

The B17 box Digital 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 box Digital 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 of this manual.

For any further information that is not contained in this manual, please contact the manufacturing company.

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The contents of this manual can be modified without forewarning.

VERSION Manual B17 Digital gb Box Encoder '25 July 2002

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

DECLARES under its own responsibility that the following product:

B17 box DIGITAL series

with its relevant accessories and options, and when installed following the operation instructions supplied by the manufacturer, 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 which does not exceed 1000V with alternate current and 1500V with direct current.

Montebello Vicentino, 17/09/98

The management

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1. SAFETY REGULATIONS

1.1. Prescriptions



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 connected points 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 evidences 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!



F8 MENU:

A0: Id, KP_Id current ring proportional constant

A1: Id, KI_Id current ring integral constant

A2: Iq, KP_Iq current ring proportional constant

A3: Iq, KI_Iq current ring integral constant

A4: WARNING: Do not modify this parameter

A5: WARNING: Do not modify this parameter

A6: KP_Id multiplier:

multiplies the KP_Id value by $1 \div 100$

A7: KI_Id multiplier:

multiplies the KI_Id value by $1 \div 100$

A8: KP_Iq multiplier:

multiplies the KP_Iq value by $1 \div 100$

A9: KI_Iq multiplier:

multiplies the KI_Iq value by $1 \div 100$

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

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

When connecting the B17 box Digital 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 onto 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 box digital 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 manufacturer.



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.



L1: analogue or digital reference

0: analogue reference

1: digital reference

If L1 = 0, the analogue speed or torque references are valid, otherwise the digital ones that can be set with the L2 and L3 parameters are valid

L2: speed reference value

0: maximum negative speed reference

50: zero speed reference

99: maximum positive speed reference

L3: current reference value

0: maximum negative current reference

50: zero current reference

99: maximum positive current reference

L4: speed or current reference inversion

0: direct current or speed references

1: negative current or speed references

L5: internal or external current limits

0: internal current limit

1: external current limit

L6: common or differential current reference

0: common mode reference

1: differential mode reference

L7: clockwise speed limitation in current control; makes it possible to limit the speed as regards parameters h5 and h6 of the "F5 MENU"

0: 0% no speed limitation

50: 50% of the bottom scale set in parameters h5/h6

80: 80% of the bottom scale set in parameters h5/h6

99: 100% of the bottom scale set in parameters h5/h6

L8: counterclockwise speed limitation in current control; makes it possible to limit the speed as regards parameters h5 and h6 of the "F5 MENU"

0: 0% no speed limitation

50: 50% of the bottom scale set in parameters h5/h6

80: 80% of the bottom scale set in parameters h5/h6

99: 100% of the bottom scale set in parameters h5/h6

F6 MENU:

P0: Iu current transducer offset

- 0: negative maximum offset
- 50: null offset
- 99: positive maximum offset

P1: Iv current transducer offset

- 0: negative maximum offset
- 50: null offset
- 99: positive maximum offset

P2: speed reference offset

- 0: 0.6% offset in a clockwise direction
- 50: null offset
- 99: 0.6% offset in a counterclockwise direction

P3: current reference of fset

- 0: negative maximum offset
- 50: null offset
- 99: positive maximum offset

P4: Phase angle visualisation

P5: WARNING: Do not modify this parameter

P6: indicates the current software version

P7: nominal speed limitation as a percentage of the h5/h6 "F5 MENU" parameter in clockwise direction with current control (see example on page 44)

- 0: 0% of the speed limitation
- 99: 100% of the speed limitation

P8: nominal speed limitation as a percentage of the h5/h6 "F5 MENU" parameter in a counterclockwise direction with current control (see example 2 on page 44)

- 0: 0% of limitation speed
- 99: 100% of limitation speed

P9: WARNING: Do not modify the parameter

F7 MENU:

L0: speed or current control

- 0: speed control
- 1: current control

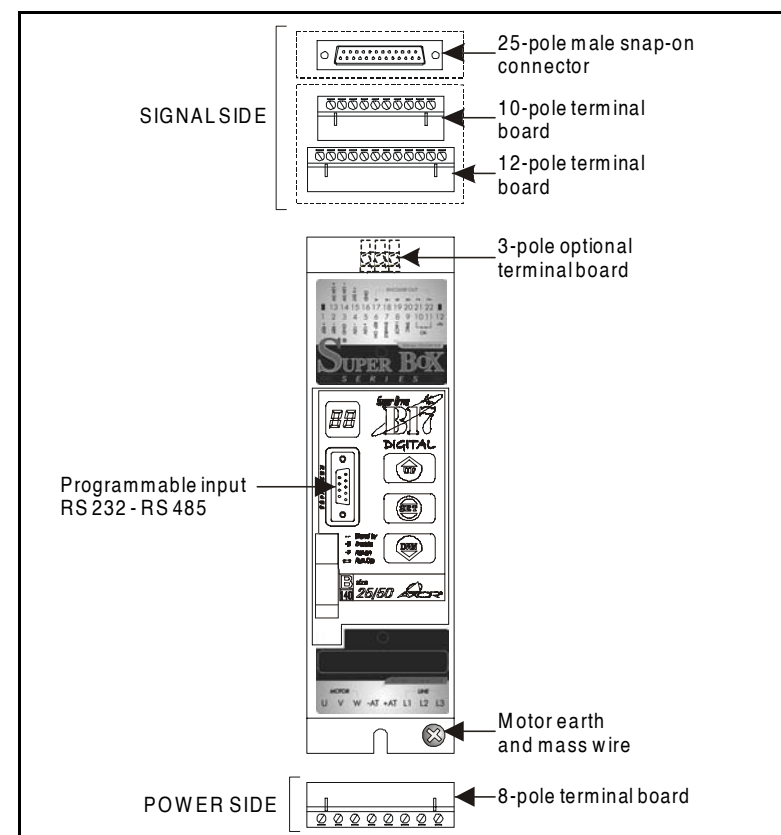
2. General description

2.1. Product description: B17 box Digital

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

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 box Digital 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:





- 2 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 three-phase 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.
- RS232 and 485 entry **vaschetta** for programming the B17 box Digital.



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 box Digitals:

Model	Supply (Vac) / 50-60 Hz
B17 box Digital C -200	145
B17 box Digital D -300	220

Size	Nominal current Arms	Peak current Arms	Peak time I ² t 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

F5 MENU:

h0: "Automatic phasing and initialisation"

- 0: does not enable initialisation
- 1: enables initialisation

h1: "Automatic phasing and initialisation"

- 0: does not enable automatic phasing
- 1: enables automatic phasing only if h0=1

h2: REF ON input function

- 0: standard enabling operation
- 1: reference enabling function in addition to parameter d3=2 of the "F6 MENU"

h3: deceleration ramp when the "AL07" and "AL03" alarms intervene

- 0: carries out a deceleration ramp with a time that can be programmed from 0.4 sec. with parameter 2 of the "F3 MENU". After the ramp, the external OK contact opens.
- 1: the external OK contact opens and carries out a deceleration ramp in a time that can be programmed from 0.4 sec. using parameter 2 of the "F3 MENU"

h4: parameter block

- 0: when h7=99, the possibility of modifying all the parameter is enabled
- 0: when h7=99, the possibility of modifying only the parameters relative to the current ring (F8 MENU) is inhibited
- 1: the possibility of modifying all the parameters is inhibited

h5: setting of the nominal speed in thousands and hundreds

h6: setting of the nominal speed in tens and units

Example: to set 3000rpm
h5 = 30
h6 = 00

h7: parameter block (see parameter h4)

h8: motor power phase inversion: to overturn the cyclic direction of the motor power phase without inverting the wires

- 0: standard Axor
- 1: inversion

h9: WARNING: Do not modify this parameter



F4 MENU:

E1: peak current; defines the correct positive size admitted by the driver as a percentage.

0: 0% of the size

99: 100% of the size

E3: Ixt intervention time setting; supplies the peak current for a time according to the electric frequency to the motor (linear function between 0 and 16Hz)

E4: Ist constant; supplies the peak current set in parameters E1 to the motor for a limited time according to the type of motor

E5: nominal current ; defines the nominal current as regards the peak values set in parameters E1 as a %

0: 0% null nominal current

99: 100% nominal current equal to the peak current

E6: limitation of the peak current with TPRC input = -10V (see "speed control with differential analogue reference or common mode and limitation of the current that can be commuted between two values" on page 33).

0: 0% of the peak current

99: 100% of the peak current

$$\frac{I_{peak}}{100} \times \text{limitation value between 0 and 100}$$

E7: stop time

0: 0 seconds

99: 4 seconds

E8: variation of the nominal turns; makes it possible to vary the nominal turns as regards those selected by the set motor type

0: equal to or greater than -10% of the nominal turns

50: nominal turns

99: equal to or greater than +10% of the nominal turns

E9: analogue reference excursion: makes it possible to reach nominal turns with an analogue input of less or equal to 10V.

80: 8V= speed bottom scale

99: 10V= speed bottom scale

Main characteristics:

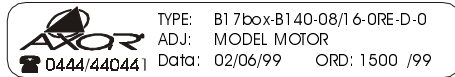
- Working and storage humidity from 10% to 95% without condensation.
- Working temperature: 0/40°C - storage temperature: -10/70°C.
- AM26LS33 encoder interface either differential or common at 5V or IET7273 at 12V if requested.
- Speed reaction from encoder up to 200KHz.
- Encoder emulation with divisions 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.
- Microcontroller, 32bit RISC.
- Galvanic insulation (only available for the D300 version).
- Programmable RS232 and RS485 interface.
- On-board positioning system.
- Two programmable digital inputs as an alternative to the Limits Switch.
- Differential reference input +/-10V.
- Analogue input for piloting with current +/-10 V.
- Thermal shunt, differential reference circuit +/- 1.8mV/°C.
- Motor current monitoring +/-10V = I peak
- Motor speed monitoring +/-10V

$$\text{Motor speed} = \frac{\text{Read voltage} \times 600000}{\text{Nr. of encoder imp./t}}$$

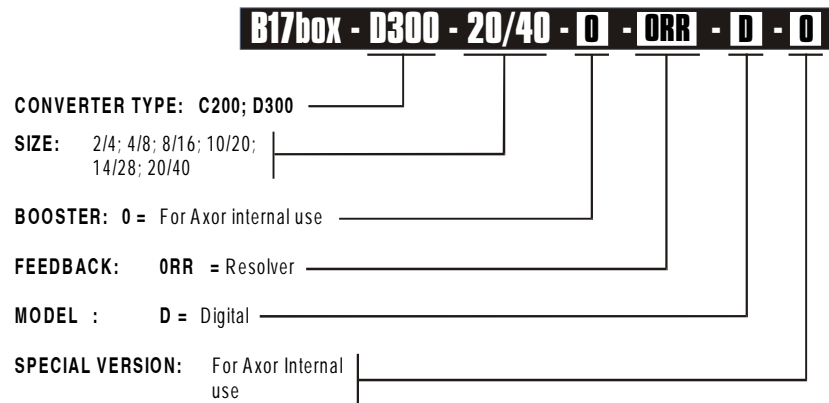
- Auxiliary voltage +/-10V max 2 mA.
- Auxiliary voltage for encoder +12V max 200mA.
- Auxiliary voltage for encoder +5V max 350mA.
- Diagnostic display for state signals and alarms.
- Motor short circuit protection.
- I2t motor protection
- Saving of the I2t drive intervention
- Motor overheating protection
- Supply over/under voltage protection
- Drive overheating protection
- Inverse polarity protection
- No speed reaction protection
- No Hall probe protection
- No +AT voltage protection
- EEPROM writing error protection



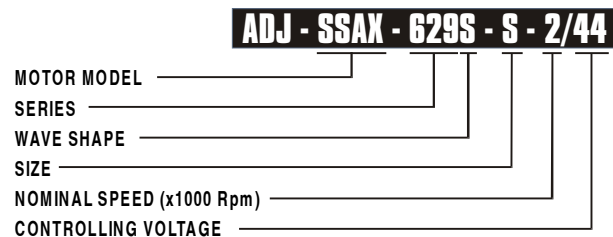
2.2. B17 box Digital plate description



There are 3 product plates on each B17 box Digital converter: one on the lid, one on the side of the box and one inside, on the 24-way DIN connector.



