DRIVES
with brushless servomotors
SERIES 8
and digital convertors
BHL-D

In conformity with EEC Directives and CE mark

Use and installation manual

Ref. MAN1U04.9607 GB
Updating 02
Edition March 1997

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ABB Servomotors S.r.l.
Registered Office: piazzale Lodi, 3 | 20137 Milano
Offices and Factory:
Frazione Stazione Portacomaro 97/C
| 14100ASTI

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1.1 Preliminary note

This manual is referred to drives (see paragraph 1.2.5) made up of brushless servomotors **SERIES 8** and of convertors **SERIES BHL-D**. It has been compiled by ABB Servomotors S.r.l. and is intended to be used by its own customers, who use it under their own responsibility. No further guarantee, besides what stated on the contract, will therefore be granted by ABB Servomotors, in particular for possible imperfections and/or incompleteness of the text and any liability is expressly excluded for direct or indirect damages, deriving from the use of this documentation.
For the correct installation and start-up of the drives, made of servomotors SERIES 8 and of convertors series BHL-D, it is necessary to follow what indicated in this manual scrupulously.

1.2 Terminology

International regulations have standardized the terminology connected to drives, their components, accessories, performances, etc... Following are some significant definitions. Numbers between square brackets refer to reference documents cited in paragraph 1.3.

1.2.1

EMC (Electro Magnetic Compatibility): the capability of a device, an apparatus or of a system to function in its electromagnetic environment satisfactorily, without introducing electromagnetic disturbances not acceptable for what is placed in that environment; in practice, this expression includes all requirements both of **emission** (disturbances provoked by the apparatus) and of **immunity** of the apparatus itself from envirorimental disturbances.

1.2.2

APPLIANCES: all electric and electronic devices, as well as apparatus, systems and plants containing electric or electronic components.

1.2.3

ELECTROMAGNETIC DISTURBANCES: electromagnetic phenomena that can alter the operation of a device, an apparatus or a system.

1.2.4

IMMUNITY: the capability of a device, an apparatus or a system to function when electromagnetic disturbances are present without affecting its performances.

1.2.5

PDS (Power Drive System); Fig. 1-1 [4] shows the configuration of a PDS placed in an installation. A PDS is a system which converts electric energy in mechanical energy, with the use of power electronics devices, according to a command function (and according to a program).
A PDS can also be represented with the block diagram of Fig. 1-2 and is mainly made up of:

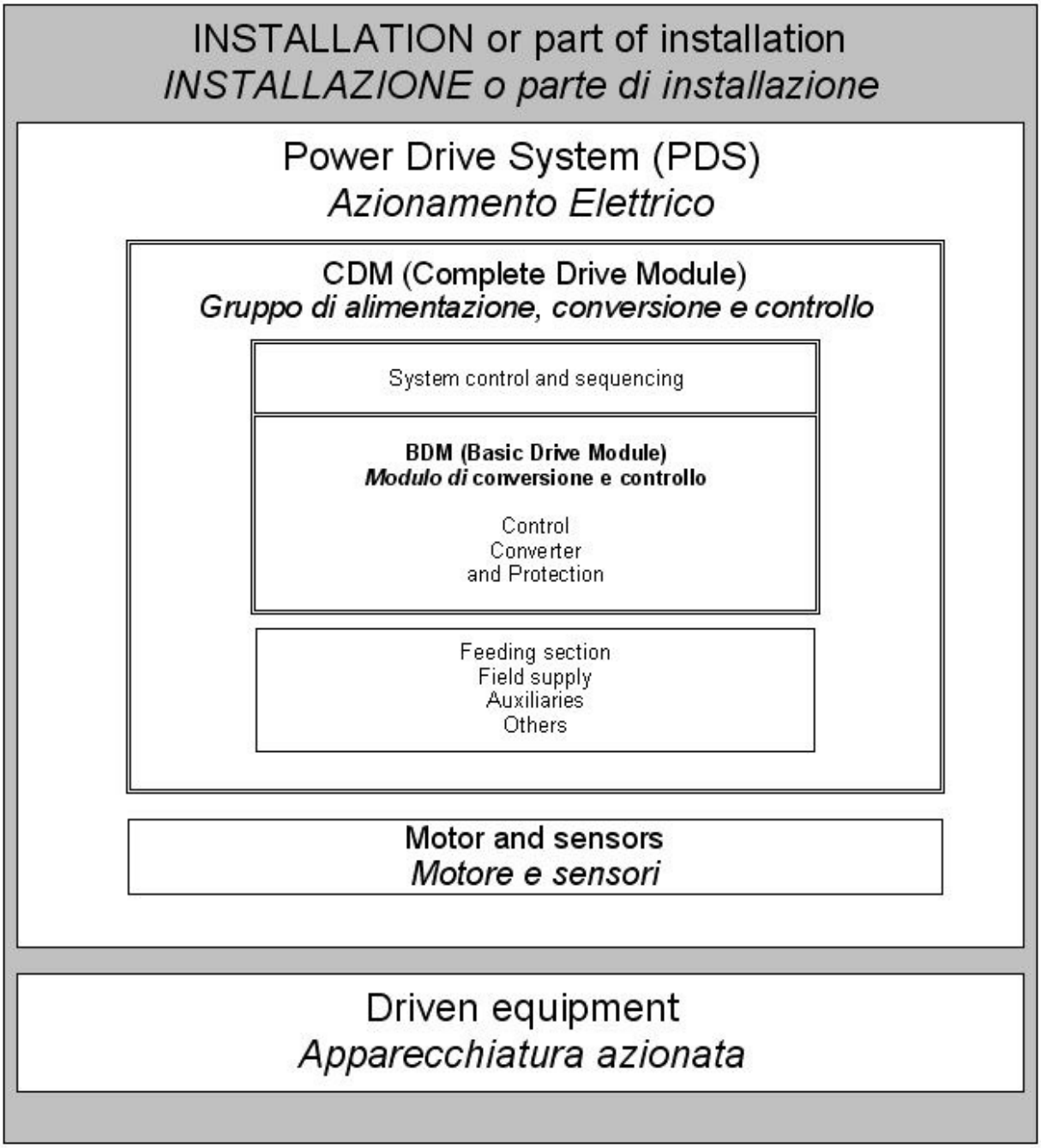

INSTALLATION or part of installation
INSTALLAZIONE o parte di installazione
Power Drive System (PDS)
Azionamento Elettrico
CDM (Complete Drive Module)
Gruppo di alimentazione, conversione e controllo
System control and sequencing
BDM (Basic Drive Module)
Modulo di conversione e controllo
Control
Converter
and Protection
Feeding section
Field supply
Auxiliaries
Others
Motor and sensors
Motore e sensori
Driven equipment
Apparecchiatura azionata

Fig.1-1

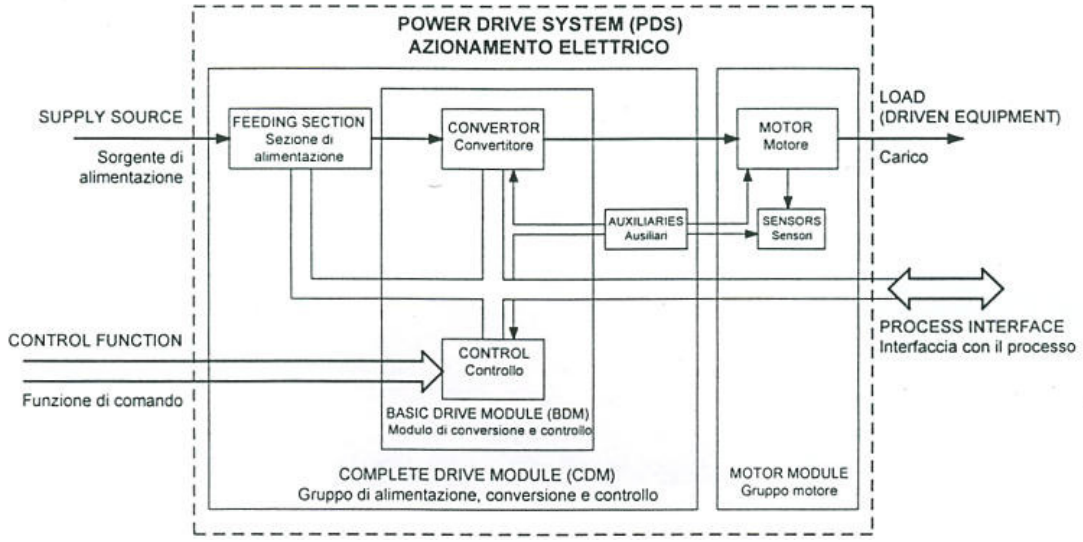


Fig. 1-2

- a **CDM** (Complete Drive Module), which includes the complete PDS except motor and sensors assembled on the motor; in particular, it includes a **BDM** (Basic Drive Module) and its possible extensions such as the supply section or some accessories (e.g. ventilation). The BDM includes all functions of conversion, control and self-protection. In practice, the CDM is normally called CONVERTOR.
- **Motors and Sensors.**

1.2.6

APPARATUS: final product with an intrinsic function for the end user, destined to be put on the market as a single commercial unit.

1.2.7

SYSTEM: union of several apparatus combined so as to obtain a specific aim and destined to be put on the market as a single commercial unit

1.2.8

INSTALLATION: union made up of several apparatus and/or systems combined together so as to obtain a specific aim but not destined to be put on the market as a single commercial unit.

1.2.9

COMPONENT: element used for the realization of an apparatus, but that cannot be regarded as an apparatus itself, since it has no intrinsic function for the end user.
Simple components are not subjected to EMC Directive.

1.2.10

UNRESTRICTED DISTRIBUTION [4]: way of commercializing where the supply of apparatus does not depend on the competence of the customer or of the user in relation to EMC for the application of PDS's. This means restrictive limits of emission in view of the essential requirements of EMC protection.

1.2.11

RESTRICTED DISTRIBUTION [4]: way of commercializing where the manufacturer limit the supply of apparatus to suppliers, customers or users that, separately or as a group**,** are

technically competent in relation to requirements of EMC for the application of PDS's. For economical reasons, the interested parties should guarantee essential requirements of EMC protection, for the specific installation, by choosing adequate categories of emission, thanks to in situ measurements of the actual conditions and thanks to the exchange of technical specifications.

1.2.12

FIRST ENVIRONMENT [4]: environment that includes domestic users. It also includes all industrial users directly connected (without intermediate transformers) to a low voltage electric supply line that supplies buildings devoted to domestic uses.

1.2.13

SECOND ENVIRONMENT [4]: environment that includes all industrial users not connected directly to a low voltage electric supply line that supplies buildings devoted to domestic uses.

1.2.14

IN SITU (for tests) [4]: environment where the apparatus is installed for its normal use by the end user and where the apparatus can be tested.

1.3 Reference documents and standards

We cite the main reference documents and standards (European Community directives, related Italian laws and reference documents), to which we refer in the text of this manual. References in the text are in square brackets.

1.3.1 Electro Magnetic Compatibility Directive

[1] Community Directive 89/336/EEC dtd 3 May 1989 related to Electro Magnetic Compatibility and following modifications 92/31/EEC and 93/68/EEC;

[2] Italian Decree Law 4 December 1992, n° 476 "Actuation of the directive 89/336/EEC of the Council on 3 May 1989, on the approximation of the laws of the member states relating to Electro Magnetic Compatibility, amended by directive 92/31/EEC of the Council on 28 April 1992";

[3] Italian Decree Law 12 November 1996, n° 615 "Actuation of the directive 89/336/EEC of the Council on 3 May 1989, on the approximation of the laws of the member states relating to Electro Magnetic Compatibility, amended and integrated by the directive 92/31/EEC of the Council on 22 July 1993 and by the directive 93/97/EEC of the Council on 29 October 1993".
Note:
This Italian Decree Law repeals Decree Law [2], except forArt. 14, paragraph 2.

1.3.2 Low Voltage Directive

[4] Directive 73/23/EEC dtd 1973-02-19, on the approximation of the laws of the member states relating to the electric material intended to be used within certain voltage limits, integrated in the directive 93/68/EEC dtd 1993-06-29.

[5] Italian Law 18 October 1977, n° 791 "Actuation of the directive of the Council of European Communities (n. 73/23/EEC) related to safety guarantees that the electric material intended to be used within certain voltage limits must possess"

[6] Italian Decree Law 25 November 1996, n° 626 "Actuation of the directive 93/68/EEC related to CE mark of electric material intended to be used within certain voltage Limits".

Reference documents

[7] Standard IEC_CENELEC EN 60204-1, class. IEC 44-5 "Safety of machinery. Electric equipment of machines. Part 1: General rules".

[8] Standard CENELEC EN 61800-3: "Adjustable speed electrical power drive systems Part 3: EMC product standard including specific test methods".

Documents [7] and [8] contain very detailed lists of standard references.

[9] Standard CENELEC EN60034-1 "Rotating Electric Machines. Part 1: Nominal and operating characteristics".

[10] Standard CENELEC EN60034-5 "Rotating Electric Machines. Part 5: Classification of the protection degrees of the cases of electric rotating machines".

[11] Standard CENELEC EN60034-7 "Rotating Electric Machines. Part 7: Classification of construction forms and of types of installation".

[12] Standard CENELEC EN60034-9 "Rotating Electric Machines. Part 9: Noise limits".

[13] Standard CENELEC EN60034-18-1 "Rotating Electric Machines. Part 18: Functional evaluations of insulation systems - Section 1: general directives".

1.4 Compliance with the EMC Directives and CE mark

1.4.1 Conditions for the compliance with the EMC directives of the drives made up of servomotors SERIES 8 and convertors SERIES BHL-D.
The compliance of the drives defined in the title of this paragraphwith directives [1], [2], [3] on Electro Magnetic Compatibility is valid only under the conditions listed below.

1.4.1.1
Drives defined in the title of this paragraph are commercialized only as PDS and in **restricted distribution** (see paragraph 1.2.11); therefore the manufacturer of the cabinet and/or the technician in charge of the installation and/or the end user are competent in EMC field.

1.4.1.2
Drives defined in the title of this paragraph must be **installed according to the instructions contained in Chapter 3 of this manual,** in particular prescriptions in paragraph 3.3 **"Guidelines on the application of Electro Magnetic Compatibility"** must rigorously be followed.

1.4.1.3
Drives defined in the title of this paragraph are **components,** sold to be included as part of an apparatus or system or installation; therefore the operating conditions of the PDS inside the apparatus, system or installation must be as prescribed in Chapter 3 of this manual.

