

Digital DRIVE for Brushless motor

MD Serial



Installation guide

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



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1- Introduction

1-1- Warning



Only suitable qualified personnel should undertake the mounting, installation, operation and maintenance of the equipment.

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

A bad shield connection can damage drive electronic components.

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

1-2- MD series drive description

Supply :	MD 230 M : 230V AC $\pm 10\%$ single phase MD 400 T : 400V AC $\pm 10\%$ three phase		
Auxiliary supply :	24 V DC $\pm 10\%$, 0.5A typical (0,7A max with encoder O/P)		
Supply filter :	Integral		
Switching frequency :	6.25 kHz sine-wave PWM		
DC bus voltage :	310 V for MD 230 series, 560V for MD 400 series		
Leakage current :	2,2 mA for MD 230 series, 1 mA for MD 400 series		
Braking resistance :	Integral MD 230 : 110 ohms 30W MD 400 : 180 ohms 30W Facility to add an external resistor :		
	Type	Min. value	Max.cont. power
	MD230/1 ou /2	60 Ω	1000W
	MD230/5 ou /7	30 Ω	1800W
	MD 400	80 Ω	2800W
			Max imp. power
			2300W
			4600W
			7000W
Protection :	Short circuit between phases, phase to earth, over current, I2t Over voltage, under voltage Motor feedback fault		
Motor feedback :	Resolver (16 bit resolution) Precision absolute resolver $\pm 0,7^\circ$ Incremental encoder (option)		
Master encoder input :	Incremental : A, /A, B, /B, Z, /Z Maximum frequency : 800 kHz		
Encoder emulation :	Incremental : A, /A, B, /B, Z, /Z 1024 points per rev		
Diagnostic display :	7 segment LED		
Communication :	RS 232 MODBUS RTU RS 422 (point to point), RS 485 MODBUS RTU (option) CANopen (option)		
Digital inputs :	4 inputs standard 12 additional inputs with expansion module Type: PNP, 24V DC, 12mA per input Logic 0: Between 0 and 5 V Logic 1: Between 10 and 30 V		

Digital outputs :	<p>2 outputs as standard</p> <p>S1 : Relay, 48V dc / 48V ac, 3A max</p> <p>S2 : NPN (open collector) 24V dc, 100mA</p> <p>8 additional outputs with expansion module</p> <p>Type : PNP 24V dc, 100mA max per output</p> <p>Protected against short circuit and over temperature.</p>
Analogue inputs :	<p>2 inputs :</p> <p>Input voltage : ± 10 V</p> <p>Maximum voltage : ± 12 V</p> <p>Input impedance : 20 kΩ</p> <p>Resolution : 10 bits</p>
Analogue output :	<p>1 output :</p> <p>Output voltage : ± 10 V</p> <p>Maximum current : 5 mA</p> <p>Resolution : 8 bits</p>
Architecture :	<p>Processor : 40 MHz DSP</p> <p>Memory : FLASH for programs and parameters</p> <p>RAM for data</p> <p>Real-time, multi-tasking kernel</p>
Control loops :	<p>Current loop : 160 μs</p> <p>Speed loop : 320 μs</p> <p>Position loop : 640μs</p>
Operating modes :	<p>Torque mode</p> <p>Speed mode</p> <p>Position mode</p> <p>Motion control</p>
Operating temperature :	0 to 40°C
Storage temperature :	-10 to 70°C
Degree of protection :	IP 20

Drive	Rated current	Peak current (2s)	Rated power	Dimensions w x h x d
MD 230 / 1	1,25 Aeff	2,5 Aeff	0,35 kVA	67 x 215 x 203
MD 230 / 2	2,5 Aeff	5 Aeff	0,7 kVA	67 x 215 x 203
MD 230 / 5	5 Aeff	10 Aeff	1,5 kVA	67 x 215 x 203
MD 230 / 7	7,5 Aeff	15 Aeff	2,3 kVA	67 x 215 x 203
MD 400 / 1	1,25 Aeff	2,5 Aeff	0,7 kVA	67 x 215 x 203
MD 400 / 2	2,5 Aeff	5 Aeff	1,4 kVA	67 x 215 x 203
MD 400 / 5	5 Aeff	10 Aeff	3 kVA	67 x 215 x 203

