COSMOS
DRIVER
SERIES 3000

USE AND MAINTENANCE MANUAL

CONTENTS

1 INTRODUCTION

1.1 Purposes of this manual

This manual contains all necessary information for safety, installation, use and maintenance of drivers COSMOS 3000.

1.2 Symbols

Symbols used in this manual:

	Danger: high voltage
	General warning

2 CE DECLARATION OF COMPLIANCE

The driver for brushless motors COSMOS-3000 complies with the provisions of the Laws based on the following directives:

LOW VOLTAGE DIRECTIVE: 2006/95/CE

The directives are in accordance with the following harmonised standards:

ELECTRICAL EQUIPMENT OF MACHINES: EN60204-1

3 SAFETY INSTRUCTIONS

The high voltage of some accessories and components in the driver might cause electrocution, if the user came into contact with them. The connectors with a dangerous voltage are: MOTOR, BRAKE R, DC BUS, LINE.

There are some condensers inside the driver which maintain a dangerous voltage for at least 10 minutes after switching them off. Before starting any operation, make sure that the driver has been switched off at least 10 minutes earlier and that the motor is still.

Never use the driver if the container is not fully assembled.

Avoid any metal components (screws, electrical cables…) fall into the driver during the installation, because they might cause short-circuits.

The driver is an electric generator. The running speed becomes electric potential. High voltage is already generated at 300 rpm.

The improper use of the motors and/or the wrong assembly of the mechanical components may seriously injure the user.

Make sure that the personnel is competent and has been informed about the risks he may run and how to avoid them.

Avoid the contact with the driver rear metal surfaces, because they may become very hot during operation.

4 PRODUCT FEATURES

4.1 Description

The series of drivers COSMOS-3000 has been designed for motors with sinusoidal electromotive force and three-phase asynchronous motors.

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 external components.

The control logic is implemented by a 32-bit micro-controller, equipped with a set of instructions optimized for speed and specialized in controlling precision motors.

Thanks to their design features, the drivers can be considered as of digital type, because they are completely controlled by the micro-controller. As a consequence, the drivers COSMOS-3000 are very flexible appliances which can be reset through a software and are open to all improvements offered by the new technologies in the future.

The driver parameters setting and the status notification are controlled by a field bus and/or, depending on the model, by a series of LEDs and by a special removable keyboard called VISIO 3000.

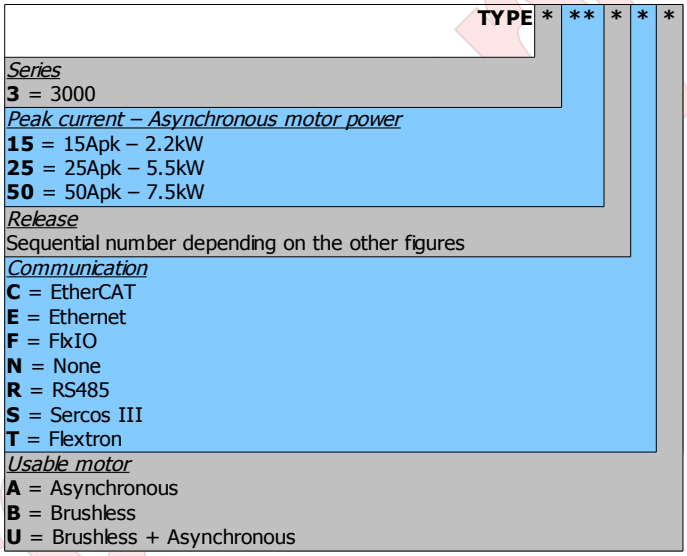
Last, but not least, the mechanical compactness makes of the COSMOS-3000 strong appliances which can be easily integrated with the fixing systems of the machine electrical panels.

4.2 Driver models

The series of drivers COSMOS 3000 includes appliances with different powers, different field buses and other different features; potentially, it is possible to create the most appropriate model for your needs.

4.2.1 Order codes

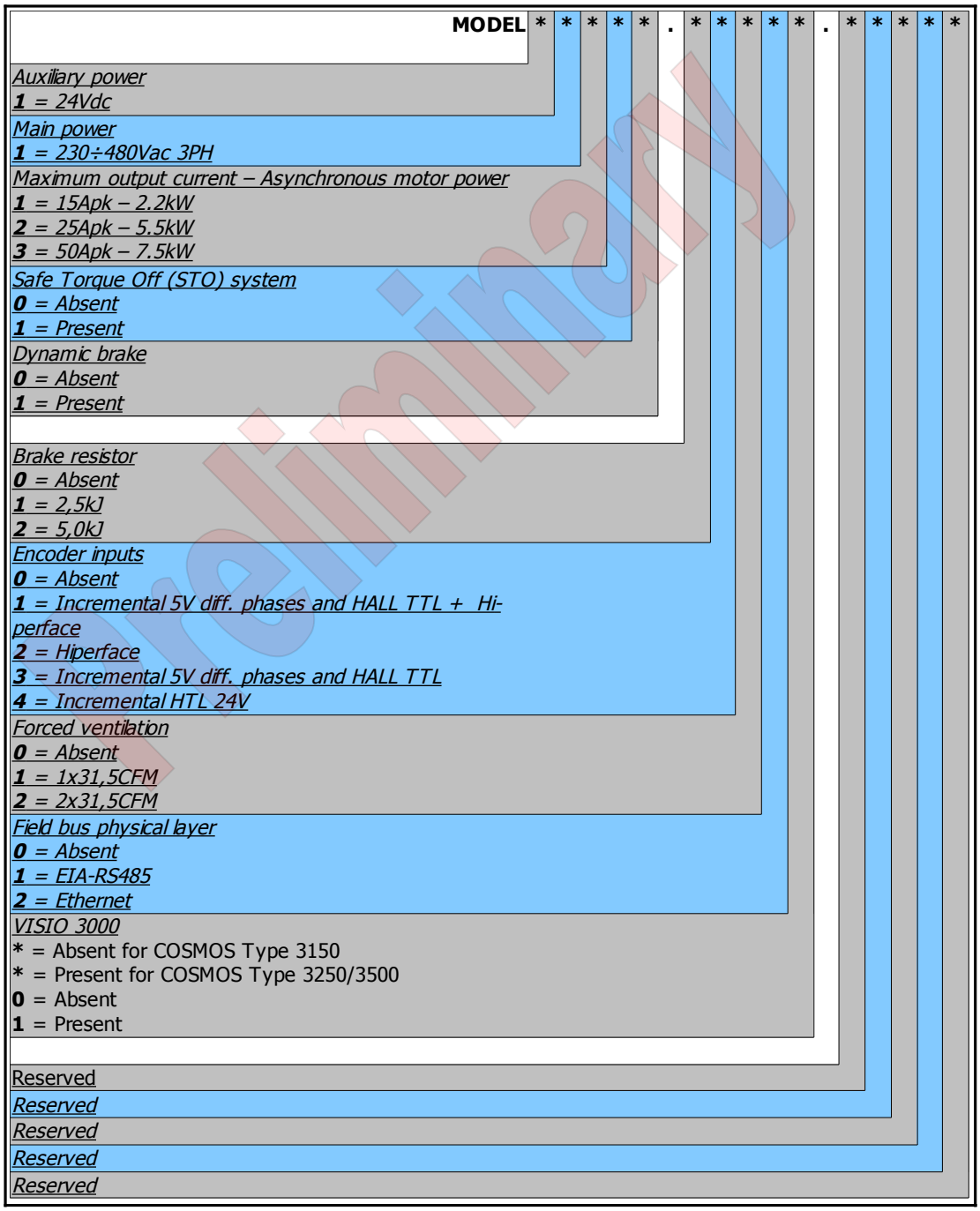
Up to date, we defined some standard configurations of driver, with its order code and type number (4 figures + 2 letters, indicating the series, the maximum current, the release, the fieldbus and the usable motors). These data are indicated on the driver label.



Order code	Cosmos Type	Field Bus	Codice firmware	Motor type	Encoder type
KZ010235	3250SB	Sercos III	KW050115	Permanent magnet brushless motors	Incremental encoder with differential line-driver outputs - 5V
KZ010271	3150FA	FlxIO	KW050117	Three-phase asynchronous motors	Incremental encoder with single-ended HTL outputs - 24V
KZ010279	3500SB	Sercos III	KW050116	Permanent magnet brushless motors	Incremental encoder with differential line-driver outputs - 5V
KZ010321	3151SA	Sercos III	KW050126	Three-phase asynchronous motor	Incremental encoder with differential line-driver outputs - 5V
KZ010338	3250SA	Sercos III	KW050126	Three-phase asynchronous motors	Incremental encoder with differential line-driver outputs - 5V
KZ010339	3500SA	Sercos III	KW050126	Three-phase asynchronous motors	Incremental encoder with differential line-driver outputs - 5V
KZ010342	3251FA	FlxIO	KW050128	Three-phase asynchronous motors	Incremental encoder with differential line-driver outputs - 5V
KZ010344	3501FA	FlxIO	KW050128	Three-phase asynchronous motors	Incremental encoder with differential line-driver outputs - 5V
KZ010345	3152FA	FlxIO	KW050128	Three-phase asynchronous motors	Incremental encoder with differential line-driver outputs - 5V
KZ010346	3151SB	Sercos III	KW050124	Permanent magnet brushless motors	Incremental encoder with differential line-driver outputs - 5V
KZ010347	3152FB	FlxIO	KW050125	Permanent magnet brushless motors	Incremental encoder with differential line-driver outputs - 5V
KZ010348	3251FB	FlxIO	KW050125	Permanent magnet brushless motors	Incremental encoder with differential line-driver outputs - 5V
KZ010349	3501FB	FlxIO	KW050125	Permanent magnet brushless motors	Incremental encoder with differential line-driver outputs - 5V

4.2.2 Model code

The specific features of each driver COSMOS 3000 are defined by an alpha-numeric code printed on the device label, near the MODEL code. Here is the code table.



4.2.3 Accessories

The drivers COSMOS 3000 are supplied with a series of connectors for power connection and STO (where relevant). The same connectors can be ordered separately, as well as other accessories not supplied with the driver.
Here is a list of the order codes.

Item	Order code
VISIO 3000	KZ010262
Connector 24VDC	KF101054
Connector LINE	KF101042
Connector MOTOR	KF101045
Connector DC BUS	KF101044
Connector BRAKE R	KF101043
Connector STO	KF101051
Cable USB 2.0 type A→mini B length: 3m	EC100213

4.3 Ratings

COSMOS Type	315X	325X	350X
Mains voltage [1, 2, 3]	230÷460Vac ± 10% 3PH 480Vac ± 5% 3PH	230÷460V ± 10% 3PH 480V ± 5% 3PH	230÷460V ± 10% 3PH 480V ± 5% 3PH
Auxiliary mains voltage[4]	24Vdc -15% +20%	24Vdc -15% +20%	24Vdc -15% +20%
Rated output current 40°C	8,5Arms @ 4KHz 7,0Arms @ 8KHz 6,0Arms @ 12KHz 4,5Arms @ 16KHz	12,5Arms @ 4KHz 10,0Arms @ 8KHz 7,5Arms @ 12KHz 5,5Arms @ 16KHz	18Arms @ 4KHz 18Arms @ 8KHz 15Arms @ 12KHz 11Arms @ 16KHz
Maximum output current	15Apk	25Apk	50Apk
Short-circuit current	10000Arms		

Note 1: The Cosmos drivers must be equipped with a residual current circuit breaker type-B, able to detect alternating current leakage and direct current leakage (IEC 61800-3 2008-01 §4.3.10).

Note 2: Installation in networks with phase connected to earth (corner grounded) is forbidden.

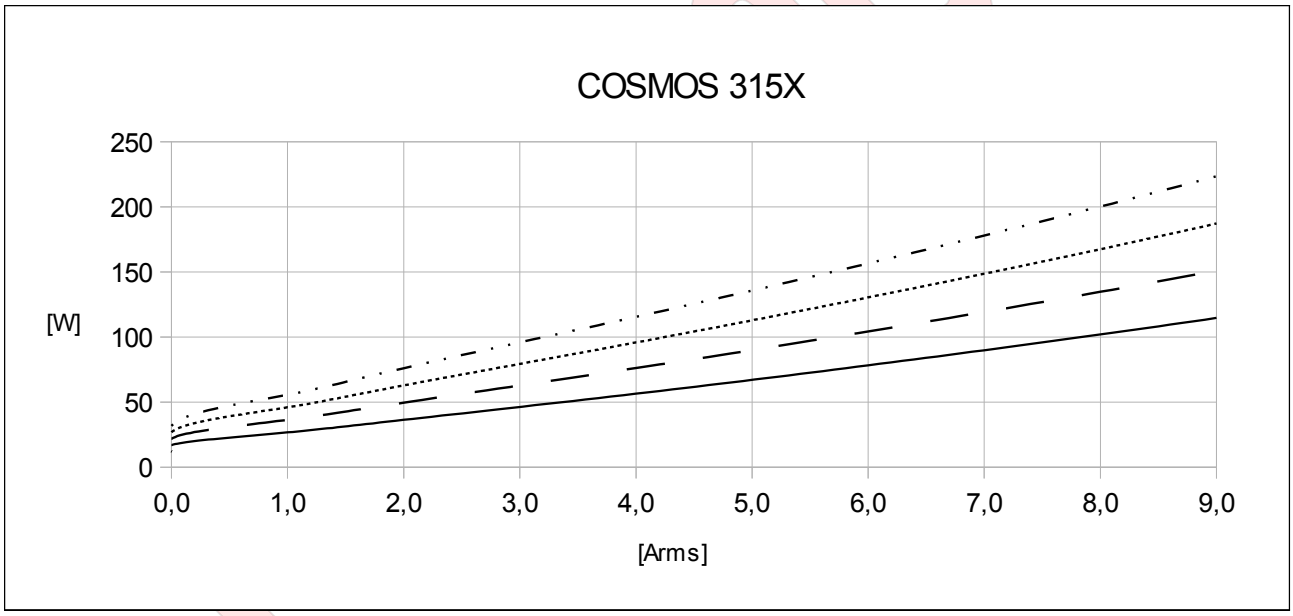
Note 3: in case of installation of the driver in a IT power supply system, it is recommended to use an isolation transformer; make sure that the voltage drop at full load is lower than 2,5% of the rated voltage. In case of direct connection, always use RFI filters, with low leakage current. In case of earth fault, in order to avoid damaging the driver due to excess voltage between input and PE terminal, it is recommended to timely remove the fault.

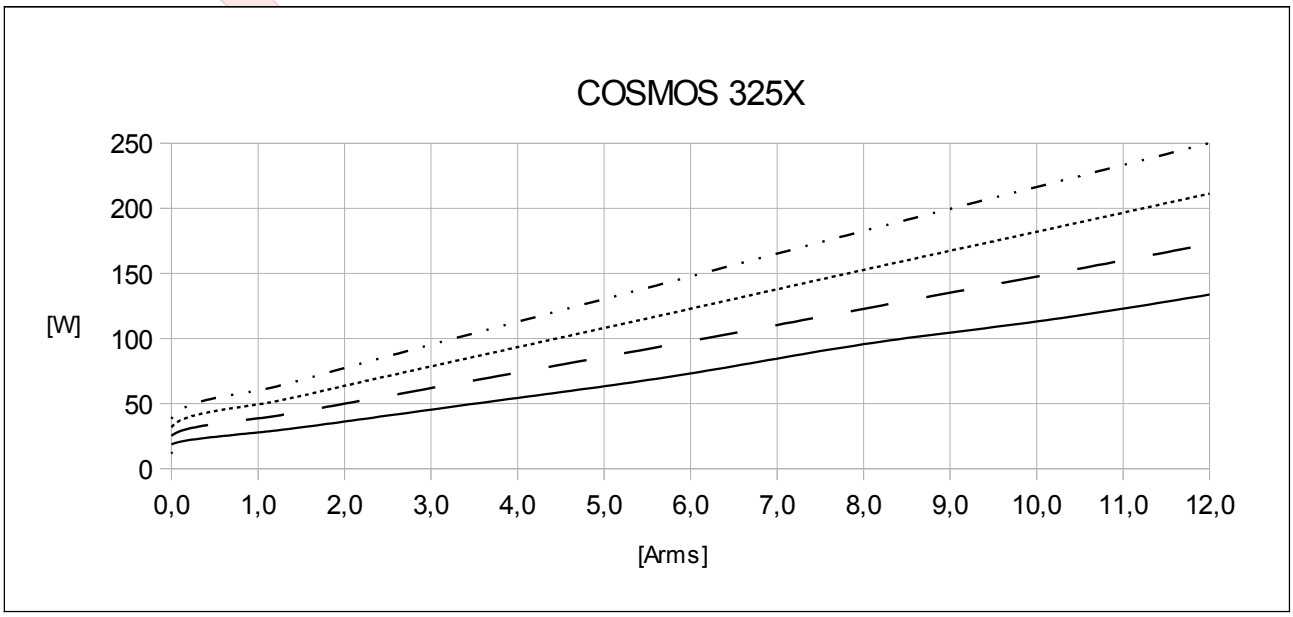
Note 4: The auxiliary power cables must be equipped with overcurrent protection devices (IEC 60204-1 §9.1.3).

