

# **Digital DRIVE for Brushless motor SMD 230-A Series**

## **INSTALLATION GUIDE**

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





# Table of contents

|             |  |           |
|-------------|--|-----------|
| <b>I.</b>   | <b>INTRODUCTION .....</b>                                | <b>1</b>  |
| I.1         | SMD SERIES DRIVE DESCRIPTION .....                       | 2         |
| I.1.1       | General .....  | 2         |
| I.1.2       | Technical data.....                                      | 2         |
| <b>II.</b>  | <b>INSTALLATION .....</b>                                | <b>4</b>  |
| II.1        | GENERAL.....   | 4         |
| II.2        | FRONT VIEW .....   | 5         |
| II.3        | TOP VIEW .....   | 6         |
| II.4        | BOTTOM VIEW .....  | 7         |
| II.5        | MOUNTING .....   | 8         |
| II.6        | CONNECTOR PIN ASSIGNMENTS .....                          | 9         |
| II.6.1      | X1 - USB : USB port for communication with a PC .....    | 9         |
| II.6.2      | X2 – COM : RS485 serial port.....                        | 9         |
| II.6.3      | X3 – I/O : Digital Inputs/Outputs .....                  | 10        |
| II.6.4      | X4 – SAFE - ANA : Safety STO inputs – Analog input ..... | 10        |
| II.6.5      | X5 – BUS : Fieldbus communication .....                  | 11        |
| II.6.6      | X6 – AUX : Auxiliary 24Vdc supply.....                   | 12        |
| II.6.7      | X7 – POWER : Power 230Vac supply .....                   | 12        |
| II.6.8      | X8 – FEEDBACK : Main feedback Encoder, Resolver .....    | 13        |
| II.6.9      | X9 – MASTER : Master feedback .....                      | 13        |
| II.6.10     | X10 – MOTOR : motor power supply .....                   | 14        |
| II.6.11     | X11 – BALLAST: External braking resistor.....            | 14        |
| II.7        | CABLES .....   | 15        |
| II.8        | PROTECTION / CONNECTION DIAGRAM .....                    | 16        |
| II.8.1      | Motor Brake output.....                                  | 16        |
| II.8.2      | STO function caution .....                               | 16        |
| II.9        | SYSTEM CHECK BEFORE STARTING .....                       | 18        |
| <b>III.</b> | <b>7 SEGMENTS STATUS DISPLAY .....</b>                   | <b>19</b> |
| III.1       | INITIALIZATION SEQUENCE.....                             | 19        |
| III.2       | SMD IN RUNNING.....                                      | 20        |
| III.3       | SPECIFIC PHASE .....                                     | 20        |
| III.4       | ERROR CODE .....   | 21        |
| III.4.1     | Errors.....  | 21        |
| III.4.2     | Hardware problems .....                                  | 23        |
| III.4.3     | Warnings .....   | 24        |
| III.4.4     | Information.....   | 24        |
| III.4.5     | Bootloader error .....                                   | 25        |
| <b>IV.</b>  | <b>REVISION .....</b>                                    | <b>26</b> |

## I. INTRODUCTION



Read this manual first before installing the drive, non-observance may result in damage to property and in personal injuries.

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

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

The safety rules are:

|                 |   |
|-----------------|---|
| <b>VDE 0100</b> | Specification for the installation of power systems up to 1000V |
| <b>VDE0113</b>  | Electrical equipment of machines                                |
| <b>VDE0160</b>  | 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 any damage caused by using this documentation and software.

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

## I.1 SMD series drive description

### I.1.1 General

The SMD Series brushless drives are specially adapted for high dynamic performance.

They contain an integrated power supply and optional mains filter.

They can be used to control motor torque, speed or position depending on their operating mode.

Various field bus configurations are available such as MODBUS, CANopen and EtherCAT that allow the use of the drives in networked systems.

Thanks to their easy-to-program Basic language, multi-tasking kernel, MOTION control features and integrated PLC functions, they are well suited to a wide range of applications.

### I.1.2 Technical data

|                              |  |   |  |  |
|------------------------------|--|---|--|--|
| <b>Supply :</b>              | 90 to 250V AC single phase, neutral system TN or TT<br>Earth leakage current ( only for model with EMC filter ) : 3,2 mA<br><b>Neutral system IT is prohibited</b>   |   |  |  |
| <b>Auxiliary supply :</b>    | 24 V DC $\pm 10\%$ , 0.2A typical, 0.7A max  |   |  |  |
| <b>Supply filter* :</b>      | EMC filter   |   |  |  |
| <b>Switching frequency :</b> | 10 kHz sine-wave PWM   |   |  |  |
| <b>DC bus voltage :</b>      | 310V to 400V   |   |  |  |
| <b>Thermal dissipation :</b> | Power stage off<br>SMD230/01: 15W max SMD230/02: 20W max SMD230/05: 20W max<br><br>Power stage on, at rated current<br>SMD230/01: 23W SMD230/02: 30W SMD230/05: 50W  |   |  |  |
| <b>Absorption :</b>          | Energy absorbable by the drive without braking resistor: 15J   |   |  |  |
| <b>Brake resistor :</b>      | Brake chopper integrated, Optional external brake resistor :<br>Min value    Typical value    Max. continous. power    Impulsional power<br>40 $\Omega$ 75 $\Omega$ 1,8kW                            4,6kW |   |  |  |
| <b>Protection :</b>          | Short circuit between phases, phase to earth, over current, I <sub>2t</sub><br>Over voltage, under voltage<br>Motor feedback fault   |   |  |  |
| <b>Motor feedback* :</b>     | Tamagawa serial  | Multi turn : Max 16bits signed<br>Bits per turn : Max 24bits  |  |  |
|                              | EnDat 2.2  | EnDat 2.2 Bidirectional<br>Multi turn : Max 32bits signed<br>Total bits (Multi turn + 1 turn ) : 64 bits  |  |  |
|                              | Biss   | Biss C unidirectional<br>Multi turn : Max 32bits signed<br>Total bits (Multi turn + 1 turn ) : 64 bits  |  |  |
|                              | Ssi  | Frequency : 200KHz – 50MHz (F <sub>min</sub> > (NBits + 1.5) / 50 $\mu$ s)<br>Multi turn : Max 32bits signed<br>Total bits (Multi turn + 1 turn ) : 64 bits |  |  |
|                              | Resolver   | Signal Sin/Cos differential<br>Excitation : +/-10Vpp 10KHz – 30mA max<br>Transformation ratio: 0.2 - 2  |  |  |