2- Installation

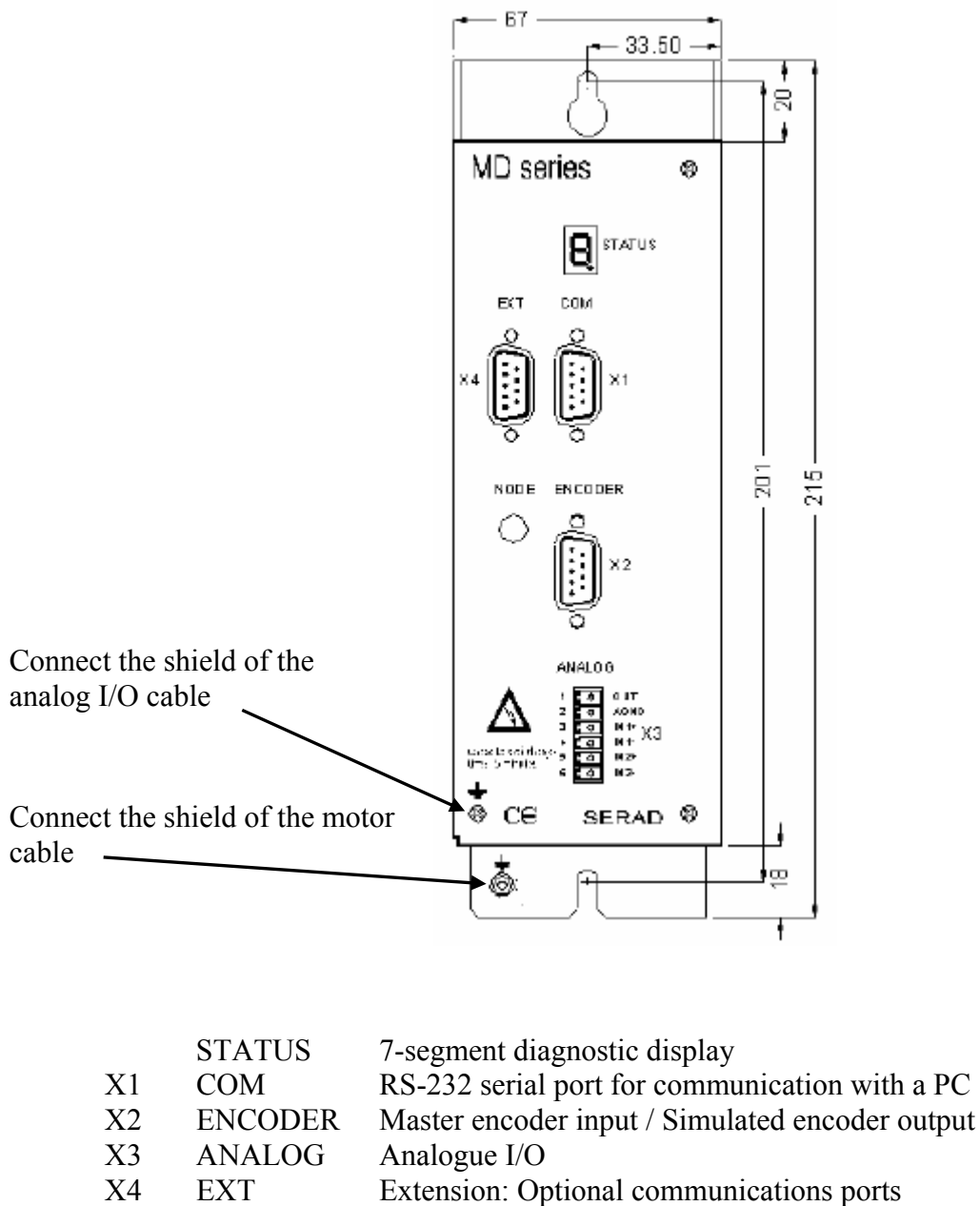
2-1- General



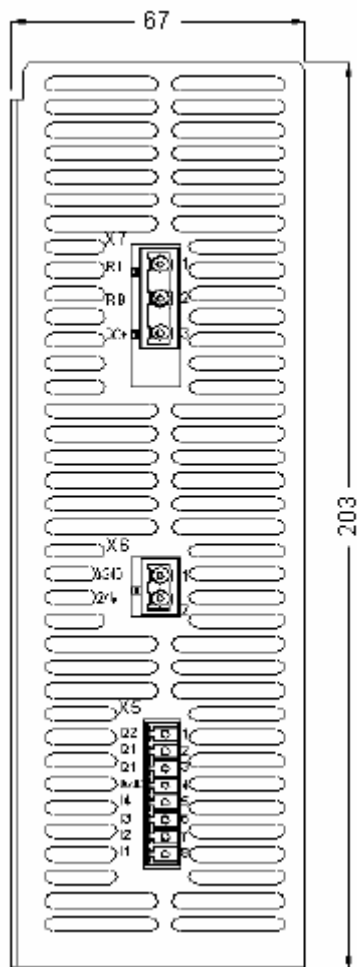
It is very important to adhere to the following:

- ↳ A bad shield connection can damage drive electronic components
- ↳ The drive must be installed vertically in free air to ensure cooling by natural convection
- ↳ 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 DPL, 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



2-3- Top view

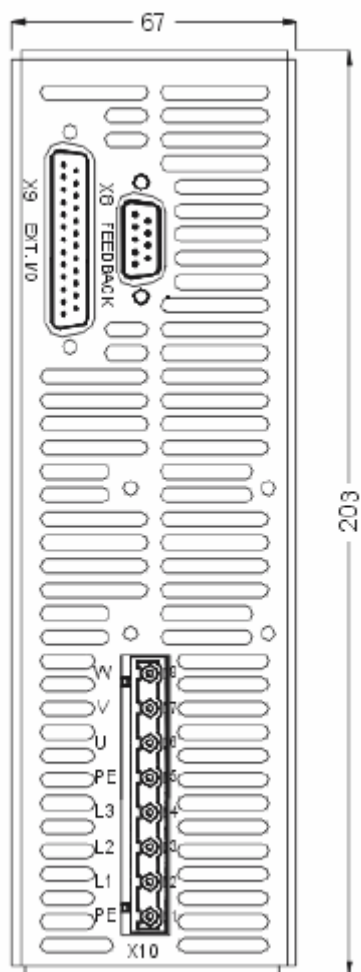


X5	I/O	Digital I/O
X6	24Vdc	Auxiliary 24V DC supply
X7	RB	External braking resistor



The voltage on connector X7 can reach 400V for an MD 230 and 800V for an MD 400!

2-4- Bottom view



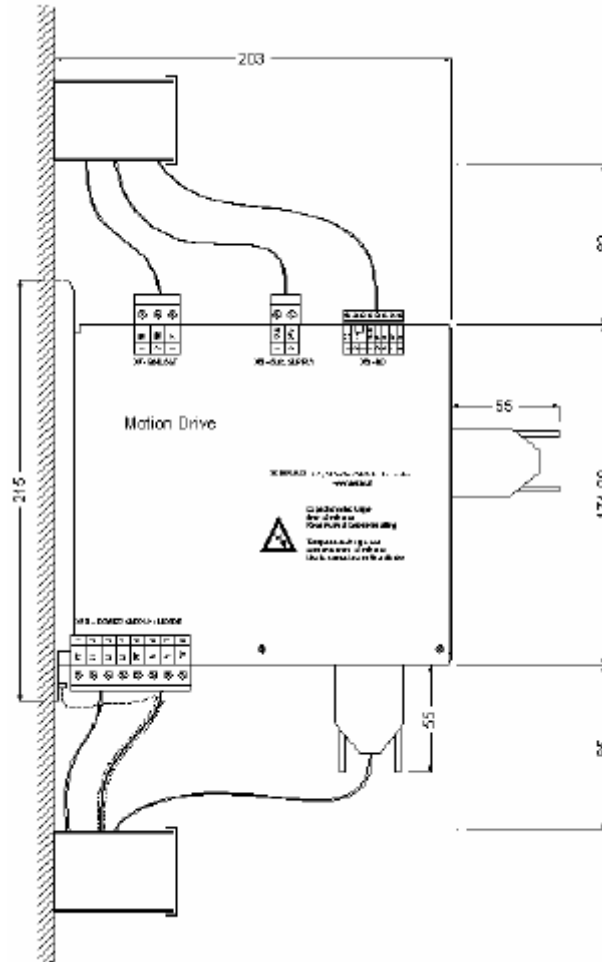
- | | | |
|-----|----------|--|
| X8 | FEEDBACK | Motor position feedback (resolver / encoder) |
| X9 | EXT I/O | Option : I/O expansion board |
| X10 | POWER | Single / Three-phase supply Motor armatures |



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

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 and also to allow for the various connectors and cables to be fitted

