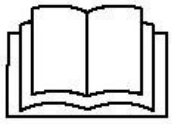
Installation, use and maintenance manual

	**BEFORE STARTING UP THE COSMOS 301X SERVO-DRIVES, CAREFULLY READ THIS MANUAL AND FOLLOW ALL INSTRUCTIONS, IN ORDER TO ENSURE MAXIMUM SAFETY**

SERVO DRIVES

COSMOS 301X SERIES

	The technical data and the drawings in this manual might have been modified later; always refer to the latest version. This manual is translated from the original written in italian language.
	It is strictly prohibited to use the equipment in an improper way, inconsistent with the intended purpose described in this manual.

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1 INTRODUCTION

This manual provides the information required for installation, use and maintenance of servo-drives/inverters of COSMOS 301X series.

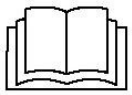
The instructions included in this manual are addressed to the following professionals:

User	User is a person, a company or an institution that buys the equipment and uses it for the purposes it was designed for.
User / operator	User or operator is a person authorized by the user to work on the equipment.
Qualified personnel	It refers to all persons with specific competence, able to recognize and avoid the dangers deriving from the use of the equipment.

The present instructions must be made available to all above persons.

2 GENERAL INSTRUCTIONS

The assembly instructions are an integral part of the equipment and must be kept for future reference, until it is dismantled. The present instructions reflect the state of the art at the moment when the equipment was sold; they will remain fully acceptable despite subsequent upgrades based on new experience.

	**DO NOT USE THE EQUIPMENT, NOR MAKE ANY INTERVENTION BEFORE INTEGRALLY READING AND UNDERSTANDING THIS MANUAL.**
IN PARTICULAR, ADOPT ALL SAFETY PRECAUTIONS AND PRESCRIPTIONS INDICATED IN THIS MANUAL.	
THE EQUIPMENT CAN NOT BE USED FOR DIFFERENT PURPOSES THAN THE ONES DESCRIBED IN THIS MANUAL; SMITEC S.p.A. SHALL NOT BE HELD RESPONSIBLE FOR ANY DAMAGES, INCONVENIENCES OR ACCIDENTS DUE TO THE NON-COMPLIANCE WITH THE PRESCRIPTIONS.	

In order to make the manual consultation easier, the following symbols have been adopted:

	The symbol "DANGER" is used when the non-compliance with the prescriptions or misuse may cause serious injuries.
	The symbol "DANGER OF HOT SURFACES" is used when the non-compliance with the prescriptions may cause serious injuries.
	The symbol "DANGER OF ELECTRICAL SHOCK" is used when the non-compliance with the prescriptions may cause serious injuries.
	The symbol "USE OF INDIVIDUAL PROTECTIONS" means that protective gloves must be worn.
	The symbol "USE OF INDIVIDUAL PROTECTIONS" means that protective glasses must be worn.
	Indication of “PROHIBITED ACTION”.

The safety prescriptions aim at establishing a series of behaviours and obligations to be complied with, while performing the activities described later on in this manual.
These prescriptions constitute the prescribed method of operating the machine, in a way that is safe for personnel, tools/equipment and environment.

3 TECHNICAL FEATURES

3.1 Description

The servo-drives/inverters of the COSMOS 301X series have been designed for three-phase asynchronous electrical motors and for brushless AC motors (BLAC). The core of the power section is an intelligent IGBT module (IPM), featuring the necessary protections that guarantee an extreme reliability and efficiency, besides reducing the need for external components. The servo-drives/inverters of the COSMOS 301X series for asynchronous and brushless motors is constituted by an aluminium dissipater and by electronic boards included in a special “plastic case”.

In particular, the servo-drives/inverters of the COSMOS 301X series for asynchronous and/or brushless AC motors can control start/stop functions, motor speed and position and motor torque and can perform diagnostic activity, etc. They are also used to manage abnormal conditions, by providing real-time diagnostic information (diagnostics are included in the machine into which the drive is incorporated) that can be viewed by connecting the system to other instruments (such as an HMI) or by using a “master” device (on versions equipped with a field bus).

Servo-drives/inverters for asynchronous and brushless motors are mainly intended for the so-called “s*econd environment*”, i.e. heavy industry. Some versions only require 230V AC single-phase power supply; others require 24V DC auxiliary power.

The control logic is implemented by 32-bit micro-controllers, equipped with a set of instructions optimized for speed and specialized in controlling precision motors. Thanks to their design features, the drives/inverters can be considered as of digital type, because they are completely controlled by the micro-controller. As a consequence, the servo-drive/inverter is a very flexible appliance which can be reset through a software and is open to all improvements offered by the new technologies in the future.

The equipment is designed for asynchronous motors and brushless AC motors. It operates on 230VAC single-phase power and on 24VDC auxiliary power (on certain versions only). Auxiliary power, when applicable, is used to feed the control section of the device.

Versions equipped with field bus interface feature a “master” device sending commands to the equipment (such as start, stop, motor speed/position, parameters for the motor and/or servo-drive/inverter, etc.), besides having a diagnostic function.

Some versions of servo-drive/inverter can be connected to an external HMI display (model “VISIO 3000”), which performs diagnostic functions, parametrization, parameters readout, analogue/digital values readout, besides sending some commands to the equipment.

The equipment operation is controlled by micro-controllers, which can be updated by uploading new firmware versions. They communicate through field bus, they can control analogue/digital I/O and the motor.

The servo-drives/inverters of the COSMOS 301X series comply with EN 61800-3 (2004) + A1 (2012) standards (EMC Requirements); they can be installed in the second environment ("*Second Environment*", category C3), provided they comply with the conditions indicated in this *Installation, Use and Maintenance Manual*.

No ordinary/extraordinary maintenance is allowed for COSMOS 301X servo-drives/inverters; in case of bad operation and/or break, it is necessary to replace the equipment integrally. Any repairs must be performed exclusively by SMITEC S.p.A.

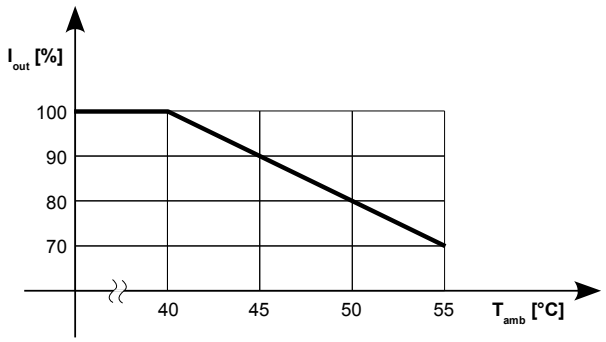
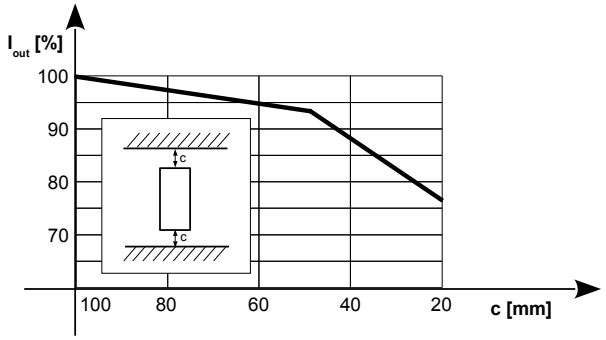
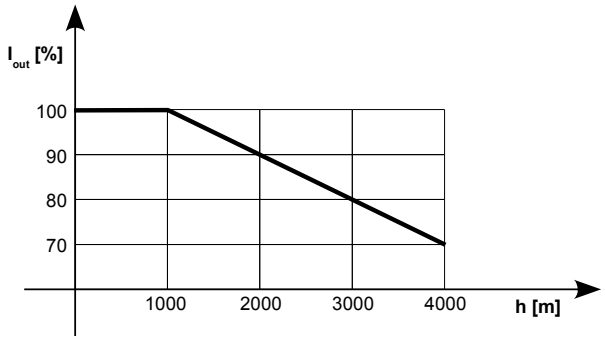
3.2 Marking

The servo-drives/inverters of the COSMOS 301X series are supplied with an adhesive label with the equipment main data. Here is an example:

<table>
<tr><td colspan="3">smitec
SMITEC S.p.A. - 24016 San Pellegrino Terme (BG)
Viale Vittorio Veneto, 4 - Italy - www.smitec.it</td></tr>
<tr><td>INPUT 230 V ±15%
50/60 Hz
10 A max</td><td>OUTPUT 0-230 V
3 + PE 0-200 Hz
4.2 A rms/ 15 A Peak
750 W / 1 HP</td><td>AUXILIARY SUPPLY
24 V⎓ -15%/+20%
0.2 A</td></tr>
<tr><td colspan="3">Type: Cosmos 3010-FA Order No: KZ010376 Lot: 03-2015
Serial No: CTJ0000001 Model: 111*0.*1010.02000</td></tr>
<tr><td colspan="3">CAUTION
For the selection of overload
protection devices see user manual.
  CE Made in Italy</td></tr>
</table>

3.3 Technical specifications

3.3.1 Environmental features

Operational temperature	0 ÷ +40°C when operating at full load
	0 ÷ +55°C with current derating
Output current derating depending on the ambient temperature	
Output current derating depending on the distance from obstructions	
Air humidity during operation	5 ÷ 85% non condensing
Storage temperature	-25 ÷ +55°C
Air humidity during storage	5 ÷ 95%
Transportation temperature	-25 ÷ +70°C
Air humidity during transportation	5 ÷ 95%
Maximum altitude	1000 m above sea level at rated output current
	4000 m above sea level with current derating
Output current derating depending on the altitude	

3.3.2 Ratings

Mains voltage	single-phase 230 VAC ± 15% 50/60 Hz
Distribution systems allowed	TT, TN (operation with IT systems is possible only by disconnecting the integrated mains filter)
Maximum short-circuit current	5 kA at the installation point
Maximum mains input current	10 A RMS
Auxiliary mains voltage	24 VDC -15 ÷ +20%; max ripple 5% of the rated value
Maximum auxiliary current	0.2 A (without I/O connection)

3.3.3 Motor output

Output voltage	Three-phase 0 ÷ 230 V
Switching frequency	4/8/10/12/16kHz or 5/10/15kHz (depending on the version)
Maximum output current	4.2 A DC
	4.2 A RMS with f_{sw} = 4 kHz
	Output current derating depending on the switching frequency, according to the following diagram: 
Asynchronous motor maximum size	0.75 kW (shaft rating)
Available active power	1 kW max.
Peak output current	15 A
Protections	Against phase-to-phase short-circuit, overload, servo-drive overheating, motor overheating

3.3.4 Dynamic brake output

Type	Control circuit of the brake resistor with IGBT
Protections	Against brake resistor short-circuit
Brake resistor resistance	30 ÷ 150 Ω
Average available power	150 W max.

3.3.5 Encoder input

Type	Input for readout of incremental encoder with 5 V differential signals

Maximum input frequency	200 kHz

3.3.6 Resolver input

Type	Input for resolver readout
Excitation signal frequency	5 kHz

3.3.7 Digital inputs

Type (KZ010375 and KZ010376)	24 V digital inputs, compatible with type 1 and type 3, according to IEC 61131-2
Type (other versions)	24 V digital inputs
Max. frequency of input signal	1 kHz

3.3.8 Digital outputs

Type	24 V pnp (current-sourcing) digital outputs
Maximum available current	30 mA
Protections	Against short-circuit, overload and overheating

3.3.9 Static brake output

Type (KZ010377 and KZ010389)	24 V pnp (current-sourcing) digital output
Type (KZ010387 and KZ010388)	24 V npn (current-sinking) digital output
Max. available current	500 mA

3.3.10 Counter input

Type	24 V digital input
Maximum input current	4.5 mA @ V_{in}=24 V
Input signal frequency range	0 ÷ 100 kHz

3.3.11 0 ÷ 10 V input

Input voltage range	0 ÷ 10 V DC
Input resistance	147 kΩ typ.
Resolution	12 bit

3.3.12 4 ÷ 20 mA input

Input current range	4 ÷ 20 mA DC
Resolution	12 bit

3.3.13 Motor temperature sensor input

Sensor type	NTC, PTC and thermal trip device
Resolution	12 bit

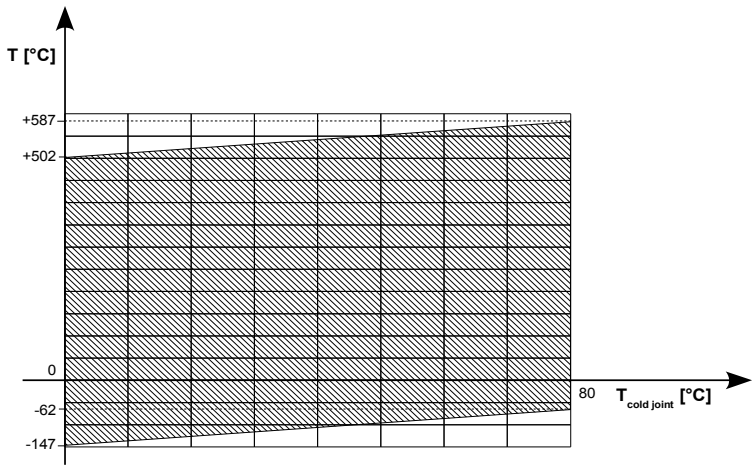
3.3.14 0 ÷ 10 V output

Output voltage range	0 ÷ 10 V DC
Resolution	10 bit
Max. available current	10 mA

3.3.15 Reference voltage output

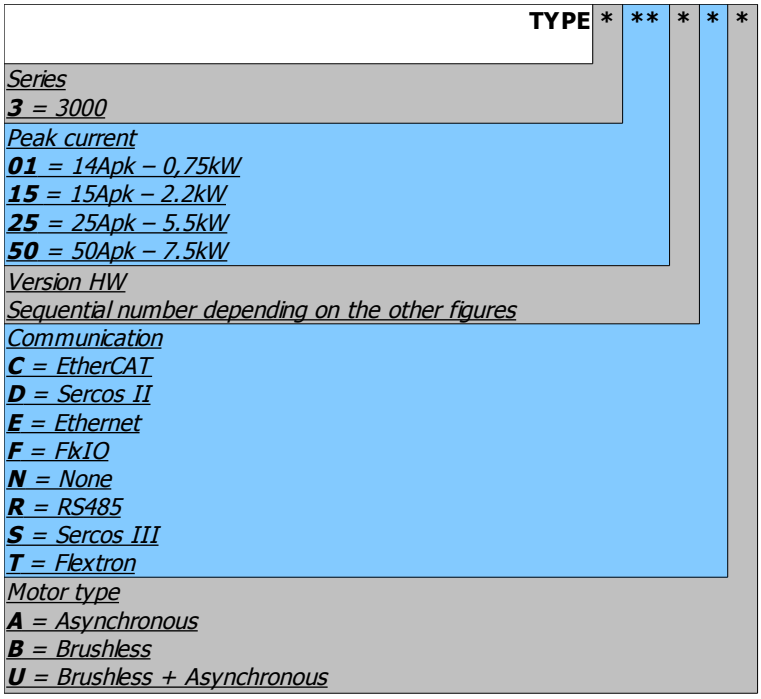
Output voltage	10 V DC - fixed value
Max. available current	10 mA

3.3.16 Thermocouple input

Sensor type	Insulated thermocouples – J type
Input voltage range	-6.3 ÷ +27.5 mV
Input temperature range	The diagram shows the temperature range depending on the cold joint temperature: 
Resolution	12 bit
Cold junction compensation	internal
Sensor interruption detection	yes (by internal pull-up and full-scale voltage readout)

3.4 Configurations / order codes

Up to date, we defined some standard configurations of servo-drives/inverters, with their order code and type number (4 figures, indicating the series, the maximum current and the release). These data are indicated on the driver label.



