For your safety, please read this manual thoroughly. After you finish studying this manual, please keep this manual in places accessible at anytime. So when you encounter problems during uses, this manual can be very handy for you.

Unauthorized copy for information (both text and graphic) contained in this manual is strictly prohibited, please consult with Earth-Chain should you have such needs.
Preface

Earth-Chain Enterprise Co., Ltd, established in 1988, is a professional manufacturer for industrial magnetic tools that are specifically utilized for metal working as well as mold and die making. Marketed under the brand name, our products include the Electro-Permanent Magnetic Chuck (EEPM series), Permanent Magnetic Clamping Block (ECB series), Permanent Lifting Magnets (ELM series), End Mill Re-Sharpener (EMG series), Grill Grinder (EDG series), SG High Speed Drill Grinder (EDSG series), Universal Arm Indicator Stand Series (ECE series), Magnetic Chucks, Magnetic V-Blocks, and Magnetic Base..., etc. Our goals are to continuously and innovatively research and develop new products, improve work efficiency, and enhance product quality. As such, we were constantly approved with domestic and international more than 30 patents and awarded with distinguished awards such as Good Product Design Award and Taiwan Excellent Product Award.

Innovation, honesty, and responsibility are our business philosophies that we are truthfully fulfilling. By innovatively devoting our efforts in product developments, honestly responding to our customers, and responsibly engaging in sustainable operations and managements, we always strive to improve our working processes, enhance our quality control and improvement ability, and develop products that constantly exceed customers’ expectations. Not only do we aim to achieve the objective – making the the leading brand in the field of magnetic vise clamping systems, but we also set a high expectation for ourselves to create glories in the machining and metalworking industry.

We sincerely appreciate your business. If you encounter any problems during use, please do not hesitate to let us know. We will serve you whenever we can and please come to us for all your magnetic tooling needs!

Thank you very much

Earth-Chain Enterprise Co., Ltd
Award

2008 Award Good Design Product qualification for ECB & ELM Series.

2010 Award Good Design Product qualification for EEPM-CIR & EEPM-CIT & ECE-AD Series.

2008 Award the 16th Taiwan Excellence qualification for ECB Series.

2010 Award the 18th Taiwan Excellence qualification for EEPM-CIR & EEPM-CIT & ECE-AD Series.

2012 Award the 19th Taiwan SMEs Innovation for EEPM-C Series.

2013 Award the 21th Taiwan Excellence qualification for EEPM-C Series.

Electro-Permanent Magnetic Chuck-Connection Type
NEW

EEPM-C SERIES

Electro-Permanent Magnetic Chuck

EEPM-CIT SERIES

Electro-Permanent Magnetic Chuck

EEPM-CIR SERIES

Permanent Magnetic Clamping Block

ECB SERIES

Universal Arm Indicator Stand

ECE-AD SERIES

Permaent Lifting Magnets

ELM SERIES
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1. Safety Instruction

1-1 Before Use

※ Without authorization from Earth-Chain, please do not change or modify internal or external structures of the equipment. Earth-Chain will not be responsible for damages cause by unauthorized adaption, modification, or maintenance.
※ There are 3 standard types of controllers (EEPM-C1, C2, C4) and customized types of controllers (EEPM-C8, C12, C16, C32…etc.) for big or multiple EEPM chucks. Please confirm if the specification meets with the magnetic chuck. If incorrect, please inform your dealer or the sales specialist from our company and we will deal with it immediately.

1-2 Installation notice

※ For safety considerations, please have a licensed electrical technician to install electrical wirings.
※ Make sure that the copper is implanted underground when installing the ground wire. Only then shall it be able to induce the electricity and ensure the safety of the machine and the operator.
※ Please place the machine on a firm platform, to avoid drops and causing damage.
※ Avoid placing the machine at a humid site to avoid the possible hazards of electric shocks.
※ Do not place any heavy objects on the machine to prevent damage.
※ Make sure to use the wires which came with the machine, and do not place any heavy objects on top. This can avoid electric leakage due to damaged or break-apart wires.

1-3 Notice when using

※ If any abnormal sounds or odors occur during the machine’s operation, immediately shut down the power switch of the machine and the master power switch.
※ When the quick connector of the controller is to connect with the magnetic chuck connector, please make sure there is no moisture or objects inside the connector, to avoid the burning the wires (P4).
※ When the quick connector is to disconnect as the magnetization process is completed, make sure to cover the connector lid of magnetic chuck to avoid any objects or water entering.
※ If it is necessary to open the machine’s outer case, please make sure that the master power switch (power supply switch) is turned off.
※ Do not let any liquid permeate into the controller body to prevent electric leakage or breakdown. Also, please maintain the outer side of the controller dry and clean.
※ In order to prevent any magnetic interference with the precision product, do not allow watches, cell phones etc. approach near this product.

1-4 Statement

1. Earth-Chain has the right to change the specifications of the hardware and software written in the manual without any notice.
2. Earth-Chain has truly made sure the accuracy and completeness of the information with our best knowledge. If any errors or missing information is found, please inform to your dealer or any professional person from Earth-Chain. We sincerely thank you.
3. Thank you for purchasing EEPM! We look forward for your continuous support and to serve you in the future.
2. Controller

2-1 Front View

1. Specification
2. Mag. Signal (Green): Light is ON, the controller is magnetized. (Green Light)
3. De-Mag. Signal (Red): Light is ON, the controller is De-magnetized. (Red Light)
4. Power

2-2 Side View

5. Remote Control Connecting Port
6. HMI Connecting Port
7. HMI Device

2-3 Rear View

8. Chuck Cable
9. Power Cord
10. Conjunction Box Connecting Cable (Spare)
11. CNC Control Output Cable

2-4 Controller Function

1. Specification: Please confirm if the product specification matches the specification on the label and your order form after unpack.
2. Mag. Signal (Green): Light is ON, the controller is magnetized. (Green Light)
3. De-Mag. Signal (Red): Light is ON, the controller is De-magnetized. (Red Light)
4. Power Switch: Switch "ON" to start controller power; switch "OFF" to shut down controller power.
5. Remote Control Connecting Port: For connect the remote controller.
6. HMI Connecting Port: For connect the HMI device.
7. HMI Device: For connect the controller to control MAG., DE-MAG. and adjust magnetic force level.
8. Chuck Cable: Connect to magnetic chuck
9. Power Cord: Connect to a power source.
10. Conjunction Box Connecting Cable (Spare): Connect to a conjunction box when connect to additional magnetic chucks.
11. CNC Control Signal Output Cable: Connect to CNC machine center. CNC machine center will operate only after it receives a magnetizing signal from the controller.

