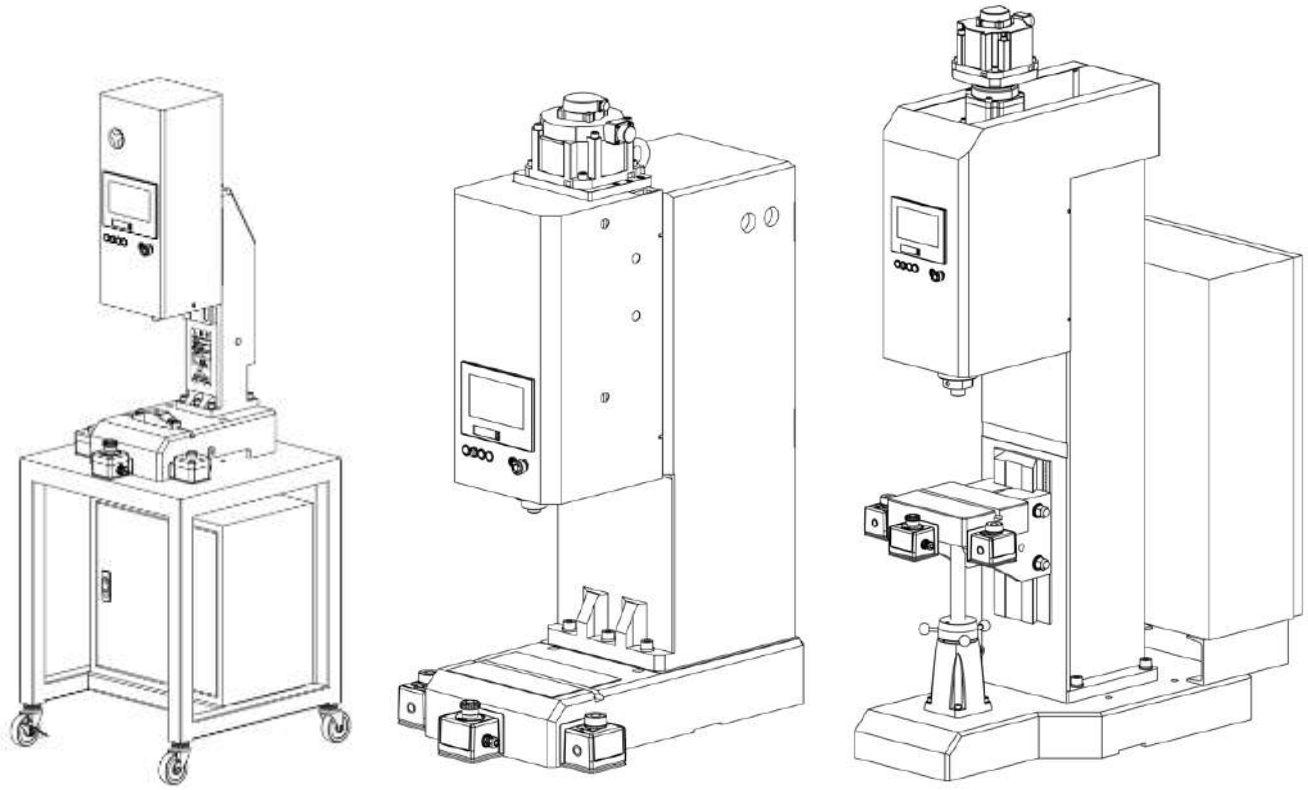
YOSHIKAWA

INSTRUCTION MANUAL

FRE Series
Riveting Machine



●Before using this product, read this Instruction Manual carefully to ensure proper use.
Improper operation may cause unexpected accidents, shorten the life of the product, and degrade its performance.

●Please keep this manual in a predetermined location so that any questions can be resolved at any time.

KV:1.1.2102A
VT:1.1.2102A
Rev:13

◆CAUTION◆

In this book, because it shows the description of the general operation of the electric riveting machine, For the optional function」, refer to the separate 「Option Function Instruction Manual」.

Please refer to the documentation for each equipment details of each device.

Contents

1 INTRODUCTION

1.1 Safety precautions

The precautons contained in this booklet should be observed in order to protest the equipment from damage whileensuring your safety as well as the safety of others.

Please use the product after fully understanding the contents.

⚠DANGER

Situation which is likely to occur and which could result in death or injury safety precautions are not observed.

⚠WARNING

Situation which could potentially result in bodily injury or equipment damage if safety precautions are not observed.

⚠CAUTION

Situation which could potentially result in bodily injury or equipment damage if safety precautions are not observed.

⚠DANGER

Overall

- As for the machine, risk assessment is carried out under the terms of use given by a customer. But lease carry out risk assessment on the condition to be used by all means.
  Failure to do so could result in fire, electrical shock, injury and equipment damage.
- Do not use the machine near the place where in an explosive atmosphere, an atmosphere of the flammable gas, a corrosive atmosphere, the side of inflammables and a water splash.
  Failure to do so could cause a fire, an electric shock and injury.
- A person having an appropriate qualification can do installation (transference), connection, operation, check, a trouble diagnosis and the repair work. Failure to do so could result a fire, an electric shock and injury.
- Do not transfer, installation, connecting and perform maintenance on equipment while it is energized. Work after switching it off. It causes the electric shock.
-  The mark shows the energizing joints such as the first power supply connection, the residual voltage and the terminal blocks.
  Do not open the enclosure and touch while energizing.
- Follow the transportation, installation, operation, maintenance and check with the country where a machine is really used in all life cycles including the disposal and the local legal regulation.

Installation

- Secure the distance that can evacuate in emergency when you install the machine, unless it might cause a fire and injury.
- Fix the machine to the floor surely not to fall. A machine turns over and causes an injury and the physical damage to the equipment.

Wire connection

- Do not use power source or voltage other than those specified for that particular model. Using an improper power source could result in equipment damage, fire and electric shock.
- Reach based on a connection diagram surely.
  There is a possibiony of causing a fire and an electric shock.

Operation

- Engage in work after having performed safety education.
  It could potentially cause an electric shock and injury.
- Do not nullify and detach the safety device.
  It could cause injury and equipment damage.
- Perform emergency stop promptly when you felt danger.
  It could cause a fire, an electric shock and injury.

Maintenance

- The person who received education have to do maintenance and check.
  It could potentially cause injury and equipment damage.

⚠WARNING

Overall

- When transferring ownership or selling this product to a third party, be sure to pass on all manual together with this machine.
- Turn off power at once when the protectors such as a breaker trip, a circuit protector trip, the thermal trip worked. Turn on a power supply after having removed a cause. When continued producing without removing a cause, a machine malfunctions can cause an injury and the physical damage to the equipment.
- Do not touch the machine with wet and oily hands.
  Doing so could result in electrical shock.

Installation

- Produce after adjusting the level at the center of the machine.
  The machine may be fallen down by unstable installation, and injury or device damage may be caused.

Wire connection

- Do not torture, pull, and stuck the cable, or it could cause a fire and an electric shock.
- Put the terminal cover after the wire connection, or electric shock may result.
- Confirm the direction where the motor is rotated when the machine is set up and transferred.
  Reverse rotation can cause motor overload damage.

Operation

- During the machine is switching on, do not open the doors such as an operation box and a control gear, and the enclosure.
  Doing so could result in a fire and an electric shock.
- Do not use it exceeding the range of the specification of the machine, or it could cause injury and device damage.

Maintenance

- Work after padlocking the breaker handle at the dangerous task when the breaker in off, otherwise it could result in a fire, an electric shock and injury.
- Do not touch each joining terminal with ten seconds after power off, or it could cause a fire and an electric shock.
- When you detach the cover, return it to former state before the operation, otherwise it could result in an electric shock and injury.

Repair, Modification

- When you repair the machine, only the person who received the education can do the range of the content described in the manual.
  If you have any questions or problems and need the repair except mentioned contents, please contact us.
- Do not remodel the machine. Contact our company when remodeling is necessary.

⚠CAUTION

Overall

- Do not use it exceeding the range of the machine specification.
  There is a possibiony of causing the electric shock and injury.
- Put neither finger nor the thing in the opening of the machine cover, the control board, the operating panel, and the enclosure.
  There is a possibiony of causing a fire, the electric shock, the injury.
- Does not touch the motor at a while be production and after it stops. When it was a high temperature, it causes the burn.
- For a while during and after stopping operation, please do not touch the regenerative resistance in the control panel.
  Because you are very hot, it may cause burns.

Installation

- Do not put the combustible around the machine.
  There is a possibiony of causing a fire, the burn.
- Do not put the obstacle that disturbs ventilation on surroundings of the machine.
  There is a possibiony of causing the device damage.

Operation

- Put it into the state that the emergency stop is always put when producing.
  There is a possibiony of causing the injury.
- Discontinue producing at once when it is abnormally occurred generated and contact the person in charge of machine. It is necessary to stop it if necessary, by the emergency stop.
  There is a possibiony of causing the injury and the device damage when keeping producing.
- Do not adjust the machine while producing.
  There is a possibiony of causing the electric shock, the injury, the device damage.
- Operate it after confirming there is no danger in surroundings of the machine enough when operating it by manual.
  There is a possibiony of causing a fire, the electric shock, the injury.
- The arrangements substitution work must turn off power after being able to do the work preparation.
  There is a possibiony of causing the electric shock, the injury.

Maintenance

- The articles of consumption and the replacement part must use our brand-name parts.
  There is a possibiony of causing the injury, the device damage.
- Only the educated person must do the mechanical inspection.
  Repair promptly when you find trouble.
  There is a possibiony of causing a fire, the electric shock, the injury the device damage.

Disposal

- Dispose of the riveting machine and parts as industrial wastes in case of disposing.
- If the disposal of the riveting machine is required, make sure that a waste disposer or a staff in charge makes a necessary arrangement.

1.2 Introduction

We thank you for adopting Yoshikawa's Riveting Machine.

The riveting machine is an excellent machine manufactured based on our experience and research over many years as a dedicated manufacturer of riveting machines.

This manual provides instructions and key points for the maintenance and operation of the machine. Wrong handling may cause an unexpected accident or failure. Read through this manual before use and handle the machine correctly.

Kindly give this manual to the operator and direct him to keep the manual.

1.3 Principle

A head which spins together with the spindle is attached to the end of a cylinder and an insert is inserted into the head so that the insert can revolve round the rotational axis of the head at an angle to the rotational axis. Since the insert itself rotates freely, the insert can stand still irrespective of head rotation. (Refer to Fig 1.3.b)

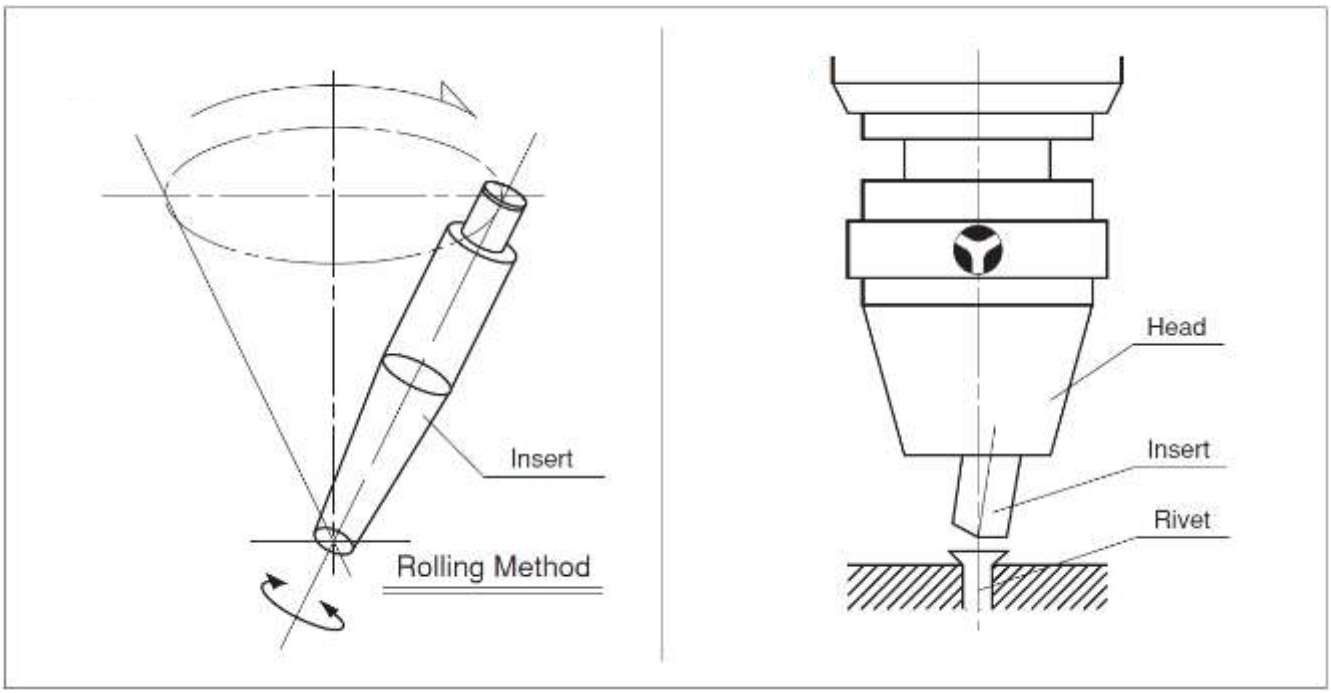


Fig 1.3.a Fig 1.3.b

The insert usually rotates together with the head, but it stops rotation when it comes into contact with a rivet end and swings around the rivet end as if sliding over the surface of an inverted cone. (Refer to Fig 1.3.a）

The end of the insert comes into contact with the rivet at a point on the surface of the end at first. The point contact grows to a line contact with the descent of the cylinder. The length of the contact line finaly develops equal to the radius of the rivet point. A surface is shaped by the revolution of a contour, and the rivet end is formed to a flat point, round point, pan point, etc. according to the shape of the insert end.

The rivet is upset little by little by the movement of the contact contour line between the rivet and the insert to from a point, finishing riveting.

1.4 Possible to do

1.4.1 To determine the presence or absence of rivets, the length, and the difference in material.

・From the position and thrust during the riveting cycle, it is available to determine the presence or absence of rivets, the length, and the difference in material.
(⇒7.4.3 Judgment P.64)

1.4.2 To make any amount of riveting from the contact position.

・The FRE machine has a function called search riveting.
By using the search riveting function, any amount of riveting can be performed from the touch position of the insert and the part.(⇒7.4.2 3)Search riveting P.56)

1.4.3 To control the FRE machine from the upper PLC or operate peripherals.

・FRE machines can be operated externally using external I/O control or network control (Ethernet,CC-Link,etc.). (⇒8.3 Interface P.85)
※Network control is optional, so please contact us.

2 SPECIFICATION

2.1 General specifications

Table 2.1

Item		Specifications
Ambient condition	Temperature	0℃~+50℃ (No Freeze)
	Humidity	85%RH or less（No condensation）
	Altitude	Above the sea 1000m or less *Do not use it in the environment where it pressurized than atmospheric pressure of meters above the sea level 0m.
	Atmosphere	Free from corrosive or flammable gases, oil and water mist and dust.
Strage environment	Ambient temperature	-25℃~+75℃ (No freeze)
	Humidity	85%RH or less（No condensation）
	Altitude	Above the sea 2000m or less * Do not use it in the environment where it pressurized than atmospheric pressure of meters above the sea level 0m.
	Atmosphere	There must be neither causticity gas nor dust. Neither water nor oil must splash.
Transportation environment	Ambient temperature	-25℃~+75℃ (Do not freeze)
	Humidity	85%RH or less（No condensation）
	Altitude	Above the sea 2000m or less * Do not use it in the environment where it pressurized than atmospheric pressure of meters above the sea level 0m.
	Atmosphere	Free from corrosive or flammable gases, dust, oil mist and water mist.

2.2 Machine specifications

Table 2.2

Drive source	Motor		Servo motor, synchronous motor		
	Oil pressure		Disuse		
	Air pressure		Disuse		
			FRE-05	FRE-10	FRE-20
Electric motor	Riveting Axis		0.75kW	2.9kW	2.9kW
	Spindle	Inverter	0.4kW	0.75kW	1.3kW
		Servo	0.75kW	0.75kW	1.5kW
Hydraulic oil			Disuse		
Air pressure			Disuse		

2.3 Performance specifications

Table 2.3

		FRE-05	FRE-10	FRE-20
Riveting ability		φ0.5~φ5mm Mild steel	φ1~φ8mm Mild steel	φ4~φ12mm Mild steel
Thrust	Riveting point	1.00~5.00kN (510kgf)	1.00~12.00kN (1,224kgf)	3.00~20.00kN (2,040kgf)
	JOG move	5.00kN (510kgf)	3.00kN (306kgf)	20.00kN (2,040kgf)
Stroke		1.000~60.000mm	0.000~200.000mm	1.000~100.000mm
Speed (Move point)		0.01~130.00mm/s		0.01~160.00mm/s
Speed (Riveting point / JOG move)		0.01~10.00mm/s		
Spindle revolutions		MAX 1,800rpm Note: The revolutions can be commanded from 1rpm. Machine operation and riveting operation are not guaranteed.		
Judge range	Position trigger	0.001~60.000mm	0.001~200.000mm	0.001~100.000mm
	Thrust trigger	0.01~5.00kN	0.01~12.00kN	0.01~20.00kN

2.3.1 Functional operation specification

When the machine operating force needs to be limited / operated, the performance specifications are shown in the table below.

① Servo return zero non-complete, soft limit disabled, alarm occurs (JOG operation is only possible).

② When returning to the home position, positioning move point operation during single operation operation, PRG check control.

Table 2.3.1

		FRE-05	FRE-10	FRE-20
①	Thrust (limit thrust)	2.00kN (204kgf)	3.00kN (306kgf)	5.00kN (510kgf)
	Speed	0.01~10.00mm/s（JOG speed setting）		
②	Thrust (low thrust)	5.00kN (510kgf)		10.00kN (1020kgf)
	Speed (low speed)	10mm/s		

2.4 Electrical specifications

Table 2.4

Power source	Number of phases	3		
	Voltage	AC200V Steady voltage: 0.9 to 1.1 of nominal voltage		
	Frequency	50/60Hz Nominal frequency 0.99 to 1.01 (continuous), 0.98 to 1.02 (short time)		
	Harmonics	Less than 10% of the total r.m.s. voltage value between charge conductors for the sum from the second to the fifth harmonic. For the total from the 6th to the 30th harmonics, the total r.m.s. voltage value between the charging conductors is up to 2%.		
	Unbalanced	All of the minus sequence ingredient voltage of 3-phase power supplies and zero sequence ingredient voltage should not exceed 2% of the original sequence ingredient voltage neither.		
	Voltage interruption	The power supply interruption or 0 voltages should not exceed 3ms with any supply cycle. The interval must exceed 1 second until the next interruption.		
	Voltage drops	The peak voltage of 20% or more should not occur over 1 cycle. The interval must exceed 1 second until the next interruption.		
		FRE-05	FRE-10	FRE-20
Power capacity	Inverter type	About 3kVA	About 11.5kVA	About 15kVA
	Servo type	About 4.5kVA	About 6kVA	About 12kVA
Rated shut-off capacity		7.5kA / AC200V		
Power system		TN/TT		

※Check with your electrical engineer about the type of wire used for the primary power supply of the FRE machine and where to connect it.

3 FOR SAFE USE

3.1 Safety device outline

Safety devices are installed in the following areas: (including options)

Table 3.1

Item	Installation location	Safety target position	Safety measures actions
Emergency stop button	Operator panel Worker hand position	Entire machine	Power OFF immediately. The spindle motor stops naturally. Turn ON the machine and the control circuit OFF. The machine turns OFF.
Light curtain※	The front of the machine	Entire machine	Power OFF immediately. The spindle motor stops naturally. Turn ON the machine and the control circuit OFF. The machine turns OFF.
STO※	Servo amplifier / Built-in inverter function	Servo amplifier / Inverter	To servo amplifier / inverter Torque OFF Directive

※Installing equipment is optional.

3.1.1 Emergency stop button

When you press the emergency stop button, the operation master is turned off, and 「EMERGENCY STOP」 is displayed on the operation MASTER OFF screen.
It will continue to appear until the emergency stop is released.
If the emergency stop is not released, master cannot be ON.

Fig 3.1.1

3.1.2 Light curtain　(option)

When the light curtain is block during running (during riveting axis operation or spindle rotation), the master is OFF and「LIGHT CURTAIN BLOCK」is displayed on the MASTER OFF screen. The display continues to appear until the master ON.
When the light curtain is in a shaded state,「LIIGHTCURTAIN BLOCK」is displayed on the MASTER OFF screen in the same way. When the light curtain is in a floodlighting, the display disappears.

Fig 3.1.2

3.1.3 Safety torque off「STO」(option)

For devices using the safety torque off function, when the power of the servo amplifier and inverter is cut off, it will be in the Safety torque Off (STO) state.
When in the STO state, the「STO」lamp on the upper left of the screen lights **yellow**, and when released, it lights **green**.

Fig 3.1.3.a　STO state

Fig 3.1.3.b　STO reeased state

To remove the STO state, do one of the following.

・Turn ON the master.
・Turn ON the next start.
・Press the reset button on the operating panel. (No alarm)※
・Turn ON the external reset signal. (No alarm)※

※When releasing the STO state with a RESET button or an external signal, if fault and count-ups are combined, it is not available to cancel everything at the same time.
RESET button are prioritized in order of anomaly reset, STO release, and count reset.
Therefore, to remove the STO, you must first reset fault and then release the STO.

3.2 Energy shut-off method that combines safety devices

The device has the following energy-blocking methods.

Table 3.2

Item	Installation location	Entire machine	Safety measures
Cuircuite breaker	Inside the control panel	Entire machine	All power is turned off

3.3 Residual risk

The machine presents the following residual risks.
Be sure to provide safety education and work education, and use safety protective equipment such as safety shoes, earplugs, earmuffs, helmets, masks, protective glasses, gloves, and safety belt as needed.

Table 3.3

Residual risk	Measures against residual risk
Part set	Work should be done with both hands and be sure to wear safety shoes.
Noise	Use earplugs and earmuffs when the machine operation sound increases in relation to the installation floor and other mechanical equipment.
Disposal	Disposal work such as disassembly should be carried out by a disposal company or a person in charge of disposal operations. When disposing of the machine, treat it as industrial waste.

3.4 About the content of the work and the scope of the implementer

This device clarifies the work and responsibilities listed below, so please check each item before starting operation.

Table 3.4

Work item	Implementers and managers
Transportation and installation	Transporter, person in charge of machinery transportation and installation
Electrical work and wiring	Electrical contractors, electrical engineers
Production	Workers trained in safety and work
Change of setup, addition of new models	Workers and persons in charge of safety and work education and training
Maintenance and inspection	Mechanical and electrical maintenance engineers
Repair (mechanical)	Mechanical Maintenance Engineer (Limited to the range specified manual)
Repair (electricity)	Electrical Maintenance Engineer (Limited to the range specified manual)
Other repairs	Manufacturers
Disposal	Disposal company, person in charge of disposal operations

※The implementer may be a person who requires multiple techniques, and may perform multiple tasks.

3.5 About work position

The working position of this machine is shown below.

Table 3.5

Work item	Work position
Main breaker ON	Operate with the control box.
Pre-start inspection	When visually inspecting the machine for any abnormalities, make sure that no other machines are working before checking from around the machine.
Part set Production	For normal production, do the work in front of the machine with the operation panel and start-up switch.

4 ACCESSORIES･OPTIONS

4.1 Accessories

This unit comes with the following tools and equipment, so please check.
If there is a shortage, please contact our nearest sales office.

●Items stored in the packing case

Table 4.1

		Model		
		FRE-05	FRE-10	FRE-20
Accessories	Instruction manual (1 copy)	Attached	Attached	Attached
	Tool case (1 bag)	Attached	Attached	Attached
	Single head wrench (1 pc)	17mm	Not attached	30mm
	Allen wrench (1 pc)	3mm	3mm	3mm, 6mm, 10mm
	Lever handle (1 pc)	φ8×195mm	φ8×195mm	φ12×248mm
	Ratchet wrench (1 pc)	10mm	Not attached	Not attached
	T nut (2 pc)	M8	M12 (※FRE-10 Only)	M12 (US-70, 150 Shared)

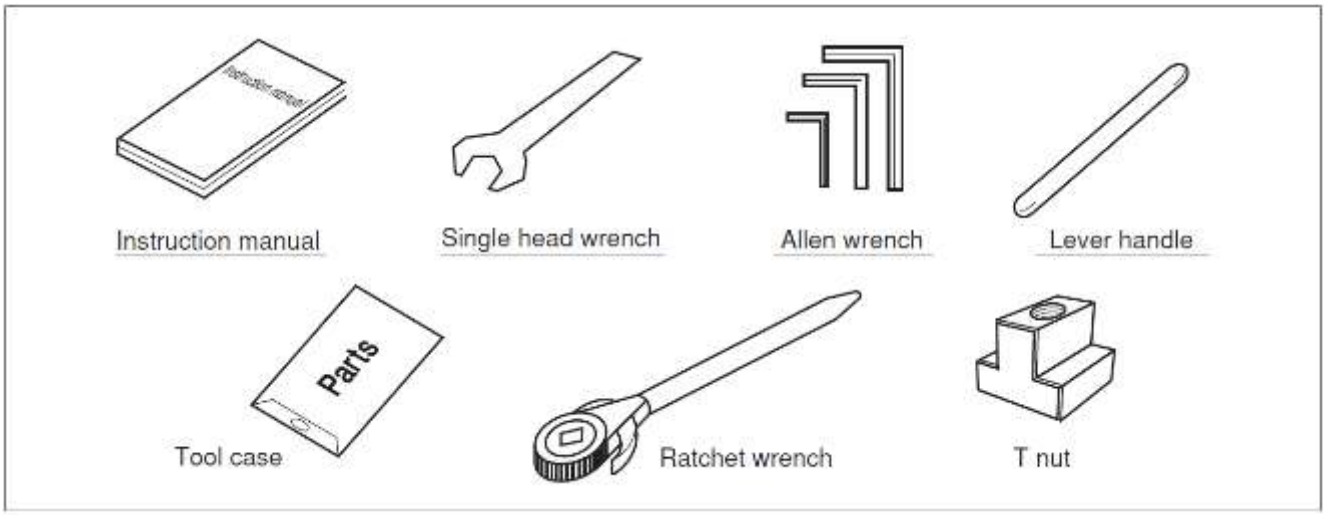


Fig 4.1

4.2 Standard head･inserts

Standard head inserts suitable for riveting machines are as follows.

Hook pin spanner wrenches are included when optional heads and inserts are purchased as a set with the machine.

●Head

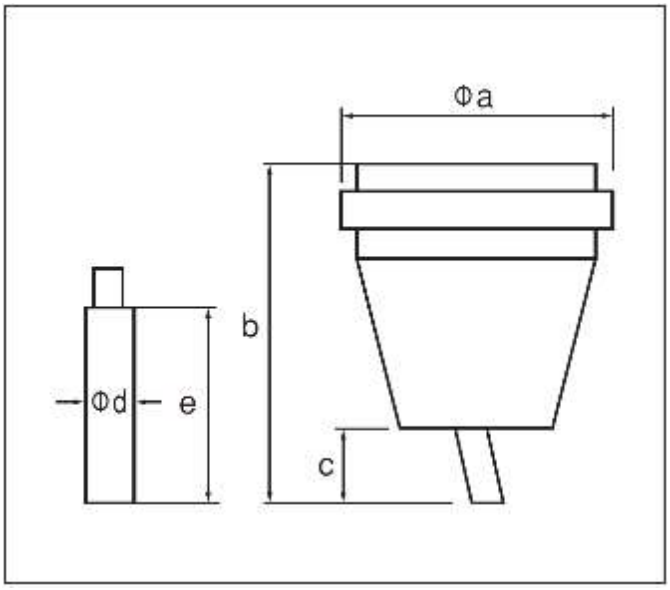


Fig 4.2.a

Accessory

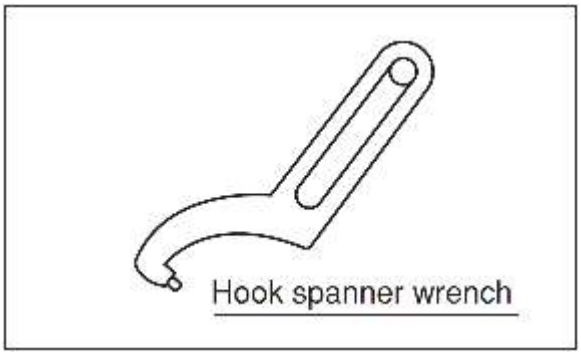


Fig 4.2.b

Table 4.2

			MODEL			Head dimensions					Hook spanner wrench	
			FRE-05 (M24)	FRE-10 (M24)	FRE-20 (M36)	a	b	c	d	e	Scope of use (mm)	Pin diameter (mm)
Head	M24	U-8	◎	×	×	45	77	20	8	45	40~42	φ3.5
	M24	U-84	◎	×	×	45	92	35		59		
	M24	U-715	◎	◎	△	56	81	15	15	43	50~55	φ4.5
	M24	U-725	◎	◎	△	66	104	38		66		
	M24	U-735	◎	◎	△	68	138.3	58.3		101	65~70	φ4.5
	M24	U-21	×	◎	×	85	122	30	20	75	80~85	φ5.5
	M24	U-214	×	◎	×		146	54		100		
	M36	U-521	×	×	◎	93	145	30		75		
	M36	U-5214	×	×	◎		169	54		100		

◎ : Standard　　△ : Can be used by changing the screw diameter with the attachment
× : Cannot be used

●In addition to the above, we have many heads according to the application, so please contact us.

●Insert

Rivet point shapes are roughly classified to the following 7 types.

The basic dimensions such as the diameter and the length of the insert depend on the point formed. However, the requirements for the rivet such as forming dimensions and material should be given to us beforehand.

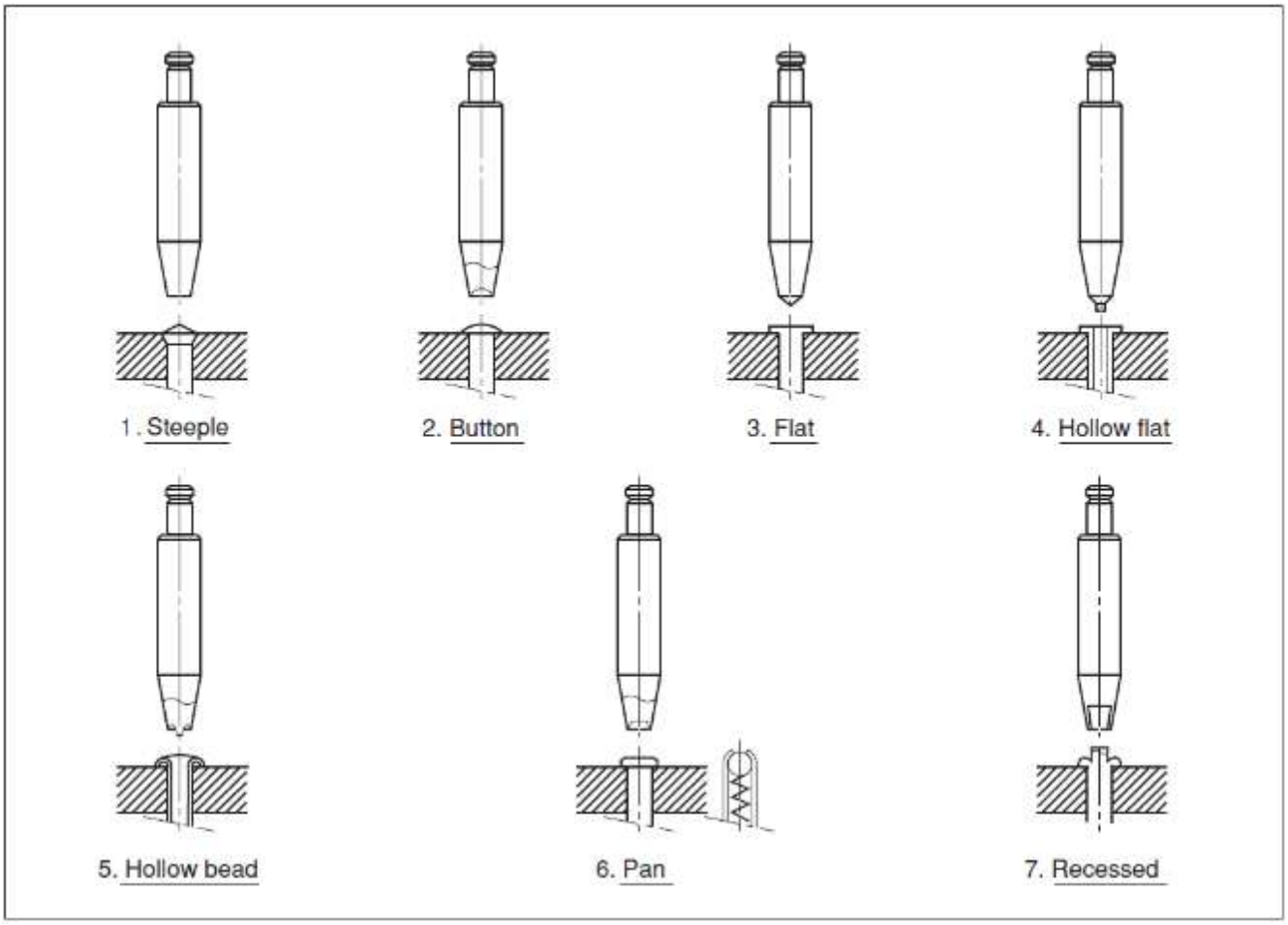


Fig 4.2.c

※ In addition to standard accessories, FRE series and riveting machines are also available with optional products for different applications. For details, please contact your local sales office.

5 OPERATE PREPARATION

5.1 Workflow

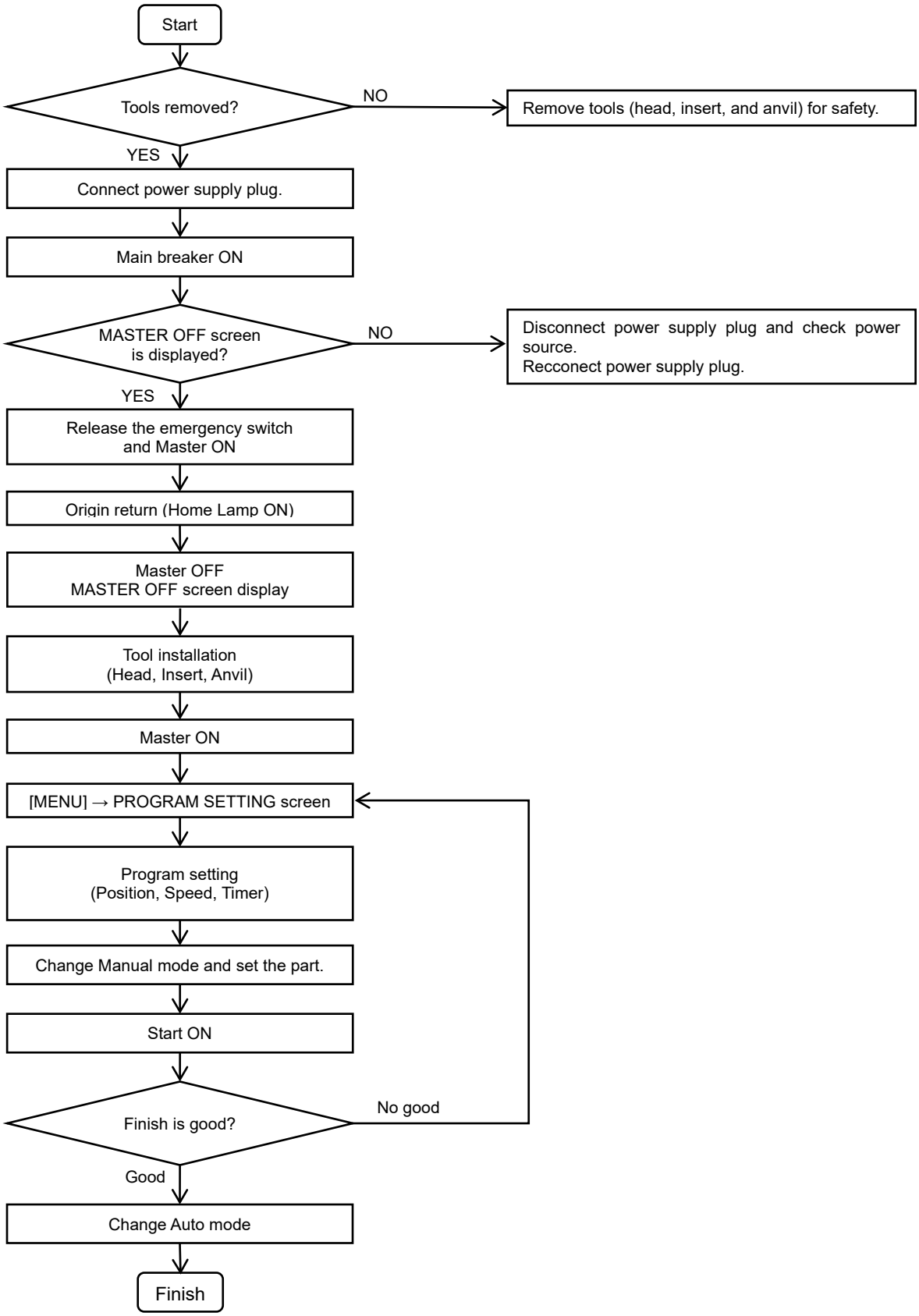


Fig 5.1

5.2 Connecting power

Connect the power supply of「2.4 Electrical specifications P.13」

Check the electrical capacity listed in the specifications for the primary side wiring thickness and determine from the wire rod specifications used.

For the primary power supply, prepare a breaker specifically for this facility and connect it.

⚠ WARNING!

Be sure to ground.
Electric shock and control equipment doing so may cause malfunctions.

5.3 How to set a riveting tool

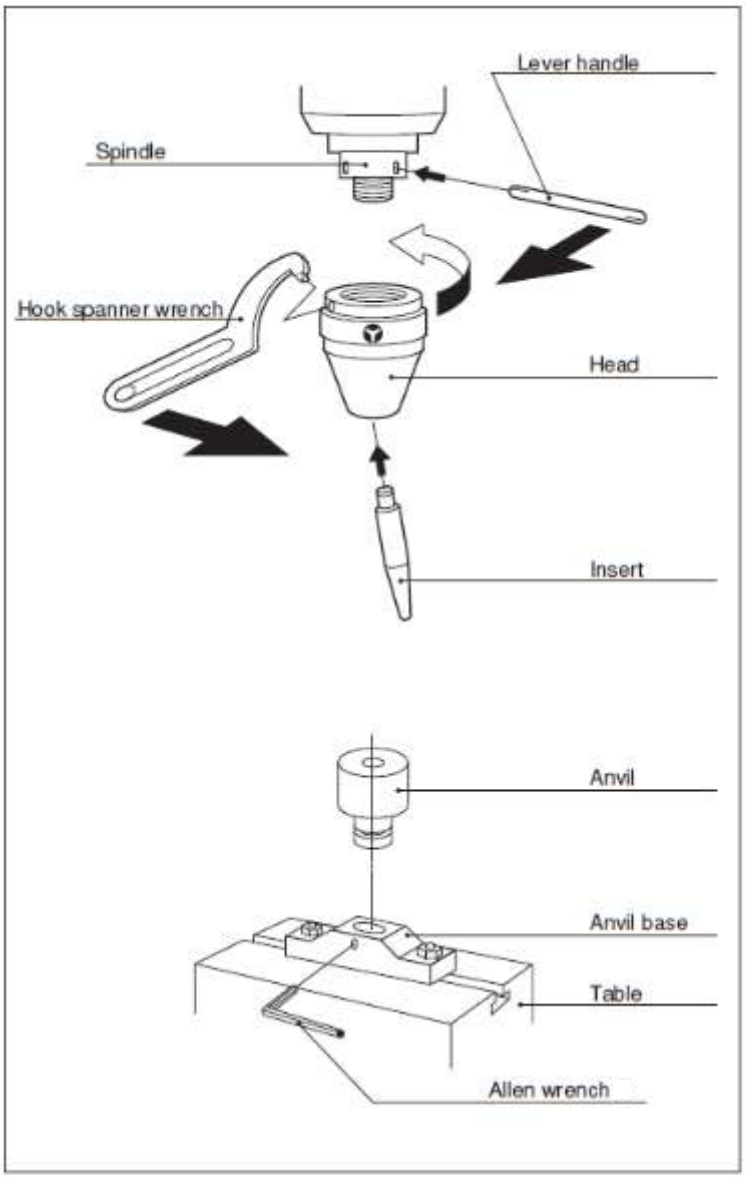


Fig 5.3

Set the jigs and tools necessary for riveting in the following steps.

1) Head (Options)

Screw the head on to the spindle end. Insert the lever handle into the spindle as illustrated and hold it by one hand. Hook the Hook spanner wrench on the head and hold it by the other hand. Fasten the head to the spindle firmly by the two hands.

2) Insert (Options)

Put the insert in the head till feeling a click.

⚠ Caution !

- Install the head and the insert firmly, or they may come off when the machine is operated.
- To remove the insert on completion of riveting, leave it on the head for a while because it is heated hot by operation with a fear of getting burnt.

3) Anvil (Extra Option)

Insert the anvil in the anvil base and fasten it with the set screw

(Install the special jig with T-nuts, extra options.)

⚠ Danger !

Always turn off the breaker before attaching jigs and tools to the riveting machine.
Working while the power is on is very dangerous as an accidental operation may cause injury.

⚠ Caution !

The anvil and the anvil base are extra options and require alignment as with the special jig.

5.4 How to control FRE-05 stroke

In regards to our Riveting machine, there are 3 major factors, “Stroke”, “Pressure”, “Applying pressure time”. They have a huge effects when rivets something.
Follow the bellow steps to rivet appropriately.

> **⚠ CAUTION!**
>
> When control the height of Cylinder slide, turn off the Spindle motor and make sure the Head stops.