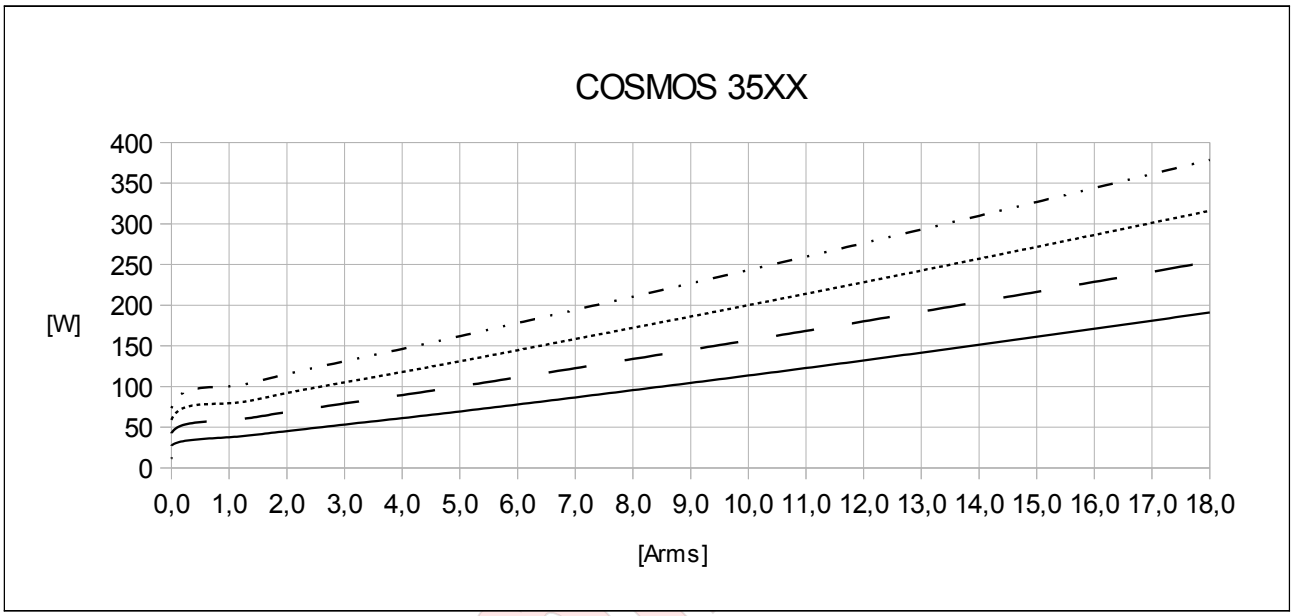
4.4 Thermal dissipation

The below graphics show the thermal dissipation, depending on the efficient output current. The four curves represent four switching frequencies of the driver, respectively 4kHz, 8kHz, 12kHz, 16kHz starting from the continuous line.
Please consider that:

- in case of variable output current, the average dissipated power must not be calculated by using the current average value, but by integrating the instant dissipated power.
- The dissipated power mostly depends on the driver switching frequency; in order to find intermediate values between those indicated in the graphics, interpolate linearly.
- The dissipated power on the braking resistors must be calculated separately.
- The dissipated power 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.







4.5 Ambient specifications

COSMOS Type	315X	325X	350X
Protection degree[1]	IP20B	IP20B	IP20B
Pollution degree	2	2	2
Ambient temperature at rated currents	0 ÷ +40°C	0 ÷ +40°C	0 ÷ +40°C
Ambient temperature with current derating -2%/°C	0 ÷ +55°C	0 ÷ +55°C	0 ÷ +55°C
Ambient humidity	5 ÷ 85% non condensing	5 ÷ 85% non condensing	5 ÷ 85% non condensing
Altitude at rated current	0 ÷ 1000m	0 ÷ 1000m	0 ÷ 1000m
Altitude with current derating -10%/1000m	0 ÷ 4000m	0 ÷ 4000m	0 ÷ 4000m
Transportation temperature	-25 ÷ +70°C	-25 ÷ +70°C	-25 ÷ +70°C
Transportation humidity	5 ÷ 95%	5 ÷ 95%	5 ÷ 95%
Transportation altitude	0 ÷ 4000m	0 ÷ 4000m	0 ÷ 4000m
Stocking temperature	-25 ÷ +55°C	-25 ÷ +55°C	-25 ÷ +55°C
Stocking humidity	5 ÷ 95%	5 ÷ 95%	5 ÷ 95%
Stocking altitude	0 ÷ 3000m	0 ÷ 3000m	0 ÷ 30

Note 1: the Cosmos drivers are designed for being installed in a closed electrical ambient, signalled by specific symbols, such as an electrical panel or a technical room, accessible to qualified personnel only. (IEC 61800-3 2008-01 §3.5).

4.6 Electromagnetic compatibility (EMC)

The drivers Cosmos 3000 comply with IEC 61800-3 2004-12 standards; they can be used in the first environment, category C2 and in the second environment, category C3, on the following conditions:

- for the wiring between the driver and the motor, a shielded cable is necessary, connected to earth on the driver
- the driver is connected to the mains voltage, through the filter Schaffner FN3258H-30-3
- the start-up is performed by technical engineers, according to the instructions of this manual.

In order for an application integrating Cosmos 3000 drivers to comply with the electromagnetic compatibility standards, it will be necessary to select one or more net filters, depending on the number of drivers installed and on the other devices connected to the same line, as well as on the circulating currents.

This product can cause interferences if it is installed in a domestic environment; in this case, it may be necessary to take countermeasures in order to reduce them.

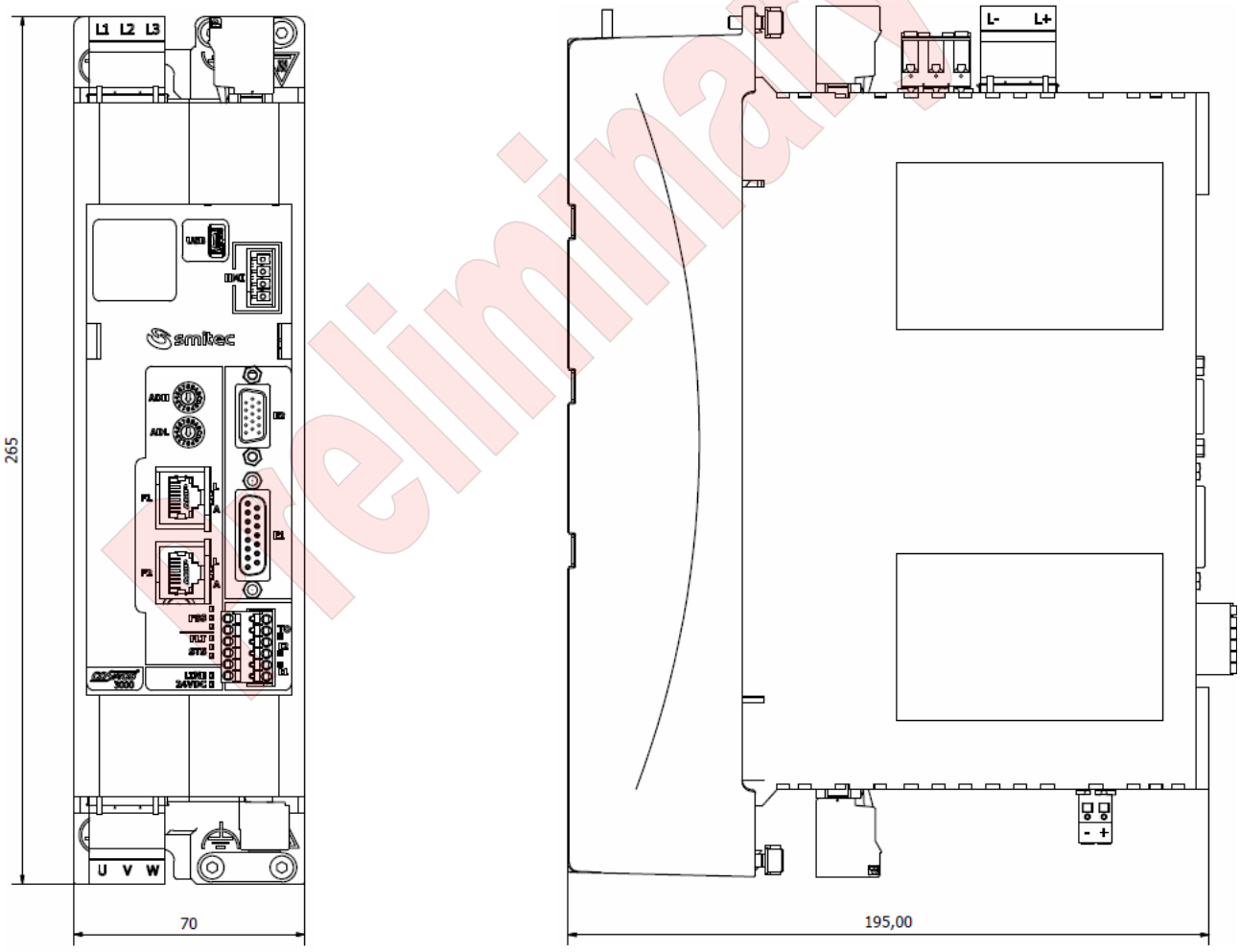
The USB port must be used exclusively for diagnostic purposes and for firmware updating. During the driver normal operation, the use of this port is not allowed.

4.7 Physical specifications

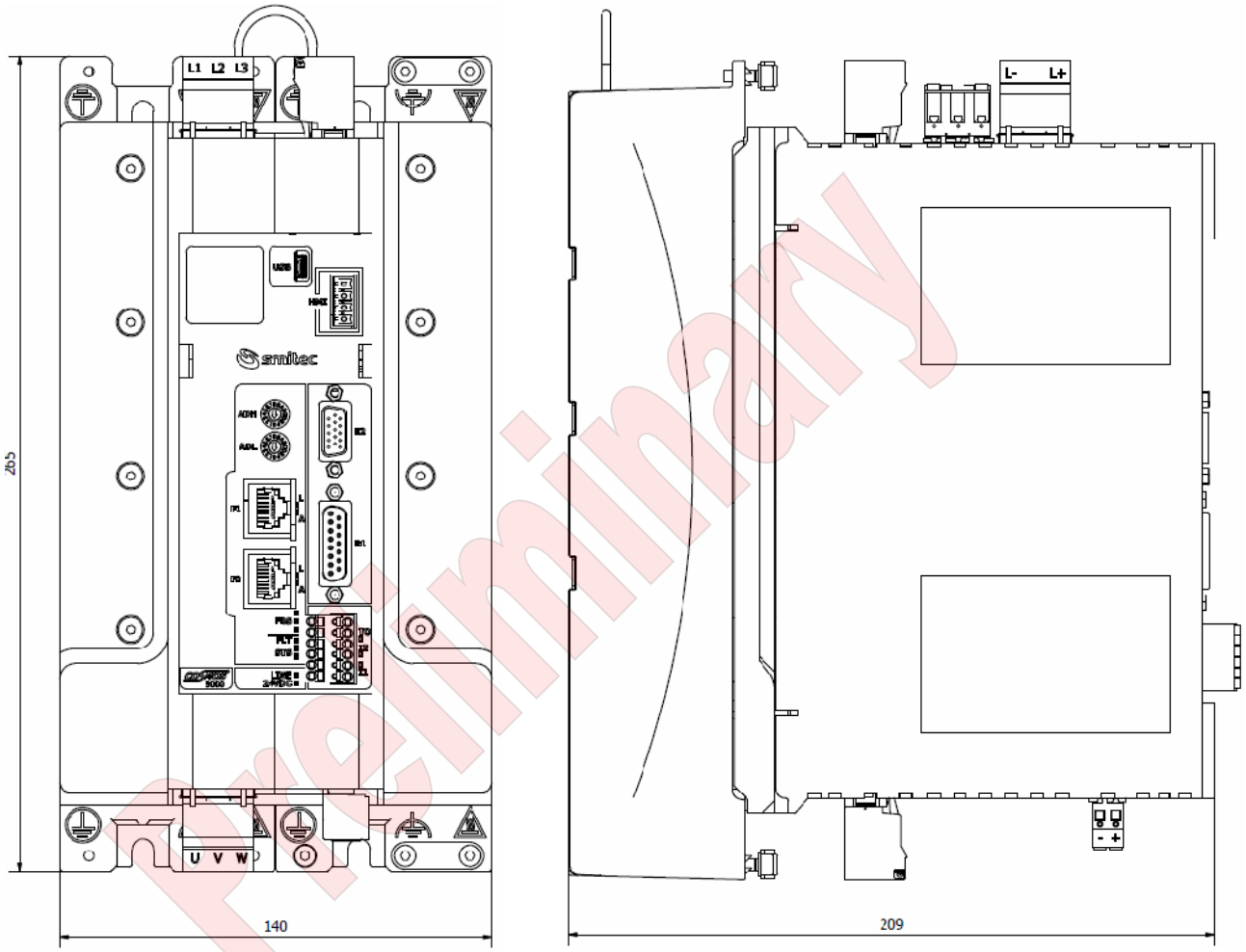
4.7.1 Weight

COSMOS Type	315X	325X	350X
Weight	1,8 kg	2,0 kg	3,9kg

4.7.2 Size of COSMOS Type 315X / 325X



4.7.3 Size of COSMOS Type 350X



5 INSTALLATION

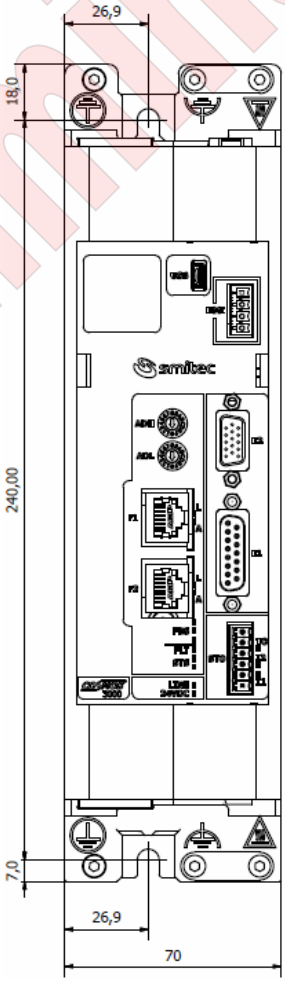
5.1 Positioning and installation

The drivers COSMOS 3000 can be installed close to an iron wall connected to earth. Install the driver in vertical position, with the fan side turned downwards, so that it can be cooled also by natural convection; a space of about 10 cm must be left above and below the driver.
In order to establish the electrical panel size, consider the thermal dissipation depending on the required output current, as indicated in chapter 4.4.

The drivers Cosmos 3000 are designed to be installed in closed electrical operating areas.

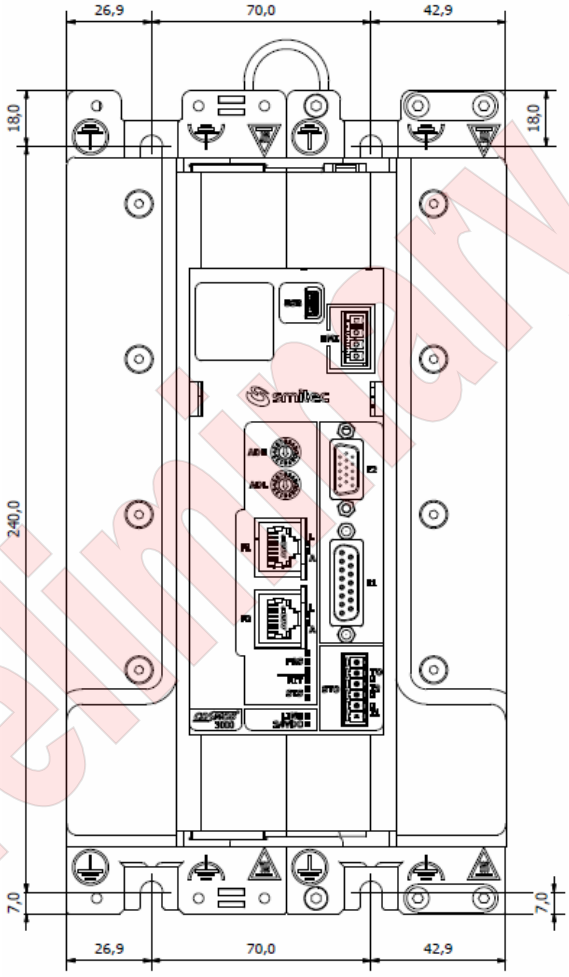
5.1.1 COSMOS Type 315X/325X

Use the below template, in order to prepare the wall and fix the device with 2 screws M5, by duly tightening them.