|                                |  |  |
|--------------------------------|--|--|
|                                | Incremental  | A-quad-B, with or without index/Halls, Step/Dir, CW/CCW<br>RS485 line receiver, differential<br>A-quad-B max input frequency : 100MHz (before quadrature)<br>Temps minimum impulsion index : 200ns<br>Halls : Differential (Positive/Negative) |
| <b>Master encoder :</b>        | Incremental  | A-quad-B, with or without index, Step/Dir, CW/CCW<br>RS485 line receiver, differential<br>A-quad-B max input frequency : 100MHz (before quadrature)<br>Temps minimum impulsion index : 200ns   |
|                                | Virtual  | DriveBasic   |
| <b>Communication* :</b>        | USB<br>RS 485: MODBUS RTU slave<br>CANopen: DS 402, SDO, PDO<br>EtherCAT CoE, SoE  |  |
| <b>Digital inputs :</b>        | 6 inputs ( 2 fast inputs I5 and I6)<br>Type: PNP, 24V DC, 10mA per input and 15mA per fast input<br>Logic 0: Between 0 and 5 V<br>Logic 1: Between 8 and 30 V  |  |
| <b>Digital outputs :</b>       | 2 outputs<br>Q1 : Relay, 48V dc / 48V ac, 3A max<br>Q2 : Static PNP 24Vdc, 1A max  |  |
| <b>Analog input :</b>          | 1 input :<br>Input voltage : 0 ... 10 V<br>Maximum voltage : 12 V<br>Input impedance : 18 Kohm<br>Resolution : 12 bit  |  |
| <b>Diagnostic :</b>            | STATUS display 7 segments  |  |
| <b>Safety* :</b>               | STO ( Safe Torque Off ), Category 4 / SIL3 / PL e<br>24 Vdc, 60 mA typical per channel   |  |
| <b>Architecture :</b>          | Processor : 200 MHz DSP<br>FLASH memory for operating system and programs<br>FRAM memory for variables and parameters<br>Real-time, multi-tasking kernel   |  |
| <b>Control loops :</b>         | Current loop : 50 $\mu$ s<br>Speed loop : 100 $\mu$ s<br>Position loop : 100 $\mu$ s   |  |
| <b>Operating modes :</b>       | Torque, Speed and Position mode<br>Motion functions (absolute, relative and infinite movements, S and Sin <sup>2</sup> profile)<br>Advanced motion functions (gearbox, CAM profiles, CAMBOX functions, triggered movement) |  |
| <b>Operating temperature :</b> | 0 to 40°C  |  |
| <b>Storage temperature :</b>   | -10 to 70°C  |  |
| <b>Degree of protection :</b>  | IP 20  |  |
| <b>Weight</b>                  | SMD 230/01 : 0.9 kg    SMD 230/02 : 1.2 kg    SMD 230/05 : 1.2 kg  |  |

\* according SMD 230 model

| Drive        | Rated current | Peak current ( 2s ) | Rated power | Dimensions w x h x d (mm) |
|--------------|---------------|---------------------|-------------|---------------------------|
| SMD 230 / 01 | 1,25 Arms     | 3,75 Arms           | 0,4 kVA     | 43 x 202 x 134            |
| SMD 230 / 02 | 2,5 Arms      | 7,5 Arms            | 0,75 kVA    | 64 x 202 x 134            |
| SMD 230 / 05 | 5 Arms        | 10 Arms             | 1,5 kVA     | 64 x 202 x 134            |

## II. INSTALLATION

### II.1 General



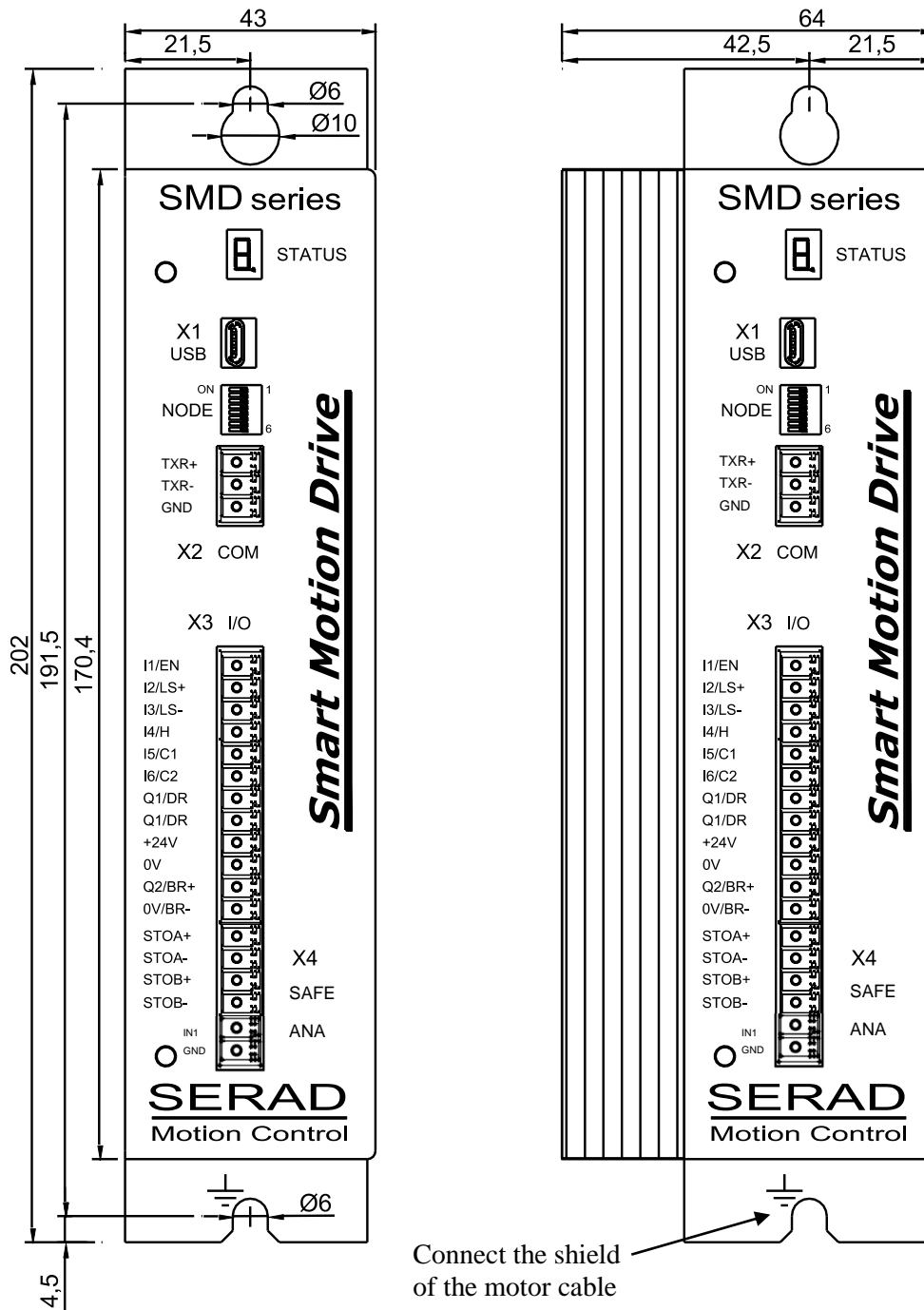
It is very important to adhere to the following:

- 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.
- All of the communication and I/O cables should be run separately from the power cables.
- The USB cable between the drive and the PC must be screened. It should be disconnected from the drive when no longer in use
- Diodes must be fitted across the loads on all static digital outputs. 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 position loop, the parameter "Maximum following error" should be set appropriately.
- If the drive contains an application program developed using Drive Studio, connect a signal 'Power 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.

