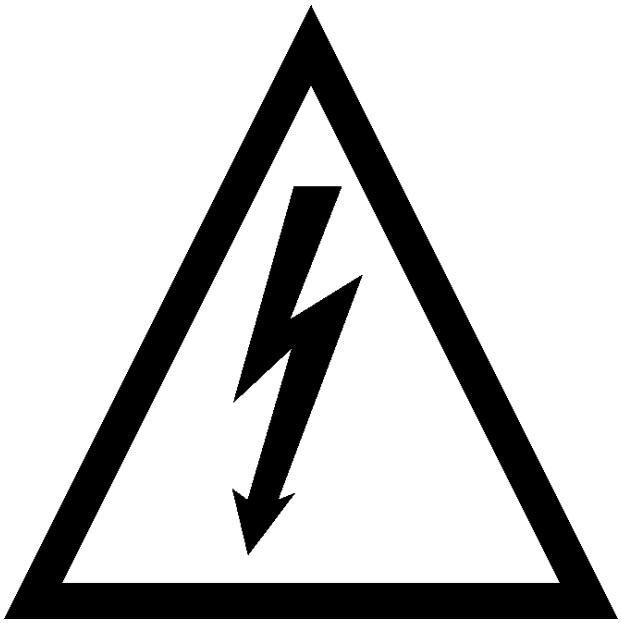
ES TECHNOLOGY

Technical features and installation instructions

BSA300

REVISION				
Code new version	**DATE**	**OBSERVATIONS**	**Compilated**	**Approved**
BSA300-GB-0.1	25/01/10	BSD 300 Reference manual		
BSA300-GB-0.2	20/04/15	Update		
BSA300-GB-0.3	19/04/22	Update		



WARNING!

The converters of the BSA 300 series are running at high voltages. Even after disconnecting the converter, the capacitor circuits are still under voltage for a short period of time. Therefore, it is absolutely recommended to wait 5 minutes until operating on the inner part of the converter.
The converter is equipped with an inner recovery resistance working at high voltages and high operating temperatures. Do not touch under no circumstances the recovery resistance also after disconnecting the converter.

GENERALITY

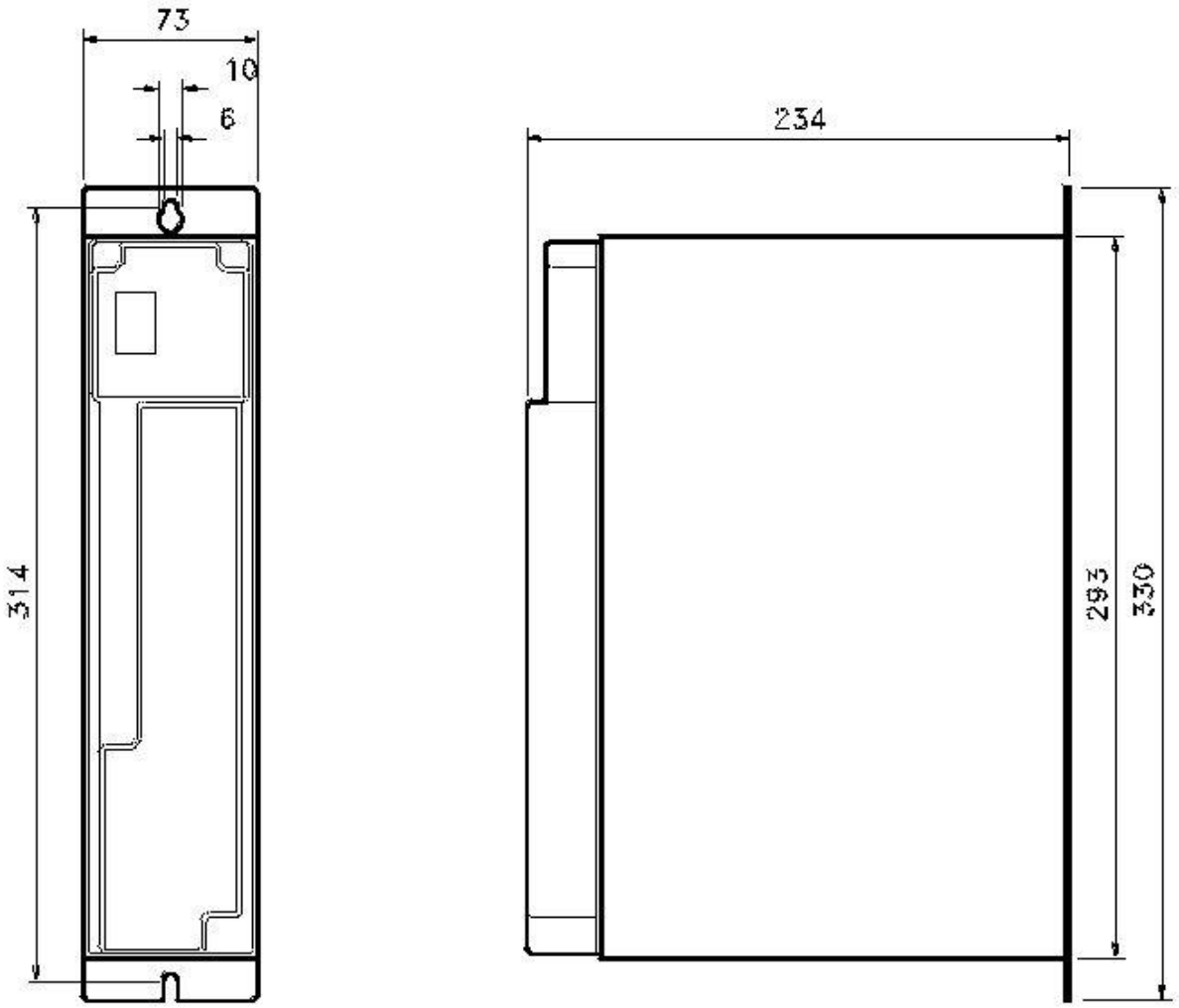
The sinusoidal brushless converters with four quadrants of the BSA 300 series form part of the new generation of power servo amplifiers with IGBT technology.

Compact realisation, complete with power supply and recovery unit for the braking energy on clamp resistance. The operations research and engineering of the converter was based on testing and burning out consequently every converter to obtain the best quality and reliability.