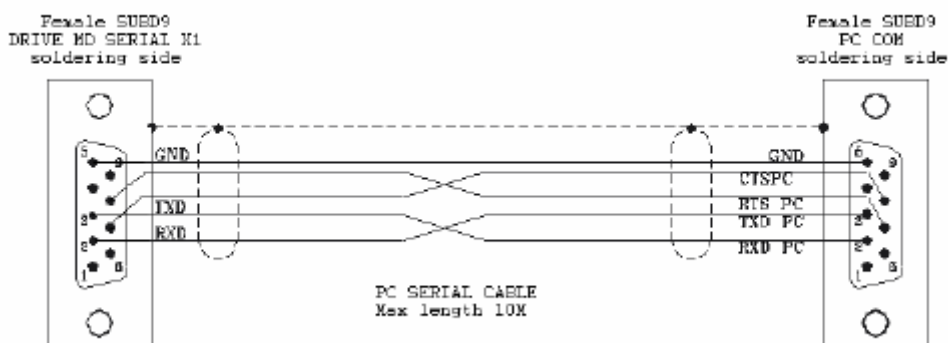


2-6- Connector pin assignments

X1: RS 232 serial port for downloading programs and parameters.

Connector: SUBD 9 way male


No.	Name	Type	Description
1			
2	RXD	In	Receive data
3	TXD	Out	Transmit data
4			
5	GND		0V
6			
7			
8	CTS	In	Clear to send
9			
	SHIELD		Connect the shield to the shell of the connector



X2: Master encoder input / simulated encoder output


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

Connector: SUBD 9 way female


No.	Name	Type	Description
1	A	I/O	Channel A
2	/A	I/O	Channel A inverted
3	B	I/O	Channel B
4	/B	I/O	Channel B inverted
5	Z	I/O	Zero marker
6	/Z	I/O	Zero marker inverted
7	+5Vdc	Out	Supply for external encoder, 100 mA max.
8	GND		0V
9			
	SHIELD		Connect the shield to the shell of the connector

X3: Analogue I/O

Connector: Removable 6 ways, 3.81mm pitch

No.	Name	Type	Description
1	OUT	Out	Analogue output (function monitor)
2	AGND		0V analogue
3	IN1+	In	Analogue input 1 : assigned to speed or torque command, according to mode
4	IN1-	In	Analogue input 1
5	IN2+	In	Analogue input 2 : assigned to torque limit
6	IN2-	In	Analogue input 2
	SHIELD		Connect the shield to the screw of the drive case

X4: Extension: Optional communications port

No.	RS 232 SUBD 9 way male	RS 422 SUBD 9 way female	RS 485 SUBD 9 way female	CANopen SUBD 9 way male
1				
2	RXD			
3	TXD	RX-		
4		RX+		
5	GND	GND	GND	CAN_GND
6				
7		TX-	TRX-	CAN_L
8		TX+	TRX+	CAN_H
9				
	SHIELD - Connect the shield to the shell of the connector			

- Node Address : For RS422, RS485 and CANopen, the NodeID corresponds to the rotary switch position + 1
e.g. : Rotary switch in position 3 \Rightarrow NodeID 4
- Extended Node Address: For RS422, RS485 and CANopen, link 1 to pin 6. The NodeID then corresponds to the rotary switch position + 17
e.g. : Rotary switch in position 3 \Rightarrow NodeID 20
- Check bus termination resistance (120 Ω) :
For RS422, link pin 2 to pin 3, and pin 8 to pin 9.
For RS485 and CANopen, link pin 8 to pin 9.

X5: Digital I/O

Connector: Removable 8 ways, 3.81mm pitch

No.	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	In	Input 4, programmable
6	I3	In	Input 3, programmable
7	I2	In	Input 2, programmable
8	I1	In	Input 1, programmable: standard function ENABLE



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

X6: 24V dc supply

Connector: Removable 2 ways, 5.08mm pitch

No.	Name	Type	Description
1	XGND		0V
2	24V dc	In	Control card supply, backup motor position

X7: External braking resistance

Connector: Removable 3 ways, 7.62mm pitch

No.	Name	Type	Description
1	RI		Internal braking resistor *
2	RB		Braking resistor *
3	DC Bus +	Out	DC bus (310 V for MD 230, 560 V for MD 400)

