V K 45 Ⅱ

MACHINING CENTER

INSTRUCTION MANUAL

SEIKI-SEICOS MⅢ

(Edition1. 7-1996)

MORI SEIKI

THE MACHINE TOOL COMPANY

CONTENTS

Chapter 1 INTRODUCTION

We are obliged to you for using our VKⅡ -type machining center.
This manual describles the installation, operation, daily maintenance and inspection, etc. of this machine in order for you to be able to properly operate the machine and make full use of its performance. Prior to its installation and test run, read this manual throughly to understand the contents provided for handling the machine.
To secure safe operation, follow the safety precautions described in this manual and the instructions given on the warning signs attached to the machine.
For your general understanding of this machine, the following documents are provided other than this instruction manual. Refer to them when necessaey:

1. Extra Specification. Instruction Manual for Extra Accessories
2. Programming Manual
3. Instruction Manual and Maintenance Manual for NC Unit
4. Electric Circuit Diagram

For adjustment/setting values data sheets such as the "Parameters List" which are packed together with this machine, keep them carefully because they are necessary for later maintenance and adjustment work.

A design is subject to change due to remodeling of this machine. Note that part of explanations in these manuals may not apply as a result.

1. General Precautions

1. OPERATION

1. Be aware of the position of the push button for emergency stop so that the operator may be able to press it instantly.
2. As for the operation of the machine, proceed in accordance with the procedure described later.
3. During operation, keep hands away from the rotating sections and movable sections.
4. When disposing of chips that wound round tooling or fell onto the table, it is dangerous to grasp and pull them. Further, when disposing of chips, be sure to do it after stopping the machine.
5. When adjusting the position of the coolant nozzle, do it after stopping the machine.

2. OPERATION FINISH

1. After operation of the machine is over, be sure to switch the power OFF in the prescribed order, clean the machine and apply rust preventive oil to each section of the machine such as the slide ways. When soluble cutting fluid is used; perform these jobs with special care.

3. LUBLICATION

Since lubrication oil exerts a great influence on machine durability and accuracy, extreme care must be taken for maintenance of the whole lubricating system. Perform the following check and maintenance precautions.

1. Fill with the oil specified in the manual to the specified amount.
2. Clear the oil port in advance and be careful that forein substances such as dust, water and chips do not enter the tank.
3. Check the bottom of the oil jug to see if there is any debris, water or cutting chips, etc. inside. Sufficient care is required to distinguish the oil jug by appropreate color coding and fixed stock location to avoid mixed use of different kinds of oil.

4. Check the oil periodically and if foreign substances are found, clean the inside of the tank promptly and replace it with new oil.
Don't use all of the oil, even from a new can. This is necessary in order to remove water and sediment etc.

5. Although low levels in the lubrication oil tank are detected by a float switch that flashes an alarm signal, check to see if discharging is normal. There are two possible problems:
Oil in the tank decreases extraodinarily fast, or it is decreasing too slowly.

6. As for the suction filter fitted to the pump and the in-line filter in the piping circuit, replace them with new ones once a year as a rule.

7. Air in the main lubrication pipes has been bled when the machine is delivered, but when the piping is removed for maintenance, bleed air completely at the time of reassembly and operate the machine after checking the state of discharging at the end.

4. COOLANT

The soluble cutting fluid is decomposed due to factors such as mixture of lubrication oil and propagation of micro-organisms that lower cutting and rust prevention efficiency. This causes various troubles to occur.
When using soluble cutting fluid, care must be taken of the following points.

1. When selecting soluble cutting fluid, carefully consider lubrication, infiltration, rust prevention, bubble prevention, separability against oil and safety needs.

2. Before operation starts and after operation ends, not only remove chips, but also wipe off soluble cutting oil adhered to each slideway, the rotating parts, the saddle and cross-slide of the machine and then be sure to apply lubrication oil thinly to those parts.