1) To control the height of Cylinder
   (1) Unclamp Cylinder
   Loosen each locknut, and also the Clamp levers.
   (2) Moving up and down the Cylinder
   If turn the Ratchet wrench which is the accessories to the left, the Cylinder goes up, and to the right, it goes down after fit into Up-Down screw end on the Column.
   Be able to change the direction of rotation by operating the Ratchet shift lever.
   (3) Control the height of Cylinder
   Control the height of Cylinder to the position, which is possible to attach / detach the product easily between the Anvil or the Jig and the tip of Insert
   However, impossible to rivet something if the pitch between the tip of Insert and the Anvil or the Jig is over the Cylinder stroke (2.36in).
   (4) Fix the Cylinder
   Tighten the Clamp lever and the locknut, then fix the Cylinder.
   (5) Fix the Up-Down screw
   To remove the backlash of the Up-Down screw, turn the Ratchet wrench clockwise and make it fixed.
   If these are there, it results in becoming dislodged by shaking force.

Before adjusting the cylinder stroke, you should
Center the anvil and insert before adjusting the cylinder stroke.

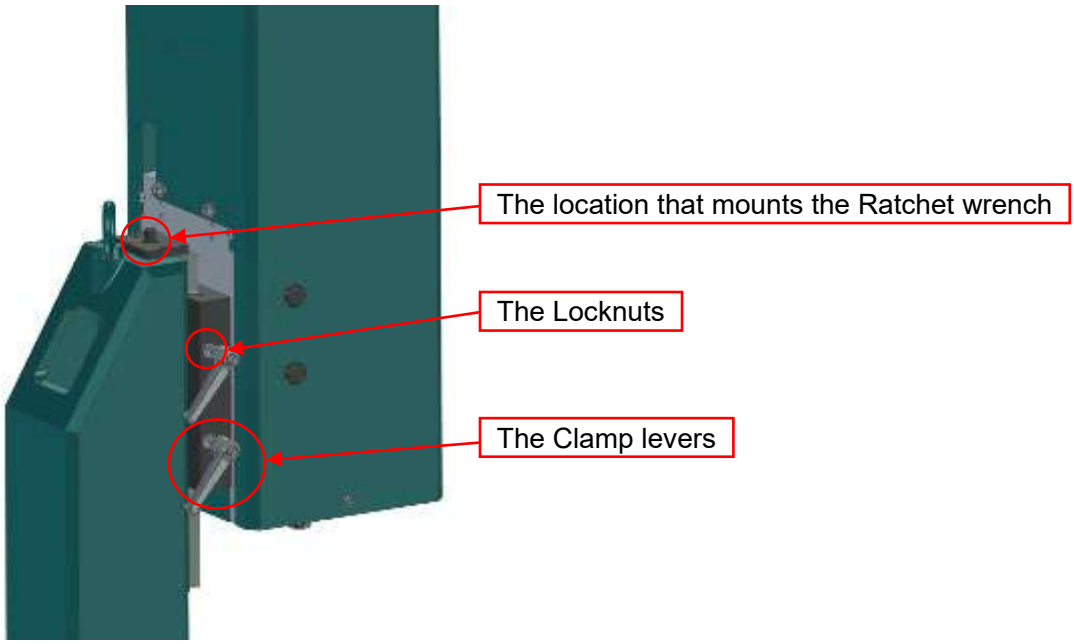


Fig 5.4

5.5 How to control FRE-20 stroke

In regards to our Riveting machine, there are 3 major factors, “Stroke”, “Pressure”, “Applying pressure time”. They have a huge effects when rivets something.
Follow the bellow steps to rivet appropriately.

> **⚠ CAUTION!**
>
> When control the height of Table, turn off the Spindle motor and make sure the Head stops.

1) To control the height of Table
   (1) Unclamp the Table
   Loosen the hexagon nut.
   (2) Loosen the Up-Down screw
   Loosen the lock bolt of the Table Up-Down stand with the Hexagon wrench size 10mm which includes accessories.
   (3) Moving up and down of the Table
   Turn the Up-Down handle and control the height of Table to the position, which is possible to attach / detach the product easily between the Anvil or the Jig and the tip of Insert.
   However, impossible to rivet something if the pitch between the tip of Insert and the Anvil or the Jig is over the Cylinder stroke (4in).
   (4) Fix the Table
   Tighten the hexagon nut.
   (5) Fix the Up-Down screw
   To remove the backlash of the Up-Down screw, turn the Up-Down handle clockwise and make it fixed.
   Loosen the lock bolt of the Table Up-Down stand with the Hexagon wrench size 10mm which includes accessories.

Before adjusting the cylinder stroke, you should
Center the anvil and insert before adjusting the cylinder stroke.

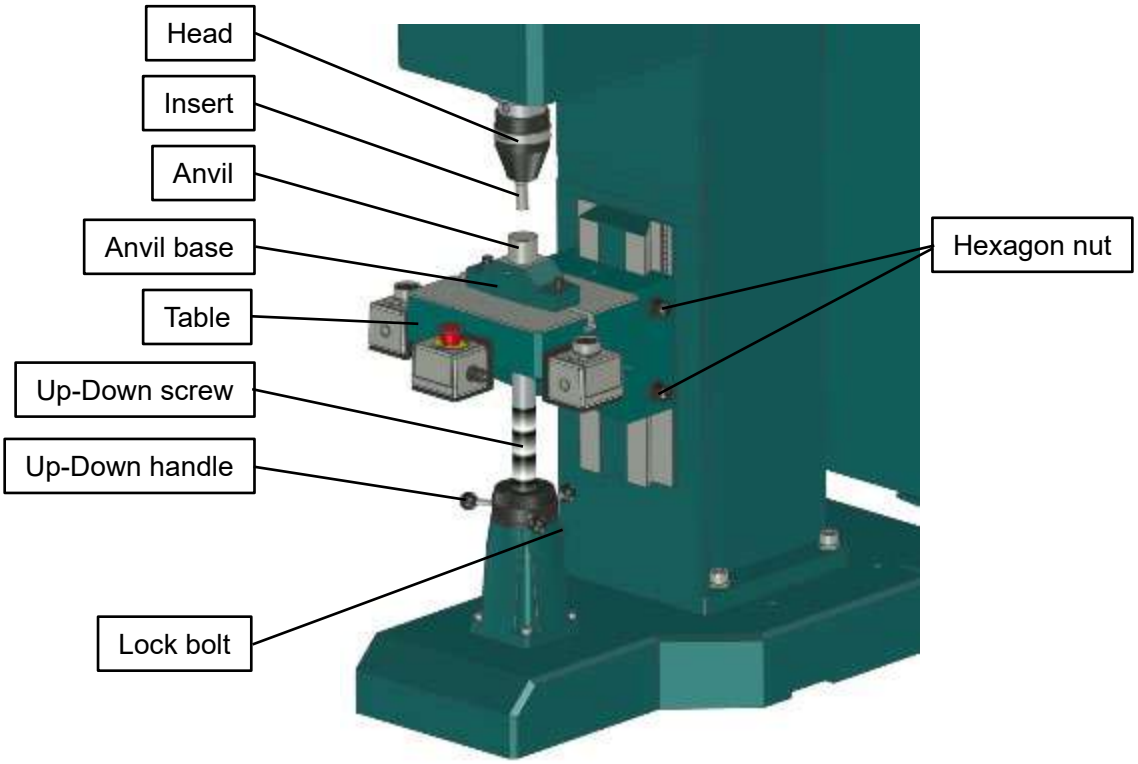
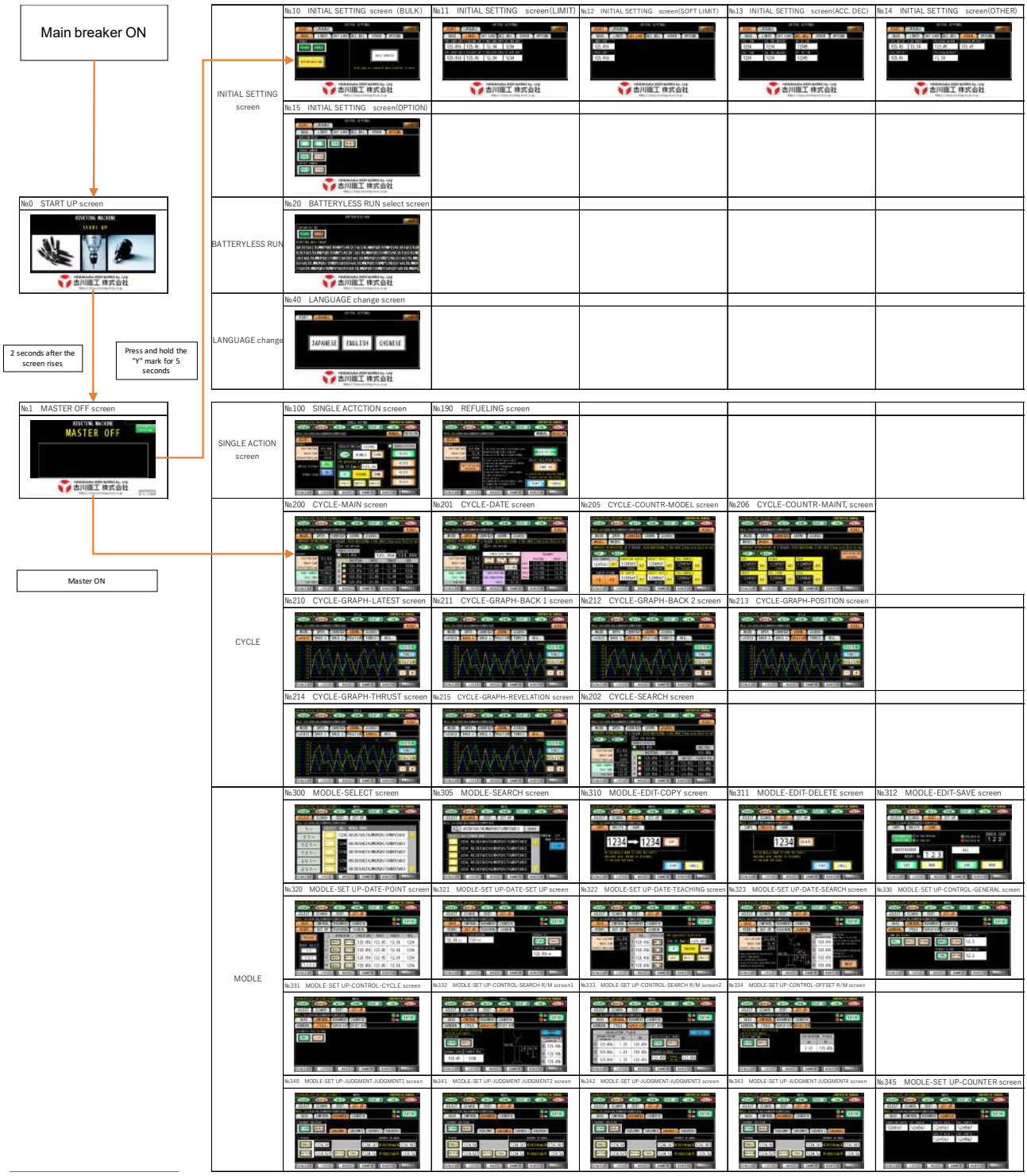


Fig 5.5

5.6 Points to note when determining riveting strokes

1) Minimum riveting stroke
For riveting strokes operated by cycles, 10mm or 1lead or more of ball screws is recommended. When used below 10mm, grease lubrication of the ball screw can not be performed sufficiently, and grease may be cut off and may become difficult.
Periodically (about once a month) grease circulation should be performed.
（⇒15.3 Daily life's check in the ball screw part and the support unit part and lubrication P.129）

5.7 Screen transitions



Press and hold the purge number at the top right of the PARAMETERscreen for 2 seconds.

PARAMETER	№400 PARAMETER-MOVEMENT-GENERAL screen	№401 PARAMETER-MOVEMENT-RETURN ZERO screen	№402 PARAMETER-MOVEMENT-PRG CHECK screen	№403 PARAMETER-MOVEMENT-Hold to run screen	№410 PARAMETER-MAINTENANCE-COUNTER screen
					
	№411 PARAMETER-MAINTENANCE-LOGGING screen	№412 PARAMETER-MAINTENANCE-REFUELING screen	№420 PARAMETER-INTERFACE-EXTERNAL screen	№421 PARAMETER-INTERFACE-INPUT screen	№430 PARAMETER-OPERATION-LOCK screen
					
	№431 PARAMETER-OPERATION-OTHER screen	№440 PARAMETER-LANGUAGE change screen			
					
BACK PARAMETER	№480 BACK PARAMETER-TORQUE screen	№481 BACK PARAMETER-GAIN- R/M AXIS screen	№490 BACK PARAMETER-ADJUSTMENT-TORQUE screen	№491 BACK PARAMETER-ADJUSTMENT-AGING screen	№498 BACK PARAMETER-RELEASE screen
					
MONITOR	№600 MONITOR-CHECK screen	№601 MONITOR-I/O MONITOR screen			
					
FAULT	№800 FAULT-DISPLAY-DEVICE screen	№801 FAULT-DISPLAY- R/M AXIS screen	№802 FAULT-DISPLAY-SPINDLE screen	№810 FAULT-HISTORY-DEVICE screen	№811 FAULT-HISTORY- R/M AXIS screen
					
	№812 FAULT-HISTORY-SPINDLE screen				
					

BALL SCREW REFUELING PROCEDURE button

№190 REF
№206 CYCLE-COUNTER-MAINTENANCE
№412 PARAMETER-MAINTENANCE-REFUELING

REFUELING PROCEDURE	№900 REFUELING PROCEDURE screen	№900-1 REFUELING POINT screen	№900-2 GREASE CIRCULATION CONTROL screen
			

5.8 Definitions used in this review

5.8.1 Common matters used on operating panels and touch panels.

Table 5.8.1

Item	Figure	Description
Operation panel Buttons, lamps	—	In order to distinguish between buttons and lamps on the operating panel and buttons and lamps on the touch panel, this book explains when explaining buttons and lamps on the control panel with an operation panel in front of the name. In the description in this document, buttons and lamps that do not have an operation panel indicate buttons and lamps on the touch panel.
Buttons		The square shape is a button.
Lamps		The round shape is a lamp.
Lamp buttons		The lamp button lights up what you have selected. A button that changes the selection state with a single button displays the current state.
		The button that switches with one button will show what is selected.
Long press button		The button with a white circle in the upper right corner of the button is a button that requires long press.

5.8.2 Common matters of display in touch panel

Fig 5.8.2

(A). Displaying the status of the FRE machine.

Table 5.8.2.a

READY	Thestatus of servos and inverters used in FRE machines is displayed. Green light: Ready to operate. Yellow light: In an in-operation state. Please identify the cause from the alarm code on FAULT screen and eliminate th Green-yellow flashing: An ABS setup of the servo amplifier is required. (⇒8.1.2 Servo return zero P.77)
STO	Only devices that use the「STO function」are displayed. See 3.1.3 Safety torque off「STO」(option) P.15 for more information on STO function Green light: Ready to operate. Yellow Light: In an in-operation state. Press the reset button on the operating panel to release the STO.
MANUAL	Lights up when in manual mode. If the Manual / Auto select switch on the operating panel is set to Manual, it will be in manual mode.
AUTO	Lights up when in auto mode. When the Manual / Auto select switch on the operating panel is set to Auto, it enters auto mode.
HOME	Lights up when the FRE machine is in its home position. The state that meets the conditions of ① and ② below is the home position. ①Being in the point 1 or in the intermediate stop position during the intermediate stop signal ON when the intermediate stop is「enable」. ②Spindle is stopped (can be rotated if spindle setting is continuous)
START OK	Lights up when the riveting cycle can be started. When you press the「START OK」lamp button, the start condition is displayed. (⇒9.5 Start ok (start condition) P.102)
RUN	Lights up during the riveting cycle.
FAULT	Flashes when a fault occurs.

(B). A button for switching screens.

(C). The FRE warning indicate.

Table 5.8.2.b

ORIGIN NON-COMPETION	Lights up when servo return zero is noncomplete. Refer to「8.1.2 Servo return zero P.77」and return to the servo origin.
SOFT LIMIT DISABLE	Lights up when the soft limit on the riveting axis is disabled. (⇒8.1.2 Servo return zero P.77)
BATTERY LOW VOLTAGE	Lights up when the servo amplifier's battery voltage is low. Refer to (⇒15.6 How to replace the sequencer battery (Servo amplifier)P.133) to replace the servo amplifier battery.
BATTERYLESS RUNNING	Lights up during battery-less running. (⇒15.7 Batteryless run P.134)

5.8.3 Defining terms

Contains definitions for FRE machines.

Table 5.8.3

Term	Defined
Home	It refers to the position of the point1 of the model setting.
Origin	The origin refers to the following positions: Servo origin returned position, grease supply position, etc. The position of the origin varies from model to model and is as follows. FRE-05/20：1.000mm FRE-10：0.000mm
R/M	It is an abbreviation of the Riveting Machine.

6 CHECK WHEN POWERING ON

6.1 Check power source

Make sure that the specifications, voltage, and frequency match.

6.2 Connecting wiring connectors

Please confirm that there is no loosening of the connector and the external connector in the control panel.

6.3 Breaker on

Turn on the breaker of the device in the control box.

6.4 Master

Fig 6.4.a MASTER OFF screen

Fig 6.4.b CYCLE screen

ON the breaker displays the「MASTER OFF」screen.
When you press the「Operation panel MASTER ON」Lamp buttons press the master ON and the「CYCLE」screen is displayed.

If you are unable to prepare for Master ON, or if the safety device is working and the master is OFF, the cause is displayed on the「MASTER OFF」screen. Again, to Master ON ready, remove the cause.

Table 6.4 MASTER OFF screen display list

Emergency stop	The emergency stop button is on. Please cancel it.
Emergency stop signal fault	The alarm occurs when both emergencies stop input signals 1 and 2 to the PLC are not ON or OFF.Check the wiring, etc.
Light curtain block	If the light curtain is block, set it to a cast state. If the light curtain is block during equipment operation, it will continue to be displayed even when it is in a cast state. ON to prepare for operation hides it.
High temperature resostive resistance	Displayed when the re-life resistance is at a high temperature (About 260°C or higher). When the temperature drops, you can ON prepare for operation.

⚠CAUTION

If the operation preparation is turned ON/OFF more than 10 times in a 2-minute time, an abnormality occurs.
Please reduce the frequency of master ON/OFF, or if you cannot reduce the frequency, please contact us.
Servo alarm「**_740_Inrush current limit resistance overload」(**varies depending on the servo amplifier of target.)

~Master ON steps~

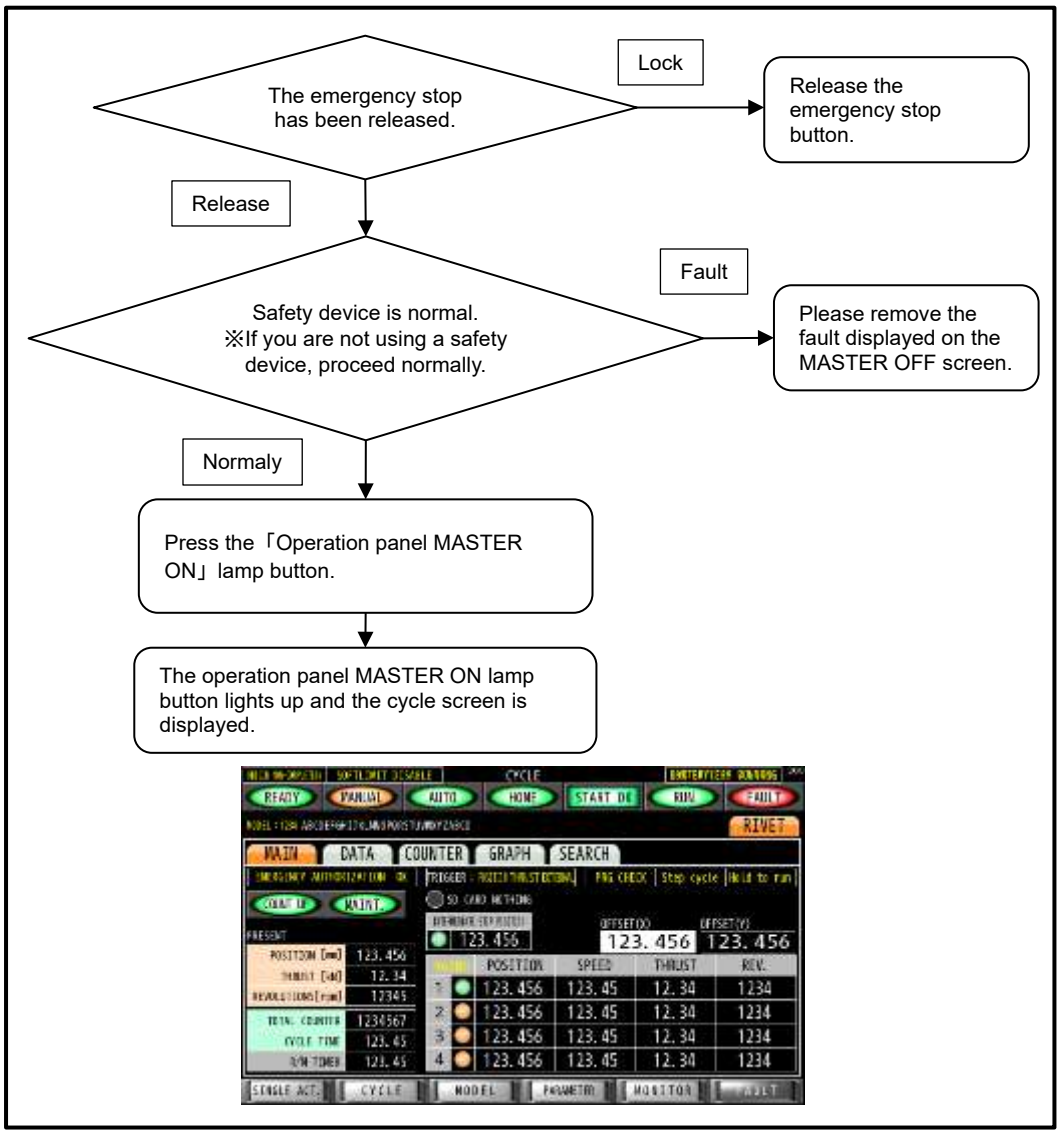


Fig 6.4.c

6.5 Emergency authorization

Fig 6.5.a

After MASTER ON, the device cannot be operated until you enter a password when this screen is displayed. Please contact us with the random number displayed on the screen.
Even if you cannot contact us due to long vacations, etc., you can perform production by emergency authorization.
Emergency authorization can be used up to 5 times, and it decreases once each time the emergency authorization is implemented.

~Emergency use permission procedure~

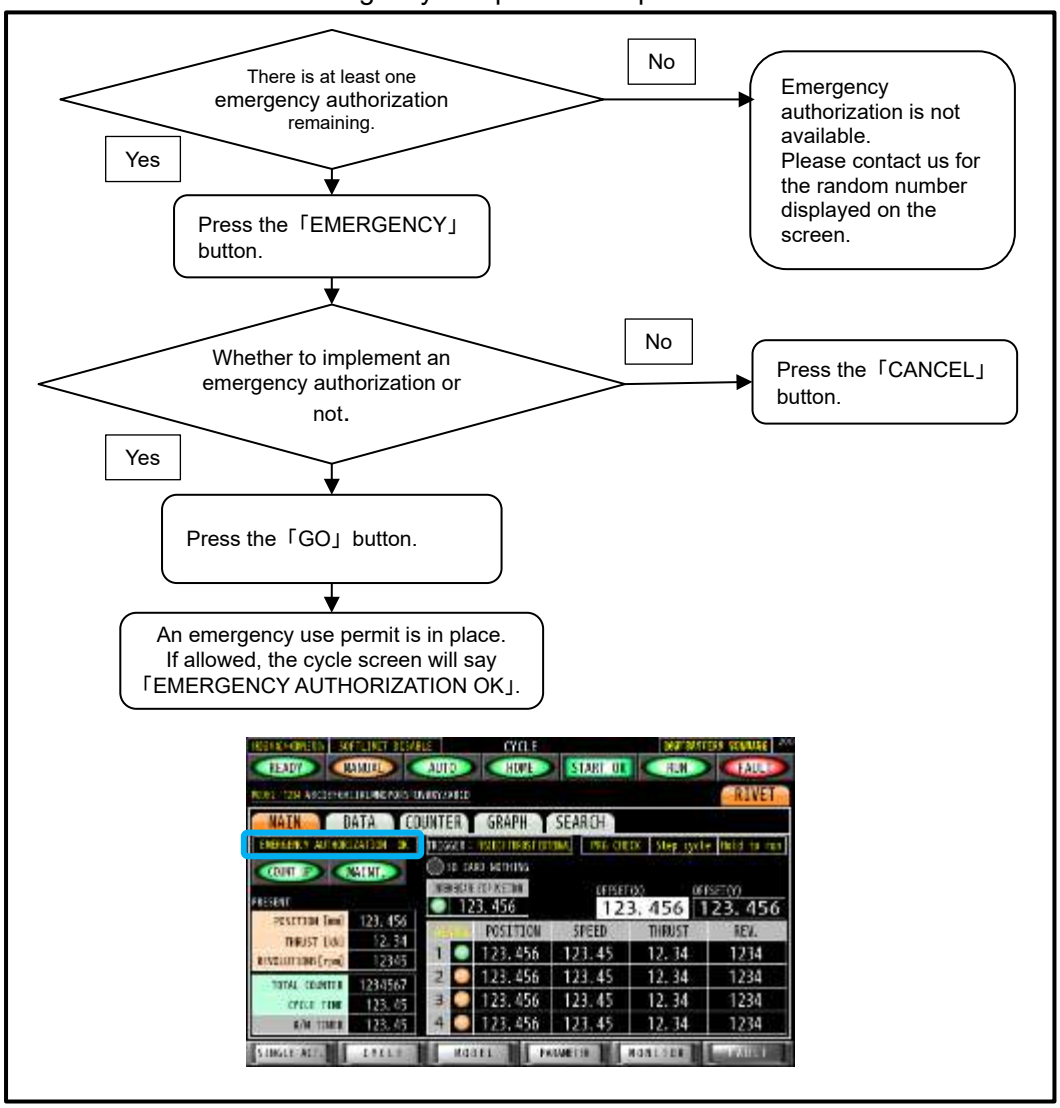


Fig 6.5.b

7 MODEL (PROGRAM) SELECT･SET UP

Fig 7.a MODEL-SELECT screen

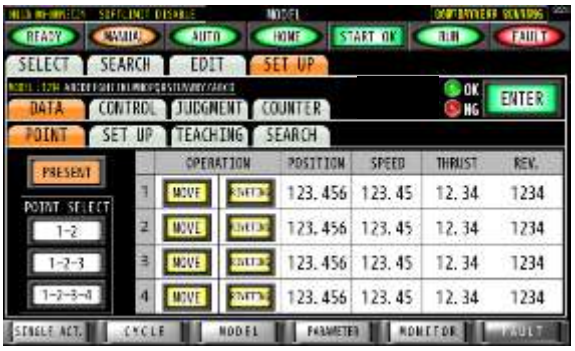


Fig 7.b MODEL-SET UP screen

When you press the「MODEL」button at the bottom of the screen, the「MODEL」screen is displayed. The「MODEL」button lights up while the MODEL screen is displayed.

When you press the「MODEL」button at the bottom of the screen, the「MODEL – SELECT」screen or the「MODEL – SET UP」screen will be displayed.
The setting of the parameter「MODEL BUTTON DESTINATION」determines which screen to go to. (⇒8.4.2 Other P.95)

7.1 Character code

Fig 7.1 Key window

The character codes available in the key window are as follows:
･Ascii Code
･Shift J IS (Hiragana, Katakana, Kanji)

7.2 Model select

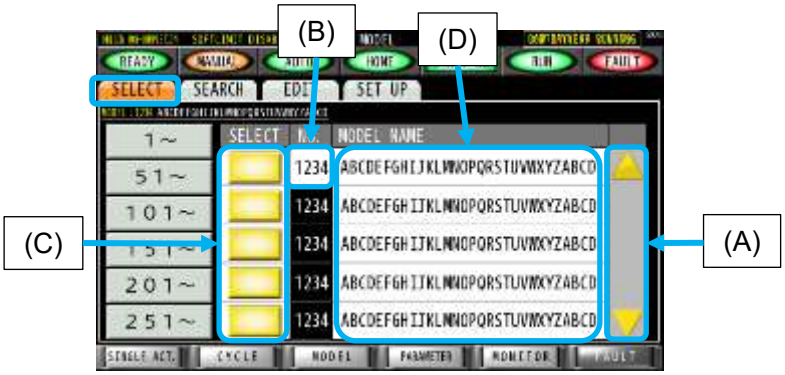


Fig 7.2 MODEL-SELECT screen

Press the「SELECT」button on the MODEL screen, the「MODEL-SELECT」screen is displayed. On this screen, you can select model and edit name model.

1) Model selects
When you press the「△」button in Fig 7.2 (A), the model number of -5 is displayed from the currently displayed model number, and when you press the「▽」button, the +5 model number is displayed.
In addition, when you press the number at lead of Fig 7.2 (B), you can enter a number, and the model number of the entered number is displayed at the lead of 5 model.

Fig 7.2 (C) press「□」button to select the model. The select button「□」lights up.

There are 300 model choose from from 1to 300.
If External model select is「ENABLE」, it is not possible to select a model from the MODEL-SELECT screen.

2) Edit Model name
If you touch the model name in Fig 7.2 (D), a key window will be displayed, and you can register the model name.
See 7.1 Character code P.35 for available characters.

7.3 Model search

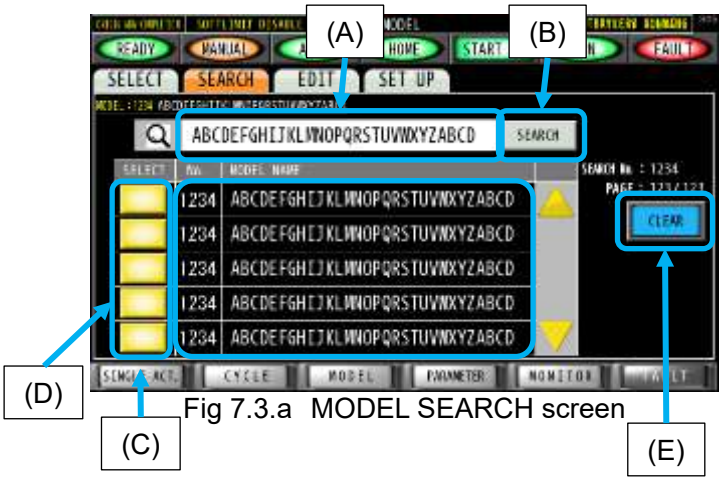


Fig 7.3.a MODEL SEARCH screen

When you press the「SEARCH」button on the MODLE screen, the「MODEL SEARCH」screen is displayed.

「MODEL-SEARCH」screen, you can search for a specific model from the model name.
The name of the model that contains the character column for the search name is searched.
See 7.1 Character code P.35 for available characters.

~MODEL search procedure~

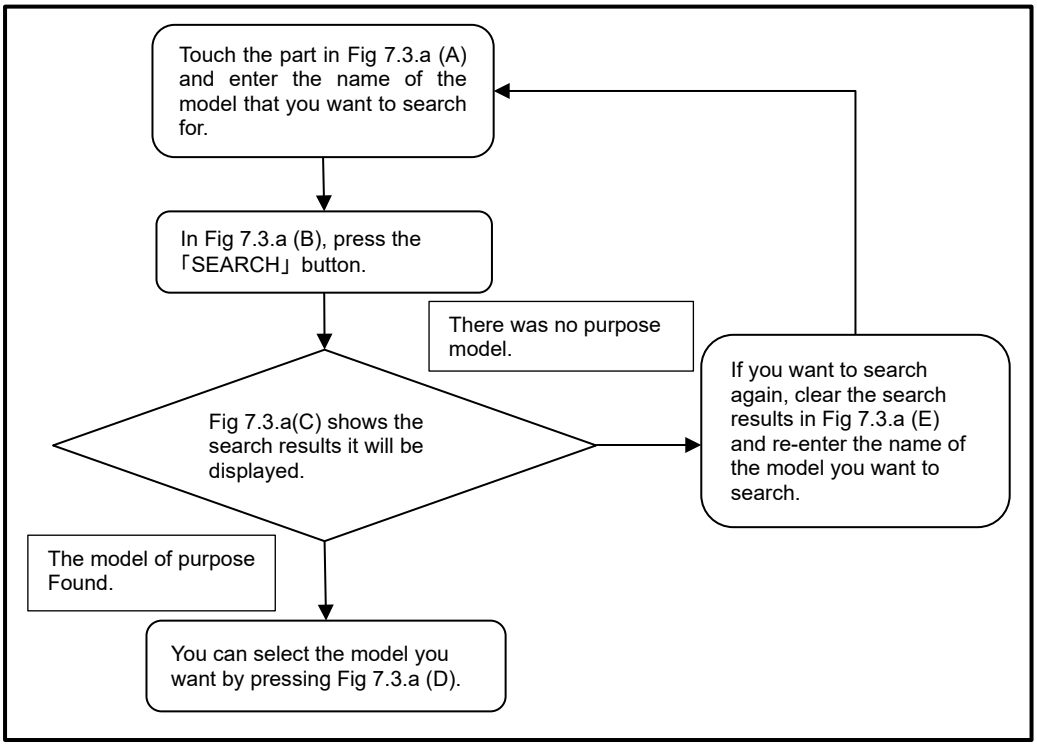


Fig 7.3.b

7.4 Model set up

Fig 7.4.a MODEL SELECT screen

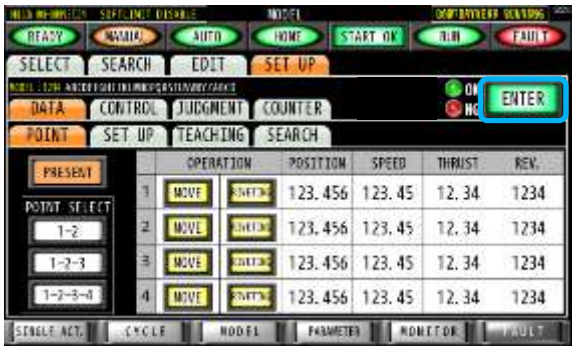


Fig 7.4.b MODEL SET UP screen

Point 1 of the position data is lower than point 2. (Large setting value)

Fig 7.4.c MODEL SET UP NG sample

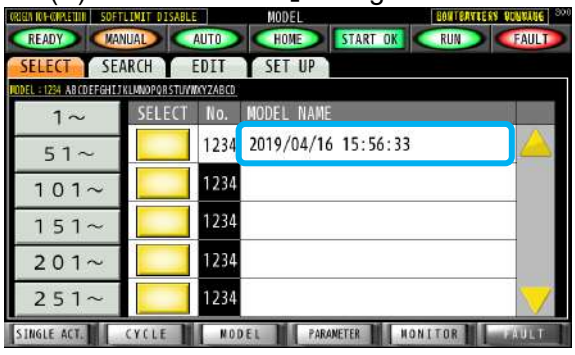
Press the「SET UP」button on the MODLE screen, the「MODEL–SET UP」screen is displayed.
Set the model on the MODEL-SET UP screen.

※ Before pressing the「ENTER」button, if you move from the MODLE-SET UP screen, the setting contents will return before setting.

1) Timestamp

If you press the ENTER button without registering the model name, the current time is registered in the model name.

When you copy a model that has a timestamp entered,「(A) Source model number」+「COPY」+「(B) the current time」is registered as the model name.



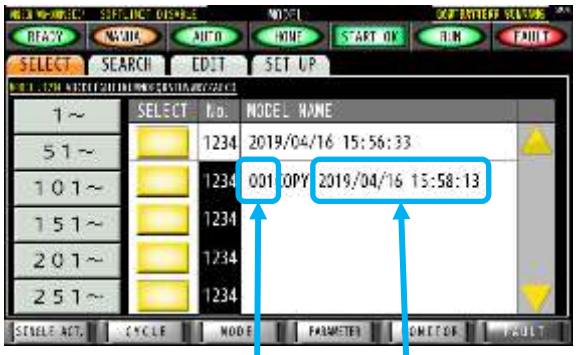


Fig 7.4.d

~Model setting procedure~

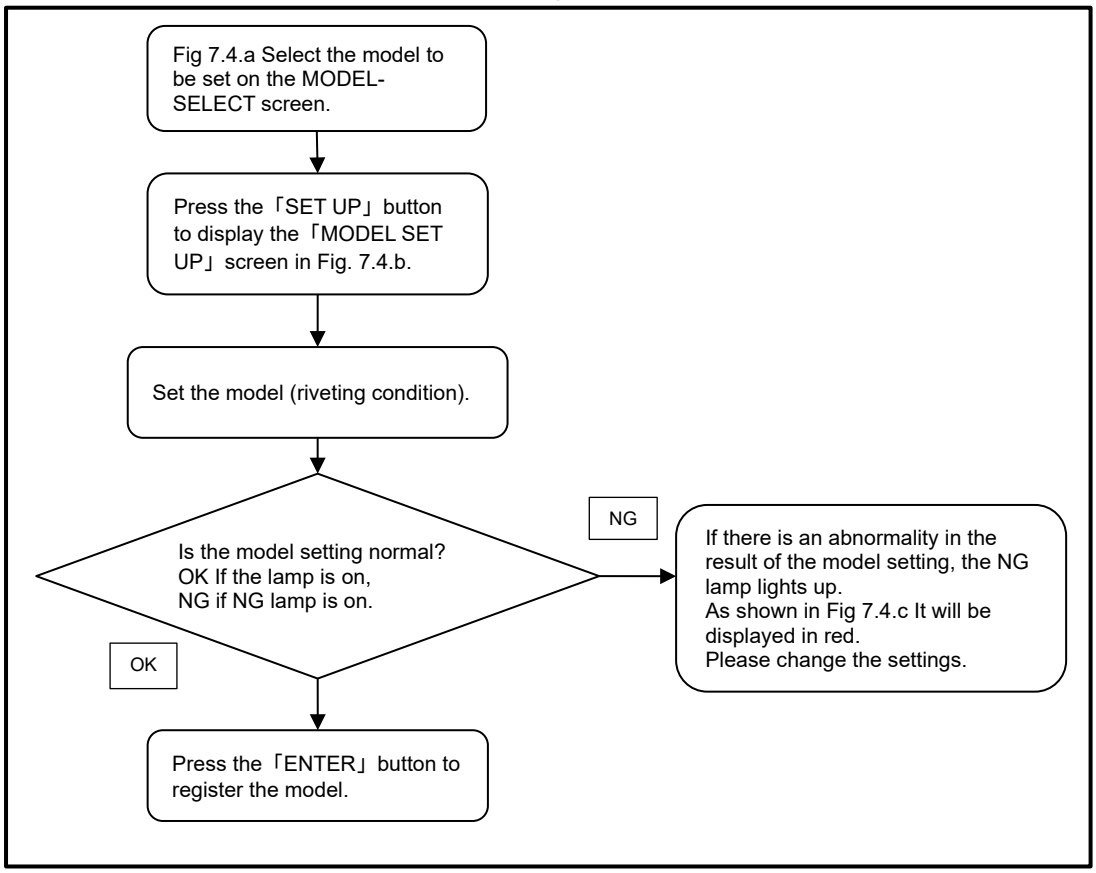


Fig 7.4.e

7.4.1 Data

1) Point selects

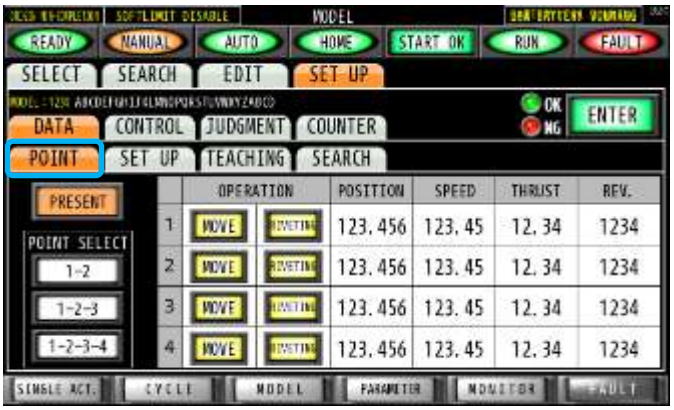


Fig 7.4.1.a POINT screen

Press the「POINT」button on the MODEL-SET UP-DATA screen to display the「POINT」screen.
Here you can set the points used in the riveting cycle, the position and thrust of each point.

(1) POINT SELECT
You can select the number of points to use in the riveting cycle.

(2) OPERATION
Select the operation you want to do at the point. The action of the final point is always「RIVETING」.

MOVE	When you set a point to Move, you can use it as a fast move. THRUST and spindle REV. cannot be set.
RIVETING	If you set a point to a riveting, you can use that point as a riveting. Set the thrust and spindle revolutions for the riveting point.

(3) POSITION
You can set the position when moving to the point. Be sure to put a number greater than the top point.

