

DIGITAL METAL DETECTOR

User Manual
(FM 2000T Series)

FINE
FINE MECHATRONICS CO.,LTD

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Chapter 1. Overview

1.1. Introduction

Thank you for purchasing FM 2000T SERIES Digital Metal Detector of our company.

This User Manual explains functions and methods of configuring FM 2000T SERIES Metal Detector as wanted by the user. We hope this Manual helps in using this product.

This digital metal detector is installed at the end of manufacturing lines such as production equipment and automatic packing machines. This metal detector protects consumers of your company by preventing shipment of defects (products inserted with foreign metals such as ferrous, non-ferrous, and stainless) through lot test. This machine is intended to enhance your brand image and, in particular for functional products, to prevent malfunctioning caused by metal insertion.

This equipment is widely used for detergents, confectioneries, food, plastic injections, plastic bags, bottles, packages like boxes, and non-packed solids. It is used to detect foreign matters (metals) inside a packed product.

The user will be satisfied with the long life span and all functions of the equipment by using and performing maintenance properly according to this Manual.

1.2 Precautions Before Installation



This digital metal detector detects metals using electric and magnetic fields. Make sure to check the following matters before installation.

- Install in a place that is not affected by vibration and heat.
- Remove moving metals nearby the metal detector head in advance.
- Check for surrounding devices that generate same frequency as the metal detector.
- Use power within the spec of 110V/220V and 50Hz/60Hz. Separate it from power lines.
- Perform grounding to prevent electric shock from electromagnetic waves and static electricity in advance.
- Install in a place with constant temperature and humidity.
- When installing this metal detector in a place that already has a metal detector, notify in advance.

1.3 Understanding FM 2000T SERIES Metal Detector

A) Shape of metal specimen

The sensitivity test of the metal detector can measure using a ball-shaped metal specimen. Needle- or wire-shaped metals instead of ball shape may show differences depending on the direction inside the metal detector head.

B) Physical properties of product

There are large differences in physical properties according type, even if size is the same. Our metal detector classified physical properties into strong and weak products. Strong products are characterized by high humidity and high conductivity. Weak products have low humidity and low conductivity. Products can be detected by physical property.

C) Head size of metal detector

Metal detection sensitivity differs according to head size of the metal detector. In general, detection sensitivity is lower when head height is higher. Sensitivity is higher when head height is lower. Check with our company in advance for strong products as they can show differences.

D) Position of metal inside metal detector head

Metal detection sensitivity is higher when it is closer to the four sides of the head. Sensitivity is lower when there is a metal at the center of the four sides of the head.

E) Change of physical properties

Physical properties change according to time. Therefore, high sensitivity detection can be performed by applying small packing of products to minimize physical properties.

1.4 Composition of FM 2000T SERIES Metal Detector



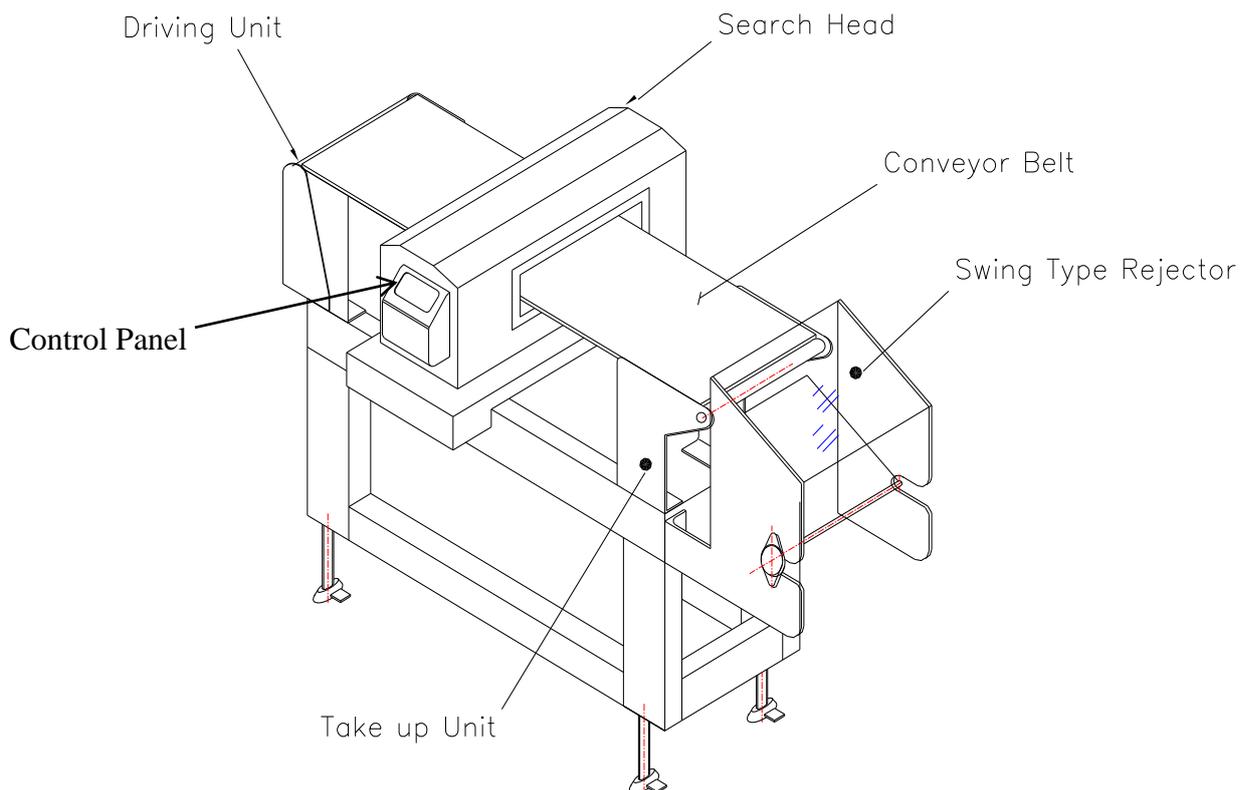
This metal detector comprises the metal detector head and conveyor.

