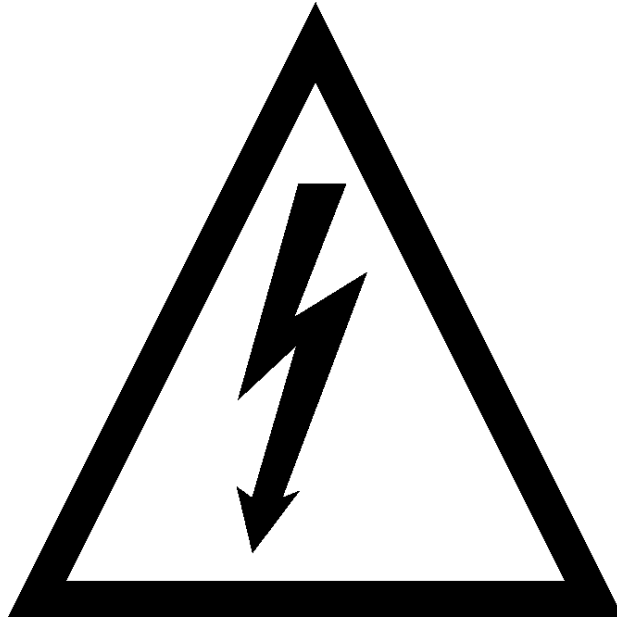


**Technical features and
installation instructions**

DSAE 150/300



WARNING!

The converters of the DSAE 150/300 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.

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GENERALITY

The four quadrant converters of the DSAE 150/300 series integrate both the power supply unit and the braking unit and have been realised to exploit the most advanced technology, the final IGBT stage which operates with a PWM switching frequency of 10 KHz.

The regulation is realised by the P.W.M. (Pulse Width Modulation) using a particular technology with 2 different signals (instead of the traditionally used single signal) with a phase displacement of 180° for controlling the final power.

The combination of these signals allows to obtain a switching cycle of the final power which reduces the current ripple by 50 % combined with all advantages regarding maintenance and life of the brushes and of the motor.

The converters of the DSAE 150/300 series are developed for controlling the speed of D.C. motors with permanent magnets.

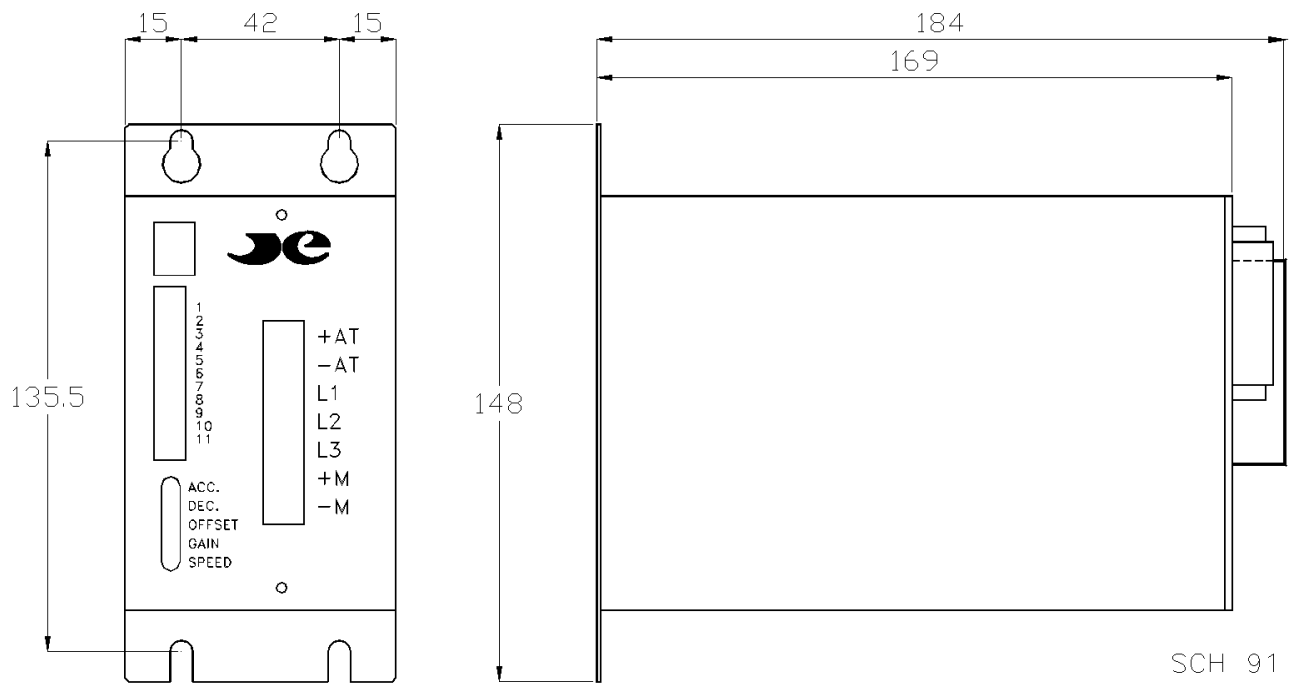
IDENTIFICATION DATA

For the identification or the order of the converters DSAE, use the following code:

DSAE - AAA - B - CC - D - EEEE - FF

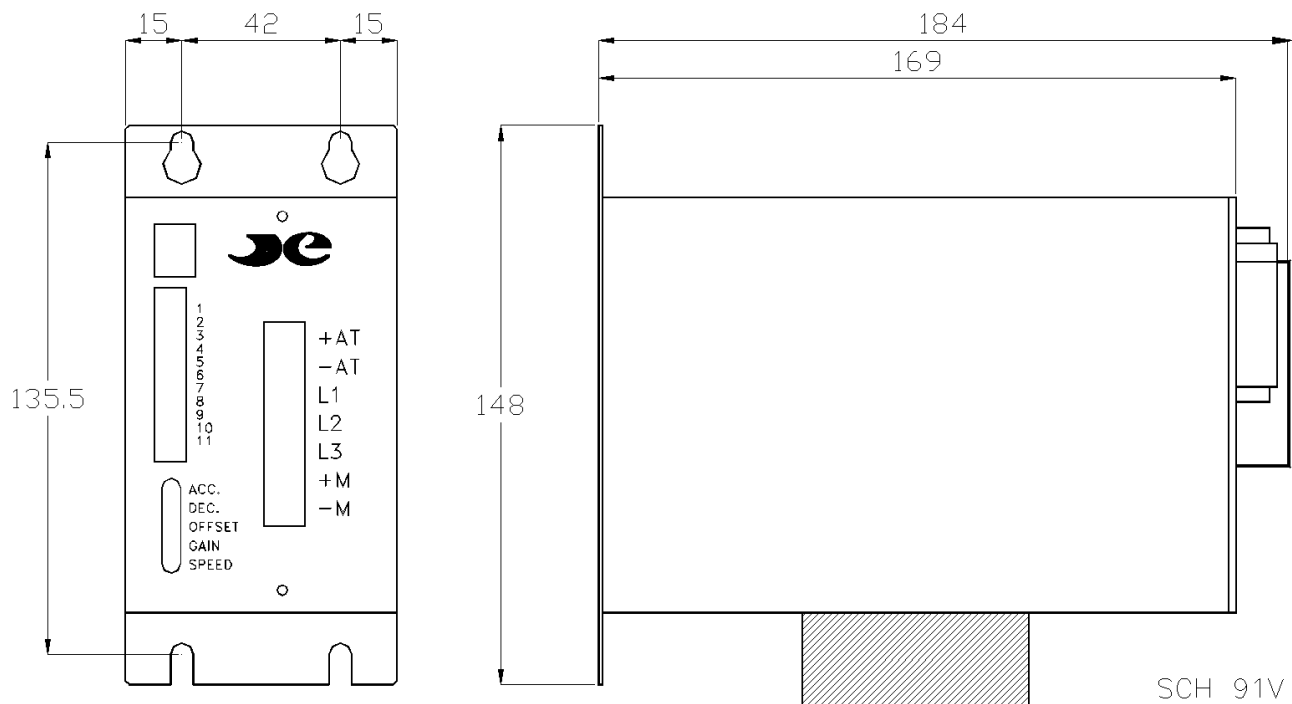
AAA	=	150	Power supply from 20 ÷ 60 Vac
		300	Power supply from 60 ÷ 220 Vac
B	=	<i>P</i>	Panel version (completely closed)
		<i>S</i>	SLIM panel version
		<i>R</i>	Rack version
CC	=		Current size
DD	=	<i>M</i>	Single-phase version
	=	<i>T</i>	Three-phase version
EEEE	=		Hardware version code
FF	=		Tacho feedback
		<i>RA</i>	Armature feedback
		<i>E</i>	Encoder feedback
		<i>AD</i>	Limit switch version

