



MOTION CONTROL SYSTEMS

**HARDWARE INSTRUCTION MANUAL
STEPPING MOTOR DRIVES
R-Mod ET SERIES**



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INDEX

1. NOTICES AND MANUAL STRUCTURE	3
2.  LIMITATIONS, HAZARDS AND CAUTIONS	4
3. GENERAL CHARACTERISTICS AND IDENTIFICATION	5
3.1. R-MOD ET IDENTIFICATION	5
4. MODELS WITH CONNECTORS: DIMENSIONS AND CONNECTIONS.....	6
4.1. MECHANICAL DIMENSIONS.....	6
4.2. ELECTRICAL CONNECTIONS.....	7
4.3. CN1 CONNECTOR	7
4.4. CN2 CN3 ETHERCAT CONNECTORS	8
4.5. EXTERNAL CONNECTIONS	9
5. DRIVE CHARACTERISTICS	10
5.1. NOMINAL VALUES OF ELECTRICAL AND ENVIRONMENTAL CHARACTERISTICS.....	10
6. ELECTRICAL DIMENSIONING OF EXTERNAL COMPONENTS	10
6.1. POWER SUPPLY	10
6.2. FUSES	10
6.3. LENGTH AND SECTION OF POWER SUPPLY CABLES	10
6.4. ETHERCAT CONNECTIONS	10
7.  APPLICATION NOTES.....	11
7.1. ELECTROMAGNETIC INTERFERENCES AND IMMUNITY (DIRECTIVE 2014/30/CE).....	11

WARNING: it is user **RESPONSIBILITY** to check that this manual refers to product model and version that will be used

Symbol meaning

 The section marked with this symbol contains warnings regarding safety problems. If the directions indicated in these sections are not fulfilled, it could arise hazardous situations .

 The section marked with this symbol contains information regarding operations which are strictly forbidden.

1. NOTICES AND MANUAL STRUCTURE

1.1 - This manual covers the following items:

- R-MOD ET series stepping motor drives in all their standard versions
- Standard characteristics of special versions of R-MOD ET series stepping motor drives
- For models and versions identification see also chapter 3.

This manual covers hardware characteristics of models described in Chap. 3.1 and contains informations for mounting and electrical connections of these drives. Software characteristics are described in programmer's manual.

1.2 - Products described in this manual are CE marked and comply with the following directives:

- Low Voltage (2014/35/CE)
- Electromagnetic Compatibility (2014/30/CE)

1.3 - Remember that, as stated in all directives, compliance exists only when a product is used in accordance with its destination and following manufacturer prescriptions. Thereby, all relevant indications about use, cautions, installation and limitations here described must be followed by user in order to stay within compliance limits; from this point of view the entire content of this manual has to be carefully read and considered in order to obtain the information necessary for a correct use.

1.4 - Conformity declaration regarding above mentioned products is kept by R.T.A. (as manufacturer residing in EEC country) together with technical construction file at authority disposal.

1.5 - This manual is conceived in a way to offer to the personnel involved in project and safety verification of a machine all information concerning characteristics, working conditions, application limits and cautions about stepping motor drives. The knowledge of this information is essential for a correct project of machines, apparatus and systems in which the drives are used; it is strongly recommended not to start any operation with the drives before you have completely read and understood the content of this manual; if you find some part of this manual not completely understandable or lacking regarding your particular application, do not hesitate to contact directly R.T.A. that can provide, if necessary, further information in order to make the user able to design his machine and the related safety systems in the best way. Take into account that an incorrect use or installation, a wrong dimensioning of external safety elements related with the drive could bring to economical damages and also to hazards for human life.

1.6 - Consider the fact that these are products with a very wide range of possible applications in many different working and environmental conditions. For this reason this manual can only fix limits and general rules but cannot take in consideration every single possible application condition. If you have problems to understand some part of this manual or to meet its indications with your specific application, do not hesitate to contact R.T.A. for further information. Take into account that R.T.A. has twenty years of experience in any kind of applications, which cannot be condensed in a manual but can always be at customer disposal.

1.7 - The terms "user and customer" often used in this manual always indicate a skilled person.