The metal detector head has an LCD panel for the user, and the control panel is divided into assembled type and separate type.

The conveyor is divided into the urethane belt method and plastic belt method.

Be cautious not to apply strong impact on the metal detector head during use.

(FM 2000T-Swing Type Rejecter Drawing)



Caution

Our company is not responsible for detachment, alteration, and modification of parts inside the metal detector head performed by an engineer who has not been designated by our company.



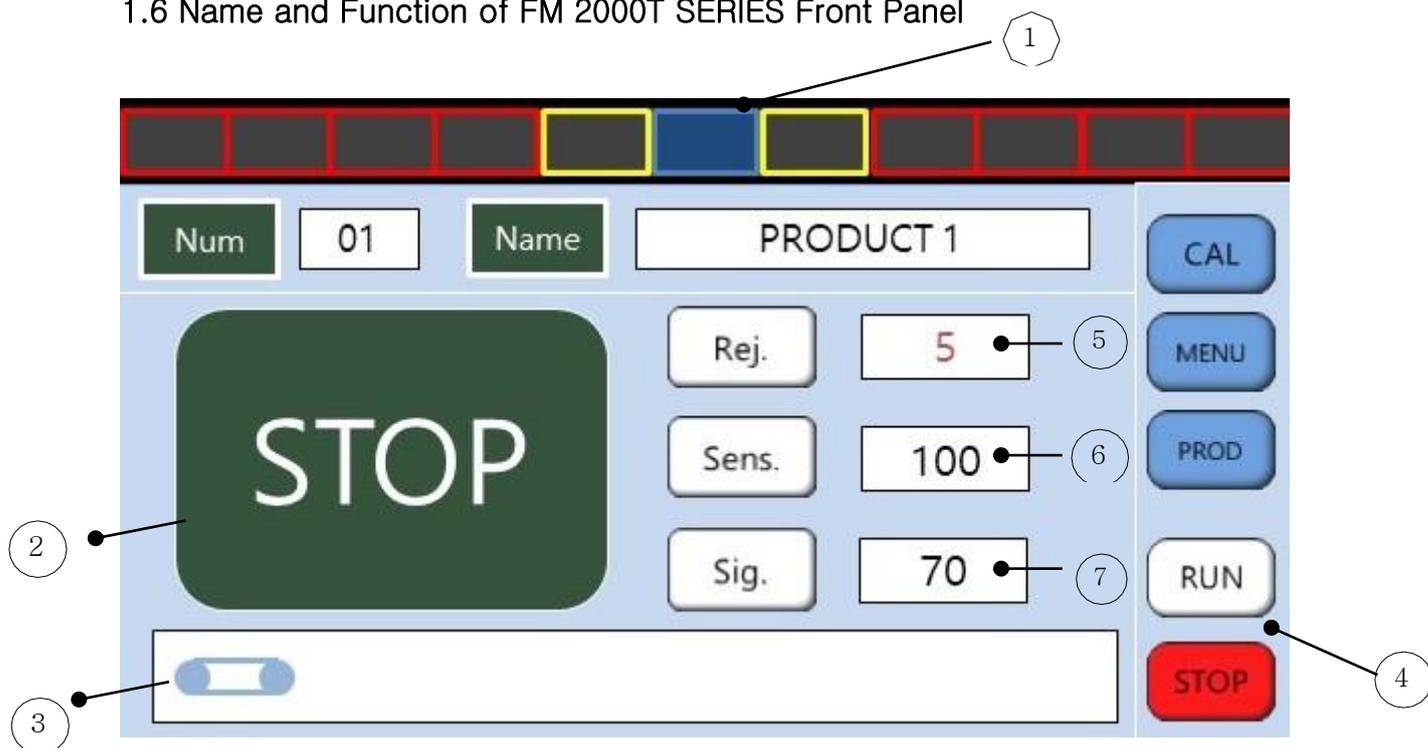
Warning

Be careful not to open and close the metal detector head by an engineer who has not been designated by our company.

1.5 Specification of FM 2000T SERIES

Specification	Details
Display	7-inch colored touch LCD (resolutions: 800 x 480)
Detection system	Closed Coil Detection
USB backup	USB memory storage and update
Product storage	Up to 99
Detection sensitivity range	00 ~ 999
Type of metal detected	Ferrous, non-ferrous, stainless
Power consumption	15w (differs according to head size)
Temperature	0°C ~ 40°C
Memory battery	Flash memory (no battery)
Belt speed	Min. 5m ~ max. 65m/min.
Detection count	0~999
Head size	According to spec
Metal detection relay output	Zero voltage "A" contact or "B" contact
Accessory	Metal specimen: Ferrous (1 ea.) and stainless (1 ea.)
Conveyor OFF/ON	Switch button method
Power	Single phase, 110/220VAC, 60Hz/50Hz (Free Voltage)

1.6 Name and Function of FM 2000T SERIES Front Panel



① Metal Detection Bar Graph

The bar turns from blue to red when a metal (ferrous, non-ferrous, stainless) is detected.

② Status Display Area

METAL is displayed when a metal is detected.

PASS is displayed when a normal product is passing.