1.4.1.4
Drives defined in the title of this paragraph must be intended only to be used in the "**Second Environment**" (see paragraph 1.2.13).

1.4.2 Compliance of the drives defined in the title of *this paragraph with the EMC directives [1], [2] and [3] and with the Low Voltage Directive [4], [5] and [6]*

Declaration of conformity
ABB Servomotors declares that, under the conditions specified in this document, in particular in paragraph 1.4, drives made up of **servomotors SERIES 8 and convertors series BHL-D** are in conformity with the EMC EEC Directives [1], including the latest amendments, with the related Italian laws of approximation, [2] and [3], and with the Low Voltage Community Directives [4], [5] and [6]; the applicable standards can be seen in paragraph 1.3.3.

1.4.3 Notes.for the application of *other EEC directives*

Drives, being electric components, are not subjected to other EEC directives, beside those indicated in paragraph 1.3. However, for application reasons, there are references in other directives in particular, to comply with the requirements of article 4 of the **Machine Directive 89/392 EEC and further amendments 91/368 EEC, 93/44 EEC, 93/68 EEC, Italian law of approximation D.P.R. n° 459 dtd 24/07/1996**, we include the manufacturer's declaration (also known as Declaration of Incorporation").

Manufacturer's Declaration
In order to comply with the Machine Directive (MD) 89/392/EEC and further amendments, ABB Servomotors declares that drives made up of **servomotors SERIES 8 and convertors series BHL-D** must be installed according to its instructions and must not be started-up until the machinery into which they are to be incorporated has been found and declared to be in conformity with a.m. MD directive.

1. 5 Symbols related to safety

In this edition the following symbols are used:

1.5.1

WARNING ! This symbol draws attention to a situation that may be (even seriously) dangerous for people or that may provoke serious damages to the apparatus or the system driven. This is the most important alarm level. It is **absolutely** necessary to follow the instructions signaled with symbols 1.5.2 and 1.5.3!

1.5.2

WARNING ! Dangerous voltage: it signals dangerous situations as described in 1.5.1, due to electric voltages.

1.5.3

WARNING ! **Generic danger:** it signals dangerous situations as described in 1.5.1, due to other causes than electric voltage.

1.5.4

CAUTION This symbol is used to signal a level of danger lower than the one indicated by "WARNING!". The situations signaled by this symbol may bring to minor damages both for people and for machinery.

1.5.5

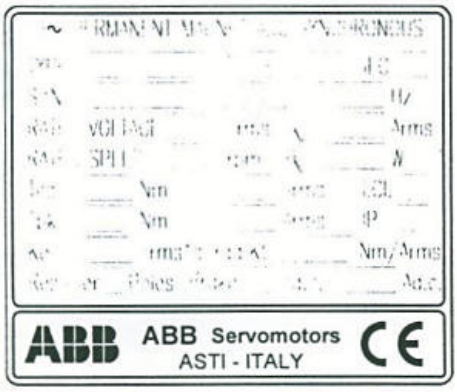
NOTE
Paragraphs opened like this are warnings of a specific type, which must always be taken into consideration during the installation, start-up and normal operation of the drive.

1.6 References for technical assistance

1.6.1 Preliminary information

NOTE This "Use and Installation Manual" is intended for the manufacturer of the cabinet, the technician in charge of the installation and the end user. It contains, in Chapter 6 "Alarms", the necessary instructions to identify, in case of difficulty of operation or of fault, the symptoms to be signaled to our **Customer Service,** in order to make as quick as possible the diagnostics of the fault and its elimination. Therefore, except for some special cases, the repairs foresees the intervention of specialized personnel.

1.6.2 Servomotor plate



1.6.3 Convertor plate

ABB Servomotors S.r.l.	MADE IN ITALY
TYPE: _____	S.N.: _____
PART NUMBER: _____	
OPTION: _____	
ADJUSTED FOR MOTOR TYPE: _____	
NOMINAL INPUT VOLTAGE: _____	
AUXILIARY INPUT VOLTAGE: _____	
NOMINAL OUTPUT POWER: _____	
RATED OUTPUT CURRENT: _____	

An additional plate specifies the Hardware and Software level of the convertor:

OPTION _____				
FACT. HW LEV. _____			**D.**	**S.**
LAST	HW	HW	HW	HW
HW	D.	D.	D.	0.
INSTAL	S.	s.	s.	Is.
FACT. SW LEV. _____			**D.**	**S.**
LAST	SW	SW	SW	SW
SW	D.	D.	D.	D.
INSTAL	S.	S.	S.	S.

1. 6.4 Customer Service

Address your requests for details, service or spare parts to:

ABB Servomotors S.r.l.
Customer Service
Frazione Stazione Portaconiaro, 97/C
I - 14100 ASTI (ITALY)
Telephone +39 (+141) 476.456 Telefax +39 (+141) 296.455

2.1 Specifications of brushless servomotors SERIES 8

Servomotors **SERIES 8** are brushless servomotors with rare **earth permanent magnets Nd_Fe - B** (neodymium, iron, boron), sinusoidal technique, 6-poles, especially designed and manufactured to be used in drives having high dynamic performances, high mechanical and electrical precision, high overload capability and no necessity for maintenance.
Each "motor & sensors" (see paragraph 1.2.5) employed in the drives described in this manual is made up of a **servomotor SERIES 8** together with a **brushless/frameless resolver** (integrated in the servomotor), a **temperature sensor** and, when required, a brake.
SERIES 8 includes three axis heights and 22 different motors, with continuous stall torque values ranging from 1.3 Nm to 37 Nm and nominal speeds equal to 1500 RPM, 3000 RPM and 6000 RPM.
Table 2/1 contains some data concerning servomotors of this series; complete data regarding dimensions, mechanical and electrical characteristics and performances of these servomotors can be found in the **catalogue 3AT K 93056 R004 ED 2/96,** that can be supplied on request; in the following pages of this manual we will refer to this publication as the "Catalogue".

Table 2/1

Servomotor Type **SERIES 8**	T_0 [Nm]	T_N [Nml	T_{max} [Nm]	n_N [RPM]
861.1.30	1.3	1.2	j.9	3000
861.1.60	13	1.05	J.9	6000
861.2.30	2.5	2.2	7.5	3000
861.2.60	2.5	1.8	7.5	6000
861.3.30	3.6	3.1	10.8	3000
861.3.60	3.6	2.3	10.8	6000
864.0.15	4	3.9	12	1500
864.0.30	4	3.6	12	3000
864.1.15	6.5	6.3	19.5	1500
864.1.30	6.5	5.8	19.5	3000
864.2.15	10	9.4	30	1500
864.2.30	10	8.4	30	3000
864.3.15	12	11.5	36	1500
864.3.30	12	10	36	3000
865.1.15	15	14.4	45	1500
865.1.30	15	12	45	3000
865.2.15	21	19.6	63	1500
865.2.30	21	15.4	63	3000
865.3.15	29	26	87	1500
865.3.30	29	21	87	3000
865.4.15	37	32	111	1500
865.4.30	37	23	111	3000

Legend
T_0 = Continuous stall torque
T_N = Continuous torque at nominal speed
T_{max} = Peak stall torque
n_N = Nominal speed

Table 2/2 contains, for each servomotor, values of axial and radial loads that must not be exceeded to guarantee a regular lifetime of about 20000 hours in continuous duty of the bearings with permanent lubrication. In general, a locked bearing is assembled on the motor A-side.

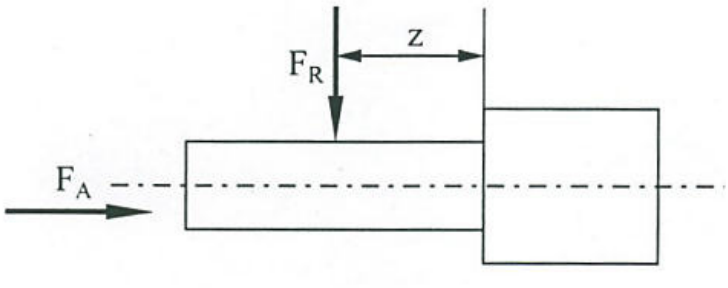


Fig. 2-1

Table 2/2

Servomotor Type **SERIES 8**	Speed [RPM]		Bearing type		Radial load F_R [N]		Axial load F_A [N]		Dist. z [mm]
	n_1	n_N	A-side (shaft end)	B-side	a n_1	a n_N	a n_1	a n_N	
861	3000	6000	6004-2ZR-C3	6002-2ZR-C3	475	375	290	240	20
864	1500	3000	6205-2ZR-C3	6204-2ZR-C3	950	750	575	475	20
865	1500	3000	6207-2ZR-C3	6205-2ZR-C3	1750	1400	1000	850	2715

Notes:
(1) Values for simultaneous axial and radial stresses are available on request.
(2) Values for versions with integrated brake (special versions) are available on request.
(3) Values for admissible axial loads are valid for force direction F_A towards the motor; for the opposite direction a reduction is necessary (values available on request).

CAUTION: Taking into account the foreseen duration, the radial laads F_R must not exceed the values indicated, even for a transient period (acceleration, deceleration). In particular, shocks provoked for example by the assembling of mechanical parts (couplings, key nuts, etc ...) on the shaft end are not allowed.

2.2 Specifications of digital convertors SERIES BHL-D

Table 2/3

BHL-D MODELS		**5/10***	**10/20***	**14/28***	**18/36***	**25/50****	**35/70****	**50/100****
Power supply		220 Vac ±10% three-phase 50/60 Hz						
Max output voltage		310 Vac three-phase						
Rated current	[Arms]	5	10	14	18	25	35	50
Peak current (max. 1.7s)	[Arms]	10	20	28	36	50	70	100
Rated power to the motor	[kVA]	1.8	3.6	5.0	6.5	9.0	12.7	18.2
Peak power to the motor (max. 1.7s)	[kVA]	3.6	7.2	10.0	13.0	18.0	25.4	36.4
Peak power of ballast circuit		3900	3900	5700	5700	11400	11400	19000
(max. 0.5s)	[W]							
Standard continuous power of ballast circuit		90	90	180	180	370	370	740
($R_{Bstandard}$)	[W]							
Max. continuous power of ballast circuit		900	900	1500	1500	2700	2700	4000
(optional) (R_{Bextra})	[W]							
Switching frequency	[kHz]	5	5	5	5	10	10	10
Speed range		0 ÷ 6000 RPM (f_{max} = 300Hz)						
Position transducer		2-pole resolver						
Resolver-motor phase adjustment		Automatic procedure						
Speed reference input		±10V (input impedance 200kΩ), differential						
Current reference input		±10V (input impedance 24 kΩ)						
Torque analog limit circuit input		0 ÷ +10V(input impedance 24 kΩ)						
Input for enabling commands		Galvanically insulated						
Reference supply outputs		±10V; 10 mA; stabilized						
Output for enabling commands supply		+15V; 100mA (short-circuit protection)						
Alarm relay: contact capability		0.5 A; 50 Vdc max; normally closed						
Operating temperature		0 ÷ 40 ° C						
Stock temperature		-25 ° ÷ +70 ° C						
Humidity		90% max without dew						
Altitude		≤1000 m above sea level						
Protection degree		IP 20						

*** Models availabie only in size 223**

**** Models availabie only in size 224**

2.3 Specifications of convertors and combinations servomotor/convertor

Table 2/4

Servomotor Type **SERIES 8**	Convertor Type **BHL-D 1310**	PDS performances			
		T_0 [Nm]	T_{max} [Nm]	T_{Nmax} [Nm]	I_{max} [Arms]
861.130	...5/10...	1.3	3.9	3.9	6.0 ①
861.1.60	...5/10...	1.3	3.9	3.9	9.3 ①
861.2.30	...5/10...	2.5	7.5	7.4	9.0 ①
861.2.60	...5/10...	2.35 ③	4.7 ②	4.7	10
861.3.30	...5/10...	3.6	9.5 ②	8.5	10
861.3.60	...10/20...	3.6	9.5 ②	9.4	20
864.0.15	...5/10...	4.0	12	10.9	8.7 ①
864.0.30	...5/10...	3.65 ③	7.3 ②	7.3	10
864.1.15	...5/10...	6.5	18.1 ②	12.8	10
864.1.30	...10/20...	6.5	17.4 ②	17.4	20
864.2.15	...5/10...	9.1 ③	18.2 ②	18.2	10
864.2.30	...10/20...	9.6 ③	19.2 ②	19.2	20
864.1.15	...10/20...	12.0	34.2 ②	34.2	20
864.3.30	...14/28...	12.0	26.3 ②	26.3	28
865.1.15	...10/20...	15.0	36.2 ②	36.2	20
865.1.30	...14/28...	13.8 ③	27.7 ②	27.7	28
865.2.15	...14/28...	21.0	48.2 ②	48.2	28
865.230	...18/36...	19.4 ③	38.9 ②	38.9	36
865.2.30	...25/50...	21.0	54 ②	40.2	50
865.3.15	...14/28...	27.1 ③	54 ②	54	28
865.3.30	...35/70...	29.0	67.9 ②	67.9	70
865.4.15	...18/36...	36.0 ③	72 ②	72	36
865.4.15	...25/50...	37.0	100 ②	100	50
865.4.30	...35/70...	37.0	77.7 ②	77.7	70

Legend

T_0 = Continuous stall torque
T_{max} = Peak stall torque
T_{Nmax} = Peak torque at nominal speed
I_{max} = Motor current at T_{max}

① The maximum current of the convertor (set through the parameter P5,I_MAX) must be limited to this value.

② The peak stall torque that can be obtained is limited by the value of the maximum current of the convertor, which corresponds to P5,I_MAX = 200%.

③ The continuous stall torque of the PDS is limited by the value of nominal current of the convertor, which corresponds to P5,I_MAX=100%.

WARNING !: In cases marked by note ①, if the value indicated for current is exceeded, the motor is seriously damaged.

3.1 Installation of BHL-D convertors

3. 1. 1 Mechanical installation

- The convertor MUST always be installed in a vertical position. The distance equal to 150 mm, indicated above and below in Fig. 3-1, is the room that must be left free for air flow; this is valid both for size 223 and for size 224.

- Do not stop the flow of cooling air with external bodies placed too close to the convertor (see minimum distances described in the figure).

- Do not place the drive near heat sources.

