CONAIR

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USERGUIDE

MNL-00008

EX - 250, 350, 450
EXF - 250, 350, 450

⚠ **WARNING - Reliance on this Manual Could Result in Severe Bodily Injury or Death!**

This manual is out-of-date and is provided only for its technical information, data and capacities. Portions of this manual detailing procedures or precautions in the operation, inspection, maintenance and repair of the product forming the subject matter of this manual may be inadequate, inaccurate, and/or incomplete and cannot be used, followed, or relied upon. Contact Conair at info@conairgroup.com or 1-800-654-6661 for more current information, warnings, and materials about more recent product manuals containing warnings, information, precautions, and procedures that may be more adequate than those contained in this out-of-date manual.

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A. AUTOMATIC PICK AND PLACE MECHANISM

1. Concept

The EX/EXF robot will take the product(s) and/or sprue runner system molded by the injection molding machine, and bring out from the machine by the arm swing.These models are mounted on the fixed platen of the injection machine ranging from 150 to 450 tons.

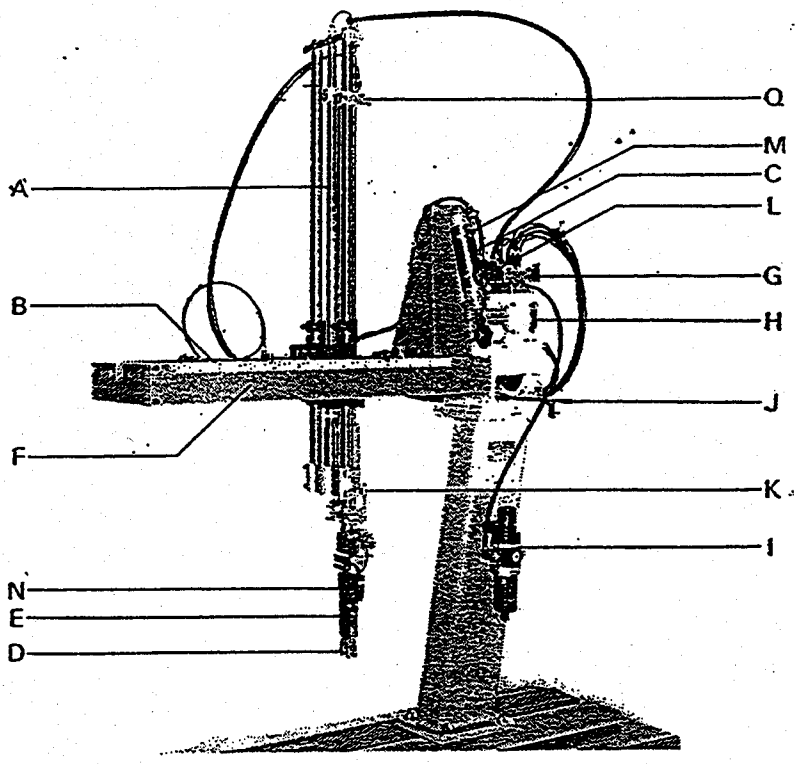
Using these robots helps to save man power and also ensure high quality products because of constant cycle time (condition).

EXF-robot has an additional function to EX-robot with the gripper's wrist rotation by 90° to release the part(s) at horizontal position from the vertical position when it is taken out from the cavity.

In addition to the vacuum suction system for the gripping of part(s), this model is capable to adopt mini cylinders and nippers for wider range of applications.

2. External view

A. Main arm cylinder
B. Kick cylinder
C. Swing cylinder
D. Finger
E. Gripper
F. Kick frame
G. Air solenoid valve
H. Connector
I. F.R. unit
J. Ratchet lever
K. Arm upward end prox. switch (LS-3)
L. Swing outward end prox. switch (LS-1)
M. Swing inward end prox. switch (LS-2)
N. Sprue verification prox. switch (LS-4)
O. Slide unit
Q. Main arm lock cylinder
R. Swing arm
S. Shock absorber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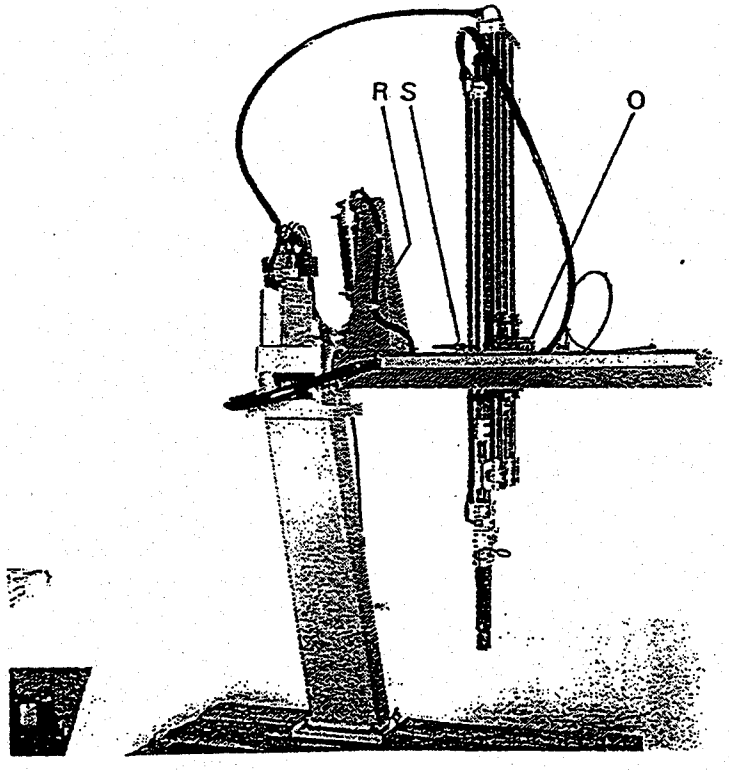
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B. SPECIFICATIONS

1. Standard specifications

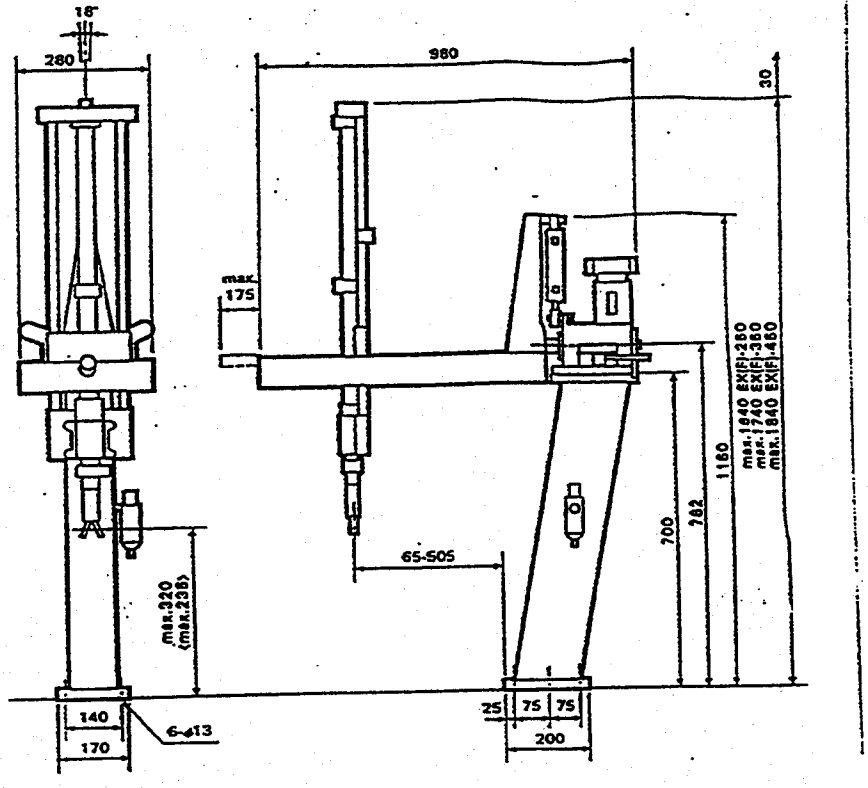
Description / Model	EX(F)-250	EX(F)-350	EX(F)-450
Injection machine size range (ton)	150 - 250	250 - 350	350 - 450
Working pressure (kg/cm^2)	5.0 - 6.5		
Max.primary pressure (kg/cm^2)	9.0		
Air consumption (Nℓ/cycle)	6.2	6.3	6.4
Min. take out time (sec.)	1.2	1.3	1.4
Min. cycle time (sec.)	3.8	4.0	4.2
Gripper center to top platen (mm)	EX : 320 EXF : 235		
Pivot point to top platen (mm)	782		
Max. main arm stroke (mm)	0 - 650	0 - 750	0 - 850
Max. kick stroke (mm)	0 - 125		
Swing angle	50°-90°		
Power supply	AC-100,110,200,220,240V Single phase		
Power consumption	25VA (PC-EIID controller)		
Weight (kg)	56	57	58
Max. payload [**]	2000g : Without wrist rotation (EX) 1000g : With wrist rotation (EXF)		

2.2 LBS
4 LBS

* : Less control box
** : Including the end of arm tooling

2. Dimensions

Unit : mm



3. Standard sequence

Following motion sequences are available by selecting switches on controller.

a) Release parts outside mold

A : U type motion
Pick-up molded parts from movable mold

B : U type motion
Pick-up molded parts from stationary mold

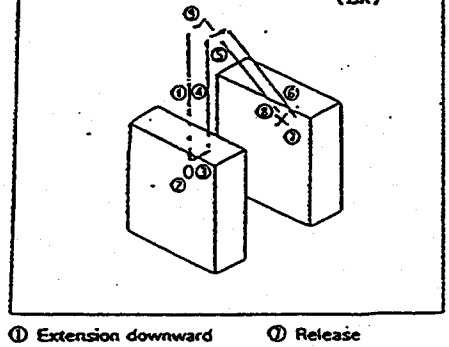
C : L type motion
Pick up molded parts from movable mold

D : L type motion
Pick-up molded parts from stationary mold

** To change parts release side whether operator side or rear side, please refer " C. FUNCTION AND ADJUSTMENT "

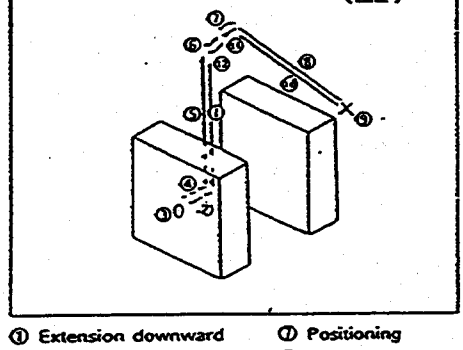
FOR 2-PLATE MOLDS

A. (EX)



① Extension downward
② Grip
③ Kick backward
④ Retraction upward
⑤ Swing outward
⑥ Extension outward
⑦ Release
⑧ Retraction inward
⑨ Swing inward to home position

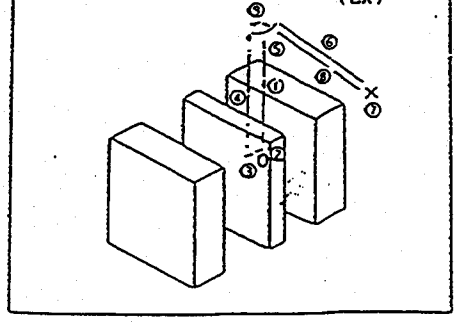
C. (EXF)



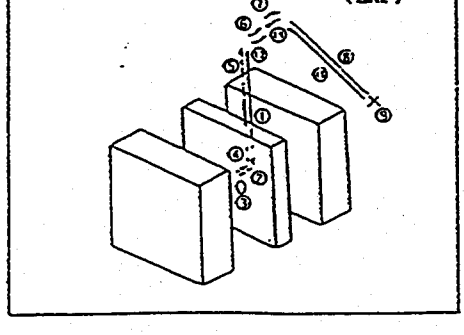
① Extension downward
② Kick forward(approach)
③ Grip
④ Kick backward(strip-off)
⑤ Retraction upward
⑥ Swing outward
⑦ Positioning
⑧ Extension outward
⑨ Release
⑩ Retraction inward
⑪ Positioning back
⑫ Swing inward to home position

FOR 3-PLATE MOLDS

B. (EX)



D. (EXF)



b) Release parts inside mold

E : U type motion
Pick-up molded parts from movable mold

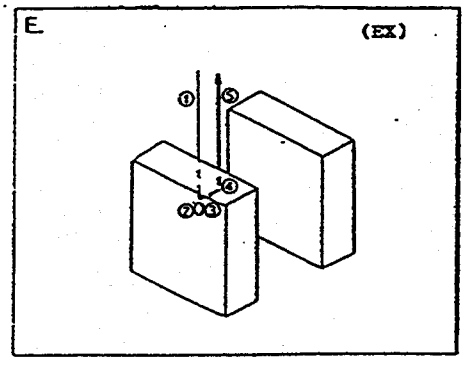
F : U type motion
Pick-up molded parts from stationary mold

G : L type motion
Pick up molded parts from movable mold

H : L type motion
Pick-up molded parts from stationary mold

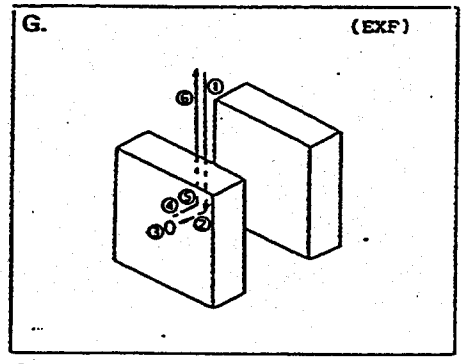
FOR 2–PLATE MOLDS

E. (EX)



① Extension downward
② Grip
③ Kick backward (strip-off)
④ Release
⑤ Retraction upward

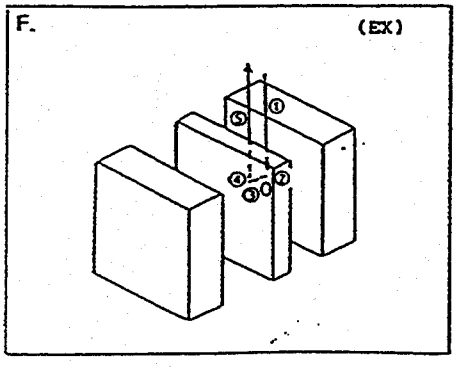
G. (EXF)



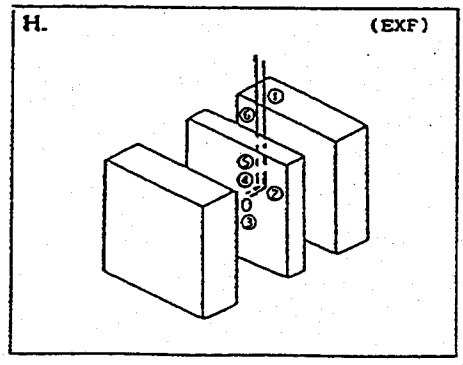
① Extension downward
② Kick forward(approach)
③ Grip
④ Kick backward(strip-off)
⑤ Release
⑥ Retraction upward

FOR 3–PLATE MOLDS

F. (EX)



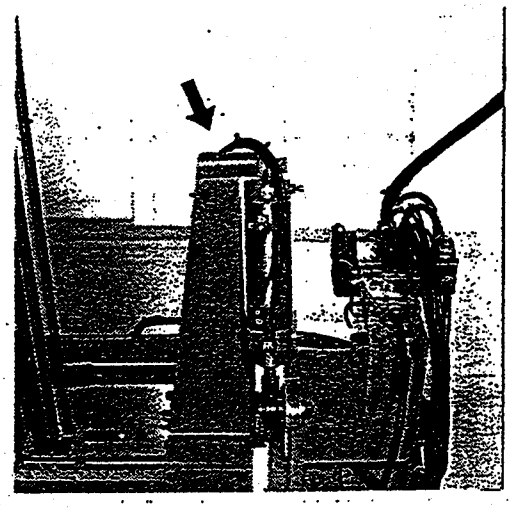
H. (EXF)



C. FUNCTION AND ADJUSTMENT

1. Lifting the robot up

When lifting the robot up, in order to avoid damages, please suspend it by a hook with M10 screw and textile belt as shown in the picture.
This designated method of lifting is only recommended. Any other method of lifting the robot will be out of our gurantee.

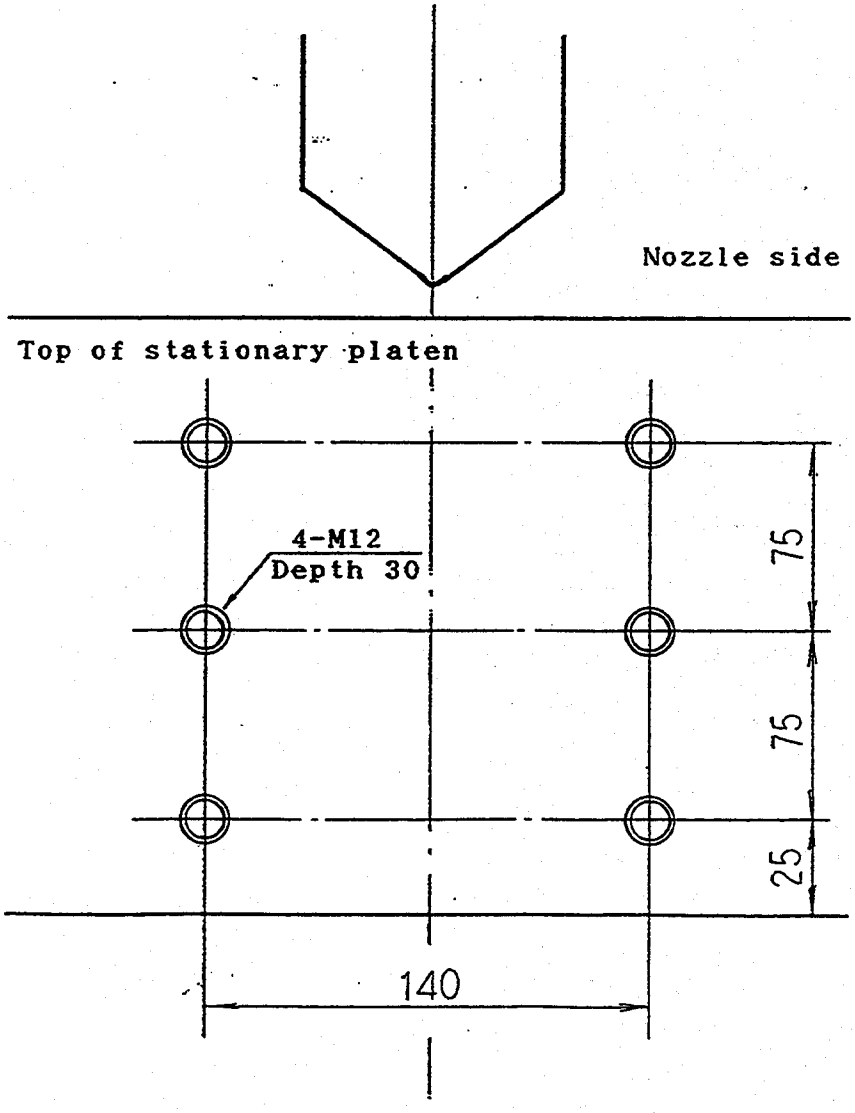


2. Mounting and setting home position

a) Mounting

To set the robot on the top of stationary platen. Make 6 of M12 with 30mm deep tap hole on the stationary platen as shown below. Fix the robot with 6 of M12 screws. lock and plane washers tightly.

ROBOT MOUNTING TAP HOLES



b) Home position (gripper position) setting

It is available to adjust a home position (gripper height) in the following ranges on the EX series robot.

	Y axis adj.	X axis adj.
EX -250,350,450	0 - 320 mm	65 - 505 mm
EXF-250,350,450	0 - 235 mm	65 - 505 mm

Y axis adj. : From platen top to gripper center
X axis adj. : From surface of stationary platen to gripper center

* Y axis adjustment (Vertical)

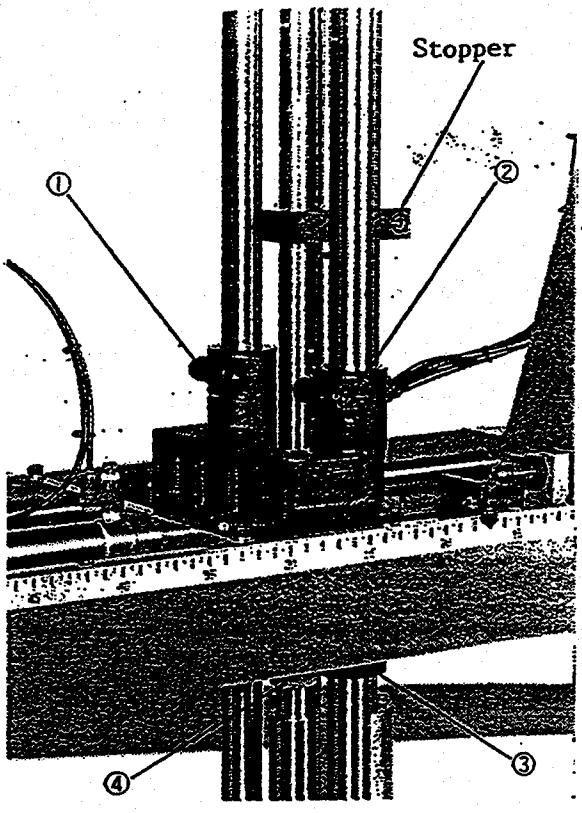
1. Loosen the 4 screws (No. 1 to 4).
   Hold the main arm while loosen the screws.
2. Set the gripper height to proper position by move the main arm up and down.
3. Tighten the 4 screws.

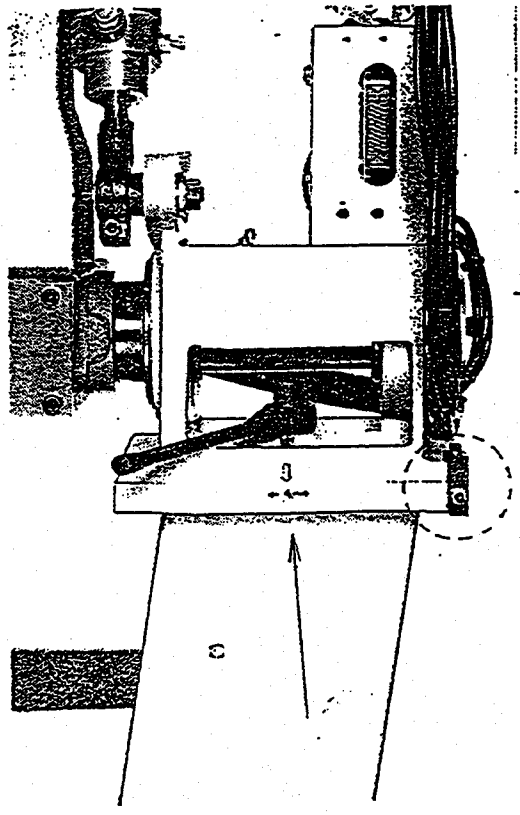
* X axis adjustment (Horizontal)

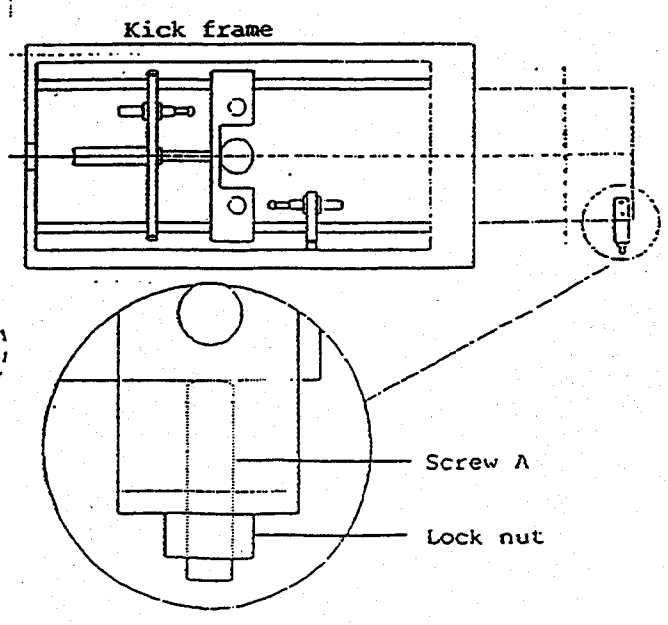
See C-4 "Kick stroke adjustment".