* As magnetizing and demagnetizing operate only take a few seconds, Please confirm the workpiece is sucked onto the chuck completely before operation to ensure safety.

2-5 Label

Warning Sign: Please do not open the controller case. Watch out for electronic shock during uses.
Serial Number: This number allows the manufacturer to track the controller.
Power Voltage: Allow power voltage AC 220V ~ 480V from Single-Phase.
3. Magnetic Chuck

3-1 Front View

1. Product Label
   - Model NO.
   - Voltage
   - Specification
   - Serial Number

2. Magnetic Chuck Handler

3. Quick Connector
   - Connector Instructions: Insert the connector into the magnetic chuck

4. Positioning Block

5. Clamping Slot
   - Screw clamping kit into the slot to fix the magnetic chuck

6. Epoxy Resin
    - Magnetic insulation

7. Induction Block fastening hole

8. Fixation hole
   - Place the screw into the hole to fix the magnetic chuck onto the machine table

3-2 Top View

3-3 Function Description

1. Product Label: Labels the Model NO., serial no., specification, operating, voltage, amperes, and controller model. (Please compared with the model Number on the controller).

2. Magnetic chuck handler: If the magnetic chuck needs to be transported, the handlers can be craned for magnetic chuck transport.

3. Quick Connectors: Once the quick connector of the controller is clicked with the magnetic chuck connector, completely rotate to the right to start magnetization or demagnetization. (Refer to page 4: 4 Installation 4-4)

4. Positioning block: Capable to avoid moving processed objects when heavy cutting is required. It can be also used for quick positioning purpose.

5. Clamping Slot: By screwing the clamping kit into the slot, the magnetic chuck is fixed.
   - (One chuck has 4 x clamping blocks as standard accessory, please prepare M16 or 5/8" screws)


7. Induction Block fastening hole: Used to fasten the induction block.

8. Fixation hole: Place the screw into the hole and lock into machine table to fix the magnetic chuck onto machine table. (Please prepare M16 or 5/8" screws).
4. Installation

4-1 Installation notice

1. Please carefully read the following operating methods, and truly follow the installation steps when installing the product.
2. A professional electric technician is required to install the master power supply. In addition, shut off the power first to ensure safety.
3. If any problems are encountered during installing, do not attempt to disassemble by yourself, to avoid causing any damage to the product.
   * Our service phone number can be found at the end of this manual. Please contact your dealer or a professional person from our company. We shall provide our best service for you.

4-2 Power installation

Single phase power supply

1. Blue wire -> phase
2. Brown wire -> shared wire
3. -> ground wire

For safety, electrical equipment should be grounded to earth.

A. With Earth Leakage Circuit Breaker
   - Grounding into dry ground surface: grounding resistance under 50 ohm.
   - Grounding into wet ground surface: grounding resistance under 20 ohm.

B. Without Earth Leakage Circuit Breaker
   - Grounding individual: grounding resistance under 5 ohm.

4-3 Magnetic chuck fixation

Take out the clamping kit. Place the clamping kit within the groove slot of the magnetic chuck. Tightly screw the screws to fix the magnetic chuck.

Besides the previous left instructions, the magnetic chuck fixation hole can be used to fix the magnetic chuck. Insert the T shape block into the T shape groove slot, and secure with the hexagon screw.

Screw/Clamp the magnetic chuck (screwed with induction blocks) onto the machining table. Whether the magnetic chuck and machining table is 100% parallel, do fine grinding the induction blocks again.

4-4 Quick connector connection

Before the connection, use an air gun first to clean the insides of the connector. Check if there is any water, oil, or objects to avoid burning of the inner wires when electricity is passed through.

Connect the controller with the front end of the groove connector (as shown in the red circle of the above figure), and then insert into the quick connector.

After the connector of the magnetic chuck is connected with the quick connector, rotate right and make sure that the connector is locked inside the groove. When the click sound is heard, the connection is completed, which also prevents water to enter the insides of the magnetic chuck.

4-5 Activation switch

After opening the master power switch, turn the power switch to ON to activate the power.

The red light shows up to indicate the power is activated. The magnetization/demagnetization process can be conducted.

Once the magnetization is complete, and if the quick connector is to be pulled off, rotate the waterproof cover right until you hear a click sound, and further rotate to the end. This can ensure the lifetime usage of the magnetic chuck and the safety of the operator.
5. Operation

5-1 Operating notice

1. Make sure that any liquids or objects inside the quick connector are cleaned and connecting is correct before magnetization and demagnetization.

2. After a workpiece is placed on the magnetic chuck, the magnetism magnitude can be adjusted to 1 to perform correction. Demagnetization is not required after the correction. Directly increase the magnitude to the required stage and press the magnetize button to complete magnetization increase operation. (Refer to page 6 : Magnetism Adjustment)

5-2 Magnetization

Simultaneously press the magnetize button (green) and the safety button (blue). The safety light (yellow) will appear after 1~2 seconds (as shown in the right figure), and magnetization shall begin to start.

The appearance of the yellow light of the safety button (blue) indicates magnetization is under process.

The green light (green) shows up, indicating magnetization is completed.

* When operating the controller, if the lights keep on lightening but without function for the controller, it’s abnormal situation. In this situation, switch off the controller and then switch it on again to get normal situation.

5-2 Demagnetization

Simultaneously press the demagnetize button (red) and the safety button (blue). The safety light (yellow) will appear after 1~2 seconds (as shown in the right figure), and demagnetization shall begin to start.

The appearance of the yellow light of the safety button (blue) indicates demagnetization is under process.