*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

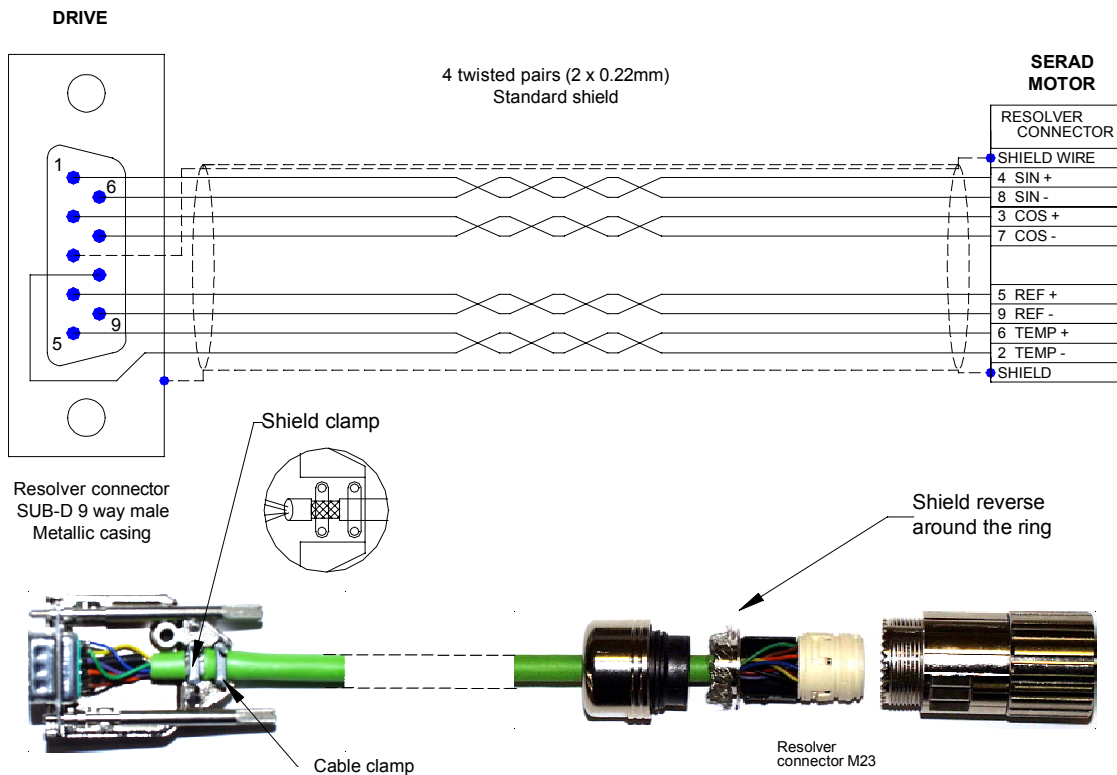


The voltage on connector X7 can reach 400V for an MD 230 and 800V for an MD 400!

X8: Motor position feedback (resolver)

Connector: SUBD 9 way female


No.	Name	Type	Description
1	S2	In	Sine Hi
2	S1	In	Cosine Hi
3	AGND		0V analogue
4	R1	Out	Reference Hi
5	°CM+	In	Motor temperature sensor Hi
6	S4	In	Sine Lo
7	S3	In	Cosine Lo
8	°CM-	In	Motor temperature sensor Lo
9	R2	Out	Reference Lo
	SHIELD		Connect the shield to the shell of the connector



The maximum length for the power and feedback cables is 20m. For more than 20m, please contact our technical support.

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

Connector: SUBD 25 way female

No.	Name	Type	Description
1	I5	In	Input 5, programmable
2	I6	In	Input 6, programmable
3	I7	In	Input 7, programmable
4	I8	In	Input 8, programmable
5	I9	In	Input 9, programmable
6	I10	In	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 24V dc**	In	External supply, 24 V dc
13	IO 24V dc**	In	External supply, 24 V dc
14	I11	In	Input 11, programmable
15	I12	In	Input 12, programmable
16	I13	In	Input 13, programmable
17	I14	In	Input 14, programmable
18	I15	In	Input 15, programmable
19	I16	In	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

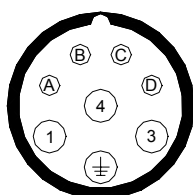
X10: High voltage supply, motor armature

Connector: Removable 8 ways, 7.62mm pitch

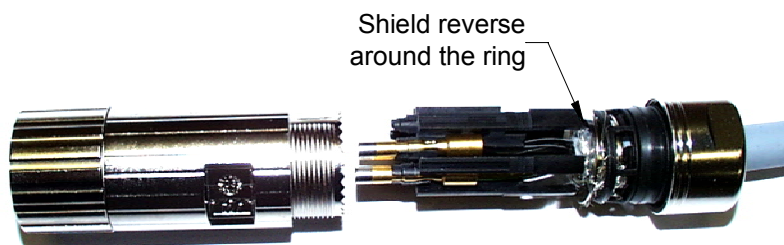
No.	Name	Type	Description
1	PE		Supply earth
2	L1*	In	Supply L1 (230V for MD 230, 400V for MD 400)
3	L2*	In	Supply L2 (230V for MD 230, 400V for MD 400)
4	L3	In	Supply L3 (230V for MD 230, 400V for MD 400)
5	PE		Motor earth
6	U	Out	Motor phase U
7	V	Out	Motor phase V
8	W	Out	Motor phase W