1.8 - This manual is considered valid at the moment of the selling of the product. It cannot be considered inadequate as a consequence of product or manual changes or improvements after the selling. R.T.A. reserves the right of products and manual revisions without notice neither obligation of previous products and manuals revision.

2. LIMITATIONS, HAZARDS AND CAUTIONS

- 2.1 - It is not allowed the use in any condition not complying with one or more specific limitations stated in this manual for electrical, mechanical and environmental quantity or characteristics.
- 2.2 - R-MOD ET series drives must be mounted as in Fig. 1. Do not take out or insert connectors when the drive is switched on.
- 2.3 - R-MOD ET series drives contain capacitors able to store a certain amount of electrical energy. As a consequence, in some cases, according with application conditions and supply dimensioning, a dangerous voltage could remain on the drive, after switching off, for a time greater than 5 seconds. So it is recommended to wait an adequate time before working on the drive.
- 2.4 - The heatsink can reach high temperatures during normal working conditions. Do not touch this component for some minutes, after switching off, in order to avoid scald hazard.
- 2.5 - The drives are suitable to be installed in environment with pollution degree 3, see Chap. 7.1. The installation in environments in which flammable and/or explosive, and/or chemically aggressive and/or electrically conductive gas, vapor or dust could be present is strictly forbidden. Avoid also to install near easily flammable or sensitive to heat materials and components; we recommend to verify that all the components located in the enclosure are realized using self-extinguishing materials.
- 2.6 - All products considered in this manual are sub-assemblies without a direct function, foreseen to be integrated in a more complex machine. Only a professional assembler, expert in the field of motor drives and in their related problems, can install and put in service this component. It is exclusive responsibility of the designer of the complete machine or installation in which this component is used to take care of the safety and reliability of his project. It is forbidden to use this material in application covered from one or more EEC directives (for instance 2014/30/CE, 2006/42/CE, etc.) before the conformity to those directives has been declared. Regarding 2014/30/CE directive, see chapter 7.
- 2.7 - Use for safety related functions is forbidden (EN 60204-1). Moreover, when the application arrangement is in such way that a drive fault or failure could generate a dangerous condition, external independent safety protection system must be provided in the machine.
- 2.8 - In some case of drive failure, dangerous high voltage could appear at logic low voltage input and output terminals, even if this event is extremely rare. For this reason, from the point of view of evaluation of the machine safety during a single fault condition, the external control system, connected to these inputs, has to be considered potentially subjected to high voltage, unless an external separation is provided.
- 2.9 - EtherCAT commands used to interrupt power to the drive outputs and internal electronic functional protections switch off the drive output power by means of semiconductor devices; they cannot be used to interrupt power in some emergency stop function or in any function involving personnel safety.

3. GENERAL CHARACTERISTICS AND IDENTIFICATION

3.1. *R-Mod ET identification*

The models identification of R-MOD ET series drives is as follows:

R MOD ET **E3HXMn.m**

R-MOD ET **A3HXMn.m**

X = Stepping motor model

1	→ 103-H7822-17xx	(1 Stack - 4 Amp)
2	→ 103-H7823-17xx	(2 Stack - 4 Amp)

n = Release software (alphanumeric character)

m = special version with some variations regards to standard models (is not present in standard models and it is alphanumeric character if present).

Each sample is also identified with a serial number.