* B axis adjustment (Pivot home position)

After the gripping position of part and/or sprue runner system is fixed, set the screw A so that the end of screw toutches to the mounting base. Then lock the screw by the lock nut. Since then, it is not necessary to readjust the Pivot Home Position from next mold change (pivot base).


Stopper
①
②
③
④




Kick frame
Screw A
Lock nut

3. Main arm stroke adjustment

a) Reduce the compressed air pressure to 2 or 3 kg/cm^2 and pull down the gripper approx. 100mm by hand.

b) Exhaust compressed air completely.

c) Loosen main arm cylinder stopper and draw the main arm cylinder down so that the fingers can be at the proper position to grip the part.

d) Keeping the proper position as set, fix the main arm cylinder stopper by tightening the set-screw with pressing down the stopper completely against the air cushion bush.

4. Kick stroke adjustment

a) Exhaust compressed air completely.

b) To fix the stationary mold side, set B at the proper position.

c) To fix the movable mold side, loosen the screws 1 and 2 and move C to the proper position, it can be adjusted by moving shock absorber precisely.

Scale for kick stroke adjustment

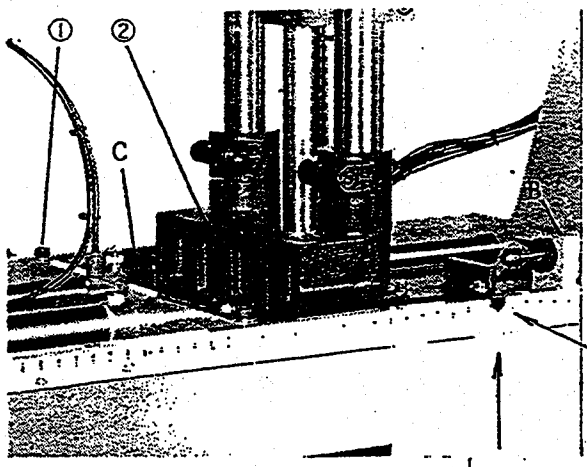
Record the kick forward and backward end position that is indicated by the indicator and scale in each application of mold.
By this record, it will be easier to re-set the kick stroke making use of scale when change the molds.

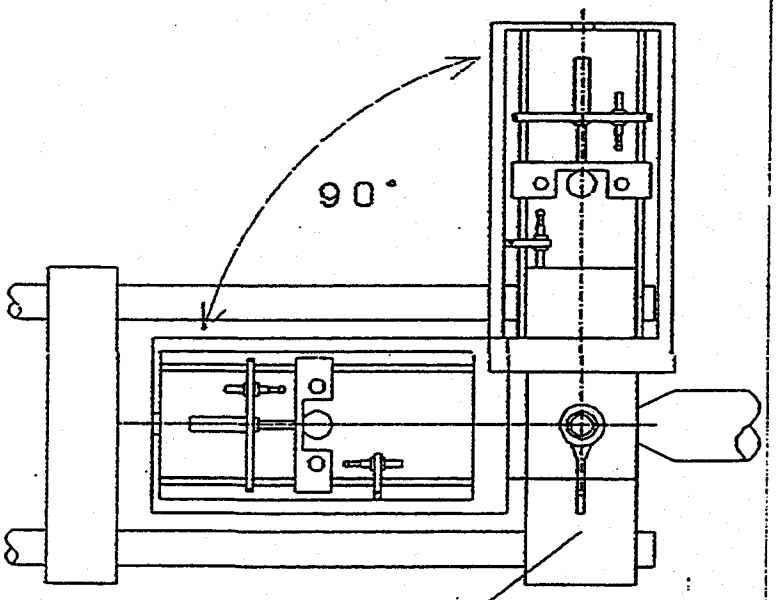
5. Ratchet lever for pivot base

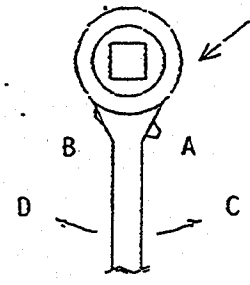
Easy to pivot the robot main body by ratchet lever when change the mold.
Push part A and turn the ratchet lever to direction C several times. Turn the robot body to the rear side of injection molding machine.
After change the mold, return the robot body to its home position. Then push part B and fix the robot by turning ratchet lever to direction D.

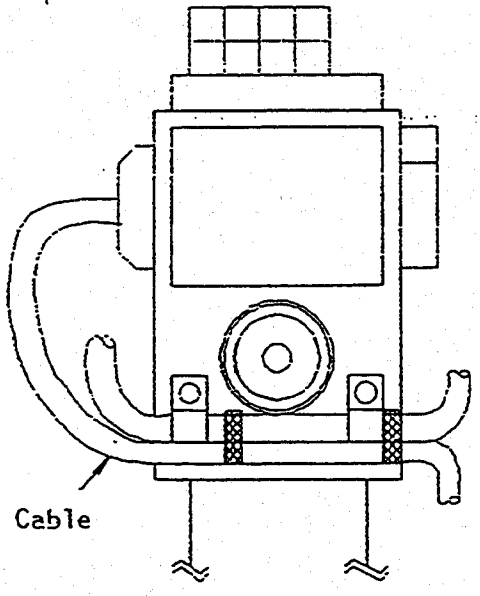
Remarks;

Fix the cable as shown to avoid any damage of connector and cables from pivot base when change the molds.


①
②
C
Indicator
Scale


90°


B
A
D
C


Cable

6. Change swing out direction and angle

The robot has been set at operator side parts release position when delivered from HARMO factory.

The swing out direction and swing angle can be are easily changed by the following manner.

EX series

a) Exhaust compressed air completely.

b) Loosen the screw.

c) Set swing out direction and angle by adjusting the screw position.

d) Tighten the screw.

CAUTION

1) Do not set in the area of oblique lined.

2) Do not set the swing angle over 90°.

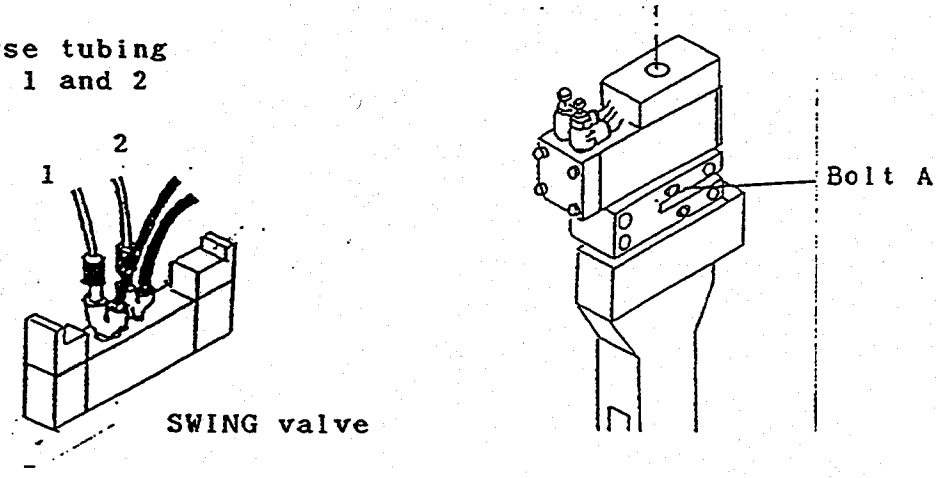
EXF series

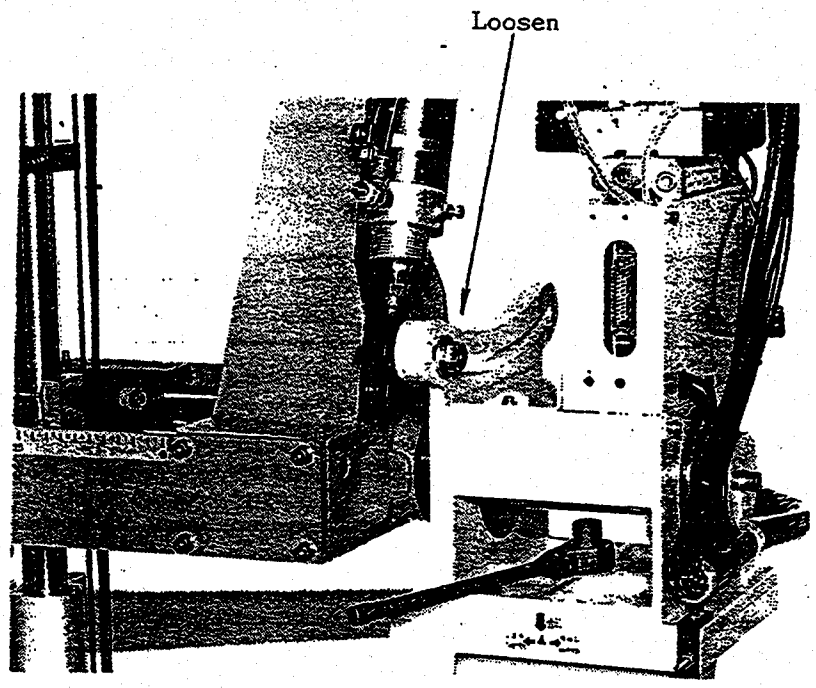
In addition to the above mentioned procedure, the following changes are necessary.

f) Reverse the tubing (4mm dia.) for wrist rotation mechanism as shown.

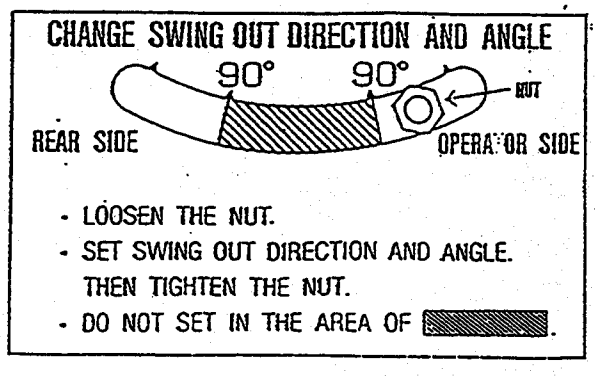
g) Supply compressed air, then gripper rotates by 90 degrees.

h) Loosen the bolt A and set the gripper to proper position (rotate 90 degrees) by hand, then tighten the bolt A.





Sticker affixed on the terminal case



7. Air solenoid valves

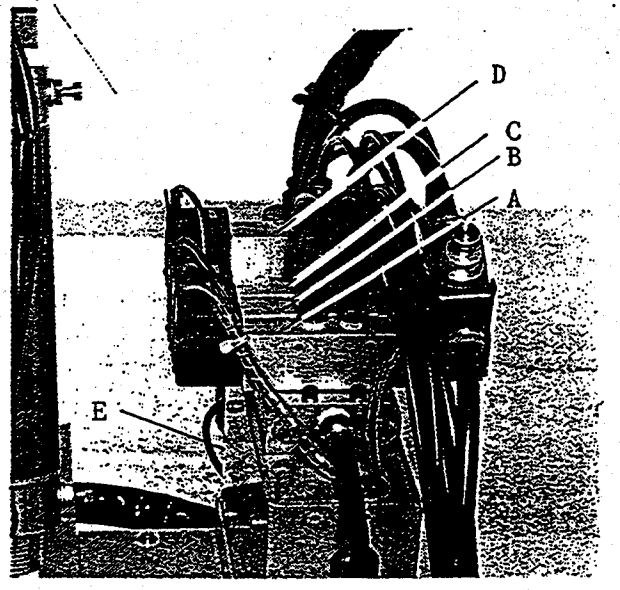
Air Selenoid Valves regulating the movement of cylinders are located behind the swing cylinder in the following order. Sticker indicating function of each valve is affixed on the manifold block.

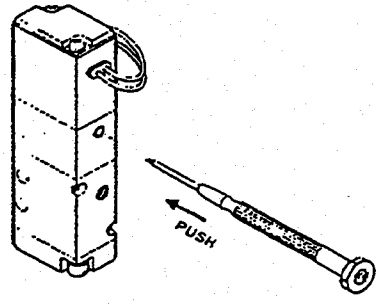
	FUNCTION	TYPE OF VALVE
A	SWING & WRIST ROTATION (EXF)	180 - 4E2 (24V DC) Double solenoid valve
B	KICK FORWARD / BACKWARD	180 - 4E1 (24V DC) Single solenoid valve
C	MAIN UP/DOWN	180 - 4E1 (24V DC) Single solenoid valve
D	* QUICK EXHAUST	180 - E1 (24V DC) Single solenoid valve
E	GRIP	181 - E1 (24V DC) Single solenoid valve

Manufacturer : KOGANEI

For manual operation, a manual button on top of the coil case installed in the body of valve should be pressed.

* The valve for quick exhaust for the main arm cylinder is equipped on the EX(F)-250,350,450 series robot in order to have fast ascent motion.





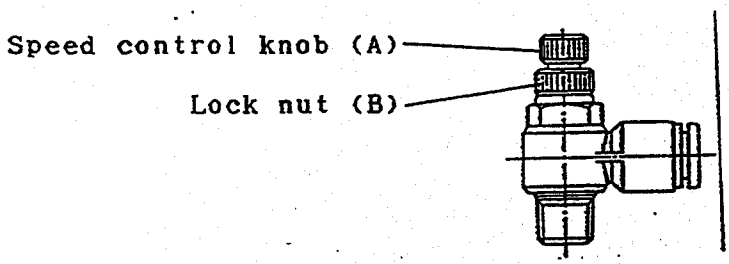
8. Air cylinder speed control

The working speed is controlled by controlling knob A and lock nut B.
The usage of those two is as follows.

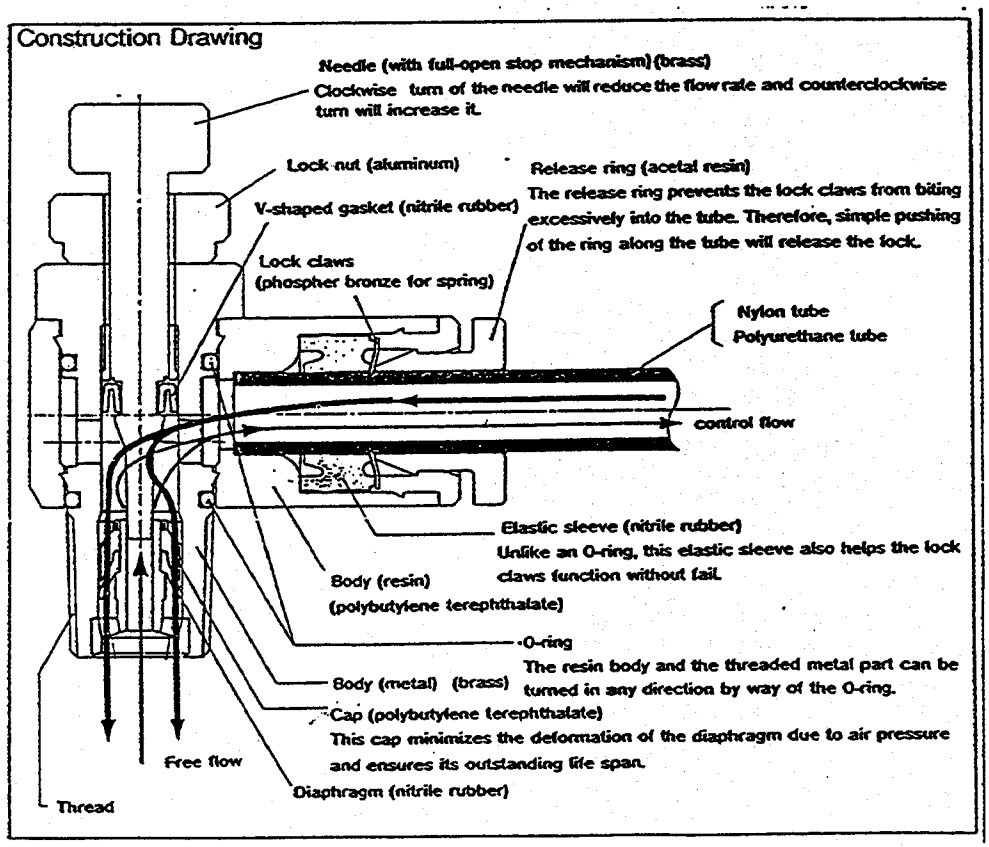
a) Loosen lock nut B.

b) Obtain the proper speed of the cylinder with rotating knob A.

c) Retighten B so as to lock A after adjustment.

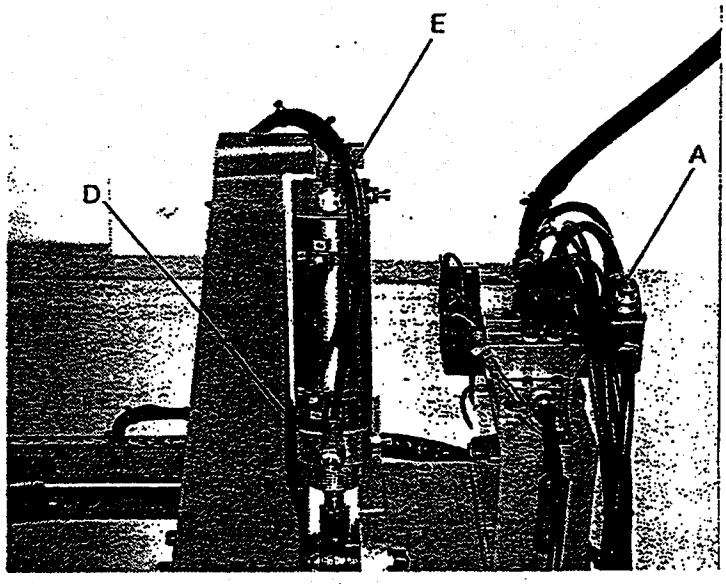


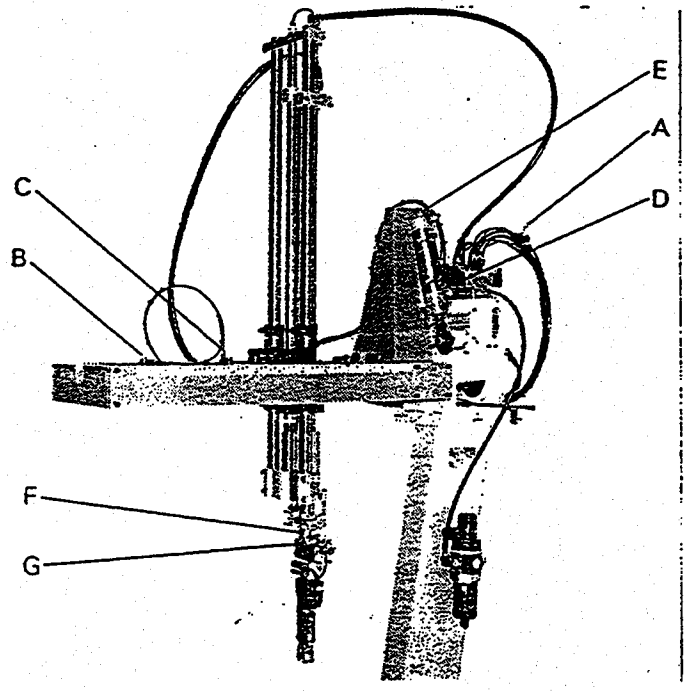
Speed controller



* Function of Each Speed Controller

A: Main arm descending speed (JNU-8)
B: Kick forward speed (JSC4-01)
C: Kick backward speed (JSS4-01)
D: Swing out speed (JSC6-01)
E: Swing back speed (JSC6-01)
F: Wrist rotation speed (JSC4-M5)
G. Wrist return speed (JSC4-M5)





9. Proximity switch

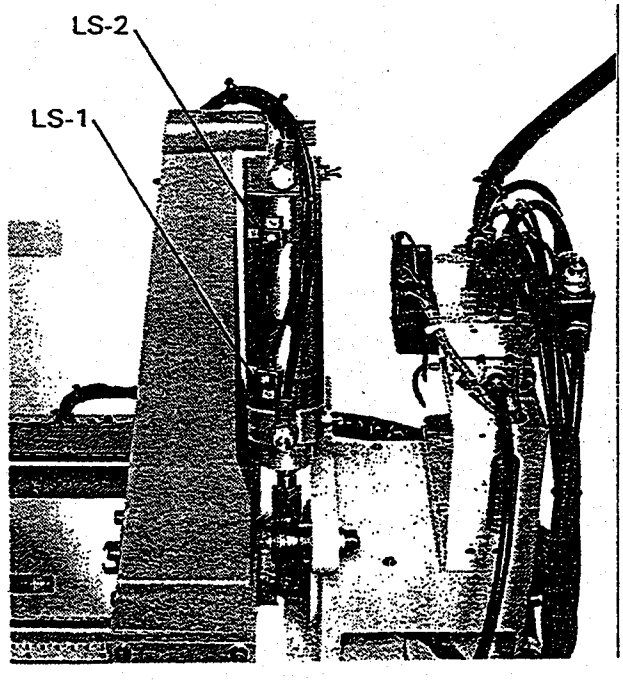
The proximity switches are equipped on the robot as follows.

a) LS-1 (Proximity switch : KOGANEI CS-7G)

To detect that the main arm cylinder reached its swing outward end position. If LS-1 is not actuated, the main arm will not extend to outside mold to release parts and/or sprue runner system.

b) LS-2 (Proximity switch : KOGANEI CS-7G)

To detect that the main arm cylinder is VERTICAL (swing inward end limit) position. If LS-2 is not actuated, the fingers will not go down even if mold open complete signal is given from injection machine.



c) LS-3 (Proximity switch : OMRON TL-Q5MC1)

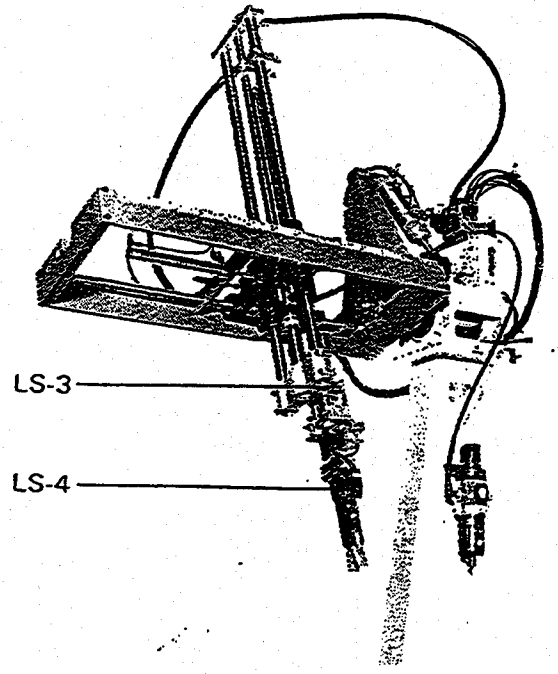
To detect that the main arm is in the upward end limit position.
Unless LS-3 is actuated, the mold clamping function is not permitted. (Safety Interlock Circuit)

d) LS-4 (Proximity switch : SUNX GXL-8F)

To detect the pick-up failure of the part to be held by the gripping fingers. When LS-4 is not actuated before CYCLE MONITOR TIMER (VR-8) is up, the main arm will not be swung out and the warning buzzer shall be sound. This switch is built in the gripper body.

