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USERGUIDE

MNL-00011

PC-II Programmable Controller

⚠ **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This manual is out-of-date and is provided only for its technical information, data and capacities.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containing warnings, information, precautions, and procedures that may be more adequate than those contained in this out-of-date manual.

Contents

1. Introduction

The HARMO programmable controller PC-II (hereafter referred to as PC-II), equipped with a sequencer PM-912C manufactured by Mitsubishi Electric Corporation, controls a robot.

The PC-II includes a battery for RAMs which may be used for maintenance of the program although the program stored in EPROMs lasts without a battery backup in a power failure.

Since the input and output circuits operate at a voltage of 24 V DC, extreme care must be taken to prevent high voltages such as 200 V AC from being applied to the circuits when modifying them. If a high voltage is applied to the input or output circuits, the PC-II or proximity switches may be damaged. In motor-traverse-type robots, the motor circuits operate at voltages of 100 or 200 V AC.

2. Operation mode

The PC-II has three operation modes, AUTO, MAN. and OFF which are selected with the ROBOT mode selector switch (SW-1).

Automatic operation (AUTO)

a. Start automatic operation

Follow the steps below to start automatic operation.

- Move the robot to the home position so that the HOME POSITION indication lamp (PL-2) lights.
- Close the mold, then start the injection machine in the automatic or semi-automatic mode.
- Set the ROBOT mode selector switch (SW-1) to AUTO.
- Press the AUTO START button (SW-2).

b. Operation when a pickup failure occurs

If a molded part is not removed correctly from the mold in the automatic operation, i.e., a pickup verification switch does not detect a molded part, the buzzer sounds to alert the operator. If this happens, follow the steps given below to resume automatic operation.

- Check that no molded part, runner or sprue remains on the mold.
- Press the RESET (SW-3) button.

c. Stop automatic operation

Follow the steps given below to stop automatic operation.

- Move the robot to a specified position (home position as a rule) where the robot is to be stopped, then set the ROBOT mode selector switch (SW-1) to MAN.

Manual operation (MAN.)

The robot can be operated using the MANUAL OPERATION switches whenever the ROBOT mode selector switch is set to MAN. and the mold open completion signal is on. When the robot is not used, set the ROBOT mode selector switch (SW-1) to OFF to avoid accidents caused by inadvertent manual operation. However, if the ROBOT mode selector switch (SW-1) is set to OFF, the injection machine cycle start signal is kept on. Therefore, the injection machine operation should be arranged so that a molded part is removed from the mold by the ejector when the injection machine is in automatic operation; or, the injection machine should be in semi-automatic operation. Numerous signals are issued from the robot to the injection machine. When the ROBOT mode selector switch (SW-1) is set to MAN., the ejector signal is kept on, and the injection machine cycle start signal is kept off, keeping the mold close and open safety interlock signals on unless the cylinder descends toward the mold.

When the robot is not used (Robot OFF)

When the ROBOT mode selector switch (SW-1) is set to OFF, the robot cannot operate in either the automatic or manual mode. The ejector signal and injection machine cycle start signal are kept on, keeping the mold close and open safety interlock signals on unless the cylinder descends toward the mold. Set the ROBOT mode selector switch (SW-1) to OFF when removing a molded part from the mold by the injection machine ejector or by the operator while operating the injection machine in the semi-automatic mode.

3. Control panel

The control panel has the switches, pushbuttons and indication lamps which are used for automatic and manual operations. For switches and pushbuttons used for manual operation, refer to 4. "Manual operation and relevant switches and buttons".

a. AUTO (Automatic operation) indication lamp (PL-1)
The AUTO indication lamp stays on while the robot is operating in the automatic mode.

b. HOME POSITION indication lamp (PL-2)
The HOME POSITION indication lamp lights when the robot is in the home position. Although the home position varies according to the program, normally the lamp lights when the following conditions are satisfied.

- Traverse inward end limit switch LS-2: ON
- Wrist flip vertical limit switch LS-8: ON
- Arm upward end limit switches LS-3 and LS-7: ON
- Main arm part verification switches (X1F): OFF
- Kick backward end limit switch LS-6: ON
- Traverse outward end limit switch LS-1: OFF
- Wrist flip horizontal limit switch LS-10: OFF
- Arm downward end limit switch LS-11: OFF

If the HOME POSITION indication lamp (PL-2) is off, the robot cannot be started by pressing the AUTO START button. Move the robot manually to the specified position so that the HOME POSITION lamp lights, referring to the input signal table.

c. MOLD OPEN COMPLETE indication lamp (PL-3)
The MOLD OPEN COMPLETE indication lamp (PL-3) lights while the mold open completion signal is on.

d. SAFETY INTERLOCK indication lamp (PL-4)

The SAFETY INTERLOCK indication lamp (PL-4) shows the condition of the injection machine mold open and mold close interlock signals. While the injection machine mold can be opened or closed at any time when the SAFETY INTERLOCK indication lamp (PL-4) is on, it cannot if the lamp is off. Since the mold open and mold close SAFETY INTERLOCK signals issued from the PC-II are transferred to the safety interlock circuit equipped with relays RY-16, RY-17 and RY-13, which have mechanical contacts, the operation of these relays should be inspected when the sequence output signals are checked.

e. EJECT (injection machine ejector interlock) indication lamp (PL-5)

The EJECT indication lamp (PL-5) shows whether the ejector operation circuit of the injection machine is interlocked with the robot operation. While the injection machine ejector can move forward at any time when the lamp is on, it cannot move if the lamp is off. However, note that some injection machines controlled by the programmable controller allow the ejector to move forward even if the lamp is off.

f. ROBOT mode selector switch (SW-1)

The ROBOT mode selector switch is used to select the robot operation mode, AUTO, MAN. or OFF.

g. AUTO START button (SW-2)

When the AUTO START button is pressed with the ROBOT mode selector switch set to AUTO and the HOME POSITION indication lamp lighting, the automatic robot operation starts. The automatic robot operation cannot be started by pressing the AUTO START button if the HOME POSITION indication lamp is off.

h. RESET (Manual part verification) button (SW-3)

The RESET button is used to reset the time-over alarm and continue robot operation if it is not verified that a molded part has been removed from the mold within the period set on the cycle monitor timer T07, which triggers the time-over alarm during automatic operation. Check that no molded parts remain in the mold before pressing the button.

i. EMERGENCY stop button (SW-4)

The EMERGENCY stop button is pressed to abruptly stop the robot. Rotate the knob in the direction of the arrow to reset the button, since the button locks when it is pressed. Follow the steps in 2. a. to resume automatic operation after the button has been pressed during automatic operation because the automatic mode is canceled by pressing the button.

j. LOCK SWITCH (SW-19)

The LOCK SWITCH (SW-19) is used to hold the current switch and button conditions, except for the EMERGENCY button. Set the LOCK SWITCH to LOCK when holding the current switch and button conditions.

Following switches are held by the LOCK SWITCH:

SW-2	AUTO START	
SW-3	RESET	
SW-5	ARM	DESCENT / ASCENT
SW-6	KICK	FORWARD / BACKWARD
SW-7	WRIST FLIP	HORIZONTAL / VERTICAL
SW-8	GRIP	ON / OFF
SW-9	TRAVERSE OUTWARD	
SW-10	TRAVERSE INWARD	

4. Manual operation and relevant switches and buttons

The robot can be operated manually when the ROBOT mode selector switch is set to MAN. and the mold open completion signal is on. Manual robot operation will be interrupted if the mold open completion signal goes off

The following Motions can be operated manually:

- Main arm and sub-arm ascent and descent
- Main arm kick cylinder and sub-arm kick cylinder forward and backward
- Main arm and sub-arm part chucking devices close or release
- Wrist flip horizontal and vertical
- Traverse outward
- Traverse inward

Since momentary pushbuttons are used for the above manual operations, except for traverse outward and inward, the operation direction alternates each time the button is pressed.

a. ARM DESCENT/ASCENT button (SW-5)

The ARM DESCENT/ASCENT button is used to manually move the main arm or sub-arm, whichever is specified with the ARM SELECTOR switch (SW-11) downward or upward. One of the following condition should be satisfied when moving the main arm or sub-arm.

- When traverse inward end limit switch LS-2 is on,
  Kick backward end limit switch LS-6: ON
  Wrist flip vertical end limit switch LS-8: ON
- When traverse outward end limit switch LS-1 is on,
  Kick backward end limit switch LS-6: ON
  Wrist flip horizontal end limit switch LS-10: ON

b. KICK FORWARD/BACKWARD button (SW-6)

The KICK FORWARD/BACKWARD button is used to manually move the main arm or sub-arm kick cylinder, whichever is specified with the ARM SELECTOR switch (SW-11) forward or backward. One of the following conditions should be satisfied when moving the main arm or sub-arm kick cylinder.

- When the ARM SELECTOR switch is set to MAIN or MAIN & SUB, Traverse inward end limit switch LS-2: ON
  Arm downward end limit switch LS-11: ON
- When the ARM SELECTOR switch is set to SUB, Traverse inward end limit switch LS-2: ON

c. WRIST FLIP HORIZONTAL/VERTICAL button (SW-7)

The WRIST FLIP HORIZONTAL/VERTICAL button is used to manually flip the gripping unit.

The following conditions should be satisfied when flipping the chuck mounting plate.

- Arm upward end limit switches LS-3 and LS-7: ON
- Kick backward end Limit switch LS-6: ON

Since the chuck mounting plate flips to the horizontal position when the button is pressed the first time, the chuck mounting plate does not move if it is in the horizontal position, When the button is pressed again, the chuck mounting plate flips to the vertical position.

d. GRIP ON/OFF button (SW-8)

The GRIP ON/OFF button is used to manually operate the gripping unit or chuck according to the ARM SELECTOR (SW-11) switch position.

- When the ARM SELECTOR switch is set to MAIN,
  Part grip
  Vacuum
  Sprue chuck (by main arm)
- When the ARM SELECTOR switch is set to SUB,
  Sprue chuck (by sub-arm)
- When the ARM SELECTOR switch is set to MAIN & SUB,
  Part grip
  Vacuum
  Sprue chuck (by main arm)
  Sprue chuck (by sub-arm)

e. TRAVERSE OUTWARD button (SW-9)

The TRAVERSE OUTWARD button is used to manually move the traverse unit away from the mold.

The following conditions should be satisfied when moving the traverse unit away from the mold.

- Arm upward end limit switches LS-3 and LS-7: ON
- Kick backward end limit switch LS-6: ON

Do not stand in the path the traverse unit follows when it moves away from the mold. Make sure that there are no obstacles in this path of motion.

f. TRAVERSE INWARD button (SW-10)

The TRAVERSE INWARD button is used to manually move the traverse unit toward the mold.

The following conditions should be satisfied when moving the traverse unit toward the mold.

- Arm upward end limit switches LS-3 and LS-7: ON
- Kick backward end limit switch LS-6: ON

Do not stand in the path the traverse unit follows when it moves toward the mold. Make sure that there are no obstacles in its path of motion.

5. Operation setting panel

The following robot operations can be specified using the operation setting panel on the control box.

- The cylinder used for removing molded parts from the mold (the main arm cylinder or sub-arm cylinder)
- Methods of part verification on the main arm cylinder
- Timing of wrist flip horizontal (above mold or traverse end)
- Timing of wrist flip vertical (above mold or traverse end)
- Timing of ejector signal issuing (when kick forward or grip part)
- Timing of sub-arm sprue release (sub-arm traverse outward or inward)

Specify the above robot operations using the operation setting panel with the ROBOT mode selector switch set to MAN or OFF.
Note that the above operations except for the methods of parts verification cannot be changed if the ROBOT mode selector switch is set to AUTO.

a. ARM SELECTOR switch (SW-11)

The ARM SELECTOR switch (SW-11) is used to specify the arm which is used to remove molded parts from the mold.

- MAIN arm

  Set the ARM SELECTOR switch to MAIN when removing a molded part from the mold, usually two-plates molds by the main arm.

- MAIN & SUB-arms

  Set the ARM SELECTOR switch to MAIN & SUB when removing a molded part from the mold, usually three-plates molds by chucking the part with main arm gripping unit and the sprue with the sub-arm chuck.

- SUB-arm

  Set the ARM SELECTOR switch to SUB when removing only a sprue from the mold, usually three-plates molds with the sub-arm chuck. Molded part is automatically ejected and dropped in this case.

b. PICK UP VERIFICATION SELECTOR switch (SW-12)

The PICK UP VERIFICATION SELECTOR switch (SW-12) is used to specify the methods of part verification on the main arm cylinder. The sub-arm cylinder is provided with only sprue verification limit switch LS-5.

- LS-4

  The limit switch LS-4, activated by a spring, verifies the part removed from the mold by the main arm.

- AUX.

  A limit switch or other switch attached to the chuck plate as an option verifies part removed from the mold by the main arm.

- VACUUM & AUX.

  A vacuum differential switch connected to the suction pad and Limit switch on the chuck plate of the gripping unit verify the part removed from the mold by the main arm. A part is regarded as correctly removed when both switches verify the part.

- VACUUM

  A vacuum switch connected to the suction pad verifies the part removed from the mold by the main arm. A part is regarded as correctly removed when the vacuum switch detects the specified level of suction.

The above verification signals are transferred to the sequencer as input signal X1F through the PICK UP VERIFICATION SELECTOR switch. The PICK UP VERIFICATION SELECTOR switch does not have the function to specify the type of chucking devices used to remove parts from the mold.

c. WRIST FLIP HORIZONTAL timing selector switch (SW-13)

The WRIST FLIP HORIZONTAL timing selector switch is used to specify the position where the chuck mounting plate is set to the horizontal position in automatic operation. Since the chuck mounting plate is kept horizontal during the main arm second descent, the chuck mounting plate flips to the horizontal position at the outside of the mold, i.e., at TRAVERSE END, as a rule.

- TRAVERSE END

  As a rule, the chuck mounting plate flips to the horizontal position when the traverse unit reaches the outward end and outward end limit switch LS-1 is pressed. Check that the chuck mounting plate does not interfere with the injection machine safety door.

- ABOVE MOLD

The chuck mounting plate flips to the horizontal position at the traverse inward end position (LS-2) before the traverse starts outward. Set the WRIST FLIP HORIZONTAL timing selector switch to ABOVE MOLD in order to prevent the chuck mounting plate or removed part from interfering with the injection machine safety door, being careful not to hit the chuck mounting plate or removed part against the sub-arm chuck or mounting base.

d. WRIST FLIP VERTICAL timing selector switch (SW-14)

The WRIST FLIP VERTICAL timing selector switch is used to specify the positon where the chuck mounting plate is returned to the vertical position after the main arm second descent in automatic operation.

- TRAVERSE END

As a rule, the chuck mounting plate flips back to the vertical position when the traverse unit is in the outward end and before moving toward the mold. Check that the gripping plate does not interfere with the injection machine safety door.