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.

F3 MENU:

- d0: acceleration ramp**; the time used to take the motor from zero to nominal speed
 - 0: no ramp
 - 50: 1 second
 - 99: 4 seconds
 - d1: deceleration ramp**: the time used to take the motor from nominal to zero speed
 - 0: no ramp
 - 50: 1 second
 - 99: 4 seconds
 - d2: deceleration ramp after alarm intervention**: the time used to take the motor from nominal to 0 speed after the motor or drive maximum temperature alarms have intervened, and when one of the +/- Limit Switches has intervened.
 - 0: no ramp
 - 50: 2 seconds
 - 99: 4 seconds
 - d3: +/- enabling of the functions associated with +/- Limit Switch inputs**
 - 0: no function associated with the +/- Limit Switch inputs
 - 1: enables Limit Switch operation
 - 2: current control with differential input with limitation of the maximum speed that can commute between the values set with parameters L7, L8 and P, P8.
 - d4: External OK relay signal intervention when the 1st alarm intervenes.**
 - 0: the OK relay does not open
 - 1: the OK relay opens
 - d5: WARNING: Do not modify the parameter**
 - d6: WARNING: Do not modify the parameter**
 - d7: enabling of the REF ON, ENABLE, LIM+, LIM- inputs with negative logic**
 - 0: positive logic for REF ON, ENABLE, LIM+ and LIM-
 - 1: positive logic for LIM+, LIM- and negative logic for REF ON and ENABLE.
 - 2: positive logic for REF ON and ENABLE and negative logic for LIM+ and LIM-
 - 3: negative logic for REF ON, ENABLE, LIM+ and LIM-
- Nota: positive logic: $10 \div 30 V_{DC}$
negative logic: $0 \div 5 V_{DC}$

F2 MENU:

c0: number of encoder turn impulses (thousands, hundreds)

c1: number of encoder turn impulses (tens, units)

c2: encoder turn impulses

0 = number of motor encoder turn impulses divided by 1

1 = number of motor encoder turn impulses divided by 2

2 = number of motor encoder turn impulses divided by 4

3 = number of motor encoder turn impulses divided by 8

4 = number of motor encoder turn impulses divided by 16

5 = number of motor encoder turn impulses divided by 32

6 = number of motor encoder turn impulses divided by 64

7 = number of motor encoder turn impulses divided by 128

c3: simulated encoder impulse direction

0: standard simulated impulse direction

1: encoder impulse negative direction

c4: number of motor polar couples

$$\text{nr. of motor polar couples} = \frac{\text{Nr. of poles}}{2}$$

c6: station address for serial communication

0: numero di indirizzo di stazione errato

1: numero di indirizzo di stazione corretto

c7: display visualisation

0: standard display

1: shows the I²t intervention level of the drive

2: shows the I²t signal level during machine operation

3: shows the immediate current value "99 = maximum current"

4: shows the number of motor revs. "thousands-hundreds"

5: shows the number of motor revs. "tens-units"

c8: **WARNING: Do not modify this parameter**

c9: programmable analogue output

0: no display

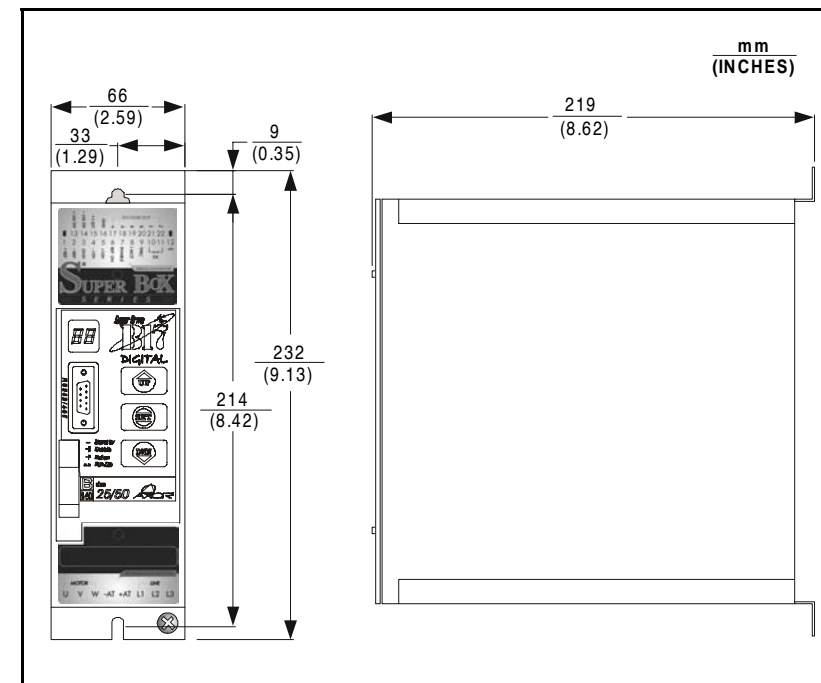
1: motor current

2: proportional voltage signal at the current that runs through the motor (10V = I_{ppico}; 5V = nominal)

3: Id current

4: Iq current reference

2.3. B17 box Digital dimensions



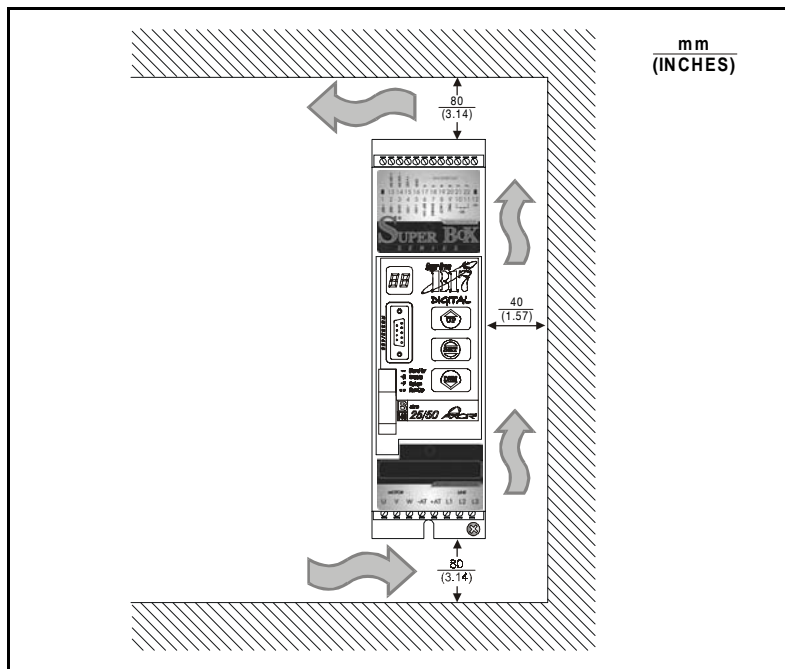
3. Installation

3.1. Assembly



The B17 box Digital is prepared for monitoring inside an electric box. The inter-axis measurements for the fixing holes can be found in chapter 2.3 "B17 box Digital 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 box Digital 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 box Digital from excessive mechanical vibrations in the electric panel
- Do not let anything metal fall inside the B17 box Digital 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

b3: filter constant: low feedback signal passes

0: 0ms
99: 14ms

b4: filter constant: low derived signal passes

0: 0ms
99: 14ms

b7: b2 derivative constant multiplier

multiplies the value of b2 by the value indicated: $1 \div 99$

b8: b0 proportional constant multiplier

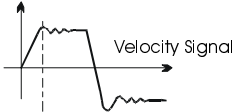
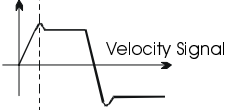
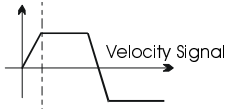
multiplies the b0 value by the indicated value: $1 \div 99$

b9: b1 integral constant multiplier

multiplies the b1 value by the indicated value: $1 \div 99$

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 **vaschetta** (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 right is obtained.	
To reduce the overshoot, increase KD until a reply similar to the one shown on the right is obtained.	
Warning: do not exceed with the gain - doing so can cause useless motor heating because of current oscillations.	

4.6. Parameter programming and visualisation

Using the "UP", "SET", "DOWN" keys and the display, it is possible to modify the driver parameters following the steps given below:

- 1 press the "SET" key once to reach the main menu, included between F1-F8;
- 2 To move from one menu to another, press the "UP" or "DOWN" key;
- 3 Once one of the menus between F1 and F8 have been chosen, press the "SET" key to reach a sub-menu that includes up to a maximum of 9 parameters;
- 4 To move from one parameter to another, press the "UP" or "DOWN" key;
- 5 Once the desired parameter has been chosen, press "SET" and with the "UP" and "DOWN" keys modify the value;
- 6 To save the new value, just press "SET" again;
- 7 The display shows the chosen parameter again. If no other keys are pressed for around 15 seconds, the display returns to showing the drive state;
- 8 It is possible to return to the previous displays by pressing the "UP" key followed by the "SET" key;

It is possible to modify the drive parameters while the motor is working. This option can be activated by following the steps given below:

- 1 set the h3 parameter of the F5 menu at 1 and press "SET";
- 2 switch the driver off and on again;
- 3 after switch-on, modify the desired parameters;
- 4 take parameter h3 from menu F5 to 0 and press "SET";

Modifying the values of the following parameters only takes effect after having removed and returned the "L1-L2-L3" power supply and the "V EXT" auxiliary one:
c0, c1, c2, c3, d3, d7, E7, h2, h3, h8.

F7 MENU:

- b0: KP speed ring proportional constant
0: min.
99: max.
- b1: KI speed ring integral constant
0: min.
99: max.
- b2: Kd speed ring derived constant
0: min.
99: max.



3.2. Ventilation

The temperature that surrounds the B17 box Digital 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:

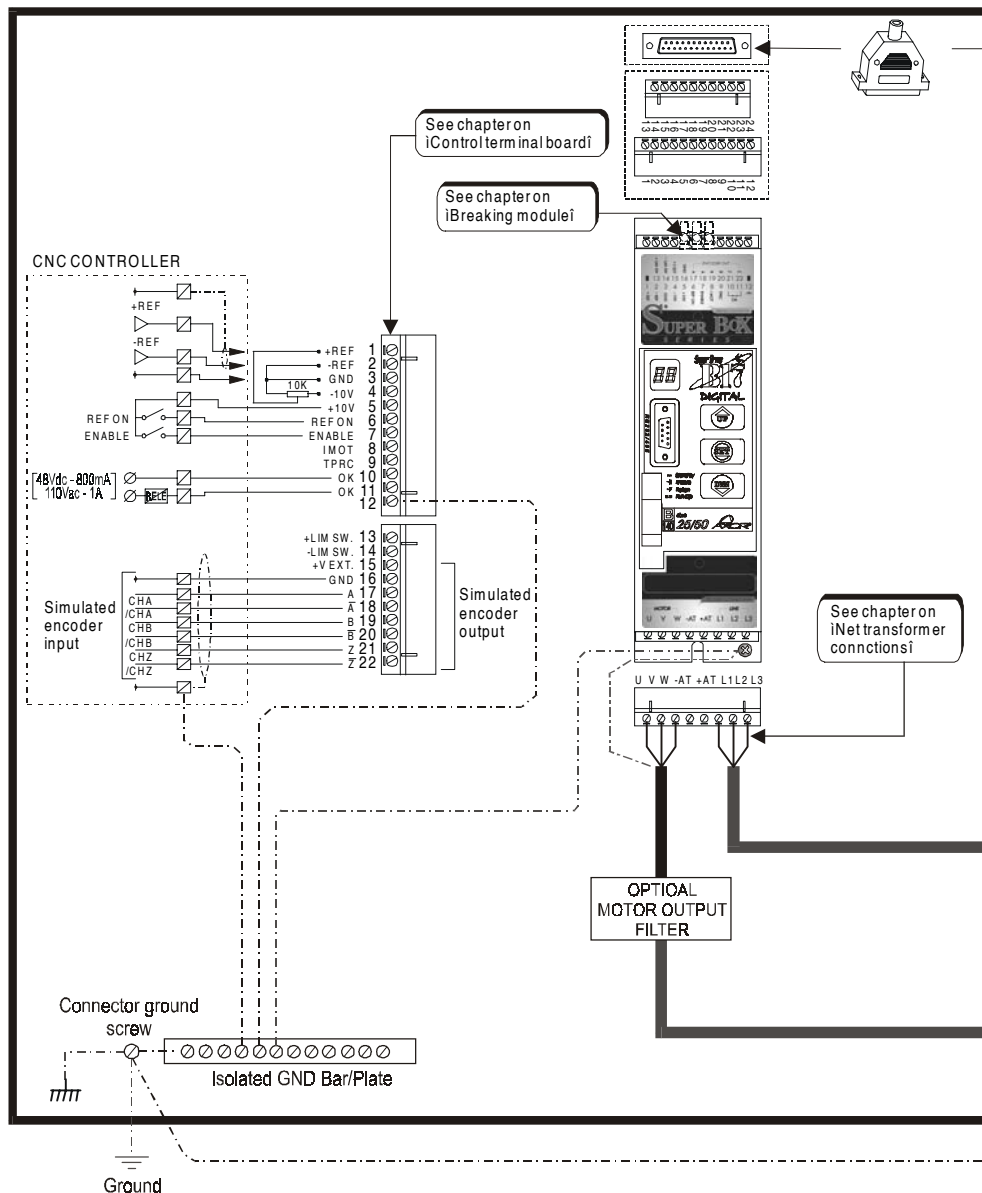
Model	2/4	4/8	8/16	10/20	14/28	20/40
200	-	-	-	V	V	V
300	-	-	-	V	V	V