4. MODELS WITH CONNECTORS: DIMENSIONS AND CONNECTIONS

4.1. Mechanical dimensions

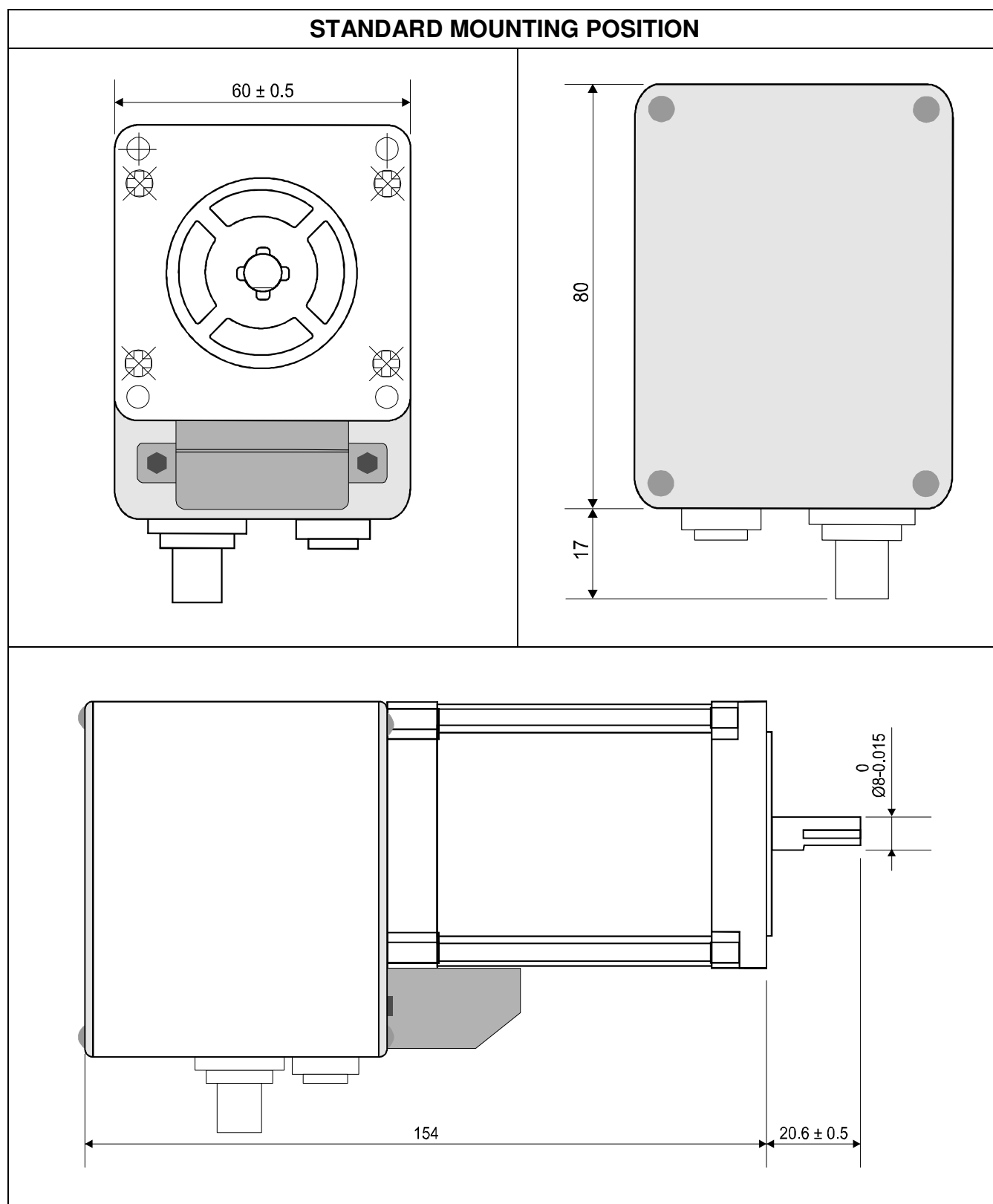


Figure 1 – Dimensions in mm.

4.2. Electrical connections

Electrical connections include:

- M12 Circular connector 5 terminals for power supply and logic signals (CN1 Figure 3 and Figure 5).
- Two M8 circular connectors for EtherCAT IN and OUT (CN2, CN3 Figure 4 and Figure 5) to allow a daisy-chain connection.

4.3. CN1 connector

1 I0 input first terminal: This input is ON (logic level 1) when at its terminals there is a voltage between 8 and 24 Volt. This input is OFF (logic level 0) when there is a voltage < 1.5 Volt. It is optically insulated as regards internal power circuits. This input can be set as:

- **Proximity (for R-Mod E3HxMn only):** when input is ON, I0 is the reference for a zero search procedure.
- **Touch Probe (for R-Mod A3HxMn only):** encoder position has been sampled on positive/negative edge of this signal.
- **General Purpose:** input status has been stored in object 0x60FD "Digital Inputs".

For proper input setting, see also software manual.