Remarks :

When the venturi-air ejector kit is used for suction pad (cup) to grip the part, change the verification method by selection switch (By LS-4 or By vacuum differential switch).



10. Adjustment of sprue verifiaction switch (LS-4) position.

The position of LS-4 proximity switch built-in the gripper has to be adjusted according to the diameter of the sprue, and their materials.

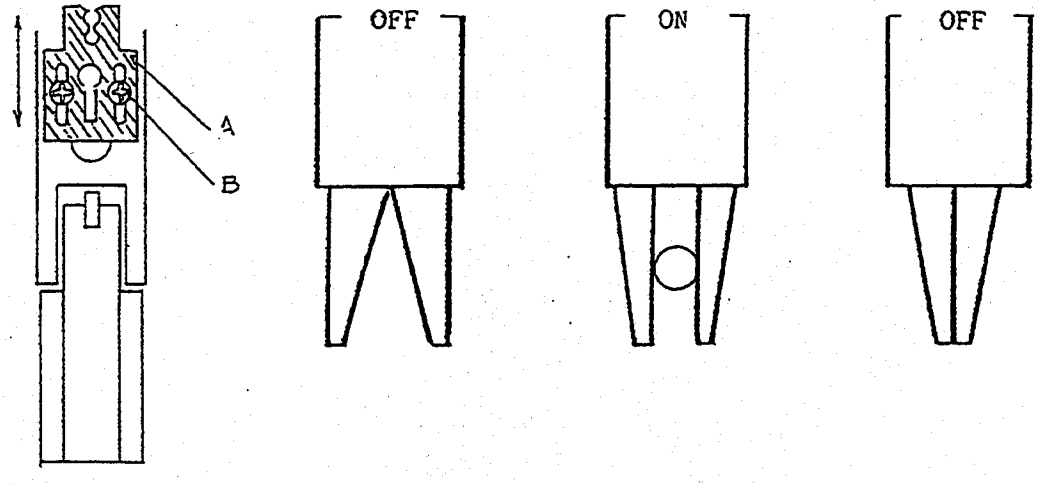
Adjust the LS-4 position as follows.

1) Loosen the fixing screw (B).

2) Actuate the "Grip" solenoid valve by manual operation switch on PC-EIID controller or mechanical manual push button on the valve.

3) Slide the proximity switch bracket (A) and set it to proper position so that LED on the proximity switch or LED on the PCB in the controller to be ON when the gripper grips the sprue and to be OFF when the gripper opens or closes completely.

4) Tighten the fixing screw.



11. F.R unit

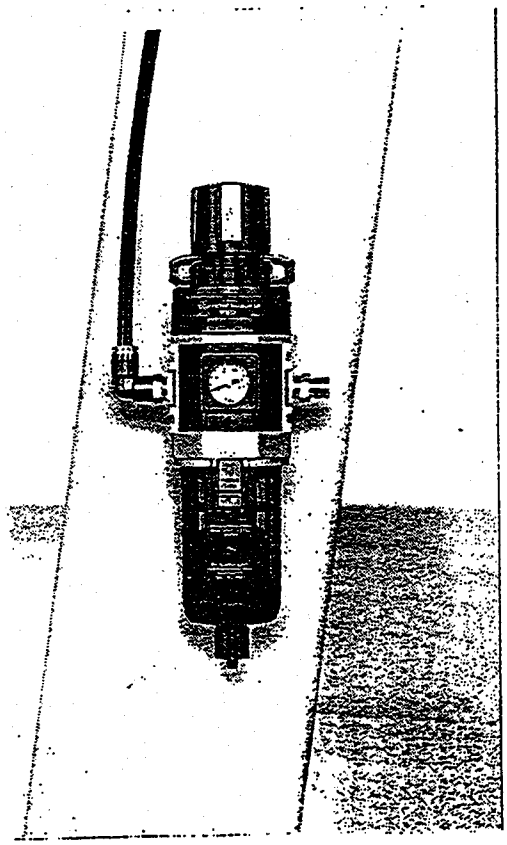
Oil free cylinders are used on the EX series robots. It is not necessary to supply lubricating oil to these robots.

* Drain Maintenance

(1) Auto drain system is applied to this F.R unit. Drainage is discharged automatically when its level reached a certain level. Put 6mm inside dia. tube to the discharging port (fitting). It is also possible to discharge the drainage manually with rotating drain cock.
CHECK THE LEVEL ONCE A DAY.

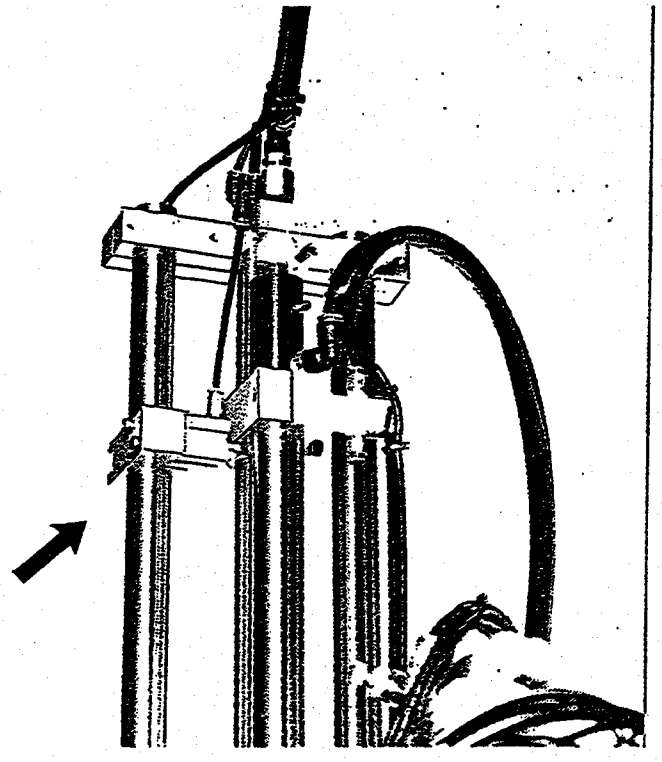
* Pressure Control

(1) The primary air pressure supplied to F.R unit should be less than 9.0 kg/cm2 and the secondary working pressure should be 5.0 to 6.5 kg/cm^2.
(2) Clockwise rotation of the control knob permits the secondary pressure to increase and anti-clockwise rotation to decrease.
(3) Push down (lock) the adjusting knob after air-pressure adjustment is done.



12. Main arm lock cylinder

For the Main arm, safety lock cylinders is provided, preventing the arms from dropping if the pneumatic pressure suddenly decreases, the pneumatic hose is disconnected from the compressor.



13. Quick fitting for air tube

(a) Connecting

Push the tube into the joint.

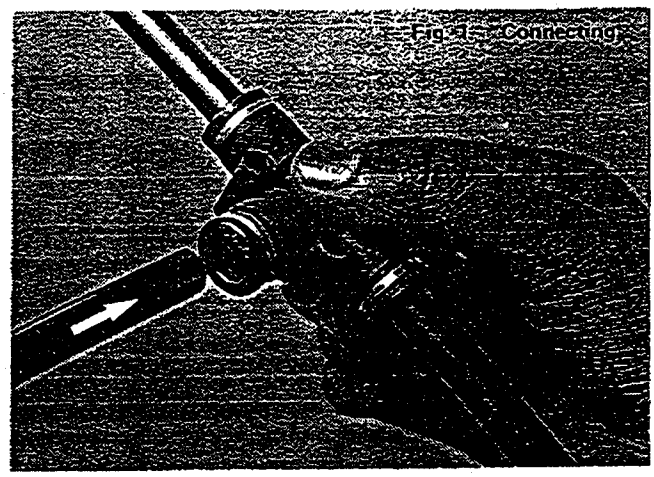


Fig. 1 Connecting

(b) Disconnecting

1) Push the releasing bush in.

2) Pull out the tube with the bush pushed in.

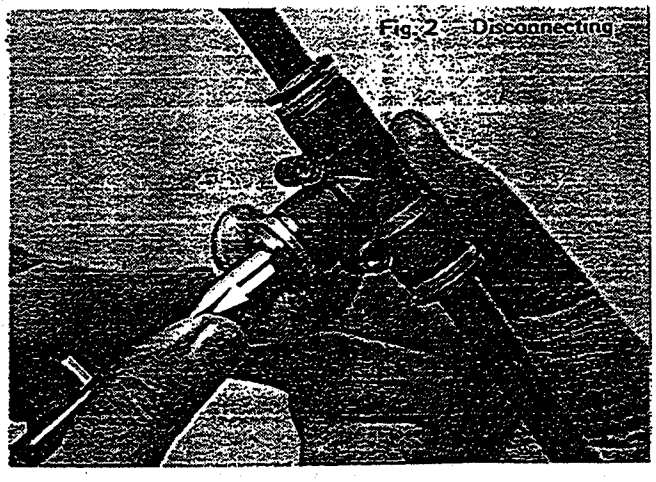


Fig. 2 Disconnecting

D. SEQUENCE CONTROLLER, TYPE PC-EIID FOR THE EX-250 SRS. ROBOT

1. External switches

1) POWER (SW-0) : Power ON / OFF switch

2) ROBOT ON/OFF (KSW-1)

a) OFF : Stop all movement for auto and manual operation except the followings;

1. Mold close/open interlock signal

   Mold close and open on the injection machine is availavle only in the position of main arm cylinder upward end or swing outward end.

2. Injection machine cycle start signal

   Injection machine cycle start signal keeps always valid (ON).

3. Ejector timing control signal

   Hydraulic knock out ejector interlock to injection machine keeps always valid (ON).

b) ON : Turn "ON" when operate robot

3) START (PSW-1) : Automatic operation switch

ROBOT ON/OFF switch (KSW-1) must be at "ON" position when press this button. Alarm buzzer will sound if ROBOT ON/OFF switch is not turned to "ON" or the robot is not at home position when press START switch. In such case, press STOP switch and turn ROBOT ON/OFF switch to "ON" and/or set the robot to home position.

4) STOP (PSW-2) : Automatic operation stop switch

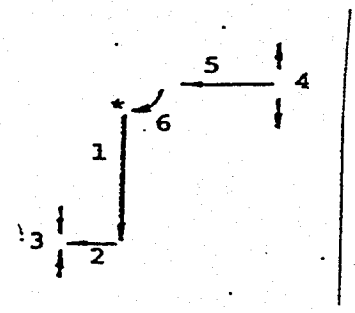
Main arm cylinder and kick cylinder returns to their home position (except swing motion).

5) MANUAL 1 (PSW-3), 2 (PSW-4) : Manual operation switch

This switch is available only when ROBOT ON/OFF switch is "ON" position. When the mold open signal is valid, all the manual operation is available. And when the mold open signal is not valid all the manual operation except main arm first extension is available. The following motions are available step by step whenever push the each button.

a) Manual 1 (PSW-3)

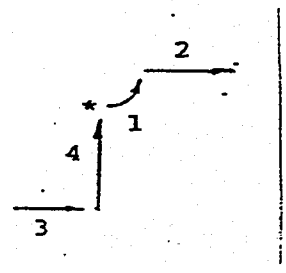
* Home position
1 Main arm first extension
2 Kick forward
3 Grip
4 Release
5 Main arm second retraction
6 Swing inward



In the mold area, it is available to grip and release repeatedly by pressing this button.

b) Manual 2 (PSW-4)

* Home position
1 Swing outward
2 Main arm second extension
3 Kick backward
4 Main arm first retraction

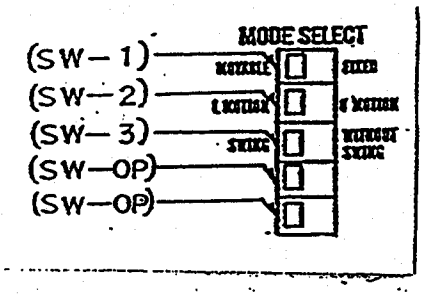


6) RESET (PSW-5) : Reset switch

In case that molded parts and/or sprue runner system are not recognized by part verification switch or vacuumm differencial switch, the alarm comes on when CYCLE MONITOR timer (VR-8) elapses. Press this button after checking no molded parts and/or sprue runner system in the mold area. Then injection machine will start mold closing and the robot starts swing out motion.
In case that molded parts and/or sprue runner system is dropped during swing outward motion and parts verification gets OFF, mold closing of injection machine is interrupted and robot stops at swing outward end position in order to prevent the molds from damage. In such case, by pressing this switch, robot and injection machine operation will be continued.

7) MODE SELECT (SW-1, SW-2, SW-3, SW-OP)

Availavle to select several motion sequence by these switches. Mode change during auto operation is not valid. Set these swithes when the robot is under manual operation mode.



a) SUB ARM SECOND DESCENT ON / OFF (SW-1)

ON : Release parts after second descent
OFF : Release parts after swing outward without second descent

b) L MOTION / U MOTION (SW-2)

L MOTION : Arm extend ... Kick forward (approach) ... Grip ... Kick backward (strip off) ... Arm retract ... Home position

U MOTION : Arm extend ... Grip ... Kick backward (strip off) ... Arm retract ... kick forward ... Home position

c) SWING / WITHOUT SWING (SW-3)

SWING : Molded part is released outside mold area.
WITHOUT SWING : Molded part is released inside mold area.

* Remark;

In the "WITHOUT SWING" mode, parts verification is not available.

d) SW-OP : For option

8) EMERGENCY STOP (PB-1)

a) When press the button on auto operation, all power source for solenoid valves are shut off. To cancell this mode, pull up the button, then, the robot become manual operation mode.

b) When press the button on manual operation, all power source for solenoild valves are shut off and manual sequence is cleared.

Mold close/open interlock signal, injection machine cycle start signal, and ejector timing control signal are all shut off, when press the button.

To release this mode, pull up the button.

2. Internal switch

EJECTOR CONTROL (RSW-1)

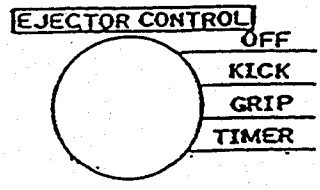
Ejector forward timing of injection machine can be controlled by this selector switch.

OFF .... Ejection of injection mahcine is not controlled by robot. (Interlock signal contact keeps ON)

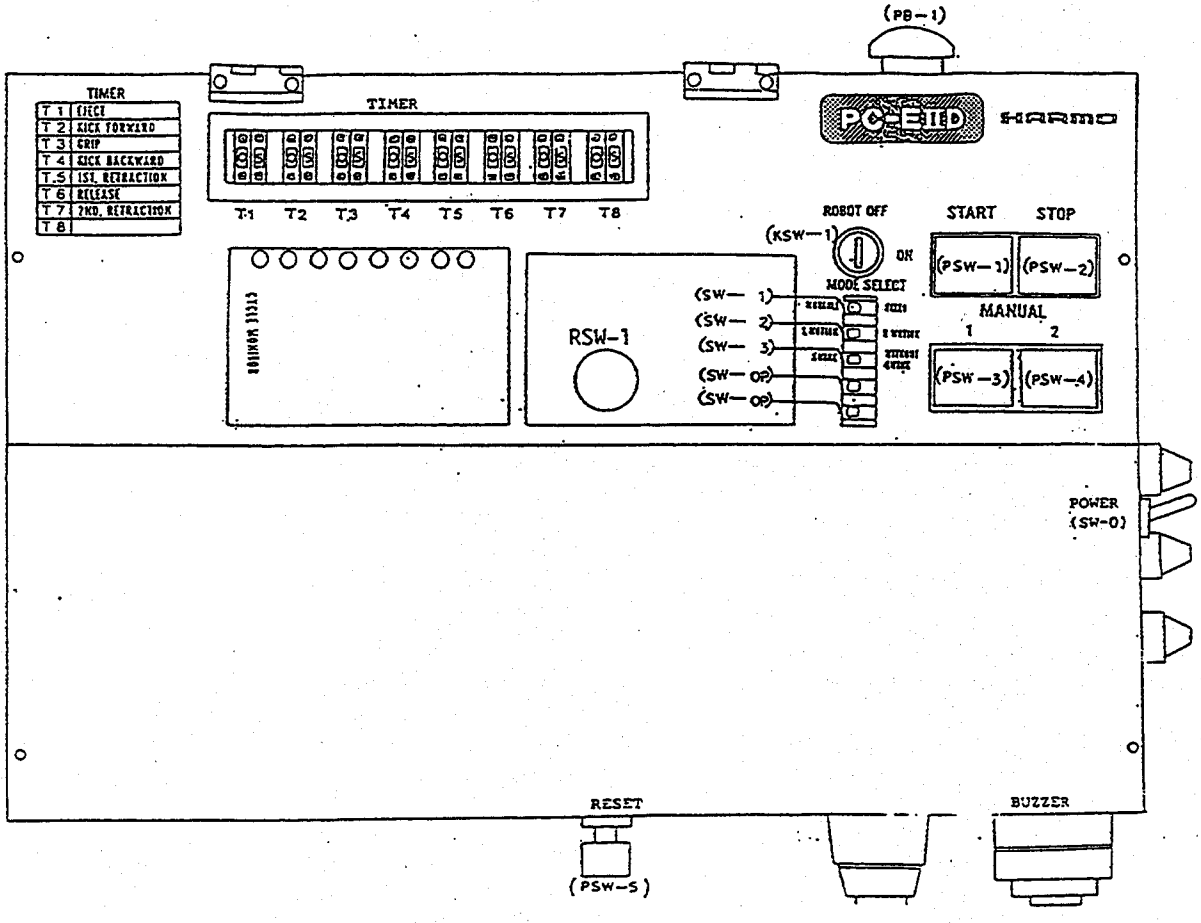
KICK .... Eject when robot kicks forward.

GRIP .... Eject when robot grips molded part and/or sprue runner system.

TIMER ... Ejection timing can be controlled by timer VR-1.



EXTERNAL VIEW

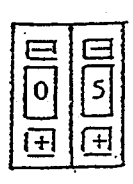


3. TIMERS

Adjust timers in order to get fast and smooth robot motion.

Digital timers (T-1 to T-8)

It can set up 0.1 second each for the range of 0.1 to 9.9 seconds.



Set each delay time by pressing small push button on digital timers.

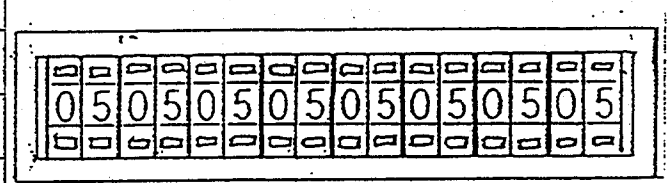
Analog timers (VR-1 to VR-8)

It can set by attached screw driver.

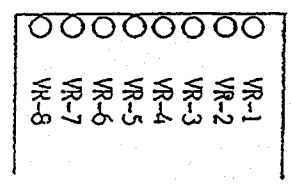
TIMER

T-1	EJECT
T-2	KICK FORWARD
T-3	GRIP
T-4	KICK BACKWARD
T-5	1ST.RETRACTION
T-6	RELEASE
T-7	2ND.RETRACTION
T-8	

TIMER



T-1 T-2 T-3 T-4 T-5 T-6 T-7 T-8



a) EJECT (T-1)

Hydraulic ejection timing of injection machine is controlled by this timer. This timer starts counting at the same time of arm extension. When T-1 elapses, eject interlock is released.

b) KICK FORWARD (T-2)

This timer starts counting at the same time of arm extension. When T-2 elapses, gripper approaches (kick forward) to the molded part and/or sprue runner system.

When the mode selector switch is set to "U MOTION", this timer is not valid.

c) GRIP (T-3)

This timer starts counting at the same time of kick forward on L motion or arm extension on U motion. When VR-3 elapses, finger and/or suction pads grips the molded part and/or sprue runner system.

d) KICK BACKWARD (T-4)

This timer starts counting at the same time of grip. And when T-4 elapses, gripper strips off the molded parts and/or sprue runner system.

e) 1ST RETRACTION (T-5)

This timer starts counting at the same time of strip off action. When T-5 elapses, main arm retracts.

f) RELEASE (T-6)

This timer starts counting at the same time of arm second extension. When T-6 elapses, robot releases molded part and/or sprue runner system.

g) 2ND RETRACTION (T-7)

This timer starts counting at the same time of grip release. When T-7 elapses, main arm retracts.

h) CYCLE MONITOR (VR-8)

This timer checks the time from mold fully open to verify the molded parts and/or sprue runner system. If molded parts and/or sprue runner system is verified at arm upward end position, arm swings out and injection machine starts mold closing. At the same time, this timer is reset and again starts counting and check the time from swing out to return to home position.

i) OPTIONAL TIMERS (T-8, VR-1 to VR-7)

These timers can be used when additional timer is needed. It is necessary to modify program stored in EPROM IC in the control box.

4. LED DISPLAY

- LEDs on PCB-E005F

a) MOLD OPEN (L-1)

Light when mold open complete signal is given to robot.

b) OPEN·CLOSE SAFETY (L-2)

Light when mold open and close interlock signal are released.

c) MOLD CLOSE (L-3)

Light then mold closing start signal is given to injection machine.

d) EJECTOR (L-4)

Light when eject interlock signal is released.

e) HOME POSITION (L-5)

Light when robot is at the following conditions.

* Main arm is at upward end position (LS-3 : ON)
* Arms are at vertical (swing inward end) position (LS-2 : ON and LS-1 : OFF)
* Part verification switch and RESET switch are OFF

In addition to above, it requires following conditions when the mode selector switch (RSW-2)is set to MAIN & SUB.

* Sub arm is at upward end position (LS-7 : ON)
* Parts verification switch (LS-5) is OFF.

f) SWING OUTWARD END (L-6)

Light when swing outward end limit switch (LS-1) is ON.

g) SWING INWARD END (L-7)

Light when swing inward end limit switch (LS-2) is ON.

h) ARM UPWARD END (L-8)

Light when main arm upward end limit switch (LS-3) is ON. It requires input signal from (LS-7) ,sub arm upward end when the mode selector switch is set to MAIN & SUB.

i) MAIN ARM PART VERIFICATION (L-9)

Light when part verification switch or reset switch is ON.

j) SUB ARM PART VERIFICATION (L-10) *
Light when part verification switch or reset switch is ON.

* Applied for EXF-60,150G

We're Here to Help

Conair has made the largest investment in customer support in the plastics industry. Our service experts are available to help with any problem you might have installing and operating your equipment. Your Conair sales representative also can help analyze the nature of your problem, assuring that it did not result from misapplication or improper use.

How to Contact Customer Service

To contact Customer Service personnel, call:

From outside the United States, call: 814-437-6861

You can commission Conair service personnel to provide on-site service by contacting the Customer Service Department. Standard rates include an on-site hourly rate, with a one-day minimum plus expenses.

Before You Call ...

If you do have a problem, please complete the following checklist before calling Conair:

- ❒ Make sure you have all model, serial and parts list numbers for your particular equipment. Service personnel will need this information to assist you.
- ❒ Make sure power is supplied to the equipment.
- ❒ Make sure that all connectors and wires within and between loading control and related components have been installed correctly.
- ❒ Check the troubleshooting guide of this manual for a solution.
- ❒ Thoroughly examine the instruction manual(s) for associated equipment, especially controls. Each manual may have its own troubleshooting guide to help you.
- ❒ Check that the equipment has been operated as described in this manual.
- ❒ Check accompanying schematic drawings for information on special considerations.

