MAN.HESM2A

SM2A

MANUAL FOR INSTALLATION USE AND MAINTENANCE

Release 0.1 Build 00

IMPORTANT

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0.0	29/01/2009	First issue
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INDEX

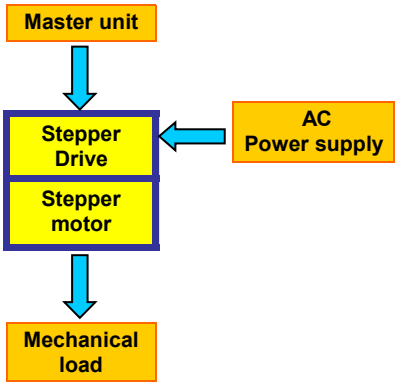
1 INTRODUCTION

This section introduces the main features of the SM2A drive as an integrated part of a stepper motor.

1.1 System components

Components which must be provided for a full installation of the drive:

Block diagram:



Design phase of a motion control system:

1. Define the application requirements (load torque, RPM, positioning precision, acceleration and velocity, etc.);
2. Select the SM2A drive which meets the requirements determined during the previous step.
3. Define the drive features:
    a. Electrical motor performances
    b. Control commands of the movement (Step / direction, serial communication, etc.).
    c. Additional characteristics (I/O user, encoder interface, etc.).
4. Dimension the power supply compatible with the motion profile, the motor characteristics and the drive;
5. Define the dissipation characteristics;

Dimensioning : Refer to chapter ***3 DRIVE INSTALLATION*** for the dimensioning of some parts of the motion system (motor, drive and power supply).

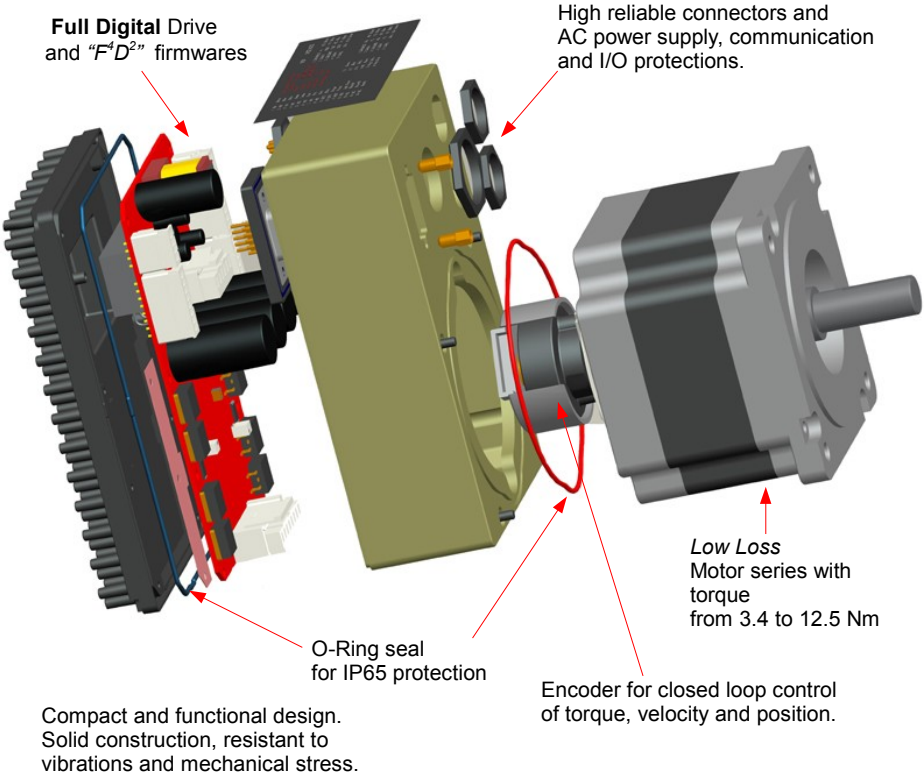
Especially for information about the power supply, refer to section ***3.2 Powering the system.***

1.2 SM2A : description

The SM2A system integrates a stepper motor, the concerning drive and a programmable controller foreseen of I/O-'s and communication interfaces.
It has been designed to control a 2 phase stepper motor with bipolar chopper technology with ultrasonic switching frequency.

The power supply for the AC motor ($18V_{AC} \div 100V_{AC}$) can be single or three phase while the control logic can be powered separately with a nominal voltage of $24V_{DC}$. Thanks to the voltage and current characteristics of the power stage, the user can control many types of stepper motors with winding currents up to $8A_{RMS}$ ($11.28A_{PK}$).

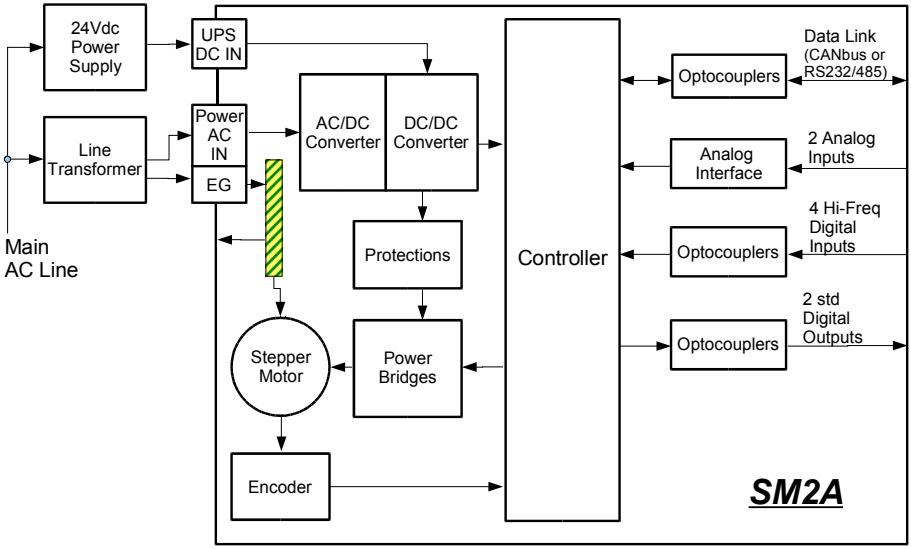
An internal encoder allows the functioning in a closed loop.
The information in this manual can be generally applied to the SM2A drive.
The peculiarity of the different versions are described in chapter ***5 VERSIONS AND SPECIFICATIONS SM2A*** .



The drive has the following features:

- Micro-stepping for high resolutions and fluid movements;
- Sinusoidal winding currents to optimize the motor performances;
- Protections set and monitoring of the system status.
- Protections to protect the electronics against eventual damage:
  - over/under voltage;
  - over temperature;
  - over current;
  - open motor phase;
- Possibility to generate functioning ramps for the motor;

The diagram shows the functional blocks which compose a *SM2A* system.



This manual contains the main information and procedures for the installation, start up and maintenance of the drive. Many drive functions depend on the drive version.

1.3 Limits of use, risks and warnings

- The installation has to be executed following the prescriptions defined in this manual.
- EVER ELETTRONICA take no responsibility for damages to persons or objects, caused by a system use deviating from the specifications in this manual.
- The drive system is a component to be installed in a more complex system: the installer is responsible for the presence of suitable working conditions of the SM2A system, to ensure the minimal immunity requirements defined by the regulations.
- This manual is written for the installer of the SM2A system and must not be used as support documentation for the end user.

The SM2A controller functions with voltages which can cause a dangerous life-threatening electrical shock.
Therefore only qualified personnel is allowed to install the equipment.
A safe and effective installation is only possible when applying the EN 60950-1, EN 61800-5-1 regulations relevant for a safe installation field of the user.

Pay attention when handling the equipment: some parts have a dangerous voltage charge at high temperatures and capacities with dangerous electrical charges. After every working phase, wait a few minutes before handling the drive. To let the temperature of the heat sink surfaces drop and let the voltages on the electrical capacities drop to a safe level.

When executing the isolation test on the machine which includes the SM2A controller, pay attention to not exceeding the maximum isolation voltage of the drive.

The equipment may cause environmental pollution if at the moment of removal the regulations in force for the removing aren't observed.

1.4 Guarantee

EVER ELETTRONICA guarantee that their motors and drives supplied to the customer (end user, machine builder or distributor), are free of defects caused by materials, shipment operations and packaging and to meet the guarantee in accordance with the customer's specifications who has accepted the written terms defined by Ever.

The product guarantee is valid for the duration of one (1) year from the date of construction, which is indicated by the code on the label present on the system.
During the guarantee period of the product, Ever is in no case responsible for damages to the product caused by improper storage or installation, negligent maintenance or unauthorized modifications or repairs to the product.

The responsibility of EVER is limited to the reparation (or replacement at their insight) of any manufactured product, or part of it, which is defect due to defect materials or a manufacturing defect, in accordance with the guarantee conditions of EVER.

The content of this manual is updated until the date of printing. With the continuous development and introduction of product improvements, EVER have the right to change the technical specifications of their products and to alter the content of this manual without the obligation to announce it.

EVER dissuades the use of its products in applications that support vital functions where in the damaging or failure of its products can directly threaten the life or safety of persons, other living beings and things. The user that applies the EVER products to applications that support vital functions is responsible for all risks during the use and the indemnify of EVER from all caused damage.

1.5 In this manual

The used symbols in this manuals have the following meaning:

Danger
Warning
Caution

Used when the life or health of the user are exposed to danger or where in serious damage to materials may occur.

Attention!

***Special instructions** for a safe use and an effective installation.*

Information

*Used to stress **important additional information.***

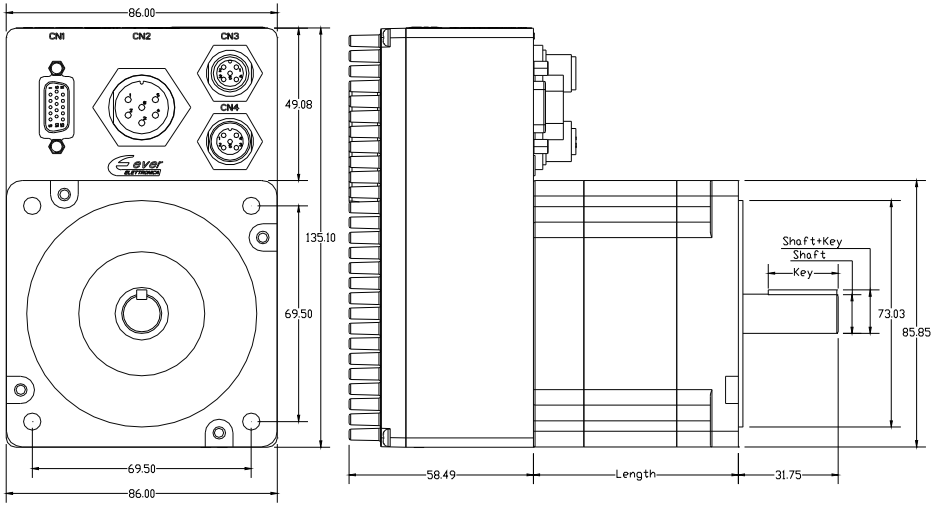
EMC

*An essential element to stay within the limits specified by the **EMC** directions is, in addition to the use of filters, the installation in accordance with the EMC requirements.*

2 SPECIFICATIONS

2.1 Mechanical specifications

- Protection degree IP 65
- Storage temperature from -25° C to +55° C
- Working temperature from 0° C to +50° C
- Humidity 0% to 90% without condensation
- Dimensions refer to the following figure:



Model	Length (mm)	Shaft ∅ (mm)	Key (mm)	Shaft + Key (mm)
SM2An60PxnnnAz0	65.0	9.525	(3.0*3.0) 22.00	10.725
SM2An60PxnnnBz0	80.0	12.70	(3.175*3.175) 22.23	14.097
SM2An60PxnnnCz0	96.0	12.70	(3.175*3.175) 22.23	14.097
SM2An60PxnnnDz0	118.0	12.70	(3.175*3.175) 22.23	14.097
SM2An60PxnnnEz0	156.5	15.87	(4.763*4.763) 22.23	17.907

2.2 Electrical specifications

2.2.1 Power supply

For the functioning of the *SM2A* drives an AC power supply is needed for the power part and, optionally, a DC voltage for the Logic.

For the technical specifications, limitations and connections of the power supply, consult also chapters ***3 DRIVE INSTALLATION*** and ***5 VERSIONS AND SPECIFICATIONS SM2A***.

		SM2A			Unit	Note
		MIN.	TYP.	MAX.		
AC Power supply PWS	Nominal Voltage	34		100	Vac	Nominal Range
	Voltage limit	32		103	Vac	Including the ripple and the network fluctuations.
	Minimal Current from AC_{IN}				A_{RMS}	@ current in the motor zero, power supply voltage = minimum allowed, no load to the shaft.
	Maximal current from AC_{IN}				A_{RMS}	@ V+ = 80Vac – three phase **(1)**
	Power				VA	@ V+ = 80Vac – three phase **(1)**
Power supply DC Logic	Nominal tension	21	24	30	Vac	Nominal range
	Current				mA	@VLOG=21Vdc
Motor	Current			8	A_{RMS}	Configurable by means of software.
				11.28	A_{PK}	
	PWM Frequency	Ultrasonic 40KHz (an event every 33µsec)			KHz	
	Step angle	Full step, ½, ¼, 1/8, 1/16, 1/32, 1/64, 1/128				Configurable by means of software.
	Rotation speed			4500	RPM	**(2)**
Protections		- Over Current - Open Phase - Over temperature - Over/Under Voltage				
Drive status		Reported through Data Link				
User settings						Configurable by means of software.

(1) Current and maximal power consumption of the drive powered by 80Vac three phase current with a load of 500W.

Attention: with a single phase power supply, the drive cannot deliver the full power. To make it easy, you can consider the power limit for a single phase power supply to be the value of: Useful Mechanical Power from the shaft = 80W equal to Electrical Power input to the drive = 160W equal to Transformer Power = 265VA

Besides these power sources a three phase power supply is needed

(2) Theoretical rotation limit managed by the drive, depending on the following physical parameters: power supply voltage, phase current, dynamic motor characteristics, load on the shaft. Without this limit the drive is not able to guarantee a correct sequences control.

2.2.2 Digital Inputs

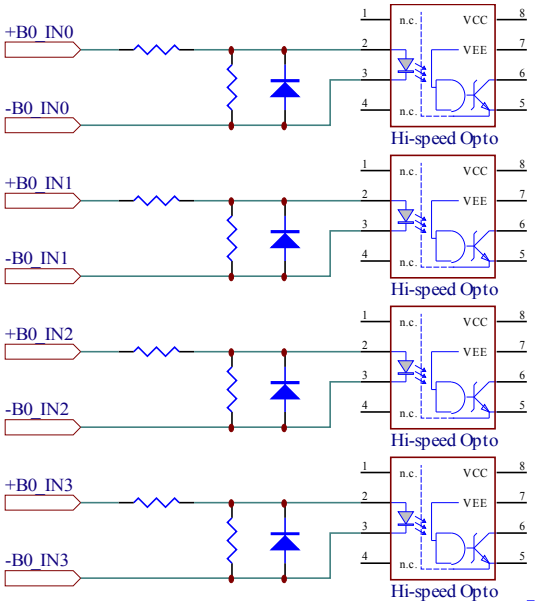
The SM2A drives are equipped with 4 digital opto-isolated inputs of 24Vdc with a bandwidth of 200KHz. They can be used in PNP, NPN, Push-Pull or Line driver mode by simply modifying the external connection to the connector. Depending on the version (consult chapter ***5 VERSIONS AND SPECIFICATIONS SM2A***), the scheme of the digital inputs and the pin-out of connector CN1, can vary as displayed by the following images.

The block with 4 digital inputs forms part of the CN1 connectors and the inputs are called ***B0_IN0÷B0_IN3*** .

Scheme of the Digital Inputs in the I/O configuration **"4"**
(see chapter ***5 VERSIONS AND SPECIFICATIONS SM2A***) :

Anode and cathode of the opto-couplers connected to the connector.