Order code	Type	Field bus	Motor type	Encoder type	I/O	Static brake	Dynamic brake
KZ010374	3010TA	Flextron	Three-phase, asynchronous motor	-	-	-	-
KZ010375	3010FU	FlxIO	Brushless motors + Three-phase, asynchronous motors	Incremental encoder with differential line-driver outputs – 5V ch. ABUVW	2 x InD	-	X
KZ010376	3010FA	FlxIO	Three-phase, asynchronous motors	Incremental encoder with differential line-driver outputs – 5V ch. AB	2 x InD	-	-
KZ010377	3010RU	RS485	Brushless motors + Three-phase, asynchronous motors	Incremental encoder with differential line-driver outputs – 5V ch. ABUVW + resolver	17 x InD 5 x OutD 2 x InA 1 x OutA	X	X
KZ010385	3012RA	RS485	Three-phase, asynchronous motors	-	4 x InD 6 x OutD 1 x InTC	-	-
KZ010387	3011RU	RS485	Brushless motors + Three-phase, asynchronous motors	Incremental encoder with differential line-driver outputs – 5V ch. ABUVW + resolver	4 x InD 1 x OutD 2 x InA 1 x OutA	X	X
KZ010388	3011RA	RS485	Three-phase, asynchronous motors	Incremental encoder with differential line-driver outputs – 5V ch. AB	4 x InD 1 x OutD 2 x InA 1 x OutA	X	-
KZ010389	3010RA	RS485	Three-phase, asynchronous motors	Incremental encoder with differential line-driver outputs – 5V ch. AB	17 x InD 5 x OutD 2 x InA 1 x OutA	X	-

3.5 Model code

The specific features of a servo-driver/inverter of the COSMOS 301X series are defined by an alpha-numeric code printed on the device label, near the MODEL code. Here is the code table:

3.6 Accessories

The servo-drives/inverters of the COSMOS 301X series are supplied with a series of removable connectors for power connection and I/O (where relevant). These connectors can be ordered separately, as well as other accessories not included in the drive.
Here is a list of the order codes.

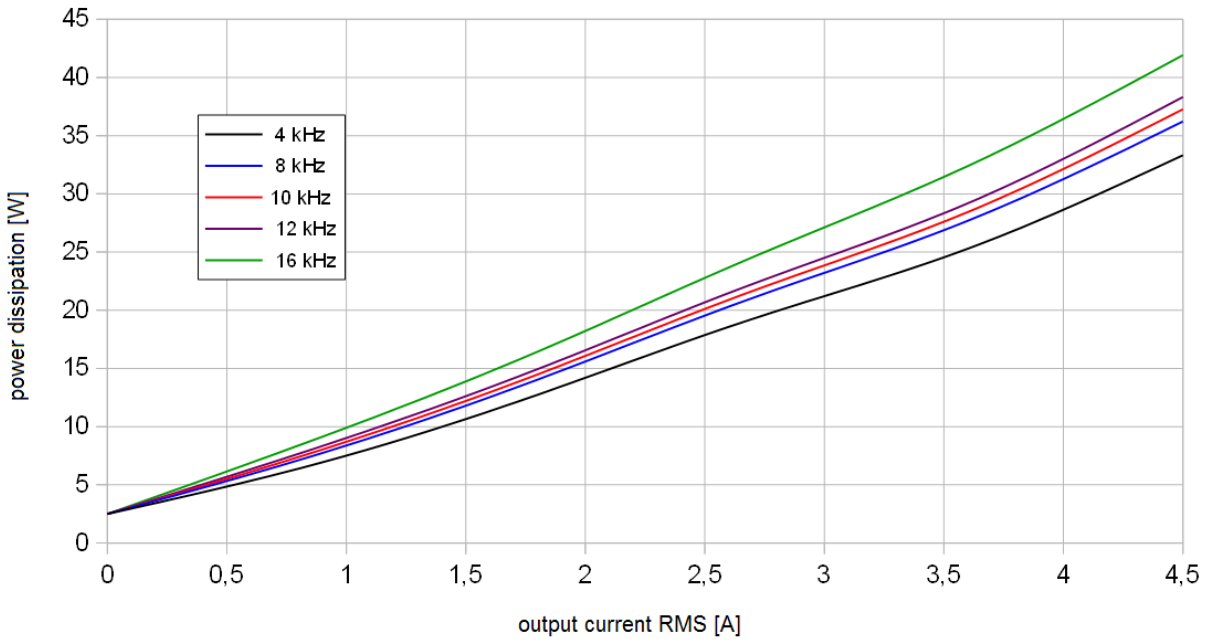
Item	Order code
Operator interface VISIO 3000	KZ010262
Connector 24VDC for code KZ010374	KF101066
Connector 24VDC for code KZ010375/76	KF101067
Connector 24VDC and I/O (8x2) for code KZ010377/89	KF101064
Connector I/O (9x2) for code KZ010377/89	KF101065
Connector 24VDC and I/O (8x1) for code KZ010385/87/88	KF101068
Connector I/O (9x1) for code KZ010385/87/88	KF101069
Adapter cable RS485 for programming	KF131284
Converter USB-RS485	KZ020087
Software WinMicro for programming	KW050111

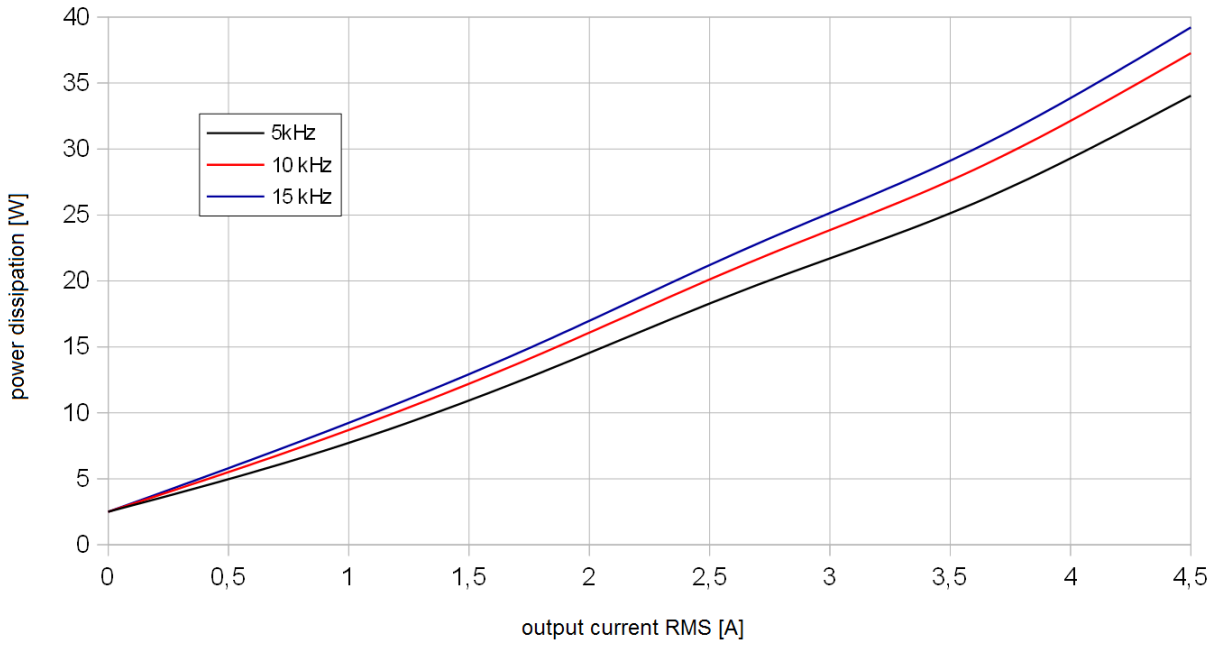
3.7 Heat dissipation

During operation, a servo-drive/inverter dissipates a certain quantity of electric power, due to the imperfect nature of electronic components. As a consequence, the components temperature increases, especially for the power section components. This increase must be taken into consideration in order to correctly determine the capacity of the electrical panel cooling system.

The amount of dissipated power depends on the supplied output current and on the switching frequency of the PWM signals. The below diagram, valid for all releases, shows the total thermal dissipation, depending on the rated output current; the four curves represent different switching frequencies. Please consider that:

- In case of variable output current, the average dissipated power must not be calculated from the average current only, but also by including instantaneous power dissipation.
- Power dissipation mostly depends on the drive switching frequency.
- The dissipated power from the braking resistors must be calculated separately.
- Power dissipation scarcely depends on the power factor of the load, but mostly on the absolute value of the output current; this is to say that the dissipated power is not strictly linked to the active power supplied to the load.





The current that a servo-drive/inverter can supply depends on the ambient temperature; in order to avoid a reduction in the actual deliverable current, install a cooling system, if necessary.

3.8 Electromagnetic compatibility (EMC)

The servo-drives/inverters comply with IEC 61800-3 2004-12 requirements; they must be installed in the second environment, category C3, on the following conditions:

- The connection between the drive and the motor is made by means of an adequately sized shielded cable.
- The shielded cable must be connected to earth on both sides, with low RF impedance connection
- The motor type and size are suitable for the servo-drive
- The start-up is performed by technical engineers, according to the instructions of this manual.

	The integrated filter ensures compliance with the IEC 61800-3, only if a single servo-drive is operating. The simultaneous operation of more than one servo-drive might increase the noise level and might exceed the emission levels fixed by the standards. In this case, an additional filter may be necessary.
	These servo-drives are not designed for domestic environment (*first-environment*, according to IEC 61800-3 Standards). In this case, it will be necessary to install an additional mains filter.
	The integrated mains filter can be disconnected if the current leakage to earth is not tolerated. In this case, it will be necessary to install an external low-leakage mains filter.

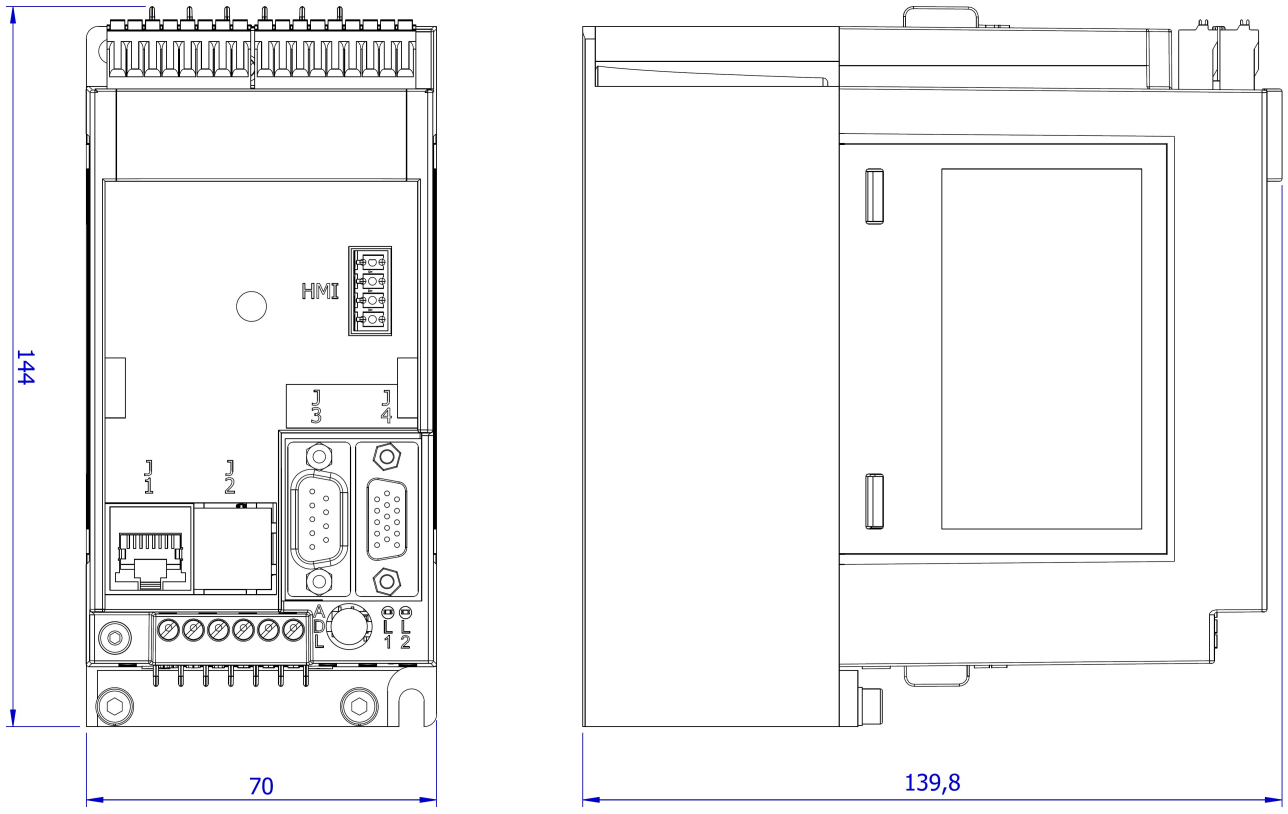
3.9 Mechanical specifications

3.9.1 Weight

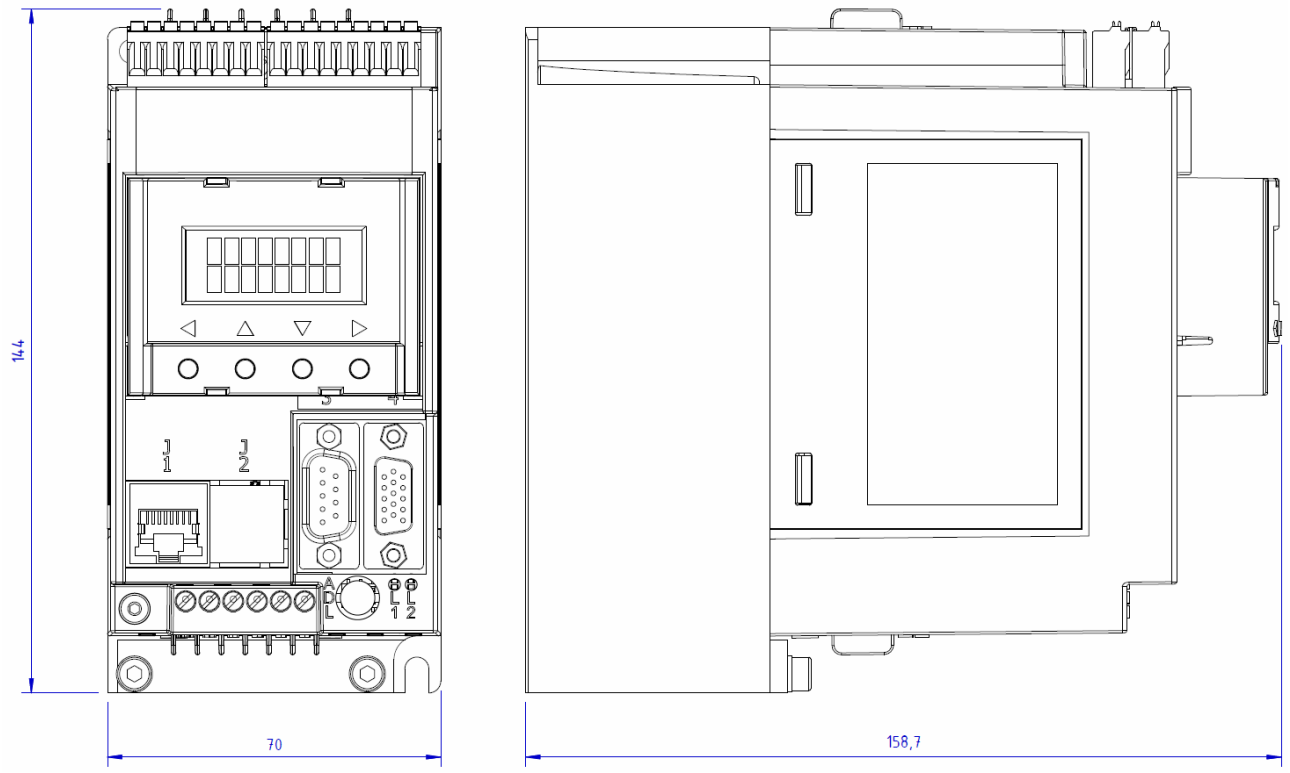
The following table indicates the weight of the different models, with all removable connectors:

Type	Weight (kg)
KZ010374	1.0
KZ010375	1.0
KZ010376	1.0
KZ010377	1.0
KZ010385	1.0
KZ010387	1.0
KZ010388	1.0
KZ010389	1.0

3.9.2 External dimensions without operator interface



3.9.3 External dimensions with operator interface VISIO 3000



4 USES OF THE EQUIPMENT

	The high voltage of some accessories and components in the servo-driver/inverter might cause electrocution, if the user came into contact with them. Be careful to the terminal boards and to the motor/dynamic brake connection.
	The motor is an electric generator. The running speed becomes electric potential. High voltage is already generated at 300 rpm.
	Make sure that the personnel is qualified and has been informed about the risks he may run and how to avoid them.
	Avoid contact with the servo-drive iron surfaces, because they may become very hot during operation. Danger of burns.
	The use of servo-drives/inverters of the COSMOS 301X series is authorized only after the operating area of the final machine is classified and after the safety level has been checked, which must be consistent with the safety level of the device.

4.1 Limitations on use

	The servo-drives/inverters of the COSMOS 301X series can not be considered as safety equipment; do not rely on the equipment to perform safety functions (such as safe stop, safe reduced speed, etc.).
	Never use the servo-drive if it is not fully assembled.
	The operational temperature range of the servo-drive is 0 to 55°C; the range at rated current (without derating) is 0 to 40°C.

