

The B17 Analogic box series drives have CE marking because they are in conformity with the Community Directives regarding Electromagnetic and Low Voltage Compatibility.



WARNING!
THE ELECTRIC APPARATUS CAN CREATE DANGEROUS SITUATIONS FOR PEOPLE AND THINGS.

This manual shows the electrical and mechanical characteristics of the B17 Analogic box C200-D300 series converters.
It is the user's responsibility to ensure that installation is in accordance with the relevant safety laws.
The installer must also rigorously follow all the technical installation instructions that are given in this manual.
For any further information that is not contained in this manual, please contact the producer company.

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The contents of this manual can be modified without forewarning.

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The Producer: AXOR S.n.c.
Address: Viale Stazione 5, 36054 Montebello Vicentino (VI)

DECLARES under its own responsibility that the following product:

B17 box ANALOGIC series

with its relevant accessories and options, and when installed following the operation instructions supplied by the producer, is in conformity with the following Community directives, including the last modifications, and with the relevant national acknowledgement laws:

Machines directive (89/392, 91/368, 93/44, 93/68)
Electromagnetic Compatibility Directive (89/336, 92/31, 93/68)

and that the following technical regulations have been applied:

CEI EN 60204-1 Machine safety: Electric machine equipment.
CEI EN 60439-1 Set of apparatus for protection and low voltage manoeuvre (BT Panels)-Part 1: Standard supply apparatus that is subject to type testing (AS) and non-standard supply apparatus that is subject to type testing (ANS).
CEI EN 61800-3 Variable speed electric drives Part 3: Product norm regarding electromagnetic compatibility and specific testing methods.
Recalls: CEI EN 61000-4-2 CEI EN 60146-1-1.
CEI 28-6 Insulation co-ordination for apparatus in low voltage systems.
CEI 64-8 Electric systems that use a nominal voltage that does not exceed 1000V with alternate current and 1500V with direct current.

Montebello Vicentino, 17/09/98

La Direzione

If the commutator has reached the maximum position "F" and a further increase of the derivative action is necessary to reduce any system oscillation in acceleration or deceleration, it is possible to increase the derivative bottom scale further by adding to the internal fixed values of the B17 analogue box new values that can be inserted in the position marked "CDER" of the removable personalisable card.

To do this, proceed as indicated:

- Extract the personalisation card.
- Insert a condensator with a different value than the internal fixed one (which is) into the "CDER" position. With a condensator value that is greater or smaller than the fixed internal value, the total value increases constantly because the additional "CDER" condensator is placed in parallel to the fixed internal one.
- Re-insert the personalisation card and the B17 drive into the B17 box, remembering to decrease "CDER" commutator in a counterclockwise direction avoiding eventual oscillation of the motor during movement.

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1. Safety regulation

1.1. Prescription



Danger symbol

This symbol can be seen wherever it is necessary to respect the safety regulations and in situations where residue risks, danger to life and injury to people are present.

The installers must scrupulously follow the relevant prescriptions and must also inform the users about them.



Voltage presence warning

This symbol warns the user / installer to take particular care, because of the presence of dangerous voltages (up to 310 Vdc).

It is advisable to always disconnect the drive from the mains before working on it.



Warning

This symbol highlights all particularly important points.

It is present where points regarding useful advice, prescriptions, indications and instructions on how to carry out interventions in order to prevent damaging the system and drives are given.

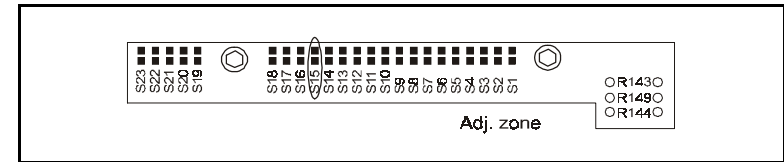
1.2. General safety regulations

Above and beyond what is given in the manual, carefully observe current safety and accident prevention laws in order to prevent accidents and residue risks!

Before carrying out any intervention on electrical or mechanical parts, disconnect the drive and system power.

All the prescriptions given in this manual should be read before assembling and starting the drive!

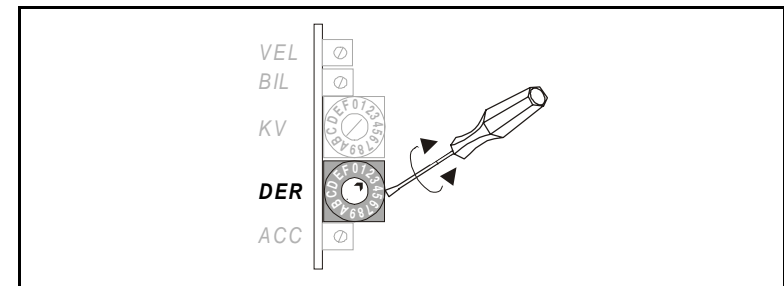
- Open the "S15" soldering point as indicated in the figure.



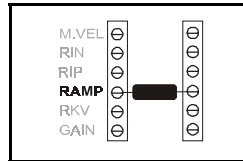
- Remove the personalisation card.
- Insert a resistance with a value different than the internal fixed one (which is of), in the "RKV" position, being careful that:
 - with a smaller resistance value the gain
 - With a greater resistance value the gain
- Insert a condensator that has a different value than the internal fixed one (which is), in the "CKV" position, being careful that:
 - with a smaller condensator value the gain
 - With a higher condensator value the gain
- Re-insert the personalisation card and the internal B127 into the B17 Analogue box, remembering to decrease in a counterclockwise direction the commutator marked "KV", avoiding possible motor oscillation during the movement.

Calibrating the derivative constant of the speed ring.

It is possible to optimise the dynamic behaviour of the motor by using the rotative commutator marked "DER". This commutator is made up of 16 hexadecimal positions from a minimum marked "O" or a maximum marked "F". Working clockwise, the derivative action increases, permitting reduction of any possible acceleration or deceleration system oscillations.

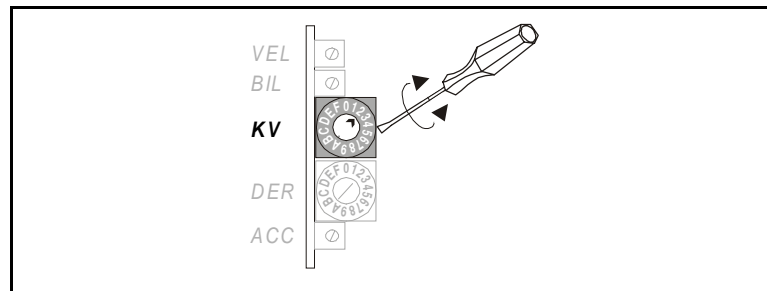


- After having selected the suitable resistance value, insert it into the "RAMP" position of the personalisation card, as shown in the figure:



Calibrating the proportional and integral constant of the speed ring.

It is possible to optimise motor dynamic behaviour using the commutator with the "KV" symbol. This commutator is made up of 16 hexadecimal positions and a symbolled minimum or maximum. Working on time the ".I." gain increase, which improves readiness and reply.



If the maximum "F" or minimum "O" position is reached by the commutator, it is necessary to increase or reduce the "P.I." gain to improve readiness and motor reply. It is possible to increase or decrease the gain bottom scale further by replacing the fixed internal values of the B17 Analogue box (using the soldering point) with new values that can be inserted into the "RKV" and "CKV" positions of the removable personalisation card.

To carry out these modifications, proceed as follows:

- Remove the internal B17.

The B17 Analogic box must only be installed by trained, qualified and authorised technicians.

Any interventions and/or modifications made to the components and accessories of the B17 Analogic box render the guarantee null and void.

When connecting the B17 Analogic box to the mains, the components of the power part and some elements of the control part will be powered.

Touching these elements can endanger your life!

Insulate the drive from the mains before removing it (by removing the fuses or deactivating the main switch).

After having cut off the voltage, wait at least 5 minutes before extracting the internal drive. Voltages of up to 310Vdc may still remain inside the condensers, so they must be left to discharge through the relevant resistors.

The drive is equipped with electronic protection devices that deactivate it when irregularities arise and as a result the motor is not controlled. This situation can stop the drive or put the motor into neutral (for a time set according to the type of system).

Under some circumstances the drive can start again automatically when the cause of the block has been corrected.

As a result, some systems could be damaged or destroyed, which would prejudice personnel safety.

In these cases, the user must either disconnect supply from the drive and the system so that the motor cannot start by itself, or plan for this situation when programming the control.

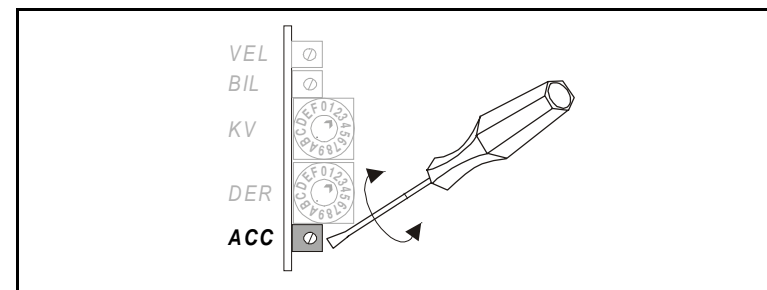
The relevant terminals of the B17 Analogic box must always be connected to earth following the instructions given in this manual.

This instruction manual must be read, understood and followed by the people who are in charge of using the drives. If there are any doubts, please contact the producer.



The company is relieved of any responsibility if malfunctions or damage of any nature are caused because the instructions given in this manual are not executed correctly.

In order to follow a continuous improvement policy, the company reserves the right to carry out any modifications felt necessary for product improvement, even if such modifications are not given in this manual.



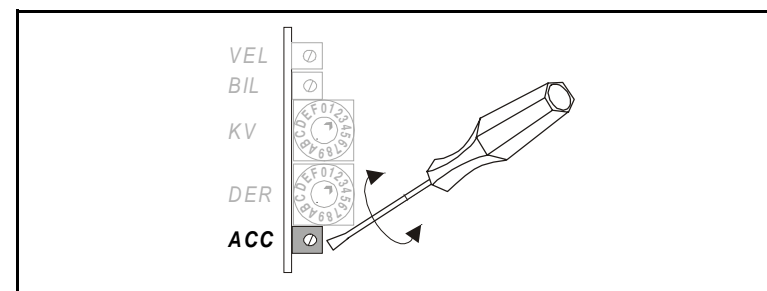
If the adjustment field from 0.15 to 15 is not sufficient, it can be increased as follows:

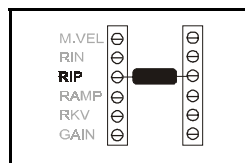
- open soldering point "S6" and leave closed points "S5" and "S7".

Insert a resistance into the "RAMP" position on the personalisation card positioned on the front of the internal B17. The resistance to be inserted can have a tolerance of 5% or 1% and a power of 1/4 or 1/8 of a Watt. The value of this resistance must be selected from those given in the table below, according to the time that is required.

Res. "RAMP"	680 Ω	820 Ω	1 M Ω	1,5 M Ω	2,2 M Ω
Ramptime	0,2 - 2,6s.	0,3 - 3,2s.	0,4 - 3,9s.	0,6 - 5,7s.	0,8 - 8,6s.

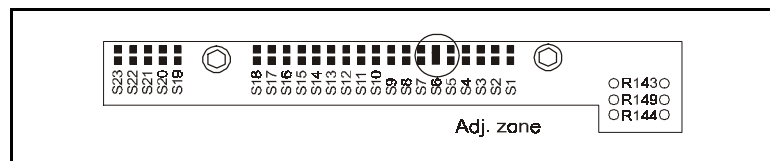
- it is possible to finely calibrate the requested time using the "ACC" trimmer of the personalisation card, as shown in the figure.



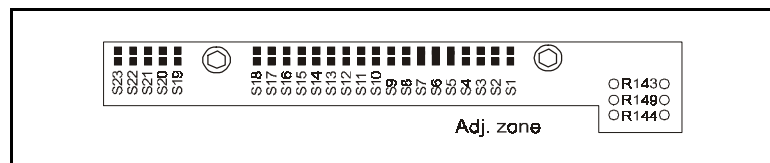


Calibrating the ramp time

Ramp acceleration and deceleration of the motor revs is not inserted in the productive standard unless specified during the order phase. The "S5, S7" welding points open and "S6" closed as shown in the figure.