3. Replace soluble cutting fluid immediately if it becomes vitiated.

4. Remove the covers every three months and clean each slideway, X, Y, Z axes ball-screws, each limit switch and feed motors etc.

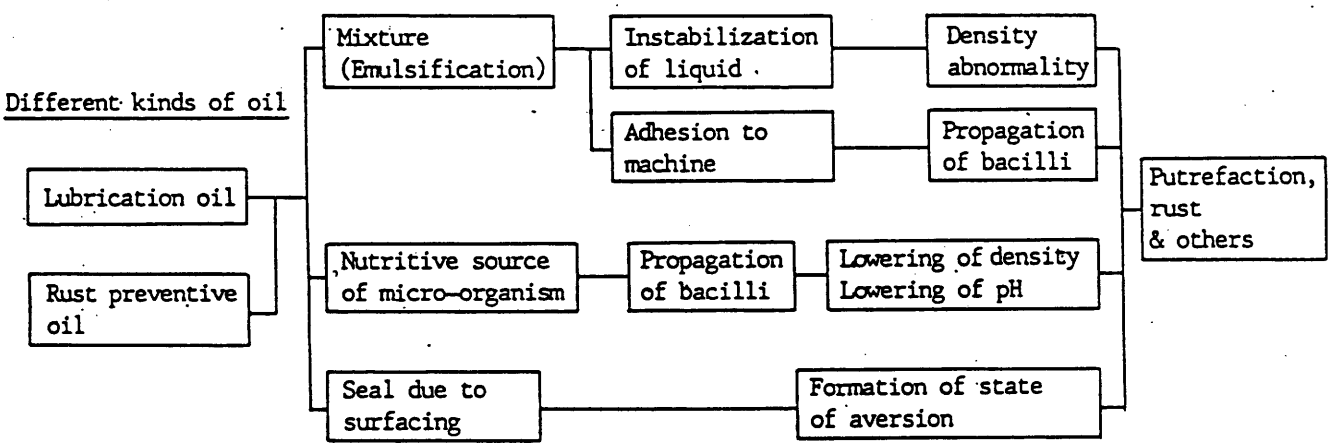
5. As soluble cutting oil is considered for rust prevention, it may be no problem when the workpiece is wet. However, when dry, it is apt to rust. Therefore, it is recommendable to apply rust preventive oil before the workpiece dries after finished machining.

6. Since soluble oil is alkalescent and has a strong degreasing action, the operator is apt to develop dermatitis.
   Therefore, the operator should take appropriate precautions.

7. As for the diluting method and soluble cutting fluid, diluting water they are different depending on the type of soluble cutting oil, so use it in accordance with the recommendations of the cutting fluid manufacturer.

8. Since there are instances where extensive micro-organisms are detected in industrial water, it is recommendable either to check it before use as water for dilution or to use service water.

9. The influences of difference kinds of oil on coolant are as follows:
   Carefully monitor the condition the coolant fluid.



5. WEIGHTS and MEASURES TABLE

(Metric and English Conversion)

1. Liner measure

1m(meter) = 39.37 inches = 3.2808 feet = 1.0936 yards
1cm(centimeter) = 0.3937 inch
1mm(millimeter) = 0.03937 inch

2. Square measure

$1m^2$(square meter) = 10.764 square feet = 1.196 square yards
$1cm^2$(square centimeter) = 0.155 square inch
$1mm^2$(square millimeter) = 0.00155 square inch

3. Cubic measure

$1m^3$(cubic meter) = 35.315 cubic feet = 1.308 cubic yards
= 264.2 U.S. gallons = 220.0 U.K. gallons
1ℓ(liter, cubic decimeter) = 0.0353 cubic foot = 61.023 cubic inches
= 0.2642 U.S. gallon = 1.0567 U.S. quarts
= 0.2200 U.K. gallon = 0.02745 bushel
$1cm^3$(cubic centimeter) = 0.061 cubic inch

