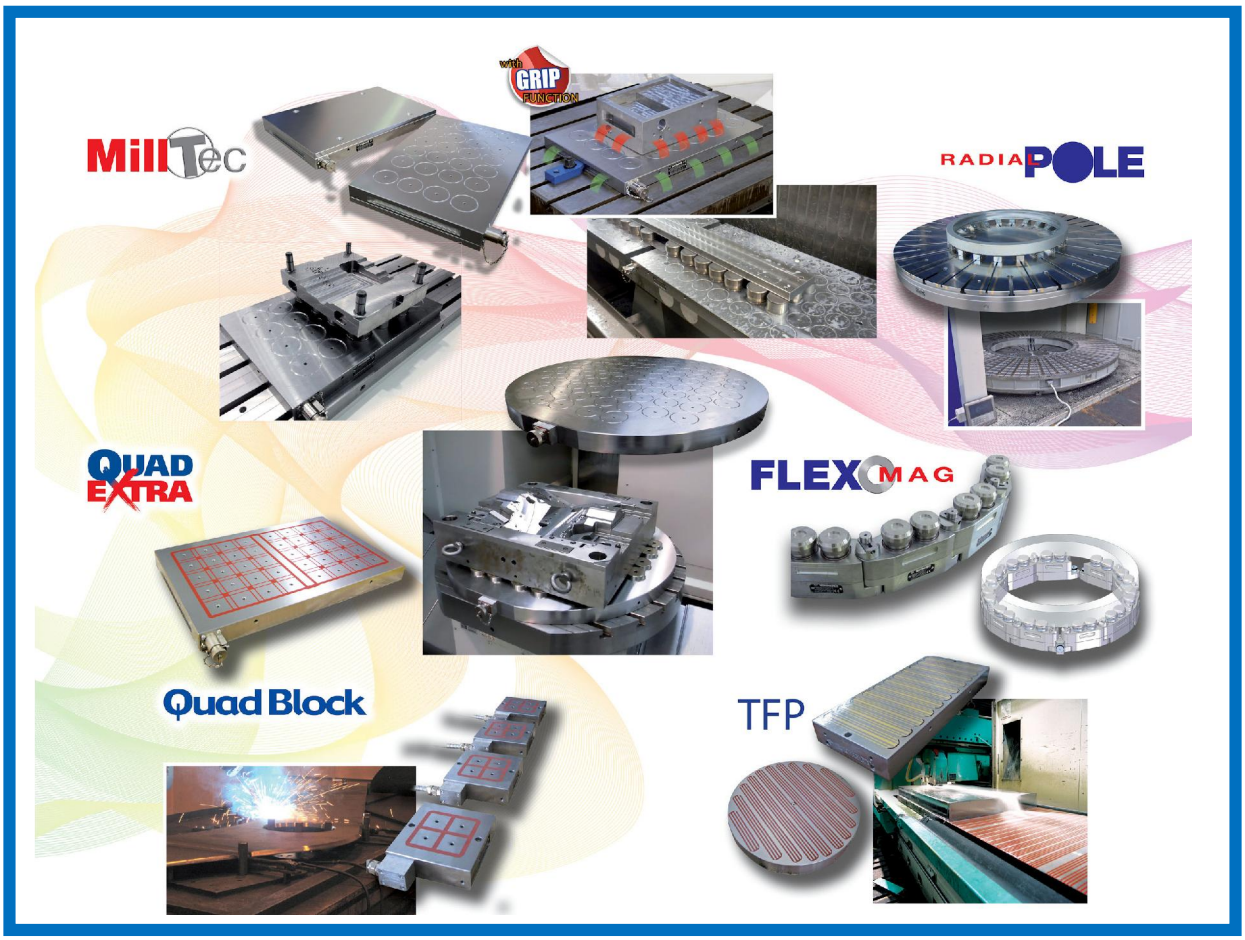
TECNOMAGNETE®
Safety through power

PERMANENT - ELECTRO MAGNETIC SYSTEMS

USE AND MAINTENANCE MANUAL

Machine Tools Clamping Division



TRANSLATION OF THE ORIGINAL INSTRUCTIONS

DIRECTIVE 2006/42/EC

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Contents

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1 GENERAL NOTES

Congratulations on choosing a TECNOMAGNETE product. This publication will help you find out more about your new product and we recommend that you carefully read these pages and always follow the instructions.
The descriptions and illustrations contained in this publication are not difficult, given the basic features of the product described.
TECNOMAGNETE reserves the right to make changes at any time to components and accessories in order to improve the product or due to manufacturing or commercial requirements.
Updates of this manual will be provided as required as Annexes or on the website www.tecnomagnete.com .
TECNOMAGNETE retains ownership of this manual and its reproduction, even partial, is prohibited, as is disclosure to third parties, without its written permission.
In the event of changes and/or updates to the product, which will be agreed exclusively with TECNOMAGNETE, additional content concerning the use and any residual risks arising from the changes shall be provided to supplement the manual.

1.1 Presentation

TECNOMAGNETE was founded in 1974 and has attained a position of leadership position in world markets as a manufacturer of powerful, flexible permanent-electro magnetic systems that operate in total safety, due to its innovative technology and numerous patents filed over the years. Permanent-electro magnetic systems produced by TECNOMAGNETE are able to generate sufficient magnetic force both for clamping and lifting workpieces, only consuming electricity when turned on and off.
The main fields of operation include:

MACHINE TOOLS CLAMPING SECTOR

- ✓ Grinding series
- ✓ Milling series
- ✓ Turning series
- ✓ Rail machining series

MOULDING SECTOR

- ✓ Systems for clamping press molds

LIGHT LIFTING SECTOR

- ✓ Manually-controlled lifters
- ✓ Battery-powered lifters

HEAVY LIFTING SECTOR

- ✓ Magnetic lifters
- ✓ Fixed beam magnetic module beam
- ✓ Telescopic beam magnetic module beam

1.2 Importance of the manual

A copy of this manual must be distributed and kept available to operators assigned to the installation, operation and maintenance of permanent-electro magnetic systems, enabling them to operate in accableance with the instructions given in this document. A careful reading of the manual will enable an permanent-electro magnetic system to be used in the correct way and safeguard the security and safety and operators and others. This manual is an integral part of the permanent-electro magnetic system, and all reproduction and dissemination rights of the manual and its attachments are reserved. Pass this manual on to any other user or subsequent owner.

1.3 Retention of the manual

Making changes to and removing parts of this manual are prohibited. When using the manual, take care not to damage it. Keep the CD-R or USB key away from impact, heat and magnetic sources and make it easily accessible to operators for further reference.

1.4 Conventions

For ease of consultation, the manual is divided into the following hierarchical order so that each phase is described in detail:

1. *Chapter 1 of the manual*
   1.1. section 1 of Chapter 1 of the manual
      1.1.1. sub-section 1 of section 1 of Chapter 1 of the manual

Some sections and/or chapters are presented with numbered sequences in order to illustrate the operation step by step.
Symbols are given in sections requiring greater attention.
Units of measurement, including the decimal point, are displayed with the international system (SI).

1.5 Definition of symbols

All parts concerning safety are highlighted in bold.
All warning notes that alert the personnel concerned that the described operation involves exposure to residual risk, with possible damage to health or injury, if not carried out in compliance with the instructions, are shown in **bold** and identified with the following symbol :

All warning notes that indicate that the described operation must be performed by trained and qualified personnel are shown in bold and indicated with the following symbol:

1.6 Personnel assigned to operations

As indicated in this manual, certain procedures must be carried out only by qualified or trained personnel.
The level of qualification is described using standard terms:

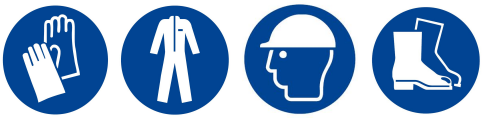
1. qualified personnel have technical knowledge and/or sufficient experience to enable them to avoid the potential dangers from electricity and/or mechanical movements (operation and maintenance personnel)
2. trained personnel are appropriately advised and/or supervised by qualified persons to enable them to avoid the potential dangers from electricity and/or mechanical movements (operation and maintenance personnel)
3. the User is obliged to obtain confirmation of the following from all designated persons, before they are allowed to work to work with the permanent-electro magnetic system:
   3.1. the personnel have received the instruction manual, and have read and understood it
   3.2. the personnel shall work in the manner described.

1.7 Trained personnel

The qualifications are given below of the personnel allowed to use the permanent-electro magnetic system:

- ✓ OPERATOR: a person or persons who, following appropriate and indispensable training, is/are assigned and authorized by the owner of the electro-permanent magnetic system to run operations. The occupier of this post must be completely aware of and understand the contents of this manual
- ✓ HANDLER: this post requires specific skills (possibly acquired by attending mandatory courses, if required by law) in handling hoists, the methods and features of harnesses and safe handling procedures. This position also requires complete awareness and understanding of the contents of this manual, in particular paragraph 2.2
- ✓ MECHANICAL MAINTENANCE OPERATOR: this post requires specific skills in the installation, adjustment, maintenance, cleaning and/or repair of systems. The occupier of this post must be completely aware of and understand the contents of this manual.
- ✓ ELECTRICAL MAINTENANCE OPERATOR (ref. EN60204 point 3.45): this post requires specific skills in carrying out electrical adjustments, maintenance and/or repairs and the ability to operate on live switchboards and electrical panels. The occupier of this post must be completely aware of and understand the contents of this manual.

1.8 Personal protective equipment (PPE)



The staff referred to in the previous paragraph must wear an adequate safety distance from the parts clamped on the magnetic equipment, with special attention when in vertical or suspended (this distance must be suggested by the plant operator in accordance with the regulations).
The staff must also wear appropriate safety clothing. Protective footwear is mandatory, while the need for headsets, helmets and goggles must be assessed by the User.
Loose fitting clothes or articles that could be trapped by moving parts are prohibited.
(see chapter 8)

1.9 General safety warnings

The rules and recommendations below are in compliance with the current safety regulations, on which they are based.
Machine safety systems must be selected and installed on the basis of the following requirements:

- ✓ safety category 4 in accableance with the EN ISO 13849-1 standard
- ✓ technical supervision by qualified staff
- ✓ integrated in technical compliance with suitable control systems
- ✓ installations designed so they cannot be neutralized or tampered with
- ✓ automatic surveillance of the electrical components, by management software, for example. Moving parts must be furnished with mechanical safety devices
- ✓ furnished with a STOP button locking system, in the event of hazardous movements and where errors occur or working conditions are abnormal

The machinery and equipment must be protected against electromagnetic interference when operating in environments with radio frequencies.
TECNOMAGNETE S.p.A. declines any liability for any damage caused to persons and property arising from failure to comply with current safety regulations and the instructions below. **All designated operators must respect and implement the following and scrupulously adhere to the regulations on accident prevention in force in the country of installation and on the use of the permanent-electro magnetic system.**
All ordinary and extraordinary maintenance must be performed with the machine halted and, if possible, with the power supply disconnected.
To avoid the danger of accidental connections during maintenance operations, attach a warning sign on the control panel with the words:

SWITCH OFF WHILE MAINTENANCE IS UNDERWAY

Before connecting the main supply cable to the general panel clamp, checking the line voltage is appropriate in accableance with the plate on the panel.
All operations of transport, installation, use, ordinary and extraordinary maintenance on the permanent-electro magnetic system must only be carried out by the personnel identified in section 6 of chapter 1.

The permanent-electro magnetic system can only be used for the applications indicated in the manual and only in combination with devices and components recommended and authorized by TECNOMAGNETE S.p.A.

1.10 Emergency drill

In an emergency, it is recommended to follow the procedures given in the operation and maintenance manual of the machine on which the permanent-electro magnetic system is installed.
Safety systems, accableing to the type, should only provide the option of a manual restart after the fault or defect that caused the machinery to stop has been remedied.
In the event of fire, use the devices provided to extinguish the fire, taking care never to use water on electrical parts.

1.11 Unintended or improper use

Permanent-electro magnetic systems are not designed or constructed for operation in explosive atmospheres.
Unintended use may:

- ✓ **cause injury to personnel**
- ✓ **damage the system or other equipment**
- ✓ **diminish reliability and performance.**

An electro-permanent magnetic system cannot be used for purposes other than those recommended and in compliance with the intended use, avoiding the following in particular:

- ✓ **starting machinery by means of stop devices**
- ✓ **unsuitable parameters of use**
- ✓ **defective or lack of maintenance**
- ✓ **use of inappropriate materials**
- ✓ **failure to follow instructions**
- ✓ **uncertain or insecure clamping of permanent-electro magnetic system or parts thereof**.

In the events of doubts over the appropriate usage, contact TECNOMAGNETE S.p.A. to determine whether it is use for which the system was intended or otherwise. For the magnetic clamping of special materials, other than those specified in this manual, the prior consent of TECNOMAGNETE S.p.A. must be obtained.

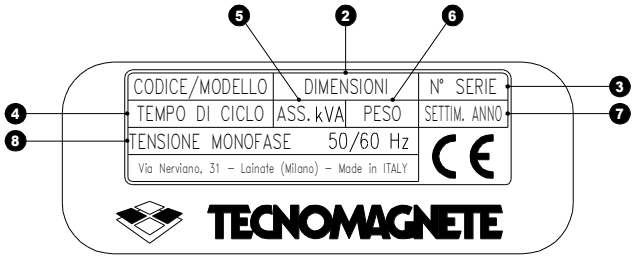
1.12Nameplate data

The manufacturer's identification plate is attached to permanent-electro magnetic systems, in compliance with the current laws. The plates must not be removed for any reason even should the permanent-electro magnetic be sold.
In the event the plate has been damaged or lost after coming away from its housing, contact TECNOMAGNETE S.p.A. to obtain a replacement.
When communicating with TECNOMAGNETE S.p.A., always quote the model on the plate.
Failure to comply with these provisions exempts TECNOMAGNETE S.p.A. from any liability for damage or injury to persons or property that may arise, which shall remain the sole responsibility of the user with regard to the competent bodies.

Example of a nameplate on an permanent-electro magnetic chuck:

1. identifying alphanumeric code of the model
2. registration number
3. weight of the permanent-electro magnetic chuck
4. the first two digits refer to the week of production, the other four digits to the year of manufacture
5. type of electronic control unit that can be combined
6. voltage and frequency of use
7. resistance value of the permanent-electro magnetic chuck circuit
8. maximum absorbed power

Example of a nameplate on the Electronic Control Unit:

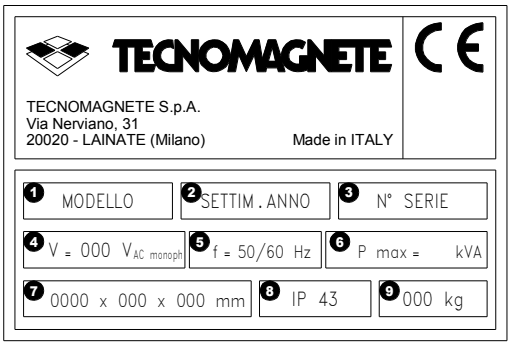


1. type of electronic control unit
2. dimensions
3. registration number
4. cycle execution time
5. absorbed power
6. electronic control unit weight
7. the first two digits refer to the week of production, the other four digits to the year of manufacture
8. voltage and frequency of use

Example of a nameplate on the remote control panel:

1. keyboard in combination with the electronic control unit
2. registration number
3. The first two digits are the week of production, the other four digits are the year of manufacture

Example of a nameplate on the Electronic Control Unit for in-case/cabinet commands:



1. type of system used and voltage of use
2. the first two digits refer to the week of production, the other four digits to the year of manufacture
3. registration number
4. operating voltage and whether single-phase or three-phase connection
5. frequency of use
6. maximum absorbed power
7. dimensions
8. degree of protection
9. weight

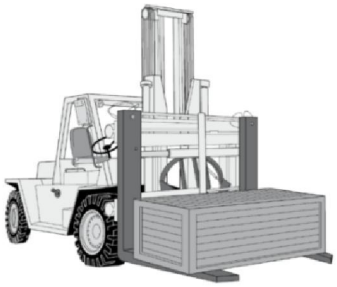
2 TRANSPORT AND HANDLING

2.1 Receipt

Permanent-electro magnetic systems are thoroughly checked before shipment. On receipt, the integrity of the package and the material contained therein must be checked (unless other instructions are issued by TECNOMAGNETE S.p.A.), in order to confirm that no damage occurred during transport and that the consignment complies with the order specifications. Otherwise, report any irregularities to TECNOMAGNETE S.p.A. and the Carrier responsible for any damage during transport.
Notification of damage or defects must be given within ten days from receipt of the supply. After that period, TECNOMAGNETE S.p.A. will consider the provision free of defects.

2.2 Handling

The permanent-electro magnetic system can be transported in wooden crates. For ease of handling, the package can be placed on a pallet.



All personnel handling loads must operate with protective gloves and safety shoes. It is the responsibility of the user to ensure that handling is conducted in compliance with current safety regulations.

When hoisting or handling the permanent-electro magnetic system, clear the operations area of obstructions and keep it clear, also consider providing a sufficient safety zone to prevent harm to persons, animals or objects that might be in maneuvering range. The permanent-electro magnetic system is designed to be hoisted and handled with suitable hoisting devices, the type and scope of which must be selected in accableance with the weight. It must be handled with extreme care, avoiding impacts that could damage delicate parts, compromising normal operation. When moved with fork-lift trucks, comply with the permitted speed and inclination. Never leave load suspended on hoists.

The permanent-electro magnetic system must be disconnected from power sources and its moving parts appropriately locked during transport, handling and storage.

Do not handle the permanent-electro magnetic system with electromagnetic hoists.

The instructions on the package must be read and digested before opening.
Keep the original packaging for later handling.

2.3 Transport

Some parts may have to be dismantled for transport, to be reassembled and reconnected during installation by TECNOMAGNETE S.p.A. technicians, or by the User on TECNOMAGNETE S.p.A.'s recommendations. The system must be transported in observance of the following environmental limits: a temperature range of -5 °C to +55 °C, rising to a maximum of +70 °C for a period no longer than 24 hours. Should it be necessary to transport the permanent-electro magnetic system by sea or by air, suitable packaging and protection systems must be provided to avoid any damage caused by impact. To protect against weathering, use anti-rust lubricants and bags of hygroscopic salts inside the packages. All moving parts must be properly anchored and removed from their housing, where possible.

2.4 Inactivity

In the event of long-term storage or inactivity, the permanent-electro magnetic system must be thoroughly cleaned of any residues and its uncovered metallic parts must be protected with oil or grease in order to avoid oxidation. Disconnect the Electronic Control Unit from the permanent-electro magnetic system and the power line. It is recommended to cover the permanent-electro magnetic system and the Electronic Control Unit with a tarpaulin and keep them in a dry, sheltered place. The room temperature should be between -5 ° C (23 ° F) and + 55 ° C (131 ° F). The relative non-condensing humidity should be between 30% and 90%,. The atmosphere should be clean, free of acids, corrosive gases, salts, etc. If restoring to operation, follow the instructions contained in this manual.

3 DESCRIPTION OF THE SYSTEM

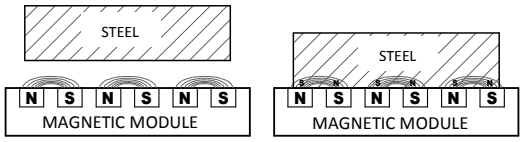
3.1 Advantages

Permanent-electro magnetic systems ensure the circulation of a continuous flow for an indefinite period since, during the work phases, they are independent of external power sources. Any interruption of the electricity supply cannot therefore alter the magnetic clamping force produced by the system. These are the so-called "COLD" magnetic clamping systems (where appropriate, see Chapter 11, only for cases in which the interruption of the electricity supply occurs during a cycle phase).

3.2 Basic principles of magnetic clamping

The lines of magnetic force (flux) lie between the north and south poles of an permanent-electro magnetic system.

This flux can be used to attract and block ferrous elements. In a steel part crossed by a magnetic field, opposite polarity is induced to that of the source flux and attraction is exerted until contact is made.



The flux induced in the steel depends on the material is made of, its size, the quality of contact established between the workpiece to be clamped and the permanent-electro magnetic system, and the ease with which the flux can pass through the steel.

3.3 Factors that determine the magnetic force

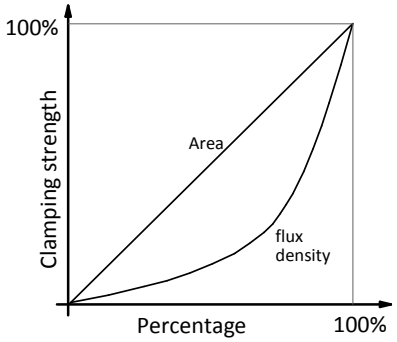
The amount of magnetic flux induced in the workpiece is the determining factor of the clamping force. For optimal clamping, the greatest magnetic flux possible must be induced in the workpiece.
To achieve this, it is important to:

- ✓ place the workpiece between the North and South poles of the permanent-electro magnet system
- ✓ ensure optimal contact between the workpiece and permanent-electro magnetic system
- ✓ cover the greatest number of North and South poles (check the number of operative poles, and multiply this value by the unit value in cm² of the pole. (QX/RQ HE50/HD50: 25 cm² – QX HD70: 49 cm² – Mill-TEC GRIP/ BASIC: 40 cm²)
- ✓ the workpiece's short-circuitry should have sufficient thickness.