2 +HVDC: Power supply positive pole (+ $V_{DC\ nom}$).

3 I0 input second terminal

4 COMMON OF POWER SUPPLY VOLTAGE:- HVDC: Power supply negative pole (- $V_{DC\ nom}$), and **-24 VDC** (logic supply negative pole). Supply negative poles must be connected to earth (PE) at power supply side.

5 +24 VDC: Control logic supply positive pole (24 Vdc).

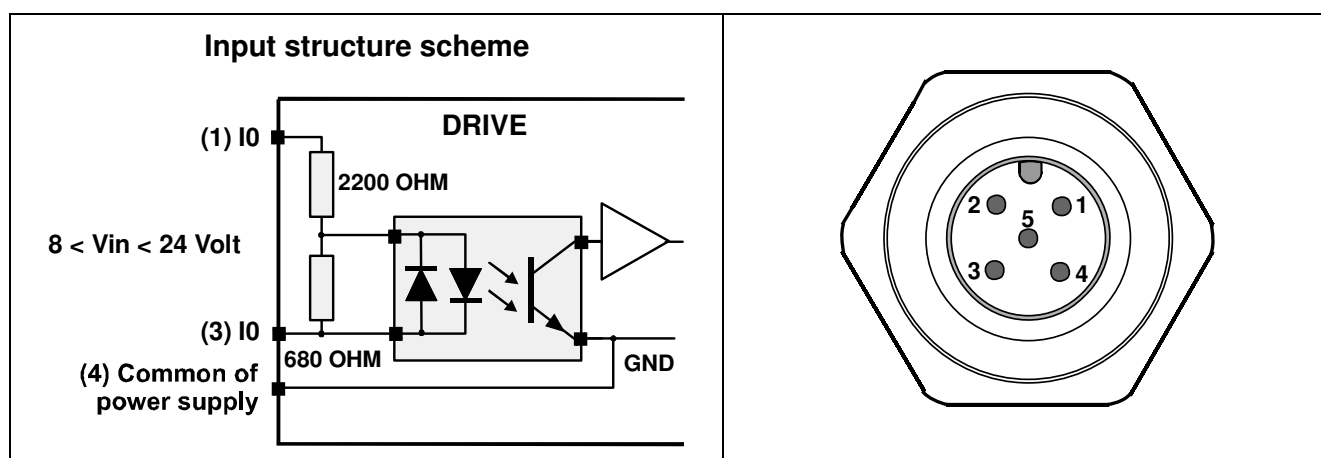


Figure 2 – Input I0 Scheme

Figure 3 – CN1 connector (Male, cod. A)

4.4. CN2 CN3 EtherCAT connectors

Two standard Ethernet M8 modular connectors (IN, OUT) are provided for the EtherCAT communication. The same pin disposition (same signal) is assigned for both connectors. Figure 4 shows connector M8 connectors used for connection between the drive and the control system.

- 1 **Trasmit Data+:** trasmit data positive pole;
- 2 **Receive Data+:** receive data positive pole;
- 3 **Receive Data-:** trasmit data negative pole;
- 4 **Trasmit Data-:** receive data positive pole.

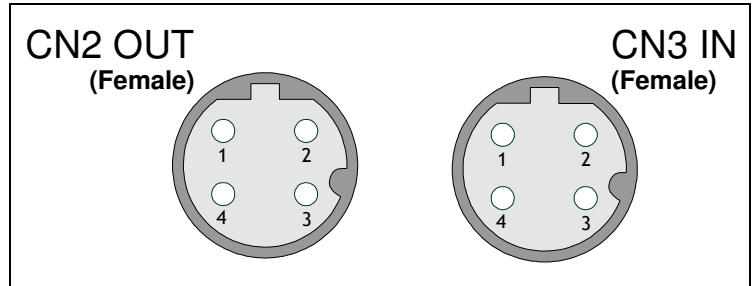


Figure 4 –CN2 and CN3 connectors

Connect IN to the higher-level device and OUT to the next slave.

Use twisted-pair cables that satisfy at least “Category 5e” to connect the cable.

When you make cables using exclusive tools, use STP (Shielded twisted pair cable) and M8 modular socket with shield.

