ALTER ELETTRONICA S.R.L.
CASALE MONFERRATO (ITALY)

4 QUADRANT BRUSHLESS

AND D.C. SERVOMOTOR

DRIVE SERIES PWM

MODEL

BTD 2
DCD 2

Instruction book **91/097** - Revision 0 - Edition **1** - Date **19/10/2005**

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1 SAFETY AND STANDARDS

1.1 Recall to the safety standards

The converters model BTD2 and DCD2 they are designed and built according to the standards recalled on the point 1.3 of this chapter and they satisfy the demanded requirements for the marking CE. About the safety it put in evidence: **a)** that it has relatively defined to a situation that could bring to damages to the people or to the equipment or to the operated system and not to the operation of the driver (you also see paragraph 9.2 of the standards recalled on [7] of the point 1.3); **b)** that for the safety it is necessary that the integrator of the driver (PDS: please to see point 2.2.2), the technician and the end user not only follow the prescriptions contained on this instruction book but also observe the standards safety specifications of the operated machine, particularly how much prescribed on the standards EN 60204-1, recalled on [9] of the point 1.3.
Please to see here following the meaning of some used symbols.

WARNING! This symbol recalls the attention to a situation of danger that could also bring to **serious damages** to the people (**also potentially lethal**) or to irreparable breakdowns to the equipment or to the operated system. This is the level of more important alarm. It's **absolutely** necessary to follow the instructions underlined with the symbols under brought.


WARNING!

Dangerous voltage: it signals the situations of danger owed from electric voltages.


WARNING!

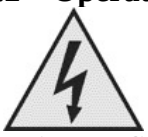
Generic danger: it signals the situations of danger owed to different causes from the electric voltage..

1.2 Safety general standards

1.2.1 Preliminary advice

Some instructions are brought about the general character safety, informing that other instructions, specific for the converters model BTD2 and DCD2, they are brought on the Chapter 2.

1.2.2 Operations of installation, startup and maintenance


WARNING!

Only qualified personnel have to operate during the installation, the possible breakdowns search and, generally, for whatever type of intervention in the drive.

This personnel has to own the special documentation furnished by ALTER, particularly this instruction book.
For any reason the unqualified operator has to operate on the terminal block of the converter. Besides it is necessary that the converter be preventively disconnected from mains, as specified on the point 2.3.4.5.

1.2.3 Power-supply sectioning device


WARNING!

Since the converter has built for being embedded on an electrical cabinet, containing eventually also other equipments, the **sectioning device for the command manual feeding**, required by EN 60204-1 §s 5.3.1, can be that common to the whole electrical cabinet and it owes - in every case - must be inserts **at the builder of the machine**.

1.2.4 Stop Function


WARNING!

The stop functions, as prescribed on EN 60204-1 §s 9.2.2, particularly **the 0 category stop, must be realized by the builder of the machine**, in how much inherent to the logic of machine, that obviously differs according to the type of machine and following the instructions contained in this instruction book.

1.2.5 Emergency Stop


WARNING!

Also **the emergency stop**, according to EN 60204-1 §s 9.2.5.4, must be made according to the specific characteristics of the operating machine and therefore **the builder of the machine must realize it**.

1.2.6 Unintentional starting and uncontrolled running


WARNING!

The motor connected to a drive type BTD2 and DCD2 can be started and stopped utilizing the commands performed by the operator (please to see point 3.3). **If it is necessary to manually act on a mover controlled by the motor**, to satisfy the safety conditions for the operator, it is necessary not only to stop the motor by the command of the converter, but also to **insulate the converter from the feeder line**. In fact the motor can to run without any command but only by cause of fault of the electronic components or other accidental causes (breakdown on mains or on the cables e/o connections, etc.). For the same causes, during the normal operation the converter would be able not to run as described in this instruction book and could be happen that the motor is fed by electric quantity not checked and therefore also the speed and the direction of rotation of the motor are uncontrolled. **The user owes therefore to predispose additional protection e/o safety systems** suitable to prevent damages to people or things.

1.3 Reference documents and standards

Here following are recalled the principals standards, to which we make reference on this instruction book. On the text the calls are brought among square parenthesis.

[1] Community directive 89/336/CEE dated May 3rd 1989 regarding the Electromagnetic Compatibility and following changes 92/31/CEE and 93/68 / CEE.

[2] Legislative Decree dated December 4th 1992, n° 476 "Putting into effect of the directive 89/336/CEE of the Board dated May 3rd 1989, in subject of approaching of the legislations of members States regarding the electromagnetic compatibility, modified by the directive 92/31/CEE of the Board dated April 28th 1992."

[3] Legislative Decree dated November 12th 1996, n° 615 "Putting into effect of the directive 89/336/CEE of the Board dated May 3rd 1989, in subject of approaching of the legislations of members States regarding the electromagnetic compatibility, modified and integrated by the directive 92/31/CEE of the Board dated July 22nd 1993 and by the directive 93/97/CEE of the Board dated October 29th 1993". (Abrogative, paragraph excepted 2 of the article 14, of the legislative decree of which to the [2]).

[4] Directive 73/23/CEE dated February 19th1973, concerning the approaching of the legislations of members States regarding the electric material destined to be used within some limits of voltage, integrated by the Directive 93/68/CEE dated June 29th 1993.

[5] Law October 18th 1977, n° 791 "Putting into effect of the directive of the Board of the European Communities (n.73/23/CEE) regarding the safety guarantees that it has to possess the electric material destined to be used within some limits of voltage."

[6] Legislative Decree dated November 25th 1996, n° 626 "Putting into effect of the directive 93/68/CEE in subject of CE marking of the electric material destined to be used within some limits of voltage."

[7] Standards CEI EN 61800-1, 2000-05, classification CEI 22-19, "Electric Drives for speed varying Part 1: General prescriptions and rated specifications of low voltage drives for D.C. motor."

[8] Standards CEI EN 61800-3, 1996-09: "Electric drives for speed varying Part 3: Product Standards regarding the electromagnetic compatibility and to the specific test methods", classification CEI 22-10, emission 2861.

[9] Standards CEI EN 60204-1, 1998-04, classification CEI 44-5, "Safety of the machinery. Electric equipment of the machines. Part 1: General rules."

[10] Standards CEI EN 60146-1-1 "Semiconductors Converters - General prescriptions and mains commutation converters. Part 1-1: Specifications for the fundamental prescriptions."

[11] Standards CEI EN 60146-1-3 "Semiconductors Converters - General prescriptions and mains commutation converters. Part 1-3: Transformers and Reactors."

[12] Standards CEI 301-1, 1997-10, Classification CEI 301-1, Electric Drives - Dictionary (bilingual).

1.4 Conformity to the CEE directives and CE marking

1.4.1 Advice

The converters model BTD2 and DCD2 are CDM (please to see the point 2.2.2) and therefore they are utilized together with a D.C. motor to constitute a drive (PDS). The PDS is, in turn, integrated in the electric equipment. The phenomenon EMCs are particularly sensitive to the conditions of the plant, what length of the connections, shielding and connections to the PE and to the earth.

The conformity of the converters model BTD2 and DCD2, listed on the **Chart 1** at page 14 and the relative CE marking, placed on the converters, for how much it concern to the **EMCs directive**, of which to the documents [1], [2], and [3] mentioned on the paragraph 1.3, ago reference to the standards [8], with the following precise statements:

1.4.1.1

The drives type BTD2 and DCD2, since are CDM, they are commercialized in condition of **narrow distribution** (please to see the point 2.2.4); this implies that the builder of the drive, and/or the electrical cabinet and/or the installer and/or the builder of the machine and/or the final user they are competent people about EMC.

1.4.1.2

The drives type BTD2 and DCD2 can be applied both in "**first environment**" that in "**second environment**" (please to see the points 2.2.5 and 2.2.6). In the case of application in first environment it is necessary to install a filter to the three-phase supply of the converter, as specified on **Chart 1** on page 14.

1.4.1.3

The drives type BTD2 and DCD2, since they are components of a PDS, they are sold to be included as a part of an apparatus or system or installed system; therefore the operational conditions of the CDM inside the PDS, and therefore of an apparatus, system or installed system, **they have to follow, in subject of EMC, how much prescribed and/or recommended on this instruction book, particularly on the Chapter 2.**

1.4.1.4

For how much required by the directives "Low Voltage", according to the documents [4], [5] and [6], the drives type BTD2 and DCD2, make reference to the standards [7], [10] and [11], however applicable

1.4.2 Declaration of conformity and CE marking

The ALTER Elettronica S.r.l. it declares that, under the conditions specified on this document, particularly at the paragraph 1.4.1, ***the converters (CDM) model BTD2 and DCD2, specified on the Chart 1 and on the Chart 2 of the Chapter 3****, result in conformity, to the community directives EMC [1], understood the last changes with the relative Italian legislation [2] and [3] , with the Low Voltage directives community [4] understood the last changes with the relative Italian legislation [5] and [6].*

The applicable standards references are brought on the paragraph 1.3.

Therefore the CE marking, placed on the converters (CDM) model BTD2 and DCD2, attest the conformity both to the EMC directive and to the Low Voltage directive*.*

1.4.3 Application of other CEE directives

The converters are not subject to other CEE directives, over those suitable to the paragraph 1.3. They exist nevertheless, for application motives, calls on other directives; particularly to comply to how much in demand on the article 4 of the **Machines Directive 89/392 CEE and following changes 91/368/CEE, 93/44 CEE, 93/68 CEE, Italian legislation of Putting into effect D.P.R. n° 459 dated July 24th 1996.**

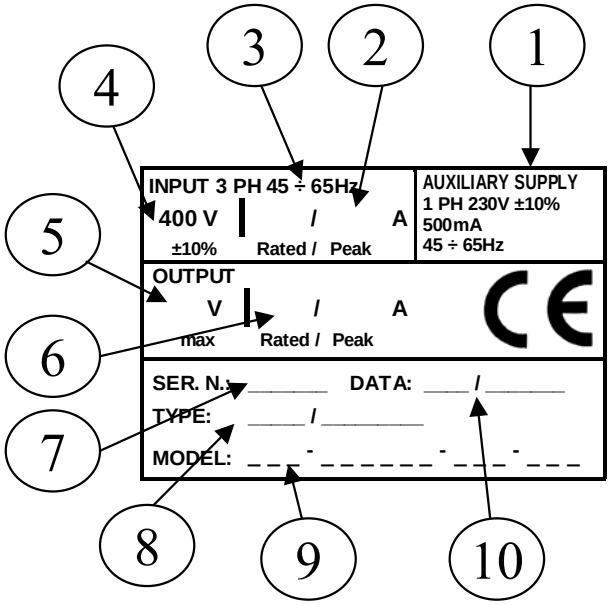
Bring here him following the declaration of the manufacturer (known also as "Declaration of Incorporation").

1.4.4 Declaration of the manufacturer

The ALTER Elettronica S.r.l., to the goals than in demand on the Machines Directive (DM) 89/392 and following changes, with the relative Italian legislation D.P.R. 459 of 1996-07-24, declare that the drives type BTD2 and DCD2 must be installed according to the instructions contained on this instruction book and must not to run as long as the machines in which will be incorporated has not been declared conforming to the DM directive here mentioned.

1.5 Rating Plate and information for the technical support

1.5.1 Rating plate of the converter



1) Rated single-phase service supply.
2) Three-phase input maximum current (Rated/peak).
3) Three-phase voltage input frequency range.
4) Three-phase voltage input supply.
5) Three-phase voltage drive output.
6) Three-phase output maximum current (Rated/peak).
7) Serial number.
8) Type of the converter.
9) Model converter (see the chart-coding on page 40 and page 41).
10) Data of registration (month/year).

1.5.2 Informative notes

We recommends you to annotate: the model of the converter, the serial number, the values of setting out read on the T.P. and the predispositions.
These data help for the ordination of the exchanges and to set a new converter in occurrence of substitution.

For commercial information, technical and application consultations are available the followings addresses:

MAIL:	**ALTER ELETTRONICA S.r.l.** Via EZIO TARANTELLI, 7 (Zona Ind.le) 15033 CASALE MONFERRATO (AL) ITALY
TELEPHONE:	+39 0142 77337
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E-MAIL:	info@alterelettronica.it

On the site **INTERNET http://www.alterelettronica.it** are available all the information about the products and the update editions of the instruction manuals.
The specifications of product and the content of this instruction book can be changed without notice, we recommends therefore to check on the special sections of the internet site the possible variations of specifications and the updating of this instruction book.
The ALTER Elettronica S.r.l. it declines every responsibility for inaccuracies or mistakes brought on this instruction book.

2 INSTALLATION GUIDE

2.1 Purpose and destination

2.1.1

This guide is also furnished in observance to how much prescribed on the paragraph 4.3 of the standards about the EMC (Electromagnetic Compatibility) of the electric drives to vary the speed [8].

2.1.2

Purpose of this guide is that to furnish to the technician, to the builder of the machine and to the final user of the drives type BTD2 and DCD2 information as required by the CEE Directives in vigor **in subject of Electromagnetic and Safety Compatibility for the so-called Low Voltage materials**. Particularly prescriptions and indications are recalled regarding the EMC to the various operators that utilize the drives type BTD2 and DCD2 to realize installations including speed varying drives by d.c. motor. With reference to this, we recall the attention on the fact that is necessary, for the performer of the drive, to **coordinate the content of this guide with the EMC guide of the builder of the d.c. motor**, that is joined to BTD2 and DCD2 drive type.

2.2 Recall of some definitions

2.2.1

The specific terms, regarding the electric drives, utilized on this instruction book, they have been defined on the standards [8] and on the dictionary [12] and it is referred to such documents. For some terms, that have a remarkable value from the technical-contractual point of view, the definitions are brought.

2.2.2

ELECTRIC DRIVE (**PDS**): an electric drive is systems that convert electric energy into mechanics, by power electronic equipments, according to a command function (and according to an established program).
A drive consist of::

- A POWER SUPPLY, CONVERSION AND CONTROL MODULE, (**CDM**) that it includes the whole drive with the exception of the motor and the sensors placed on the motor; particularly it includes a CONVERSION AND CONTROL MODULE (**BDM**) and its possible extensions as the supply module or some auxiliary ones (for example: fan). The BDM includes the functions of conversion, control and self-protection. In the practice the CDM has often called, shortly, **CONVERTER**.
- A MOTOR UNIT.

2.2.3

NOT NARROW DISTRIBUTION: marketing modality in which the supply of the equipments doesn't depend from the competence of the client or of the user about EMC for the utilization of drives. This involves restrictive limits of emission according to the essential requirements of EMC protection.

2.2.4

NARROW DISTRIBUTION: marketing modality in which the builder limits the supply of the equipments to suppliers, clients or users that, separately or jointly have technical competence of the requisite regarding the EMC for the application of drives. For economic motives, the interested parts should guarantee the essential requisite of EMC protection, for the specific installation, choosing suitable categories of emission, through measurement "on site" at the real conditions to the contour and through exchange of exchange of technical specifications.