STOP is displayed when stopped.

③ Conveyor Run/Stop Icon

This icon indicates that the conveyor is running/stopped.

④ Conveyor Run/Stop Button

This button is used to run or stop the conveyor.

The stop button can be used if manual screen run/stop is ON.

⑤ Rejection

Metal detection quantity is displayed.

Quantity is reset by pressing the rejection button.

⑥ Sensitivity

Detection sensitivity is adjusted. (0~999)

⑦ Physical Property

If physical property is 100 or above when a product passes, it is recognized as metal detection.

Adjust sensitivity so that physical property of normal products does not exceed 100.

Physical property display is reset by pressing this button.

Chapter 2 Basic Operation Method

2-1. Basic Operation Sequence

1. Check power (default: single phase, 220VAC, 60Hz) of the metal detector and turn main power of the electric panel ON.

2. Press the RUN/STOP switch to operate the conveyor.

3. Set sensitivity to "80" and press the calibration button.

4. When "Inject" appears on the calibration screen, pass the product through the tunnel.

- After passing 3~4 consecutive products, "Complete" appears in the calibration mode. Press **End** to leave the mode.
- If status does not turn to "Complete" after passing 3~4 products, switch "Calibration Mode" to "Complete" and change "Product Property" from "Strong" to "Weak".

5. Set sensitivity of the metal detector.

- Repeatedly pass 3~10 sample products and adjust sensitivity until physical property on the default screen becomes $80 \pm 10\%$.
- If physical property is higher than $80 \pm 10\%$ after passing 3~10 products, lower sensitivity by 5 at a time to adjust physical property until it reaches $80 \pm 10\%$ or below.
- On the contrary, if physical property is below $80 \pm 10\%$, increase sensitivity by 5 at a time to adjust physical property to $80 \pm 10\%$ or below.
- If physical property is 30 or below after passing about 5 products, increase sensitivity by 50 to adjust physical property to $80 \pm 10\%$ or below.

6. Add name of the product to be detected.

- Press the PROD button on the default screen.
- Press the Product Name button.
- Use the keyboard screen to select alphabets and press ENTER. Once the name is entered, press End on the screen to return to the initial screen.

7. Load and use an existing product.

- Press the PROD button on the default screen.
- Press the Entry No. button.
- The list of registered products and numbers appears.
- Select the product and number to be found and press the End button.

8. Set rejection time of the rejector.

- Press the MENU button on the default screen.
- Set delay time (metal signal delay time) and press the Close button.
- Set operation time (rejector operation time) and press the Close button.

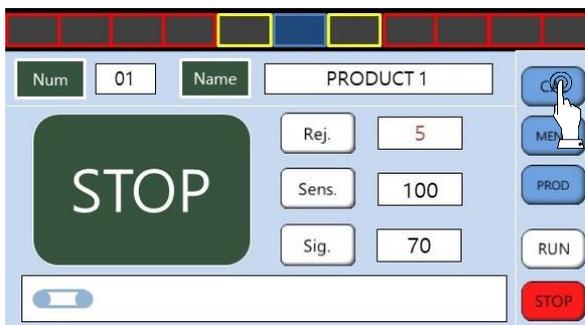
Chapter 3 Setting

3-1. Auto Calibration

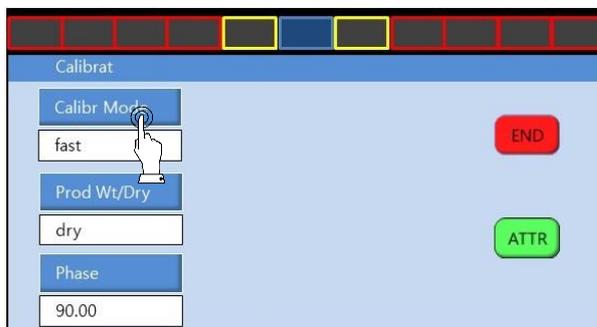
All products have unique physical properties regardless of shape and size.

Therefore, it is difficult to find unique phase of each product depending on physical properties.

Auto calibration is a function to find the phase of a product while passing the product through the metal detector.



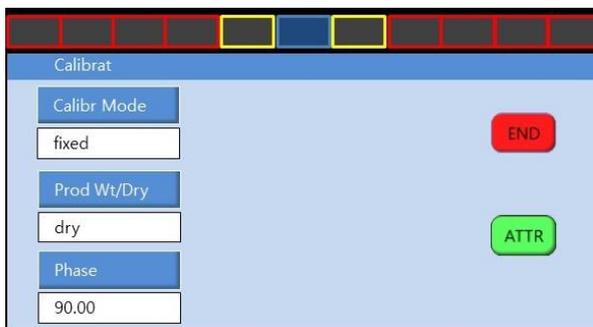
- (1) Press the Conveyor Run/Stop button.
- (2) Press the "Calibration" button.



- (1) Press the Calibration Mode button to switch to the "Injection" mode.

- (2) Pass products until the "Injection" mode turns to "Complete".

- (3) If the status does not turn to "Complete", physical property of the product is low. Fix it to "Complete" arbitrarily.



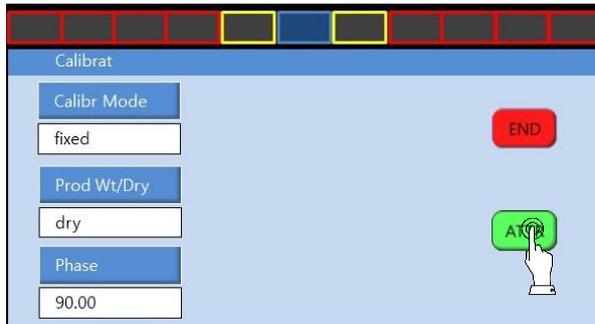
- (1) Press End once the "Injection" mode turns to "Complete".