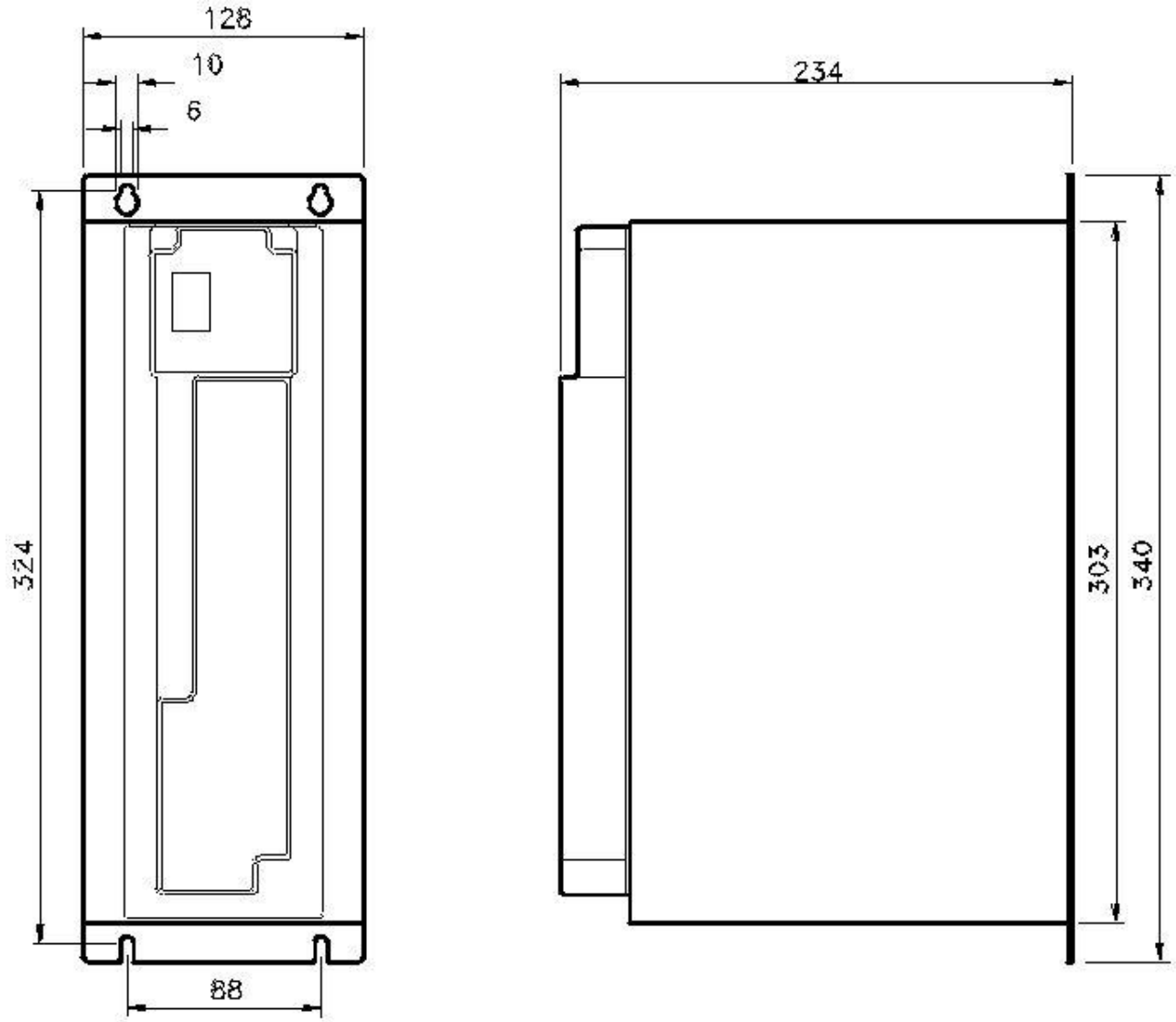
The converters of the BSA 300 series are designed to control the speed of a.c. synchronous motors of the sinusoidal type for applications with a high dynamic response and where a perfect motion smoothness and uniformity of positioning is required.

OVERALL DIMENSIONS

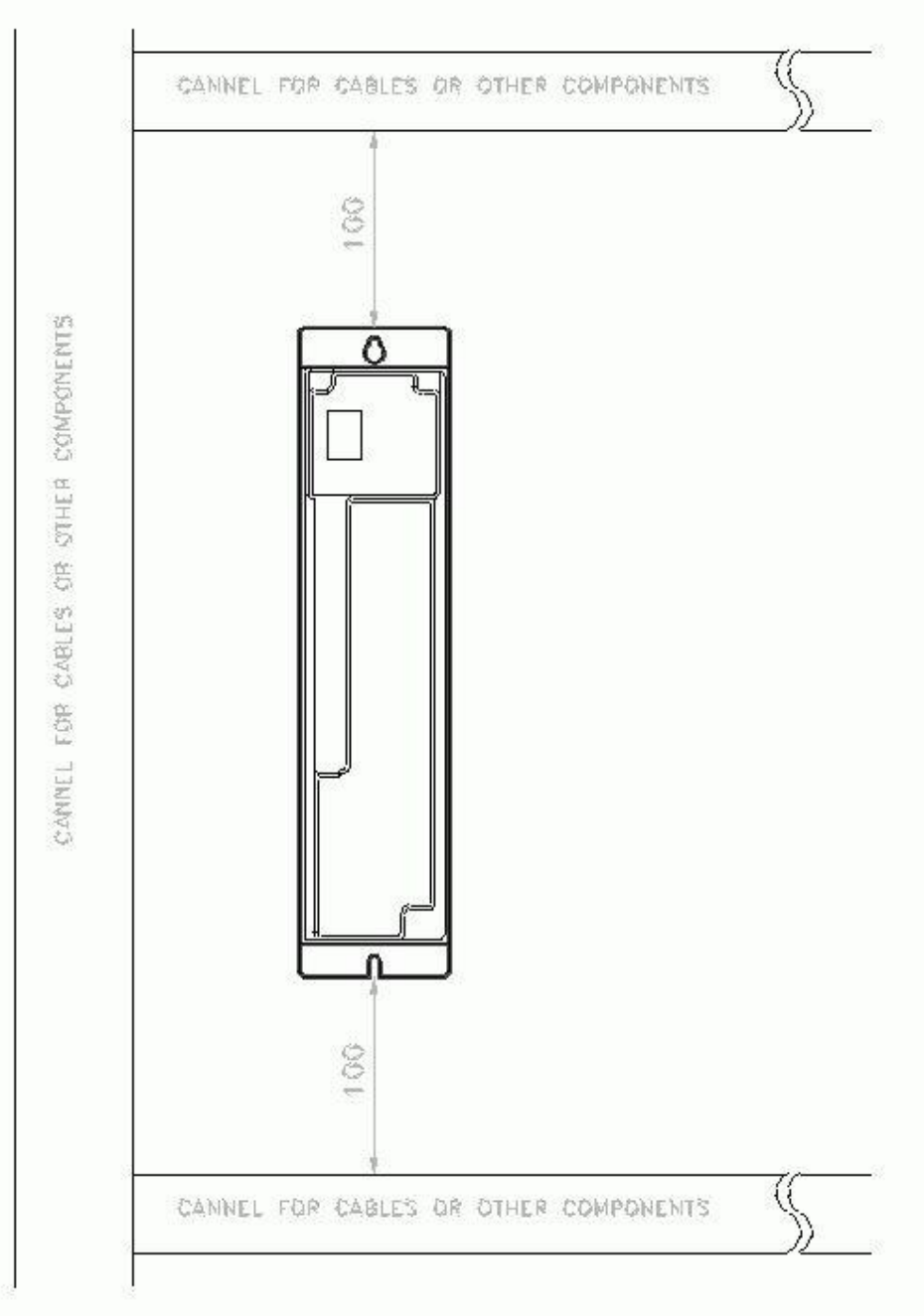
BSA 300 5/10 10/20 15/30



BSA 300 25/50 35/70 50/100



NOTE: Observe a minimum free distance of 10 cm between converter and surrounding components so as not to hinder the ventilation of the converter.



TECHNICAL FEATURES

Drive sizes

MODEL	INPUT VOLTAGE	NOMINAL CURRENT RMS AT 40 °C	CURRENT PEAK RMS FOR 1.5 sec.
BSA 300 / 5A	Tree-phase 140 ÷ 220 Vac ± 10% 50 ÷ 60 Hz	5A	10A
BSA 300 / 10A		10A	20A
BSA 300 / 15A		15A	30A
BSA 300 / 25A		25A	50A
BSA 300 / 35A		35A	70A
BSA 300 / 50A		50A	100A

GENERAL CHARACTERISTICS

Supply voltage of the BSA 300:	from autotransformer three-phase secondary voltage 220 V_{AC} ±10%
Mains frequency:	50/60 Hz
Output voltage:	200 V_{AC}
Speed loop bandwidth:	> 100 Hz
Switching frequency PWM:	10 K Hz
Velocity input reference:	±10 V (input impedance 100 KΩ)

Regulation:

- Fine velocity tuning with trimmer **P1** on the customising card (3013.0)
- Offset compensation of the velocity signal with trimmer **P1** on the regulation card (sch. 006.0)
- Acceleration ramp gradient adjustable from 0÷2 seconds with trimmer **P3** on the customising card (sch. 013.0)
- Deceleration ramp gradient adjustable from 0÷2 seconds with trimmer **P4** on the customising card (sch. 013.0)
- Dynamic gain of velocity block with trimmer **P2** on the customising card (sch. 013.0)

Functions:

- Diagnostics on DISPLAY
- Torque programming for the outside by signal from 0 to +10V

Inner protections:

- Against short-circuit between motor terminals
- Against short-circuit between motor and towards earth
- Against mains overvoltage
- Against mains undervoltage
- Against power overheat
- Against motor overheat (thermal protection with PTC probes)
- Against overload on the inner braking resistance
- Against resolver failure or connections