2.2.5

FIRST ENVIRONMENT: environment that include the home purposes. It directly includes also the connected industrial uses, without input transformers, to low voltage mains that feed buildings assigned to home purposes.

2.2.6

SECOND ENVIRONMENT: environment that includes all the different industrial purposes, not those connected to low voltage mains that feed buildings assigned to home purposes.

2.3 Indications for the installation

2.3.1 General indications

2.3.1.1

We essentially report on these paragraphs the particular dispositions of installation concerning the electromagnetic compatibility, both as phenomenon of emission that can disturb other equipments, and both as immunity from the electric noise. The measures to be adopted, that they are recommended on this instruction book, are useful very often in all cases.

2.3.1.2

Very particular cases accepted, the **converters BTD2 and DCD2** are placed inside a metallic cabinet (so-called electrical cabinet), that contains also electric equipments of various type (other electronic power converters, contactors, transformers, inductors, etc.)

The motor or, better, the motor unit (because they can also exist other accessories what a tachogenerator, an electric fan, a brake, etc.) it is located on the machine, to a certain distance from the electrical cabinet.

They exist therefore, in reality, two separate types of plant: what refers to the wiring of the electrical cabinet and the real definitive plant that the technician realizes at the final client.

2.3.2 Installation of the converter inside the electrical cabinet

2.3.2.1

The drives type BTD2 and DCD2, have **IP20** degree of protection (please to see the point 3.2.1). To comply with how much prescribed on the § 4.4.6 "Contaminating" of the EN 60204-1 (1998) standards it is necessary, that they be situated, by the builder of the machine, in a suitable case, according to the required protection degree. Of rule they will have placed therefore inside a cabinet; **to satisfy EMC standards the cabinet has to be metallic made by iron plate having thickness at least 1 mm**.

It is important that inside the electric cabinet all the panels are connected among them by mechanical connections that introduce low electric impedance at high frequencies. This can be made, for example, adding fastening screws, using galvanized surface panels or cadmium plated rather than painted or removing the paint under the connection points, using special metallic EMC gaskets.

2.3.2.2

The **components' layout** inside the electrical cabinet, both in terms of positioning and in terms of distances, must be performs with the criterion to minimize the mutual influences regarding the electromagnetic noises of the equipments. Generally the transformers, the inductors, the contactors, because of their coils, they can produce high electric field at close distance.

2.3.2.3

The wiring of the power circuits must be physically separated from the wiring of the control circuits (signal circuits); the power circuits must carefully be shielded from the signal circuits; this is made utilizing some metallic raceways inside the electrical cabinet, metallic sheath or shielded cables, also for power connection.

2.3.2.4

Particular attention must be put on the **wiring of the signal circuits**, for motives about electromagnetic immunity. Is necessary therefore that the **connections of the signal circuits** of the converter, both input and output, **are made using twisted pair cables and carefully shielded.** The shield must be connected to ground on the converter side, as illustrated on point 5.1.1 on page 29 of this instruction book and, where it is necessary, also to the ground connection of the interested peripheral.

2.3.2.5

All the equipments, for which **additional devices** are prescribed to conform them to the EMC standards, must be provided of such devices, placed according to the prescriptions of the manufacturer; particularly the good rules recalls to place the **spikes limiting devices** in parallel to the a.c. coils of the contactors, the **diodes** in parallel to the d.c. coils of relay or contactors, the **filters** against the conducted H.F. electrical noises placed on the three-phases power input of some converters, when is prescribed.

2.3.2.6

The shielding of the cables have to finish the nearest possible to the terminal block; if the connection of the shield is prescribed to ground or, in some cases, to the earth, it must possibly be made by some special cable-head that let a 360° contact between the shield and the ground, in absence of this, by connections as short as possible and having a suitable cross section area.

2.3.2.7


WARNING!

To disconnect the converter from the circuit under electric test, before making resistance or isolation tests and/or applied voltage test.
The not compliance of this prescription can seriously damage the converter.

2.3.3 Complete electric plant

2.3.3.1

As we have previously said, we report there to the plant in the final installation of the machine. For some types of machines the electrical cabinet is physically connected to the machine and therefore, in practice, the electric plant "on site" is reduced to the connection of the machine to mains.
Usually, nevertheless, the electrical cabinet is found to a certain distance from the machine, on which is placed the motor unit; a pulpit sometimes exists for also remote command, to which some conductors could be connected.
In this case, since the problem list of the emissions is very tied up to factors of plant, the recommendations that follow they are dictated by good technique standards and by experiences on the field and they must essentially have concerned as reference lines and not as certain solutions.

2.3.3.2

The three-phase transformer MV/LV of the feeder line to which some converters of electric drives are connected must have an apparent power suitable to the loads, keeping in mind the power factor and the distortion factor. For the converters BTD2 and DCD2 please to see **Chart 1** on page 14.

2.3.3.3

The copper cross section area of the feeder line connected to the terminal block of the converter (see the schemes "external Connections for converters" Figure 14 on page 34 and Figure 15 on page 35), must be suitable to the rated current of every converter. The design must be made in such way to avoid voltage drops that can bring the supply voltage values out of the contractual tolerance.
The **Chart 2** on page 14 shows the maximum section of the conductors that they are usable on every type of converter.
Moreover it is necessary to carefully study the runs to minimize the cables length.

2.3.3.4

All the metallic raceways, the metallic sheaths and, all the shielding, if not otherwise specified, must generally to be connected to the PE both on the electrical cabinet both on the motor; these connections must to be very short and have a wide cross section area.

2.3.4 Specific indications for the drives type BTD2 and DCD2

2.3.4.1

The drives type BTD2 and DCD2 don't require, generally, particular modality for placing and installation over the normal professionalism and knowledge of the rules of the art of the electric and electronic planting sector.
In every case, it is necessary to follow how much prescribed or recommended on this instruction book.
Following some specific indications are brought for the installation of the converters BTD2 and DCD2, as it regards the EMC and Low Voltage directive.

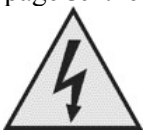
2.3.4.2

The connection schemes on Figure 14 on page 34 and Figure 15 on page 35 contains some important practical instructions about wiring to respect the EMC standards, and about the shields connections to the drives type BTD2 and DCD2.
When the drives type BTD2 and DCD2 are utilized in **first environment**, with reference to how much brought

on the point 1.4.1.2 it is necessary to install a **filter** on the three-phase supply of the converter; also the connections of such filters are suitable on the figure above pointed.
On the **Chart 1** on page 14 to chapter 3 are brought the types of the three-phase filters to utilize when is used the scheme at Figure 14 on page 34 and Figure 15 on page 35.
Making the connections brought on the pointed scheme must be observed the following rules:

WARNING! It is necessary to keep in mind that the run of the cables, their length, their shielding and the shield connection to the right ground point of the converter are **essential to the EMC compliance**.

- The **location of the filter** is very important: it must be placed, inside the electrical cabinet, the nearest possible to the component connected to her output. On the Figure 14 on page 34 and Figure 15 on page 35 such component is named “**FILTER**”.
- **The length of the connections** between the filter output and the input of the component connected to its output **should not overcome 0,3 m** and must be made by conductors, having a suitable cross section area, shielded as far as possible. It is evident that, in certain cases, is not be possible to shield components as fuses and contactors; for this reason it is necessary that the runs of the connections are the shortest possible.
- **WARNING! The input and the output of the filter cannot be exchanged!**
- The ground connections of the converter have been increased for making the most functional wiring; different ground points in the converter exist, marked by the symbol “⏚”. Please to see the schemes to Figure 16 on page 39 the pointed out connections “E1” and “E2”.


WARNING!

E1 (Figure 16), made by one M5 screws. It is the main ground and must to be connected to the PE and therefore to the earth of the plant, by a conductor having a cross section area not less then that of the three-phase supply conductors. **This connection is essential to the protection compliance** and not only to the EMC compliance.
E2 it is the connecting point of the shields of the signal cables, that they are brought on figure of the point 5.1.1 on page 29.

- The ground terminal of the metallic frame of the filter, must to be connected as suitable on Figure 14 on page and on Figure 15 on page 35.

2.3.4.3

You have seen, on the point 2.3.3.2 that the three-phase MV/LV transformer must have a suitable apparent power (kVA).
In this session it is important to note however that in addition to the transformer, also the filter must have a power suitable to that of the converter (or of the converters); it is also necessary that the voltage drop of the transformer, to full load, it must be less them 3%

2.3.4.4

To comply with how much prescribed on the Low Voltage directive and on the standards that can make reference to it, we recall, as follow, some connected general safety dispositions with specific references to the drives type BTD2 and DCD2.

2.3.4.5


WARNING!

For any reason, safe during the operations of which to the point 2.3.4.6, are had to enter inside the converter when it is fed. To enter **must surely be disconnected: the three-phase supply (terminals L1, L2, L3), the single-phase supply (terminals FL1, FL2)**, **the service supply (terminals 230V, 230V)** and every other supply having a voltage value more them 50Va.c. and 75Vd.c., eventually existing on the connectors. Inside the converter, when it is fed, **there are some voltages potentially dangerous for the safety of the operator!**

2.3.4.6

The startup of the converter, can directly be performed by the frontal panel, without the need to open the equipment; therefore **you are not allowed to open** (even provisionally) the metallic container to effect this operation.

2.3.4.7


WARNING!

To observance the instructions contained on this instruction book, **from the point of view of the safety, it is important to follow the prescriptions regarding the value and the type of protections (fuses) prescribed** (please to see **Chart 1** on page 14).

2.3.4.8

In relationship to the current of every type of the converters BTD2 and DCD2, current range from 6A up to 80A, it is **necessary that the cross section area of the conductors** for the connection to the feeder line and to the motor **must guarantee a current density according to the general prescriptions of the plant.**. Make reference to the **Chart 2** on page 14.

2.3.4.9


WARNING!

All the connections to the common ground of the electrical cabinet has to be short and have a suitable cross section area; the PE of the electrical cabinet must to be connected to a **good ground**. Also the ground of the motor must be connected to a good heart, as suggested on Figure 14 on page 34 and Figure 15 on page 35.

3 TECHNICAL CHARACTERISTICS

3.1 Generality

These converters are designed to feed and to control the running of brushless and d.c. servomotor.
The IGBT bridge is built inside the frame.
The recovery of energy happens on breaking resistor internally assembled (or externally in option).
All the regulation circuits and control are analogical and completely isolated by the power.
The inputs and the digital outputs are type static and optoinsulated.
By a digital input it is possible to have a ramp of acceleration and deceleration on the speed reference.
The acceleration and deceleration times are adjustable.
The current limit is internally set in constant mode and is also adjustable from the outside by an analog reference.
The I/O Connectors, Test Points, LEDs, Trimmers are placed on a completely accessible frontal card, this placing facilitate the connections, the measures, the regulations, the adjustments and the operation diagnosis.
These converters are designed to feed and to control the running of the servomotors utilized in the machines-tool, graphics, tape motion control, etc. and in all those applications where it is requires a great flexibility of operation.
On the **Chart 1** and **Chart 2** on page 14 are available the rated values of some greatness for every size of the converters.

3.2 Technical data

3.2.1 General technical characteristics

- Vertical placing on the panel board. Degree of protection: IP20.
- Operating temperature: from 0 to +40°C (32°F to 104°F).
- Storage temperature: from -10 to +70°C (14°C to 158°F).
- Relative maximum humidity: 95% without it condenses.
- Maximum altitude: 1000 m. o.s.l. (3280 ft)
- Auxiliary monophase supply: 230Va.c. ±10% - 500mA max
  (to protect with delayed external fuses 250V - 1A).
- Power supply three-phase: to see plate converter.
  (to protect with external fuses; see the **Chart 1** on page 14)
- Frequency supplies: from 45 to 65Hz.
- Output current: see the **Chart 1** on page 14.
- Maximum threephase supply current: 0,82 x Output current.
- Dissipated maximum power: 5 x rated output current.
- Thermal time constant: 15’
- Continuous power dissipated by the breaking resistor inside: see the **Chart 1** on page 14.
- Breaking resistor outside (OPTION).
- Connection clamps to the D.C. BUS (OPTION).
- Galvanic isolation among power and electronics.
- Protection against overvoltages on:
  - Signal input and output.
  - Auxiliary and power supply.
- “switching” frequency: 16KHz.
- Least value of the electric constant of time of the motor: 1 msec. To calculate this value to see the formula on page 34.
- Connections: power and service on terminal block, signal on connectors.
- To use with brushless motor (model BTD2) endowed with one of the regulating followings:
  - Brushless tachogenerator and HALL sensor.
  - Special Encoder for brushless motor (5V line driver).
  - Resolver.

- To use with motor direct current (model DCD2) endowed with one of the regulating followings:
  - Tachogenerator.
  - Encoder (5V line driver).
- Simulated encoder output 1024 div/turn 5V line driver (only by resolver).
- Output on connector for channel A, B, Z of the encoder (only by encoder).
- The ramp on the speed signal is adjustable from 0,15 to 1,5 sec (enabled by logical command).
- Optoinsulated digital inputs (command from 15 to 30Vcc - 10mA max):
  - Enable of speed reference ramp.
  - Enable of converter.
  - Charge/discharge D.C. BUS capacitors and memorized alarms RESET.
- Optoinsulated digital outputs (24Vc.c. - 100mA max) protected against the overload and the short circuit:
  - Converter ready.
  - Motor temperature OK.
- Analog inputs (differential maximum tension and of common way 10V. Input resistance: 100KΩ):
  - Differential input circuit for the speed reference.
  - External setup input for current limit (+10V max.).
- Analog outputs (±10V max. – output resistance 1KΩ):
  - Proportional output to the speed of the motor.
  - Proportional output to the current of the motor.
- Voltage outputs:
  - +24V ±20% - 100mA max.
  - +10V ±5% - 5mA max.
  - -10V ±5% - 5mA max.
- Entry for the thermal probe (PTC) assembled in the motor.
- Visualization with LED of the drive status and the alarms.
- Automatic locking of the converter for:
  - Service Supply fault.
  - Three-phase mains fault.
  - D.C. BUS over voltage.
  - Wrong motor connection.
  - Converter overtemperature.
  - Converter overload.
  - Motor overcurrent.
  - Failure: tachogenerator – Hall sensor - encoder - resolver
  - Failure or overload in the breaking resistor circuit.

3.2.2 Supply

NOTES

The differential circuit breaker utilized to protect the converters must have a B type-working characteristic (According to the 2nd amendment of the IEC 755 standards).

SERVICES SUPPLY

Supply: single-phase 230Va.c. ±10% - 500mA max. (Terminals: 230V)
Cross section area of the connection cables: 1,5 mm^2
Supply Protection by N°2 fuses having rated current 1A.