4. Weight

1 ton (metric ton) = 0.9842 U.S. (long)ton = 2204.6 pounds
= 1.1023 U.K. (short)ton
1 kg (kilogram) = 2.2046 pounds = 35.274 ounces avoirdupois

5. Others

1 kg/cm^2(kilogram per square centimeter) = 14.223 pounds per square inch
1 kg-m(kilogram-meter) = 7.233 foot-pounds

Chapter 2 SPECIFICATIONS

1. Outline of Machine

This is a high-rigidity high-accuracy vertical machining center with symmetric structure and thermal symmetry. It does not have its axes piled one on another, its moving parts are free from overhang which is consequent upon a move of each axis, thus providing stable operating accuracy.

- **Features of machine**

1. Stable Operating Accuracy
   In addition to the above-mentioned axial structure which does not have the axes piled one on another, the guide block uses a rigid high-speed rolling guide to assure good operating accuracy.

2. Doubled Rapid Traverse Rate
   In order to reduce a non-cutting time, a rapid traverse rated has been doubled to 30 m/min.(X- and Y-axes), compared with conventional machines.

3. Succession of easy operation as kind to humon
   This machine adopts column traverse system and ensure the accessibility to the table with one axis movement of X axis only at the table movement.
   The operation panel is designed with inclination 10 ° to the main operating section and whole panel rotates 60° horizontally and can be used it with fix as easy to look at the CRT.
   Needless to say, the UTS is provided as standard equipment and set up saving function is available such as W setter as usual.

4. We keep a rich assortment of goods to widen selection of customer.

• Outline of machine structure

Standard specification consist of T shape bed, column, spindle head, table, ATC, power cabinet (Including controller), splush guard and hydraulic-pneumatic devices and also it is integrated structure of machine, electric and hydraulic components. (Refer to nomenclature of each section)

1. Bed

   The bed has a box-type enclosed structure and high regidity. A spiral conveyor has been installed in the X-axis direction on the column side to fully dispose of cutting chips.

2. Column

   In addition to high rigidity secured by a box-type structure, the machine has been designed symmetric to assure high thermal symmetry. The column, which is of traverse system, moves in the longitudinal direction (Y-axis direction).

3. Spindle head

   Spindle drive uses built-in type direct drive with wide range constant power motor and adopts a new spindle head cooling system so that prevent a heat transmission of spindle bearing and built-in motor to the machine and control a heat deformation as small as possible.

4. Table

   The table has sufficient thickness to secure rigidity. When moving the table to the left and right, stable operating accuracy can be obtained because there is no overhang.

5. Guide Block and Feed Mechanism

   Each of the moving parts, X-, Y-, and Z-axes, uses a rigid rolling guide, and a 12mm-lead ball screw, both allowing for high-speed operation.

6. ATC (Automatic tool changer)

   Tool change is executed at the top end of the spindle head.
   20 tools can be stored in the tool magazine as standard and fixed address system is applied to secure tool change with easy operation.
   Because of simple and compact structure, interference with workpiece at the time of tool change is very rare.

- Production support system (STAF function)

  Review a developed system to improve a productivity for the customer and provide the production support system (STAF) with more easy use.
  STAF consist of the following items.

1. Tool management

   Tool life, cutting monitor, management of ID tool etc.

2. Scheduler (Option)

   Pallet management such as PPL, VWC, VPS etc.

3. Periodical check

   Maintenance of lubricant or battery etc.