CN1	net
CN1.1	+B0_IN0
CN1.2	-B0_IN0
CN1.3	+B0_IN1
CN1.4	-B0_IN1
CN1.5	+B0_IN2
CN1.6	-B0_IN2
CN1.7	+B0_IN3
CN1.8	-B0_IN3



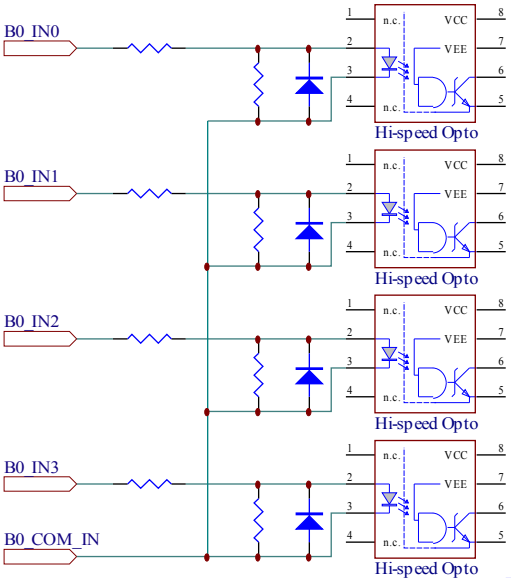
Possible connections:

- PNP Source
- NPN Sink
- Push-Pull Sink
- Push-Pull Source
- Push-Pull Sink/Source
- Line Driver (24Vdc)

Scheme of the Digital Inputs of the I/O configuration **"6"**
(see chapter ***5 VERSIONS AND SPECIFICATIONS SM2A***) :

Anode and common of the opto-couplers connected to the connector.

CN1	net
CN1.1	+B0_IN0
CN1.2	
CN1.3	+B0_IN1
CN1.4	
CN1.5	+B0_IN2
CN1.6	
CN1.7	+B0_IN3
CN1.8	B0_COM_IN



Possible connections :

- PNP Source
- Push-Pull Source

If you want to use the inputs with voltages higher then $24V_{DC}$, it is necessary to externally insert a limiting resistance in series as shown in the next table:

V_{INPUT}	R_{EXT}
$30V_{DC}$	**390 Ω 0.25W**
$36V_{DC}$	**1000 Ω 0.25W**
$40V_{DC}$	**1300 Ω 0.25W**
$48V_{DC}$	**2000 Ω 0.5W**

Use the following formulas to calculate the resistance value and the resistances power to insert in series as a function of the input voltage.

$R_{EXT} = ((V_{INPUT} - 1.5) / 0.011) – 2200$

$P_{R\_EXT} = ((V_{INPUT} – 1.5) / (R_{EXT} + 2200))^2 * R_{EXT}$

Example for V_{INPUT} =36V :

R_{EXT} =((36-1.5) / 0.011)–2200 = 936 Ω => near to the commercial value of 1K

P_{R_EXT} = (((36 – 1.5) / (1000 + 2200))² * 1000)/0.8 = 0.145W => near to the commercial value of 0.25 W or higher.

To avoid wrong connections and damages of the input circuit the user must not exceed the maximum characteristics of the input listed in the following table.

Electrical specifications

Digital Input					
Nominal Voltage	**Limits**	**State 0** (1)		**State 1** (2)	
		UL (3) **(V)**	**IL** (4) **(mA)**	**UH** (5) **(V)**	**IH** (6) **(mA)**
24 Vdc ± 20%	**Min.**	ND (7)	ND	19.2	7
	Max.	ND	ND	28.8	13
f_{MAX}		200kHz			
Minimal duration pulse T_{ON}		2µsec			
Minimal duration pulse T_{OFF}		2µsec			
Protections		Polarity inversion			

(1) : State 0 = Input NOT busy
(2) : State 1 = Input busy
(3) : UL = voltage under the level on which the input is NOT busy.
(4) : IL = current under the level on which the input is NOT busy.
(5) : UH = voltage above the level on which the input is Busy.
(6) : IH = current level higher then that on which the input is Busy.
(7) : ND = parameter Not Defined.

The device connected to the drive input has to be powered by means of a voltage deriving from a suitable power supply

For a correct use, the digital inputs must be wired using shielded cables. The connection of the shield must be evaluated for every application, on base of the machine lay-out. Generally it's more effective to connect the shield from both sides to the ground.
*It's important that the concerning cables to the digital inputs aren't exposed to disturbances. Therefore, consult the requirements described in paragraph **3.5.1 Guideline for cabling**.*

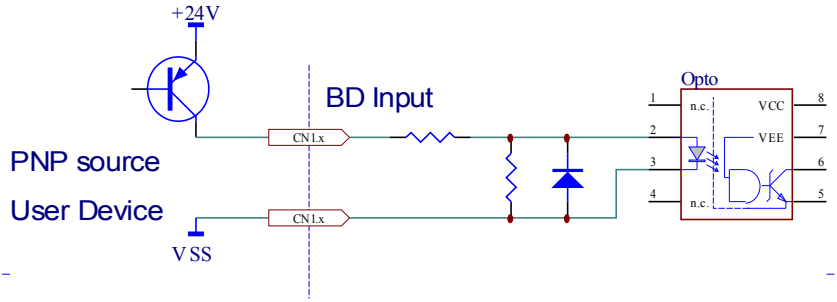
The functionality of the digital inputs depend on the Firmware installed on the drive ***(A.2 Firmware and applicable notes)***. Refer to the software manuals (***A.1 Applicable manuals and documentation*)**.

Electrical connection of the digital inputs

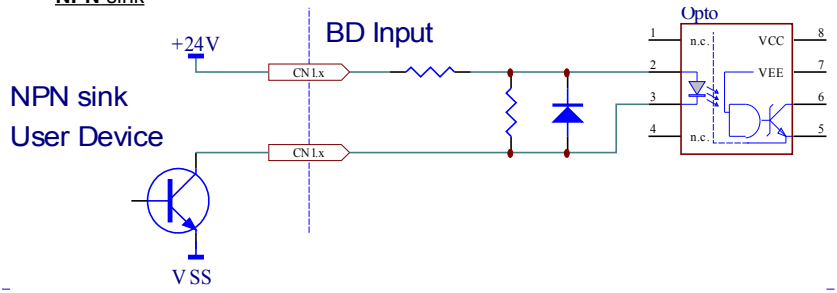
Connection guide of the digital inputs on base of the output typology of the controlling device.

Note : BD = Basic Drive Input

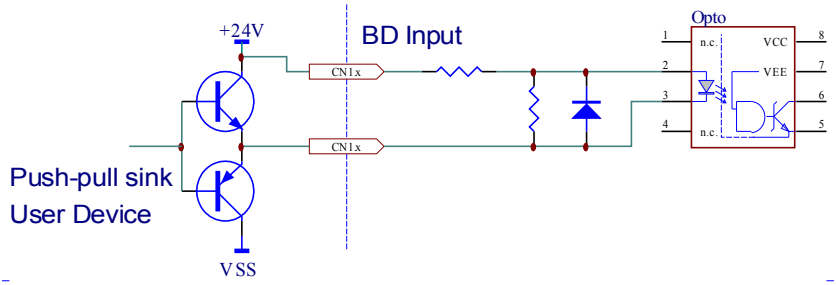
PNP source



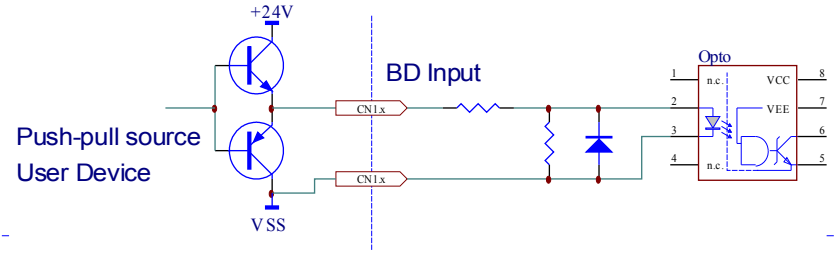
NPN sink



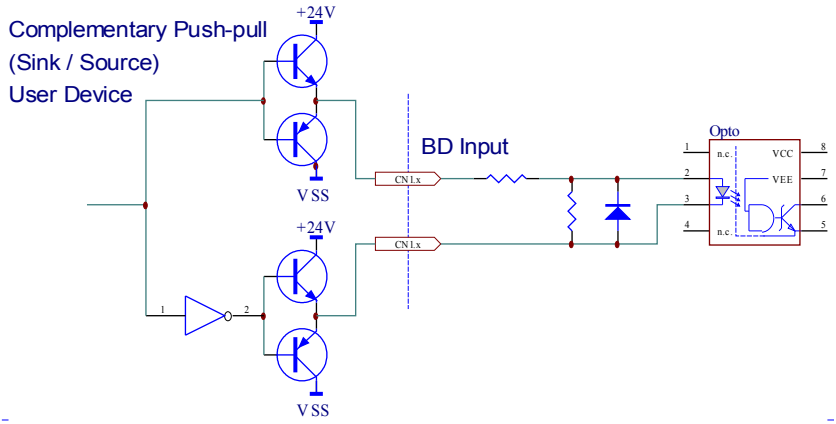
Push-Pull sink



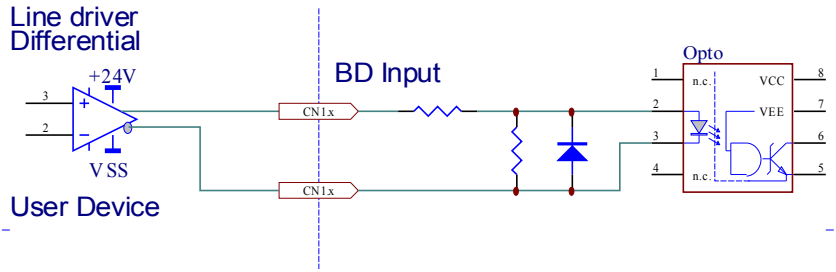
Push-Pull source



Push-pull sink-source



Line-Driver



2.2.2.1 Connection of an incremental encoder

The SM2A systems are able to interface with an external incremental encoder, connected to the digital inputs (CN1).
The connection of the encoder signals, based on the user needs, has to be established as indicated in the table:

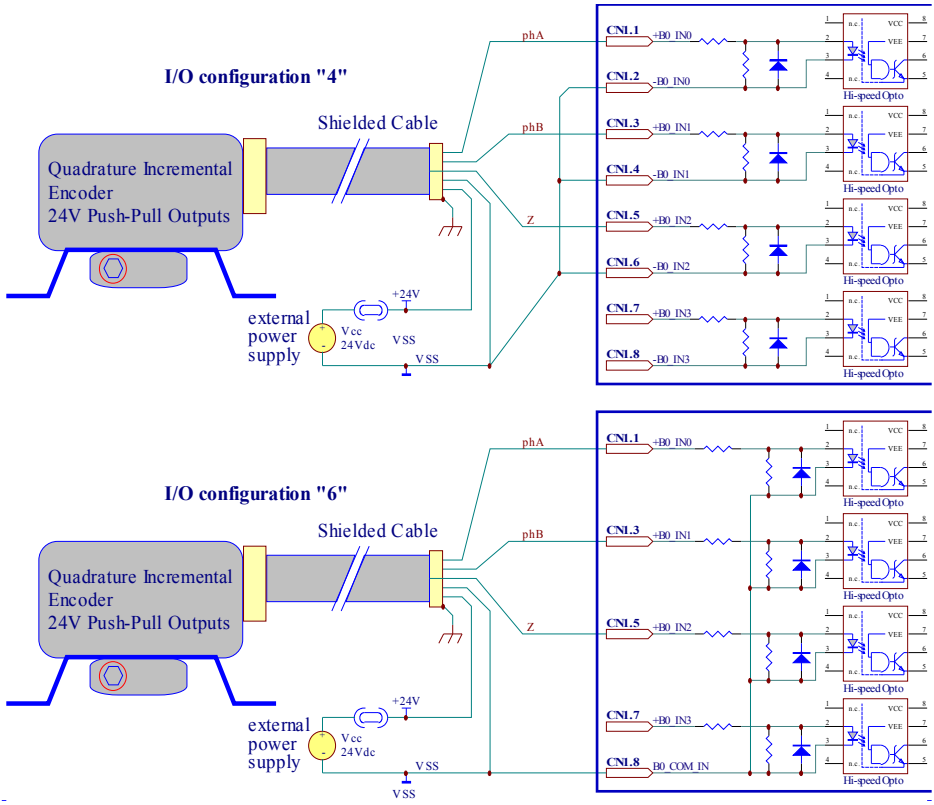
SM2A Series Drives			
Input	**Encoder Quadrature**	**Up/down Counter**	**Up Counter**
B0_In0	Phase A Encoder #1	//	//
B0_In1	Phase B Encoder #1	//	//
B0_In2	//	Encoder #1(dir)	//
B0_In3	//	Encoder #1 (clock)	Encoder #1(clock)

*The features related to the reading of the incremental encoders, depend on the Firmware installed on the drive (**A.2 Firmware and applicable notes**). Refer to the Software Manuals (**A.1 Applicable manuals and documentation**).*

The Zero Encoder (Index) signal is a General Purpose Input, and can thus be connected to any free digital input.

The Encoder must be 24V and powered with an external power supply source.

Examples of 24V Push-Pull encoder.



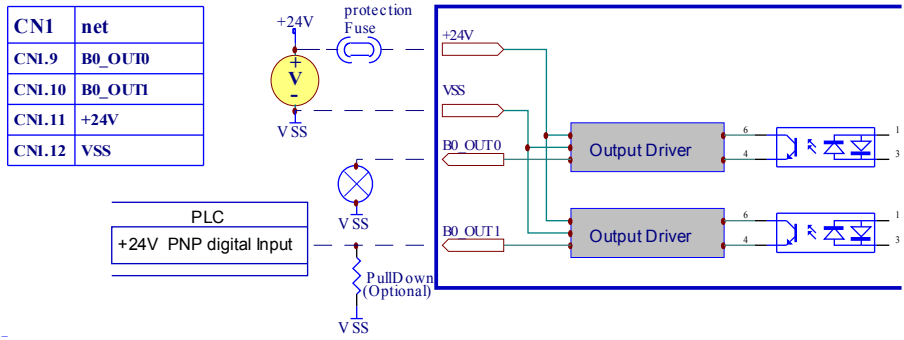
2.2.3 Digital outputs

The SM2A drives are equipped with 2 digital optically isolated outputs, protected against short circuit, type 24Vdc PNP (Source = 24 Vdc forcing and 0V not forcing).

Electrical specifications of the Digital Outputs		
Nominal current (state 1)	In (A)	0.5
Maximal current (state 1 = output ON)	Max (A)	0.7
Maximal current for output with 4 ON outputs	Iout(A)	0.5 @ 24Vdc
maximum N° of ON outputs at maximal current.	N°	2
Voltage drop (state 1)	Max (V)	3
Loss current (state 0 = output OFF)	Max (µA)	2
Nominal Voltage	Vnom	24Vdc
Minimal output Voltage	Vmin	19Vdc
Maximal output Voltage	Vmax	28.8Vdc
Maximum Voltage ripple	Vrmax	1Vdc
Typology	PNP	current source
Output frequency	Frequency	1kHz
Protections	Short circuits between output and GROUND, between output and 24Vdc, output and output, Open Load Detection.	
Threshold intervention protection against overload / short circuit.	The over current	= 0.7A min = 2.5A max
Intervention time of the protection.	$tshort_{MAX}$	100µs @Vout = 30Vdc @RL = 0

For the functioning of the digital outputs, a power supply is needed of +24Vdc=CN1.11 , VSS=CN1.12 .

Scheme digital outputs:



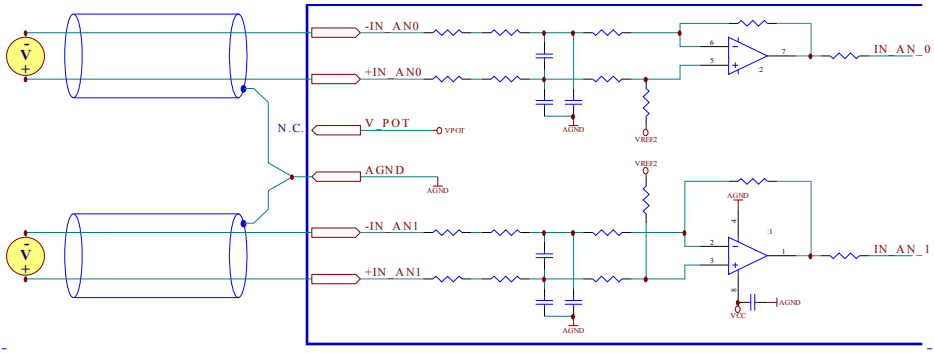
For a correct use, the digital outputs must be wired using shielded cables. The shield connection must be evaluated for every application; on base of the machine lay-out. Generally, it is the best to connect the shield from both sides to the ground.
*It's important that the concerning cables to the digital outputs are not exposed to disturbances. Therefore, follow the requirements defined in paragraph **3.5.1 Guideline for cabling**.*

The functionality of the digital outputs depends on the Firmware installed on the drive. (***A.2 Firmware and applicable notes***). Refer to Software Manuals (***A.1 Applicable manuals and documentation***).