Note: V=Forced ventilation



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


3.3. General connections



Start up and settings

- Simulated encoder rev. impulses
- Indicates the current version of the software
- Station address for serial communication
- Motor power phase inversion
- Speed or current reference inversion
- Peak current limitation with inputs TPRC = -10V
- Counterclockwise speed limitation with current control
- Clockwise speed limitation with current control
- Counterclockwise speed limitation with current control
- Clockwise speed limitation with current control
- Nominal speed limitation
- Nominal speed limitation
- Internal or external current limit
- b2 derivative constant multiplier
- b0 proportional constant multiplier
- KI_Id multiplier
- KI_Iq multiplier
- KP_Id multiplier
- KP_Iq multiplier
- Number of motor polar rotations
- Number of encoder turn impulses (tens, units)
- Number of encoder turn impulses (thousands, hundreds)
- Current reference offset
- Speed reference offset
- Iu current transducer offset
- Iv current transducer offset
- Acceleration ramp
- Deceleration ramp
- Decel. ramp when "AL07" and "AL03" alarms intervene
- Deceleration ramp after alarm intervention
- Analogue or digital reference
- Current reference in common or differential mode
- OK relay interv. on the ext. signal when the I²t alarm inter.
- Ext intervention time setting
- Stop time
- Programmable analogue output
- Current reference value
- Speed reference value
- Nominal rev. variations
- Phase angle visualisation
- Display visualisation

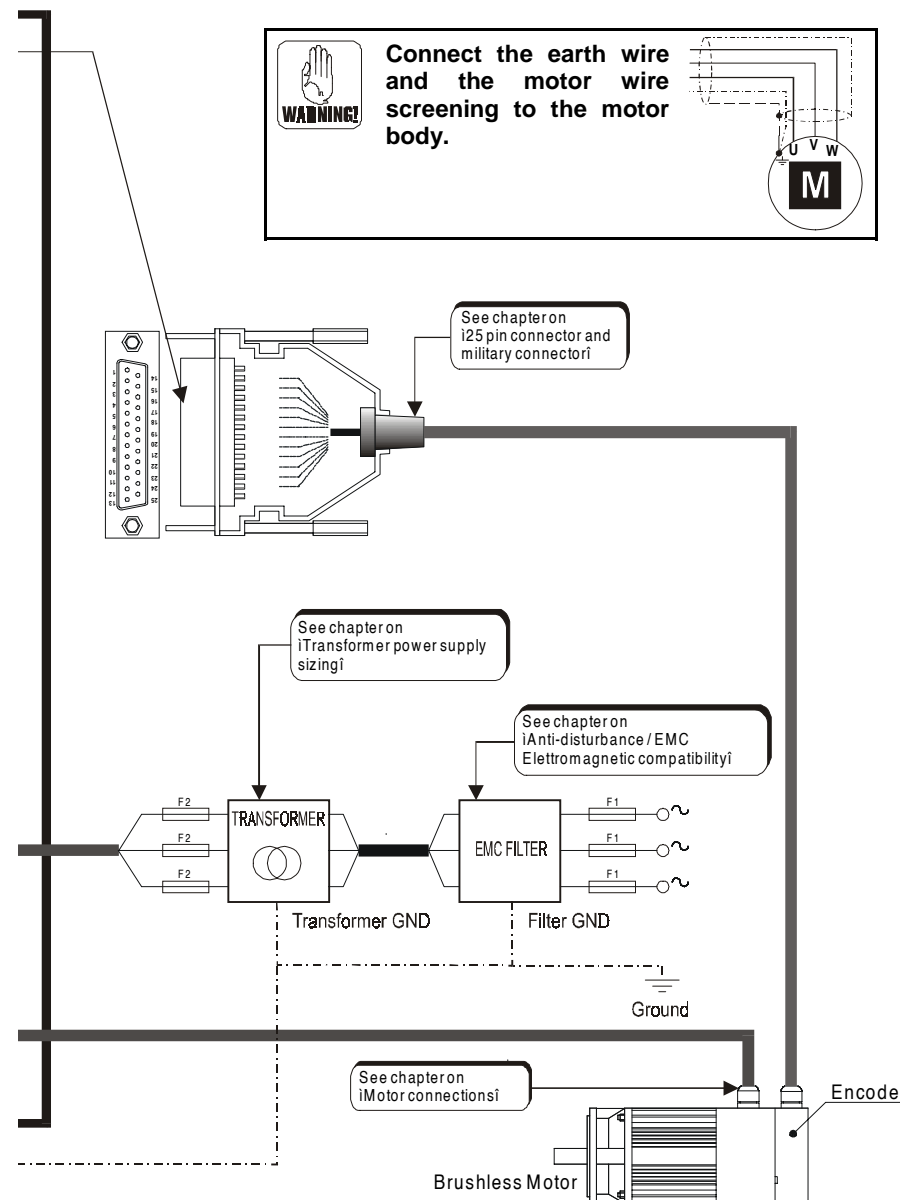
- MENU F2 c2
- MENU F6 P6
- MENU F2 c6
- MENU F5 h8
- MENU F7 L4
- MENU F4 E6
- MENU F7 L8
- MENU F7 L7
- MENU F7 L7
- MENU F7 L8
- MENU F6 P7
- MENU F6 P8
- MENU F7 L5
- MENU F1 b7
- MENU F1 b8
- MENU F1 b9
- MENU F8 A7
- MENU F8 A9
- MENU F8 A6
- MENU F8 A8
- MENU F2 c4
- MENU F2 c1
- MENU F2 c0
- MENU F6 P3
- MENU F6 P2
- MENU F6 P0
- MENU F6 P1
- MENU F3 d0
- MENU F5 h3
- MENU F5 h3
- MENU F3 d2
- MENU F7 L1
- MENU F7 L6
- MENU F3 d4
- MENU F4 E3
- MENU F4 E7
- MENU F2 c9
- MENU F7 L3
- MENU F7 L2
- MENU F4 E8
- MENU F6 P4
- MENU F2 c7

SYMBOL	DESCRIPTION	SOLUTION
	Signals contemporaneous opening of the "Limit-Switch" contacts.	<ul style="list-style-type: none"> Check the limit switch contacts.

4.5. Programming index

- Enabling of the functions associated with the inputs
- Enabling of the Limit Switch +/- inputs
- WARNING: Do not modify the parameter
- WARNING: Do not modify the parameter
- WARNING: Do not modify the parameter
- WARNING: Do not modify the parameter
- WARNING: Do not modify the parameter
- WARNING: Do not modify the set parameter
- WARNING: Do not modify the set parameter
- Parameter blockage
- Parameter blockage
- F.c.e.m. "feed-forward" compensation
- Speed or current control
- Nominal current
- Peak current
- Constant derived from the Kd speed ring
- Feedback signal low pass filter constant
- Derived signal low pass filter constant
- I²t constant
- Integral constant of the KI speed ring
- Integral constant of the Id, KI Id current ring
- Integral constant of the Iq, KI Iq current ring
- Proportional constant of the KP speed ring
- Proportional constant of the Id, KP Id current ring
- Proportional constant of the Iq, KI Iq current ring
- Direction of the simulated encoder simulated impulses
- Analogue reference amplitude
- Automatic phasing and initialisation
- Automatic phasing and initialisation
- REF ON input function
- Nom. speed setting (tens and units)
- Nom. speed setting (thousands and hundreds)

- MENU F3 d7
- MENU F3 d3
- MENU F8 A4
- MENU F8 A5
- MENU F2 c8
- MENU F6 P5
- MENU F3 d5
- MENU F3 d6
- MENU F5 h9
- MENU F6 P9
- MENU F5 h4
- MENU F5 h7
- MENU F8 A5
- MENU F7 L0
- MENU F4 E5
- MENU F4 E1
- MENU F1 b2
- MENU F1 b3
- MENU F1 b4
- MENU F4 E4
- MENU F1 b1
- MENU F8 A1
- MENU F8 A3
- MENU F1 b0
- MENU F8 A0
- MENU F8 A2
- MENU F2 c3
- MENU F4 E9
- MENU F5 h0
- MENU F5 h1
- MENU F5 h2
- MENU F5 h6
- MENU F5 h5

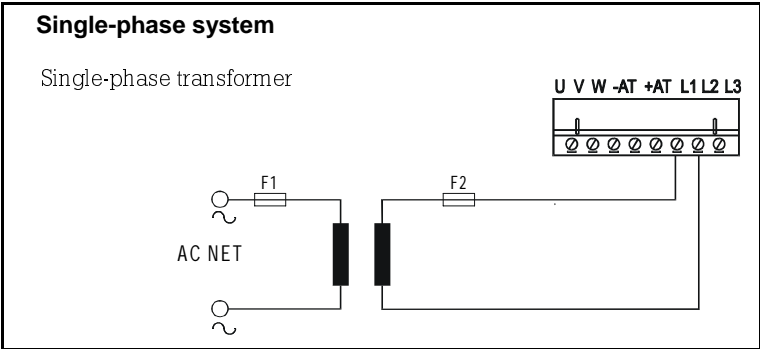


3.4. Supply transformer dimensioning

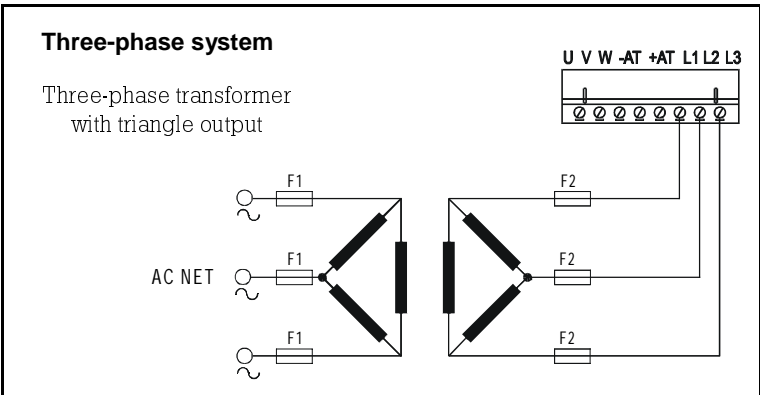
The B17 box Digital converters can be divided into two versions:



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









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










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

Start up and settings

SYMBOL	DESCRIPTION	SOLUTION
	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 box Digital.
	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 box Digital.
	Signals maximum recovery pre-alarm intervention. This alarm is visual, and indicates a subsequent intervention of alarm 8.	<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 box Digital.
	Signals motor power or encoder channel phase inversion. Only active during automatic phasing or initialisation.	<ul style="list-style-type: none">• Check motor wire and encoder wire connection.
	Signals the incorrect setting of the number of motor poles or encoder channels (only active during automatic phasing and initialisation).	<ul style="list-style-type: none">• Check the setting of the number of motor or encoder poles.