OVERALL DIMENSIONS

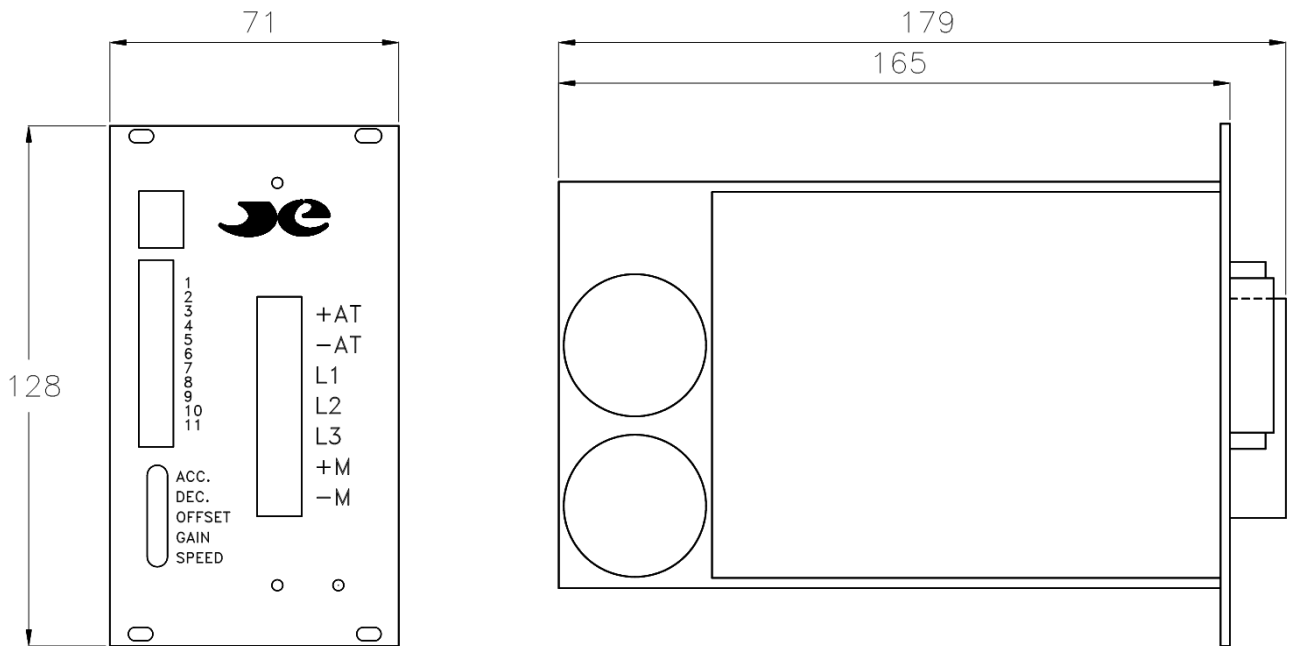


DSAE 150 P / DSAE 300 P 5/10, 7.5/15

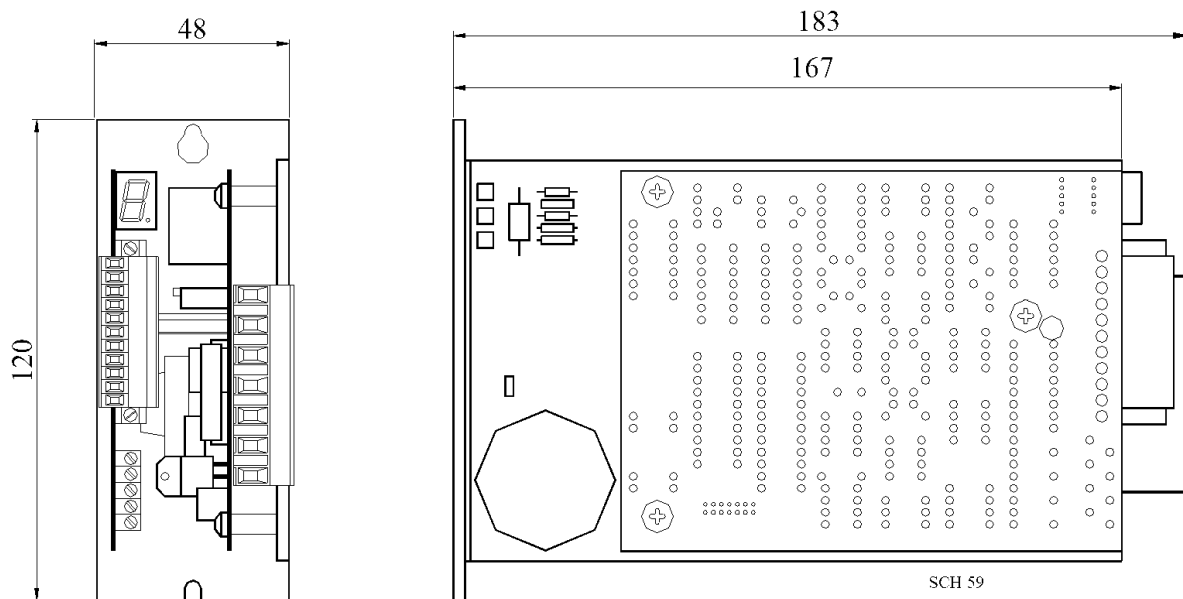
DSAE 150 P / DSAE 300 P 10/20, 15/30



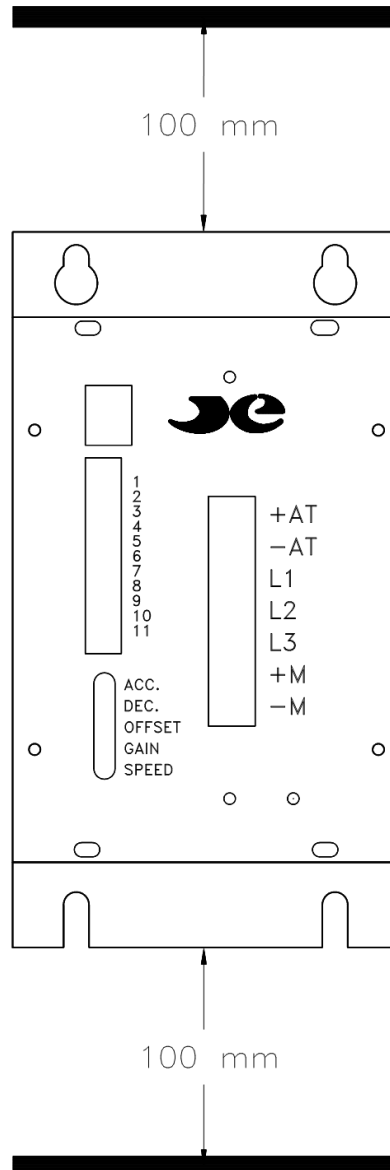
DSAE 150 R / DSAE 300 R 5/10 ÷ 15/30



DSAE 150 S / DSAE 300 S [SLIM VERSION]



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



TECNICAL FEATURES

Version “DSAE 150”

TYPE	POWER SUPPLY	NOMINAL CURRENT AT 40 °C	PEAK CURRENT FOR 1.5 sec.	OUTPUT VOLTAGE
DSAE 150 / 5A	Three-phase 20 ÷ 60 Vac ± 10% 50 - 60 Hz.	5A	10A	25÷80 Vcc
DSAE 150 / 7.5A		7.5A	15A	
DSAE 150 / 10A		10A	20A	
DSAE 150 / 15A		15A	30A	

Version “DSAE 300”

TYPE	POWER SUPPLY	NOMINAL CURRENT AT 40 °C	PEAK CURRENT FOR 1.5 sec.	OUTPUT VOLTAGE
DSAE 300 / 5A	Three-phase 60 ÷ 220 VAC ± 10% 50 - 60 Hz.	5A	10A	80÷300* Vcc
DSAE 300 / 7.5A		7.5A	15A	
DSAE 300 / 10A		10A	20A	
DSAE 300 / 15A		15A	30A	

All converter versions can also be supplied in single-phase configuration. In this case, for sizes 10A and 15A it is necessary to install an additional connector externally (connected between the +/- AT terminals). Contact ES TECHNOLOGY assistance service for more information.

GENERAL CHARACTERISTICS

<i>Supply voltage of the DSAE 150:</i>	from three-phase autotransformer with a secondary voltage of 20V ÷ 60VAC ±10%
<i>Supply voltage of the DSAE 150 M:</i>	from single-phase autotransformer with a secondary voltage of 20V ÷ 60VAC ±10%
<i>Supply voltage of the DSAE 300:</i>	from three-phase autotransformer with a secondary voltage of 60V ÷ 220VAC ±10%
<i>Supply voltage of the DSAE 300 M:</i>	from single-phase autotransformer with a secondary voltage of 60V ÷ 220VAC ±10%
<i>Mains frequency:</i>	50/60 Hz.
<i>Output voltage: (DSAE 150)</i>	25 / 80 Vdc
<i>Output voltage: (DSAE 300)</i>	80 / 300 Vdc
<i>Speed loop bandwidth:</i>	> 100 Hz.
<i>PWM switching frequency:</i>	10 KHz
<i>Switching frequency:</i>	20 KHz on motor
<i>Velocity input reference:</i>	±10 VDC (input impedance 100 KΩ)

Regulation:

- Maximum adjustable speed with a resistance of **R88** on regulation card
- Adjustment *end* of speed by trimmer **P5** "SPEED" on regulation card
- Compensation of the offset of the speed signal with trimmer **P3** "OFFSET" on regulation card
- Acceleration ramp slope adjustable from 0 a 1 sec. with trimmer **P1** "ACC." on regulation card
- Deceleration ramp slope adjustable from 0 a 1 sec. with trimmer **P2** "DEC." on regulation card
- Current limit adjustable with resistance **R83** on regulation card
- Rating current of the motor and intervention I*T adjustable with resistance **R84** and **R86** on regulation card
- Proportional gain of the speed ring adjustable with trimmer **P4** "GAIN". Dynamic constants adjustable through **R87** and **C24**

Function:

- Diagnostics on DISPLAY
- Torque programming from the outside by signal from 0 to +10V_{DC} trough closing of the welding point **S2** on regulation card
- Possibility to connect an external recovery resistance if required (the operation can be made, during the assembly phase, in our firm only)
- Possibility to share the **CC** supply **BUS** through suitable power terminals.