The clamping force is proportional to:

- ✓ the square of the magnetic flux density in the face in contact with the workpiece
- ✓ workpiece area in contact with the magnetic chuck, up to the maximum point of its saturation.

By halving the contact area, the clamping force is also halved and, if the density of the magnetic flux is halved, the strength is reduced by 75%.
So reductions in the flux density influence the magnetic force developed.

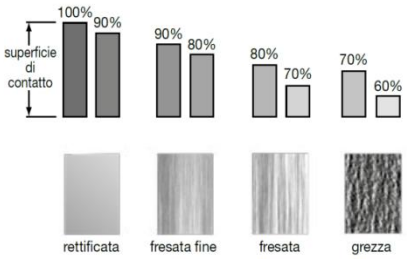


Air gaps are an immediate example (an air gap is the average contact distance between the workpiece to be clamped and the source of magnetic flux).
The main factors that can affect the flux density and the magnetic clamping of a workpiece of any size are described in the following paragraphs.

3.3.1 Air gap and roughness

The condition that guarantees the highest performing magnetic attraction is obtained when air gaps are minimized and there is a substantial area of continuous contact. The worst results occur with the highest number of air gaps and minimum contact. A very important aspect is therefore the degree of surface roughness. A good contact surface decreases the air gaps considerably, thereby achieving an optimal force of magnetic attraction.

- ✓ 100% = adjusted
- ✓ 90 ÷ 80% = fine milled
- ✓ 80 ÷ 70% = milled
- ✓ 70 ÷ 60% = untreated



3.3.2 Contact surface

To ensure excellent magnetic performance, the greatest number of North and South poles must be covered in equal amounts. The magnetic attraction force is directly proportional to the useful area of contact (for further details see section **3.3**).

3.3.3 Type of material

Check the type of material to be magnetically clamped. The technical property required from the material is its magnetic conductivity (magnetic permeability).
The most permeable material is mild steel, while for different materials consider the following reduction factors:

- ✓ 1,0 mild steel
- ✓ 0,7 ÷ 0,8 alloy steel
- ✓ 0,5 cast iron
- ✓ 0,2 nickel
- ✓ 0 (zero) non-magnetic stainless steel, brass, aluminium

These values are to be used for clamping force calculation (see example to section **9.5**)

3.3.4 Workpiece surface condition

Surface heat treatment of materials affects their physical structure, as well as the ability to absorb the magnetic flux. Annealed materials are best. Hardened materials do not satisfactorily absorb the flux and have a tendency to retain a certain amount of magnetism when the chuck is deactivated (DEMAG). It may sometimes be difficult to remove the workpiece from the permanent-electro magnetic system due to the residual magnetism of the piece. This residual magnetism can be eliminated with a demagnetizer.

3.3.5 Material thickness

As an approximation, it can be assumed that the path of the magnetic flux in a magnetically clamped workpiece is formed of a semicircle, starting from the centre of a pole (North) and reaching the centre of the next (South). If the workpiece fails to contain all the magnetic flux generated, the surplus leaks out and does not contribute to the clamping. The resulting attraction will therefore be less than when the entire flow is absorbed by a workpiece of sufficient thickness to contain it.

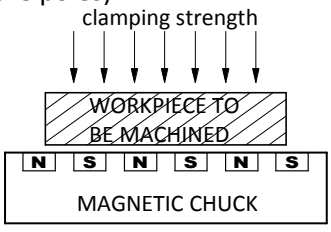
CHECK THE THICKNESS OF THE WORKPIECE TO BE MACHINED

If the thickness of the workpiece to be machined is insufficient, once magnetically clamp, a magnetic residue will be seen on the surface opposite to that of contact, and the performance of the magnetic chuck will be reduced as a consequence.

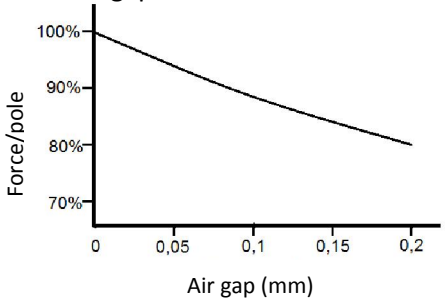
3.4 The magnetic force

Each pole (North/South) of the permanent-electro magnetic system is an independent magnetic island, consisting of a magnetic flux conductor steel core, capable of generating a high magnetic force, concentrated and constant over time (under optimal conditions, it is 16 daN/cm²).
The total force of magnetic attraction available is directly proportional to the operating magnetic surface, the type of material to be machined and the condition of its surface.

- ✓ Material to be machined (mild steel, alloy steel, cast iron ….)
- ✓ Conditions of the workpiece surface (roughness, flatness ….)
- ✓ Workpiece flat contact surface (meaning the surface is in contact with the poles).



As already pointed out, the value of the magnetic force decreases as the air gap increases.

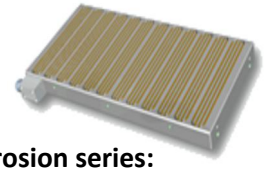


4 AVAILABLE MODELS

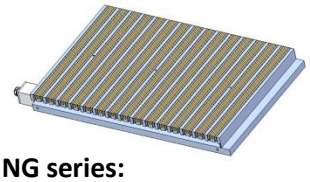
4.1 Permanent-electro magnetic systems

For the Machine Tools Clamping Division, TECNOMAGNETE divides magnetic-permanent-electro chucks into the following categories:

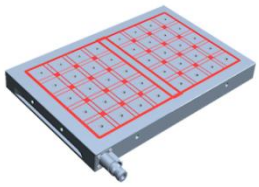
- ✓ **GRINDING series:**
  TFP0/T - TFP1/T - TPF/T - TPF/C - RP/C - HQ 50

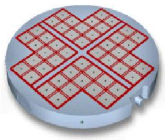


- ✓ **Spark Erosion series:**
  MDS



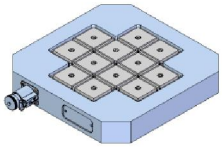
- ✓ **MILLING series:**
  QX HE50/HD50 - QX HD70 - Mill-TEC - RQ HD50
  Mill-GRIP TEC/R - Mill-TEC GRIP - Mill-TEC BASIC (5 Pin 10 Pin Ergon)



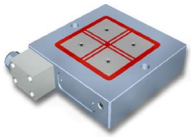


- ✓ **CUBOTEC series:**
  Cubotec CT1 Mill-TEC GRIP - Cubotec CT2 Mill-TEC GRIP

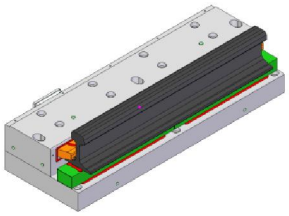
- ✓ **MAGNETIC PALLET series:**
  Pall-TEC PT/M - Pall-MAG



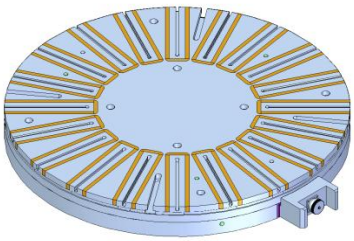
- ✓ **MODULAR CHUCK series:**
  Uniblock - Quad-Block - Block Quad-GRIP



- ✓ **RAIL MACHINING series:**
  Quad-RAIL (see the dedicated user manual)

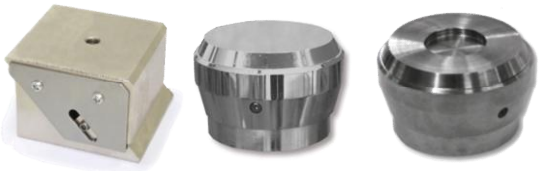


- ✓ **RADIAL series:**
  Radial-POLE and Flexo-MAG (see the dedicated user manual)

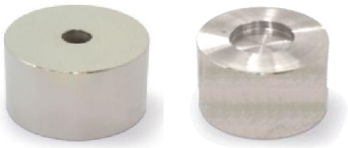


Moreover, combined with the permanent-electro magnetic chucks, TECNOMAGNETE is able to provide the polar extensions that represent an innovative, unique and patented technical solution, arising from the need to clamp workpieces on even levels or warped surfaces.

- ✓ **MOBILE pole extensions:**
  PMQ - RPM - RPM/SC



- ✓ **FIXED pole extensions:**
  PRF - PRF/SC



4.2 Electronic Control Unit

XT200 and **ST200** are systems described as Electronic Control Units (hereinafter, referred to as the Control Unit) Unit for combination with a number of permanent-electro magnetic systems.

Chapter 6 gives descriptions of the supplies (and the operation of the respective keyboards) of the following Control Units:

- ✓ **XT200 (Milling)**
- ✓ **ST200F, ST200FB, ST200FA, ST200SK, ST200SKA (Milling)**
- ✓ **ST200RB, ST200QE (Grinding)**
- ✓ **ST200 Special in cabinet**

5 TECHNICAL SPECIFICATIONS AND ELECTRICAL BASICS

5.1 Technical specifications

In this manual, the term "cycle" refers to pressing the **MAG/SAFE/DEMAG** buttons for a power running in order to obtain a state of magnetization/demagnetization.
The **XT200** and **ST200** Control Units are suitable for use in the environments and operating conditions given below:

Control Unit	
Noise emission	<70dB
Voltage	nominal ± 10%
Frequency	nominal 50/60Hz ± 1%
Operating temperature	da -5°C a +40°C (23°F ÷ 104°F)
Humidity	<80% at + 40 ° C (104 ° F)
Degree of protection	IP43 for XT200 and ST200
Degree of protection	IP43 intermediate junction boxes
Degree of protection	IP40 for all pushbutton panels
Maximum altitude	2000m above sea level
Time keys pressed	Minimum 500ms (0.5 seconds)
Radius of cable curvature	Minimum of 10 times the diameter
Max cable traction	15N/mm²
Number of cycles	max 20 cycles/hour
Permanent-electro Magnetic Chucks	
Operating temperature	max + 80°C (176°F)
Degree of protection	IP65

5.2 Supply and Power

The nominal operating voltage of an permanent-electro magnetic chuck must correspond to the nominal voltage of the Control Units.
The values of the nominal voltages of use for the **ST200** and **XT200** Control Units are identified by the following abbreviations:

V1 = 200V	**V2** = 230V
V3 = 380V/400V/415V/440V	**V4** = 460V/480V

In the event of the installation of permanent-electro magnetic chucks with different nominal voltages, a transformer with a suitable ratio for the purpose and, of course, with a nominal power sufficient for the maximum power of the magnetic chuck.

To ensure optimum safety during the activation cycles, it is important that an earth connection is made to the Control Unit and that earthing system is fully operational (connection to be made through the main supply cable provided with **XT200** and **ST200**).

The **XT200** and **ST200** Control Unit consists of:

- ✓ **Controller**
- ✓ **Keyboard**
- ✓ **DB9 key-lock**

In subparagraph **6.4.7**, however, the **DB9 stopper** is described as an alternative to the **DB9 key-lock**.

The outside of the **XT200** Controller is made of a plastic housing while the **ST200** Controller housing is made of metal cable connected to the lid is assembled inside the ST200, which must not be removed, in turn connected to earth cables.
Short-circuit protection is the responsibility of the user and must be ensured by a suitable system positioned upstream of the Control Unit.
It is advisable to incorporate a thermal-magnetic switch in the ***C*** curve with the value of ***In*** taken from the data on the nameplate of the magnetic chuck to which the Control Unit shall be connected.
The maximum power for **XT200** and **ST200** is roughly:

- 15 KVA (cosφ = 0.9) for a supply voltage of 230V single-phase
- 25KVA (cosφ = 0.9) for a supply voltage of 400V single-phase
- 30KVA (cosφ = 0.9) for a supply voltage of 480V single-phase

The current absorbed is the impulsive type.
TECNOMAGNETE Control Units directly use the power grid via a sophisticated splitting process. They always and only operate with the machine stopped and usually need a lower effective current than required to operate the machine on which the permanent-electro magnetic chuck to be controlled is installed.
Should there be a need for the Control Unit to perform/repeat the cycles with very brief intervals, a respective increase in temperature must be considered in the permanent-electro magnetic chuck. We therefore recommend avoiding running unnecessary cycles.

DO NOT PERFORM REPEATED MAGNETIZING AND DEMAGNETIZING CYCLES WITHOUT A SUFFICIENT TIME INTERVAL (see section 5.1)
IT IS ALSO PROHIBITED TO CHANGE THE FACTORY SETTINGS ON TECNOMAGNETE SYSTEMS

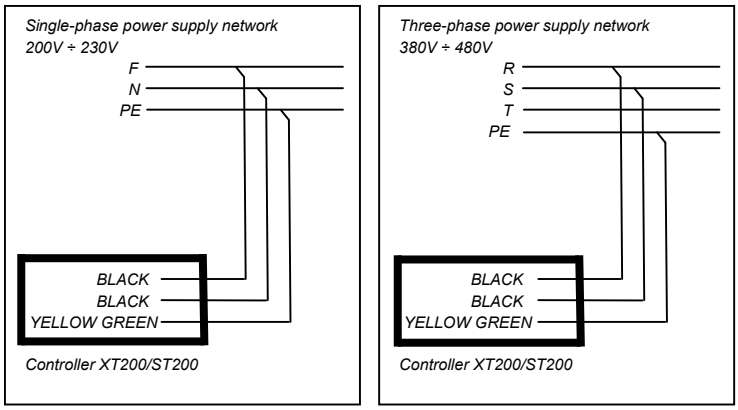
5.3 Electrical connections

The operations to connect electrical equipment must be performed by skilled personnel. It is vital that the electrical supply plant, including the place where the Control Unit is to be installed, is carried out in accableance with the current regulations.

TECNOMAGNETE cannot be held liable for any damage caused by a failure to earth the system. It will be the responsibility of the customer to ensure that the Control Unit is protected.
The wiring diagrams must be consulted in combination with the type of machinery to be installed.

5.4 Connection to the supply

XT200 and **ST200** can be connected to the distribution grid via the multipolar cable provided, which has three wires suitable for the purpose.
Connection to the distribution grid depends on the plate both on the controller and the respective permanent-electro magnetic chuck. The following wiring diagrams simplify the process of connecting the controller to the appropriate power supply.



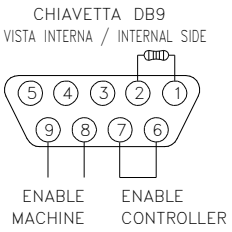
5.5 Power cable

For **XT200** and the **ST200**, TECNOMAGNETE provides a 4 meter long, multipolar power cable suitable for the purpose. Under normal operating conditions, there are no overheating problems and a fall in the voltage required to power TECNOMAGNETE systems.
For longer than standard lengths, the diameter of the wire must ensure a voltage drop of less than 1%.
Caution: the control unit is supplied without a mains connection plug.

5.6 Enabling XT200 and ST200 Control Units

XT200 and **ST200** are supplied with a key with a DB9 connector (referred to as the **DB9 key-lock**) inside which (by means of the PIN) the following signals can be found:

pin # 1 ➞ B1
pin # 2 ➞ A2
pin # 3 ➞ VDC
pin # 4 ➞ Cnd
pin # 5 ➞ Alarm
pin # 6 ➞ COM ENABLE Controller
pin # 7 ➞ ENABLE Controller
pin # 8 ➞ COM ENABLE machine
pin # 9 ➞ ENABLE machine



The voltages of use for the 8 and 9 PINs of the DB9 are the following:

- Voltage 24V to 30V - max current 1A
- Voltage 110V - max current 0,3A

A 120 Ω resistance is soldered between PINs 1 and 2, useful for the correct balance in the internal communication of Control Unit.

The **DB9 key-lock** is connected to the Control Unit in accableance with the examples in paragraph **7.2** and allows both a Controller enabling service (**Controller Enable**) and an enabling service for the machine (**Machine Enable**) as described below:

- **Controller Enable: from** PINs 6 and 7, it is possible to enable/disable the controller to perform the cycles; when PINs 6 and 7 are closed, the Controller Enable is active and enabled the cycles to be performed, which is not possible when they are open.
  It is recommended that an auxiliary relay is always used for the Controller Enable.
- **Machine Enable:** when at least one of the magnetic chucks managed by the Controller is in a state of magnetization, the **Machine Enable** (PINs 8 and 9) is closed.

In sub-section **6.4.7,** the **DB9 stopper** is given as an alternative to the **DB9 key-lock** should the Control Unit use a specific keyboard (hereinafter, referred to as **PCR1**) with signals for interfacing to a PLC system.

6 GENERAL DESCRIPTION OF THE SUPPLIES

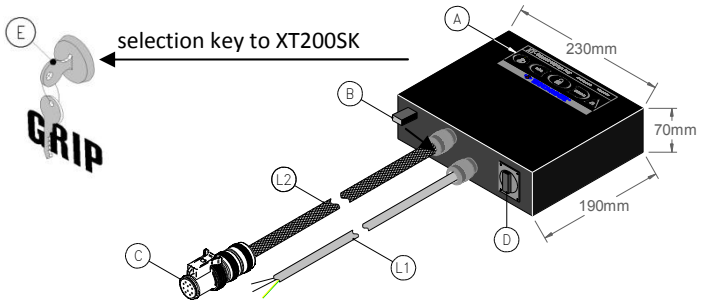
WARNING: should the Control Units have removable connectors, once the discharge cable with in-line connector has been removed, the cap provided must be placed on the connector from the panel in order to prevent penetration of liquids or various processing residues.

6.1 XT200, XT200SK description of the supplies

The **XT200** Control Unit is made up of:

- ✓ controller made with a plastic container, which houses the components regarding the electrical and electronic control/power parts
- ✓ main on-board controller switch (ON-OFF)
- ✓ enabling DB9 key-lock connected to the controller
- ✓ keyboard incorporated in the controller to manage the **MAG** and **DEMAG** cycles with the aid of the **ENABLE** key
- ✓ for the **XT200SK** alone, a selection key-switch is provided on the controller for the GRIP function, the operation of which is described in sections **7.3** and **7.4**.
- ✓ LED display of the states of **MAG, DEMAG**, and **ALARM CYCLE**
- ✓ discharge cable from the controller for the magnetic chuck
- ✓ power cable from the controller for the grid

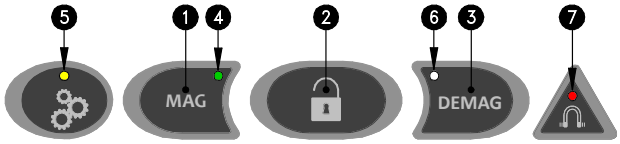
The description of the components and the size of **XT200** Control Unit are shown in diagrammatic form in the following drawing and the respective table:



Description		Type
Pulsantiera Keyboard	A	MAG – SAFE – DEMAG (without levels Mag)
Abilitazione Enable	B	Chiavetta DB9 DB9 Key lock
Connettore Connector	C	5PFV ERGON
Interruttore generale Main switch	D	ON – OFF
Chiave di selezione Key switch select	E	servizio GRIP GRIP service
Cavo di alimentazione Main supply cable	L1	PVC 3G4mm² Ø 12mm
Cavo di scarica Discharge cable	L2	PVC Armored 80% 5G2,5mm² Ø 14mm

6.2 XT200, XT200SK keyboard

The keyboard, as shown in diagrammatic below, is formed by three membrane keys and four LED signals:



❶→ total magnetization key FULL-MAG
❷→ Enabling key ENABLE
❸→ Total demagnetization key DEMAG
❹→ Total magnetization LED FULL-MAG
❺→ CYCLE Waiting LED
❻→ Total magnetization LED DEMAG
❼→ ALARM LED

minimum time of 500ms pressed keys (buttons)

XT200 is set to function in conjunction with Milling series chucks with ERGON type 5 PIN connector.

To perform magnetization or demagnetization cycles, press the **ENABLE** and **MAG** or **DEMAG** keys simultaneously, depending on the activation state desired.

The keyboard also has four LED warning lights corresponding to the **MAG** (green LED) and **DEMAG** (white LED) keys and the **CYCLE** (yellow LED) and **ALARM** (red LED) states. These warning lights are used to indicate the system status. On turning on, the LEDs corresponding to the Control Unit's current state will be turned on.

In addition, for a short time from start of the Controller only, or during the magnetization/demagnetization cycle, the yellow **CYCLE** LED turns on while all the other LEDs remain off. At the end of the **CYCLE** period, only warning the LED showing the system status will light up.

CAUTION: In the event the keyboard detect an **ALARM** status, the procedure to follow is to try to perform a **DEMAG** cycle (which restores the system) before performing another **MAG** cycle. The anomaly must in any event be reported to TECNOMAGNETE's Technical Assistance Service.