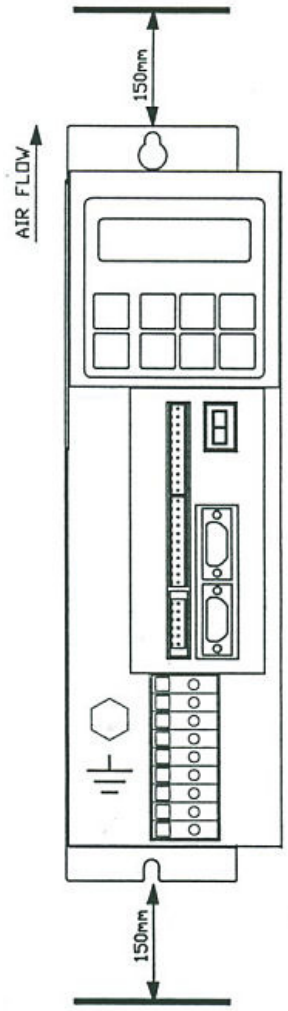


Fig. 3-1

3. 1. 2 Dimensions

SIZE 223

Models from 5/10 to 18/36:

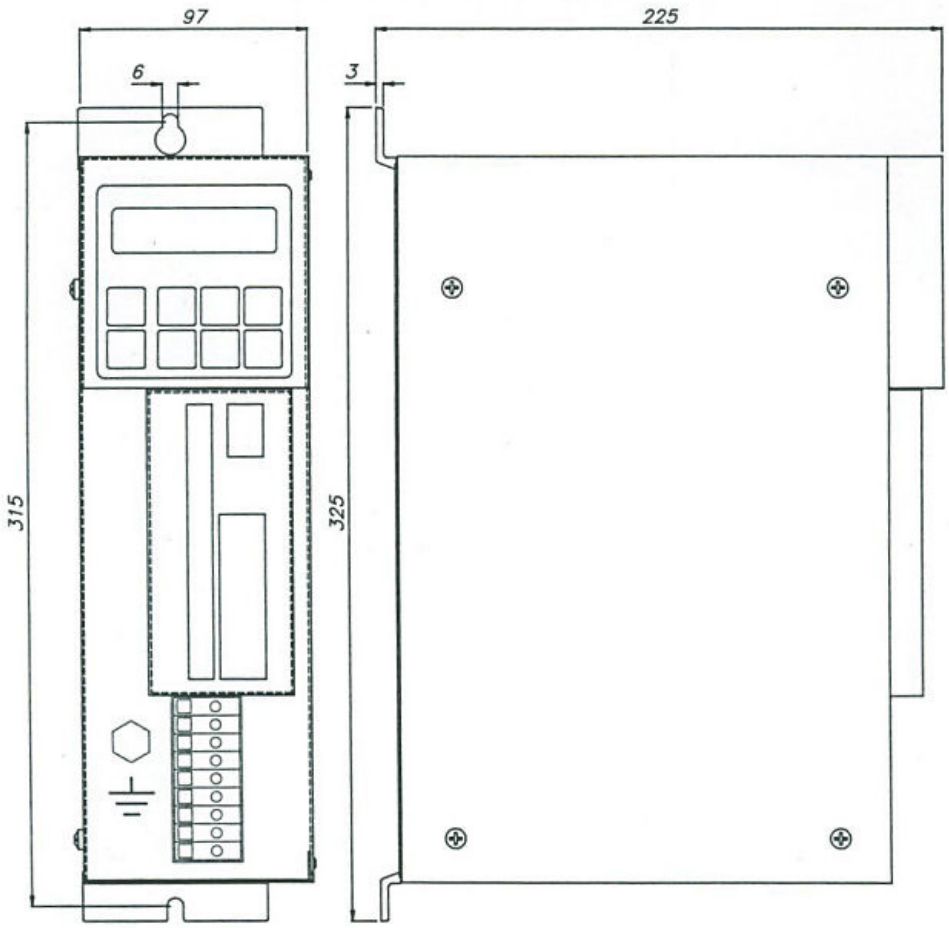


Fig. 3-2

SIZE 224

Models 25/50

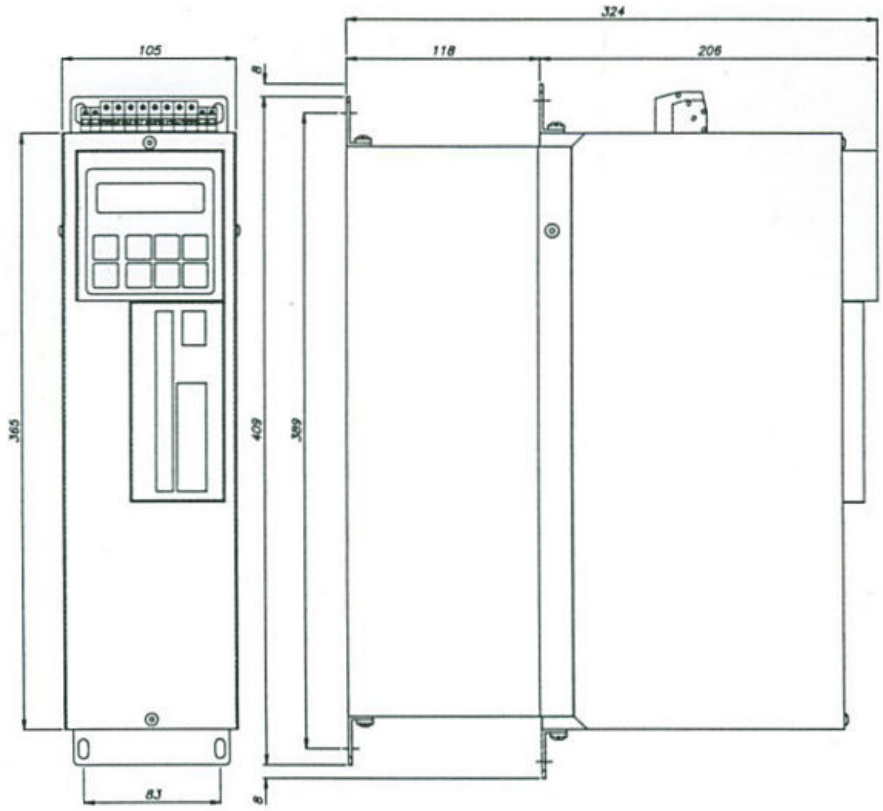


Fig.3-3

SIZE 224

Models 35/70 and 50/100

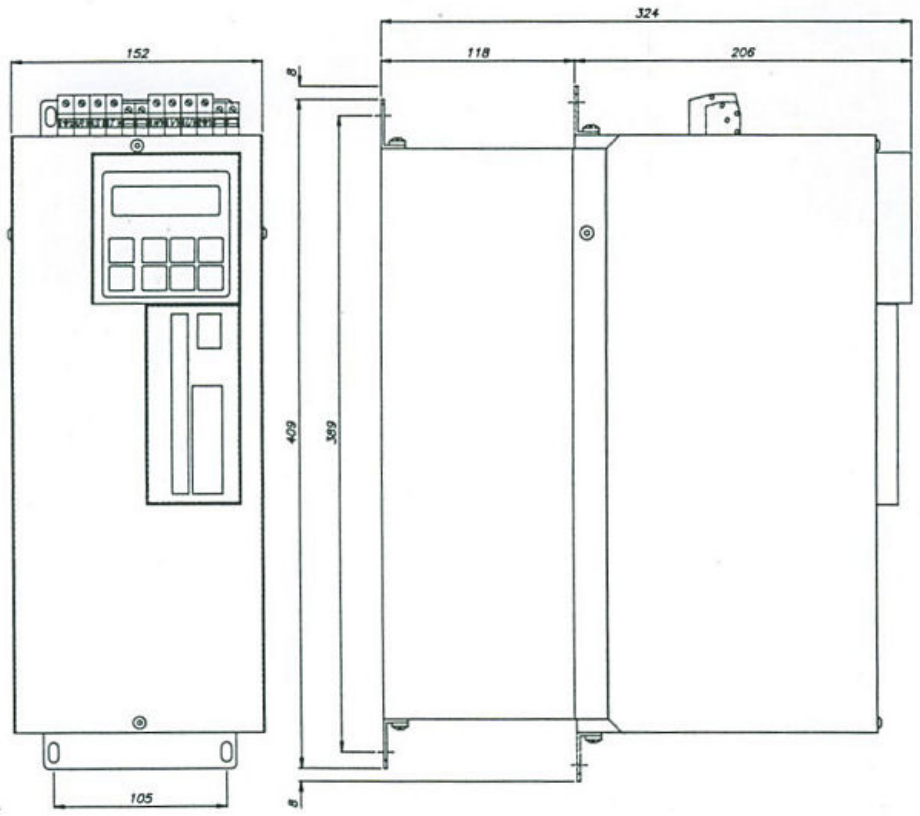


Fig.3-4

3.1.3 Electrical installation

As regards power and signal connections, please refer to paragraphs 4.3 and 4.4.

3.2 Installation of servomotors SERIES 8

3.2.1 Mechanical installation

There are no special specifications for the installation of servomotors **SERIES 8**. In any case, the following notes can be useful as further guidelines.
During installation the characteristics of the standard execution of this series must be taken into account (see also page 1 of the Catalogue): among them we cite the following.

3.2.1.1 Protection degree
IP55: protection against dust and water sprays.

3.2.1.2 Construction form and type of installation
Servomotors of this series can be mounted only on to a flange. As stated in the drawings from the Catalogue, there are different possibilities for the various sizes. Table 3/1 summarizes them.

Table 3/1

Size	Construction form and type of installation					
	IMB5	IMV1	IMV3	IMB14	IMV18	IMV19
861	no	no	no	yes	yes	yes
864	yes	yes	yes	no	no	no
865	yes	yes	yes	yes	yes	yes

Legend

The exact definitions of the IM code are contained in the standard IEC EN 60034-7 (1993), part 2179 E; the practical meaning is described hereafter.

IMB5: flange mounted with passing holes on the flange, horizontal.
IMV1: flange mounted with passing holes on the flange, vertical, shaft down.
IMV3: flange mounted with passing holes on the flange, vertical, shaft up.
IMB14: flange mounted with blind tapped holes on the flange, horizontal.
IMV18: flange mounted with blind tapped holes on the flange, vertical, shaft down.
IMV19: flange mounted with blind tapped holes on the flange, vertical, shaft up.

3.2.1.3 Pulleys and couplings
Couplings, pulleys and pinions must be assembled using suitable tools, **completely avoiding the use of hammers,** which could seriously damage the motor. Before the operation the protection against rust applied on the shaft end must be removed with alcohol and it is advisable to grease the shaft end itself once the assembling has been completed, to avoid oxidation.

3.2.1.4 Oil sealer
All servomotors of this series are mechanically prepared to accept an oil sealer on the shaft (so called "front oil sealer' or "corteco"); in the standard version this sealer is not included and is supplied or inserted on request (see Order code in the Catalogue).

WARNING !: This sealer will be installed (care of the end user or of ABB on request), **only** in case the motor shaft and the oil sealer itself are actually in contact with oil. In case of the presence of lubricant liquids other than commonly used mineral or synthetic oils and in the presence of overpressures of these liquids, contact ABB Servomotors.

3.2.2 Electrical installation

The electrical installation consists of the connection to "motor & sensors" (see paragraph 1.2.5) of the following:
a) inside the connection box of the servomotor:
a1) power supply cables of the servomotor, coming from the convertor
a2) supply cables of the brake (only if this option has been chosen);
a3) connection of the thermal contact (only if it is employed);
b) to the connector mounted on the connection box of the servomotor:
connections to the resolver.
Connections, convertor side, are described in paragraphs 4.3 and 4.4 of this manual; it is important to remember that it is also important to respect scrupulously what described in paragraph 3.3 "Guidelines on the application of Electromagnetic compatibility".
Fig. 3-5 shows the drawing *of* the connection box of servomotors SERIES 861 and Fig. 3-6 the drawing *of* the connection box *of* servomotors SERIES 864 and 865.
A kit of nuts and washers of a type suitable for all kinds of connection screws is supplied inside the connection box for the connection of cables.

3.2.2.1 Power supply connections of the servomotor
The power supply cables to the motor, of a section adequate to nominal current (see Table 4/1 in paragraph 4.4.1 in this respect), must be connected to the terminals marked with the letters **U**, **V** and **W**. For servomotors SERIES 864 and 865, the terminal marked with A (Fig. 3-6) must not be connected.

CAUTION It is necessary to **respect the correspondence of the connections between motor and convertor without fail.** A mistake in phase connection will not make drive operation possible.

The yellow-green connection cable between the ground of the motor and the ground of the convertor must be connected to the terminal marked with the symbol ⏚.
For these connections, a shielded power cable or (see paragraph 3.3) cables contained in metal shields can be used. In any case, the external shield must be connected to the ground of the motor; it can be useful to employ the extra M5 tapped hole, outside the connection box and marked by the symbol ⏚
Cables must be inserted in the box through the hole PG21 with the use of a suitable cable gland.

3.2.2.2 Connections to the resolver
On the connection box of the motor there is a suitable 12-pin connector, 7 of which are used (see Fig. 3-5 and Fig. 3-6). For the connection of the resolver between "motor & sensors" (see paragraph 1.2) and convertor **prepared standardized cables** are available, equipped with connector both on motor side and on convertor side. Such cables can be purchased together with the drive, by specifying the code, according to the length needed (see Table 3/2).

Table 3/2

Length [m]	Code
2	BRS5CBSGN2L02XX
2,5	BRS5CBSGN2L52XX
5	BRS5CSSGN5L02XX
10	BRS5CSSGNL102XX
15	BRS5CBSGNL1S2XX
20	BRS5CBSGNL202XX
25	BRS5CBSGNL252XX
30	BRS5CBSGNL302XX

NOTE: In position 13 of the code the type of connector motor side is indicated:

2 -connectort ype MS 3106A18 1S
4 - connector type CONNEI / CONINVERS.
Cabling diagrams are available on request.