Inner protections:

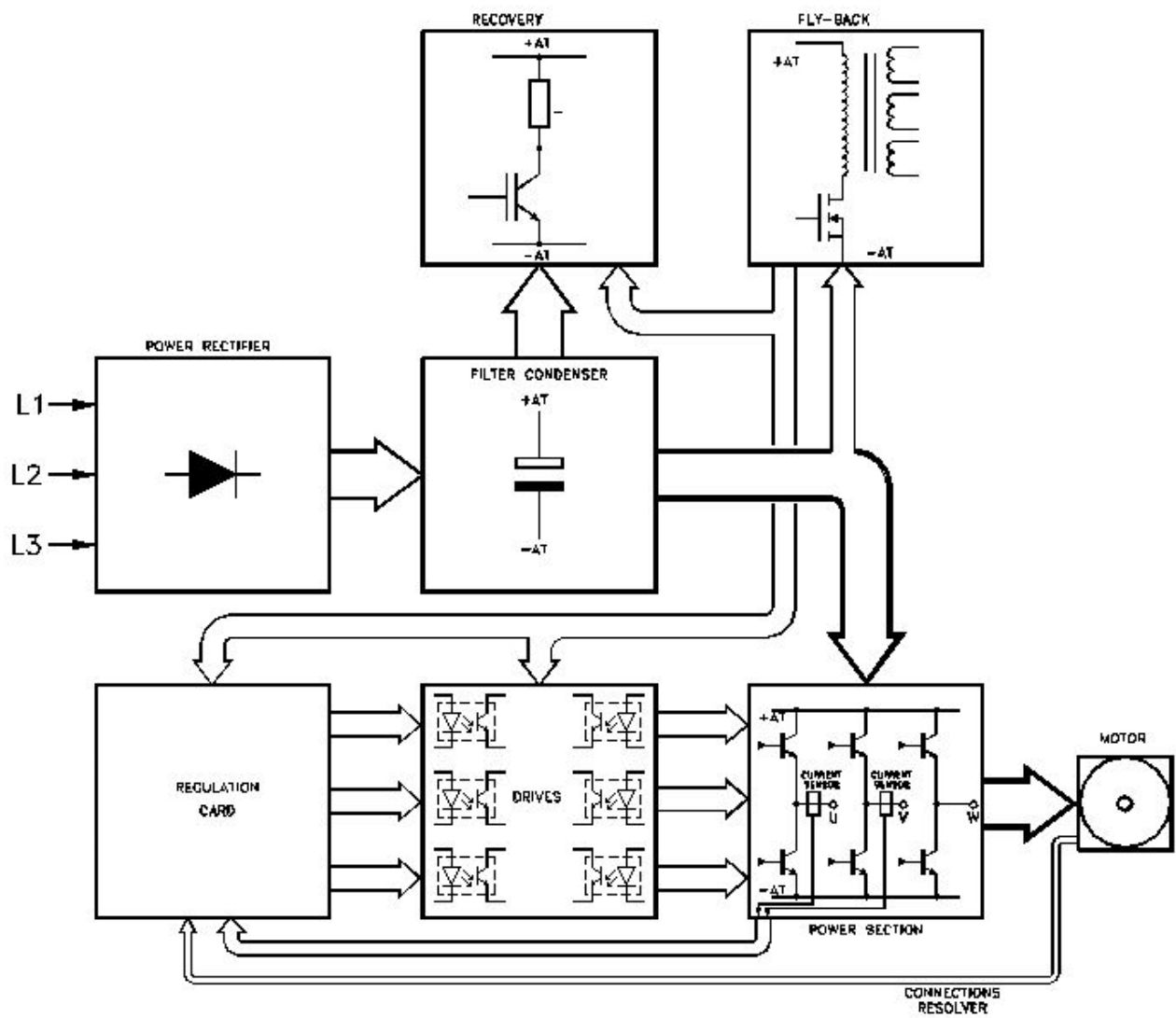
- Against short-circuit between motor terminals
- Against mains overvoltage
- Against mains undervoltage
- Against power overheat
- Against excessive energy gain on inner clamp resistance's
- Against breakage or failure of tachogenerator connections

Optional:

- Velocity regulation with armature feedback
- Velocity regulation with encoder feedback
- Limit switch option

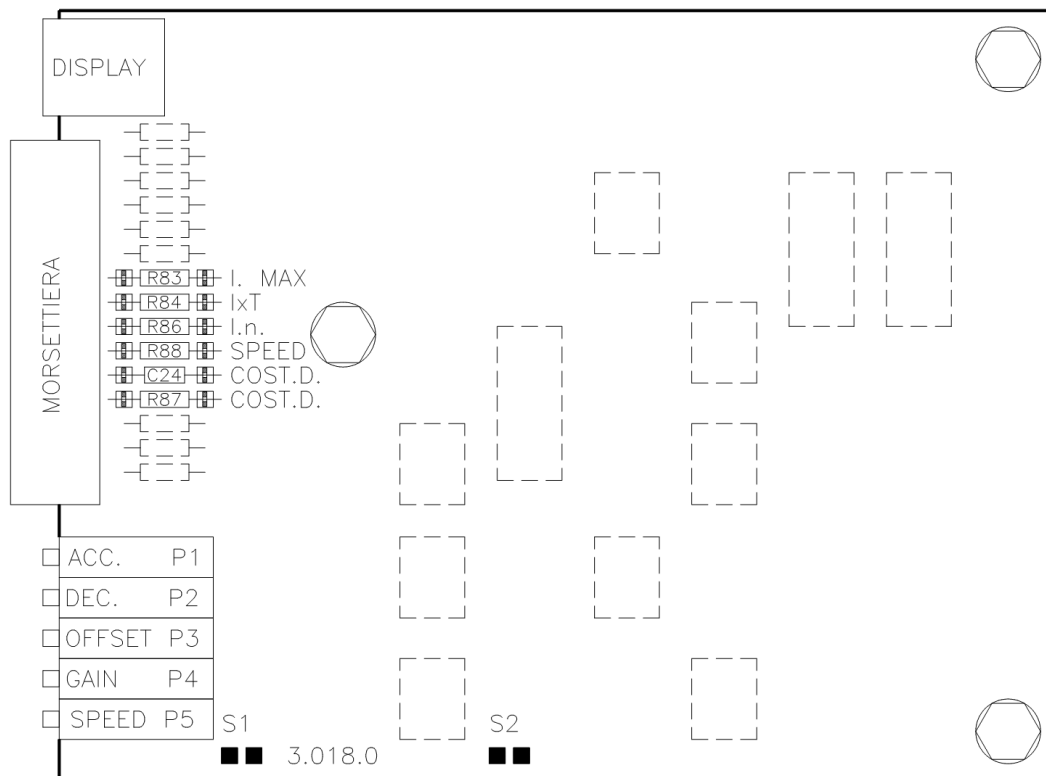
Operation:

<i>Temperature:</i>	from 0 ÷ 40°C
<i>Humidity:</i>	90% max. without condensation
<i>Altitude:</i>	1000 m.

FUNCTIONAL DIAGRAM

CALIBRATIONS

Map of the adjustment and calibrations' board



Speed calibration

The maximum speed of the motor can be modified by changing the value of the resistance **R88** [SPEED].

The following table allows a quick calculation of the resistance itself.

R88	Tachogenerator voltage	
	Min.	Max.
0 Kohm	2,2 V	5 V
3,3 Kohm	3,7 V	8 V
10 Kohm	7 V	15 V
18 Kohm	10 V	22 V
39 Kohm	19 V	42 V
68 Kohm	31 V	69 V
120 Kohm	54 V	118 V

In the columns “*Tachogenerator voltage*” we show the voltage which can be obtained by operating on the resistance **R88** and on the related trimmer “SPEED” on the front part of the converter.

As an alternative to the values indicated on the table, you can calculate the value of the resistance **R88** by using the following formula:

$$R88[Kohm] = Vtacho_max. * 1.06 - 6.3$$

Where:

Vtacho_max. = Maximum obtainable tachogenerator voltage (expressed in volts)

Calibration of maximum current

The value of the resistance **R83** [I.MAX.] determines the maximum current which can be issued by the converter. This resistance can be determined through the following formula:

$$R83[ohm] = \frac{8800}{Ipicco[A]}$$

Where:

I peak = Value of maximum current the DRIVE can issue (expressed in A)

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

The value of the resistance **R84** [I*T] determines the point of intervention of the device **I*T**. This device allows to safeguard the motor from an excess of power dissipation if it undergoes a load which normally exceeds the rating one.

The value can be calculated by using the following table or the related formula.

R84	I*T (It)
820 ohm	50% di <i>I picco</i>
680 ohm	40% di <i>I picco</i>
560 ohm	35% di <i>I picco</i>
470 ohm	30% di <i>I picco</i>
390 ohm	28% di <i>I picco</i>
330 ohm	25% di <i>I picco</i>
270 ohm	21% di <i>I picco</i>

$$R84[Kohm] = \frac{10 * It[A]}{6.5 * Ipicco - It[A]}$$

Calibration of the rating current of the motor

The value of the resistance **R86** [I.n.] determines the current issued by the DRIVE after the intervention of the device **I*T**. This current is normally equal to the rating current of the motor less 10%. The following table the related formula allows a quick calculation of this resistance.