- ABOVE MOLD

The chuck mounting plate flips back to the vertical position when the traverse unit reaches the inward end and inward end limit switch LS-2 is pressed.

Check that the gripping plate does not interfere with the mounting base while the traverse unit is returning to the inward end.

e. RUNNER/SPRUE RELEASE timing selector switch (SW-15)

The RUNNER/SPRUE RELEASE timing switch is used to specify when the sub-arm chuck and or main arm sprue chuck releases the runner or sprue. Set the RUNNER/SPRUE RELEASE timing switch to ON WAY OUT or ON WAY IN in accordance with the application required.

- ON WAY OUT

The chuck releases the runner or sprue when sprue releasing position limit switch LS-9 is pressed while the traverse unit moves toward the outward end.

- ON WAY IN

The chuck releases the runner or sprue when sprue releasing position limit switch LS-9 is pressed while the traverse unit moves toward the inward end.

The sub-arm chuck cannot release the runner or sprue when the traverse unit reaches the outward end.

Remarks:

Sprue is chucked either by sub-arm chuck (double cylinder type robot) or the chuck equipped on the main arm. SW-15 is in effect for sub-arm chuck regardless of the position of the ARM SELECTOR switch (SW-11), but, when the MAIN & SUB is selected by the ARM SELECTOR switch sprue chuck on the main arm releases the sprue when LS-9 is pressed while the traverse unit moves toward the inward end.

Mode selector by the ARM SELECTOR SWITCH (SW-11)	Function of RUNNER SPRUE RELEASE timing selector switch (SW-15)
MAIN	Selectable
MAIN & SUB	SUB —— Selectable MAIN —— Fixed (traverse inward)
SUB	Selectable

f. EJECT timing selector switch (SW-16)

The EJECT timing selector switch is used to specify when the robot issues the ejector signal to the injection machine in automatic operation.

- ON KICK FORWARD

  The ejector signal is issued when the kick cylinder starts moving forward.

- ON GRIP

  The ejector signal is issued when the gripping unit or chuck clamps a molded part, or sprue or runner.

Adjust the injection machine ejector timer and ejector speed to grip a part, or/and runner or sprue.

g. TRAVERSE SPEED HIGH SPEED adjustment knob (VR-1)

For the motor traverse type, the TRAVERSE SPEED HIGH SPEED adjustment knob is used to specify the high traverse speed. When the knob is set to MAX., the motor rotates at its rated speed.

h. TRAVERSE SPEED LOW SPEED adjustment knob (VR-2)

For the motor traverse type, the TRAVERSE SPEED LOW SPEED adjustment knob is used to specify the low traverse speed.

6. Timers

The PC-II has the following analogue timers.

VR8 : Nipper cut delay timer
When the nippers are mounted on the end of arm tooling(chucking plate) and air nipper circuit is equipped on the robot, VR8 controls the nipper cut timing. VR8 starts counting when the robot starts second descending, when this timer elapses nipper blades close. At the same time of Main arm ascent, nipper blades open.

VR7 : Kick forward delay timer
When the main arm reaches the downward end and downward end limit switch LS-11 is pressed after the mold has opened, the kick forward delay timer starts. When the time set on the timer elapses, the main arm and sub-arm kick forward starts.

VR6 : Grip timing delay timer
When the main arm reaches the downward end and downward end limit switch LS-11 is pressed, the grip timing delay timer starts in the same way as the kick forward delay timer.
When the time set on the timer elapses, the main arm gripping unit and main arm sprue chuck clamp the molded part and its sprue, respectively, if the main arm is selected. The sub-arm sprue chuck clamps the sprue if the sub-arm is selected. The suction starts immediately after the main arm starts descending, irrespective of the time set on timer, because the suction pad takes the specified time to reach the specified level of suction adequate to hold the molded part.
If the time set on kick backward delay timer VR5 elapses before the time set on grip timing delay timer VR4, because no interlocks are provided for both timers, the kick backward operation starts before the sub-arm sprue chuck holds the sprue, resulting in pickup failure. To avoid the above operation, the sub-arm sprue chuck starts holding the sprue when either the time set on kick backward delay timer T03 or the time set on grip timing delay timer elapses.

VR5 : Kick backward delay timer
When the time set on kick forward delay timer VR7 elapses, kick backward delay timer VR5 starts. When the time set on the timer elapses, the main arm and sub-arm kick backward operation starts.
A too short kick backward delay time results in inadequate kick operation. Be sure to set enough time on the timer to obtain secure kick operation.

If the time set on grip timing delay timer VR6 is longer than the time set on kick backward delay timer, the part will be chucked while being ejected by the injection machine ejector in the same direction as the kick backward operation during the kick backward operation.
The main arm and/or sub-arm move upward when kick backward end limit switch LS-6 is pressed after the times set on grip timing delay timer VR6 and kick backward delay timer VR5 have elapsed.

VR4 : Grip release timing delay timer
When downward end limit switch LS-11 is pressed after the main arm has reached the second descent position, grip release timing delay timer VR4 starts. When the time set on the timer elapses, the main arm gripping unit and suction pad release the molded part. The main arm sprue chuck can release the sprue only when sprue releasing position limit switch LS-9 is pressed while the traverse unit moves toward the traverse outward or inward end. The sprue releasing position can be specified using the RUNNER/SPRUE RELEASE switch (SW-15) on the operation setting panel. It cannot release the sprue or runner when the sub-arm reaches the second descent position.

VR3 : Main arm second ascent delay timer
When the time set on grip release timing delay timer VR4 elapses, main arm second ascent delay timer starts. Set the time long enough for the part gripping unit and suction pad to release the part. When the time set on the timer elapses, the main arm starts to move upwards.

VR1 : Cycle monitor timer
The time required for one automatic cycle, from the main arm descent operation above the mold, which starts when the mold open completion signal is on, to the main arm and/or sub-arm at the standby position for removing the next part, is set on cycle monitor timer VR1. If the time set on the timer elapses before one automatic cycle has been completed, because of delay caused by a pickup failure or robot malfunction, an alarm is generated. The longer the time set on the timer, the more the injection machine idle time. Set the time just slightly longer than the time which allows the robot to complete the one automatic cycle without an alarm.

7. Turning on or off the power

The PC-II is turned on and off using AC power switch NFB1 and DC power switch NFB2 on the operation setting panel. Those two switches function as a circuit protector. Before turning on the power check the following:

- The electric circuits are not being inspected.
- The correct pair of connectors are plugged together.
- There is no-one in the robot working area. If there is somebody in the robot working area, notify him that the robot power will be turned on.
- The sequencer is ready to operate.

- The robot is provided with compressed air at the specified pressure.
- If the power switch, which functions as a circuit protector, has been tripped, i.e., if the lever of the switch is placed in a position between the on and off positions, eliminate the problem which caused the tripping first, then set the lever to the off position once before turning on the power.

Before turning off the power, check the following:

- The robot is stopped.
- Turning off the power does not cause the robot to move. The main arm and sub-arm are at the ascent ends.
- The injection machine is ready to stop, because stopping the robot usually requires the injection machine to stop.

8. Signals transferred between the injection machine and robot

Signals issued from the injection machine to the robot
- Mold open completion signal (coil voltage input)
- Injection machine emergency stop signal (dry contact input)

Signals issued from the robot to the injection machine
- Mold close safety interlock signal (dry contact output)
- Mold open safety interlock signal (dry contact output)
- Injection machine cycle start signal (dry contact output)
- Injection machine ejector forward signal (dry contact output)
- Robot emergency stop signal (dry contact output)

The above signals are issued in the following conditions.

Signal name	ROBOT mode selector switch is set to OFF.	ROBOT mode selector is set to MAN.	ROBOT mode selector switch is set to AUTO.
Mold close/open safety interlock signals	The contacts close when traverse outward end limit switch LS-1 is pressed or when arm upward end limit switches LS-3 and LS-7 are pressed.	Same as the left.	The contacts close when pickup verification switches are on and traverse outward end limit switch LS-1 is pressed or when arm upward limit switches LS-3 and LS-7 are pressed. The contacts open the next time the mold open completion signal comes on.
Cycle start signal	The contacts are kept closed.	The contacts are kept opened.	The contacts close when pickup verification switches are on and traverse outward end limit switch LS-1 is pressed or when pickup verification switches are on and arm upward limit switches LS-3 and LS-7 are pressed. The contacts open when the mold open completion signal goes off.
Ejector forward signal	The contacts are kept closed.	The contacts are kept closed.	The contacts close when the time set on kick forward delay timer elapses or when the time set on grip timing delay timer elapses. The contacts open when the mold open completion signal goes off.

9 . Switches and delay timer for options

Switches

a. WAITING NIPPER ON/OFF switch

The WAITING NIPPER ON/OFF switch controls ON/OFF of waiting nipper circuit.

The switch is in effect when the ROBOT mode selector is set to MAN or OFF.

b. VACUUM ON/OFF switch (SW-18)

The VACUUM ON/OFF switch is used to control ON/OFF of vacuum suction system by venturi air ejector.

The switch is in effect regardless of operation mode because the switch is inserted in the external hard wired circuit to the vacuum valve.

c. LOCK switch (SW-19)

See page 6. -j.

Timers

VR8 : Waiting nipper timing control timer

Waiting nipper timing control timer sets following two timings.

- When the traverse unit reaches to the traverse outward end position, the kick forward delay timer VR7 starts.
  When the time set on the timer elapses, the main arm of robot approaches to the waiting nipper fixture and the waiting nipper timing control timer starts. When the time set on the timer elapses, the valve for waiting nipper is actuated and blades of nipper are closed. Set the tiemr so that the blades are closed when gates of molded parts are fully in the cutting area of nipper blades.
- When the time set on the timer elapses, the timer VR1 starts.
  When the time set on the timer VR1 elapses, the main arm steps(kick) backward.
  Set the timer so that the main arm steps backward after waiting nipper blades are fully opened.

VR2 : Waiting nipper ON (hold) timer

When the timer VR8 elapses, the waiting nipper ON timer starts. When the time set on the timer elapses, the nipper valve stops air supply to the nipper and blades of nipper are opened.

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:

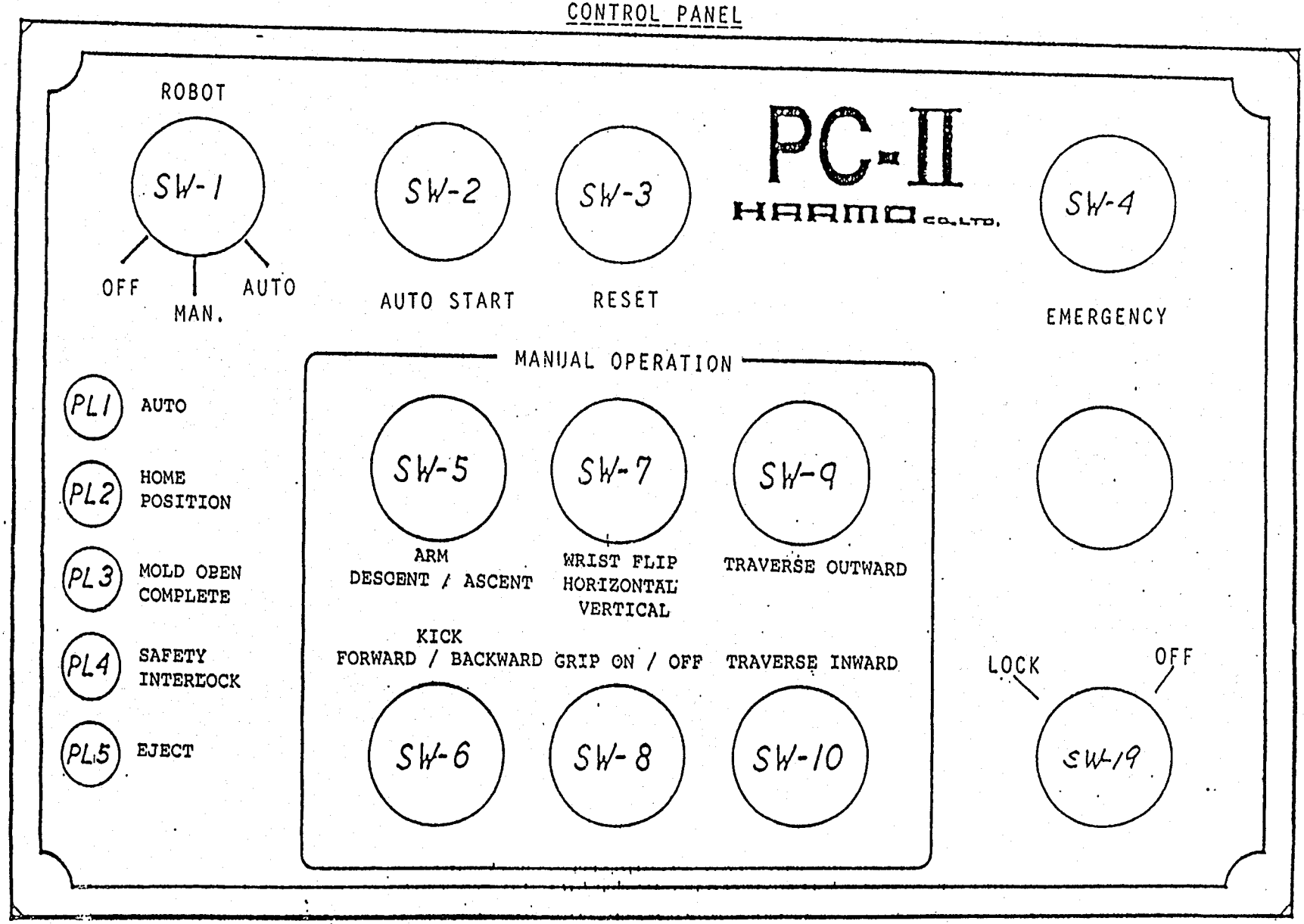
- Inspect the equipment and perform alterations or adjustments to satisfy performance claims. (Charges for such inspections and corrections will be waived unless failure to meet warranty is due to misapplication, improper installation, poor maintenance practices or improper operation.)
- Replace the 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

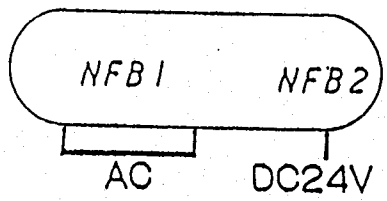
Except for the Equipment Guarantee and Performance Warranty stated above, Conair disclaims all other warranties with respect to the equipment, express or implied, arising by operation of law, course of dealing, usage of trade or otherwise, including but not limited to the implied warranties of merchantability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