5.1.2 COSMOS Type 350X

Use the below template, in order to prepare the wall and fix the device with 4 screws M5, by duly tightening them.



5.2 Electrical installation

For all models of COSMOS 3000, the connectors and their position as to the driver plastic body are identical. The electrical wiring is possible through removable connectors, in order to install and remove the drivers from the electrical panel more easily.
The following pictures represent the Type 3250, taken as an example.

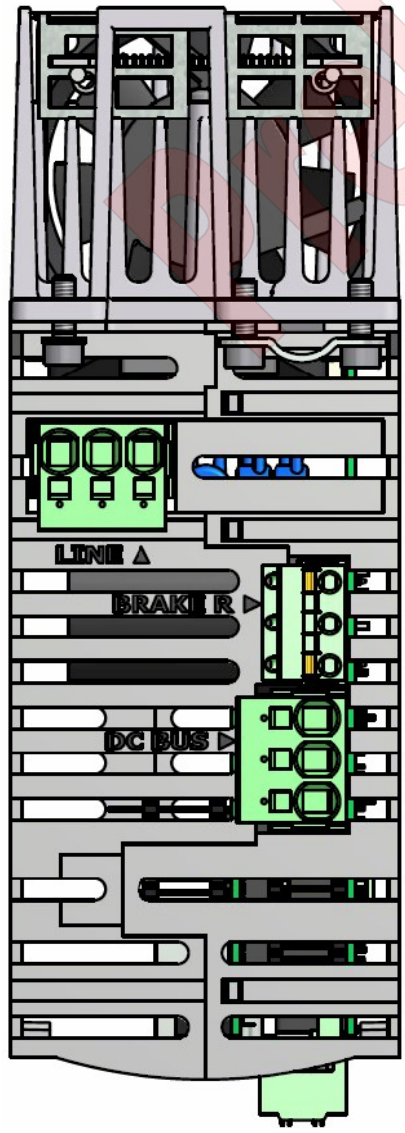
5.2.1 Power installation

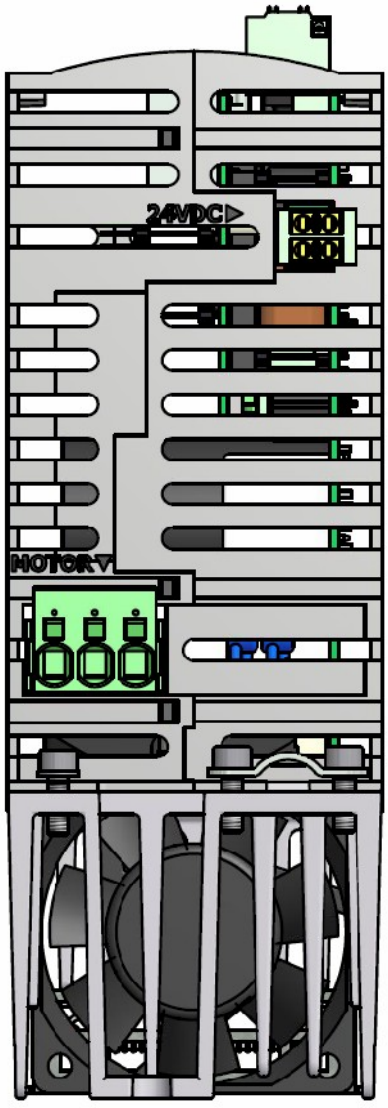
Due to the presence of high capacitance inside the driver, all power wiring must be connected or disconnected when the main power supply is absent for at least 10 minutes.

We consider as power wiring, the mains and auxiliary voltage, the motor output, the DC BUS voltage, the dynamic brake resistor.

The upper side houses the main power supply input (LINE), the DC BUS voltage (DC BUS) and the output for the dynamic brake resistor (BRAKE R).

The bottom side houses the auxiliary voltage input (24VDC) and the motor output (MOTOR).

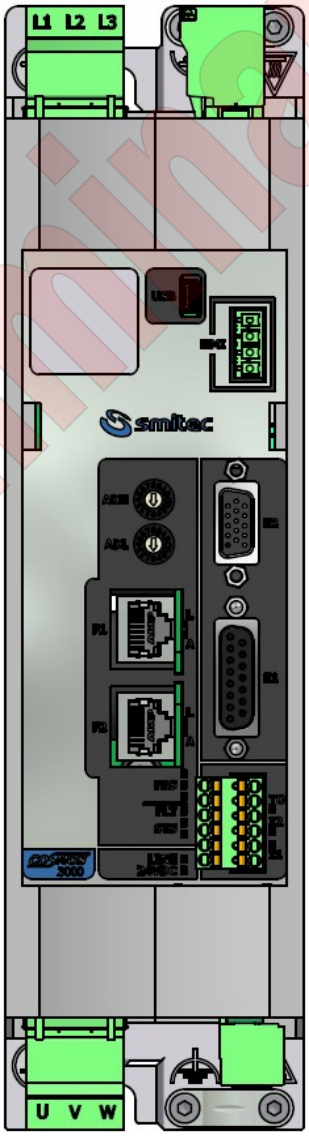




5.2.2 Signal installation

We consider as signal wiring the encoder inputs (E1, E2), the I/O of the STO system (STO), the USB connection (USB), the connection for the VISIO 3000 (HMI), the connections for the field bus (F1, F2). They are all situated on the front side.

In order to avoid damaging the driver, all connections, except USB and HMI, must be connected/disconnected while the driver is off and the auxiliary voltage is absent.

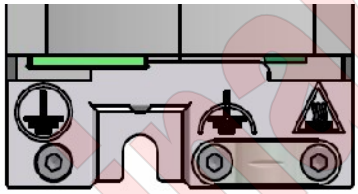


5.2.3 Earth wiring

For the driver electrical safety, it is obligatory to always connect the earth protection.

Protective earth wiring must be made by means of the specific contact areas on the driver iron frame and are identified by the symbol of protection earth.

For shielded cables, the functional earth wiring must be made by means of the contact areas and by means of the cable-passes on the driver iron frame, identified by the symbol of functional earth.



5.3 Connectors wiring

Please find here below the features of the allowed cables and connectors, as well as the legend of each connection of the drivers COSMOS 3000.

The drivers COSMOS 3000 are electronic devices, sensitive to electrostatic charges.
In order to avoid damages, it is necessary to adopt all preventive measures.

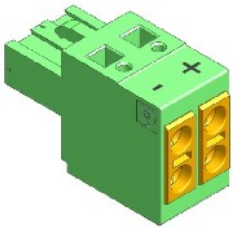
5.3.1 Auxiliary power supply input (24VDC)

The auxiliary power supply is essential for the driver operation; in fact from the auxiliary power supply you can infer the necessary power for the inner electronic control .
The supplied connector is equipped with a double contact for each pole, in order to allow the connection of several drivers in parallel.

It is necessary to strictly adhere to the polarity for the connection of the auxiliary voltage, in order to avoid irreversible damages to the driver.
It is very important to strictly adhere to the voltage limits indicated in the specifications, in order to avoid bad operation and/or irreversible damages.

Connector type: Phoenix Contact TVFKC 1,5/2-ST (1713839) **Order code: KF101054**			
Features		**Conductor cross section**	
Connection in accordance with	EN-VDE	Solid min.	0,2mm²
Rated voltage	250V	Solid max.	1,5mm²
Rated current	10A	Stranded min.	0,2mm²
		Stranded max.	1,5mm²
Insulating material	PA	Stranded ferrule without plastic sleeve, min.	0,25mm²
Flammability rating (Standard UL 94)	V0	Stranded ferrule without plastic sleeve max.	1,5mm²
Stripping length	8mm	Stranded ferrule with plastic sleeve min.	0,25mm²
Screwdriver to be used in order to open the connections	0,6 x 3,5mm	Stranded ferrule with plastic sleeve max.	1,5mm²

Connector 24VDC	
Label	Signal
+	Auxiliary 24V
-	GND



5.3.2 Main power supply input (LINE)

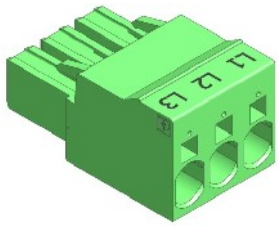
The main power supply is used in order to provide the motor with power.

It is necessary to strictly adhere to the voltage limits indicated in the specifications, in order to avoid irreversible damages to the driver.

The connector is not provided with safety earth connection.
It is necessary to connect the connector with earth, through the specific connection areas on the driver iron body.

Connector type: Phoenix Contact SPC5/3-ST (1996029) **Order code: KF101042**			
Features		**Conductor cross section**	
Connection in accordance with	EN-VDE	Solid min.	0,2mm²
Rated voltage	1000V	Solid max.	10mm²
Rated current	41A	Stranded min.	0,2mm²
		Stranded max.	6mm²
Insulating material	PA	Stranded ferrule without plastic sleeve, min.	0,25mm²
Flammability rating (Standard UL 94)	V0	Stranded ferrule without plastic sleeve max.	6mm²
Stripping length	15mm	Stranded ferrule with plastic sleeve min.	0,25mm²
Screwdriver to be used in order to open the connections	0,6 x 3,5mm	Stranded ferrule with plastic sleeve max.	4mm²

Connector LINE	
Label	Signal
L1	Line 1
L2	Line 2
L3	Line 2



5.3.3 Motor output (MOTOR)

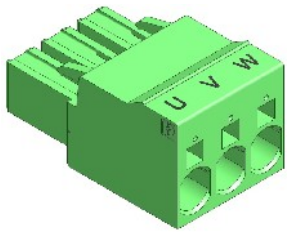
The motor output is the power adjusted by the driver in order to start the connected motor.

In order to avoid electro-magnetic interferences, it is necessary to use a shielded cable to be fixed by means of a cable-pass applied to the driver iron frame.

The connector is not provided with the motor safety earth connection.
It is necessary to connect the motor with earth, through the specific connection areas on the driver iron body.

Connector type: Phoenix Contact SPC5/3-ST (1996029) **Order code: KF101045**			
Features		**Conductor cross section**	
Connection in accordance with	EN-VDE	Solid min.	0,2mm²
Rated voltage	1000V	Solid max.	10mm²
Rated current	41A	Stranded min.	0,2mm²
		Stranded max.	6mm²
Insulating material	PA	Stranded ferrule without plastic sleeve, min.	0,25mm²
Flammability rating (Standard UL 94)	V0	Stranded ferrule without plastic sleeve max.	6mm²
Stripping length	15mm	Stranded ferrule with plastic sleeve min.	0,25mm²
Screwdriver to be used in order to open the connections	0,6 x 3,5mm	Stranded ferrule with plastic sleeve max.	4mm²

Connector MOTOR	
Label	Signal
U	Motor U phase
V	Motor V phase
W	Motor W phase



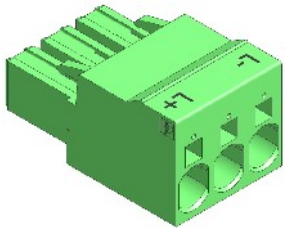
5.3.4 DC BUS power supply (DC BUS)

The DC BUS power supply is a continuous voltage obtained by rectifying the voltage of the main power supply input; it is very useful for connecting in parallel several drivers, in order to recover the power produced by the braking motors and use it for the other motors. Furthermore, it is useful to distribute to different drivers the power dissipated by the dynamic brake.

It is necessary to strictly adhere to the polarity of the DC BUS power supply, in order to avoid irreversible damages to the driver.

Connector type: Phoenix Contact SPC5/3-ST (1996029) **Order code: KF101044**			
Features		**Conductor cross section**	
Connection in accordance with	EN-VDE	Solid min.	0,2mm²
Rated voltage	1000V	Solid max.	10mm²
Rated current	41A	Stranded min.	0,2mm²
		Stranded max.	6mm²
Insulating material	PA	Stranded ferrule without plastic sleeve, min.	0,25mm²
Flammability rating (Standard UL 94)	V0	Stranded ferrule without plastic sleeve max.	6mm²
Stripping length	15mm	Stranded ferrule with plastic sleeve min.	0,25mm²
Screwdriver to be used in order to open the connections	0,6 x 3,5mm	Stranded ferrule with plastic sleeve max.	4mm²

Connector DC BUS	
Label	Signal
L+	+ DC BUS
L-	- DC BUS



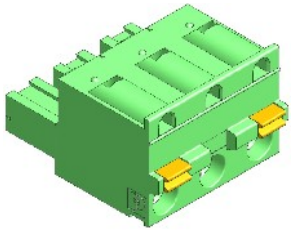
5.3.5 Dynamic brake output (BRAKE R)

The dynamic brake output is arranged for the connection of a power resistor necessary for the dissipation of the power produced by the braking motors.

In the driver models equipped with dynamic brake it is essential that the internal resistance or an external one is connected to this output.

Connector type: Phoenix Contact GFKC2,5/3-ST (1939646) **Order code: KF101043**			
Features		**Connector cross section**	
Connection in accordance with	EN-VDE	Solid min.	0,2mm²
Rated voltage	900V	Solid max.	2,5mm²
Rated current	12A	Stranded min.	0,2mm²
		Stranded max.	2,5mm²
Insulating material	PA	Stranded ferrule without plastic sleeve, min.	0,25mm²
Flammability rating (Standard UL 94)	V0	Stranded ferrule without plastic sleeve max.	2,5mm²
Stripping length	8mm	Stranded ferrule with plastic sleeve min.	0,25mm²
Screwdriver to be used in order to open the connections	0,6 x 3,5mm	Stranded ferrule with plastic sleeve max.	2,5mm²

Connector BRAKE R	
Label	Signal
	Resistor
	Resistor



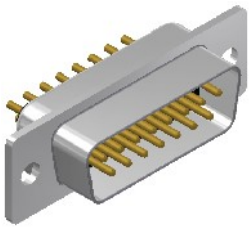
5.3.6 Encoder 1 input (E1)

The encoder 1 input, if present, is used in mutual exclusion with the encoder 2 input; it is useful for the driver or for the process controlling device, in order to know the real position of the motor or of a mechanical component and take corrective measures, if necessary. The encoder type depends on the driver model (see chapter 4.2.2).

Connector type: D-SUB SD15 M (not supplied) **Order code: --------**			
Features		**Connector cross section**	

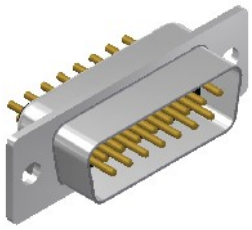
5.3.6.1 Encoder connections 24V OC/HTL

Connector E1	
Label	Signal
1	Shield
2	Phase A
3	Phase B
4	
5	NTC
6	
7	
8	+24Vdc
9	GND
10	
11	
12	
13	NTC
14	
15	GND
SHELL	Shield



5.3.6.2 Differential Encoder 5V connections

Connector E1	
Label	Signal
1	Shield
2	Phase A+
3	Phase B+
4	Zero +
5	NTC
6	HALL U
7	HALL V
8	+5Vdc
9	GND
10	Phase A-
11	Phase B-
12	Zero -
13	NTC
14	HALL W
15	GND
SHELL	Shield



5.3.7 Encoder 2 input (E2)

The encoder 2 input, if present, is used in mutual exclusion with the encoder 1 input and is useful for the driver or for the process controlling device, in order to know the real position of the motor or of a mechanical component and take the corrective measures, if necessary. This input is mainly designed for Hyperface encoders.

Connector type: D-SUB HD15 M (not supplied) **Order code: --------**			
Features		**Conductor cross section**	

Connector E2	
Label	Signal
1	+8Vdc
2	Sine +
3	Sine - (Rif.)
4	Cosine +
5	Cosine - (Rif.)
6	
7	
8	
9	
10	
11	GND
12	Data +
13	Data -
14	NTC
15	NTC
SHELL	Shield

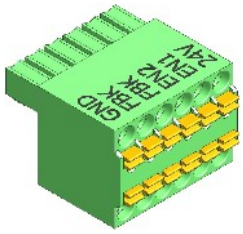
5.3.8 STO system I/O (STO)

The I/O of this connector are signals that are controlled by the integrated safety system; this system guarantees the absence of electrical power at the motor output.
The connector we are supplying is equipped with a double throw for each pole, in order to allow the connection of several drivers in parallel.

