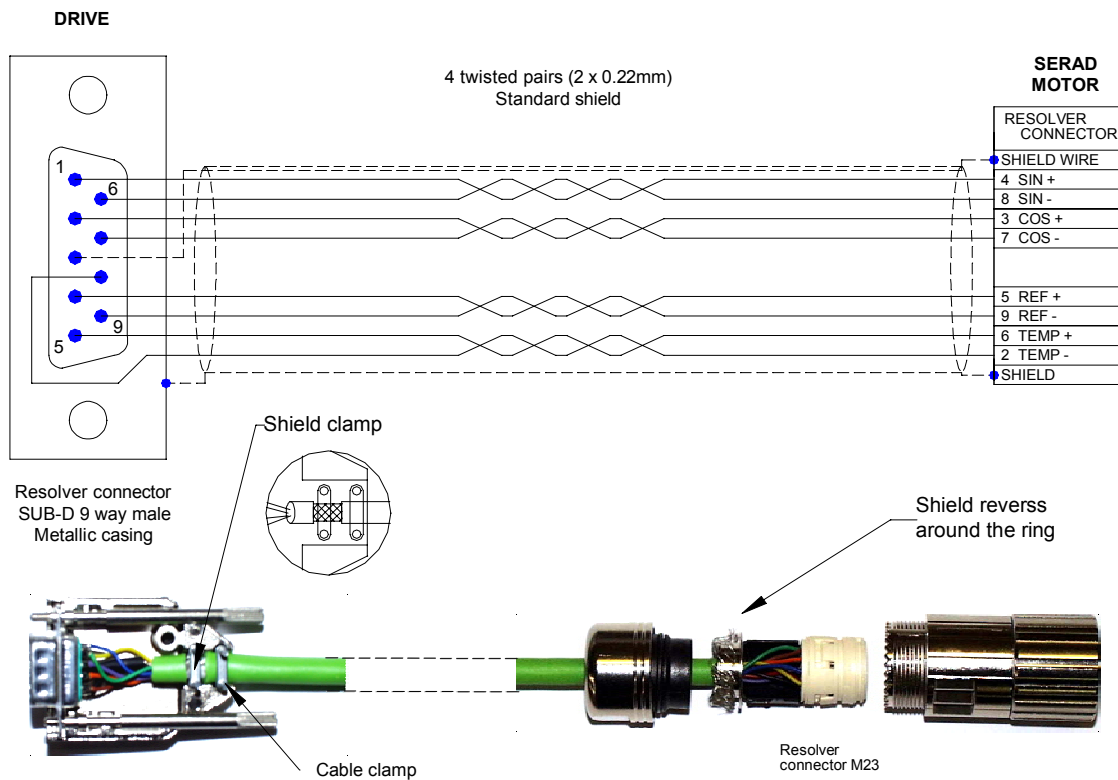
DESCRIPTION	
1	Phase U
4	Phase V
3	Phase W
2	Earth
C	Break +
D	Break -



X11: Motor position feedback (resolver)

Connector: SUBD 9 way female

N°	Name	Type	Description
1	S2	Inp	Sine Hi
2	S1	Inp	Cosine Hi
3	AGND		0V analogue
4	R1	Out	Reference Hi
5	°CM+	Inp	Motor temperature sensor Hi
6	S4	Inp	Sine Lo
7	S3	Inp	Cosine Lo
8	°CM-	Inp	Motor temperature sensor Lo
9	R2	Out	Reference Lo
	SHIELD		Connect the shield to the shell of the connector



X12: Analogue I/O

Connector : SUBD 9 way male

N°	Name	Type	Description
1	IN2 -	Inp	Analogue input 2
2	IN2+	Inp	Analogue input 2 : assigned to torque limit
3	IN1-	Inp	Analogue input 1
4	IN1+	Inp	Analogue input 1 : assigned to speed or torque command
5	AGND		0V analogue
6	-12V	Out	-12V, 20 mA output
7	AGND		0V analogue
8	+12V	Out	+12V, 20 mA output
9	OUT	Out	Analogue output (function monitor)
	SHIELD		Connect the shield to the shell of the connector

