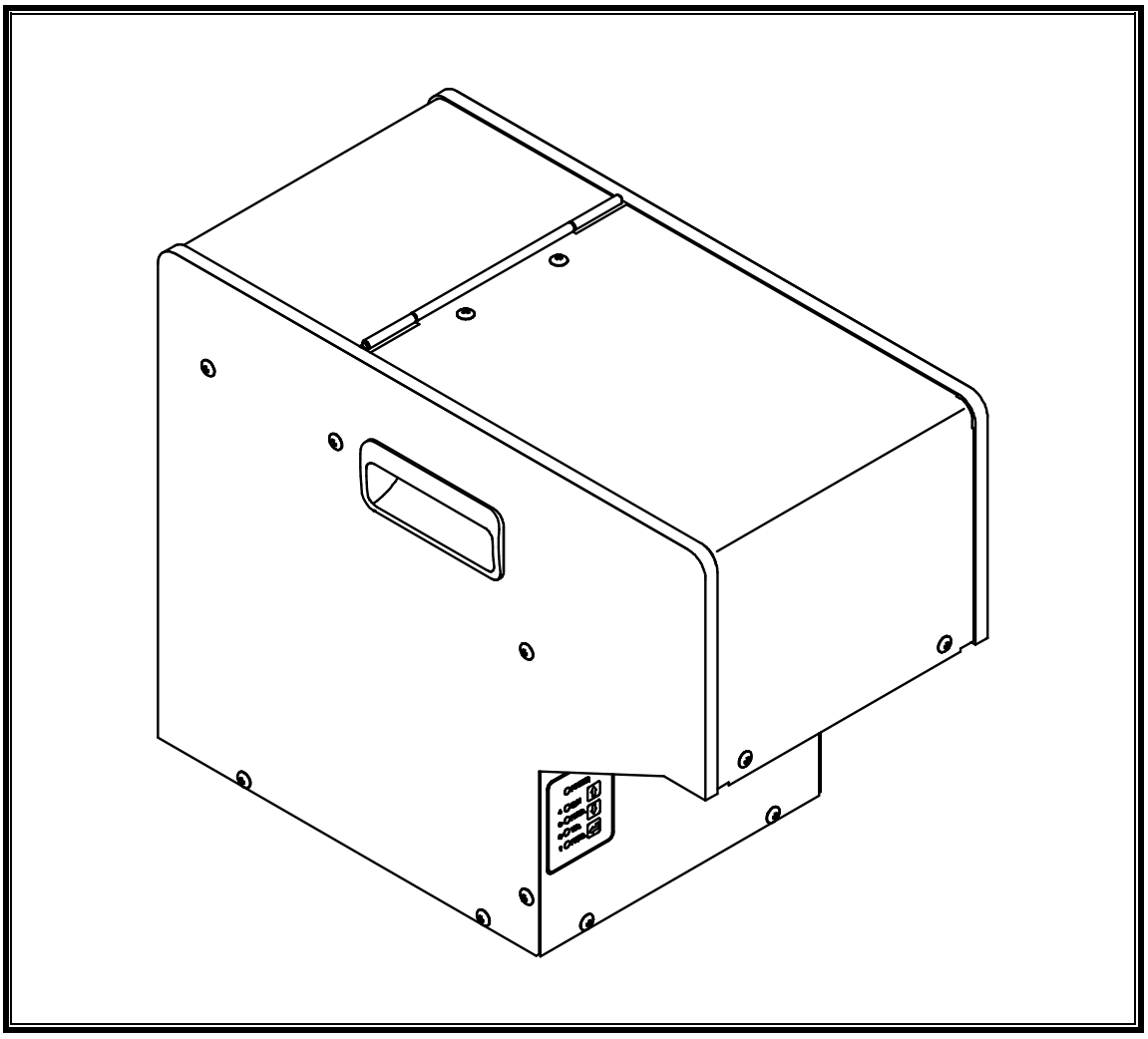
Vibratory Track Screw Feeder

FF/FM503H Ver2 Instruction Manual

(For system version 02.02、02.03)



FF503H type

Assembly Machine Division
NITTO SEIKO CO., LTD.

【Notes】

(1) All rights reserved.　No part of or whole of this may be reproduced, stored in a retrieval
system, or transmitted in any form or by any means without the prior written permission of Nitto Seiko Co., Ltd.

(2) By provision of operating manual recorded on CD-ROM, you shall be deemed to have agreed to the Terms and Conditions written in “readme.txt” on it.

(3) Contents of this manual are subject to update without notice according to specification change of the products.

(4) Unique nouns like the product name indicated in this brochure are registered or not registered trademark of each company.

◎ Preface

Thank you very much for your purchase of vibratory track screw feeder “FF/FM503H” (hereafter called “FF/FM503H”). This FF/FM503H screw feeder, allowing optimal alignment and feeding of screws depending on the type of screws, has characteristics shown below.

(1) It is applicable to main commercial supply voltage used worldwide.
(2) The intermediate plate type hopper is driven by the stepping motor, and the vibrator is controlled by the inverter unique to Nitto Seiko.

This FF/FM503H does not comply with the CE marking. If you want to purchase a CE-compliant machine, order the FF/FM503H-E that complies with the CE marking.

- **Keep this instruction manual for your later reference.**
  If you need to order a new instruction manual because, for example, you have lost this instruction manual, make a note of your machine serial number and contact our sales agent or your nearest sales office of Nitto Seiko Co., Ltd.

- **Specifications may be subject to alterations for improvement in the product without notice. The manual may also be subject to changes with the alteration without any notice.**

◎ Marks and pictographs used in this manual

DANGER **Inappropriate handling may lead to imminent serious accidents (death or serious injury).**

WARNING **Inappropriate handling may lead to serious accidents (death or serious injury).**

CAUTION **Inappropriate handling may lead to injury, physical damage, or damage to the product.**

☞ **References follow this mark.**

Meanings of pictographs

(Examples)

This pictograph means necessity of **paying attention**.

This pictograph **means don'ts**.

These pictographs **mean musts**.

◎ For safe use

Prior to use of this product (installation, connection, operation, maintenance, and inspection), fully read and understand the safety precautions shown below, and appropriately handle it with care. Note that it is very difficult to cover all the detailed precautions for safety by this manual only, and proper judgment on safety and actions taken by operators are very important for prevention of possible hazards.

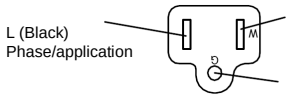
- **Always observe the instructions following the marks of ◇!DANGER, ⚠WARNING, and ⚠CAUTION.**
  Inappropriate installation, power supply, connection of earth, signal communication with outside, maintenance, or inspection may cause unexpected accidents, shorter service life, degraded performance, damage to product, or accidents leading to a loss of life or injuries, occasionally. Be sure to read this manual before usage for appropriate use.
  Serious accidents may occur even if instructions following the mark of ⚠CAUTION are not observed, depending on the situations. Always observe the instructions including very important information.

◇! DANGER

◇!DANGER **Always connect the earth cable led from the AC input power cable to the grounding electrode.**

Otherwise, fires, electric shocks, accidents, or faults may occur. Furthermore, we cannot guarantee the performance of the product.
Electric wires in the colors shown in the figure on the right are connected to the terminals of the AC input power cable plug. Thus, always connect the electric wires to the specified terminals when wiring on the side of receptacle to be prepared by customers.
If no plug is provided, be sure to connect the electric wires to the specified terminals according to the colors of wires shown in the figure on the right.

With plug (Only for 100 VAC in Japan)



(The colors shown above are those of the wires.)

Without plug

L (Brown) Phase/application
N (Pale blue) Neutral
PE (Yellow/Green) Earth

(The colors shown above are those of the wires.)

⚠ WARNING

⚠WARNING **DO NOT disassemble or modify the product.**

Otherwise, fires, electric shocks, or accidents may occur. If the product is disassembled or modified, we cannot take any responsibility for all the troubles, including degradation of performance, since the disassembled or modified product is out of our guaranteed coverage. Note that covers or safety shields are omitted in the figures in this manual for convenience of descriptions of details.

⚠WARNING **Shut down the power immediately if any fault is found in the machine.**

If any fault, including fume, abnormal odor and noise, is found in the machine, turn off the power switch first, then shut down the power supplied, and ask sales agent or your nearest sales office of Nitto Seiko Co., Ltd. for repair. Use of the faulty machine without repair may cause fires, electric shocks, or accidents.

⚠WARNING **DO NOT apply voltage out of specifications to this product.**

Otherwise, fires, electric shocks, accidents, or malfunctions may occur.

Input power voltage: Single phase, 100 to 240 VAC 50/60 Hz
Power capacity: max. 50 VA

⚠WARNING **Satisfy the conditions required for the operating environment.**

Otherwise, fires, electric shock, or faults may occur. Use this product at a 1000 m or less height in ordinary indoor environment, satisfying the conditions shown below.

- Free from corrosive or flammable gas
- The atmosphere is free from conductive powder, including iron powder.
- Well-ventilated and free from dusts
- No vibration or heat source is nearby placed.
- No fluid, including water, is splashed with the product.
- Free from soot
- The environmental temperature is within a range from 0 to 40°C.
- The relative humidity is within a range from 30 to 90% RH, free from freezing or dew condensation.
- No flammable is nearby placed.
- Easy to be checked or cleaned
- Free from strong electric or magnetic field

⚠WARNING **Always shut down the power source before providing or changing wiring.**

Otherwise, electric shocks (including residual voltage), accidents, or malfunctions may occur. NEVER touch any of the connecting terminals of the AC inlet installed on the back panel for at least one minute after the power supply is shut off.

⚠WARNING **Use the machine under the specified air pressure.**

Use of it under the air pressure exceeding the specified level may cause burst or breakdown of pneumatic equipment or jumping of a screw fed by compressed air, leading to injuries (if it hits your eye, you may lose your sight) or damage to peripheral equipment.

⚠WARNING **Do not look into the escapement unit or screw feeding hose inadvertently or direct them to anyone.**

Otherwise, a screw fed from the escapement unit or screw feeding hose by compressed air may jump off, leading to injuries (if it hits your eye, you may lose your sight) or damage to peripheral equipment.

⚠WARNING **When connecting the screw feeding hose, fix the both ends securely.**

If it comes off, a screw fed by compressed air may jump off from an end of the hose, leading to injuries (if it hits your eye, you may lose your sight) or damage to peripheral equipment.

⚠WARNING **Ensure that the power and air supply are shut down before maintenance or inspection of the machine.**

Before restarting it after a long interval, completely clean and check it, and perform test run to ensure that it is free from any fault.

Otherwise, electric shocks, accidents, or malfunctions may occur.

⚠WARNING **In principle, do not adjust the machine being energized with the cover removed.**

The machine is adjusted optimally at the factory before shipping.

Otherwise, fires, electric shocks, accidents, or malfunctions may occur.

If you adjust the machine with the cover removed by necessity and any trouble occurs, Nitto Seiko assumes no responsibility for it because it is not covered by our warranty.

(Note that the procedures for adjusting the machine with the cover removed described in “7.9. Adjustment of photoelectric sensor” to “7.14. Adjustment of clearance” are shown for convenience sake in order for you to understand the characteristics of the machine.)

⚠ CAUTION

⚠CAUTION **DO NOT touch any of moving parts while the machine is running.**
Otherwise, injuries or malfunctions may occur.

⚠CAUTION **Always use the connecting cables specified by us. When handing them, pay extreme attention.**
Carefully lay connecting cables to prevent them from being caught by your foot or pinched by a heavy object placed on it. DO NOT forcibly pull or twist them, but handle them carefully. Use of cables that are not specified by us or damaged or disconnected cables may cause fires, electric shocks, accidents, or malfunctions.

⚠CAUTION **Be sure to use the fuses designated by us.**
Otherwise, fires, electric shocks, accidents, or malfunctions may occur.

⚠CAUTION **When installing this product to a high place, provide measures against tipping and dropping.**
Otherwise, you may suffer from injuries, or the machine may be damaged or malfunctioned.

⚠CAUTION **DO NOT remove the rubber foot to fix the unit directly on a surface.**
Otherwise, the straightforward rail may not be vibrated enough to feed the screws properly.

◎ Check at arrival of delivered product

Check the following items when the product is delivered to you.

Items to be checked	Remarks
(1) Ensure that the correct product has been delivered to you.	Check the "Model" on the nameplate.
(2) Accessories • Ensure that the connecting cables are attached. • Ensure that the screw feeding hose is attached. • Ensure that the other accessories are attached.	a) Connecting cable (Refer to ☞ 2.2 Designations and models of connecting cables".) • AC input power cable: 1 (Because the model FF503H-AC●●●● varies depending on the specifications of the ordered machine, check if the correct cable is attached while referring to the separate part list.) • External I/O cable: 1 (Because the model FF503H-IC●● varies depending on the specifications of the ordered machine, check if the correct cable is attached while referring to the separate part list.) b) Screw feeding hose: 1 pc. (2 pcs. in the case of feeding 2 pcs.) (Because the number of hoses varies depending on the specifications of the ordered machine, check if the number of hoses is correct while referring to the separate part list.) c) Other accessories (Because the other accessories vary depending on the specifications of the ordered machine, check if the correct accessories are attached while referring to the separate part list. No tools are attached.)
(3) Ensure that all of the spares are attached.	Fuse: 2 pcs. (Refer to ☞ "2.3.2 Back face" and "12.1 Specifications".)
(4) Ensure that the machine is free from damages.	Check for damages occurred during transportation.
(5) Ensure that the covers are attached.	Ensure that all the covers shown in the figure below are attached.
(6) Ensure that screws are tightened.	Check for looseness of the screws indicated by arrows shown in the figure below with using a screwdriver.

Immediately contact the sales agent, for which you purchased the product, or your nearest sales office of Nitto Seiko Co., Ltd., if there is any fault in items to be checked from (1) to (6) above.

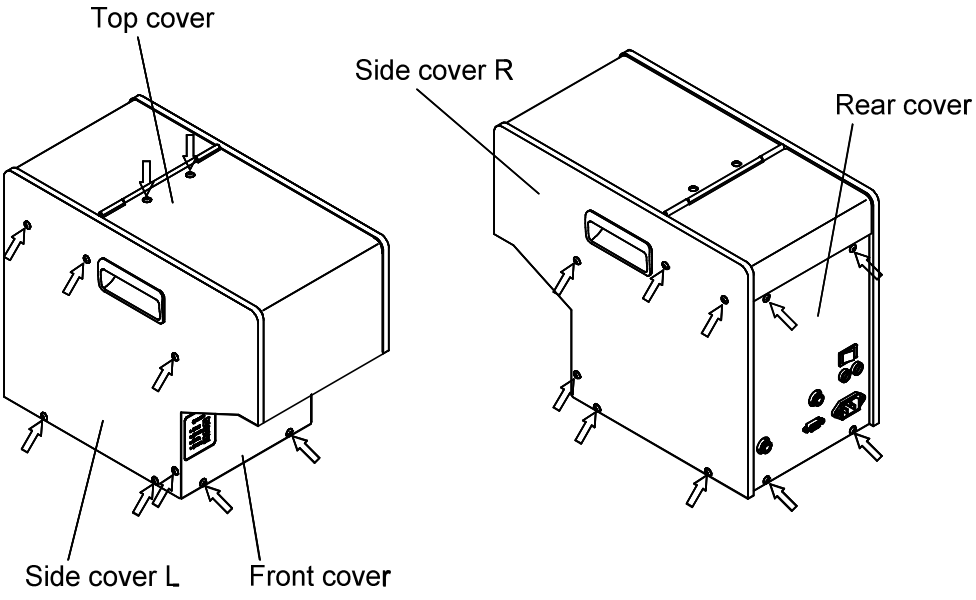


Fig.1

◎ Contents

1. Outline of FF/FM503H

1.1. Features of FF/FM503H

FF/FM503H automatically feeds screws as shown below before screw tightening operations.

(1) Screws loaded into the basket are scooped up by swaying of the hopper track driven by the stepping motor, and fed onto the track.
(2) The track is slightly and horizontally vibrated by the vibrator. Screws on the track are gradually moved by the slight vibration until they arrive at the escapement unit.
(3) After screws arrive at the escapement unit, the screw feeding solenoid valve is operated by the screw feeding signal from the outside, and they are fed to the chuck unit of the driver unit by compressed air through the screw feeding hose from the escapement unit.
(4) Screws fed to the chuck unit by compressed air are tightened until they are screwed into works.

1.2. Structure of FF/FM503H

The main structure of FF/FM503H is as shown in the figure below.

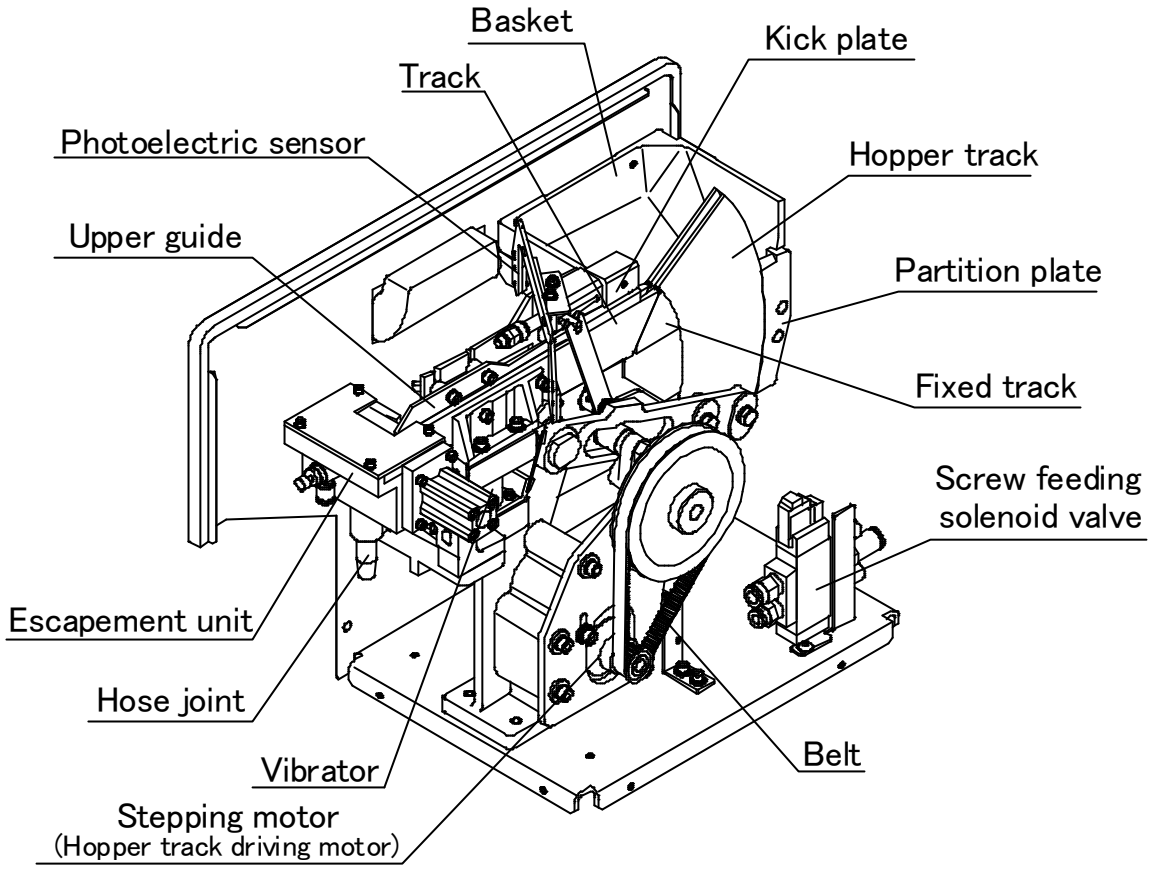


Fig.2

2. Types of FF/FM503H

2.1. Model

Models of the FF/FM503H are defined by substituting the specified symbols for (1) to (3) shown below.

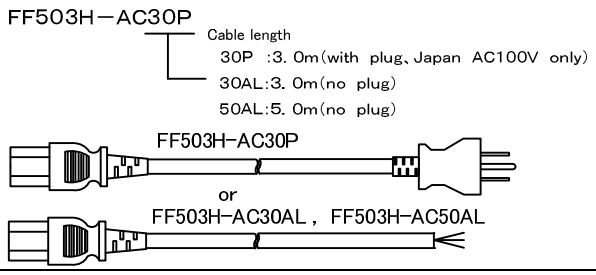
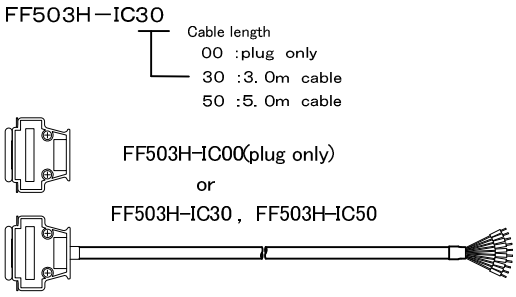
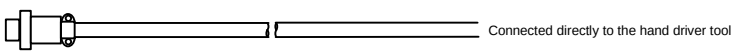
FF503H-(1)(2)(3): Automatic type (including screw taking-out type)

FM503H-(1)(2)(3): Hand driver type

Symbols	Details
(1)(2) Escapement unit type	
S1	4K20 (for feeding 1 pc. only)
D1	4G00 (for feeding 1 pc.)
D2	4G00 (for feeding 2 pcs.)
SP	Special
(3) External I/O type	
N	SINK (NPN) type
P	SOURCE (PNP) type
X	None

2.2. Designations and models of connecting cables

Three types of the dedicated connecting cables shown below are applicable to the FF/FM503H.