- (2) If the status does not turn to "Complete", physical property of the product is low. Fix it to "Weak" arbitrarily.

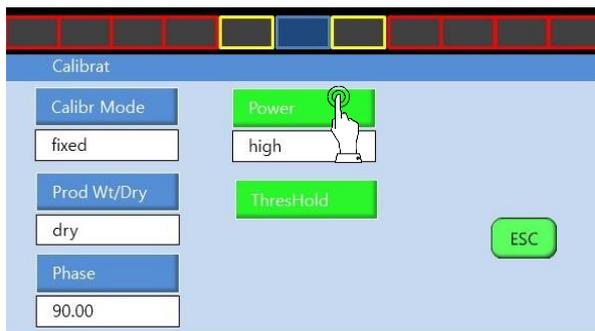
3-2. Adjustment According to Physical Properties

Products like raw meat, raw fish, sauce, and cheese have strong physical properties.

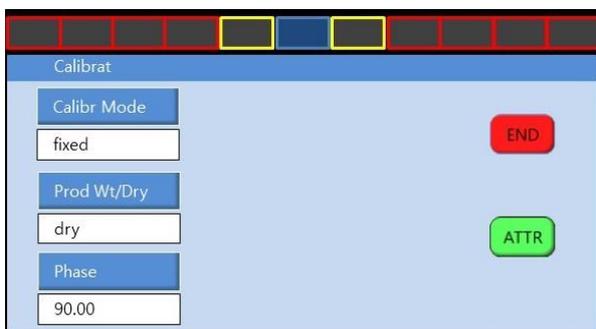
Such products can be detected at high sensitivity by using low power frequency rather than high power frequency.



(1) Press the Attribute button.



- (1) Press the Power button.
- (2) The bar graph turns to red.
- (3) Wait a moment until the red bar graph turns to blue lamp.



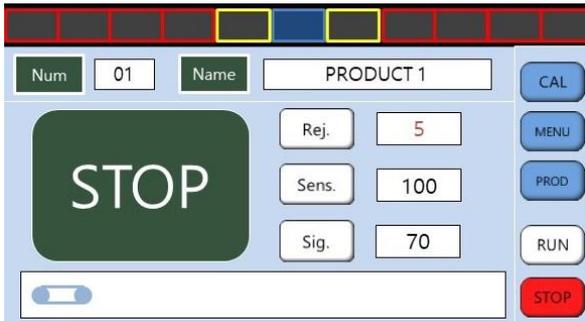
- (1) Press the Previous button.
- (2) Reconfigure auto calibration.

3-3. Menu Screen

When detecting metals, rejection delay and operation time are configured by rejection time.

Time unit of rejection delay and operation time is 1/100th of a second (0.01 second).

Operation time of belt type rejectors is 0.01 second. Adjust rejection delay according to product length. If a separate rejector is attached, adjust rejection delay and operation time according to product length and direction.



(1) Press the MENU button.



Rejection Delay and Operation Time

-Adjust rejection delay and operation time according to the position of the product after metal detection.

-If delay time is 0.00 second, the rejector is operated immediately after metal detection.

Clock Setting

- Set the clock.

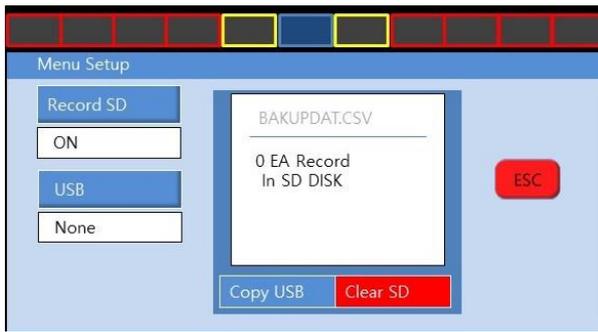
- Configure clock time when using USB backup.

Touch Run/Stop

If Touch Run/Stop is ON, the Run/Stop button can be used on the touch screen.

Language

-Select Korean/English.



Record SD

Turn this option ON when using USB data backup.

USB

This ` is displayed as “Yes” if a USB drive is inserted.

Copy USB

Press the Copy USB button for USB backup.

Clear SD

Press the Clear SD button to clear data history.

SAMPLE

1	2020.01.30	11:10:13	METAL
2	2020.01.30	11:11:45	METAL
3	2020.01.30	11:11:54	METAL
4	2020.01.30	11:12:05	METAL
5	2020.01.30	11:12:08	METAL
6	2020.01.30	11:07:44	METAL
7	2020.01.30	11:07:46	METAL
8	2020.01.30	11:07:50	METAL

During USB backup, file name is saved based on date and time.