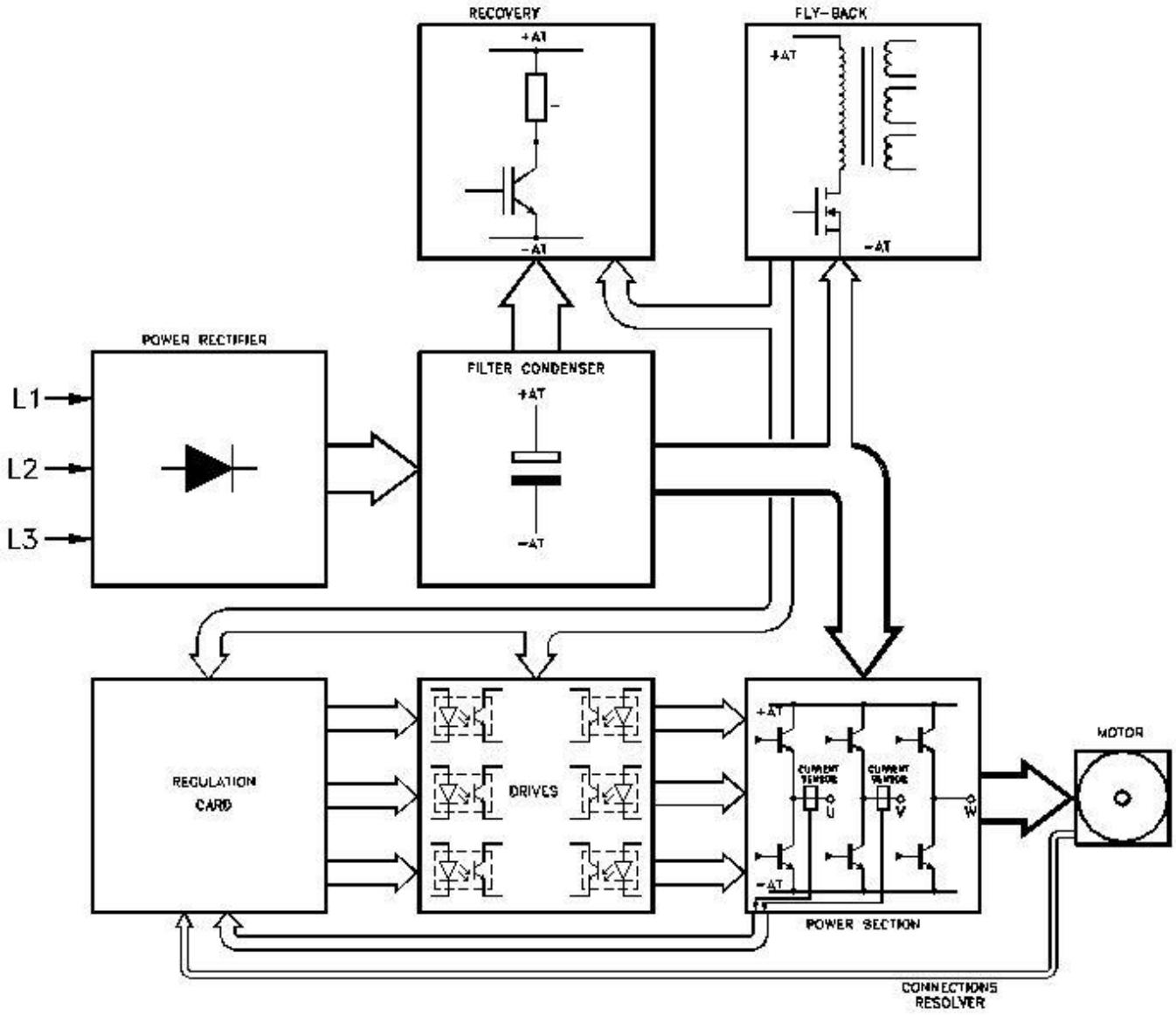
Optional:

- ❑ Encoder simulation card

Operation:

Temperature:	from 0 ÷ 40°C
Humidity:	90% max. without condensation
Altitude:	1000 m. sea level
Protection degree:	IP 20

FUNCTIONAL DIAGRAM

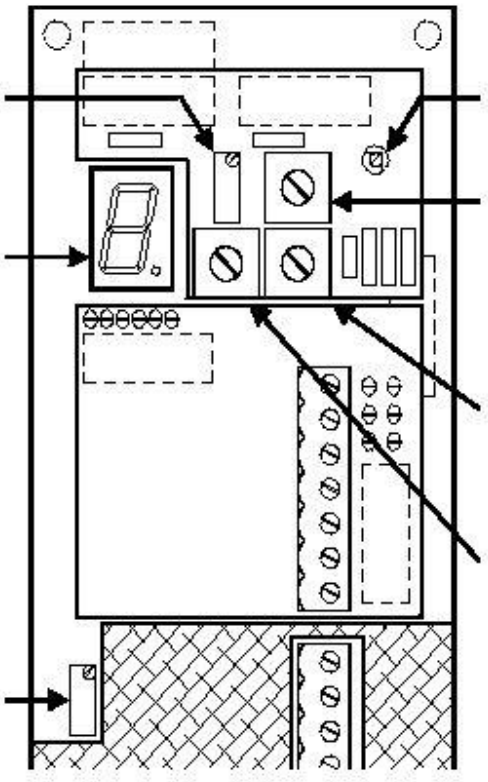


CALIBRATTIONS

Trimmer for the velocity setting

Display for the monitoring of functions and alarms

Trimmer for the offset compensation of the velocity signal (setting made when installing the unit tuning this trimmer in a clockwise or anticlockwise direction until the motor does not stops allows the zeroing of the reference signal



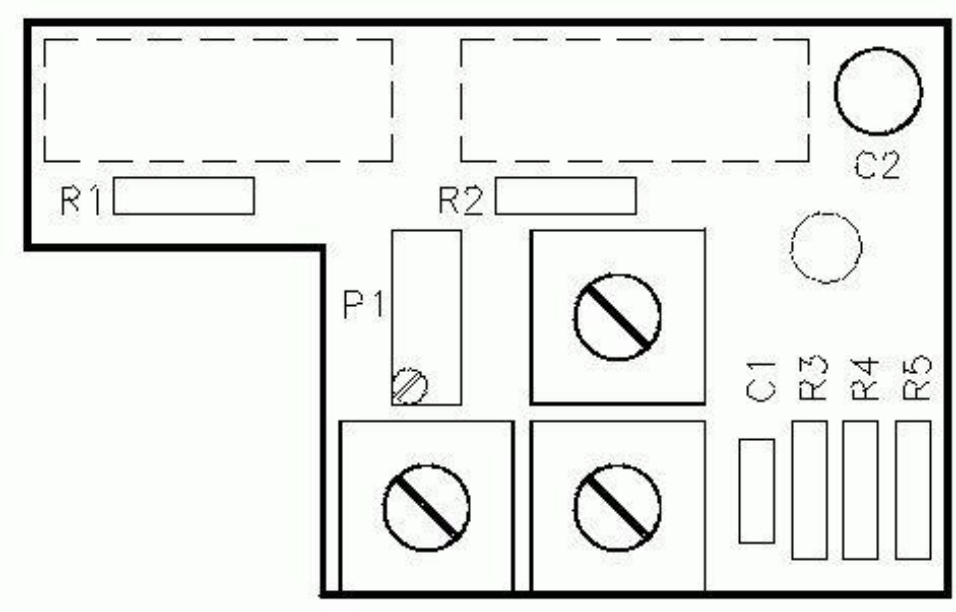
Trimmer for the rough adjust of the speed offset

Trimmer for the adjust of the dynamic gain. The gain is increased by rotating the trimmer clockwise.

Trimmer for the setting of “ACCELERATION” ramp gradient adjustable from 0 to 2 sec.

Trimmer for the setting of “DECELERATION” ramp gradient adjustable from 0 to 2 sec.