Designations	Models
(1) AC input power cable Dedicated cable to supply power to FF/FM503H (Standard accessory)	
(2) External I/O cable Dedicated cable to connect external controllers to FF/FM503H (Only the plug is provided as a standard accessory for the standard machine of automatic type. Plug with cable is optional.) (Both the plug and the plug with cable are optional for the hand driver type.)	
(3) Screw feeding signal cable It is a dedicated cable to be connected to the hand driver tool. (Hand driver type)	

2.3. Designations of components

2.3.1. Front face

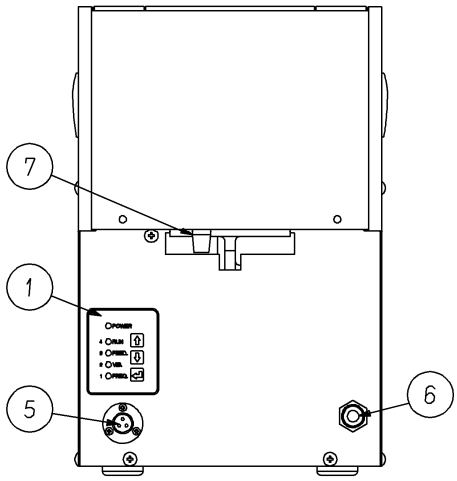
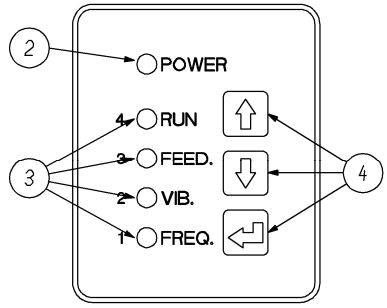


Fig.3



Setup panel detail drawing

Fig.4

(1) Setup panel
This panel is intended for indication of power ON and setup and display of modes and parameters.

(2) POWER LED
This LED lights up when the power is supplied. (Color: Green)

(3) Controller status LEDs
These LEDs indicate the status of controller. (Color: Orange) They indicate the setup statuses while the machine is in the setup or adjustment mode.
(For details, refer to ☞ “8. Setup procedures”.)

(4) Setup keys
Any intended functions or setup values could be selected with these keys while the machine is in the setup mode.
[▲]: UP key (Item number is increased by one, setup value is increased by one)
[▼]: DOWN key (Item number is decreased by one, setup value is decreased by one)
[↵]: ENTER key (Confirmation of item number or change in setup value)

(5) Screw feeding receptacle (3P) (CN FEED) (Hand driver type)
This receptacle is intended for connection of the screw feeding signal cable for the hand driver type. It is not provided for the automatic type.

(6) Air supply port for air driver (Hand driver type)
This air supply port is intended to supply air to the hand driver tool (air driver).

(7) Escapement unit
This unit feeds screws by compressed air.

2.3.2. Back face

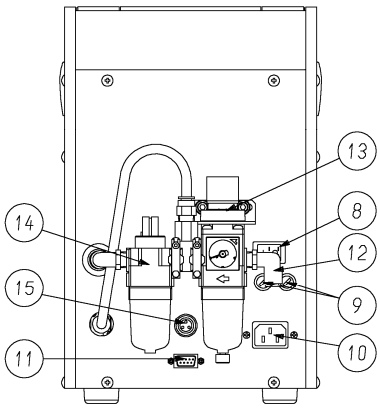


Fig.5

(8) Power switch (SW1)
This switch turns ON/OFF the FF/FM503H.

(9) Fuse (Contained in fuse holders FU2 and FU3)
0215004. MXP made by Littelfuse
(5 × 20 mm 250 VAC 4 A time lag type complying with RoHS)

(10) AC inlet (NF1)
Our specified AC input power cable should be connected to this inlet. Connect the plug of the AC input power cable to the specified receptacle. (For details, refer to ☞ “For safe use”.)

(11) External I/O receptacle (CN IO) (9P)
This receptacle is intended for connection of our specified external I/O plug (or external I/O cable) for automatic type. Connect the other end of the external I/O cable to the programmable logic controller (PLC) etc. stored in the separate external controller (to be prepared by customers). (This receptacle is not attached to the hand driver type. However, it can be attached optionally.)

(12) a. Air supply port (for the automatic type)
b. Air supply port (for the hand driver type or (13) attached optionally)
Connect the air tube with 8 mm outer diameter.

(13) Filter regulator
Set this regulator to the specified pressure. This filter regulator is not attached to the automatic type. However, it can be attached optionally.

(14) Lubricator
This lubricator supplies lubricating oil to the hand driver tool. It is not attached to the automatic type and the hand driver type of electric driver specification. However, the lubricator can be attached optionally.

(15) 3P receptacle for connecting SH300 (CN SH)
This is a 3P receptacle for connecting the optional rotary drum auxiliary hopper SH300.

3. Installation of FF/FM503H

3.1. Operating environment

> ⚠**WARNING** **Satisfy the conditions required for the operating environment.**
> Otherwise, fires, electric shocks, accidents, or malfunctions may occur.
> For the operating environment, refer to ☞ "Preface", ☞ "For safe use", and ☞ "12.1 Specifications".

3.2. Installation

Install the FF/FM503H on a solid and horizontal floor (or table) so that screws can be fed from the top face, setup can be carried out from the front face, and the power switch can be operated from the back face, for correct vibration to be performed for screw alignment (see the figure shown below). Installation of the machine onto the place where measures against vibration are provided or onto a slope may cause troubles in screw feeding. Provide some measures against tipping or dropping, if necessary.

> ⚠**CAUTION** **Do not remove the rubber foot to fix the unit directly on a surface.**
> Otherwise, the straightforward rail may not be vibrated enough to feed the screws properly.

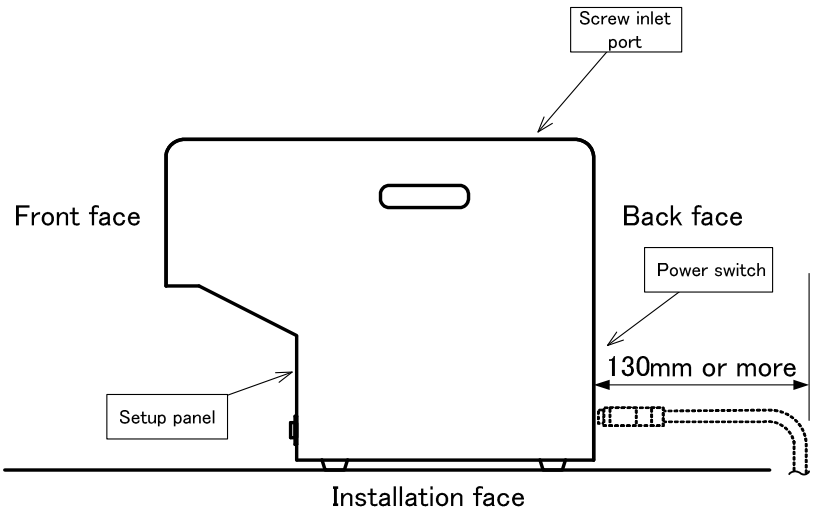


Fig.6

4. Preparation of operation

Before starting operation, make preparations as follows:

4.1. Connection of screw feeding hose

⚠WARNING **When connecting the screw feeding hose**

(1) Make sure that the air supply is shut down.

(2) Fix both ends securely.
If the screw feeding hose comes off with air being supplied, a screw fed by compressed air may jump off from an end of the hose, leading to injuries (if it hits your eye, you may lose your sight) or damage to equipment around the machine. To ensure safety, do not look into the screw feeding hose inadvertently or direct them to anyone.

(3) Take care not to have your hand or finger cut as a result of touching the edge of the hose connector or the edge face of the screw feeding hose.

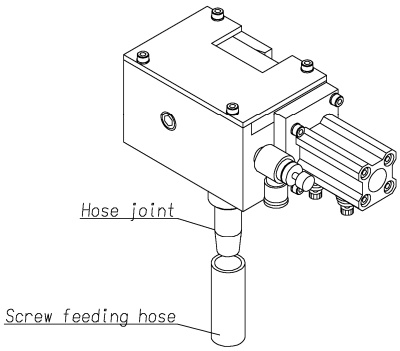


Fig.7

After inserting the screw feeding hose over the hose connector, be sure to clamp the hose with a hose band to prevent it from being disconnected.
If it is difficult to insert the hose, spread the end using a tapered tool.

4.2. Connection of connecting cable

⚠WARNING **Always connect the earth cable led from the AC input power cable to the grounding electrode.**
Otherwise, fires, electric shocks, accidents, or faults may occur. Furthermore, we cannot guarantee the performance of the product.
(Refer to ☞ “For safe use”.)

⚠WARNING **Do not apply a voltage out of specifications to this product.**
Otherwise, fires, electric shocks, accidents, or malfunctions may occur.

⚠WARNING **Always shut down the power source before providing or changing wiring.**
Otherwise, electric shocks (including residual voltage), accidents, or malfunctions may occur. Never touch any of the connecting terminals of the AC inlet installed on the back panel for at least one minute after the power supply is shut off.

⚠CAUTION **Always use the connecting cables specified by us. When handing them, pay extreme attention**.
Carefully lay connecting cables to prevent them from being caught by your foot or pinched by a heavy object placed on it. DO NOT forcibly pull or twist them, but handle them carefully. Use of cables that are not specified by us or damaged or disconnected cables may cause fires, electric shocks, accidents, or malfunctions.

Connect the cables to the FF/FM503H in the following procedure.

(1) Confirm that the power switch of the FF/FM503H is turned off.

(2) Connect the cables securely to the specified positions as shown below. Be sure to tighten the fixing screws if installed in the plugs.

(3) Customers should prepare the wiring at the receptacle side to which the AC input power cable plug is connected. Be sure to connect each cable to a specified terminal. Check again if the voltage supplied to the receptacle is as specified, if the power source capacity is sufficient and if the earth wire is connected to the grounding electrode. (Refer to ☞ "For safe use".)

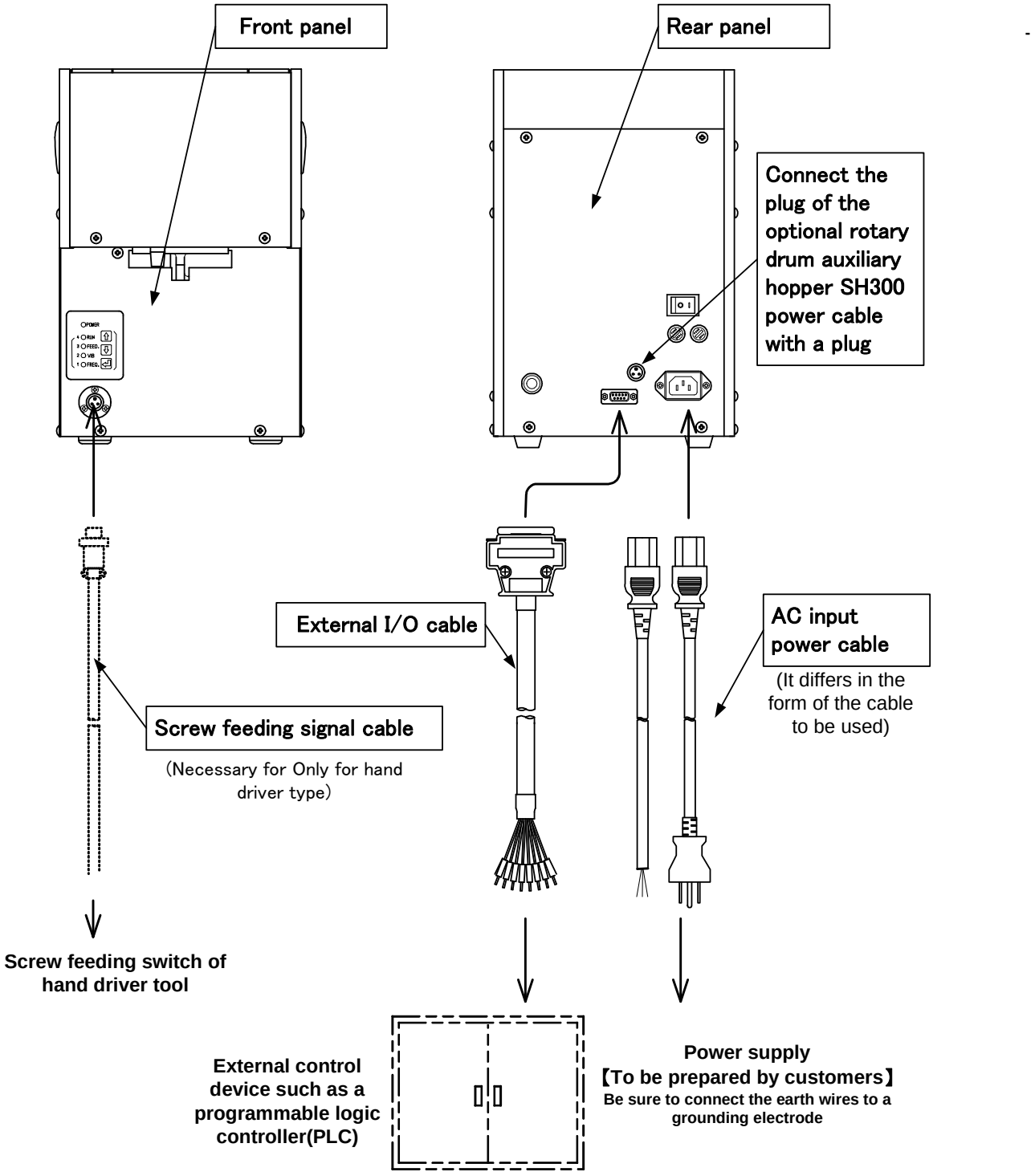


Fig.8

4.3. Air supply

WARNING **Use the machine under the specified air pressure.**
Use of it under the air pressure exceeding the specified level may cause burst or breakdown of pneumatic equipment or jumping of a screw fed by compressed air, leading to injuries (if it hits your eye, you may lose your sight) or damage to peripheral equipment.

4.3.1. When the filter regulator is installed

Connect the air supply line in the factory to the filter regulator on the rear surface of the FF/FM503H with an air tube of a diameter ϕ8. The air to be supplied should be clean at a pressure of 0.5–0.6 MPa.
After connecting the tube, rotate the pressure adjustment handle of the filter regulator so that the pressure gauge indicates 0.4–0.5 MPa.
(Refer to ☞ "7.1 Adjustment of air pressure".)

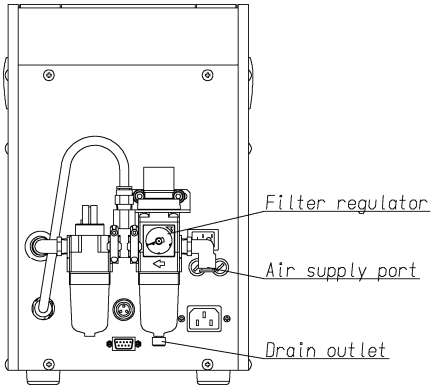


Fig.9

4.3.2. When the filter regulator is not installed

Connect the air supply line in the factory to the filter regulator on the rear surface of the FF/FM503H with an air tube of a diameter ϕ8. The air to be supplied should be clean at a pressure of 0.4–0.5 MPa.

Caution: If the amount of air becomes insufficient in the factory air supply line, a trouble with screw supply will happen. Ensure adequate amount of air supply. Furthermore, improve the air supply path if the pressure drops excessively during operation.

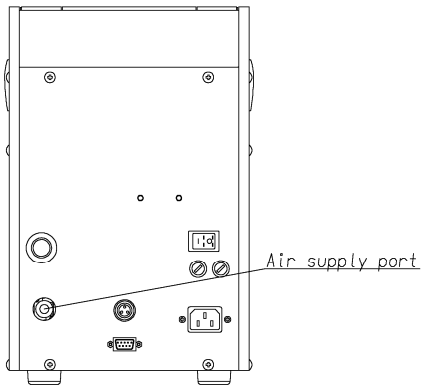


Fig.10

4.3.3. For hand driver type of air driver specification

In the case of the hand driver type of air driver specification, connect an air tube for hand driver tool (outer diameter ϕ8) to the air supply port for air driver on the front face of the FF/FM503H.

4.4. Loading screws

Opening the screw inlet cover, load the screws conforming to FF/FM503H specifications into the basket. Do not load the screws exceeding the height of the partition plate (red mark). Close the screw inlet cover after you have loaded the screws.

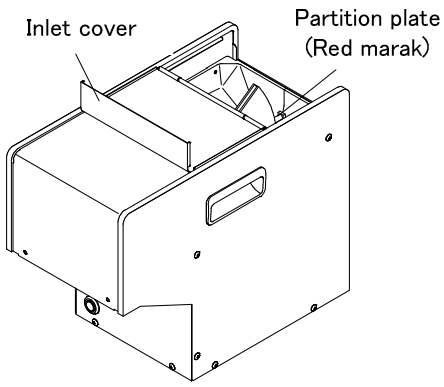


Fig.11

⚠CAUTION	**Precautions about the screws to be loaded into the basket** (1) Before loading the screws, be sure to check if they conform to the specification (size, head type, etc.) specified when the FF/FM503H was ordered. Otherwise, machine failures or incorrect feeding may happen. (2) Do not use used screws, magnetized screws, and screws contaminated with oil. Otherwise, machine failures or incorrect feeding may happen. (3) Do not load the screws in the basket exceeding the height of the partition plate upper surface (red mark). Otherwise, machine failures, jamming or incorrect feeding may happen. (4) Close the screw-inlet cover after loading the screws so as not to mix foreign materials into the screws. Otherwise, machine failures, jamming or incorrect feeding may happen.
⚠CAUTION	**Precautions in taking out the screws from the basket** Take care not to have your hand cut with iron powder etc.

4.5. Turning on power

⚠CAUTION	**Precautions in turning on the power switch** (1) To turn on the machine again after turning it off, be sure to wait for at least 5 seconds after the POWER LED (green) goes off before turning on the power switch. (2) Do not turn on/off the power many times in a short time. Otherwise, the useful time of the FF/FM503H may be reduced and failure may happen.

4.5.1. Checking of LED light

Turn on the power switch on the rear surface of the unit, and check that the LEDs light up as shown in (1)–(4) below:
(Refer to ☞ "2.3.1 Front face" and "8.1.1 Appearance of setup panel".)

(1) The POWER LED (green) lights up on the set up panel.
↓
(2) The LEDs from LED1 (=1○FREQ.) to LED4 (=4○RUN) light up in a flash.
↓
(3) The LEDs from LED1 (=1○FREQ.) to LED4 (=4○RUN) light up in sequence.
↓
(4) The above-mentioned LEDs from LED1 (=1○FREQ.) to LED4 (=4○RUN) go off once.
↓
(5) "LED4 (=4○RUN)" LED flashes. (On and off each for 0.1 sec)

4.5.2. Checking of operation

At the same time when the "LED4 (=4○RUN)" starts to blink, the FF/FM503H performs the following operations automatically.

(1) The screws loaded into the basket are scooped up by swaying of the hopper track driven by the stepping motor, and fed onto the track.
↓
(2) Since the above-mentioned track is slightly and horizontally vibrated by the vibrator, the screws on the track are gradually moved by the slight vibration until they arrive at the escapement unit.
↓

(3) After the first screw reaches the escapement unit and when the screws that follow are aligned along the track to the photoelectric sensor detection point, the hopper track stops swaying automatically.

4.6. Checking of screw feeding

After screws arrive at the escapement unit, the screw feeding solenoid valve is operated by the screw feeding signal from the outside, and they are fed to the chuck unit of the driver unit by compressed air through the screw feeding hose from the escapement unit. Attach a sensor to the screw feeding hose as necessary and check if the screws are fed to the chuck unit correctly by compressed air. We have adjusted the screw feeding to the specification. However, if a screw feeding failure happens, adjust the feeding. (Refer to ☞ "7.3 Adjustment of screw feeding time" and ☞ "7.4 Adjustment of screw feeding air flow rate".)

5. Start of operation

5.1. For automatic type (Type:FF503H)

In sync with the screw tightening operation, input a screw feeding signal from an external control device, such as a PLC, into the No. 7 pin of the FF/FM503H external I/O receptacle (CN IO). With this signal, the FF/FM503H starts to feed screws by compressed air.
If you use the machine of this type, you need to set the type setting parameter (Pa.E1) to "Automatic type" in advance. (For details of setup and adjustment mode, refer to ☞ "8.2.3 FF/FM503H Setup and adjustment mode function list".)

(Each machine is shipped from the factory with the parameters set in accordance with specified specification.)

5.2. For hand driver type (Type:FM503H)

Connect the screw feeding signal cable of the hand driver tool to the screw feeding receptacle (CN FEED) (hand driver type) of the FF/FM503H. When you tighten a screw with the hand driver tool (or when you expand/contract the driver unit), the built-in switch of the driver unit is activated to input a screw feeding signal to the FF/FM503H through the screw feeding receptacle (CN FEED) (hand driver type). With this signal, the FF/FM503H starts to feed screws to the driver unit automatically.
IF you use this type, you need to set the type setting parameter (Pa.E1) to either "Hand driver type (micro switch)" or "Hand driver type (reed switch)". (For details of setup and adjustment mode, refer to ☞ "8.2.3 FF/FM503H Setup and adjustment mode function list".)

(Each machine is shipped from the factory with the parameters set in accordance with specified specification.)

5.3. For screw taking-out type

The escapement unit of the screw taking-out type differs in construction from that of the standard type; it is equipped with a photoelectric sensor etc. in order to check whether there are screws in the taking-out position. If you want to purchase the taking-out type, order the FF503H of taking-out type.
If you use this screw taking-out type, you need to set the type setting parameter (Pa.E1) to "Screw taking-out type". (For details of setup and adjustment mode, refer to ☞ "8.2.3 FF/FM503H Setup and adjustment mode function list".)

(Each machine is shipped from the factory with the parameters set in accordance with specified specification.)

6. Explanation of operation

This chapter explains the operation of the major parts of the FF/FM503H. (Refer to ☞ "6.2 Operation time chart" described below.)

6.1. Operation of each part

The operations of major parts are shown as follows. The (Pa.**) in the explanation represents a parameter number that allows setting change or adjustment. For details of parameter setting, refer to ☞ "8. Setup procedures".

6.1.1. Hopper track

The hopper track starts swaying in a preset time (Pa.85) after the photoelectric sensor on the track is turned on (by the absence of screws), and stops swaying in a preset time (Pa.86) after the photoelectric sensor is turned off (by the presence of the screws).
If the swaying continues exceeding a preset time (2 minutes) with the photoelectric sensor staying ON, the machine enters an intermittent operation mode with predetermined intervals (Pa.88 and Pa.89, which are specified by the "Hopper track intermittent running ON time setting" and "Hopper track intermittent running OFF time setting" respectively. If the swaying continues further for a long time (about 2 hours), the machine enters a suspend mode assuming that there are no works (screws) in the basket. "LED4 (=4○RUN)" LED on the setup panel flashes at 1 second intervals. (Refer to ☞ "10.1 Malfunction".) To exit from the suspend mode, turn on the machine again or input the screw feeding signal.