The red light (red) shows up, indicating demagnetization is completed.

* When chuck is demagnetized but the workpiece is hardly to be took away, adjust the magnetism to level 1 and magnetize the chuck again, and then demagnetize the chuck to take away the workpiece easily.

5-4 Magnetization and demagnetization time duration specification

<table>
<thead>
<tr>
<th>Controller</th>
<th>Item no.</th>
<th>Magnetization time</th>
<th>Demagnetization time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EEPM-C1</td>
<td>EEPM-C2</td>
<td>EEPM-C4</td>
</tr>
<tr>
<td>AC220V</td>
<td>Magnetization</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Demagnetization</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>AC380V ± AC440V</td>
<td>Magnetization</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Demagnetization</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

The time listed on the left was tested when the current provided was sufficient. When the amperes of the current are insufficient, the magnetization/demagnetization time for each specification will increase and the magnetization/demagnetization procedure might not be completed. May operators please make notice of the situation above.

* During the magnetization process, if sparks or white smoke appears from the quick connector of the magnetic chuck, this represents that the operator did not follow the instruction of clearing any liquid or objects inside the connector. If the situation occurs, immediately shut off the master power supply and inform your dealer or our company.
6. Magnetism Adjustment

6-1 Function description

Different from the electro-permanent magnetic chucks of other manufacturers, our product is designed to meet with the client requirements in sizes and applications, or to deal with the issues of special materials. The magnetism is designed with an adjustable function. This design has divided the magnetism into 8 levels. The client can adjust the magnetism based on the requirements:

6-2 Relative magnetic force strength percentage table

<table>
<thead>
<tr>
<th>Level No.</th>
<th>8</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>100</td>
<td>88</td>
<td>76</td>
<td>64</td>
<td>52</td>
<td>40</td>
<td>28</td>
<td>16</td>
</tr>
</tbody>
</table>

1. The magnetic force of our product can reach up to 1250 KGF/100cm² ± 5%.
2. Level 8 represents maximum magnetic force. Lower numbers refer to lower magnetic forces.

6-3 Magnetism adjustment operation

6-3-1 Decreasing the magnetic force

According to requirements of the workpiece size or the material, press the decrease button (red button with “−”) to reduce the magnetism to a lower level. The magnetism is adjusted to level (3) as shown in the above figure.

Press the magnetization button (green) and the safety button (blue) simultaneously. The safety light shall light up (yellow light) as shown in the above figure. The magnetization process shall start.

When the light (green) of the magnetization button appears, the magnetization process at the certain level (3) is completed.

6-3-2 Increasing the magnetic force

According to requirements of the workpiece size or the material, press the increase button (green button with “+”) to increase the magnetism to a higher level. The magnetism is adjusted to a level (6) as shown in the above figure.

Press the magnetization button (green) and the safety button (blue) simultaneously. The safety light shall light up (yellow light) as shown in the above figure. The magnetization process shall start.

When the light (green) of the magnetization button appears, the magnetization process at the certain level (6) is completed.

6-4 Magnetism adjustment notice

1. For all workpieces, please examine the first piece before processing the first machining. Please aware that the external factors of the workpiece size, material, cutters wearing, machine performance, machining method etc., all the above data shall affect the magnetic force of the EEPM chucks.
2. When the workpiece is high-carbon steel, if processing time is longer, the workpiece may not be able to be released easily due to the high carbon content. In order to avoid this issue, we suggest besides reducing the magnetism level for decreasing the magnetism, induction blocks may also be used to accelerate the unloading time (page 20).
3. When processing with small size or thin objects. If there’s qualm about object move due to the decreasing of the magnetism level, induction blocks may be used with the clamping. (page 16-20)

* If the magnetism needs to be decreased when the controller is already performing magnetization, please FIRST perform the demagnetization step!
7. Abnormal Signal

7-1 Number display flashes “0” (Detect Time: 5 sec.)

※ When the number flashes “0”, this indicates the input voltage is lower than the Controller’s lower limit.

<table>
<thead>
<tr>
<th>Voltage limit</th>
<th>Upper voltage limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>220V~480V</td>
<td>186V</td>
</tr>
<tr>
<td></td>
<td>500V</td>
</tr>
</tbody>
</table>

For above situation, please check the operation voltage is correct or not.

7-2 Number display flashes “8”
When operating the Controller to magnetize a chuck, if the red and yellow lights stay lit and the green light and number “8” flash, this indicates an SCR failure.

7-3 Yellow light flashes for 15 seconds and red light remains on
During the magnetization process, if the red light remains on and the yellow light flashes for 15 seconds, this indicates the chuck cable is disconnected from the chuck.

7-4 Yellow light flashes for 15 seconds and then green light remains on flashes
During the magnetization process, if the yellow light flashes for 15 seconds and then green light remains on flashes, this indicates one block has malfunctioned and cannot be magnetized or demagnetized.
8. HMI - Controlling Pages
(EEPM-C1/C2 is option, EEPM-C4 is standard)

8-1 Controlling Pages:

   8 magnetic force levels for different machining demand
   Reference index

<table>
<thead>
<tr>
<th>Number of segments</th>
<th>8</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>100</td>
<td>88</td>
<td>76</td>
<td>64</td>
<td>52</td>
<td>40</td>
<td>28</td>
<td>16</td>
</tr>
</tbody>
</table>

   (1) Max. level 8 is about 1250 kgf/100 cm² +/- 5% (4 poles)
   (2) Max. level is 8, low level number will get less magnetic force.


4. MAG. Button: Push button to conduct chuck magnetization.
5. MAG. Lamp: Green light ON is chuck magnetized.
6. DE-MAG. Button: Push button to conduct chuck demagnetization.
7. DE-MAG. Lamp: Red light ON is chuck demagnetized.

8-2 Controlling Pages Character

   8 magnetic force levels for different machining demand
   Reference index

<table>
<thead>
<tr>
<th>Number of segments</th>
<th>8</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
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<td>40</td>
<td>28</td>
<td>16</td>
</tr>
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</table>

   (1) Max. level 8 is about 1250 kgf/100 cm² +/- 5% (4 poles)
   (2) Max. level is 8, low level number will get less magnetic force.