4. Alarm diagnosis

   Display of alarm

5. System

   Display of various data, maintenance of PC (Program controller)

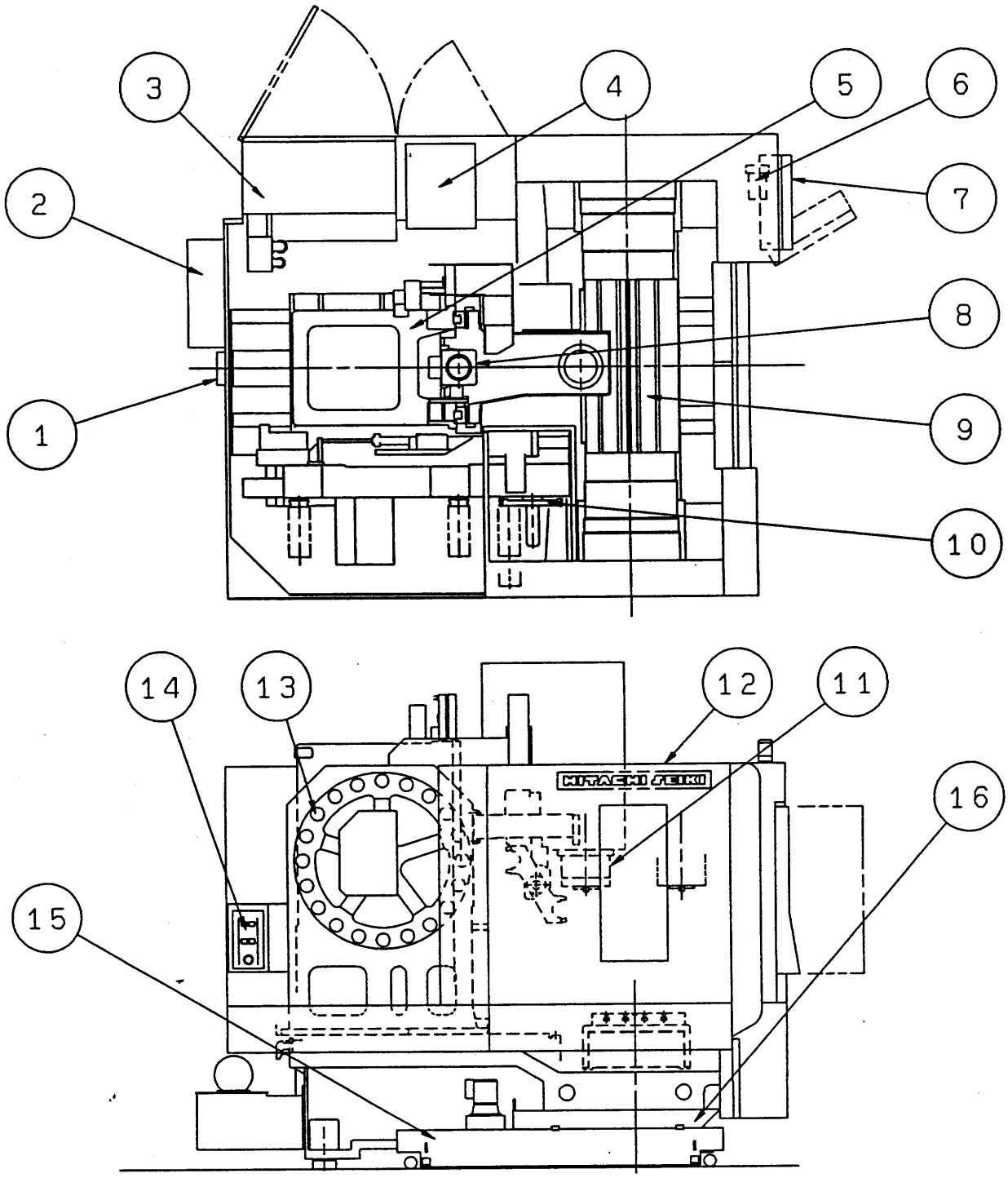
6. Information of instruction manual

   G code, M code list

7. User function

   Clock setting, memorandum function

2. Name of Component Unit



1	Y-axis feed motor	7	Main operation panel	13	ATC magazine
2	Hydraulic unit	8	Z-axis feed motor	14	ATC independent box
3	Electric cabinet	9	Table	15	Coolant tank
4	Spindle cooling unit	10	ATC twin arm	16	Chip box
5	Column	11	Spindle head		
6	Lubricating tank	12	Splush guard		