4.5. External connections

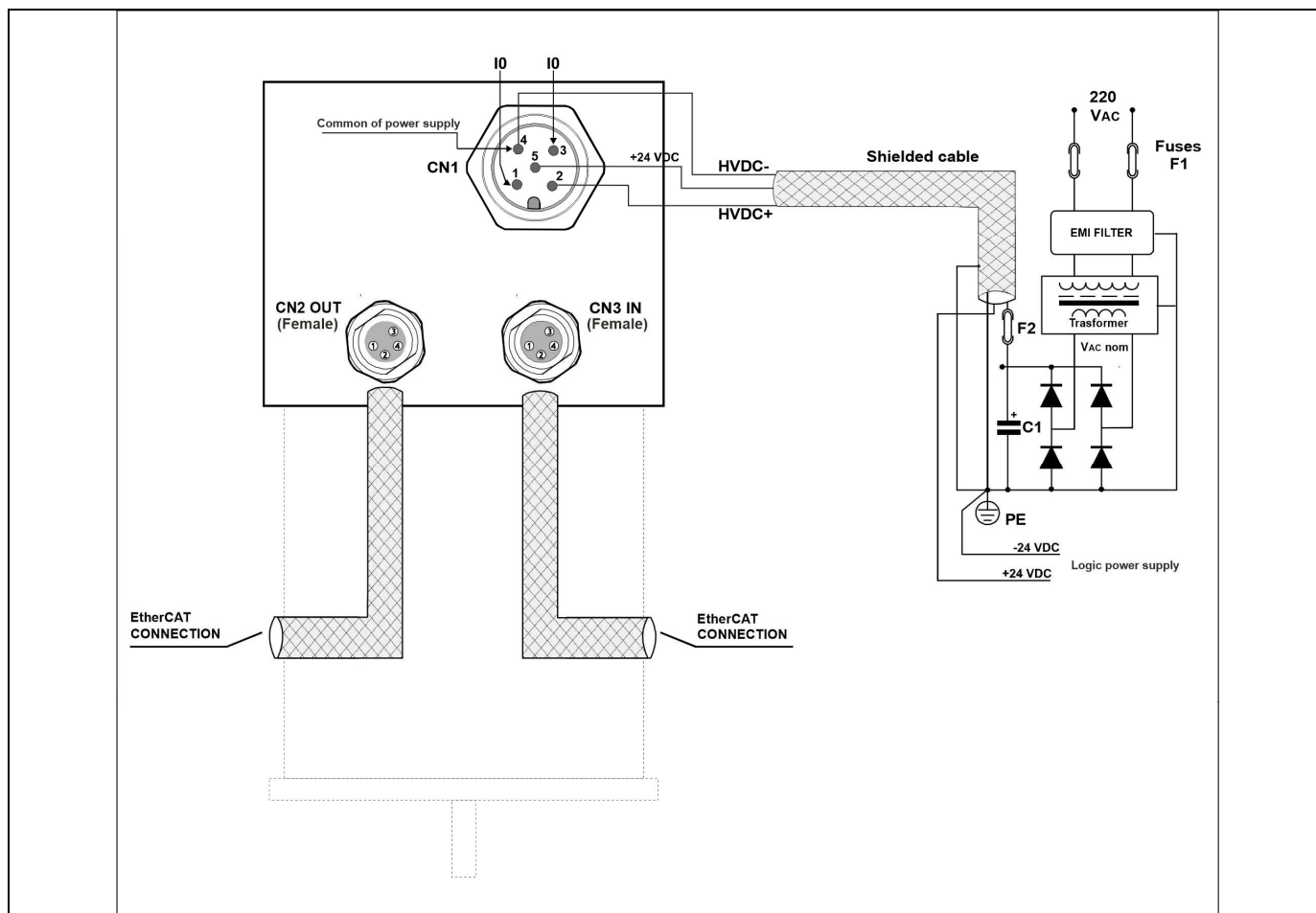


Figure 5 – Connections scheme

Note 1: See Chap. 7 for power supply and fuses dimensioning and features.