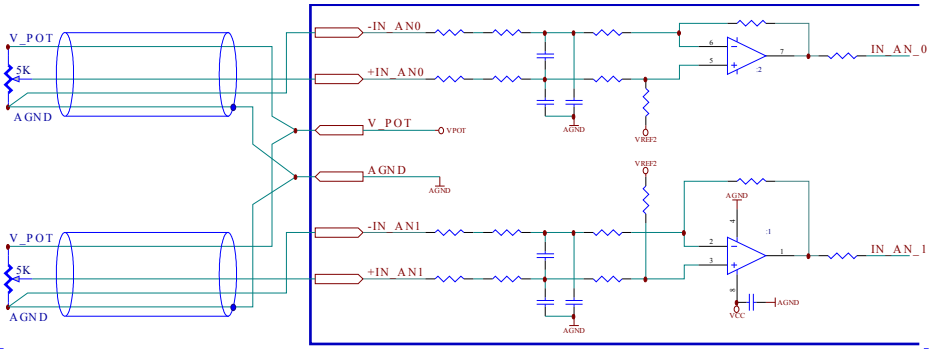
2.2.4 Analog inputs

The SM2A drives are equipped with 2 analog Inputs of the type +/-10Vdc CEI EN 61131-2, not isolated.
The presence of the analog inputs depends on the system version.
Refer to chapter ***5 VERSIONS AND SPECIFICATIONS SM2A.***

Scheme analog inputs with configuration ±10V :



Scheme analog inputs with potentiometer configuration :



*The functionality of the analog inputs depends on the Firmware installed on the drive (**A.2 Firmware and applicable notes**). Refer to Software Manuals (**A.1 Applicable manuals and documentation**).*

*For a correct use, the analog inputs must be wired using shielded cables. The shield connection must be evaluated for every application; on base of the machine lay-out. Generally, it is the best to connect the shield from both sides to the protective earth (PE) or only from one drive side to pin CN4.2 (AGND). It's important that the concerning cables to the analog inputs aren't exposed to disturbances. Therefore it's necessary to meet the requirements defined in paragraph **3.5.1 Guideline for cabling**.*

Attention : the reference ground of the potentiometer (AGND) has the same characteristics as the power supply ground of the motor, and may thus be dangerous. Take all necessary measures to avoid possible contacts.

Electrical specifications

Compatible analog input CEI EN 61131-2	
Input type	Differential not isolated
Conversion Method	Sample & Hold
Functioning mode	Autoscan
Nominal input Voltage	±10Vdc
Impedance limits of the input	≥10Kohm
Reading resolution	29mV
ADC resolution (±10Vdc)	10 bit
ADC resolution (potentiometer)	8 bit
Maximum error of the full temperature range	± 8% of full range
Maximal overload	V_{IN} = 57Vdc I_{MAX} = 2mA
Sampling duration	T_{SAMPLE} = 1ms
Sampling period	T=1ms
Characteristics input filter	HW: low step 1st order F0 = 3.4KHz SW : configurable
Type of protection	Current isolation and limitation.

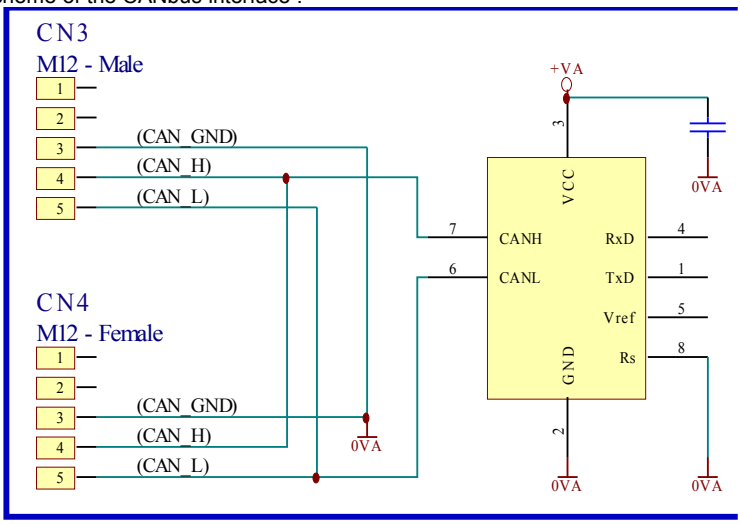
2.2.5 CAN Bus interface

The CAN bus interface allows a multi-point connection in accordance to the ISO 11898 standard. The isolated interface is powered by means of an internal isolated DC/DC converter, no external power supply is required.

The presence of the CANbus interface depends on the system version.
Refer to chapter ***5 VERSIONS AND SPECIFICATIONS SM2A***.

The SM2A drives are equipped with 2 parallel circular connectors M12 5 poles(CN3=M, CN4=F) to simplify the CANbus network connection of the nodes.

Scheme of the CANbus interface :

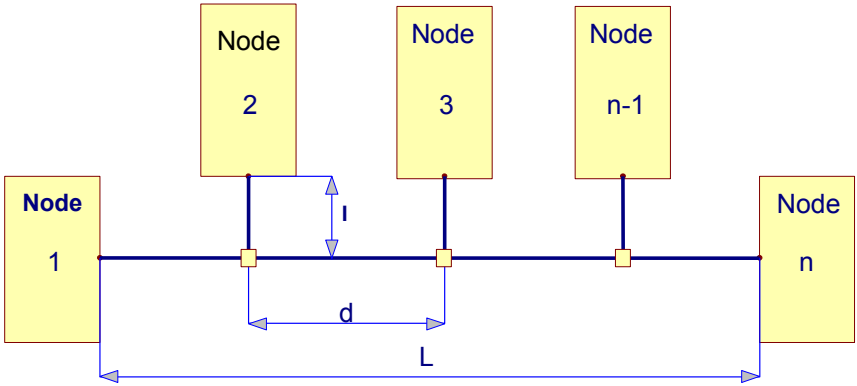


Refer to software manuals (***A.1 Applicable manuals and documentation***) for information about the functioning of the CANbus interface.

For a correct use, the communication interface must be wired with shielded cables. The shield connection must be evaluated for every application, on base of the machine lay-out. Generally it is the best to connect the shield from both sides to the ground .
It's important that the concerning cables to the communication interfaces aren't exposed to disturbances. Therefore the user needs to meet requirements defined in paragraph ***3.5.1 Guideline for cabling****.*

For information about the cable and adaptor schemes , refer to appendix ***A.3 Cables and adapters****.*

Connection to the CANbus network

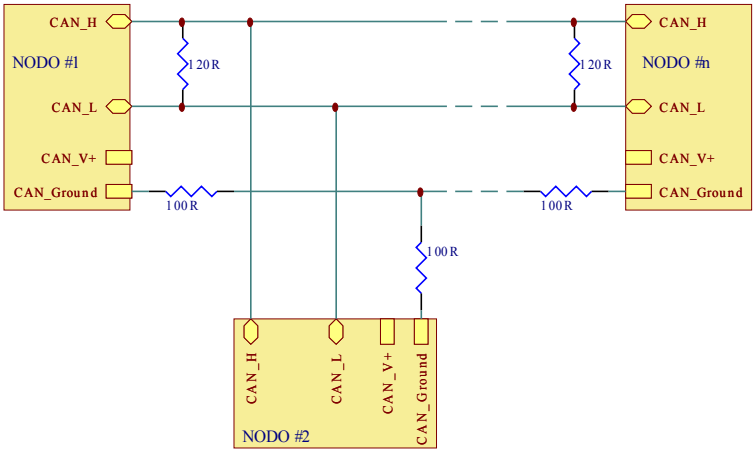


Network parameters (defined by ISO 11898)						
Parameters	**Size**	**Unit**	**Values**			**Conditions**
			Min.	**Nom.**	**Max.**	
Bus length	L	m	0		40	
Deviation length	l	m	0		0.3	Bit rate: 1Mbit/sec
Nodes distance	d	m	0.1		40	

Defined by *Can In Automation (CIA)*				
Bus length	**Cable**		**Termination resistance**	**Data rate max [kbit/s]**
	Res/m	**Section**		
0..40m	70 mΩ/m	0.25mm²..0.34mm² AWG23, AWG22	124Ω (1%)	1 Mbit/s at 40m
40..300m	< 60 mΩ/m	0.34mm²..0.6mm² AWG22, AWG20	127Ω (1%)	500 Kbit/s at 100m
300..600m	< 40 mΩ/m	0.5mm²..0.6mm² AWG20	150Ω to 300Ω	100 Kbit/s at 500m
600m..1km	< 26 mΩ/m	0.75mm²..0.8mm² AWG18	150Ω to 300Ω	50 Kbit/s at 1Km

Wiring Use paired cables with braided and shielded wires.
requirements : ***Refer to the specifications defined by Can In Automation (CiA).***

Scheme of the CanOpen network:



Note: the first and last system connected to the network must have a termination resistance. The CAN_Ground connection is optional.

2.2.6 Interface RS232 and RS485

The RS232 interface allows a point-to-point connection while the RS485 interface allows a multi-point link connection in accordance to the EIA/TIA232E CCIT V.28 and RS-485 CCITT V.11 X.27 standards.

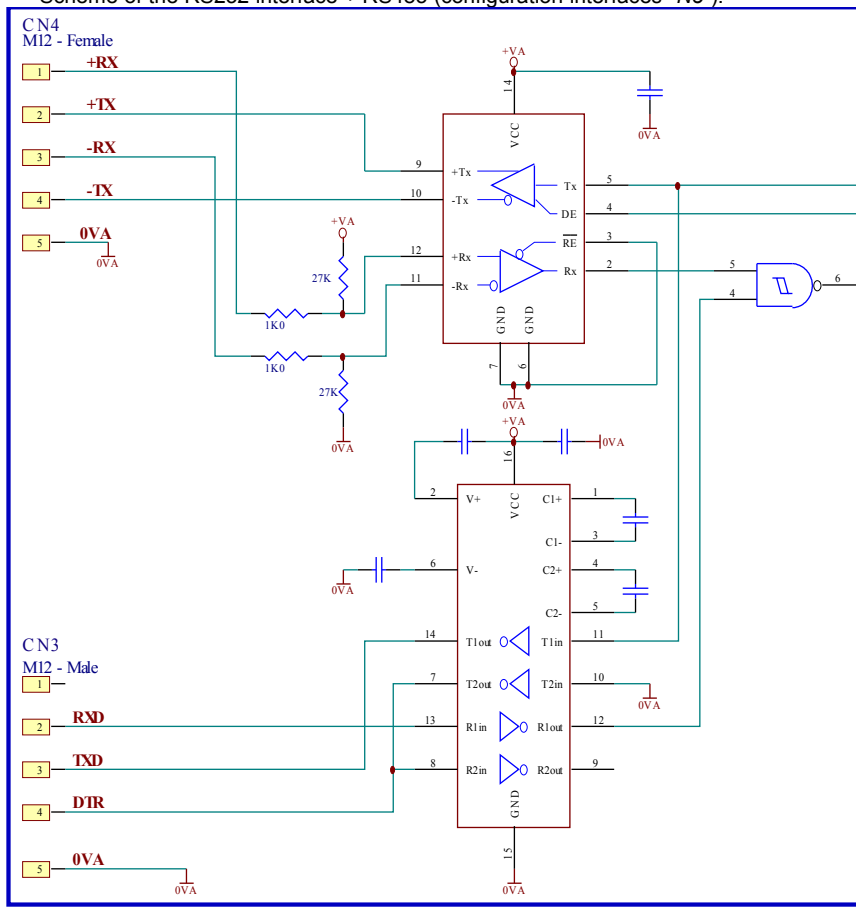
The isolated interface is powered by means of an internal isolated DC/DC converter, no external power supply is needed.

The presence of the serial interfaces depends on the system version.
Refer to chapter ***5 VERSIONS AND SPECIFICATIONS SM2A***.

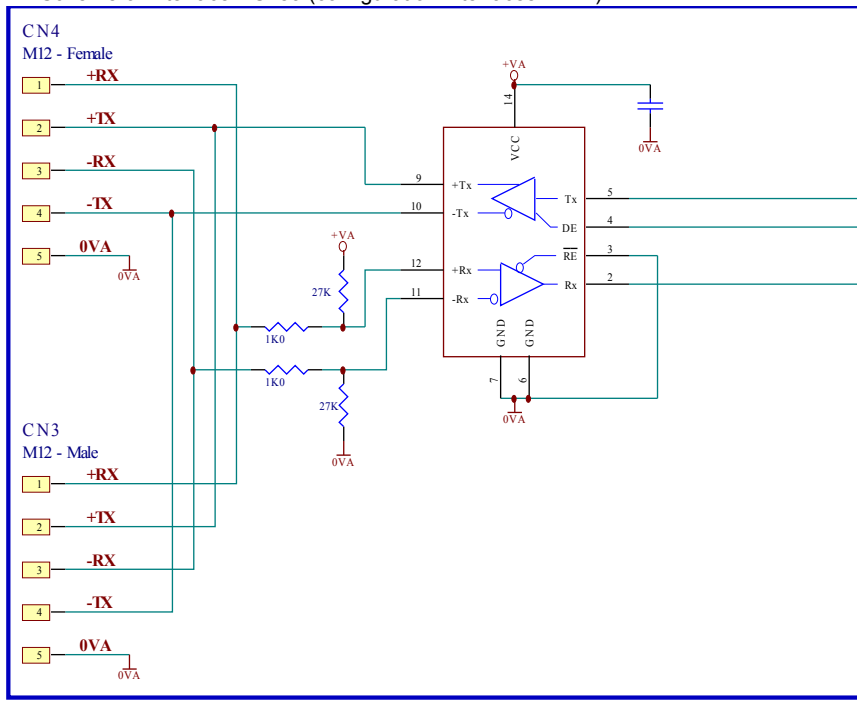
The SM2A drives are equipped with 2 parallel circular connectors M12 5 poles(CN3=M, CN4=F) for serial interfaces. Depending on the versions, it can be:

- CN3 for RS232 and CN4 for RS485
- CN3 and CN4 are parallel to simplify the MODBUS® network connection of the nodes (RS232 not present).

Scheme of the RS232 interface + RS485 (configuration interfaces "*N3*"):



Scheme of interface RS485 (configuration interfaces *"N2"*) :



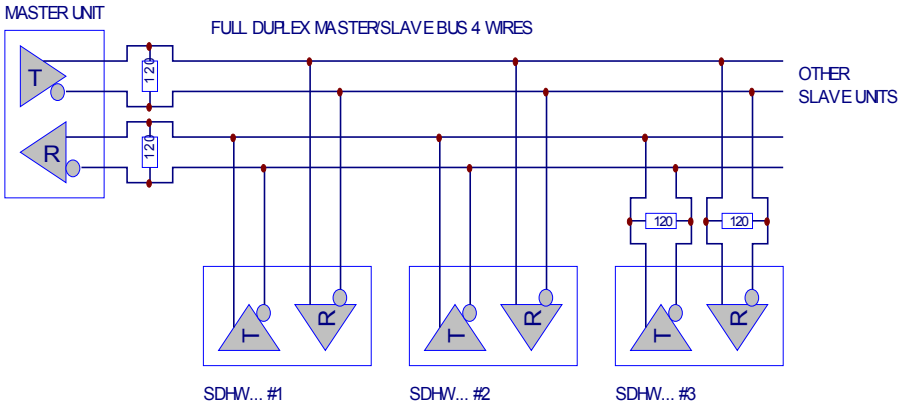
Refer to software manuals (***A.1 Applicable manuals and documentation)*** for information about the functioning of the RS232/RS485 interface.

For a correct use, the communication interfaces must be wired using shielded cables. The connection of the shield must be evaluated for every application; on base of the machine lay-out. Generally, it's the best to connect the shield from both sides to the ground.