4.2 Handling precautions

	It is strictly prohibited to use the equipment in an improper way, different from the intended purposes described in this manual. The technical data and the drawings in this manual might have been modified later; please, always refer to the latest release. Upgrades may be requested directly from SMITEC S.p.A.

5 RESIDUAL RISKS

	There are some capacitors inside the drive which store a dangerous voltage for at least 10 minutes after switching them off. Before starting any operation, make sure that the drive has been switched off at least 10 minutes earlier and that the motor is still.
	Some of the servo-drive components are made of highly conductive materials (example: dissipater, connectors shell). It is absolutely necessary to make a safe connection to the protective connector (PE) by means of the provided contact, in order to avoid electrocution
	Before starting any maintenance intervention and during all maintenance phases, the servo-drives/inverters of the COSMOS 301X series must be isolated from the mains supply.
	Some components may become very hot during operation or after operation; do not touch these components or use specific protections while handling.
	When designing a machine including servo-drives/inverters of the COSMOS 301X series, adopt specific precautions, in order to avoid contacts with hot components.
	Metal components and sharp surfaces may cause cuts and tears. In case of contact, be very careful and wear the personal protection equipment.

6 INSTALLATION AND START-UP

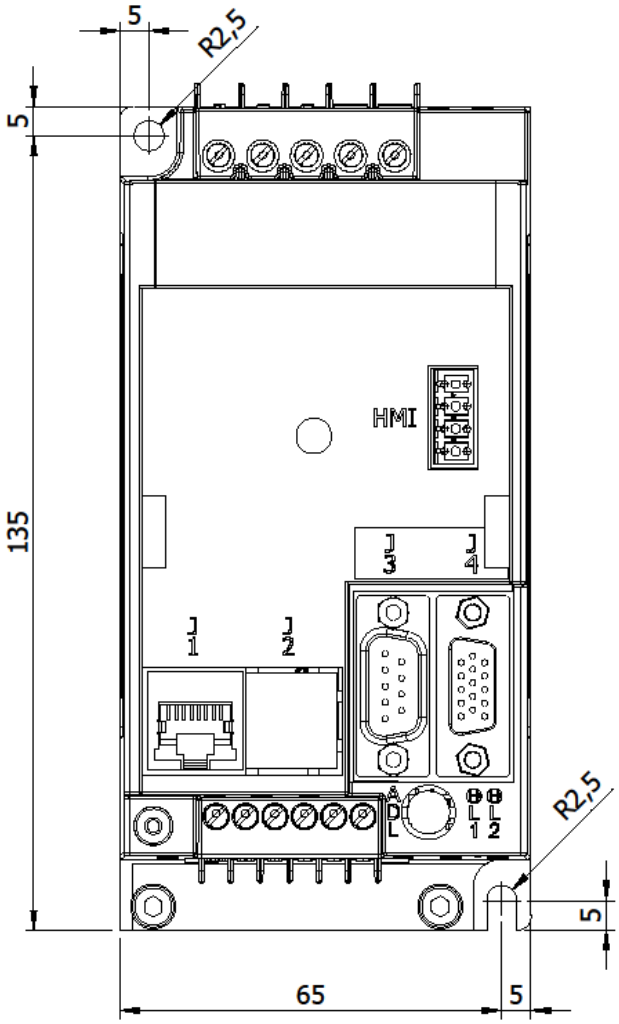
6.1 Preliminary operations

- Verify the perfect integrity of the equipment and its components.
- Make sure the installation manual is present.

6.2 Positioning and installation

	The servo-drives/inverters of the COSMOS 301X series are designed for operating in *closed electrical operating areas* (as defined in the IEC 61800-5-1:2009-04 Standard); installation outside an electrical panel is not allowed.

The device must be duly tightened to the metal wall of the electrical panel, by means of two screws M5 x 0.8 mm; if the operation generates vibrations, use retention washers (Grover or Belleville) or a thread-lock compound. The following picture shows the front view and the recommended hole pattern.



The servo-drives/inverters of the COSMOS 301X series generate a certain quantity of heat during operation; the electrical panel must be able to dissipate it, in order to avoid an excessive temperature increase. A common solution consists in installing cooling fans or a conditioner. In order to avoid dust ingress, which might degrade the dissipater performance, it is recommended to use filters. The cooling system must be adequately sized by taking into consideration the total dissipation.

In order to ensure the performance characteristics, the servo-drives/inverters of the COSMOS 301X series must be installed exclusively in vertical position (as indicated in the previous picture), leaving at least 100mm of obstacle-free space above and below the driver. If such conditions could not be fulfilled, apply a derating of the available current.

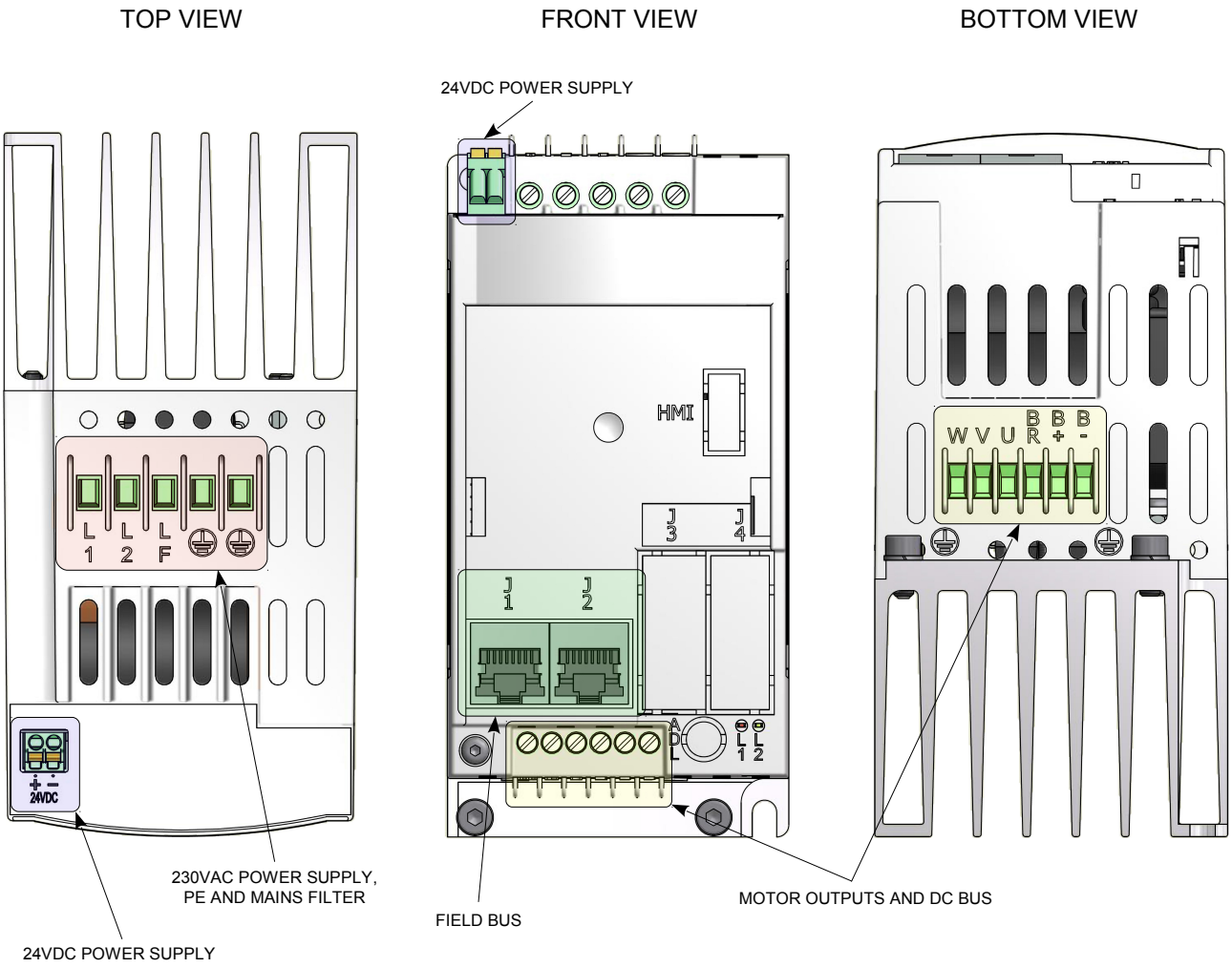
6.3 Electrical connections

The devices described in this manual are equipped with a screw-type terminal board for high-voltage connections (mains power, motor outputs, bus voltage, brake resistor, protective conductor PE); low-voltage connection (24V power supply, I/Os) is possible through removable connectors.

The following sub-sections show the location of the connectors and terminal boards for the different models.

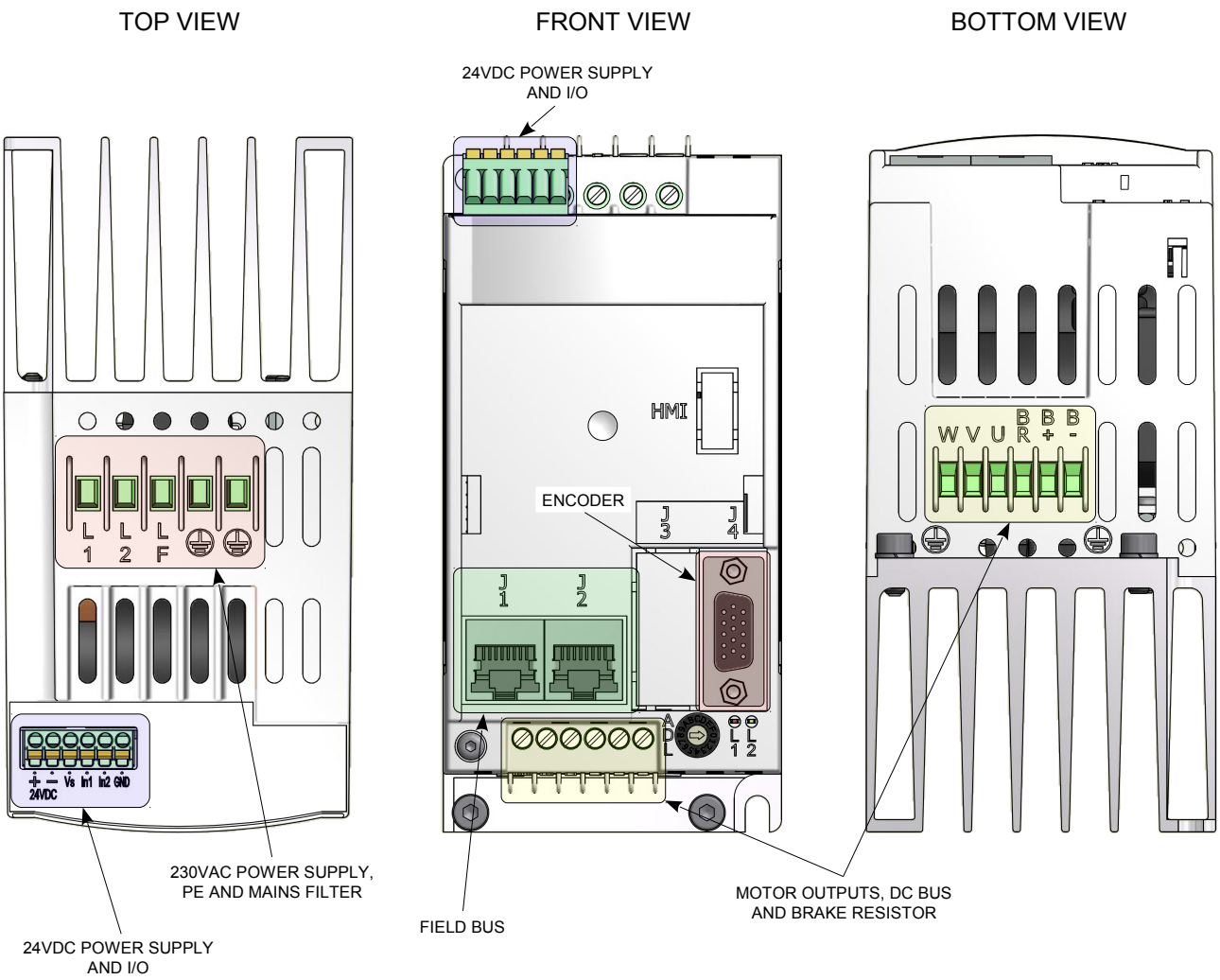
6.3.1 Connections (KZ010374)

The following picture shows the arrangement of the connectors and terminal boards:



6.3.2 Connections (KZ010375 and KZ010376)

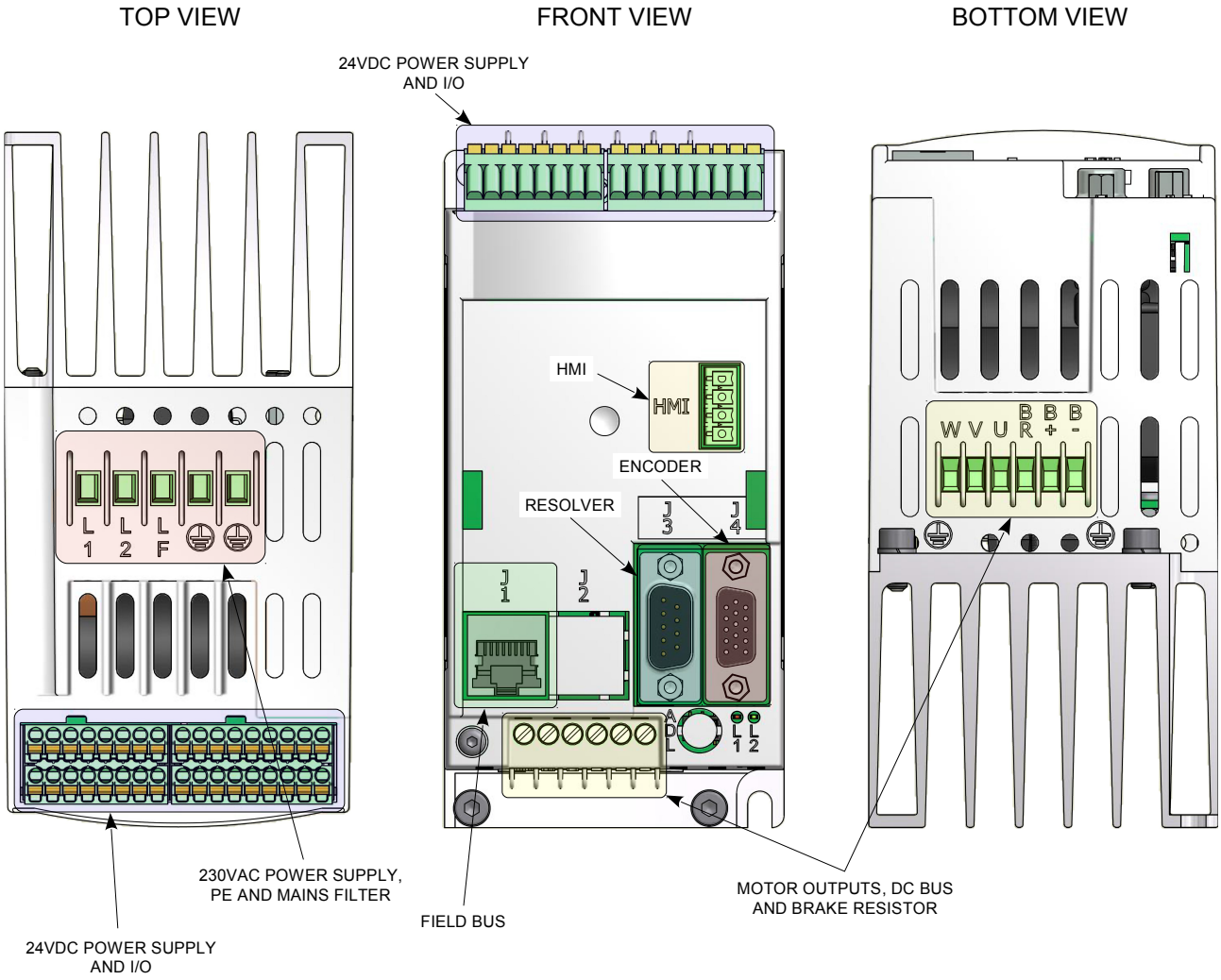
The following picture shows the arrangement of the connectors and terminal boards:



The release code KZ010375 is also equipped with a stage for piloting the brake resistor.