3. Machine Specification

Specification		VK45 II −40	VK45 II −50
Travel	Travelling distance of X axis (Tabled, longitudinal)	760mm	
	Travelling distance of Y axis (Column, cross)	500mm	
	Travelling distance of Z axis (Spindle head, up and down)	500mm	
	Distance from table top to spindle nose	150～650mm	
	Distance from column front face to center line of spindle	508mm	
Table	Size of table working surface	1120 X 485mm	
	Maximum load capacity on table	750kg	
	DConfigulation of table top	18mm T groove X 4	
	Size of workpiece (Length X Width X Height)	1120 X 485 X 500	
Spindled	Spindle speed Standard * High speed	60~8000min^{-1} 120~12000min^{-1}	45~4500min^{-1} 80~8000min^{-1}
	No. of range of spindle speed change	Full automatic, stepless	Full automatic, stepless
	Spindle tapered hole	7/24 Taper No.40	7/24 Taper No.50
	ID of spindle bearing	75mm	90mm
Feedrate	Rapid traverse	X/Y axes 30000mm/min Z axis 20000mm/min	
	Cutting feedrate	1~10000mm/min	
	Jog feedrate	0~5000mm/min	
	Minimum increment	0.001mm	
Auto-matic tool changer	Type of tool shank	MAS-BT40	MAS-BT50
	Type of pull stud	MAS type P40T-1 (45″)	MAS type P50T-°
	Tool storage capacity	20pcs.	20pcs.
	Max. diameter of tool	110mm	110mm
	Max. length of tool	300mm	300mm
	Max. weight of tool	10kg	20kg
	Tool selection system	Fixed address, random memory, T-4 digits	

Specification		VK45Ⅱ−40	VK45Ⅱ−50
Motor	Main spindle motor Standard	AC7.5/5.5KW (50% ED/Continuous)	**AC11/7.5KW** (50% ED/Continuous)
	* High speed	AC11/7.5KW (50% ED/Continuous)	**AC18.5/15KW** (50% ED/Continuous)
	Feed axis motor	X, Y axes:AC2.3KW, Z axes:AC3.3KW	
	Hydraulic motor	1.5KW	
	Lubrication motor	20W	
	Coolant motor	180W	
	Motor for spindle cooling device (Compressor)	0.5KW	
	Motor for spindle cooling device (Pump)	0.2KW	
	Motor for screw conveyor in machine (Column side, operator side)	0.1KW	
Required power source	Electric power source	22 KVA (Standard specification)	
	Pneumatic power source	0.5 MPa {5kg / cm²} 750 Nl/min	
Tank capacity	Capacity of hydraulic tank	40L (Up to upper limit)	
	Capacity of lubrication tank	1.5L (Up to upper limit)	
	Capacity of coolant tank	180L (Up to upper limit)	
Size of machine	Height of machine	2628mm	
	Floor Space	2400 × 3150mm	
	Machine weight (Including NC unit)	6500kg	

Standard accessories

1. Direct tapping function
2. Spindle cooling device (1250 Kcal/H)
3. Chip converyor in machine (Column side)
4. Splash guard (Totally closed)
5. Flood coolant device (Including coolant tank 180ℓ)
6. Movable manual pulse generator (Changeover each axis of X, Y, Z, A, C)
7. Lighting device (Inside of splash guard)
8. Call light (Yellow)
9. Automatic power shut off device (With leak breaker)
10. Leak breaker
11. Automatic memorization of override (Available both spindle and feed)
12. W setter
13. Easy setter
14. Safety guard
15. Advenced notice function of machining completion
16. Hand tools (Spamners & wrenches one set)
17. Spindle hole cleaner 1 pc.
18. Installation patrs for foundation
19. Melodia