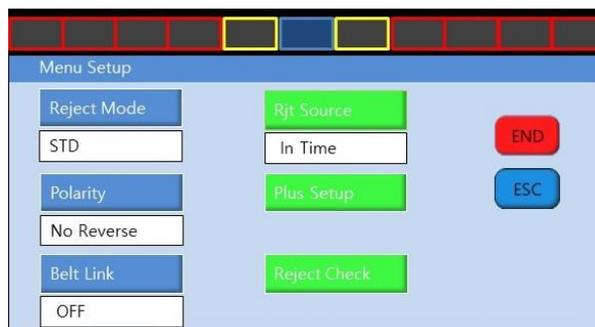
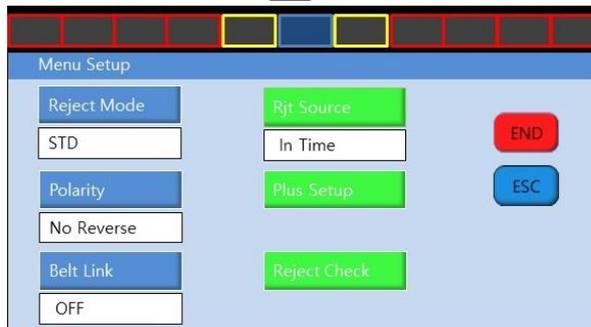
Ex) If backup is done at 02:10 on January 30: 01300210.CSV

3-4. Rejection Method

3-4-1. Polarity (No Reverse / Reverse)

Polarity of metal detection includes zero voltage “A” contact (normal open) and “B” contact. Polarity can be adjusted freely according to the contact method of the rejector.

Also, operating status of the rejector can be checked by pressing ENTER.



(1) Press the NEXT button.

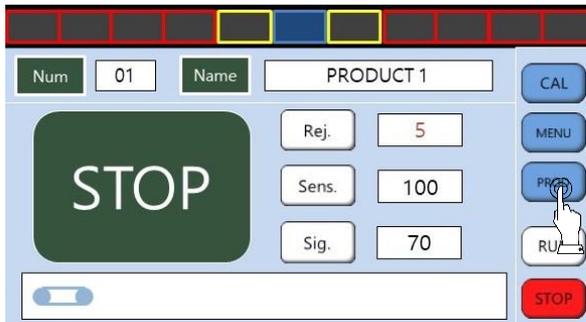
- (1) Use STD for the reject mode.
- (2) Press the Polarity button and set it to No Reverse.
- (3) Metal detection signals will be generated as no reverse.
- (4) The belt does not stop during metal detection if Belt Link is OFF.

- (1) Press the Polarity button and set it to Reverse.
- (2) Metal detection signals will be generated as reverse.
- (3) The belt stops during metal detection if Belt Link is ON.

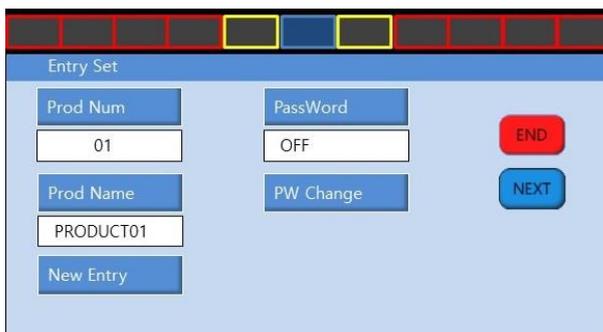
Chapter 4 Product Add, Change, Select

4-1. Adding New Product

This function is used to add a new product. Product name and settings of the product are added at the same time. Up to 99 products can be added.



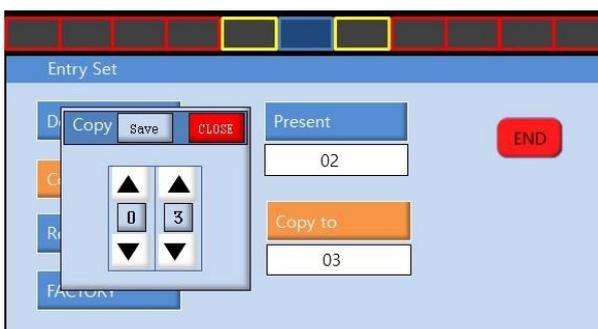
(1) To add a new product, press the PROD button.



(2) Press the PROD button.



(3) Press the Copy Entry button.



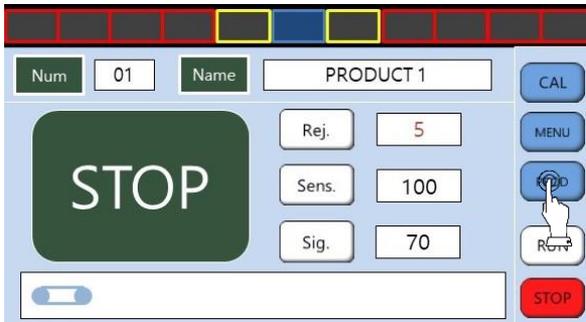
(4) Press the Entry No. button, select a new number to be created, and press the Save and CLOSE buttons.

For reference, all settings of the original entry number are copied to the target entry number.

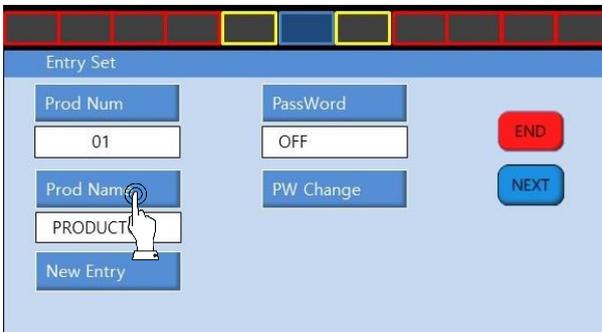
If the target entry number is similar to the original entry number, only change sensitivity.

If physical properties differ, reconfigure auto calibration on the default screen.