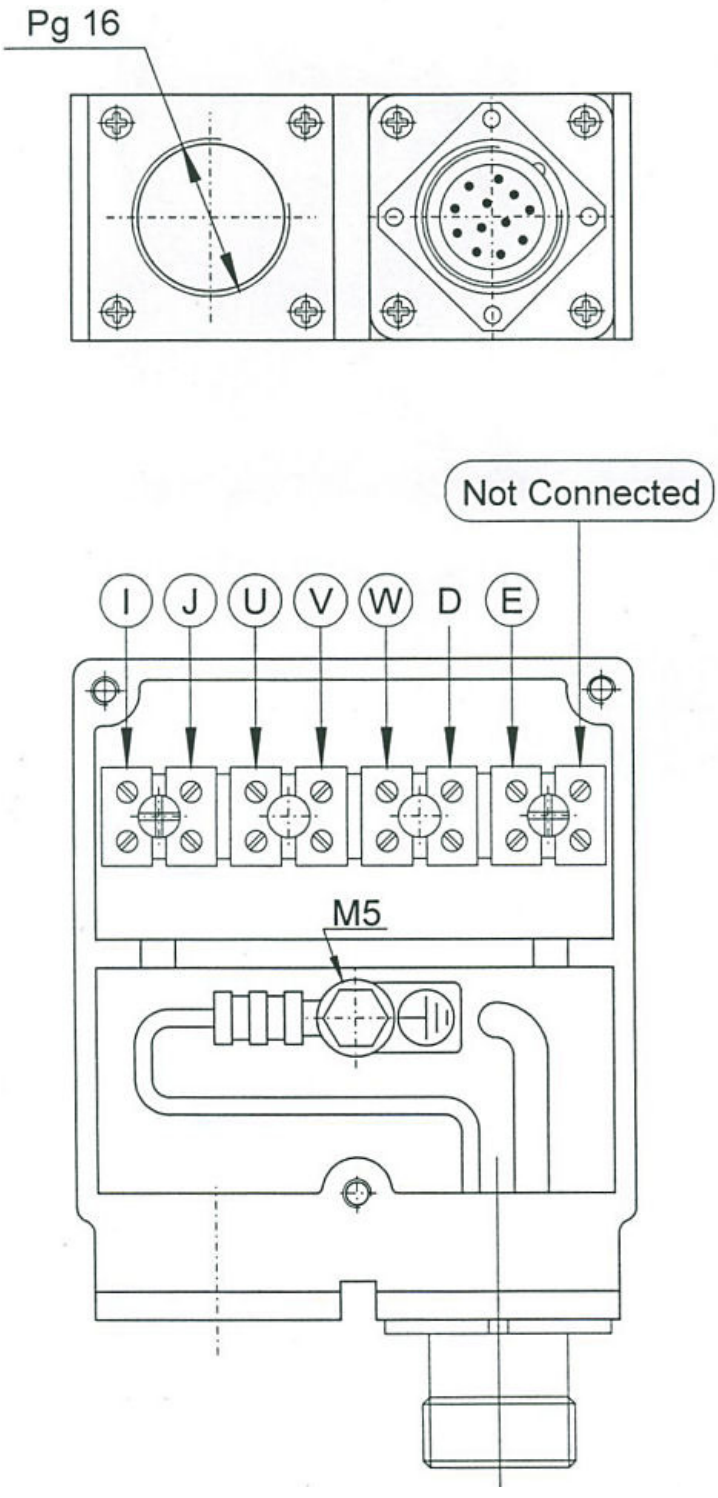
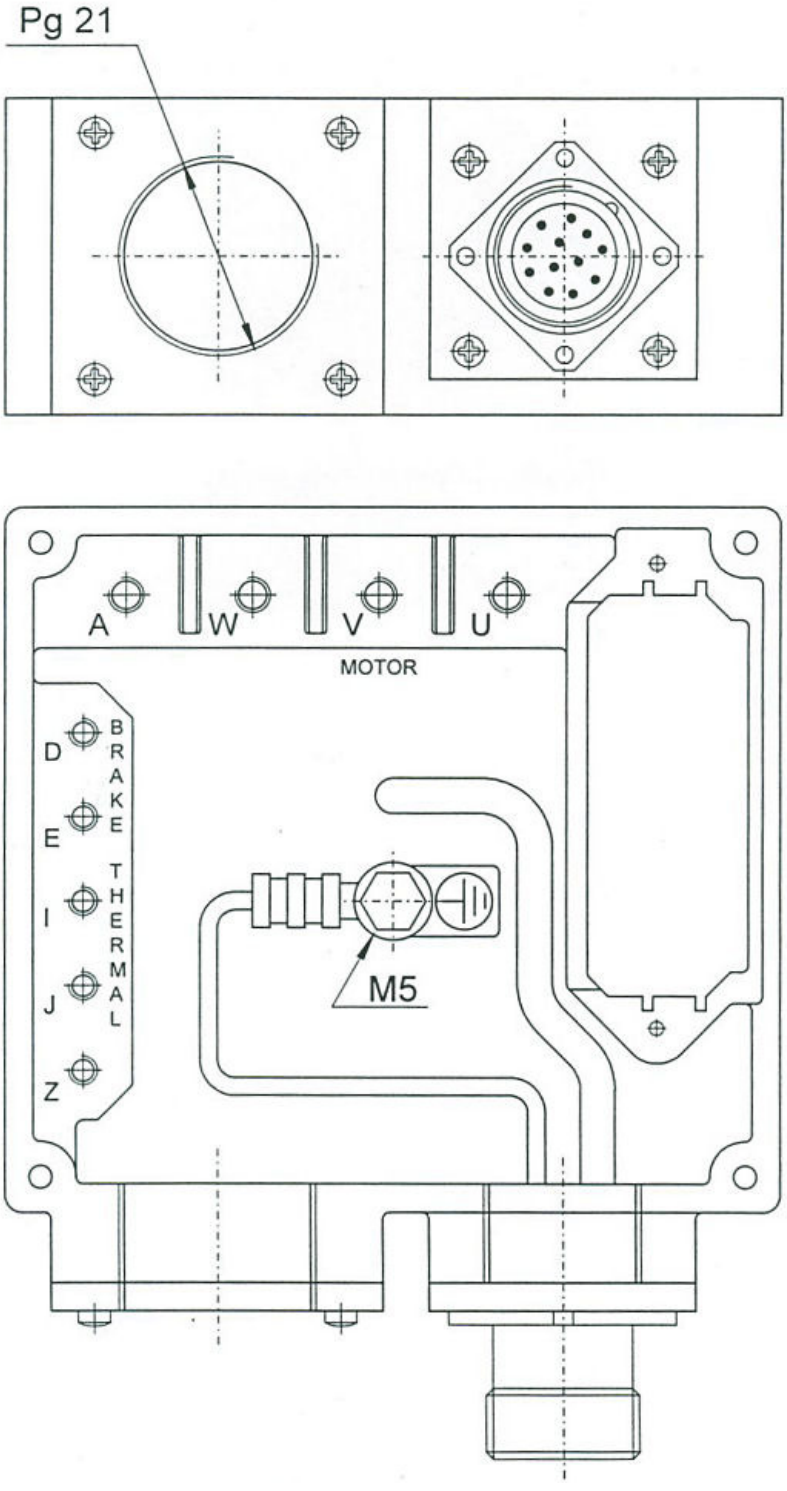

Pg 16
Not Connected
I
J
U
V
W
D
E
M5
Extra M5 hole available ⏚
outside the connection box

Fig. 3-5



Extra M5 hole available ⏚
outside the connection box

Fig. 3-6

If the final user wants to manufacture the complete cable himself, assembling connectors plug parts on his own, it is necessary to follow these instructions:
a) the assembly must be carried out by specialized personnel;
b) only the cable indicated in paragraph 4.3.5 must be used;
c) only connectors plug parts that are supplied as an option of motor and convertor must be used;
d) it is necessary to fulfill the prescriptions mentioned in paragraph 3.3 "Guidelines on the application of electromagnetic compatibility";
e) the cable must not be interrupted for any reason between the connector on the "motor & sensors" and the connector on the convertor: no intermediate terminal boards and/or connectors are allowed;
f) the maximum length of the cable must not exceed 30 m.

When, for special reasons, it is necessary to use a type of cable which is not approved, the Customer Service must be contacted in advance (see paragraph 1.6.4).

CAUTION **Resolver connections are extremely importantl** A bad operation of this part of the circuit can provoke serious problems to the operation of the entire drive.

3.2.2.3 (Possible) connection to the thermal switch
The motor is equipped with a thermal switch, normally closed, which opens in case of motor overtemperature (terminal **I** and **J** -thermal- of Fig. 3-5 and Fig, 3-6). Terminal **Z** (Fig. 3-6) must not be connected.
This switch is not normally used in connection with the convertor (see paragraph 4.3.5). It can be used, for example, in special cases, as signaling in possible circuits of plant supervision, connected to a system PLC. The contact can work at 220 Vac, with a current up to 5 A.

3.2.2.4 Brake connections (only if this option exists)
When the brake option is present, connections must be made according to the following instructions.

WARNING: The management of the brake is completely care of and under the responsibility of the manufacturer of the electric cabin. The brake installed is an emergency brake, therefore **it works (i.e. it brakes) when it is not supplied.** Therefore it is absolutely necessary that the motor is free (not locked) before being supplied, so the logic of the electric cabin must be able to supply the brake when and where it is suitable, furthermore checking that, during operation of the servomotor, the brake is always supplied.

All electrical and mechanical data related to brakes can be found in the Catalogue, for the various sizes of servomotors. In this respect, please note:
a) the supply of the brake is in continuous current, coming from a power supply (which is not a part of the supply of the drive) of an adequate power and with tolerances of voltages specified in the Catalogue;
b) the power supply of the brake must come from a circuit insulated from the net;
c) the connections of the supply circuit must fulfill what indicated in paragraph 3.3;
d) **the polarity of supply must be respected absolutely** (positive pole on terminal **D** and negative on terminal **E**): inversion of polarity equals lack of supply, therefore the motor is stopped.

3.3 Guidelines on the application of electromagnetic compatibility

3.3.1
This paragraph is compiled observing what prescribed in paragraph 1.4.3 of the standard on electromagnetic compatibility for drives [8].

3.3.2
The necessity to fulfill precise standards as regards EMC is due to the ever increasing use of power electronic devices, which, for the techniques used, are a source of disturbances in a very wide range of frequencies (**emission**) and, at the same time, are sensitive to disturbances produced by other devices, therefore they must have an adequate level of **immunity**.

3.3.3
Disturbances are conventionally classified in **low frequency** (0 = < f < 9 kHz) and **high frequency** (f > 9 kHz).
Among phenomena at low frequency, phenomena at **harmonic frequency** of the frequency of the net are particularly important.
Beside, there exist phenomena at wide spectrum, such as electrostatic discharges in air or for contact.

3.3.4
Disturbances must be transmitted both through conductors (**<conducted disturbances>**; conducted emission: 0,15 MHz ÷ 30 MHz) and by irradiation (**<irradiated disturbances>**; irradiated disturbances: 30 MHz ÷ 1000 MHz).

3.3.5
Industrial experience has demonstrated that the main causes of lack of compatibility are due to condueted disturbances.

3.3.6
The installation of the drive must be executed scrupulously following the instructions contained in the paragraphs 3.1 and 3.2 of this chapter.

3.3.7
In view of electromagnetic compatibility, the installation must be carried out fulfilling some suitable directions; here are the main ones.
Except some very special cases, the **BHL-D convertor** is assembled inside a metal cabin (the so-called electric cabin), which also contains different electric equipment (other electronic power convertors, contactors, transformers, impedances, etc ...).
The "**motor & sensors**" (see paragraph 1.2.5), which includes beside a motor series 8 also an angular position transducer RESOLVER, the motor thermal switch and, where required, the brake, is normally assembled on the machine at some distance from the electric cabin.
Therefore, actually there exist two different types of plant: one refers to the manufacturing of the electric cabin and one is the real "in situ" plant, which is reafized by the construction electrician at the final customer.

3.3.8 Electric cabin
In view of EMC, some important prescriptions must be considered in the electric cabin; they are related in the following paragraphs.

3.3.8.1

The layout of the components inside the electric cabin, both in terms of location and in terms of distances, must be carried out with the criterion to minimize the mutual influences of the equipment assembled for electromagnetic disturbances.

As an example, keep in mind that some types of transformers, power impedances or even coils of contactors can produce rather high fields at short distance.

3.3.8.2

Cablings of power circuits must be physically separated from the cablings of the command and control circuits (signal circuits); power circuits must be accurately shielded as against the signal circuits; this is obtained either by using metal raceways or metal shields in the electric cabin or by using shielded cables, also power cables, inside plastic raceways.

As an example, power circuits (cables that in Fig. 4-4 and 4-5 reach terminal boards N1A or N1B) must be kept separate, as mentioned above, from the cables that reach terminal boards J1 and J2.

3.3.8.3

All apparatus, for which accessories are prescribed to make them comply with EMC standards, must be equipped with such accessories, assembled according to the instructions of the manufacturer.

For example, the devices against disturbances to be assembled in parallel to ac contactor coils, the diods to be assembled in parallel to the relays or contactors with dc coils, the filters against HF conducted disturbances to be assembled on the line input of some convertors.

3.3.8.4

Cable shieldings must stop as nearer as possible the terminal board; if the connection of the shield to a mass or, in some cases, to ground is prescribed, it must be carried out with the shortest possible connections and with conductors with an adequate section.

3.3.8.5

It is important that all panels within the electric board are connected with mechanical connections that present low electrical impedance at high frequencies.

As an example, to obtain this it may be necessary to add locking screws, to remove the paint in the interconnecting parts, to use special metal shields for EMC.

3.3.9 Electric system

As already stated in paragraph 3.3.7, we refer to the system "in situ", in the final installation of the machine. For some types of machines (as for example small machine tools) the electric cabinet is physically connected to the machine, therefore, in practice, the electric system «in situ" is reduced to the connection of the machine to the supply line.

Usually, however, the electric cabinet is situated at a certain distance from the machine, on which the motor is assembled; sometimes there is also a remote control device, to which conductors may be connected.

In this case, since the problem of emissions is tightly connected to system factors, the following recommendations derive from technical competence and experience in field and must be essentially regarded as guidelines and not as solutions.

3.3.9.1

Keep in mind that (paragraph 1.2.13) the BHL-D convertor is intended to be used in "Second Environment", i.e., in practice, to the use in industrial environments, where the low voltage net does not supply domestic buildings.

3.3.9.2

The apparent power of the transformer or of the three-phase 380/220 autotransformer, to which the BHL-D is connected, must be adequate to the loads supplied, taking into account power factors and distortion factors.

3.3.9.3

Connections lines of the secondary of the transformer or autotransformer to terminal boards N1A or N1B must correspond to what described in paragraph 4.4.1. The connection between transformers/autotransformers of BHL-D and medium voltage transformer of the industrial plant must be adequate to avoid voltage drops that can throw supply voltage values out of contractual tolerance.

3.3.9.4

In some case low voltage phase adjustment systems of the supply net can create problems, with possibility of resonances.

3.3.9.5

Study routes of the cables of the system accurately, minimizing length.