POWER SUPPLY

The converter must be connected to a three-phase mains having grounded neutral and rating voltage equal to that suitable on the plate of the converter (see point 1.5.1 on page 6).
To insert between the three-phase mains and the converter a three-phase inductor having an inductance of at least 100μH, that must to be designed for the current supplied to the converter and having a saturation current at least the double one of the designing current.
To use some transformer having connections △/⅄ with center tap connected to ground or some autotransformer (⅄/⅄) to fit mains.
To protect the converter bridge by N°3 ultra-fast fuses as suitable on the Figure 14 on page 34.

CONVERTER						FILTER	INDUCTANCE	FUSE ON L1-L2-L3 (4)	
OUTPUT CURRENT Rated/Peak	SIZE	ABSORBED APPARENT POWER Rated/Peak		INTERNAL BREAKING RESISTOR POWER				I_{nom}	Max. I^2t at 10ms
		230V	400V	230V	400V				
(1) [A]	(2)	[KVA]	[KVA]	[W]	[W]	(3) TIPO	TIPO	[A]	[A^2s]
6 / 12	1	1,9 / 3,9	3,4 / 6,8	150	300	23/001	17/001	15	500
10 / 20	1	3,3 / 6,5	5,7 / 11,4	150	300	23/001	17/001	25	500
20 / 40	1	6,5 / 13	11,4 / 22,7	150	300	23/002	17/001	50	1.000
30 / 60	2	9,8 / 19,5	17 / 34	300	300	23/002	17/002	63	1.300
40 / 80	2	13 / 26	22,7 / 45,4	300	450	23/003	17/002	80	2.000
50 / 100	2	16,3 / 32,7	28,4 / 56,8	300	450	23/003	17/003	100	10.000
60 / 120	2	19,6 / 39,2	34,1 / 68,2	450	600	23/004	17/003	100	10.000
80 / 120	2	26,1 / 39,2	45,4 / 68,2	450	600	23/005	17/004	100	10.000
100 / 200	2	32,6 / 65,2	56,7 / 113,5	600	600	23/006	17/005	--	--

Chart 1

In the Chart 1 the apparent powers are reported in also entry of the drives type BTD, when they disburses the nominal power and peak.

CONVERTER	CONNECTION CABLES SIZE					
OUTPUT CURRENT Rated/Peak	L1-L2-L3	A-B-C	R1-R2	230V	CN1-CN2	CO1-CO3 CO4
(1) [A]	[mm^2]	[mm^2]	[mm^2]	[mm^2]	[mm^2]	[mm^2]
6 / 12	2,5	2,5	2,5	1,5	1,5	0,5
10 / 20	2,5	4	2,5	1,5	1,5	0,5
20 / 40	6	6	2,5	1,5	1,5	0,5
30 / 60	10	10	2,5	1,5	1,5	0,5
40 / 80	10	16	2,5	1,5	1,5	0,5
50 / 100	16	16	2,5	1,5	1,5	0,5
60 / 120	16	16	2,5	1,5	1,5	0,5
80 / 120	16	16	2,5	1,5	1,5	0,5
100 / 200	35	35	10	1,5	1,5	0,5

Chart 2

NOTE

[1] With inside temperature to the electrical cabinet where is mounted the converter from 0°C to 40^0C (32°F to 104°F). Nominal current reduction of 4% for any ^{0}C over the 40^0C (104°F). The peak current is disbursed for 2,5 seconds maximum.

[2] Outline dimensions and weights on page 39.

[3] The filter is necessary when the drives type TTB and TTU are utilized in first environment, to satisfy the requisite regarding the EMC compatibility (please to see the point 2.3.4.2).

[4] On the three-phase input **it is essential to install only Ultra rapid fuses of protection** (for protection semiconductors). Fuses of other type don't give a degree of enough protection and therefore, in case of damage, the converter can seriously be damaged.

3.3 Commands, signaling, inputs and outputs (I/O)

3.3.1 Switch (SW1)

SW1.1
SW1.2] Dependent setting out from the model of converter (See point 4.5.4 on page 27).
SW1.3]
SW1.4 – Current limit external setting out (see point 4.5.3 on page 26).

3.3.2 Signaling LED (green)

The converter only checks the motor when they occur both the conditions:
- All the Green leds suitable with (*) they have turned on.
- All the Red leds are off.

DRIVE ENABLE (*)	Turned on it shows the presence of the converter external enable command. If it misses this command the shaft of the motor is neutral.
DRIVE PRESET (*)	Turned on it shows the presence of D.C. BUS charge command (DPR).
SPEED RAMP ENABLE	Turned on it shows the presence of the ramp on speed reference command.
DRIVE READY (*)	Turned on it shows that alarms don't exist in the converter. Turned off it shows: - The presence of an alarm (in this case he has also turned on a red led of alarm). - The charge phase of the condensers on the D.C. BUS.
MOTOR TEMP. OK	Turned on it shows that the temperature of the motor is inferior to that of intervention of the probe PTC mounted in the motor. Out it shows that the temperature of the motor is superior to that of intervention of the probe PTC. (NOTE: Such signaling must opportunely be managed by the user. In fact, in case of overtemperature of the motor, the converter doesn't go to alarm, but continuous to regularly work).
SUPPLY OK (*)	Turned on it shows the presence of all the internal supplies. With switched off led to verify: - The service supply 230Va.c. ±10%. - Possible short-circuit to ground of the output +24V.

3.3.3 Signaling LED (red)

The turned on led shows the corresponding cause of damage of the converter.
To see point 4.3 on page 22.

DRIVE OVERLOAD	Attainment of the maximum time allowed for the disbursement of a current superior that nominal. (MEMORIZED). For this alarm to check: - The mechanical load applied to the Motor. - The windings and the connections of the Motor. (to see point 5.1.4 on page 34 and point 5.1.5 on page 36).
DIG. OUTPUT FAULT	Overloaded or short-circuit on one or more logical outputs. (MEMORIZED). With this alarm all the digital outputs are OFF and the converter is disabled.
CLAMP OVERLOAD	Attainment of the maximum time allowed for the running of the breaking resistor (MEMORIZED). For this alarm to check: - The frequency and the duration of the cycles of stop of the Motor. - The voltage of the three-phase power supply that doesn't exceed the allowed maximum value. - The presence of oscillations in the motor speed caused by anomalies in the speed or the shaft motor position control system. - Speed reference undulations.
BUS FAULT	The voltage on the D.C. BUS doesn't reenter within the scheduled limits. (MEMORIZED). For this alarm to check: - The voltage on T.P. BUS VOLTAGE (to see point 3.3.4 on page 17). - The voltage of the threephase power supply. - The external braking resistor (OPTION) and the converter connections.
THREE-PHASE FAULT	Lack of one or more phases of the three-phase power supply or inadequate voltage supply. (MEMORIZED).
BRIDGE OVERTEMP.	Overtemperature of the internal heat-sink (MEMORIZED). For this alarm to check: - The temperature inside the electrical cabinet. - The regular running of the fans mounted inside the converter. NOTE: To await some minutes before performing the reset to allow the temperature to go down under the value of alarm.
FEEDBACK FAULT	Anomaly in the signals provided by the speed control system or by the shaft motor position control system. (MEMORIZED). For this alarm to check: - The connections between motor and converter. (to see point 5.1.4 on page 34 and point 5.1.5 on page 36.
OVERCURRENT	Superior current to the level of peak of the converter. (MEMORIZED). For this alarm to check: - The connection cables and the windings of the Motor.
SPEED ERROR	The speed motor doesn't follow the reference of speed. For this alarm to check: - The current limit planned (to see T.P. CURRENT LIMIT). - The time of rise / fall of the speed reference. - The presence of oscillations in the motor speed caused by anomalies in the speed or the shaft motor position control system. - Voltage undulations on the speed reference. - The mechanical load applied to the Motor. - The windings and the connections of the Motor. (to see point 5.1.4 on page 34 and point 5.1.5 on page 36).

NOTE:
The reset of the memorized alarms happens with the digital command DPR (DRIVE PRESET).

3.3.4 Test point of measure (T.P.)

CURRENT LIMIT REF.	Voltage reference correspondent to the current limit planned. (10V on this T.P. they correspond to the converter peak current)
SPEED REFERENCE	Speed reference.
CURRENT MONITOR	Proportional signal to the current of the motor. +/-10V correspond to the converter peak current. Output resistance: 1KΩ.
SPEED MONITOR	Proportional signal to the speed of the motor. Voltage +/-10V max. Output resistance: 1KΩ.
OVER LOAD LEVEL	Proportional signal to the entity of converter current overload. If the voltage on this T.P. it reaches 10V, the protection intervenes against the overload of the converter. (To see alarm led DRIVE OVERLOAD on page 16)
BUS VOLTAGE	Proportional signal to the present voltage on D.C. BUS. 1V on T.P. they correspond to 100V on D.C. BUS. Under normal conditions of running the voltage on D.C. BUS it has to be equal to: $V_{BUS} = 1{,}41 \bullet V_{THREEPHASE}$ If, during the running, the voltage goes down under the least threshold or it overcomes the maximum threshold, the anomaly has signaled with the lighting of the red led of alarm BUS FAULT (to see page 16).
ØV	Common supplies and points of measure. (Connected to the carpentry of the converter).

3.3.5 Regulation trimmers

SPEED OFFSET	Standstill motor with void reference of speed.
<u>For the following trimmers the rotation in hourly sense of the regulation screw increases the regulated greatness.</u>	
CURRENT LIMIT	Peak current. (The planned value is measured on the T.P. CURRENT LIMIT REF.).
SPEED	Motor speed.
SPEED LOOP GAIN	Promptness of the converter in to respond to the variations of the reference of the speed and the load on the motor. With hourly rotation it increases him the promptness of response. An excessive promptness of response brings motor to vibrations of the shaft.
SPEED RAMP TIME	Regulation of the time of acceleration and deceleration. The regulation is active only if it is present the command SPEED RAMP ENABLE Range of regulation times from 0,15 to 1,9 sec. The suitable times are gotten with speed reference of 10V. With inferior speed reference the obtainable times are proportionally inferior.

3.3.6 Analog input

NOTE:
To always use cables shielded of good quality and to connect the two extreme of the shield to ground.
On the frame of the converter, next to the connectors, the anchorages are available for the shields (to see Figure 16 on page 39.

For the connections to make reference to the examples of the point 5.1.1 on page 29.

AØV	ANALOG ØV (clamps 10-15-18-20-23). The analogical 0V is connected to the frame of the converter.
PTC	SONDA PTC (clamp 16). Probe PTC input (maximum resistance to temperature environment = 1KΩ) mounted in the motor for the control of the temperature.
CLI	CURRENT LIMIT INPUT (clamp 19) Entry of external reference of the maximum limit of current (0 ÷ 10V). +10V correspond to the current of peak of the converter. Examples of connection at point 5.1.1.2 on page 30.
SIL	SPEED INPUT LOW (clamp 21). Cold entry for the speed reference.
SIH	SPEED INPUT HIGHT (clamp 22). Warm entry for the reference of speed. - Voltage from: SIH and A0V, SIL and A0V, SIH and SIL = 10V max. - Input resistance: 100KΩ.

3.3.7 Analog output

NOTE:
To always use cables shielded of good quality and to connect the two extreme of the shield to ground.
On the frame of the converter, next to the connectors, the anchorages are available for the shields (to see Figure 16 on page 39.

For the connections to make reference to the examples of the point 5.1.1 on page 29.

ACM	ARMATURE CURRENT MONITOR (clamp 9) Proportional signal to the current of the motor. +/-10V they correspond to the peak current of the converter. – Output resistance: 1KΩ.
SPM	SPEED MONITOR (clamp 11) Proportional signal to the speed of the motor. Voltage +/-10V max. – Output resistance 1KΩ.
-10V	Supply output -10V ±5% - 5mA max. (clamp 12)
+10V	Supply output +10V ±5% - 5mA max. (clamp 13)
+24V	Supply output +24V ±20% - 100mA max. (clamp 14)

3.3.8 Common digital I/O

DØV	DIGITAL ØV (clamp 1) 0V Digital. To connect this clamp to the supply 0V of the digital inputs / outputs. For the connections to make reference to the examples of the point 5.1.2 on page 32.
D24	DIGITAL 24V (clamp 8) Supply 24V for the digital output. To connect this clamp to the +24V digital inputs/outputs supply. For the connections to make reference to the examples of the point 5.1.2 on page 32.

3.3.9 Digital inputs

NOTE:
Supply voltage from 18Vcc to 30Vcc (rated 24Vcc)
Absorbed current 10mA
The corresponding lit up led points out the presence of the corresponding command (to see point 3.3.2 on page 15).
In presence of strong nuisances it is advised to use cables shielded of good quality and to connect the two extreme of the shield to ground.
On the frame of the converter, next to the connectors, the anchorages are available for the shields (to see Figure 16 on page 39).

For the connections to make reference to the examples of the point 5.1.2 on page 32.

DEN	DRIVE ENABLE (clamp 2). Enabling of the converter. If it misses this command the shaft of the motor it is neutral.
DPR	DRIVE PRESET (clamp 3) Charge command of the condensers on the D.C.BUS and of Reset of the memorized alarms.
SRE	SPEED RAMP ENABLE (clamp 4) Enabling of the speed ramp.

Further information are available in the chapter 4 on page 21.

3.3.10 Digital outputs

NOTE:
Supply voltage from l8Vcc to 30Vcc (rated 24Vc.c.)
States of the outputs:
OFF = Floating
ON = Connected to the supply +24V (D24) (signaled by the lighting of the corresponding led)
Maximum current for every output 100 mA
Fall of inside voltage to the maximum current 2V
Without service supply all the outputs are OFF.
The state of the outputs is valid 200 msecs after having powered the services.
In case of overload or short circuit on one or more outputs all the outputs are forced in the state OFF in permanent way.
The anomaly is signalled with the led of alarm OUF and the armature bridge is disabled.
The reset of the alarm happens with the digital command ALR.

For the connections to make reference to the examples of the point 5.1.2 on page 32.

RDY	READY (clamp 6). Ready converter and Regularly Working (ANY PRESENT ALARM). Further information are available in the chapter 4 on page 21.
MTOK	MOTOR TEMPERATURE OK (clamp 7). The state ON signals that the temperature of the motor is inferior to that of intervention of the probe PTC mounted in the motor. The state OFF signals that the temperature of the motor is superior to that of intervention of the probe PTC. *NOTE: This is only a signaling and it doesn't condition the running of the converter.*

3.3.11 Signal connector

	BTD2 ENCODER	**BTD2 RESOLVER**	**BTD2 TACHOMETER**	**DCD2 ENCODER**	**DCD2 TACHOMETER**
CO1	ENCODER OUTPUT	SIMULATED ENCODER OUTPUT	---	ENCODER OUTPUT	---
CO3	ENCODER INPUT	RESOLVER INPUT	TACHOMETER INPUT	ENCODER INPUT	---
CO4	CONNECTION AMONG CONVERTERS MASTER / SLAVE (option). It connects the converter Master to the converter Slave for the interchange of the signals to realize the function of Master/Slave for the recovery of the backlash of the transmissions.				