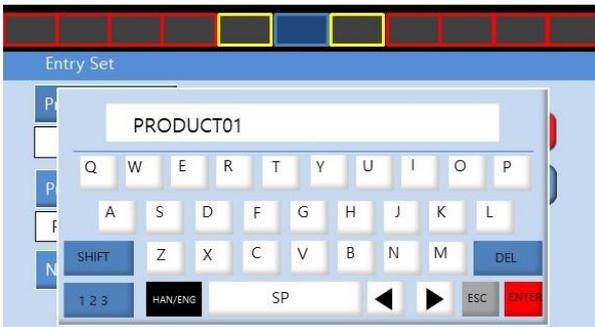
4-2. Changing Product Name



(1) Press the PROD button to change product name.



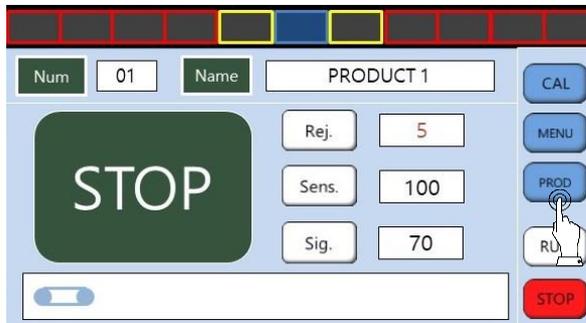
(2) Press the Product Name button.



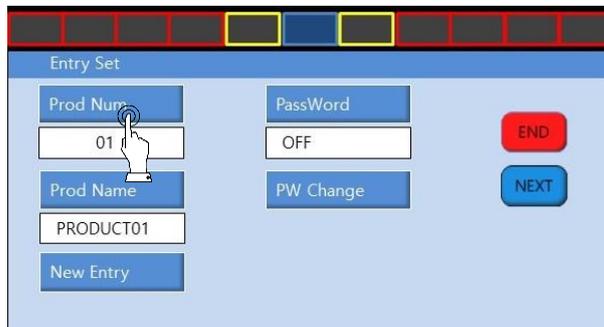
(3) Use the keypad to enter product name and press the ENTER button.

4-2. Selecting Existing Entry

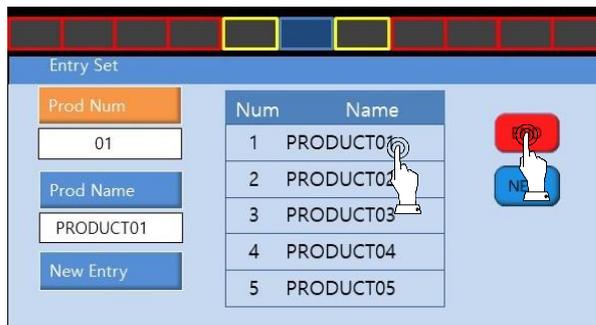
Up to 99 products can be added. To use an existing product, you can easily select and use an existing number.



(1) Press the “PROD” button.



(2) Press the Product Number button.

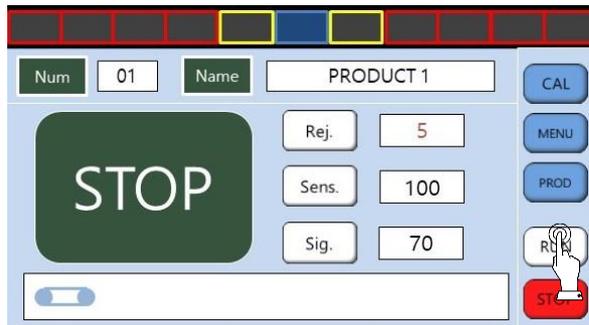


(3) Press the NEXT button to change the list of product numbers.

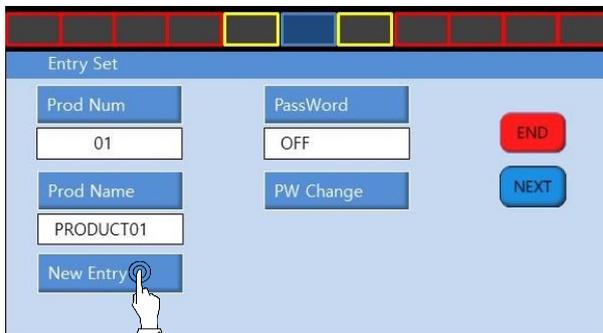
Select the product number to be changed and press the END button.

4-3. Deleting Existing Entry

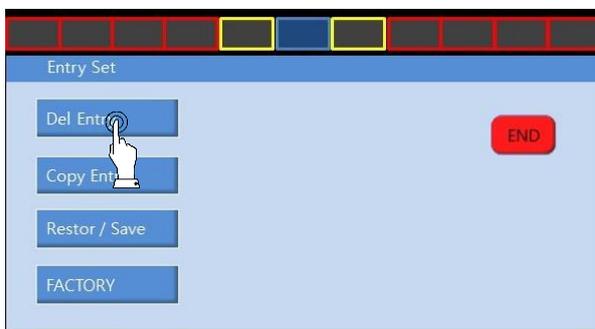
If an existing product becomes unnecessary, delete the entry as follows.



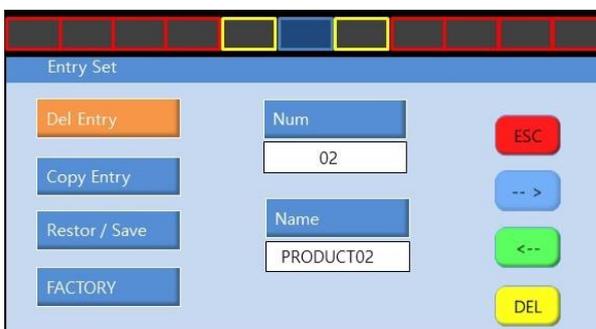
(1) Press the PROD button.



(2) Press the New Entry button.



(3) Press the Delete Entry button.