3.3.9.6

All metal raceways, metal shields and, in general, all shields, except otherwise stated, must be connected to ground both cabin-side and motor-side; ground connoctions must be of adequate section and very short.
This is an EMC specific requirement, which can apparently in contrast with what often prescribed, i.e. the opportunity to connect shields to ground on one side only; this prescription requires very efficient grounds.

3.4 External ballast resistors

When the ballast resistor is external, this must be assembled in an electric cabin because its protection degree is IP00.

NOTE For the external ballast resistor, the drive is completely protected from short circuits between resistor terminals and between one terminal and the ground.

The resistor must be assembled in a vertical position and an open space must be provided for of about 100 mm all around, to make adequate heat sinking possible. Please contact ABB Servomotors for dimensions of resistors.
For the connection between the convertor and resistor, use cables at least equal to the section of power supply cables; cables must be twisted and as short as possible. The route of these cables must be chosen so that it does not interfere with other signal or power cables.

WARNING !: The terminals of the ballast resistor are at dangerous dc electric potentials (about 400V).

3.5 Reference to safety standards

3.5.1 Installation operations

WARNING !: Qualified personnel only are allowed to operate on the installation, in trouble shooting and, in general, for any type of intervention on the drive.

This personnel must have adequate documentation supplied by ABB Servomotors, this manual in particular.
It is forbidden for non qualified personnel to intervene on the terminal board of the convertor or open the connection box of the servomotor.

3.5.2 Residual voltage

WARNING !: In the BHL-D convertor capacitors of great capacity are present, which, for functional reasons, cannot always be discharged in a time shorter than 5 seconds, after the interruption of supply.

It is forbidden to touch inside the BHL-D convertor before at least three minutes have passed after the interruption of supply. Potentially lethal voltages may be present on the dc intermediate circuit and on the associated circuits!
A proper warning, placed visibly, must be present on the BHL-D convertor to warn about this danger, according to what established in EN 60204-1 § 6.2.3.

3.5.3 Supply sectioning device

WARNING !: Since the BHL-D convertor is prepared to be put in an electric cabin, possibly also containing other apparatus, the **supply sectioning device manually controlled,** required by EN 60204-2 § 5.3.1, can be the one common to the whole electric cabin and must - in any case - be inserted **care of the manufacturer of the machine.**

3.5.4 Stop function

WARNING !: **Stop functions,** as prescribed in EN 60204-1 § 9.2.2, in particular **0 category stop, must be realized by the manufacturer of the machine,** because they are related to the logic of the machine, which obviously differs according to the type of machine driven, following the instructions contained in the present manual.

3.5.5 Emergency stop

WARNING !: Also **emergency stop,** according to EN 60204-1 § 9.2.5.4, must be foreseen following the specific characteristics of the machine driven. Therefore it **must be realized by the manufacturer of the machine.**

3.5.6 Protection degree of the drive components

Servomotors series 8 have **IP 55 protection degree.**

BHL-D convertors have **IP20 protection degree;** to fulfill what prescribed in §4.4.5 "Contaminating elements" of the standard EN 60204-1 they must, care of the manufacturer of the machine, be put into an adequate case (electric cabin), according to the required protection degree.

CHAPTER 4 - START-UP AND ADJUSTMENT OF THE DRIVE

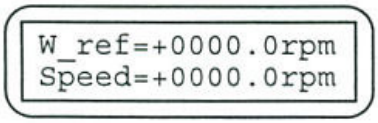
4.1 Introduction

For the procedures of start-up and adjustment of BHL-D (see chapter 7), both the keyboard and the serial interface can be used. The following paragraphs outline procedures that can be carried out using the keyboard.
Afterwards, signals available on the terminal boards and some possible connections will be described. In the end basic procedures for the start-up and the adjustment of the convertor will be outlined.

4.2 How to use the keyboard

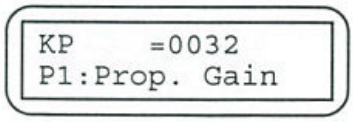
The alphanumerical keyboard consists of 8 membrane keys and of an alphanumerical display with two lines of 16 characters each. It can be assembled on the front of the drive or connected with a flat cable in the appropriate connector.

The keyboard management is arranged in three visualizstion windows, each one with a different function: the first window, the window of References, is shown when the unit is switched on. The second window shown is for Parameters and the third one contains Flags.

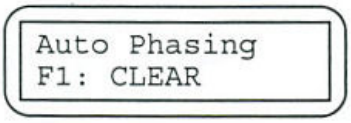


To move from one window to another use **MODE** key.
The first window shows all references of speed (W_ref), position (P_ref), and current (I_ref), all in the first line. The second line always visualizes the actual speed (Speed). To see the three references use **UP (▲) and DOWN (▼)** keys . To modify them press **ENTER** key and the cursor will start blinking: use the arrow keys **UP** and **DOWN** to increase or decrease the set value.
All keys have a "hold" function: this means that, if a key is pressed for a long time, the increasing or decreasing of the value that you are setting becomes faster . By pressing **CLR** key , the set value will be canceled.

Once the required value has been reached, press **ENTER** again to confirm: the cursor disappears and the arrow keys **UP** and **DOWN** go back to their previous function.
As you can see, every reference can have a different resolution from the others, therefore it is not possible to set all the values between minimum and maximum. Moreover, please consider that there are some maximum values, which depend on the operating conditions (for example W_ref cannot exceed W_MAX previously fixed).
The second window shown is for parameters. The default start is from parameter P1, KP:



The value for each parameter is indicated (sometimes with a measuring unit) with a short description (on the second line). To see the parameters one by one use the arrow keys **UP** and **DOWN.**
To modify them apply the same procedure used for the first window: press the **ENTER** key to reveal the cursor and the arrow keys to modify the value : use **ENTER** again to confirm; press the **CLR** key to set the minimum value for that parameter.
The resolution with which a parameter can vary depends on the parameter itself, together with its resolution in terms of figures (with or without decimal point).
The only parameter that cannot be modified is parameter **P28, ALARM,** that shows the kind of alarm occurred.
With **MODE** key it is possible to move from the second to the third window, containing flags:

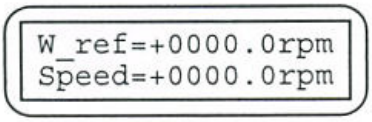


Again, together with a short description of the kind of flag, the words **SET** or **CLEAR** will appear on the second line (except for flag **F9, Thermal probe,** where PTC or NTC are visualized) whether it is set or not.
Flags can be grouped in two different types: procedure flags and configuration flags. The former are used to generate a particular sequence of actions that will then bring the drive back to start condition (usually these are autoadjusting or autotuning procedures). In general, they are **CLEAR**-type flags. If first **ENTER** (the cursor appears) and then the arrow key UP are pressed, the word on the second line changes from **CLEAR** to **SET** and at the same time the automatic procedure defined by that flag starts. At the end of the procedure the word **DONE** will appear for some seconds, indicating that it has been concluded, and then the word **CLEAR** appears again.
For example, for the flag **F1, Auto Phasing,** when changing from **CLEAR** to **SET**, the sequence for the autophasing of resolver starts; when it is finished, the word **DONE** appears and after a few seconds the word **CLEAR** appears again, showing that the autophasing has been concluded and that the drive has returned to its previous condition (consider that any kind of procedure can modify some parameters during its course).
The latter type of flags are for drive configuration. They are used to set the drive for some particular operating conditions, as for example ramp enabling, etc.
To choose a specific configuration select the flag that should be set (use arrows), press **ENTER** key (the cursor will appear) and then press the **UP** key; the word changes from **SET** to **CLEAR** or vice versa and the cursor disappears; from this moment onwards the configuration changes according to the flag condition (**SET**=enabled, **CLEAR**=disabled).
Remember that both procedures and configurations are usually mutually exclusive. As regards procedures, it is necessary to start them one by one, making sure that they have

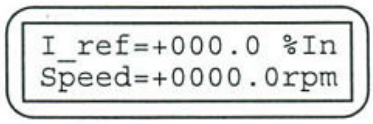
been concluded. For the possible configurations, on the other hand, the choice is limited to a small number (it is always necessary to refer to the predefined configurations, setting the flags in the order indicated).
The three keys not yet defined **INV, RUN and STOP,** have a fixed function, no matter under which window and condition they appear. Their function is respectively to invert the speed reference, to start the motor if it is stopped until it reaches the set speed and to stop the motor at zero speed.
If two keys are pressed simultaneously by mistake, the display will show a message of keyboard error. Press any key to return to the normal condition. The keyboard can be disconnected from the drive at any time; the condition saved at the moment of disconnection will reappear when reconnecting the unit.

4.2. 1 Description of references window

The actual speed in rpm is always displayed on the second line. On the contrary, the first reference is the speed of the motor shaft in rpm, visualized as follows:



The maximum settable value is limited by parameter **P4, W-MAX,** that represents the maximum absolute value of speed in rpm.
The second reference is the value of current, that can be set when the motor is controlled in torque mode:



The settable value changes from +200.0 %In to - 200.0 %In, in relation to the rated current of the drive; the value that can be set is limited by parameter **P5, I_MAX,** that represents the maximum absolute value of current, always referred to the rated current. On the contrary, if, instead of considering this parameter as current limit, analog current limit is used, then I_ref visualizes it (in this case I-MAX has to be set at its maximum value, equal to 200.0% In)

4.2.2 Description of parameters window

The parameters window shows all parameters that can be modified with the keyboard: the total number is 38 among control adjustments, input and output configurations and internal values of the drive. The parameters list with a description of the function and of the values range is shown below.
P1, KP, *Proportional gain:* it is the proportional gain of the PI speed digital controller.
P2, KI, *Integral gain:* it is the integral gain of the PI speed digital controller: the KP/KI relationship determines the position of the zero of the regulator.
P3: Parameter currently not used.
P4, W-MAX, *Maximum velocity:* it is the maximum value of speed reference, expressed in rpm.
P5, I_MAX, *Maximum current:* it is the maximum current value that can be set, measured in rms value. This also acts as saturation limit in the case of speed control; in case of torque limit with analog signal, this parameter must be set to the maximum value, that is I_MAX=200.0% In.

P6, ACC_RP, *Acceleration ramp counterclockwise:* it represents the positive speed ramp counterclockwise (acceleration), expressed in seconds, within a range 00.01 s ÷ 30.00 s, with all intermediate values.
P7, DEC_RP, *Deceleration ramp counterclockwise:* it represents the negative speed ramp counterclockwise (deceleration), expressed in seconds, within a range 00.01 s ÷ 30.00 s, with all intermediate values.
P8, ACC_RN, *Acceleration ramp clockwise:* it represents the positive speed ramp clockwise (acceleration),expressed in seconds, within a range 00.01 s ÷ 30.00 s, with all intermediate values.
P9, DEC_RN, *Deceleration ramp clockwise:* it represents the negative speed ramp clockwise (deceleration), expressed in seconds, within a range 00.01 s ÷ 30.00 s, with all intermediate values.
P10, IN3_CF, *Input 3 configuration:* it is the configuration of input 3 (on terminal board **TE,J1/5):** 7 configurations are possible (see table 5/1).
P11, IN4_CF, *Input 4 configuration:* it is the configuration of input 4 (on terminal board **UE,J1/2**): 7 configurations are possible (see table 5/1).
P12, OUT1_A, *Analog output 1:* it shows the configuration of the analog output **DAC1, J1/21**, within a range ±10V; the several possible configurations are described in table 5/3.
P13, DA1SHF, *Analog output 1 shift:* it is the number of shifts (divisions by 2) of the numerical value to be represented with the analog output DAC1, to return within the allowed limits or to increase the resolution within a given range. In other words, it is the scaling factor between the numerical value and the analog value of the internal variable to be visualized.
P14, OUT2_A, *Analog output 2:* it shows the configuration of the analog output **DAC2, J1/22,** within a range ±10V; the several configurations are described in table 5/3.
P15, DA2SHF, *Analog output 2 shift:* it is the number of shifts (divisions by 2) of the numerical value to be represented with the analog output DAC2, to return within the allowed limits or to increase the resolution within a given range. In other words, it is the scaling factor between the numerical value and the analog value of the internal variable to be visualized.
On defauft configuration OUT1_A=4 (actual speed monitor) and OUT2_A=5 (torque signal monitor) are set, already normalized according to the maximum values set with **P4, W - MAX** and **P5, I_MAX** (the parameters DA1SHF and DA2SHF are set to zero), corresponding to a signal full scale factor equal to 7.5V.
P16, DIG_01, *Digital output 1:* configurable digital output, available on terminal board on **DIG1, J1/10**, with signal 0 ÷ +15V (for size 224 0 ÷ +24V) (see configuration table 5/2).
P17, DIG_02, *Digital output 2:* configurable digital output, available on terminal board on **DIG2, J1/11**, with signal 0 ÷ +15V (for size 224 0 ÷ +24V) (see configuration table 5/2).
P18, IN_MOT, *Rated motor current:* it defines the rated current of the motor or the current at which thermal steady state is reached. Its dynamics is set by the thermal time constant, defined with P19, TH_MOT; in practice, together with P19, it defines the intervention threshold of the motor I^2t protection. It is expressed as a percentage of the rated current of the drive.
P19, TH_MOT, *Motor thermic time constant:* it defines, in seconds, the thermal time constant of the motor, that must be specified by the motor manufacturer; together with IN_MOT, it defines the intervention threshold of the motor I^2t protection.
P20, OFF_AN: Internal parameter not to be modified.
P21, OFFMED, *Analog velocity offset, accurete value:* it is the parameter that accurately sets the offset of the 12-bit A/D converter for the speed analog reference. It is determined during the offset adjusting procedure, together with **P20, OFF_AN**, but it can be modified if the calculated value is not accurate enough and the control to 0V is not satisfactory.
P22: Parameter currently not used.
P23, K-LEAD: Internal parameter not to be modified.
P24, ZERO_S, *Minimum velocity:* it can be used to have a low signal whenever the motor speed is lower than the value set with this parameter (in rpm). Therefore, when it is used

with configuration n° 7 of DIG_01 or of DIG_02 (see table 5/2), it represents a signal of minimum speed (see also the configuration of digital outputs for its use).
P25 : Parameter currently not used.
P26 : Parameter currently not used.
P27 : Parameter currently not used.
P28, ALARM, *Alarm representation:* it is the memorization of the occurred alarms; for each alarm, it shows a number that corresponds to the one represented on the 7-segment alarm display at the front of the drive (except for alarm 9, I^2t and alarm F, which indicates limit switch reached). This parameter cannot be modified.
P29, RS_OFF: Internal parameter not to be modified.
P30, R_ADG: Internal parameter not to be modified.
P31, IU_OFF: Internal parameter not to be modified.
P32, IV_OFF: Internal parameter not to be modified.
P33, POLES: Internal parameter not to be modified.
P34, RES_PP: Internal parameter not to be modified.
P35, BAUD_R, *Serial baud rate:* it is the baud rate of the serial interface RS 485 and it can assume a finite number of values.
P36, EN_RES, *Simulated encoder resolution:* it sets the output resolution of encoder simulation; the possibilities are 128, 256, 512 and 1024 pulses per revolution.
P37, TOPØ_W, *Simulated encoder TOPØ width:* it sets the pulse width of TOPØ for encoder simulation; it can change from half of the encoder pulse width at 1024 pulses per revolution (value equal to 12), till to the encoder pulse width at 256 pulse per revolution (value equal to 9). If for the external control it is enough to detect a rising or falling wave front, it is not necessary to specify it.
P38, SER_ID: Internal parameter not to be modified (except if serial communication is used).