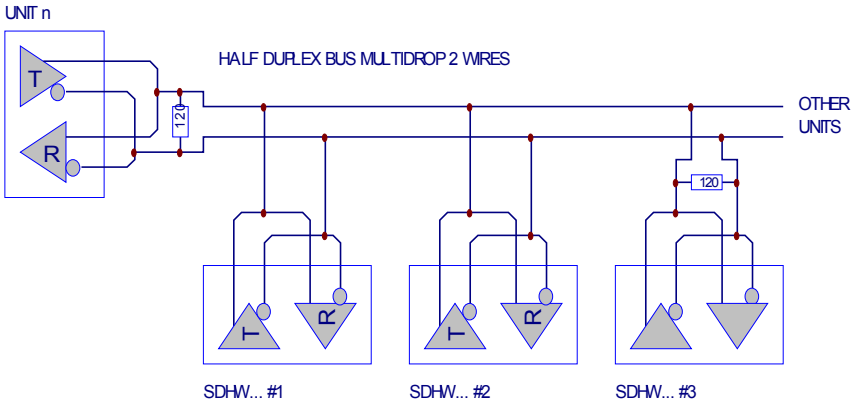
It's important that the concerning cables to the communication interfaces aren't exposed to disturbances. Therefore, it's necessary to meet the requirements defined in paragraph ***3.5.1 Guideline for cabling.***

For information about schemes of cables and adapters, refer to appendix ***A.3 Cables and adapters.***

Connection to the RS485 network



Note : the first and the last unit of the network should have the termination resistors inserted



Note : the first and the last unit of the network should have the termination resistor inserted

The Half-Duplex configuration is obtained by connecting the following conductors externally to the connectors CN3 and CN4:

+Tx with +Rx
-Tx with -Rx

2.3 STANDARDS

The EVER SM2A systems are designed and produced in compliance with the following Directives and Standards:

Directives :	73/23/CE	Low Voltage Material
	89/392/CE	Machines
	89/336/CE	Electromagnetic compatibility
Regulations :	EN 61800-3	Drives at variable speed – Electromagnetic compatibility and specific testing methods.
	EN 61800-5-1	Drives at variable speed – Safety requirements.
	EN 60950-1	Equipment for information technology – Security.
	EN60204-1	Machinery Safety – Electrical equipment of the machines.

The compliance of the EVER product with the EMC directives (Electromagnetic compatibility) can only be verified if the entire machine, of which the drive is a component, is designed and built in compliance with the requirements for Electromagnetic Compatibility.

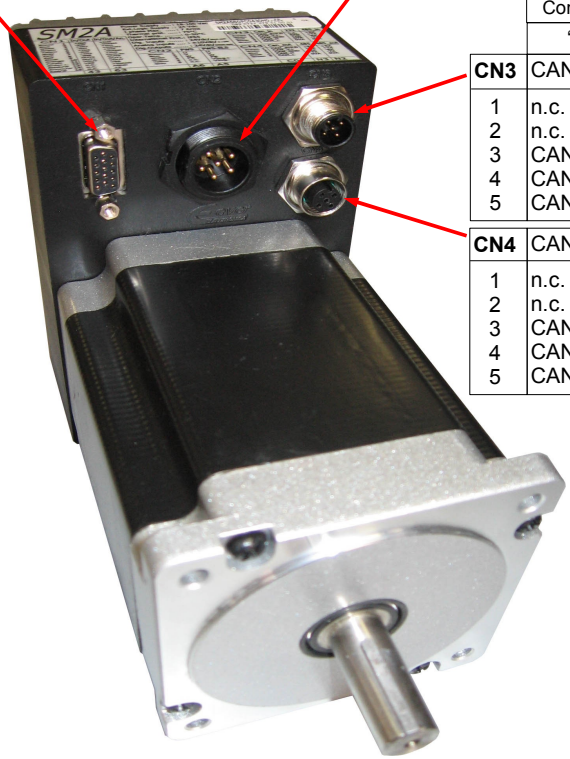
The drive must be installed following the guidelines indicated in chapter
3 DRIVE INSTALLATION.

3 DRIVE INSTALLATION

This section supplies some guidelines for a safe installation of the SM2A systems.

	I/O Code	
	"4"	"6"
CN1	Digital I/O	Digital I/O Analog In
1	+B0_IN0	+B0_IN0
2	-B0_IN0	-IN_AN1
3	+B0_IN1	+B0_IN1
4	-B0_IN1	+IN_AN1
5	+B0_IN2	+B0_IN2
6	-B0_IN2	-IN_AN0
7	+B0_IN3	+B0_IN3
8	-B0_IN3	B0_COM_IN
9	B0_OUT0	B0_OUT0
10	B0_OUT1	B0_OUT1
11	+24V	+24V
12	VSS	VSS
13	n.c.	+IN_AN0
14	n.c.	AGND
15	n.c.	VPOT

	Supply Code	
	"6"	"5"
CN2	PWS	PWS+ELS
1	ACin	ACin
2	ACin	ACin
3	ACin	ACin
4	PE	PE
5	n.c.	+Vlog
6	n.c.	-Vlog



	Communication Interface Code		
	"C0"	"N3"	"N2"
CN3	CANbus	RS232	RS485
1	n.c.	n.c.	+RX
2	n.c.	RXD	+TX
3	CAN_GND	TXD	-RX
4	CAN_H	DTR	-TX
5	CAN_L	0VA	0VA

CN4	CANbus	RS485	RS485
1	n.c.	+RX	+RX
2	n.c.	+TX	+TX
3	CAN_GND	-RX	-RX
4	CAN_H	-TX	-TX
5	CAN_L	0VA	0VA

3.1 Safe installation and use of the unit

Only qualified personnel should install the SM2A drives, after having read and understood the information in this manual. The installation instructions must be executed and approved. Any doubts should be clarified with the supplier before using the unit.

EVER takes no responsibility for indirect damages to the unit as a result of negligence, wrong installation, unauthorized modifications to the product or wrong cable connections.

SECURITY

In particular, the user must:

- disconnect the power supply before realizing or removing a connection;
- not work on the drive without that a ground connection for the drive and the motor has been realized. The Protective Earth connection (PE) must meet the local requirements in force.
- not establish connections to the internal drive circuit;
- Wait some minutes after the system has been disconnected from the power supply before manipulating it or executing maintenance to the system;
- not use a digital input with ENABLE function as safety stop. Remove always the power supply voltage from the drive to execute a safe system shut down;
- Pay attention to the thermal dissipation of some drive parts: when using the unit in extreme applications, some surfaces reach high temperatures. Before disconnecting the device wait some time until it has cooled.
- The motor, in case of missing voltage, is not able to keep the load; it's thus forbidden to use the motor if a missing torque creates a dangerous situation, unless the user places special devices to block the load.

*The negative pole of the power supply is **NOT** connected to the ground by means of an internal connection to the drive. When this default connection doesn't suit the specific application requirements, the user needs to contact the support department (e-mail: support@everelettronica.it for the necessary technical information.*

ELECTROMAGNETIC COMPATIBILITY

EMC

Take all precautions and measures to meet the requirements for electromagnetic compatibility.

Some disturbances generated by other insufficiently filtered and/or shielded equipment, may cause other malfunctions causing uncontrolled movements of the drive.

When establishing the connections the user needs to take into account the requirements defined in paragraph ***3.5.1 Guideline for cabling***.

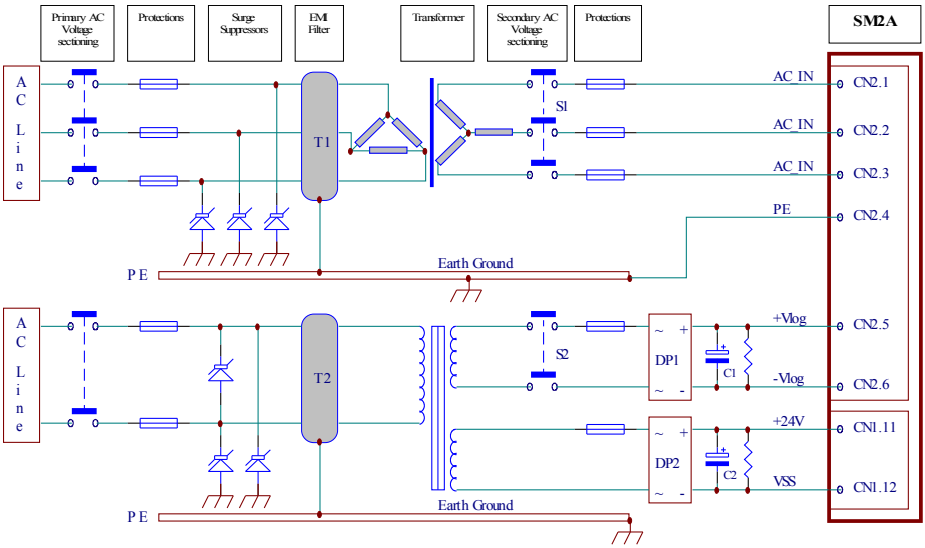
The operating drive generates emissions which need to be filtered properly, otherwise they might disturb the correct functioning of other equipment.

The end user needs to install an appropriate filtering system (network filter), depending on the personal application requirements.

3.2 Powering the system

The SM2A drives have to be powered by AC sources, concerning the (Motor) Power supply. Such power supply can be single phase or three phase. In some system versions Power and Logic can be powered separately.
(see chapter ***5 VERSIONS AND SPECIFICATIONS SM2A***).
In this case, the Logic section needs a DC voltage of nominal 24 Vdc.
The 24Vdc power supply to the I/O devices (digital inputs and outputs powered by +24V) have to be supplied in DC.

Example of three phase power supply:

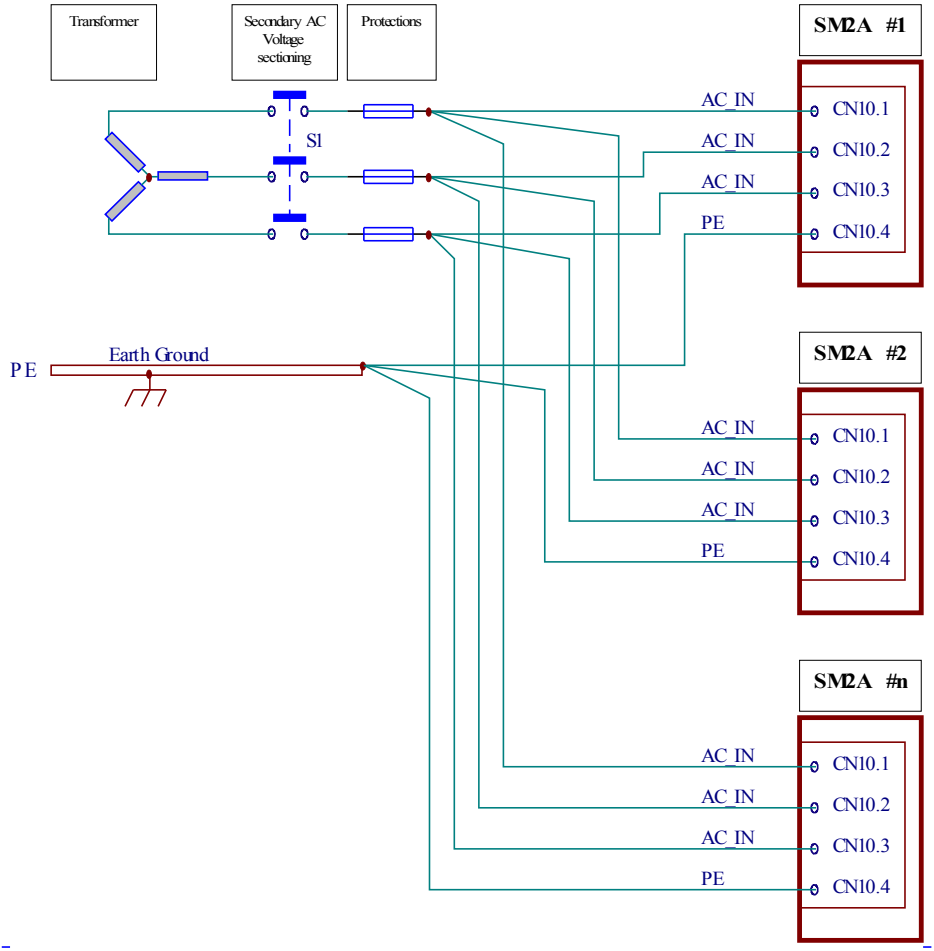


Line type:
The SM2A drive is equipped with an internal AC/DC converter able to accept AC single phase and three phase power supply lines. The connection to a single phase line is established by connecting indifferently 2 ACIN terminals of the CN2 connector.
Above a determined required power to the shaft, it's mandatory to use a three phase line in order not to exceed the current limits of the capacitive filter on the output to the AC/DC Converter.

To make it easy, you can consider the power limit for a single phase power supply to be the value of : Mechanical Power available from the motor shaft = 80W equal to
Electrical Power Input to the drive = 160W equal to
Transformer power = 265VA
For a higher power level it's necessary to use a three phase power supply.

It's good that multi-axles installations are executed with three phase line, as the power consumption of a single phase line might cause network unbalance.
For details, consult paragraph ***2.2 Electrical specifications***.
Attention: the example scheme presents a system equipped with a separated power supply for the logic. It is a utile functionality for sectioning the power supply from the power part leaving the Logic powered, maintaining the process and communications control. The versions offering this functionality won't function if +Vlog/-Vlog aren't supplied.

Example of multi-axles power supply (to simplify, the power supply for AC_{LOG} and +24Vdc has been left out).



AC_{IN} : input for AC power supply for the power section (motor).
There can be supplied an AC single phase or three phase power supply.

+Vlog : input for AC power supply for the Logic section.
-Vlog

PE : Environmental (Protective Earth)

+24 : Power supply for the digital outputs and Std. Inputs.
VSS For the applications where in the digital outputs and Std. Inputs aren't used, this power supply section can be left out.

Main characteristics of the drive's power supply:

Disconnection AC network: is a recommended safety device.

Primary protections use the fuses on bus AC or an equivalent safety switch.

Surge suppressors: on the primary circuit, they protect the drive against surges deriving from the primary network power supply.

EMC filter : it's generally necessary to satisfy the EMC compatibility requirements related to the emissions. An EMC filter is recommended in presence of sensible circuits powered by the AC line. If a commercial line filter is chosen, consider the total RMS current of the powered system.

The AC line filter must be installed following the builder's directives. Generally, it must be inserted between the main AC line and the transformer, if the last one is near to the drive or the electrical cabinet, between the transformer and the rectifier bridge in the other cases, keeping the bridge near the drive and keeping the connection between the filter and the transformer as short as possible.

Transformer: The primary circuit of the transformer has to be dimensioned in function of the characteristics of the AC power supply line. The voltage peaks on the secondary circuit of the transformer are equal to 1.41*secondary RMS voltage. The DC power supply voltage must not exceed the Vdc power supply Voltage of the drive.

DON'T use an Auto-transformer to interface with the electrical network. Only a transformer guarantees the galvanic isolation of the network.

The power of the transformer depends on the power required by the motor: to define the movement characteristics under control (dimensioned by the power supply and the motor) it's possible to refer to our support department (e-mail: support@everelettronica.it). It's also possible to use the following procedure to define approximately the power supply characteristics:

1. power in Watt to the motor shaft for every axle:
   Wn =π*Nn[RPM]*Tn[Nm]/30
2. power in Watt to the total load:
   W_S = sum of the Wn of the simultaneously moving axles;
3. power in Watt of the transformer:
   $T_W = 2 * W_S$ (efficiency = 0.5)
4. power in VA of the transformer:
   $T_{VA}=T_W$ / 0,7 (single phase) or $T_{VA}= T_W$ / 0,8 (three phase);
5. assume a voltage drop of about 8% during the application of the load (the secondary voltage must not exceed a voltage value of 108% of the nominal value if the load is zero).

An alternative, simple and fast method to calculate the power in VA of the transformer is : $T_{VA}(VA) = \sqrt{2}*Vdc_{BUS}*Imax_{PHASE(RMS)}$.

Secondary disconnection: can be used to disconnect only some voltages (for example the power supply leaving the Logic powered.

Secondary protections : must be present before the rectifier bridges and must be calibrated in function of the configured phase currents. Alternatively, an automatic safety switch can be used.

3.3 Selection criteria for the SM2A version

The SM2A system model is chosen on base of a variables series depending on the application:
- torque required by the shaft
- velocity
- physical system dimensions
- type of power supply
- communication interfaces
- digital and analog I/O-'s

Chapter ***5 VERSIONS AND SPECIFICATIONS SM2A*** gives the necessary indications to identify the most suitable model for the concerning application.

The dynamic performances of the motors depend on the power supply voltage: using a higher voltage the performances increase.

3.4 Assembling of the drive

For the assembling, refer to the figures of paragraph ***2.1 Mechanical specifications.*** Use M5 screws to mount the system to a wall.

The environment in which the drive is installed must be free of dirt, corrosive vapours, gases and liquids. Avoid areas where the vapours and atmospheric humidity condense.

When installing the drive in an electrical cabinet, make sure that the air stream openings or the cooling system prevent the rising of the internal temperature of the electrical cabinet above the maximum allowed working temperature.