6.3.3 Connections (KZ010377 and KZ010389)

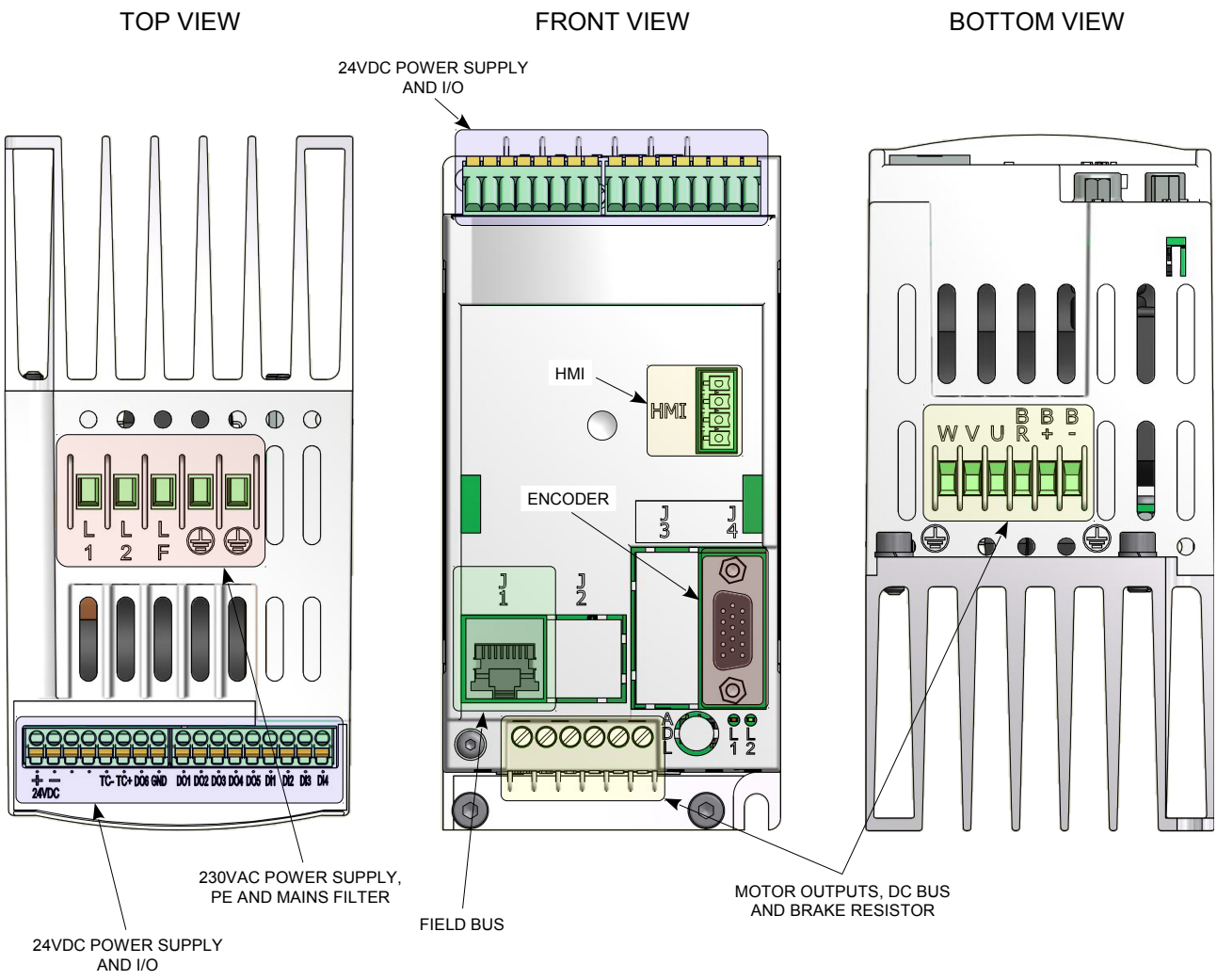
The following picture shows the arrangement of the connectors and terminal boards:



The release code KZ010377 is also equipped with a stage for piloting the brake resistor.

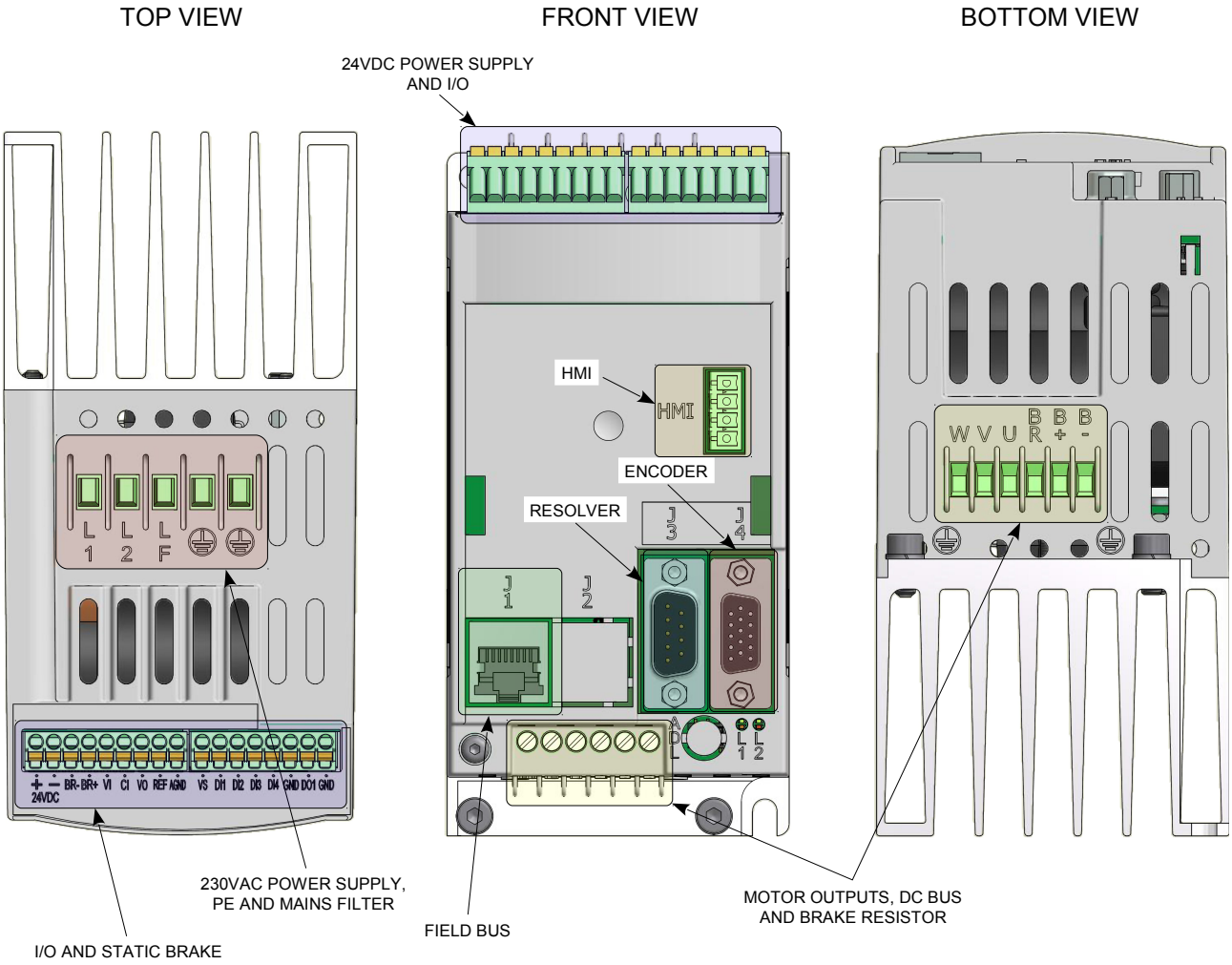
6.3.4 Connections (KZ010385)

The following picture shows the arrangement of the connectors and terminal boards:



6.3.5 Connections (KZ010387 and KZ010388)

The following picture shows the arrangement of the connectors and terminal boards:



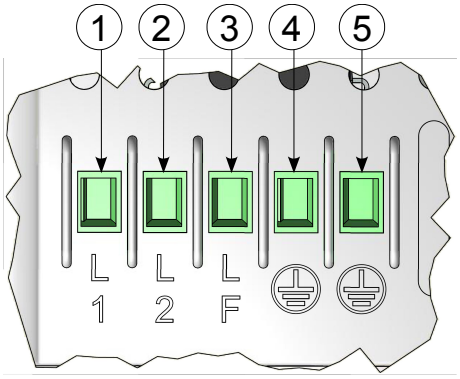
The release code KZ010387 is also equipped with a stage for piloting the brake resistor.

6.4 Mains power and EMI filters

These are the connections of 230VAC supply and of the mains filter.

	Due to the presence of high capacitance inside the driver, all power connections must be made or disconnected only after the mains power has been removed for at least 10 minutes.

The power wiring must be made by means of the 5-pole terminal board situated on the container top (see picture); it is the same for all releases.



230VAC mains power and EMI filter	
label	**signal**
L1	230VAC mains – phase 1
L2	230VAC mains – phase 2
LF	EMI filter – connection to PE
⏚	PE
⏚	PE

These devices are designed for operating with TT or TN distribution systems; the picture shows the recommended wiring diagram:

	For safety reasons, the device must always operate with PE connected; risk of electric shock! PE connection must be made by means of the specific terminal and not merely with screws.

Here are the specifications of the cables to be used for wiring:

Minimum cross-section of solid conductor	1.5 mm^2
Maximum cross-section of solid conductor	4.0 mm^2
Minimum cross-section of flexible conductor	1.5 mm^2
Maximum cross-section of flexible conductor	2.5 mm^2

The terminal board contacts must be tightened by means of a flat-blade screwdriver (blade width: 3.5 mm); the recommended tightening torque is equal to 0.55 Nm ±10%.

In order to protect the device and the power cables, install a protective device against overload and short-circuit. Since the input current is strongly distorted by the rectifier, its efficient value may be far higher than the output current, therefore it is necessary to carefully choose the protective devices.

In case of failure, the input current might include a significant direct component; if no fuse is used for protection, install a type-B protective device.

	An inadequate overload protection device might not trip, with consequent danger for people and equipment. Spurious tripping of the protective device might also occur.

	Make sure the maximum short-circuit current of the power supply terminal boards is lower than 5 kA; otherwise, use adequate limiting devices (such as fuses).

If the servo-drive protection is ensured by fuses, their size must guarantee the protection of both the device and the conductors. If you use 10x38mm class gG cartridge-type fuses, their minimum size for ensuring the servo-drive full-power operation is 12 A. If you install higher rated current fuses, do not exceed 20 A: in case of failure, the maximum short-circuit current that the drive can handle might be exceeded.

If bus voltage and/or voltage on the dynamic brake resistor is/are connected, a down-stream short-circuit might damage the rectifier bridge; in order to provide protection, use fuses with a I^2t value lower than 90 A^2s. Also the gG-type 10x38mm cartridge fuses with 12A rated current will protect the servo-drive.

If protection against short-circuits is provided by partial-range fuses (such as aR type), the overload protection must be provided in other ways (for example with circuit breakers).
If the servo-drive must be used for building a machine, please refer to EN 60204-1 Standard for further details about the sizing criteria.

	The protective fuses must be sized in such a way as to ensure protection against short-circuit and overload. Their cut-off rating must not be lower than the maximum specified short-circuit current.

The device integrates a EMI filter reducing conducted emissions; it complies with IEC 61800-3 Standard (second environment, C3 category). If it is installed according to the manual instructions, it is adequate for its protective purposes. The filter is optional. It can be installed by means of a short piece of cable to short-circuit the pin 3 (LF) and 4 (PE) on the terminal board.

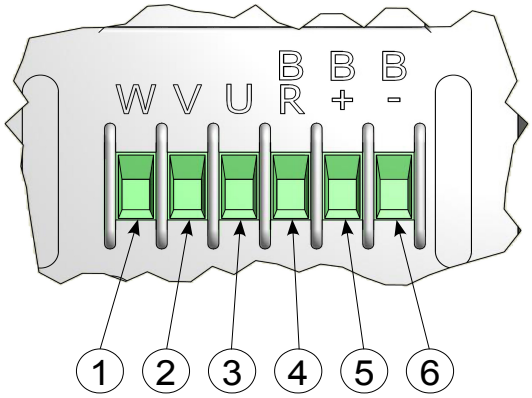
The EMI filter causes a considerable current waste to earth; in applications where such current may cause problems (such as untimely tripping of differential circuit breakers), the user may disconnect the internal mains filter. However, this will cause a considerable increase in conducted emissions, therefore it will be necessary to install an external EMI filter. In this case or in case different emission levels are required (for example due to different regulations or different installation categories, etc.), the user is solely responsible for the choice of the correct filter.

	The EMI filter causes a considerable current waste to earth; do not supply power to the servo-drive without PE connection, in order to avoid electrocution when touching the metal components (such as the dissipater).

The installation of a battery for several devices causes an increase in the noise level which may exceed the emissions level provided by the Standards. In this case, an additional external filter may be necessary. Due to the extremely variable operating conditions (number of servo-drives, cable length, total current values, required insertion loss), the choice of the filter is up to the user.

6.5 Motor, brake resistor and DC bus wiring

The power wiring must be made by means of a 6-pole terminal board; the following picture shows the pin configuration.



Motor, brake resistor and DC bus	
label	**signal**
W	Motor output – phase W
V	Motor output – phase V
U	Motor output – phase U
BR	Brake resistor output
B+	Bus voltage - positive
B-	Bus voltage - negative

Here are the specifications of the cables to be used for wiring:

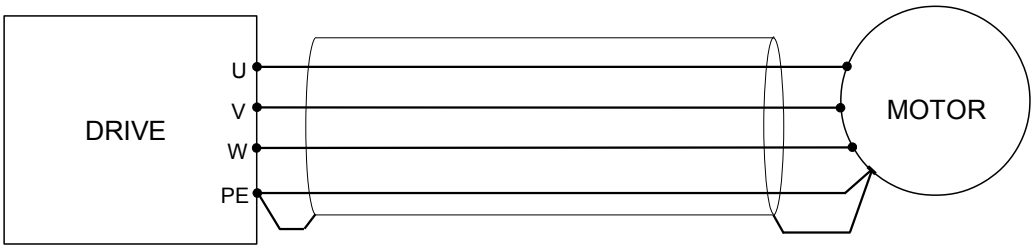
Minimum cross-section of solid conductor	0.75 mm^2
Maximum cross-section of solid conductor	2.5 mm^2
Minimum cross-section of flexible conductor	0.75 mm^2
Maximum cross-section of flexible conductor	2.5 mm^2

The terminal board contacts must be tightened by means of a flat-blade screwdriver (blade width: 3.5 mm) or by means of a cross-head screw-driver (PH 0); the recommended tightening torque is 0.55 Nm ±10%.

The conductor section size depends on the maximum current; in case of installation in the electrical panel of a machine, please consider that the EN 60204-1 Standard does not allow the use of cables with a cross-section smaller than 0.75 mm^2 inside the housings and 1.0 mm^2 outside (0.75 mm^2 for multicore cables). To connect the motor, a shielded multicore cable with a cross-section of 0.75 mm^2 may be an excellent choice in most applications.

The conductors cross-section for connecting bus and brake resistor voltages must be large enough to handle the maximum short-circuit voltage on the power terminals of the servo-drive.

The motor must be connected as shown in the following picture:



Due to the high noise levels generated by PWM modulation on the motor outputs, it is obligatory to use a shielded cable for connecting motors. The shield must be connected to earth on both sides with a low-impedance connection (such as a metal cam); using an unshielded cable or a shielded cable whose shield is not connected to earth may generate EMC problems and interference with nearby devices.

As a safety measure, the motor must be connected to a PE using a cable. Do not rely solely on the electrical conductivity of the machinery frame.

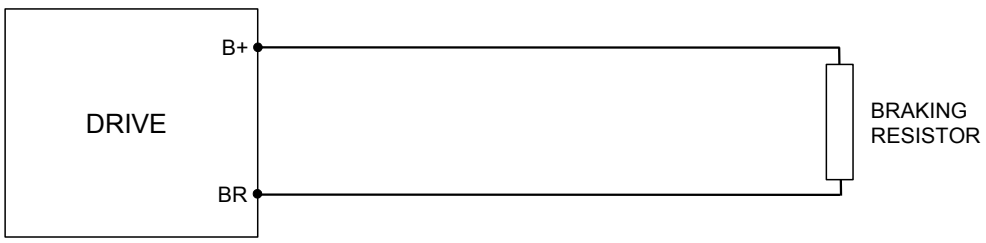
The motor direction of rotation depends on the order in which the phases (U, V and W) are connected. To reverse the rotation of an asynchronous motor, simply invert two phases; in case of a brushless motor, an incorrect connection of the phases can cause unpredictable operation and possible injury to persons/property.