4.4. Alarms

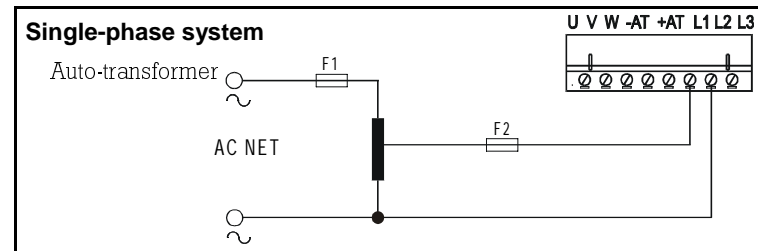
If an alarm is activated, the letters "AL" and the alarm number appear alternately.

SYMBOL	DESCRIPTION	SOLUTION
	Parameter saving error on EEPROM. This intervention opens the external OK contact.	<ul style="list-style-type: none"> This indication appears if the parameter saving process fails. Disconnect the current, then re-set and save the parameter again. If the alarm persists, contact the manufacturer.
	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. Reset by removing supply and resetting after the dissipater has cooled.
	Signals a Hall sensor alarm. This intervention opens the external OK contact.	<ul style="list-style-type: none"> Check the Hall probe connections. Probable Hall probe breakage. Reset by removing current and resetting it.
	Signals an encoder alarm. This intervention opens the external OK contact.	<ul style="list-style-type: none"> Check encoder connections. Probable encoder breakage. Reset by removing current and resetting.
	Signals that nominal current is running through the motor. If parameter d4 of the "F3 MENU" is set at 1 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. Motor phase inversion.
	Saving of the nominal current intervention (I _{2t}).	<p>If the oL (overload) symbol flashes, this shows that alarm 6 was activated during the work cycle. This display does not cause converter blockage. Reset by removing current and resetting.</p>

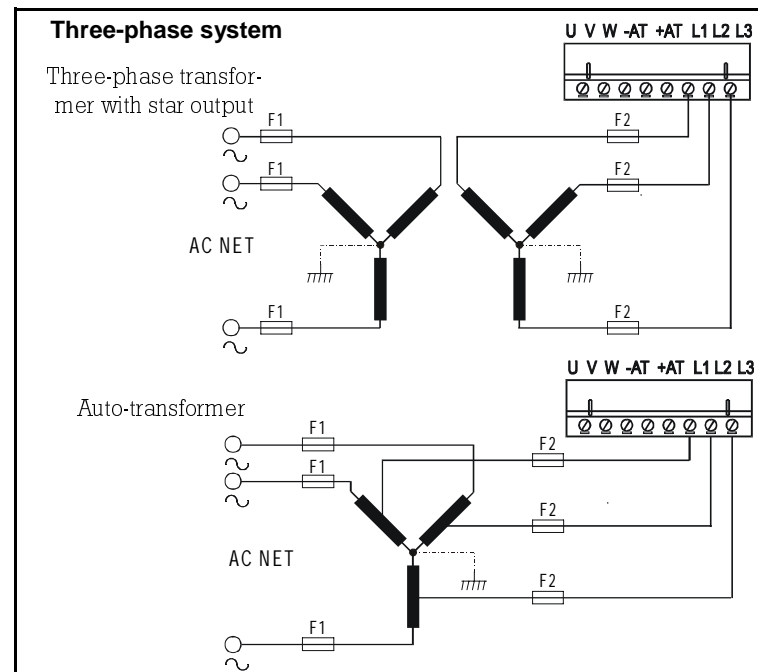


- The Optoinsulated D300 series uses:
 - single phase or three -phase transformers with star or triangle output.
 - single phase or three -phase auto -transformers.

The manufacturer recommends using transformers or auto-transformers in order to supply the B17 box Digitals directly from a "220 Vac" power grid. Direct supply with this power grid is not possible.



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





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 (Vac).
V(motor) = voltage necessary for the motor to reach 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 that are accepted by the B17 box Digitals are respectively:

V(secondary)	52-145	Vac	peril	B17box	200
	100-240	Vac	peril	B17box	300

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

SYMBOL	DESCRIPTION	SOLUTION
	No REF ON enabling input. The motor shaft results as being in still torque.	<ul style="list-style-type: none"> REF ON enabling with positive logic: make sure that the enabling voltage is between +10/30Vdc, that the drive has been set to accept positive logic. REF ON enabling with negative logic: make sure that the enabling voltage is between +10/30Vdc, that the drive has been set to accept negative logic. 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 12 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 12 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 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".
	Signal showing that there is no continuous +/-AT supply or L1-L2-L3 power phases	<ul style="list-style-type: none"> This symbol appears when the external 24Vdc auxiliary voltage for the resolver is present and when there is no continuous +AT supply voltage.
	"-LIM SW" intervention	<ul style="list-style-type: none"> Check the limit switch contacts.
	" +LIM SW" intervention	<ul style="list-style-type: none"> Check the limit switch contacts.

4.3. 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"> Enabling with positive logic: make sure that the enabling voltage is between +10/30Vdc, that the drive has been set to accept positive logic. Enabling with negative logic: make sure that the enabling voltage is between +10/30Vdc, that the drive has been set to accept negative logic. 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 auto-transformer power exceeds a set value, the B17 box Digital could be damaged during the supply insertion phase because of the over-current that is caused by the internal capacity load. These values are:
 - for transformers the maximum power is 8KVA;
 - for auto-transformers the maximum power is

If these values are exceeded it is necessary to:

- use two transformers or auto-transformers, which supply 2 separate B17 box Digital groups.
 - Use an initial pre-load system.
- In both cases, please contact the manufacturer for further information and dimensions.

The transformer or auto-transformer 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:

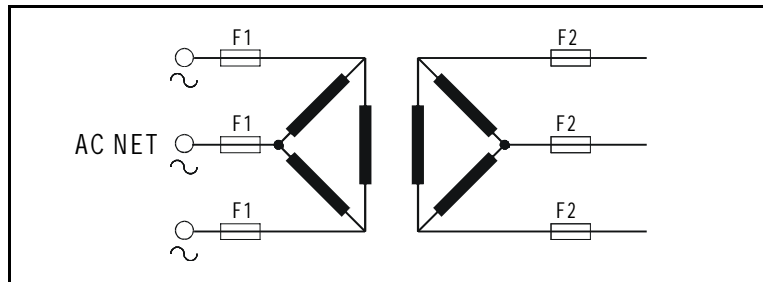
$$P_n = \frac{n \times C_n}{9,55}$$

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 auto-transformer power can be derated by up to 30-40% according to the usage cycles.



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



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

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

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

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

- 5 when the "SET" key has been pressed, the motor should start turning and the display should show a flashing "Ph"
 - 6 after one complete mechanical turn the initialisation process has been completed
- If an alarm should activate during the initialisation, in particular alarms "11" and "12", consult chapter 4.4. "Alarms".

- 25 If you want to know how much current the motor is absorbing at that precise moment, just enter the "F2 MENU" and take parameter "c9" to "2". With the use of a tester that has been prepared for Vdc measures, read the voltage value between terminals 8 "Imot" and 3 "GND" and work out the direct proportion using these fixed values:
 - The peak current corresponds to +10V.
- 26 When testing is finished, take parameter "c9" to "0".
- 27 Switch on and set the dynamic constants (see chap. 4.6. "Parameter visualisation and programming").
- 28 Carry out work cycles, even under heaviest working conditions, making sure that no I²t alarms or interventions appear.

4.2. Automatic phasing and initialisation

• Phasing

Automatic phasing calculates the correct phase angle, verifies the exact set up of the ratio between the number of motor poles and the connection of motor wires and encoder. To automatically phase, follow the points below:

- 1 make sure that the h4 "F5 MENU" parameter block is not active;
- 2 make sure that the motor shaft is free from mechanical load;
- 3 make sure that the "REF ON" and "ENABLE" inputs are not active;
- 4 set parameter h1=1 from the "F5 MENU" and press the "SET" key;
- 5 set parameter h0=1 from the "F5 MENU" and press the "SET" key;
- 6 when "SET" has been pressed, the motor should start turning slowly and the display should show a flashing "Ph"
- 7 after a complete mechanical turn the phasing process has been completed

If an alarm is activated during phasing, in particular alarms "11" and "12", consult chapter 4.4. "Alarms". The phasing angle is shown in parameter "P4" expressed in hundredths of electric angle.

• Initialisation

Initialisation makes it possible to verify the exact phasing, checking the ratio between the number of motor and resolver poles and the motor and encoder wire connection. To carry out initialisation follow the points below:

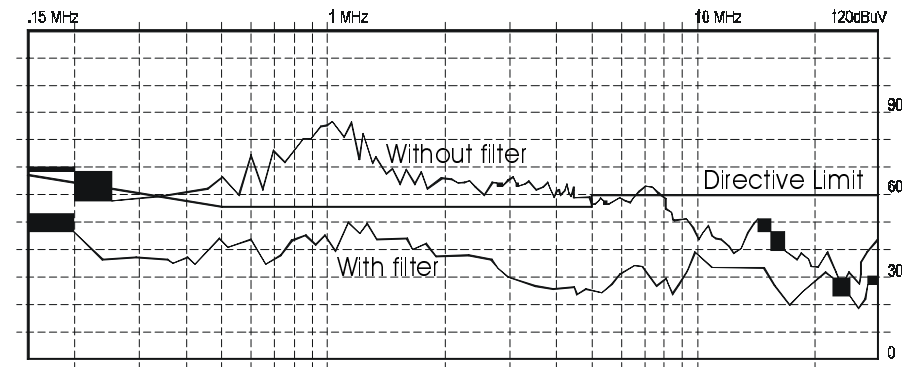
- 1 make sure that the h4 "F5 MENU" parameter block is not active;
- 2 make sure that the motor shaft is free from any mechanical load
- 3 make sure that the "REF ON" and "ENABLE" inputs are not active
- 4 set parameter h0=1 from the "F5 MENU" and press the "SET" key

3.5. Anti-disturbance / 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 box Digital 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 box Digital.



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 SHAFFNER and TIMONTA filters.

Different if used with three-phase or single phase supply (see table). 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 Digital.

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

Tree-phase:

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

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

Single-phase:

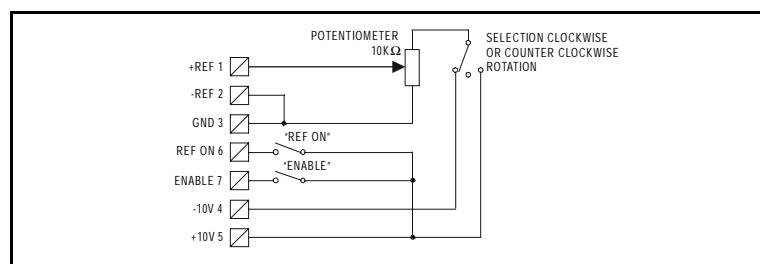
$$I \text{ (primary)} = \frac{Pt}{V \text{ (primary)}} \times 1.1$$

I(primary) = primary current (A).
Pt = trasformatore power (VA).
V(primary) = primary voltage (Vac).