Every local safety aspect concerning the drive installation has to be considered a project requirement for the entire application.

Assembling guide

The installation has to meet at least the following requirements:

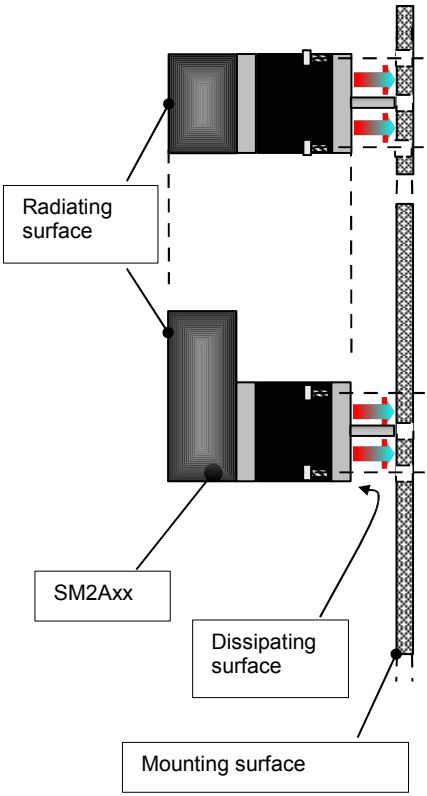
- *avoid excessive vibrations or shocks;*
- *provide a free space for the air flow above and under the drive;*
- *apply the minimum distances indicated in the following figure;*

The cooling of the SM2A drives happens in the first place through radiation of the heat sink wings and secondly, by the contact of the fixation side of the motor to the wall.

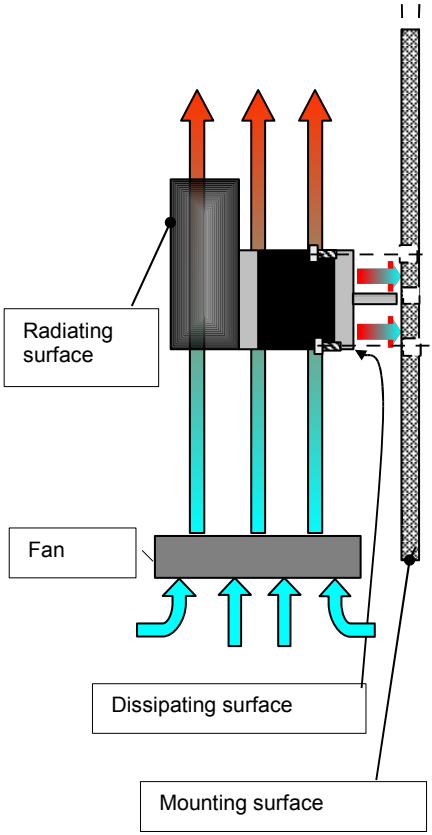
An insufficient heat exchange may rise the drive temperature until the threshold of the thermal protection causes a system block alarm.

Optimize these two dissipation channels in the installation project.

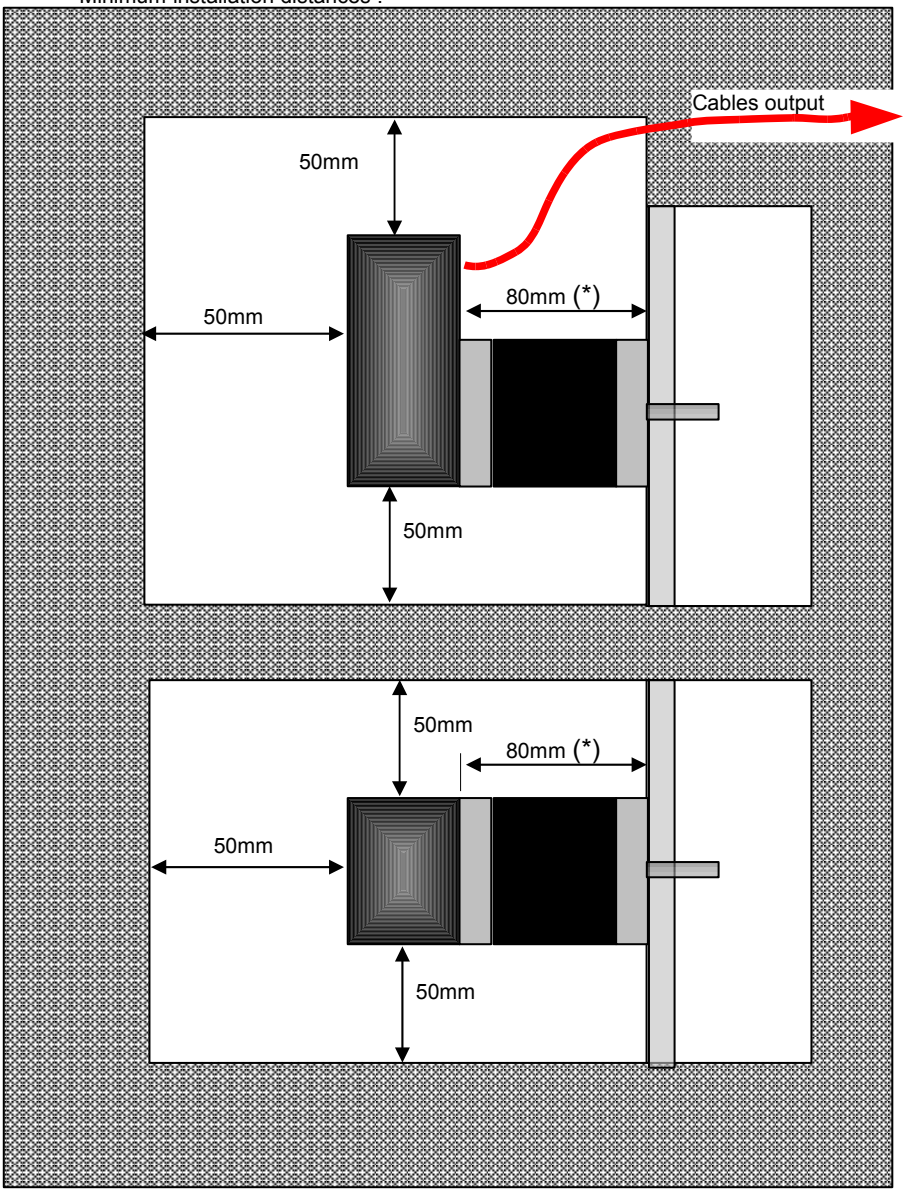
Dissipation
with free air



Dissipation
with forced air



Minimum installation distances :



(*) Attention : the minimal distance of 80mm between the body of the drive and the clamping surfaces depends on the dimensions of the connectors and the flying cables. In case a SM2An60Pxnn3Aw0 system is used (motor of a ½ stack), the body length of the motor is 65 mm. Therefore it is necessary to provide a space into the wall for the placing of the connectors and cables.

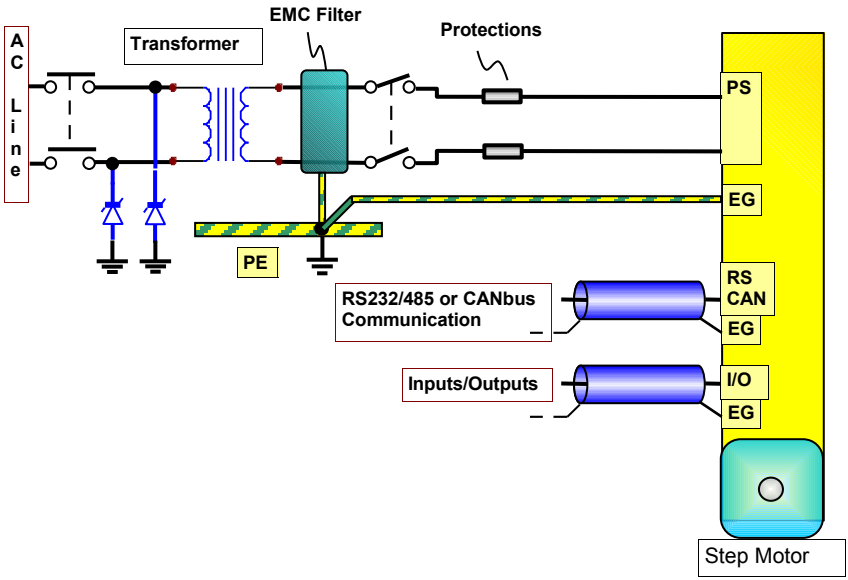
3.5 Connection of the drive

The connections which can be made to the inputs and outputs of the drive are

EG	- Earth Ground
PS	- AC power supply input
I/O	- Inputs / Outputs (digital and analog)
CAN*	- CAN bus
RS*	- RS232 and RS485 interface

(*)functions depending on the used system version.

Connection diagram



3.5.1 Guideline for cabling

The information in this section about the wiring and the protective earthing and shielding technology explains how to put into practice the wiring for most applications in general.

For a good drive installation:

Guideline for cabling	*Effects*
Connect the ground terminal to **CN2.4** of the main protective earthing **(PE)** terminal of the installation.	Necessary connection for electrical safety. Increases the resistance against: radiated disturbances and electrostatic discharges (ESD).
Use shielded cables for command signals (digital and analog inputs, communication interfaces).	Increases the resistance against disturbances and reduces the radiated and conducted emissions.
Use braided cables for power supply and I/O lines.	Increases the resistance against disturbances and reduces the radiated and conducted emissions.
Use twisted and shielded cables for RS485 and CANbus.	Increases the resistance against disturbances and reduces the radiated and conducted emissions. It's required by the MODBUS® and CANopen communication specifications.
Connect the shield ends from the signal cables from both sides to the ground.	Increases the resistance against disturbances and reduces the radiated and conducted emissions. In some applications, depending on the machine Lay-out, it can be more effective to connect the shield with only one side.
When powering different drives with only one power supply, establish a star connection of every drive to the distribution terminals (star centre).	Reduces the disturbances due to pulse currents.
Keep the (cable) connections as short as possible and avoid ground rings.	Increases the resistance against disturbances and reduces the radiated and conducted emissions.
The signal cable and command cable paths have to be separated and/or shielded from the power supply cables and from relative power to other equipment to avoid that the inductive coupling of the disturbances can cause incorrect operations.	Increases the resistance against disturbances.

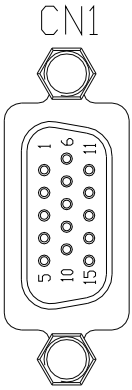
Local electrical standards, special working conditions and special cabling standards have priority over the information in this section of the manual.

3.5.2 System connectors

The lay-out and functionality of the connectors are displayed in the figure of paragraph ***3 DRIVE INSTALLATION***.

Some functions and, as a result, the pin-out of the connectors depend on the system version. Consult chapter ***5 VERSIONS AND SPECIFICATIONS SM2A.***

3.5.2.1 CN1 : Connection of the Inputs/Outputs



Type : SubD 15 pins, Female, High Density, IP68
Manufacturer : LTW
Model : LTWHDB-15PFFS-SL8001

Configuration I/O *"4"* :
4 digital Inputs (differential), 2 digital outputs.

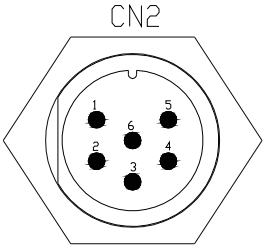
CN1 : Digital Inputs Hi-Freq			
15 position, SubD Female high density			
Pos	**Name**	**Characteristics**	
1	+B0_IN0	Digital Input	Positive digital input terminal B0_IN0
2	-B0_IN0	Digital Input	Negative digital input terminal B0_IN0
3	+B0_IN1	Digital Input	Positive digital input terminal B0_IN1
4	-B0_IN1	Digital Input	Negative digital input terminal B0_IN1
5	+B0_IN2	Digital Input	Positive digital input terminal B0_IN2
6	-B0_IN2	Digital Input	Negative digital input terminal B0_IN2
7	+B0_IN3	Digital Input	Positive digital input terminal B0_IN3
8	-B0_IN3	Digital Input	Negative digital input terminal B0_IN3
9	B0_OUT0	Digital Output	PNP Output (Source Current) B0_OUT0
10	B0_OUT1	Digital Output	PNP Output (Source Current) B0_OUT1
11	+24V	PWR Input	Input positive power supply digital outputs
12	VSS	PWR Input	Negative reference power supply digital outputs
13	n.c.		Not connected
14	n.c.		Not connected
15	n.c.		Not connected

Configuration I/O *"6"* :

4 digital Input (common pin), 2 digital outputs, 2 analog inputs.

CN1 : Digital Inputs Hi-Freq			
15 position, SubD high density			
Pos	**Name**	**Features**	
1	+B0_IN0	Digital Input	Positive terminal digital input B0_IN0
2	-IN_AN1	Analog Input	Negative terminal analog input IN_AN_1
3	+B0_IN1	Digital Input	Positive terminal digital input B0_IN1
4	+IN_AN1	Analog Input	Positive terminal analog input IN_AN_1
5	+B0_IN2	Digital Input	Positive terminal digital input B0_IN2
6	-IN_AN0	Analog Input	Negative terminal analog input IN_AN_0
7	+B0_IN3	Digital Input	Positive terminal digital input B0_IN3
8	B0_COM_IN	PWR Input	Reference common inputs
9	B0_OUT0	Digital Output	Output PNP (Source Current) B0_OUT0
10	B0_OUT1	Digital Output	Output PNP (Source Current) B0_OUT1
11	+24V	PWR Input	Input positive power supply digital outputs
12	VSS	PWR Input	Reference negative power supply digital outputs
13	+IN_AN0	Analog Input	Positive terminal analog input IN_AN_0
14	AGND	PWR Output	Output negative reference for potentiometers.
15	V_POT	PWR Output	Output positive power supply for potentiometers.

3.5.2.2 CN2 : Connection to the power supply



Type : 13/16'-28UN , 6 pins, Male, IP67
Manufacturer : LTW
Model : LTWCB-06PMMS-SC7001

Configuration power supply “6” :
single AC power supply for logic and power.

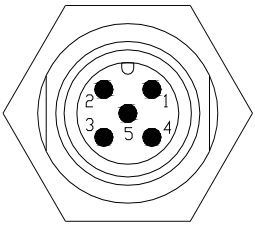
CN2 : Power Supply			
6 position, Male			
Pos	**Name**	**Features**	
1	AC_{IN}	PWR Input	AC input single power supply for Power and Logic
2	AC_{IN}	PWR Input	AC input single power supply for Power and Logic
3	AC_{IN}	PWR Input	AC input single power supply for Power and Logic
4	PE	EARTH Input	Environmental Protective Earthing (PE)
5	n.c.		Not connected
6	n.c.		Not connected

Configuration power supply “5” :
Separated power supplies, AC for power and DC (24Vdc) for logic.

CN2 : Power Supply			
6 position, Male			
Pos	**Name**	**Features**	
1	AC_{IN}	PWR Input	AC Input power supply Power
2	AC_{IN}	PWR Input	AC Input power supply Power
3	AC_{IN}	PWR Input	AC Input power supply Power
4	PE	EARTH Input	Environmental protective earthing (PE)
5	+Vlog	PWR Input	Positive power supply outputs Logic
6	-Vlog	PWR Input	Reference negative power supply Logic

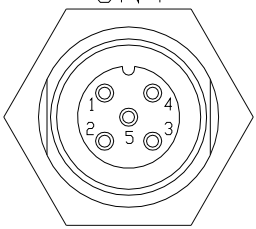
3.5.2.3 CN3-CN4 : Connection to the communication interface

CN3



Type : M12 , 5 pins, Male, IP68
Manufacturer : LTW
Model : LTW1205-05PMMS-SF8001

CN4



Type : M12 , 5 pins, Female, IP68
Manufacturer : LTW
Model : LTW1205-05PFFS-SF8001

Configuration interfaces *"C0"* :
CANbus, 2 parallel connectors.