## II.2 Front view

Model : SMD 230 / 01

SMD 230 / 02 - SMD 230 / 05



|    |          |                                      |
|----|----------|--------------------------------------|
|    | STATUS   | 7-segment diagnostic display         |
|    | NODE     | Node address                         |
| X1 | USB      | USB port for communication with a PC |
| X2 | COM      | RS485 serial port                    |
| X3 | I/O      | Digital Inputs / Outputs             |
| X4 | SAFE-ANA | SAFETY STO inputs, Analog input      |

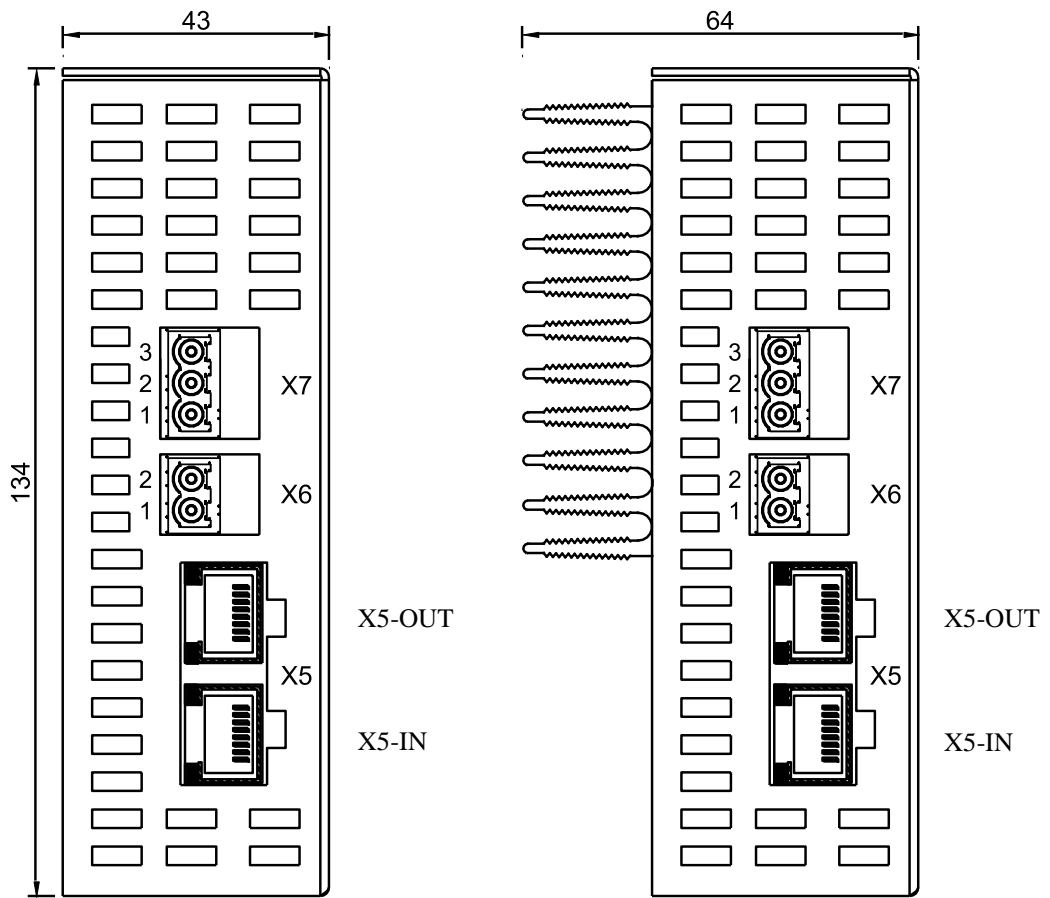


### II.3 Top view

Model :

SMD 230 / 01

SMD 230 / 02 - SMD 230 / 05



- |    |       |  |
|----|-------|--|
| X5 | BUS   | Fieldbus communication (CANopen, EtherCAT) |
| X6 | AUX   | Auxiliary 24 Vdc supply                    |
| X7 | POWER | Single phase power 230 Vac supply          |



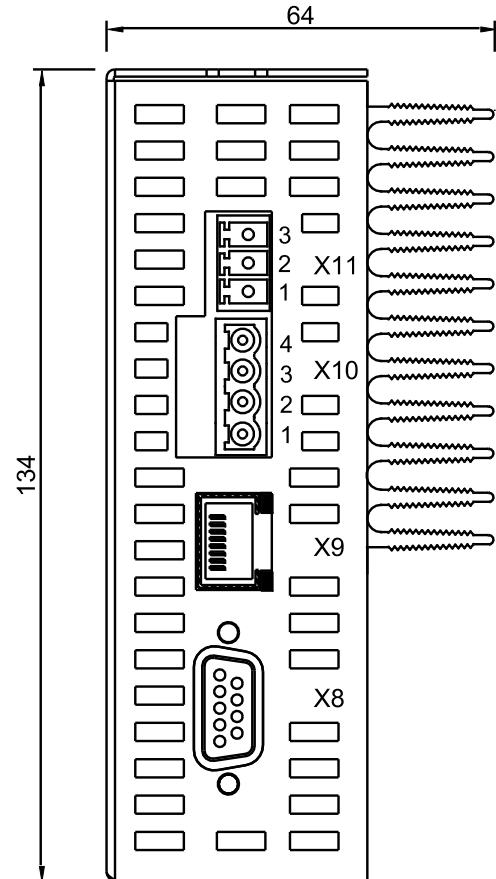
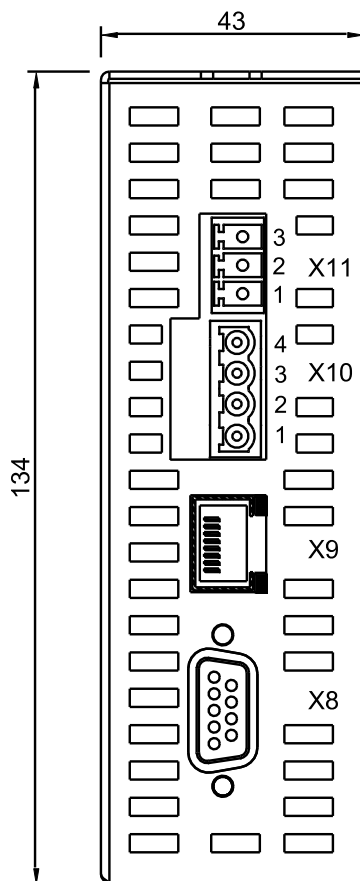
**The voltage on connector X7 can reach 230Vac !**

## II.4 Bottom view

Model :

SMD 230 / 01

SMD 230 / 02 - SMD 230 / 05



|     |          |   |
|-----|----------|---|
| X8  | FEEDBACK | Main feedback (resolver / Tamagawa encoder / incremental) |
| X9  | MASTER   | Master feedback (incremental encoder / stepper)           |
| X10 | MOTOR    | Motor power supply  |
| X11 | BALLAST  | External braking resistor                                 |