4.2.3 Description of flags window

This window shows all the flags that it is possible to set, either configuration flags or procedure flags; the list shows the order in which they are visualized. Both procedures and configurations are enabled when the flag is set (SET).

F1, Auto phasing: flag of resolver autophasing procedure; the flag normally on **CLEAR** condition, is set when you want to execute the autophasing procedure. In general, this operation is carried once only during start up.
F2, Reference from potentiometer: configuration flag; when set, it enables speed analog reference,
F3, Enable ramp: configuration flag: when set, it enables the acceleration and deceleration ramps on the 4 quadrants: they are set with parameters P6, P7, P8 e P9.
F4: Flag currently not used.
F5, EPROM gains: procedure flag that reads all default parameters, as they are memorized into EPROM.
F6, Torque reference: configuration flag that enables torque reference: it is taken from current analog input, with the full scale value set by the parameter **P5, I_MAX.**
F7: Flag currently not used.
F8: Flag currently not used.
F9, Thermal probe: configuration flag that shows the kind of thermal probe mounted on the motor: it can be PTC or NTC type
F10: Flag currently not used.
F11: Flag currently not used.
F12, Store on EEPROM: procedure flag for the mmorization of parameters and of the global configuration of the drive in EEPROM.

F13, A/D converter tuning: procedure flag for the adjustment of the 12-bit A/D converter, used for speed analog reference: the procedure calculates the parameters **P20, OFF_AN**, and **P21, OFFMED**. On the latter only it is possible to intervene to correct speed offset.
F14: Flag currently not used.
F15, EEPROM Gains: procedure flag that makes it possible to go back to all parameters as they are memorized into EEPROM. It can be used when, after some parameters have been changed, you want to go back to the initial conditions.
F16, Analog current limit: confiuration flag that makes it possible to use the current analog reference as torque limit; to use it, it is necessary to set parameter **P5, I_MAX**, to its maximum vaiue (200.0% In).

4.3 External connections

BHL-D has some signal terminal boards (J1, J2), and a power terminal board (N1). The latter exists in two versions, indicated hereafter as N1A (size 223, Fig. 4-2) and N1B (size 224, Fig. 4-3). Besides terminal boards, there are two 9-pin sub-D connectors (J3 and J4) dedicated to the possible connection of the serial fine (J3 - female) and of the resolver cable (J4 - male).

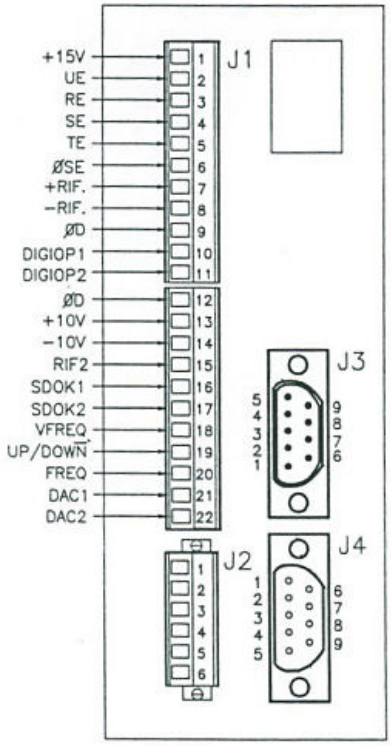


Fig. 4-1

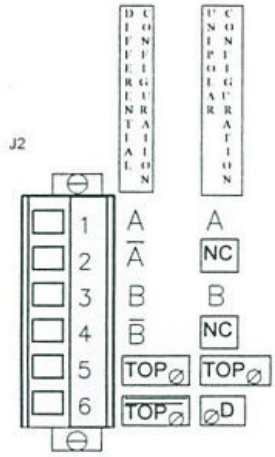
4.3.1 Commands terminal board J1

J1/1 +15V
Supply available for drive enabling; maximum load is 100mA. The output is protected against external short-circuits.
J1/2 UE
Optoinsulated configurable input CONF2. To configure, use parameter **P11, IN4_CF** (see paragraph 4.2, in the description of parameters window). To enable, connect to +15V or +24V, referring to ØSE.

J1/3 RE
Optoinsulated input for torque enabling. To enable, connect to +15V or +24V, referring to ØSE.
J1/4 SE
Optoinsulated input for speed reference enabling. To enable, connect to +15V or +24V, referring to ØSE.
J1/5 TE
Optoinsulated configurable input CONF1. To configure, use parameter **P10, IN3_CF** (see paragraph 4.2, in the description of parameters window). To enable, connect to +15V or +24V, referring to ØSE.
J1/6 ØSE
Common terminal to enable. If using +15V available on the connector terminal (J1/1) for drive enabling, connect this terminal to **ØD** (**J1/9** or **J1/12**).
J1/7 +RIF
Positive input of the speed differential stage.
J1/18 -RIF
Negative input of the speed differential stage.
J1/9 ØD
Zero reference of the board; used also as 0V for the output at +15V, J1/1 and for speed differential input and current analog input.
J1/10 DIGIOP1.
Digital configurable output 0V ÷ +15V (for size 224 0V ÷ +24V); the configuration can be selected on the keyboard with parameter **P16, DIG_O1** (see paragraph 4.2).
J1/11 DIGIOP2.
Digital configurable output 0V ÷ +15V (for size 224 0V ÷ +24V); the configuration can be selected on the keyboard with parameter **P17, DIG_O2** (see paragraph 4.2).
J1/12 ØD
Zero reference of the board; used also as 0V for the auxiliary supply **+15V, J1/1** and for speed differential input and current analog input.
J1/13 +10V
Stabilized supply +10V available externally with maximum load 10mA.
J1/14 -10V
Stabilized supply -10V available externally with maximum load 10mA.
J1/15 RIF2
Input for current reference or for torque analog limit. For current reference the input range is ±10V, while for torque limit the range lies between 0V and +10V (for 0V use **ØD, J1/9** or **J1/12**)
J1/16 SDOK1
Relay contact 1 that indicates regular operation of the drive.
J1/17 SDOK2
Relay contact 2 that indicates regular operation of the drive. The contact is normally closed type and opens in case of an alarm.
J1/18, J1/19, J1/20
Terminals currently not used.
J1/21 DAC1
Analog configurable output ±10V: this represents an internal variable of the drive. The configuration can be set on the keyboard with parameter **P12, OUT1_A** and **P13, DA1SHF** (see paragraph 4.2).
J1/22 DAC2
Analog configurable output ±10V: this represents an internal variable of the drive. The configuration can be set on the keyboard with parameter **P14, OUT2_A** and **P15, DA2SHF** (see par. 4.2).

4.3.2 Encoder emulator output terminal J2

Encoder emulator signal can be supplied both in a unipolar and in a differential way. The selection between the two ways is carried out by the manufacturer, according to the configuration ordered.



Differential line-drive configuration
J2/1,2
Channel A differential output
J2/3,4
Channel B differential output
J2/5,6
Channel TOPØ differential output

Unipolar line-drive configuration
J2/1
Channel A unipolar output
J2/3
Channel B unipolar output
J2/5
Channel TOPØ unipolar output
(The three unipolar outputs are referred to ØD, **J2/6**)

Technical characteristics of the outputs:

Number of pulses/rev. : programmable resolutions through parameter **P36, EN_RES:** 128, 256, 512 and 1024 pulses/rev.

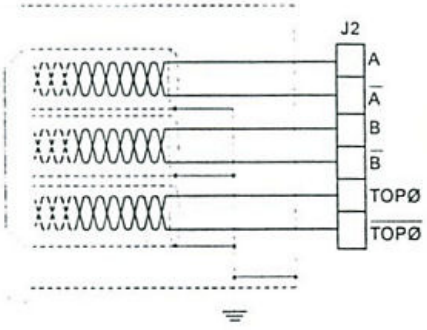
Zero notch : one pulse/rev. of width programmable through parameter **P37, TOPØ_W**.

Output voltages
- differential:
  V_{out} = ± 4V typical
  V_{out} = ±2.5V min @ I_{out} = 20mA max.
- unipolar:
  V_{out} = 0 ÷ + 15V typical
  I_{out} = 50mA max
  V_{OH} = +14V min
  V_{OL} = +0.8V max.

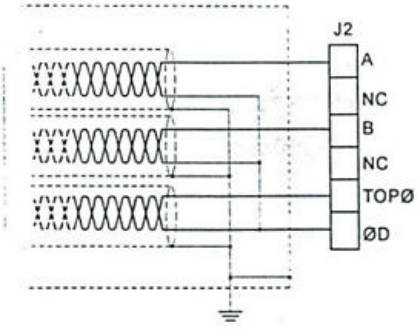
Connection of encoder emulator:

To connect encoder emulator, please follow instructions below very carefully. The incorrect execution of signal connection can cause bad operating or even a failure of the encoder emulator.

Differential operation



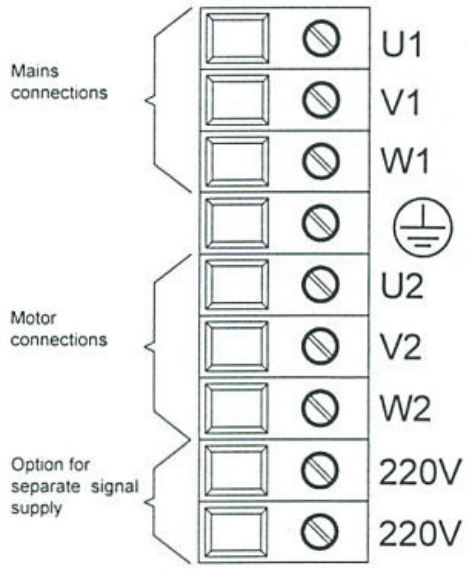
Unipolar operation



With reference to standards on electromagnetic compatibility (see paragraph 3.3), a 6-wire cable twisted and shielded two by two, 3x(2x0.25) shielded must be used for connection.

4.3.3 Power terminal NI

Terminal for size 223 (N1A)



CAUTION: It is important to respect phase sequence for connection to the motor; if phases are exchanged, the drive may not function.

Fig. 4-2

Terminal for size 224 (N1B)

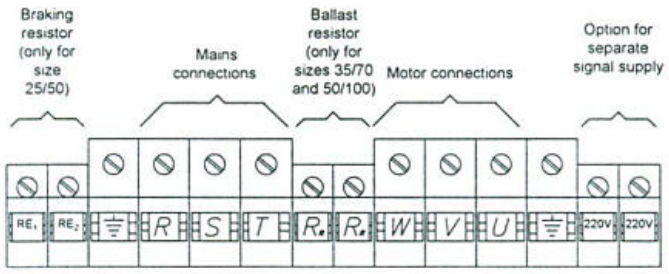
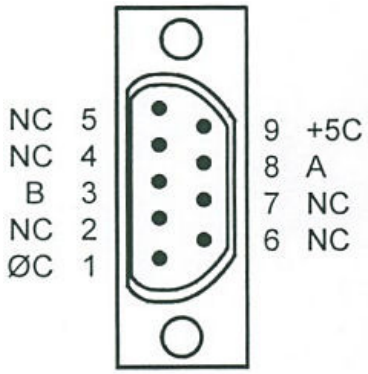


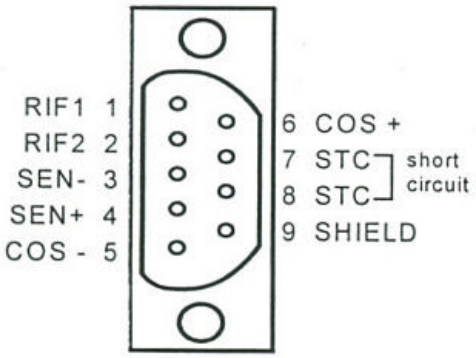
Fig. 4-3

4.3.4 Serial interface connector J3



J3/1. ØC
External supply zero reference of the serial interface.
J3/2. NC
J3/3. B
Channel B of serial interface RS 485.
J3/4. NC
J3/5. NC
J3/6. NC
J3/7, NC
J3/8. A
Channel A of serial interface RS 485.
J3/9. +5C
Input for external supply of the serial interface.

4.3.5 Resolver connector J4



J4/1. RIF1
Reference signal for resolver (0-6Vrms, 300mA).
J4/2. RIF2
Reference zero.
J4/3. SEN-
Sine input (input impedance 20kΩ).
J4/4. SEN+
Sine input (input impedance 20kΩ).
J4/5. COS-
Cosine input (input impedance 20kΩ).
J4/6. COS+
Cosine input (input impedance 20kΩ).
J4/7, J4/8. STC
Motor thermal probe.
J4/9. SHIELD
Resolver cable shield.

The resolver cable must be of the type approved of by ABB (code 16080125). Connections to the plug must comply with drawing DMGCAV067, available on request.

As regards the connection of the motor thermal probe, the standard configuration foresees the short circuit between terminal J4/7 and J4/8, since flag **F9, Thermal Probe** is set as PTC. The motor thermal protection is carried out through I^2t alarm (see parameters **P18, IN_MOT and P19, TH_MOT).** The same type of motor thermal protection can be used by configuring F9 as NTC and leaving terminals J4/7 and J4/8 disconnected.
On request, it is possible to foresee a direct connection between terminals J4/7 and J4/8 and the thermal probe mounted on the motor (normally closed). Flag F9 is set as PTC. To make the connection it is possible to use the double wire available in the a.m. cable. This solution is not advisable to comply with EMC standards.