4. MAG. Button: Push button to conduct chuck magnetization.
5. MAG. Lamp: Green light ON is chuck magnetized.
6. DE-MAG. Button: Push button to conduct chuck demagnetization.
7. DE-MAG. Lamp: Red light ON is chuck demagnetized.
9. HMI - MAG./DE-MAG. and magnetic force adjustment.

9-1 Magnetization

Push MAG. button

YES, confirm

MAG. button green light ON is chuck magnetized.

9-2 Demagnetization

Push DE-MAG. button

YES, confirm

DE-MAG. button red light ON is chuck demagnetized.

9-3 Magnetic Force Level Down (Need to DE-MAG then conduct MAG. process again)

Push button to adjust the agnetic force level.

Push number button "3" to select magnetic force level.

Number "3" show up then push MAG. button to magnetize the chuck(Need to DE-MAG then lower the magnetic force level)

9-3 Magnetic Force Level UP (Adjust to the level need then conduct MAG. process directly)

Push button to adjust the agnetic force level.

Push number button "6" to select magnetic force level.

Number "6" show up then push MAG. button to magnetize the chuck
10. HMI - System Setup

10-2 Setup Page

1. Chuck Number Setting
2. Language (Chinese/English)
3. Brightness
4. Beep Sounds
5. Power Management
6. Return to last page
7. Advanced Setup

10-3 Power Management

1. Standby Mode
2. Password Setting
3. Password

10-4 System Setup Character

** At Controlling Page push System Setup button to enter System Setup page

1. Chuck Number Setting: Push this button enter to chuck numbers setting page (Chuck number above 2 pcs with this function) (e.g. page 14)
2. Language (Chinese/English): Language setup
3. Brightness: Adjust the brightness of HMI (light/dark)
4. Beep Sounds: Sound ON or OFF
5. Power Management: Push this button enter to Power Management page
6. Return: Push this button back to last page
7. Advanced Setup: Adjust before Ex-work, for controller adjustment
8. Sleep Mode: Period setting, have HMI go to sleep mode
9. Password Setting: Function reserved
10. Password Edit: Function reserved
11. HMI - Sleep Mode

At Controlling Page push System Setup button.

Enter to system setup page, push Power Management button.

Enter to Power Management page, push HMI sleep mode button.

Push button.

1 ~ 999 minutes setting. Push 5, and push ENTER confirm.

5 minutes show up at the blank, push save button to save this setting.

HMI show EARTH-CHAIN logo, means sleep mode saved.

After 5 minutes, HMI will close the monitor and standby to operate. Touch the surface of the HMI monitor to start up HMI again.
12. HMI - Troubleshooting

12-1 Voltage Insufficient

Power start.

Voltage insufficient show up at this page, means current power voltage is under AC186V.

Check whether the power voltage is within the acceptable voltage range, Confirm the voltage improved, then push disable button.

Re-start the power, no warning message on the controlling page, the situation is normal.

12-2 Chuck cable unconnected

Push MAG. button.

Chuck cable unconnected message show up. Please check chuck cable connecting status, or connector pin burnt. Then push HMI monitor surface.

Check whether the chuck cable is connected. Confirm the cable connecting then push disable button.

Push MAG. button again, no warning signal on the controlling page, the situation is normal.
12. HMI - Troubleshooting

12-3 Magnetization failure

Push MAG. button.

1. Check chuck cable connecting status. 2. Check connector pin status. 3. Chuck MAG. or DE-MAG. status. Confirm the situation improved, push disable button.

CH1 magnetization failure show up. Please check chuck cable connecting status, or connector pin burnt. Then push HMI monitor surface.

1. Push MAG. button again, no warning message on the controlling page, the situation is normal. 2. If connector failure, please contact the distributor or the manufacturer.

12-4 Demagnetization failure

Push DE-MAG. button.

CH1 demagnetization failure show up. Please check chuck cable connecting status, or connector pin burnt. Then push HMI monitor surface.

1. Check chuck cable connecting status. 2. Check connector pin status. 3. Chuck MAG. or DE-MAG. status. Confirm the situation improved, push disable button.

1. Push DE-MAG. button again, no warning message on the controlling page, the situation is normal. 2. If connector failure, please contact the distributor or the manufacturer.
13. HMI - Chuck Numbers Switch Setup
(Option for one controller for two and above chucks)

13-1 Controlling Page

13-2 System Setup Page

13-3 Chuck Numbers Setup Page

13-4 Chuck Numbers Switch Setup Character

** At Controlling Page push System Setup button to enter System Setup page Then push Chuck Number Setting enter to chuck numbers setting page (Only chuck number above 2 pcs can access this page)

1. Product Specification: EEPM-C2-2C1 is C2 mode, for 2 * C1 controller.
2. CH1 : Switch for Chuck no. 1
3. ON : Orange light ON is chuck ON status.
4. CH2 : Switch for Chuck no. 2
5. OFF : OFF status.
6. Return: Back to last page.
14. HMI - Chuck Numbers Setup Operation

14-1 EEPM-C1, C2, C4 is one controller for one chuck type. Not able to access chuck numbers setup page.

For EEPM-C1, C2, C4 one controller for one chuck: At controlling page push system setup button.

This controller is not able to set one controller for two magnetization areas. Then push confirm button.

14-2 One controller for two chucks setting

For EEPM-C2-2C1, it can control 2 * EEPM-C1 type chucks. At controlling page push system setup button.

Access to system setup page, push chuck numbers setup button.

Access to chuck numbers setup page. Push CH1 button, orange light ON; push CH1 again, light OFF. Push return button when CH1 is orange light ON.

Push MAG. button at controlling page. CH1 is magnetized; and CH2 is no action.
15. Induction Block Working Example
(Download ECE APP. refer application example)

*When the induction blocks to be screwed on the magnetic chuck for the first time, please directly fine grinding those blocks after installing the magnetic chuck onto the machining table. This allows the system to achieve the best parallel surface, and to obtain the best contact surface and magnetic force.