Additional manuals and prints for your Conair equipment may be ordered through the Customer Service or Parts Departments for a nominal fee.

EQUIPMENT GUARANTEE

Conair guarantees the machinery and equipment on this order, for a period as defined in the quotation from date of shipment, against defects in material and workmanship under the normal use and service for which it was recommended (except for parts that are typically replaced after normal usage, such as filters, liner plates, etc.). Conair's guarantee is limited to replacing, at our option, the part or parts determined by us to be defective after examination. The customer assumes the cost of transportation of the part or parts to and from the factory.

PERFORMANCE WARRANTY

Conair warrants that this equipment will perform at or above the ratings stated in specific quotations covering the equipment or as detailed in engineering specifications, provided the equipment is applied, installed, operated and maintained in the recommended manner as outlined in our quotation or specifications.

Should performance not meet warranted levels, Conair at its discretion will exercise one of the following options:

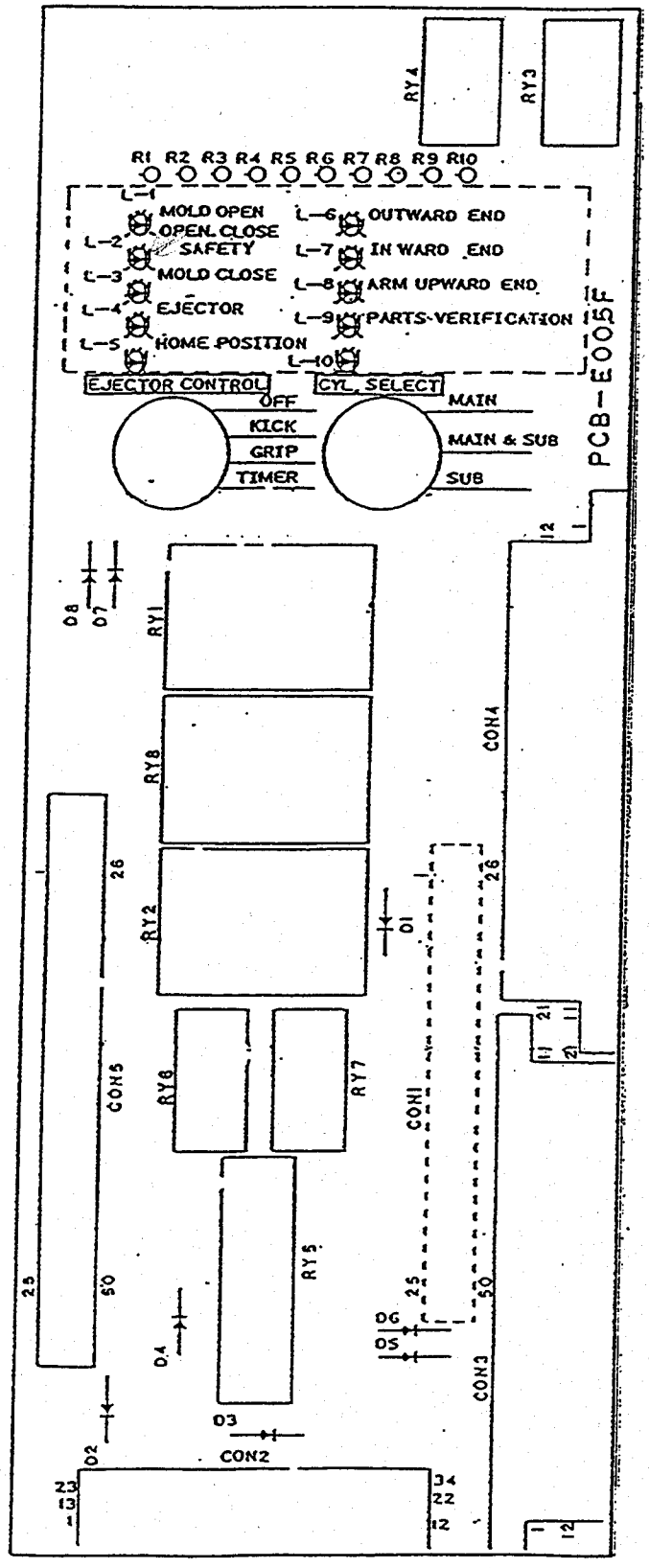
- Inspect the equipment and perform alterations or adjustments to satisfy performance claims. (Charges for such inspections and corrections will be waived unless failure to meet warranty is due to misapplication, improper installation, poor maintenance practices or improper operation.)
- Replace the original equipment with other Conair equipment that will meet original performance claims at no extra cost to the customer.
- Refund the invoiced cost to the customer. Credit is subject to prior notice by the customer at which time a Return Goods Authorization Number (RGA) will be issued by Conair's Service Department. Returned equipment must be well crated and in proper operating condition, including all parts. Returns must be prepaid.

Purchaser must notify Conair in writing of any claim and provide a customer receipt and other evidence that a claim is being made.

WARRANTY LIMITATIONS

Except for the Equipment Guarantee and Performance Warranty stated above, Conair disclaims all other warranties with respect to the equipment, express or implied, arising by operation of law, course of dealing, usage of trade or otherwise, including but not limited to the implied warranties of merchantability and fitness for a particular purpose.

LED DISPLAY


RY4
RY3
R1 R2 R3 R4 R5 R6 R7 R8 R9 R10
L-1 MOLD OPEN
L-2 OPEN CLOSE SAFETY
L-3 MOLD CLOSE
L-4 EJECTOR
L-5 HOME POSITION
L-6 OUTWARD END
L-7 IN WARD END
L-8 ARM UPWARD END
L-9 PARTS-VERIFICATION
L-10
EJECTOR CONTROL
OFF
KICK
GRIP
TIMER
CYL. SELECT
MAIN
MAIN & SUB
SUB
PCB-E005F
D8
D7
RY1
RY8
RY2
RY6
RY7
RY5
CON5
CON4
CON1
CON3
CON2
D1
D2
D3
D4
D5
D6
26
50
25
12
1
21
11
2
23
13
34
22
24

LEDs on sequence controller PM-911C

	POWER	Light when power is ON.
	CPU	Light when "Sequence error". Shut off all output signal from sequencer.
Y00 -	HOME PSTN/ALARM .	Home position and alarm
Y01 -	MOLD SAFETY	Mold open/close safety interlock (RY2 & 3)
Y02 -	EJECTOR FWD	Ejector forward signal (RY4)
Y03 -	MAIN CYL. SOL. ..	Main arm extend (SOL-3)
Y04 -	SWING OUT SOL. ..	Swing outward (SOL-1)
Y05 -	SWING SIN SOL. ..	Swing inward (SOL-2)
Y06 -	KICK CYL. SOL. ..	Kick forward (SOL-4)
Y07 -	GRIP SOL.	Grip, vacuum (SOL-5 & 6)
X00 -	MOLD OPEN	Mold open completion signal(RY-1)
X01 -	ROBOT OFF	Without robot operation (KSW-1)
X02 -	AUTO START	Auto operation start (PSW-1)
X03 -	MANUAL 1	Manual operation 1 (PSW-3)
X04 -	MANUAL 2	Manual operation 2 (PSW-4)
X05 -	MODE SELECT 1 ...	Take out from fixed mold(SW-1)
X06 -	MODE SELECT 2 ...	U motion (SW-2)
X07 -	MODE SELECT 3 ...	Without swing (SW-3)
X08 -	LS-1	Swing outward end limit (LS-1)
X09 -	LS-2	Swing inward end limit (LS-2)
*X13 -	LS-5	Part verification (LS-OPT1)
X0A -	LS-3	Arm upward end limit (LS-3,7)
X0B -	LS-4,VS,AUX.	Part verification (LS-4,vacuum switch,Aux. switch)

LEDs on PCB-E006A

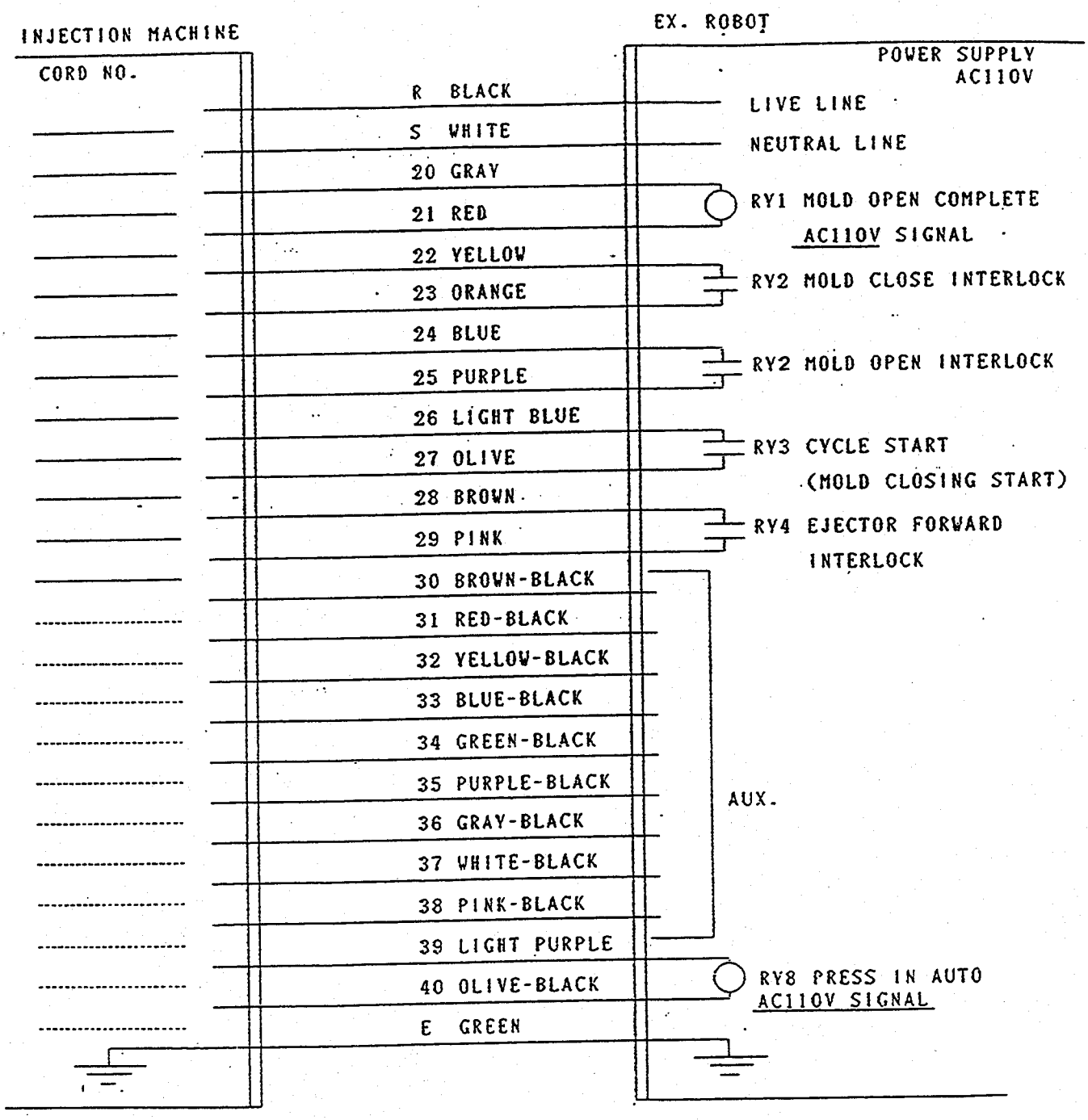
*Y08 -	Sub arm extend (SOL-OPT1)
*Y09 -	Sub arm grip (SOL-OPT2)
Y0A -	Aux. output
Y0B -	Aux. output
Y0C -	Aux. external signal output
X0C -	Not valid for EX series robot
X0D -	Not valid for EX series robot
X0E -	Mode select, option switch (SW-OP)
X0F -	Mode select, option switch (SW-OP)

Remarks,

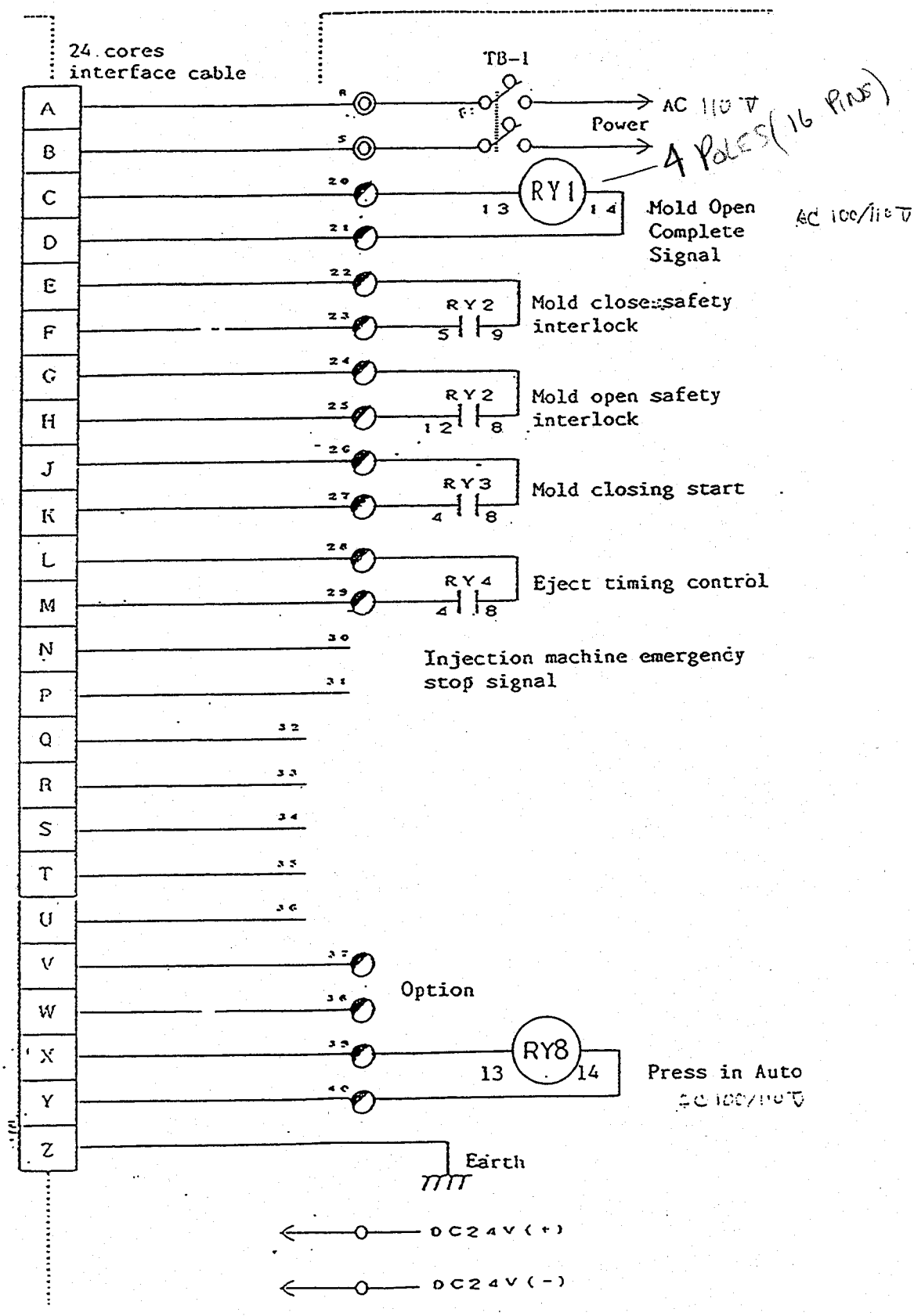
1. 3 aux. inputs and 2 aux. outputs on robot are available.
2. 2 aux. inputs for mode select are available.
3. 1 aux. output for interfacing is available.