4.4 Indications for connections to terminal boards

Hereafter you will find some examples of how the convertor should be connected for the start up.

4.4.1 Power connection (Soft-start)

Power conncetion for SIZE 223

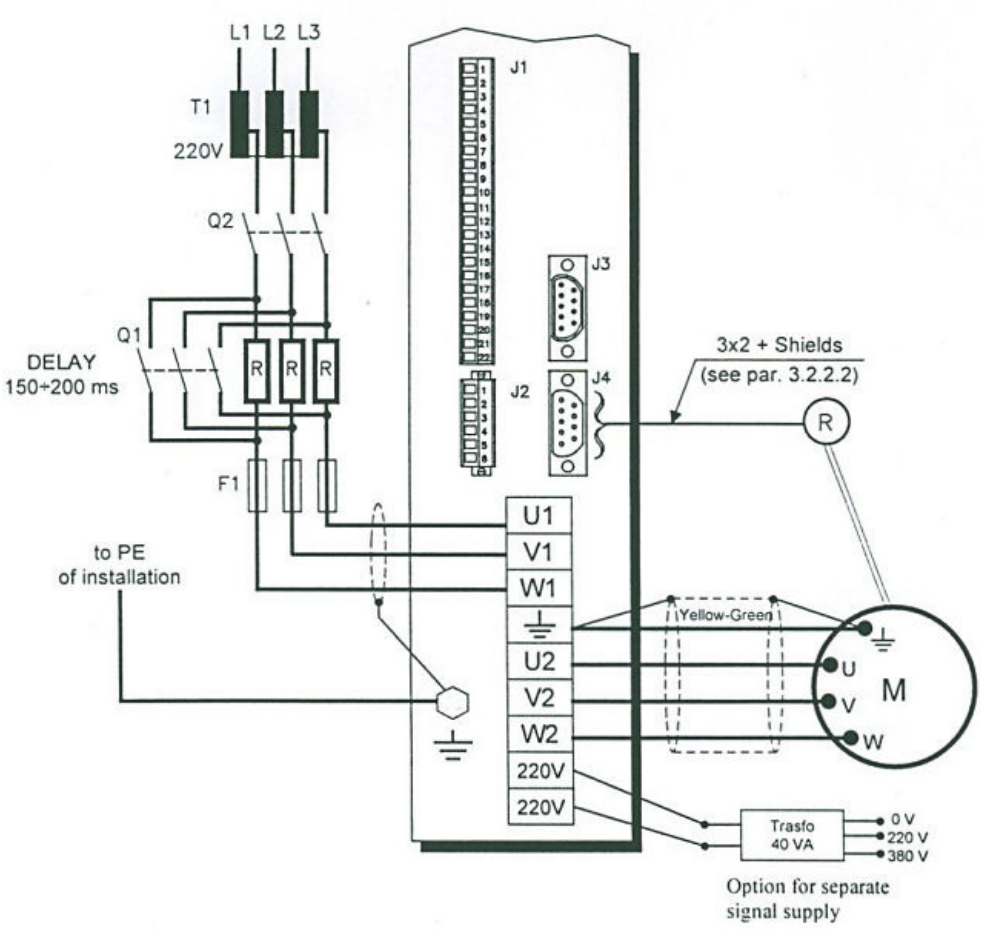


Fig. 4-4

Power connection for SIZE 224

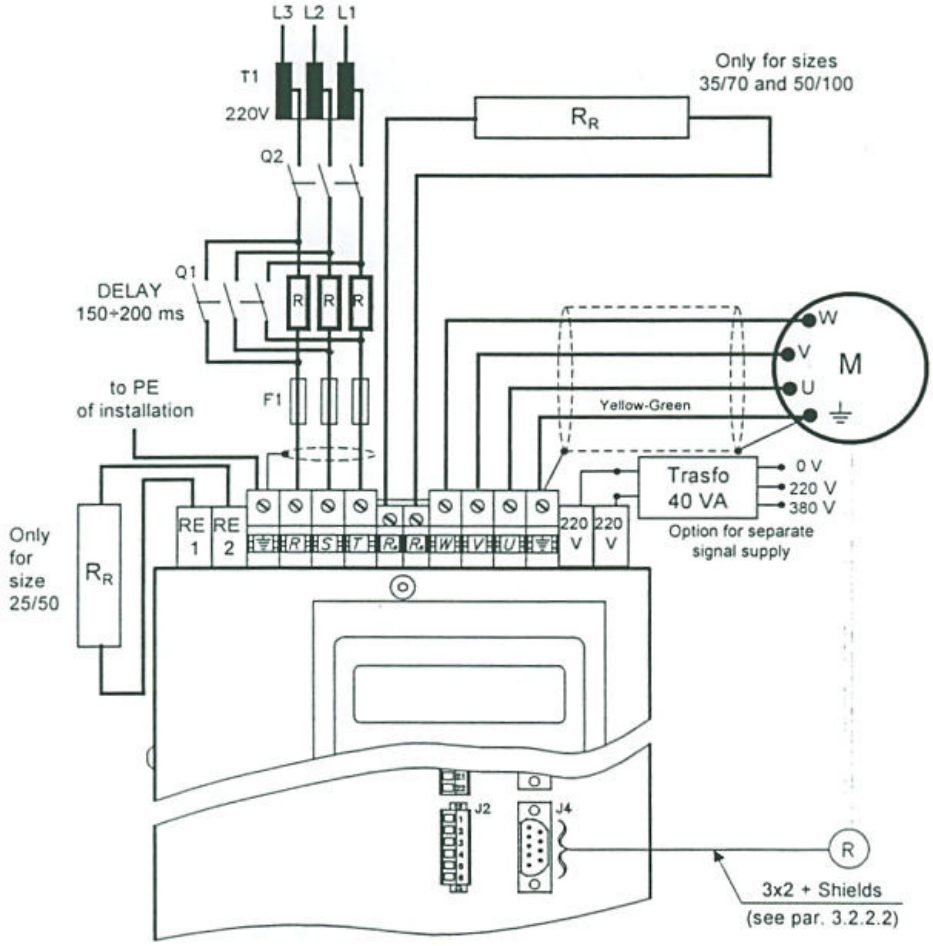


Fig. 4-5

The connection indicated in Fig. 4-4 and 4-5 includes also (resistors R and contactor Q1) the in-rush current limit circuit. The connection of this circuit is optional for models 5/10, 10/20, 14/28, 18/36 and compulsory for models 25/50, 35/70, 50/100. In general, the limit circuit must be inserted in all cases where the autotransformer T1 has a nominal power higher than 8kVA (this rule is also true in case a single autotransformer supplies more than one convertor).
The soft-start resistors must be short-circuited after 150÷200 ms from start up; they must have a value in the range 10÷20Ω with power 50÷100W and can be bought together with the drive (see chapter 7).

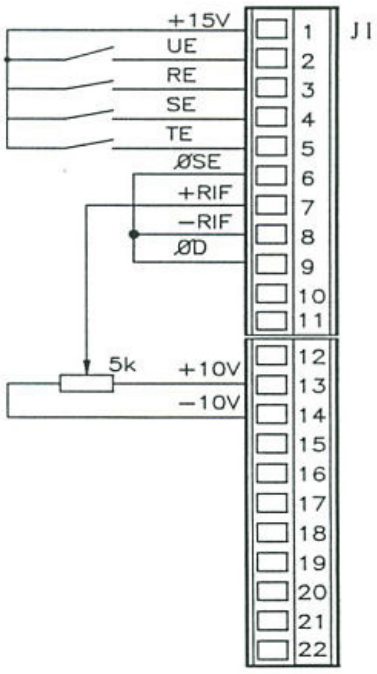
Table of advised components

Table 4/1

Convertor model	5/10	10/20	14/28	18/36	25/50	35/70	50/100
Nominal power to the motor [kVA]	1,8	3,6	5,0	6,5	9	12,7	18,2
T1 [kVA]	1,9	3,8	5,3	7,0	9,6	13,3	19
Q1 / Q2	16A	16A	16A	25A	25A	40A	63A
F1 (AM)	10A	16A	25A	25A	32A	50A	63A
Power cable section (3+T) [mm^2]	1,5	2,5	4	4	6	10	16

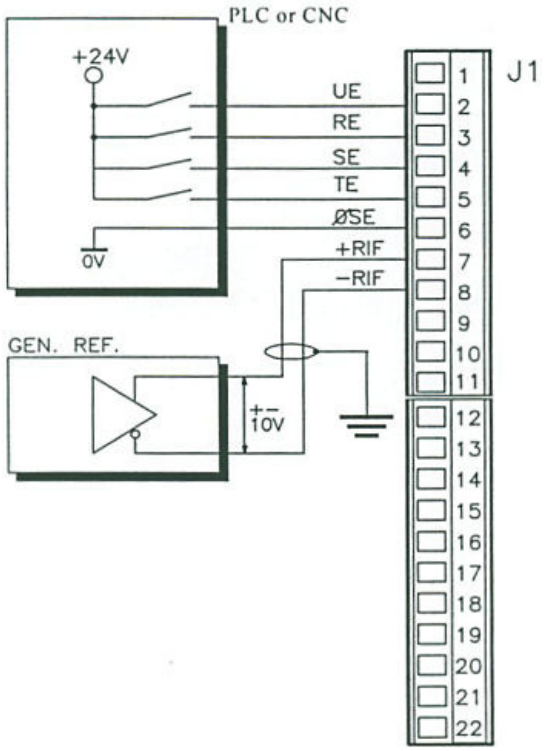
4.4.2 Connection for regulation with potentiometer

The diagram below exploits the +15V supply available on terminal for enabling and the ±10V supply for speed reference, using the speed reference input in a non-differential way.



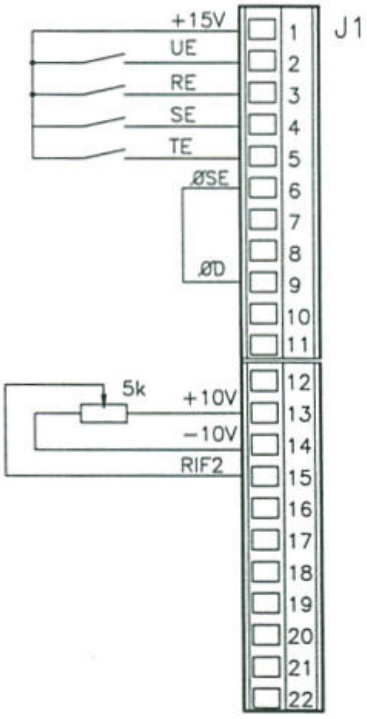
4.4.3 Standard regulation connection

Hereafter we illustrate another type of connection, which, unlike the previous one, maintains galvanic insulation between external commands and regulation. The input reference is differential.



4.4.4 Connection for torque mode

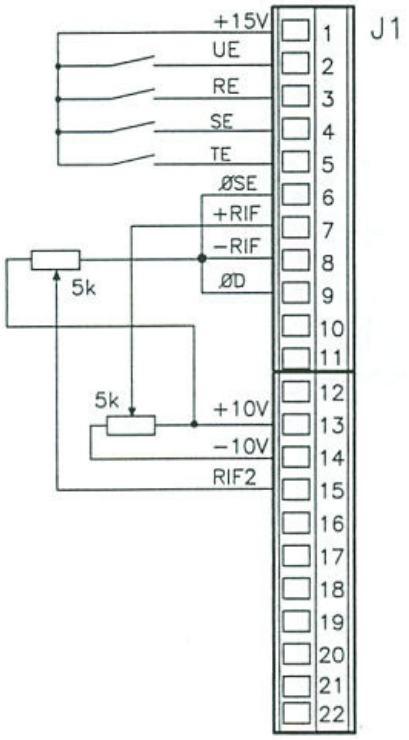
The picture below illustrates a simple application for using the convertor in torque mode.



To use torque mode, see paragraph 4.5.4. The value of the applied signal determines the rms value of the phase current of the motor, with a maximum equal to the peak current of the drive. The sign indicates the rotation sense of the motor (positive reference = motor rotation counterclockwise).

4.4.5 Connection for analog torque limit

The picture shows a typical application for torque limit.



To use analog torque limit, see paragraph 4.5.4.

4.5 Adjustment and regulation procedures

4.5.1 Resolver autophasing

The procedure for resolver autophasing is carried out just once by the manufacturer, using the convertor and the "motor & sensors" that make up the drive. The procedure must be repeated only if the mechanical assembly of the resolver on the motor shaft has been modified. In this case proceed as follows:
The motor must be able to rotate freely, since it makes almost one complete mechanical revolution.
Once having supplied, to execute the autophasing, it will be necessary to set to zero the proportional gain **P1, KP,** as well as the integral gain **P2, KI**. Now enable torque (input on terminal **RE, J1/3**) and speed reference (input on terminal **SE, J1/4**): with this procedure the 7-segment display stands still (no more blinking) and visualizes **0**.
At this moment set **F1, Auto phasing=SET,** with the keyboard. At the end of autophasing, the keyboard, in correspondence of F1, will display the word **"DONE"** for a few seconds, and will then go back to **"CLEAR".** The resolver phase is automatically memorized in parameter **P29, RS_OFF** and it should not be modified. Moreover, the parameter is automatically memorized in EEPROM. To reset the parameters P1 and P2 to their original values it will be enough to set the flag **F15 , EEPROM gains,** thus re-obtaining the memorized values. The drive is now able to work under any condition.

4.5.2 Adjusting the I^2t thermal protection threshold

The drive is equipped with two different protections against overtemperature: one for the convertor and one for the motor.
The first is set according to the size of the convertor and does not need further adjusting. In fact, the convertor is able to deliver maximum current for about 1,7 seconds, before the I^2t

alarm: the convertor remains enabled, but with maximum current equal to the motor rated current, set with **P18, IN_MOT**.
On the other side, to protect the motor, besides the rated current of the motor, it is necessary to set also the thermal time constant, with the parameter **P19, TH_MOT,** expressed in seconds. In this way, if higher current than the rated current of the motor, but lower than the rated current of the convertor (that could be delivered indefinitely) is required in steady-state, the I^2t alarm for the motor protection intervenes. The drive remains enabled, but the maximum current limit is set in relation to the rated current of the motor.
In both cases, the I^2t alarm will be visualized both on the 7-segment display and on the keyboard.
To reset the drive to normal conditions, it is necessary to reset the alarm, once its possible cause has been removed.