Extra accessories

1. Tool storage capacity of ATC 30, 60, 90, 120 tools
2. High speed spindle NT50:8000min^{-1}, NT40:12000min^{-1}
3. APC system (Parallel shuttle type)
4. NC rotary table
5. A pallet itsell
6. Pallet pool line (6PPL, 8PPL)
7. Pull stud bolt (45° MAS-1 type BT50, 30° MAS-2 type BT50, 30° MAS-2 type BT40)
8. Coolant device Jet coolant Coolant gun
   Oil hole coolant Spindle through coolant
9. Oil mist device Oil mist coolant, continuous type
   Needle coolant, one shot type
10. Mist collector
11. Tool nose air blow
12. Spindle through air blow
13. Internal chips conveyor (Operator side)
14. External chip conveyor, flat type, scraper type, for aluminum chips
15. Magnet roller conveyor (For anti-sludge)
16. Chip wagon (With caster)
17. Closed loop
18. Automatic measuring equipment, automatic centering
19. Measuring equipment on machine
20. Printer equipment for automatic measuring
21. Cleaning tool for automatic measuring
22. Tool length measuring equipment
23. Cutting monitor
24. Spindle load meter
25. Spindle tachometer
26. Additional call light
27. Buzzer alarm unit
28. Integrating timer
29. Work counter (Total 6 digits)
30. Weekly timer
31. Automatic extinguisher
32. Sub table for additional axis
33. Standard fixure (Box type, angle block, sub table)
34. Clamping metal
35. External power transformer 32KVA 65KVA

Note 1. Contents of accessories and optional equipments are subject to change without notice by reasons of production and usage, contact HITACHI SEIKI if any doubt about it.

4. Specification of NC Unit (SEICOS-MIII)

B: Standard O: Option

No.	Item	Specification	Division
Controlled axis			
1	Controlled axis	3 axes: X, Y, Z	B
2	Simultaneously controlled axis	3 axes (Positioning, Linear interpolation)	B
		2 axes (Circular interpolation)	B
3	Additional controlled axis	. Number of additional controlled axis (Total 4 axes)	O
		Simultaneously controlled axis 4 axes (Positioning Linear interpolation)	
Input command			
1	Least input increment	0.001mm	B
2	Least motion increment	0.001mm	B
3	Maximum commandable value	±99999.999mm	B
4	Absolute incremental programming	G90/G91	B
5	Decimal point input		B
6	Inch metric conversion		B
7	Tape code	EIA/ISO automatic recognition	B
8	NC tape (Tape operation is not available)	8 channel black paper tape	B
Interpolation			
1	Positioning	G00	B
2	Linear interpolation	G01	B
3	Multi-guandrant circular interpolation	G02/G03: CW/CCW	B
4	Helical interpolation	Additional axis also available	O
5	Hypothetical axis interpolation		O
6	Polar coordinate interpolation		O
7	Cylindrical interpolation		O
8	Exponential interpolation		O
9	Normal direction control	G411 G421 G401	O

No.	Item	Specification	Di-vision
Feed			
1	Cutting feedrate	F4 digits, feedrate direct designation	B
2	Dwell	G04	B
3	Handle feed	Manual pulse generator 1pc.	B
		0.001/0.01/0.1mm (Per one division)	
		Provided 3pcs. Independent each axis (Usual type)	O
		Provided 3pcs. Independent each axis (Handle type)	O
4	Automatic acceleration deceleration		B
5	Rapid travese override	0.1/10/25/50/100 % Selectable 8 kinds	B
6	Cutting feedrate override	0 ~ 255 % (10% each)	B
7	Feedrate override cancel		B
Program memory · editting			
1	Program memory capacity	Equivalent to tape length 80m	B
2	Additional program memory capacity	Total 160, 320, 500, 1000, 2000, 4000 (Max.) m Equivalent to tape length	O
3	Registrable programs	100pcs.	B
4	Additional registrable programs	Total 200, 400 pcs. (320m of program memory capacity is required)	O
		800, 1000 pcs. (1000m of program memory capacity is required)	
5	Program editing	Deletion, Insertion, Alteration	B
6	Background editing function		B
7	Expandable program editing		O
8	Program number search		B
9	Sequence number search		B
10	Sequence number comparison and stop		B
11	Address search		B