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

- Power the B17 box Digital and look for the "-" symbol on the display.
- Activate the "ENABLE" input and make sure that the "-F" symbol appears and that the motor is in stopped torque.
- Enable the "REF-ON" input, make sure that the symbol " " is on the display, that the motor is still in still torque, then take the deviator to "+10" or "-10" and rotate the potentiometer slightly.
- The motor starts moving and the display shows the "-" symbol which rotates either clockwise or counterclockwise. Make sure that when the deviator is taken to the next position, the motor inverts its rotational direction. Increase the reference and make sure that the motor results as being controlled. You should see the analogue signal of the simulated speedometer on the oscilloscope.
- Apply the load to the motor shaft, take the motor to around 30% of the maximum speed and carry out some rotation inversions. You should see a certain wave shape on the oscilloscope. Compare the wave shape that can be seen on the oscilloscope with the one given below and increase or decrease the drive parameters as necessary.
- When the axis dynamic settings have been finished, take the motor to still torque, deactivating the "REF-ON" input. Forcing the stopped axis you should note if it is rigid or is elastic. If it is elastic, increase the parameter.
- Disconnect the potentiometer and the external switches and reconnect the analogue reference of the CNC or axis card and the "ENABLE" and "REF-ON" control outputs.
- 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 a segment that rotates in the same direction. Take the reference to +10V and -10V, checking operation at maximum speed in a clockwise and counterclockwise direction.
- Deactivate the drive, enter the "F2 MENU", take parameter "c7" to "1" and read the numeric value that is displayed. After this, take the same parameter to "2". Now start a machine cycle under the heaviest conditions. A number should appear on the display which could increase during the cycle run. This value must not in any way come close to or equal the value read previously when the "c7" parameter is at "1". Exceeding or equalling this value can cause "AL06" protection intervention, which corresponds to a loss of torque.
- When testing is finished, take parameter "c7" back to "0".
 - The nominal current corresponds to +5V.

- 10 Make sure that the symbol " - - " appears on the display.
- 11 If the drive has not been set for the motor it is to control, proceed as follows:
 - Set the peak current value to be supplied to the motor with parameter "E1" in the "F4 MENU".
 - Set the nominal current value to be supplied to the motor with parameter "E5" in the "F4 MENU".
 - Set the number of polar torque that the motor already possesses with parameter "c0" of the "F2 MENU".
 - Set the number of polar torque that the resolver possesses with the "c1" parameter of the "F2 MENU".
 $2048 = c0 = 20$
 $c1 = 20$
 - Set the number of revs. that is to be obtained from the motor with parameters "h5" and "h6" of the "F5 MENU".
 - Set the number of simulated encoder rev. impulses desired at output with parameter "c2" of the "F2 MENU".
 - Set the number of polar torque that the motor has with parameter "c4" of the "F2 MENU".
 - Carry out automatic phasing or startup (see chap. 4.2. "Automatic phasing and startup").
- 12 Disconnect terminals 12 "+ REF / -REF", terminal 7 "ENABLE" and terminal 6 "REF-ON". Using a 10KΩ potentiometer, a three-position deviator and two two-position switches, connect as indicated:



- 13 Using an oscilloscope, connect the probe to pin 1 of the 9-way **vaschetta**, which is on the front of the drive and connect the braiding to the metallic rim of the connector.
- 14 Take the potentiometer to 0V, the deviator to the central position and the two switches to "OFF".

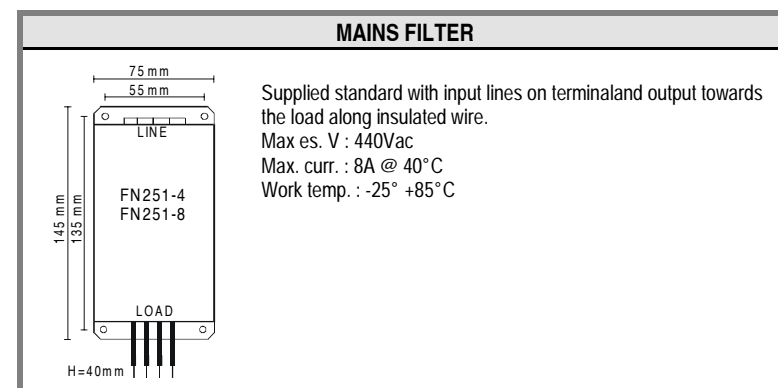
This method, as well as offering the best result from a disturbance suppression point of view, makes it possible to use filters that can support very low currents. In this way best use is made of the transformer transformation ratio and as a result filters are cheaper.

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

Leakage currents and nominal currents:

MODEL	REFERENCE CURRENT (A)	CURRENT LOSS (mA)	POWER LOSS (W)	WEIGHT (Kg)
FN251 - 4	4 (40°) / 4,6 (25°)	1,31 (400V 50Hz)	5,5	0,75
FN251 - 8	8 (40°) / 9,2 (25°)	1,31 (400V 50Hz)	7	0,75

Mechanical and electrical characteristics:

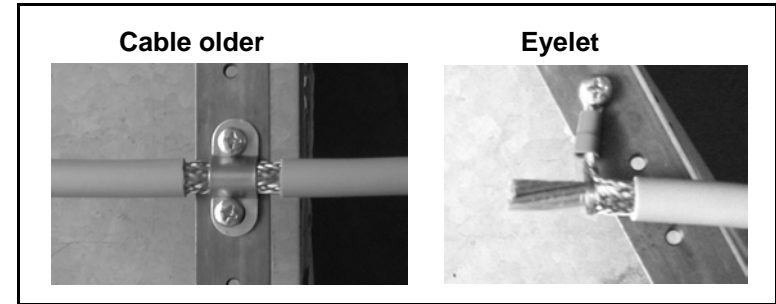


If using single phase, connect only the L1 -L2 inputs.

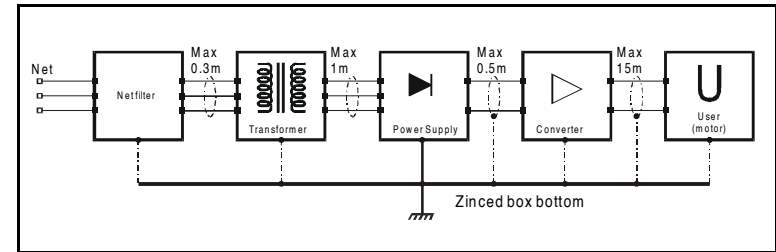
2 Using screened cables: all connections downstream of the power grid filter must be screened. The screening braiding of the cable being used must be laid on the zinced panel of the panel near both the supply terminals and the terminals of each motor using cable holders as shown in the following diagrams.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

Collegamenti agli schermi:

- 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).
- Do not connect the cable screen of the transformer secondary that goes towards the B17 Box Digital.



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.



4. Start up and settings

4.1. Start up

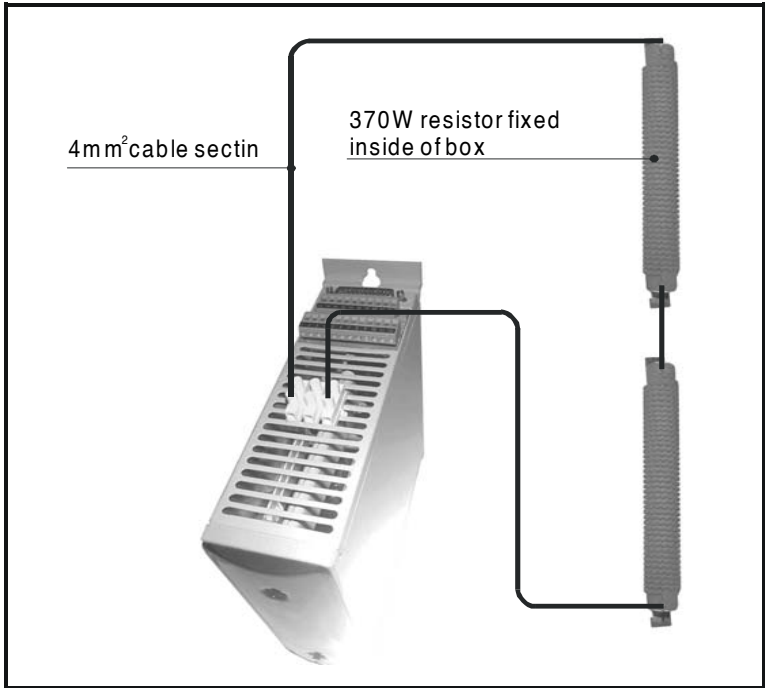
The driver is supplied already set for the requested motor. If the motor is not specified, **standard settings (STD)** are inserted with the following characteristics:

- Drive peak current.
- Drive nominal current.
- Feedback encoder: 2000 imp./rev.
- Motor poles: 6P.
- Nominal speed at 10V reference: 3000RPM.
- Simulated encoder: 4096 imp./rev.

Whether the drive corresponds to the motor that it is to control or not, proceed as follows:

- 1 Make sure that the output voltage of the transformer or auto-transformer is in conformity with the B17 box Digital input one.
- 2 Make sure that the B17 Digitals in the Super BOX are 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 box Digital 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. "Vaschetta connection and snap-on connector").
 - Speed reference wire coming from the control (see chap. 3.11. "Speed and current references").
 - 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 converter, making sure that the **Ref On** and **Enable** inputs are not active.

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 Digital	C 200	D 300
400W	1 resistor 9 □	1 resistor 14 □
800W	No available	2 resistors 7 □

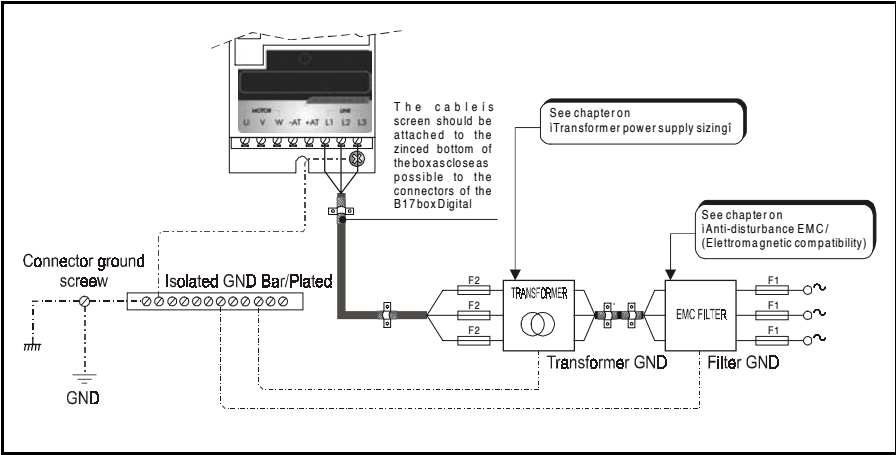


In these cases, contact the manufacturer for resistors power dimensioning and ohm value.


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



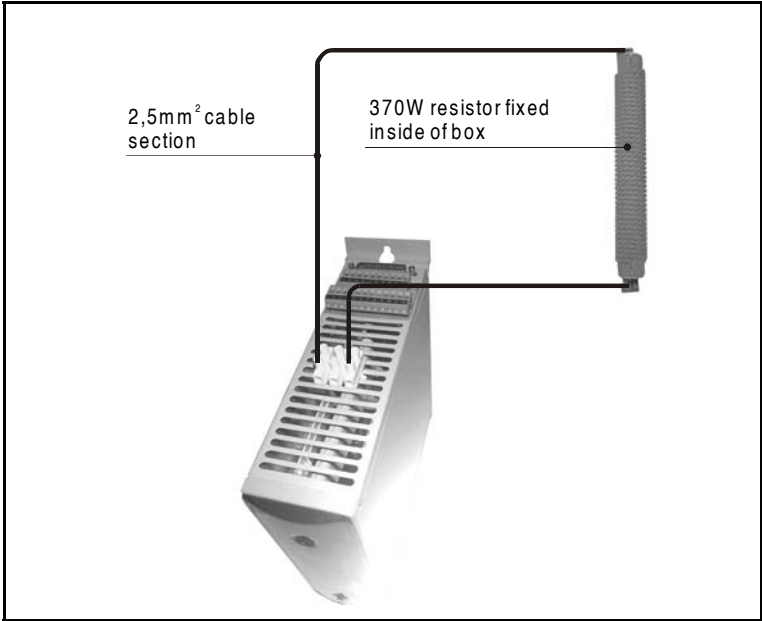
It is essential to use a **screened cable** from the EMC filter to the B17 box Digital input when connecting to the mains. It is also necessary to connect the cable braiding to the zinc bottom of the panel near each interruption, either using a cable holder as shown above or eyelet fast-ons.