The motor cables are significant sources of noise; keep them as far away as possible from the signal cables, in order to avoid deterioration of the signals.

Some versions of this servo-drive/inverter are equipped with a stage for piloting a resistor used to generate dynamic braking. This function is useful when the motor must be abruptly decelerated (for example, during an emergency stop or due to the action of cams controlling operation). When a motor is abruptly braked, a flow of electric power is generated and directed to the servo-drive; this energy is stored in the bus capacitors, thus increasing their voltage. If a dynamic brake stage is not included, the servo-drive will be disabled and an error code will be generated, when the bus voltage reaches the safety threshold. In order to overcome this problem, the device incorporates an electronically controlled IGBT that is activated when a pre-set voltage threshold is exceeded, thus dissipating the energy of the external braking resistor.

When a brake resistor is used, remember that the servo-drive must be programmed with correct parameters. The use of incorrect parameters could damage the resistor and/or servo-drive, besides causing a risk of fire.

The recommended connection diagram is shown in the following picture:



The bus voltage is available on the terminal board (contacts B+ and B-), for connecting a servo-drive battery in parallel. This connection is advantageous form the standpoint of power dissipation in the braking resistors, because a portion of the power generated during braking can be used by another servo-drive, instead of being dissipated in the braking resistor.
Using this type of connection is essential for ensuring that the power of all servo-drives is connected and/or cut off at the same time, in order to avoid overloading the devices.

	When connecting multiple servo-drives/inverters to a common bus voltage, be sure to observe the polarity of the bus voltage; risk of damaging the servo-drives and/or risk of fire.
	When connecting multiple servo-drives/inverters to a common bus voltage, the power on all devices must be switched on/off at the same time; risk of damaging the servo-drives and/or risk of fire.
	When multiple servo-drives/inverters are connected to a common bus voltage and the power to an individual device is switched off, it will continue to be electrically live; do not touch the terminal boards or perform any maintenance on the device; risk of electrocution.
	When multiple servo-drives/inverters are connected to a common bus voltage and the power to an individual device is switched off, it will continue to be electrically live and therefore able to start the motor; do not perform any mechanical maintenance, due to the risk of injury to persons/property.

The use of an external braking resistor or the bus voltage connection may damage the servo-drive in case of short-circuit. Use protection devices that can limit the current value I^2t (see previous paragraph for more details).

6.6 24V auxiliary and I/O power

The family of servo-drives/inverters can be equipped with one or more connectors for connecting 24V auxiliary power (where required) and I/Os. The following paragraphs describe the pin configuration of the connectors.

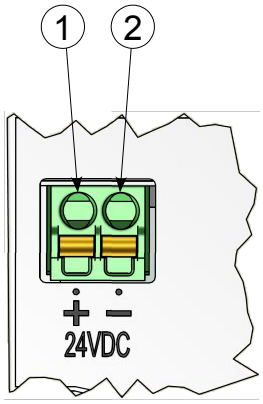
All servo-drive versions feature removable spring-loaded connectors; the acceptable cross-sections of the cables to be used for wiring are as follows:

Minimum cross-section of solid conductor	0.20 mm^2
Maximum cross-section of solid conductor	1.5 mm^2
Minimum cross-section of flexible conductor	0.20 mm^2
Maximum cross-section of flexible conductor	1.5 mm^2
Minimum cross-section of flexible conductor with terminal	0.25 mm^2
Maximum cross-section of flexible conductor with terminal	0.75 mm^2

Use a flat-head screwdriver to wire the connector; insert the edge of the head into the orange cavity and press to open the contact. At the same time, insert the cable. It is recommended to use a screwdriver with a 2.5 mm flat head.

6.6.1 Connections (KZ010374)

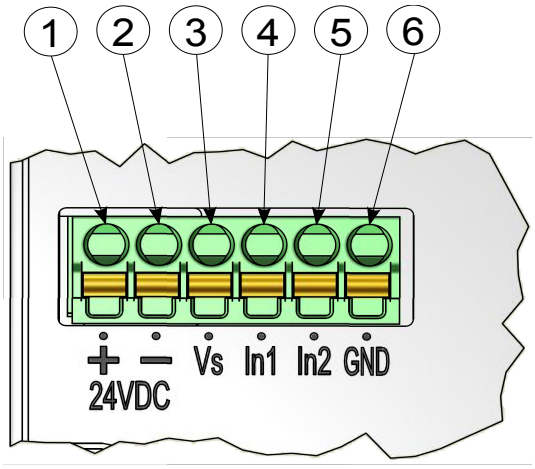
This version is equipped with a removable connector for wiring 24V auxiliary power. Here is the pin configuration of the connector:



24V power supply		
pin	**label**	**signal**
1	24VDC +	24VDC power – positive side
2	24VDC -	24VDC power – negative side

6.6.2 Connections (KZ010375 and KZ010376)

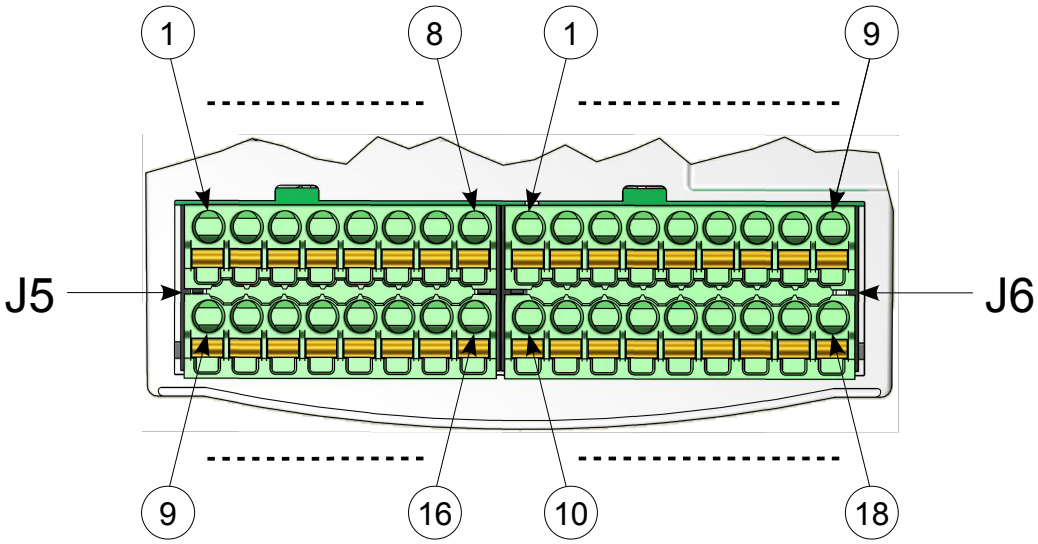
This version is equipped with a removable connector for wiring 24V auxiliary power and digital I/O power. Here is the pin configuration of the connector:



24V and I/O power		
pin	**label**	**signal**
1	24VDC +	24VDC power – positive side
2	24VDC -	24VDC power – negative side
3	Vs	24VDC sensor power
4	In1	digital input #1
5	In2	digital input #2
6	GND	earth

6.6.3 Connections (KZ010377 and KZ010389)

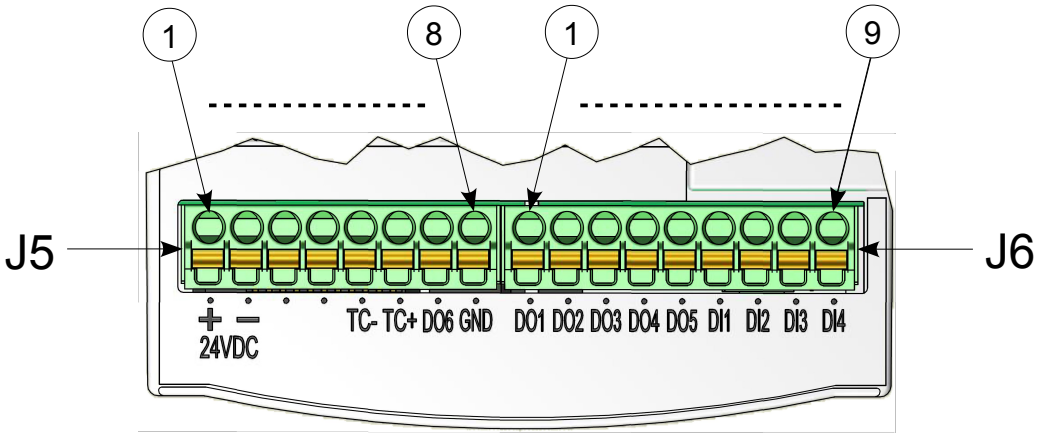
This version is equipped with two removable connectors (J5 and J6) for wiring 24V auxiliary power and digital/analogue I/Os. Here is the pin configuration of the connectors:



24V and I/O power			
connector J5		connector J6	
pin	signal	pin	signal
1	24VDC power – positive side	1	Digital output #1
2	24VDC power – negative side	2	Digital output #2
3	Earth on analogue I/O	3	Digital output #3
4	0 to 10 V input	4	Digital output #4
5	reserved	5	Digital output #5
6	reserved	6	Digital input #1
7	Motor brake output – positive side	7	Digital input #2
8	Motor brake output – negative side / I/O earth	8	Digital input #3
9	Digital counter input	9	Digital input #4
10	Earth on digital I/O	10	Digital input #13
11	0 to10 V output	11	Digital input #12
12	10V reference voltage output	12	Digital input #11
13	4÷20mA input	13	Digital input #10
14	Digital input #16	14	Digital input #9
15	Digital input #15	15	Digital input #8
16	Digital input #14	16	Digital input #7
		17	Digital input #6
		18	Digital input #5

6.6.4 Connections (KZ010385)

This version is equipped with two removable connectors (J5 and J6) for wiring 24V auxiliary power and digital/analogue I/Os. Here is the pin configuration of the connectors:

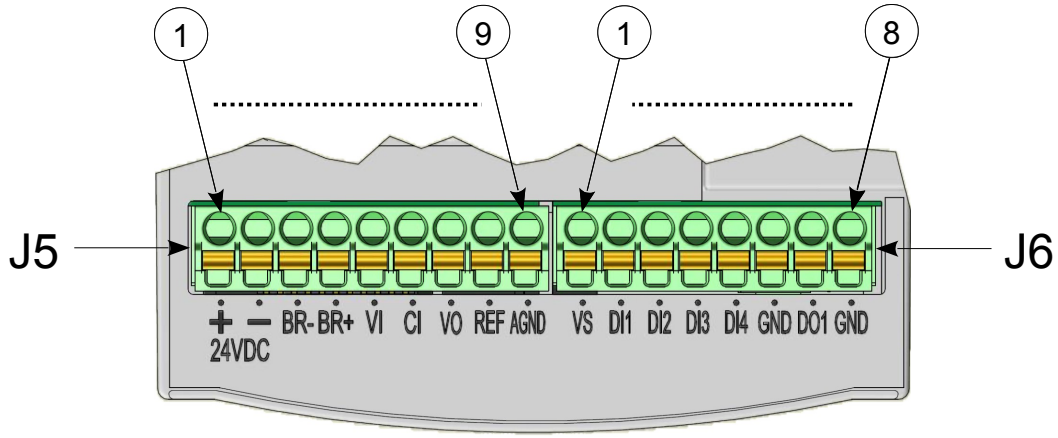


24V and I/O power					
connector J5			connector J6		
pin	label	signal	pin	label	signal
1	24VDC +	24VDC power – positive side	1	D01	Digital output #1
2	24VDC -	24VDC power – negative side	2	D02	Digital output #2
3	-	NC	3	D03	Digital output #3
4	-	NC	4	D04	Digital output #4
5	TC-	thermocouple J input - negative	5	D05	Digital output #5
6	TC+	thermocouple J input - positive	6	DI1	Digital input #1
7	D06	Digital output #6	7	DI2	Digital input #2
8	GND	Earth on digital I/Os	8	DI3	Digital input #3
			9	DI4	Digital input #4

6.6.5 Connections (KZ010387 and KZ010388)

This version is equipped with two removable connectors (J5 and J6) for wiring digital/analogue I/Os.

Unlike other versions, 24V auxiliary power is used only for motor braking; the control logic is powered directly from the 230 VAC mains. Here is the pin configuration of the connectors:



24V and I/O power					
connector J5			connector J6		
pin	label	signal	pin	label	signal
1	24VDC +	24VDC power – positive side	1	VS	24V power for sensors
2	24VDC -	24VDC power – negative side	2	DI1	digital input #1
3	BR-	Motor brake output – negative side	3	DI2	digital input #2
4	BR+	Motor brake output – positive side	4	DI3	digital input #3
5	VI	0 to 0 V input	5	DI4	digital input #4
6	CI	4 to 20mA input	6	GND	earth on analogue I/Os
7	VO	0 to 10 V output	7	DO1	digital output #1
8	REF	10V reference voltage output	8	GND	earth on analogue I/Os
9	AGND	earth on analogue I/Os			

6.6.6 24V auxiliary power

Some versions of the servo-drive/inverter require 24VDC auxiliary power to operate the control logic, the I/Os and other peripherals (such as encoder). If auxiliary power is absent, the servo-drive will not operate, even though it is powered by 230VAC.

	For safety reasons, the auxiliary power must be supplied by a PELV power supply with its earth terminal connected to earth (preferably only at one point, to prevent earth loops).

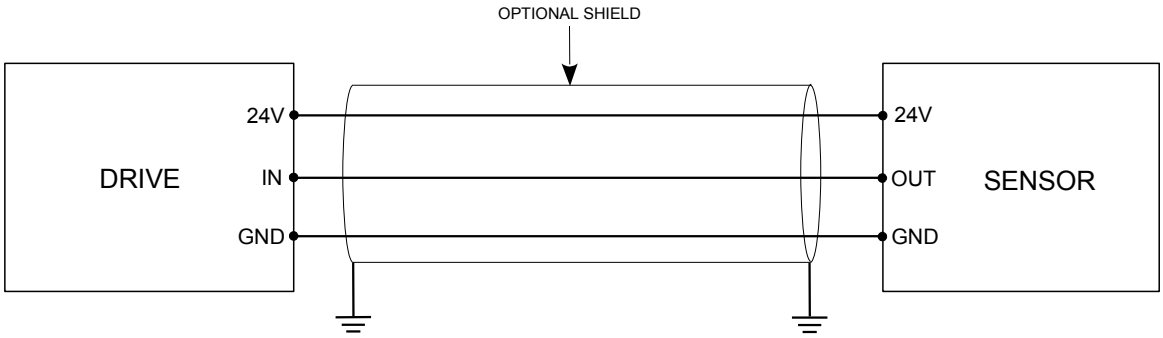
The auxiliary voltage must be stable and within the limits of the servo-drive (see specific paragraph). If this voltage is outside the prescribed limits, the servo-drive may be damaged.

	Check the polarity of the auxiliary power before connecting the servo-drive; otherwise it may be damaged.

6.6.7 24V digital inputs

Some versions of the servo-drive/inverter are equipped with a certain number of 24V general-purpose digital inputs. These inputs are typically used to acquire data from sensors with digital output, which are very common in industry (such as photocells, limit switches, etc.).

The following picture shows an example of how a sensor is connected; in most applications, the wiring can be made by means of an ordinary unshielded cable.



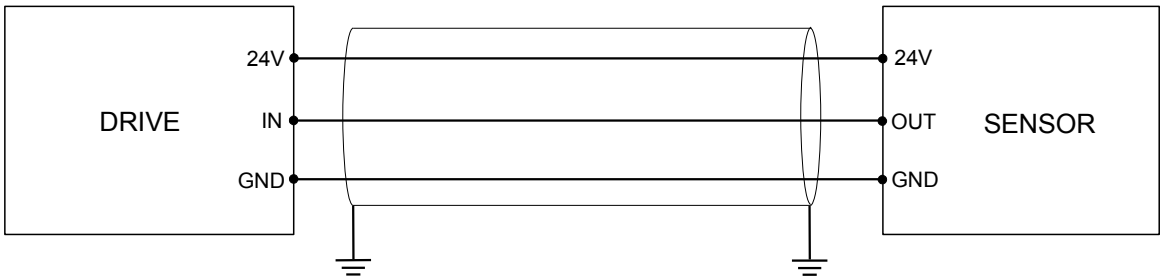
However, if the operating environment is affected by significant electrical noise or the distances to be crossed are significant, the use of a shielded cable may be necessary. In this case, the shield must be connected to earth on both sides, preferably with low-impedance connection, such as a metal cam; the shield is totally ineffective if it is left floating.