It is necessary to strictly adhere to the connection polarity of the mains voltage of the STO section, in order to avoid irreversible damages to the driver.
It is necessary to strictly adhere to the voltage limits indicated in the specifications, in order to avoid irreversible damages to the driver.

Connector type: Phoenix Contact TFMC1,5/6-ST-3,5 (1772650) **Order code: KF101051**			
Features		**Conductor cross section**	
Connection in accordance with	EN-VDE	Solid min.	0,2mm²
Rated voltage	160V	Solid max.	1,5mm²
Rated current	8A	Stranded min.	0,2mm²
		Stranded max.	1,5mm²
Insulating material	PA	Stranded ferrule without plastic sleeve, min.	0,25mm²
Flammability rating (Standard UL 94)	V0	Stranded ferrule without plastic sleeve max.	1,5mm²
Stripping length	10mm	Stranded ferrule with plastic sleeve min.	0,25mm²
Screwdriver to be used in order to open the connections	0,6 x 3,5mm	Stranded ferrule with plastic sleeve max.	0,75mm²

Connector STO	
Label	Signal
GND	GND
FBK	Feedback contact
FBK	Feedback contact
EN2	Enable 2
EN1	Enable 1
24V	+ 24Vdc



5.3.9 Field Bus (F1, F2)

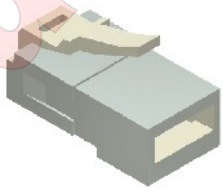
The field bus connection allows the drivers communication with a control system.

Connector type: SHIELDED PLUG RJ45 Cat. 5E (not supplied) **Order code: --------**			
Features		**Conductor cross section**	

5.3.9.1 FLXIO connection

The communication bus is based on physical layer EIA-RS485.

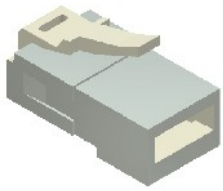
Connector F1, F2	
Label	Signal
1	DATA +
2	DATA -
3	
4	
5	
6	
7	
8	
SHELL	Shield



5.3.9.2 SERCOS III connection

The communication bus is based on physical layer ETHERNET 100Mbps.

Connector F1, F2	
Label	Signal
1	TX +
2	TX -
3	RX +
4	
5	
6	RX -
7	
8	
SHELL	Shield



5.3.10 Operator interface (HMI)

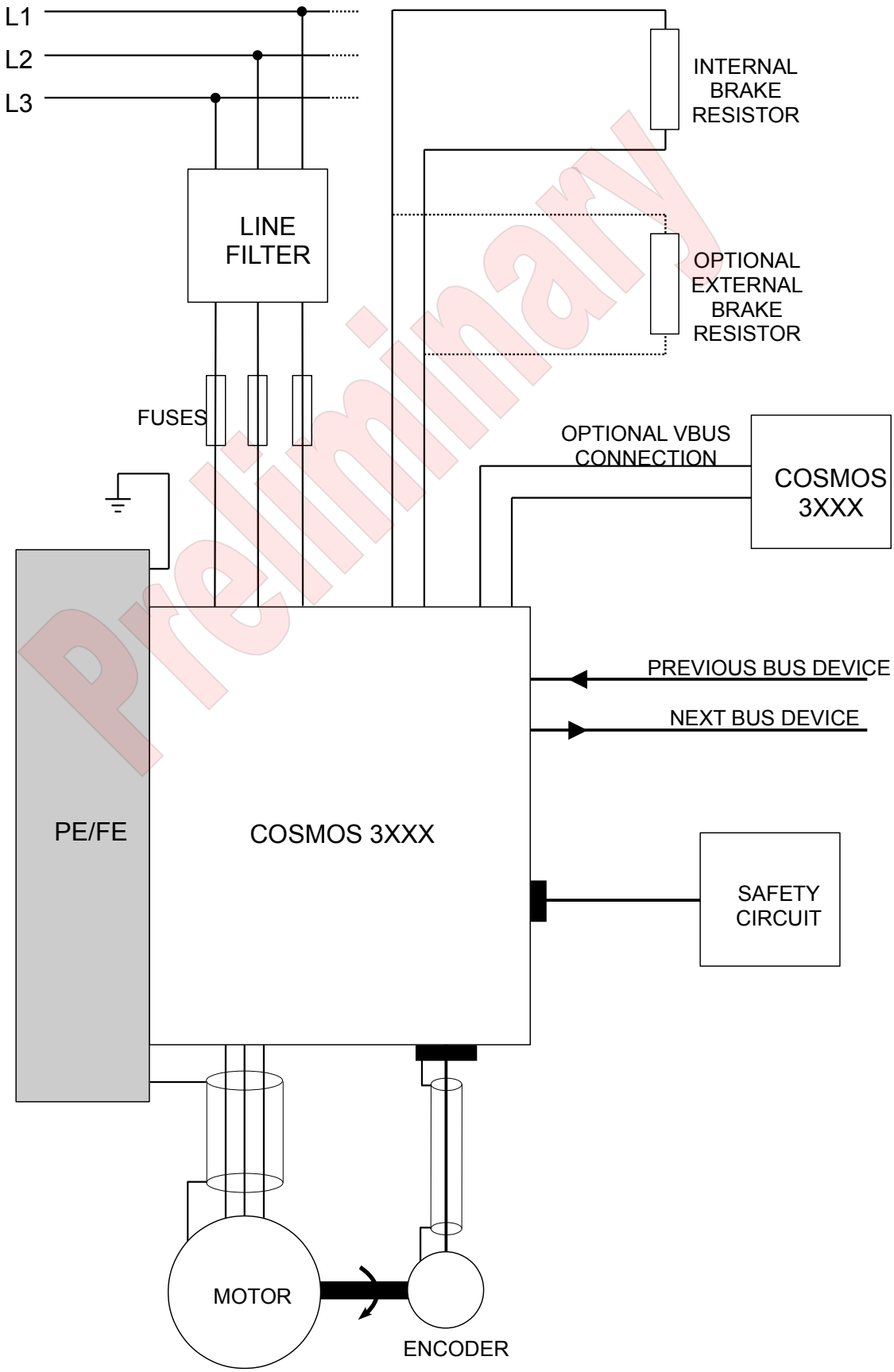
This is a specific connection for the operator interface VISIO 3000.

5.3.11 USB (USB)

This connection is a standard USB port 2.0 for firmware updating and diagnostic purposes. The connector type installed in the driver is 5-pin USB Mini-B, very common in hand-held devices.

The USB port must be used exclusively for diagnostic purposes or for firmware updating. It is not allowed during the driver normal operation.

5.4 Wiring diagram



5.5 Choice of the wires and fuses

The below chart shows the size of the power supply cables and fuses; the values refer to ambient temperature equal to 40°C and to PVC insulated wires.

Input current [A]	Minimum section [mm²]	Maximum fuse rating [A]
Cable laying mode: category B1 (in accordance with EN 60204-1). gG fuses.		
I < 8.5	1.5	10
8.5 ≤ I < 10.0	2.5	16
10.0 ≤ I < 17.0	4.0	20
I ≥ 17.0	6.0	25
Cable laying mode: category B2 (in accordance with EN 60204-1). gG fuses.		
I < 5.0	1.0	6
5.0 ≤ I < 8.5	1.5	10
8.5 ≤ I < 10.0	2.5	12
10.0 ≤ I < 17.0	4.0	20
I ≥ 17.0	6.0	25

6 Safety integrated system

6.1 Description

The drivers COSMOS 3000 are equipped with a circuit for the STO function (Safe Torque Off). This function, if enabled, allows the driver output to be disabled so that the driver cannot generate torque (or force, in case of linear motors). The motor will actually stop in a time that can vary according to the inertia or to the load mechanical features; if it were necessary to guarantee the stop of the mechanical device within a maximum time (example a load lifted by a pulley), it will be necessary to implement this function with additional systems.
Features:

- the intervention of the STO function totally excludes the driver possibility to control the motor
- there is no way to disable the safety function, either intentionally or unintentionally
- the STO system is equipped with two independent inputs; a break-down of one of the two channels does not interfere with the operation of the other channel
- the two inputs are powered by the same power supply, independent from any other power supplies of the driver
- the STO system was designed to tolerate 1 hardware break-down
- the level of safety integrity is SIL2 with PFH (Probability of random Failure per Hour) < $1x10^{-9}$
- The STO mission time is 20 years
- The required ambient conditions, the use and maintenance are the same as those required by the driver.

In order to guarantee the required safety degree, it is necessary to adequately control the signals, for example by using a certified safety PLC.

6.2 Operation

6.2.1 Signals

The below chart shows the wiring and meaning of the signals.

Signal	Description
24V	Positive power supply for the safety circuit section
GND	Mass of the power supply of the safety circuit section and reference for the inputs
EN1	Enable 1 signal, active at high logical level (24V = enabled, 0V = disabled)
EN2	Enable 2 signal, active at high logical level (24V = enabled, 0V = disabled)
FBK-FBK	Potential free contact; open, in case of safety system failure

6.2.2 Electrical specifications

Mains voltage	24V -15% ÷ +20%, with a ripple with a peak value equal to 5% of the rated value (extreme values equal to respectively 19.2 and 30.0 V)
EN1 and EN2 inputs	Type 1 and type 3 in accordance with IEC61131-2 standards
EN1 and EN2 limits	V_{IL}=5,0V max.; V_{IH}= 15,0V min.
Ammissible voltage EN1 e EN2	30V max.
Absorbed current EN1 e EN2	5.5 mA max. each
Ammissible voltage FBK-FBK	30V max.
Ammissible current FBK-FBK	500mA max.

6.2.3 System status

The below chart shows the safety circuits possible statuses.

24V	EN1	EN2	[SAFETY CIRCUIT]	I1	I2	TO	FBK-FBK	[TORQUE]
<16V	X	X	X	X	X	OFF	OPEN	DISABLED
>31V	X	X	X	X	X	OFF	OPEN	DISABLED
OK	OFF	OFF	OK	OFF	OFF	ON	CLOSE	DISABLED
OK	ON	OFF	OK	ON	OFF	ON	CLOSE	DISABLED
OK	OFF	ON	OK	OFF	ON	ON	CLOSE	DISABLED
OK	ON	ON	OK	ON	ON	ON	CLOSE	ENABLED
OK	X	X	FAULTY	X	X	OFF	OPEN	DISABLED

X = Not consistent

The driver can be enabled only with a correctly powered safety circuit, free from failures, with EN1 and EN2 inputs active.

6.2.4 Intervention times

The drivers COSMOS 3000 feature the following intervention times.

$T_{t(off)}$	Time that elapsed between the safety inputs disabling and the STO function intervention	< 100ms
$T_{flt(off)}$	Time that elapsed between the failure detection in the safety circuit and the STO function intervention	< 100ms
$T_{mot(off)}$	Time that elapsed between the STO function activation and the actual motor stop	Depending on the motor and on the load

7 Operator interface

The operator interface of the COSMOS 3000 (where present) is the VISIO 3000, consisting of an alphanumeric display with 2 rows of 8 characters each and 4 directional keys. The VISIO is installed on the front side of the driver and is connected to the HMI.

7.1 Function of the keys

◄	Navigation: by pressing the left arrow, you go back to the upper level menu. If you are in the main menu, the device status will be displayed. By pressing this key again, the firmware version and the driver model will be displayed. Data modification: it shifts the tab on the figure on the left side of the displayed figure. If the tab is already on the figure on the extreme left, no shift occurs. It is possible to eliminate a modification, while it has not been confirmed yet, by pressing this key for 1 second.
►	Navigation: by pressing the right arrow, you go to the lower level menu. The items accepting a lower value, that is to say a submenu, are indicated by ">". The active entry is situated on the first row of the LCD. Data modification: by pressing this key for at least 1 second, you activate the mode to modify the selected parameter (hereinafter indicated by the symbol). This mode is identified by the presence of the tab below the character situated at the extreme right: by pressing this key, you shift the tab on the figure on the right side of the displayed figure. If the tab is already on the figure on the extreme right, no shift occurs. In order to confirm the modification, press this key for at least 1 second.
▲	Navigation: By pressing the arrow "upwards", you go to the previous entry of the current menu. If you are at the first entry of the main menu, you go back to the driver status message. Data modification: it increases the figure on which the tab is positioned. If the figure reaches the maximum value, the LCD will try to increase the figure on the left, if it is not already at its maximum value.
▼	Navigation: by pressing the arrow "downwards", you go to the next entry of the current menu. The end of the list of the entries in the menu is displayed by a series of hyphens (-). Data modification: it decreases the figure on which the tab is positioned. If the figure reaches the minimum value, the LCD will try to decrease the figure on the left, if it is not already at its minimum value.

7.2 Interaction

The menus displayed by the LCD are organized in a hierarchic way. From the status message, it is possible to enter the main menu by pressing ► or ▼.

For the parameters, there is an access level classification: as a consequence, each datum can be matched to a protection level. In order to shift to the next level, you must enter a password, by using the special function.

7.2.1 Status message

As soon as you supply the auxiliary power or you push the navigation key ◄ in the main menu, a message will be displayed for 2 seconds: the first row of the message will indicate the driver model, called ASI if the device controls an asynchronous motor or BRU if the device controls a brushless motor; the second row will display the firmware version.

```
ASI 3150
VER 3.00
```

Then, the LCD will display the status message, where you can find information about the status of the field bus and of the driver.
The status message is automatically displayed also during the navigation in the menus, when an error condition occurs. In this case, by pressing any key you will go back to the entry previously displayed.
The LCD also includes a time function which automatically returns to the welcome message if no key is pressed for more than 5 minutes.

```
NO POWER
001 PN D
```

The first row indicates the driver status, according to the following chart:

NO POWER	The device is waiting for the main power supply
DISABLED	The driver is disabled: the main power supply is present and the driver is waiting for the enabling command
ENABLED	Driver enabled
ERROR xx	Error condition: xx is the code identifying the error; see following chapters, in order to decode the error

The second row displays the field bus condition and is strictly depending on the communication protocol in use.

7.2.1.1 Field bus Sercos III

In case of field bus Sercos III, the row consists of 3 fields:

1. the first field consists of three numeric characters; it indicates the node address, expressed in decimal value (in the previous example: 001)
2. the second field consists of two alphanumeric characters indicating the Sercos communication phase (in the previous example: PN):
   - PN = the bus is not active: the device is waiting for initialization
   - P0 = the bus is in phase 0: the device is being initialized
   - P1 = the bus is in phase 1: the device is being initialized
   - P2 = the bus is in phase 2: the device is being initialized
   - P3 = the bus is in phase 3: the device is being initialized
   - P4 = the bus is in phase 4: in this phase the device is ready to work in realtime
   - PH = the device has been connected to a bus that is already active and is waiting for initialization (hot-plug)
3. the third field consists of only one alphanumeric character: it indicates the connection topology (in the previous example: D):
   - D = topology being identified (Detecting)
   - R = ring topology (Ring)
   - 1 = topology in line with master on port 1
   - 2 = topology in line with master on port 2

As far as topology is concerned, please note that the optimal operation condition, to be taken into consideration during the design phase, is the ring topology, because it guarantees the redundancy of master connection; in other words, should one of the two Ethernet connections be lacking, the driver can continue working without interruptions. In this

case, the displayed topology will change from R to 1 or 2, depending on the port from where the driver receives the data from the master.
If you select the topology in line, the driver will display 1 or 2, depending on the port from where the driver receives the data from the master.

7.2.1.2 Field bus FlxIO

NO COMM	The field bus is not active and the device is not in service mode
XXX.X Hz	The device is generating the frequency XXX.X; the field bus is active or in service mode

7.2.2 Access level

By selecting the item LEVEL in the main menu and by pressing the key ↵, you enter the function to insert the password, in order to modify the parameter access level.

```
LEVEL[1]
PW XXXXX
```

By means of the arrows, it is possible to enter the password, by confirming it by pressing the key ↵.
If the password is correct, the LCD will display a message of successful result and will display a new access level.

```
LEVEL[3]
PW RIGHT
```

By pressing any key, the LCD will return to the main menu.
Here are the passwords available for the user:

Level	Password
1	-
2	PROGR
3	TARAT
4	*>Reserved to SMITEC<*

If no key is pressed for 5 minutes, the system will return to level 1 and it will not be possible to modify the data any longer, unless you enter the password of the next level.

7.2.3 Main menu

The following chart shows the menu hierarchy, the entries displayed, the minimum level necessary for the modification and the description.