X13: Option: SinCos encoder input

Connector: SUBD 15 way male

N°	Name	Type	Description
1	°CM +	Inp	Motor temperature sensor Hi
2	AGND		0V analogue
3	/DATA	I/O	/DATA (EnDat*) /RS485 (HIPERFACE)
4	/CLK	Out	/CLOCK (EndDat*)
5	+5V	Out	+5V, 200 mA output (EnDat*)
6			
7	REFCOS	Inp	Cosine Hi
8	REFSIN	Inp	Sine Hi
9	°CM-	Inp	Motor temperature sensor Lo
10	+8.3V	Out	+8.3V, 150 mA output(HIPERFACE)
11	DATA	I/O	DATA (EnDat*) RS485 (HIPERFACE)
12	CLK	Out	CLOCK (EndDat*)
13			
14	COS	Inp	Cosine Lo
15	SIN	Inp	Sine Lo
	SHIELD		Connect the shield to the shell of the connector

* EnDat in develloping

2-7- Cables

We can made you all cables with connectors (standard, robotics ...), contacts us.

- RS 232 serial communication cable, X1:

Screened cable, 4 core

Connect the shield on each extremity, to the shell of the connector (RJ45 and SUBD).

- Encoder cable, X4/X5:

Screened cable with 4 twisted pairs, 0.25 mm²

Connect the shield on each extremity, to the shell of the connector.

- Analogue cable, X12:

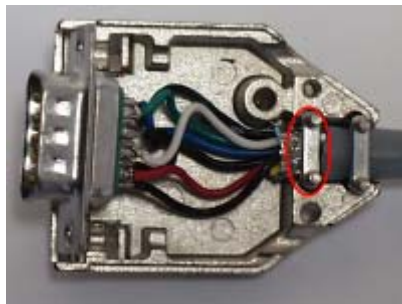
Screened cable, 2 core, 0.25 mm² per analogue input.

Connect the shield: on drive side to the screw provided (see 2-2 Front view) and on the other side to the shell equipment (ex. Motion controller ...)

- Motor feedback cable (resolver), X11:

Screened cable with 4 twisted pairs, 0.25 mm²

Ground the shield of the feedback SUBD as shown below:



- Motor power cable, X10:

Screened cable, 4 core, (+2 for a brake), 1.5 mm² until 8A drive else use 2,5 mm²

Connect the shield (on drive side) to the screw provided (see Front view of the drive).



2-8- Connection diagrams / Protections



All connections must be realised by qualified personnel. The cables must be tested before being connected as any wiring fault can give rise to serious problems

Remove all voltages before inserting the connectors.

Ensure that the earth connection to the drive is correctly made (pin 4 of the connector X8).

Connect the motor earth to the drive (pin 5 of the connector X10) before applying any voltages.