6.1.2. Vibrator

The track vibrator starts vibration in a preset time (Pa.85) after the photoelectric sensor on the track is turned on (by the absence of screws), and stops vibration in a preset time (Pa.86) after the photoelectric sensor is turned off (by the presence of the screws).
Separately from the above-mentioned operation, this vibrator starts operation at the same time when the screw feeding solenoid valve is activated, and continues until a preset time (Pa.87) expires after the screw feeding solenoid valve stops. This is a preparation for next feeding.

6.1.3. Screw feeding

6.1.3.1. For automatic type

The screw feeding solenoid valve and the track driving vibrator (to be more precise, the screw feeding signal ON time + Pa.87 for the track driving vibrator) continue operations (irrespective of Pa.41) while a screw feeding signal is being input into the No. 7 pin of the external I/O receptacle (CN IO).

6.1.3.2. For hand driver type

With the screw feeding signal from the switch in the hand driver tool, the screw feeding solenoid valve and the track driving vibrator (to be more precise, Pa.41 + Pa.87 for the track driving vibrator) start operations for a preset time (Pa.41).

(1) For hand driver type (micro switch)
Such a contact is used for the screw feeding signal that turns ON during screw tightening operation. When this contact turns OFF → ON → OFF, the screw feeding starts and the screw feeding solenoid valves and the track driving vibrator (to be more precise, Pa.41 + Pa.87 for the track driving vibrator) operate for a preset time (Pa.41).

(2) For hand driver type (reed switch)
Such a contact is used for the screw feeding signal that turns ON during screw tightening. The screw feeding starts in a specific time (Pa.82) after this contact turns OFF → ON → OFF. The screw feeding solenoid valve and the track driving vibrator (to be more precise, Pa.41 + Pa.87 for the track driving vibrator) continue operations for a preset time (Pa.41).

6.1.4. Screw taking-out

6.1.4.1. For screw taking-out type

(1) In the case of the FF503H of screw taking-out type, the presence or absence of screws in the taking-out position is always monitored with the escapement unit photoelectric sensor.
↓
(2) When the operation enable input signal is output (ON) from the external control equipment to the FF503H with no screws existing in the taking-out position, the escapement unit operates to provide screws to the taking-out position.
↓
(3) When the preparation for screw taking-out is completed in the taking-out position, the FF503H outputs (ON) the taking-out enable output signal to the external control equipment.
↓
(4) The external control equipment receives this taking-out enable output signal and turns OFF the operation enable input signal to prevent the escapement unit of the FF503H from operating (interlock). Then, take out the screws with the external equipment.
↓
(5) When the screws have been taken out, because there are no screws in the taking-out position, repeat steps (2), (3) and (4) after making sure that the external equipment is out of the interference range.

6.2. Operation time chart

6.2.1. Screw feeding

The following figure shows the operations of major parts.

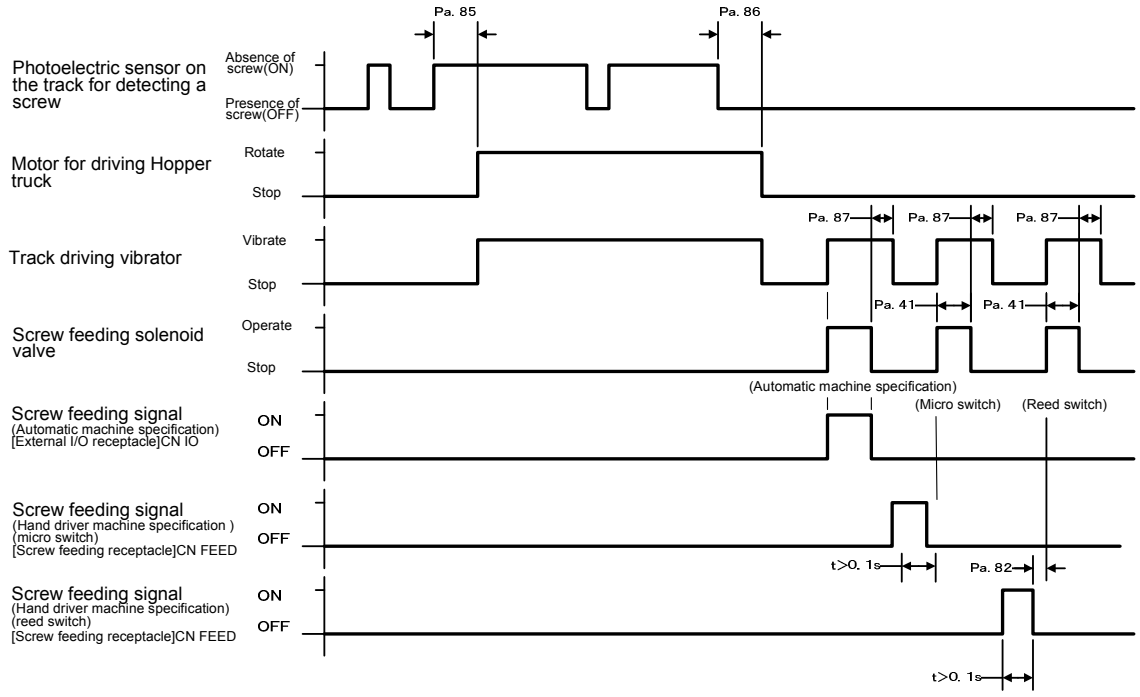


Fig.12

Caution: You can select only one type of screw feeding signal according to the specification.
If the hopper track driving motor continues swaying movement exceeding a preset time (2 minutes), the machine enters into an intermittent operation mode with intervals preset by “Hopper track intermittent running ON time setting (Pa.88)” and “Hopper track intermittent running OFF time setting (Pa.89)”. If the swaying movement continues further, the machine enters into a suspend mode assuming that there are no screws in the basket. In the suspend mode, “LED4 (=4○RUN)” LED on the setup panel flashes at 1 second intervals. (Refer to ☞ “10.1 Malfunction”.) To exit from the suspend mode, turn on the machine again or input the screw feeding signal.

6.2.2. Screw taking-out

The figure below shows the operation timing of the screw taking-out type.

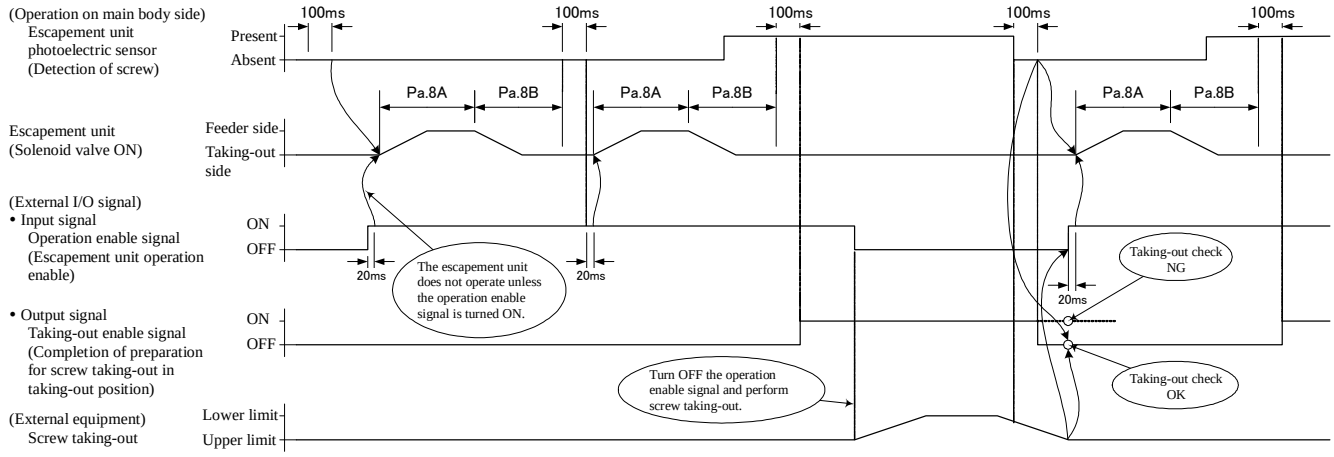


Fig.13

Caution: 1. Pa.8A and Pa.8B in the figure are operation parameter Nos. of the FF503H. Each of them can be adjusted within the range of 0.5 to 10.0 seconds.
2. The escapement unit does not operate unless the operation enable signal is turned ON.
In order to prevent interference, perform screw taking-out with the external equipment with the operation enable signal turned OFF to stop the escapement unit from operating.
3. To check the result of screw taking-out after taking out the screw with the external equipment, check at the time shown in the figure above if the taking-out enable signal is OFF.

7. Instructions on adjustment of each part

Although the parts of the machine have been adjusted optimally at the factory before shipment, you can adjust them again following the instructions described below. This chapter explains some major adjustment items. After adjusting the following items, be sure to tighten the set screws and carefully check the operation before starting to operate the part. The (Pa.**) in the instructions denotes a parameter number to be mentioned later that allows setting change or adjustment. For details of parameter setting, refer to ☞ “8. Setup procedures”.

7.1. Adjustment of air pressure (Applicable only when a filter regulator is installed)

This adjusts the pressure of the air supplied to the FF/FM503H. Raise the pressure adjustment handle of the filter regulator, on the rear surface of the FF/FM503H, to release the lock, and rotate the pressure adjustment handle to adjust the pressure. Adjust the air pressure in the increasing direction. After you have finished the adjustment, be sure to lower the pressure adjustment handle to lock it.

The air pressure adjusted here has effects on the ☞ "7.3 Adjustment of screw feeding time", ☞ "7.4 Adjustment of screw feeding air flow rate", and ☞ "7.5 Escapement unit left and right operation speeds adjustment". First start "Adjustment of air pressure".

<Relation between adjustment methods and results>

Pressure adjustment handle rotating direction	Air pressure
Rotate to the right	Increases
Rotate to the left	Decreases

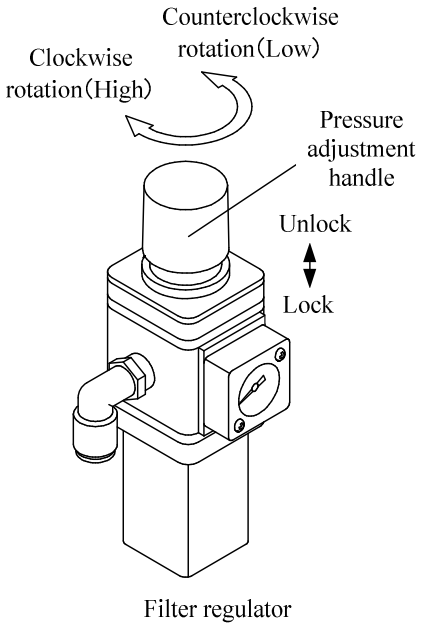


Fig.14

7.2. Lubricator oil drop adjustment (Applicable only when the lubricator is installed)

This adjusts the lubrication oil supplied to the hand driver tool (hand driver type of air driver type). Adjust the oil drops by rotating the adjusting dome of the lubricator on the rear surface of the FF/FM503H. The values on the dial (graduations) dose not represent the amount of oil drops, the values should be used as marks for reference after the adjustment.

<Relation between adjustment methods and results>

Adjusting dome rotating direction	Amount of drops
Rotate to the right	Decreases
Rotate to the left	Increases

Caution: Use Type I turbine oil (additive-free) **ISO VG32** for the lubricator.

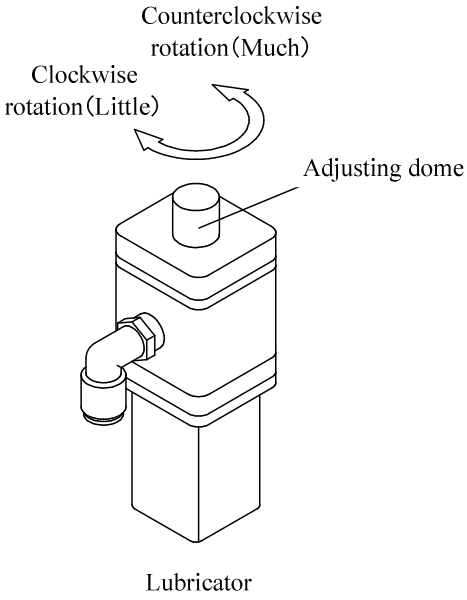


Fig.15

7.3. Adjustment of screw feeding time

This adjusts the operation time of the solenoid valve for feeding the screws. Adjust the time so that a screw at the FF/FM503H can reach the chuck unit of the driver unit. The screw feeding time is influenced by the screw size, air pressure, screw feeding air flow rate, and screw feeding hose diameter etc. For this reason, after adjusting the air pressure, set the feeding time to a little longer than a time necessary for the screws to reach the tip of the chuck unit, by feeding the screws actually. Since actual screw feeding time varies depending on the contamination inside the hose or the degree of wear, you should allow for some delay.

(1) For automatic type

Irrespective of the operation parameter setting “Screw feeding time setting (hand driver type) (Pa.41)”, screws are fed while the screw feeding signal is being input from the external I/O receptacle.
To adjust the time, use an external control device, such as a PLC.

(2) For hand driver type
To adjust the screw feeding time, change the operation parameter “Screw feeding time setting (hand driver type) (Pa.41)”. For how to change the parameter, refer to ☞ “8. Setup procedures”.

[1] For hand driver type (micro switch)
Such a contact is used for the screw driving signal that turns ON during screw tightening operation. When this contact turns OFF → ON → OFF, the screw feeding starts and the screw feeding solenoid valves and the track driving vibrator (to be more precise, Pa.41 + Pa.87 for the track driving vibrator) operate for a preset time (Pa.41).

[2] For hand driver type (reed switch)
Such a contact is used for the screw driving signal that turns ON during screw tightening operation. The screw feeding starts in a specific time (Pa.82) after this contact turns OFF → ON → OFF. The screw feeding solenoid valve and the track driving vibrator (to be more precise, Pa.41 + Pa.87 for the track driving vibrator) continue operations for a preset time (Pa.41).

7.4. Adjustment of screw feeding air flow rate

This adjusts the air flow rate at screw feeding operation. To adjust the flow rate, loosen the lock nut (as shown in the figure below) and rotate the speed controller (4K type) or the screw feeding air flow rate adjustment screw (4G type) according to the table below. The air flow rate is influenced by the screw size, air pressure, screw feeding time, and screw feeding hose diameter. For this reason, after adjusting the air pressure, you need to adjust the flow rate by actually feeding the screws. After the adjustment, be sure to tighten the lock nut.

> ⚠**CAUTION** **Be careful! If the amount of air flow is too large, the screw may be removed from the chuck unit and thrown away.**
> The screw thrown may cause an injury (You may lose your eyesight if it hits against your eye), or damage to peripheral devices.

<Relation between adjustment methods and results>

Rotating direction of the speed controller or screw feeding air flow rate adjustment screw	Screw feeding air flow rate
Rotate to the right. (Tightening direction)	Flow amount decreases. (Screw feeding time increases.)
Rotate to the left. (Loosening direction)	Flow amount increases. (Screw feeding time decreases.)

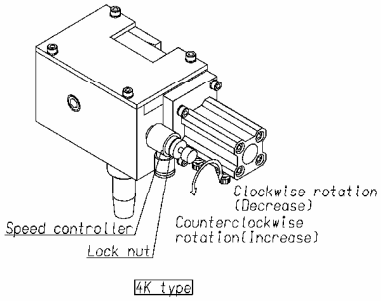


Fig.16

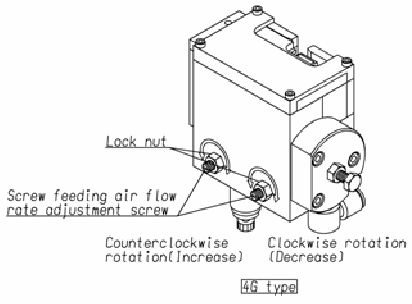


Fig.17

7.5. Escapement unit left and right operation speeds adjustment

This adjusts the left and right operation speeds of the escapement unit. To adjust the speeds, loosen the lock nut (as shown in the figure below) and rotate the speed controller (4K type) or the speed controller (or SpiCon bolt) (4G type) according to the table below. The left and right operation speeds are influenced by the air pressure and the screw feeding air flow rate etc. For this reason, after adjusting the air pressure, adjust the movement speeds by actually feeding the screws. After the adjustment, be sure to tighten the lock nut.

<Relation between adjustment methods and results>

Speed controller or SpiCon bolt rotating direction	Escapement unit left and right operation speeds
Rotate to the right (Tightening direction)	Decreases
Rotate to the left (Loosening direction)	Increases

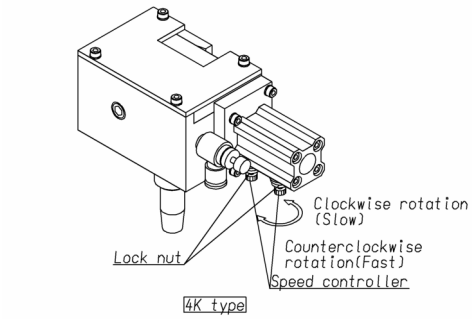


Fig.18

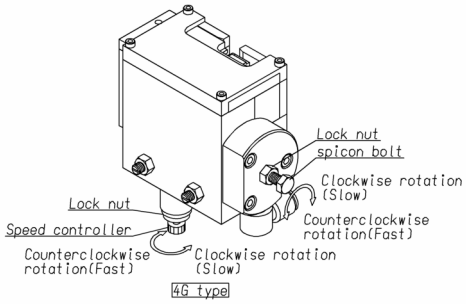


Fig.19

7.6. Adjustment of vibrator vibration frequency

This adjusts the speed of the screws traveling along the track.
The following figure shows an approximate relationship between the vibrator vibration frequency and the vibrator vibration strength.
Although the vibrator vibration strength is largest near the resonance frequency as shown in the figure. However, we recommend that the frequency be adjusted to a frequency a little higher than the resonance frequency for stable vibration. (See the range surrounded by the broken line in the figure.)
That is to say, find out a point at which the vibration becomes strongest by varying the frequency. Adjust the frequency to a value a little higher than the frequency of that point.
If the vibration becomes too strong during the vibrator vibration frequency adjustment operation, weaken the vibration by performing the vibrator vibration strength adjustment described in the next section, and adjust the vibrator vibration frequency again.
To adjust the vibrator vibration frequency, change the value of the operation parameter “Vibrator vibration frequency setting (Pa.11)”. For how to adjust the parameter, refer to ☞ “8. Setup procedures”.

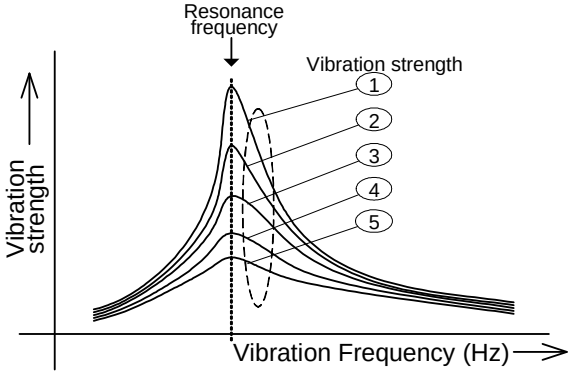


Fig.20

The figure to the left is a schematic diagram showing how the vibrator vibration strength changes as the vibration frequency varies with the strength set values being as parameters (5 types are shown).
(The resonance frequency is determined by mechanical factors, such as the track mass and the flat spring strength.)

7.7. Setting of vibrator vibration strength

This adjusts the speed of the screws traveling along the track.
After setting the vibrator vibration frequency by adjusting the "7.6 Adjustment of vibrator vibration frequency" in previous section, set the vibrator vibration strength in this section so that the screws can travel along the track smoothly.
To adjust the vibrator vibration strength, change the value of the operation parameter "Vibrator vibration strength setting (Pa.21)". For how to adjust the parameter, refer to ☞ "8. Setup procedures".
Do not set the strength too strong so that the screws move about on the track.
If the vibrator vibration strength is too strong, track may be worn earlier or a failure with the escapement unit may happen.

7.8. Adjustment of vibrator vibration time

In the escapement unit of the 2-piece feeding type, a screw is fed to the feeding unit after a previous screw has been fed. For this reason, the vibrator is required to vibrate for a certain time after a feeding operation completes. This section sets the vibration time.
To adjust the vibrator vibration time, change the value of the operation parameter "Vibrator vibration time setting (Pa.87) after screw feeding". For how to adjust the parameter, refer to ☞ "8. Setup procedures".

Caution: If the setting time is too short, a problem with screw feeding will happen.

7.9. Adjustment of photoelectric sensor

The photoelectric sensor is mounted on the top of the track. When the screws aligned on the track reach the detection position of the photoelectric sensor and the photoelectric sensor turns ON, the hopper track stops swaying and the vibrator stops vibrating automatically. When the number of screws on the track decreases as a result of screw tightening operations etc., the hopper track starts swaying and the vibrator starts vibrating automatically to supply screws in the basket onto the track. It is therefore necessary to position the photoelectric sensor properly in order to detect screws on the track.

(1) Sensitivity adjustment
Because the photoelectric sensor used is a sensor of built-in amp type, it is not necessary to adjust its sensitivity.

(2) Adjustment of mounting position
The photoelectric sensor whose mounting position is proper is shown in Fig.2 2 and Fig.2 3; the photoelectric sensor whose mounting position is improper is shown in Fig. 24, Fig.2 5 and Fig.2 6.
In the latter case, loosen screw A or screw B shown in Fig. 21 and adjust the mounting position of the photoelectric sensor properly.