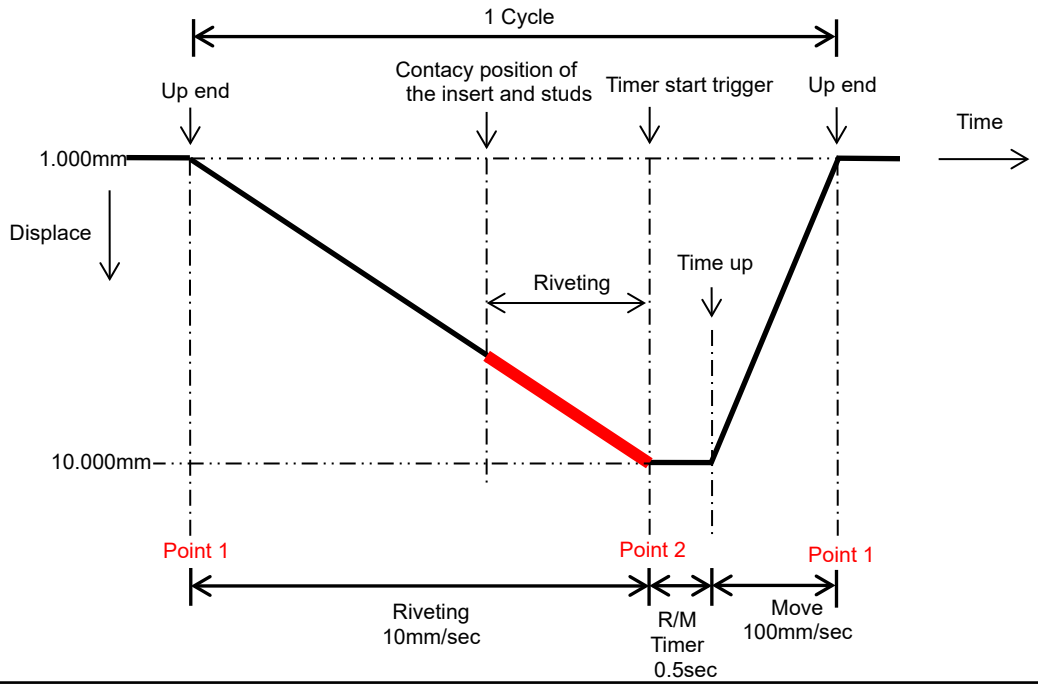
(4) SPEED
You can set the speed at which you move to a point.

(5) THRUST
You can set the thrust when riveting. Only points in the riveting are displayed.

(6) REV.
You can set the number of revolutions when riveting. Only points in the riveting are displayed.

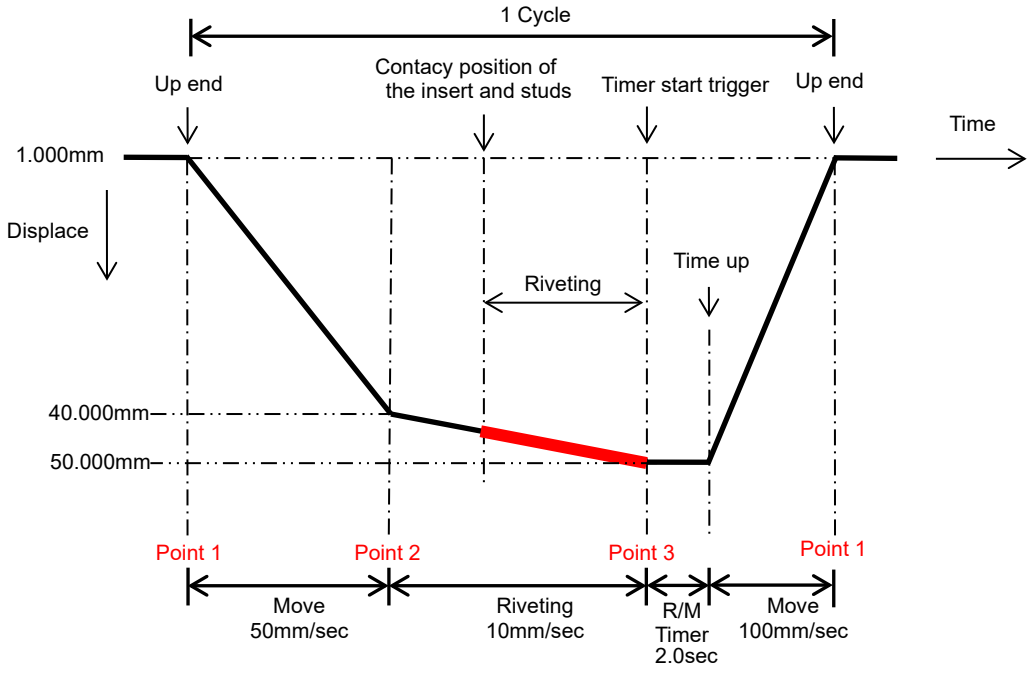
※ Example1

Point 1	Move	1.000mm	100mm/s
Point 2	Riveting	10.000mm	10mm/s
Point 3	Disable		
Point 4	Disable		
R/M Timer		0.5sec	



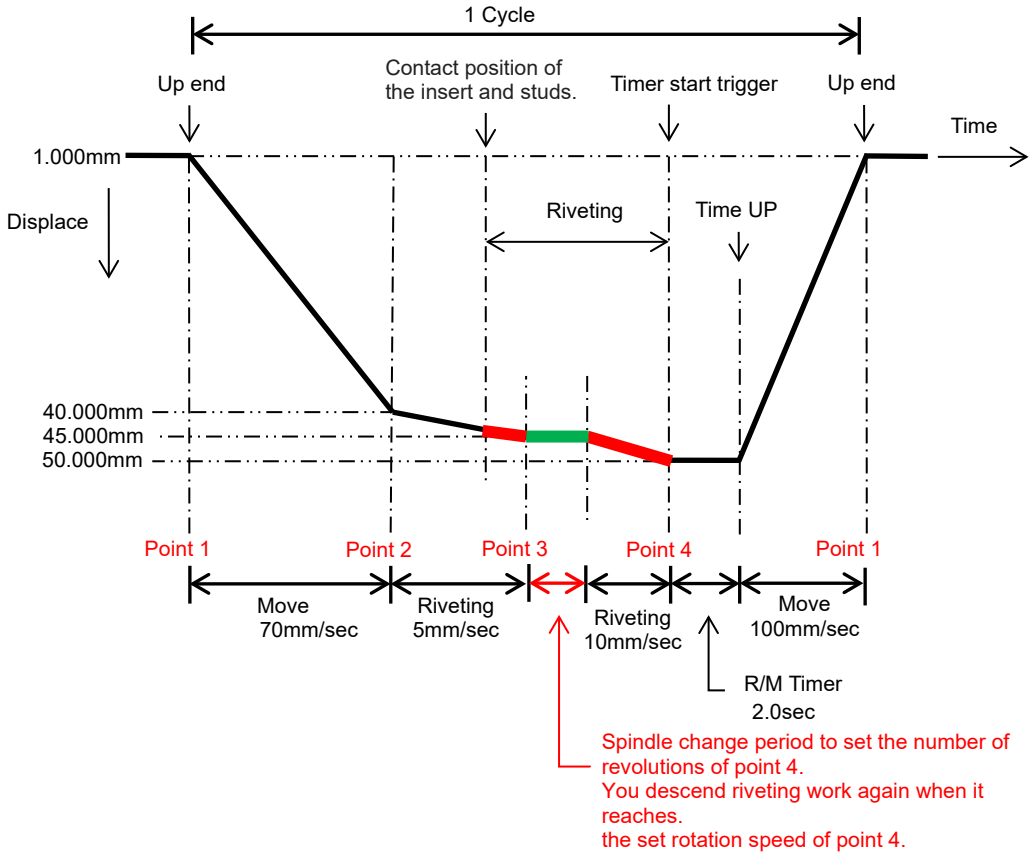
※ Example2

Point 1	Move	1.000mm	100mm/s
Point 2	Move	40.000mm	50mm/s
Point 3	Riveting	50.000mm	10mm/s
Point 4	Disable		
R/M Timer		2.0sec	



※ Example 3

Point 1	Move	1.000mm	100mm/sec
Point 2	Move	40.000mm	70mm/sec
Point 3	Riveting	45.000mm	5mm/sec
Point 4	Riveting	50.000mm	10mm/sec
R/M Timer		2.0sec	



2) Set up

Fig 7.4.1.b SET UP screen

Press the「SET UP」button on the MODEL-SET UP-DATA screen to display the「SET UP」screen.
You can set the riveting timer and the intermediate stop position.
When you touch the number part, a key window is displayed.

(1) R/M timer
You can set the time for the timer start trigger to ON and then riveting.
○Setting range：0~99.99sec

(2) Riveting overtime
The overtime value of the riveting cycle can be set for each model.
If the setting is「0.00」sec, it is disabled and the PARAMETER screen overtime value is applied.
If the cycle time exceeds the set value, an fault of「R/M overtime (MODEL)」occurs.
○Setting range：0~999sec

(3) Intermediate stop
It can be used when the external input「Intermediate Stop」and the model setting「Intermediate Stop」are enabled.
With intermediate stop, when rising after the riveting cycle is completed, it moves to the coordinates set at the intermediate stop position without moving to the position of point1.
※The coordinates of the intermediate stop position must be at least the coordinates of the point2 and within the coordinates of point2. If it is out of range, an「Inteermediate stop position error」will occur.

① How to move to the intermediate position

Riveting cycle	If the intermediate stop signal is ON from the start of the riveting cycle to the R/M time up, it will move to the coordinates set at the intermediate stop position without moving to point1 position when move.
Return to intermediate position	When the intermediate stop signal returns to its home position with ON, the riveting machine moves to the coordinates set at the intermediate stop position. When returning to the intermediate stop position, it moves at the point1 move speed. Even if the intermediate stop signal is turned off while the intermediate position is being restored, it will return to the intermediate position.

② Cycle start condition

If the intermediate position signalis in the O N state, you can do a riveting cycle from the intermediate position.

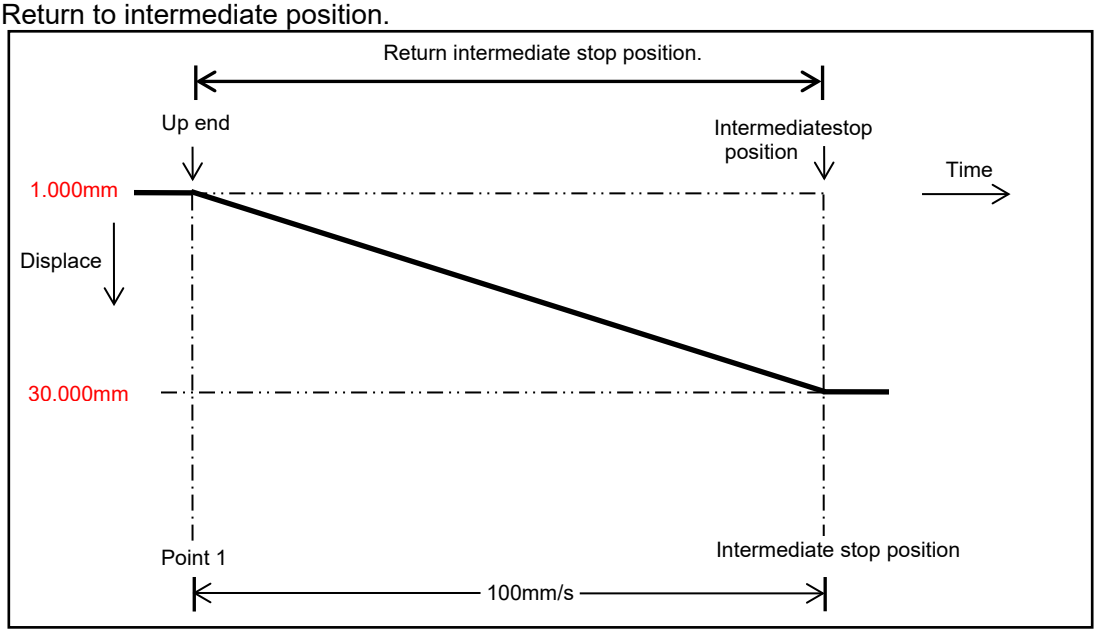
You can also do a riveting cycle from the point1 with the intermediate position signal at ON.

When the intermediate position signalis OFF, the riveting cycle cannot be performed from the intermediate position.

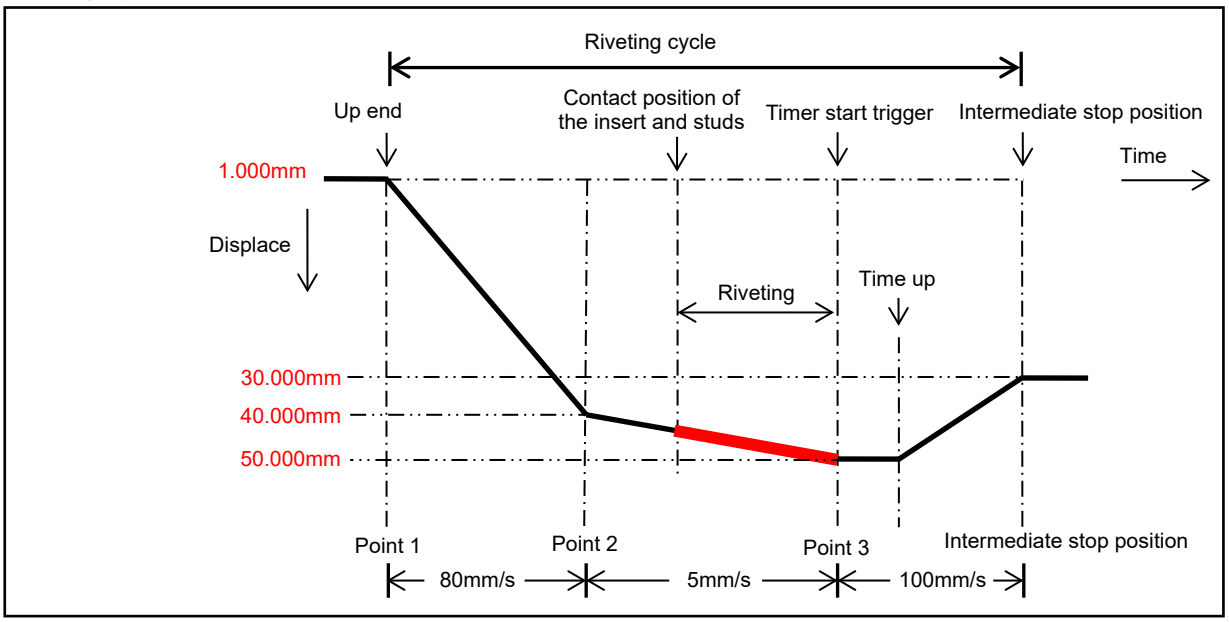
※Example of intermediate stop data setting

	Position	Speed	Intermediate stop position
Point 1 Move	1.000mm	100mm/s	30.000mm
Point 2 Move	40.000mm	80mm/s	
Point 3 Riveting	50.000mm	5mm/s	
Point 4 Disable			
R/M Timer	2.0sec		

Return to intermediate position.



Riveting cycle



3) Teaching

Fig 7.4.1.c TEACHING screen

Press the「TEACHING」button on the MODEL-SET UP-DATA screen to display the「TEACHING」screen.

Press the「WRITE」button on each point to write the current position to the position of each point.
Position data can be registered while checking the position with JOG or INCHING operation.
For more information on JOG / INCHING, see 10.1.1 Riveting P.104.

Points with disable point settings do not display a number, and the「WRITE」button is off.
※On the teaching screen, you can only set the position.
Please register the R/M timer, speed, thrust, and revolutions in advance.

~Teaching Procedure~

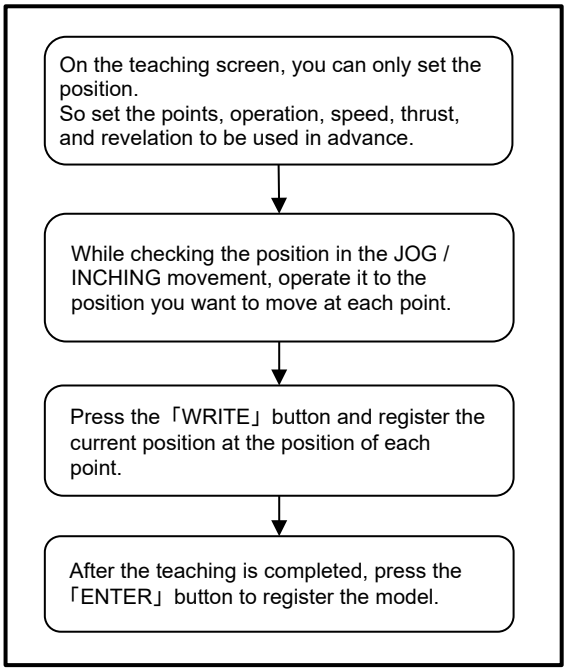


Fig 7.4.1.d

4) Search

※ It is a function that finds the position where the insert touches the tip of the rivet and creates a model setting of the position.

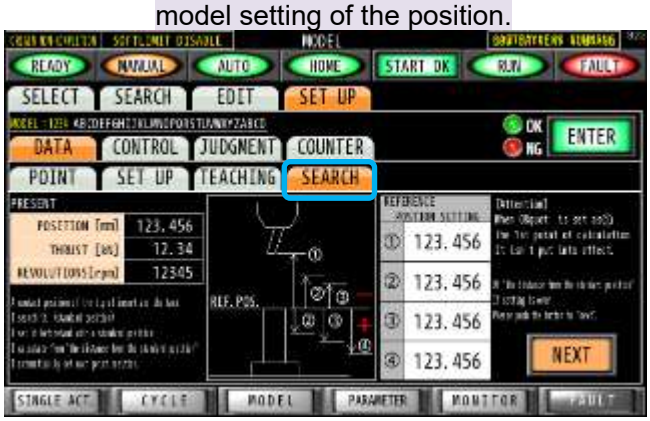


Fig 7.4.1.e SEARCH CONDITION screen

Fig 7.4.1.f SEARC OPERATION screen

Press the「SEARCH」button on the MODEL-SET UP-DATA screen to display the「SEARCH」screen.

Set the rivet to the anvil and write the position of each point by searching for the tip position of the rivet.
When the search is started, the cylinder moves down and writes the touches from the base position set in advance as the base position where the tip of the rivet contacts the insert as position data.

Press operating panel RESET button on the during the search interrupts the search.

※ Since the descent speed at the time of search is slow, please move it near the rivet by JOG / INCHING operation in advance.

Table 7.4.1.a Search terms

Base position	The position where the insert touches the tip of the rivet is the base position. The base position is determined by the riveting machine itself.
Distance from base position	Enter the distance from the base position at each point. Enter a value of +(plus) for the lower side (riveting) and -(minus) for the upper (move) for the base position. Disable points in the point settings do not display a number.

~Search steps~

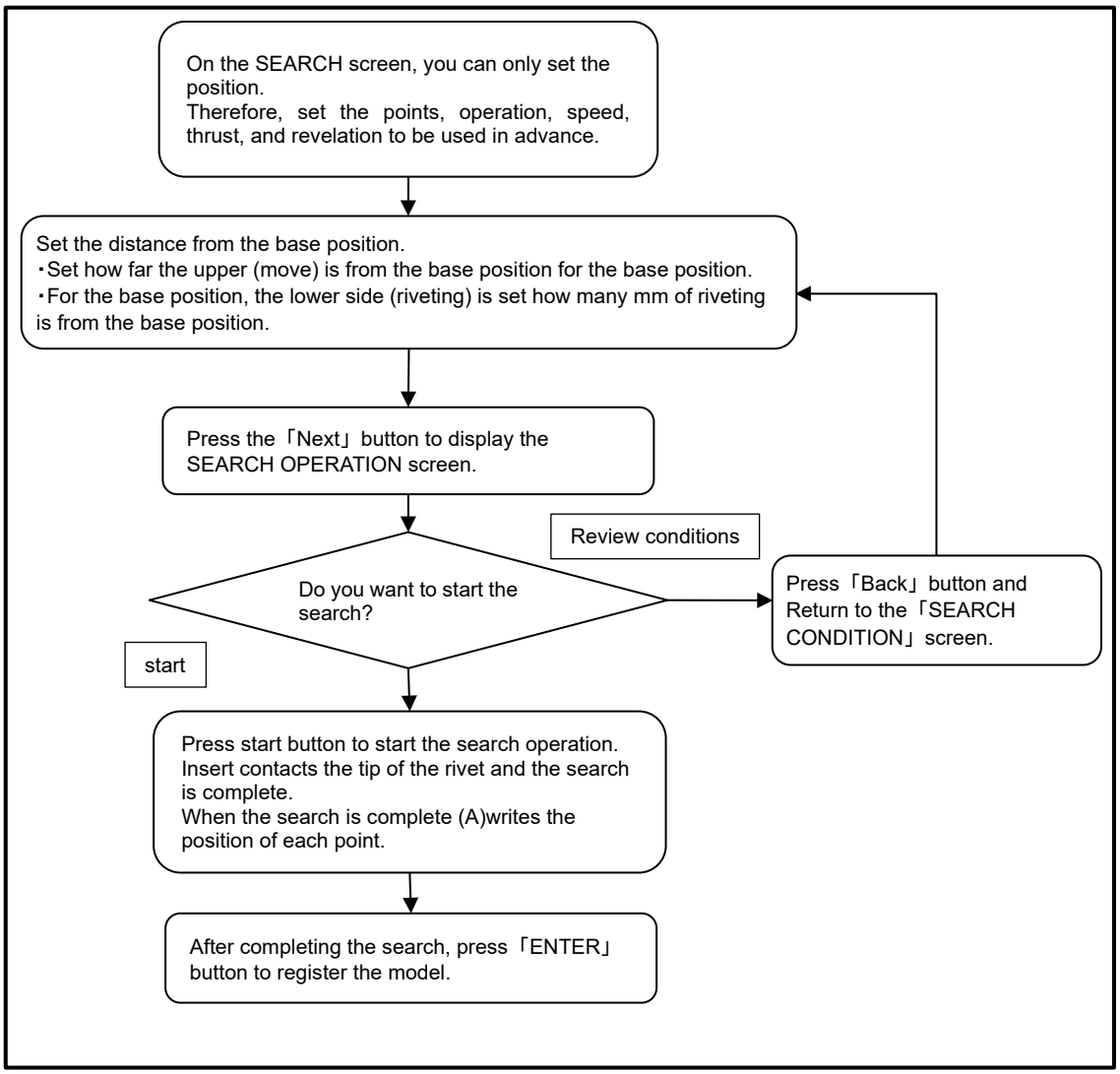


Fig 7.4.1.g

※ Search setting example

The base position of the search result 25.500mm

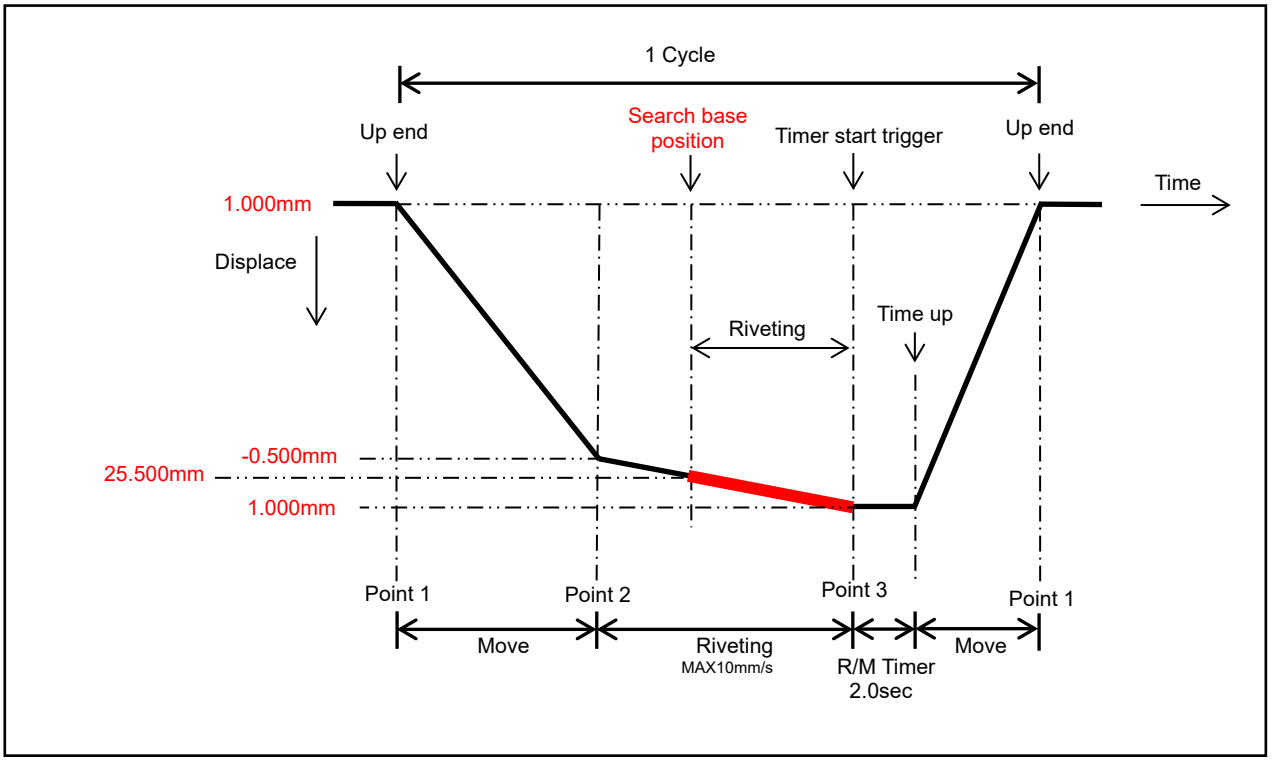
Distance from base position

Point 1	-23.500mm
Point 2	-0.500mm
Point 3	1.000mm

Distance from base position

Point 1	Move	25.500+(-23.500)=2.000mm
Point 2	Move	25.500+(-0.500)=25.000mm
Point 3	Riveting	25.500+(+1.000)=26.500mm
Point 4	Disable	
R/M Timer		2.0sec

Base position + set distance of each point = each point position



7.4.2 Control

1) General

Fig 7.4.2.a GENERAL screen

Press the 「GENARAL」 button on the MODEL-SET UP-CONTROL screen to display the 「GENERAL」 screen.

(1) TIMER START TRIGGER

Set the trigger to become a down end signal.

When the timer start trigger turns ON, riveting is performed at that position for the time set by the R/M timer.

Position	When it reaches the position of the down end point, the timer start trigger ON.
Thrust	Between the start of riveting to the down end point and reaching down end position, timer start trigger is turned on when the thrust reaches the set thrust. Once the set thrust is reached, the timer start trigger continues to ON, even if the thrust is lower than the set thrust during the riveting cycle. When thrust is reached, the riveting cycle ends, so it may not move to the down end position. When the down end is reached, it becomes fault, 「M_70_R/M thrust trigger down end over」. (⇒8.3.1 Common specifications 3)List of signal contents P.87)
External	The timer start trigger is turned on when the external down end signal is turned on between the start of move to the down end point and the time it reaches the down end position.

(2) Spindle / Spindle operation
Set the spindle behavior during the riveting cycle.

① Disable
The spindle does not turn during the riveting cycle.

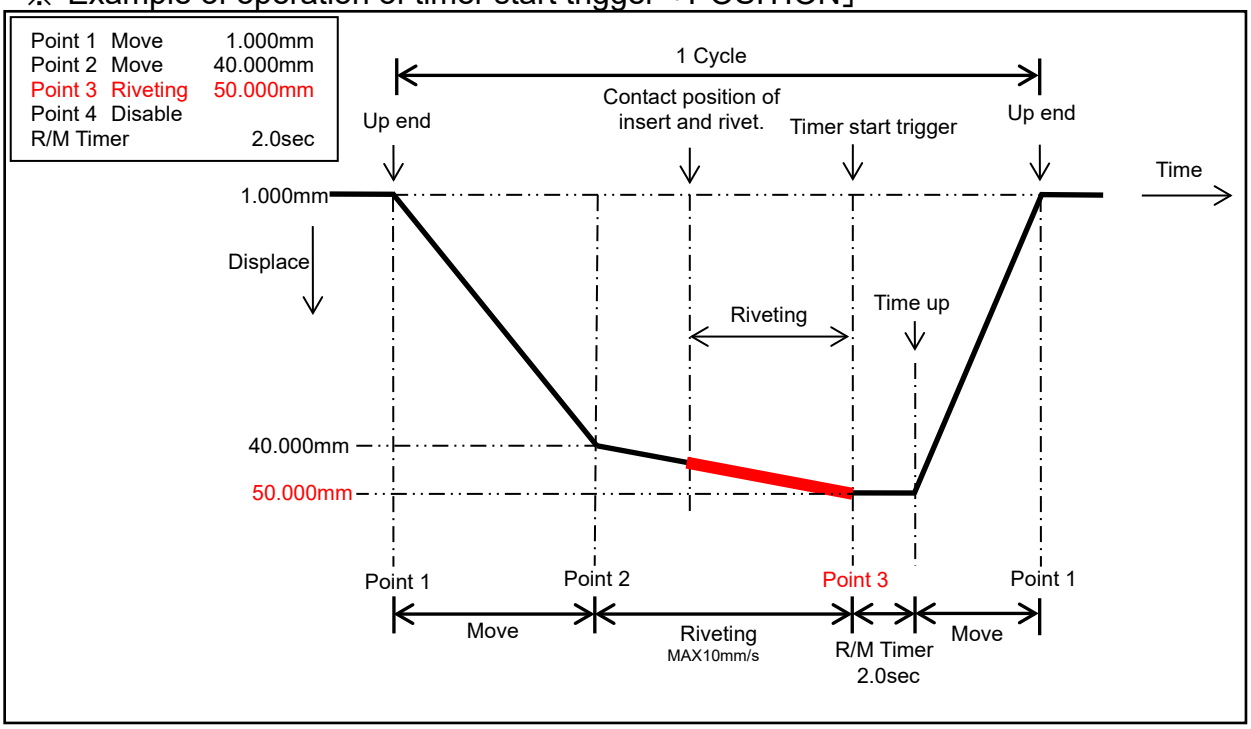
② Enable
The spindle turns during the riveting cycle.
※The「SYNC」and「CONTINUE」settings are applied only in「AUTO」mode.
When in「MANUAL」mode, it is always「SYNC」.

I. SYNC
When the riveting cycle begins, the spindle turns, and the cylinder move.
Check that the revolutions has reached the set value before the movement moves to the「RIVETING」point.
Start moving to the「RIVETING」point if you have reached it, and wait at that position to reach it if you have not.
When the cylinder moves to its home position, the spindle stops.

II. CONTINUE
When the riveting cycle begins, the spindle rotates, and the cylinder move.
Continues to turn as the cylinder moves to its home position.

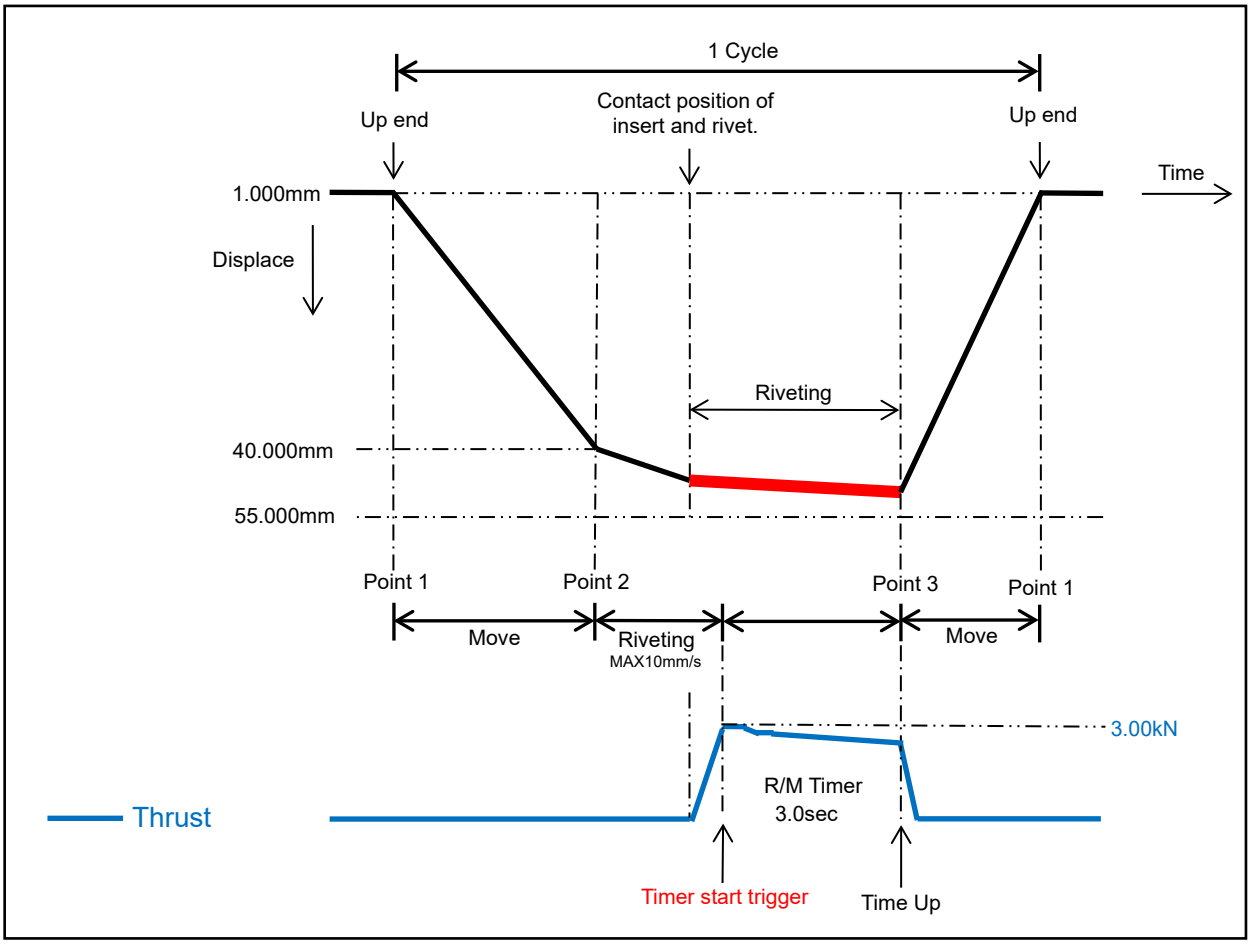
The rotation stops when:
・When in manual mode
・When an fault occurs
・When the spindle stop button is pressed

※ Example of operation of timer start trigger「POSITION」



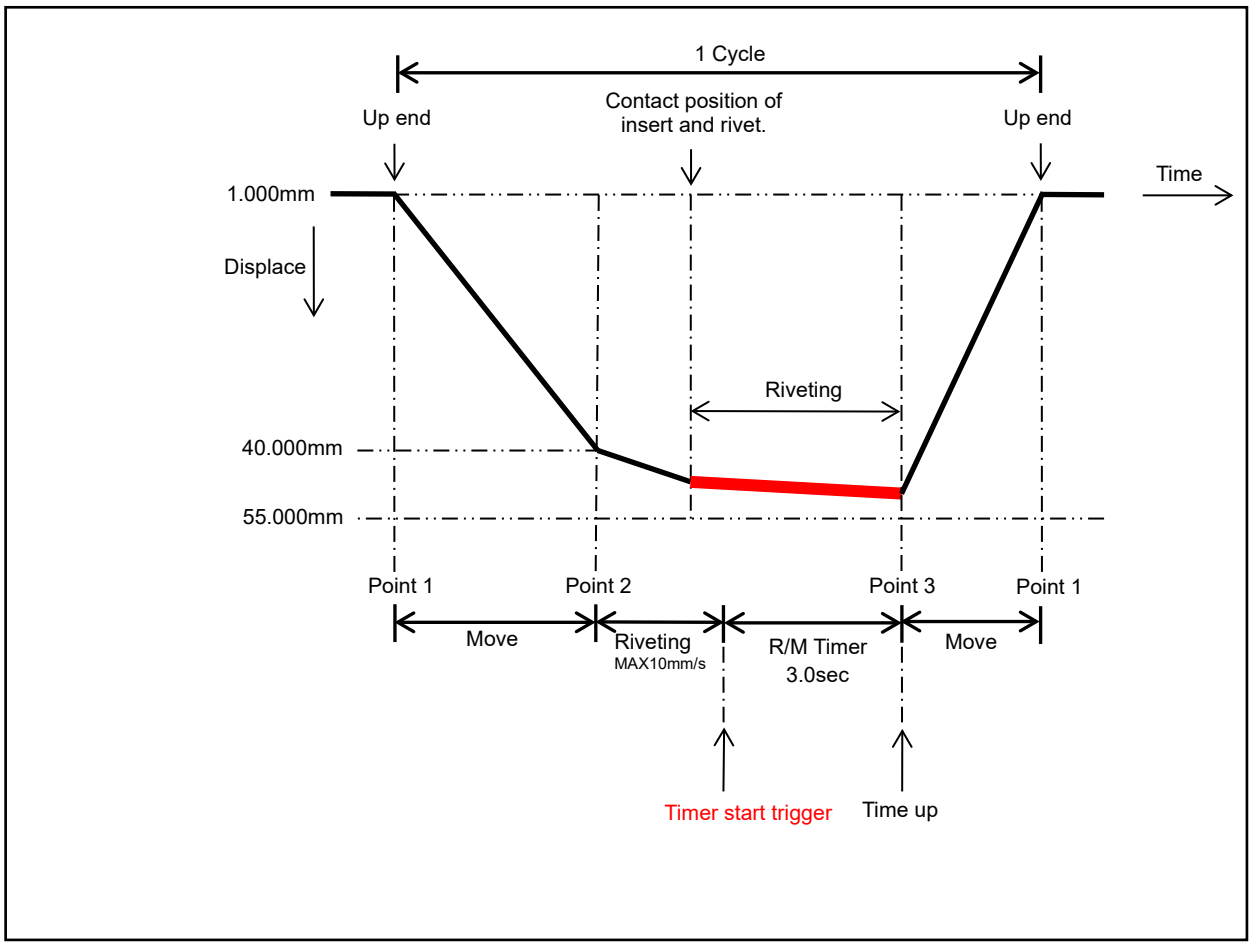
※ Example of operation of timer start trigger「THRUST」

		Position	Thrust
Point 1	Move	1.000mm	
Point 2	Move	40.000mm	
Point 3	Riveting	55.000mm	3.00kN
Point 4	Disable		
R/M Timer		3.0sec	



※ Exsample of operation of timer start trigger「EXTERNAL」

		Position	Thrust
Point 1	Move	1.000mm	
Point 2	Move	40.000mm	
Point 3	Riveting	55.000mm	3.00kN
Point 4	Disable		
R/M Timer		3.0sec	



2) Cycle

Fig 7.4.2.b CYCLE screen

Press the「CYCLE」button on the MODEL-SET UP-CONTROL screen to display the「CYCLE」screen.

There are「Continuous (CONT.)」and「STEP」in how the riveting cycleworks.
Press the「Continuous (CONT.)」and「STEP」buttons, and the selected lamp will light up.
The behavior changesdepending on the「Hold to run」setting. (⇒8.1.4 Hold to run P.80)

Cycle	Hold to run	Action
Continuous	Disable	When the start up signal is turned on, the riveting cycle starts. If you OFF the start up signal after the riveting cycle starts, the riveting cycle continues.
	Enable	When you start a riveting cycle, you must continue to ON the start up signal until you reach the「RIVETING」or「DOWN END」, and the riveting cycle will not be preserved. If the start up signal turns off before it is retained, it becomes「Hold to run fault」and the cycle stops in place.
STEP	Disable	When the start up signal is turned on, the riveting cycle operation starts. When the riveting cycle starts, it moves to point2. Wait when the move is completed to point2 and move to the next point by OFF the start up signal once and on again. It automatically rises after reaching the down end. If you turn off the start up signal while moving to the next point, it continues to move.
	Enable	If you do not continue to ON the start up signal from the start of the move to the next point until the move is complete, the riveting cycle will not be preserved. Once the move is complete, the cycle is preserved, so the boot signal is OFF once and ON again to start moving again. When you start the move, the retention is released. If the start up signal is turned off when the hold is released, it becomes「Hold to run error」and the cycle stops in place.

~Example of automatic 1 cycle operation~

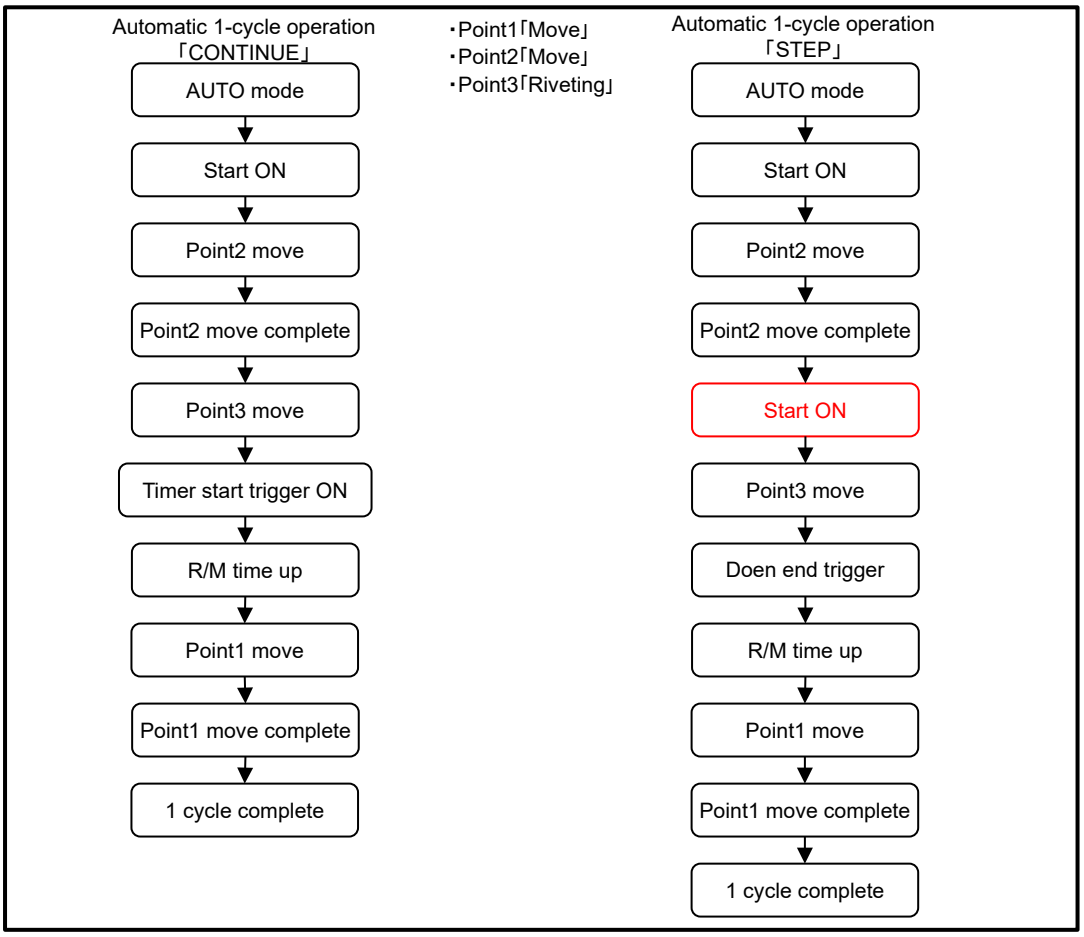


Fig 7.4.2.c

3) Search riveting

(1) Search riveting overview

Search riveting is a function that detects the touch position of the tip of the insert and the rivet every cycle and performs the riveting operation of the amount of riveting set in advance from the touch position relative to the touch position.