Note 2: See software manual, cap. 3.7 for informations about reverse energy

5. DRIVE CHARACTERISTICS

5.1. Nominal values of electrical and environmental characteristics

Table 1		
HV _{DC} nom	(V)	from 24 to 48
V _{DC} nom tolerance	(%)	+/-10
I _{ph} nom	(A)	4.0
I _{ph} % (M motors)	(%)	0÷120%
Operating temperature	(%)	from + 5°C to + 40°C
Environment installation pollution degree		3
Overvoltage category		II

Definition of terms used in Table 1:

V_{DC} nom: Nominal value of DC voltage supply at the drive input.

Tolerance: Maximum percentage variation allowed regard to VDC nom values.

I nom: Nominal current at the drive power supply input.

I_{ph} nom RMS value of motor nominal phase current.

I_{ph} %: Percentage values regard to phase current nominal values, setting by means of software commands (see software manual).

6. ELECTRICAL DIMENSIONING OF EXTERNAL COMPONENTS

6.1. Power supply

Power supply shown in Figure 5 can be realized with single-phase bridge rectifier (as indicated in figure) or with three-phase bridge rectifier. C1 filter capacitor can never have a capacitance below $4700 \times n \mu\text{F}$ (n = number of drives connected to the same power supply). The use of three-phase solution has to be preferred when the number of drives connected to the same power supply is more than three.

Power supply must fulfill the following requirements:

- Separation from the main: the separation from the main must be granted in order to ensure that the over-voltage category of the DC side is II.
- Nominal power of power supply has to be the sum of every single connected drive power.
- Short-circuit current must be lower than 1000 Amp

6.2. Fuses

F1 and F2 fuses (or equivalent protection systems) must be dimensioned in accordance with flowing power of power supply.

6.3. Length and section of power supply cables

For power supply can be used AWG16 cables for a length of 25 mt.

6.4. EtherCAT connections

For this connection can be used whatever EtherCAT bus cable in accordance with valid directive and with drive connectors.

7. APPLICATION NOTES

7.1. *Electromagnetic interferences and immunity (directive 2014/30/CE)*

R-MOD ET series drives are BDM (Basic Drive Module) conceived for restricted distribution (EN 61800-3). This means that R.T.A. has the responsibility to verify the products compatibility in some typical way of use in order to give correct installation information. In any cases, it is responsibility of the professional assembler, who installs this product, to verify the compatibility of the complete machine or system.

7.1.1 - The set consisting of drive, motor and all related cablings are source of electromagnetic interferences. The assembler of installation must consider these problems during the project of the plant where the drive (or drives) will be installed in order to shield and/or reduce these interferences. Tests performed by R.T.A. show that the most effective measures able to reduce these interferences are the following:

- Use only shielded cable for power supply.
- Interpose an EMI filter (CORCOM mod. 6VVK1) on the transformer power that is used to supply the drives in order to reduce conducted electromagnetic interferences.
- Connection made to Protective Earth terminal (PE), shown in Fig. 5, must be short and have the lowest possible inductance.
- All connections made to Protective Earth (PE) must be realized to have the lowest possible inductance.

7.1.2 - Considering drive logic input signals immunity from external noise present in the environment in which they are most often used, take in account following normal procedures, suggested from the classical techniques about relatively fast signals treatment:

- Use shielded cables.
- Keep shielded signal cables separate from shielded power cables.
- Verify carefully logic level compatibility when interfacing drive with control system.

7.1.3 - A correct accomplishment of these procedures constitutes an essential starting point in order to realize an installation which complies with the requirements of 2014/30/CE directive. The effective compliance with specific standards covering the particular application in which this drive is used will have in any case to be proved in the complete installation, because the effectiveness of suggested actions depends also on machine topology and on their correct fulfillment. Tests performed by R.T.A. simulating typical installations and following above mentioned indications show that it is possible to stay within the limit of EN61800-3 standard.

7.1.4 - In some cases, due to the characteristics of particular installations, conflicts between ground connections necessary for shielding purposes and ground connections necessary for safety reasons could arise. Remember that, in such cases, prescriptions regarding safety take priority, but remember also that, in the great majority of cases it is possible to find a solution meeting both prescriptions; R.T.A. is at disposal for further information about these problems.