It is however possible to close the "S5" "S6" "S7" soldering points. Insert them when the "ACC" trimmer is at 10 revs, then calibrate the time with a range from 0.1 sec. to 1 sec. as shown in the figures:



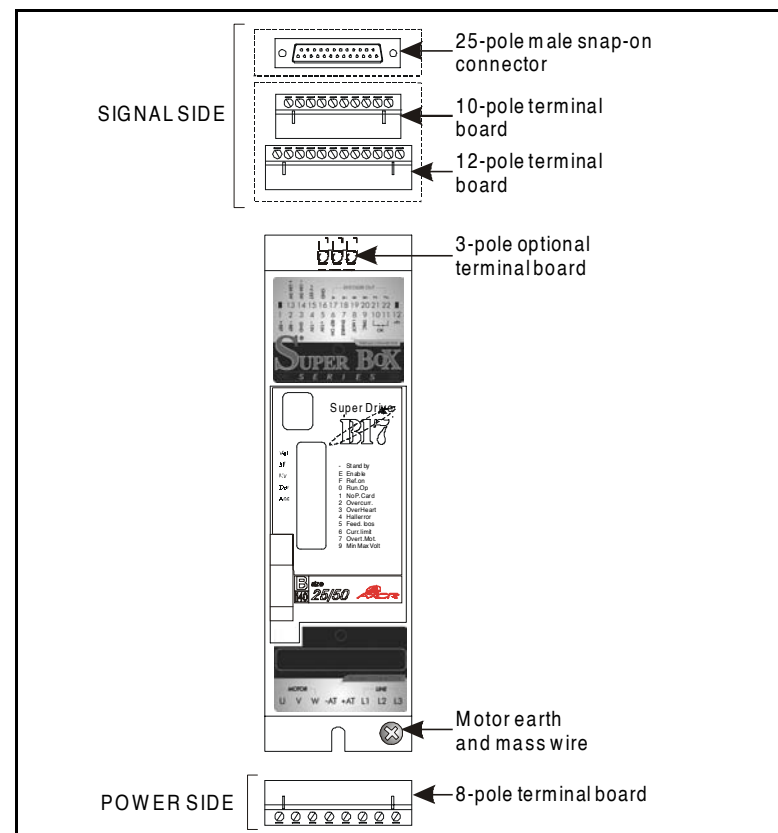
2. General description

2.1. Product description B17 Analogic box

The B17 Analogic box series converter is a two-way sinusoidal drive with four quadrants for AC Brushless motors with feedback from encoder. (resolver)

The Power Mosfet or IGBT power stage is driven in PWM by 20 KHZ of modulation. This makes it very suitable for piloting small and medium-sized Brushless servomotors from 0.1 to 20Nm, where dynamic performance and notable operational regularity are necessary.

The braking power of each B17 Analogic box is dimensioned according to the drive size and model. There is also the possibility of increasing the braking power, taking it to 400 or 800W nominal. The inputs and outputs are shown in the photo below:





- Two extractable 12 and 10 terminal boards for the entry and exit of signals coming from the C.N.C. or the axis card.
- Snap-on connector, 25 poles, male, for connecting the motor output signals.
- 8-pole extractable terminal board for connecting the motor phases and the alternate threephase or single phase supply L1-L2-L3.
- Fixed 3-pole terminal board for any external braking resistances with a power of 400W or 800W optional.



If external braking is to be used, please contact the manufacturer for further information.

The tables below give the models and sizes of the available B17 Analogue box:

Model	Supply (Vac) 50-60 Hz
B17 box Analogico C200	145
B17 box Analogico D300	220

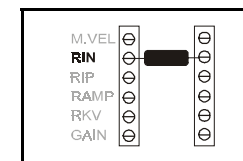
Size	Nominal current Arms	Peak current Arms	Peak time I _{pt} in s
2/4	2	4	2
4/8	4	8	2
8/16	8	16	2
10/20	10	20	2
14/28	14	28	2
20/40	20	40	1

Main characteristics:

- Working and storage humidity from 10% to 95% without condensation.
- Working temperature: 0/40°C - storage temperature: -10/70°C.
- AM26LS33 encoder interface either differential or common at 5V or IET7273 at 12V if requested.



- From the "B17 Analogue box size" band, choose the current value that is closest to the one that is to be obtained.
- After having selected the current value, find and read in the relevant box of the "Rin value" band the value of this resistance expressed in K Ω . The resistance is of a commercial value, therefore easy to find with tolerance that can be 1% or 5% with a power of 1/4 or 1/8 of a Watt and inserted in the position indicated below:



Calibrating the peak current

The "Rin" resistance is inserted to limit the direct current that runs through the motor to safeguard the windings when the cycle is heavy or when the axis goes into mechanical end of stroke. The disadvantage of inserting this resistance is that the current peak time decreases, falling below two seconds as the nominal current decreases.

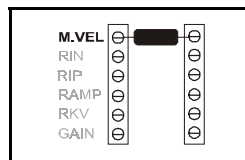
The B17 Analogue box is already supplied with a "Rin" if the type of motor or current value that the converter must supply is specified during the order phase.

If it is necessary to replace or insert a new resistance value, it should be between those given in the following table:

B17 box Analogue size	Without resistors	120 K Ω	68 K Ω	47 K Ω	33 K Ω	22 K Ω	15 K Ω	12 K Ω	10 K Ω	8,2 K Ω
B17 4/8 (A)	8	7,6	7,3	6,9	6,4	5,8	5,2	4,8	4,4	4
B17 8/16 (A)	16	15,2	14,3	13	12,2	10,7	10	9,6	8,8	8
B17 10/20 (A)	20	19	18	17,1	16	14,6	13	12	11	10
B17 14/28 (A)	28	26,7	25,3	24	22,2	20,5	18,1	16,6	15,4	14
B17 20/40 (A)	40	38	36	34	32	29	25,6	23,5	21,8	20
B17 25/50 (A)	50	47,5	45	42,5	40	36,5	32	29,3	27,2	25



The value that is to be inserted into the card should be as commercially close as possible to the value given by the formula, with a tolerance of 1% or 5% and with a power of 1/4 or 1/8 of a Watt in the position indicated below:



Calibrating the nominal current

The "Rin" resistance is inserted to limit the direct current that runs through the motor to safeguard the windings when the cycle is heavy or when the axis goes into mechanical end of stroke. The disadvantage of inserting this resistance is that current peak time decreases, and goes below two seconds, which also makes the nominal current decrease. The B17 Analogue box is already supplied with its "Rin" if the type of motor or current value that the converter must supply is specified during the order phase.

If you want to replace or insert a new resistance value, it should be between those given in the following table:

B17 box Analogue size	Without resistors	12 KΩ	3,9 KΩ	2,2 KΩ	1,5 KΩ	1 KΩ	560 Ω	330 Ω	180 Ω	82 Ω
B17 4/8 (A)	4	3,6	3,3	3	2,7	2,4	2,1	1,8	1,5	1,2
B17 8/16 (A)	8	7,2	6,6	6	5,4	5,1	4,2	3,6	3	2,4
B17 10/20 (A)	10	9	8	7,3	6,7	6	5,2	4,4	3,7	3
B17 14/28 (A)	14	12,8	11,5	10,2	9,5	8,7	7,4	6,2	5,2	4,2
B17 20/40 (A)	20	19,2	17,5	16	14,6	13,3	11,3	9,6	8	6,5

To choose the resistance value, proceed as follows:

- Know the current size of your B17 Analogue box.
- From among the "B17 Analogue box size" bands, choose the one that corresponds to yours.
- Know the value in "Arms" of the desired current and the current that the motor needs.



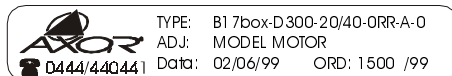
- Speed reaction from resolver 2-4-6 poles.
- Encoder emulation with divisions from 1-128.
- Zero notch according to the number of motor poles (2 poles = 1 notch; 4 poles = 2 notches; 6 poles = 3 notches).
- Current ring passing band 2,5kHz.
- Galvanic insulation (only available for the D300 version).
- Differential reference input +/-10V.
- Analogue input for piloting with current +/-10 V.
- Thermal shunt, differential reference circuit +/- 1.8mV/°C.
- Motor current monitoring +/-8V = I peak
- Motor speed monitoring +/-8V

$$\text{Motor speed (rpm)} = \frac{\text{Max rpm}}{8}$$

- Auxiliary voltage +/-10V max 4 mA.
- Auxiliary voltage for resolver 4,1 Vrms
- Diagnostic display for state signals and alarms.
- Motor short circuit protection.
- I2t motor protection
- Saving of the I2t drive intervention
- Motor overheating protection
- Supply over/under voltage protection
- Drive overheating protection
- Inverse polarity protection
- No speed reaction protection
- MAX-REC protection
- Pre-alarm MAX-REC.
- P.C. missing protection



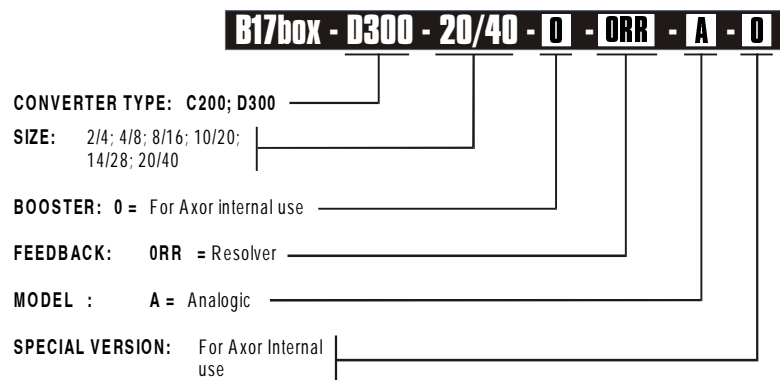
2.2. B17 Analogic box plate description



There are four product plates on each B17 box converter: one on the lid, one on the side of the box, one on the inside of the 24-way DIN connector, and the last one under the removable personalised plate.

Information found on plate:

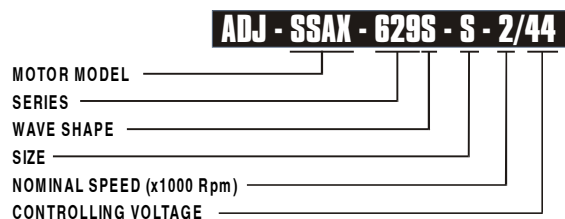
Product **TYPE** and identification.



ADJ is the motor model, therefore the drive has been set.

If the product is supplied in the standard version, the letters STD (STANDARD) are shown in the ADJ box (see chapter 4.1. "Setting at work").

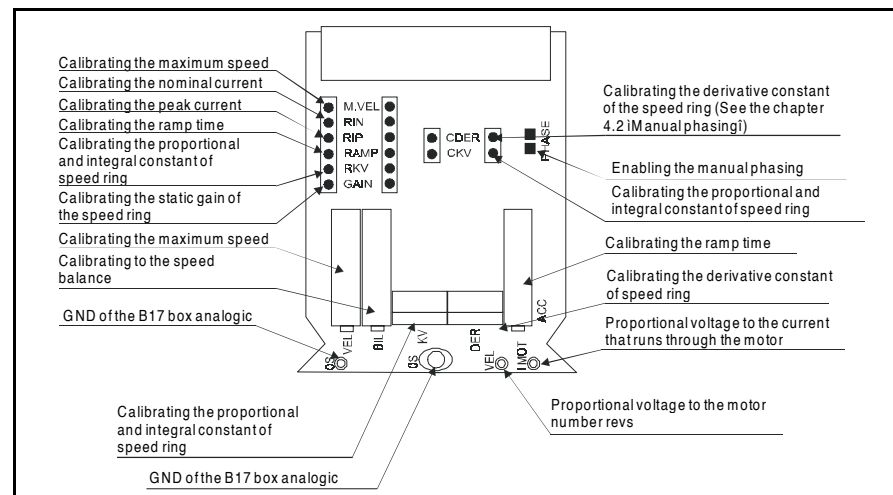
The example below is of an Axor motor.



ORD is the internal order number relative to the product supply. Always use this number when making requests.



The following diagram shows the personalisation points.



Calibrating the maximum speed

The B17 Analogue box is already supplied with "M.VEL" if the type and number of revs. that the motor must carry out are specified during the order phase. If you want to replace or insert a new resistance value, just use the following formula:

$$M. VEL = \frac{600000}{68 \times Kpm}$$

M.Vel = Resistance value (KΩ).