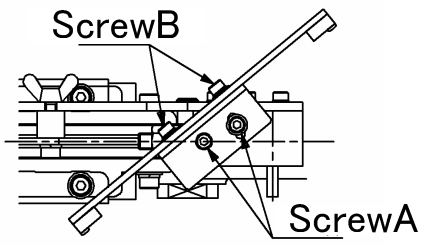
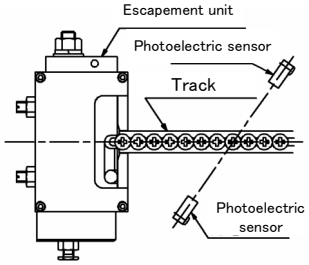
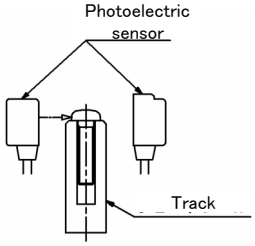


Fig. 21

Proper mounting position	
The optical axis of the photoelectric sensor is in a position that allows it to detect the head of a screw properly.	
 Fig. 22	 Fig. 23

Improper mounting position		
The optical axis of the photoelectric sensor is not in a position that allows it to detect the head of a screw properly.		
The optical axis passes between screws.	The position of the optical axis is too high.	The position of the optical axis is too low.

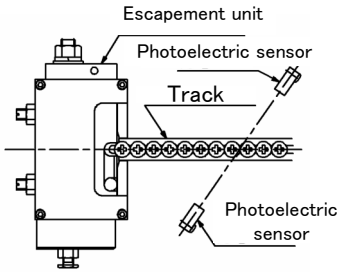
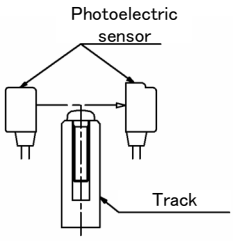
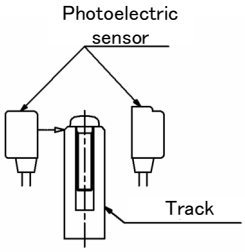

		

Fig. 24	Fig. 25	Fig. 26

7.10. Adjustment of hopper track, fixed track and track

In order for the hopper track to scoop up screws out of the basket and feed them onto the track smoothly, it is necessary to position the hopper track, fixed track and track properly.

(1) Relation between top dead center of hopper track and height of track

A proper relation between the top dead center of the hopper track and the height of the track is shown in Fig. 28; an improper relation between them is shown in Fig. 9 and Fig. 10. In the latter case, loosen screw C shown in Fig. 27 and adjust the top dead center of the hopper track properly.

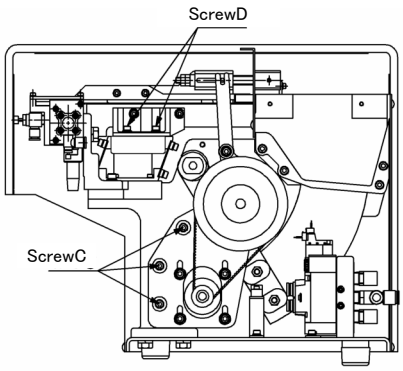


Fig. 27

Proper mounting position	Improper mounting position	
There is a proper level difference between the top dead center of the hopper track and the track.	Screws are not fed smoothly because the top dead center of the hopper track is too high.	Screws are not fed because the top dead center of the hopper track is too low.

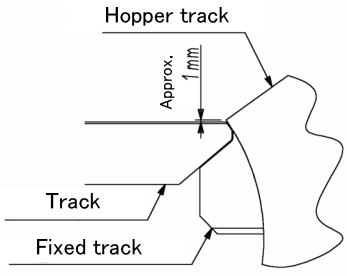
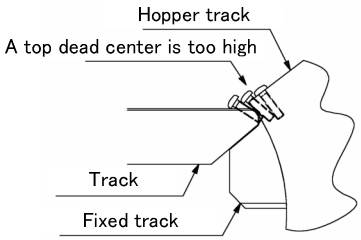
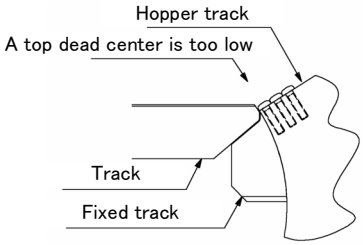
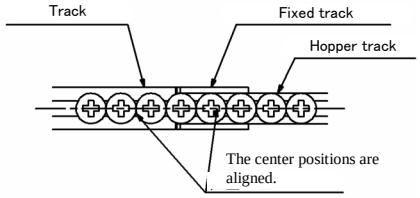
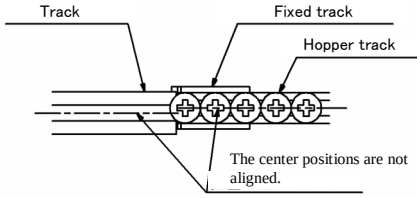

		

Fig. 28	Fig. 29	Fig. 30

(2) Relation between center positions of grooves in hopper track, fixed track and track
A proper relation between the center positions of the grooves in the hopper track, fixed track and track is shown in Fig. 31; an improper relation between them is shown in Fig. 32. In the latter case, loosen screw D shown in Fig. 27 and adjust the center positions of the grooves properly.

Proper mounting position	Improper mounting position
The center positions of the grooves in the hopper track, fixed track and track are aligned.	Screws are not fed because the center positions of the grooves in the hopper track, fixed track and track are not aligned.
 Fig. 31	 Fig. 32

7.11. Adjustment of kick plate

The kick plate serves as a gate that allows only aligned screws to pass on the track. If screws turned sideways are fed onto the track or screws aligned properly by the hopper track are not fed onto the track, adjust the height of the kick plate while referring to Fig. 33.

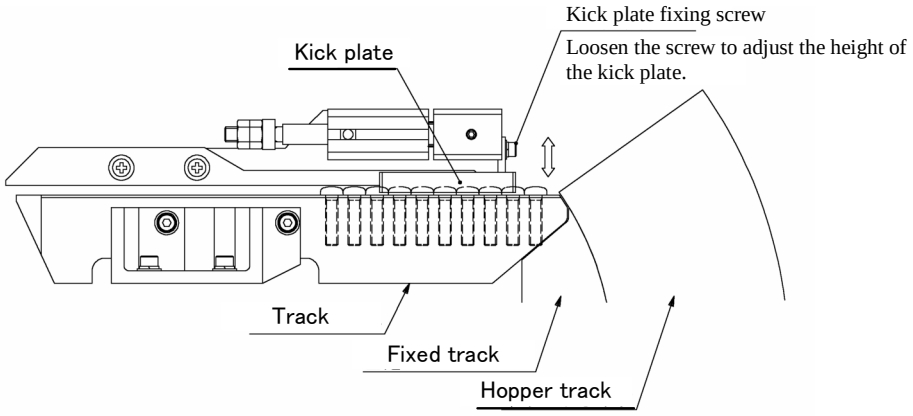


Fig. 33

7.12. Adjustment of track and upper guide

In order to transfer screws on the track toward the escapement unit smoothly, it is necessary to position the upper guide properly. A proper relation between the track and upper guide is shown in Fig. 35; an improper relation between them is shown in Fig. 36 and Fig. 37. In the latter case, loosen screw E shown in Fig. 34 and adjust the relation properly.

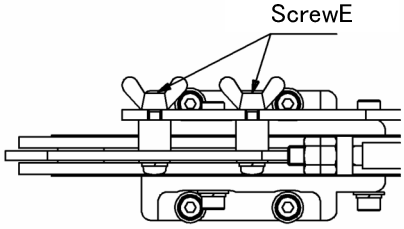
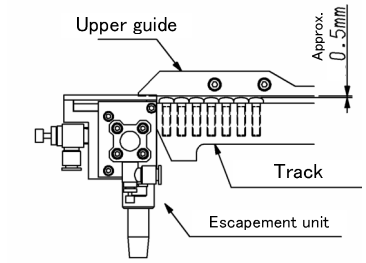
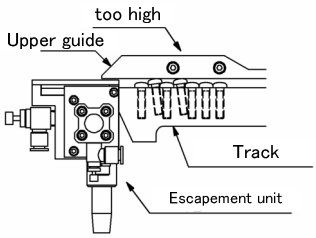
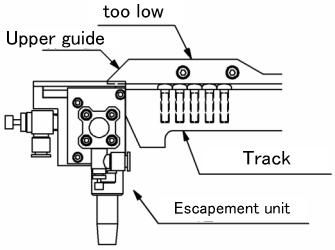


Fig. 34

Proper mounting position	Improper mounting position	
There is a proper clearance between the head of a screw and the lower surface of the upper guide.	Screws are not fed as a result of overlapping each other because the mounting position of the upper guide is too high.	Screws are not fed as a result of their heads touching the upper guide because the mounting position of the upper guide is too low.
 Fig. 35	 Fig. 36	 Fig. 37

7.13. Adjustment of track and escapement unit

In order to feed screws aligned on the track into the escapement unit smoothly, it is necessary to position the track and the screw receiving plate in the escapement unit properly.

(1) Relation between track and height of receiving plate
A proper relation between the track and the height of the screw receiving plate is shown in Fig. 39; an improper relation between them is shown in Fig. 40 and Fig. 41. In the latter case, loosen screw F shown in Fig. 38 and adjust the relation properly.

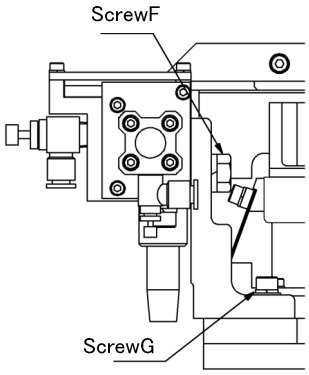
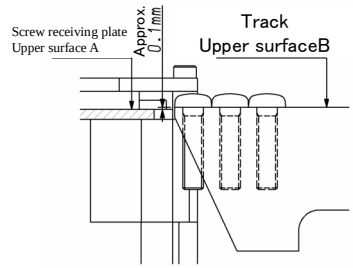
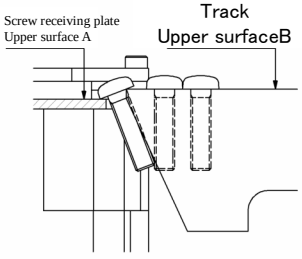
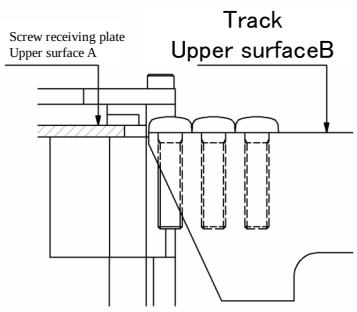
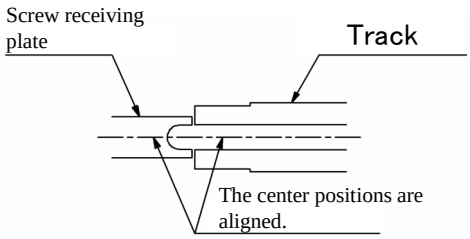
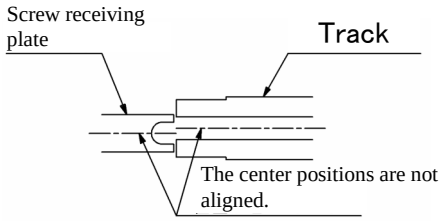


Fig. 38

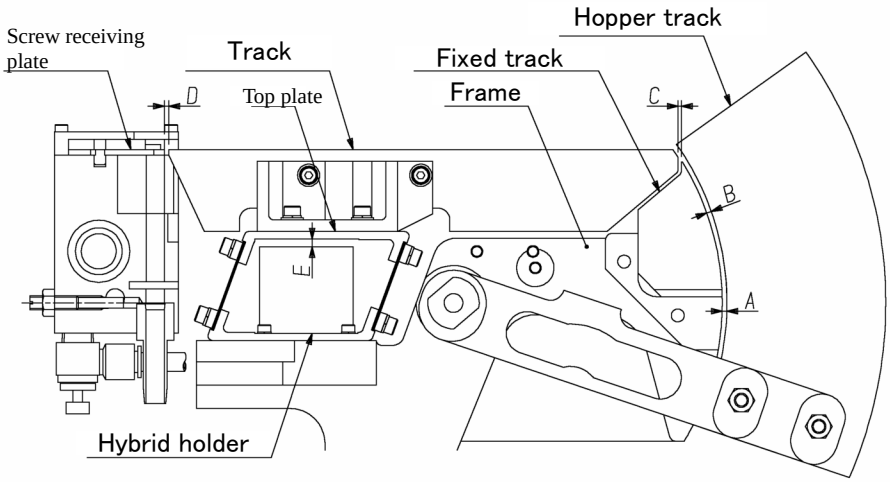
Proper mounting position	Improper mounting position	
There is a proper level difference between the track and the screw receiving plate.	Screws are not fed smoothly because the position of the screw receiving plate is too low as compared with the track.	Screws are not fed because the position of the screw receiving plate is too high as compared with the track.
Surface A should be lower than surface B by about 0.1 mm.  Fig. 39	 Fig. 40	 Fig. 41

(2) Relation between center positions of grooves in track and screw receiving plate
A proper relation between the center positions of the grooves in the track and screw receiving plate is shown in Fig. 42; an improper relation between them is shown in Fig. 43. In the latter case, loosen screw G shown in Fig. 38 and adjust the center positions of the grooves properly.

Proper mounting position	Improper mounting position
The center positions of the grooves in the track and screw receiving plate are aligned.	Screws are not fed because the center positions of the grooves in the track and screw receiving plate are not aligned.
 Fig. 42	 Fig. 43

7.14. Adjustment of clearance

The track is vibrated horizontally by the vibrator and this vibration moves screws little by little on the track and sends them to the escapement unit. In order for the track to vibrate properly, it is therefore important for the proper clearances between the sections shown in Fig. 44. If the track does not vibrate properly, adjust the clearances between these sections while referring to Fig. 44 and Table 1.



This figure is partially exaggerated for purposes of illustration.
Fig. 44

Table 1. Standard clearances

Symbol	Location	Clearance [mm]
A	Clearance between frame and hopper track	0.1
B	Clearance between hopper track and fixed track	0.1
C	Clearance between fixed track and track	0.4
D	Clearance between track and screw receiving plate	0.6
E	Clearance between hybrid holder and top plate	0.3

Cautions: The clearances shown in the table above are standard values.
It is necessary to make adjustments depending on the shape of a screw and the vibration, frequency, vibration strength, etc. of the vibrator.

8. Setup procedures

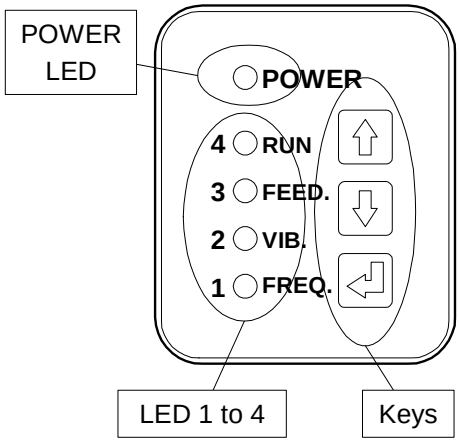
> ⚠**CAUTION** **Setup and adjustment works described in this section have direct influence on the operation of FF/FM503H.**
> Even if change in the setup is within the range setup and adjustment are possible, correct operation is disabled unless the setup and adjustment is appropriate. Fully understand the functions before the setup and adjustment.
> Functions of FF/FM503H are limited in the setup and adjustment mode. In such a status, screw feeding may not be carried out correctly.

All the parameters have been setup optimally before delivery. When readjustment is required, operate the setup panel as shown below.

8.1. Setup panel

8.1.1. Appearance of setup panel

Appearance of setup panel is as shown in the figure on the right side.



8.1.2. Functions of setup keys

Functions of setup keys on the setup panel are as shown in the table below.

Keys	Designations	Functions
⇧	UP key	• Setup item number can be selected (item number is increased by one) • Setup value of selected item can be changed (setup value is increased by a step)
⇩	DOWN key	• Setup item number can be selected (item number is decreased by one) • Setup value of selected item can be changed (setup value is decreased by a step)
↵	ENTER key	• Selected item number can be confirmed. • Altered setup value can be confirmed.

8.1.3. Indication by LEDs

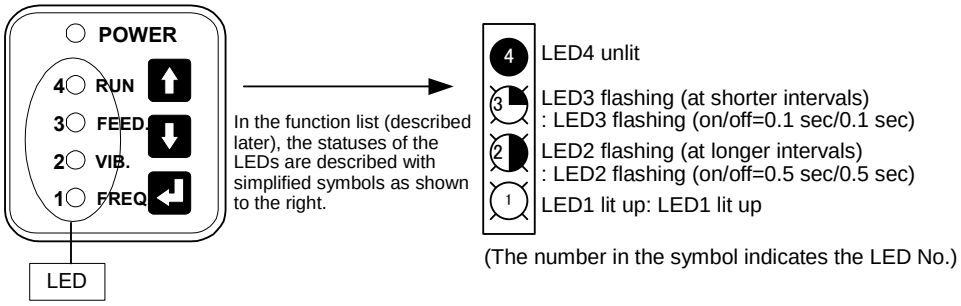
Details of statuses indicated by LEDs on the setup panel are as shown in the table below.

Indications	Display color	Functions
POWER	Green	• It is lit up when power is turned ON.
4○RUN (=LED4)	Orange	• It is lit up during running of the machine. • It is lit up when fault occurs. (Note 1) • It is lit up while the machine is in the setup mode. (Note 2)
3○FEED. (=LED3)	Orange	• It is lit up while the screw feeding time (hand driver type) is set up. • It is lit up while the machine is in the setup mode. (Note 2)
2○VIB. (=LED2)	Orange	• It is lit up when the vibrator vibration strength is set up. • It is lit up while the machine is in the setup mode. (Note 2)
1○FREQ. (=LED1)	Orange	• It is lit up when the vibrator vibration frequency is set up. • It is lit up while the machine is in the setup mode. (Note 2)

Note 1: Refer to ☞ “10.1 Malfunction”.

Note 2: Refer to ☞ “8.2 Setup and adjustment procedures”.

In the setup and adjustment mode, as shown in the figure below, the combination of 4 statuses (lit up, flashing at longer intervals, flashing at shorter intervals, unlit) of the 4 LEDs of LED1 (=1○FREQ.) to LED4 (=4○RUN) on the setup panel is changed with the key for setup and adjustment. (Hereinafter the statuses of the LEDs are described with simplified symbols.)



(Example)

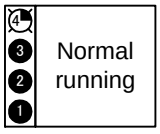
The figure shown to the right indicates that the statuses of the LEDs in the “Normal running” mode are as follows.

LED4: LED4 flashing (at shorter intervals) (on/off=0.1 sec/0.1 sec)

3: LED3 unlit

2: LED2 unlit

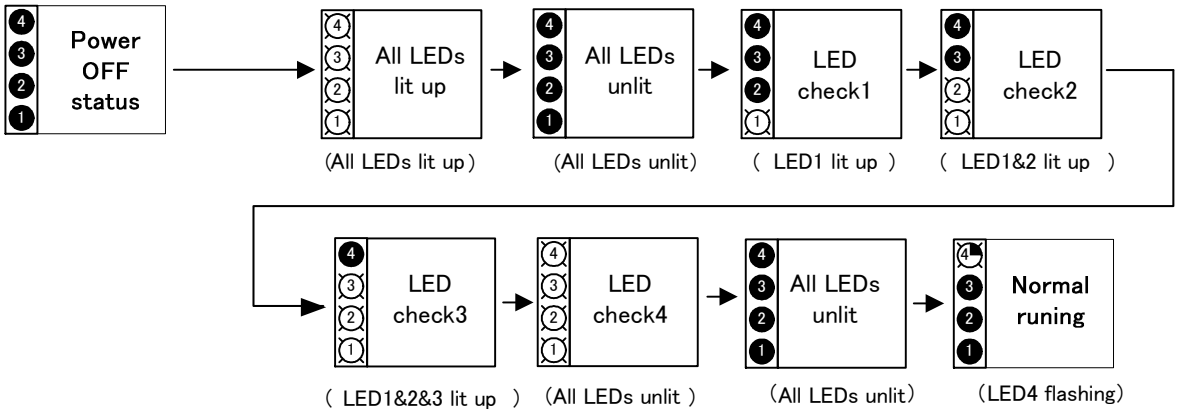
LED1: LED1 unlit



8.2. Setup and adjustment procedures

8.2.1. Before setup

When power is supplied, the POWER LED (Green) on the setup panel is lit up. Then, statuses of the LEDs from LED1 (=1○FREQ.) to LED4 (=4○RUN) are changed as shown below. Ensure that the normal running indication status is restored.



- When the machine starts normal running, components of FF/FM503H start operation.
- Make sure that the normal running indication status is restored, and then, carry out setup and adjustment.
- Ensure that all the LEDs are lit up in the LED check 4 status. If any LED is faulty, correct indication during setup or adjustment work is disabled.

8.2.2. Outline of operation in setup and adjustment mode

For details of the setup and adjustment mode, refer to ☞ "8.2.3 FF/FM503H Setup and adjustment mode function list".

Outline of operation is as shown below.

1) Entering setup and adjustment mode
   When the "↲" key is pressed for three seconds during normal running indication status, the machine enters the setup and adjustment mode.
   (The "LED1" flashes, and any intended vibrator vibration frequency setup item can be selected.)
2) Operations in setup and adjustment mode
   (1) It is possible to move to and fro in arrow directions freely inside the table. First, move between setup and adjustment items using "↑" "↓" keys. Confirm a selected item for setup and adjustment using "↲" key. If you selected an item that has only one arrow symbol by mistake and if you wish to move back to a previous item, exit the setup and adjustment mode before starting item selection again.
   (2) After confirming that an intended setup and adjustment item has been selected, increase and decrease the setting value using "↑" and "↓" keys. Confirm the setting value using "↲" key, and then return to the item selection status in arrow direction.
3) Exiting setup and adjustment mode
   Performing either of the following makes the normal running indication appear again.
   (1) Turning OFF the power and then turning it ON again
   (2) Operating no key for 60 seconds or more

8.2.3. FF/FM503H Setup and adjustment mode function list

FF/FM503H-E Setup and adjustment mode function list (1/4)

The keys and LEDs on the setup panel are used to perform setup and adjustment operation, and to indicate the result of checking.

[1] Entering into setup and adjustment mode

Setup mode is entered when the "↵" key is pressed and held down for 3 seconds or more during "Normal running" status indication.