For a 230V ac single-phase supply, connect Live to L1 and Neutral to L2

SERAD MOTOR



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



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

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

Connect the shield (on drive side) to the screw provided (see 2-2 Front view).

The maximum length for the power and feedback cables is 20m. For more than 20m, please contact our technical support.

2-7- Cables

- **RS 232 serial communication cable, X1 :**

Screened cable, 4 core

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

- **Encoder cable, X2 :**

Screened cable with 4 twisted pairs, 0.25 mm²

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

- **Analogue cable, X3 :**

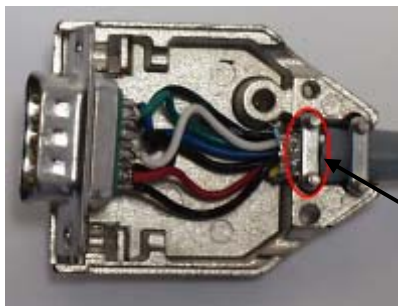
Screened cable, 2 core, 0.25 mm² per analogue input.

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

- **Motor feedback cable (resolver), X8 :**

Screened cable with 4 twisted pairs, 0.25 mm²

Ground the shield of the feedback SUBD as shown below:



Bonding strip in contact with the metal support

- **Motor power cable, X10 :**

Cable with general shielding, 4 wires (more two if brake).

Section 1,5 mm² for variator until 8 A. Beyond that, envisage of the 2,5 mm².

Connect the shield (on drive side) to the screw provided (see 2-2 Front view).

The maximum length for the power and feedback cables is 20m. For more than 20m, please contact our technical support.

2-8- Connection diagrams / Protections



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 1 of the connector X10).

Connect the motor earth to the drive (pin 1 of the connector X10) before applying any voltages.

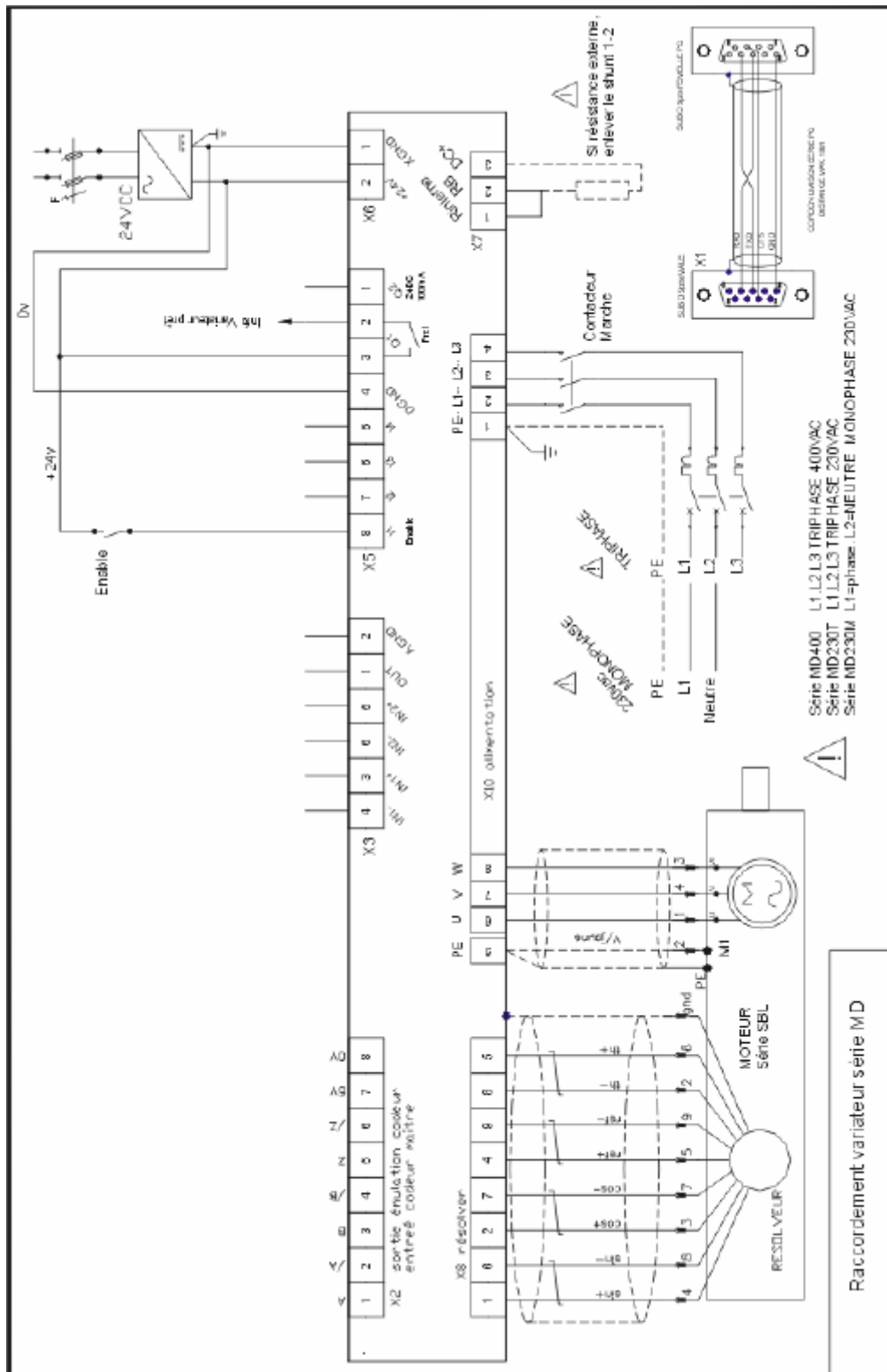
For the shielded cables, to connect the braid to the frame at each extremity via the caps of the connectors (for the SUBD) or the screws provided for this purpose (X3 connectors, X10) in order to ensure an optimal equipotentiality.