Rpm = Number of desired revolutions (rpm)

2048 Imp/rev	=	S13 - S17 Closed
1024 Imp/rev	=	S12 - S16 Closed
512 Imp/rev	=	S11 - S15 Closed
256 Imp/rev	=	S10 - S14 Closed

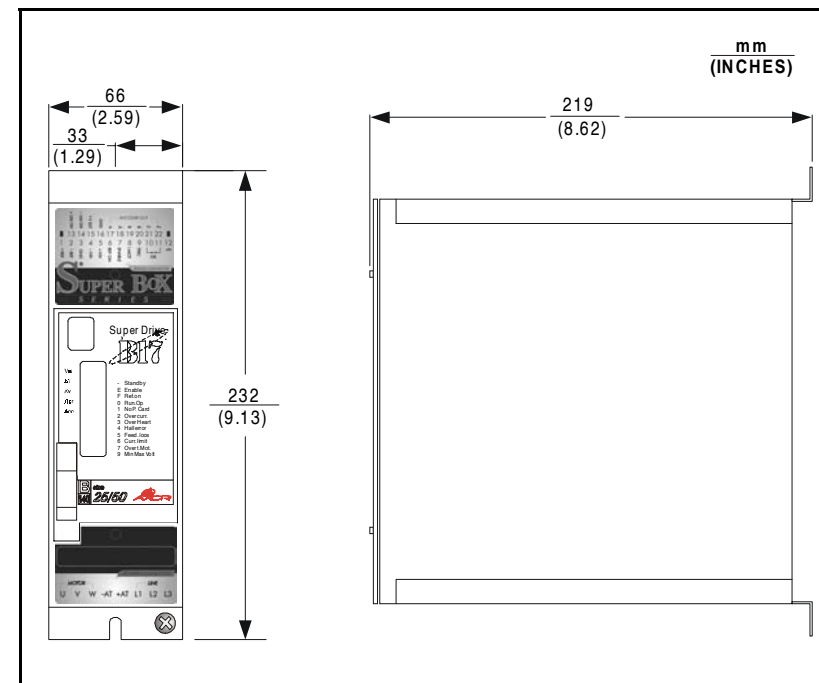
Welding point	Condition	DESCRIPTION
S18 S19	Normally closed Normally open	Points S18 and S19 configure resolver/digital internal converter resolution.
S20 S21	Normally open Normally closed	With points S20 and S21 you can configure the number of poles that the motor has. The table below shows the possible combinations.

2 Poles	=	S20 Open - S21 Open
4 Poles	=	S20 Closed - S21 Closed
6 Poles	=	S20 Open - S21 Closed
8 Poles	=	S20 Closed - S21 Open

Soldering point	Condition	DESCRIPTION
S22 S23	Normally open Normally open	When points S22 and S23 are closed, the dynamic constants of the current rings increase when motors with elevated inductance and resistance levels are present.

As well as the soldering points in the "ADJ zone", the internal B17 also has a removable personalisation card that is positioned at the front. You can carry out the remaining B17 Analogue box calibration operations with this card, but you must be careful to extract it and insert it carefully. If the B17 Analogue box is powered and you want to carry out operations on the card, disconnect the power and wait 10 seconds before extracting it.

2.3. B17 box Analogic dimensions



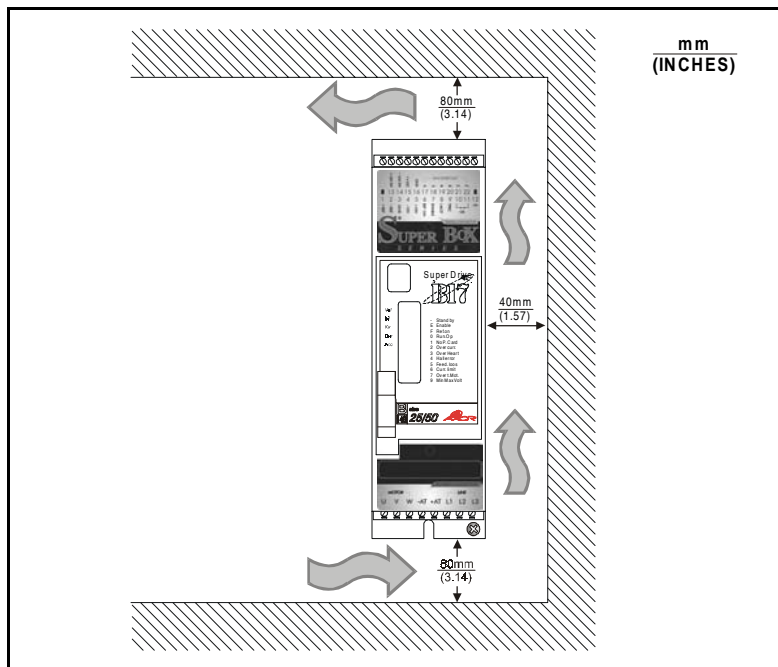
3. Installation

3.1. Assembly



The B17 box Digital is prepared for monitoring inside an electric box. The interaxis measurements for the fixing holes can be found in chapter 2.3 "B17 Analogic box dimensions". The B17 should be fixed vertically to the bottom of the box in order to guarantee that the internal converter is reliably cooled. The B17 Analogic box must be positioned inside the electric box and must satisfy the following conditions:

- For good converter operation, the temperature inside the electric box must be between 0°C and +40°C, with from 10% to 95% humidity without condensation.
- Protect the B17 Analogic box from excessive mechanical vibrations in the electric panel.
- Do not let anything metal fall inside the B17 Analogic box while it is being installed.
- Always keep a distance of 80 mm from heat sources.
- The electric box must have suitably filtered air intakes.
- Maintain the minimum distances indicated in the following diagram:



Start up and settings

- Pushing the lower handle with your other hand, extract the internal B17 (see figure).

WARNING: The following operations to the converter should be carried out after removing voltage from the apparatus and waiting for at least 10 sec.

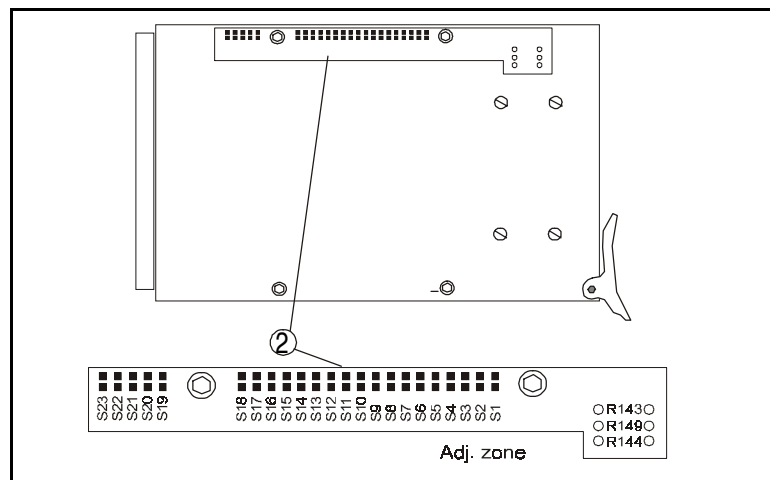
The functions of each soldering point are as follows:

Soldering point	CONDITION	DESCRIPTION
S1	Normally open	If closed, 1st alarm intervention causes the external contact to open.
S2	Normally closed	If open, the intervention of the resolver absent alarm device does not deactivate the converter and does not cause the external iOKi contact to open.
S3	Normally open	If closed, the minimum ñ maximum voltage device is saved by the converter and the external iOKi opens.
S4	Normally open	If closed, the iBILi balance trimmer positioned above the personalisation card acts as a speed reference (Only to be used for possible tests during converter starting).
S5 S6 S7	Normally open Normally closed Normally open	
S8	Normally closed	If open it deactivates the "CKV" and "RKV" standard constants of the speed loop with the possibility of increasing or decreasing them by inserting suitable condenser values for iCKVi and resistor values for iRKVi in the personalisation card.
S9	Normally closed	If open deactivates internal static gain of the speed loop.
S10 - S1 S12 - S1 S14 - S1 S16 - S17		With these soldering points you can set the number of impulses per encoder rev. simulated in output for the C.N.C. and the axis card. The table in the following pages shows the possible combinations.

- Activate the B17 Analogue box by closing the bridge between inputs 6 "ENABLE" and 5 "+10". When the B17 Analogue box is activated, the motor goes simultaneously to a balance position.
- If the motor is already phased, the display shows the symbol "P".
- If the motor is out of phase, the display shows the symbol " ".
- If the motor is out of phase, loosen the screws that fix the resolver stator slightly so that it can be moved.
- Rotate the resolver stator slowly clockwise or anticlockwise until the symbol "P" appears on the display.
- When the symbol "P" appears on the display, tighten the stator screws, being careful not to move the stator itself.
- At this point the motor is phased, so remove supply from the B17 Analogue box, remove the internal B17 personalisation card, open the "PHASE" welding point again and insert the card again.

4.5. Calibration and personalisation card

The internal B17 has been prepared with an area called the "ADJ ZONE", which has 23 soldering points named "S...". With these points it is possible to activate and deactivate some internal B17 functions, as shown in the figure:



To reach the welding points shown in the diagram, you must extract the internal B17, proceeding as indicated:

- Push the red card blocker upwards with one hand.

3.2. Ventilation

The temperature that surrounds the B17 Analogic box should be between +0°C and +40°C. If a fan is necessary because of model or current size, it is added during production. The following model sizes are ventilated:

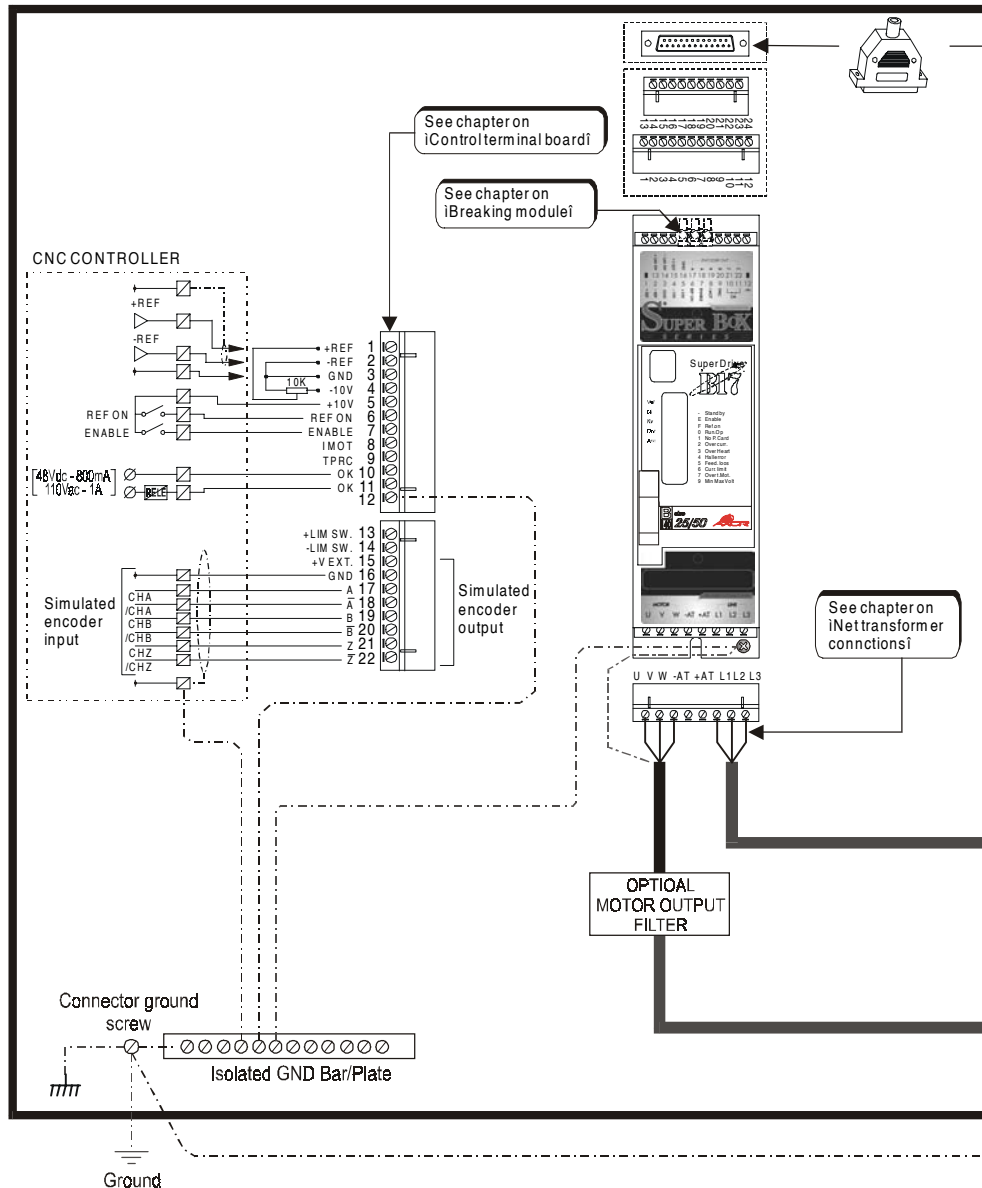
Model	2/4	4/8	8/16	10/20	14/28	20/40
200	-	-	-	V	V	V
300	-	-	-	V	V	V

Note: V=Forced ventilation



If the B17 Analogic box is installed in places where a temperature of between +0°C and +40°C cannot be guaranteed, please inform the producer, who will take the necessary action.