Functions and applications

1. The client can make their own induction blocks according to the object, processing method, and convenience. The best condition for material of the induction blocks is S20C. The induction blocks’ contact surface and the magnetic chuck surface require grinding to enhance the magnetic inducting function.

2. The induction blocks are replaceable and consumable accessories. It can increase the usage life of the magnetic chuck, and can expand processing methods.

3. The client can make their own induction blocks. We may offer consulting, suggestions, and the processing diagrams for free. We also accept customize orders. (The client is required to provide relevant detailed information such as the object diagram and processing method)

4. Without any obstructed movement of cutters during machining. Can do 5-sided machining, drilling, tapping, grooving and forming can be done all in one cycle. This greatly enhances work efficiency, and reduces repeated positioning tolerances to achieve best machining accuracy.

5. Can perform fast positioning for mass production which totally shortens the loading and unloading time of the objects.

Induction Block Working Example (Workpiece set up and slots for stopping)

The notch space is required when processing the grooving. This avoids the air gaps on the attracting surface caused by the burrs of the workpiece which may affect the magnetic force and cause the workpiece to move.

In order to truly perform the stopping function of grooves, the cutters entering and machining way should toward to one direction (positioning way)

When the size of the objects highly varies, a 7mm wide groove may be machined around the induction blocks. Aluminum or copper rods (non-magnetic materials) are then cut into the required length, and then placed at the appropriate locations according to the variations of the objects. This enables fast positioning and stopping.
16. Induction Block – EEPM-IB Series

* Used with the EEPM Magnetic chuck series to enhance more functions on workholding. For example, it can be used for the clamping and processing of round shaped objects and irregular shaped objects. The induction blocks may be also used for positioning during the process, and angle processing etc.

1. Can increase the usage life of the magnetic chuck: The induction blocks are suggested to be used as possible for processing. Since the object does not need to directly contact the magnetic chuck surface, the magnetic chuck surface can always remain brand new.

2. Convenience and accuracy: The induction blocks screwed on the magnetic chuck are replaceable and consumable accessories. You can fine grinding the surface or forming induction blocks according to requirements of workpiece by the machine directly that the parallelism of induction blocks can be 100% with the machine and the 5-sided machining can be easily conducted.

<table>
<thead>
<tr>
<th>Height:25mm</th>
<th>Height:50mm</th>
<th>Height:75mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEPM-IB225</td>
<td>EEPM-IB250</td>
<td>EEPM-IB475</td>
</tr>
<tr>
<td>EEPM-IB325</td>
<td>EEPM-IB350</td>
<td></td>
</tr>
<tr>
<td>EEPM-IB425</td>
<td>EEPM-IB450</td>
<td></td>
</tr>
<tr>
<td>EEPM-IB625</td>
<td>EEPM-IB650</td>
<td></td>
</tr>
</tbody>
</table>

EEPM-IB Series Working Example

- Using height 25 and 50 (mm) induction blocks for positioning and surface machining.
- Using height 25 and 75 (mm) induction blocks for positioning and surface machining.
- Directly processing a positioning groove on the induction blocks for 5-sided machining on multiple workpieces.
17. Induction Block – EEPM-IBT & IBV Series

Induction Block – EEPM-IBT series:

1. The EEPM-IBT Series are purposed for the convenience of angle machining, and specially designed 4 different standard angle specifications: EEPM-IBT30, EEPM-IBT45, EEPM-IBT60, EEPM-IBT90. We also accept customized orders for the special needs from our clients.

2. With its special component structure, please make sure that the first workpiece is truly secured when machining.

<table>
<thead>
<tr>
<th>Angle</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>30°</td>
<td>EEPM-IBT30</td>
</tr>
<tr>
<td>45°</td>
<td>EEPM-IBT45</td>
</tr>
<tr>
<td>60°</td>
<td>EEPM-IBT60</td>
</tr>
<tr>
<td>90°</td>
<td>EEPM-IBT90</td>
</tr>
</tbody>
</table>

* Using IBT30(30°) for direct forming processing.
* Using IBT45(45°) for direct forming processing.
* Using IBT60(60°) for direct forming processing.
* Using IBT90(90°) for direct forming processing.

Induction Block – EEPM-IBV series:

1. The EEPM-IBV Series are purposed for the convenience of cylindrical workpiece machining, and specially designed 6 different standard specifications: EEPM-IB90V3, EEPM-IB90V4, EEPM-IB90V6, EEPM-IB120V3, EEPM-IB120V4, and EEPM-IB120V6. We also accept customized orders for the special needs from our clients.

<table>
<thead>
<tr>
<th>Angle</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>90°V</td>
<td>EEPM-IB90V3, EEPM-IB90V4, EEPM-IB90V6</td>
</tr>
<tr>
<td>120°V</td>
<td>EEPM-IB120V3, EEPM-IB120V4, EEPM-IB120V6</td>
</tr>
</tbody>
</table>

* Intermediate and small size cylindrical objects: Using the 90°V induction blocks for processing.
* Large size cylindrical object: Using the 120°V induction blocks for processing.
18. Induction Sub Plate – EEPM-ISP Series

Functions and applications:
1. Suitable for big quantity of irregular and small size objects. Able to machining multi-workpiece simultaneously.
2. One EEPM magnetic chuck can use several Induction Sub Plates with exchangeability for machining different shapes of workpiece. Not only does it achieve fast positioning, but also serves as a stopping plate.

Attention:
1. Do not cut/mill along the yellow epoxy resins when grooving to prevent deformation or crack of the sub plate.
2. When machining a small or thin object, please decrease the magnetism to appropriate level to avoid iron chips attaching onto the object due to through magnetism.
3. Please inform the required specification of EEPM magnetic chuck when place orders.

Induction Sub Plate Working Example

Please screw the Induction Sub Plate onto the EEPM chuck tightly and fine machining directly on the plate with the machine to complete plate installation.