CONTROL PANEL

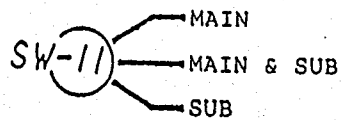


OPERATION SETTING PANEL

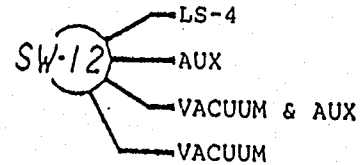
MAIN CIRCUIT BREAKER

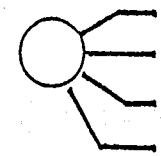


ARM SELECTOR



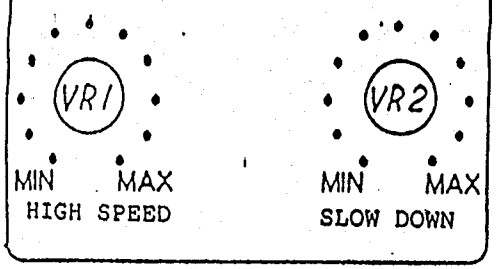
PICK UP VERIFICATION SELECTOR





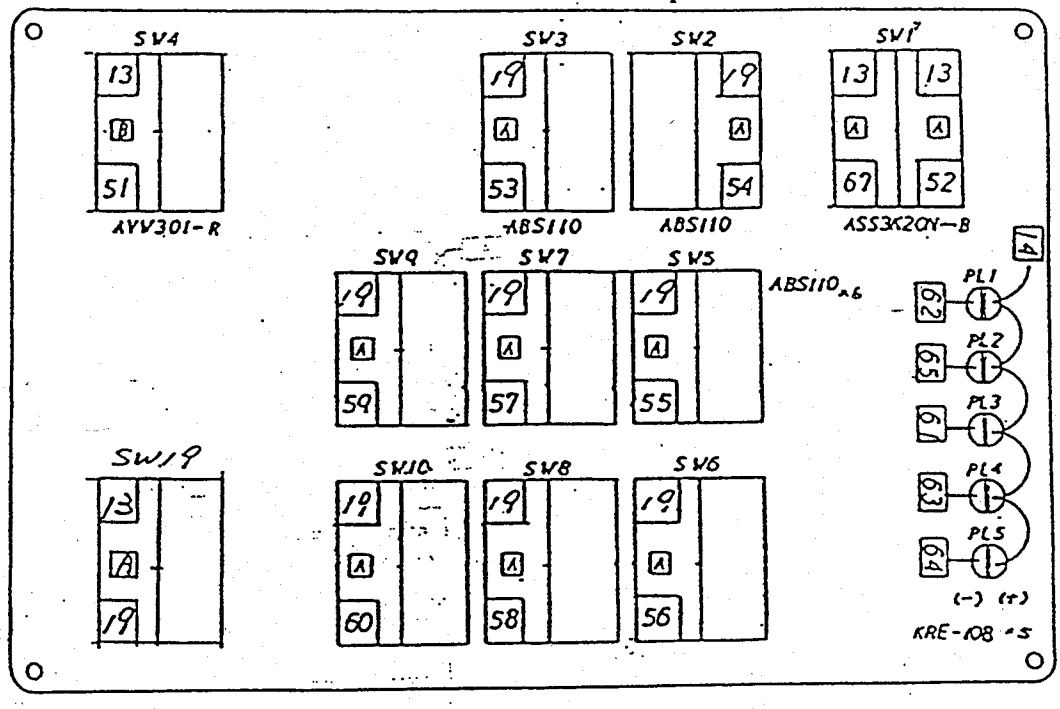
WRIST FLIP HORIZONTAL TRAVERSE END	WRIST FLIP VERTICAL ABOVE MOLD	RUNNER/SPRUE RELEASE ON WAY OUT	EJECT ON KICK FORWARD ON WAY IN		
SW-13	SW-14	SW-15	SW-16		
			ON GRIP		

TRAVERSE SPEED (MOTOR)

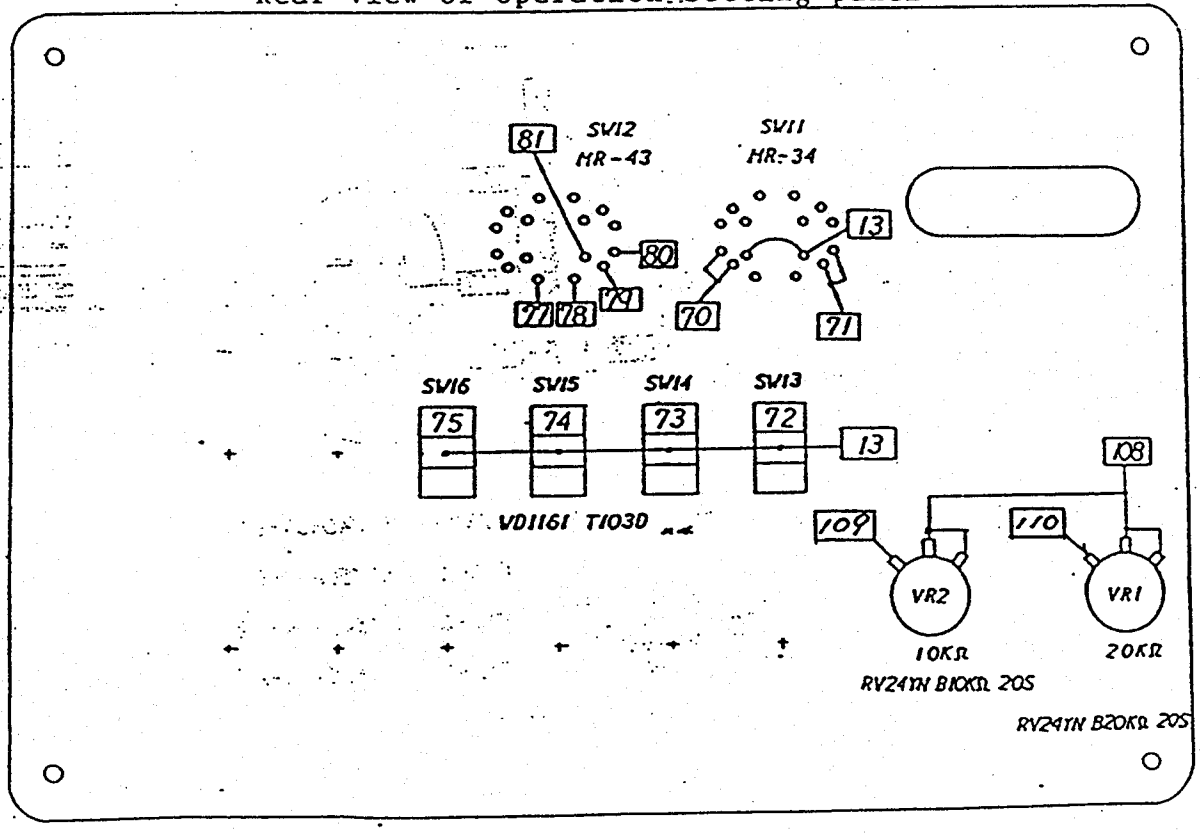


PARTS LAYOUT

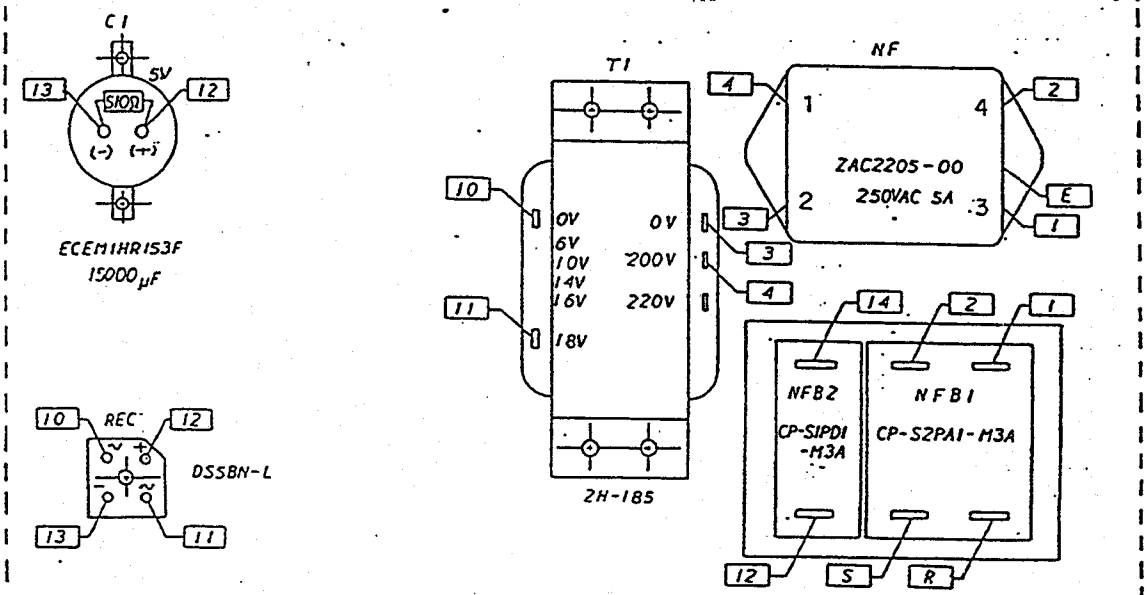
Rear view of Control panel

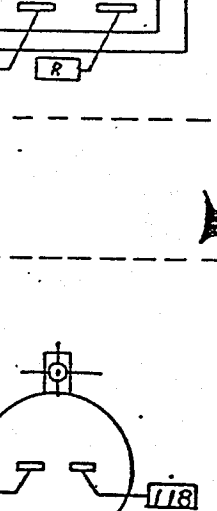


Rear view of Operation setting panel



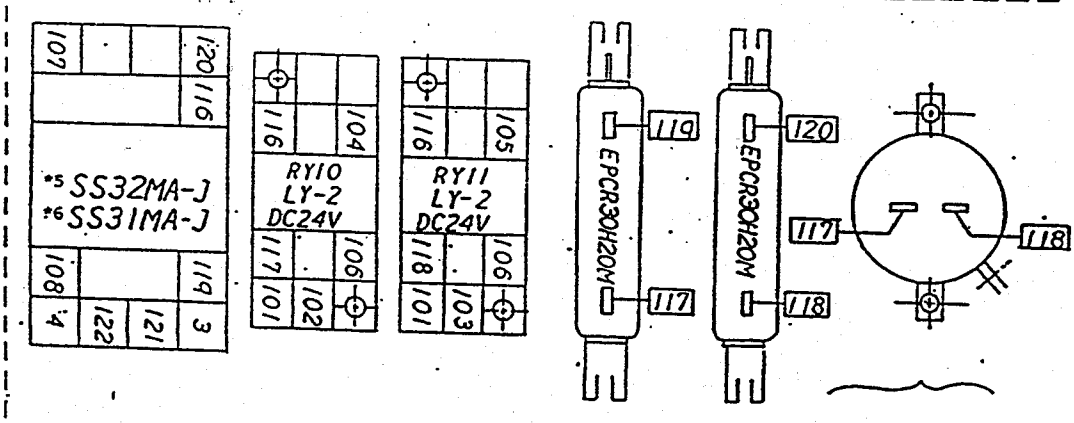
POWER SUPPLY UNIT





Inside of cabinc

MOTOR CONTROL UNIT

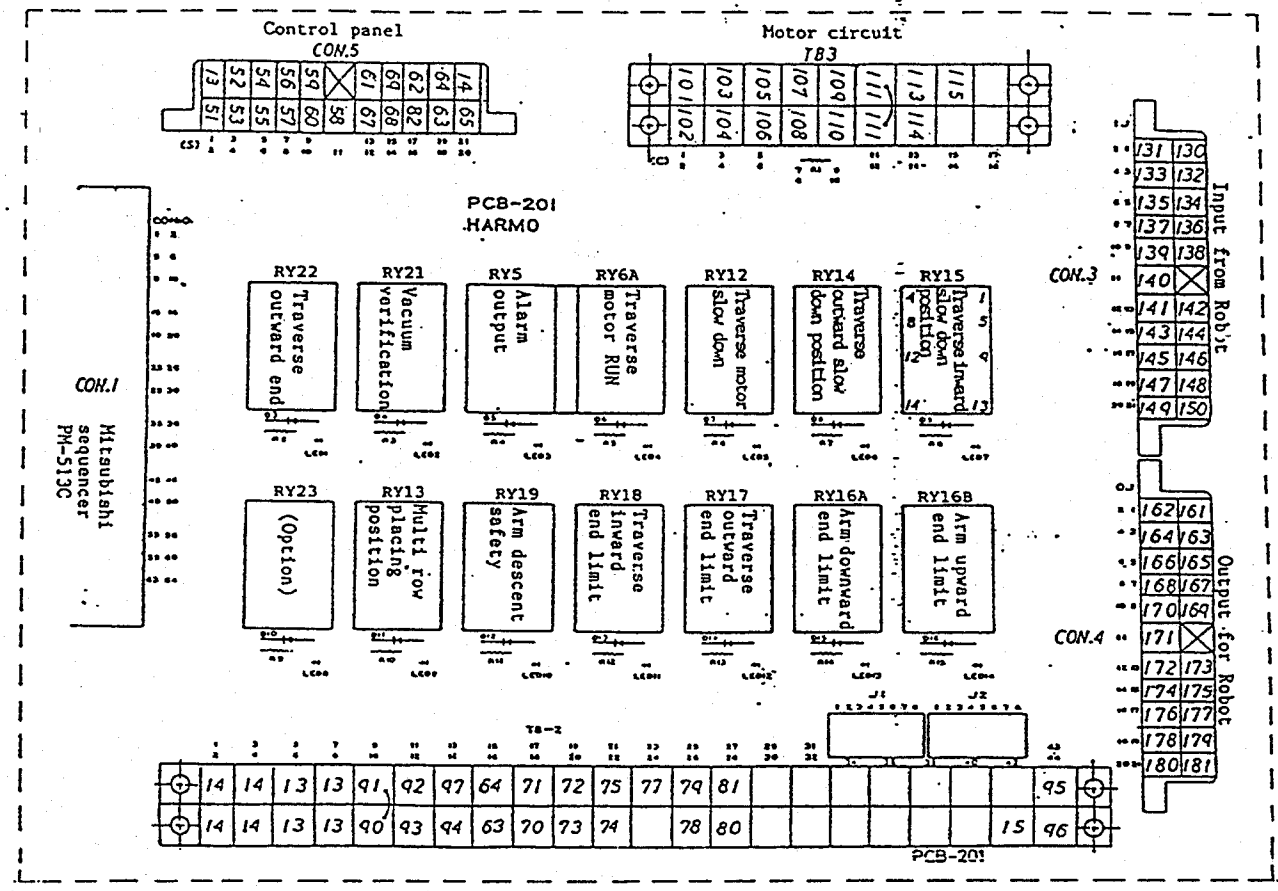


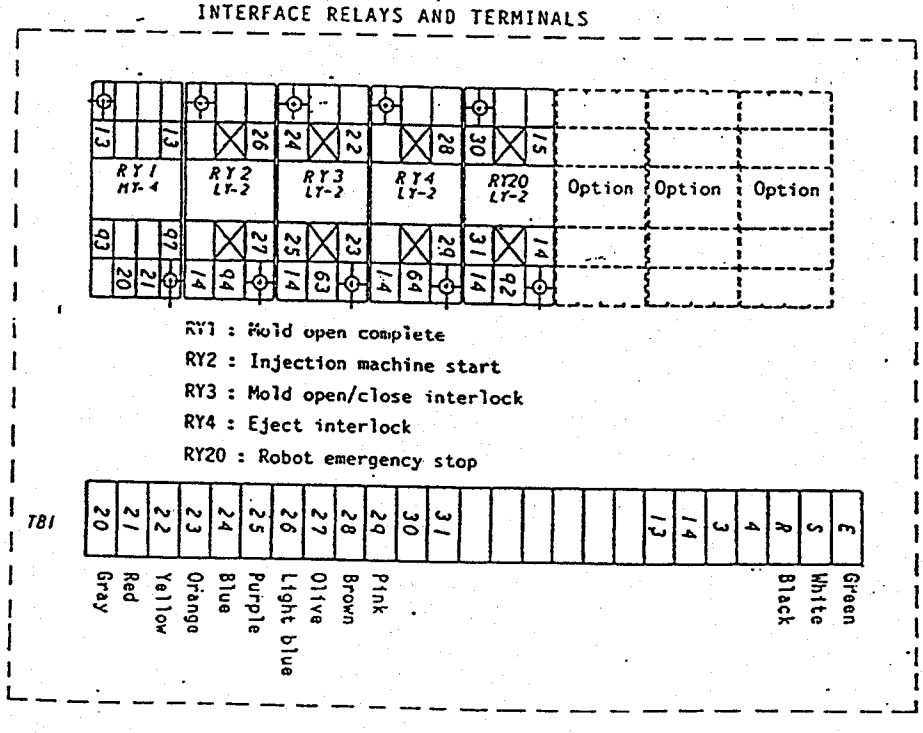
*5 - Control pack 200V rating
*6 - " " 100V rating