In this unit, the operation of detecting the touch position between the tip of the insert and the rivet and calculating the position where the rivting machine finally down (the final riveting position) is defined as the **Search operation**, and the operation of riveting to the final riveting position is defined as the **Riveting operation**.

Search riveting is a combination of these two operations.

Search operation	When searching operates differently than riveting program. speed operates at search speed and revolutions operates at search revolutions.
Riveting operation	Performs the same operation as set in riveting program, which is the same as normal riveting.

(2) Search riveting operation

① Set program and start 1 Cycle.

② In search riveting control, until the position where the operation switches from move to riveting (riveting operation start position) when moved, search operation is started to detect position of rivet the position.

③ Touch position with the rivet is defined as touch position, and riveting amount is added to it. When final riveting position is calculated, search operation is completed.

④ When search is completed, riveting operation starts until the calculated final riveting position.

⑤ When riveting is completed, it moves to point1 in the same way as normal riveting.

(3) Calculation formula

Search riveting calculates riveting amount based on calculation formula below.

「Actual riveting amount (Y)」=「Coefficient (a)」×「Riveting amount theoretical value(X)」+「Offset value (b)」

By riveting conditions such as search speed, insert, rivet, etc.

There will be an error between the set amount of riveting and actual amount of riveting.

Therefore, the theoretical Riveting amount theoretical value (X) is corrected using the Coefficient (a) and the Offset value (b), and the Actual riveting amount (Y) is calculated.

Therefore, use「Coefficient (a)」and「Offset value (b)」to correct the 「Riveting amount theoretical value (X)」to calculate「Actual riveting amount (Y)」.

In Initial setting,「Coefficient (a) =1.00」「Offset value (b) =0」is set.

The offset amount can be set and operated within the stroke range of the riveting machine.

(4) ONLINE / OFFLINE function

When Offline is selected, the「Riveting amount theoretical value (X)」uses the value entered on the Touch panel.

When「Online」is selected,the value input from「External」is used for「Riveting amount theoretical value (X)」(⇒8.3 Interface P.85)

(5) Search riveting setting method

Fig 7.4.2.d SEARCH R/M screen

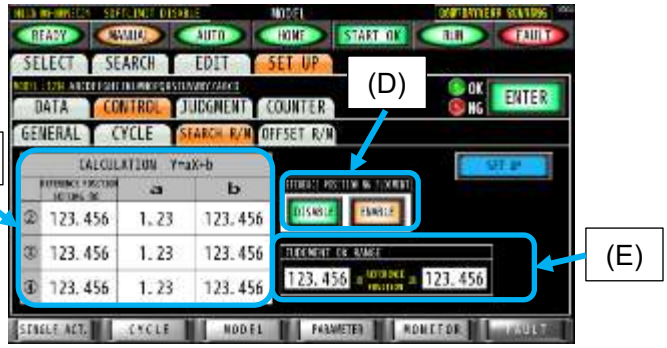


Fig 7.4.2.e SEARCH R/M screen (Details)

Press the 「SEARCH R/M」 button on the MODEL-SET UP-CONTROL screen to display the 「SEARCH R/M」 screen.
To use the search riveting function, set 「Search riveting」 to 「ENABLE」.
※Search riveting function and Offset riveting function cannot be used together.
When using the search riveting function set Offset Function to 「disable」 and select 「enable」 for search riveting Function.

① SEARCH SPEED / REVOLUTIONS(A)
In search speed / revolutions, you can set speed and revolutions of search.
※ An error occurs when the speed is 0mm/sec.
Be sure to enter a value of 0.01mm/sec or more.
It is subject to 「R/M overtime」 even during the search operation.

② REFERENCE POSITION SETTING(B)
You can set the amount of riveting by 「REFERENCE POSITION SETTING(X)」.
Press the 「ADVANCED FORMULA」 button to display the SEARCH R/M screen(Details).
Depending on the riveting conditions such as search speed, insert, and rivet, there will be an error between the set riveting amount and the actual riveting amount.
Therefore, the riveting amount is corrected using the calculation (C).
For details of the calculation formula, refer to 7.4.2 Control 3)Search riveting (3)Calculation formula P.56.

When online is selected, the 「REFERENCE POSITION SETTING(X)」 uses the value instructed by network communication.

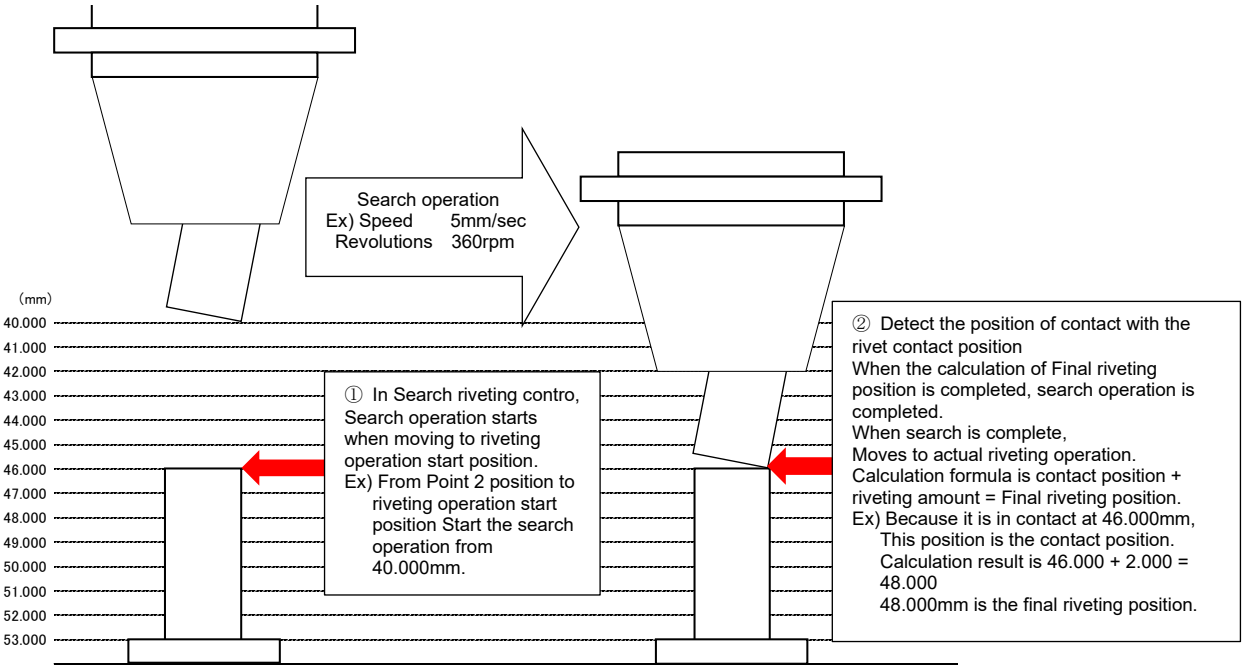
③ REFERENCE POSITION NG JUDGMENT (D)
It is used when you want to judge whether the base position detected by search riveting is within the set range.
When set to 「ENABLE」, it is possible to set base position NG judgment.
JUDGMENT OK RANGE (E) can be set, and it will be NG when touch position is out of range.

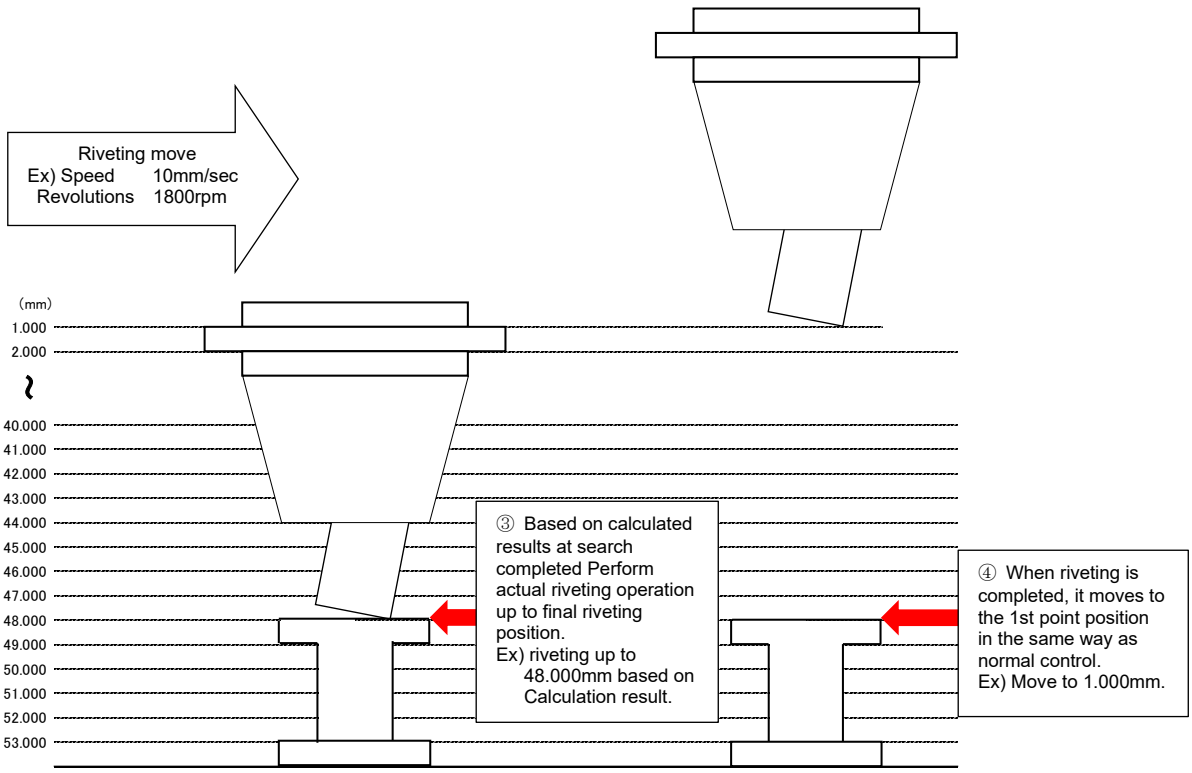
(6) Search riveting operation diagram

① Basic operation of search riveting
Explains the basic operation of search riveting.

Example program)

Point	Operation	Position (mm)	Speed (mm/s)	Thrust (kN)	Revolutions (rpm)	Down end trigger	Riveting amount (mm)	Search speed (mm/s)	Search revolutions (rpm)
P1	Move	1.000	130.00	-	-	Position	-	5.00	360
P2	Move	40.000	130.00	-	-		-		
P3	Riveting	50.000	10.00	5.00	1800		2.000		
P4	-	-	-	-	-		-		





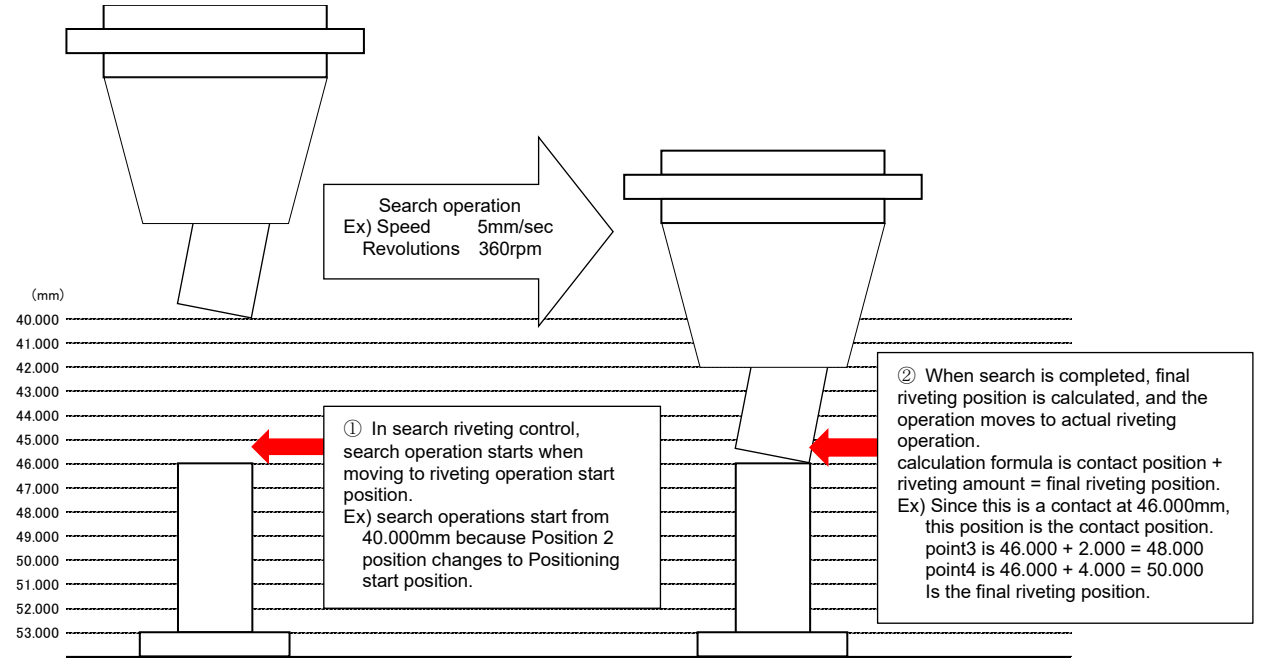
② Example of operation when there is multiple riveting operation points
This section describes the operation when multiple riveting points are used.

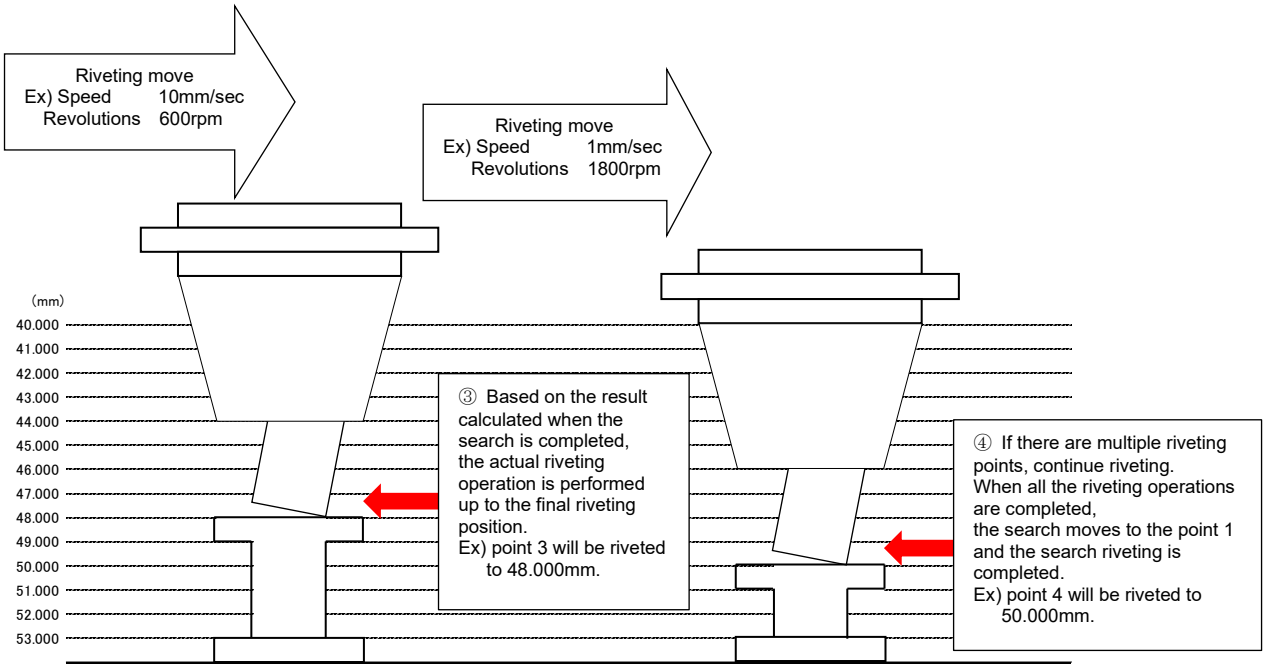
※If there are multiple riveting points, enter a value so that the riveting amount increases as after points.
If the setting is NG, the Product setting NG lamp lights up.

OK ex) Point 3-2.00mm Point 4：4.000mm
NG ex1) Point 3-2.00mm Point 4：2.000mm…Point 3 and Point have the same riveting amount
NG ex2) Point 3-4.00mm Point 4：2.000mm…Point has less riveting amount than point 3

Example program)

Point	Operation	Position (mm)	Speed (mm/s)	Thrust (kN)	Revolutions (rpm)	Down end trigger	Riveting amount (mm)	Search speed (mm/s)	Search revolutions (rpm)
P1	Move	1.000	130.00	-	-	Position	-	5.00	360
P2	Move	40.000	130.00	-	-		-		
P3	Riveting	50.000	10.00	5.00	600		2.000		
P4	Riveting	55.000	1.00	5.00	1800		4.000		





③ Touch position NG

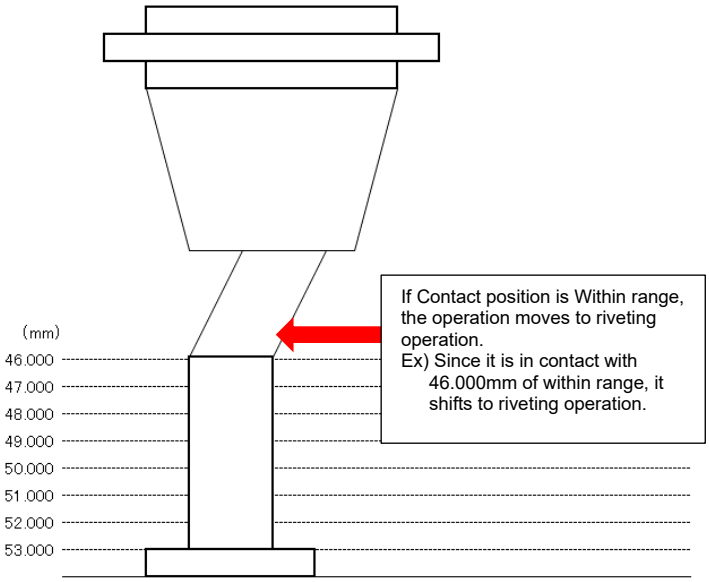
NG can be set for touch position.

By specifying NG range for touch position,monitor difference in height of rivet It is possible to prevent mistakes.

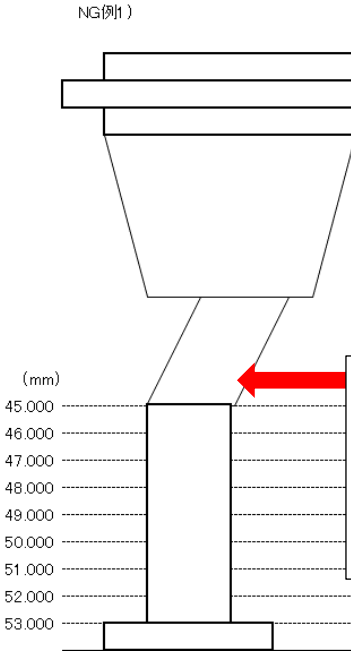
Example program)

Point	Operation	Position (mm)	NG judge range lower (mm)	NG judge range upper (mm)
P1	Move	1.000	45.500	46.500
P2	Move	40.000		
P3	Riveting	50.000		
P4	-	-		

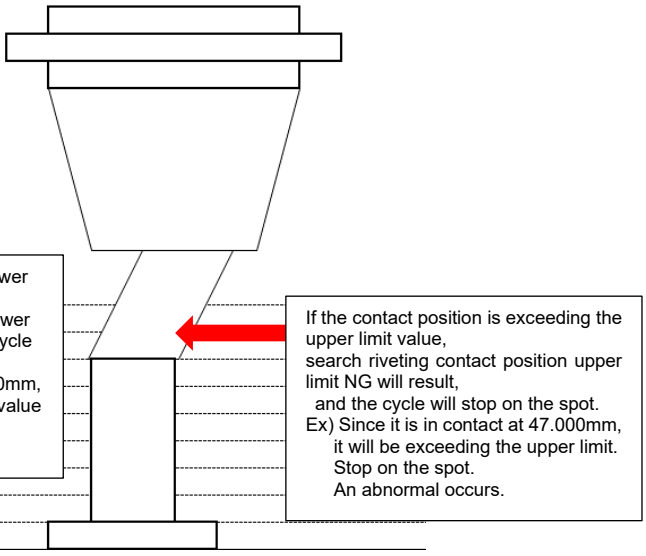
OK例)



NG例1)



NG例2)

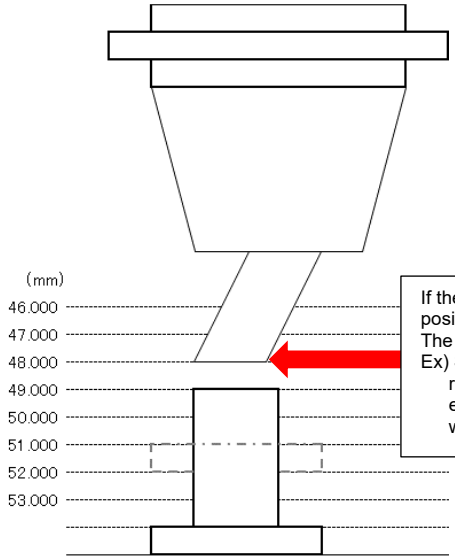


④ Fault

Occurs when search riveting cannot be performed normally.
Review settings and conditions.

Example program)

Point	Operation	Position(mm)	Riveting amount (mm)
P1	Move	1.000	-
P2	Move	40.000	-
P3	Riveting	50.000	2.000
P4	-	-	-



If the final riveting position exceeds the riveting setting position, a search riveting position fault will occur.
The cycle stops on the spot.
Ex) Since it is not in contact with the work when it reaches 48.000 mm, the final riveting position exceeds the riveting setting position 50.000 mm, which is fault.

4) Offset R/M

Offset riveting is a control that offsets the operation「RIVETING」with respect to the position of the selected point.

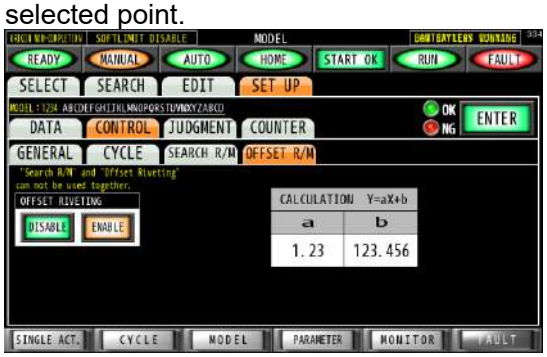


Fig 7.4.2.f OFFSET R/M screen

Fig 7.4.2.g CYCLE screen

Press the「OFFSET R/M」button on the MODEL-SET UP-CONTROL screen to display the「OFFSET R/M」screen.

To use the offset riveting function, set「OFFSET RIVETING」to「ENABLE」.

※Search riveting function and offset riveting function cannot be used together.

When using the offset riveting function set search riveting function to「DISABLE」and select「ENABLE」for offset riveting function.

When reading offset value from the outside,

select「online」of「offset」of「interface」from the operation of「PARAMETER」screen.

(⇒8.3 Interface P.85)

(1) Calculation

「Offset value (Y)」=「Coefficient (a)」x「Offset value (X)」+「Correction value (b)」.

Offset value can be entered on the CYCLE screen.

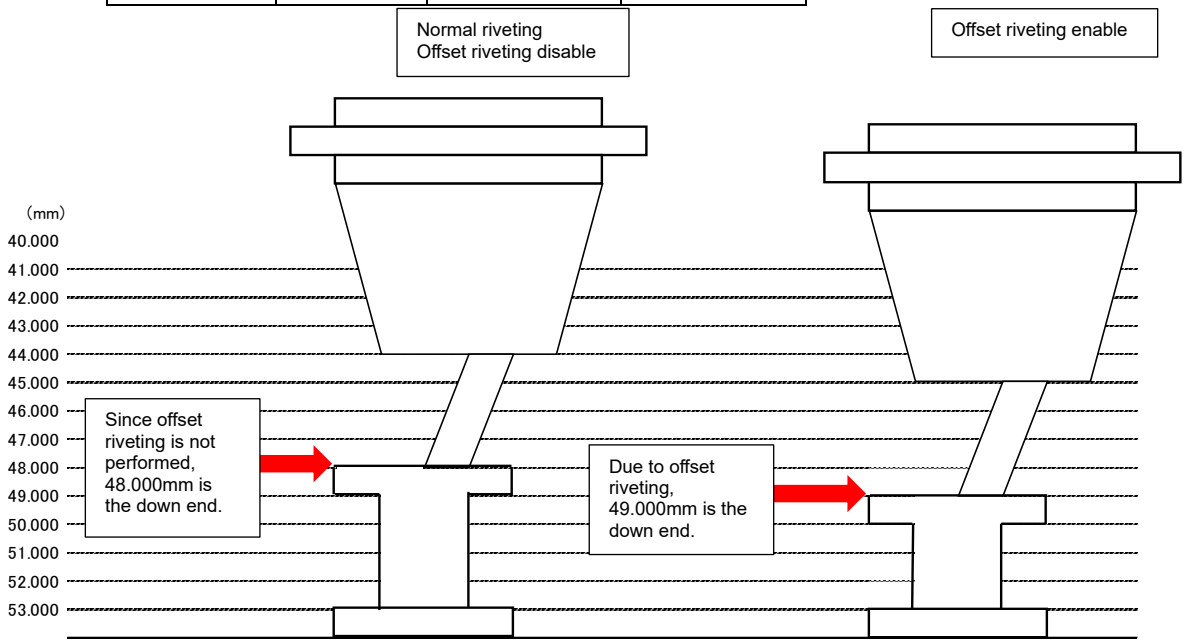
In Initial setting, the「Coefficient (a) =1.00」「Correction value (b) =0」.

Therefore,「input value」=「offset value」.

In case of online, offset value (X) can be set from external communication.

Example program)

Point	Operation	Position(mm)	Offset(mm)
P1	Move	1.000	-
P2	Move	40.000	-
P3	Riveting	48.000	1.000
P4	-	-	-



7.4.3 Judgment

By using the judgment function, it is possible to judge the presence or absence of rivet and the difference in length and material from the position or thrust of during riveting cycle.

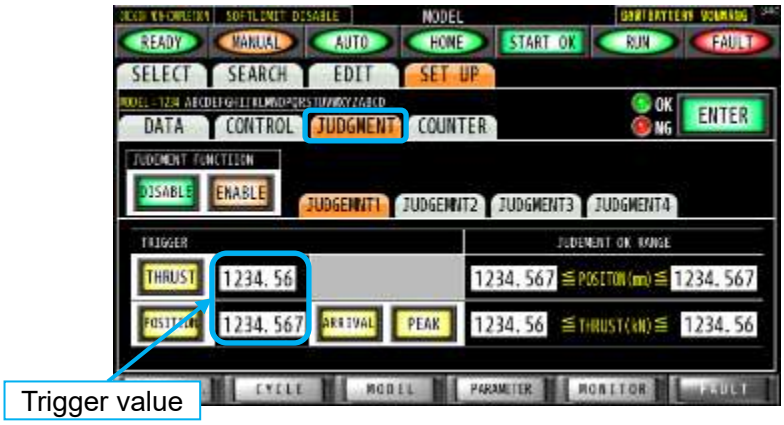
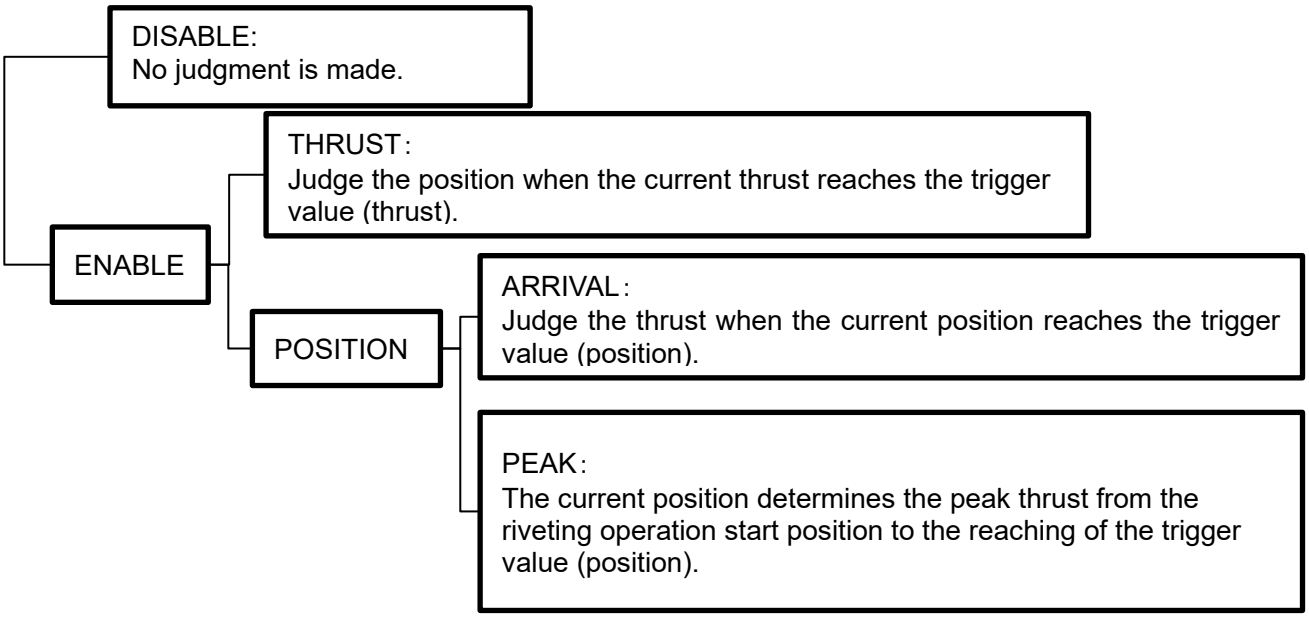


Fig 7.4.3.a JUDGMENT screen

Press the「JUDGMENT」 button on the MODEL-SET UP screen to display the「JUDGMENT」 screen.

Judgment uses position and thrust of during riveting cycle as trigger, Thrust for Position, and Position for Thrust within the OK range. It is a function to judge whether.
It monitors the period from moving to the riveting point to down end.
Judgment item can be selected from Position or Thrust, and Judgment trigger turns ON when Judgment item reaches Trigger value.
Four judgments can be set.
The only trigger that can be set for one judgment is either「thrust」or「position」.
If the judgment trigger does not turn ON when the judgment function is「ENABLE」,「R/M judge trigger OFF fault」occur.



~Judgment function setting procedure~

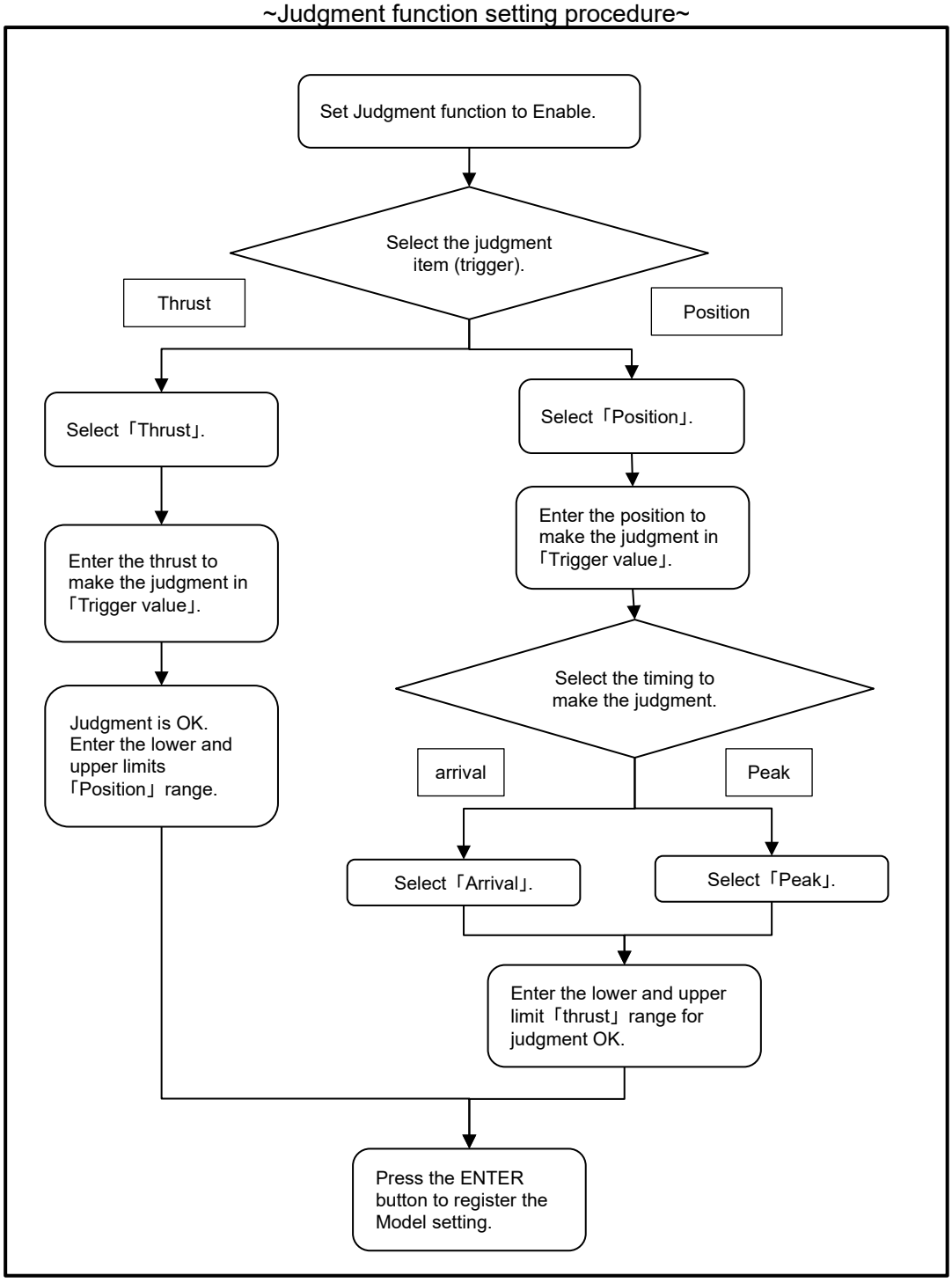


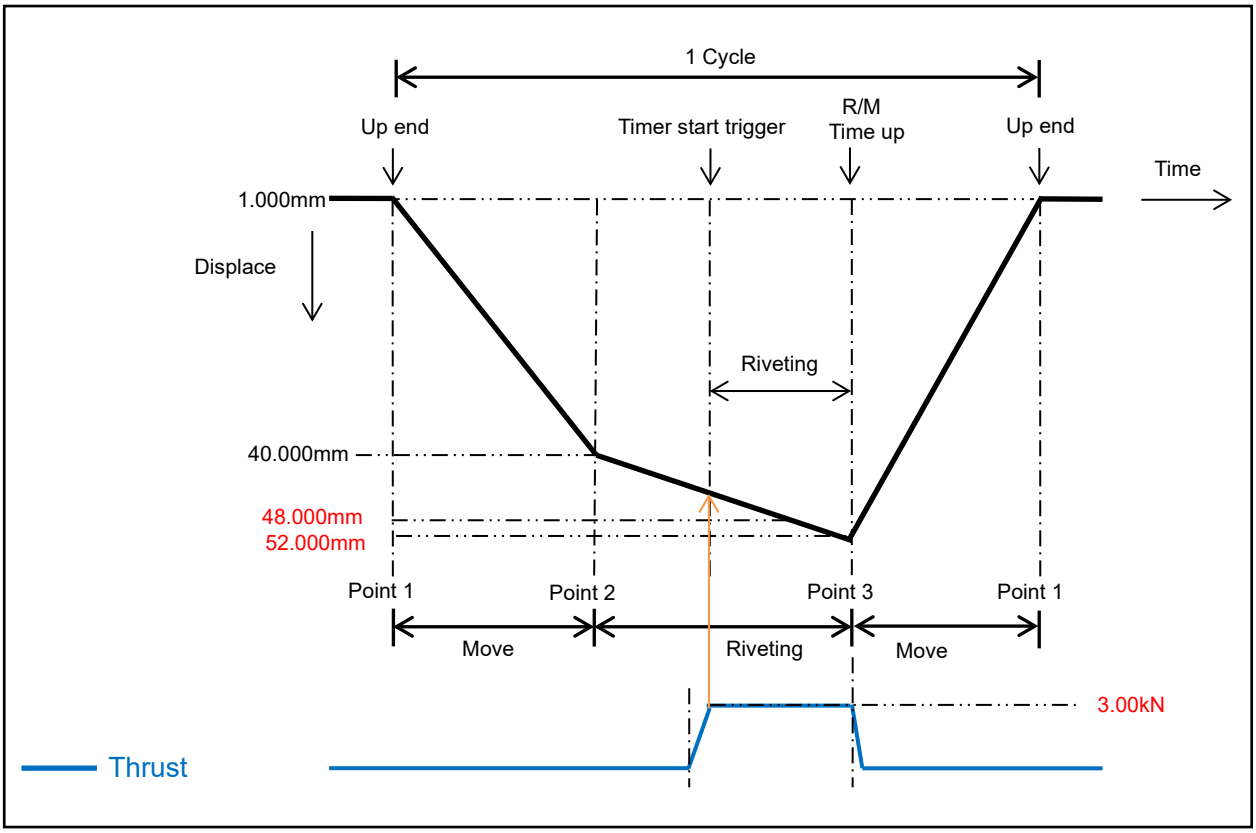
Fig 7.4.3.b

※ NG example of the operation of the trigger「Thrust」

		Position	Thrust
Point 1	Move	1.000mm	
Point 2	Move	40.000mm	
Point 3	R/M	55.000mm	3.00kN
Point 4	Disable		
R/M timer		2.0sec	

Judgment Enable
Trigger Thrust
Trigger value 3.00kN
Enable 48.000 > Position > 52.000

When the current position of Riveting Machine reaches「3.00」kN,If it is less than 48.000 mm, it becomes Position lower limit, and if it is 52.000 mm or more, it becomes Position upper limit.In the following figure, when the trigger value reaches「3.00」kN, it is less than「48.000」mm, so it is position lower limit.