R86	I n
1.8 Kohm	18% di <i>I picco</i>
2.2 Kohm	25% di <i>I picco</i>
2.7 Kohm	26% di <i>I picco</i>
3.3 Kohm	30% di <i>I picco</i>
4.7 Kohm	35% di <i>I picco</i>
5.6 Kohm	40% di <i>I picco</i>

OBSERVATIONS

Dynamic constants

The dynamic constant of the speed ring is made of the condenser **C24** [COST.D.] and by the resistance **R87** [COST.D.]. Normally these components have the following value:

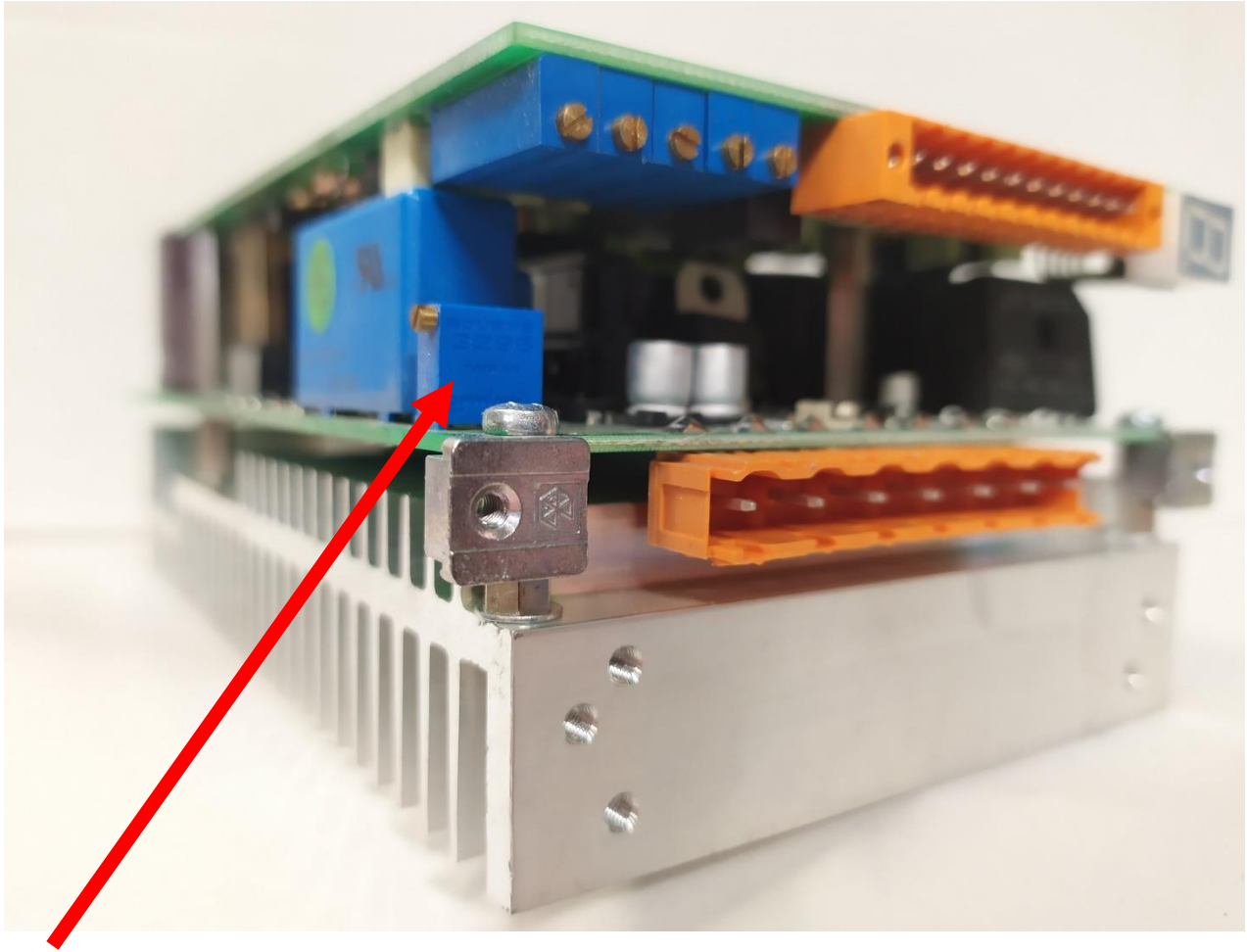
C24 = 47 nF **R87** = 390 Kohm

If you need to modify the value of these components, we recommend contacting the assistance service of ES-TECHNOLOGY.

The gain of the speed ring can be modified by operating on the trimmer **P4** "GAIN", placed on the front part of the drive. This trimmer changes only the proportional component of the signal.

Calibration of the optional card “ARMATURE REACTION NOT ISOLATE”

The setting of the armature feedback is performed by the personnel assigned during the testing phase and it is not possible to change the configuration after this passage



P3

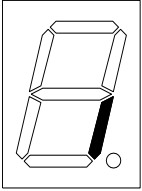
Calibration of the maximum motor speed

With the speed reference at maximum, act on the P3 trimmer, for a coarse adjustment, until the desired speed is obtained. For better calibration, use the P5 “SPEED” trimmer on the front.

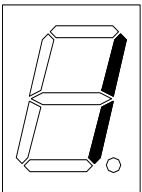
SIZING OF COMPONENTS

Size DSAE	Fuses AC	Cable section	Recovery resistance	Filter
DSAE 300 / 5A	3 x 10	∅	78Ω 56W	Three-phase 440Vac 5A
DSAE 300 / 7.5A	3 x 10	∅	56Ω 56W	Three-phase 440Vac 5A
DSAE 300 / 10A	3 x 16	∅	39Ω 56W	Three-phase 440Vac 5A
DSAE 300 / 15A	3 x 20	∅	27Ω 56W	Three-phase 440Vac 5A

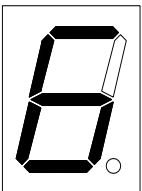
DISPLAY SIGNALS



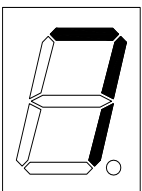
Segment Indicates that the unit is supplied with power, however not enabled for operation



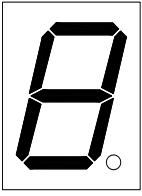
One Drive enabled for operation



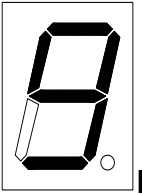
Six Fault alarm. Short-circuit between the motor connections or of the power unit. Check the insulation of the motor terminals and towards earth (motor housing) by measuring the resistance. The measured value has to be inferior to 1 Mohm. During this operation the DRIVE is blocked and can be reset by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



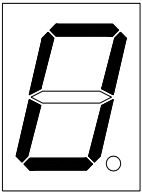
Seven The IxT device is activated. This protection circuit limits the DRIVE current to the fixed nominal current (which corresponds normally to the nominal current of the motor). After 2 seconds this function is disactivated and allows the maximum current output of the motor size.

**Eight**

Alarm of missing or inverted connections of terminal 7 and 8 of the tachogenerator. During this operation the DRIVE is blocked and can be reset by tuning 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**

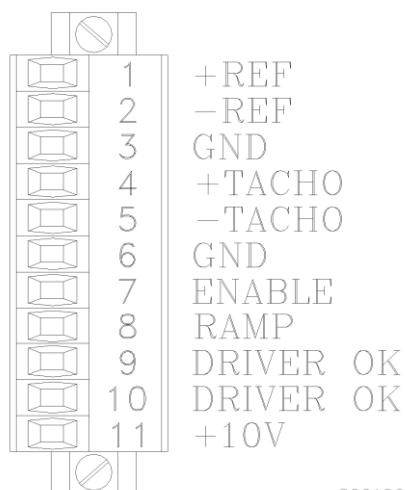
Overheat alarm of the power supply. Until the abnormality continues, the drive is disabled. Automatic reset is done when the normal operation temperature is achieved. Check the well functioning of the ventilation. Observe the minimum free distance of at least **10 cm.** of the inferior part when installing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

TERMINAL CONNECTIONS

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

Connector "X1"


TERMINAL	NAME	TYPE	DESCRIPTION
1	+REF	IN	Non inverting 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 terminal 6
4	+TACHO	IN	Positive input signal of the tachogenerator
5	-TACHO	IN	Negative input signal of the tachogenerator
6	GND		0V of the regulation circuits, such as terminal 3
7	ENABLE	IN	0V input signal for drive enable
8	RAMP	IN	Input for the introduction of the internal ramp circuit. With the terminal free, the ramps are of zero second (ramps excluded) with +10V the ramp are included
9	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)
10	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)
11	+10V	OUT	Auxiliary voltage of +10V (max. 2mA)



200109

POWER CONNECTIONS

Connector "X2"

TERMINAL	NAME	TYPE	DESCRIPTION
	+AT		Terminal for the connection to the internal BUS of power supply
	-AT / R.R.		Terminal for the connection to the internal BUS of power supply / connection of the external recovery resistance (an operation which can be performed only at ES-Technology)
	L1	IN	Phase 1 of the secondary of the three-phase transformer for the power supply of the converter (60 VAC max. for "DSAE 150" version, 220 VAC max. for "DSAE 300" version)
	L2	IN	Phase 2 of the secondary of the three-phase transformer for the power supply of the converter (60 VAC max. for "DSAE 150" version, 220 VAC max. for "DSAE 300" version)
	L3	IN	Phase 3 of the secondary of the three-phase transformer for the power supply of the converter (60 VAC max. for "DSAE 150" version, 220 VAC max. for "DSAE 300" version)
	-M	OUT	Negative motor connection terminal
	+M	OUT	Positive motor connection terminal
			Connection terminal for grounding