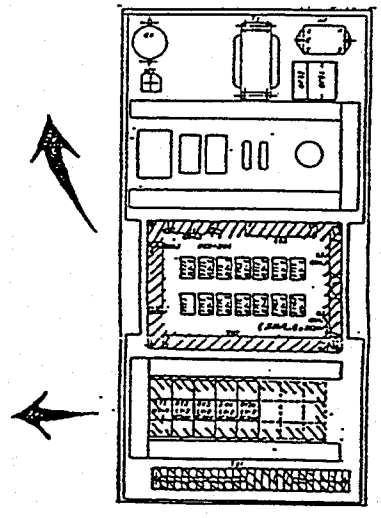
*1 - 200V 40W motor for HFM-600 Sseries
*2 - 200V 60W motor for New HM series
*3 - 100V 40W motor for HFM-600 series
*4 - 100V 60W motor for New HM series

CY35B	*1 (5RK40RGK-C2)
CY60B	*2 (6RK60RGK-C)
CY150	*3 (5RK40RGK-A2)
CY250	*4 (6RK60RGK-A)

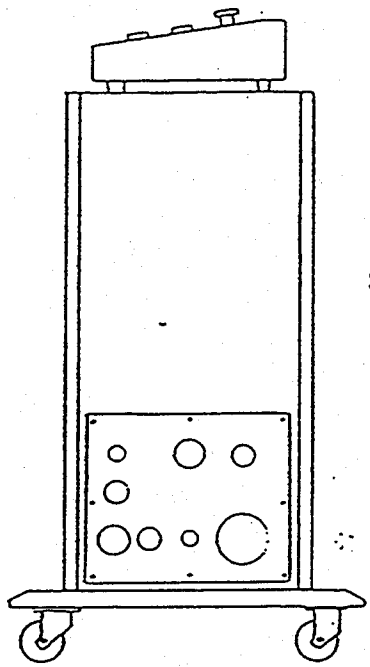
Safety circuit relays and wiring distribution terminals (PCB-201)



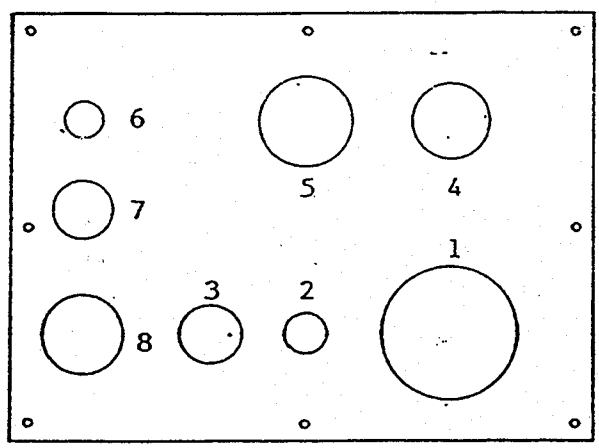




CONNECTORS



Side view
of PC-II



1 48P connector (Input & Output for robot) CON. 7

2 3 core cable for power supply

3 24 core cable for interface between controller and injection molding machine

4 5P connector for motor (HM series robot) CON. 9

5 24P connector for operation panel CON. 8

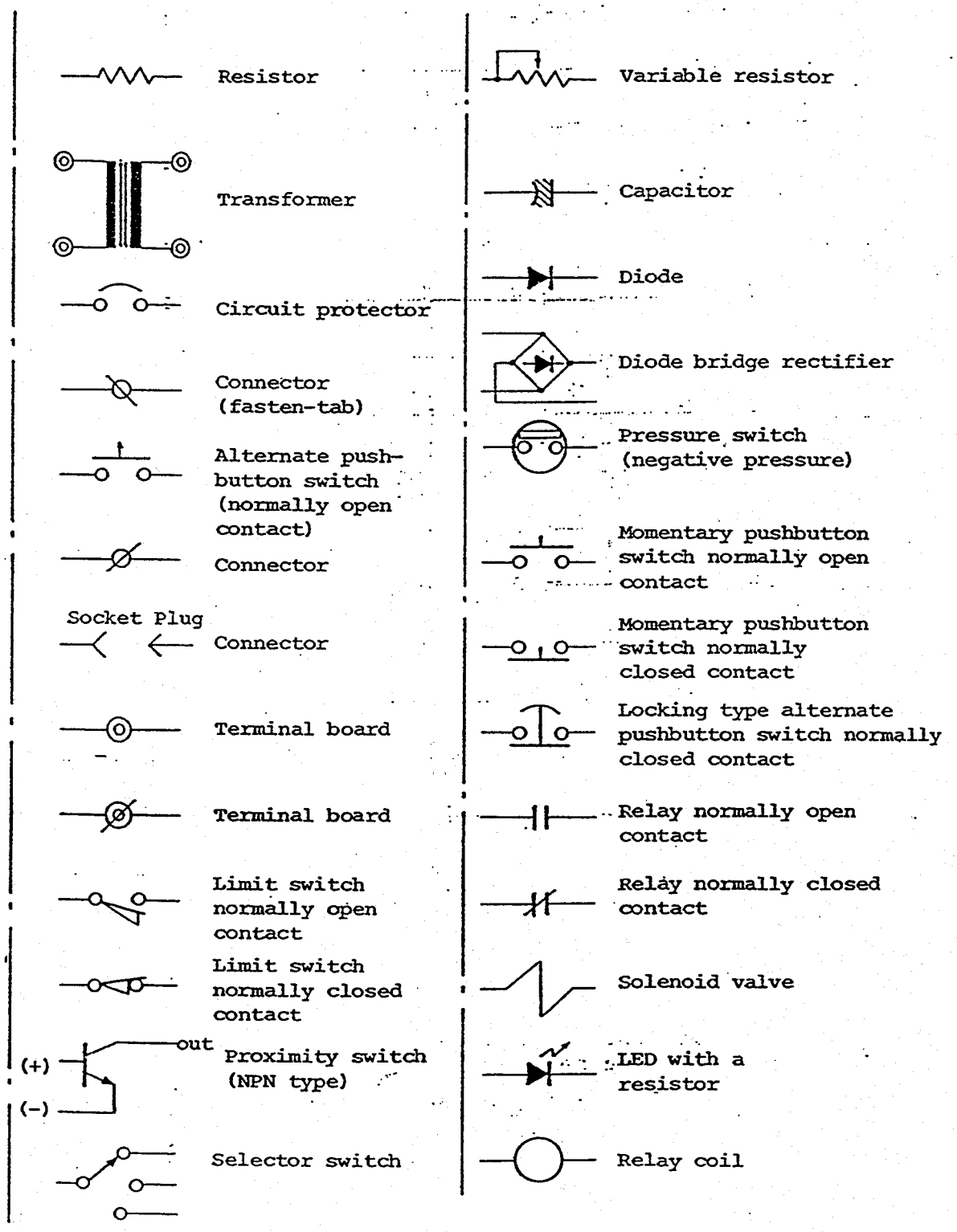
6 Option (Output for conveyor)