Signal quality may be further improved by keeping the cables as far as possible from noise sources, such as power cables, inverters, power supplies, relays, etc.

	Check the sensor polarity before connection; inverted polarity may damage the sensor and/or servo-drive.

6.6.8 Counter input

Some versions of the servo-drive/inverter are equipped with a high-speed digital input to be used as a counter. It accepts 24V digital signals and can acquire signals with a maximum frequency of 100kHz. The recommended connection diagram is shown in the following picture:



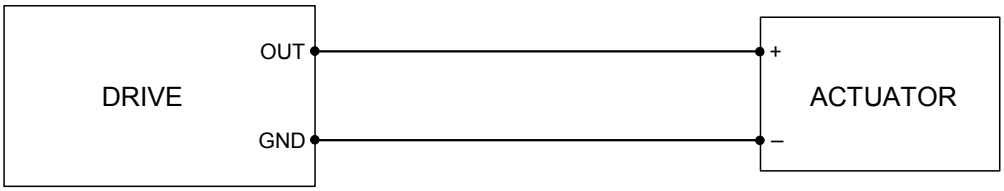
Since the input stage has a relatively wide passband to allow acquisition of high-frequency signals, it is particularly susceptible to electrical interference. Therefore, it is recommended to use a shielded cable for the wiring. In this case, the shield must be connected to earth on both sides, preferably with low-impedance connection, such as a metal cam; the shield is totally ineffective if it is left floating.

	Check the sensor polarity before connection; inverted polarity may damage the sensor and/or servo-drive.

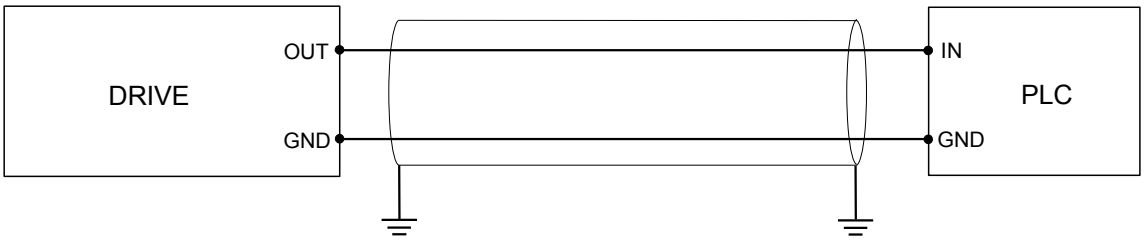
6.6.9 24V digital outputs

Some versions of the servo-drive/inverter are equipped with a certain number of 24V general-purpose digital outputs. They are typically used for piloting 24V actuators (such as solenoid valves, relay or contactor coils, lamps, etc.), or for generating digital signals (for example, for communicating with a PLC).

The following picture shows an example of actuator connection; in most applications, the wiring does not require a shielded cable, unless it interferes with nearby devices.



If a digital signal must be generated for communicating with another device (such as PLC, shown in the example), the recommended connection scheme is as follows:

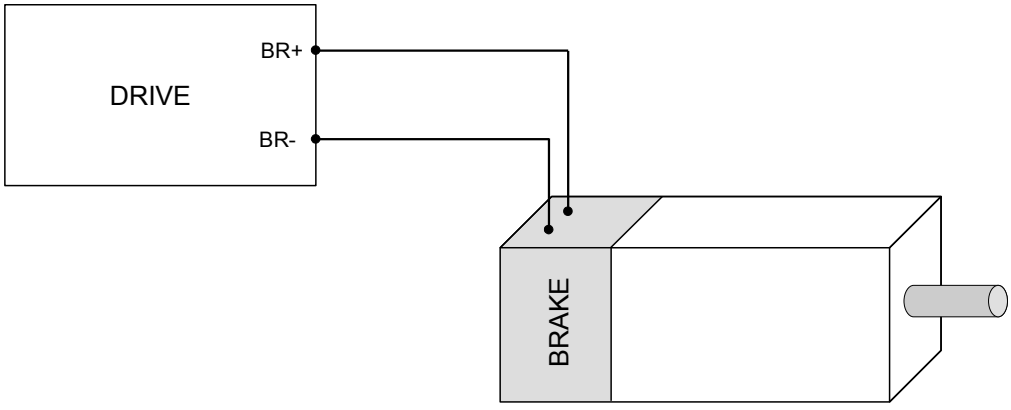


In this case, electrical interference problems are more likely, therefore it is recommended to use a shielded cable for the connections. The shield must be connected to earth on both sides, preferably with low-impedance connection, such as a metal cam; the shield is totally ineffective if it is left floating.

6.6.10 Motor brake output

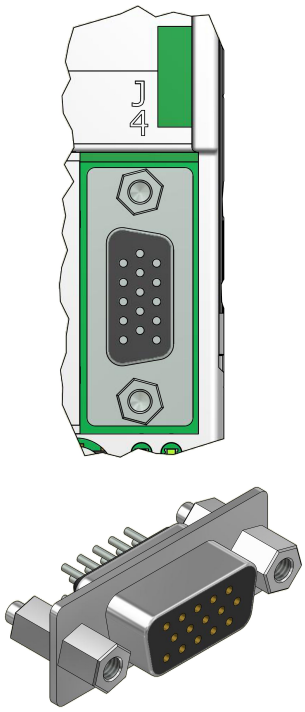
Some versions of the servo-drive/inverter are equipped with a digital output for controlling a 24V motor brake.

The following picture shows an example of motor brake connection; in most applications, the wiring does not require a shielded cable, unless it interferes with nearby devices.



6.6.11 Incremental encoder

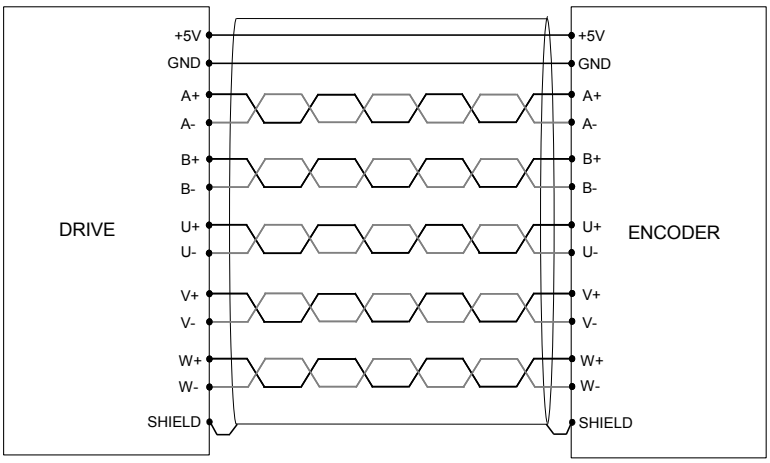
An encoder is used as a feedback device for reading and controlling the motor position and speed. These servo-drives are equipped with a peripheral device that can acquire data from incremental digital encoders, which are powered by 5 VDC and have differential output signals. Differential outputs offer grater noise rejection than common single-ended outputs. When brushless motors are used, it is necessary to know also the rotor initial position; therefore, the encoder must also be equipped with three Hall-effect sensors. The connector used on the encoder is removable; the following picture shows the pin configuration:



Incremental encoder	
pin	**signal**
1	Temperature sensor – pin 1
2	Temperature sensor – pin 2
3	+5VDC
4	GND
5	earth
6	A+ channel
7	B+ channel
8	Hall U+
9	Hall V+
10	Hall W+
11	A- channel
12	B- channel
13	Hall U-
14	Hall V-
15	Hall W-

The interface for the Hall sensors is only provided on versions that can also pilot brushless motors. Carefully check the signal polarity before connecting the encoder; otherwise, the motor might rotate uncontrollably. Risk of electrical and/or mechanical damage to the system.

The following picture shows an example of connection; in case of asynchronous motor, the Hall sensors are not included.

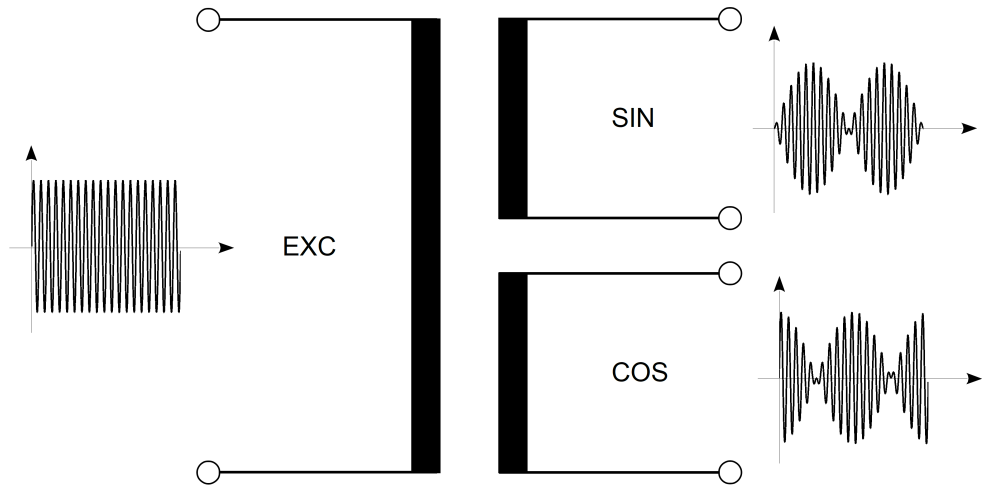


The wiring must be made by a shielded cable; the shield on the cable end on the servo-drive side must be soldered directly to the connector shell. Connect the other end of the shield to the encoder housing, when possible.

Since differential signals are involved, each pair of signals (such as U+ and U-) must be carried with a twisted pair. As to the power conductors, they must be properly sized, in order to prevent excessive voltage drops; conductors with a larger cross-section may be necessary when the wiring extends over great distances. Consult the technical documentation supplied by the manufacturer of the encoder for further details.

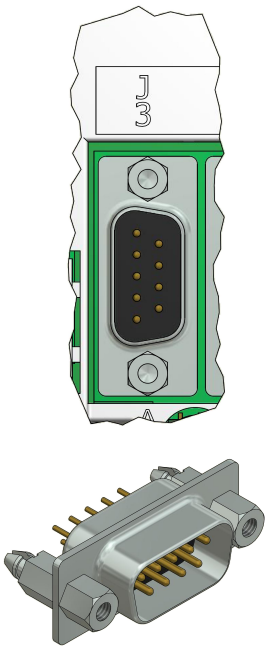
6.6.12 Resolver

Some versions of the servo-drive are equipped with a peripheral unit for the acquisition of resolvers, used as a feedback for reading and controlling the motor position and speed. The schematic diagram of this transducer is shown in the following picture:



The resolver operates as follows: the servo-drive generates a sinusoidal excitation signal with a constant frequency (10 kHz) and amplitude. The resolver features two output coils that generate two sinusoidal signals at the same frequency as the excitation signal, but with an amplitude that depends on the mechanical angle between rotor and stator. By measuring the two instantaneous amplitudes, it is possible to determine the position on the rotor, in a way that is completely similar to the method used in a digital encoder.

The connector for the resolver is removable; the pin configuration and a diagram of the connector are shown in the following picture:

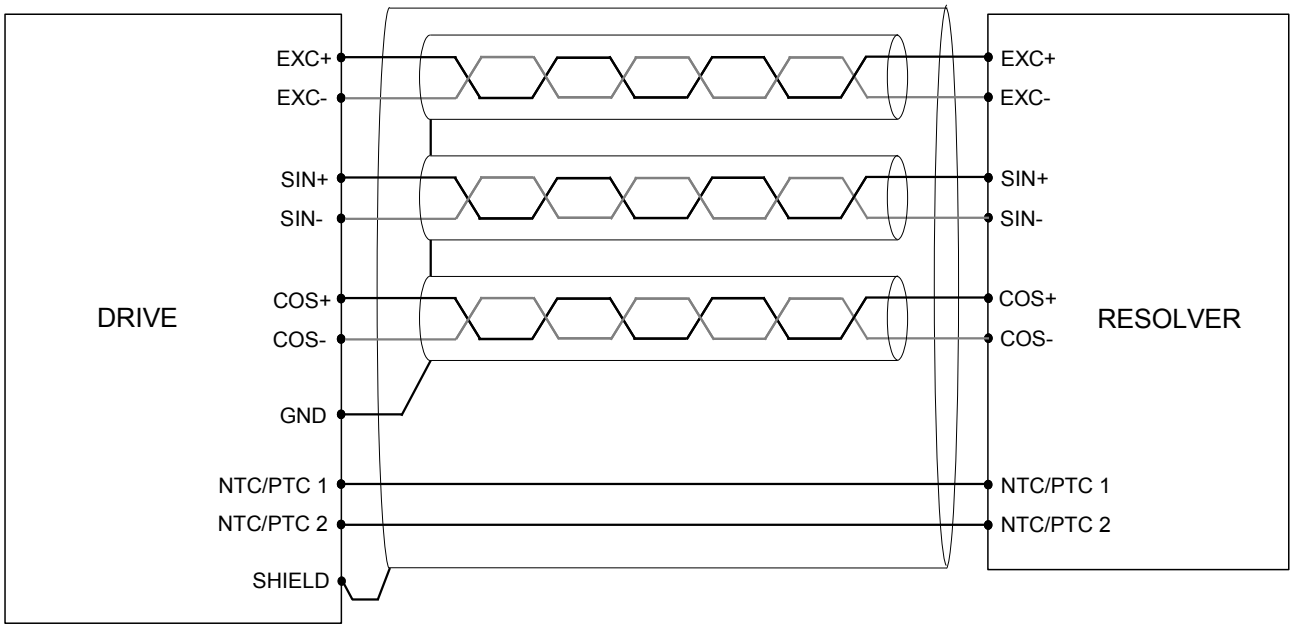


Resolver	
pin	**signal**
1	GND
2	SIN+
3	SIN-
4	EXC-
5	EXC+
6	COS-
7	temperature sensor – pin 1
8	temperature sensor – pin 2
9	COS+

The connections for the motor temperature sensor are also provided on pins 1 and 2 of the connector (see specific paragraph).
The cable to be used for the wiring must be shielded; the wiring must be made with three pairs of twisted conductors; each pair must be individually shielded. The internal shields must be earthed (GND, pin 1 on the connector), while the external shield must be earthed only on the servo-drive side, through the connector metal shell.

The resolver sends analogue signals, which are prone to electrical interference. Make sure the cable is positioned far away from noise sources (such as power cables, inverters, switching power supplies, contactors, motors, etc.). In case of excessive interference in the feedback signal, the motor may behave uncontrollably.

The recommended connection scheme for the resolver is shown in the following picture:



6.6.13 Motor temperature sensor

The servo-drive is equipped with an input for reading the temperature sensors, which are often installed inside the windings, in order to protect them in case of overheating. This peripheral device is designed to acquire data from three different types of sensors:

- NTC, resistors whose resistance decreases as temperature increases
- PTC, resistors whose resistance increases as temperature increases
- Bi-metal switches, which open or close a contact when a temperature threshold is exceeded

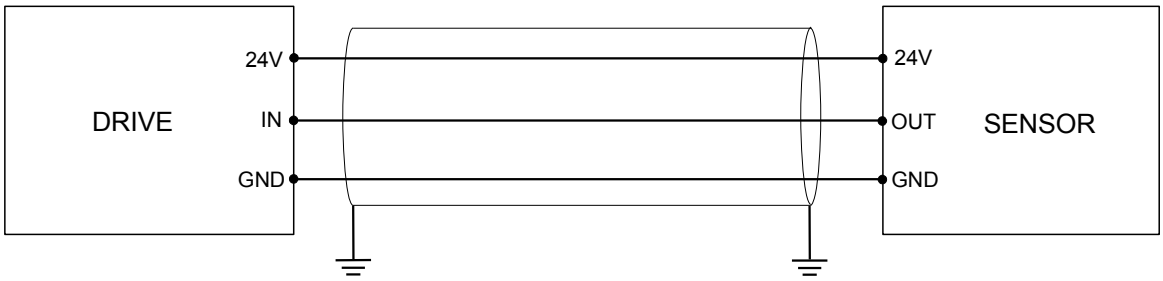
The polarisation current is delivered directly by the servo-drive; it is simply necessary to connect the sensor and program the servo-drive correctly. Since these sensors are not polarized, the two terminals can be inverted with no adverse effect.

The servo-drive must be programmed with the correct parameters for the sensor; otherwise the temperature value will be detected incorrectly. This may negatively affect the operation of the thermal protection system, with the risk of damaging the motor.