No.	Item	Specification	Division
Operation . display			
1	Operation panel: Display section	10" plasma display (Thin type)	B
	: Operation section	Flat key board	
2	Display function	Current position, Command value, Compensating value, Parameter etc.	B
3	MDI function		B
4	Advanced notice of machining Completion		B
5	Machining time display function	Incl. operating time display	O
6	Clock function		B
7	Display change with Chinese, English or German charactor		B
8	14" CRT color display		O
9	Bar graphic display of load for each axis	Spindle, X, Y, Z axes	B
10	Trace drawing function		B
11	Background drawing		O
In/Output function . Devices			
1	Tape reader without reel		O
2	In/output interface	RS-232-C *2 Interface only. Cables for connection with I/O devices are not included.	B
3	External data In/output		O
MSTB function			
1	Spindle function (S function)	Direct designation of rotating number by S code	B
2	Spindle speed override	50 ~ 150 % (10% increment)	B
3	Tool function	T-4 digits desingation	B
4	Auxiliary function	M-4 digits designation	B
5	Second auxiliary function (B function)	B-3 digits designation (Investigation is required for specification)	O

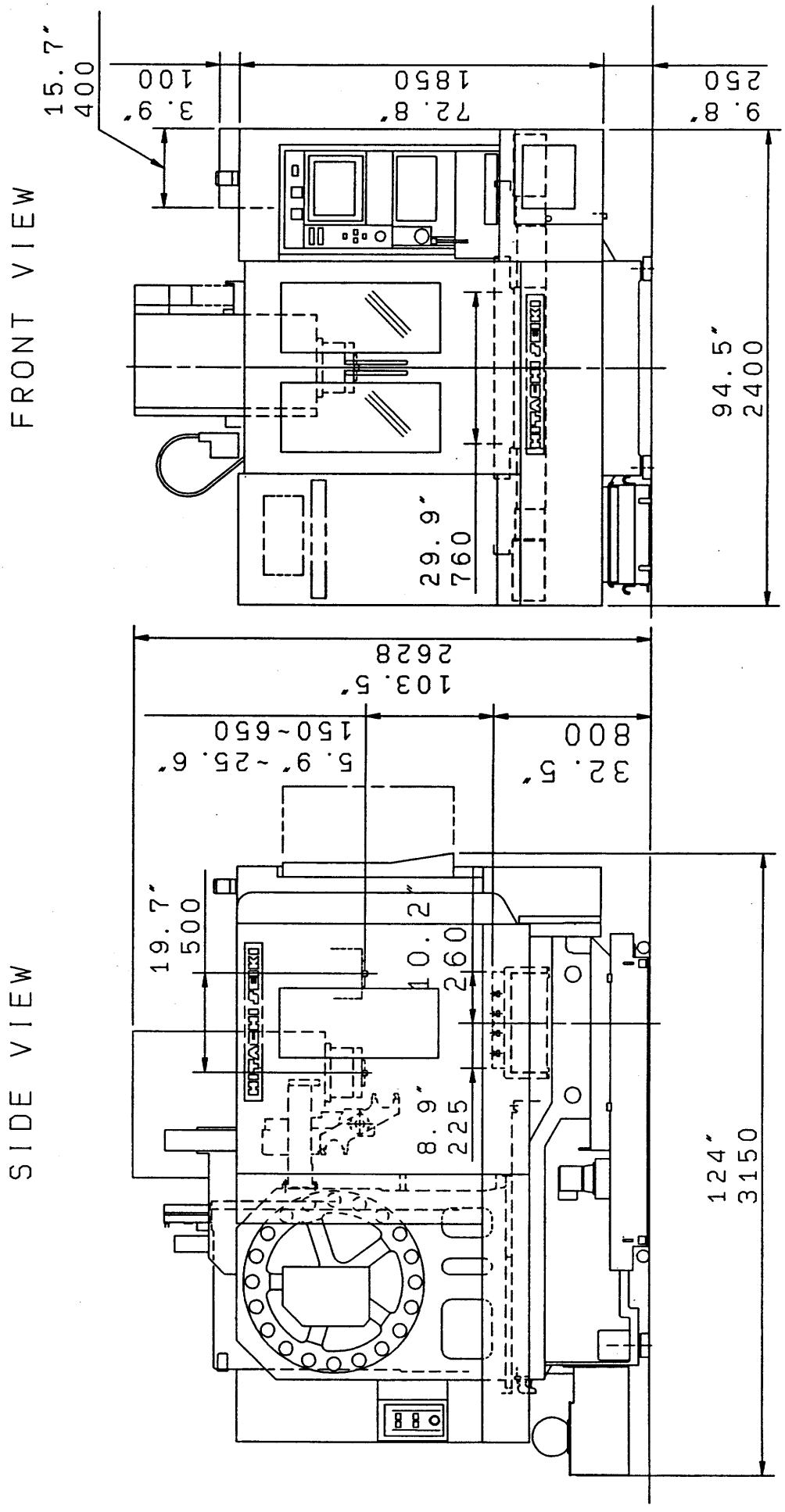
No.	Item	Specification	Di-vision
Tool offset			
1	Tool length offset	G43, G44/49	B
2	Tool position offset	G45 ~ G48	B
3	Tool radius compensation	G41, G42/G40	B
4	No. of tool offset	32 pcs.	B
5	Additional No. tool offset	Total 64, 100, 200 pcs.	O
		Total 400 pcs. (160m of program storage is required)	O
6	Tool compensation memory C	Geometric, Wear + length compensation, Radius compemsation	B
7	Three dimension tool compensation	G40, G41	O
Coordinate system			
1	Manual reference point return		B
2	Automatic reference point return	G28	B