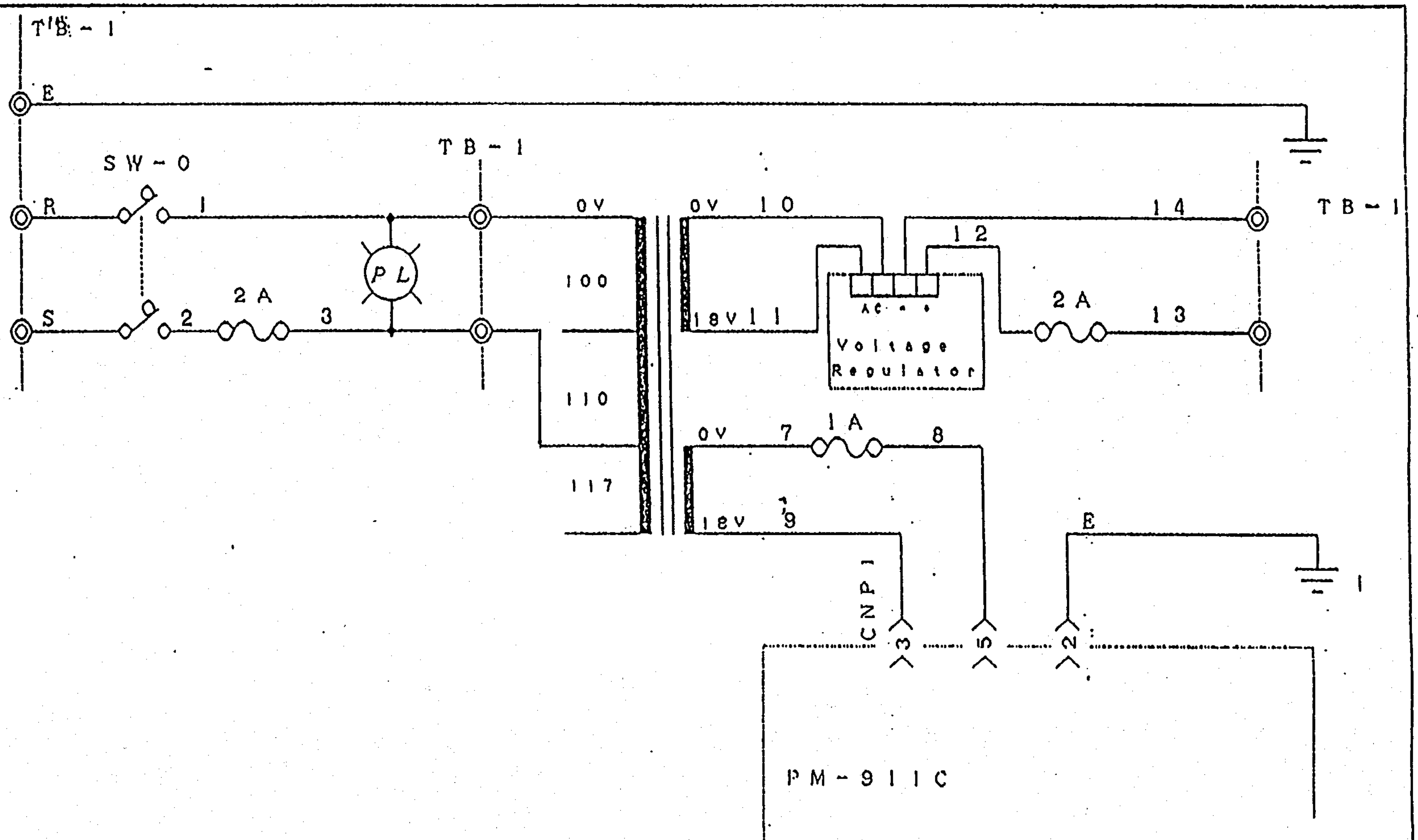
* Applied for EXF-60, 150G

E. CONNECTION BETWEEN ROBOT & INJECTION MACHINE



F. WIRING DIAGRAM FOR THE PC-EIID CONTROLLER

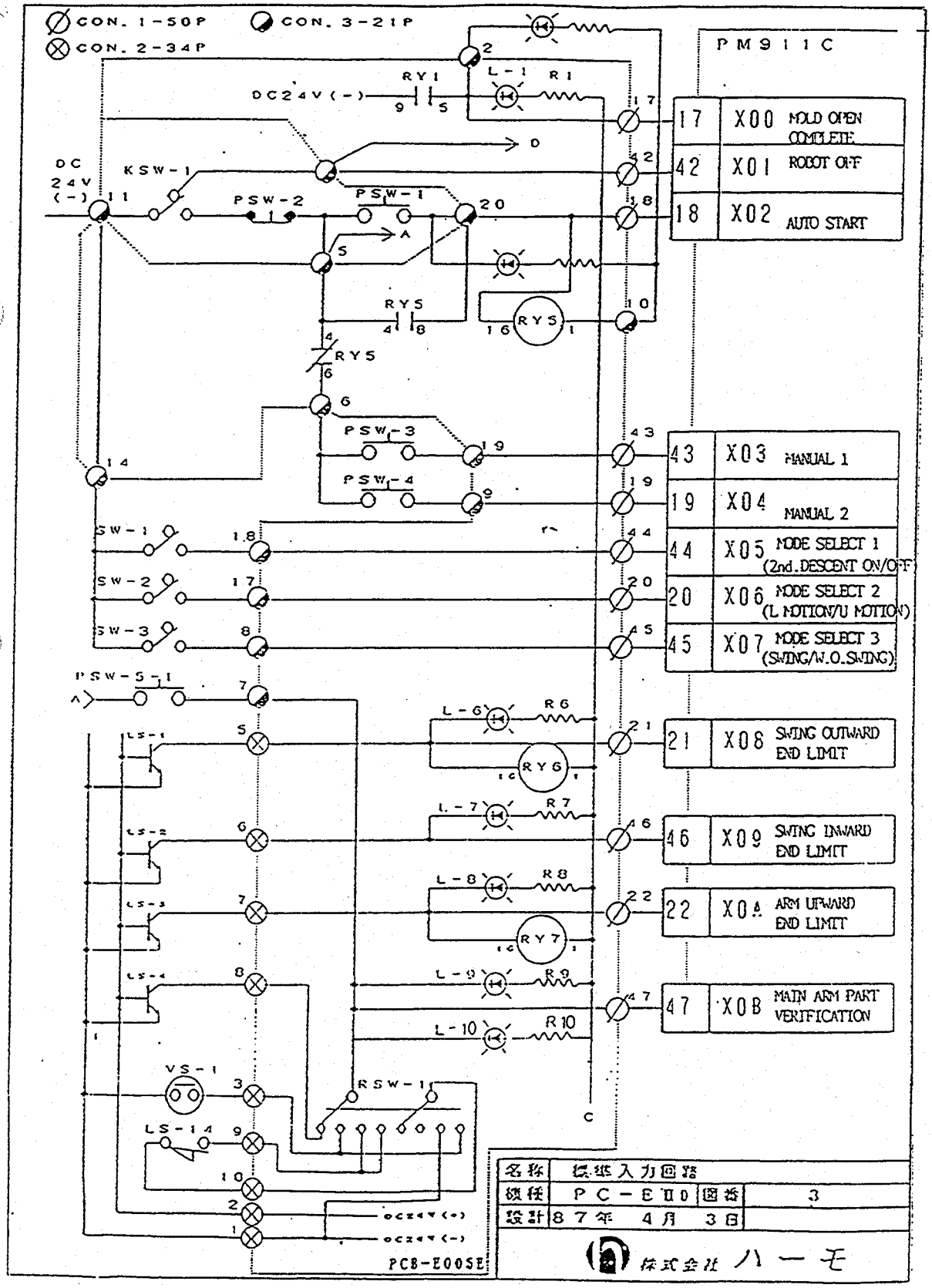


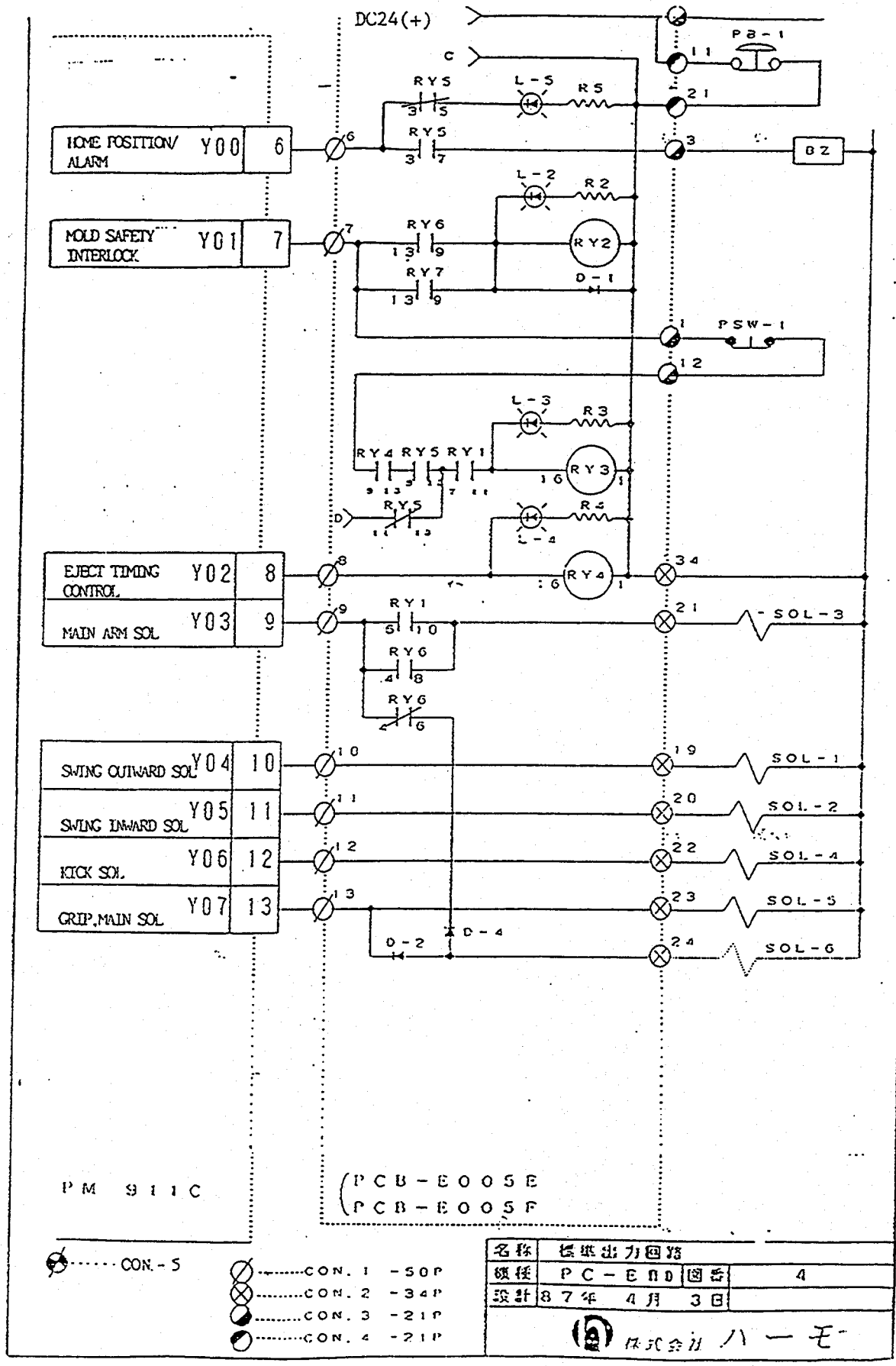


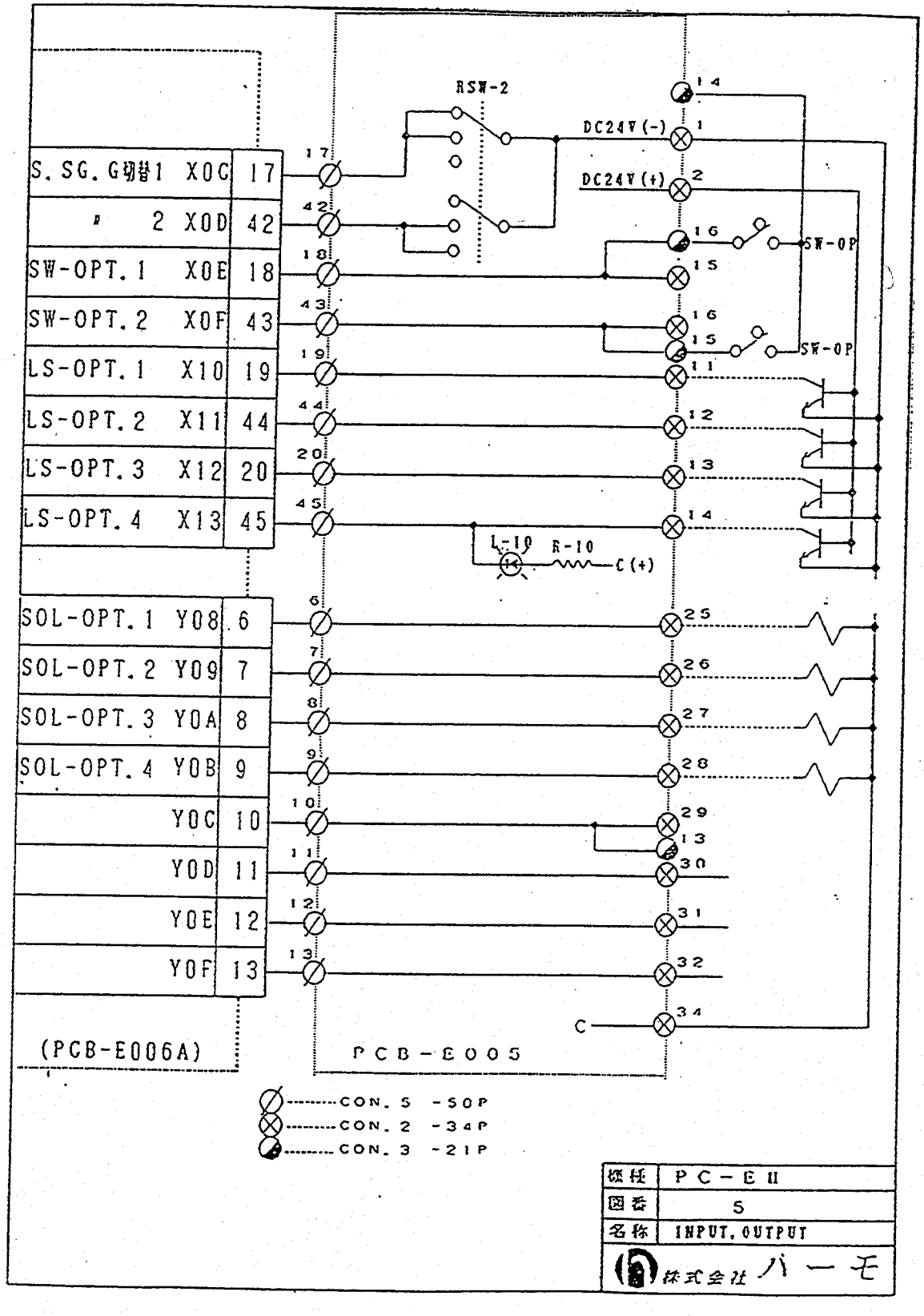
機種	PC-EII, HII	図番	2
名称	POWER SUPPLY		

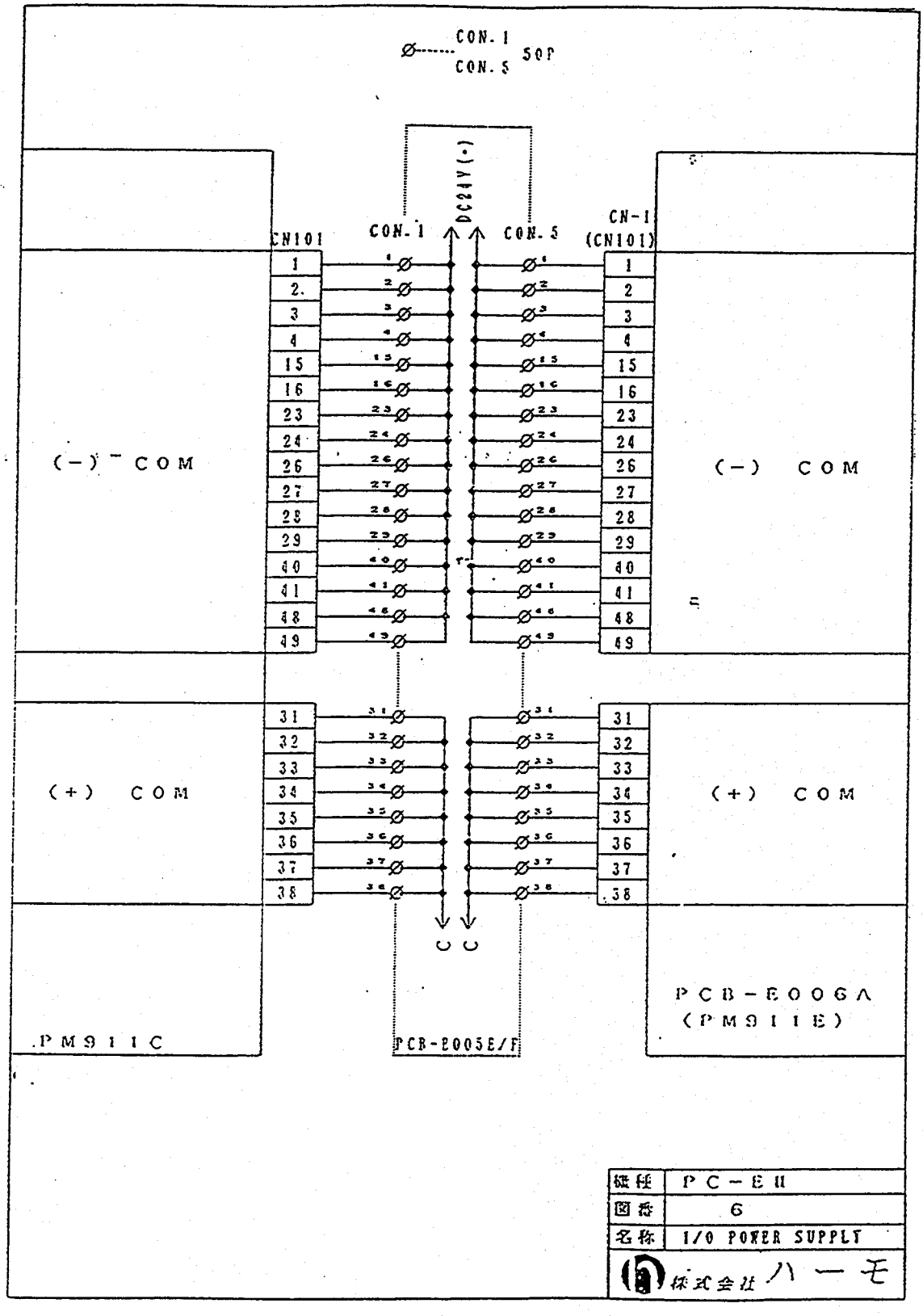
株式会社 ハーモ

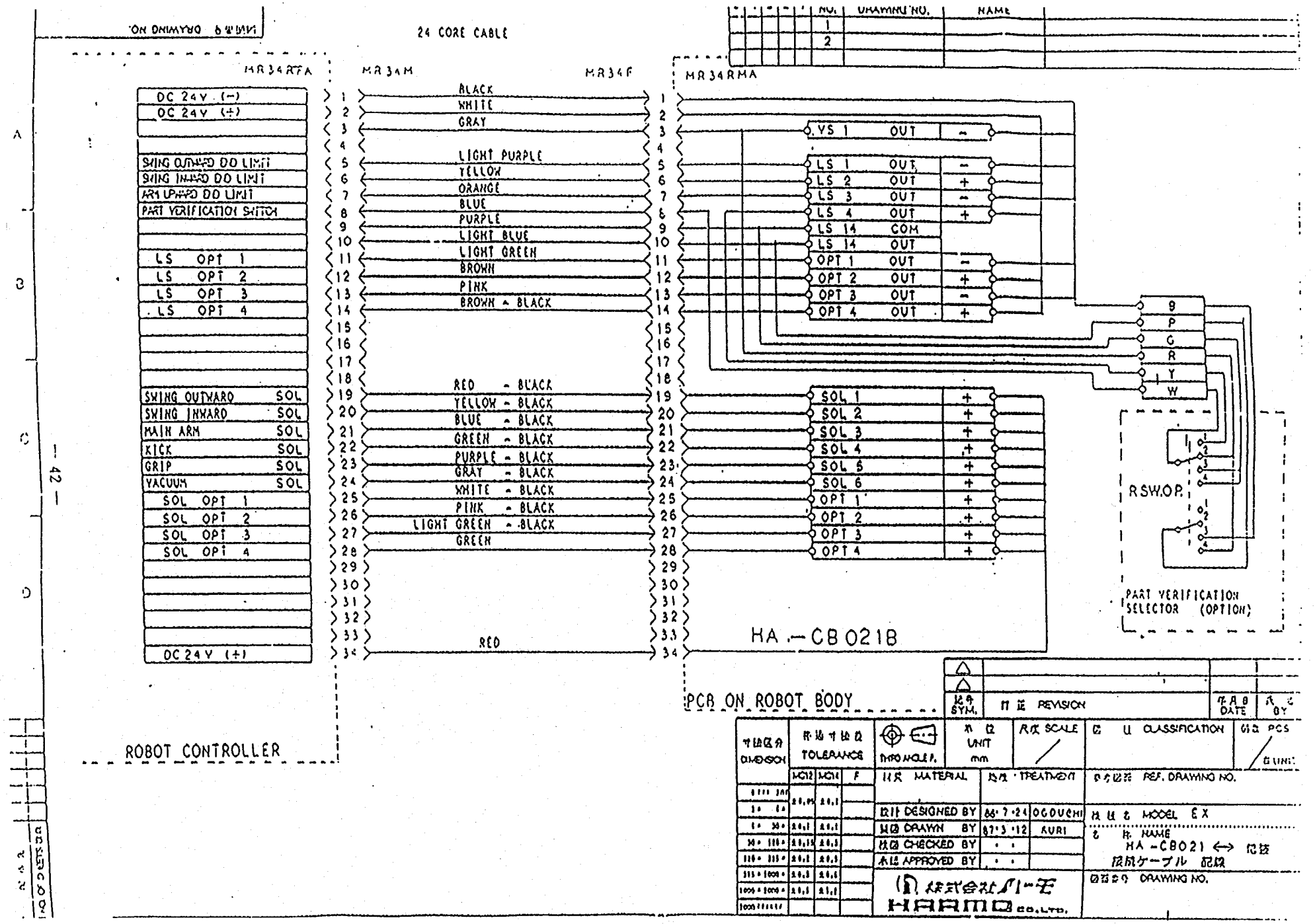
5O2-827-9841


CON. 1-50P
CON. 3-21P
CON. 2-34P
PM911C
DC24V(-)
RY1
L-1
R1
DC 24V (-)
KSW-1
PSW-2
PSW-1
RY5
PSW-3
PSW-4
SW-1
SW-2
SW-3
PSW-5-1
L-6
R6
RY6
L-7
R7
L-8
R8
RY7
L-9
R9
L-10
R10
LS-1
LS-2
LS-3
LS-4
LS-14
VS-1
RSW-1
17 X00 MOLD OPEN COMPLETE
42 X01 ROBOT OFF
18 X02 AUTO START
43 X03 MANUAL 1
19 X04 MANUAL 2
44 X05 MODE SELECT 1 (2nd.DESCENT ON/OFF)
20 X06 MODE SELECT 2 (L MOTION/U MOTION)
45 X07 MODE SELECT 3 (SWING/W.O.SWING)
21 X08 SWING OUTWARD END LIMIT
46 X09 SWING INWARD END LIMIT
22 X0A ARM UPWARD END LIMIT
47 X0B MAIN ARM PART VERIFICATION
名称 操作入力回路
機種 PC-E110 図番 3
設計 87年 4月 3日
株式会社ハーモ
PCB-E005E


DC24(+)
PB-1
RY5
L-5
R5
HOME POSITION/ ALARM Y00 6
BZ
L-2
R2
MOLD SAFETY INTERLOCK Y01 7
RY6
RY2
RY7
D-1
PSW-1
L-3
R3
RY4 RY5 RY1
RY3
RY5
L-4
R4
EJECT TIMING CONTROL Y02 8
RY4
MAIN ARM SOL Y03 9
RY1
RY6
SOL-3
SWING OUTWARD SOL Y04 10
SOL-1
SWING INWARD SOL Y05 11
SOL-2
KICK SOL Y06 12
SOL-4
GRIP,MAIN SOL Y07 13
SOL-5
D-2
D-4
SOL-6
PM 911C
PCB-E005E
PCB-E005F
CON.-5
CON.1 -50P
CON.2 -34P
CON.3 -21P
CON.4 -21P
名称 標準出力回路
機種 PC-END 図番 4
設計 87年 4月 3日
株式会社 ハーモ


S. SG. G切替1 X0C 17
〃 2 X0D 42
SW-OPT. 1 X0E 18
SW-OPT. 2 X0F 43
LS-OPT. 1 X10 19
LS-OPT. 2 X11 44
LS-OPT. 3 X12 20
LS-OPT. 4 X13 45
SOL-OPT. 1 Y08 6
SOL-OPT. 2 Y09 7
SOL-OPT. 3 Y0A 8
SOL-OPT. 4 Y0B 9
Y0C 10
Y0D 11
Y0E 12
Y0F 13
(PCB-E006A)
RSW-2
DC24V(-)
DC24V(+)
SW-OP
SW-OP
L-10
R-10
C(+)
C
PCB-E005
CON. 5 -50P
CON. 2 -34P
CON. 3 -21P
機種 PC-EII
図番 5
名称 INPUT, OUTPUT
株式会社 ハーモ


CON. 1
CON. 5
50P
DC24V(-)
CN101
CON. 1
CON. 5
CN-1
(CN101)
(−) COM
(−) COM
(+) COM
(+) COM
PCB-E006A
(PM911E)
PM911C
PCB-E005E/F
機種 PC-E11
図番 6
名称 I/O POWER SUPPLY
株式会社ハーモ



SYM.	REVISION	DATE	BY

DIMENSION	TOLERANCE			UNIT mm	SCALE	CLASSIFICATION
	MC12	MC14	F			
0 ~ 3	±0.05	±0.1		MATERIAL	TREATMENT	REF. DRAWING NO.
3 ~ 6				DESIGNED BY	88·7·24 OGOUCHI	MODEL EX
6 ~ 30	±0.1	±0.1		DRAWN BY	87·3·12 KURI	NAME HA-CB021 ⟷ 接続ケーブル 配線
30 ~ 120	±0.15	±0.3		CHECKED BY	· ·	
120 ~ 315	±0.2	±0.5		APPROVED BY	· ·	
315 ~ 1000	±0.3	±0.6				
1000 ~ 2000	±0.5	±1.0				
2000 ~						

ハーモ株式会社 HARMO CO.,LTD.

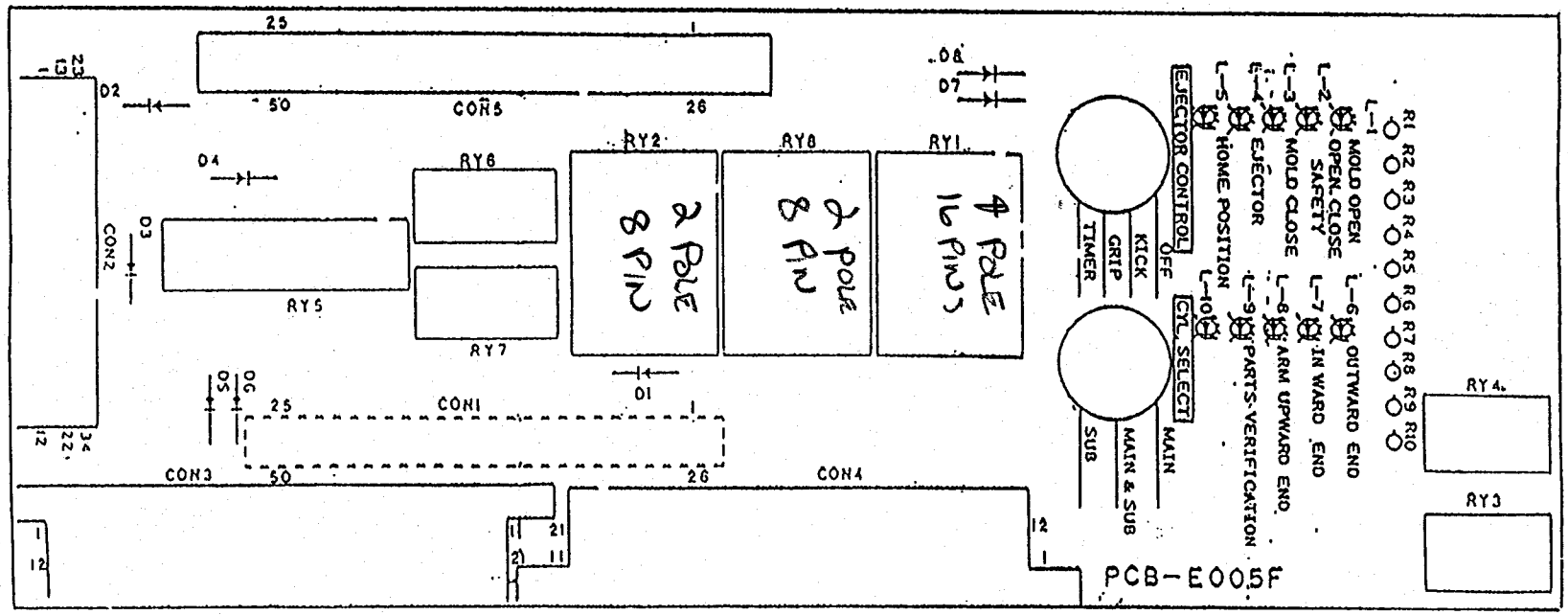
DRAWING NO.