Customising card



Component	Description
C2	It fixes the issue delay of the maximum current before operating the device IxT
R1	It establishes the current besides which the protection ixT is switched on.
R2	It states the value of current rating of the drive (motor current rating)
C1	Capacitive component of the dynamic gain of the speed loop
R3	Resistive component of the dynamic gain of the speed loop
R4	It states the level of maximum current which can be issued by the drive
R5	It establishes the maximum motor speed (adjustable with the multi rotation trimmer P1).

Calibration of R1, "current of I*T operation"

R1	5/10	10/20	15/30	25/50	35/70	50/100
3.3 KΩ			6	10	14	20
3.9 KΩ	2	4	7	11	15	24
4.7 KΩ	2.5	4.5	8	13	17	27
5.6 KΩ	3	5	9	15	19	30
6.8 KΩ	3.5	6	10	17	22	35
8.2 KΩ	4	7	11	19	26	40
10 KΩ	4.5	8	13	22	31	45
12 KΩ	5	9	15	25	35	50
15 KΩ		10				

Remark: all values of current are expressed in "*Arms*"

The converter is normally delivered calibrated for the motor specified in the order; it does not need then any special calibration. If, however the converter has been ordered as standard, you may follow the procedures of calibration indicated in the following paragraphs.

Calibration of maximum current

The resistance ***R4*** indicates the maximum current which can be issued by the converter; in case of need, this resistance may be changed, to reduce the maximum current of the converter (The current can never be increased). This formula allows you to establish the value:

$$R4 = 10000 * \left(\frac{I\max \text{ az} - I1}{I1} \right)$$

Where:

R4 is expressed in ohm

***I*max** is the maximum current which can be issued the converter in standard configuration (example BSA 15/30 issues for 2 seconds a current of 30A)

I1 is the maximum current you wish the converter to issue

Calibration of the current of intervention of the device I*T

R1 states the point of intervention of the protection I*T, the table indicated on page 15 indicates the currents which can be obtained using normalised values R1. In any case if you wish to calibrate the point of intervention I*T in “manual” mode you can use the following formula.

$$R1 = \frac{47000 * I2}{\frac{20}{KV\ \max - 0.8} * I1 - I2}$$

Where:

R1 is expressed in ohm

I2 è is the current which you wish to calibrate to start the device I*T (normally the rating current of the motor is + 10 %)

***KV* max** it is in function of the value of the resistance **R4** and it is calculated with the following formula

$$KV\ \max = 8.8 * \frac{10000}{10000 + R4}$$

I1 is the maximum current which can be issued by the converter (depending upon the value of R4).

Calibration of the rating current of the motor

The resistance **R87** normally mounted has a value of 2.7 kW and states the rating current of the drive at 20 % of maximum current. This resistance can also be recalculated with the following formula if needed:

$$R2 = \frac{I4}{I1 - I4} * \left(10000 + \frac{R4 \cdot 10000}{R4 + 10000}\right)$$

I1 is the maximum current which you wish the converter to issue converter (depending upon the value R4).

I4 is the current which can be issued by the converter during the time of limitation I*T (normally this current is 20 % of maximum current issued by the converter).

Time of intervention I*T

The ***C2*** condenser determines the duration of issue of the maximum current of the converter. In case of need it can be replaced to obtain different times, by doubling the value the time is doubled too, by halving its value, the time is halved, etc. (in case of modification of this component, we suggest to contact the assistance service of ES-TECHNOLOGY).

Dynamic constants

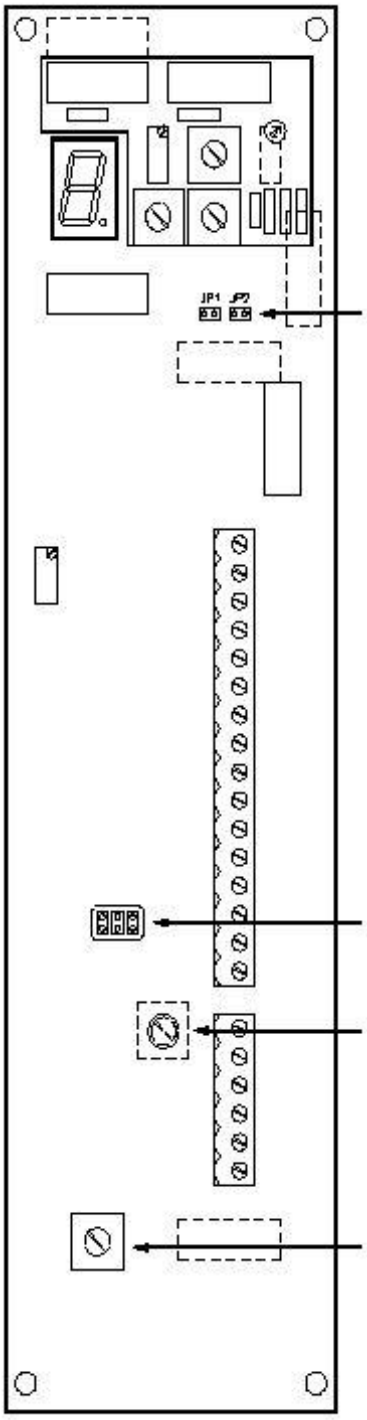
The components **C1** and **R3** state the dynamic gain of the converter's speed loop. Their value is such to guarantee the best operation of the loop with most of the motors, however in case it is necessary the modification of these components to further optimise the converter's operation, we recommend to contact the assistance service of ES-TECHNOLOGY.

Speed calibration

The resistance **R45** states the speed range of rotation of the motor (with the speed reference at maximum), the following table allows to mount suitable resistance according to the speed to be reached.

R5	**1 MΩ**	**820 KΩ**	**680 KΩ**	**560 KΩ**	**470 KΩ**	**390 KΩ**	**330 KΩ**	**270 KΩ**	**220 KΩ**
n° rpm *± 15%*	1000	1200	1400	1700	2000	2500	3000	3500	4300

Resolver adjustment



Jumpers for the selection of the ratio motor poles/resolver

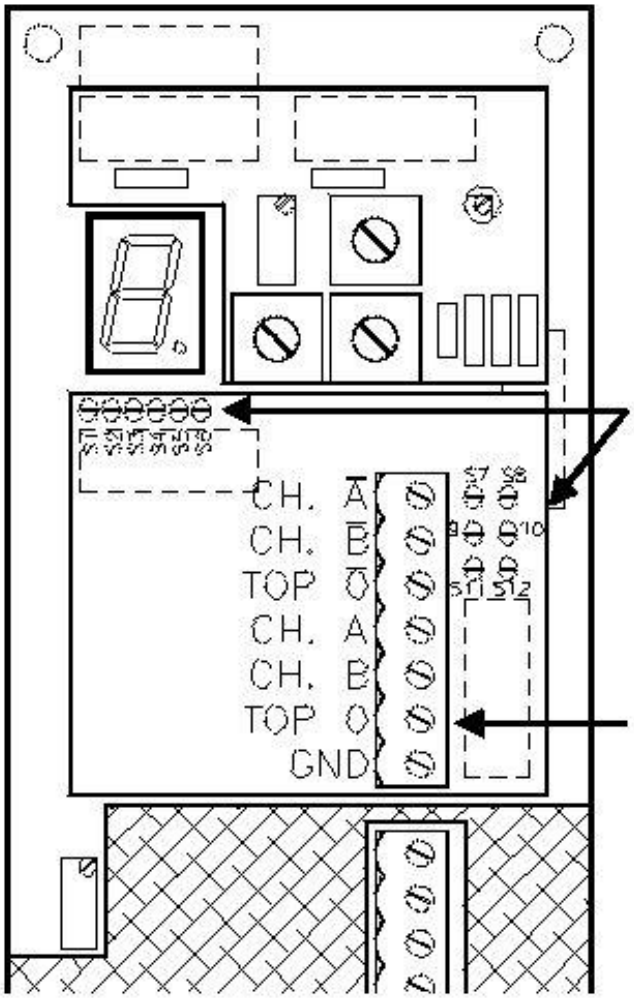
Ratio	JP1	JP2
x 1	☸	☸
x 2		☸
x 3	☸	
x 4		
☸ = Closed		

Jumpers for selection “normal” mode or “put in phase” mode
Unused function

It establishes the level of the supply of resolver

Resolver balance. It reduces the velocity ripple.

