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OPERATING MANUAL

ELECTROPERMANENT MAGNETIC TABLE OF TSSE SERIES

CE

Manufacturer:

ENES Magnesy Paweł i Tomasz Zientek Sp. k.

This operating manual refers to electro-permanent electronically controlled magnetic tables of type: **TSSE-3026, TSSE-3031, TSSE-3043, TSSE-3059**

Please read the manual carefully before using the tables.

The manual should be stored at the workstation.

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1. General information

1.1. Principle of operation

Electro-permanent electronically controlled magnetic tables (hereinafter referred to as TSSE) operate on the basis of Alnico magnets. Thanks to their unique properties they can be excited by low-voltage electric impulse. The device can be controlled directly via the included controller (with adjustable clamping force) or by the PLC or logic relay. Working surface the magnetic fields (dimensions 50x50mm) are arranged with the poles interchangeably (in the form of a chessboard), which provides an effective and strong workpiece holding with cross magnetic field lines. Magnets on the device are excited and demagnetized using direct current impulse generated in the controller. TSSE tables are supplied with alternating current with a voltage of 380V ± 10% and frequency of 45-65Hz.

To obtain the full holding force, clamped element should connect at least 4 poles (i.e. min. 110x110 mm).

TSSE tables require power supply only during the magnetization and demagnetization, and while machining the clamped element the power cord can be unplugged, which is beneficial for the safety and energy efficiency of the operation.

1.2. Application of TSSE tables.

Electro-permanent TSSE tables are characterized by a very high clamping force and are used for clamping ferromagnetic elements (i.e. low-carbon steel, low-alloy steel, cast iron, etc.) during milling, drilling, grinding, planing on CNC as well as conventional shaping machines and as an associated equipment for injection moulding machines with clamping forms. The working surface is rigid and is not subject to deformation, which makes the machining accuracy very high. They can be used both for clamping flat elements, and after the application of the corresponding pole pieces also the elements with round and irregular shapes.If all the operation and maintenance conditions are maintained the device will be operable for many years.

TSSE tables enable the machining of the five sides at one clamping, by using epoxy resins they are completely sealed and resistant to water and all kinds of coolants.

Maximum operating temperature of "TSSE" tables is 80ºC

Please read the manual carefully before using the magnetic table.

The manual should be stored at the workstation.

1.3. General safety regulations

There is always the risk of injury which may consequently lead to death. Respecting the following principles will help to avoid accidents:

- The handle should not be used without prior careful reading of the instructions
- The device should not be disconnected from the controlled during magnetization or demagnetization of the table (occurrence of an electric arc may cause personal injury or death).
- Do not use the handle if the controller or magnetic table is damaged.
- The device must be connected to a proper earthing (according to the scheme).
- After each disassembly and repair, the device should be inspected for proper power supply and earthing.
- Repair and possible device modifications may be carried out only by the manufacturer. Modifications carried out independently will void the warranty and cause a risk of electric shock and/or malfunction