ENCODER INPUT	Connector for the connection of the encoder mounted on the motor, used as retroaction of speed. In the case of converter BTD2 the encoder has to be a special model for motor brushless with effect sensors Hall. Instead for the converter DCD2 can be an incremental encoder with the only channels A, B. The number of impulses / turn can be select to pleasure, keeping in mind to remain in the characteristics of the converter brought to the point 4.5.4.1 on page 27 or point 4.5.4.4 on page 27. Connector type “D” 25 pole male.
ENCODER OUTPUT	Connector that furnishes in output the same present signal on the CO3. For this reason the present signal is not definable previously, but it depends on the type of encoder mounted on the motor. Connector type "D" 9 poles female.
RESOLVER INPUT	Connector for the connection of the resolver (to 2 poles) mounted on the motor. Connector type "D" 9 poles male.
SIMULATED ENCODER OUTPUT	Connector that furnishes in output a signal of "simulated encoder" with 1024 divisions / turn for the channels A and B besides the nick of zero Z. The outputs (normal and negate) they use the Line Driver to 5V type AM26LS31. For further information to consult the data sheet of this component. Connector type "D" 9 poles female.
TACHOMETER INPUT	Connector for the connection of a Tachogenerator Brushless provided of effect sensors Hall that is connected to the motor. Connector type "D" 15 poles male.

4 CONVERTER STARTUP

IMPORTANT NOTE:
All the prescriptions concern the sequences of starting and stop have to be respected peremptory. Their non-observance can provoke the interruption of the fuses of protection on the three-phase supply of power and damages to the converter.

4.1 Running sequence

4.1.1 Note

If the power supply three-phase (L1-L2-L3) is given to the converter when the condensers on the D.C. BUS are discharged, they occur peak of current in line, as a result of the extremely rapid charge of these condensers. These current peak can provoke the interruption of the protection fuses on the three-phase power supply and to damage, besides, both the contacts of the contactor set on the three-phase power supply, that the rectifier bridge and the condensers themselves, set inside the converter. To avoid all this has been inserted, inside the converter, a power supply with the function to charge and to maintain charged the condensers on the D.C. BUS up to when the three-phase power supply (L1-L2-L3) is given to the converter.
The command **DRIVE PRESET** enables the running of this power supply and it also executes the reset of the memorized alarms.
The output **READY** passes from the state OFF to the state ON at the end of the condensers charge (lasted of the position around 6 seconds). If the charge of the condensers doesn't happen within the anticipated time, or they is present other causes of alarm in the converter, the output **READY** remains in the state **OFF**.

***WARNING**:*
Only when the output READY is in the state ON the three-phase power supply (L1-L2-L3) can be given to the converter.
To always remove the three-phase power supply (L1-L2-L3) to the converter when the output READY is in the state OFF.

4.1.2 Commands sequence

1. To give the supply of service 230Vc.a.
2. To give the command **DRIVE PRESET** (in this way the RESET of the possible present alarms happens also).
   To await that the output **READY** goes through from the state OFF to the state ON.
   If the charge of the condensers is regular and they is not present alarms, the output **READY** passes later from the state OFF to the state ON around 6 seconds. In contrary case the output **READY** remains in the state OFF.
3. To furnish the three-phase supply of power (L1-L2-L3) only when the output **READY** is in the state ON.
4. To furnish the command **DRIVE ENABLE** and the reference of speed to put in rotation the motor.

Important:
- *To maintain active the command **DRIVE PRESET** for the points 3 and 4.*
- *If the output READY doesn't go through later from the state OFF to the state ON around 6 seconds to verify if the converter is in state of alarm (to see on page 15).*

4.2 Stop sequence

4.2.1 Note

For safety motives, some times, it is necessary to prevent that a converter can feed a motor, to it connected, making therefore impossible also any movement of its shaft.
To get this is necessary that there is not voltage on the D.C. BUS of the converter.
This is obtained removing from the converter the power three-phase supply (L1-L2-L3) than the command **DRIVE PRESET**. If they miss, in fact, both the command **DRIVE PRESET** than the power three-phase supply, the converter handles to discharge immediately the condensers on the D.C. BUS annulling so the voltage on the same D.C. BUS.

WARNING:
To have the stop of the motor in safety condition it is necessary to remove both the power three-phase supply (L1-L2-L3) that the command DRIVE PRESET.

4.2.2 Commands sequence

1. To take the reference of speed to 0V and to await up to when the motor is standstill.
2. Remove the command **DRIVE ENABLE.**
   In this way the motor doesn't is not power anymore therefore, during the normal running, the phase of stop can stop to this point. Wanting to put again in running the motor is enough therefore to leave again from the point "4" of the running sequence (to see point 4.1.2 on page 21).
3. If it is desired to do instead, to this point, a **stop of the motor under safety conditions**, it is necessary to remove both the power three-phase supply (L1-L2-L3) than the command **DRIVE PRESET**. To leave again it is necessary however to follow the running sequence beginning from the point "2" (to see point 4.1.2 on page 21).
4. Remove the service supply 230Vc.a.

Important:
- *To maintain active the command **DRIVE PRESET** for the points 1 and 2.*

NOTE:
During the normal operation running-stop of the motor, is advised to act only on the reference of speed and on the command DRIVE ENABLE to avoid useless waits.
To also remove the power three-phase supply (L1-L2-L3) and the command DRIVE PRESET only when he is wanted to arrest the motor under safety conditions.

4.3 Stop and starting following an alarm

When the converter gives in state of alarm, it is involved as if it missed the command **DRIVE ENABLE**, therefore the shaft of the motor, in natural way, up to stop and standstill in neutral.
The state of alarm of the converter has signaled from the logical level "0" of the output **READY**. In this case it is necessary to immediately remove from the converter:

- The command **DRIVE ENABLE.**
- The **power three-phase supply** (L1-L2-L3).
- The command **DRIVE PRESET.**

To relieve and, if possible, to set remedy to the damage, following the indications related to the cause of alarm indicated by the lighting of the corresponding led (to see on page 15).
To put again in operation the converter, to execute therefore the sequence of the anticipated commands for the starting (to see point 4.1.2 on page 21).
If the damage remains the reset of the alarms is not performed and the converter remains in state of alarm.

4.4 Command timing

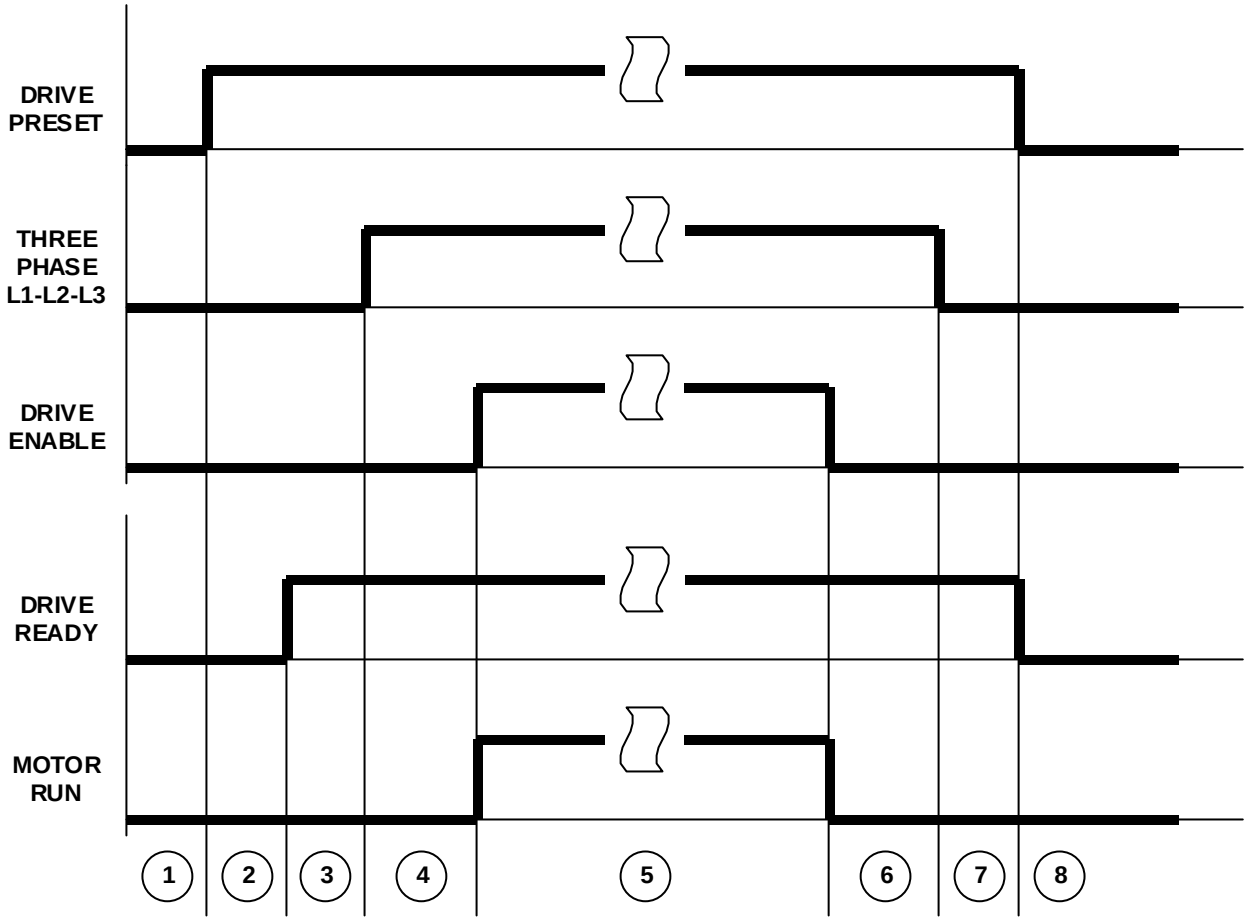


Figure 1

PHASE DESCRIPTION

1 **Safety condition disabled**: on D.C. BUS any electric voltage is present, therefore the motor cannot put on in rotation.
Duration of the phase: unlimited.

2 **Converter preset**: the charge of the D.C. BUS condensers and the possible reset of the alarms happens.
From this phase in there could be ahead dangerous voltages on the cables of connection to the motor and, in case of failure, also a possible movement of the shaft motor.
At the end of this phase, if there are no alarms, the output READY brings him to logical level "1."
Duration of the phase: around 6 seconds.

3 **Attended insertion three-phase supply:** the converter gives the signal of READY and the D.C. BUS it is to the correct voltage.
The converter is ready to receive the power three-phase supply on L1 - L2 - L3.
Duration of the phase: unlimited.

4 **Attended enabling**: the situation is similar to the phase 3, but it is present the power three-phase supply on L1-L2-L3 and the converter now it waits for the command "DRIVE ENABLE" to pass to the phase of job.
Duration of the phase: unlimited.

5 **Control of the motor**: the converter has received the command "DRIVE ENABLE" and it regulates the speed of the motor following the references of speed and current.
This phase finishes when the command "DRIVE ENABLE" is removed.
Duration of the phase: unlimited.

6 **Attended disconnection three-phase supply**: the converter has been disabled removing the command "DRIVE ENABLE". The shaft motor is neutral. The D.C. BUS has kept on voltage by the power three-phase supply existing on L1-L2-L3.
If it is necessary to make to leave again the motor, all it takes is furnishing the command "DRIVE ENABLE".
In fact, under normal conditions of running (Stop and Go), the interested phases are the 5 and the 6.
To the following phase he only passes if is necessary a disabling in safety condition.
To do this it is necessary to remove the power three-phase supply on L1-L2-L3.
Duration of the phase: unlimited.

7 **Attended disabling in safety condition**: missing the power three-phase supply on L1-L2-L3, the converter activates his own inside circuit to maintain charged the condensers on the D.C. BUS.
ATTENTION: the converter has not disabled in safety condition.
Duration of the phase: unlimited.

8 **Disabling in safety condition**: without the command "Drive PRESET", the converter discharges the condensers on the D.C. BUS and takes to logical level "0" the output READY to signal that the converter cannot work in this state.
Now the converter has disabled in safety condition.
Duration of the phase: unlimited.

4.5 Startup

4.5.1 Operation flow-chart

Report you a synoptic of the operations of startup, that are specified in way detailed in the following paragraphs.