[2] Operations in setup and adjustment mode

Selecting setup and adjustment items

It is possible to move in arrow directions freely. First, move between setup and adjustment items using "↑" "↓"keys. Confirm a selected item for setup and adjustment using "↵" key. If you selected an item that has only one arrow symbol by mistake and if you wish to move back to a previous item, exit the setup and adjustment mode before starting item selection again.

Setup and adjustment

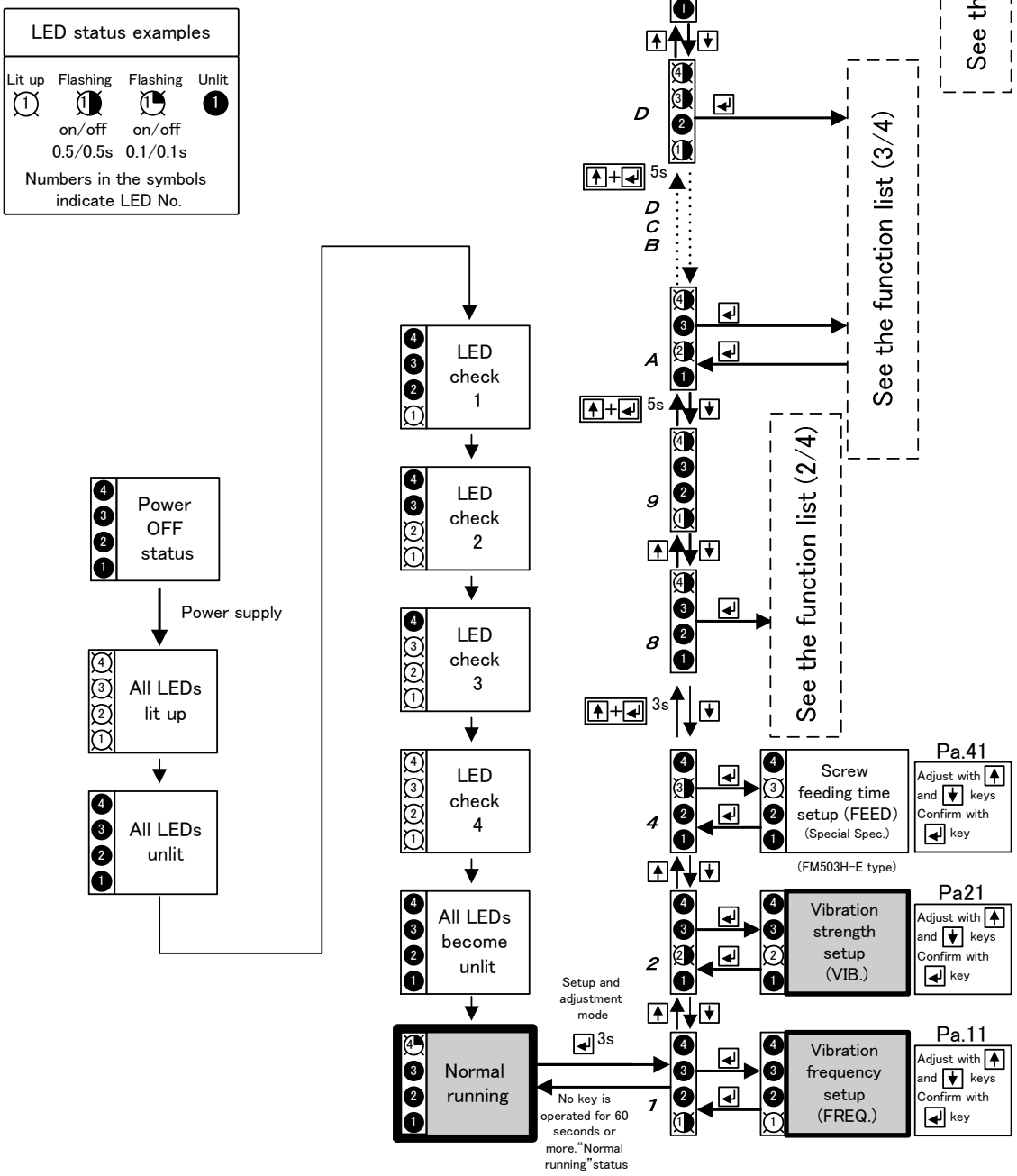
After confirming that an intended setup and adjustment item has been selected, increase and decrease the setting value using "↑" and "↓" keys. Confirm the setting value using "↵" key, and then return to the item selection status in arrow direction.

[3] Key operation in setup and adjustment mode

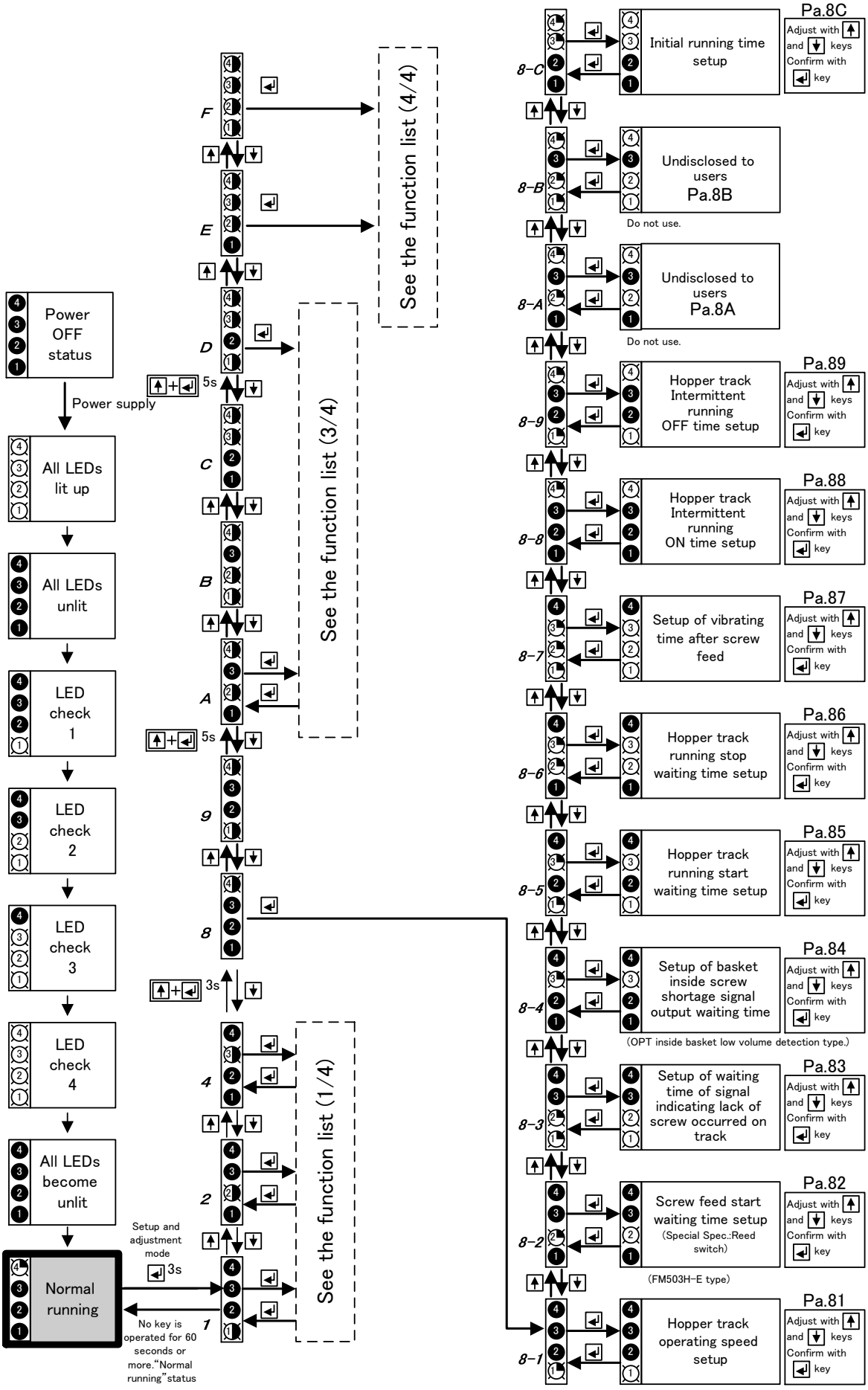
" ↑+↵ 3s " and " ↑+↵ 5s " denote that "↑" key is pressed for a specified time (seconds) while "↵" key is pressed and held down.

[4] Exiting setup and adjustment mode

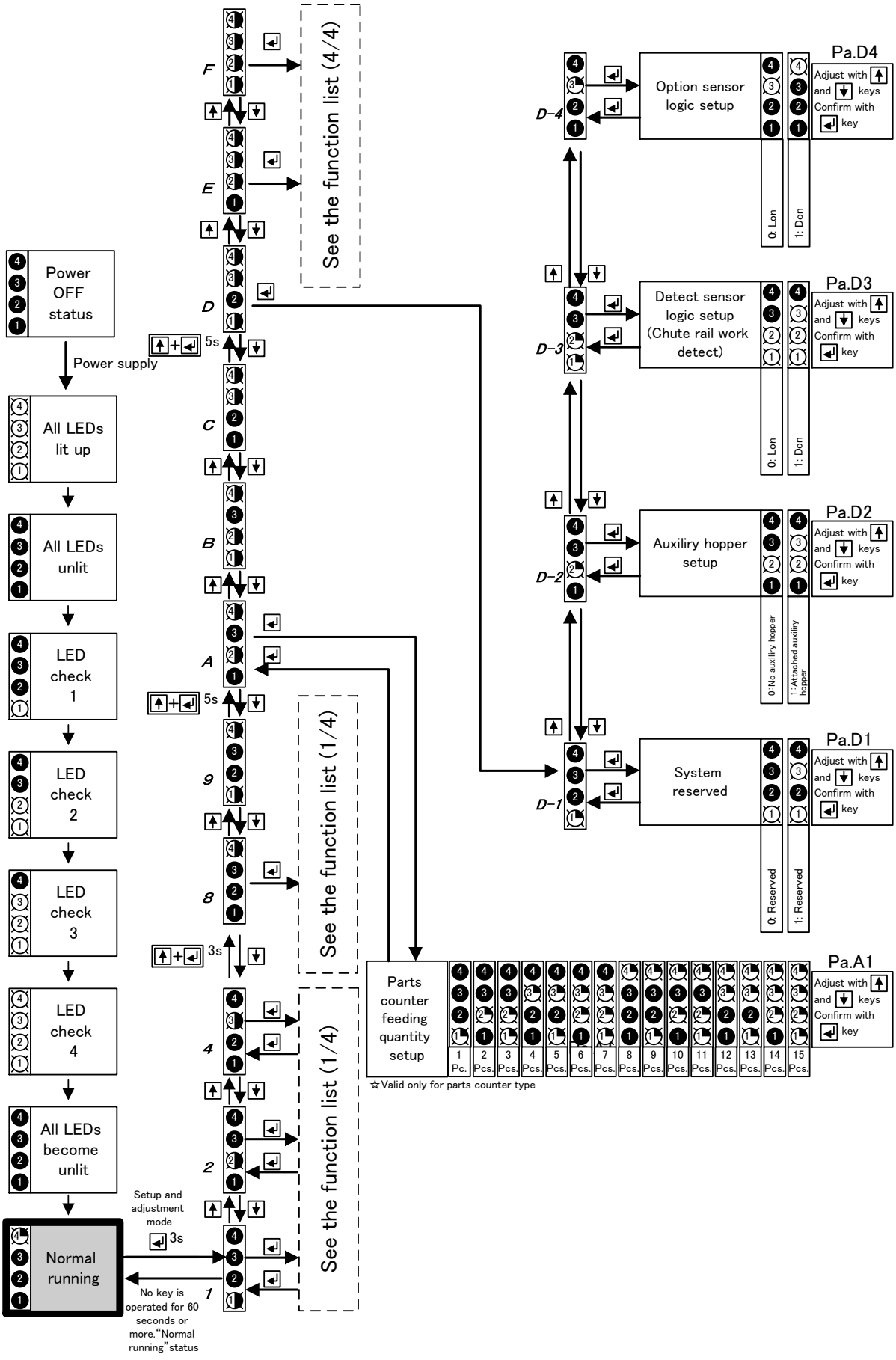
The setup and adjustment mode is exited and the "Normal running" status indication appears if the power is turned ON again after turned OFF, or no key is operated for 60 seconds or more.



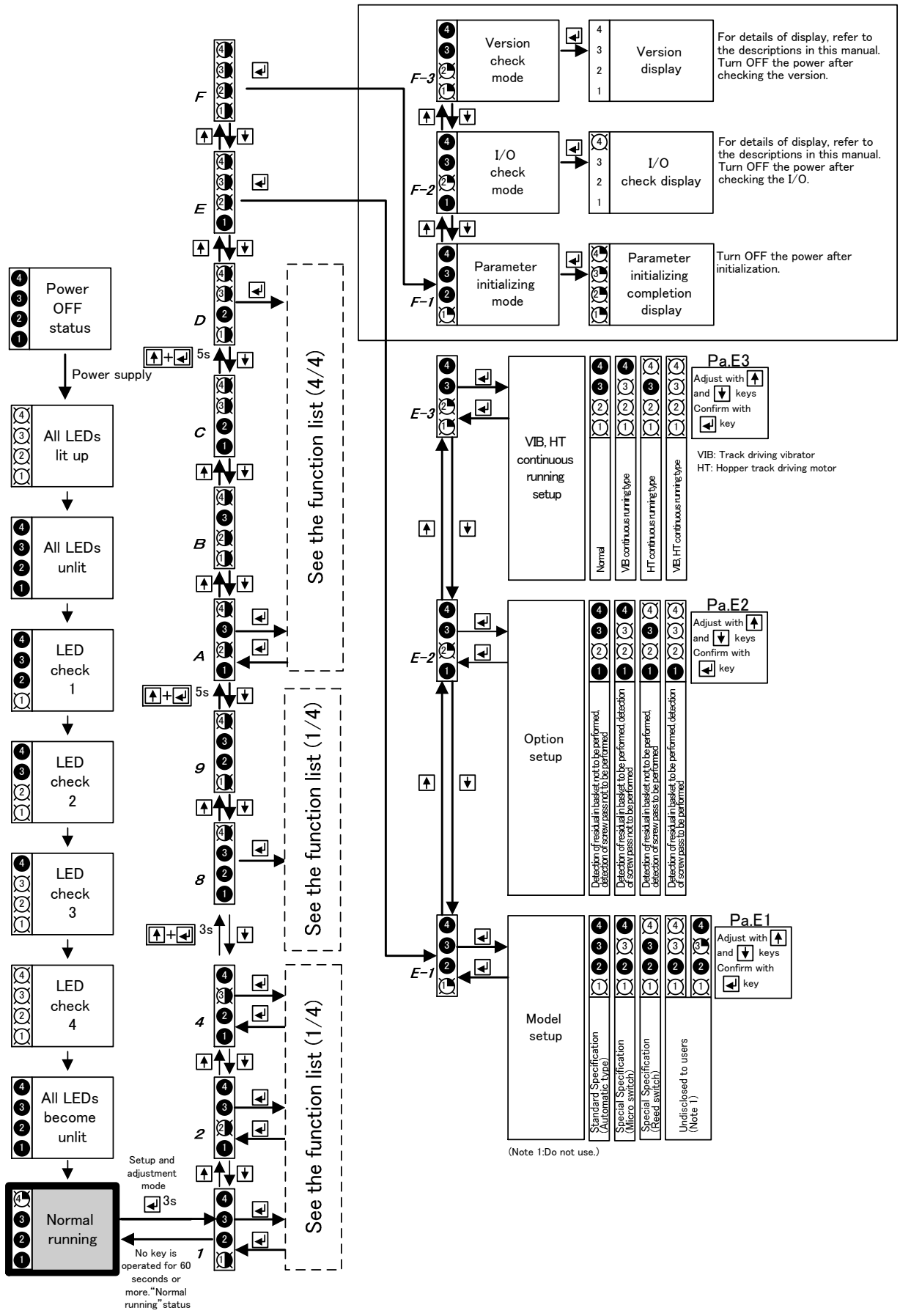
FF/FM503H-E Setup and adjustment mode function list (2/4)



FF/FM503H-E Setup and adjustment mode function list (3/4)



FF/FM503H-E Setup and adjustment mode function list (4/4)



8.3. Setup and adjustment items

Items shown below can be set up or adjusted from the setup panel.

(1) Operation parameter setup

(A) Basic adjustment mode: Mode for performing the basic vibrator setup (frequency, strength)

- Vibrator vibration frequency setup (FREQ.) (Pa.11)
- Vibrator vibration strength setup (VIB.) (Pa.21)
- Screw feeding time setup (hand driver type) (FEED) (Pa.41)

(B) Fine adjustment mode: Mode for making fine adjustments in order to obtain optimum screw conditions.

- Hopper track operating speed setup (Pa.81)
- Screw feeding start waiting time setup (hand driver type: reed switch) (Pa.82)
- Setup of waiting time of signal indicating lack of screw occurred on track (Pa.83)
- Setup of basket inside lack of screw signal output waiting time (Pa.84) (optional)
- Hopper track running start waiting time setup (Pa.85)
- Hopper track running stop waiting time setup (Pa.86)
- Setup of vibrating time after screw feed (Pa.87)
- Hopper track intermittent running ON time setup (Pa.88)
- Hopper track intermittent running OFF time setup (Pa.89)

(C) Special mode: Items can be selected when special specifications are selected.

- Screw taking-out type/Parts counter type screw feeding solenoid valve ON time setup (Pa.8A)
- Screw taking-out type/Parts counter type screw feeding solenoid valve OFF time setup (Pa.8B)
- Initial running time setup(Pa.8C)
- Parts counter feeding count setup (Pa.A1)

(2) Equipment parameter setup: Model setup, setup of presence or absence of optional sensor and continuous running setup can be performed.

- Model setup (Pa.E1)
- Option setup (Pa.E2)
- VIB, HT continuous running setup (Pa.E3)
- System reserved(Pa.D1)
- The presence of the auxiliry hopper (Pa.D2)
- The logic of chute rail work detect sensor (Pa.D3)
- The logic of option sensor (Pa.D4)

(3) Special mode setup

The special mode setup comprises the parameter initializing mode, I/O check mode and version check mode.

8.3.1. Operation parameter setup

"**" of "Pa.**" in the descriptions means the parameter number. Also refer to ☞ "8.2.3 FF/FM503H Setup and adjustment mode function list". Items shown in the tables are as shown below.

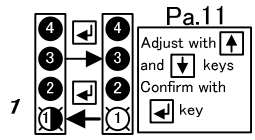
Variable range:	Range which setup is enabled.
Setup step:	Variation per step
Default:	Value to be set up when parameters are initialized

Caution: For the parameters (Pa.11 to Pa.8B) shown in 1/2 of the function list, an external screw feeding signal is accepted even during setup and adjustment.

Setup and adjustment items related to the operation of the FF/FM503H components are shown below.

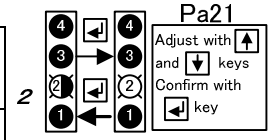
1) Vibrator vibration frequency setup (FREQ.) (Pa.11)
Vibrator vibration frequency of the vibrator can be set up.

Variable range	Approx. 50 to 70 Hz
Setup step	Approx. 0.2 Hz
Default	Approx. 60 Hz



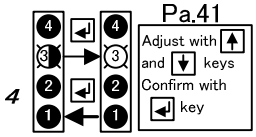
2) Vibrator vibration strength setup (VIB.) (Pa.21)
Vibrator vibration strength of the vibrator can be set up.

Variable range	About 40% to about 80% steps (depending on the vibrator vibration frequency)
Setup step	Undefined
Default	About 45%



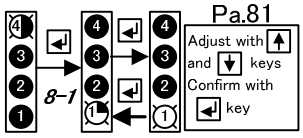
3) Screw feeding time setup (hand driver type) (FEED) (Pa.41)
Screw feeding time (operating time of screw feeding solenoid valve) of the hand driver type can be set up.
(Valid for hand driver type only)

Variable range	From 0.2 to 10.0 sec.
Setup step	0.1 sec.
Default	1.5 sec.



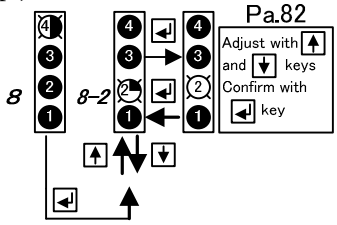
4) Hopper track operating speed setup (Pa.81)
Operating speed of the hopper track can be set up.

Variable range	From 25 to 40 times/min.
Setup step	Approx. 0.8 times/min.
Default	30 times/min.



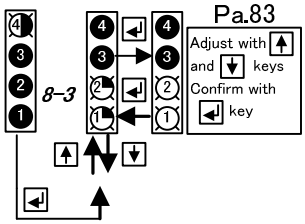
5) Screw feeding start waiting time setup (hand driver type: reed switch) (Pa.82)
If the hand driver type (reed switch) is used, waiting time required after operation of the screw feeding switch (OFF → ON → OFF) until screw feeding is started can be set up.
(Valid only when the hand driver type (reed switch) is selected for the model setup.)

Variable range	From 0.2 to 2.0 sec.
Setup step	0.1 sec.
Default	0.5 sec.



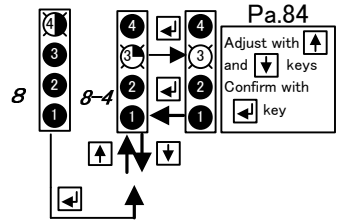
6) Setup of waiting time of signal indicating lack of screw occurred on track (Pa.83)
Time required until the "lack of screw on track" signal will be output can be set up if no screw has been detected at the photoelectric sensor position on the track.

Variable range	From 1 to 60 sec.
Setup step	1 sec.
Default	25 sec.



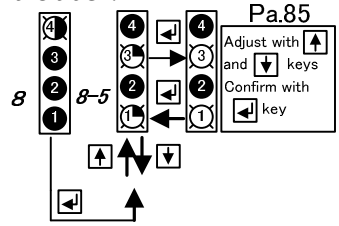
7) Setup of basket inside lack of screw signal output waiting time (Pa.84) (optional)
Time required until the "basket inside lack of screw" signal will be output can be set up if no screw has been detected at the proximity switch for detection of basket inside lack of screw.
(Valid when detection of basket inside residual is to be carried out.)