3.3. General connections

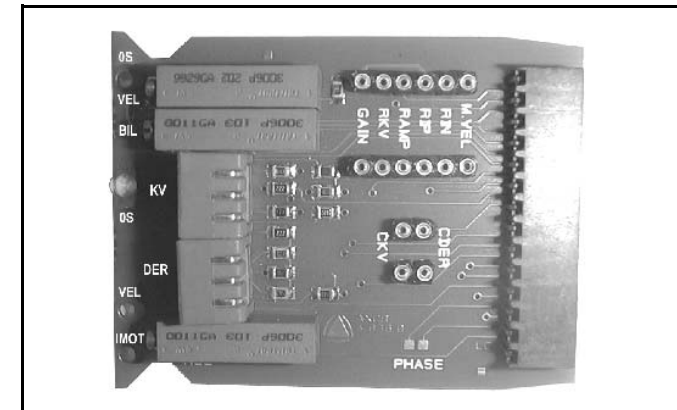


- Position the positive prod on the test point of the personalisation card named "VEL".
- Rotate the motor shaft clockwise and make sure that the signal on the multimeter is negative with a value of several millivolts.
- If the value read is positive, it is necessary to invert double the "Sine" with the "cosine".
- A negative signal shows that the resolver connections are correct.

Manual phasing

Connect the previously defined motor power phases to those of the B17 Analogic box, insert the two resolver connectors between the motor and the box, and proceed as follows:

- Find the number of motor poles, extract the internal B17 from the Box and set the correct number of poles (refer to the "Calibration and personalisation card" chapter). Reinsert the internal B17 into the box, making sure that the base is well supported.
- Extract the personalisation card from the internal B17 and close the "PHASE" welding point positioned above, as shown in the figure below. Insert the card again.



- Make a bridge between terminals 6 "ENABLE" and 5 "+10" to enable the B17 Analogue box.
- Power the B17 Analogue box. The display shows "H".
- Remove the rear motor cap to reach the resolver.



4.4. Manual phasing

Manual phasing is carried out when the motor to be used is not an Axor product, therefore the correct sequence of the power phases of the motor, signal and the mechanical position of the resolver are not known. These tests should be carried out with the motor disconnected from its load. These procedures permit recognition and correct resolver positioning.

Recognising the motor power phases

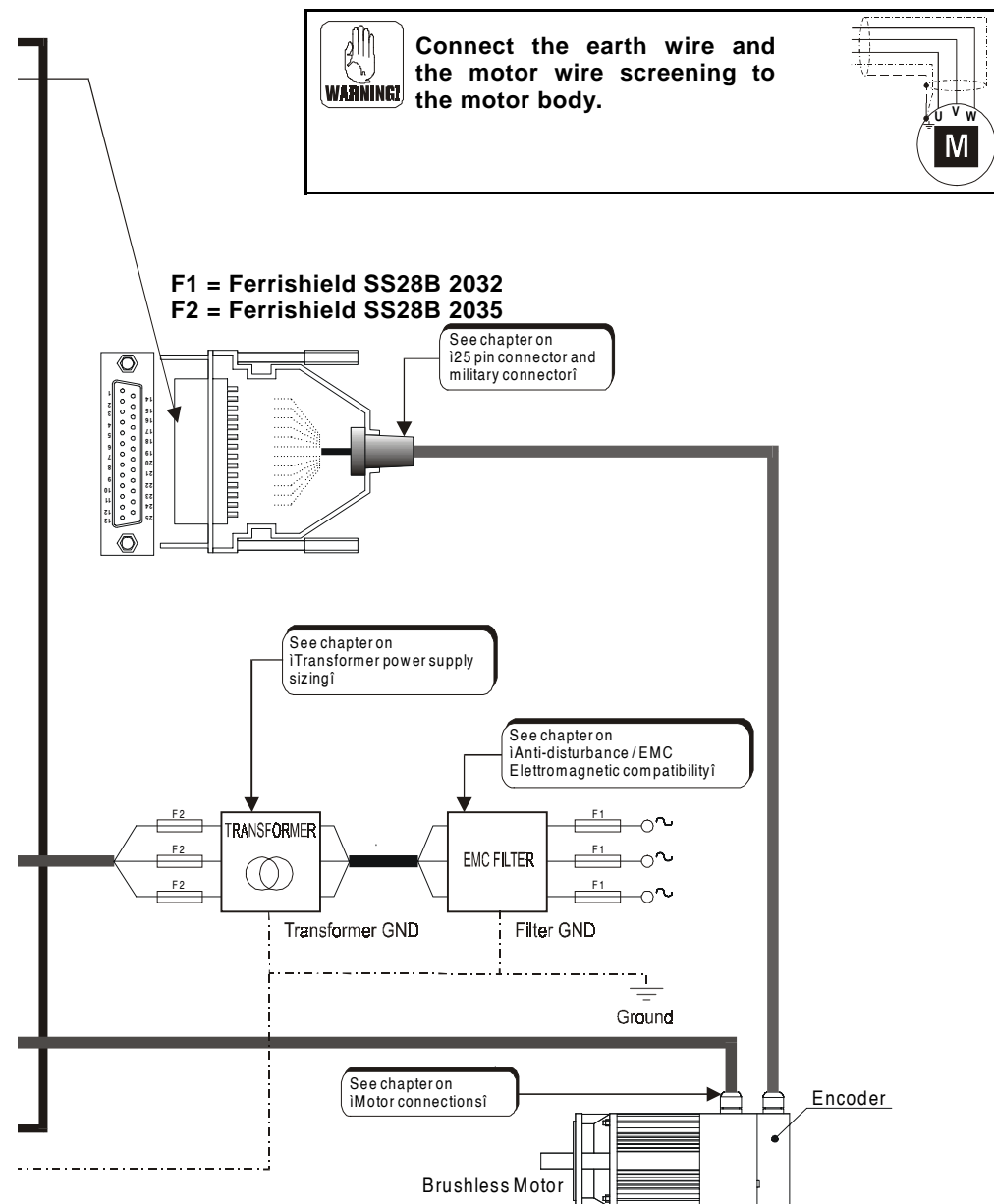
Using a 3A current generator, proceed as follows:

- Position the motor with the shaft facing frontwise.
- Connect the generator positive pole to any phase, which we will call "U".
- Connect the generator negative pole to one of the remaining two phases. The motor shaft moves to a fixed position from which phase recognition is started.
- Disconnect the generator negative pole from the motor phase and see in which direction the motor shaft rotates when the generator negative pole is connected to the other phase.
- If the motor shaft rotates anticlockwise, the phase connected to the negative terminal is phase "V". The other is phase "W".
- If the motor shaft rotates clockwise, the phase connected to the negative terminal is phase "W". The other is phase "V".

Recognising the resolver signals

Using a multimeter, proceed as follows:

- Solder the motor wheel connector to the 25-way computer plug of the B17 analogue box following the resolver output pins and the box input pins indications.
- Connect the two connectors without motor power phases and power the analogue box.
- Position the motor so that the shaft can be seen frontally and observe its rotational direction.
- Prepare the multimeter for measuring continuous voltages with a bottom scale in "mV".
- Position the negative prod on a test point of the personalisation card, named "0s". If the shaft rotates anticlockwise, the phase connected to the negative terminal is phase "V". The other is phase "W".
- If the shaft rotates clockwise, the phase connected to the negative terminal is phase "W". The other is phase "V".





3.4. Supply transformer dimensioning

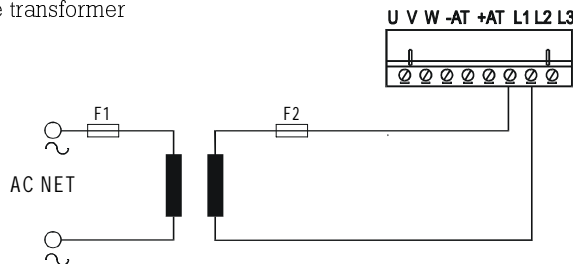
The B17 Analogic box converters can be divided into two versions:



- The C200 series only uses single phase or threephase transformers with triangle output.

Single phase system

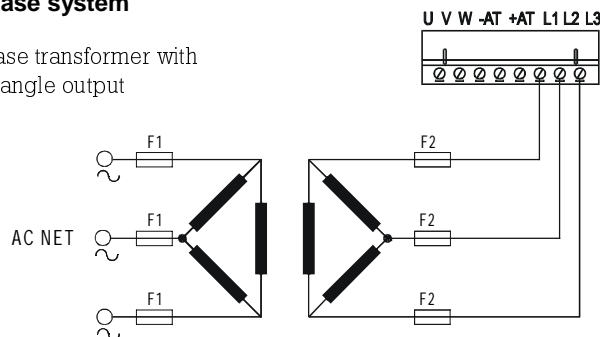
Single phase transformer



Only use single phase supply when strictly necessary. We recommend threephase configuration.

Threephase system

Threephase transformer with triangle output



Please consult the producer before installing transformers with characteristics that are different from those requested.



SIMBOLO	DESCRIZIONE	RIMEDIO
	Signals motor thermal probe intervention. This intervention opens the external OK contact.	<ul style="list-style-type: none"> Lower the dynamic constants if the motor vibrates in still torque or when moving. This condition provokes oscillation of the current that runs through the motor and its heating. Probable thermal probe breakage. Reset by removing supply and resetting after the motor has cooled.
	Signals maximum energy recovery has been reached during the braking phases. This intervention opens the external OK contact.	<ul style="list-style-type: none"> In case of external resistances, make sure that they are using the correct ohm value and that they are connected as shown in the manual. Check the entering alternate supply voltage of the B17 Analogic box.
	Signals minimum or maximum continuous voltage intervention.	<ul style="list-style-type: none"> In case of external resistances, make sure that they are using the correct ohm value and that they are connected as shown in the manual. Check the entering supply voltage of the B17 Analogic box.
	Signals maximum recovery pre-alarm intervention. This alarm is visual, and indicates a subsequent interven-	<ul style="list-style-type: none"> In case of external resistances, make sure that they are using the correct ohm value and that they are connected as shown in the manual. Check the entering supply voltage of the B17 Analogic box.



4.3. Alarms

If an alarm is activated, the alarm number will appear. The meanings of the indications and alarms are given in the table:

SYMBOL	DESCRIPTION	SOLUTION
	Signals that there is no personalisation card. This intervention opens the external OK contact.	<ul style="list-style-type: none"> Make sure that the card is inserted correctly. Reset by removing and restoring the power.
	Signals a short circuit intervention. This intervention opens the external OK contact.	<ul style="list-style-type: none"> Check the short circuit between motor terminals or towards earth. Reset by removing supply and resetting.
	Signals that the converter thermal probe has intervened. This intervention opens the external OK contact.	<ul style="list-style-type: none"> Check that the forced ventilation is working. Check the environmental temperature. <p>Reset by removing supply and resetting after the dissipater has cooled.</p>
	Signals resolver alarm. This intervention opens the external OK contact.	<ul style="list-style-type: none"> Check resolver connections. Probable resolver breakage. <p>Reset by removing current and resetting it.</p>
	Signals that nominal current is running through the motor. If S1 welding point is closed, the external OK contact opens.	<ul style="list-style-type: none"> Check the work cycle, which could be too heavy. Probable mechanical block. Motor phase inversion. Electromechanical brake has not been unblocked.
	Saving of the nominal current intervention (I ² t).	The fixed point indicates that alarm 6 intervened during a work cycle. This display does not cause converter blockage. Reset by removing current and resetting.