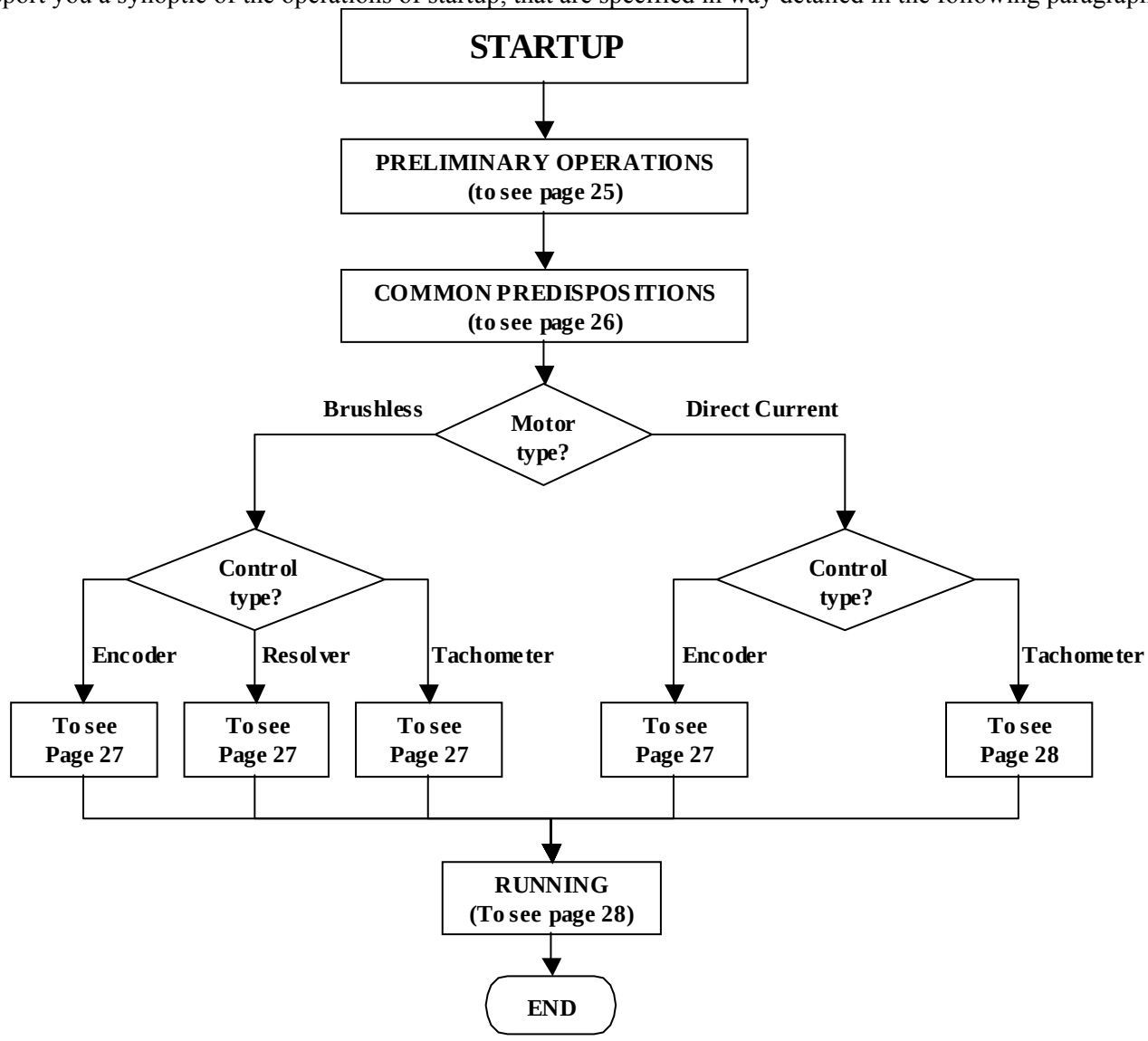


Figure 2

4.5.2 Preliminary operations

- To check that the converter has not received damages in the transport.
- To mount the converter in vertical sense away from sources of heat and so that enough free space exists above and below for a good circulation of the air of cooling.
- To use fixing panels in plate not painted connected to ground.
- To connect to a good ground the ground terminal set on the right side of the terminal block of the converter.
- To meticulously follow the schemes of connection brought in the manual.
- To use cables shielded for the signal and power connections.
- To connect the two extremities of the shields to ground, on the carpentry or on the predisposed terminals.
- For the junctions of the signal and of power cables shielded, not to use terminal block, but only shielded connectors..
- To mount blanker of disturbs (arcing contact for a.c. / diodes for d.c.) in parallel to the coils of all the contactors, relay, solenoid valve, motor monophase, motor three-phase, etc.

4.5.3 Common predisposition

Premised that:

- *The commune of the inside supplies is connected to the carpentry.*
- *The negative probe of the voltmeter and the mass of the oscilloscope have to be connected to the test point suitable "ØV" or to the frame.*
- *It is obligatory to use completely isolated screwdrivers for the regulation of the trimmers.*

To check that the voltages of service and power supplies are those suitable on the plate of the converter (to see point 1.5.1 on page 6).

To follow the followings points:

1 To power the services of the converter and to verify that the led **SUPPLY OK** illuminates him. All the RED LEDS must be switches off.

2 To rotate counterclockwise to end run the trimmer SPEED.

3 To calculate the value to measure on the T.P. "CURRENT LIMIT REF." with the following formula:

$$V_{T.P.ACL} = 10 \bullet \frac{I_{MOT}}{I_{CONV}}$$

$V_{T.P.ACL}$ = Voltage to be planned on the Test Point “CURRENT LIMIT REF.” [V].
I_{MOT} = Rated current indicated on the plate of the motor [A].
I_{CONV} = Peak current indicated on the plate of the converter [A].

To implement the setting of the current limit according to the necessary formality:

3.1 **Current limit internally planned (fixed):**

3.1.1 To setup the switch SW1.4 in position ON.

3.1.2 To adjust the trimmer "CURRENT LIMIT" so that to have on the Test Point "CURRENT LIMIT REF" the value calculated with the suitable formula to the point 3.

3.1.3 Go to point 4.

3.2 **Current limit externally planned (variable):**

3.2.4 To setup the switch SW1.4 in position OFF.

3.2.5 To provide the maximum signal (+10V) on the input "CLI" (clamp 19).

3.2.6 To adjust the trimmer “CURRENT LIMIT” so that to have on the Test Point "CURRENT LIMIT REF" the value calculated with the suitable formula to the point 3. This limit represents the maximum value of current in output from the converter.

3.2.7 Opportunely regulating the reference in the input "CLI", it is possible to modify the limit of current of the converter to suit it for his own application (within the limit to the point 3.2.6).

3.2.8 Go to the point 4.

4 To enable (if required by the application) the ramp on the reference of speed through the command "SPEED RAMP ENABLE" ("SRE") on the clamp 4.

4.5.4 Specific predispositions of the model

According to the model of used converter, it is necessary to follow one of the following paragraphs.

4.5.4.1 Model BTD2, regulation from Encoder

To suit the converter for the encoder mounted on the motor and to the reference of speed it is necessary to calculate:

$$X = \frac{PPR \bullet \omega \bullet 8}{V_{REF} \bullet 3000}$$

PPR = Number of impulses/turn of the encoder (from plate encoder) [impulses].
ω = Maximum speed of use of the motor [RPM].
V_{REF} = Value of the reference of speed to get the speed "ω" from the motor [V].

To predispose the switches as suitable in the following chart:

X	0 ÷ 1024	1025 ÷ 2048	2049 ÷ 4096	4097 ÷ 8192
SW1.1	ON	OFF	ON	OFF
SW1.2	ON	ON	OFF	OFF

NOTE: The SW1.3 has not used, therefore the position is indifferent.

4.5.4.2 Model BTD2, regulation from Resolver

In base to the type of motor to setup the switches as suitable in the following charts:

	N° POLE MOTOR		
	4 POLE	**6 POLE**	**8 POLE**
SW1.1	OFF	ON	OFF
SW1.2	OFF	OFF	ON

	RPM MAX. MOTOR	
	3000 RPM	**6000 RPM**
SW1.3	OFF	ON

4.5.4.3 Model BTD2, regulation from Dynamo Tachometer Brushless

To suit the converter for the characteristics of the Tachogenerator mounted on the motor and to the reference of speed, it is necessary to calculate:

$$X = \frac{K_{DT} \bullet \omega \bullet 8}{V_{REF}}$$

K_{DT} = Constant of speed of the Tachogenerator (read on her plate) [V/turn].
ω = Maximum speed of use of the motor [RPM].
V_{REF} = Value of the reference of speed to get the speed "ω" from the motor [V].

To predispose the switches as suitable in the following chart:

X	0 ÷ 16	17 ÷ 40	41 ÷ 56	57 ÷ 80
SW1.1	OFF	ON	OFF	ON
SW1.2	OFF	OFF	ON	ON

NOTE: The SW1.3 has not used, therefore the position is indifferent.

4.5.4.4 Model DCD2, regulation from Encoder

To suit the converter for the encoder mounted on the motor and to the reference of speed it is necessary to calculate:

$$X = \frac{PPR \bullet \omega \bullet 8}{V_{REF} \bullet 3000}$$

PPR = Number of impulses/turn of the encoder (from plate encoder) [impulses].
ω = Maximum speed of use of the motor [RPM].
V_{REF} = Value of the reference of speed to get the speed "ω" from the motor [V].

To predispose the switches as suitable in the following chart:

X	0 ÷ 1024	1025 ÷ 2048	2049 ÷ 4096	4097 ÷ 8192
SW1.1	ON	OFF	ON	OFF
SW1.2	ON	ON	OFF	OFF

NOTE: The SW1.3 has not used, therefore the position is indifferent.

4.5.4.5 Model DCD2, regulation from Dynamo Tachometer

To suit the converter for the characteristics of the Tachogenerator mounted on the motor and to the reference of speed, it is necessary to calculate:

$$X = \frac{K_{DT} \bullet \omega \bullet 10}{V_{REF}}$$

K_{DT} = Constant of speed of the Tachogenerator (read on her plate) [V/turn].
ω = Maximum speed of use of the motor [RPM].
V_{REF} = Value of the reference of speed to get the speed “ω“ from the motor [V].

To predispose the switches as suitable in the following chart:

X	**0 ÷ 50**	**51 ÷ 130**	**131 ÷ 292**	**293 ÷ 372**
SW1.1	OFF	OFF	ON	ON
SW1.2	OFF	ON	OFF	ON

NOTE: The SW1.3 has not used, therefore the position is indifferent.

4.5.5 Running

To meticulously respect the sequences of the commands described to the paragraph 4.4 on page 23.

1. To command the charge of the condensers on the D.C. BUS with the logical command “DRIVE PRESET”.
2. To only enable after the lighting of the led READY the converter with the command DRIVE ENABLE.
3. To send the maximum reference of speed to the converter and to regulate the maximum speed of the motor with the trimmer SPEED. If the sense of rotation of the shaft of the motor is contrary to that expectation, it is necessary to reverse the sign of the reference of speed or to reverse the connection of the terminal REFL and REFH. If the red led “FEEDBACK FAULT” illuminates him, to see point 3.3.3 on page 15 and point 4.3 on page 22.
4. Regular the promptness of response of the motor with the trimmer SPEED LOOP GAIN.
5. To take to “0” the speed reference. To arrest the possible slow rotation of the shaft motor, to act on the trimmer "SPEED OFFSET".
6. If the speed ramp is used (command "Speed Ramp Enable"), it is possible to regulate with the trimmer "SPEED RAMP TIME" the time of acceleration and deceleration of the motor (to see point 3.3.5 on page 17).
7. If it lights up him some leds of alarm (ROSSO), to see point 3.3.3 on page 15 and point 4.3 on page 22.

5 ENCLOSURES

5.1 External connections

5.1.1 Analog I/O

5.1.1.1 Speed reference input

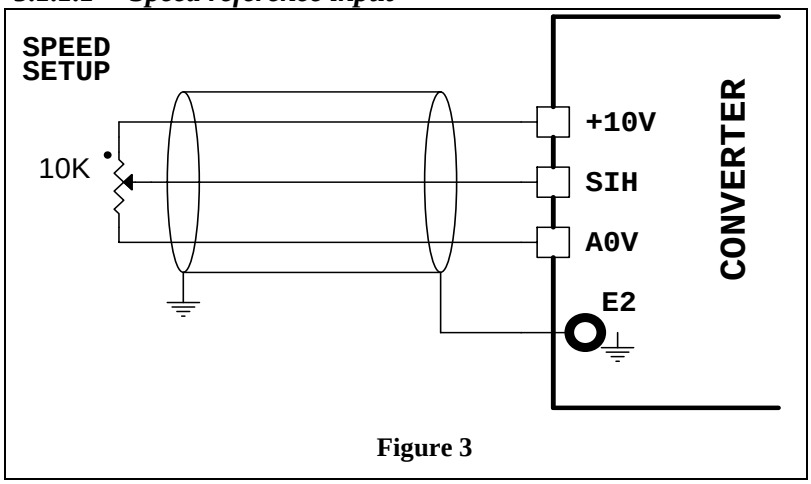


Figure 3

Example 1
Connection of a **potentiometer** to provide the reference of speed.

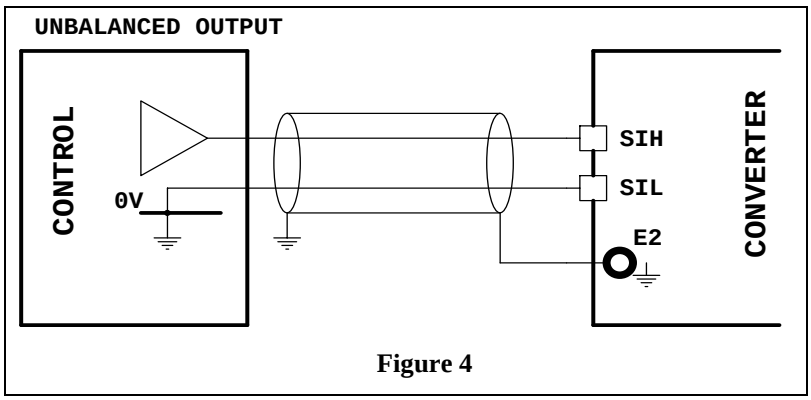


Figure 4

Example 2
Connection of a Numerical Control (or a PLC) with **unbalanced output** to furnish the reference of speed.

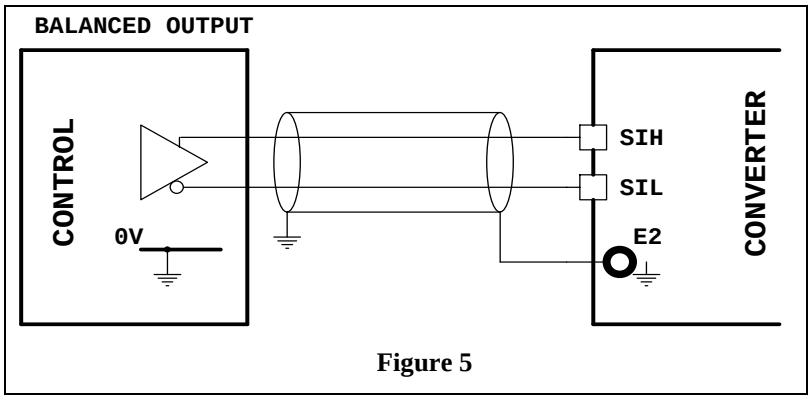


Figure 5

Example 3
Connection of a Numerical Control (or a PLC) with **output balanced** for furnishing the reference of speed.

5.1.1.2 External current limit input

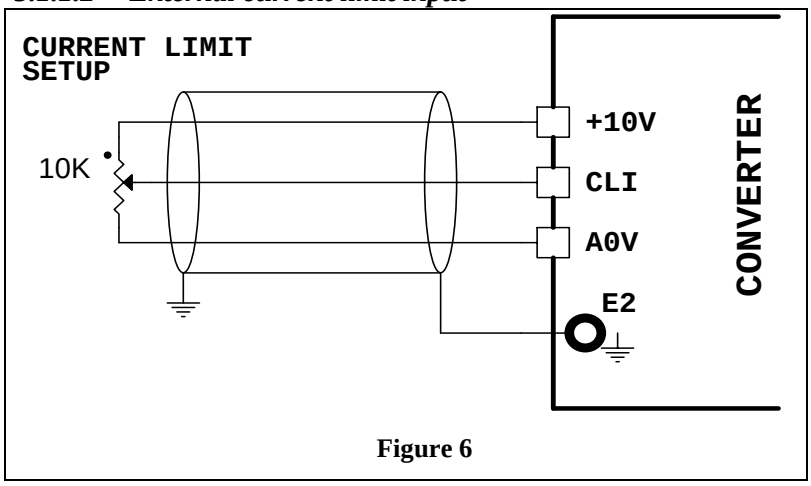


Figure 6

Example 1
Connection of a **potentiometer** to provide the reference of current limit.