PC-EIID INTERFACE BOARD

RY-1 :	MOLD OPEN COMPLETE RELAY	(OMRON MY-4 AC110V*)
RY-2 :	MOLD OPEN/CLOSE SAFETY INTERLOCK RELAY	(OMRON MY-2 DC24V)
RY-3 :	MOLD CLOSING START RELAY	(MATSUSHITA AG2024)
RY-4 :	EJECT INTERLOCK RELAY	(MATSUSHITA AG2024)
RY-5 :	AUTO OPERATION RELAY	(MATSUSHITA AG2044)
RY-6 :	SWING OUTWARD END RELAY	(MATSUSHITA AG2024)
RY-7 :	ARM UPWARD END RELAY	(MATSUSHITA AG2024)
RY-8 :	PRESS IN AUTO RELAY	(OMRON MY-2 DC24V *)

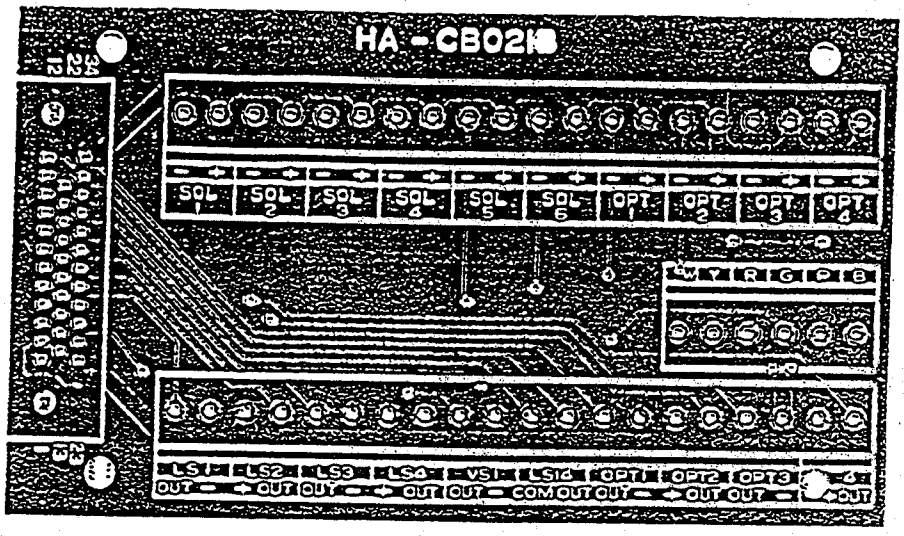
CON1 : I/O CABLE CONNECTOR FOR PM911C BOARD
CON2 : I/O CABLE CONNECTOR FOR ROBOT
CON3 : I/O CABLE CONNECTOR FOR EXTERNAL SWITCHES
CON4 : CONNECTOR FOR INTERFACE CABLE FOR PRESS
CON5 : I/O CABLE CONNECTOR FOR ADDITIONAL BOARD PCB-E006A

* Depends on the voltage of signal



J. PCB, HA-CB021B

Cables for solenoid valves and switches are connected to the PCB HA-CB021B. This PCB is located under the solenoid valves on main body of EX series robot.



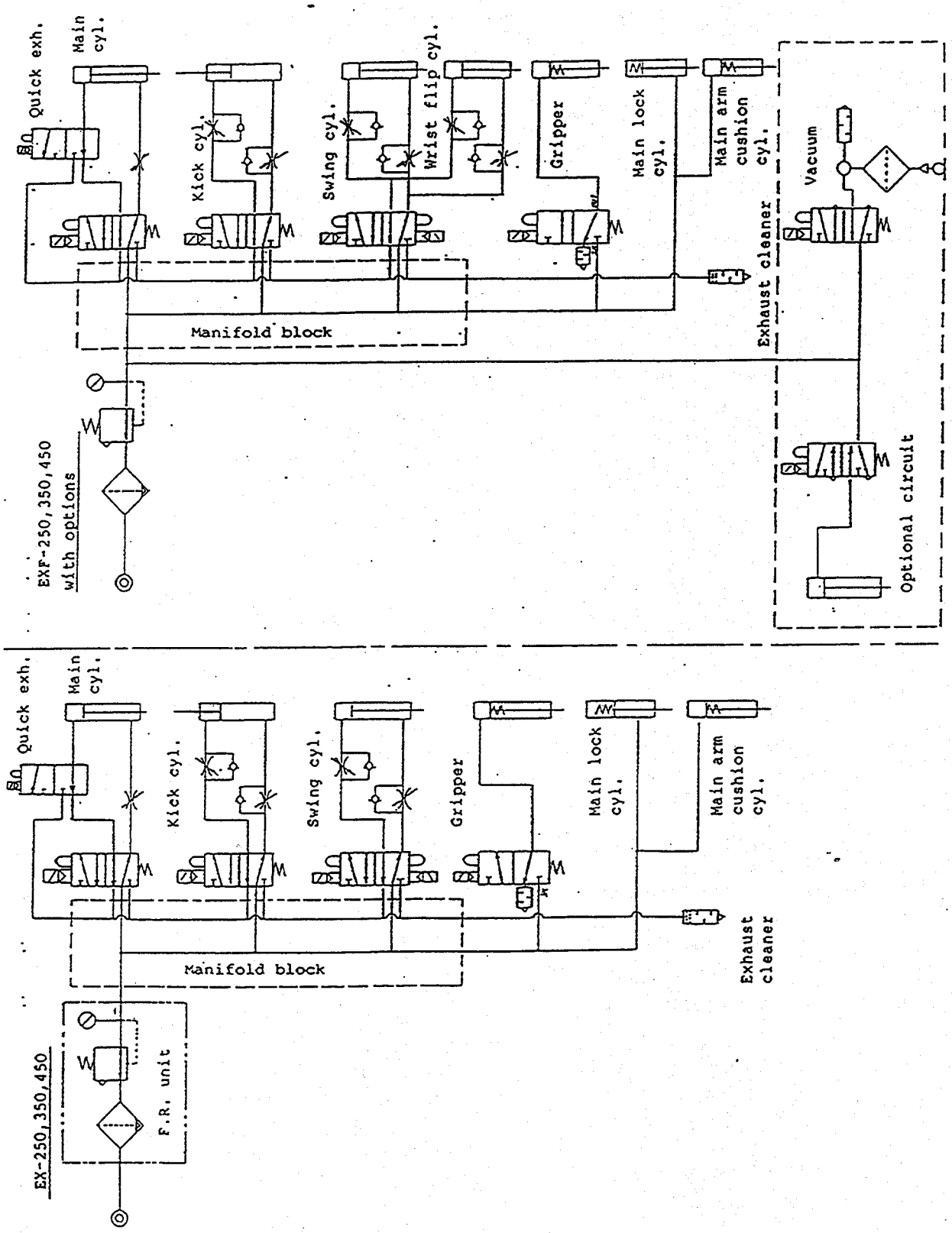
Assignment for each LS and SOL. is as follows;

SOL 1 ... Swing ourward solenoid valve
SOL 2 ... Swing inward solenoid valve
SOL 3 ... Main arm cylinder solenoid valve
SOL 4 ... Kick cylinder solenoid valve
SOL 5 ... Main arm grip solenoid valve
SOL 6 ... Vacuum solenoid valve
*SOL OPT1. Sub arm cylinder solenoid valve
*SOL OPT2. Sub arm grip solenoid valve
OPT 3 to 4 ...Optional output

LS 1 ... Swing outward end proximity switch
LS 2 ... Swing inward end proximity switch
LS 3 ... Main arm upward end proximity switch
LS 7 ... Sub arm upward end proximity switch
LS 4 ... Part verification, Main arm
*LS 5 ... Part verification, Sub arm
LS 14 ... Aux. part verification switch
VS 1 ... Vacuum differencial switch
OPT 1 to 4 ... Optional input

* Applied for EXE-60,150G

J. AIR SCHEMATIC



K. MAINTENANCE MANUAL

The maintenance manual describes the items to be inspected periodically by the customer. Follow the instructions in the maintenance manual for best results, to ensure long service life.

The maintenance manual includes (I.) Inspection items common to all models, and (II.) Inspection items for particular models.

Check all the inspection items in (I.) and depending on your model, check the appropriate inspection items in (II.) at the specified intervals.

This manual assumes that the Harmo's standard robots are operated under normal conditions.

Note that the inspection items for nonstandard models differ from those for standard models. Nonstandard models should be inspected accordingly, referring to the inspection items described in this manual.

Inspection procedures and intervals should be determined by the customer, depending on the operating conditions and the results of daily checks, because load applied to each part of the robots varies widely with operating conditions.

The followings are the major operating conditions regarding which extreme care must be taken.

1. Environmental conditions : Dust and moisture

2. Molded part specifications : Material (Emission of gas), weight and shape.

3. Molding cycle : If the molding cycle is short, check the inspection items frequently.

4. Continuous operation period

5. Removal of molded parts (Are molded parts easily removed from the molds ?)

When operating the robot, for example, moving an air cylinder for inspection, or when inspecting the robot with power supplied, extreme care must be taken to avoid an accident.

I. INSPECTION SCHEDULES COMMONLY APPLIED TO ALL MODELS

Inspection Schedule

	Daily	Every 3 days	Every 10 days	Monthly
A. Mechanical parts				
1. F-R unit a. Regulated air pressure, amount of drain	Before operation and every two hours during operation			
b. Filter - check for cleanliness				*
2. Screws and nuts - check for looseness a. Stoppers and adjusting for air cylinder strokes		*		
b. Screws and nuts in other sections			*	
c. Robot mounting screw			*	
3. Air leakage		*		
4. Bent or damaged hose	Before and after operation			
5. Quick fittings and speed controllers	*			
6. Air solenoid valve - check for operation by pushing the manual push pin				*
7. Shock absorbers and cushion	*			
8. Air pressure adjusted by the pressure regulators for optional circuit	*			

	Daily	Every 3 days	Every 10 days	Monthly
B. Electrical parts				
1. Loose, damaged wires and wires which are pulled by robot movement		*		
2. Faulty limit switches wires		*		
3. Loose or faulty relays or timers				*
4. Limit & prox. switch	Before operation			
5. Interlocking function	Before operation			
C. External equipment				
1. Compressor - check for discharge pressure and drain	Before and after operation			
2. Dryer	*			
D. Others				
1. Abnormal noise or operation	*			

(Common applied to all models)

Note : For details, refer to the description on the following pages.

To obtain the best results from the robot, the robot and control box should be periodically checked and compressed air should be kept free of moisture or foreign matter.

Wet or contaminated air adversely affects the air solenoid valves, hoses and air cylinders, shortening their service life.

For operation at a place with high temperature and humidity, a dryer should be provided.

A. Mechanical parts

1. F.R. unit

a. Check that the air pressure adjusted by the filter regulator is at an appropriate level before operation, and every two hours during operation.

EX series robot ------ 5 kg/cm^2

b. Check that the excessive drainage is accumulating in the bowl of the filter regulator before operation and every two hours during operation.
The Harmo robot is equipped with a floating type auto drain unit.

c. Check the cleanliness of the filter every month. If the compressed air is contaminated, the filter is easily stained and clogged. If this happens, remove the filter cover, then clean the filter or replace it with a new one.

2. Screws and Nuts

a. Securely tighten the screws and nuts such as the stoppers for each cylinder where force is directly applied, every three days.

b. Securely tighten the screws and nuts which are subject to vibration, every 10 days.

c. Check the robot mounting screws for looseness every 10 days.

3. Check for air leakage every three days

Operate air cylinders and check that there is no hissing noise caused by air leakage from the cylinders. Check for air leakage by applying turbine oil to any suspected part of the air cylinder.

4. Check for bent or damaged hoses before and after operation

If a bent or damaged hose is found, replace it with a new one to ensure correct air flow through the hose.

5. Check that the hoses are sucurely connected to the quick fittings and speed controllers, and that the needles of the speed controllers are securely locked by the lock nuts, every 10 days.

6. Stop robot operation, turn the power OFF. Check that the air solenoid valves operate correctly, supplying compressed air to the cylinders by pushing the manual push pins of each solenoid valve, every month.

7. Check that the shock absorbers and cushion rubbers are not damaged due to long use, every month.

B. Electric parts

1. Check for loose, damaged wires and wires which are pulled by robot movement, every 10 days.

   A wire which is pulled by robot movement or whose insulation is damaged may cause broken circuits or shortcircuiting.

2. Limit switches, aux. switches should be checked for damage every three days.

   The robot cannot operate correctly if one limit switch malfunctions. Extreme care should be taken to ensure that molded part verification switches LS-4,LS-5 and VS -1 in the beam type robot and LS-4 in swing type robot and main arm upward end limit switches LS-3 and LS-7 operate correctly.

3. Open the front panel of the control box, then check that the relays, timers and a PCB are securely connected and that they are free from water, oil and foreign matter, every month.

4. Press the actuators or levers of the limit switches by hand, and check that they turn on and off correctly, with the clicking sound. Also check that the relays in the control box are energized before operation.

5. In the following manneer, check that the interlocking functions operate correctly before operation.

Signals between the injection machine and the robot

The robot issues the following signals in order to protect the mold and the robot.

Mold close safety interlock

This signal is issued to prevent the robot from being damaged by closing the molds when the main arm of the robot is in the mold area.

Mold open safety interlock

This signal is issued to avoid the mold opening when the main arm of the robot is not home position.

Cycle start signal

In addition to the mold open/close safety interlock, robot issues the cycle start signal in order to ensure the security. This signal is issued as the order signal for the mold closing when the mode selector switch of the robot is set to auto.

Ejector forward signal

This signal is equipped in order to make it easy to take out the parts, and it is issued when the timer can be adjusted optionary is up.

Procedure for checking the function of signals up

It is available for making the function of signals sure to try the following procedure.

Mold close interlocking function

a. Start the injection machine and open the molds.

b. If the cable which sends the signals from the injection machine to the robot control box can be disconnected, disconnect it. Turn on the mold close switch in manual mode and check that the molds do not move at all and abnormal sound does not occur.

c. If the cable cannot be disconnected, turn off the injection machine.

d. Discharge the air from the robot. Extend the main arm cylinder until it is stopped by the stopper where the actuator is away from the main arm upward end switch and the main arm grip will not interfere with the molds or mold plates even when they start closing.

e. Restart the injection machine. Turn on the mold close switch in the manual mode and check that the molds do not move at all. If the molds move, even slightly, check the cable for a connection error.

Mold open interlocking function

a. Start the injection machine and close the molds completely. The molds cannot be closed unless the main arm upward end switch detects that the main arm is at the upward end.

b. If the cable which sends the signals from the injection machine to the robot control box can be disconnected, disconnect it. Turn the mold open switch in the manual mode, and check that the molds do not open at all and abnormal sound does not occur.

c. If the cable cannot be disconnected, turn off the injection machine.

d. Discharge the air from the robot. Extend the main arm cylinder until it is stopped by the stopper where the actuator is away from the main arm upward end switch and the main arm grip will not interfere with the molds or mold plates even when they start opening.

e. Restart the injection machine. Turn on the mold open switch in the manual mode, then check that the molds do not move at all. If the molds move, even slightly, check the cable for a connection error.

Cycle start

a. Turn the key on the controller on, and operate the injection machine in manual mode.

b. After a cycle of the injection machine,(mold closing, injection, mold opening, ejecting,) then check the molds do not move at all. If the molds move, even slightly, check the cable for a connection error.

c. Start the robot in auto mode, after taking out the parts, then check the molds start to close. If the molds do not start to close, check the cable for a connection error.

6. Controller, PC-EIID

a. Check that the emergency stop function operates correctly, every day.

b. Check that the keyswitch operate correctly, every 10 days.

c. Check that the LEDs go on and off correctly, every day.

The mechanical lives of limit switches, micro switches and relays are as follows ;

* Micro switch (aux. switch)	:	100,000 closures
* Limit switches	:	300,000 closures
* Relays	:	300,000 closures

If one robot operation takes only 20 seconds, the switches should operate three times a minute, and 1.08 million times a year on the assumption that the robot operates 20 hours a day and 300 days a year. This reasonably causes some switches to malfunction within a year after the initial installation.

C. External Equipment

1. Check that the compressor discharges air with appropriate pressure, and discharge drainage from the compressor before and after operation.

2. Dryer

Check that the dryer sufficiently dehumidifies the air discharged from the compressor.

* To ensure long service life for air cylinders, extreme care should be taken to remove moisture and foreign matter from the compressed air supplied to the cylinders.

II. Inspection schedule for the Model EX series

	Daily	Every 3 days	Every 10 days	Monthly
1. Gripper				*
2. Return springs for gripper	Before operation			
3. Wedge and wedge spring in gripper				*
4. Screws securing gripper - check for looseness			*	
5. Main & sub arm safety lock cylinders - check for operation	Before and after operation			
6. Screws securing the E.O.A.T. - check for looseness		*		
7. Components on E.O.A.T - check for damage	*			
8. Air nippers - check for sharpness	Every hour			
9. Suction pad - check for damage		*		
10. Fittings - check for damage			*	
14. Exhaust cleaner - discharge drain and clean the oil container	As required			

Inspection procedures

1. Check that the E.O.A.T. is securely attached to the E.O.A.T. mounting plate and that the components such as mini cylinder grippers and suction pads on the end of arm tooling operate correctly.

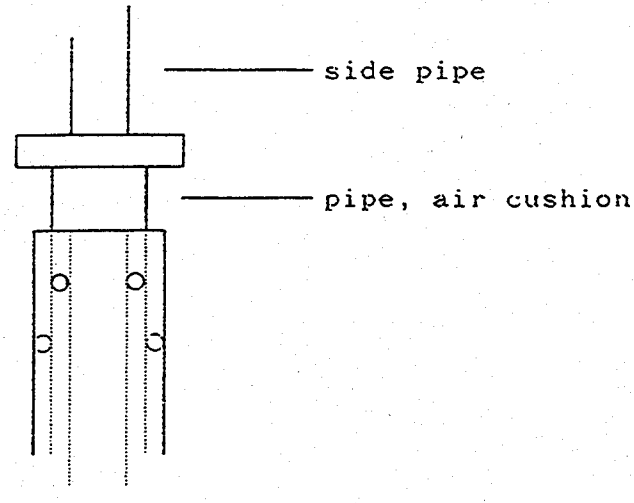
2. Check sharpness of the air nippers, sharpen the blades if necessary.

3. Check that the main arm cylinder is supported by the main arm lock cylinder when compressed air is not supplied to the robot. Also check that the lock cylinder rod retracts when compressed air is supplied to the robot. Discharge the air from the robot after operation and check that the main arm cylinder is supported by the cylinder.

   When checking that the main arm cylinder is supported by the cylinder, stop the compressor or air supply to the robot, bacause the compressed air discharged from the compressor is directly supplied to the lock cylinder. Air supplid to the cylinder is not relieved by adjusting the filter regulator in the F-R-L unit, keeping the lock cylinder diengaged from the main arm cylinder.

4. Apply lithium soap grease No. 2 to the kick mechanism on the EX series.

5. Apply designated oil to the side pipe and the air cushion shown as below to prevent the seals inside the air cushion from being worn out.



K. EXPLODED VIWS

DESCRIPTION

1. BASE, SWING, SUPPORT PARTS
2. VALVE PARTS
3. KICK FRAME PARTS 1
4. MAIN CYL.PARTS
5. MAIN ARM PARTS
6. WRIST UNIT PARTS
7. GRIPPER MOUNT PARTS
8. WRIST CYL. PARTS
9. GRIPPER PARTS
10. EX SRS.OPTION
11. LABELS

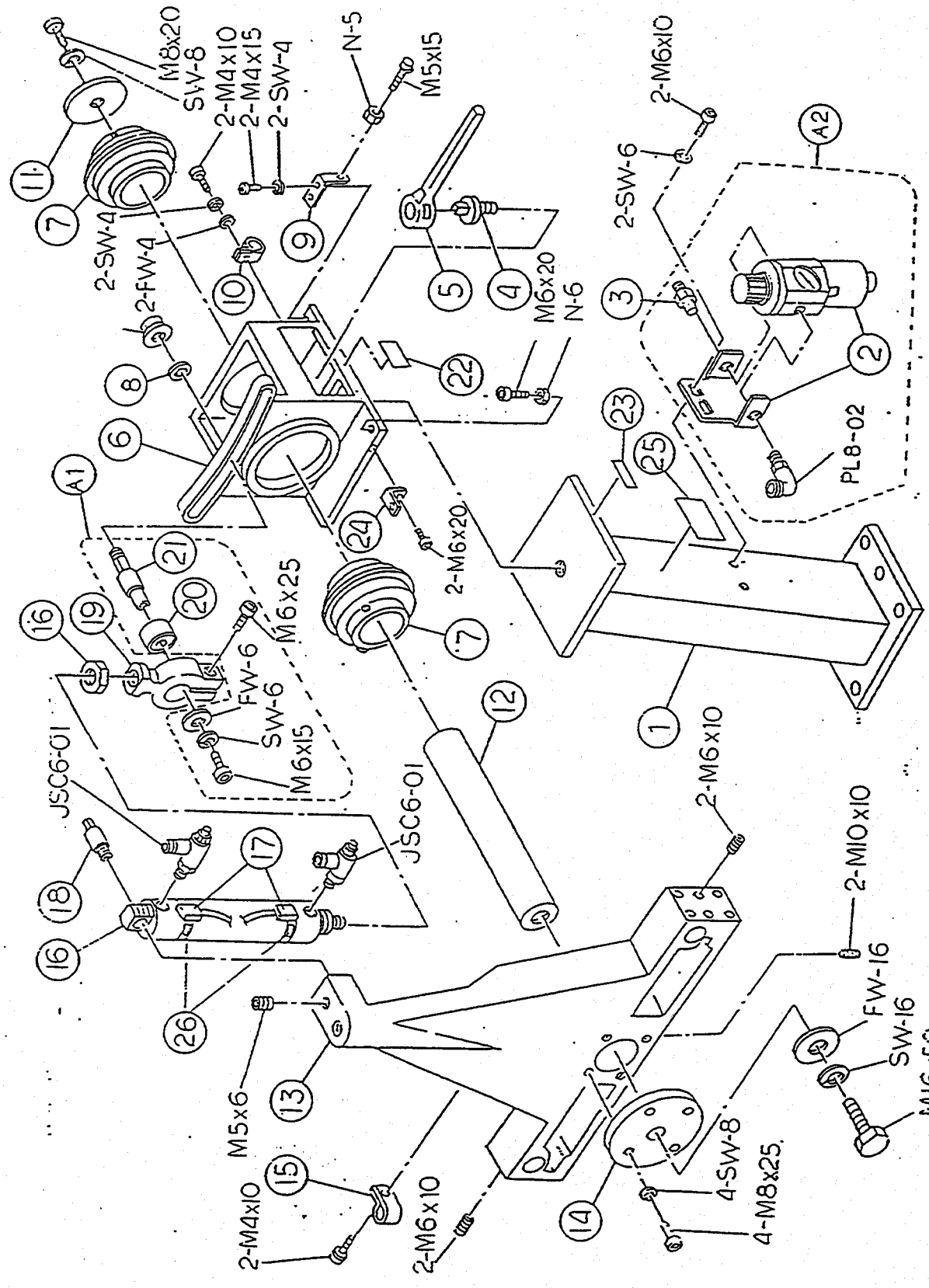
Note :

when you place order spare parts, state clearly Part Number, robot Model and Quantity as shown below.