OPTIONAL CARD "ENCODER SIMULATOR"



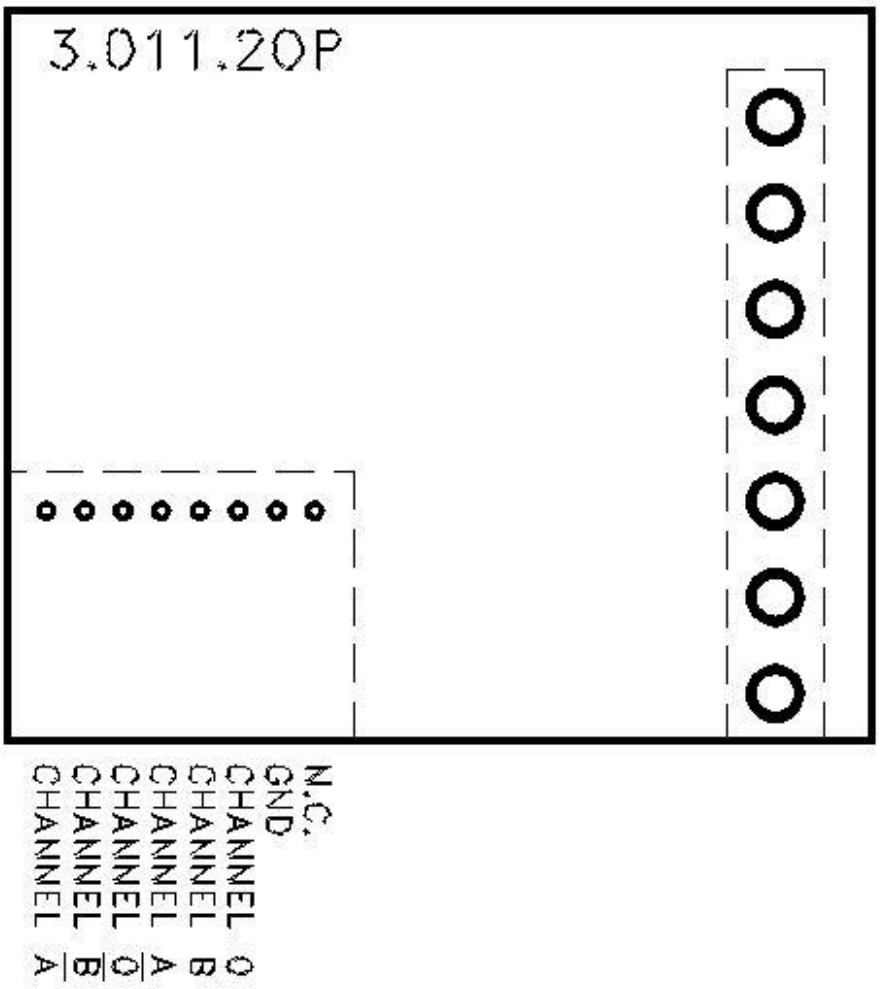
Solder point for the selection of the resolution of the simulated encoder from 128 to 1024 impulse.

Terminal for the connections signal A, B, Top 0 to simulated encoder.

Selection of the resolution of the simulated encoder

IMPULSES/ RPM		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
128					O	O		O	O		
256		O		O			O	O			
512		O			O	O				O	
1024				O			O			O	O

OPTIONAL CARD “ENCODER SIMULATOR” 15/24V

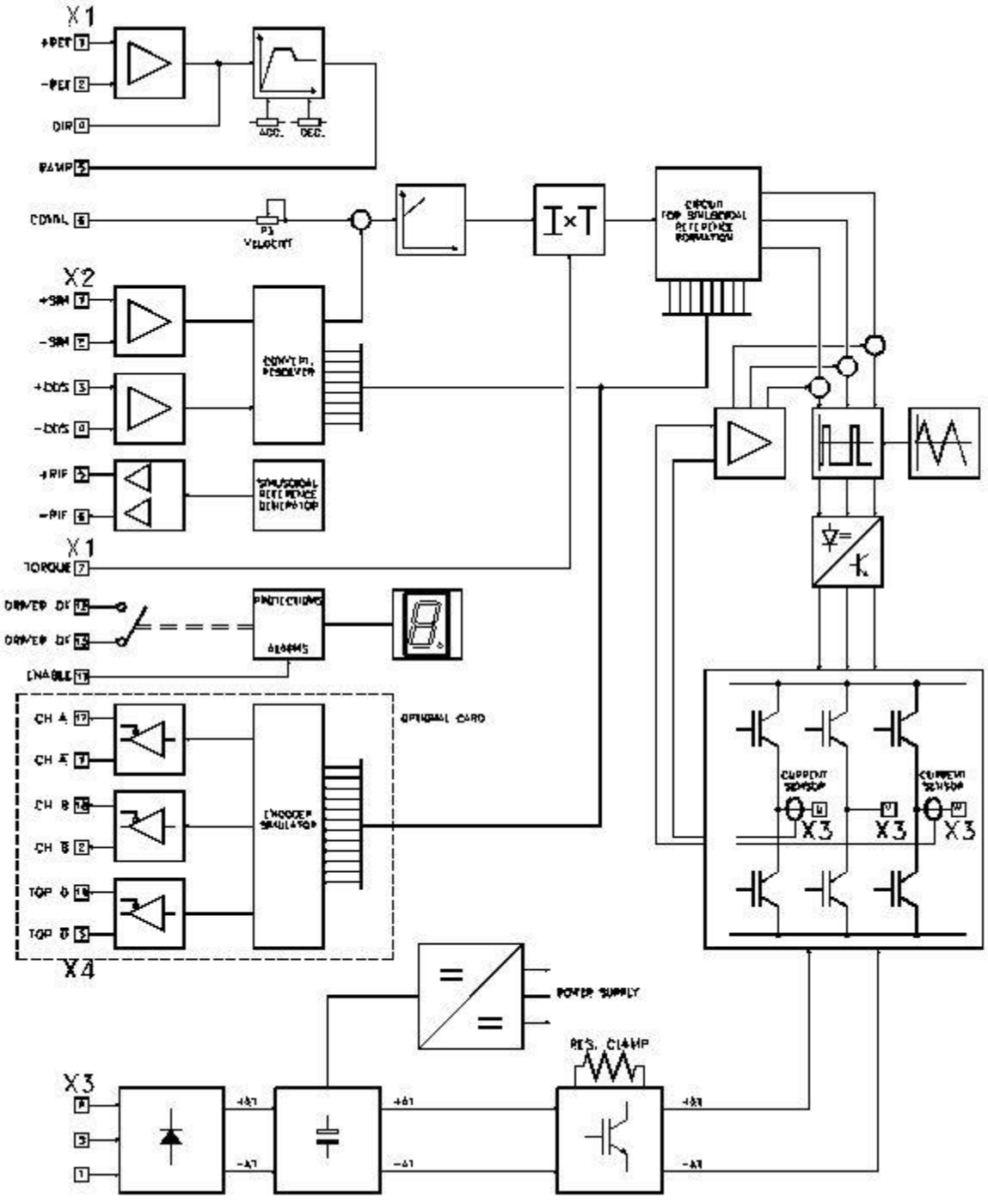


The drive equipped with a card of encoder simulator may be equipped with the “amplifier” card 3.011.2 OP in order to obtain signals of “encoder” at 15Vcc, instead of 5Vcc of the standard model.

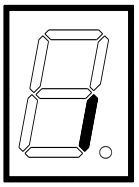
This card is mounted “on board” of the card 011.0 and foresees, for the connection, a removable connector at 8 ways with conductors to crimp.

The voltage in output ca be upon request of 15V or 24V.

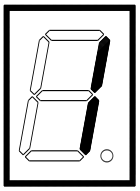
BLOCK DIAGRAM OF THE REGULATION CIRCUIT



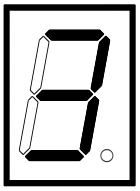
DISPLAY SIGNALS



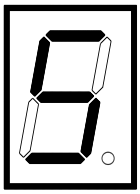
Segment Indicates that the unit is supplied with power and not enabled for operation.