Menu	Entry	Lev.	Description
1	>PARAM	-	This section lists all entries that enable you to set the driver parameters and displays the size units measured by the driver.
2	LEVEL	-	Modification of the access level

7.2.4 Measure menu

7.2.4.1 Models for brushless motor

Menu	Entry	Lev.	Description
1.1	>MEASURES	-	This section displays all size units measured by the driver; moreover, it stores the minimum or maximum values measured for some size units.
1.1.2	VBUS RMS [V]	-	Root mean square voltage
1.1.2	VBUS DC [V]	-	Rectified voltage
1.1.3	VBUS DC MIN [V]	-	Rectified minimum mains voltage
1.1.4	VBUS DC MAX [V]	-	Rectified maximum mains voltage
1.1.5	IQ RMS [A]	-	Root mean square direct current
1.1.6	IQ MAX [A]	-	Maximum direct current
1.1.7	ID RMS [A]	-	Root mean square reverse current
1.1.8	ID MAX [A]	-	Maximum reverse current
1.1.9	IQ RMS MEAN [A]		
1.1.10	IRMS MEAN MAX[A]		
1.1.11	SPEED [rpm]	-	Motor rotation speed
1.1.12	SPEED MAX [rpm]		
1.1.13	SPEED REF [rpm]	-	Preset motor rotation speed
1.1.14	TORQUE [Nm]	-	Torque generated by the motor
1.1.15	TORQUE MAX [Nm]	-	Maximum torque generated by the motor
1.1.16	DRIVE TEMP [°C]	-	Driver dissipator temperature
1.1.17	DRIVE TEMP MAX [°C]	-	Maximum driver dissipator temperature
1.1.18	MOTOR TEMP [°C]	-	Motor temperature
1.1.19	MOTOR TEMP MAX [°C]	-	Maximum motor temperature
1.1.20	BRAKE TEMP [°C] [1]	-	Dynamic brake resistor temperature
e1.1.21	BRAKE TEMP MAX [°C] [1]	-	Dynamic brake resistor maximum temperature
1.1.22	BOARD TEMP [°C]	-	Logic board temperature
1.1.23	VDC MAIN [V]	-	Auxiliary voltage
1.1.24	MEASURE RESET	1	Elimination of the maximum and minimum values recorded Options=No, Yes

Note 1: only for models with dynamic brake

7.2.4.2 Models for asynchronous motor

Menu	Entry	Lev.	Description
1.1	>MEASURES	-	This section displays all size units measured by the driver; moreover, it stores the minimum or maximum values measured for some size units.
1.1.2	VBUS RMS [V]	-	Root mean square voltage
1.1.2	VBUS DC [V]	-	Rectified voltage
1.1.3	VBUS DC MIN [V]	-	Rectified minimum mains voltage
1.1.4	VBUS DC MAX [V]	-	Rectified maximum mains voltage
1.1.5	IRMS [A]	-	Root mean square current
1.1.6	IRMS MAX [A]	-	Root mean square maximum current
1.1.7	SPEED [rpm]	-	Motor rotation speed
1.1.8	SPEED MAX [rpm]	-	Maximum value detected of motor rotation speed
1.1.9	DRIVE TEMP [°C]	-	Driver dissipator temperature
1.1.10	DRIVE TEMP MAX [°C]	-	Maximum driver dissipator temperature
1.1.11	MOTOR TEMP [°C]	-	Motor temperature
1.1.12	MOTOR TEMP MAX [°C]	-	Maximum motor temperature
1.1.13	BRAKE TEMP [°C] [1]	-	Dynamic brake resistor temperature
1.1.14	BRAKE TEMP MAX [°C] [1]	-	Dynamic brake resistor maximum temperature
1.1.15	BOARD TEMP [°C]	-	Logic board temperature
1.1.16	IRMS MEAN [A]	-	Average root mean square current in the last 4 minutes
1.1.17	IRMS MEAN MAX [A]	-	Maximum root mean square current in the last 4 minutes
1.1.18	VDC MAIN [V]	-	Auxiliary voltage
1.1.19	MEASURE RESET	1	Elimination of the maximum and minimum values recorded Options=No, Yes

Note 1: only in models with dynamic brake

7.2.5 Status menu

Menu	Entry	Lev.	Description
1.2	>STATUS	-	This section includes detailed information about the driver status.
1.2.1	DRIVE STATE	-	Driver status; see chapter 9.2 in order to decode any errors
1.2.2	LAST ERRORS	-	List of the last 3 errors; chapter 9.2 in order to decode any errors
1.2.3	ERROR LIST CLEAR	1	Elimination of the error list. Options=No, Yes
1.2.4	HARDWARE STATE	-	It displays hardware diagnostic information

7.2.6 Control menu

7.2.6.1 Models for brushless motor

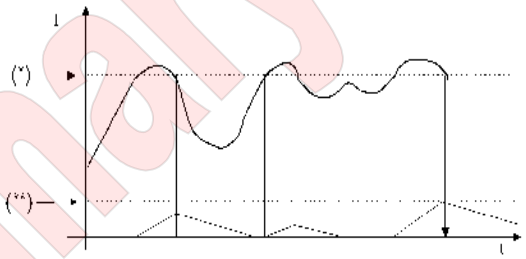
Menu	Entry	Lev.	Description
1.3	>CONTROL	-	This section includes the controller setting and the parameters of the driver control system.
1.3.1	CONTROLLER	3	It defines the driver control mode. Options=Sercos, Service
1.3.2	TORQUE LIMIT[Nm]	2	Torque limit that the motor can generate in this application; this value must be absolutely inferior to the maximum torque indicated by the supplier of the motor and set in the parameter TORQUE MAX [1.4.7]; also refer to parameter KT [1.4.17] in order to determine the maximum current required by the motor. Min=0.00Nm, Max=+58.00Nm
1.3.3	SPEED LIM+ [rpm]	2	Motor speed positive limit Min=0rpm, Max=+7000rpm
1.3.4	SPEED LIM- [rpm]	2	Motor speed negative limit. Min=0rpm, Max=-7000rpm
1.3.5	TORQUE LIM TIME [s]	2	Torque time limit: if the motor torque exceeds the limit value set in TORQUE LIMIT [1.3.2], a timer is increased; as soon as the torque returns below the limit, the timer is decreased. If the total time marked by this timer exceeds the value set in this parameter, the error "Torque time limit exceeded" is displayed. Broadly speaking, a heavy load for a longer time than the limit value will cause the motor disabling and the generation of an error state. Thanks to this parameter, it is possible to find out any jams and/or collisions of mechanical components. Min=0.0s, Max=+32.0s

1.3.6	KPV [A/rpm]	2	Speed proportional gain. The driver continuously detects the rotor speed and compares it to the reference speed rate. The difference between the two values is multiplied by the proportional gain, in order to determine the proportional current. This value of the current is summed up to the current due to the integrative gain. These two values determine the motor current. The higher the difference of speed is, the more the current in the motor is. Through this process, if it is continuous, the motor tends to assume the reference speed, even when the load conditions applied to the motor change. The proportional gain must be usually determined for each specific case, according to the motor application. This value is strongly influenced by the inertial mass applied to the motor shaft. The more the mass is, the lower the gain will be. In the practical tests, it is necessary to find out the gain empirically, by progressively increasing the value, until the motor begins to be unsteady, depending on the motor noise and vibrations. Once you reached the limit, decrease the gain by 10–20%, as a safety margin. Larger size motors usually show higher values than smaller size motors. Min=0.000A/rpm, Max=+3.430A/rpm
1.3.7	KIV [A/G]	2	Speed integrative gain. The angular difference between the reference and the rotor is integrated and multiplied by this factor, in order to determine the integrative current. This current value is summed up to the current due to the proportional gain. They altogether determine the motor current. If you integrate the angular speed within the time, you will obtain an angle; as a consequence, it is possible to express this factor in Ampere per degree; in fact, if you set a speed rate of 1000 rpm and you set this value at 1, the current in the motor will increase by 1 ampere when the rotor slows down and loses 1 degree. Thanks to this datum, it is possible to adjust the rotor speed in a very precise way, with consequent great advantages, especially for the applications requiring high stability while running. Please note that this value is directly proportional to the proportional gain; therefore, it is not possible to set an integrative gain without a proportional gain. This parameter has one negative effect on the motion, especially at low speed rates: hunting. It is necessary to find the correct value of integrative gain, after determining the proportional gain, by progressively increasing it until the hunting begins. Once you reached the limit, decrease the gain value by 10–20%, as a safety margin, as you did for the proportional gain. Min=0.0A/Gr, Max=+540.4A/Gr

1.3.8	KPP [rpm/G]	2	Position proportional gain. The driver continuously detects the rotor position and compares it to the reference position. The difference between the two values is multiplied by the proportional gain, in order to determine the proportional speed. The higher the position difference is, the higher the speed rate applied to the motor will be. Through this process, if it is continuous, the motor tends to assume the reference position, even when the load conditions applied to the motor change. The proportional gain must be usually determined for each specific case, according to the motor application. This value is strongly influenced by the inertial mass applied to the motor shaft. The more the mass is, the lower the gain will be. In the practical tests, it is necessary to find out the gain empirically, by progressively increasing the value, until the motor begins to be unsteady, depending on the motor noise and vibrations. Once you reached the limit, decrease the gain by 10–20%, as a safety margin. Min=0.0rpm/Gr, Max=+2500.4rpm/Gr
1.3.9	KDP []	2	Reserved.
1.3.10	VRMS NOMINAL[V]	3	Driver rated voltage. This value indicates the driver power supply. If the rated voltage of the selected motor is not included in the value range set for the driver, the error "Motor voltage different from driver voltage" will be displayed. Min=0V, Max=+1000V
1.3.11	USE EXT BRAKE	3	Use of the external brake resistance. It enables you to determine whether to use the internal resistance or the external one. Options=No, Yes
1.3.12	CHECK 3PH LINE	3	It enables the control of absence of one or more phases of input line voltage. Options=No, Yes
1.3.13	PWM FREQ [KHz]	3	It sets the switching frequency of the motor output; the higher the frequency is, the more the energy losses are, causing the motor heating; the higher the frequency is, the lower is the noise generated by the switching. Options=4, 8, 12, 16 kHz
1.3.14	CONTROL MODE	-	It displays whether the control is in position, in speed or in torque.

7.2.6.2 Modells for asynchronous motor

Menu	Entry	Lev.	Description
1.3	>CONTROL	-	This section includes the controller setting and the parameters of the driver control system.
1.3.1	CONTROLLER	3	It determines the driver control mode. Options=FLXIO, Service
1.3.2	ACC RAMP [Hz/s]	2	Frequency ramps acceleration value
1.3.3	DEC RAMP [Hz/s]	2	Frequency ramps deceleration value
1.3.4	FREQ MIN [Hz]	2	Minimum frequency that can be generated by the driver, expressed in hertz. Together with the value VRMS MIN, it determines one of the points defining the line V/f that determines the voltage generated depending on the required frequency.
1.3.5	FREQ NOM [Hz]	2	Rated frequency in hertz. Together with the value VRMS NOM, it determines one of the points defining the line V/f that determines the voltage generated depending on the required frequency.
1.3.6	FREQ MAX [Hz]	2	Maximum frequency that can be generated by the driver, expressed in hertz. By setting higher references, the driver generates this frequency.
1.3.7	VRMS MIV [V]	2	rms voltage, expressed in volt, at minimum frequency. Together with the value FREQ MIN, it determines one of the points defining the line V/f that determines the voltage generated depending on the required frequency.
1.3.8	VRMS NOM [V]	2	Rms voltage, expressed in volt, at rated frequency. Together with the value FREQ NOM, it determines one of the points defining the line V/f that determines the voltage generated depending on the required frequency.

1.3.9	IRMS LIMIT [mA]	2	Current limit value, calculated by the driver in order to generate the error 18. The driver takes into consideration the lowest rms current value among the current values of the motor and of the driver. This value is considered as the maximum limit value. In this menu, the rms limit current (*) can be set up to the maximum value. By confirming the set value, it is possible to apply an approximation. Error 18 occurs when the motor torque exceeds the maximum torque set for a longer time than the pre-set time [1.3.5]:  When the current level exceeds the maximum value (*), the timer increases. When the current returns below the maximum level, the timer decreases. If the timer exceeds the pre-set value (**), the error signal is enabled. This is a safety function that the user has at his disposal in order to protect the application.
1.3.10	I TIME LIMIT[mS]	2	Time limit for exceeding the limit current(**). This is the time limit for the generation of error 18.
1.3.1	DIRECTION	2	Motor rotation direction. This parameter enables you to adjust the motor rotation direction to the pre-set reference. Options=Normal, Inverted.
1.3.12	CHECK 3PH LINE	3	It enables the check of absence of one or more phases of input line voltage. Options=Enabled, Disabled.
1.3.13	PWM FREQ [Khz]	3	It sets the switching frequency of the motor output; the higher the frequency is, the more the energy losses are, causing the motor heating; the higher the frequency is, the lower is the noise generated by the switching. Options= 4, 8, 10, 12, 16 kHz.

7.2.7 Motor menu

7.2.7.1 Models for brushless motor

Menu	Entry	Lev.	Description
1.4	>MOTOR	-	In this section it is possible to set the motor type in use and the corresponding parameters
1.4.1	MODEL VVV SSSS	3	Motor model. The first row indicates the model/identification code of the motor you are going to use; the second row displays the data concerning the phase voltage and rated speed. These data can be modified by the next parameters. Options: motor homologated models
1.4.2	VRMS NOM [V]	3	Rms rated voltage indicated by the motor supplier. Min=0V, Max=+1000V
1.4.3	VP MAX [V]	4	Maximum peak voltage that the motor winding can tolerate.
1.4.4	IRMS NOM [A]	4	Rms rated current of motor phase.
1.4.5	I MAX [A]	4	Maximum rms current of motor phase.
1.4.6	TORQUE NOM [Nm]	4	Rated torque generated by the motor.
1.4.7	TORQUE MAX [Nm]	4	Maximum rated torque generated by the motor.
1.4.8	SPEED NOM [rpm]	3	Rated speed indicated by the motor supplier. Min=0rpm, Max=+7000rpm
1.4.9	SPEED MAX [rpm]	3	Motor maximum speed, expressed in rpm; beyond this value, the error "too high speed" is displayed immediately. It is recommended to set this value at 100-200 rpm besides the maximum speed required by the application. This parameter is a protection for the mechanical components and for the motor, in case of jams and/or not correct setting. Min=0rpm, Max=+7000rpm
1.4.10	TEMP MAX[°C]	3	Motor maximum temperature; beyond this value, the error "motor temperature: too high" is displayed. This parameter is important for the protection of the motor; this value must be set by the supplier. The supplier's setting is 105°C, but the motor class generally allows you to reach up to 120°C. It is recommended to reach this limit only in the applications which require the maximum power of the motor and anyway after discussing the matter with the supplier. Min=0°C, Max=+155°C
1.4.11	PAIR POLE NUMBER	4	Number of motor poles
1.4.12	ENCODER PULSE	4	Number of impulses of the encoder revolution
1.4.13	NTC TYPE	4	NTC type present in the motor
1.4.14	KP [V/A]	4	Proportional gain of the current ring.
1.4.15	KPI []	4	Integrative gain of the current ring.
1.4.16	FCEM [V/rpm]	4	Counter-electromotive force generated by the motor.

1.4.17	KT [Nm/A]	4	Torque constant. This parameter determines the formula between the motor torque and current: T[Nm] = KT · Ieff[A].
1.4.18	OF-Θ [G]	4	Reserved.
1.4.19	K-Θ/I [G/A]	4	Reserved.

7.2.7.2 Models for asynchronous motor

Menu	Entry	Lev.	Description
1.4	>MOTOR	-	In this section it is possible to set the parameters of the motor type in use.
1.4.1	I RMS [mA]	3	Motor rated current.
1.4.2	I PEAK MAX [mA]	3	Motor maximum peak current. This is the limit for the maximum instant current that can be supplied to the motor. This parameter is a protection for the application.
1.4.3	NTC TYPE	3	It selects the type of NTC sensor for detecting the motor temperature. Options: None (NTC absent), B57227K.
1.4.4	TEMP MAX [°C]	3	Maximum temperature allowed for the motor. Min 0°C, Max 155 °C.

7.2.8 Service menu

The service menu is present only when the parameter CONTROLLER is set as SERVICE [1.3.1].