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
MD230/1	230V single phase	3,5A	10A maxi	1,5 ²
MD230/2	230V single phase	7A	10A maxi	1,5 ²
MD230/5	230V single phase	14A	10A maxi	1,5 ²
MD230/7	230V single phase	21A	16A maxi	2,5 ²
MD400/1	400V three phase	2,2A	10A maxi	1,5 ²
MD400/2	400V three phase	4,2A	10A maxi	1,5 ²
MD400/5	400V three phase	8,2A	10A maxi	1,5 ²

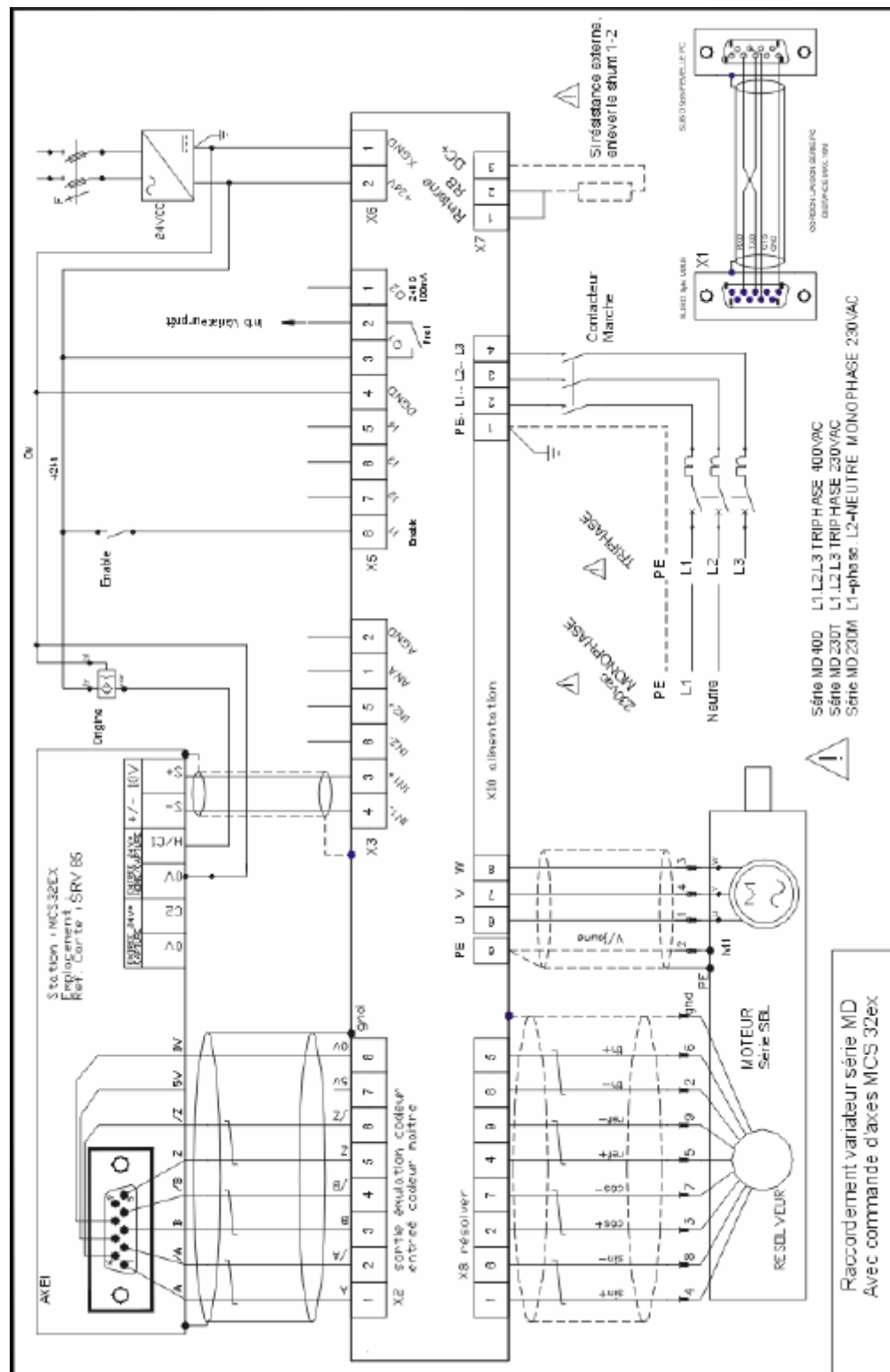
Caution: the ringing current can reach 25 A.