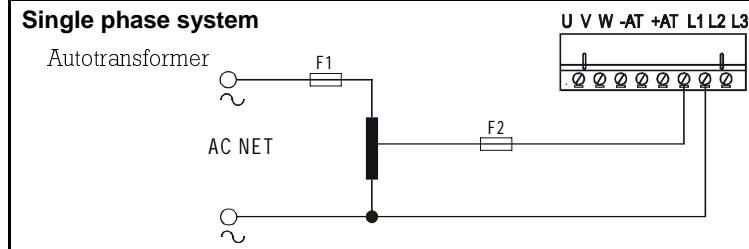


- The Optoinsulated D300 series uses:
 - single phase or threephase transformers with star or triangle output
 - single phase or threephase autotransformers

The producer recommends using transformers or autotransformers in order to supply the B17 Analogic box directly from a "220 Vac" power grid. Direct supply with this power grid is NOT

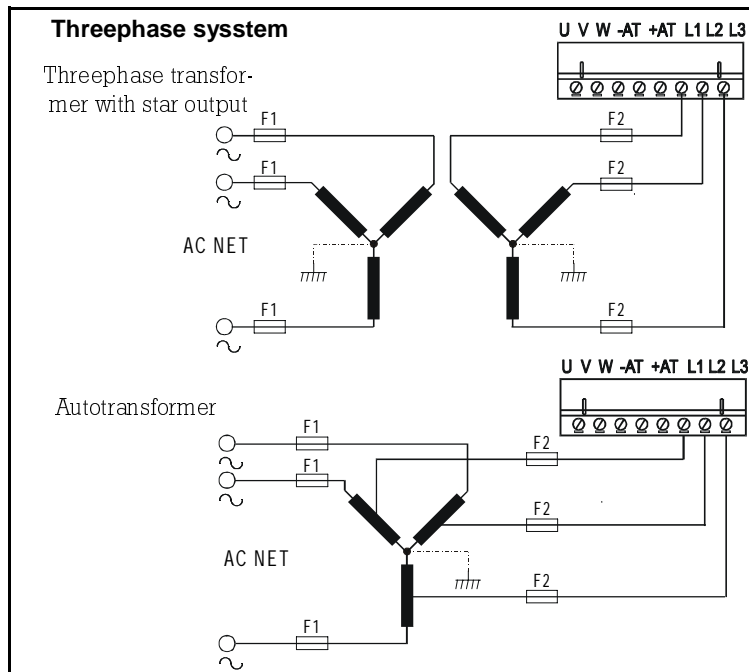


Single phase system



Only use single phase supply if strictly necessary. We recommend the threephase configuration.

Threephase system





- **VOLTAGE:** the primary voltage is tied to the voltage available from the line. The secondary voltage is calculated according to the parameters of the motor to be driven while remaining inside the voltage values. This value is:

$$V(\text{secondary}) = \frac{V(\text{motor})}{0,9 \times 1,36}$$

V(secondary) = secondary voltage in (Vac).
V(motor) = voltage necessary for the motor in order to obtain maximum speed at nominal torque (Vrms).

$$V(\text{motor}) = E_{\text{max}} + (R_i \times I_n)$$

V(motor) = voltage necessary for the motor in order to obtain maximum speed at nominal torque (Vrms).
E_{max} = force against electric motor at nominal speed (Vrms).
R_w = motor line resistance (W).
I_n = nominal current at stall (Arms).

The **nominal voltage load values** exiting from the transformer or auto-transformer accepted by the B17 Analogic box are respectively:

V(secondary)	52-145	Vac	peril	B17box	C200
	100-240	Vac	peril	B17box	D300

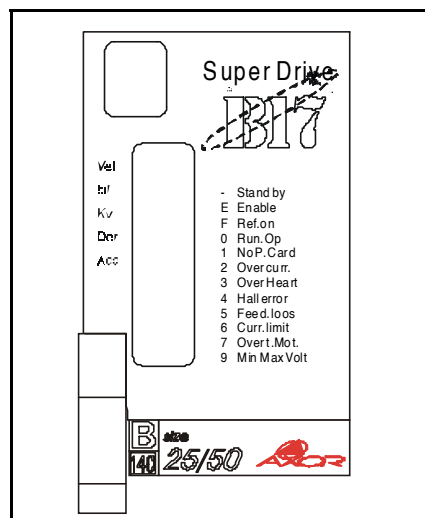
The declared minimum and maximum supply values refer to the transformer or autotransformer load voltage with accepted loadless maximum deviation +5% and a network voltage deviation of +/-10%.





SYMBOL	DESCRIPTION	SOLUTION
	There is no REF ON enabling input. The motor shaft results as being free.	<ul style="list-style-type: none"> • Make sure that the enabling voltage is between +10/30Vdc. • If the REF ON enabling comes from an external voltage, make sure that its GND is connected to pin 3 of the "control terminal board"
	The drive with "ENABLE" and "REF ON" present maintains its motor in still torque if there is no reference voltage at the "+/-REF" inputs.	<ul style="list-style-type: none"> • If the motor does not rotate, check if there is a reference voltage at terminals 1 and 2 of the "control terminal board". • If the motor does not remain in still torque, check if there is a reference voltage at terminals 1 and 2 of the "control terminal board".
	Motor rotation in a clockwise direction.	<ul style="list-style-type: none"> • If the motor does not rotate, check if there is a reference voltage at terminals 1 and 2 of the "control terminal board".
	Motor rotation in a counterclockwise.	<ul style="list-style-type: none"> • If the motor does not rotate, check if there is a reference voltage at terminals 1 and 2 of the "control terminal board".

4.2. State signals

The front display shows the driver state using the following symbols:



SYMBOL	DESCRIPTION	SOLUTION
	The converter is being supplied correctly, without REF ON and ENABLE and there are no alarms present	
	There is no ENABLE enabling input. The motor shaft results as being free.	<ul style="list-style-type: none"> Make sure that the enabling voltage is between +10/30Vdc. If enabling comes from an external voltage, make sure that its GND is connected to pin 3 of the "control terminal board"



- POWER:** if transformer or autotransformer power exceeds a set value, the B17 Analogic box could be damaged during the supply insertion phase because of the overcurrent that is caused by the internal capacity load. These values are:
 - for transformers the maximum power is 8KVA;
 - for autotransformers the maximum power is;

If these values are exceeded it is necessary to:

- use two transformers or autotransformers, which supply 2 separate B17 Analogic box groups.
 - Use an initial preload system.
- In both cases, please contact the producer for further information and sizings.

The transformer or autotransformer power is calculated as follows:

$$P_t = P_n + P_n + P_n + \dots$$

- P_t** = transformer power (VA).
P_n = nominal power of each motor (VA).

The nominal power of each motor is calculated as follows:

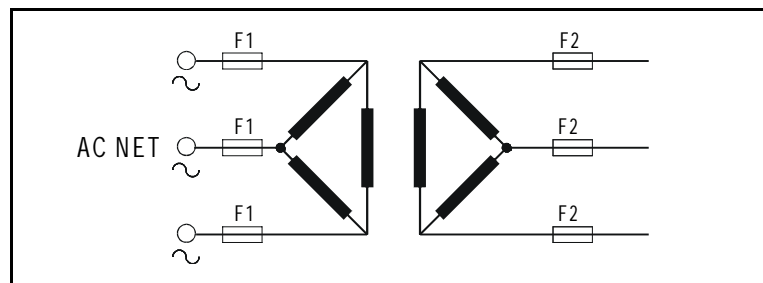
$$P_n = \frac{n \times C_n}{9,55}$$

- P_n** = nominal power of one motor (VA).
n = maximum motor speed (rpm).
C_n = nominal motor torque (Nm).

With multi-axis applications, the transformer or autotransformer power can be derated by up to 30-40% according to the usage cycles.



- **FUSES:** use F1 and F2 fuses with the transformer or autotransformer primary and secondary. When the F1 fuse is used with the primary, it protects the transformer or autotransformer against current overloads caused on the secondary. This fuse is the "slow" type. When the F2 fuse is used with the secondary, it protects the transformer or autotransformer against short circuits caused by the rectifier bridge. This fuse is the "slow" type. **The fuses can be replaced by circuit breaker switches of the same value.**



$$IF1 = \frac{P \text{ transformer} \times 1,1}{V(\text{primary}) \times 1,73}$$

P = transformer power (VA).
V = primary voltage in (Vac).
IF1 = fuse current value (A).

$$IF2 = \frac{P \text{ transformer} \times 1,1}{V(\text{secondary}) \times 1,73}$$

P = transformer power (VA).
V = primary voltage in (Vac).
IF2 = fuse current value (A).



General rules for setting the speed ring

- Dynamic setting should be carried out using an oscilloscope. Position the probe on pin 1 of the 9-way computer plug (which can be found on the drive front), and the 0 (probe braiding) on the metallic rim of same.
- To increase the passing band of the speed ring, increase the KP constant, decrease the KI constant or diminish the K filter constant of the speed signal. This produces an increase in the reply speed.
- To decrease elasticity, increase the KI constant. This makes the system more rigid.

Low integral proportional gain	Diagrams
Increase the KP and KI gains until a reply similar to the one given on the side is obtained.	
To reduce the overshoot, increase KD until a reply similar to the one shown on the side is obtained.	
Warning: do not exceed with the gain - doing so can cause useless motor heating because of current oscillations.	



- Simulated encoder channel wire of the drive towards the control (see chap. 3.14. "Simulated encoder channels").
- 6 Make sure that any external braking resistors are connected (see chap. 3.15. "Braking module").
- 7 Make sure that the motor shaft is free from loads.
- 8 If the motor has a mechanical brake, supply the pre-set terminals with a suitable continuous voltage, respecting their polarity. Then make sure that the motor shaft is free.
- 9 Supply the B17 box, making sure that the Ref On and Enable inputs are not active.
- 10 Make sure that the symbol " - - " appears on the display.
- 11 Carry out automatic phasing(see chap. 4.2. "Automatic phasing")if necessary.
- 12 Activate the "ENABLE" input and make sure that the "F" symbol appears on the display. In these conditions the motor should remain stopped in torque without any vibrations or speed offsets.
- 13 Give a +0.5V reference and enable the "ENABLE" and "REF-ON" inputs. The motor should rotate in a counterclockwise direction at a speed that is 1/20 of the nominal motor speed and on the display you should see the symbol "O". Take the reference to +10V and -10V, checking operation at maximum speed in a clockwise and counterclockwise direction.
- 14 Switch off the converter and apply the load to the motor.
- 15 Switch on and set the dynamic constants (see chap. 4.6. "Parameter visualisation and programming").
- 16 Carry out work cycles, even under heaviest working conditions, making sure that no I²t alarms or interventions appear.

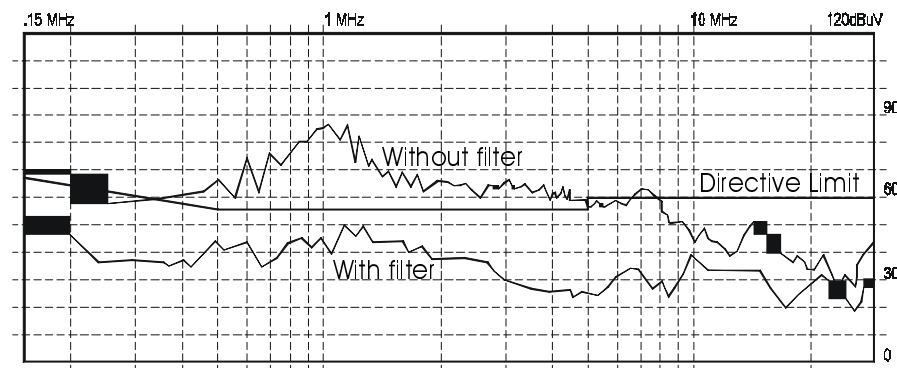


3.5. Antidisturbance / EMC (Electromagnetic compatibility) precautions

The reference regulation used for conformity of electromagnetic compatibility is summarised in the Italian CEI EN 61800 law (all parts). Conformity of the B17 Analogic box is ensured, if it results as being installed following the wiring points given below:

- 1 *If suitable power grid filters are used.*
- 2 *If screened cable is used.*
- 3 *If cable de-coupling techniques are used.*
- 4 *Connections to the panel.*

1 Use of suitable power grid filters: Among the previously mentioned systems, the use of power grid filters should, without a doubt, be considered fundamental for suppressing disturbances, but it is also the most onerous from an economic point of view. While carrying out tests Axor found some optimum solutions, but **only for the company's own products**. Correct filter operation with other products is not guaranteed. The graph shows an example of the disturbance levels measured without and with a filter that has been adapted for the B17 Analogic box.



Note: The graph is for demonstration purposes only and does not represent a reference datum.



Adding an inductance to the power grid filter that works with the motor in some cases improves the shape factor of the circulating current and also the entity of the disturbances that are issued. This makes it possible to use less costly filters.

The electromagnetic compatibility tests were carried out using SHAFNER and TIMONTA filters.

Other filters with the same characteristics can be just as satisfactory, but they must be tested and evaluated while being used with the B17 box.



As deviating undesired frequencies towards earth or earth is understood for filter operation, these devices can produce leakage currents of milliAmperes towards earth. For the safety of your system therefore, the filter should be connected to earth before the supply voltage is inserted. Wrong connection makes filter operation unreliable.

Regarding the leakage current and variable nominal current, we remind you that the working temperature should be kept in mind when calibrating differential devices in order to avoid useless interventions.