2. Specifications and construction of a magnetic table

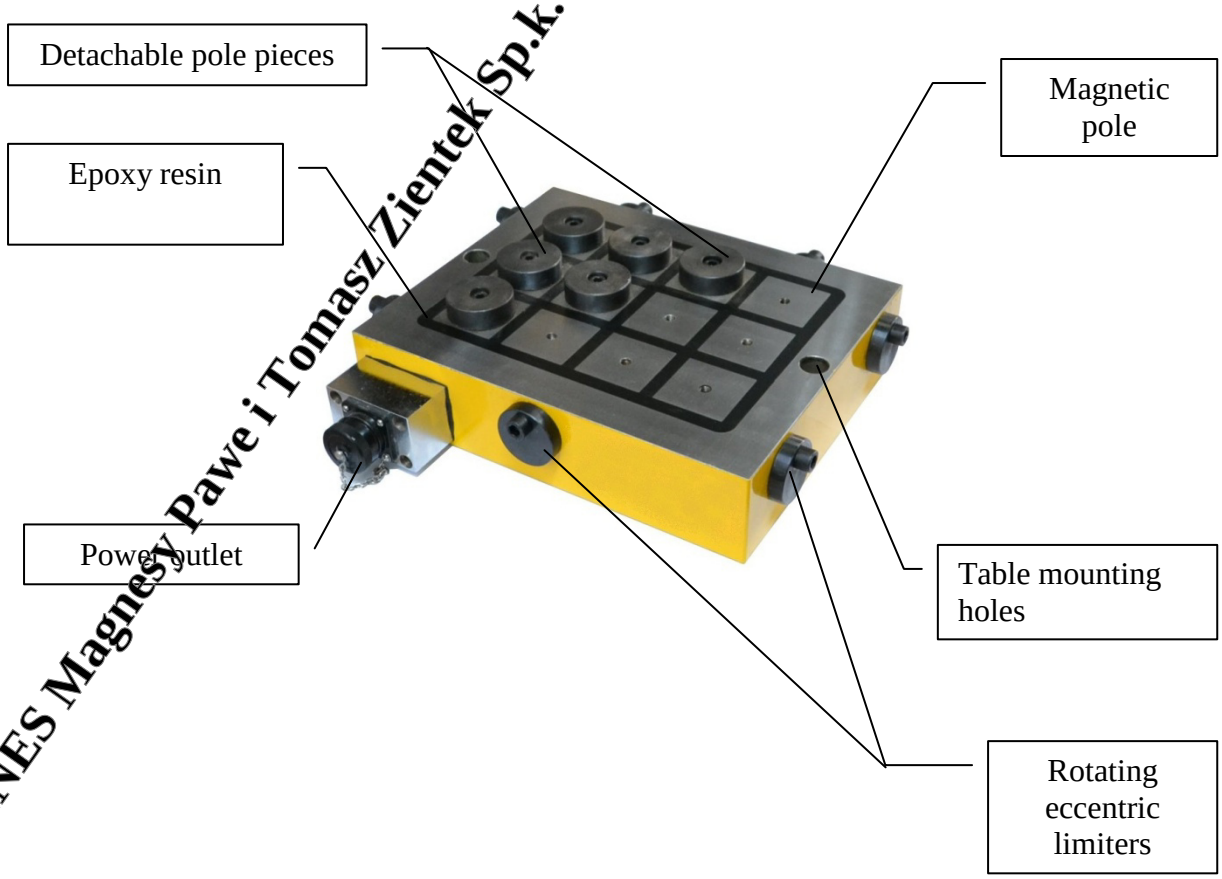
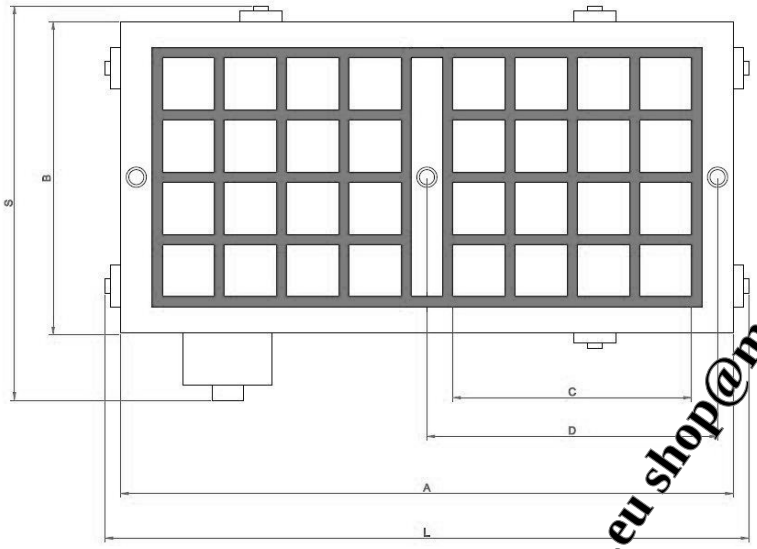


Table scheme:



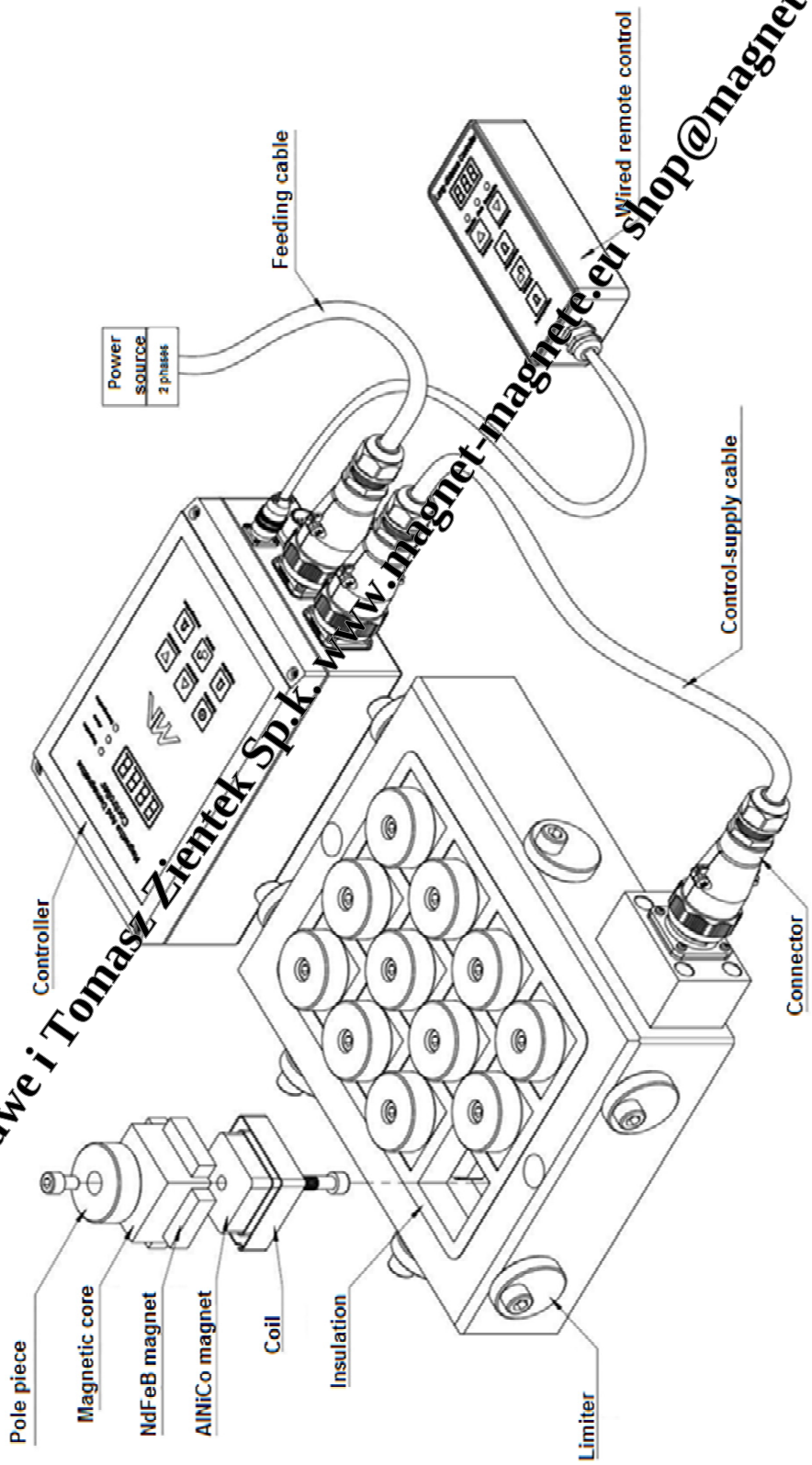
Type	Dimensions [mm]						Height [mm]	Number of magnetic fields	Maximum clamping force of the table [kg]
	A	B	C	D	L	S			
TSSE-3026	300	260	230	280	350	340	70	12	4200
TSSE-3031	310	300	230		350	400		16	5600
TSSE-3043	430	300	350		470	400		24	8400
TSSE-3059	590	300	510		630	400		32	11200

Magnetic checker electronically controlled table of TSSE series has magnetic fields being the pole pieces with the dimensions of 50 x 50 mm, isolated from each other with 10 mm layer of epoxy resin. The handle's body is entirely made of low-carbon steel. Maximum clamping force is 350 kgf / 1 magnetic field and is obtained for the elements with a minimum thickness of 20 mm. The body with the thickness of 70 mm ensures clamping rigidity thus providing accurate machining of the workpiece.

The equipment of the table includes additional cylindrical pole pieces allowing clamping the elements of irregular shapes, whereas adjustable limiters are placed on the sides of the body for better clamping. The construction of the limiters allows smooth height adjustment of the limiter up to a workpiece thickness in the range of 0 to 20 mm above the surface of the table. Taking into account machining of unusual workpieces, it is possible to perform additional pole pieces according to the drawing. The table is made in IP 43 protection class. Table allows switching on and off the magnetic field by means of electric current impulse. Magnetization and demagnetization is very fast (within 1-2 seconds).