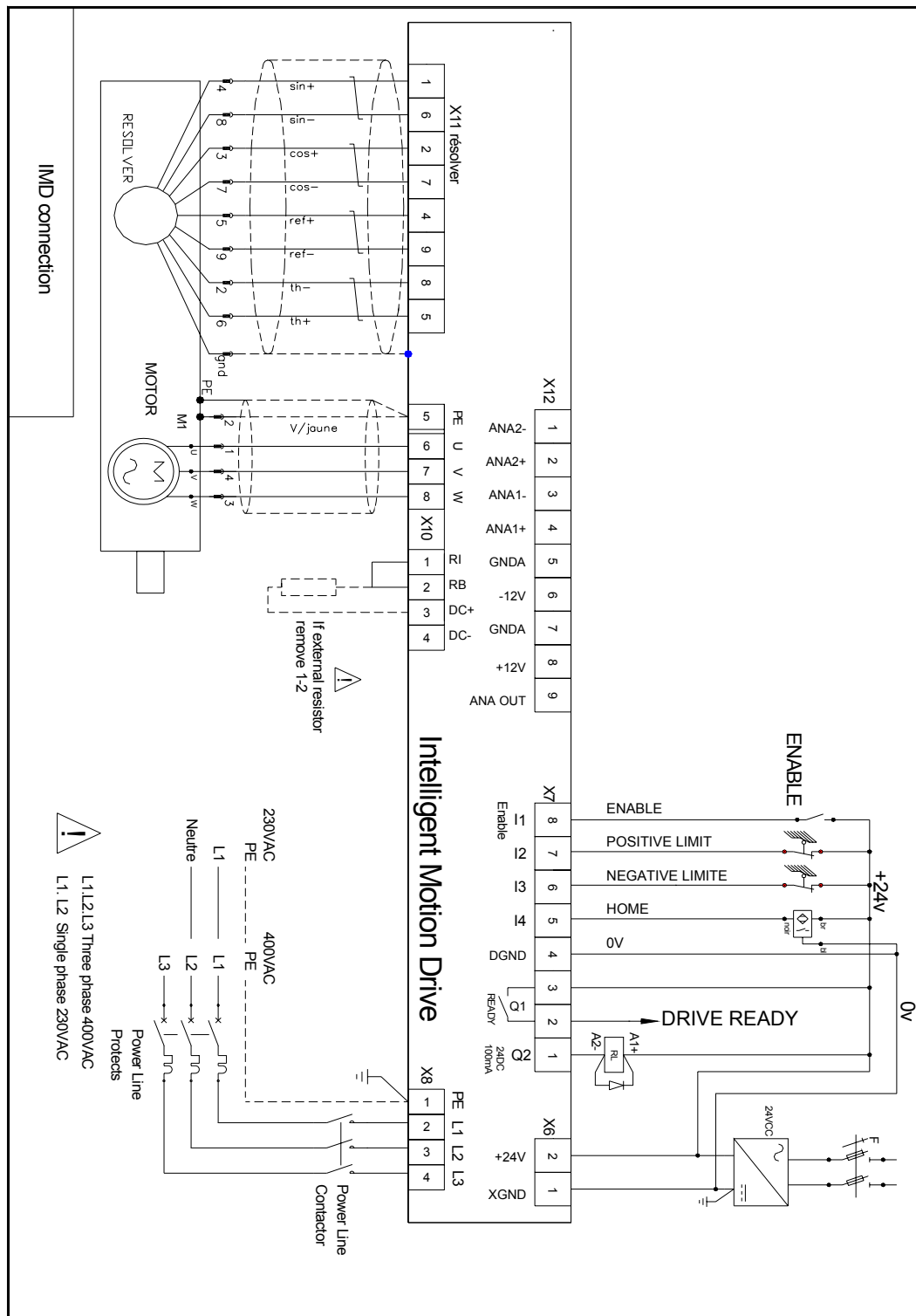
For the shielded cables, to connect the braid to the frame at each extremity via the caps of the connectors (for the SUBD) or the screws provided for this purpose (X7) in order to ensure an optimal equipotentiality.

Preventive reference rejection measures should be taken for control panel, such as connections contactors (obligatory on brake) and relay using RC elements or diodes(ex 1N4007).

Drive	Input voltage	Maximal input current	Safety device : cutout C curve	Wire
IMD / 1	400V triphased	2,2A	20A maxi	1,5 ²
	230V monophased	3,5A	20A maxi	1,5 ²
IMD / 2	400V triphased	4,2A	20A maxi	1,5 ²
	230V monophased	7A	20A maxi	1,5 ²
IMD / 5	400V triphased	8,2A	20A maxi	1,5 ²
	230V monophased	14A	20A maxi	2,5 ²
IMD / 10	400V triphased	16A	20A maxi	2,5 ²