**Care must be taken when making connections to connector X10 and X11.**

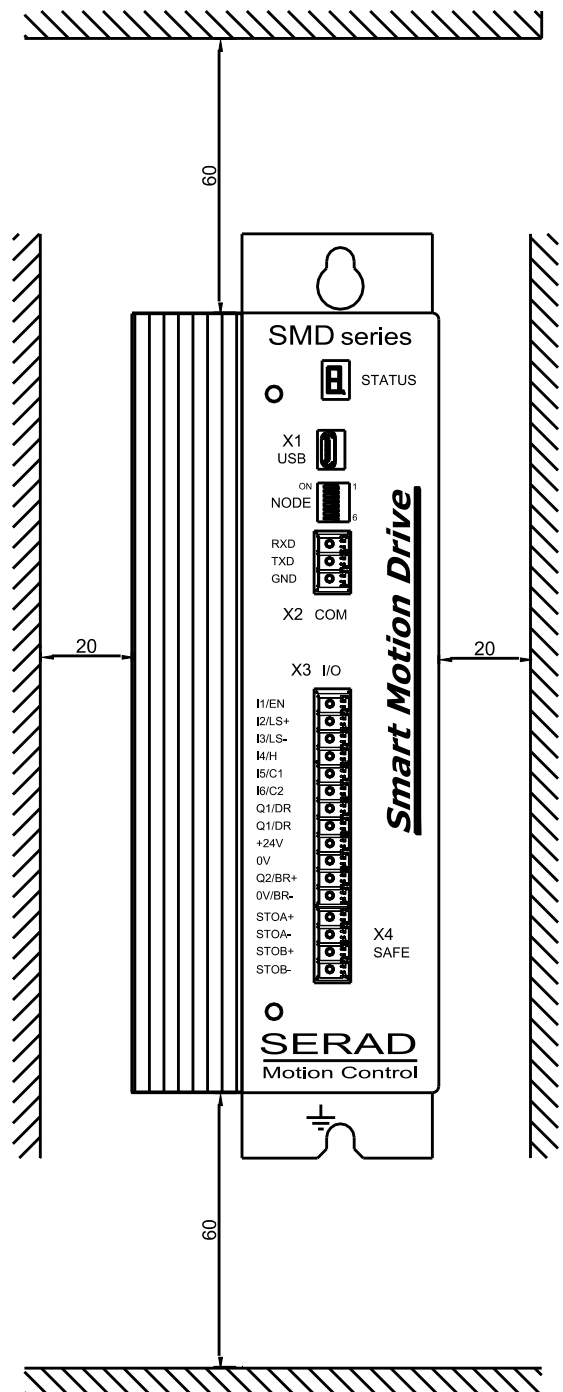
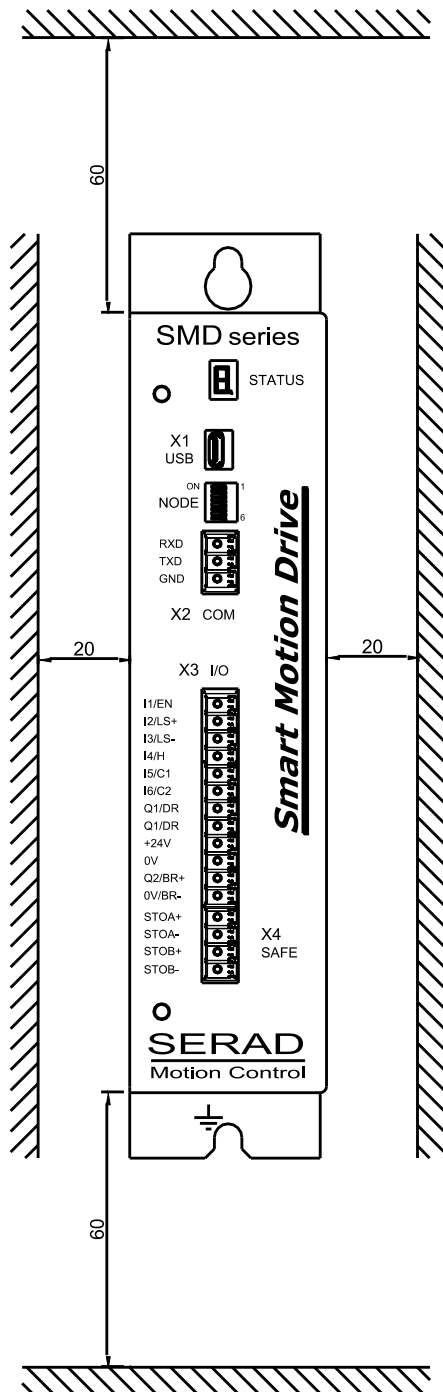
**An incorrect connection can seriously damage the drive. Dangerous voltages are present (320V).**

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

## II.5 Mounting

Model : SMD 230 / 01

SMD 230 / 02 - SMD 230 / 05

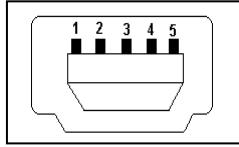


Several drives can be mounted side-by-side provided that enough space (at least 20mm) is left to ensure good natural convection. Leave a space greater than 60mm over and under the drives to allow for the various connectors and cables to be fitted.

## II.6 Connector pin assignments

### II.6.1 X1 - USB : USB port for communication with a PC

Connector type (device side) : Mini USB female

| N° | Name   | Type    | Description   |
|----|--------|---------|---|
| 1  | VCC    | Inp     | V Bus   |
| 2  | USB D- | Inp/Out | USB Data -  |
| 3  | USB D+ | Inp/Out | USB data +  |
| 4  | NC     |         |   |
| 5  | GND    |         | 0V  |

### II.6.2 X2 – COM : RS485 serial port

Connector type (Device side) : 3 ways, 3.81 pitch

| N° | Name | Type    | Description                     |
|----|------|---------|---------------------------------|
| 1  | TXR+ | Inp/Out | Transmit & receive data + ( A ) |
| 2  | TXR- | Inp/Out | Transmit & receive data - ( B ) |
| 3  | GND  |         | 0V                              |

- **RS485 Node Address :**

NodeID Adress = ( binary to decimal conversion of Dipswitchs 1,2,3,4,5,6 ) + 1

| Node ID N° | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | ... | 63  | Reserved |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------|
| Dip 1      | OFF | ON  | OFF | ON  | OFF | ON  | OFF | ON  | OFF | ON  |     | OFF | ON       |
| Dip 2      | OFF | OFF | ON  | ON  | OFF | OFF | ON  | ON  | OFF | OFF |     | ON  | ON       |
| Dip 3      | OFF | OFF | OFF | OFF | ON  | ON  | ON  | ON  | OFF | OFF |     | ON  | ON       |
| Dip 4      | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | ON  | ON  |     | ON  | ON       |
| Dip 5      | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF |     | ON  | ON       |
| Dip 6      | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF |     | ON  | ON       |

Note: In case of also CANopen communication on the SMD drive, the Dip switch 6 is used to activate the terminal resistor of the CANopen bus and not available to select the nodeID.

Note: If needed, the RS485 terminal resistor (120Ω) must be placed on the X2 connector between pins 1 and 2.

### II.6.3 X3 – I/O : Digital Inputs/Outputs

**Connector type (device side): 12 ways, 3.81 pitch**

| N° | Name     | Type | Description   |
|----|----------|------|---|
| 1  | I1 / EN  | Inp  | Input 1 / Specific function: Enable   |
| 2  | I2 / LS+ | Inp  | Input 2 / Specific function: Limit Switch +                                       |
| 3  | I3 / LS- | Inp  | Input 3 / Specific function: Limit Switch -                                       |
| 4  | I4 / H   | Inp  | Input 4 / Specific function: Home switch  |
| 5  | I5 / C1  | Inp  | Input 5 / Specific function: Capture 1 ( fast input )                             |
| 6  | I6 / C2  | Inp  | Input 6 / Specific function: Capture 2 ( fast input )                             |
| 7  | Q1 / DR  | Out  | Output 1 / Specific function: Drive Ready<br>Relay contact NO between way 7 and 8 |
| 8  | Q1 / DR  | Out  | Relay contact NO between way 7 and 8  |
| 9  | +24V     | Inp  | 24Vdc for Output 2 supply   |
| 10 | 0V       |      | 0V for I/O reference  |
| 11 | Q2 / BR+ | Out  | Output 2 / Specific function: Motor Brake +<br>PNP 24Vdc type, 1A max             |
| 12 | 0V / BR- |      | 0V / Motor Brake -  |