Example :

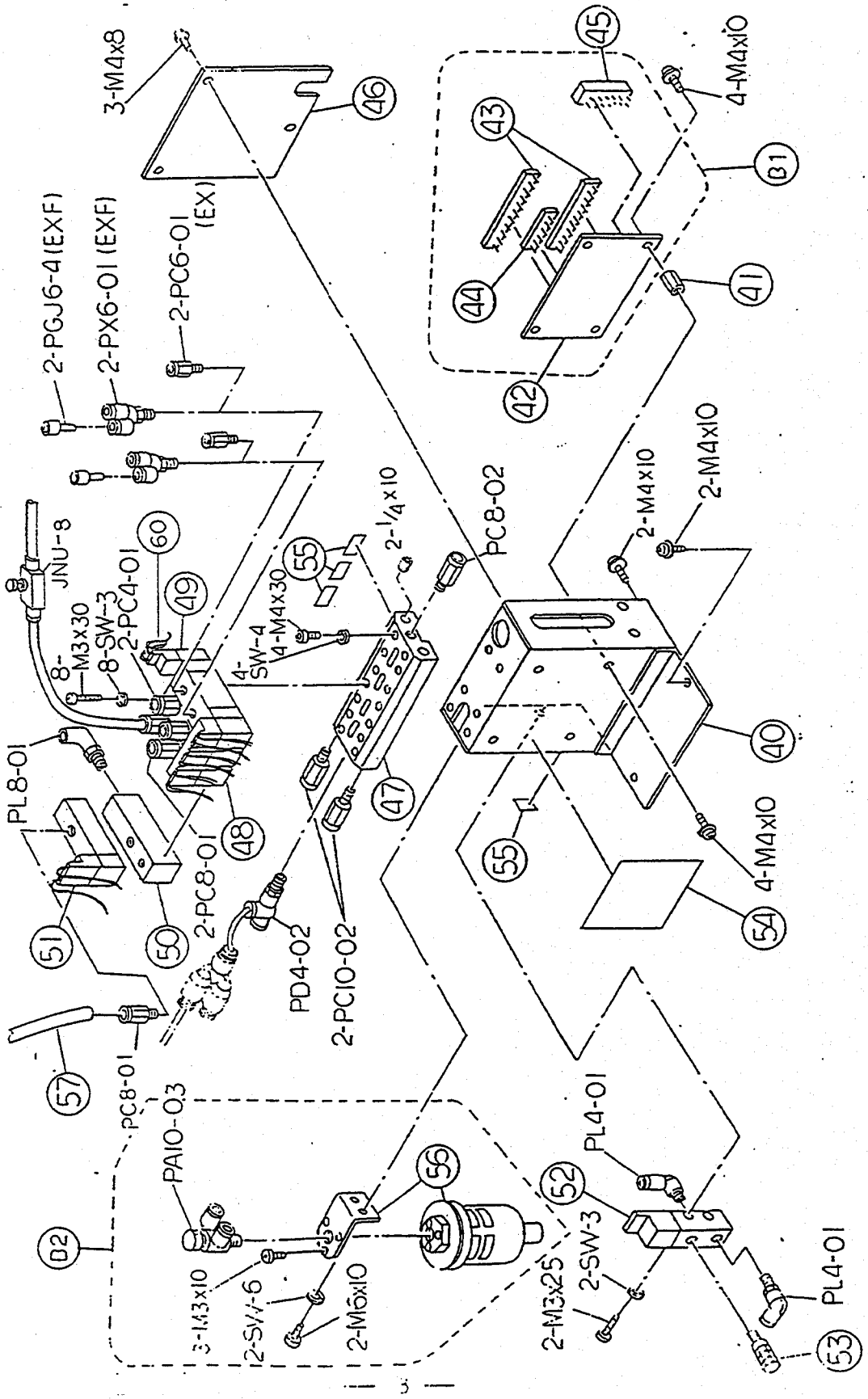
Model	Part No .	Quantity
EX-60 G	# 9	1 pcs .
	# 33	1 pcs .
EXF-150 G	# 550	1 pcs .
	JSC4-M5	3 pcs .
	Nylon tube 6mm dia.	5 m

1. BASE, SWING PARTS

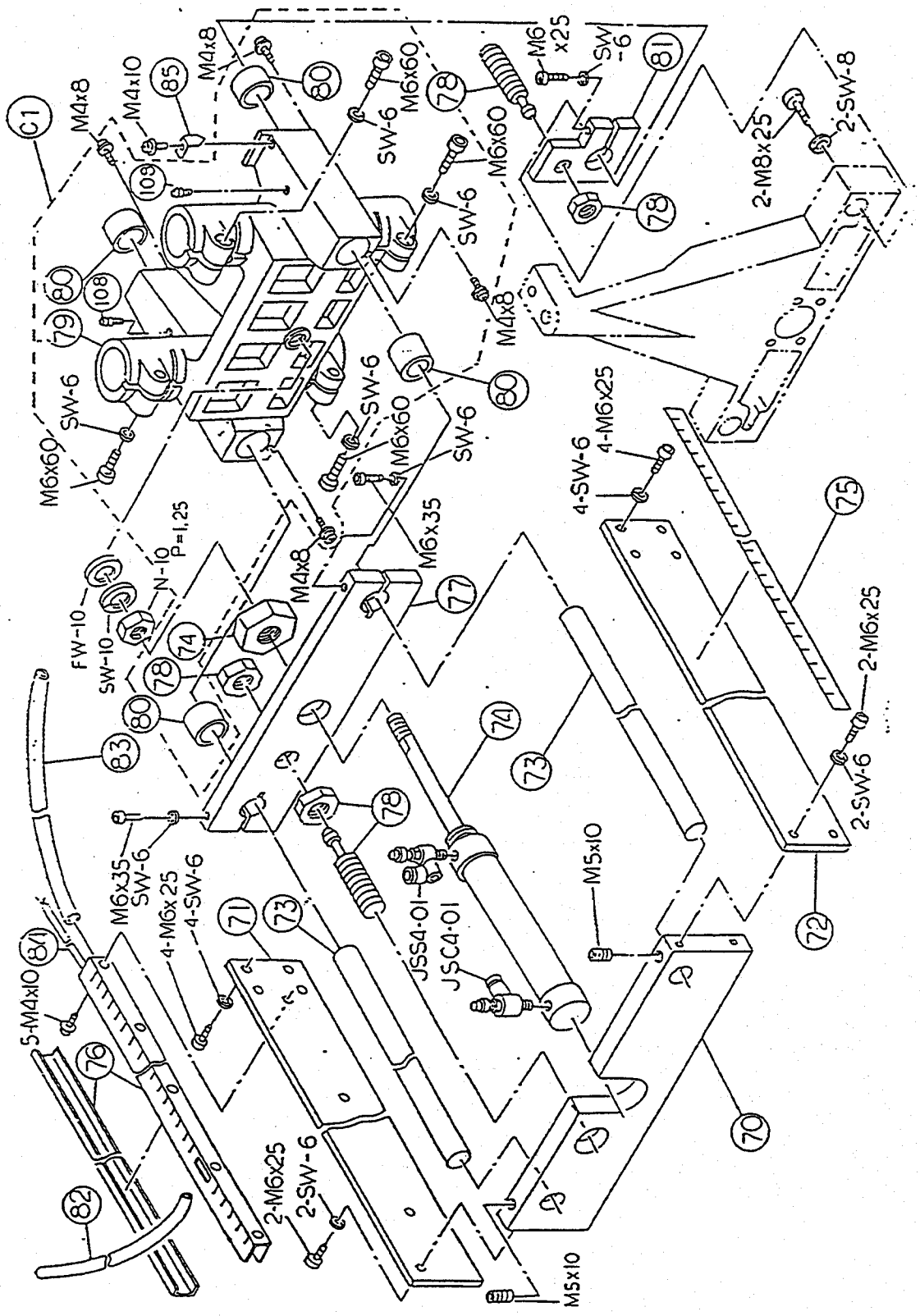


1. BASE, SWING PARTS

2. VALVE PARTS

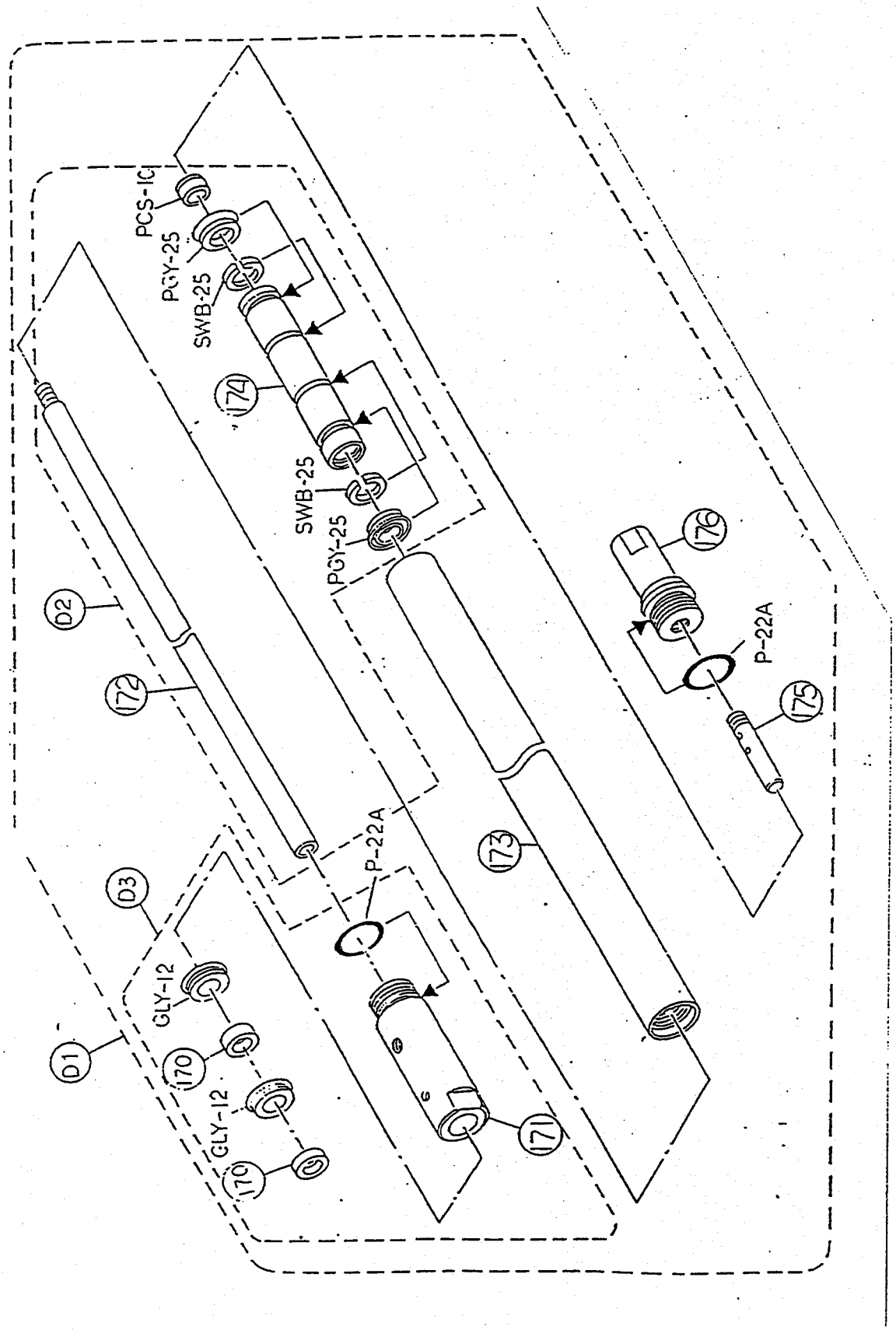


3. KICK FRAME PARTS

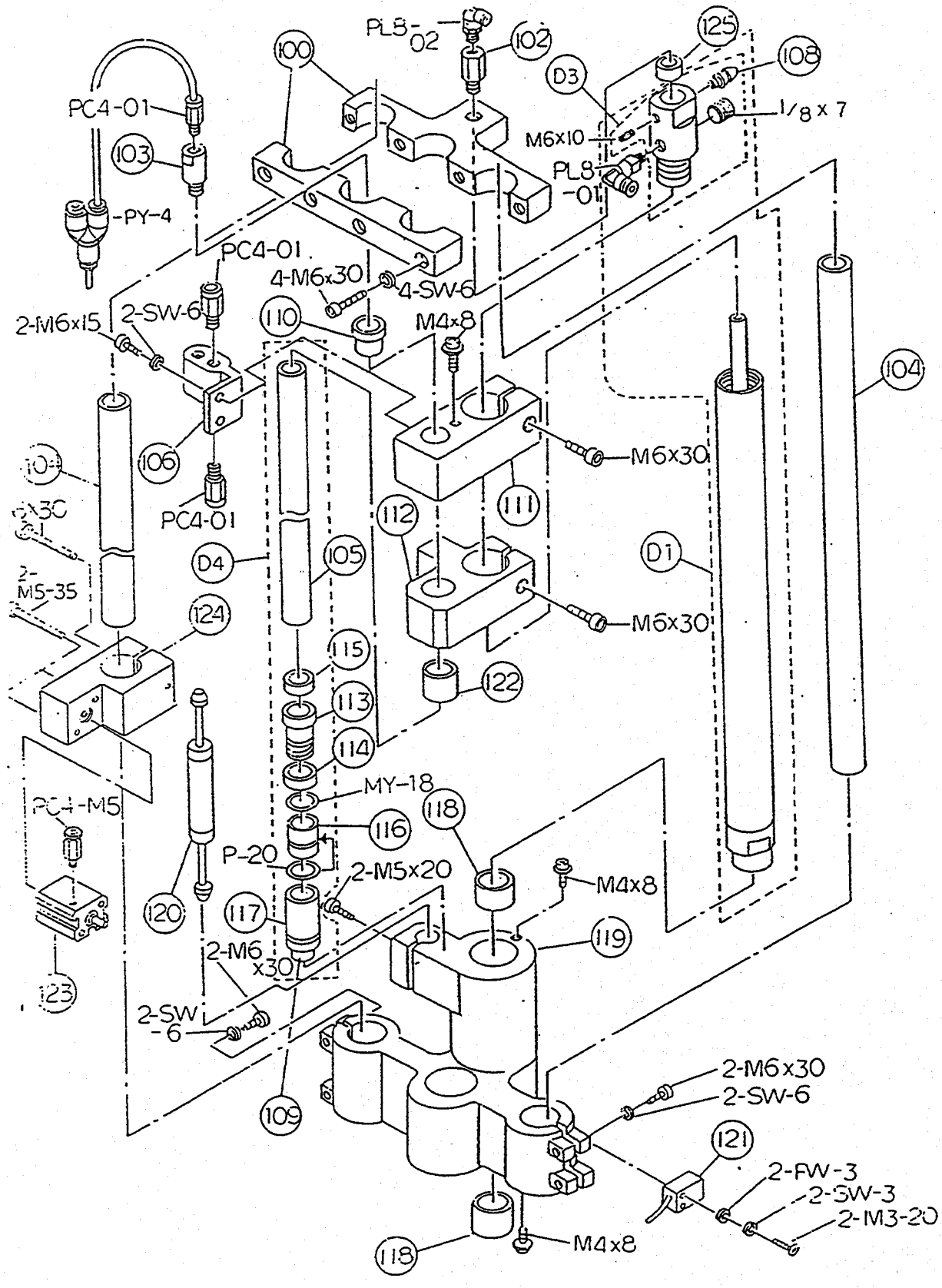


3. KICK FRAME PARTS

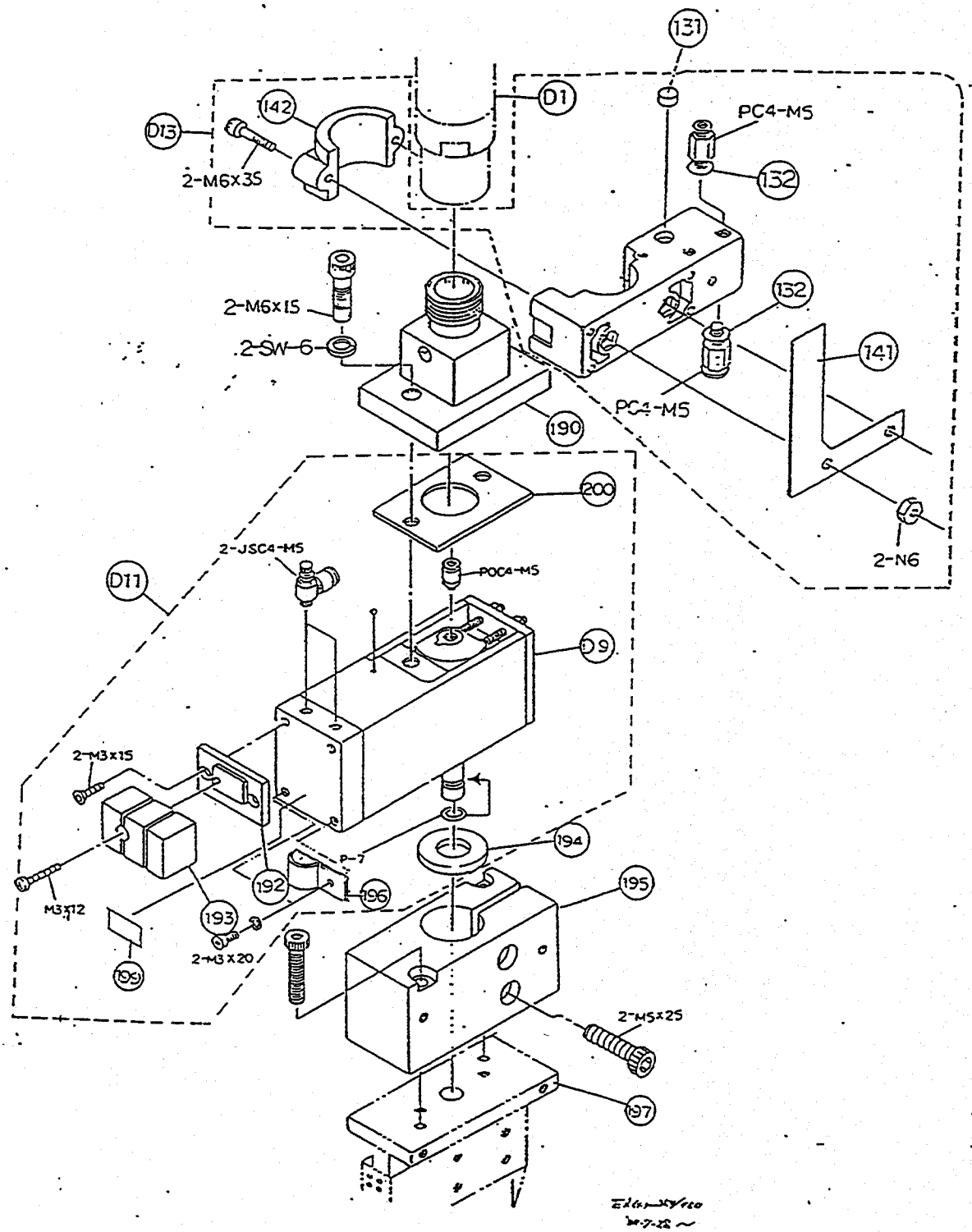
4. MAIN CYL. PARTS.