Working Example

Machining 1mm grooves at the position where the workpiece is to be placed on the plate. Once completed, place the workpieces onto the positioning grooves. The machining may be then proceeded after magnetized the chuck.
19. Spring Blocks -EEPM-SP Series

1. Suitable for objects of casting iron, irregular shapes and curved surfaces, which ensures the object not to deform after machining.
2. Each object requires 3 fixed blocks (EEPM-SPF) for basic level of clamping (shown below).
3. The elastic range of each spring block set is ±2.5mm.

<table>
<thead>
<tr>
<th>Spring block</th>
<th>Fixed block</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEPM-SP</td>
<td>EEPM-SPF</td>
</tr>
</tbody>
</table>

Please use the triangle as the basis point when installing the fixed blocks.

Irregular object processing example

Spring blocks application illustration

Unloading method of special steel materials

Since the carbon content amount is high for high-carbon materials, the object might be unable to be instantly released after machining cycle is completed due to residual magnetism. To deal with this situation:
1. Use a lifting magnet (ELM) to attract the corner of the object, slightly pull to remove the object.
2. Install induction blocks to unload the object by applying the lever principle.

Note: 1. All carbon-containing materials will become magnetic (with residual magnetism) after clamping with the Magnetic Workholding (clamping system) based on the principles of magnets. However once they leave the Magnetic Workholding (clamping system), their magnetic properties will eventually reduce to a minimum after a period of time.
2. In order to avoid this situation happen, please reduce the magnetism level. This can weaken the magnetizing magnitude of the object.

Induction blocks can be added (strongly suggested) for machining. Once the parallelism position of the positioning grooves on the induction blocks is fine ground, place the object to start machining.

After the machining and demagnetize the EEPM chuck, place two processed slant aluminum rods underneath the object and strike the rods inwards to easily remove the object.
20. Specification for Optional Controller & Chuck

Optional controllers: EEPM-C4-4C1, EEPM-C4-2C2, EEPM-C8, EEPM-C8-4C2, EEPM-C8-2C4, EEPM-C12-3C4, EEPM-C16-4C4

1. Please mark the item no. of the controller that came with the magnetic chuck in the following table, to prevent any mistakes.
2. If several magnetic chucks were purchased, the table can show the correspondence between the controller and the magnetic chuck.
3. If a single machine needs several magnetic chucks, conjunction box(es) may be installed with the machine to perform processing and unloading operations separately.

<table>
<thead>
<tr>
<th>Control for 1 to 1 pieces of C1 EEPM chucks</th>
<th>Control for 1 to 1 pieces of C2 EEPM chucks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>Magnetizing</td>
</tr>
<tr>
<td>220V</td>
<td>1 Second</td>
</tr>
<tr>
<td>380V~440V</td>
<td>2 Second</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Control for 1 to 2 pieces of C2 EEPM chucks</th>
<th>Control for 1 to 4 pieces of C1 EEPM chucks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>Magnetizing</td>
</tr>
<tr>
<td>220V</td>
<td>3 Second</td>
</tr>
<tr>
<td>380V~440V</td>
<td>6 Second</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Control for 1 to 2 pieces of C4 EEPM chucks</th>
<th>Control for 1 to 4 pieces of C2 EEPM chucks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>Magnetizing</td>
</tr>
<tr>
<td>220V</td>
<td>6 Second</td>
</tr>
<tr>
<td>380V~440V</td>
<td>11 Second</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Control for 1 to 3 pieces of C4 EEPM chucks</th>
<th>Control for 1 to 4 pieces of C4 EEPM chucks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>Magnetizing</td>
</tr>
<tr>
<td>220V</td>
<td>9 Second</td>
</tr>
<tr>
<td>380V~440V</td>
<td>17 Second</td>
</tr>
</tbody>
</table>
# 21. Troubleshooting

## Newly installed product unable to operate

<table>
<thead>
<tr>
<th>Description</th>
<th>Troubleshooting method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Incorrect voltage</td>
<td>1. Check first if the voltage is correct? (Single phase, with 2 wires)</td>
</tr>
<tr>
<td></td>
<td>2. Connect the blue and brown wires to the master power supply at any 2 points, and tighten (P4)</td>
</tr>
<tr>
<td>2. Insufficient current (ampere)</td>
<td>1. All of the EEPM chucks are impulse/instant electric charged that require a large current. Therefore, the current should be at least 60% of indicated current for each EEPM chuck to operate the chucks.</td>
</tr>
<tr>
<td></td>
<td>2. Please examine if the current from the master power supply is sufficient (refer to the current data of the specification table)</td>
</tr>
<tr>
<td>3. Quick connector connection is not completed</td>
<td>1. The connection between the EEPM chuck connector and quick connector is required to be well and tightly connected to provide an instant large current. If the connection is incomplete, the current is unable to pass though, and the magnetic chuck cannot be operated.</td>
</tr>
<tr>
<td></td>
<td>2. Please connect again (P4)</td>
</tr>
<tr>
<td>4. Mistake with operation</td>
<td>1. When the providing current is sufficient, the controller only needs a few seconds to complete the magnetizing process. If the buttons are pressed by force for several minutes, the protection circuit shall activate, which the operation ceases.</td>
</tr>
<tr>
<td></td>
<td>2. When the yellow light of the safety button shows up, release the button. The green light shall appear, and indicating that the magnetization is completed. (P5)</td>
</tr>
<tr>
<td>5. Insufficient magnetism</td>
<td>1. Adjust the magnetism according to the material, size and thickness of the workpiece. For thin and small workpieces, please adjust the magnetism to the maximum level 8~1, and so on.</td>
</tr>
<tr>
<td></td>
<td>2. The magnetism adjusting method and ratio are given in the operating instruction (P6)</td>
</tr>
</tbody>
</table>