### II.6.4 X4 – SAFE - ANA : Safety STO inputs – Analog input

**Connector type (device side): 6 ways, 3.81 pitch**

| N° | Name  | Type | Description   |
|----|-------|------|---|
| 1  | STOA+ | Inp  | Safe Torque Off input A.<br>Must be hold to 24V (60 mA typical) |
| 2  | STOA- | Inp  | Safe Torque Off input A.<br>Must be hold to 0V                  |
| 3  | STOB+ | Inp  | Safe Torque Off input B.<br>Must be hold to 24V (60 mA typical) |
| 4  | STOB- | Inp  | Safe Torque Off input B.<br>Must be hold to 0V                  |
| 5  | IN1   | Inp  | Analog input  |
| 6  | GND   |      | Analog 0V   |

## II.6.5 X5 – BUS : Fieldbus communication

### Connector type (device side): RJ45

| N° | CANOpen |         | EtherCAT |      |
|----|---------|---------|----------|------|
|    | Name    | Type    | Name     | Type |
| 1  | CAN_H   | Inp/Out | TD+      | Out  |
| 2  | CAN_L   | Inp/Out | TD-      | Out  |
| 3  | CAN_GND |         | RD+      | Inp  |
| 4  |         |         |          |      |
| 5  |         |         |          |      |
| 6  |         |         | RD-      | Inp  |
| 7  | CAN_GND |         |          |      |
| 8  |         |         |          |      |
|    | Shield  |         | Shield   |      |

- **CANopen Node Address :**

NodeID Adress = ( binary to decimal conversion of Dipswitchs 1,2,3,4,5 ) + 1

The terminal resistor is activated by the dipswitch n°6 (120 Ω).

| Node ID N° | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | ... | 31  | Reserved |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------|
| Dip 1      | OFF | ON  | OFF | ON  | OFF | ON  | OFF | ON  | OFF | ON  |     | OFF | ON       |
| Dip 2      | OFF | OFF | ON  | ON  | OFF | OFF | ON  | ON  | OFF | OFF |     | ON  | ON       |
| Dip 3      | OFF | OFF | OFF | OFF | ON  | ON  | ON  | ON  | OFF | OFF |     | ON  | ON       |
| Dip 4      | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | ON  | ON  |     | ON  | ON       |
| Dip 5      | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF |     | ON  | ON       |
| Dip 6      | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF |     | OFF | OFF      |

- **EtherCAT Node Address :**

NodeID Adress = ( binary to decimal conversion of Dipswitchs 1,2,3,4,5,6 ) + 1

| Node ID N° | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | ... | 63  | Reserved |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----------|
| Dip 1      | OFF | ON  | OFF | ON  | OFF | ON  | OFF | ON  | OFF | ON  |     | OFF | ON       |
| Dip 2      | OFF | OFF | ON  | ON  | OFF | OFF | ON  | ON  | OFF | OFF |     | ON  | ON       |
| Dip 3      | OFF | OFF | OFF | OFF | ON  | ON  | ON  | ON  | OFF | OFF |     | ON  | ON       |
| Dip 4      | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | ON  | ON  |     | ON  | ON       |
| Dip 5      | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF |     | ON  | ON       |
| Dip 6      | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF | OFF |     | ON  | ON       |



**Node ID is taken into account by the drive only when auxiliary supply ( X6 connector ) is turned on.**

### II.6.6 X6 – AUX : Auxiliary 24Vdc supply

**Connector type (device side): 2 ways, 5.08 pitch**

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

### II.6.7 X7 – POWER : Power 230Vac supply

**Connector type (device side) : 3 ways, 5.08 pitch**

| N° | Name | Type | Description  |
|----|------|------|--------------|
| 1  | L1   | Inp  | Line L1      |
| 2  | N    | Inp  | Neutral      |
| 3  | PE   |      | Supply earth |



**Neutral system : TN or TT only. Neutral system IT is prohibited**

**Care must be taken when making connections to connector X7.**

**An incorrect connection can seriously damage the drive. Dangerous voltages are present on X7.**

## II.6.8 X8 – FEEDBACK : Main feedback Encoder, Resolver

Connector type ( device side ) : Sub-D 9/25 female

| N° | Tamagawa encoder      |         | Resolver              |      | Incremental           |      | EnDat 2.2          |         |
|----|-----------------------|---------|-----------------------|------|-----------------------|------|--------------------|---------|
|    | Name                  | Type    | Name                  | Type | Name                  | Type | Nom                | Type    |
| 1  | SD+                   | Inp/Out | S2 (sinus+)           | Inp  | A                     | Inp  | Data               | Inp/Out |
| 2  | SD-                   | Inp/Out | S1 (cosinus+)         | Inp  | A/                    | Inp  | /Data              | Inp/Out |
| 3  | GND                   |         | GND                   |      | B                     | Inp  | GND                |         |
| 4  |                       |         | R1 (reference+)       | Out  | B/                    | Inp  |                    |         |
| 5  | °CM+ (thermal sensor) | Inp     | °CM+ (thermal sensor) | Inp  | Z                     | Inp  | °CM+               | Inp     |
| 6  |                       |         | S4 (sinus-)           | Inp  | Z/                    | Inp  | Clk                | Out     |
| 7  | +5Vdc (100 mA max)    | Out     | S3 (cosinus-)         | Inp  | HALL U                | Inp  | +5Vdc (100 mA max) | Out     |
| 8  | °CM- (thermal sensor) | Inp     | °CM- (thermal sensor) | Inp  | HALL U/               | Inp  | °CM-               | Inp     |
| 9  |                       |         | S2 (sinus+)           | Out  | HALL V                | Inp  | /Clk               | Out     |
| 10 |                       |         |                       |      | HALL V/               | Inp  |                    |         |
| 11 |                       |         |                       |      | HALL W                | Inp  |                    |         |
| 12 |                       |         |                       |      | HALL W/               | Inp  |                    |         |
| 13 |                       |         |                       |      | °CM+ (thermal sensor) | Inp  |                    |         |
| 14 |                       |         |                       |      | +5Vdc (100 mA max)    | Inp  |                    |         |
| 15 |                       |         |                       |      | GND                   |      |                    |         |
|    | Shield                |         | Shield                |      | Shield                |      | Shield             |         |

## II.6.9 X9 – MASTER : Master feedback

Connector type (device side) : RJ45

| N° | Incremental encoder |      | Stepper            |      |
|----|---------------------|------|--------------------|------|
|    | Name                | Type | Name               | Type |
| 1  | A                   | Inp  | Pulse              | Inp  |
| 2  | A/                  | Inp  | Pulse/             | Inp  |
| 3  | B                   | Inp  | Direction          | Inp  |
| 4  | Z/                  | Inp  |                    |      |
| 5  | Z                   | Inp  |                    |      |
| 6  | B/                  | Inp  | Direction/         | Inp  |
| 7  | +5Vdc (100 mA max)  | Out  | +5Vdc (100 mA max) | Out  |
| 8  | GND                 |      | GND                |      |
|    | shield              |      | shield             |      |



### II.6.10 X10 – MOTOR : motor power supply

**Connector type (device side) : 4 ways, 5.08 pitch**

| N° | Name | Type | Description   |
|----|------|------|---------------|
| 1  | PE   |      | Motor earth   |
| 2  | U    | Out  | Motor phase U |
| 3  | V    | Out  | Motor phase V |
| 4  | W    | Out  | Motor phase W |

The shielded motor cable must be connected directly to the terminals of the drive.  
Connect the shield, on drive side, to the lower fixing hole (see “Front view” picture).