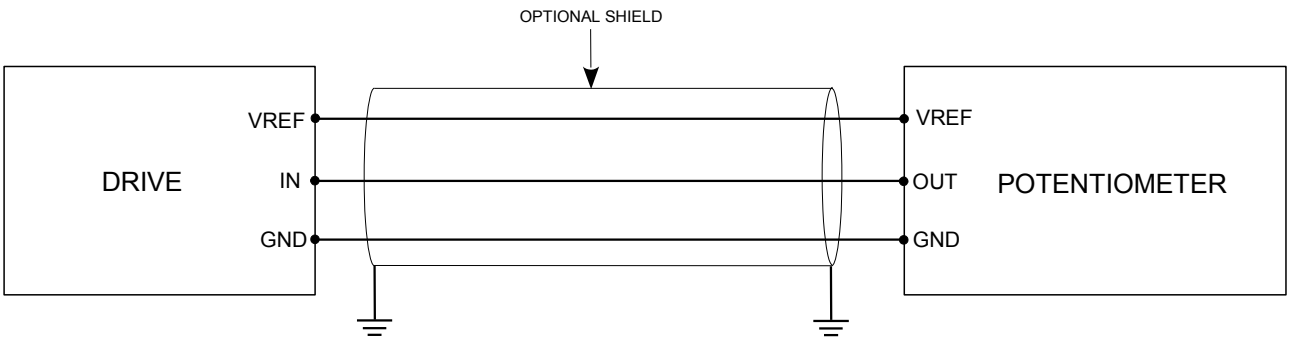
6.6.14 0 to 10V analogue input and 10V reference generator

Some versions of the servo-drive/inverter are equipped with an analogue input stage for 0 to 10V signals. Since potentiometers and potentiometer-type position sensors are commonly used, a fixed 10V voltage is generated for polarizing them.

The recommended connection scheme for a sensor is shown in the following picture:



A potentiometer, on the other hand, is connected as follows:



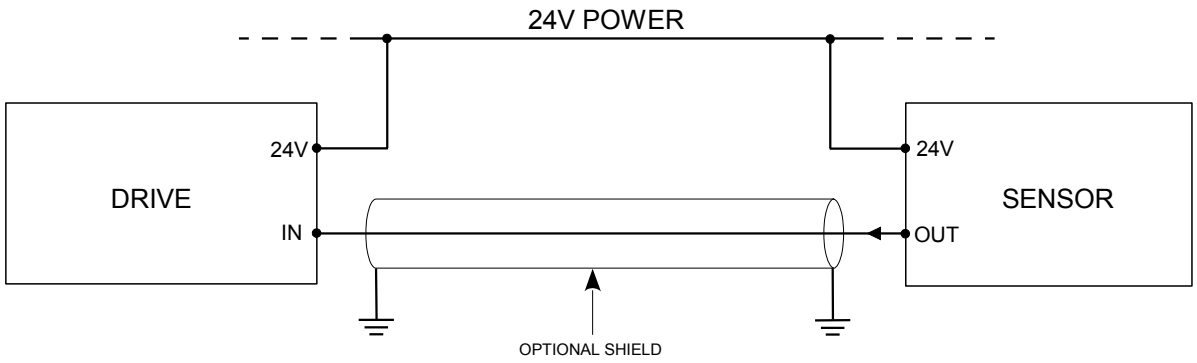
In both cases, it is recommended to use shielded cables for the connections.

Be careful about the analogue signal wiring, if these signals are used as reference signals for motor speed or motor position. In case of excessive interference, the motor may behave uncontrollably; position the cable far away from sources of noise (such as power cables, inverters, switching power supplies, contactors, motors, etc.).

6.6.15 4 to 20mA analogue input

Some versions of the servo-drive/inverter are equipped with an analogue input stage for 4 to 20mA signals. Current output sensors are very commonly used in industry, because they are less susceptible to electrical interference than voltage signals. An additional advantage consists in that a disconnected cable is easier to diagnose (due to absence of current).

The most common type of sensor has only two contacts: one for 24V power and an output contact; the recommended connection scheme is as follows:

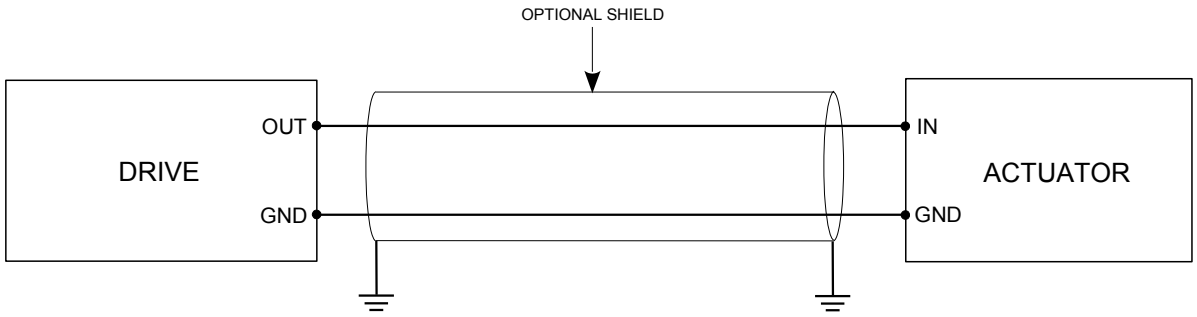


Since 4 to 20mA signals are inherently resistant to electrical interference, the wiring can be made by using unshielded cables in many cases. However, a shielded cable is preferred when the wiring extends over great distances or through particularly unfavourable environments.
Be careful about the analogue signal wiring, if these signals are used as reference signals for motor speed or motor position. In case of excessive interference, the motor may behave uncontrollably; position the cable far away from sources of noise (such as power cables, inverters, switching power supplies, contactors, motors, etc.).

6.6.16 0 to 10V analogue output

Some versions of the servo-drive/inverter are equipped with an analogue output stage for 0 to 10V. This type of interface is normally used to transmit certain measurements, such as motor rotation speed, in an analogue way, to other devices (such as a PLC).

The recommended connection diagram is shown in the following picture:



In order to avoid signal corruption, it is recommended to use a shielded cable.

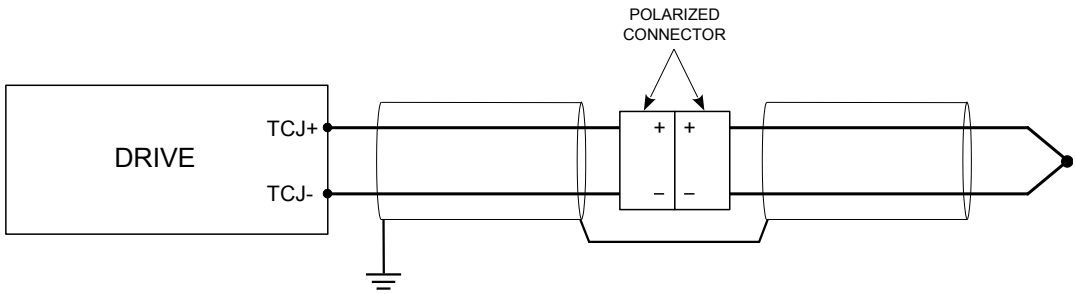
6.6.17 Thermocouple J input

Some versions of servo-drives/inverters are equipped with an input for reading type-J thermocouples; they are commonly used for temperature detection in several industrial applications. Since these sensors deliver a voltage signal depending on the different temperature of the hot joint and of the cold joint, it is necessary to measure the cold joint temperature by means of a different device, in order to obtain the absolute temperature of the hot joint (that is to say the sensor). The servo-drive integrates an electronic temperature sensor, that is to say it compensates the cold joint temperature automatically. Since the sensors are polarized, be careful to the polarity during the wiring.

Thermocouples of different types are made of different alloys; therefore, the use of different thermocouples would imply a wrong detection. If the thermocouple cable should not be long enough, use the provided extension cables, made of the same material as of the thermocouple. Also the junctions must be made with the provided polarized connectors.

The thermocouples can be insulated or not insulated; in the latter case, the junction is electrically connected to the sheath. Since the acquisition stage is of non-insulated type, it is strictly recommended to use insulated thermocouples; otherwise, eddy currents may generate, due to imperfect equipotentiality between the thermocouple and the servo-drive, with consequent errors of measurement.

The recommended connection scheme, including extension cable, is shown in the following picture.



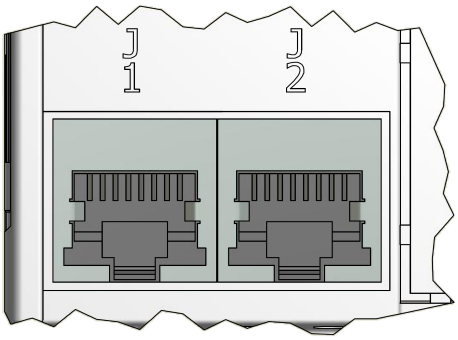
Since the amplitude of the signals delivered by the thermocouple is very low, the signals are particularly susceptible to electrical interference. For this reason, above all when the wiring extends over great distances, it is strictly recommended to use a shielded cable. If an extension cable is used, it is necessary to join the thermocouple shield and the extension cable (see picture).

6.7 Field bus

6.7.1 FLEXTRON versions

These versions of servo-driver/inverter are equipped with an interface for FLEXTRON field bus. This bus, based on a RS485 electrical non-insulated interface, performs a reliable, real-time control of complex applications.

The connections are made by means of RJ45 connectors, situated on the front panel; the following picture indicates the pin configuration.



FLEXTRON field bus			
connector J1		connector J2	
pin		pin	signal
1	DATA+	1	DATA+
2	DATA-	2	DATA-
3	GND	3	GND
4	Internal use	4	Internal use
5	Internal use	5	Internal use
6	NC	6	NC
7	Internal use	7	Internal use
8	Internal use	8	Internal use

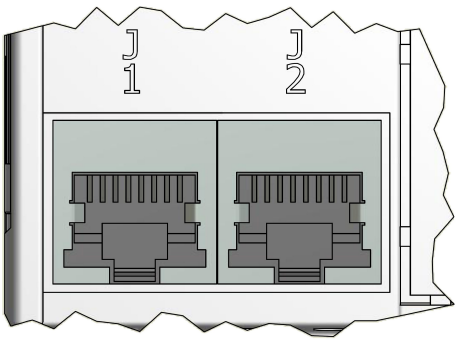
The servo-drives equipped with FLEXTRON field bus implement a mechanism of automatic address setting: each device receives a progressively increasing address, according to the electric position of the slave.
This is to say that the devices create a chain, starting from the master and finishing at the last slave; the addresses follow the same order.

Do not change the devices wiring order in a FLEXTRON bus, otherwise the system may behave uncontrollably; risk of damages to persons and/or property.

FLEXTRON devices implement an automatic termination system; this is to say that the last device in the chain automatically inserts a termination resistor, in order to prevent reflections on the transmission line.

6.7.2 FLXIO versions

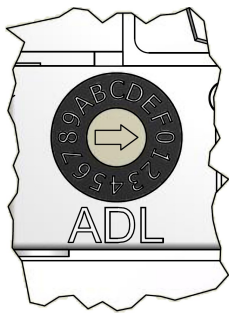
These versions of servo-driver/inverter are equipped with an interface for FLXIO field bus. This bus, based on a RS485 electrical non-insulated interface, performs a reliable, real-time control of complex applications. The connections are made by means of RJ45 connectors, situated on the front panel; the following picture indicates the pin configuration.



FLEXIO field bus			
connector J1		connector J2	
pin		pin	signal
1	DATA+	1	DATA+
2	DATA-	2	DATA-
3	GND	3	GND
4	NC	4	NC
5	NC	5	NC
6	NC	6	NC
7	Internal use	7	Internal use
8	Internal use	8	Internal use

This field bus requires standard cables, Ethernet CAT 5E type, with RJ45 connectors; in order to avoid dangerous reflections, a termination resistor is necessary at the end of the chain. To this purpose, a solution for automatic termination has been implemented: the last device in the chain (J2 port is not used on the last slave) detects the lack of cable on the J2 port and automatically activates the termination. By contrast, if further devices are installed downstream, the termination is automatically disconnected by the servo-drive. In this way, only the last device terminates the cable; the other end is terminated by the master device.

Each slave in a FLXIO bus must have its address, which can be modified in a very easy way. To this purpose, the servo-drive is equipped with a rotary switch (on the front panel), with 16 different positions (from 0 to F, in hexadecimal notation). The address can be set by means of a flat-head screwdriver. The following table shows the correspondence between decimal and hexadecimal values:



Decimal	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Hexadecimal	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F

Address 0 can not be used; each device on the same bus must have a different address. The presence of two devices with the same address creates communication problems and may cause the system to behave uncontrollably.

Since the address is read only when the device is switched on, the address must be set before powering the

system, otherwise it will not be possible to see the modifications until the system re-starts.

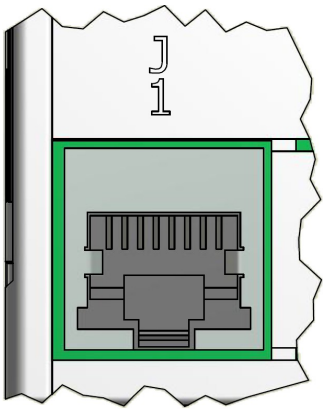
	Make sure the address is correct before powering up the devices; otherwise the system may behave uncontrollably; risk of danger to persons and/or property.

For further details about FLXIO bus operation and types of connection, please refer to the specific documentation.

6.8 RS485 interface

Some versions of servo-drive/inverter are equipped with a RS485 serial non-insulated interface. It can be used for the control/diagnosis/parametrization of a device with MODBUS RTU protocol.

The connections are made by means of RJ45 connector on the front panel (J1); the following picture shows the pin configuration.



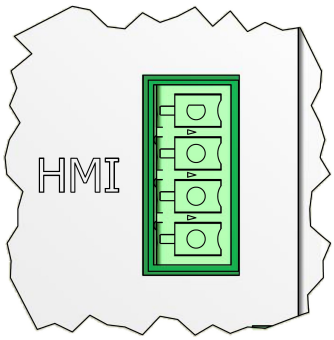
RS485 connector J1	
pin	**signal**
1	DATA+
2	DATA-
3	GND
4	NC
5	NC
6	NC
7	NC
8	NC

In order to avoid reflections, it is necessary to install a 120Ω termination resistor on the end of the wired section. The wiring can be made by means of Ethernet CAT 5E cable; otherwise, choose a shielded cable with typical impedance of 120Ω. The shield must be connected to both sides of the connector shell.

Please refer to the Operation and Programming Manual for further information.

6.9 Removable operator interface (HMI)

Some versions of servo-drive/inverter of the COSMOS 301X series are pre-arranged for accepting a VISIO 3000 removable operator interface, for the parametrization of the servo-drive and for reading error codes. It consists of a 2-line, 8-character alphanumeric display and 4 arrow keys; a special seat for snapping in the interface and its HMI port is provided on the servo-drive front side.



6.9.1 Function of the keys

◀	**Navigation**: By pressing the left arrow key, you return to a higher level menu. If you are in the main menu, the screen showing the device status is displayed. From this screen, you can press the left key again, for displaying the firmware version and the servo-drive model. **Modify data:** this key moves the cursor to the digit immediately on the left of the one currently indicated by the cursor. If the cursor is positioned over the digit on the extreme left, the cursor will not move. It is possible to cancel a change in progress (that is a change that has not been confirmed yet), by holding down this key for 1 second.
▶	**Navigation:** By pressing the right arrow key, you can move to the lower level menu. The active entry is situated on the first line on the LCD and is indicated by the flashing character " > " on the left of the wording. **Modify data:** By holding down this key for at least 1 second, the system will enter the modification mode for the selected parameter, if it can be modified under the current conditions and if you are at a level of access that allows the parameter to be modified. When the cursor is under the character on the farthest right in the field, this means that the system is in the modification mode: if you press the key, the cursor will move to the digit immediately to the right of the currently indicated digit. If the cursor is positioned over the digit on the extreme right, it will not move. To confirm a modification, hold down this key for at least 1 second.
▲	**Navigation:** the up arrow key moves the system to the previous item in the current menu. The key will have no effect, if you are already positioned on the first item. **Modify data:** this key increases the digit where the cursor is positioned. If the digit reaches the maximum value allowed, the LCD will try to increase the digit on the immediate left (unless it is at its maximum level, too).
▼	**Navigation:** the down arrow moves the system to the next item in the menu. The end of the list of items in the menu is indicated by a line consisting of minus signs (----). **Modify data:** this key decreases the digit where the cursor is positioned. If the digit reaches the minimum value allowed, the LCD will try to decrease the digit on the immediate left, unless it is at its minimum value, too.