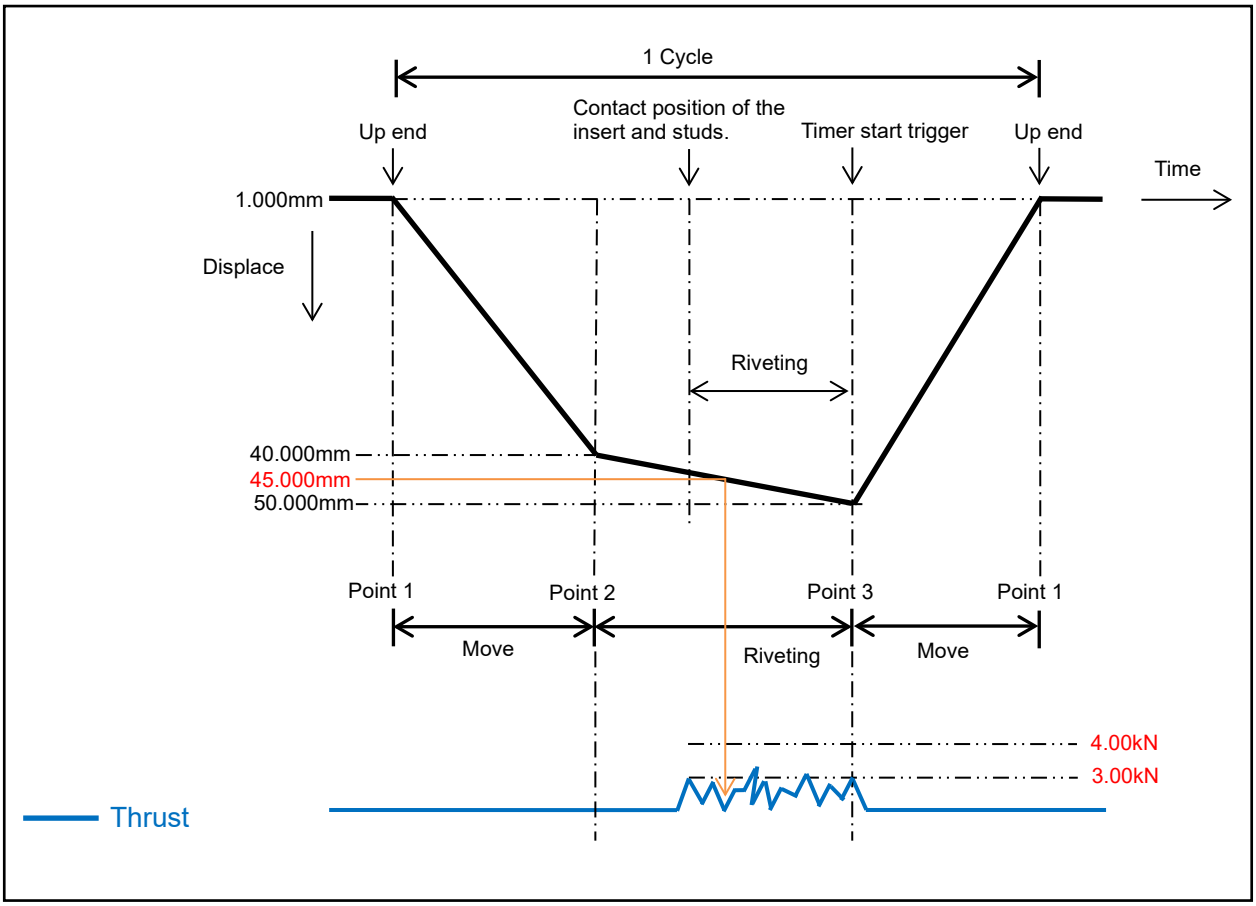


※ NG example of the operation of the trigger「Position」「Arrival」

		Position	Thrust
Point 1	Move	1.000mm	
Point 2	Move	40.000mm	
Point 3	Riveting	50.000mm	5.00kN
Point 4	Disable		
R/M timer		2.0sec	

Judgment Enable
Trigger Position Arrival
Trigger value 45.000mm
Enable 3.00 ＞ Thrust ＞ 4.00

When the「current position」of the riveting machine reaches「45.000」mm,
If it is 3.00kN or less, it will be thrust lower limit, and if it is 4.00 or more,
it will be thrust upper limit. In the following figure, when the trigger value 「45.000mm」is reached, it is below「3.00 kN」so it is thrust lower

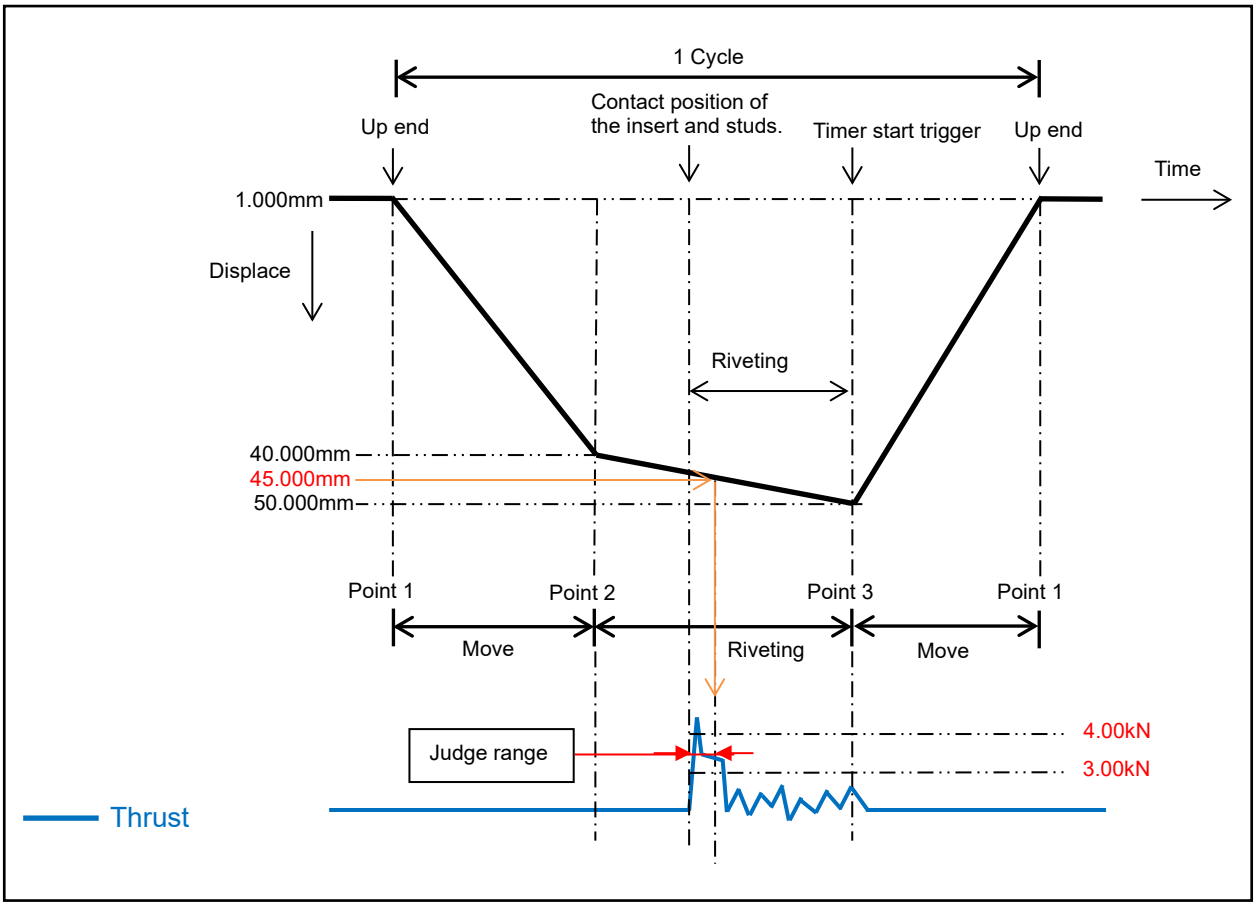


※ NG example of the operation of the trigger「Position」「Peak」

		Position	Thrust
Point 1	Move	1.000mm	
Point 2	Move	40.000mm	
Point 3	R/M	50.000mm	5.00kN
Point 4	Disable		
R/M timer		2.0sec	

Judgment Enable
Trigger Position Peak
Trigger value 45.000mm
Enable 3.00 ＞ Thrust ＞ 4.00

By the time the current position of the riveting machine reaches「45.000 」mm, When it is 3.00kN or less, it becomes thrust lower limit, and when it is 4.00 or more, it becomes thrust upper limit.
In the following figure, it is thrust upper limit because it exceeds「4.00 」kN until the trigger value「45.000 」mm is reached.



7.4.4 Model counter

Fig 7.4.4 MODEL COUNTER screen

Press the「COUNTER」button on the MODEL-SET UP screen to display the「COUNTER」screen.
When the screen is displayed, the lamp lights up.

You can select the counter required for each model.
When the counter reaches this set value, it「counts up」.
(⇒9.3 Counter screen P.99)
Use when production control is required.

If the numerical value of each counter is「0」, it is disable.
To change the setting value, touch the numerical part, the key window will be displayed, and the set value can be changed.

Each counter is added when R/M time up without「R/M upper / lower limit fault」occurring.

○Setting range:0~9,999,999

7.5 Model edit

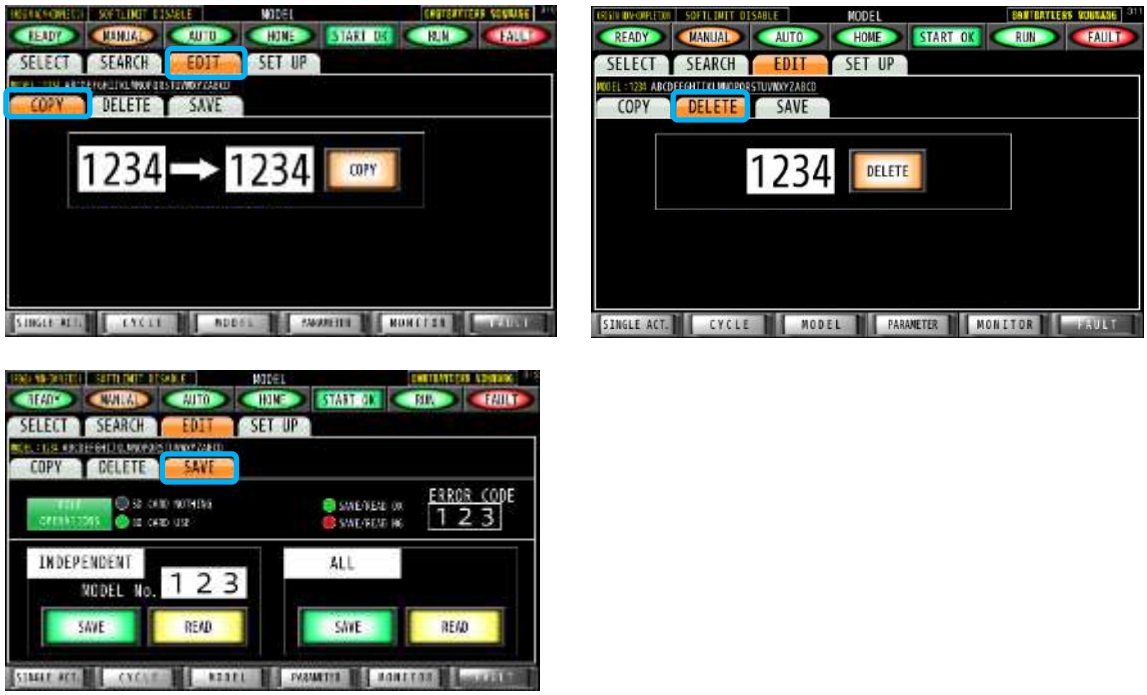


Fig 7.5

Press the「EDIT」button on the MODEL screen to display the「MODEL COPY」screen. The lamp lights up when the screen is displayed.

7.5.1 Copy

Fig7.5.1.a MODEL COPY screen

Press the「COPY」button on the MODEL EDIT screen to display the「MODEL COPY」screen.
By copying, you can copy the model setting to another model.
「Copy origin model number」+「* COPY」is registered in model name of Copy.

~Model copy procedure~

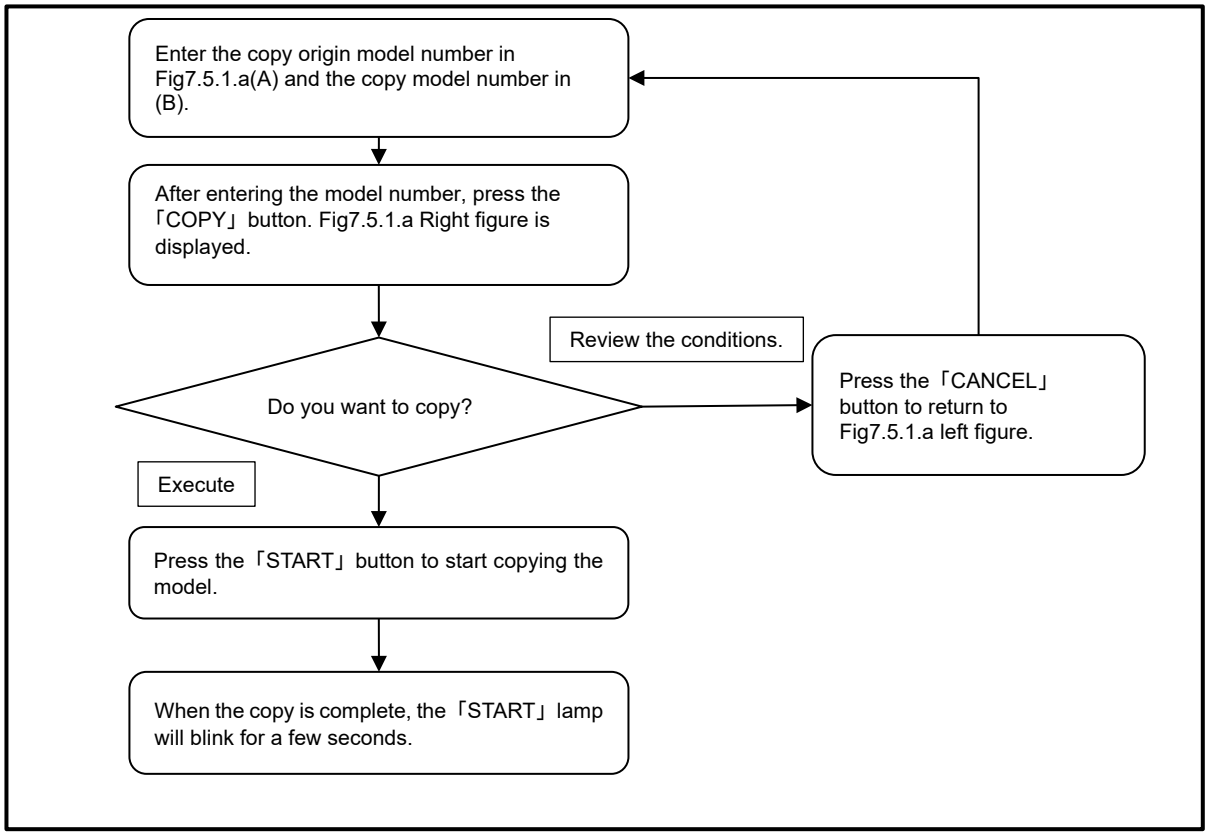


Fig 7.5.1.b

7.5.2 Delete

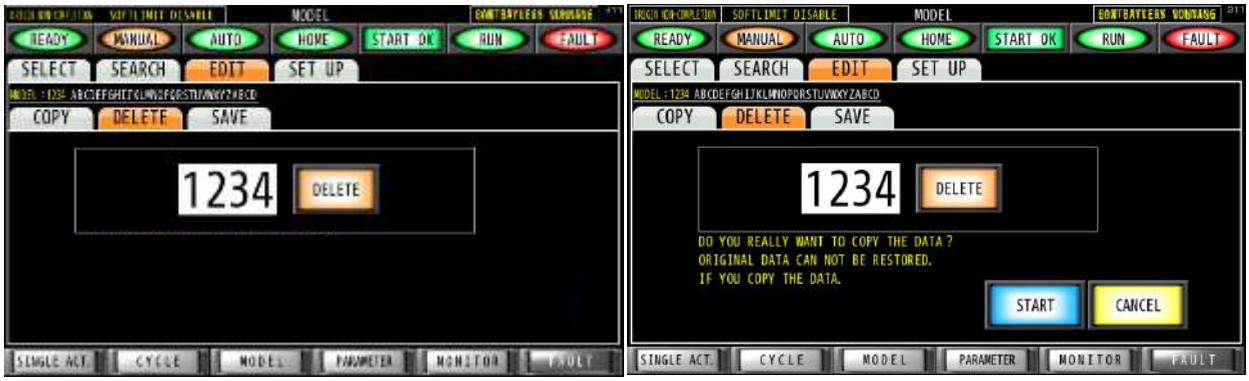


Fig 7.5.2.a MODEL DELETE screen

Press the「DELETE」button on the MODEL EDIT screen to display the「MODEL DELETE」screen. By deleting, you can delete the model setting.

~Model delete procedure~

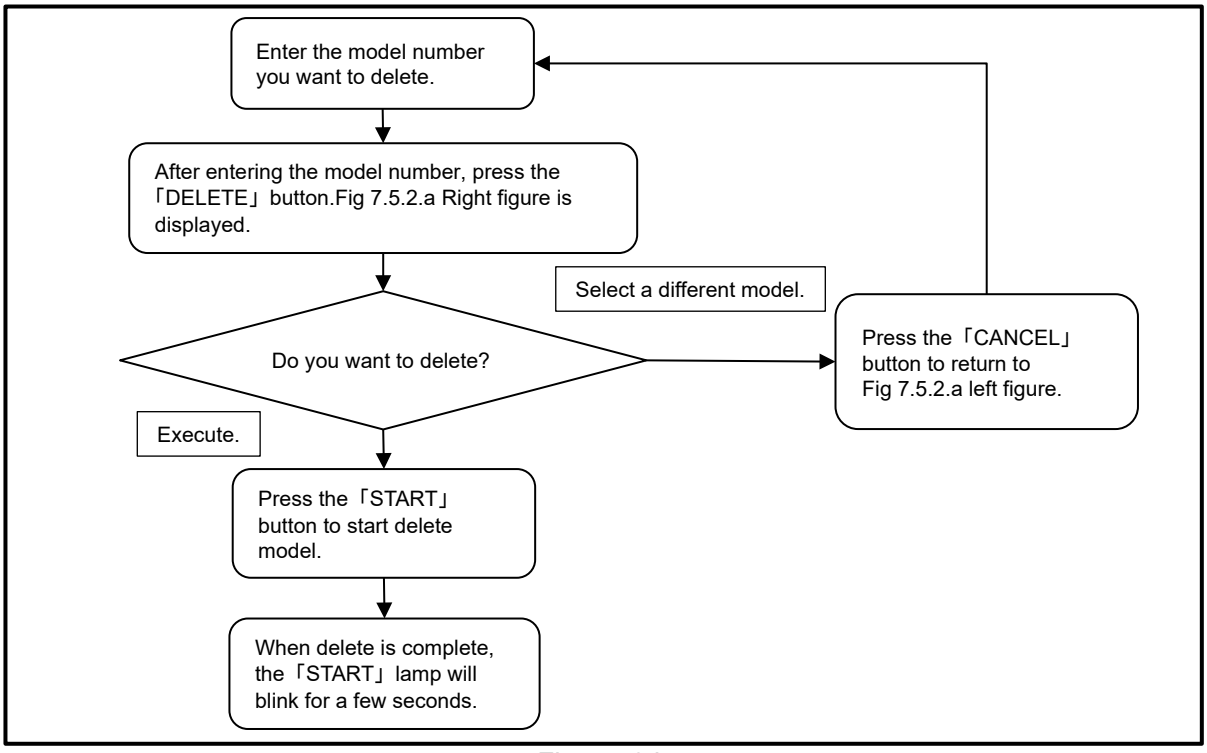


Fig 7.5.2.b

7.5.3 Save

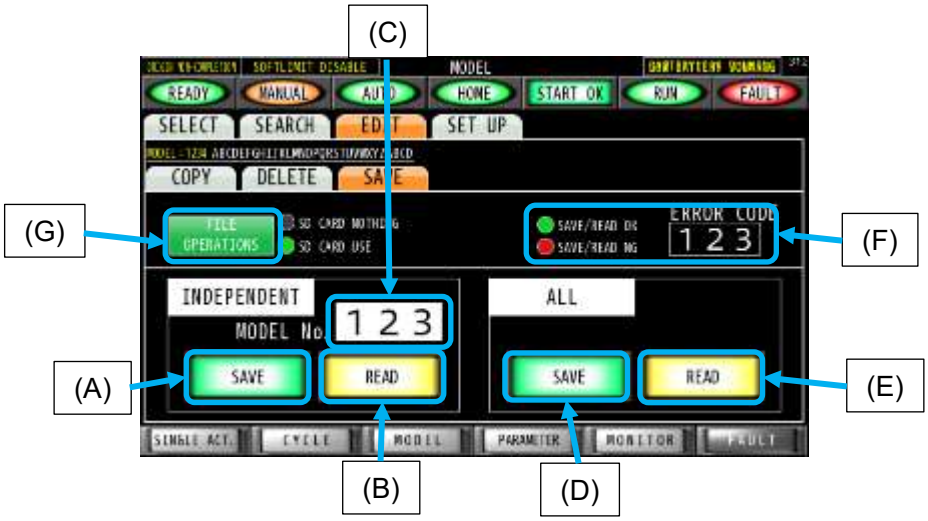


Fig7.5.3.a MODEL SAVE screen

Press the「SAVE」button on the MODEL EDIT screen to display the model「MODEL SAVE」screen.
You can save or read the model when the「SD card available」lamp is lit and not「SD card use」.

1) INDEPENDENT SAVE (A)
When you press the「SAVE」button, the model data of 1 to 300 set in the model number will be saved.
Save the FR folder in the SD card and the「FR *** (model number) (C) .FRU」file in the folder.
If a file with the same name exists in the folder, it will be overwritten.

2) INDEPENDENT READ (B)
When you press the「READ」button, the 1 to 300 model set in the model number will be read from the SD card.
Read from the「FR *** (model number) (C) .FRU」file saved in the FR folder of the SD card.

3) ALL SAVE (D)
When you press the「ALL SAVE」button, All model data will be saved to the SD card.
Save 5 files of「FR900.FRU」~「FR904.FRU」in the FR folder of the SD card.
If a file with the same name exists in the folder, it will be overwritten.

4) ALL READ (E)
When you press the「ALL READ」button, All model data will be read from the SD card.
Read from 5 files of「FR900.FRU」~「FR904.FRU」saved in FR folder of SD card.

When「ALL SAVE」or「SAVE」, if the file already exists in SD card, it will be overwritten.
If you want to save the data separately, please prepare another SD card.

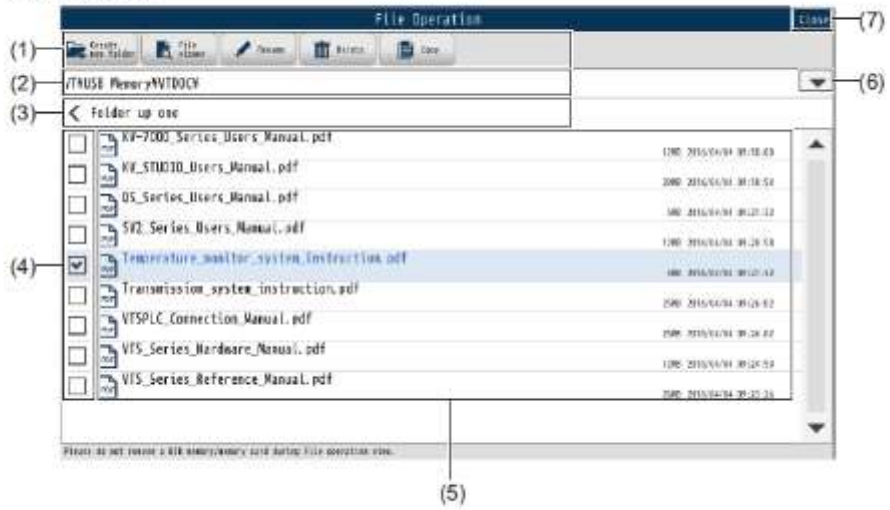
5) Save / Read result (F)
When Save / Read is completed normally,「Save / Read OK」lights up and
If Save / Read fails,「Save / Read NG」lights up.
In case of「Save / Read NG」,Error code is displayed.

The error code will be displayed until the next save or read is completed successfully.
When ALL READ or READ, the error code「3」is displayed if the file does not exist in the SD card.

6) FILE OPERATIONS (G)
You can operate and check the files in the PLC.

■ File Operations Screen

(Main screen)



(1)	Create new folder	Creates new folders in the current directory.
	File viewer	Allows you to view the selected PDF file.
	Rename	Renames selected files or folders.
	Delete	Deletes selected files or folders.
	Copy	Copies selected files or folders.
(2)	Displays the location of the current folder.	
(3)	Touch to move to the next higher folder.	
(4)	Tick the File viewer, Rename, Delete or Copy checkboxes when a file is selected.	
(5)	Displays a list all files and folders in the current folder. Touch a folder to move to the next lower layer folder.	
(6)	Touch to select a drive.	
(7)	Exits the file operation function and opens the operation screen.	

Fig7.5.3.b File operations screen

8 PARAMETER

Press the「PARAMETER」button at the bottom of the screen, the「PARAMETER」screen is displayed. In the parameters, you can set「MOVEMENT」,「MAINTENANCE(MAINT.)」,「INTERFACE」,「OPERATION」, and「LANGUAGE」.

Fig 8 PARAMETER screen

8.1 Movement

Press the 「MOVEMENT」 button on the PARAMETER screen, the 「MOVEMENT」 screen is displayed.
MOVEMENT screen can be set the「GENERAL」「RETURN ZERO」「PRG CHECK」「Hold to run」.
These settings can not be set for each program.

8.1.1 General

Fig 8.1.1 GENERAL screen

1) Start method
You can select how to start the riveting cycle. (Both-hand is recommended.)

BOTH HAND	It is used to start the riveting cycle with the left and right start buttons. If the left and right start buttons are not turned on within 0.5 seconds, the start signal will not be output.
LEFT / RIGHT HAND	It is used to start the riveting cycle with the selected start button.
FOOT SWITCH	It is used to start the riveting cycle with the foot switch.

2) Start timing
You can select whether to start by ON when the start button is turned on during auto riveting cycle or by ON→OFF.

ON	When the start button is turned on, auto riveting cycle starts.
ON→OFF	When the start button turns on and you release the start button, auto riveting cycle starts.

When Hold to run is enabled or the external input manual riveting signal is turned on, it automatically becomes 「ON」.
This setting applies only to the start button. The external start signal is always 「ON」.

3) At the time of judgment fault
You can select whether to Continue or Stop the cycle when judgment error.

CONTINUE	After judgment error, riveting cycle is continued, and after riveting time up, it rises, and an alarm is generated.
STOP	The riveting cycle ends immediately when judgment error, and an alarm is generated after rising. Use this when you do not want to continue riveting when judgment error.

4) CURRENT VALUE UPDATE CYCLE
Select update cycle of Current value monitor of Position, Thrust, Revolutions displayed on the CYCLE screen.
The selection can be selected from 「REAL TIME」, 「0.1 SEC」, and 「1 SEC」.

5) SPINDLE _ acceleration time (ACC.) / Deceleration time (DEC.)
You can set the acceleration / deceleration time of the spindle motor. If you want to use a non-standard head, please contact us as it is necessary to change the acceleration / deceleration time. The factory settings are acceleration: 0.3 sec and deceleration: 1.2 sec.

6) R/M Overtime
You can set the overtime value of riveting cycle.
This setting works when 「Riveting overtime」 of Model setting is not set.
The factory setting is 「10.00」 sec.(⇒7.4.1 Data 2)Set up (2)Riveting overtime P.43)

8.1.2 Servo return zero

Fig 8.1.2.a SERVO RETURN ZERO screen

Press the「RETURN ZERO」button on the PARAMETER-MOVEMENT screen to display the 「SERVO RETURN ZERO」screen.
The origin of the riveting axis servo motor can be returned.
Servo return zero is a function to set the origin which is the reference of the position of the riveting machine.
It is not normally used, and is required when return to origin is required for motor replacement, encoder cable replacement, etc.

※ Servo origin return not completed,Soft limit disabled,Fault condition,
the JOG operation will be slow and the thrust limit.
(⇒2.3.1 Functional operation specification P.12), and STEP operation cannot be performed.
※ Changing JOG speed at Low speed does not change Machine speed.

1) SOFT LIMIT
It is used when you want to operate beyond the soft limit of the riveting axis. The settings will be reflected when you switch between enable / disable.

2) ABS SET UP
The current position of the encoder is maintained by the lithium battery of the built-in encoder cable with battery (SV2-BE□) even while the breaker is turned off.

When the battery runs out, the current position of the encoder will not be retained.
If you turn on the breaker in that state, the「RB_810_ encoder backup alarm」will occur.

The current position is retained when ABS setup is performed.

However, since the origin position is out of alignment, it is necessary to perform servo origin return.

3) SV RETURN ZERO
It is used to set the origin that is the reference for the position of the riveting machine.

~Servo return zero procedure~

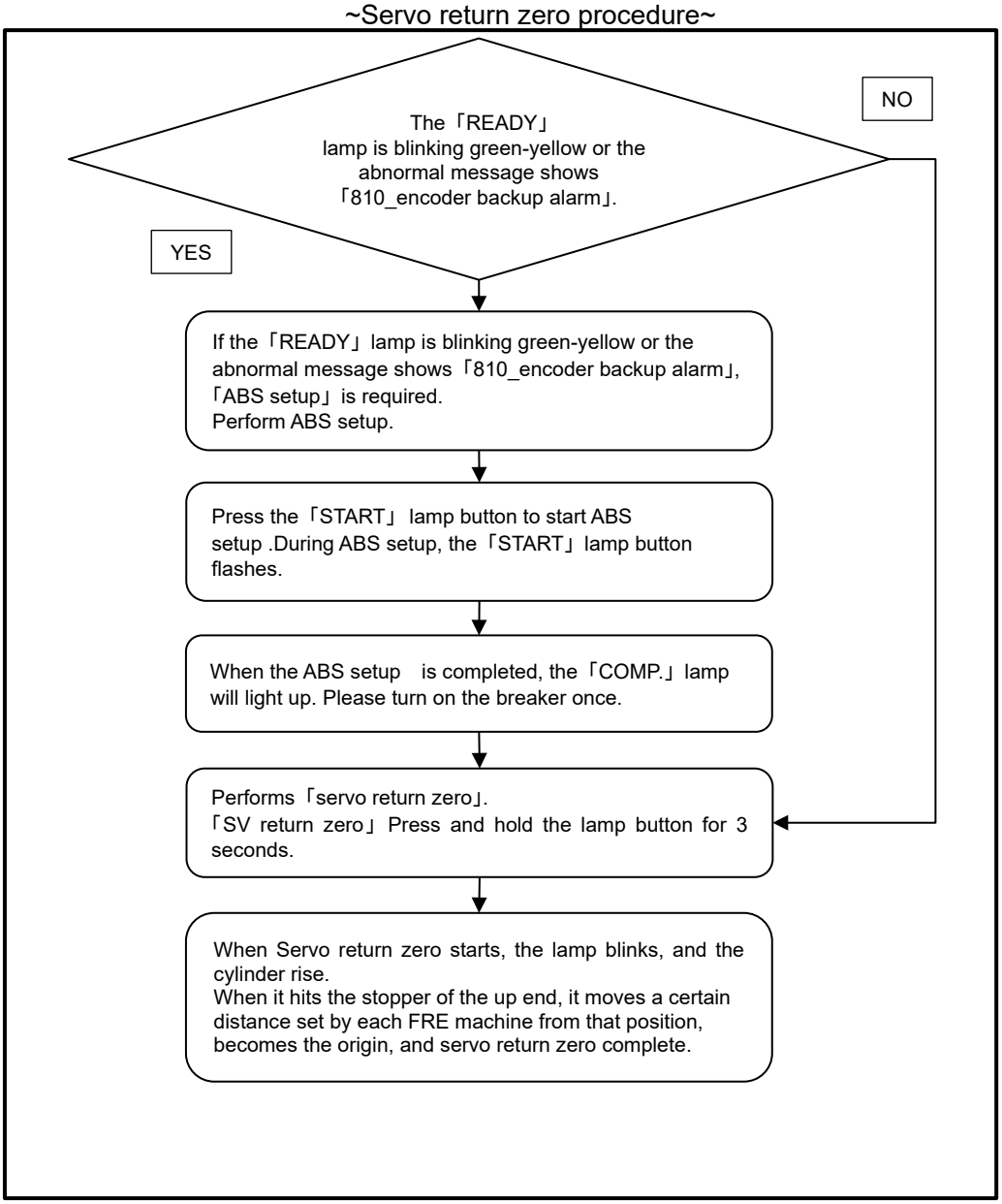


Fig 8.1.2.b

8.1.3 PRG check control

Fig 8.1.3 PRG CHECK screen

Press the「PRG CHECK」button on the PARAMETER-MOVEMENT screen to display the「PRG CHECK」screen.
This function reduces damage when contacting the workpiece and jig during high-speed move due to select model (program) and setting error.

This function is not a function that can reliably detect model select and setting error.

DISABLE	After switching the model, perform the operation of program.
ENABLE	In the first riveting cycle, the move point (high-speed move) operates at low speed and low thrust(⇒2.3.1 Functional operation specification P.12) If the set thrust is reached during move point operation, it becomes fault and stops on the position. When the movement to the down end is completed, PRG safety control is OK. From the next riveting cycle, the operation will be program.

8.1.4 Hold to run

Fig 8.1.4.a Hold to run screen

Press the「Hold to run」button on the PARAMETER-MOVEMENT screen to display the「Hold to run」screen.
You can select Enable or Disable for Hold to run function. The selected lamp lights up.
The Hold to run function does not hold the riveting cycle until it reaches the「RIVETING START」position or the「DOWN END」position during the riveting cycle, and when the start signal is turned off during the moving ,「Hold to run error」, cycle is functioned to stop on the position.
The Hold to run function is only applicable in auto mode. Even if the Hold to run function is「ENABLE」, during riveting cycle in manual mode is ignored.

DISABLE	The operation is maintained when the start signal is turned on and the auto riveting cycle is started. Even if the start signal is turned off, the auto riveting cycle will operate. (Fig 8.1.4.b)
ENABLE	When the auto riveting cycle starts, the auto riveting cycle is not held until the「Riveting Start」position or the「Down End」position is reached. If the start signal is turned off before it is held, a「Hold to run error」will occur and the cycle will stop immediately. (Fig 8.1.4.c)

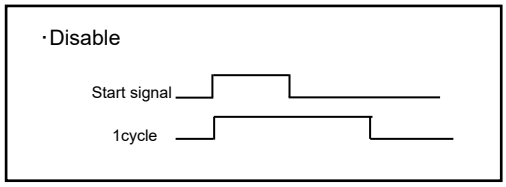


Fig 8.1.4.b

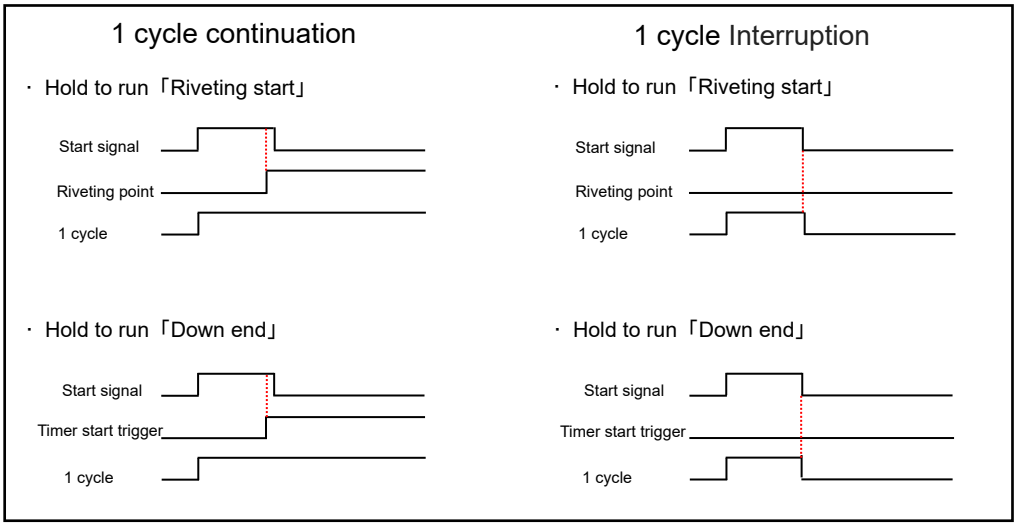


Fig 8.1.4.c

8.2 Maintenance

Fig 8.2 MAINTENANCE screen

Press the「MAINTENANCE」button on the PARAMETER screen to display the「MAINTENANCE」screen.
By input of maintenance counter set value and set the logging (Enable-Disable) setting of each setting,
You can write the model data to the SD card.

8.2.1 Maintenance counter

Fig 8.2.1 MAINRENANCE COUNTR screen

Press the「COUNTER」button on the PARAMETER-MAINTENANCE screen to display the「MAINTENANCE COUNTER」screen.
Factory setting, the following counters are enabled.
Head: 5 Million times（※ Lubricate with the grease）
Insert: 10 Million times（※ Inspect the wear）
Spindle: 50 Million times（※Lubricate with the grease）
Ball screw: 50 Million times（※Lubricate with the grease）

The above is recommended value by the manufacturer. Depends on work situation, please change the setting by the customer.

For the inspection method, refer to「15 MAINTENANCE & INSPECTION P.127」
○Setting range:0~9,999,999

8.2.2 Logging

Fig 8.2.2 LOGGING screen

Press the 「LOGGING」 button on the PARAMETER-MAINTENANCE screen to display the 「LOGGING」 screen.
Logging data can be written to SD card with 「ENABLE-DISABLE」 setting.
(⇒13.1 Logging data P.113)

ENABLE	It will save the logging data to the SD card.
DISABLE	It won't save the logging data to the SD card.

8.2.3 Refueling

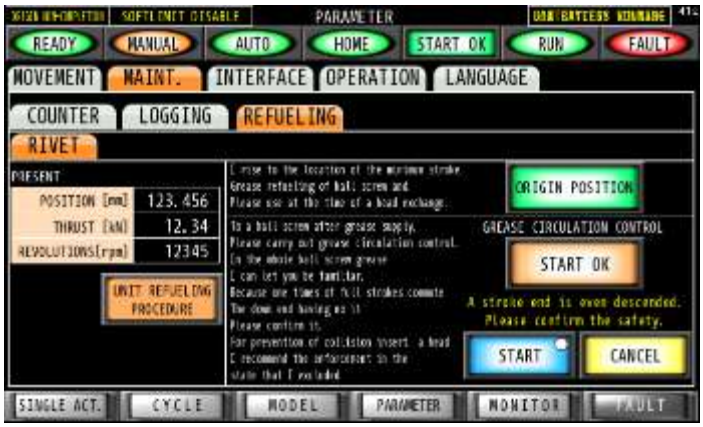


Fig 8.2.3.a REFUELING screen

Press the 「REFUELING」 button on the PARAMETER-MAINTENANCE screen, the 「REFUELING」 screen is displayed.
On the REFUELING screen, Full stroke operation is performed after grease refueling, and Grease can be applied to the whole ball screw.

⚠CAUTION

Since it operates at full stroke, remove the insert and head, and make sure that there is nothing to touch when operating at full stroke before using.
If it cannot be used, do not use the grease circulation function and operate the cylinder with single operation so that the grease in the ball screw circulates.

1) Ball screw refueling procedure

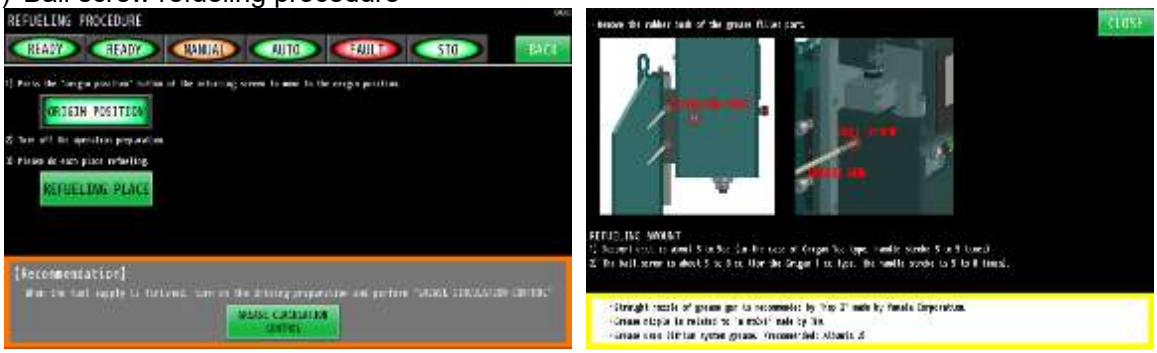


Fig 8.2.3.b BALL SCREW REFUELING PPROCEDURE screen

When you press the「BALL SCREW REFUELING PROCEDURE」button, the BALL SCREW REFUELING PROCEDURE screen is displayed.
Press「BACK」and「CLOSE」to return to the original screen.
riveting cycle, return to home, and single operation cannot be performed during displaying this screen.
For details, refer to「15.3 Daily life's check in the ball screw part and the support unit part and lubrication P.129」.

~Grease circulation control procedure~

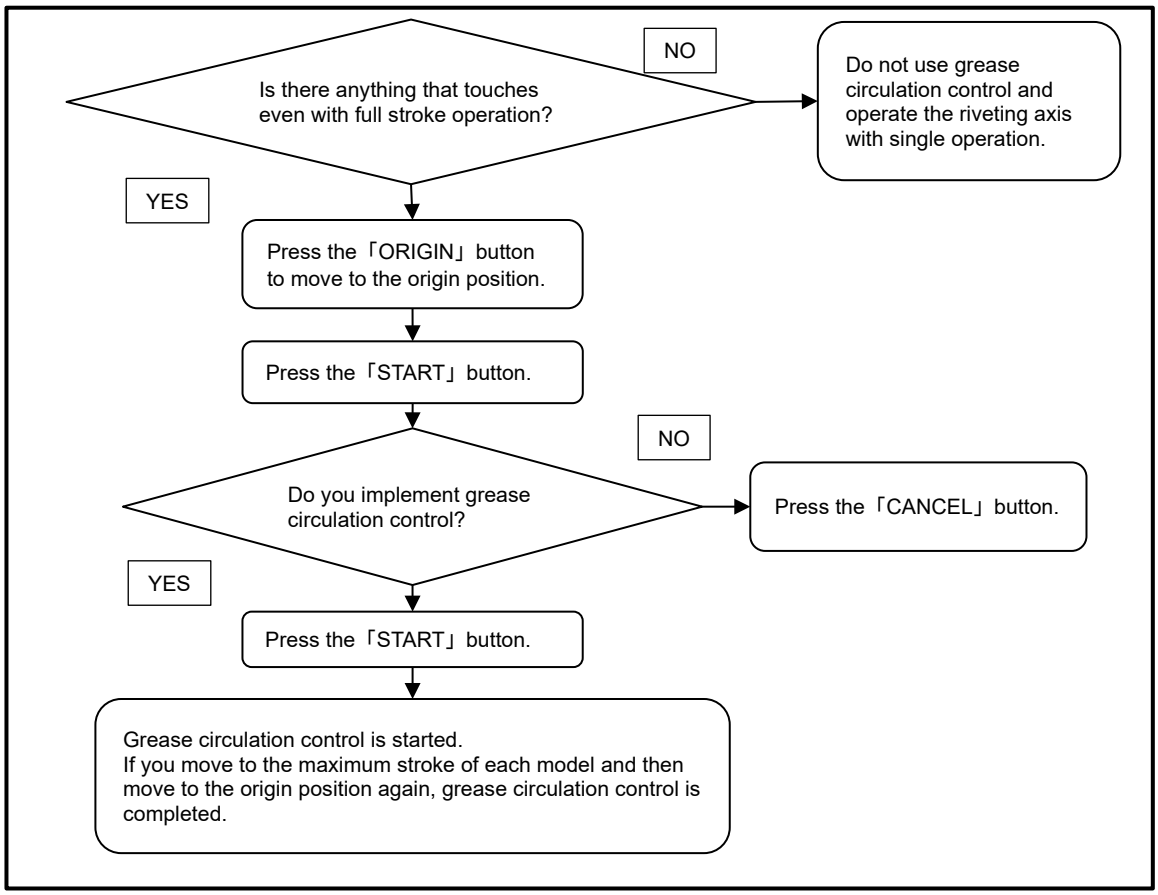


Fig 8.2.3.c

8.3 Interface

Set when using external communication.