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

### II.6.11 X11 – BALLAST: External braking resistor

**Connector type (device side) : 3 ways, 5.08 pitch**

| N° | Name     | Type | Description      |
|----|----------|------|------------------|
| 1  | DC BUS - | Out  | DC Bus (320 Vdc) |
| 2  | RB       | Out  | Braking resistor |
| 3  | DC BUS + | Out  | DC Bus (320 Vdc) |

The external braking resistor must be connected between the terminals 2 and 3 ( RB and DC BUS+ ).

For SMD 230 / 02 and SMD 230 / 05 models, the external resistor can be mounted on the heatsink using the two screws provided .

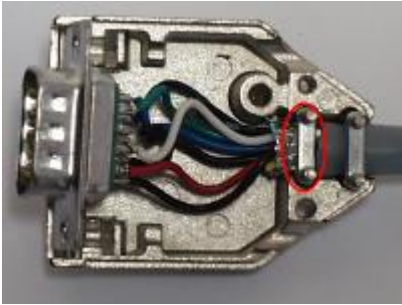


**If you have lost the supplied screws for the external resistor, you must use only M4 x 6 screw or you will damage the drive.**

## II.7 Cables

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

- Motor feedback cable ( encoder or resolver ), X8:  
Screened cable with 4 twisted pairs, 0.25 mm<sup>2</sup>  
Ground the shield of the feedback SUBD as shown below.



- Motor power cable, X10:  
Screened cable, 4 core, 1.5 mm<sup>2</sup>  
Connect the shield, on drive side, to the lower fixing hole (see “Front view” picture).

## II.8 Protection / Connection diagram

| Drive        | Input voltage     | Maximal input current | Safety device: cutout curve C | Wire             |
|--------------|-------------------|-----------------------|-------------------------------|------------------|
| SMD 230 / 01 | 230V single phase | 3 A                   | 10 A maxi                     | 1,5 <sup>2</sup> |
| SMD 230 / 02 | 230V single phase | 7 A                   | 10 A maxi                     | 1,5 <sup>2</sup> |
| SMD 230 / 05 | 230V single phase | 14 A                  | 10 A maxi                     | 1,5 <sup>2</sup> |

**Caution: the in-rush current can reach 10A with a duration of 20ms.**



**All connections must be made 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.

Connect the motor earth to the drive (pin 1 of the connector X10) before applying any voltages. For the shielded cables, connect the screen to the chassis at each extremity via the shell of the connectors (for the SUBD) .

Transient suppression measures should be taken on control panel components such as contactors (obligatory on brake) and relays using RC elements or diodes (e.g. 1N4007).

### II.8.1 Motor Brake output

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



**The output Q2 is PNP 24V, 1A max. It is obligatory to use protection diode otherwise drive components can be damaged.**

### II.8.2 STO function caution

If the drive integrate Safety inputs ( optional STO function ), when there is no voltage on the Safety Input but several of the transistors in the IGBT bridge have failed short circuit, it is possible that a small uncontrolled movement of the motor can take place. The maximum movement depends on the number of motor poles:  
**Maximum movement = 360° / Motor poles, e.g. a 6 pole motor can move 60°.**

If the motor is in motion before the Safety Input is removed it will coast to a stop. The time taken to stop will depend on the mechanics of the system.

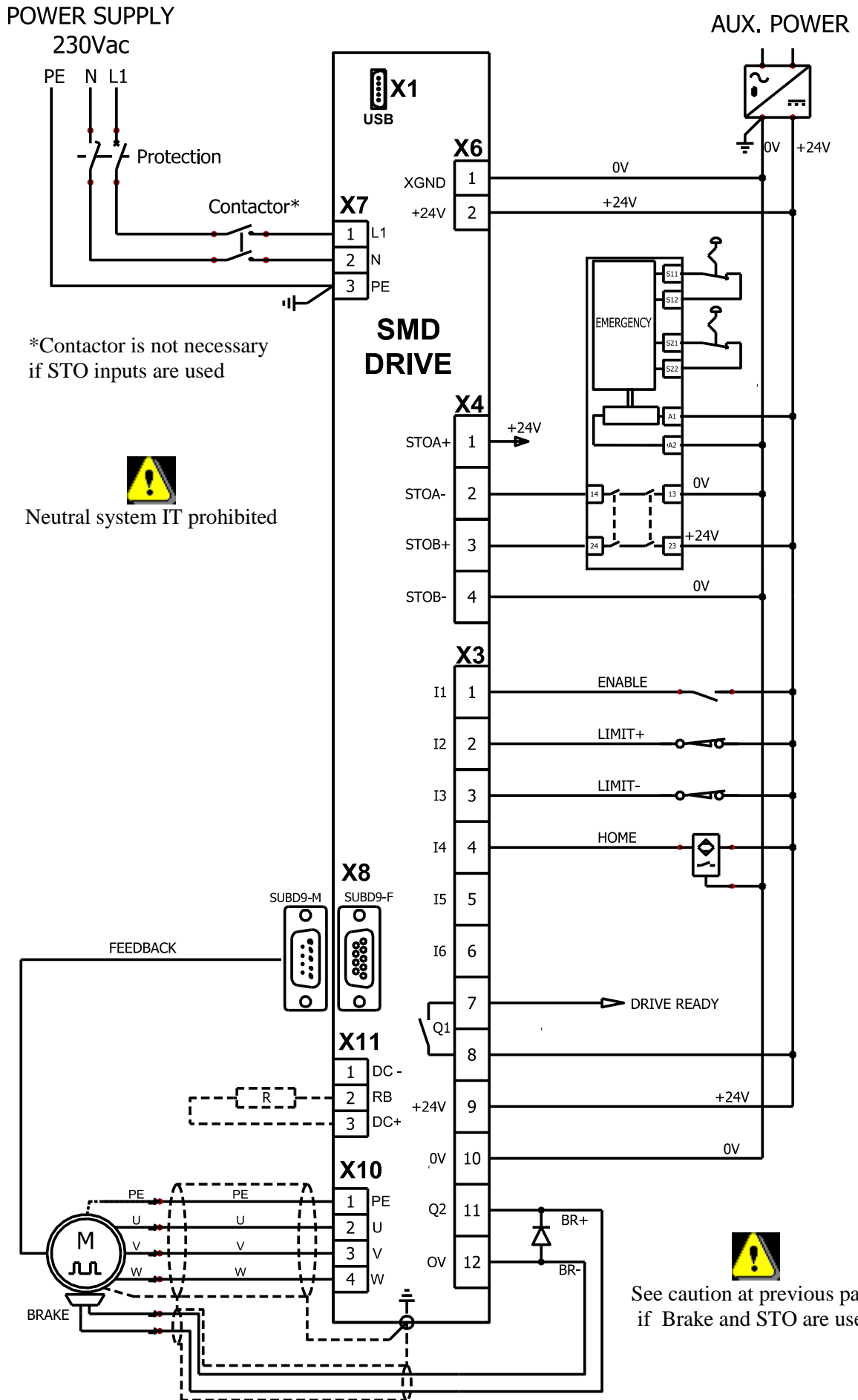
Similarly, as the drive is no longer controlling the motor it is no longer able to support a vertical load. A correctly sized braked must be provided to stop the axis in such cases.