## Unable to normally operate after using for a period of time

<table>
<thead>
<tr>
<th>Description</th>
<th>Troubleshooting method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Unstable voltage</td>
<td>1. Unsteady voltages and currents can easily cause an instant excess current, and causing the fuse to burn.</td>
</tr>
<tr>
<td>2. Controller was in contact with moisture, causing a short circuit</td>
<td>2. Two fuses are enclosed inside the controller. When the machine cannot activate, please check if the fuse is burned. Replace the fuse.</td>
</tr>
<tr>
<td>3. The quick connector was not truly cleaned, resulting of a short circuit by dust or water</td>
<td>1. The controller is a precise electronic component. Although the product was designed to be protected from moisture, place the controller at a place where it cannot easily be splashed by the cutting liquid or cooling water when use.</td>
</tr>
<tr>
<td></td>
<td>2. Maintain the cleanliness and dryness of the controller at all times.</td>
</tr>
<tr>
<td></td>
<td>3. The quick connector and connector of the magnetic chuck require a large current supply passing through, where dust and moisture can easily cause a short circuit.</td>
</tr>
<tr>
<td></td>
<td>2. Truly clean any contaminants such as iron chips or water vapors before each connecting the quick connector.</td>
</tr>
<tr>
<td></td>
<td>3. When the magnetic chuck connector and quick connector are not connected, please replace the connection cover and tighten it until it locks tight.</td>
</tr>
</tbody>
</table>

## Conclusion:

1. The Electro-Permanent magnetic chuck is a permanent magnetic chuck device. Therefore, under normal operating circumstances, the magnetism will not vanish. If any problems are encountered when use, it would not be a magnetism issue. If the chuck cannot operate or work normally, please carefully read the examining and troubleshooting of this manual, which should be able to solve the problems.

2. This product does not require power supply once it is magnetized, and its magnetism can remain for a half year. Therefore, you don’t need to worry of an electric power failure during the machining operation.

3. Do not continuously perform magnetize/demagnetize within a short period of time to prevent overheat of the coils, and causing the circuit to burn. Do not exceed 80°C for normal use of the magnetic chuck.
22. Description of special processing situations

<table>
<thead>
<tr>
<th>Reason</th>
<th>Description</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Different materials cause different magnetic forces</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1. The magnetism will be different according to the carbon content of workpiece. In other words, the higher carbon amount, the less magnetic force. On the contrary, the less carbon amount, the stronger the magnetic force.</td>
<td>1. Please adjust the most suitable magnetic level (such as P6) according to the illustration. 2. Please use the stopping plate for assistance. 3. Change the feeding rate of machining</td>
</tr>
<tr>
<td></td>
<td>2. The carbon content amount can be determined by the hardness of the material. The hardness is higher with higher carbon content, while softer when the carbon content is lower.</td>
<td></td>
</tr>
<tr>
<td>2. Object thickness</td>
<td>Due to the properties of the magnetic tools, the object thickness shall directly affect the magnetic force. The minimum thickness requirement is 30mm, whereas the magnetic force reduces as the thickness becomes thinner. Thus, when the object is too thin, the magnetic force decreases due to the thinness.</td>
<td>Install induction blocks, and machining an approximately 1mm groove according to the object shape for stopping. This can improve object clamping issues (as shown on P11)</td>
</tr>
<tr>
<td>Thickness</td>
<td>Magnetic force</td>
<td></td>
</tr>
<tr>
<td>0mm</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>20mm</td>
<td>85%</td>
<td></td>
</tr>
<tr>
<td>30mm</td>
<td>90%</td>
<td></td>
</tr>
<tr>
<td>3. Flatness</td>
<td>The attractive surface roughness shall directly affect the fitting between the magnetic chuck and the object. Whereas the fitting shall directly affect the magnetic force, i.e. a rougher surface provides a weaker force, where a finer surface provides a stronger force.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. If the object surface is rough, use a portable grinder to grind the surface first. 2. Increase the magnetism level, i.e. for a rougher surface, adjust the magnetism to a larger level (level 8 of the controller)</td>
</tr>
<tr>
<td>4. Object size</td>
<td>* The object size shall directly affect the contact area of the magnetic poles, i.e. the larger the contact area, the larger the magnetic force. Thus, place the object at the poles crossing locations as possible. * The most basic requirement is that the object contacts with 4 magnetic poles, whereas the magnetic force of the 4 poles is 1 ton, 8 poles is 2 tons, and so on.</td>
<td>1. For fewer magnetic poles contacted with the object, adjust the magnetism to maximum level (8). 2. When the object contact with many magnetic poles, adjust the magnetism according to the material (as shown on P6)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Fitting of attractive surfaces between the object and magnetic chuck</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reason</td>
<td>Description</td>
<td>Method</td>
</tr>
<tr>
<td>A. The surface of the magnetic chuck becomes uneven after a using period</td>
<td>The surface plates of the magnetic chuck are all made with low-carbon steel, which has better magnetic inductive properties. However, the material is relatively soft that will easily become uneven due to collisions by the object during machining process.</td>
<td>1. If the surface is slightly uneven, gently grind it to flatness with ceramic stone. 2. For a more serious situation, please grind the surface again to get better magnetic force.</td>
</tr>
<tr>
<td>B. The contact surface between induction blocks and the magnetic chuck is not well (poor fitting) (didn’t clean contact surface before installation)</td>
<td>In order to obtain the best fitting surface between the induction blocks and magnetic chuck, all contact surfaces are ground surfaces. Thus, clean thoroughly while installing.</td>
<td>1. Use an air gun for cleaning while assembling the magnetic chuck. 2. Screw tightly with a hexagon wrench to obtain the best fitting surface.</td>
</tr>
<tr>
<td>C. First assembling induction blocks requires fine grinding</td>
<td>Make sure that the attractive surface is evenly flat when machining an object. The first assembling induction blocks may be uneven the surface that causing insufficient magnetic force.</td>
<td>Directly fine grind the induction blocks when installing them onto the magnetic chuck to obtain a 100% flat surface.</td>
</tr>
<tr>
<td>D. Protruded edges of the magnetic chuck surface due to collision</td>
<td>During the object loading/unloading of the processing, improper operating might cause collisions toward the magnetic chuck and cause its surface to be uneven.</td>
<td>1. If the surface is slightly uneven, grind it to flatness with diamond file and ceramic stone. 2. Grind the magnetic chuck surface again.</td>
</tr>
<tr>
<td>Reason</td>
<td>Description</td>
<td>Method</td>
</tr>
<tr>
<td>--------</td>
<td>-------------</td>
<td>--------</td>
</tr>
<tr>
<td>E. Rough surface of object, causing air gaps on contact surface affect the fitting contact</td>
<td>The surface of the materials is rough and contains many impurities. This causes poor fitting with the attractive surface to the magnetic chuck</td>
<td>Grind the original materials with a portable grinder before machining.</td>
</tr>
<tr>
<td>F. Dust, impurities, iron chips</td>
<td>The fitting at the surface shall directly affect the magnetic force. Any uncleaned impurities or iron chips can easily cause air gaps at the attractive surface, and affecting magnetic force.</td>
<td>1. Execute the demagnetizing process to prevent iron chips attached to the attractive surface. 2. Thoroughly clean the contact surface between the object and magnetic chuck with an air gun.</td>
</tr>
</tbody>
</table>