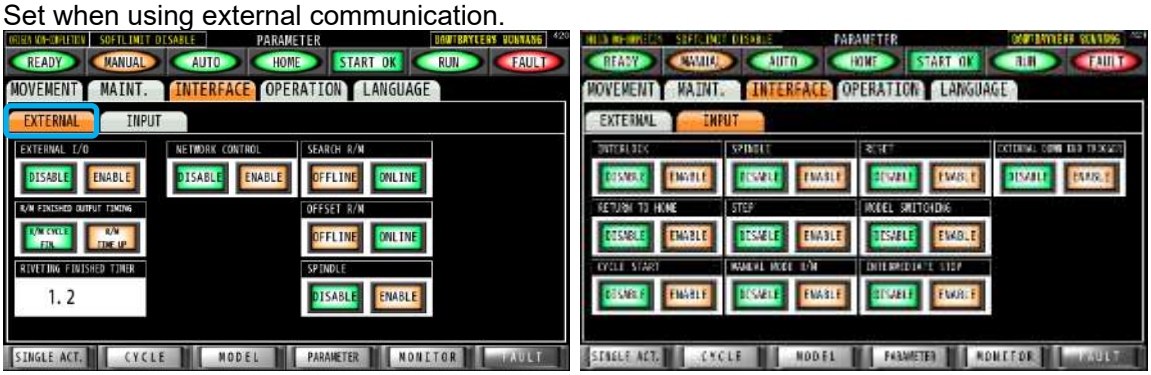


Fig 8.3

8.3.1 Common specifications

1) Communication type

Form	Content
EXTERNAL I/O CONTROL	Function for External communication using External I/O.
NETWORK CONTROL	Function for external communication using Ethernet/IP or CC-Link. ※Network control is an optional function. It cannot be used with standard specification equipment.

2) Setting method

Pless「INTERFACE」in the「PARAMETER」screen.
When using external I/O, switch「EXTERNAL I/O CONTROL」to「ENABLE」.
To use Network control, switch「NETWORK CONTROL」to「ENABLE」.
Also, external I/O and network control can be used together, but the input of external I/O has priority.

(1) Input

If you press「Input」on the「INTERFACE」screen, the functions that can be used in External communication will be displayed.
In external I/O control and network control, external I/O is prioritized, so the input signal used in external I/O control is used in「ENABLE」and network control. Set the input signal to be「DISABLE」.
※Since Network Control is an optional function,「ENABLE」cannot be selected for standard devices.

(2) Output

Each signal is always output.

RIVETING FINISHED TIMER	You can set how many seconds the「Riveting Fin. signal」is output. If the next riveting cycle starts during output, the output will turn off without waiting for time up. ○ Setting range: 0.0~9.9 sec
R/M FINISHED OUTPUT TIMING	You can select whether to set the output timing of the「Riveting Fin. signal」to「R/M CYCLE FIN.」or「R/M TIME UP」. R/M CYCLE FIN.…Output when the riveting cycle is completed, and the home position is reached. R/M TIME UP…Output when the R/M timer is time up.

(3) Search riveting / Offset riveting

Setting is possible only when Network control is「ENABLE」.
When online is set, the Input value used for Search riveting / Offset riveting,
It can be read from External.
If you do not want to read input value from external, set it too Offline.

(4) Spindle

This can be set only when Network Control is「ENABLE」.

When turn the spindle using network control, set it to「ENABLE」and set the spindle on the input screen to「DISABLE」.

3) List of signal contents

This section describes the contents of signals that can be used for communication with external devices.

The address indicates the signal address when external I/O is used.

The address when network control is used depends on customer settings.

(1) Input

Address	Signal name	Explanation
R30100	Interlock	Only when this signal is ON, Cycle start can be started. If this signal turns OFF during cycle, an error「Outside external interlock signal OFF fault」occurs and the cycle is interrupted. When STEP operation is enabled, waiting does not cause an error even if this signal turns OFF.
R30101	Home position return	When This signal is turned ON, riveting machine moves to home position (first point of the program). It operates only while it is ON. During operation, it operates at low speed and low thrust. (⇒2.3.1 Functional operation specification P.12)
R30102	Cycle start	When this signal is turned ON, the riveting machine executes riveting cycle operation. However, if the device is not in the home position or is not in Operation ready state, it will not start even if this signal is turned ON. Check the status of the external output signal and turn this signal ON. When external start signal is enabled, cycle start cannot be performed with the start button of the device in auto mode.
R30103	Spindle turn	When this signal is turned on, the motor rotates at the spindle speed set in the program. It stops when This signal is turned OFF. When External input of the spindle is enabled, Spindle enable / disable setting of program control setting is ignored. If this signal is turned ON during the riveting cycle, turn will start even while moving. When starting the movement to the next point, the movement will start after the revolutions is reached.
R30104	STEP Move	When STEP operation is enabled, Cycle operation signal is ON, and operation ready signal is ON, when this signal is turned ON the actuator moves to next point. The timing to accept the STEP operation input can be confirmed with the「start OK」output signal.
R30105	Manual riveting	If cycle start-up is applied with this signal turned on, riveting cycle is executed only during cycle start-up signal ON, and it rises after time up. When cycle start signal is turned OFF, cycle is interrupted and returns to home position.
R30106	Reset	When this signal is turned ON, the current error is reset. When cycle operation is interrupted, a「cycle interrupted」error occurs.
R30107	Intermediate stop	When the riveting machine to home position return with this signal ON, the riveting machine moves to the coordinates of the intermediate stop set by the variety. When starting a cycle in the intermediate stop position, start the cycle with this signal ON. If this signal is ON when the R/M time up, the riveting machine moves to the intermediate stop position when it rises.
R30108	Model No.1	You can change 15 types of Program No. from 1 to 15 from the outside. (BIN) Specify Program No. before turning on cycle start signal. If this signal is not ON when switching model from external is enable,「0」is selected for model number. Since the model number「0」cannot be used, it will not be in the「home position」, and if you try to operate it, an「inoperable error」will occur.
R30109	Model No.2	
R30110	Model No.4	
R30111	Model No.8	

R30115	External timer start trigger	When the timer start trigger is "external" and the motion is moving to the point of riveting, turning on this signal during riveting will turn on the timer start trigger.
※1	High-speed home position return	When this signal is turned on, the riveting machine moves to the home position (the first point of the program) at high speed (the speed of the point1 of the program). It works only while it is ON.

※1：This signal can only be used in Network Control.

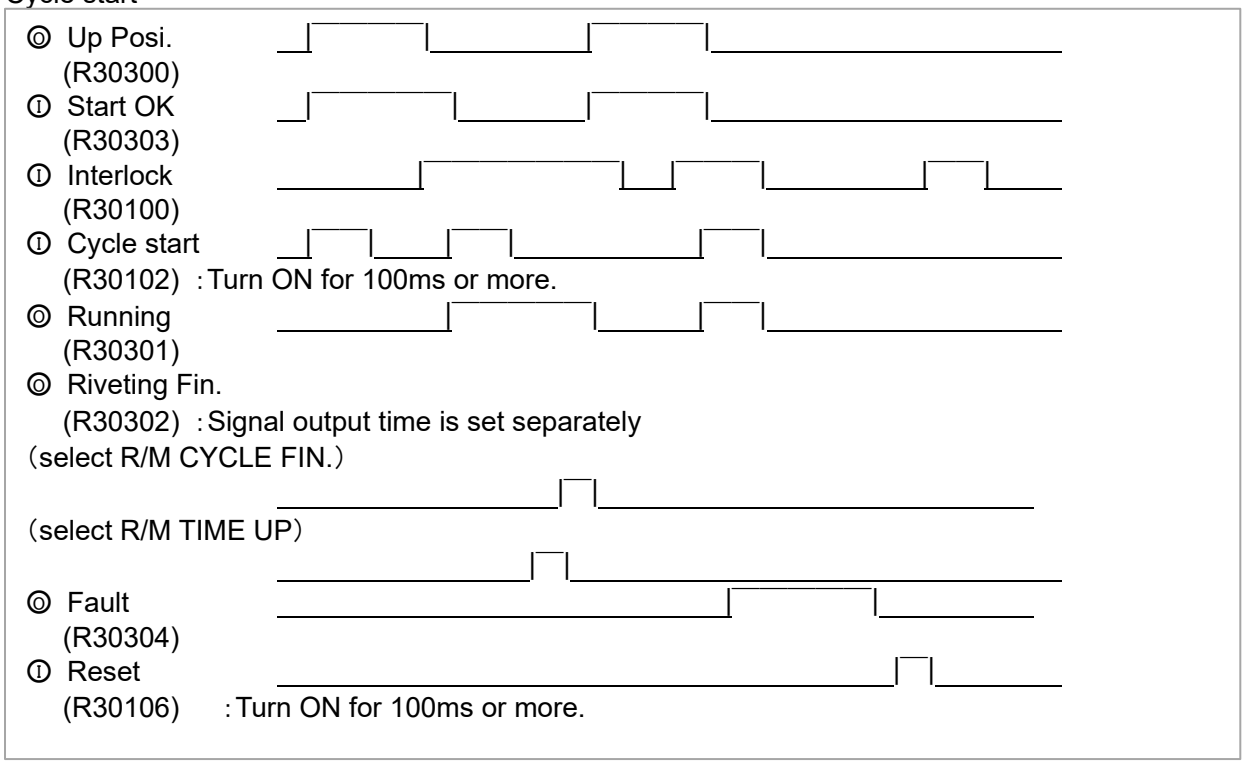
(2) Output

Address	Signal name	Explanation
R30300	Up position (Start position)	Signal turns ON when riveting machine is in home position.
R30301	Running	This signal turns ON during riveting 1 cycle and returning to home position.
R30302	Riveting Fin	When a riveting cycle is completed or R/M times up, this signal turns ON for the time set by the riveting completion signal timer. The output timing can be changed on the parameter screen.
R30303	Start OK	This signal turns ON when the cycle is ready to start. This signal is also turned ON when waiting for the STEP signal.
R30304	Fault	This signal turns ON when an error occurs in the riveting machine.
※1	Origin position	This signal turns ON when the riveting machine is at the origin position (FRE-05, 20: 1mm, FRE-10: 0mm).
※1	Intermediate stop position	This signal turns ON when the riveting machine is in the Intermediate stop position.

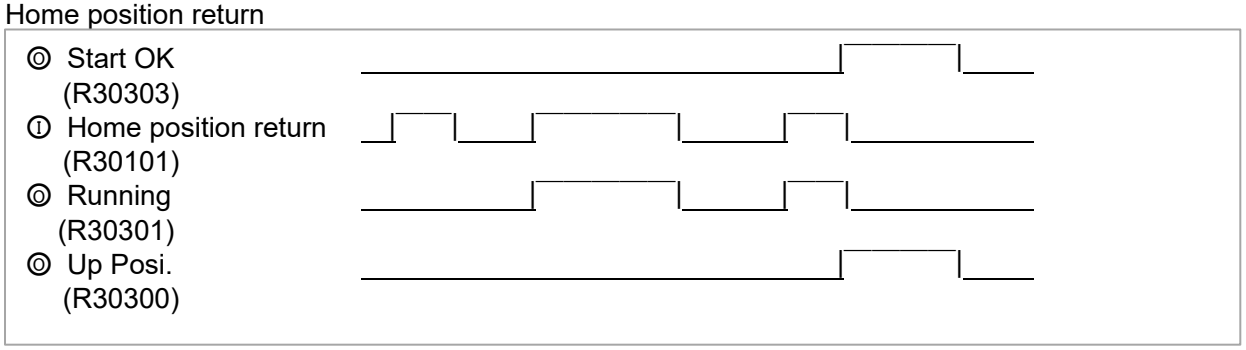
※1：This signal can only be used in Network Control.

4) Time charts
The time chart of each signal is described.

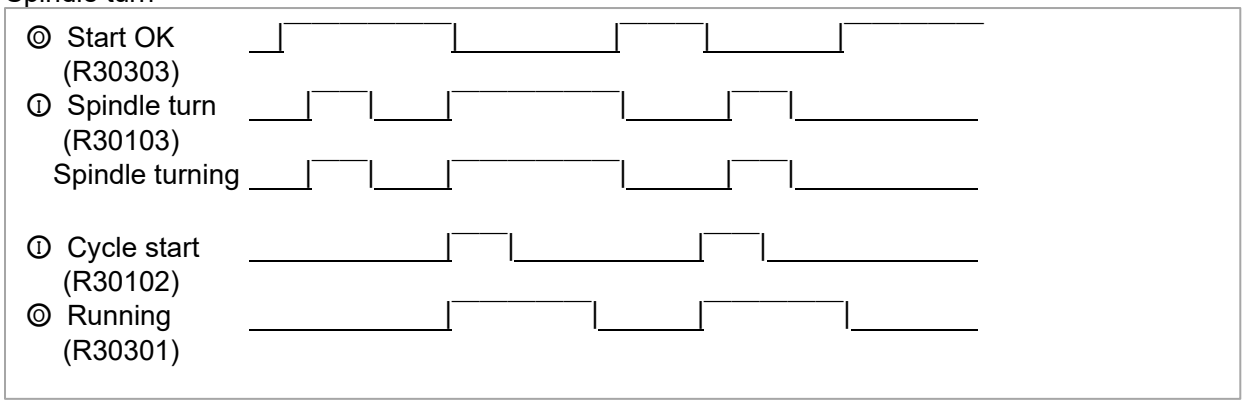
(1) Cycle start



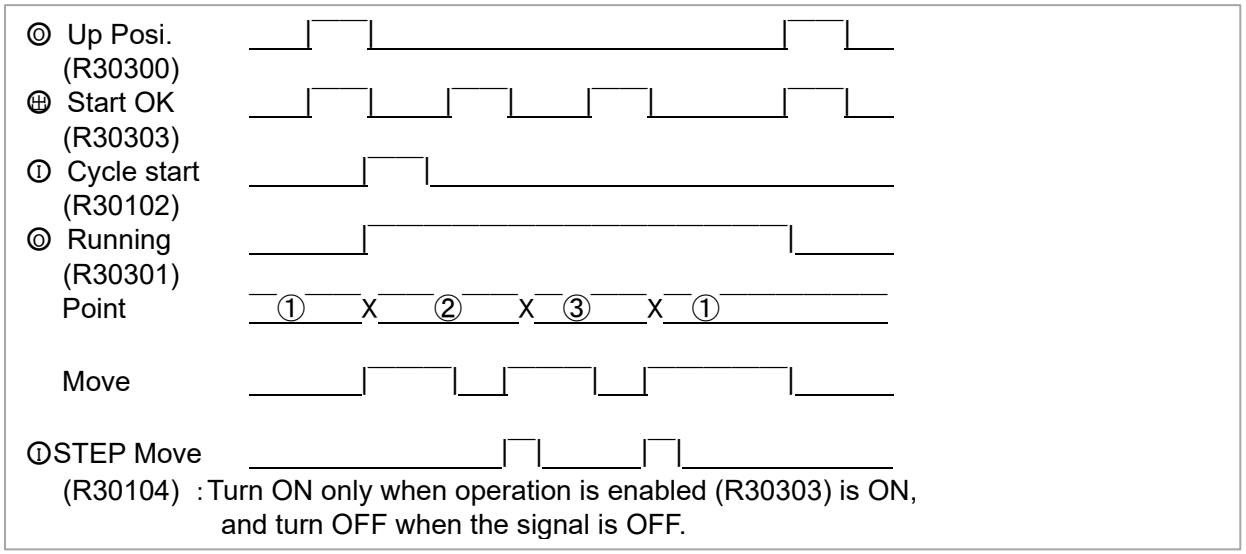
(2) Home position return



(3) Spindle turn

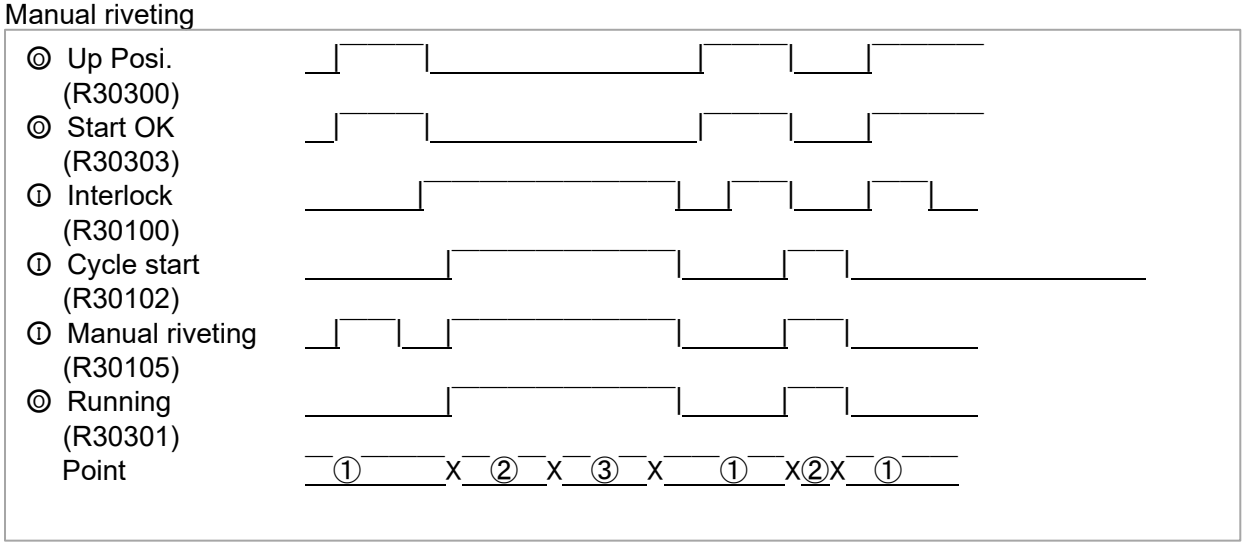


(4) STEP Move

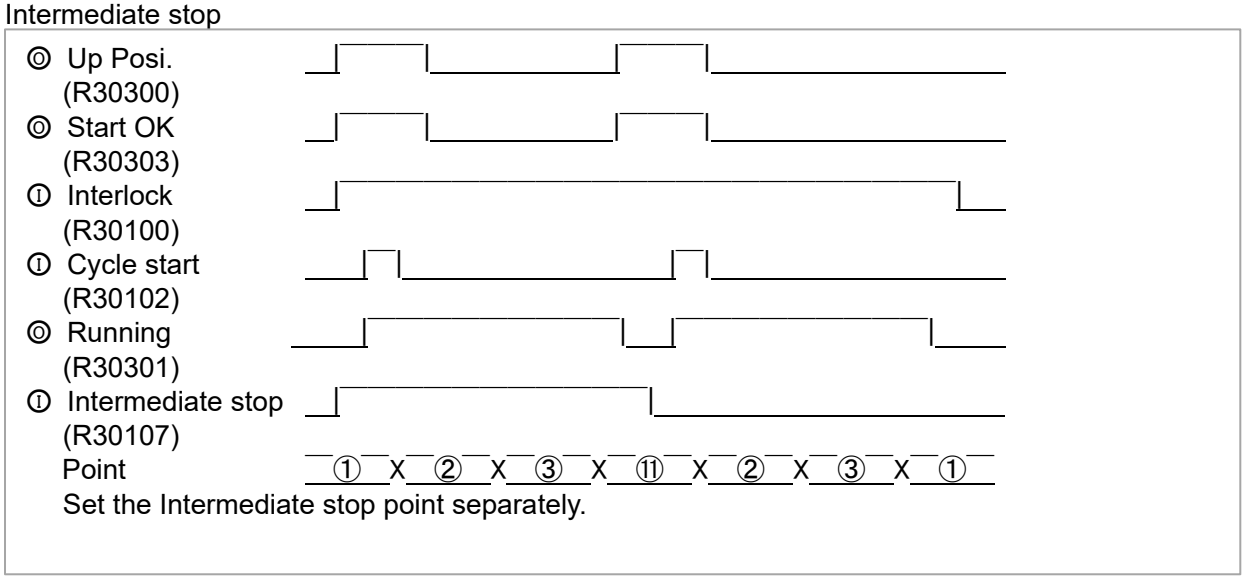


: Turn ON only when operation is enabled (R30303) is ON, and turn OFF when the signal is OFF.

(5) Manual riveting



(6) Intermediate stop



Set the Intermediate stop point separately.

(7) Model No.

①Model No.No.1 (R30108)
①Model No.No.2 (R30109)
①Model No.No.4 (R30110)
①Model No.No.8 (R30111)
Model No. X ① X ③ X ④ X ⑨ X ⑮ X ②

※Turn ON before cycle start.

List of Model No signal

Input signal / Model No.	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	No. 10	No. 11	No. 12	No. 13	No. 14	No. 15
R30108	●	―	●	―	●	―	●	―	●	―	●	―	●	―	●
R30109	―	●	●	―	―	●	●	―	―	●	●	―	―	●	●
R30110	―	―	―	●	●	●	●	―	―	―	―	●	●	●	●
R30111	―	―	―	―	―	―	―	●	●	●	●	●	●	●	●

●: ON

(8) External timer start trigger

◎ Up Posi. (R30300)
◎ Start OK (R30303)
① Interlock (R30100)
① Cycle start (R30102)
◎ Running (R30301)
① External timer start trigger (R30115)
◎ Riveting Fin. (R30302) : Signal output time is set separately

8.3.2 External I/O control

Fig 8.3.2

This section describes the external I/O assigned to the FRE series as standard.

1) Signal specifications

(1) Input

Form	Rated input voltage	Minimum ON voltage	Maximum OFF current	Input time constant
Open collector	DC24V / 5.1mA	19V	1.5mA	10μ

(2) Output

Form	Rated load	Leakage current when OFF	Residual voltage when ON	Common method	Operating time
MOSFET	DC30V / 0.2A (1.6A/1common)	100μA Less than	DC0.5V Less than	16 points 1 common	OFF→ON：1μs Less than ON→OFF：5μs Less than

2) Set up method

Press「INTERFACE」in the PARAMETER screen of the machine operation panel.
When using External I/O, switch「External communication」to「ENABLE」.

(1) Input

Each signal can be used by switching between「ENABLE」and「DISABLE」.
In external I/O and bus communication, input signals from external I/O are given priority.
Switch the input signal to be used to「ENABLE」.

Also, when using in combination with Network control, the input signal used for external I/O is「ENABLE」Set the input signal used for Network control to「DISABLE」.

(2) Output

Each signal is always output.

8.3.3 Network control

※ Network control is optional. It cannot be used with standard equipment.

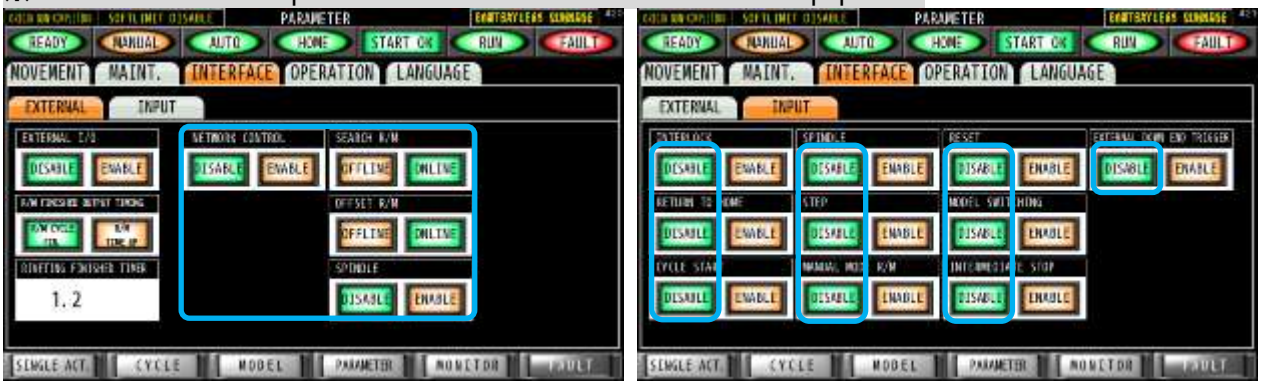


Fig 8.3.3

This section describes the specifications of FRE machines that use network control.

1) Signal specifications
With network control, you can communicate with external devices using Ethernet/IP, CC-Link, etc.
Equipment used for communication, communication specifications, and address used vary depending on the customer's machine specifications.

2) Set up method
Press「INTERFACE」in the「PARAMETER」screen of the machine operation panel.
Switch「NETWORK CONTROL」to「ENABLE」.
※ Since the Network control is an optional function,「ENABLE」cannot be selected for standard equipment.

(1) Input
Each signal can be used by switching between「ENABLE」and「DISABLE」.
In external I/O and Network control, input signals from external I/O are given priority.
Switch the input signal to be used to「DISABLE」.

Also, when using in combination with Network control, the input signal used for external I/O is「ENABLE」Set the input signal used for bus communication to「DISABLE」.

(2) Output
Each signal is always output.

(3) Search riveting / Offset riveting
Setting is possible only when the network control is「ENABLE」.
When set to「ONLINE」, the input value (X) used for Search R/M, Offset R/M
It can be read from the outside.

(4) Spindle
Set when using the spindle with network control.
Switch「Spindle」on the「External communication」screen to「ENABLE」, and set「Spindle」on the「Input」screen to「DISABLE」.

8.4 Operation

8.4.1 Edit lock

Fig 8.4.1.a

Press the「LOCK」button on the PARAMETER screen to display the Password screen.
The Program settings and Parameter are password locked.

Press the 「ENABLE」button of edit lock on the PASSWORD screen, password is enabled.
Once the password is enabled, you will be able to register the new password.
「0000」is impossible. If you do not want to register, the initial value「8888」is the password.
Once you disable the password and re enable it, it returns to the initial value.

When the lock is turned on, the password will be requested at the screen transition described below.

1) Change of model name
2) Transition to MODEL EDIT screen
3) Transition to MODEL SET UP screen
4) Transition to PARAMETER screen

Fig 8.4.1.b

When Edit Lock is set to Enabled, a password is required as shown in Fig 8.4.1.b.

Touch Password number part and enter Password.
It is judged by pressing the「ENTER」button. You can change the settings when the「OK」lamp lights up.

8.4.2 Other

Fig 8.4.2

1) MODEL BUTTON DESTINATIONS
When you press the「MODEL」button in the main bottom menu, you can select whether to move to the 」MODEL SELECT」screen or the「MODEL SET UP」screen.
(⇒7 MODEL (PROGRAM) SELECT･SET UP P.35)

2) CLEAR RESET BUTTON WHEN COUNTING UP
When「ENABLE」is selected, count is cleared when reset button on operation panel is pressed when product counter is count up.
(⇒9.3.1 Model counter 1)Count up P.99)

8.5 Language

Fig 8.5

The language of the entire screen can be switch.

8.6 Date / Time

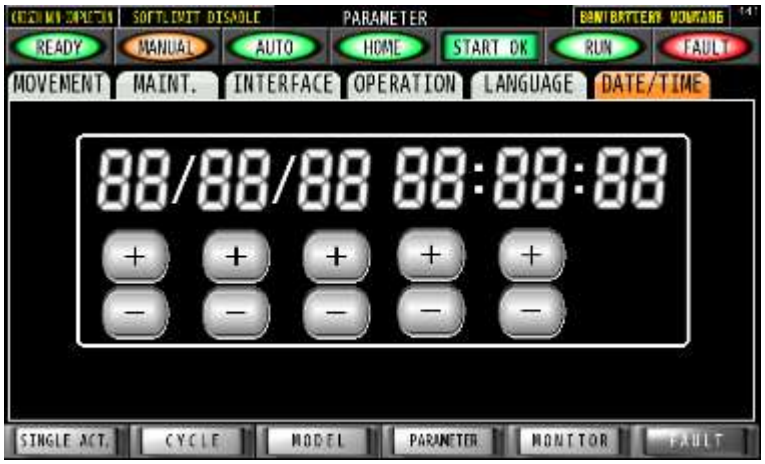


Fig 8.6

From the left,「year / month / day」and「hour / minute / second」are displayed.
You can change it by pressing the「+」and「-」buttons under each numerical value.

This date and time are synchronized with the date and time of PLC (KV-7500).
「Synchronization timing」updates the「PLC date and time」at「when the breaker is turned ON」and「when master is turned off」.

9 CYCLE SCREEN

9.1 Main･Search screen

MAIN screen

SEARCH screen

Fig 9.1

Press the「MAIN」button, the MAIN screen is displayed.
On the MAIN screen, you can monitor the setting data and current value data of for each program.
If you press the「SEARCH」button, the Setting data of When search riveting is enabled will be displayed.
In the MAIN screen of when search / offset riveting is enabled, in addition to setting data and current value data of for each model, setting data and search position data of offset amount are monitored.

Numeric value is not displayed for Point whose Point setting is disabe.
For Point where Point setting is Move, the values of Thrust and revolutions are not displayed.

When moving to each point, the lamp on the left blinks.
Lights when move completed or Down end arrival.

9.2 Data screen

Fig 9.2 DATA screen

Press the「DATE」button, the DATA screen is displayed.
DATA screen can be monitored the total counter, the cycle time, the state of each peak value.

1) PEAK POSITION
   Record the positional peak of during riveting cycle.

2) PEAK REVOLUTIONS
   Record the peak revolutions of during riveting cycle.

3) THRUST
   Record the thrust during riveting cycle.
   When to record the thrust value depends on the thrust data timing.

R/M PEAK	Record the peak thrust from riveting point start of move to R/M time up.
R/M TIME UP	Record the thrust of R/M time up.
SET UP POSITION	Record the peak thrust from the set position to the R/M time up.

4) JUDGMENT
   The judgment value is displayed when judgment is enabled.

9.3 Counter screen

9.3.1 Model counter

Fig 9.3.1 MODEL COUNTER screen

Press the「MODEL」button to display the MODEL COUNTER screen.
On the MODEL COUNTER screen, you can monitor and reset the total production (total counter), production counter, lot, and quality check 1, and quality check 2 counters.

The numeric part of the disabled counter is not displayed.
Refer to「7.4.4 Model counter P.69」for the setting method.

1) Count up
When any counter other than the total production counts up, the「COUNT UP」lamp is lit.
For items that have been count up, the name part flashes yellow and a buzzer sound.
（Check buzzer sound in Table 9.3.3 BUZZER SOUND BY COUNTER P.101）

Next riveting cycle start cannot be performed in the count up state.
To clear the count up, do one of the following.

(1) Press and hold the counted up「RST」button for 1 second.

(2) Press the reset button on the operation panel.
button on the operation panel. COUNTING UP is enabled.
(⇒8.4.2 Other 2)CLEAR RESET BUTTON WHEN COUNTING UP P.95)

2) Change counter value
Total production, production counter, lot counter, quality check 1 and 2 can temporarily change the counter value in this screen.
Tool counters 1 and 2 and maintenance counters cannot be changed.

(1) Touch the numerical value part of counter you want to change and change counter with displayed numeric keypad.

(2) Pressing and holding the「+1」and「-1」buttons adds or subtracts 1 from or subtracts 1 from the total production, production counter, lot counter, and quality check 1 and 2 counters.

9.3.2 Maintenance counter

Fig 9.3.2 MAINTENANCE COUNTER screen

Press the「MAINTENANCE」button to display the MAINTENANCE COUNTER screen.
On the MAINTENANCE COUNTER screen, monitor and reset of Various maintenance counters can be performed.

Refer to「8.2.1 Maintenance counter P.81」for setting value.

1）Count up
When the Maintenance counter exceeds the set value, the「MAINTE.」lamp blinks.
For items that exceed the set value, the name part flashes yellow.
Press and hold the count up「RST」button for 1 second to clear the value.

When the count is up, the lamp will blink, and a buzzer will sound.
（Check buzzer sound in Table 9.3.3 BUZZER SOUND BY COUNTER P.101）

To resume production, do one of the following:
The buzzer will stop when production can be resumed.

(1) After performing maintenance on the relevant parts / tools, press and hold the「RST」button on the counter that counts up for 1 second to clear the value.

(2) Press the reset button on the operation panel.
※The function to restart production by pressing the Reset button on the operation panel is a function to temporarily restart production, so the counter is not cleared.
Currently, the blinking「MAINTENANCE」lamp turns on.
In this state, if master OFF-ON, production will not be possible again.
At that time, the buzzer will resume the alarm and the「maintenance」lamp will return to blinking.
If you want to perform maintenance to reset the counter or perform maintenance later, press the reset button on the operation panel again to restart production.

9.3.3 Buzzer when count up

A buzzer sounds when each counter counts up. For the setting method of「Table 9.3.3 BUZZER SOUND BY COUNTER P.101」, refer to「7.4.4 Model counter P.69」,
「8.2.1 Maintenance counter P.81」.

Table 9.3.3 BUZZER SOUND BY COUNTER

Counter name	Sound	Interval
Lot Counter	Pi_pi _...	1 sound, 1 second interval, 1 sound
Production Counter	Pipi _pipi _...	2 sounds, 1 second interval, 2 sounds
Qualitycheck1 Counter	Pipipi _pipipi _...	3 sounds, 1 second interval, 3 sounds
Qualitycheck2 Counter	Pipipipi _pipipipi _...	4 sounds, 1 second interval, 4 sounds
Tool counter1 Counter	Pipipipipi_pipipipipi_...	5 sounds, 1 second interval, 5 sounds
Tool counter2 Counter	Pipipipipipi_pipipipipipi _...	6 sounds, 1 second interval, 6 sounds
Maintenance Counter	Pi-pi-...	Intermittently at 1 second intervals

9.4 Graph screen

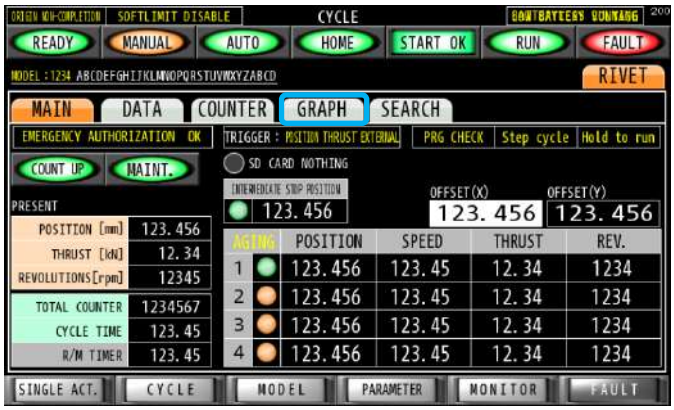


Fig 9.4.a MAIN screen

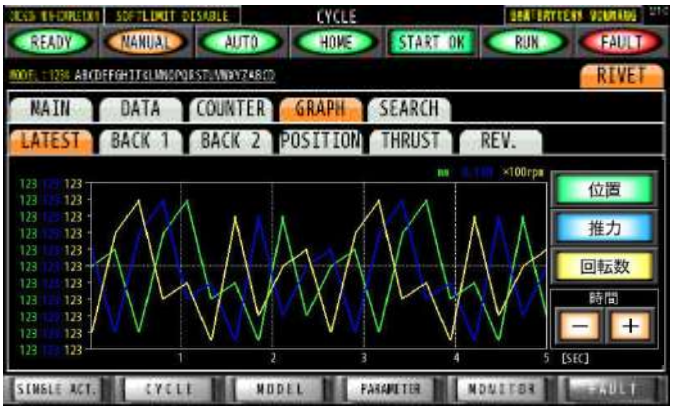


Fig 9.4.b GRAPH screen

The「GRAPH」screen is displayed by pressing the「GRAPH」button.
The graph measures the position, thrust, and revolutions during the riveting cycle.
In「LATEST」,「BACK 1」, and「BACK 2」, you can check the position, thrust, and revolutions during the riveting cycle from the latest to 2 before.
For「POSITION」,「THRUST」, and「REVOLUTIONS」, you can check the position, thrust, and revolutions during the riveting cycle from the latest to the previous two.
Press the「+」button in time to switch 5 seconds, 10 seconds, 20 seconds in that order.
Press the「-」button to switch in reverse order.

If you want to display the「POSITION」in graphs of the「LATEST」,「BACK 1」,「BACK 2」, press the same button, the graph is displayed, then the same light up.
Press the button again to delete the graph and turn off the same lamp.
Show / hide of「REVOLUTION」and「THRUST」graph can also operate in the same way.

The「POSITION」,「THRUST」,「REVOLUTION」graph can display the 3 pieces of data.
Press the「LATEST」button to display the graph and the same lamp flashes.
Press the button again to delete the graph and turn off the same lamp.
Show / hide of「BACK 1」and「BACK 2」graph can also operate in the same way.

9.5 Start ok (start condition)

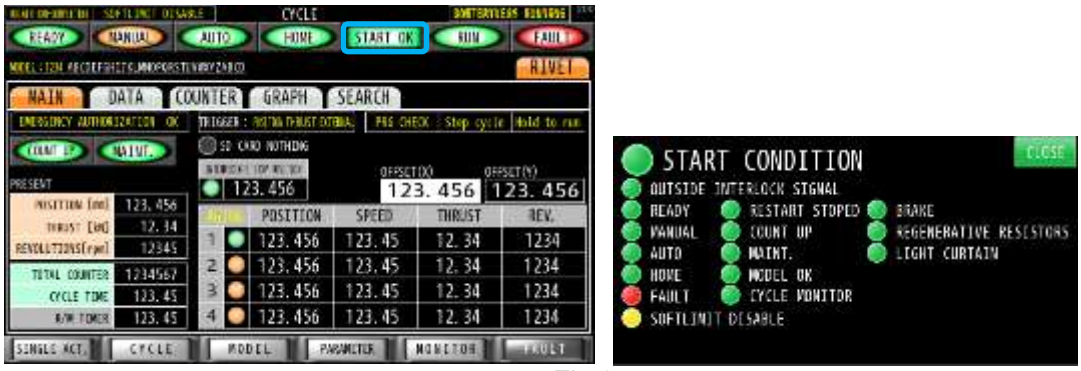


Fig 9.5

If you press the「START OK」button at the top of the cycle screen, the start conditions will be displayed.
If the riveting cycle cannot be started, check the start condition.
For details on Start conditions, refer to 11.3 Start condition P.109.

10 SINGLE OPERATION (MANUAL MODE)

Fig 10

To operate the FRE machine in single operation, set the「MANUAL / AUTO」select switch on the control panel to「MANUAL」.
The「MANUAL」lamp on the screen lights up and you are in manual mode.

10.1 Single operation

In manual mode, riveting axis and spindle can be operated by single operation.

10.1.1 Riveting

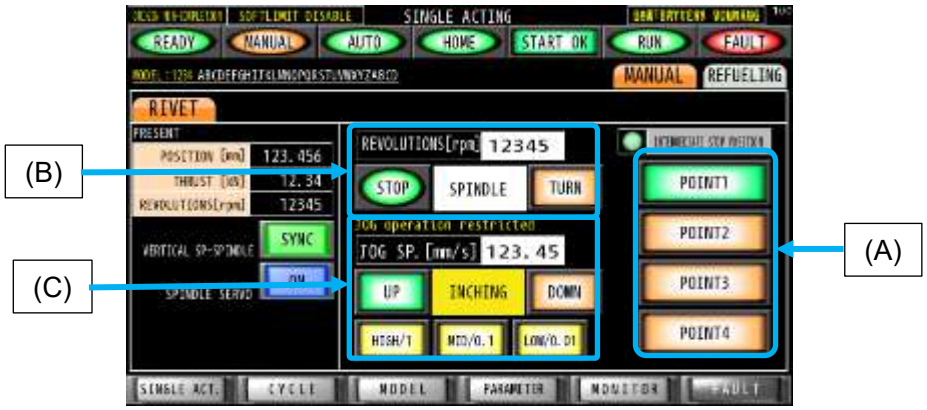


Fig 10.1.1

In single operation operation, riveting axis and spindle can be operated in single motion.
If operation is not impossible error,「JOG」operation can be performed by single operation.

1) Positioning operation (A)
   In the selected program It moves to the position set for each point by the set speed and thrust, and the「MOVE」point will move at low speed and low thrust.
   (⇒2.3.1 Functional operation specification P.12)
   The lamp of each point flash when the movement is completed.
   The「1 point」button wii be the position to upward of the program.
   Number of positioning points can be set by 2~4 points for each program.
   Please refer to the「7.4 Model set up P.38」for more information, such as how to set.

> **⚠ CAUTION**
> There is a possibility that the position of the「point 1」and the machine home may be different, the「point 1」might move to downward.
> Please be careful when operating.

2) Spindle turn / stop (B)
   It can turn / stop of the spindle. The spindle turn while you hold down the「TURN」button.
   It works at the revolutions set in revolutions [rpm].
   Please touch the numerical part and input the revolutions.

3) JOG / INCHING (C)

To switch between JOG / INCHING, press「JOG / INCHING」between UP and DOWN.
The current mode is displayed.

JOG (Manual any feed)	Press the JOG button, the lamp flashes, and the JOG operation can be run. It works as 100% which the speed set in「JOG speed mm/s」. By pressing「HIGH / 1」「MID / 0.1」「LOW / 0.01」button you can switch the speed of「 JOG / INCHING」to display speed. At low speed, it works at the setting speed of「25%」, the medium speed at「50%」, and the high speed at「100%」.
INCHING (Fixed size feed)	Press the INCHING button, the same lamp flashes, the INCHING operation can be run. By pressing the「HIGH / 1」「MID / 0.1」「LOW / 0.01」button you can switch the moving distance of「JOG / INCHING」to the display distance. It works with「0.01 mm」,「0.1 mm」,「1 mm」.

10.1.2 Refueling

Fig 10.1.2 REFUELING screen

When the「REFUELING」button is pressed, the grease circulation control screen is displayed.
On the grease circulation control screen, full stroke operation can be performed after grease refueling, and grease can be adapted to whole ball screw.

⚠CAUTION

Since it operates at full stroke, remove the insert and head, and make sure that there is nothing to touch when operating at full stroke before using.
If it cannot be used, do not use the grease circulation function, and operate the cylinder with single operation so that the grease in the ball screw circulates.