7.2.8.1 Models for brushless motor

Menu	Entry	Lev.	Description
1.5	>SERVICE	-	This section includes the parameters for controlling the motor by means of the VISIO.
1.5.1	DRIVE STATE	-	Driver status; see chapter 9.2 in order to decode any errors
1.5.2	ERROR RESET	3	Error cancellation. If the error is irretrievable or the problem is not solved, the error will recur again. Options=No, Yes
1.5.3	CONTROL MODE	-	Motor control mode in SERVICE mode.
1.5.4	ENABLE DRIVE	3	Driver enabled to SERVICE mode. If the driver is not in error state, it will be possible to enable it, by setting this entry. In this case, the motor will be energized. If the values of the parameters RAMP and SPEED REF, [1.5.5] and [1.5.6], are different from zero, the motor will be operated. WARNING: if the setting of the parameters RAMP and SPEED REF is carried out while the driver is disabled, no ramp will be executed, but the system will try to reach the final speed as soon as it is enabled. Options:No, Yes
1.5.5	RAMP [rpm/s]	3	It determines the acceleration/deceleration ramp of the motor for the mode "SERVICE controllo VELOCITY". Min=0rpm/s, Max +3500rpm/s
1.5.6	SPEED REF [rpm]	3	It sets the motor speed for the mode "SERVICE controllo VELOCITY". Min=-3500rpm, Max=+3500rpm
1.5.7	SPEED [rpm]	-	Motor rotation speed

7.2.8.2 Models for asynchronous motor

Menu	Entry	Lev.	Description
1.5	>SERVICE	-	In this section it is possible to command the motor and set some parameters locally, by means of the interface VISIO 3000. For this purpose, it is necessary to set the parameter CONTROLLER as SERVICE [1.3.1].
1.5.1	ERROR RESET	3	It allows you to come out from the error condition. Options:No, Yes.
1.5.2	ENABLE DRIVE	3	It allows you to enable or disable the driver. Options: Enabled, Disabled.
1.5.3	ACC RAMP [Hz/s]	3	Frequency ramps acceleration value
1.5.4	DEC RAMP [Hz/s]	3	Frequency ramps deceleration value
1.5.5	FREQ REF [Hz]	3	It allows you to set the speed reference within a range from -128,0 to +128,0 Hz.

1.5.6	FREQ OUT [Hz]	-	It displays the voltage frequency actually generated by the driver.
1.5.7	SPEED [rpm]	-	If present, the encoder displays the motor rotation speed expressed in revolutions per minute.
1.5.8	DIRECTION	3	Motor rotation direction. This parameter allows you to adjust the motor rotation direction to the pre-set reference. Options=Normal, Inverted.

7.2.9 External brake menu

The external brake menu is present only if the model is equipped with the dynamic brake output.

7.2.9.1 Models for brushless motor

Menu	Entry	Lev.	Description
1.6	>E-BRAKE	-	This section includes the parameters for the external brake resistor.
1.6.1	RESISTANCE[Ω]	3	This is the value expressed in ohm of the resistor connected externally. This parameter is set by the supplier. Min=+30Ω, Max=+500Ω
1.6.2	RTH [°C/W]	3	Thermal coefficient of the external resistance. It represents the temperature increase, expressed in °C, depending on the power that the resistor must dissipate, expressed in W. The best dissipation conditions are possible with low values of this constant. This datum is set by the supplier. Min=+0.1°C/W, Max +10.0°C/W
1.6.3	ENV TEMP [°C]	3	Average ambient temperature at which the external resistor is situated. Min=0°C, Max=+500°C
1.6.4	POWER NOM [W]	3	Rated power that can be dissipated by the external resistor. This datum is set by the supplier. Min=0W, Max=+20000W
1.6.5	TEMP MAX [°C]	3	Maximum temperature that can be reached by the external resistor. If this limit is overtaken, the error "Brake resistance temperature too high" is displayed. This datum is set by the supplier. Min=0°C, Max=+350°C

7.2.9.2 Models for asynchronous motor

Menu	Entry	Lev.	Description
1.6	>E-BRAKE	-	This section includes the parameters for the external brake resistor.
1.6.1	USE EXT BRAKE	3	This parameter allows you to select the external brake resistance, in order for the driver to be able to apply the correct thermal model for measuring the temperature of the external brake resistance according to parameters [1.6.2] and [1.6.4].
1.6.2	RESISTANCE [Ω]	3	This is the value expressed in ohm of the resistor connected externally. This parameter is set by the supplier. Min=+30Ω, Max=+500Ω
1.6.3	POWER NOM [W]	3	Rated power that can be dissipated by the external resistor. This datum is set by the supplier. Min=0W, Max=+20000W

1.6.4	RTH [°C/W]	3	Thermal coefficient of the external resistance. It represents the temperature increase, expressed in °C, depending on the power that the resistor must dissipate, expressed in W. The best dissipation conditions are possible with low values of this constant. This datum is set by the supplier. Min=+0.1°C/W, Max +10.0°C/W
1.6.5	MAX TEMP [°C]	3	Maximum temperature that can be reached by the external resistor. If this limit is overtaken, the error "Brake resistance temperature too high" is displayed. This datum is set by the supplier. Min=0°C, Max=+350°C
1.6.6	ENV TEMP [°C]	3	Average ambient temperature at which the external resistor is situated. Min=0°C, Max=+150°C

7.2.10 Driver menu

7.2.10.1 Models for brushless motor

Menu	Entry	Lev.	Description
1.7	>DRIVE	-	This section includes the parameters for the driver configuration.
1.7.1	MODEL	-	Code indicating the driver features, as per chapter 4.2.2.
1.7.2	VRMS NOMINAL[V]	3	Rms rated voltage for the driver. This parameter must be set according to the mains voltage. The value must coincide with the rms rated voltage of the selected motor [1.4.2]. Otherwise, the error 21 will occur (motor voltage different from driver voltage). Min=+230V, Max=+480V
1.7.3	VBUS DC MAX [V]	4	Maximum DC BUS voltage, beyond which the error 10 occurs (DCBUS voltage beyond maximum limit).
1.7.4	VBUS DC MIN [V]	4	Minimum DC BUS voltage, below which the error 14 occurs (DCBUS voltage too low).
1.7.5	VDC BRAKE ACT[V]	4	DC BUS voltage for the intervention of the brake resistor.
1.7.6	IRMS NOM [A]	3	It sets the rms rated current that will be supplied to the driver. This parameter allows you to limit the current depending on the application to be controlled and according to the exigencies of thermal dissipation. Min=+0.01A, Max=depending on the model and on the switching frequency.
1.7.7	IRMS MAX [A]	4	Maximum rms current that can be supplied by the driver.
1.7.8	SPEED MAX[rpm]	4	Maximum motor rotation speed that can be controlled by the driver.
1.7.9	DRIVE TEMP MAX [°C]	4	Maximum temperature allowed for the driver dissipator.
1.7.10	INT BRAKE TMAX [°C]	4	Maximum temperature allowed for the internal brake resistor.

1.7.11	USE EXT BRAKE	3	Use of the external brake resistor. It allows you to determine whether to use the internal resistor or the external one. If it is set at "No", the driver will use the internal resistor; if it is set at "Yes", the driver will use the external one. Warning: if you set the external resistor use, but you connect the internal one, you can damage it. Options: No, Yes
1.7.12	DISABLE FAN ERR	4	It disables the error of the cooling fan speed.
1.7.13	DISABLE VDC ERR	4	It disables the error of 24 Volt power supply.

7.2.10.2 Models for asynchronous motor

Menu	Entry	Lev.	Description
1.7	>DRIVE	-	In this section you can set the driver parameters.
1.7.1	MODEL	-	Code indicating the driver features, as per chapter 4.2.2.
1.7.2	VRMS NOM [V]	3	Driver rated voltage. This parameter determines the voltage limits, in order to enable the driver.
1.7.3	I RMS NOM [mA]	4	Rms rated current that the driver can supply. This parameter depends on the driver model and on the pwm frequency.
1.7.4	I PEAK MAX [mA]	4	It displays the maximum peak current that the driver can supply.
1.7.5	FAN TEMP ON [°C]	3	It sets the temperature for the activation of the cooling fan. For the models equipped with brake resistance, the fan intervention is immediate.
1.7.6	DRIVE TEMP MAX [°C]	4	It sets the maximum temperature for the driver operation. Default 100°C. Min 0°C, Max 155°C
1.7.7	DISABLE VDC ERR	4	It disables the error of 24 Volt power supply.

7.2.11 Ethernet menu

The Ethernet menu is present only in models equipped with controller Sercos III.

Menu	Entry	Lev.	Description
1.8	>ETHNET	-	In this section it is possible to display the Ethernet connection parameters.
1.8.1	MAC ADDR	-	It displays the mac address.
1.8.2	IP ADDR	-	It displays the ip address.
1.8.3	ENABLE DHCP	4	It enables the DHCP client.

7.2.12 Encoder menu

The encoder menu is present only in the models for asynchronous motor.

Menu	Entry	Lev.	Description
1.9	>ENCODER	-	This section includes the parameters for the encoder.
1.9.1	ENCODER TYPE	3	Type of encoder present. Options: None, Incr.
1.9.2	ENCODER DIR	3	Encoder direction. This parameter gives you the possibility to reverse or not the reference given by the encoder. Options: Normal, Inverted.
1.9.3	ENCODER RES	3	Number of impulses of the encoder revolution. This parameter is essential for a correct detection of the motor rotation speed [1.1.7].

7.2.13 VISIO menu

7.2.13.1 Models for brushless motor

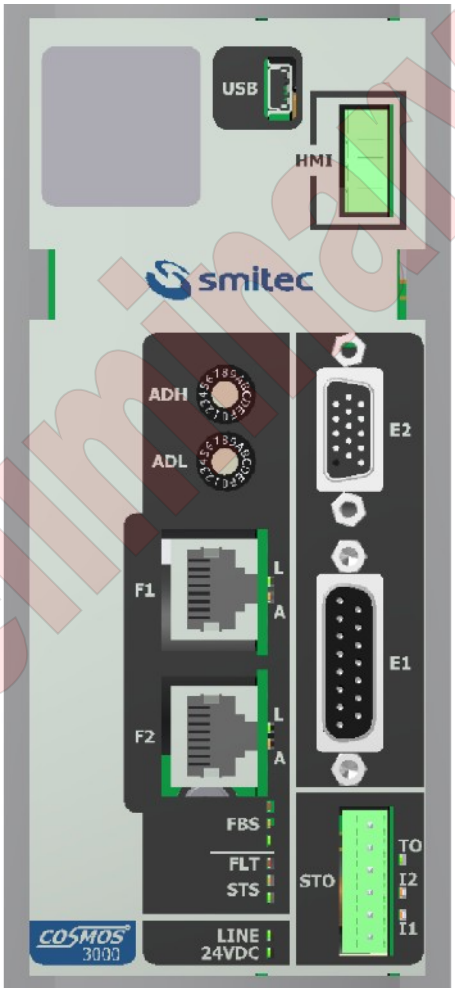
Menu	Entry	Lev.	Description
1.10	>VISIO	-	This section includes the operation options of the VISIO 3000.
1.10.1	ALWAYS LIGHT ON	1	It sets the LCD lighting always on or with the possibility to switch off by means of a timer. By setting "No", the light will switch off after some minutes of inactivity. Options: No, Yes
1.10.2	RESET DISPLAY	1	It sets the return to the status display, by means of a timer. By setting "Yes", the driver status will be displayed after 5 minutes of inactivity. Options: No, Yes

7.2.13.2 Models for asynchronous motor

Menu	Entry	Lev.	Description
1.10	>VISIO	-	This section includes the operation options of the VISIO 3000.
1.10.1	LANGUAGE	2	It sets the language of the messages. Options: English, Italian.
1.10.2	ALWAYS LIGHT ON	1	It sets the LCD lighting always on or with the possibility to switch off by means of a timer. By setting "No", the light will switch off after some minutes of inactivity. Options: No, Yes

8 LEDs and address

The drivers COSMOS 3000 are equipped with several status LEDs and with selectors for the field bus address setting.
The LEDs are of different colours and are grouped according to their function, in order to be easily understood; the number and colour depends on the COSMOS models, according to the integrated field bus.
Also the number of address selectors changes according to the integrated field bus and can vary from 0 to 2.



8.1 Address setting

As you know, the field buses need to identify the devices connected to them in an unequivocal way, in order to ensure a precise data communication. In the drivers COSMOS 3000, equipped with field bus, the identification (address) is set by means of the rotary selector situated on the front side; the address must be unequivocal; the selector features hexadecimal notation.
Here is the decimal-to-hexadecimal conversion table:

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

If only one selector (ADL) is present, the address will correspond to the number selected by the selector arrow.
If there are two selectors (ADL and ADH), the address will correspond to the number selected by the ADH arrow, multiplied by 16 and summed up to the number selected by the ADL arrow. Therefore:

*Address = ADH*16 + ADL*

The address 0 can not be used.

Example 1: ADH set on A, ADL set to 5; the hexadecimal address is A5, the decimal address is 10*16 + 5 = 165

Example 2: ADH set to 7, ADL set on E; the hexadecimal address is 7E, the decimal address is 7*16 + 14 = 126

Example 3: ADH set to 0, ADL set on B; lthe hexadecimal address is 0B, the decimal address is 0*16 + 11 = 11

8.2 LEDs "LINE" and "24VDC"

The two LEDs "LINE" and "24VDC" indicate the status of the main power supply (LINE) and auxiliary power supply (24VDC).

LINE	24VDC	LINE	24VDC
<50V	X	OFF	X
>50V and < VDC BUS MIN	X	FLASH	X
>VDC BUS MIN	X	ON	X
X	<~16V	X	OFF
X	>~16V and <20,4	X	FLASH
X	>21,4	X	ON

X = Not consistent

If the main power supply LINE is inferior to VDC BUS MIN, the driver is disabled.
If the auxiliary power supply 24VDC is inferior to 20,4V, the driver might not operate correctly.

8.3 LEDs "FLT" and "STS"

FLT and STS are LEDs indicating the driver general status.
FLT (fault) consists of a red LED, while STS (status) consists of an orange LED and a green LED.

Status	FLT	STS	
Hardware error or critical firmware	ON	Seq.	Seq.
Driver retrievable error	OFF	Seq.	Seq.
Driver ready	OFF	OFF	OFF
Driver enabled	OFF	OFF	ON

If the STS LEDs are flashing, the following sequence occurs:

Seq.	Meaning	STS	
1	Error code start	FLASH	FLASH
2	It indicates the tens in the error code	FLASH D	OFF
3	It indicates the units in the error code	OFF	FLASH U
4	Repetition of the sequence from point 1		

After the simultaneous flashing of the orange and green LEDs, count the number of flashing of the orange LED and you will obtain the number of tens in the error code; if you count the flashing of the green LED, you will obtain the number of units in the error code.

Example: 1 flashing of the orange LED, 4 flashing of the green LED: the error code will be 14.

See chapter 9.1 for the error decoding.

8.4 LEDs I1, I2 and TO

I1, I2 and TO concern the STO safety system. Their meaning is specified in details at paragraph 6.2.3.

8.5 LEDs A and L

The LEDs A and L concern the field bus connections (F1 and F2). The field bus FlxIO has no LED.

For the field bus Ethernet IP/Sercos III, the LEDs have the following meaning:

Meaning	A	L
Disconnected cable or no network signal	X	OFF
Network signal present, but data packs absent	OFF	ON
Network signal present, data packs present	FLASH	ON

8.6 LEDs FBS

FBS LEDs (fieldbus status) concern the field bus status; the number of LEDs and the colours depend on the integrated field bus.

8.6.1 Field bus FlxIO

Status	FBS		
Field bus firmware updating	ON		FLASH S
Field bus hardware error	ON		ON
Field bus hardware error	ON		OFF
Field bus initialization	OFF		FLASH S
Field bus communication error	OFF		FLASH Q
Field bus Master not active or regular communication	OFF		ON

FLASH S = 1Hz, FLASH Q = 8Hz

8.6.2 Field bus Sercos III

The signal is given according to the specifications included in the document "Generic Device Profile" version 1.1.2.1.1 dated 31 March 2009, developed by SERCOS III Working Group - TWG Profile".

Status	FBS		
On,CP4 no error, priority 0 (CPT stm)	OFF	OFF	ON
Loopback, changed from fast-forward to loopback, priority 2	OFF	OFF	FLASH
Communication error, depending S-0-1003, priority 0 (CPT stm)	FLASH	OFF	FLASH
SIII C1D, class 1 diagnosis, priority 1	ON	OFF	OFF
On, CP0..CP3, priority 0 (CPT stm)	OFF	ON	OFF
Identification, address allocation or configuration error or other identification purposes, priority 3	OFF	FLASH	OFF
Off, no Sercos communication, priority 0 (CPT stm)	OFF	OFF	OFF

8.6.3 Field bus Ethernet IP

TBD

9 Error codes

The drivers COSMOS 3000 include two series of error codes: one for the errors deriving from the control board and one for the errors deriving from external causes or from the power section.