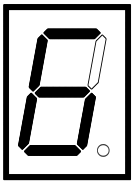
One Drive enabled for operation.



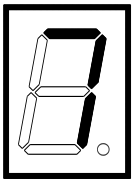
Three Motor overheating alarm. Until the abnormality continues, the drive is disabled. Automatic reset is done when the normal operation conditions are achieved.



Five Alarm of the protection device against mains over- and undervoltage. Check the L1, L2, L3 power supply. Until the abnormality continues, the drive is disabled. Automatic reset is done when the normal operation conditions are achieved.

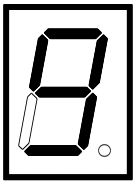


Six Fault alarm. Short-circuit between the motor connections or of the power unit. Check the insulation of the motor terminals and towards earth (motor housing) by measuring the resistance. The measured value must be inferior to 1 Mohm. During this operation the drive is blocked and can be reset by turning off from the L1, L2, L3 power supply for at least 5 seconds.

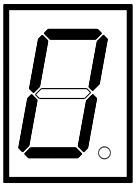


Seven The IxT device is activated. This protection circuit limits the drive current to the fixed nominal current (which corresponds normally to the nominal current of the motor). After 2 seconds this function is disactivated and allows the maximum current output of the motor size.

Eight Alarm of missing resolver signal (missing or interrupted connection of the resolver terminals 1-6). During this operation the drive is blocked and can be reset by turning off from the L1, L2, L3 power supply for at least 5 seconds.



Nine Alarm of excessive gain and overheat of the inner braking resistance. The machine cycle or the deceleration ramp timing have to be increased. During this operation the drive is blocked and can be reset by turning off the L1, L2, L3 power supply for at least 5 seconds.



Zero Overheat alarm of the power supply. Until the abnormality continues, the drive is disabled. Automatic reset is done when the normal operation temperature is achieved. Check the well-functioning of the ventilation. Observe the minimum free distance of at least **10 cm** of the inferior part when installing the drive.

TERMINAL CONNECTINS

Table of available INPUT/OUTPUT terminals of the plug-out connector: Connector "X1"

TERMINAL	NAME	TYPE	DESCRIPTION
1	**+REF**	**IN**	Noninverting input of the analogic reference signal
2	**-REF**	**IN**	Inverting input of the analogic reference signal
3	**GND**		0V of the regulation circuits, such as terminals 9 and 16
4	**DIR**	**OUT**	Output of the differential input stage. It must be connected to terminal 6 CONN. when the inner ramp circuit is not used. The terminal remains free when the inner ACC/DEC ramps are used
5	**RAMP**	**OUT**	Output of the ramp circuit. It must be connected to terminal 6 CONN. when the inner ramp circuit is used. The terminal remains free when the inner ACC/DEC ramps are used.
6	**CONN.**	**IN**	Connection terminal for the function mode. When connected to terminal 4 (DIR), the inner ACC/DEC ramp circuits are excluded, when connected to terminal 5 (RAMP) they are enclosed
7	**TORQUE**	**IN**	Input for the signal from 0 to +10V for the external torque regulation (+10V correspond to the peak current of the drive). Do not use this input and let disconnected the terminal when running at the max. available torque
8	**P.T.C.**	**IN**	Input of the motor resistance with positive coefficient
9	**GND**		0V of the regulation circuit, such as terminals 3 and 16
10	**TACHO**	**OUT**	Velocity signal (0 to +/-8V) proportional to the real motor velocity
11	**ENABLE**	**IN**	0V input signal for drive enable
12	**DRIVE OK**		Output with no voltage applied for the contact of the inner protection relay. During faultless operation, the contact is normally closed. When a protection device is activated, the contact is open (max. 24V, 100 mA)
13	**DRIVE OK**		Output with no voltage applied for the contact of the inner protection relay. During faultless operation, the contact is normally closed. When a protection device is activated, the contact is open (max. 24V, 100 mA)
14	**-10V**	**OUT**	Auxiliary voltage of -10V (max. 2mA)
15	**+10V**	**OUT**	Auxiliary voltage of +10V (max. 2mA)
16	**GND**		0V of the regulation circuits, such as terminals 3 and 9

Table available INPUT/OUTPUT of the plug-out connector "RESOLVER": Connector X2

TERMINAL	NAME	TYPE	DESCRIPTION
1	**+SIN**	**IN**	Connection terminal for the **SIN** winding of the *RESOLVER*
2	**-SIN**	**IN**	Connection terminal for the **SIN** winding of the *RESOLVER*
3	**+COS**	**IN**	Connection terminal for the **COS** winding of the *RESOLVER*
4	**-COS**	**IN**	Connection terminal for the **COS** winding of the *RESOLVER*
5	**+RIF**	**OUT**	Connection terminal for the **RIF** winding of the *RESOLVER*
6	**-RIF**	**OUT**	Connection terminal for the **RIF** winding of the *RESOLVER*

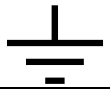
N.B. The resolver connection must be performed using a shielded cable with three pairs of individually shielded conductors. The shield must be connected to GND (-RIF).

Table available OUTPUT on the optional card "SIMULATED ENCODER": Connector X4

TERMINAL	NAME	TYPE	DESCRIPTION
1	**CH A** *COMPLEM.*	**OUT**	Connection terminal "SIMULATED ENCODER CHANNEL A COMPLEMENTARY". It is connected to the input of the numerical control or positioning system
2	**CH B** *COMPLEM.*	**OUT**	Connection terminal "SIMULATED ENCODER CHANNEL B COMPLEMENTARY". It is connected to the input of the numerical control or positioning system
3	**TOP 0** *COMPLEM.*	**OUT**	Connection terminal "SIMULATED ENCODER CHANNEL TOP 0 COMPLEMENTARY". It is connected to the input of the numerical control or positioning system
4	**CH A**	**OUT**	Connection terminal "SIMULATED ENCODER CHANNEL A". It is connected to the encoder input for numerical control or positioning system
5	**CH B**	**OUT**	Connection terminal "SIMULATED ENCODER CHANNEL B". It is connected to the encoder input for numerical control or positioning system
6	**TOP 0**	**OUT**	Connection terminal "SIMULATED ENCODER CHANNEL TOP 0". It is connected to the encoder input for numerical control or positioning system
7	**GND**		0V of the regulation circuit, such as terminals 3, 9 and 16