Moreover, in case of alternating operation of an **XT200** controller for two or more chucks, the procedure is to perform a **DEMAG** cycle before performing a **MAG** cycle again.

6.3 ST200 Separate supplies

Supplies of **ST200** Control Units are divided (depending on their manufacturing components) into the following sub-sections:

6.3.1 for **ST200F, ST200FB, ST200SK, ST200RB**

6.3.2 for **ST200FA, ST200SKA**

6.3.3 for **ST200QE**

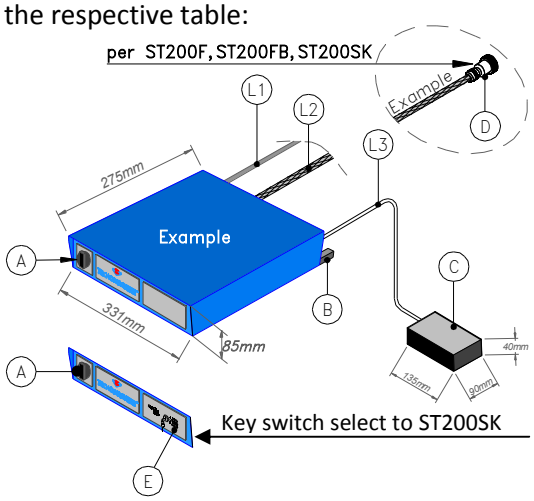
6.3.4 for **ST200 Special in cabinet**

6.3.1 ST200F, ST200FB, ST200SK, ST200RB Description of the supplies

The **ST200F, ST200FB, ST200SK** and **ST200RB** Control Units consisting of:

- ✓ controller made with metal container housing the components regarding the electrical and electronic control/power parts
- ✓ Main on-board controller switch (ON-OFF)
- ✓ enabling by DB9 key-lock connected to the controller
- ✓ for the **ST200SK** only, a key-switch select is provided on-board the controller for the **GRIP** service, the operation of which is described in sections **7.3** and **7.4**.
- ✓ keyboard placed outside the controller to handle the **MAG** and **DEMAG** cycles with the help of the **ENABLE** key (in some models, magnetization levels can be managed with dedicated keys), with external keyboard, a cable to connect to the controller is also included
- ✓ LED panel displaying the states of **MAG**, **DEMAG**, **CYCLE** and **ALARM** (**LEVEL +/-** LEDs are shown for models that include magnetization levels)
- ✓ discharge cable from the controller to the magnetic chuck. Moreover, TECNOMAGNETE defines the installation of multiple magnetic chucks as “banked” and, in this case, the discharge cable from the controller could provide the connection to an intermediate junction box
- ✓ power cable from the controller for the grid

The description of the components and dimensions of the **ST200F, ST200FB, ST200SK** and **ST200RB** Control Units are shown in diagrammatic format in the following drawings and the respective table:



Description		Type
Interruttore generale Main switch	A	ON - OFF
Abilitazione Enable	B	chiavetta DB9 DB9 Key lock
Pulsantiera remota Remote control	C	MAG - SAFE - DEMAG (Some type levels included Sp)
Connettore Connector	D	example: FEME example: FEME
Chiave di selezione Key switch select	E	GRIP service GRIP service
Cavo di alimentazione Main supply cable	L1	PVC 3G4mm² Ø 12mm
Cavo di scarica Discharge cable	L2	PVC Armored (for ST200F, ST200FB, ST200SK) PVC (for ST200RB)
Cavo della pulsantiera Cable of remote control	L3	Shielded PVC/PVC screened 5 coaxial 22AWG x Ø 9mm

Some examples of keyboards that can be used for for the keyboard:

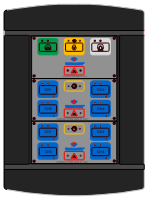
keyboard without magnetization levels (sign as **TCF**)

keyboard with three levels of magnetization (sign as **TCF 3L**)

keyboard with seven levels of magnetization (sign as **TCR**)

keyboard interfacing with PLC systems (sign as **PCR1**)

complete keyboard: keyboard without magnetization levels plus a keyboard for select (sign as **TCF4**) or with two keyboard for select (sign as **TCF8**)

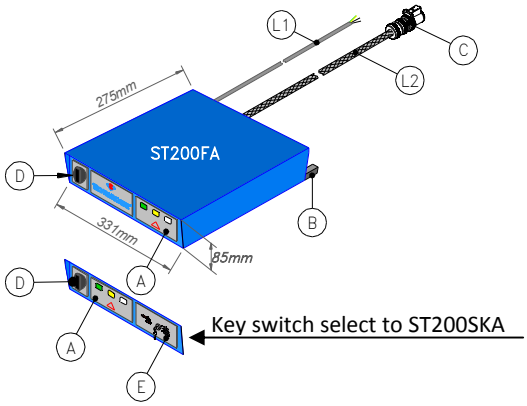


6.3.2 ST200FA, ST200SKA Description of supplies

The **ST200FA** Control Unit, are **ST200SKA** consisting of:

- ✓ controller with metal container inside which the components are housed related to the electrical and electronic part of command/power
- ✓ Main switch on board of the controller (ON-OFF)
- ✓ qualifications through DB9 key-lock connected to the controller
- ✓ built-in keyboard to the controller to manage the **MAG** and **DEMAG** cycles with the aid of the **ENABLE** key (only for **ST200SKA** it is also provided, on board of the controller, a key switch select for the GRIP function whose operation is described in sections **7.3** and **7.4**).
- ✓ LED display control panel in the states of **MAG**, **DEMAG**, and **ALARM CYCLE**
- ✓ discharge cable from the controller to the magnetic chuck
- ✓ power cable from the controller to the network

The description of the components and the size of the **ST200FA** and **ST200SKA** Control Unit are shown in diagrammatic form in the following drawings and the related table:



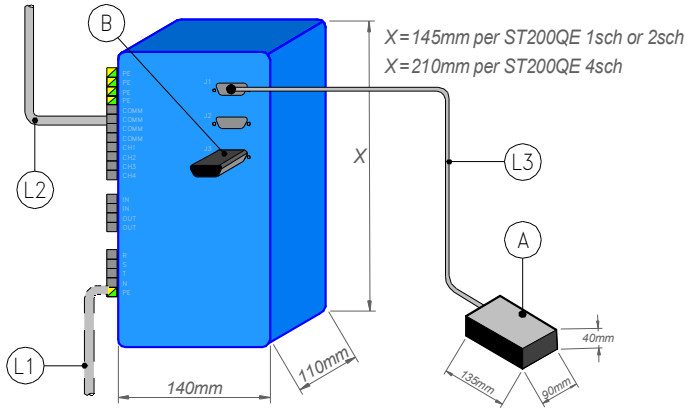
Decription		Type
Tastiera Keyboard	A	MAG - SAFE - DEMAG
Abilitazione Enable	B	chiavetta DB9 DB9 Key lock
Connettore 10P Ergon Connector 10P Ergon	C	10PFV Ergon
Interruttore generale Main switch	D	ON - OFF
Chiave di selezione Key switch select	E	GRIP service GRIP service
Cavo di alimentazione Main supply cable	L1	PVC 3G4mm² Ø 12mm
Cavo di scarica Discharge cable	L2	PVC Armored 80% 10x2mm² Ø 15.7mm

6.3.3 ST200QE Description of the supply

The **ST200QE** Control Unit is made up of:

- ✓ controller with metal container housing the components related to the electrical and electronic control /power part
- ✓ provision of a remote-control switch in the terminal box at the responsibility of the customer (in addition, a number of alternatives, for example using the contacts of a relay, remain the responsibility of the cust, as detailed in the specific wiring diagram)
- ✓ enabling by DB9 key-lock connected to the controller
- ✓ keyboard placed outside the controller to handle the **MAG** and **DEMAG** cycles, with the help of the **ENABLE** key (for some models, it is possible to manage the magnetization levels using dedicated keys), with the external panel, a cable for connecting to the controller is also included
- ✓ LED panel displaying the states of **MAG, DEMAG**, **CYCLE** and **ALARM** (**LEVEL +/-** LEDs are displayed for models that include the levels of magnetization)
- ✓ discharge cable from the controller to the magnetic chuck

The description of the components and the dimensions of the **ST200QE** Control Unit are shown in diagrammatic form in the following drawing and respective table:



Description		Type
Pulsantiera remota Remote control	A	MAG - SAFE - DEMAG (Some type levels included levels mag)
Abilitazione Enable	B	chiavetta DB9 DB9 Key lock
Cavo di alimentazione Main supply cable	L1	At customer's charge At customer charge
Cavo di scarica Discharge cable	L2	PVC or PVC Armored in accableing with magnetic chuck type
Cavo della pulsantiera Cable of remote control	L3	PVC shielded 5 coaxial 22AWG x Ø 9mm

6.3.4 ST200 Special in cabinet Description of the supply

The **ST200 Special in cabinet** Control Unit can be made both with external push-button panel (identified by the abbreviation **CCE**) or with push-button panel incorporated in the controller's hatch (identified by the abbreviation **CCU**).

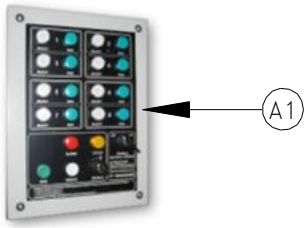
Both types of **ST200 Special in cabinet** Control Unit are made up of:

- ✓ controller made with metal case/cabinet housing the components related to the electrical and electronics control/power part
- ✓ Main on-board controller switch (ON-OFF)
- ✓ on-board controller network light for on/off system alerts
- ✓ Controller activation via the **Controller Enable** contacts (or **Input Enable**) wired in the controller's terminal box
- ✓ for the **ST200 Special SK** model only, a key switch select is provided for the **GRIP** service, placed on the controller's hatch, the function of which is described in sections **7.3** and **7.4**.
- ✓ push-button panel to manage **MAG** and **DEMAG** cycles with the aid of the **ENABLE** button (for some models, magnetization levels can be managed via dedicated buttons). For banked panels, single and multiple magnetic chucks can be selected. A cable to connect to the controller is provided with the external push-button panel
- ✓ LED control panel displaying the states of **MAG, DEMAG, CYCLE** and **ALARM** (**LEVEL +/-** LEDs can be displayed for models that include the magnetization levels). For banked panels in which selections are required, the push-button panel includes the buttons and respective **SELECT** LEDs
- ✓ discharge cables from the controller(s) to the magnetic chuck(s). For banked panels, the discharge cable from the controller could provide the connection to one or more intermediate junction boxes
- ✓ Optional: Radio Control (identified by the abbreviation **RCM**) including receiver housed inside the controller, with antenna that can be placed externally and the portable transmitter with **MAG, DEMAG, SAFE, POWER** functions (complete set of batteries and battery chargers)
- ✓ Optional: external alert lights for additional display of the states of **MAG, DEMAG, CYCLE** and **ALARM**

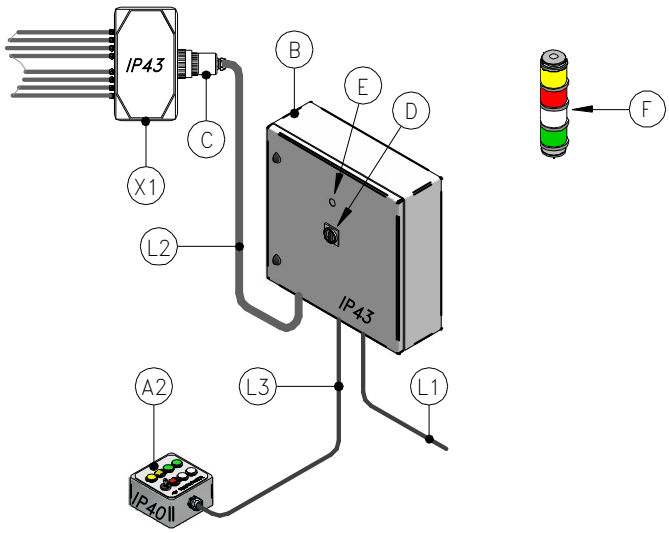
The size of the **ST200 Special in cabinet** Control Unit is tied to the number of permanent-electro magnetic chucks to be activated.

Some examples with the respective table are given below:

ST200 Special in cabinet abbreviated as **CCU**



ST200 Special in cabinet abbreviated as **CCE**



Description		Type
Pulsantiera remota Remote control	A	MAG-SAFE-DEMAG-SELECT A1=integrated A2=remote
Controller Controller	B	box or cabinet
Connettore Connector	C	Example: FEME or HARTING
Interruttore generale Main switch	D	ON - OFF
Lampada di rete Main lamp	E	LED bianco white LED
Lampade esterne External lamps	F	Verde/Bianca/rossa/gialla green/white/red/yellow
Cavo di alimentazione Main supply cable	L1	PVC 3G4mm² Ø 12mm
Cavo di scarica Discharge cable	L2	PVC or PVC Armored in accableance with magnetic chuck type
Cavo della pulsantiera Cable of remote control	L3	PVC Example 25G0,5mm² Ø 13mm
Cassetta di derivazione Junction box	X1	Example: ILME_19

6.4 ST200 Different keyboards

The keyboards for the **ST200** Control Unit differ, depending on their configuration, in the membrane keys and operation. They are described in the following sub-sections:

6.4.1 for **TCF**

6.4.2 for **TCF 3L**

6.4.3 for **TCR**

6.4.4 for **CH Enable**

6.4.5 for **TCF4**

6.4.6 for **TCF8**

6.4.7 for **PCR1**

6.4.8 for **PCR2**

6.4.9 for **PCR3**

6.4.10 for **PCR Plus**

6.4.11 for **SPECIAL push-button** (for cabinet control)

CAUTION: For all keyboards of the **ST200** Control Unit, in the event the **ALARM** state is detected, the procedure to be followed is to try to perform a **DEMAG** cycle (which resets the system) before performing a **MAG** cycle again. The anomaly must, in any case, be reported to TECNOMAGNETE's Technical Assistance Service.

In the event a single **ST200** controller is used to alternate the operation of two or more magnetic chucks, it must be taken into account that the Controller's memory will contain the system state of the last performed cycle. Therefore, when detaching the controller from the current magnetic chuck and connecting it to another magnetic chuck, the procedure involves performing a **DEMAG** cycle before performing a **MAG** cycle.

For all **ST200** Control Unit keyboards, the yellow **CYCLE** LED lights up while all the others remain off for a short time after starting the controller, or during the magnetization/demagnetization cycles. At the end of the **CYCLE** period, only the alert LED light turns on to represent the system status.

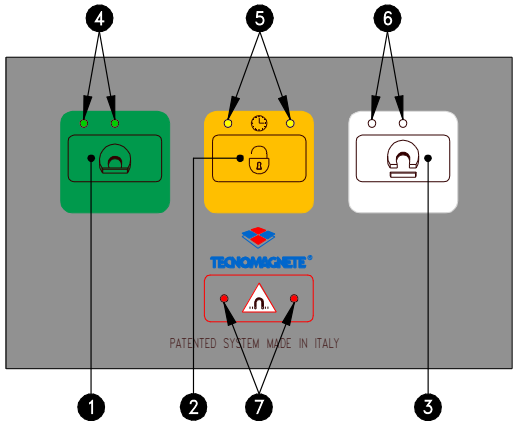
For every **ST200** keyboard, a summary table is given of the system states with the corresponding LED operation.

The following abbreviations for LED operation are used:

- **AF = LED On Steady**
- **AL = LED On Flashing**
- **SP = Led Off**

6.4.1 ST200 TCF keyboard

The keyboard, shown in diagrammatic form below, is made up of three membrane keys and eight alert LEDs:



1 → Total magnetization key **FULL-MAG**

2 → Enabling key **ENABLE**

3 → Total demagnetization key **DEMAG**

4 → Total magnetization LED **FULL-MAG**

5 → **CYCLE** Waiting LED

6 → Total magnetization LED **DEMAG**

7 → **ALARM** LED

minimum time of 500ms pressed keys

This keyboard is the basic model for the **ST200** Controllers and can be used for both Milling and Grinding systems.

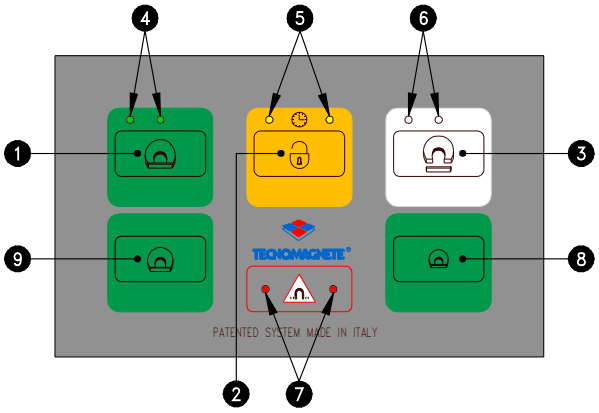
To carry out the cycles of magnetization or demagnetization, press the **ENABLE** key and the **MAG**, or the **DEMAG** key at the same time, depending on the activation state to be obtained.

The keyboard also has eight LED alert lights placed in correspondence with the **MAG** (green LED) and **DEMAG** (white LED) keys and the **CYCLE** (yellow LED) and **ALARM** (red LED) states. These lights are used to indicate the system status. When the power will be turned on, the LEDs corresponding to the current state of the controller will turn on.

System Status	MAG LED	DEMAG led	CYCLE LED	ALARM LED
Full-Mag	AF	SP	SP	SP
Demag	SP	AF	SP	SP
Cycle in progress	SP	SP	AF	SP
Alarm current	SP	SP	SP	AF
Alarm Communications	SP	SP	SP	AL

6.4.2 ST200 TCF 3L keyboard

The keyboard, as shown in diagrammatic form below, is made up of five membrane keys and eight alert LEDs:



1 → Total magnetization key **FULL-MAG**
2 → Enabling key **ENABLE**
3 → Total demagnetization key **DEMAG**
4 → Total magnetization LED **FULL-MAG**
5 → **CYCLE** Waiting LED
6 → Total magnetization LED **DEMAG**
7 → **ALARM** LED
8 → 1st level partial magnetization key **MAG 1L**
9 → 2nd level partial magnetization key **MAG 2L**

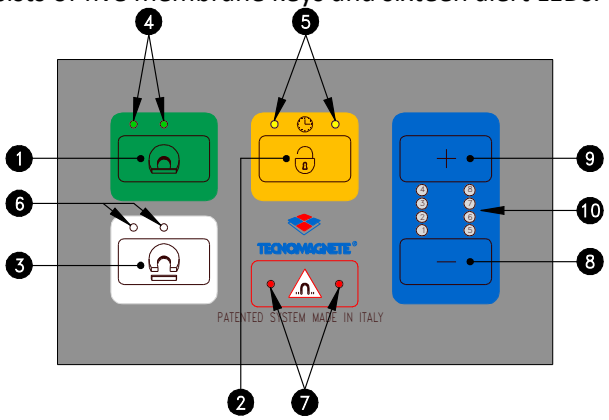
minimum time of 500ms pressed keys

This **ST200** panel can be used both in Milling and Grinding systems Grinding should it be necessary to manage three different levels of magnetization.
To perform the magnetization or demagnetization cycles, press the **ENABLE** key at the same time as one of the following: **MAG 1L, MAG 2L**, FULL-**MAG** or **DEMAG,** depending on the activation state desired.
The keyboard also has eight LEDs placed in correspondence with the **MAG** (green LED) and **DEMAG** (white LED) keys and the **CYCLE** (yellow LED) and **ALARM** (red LED) states. These lights are used to indicate the system state. When the power is turned on, the LEDs corresponding to the controller's current status will be on.

System Status	MAG LED	DEMAG LED	CYCLE LED	ALARM LED
Full-MAG	AF	SP	SP	SP
MAG 1L	AL	SP	SP	SP
MAG 2L	AL	SP	SP	SP
Demag	SP	AF	SP	SP
Cycle in progress	SP	SP	AF	SP
Alarm current	SP	SP	SP	AF
Alarm communication	SP	SP	SP	AL

6.4.3 ST200 TCR keyboard (7 levels)

The keyboard, as shown in diagrammatic form below, consists of five membrane keys and sixteen alert LEDs:



1 → Magnetization key **MAG**
2 → Enabling key **ENABLE**
3 → Total demagnetization key **DEMAG**
4 → Magnetization LED **MAG** (Partial magnetization and Full-MAG)
5 → **CYCLE** waiting LED
6 → Total magnetization LED **DEMAG**
7 → **ALARM** LED
8 → Increase magnetization key +
9 → Decrease magnetization key —
10 → LEDs 1 to 7 partial levels of magnetization / LED 8 Full-MAG

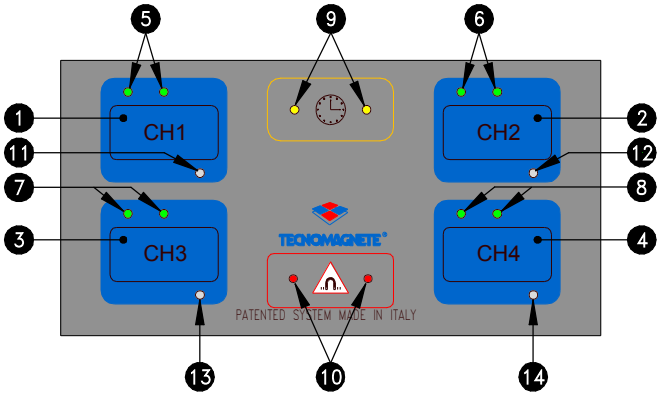
minimum time of 500ms pressed keys

This **ST200** keyboard can be used both in Grinding and Radial systems, should it be necessary to manage eight different levels of magnetization (it can also be used for Milling systems).
To perform magnetization or demagnetization cycles, press the **ENABLE** key at the same time as the **MAG** or **DEMAG** keys, depending on the activation state desired.
With **+** and **-** keys allows the level of magnetization displayed on the corresponding LEDs to be increased or decreased (operation to be performed only when the controller is not performing a cycle).
The keyboard also has eight LEDs placed in correspondence with the **MAG** (green LED) and **DEMAG** (white LED) keys and the **CYCLE** (yellow LED) and **ALARM** (red LED) states. These alert lights are used to indicate the system state. When the power is turned on, the LEDs corresponding to the controller's current state will be illuminated.