7 Option

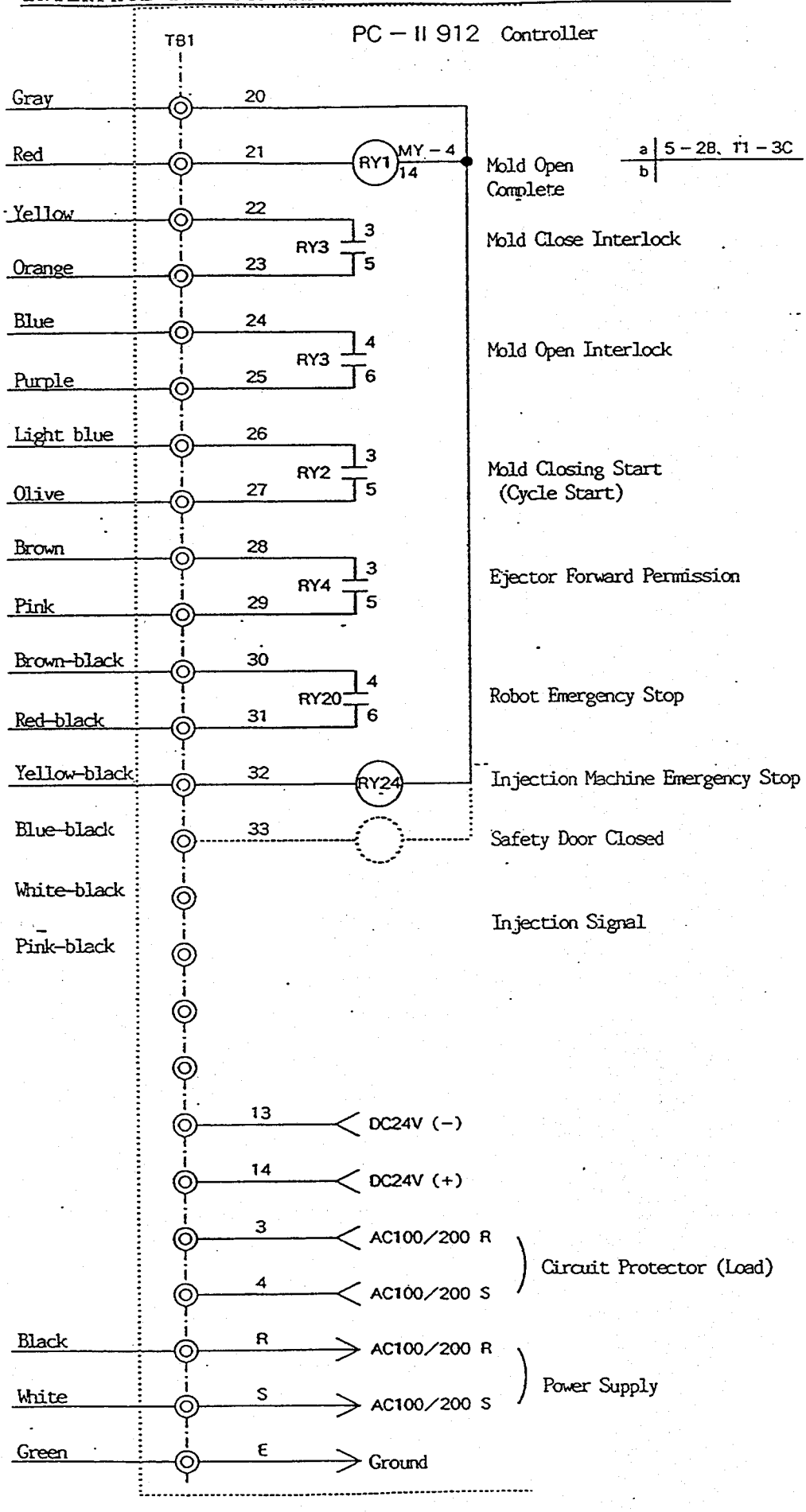
8 Option

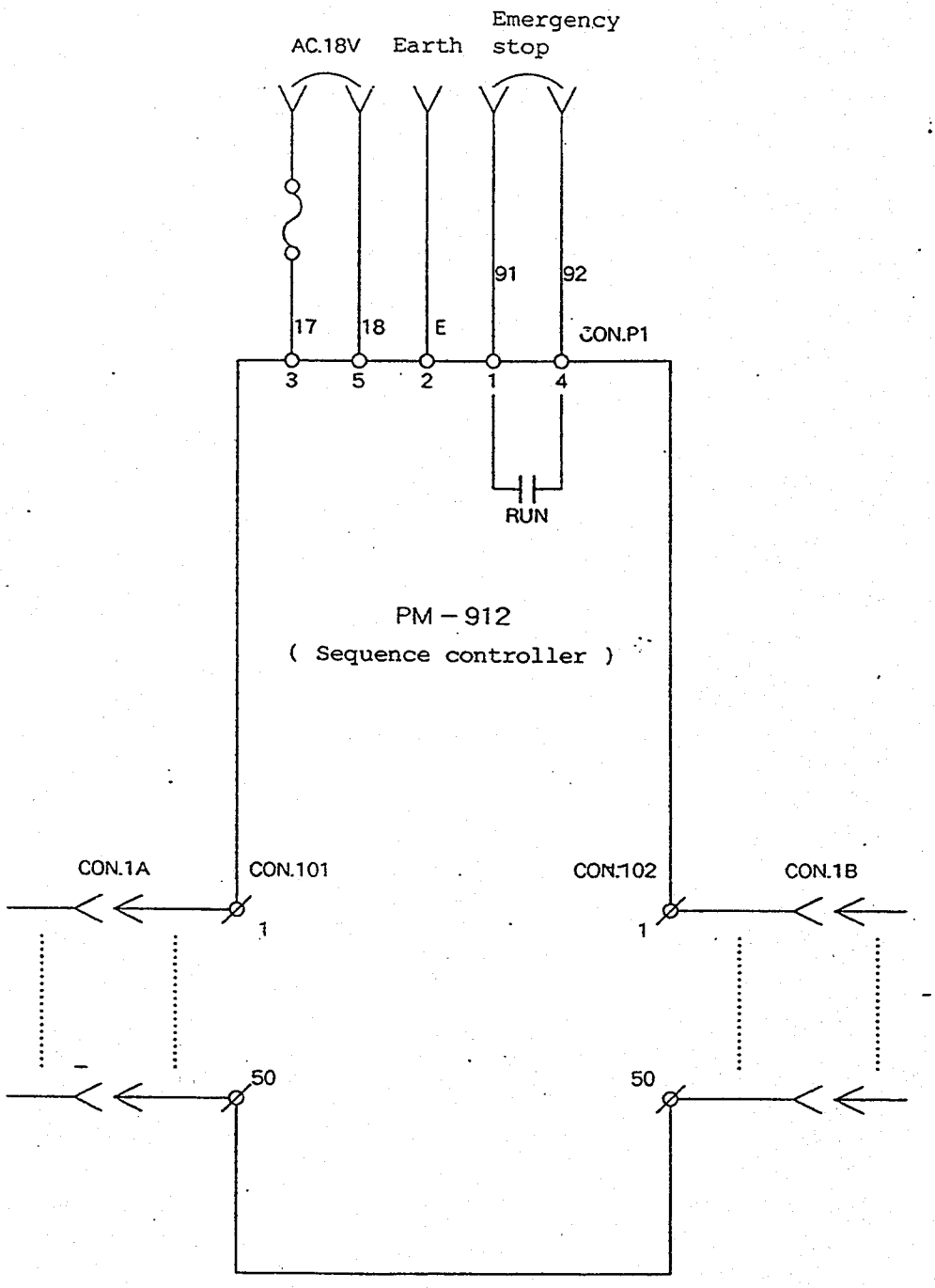
Electrical wiring diagram

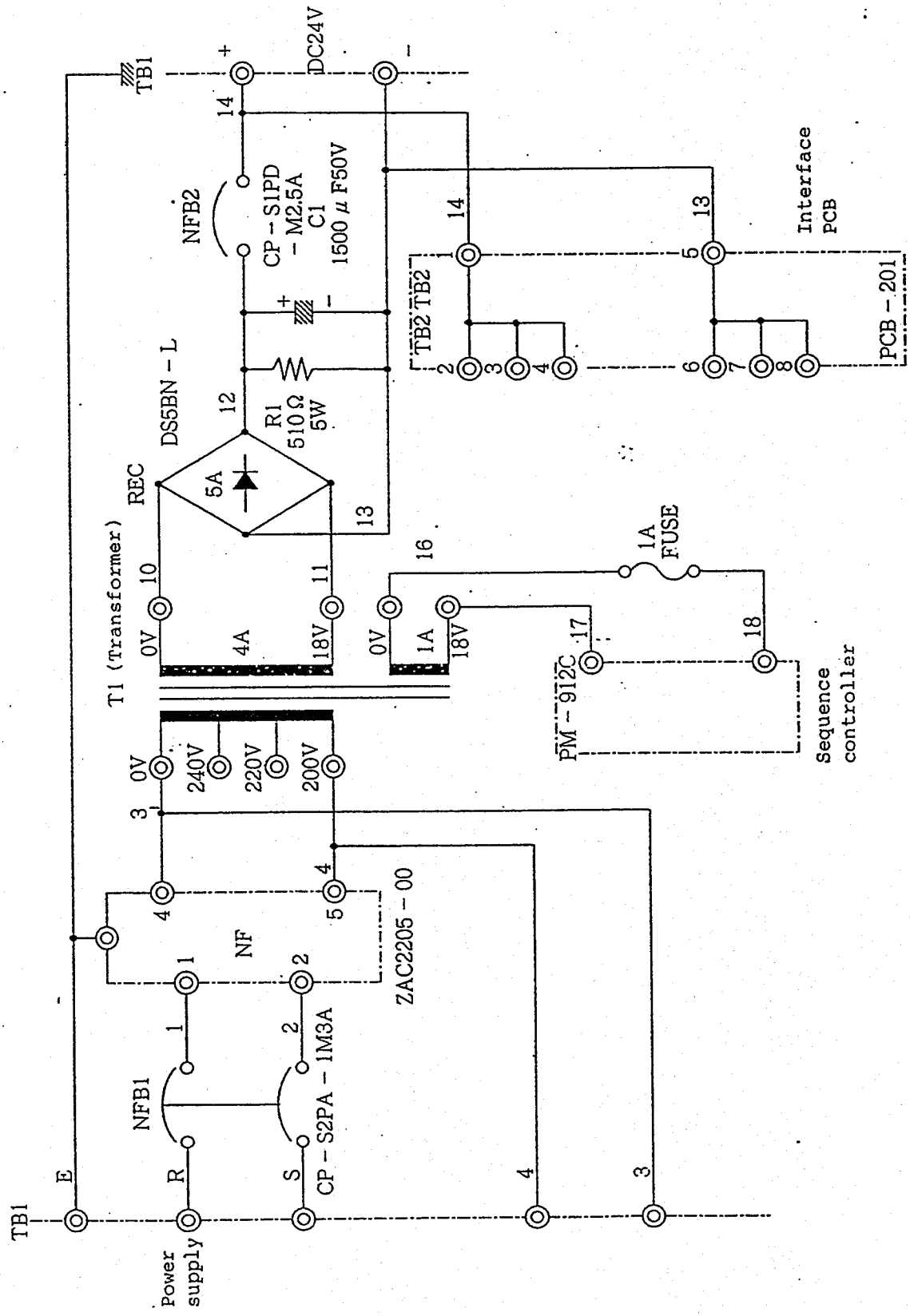
Symbols

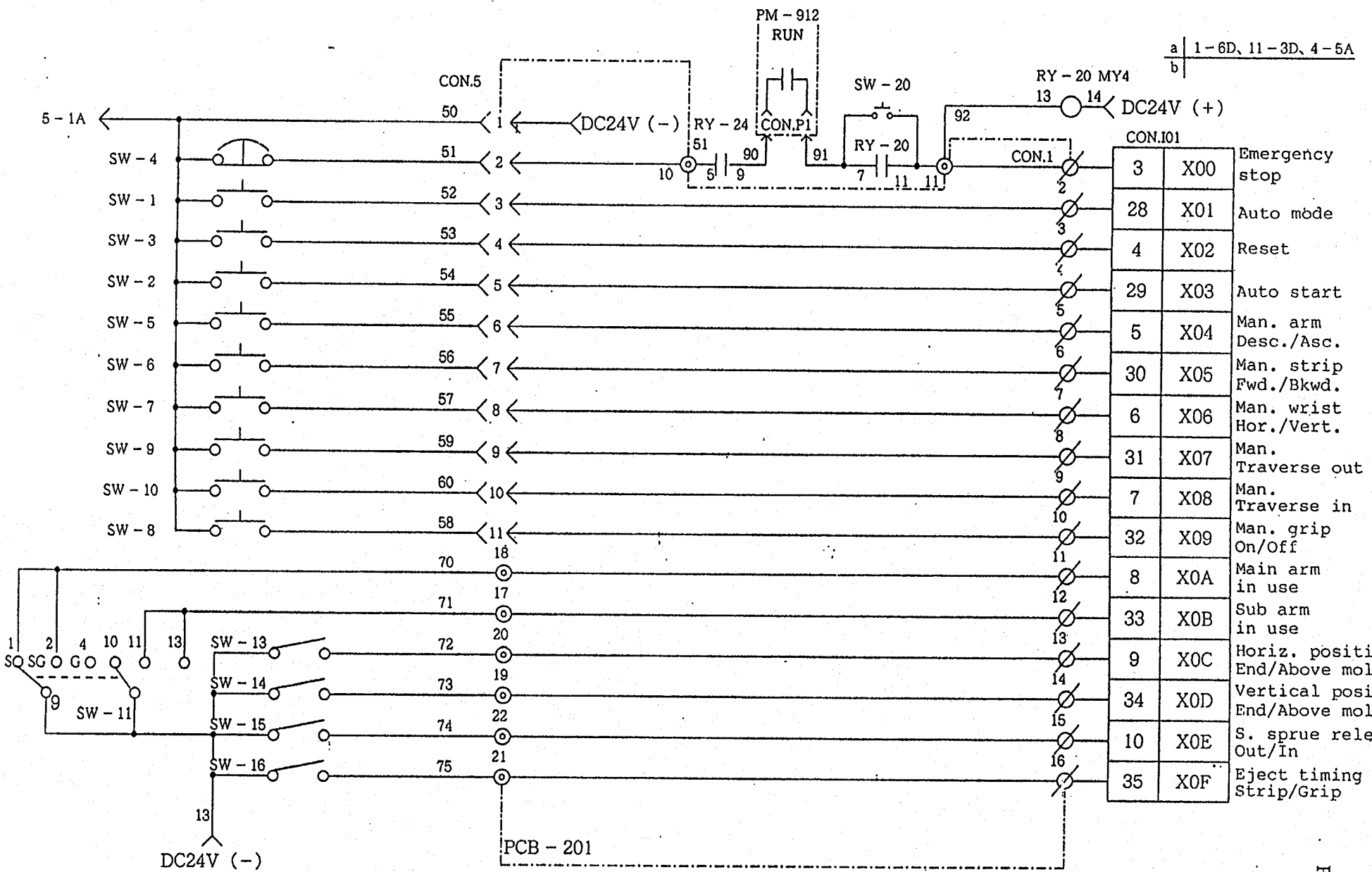


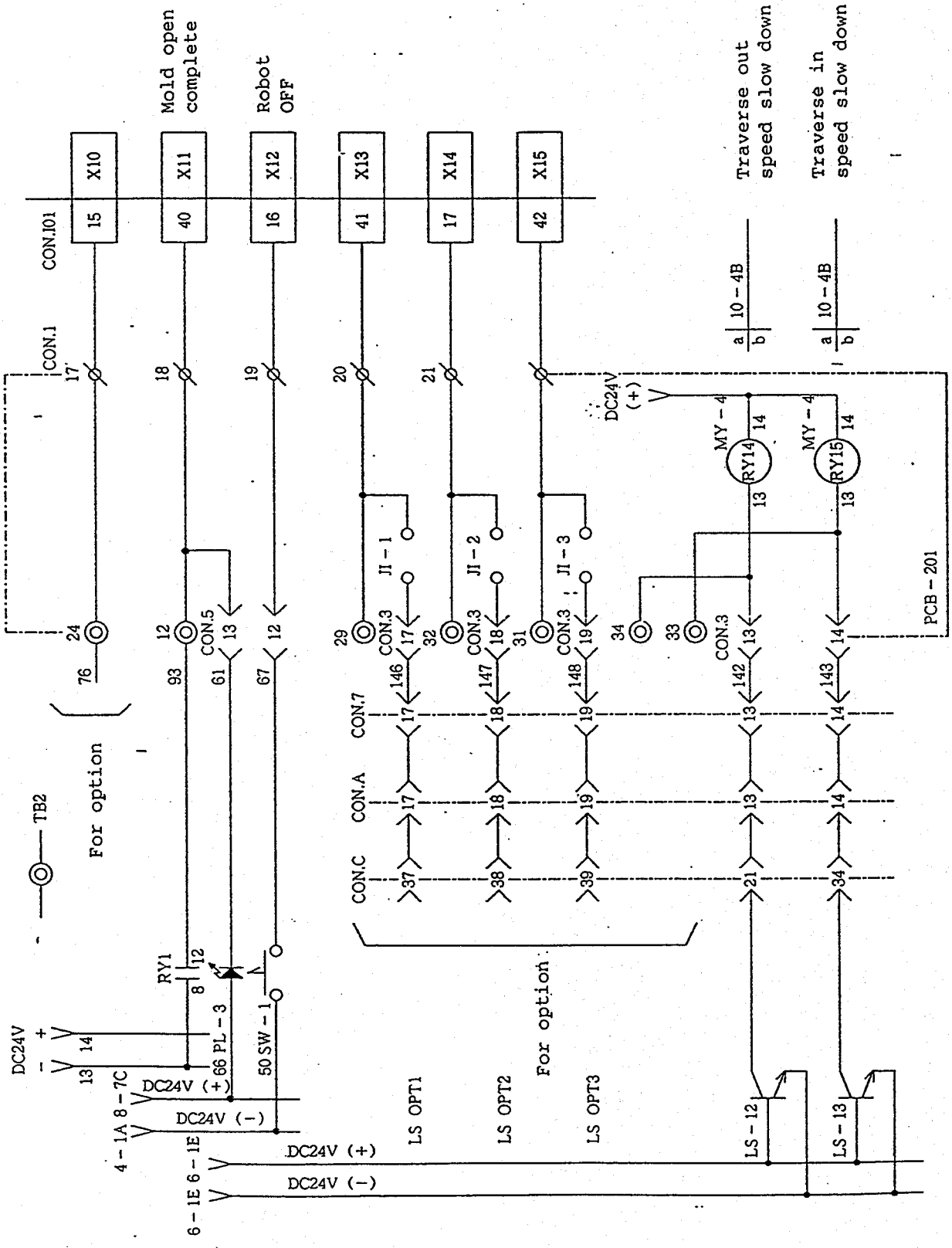
INTERFACE BETWEEN THE ROBOT AND INJECTION MACHINE