Refer to 8.2.3 Refueling P.82 for the operation method.

10.1.3 Spindle servo off

(※When the spindle servo specification only)

Fig 10.1.3

If the spindle servo specification,「SPINDLE SERVO OFF-ON」button will appear.
Press the「SPINDLE SERVO OFF」button, the same lamp blinks and the servo is off.
When it comes to this state, you will be able to turn spindle by hand.
To return to the servo ON When you press the same button again.

※When the spindle servo is turned off, the spindle cannot revolution.

10.2 Manual riveting cycle

When the cycle work is started,「RUN」lamp flashes.
While it is pushed the start button, the manual riveting cycle operation is run.
If the start signal turns off during the cycle work, the cycle stops and moves upward to home position.
※The operation of「hold to run」and「step」is invalid in the manual riveting cycle.

For details, refer to 「11.1 Riveting cycle P.108」.

10.3 Home position return

Press the「HOME」button on the setting screen to the home position return.
While the home position return, the same lamp blinks.
When the setting is at point 1 and spindle stop, the「HOME」lamp.

Home position…The state where all the following conditions are met is called home position.

1) Being in the point 1 position, or in the intermediate stop position while intermediate stop signal is ON when the intermediate stop is「ENABLE」.

2) Spindle stopped (may turn if spindle settings are continuous)

During movement, it operates at low speed and low thrust.
(⇒2.3.1 Functional operation specification P.12)

11 RIVETING CYCLE

Fig 11

11.1 Riveting cycle operation

If the start signal is turned on while the start conditions are met, the riveting cycle will start.
When the riveting cycle starts, the「RUN」lamp lights up.
riveting cycle works according to the selected model setting.

The operation of riveting cycle differs depending on the Manual / Auto mode.

Manual mode	While the start button is ON, the riveting cycle is executed. If the start button is turned off during operation, the riveting cycle will stop, and the position will move to the home position. ※During manual riveting cycle,「Hold to run」and「STEP」operations are ignored.
Auto mode	When the start button is turned on, the riveting cycle is executed.

11.2 Start signal

To start the riveting cycle, it is necessary to turn on the start signal when the start conditions are met.

When using the both-hand start button, the start signal will not be output unless the left and right start buttons are turned on within 0.5 seconds.

When the external start signal is enabled, cycle start cannot be performed with the device start button in Auto mode.

11.3 Start condition

When the「START OK」lamp at the top of the screen is lit, you can perform a riveting cycle.
The lighting conditions for the「START OK」lamp are shown below.

Table 11.3 Start condition

Outside interlock signal ON	When the interface interlock is「ENABLE」
Ready (green) light	Lights (green) when the servo and inverter of the riveting machine can be operated. Lights when operation is not possible (yellow). A fault has occurred in the servo and inverter. Check the contents from the fault screen and resolve the fault.
Manual / Auto mode	It can only be started in either mode.
Home position	① At the point 1, or when the intermediate stop is「ENABLE」, you must be in the intermediate stop position while the intermediate stop signal is ON. ② Spindle is stopped (turn is possible when spindle setting is continuou)
Fault (green) light	Lights (green) when no fault has occurred. If a fault has occurred, it lights up (red). Check the contents from the FAULT screen and eliminate the fault.
Restart stoped	After riveting cycle, once release the Both-hand start button.
Count up, Maintenance (green) lights	Each counter is not count up.
Model OK	Setting of selected models is normal
Cycle screen monitor	Cycle screen is displayed (manual only)
Safety device normal (Brake, Regenerative Resistors, Light curtain)	If safety device is attached, each safety device is normal (device is operational)

11.4 Timer start trigger

※Trigger to become a down end signal
Timer start trigger has「POSITION」,「THRUST」, and「EXTERNAL」.
When the down end is reached, the R/M timer is timed and the time is up, then the machine rises.
Refer to「7.4.2 Control P.50」for the setting method.

Table 11.4 Timer start trigger list

Position	When the position of the down end point is reached, the timer start trigger turns ON.
Thrust	To the down end point the timer start trigger turns ON when the thrust reaches the set thrust between the start of movement and the arrival at the position. Once the set thrust is reached, the timer start trigger will continue to turn on even if the thrust is lower than the set thrust during the riveting cycle.
External	When the external down end signal turns ON between start of movement and reaching the position to the down end point, the timer start trigger turns ON.

11.5 Riveting cycle operation

This section describes the operation during the riveting cycle.
For the setting method, refer to「7.4.2 Control P.50」「8.1.3 PRG check control P.79」「8.1.4 Hold to run P.80」.

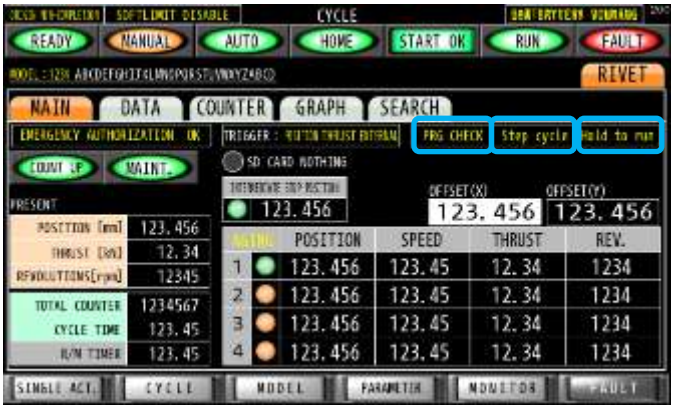


Fig 11.5

1) PRG CHECK CONTROL
In the first riveting cycle where the MODEL (PROGRAM) is switched, the move point operates at low speed and low thrust.
If the set thrust is reached during move point operation, it becomes fault and stops on the spot.
When the movement to the down end is completed, PRG check control is OK.
From the next cycle, the operation will be as programmed.

「PRG CHECK」is displayed on the CYCLE screen during「PRG CHECK CONTROL」.
For functional details, refer to「8.1.3 PRG check control P.79」

2) STEP / Continuous

STEP ※Auto mode only	If you press the start button while the「START OK」lamp is lit, the riveting cycle will start. When you start the riveting cycle, you will move to point 2. When you complete the move to point 2, press the start button again to move to the next point. After reaching the down end, it will rise automatically. If you start the riveting cycle in Manual mode, the operation will be「CONTINUE」. While「STEP」is selected,「Step cycle」is displayed on the CYCLE screen.
Continue	If you press the start button while the「START OK」lamp is lit, the riveting cycle will start. riveting cycle will continue as it is. 「Step cycle」is not displayed on the CYCLE screen while「CONTINUOUS」is selected.

3) Hold to run ※Auto mode only
If you press the start button while the「START OK」lamp is lit, the riveting cycle will start.
After the start, if the start button is turned off before reaching the「start of riveting」or the「Down end」, the riveting cycle will stop on the spot with「Hold to run error」.

If you start the riveting cycle in Manual mode,「Hold to run」will not work.
During「Hold to run」,「Hold to run」is displayed on the CYCLE screen.
Please refer to「8.1.4 Hold to run P.80」for the details of the function.

11.5.1 Auto riveting cycle flow

Point	Position[mm]	Speed[mm/sec]	Thrust[kN]	Revolutions [rpm]
1	10.000	130.00	-	-
2	30.000	100.00	-	-
3	35.000	10.00	5.00	1800
4	40.000	5.00	3.00	600

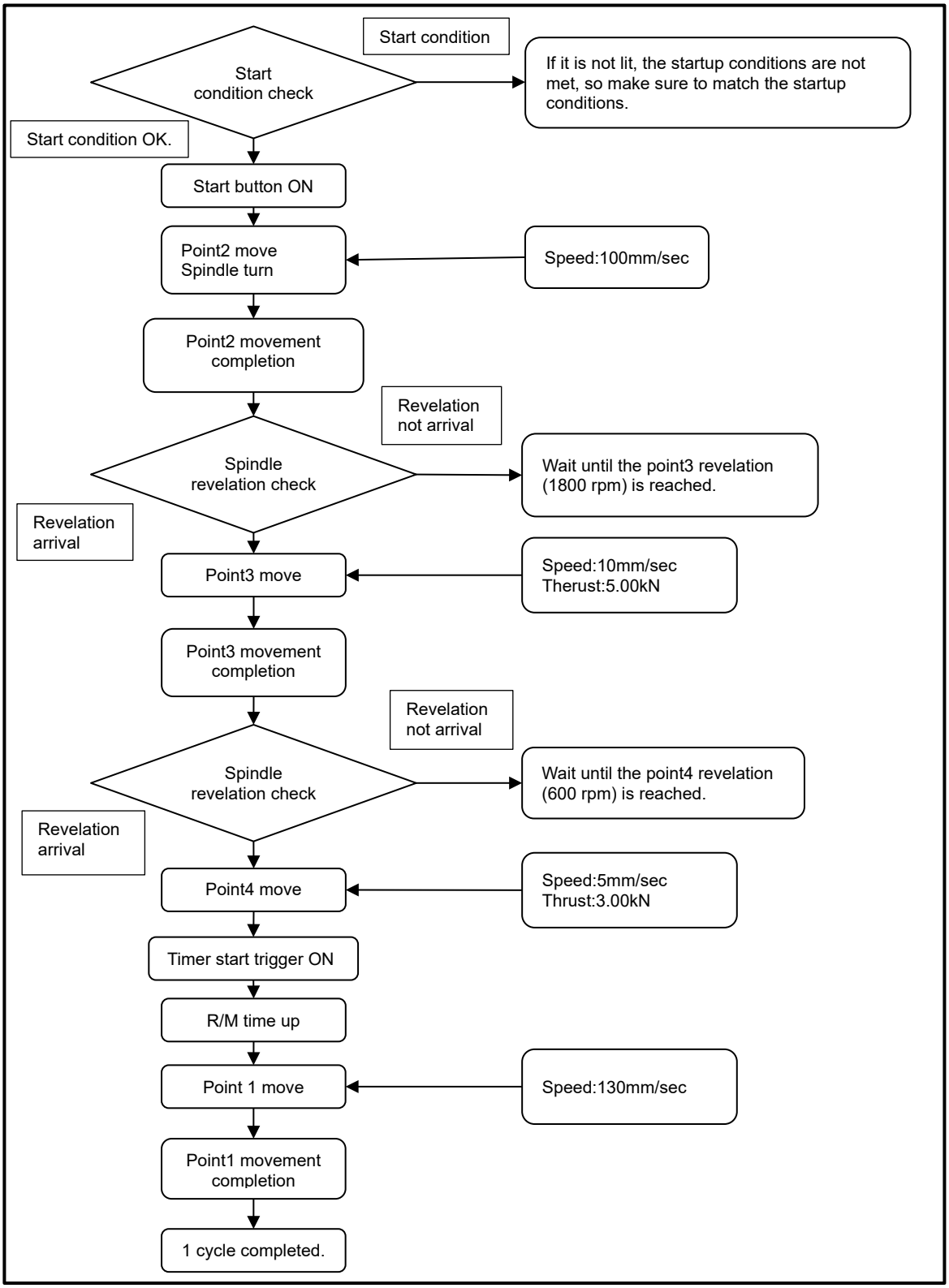


Fig 11.5.1

12 MONITOR

12.1 Diagnos

Fig 12.1 CHECK screen

Press the「MONITOR」button at the bottom of the screen to display the「CHECK」screen.
On the「CHECK」screen, you can check the status of the「RIVETING AXIS」and 「SPINDLE MOTOR」.

Table 12.1 CHECK screen counter list

LIFETIME COUNTER	Counts the number of times the FRE machine has performed a riveting cycle.
EMERGENCY STOP COUNTER	Counts the number of times the emergency stop button is turned on during FRE machine operation.
STO COUNTER	Counts the number of times the STO state is entered during FRE machine operation.
MASTER ON TIME	Record the total time when master ON. If it exceeds 999,999h：60m, it will be reset to 0.
R/M CYCLE TIME	Record the total time of the riveting cycle. If it exceeds 999,999h：60m, it will be reset to 0.
TRAVELING DISTANCE	Record the traveling distance of the FRE machine. It will be reset when it reaches 999,999.999km.

12.2 I/O monitor

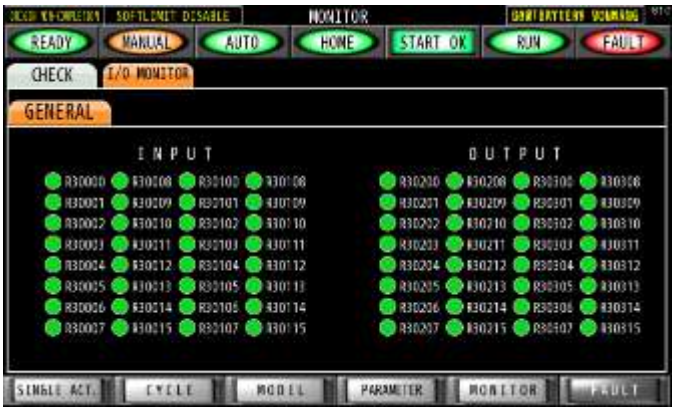


Fig 12.2 I/O MONITOR screen

Press the I/O Monitor button, the I/O MONITOR screen is displayed.
On the I/O MONITOR screen, you can monitor the status of input / output signals.

13 DATA COLLECTION

This Machine collects logs when machine is in operation.
It can be used for product quality check, traceability, and check in case of machine failure.
※The collection items are being reviewed as appropriate, so please contact our sales staff for details.

13.1 Logging data collected

Table 13.1 Logging data collected

DATA No.	DATA No. is entered at 10 ms intervals.
DATE.	The acquisition date is entered.
TIME	The acquisition time is entered as hour: minute: second.
Riveting model name	The model name at the time of automatic operation execution is entered.
Current position [μm]	Current position data is entered in units of 1 μm.
Servo torque [0.01%]	Data is entered.
Current thrust [10N]	Data is entered.
Revolution speed [rpm]	The revolution speed of the spindle motor is entered.
Servo load factor [%]	The load factor of the riveting axis motor is entered.
Servo peak current value [%]	The peak current value of riveting axis motor is entered.
Regenerative load factor [%]	The regenerative load ratio of riveting axis motor is entered.
INV frequency [0.01Hz]	At inverter specification, the revolution command frequency of the spindle motor is entered in units of 0.01 Hz.
INV current value [0.01A]	At inverter specification, the current value of the spindle motor is entered in units of 0.01 A.
INV torque current [0.1%]	When the inverter is specified, the torque current value of the spindle motor is entered in units of 0.1%.
INV excitation current value [0.1%]	When the inverter is specified, the excitation current value of the spindle motor is entered in units of 0.1%.
Servo peak load factor [%]	At servo specification, the peak load ratio of the spindle motor is entered.
Servo execution load factor [%]	When servo is specified, the execution load ratio of the spindle motor is entered.
Servo regeneration load factor [%]	At servo specification, the regenerative load ratio of the spindle motor is entered.
Servo feedback torque [0.01%]	When the servo is specified, the feedback torque of the spindle motor is entered in units of 0.01%.
Total counter value	The current value of the total counter is entered.
R/M downward end	The riveting cylinder is entered as 1 when it reaches to the downward end.

13.2 Collection method

It collects automatically when the Automatic operation cycle starts, by putting the SD card in the controller and the logging data is「Enable」,
For details, refer to「8.2.2 Logging P.82」.

13.3 Equipment

The SD card installed at shipment is considered as a consumable item.
We recommend the SD card which Class 6 and larger and 16 GB or larger capacity.

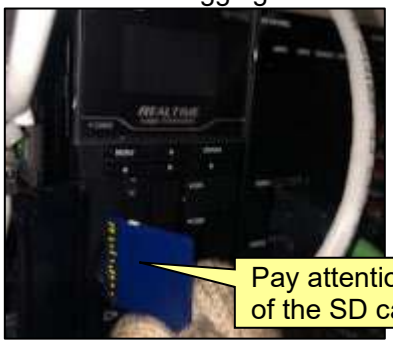
13.4 Remove SD card

Open the card cover of the sequencer in the control box.
When you press the SD card, the SD card comes up.

※Never remove the card or turn off the power while accessing the memory card while the lamp flashes. As it may cause the card data is discarded.

13.5 How to Insert the SD card

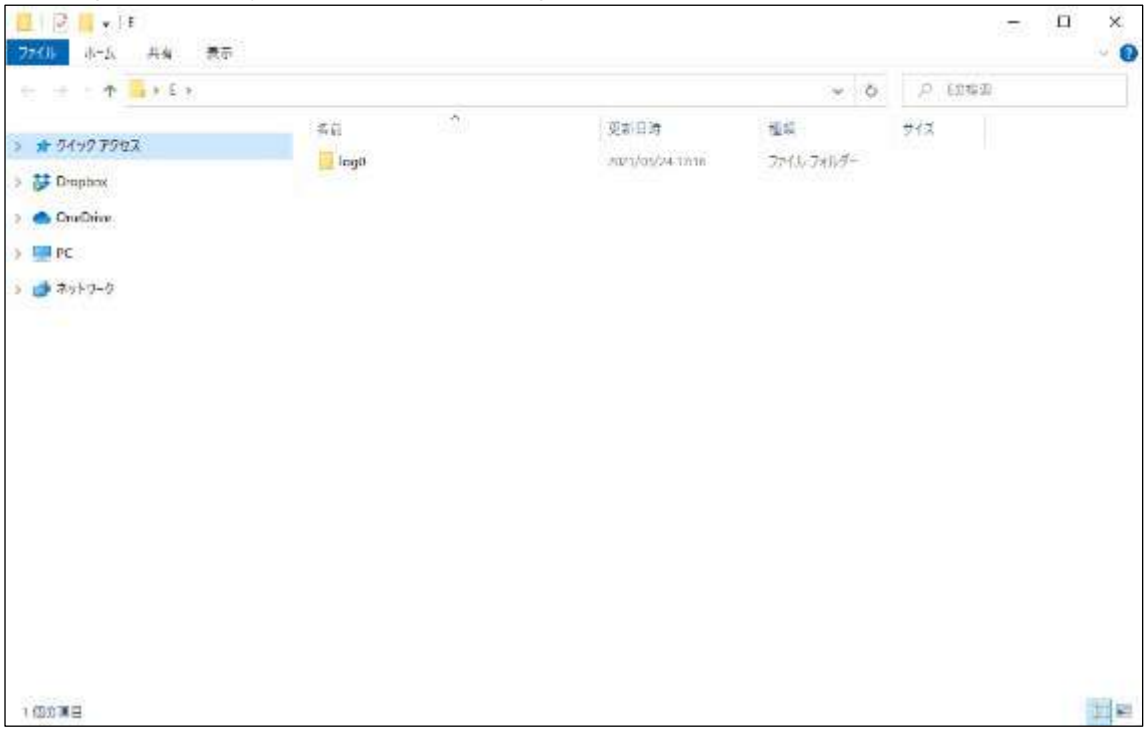
1) Insert the SD card until it clicks.
2) Confirm the SD card have inserted and close the cover.
   You can't that logging the data when the cover is open.



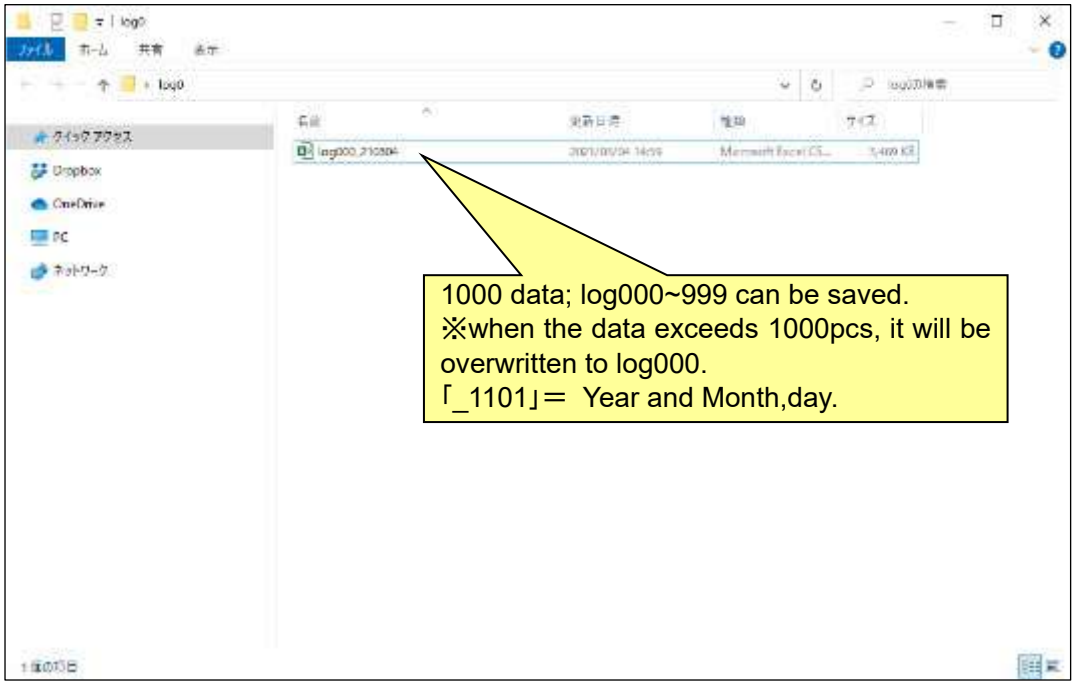
13.6 Reading the data

1) Connect the card reader with PC and insert the SD card.

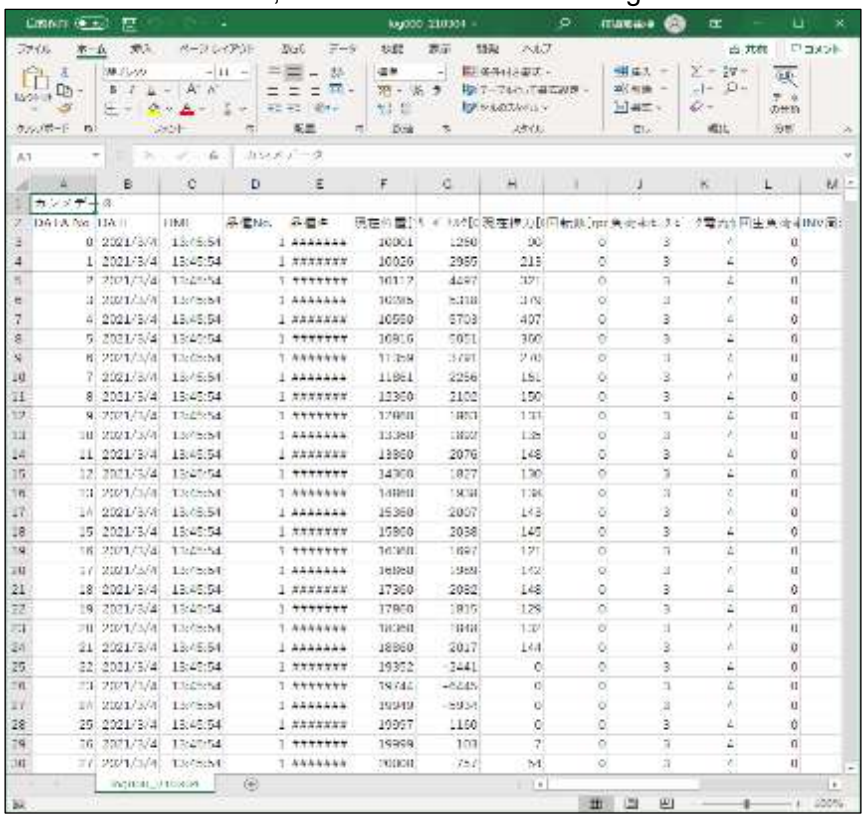
2) The following windows open, when the memory card is inserted.
Double-click the「log0」folder if you want to use the Japanese version or double-click the「log1」folder if you want to use the English version.



3) At the logging data collected, double click the folder, the following window is displayed. Double click on the file which want to check.



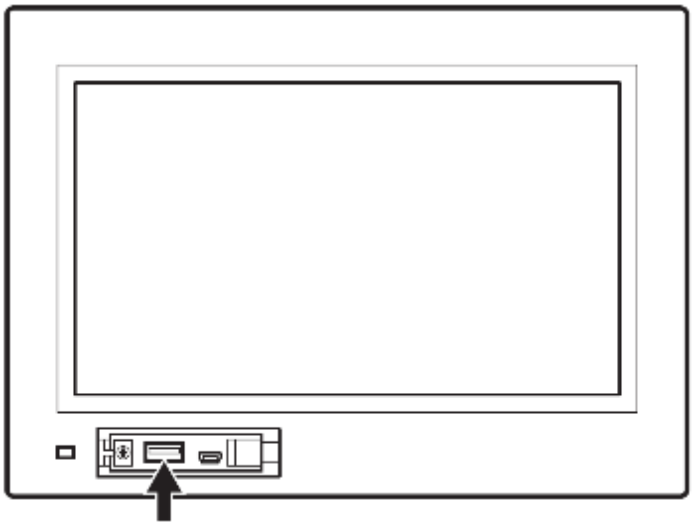
4) At the Microsoft Excel, the file is shown as following.



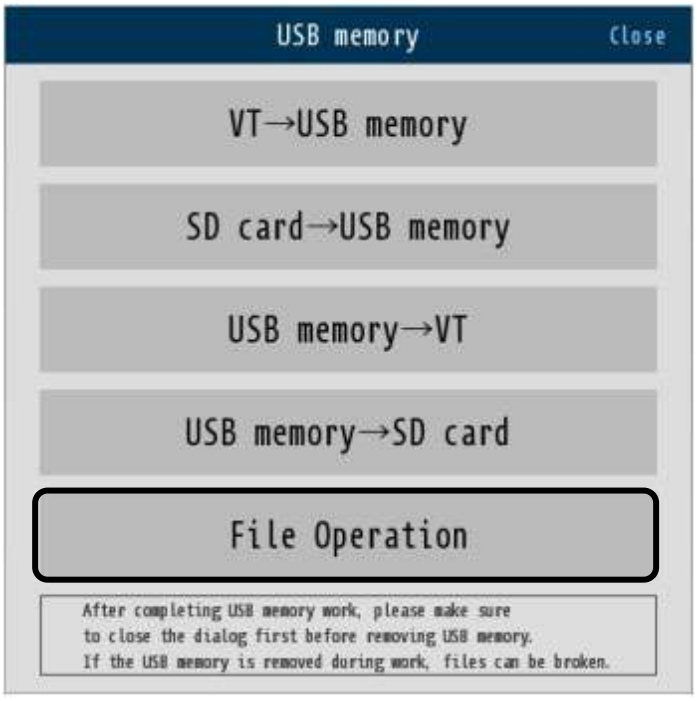
13.7 Reading data using USB memory

Logging data can be read using USB memory.

1) Attach the USB memory to the USB port.



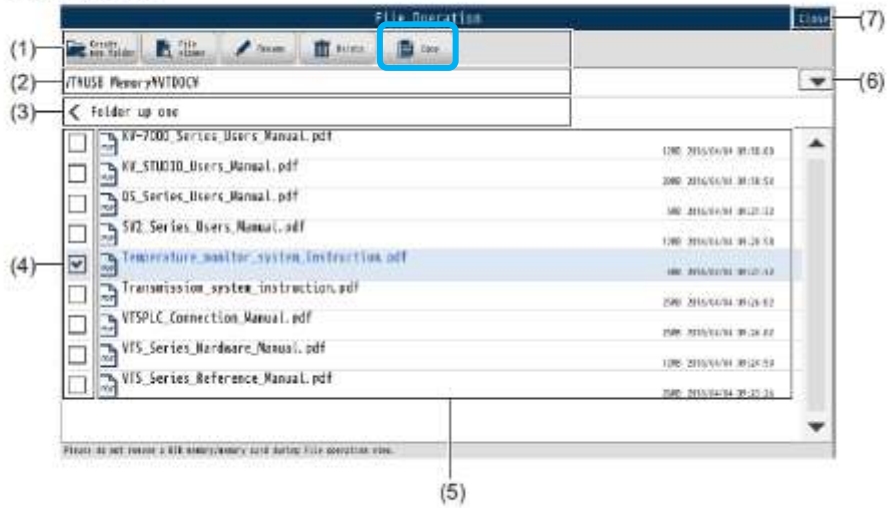
2) When the USB memory is installed, the USB memory dialog is displayed.
Please select a file operation.



3) After opening the file operation screen, touch the Copy button to display the Copy operation screen.

■ File Operations Screen

(Main screen)

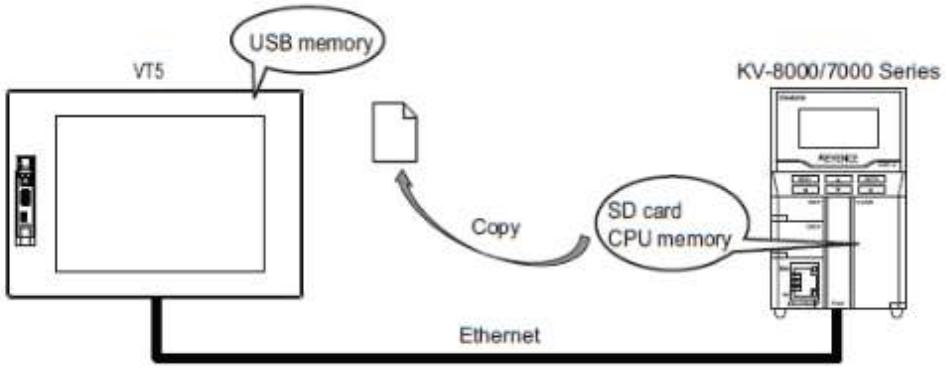


(1)	Create new folder	Creates new folders in the current directory.
	File viewer	Allows you to view the selected PDF file.
	Rename	Renames selected files or folders.
	Delete	Deletes selected files or folders.
	Copy	Copies selected files or folders.
(2)	Displays the location of the current folder.	
(3)	Touch to move to the next higher folder.	
(4)	Tick the File viewer, Rename, Delete or Copy checkboxes when a file is selected.	
(5)	Displays a list all files and folders in the current folder. Touch a folder to move to the next lower layer folder.	
(6)	Touch to select a drive.	
(7)	Exits the file operation function and opens the operation screen.	

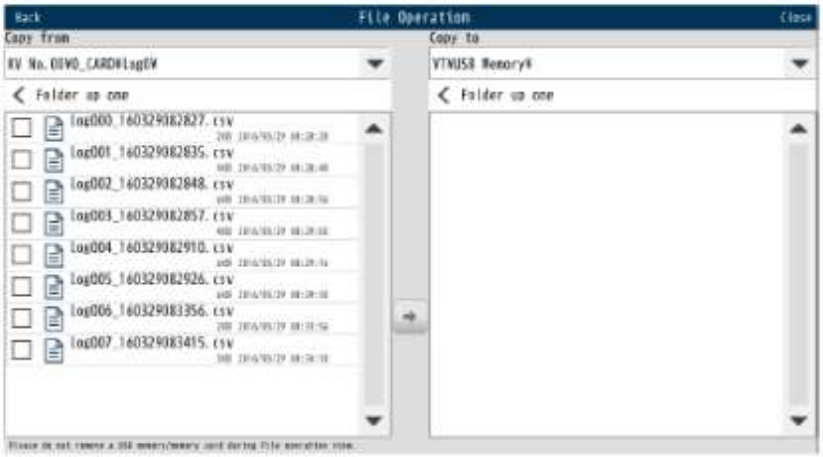
■ Copy

Use this function to copy the specified files or folders from one folder to another.
You can use this function to copy alarm log files on the VT5 to a USB memory device and copy files between the VT5 and the KV-8000/7000.
It is also possible to copy files on an SD card or in CPU memory of a separate KV-7000 when MultiTalk is used.

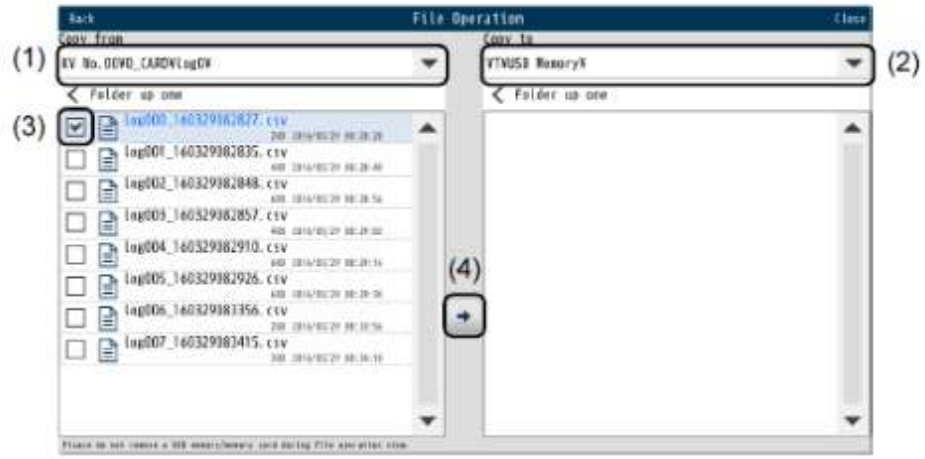
[Example] How to copy logging data collected on the KV-8000/7000 to a USB memory device on a VT5



1 **Touch the "Copy" button to open the Copy screen.**

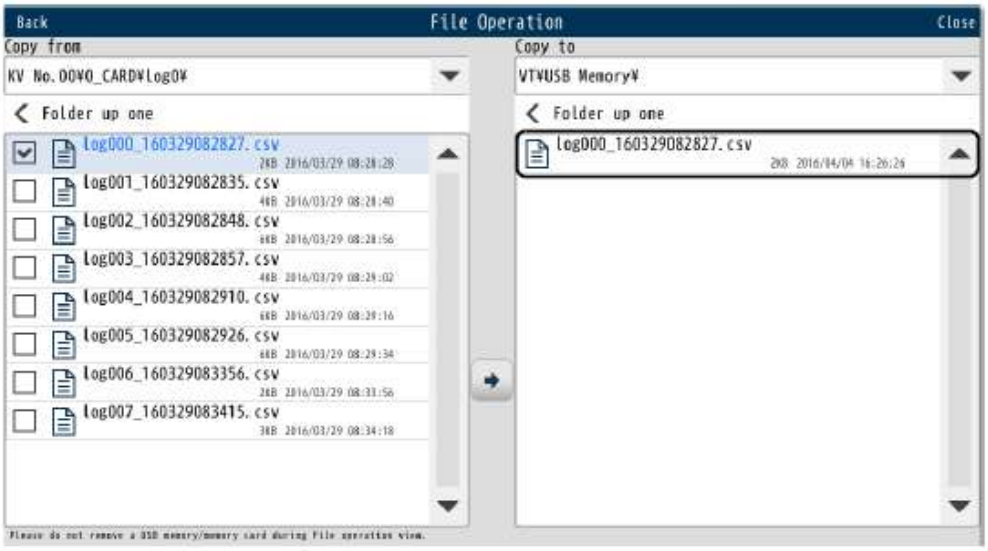


2 **Select the source folder (1) and the destination folder (2).**
Select the file (3) you want to copy and touch the "Copy" (4) button at the center.



3 Touch the "OK" button in the confirmation screen that appears to start copying.

4 The following message appears when copying is completed.



Point

- **You can select multiple files at the same time.**
- **If a file selected for copying already exists at the destination, a confirmation message asking whether you want to overwrite it will appear. (Subfolders are always overwritten).**
- **File attributes of the source file are not copied.**

14 FAULT

14.1 Fault display

Press the「FAULT」button at the bottom of the screen, the「FAULT」screen is displayed.
When Fault occurs, the「FAULT」lamp on the upper right of the screen lights up, and the「FAULT」button on the lower right of the screen also blinks.
Alarm content is displayed on the FAULT screen.
The FAULT screen is divided into「Device」,「Riveting axis」, and「Spindle」.

CYCLE screen　　FAULT screen

Fig 14.1

1) Alarm code
Fault The「ALARM」and「DRIVER ALARM」at the bottom of the screen are called「alarm code」.
In Alarm code, you can check the Alarm content generated by Servo and Inverter.
Check the Detailed name on the RIVETING AXIS and SPINDLE screens.
For Remedy for Alarm, refer to Instruction Manual for Each Device.

2) Fault content
The Fault alarm code and alarm name that occur in device fault are listed in Table 14.1 Device fault alarm list P.122 If you cannot solve the problem, please contact us.

・For email / fax: Please contact us by describing the contents in the Troubleshooting questionnaire (⇒Appendix B: Troubleshooting questionnaire P.**エラー! ブックマークが定義されていません。**).
・By phone: Please contact us with the confirmation items according to the contents of, troubleshooting questionnaire so that you can understand the situation.

Table 14.1 Device fault alarm list

Alarm code	Alarm name	Cause	Coping
M_000	Origin return overtime	This error occurs when the home position return is not completed within 30 seconds.	Eliminate any obstacles to the home position return.
M_001	Automatic operation overtime	Occurs when automatic operation is not completed within 60 seconds.	Eliminate obstacles to automatic operation.
M_002	R/M cycle overtime	Occurs when the riveting cycle time exceeds the overtime value on the PARAMETER screen. The factory setting is 10 seconds. If Overtime is set in model setting, that will be prioritized, so overtime in parameter will not occur.	Review the overtime setting or, eliminate anything that interferes with the riveting cycle.
M_003	R/M cycle overtime (MODEL)	Occurs when the riveting cycle time exceeds the overtime value set for each model. If the setting value is 0.00 seconds, the parameter side setting is valid.	Review the overtime setting or, eliminate anything that interferes with the riveting cycle.
M_004	R/M lack of torque	Occurs when the command thrust is small in auto operation of positioning control and riveting is not possible and the down end position is not reached.	Review the part, riveting condition or thrust setting value.
M_010	R/M up end sensor ON error	Occurs when the up-end sensor is turned on when the up-end sensor is not turned on in normal operation. (Normally, the up-end sensor does not turn on at coordinates larger than FRE-05: 5.000mm, FRE-10: 0.000mm, and FRE-20: 3.000mm.)	Check the Up-end sensor.
M_011	R/M up end sensor OFF error	It occurs when the up-end sensor is turned off at the position where the up-end sensor is not originally turned off. (At the position where the current position of the FRE machine is -1.00 mm or less, the up-end sensor is originally turned on.)	Check the Up-end sensor.
M_012	During operation up end sensor ON error	Occurs when the up-end sensor is turned on while the riveting axis is operating. This is a fault that occurs to prevent interference (collision) with the up-end sensor.	Check the Up-end sensor.
M_020	Search R/M position fault	Occurs when the final riveting position calculated by search riveting is greater than the position of the point where the operation is set to riveting.	Review the part, riveting condition or the set value.
M_021	Search R/M position over	Occurs when the part is not touched even after reaching the position set in the riveting point.	Review the part, riveting condition or the set value.

M_022	Search R/M reference position lower limit fault	Occurs when the search riveting base position does not reach the NG judgment range upper / lower limit position.	Review the part, riveting condition or the set value.
M_023	Search R/M reference position upper limit fault		
M_024	Search R/M reference position fault		
M_025	Search R/M_offset value error	Occurs when the offset value (Y) exceeds the stroke upper limit.	Review the search riveting setting value.
M_028	Offset R/M_offset value error	Occurs when the offset value (Y) exceeds the stroke upper limit.	Review the offset setting value.
M_029	Offset R/M_offset position error	It occurs when the offset position is below the position of the previous point or when the position setting range upper limit is exceeded.	Review the offset setting value.
M_02C	External timer start trigger down end over	It occurs when the down end set in auto riveting is reached when external timer start trigger is enabled.	Review the part, riveting condition, or down end position.
M_02D	External timer start trigger ON error	Occurs when the cycle is started with the external down end signal turned on.	When starting the riveting cycle, turn off the external down end signal before starting.
M_031	Light curtain was blocked	Occurs when the light curtain is blocked from light while the machine is operating.	Do not block the light curtain during operation.
M_050	High temp. regenerative resistors	When the regenerative resistance becomes high (about 260 ° C or higher), the master turns off. When the temperature of regenerative resistance drops and the display disappears, master can be turned on.	Turn off the breaker until the temperature drops.
M_051	Riveting axis brake error	The riveting axis brake may be defective.	Please contact us when the display appears.
M_052	Light curtain input error	The light curtain may be out of order.	Please contact us when the display appears.
M_053	Light curtain output error	The light curtain may be out of order.	Please contact us when the display appears.
M_054	Servo motor torque OFF signal error	The relay may be defective.	Please contact us when the display appears.
M_055	STO undetected error	It occurs when the servo amplifier and inverter are in the STO state when the power is OFF. It may be affected by relay failure, wiring mistakes, noise, etc.	If there is no problem with wiring or relay but fault occurs, please contact us.
M_056	STO detection error	It occurs when the servo amplifier and inverter are in the STO state when the power is ON. It may be affected by relay failure, wiring mistakes, noise, etc.	If there is no problem with wiring or relay but this fault occurs, please contact us.
M_070	R/M thrust trigger down end over	It occurs when the down end set in auto riveting cycle of thrust control is reached.	Review the part, riveting condition or down end position.