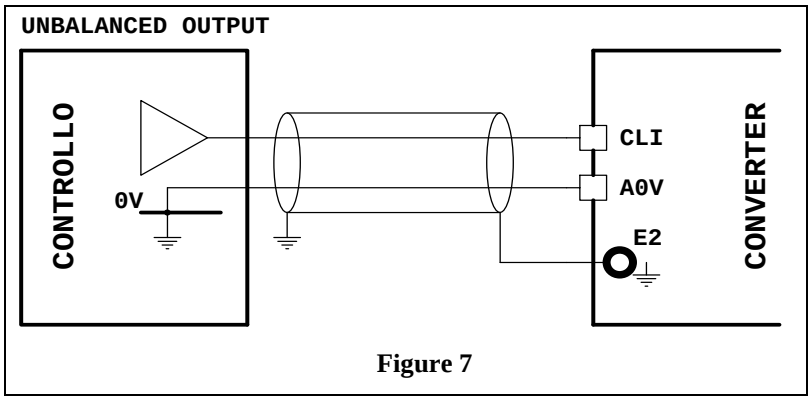


Figure 7

Example 2
Connection of a Numerical Control (or a PLC) with **unbalanced output** to furnish the reference of current limit.

5.1.1.3 Output speed monitor

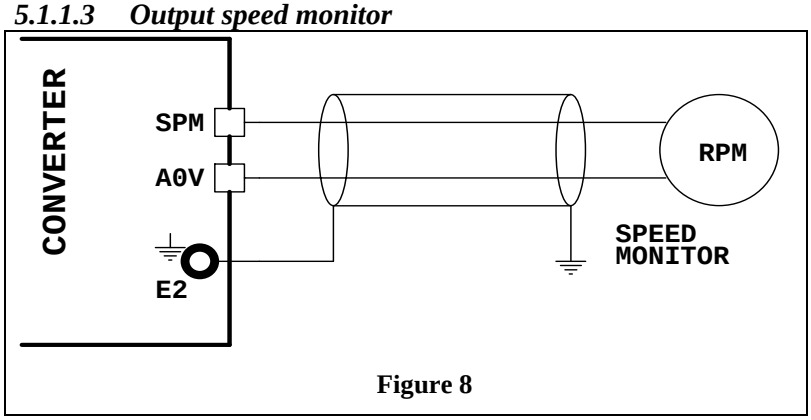


Figure 8

Example 1
Connection of an **indicative instrument of speed** with input in voltage (+/-10Vdc).

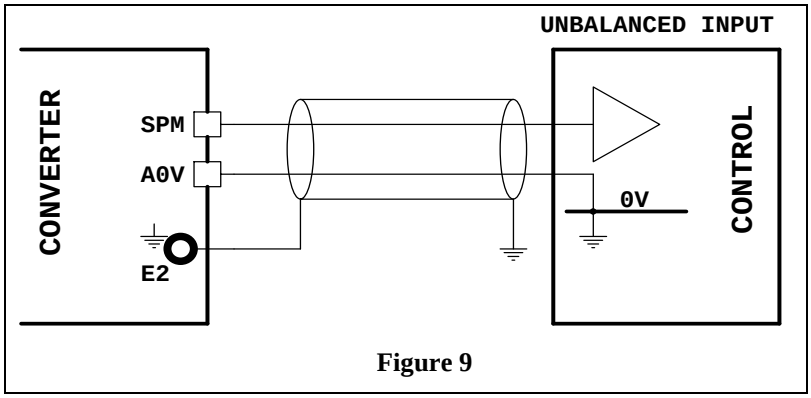


Figure 9

Example 2
Connection of an **analogical input** of the numerical control (or a PLC) to show the speed of the motor.
Furnished signal +/-10Vcc.

5.1.1.4 Output current monitor

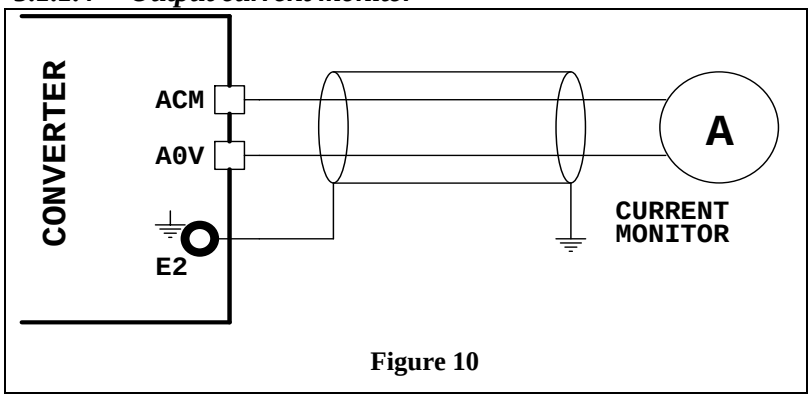


Figure 10

Example 1
Connection of an **instrument indicator of current** with voltage input (+/-10Vcc).

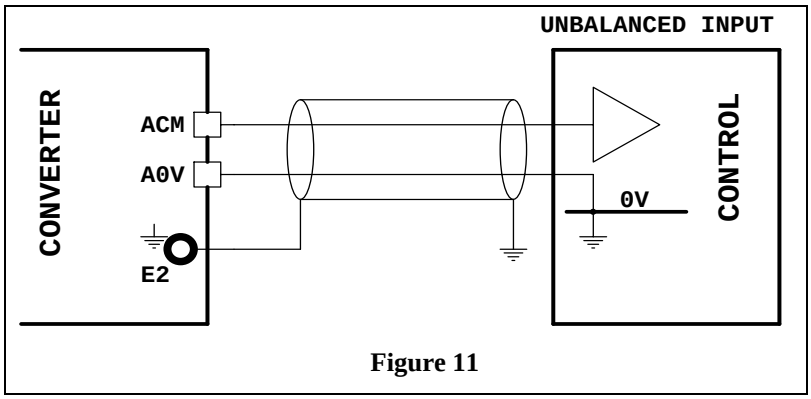


Figure 11

Example 2
Connection of an **analogical input** of the numerical control (or a PLC) to show the current of the motor.
Furnished signal +/-10Vcc.

5.1.2 Digital I/O

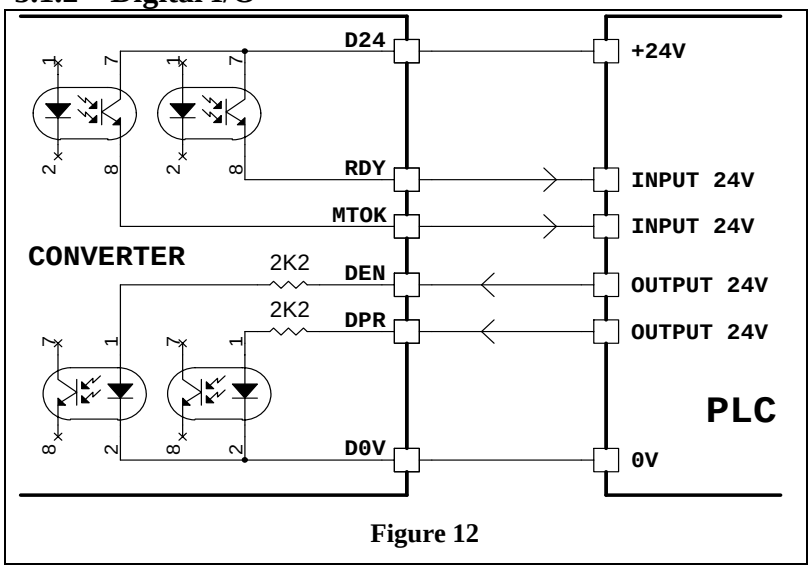


Figure 12

Example 1
Connection of a **PLC** to send and to receive the commands from the converter. Inputs and digital outputs of the PLC have to receive and/or to furnish a voltage of 24Vcc. it is necessary to connect the supply +24V of the PLC with the D24 of the converter and the 0V of the PLC with the D0V of the converter.

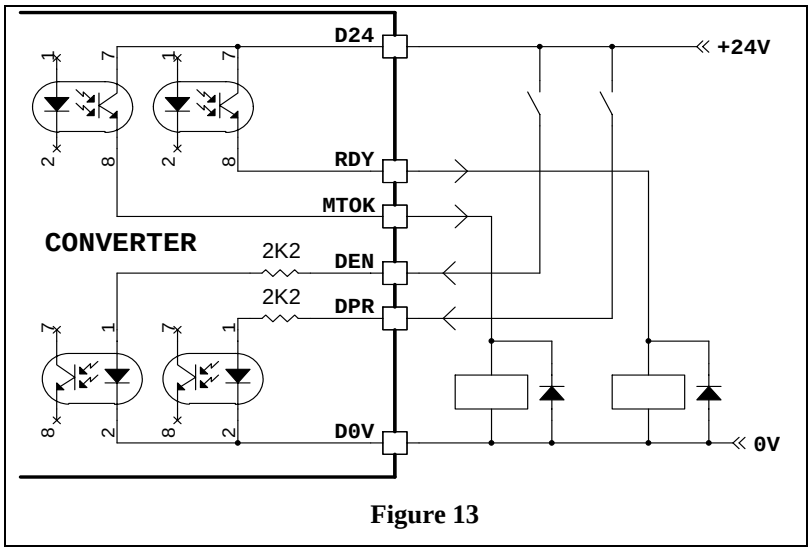


Figure 13

Example 2
Connection of **relay and contacts** to send and to receive the commands from the converter. It is necessary to connect the D24 to a supply +24Vdc and the D0V to 0V.

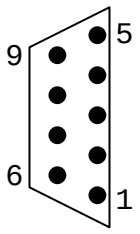
The supply 24Vcc can be furnished by the same converter (if the total current absorbed by the loads connected to the outputs doesn't overcome 100mA): to connect D24 with the clamp +24V and the D0V with the clamp A0V. In the circumstance that was not possible to use the inside supply, it is necessary to use an external feeder.

5.1.3 Signal on the I/O connector

5.1.3.1 Screws connector.

1	**D0V**	0V Digital input.
2	**DEN**	Input "Drive Enable" to enable the converter.
3	**DPR**	Input "Drive Preset" to command the D.C. bus condensers charge and to implement the Reset alarms.
4	**SRE**	Input "Speed Ramp Enable" to enable the speed ramp.
5		Not connected
6	**RDY**	Output "Ready" for signaling of ready converter to the running.
7	**MTOK**	Output "Motor Temperature OK" for signaling of the correct temperature of the motor.
8	**D24**	+24V Digital Output.
9	**ACM**	Analog output "Armature Current Monitor" to indicate the current required by the motor.
10	**A0V**	0V Analog.
11	**SPM**	Analog output "Speed Monitor" to indicate the motor speed.
12	**-10V**	Output –10V
13	**+10V**	Output +10V
14	**+24V**	Output +24V
15	**A0V**	0V analog.
16	**PTC**	Analogical input for probe PTC mounted in the motor.
17		Not connected
18	**A0V**	0V analog.
19	**CLI**	Analog input "Current Limit Input" to regulate the current limit of the converter from the outside.
20	**A0V**	0V analog.
21	**SIL**	Analog input "Speed Input Low" to connect the cable speed signal cold pole.
22	**SIH**	Analog input "Speed Input High to connect the cable speed signal hot pole.
23	**A0V**	0V analog.
24		Not connected
25	**TGO**	Tachogenerator output (only model DCD2).
26	**TGI**	Tachogenerator input (only model DCD2).

5.1.3.2 Connector CO1



PIN	SIGNAL TYPE
1	Channel "A" encoder or simulated encoder.
2	Channel "AN" encoder or simulated encoder.
3	Channel "B" encoder or simulated encoder.
4	Channel "BN" encoder or simulated encoder.
5	Channel "Z" encoder or simulated encoder.
6	Channel "ZN" encoder or simulated encoder.
9	0V

Sees connector from the side welding.

NOTE: The type of present signal on this connector has referred to the point 3.3.11 on page 20.

5.1.3.3 Connector CO3

Connector used for relieving the speed of the motor.

For the connection to see the paragraph 5.1.5 on page 36.

5.1.3.4 Connector CO4

Connector used for the "Special Functions". He is only mounted if the converter has some special function as suitable to the paragraph 6 on page 42.

5.1.4 External connection

5.1.4.1 Converter BTD2

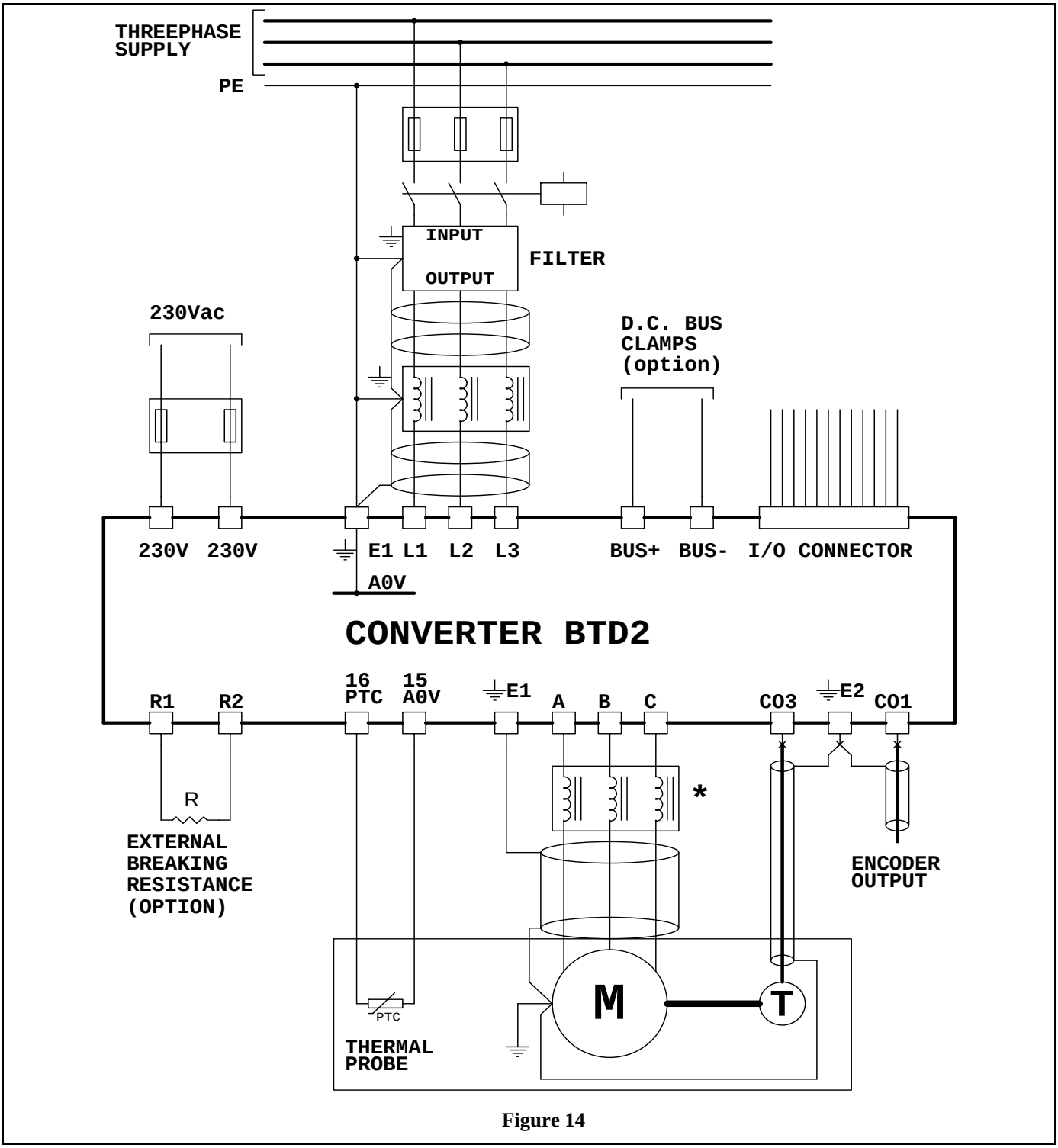


Figure 14

***:** Inductance must have mounted if the value of the "electric time constant" some motor is smaller then 1msec:

$$T_e = \frac{L_{MOT}}{R_{MOT}}$$

T_e= Electric time constant [msec].
L_{MOT} = Motor inductance (to see technical specifications of the motor) [mH].
R_{MOT} = Resistance of the motor (to see technical specifications of the motor) [Ω].