POWER CONNECTIONS

Connector X3

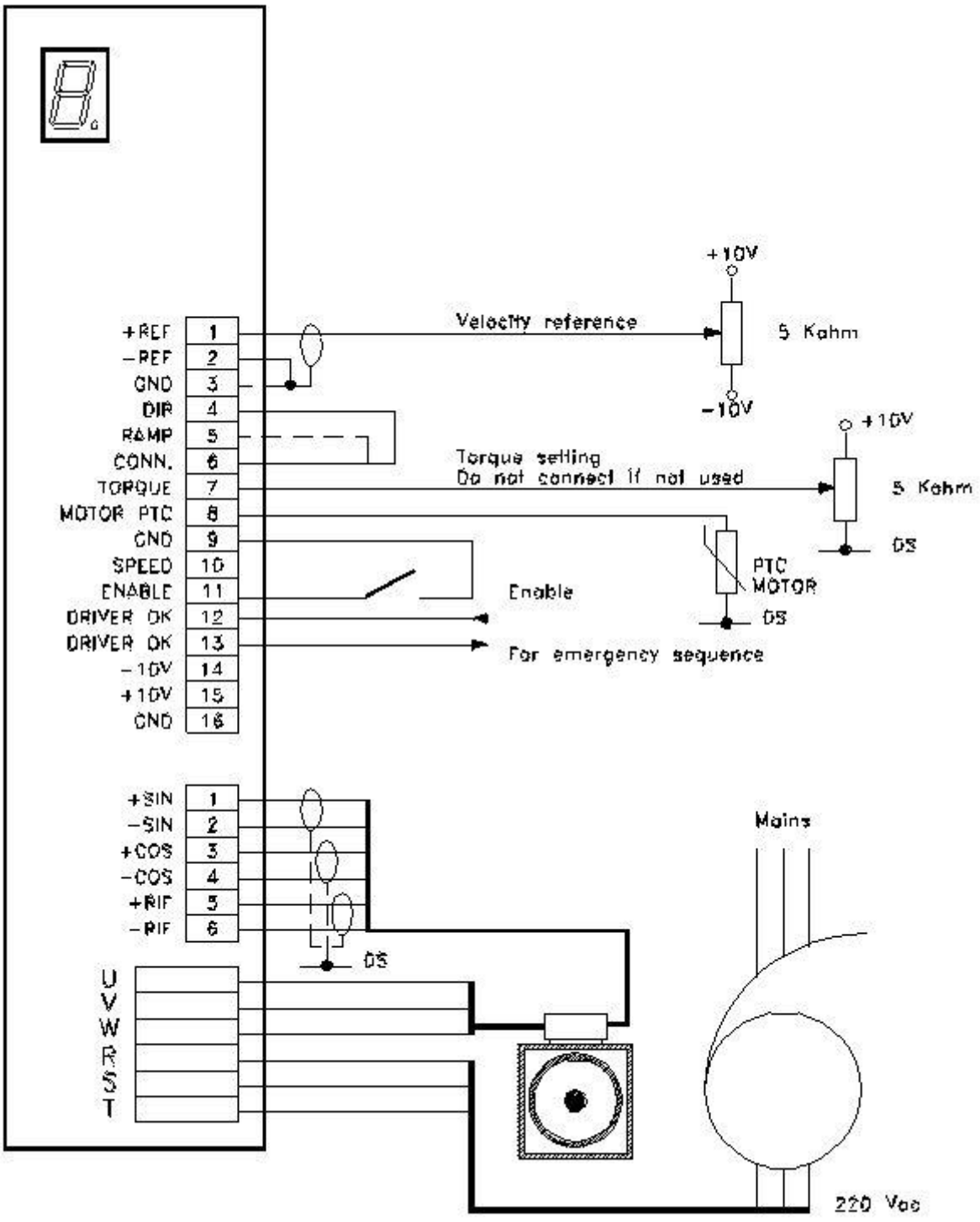
TERMINAL	NAME	TYPE	DESCRIPTION
	U	**OUT**	Connection terminal for the **U**-phase of the motor
	V	**OUT**	Connection terminal for the **V**-phase of the motor
	W	**OUT**	Connection terminal for the **W**-phase of the motor
	L1	**IN**	Phase 1 of the secondary of the three-phase transformer for the power supply of the converter (220VAC maximum)
	L2	**IN**	Phase 2 of the secondary of the three-phase transformer for the power supply of the converter (220VAC maximum)
	L3	**IN**	Phase 3 of the secondary of the three-phase transformer for the power supply of the converter (220VAC maximum)
			Connection terminal for grounding

Attention: ***USE SHIELDED CABLES FOR POWER CONNECTIONS***

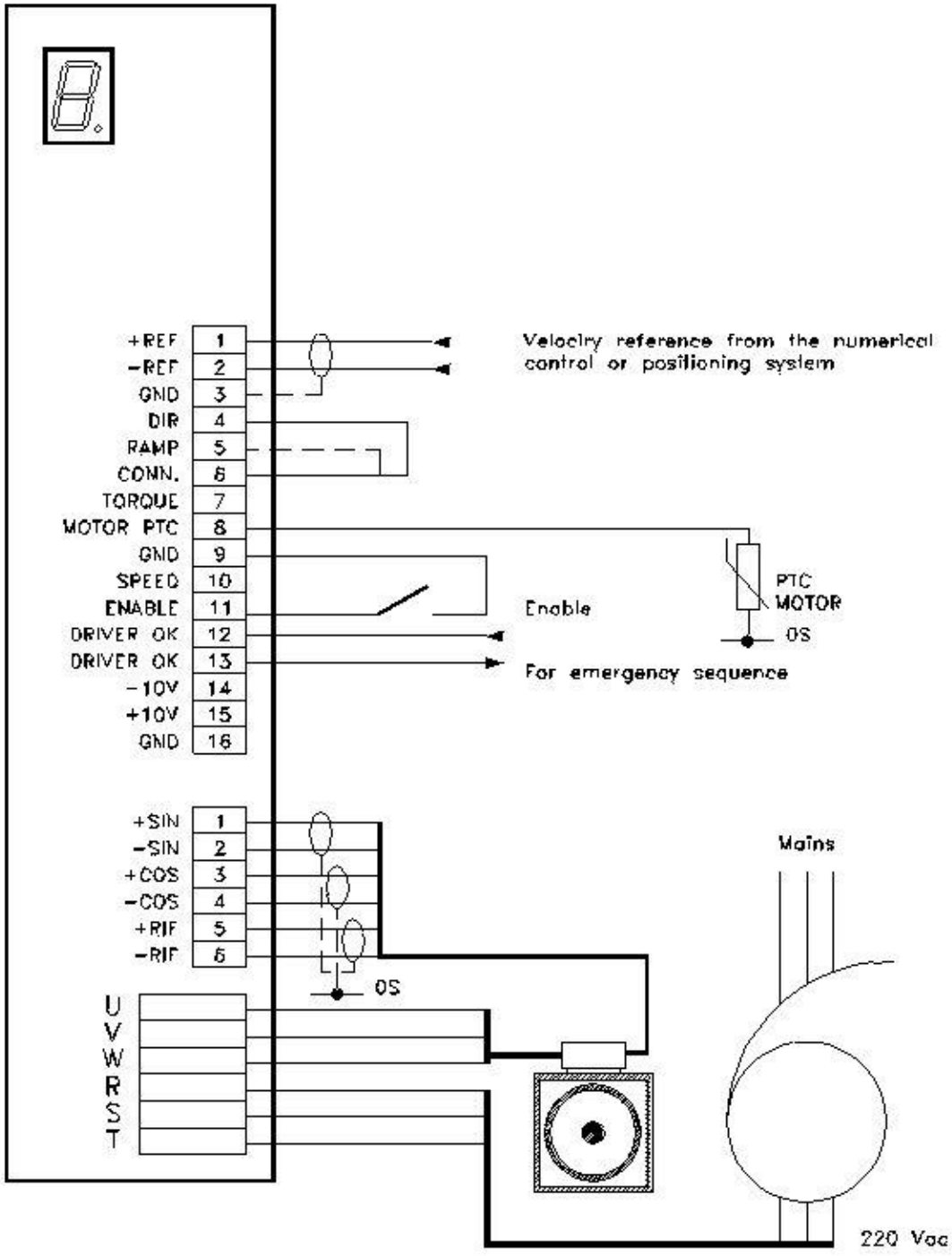
Do not disconnect the motor when the converter is supplied, even by converter disabled. Do not supply the converter during controls and maintenance.