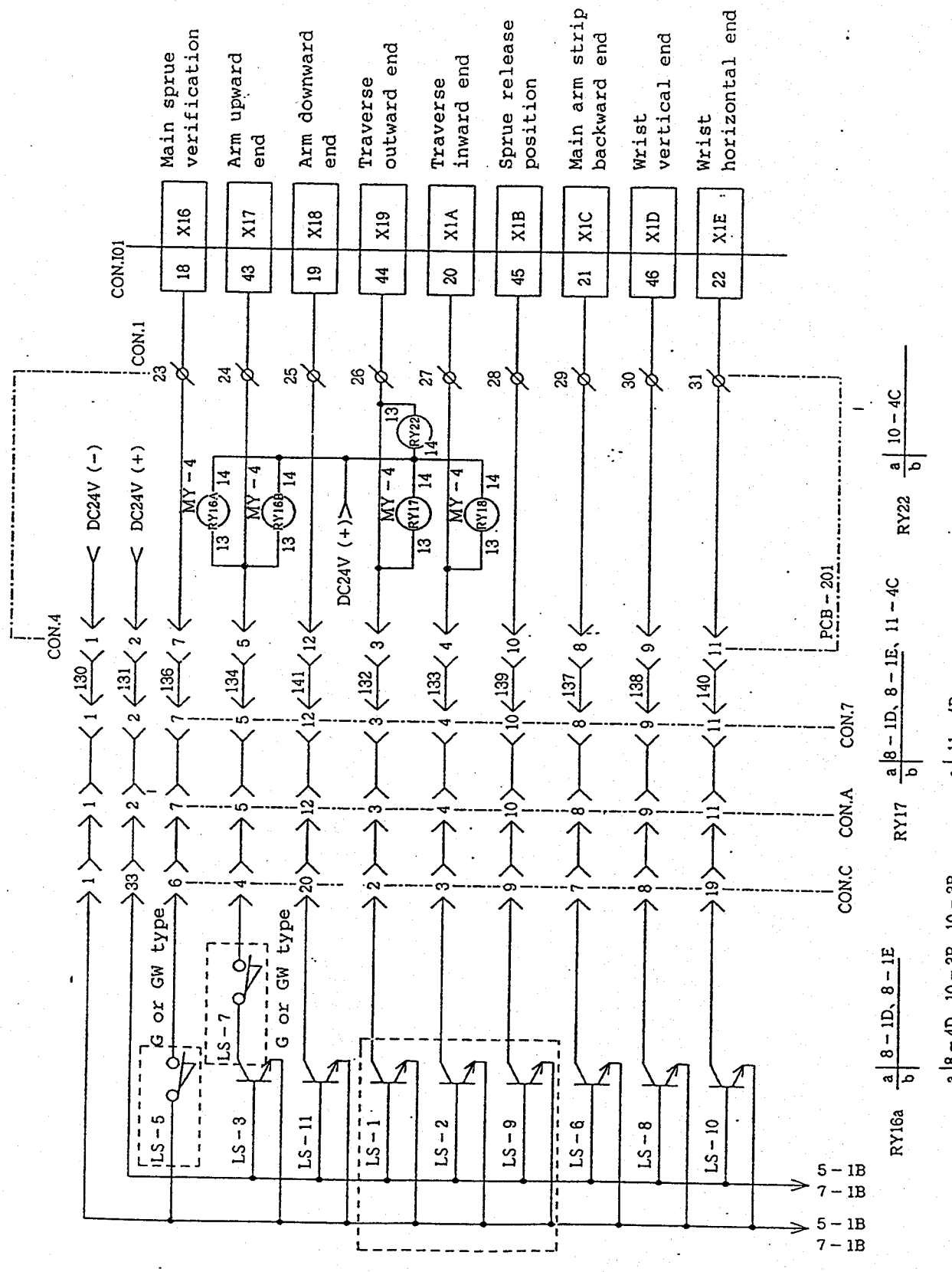


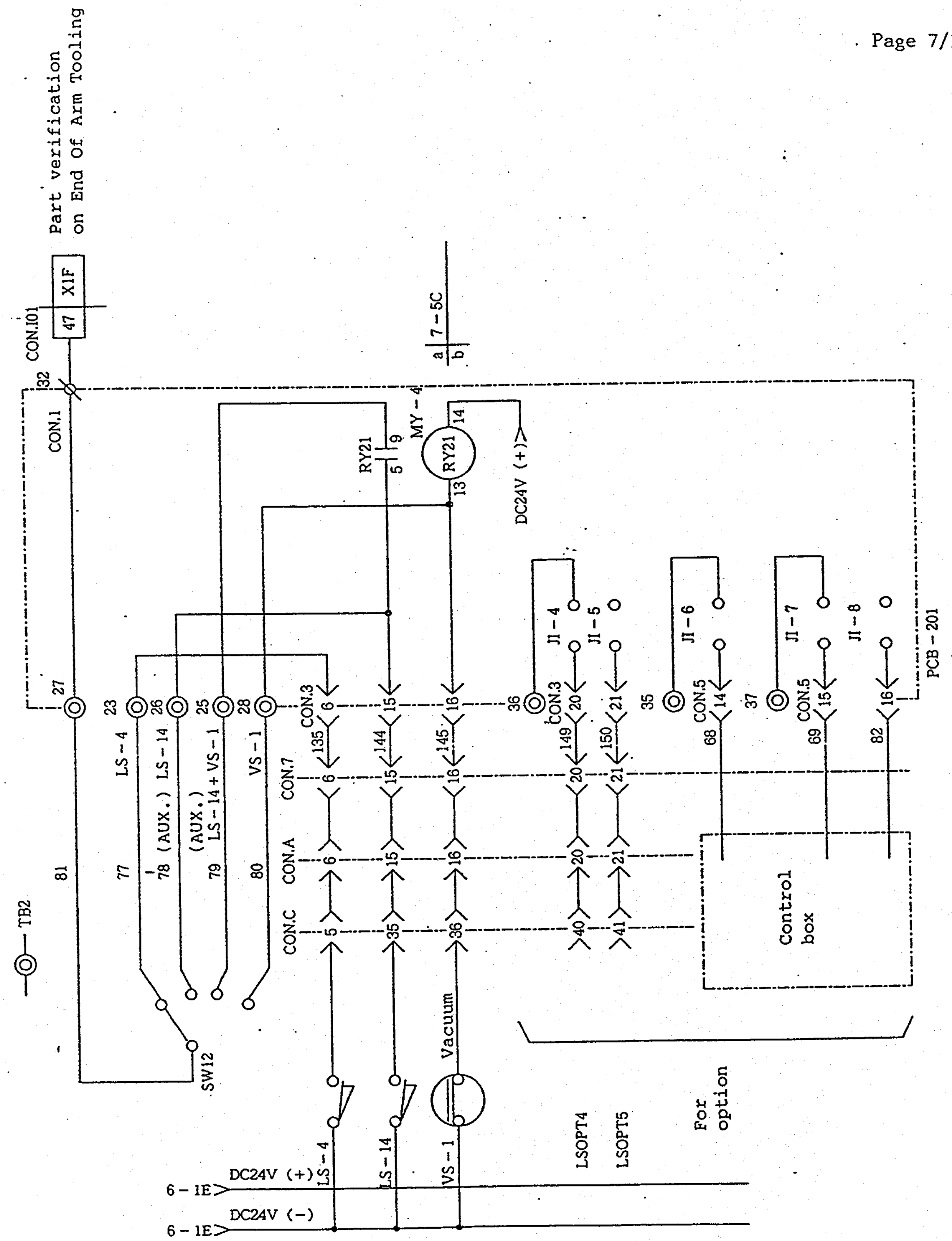

AC.18V
Earth
Emergency stop
91
92
17
18
E
CON.P1
3
5
2
1
4
RUN
PM – 912
(Sequence controller)
CON.1A
CON.101
CON.102
CON.1B
1
1
50
50

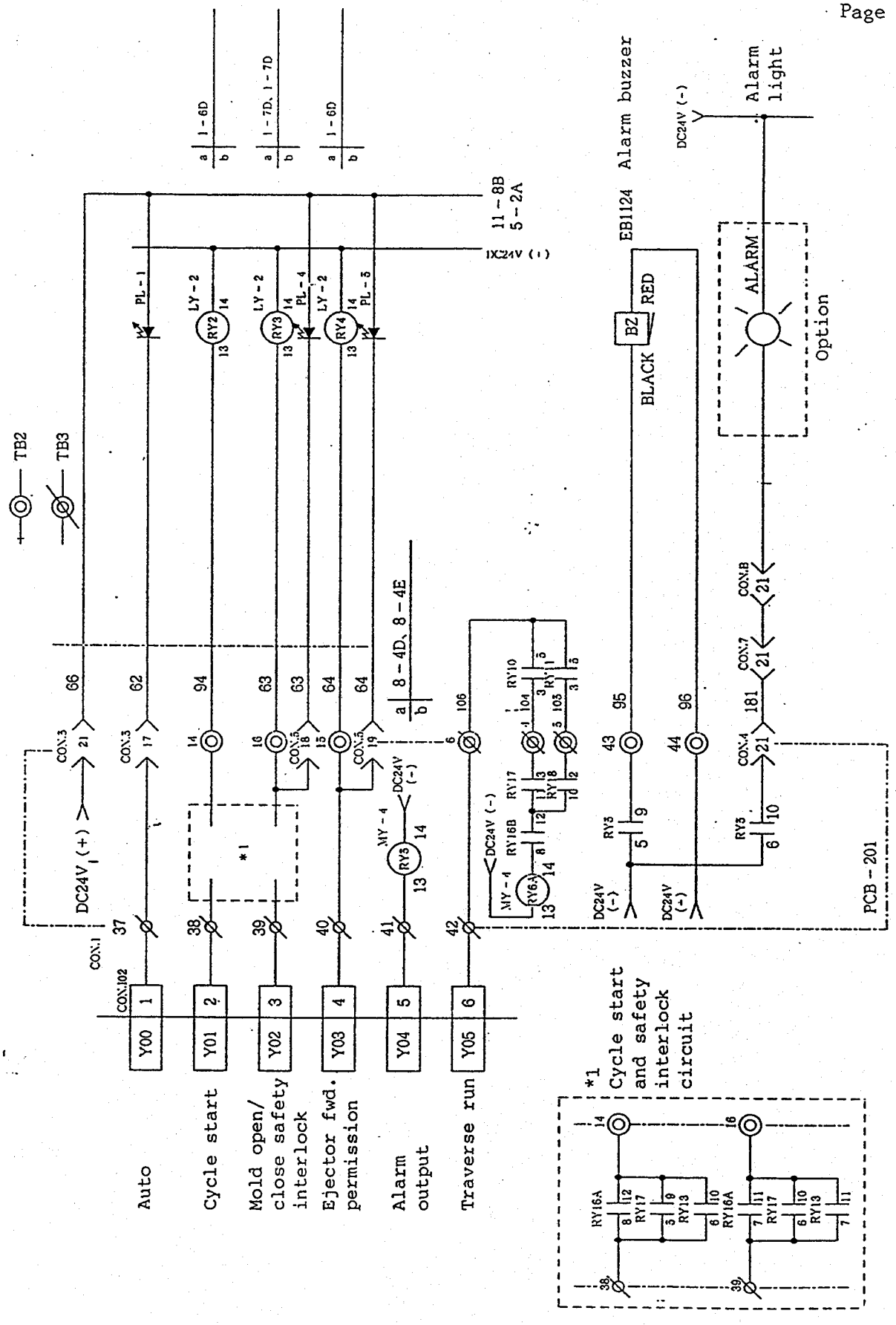

TB1
E
R
S
Power supply
NFB1
CP – S2PA – 1M3A
NF
ZAC2205 – 00
T1 (Transformer)
0V
240V
220V
200V
REC
DS5BN – L
5A
R1
510Ω
5W
CP – S1PD – M2.5A
C1
1500μF50V
NFB2
DC24V
TB2
Interface PCB
PCB – 201
4A
18V
1A
FUSE
PM – 912C
Sequence controller

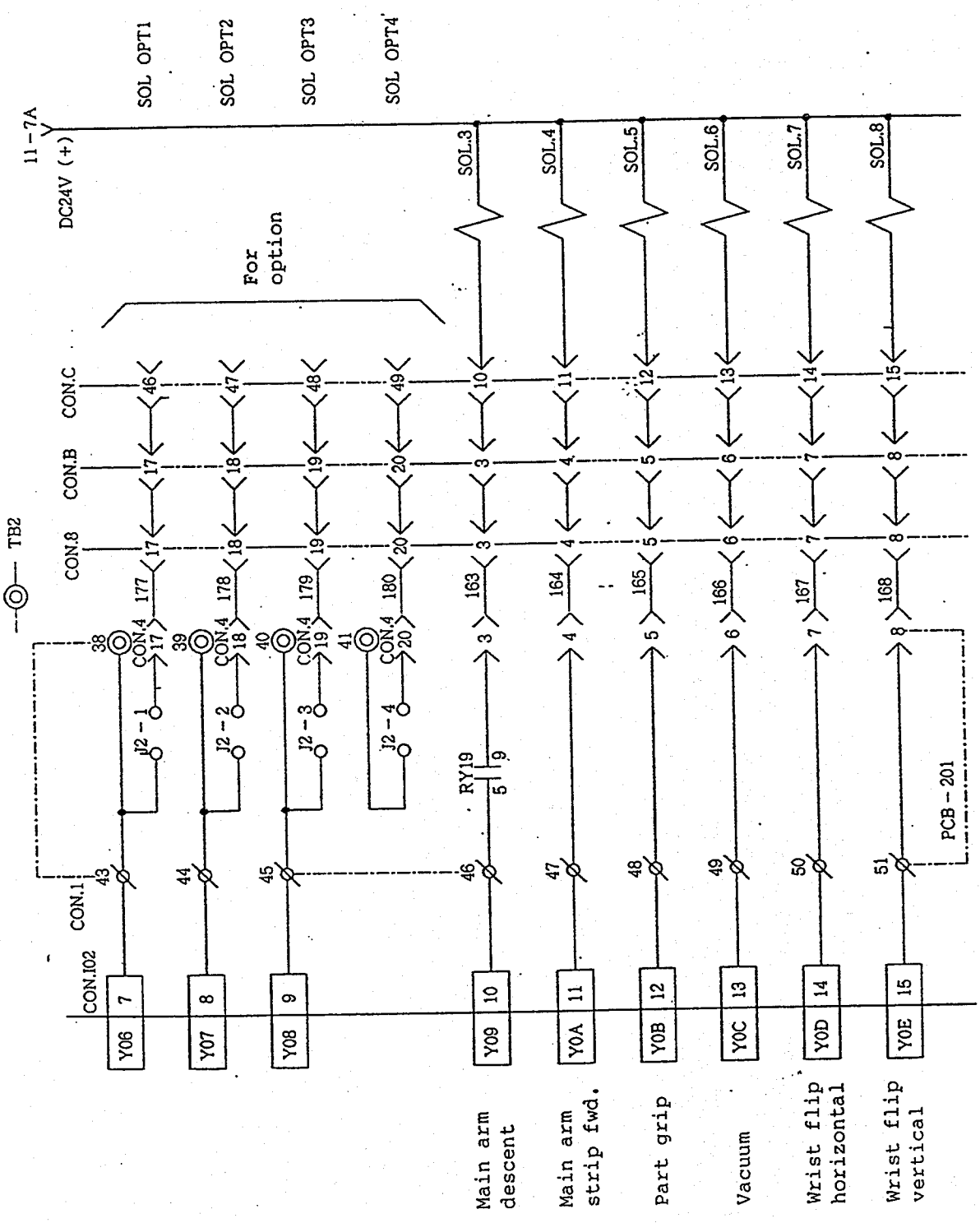

a | 1 - 6D, 11 - 3D, 4 - 5A
b
PM - 912
RUN
CON.5
5 - 1A
50
1
DC24V (-)
RY - 24
CON.P1
51
10
5
90
9
91
SW - 20
RY - 20
7
11
11
92
RY - 20 MY4
13
14
DC24V (+)
CON.1
CON.I01
SW - 4
51
2
SW - 1
52
3
SW - 3
53
4
SW - 2
54
5
SW - 5
55
6
SW - 6
56
7
SW - 7
57
8
SW - 9
59
9
SW - 10
60
10
SW - 8
58
11
70
18
71
17
1
2
4
10
11
13
SG
G
9
SW - 11
SW - 13
72
20
SW - 14
73
19
SW - 15
74
22
SW - 16
75
21
13
DC24V (-)
PCB - 201
3 X00 Emergency stop
28 X01 Auto mode
4 X02 Reset
29 X03 Auto start
5 X04 Man. arm Desc./Asc.
30 X05 Man. strip Fwd./Bkwd.
6 X06 Man. wrist Hor./Vert.
31 X07 Man. Traverse out
7 X08 Man. Traverse in
32 X09 Man. grip On/Off
8 X0A Main arm in use
33 X0B Sub arm in use
9 X0C Horiz. position End/Above mold
34 X0D Vertical position End/Above mold
10 X0E S. sprue release Out/In
35 X0F Eject timing Strip/Grip