CN3 : CANbus			
5 position, Male			
Pos	**Name**	**Features**	
1	n.c.		Not connected
2	n.c.		Not connected
3	CAN_GND	PWR Output	Signal Ground
4	CAN_H	Digital I/O	Bus Line Dominant HIGH
5	CAN_L	Digital I/O	Bus Line Dominant LOW

CN4 : CANbus			
5 position, Female			
Pos	**Name**	**Features**	
1	n.c.		Not connected
2	n.c.		Not connected
3	CAN_GND	PWR Output	Signal Ground
4	CAN_H	Digital I/O	Bus Line Dominant HIGH
5	CAN_L	Digital I/O	Bus Line Dominant LOW

Configuration interface *"N3"*:
RS232 (CN3) + RS485 (CN4)

CN3 : RS232			
5 position, Male			
Pos	**Name**	**Features**	
1	n.c.		Not connected
2	RXD	Digital Input	Input receiver RS232
3	TXD	Digital Output	Transmitter output RS232
4	DTR	Digital Output	Output Data Transmission Ready RS232
5	0V_A	PWR Output	Reference (ground) communication interface

CN4 : RS485			
5 position, Female			
Pos	**Name**	**Features**	
1	+RX	Digital Input	Non-inverting input receiver RS485
2	+TX	Digital Output	Non-inverting output transmitter RS485
3	-RX	Digital Input	Inverting input receiver RS485
4	-TX	Digital Output	Output inverting transmitter RS485
5	0V_A	PWR Output	Reference (ground) communication interface

Configuration interfaces *"N2"*:
RS485, 2 parallel connectors

CN3 : RS485			
5 position, Male			
Pos	**Name**	**Features**	
1	+RX	Digital Input	Non-inverting input receiver RS485
2	+TX	Digital Output	Non-inverting output transmitter RS485
3	-RX	Digital Input	Inverting input receiver RS485
4	-TX	Digital Output	Inverting output transmitter RS485
5	0V_A	PWR Output	Reference (ground) communication interface

CN4 : RS485			
5 position, Female			
Pos	**Name**	**Features**	
1	+RX	Digital Input	Non-inverting input receiver RS485
2	+TX	Digital Output	Non-inverting output transmitter RS485
3	-RX	Digital Input	Inverting input receiver RS485
4	-TX	Digital Output	Inverting output transmitter RS485
5	0V_A	PWR Output	Reference (ground) communication interface

3.5.3 Mating cables kit for SM2A

For the SM2A systems, EVER supplies flying connectors with pre-wired cables of the desired length.

For CN1

Pin#	Cable Color	Pin#	Cable Color
1	Brown	9	Black
2	Blue	10	Orange
3	White	11	Purple
4	Green	12	Green L.
5	Yellow	13	Black/W
6	Grey	14	Brown/W
7	Pink	15	Red/W
8	Red		

Manufacturer : EVER
Code : CA/LTWHDC15AF*nn*
(nn=length : 01=1m, 02=2m ...)
Conductors : UL2464 AWG26*15C+Drain+AL/My
Cable : Black PVC Jacket (UV resistant)
ext. ∅6.5mm
Waterproof Rate : IP67

For CN2

Pin#	Cable Color
1	Brown
2	Blue
3	White
4	Green
5	Yellow
6	Grey

Manufacturer : EVER
Code : CA/LTWCB06BF01*nn*
(nn=length : 01=1m, 02=2m ...)
Conductors : UL2464 AWG20*6C+Drain+AL/My
Cable : Black PVC Jacket (UV resistant)
ext. ∅6.5mm
Waterproof Rate : IP67

For CN3

Pin#	Cable Color
1	Brown
2	White
3	Blue
4	Black
5	Green

Manufacturer : EVER
Code : CA/LTW1205BF*nn*
(nn=length : 01=1m, 02=2m ...)
Conductors : UL2464 AWG24*5C+Drain+AL/My
Cable : Black PVC Jacket (UV resistant)
ext. ∅6.0mm
Waterproof Rate: IP68

For CN4

Pin#	Cable Color
1	Brown
2	White
3	Blue
4	Black
5	Green

Manufacturer : EVER
Code : CA/LTW1205BM01*nn*
(nn=length : 01=1m, 02=2m ...)
Conductors : UL2464 AWG24*5C+Drain+AL/My
Cable : Black PVC Jacket (UV resistant)
ext. ∅6.0mm
Waterproof Rate : IP68

3.5.4 Section of the SM2A cables

When connecting the pre-wired flying cables to other conductors, use the minimal recommended sections.

	Minimum section
AC Power	0.5mm^2 (AWG20)
Logic Supply	0.5mm^2 (AWG20)
Digital I/O	0.14mm^2 (AWG25)
Analog inputs	0.14mm^2 (AWG25)
Communication Interfaces	0.25mm^2 (AWG23); for CANbus follow the CIA-CANOpen regulations.

4 START UP OF THE DRIVE

This section explains how to start up the SM2A drive after installation. Typical actions:

- Verify the drive
- Verify the installation
- Maintain the SM2A drive

4.1 Verify the installation

- Control all connections: power supply, motor and logics control.
- Make sure that all settings for the application are correct
- Make sure that the power supply characteristics are suitable for the drive.
- If possible, remove the load from the motor shaft to avoid that wrong movements cause damage.
- Supply of power and make sure that there are no protection signals.
- If it's not possible to communicate with the system or if activated protections are signalized, shut down immediately and verify if all connections are established and correct.
- Enable the current to the motor and verify the applied torque.
- Enable a movement of some steps and verify if the rotation direction is the desired one.
- Disconnect the power supply, fixate the motor to the load and check the full functionality.

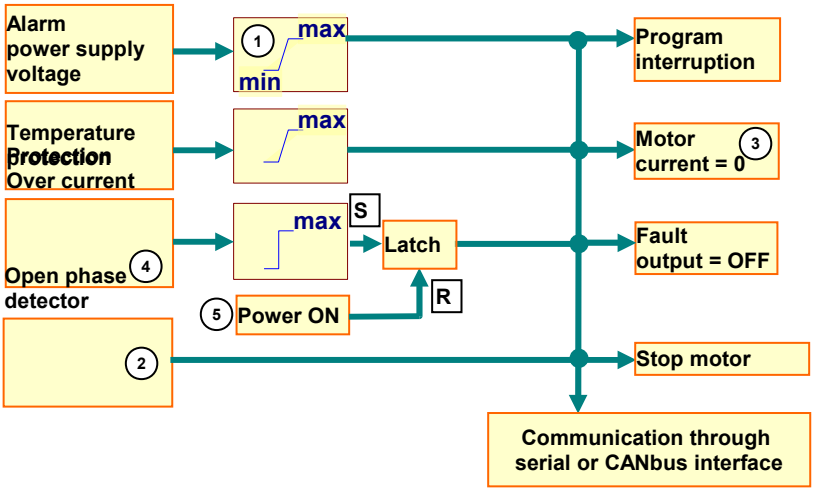
4.2 Maintenance

- The SM2A system is designed for minimal maintenance.
- Remove the dust and dirt from the system surface and the dissipation devices using only clean and dry air at low pressure.

4.3 *Functioning statuses and their signalling*

The working condition of the SM2A system can be visualized by means of the present communication interface and eventually by means of a FAULT output.

Functioning diagram of the protections



Note:

(1) The range of acceptable power supply voltage is defined in paragraph ***2.2 Electrical specifications***.

(2) Open phase: the winding current doesn't reach the set value;

(3) *When the SM2A system indicates a "FAULT" status, the drive converter is disabled and the **motor looses the holding torque.***
The installer needs to realize a safety system to avoid damage to things or persons in case the motor is dragged by the load.

(4) *In case of **over current** protections, shut down the drive and define the problem before restarting the device.*

(5) *Shut down the drive by disconnecting the voltage to exit the over current protection status .*

Protections:

Protection	*Trigger*	*Effect*	*Restore*
Over Current Fast electronic protection on the motor outputs against short circuits between the motor phases and between phases and ground.	**Short circuit or excessive current absorption.**	**- opening drive power stages** **- Reporting through Data Link**	**It's necessary to disconnect the power supply to the drive to remove the cause of the protection.**

Protection	*Trigger*	*Effect*	*Restore*
Open Phase Detects the missing connection to one or more motor phases.	**Impossible for the drive to adjust the motor current**	**- opening of the power stages of the drive** **- Reporting through Data Link**	**It's necessary to disconnect the power supply to the drive to remove the cause of the protection.**

Protection	*Trigger*	*Effect*	*Restore*
Over Temperature Detects a high temperature of the heat sink.	**heat sink temperature >75°C**	**- opening of the drive statuses** **-Reporting through Data Link**	**Automatically when the temperature drops within the correct range.**

Protection	*Trigger*	*Effect*	*Restore*
Over/Under Voltage Detects a power supply voltage outside the functioning range	**(1)too low or too high power supply voltage,** extra-voltages due to a BEMF generated by the motor dragged by the load .	**- opening of the power stages of the drive** **- Reporting through Data Link**	**Automatically when the voltage drops within the correct range**

(1) Note: the voltage value is measured on base of the power supply voltage to the motor. Eventual out of Range voltages of VLOG and/or 24V_{DC} are not detected.

In condition of Protection, the working of the drive depends on the type of protection and firmware. When the protection provides a safety switch of the power supply to the motor, no holding torque is supplied and the load can drag the motor shaft. The user must provide devices to protect the load.

4.3.1 Analysis of not detected malfunctions

When one of the following situations occur, the drive doesn't function correctly and isn't reported as an error.

DEFECT	When starting up the system nothing happens.
CAUSE	Can be caused due to a wrong connection of the power supply.
ACTION	Check the power supply cables.

DEFECT	The external fuse to the drive burns
CAUSE	May be due to a wrong connection of the power supply.
ACTION	Adjust the connection and substitute the fuse. Use fuses which are suitable for the application.

DEFECT	Noisy motor movement with vibrations.
CAUSE	May be caused due to a state of resonance
ACTION	Increase the resolution of the step angle and/or change the motor velocity to exit a resonance region.

DEFECT	At high speed, the motor hasn't sufficient torque
CAUSE	Can be caused due to the auto limitation of the motor currents.
ACTION	Try to reduce the fragmentation of the step angle, increase the current in the motor (always remaining within the specified values of the drive and the motor), increase the power supply voltage.

DEFECT	The motor produces torque but doesn't rotate.
CAUSE	May be caused due to a wrong connection of the I/O-'s
ACTION	Check the connection of the I/O-'s.

In case it's not possible to solve the problem, and thinking that the system isn't damaged, contact EVER for technical support or send a message including the following information:

- The system version (SM2A) and serial number printed on the system label.
- The complete problem description and the conditions where in the problem occurs.
- The description of the drive configuration in the application (Current, step type, functioning type, etc.)
- The value of the power supply voltage and the characteristics (single phase, three phase,ripple....).
- The description of the power feeding and the control signals cabling and the presence of other components in the installation.
- The description of the application (motor movements, loads, velocity, etc.).

Return procedure To return a defect drive to EVER for reparation or substitution:

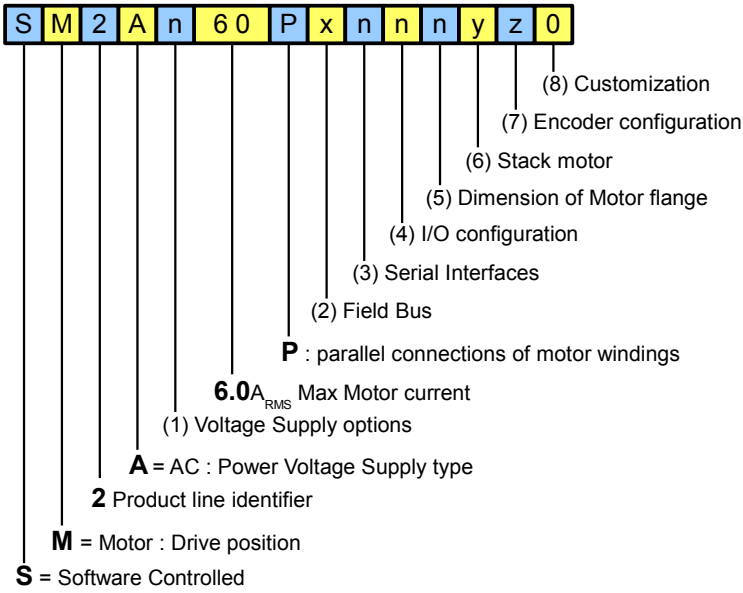
1) If possible put the drive back in its original package.
   [EVER is not responsible for damages as a result of inadequate packing or shipping].
   Attach if possible a complete problem description in a way that the damage can be detected faster.
2) Send the drive to:

EVER Elettronica s.r.l.
Via del Commercio 9/11
Zona Industriale Loc. San Grato
26900 - LODI - ITALY
Attn: AR Dept.
E-mail: reparations@everelettronica.it

*EVER co. is used to sends to customers a **repair costs estimation offer** before repairing the unit .*
All shipment costs are charged to customer.

5 VERSIONS AND SPECIFICATIONS SM2A

The SM2A system codes are composed as follows:



(1) Voltage supply option	
5	Separate power supply inputs for Power and Logic
6	Single AC power supply input

(2) Field Bus	
N	No Field Bus
C	CANbus

(3) Serial interfaces	
0	No interfaces
2	RS485 (in/out)
3	RS232 + RS485

(4) I/O Configuration	
4	4 Dig_IN + 2 Dig_OUT
6	4 Dig_IN + 2 Dig_OUT + 2 Analog_IN

(5) Dimension of motor flange	
3	3.4' (86mm)
..	other

(6) Stack motor	
A	0.5 stack
B	1 stack
C	1.5 stack
D	2 stack
E	3 stack

(8) Customization	
0	No customization
..	other

(7) Encoder Configuration	
N	No Encoder
4	400 ppr incremental
..	other

Examples :

SM2A660PC043E40 : drive integrated with the motor, single power supply for logic and power 18÷100Vac, motor current up to $6A_{RMS}$, internal parallel connection of the motor windings, CANbus (in/out connectors), no serial interface, 4 digital IN, 2 digital OUT, no analog IN, motor with a flange of 3.4' (86mm), motor length of 3 stack, incremental internal encoder of 400ppr, no customization.

SM2A560PN263D40 : drive integrated with the motor, separated power supply for Logic and Power (18÷100Vac for power, 24Vdc for Logic), motor current up to $6A_{RMS}$, internal parallel connection of the motor windings, no CANbus interface, no serial RS485 interface (in/out connectors), 4 digital IN, 2 digital OUT, 2 analog IN, motor with a flange of 3.4' (86mm), motor length of 2 stack, incremental internal encoder of 400ppr, no customization.

SM2A560PN343DN0: drive integrated with the motor, separated power supply for Logic and power (18÷100Vac for power, 24Vdc for Logic, motor current up to $6A_{RMS}$, internal parallel connection of the motor windings, no CANbus interface, serial RS232 interface, serial RS485 interface, 4 digital IN, 2 digital OUT, no analog IN, motor with a flange of 3.4' (86mm), motor length of 2 stack, no incremental encoder, no customization.

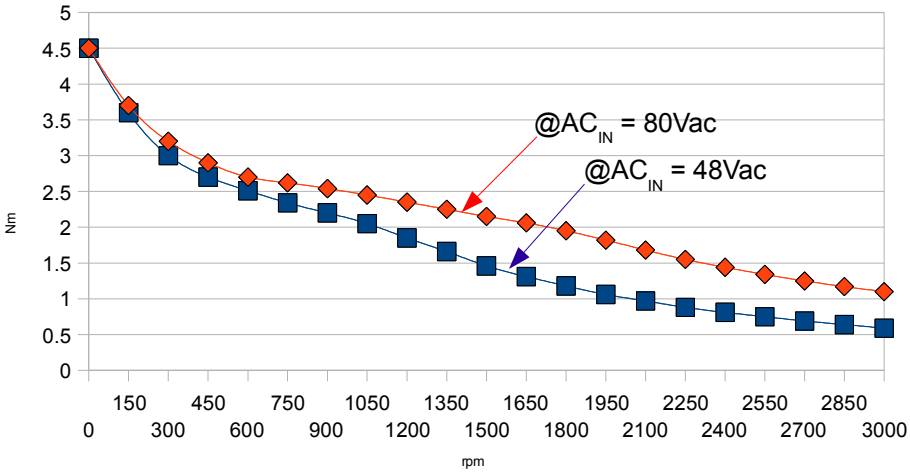
Note :

		SM2Ax60Pxx43Ax0	SM2Ax60Pxx43Bx0	SM2Ax60Pxx43Dx0	SM2Ax60Pxx43Ex0
Drives	Power supply voltage	On the models SM2A5... : separated power supply 24 Vdc (logic) e 24 ÷ 100 Vac (power) On the models SM2A6... : single power supply 24 ÷ 100 Vac			
	Current	8.0 A_{RMS} (11.0 Apeak)			
	Chopper frequency	40 kHz			
	Interfaces	On models SM2AxxxxC0xxxxx : CANBus (CANopen) On models SM2AxxxxN3xxxxx : Serial RS232 / RS485 On models SM2AxxxxN2xxxxx : Serial RS485 / RS485			
	Optically isolated inputs	4 digital			
	Analog inputs	2 ±10Vdc			
	Optically isolated outputs	2 digital			
	Step angle	From full step to 1/128 step			
	Protections	Over/Under-voltage, over current, open phases and over temperature			
Motor	Step angle	1,8° ±5%			
	Static torque	3,40 Nm ±10%	4,5 Nm ±10%	8,5 Nm ±10%	12,5 Nm ±10%
	Internal connection	Bipolar parallel			
	Resistance	0,44 ohm ±10%	0,19 ohm ±10%	0,27 ohm ±10%	0,35 ohm ±10%
	Inductance	2,54 mH ±10%	1,70 mH ±10%	3,00 mH ±10%	4,80 mH ±10%
	Rotor inertia	1000 g.cm²	1400 g.cm²	2700 g.cm²	4000 g.cm²
	Residual torque	0,08 Nm	0,13 Nm	0,25 Nm	0,38 Nm
Encoder (if present)	Functions	Closed loop of torque, velocity and position			
	Type	Incremental bidirectional with zero			
	Resolution	400 pulses			
	Inertia	6 g.cm²			
General	Connections (drive side)	High density D-Sub HD15P 15 female poles for the inputs and outputs (CN1); 13/16' screwed circular connections with 6 male poles for the connection to the power supply (CN2); M12 screwed circular connections with 5 male poles for the connection of the fieldbus or serial interface (CN3) input ; M12 screwed circular connections with 5 female poles for the connection of the fieldbus or serial interface (CN4) output.			
	Protection	IP65			
	Dimensions	86 x 86 x 150,5 mm	86 x 86 x 165,5 mm	86 x 86 x 203,5 mm	86 x 86 x 242,0 mm
	Weight	2,60 Kg. Approx.	3,20 Kg. Approx.	4,70 Kg. Approx.	6,20 Kg. Approx.