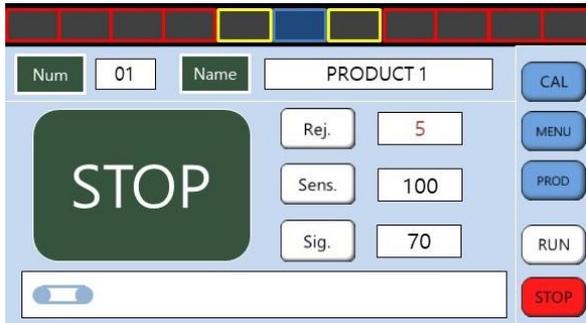


(4) Use <-->, --> buttons to select the product number to be deleted and press the "DEL" button.

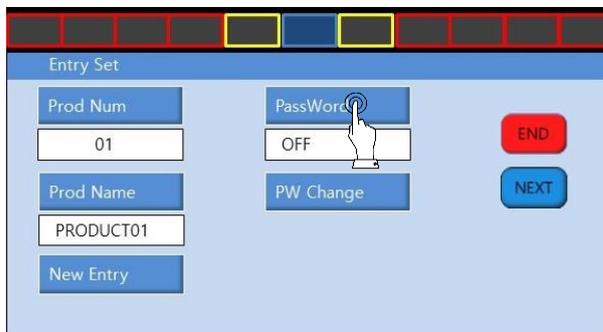
Product numbers in use cannot be deleted.

4-4. Setting Password

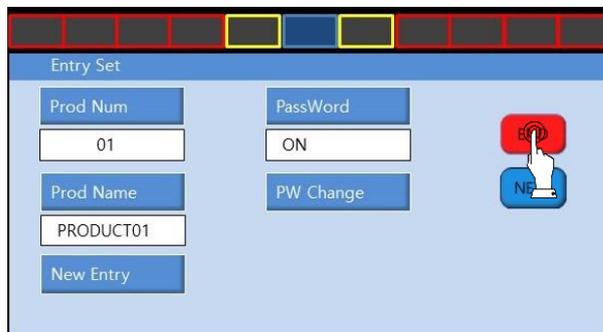
Enter password when changing the setting.



(1) Press the PROD button.



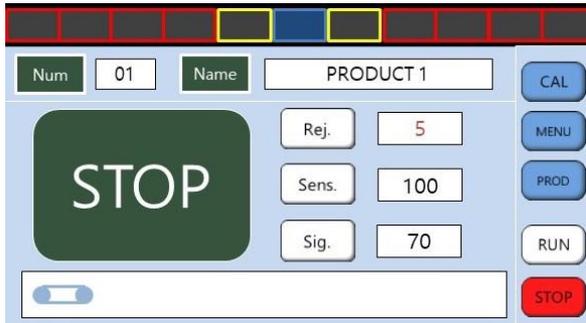
(2) Press the Password button.



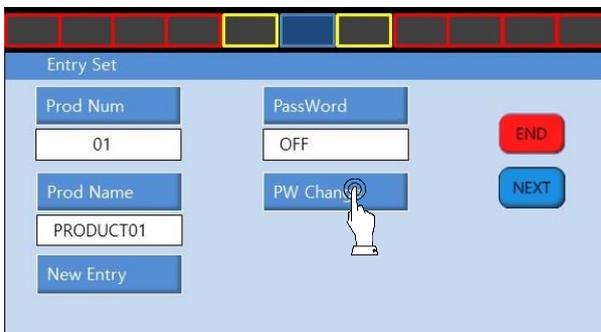
(3) Press the END button. You will be required to enter password when pressing other buttons.

4-5. Changing Password

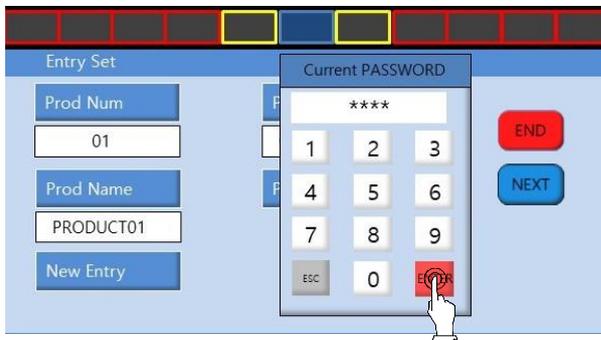
Change password.



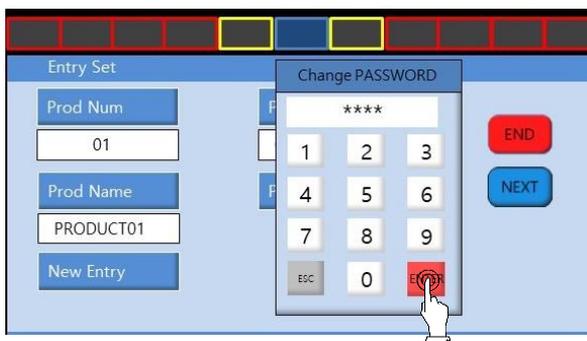
(1) Press the PROD button.



(2) Press the Password Change button.