The most suitable filter should be chosen taking into consideration the following points:

- transformer or autotransformer dimensioning.
- Calculate the value of the nominal current that is circulating in the threephase or single phase transformer or autotransformer primary using the following formula:

Threephase:

$$I \text{ (primary)} = \frac{P_t}{V \text{ (primary)} \times 1,73} \times 1.1$$

I(primary) = primary current (A).
P_t = transformer power (VA).
V(primary) = primary voltage (Vac)

Single phase:

$$I \text{ (primary)} = \frac{P_t}{V \text{ (primary)}} \times 1.1$$

I(primary) = primary current (A).
P_t = transformer power (VA).
V(primary) = primary voltage (Vac)



4. Start up and settings

4.1. Start up

The driver is supplied already set for the requested motor. If the motor is not specified, standard settings (STD) are inserted with the following characteristics:

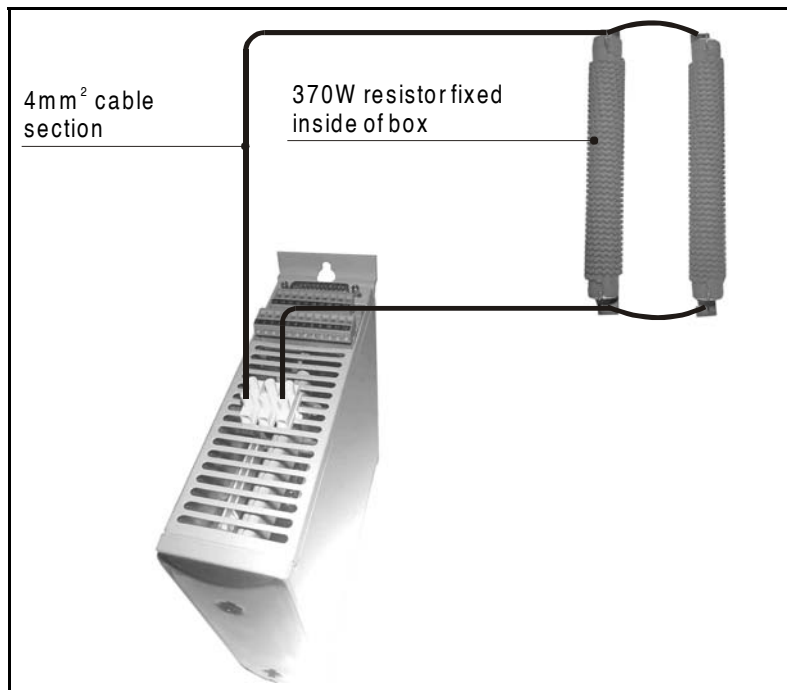
- Drive peak current
- Drive nominal current
- Resolver 2 poles.
- Motor poles 6p with S20 opened and S21 closed.
- Nominal speed at 10V reference: 3000RPM with an "M.VEL" 2.55 Kohm resistance.
- Trimmer gain proportional to KV positioned at 1.
- DER integral trimmer positioned at 1 (1024).
- Simulated encoder: with resolution at 1024 imp./rev. with S12-S16 closed and S10-S11-S13-S14-S15-S17 open.
- The remaining welding points are set as follows: S1-S3-S4-S5-S7-S8-S9-S22-S23 open and S2-S6 closed.
- The product is standard produced with the possibility of working with the converter resolver / Digital bottom scale at 14 bits, with a maximum of 4000 rpm. For higher speeds with 12 bit setting, please contact Axor.

Check that the drive corresponds to the motor that it is to control and proceed as follows:

- 1 Make sure that the output voltage of the transformer or autotransformer is in conformity with the B17 box input one.
- 2 Make sure that the B17 Analogic in the Super BOX is the correct model for the alternate current that supplies the B17 box (see chap. 3.4. "Supply transformer dimensioning").
- 3 Make sure that terminal 12 of the control terminal board is connected as specified (see chap. 3.10. "Control Terminal Board").
- 4 Make sure that the mass terminal of the B17 Analogic box is connected as specified (see chap. 3.6. "Connecting to the power grid transformer").
- 5 Make sure that the screen of the following wires are connected as specified:
 - Motor power wire (see chap. 3.8. "Motor connection").
 - Transformer primary and secondary wires (see chap. 3.6. "Connecting to the power grid transformer").
 - Wire of the encoder signals coming from the motor (see chap. 3.9. "Computer connection and snap-on connector").
 - Speed reference wire coming from the control (see chap. 3.11. "Speed and current references").



External connection of 2 resistors with a power of 370W



The table below gives the ohm values and the power in Watts of the available resistors:

B17 box Analogic	C 200	D 300
400W		
800W		



In these cases, contact the manufacturer for resistors power dimensioning and ohm value.



- Choose the filter that has a nominal current which is greater or equal to that of the transformer or autotransformer primary;
- The filter should be used with the transformer or autotransformer primary.

This method, as well as offering the best result from a disturbance suppression point of view, makes it possible to use filters that can support very low currents. In this way best use is made of the transformer transformation ratio and as a result filters are cheaper.

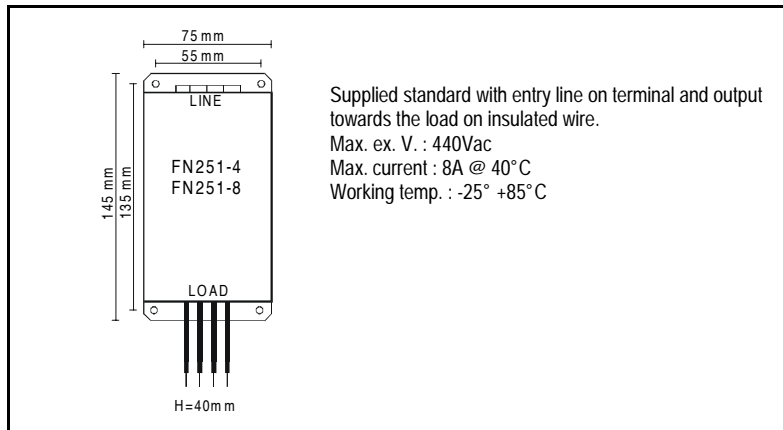
SINGLE AXIS CONFIGURATION B17 Box Analogic	Filter nominal current (A)	Filter model
B17 Box Analogic C200	8	FN251-8
B17 Box Analogic D300	8	FN251-8

Leakage currents and nominal currents:

MODEL	REFERENCE CURRENT (A)	CURRENT LOSS (mA)	POWER LOSS (W)	WEIGHT (Kg)
FN251 - 4	4 (400)/4,6 (2500)	1,31 (400V 50Hz)	5,5	0,75
FN251 - 8	8 (400)/9,2 (2500)	1,31 (400V 50Hz)	7	0,75



Mechanical and electrical characteristics:



If using single phase, connect only the L1 -L2 inputs.

2 Using screened cables: all connections downstream of the power grid filter **must be screened**. The screening braiding of the cable being used must be laid on the zinc panel of the panel near both the supply terminals and the terminals of each motor using cable holders as shown in the following diagrams. The panel on which the screening braiding is laid must be connected to earth.

Connections to the screens:

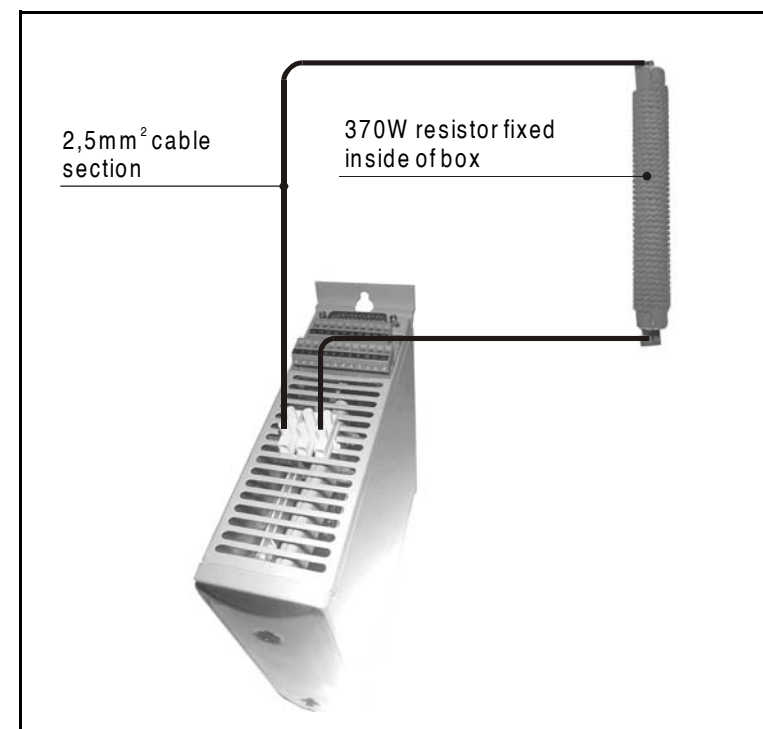
- Connect the motor cable screen to the motor body (motor side).
- Connect the control cable screen to the motor body (motor side).
- Connect the control cable screen to the 0 (driver side).
- Do not connect the motor cable screen to the panel (driver side).
- Leave the driver transformer wire screen floating.



3.15. Braking module

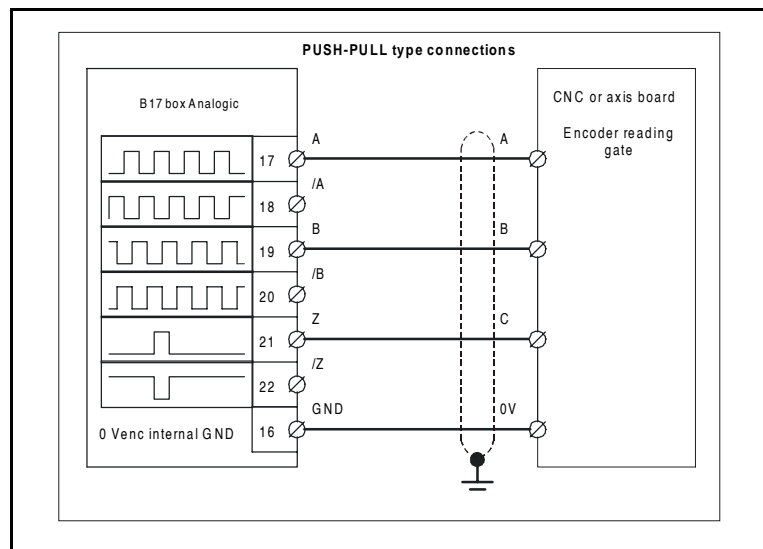
The Super Box is equipped with an internal braking system that uses resistors. If alarm "A" activates (Maximum recovery pre-alarm) during the motor deceleration phase, it is advisable to upgrade the braking. The resistor ohm value and Watt power depend on the Box model and the Watt power produced by the motors themselves that is to be eliminated. The diagram below shows how to connect external resistors.

External connection of 1 resistor with a power of 370W





- **Push-pull:** Only the positive channels that refer to the common GND are used.

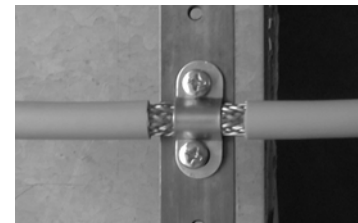


Unless requested otherwise, the B17BOX is supplied selected for 1024 Imp/Rev.

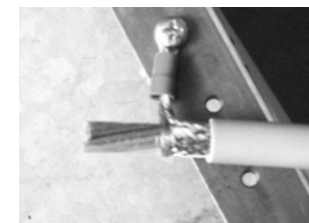
S13 .. S17 Closed = 2048 Imp/rev
S12 .. S16 Closed = 1024 Imp/rev
S11 .. S15 Closed = 512 Imp/rev
S10 .. S14 Closed = 256 Imp/rev



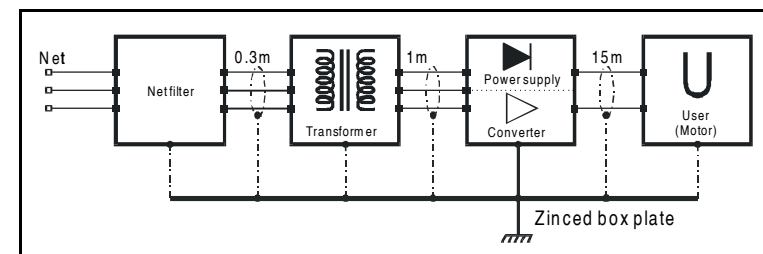
Cable holder



Eyelet



Correct wiring and laying techniques are essential for good system operation and disturbance suppression. The diagram below shows the correct connections and the distances to be kept.