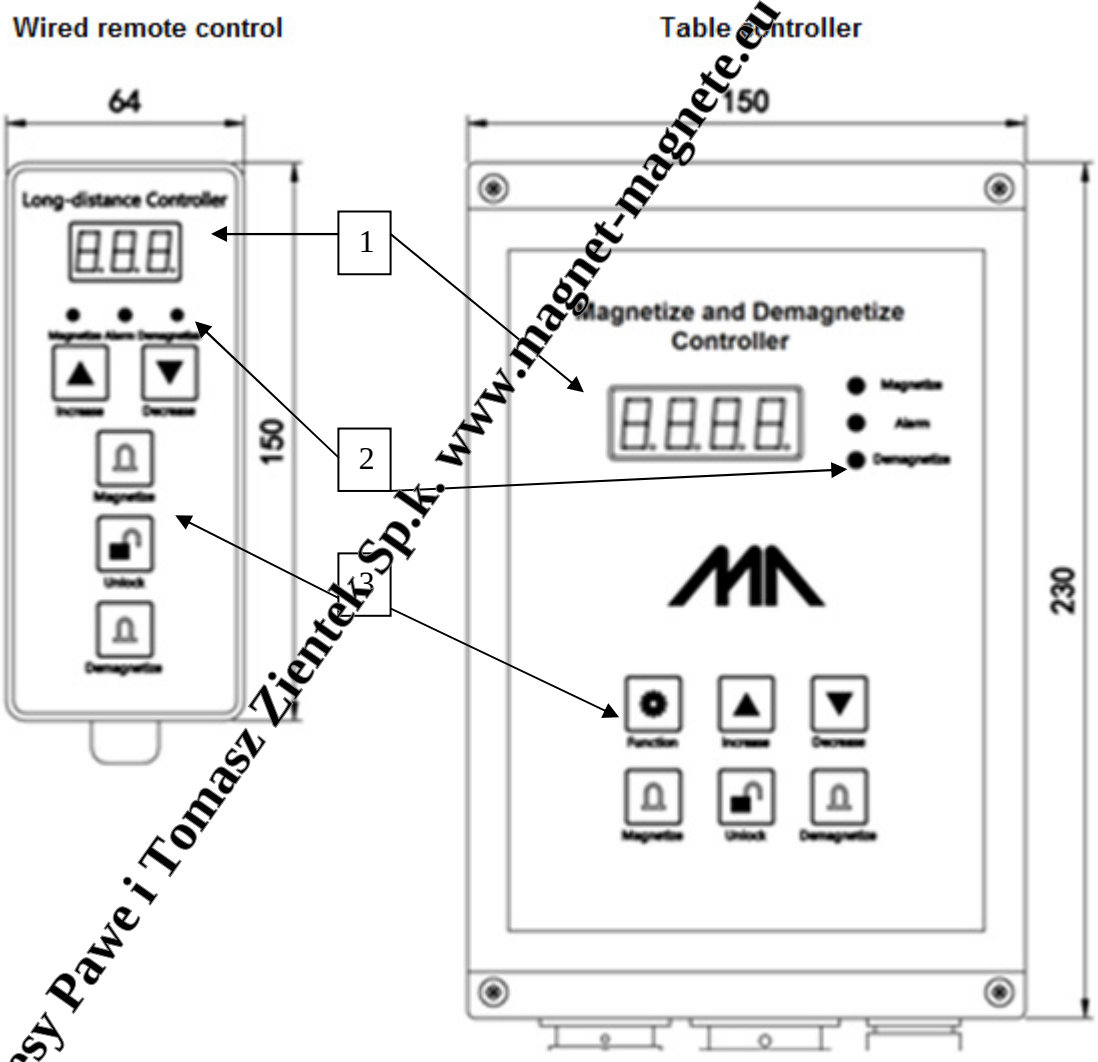
Electro-permanent magnetic table is the electrically controlled device with a short operating time due to high current values. Therefore, a time interval, of not less than 10 seconds, is recommended between the magnetization and demagnetization operation

Construction of the table and scheme of components connections



3. Construction and operation of the controller

Standard equipment includes the controller to control 1 magnetic table. It is possible to make the controller to control two or more tables. The controller is suitable for dry run (IP 20 protection class). One must make sure that the controller is always dry and has been installed in the areas not exposed to water. The control panel allows to set the degree of clamping force within the range of 1-8. In addition, each controller has a remote control with a wire 3 meters long to control the table in a comfortable position. A table controller is a specially designed driver that can not be replaced by a direct power supply.



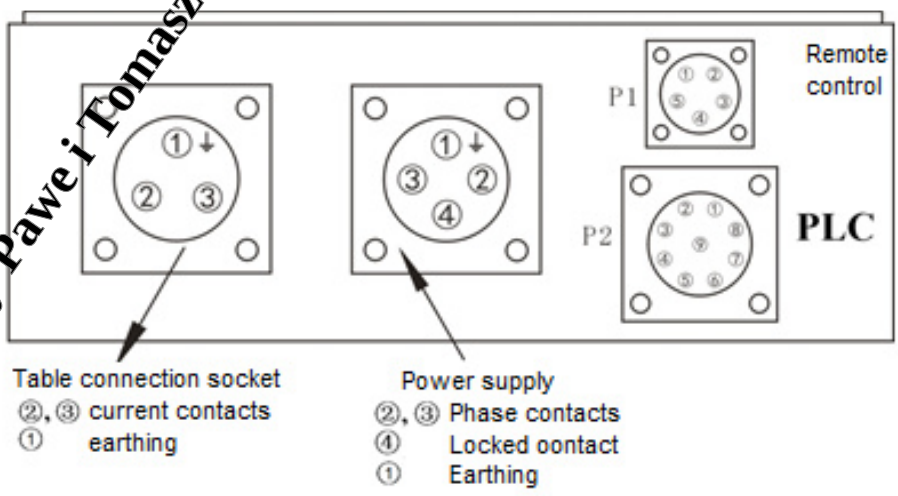
1. Display
2. Control lights:

- Magnetize (green) – indicating that the table is magnetized;
- Alarm (red) – activates simultaneously during the magnetization and demagnetization or indicating an error;
- Demagnetize (yellow) – indicating that the table is demagnetized;

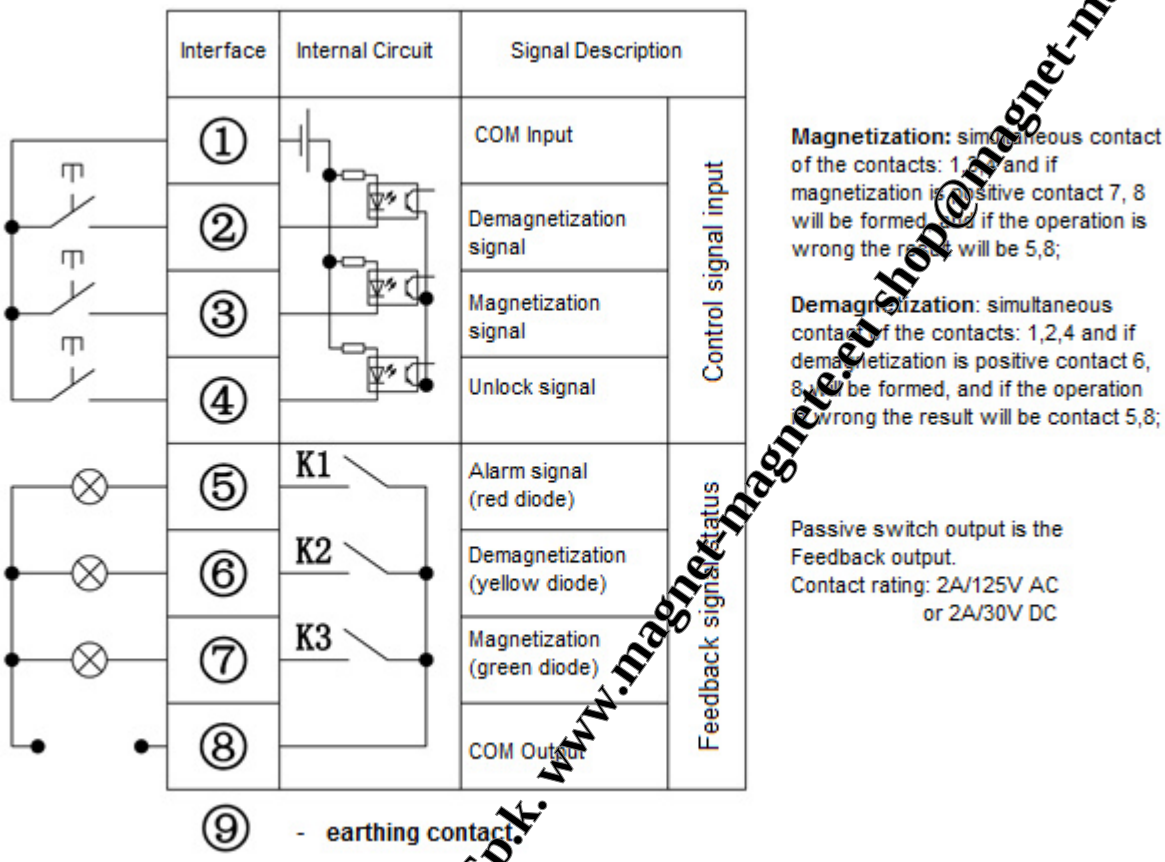
3. Control buttons:

- Function – launching the menu of controller functions;
- Increase – increasing the clamping force or after launching the function menu, button for selecting functions
- Decrease – decreasing the clamping force or after launching the function menu, button for selecting functions
- Magnetize – magnetization button;
- Unlock – unlocking button ;
- Demagnetize – demagnetization button.

3.1 The scheme and descriptions of the controller sockets



- **Remote control P1 socket–** the socket for connecting the remote control. Descriptions of the contacts: 1. VCC, 2. 485+, 3. 485-, 4. GND, 5. PE.
- **PLC P2 socket –** socket for connecting the PLC. Below the control scheme with the description of PLC contacts



3.2. Preparing the workstation.

Set the table on a level smooth surface and fasten with the screws so that the table was stationary.

Place the controller in a suitable dry place in the operating position and tighten the screws. If needed, the controller might be installed in the control cabinets and controlled through the PLC socket or the remote control. Wiring of the device and the controller have been tested at the factory, so before use its is just enough to tighten the connectors of the table and the controller. Connections must be performed carefully because of the possibility of damaging (breaking) the contacts, the plugs may not be pushed in using force. To connect the connector, first put the connector against the socket and turn gently until the connector locks itself at the correct position.