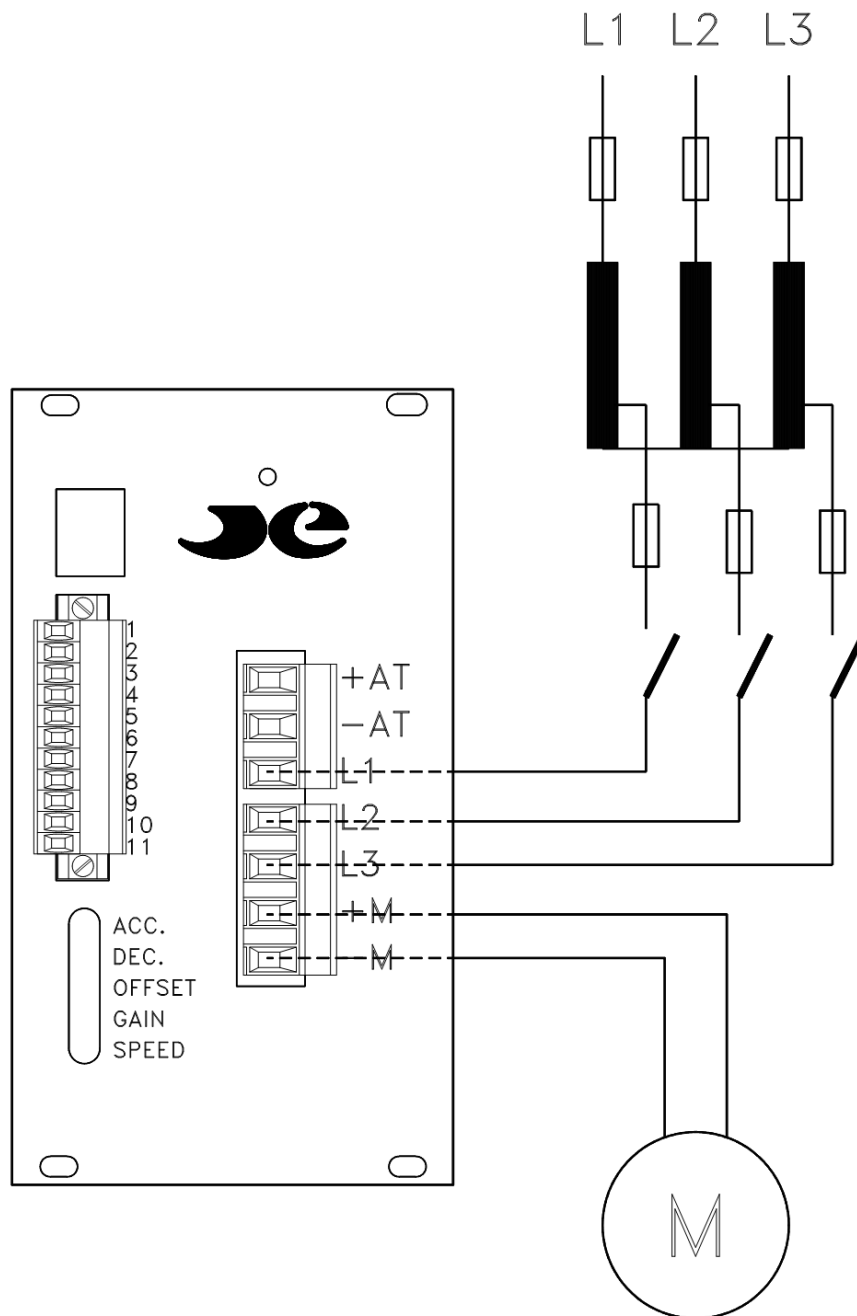
Attention:

USE SHIELDED CABLES FOR POWER AND DYNAMO CONNECTIONS

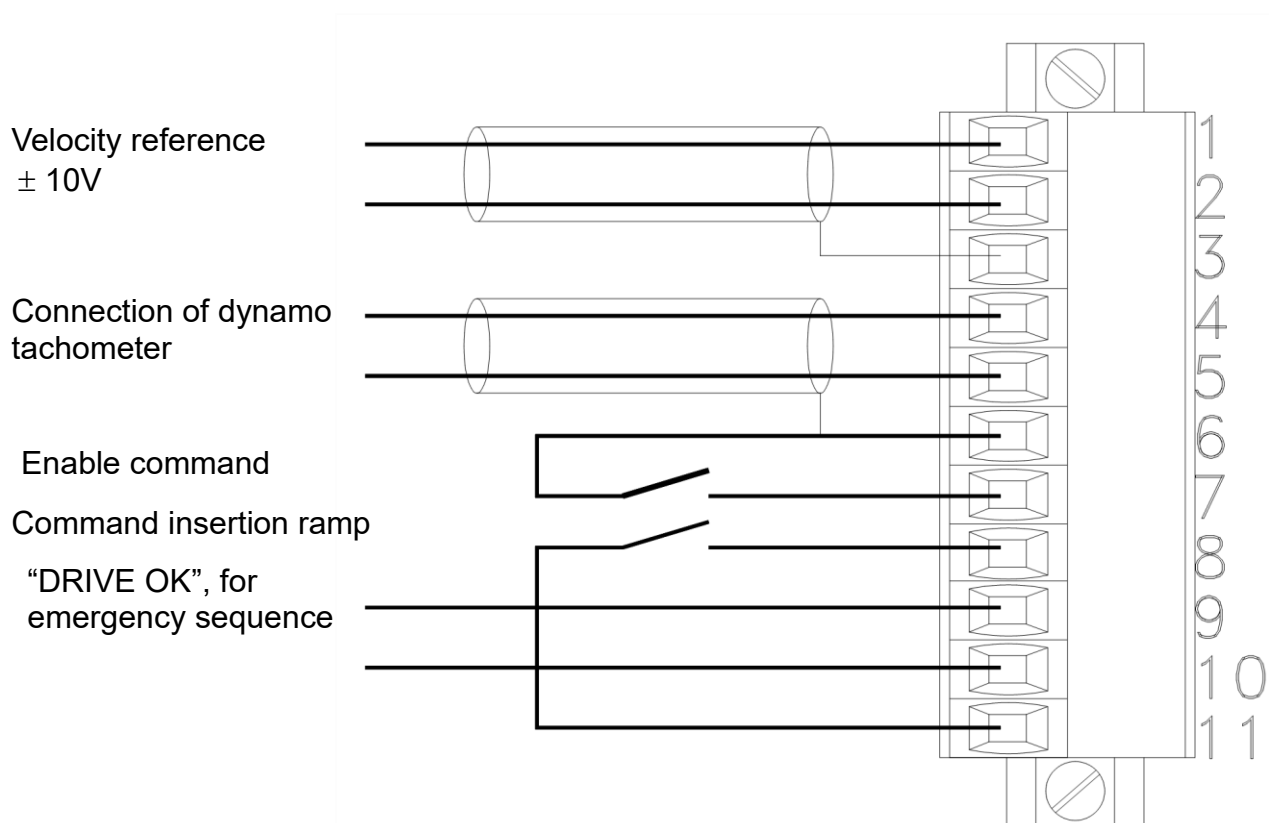
Do not disconnect the motor when the converter is supplied, even by converter disabled. Do not supply the converter during controls and maintenance.