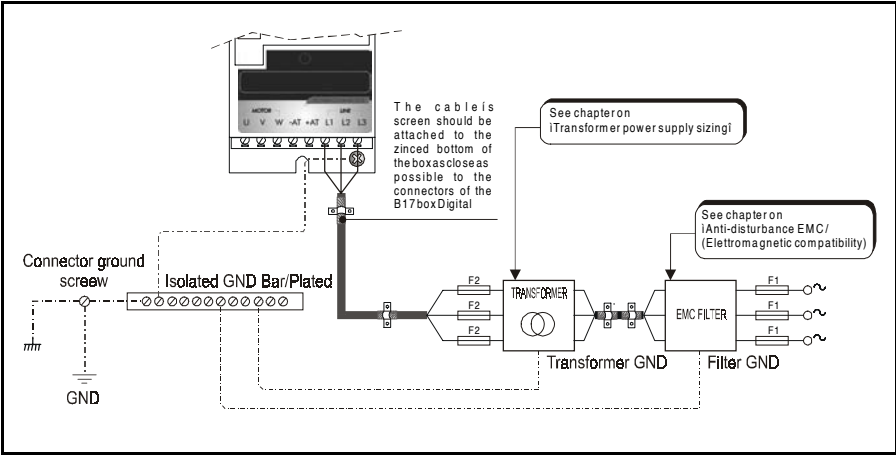


3 Using wire de-coupling techniques: when laying the wires, please keep in mind that the power conductors must be kept **physically separate from the command or signal conductors**. Crossovers, overlapping and kinks should be avoided. If crossing over is unavoidable, cross at an angle of 90°. When laying power conductors, use metal channels that are earth connected wherever possible. The motor mass wire must always be kept separate and should not be placed beside multipolar wires.


4 Connecting to the panel:

- Connect the internal 0 of the servodrive to the panel using a wire that is not any longer than 40cm.
- Connect the motor mass wire at a distance of less than 5 cm from the internal 0 connection on the panel.
- Always make sure that there are no false contacts caused by galvanising or other things in the connections to the panel.

3.6. Connection to the power grid transformer



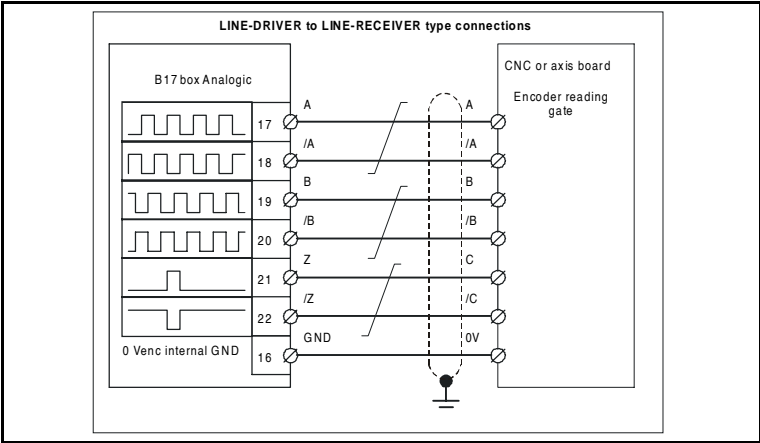
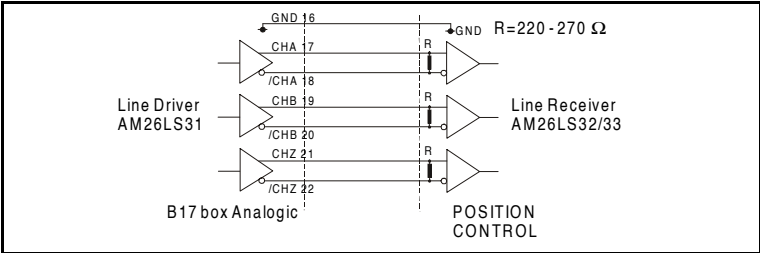
It is essential to use a **screened cable** from the EMC filter to the B17 Analogic box input when connecting to the mains. It is also necessary to connect the cable braiding to the zinc bottom of the panel near each interruption, either using a cable holder as shown above or eyelet fast-ons.

SUPERBOX SILKSCREENING	DESCRIPTION	
L1	(INPUT)	Alternate supply coming from the transformer secondary
L2	(INPUT)	Alternate supply coming from the transformer secondary
L3	(INPUT)	Alternate supply coming from the transformer secondary
	(INPUT)	Connection to the insulated earth bar

3.14. Simulated encoder channels

Each encoder channel can carry a current of approximately 20mA. The output impulses can be divided according to the setting of the S10 to the S17 welding points carried in the B17 Analogic box. The simulated impulses can be used in the following two ways:

- Line driver:** all positive and negative channels are used. In some cases the axis cards or CNCs can read the simulated impulses incorrectly, because of disturbances induced in the wires. The maximum distance for guaranteeing a clean signal depends on the wire impedance and characteristics. In these cases it is advisable to connect a resistor of approx. 220 or 270Ω between channels A-/A, B-/B, Z-/Z at the input of the axis card or the CNC (if not already present inside). If there are several axis cards or CNCs which read the same channels in parallel, the resistors should be connected to the axis card or on the furthest away CNC.

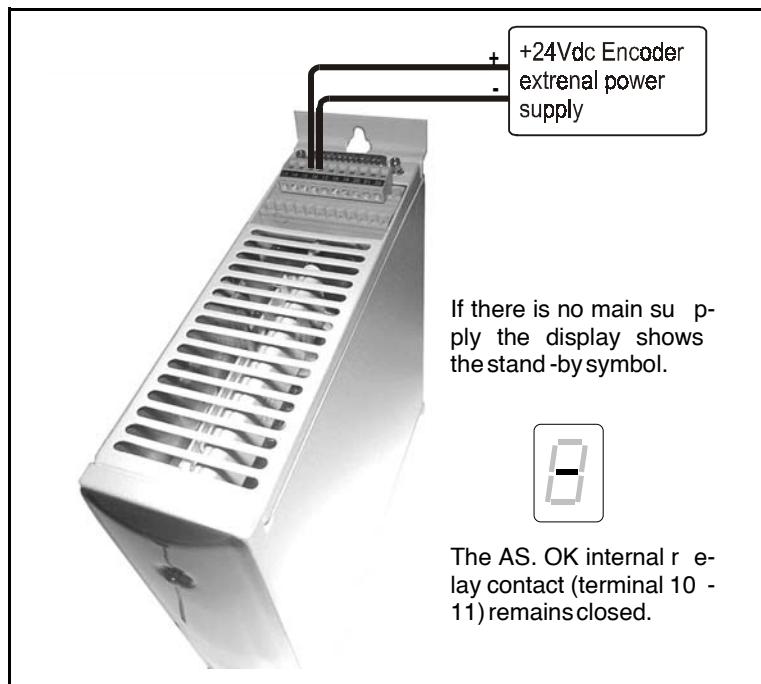




3.13. External supply of the encoder and the logic card

It is possible to supply the encoder and the logic card using an external 24Vdc +25% / -30% supply. Connect the positive pole of the supply to the 15 "+Vext." terminal and the negative pole to the 16 "GND" terminal, as shown in the diagram.

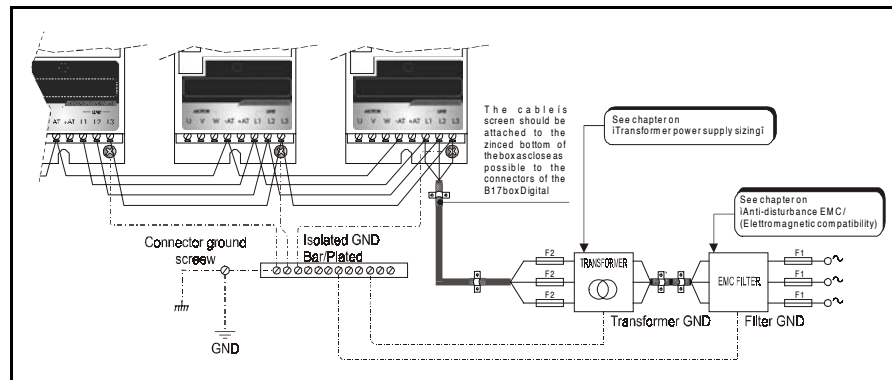
Doing this makes it possible to keep the simulated encoder output signals active even when the converter is switched off.



Pay attention to the polarity of the external supply voltage.



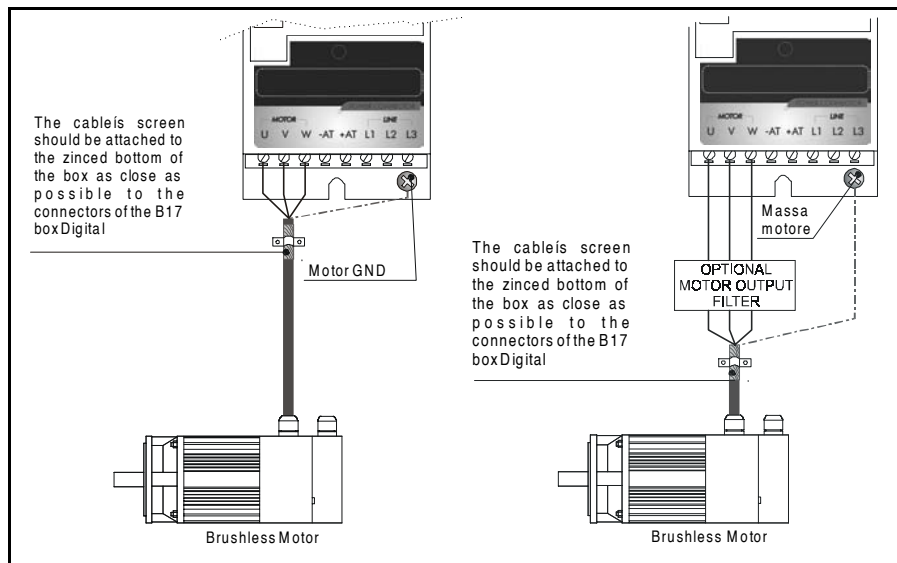
3.7. Connection to the power grid transformer on a multi-axis application



With multi-axis applications that use one single power grid transformer, it is advisable (but only for the B17 box C200 model) to join the terminal to the "-AT" power side of each drive using a 2.5mm² sectioned wire. When connecting to the mains **use a screened wire** from the EMC filter to the B17 Analogic box. Please note that the wire braiding should be connected to the zinc bottom of the panel near each interruption, either using a cable holder as shown above or eyelet fast-ons.

SUPERBOX SILKSCREENING	DESCRIPTION	
L1	(INPUT)	Alimentazione alternata proveniente dal secondario trasformatore
L2	(INPUT)	Alimentazione alternata proveniente dal secondario trasformatore
L3	(INPUT)	Alimentazione alternata proveniente dal secondario trasformatore
	(INPUT)	Collegamento alla barra isolata di massa
-AT	(INPUT)	Accomunamento dei morsetti di -AT solo per il modello C200

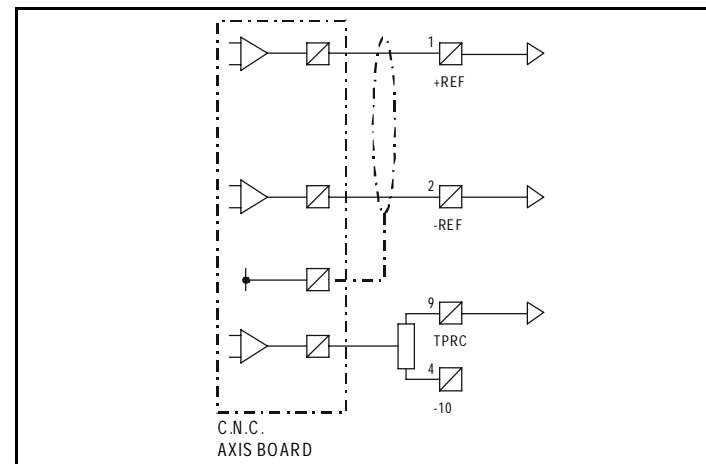
3.8. Motor connections



A **screened 3P+T cable must be used** to connect the motor. Match the U-V-W phases of the motor with terminals U-V-W of the B17 Analogic box and the earth wire with the corresponding screw. The motor wire braiding should be positioned on the zined bottom of the panel near the terminals themselves, either using a cable holder as shown or eyelet fast-ons. These wires must be placed in separate channels from the signal wires and should have the following sections:

MODEL	SIZE	SECTION
B17box Analogic	2/4 -4/8 -8/16	1,5mm \leq
B17box Analogic	10/20 -14/28 -20/40	2,5mm \leq

Example of differential speed control with limitation of the current that can commute between two values.