9.1 Internal errors

These errors derive from the control circuits or from the firmware. They indicate critical problems which imply the stop of all the driver activities.
The error code is represented exclusively on the status LEDs (not on VISIO), according to the modes specified in chapter 8.3.

Cod.	Error	Description
01	FATAL_ERROR_INT_RAM	Error in the test of the internal RAM
02	FATAL_ERROR_INT_FLASH	Error in the test of the internal FLASH
03	FATAL_ERROR_EXT_RAM	Error in the test of the external RAM
04	FATAL_ERROR_EXT_FLASH	Error in the test of the external FLASH
05	FATAL_ERROR_ILLEGAL_OP	SW/HW error in the execution of the CPU instructions
06	FATAL_ERROR_ADDRESS	SW/HW error in the execution of the CPU instructions
07	FATAL_ERROR_NMI	Unexpected, non maskable interrupt HW
08	FATAL_ERROR_BANK	SW/HW error in the system interrupt control
09	FATAL_ERROR_MATH	SW/HW error in the execution of the CPU instructions
10	FATAL_ERROR_TRAPA	Unexpected interrupt SW
11	FATAL_ERROR_INT	Unexpected, maskable interrupt HW
12	FATAL_ERROR_TASK	Task creation OS error
13	FATAL_ERROR_RESOURCE	Resource allocation OS error
14	FATAL_ERROR_HW_TEMP	Internal temperature beyond the limits (>85°C)
15	FATAL_ERROR_HW_VOLTAGE	Reserved
16	FATAL_ERROR_FPGA	HW error in the FPGA setting
17	FATAL_ERROR_MODESET	Reserved
18	FATAL_ERROR_INIT	Application initialization error

9.2 Control errors

They are generated by external problems or by the driver power section.
An example of external problem could be the motor overload due to a too heavy mechanical load; an example for the errors due to power section could be the brake resistor overheating.

During the error condition the driver can not be enabled. It is necessary to carry out a specific procedure for the elimination of the error status; there are different procedures, according to the selected controller type.
An irretrievable error can not be cancelled by software procedures. Try to disconnect the auxiliary power supply from the driver and then connect it again. If the error persists, it might be necessary to replace it.

The error code is displayed on the VISIO and on the LEDs, according to the modes specified in chapter 8.3.

9.2.1 Models for brushless motor

Cod.	Error	Description
01	VRef beyond limits	**Irretrievable.** The detected value of the reference voltage is beyond the tolerance limits.
02	The currents are not balanced	**Irretrievable**. The sum of the three-phase currents of the motor are not balanced. The current may be wasted down to earth on the motor side and/or a current sensor module may be damaged.
03		Reserved.
04	NTC driver interrupted	The temperature sensor of the driver is interrupted.
05	NTC motor interrupted	The temperature sensor of the motor is interrupted. Make sure that the encoder cable is connected properly.
06	Motor temperature too high	The motor temperature exceeds the limit set in the parameter [1.4.10]. Make sure that the load applied to the motor is correct (no obstructions, nor frictions). If everything is ok or if you are testing the motor and it has not reached the operating temperature yet, it is recommended to increase the limit or to cool the motor. If these hypotheses are all to be discarded, it is recommended to replace the motor with one of a larger size.
07	Driver temperature too high	The temperature inside the driver is too high. It is recommended to increase the ventilation.
08	Intervention of protection	**Irretrievable**. This error signals the intervention of the hardware protection inside the power board. Here are the main causes: a) over-current in the output phases b) simultaneous conduction of IGBT c) power supply default on the IGBT Gates d) disturb current impulse There are several causes for these defects, both inside and outside the driver: motor cable, motor turning-up, wrong connections of the earth lines. If the error persists, it will be necessary to replace the driver.
09	Converter I out of limits	This error indicates that the data applied to the motor must be better calibrated or that the application requires too quick current increases which can not be controlled by the driver. While waiting for a more precise calibration of the parameters, please reduce the maximum speed rates and the speed increase fronts. Moreover, make sure that the pre-selected motor is the one actually in use.
10	DC BUS voltage exceeding the maximum limit	This error occurs if the brake resistor can not absorb all power generated by the motor. It can also indicate that the mains voltage is higher than the limits permitted or is considerably fluctuating.

11	Hall sensors code not correct	This error occurs if the motor encoder cable is not connected or if the wiring is not correct. It can also occur in case of break-down of the motor encoder or of the hardware inside the driver.
12		Reserved.
13	Brake resistor temperature too high	The brake resistor temperature exceeds the pre-set limits. The cause might be a too high voltage or an excessive mass applied to the motor shaft.
14	DC BUS voltage too low	The mains voltage is not enough or one of the phases of the main power supply is absent. It is recommended to check the power supply line and the parameter [1.7.2].
15	Corrupted data in EEPROM	**Irretrievable**. This error occurs due to the EEPROM memory damaged.
16	Too high speed	This error occurs when the parameter [1.4.9] is not properly installed or when a too high integrative gain implies an excessive adjustment, which leads the motor out of the limits permitted.
17	SW no longer under control	**Irretrievable**. The microprocessor does not execute the main programme
18	Torque time limit overtaken	This error occurs when the time set in parameter [1.3.5] is inferior to the time when the motor torque overtakes the pre-set maximum torque value.
19		Reserved.
20		Reserved.
21	Motor voltage different from driver voltage	The rated voltage set for the driver is different from the motor voltage. This problem causes an excessive power supply to the motor windings.
22	Excessive current for disabled driver	**Irretrievable**. While the driver was disabled, the sensors detected too high current. This problem is due to the hardware bad functioning.
23	Field bus hardware error	**Irretrievable**. During the HW test on the field bus control section, some errors occurred.
24	Excessive deviation of position	This error occurs when the position control is active and the driver can not position the motor in the required position. This error could be due to an excessive load which can not be controlled or to a position too distant from the present one. The error is not stored in EEPROM in order to avoid saturating the available positions, because the error might be frequent.
25		Reserved.
26	FAULT in the STO circuit	It was not possible to enable the driver due to the fault in the safety circuit. Make sure the mains voltage is supplied to the connector of the safety circuit.
27	No signal of STO enabling	The driver could not be enabled because there were no signals to the safety circuit.
28	Auxiliary voltage out of range	The auxiliary voltage (24VDC) is out of the permitted range (<20.4V o >28V).
29	Ventilation not enough	At least one of the fans is running at insufficient speed. Check if there are any obstructions that prevent the fans from operating correctly.

9.2.2 Models for asynchronous motor

Cod.	Error	Description
03	Auxiliary voltage out of range	The auxiliary voltage (24VDC) is out of the permitted range (<20.4V o >28V).
05	NTC motor interrupted	The temperature sensor of the motor is interrupted. Make sure that the encoder cable is connected properly.
06	Motor temperature too high	The motor temperature exceeds the limit set in the parameter [1.4.10]. Make sure that the load applied to the motor is correct (no obstructions, nor frictions). If everything is ok or if you are testing the motor and it has not reached the operating temperature yet, it is recommended to increase the limit or to cool the motor. If these hypotheses are all to be discarded, it is recommended to replace the motor with one of a larger size.
07	Driver temperature too high	The temperature inside the driver is too high. It is recommended to increase the ventilation.
08	Intervention of protection	**Irretrievable**. This error signals the intervention of the hardware protection inside the power board. Here are the main causes: a) over-current in the output phases b) simultaneous conduction of IGBT c) power supply default on the IGBT Gates d) disturb current impulse There are several causes for these defects, both inside and outside the driver: motor cable, motor turning-up, wrong connections of the earth lines. If the error persists, it will be necessary to replace the driver.
09	Maximum current overtaken	This error indicates that the current supplied to the motor exceeds the maximum value permitted; this value is calculated by choosing the lowest value among the maximum current accepted by the motor and the maximum current accepted by the driver.
10	DC BUS voltage exceeding the maximum limit	This error occurs if the brake resistor can not absorb all power generated by the motor. It can also indicate that the mains voltage is higher than the limits permitted or is considerably fluctuating.
13	Brake resistor temperature too high	The brake resistor temperature exceeds the pre-set limits. The cause might be a too high voltage or an excessive mass applied to the motor shaft.
14	DC BUS voltage too low	The mains voltage is not enough or one of the phases of the main power supply is absent. It is recommended to check the power supply line and the parameter [1.7.2].
15	Corrupted data in EEPROM	**Irretrievable**. This error occurs due to the EEPROM memory damaged.
18	Current limit for time limit overtaken	See description of [1.3.9] in the menu VISIO 3000.
26	Ventilation not enough	At least one of the fans is running at insufficient speed. Check if there are any obstructions that prevent the fans from operating correctly.
27	Diagnostic problem	The inverter was disabled due to some problems in the hardware diagnostic. If the problem persists, it is recommended to replace the device.

28	Mains voltage problem	There are some problems to the three-phase mains voltage, due to the absence of one or more phases and/or lack of voltage. It is recommended to check the correct operation of the power supply protection systems.
29	FAULT in the STO circuit	It was not possible to enable the driver due to the fault in the safety circuit. Make sure the mains voltage is supplied to the connector of the safety circuit.
30	STO circuit enabling	The driver safety circuit has no external consent signals

9.3 Warnings

9.3.1 Models for brushless motor

TBD

9.3.2 Models for asynchronous motor

Cod.	Error	Description
26	Ventilation not enough	At least one of the fans is running at insufficient speed rate. Check if there are any obstructions that prevent the fans from operating correctly.

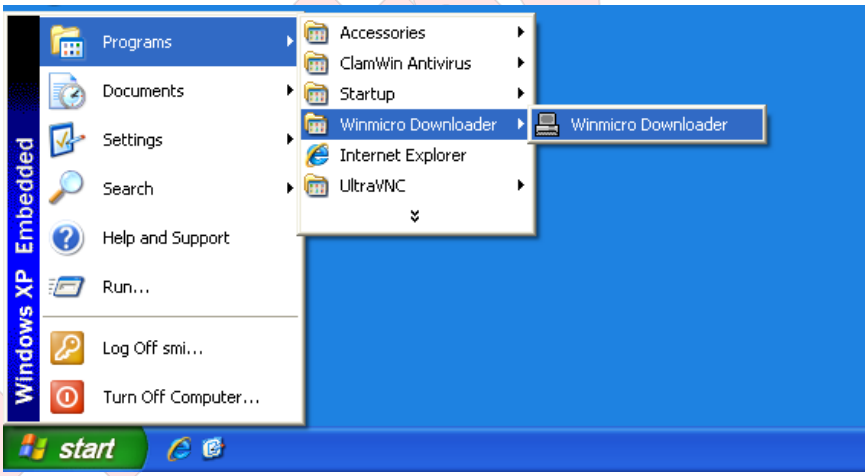
10 Firmware update

Further to upgrades or features implementation, COSMOS 3000 servodrives can be updated to a later firmware release. The firmware can be updated from your PC via USB connection and for some models also via Ethernet using the master device (available shortly).

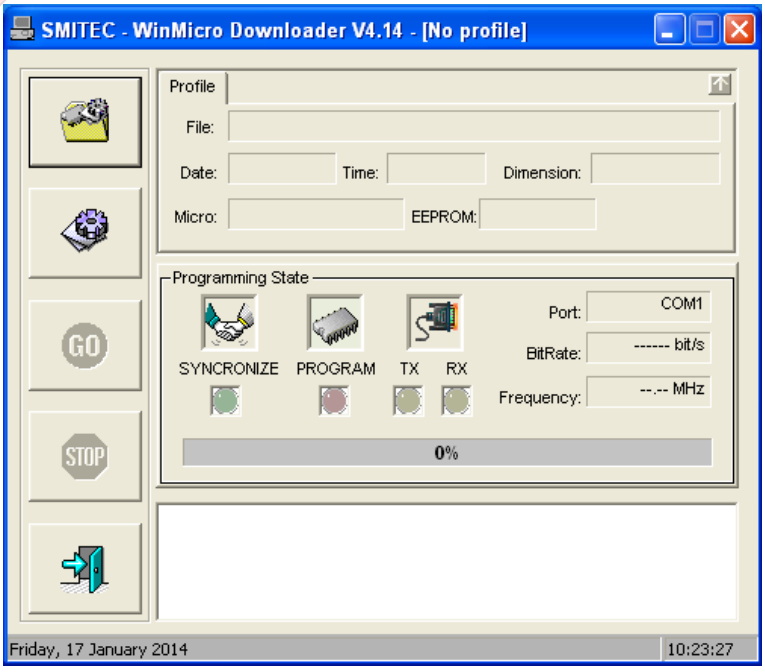
10.1 Update on PC via USB connection

To carry out this operation you need a PC running Windows XP or later OS with a free USB port. Smitec proprietary software Winmicro and the drivers for the USB port of COSMOS-3000 must be already installed. Refer to the instructions included in the installation file.

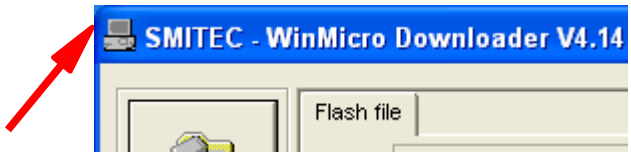
1. Connect the USB cable (type A->mini-B) - mini-B side – to COSMOS 3000 servodrive; it doesn't need to be switched off.
2. Connect the USB cable – side A – to a free USB port
3. Switch on the COSMOS 3000 servodrive
4. Start Smitec Winmicro software



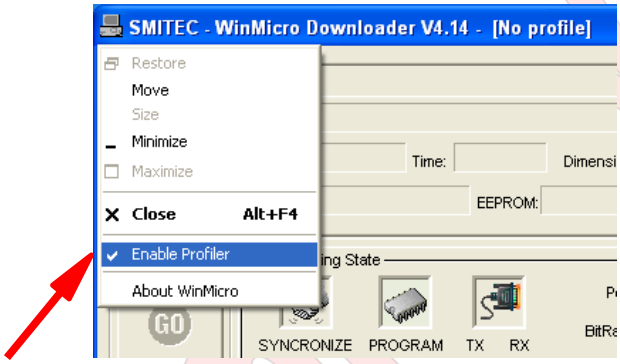
5. Once started the following window will pop up