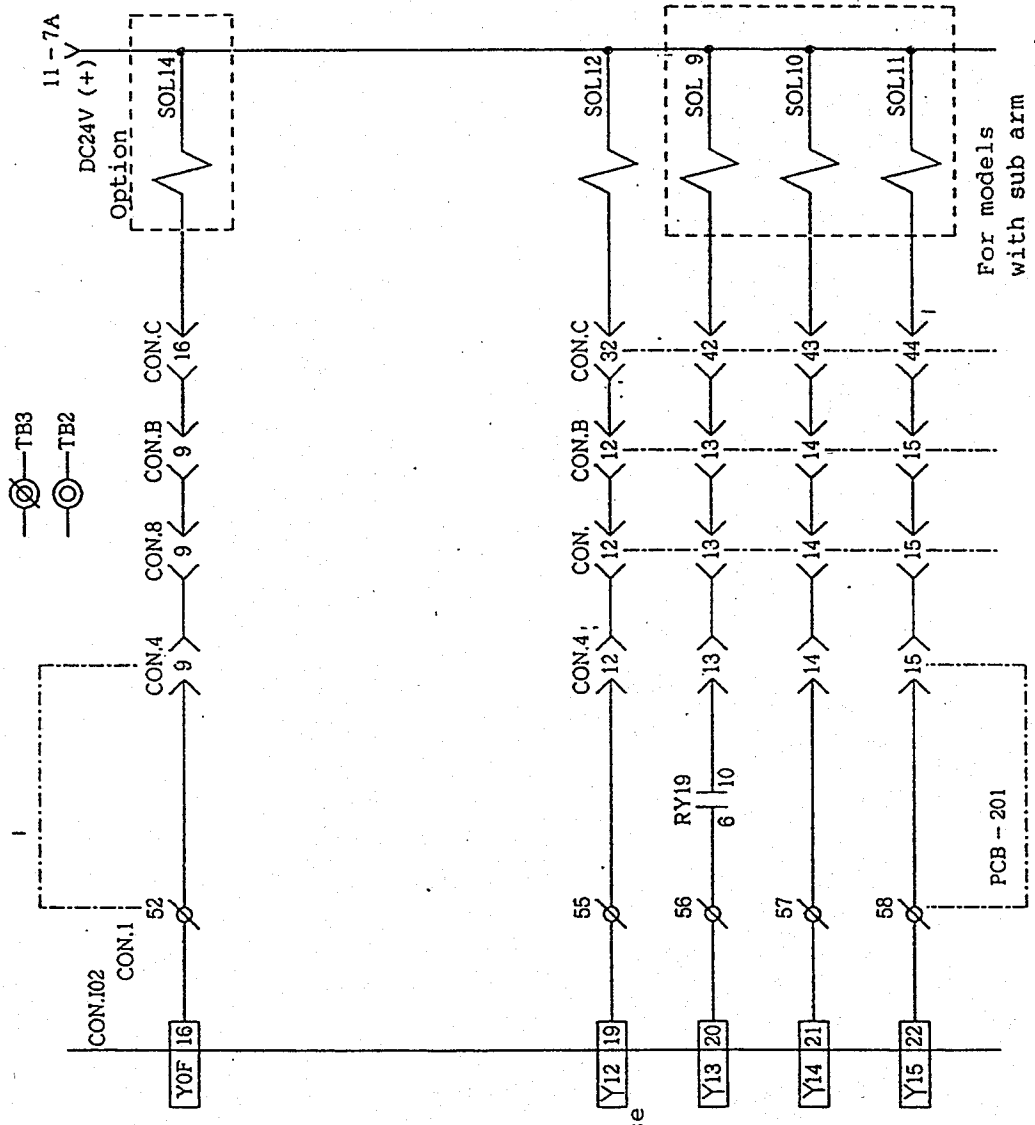

Mold open complete
Robot OFF
Traverse out speed slow down
Traverse in speed slow down
CON.101
X10
X11
X12
X13
X14
X15
CON.1
TB2
For option
DC24V
DC24V (+)
DC24V (-)
MY - 4
RY14
RY15
PCB - 201
JI - 1
JI - 2
JI - 3
CON.3
CON.5
CON.7
CON.A
CON.C
RY1
66 PL - 3
50 SW - 1
LS OPT1
LS OPT2
LS OPT3
For option
LS - 12
LS - 13
4 - 1A 8 - 7C
6 - 1E 6 - 1E

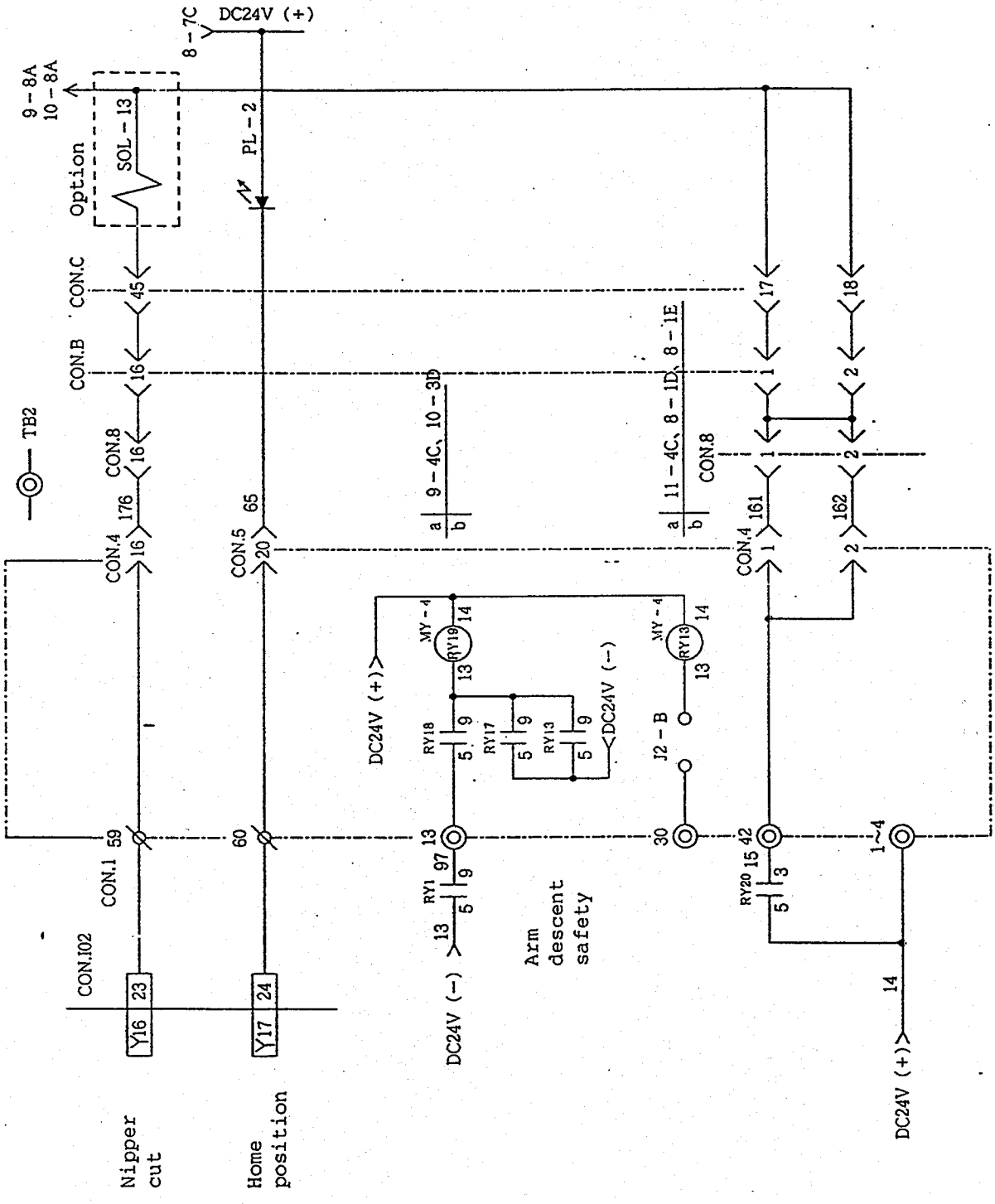

Main sprue verification
Arm upward end
Arm downward end
Traverse outward end
Traverse inward end
Sprue release position
Main arm strip backward end
Wrist vertical end
Wrist horizontal end
CON.101
CON.1
CON.4
CON.C
CON.A
CON.7
PCB-201
DC24V (-)
DC24V (+)
MY-4
RY16A
RY16B
RY17
RY18
RY22
LS-1
LS-2
LS-3
LS-5
LS-6
LS-7
LS-8
LS-9
LS-10
LS-11
G or GW type
5-1B
7-1B
RY16a
RY16B
RY17
RY18
RY22
8-1D, 8-1E
8-4D, 10-3B
8-1D, 8-1E, 11-4C
8-4D, 10-4C
10-4C

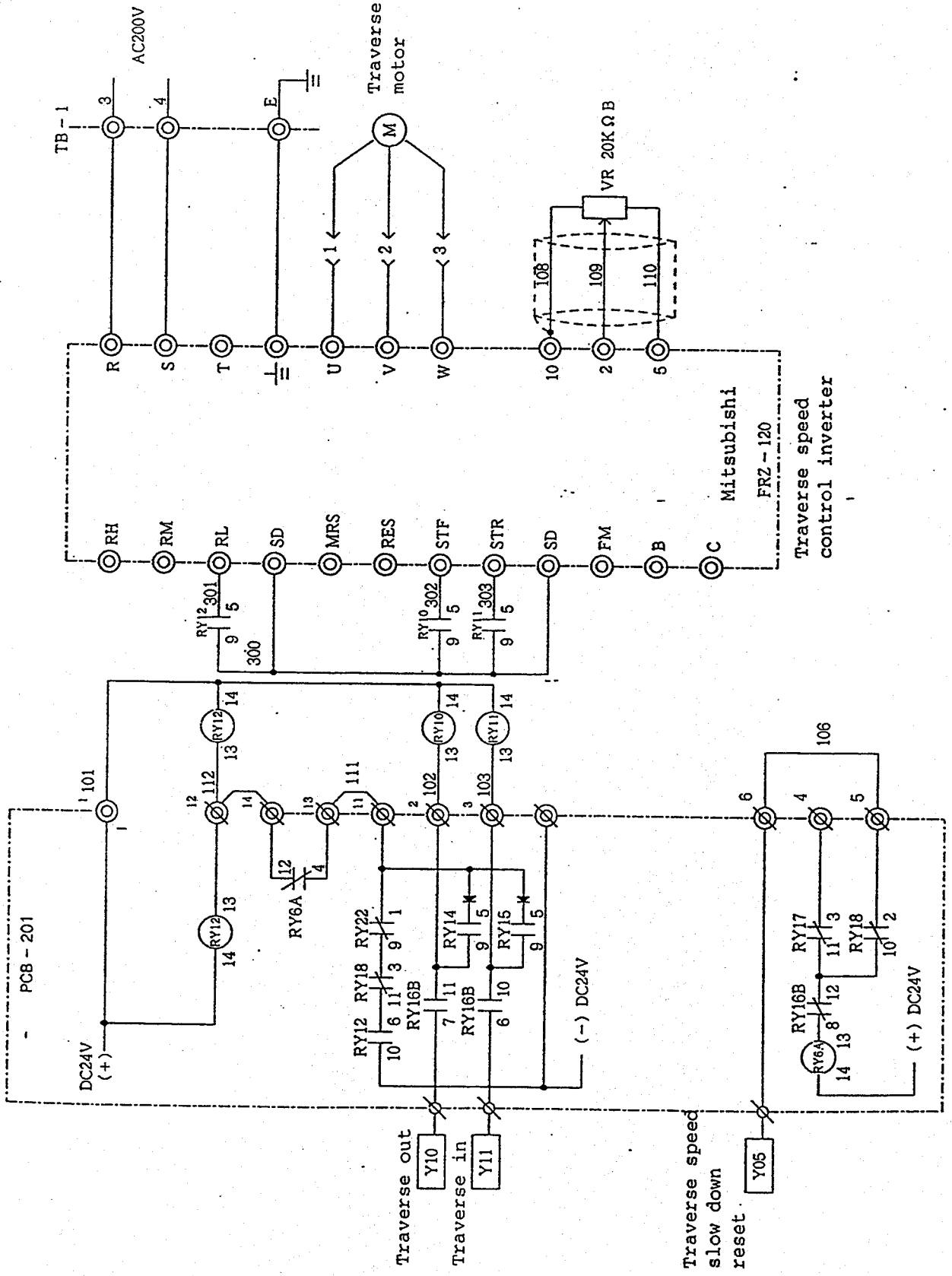

Part verification
on End Of Arm Tooling
XIF
47
CON.101
32
CON.1
7 - 5C
a
b
MY - 4
RY21
9
5
14
13
DC24V (+)
27
23
26
25
28
LS - 4
(AUX.) LS - 14
(AUX.)
LS - 14 + VS - 1
VS - 1
CON.3
CON.7
CON.A
CON.C
36
35
37
JI - 4
JI - 5
JI - 6
JI - 7
JI - 8
PCB - 201
CON.5
135
144
145
149
150
68
69
82
81
77
78
79
80
TB2
SW12
Control
box
Vacuum
LSOPT4
LSOPT5
For
option
DC24V (+)
DC24V (-)
6 - 1E
LS - 4
LS - 14
VS - 1


TB2
TB3
DC24V (+)
CON.1
CON.102
Y00
Y01
Y02
Y03
Y04
Y05
Auto
Cycle start
Mold open/ close safety interlock
Ejector fwd. permission
Alarm output
Traverse run
*1
Cycle start and safety interlock circuit
RY16A
RY17
RY13
RY16B
MY-4
PL-1
PL-4
PL-5
LY-2
RY2
RY3
RY4
a 1-6D
b
a 1-7D, 1-7D
b
a 1-6D
b
11-8B
5-2A
DC24V (-)
a 8-4D, 8-4E
b
RY10
RY1
EB1124 Alarm buzzer
BZ
BLACK
RED
DC24V (-)
Alarm light
ALARM
Option
CON.8
CON.7
CON.4
RY3
PCB-201


11-7A
DC24V (+)
SOL OPT1
SOL OPT2
SOL OPT3
SOL OPT4
For option
SOL.3
SOL.4
SOL.5
SOL.6
SOL.7
SOL.8
TB2
CON.C
CON.B
CON.8
CON.4
CON.1
CON.102
J2-1
J2-2
J2-3
J2-4
RY19
PCB-201
Y06
Y07
Y08
Y09
Y0A
Y0B
Y0C
Y0D
Y0E
Main arm descent
Main arm strip fwd.
Part grip
Vacuum
Wrist flip horizontal
Wrist flip vertical