- For the sizing of the reported components in the Figure 14 to see **Chart 1** and **Chart 2** on page 14.
- To connect the thermal probe in the suitable way in the Figure 14 only if such signal is not available on the connector of the transducer.

5.1.4.2 Converter DCD2

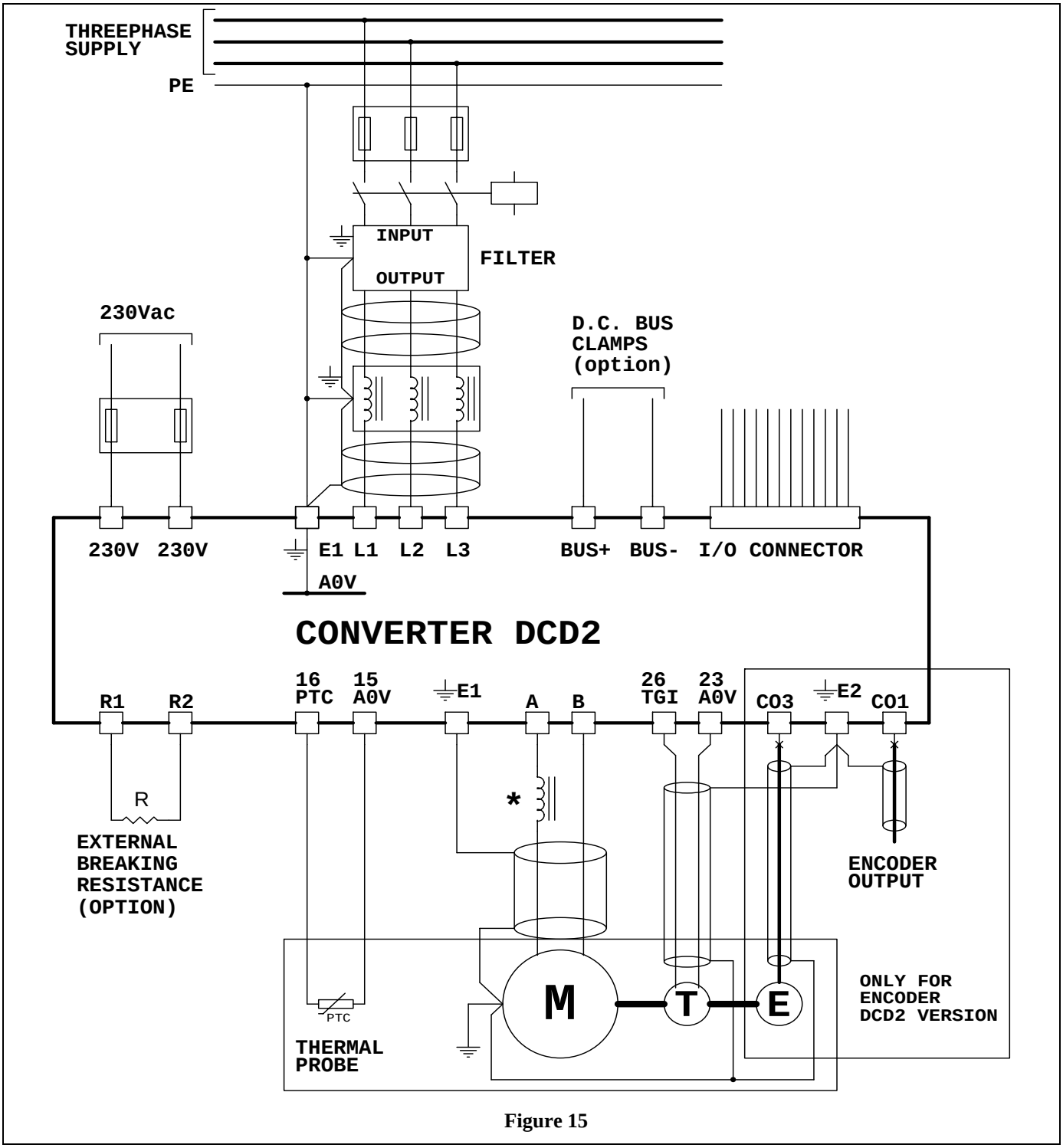


Figure 15

***:** Inductance must have mounted if the value of the "electric time constant" some motor is smaller then 1msec:

$$T_e = \frac{L_{MOT}}{R_{MOT}}$$

T_e= Electric time constant [msec].
L_{MOT} = Motor inductance (to see technical specifications of the motor) [mH].
R_{MOT} = Resistance of the motor (to see technical specifications of the motor) [Ω].

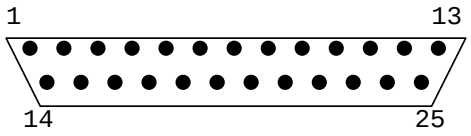
- For the sizing of the reported components in the Figure 15 to see **Chart 1** and **Chart 2** on page 14.
- To connect the thermal probe in the suitable way in the Figure 15 only if such signal is not available on the connector of the transducer.

5.1.5 Connections specific motor-converter

5.1.5.1 Brushless Motor with encoder

MOTOR MODEL	MOTOR SIDE CONNECTION														
	MOTOR			SIGNAL CONNECTOR (pin)											
				ENCODER											PTC
R.C.V. series UL5 e UL7	C	B	A	E	D	C	P	J	F	M	K	L	H	A	*	*
R.C.V. series UL5 e UL7	Yell.	red	blue	E	D	C	P	J	F	M	K	L	H	A	*	*
LAFERT series T (new)	W	U	V	A	H	G	F	P	B	M	N	R	L	C		
BRUSATORI series BR	W	V	U	P	C	E	G	L	K	H	J	M	N	A	S	T
BRUSATORI series BR	C	B	A	P	C	E	G	L	K	H	J	M	N	A	S	T

A	B	C	21	20	18	19	22	23	24	25	12	13	7	1	14
CLAMPS			CONNECTOR CO3 (pin)												



SEES SIDE WELDINGS

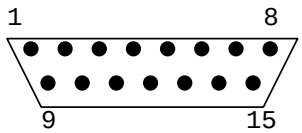
CONVERTER SIDE CONNECTION

***** = In this motor the thermal probe (PTC) it is not connected on the connector of the signals. To connect her therefore to the clamps n°15 and n°16 of the converter (to see Figure 14 on page 34 and point 3.3.6 on page 18).

5.1.5.2 Brushless Motor with Tachogenerator Brushless and Hall sensor

MOTOR MODEL	MOTOR SIDE CONNECTION													
	MOTOR			SIGNAL CONNECTOR (pin)										
				TACHOGENERATOR BRUSHLESS									PTC	
LAFERT series T (old)	W	V	U	GW	GV	GU	GØ	Vcc	SU	SV	SW	VØ		
LAFERT series T (old)	4	3	2	12	11	7	6	4	1	2	3	5		
SIEMENS series FT1 e FT5	4	3	2	12	11	7	6	4	1	2	3	5		
SIEMENS series FT1 e FT5	W	V	U	12	11	7	6	4	1	2	3	5		
A.B.B. (Isoflux) series 64 e 74	C	G	F	G	H	F	I	B	E	D	C	A		
BAUMULLER series DS56-DS71-DS100	U	V	W	9	10	7	6-8-11	2	5	3	4	1		
LAFERT series T (new)	C	B	A	12	11	7	6	4	1	2	3	5		
LAFERT series T (new)	W	V	U	12	11	7	6	4	1	2	3	5		
DRIVE SYSTEM series BLT	1	2	3	B	K	A	J	D	N	W	Z	M		
BAUMULLER series SM	V	W	U	10	11	9	8	2-4-6	7	5	3	1-12		

A	B	C	11	10	12	2	6	15	14	13	7	1	9
CLAMPS			CONNECTOR CO3 (pin)										



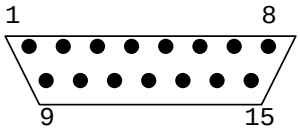
SEES SIDE WELDINGS

CONVERTER SIDE CONNECTION

***** = In this motor the thermal probe (PTC) it is not connected on the connector of the signals.
To connect her therefore to the clamps n°15 and n°16 of the converter (to see Figure 14 on page 34 and point 3.3.6 on page 18).

5.1.5.3 Brushless Motor with Tachogenerator D.C. and Hall sensor

MOTOR MODEL	MOTOR SIDE CONNECTION												
	MOTOR			SIGNAL CONNECTOR (pin)									
				TACHOGENERATOR D.C.								PTC	
BOSCH SD-B4	3	1	2	1	2	3	4	5	9	10	11		
	A	B	C	15	14	13	10	11	6	7	8	1	9
	CLAMPS			CONNECTOR CO3 (pin)									



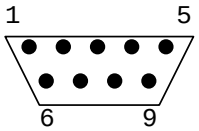
SEES SIDE WELDINGS

CONVERTER SIDE CONNECTION

***** = In this motor the thermal probe (PTC) it is not connected on the connector of the signals.
To connect her therefore to the clamps n°15 and n°16 of the converter (to see Figure 14 on page 34 and point 3.3.6 on page 18).

5.1.5.4 Brushless Motor with resolver

MOTOR MODEL		MOTOR SIDE CONNECTION										
TYPE	POLE	MOTOR			SIGNAL CONNECTOR (pin)							
					RESOLVER						PTC	
R.C.V. series UL5 e UL7	8	B	C	A	F	D	C	B	E	A		
R.C.V. series UL5 e UL7	8	red	Yell.	blue	F	D	C	B	E	A		
LAFERT series T (old)	6	3	4	2	11	7	3	1	2	6		
STOEBER	6	2	3	1	8	7	3	2	4	1		
ISOFLUX series 6 e 7	4	G	C	F	7	5	1	10	2	11		
LAFERT series T (new)	6	B	C	A	11	7	3	1	2	6		
LAFERT series T (new)	6	V	W	U	11	7	3	1	2	6		
LAFERT series S	6	V	W	U	7	11	6	1	2	3		
MOOG	12	4	1	2	8	7	3	2	4	1		
MAGNETIC	6	U	V	W	E	A	G	B	H	C		
A.B.B. series 8	6	V	W	U	7	5	1	10	2	11		
SOELMA	6	C	B	A	E	R	F	H	S	G		
LAFERT series T (new)	4	V	U	W	11	7	2	1	3	6		
VICKERS type FAS-T	6	C	A	B	B	D	H	E	G	C		
VICKERS type FAS-T	6	W	U	V	B	D	H	E	G	C		
BRUSATORI series BR	8	B	C	A	V	U	F	C	E	D	S	T
BRUSATORI series BR (from 10/2000)	8	C	A	B	V	U	F	C	E	D	S	T
LAFERT series S	4	V	W	U	11	7	6	1	2	3		
BAUMULLER series DS100M	6	V	W	U	10	12	6	1	5	8		
Control Techniques type MSB	6	B	A	C	B	A	F	C	E	D		
E.C.S. type 145ES20	8	B	A	C	A	B	F	C	E	D		
		A	B	C	7	2	8	4	3	9	1	6
		CLAMPS			CONNECTOR CO3 (pin)							



SEES SIDE WELDINGS

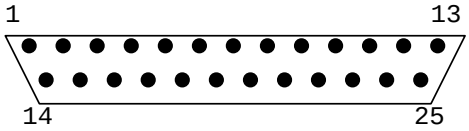
CONVERTER SIDE CONNECTION

***** = In this motor the thermal probe (PTC) it is not connected on the connector of the signals. To connect her therefore to the clamps n°15 and n°16 of the converter (to see Figure 14 on page 34 and point 3.3.6 on page 18).

5.1.5.5 Direct current motor with tachogenerator

For this type of motor they are not scheduled subordinate specific connections from the model of the motor.
To follow the connections of the motor and the tachogenerator ("T") as indicated in the Figure 15 on page 35.

5.1.5.6 Direct current motor with encoder

MOTOR SIDE CONNECTION									
SIGNAL CONNECTOR (pin)									
ENCODER								**PTC**	
Z	**ZN**	**A**	**AN**	**B**	**BN**	**+5V**	**0V**	**+P**	**0V**
12	**13**	**22**	**23**	**24**	**25**	**21**	**7**	**14**	**1**
CONNECTOR CO3 (pin)									
									
SEES SIDE WELDINGS									
CONVERTER SIDE CONNECTION									

- To connect the encoder as indicated to the left in the chart.
- To connect the armature of the motor as indicated in Figure 15 on page 35.
- If the probe of temperature PTC of the motor is not connected on the connector of the signals, it is possible to use the clamps 15 and 16 of the converter (to see Figure 15 on page 35 and the point 3.3.6 on page 18).