System Status	MAG LED	DEMAG led	CYCLE LED	ALARM LED
Full-Mag (LED 8)	AF	SP	SP	SP
partial Mag (LEDs 1 ÷ 7)	AL	SP	SP	SP
Demag	SP	AF	SP	SP
Cycle in progress	SP	SP	AF	SP
Alarm current	SP	SP	SP	AF
Alarm Communications	SP	SP	SP	AL

6.4.4 ST200 CH ENABLE keyboard

The keyboard, as shown in diagrammatic form below, consists of four membrane keys and sixteen alert LEDs:



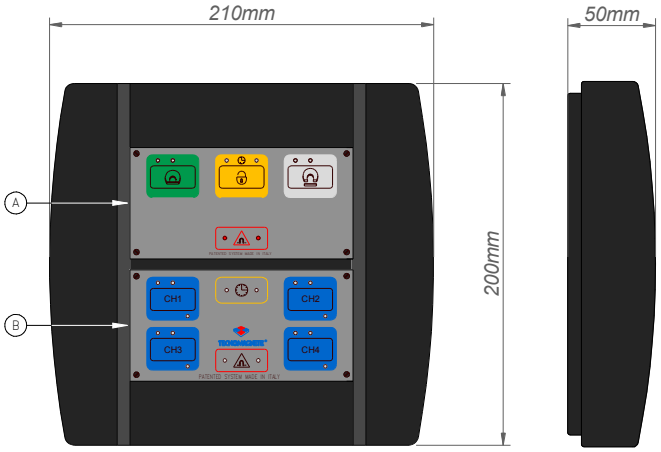
❶→ **CH1** selection key
❷→ **CH2** selection key
❸→ **CH3** selection key
❹→ **CH4** selection key
❺→ **CH1** magnetization LED MAG
❻→ **CH2** magnetization LED MAG
❼→ **CH3** magnetization LED MAG
❽→ **CH4** magnetization LED MAG
❾→ **CYCLE** waiting LED
❿→ **ALARM** LED
⓫→ **CH1** selected LED
⓬→ **CH2** selected LED
⓭→ **CH3** selected LED
⓮→ **CH4** selected LED

minimum time of 500ms pressed keys

This **ST200** keyboard can be used for all systems in which the channels from which to perform a cycle must be selected.
The **CH ENABLE** keyboard manages the selection and de-selection of up to four channels that can be identified by state of the corresponding LED .
After setting the Control Unit to the sequence to be managed during the cycles, the system state enables the identification of which activated channels have correctly performed the total magnetization (fixed **MAG** LED illuminated) or the partial magnetization (flashing **MAG** LEDs).
The magnetization LEDs will be off when the select key shows the **DEMAG** state.
The **ALARM** LEDs will turn on (not flashing) under any alarm condition, excluding the communication alarm condition (where they are flashing).

6.4.5 ST200 TCF4 keyboard

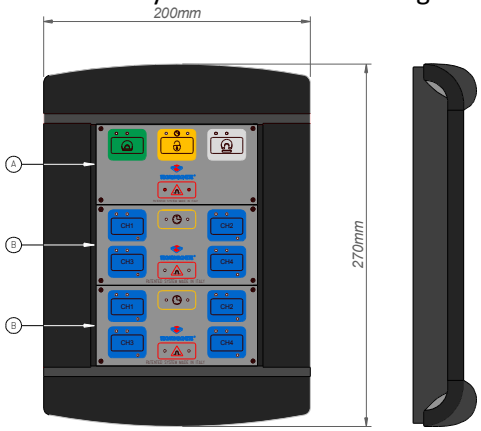
The **TCF4** keyboard is the combination of a **TCF** keyboard and a **CH ENABLE** keyboard.
The function of each key is described in the previous sub-sections **6.4.1** and **6.4.4**.
The **TCF4** keyboard is shown in diagrammatical form below:



ⓐ→ **TCF** keyboard (See sub-section 6.4.1)
ⓑ→ **CH ENABLE** keyboard (See sub-section 6.4.4)

6.4.6 ST200 TCF8 keyboard

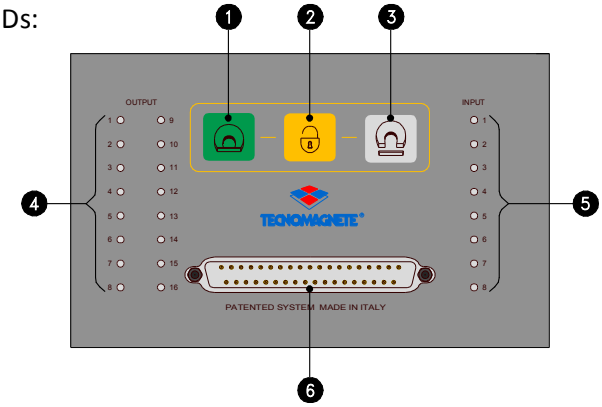
The **TCF8** keyboard is a combination of a **TCF** keyboard plus two **CH ENABLE** keyboards in order to manage eight different channel selections.
The function of each key is described in the previous sub-sections **6.4.1** and **6.4.4**.
The **TCF8** keyboard is shown in diagrammatic form below:



ⓐ→TCF keyboard (See sub-section 6.4.1)
ⓑ→CH ENABLE keyboard (See sub-section 6.4.4)

6.4.7 ST200 PCR1 keyboard

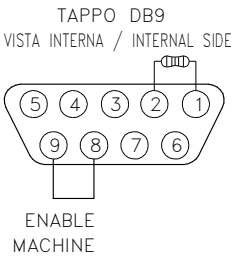
The keyboard, as shown in diagrammatic form below, is made up of three membrane keys and twenty-four alert LEDs:



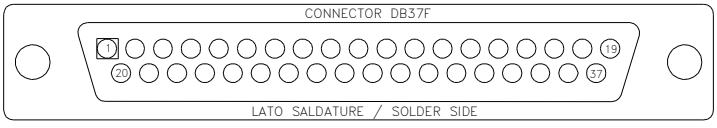
1 → Magnetization key **MAG**
2 → Enabling key **ENABLE**
3 → Total demagnetization key **DEMAG**
4 → **OUTPUT** 16 LED signals
5 → **INPUT** 8 LED signals
6 → **DB37** connector

minimum time of 500ms pressed keys

This **ST200** keyboard can be used in Milling, Grinding and Radial systems where it is necessary to manage seven levels of partial magnetization plus a Full-MAG magnetization level.
The **PCR1** keyboard enables the activation of the Control Unit and communication with the user's PLC via a 24V DC power supply (max 1A) with an opto-isolated system.
It is important to use the **DB9 stopper** (via PIN 1-2) connected inside to a 120 Ω resistance to aid the correct balance in the internal communication of the Control Unit.



The **DB9 stopper**, to be connected to the Controller as indicated in paragraph **7.2**, has the machine enable service (**Machine Enable**) in its internal short-circuitry, and connects to the Controller activation service (**Controller Enable**) via the **DB37** connector.

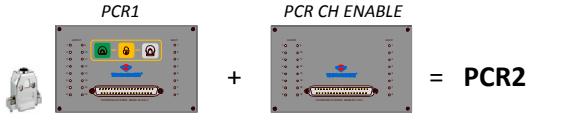


To activate the operation of the **ST200,** the **PCR1** keyboard requires, via the **DB37** connector, both power and voltage on the **INPUT ENABLE** contact (both 24V DC max 1A , at the responsibility of the user).
Once activated, the **PCR1** keyboard enables magnetization or demagnetization cycles to be performed through the user's PLC. Alternatively, the on-board **ENABLE, MAG, DEMAG** keys of the keyboard can be used, which, as also described in the previous sub-sections, involves pressing the **ENABLE** key at the same time as the **MAG** or **DEMAG** key, depending on the activation state desired.
The magnetization levels, activation of the magnetization/ demagnetization cycles and obtaining the operational state of the Control Unit can be managed from the user's PLC through the **DB37** connector. All operations can still be observed via the LEDs, both **INPUT** and **OUTPUT**, on the keyboard.
The specific circuit diagram for this keyboard provides full information.
The functions of the LEDs of both **INPUT** and **OUTPUT** are given below:

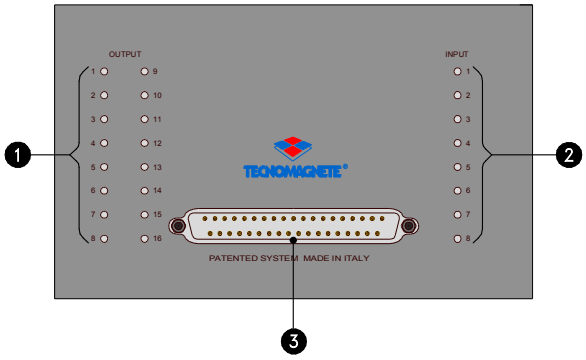
INPUT LED	**Function**
1	on with INPUT ENABLE activated
2	not used
3	on when **MAG** key pressed
4	on when **DEMAG** key pressed
5	on when **LEVEL -** key pressed
6	on when **LEVEL +** key pressed
7	not used
8	not used
OUTPUT LED	**Function**
1	the combination of these LED (on/off) encode the level of magnetization. See specific circuit diagram for details
2	
3	
4	not used
5	not used
6	not used
7	not used
8	not used
9	on in **MAG** state
10	on in **DEMAG** state
11	on in **ALARM** state
12	not used
13	on in **CYCLE** state
14	not used
15	not used
16	on from communication (OUTPUT ENABLE active)

6.4.8 ST200 PCR2 keyboard

The **PCR2** keyboards are a combination of a **PCR1** keyboard plus a second PCR keyboard that has the channel selection function (also called **PCR CH ENABLE** keyboard).

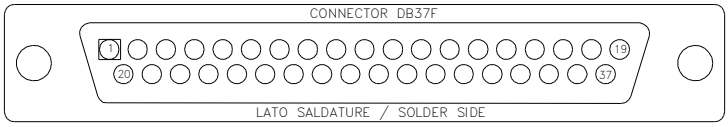


In the previous sub-section **6.4.7**, the **PCR1** keyboard was analyzed, while in this sub-section only the **PCR CH ENABLE** keyboard will be analyzed.
Its construction can be seen below. It consists of twenty-four alert LEDs and without keys:



❶→ **OUTPUT** 16 LED signals
❷→ **INPUT** 8 LED signals
❸→ **DB37** connector

This **ST200** keyboard can be used for all systems in which it is necessary to select the channels from which to perform a cycle.
The **PCR CH ENABLE** keyboard requires a 24V DC power supply (max 1A); It operates, like the **PCR1**, with an opto-isolated system via the user's PLC.
All functions of the **PCR CH ENABLE** can be activated from the **DB37** connector.



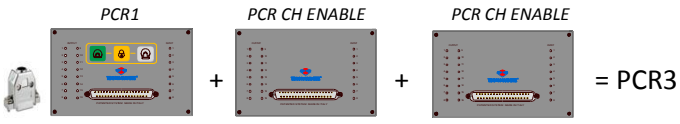
After setting the cycle for the Main Control Unit, the PCR CH ENABLE enables the selection of up to four channels (**CH1, CH2, CH3, CH4**), the operating states of which are also shown by the keyboard LEDs.
For example, the user can send, via a PLC, a 24V DC pulse for a minimum time of 500ms to **CH1** channel and obtain the state of active selection of the **CH1** channel. To deactivate the **CH1** channel , it is sufficient to send a new 24V DC pulse to that channel.
The specific circuit diagram for this panel gives full information.

The table below shows the functions of both **INPUT** and **OUTPUT** LEDs:

INPUT LED	Function
1	not used
2	not used
3	on when the **CH1** button is pressed
4	on when the **CH3** button is pressed
5	on when the **CH4** button is pressed
6	on when the **CH2** button is pressed
7	not used
8	not used
LED OUTPUT	**Function**
1	on in **MAG** state of **CH4** channel
2	on in **MAG** state of **CH2** channel
3	not used
4	on when **CH4** channel is in active selection state
5	not used
6	on when **CH1** channel is in active selection state
7	on when **CH3** channel is in active selection state
8	on when **CH2** channel is in active selection state
9	on in **MAG** state of **CH1** channel
10	on in **MAG** state of **CH3** channel
11	on in **ALARM** state
12	not used
13	on in **CYCLE** state
14	not used
15	not used
16	on from communication (OUTPUT ENABLE active)

6.4.9 ST200 PCR3 keyboard

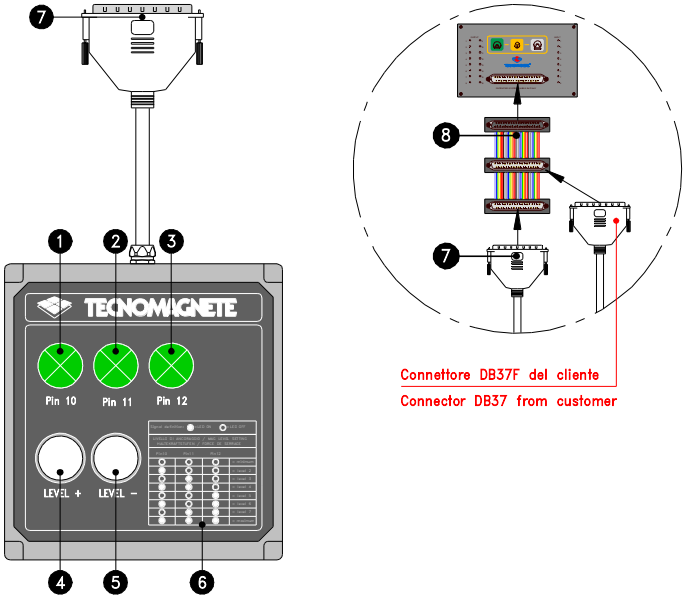
The **PCR3** keyboard is a combination of a **PCR1** panel plus two **PCR CH ENABLE** panels.



In sub-section **6.4.7**, the PCR1 keyboard was analyzed, while the PCR CH ENABLE keyboard is analyzed in sub-section **6.4.8**.
The use of the two **PCR CH ENABLE** panels enables the selection of up to eight channels (this application involves the combination of two Controllers in series, as in the example shown in section **7.2**).

6.4.10 ST200 PCR Plus push-button

The PCR PLUS push-button, unlike other panels described in the sub-sections above, is made with components usually housed in a "casing."
It provides buttons and alert LEDs in accableance with the following drawing:



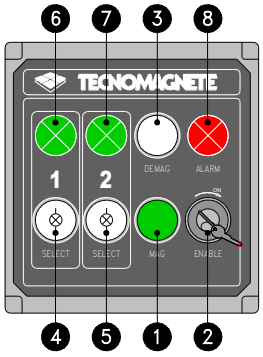
❶→ Magnetization level LED layout **PIN10**
❷→ Magnetization level LED layout **PIN11**
❸→ Magnetization level **PIN12**
❹→ Magnetization level increase button **LEVEL +**
❺→ Magnetization level decrease button **LEVEL-**
❻→ Magnetization level decoding table
❼→ **DB37F** connector
❽→ **flat cable** with two connectors DB37M and DB37F connector

! minimum time of 500ms pressed the buttons

This keyboard is used in combination with the **PCR1** panel to manage the magnetization levels when the user 's PLC does not so provide.
With the **LEVEL +** and **LEVEL-** buttons, it is possible to increase or decrease the magnetization level detected by the **PIN10**, **PIN11** and **PIN12** LEDs that light up in accableance with a binary code (increasing/decreasing the magnetization level can only be performed when the **ST200** Controller is not performing a cycle).
Depending on which LEDs are on/off, the table ❻ for reading magnetization levels is shown on the push-button panel.
The specific circuit diagram for this panel gives full information on the wiring and the correct connection of the DB37F ❼ connector on the support Flat ❽ in turn connected to the **PCR1** keyboard.

6.4.11 ST200 Special in cabinet push-button panel

The **Special in cabinet push button panel** is made with components usually housed in a "case."
For example, it can be made with buttons, alert LED lamps and key switches, as follows:



❶→ Magnetization button **MAG**
❷→ Enabling key selector **ENABLE**
❸→ Total demagnetization button **DEMAG**
❹→ **CH1** channel select luminous button
❺→ **CH1** channel select luminous button
❻→ **CH1** magnetization LED **MAG**
❼→ **CH2** magnetization LED **MAG**
❽→ **ALARM** alert LED

! minimum time of 500ms pressed the buttons

This ST200 push-button panel can be used in Milling, Grinding and Radial systems.

Other solutions may also include a selector for the management of partial magnetization levels plus a total Full-MAG magnetization level; in this case the panel is specially recommended for Grinding and Radial systems.

To carry out the magnetization or demagnetization cycles, the panel provides a key-switch selector (with spring return) called **ENABLE** to be used at the same time as pressing the **MAG** or **DEMAG** button, depending on the activation state desired.

In the **Special in cabinet push button panel**, alert lights can be included consisting of LEDs placed in correspondence with the **MAG** (green LED buttons) and **DEMAG** (white LED) buttons and the **CYCLE** (yellow LED) and **ALARM** (red LED) states; in the event the panel has selection buttons, the **MAG** LEDs will be those corresponding to the activated selection channel.

These alert lights (LEDs) are used to indicate the state of the system. When turned on, the LEDs corresponding to the current state of the controller will be illuminated.

7 INSTALLATION

7.1 Generic installation

Before installing the magnetic chuck on the intended machine table, perform the following checks:

- The positioning of the machine must ensure access to perform the ordinary and extraordinary maintenance operations that may be necessary, therefore paying attention to the lateral clearance measurements (about 1 m around the perimeter of the machine)
- The lighting of the area should allow the production cycle to be clearly visible from all sides of the machine
- Check the main chucks are perfectly level by means of a spirit level and adjust as necessary with shims on the support points
- Wipe all parts with a clean, dry cloth to remove any antioxidant film
- Check the correct positioning and alignment of all moving parts

For the models listed in the user manual, TECNOMAGNETE guarantees a parallelism tolerance of +/- 0.05/1000 between the magnetic surface and the one resting on the machine table (perpendicular, for CUBOTEC systems or to form MAGNETIC TEAMS).

After installation, TECNOMAGNETE recommends a machined finish of the magnetic milling surface with a milling cutter on the milling machines, and a grinder on the grinding machine. If the mechanical installation of the magnetic system was performed by the user, it is recommended to refer to this manual.

Should it be necessary to provide additional fastening holes, use the surfaces of the containment frame that surrounds the magnetic circuit. These surfaces can be used also for any positioning and reference holes for the workpieces (the use of holes on the poles for this purpose is not recommended).

TECNOMAGNETE S.p.A. can provide drawings of the areas of magnetic chucks that can be drilled and machined.

The following table provides values for the axial preload P and the corresponding tightening torques M to be applied to the screws used to mount the chuck on the machine tool.
The table applies to hexagonal screws type UNI 5737-65 and cylindrical head screws with hexagon socket type UNI 5931-67.
The friction coefficient is taken equal to 0.14 valid for machined surfaces blackened or oiled. The tightening torque must be applied slowly with torque wrenches.