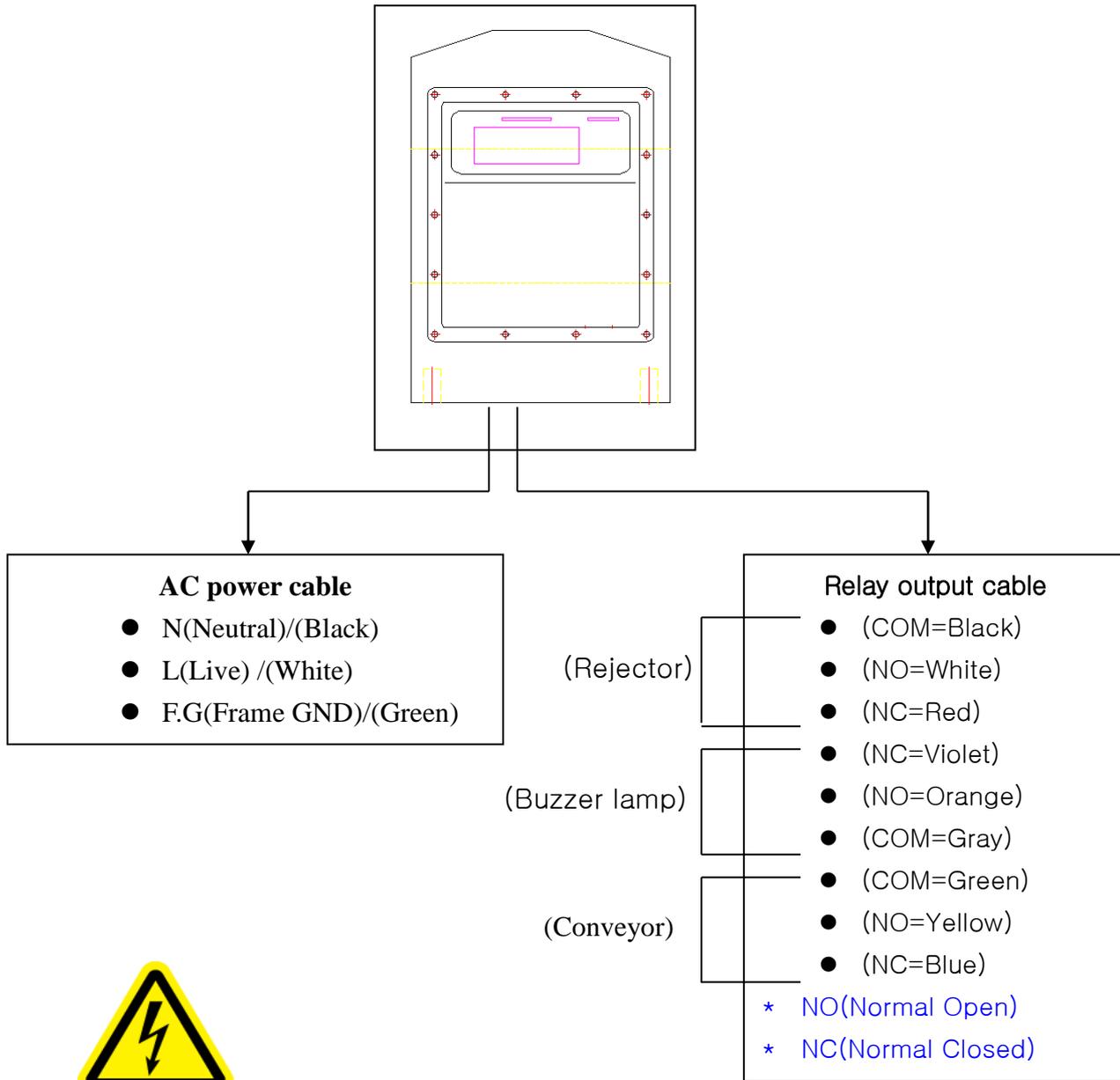


(3) Enter current password.
Press the ENTER button.



(4) Enter new password.
Press ENTER button to change password.

Chapter 5 Wiring Diagram



Caution

Make sure to check contact output using an electric tester before connecting an external device to the metal detector.

Since contact of this metal detector is directly connected to the main board, incorrect connection can lead to fatal damaging of the main board.

Chapter 6 Precautions During Maintenance



- 6-1 Since fine metal particles can cause malfunctioning of the metal detector, make sure to check proper operation of the conveyor without injecting products prior to work.
- 6-2 Before starting work, inject the test specimen supplied by our company to check operation of the metal detector.
- 6-3 When passing products, adjust the guide so that products do not touch the metal detector head.
- 6-4 Check positioning of the plastic washer for insulation.
Poor positioning of the washer can lead to malfunctioning.
- 6-5 When opening the front panel, be careful while removing bolts. Do not tighten bolts too hard when reassembling.
- 6-6 When cleaning the conveyor, wet a dry towel with alcohol.
- 6-7 Be careful not to touch the metal detector head with hands while moving the metal detector.
- 6-8 Contact our company if you have any questions during use.

Chapter 7 Part List

No.	Description	Quantity	Reference
1	Main Board Set	1 EA	Signal Input &Output
2	RTX Board Set	1 EA	TX Coil & RX Coil Input
3	Display Board Set	1 EA	Display Board
4	LCD Display Set	1 EA	800Dot X 480Dot
5	Power Supply Set	1 EA	DC 5V & DC 24V
6	20Pin Flat Cable	1 EA	Main Board
7	10Pin Flat Cable	1 EA	Main Board
8	3Pin TX Coil Cable	1 EA	RTX Board
9	3Pin RX Coil Cable	1 EA	RTX Board
10	Bolts	1 EA	Display Bolt

 Warning	<p>Our company is not responsible for malfunctioning and damaging of the equipment caused by remodeling of the metal detector or replacement of parts by a person not designated or entrusted by our company.</p>
 Caution	<p>Our company is not responsible for malfunctioning and damaging of the equipment caused by opening and closing of the front panel of the metal detector head by a person not designated or entrusted by our company.</p>

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