EXAMPLES OF CONNECTIONS

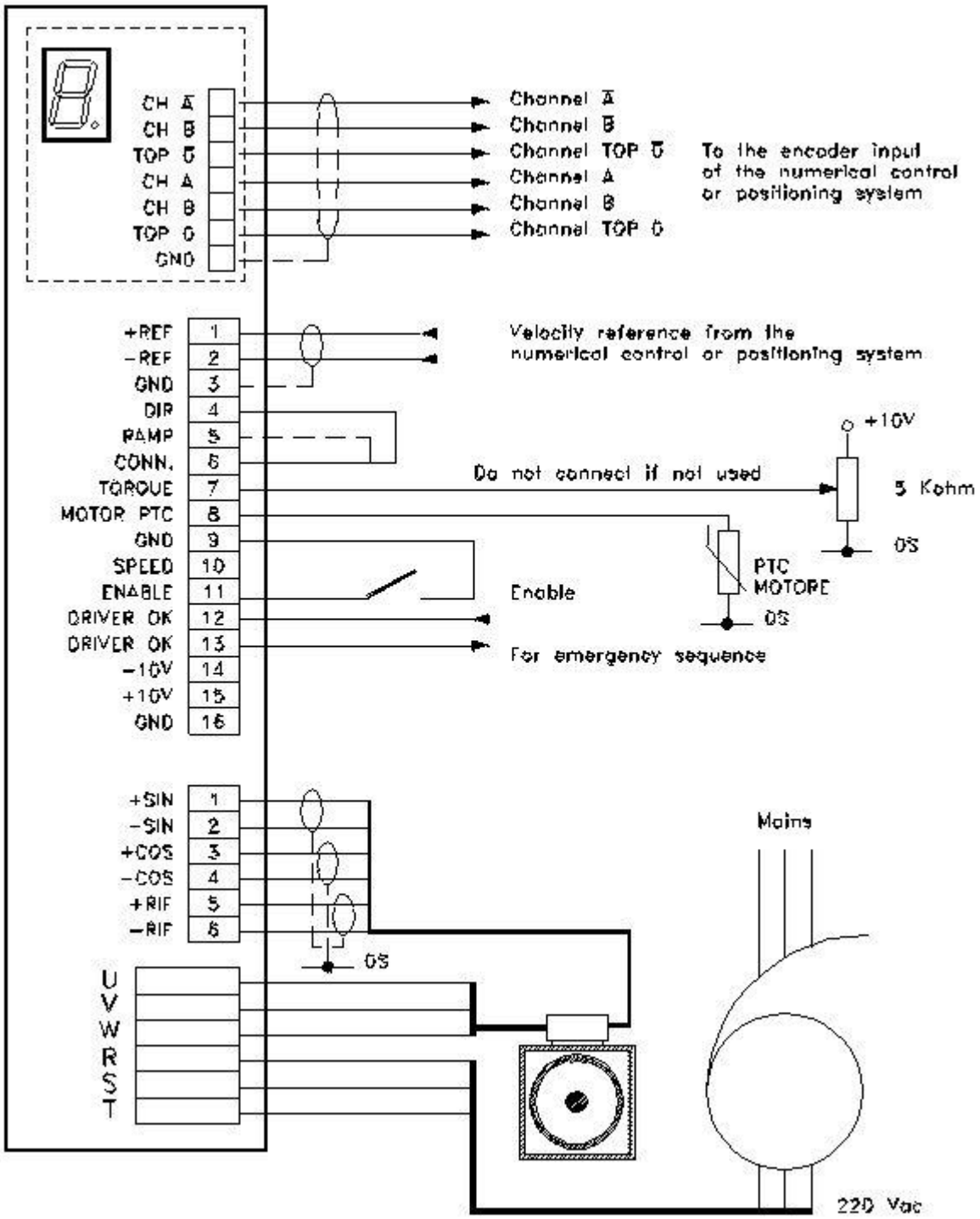
Connections with potentiometer reference



Connections with PLC or CNC reference



Connections with PLC, CNC or positioning system reference with the optional card "simulated encoder"



RECOMMENDATIONS FOR THE INSTALLATION AND OPERATION

- Unpack the BSA 300 and verify the integrity of all the single parts

- Connect a potentiometer of **10 K ohm** to the terminals **14** and **15**. Connect the cursor of the potentiometer to terminal **2**, and terminal **1** to terminal **3**. With the potentiometer in a central position, the motor stands still, when turning it to the right or to the left, the motor rotates in one or the other direction

- Make a jumper between the terminals **5**/**6** or **4**/**6**, depending on if the inner ramp circuit will be used or not.

- Prepare a jumper between terminal **11** and **ØS** (terminal **9**), without connecting it.

- Connect the armature circuit of the motor to the **U**, **V** and **W** terminals

- Connect the resolver (with a 6-way cable, individually screened) to the terminals **1 ÷ 6** of the resolver connector, and connect the screens to terminal **6**

- If the P.T.C. of the motor is not connected, connect terminal **8** to **ØS**

- Connect the three-phase power supply inferior to **220 VAC** to the **L1, L2, L3** terminals

- Supply the BSA 300 and check the flash-up of the **segment** on the DISPLAY

- Close the jumper of terminal **11** towards **ØS** and supply with a potentiometer a voltage of at least **100 mV** on the reference input. Now the number **ONE** lights up on the DISPLAY and the motor will start rotating in one direction.

- Tune the maximum velocity by setting the highest possible input reference (highest value) and turn the **P1** trimmer on the customising card to the desired value.

- Check the well-functioning of the drive and proceed the offset tuning by applying a 0V reference voltage and turning the **P1** trimmer (on the regulation card) until the motor stops rotating.

DIAGNOSTICS
Trouble shooting guide

The DISPLAY does not light up

Check the power supply (within the allowed range) on the L1, L2, L3 terminals. If there is no voltage supplied, check the fuses mounted before and after the power transformer.

If the terminals result under voltage, but the BSA 300 is not enabled, please contact the customer service of ES-TECHNOLOGY or the supplier of the drive

The DISPLAY shows "1" however the motor stands still and has no torque

If the display signals that the drive is enabled but the motor does not rotate or shows no resistance (the rotor rotates freely), check that the terminal 10 is not occupied, or if used, that there is a sufficient positive voltage towards ground which allows to generate an appropriate torque (see description of terminal 7 TORQUE)

The DISPLAY shows "3" and the motor stops rotating

This alarm indicates that the motor temperature (measured by the P.T.C. motor probe) is too high for a faultless operation. The DRIVE is disabled until the motor temperature does not reach the allowed values. This alarm occurs also if the P.T.C. probe is not connected to terminal 8 of the BSA 300. If this protection will not be used, connect terminal 8 towards ground (terminals 3, 9, and 16)

The DISPLAY shows "5" and the motor rotates irregular

This alarm ("mains under or over voltage") occurs instantaneously until the power supply is too low for a well operation of the drive. This alarm occurs also if the power supply exceeds the maximum allowed value for the drive. If this alarm is displayed during the acceleration period of the motor, probably one of the phases which supplies the BSA 300 fails. It is recommended to check the fuses before and/or after the power transformer. If the fuses are in perfect conditions and the three-phase power supply is present on the L1, L2, L3 terminals, please contact the customer service of ES-TECHNOLOGY or the supplier of the DRIVE

The DISPLAY shows "6" when starting or during normal operation

If this alarm occurs, cut off immediately the power supply of the BSA unit or better of the complete electrical installation. Check the motor connections and the electrical insulation of the motor terminals towards ground (housing). The normal value is in the range of megaohm. If the alarm continues after having carried out the controls without having noticed any abnormality, please contact the customer service of ES-TECHNOLOGY or the supplier of the DRIVE

The DISPLAY shows "7" and the motor lose speed

It signalises that the motor has absorbed a current superior to its nominal current for more than 3 seconds. When the **IxT** protection is activated, the current output of the drive is reduced by a value inferior to 50 % in consequence of which the current output of the drive decreases. This abnormality can be caused by a hardening of the mechanical motor connections or by a wrong motor dimensioning.

The DISPLAY shows "8" and the drive is blocked

This alarm occurs only if the resolver circuit is interrupted. Check the corresponding connections.

The alarm is also displayed in case of mechanical resolver breakage.

The DISPLAY shows "9" and the drive is blocked

This alarm protects against excessive gain on the braking circuit. This condition can cause the breakage of the inner recovery resistance of the DRIVE. For a faultless operation, reduce the motor velocity or increase the deceleration ramp period.

The DISPLAY shows "0" and the drive is blocked

This alarm protects against overheat of the drive dissipator. Verify that the inner working temperature is inferior to 40°C, that the air shafts of the installation are free, and that the ventilation of the DRIVE is not hindered due to dirt or that the minimum free distance is not observed and therefore a well ventilation is not guaranteed. Also verify the faultless operation of the inner DRIVE fans (if mounted) by controlling if there is an air outflow on the top side and that the fans are not hindered by some small objects which were fallen into. If the alarm continues after having carried out all the controls without having noticed any abnormality, please contact the customer service of ES-TECHNOLOGY or the supplier of the DRIVE.

NOTES:

All the information included in this USER'S MANUAL can be modified by ES-TECHNOLOGY S.r.l. without notice.

If you will find some mistakes inside the manual, please let us know to make changes in it

ES TECHNOLOGY S.R.L.

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