SUPERBOX SILK SCREENING DESCRIPTION	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

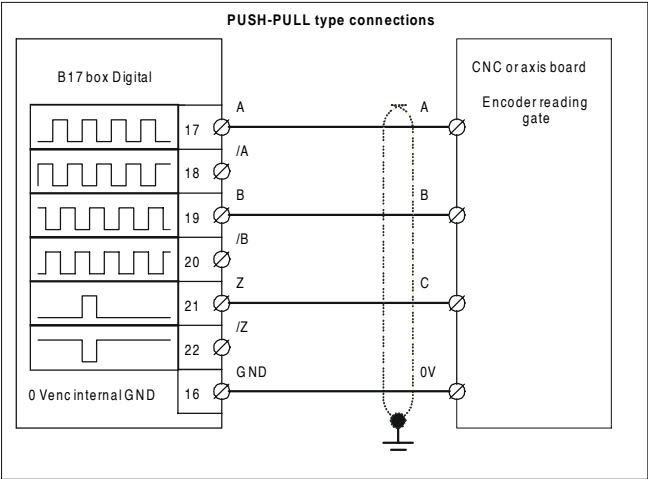
3.15. Braking module

The Super Box is equipped with an internal braking system that uses resistors. If alarm **10 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.

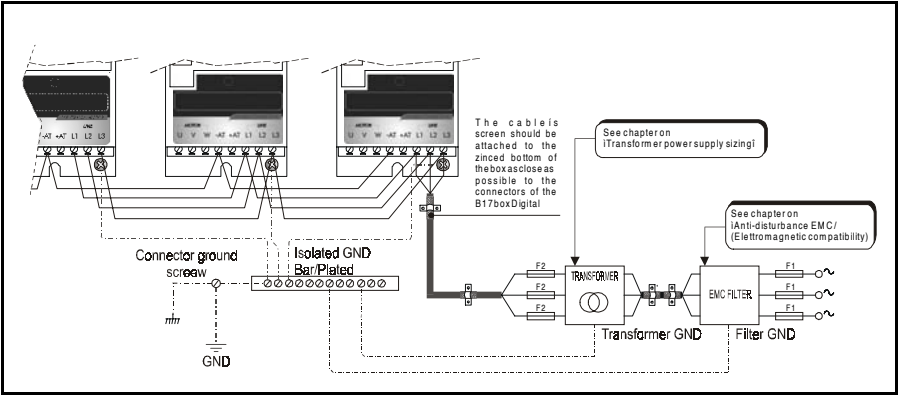
External connection of 1 resistor with a power of 370W




- Push-pull:** Only the positive channels that refer to the common 0 are used.



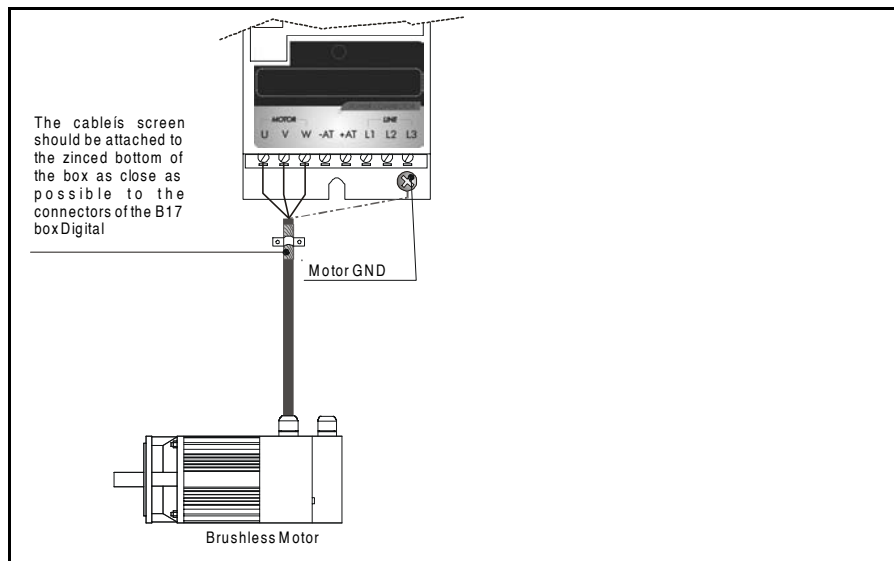
3.7. Connection to the power grid transformer on a multi-axis application



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 box Digital. 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 SILK SCREENING DESCRIPTION	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
-AT	(INPUT)	Joining of the "-AT" terminals for the C200 model only

3.8. Motor connection



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 box Digital 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
B17 box Digital	2/4 - 4/8 - 8/16	1,5 mm \leq
B17 box Digital	10/20 - 14/28 - 20/40	2,5 mm \leq

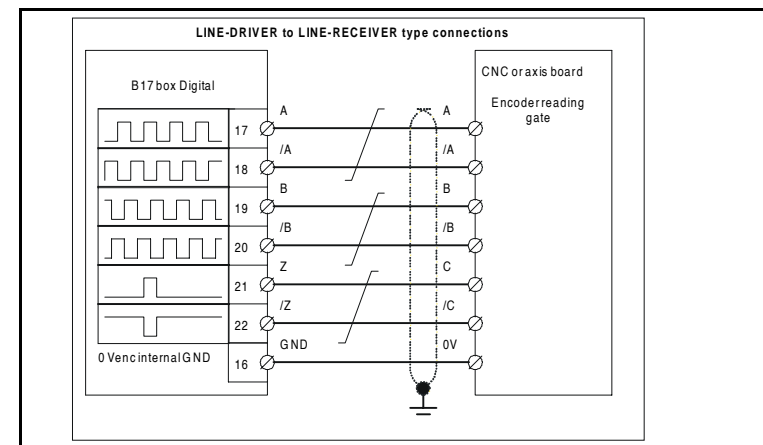
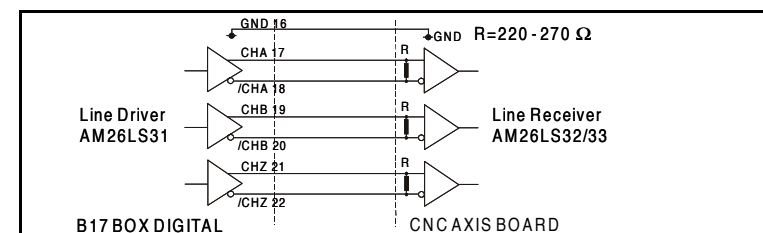


If the motor has an electromechanical brake, supply the + and - terminals with a continuous voltage of around 24Vdc, being careful not to invert polarity.

3.14. Simulated encoder channels

Each encoder channel can carry a current of approximately 20mA, with a voltage of 4.5 - 5V for the STANDARD version or 12V if requested while ordering. The output impulses can be divided in the B17 Digital according to the programming carried out using the indications given in chap. 4.6. "Parameter visualisation and programming". 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 270 Ω 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.

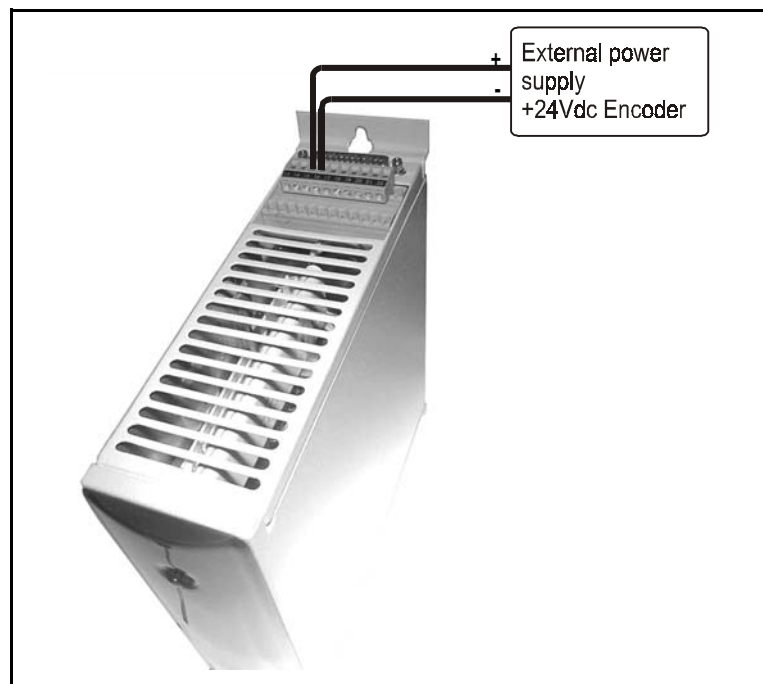




3.13. External supply of the encoder and the logic card

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.

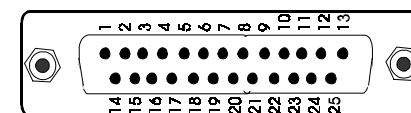
3.9. Box connection and snap-on connector

The signals coming from the brushless motor meet on these connectors. The wire to be used must be **screened and the section of the single wires must be 0.25 or 0.5 mm²**. The braiding and remaining wires should be welded as indicated.

Box connector



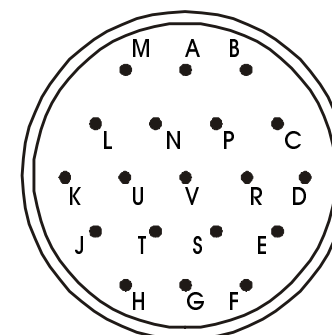
View from welding side



Snap-on connector



View from welding side





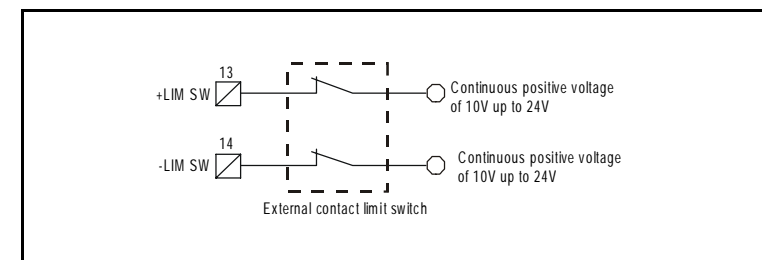
VASCHETTA PIN	SNAP-ON PIN	SIGNAL	DESCRIPTION
1		Hall U /	Negative Hall angular position signal
2		Hall V /	Negative Hall angular position signal
3		Hall W /	Negative Hall angular position signal
4		ST	Motor thermal probe
5		A	Channel A of the positive encoder
6		B	Channel B of the positive encoder
7		Z	Channel Z of the positive encoder
8		GND	Encoder GND and wire screening
8		SREEN	Wire screening
10		Hall U	Positive Hall angular position signal
11		Hall V	Positive Hall angular position signal
12		Hall W	Positive Hall angular position signal
17		ST	Motor thermal probe
18		A /	Channel A of the negative encoder
19		B /	Channel B of the negative encoder
20		Z /	Channel Z of the negative encoder
21		+5V	Encoder supply, max. load 350mA. Protected from short circuits, not protected from negative or alternate voltages.
22		+12V	Encoder supply, max. load 200mA. Protected from short circuits, not protected from negative or alternate voltages.