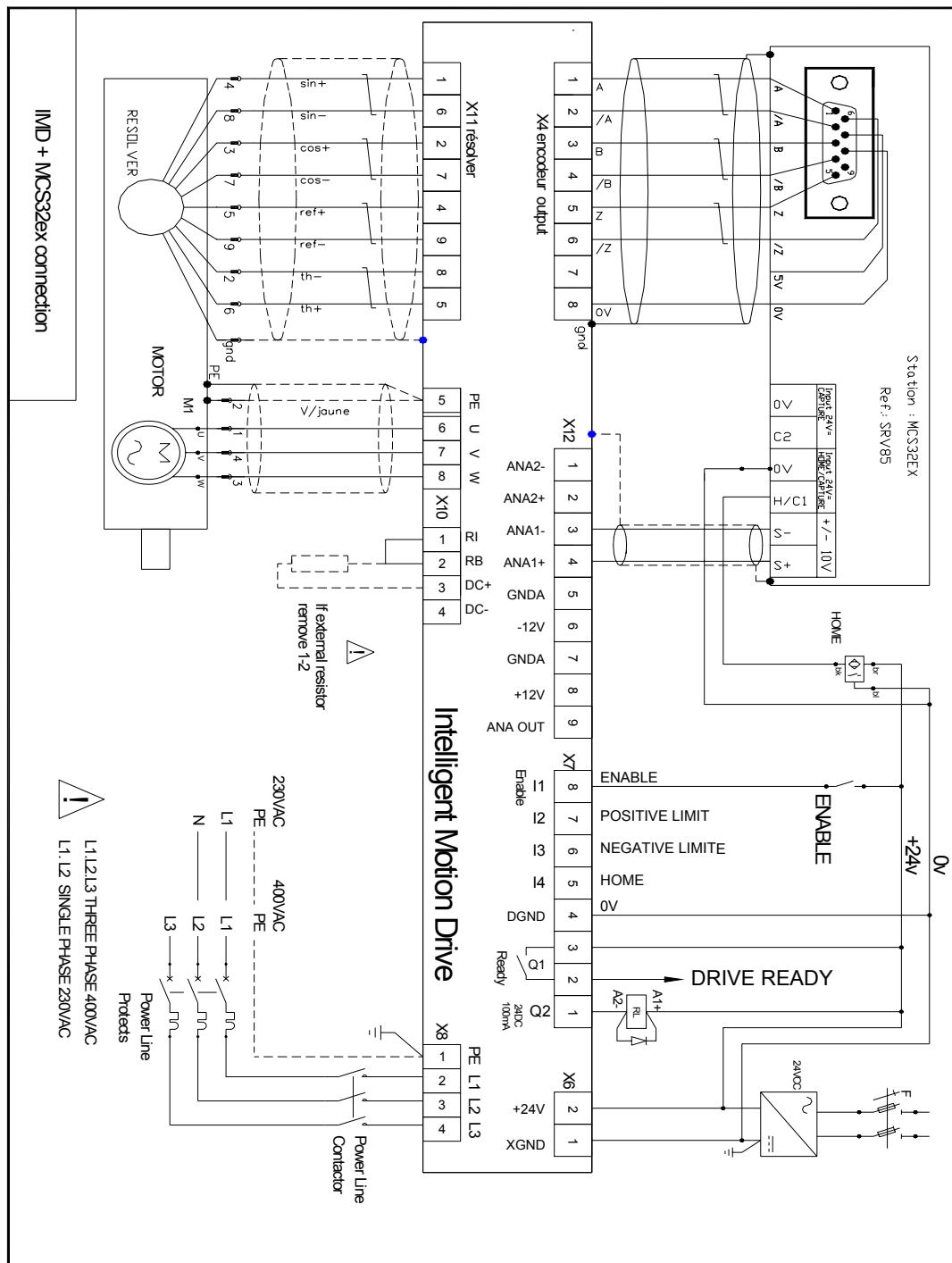
Caution: the ringing current can reach 25A during 10ms.