• Current control with common mode input

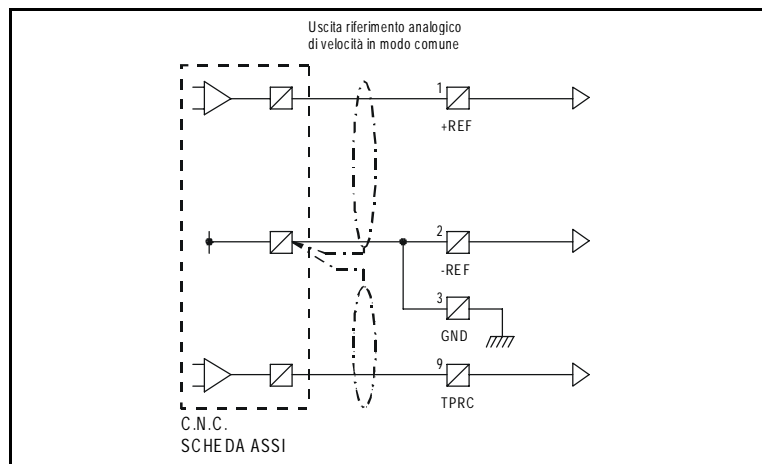
Piloting is carried out by applying a $\pm 10V$ max. signal, to which the pickup current issued by the converter corresponds. In this case the speed loop is excluded automatically and does not interfere with the system.

Terminal 9 can be used (in alternative to cases 1 and 2), as a monitoring signal for the drive current request.

N.B.: connect instruments with an input impedance of more than 100Kohm.

Types of current control:

- With $\pm 10V$ without reference.
- Current limitation with $\pm 10V$ and inserted reference.
- Current limitation by way of external resistance.



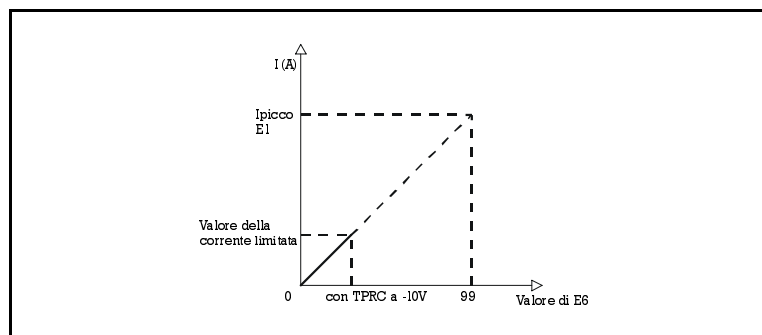
• Speed control with differential analogue reference or commonly and current limitation.

This configuration makes it possible to control motor speed with a differential analogue reference or commonly using terminals 1-2 "+/-REF" and to limit the current size.

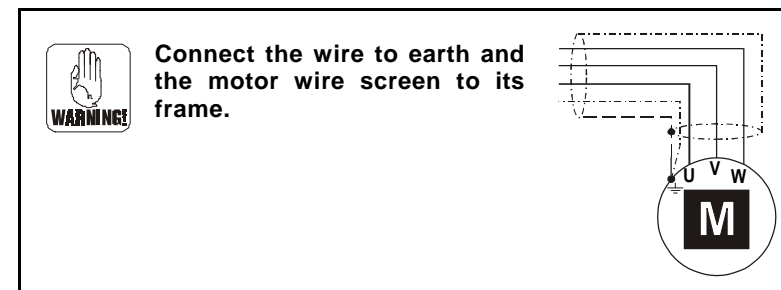
The current value is determined by the value of the resistor positioned between terminal 9 "TPRC" and terminal 3 "0S".

Limitation of the issued current:

Happens by connecting an external resistor to zero; linear distribution with internal $R = 47\text{Kohm}$. (Internal speed loop continues working). Example: With an external R of 47Kohm the current is limited by 50% of the I_{Max} sizing.



In some cases motor operation regularity is obtained by adding a filter near the box on the power phase of the motor, making it possible in this way to attenuate disturbances on the wires of the resolver, which is very sensitive. Axor can supply filters that are suitable for these types of problem.



Se è presente nel motore il freno elettromeccanico, alimentare i morsetti + e - con una tensione continua di circa 24 Vdc, ponendo attenzione a non invertirne la polarità.



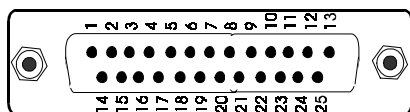
3.9. Box connection and snap-on connector

The signals coming from the brushless motor meet on these connectors. The wire to **be used must be screened totally with 4 pairs of twisted wires and screened**. The recommended conductor section is 0.15 – 0.25 mm². The braiding and wires should be welded as indicated.

Box connector



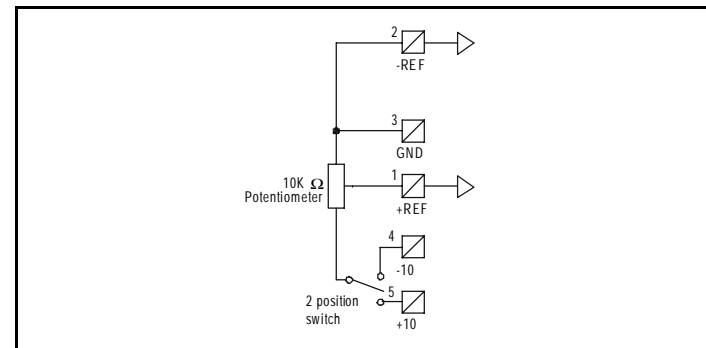
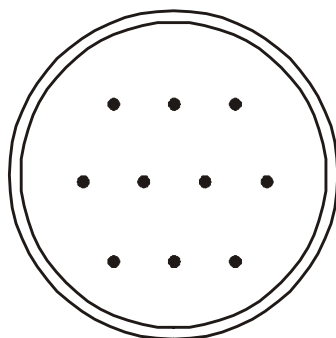
View from welding side



Snap-on connector



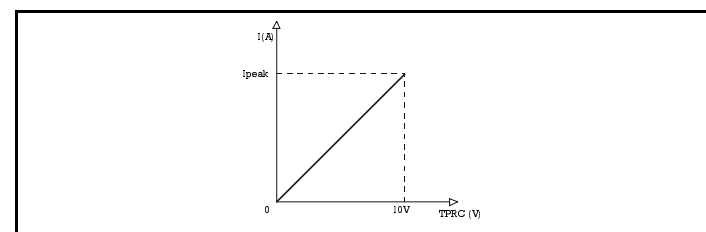
View from welding side



Do not use potentiometers with a value of less than 10KΩ.

• Speed control with differential analogue reference or commonly and analogue current limitation

This configuration makes it possible to control motor speed with a differential analogue reference or commonly by way of terminals 1-2 "+/-REF". If terminal 9 "TPRC" is used, converter current can be limited from 0 to the peak cutting value with a voltage from +0V to +10V.

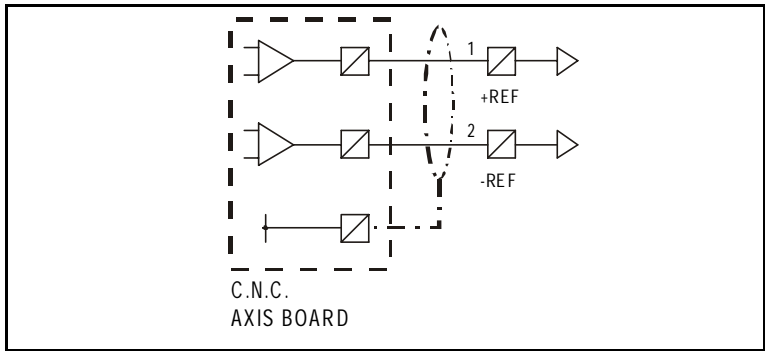


Example of speed control with reference in common mode and analogue current limitation:

3.11. Speed and current references

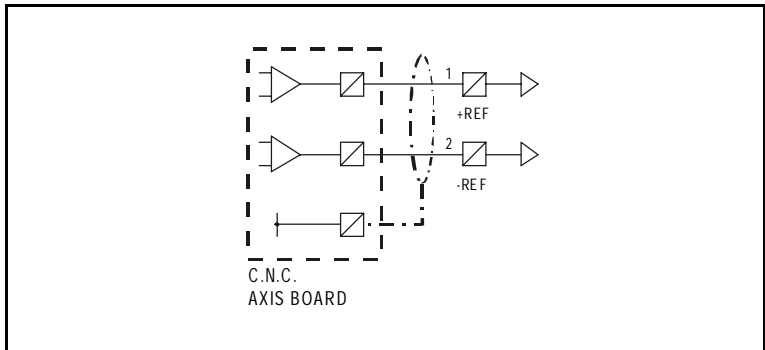
Terminals 1-2 "+/-REF" and terminal 9 "TPRC" can be used to control the speed or the current.
The possible applications of these 3 inputs are as follows:

- Speed control with differential analogue reference +/-10V or less.



- Speed control with analogue reference commonly with +/-10V or lower.

In this configuration the motor shaft rotates clockwise if seen from the front with a +10V signal at terminal 1 "+REF", while with a +10V signal at terminal 2 "-REF", the shaft rotates anticlockwise.



BOX PIN	SNAP-ON PIN	SIGNAL	DESCRIPTION
4		ST	Motor thermal probe
8		SCREEN	3 double wire screen
13		SCREEN	Wire screening
14		-SEN	Resolver secondary winding input ((connected to zero signal)
15		-COS	Resolver secondary winding input (connected to zero signals)
16		-ECC	Supply output for resolver primary winding
17		ST	Motor thermal probe
23		+SEN	Resolver secondary winding input
24		+COS	Resolver secondary winding input
25		+ECC	Supply for the resolver primary winding




3.10. Control terminal board

The drive command inputs, the simulated encoder signal outputs and the +/-10V auxiliary supplies are all present on the terminal board. It is advisable to use screened cable when connecting terminals 1-2-9-15-16-17-18-19-20-21-22 in order to avoid signal disturbances.

NR. OF POLES	FUNCTION	DESCRIPTION
1	+REF	INPUT Non inverting input with differential speed stage with +/-10V (see chapter 3.11. "Speed and current references").
2	-REF	INPUT Inverting input of the differential speed stage with +/-10V (see chapter 3.11. "Speed and current references").
3	GND	Common zero signal
4	-10V	OUTPUT Auxiliary output voltage of -10V with 4mA maximum
5	+10V	OUTPUT Auxiliary output voltage of +10V with 4mA maximum
6	REF ON	INPUT It allows the converter to accept the input reference at terminals 1 -2 "+/-REF" with 10/30Vdc positive logic signal.
7	ENABLE	INPUT It allows the converter to take the motor to torque standstill with positive 10/30Vdc
8	IMOTORE	OUTPUT Signal that corresponds to the true current that circulates in the motor. Maximum level +/- 8V, which corresponds to the converter peak current. (This signal is also available on the il MOTi Test Point of the removable personalisation card.) Example: B17BOX 1408/16Ö...4V correspond to 8Arms.
9	TPRC	INPUT This input can be used as a current control. (See chapter 3.11. "Speed and current references").



NR OF POLES	FUNCTION	DESCRIPTION
10	OK	 <p>This contact is normally closed. It opens when one of the internal protections of the converter intervenes and when the external signal showing motor nominal protection intervention is activated (Ist).</p>
11	OK	
		Max. capacity 48Vdc -800mA 110Vac -1A
12	Mass point	INPUT Terminal for common zero earthing. This terminal should be connected to the insulated earth bar. Minimum section 1.5 mm ² .
13	+LIM SW	INPUT Not active
14	-LIM SW	INPUT Not active
15	V EXT.	INPUT External voltage for the supply of the resolver and the logic card (see chap. 3.13. "External supply of the resolver and the logic card")
16	GND	Common zero signal
17	A	OUTPUT Channel A simulated positive (see chapter 3.14. "Simulated encoder channels")
18	/A	OUTPUT Channel A/ simulated negative (see chapter 3.14. "Simulated encoder channels")
19	B	OUTPUT Channel B simulated positive (see chapter 3.14. "Simulated encoder channels")
20	/B	OUTPUT Channel B/ simulated negative (see chapter 3.14. "Simulated encoder channels")
21	Z	OUTPUT Channel Z simulated positive (see chapter 3.14. "Simulated encoder channels")
22	/Z	OUTPUT Channel Z/ simulated negative (see chapter 3.14. "Simulated encoder channels")