**The Q2 output for brake is not SIL3 / PL e level. You must add a serial NO contact, controlled by external emergency safety module, between Q2 and motor brake.**

It is important to remember that even when the Safety Input is removed there is still approximately 320V dc present on the internal dc bus .

Therefore it is imperative that the main supply to the equipment is removed before any attempt is made to work on the motor or the drive.



## II.9 System check before starting

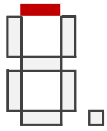
- With the Enable input off, switch on the auxiliary 24V dc supply.
- Ensure that on the **STATUS display**, the point blinking.
- Apply power.
- If the Status display shows an **error message** check the list of error codes.

### III. 7 SEGMENTS STATUS DISPLAY

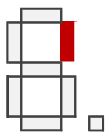
The drive can display some information through the 7 segments STATUS display.

#### III.1 Initialization sequence

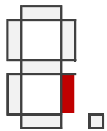
On power on, the drive display the initialization sequence:



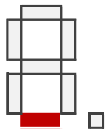
Start



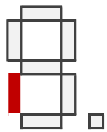
Driver initialized  
Fram/Flash init (Can be display E or F)  
Communication init



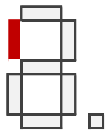
Communication Ok  
Init feedback



Init Feedback Ok  
Init application



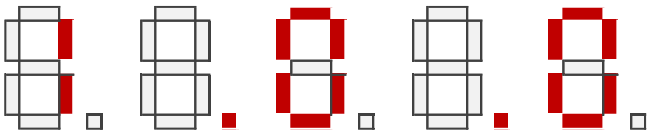
Init application done  
Init analog resources



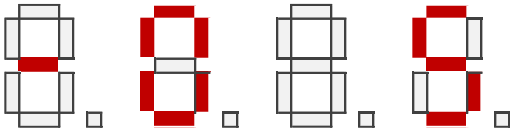
Initialization done

If OS problem occurs during this sequence, display will lead infinitely to the following sequence:  
x-x-x... With x a specific character. Please contact support.

Then, the software version is displayed. (Example v1.0.0):

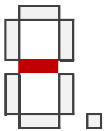


Then, on drive with fieldbus, the configured nodeID with Dipswitchs is displayed (Example node ID = 5):



### III.2 SMD in running

In running, the middle segment indicate if the drive is enable (segment on) or not (segment off).

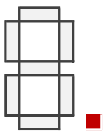


Then the peripheral segments move as the motor feedback in clockwise or counterclockwise direction.



If the instructions display is used in a tasks, the display is a priority.

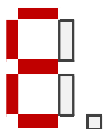
The dot information is according the number of flash:



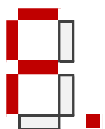
- 1 Flash : No communication
- 3 Flashes: USB communication
- 4 Flashes: USB communication in Supervision mode (CANopen / EtherCAT are disable)
- 6 Flashes: Communication is Ok (CANopen / EtherCAT are enable)

### III.3 Specific phase

With some operation, the drive memories can be erase and program.



Flashing “E” indicate the erase of the flash memory (OS/PGM update)



“F” indicate the program of the flash memory (OS/PGM update)

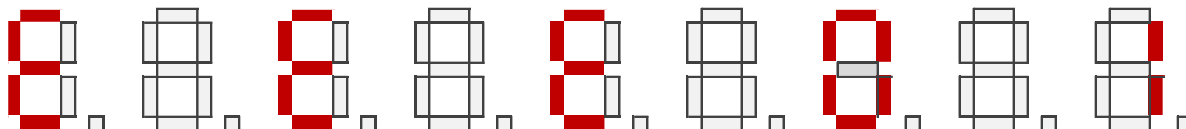
## III.4 Error code

Then, after specific event, errors could be displayed.

### III.4.1 Errors

The sequence is a 3 flashes with “E” letter, following by two numbers.

Example for Error E01:



| Code       | Description   |
|------------|---|
| <b>E01</b> | DC bus overvoltage: An overvoltage has been detected on the internal DC bus. This fault may be due to overvoltage on the network or due to overloaded ballast resistor (E51).   |
| <b>E02</b> | Undervoltage DC Bus: The internal DC bus has dropped below the configured minimum voltage. This fault is managed while the drive is enabled.  |
| <b>E03</b> | Pt motor: Overload on the motor, possible causes:<br>Mechanical hard point, bad power wiring, motor feedback problem, poorly controlled brake.  |
| <b>E04</b> | Overcurrent: A current greater than the maximum measurable current has been detected on at least one of the motor phases. The drive must be powered 24Vdc ( connector X6 ) for 15 min before it can be unlocked. Immediate unlocking possible by computer with Drive Studio in advanced mode. |
| <b>E05</b> | Short circuit: A short-circuit between phases or the earthing of a motor phase has been detected. The drive must be powered 24Vdc ( connector X6 ) for 15 min before it can be unlocked. Immediate unlocking possible by computer with Drive Studio in advanced mode.                         |
| <b>E06</b> | IGBT temperature: maximum temperature reached in the drive. It is impossible to acknowledge the fault until the temperature has gone back down.   |
| <b>E07</b> | Motor temperature: maximum temperature reached in the motor. It is impossible to acknowledge the fault until the temperature has gone back down.  |
| <b>E08</b> | Resolver fault: Defective resolver signals.   |
| <b>E09</b> | Coil temperature: maximum temperature reached in the self. It is impossible to acknowledge the fault until the temperature has gone back down.  |
| <b>E10</b> | Internal error on trajectory computation. Please, contact your vendor.  |
| <b>E11</b> | Drive Studio program error: an error has been detected during the execution of the tasks (division by zero, not correct instruction, CAM or synchro. movement error ...).   |
| <b>E12</b> | Following error: The drive has exceeded the allowed Following error.  |
| <b>E13</b> | Parameter error: Feedback / Auxiliary configuration on Range / Ratio  |
| <b>E14</b> | FRAM read or write error for DriveBasic variable  |
| <b>E15</b> | Overspeed: Speed greater than max defined by object 0x6080 (Max Motor Speed).   |
| <b>E16</b> | Resolver saturation: Sin / Cos resolver signals received too high.  |