If the connection requires new wires connecting the controller with the magnetic table, soft copper wires should be used with a cross-section of 2.5 mm2 associating appropriate contacts. (see scheme of the controller and magnetic table connections). 2-phase fuse 63A must be installed between the power source and the controller. After connecting all the wires the input power (two-phase AC 380 V ± 10% 45-65Hz) must be connected.

Warning:

Before using the table, carefully check if the power supply was connected correctly.

Note: after magnetization of the table, power cord may be disconnected until the demagnetization. However, then the table socket must be protected with a plug so that the water does not get inside.

4. Table control

After the power is turned on, the display will show nothing and no indicator lights will be lit. To set the level of magnetization (clamping force) one must use the arrows, setting the level from 1 to 8 on the display. The displayed number from 0 to 8 is the magnetization or demagnetization control value. 1 is the minimum magnetization level, and 8 is the maximum value of magnetization. The controller can be used only for the operation of magnetization or demagnetization in working mode 6 in the mode of changing the control channel. Having turned on the power supply, the controller will be immediately in standby mode.

Having connected the plug to the PLC socket the table can be controlled by the PLCs and does not require the control channel change after connecting as well as disconnecting the PLC plug. In order to facilitate the assembly of the plug all the contacts are indicated with the numbers corresponding to the numbers on the scheme (p. 10).

4.1. Working mode

To check working mode, press 🔓 and hold for 1 sec.: in standby mode, the 4 - digit display will show the operating status of the channels 1 to 4 from the right to left side of the display. Below there is a description of the channel status:

- No backlight: indicates that the corresponding channel is off and is not operable.
- Continuous backlight: indicates normal working mode on this channel.
- Fast flashing (< 0.6 s): indicates that the magnetization and demagnetization of the table is not possible due to excessive current, short-circuit caused by the damage to the wire insulation or partial short-circuit in the winding inside the magnetic table.
- Slow flashing (> 0.8 s): indicates that the magnetization and demagnetization of the table is not possible due to too low current flowing through the circuit (check that cable connection was properly made or whether an electrical circuit is not partially open.

Example:

if the display shows the message: 0001 or 0002 (two vertical lines on top of the numbers) with a steady light it indicates that the demagnetization in channels 2 or 1 is working properly and that other channels do not operate. Pressing ⚙ or 🔓 will return to standby mode.

To view the size of the current impulse in the magnetization or demagnetization channels press ⚙ and hold for 3 sec. in standby mode. A message will be displayed which may be 2=48 read as follows: magnetic table working on channel 2, magnetizing current 48A. If other channels are active they may be displayed by pressing ▲ or ▼. Pressing ⚙ or 🔓 will return to standby mode.

4.2 Magnetization and demagnetization.

Proper operation and maintenance of the table with the panel controller is possible if:
- the controller is in standby or operating mode and displays the status of the action.
- the controller after starting the magnetization and blocking the input signal is cut off.

The order of the operations is as follows:

magnetization: in standby mode - press ▲ or ▼ to set the desired level of the magnetizing force, and then press Ω and hold for over 1 s. If the operation is successful the green control light will light up indicating the magnetization of the

table. If the operation fails, the Alarm red control light will light up and the green one will be flashing.

- demagnetization: in standby mode- simultaneously press and hold and for over 1 s. If the operation is successful the yellow control light will light up indicating the demagnetization of the table. If the operation fails, the Alarm red control light will light up and the yellow one will be flashing.

Note: During the magnetization and demagnetization the following symbol flashes on the display: 8888 at this point be careful and do not touch the table or clamped element with any magnetic or metal object.

4.3 Controller settings

- Switching the channels.

  In standby mode simultaneously press and for 3 sec. the following message will appear on the display: PASS then press - the display will show: 0001 and set the desired channel number with the buttons▲ or▼ and confirm with . The following message will appear on the display: on indicating the channel number: „1" and the status of the channel „on" – turned on or if the display shows oF - „of" – the channel is turned off. Use the buttons ▲ and ▼ to change the channel numbers and the status to "on" or "of". In order to confirm the operation press