11-7A
DC24V (+)
Option
SOL14
SOL12
SOL 9
SOL10
SOL11
For models
with sub arm
TB3
TB2
CON.C
CON.B
CON.8
CON.4
CON.
CON.4
CON.1
CON.102
RY19
PCB-201
YOF
Y12
Y13
Y14
Y15
Main sprue
grip
Traverse
lock release
Sub arm
descent
Sub arm
strip fwd.
Sub sprue
grip


DC24V (+)
8 - 7C
9 - 8A
10 - 8A
Option
SOL - 13
PL - 2
CON.C
CON.B
CON.8
CON.4
CON.5
CON.1
CON.102
TB2
45
16
176
65
20
59
60
Y16
Y17
23
24
9 - 4C, 10 - 3D
11 - 4C, 8 - 1D, 8 - 1E
17
18
161
162
42
15
1~4
14
MY - 4
RY19
RY18
RY17
RY13
RY1
RY20
J2 - B
DC24V (-)
Nipper cut
Home position
Arm descent safety


AC200V
TB-1
3
4
E
Traverse motor
M
1
2
3
VR 20K Ω B
108
109
110
R
S
T
U
V
W
10
2
5
Mitsubishi
FR2-120
Traverse speed control inverter
RH
RM
RL
SD
MRS
RES
STF
STR
SD
FM
B
C
RY12 301 5 9
300
RY10 302 5 9
RY11 303 5 9
PCB-201
DC24V (+)
101
112
111
102
103
106
RY6A
RY22
RY18
RY16B
RY14
RY15
RY17
(-) DC24V
(+) DC24V
Traverse out
Traverse in
Traverse speed slow down reset
Y10
Y11
Y05

List of electrical components

Ref. No.	Description	Model	Manufacturer
	Sequencer	PM-912C	MITSUBISHI
	Battery	PM-54B	"
SW2, 3, 5 - 10	Push button switch	AB5110	IZUMI
SW-4	Locking type push button switch	AVW301-R	"
SW-1	Selector switch with key	AS53K20N-B	"
REC	Diode bridge	DS5BN-L	MITSUBISHI
PL1 - 5	LED	KRE-10824VDC green	KIMDEN
T1 T2	Transformer (200V) " (240V)	2H-185 2TZ-3S	TOYODEN "
	Diode	S5200D	TOSHIBA
SW13 -16	Snap type selector switch	WD1161 T103D	MATSUSHITA
SW11	Rotary type selector switch	MR-34	ALPS
SW12	"	MR-43	"
BZ	Buzzer	EB1124	MATSUSHITA
C1	Capacitor	ECEM1MR153F	"
RY1	Relay	MY-4 (Corresponds to the voltage of mold open signal)	OMRON
RY2 - 5	Relay	LY-2 24V DC	"
RY6A, B	Relay	MY-4 24V DC	"
RY12 - 22	Relay	"	"
	Transistor for output of PM-513C (in the PM-513C)	2SD633	TOSHIBA
	Speed control pack (200V) " (100V)	SS32MA-J SS31MA-J	ORIENTAL "
	Enameled resistor 30Ω 20W	EPCR30H20M	"
	Capacitor	CY60B	"
RY10, 11	Relay	LY-2 24V DC	OMRON
VR1	Variable resistor 20KΩ	RV24YN B20K-20S	-
VR2	Variable resistor 10KΩ	RV24YN B10K-20S	-

Input and output signals and timers

Input signal	Signal name	Symbol	Remarks
X 000	Emergency stop	SW- 0	Including external emergency stop signals.
X 001	Automatic operation	SW-1	
X 002	Reset (manual parts verification)	SW- 2	
X 003	Auto start	SW- 3	
X 004	Man. arm descent/ascent	SW- 4	
X 005	Man. kick forward/backward	SW- 5	
X 006	Man. wrist flip horizontal/ vertical	SW- 6	
X 007	Man. traverse outward	SW- 7	
X 008	Man. traverse inward	SW- 8	
X 009	Man. grip ON/OFF	SW- 9	
X 00A	Arm selector, main arm	SW-11	
X 00B	Arm selector, sub-arm	SW-11	
X 00C	Wrist flip horizontal, traverse end/above mold	SW-13	
X 00D	Wrist flip vertical, traverse end/above mold	SW-14	

Input signal	Signal name	Symbol	Remarks
X 00E	Runner sprue release, on way out / on way in	SW-15	
X 00F	Eject on kick forward/on grip	SW-16	
X 010			TB2 - 24
X 011	Mold open completion signal	RY-1	
X 012	Robot OFF		
X 013			TB2 - 29 LS OPT1
X 014			TB2 - 23 LS OPT2
X 015			TB2 - 22 LS OPT3
X 016	Sub-arm sprue verification		
X 017	Upward end	LS-3 LS- 5	
X 018	Downward end	LS-7 LS-11	
X 019	Traverse outward end	LS-1	
X 01A	Traverse inward end	LS-2	
X 01B	Sprue releasing position	LS-9	

Input signal	Signal name	symbol	Remarks
X /C	Kick backward end	LS-6	
X /D	Wrist flip vertical end	LS-8	
X /E	Wrist flip horizontal end	LS-10	
X /F	Main arm pickup verification	LS-4, 14 VS-1	

Output signal	Signal name	Symbol	Remarks
Y 000	Automatic operation	PL-1	
Y 001	Injection machine start signal	RY-2	
Y 002	Injection machine mold close, open safety interlock signal	RY-3	
Y 003	Injection machine ejector forward signal	RY-4	
Y 004	Alarm signal	RY-5	
Y 005	Traverse start	RY-6A	
Y 006			TB2 - 38
Y 007			TB2 - 39 SOL OPT2
Y 008			TB2 - 40 SOL OPT3
Y 009	Main arm cylinder descend	SOL-3	
Y 00A	Main kick forward	SOL-4	
Y 00B	Grip	SOL-5	
Y 00C	Vacuum	SOL-6	
Y 00D	Wrist flip horizontal	SOL-7	
Y 00E	Wrist flip vertical	SOL-8	

Output signal	Signal name	Symbol	Remarks
Y06F	Main arm cyl. sprue grip	SOL-14	
Y010	Traverse outward	SOL-1 RY-10	
Y011	Traverse inward	SOL-2 RY-11	
Y012	Traverse lock release	SOL-12	
Y013	Sub-arm cyl. descend	SOL-9	
Y014	Sub-arm cyl. kick forward	SOL-10	
Y015	Sub-arm cyl. sprue grip	SOL-11	
Y016	Nipper	SOL-13	
Y017	Home position	PL-2	

Timer No.	Timer name	Remarks
T023 (VR8)	Nipper cut delay timer	
T022 (VR7)	Kick forward delay timer	
T021 (VR6)	Grip timing delay timer	
T020 (VR5)	Kick backward delay timer	
T019 (VR4)	Grip release timing delay timer	
T018 (VR3)	Main arm cyl. second ascent delay timer	
T017 (VR2)	Aux.	
T016 (VR1)	Cycle monitor timer	

Assignment of Input/Out put signals and analogue timers for sequencer PM-513C

	POWER
	CPU
	BATT

BATTERY REPLACEMENT

IN

	X00	EMERGENCY STOP
	X01	AUTO MODE
	X02	RESET
	X03	AUTO START
	X04	MAN.ARM DESCENT/ASCENT
	X05	MAN. KICK FORWARD/BACKWARD
	X06	MAN.WRIST FLIP
	X07	MAN.TRAVERSE OUTWARD
	X08	MAN.TRAVERSE INWARD
	X09	MAN.GRIP
	X0A	ARM SELECTOR.MAIN
	X0B	ARM SELECTOR. SUB
	X0C	WRIST FLIP HORIZONTAL POSITION SELECT
	X0D	WRIST FLIP VERTICAL POSITION SELECT
	X0E	SUB ARM SPRUE RELEASING POSITION SELECT
	X0F	EJECT TIMING SELECT
	X10	
	X11	MOLD OPEN SIGNAL
	X12	ROBOT OFF
	X13	
	X14	
	X15	
X	X16	SPRUE VERIFICATION (LS-5)
O	X17	ARM UPWARD END (LS-3,7)
X	X18	MAIN ARM DOWNWARD END (LS-11)
X	X19	TRAVERSE OUTWARD END (LS-1)
O	X1A	TRAVERSE INWARD END (LS-2)
X	X1B	SPRUE RELEASING POSITION (LS-9)
O	X1C	KICK BACKWARD END (LS-6)
O	X1D	WRIST FLIP VERTICAL (LS-8)
X	X1E	WRIST FLIP HORIZONTAL (LS-10)
X	X1F	PARTS VERIFICATION (LS-4,14,VS-1)

└HOME POSITION:LED INDICATION
O=ON X=OFF

TIMER

	VR8	
	VR7	KICK FORWARD DELAY
	VR6	GRIP DELAY
	VR5	KICK BACKWARD DELAY
	VR4	GRIP RELEASE DELAY
	VR3	MAIN ARM SECOND ASCENT DELAY
	VR2	
	VR1	CYCLE MONITOR TIMER

OUT

	Y00	AUTO OPERATION
	Y01	MOLD CLOSE START SIGNAL
	Y02	MOLD CLOSE/OPEN SAFETY INTERLOCK SIGNAL
	Y03	EJECTOR START SIGNAL
	Y04	ALARM
	Y05	TRAVERSE MOTOR RUN
	Y06	
	Y07	
	Y08	
	Y09	MAIN ARM DESCENT (SOL-3)
	Y0A	MAIN ARM KICK FORWARD (SOL-4)
	Y0B	PART GRIP (SOL-5)
	Y0C	VACUUM SUCTION (SOL-6)
	Y0D	WRIST FLIP HORIZONTAL (SOL-7)
	Y0E	WRIST FLIP VERTICAL (SOL-8)
	Y0F	MAIN ARM SPRUE GRIP (SOL-14)
	Y10	TRAVERSE OUTWARD (SOL-1)
	Y11	TRAVERSE INWARD (SOL-2)
	Y12	TRAVERSE LOCK RELEASE (SOL-12)
	Y13	SUB ARM DESCENT (SOL-9)
	Y14	SUB ARM KICK FORWARD (SOL-10)
	Y15	SUB ARM SPRUE GRIP (SOL-11)
	Y16	NIPPER CUT (SOL-13)
	Y17	HOME POSITION

Input and Output signal indication

○ OFF
● ON (Light)
ϑ Unfixed

			Home position	First descent	Kick forward	Grip	Kick backward	First ascent	Verification	Wrist horizontal above mold	Traverse outward	Sprue release	Wrist horizontal at traverse end	Second descent	Grip release	Second ascent	Wrist return vertical at traverse end	Traverse inward	Sprue release	Wrist return vertical above mold	Cycle end	
Main descent	SOL-3	Y09	○	●	●	●	●	○	○	○	○	○	○	●	●	○	○	○	○	○	○	○
Main kick.	SOL-4	Y0A	○	○	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Grip	SOL-5	Y0B	○	○	○	●	●	●	●	●	●	●	●	●	○	○	○	○	○	○	○	○
Vacuum	SOL-6	Y0C	○	●	●	●	●	●	●	●	●	●	●	●	○	○	○	○	○	○	○	○
Wrist (flip) horizontal	SOL-7	Y0D	○	○	○	○	○	○	○	●	○	○	●	○	○	○	○	○	○	○	○	○
Wrist (flip) vertical	SOL-8	Y0E	○	○	○	○	○	○	○	○	○	○	○	○	○	○	●	○	○	●	○	○
Main sprue grip	SOL-14	Y0F	○	○	○	●	●	●	●	●	●	●	●	●	●	●	●	●	○	○	○	○
Traverse outward	SOL-1	Y10	○	○	○	○	○	○	○	○	●	●	○	○	○	○	○	○	○	○	○	○
Traverse inward	SOL-2	Y11	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	●	●	○	○	○
Traverse lock release	SOL-12	Y12	○	○	○	○	○	○	○	○	●	●	○	○	○	○	○	●	●	○	○	○
Sub descent	SOL-9	Y13	○	●	●	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Sub kick	SOL-10	Y14	○	○	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Sub sprue chuck	SOL-11	Y15	○	○	○	●	●	●	●	●	●	ϑ	ϑ	ϑ	ϑ	ϑ	ϑ	ϑ	○	○	○	○
Nipper	SOL-13	Y16	○	○	○	○	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○	○
Home position		Y17	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	●	○
AUX.		VR8	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Kick fwd. delay		VR7	○	○	●	●	●	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○
Grip delay		VR6	○	○	○	●	●	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○
Kick back delay		VR5	○	○	○	○	●	●	●	○	○	○	○	○	○	○	○	○	○	○	○	○
Grip release delay		VR4	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Second ascent delay		VR3	○	○	○	○	○	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○
AUX.		VR2	○	○	○	○	○	○	○	○	○	○	○	○	○	●	○	○	○	○	○	○
Cycle monitor		VR1	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
Sub arm sprue verification	LS-5	X16	○	○	○	○	○	○	●	●	●	ϑ	ϑ	ϑ	ϑ	ϑ	ϑ	ϑ	ϑ	○	○	○
Upward end	LS-3,7	X17	●	○	○	○	○	○	●	●	●	●	●	○	○	●	●	●	●	●	●	○
Downward end	LS-11	X18	○	●	●	●	●	○	○	○	○	○	○	●	●	○	○	○	○	○	○	○
Traverse outward end	LS-1	X19	○	○	○	○	○	○	○	○	○	○	●	●	●	○	○	○	○	○	○	○
Traverse inward end	LS-2	X1A	●	●	●	●	●	●	●	●	○	○	○	○	○	○	○	○	○	○	○	○
Sprue releasing position	LS-9	X1B	○	○	○	○	○	○	○	○	○	●	○	○	○	○	○	○	○	●	●	○
Kick backward end	LS-6	X1C	●	●	○	○	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	○
Wrist flip vertical end	LS-8	X1D	●	●	●	●	●	●	○	○	ϑ	ϑ	○	○	○	○	●	●	●	●	●	○
Wrist flip horizontal end	LS-10	X1E	○	○	○	○	○	○	○	ϑ	ϑ	ϑ	○	○	○	○	●	●	●	●	●	○
Main arm part verification	(Note)	X1F	○	○	○	○	○	○	●	ϑ	ϑ	ϑ	ϑ	●	●	●	○	●	●	○	○	○
Mold open completion		X11	ϑ	●	●	●	●	●	●	ϑ	ϑ	ϑ	ϑ	ϑ	ϑ	ϑ	ϑ	ϑ	ϑ	ϑ	ϑ	○

Note: X37 lights when parts grip is rerifired at any selected position of SW- 12