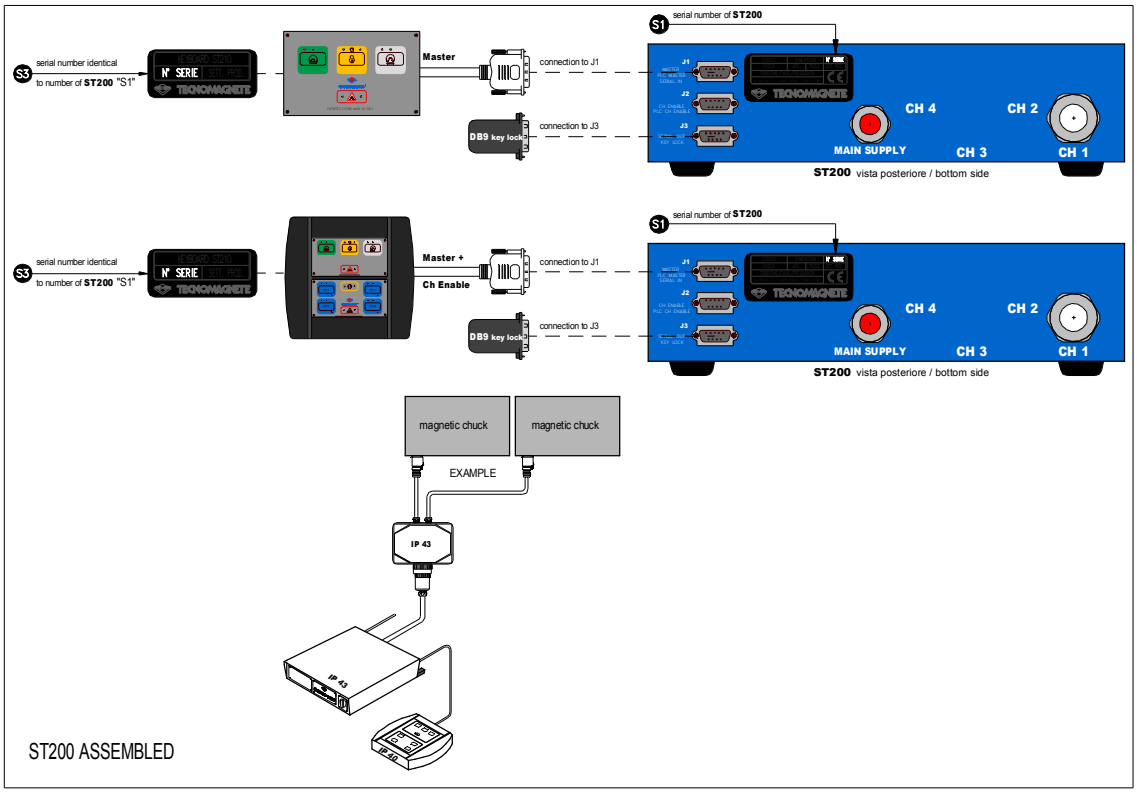
Thread		Class of resistance 8.8		Class of resistance 12.9	
		P [N]	M [Nm]	P [N]	M [Nm]
M	6x1	9000	10.4	15200	17.5
M	8x1,25	16400	24.6	27700	41.6
M	10x1,5	26000	50.1	43900	84.6
M	12x1,75	37800	84.8	63700	143
M	14x2	51500	135	86900	228
M	16x2	70300	205	119000	346
M	18x2,5	86000	283	145000	478
M	20x2,5	110000	400	185000	674
M	22x2,5	136000	532	229000	897
M	24x3	158000	691	267000	1170
M	27x3	206000	1010	347000	1700
M	30x3,5	251000	1370	424000	2310

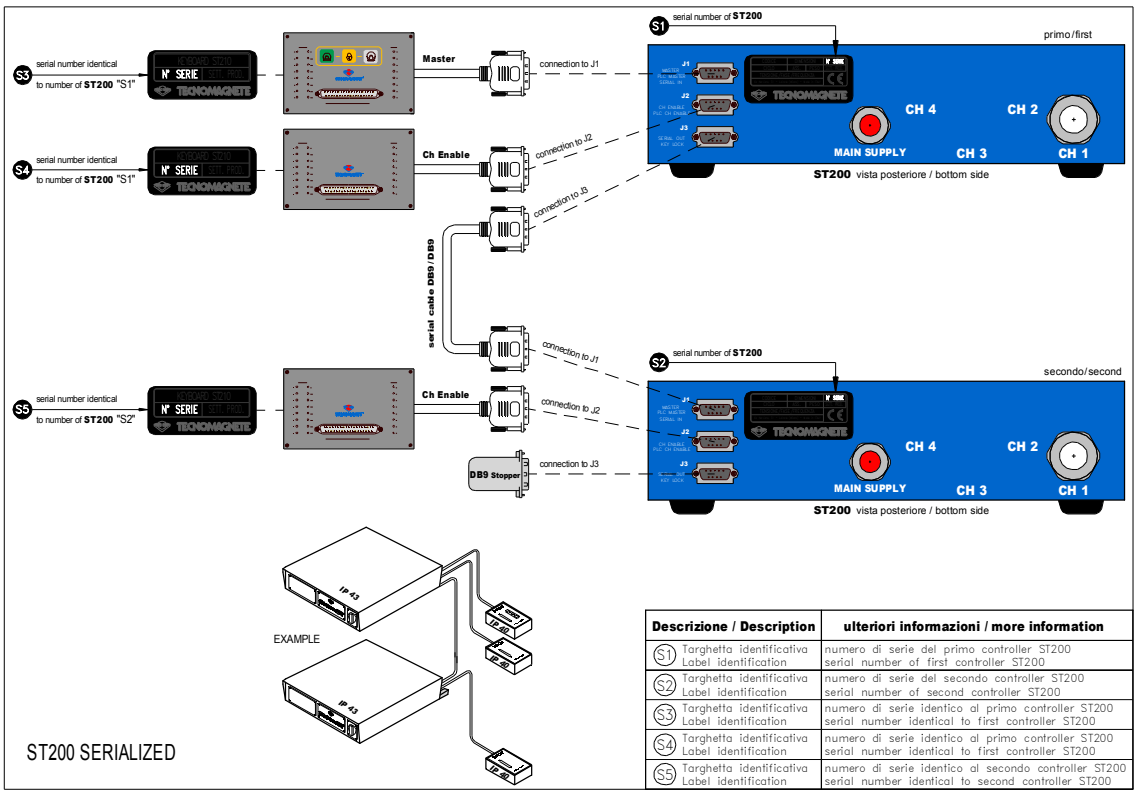
Thread		P [lbf]	M (lbf.ft)
UNC	1/4 "	1870	7.60
UNC	5/16 "	3136	15.71
UNC	3/8 "	5161	27.95
UNC	7/16 "	6434	44.77
UNC	1/2 "	8646	68.37
UNC	9/16 "	11137	98.83
UNC	5/8 "	13861	136.45
UNC	3/4 "	21263	249.3
UNC	7/8 "	28685	391
UNC	1 "	37682	586
UNC	1.1/8 "	47415	830
UNC	1.1/4 "	60718	1173
UNC	1.3/8 "	72032	1536
UNC	1.1/2 "	88237	2041

7.2 Connection of components and serialization of the Controllers

The following drawings show simplified examples of the connection of components of the **ST200** Control Unit plus an example of the serialization of **ST200** Controllers with the **PCR2** keyboard.

CAUTION: only the XT200SK Control Unit, ST200SK, ST200SKA and ST200QE GRIP are **NOT** serializable.

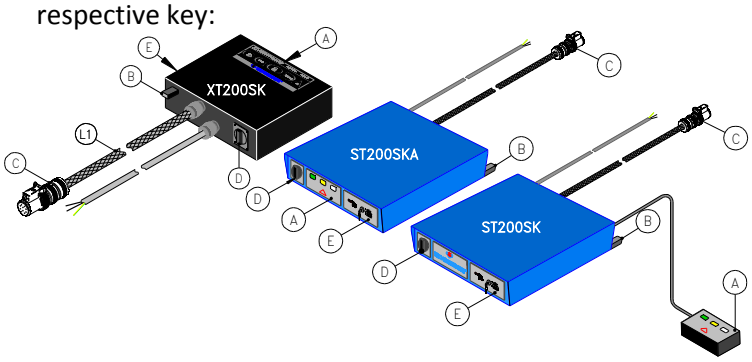


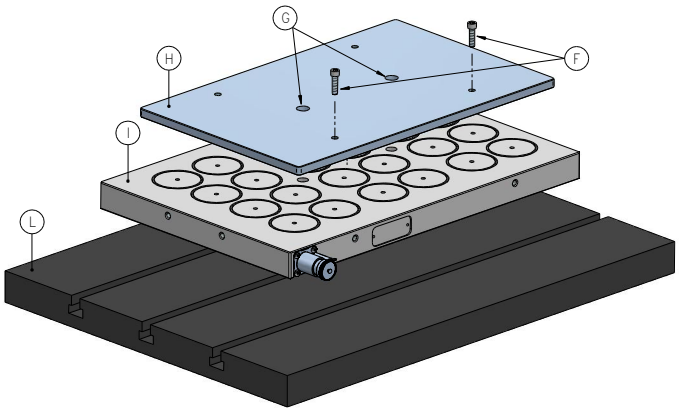


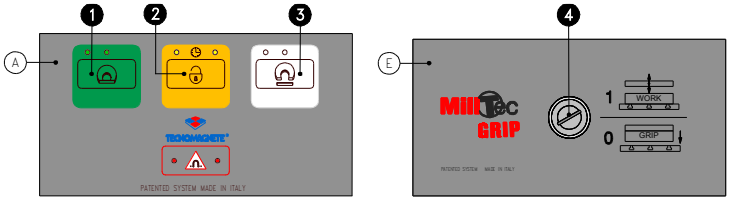
Descrizione / Description	ulteriori informazioni / more information
S1 Targhetta identificativa Label identification	numero di serie del primo controller ST200 serial number of first controller ST200
S2 Targhetta identificativa Label identification	numero di serie del secondo controller ST200 serial number of second controller ST200
S3 Targhetta identificativa Label identification	numero di serie identico al primo controller ST200 serial number identical to first controller ST200
S4 Targhetta identificativa Label identification	numero di serie identico al primo controller ST200 serial number identical to first controller ST200
S5 Targhetta identificativa Label identification	numero di serie identico al secondo controller ST200 serial number identical to second controller ST200

7.3 Mill-TEC GRIP installations

Installations of Mill-TEC GRIP systems are divided into the following sub-sections:
7.3.1 Mill-TEC GRIP on a horizontal base
7.3.3 Mill-TEC GRIP of a vertical base
The installation components for both are shown in diagrammatic form in the following drawings with respective key:







Ⓐ→ keyboard
Ⓑ→ DB9 connector
Ⓒ→ **Ergon** connector
Ⓓ→ main switch
Ⓔ→ **GRIP** overlay selection
Ⓕ→ safety screws
Ⓖ→ chuck/ table fixing holes
Ⓗ→ parking plate
Ⓘ→ an example of a **Mill-TEC GRIP** magnetic chuck
Ⓛ→ machine table

❶→ **MAG** key
❷→ **ENABLE** key
❸→ **DEMAG** key
❹→ key-switch selector

7.3.1 Mill-TEC GRIP on HORIZONTAL BASE Installation

WARNING!

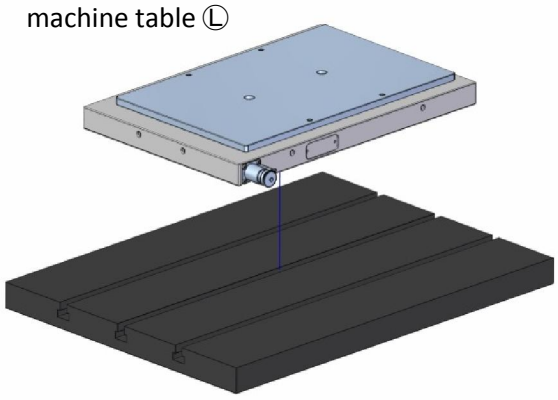
This paragraph applies only to installation on a horizontal base

The parking plate Ⓗ has two holes Ⓖ aligned with the two holes on the magnetic chuck Ⓘ with are indispensable for two screws useful to mechanically attach the Mill-TEC GRIP magnetic plate Ⓘ the machine table Ⓛ.
The screws for mounting the floor/table are the responsibility of the user.

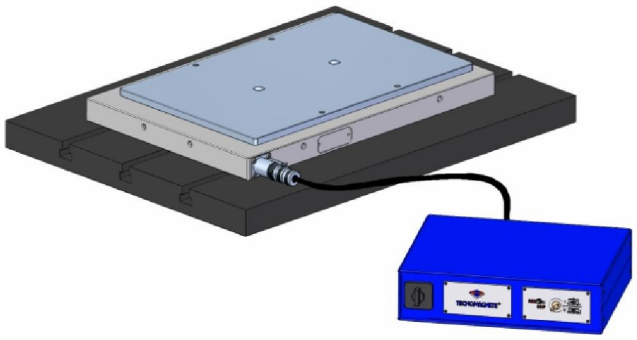
Warning! If required, the use of alternative or additional mounting holes must be in accableance with the procedure described in paragraph **7.4**

The Mill-TEC GRIP is equipped with parking plate Ⓗ clamped magnetically by the two safety screws Ⓕ (The two security screws are vital for installation/removal of a vertical base; see below in the subsequent section **7.3.3**)

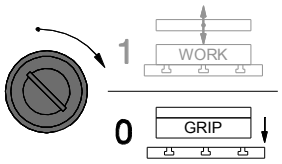
A) place the magnetic Mill-TEC GRIP plate Ⓘ on the machine table Ⓛ



B) Fix the magnetic chuck Ⓘ to the machine tabe Ⓛ by passing screws provided by the user through the holes Ⓖ then connect the magnetic chuck to the Mill-TEC GRIP Control Unit Ⓘ

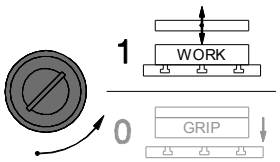


C) turn the Controller's key-switch ❹ to **position "0"** **GRIP**



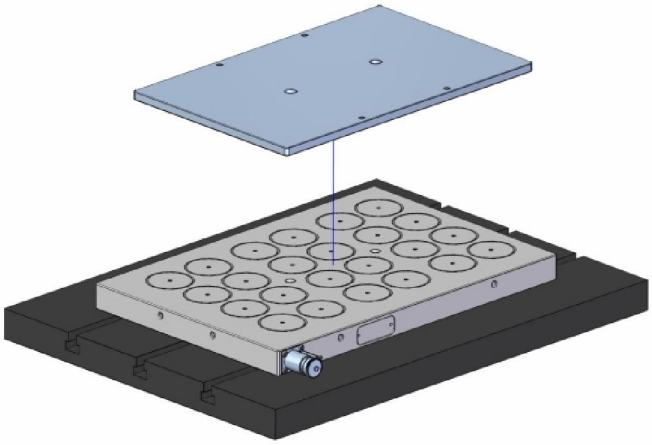
D) on the keyboard Ⓐ press the magnetization ❶ **MAG** key while pressing **ENABLE** ❷

E) turn the controller's key-switch ❹ to **position "1"** **WORK**



F) on the keyboard Ⓐ press the **DEMAG** button ❸ while pressing **ENABLE** ❷

G) Locate the two security screws Ⓕ that clamping the parking plate Ⓗ and remove them.
Keep the parking plate Ⓗ for the removal of the Mill-TEC GRIP magnetic chuck Ⓘ from the machine bed Ⓛ.
Remove the key ❹ from the Controller to prevent improper use and entrust it to AUTHORIZED PERSONNEL.



AT THIS POINT, THE SYSTEM IS READY TO BE USED

WARNING!

During operation, the switch should always be in the **"1" WORK position**.
NEVER carry out magnetization demagnetization operations without partial or complete coverage of the magnetic chuck.

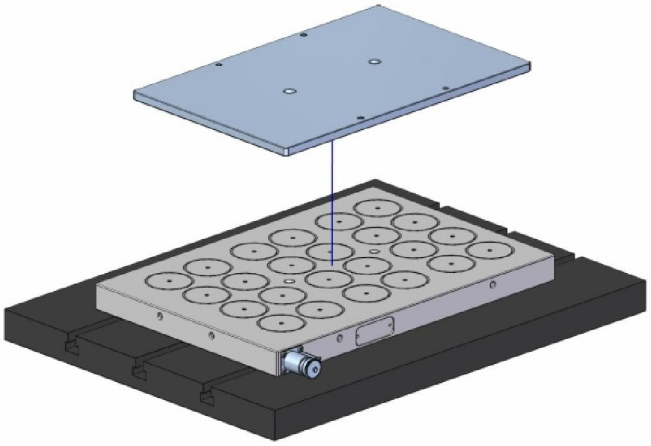
7.3.2 Mill-TEC GRIP on HORIZONTAL BASE Removal

WARNING!

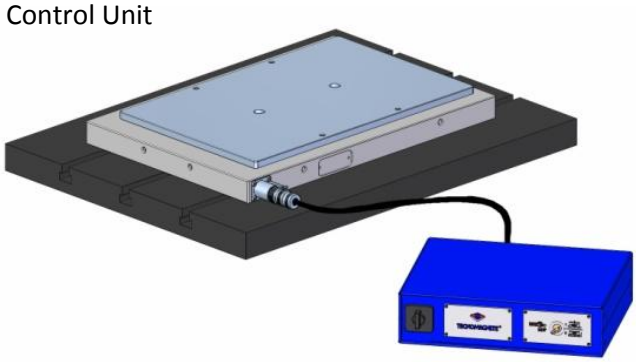
This paragraph applies only to the removal of a horizontal base

A) extract any clamping screws from the holes Ⓖ connecting the Mill-TEC GRIP magnetic chuck to the machine table Ⓛ

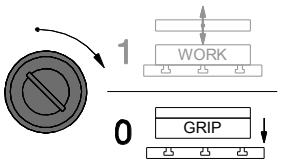
B) ensure the Mill-TEC GRIP Ⓘ magnetic plate is demagnetized and that there are no processing shards or residues.
Position the parking plate Ⓗ so that it full covers the magnetic surface of the Mill-TEC GRIP chuck Ⓘ



C) connect the Mill-TEC GRIP magnetic chuck Ⓘ to the Control Unit



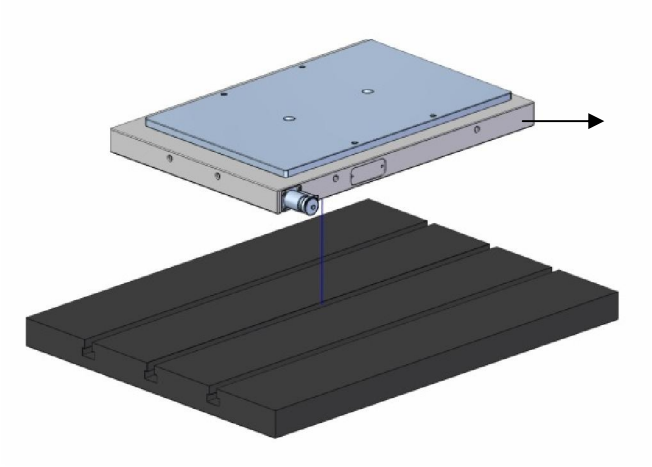
D) insert the key-switch in the Controller selector ❹ and turn to the **position "0"** **GRIP**



E) on the keyboard Ⓐ, press the magnetization ❶ **MAG** key while pressing ❷ **ENABLE**. At this point, the parking plate Ⓗ is clamped to the Mill-TEC GRIP magnetic chuck Ⓘ

F) on the keyboard Ⓐ, press the **DEMAG** key ❸ while pressing **ENABLE** ❷. At this point the Mill-TEC GRIP magnetic plate Ⓘ is released from the machine table Ⓛ (this procedure leaves the parking plate Ⓗ clamped magnetically to the Mill-TEC GRIP magnetic chuck Ⓘ)

G) Disconnect the Control Unit from the Mill-TEC GRIP magnetic chuck Ⓘ



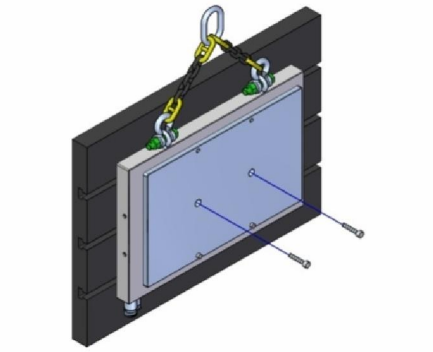
AT THIS POINT, THE EQUIPMENT CAN BE REMOVED

7.3.3 Mill-TEC GRIP VERTICAL BASE Installation

WARNING!

This paragraph applies only to the installation of a vertical base

The parking plate Ⓗ has two holes Ⓖ aligned with the two holes on the magnetic chuck Ⓘ required to accommodate the two screws used for the mechanical clamping of the Mill-TEC GRIP magnetic chuck Ⓘ to the machine table Ⓛ.

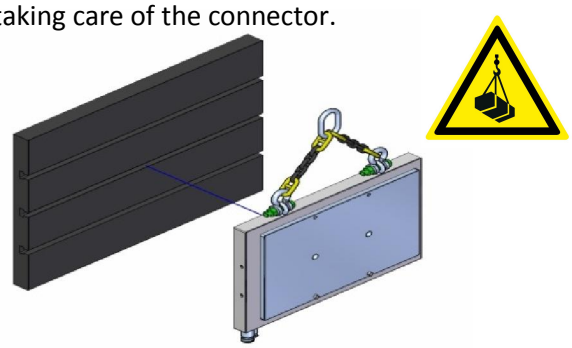


Screws MUST BE USED for clamping chuck/table and are **MANDATORY** and the responsibility of the user.