EXAMPLES OF CONNECTIONS

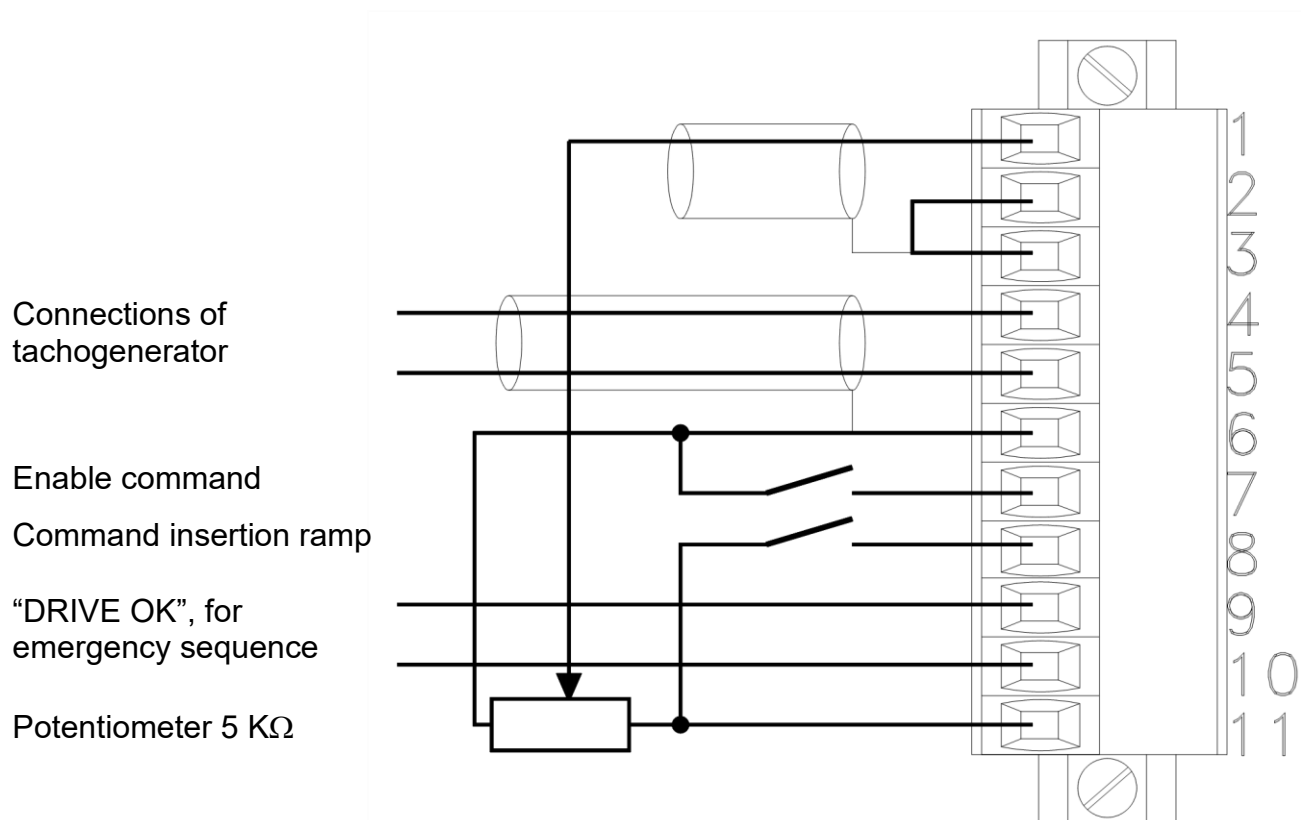
Power connections



Connection with PLC or CNC reference



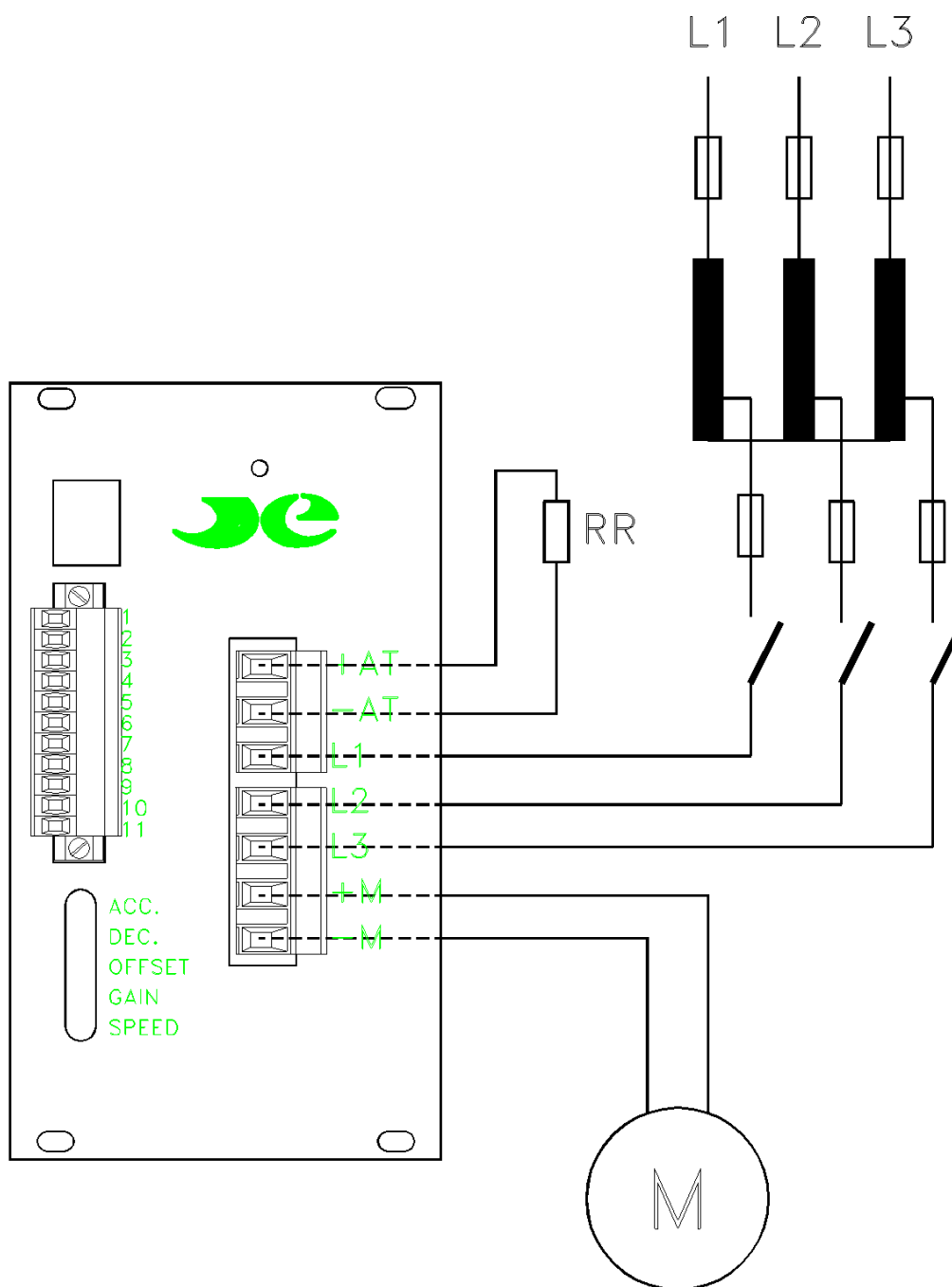
Connection with potentiometer reference



Remark: To obtain the inversion of the direction of rotation of the motor, connect the cursor of the potentiometer to the terminal **2** and connect the terminal **1** to the terminal **3**.

Connection of the external recovery resistance

(When forecast if pre-arranged)



For the sizing of the external recovery resistance “RR” see the table “ power connections “.

RECOMMENDATIONS FOR THE INSTALLATION AND OPERATION

- ◆ Unpack the DSAE 150 (DSAE 300) and verify the integrity of all the single parts.
- ◆ Connect a potentiometer of **5 K Ω** to terminals **11** and **6**. Connect the cursor of the potentiometer to terminal **1**, and terminal **2** to terminal **3**. (with a screened cable).
- ◆ Connect the terminal **8** to the power supply +10V if you wish to use internal ramps, otherwise let this terminal free.
- ◆ Prepare a jumper between the terminal **7** and **ØS** (terminal **6**).
- ◆ Connect the armature circuit of the motor to the **+M** and **-M** terminals.
- ◆ Connect the tachogenerator (with a screened cable) to terminals **4** and **5**, connect the screen to terminal **6**.
- ◆ Connect to terminals **L1**, **L2**, **L3**, the three-phase power supply, inferior to **60 V_{Ac}** (for DSAE 150) or **220 V_{Ac}** (for DSAE 300).
- ◆ Supply the DSAE 150 (DSAE 300) and check the flash-up of the *segment* on the Display.
- ◆ Close the jumper of the terminal **7** 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. If the number **EIGHT** light up, invert the connection of terminals **4** and **5**.

- ◆ Tune the maximum velocity by setting the possible input reference (example +10V) and turn the **P5** "SPEED" trimmer on the regulation 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 **P3** "OFFSET" 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 DSAE 150/300 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 there is a signalling of enabling performed but the motor does not move and does not produce any resistance (the rotor is turning freely), check the correct sizing of the resistance R83. If this is absent or it has a mistaken value, mount a suitable resistance by the following the suggestions indicated on page 14

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

If this alarm occurs, cut off immediately the power supply of the DSAE 300 unit or better of the complete electrical installation and check the motor connections. If the connections result correct, check the condition of the brushes and if the motor is clean and free of carbon residues. (Take note that dirt or carbon dust as a sign of wear of the brushes might cause an insufficient insulation of the motor armature circuit towards ground). In case of malfunction of the motor collector and the brushes, a motor inspection is recommended. 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

This alarm occurs always after the lighting up of the **point** on the DISPLAY. 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 tachogenerator circuit is interrupted or if the tachogenerator has been wrongly connected when installing the unit. In any case, the motor will not be out of control; check the tachogenerator and the corresponding connections

This alarm might also occur if the dynamo connection towards the motor is lose or broken

NOTE: A lose tachogenerator connection might cause an irregularly motor rotation varying according to the rotation speed

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

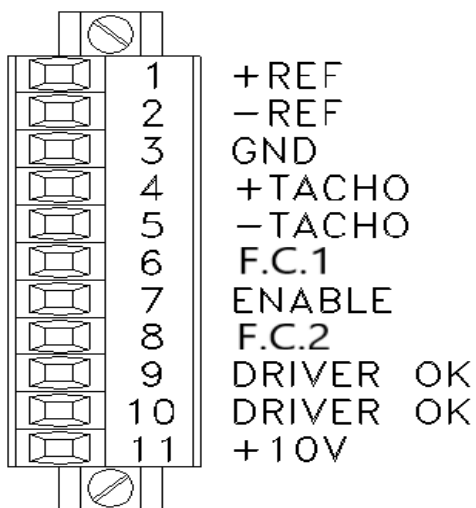
This alarm protects against overheat of the DRIVE dissipator. Verify that the inner working temperature is inferior to 40°C, that the air shafts of the installation are free, and that the ventilation of the DRIVE is not hindered due to dirt or that the minimum free distance is not observed and therefore 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.