2-9- Stand-alone drive



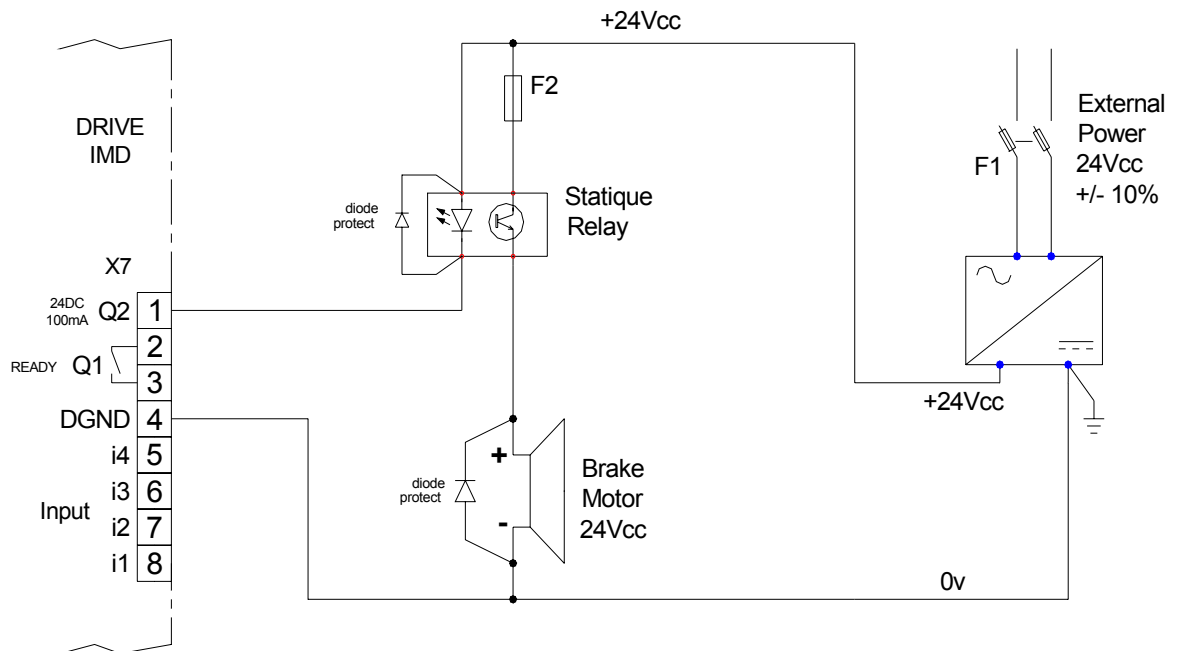
The output Q2 is NPN open collector, 100mA max. The load must be connected between Q2 and +24Vdc.

2-10- Drive controlled by a motion controller



 The output Q2 is NPN open collector, 100mA max. The load must be connected between Q2 and +24Vdc.

2-11- Connecting a motor brake



The output Q2 is NPN open collector, 100mA max. The load must be connected between Q2 and +24Vdc.

Using the iDPL parameter set-up window, select the function Brake for output 2.



It is obligatory to put the 2 protection diodes else drive components can be damaged.

2-12- System checks before starting

- ✎ With the Enable input off, switch on the auxiliary 24V dc supply.
- ✎ Ensure that the **STATUS display** is lit.
- ✎ Apply power.
- ✎ If the Status display shows an **error message** check the list of error codes.

2-13- Error messages:

E01

DC Bus over-voltage : an over-voltage has been detected on the internal dc bus. This fault can be due either to an over-voltage on the supply or to the braking resistance being insufficient.

E02

DC Bus under-voltage : an under-voltage has been detected on the internal dc bus. This condition is only monitoring when the drive is active (Enable = ON, tension DC Bus voltage lesser then a drive's parameter) and when drive try to pass enable (DC Bus voltage lesser than 250V).

E03

I²t motor : I²t motor detected.

E04

Over-current : a current greater than the maximum current has been detected.

E05

Short-circuit : a short-circuit between phases or between a motor phase and earth has been detected.

E06

Temperature IGBT : maximum temperature attained in the drive.

E07

Temperature motor : maximum motor temperature attained.

E08

Resolver fault : Resolver feedback or absolute encoder or SinCOS signals defective.

E09

Invalid parameters : checksum error on the drive parameters or parameters not initialised.

E10

Drive type error : the parameter file does not correspond to the drive type or parameters not configured.

E11

iDPL error : an error has been detected during the execution of the iDPL tasks (division by zero, not correct instruction, CAM or synchro. movement error ...).

E12

Following error : the maximum following error has been exceeded. Contact technical support.

E13

FLASH memory error: impossible writting. Contact technical support.

E 14

FPGA error : impossible loading or CAN communication error.
Contact technical support.

E 15

Over velocity : motor velocity is higher than nominal speed in torque mode

E 16

Feedback saturation error. Feedback or SinCos signals are too high.