  Channel no. 1 – control via the main controller

  Channel no. 2 – free channel

  Channel no. 3 – control via the wired remote control

- Wired remote control settings

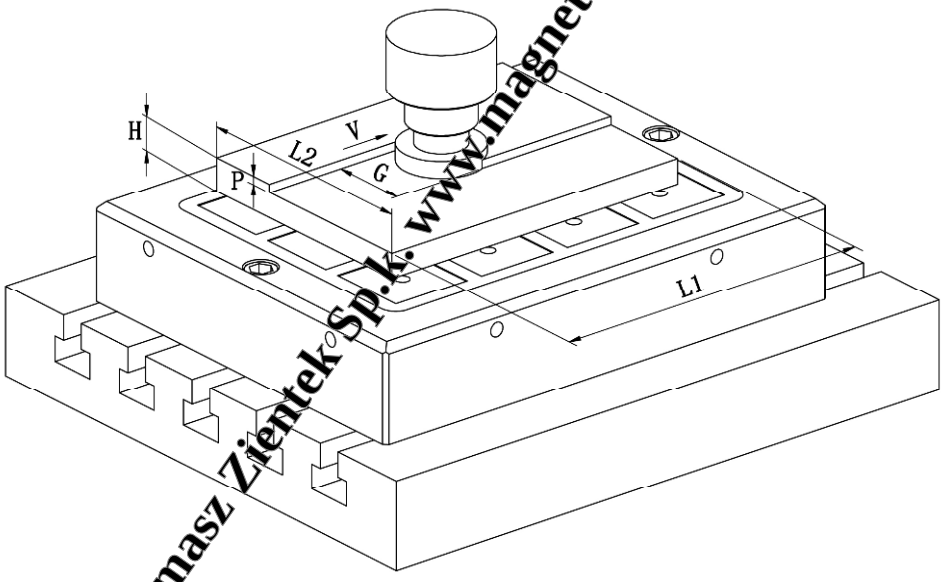
  In standby mode simultaneously press and for 3 sec. until the following message appears on the display: PASS, then confirm with , and set with the buttons▲ and ▼ the value 0003 and then press and with the buttons ▲ or ▼ the code LonS or LocA may be set on the display. If the code LocA appears on the display it indicates that the control is performed via the remote control, whereas command LonS blocks the main controller. For the controller to remember and enter new settling one must press and hold for about 3 s., return to standby mode by pressing . The default controller settings are restored when the power supply is disconnected or by switching the controller to operate on channel no. 1.

For the safety reasons and exclusion of the accidental magnetization and demagnetization run control via the remote control is performed as follows:

Magnetization using the remote control is performed by setting the magnetizing force with the arrows and at the same time pressing the buttons: Magnetize and Unlock and holding for about 2 seconds.

Magnetization is performed by simultaneous pressing and holding the buttons Demagnetize and Unlock for about 2 sec. The default settings are restored when the power supply of the controller is off. Due to safeguards of the device and safety of the users, during the magnetization and demagnetization it is possible to carry out only the whole duty cycle of the table, meaning that after the magnetization only the demagnetization may be performed. Each operation lasts about 1 sec.

5. Calculation of machining parameters



Thickness of the scraped layer:

$$P=(A \times \Delta)/(G \times V)$$

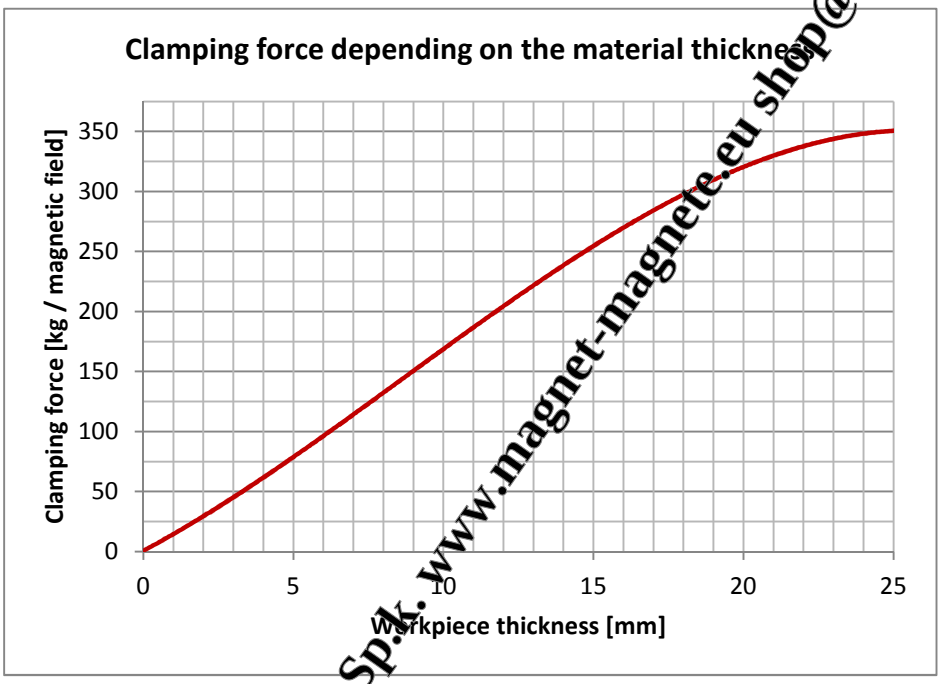
Machining capacity:

$$Qmax = A \times \Delta \ [mm^3/min]$$

G – width of the scraped layer [mm]
V – feedrate [mm/min]
Δ – coefficient of the workpiece surface [mm/min]
A = L1 x L2 – workpiece surface [mm2]

Coefficient selection table Δ [mm/min]