6. Open the program menu clicking on the top left icon.

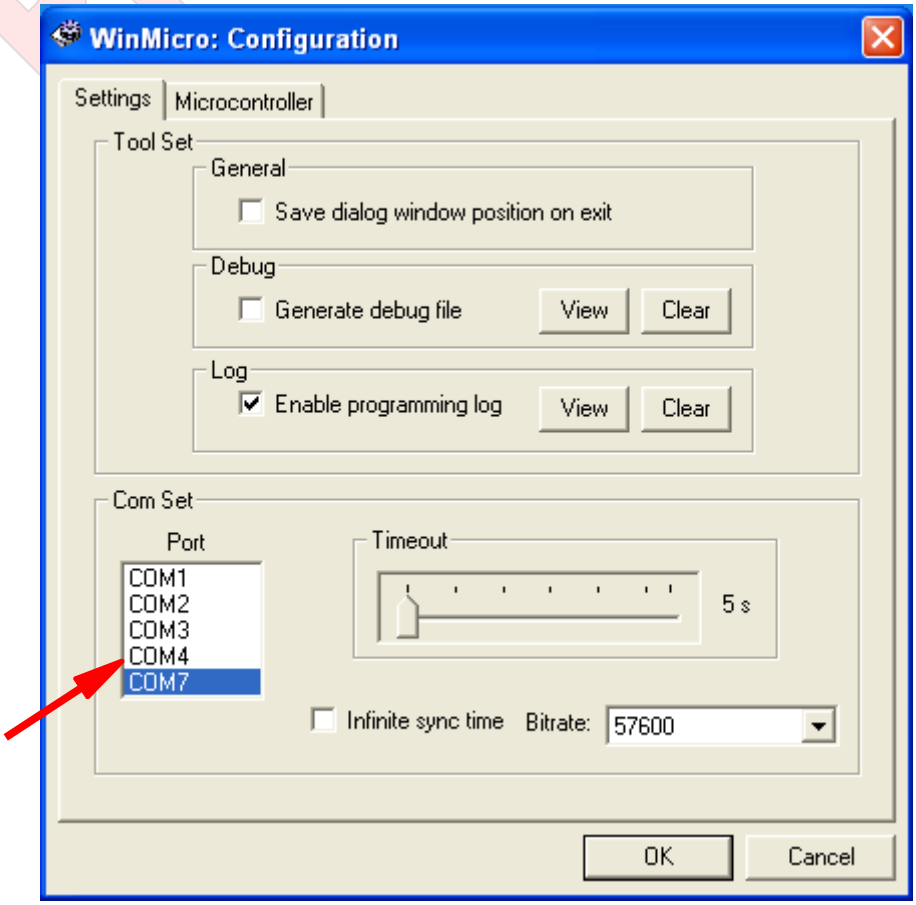


7. Unflag the option "Enable Profiler"

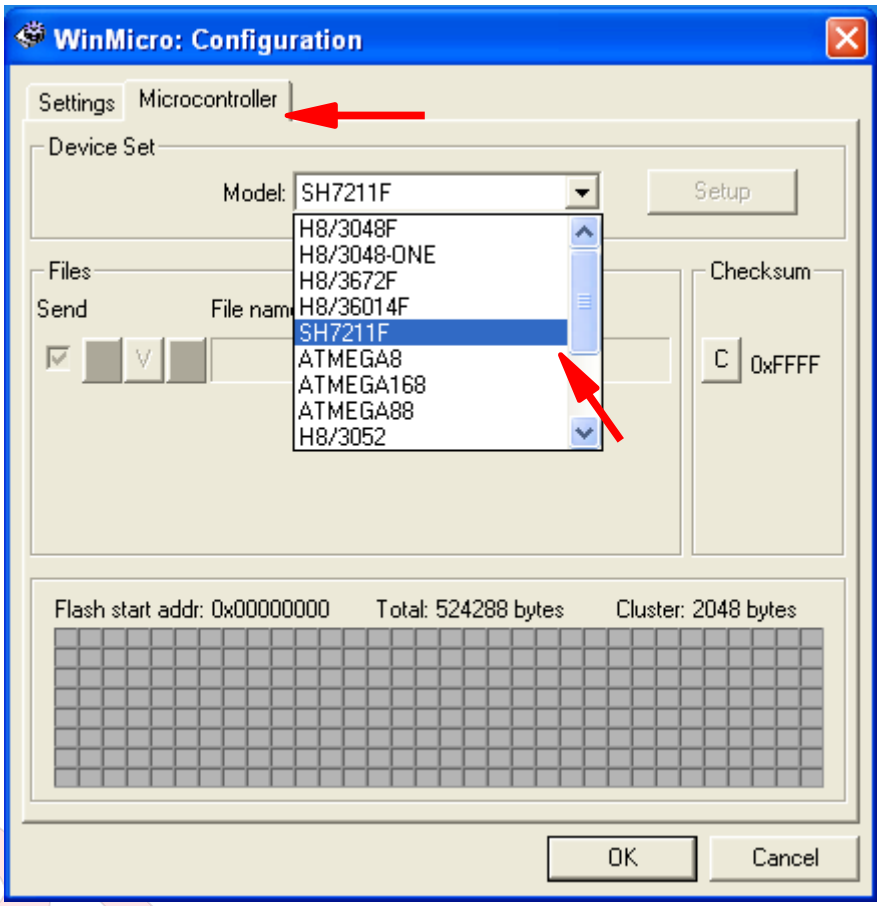


8. Click on the "Settings" button

9. The Settings window will open: set the serial port number you will use for the programming (the Cosmos 3000 usb port is recognized by Windows as serial port); as a rule it's the higher COM number available.

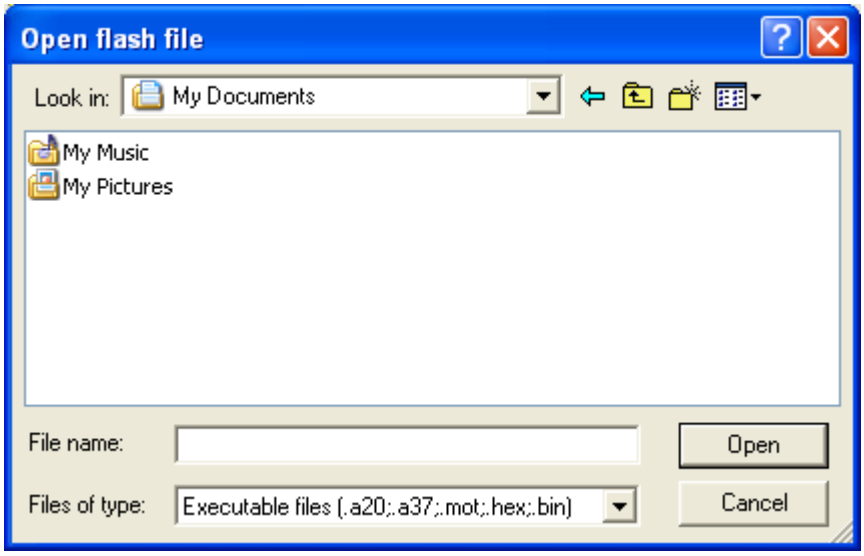


10. Switch to Microcontroller window and set the microcontroller type, which in COSMOS 3000 is SH7211F

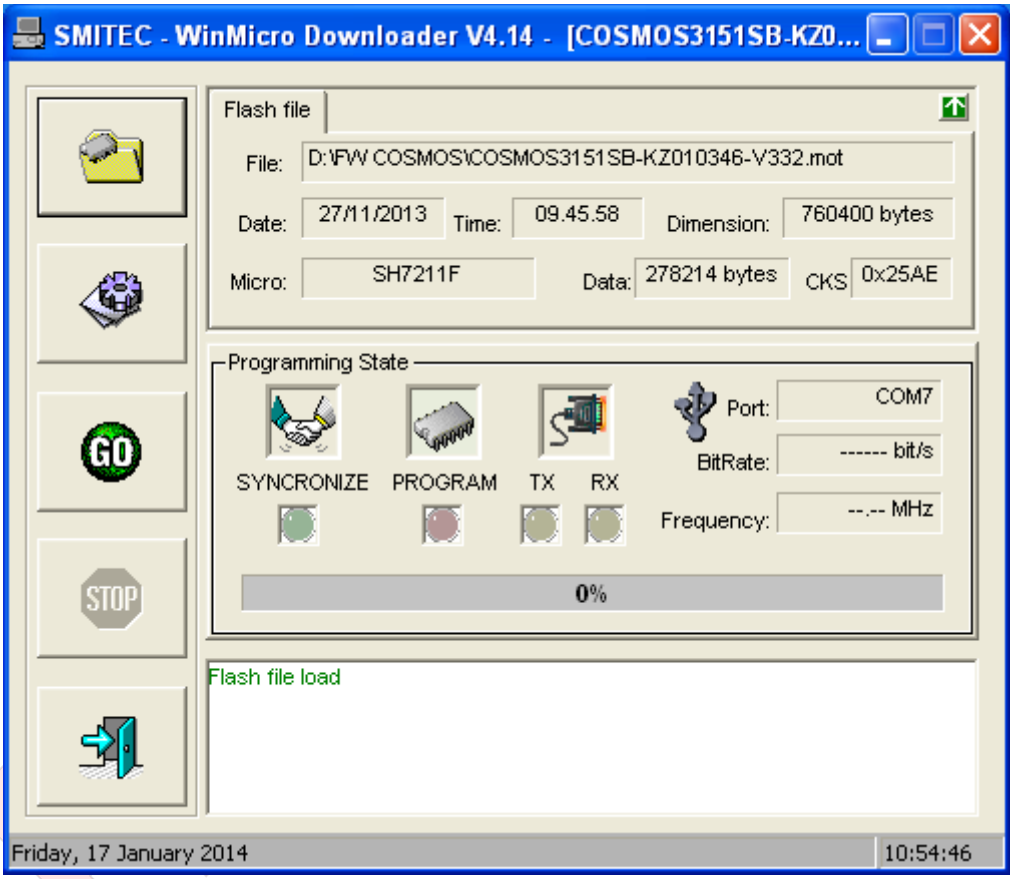


11. Click on the OK button
12. Click on the button in the main window

13. The window for the selection of the file for the firmware update will pop up: make sure you select the correct file

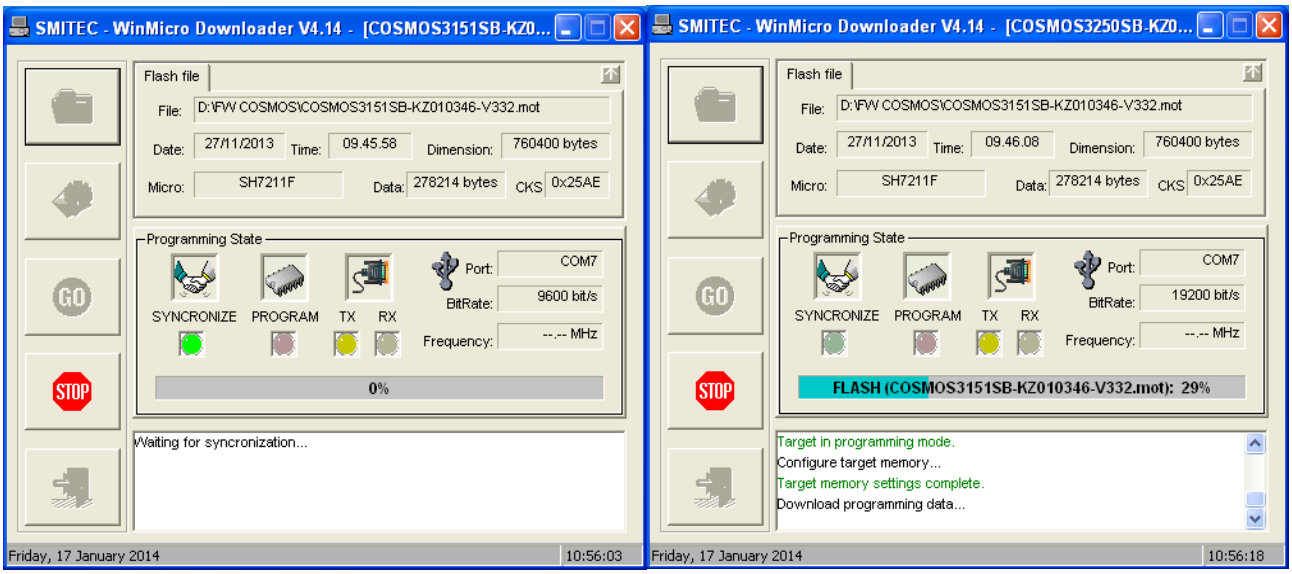


14. Once the file has been uploaded, the main Winmicro window will feature some info on the file and on the selected controller; if the COSMOS 3000 is switched on, the usb cable is properly connected to the PC and to the servodrive, and the selected port is correct, the USB symbol will pop up beside the word "Port".



15. Click on the GO button to start programming

16. During programming, status messages will pop up in the lower window and the progress index will proceed



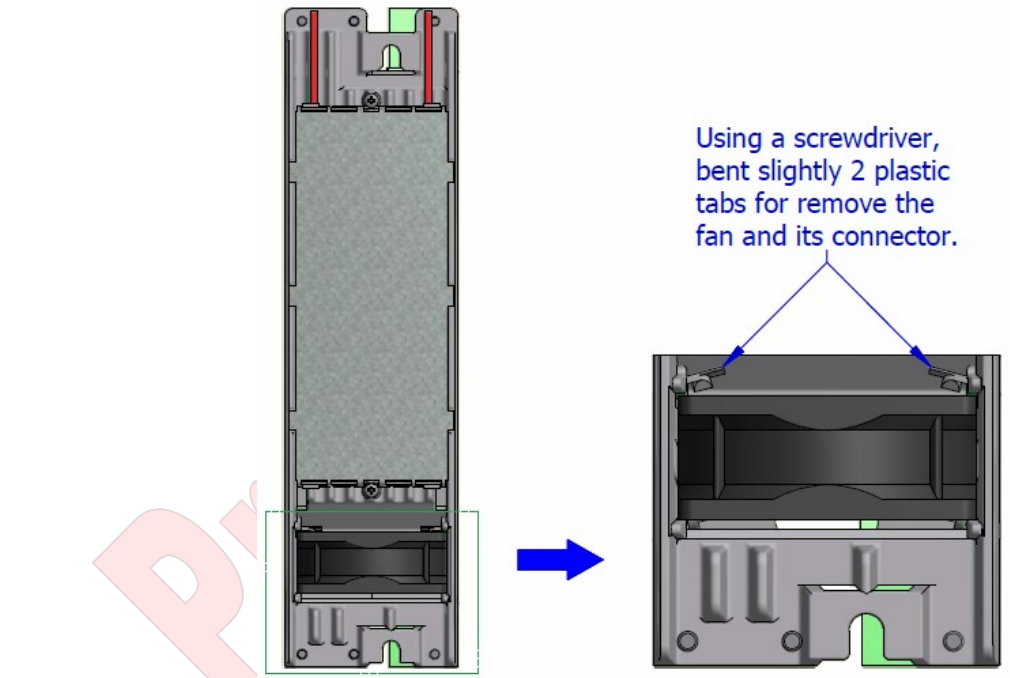
17. At the end of programming the lower window will notify the operation success and the time employed.
18. In case of failure with message "Synchronization Error", make sure that the microcontroller type, the selected file and port number are correct.
19. Once the update has been completed, exit the program by clicking on the following button

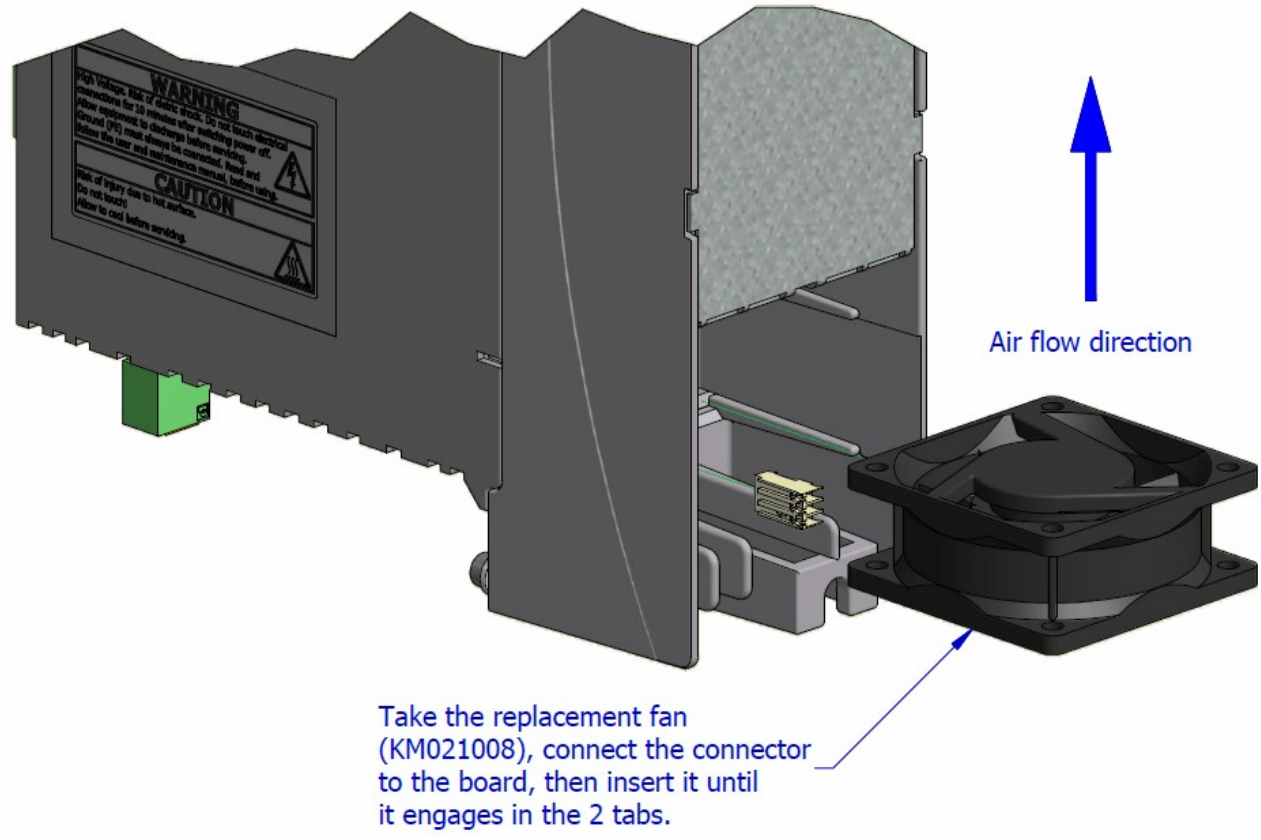
11 Maintenance

Before performing any type of maintenance, remove power to the device, wait 10 minutes and disconnect all electrical connections.

11.1 Replacing failed fan

11.1.1 COSMOS Type 315X/325X





11.1.2 COSMOS Type 350X

For safety reasons, the fans are not replaceable by the user.