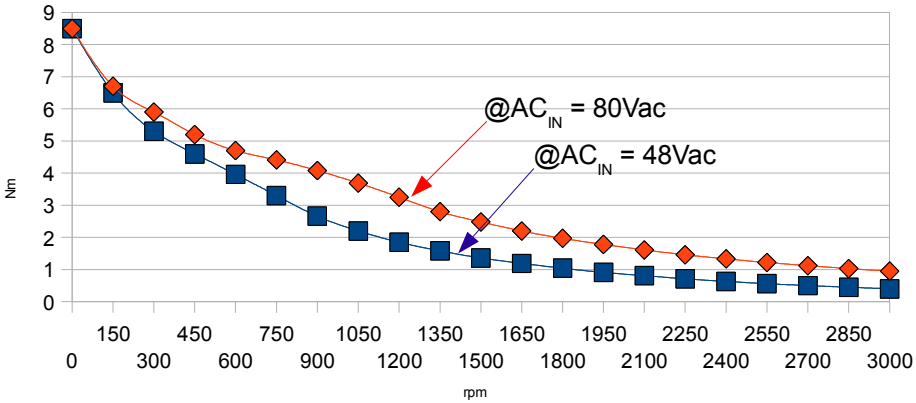
5.1 Torque diagrams

Here follow some examples of torque diagrams of the SM2A systems equipped with motors of 1, 2 and 3 stacks.

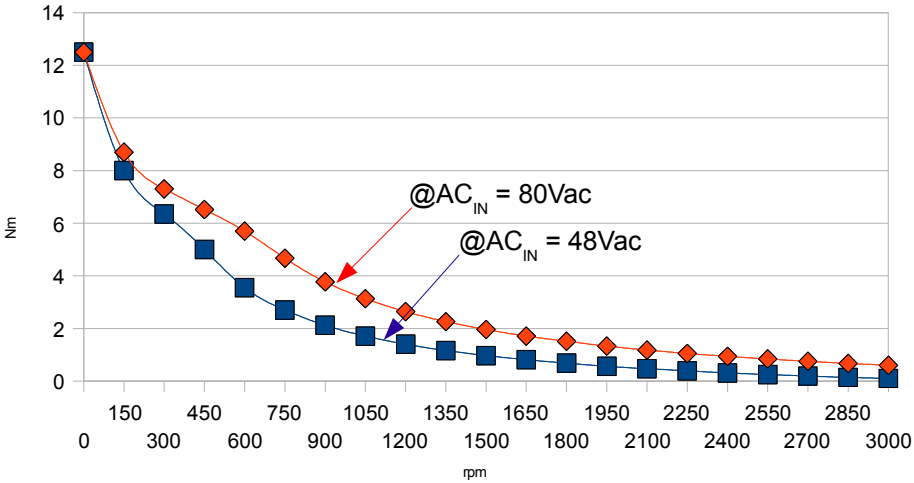
Model : SM2Ax60PXny3*B*n0
Voltage : 48Vac and 80Vac
Motor current: 8.0A_{RMS}
Step angle : Full Step



Model: SM2Ax60PXny3***D***n0
Voltage : 48Vac and 80Vac
Motor current : 8.0A_{RMS}
Step angle: Full Step



Model : SM2Ax60PXny3*E*n0
Voltage: 48Vac and 80Vac
Motor current: 8.0A_{RMS}
Step angle: Full Step



A APPENDICES

A.1 Applicable manuals and documentation

Hardware Manuals SM2A :

Manual Code	File name (.pdf)	Manual description
MAN.HISM2A	Manual_SM2A_IT	**SM2A MANUALE DI INSTALLAZIONE USO E MANUTENZIONE (IT)**
MAN.HESM2A	Manual_SM2A_GB	**SM2A MANUAL FOR INSTALLATION, USE AND MAINTENANCE (GB)**

Software Manuals SM2A :

Manual code	File name PDF	Manual description
MAN.SISDMMODBUS	Manual_SDM_MD_Modbus_IT.pdf	**(C0400) MODBUS® Protocol Specification for SDM/MD/SM2A**
MAN.SESDMMODBUS	Manual_SDM_MD_Modbus_EN.pdf	
MAN.SCSDMMODBUS	Manual_SDM_MD_Modbus_CN.pdf	
MAN.SRSDMMODBUS	Manual_SDM_MD_Modbus_RU.pdf	
MAN.SISDMQKMOD	QuickGuide_SDM_Modbus_IT.pdf	**(C0400) MODBUS® Quick Start Guide for SDM/MD/SM2A**
MAN.SESDMQKMOD	QuickGuide_SDM_Modbus_EN.pdf	
MAN.SCSDMQKMOD	QuickGuide_SDM_Modbus_CN.pdf	
MAN.SRSDMQKMOD	QuickGuide_SDM_Modbus_RU.pdf	
MAN.SISDMCANOPEN	Manual_SDM_MD_CANopen_IT.pdf	**(C0300) CANopen Protocol Specification for SDM/MD/SM2A**
MAN.SESDMCANOPEN	Manual_SDM_MD_CANopen_EN.pdf	
MAN.SCSDMCANOPEN	Manual_SDM_MD_CANopen_CN.pdf	
MAN.SRSDMCANOPEN	Manual_SDM_MD_CANopen_RU.pdf	
MAN.SISDMQKCAN	QuickGuide_SDM_CANopen_IT.pdf	**(C0300) CANopen Quick Start Guide for SDM/MD/SM2A**
MAN.SESDMQKCAN	QuickGuide_SDM_CANopen_EN.pdf	
MAN.SCSDMQKCAN	QuickGuide_SDM_CANopen_CN.pdf	
MAN.SRSDMQKCAN	QuickGuide_SDM_CANopen_RU.pdf	
MAN.SISDMATOMIC	Manual_SDM_MD_Atomic_IT.pdf	**(C0499) Atomic® Software Manual for SDM/MD/SM2A**
MAN.SESDMATOMIC	Manual_SDM_MD_Atomic_EN.pdf	
MAN.SCSDMATOMIC	Manual_SDM_MD_Atomic_CN.pdf	
MAN.SRSDMATOMIC	Manual_SDM_MD_Atomic_RU.pdf	
MAN.SISDMGOLDXP	Manual_SDM_Labelling_C450_IT.pdf	**(C0450) Labelling GoldXp® Manual for SDM drive**
MAN.SESDMGOLDXP	Manual_SDM_Labelling_C450_EN.pdf	
MAN.SCSDMGOLDXP	Manual_SDM_Labelling_C450_CN.pdf	
MAN.SIRDMGOLDXP	Manual_SDM_Labelling_C450_RU.pdf	
MAN.SISDMSILVER	Manual_SDM_Labelling_C404_IT.pdf	**(C0404) Labelling Silver® Manual for SDM drive**
MAN.SESDMSILVER	Manual_SDM_Labelling_C404_EN.pdf	
MAN.SCSDMSILVER	Manual_SDM_Labelling_C404_CN.pdf	
MAN.SIRDMSILVER	Manual_SDM_Labelling_C404_RU.pdf	
MAN.SISDMTRACKER	Manual_SDM_Tracker_C420_IT.pdf	**(C0420) Digital Tracker Manual for SDM drive**
MAN.SESDMTRACKER	Manual_SDM_Tracker_C420_EN.pdf	
MAN.SCSDMTRACKER	Manual_SDM_Tracker_C420_CN.pdf	
MAN.SRSDMTRACKER	Manual_SDM_Tracker_C420_RU.pdf	
		(C0480) MODBUS® - Electric CAM for SDM/MD/SM2A
	Under development	
		(C0380) CANopen - Electric CAM for SDM/MD/SM2A
	Under development	

A.2 Firmware and applicable notes

This appendix presents some available firmwares and some practice examples of possible applications of the SM2A systems.

The differences between the SM2A *systems* occur in the hardware and software configurations. For all hardware configurations it's possible to obtain different functionalities on base of the firmware programmed on the system.

Hardware	*Firmware*	*Description*	*Note*
SM2A	***C0300***	**CANbus Slave**	**Stepper Drive Module equipped with CANbus (CANopen) communication protocol able to function as Slave in a system with a Master controller.**
SM2A	***C0400***	**MODBUS® Slave**	**Stepper Drive Module equipped with MODBUS® RTU communication protocol (serial interfaces RS232 and RS485) able to function as Slave in a system with a Master controller**
SM2A	***C0499***	**Atomic®**	**Stepper Drive Module equipped with MODBUS® RTU (serial interfaces RS232 and RS485) able to execute the motion functions and Programmable Master Controller of the system.**

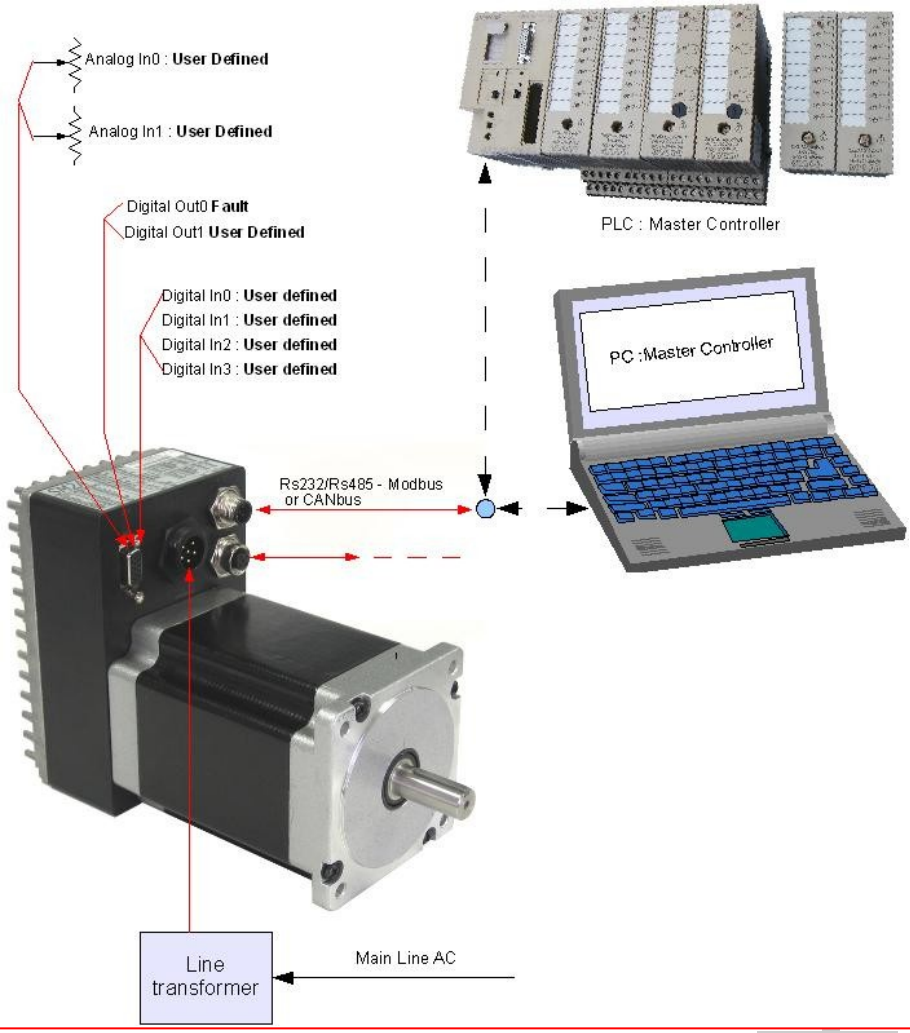
For the functioning details, refer to the software manuals of the concerning version.

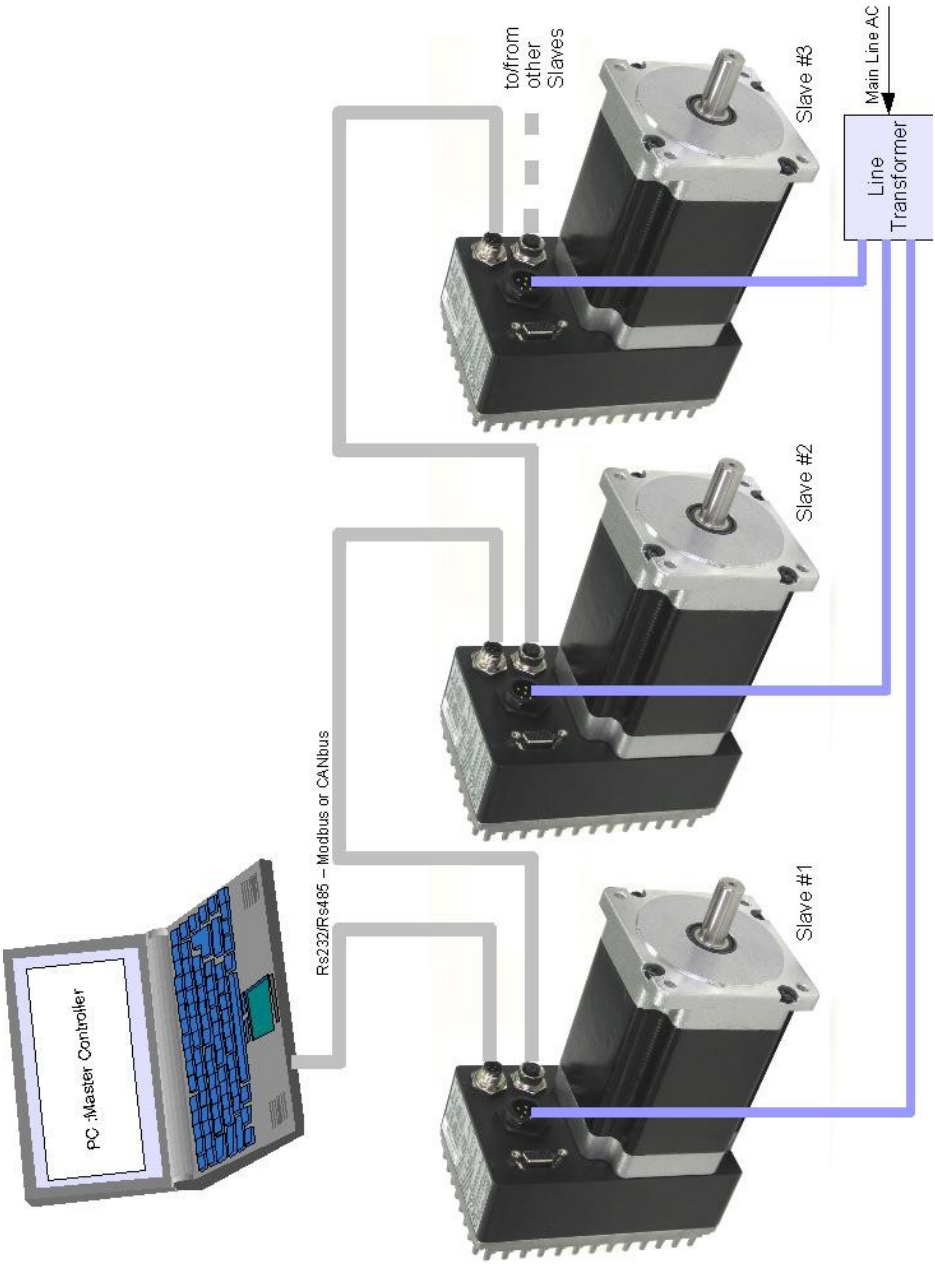
Next follow some application examples.
The images are purely indicative and may display drives which aren't described in this manual.