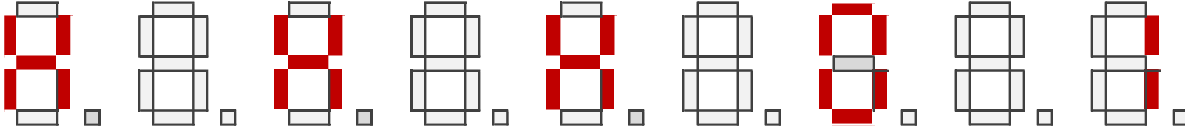


|            |  |
|------------|--|
| <b>E17</b> | 24V auxiliary supply error. This fault is triggered if the 24V auxiliary power supply is noisy or has a voltage dip (<15V). Check the 24V supply.  |
| <b>E20</b> | Communication error<br>CAN*: Transition to STOPPED, INIT or RESET<br>EtherCAT*: Transition from OPERATIONEL to other<br>EtherCAT MPC: SMD accept full etherCAT mapping only.<br>PROFINET*: Module Profinet internal Error or exception<br><i>(*Note: error reported only if object 0x6007 -Abort Connection Option Code- is different from "NO ACTION")</i>  |
| <b>E21</b> | With Serad MPC only: occurs when Axis on asked whereas Input 1 on Validation mode is not set   |
| <b>E23</b> | Error on the communication bus.<br>CAN:<br><ul style="list-style-type: none"> <li>• Supervision error (LifeGuard / Heartbit event)</li> <li>• CAN BusOff error</li> </ul> Profinet:<br><ul style="list-style-type: none"> <li>• Lost communication with Profinet Master</li> </ul> EtherCAT: Cyclic frame not received under expected time<br><i>(Note: error reported only if object 0x6007 -Abort Connection Option Code- is different from "NO ACTION")</i> |
| <b>E24</b> | Tamagawa encoder (communication or internal error)   |
| <b>E25</b> | Watchdog: The drive has restarted because of the internal watchdog timeout reached   |
| <b>E26</b> | EnDat / Biss feedback (Communication, CEC, init phase error)   |
| <b>E27</b> | Incremental/Hall sensor default. Check wiring.   |
| <b>E28</b> | Sensor position supply: Detection problem on the sensor position 5 Vdc supply (Tamagawa, Resolver, Endat ...)<br>This may be due to a short-circuit, an over-current on the 5Vdc supply ...  |
| <b>E29</b> | The configuration of the servo loops (0x2111.B, 0x2111.C, 0x2111.D) uses unactivated feedback. (0x2120.1, 0x2121.1, 0x2122.1, 0x2130.1).   |
| <b>E51</b> | Brake resistor overload: This fault may be due to an overloaded ballast resistor (not enough) or wrong setting.  |

### III.4.2 Hardware problems

The sequence is a 3 flashes with “H” letter, following by two numbers.  
If these errors occurs, contact the manufacturer.

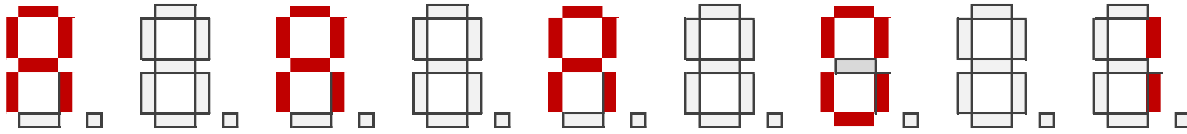
Example for Hardware H01:



| Code       | Description  |
|------------|--|
| <b>H01</b> | FRam memory module not detected.   |
| <b>H02</b> | Flash memory module not detected.  |
| <b>H03</b> | Failed write Flash memory module.  |
| <b>H04</b> | Asic EtherCAT not detected.  |
| <b>H05</b> | Eeprom memory Asic EtherCAT not detected.  |
| <b>H06</b> | Flash memory module detected as empty. The copy of the OS to the Flash memory module has taken place, but the CRC check is bad.                |
| <b>H07</b> | Empty hardware signature error. (No hardware signature in DSP Flash). Factory return for signature programming is needed (non-erasable error). |
| <b>H08</b> | Corrupted hardware signature error (Bad CRC). Factory return for signature programming is needed (Nnn-erasable error).                         |
| <b>H09</b> | Hardware signature error in memory module. Factory return for signature programming is needed (non-erasable error).                            |
| <b>H10</b> | Internal system error. Please contact manufacturer   |
| <b>H11</b> | Internal system error. Please contact manufacturer   |
| <b>H12</b> | Internal system error. Please contact manufacturer   |
| <b>H13</b> | Internal system error. Please contact manufacturer   |
| <b>H14</b> | Internal system error. Please contact manufacturer   |

### III.4.3 Warnings

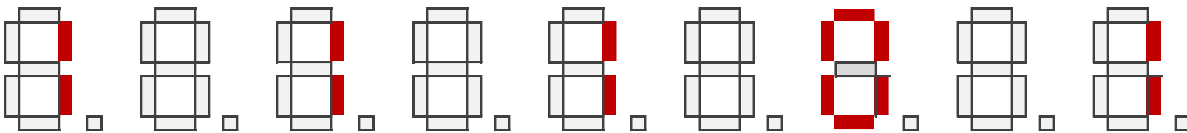
The sequence is a 3 flashes with “A” letter, following by two numbers.  
 Example for Warning A01:



| Code | Description   |
|------|---|
| A01  | Parameter memory problem: at least one parameter and/or DriveBasic variables has been restored to its factory value   |
| A02  | Tamagawa encoder battery too low: the encoder has detected the battery level too low. The absolute position may not be consistent after power on. Change battery is needed. |
| A03  | ENABLE request asked while the internal DC bus has not reached the level sufficient to trigger the soft start.  |
| A04  | Safety 1: the safety STO A channel has tripped.   |
| A05  | Safety 2: the safety STO B channel has tripped.   |

### III.4.4 Information

The sequence is a 3 flashes with “I” letter, following by two numbers.  
 Example for Info I01:

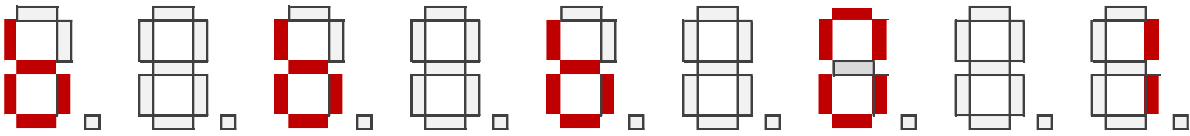


| Code | Description  |
|------|--|
| I01  | DS-402 Mode: Wrong Transition Requested  |
| I02  | EtherCAT : EtherCAT error detected and set to AL Status register of EtherCAT chip. |

### III.4.5 Bootloader error

The sequence is a 3 flashes with “b” letter, following by two numbers.

Example for boot error b01:



| Code       | Description  |
|------------|--|
| <b>b01</b> | Bootloader error: The DSP Flash memory is empty, the Flash memory module has not been found. But it is mandatory. You cannot reload a program. |
| <b>b02</b> | Bootloader error: DSP Flash memory error, Unable to activate bank1   |
| <b>b03</b> | Bootloader error: DSP Flash memory error, Blank check fail   |
| <b>b04</b> | Bootloader error: DSP Flash memory error, Programming fail   |
| <b>b05</b> | Bootloader error: DSP Flash memory error, Header fail programming  |

## IV. REVISION

|       |  |
|-------|--|
| R1821 | Initial version  |
| R1837 | Add Hardware error H10.  |
| R1840 | Add information about display on DriveBasic  |
| R1844 | On Display 7 seg init sequence, add OS problem possibility   |
| R1851 | Error code updated for Profinet<br>Add earth leakage current   |
| R1908 | X5-IN et X5-OUT connectors information on top view<br>SAFETY Error Code: E21/E22 -> A04/A05  |
| R1915 | Add E10 error description  |
| R1925 | Add EtherCAT MPC error description for E20 and E23   |
| R1931 | Add E13 error<br>Correction Pulse & Direction pin assignment on X9 connector   |
| R1939 | Add E26 error description  |
| R1941 | Add H11 error  |
| R1945 | Hardware modifications on SMD230xxxxxA models :<br>Connector X2 – COM : serial port RS485 instead of RS232<br>Connector X4 – SAFE – ANA : add analog input 0 ... 10 V<br>Connector X9 – MASTER : pin assignment modification on signals Z/, B/, Direction/ |
| R1950 | E27 error added  |
| R2002 | Add E21 Error description  |
| R2009 | Additional information in error E04 and E05 description  |
| R2021 | Add incremental encoder  |
| R2038 | Add H14 Error description, A01 description, add E14 error  |
| R2042 | Update feedback information<br>Add thermal dissipation   |

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