3.12. Limit Switch +/-

Terminals 13 "+LIM SW" and 14 "-LIM SW" of the control terminal board can be programmed as a limit switch by setting parameter d3 in menu F3 at 1. If this parameter is at 0 the limit switches are not active. The limit switches work as follows:

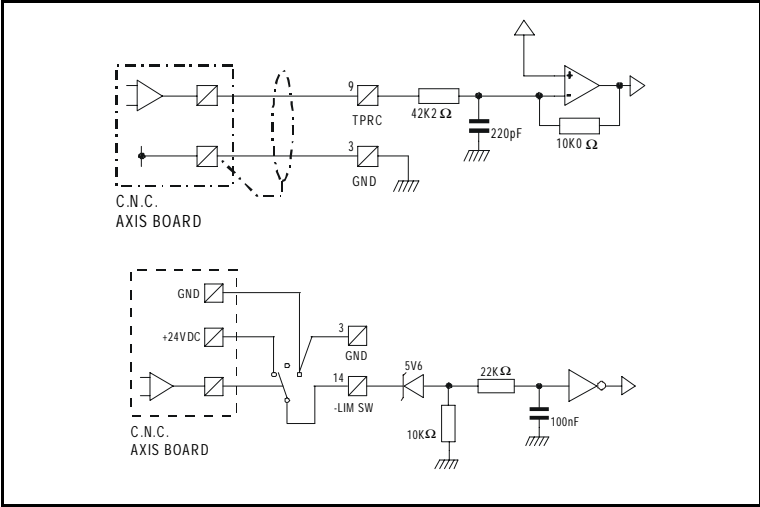
- * If the motor is turning clockwise and the terminal 13 "+LIM SW" contact is open, the motor stops. Only movement in a counterclockwise direction is permitted.
- If the motor is turning counterclockwise and the terminal 14 "-LIM SW" contact is open, the motor stops. Only movement in a clockwise direction is permitted.
- If both limit switch contacts are open at the same time, the driver would show alarm 13 (see chap. 4.4. "Alarms").
- To restart movement, both contacts must be closed.
- Switch the drive off and on again and reset the alarm.

An example of Limit Switch connection:



If using external supply for terminals 14 "-LIM SW" and 13 "+LIM SW", remember to join the "GND" of each supply to terminal 3 "GND" of the control terminal board (see chap. 3.10. "Control terminal board").

An example of current control with common mode input with limitation of the maximum revs.:




If external supply is used for the 14 "-LIM SW" terminal, it is necessary to join the "GND" of this supply to terminal 3 "GND" of the control terminal board (see chap. 3.10. "Control terminal board").



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 POLES	FUNCTION	DESCRIPTION	
1	+REF	INPUT	Non inverting input with differential speed or torque stages with +/- 10V (see chapter 3.11. "Speed and current references").
2	-REF	INPUT	Inverting input of the differential speed or torque 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 2mA max i-
5	+10V	OUTPUT	Auxiliary output voltage of +10V with 2mA max i-
6	REF ON	INPUT	Using menu F3, parameter d7, it is possible to activate the converter to accept the input reference at terminals 1 -2 "+/- REF" with positive 10/30Vdc or negative 0 -5Vdc logic signal (see chapter 4.6. "Parameter programming and viewing").
7	ENABLE	INPUT	Using menu F3, parameter d7, it is possible to activate the converter to take the motor to torque standstill with positive 10/30Vdc or negative 0/5Vdc logic signal (see chapter 4.6. "Parameter programming and viewing").
8	PROGRAM-MABLE LOGIC OUT-	OUTPUT	With parameter c9 in the F2 menu it is possible to select and read some values (see chapter 4.6. "Parameter programming and view ing").
9	TPRC	INPUT	This input can be used as a current control. (See chapter 3.11. "Speed and current references").
10	OK		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). Max. capacity 48Vdc -800mA 110Vac -1A
11	OK		

NR POLES	FUNCTION	DESCRIPTION	
12	Mass point	INPUT	Terminal for common zero earthing . <i>This terminal should be connected to the insulated earth bar.</i>
13	+LIM SW	INPUT	Extra right run limit or alternatively can be programmed with other functions (see chapter 3. 12. "Limit switch +/- ").
14	-LIM SW	INPUT	Extra left run limit or alternatively can be programmed with other functions (see chapter 3. 12. "Limit switch +/- ").
15	V EXT.	INPUT	External voltage for supplying the logic card and the encoder (see chapter 3. 13. "External encoder and logic card supply").
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")

F6 MENU:

P7: speed limitation in a clockwise direction with current control

30: 30% of the bottom scale set with parameters h5/h6

P8: speed limitation in a counterclockwise direction with current control

30: 40% of the bottom scale set with parameters h5/h6

F7 MENU:

L0: speed or current control

1: current control

L1: analogue or digital reference

0: analogue reference

L4: speed and current reference inversion

0: direct current or speed references

L6: current reference in common or differential mode

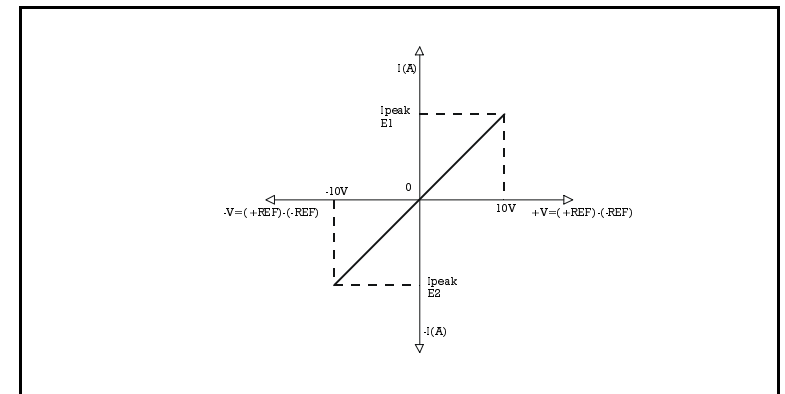
1: reference in differential mode

L7: hourly speed limitation in current control

50: 50% of the bottom scale set with parameters h5/h6

L8: counterclockwise speed limitation in current control

80: 80% of the scale bottom set with h5/h6



- L4: speed and current reference inversion**
 0: direct current or speed references
- L6: current reference in common or differential mode**
 1: reference in differential mode
- L7: hourly speed limitation in current control**
 50: 50% speed of the bottom scale set with h5/h6
- L8: counterclockwise speed limitation in current control**
 80: 80% speed of the scale bottom set with h5/h6

When the parameters are configured as given in Example 1, you obtain maximum current limitation that depends on the voltage at the "TPRC" terminal (L6=0). The maximum speed cannot exceed 50% (L7=50) of the value that can be set with parameters h5 and h6 in a clockwise direction and 80% (L8=80) in a counterclockwise direction.

Example 2:

Description: controllo in corrente con ingresso differenziale con limitazione della velocità massima commutabile tra i valori impostati con i parametri L7, L8 e P7, P8.

F3 MENU:

- d3: enabling of functions associated with Limit Switch +/- inputs**
 2: The -LIM SW input (14-pin connector belonging to the client) takes on the following meaning: if connected to +10/+24Vdc, maximum speed is limited setting parameters **L7** and **L8**. If left free, maximum speed is limited by setting parameters **P7**, **P8**. The display shows the letter "**L**" on the right and rotating segments on the left.
 Parameters **L7**, **P7** and **L8**, **P8** indicate the maximum speed in a clockwise and counterclockwise direction as a percentage of the speed set with parameters h5 and h6.

F4 MENU:

- E1: peak current**
 0: 0% size
 99: 100% size

3.11. Speed and current references

Terminals 1-2 "+/-REF" and terminal 9 "TPRC" can be used to control the speed, the current or both together when terminals 13 "+LIM-SW" and 14 "-LIM-SW" are used.

If motor turn limitation is needed with current control, just set parameters L7 and L8 with the following values:

F7 MENU:

L7: hourly speed limitation with current control:

Makes it possible to limit the speed as regards the h5-h6 parameters of the "F5 MENU".

- 0: 0% no speed limit
 50: 50% of the bottom scale set with parameters h5/h6
 80: 80% of the bottom scale set with parameters h5/h6
 99: 100% of the bottom scale set with parameters h5/h6

L8: limitation of the counter -clockwise speed in current control:

Makes it possible to limit the speed as regards the h5-h6 parameters of the "F5 MENU"

- 0: 0% no speed limit
 50: 50% of the bottom scale set with parameters h5/h6
 80: 80% of the bottom scale set with parameters h5/h6
 99: 100% of the bottom scale set with parameters h5/h6

To reach the number of revs. that correspond to the set value, use the formula below:

$$NR \text{ of desired revs.} = \frac{\text{Speed bottom scale}}{100} \times \text{set value}$$

To reach the value to be set to obtain the number of desired revs., use the formula below:

$$\text{Value to be set} = \frac{NR \text{ of desired revs. (Rpm)} \times 100}{\text{Speed bottom scale (Rpm)}}$$

The possible applications of these 3 inputs are as follows:

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

F7 MENU:

L0: speed or current control

0: speed control

L1: analogue or digital reference

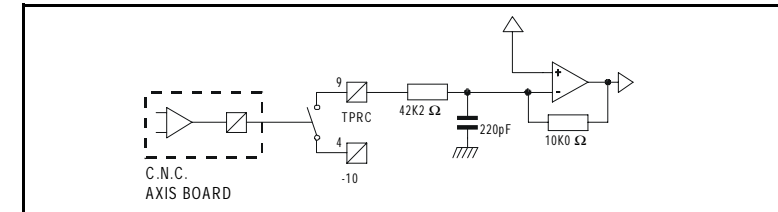
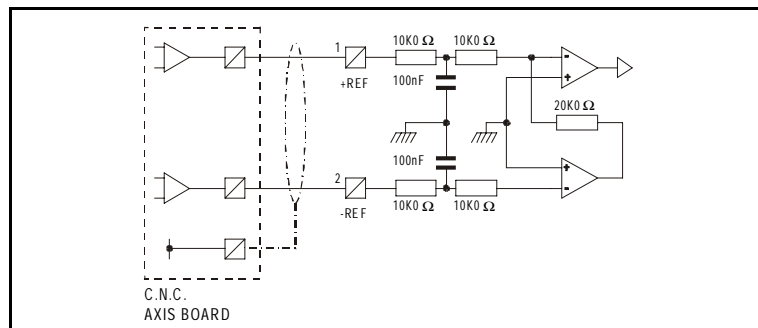
0: analogue reference

L4: speed or current reference inversion

0: direct current or speed references

L5: internal or external current limit

0: internal current limit



- **current control with common or differential input and limitation of the maximum revs.**

This configuration makes it possible to control the converter current with an analogue signal of +/-10V in common mode using terminal 9 "TPRC" or differentially using terminals 1-2 "+/-REF" by means of terminal 6. The current value depends on the voltage present at terminal 9 "TPRC", or on the difference between terminals 1-2 "+/-REF". The maximum current value cannot exceed the limit set by parameter E1.

It is possible to limit the maximum turns of the motor with parameters L7 and L8, or else with parameters P7 and P8, according to the voltage present at the "LIM-SW" input and the value of parameter d3. The examples that follow clear the concept:

Example 1:

Description: current control with differential input and limitation of the maximum speed, which can be set with parameters L7, L8.

F3 MENU:

d3: Limit Switch +/- input enabling

0: nessuna funzione associata agli ingressi +Lim, -Lim

F4 MENU:

E1: peak current

0: 0% size

99: 100% size

F7 MENU:

L0: speed or current control

1: current control

L1: analogue or digital reference

0: analogue reference

1: differential mode reference

F4 MENU:

E1: peak current

0: 0% size

99: 100% size

E6: peak current limitation

0: 0% peak current

99: 100% peak current

$$\text{Value to be set} = \frac{\text{Desired current (A)} \times 100}{I_{\text{peak}} \text{ (A)}}$$

F7 MENU:

L0: speed or current control

1: current control

L1: analogue or digital reference

1: digital reference

L3: current reference value

0: maximum negative current reference

50: zero current reference

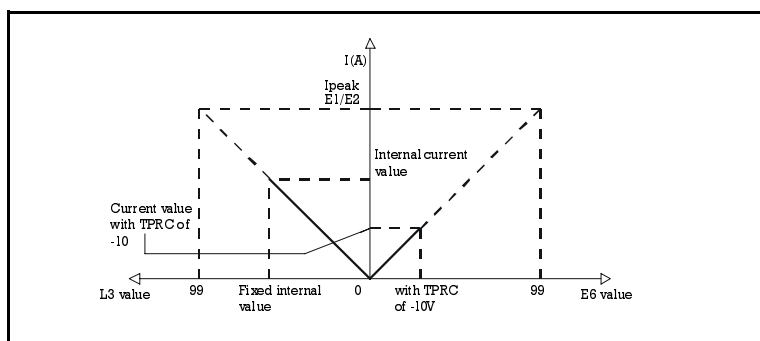
99: maximum positive current reference

L7: hourly speed limitation in current control

0: 0% no speed limitation

L8: counterclockwise speed limitation in current control

0: 0% no speed limitation



An example of current control with digital input without limitation of the maximum revs.:

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

In this configuration the motor shaft (seen frontally) turns in a clockwise direction with a +10V signal at terminal 1 "+REF". With a +10V signal at terminal 2 "-REF", however, the motor shaft turns in a counterclockwise direction.