2-9- Stand-alone drive



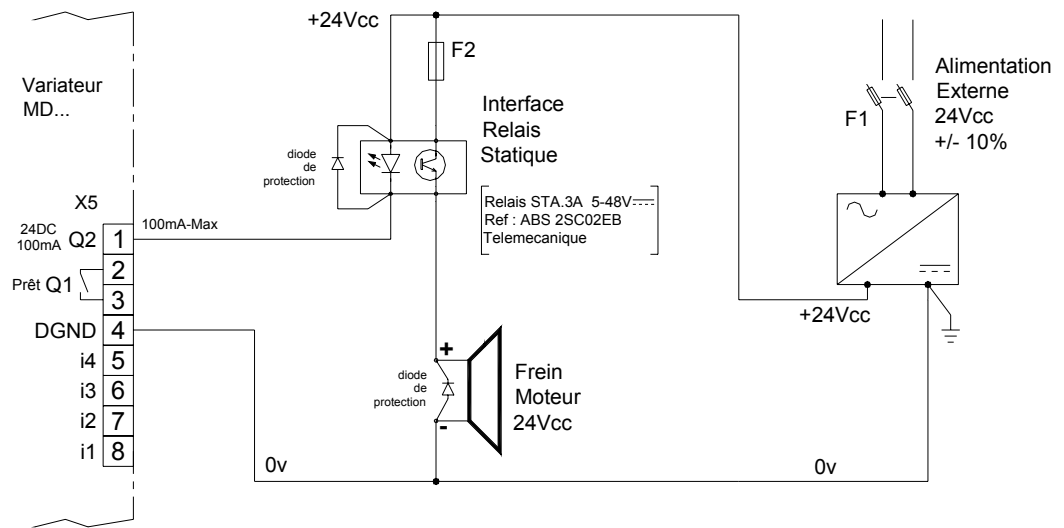
The output Q2 is NPN open collector, 100mA max. The load must be connected between Q2 and +24Vdc.

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 DPL 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:



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.



DC Bus under-voltage: an under-voltage has been detected on the internal dc bus. This condition is only monitored when the drive is active (Enable = ON).



I²t motor: I²t motor detected.



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



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



Temperature IGBT: maximum temperature attained in the drive.



Temperature motor: maximum motor temperature attained.



Resolver fault: Resolver feedback signals defective (verify feedback cable and motor connector).



Invalid parameters: checksum error on the drive parameters.



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



DPL error: an error has been detected during the execution of the DPL tasks.



Following error: the maximum following error has been exceeded.