Variable range	From 6 to 65 sec.
Setup step	1 sec.
Default	30 sec.



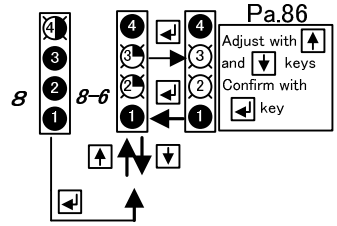
8) Hopper track running start waiting time setup (Pa.85)
Time required until running of the track driving vibrator and hopper track driving motor will be started can be set up if no screw has been detected at the photoelectric sensor position on the track.

Variable range	From 0.5 to 10.0 sec.
Setup step	0.1 sec.
Default	4.0 sec.



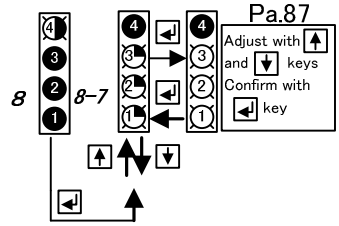
9) Hopper track running stop waiting time setup (Pa.86)
Time required until running of the vibrator and hopper track will be stopped can be set up if any screw has been detected at the photoelectric sensor position on the track.

Variable range	From 0.5 to 10.0 sec.
Setup step	0.1 sec.
Default	4.0 sec.



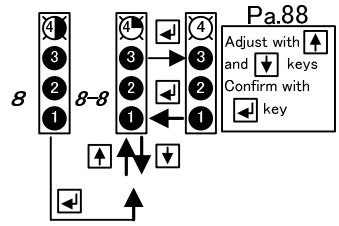
10) Setup of vibrating time after screw feed (Pa.87)
Track driving vibrator running time required for feeding of a next screw to the escapement unit after a screw is fed can be set up.
(Time from de-energizing of the screw feeding solenoid valve to the stop of track driving vibrator can be set up.)

Variable range	From 0.5 to 10.0 sec.
Setup step	0.1 sec.
Default	3.0 sec.



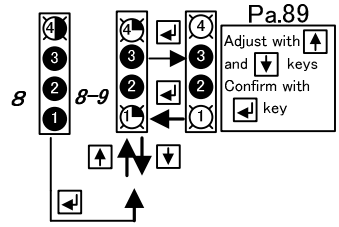
11) Hopper track intermittent running ON time setup (Pa.88)
The hopper track starts intermittent running if the machine is run continuously for the fixed time. The intermittent running time (ON time) can be set up.

Variable range	From 10 to 30 sec.
Setup step	1 sec.
Default	10 sec.

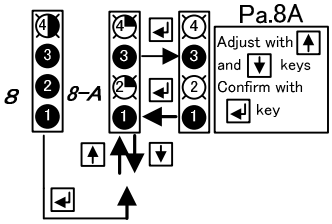


12) Hopper track intermittent running OFF time setup (Pa.89)
The hopper track starts intermittent running if the machine is run continuously for the fixed time. The intermittent running time (OFF time) can be set up.

Variable range	From 10 to 30 sec.
Setup step	1 sec.
Default	10 sec.

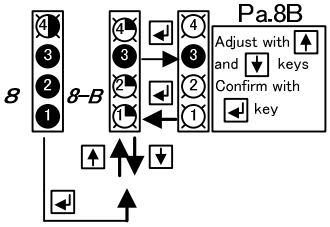


13) Screw taking-out type/Parts counter type screw feeding solenoid valve ON time setup (Pa.8A)
If the screw taking-out type or parts counter type is used, the screw feeding solenoid valve ON time can be set up.
(Valid only when the screw taking-out type or parts counter type is used.)



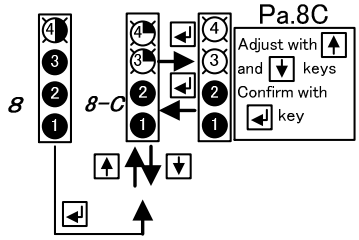
Variable range	From 0.5 to 10.0 sec.
Setup step	0.1 sec.
Default	1 sec.

14) Screw taking-out type/Parts counter type screw feeding solenoid valve OFF time setup (Pa.8B)
If the screw taking-out type or parts counter type is used, the screw feeding solenoid valve OFF time can be set up.
(Valid only when the screw taking-out type or parts counter type is used.)



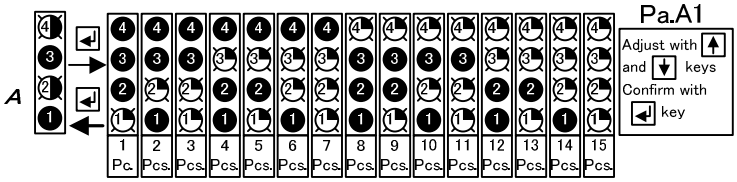
Variable range	From 0.5 to 10.0 sec.
Setup step	0.1 sec.
Default	1 sec.

15) Initial running time setup (Pa.8C)
After the power supply is turned on, the compulsion running time of the hopper and the vibrator can be set up.



Variable range	From 0 to 10.0 sec.
Setup step	1 sec.
Default	5 sec.

16) Parts counter feeding count setup (Pa.A1)
If the parts counter type is used, the number of screws fed per screw feeding signal can be set up.
(Valid only when the parts counter type is used.)



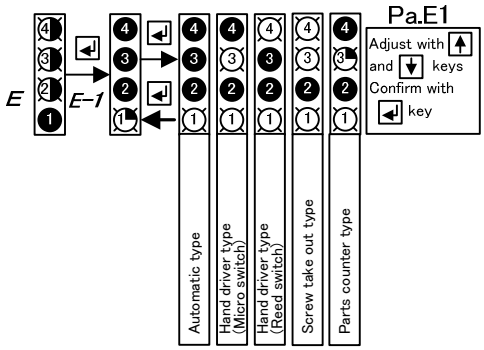
Variable range	1 to 15 screws
Setup step	1 screw
Default	1 screw

8.3.2. Equipment parameter setup

Setup and adjustment items related to models and options of FF/FM503H are as shown below.

Caution: Normal running operations including screw feed are disabled while the equipment parameter is set up. (To be more precise, setup items after the parameter Pa.A1 in 2/2 of the function list)

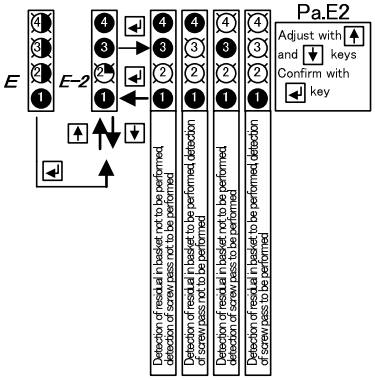
1) Model setup (Pa.E1)
Model of FF/FM503H can be set up.
Select any of choices from 1 to 5, depending on the type of equipment.
0. Automatic type <default>
1. Hand driver type (micro switch)
2. Hand driver type (reed switch)
3. Screw taking-out type
4. System reserved
5. Parts counter type



As for the correspondence of the indicating status of the LEDs on the panel during the model setup with the actually selected model, refer to ☞ “8.2.3 FF/FM503H Setup and adjustment mode function list”.

Setup items	0:Automatic type 1:Hand driver type (micro switch) 2:Hand driver type (reed switch) 3:Screw taking-out type 5:Parts counter type
Default	0:Automatic type

2) Option setup (Pa.E2)



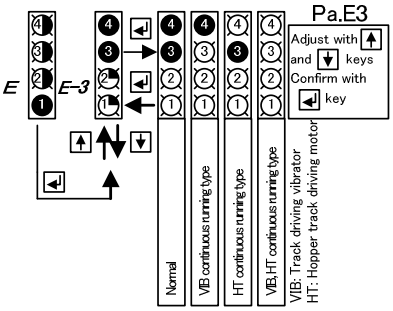
Whether optional sensor should be provided or not can be decided.
Select any of choices from 1 to 4, depending on the type of equipment.

0. Detection of basket inside residual not to be performed - Screw pass detection not to be performed <default>
1. Detection of basket inside residual to be performed - Screw pass detection not to be performed
2. Detection of basket inside residual not to be performed - Screw pass detection to be performed
3. Detection of basket inside residual to be performed - Screw pass detection to be performed

As for the correspondence of the indicating status of the LEDs on the panel during the option setup with the actually selected option, refer to ☞ "8.2.3 FF/FM503H Setup and adjustment mode function list".

Setup items	0:Detection of basket inside residual not to be performed - Screw pass detection not to be performed 1:Detection of basket inside residual to be performed - Screw pass detection not to be performed 2:Detection of basket inside residual not to be performed - Screw pass detection to be performed 3:Detection of basket inside residual to be performed - Screw pass detection to be performed
Default	0:Detection of basket inside residual not to be performed - Screw pass detection not to be performed

3) VIB, HT continuous running setup (Pa.E3)



Type of running of the track driving vibrator (VIB) and hopper track driving motor (HT) can be set up.
If continuous running is selected, premature wear of track and driving parts may occur. Be sure to select normal running unless otherwise the continuous running is absolutely necessary.
Select any of choices from 1 to 4, depending on your desired operation.

0. Normal (without continuous running) <default>
1. VIB continuous running type
2. HT continuous running type
3. VIB, HT continuous running type

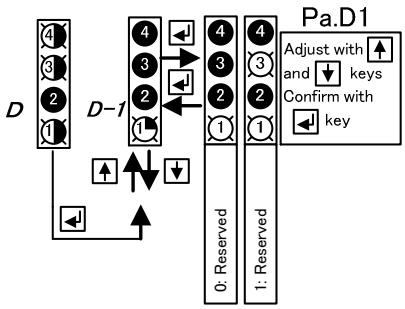
As for the correspondence of the indicating status of the LEDs on the panel during the VIB, HT continuous running setup with the actually selected continuous running setup, refer to ☞ "8.2.3 FF/FM503H Setup and adjustment mode function list".

Setup items	0:Normal (without continuous running) 1:VIB continuous running type 2:HT continuous running type 3:VIB, HT continuous running type
Default	0:Normal (without continuous running)

If the swaying continues exceeding a preset time (2 minutes) with the photoelectric sensor staying ON (no screw), the machine enters an intermittent operation mode with predetermined intervals. If the swaying

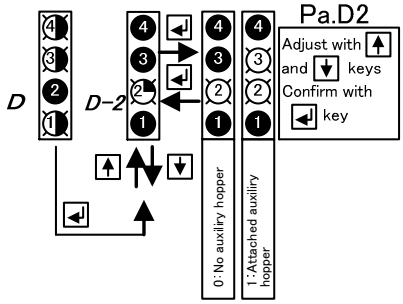
continues further for a long time (about 2 hours), the machine enters a suspend mode assuming that there are no works (screws) in the basket. In the suspend mode, “LED4 (=4○RUN)” LED on the setup panel flashes at 1 second intervals. (Refer to ☞ “10.1 Malfunction”.) To exit from the suspend mode, turn on the machine again or input the screw feeding signal.

4) System reserved (Pa.D1)
This parameter is used with the system.



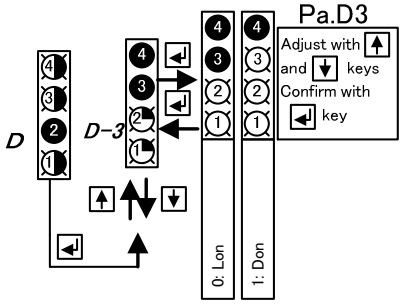
5) The presence of the auxiliry hopper (Pa.D2)
The presence of the auxiliry hopper can be set up.

Setup items	0:No auxiliry hopper 1:Attached auxiliry hopper
Default	0: No auxiliry hopper



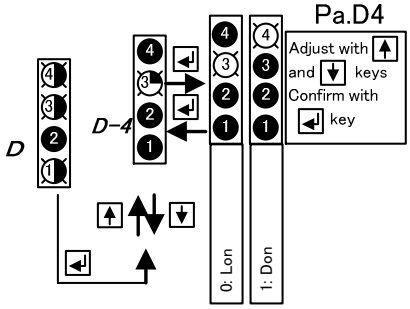
6) The logic of chute rail work detect sensor (Pa.D3)
The logic of chute rail work detect sensor can be set up.

Setup items	0:Light on 1:Dark on
Default	0: Light on



7) The logic of option sensor (Pa.D4)
The logic of option sensor can be set up.

Setup items	0:Light on 1:Dark on
Default	1:Dark on



8.3.3. Special mode setup

The special mode setup comprises the three items shown below.

(1) Parameter initializing mode
(2) I/O check mode
(3) Version check mode

Caution: Normal running operations including screw feed are disabled while the special mode is selected.

8.3.3.1. Parameter initializing mode

Operation parameter and equipment parameter are initialized in this mode. After initialization is finished, parameters are the same as the defaults shown in the tables of "8.3.1 Operation parameter setup" and "8.3.2 Equipment parameter setup".

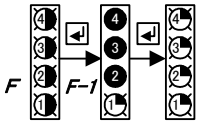
For the operating procedures to enter into the parameter initialization mode, refer to ☞ "8.2.3 FF/FM503H Setup and adjustment mode function list".

When the parameter initialization is completed, LEDs from LED1 (=1○FREQ.) to LED4 (=4○RUN) flash.

To finish the parameter initializing mode, shut down the power.

Caution: If the initialization is performed, the machine cannot be operated correctly unless parameters are set up again depending on the type of FF/FM503H and status of equipment.

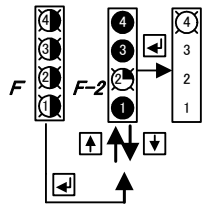
Do not perform this operation except in special cases such as replacing the "FF/FM503H-MAIN-R PCB" after removing the cover of the main body.



8.3.3.2. I/O check mode

> ⚠**WARNING** **This operation includes functions such as energization/de-energization of the solenoid valve incorporated in FF/FM503H.**
> Since screws may be fed depending on the operation, you may lose your sight or suffer from injuries. Perform the operation after fully understanding the descriptions in ☞ "For safe use".

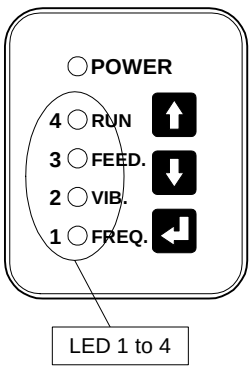
In this mode, input and output (inside and outside) of FF/FM503H can be checked. Input signals can be checked by the LEDs on the setup panel, and output signals can be checked with using the key switches. For operating procedures required in order to enter the I/O check mode, see ☞ "8.2.3 FF/FM503H Setup and adjustment mode function list".



(1) Input check

When input signals are turned on, corresponding LEDs in the table below light up. Use the LEDs to check input signals as necessary.

The following table shows LEDs that light up according to input signals. Note that you cannot check correctly, if some input signals are set to the "ON" status.



Lit up LEDs	Input signals				
LED4	Lit up in I/O check mode regardless of input signal				
LED3	Hopper lower limit detection		Screw feeding signal (automatic type)★	Screw feeding signal (hand driver type)♦	Operation enable signal (screw taking-out type) ★ (Note 1)
LED2	Basket inside residual detection (Note 1)	Optional sensor (Note 2)	Screw feeding signal (automatic type)★		Operation enable signal (screw taking-out type) ★ (Note 1)

LED1	Detection of screw on track	Optional sensor (Note 2)		Screw feeding signal (hand driver type)♦	Operation enable signal (screw taking-out type) ★ (Note 1)

The ★-marks shown in the table above indicate the signals of external I/O receptacle (CN IO).

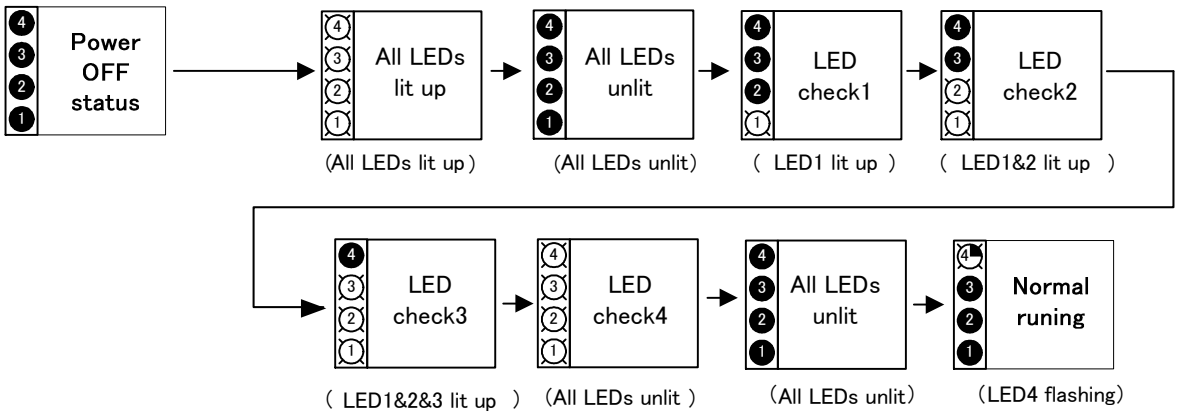
The ♦-marks shown in the table above indicate the signals of screw feeding receptacle (CN FEED) (hand driver type).

Note 1: To be used for optional type.

Note 2: To be used for optional (special) type.

(Notes)

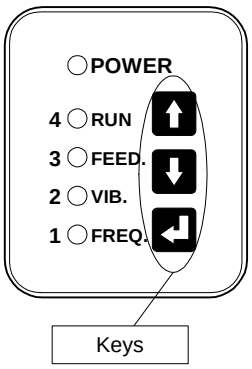
1) The "LED4 (=4○RUN)" is always lit up in the I/O check mode.
2) Some LEDs may be lit up depending on the signal input. For example, when the "screw feeding signal (hand driver type)" is input, the LEDs 1(=1○Freq.), 3 (=3○FEED), and 4 (=4○RUN) are lit up, as shown in the table above.
3) If some input signals are turned "ON" simultaneously, correct judgment may be disabled.
   If any of the LEDs is faulty, correct indication is disabled. Ensure that all the LEDs are lit up by checking operation of the LEDs when power is supplied.
4) To finish the I/O check mode, shut down the power supply.



(2) Output check

You can turn "ON" or "OFF" the following output signals by pressing some keys on the setup panel. Use the LEDs to check output signals as necessary.

The table shown below indicates which signal is output by which key operation.



Signal to be output by the operation of the keys to the right	Key operation
Screw feeding solenoid valve	↑ key
Spare OT1 (Note 3)	↓ key
Spare OT2 (Note 3)	↑ + ↓ keys
Basket inside lack of screw signal (Note 1) ★	↵ key
Spare output signal (Note 3) ★	↑ + ↵ keys
Signal indicating lack of screw on track ★	↓ + ↵ keys
Taking-out enable signal (screw taking-out type) (Note 2) ★	↑ + ↓ + ↵ keys

The ★-marks shown in the table above indicate the signals of external I/O receptacle (CN IO).

Note 1: To be used for optional type. (Effective only when the inside basket low volume detection type is applied)

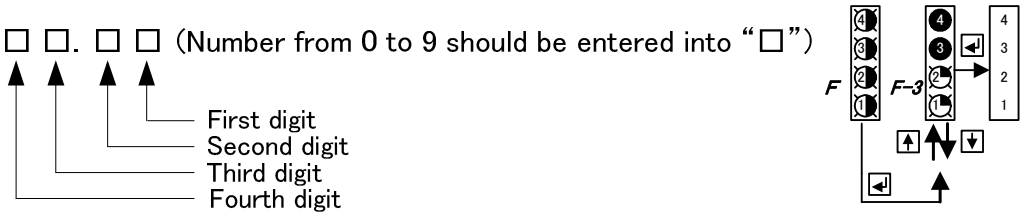
Note 2: To be used for optional type.
Note 3: To be used for optional (special) type.

(Notes)

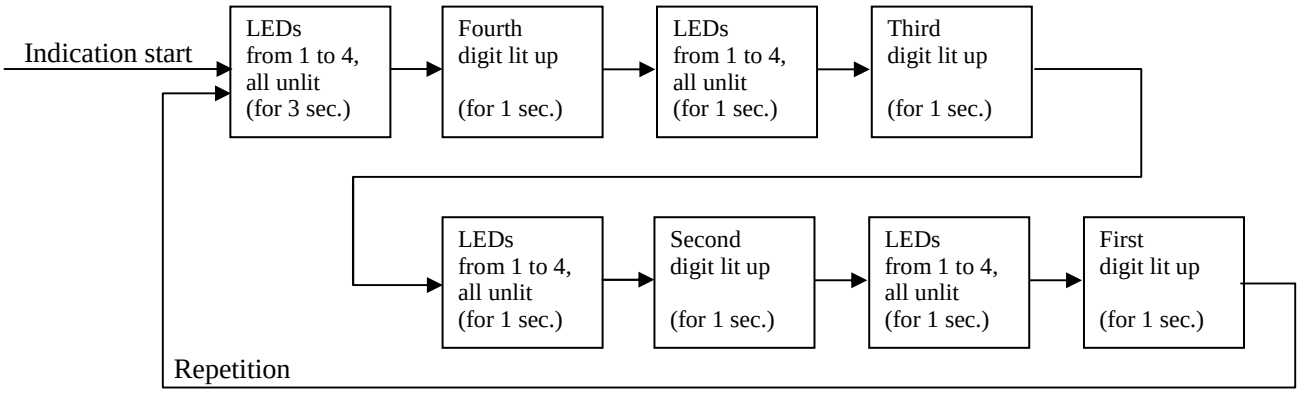
1) The "+" sign shown in the table above indicate simultaneous pressing of keys. For example, "▼ + ↵" keys means pressing of the "↵" key while pressing the "▼" key.
2) Pay extreme attention to output signal to be output corresponding with the keys pressed while some keys are pressed. (For example, when you try to output the signal indicating the lack of screw on the track with using the "▼ + ↵" keys, the signal corresponding with the "▼" key is output, until "▼ + ↵" key operation becomes effective after the "▼" key is pressed.)
3) To finish the I/O check mode, shut down the power supply.