4.5.3 Speed mode

4.5.3.1 Adjusting of PI controller

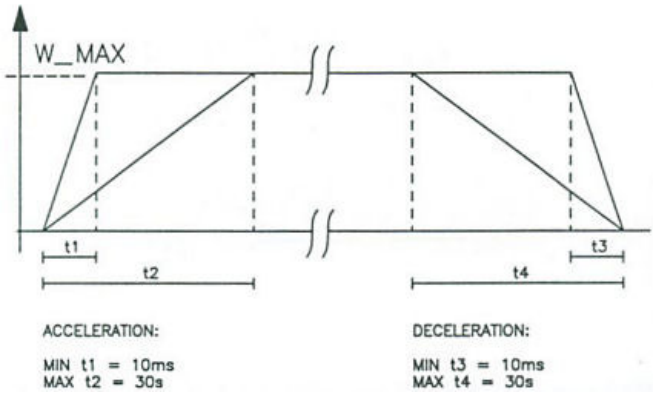
The drive uses a PI algorithm for speed mode. It is therefore necessary to set the dynamics of controller through parameters **P1, KP,** that represents the proportional gain of controller, and **P2, KI,** that represents the integral gain.
Basically, it can be said that when stepping up both gains, it is possible to increase the transient response of the motor to the reference changes and to noises. This will however also decrease the system stability margin. Moreover, the relation KP/KI, that sets the zero of the PI regulator, is also important for good control and stability. When increasing the KI gain, the drive capability to maintain the motor stopped in one position, delivering torque, is increased.
However, it is necessary to adjust the dynamic characteristics of the system convertor-motor to the mechanical system in which it is used. Therefore, we advise to adopt such values for KP and KI as to guarantee a good compromise between dynamic performances and noise sensitivity.
As well as with analog reference, the speed command can be set directly with the keyboard. At start up, this is the default condition.

4.5.3.2 Speed analog reference: offset adjusting

The speed analog reference is drawn from the differential input related to the terminals **+RIF (J1/7) and -RIF (J1/8).** It can be enabled with the keyboard through the flag **F2, Reference from potentiometer,** through serial interface or with one of the two configurable inputs.
The reference enabling input (terminal SE, J1/4) can be used as START/STOP command: its function is setting the reference to zero when it is disabled.
To use the speed analog reference it is necessary to calibrate the offset of 12-bit A/D converter: this procedure is totally automatic and can be carried out by setting flag **F13, A/D Converter tuning,** which will determine the value of parameters **P20, OFF_AN** and **P21, OFFMED.**
To adjust the offset, put a 0V value between the two inputs +RIF and -RIF, enable the speed reference (SE=H) and set the flag F2: at this moment set also the flag F13, to start the offset adjusting. The procedure stops when the keyboard shows the word **DONE,** in correspondence with F13. Now it is possible to drive the convertor in speed mode with analog reference.
NOTE: If the offset adjustment is not satisfactory (with 0V reference the motor turns slowly) it is possible to repeat the procedure with torque enabled (terminal **RE, J1/3**): if the adjusting is still not satisfactory, it is possible to intervene and directly modify the parameter P21, increasing or decreasing the value to correct the motor performances.

4.5.3.3 Acceleration and deceleration ramps

Acceleration and deceleration ramps can be set through the parameters **P6,P7,P8** and **P9**: it is acceleration and deceleration in both directions, within a range 10ms min ÷ 30s max. They can be enabled globally through the flag **F3, Ramp enable**, that can be set with the keyboard, via serial interface or with one of the configurable inputs.



4.5.4 Torque mode or torque analog limit

To drive the convertor directly with a torque signal use the input for current reference (terminal **RIF2, J1/15).** This signal, with a voltage range of ±10V, is referred to **ØD (J1/9** or **J1/12).** The full scale of reference signal depends on the maximum current set with the parameter **P5, I_MAX,** that represents a percentage of the drive rated current. After setting the parameter P5, it is necessary to set the flag **F6***,* **Torque reference.**
In speed mode, the torque limit (in addition to P5) can be set in an analog way through the input for the current reference RIF2, previously considered, but with a unipolar signal **0V÷+10V**. For torque analog limit it is necessary to set the flag **F16***,* **Analog current limit,** too.

4.6 Rules for start up

At the moment of installation and start-up of the drive, You will have to observe the following rules, in this order:

a) Make sure that all connections have been carried out according to what prescribed: check that all the terminals are tightened, in particular the power connections. Check that the resolver cable is connected to connector J4 and to the motor.

b) Make sure that the four digital inputs (terminals **UE,J1/2, RE,J1/3, SE,J1/4, TE,J1/5)** have all been disabled. Set current and speed references, if enabled, to a zero value.

c) Supply the drive: on the 7-segment display a blinking '0' appears, while on the alphanumerical display, the following words appear: ABB SERVOMOTORS, followed by BRS 223/224 DIG on the first line and by the complete software version and the date on the second line. The last information is given in this way: VERx.x.x, followed by the month and the year of introduction. Take down the version number, that will have to be reported in case of service requests.

d) When starting the machine, the last used parameters (memorized into EEPROM) will be loaded. If this is the start-up or if no modifications have been made to configuration and parameters, the default configuration will appear. In the default configuration, the speed reference is digital, i.e. it can be set by keyboard or serial interface.

e) The defauft configuration at start-up usually covers most applications, except for the parameters related to the type of application (speed mode gains, acceleration and deceleration ramps, etc.). In any case every modification can be memorized only if parameters and configuration are saved in EEPROM; to do this it is necessary to set the flag **F12, Store on EEPROM.**

f) The motor is stopped delivering torque if the speed digital reference, read on the alphanumerical display, is zero, or it turns slowly if the speed analog reference is enabled and there is an offset; in both cases, you must supply a positive reference and check that the motor turns counterclockwise. To correct the offset of speed analog reference (if present) there is an automatic procedure: see paragraph 4.5.3.2.
In these conditions the drive is ready for use: make some typical duty cycles of the application, to make sure that I^2t protection does not intervene or there are no alarms (terminals J1/16 and J1/17 are terminals SDOK1 and SDOK2 of the relay DRIVE OK and must always be short-circuited in normal conditions of operation).

5.1 Configuration of external programmable interfaces

Some configurable inputs and outputs are available, which makes it possible to reach a personalization level of the drive and an adequate diagnostic.
Together with the two inputs with set configuration, **RE, J1/3,** for torque enabling and **SE, J1/4,** for the enabling of the speed reference, there are another two digital inputs: their function can be configured through the parameters **P10, IN3_CF**, related to the input TE, **J1/5,** and **P11, IN4_CF,** related to the input **UE, J1/2**: the meaning is shown in Table 5/1, together with the state in which the command is active:

Table 5/1

IN3_CF and IN4_CF	Meaning	active state
0	input not used	//
1	alarm reset	H=reset
2	ramp disabling/enabling	H=enable
3	speed analog ref. disabling/enabling	H=enable
4	torque ref. disabling/enabling	H=enable
5	HW limit switch 1	L=reached
6	HW limit switch 2	L=reached
7	inversion	H=inv. CW

For alarm reset it is necessary to give a positive impulse(not a positive level) of at least 1.5 ms; on the contrary, the remaining configurations are sensitive to the level. The HW limit switch inputs are used to generate an alarm (that can be reset only when the limit switch signal becomes H again). There are many different possibilities for the management of such an alarm; contact Customer Service in case of need.
For diagnostics, two digital configurable outputs and two analog configurable outputs are available on the terminal board J1; while the former makes it possible to control the condition of some flags of internal control, the latter give an analog representation of some internal variables. The digital outputs are related to the terminals **DIG1, J1/10** and **DIG2, J1/11,** with a signal 0/+15V (for size 224 0/+24V), in relation to ØD, not optoinsulated and with capability of driving only a few mA. For the configuration of digital outputs see Table 5/2.

Table 5/2

DIG_O1 and DIG_O2	Meaning
0	Shaft direction (H=CCW, L=CW)
1	One alarm occurred(H=alarm)
2	Convertor I^2t alarm (H=alarm)
3	Motor I^2t alarm (H=alarm)
4	Stop command from keyboard (H=stop)
5	Resolver alarm (H=alarm)
6	Max speed reached (H=reached)
7	Minimum speed (L=reached)

Finally, the analog configurable outputs refer to terminals **DAC1, J1/21** and **DAC2, J1/22,** with a signal of ±10V in relation to ØD and driving capability of 10 mA. The configuration is

set by parameters **P12, OUT1_A** and **P14, OUT2_A,** with the possibilities shown in Table 5/3

Table 5/3

OUT1_A and OUT2_A	Meaning
1	Current analog reference I_ref
2	Speed reference W_ref
3	Available for further developments
4	Actual speed monitor
5	Torque signal monitor
6	Available for further developments
7	Available for further developments
8	Reference current monitor phase U
9	Reference current monitor phase V

The configuration also makes it possible to set the scaling factor for the representation of the internal numerical values: in fact, once the analog full scale has been set in the range ±10V, it is possible to change the resolution of the representation with parameters **P13, DA1SHF** and **P15, DA2SHF,** that determine the number of shifts and therefore the number of divisions by 2 of the numerical value before representing it in an analog way. In this way the user can set the use of these signals arbitrarily.
Since in the majority of cases the most significant numerical values are motor rotation speed and delivered torque, the default configuration of these outputs is OUT1_A=4 and OUT2_A=5 respectively. In this case the two shift parameters (P13 and P15) are set to zero and the full scale is calculated automatically, basing on the limits set with **P4, W_MAX,** that is maximum speed, and **P5, I_MAX** for maximum torque (maximum current). When the maximum values of P4 and P5 are reached, the representation on output has a value equal to +7.5V (or -7.5V if negative) rather than +10V, allowing a further 25% margin for overshoots.

6.1 Alarms and diagnostics

There are different sources to get information about both the operating state of the convertor (either in the presence of alarms or not) and the various causes that have brought the system in alarm/ stop condition.
As already stated in the previous chapter, 4 alarm states of the convertor are available on the digital outputs of terminal board J1; some information is available using the keyboard while other information, not necessarily different, can be derived from the 7-segment display on the front of the convertor.

6.1.1 Visualization and codifying of alarms on the keyboard

Hereafter you will find a table where the different visualizations of memorized alarms are listed, together with the corresponding number which appears on the 7-segment display. Moreover, you can see the various messages that appear cyclically when one or more alarms are memorized (the first line of the alphanumerical display blinks). If various alarms are memorized, the message which appears is referred to the alarm with highest priority: it increases with the increasing of the number, except for I^2t and limit switch alarms.

Description	Codifying	Visualization	Display
Thermal probe drive	0000000001 F987654321	<<< ALARM 1! >>> Drive thermal probe	1
Thermal probe motor (when connected)	0000000010 F987654321	<<< ALARM 2! >>> Motor thermal probe	2
Resolver failure	0000000100 F987654321	<<< ALARM 3! >>> Resolver failure	3
Overbraking	0000001000 F987654321	<<< ALARM 4! >>> Overbraking	4
Overvoltage	0000010000 F987654321	<<< ALARM 5! >>> Overvoltage	5
Brake fault	0000100000 F987654321	<<< ALARM 6! >>> Brake fault	6
Power fault	0001000000 F987654321	<<< ALARM 7! >>> Power fault	7
Undervoltage	0010000000 F987654321	<<< ALARM 8! >>> Undervoltage	8
I^2t protection	0100000000 F987654321	<<< ALARM 9! >>> I^2t protection	9
Limit switch	1000000000 F987654321	<<< ALARM 10! >>> Limit switch	F

6.1.2 Visualization and codifying of alarms on the 7-segment display

As in the previous case, the following table describes the codes adopted on the display to represent the different alarms.

DISPLAY lamp	DISPLAY no lamp	ALARM OR CONDITION	CONVERTOR-MOTOR CONDITION
0		Stand by	Supplied drive without any occurred alarm
	0	Torque	Normal operating condition
1		Convertor Thermal Protection	Drive thermal sensor intervention Drive disabled
2		Motor Thermal Protection	Motor thermal sensor intervention Drive disabled
3		Resolver connector detachment	Resolver signals missing Drive disabled
4		Overbraking	Overbraking Drive disabled
5		Overvoltage	Overvoltage on the DC BUS Drive disabled
6		Braking circuit fault	Brake module fault Drive disabled
7		Fault on the inverter bridge	IPM Fault Drive disabled
8		Undervoltage	Undervoltage on the DC BUS Drive disabled
9		I^2t motor or convertor	Overtemperature protection Drive enabled

NOTE: All a.m. alarms are visualized on the alphanumeric keyboard through parameter **P28, ALARM.** After suspension of the alarm cause, reset the drive by pressing the **CLR** key or setting one of the configurable inputs.
To reset **7** and **8** alarms, the power supply of the drive must be interrupted (with 8 blinking, the alarm reset can be carried out by pressing the **CLR** key directly on the keyboard). A generic alarm condition is also shown on the commands connector terminals **SDOK1** and **SDOK2 (J1/16, J1/17).** During normal operating conditions SDOK relay is energized and the terminals are short-circuited.

7.1

The following optional devices are available besides the standard equipment of the convertor:

- the possibility to obtain the maximum continuous power when braking (specified in table 2/3, paragraph 2.2) by connecting externally an extra ballast resistor, suitably dimensioned as regards heat sinking; this option must be specified when ordering the convertor.

- the possibility to limit the inrush current, where necessary (see paragraph 4.4.1), through suitable soft-start resistors; ABB can supply armored resistors 10Ω, 50W. Order code UREP6996.

- resolver connection cable between motor and convertor, complete with connector both motor side and convertor side; in table 3/2, paragraph 3.2.2.2, the code of the cable is specified, according to the length.

- the possibility to keep pseudoencoder alive in case of lack of supply, by using a separate signal supply. The kit related to this function is made up of a personalization inside the convertor and of an external transformer that goes with the convertor. This configuration is available: please require the suitable code when ordering the convertor.

- External adapter ABB code BRS5RS232RS485, which makes it possible to have a serial interface between the serial interface RS485 of the BHL-D and a PC, generally having a serial interface RS232.

- alphanumerical keyboard for the start up and the regulation of the BHL-D, that can be supplied separately, together with the connection flat cable. Ordering code:
  - for size 223: BRS5TXDXXXXXXX
  - for size 224: BRS5T1DXXXXXXX

- communication program between PC and BHL-D. This program makes it possible to communicate with the BHL-D without keyboard. Ordering code GDSC010A.

Verkauf +
Service

ABB Automation GmbH
Edisonstr. 15
D – 68623 Lampertheim

Telefon: + 49 (0) 6206 / 503 - 553
Telefax: + 49 (0) 6206 / 503 - 269