**Conclusion:**

1. The Electro-Permanent Magnetic Chuck has the advantages of fast loading and unloading of objects, and can do 5-sided machining simultaneously. However, the differences between materials, object thickness, flatness, and sizes are still to be considered. In other words, if the object is thicker, larger, or the material is softer, the magnetic force is stronger and suitable for heavy cutting; on the contrary, the thinner and smaller objects, or harder materials, the magnetic force is weaker and only suitable for light cutting.

2. In addition to the above reasons, the fitness between the object and the magnetic chuck shall directly affect the magnetic force. Therefore, besides the first usage of induction blocks requires fine grinding the surface, keeps the flatness of the attractive surface between the magnetic chuck and object, also the cleanliness during the machining process is to be noticed to achieve the maximum efficiency and accuracy with the magnetic chuck.

**Reasons for object shifting when using the same processing conditions**

<table>
<thead>
<tr>
<th>Reason</th>
<th>Description</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cutters become blunt after long period of use and increase the receiving force.</td>
<td>When the cutters are used for a period of time, the cutters are worn and reduce the cutting force. It increases the receiving force of the magnetic chuck and causes possible shifting of the object.</td>
<td>When processing to a general amount of objects, please examine if the cutters are worn. Replace the cutters if they become blunt.</td>
</tr>
<tr>
<td>2. Increase the machining speed and increases the receiving force.</td>
<td>When the cutters are in motion, the rotary speed of the spindle and feeding rate are not coordinated appropriately. This causes the cutters to overly worn out and become damaged and causing possible shifting of an object.</td>
<td>1. Coordinate the rotary speed and feeding rate appropriately with the cutters. 2. Adjust the rotary speed and feeding rate according to the material, thickness, and size of the object. 3. Pay attention to the wearing status of the cutters.</td>
</tr>
<tr>
<td>3. Depth of cutting</td>
<td>Decreasing the feeding rate can reduce the wearing of the cutter, and increase the usage life of the spindle. And, relatively increases the cutting rotary speed and line progressing speed, which will not increase the processing time.</td>
<td>1. Reduce the depth of cutting. 2. Increase the cutting rotary speed. 3. Increase the line speed. 4. Use the stopping plate and processing direction for assistance. 5. Install induction blocks.</td>
</tr>
<tr>
<td>4. Uncleaned surface, causing uneven thickness. The fitting is poor with air gaps and decrease the magnetic force accordingly.</td>
<td>Objects are usually magnetic material, where each object may attach iron chips if not cleaned. This causes poor fitting with the magnetic chuck, and reduction in the magnetic suction.</td>
<td>1. Use a portable grinder to fine grind the original material before each processing. 2. Thoroughly clean the contact surface when an object is placed on the magnetic chuck.</td>
</tr>
</tbody>
</table>

**Conclusion:**

1. During the machining, the shifting of the object is not the quality issue of magnetic chuck, but rather the physical principle. By adjusting the magnetic force, the cutters speeds, replacing the cutters during the process, reducing the feeding rate, and further accelerate the rotary speed and line processing speed enables to increase the efficiency and accuracy, and can extend the usage life of the machine’s spindle.

2. From the above descriptions, it is realized that the magnetic force of the Electro-Permanent Magnetic Chuck will not decrease due to time. The processing method can be changed by selecting thicker, larger, and soft objects to perform heavy cutting, while selecting thinner, smaller, and hard objects for light cutting.
23. Notice
1. For your safety, please make sure it’s on the demagnetization process before you put the work piece on the electro-permanent magnetic chuck.
2. For your safety, please make sure it’s on the magnetization process before you process the work piece on the electro-permanent magnetic chuck.
3. In order to prevent any magnetic interference with the precision product, do not allow attches, cell phones etc. approach near this electro-permanent magnetic chuck product.

24. Maintenance
To maintain the users’ safety, product’s quality and usage life, please follow the below maintenance steps. Thank you for your cooperation!

24-1 Controller maintenance
1. Clean the iron chips, oil, water, and other contaminants off the magnetic chuck after use to avoid short circuits.
2. Store the controller, with the remote control, quick connectors, electric wires and other parts, at a dry and well-ventilated place after use.
3. Examine if the electric wires are damaged or if any copper wire are exposed on a weekly basis!
4. Examine if the wires have fallen off or if the fixing screws have loosen on a weekly basis!

24-2 Magnetic chuck maintenance
1. Clean the iron chips, oil, water, and other contaminants off the magnetic chuck after use.
2. When not in use for long periods, replace the connection cover of the magnetic chuck and tighten it until it locks tight. Also, apply anti-rust oil on the magnetic chuck panel to prevent rusting.
3. Examine if the press blocks on the magnetic chuck fixed onto the machine have loosen on a weekly basis!
4. Examine if the fixing screws of the induction blocks have loosen on a weekly basis!

24-3 Notice before maintenance
1. All examinations in relevant with the product may only be performed by a licensed electrical technician.
2. Turn off the electric power master switch before examining and maintenance to avoid electrical shocks.
3. Do not stand on wet floors.
4. Wear plastic gloves and protection shoes while performing an examination.
5. If not necessary, do not disassemble any components inside the controller.

* Thank you for choosing EARTH-CHAIN. Please carefully read the operation instructions. We look forward to serving you again!