5. MAIN ARM·PARTS

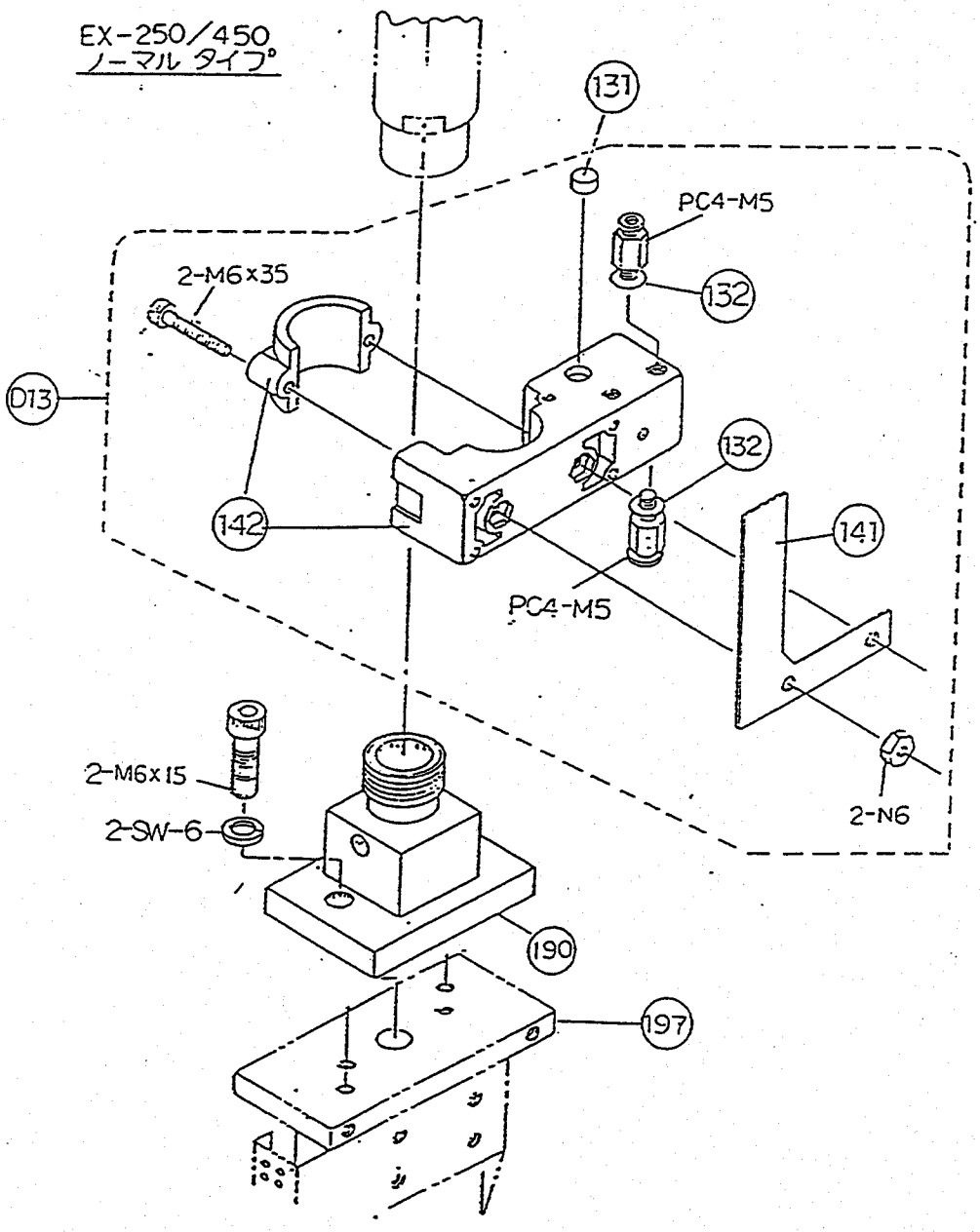


6. WRIST UNIT PARTS



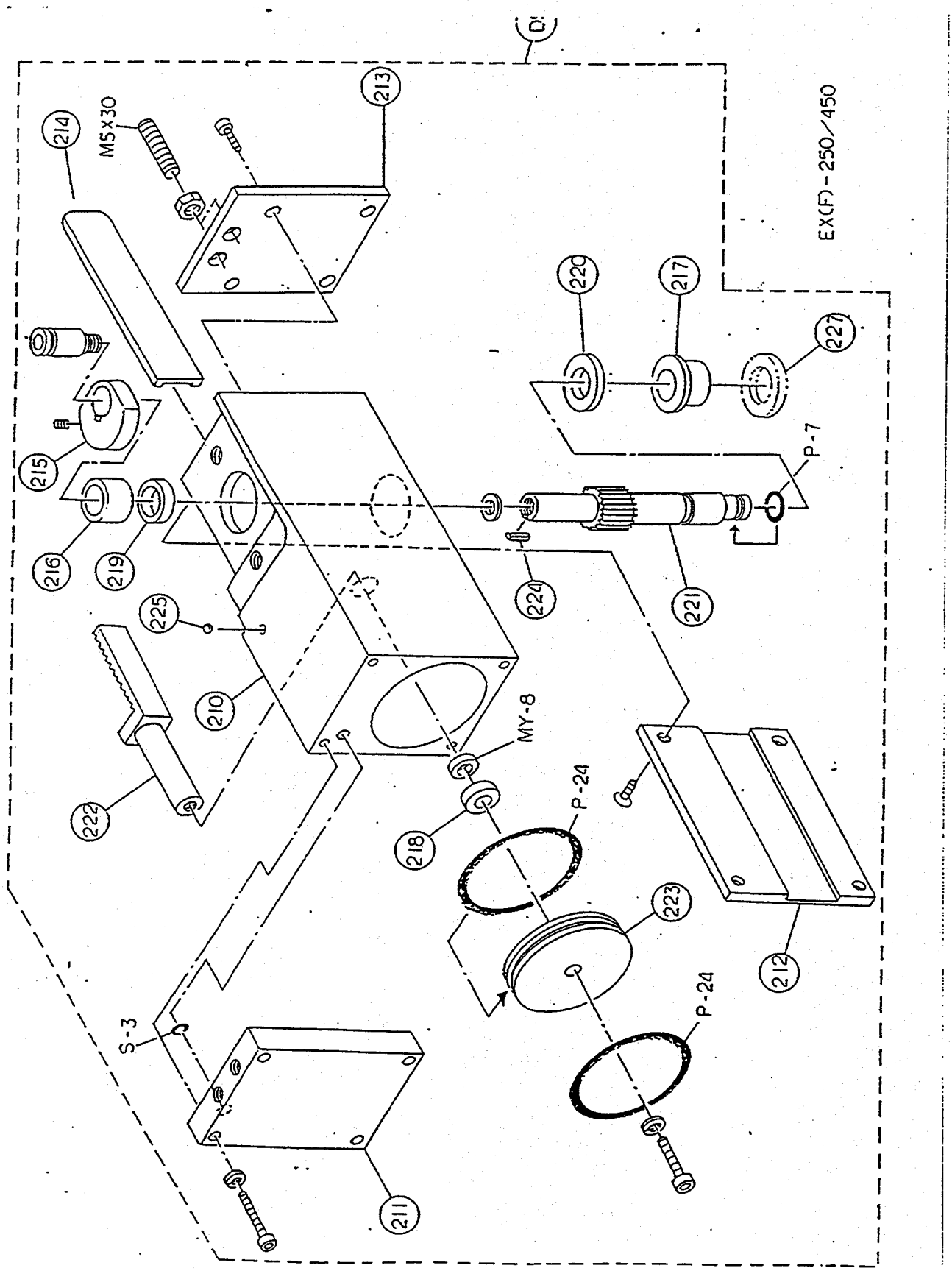
6. WRIST UNIT PARTS

7. GRIPPER MOUNT

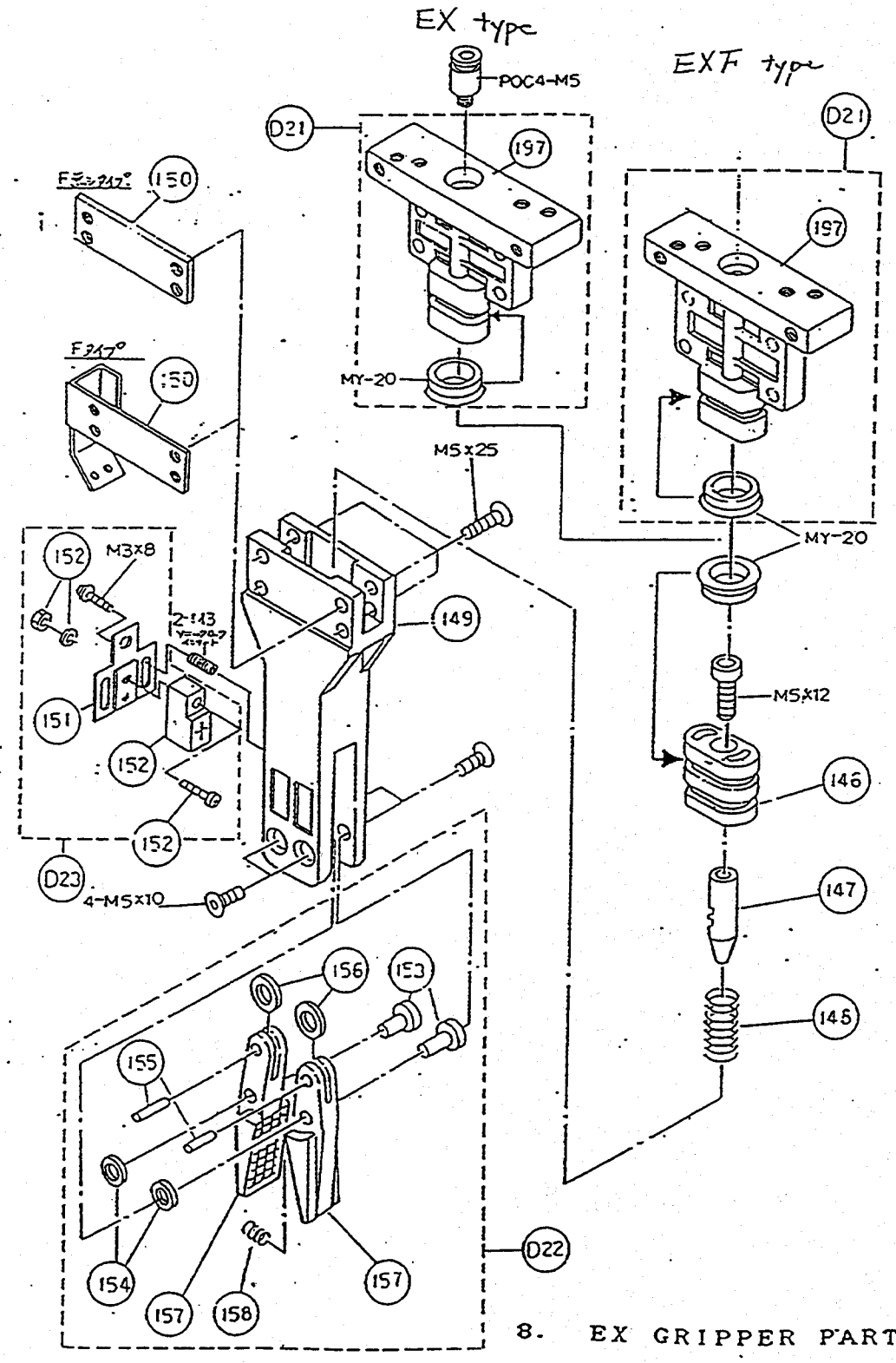


7. MAIN ARM END PARTS

8. WRIST CYL.PARTS

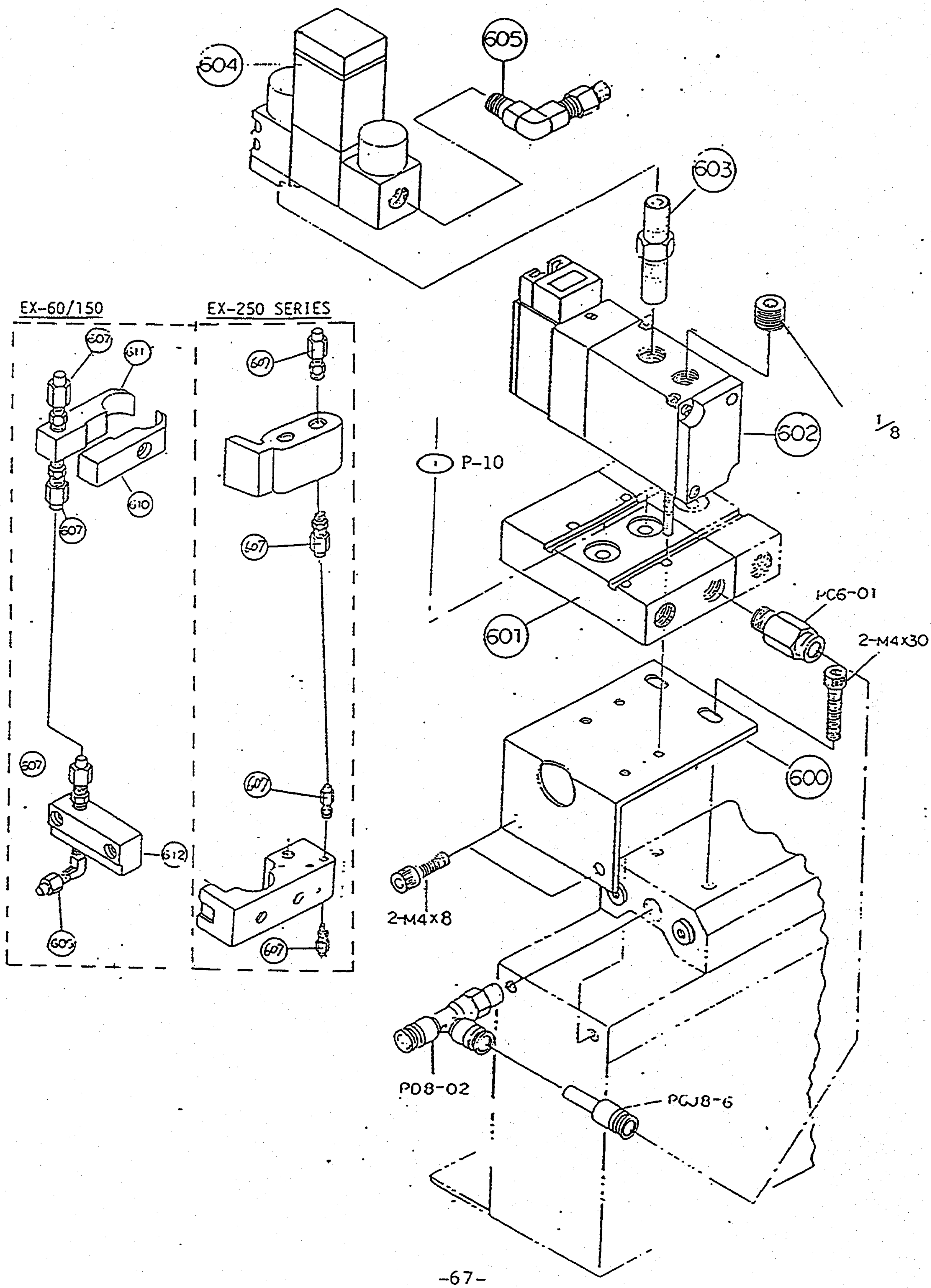


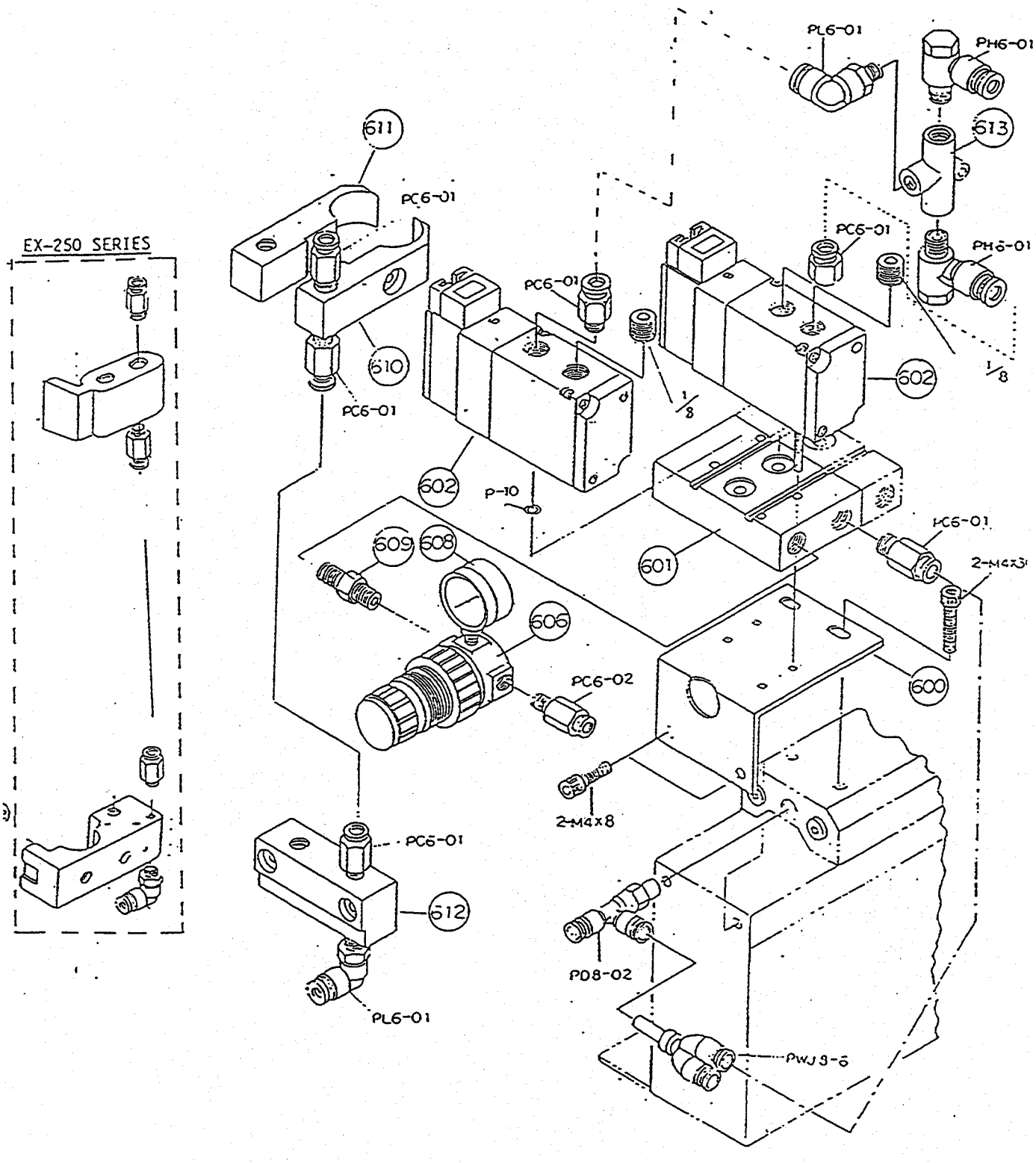
9. GRIPPER PARTS

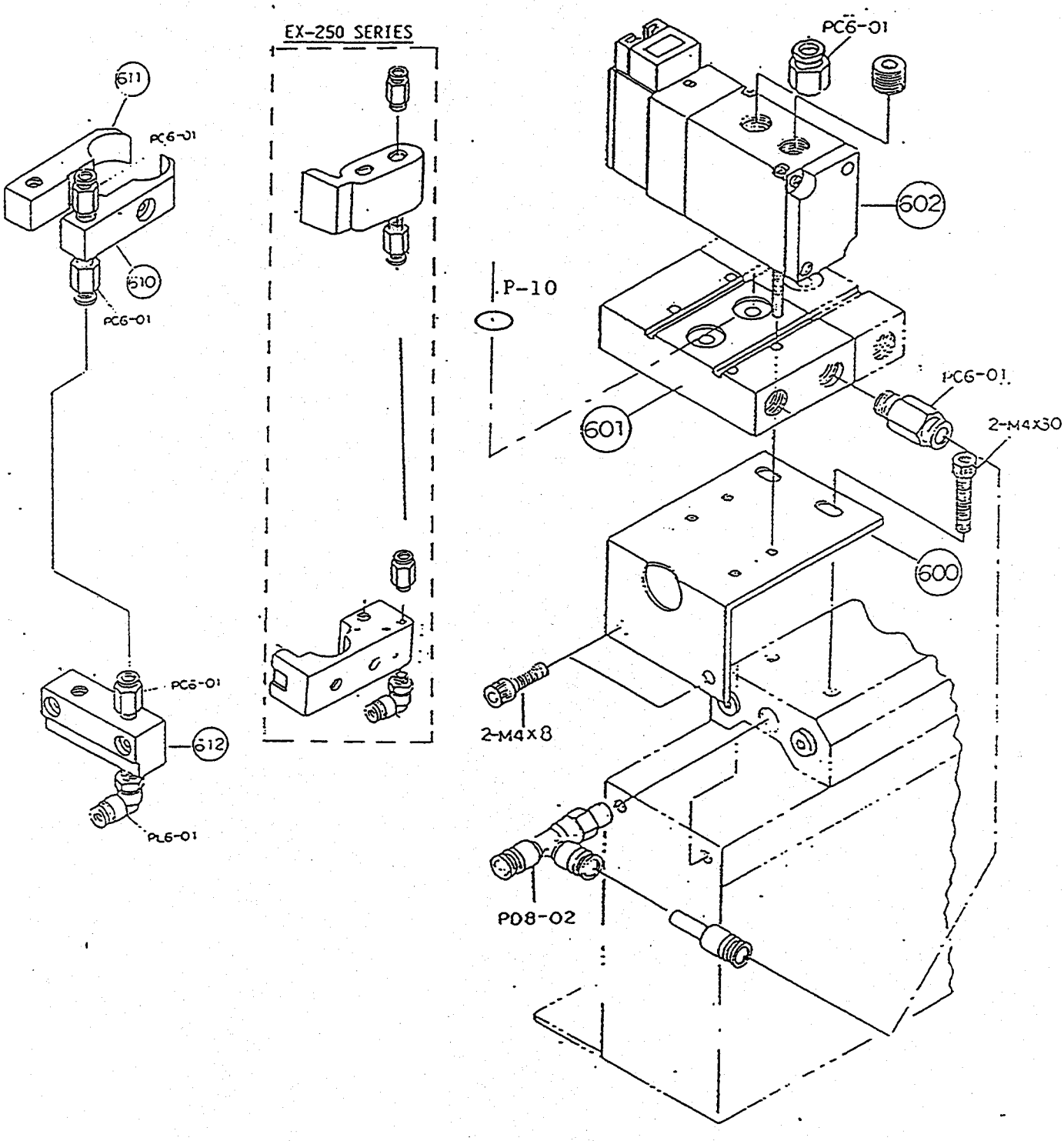


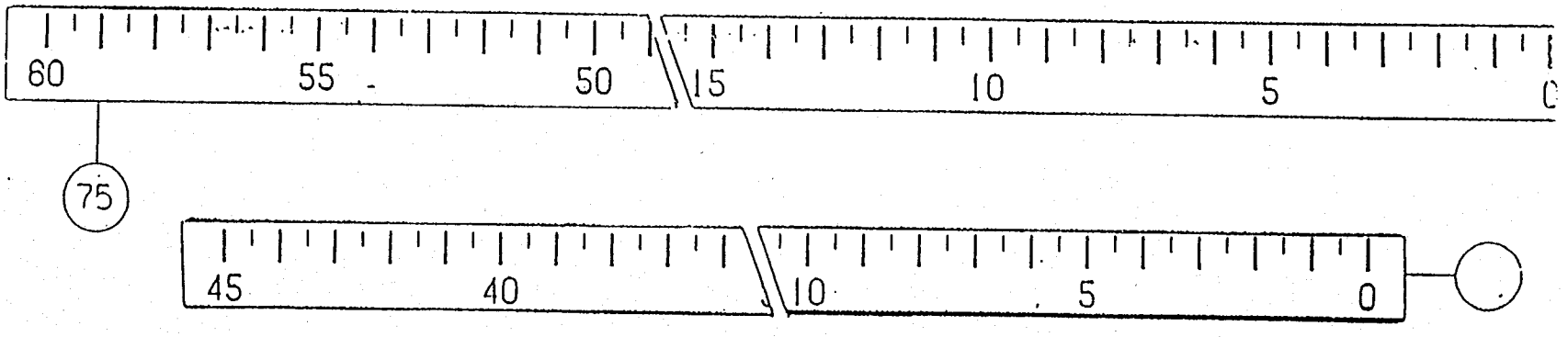
8. EX GRIPPER PARTS

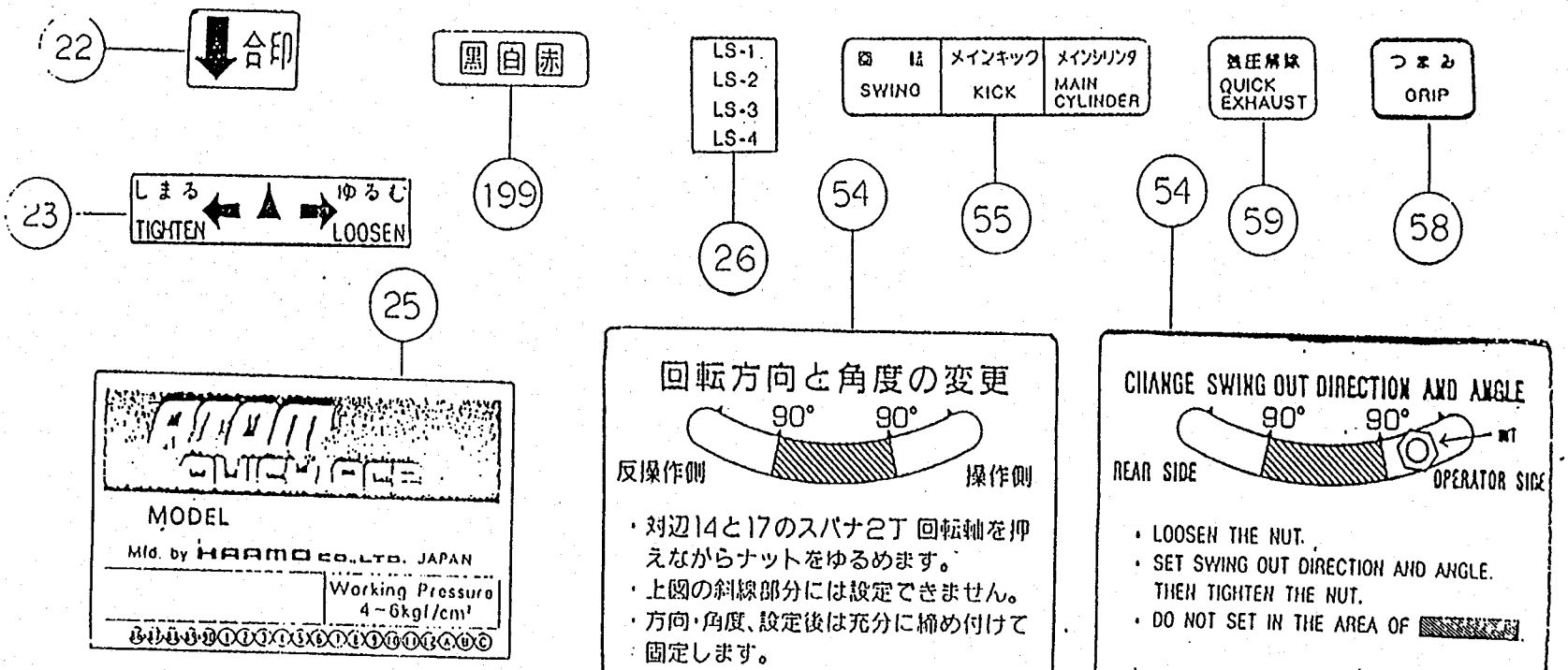
OPTION AIR CIRCUIT, EX SERIES VACUUM EJECTOR




EX-250 SERIES
PL6-01
PH6-01
613
611
PC6-01
PC6-01
PC6-01
PH6-01
610
PC6-01
1/8
602
602
P-10
PC6-01
609
608
601
2-M4x3
606
PC6-02
600
2-M4x8
PC6-01
612
PD8-02
PL6-01
PWJ3-6


EX-250 SERIES
611
PC6-01
610
PC6-01
PC6-01
612
PL6-01
PC6-01
602
P-10
601
PC6-01
2-M4x30
600
2-M4x8
P08-02


60
55
50
15
10
5
0
75
45
40
10
5
0


22
合印
黒白赤
199
LS-1
LS-2
LS-3
LS-4
26
SWING
メインキック
KICK
メインシリンダ
MAIN CYLINDER
55
54
圧抜弁
QUICK EXHAUST
59
つまみ
GRIP
58
54
23
しまる
TIGHTEN
ゆるむ
LOOSEN
25
MODEL
Mfd. by HARMO CO.,LTD. JAPAN
Working Pressure
4~6kgf/cm²
回転方向と角度の変更
90°
90°
反操作側
操作側
・対辺14と17のスパナ2丁 回転軸を押えながらナットをゆるめます。
・上図の斜線部分には設定できません。
・方向・角度、設定後は充分に締め付けて固定します。
CHANGE SWING OUT DIRECTION AND ANGLE
90°
90°
NUT
REAR SIDE
OPERATOR SIDE
• LOOSEN THE NUT.
• SET SWING OUT DIRECTION AND ANGLE. THEN TIGHTEN THE NUT.
• DO NOT SET IN THE AREA OF

9. LABELS