5.2 Mechanical characteristics

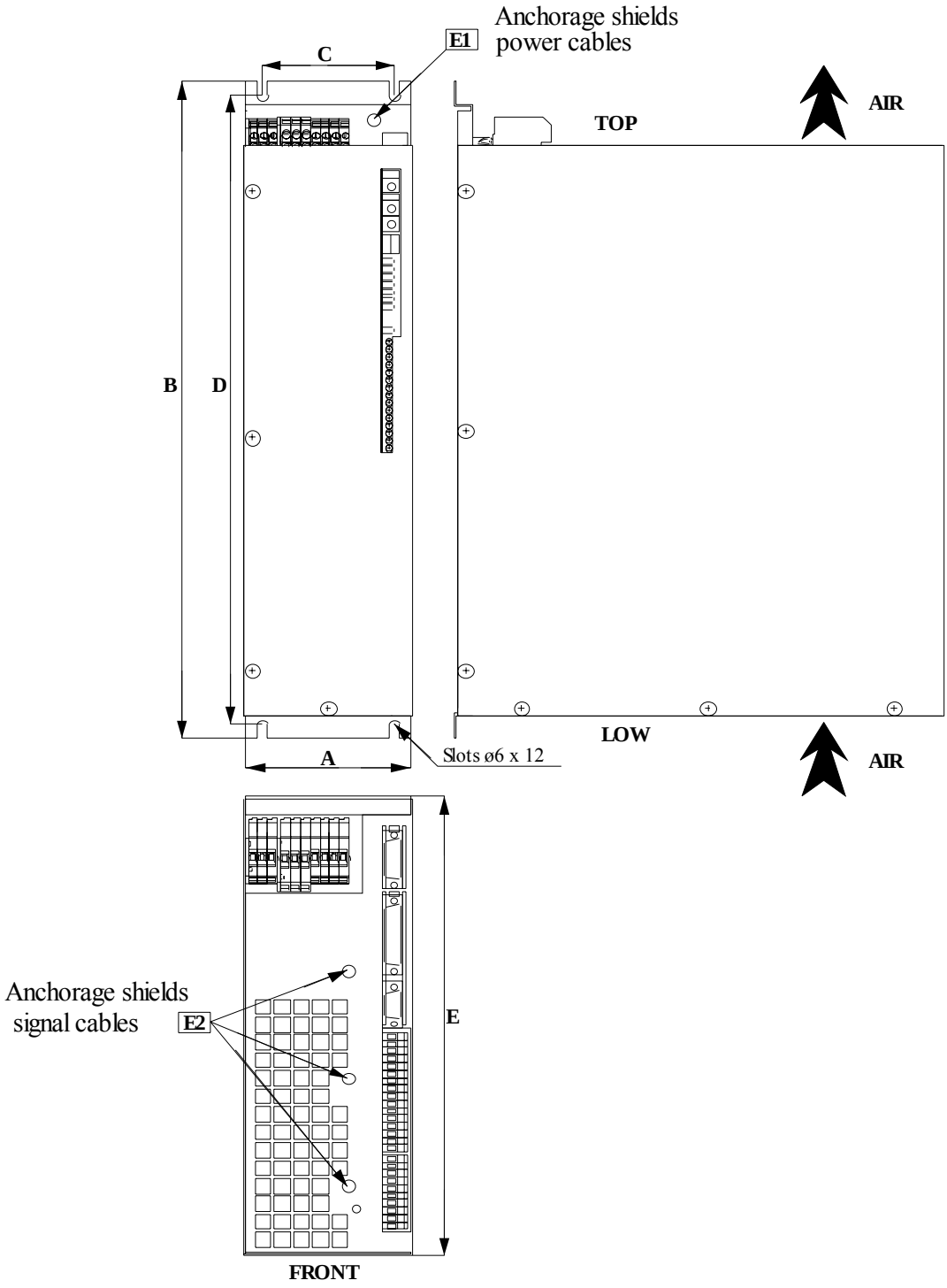


Figure 16

SIZE	DIMENSION [mm]					MASS
	A	B	C	D	E	[Kg] (max)
1	106	439	83,3	421	307	9,4
2	162	439	140	421	382	17,3

5.3 Coding charts

5.3.1 Model BTD2

Drive model	type of transducer mounted on the motor		resistance of recovery	options			output maximum voltage	output current rated
BTD2-	**x**	**x**	**x**	**x**	**x**	**x**	**-xxx -**	**xxx**
								006= 6A 010= 10A 020= 20A 030= 30A 040= 40A 050= 50A 060= 60A 080= 80A 100= 100A
							230 = 230V 400 = 400V	
				000 = standard M01 = Master 1 (Antibacklash function) S01 = Slave 1 (Antibacklash function) MF1 = Master 1 (Antibacklash function) + Three phase filter incorporated SF1 = Slave 1 (Antibacklash function) + Three phase filter incorporated 0F1 = Three phase filter incorporated C01= CANBUS card version 01 CF1= CANBUS card version 01 + Three phase filter incorporated			
			I = resistance of recovery, inside to the converter E = resistance of recovery to be mounted external to the converter					
	R 2 = 2 pole resolver R 6 = 6 pole resolver T 0 = brushless tachogenerator + hall sensor to 120° T 1 = d.c. tachogenerator + hall sensor 12V to 60° E 0= incremental encoder + sectors to 120°							
BTD2 = brushless drive series 2								

5.3.2 Model DCD2

Drive model	type of transducer mounted on the motor		resistance of recovery	options			output maximum voltage	output current rated
DCD2-	**x**	**x**	**x**	**x**	**x**	**x**	**-xxx -**	**xxx**
								006= 6A 010= 10A 020= 20A 030= 30A 040= 40A 050= 50A 060= 60A 080= 80A
							230 = 230V 400 = 400V	
				000 = standard M01 = Master 1 (Antibacklash function) S01 = Slave 1 (Antibacklash function) MF1 = Master 1 (Antibacklash function) + Three phase filter incorporated SF1 = Slave 1 (Antibacklash function) + Three phase filter incorporated 0F1 = Three phase filter incorporated				
			I = resistance of recovery, inside to the converter E = resistance of recovery to be mounted external to the converter					
	T 1= d.c. tachogenerator E 1= incremental encoder							
DCD2 = direct current drive series 2								

Example:

DCD2-T1I000-400-006 it corresponds to:
- direct current drive series 2
- predisposed for d.c. tachogenerator
- with inside resistance of recovery
- output maximum voltage 400V
- output current rated 6A

6 SPECIAL FUNCTION

6.1 Antibacklash with two converter

6.1.1 Preliminary

Using two converters and two motors is possible to eliminate the mechanical backlash between pinion and rack.
The two converters must be predispose in factory for this type of functioning.
The converters predisposed with this function are identified with the nameplate "M01" or "MF1" (for the MASTER) and "S01" or "SF1" (for the SLAVE), on the nameplate of the converter in the section "options" (to see Coding charts on page40).

6.1.2 Connection draft

The following draft of connection is an integration of the Figure 14 on page 34 or of the Figure 15 on page 35.
Therefore it will need to effect the suitable connections in the Figure 14 or in the Figure 15 as it regards the connections "standard" (motor, transducer of speed, supply, commands, options); it will need to follow the indications of the Figure 17 as it regards the realization of this special function.

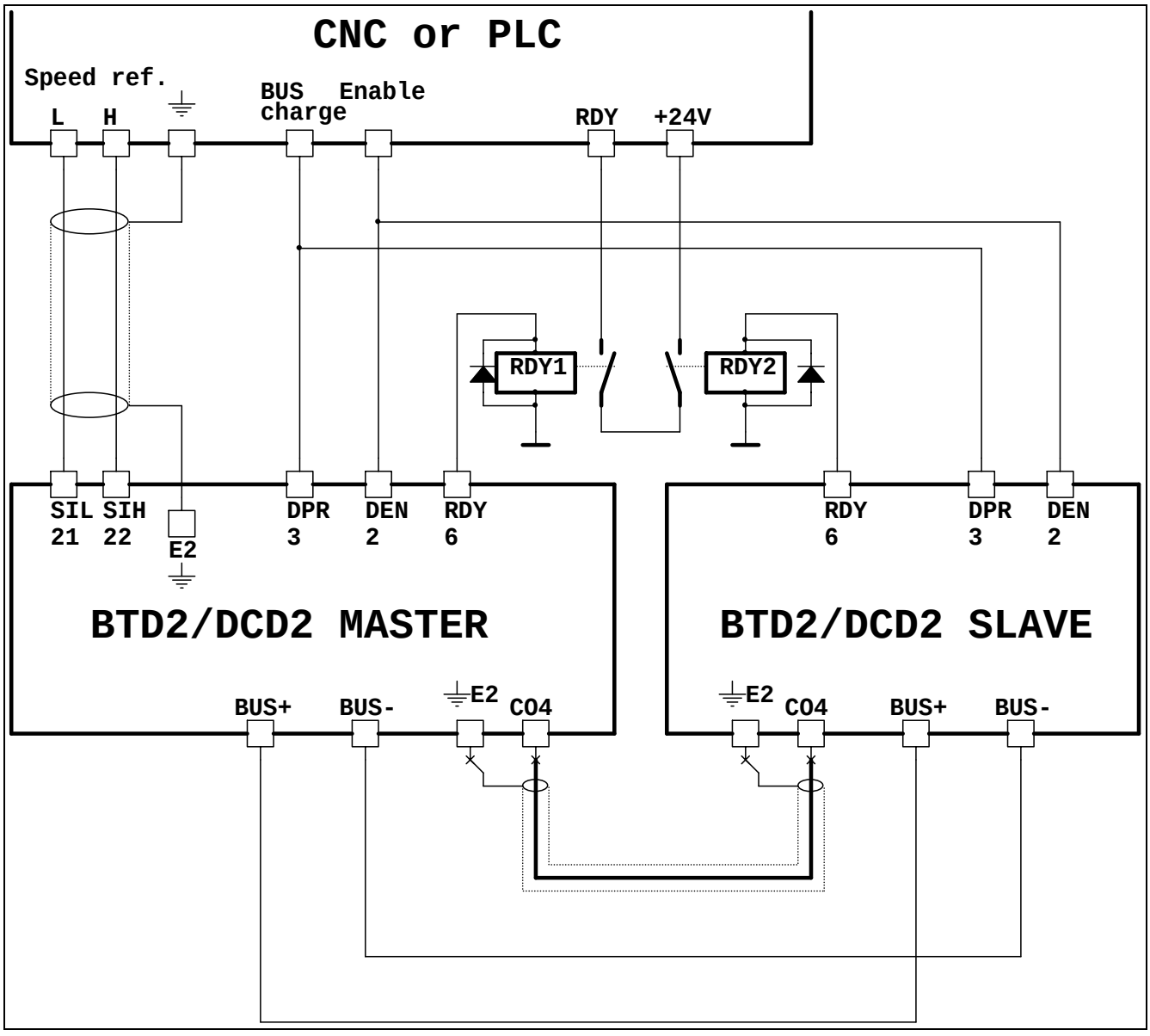


Figure 17

The two converters (Master and Slave) they must be sees from the unity of command (CNC or PLC) as an only unity, so that if one of the two converters goes to alarm, also the other one has to stay. For this motive the digital outputs "Ready" some two converters are connected as suitable in the Figure 17; if a PLC is used, it is possible not to use the two suitable relays as "RDY1" and "RDY2" in figure, but to directly connect the two digital outputs to the digital inputs of the PLC and to realize the equivalent circuit (that is the series of the open contacts) inside the software.

6.1.3 Predispositions

Before starting the motors, it is necessary to realize the following predispositions:

1. To connect through the two converters the connectors "CO4" with a special cable that can be realized following this scheme:

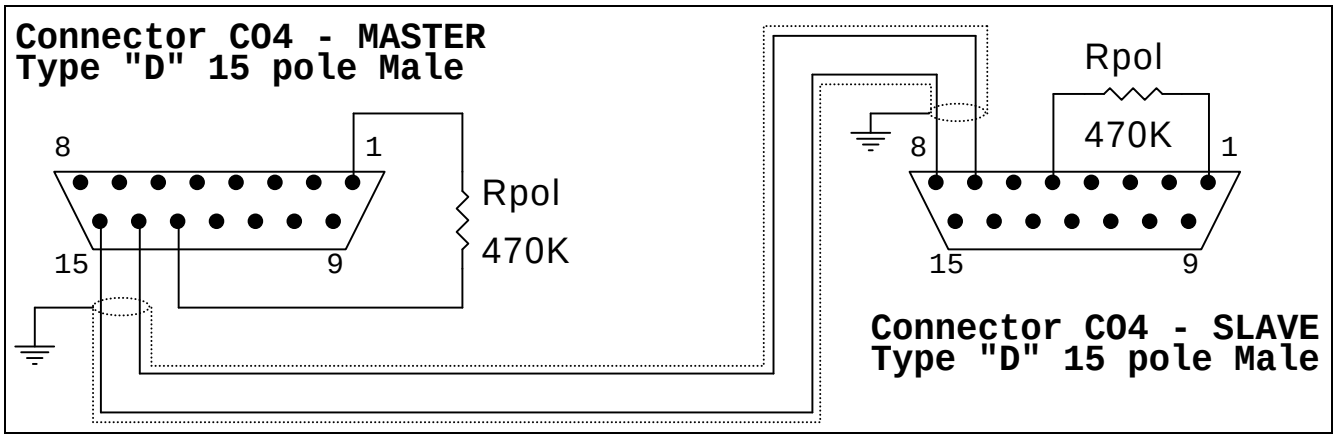


Figure 18

2. To calculate the value of the resistances "Rpol" suitable in the Figure 18 that regulate the current of opposition in the motors, respecting the followings points:
   - The resistances have to have equal value.
   - Reducing the value him increases the current of opposition in the motors.
   - The value is calculated with the following formula:

$R_{pol} = \frac{30.000}{I_{CONT}} \times I_{CONV}$	R_{POL}= *Resistor Rpol value [ohm]* I_{CONV}= *Peak current indicated on the plate of the motor [A]* I_{CONT}= *Opposition current in the motors [A]*

   - With a value of R_{POL}=470KΩ a current of opposition is had in the motors equal to around the 6% of the current of peak of the converters.

Note:

1. The senses of rotation of the motors have to be concordant.
2. The converter Master must be mounts placed side by side to the converter Slave.
3. To connect the motor MASTER and SLAVE as described in the Figure 14 on page 34 or in the Figure 15 on page 35.
4. To perform the connection among the converters as described in the Figure 17.
5. To give the commands of "charge bus" (DPR) and "enabling" (DEN) contemporarily to both the converters, as represented in the Figure 17.
6. To realize with logic hardware (relay) or software (program PLC), the series of the outputs "ready" (RDY) of the converters so that if two one goes to alarm, you also provoke the stop some other, as represented in the Figure 17.
7. To perform only the settings on the converter MASTER as described in the paragraph 4.5 on page 25.
8. On the converter SLAVE is not necessary to perform settings.

6.1.4 Startup

To meticulously respect the sequences of the commands described to the paragraph 4.4 on page 23.

For the starting of the converter MASTER to follow the suitable procedure to the point 4.5.5 on page 28.

NOTES

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