LIMIT SWITCH OPTION (AD)**CONNECTIONS OF THE REGULATION**

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

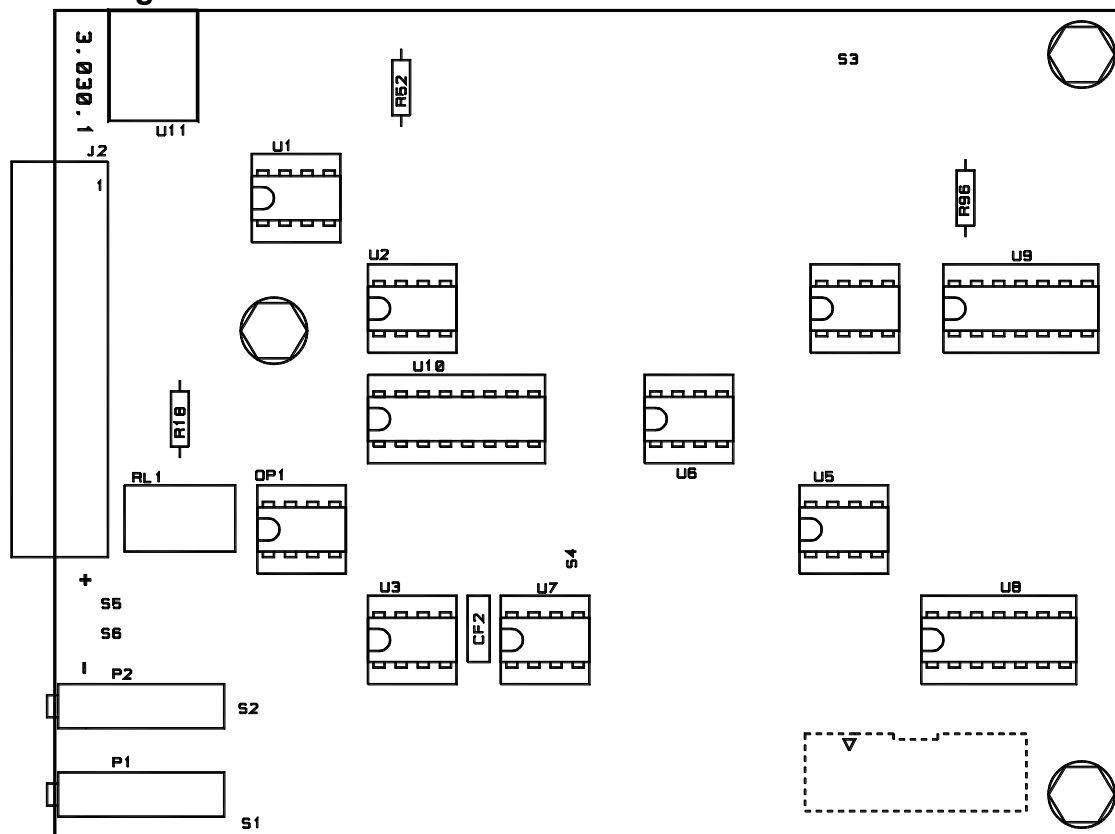
Connector "X1"

TERMINAL	NAME	TYPE	DESCRIPTION
1	+REF	IN	Non inverting 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 terminal 6
4	+TACHO	IN	Positive input signal of the tachogenerator
5	-TACHO/GND	IN	Negative input signal of the tachogenerator
6	F.C.1	IN	Limit switch input N.C at +24V
7	ENABLE	IN	0V input signal for drive enable
8	F.C.2	IN	Limit switch input N.C at +24V
9	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)
10	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)
11	+10V	OUT	Auxiliary voltage of +10V (max. 2mA)



CALIBRATIONS

Map of the regulation and calibration card EST030. 1



Trimmer P1 OFFSET

Trimmer P2 SPEED

Calibration:

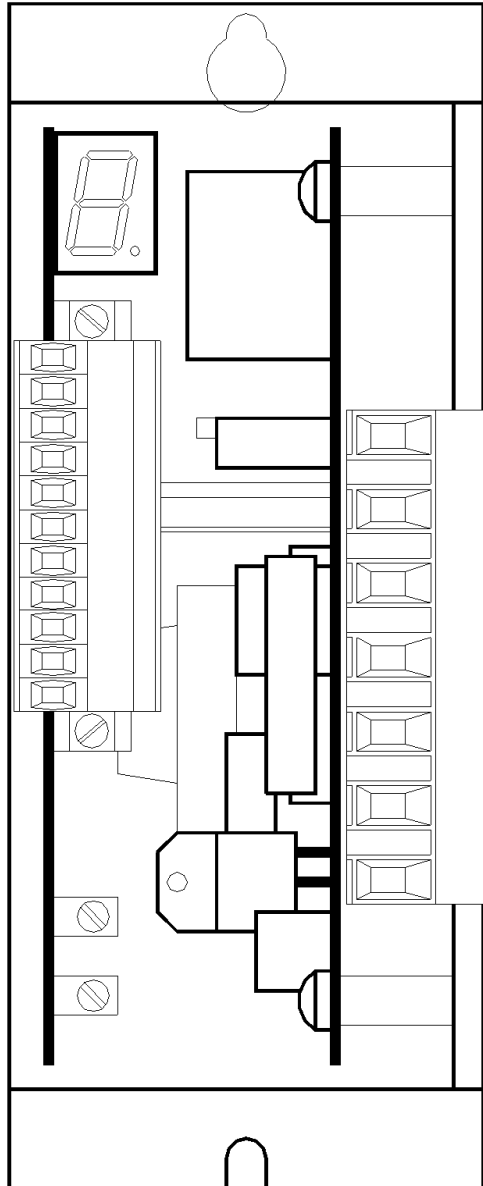
As regards the settings, follow the instructions for card 3018.2, with the following numbering of the resistors to be modified:

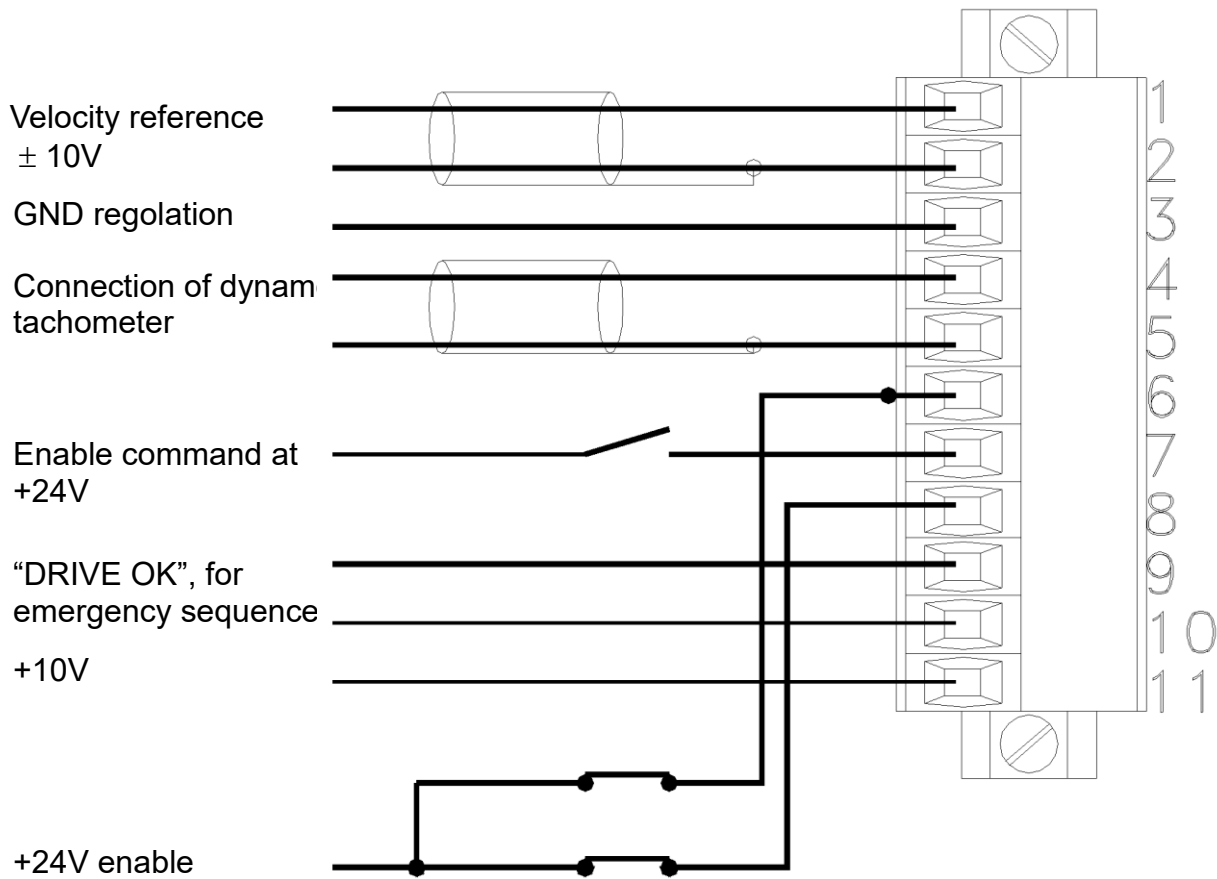
Resistors on 3030.1	Corresponding resistance on the 3018,2
R18	R88
R96	R83
R52*	R84

* The selected R52 value must be multiplied by 10 with respect to the value reported in the R84 table (e.g., if R84 = 820 ohm R52 will be 8.2 Kohm)

FRONT VIEW

**OFFSET
SPEED**



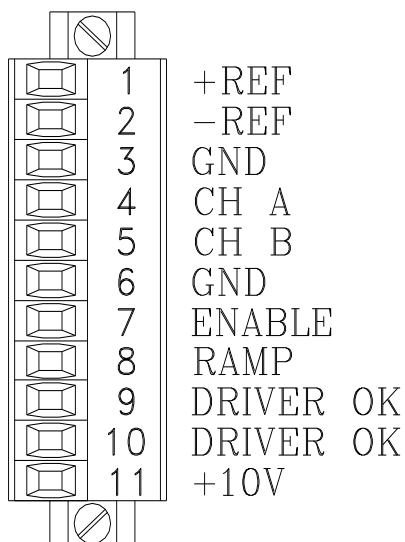
LIMIT SWITCH CONNESSION

ENCODER FEEDBACK OPTION (E)

INPUT / OUTPUT TABLE AVAILABLE ON THE CARD REMOVABLE TERMINAL BLOCK EST084.0

Connector "X1"

TERMINAL	NAME	TYPE	DESCRIPTION
1	+REF	IN	Non inverting 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 terminal 6
4	CH A	IN	Channel A input of the feed-back encoder (da 5 a 24V)
5	CH B	IN	Channel B input of the feed-back encoder (da 5 a 24V)
6	GND		0V of the regulation circuits, such as terminal 3
7	ENABLE	IN	0V input signal for drive enable
8	RAMP	IN	Input for the introduction of the internal ramp circuit. With the terminal free, the ramps are of zero second (ramps excluded) with +10V the ramp are included
9	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)
10	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)
11	+10V	OUT	Auxiliary voltage of +10V (max. 2mA)