8.3.3.3. Version check mode

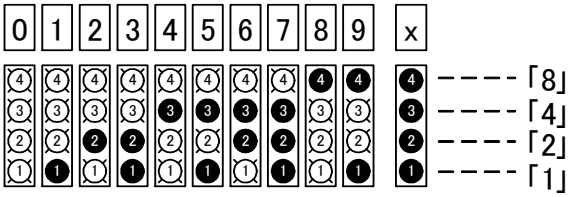
In this mode, software version of the PCB (FF/FM503H-MAIN-R) in the main body can be checked.
The software version is indicated by four-digit number.



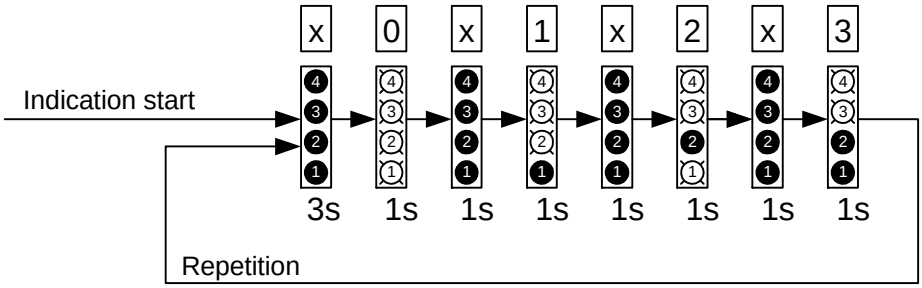
After this operation is finished, each of the LEDs from LED1 (=1○FREQ.) to LED4 (=4○RUN) on the setup panel indicate the statuses shown below.



Correspondence of the indicating statuses of the LEDs with the indicated numbers is shown below.
The "x" shown below indicates the status of all the unlit LEDs for the separation between numbers.



(Example) When the software version is 01.23, indicating status of the LEDs is as shown below.



(CAUTION)
To finish the version check mode, shut off the power supply.

9. Maintenance and check

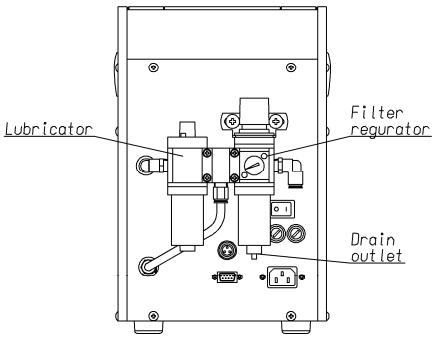
⚠**WARNING**	**Ensure that the power and air supply are shut down before adjustment, maintenance, or inspection of the machine. Before restarting it after a long interval, completely clean and check it, and perform a test run to ensure that it is free from any fault.** Otherwise, electric shocks, accidents, or malfunctions may occur.

⚠**CAUTION**	**After a maintenance, check or adjustment operation is over, be sure to put back the tools you have prepared and used in the box they were in.** If you leave the tools on the machines or the floor around you, accidents or malfunctions may happen.

Perform maintenance of the following items. The indicated “maintenance cycles” are rough standards. Increase or decrease the cycles as necessary judging from the use conditions and environments as necessary.

9.1. Filter regulator

Check if there is water collected inside the filter regulator every day before starting operation. Drain the water if found.



9.2. Lubricator

In order to keep the oil surface at or above the lowest limit inside the bowl of the lubricator, add the oil periodically. If the oil does not drop properly, a problem with lubrication may happen in the target machine. Check the lubricator for the amount of oil drops every day before starting operation.

9.3. Inside the FF/FM503H

If oil or dust is attached on the track, basket, hopper track, or escapement unit, remove it with a cloth etc. carefully. Otherwise, a trouble with screw supply may happen.

⚠**CAUTION**	**Be careful not to cut or rub your hand or finger.**

9.4. Screw feeding hose

Check the screw feeding hose every day before starting operation. If screws cannot be fed properly due to wear or dirt on internal surface, replace the screw feeding hose with a new one.

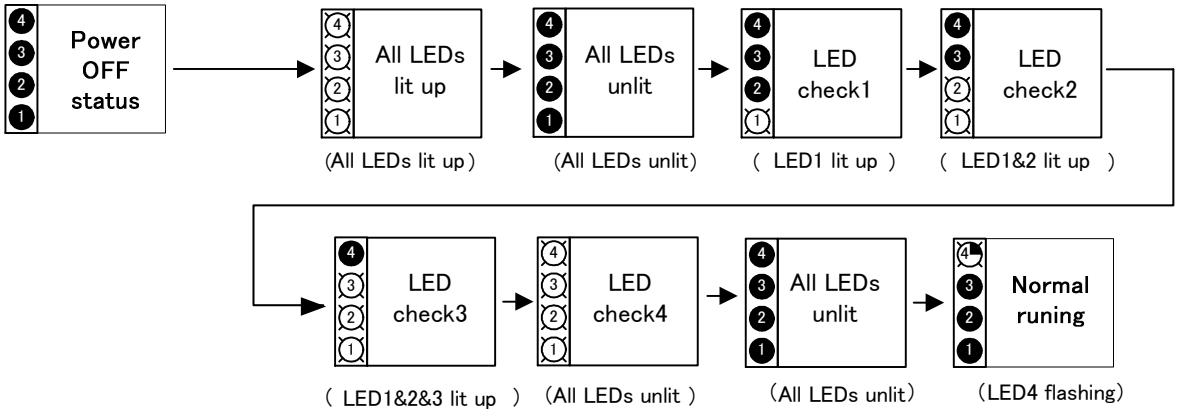
> **⚠CAUTION** **When replacing the screw feeding hose**
>
> **(1) Make sure that the air supply is shut down.**
>
> **(2) Fix both ends securely.**
>
> If the screw feeding hose comes off with air being supplied, a screw fed by compressed air may jump off from an end of the hose, leading to injuries (if it hits your eye, you may lose your sight) or damage to equipment around the machine. To ensure safety, do not look into the screw feeding hose inadvertently or direct them to anyone.
>
> **(3) Take care not to have your hand or finger cut as a result of touching the edge of the hose connector or the edge face of the screw feeding hose.**

10. Failure cause and corrective measure

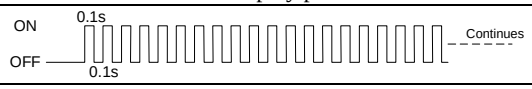
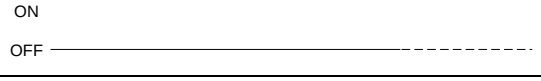
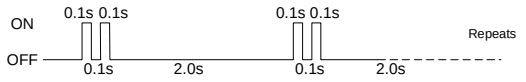
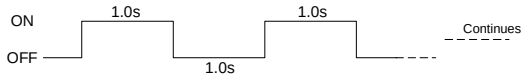
This chapter describes the causes of typical troubles and corresponding corrective measures.

10.1. Malfunction

The FF/FM503H checks the LEDs immediately after the power is turned on as shown below. And if in normal state, the machine starts normal running (“LED4”: flashes (On and off each for 0.1 sec)) and components of the machine start operation. The LED4 (=4○RUN) keeps flashing except when machine is being set up or adjusted.



To show whether the machine is at normal operation or abnormal operation, the LED4 (=4○RUN) on the setup panel flashes as described in the following table.
(For LED4 indication in setup and adjustment mode, refer to ☞ “8.2.3 FF/FM503H Setup and adjustment mode function list”.)

LED4 display pattern	Cause	Corrective measure
	Normal operation	No problem
	CPU stops operation	Repair or replace main unit unless it recovers after powered on again.
	CPU stops operation	Repair or replace main unit unless it recovers after powered on again.
	Control section power failure (5V)	Repair or replace main unit unless it recovers after powered on again.
	Hopper track stops for a long time due to absence of screws.	Turn on power again or input screw feeding signal.

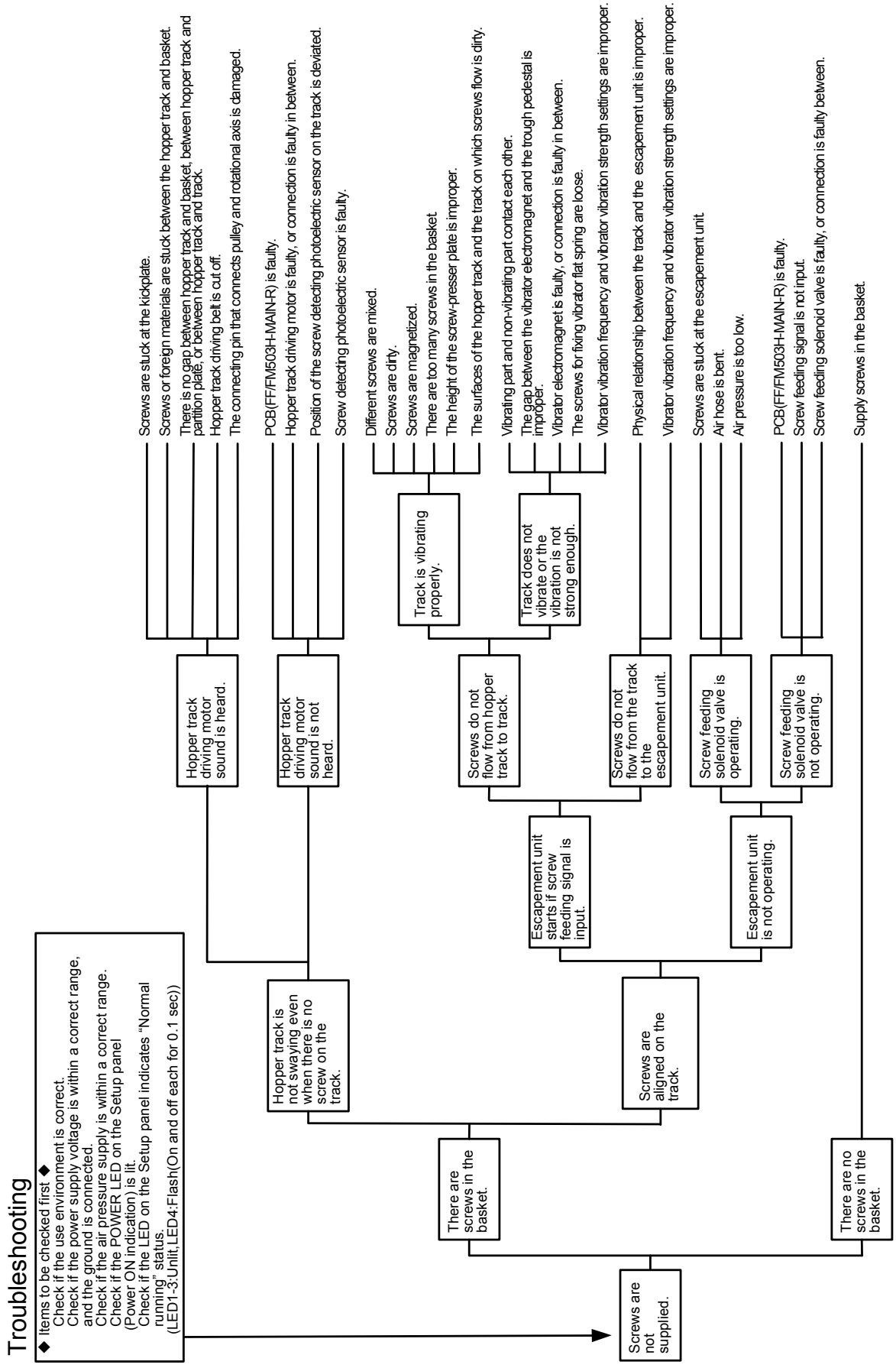
10.2. Other malfunctions

Symptom	Cause	Corrective measure
Power LED (Green) on setup panel does not light up even when the power is turned on.	Fuse is blown	Replace the fuse on the rear panel with a specified one shown below. (Refer to ☞ [9] in “2.3.2 Back face” and “12.1 Specifications”.) If the fuse blows again, repair or replace main unit.
	Failures of PCB, power supply, etc.	Repair or replace main unit.

⚠**WARNING** **If you replace the fuse in fuse holder (FU2 or FU3), be sure to use a specified one. If replaced fuse blows again, ask our sales agent or your nearest sales office of Nitto Seiko Co., Ltd. for repair.**
Model: 0215004. MXP made by Littelfuse
(5 × 20 mm 250 VAC 4 A time lag type complying with RoHS)

10.3. Troubleshooting

The causes of typical failures of the “FF/FM503H” and the remedies to them are described below.



10.4. Repair

⚠**WARNING**	**Do not disassemble, modify, or repair the product.**

⚠**WARNING**	**Shut down the power immediately if any fault is found in the machine, and ask our sales agent or your nearest sales office of Nitto Seiko Co., Ltd. for repair. We are not responsible for any product failures or accidents resulting from product repair by customers.**

11. Guarantee

We guarantee as described in the warranty below if the product you have purchased fails. Note that the product that failed outside Japan is to be repaired by your nearest sales agent.

11.1. Warrantee

We repair the components of this product free of charge if judged as defective and if the defects are caused by or attributable to a problem with materials or our production.
However, the warranty does not extend to the failures attributable to the following causes:

(1) Natural disasters such as an earthquake, lightning, typhoon (violent storm), and flood; fire; and accident
(2) Modification, disassembling, or repair by customers
(3) Use of undesignated parts, lubrication oils or grease
(4) Improper maintenance or checking
(5) Improper adjustment or operation
(6) Incorrect operation
(7) Maintenance not done by us or our designated sales agents
(8) Applied voltage out of specification
(9) Neglection of the use environment described in ☞ "For safe use"
(10) Fall or drop of product or physical shock applied
(11) Negligence of handling methods instructed in documents such as operation manual
(12) Using the product as a CE-marking-compliant machine

11.2. Warranty period

This warranty is effective for the following periods after an acceptance inspection.

Applicable parts	Warranty period
Machined parts other than consumables	1 year or 2500 operation hours
Commercially available parts	6 months or 1300 operation hours
Consumables	Excluded from this warranty
Specific parts (including fasteners and wiring/piping parts)	Excluded from this warranty

(8 operation hours/day)

11.3. Exclusion from warranty coverage

Failures (including natural discoloration and removal of coating and plating, and deterioration of consumables) caused by deterioration with age or defects/wear under normal use are to be excluded from the warranty coverage.

12. Appendix

12.1. Specifications

<table>
<tr><th colspan="5">Item</th><th>Specification</th></tr>
<tr><td colspan="2" rowspan="3">Applicable screws</td><td colspan="2">Nominal diameter</td><td>2–5 mm</td></tr>
<tr><td colspan="2">Length</td><td>max. 25 mm</td></tr>
<tr><td colspan="2">Head diameter</td><td>max. 12 mm</td></tr>
<tr><td colspan="5">Supply capacity</td><td>max. 50 pcs./min.</td></tr>
<tr><td colspan="5">Basket capacity</td><td>Approx. 450 mL</td></tr>
<tr><td colspan="5">Input power voltage</td><td>Single phase, 100–240 VAC</td></tr>
<tr><td colspan="5">Power supply frequency</td><td>50/60 Hz</td></tr>
<tr><td colspan="5">Power capacity</td><td>max. 50 VA</td></tr>
<tr><td colspan="5">Leakage current</td><td>max. 1.5 mA</td></tr>
<tr><td colspan="5">Noise</td><td>Approx. 65.5 dB</td></tr>
<tr><td colspan="5">Fuses
(Contained in fuse holders FU2 and FU3)</td><td>0215004. MXP made by Littelfuse
(5 × 20 mm 250 VAC 4 A time lag type complying with RoHS)</td></tr>
<tr><td rowspan="7">I/O</td><td rowspan="5">External I/O</td><td rowspan="2">Input</td><td>Standard</td><td>Screw feeding (Only for automatic type)</td></tr>
<tr><td>Optional</td><td>Operation enable (Only for screw taking-out type)</td></tr>
<tr><td rowspan="2">Output</td><td>Standard</td><td>Lack of screw on track (Only for automatic type)</td></tr>
<tr><td>Optional</td><td>Lack of screw in basket, taking-out enable (Only for screw taking-out type)</td></tr>
<tr><td>Specification</td><td></td><td>Selection of SINK (NPN) specification or SOURCE (PNP) specification</td></tr>
<tr><td>Power supply</td><td></td><td>Supplied externally (24 VDC, 200 mA) (Prepared by customers)</td></tr>
<tr><td>Screw feeding receptacle</td><td>Input</td><td></td><td>Screw feeding (Hand driver type)</td></tr>
<tr><td colspan="5">Memory</td><td>Flash memory (Nonvolatile)</td></tr>
<tr><td colspan="5">Air pressure</td><td>0.4 MPa</td></tr>
<tr><td colspan="5">Air consumption</td><td>Approx. 1.7 L/cycle (ANR)</td></tr>
<tr><td colspan="5">Coating color</td><td>Hammertone blue</td></tr>
<tr><td colspan="5">External dimension (Maximum)</td><td>220 W × 334.6 H × 412 D (mm)</td></tr>
<tr><td colspan="5">Machine mass</td><td>Approx. 18 kg</td></tr>
<tr><td colspan="2" rowspan="4">Use environment
(Note 1)</td><td colspan="2">Installation location</td><td>Indoor at altitude up to 1000 m</td></tr>
<tr><td colspan="2">Use ambient temperature range</td><td>0–40°C</td></tr>
<tr><td colspan="2">Use ambient humidity range</td><td>30–90%RH (No freezing and no condensation)</td></tr>
<tr><td colspan="2">Vibration condition</td><td>Free from vibration</td></tr>
<tr><td colspan="5">About disposal</td><td>Gallium arsenide (GaAs) is used in the parts mounted on the PCB .
• GaAs powder and vapor is toxic. Do not burn, destroy, crush or chemically decompose the PCB.
• Do not put the PCB in your mouth.
• Distinguish this product from general industrial waste and household waste and dispose of it according to related laws and regulations.</td></tr>
</table>

Note: For specifications in detail, refer to the specifications for each product.

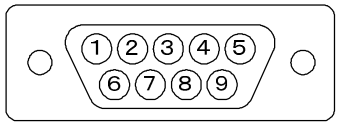
Note 1: For other use environments in detail, refer to ☞ “For safe use”.

12.2. External I/O receptacle (CN IO) pin layout

12.2.1. External I/O receptacle (CN IO) pin layout (SINK (NPN) type)

Pin No.	Signal	Type	Signal description
1	EX0V	Common	0 VDC (External supply)
2	EXOT3*	Output	Taking-out enable (Screw taking-out type) [optional]
3	EXOT2*	Output	Lack of screw on track (Standard:Automatic type)
4	EXOT1*	Output	Spare
5	EXOT0*	Output	Lack of screw in basket [Optional]
6			
7	EXIN0*	Input	Screw feeding (Automatic type)
8	EXIN1*	Input	Operation enable (Screw taking-out type) [optional]
9	EX24V	Common	24 VDC (External supply)

Pin layout of
External I/O receptacle(CN IO)
when viewed from outside



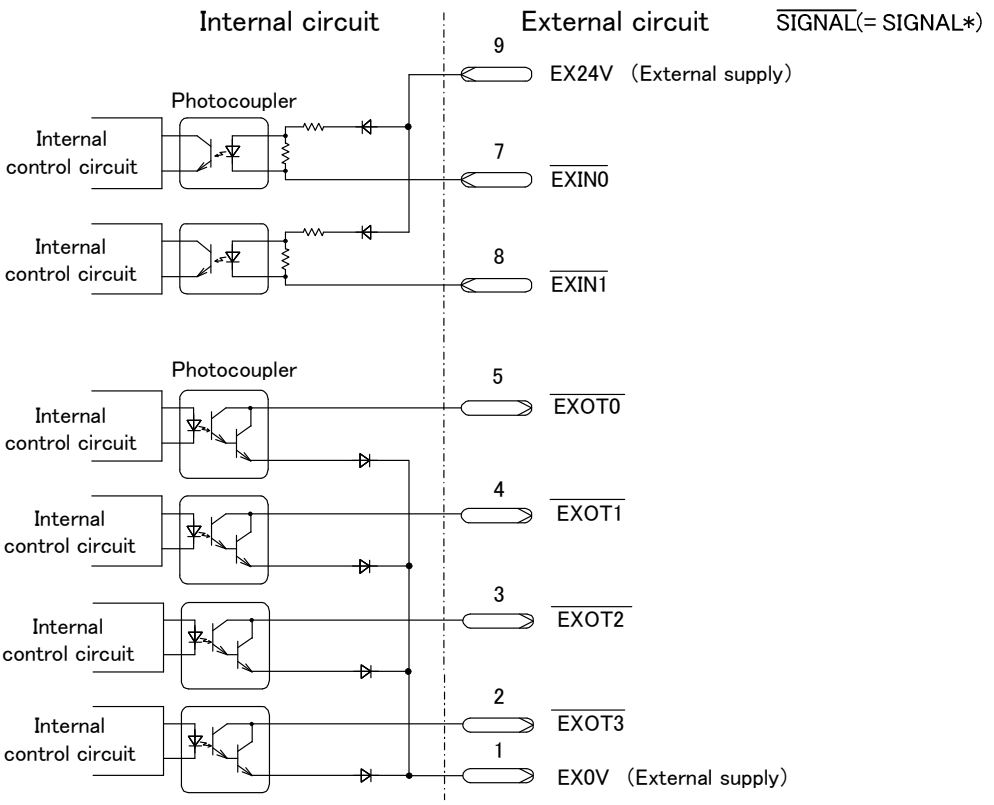
Main-body-side receptacle [DE-9PF-N (JAE) Dsub 9P pin / D20418-J3F (JAE) M2.6 screw mating fixed base]
Applicable plug [XM2D-0901 (Omron) Dsub 9P socket / XM2S-0911 (Omron) M2.6 screw hood]

Electrical specifications

(1) Input signal: Photocoupler insulation
Input current: 10 mA/24 VDC
To be input with non-voltage contact or open collector.

(2) Output signal: Photocoupler insulation
Maximum output current: 40 mA/24 VDC (Resistance load)
For inductive load, be sure to use an external diode or others for protection.
Overcurrent protection is not incorporated. Be careful that short-circuit may result in a fault.