Warning! If alternative or additional mounting holes are required, the procedure described in paragraph **7.4** must be followed

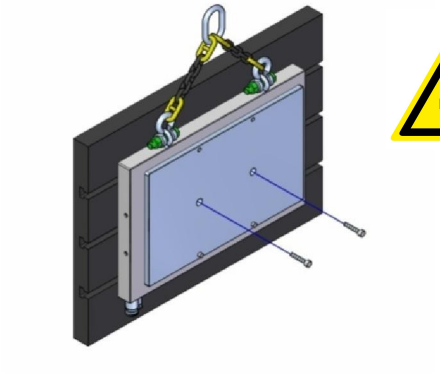
The Mill-TEC GRIP is provided with the parking plate Ⓗ clamped magnetically by two safety screws s Ⓕ. The two safety screws are vital for the installation/removal of the vertical base.

A) place the Mill-TEC GRIP magnetic chuck Ⓘ on the vertical base by means of lifting system (hoist, crane, etc.), taking care of the connector.

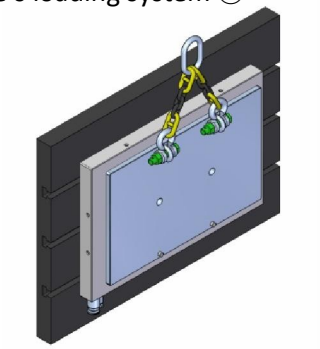


Place the Mill-TEC GRIP magnetic chuck Ⓘ so that it is in close contact with the surface of the machine's vertical table Ⓛ

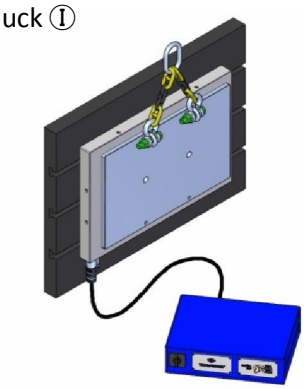
B) Insert screws, at the responsibility of the user, in the holes and tighten Ⓖ to mechanically clamp the Mill-TEC GRIP magnetic chuck Ⓘ to the machine's vertical table Ⓛ



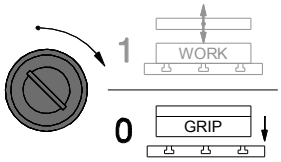
C) disengage the Mill-TEC GRIP magnetic chuck Ⓘ from the loading system and, at the same, attach the parking plate's loading system Ⓗ



D) connect the control unit to the Mill-TEC GRIP magnetic chuck Ⓘ



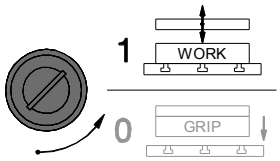
E) turn the controller's key-switch ❹ to the **position "0"** **GRIP**



F) on the keyboard Ⓐ, press the **MAG** magnetization key ❶ while pressing the **ENABLE** key ❷

At this point, the magnetic plate Mill-TEC GRIP Ⓘ is magnetically clamped to the machine's vertical table Ⓛ

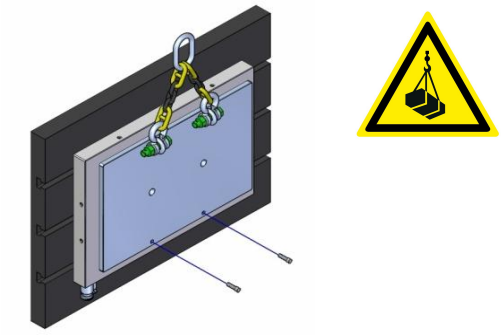
G) turn the controller's key-switch ❹ to **position "1"** **WORK**



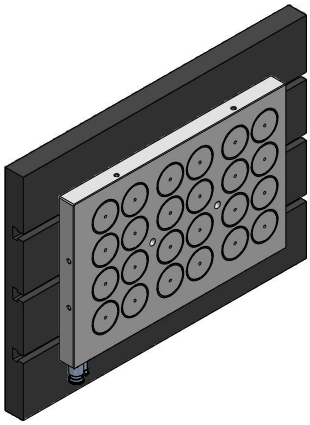
H) on the keyboard Ⓐ, press the **DEMAG** key ❸ while pressing **ENABLE** ❷

At this point, the parking plate Ⓗ is released from the Mill-TEC GRIP magnetic chuck Ⓘ

I) Extract the two safety screws Ⓕ clamping the parking plate Ⓗ and remove it



Retain the parking plate Ⓗ for the removal of the Mill-TEC GRIP magnetic chuck Ⓘ from the machine's vertical table Ⓛ. Remove the Controller key ❹ to prevent improper use and entrust it to AUTHORIZED PERSONNEL.



AT THIS POINT, THE SYSTEM IS READY TO BE USED

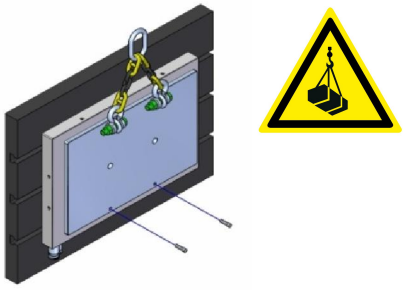
7.3.4 Mill-TEC GRIP on a VERTICAL BASE Removal

WARNING!

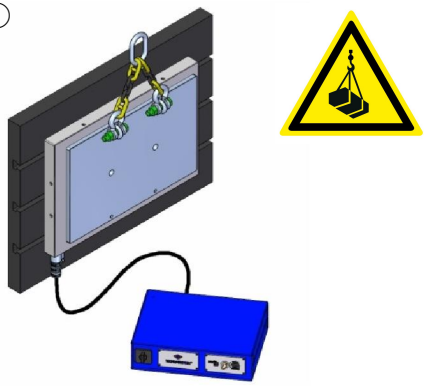
This paragraph only concerns the removal from a vertical base

A) ensure that the Mill-TEC GRIP magnetic chuck Ⓘ is demagnetized and free of processing shards or residues. Position the supporting parking plate Ⓗ so that it fully covers the magnetic surface of the Mill-TEC GRIP magnetic chuck Ⓘ taking care to align the holes for the clamping screws Ⓖ with the safety screw holes Ⓕ

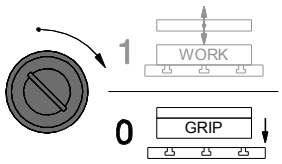
B) screw the two safety screws Ⓕ to the Mill-TEC GRIP magnetic chuck Ⓘ in order to mechanically clamp the parking plate Ⓗ



C) connect the Control Unit to the Mill-TEC GRIP magnetic chuck Ⓘ

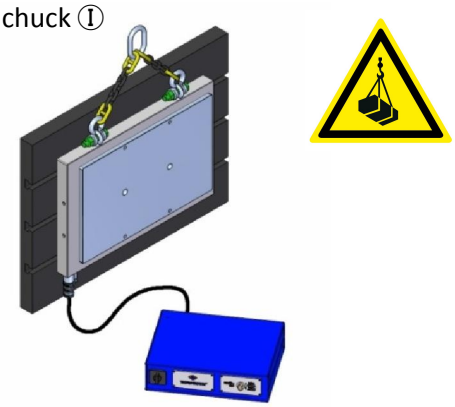


D) insert the key-switch in the Controller in the selector ❹ and turn to the **position "0"** **GRIP**



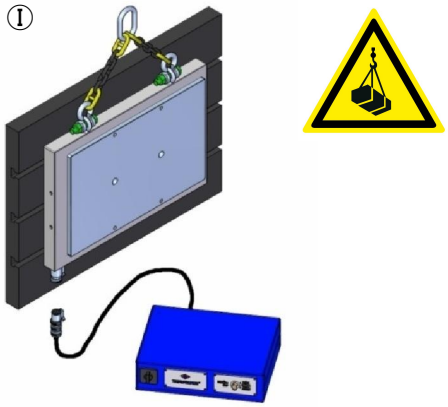
E) on the keyboard Ⓐ press the ❶ **MAG** magnetization key while pressing ❷ **ENABLE**. At this point, the parking plate Ⓗ is clamped to the Mill-TEC GRIP magnetic chuck Ⓘ

F) disengage the parking plate Ⓗ from the loading system and attach the loading system to the Mill-TEC GRIP magnetic chuck Ⓘ

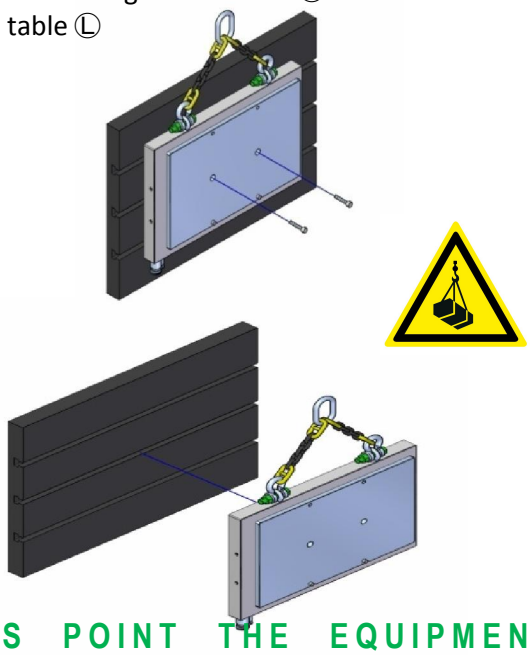


G) on the keyboard Ⓐ press the **DEMAG** key ❸ and at the same time the **ENABLE** button ❷. At this point, the Mill-TEC GRIP magnetic chuck Ⓘ is released from the vertical machine table Ⓛ (with this procedure, the parking plate Ⓗ remains magnetically attached to the Mill-TEC GRIP magnetic chuck Ⓘ)

H) disconnect the Control Unit from the Mill-TEC GRIP magnetic chuck Ⓘ



H) remove the two mechanical clamping screws of the Mill-TEC GRIP magnetic chuck Ⓘ from the vertical machine table Ⓛ

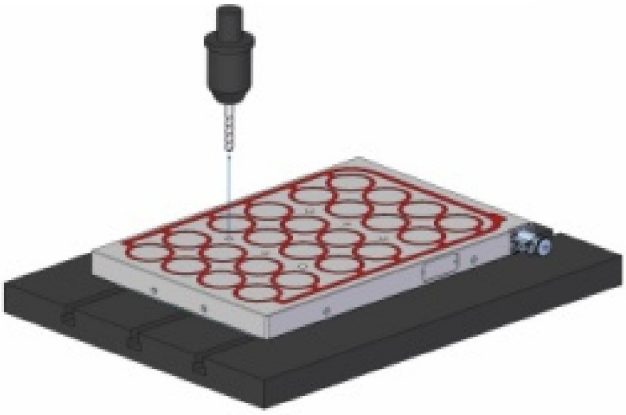


AT THIS POINT THE EQUIPMENT CAN BE REMOVED

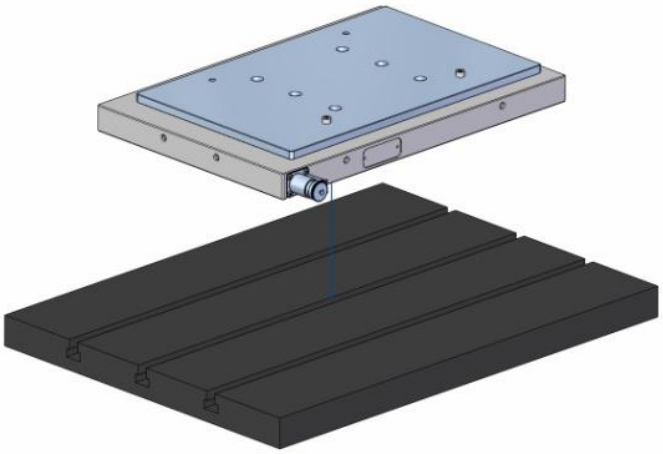
7.4 Mill-TEC GRIP Drilling the chucks

A) place the Mill-TEC GRIP magnetic chuck Ⓘ with the parking plate Ⓗ face down and clamped

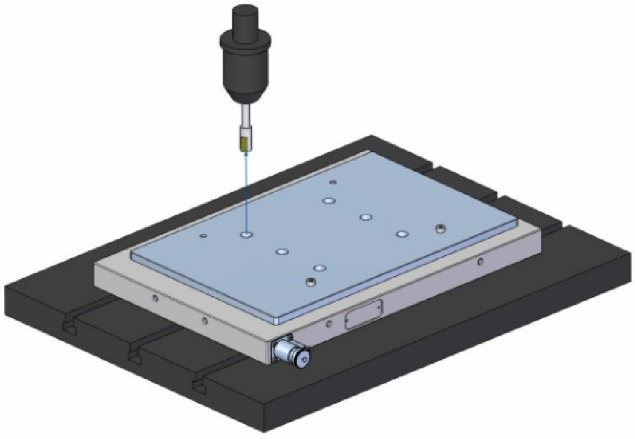
B) check the area availabe for drilling on the drawing provided by TECNOMAGNETE. Drill holes through the parking plate Ⓗ



C) rotate/return the Mill-TEC GRIP magnetic chuck Ⓘ, with the parking plate Ⓗ facing upwards



D) use the holes to bore the seats for the screw heads. This operation can be performed without uninstalling the parking plate Ⓗ



E) perform the installation of the Mill TEC-GRIP magnetic chuck as described in sub-sections **7.3.1** and **7.3.3**

8 RESIDUAL RISK ASSESSMENT

In producing the permanent-electro magnetic systems, TECNOMAGNETE pays great attention to the construction criteria and regulations on safety. Nevertheless, hazardous conditions may remain. This section gives advice on the risks that could arise in certain situations.

8.1 Risks related to the permanent-electro magnet system

By its very nature, the permanent-electro magnetic system can be installed in various applications, but it is vital that the user fully understands and follows both the instructions of this manual and the instructions in the installation manual of the plant on which it is installed.
The user must therefore be made aware of any residual risks that could arise during handling and installation.

8.2 Personal protective equipment

The personal protective equipment (PPE) (see also paragraph **1.8**) required for the use of permanent-electro magnetic system are the same as required for using the machine on which it is installed (for example, milling machine, grinding machine etc.).

8.3 Exposure to magnetic fields

For any risks associated with exposure to electromagnetic fields, it is recommended to give careful consideration to the possible effects on pregnant women, those with specific diseases, pacemakers or other implants with electronic circuitry, such as acoustic equipment, intracranial metal preparation (or placed close to vital anatomical structures), vascular clips or fragments of ferromagnetic material.

Notice is given therefore that:

1. The permanent-electro magnetic systems produced by TECNOMAGNETE are stationary magnetic systems and, as such, do not emit electric fields
2. The V/m (Volt/meter) emitted during operation is equal to 0 (ZERO)
3. The emission of an electromagnetic field during activation/deactivation does not exceed 100 Gauss at a distance of 100 mm from the magnetic system

It is made clear, therefore that during activation/deactivation, the values of the electromagnetic fields are below the levels given in Table 2 of Annex XXXVI of Legislative Decree 81/2008

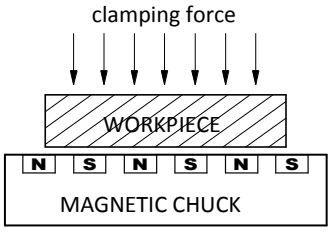
9 NORMAL USE OF PERMANENT-ELECTRO MAGNETIC SYSTEM

The basic operating procedure is given below.

9.1 Clamping force

The force of magnetic attraction of TECNOMAGNETE's permanent-electro magnetic systems is tested and certified.
The clamping force is directly proportional to the operative magnetic surface, the type of material to be processed and the conditions of its surface.

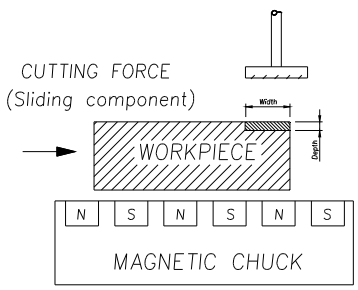
- Workpiece material (mild steel, alloy steel, cast iron ...)
- Conditions of the workpiece surface (roughness, flatness ....)
- Contact surface of the workpiece (the surface in contact with the poles)



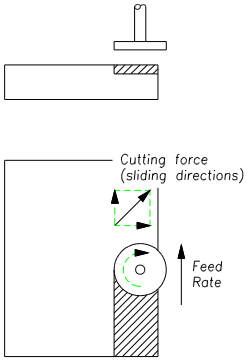
The clamping force is distributed evenly.
The magnetic clamping force is always directed towards the surface of the magnetic chuck.

9.2 Cutting force

In any machining, the cutting force is dependent on the operating conditions of the tool (depth, feed rate, RPM) and the hardness of the material being machined.
The cutting force exerted by any tool includes a component that makes the workpiece slide on the surface of the magnetic chuck.



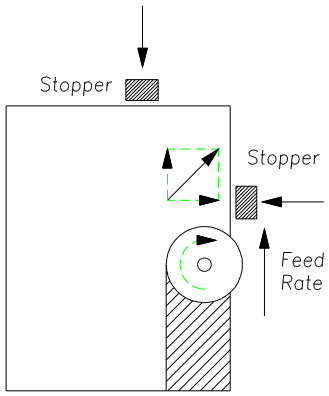
The horizontal component originates from the geometry and the rate of feed of the tool. The clamping force must necessarily be greater than the cutting force, which is exerted in all directions, in order to keep the workpiece being machined in place.
It is therefore very important that the clamping force, which is exerted perpendicular to the magnetic chuck, is reduced to a fifth when making the calculations in order to counteract the tangential force that would make the workpiece slide.



Example: Cutting force 1000 daN.
Clamping force 4000 daN.
Clamping force = 4000 daN/5 = 800 daN
Therefore: clamping force 800 daN < cutting force 1000 daN (insufficient clamping force).

If mechanical stops are introduced to counter the tangential force, and any slippage of the workpiece being machined on the magnetic chuck, it is clear that the forces in play are altered accableingly:

clamping force 4000 daN > cutting force 1000 daN (sufficient clamping force).



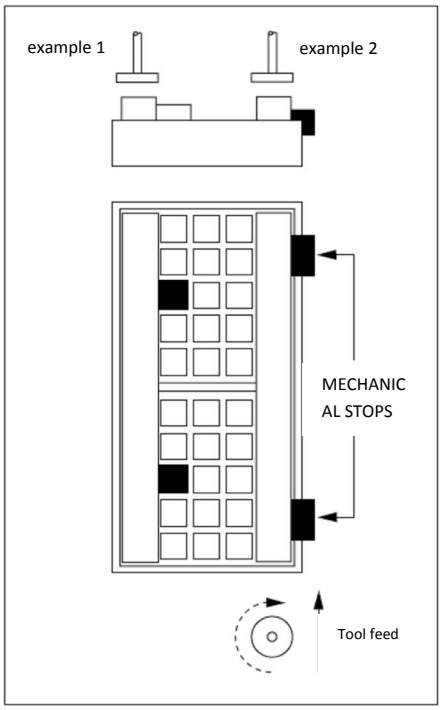
In other words, the introduction of mechanical stops ensures that the tangential component that makes the piece slide is annulled, thereby obtaining extremely safe conditions.
The correct positioning of the mechanical stops is very important, especially when the contact surface between the workpiece and the magnetic chuck is limited (this is also true of the clamping force). A mechanical stop can also be used as a point of reference (the machine's zero point).

CAUTION: Take care when machining very long pieces with reduced thicknesses because the vectorial moment exerted by the cutting force of the rotating tool can cause the workpiece to rotate.

In this case, two mechanical stops placed on the long side of the piece (against the direction of the rotating tool's cutting force) will be sufficient. See **example 2** of the drawing below.

Another valid alternative is the use of fixed pole extensions that can act as mechanical stops. See **example 1**.

The fixed pole extensions make use of both mechanical support and magnetic clamping systems (magnetic flux conductors).



9.3 Placing the workpiece for machining on pole extensions

Traditionally, to mill a workpiece and obtain a planar and parallel surface without the aid of an permanent-electro magnetic chuck, shimming operations are carried out on the support surface.

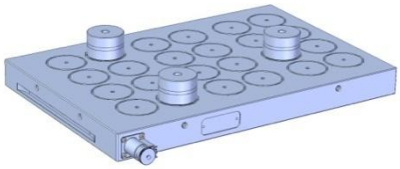
This operation, performed manually, requires long set-up times and skill on the part of the operator in order to obtain a satisfactory result.

With the aid of technology, TECNOMAGNETE's pole extensions, both fixed and mobile, greatly facilitate and speed up shimming operations.

The pole extensions are designed for automatic, even shimming. The correct use of these accessories enables high tolerances to be obtained to flatness and parallelism from the first milling phase, as well as qualitative improvements in the finishing phase. It also enables a reduction in vibrations due to uneven clamping, which cause tools to wear out prematurely.

The steps for positioning of the pole extensions and the operating principle are as follows:

1- A plane must be created by placing three fixed points (using the Fixed pole extensions) in order to obtain a working surface (the principle by which a plane passes through three points).