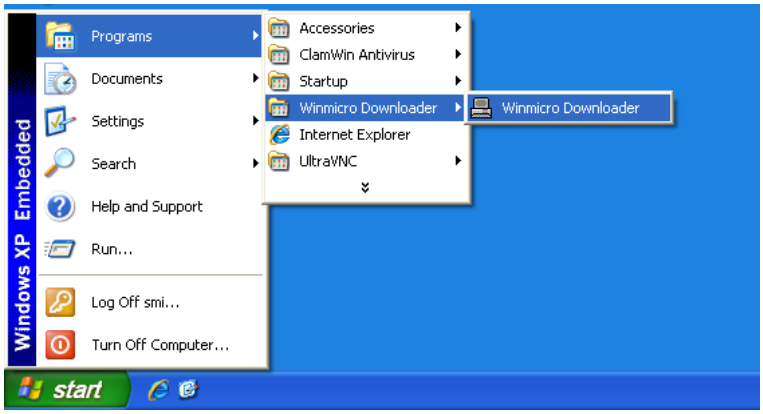
7 UPDATING THE FIRMWARE

Due to improvements or additional functions, the servo-drives/inverters of the COSMOS 301X series can be upgraded with a more recent firmware version.

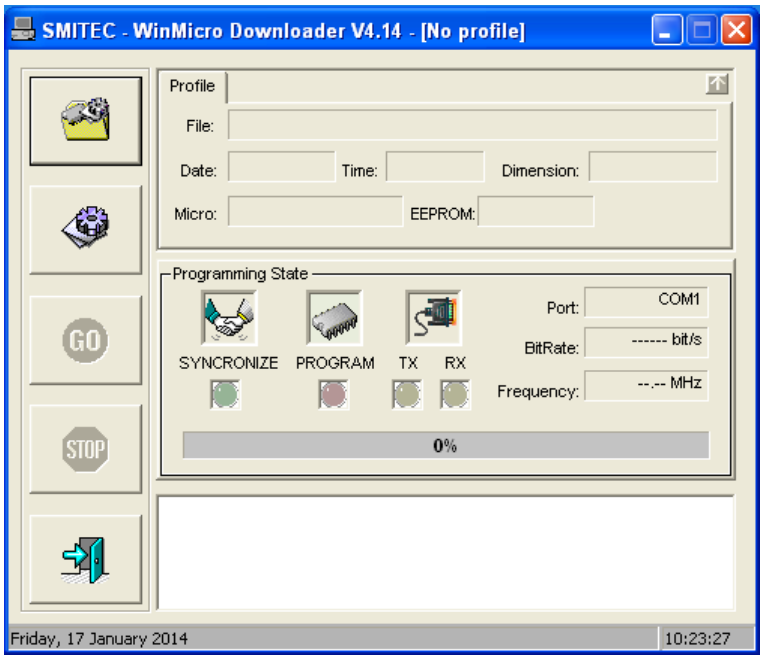
In models KZ010374/5/6, the upgrade is automatic, through Flextron/FlxIO bus and it is not possible to perform updating procedures directly on the device. By upgrading the firmware of the master device, all drives/inverters connected to the master device will be upgraded when they are started.

For other models, the upgrading operation requires a PC with Windows XP or recent release, equipped with a free USB port; also the SMITEC Winmicro dedicated software must be already installed on the PC. In order to install this utility, refer to the guide included in the installation files. Also the RS-USB485 adapter (cod. KZ020087) and the programming cable (cod. KF131284) are required.

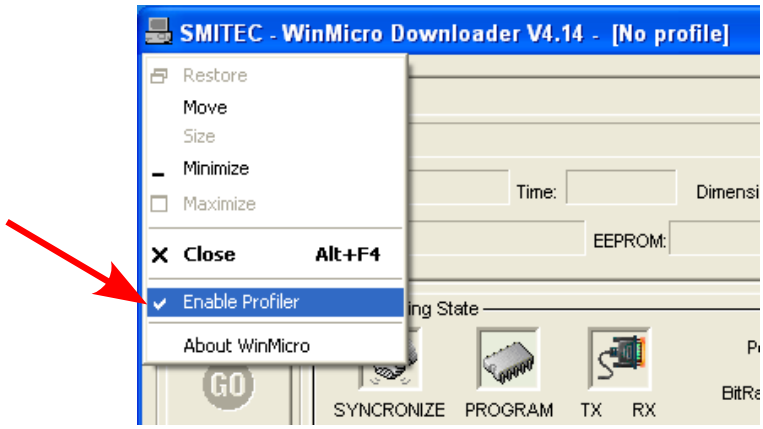
- Connect the USB-RS485 adapter (KZ020087) to a USB port on the computer, by means of the programming cable. If you use a commercial cable, its length must not exceed 3 metres.
- Connect the RS485 cable (cod. KF131284) to the connector J1 on the servo-drive.
- Power up the servo-drive.
- Start Winmicro from the programme menu, as indicated in the following picture:



- After the software has been started, the following window will be displayed:

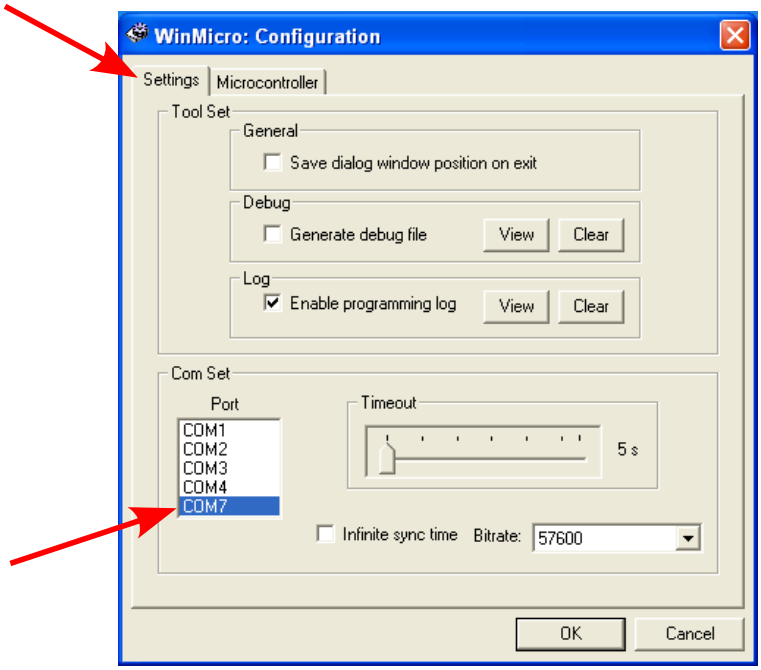


- Open the menu by clicking on the left top button:
- Deselect the item *Enable Profiler*.

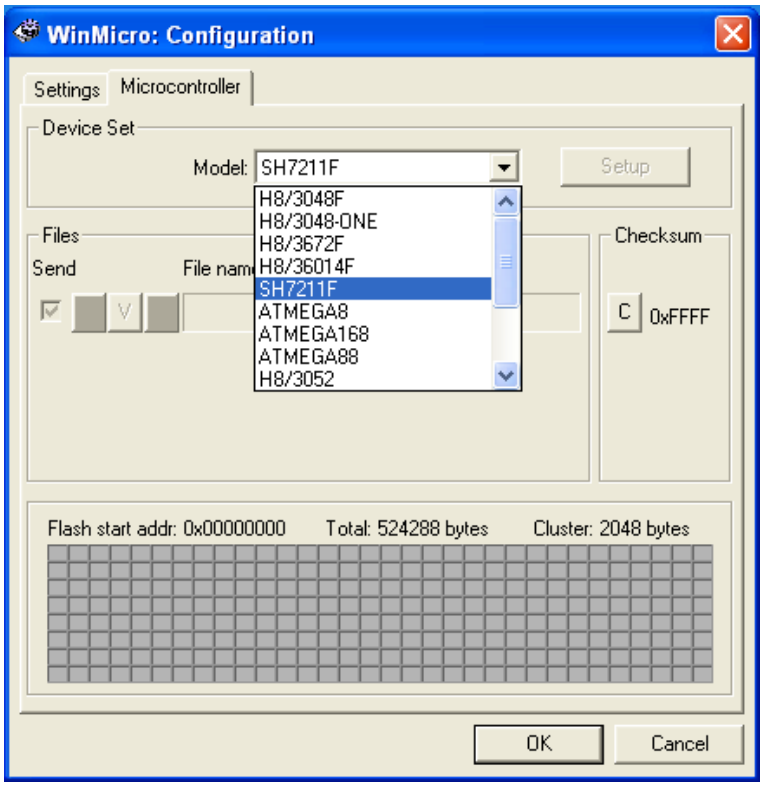


- Click on the configuration button:

- The configuration window will be displayed; in the section *Settings*, select the COM port to be used (in general, you should select the COM with the highest value).

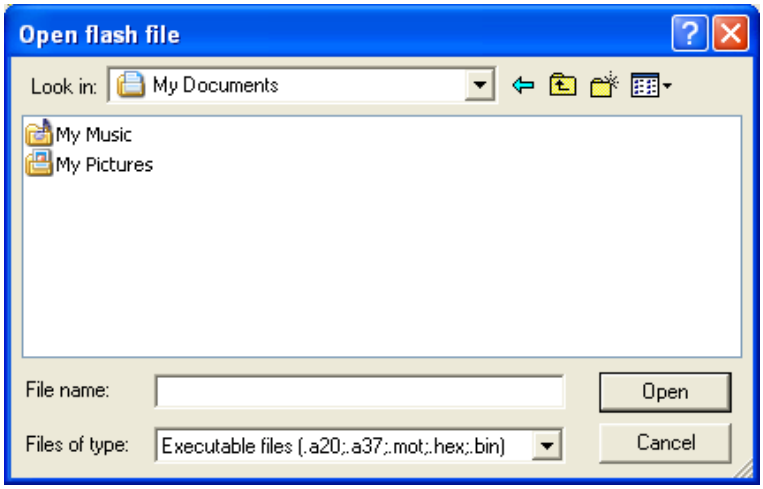


- Now, select the type of microcontroller “RX62T...” in the Model list.

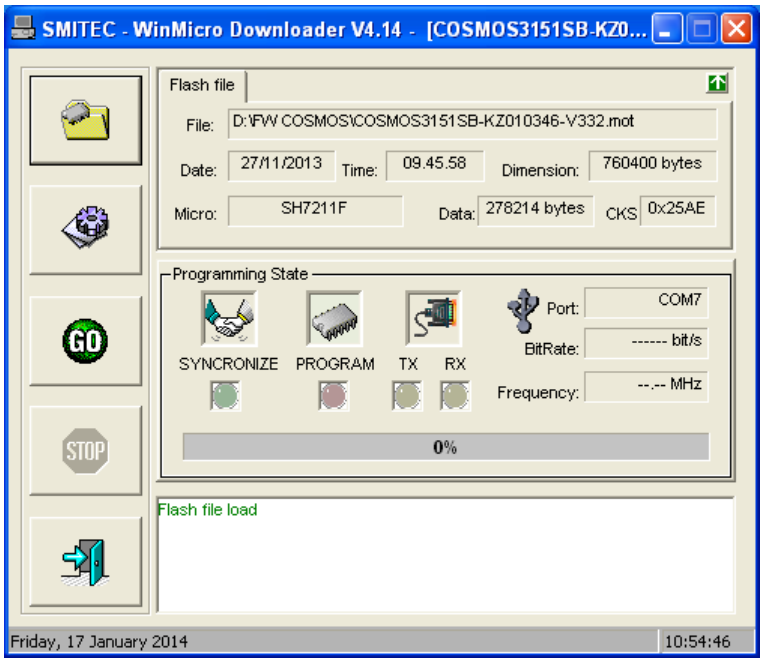


- Click on *OK*.
- Click the following button on the main window:

- the following window will be displayed, where it will be possible to select the file to be programmed; make sure to upload the correct file.

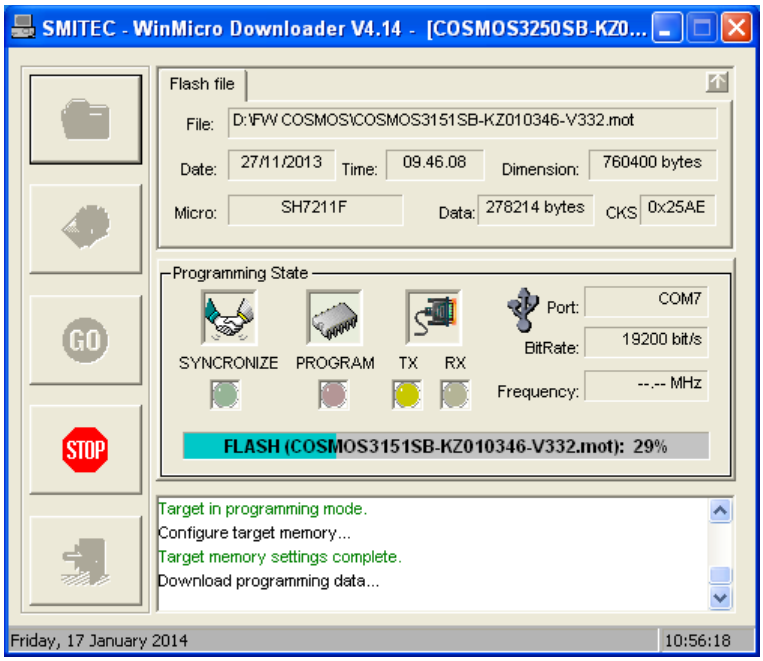


- Once the selected file has been uploaded, some information about the file and the controller will be displayed on Winmicro main window. If the port is correct, the symbol of the USB port will be displayed near the wording *"Port:"*.

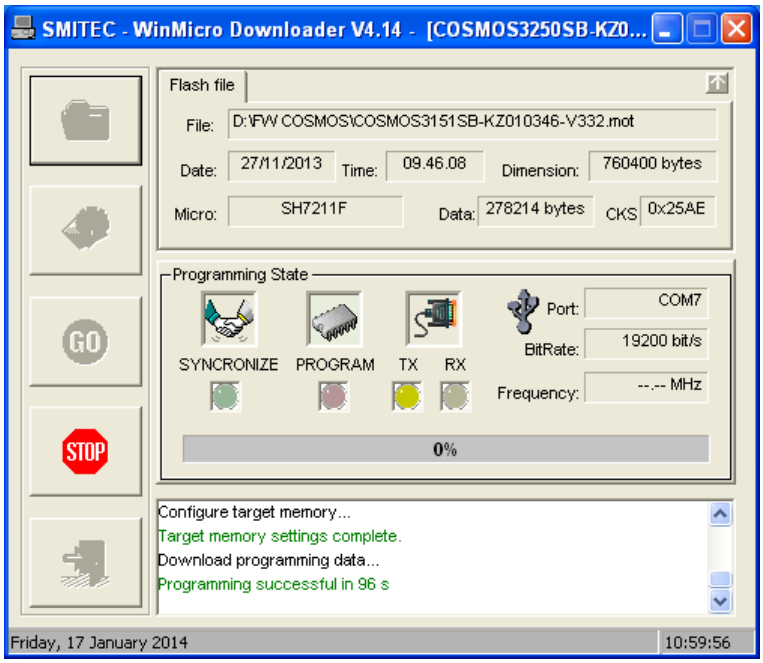


- Click the button GO to start programming.

- The programming procedure will start, clearly indicated by the progress bar:



- At the end of the programming procedure, a message will be displayed, indicating if the operation has been successful and the time required to perform it.



- In case of failure (message: *Synchronization Error*), make sure the type of microcontroller, the file and the port number are correct.
- After the upgrades, leave the programme, by clicking on the button:

- Now the programming procedure is over; it is possible to disconnect all cables.

8 STORAGE

The equipment can be stored in its original package for the necessary period; it must be kept in a covered area even if it is packed. Protect the equipment from dust and weather.

Do not stack more than 10 servo-drives, in order to avoid the package and/or the device being subject to excessive stress.

The equipment can be stored at temperatures from 0° to +40°C.

9 MAINTENANCE

SMITEC S.p.A. does not require any ordinary maintenance to be performed on servo-drives/inverters of the COSMOS 301X series; remember that no component may be removed from the device, since such removal may compromise the safety level.

Any required repair must be performed exclusively by SMITEC S.p.A.

10 DISPOSAL AND DEMOLITION

The equipment must be disposed of in compliance with the legislation in force in the Country where it is installed. In case of partial disposal of the equipment (frame, dissipater, electronic boards), the different materials must be separated (aluminium, plastic, etc.). Also these components must be disposed of in compliance with the legislation in force in the Country where it is installed.