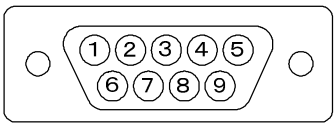
(3) Power supply (To be prepared by customers)
Prepare an external stabilized power supply of 24 VDC 200 mA (Max).


Internal circuit
External circuit
SIGNAL(= SIGNAL*)
9
EX24V （External supply）
Photocoupler
Internal
control circuit
7
EXIN0
Internal
control circuit
8
EXIN1
Photocoupler
5
EXOT0
Internal
control circuit
4
EXOT1
Internal
control circuit
3
EXOT2
Internal
control circuit
2
EXOT3
Internal
control circuit
1
EX0V （External supply）

12.2.2. External I/O receptacle (CN IO) pin layout (SOURCE (PNP) type)

Pin No.	Signal	Type	Signal description
1	EX0V	Common	0 VDC (External supply)
2	EXOT3	Output	Taking-out enable (Screw taking-out type) [optional]
3	EXOT2	Output	Lack of screw on track (Standard:Automatic type)
4	EXOT1	Output	Spare
5	EXOT0	Output	Lack of screw in basket [Optional]
6			
7	EXIN0	Input	Screw feeding (Automatic type)
8	EXIN1	Input	Operation enable (Screw taking-out type) [optional]
9	EX24V	Common	24 VDC (External supply)

Pin layout of
External I/O receptacle(CN IO)
when viewed from outside



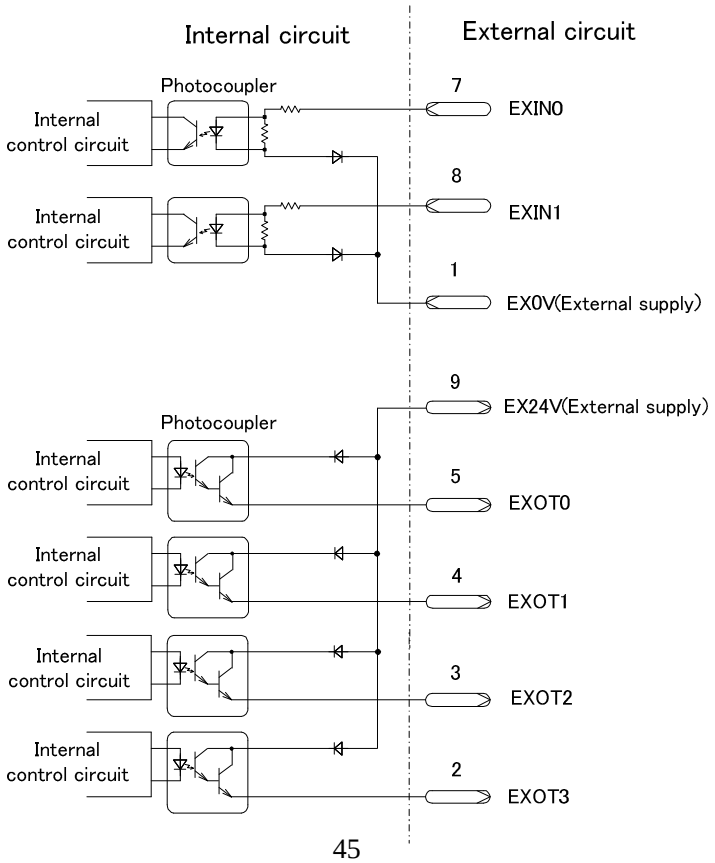
Main-body-side receptacle [DE-9PF-N (JAE) Dsub 9P pin / D20418-J3F (JAE) M2.6 screw mating fixed base]
Applicable plug [XM2D-0901 (Omron) Dsub 9P socket / XM2S-0911 (Omron) M2.6 screw hood]
When taking an order by the SOURCE (PNP) type , a “yellow circle”seal is stuck and shipped in the upper part of the “CN IO” receptacle of the back panel at the time of shipment.

Electrical specifications

(1) Input signal: Photocoupler insulation
Input current: 10 mA/24 VDC
To be input with non-voltage contact or open collector.

(2) Output signal: Photocoupler insulation
Maximum output current: 40 mA/24 VDC (Resistance load)
For inductive load, be sure to use an external diode or others for protection.
Overcurrent protection is not incorporated. Be careful that short-circuit may result in a fault.

(3) Power supply (To be prepared by customers)
Prepare an external stabilized power supply of 24 VDC 200 mA (Max).



12.2.3. Descriptions of external I/O receptacle (CN IO) signals

(1) Input signals

Feed Screw (EXIN0)	For automatic type, screw feeding signal is input. While this signal is being input, screw feeding operation continues.
Operation enable (EXIN1)	While this operation enable (interlock) signal for the screw taking-out type is being input, the FF/FM503H is operable. (Effective only when the screw taking-out type is used.)

(2) Output signal

Lack of Screw in Basket (EXOT0)	To be output when a screw is not detected for a period, specified by the wait setting (Pa.84) for outputting “Lack of Screw in Basket” signal, at the low volume detecting proximity switch inside basket. (Option: Effective for the inside basket low volume detection type.)
Spare (EXOT1)	(Not used) Do not use.
Lack of Screw on Track (EXOT2)	To be output when a screw is not detected for a period, specified by the wait setting (Pa.83) for outputting “Lack of Screw on Track” signal, at the photoelectric sensor on the track. (Standard:Automatic type)
Taking-out enable (EXOT3)	This taking-out enable signal for the screw taking-out type is output when the preparation for screw taking-out is completed in the taking-out position. (Effective only when the screw taking-out type is used.)

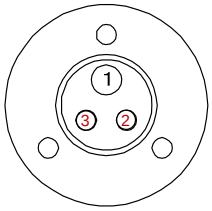
12.3. Pin layout of receptacle (CN FEED) (hand driver type) for screw feeding

Screw feeding signal input mode when “Model setup (Pa.E1)” is set to “2. Hand driver type (micro switch)” or “3. Hand driver type (reed switch)”.
(For further details, refer to ☞ “8.3.2 Equipment parameter setup”.)

Pin No.	Signal	Type	Signal description
1	IN4	Input	Screw feeding (Hand driver type)
2	0V	Common	Common (Internal 0 V)
3			Not used

Main-body-side receptacle [3P pin]
Applicable plug [3P socket]

Pin layout of
receptacle for screw feeding(CN FEED)
when viewed from outside

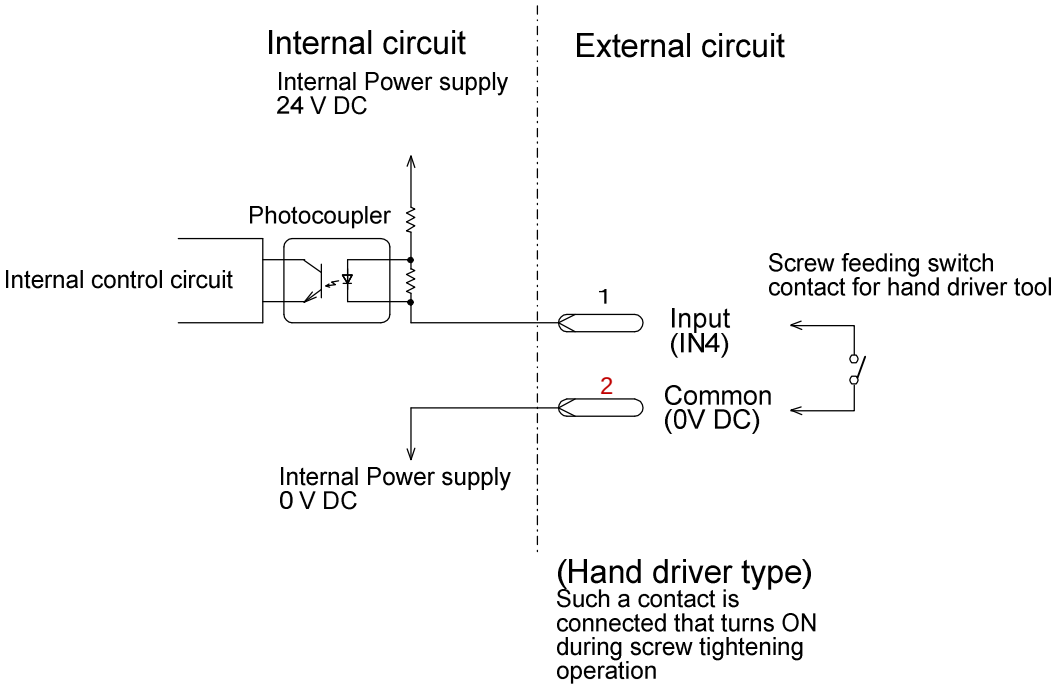


Electrical specifications

Input signal: Photocoupler

Input current: 10 mA/24 VDC

To be input with non-voltage contact



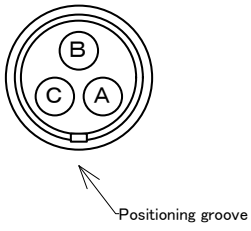
12.4. Pin layout of 3P receptacle (CN SH) for connection of “SH300”

It is a 3P receptacle (CN SH) for supplying +24 V to the optional rotating-drum-type auxiliary hopper “SH300”.

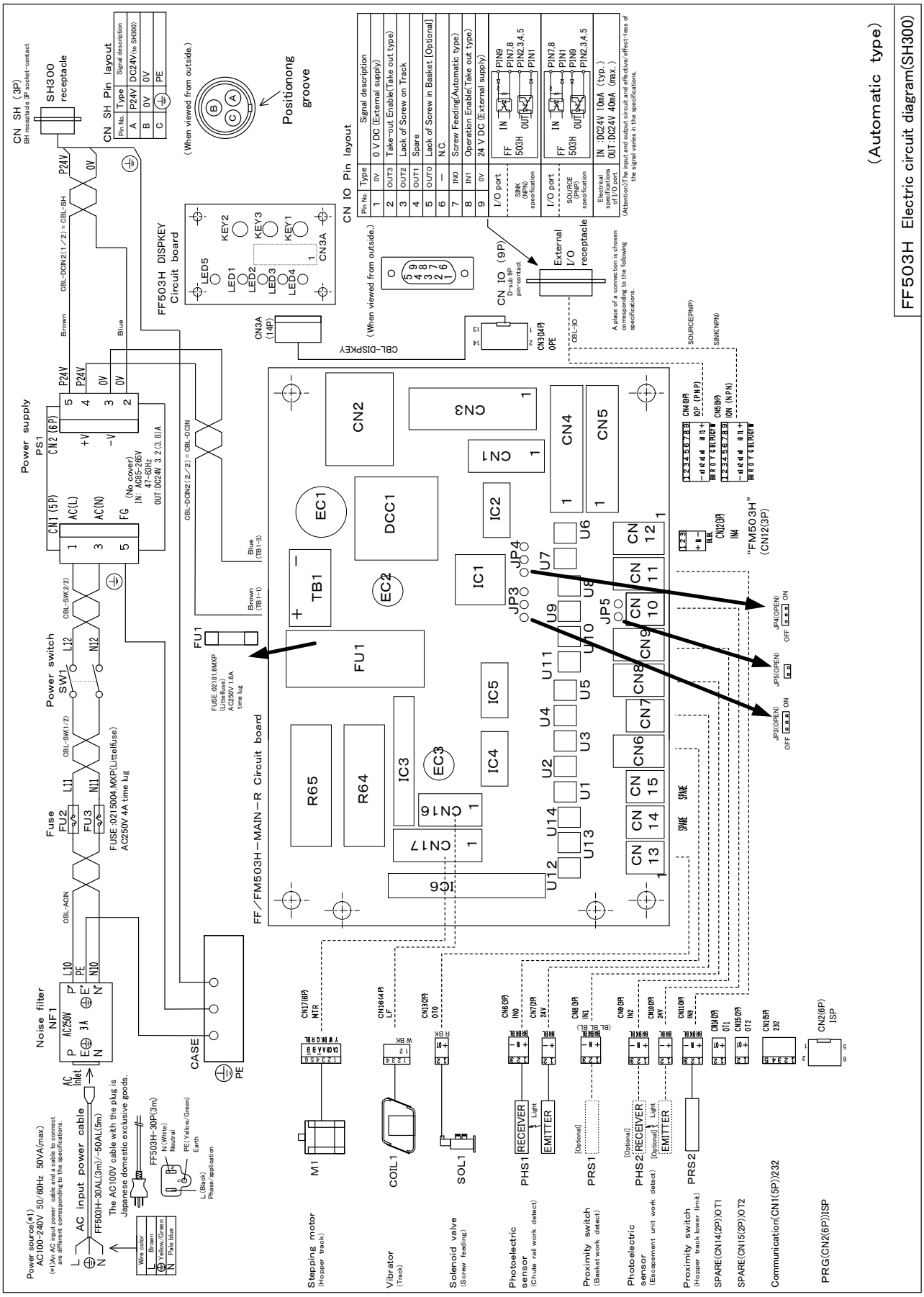
Pin No.	Signal	Signal description
A	P24V	+24 V
B	0V	Common (Internal 0V)
C	⏚	Earth(PE)

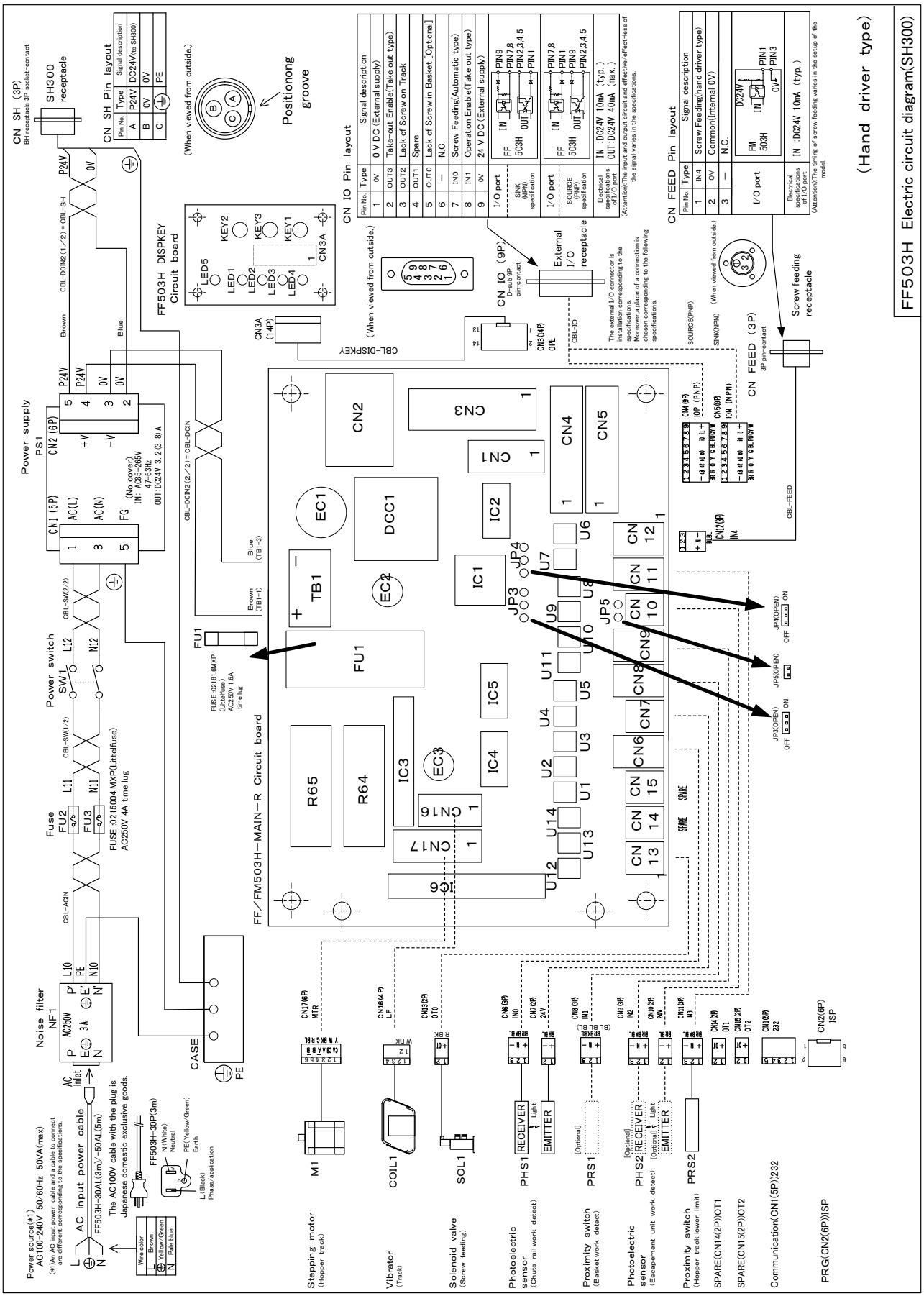
Main-body-side receptacle [PRC03-23A10-3AF (Tajimi Electronics) 3P socket]
Applicable plug [PRC03-12A10-3AM 10.5 (Tajimi Electronics) 3P pin]

Pin layout
3P receptacle for connecting SH300(CN SH)
When viewed from outside



12.5. Electric circuit diagram (FF503H, FM503H)




FF503H Electric circuit diagram(SH300)
(Hand driver type)
Power source(*1)
AC100-240V 50/60Hz 50VA(max)
(*1)Use AC input power cable and a cable to connect are different corresponding to the specifications.
AC input power cable
FF503H-30AL(3m)/-50AL(5m)
The AC100V cable with the plug is Japanese domestic exclusive goods.
Wire color
Brown
Yellow/Green
Pale blue
FF503H-30P(3m)
N(White) Neutral
PE(Yellow/Green) Earth
L(Black) Phase/application
AC Inlet
Noise filter NF1
AC250V 3A
CASE
PE
Fuse FU2 FU3
FUSE 0215004.MXP(Littelfuse) AC250V 4A time lug
Power switch SW1
Power supply PS1
CN1 (5P)
CN2 (6P)
AC(L)
AC(N)
FG
(No cover)
IN: AC85-265V 47-63Hz
OUT: DC24V 3.2/3.8A
P24V
0V
CN SH (3P)
BH receptacle 3P socket-contact
SH300 receptacle
CN SH Pin layout
Pin No. | Type | Signal description
A | P24V | DC24V(to SH300)
B | 0V | 0V
C | PE
(When viewed from outside.)
Positionong groove
FF503H DISPKEY Circuit board
LED5
LED1 LED2 LED3 LED4
KEY2 KEY3 KEY1
CN3A
CBL-DISPKEY
CN3A (14P)
CN3 (6P) OPE
CN IO (9P) D-sub 9P pin-contact
External I/O receptacle
CBL-IO
CN IO Pin layout
Pin No. | Type | Signal description
1 | 0V | 0 V DC (External supply)
2 | OUT3 | Take-out Enable(Take out type)
3 | OUT2 | Lack of Screw on Track
4 | OUT1 | Spare
5 | OUT0 | Lack of Screw in Basket [Optional]
6 | — | N.C.
7 | IN0 | Screw Feeding(Automatic type)
8 | IN1 | Operation Enable(Take out type)
9 | 0V | 24 V DC (External supply)
I/O port
FF 503H
SINK (NPN) specification
SOURCE (PNP) specification
Electrical specifications of I/O port
IN :DC24V 10mA (typ.)
OUT:DC24V 40mA (max.)
(Attention)The input and output circuit and effective/effect-less of the signal varies in the specifications.
The external I/O connector is installation corresponding to the specifications.
Mistaken choice of a connection is chosen corresponding to the following specifications.
SOURCE(PNP)
SINK(NPN)
(When viewed from outside.)
CN FEED (3P) 3P pin-contact
Screw feeding receptacle
CN FEED Pin layout
Pin No. | Type | Signal description
1 | IN4 | Screw Feeding(hand driver type)
2 | 0V | Common(Internal 0V)
3 | — | N.C.
I/O port
FM 503H
DC24V
IN
0V
PIN1
PIN3
Electrical specifications of I/O port
IN :DC24V 10mA (typ.)
(Attention)The timing of screw feeding varies in the setup of the model.
FF/FM503H-MAIN-R Circuit board
CN1 CN2 CN3 CN4 CN5 CN6 CN7 CN8 CN9 CN10 CN11 CN12 CN13 CN14 CN15 CN16 CN17
IC1 IC2 IC3 IC4 IC5 IC6
EC1 EC2 EC3
DCC1
TB1
FU1
R64 R65
SW1 SW2
JP3 JP4 JP5
U1 U2 U3 U4 U5 U6 U7 U8 U9 U10 U11 U12 U13 U14
CBL-DCIN2(1/2)=CBL-SH
CBL-DCIN2(2/2)=CBL-DCIN
CBL-AC/N
CBL-SW1(2)
CBL-SW2(2)
FUSE 0218.8MXP (Littelfuse) AC250V 8A time lug
Brown (TB1-1)
Blue (TB1-3)
CN12(3P) IN4
CBL-FEED
JP3(OPEN) OFF ON
JP4(OPEN) OFF ON
JP5(OPEN) OFF ON
Stepping motor (Hopper track)
M1
CN17(6P) MTR
Vibrator (Track)
COIL1
CN16(4P) LF
Solenoid valve (Screw feeding)
SOL1
CN13(2P) OT0
Photoelectric sensor (Chute rail work detect)
PHS1
RECEIVER
EMITTER
Light
CN6(3P) IN0
CN7(2P) 24V
Proximity switch (Basket work detect)
PRS1
[Optional]
CN8(3P) IN1
Photoelectric sensor (Escapement unit work detect)
PHS2
[Optional]
CN9(3P) IN2
CN10(2P) 24V
Proximity switch (Hopper track lower limit)
PRS2
CN11(3P) IN3
SPARE(CN14(2P))OT1
CN14(2P) OT1
SPARE(CN15(2P))OT2
CN15(2P) OT2
Communication(CN1(5P))232
CN1(5P) 232
PRG(CN2(6P))ISP
CN2(6P) ISP
CN4(8P) IOP (PNP)
CN5(8P) ION (NPN)

Memo

Vibratory Track Screw Feeder
FF/FM503H Ver2
Instruction Manual
(Ver. 1.01)

Prepared on August 8, 2012

Revised on January 16, 2018

(For system version 02.02、02.03)

NITTO SEIKO CO., LTD.
Assembly Machine Division
http://www.nittoseiko.co.jp/