CAUTION: The holes in the poles of the permanent-electro magnetic chucks have been specifically designed for placing pole extensions. These accessories, specifically acting as magnetic flux conductors, do not require the screws to be excessively tightened.

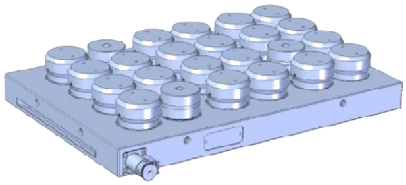
Recommended torque wrench setting M = 15 Nm

Maximum torque wrench setting, M = 23 Nm

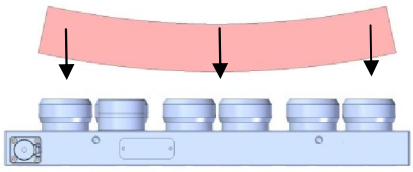
It is also recommended to mill the Fixed pole extensions in order to obtain a flat, parallel support surface for the permanent-electro magnetic chuck.

2- The remaining surface (support bed of the workpiece to be machined) must be covered by Mobile pole extensions that will adapt to the surface irregularities of the workpiece, as well as continuity of the passage of magnetic flux between the permanent-electro magnetic chuck and the workpiece.

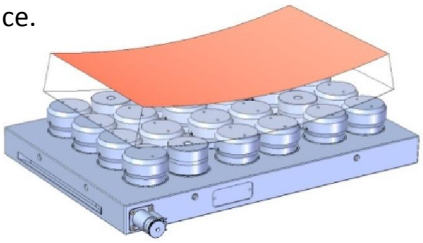
It is very important to deploy the greatest possible number of mobile pole extensions since their quantity determines the clamping force exerted on the workpiece.



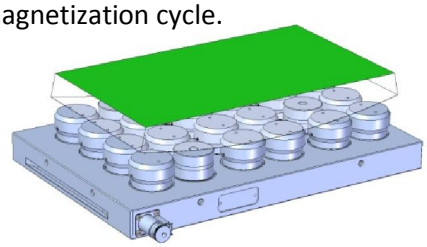
3- Place the workpiece on the bed of pole extensions.



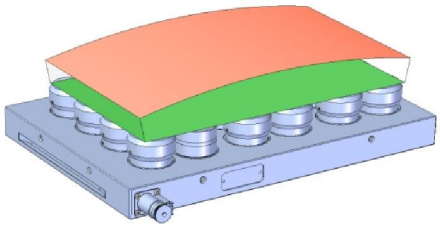
4- On starting a Magnetization cycle on the permanent-electro magnetic chuck, the mobile pole extensions will observed adapting to the contour of the workpiece.
At this point, initiate machining on the upper surface.



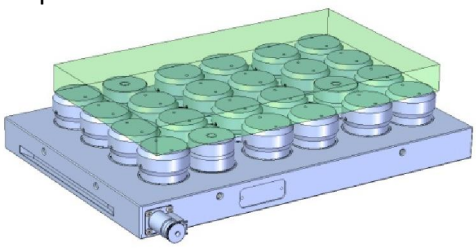
5- After the first machining, initiate a Demagnetization cycle.



6- Turn the workpiece over so the machined side rests on the bed of pole extensions. Initiate a magnetization cycle and, at this point, initiate the second machining.

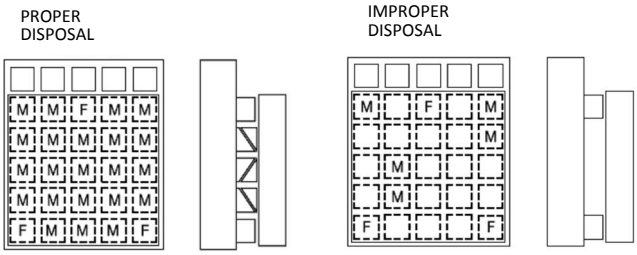


7- After the second machining, a Demagnetization cycle can be initiated in order to remove the workpiece.



CAUTION: When using pole extensions (Milling series), ensure the entire surface of the workpiece is covered by the pole extensions.

F = Fixed pole extensions
M = Mobile pole extensions

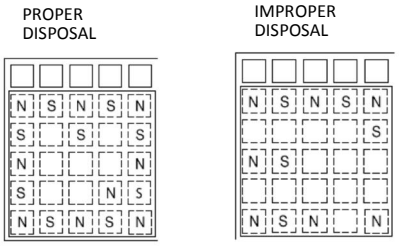


The clamping force is directly proportional to the surface in contact with the workpiece (and therefore to the number of pole extensions). The higher the number, the greater the clamping force.
Check the correct positioning of the pole extensions, ensuring a magnetic balance (the number of poles with extensions housed on the SOUTH polarity corresponds to the number of poles with extensions housed on the NORTH polarity).
In other words, should it not be possible for any reason to use the whole surface of the workpiece for magnetic clamping with the aid of pole extensions, make sure those present comply with the following:

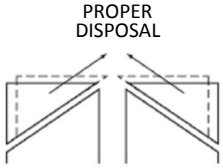
A - the number of pole extensions housed on the North (N) polarity is equal to the number of pole extensions housed on the South (S) polarity (it is generally sufficient to ensure the extensions face each other since the checkerboard layout of the poles provides alternation between South and North).

B - place the polar extensions that will contact with the workpiece on its entire perimeter, as far as possible. This ensures a better clamping force to counteract the cutting force.

C - for mobile polar extensions with a square layout only, the correct use of a shimming system is important. Indeed, the correct positioning of the mobile polar extensions with a square layout must necessarily be in opposition.



When moving vertically, the moving parts of the pole extensions must only move away or closer. Their movement must never be simultaneous and parallel (this measure is not necessary with the rounded mobile pole extensions).



9.4 How to calculate the clamping force

The magnetic clamping force is very easy to calculate and depends on:

- the surface of the magnetic chuck in contact with the workpiece to be clamped
- the conditions of the surfaces in contact with the workpiece to be clamped
- technical specifications of the material of which the workpiece is made
- model of the magnetic chuck used

9.5 Example of magnetic chuck clamping force calculation

a = Model of magnetic chuck: Mill Tec GRIP in the calculation a value of **40** will be used (cm² per pole) (see paragraph 3.3)

b = n° of operative poles **10** (it's an example of number of poles used/covered by the workpiece)

c = value of magnetic force concentrated and constand over time: in the best conditions is **16** daN/cm² (see section 3.4)

d = Roughness: Milling **0,7** (corrsponding to the percentage value of 70%)

e = Mild steel: value is **1** (see section 3.3.3)

Give the foregoing, the clamping force is calculated with the following formula:

Total clamping force = a x b x c x d x e

or rather:

Total clamping force = 40 x 10 x 16 x 0,7 x 1 = 4700 da/N

Since this is a purely theoretical calculation, it cannot, of course, take into account all the variables that arise during machining (uneven material with some areas harder than others, surface distortions that prevent perfect contact between the workpiece and the extensions, a surface that does not allow even removal by wiping, etc.), a safety factor **(Fa)** of **0,5** is recommended:

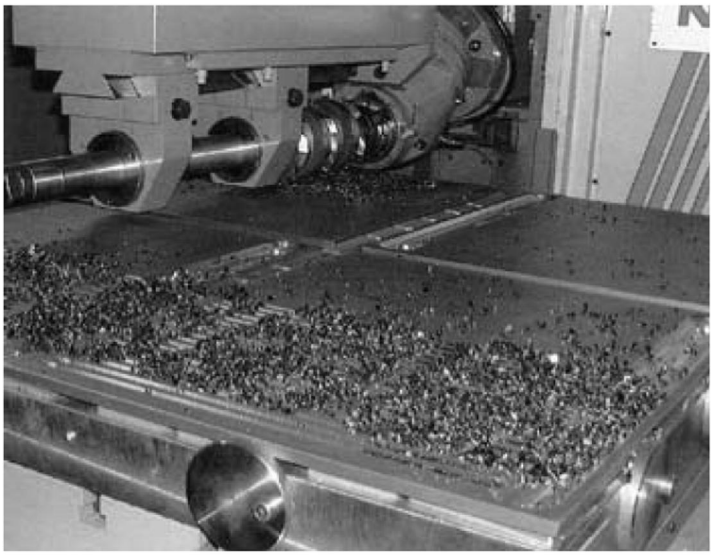
therefore, with reference to the example of the previous calculation:

Total clamping force with Fa = 4700 x 0,5 = 2350 da/N

9.6 Clamping rules for conventional machining

In the following sub-sections, some examples of conventional machining are analyzed.

9.6.1 Face milling: Direct clamping to the permanent-electro magnetic chuck



A typical process that can be performed on an permanent-electro magnetic chuck is the face milling of plates. After removing any fouling and burrs, which can increase the air gap and therefore the clamping force (see Chapter **3**), position the workpiece and carry out manual shimming.

This is to limit any distortion due to the force of the system's magnetic attraction any vibrations caused by the machining.

This type of machining has the sole advantage of placing the workpiece directly on to the magnetic chuck, but presents the disadvantage of not allowing processes such as contouring, drilling and through machining in general, and the flatness obtained will depend on the skill of the operator.

9.6.2 Face milling: Clamping on pole extensions

To obtain further advantages from the permanent-electro magnetic system, such as an optimal flatness of the machined workpiece, TECNOMAGNETE can also provide both Fixed and Mobile pole extensions (see the models in section **4.1**).

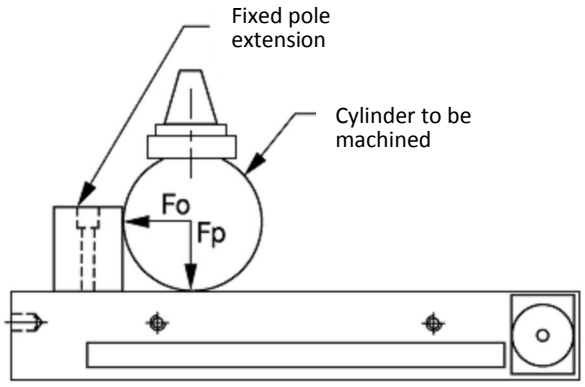
The steps required to position pole extensions and the operating principle are described in section **9.3**. The mechanical machining first involves the roughing and contouring of both faces of the workpiece, then a demagnetization cycle of the permanent-electro magnetic chuck. The plate (the machined workpiece), distorted due to yield and overheating of the material, is released from internal stresses and takes a new position. At this point, perform a new magnetization cycle of the permanent-electro magnetic chuck so that the mobile pole extensions readjust to the surfaces in contact with the plate, and perform the finishing of the upper face.
The last step is a demagnetization cycle of the permanent-electro magnetic chuck, then turning the plate over and replacing it with the finished face on the bed of extensions. At this point, the finishing of the plate's other face can be performed.

9.6.3 Through machining operations: clamping on pole extensions

To perform through machining, it is indispensable to raise the workpiece above the base to enable the tool to pierce the workpiece without damaging the surface of the permanent-electro magnetic chuck.
Among the accessories supplied by TECNOMAGNETE are Fixed and Mobile pole extensions (see the models in section **4.1**) that have been designed to ensure optimum circulation of magnetic flux and obtain magnetic clamping.
The steps for positioning of pole extensions and the operating principle are described in section **9.3**.

9.6.4 Machining cylindrical workpieces

For the machining of cylindrical workpieces, or in any case when the supporting surface is not flat, the workpiece should be placed directly on the permanent-electro magnetic chuck, in addition to the aid of fixed pole extensions, in order to create a support with more points of magnetic clamping. As well as stopping the workpiece rolling, this acts as a magnetic flux conductor and therefore a clamp. To machine the workpiece, ensure the components of the machining cutting force are directed towards the extension.



9.6.5 Machining parts in series

For the machining of parts in series or with irregular shapes, we recommend the use of pole extensions or the use of top plates. To use top plates, make pole extensions of diameters equal to the diameter of the poles and combine them with non-magnetic material (stainless steel, aluminum, etc.). It is recommended to respect the pole pitch of the permanent-electro magnetic chuck, both regarding the size of the polar extension, which must the same as the poles, and regarding the spaces between the poles. At this point, shape the top plate in order to make a workpiece positioning mask. The entire frame of the permanent-electro magnetic chuck surrounding the magnetic islands (with the sole exception of the area of the discharge cable connection) can be drilled to insert pegs to aid positioning and removal. The magnetic chuck can also be used for clamping vices, dividers and jigs for clamping material that is particularly difficult to clamp or non-magnetic material.