A.2.1 MODBUS® and CANbus Slave

The software configurations CANbus C0300 and MODBUS® Slave C0400, differ because they have a different type of implemented communication bus and software protocol.
All other characteristics are identical.
The “Slave” software configurations are developed to allow the drive control by a “Master” which normally is represented by a PC or PLC.
All drive functionalities (motor parameters, digital inputs/outputs, motor inputs etc.) are parametrized by means of control and command strings send by the Master.
This type of software configuration is especially applicable for applications which already have a machine Master and for multi-axles installations.

For details about the application, consult the concerning software manuals.
C0300 : CANbus (CANOpen)
C0400 : RS232/RS485 (MODBUS® RTU)




to/from
other
Slaves
Slave #3
Main Line AC
Line
Transformer
Slave #2
Rs232/Rs485 – Modbus or CANbus
Slave #1
PC :Master Controller

A.2.2 Atomic®

*The **Atomic®** technology patented by EVER, integrates in one single device the functions of:*

- *Motion Controller*
- *PLC*

With the SM2A Atomic® *(C0*499) systems can be realized a stand-alone motion and control device able to manage autonomously all machine processes without using a supervising controller (PLC or PC).

Atomic® is a MS Windows® programming environment allowing users to autonomously develop and personalize their own motion control application, in an easy way.

Atomic® supplies an extremely simple interface to compile, execute, test and debug with one single software tool.

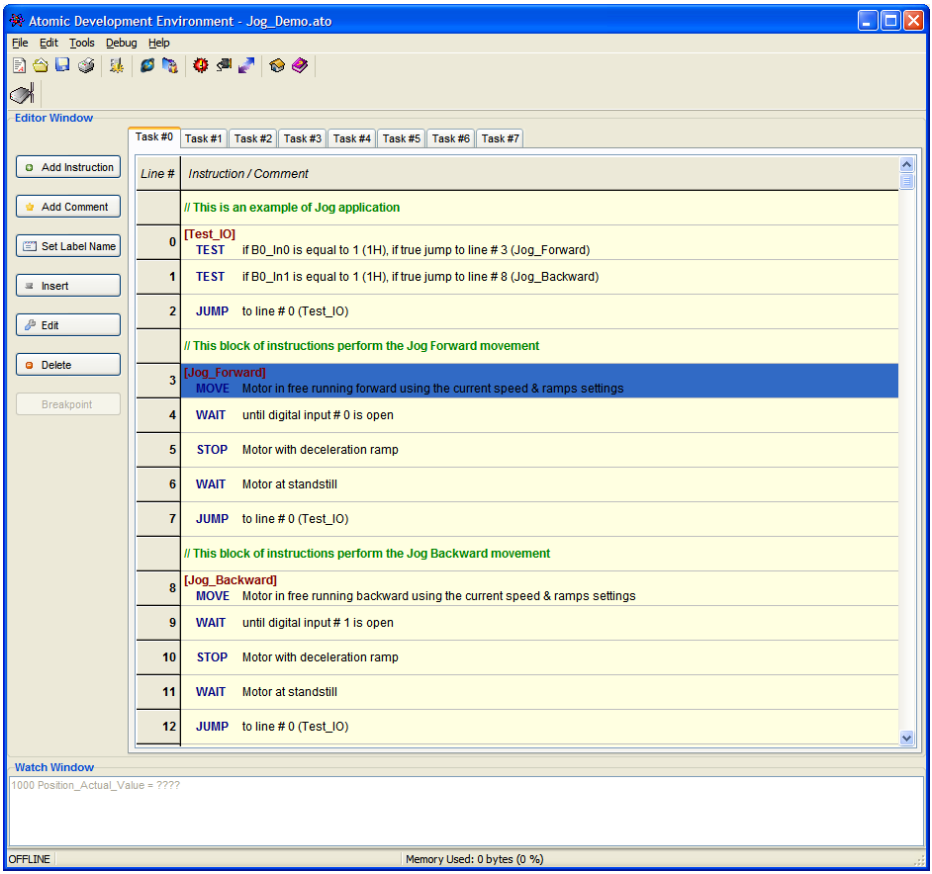
The *Atomic® environment* is composed of *:*

- *Microsoft Windows® programming environment*
- *Programming cable*

The application parameters are inserted replying to a series of questions in specific dialogue windows: drive type, axles, programming of digital inputs and outputs, programming of analog inputs, setting of the motion criteria, criteria of the motor performances.
For all aspects appears a specific dialogue window foreseen of a on-line help menu.
The programming is done quickly without the risk of making syntax or compilation errors.
The communication interface can be used, besides for the programming of the functioning parameters, to realize a control / data display panel for the user.

For application details, consult the Atomic® software manual.

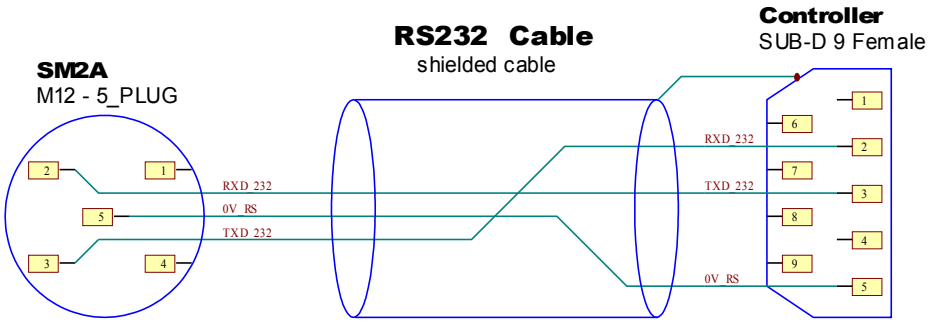
Atomic IDE main window



A.3 Cables and adapters

A.3.1 Cable RS232 point-to-point SM2A-Controller

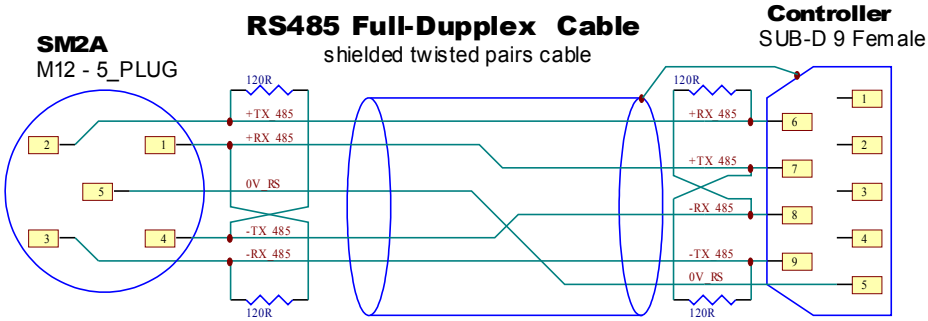
Description: cable for the direct point-to-point connection through RS232 of a SM2A drive to a controller (PC, PLC, GWC etc.) equipped with a SUBD-9M connector with a pin-out consistent with the scheme.



SM2A M12 - 5_PLUG pin#	Controller SUB-D 9 F pin#
1	
2	3
3	2
4	
5	5

A.3.2 Cable RS485 Full-Duplex point-to-point SM2A-Controller

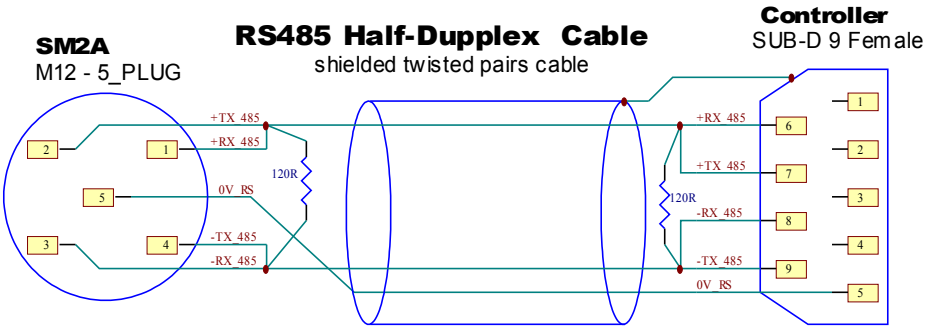
Description : cable for the direct point-to-point connection through RS485 Full-Duplex (4 wires+ground) of a SM2A drive to a controller (PC, PLC, GWC etc.) equipped with a SUBD-9M connector with a pin-out consistent with the scheme.



SM2A M12 - 5_PLUG pin#	Controller SUB-D 9 F pin#
1	7
2	6
3	9
4	8
5	5

A.3.3 Cable RS485 Half-Duplex point-to-point SM2A-Controller

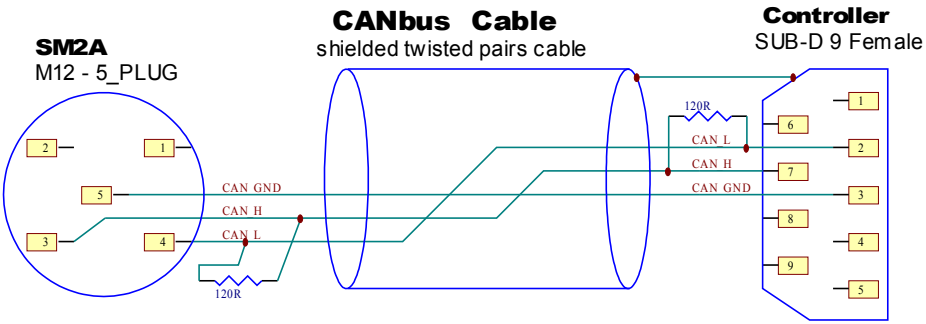
Description: cable for the direct point-to-point direction through RS485 Half-Duplex (2 wires + ground) of a SM2A drive and a controller (PC, PLC, GWC etc.) equipped with a SUBD-9M connector with a pin out consistent with the scheme.



SM2A M12 - 5_PLUG pin #	Controller SUB-D 9 F pin #
1+2	6+7
3+4	8+9
5	5

A.3.4 CANbus point-to-point SM2A-Controller

Description :cable for the direct point-to-point connection through CANbus (CANOpen) of a SM2A drive to a controller (PC, PLC, GWC, etc.) equipped with SUBD-9M connector with a pin-out consistent with the scheme (CIA-CANopen).



SM2A M12 - 5_PLUG pin #	Controller SUB-D 9 F pin #
1	
2	
3	7
4	2
5	3

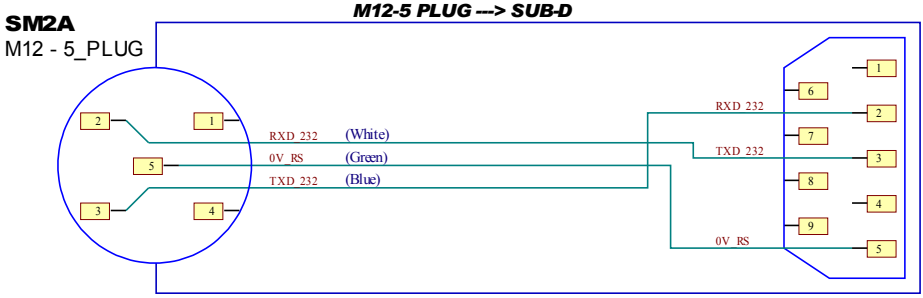
A.3.5 RS232 adapter SM2A-Controller

Description : adapter to use RS232 cables at 3 wires (RXD, TXD, GND) equipped with SUBD 9p connectors, for the connection through RS232 of a SM2A drive to a controller (PC, PLC, GWC etc.) equipped with a SUBD-9M connector with a pin-out consistent with the scheme.

The adapter must be placed on the Drive side.

RS232 - ADAPTER

M12-5 PLUG ---> SUB-D



*The cable colour is related to the pre-wired EVER cables described in paragraph **3.5.3 Mating cables kit for SM2A**.*

A.3.6 adapter RS485 SM2A-Controller

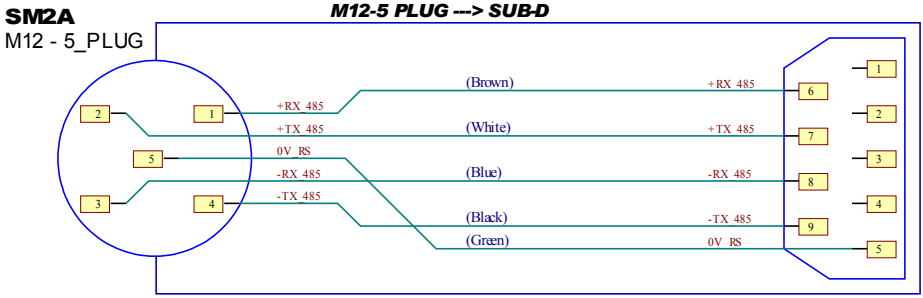
Description: adapter for the RS485 full duplex connection of 5 wires (+RX, -RX, +TX, -TX, 0VA) with cable equipped with SUBD 9p connectors, for the connection of a SM2A drive to a controller (PC, PLC, GWC etc.) equipped with the SUBD-9M connector with a pin-out consistent with the scheme.

The adapter has to be placed on the Drive side.

*The cables colour is related to the pre-wired EVER cables described in paragraph **3.5.3 Mating cables kit for SM2A**.*

RS485 Full-Duplex - ADAPTER

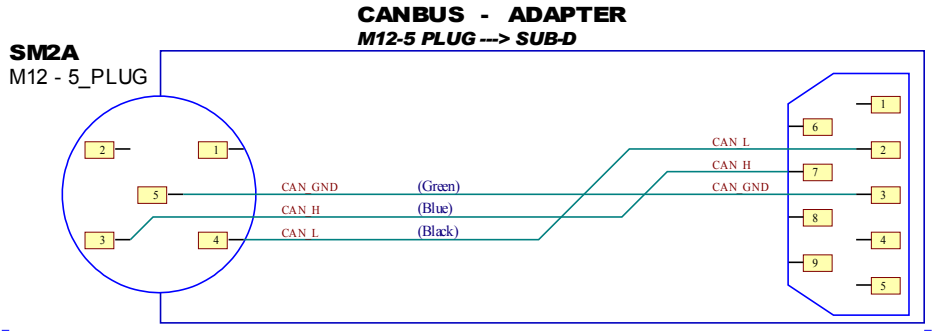
M12-5 PLUG ---> SUB-D



A.3.7 CANbus adapter SM2A-Controller

Description: adapter for the CANbus (CANopen) connection with 3 wires (CAN_H, CAN_L, CAN_GND) with cables equipped with SUBD 9p connectors, for the connection of a SM2A drive to a controller (PC, PLC, GWC etc.) equipped with a SUBD-9M connector with a pin-out consistent with the scheme (CIA CANopen directives).
The adapter must be placed on the Drive side.

*The cables color is related to the pre-wired EVER cables described in paragraph **3.5.3 Mating cables kit for SM2A**.*



A.4 Encoder

The specifications of the internal encoder for the Closed Loop function are the following:

Specifications	
Outputs	Line driver 5Vdc
Resolution	400ppr
Power supply voltage *Vdc*	5Vdc ±10%
Output current *mA*	±20
Max current *mA*	100 @ VDD=24Vdc
Maximum output frequency *kHz*	200
Phasing	90 electrical degrees between PHA and PHB
Feedback signals	PHA, PHAn, PHB, PHBn, ZE, ZEn
Electrical protection	Reverse polarity of power supply and over voltage
Inertia *g.cm²*	6
Axial movement shaft *mm*	±1.0
Radial movement shaft *mm*	0.05
Environment temperature *°C*	-40 ÷ +100
Working temperature *°C*	-10 ÷ +100
Resistance against vibrations *m/s²*	100
Resistance against collision *m/s²*	500 for 11 ms
Material body encoder	Aluminium
Conforming EMC (Electro Magnetic Compatibility)	EN 50082-2 / EN 50081-2
Weight *g.*	80 (cable included)