F7 MENU:

L0: speed or current control

0: speed control

L1: analogue or digital reference

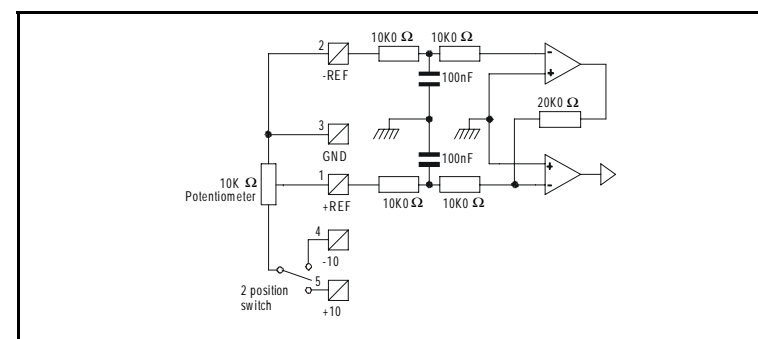
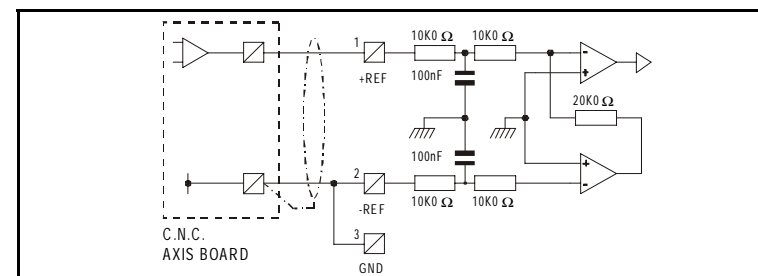
0: analogue reference

L4: speed or current reference inversion

0: direct current or speed references

L5: internal or external current limit

0: internal current limit



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

• **speed control with differential or common mode analogue reference and analogue current limitation**

This configuration makes it possible to control the motor speed using a differential or common mode analogue reference between terminals 1-2 "+/-REF". The use of terminal 9 "TPRC" makes it possible to limit the converter current from 0 to the peak size value, using a voltage from +0V to +10V. To obtain this type of control, set the parameters as follows:

F7 MENU:

L0: speed or current control

0: speed control

L1: analogue or digital reference

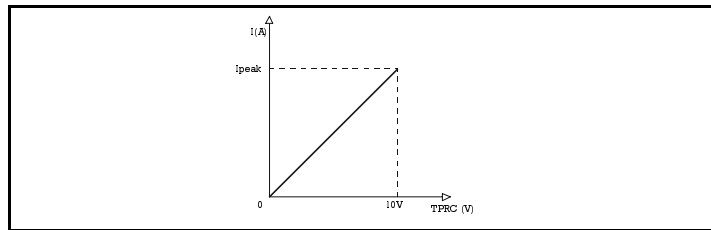
0: analogue reference

L4: speed or current reference inversion

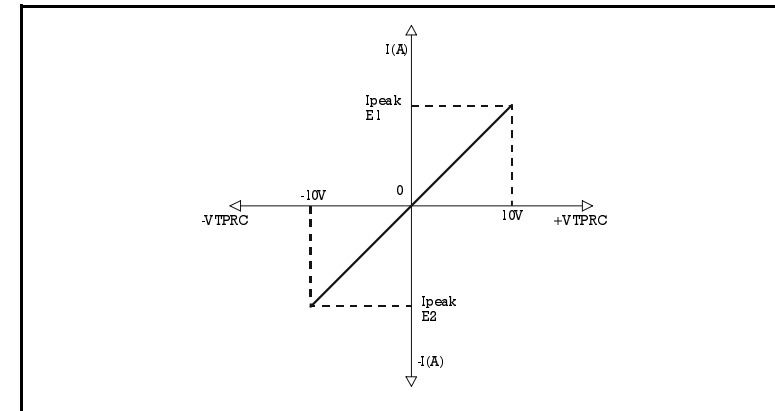
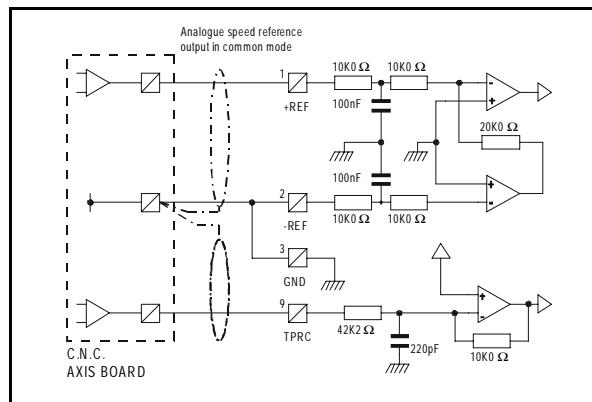
0: direct current or speed references

L5: internal or external current limit

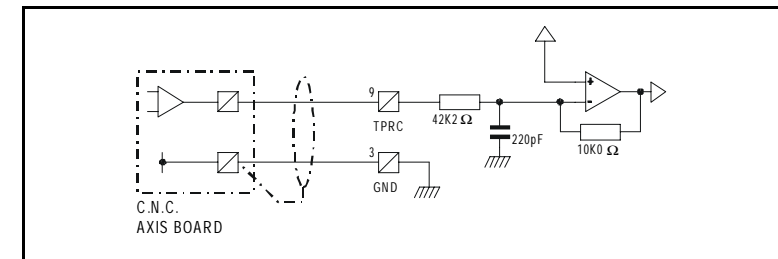
1: internal current limit



An example of speed control with reference to common mode and analogue limitation of the current:



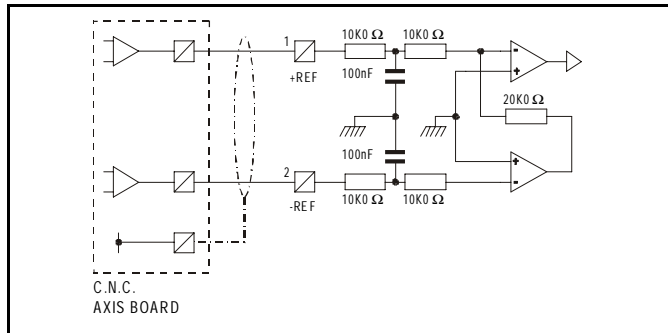
An example of current control with input in common mode with no limitation of the maximum revs.:



• **In current control with digital input without limitation of the maximum revs.**

This configuration makes it possible to have a fixed internal current value that can be set with parameter L3. With parameter E6 it is also possible to limit the current at a second value. Both values are expressed as a percentage of the value set in parameter E1. If terminal 9 "TPRC" is not connected, the current value is determined by parameter L3, while if it is connected to terminal 4 "-10" the value of the current results as being limited as regards parameter E6. To obtain this type of control, set the parameters as follows:

An example of current control with input in differential with no limitation of the maximum revs.:



- **current control with common mode input without limitation of the maximum revs.**

This configuration makes it possible to control the converter current with an analogue signal of +/-10V in common mode using the 9 "TPRC" terminal. The current value depends on the voltage present at terminal 9 "TPRC", the maximum value cannot exceed the limit set in parameter E1. To obtain this type of control, set the parameters as follows:

F4 MENU:

E1: peak current

- 0: 0% null current
- 99: 100% maximum current

F7 MENU:

L0: speed or current control

- 1: current control

L1: analogue or digital reference

- 0: analogue reference

L6: current reference in common or differential mode

- 0: differential mode reference

L7: hourly speed limitation in current control

- 0: 0% no speed limitation

L8: counterclockwise speed limitation in current control

- 0: 0% no speed limitation

- **speed control with differential or common mode analogue reference and analogue current limitation.**

This configuration makes it possible to control the motor speed with a differential analogue reference or in common mode using terminals 1-2 "+/- REF". The size current can also be limited by setting parameter E6 at a value of between 0 and 99.

The current value is determined by parameter E1 if terminal 9 "TPRC" is not connected, otherwise it is determined by parameter E6 if terminal 9 "TPRC" is connected to terminal 4 "-10V". It is therefore possible to commute immediately from one current limit to another using terminal 9 "TPRC". To obtain this type of control, set the parameters below:

F4 MENU:

E1: peak current; defines the maximum positive current issued by the driver as a percentage %

0: 0% size

99: 100% size

E6: peak current limitation

0: 0% peak current

99: 100% peak current

F7 MENU:

L0: speed or current control

0: speed control

L1: analogue or digital reference

0: analogue reference

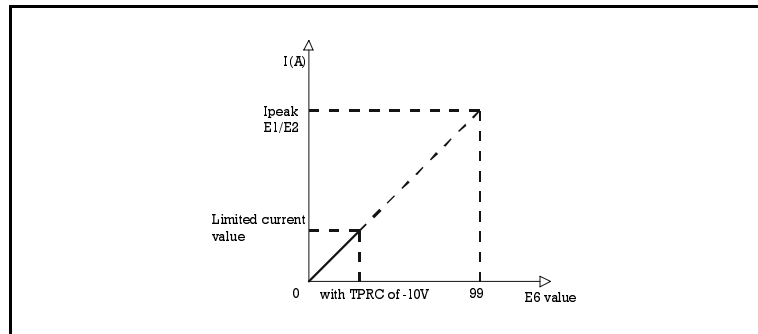
L4: speed or current reference inversion

0: direct current or speed references

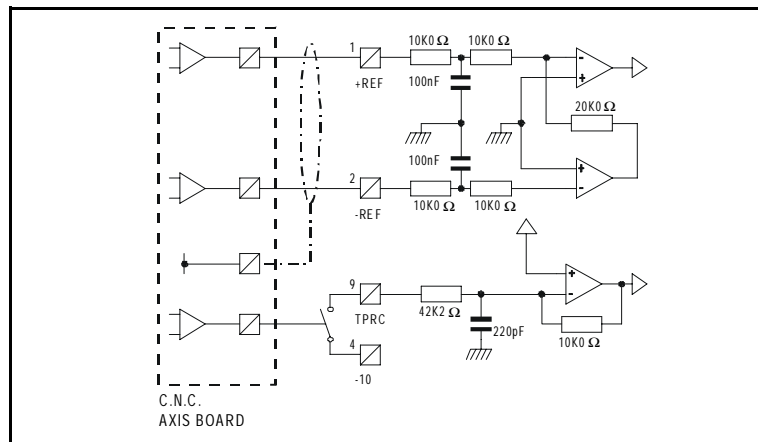
L5: internal or external current limit

0: internal current limit

$$\text{Value to be set} = \frac{\text{Desired current (A)} \times 100}{I_{\text{peak}} \text{ (A)}}$$



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



• **current control with differential input without maximum rev. limitation**

This configuration makes it possible to control the converter current with an analogue signal of $\pm 10V$ differential using terminals 1-2 "+/-REF". The current value depends on the differential voltage present between terminals 1-2 "+/-REF", the maximum value cannot exceed the limit set by parameter E1. To obtain this type of control, set the parameters as follows:

F4 MENU:

E1: peak current

0: 0% null current

99: 100% maximum current

F7 MENU:

L0: speed or current control

1: current control

L1: analogue or digital reference

0: analogue reference

L6: current reference in common or differential mode

1: differential mode reference

L7: hourly speed limitation in current control

0: 0% no speed limitation

L8: counterclockwise speed limitation in current control

0: 0% no speed limitation