9.7 Machining examples

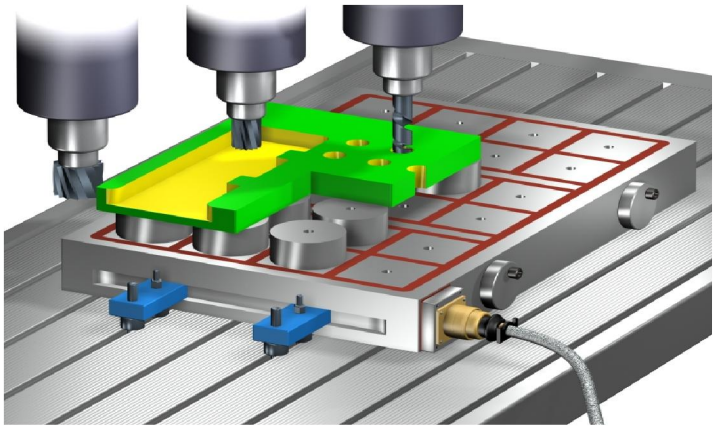


Figure 9.7A - Face milling, drilling, running tracks

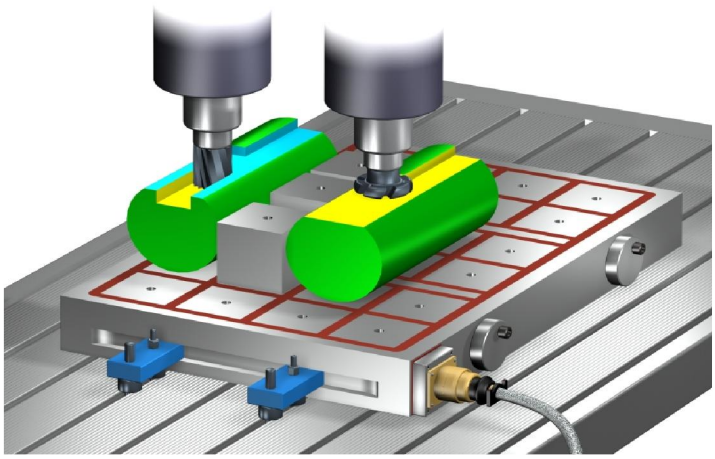


Figure 9.7B – Curtain facing and execution of key seats

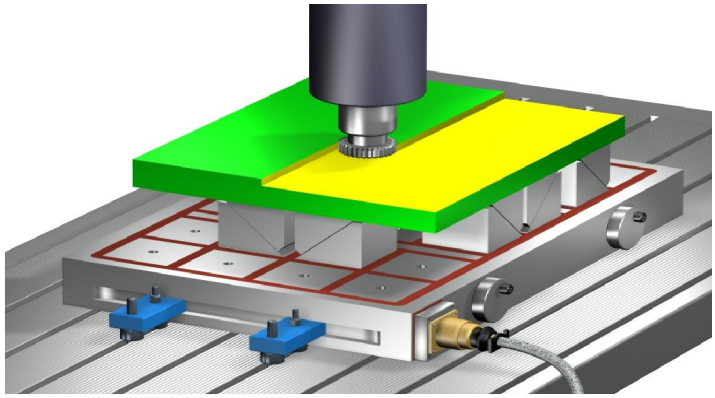


Figure 9.7C - Roughing first face

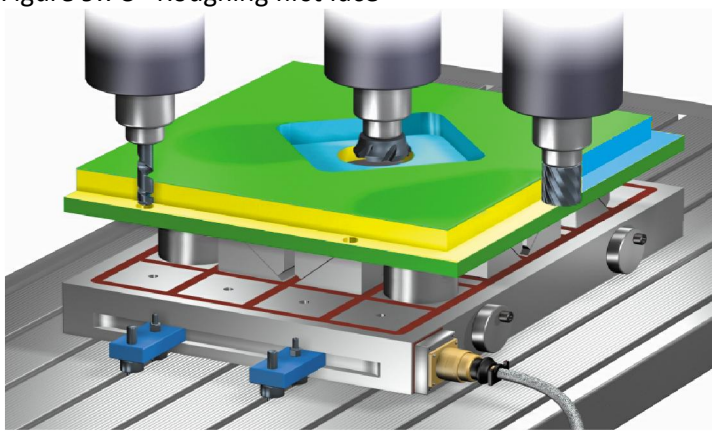


Figure 9.7D – Turning over, roughing, stress release and finishing second face

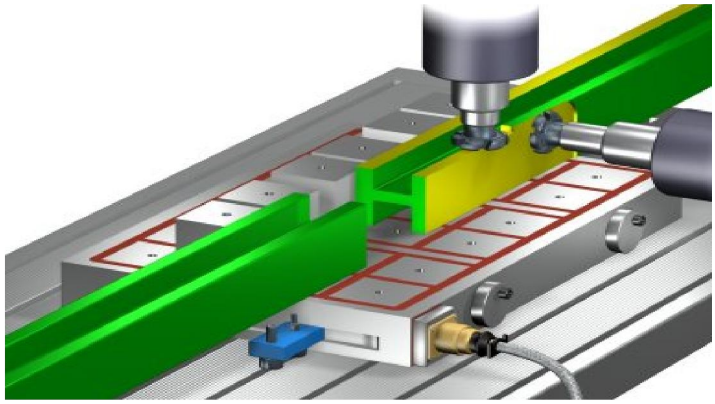


Figure 9.7E - Flattening and butting profiles

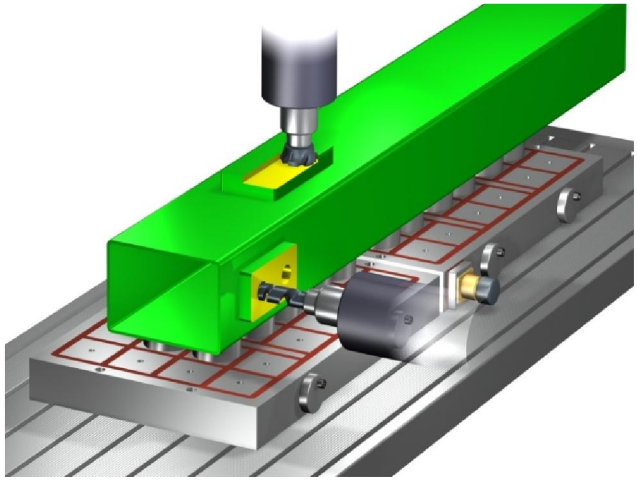


Figure 9.7F - Butting and tubular drilling

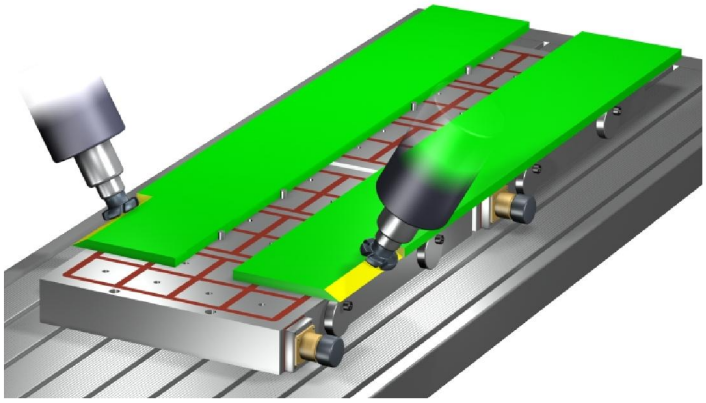


Figure 9.7G - Blade profiling and sheet metal chamfering

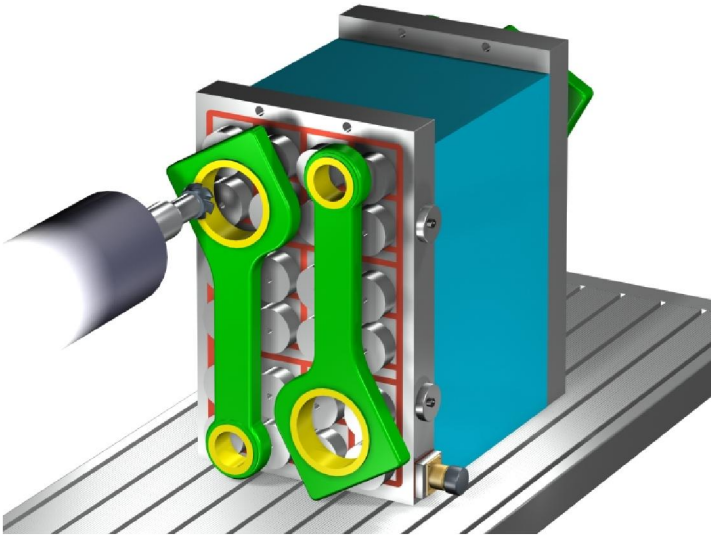


Figure 9.7L - Flattening, contouring and boring details in cast steel

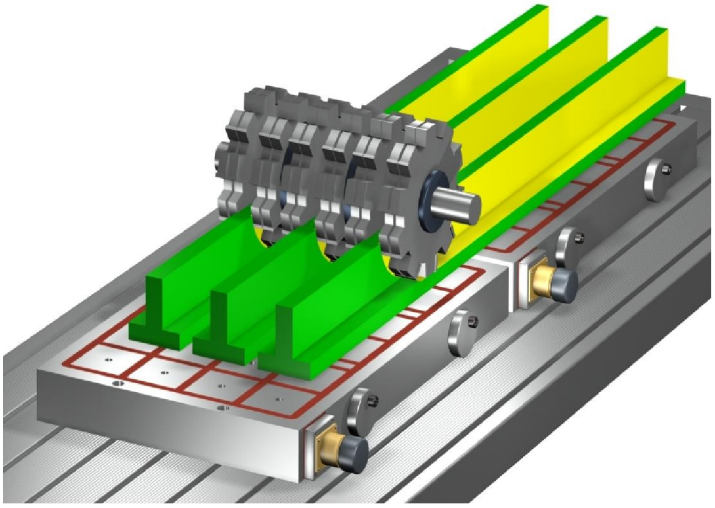


Figure 9.7H - Multiple coupled guides profiling

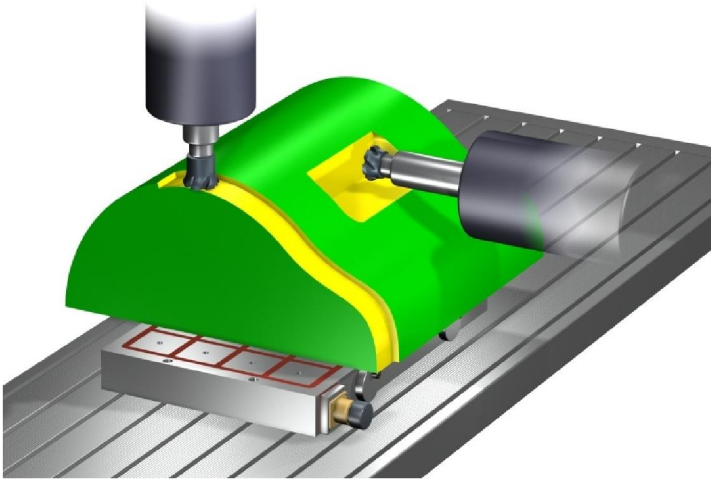


Figure 9.7M - Three-dimensional machining

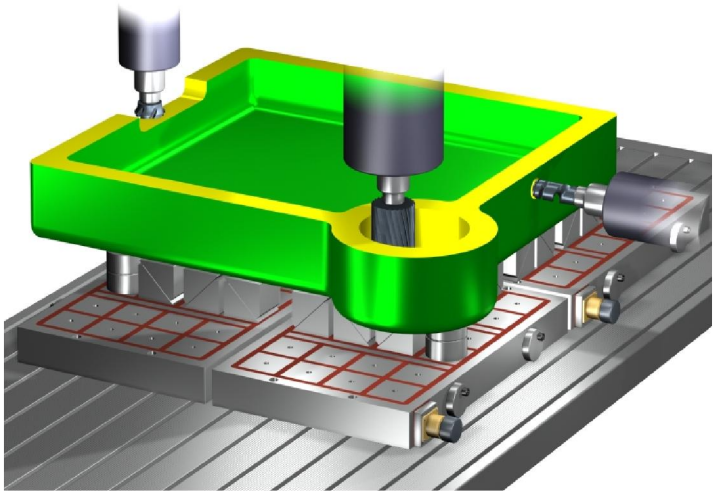


Figure 9.7I - Flattening and contouring details on cast and moulded metals

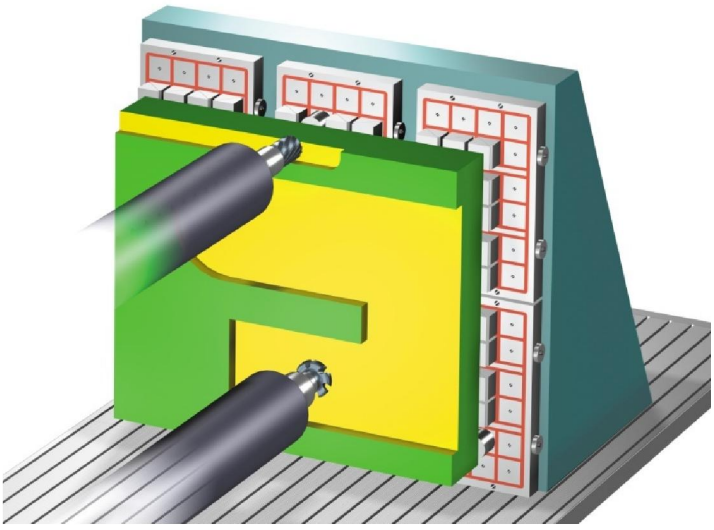


Figure 9.7N - Machining plates with horizontal axis

10 MAINTENANCE

Adequate maintenance is vital to maximise equipment duration under operating conditions and for optimal yield, as well as operational safety over time.

10.1 Safety rules during maintenance

THE OPERATIONS MUST BE CARRIED OUT ONLY BY TRAINED PERSONNEL

The main precautions to be taken during maintenance operations are:

- ✓ all maintenance work should be performed with equipment turned off and, where possible, disconnected from the mains supply
- ✓ repairs of electrical equipment must be carried out in the absence of voltage and with the emergency button activated. Operational, maintenance and cleaning personnel etc. must strictly comply with the safety rules in force in the country of operation
- ✓ always wear protective gloves and safety shoes, as well as any other personal protective equipment and clothing that covers body parts as much as possible, where required
- ✓ do not wear rings, watches, chains, bracelets, loose clothing etc. during maintenance operations
- ✓ place an insulating rubber mat under the feet (where possible) when performing maintenance
- ✓ avoid operating on a wet floor or in a humid environment
- ✓ comply with the maintenance schedule
- ✓ components must only be replaced with original spare parts in order to ensure perfect operation
- ✓ during machine cleaning, take care not to use grinding wheels, abrasives, corrosives or solvents that could remove or make unreadable numbers, abbreviations, and information placed on the equipment
- ✓ never allow electrical and electronic equipment to become wet
- ✓ only use a vacuum cleaner on electrical parts, no compressed air.

10.2 Daily maintenance

This can be performed by the operator or emergency personnel at the end of the day's production:

- ✓ general cleaning of equipment
- ✓ check the mobile/fixed connectors are operating correctly, where they form part of the permanent-electro magnetic system (pay particular attention to any blackened/scorched areas suggesting an electrical problem)

10.3 Weekly maintenance

This is performed by the operator at the end of the weekly production:

- ✓ check of lamps and LED indicators (see chapter **6**)
- ✓ check of buttons/keys (see chapter **6**).

10.4 Monthly maintenance

This is performed by qualified, skilled operators every month, if the work is routinely carried out in daily shifts of 8 to 10 hours:

- ✓ visual inspection of the surfaces and the general state of the permanent-electro magnetic chucks
- ✓ check the tightness of the screws of permanent-electro magnetic chucks
- ✓ elimination of any uneven edges and roughness
- ✓ inspect and check the tightness of the Control Unit screws of the (particular attention should be paid to tightening the terminal screws)
- ✓ check that there is no leakage of liquid (water, coolant, machining oil etc. for processing) in all Control Unit components (particular attention should be paid to the connectors and junction boxes)
- ✓ check structural work of the enclosures, boxes, cabinets, etc.

10.5 Six-monthly maintenance

This is performed by trained, skilled operators every six months if the work is routinely carried out in daily shifts of 8 to 10 hours:

- ✓ check for cable slippage throughout the whole permanent-electro magnetic system
- ✓ check the continuity of earth conductors and protection
- ✓ measure the resistance values and insulation at 500V
- ✓ pass a piece of steel across the surface of the demagnetised permanent-electro magnetic chucks to detect any significant residual magnetic halos

10.6 Extraordinary maintenance

Maintenance operations not described in this manual are considered to be extraordinary maintenance and must be performed by skilled personnel identified by TECNOMAGNETE S.p.A.

10.7 Information for repairs and extraordinary maintenance operations

In order to quickly find any faults, TECNOMAGNETE, on completion of the permanent-electro magnet system, supplies:

- ✓ dimensional layout and assembly instructions
- ✓ specifications of the model of permanent-electro magnetic chuck and Control Unit
- ✓ circuit diagrams

TECNOMAGNETE S.p.A. is at the disposal of customers for any requirements and to clarify any doubts about the operation and maintenance of the permanent-electro magnetic system.

11 PROBLEMS AND THEIR SOLUTIONS

The purpose of this section is to aid the operator in identifying and resolving problems that may arise during the use of the permanent-electro magnetic system.
Repairs to electrical equipment must be carried out in the absence of voltage and with the emergency button activated. Personnel assigned to repairs must strictly observe the safety rules in force in the country of use.

11.1 Problems

Avoid problems in calculating forces by referring to the specific sections, taking account of the safety factors to be included in the calculations. Take care always to check that the machining forces do not exceed those of the clamping, in certain situations. To remedy electrical faults, refer both to the circuit diagrams attached to the electro-permanent magnetic system and the Control Unit's Use and Maintenance Manual provided.
Repairs to electrical equipment must be carried out in the absence of voltage and with the emergency button activated.

ALL CHANGES TO THE ORIGINAL WIRING OF THE PERMANENT-ELECTRO MAGNETIC SYSTEM MUST BE CARRIED OUT ONLY BY THE PERSONNEL OF THE TECHNICAL ASSISTANCE SERVICE OR THROUGH SPECIFICATIONS SENT BY TECNOMAGNETE'S TECHNICAL ASSISTANCE SERVICE

CAUTION: As stated previously in Chapter 6, should the Control Unit include removable connectors, once the discharge cable with flying connection, it is mandatory to insert the cap provided on the panel connector in order to prevent penetration by liquids or various machining residues.

Problem	Remedy
The controller does not start	Check the supply voltage and frequency are suitable and correct (the power supply must be sufficient for both the control unit and the magnetic chuck)
On starting, the system enters the ALARM state	Check that the DB9 key has been inserted properly (see section 5.6)
	Check the DB9 key has been correctly inserted for the Control Unit using the PLC interface keyboard (see section 6.4.7)
	If the keyboard has been replaced with a new one, the SET-UP procedure must be repeated (see ST200 Manual)
	Check that the keyboard is properly connected to the Controller
The Control Unit does not perform the MAG cycle	Check the ENABLE button was pressed together with the MAG button
	Ensure the correct keys are pressed for at least 500 ms (half a second)
	Check the DB9 key has been inserted correctly (see section 5.6)
	Check the DB9 plug for the control unit that uses the PLC interface keyboard has been inserted correctly (see section 6.4.7)
The Control Unit does not perform the DEMAG cycle	Make sure the ENABLE key is pressed together with the DEMAG key
	Ensure the correct keys are pressed for at least 500 ms (half a second)
	Check the DB9 key has been inserted correctly (see section 5.6)
	Check the DB9 plug for the control unit that uses the PLC interface keyboard has been inserted correctly (see section 6.4.7)
The Control Unit attempts to perform a MAG cycle, but remains in ALARM state	Check the power supply, as with cases when the controller will not turn on
	Check the correct wiring and correct connection of the discharge cables
	Perform a DEMAG cycle (which should reset the Control Unit) before repeating a MAG cycle
The Control Unit demagnetizes the magnetic chuck (and vice versa) during performance of the MAG cycle	Check the correct wiring of the discharge cables and any cabling between the controller and the electro-permanent magnetic chuck through an intermediate junction

Any malfunction of the Unit Control must, in any event, be reported to the TECNOMAGNETE Technical Assistance Service.

12 DECOMMISSIONING AND DISPOSAL

12.1 Decommissioning

Should it be decided not to use the permanent-electro magnetic system any more, it is advisable to disconnect it from the power supply and to make it inoperative by removing it from the machine on which it is installed, also removing the controller and any moving parts.

12.2 Disposal

In accableance with EU Directives, or the laws in force in the country of use, the user must arrange the destruction, disposal and elimination of the various materials that make up the equipment.
In the case of equipment destruction, safety precautions must be taken to avoid risks associated with the decommissioning of industrial machinery, paying particular attention to the following:

- ✓ dismantling equipment in the installation area
- ✓ carriage and handling of the equipment
- ✓ dismantling the equipment
- ✓ separation of the various materials that make up the equipment

To carry out the destruction and disposal of the permanent-electro magnetic system, some basic rules designed to safeguard health and the environment must be observed, paying particular attention to the separation, recycling or disposal of materials, always referring to the National or Regional laws in force on the disposal of industrial solid waste and toxic and harmful waste.
Sheaths, flexible ducts and plastic or non-metallic elements in general must be dismantled and disposed of separately.

Electrical components such as circuit breakers, transformers, sockets etc. must be dismantled for reuse, if in good condition, or reconditioning and recycling.

13 SPARE PARTS

All permanent-electro magnetic systems come with a parts list together with the other product documentation (see section 16 Attachments).

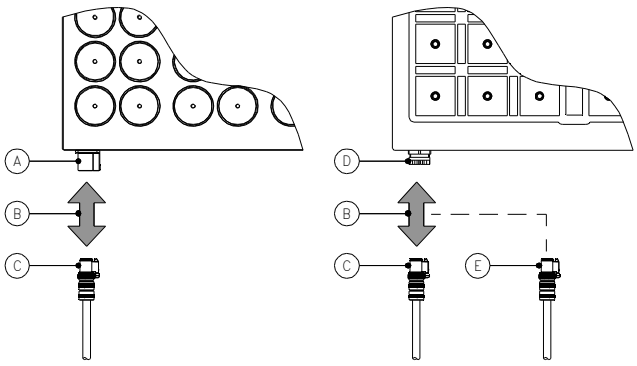
ALL OPERATIONS TO REPLACE OR EXCHANGE PARTS OF THE CONTROL UNIT SHOULD BE HANDLED BY TECNOMAGNETE'S TECHNICAL ASSISTANCE SERVICE

13.1 Spare controller and permanent-electro magnetic chucks

In the event the permanent-electro magnetic chucks or the Controller are replaced/exchanged, it is vital to contact TECNOMAGNETE's Technical Assistance Service to ensure the equipment is replaced with a suitable product with adequate performance and specifications.

13.2 Adaptors per connectors 7PIN – 10PIN – 5PIN

Special adaptors are available on request to be installed on the permanent-electro magnetic chuck, to let it compatible in presence of ERGON 5PIN connector on discharge cable.



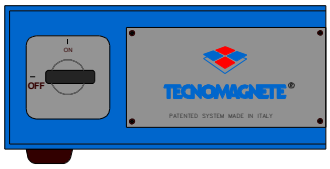
Descrizione / Description		Tipologia / Type
Connettore Connector	A	10PIN M.P. Ergon
Adattatore Adaptor	B	Simbolo indicativo Indicative symbol
Connettore Connector	C	5PIN F.V. Ergon
Connettore Connector	D	7PIN M.P. HML or REC
Connettore Connector	E	10PIN F.V. Ergon

13.3Spare keyboards (only applicable for remote control panels)

In the event the ALARM LEDs illuminate (after replacing/changing the only remote keyboard) a SET-UP procedure must be performed to enable the reconfiguration of the keyboard with the remaining components of the Control Unit.

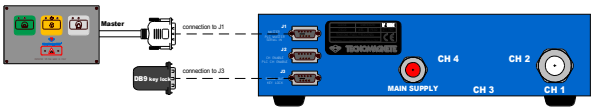
The **SET-UP** procedure is as follows:

a) TURN OFF the Controller



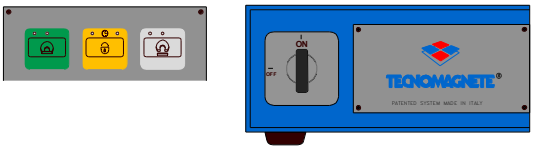
b) replace the remote control (included keyboard) with the new one, connecting it in exactly the same position on the Controller

EXAMPLE



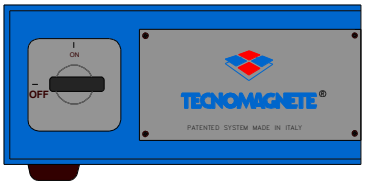
ST200 rear view/bottom side

c) Simultaneously press the **MAG, ENABLE** and **DEMAG** keys, then (while holding down the three keys) turn on the Controller

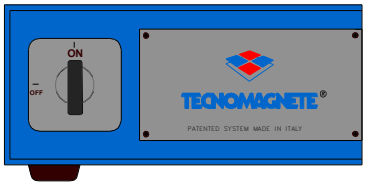


d) still pressing the keys as instructed in step **c),** wait a few seconds until all the cycle LEDs flash (except the **ALARM** led)

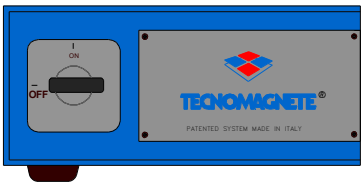
e) release the **MAG**, **ENABLE** and **DEMAG** keys, then turn off the Controller within 10 seconds



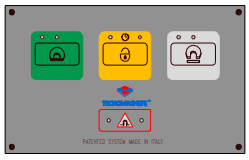
f) turn on the Controller and automatically all the LEDs will flash

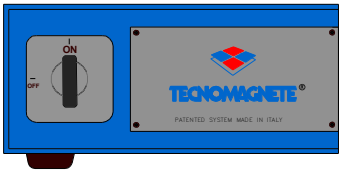


g) turn off the Controller (it is suggested to turn off within five seconds)



h) at this point, turn the Controller back on and the Control Unit will be operational.





CAUTION: IF, DURING STEP h), THE ALARM LEDS ARE ILLUMINATED, THIS MEANS THE KEYBOARD'S INTERNAL ELECTRONICS ARE NOT CONFIGURED CORRECTLY. CONTACT TECNOMAGNETE'S TECHNICAL ASSISTANCE SERVICE AND REPORT THE ANOMALY.

14 WARRANTY AND ASSISTANCE

14.1 Warranty conditions

The permanent-electro magnetic systems produced by TECNOMAGNETE are guaranteed for a period of 24 months from the date of invoice, unless otherwise agreed. The warranty covers all material and manufacturing defects, and provides for the replacement of parts or the repair of defective parts solely by and/or at the premises of TECNOMAGNETE.
Products must be sent for repair by the client CARRIAGE PAID.
Once repaired, products will be returned to the customer CARRIAGE FORWARD.
The warranty does not envisage either the intervention of the workers or employees of TECNOMAGNETE at the installation site, or the dismantling of TECNOMAGNETE products from the plant. Should TECNOMAGNETE send a member of staff for practical reasons, the labour will be invoiced at current rate plus any transfer and travel expenses.
Under no circumstances does the warranty give the right to indemnity for any direct or indirect damage caused to persons or property or for repairs made by the buyer or third parties. Repairs carried out under warranty do not alter its duration.
The following are excluded from the warranty:

- ✓ damage resulting from normal wear and tear from use
- ✓ faults caused by incorrect use or installation
- ✓ damage caused by the use of spare parts other than those recommended
- ✓ damage caused by fouling

14.2 Invalidity of warranty

The warranty does not apply in the following cases:

- ✓ non-payment or other breach of contract
- ✓ changes made without TECNOMAGNETE's consent
- ✓ when the serial number has been tampered with or deleted
- ✓ when the damage is caused by:
  - ✓ improper operation or misuse
  - ✓ mistreatment
  - ✓ impacts or other causes not attributable to the normal conditions of operation and/or use
- ✓ if dismantled, tampered with or repaired without the authorisation of TECNOMAGNETE S.p.A.
- ✓ if used in hazardous areas where adequate safety systems have not been installed with fixed and mobile protection with additional interconnected alert devices

For any dispute, the Court of Milan has jurisdiction.
For any problem or information, contact the Technical Assistance Service at the following address:

SERVIZIO ASSISTENZA TECNICA

TECNOMAGNETE®

TECNOMAGNETE S.p.A.
Via Nerviano, 31 - 20020 Lainate (Mi) - ITALY
Tel. +39-02.937.59.208 - Fax. +39-02.937.59.212
service@tecnomagnete.it

15 TECNOMAGNETE SERVICE NETWORK

HEADQUARTERS
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Fax +39 0293759212
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Company with certified quality system

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TECNOMAGNETE Shanghai Liaison Office
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info@tecnomagnete.com.cn

The information on authorized Service Centers can be found by visiting the website:

www.tecnomagnete.com

and accessing the menu **CONTACT/Sales networks and branches**

16 ATTACHMENTS

"Attachments" means certificates, technical drawings, spare parts, etc. These are, if necessary, added to this Use and maintenance manual for further information.

16.1 Declaration of conformity

The EC declaration of conformity can be consulted and downloaded in pdf format via the website:

www.tecnomagnete.com/engcecertificate.htm