Surface type	Material	Flatness ≤ 0,1 mm	Flatness ≤ 1,0 mm
Clamping the workpiece on the machined surface	Low-carbon steel	12.6	7.0
	Alloy steel	9.6	5.0
	Cast iron	6.0	3.0
Clamping the workpiece on the raw surface	Low-carbon steel	4.2	2.3
	Alloy steel	2.8	1.7
	Cast iron	2.0	1.0



The following table shows the minimum thickness of the workpiece, depending on the type of material:

Material	Minimum thickness H[mm]
Low-carbon steel	8
Alloy steel	10
Cast iron	15

The data presented in the above tables is approximate and is defined together with the following conditions:

$$L1 / L2 \leq 2 \qquad H / L2 \leq 1$$

- The workpiece must be properly clamped on the table. If the thickness of the machined workpiece is smaller than the minimum thickness the data in the table must be reduced proportionally.
- In order to protect the table while drilling one must lift up the workpiece using suitable pole pieces.
- To increase the machining accuracy it is recommended to use the "floating" pole pieces in order to reduce the workpiece deformation and reduce the machining speed.
- While machining small items, the workpiece must be locked using eccentric limiters mounted on the body of the table.
- Damaged or worn surface of the table can be regenerated by grinding. Up to 5 mm the table thickness may be ground.

6. Safety precautions and unacceptable use

Operation of the magnetic table and the controller must be conducted strictly according to the operating manual:

- Each controller is only suitable for one type of the table, and therefore it is forbidden to connect the controller to the tables other than those specified in the manual.
- To obtain the full clamping force the object must be clamped on minimum 4 poles.
- If the base of the workpiece is irregular the clamping force can be increased by tightening additional pole pieces in the right places.
- Installation of the device and modification of the table and controller cable connections in the workplace may be carried out only by an authorized person (e.g. an electrician).
- Magnetic circuit is closed by the workpiece so the workpiece must be placed on the table before starting the magnetization.
- do not use the table for purposes other than those described in the manual.
- When magnetizing keep all the magnetic elements (e.g. keys or other tools) away from the table so that they are not pulled to the surface.
- If the machining force is too large circular limiters on either side of the table must be used.
- The table is designed to operate only in a horizontal position,
- To increase the machining accuracy is recommended to use the "floating" pole pieces in order to reduce the workpiece deformation.
- the device can only be operated by authorized persons trained in the operation of the device

- The time between the magnetization and demagnetization of the table should not be less than 10 seconds.
- during operation avoid strikes, breakages, and the destruction of the surface of the pole pieces,
- the magnetic table can be used at the temperatures below 80°C and do not clamp the elements heated above this temperature,
- do not start the magnetization is the workpiece is not placed on the table.
- do not allow people with cardiac pacemakers, pulse generators and other medical apparatuses to work with the device without consulting the doctor.
- after each disassembly and repair, the device should be inspected for proper power supply and earthing.
- repair and possible device modifications may be carried out only at the manufacturer's service. Modifications carried out independently will void the warranty and cause a risk of electric shock and/or malfunction.
- Do not use the device if the controller, magnetic table or other piece of equipment is damaged or without insulation.

7. Maintenance and service

Having completed the work, disconnect the table power supply, clean the working surface of chips, grease and other contaminants and moisture (use WD-40 liquids to facilitate cleaning). Such maintenance will allow long-term trouble-free operation of the table.
If the table is mounted on another device, the table substrate should always be clean and the surface smooth so that the table is immobilized. This will help to avoid problems and improve the machining accuracy.

Damaged or worn table surface can be regenerated by grinding. Up to 5 mm of the table thickness may be ground.
Our liability under this warranty is limited to repair or possible replacement of any faulty component. Due to the type and way of using the working surface the warranty does not cover restoration, meaning the working surface grinding). This warranty does not apply to product defects or damages, which arose as a result of improper or inadequate maintenance, repairs or unauthorized modifications made outside **ENES Magnesy Paweł i Tomasz Zientek Sp. k.**

After unpacking the product, check for completeness. The package should include:

1. Magnetic table.
2. A set of pole pieces and clamping screws.
3. Table controller together with the table connection cable.
4. Connector for PLC terminal.
4. Power cable.
5. Portable control panel with 3 m cable

7.1. Inspections and audits

During operation and upon its completion, pay attention to electrical wires connecting different parts of the table, whether they are not damaged and whether the wire insulation is intact. During operation place the wires in such a way so they are not squeezed or pinched by other objects. In case of cable or insulation stop the operation and rectify the fault (only a person with appropriate licences may do that). Under no circumstances run the table if any cable is damaged. This may cause electric shock or even death. The table has a number of electronic safeguards that prevent running the table in the event of detecting malfunctions in the electrical system or the inability to close the magnetic circuit by the clamped workpiece.

In case of any questions please contact ENES Magnesy: tel. +48 22 7331465, e-mail: shop@magnet-magnete.eu