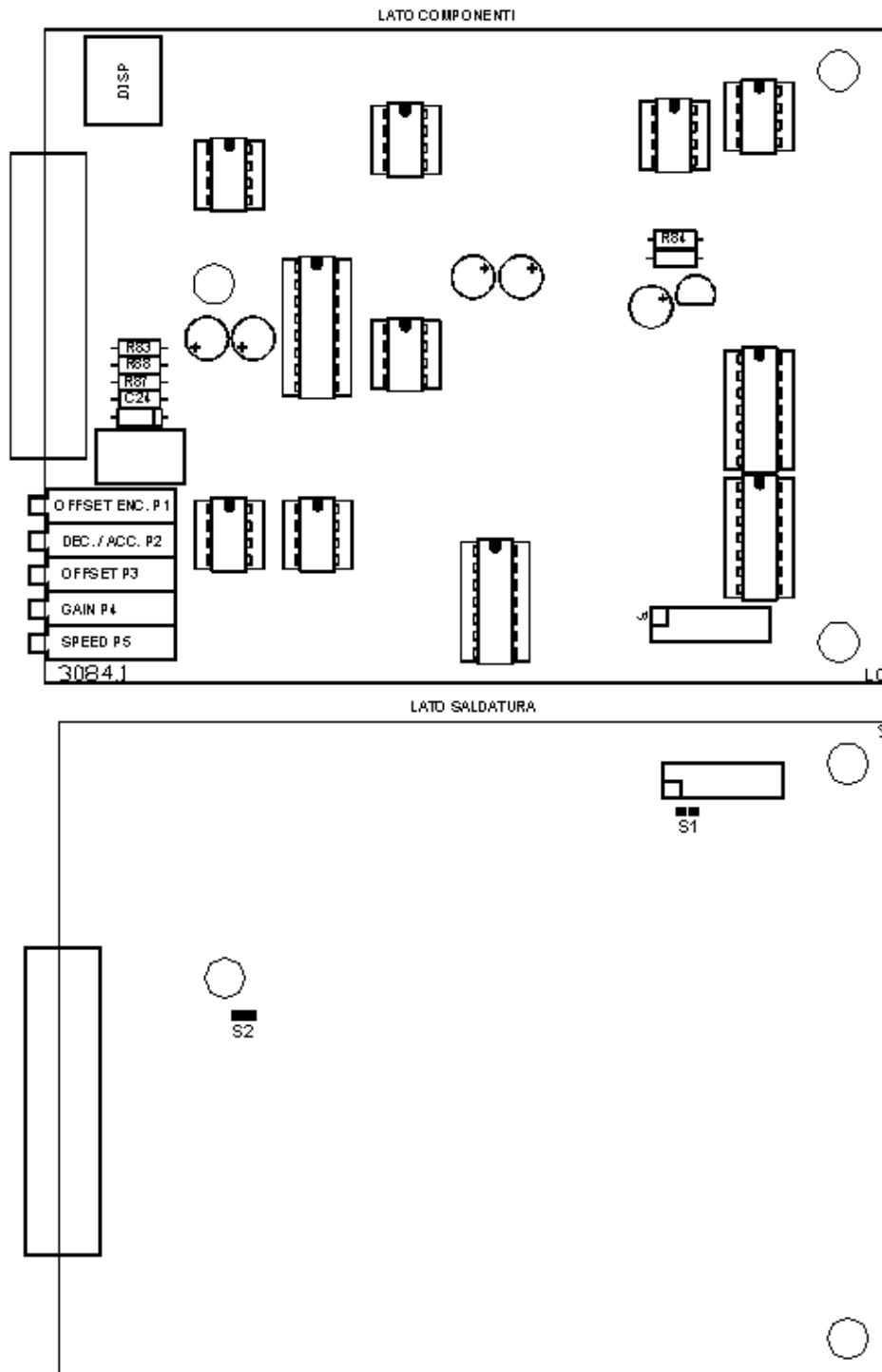


When ordering, it is necessary to indicate the amount of pulses / revolution of the encoder to be connected, its configuration (e.g., line drive, push pull) and the voltage level of signals A and B.

ATTENTION: Use the P1 trimmer on the front of the drive to adjust the offset introduced by the encoder feedback

CALIBRATIONS

Map of the adjustment and calibration sheet



As regards the settings of R83-R88-R84, follow the instructions in the manual for the standard EST018.0 card. The R86 has been eliminated, therefore it does not appear on EST084.0

RECOMMENDATION FOR INSTALLATION ACCORDING TO THE EMC STANDARDS

The application standards illustrated here below aim to reduce the interference coming either from the converter or those referred to it.

For the use of converter in EMC environments, it is necessary to use the mains filter, which reduces the converter emission. The filter must be connected observing the connection diagram indicated. (Fig. 1)

For the power supply of the converter a transformer is necessary, the wirings must be performed with screened cables according to the connection diagram (see Fig.1).

The filter, suitably chosen according to the converter size, must be located as near as possible to the converter, but in such a way not to obstruct the ventilation of the same.

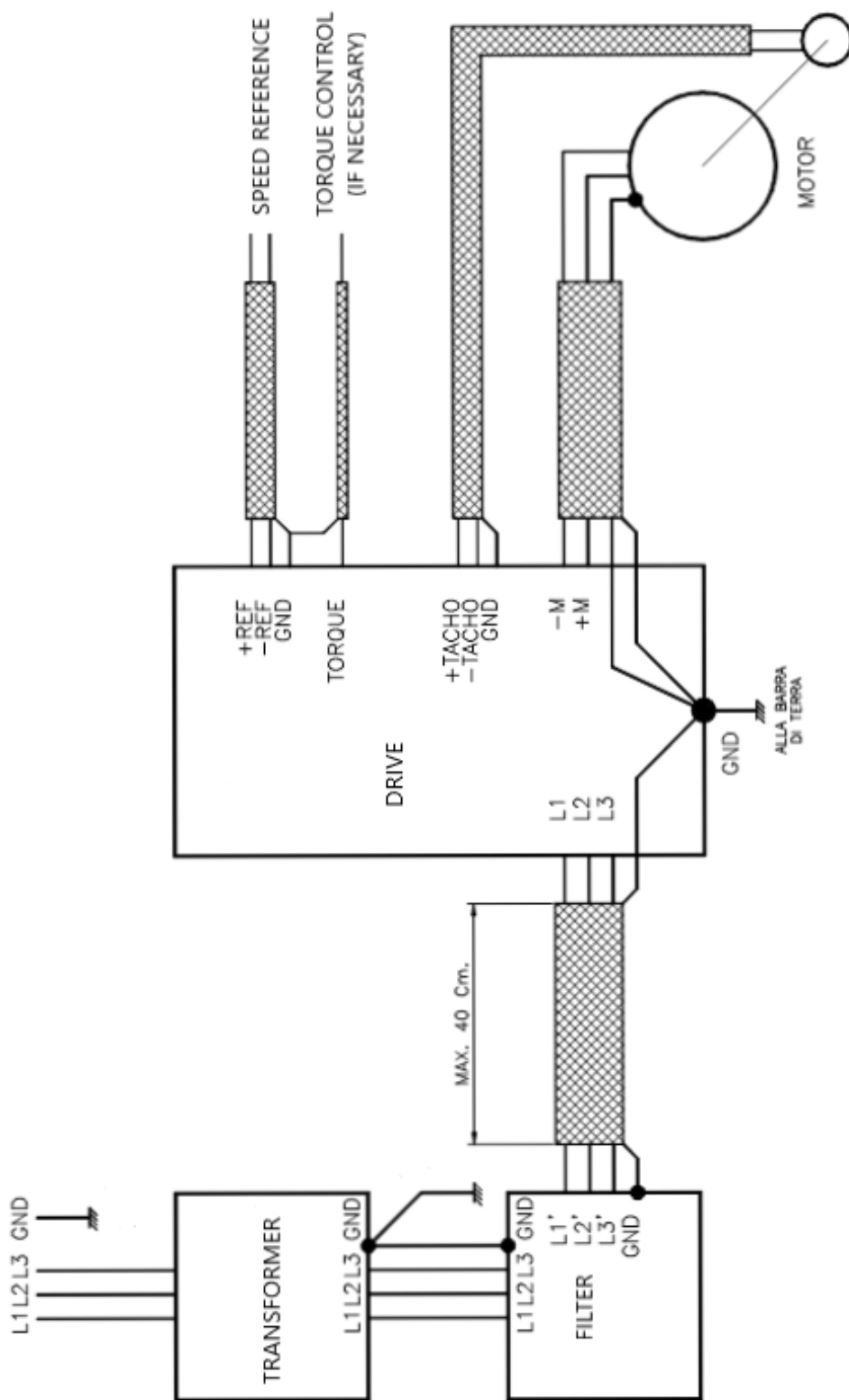
The filter connection to the converter must be performed with a no longer than 40Cm **three-phase screened cable**.

As for the cable upstream the filter, i.e., from the filter to the transformer and from it to the mains, it is not necessary for them to be performed in a screened cable.

Three conductors plus a ground connection also perform the converter connection to the motor in a screened cable. For the cable related to the motor feedback is necessary to use **a three separated screened couple**, to guarantee a low noise on the motor, even in presence of long tracts.

The connections of the speed reference and torque must be performed in a shielded cable.

The remaining control signal e.g., unlocks and signalling does not require the use of a screened cable: it is sufficient that the path is as much as possible separated from the power cables. Here below, it is shown a generically diagram for the connection of a converter, with the indication on the connection of the screened cables in use.



TACHOGENERATOR

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



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