M_071	Hold to run error	Occurs when hold to run is set. Occurs when the start signal is turned off before riveting start or before reaching the down end auto riveting cycle operation.	Do not let go of the start button until the riveting cycle is held.
M_072	PRG safety check thrust limit arrival error	Occurs when the Thrust Limit is reached at the Move Point under PRG check control.	Make sure there is no interference and that the thrust setting is not too low.
M_077	Outside interlock signal OFF fault	Occurs when the external interlock signal is turned off during the riveting cycle.	Keep the interlock signal ON during riveting cycle.
M_078	R/M upper limit fault (judge1)	It occurs when the judgment value set in per program does not reach the upper and lower limit values.	Review the part, riveting condition or the set value.
M_079	R/M lower limit fault (judge1)		
M_07A	R/M upper limit fault (judge2)		
M_07B	R/M lower limit fault (judge2)		
M_07C	R/M upper limit fault (judge3)		
M_07D	R/M lower limit fault (judge3)		
M_07E	R/M upper limit fault (judge4)		
M_07F	R/M lower limit fault (judge4)		
M_080	Riveting axis servo alarm	A fault has occurred in the servo.	Please check the alarm code at the bottom of the screen and contact us.
M_081	Origin return error (Riveting axis)	Occurs when the cylinder has not risen to the stopper during servo return zero.	Please contact us.
M_082	Origin return complete position error (Riveting axis)	It occurs when the up-end sensor is not turned on when servo return zero is completed.	Check the up-end sensor.
M_083	Origin return not completed (Riveting axis)	Occurs when Servo return zero is not completed. Also, if Servo return zero is not completed, Positioning in Auto cycle and Manual cycle cannot be operated.	Perform the servo return zero. (⇒8.1.2 Servo return zero P.77)
M_084	Positioning ctrl start error (Riveting axis)	Occurs when the start of operation fails.	Please contact us.
M_085	Deceleration stop error completion (Riveting axis)	Occurs when deceleration stop fails.	Please contact us.
M_086	Inoperable error (Out of range Model No)	Occurs when the selected model number is out of range or when no model is selected. (Outside the range of 1 to 300)	Please review the model number.
M_087	Inoperable error (No Model data)	There is no data in the model data settings.	Please review the model setting.

M_088	Intermediate stop position error	If the intermediate stop position is larger than the position set in the riveting point Or it occurs when the intermediate position is outside the range of point1 or more and point2 or less.	Review the intermediate stop position setting.
M_089	R/M judge1 trigger OFF fault	Occurs when the judgment trigger does not turn ON during the R/M cycle.	Review the part, riveting condition or the set value.
M_08A	R/M judge2 trigger OFF fault		
M_08B	R/M judge3 trigger OFF fault		
M_08C	R/M judge4 trigger OFF fault		
M_090	Spindle alarm	A fault has occurred in the inverter or servo of the spindle.	Please check the alarm code at the bottom of the screen and contact us.
M_091	Mode transformation error completion (Spindle)	Occurs when mode conversion fails.	Please contact us.
M_092	Command communication response error (Spindle)	Occurs when command communication fails.	Please contact us.
M_093	Servo parameter read fault (Spindle)	Occurs when reading servo parameters fails.	Please contact us.
M_094	Servo parameter write fault (Spindle)	Occurs when writing out servo parameters fails.	Please contact us.
M_095	Spindle INV woring STOP fault	Occurs when a warning occurs in the inverter during spindle turn.	Please check the alarm code at the bottom of the screen and contact us.

14.2 Fault history

FAULT HISTORY screen Is displayed when you press the「HISTORY」button on top right of the screen
The alarm contents in the past are shown to FAULT HISTORY screen.

FAULT screen　　FAULT HISTORY screen

Fig 14.2

In FAULT HISTORY screen, the history of occurred errors and the number of occurrences is displayed.
Even when the power is turned OFF, the history of faults is memorized.

Touch the part where the fault history is displayed, the cursor is displayed and the operation of「CLEAR」,「UP」「DOWN」buttons is effective.

1）CLEAR
Press the「CLR」button delete the history. However, it will not let you clear the number of occurrences.
2）UP / DOWN
Press the「Up」or「Down」button to move the cursor. Up to 768 abnormality histories can be confirmed.

15 MAINTENANCE & INSPECTION

15.1 Maintenance & Inspection

Carry out the inspection outline below before starting the day's operation to maintain stable finish of riveting and detecting a machine failure early.

※ Be sure to disconnect the power supply plug before starting maintenance.
Confirm the safety for every device.

Maintenance and Inspection sheet

Check point		Check contents	Check cycle				Processing
			Daily	Weekly	Monthly	Half year.	
The whole		Fault Noise Operation State	○				Deal depending on the causes.
Each conclusion part		State of fastener (Looseness etc.)				○	Retighten
The consumption part		Friction / Deformation				○	Replace or repair
Riveting Machine	Head	Riveting state	○				Grease supply, Replace Bearing
	Body	Ball screw			○		Grease supply, Replace Bearing
		Support unit				○	Grease supply
		Guide				○	Grease supply
		Spindle				○	Grease supply, Replace Bearing
Proximity sensor		Detection state	○				Adjust Position ※Please check it at the time of return to zero.

Recommendation grease：Lithium grease (Alvania 2)

15.2 Lubrication of spindle section

To carry out preventive maintenance thoroughly, please perform the inspection work of each equipment based on the maintenance checklist.
There are differences depending on the frequency of use of the machine, but please refuel with 500,000 shots as a guide.

~Refueling procedure~

1）[FRE-10 only] Lower the cylinder by single operation to the position (around 30 mm) where the plug (M6) in Fig. 15.2 (right) can be seen.
2）For FRE-05 / 20, remove the plug at the bottom of the spindle, and for FRE-10, remove the plug on the right side of the cylinder and screw the mouthepiece of the grease gun in the port.
3）An amount of grease supplied by one stroke of the grease gun handle is adequate.
4）Grease cancer is removed and screw the plug (M6).

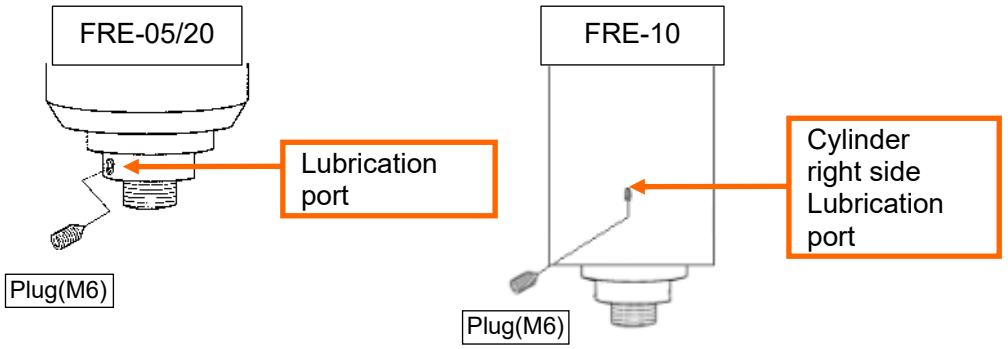


Fig 15.2

The use equipments
Grease: Lithium grease (Alvania 2)
Grease gun：Our genuine products (option) *The shape of the tip is M6 screw

15.3 Daily life's check in the ball screw part and the support unit part and lubrication

Daily check is necessary to keep the stable forming accuracy and find mechanical abnormality early.
Please be sure to put daily check into effect at the time of starting of work.
To be able to sufficiently lubricate the grease of the ball screw, please make a full stroke several times work by grease circulation control (Refer to 10.1.2 Refueling P.105) once a month so that the grease inside the ball screw circulates.
Also, please check whether faulty noise occurs during operation.
If faulty noise occurs, it is considered out of grease, so repair is necessary.
The frequency of refueling varies depending on the frequency of use, but please refuel with 500,000 shots as a guide.
Depending on usage if it is high utilization rate, please shorten the lubrication period.

~Refueling procedure~

1) Press and hold until the「ORIGIN POSITION」button on the REFUELING screen lights up, Move to the minimum stroke position of the model you are using.
2) Turn off the power to the machine.
3) Loosen the knob on the left side of the machine and remove the cover.
（FRE-20 cover mounting type only)
4) Remove rubber bush of machine. (Grease filler)
5) Refuel from the grease refueling point.

Only FRE-10
There are 8 refueling ports on the left and right.
Grease is supplied to both the ball screw part and the support unit part by refueling from either the left or right direction.
Refuel the LM Guide from all four lubrication ports on the top, bottom, left and right.

6) Please lubricate while inserting the straight nozzle (Recommended model: HSP - 2: Yamada Corporation) of the grease gun into the grease nipple.
The grease nipple (THK: A-MT6X1) is attached on the machine side at delivery.

Only FRE-10
When inserting the grease gun into the fuel filler port of the LM Guide, insert the nozzle from diagonally upward on the left and right upper sides and from diagonally downward on the left and right lower sides.

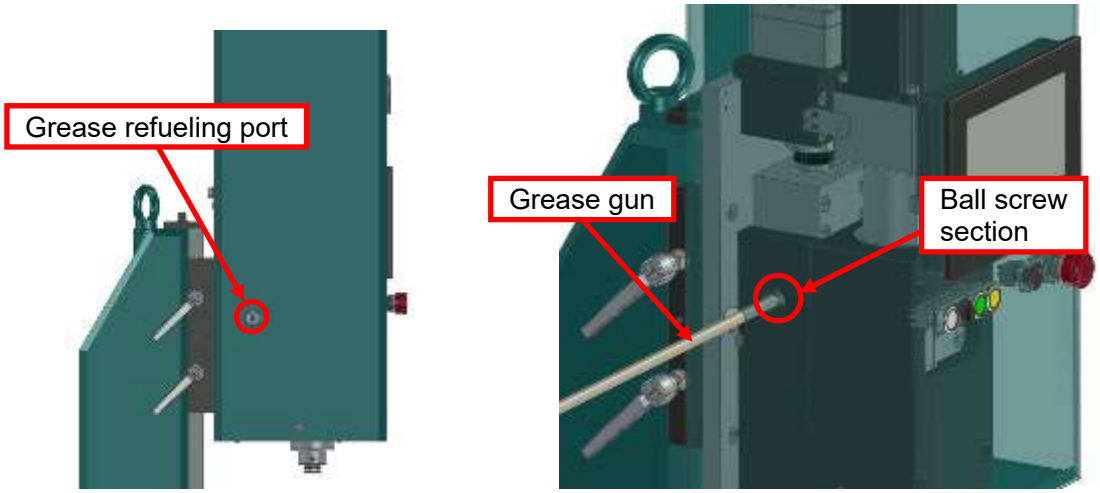
※Once of the lubrication amount
(1) [FRE-10,20 only] The support unit is about 3 ~ 5 cc.
(Grease gun 1cc type: 3 to 5 stroke of handle)
(2) The ball screw is about 5 ~ 8 cc.
(Grease gun 1 cc type： 5 to 8 strokes of handle）
(3) [FRE-10 only] The guide is about 1 ~ 2cc.
(Grease gun 1cc type：1 to 2 strokes of handle）

7) After refueling, turn on the power and operate the cylinder several times with full stroke so that grease spreads over the whole ball screw.
※When operating full stroke, you can automatically operate full stroke by using the grease Circulation Function (⇒8.2.3 Refueling P.82).

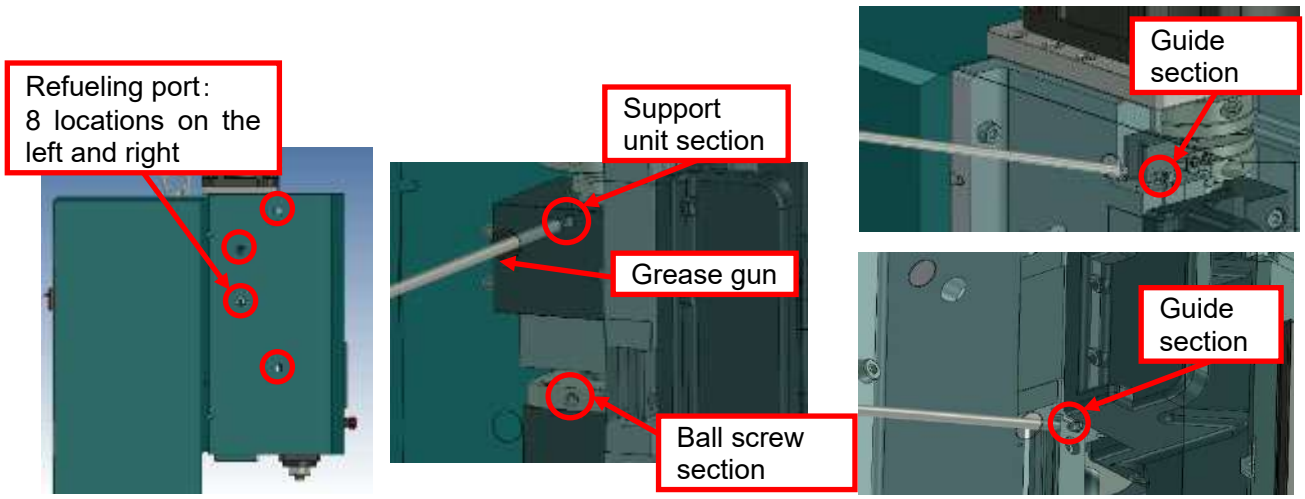
⚠CAUTION

Since it operates in full stroke, remove the insert and head, and make sure that there is nothing to touch during full stroke operation before using.
If it cannot be used, do not use the grease circulation function, and operate the cylinder with single operation so that the grease in the ball screw circulates.

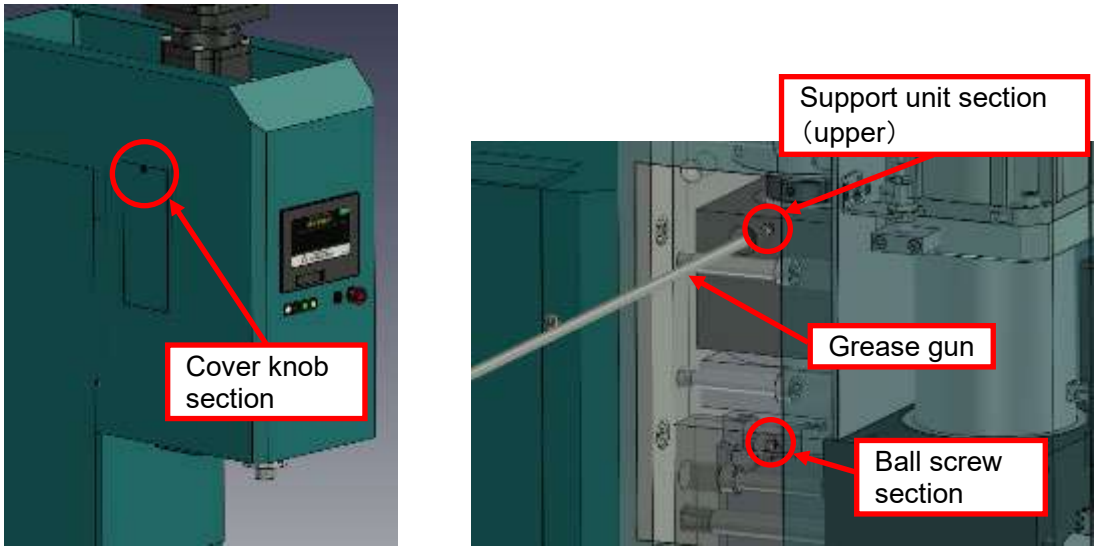
・FRE-05



・FRE-10



・FRE-20



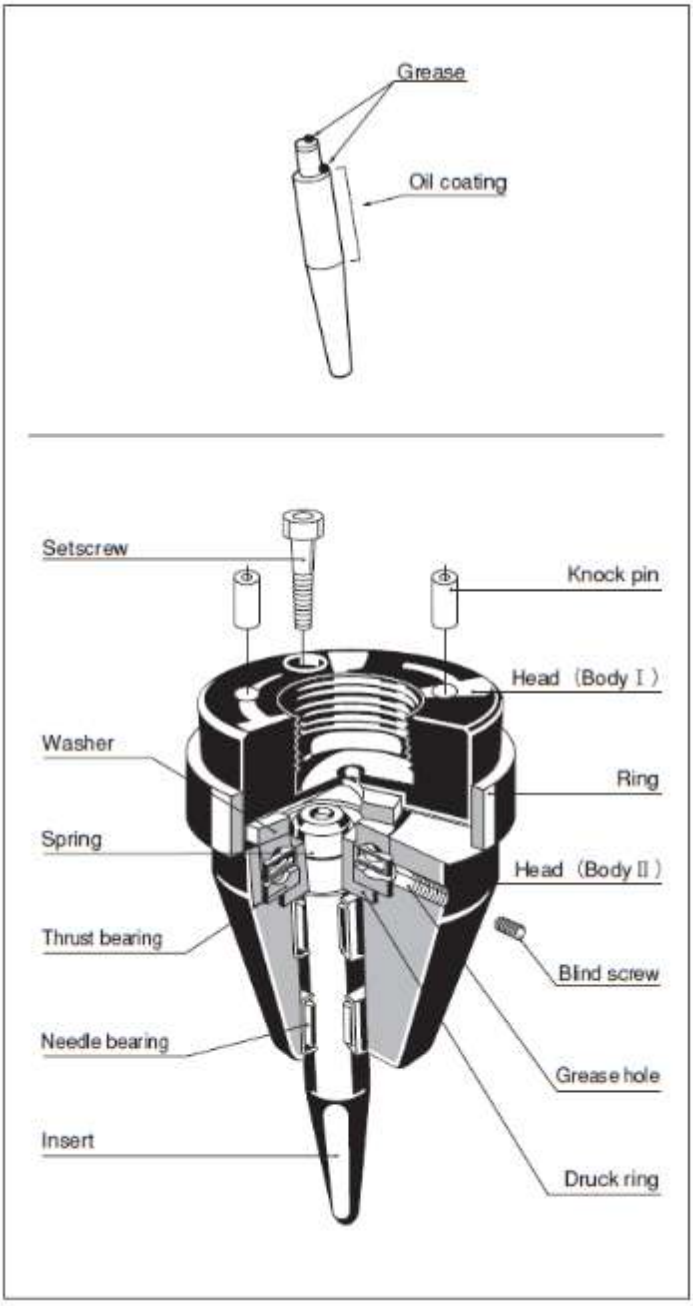
The use equipments
Grease: Lithium grease (Alvania 2)
Grease gun: Our genuine products (option) *The shape of the tip is M6 screw

■Maintenance of Head

The head incorporates bearings for carrying the insert. If the lubricant in the head is used up or the bearings are worn out, intended finish of riveting is not obtained.
Carry out maintenance such as lubrication at regular intervals to secure satisfactory finish always.

⚠ Danger !

●It is very dangerous if the machine is operated by mistake during maintenance. Must disconnect the power supply plug before starting maintenance.



◎Relubrication

Lubricate the head every 50,000 shots.
There are two types of lubricants.
Grease: Lithium grease
(Albania No. 2)
Lubricating oil: Third petroleum lubricating oil
(BIRAL T & D-S, etc.)

Apply a small amount (0.2cc) of grease to the upper end of the insert.
If the amount of coating is large, the rotation of the insert itself will be poor, and if the stud diameter is small (5 mm or less), the finish may be adversely affected.
If the stud diameter is small (5 mm or less), apply lubricating oil to the entire insert.

◎Replacement parts

All the parts used in the head are consumables.
It should be replaced regularly depending on usage.
In addition, genuine parts and special tools are required for parts replacement work, so please contact our nearest sales office.

15.5 How to replace the sequencer battery

※Not used by default.

■ When the battery is depleted

When the battery is fully depleted, the clock data will be lost, but memory data and ladder programs will remain. As long as the ladder programs do not require clock data, you will be able to run the programs for temporarily by performing an error clear in the access window.
Replace the battery with the following product.
Replacement lithium battery Product No.: KV-B1 (KEYENCE)

Reference When no battery is used, a battery depleted error will not be generated.

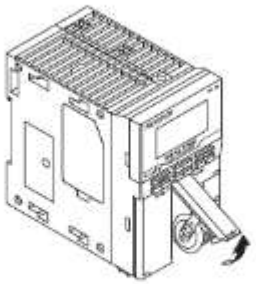
■ Operation with no battery

The KV-7500/7300 can be operated without a battery, but if a battery is not installed, the clock data will be cleared.
If clock data is required, a battery must be installed.

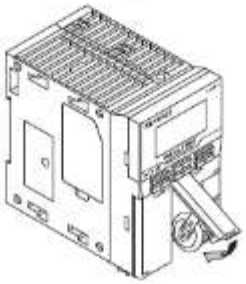
■ Battery replacement procedure

1 **Remove the backup battery cover and remove the old battery.**

- When exchanging during power OFF, flow the current for 10 minutes or longer prior to exchange and complete the exchange task in 10 minutes or shorter.



2 **Insert a new battery.**



3 **Turn the power ON and make sure that the access window is not displaying an error.**

NOTICE	• Battery life is as follows: 25°C: 5 years 40°C: 2 years 75°C: 1 year • The battery can be replaced while the power is on. • The system must be on for 10 minutes or more before replacing the battery or the data may be lost. Battery replacement must be completed within 10 minutes. • Never throw a KV-7500/7300 battery into fire or disassemble it. The battery is not rechargeable. Do not attempt to recharge it. Attempts to recharge it could cause an explosion. • Be sure to use only the KV-B1 battery as use of any other battery could result in a fire or explosion.

15.6 How to replace the sequencer battery (Servo amplifier)

When the battery of the servo amplifier is low, a pop-up will be displayed on the screen when master is turned on.
When you press「CLEAR WARNING」button, the Pop-up disappears.
It is displayed every time Master is turned ON until Battery is replaced.
If this pop-up is displayed, purchase and replace the battery of the servo amplifier.
If you cannot replace the battery immediately (⇒15.7 Batteryless run P.134)
You can use the function to start production even if the battery is temporarily dead.

Fig 15.6

Replacing the lithium battery

Replace the lithium battery when the voltage is low and both the "encoder battery alarm" (830) and the "encoder battery warning" (930) occur.
Please replace the battery even if the former alarm warnings have not occurred but the recommended replacement time (3 years) has elapsed.
Please replace the lithium battery following the procedure below, replacing the lithium battery in use with the replacement lithium battery (OP-88006).

Point

- **Please replace the lithium battery when the control circuit power is ON. If the lithium battery is removed when the control circuit power is OFF, the current position will be lost.**
- **Please replace the lithium battery when the main circuit power is OFF, in order to avoid electrical shocks.**

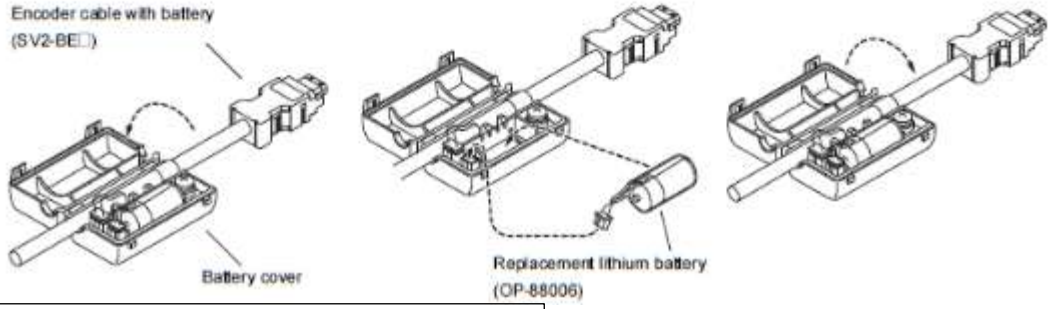
■ Replacing the lithium battery

When replacing the lithium battery of the encoder cable with battery (SV2-BE□), open the battery cover of the encoder cable with battery (SV2-BE□) and replace the inner lithium battery with the replacement lithium battery (OP-88006).

Open the battery cover of the encoder cable with battery (SV2-BE□).

Replace the lithium battery in use with the replacement lithium battery (OP-88006).

Close the battery cover.



Replacement lithium battery model number OP-88006 (KEYENCE)

15.7 Batteryless run

Fig 15.7.a MASTER OFF screen

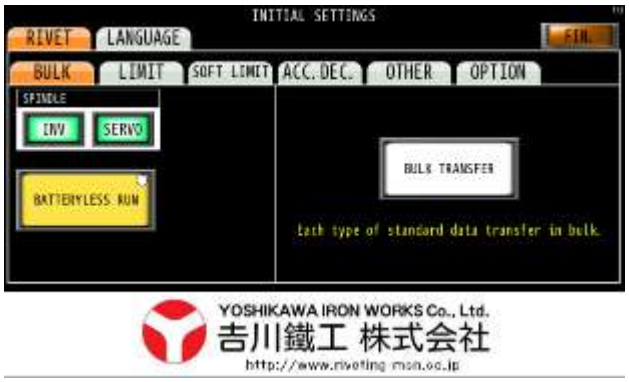


Fig 15.7.b INITIAL SETTEINGS screen

Fig 15.7.c

Fig 15.7.d

If the servo amplifier battery of the riveting axis runs out and production becomes impossible, you can perform「BATTERYLESS RUN」that operates without a battery.

1) Press and hold the「Y mark」part of the MASTER OFF screen to enter the INITIAL SETTING screen. (Fig 15.7.a)
2) Press and hold the「BATTERYLESS RUN」button to move to the BATTERYLESS RUN screen. (Fig 15.7.b)
   If fault appears on the riveting axis, switch to Manual mode, and clear the fault from the reset button on the operation panel.
3) Press the「Enable」button of Batteryless Run, and when the button lights up, it switches to BATTERYLESS RUN. (Fig 15.7.c)
   At that time, please turn the breaker off and on once.
   ※Similarly, when switching from enabled to disabled, turn the breaker off and on once.
   ※The screen does not switch even if you prepare for operation without turning off the power.

   When Battery less run is set, the「Battery less run」message flashes in the upper right corner of the MASTER OFF screen and Other screens.

4) When performing batteryless run, it is necessary to perform servo return zero every time the breaker is turned on. Only in battery less run, if servo return zero is required, the operation panel home button will blink. Only in battery less run, you can press the operation panel home button to perform servo return zero. You can also perform servo zero return by the method of「8.1.2 Servo return zero P.77」as usual. Production is possible by performing servo return zero.

5) For after battery replacement, perform steps 1)~2), switch to the「DISABLE」button of batteryless run, and turn the breaker off and on once.

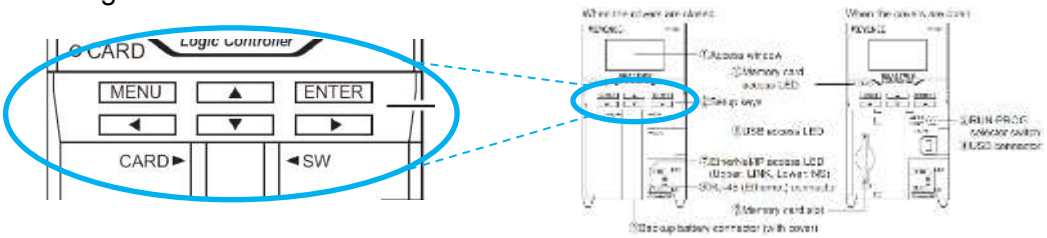
15.8 SD card (PLC)

Save PLC data to the SD card installed in the PLC from the access window.
Back up data stored on the SD card (memory card) can be loaded to the PLC.
You can also check the SD card file list and free space.

15.8.1 Back up

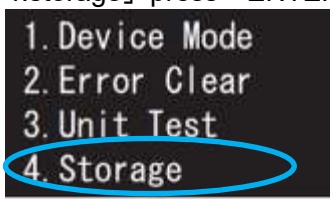
Operate PLC and make a backup of PLC data to the SD card attached to PLC.By performing this operation, it is possible to back up the current ladder program and model setting.
※Please make a back up file in advance, because if the PLC is faulty and you can't do this operation, you will not be able to make a backup.

・How to recognize a PLC

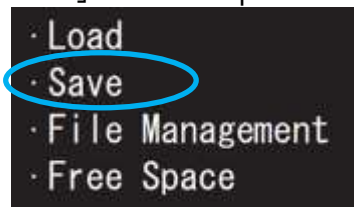


1) Press the「MENU」key on the Setup Keys several times to display t he「Menu screen」in the access window.

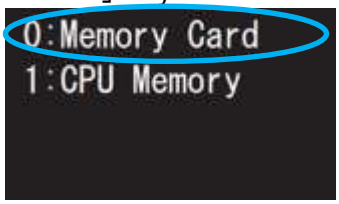
2) Use「▼」and「▲」keys to select「4.storage」press「ENTER」key.



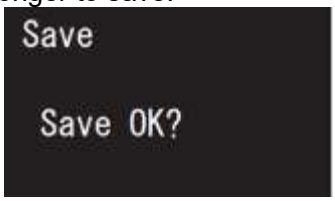
3) After the「Storage screen」is displayed, select「Save」and select press「ENTER」key.



4) After displaying the「Save screen」, select「0: Memory card」and select press「ENTER」key.



5) After displaying the「Memory Card」screen a confirmation message will be displayed asking「save OK?」press「ENTER」key for 1 second or longer to save.



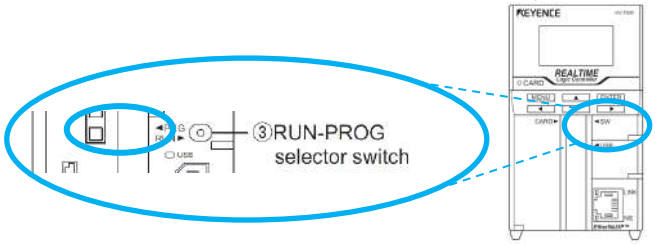
6) Search for a directory named「KVSAVE ??」(where ?? is a two-digit half-width number) and create an unused minimum two-digit number directory. and save.
Example. Already called「KVSAVE01」and「KVSAVE03」If a directory exists, save a new one creates a directory called KVSAVE02.

7) When save is completed,「Save Done」is displayed and the saved project folder name is displayed.

15.8.2 Restore

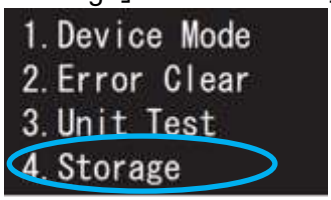
Operate PLC and restore PLC data with Back up in SD card of PLC.
By performing this operation, you can restore the data such as ladder program and model setting saved in the SD card.

1) Open the cover of PLC 「◂ SW」 and 「RUN-PRG switching」Switch the switch to 「◂ PRG」.
When you switch to 「PRG」, the access window turns orange.

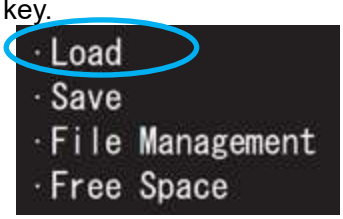


2) Press the 「MENU」 key on the Setup Keys several times to display the 「Menu screen」 in the access window.

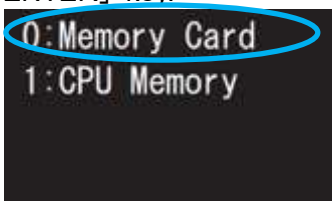
3) Use 「▼」 and「▲」 keys to select 「4.storage」Press 「ENTER」 key.



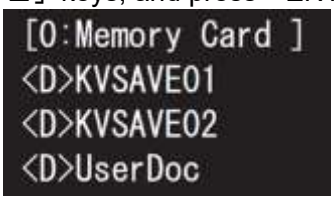
4) After the 「Storage screen」 is displayed, select 「Load」 and select Press 「ENTER」 key.



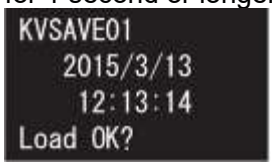
5) After displaying the 「Load screen」, select 「0: Memory card」 and select press 「ENTER」 key.



6) Select the folder to read with the 「▼」 and 「▲」 keys, and press 「ENTER」 key.



7) After displaying 「Memory Card」 screen a confirmation message will be displayed asking 「Load OK?」 press 「ENTER」 key for 1 second or longer to load.



8) Then load is completed, 「Load Done」 is displayed.
Open the cover of the PLC 「◂ SW」 section and switch 「RUN-PRG selector」 switch to 「RUN ▸」.
When you switch to 「RUN」, the access window turns white.

● File Management

1 **Please select "File Management" from the menu of storage and press "ENTER" key.**
A message appears prompting you to select storage device, either a memory card or CPU memory.

2 **Use "▲" and "▼" to select a storage device, then press the "ENTER" key or the "▶"key.**
The (project) folder and files in the root folder appear.

Reference

- Long file names and folder names scroll across the display.
- Folder names are displayed as "<D>KVSAVE01"where the first three characters are displayed as "<D>."
- Please use "▶" key or the "◀" key when moving the folder.
- "<D>." represents the current folder and "<D>.." represents the folder that is one hierarchy above.

3 **Select folder and file with "▲" "▼" and press "ENTER" key.**
The Operation list appears.

4 **Select an operation by pressing "▲" and "▼", then press the "ENTER" key or the "▶" key.**
The Operation list display appears.

"File information" (page 5-118)
"Copy" (page 5-119)
"Move" (page 5-121)
"Delete" (page 5-123)

Press the "MENU," "ENTER," "◀," and "▶" key to return to the file list display.

●File Information

1 **Check file information.**

Reference Scroll to display long file names.

●Copy

1 **Press the "ENTER" key or the "▶" key.**
The operation guide screen will be displayed.

2 **Press the "▶" key after confirming the operation.**
The folder selection screen of the copy destination will be displayed.

- Please use "▶" key or the "◀" key when moving the folder.
- "<D>." represents the current folder and "<D>.." represents the folder that is one hierarchy above.

Reference You can only copy data between different storage devices, for example, between memory card and CPU memory, or vice versa. (You cannot copy data to the same storage folder.)

3 **Press the "ENTER" key.**

- Please use "ENTER" / "▶" key or the "MENU" / "◀" key when moving the folder.

"<D>." represents the current folder and "<D>.." represents the folder that is one hierarchy above.

4 **Copy the file by pressing the "ENTER" key for 1 second or longer.**
A message asking you to confirm that you want to perform the copy operation is displayed.

Point

- **A file/folder with the same name as the source is displayed in the screen shown below.**
  It will be overwritten when the "ENTER" key is pressed for 1 second.
  Copying is canceled by pressing the "MENU" key or "◀" key.

- **To abort an ongoing copy process, press the "MENU" key.**

In the screen shown below, hold down the "ENTER" key for 1 second or longer to cancel copying.

●Move

1 **Press the "ENTER" key or the "▶" key.**
The operation guide screen will be displayed.

2 **Press the "▶" key after confirming the operation.**
A screen for selecting a folder at a move destination appears.

- Please use "▶" key or the "◀" key when moving the folder.
- "<D>." represents the current folder and "<D>.." represents the folder that is one hierarchy above.

Reference

The copy can only be executed towards the storage that differs such as memory card→CPU memory, or CPU memory→memory card (It can not copy to the same storage folder).

3 **Select a folder by pressing "ENTER"/"▶" key or the "MENU"/"◀" key.**

4 **Press the "ENTER" or "▶" for 1 second or longer and move the file.**
A message asking you to confirm that you want to perform the move operation is displayed.

Point

- **A file/folder with the same name as the source is displayed in the screen shown below.**
  Press the "ENTER" key or "▶" key for 1 second or more to overwrite.
  The move is canceled by pressing the "MENU" key or "◀" key.

- **To abort an ongoing move process, press the "MENU" key.**

In the screen shown below, hold down the "ENTER" for 1 second or longer to cancel a move operation.

●Delete

1 **Keep on pressing the "ENTER" key for 1 second or longer.**

2 **The deletion has completed.**

Reference Deleting a selected folder will also delete all the files and folders it contains.

●Free Space

1 **Select "Free space" in the storage menu, and then press the "ENTER" key.**
A message appears prompting you to select a storage device, either memory card or CPU memory.

2 **Use "▲" and "▼" to select a storage device, then press the "ENTER" key or the "▶" key.**
The free space on each storage device will be displayed.

15.9 Parameter initialization

MASTER OFF screen

INITIAL SETTINGS screen

Fig 15.9

Press and hold the「Y mark」part of the「MASTER OFF」screen to enter the「INITIAL SETTING」screen.
If you press and hold the「BULK TRANSFER」button on the「INITIAL SETTING」screen, the factory parameter settings will be transferred.
The initial parameters of the standard machine are listed in「Table 15.9 Initial Parameter List」.
Depending on the device, the parameter may differ from the initial value.
Refer to the FRE Parameter Sheet enclosed in the Instruction Manual at the time of shipment and change the settings.

⚠CAUTION

Perform this operation according to the instructions from the manufacturer.
Incorrect operation of settings may damage the machine.

Table 15.9 Initial parameters list

ITEM	CONTENT	FRE-05	FRE-10	FRE-20
TORQUE [%] PER 1 [kN]	Set value of the torque adjustment [%]	FRE parameter sheet please refer to.		
REDUCTION RATIO	Selection of REDUCTION RATIO			
FORWARD COMMAND	Selection of FORWARD COMMAND			
REVERSE COMMAND	Selection of REVERSE COMMAND			
STO	DISABLE or ENABLE selection of STO			
POS._LOWER LIMIT	Set the position setting range.	1.00	0.00	1.00
POS._UPPER LIMIT		60.00	200.00	100.00
SPEED_LOWER LIMIT	Set the speed setting range.	0.01		
SPEED_UPPER LIMIT		130.00		160.00
THRUST_LOWER LIMIT	Set the thrust setting range.	1.00		3.00
THRUST_UPPER LIMIT		5.00	12.00	20.00
REV._LOWER LIMIT	Set the revolutions setting range.	0		
REV._UPPER LIMIT		1800		
LOWER LIMIT	Set the soft limit.	0.500	-2.000	0.500
UPPER LIMIT		61.500	202.000	101.500
ACC. TIME	Acceleration and Deceleration time setting value of vertical spindle [ms]	200	100	
DEC. TIME		100		
ACC. TIME（LOW-SPEED）	Acceleration and Deceleration time setting value of vertical spindle [ms] (low)	500		3000
DEC. TIME（LOW-SPEED）		500		3000
REV. ACC. TIME	Acceleration and Deceleration time setting value of revolution spindle [ms]	900		450
REV. DEC. TIME		900		450
JOG SP._LOWER LIMIT	Set the JOG speed setting range.	0.01		
JOG SP._UPPER LIMIT		10.00		
JOG THRUST	Set the JOG thrust setting range.	5.00	3.00	20.00
Positioning Low Speed	Set positioning speed.	10.00		
Positioning Low Thurust	Set positioning thrust.	5.00		10.00
Rivet Point MAX Speed [mm/s]	Set the Rivet Point MAX Speed.	10.00		
EXTERNAL	Selection of EXTERNAL	FRE parameter sheet please refer to.		
PRG CHECK CONTROL	Selection of PRG CHECK CONTROL			
Spindle_acceleration time (s)	Set the acceleration time of the spindle.	0.3		
Spindle_deceleration time (s)	Set the deceleration time of the spindle.	1.2		
Riveting Overtime (s)	Set the riveting overtime on the parameter screen.	10		
CONTENTION DETECTION	Selection of CONTENTION DETECTION	FRE parameter sheet please refer to.		
THRUST COEFFICIENT [%] (ACC.DEC.)	Set the thrust coefficient until the torque stabilizes.	200	50	300
THRUST COEFFICIENT [%] (ACC.DEC.)	Set the thrust coefficient when torque is stable.	200	50	300
TORQUE STABLE THRUST LIMIT	Set the thrust when torque is stable.	5.00	3.00	15.00
THRUST COEFFICIENT [%] (CONTENTION DETECTION)	Set the thrust coefficient to detect a contention.	50	50	600
THRUST COEFFICIENT [%] (CONTACT CHECK)	Set the thrust coefficient to check contact.	50	50	100
Down On Torque [%]	Set the torque value for confirming the Down.	2.00	-5.00	0.00
Up On Torque [%]	Set the torque value for confirming the Up.	-4.00	-5.80	-5.80

16 FAQ

Q1. The buzzer sounds even though Fault has not occurred.

A1. The model counter or maintenance counter is count up.
Check the counter. (⇒9.3 Counter screen P.99)(⇒9.3.3 Buzzer when count up P.101)

Q2. The counter does not count.

A2. If the counter value other than total counter is 0, the counter function will be disable and will not be counted.
When using the counter function, enter the counter value. (⇒7.4.4 Model counter P.69)

Q3. When the PLC is replaced, the message「It can't be used !!」

A3. Please contact your nearest sales office. (⇒6.5 Emergency authorization P.34)

Q4. Spindle does not turn.

A4. The following factors can be considered.
・Spindle is not set to「Enable」in Model setting. (⇒7.4.2 Control 1)General P.50)
・The rotation speed of the spindle is「0 rpm」. (⇒7.4.1 Data 2)Set up P.43)
・Spindle servo is off. (⇒10.1.3 Spindle servo off P.106)

Q5.「RB_810 encoder backup alarm」is displayed in the alarm message.

A5. The battery of the servo amplifier is dead and needs to be replaced.
Refer to「15.6 How to replace the sequencer battery (Servo amplifier) P.133」, and after replacing the battery, refer to「8.1.2 Servo return zero P.77」and perform ABS Setup and Servo Return Zero.

Q6.「Origin return not completed」and「Origin return required」are displayed in the alarm message.

A6. The battery of the servo amplifier is dead and needs to be replaced.
Refer to「15.6 How to replace the sequencer battery (Servo amplifier) P.133」, and after replacing the battery, refer to「8.1.2 Servo return zero P.77」and perform ABS Setup and Servo Return Zero.

Revision History

Printing Date	Version	Details of Rivesion
Jul. 2019	Initial version	First edition
Aug. 2019	Version 2	Change of description contents according to Software version upgrade. Revised contents.
Sep. 2019	Version 3	Change of description contents according to Software version upgrade.
Oct. 2019	Version 4	Change of description contents according to Software version upgrade.
Feb. 2020	Version 5	Addition Appendix A: FRE Program recording sheet
Mar. 2020	Version 6	Change of description contents according to Software version upgrade. Revised contents.
Jun. 2020	Version 7	15.2 Spindle lubrication part image added. Addition of description contents accompanying software version upgrade.
Sep. 2020	Version 8	15.2 & 15.3 refueling procedure added.
Nov. 2020	Version 9	15.7 PLC data backup / restore method Changes to the description.
Dec. 2020	Version 10	Revised contents.
Feb. 2021	Version 11	Change of description contents according to Software version upgrade.
Mar. 2021	Version 12	Changes in description due to screen layout changes. Addendum with the addition of the DATE / TIME function.
Apr. 2022	Version 13	5.4 Addition of stroke adjustment method for FRE-05. 5.5 Addition of stroke adjustment method for FRE-20. 15.3 Daily life's check in the ball screw part and the support unit part and lubrication. Replaced images of FRE-05 due to change in lubrication points. Revised contents.