3	Second reference point return	G30	B
4	3rd ~ 4th reference point return		O
5	Reference point return check	G27	B
6	Return from reference point	G29	B
7	Automatic coordinate system setting		B
8	Work coordinate system selection	G54 ~ G59	B
9	Additional work coordinate system	60 sets	O
10	Work coordinate system change	G92	B
11	Work coordinate system preset		B
12	Local coordinate system setting	G52	B
13	Machine coordinate system	G53	B
14	Three dimension coordinate change		O
Operation support function			
1	Single block		B
2	Optional stop		B
3	Optional block stop	1 set	B
4	Additional optional block skip	Total 9 pcs.	O
5	Dry run		B
6	Machine lock		B
7	Auxiliary function lock		B
8	Mirror image	CRT setting	B
9	Manual absolute	"ON" fixed	B
10	X axis command cancel		B

No.	Item	Specification	Di-vision
11	Automatic override memory		B
12	Manual handle interruption		O
13	Block restart		O
14	Program restart		O
15	Machining interruption point return	Return shelter	B
16	Tool length measurement Measured value direct input	Manual	B
17	Tool offset by tool No.		O
18	Part program collation		B
19	Memory lock key		B
20	Buffer register		B
21	Cycle start/feed hold		B
22	Follow up		B
23	Stroke check before move		B
24	Program name	16 charactors	B
25	High speed machining		O
26	Multi buffer		O
27	Retrace		O
28	Automatic manual simultaneous operation		O
Program support function			
1	Circular interpolation by R designation		B
2	Optional angle, chamfering corner R designation		B
3	Fixed cycle	G73, G74, G76, G80~G89	B
4	True circle cutting	Including spiral true circle cutting	B
5	Sub program		B
6	Custom macro program	Common variable 100	B
7	Custom macro program	Common variable 200, 300, 600	O
8	Interruption type custom macro	100 of common variable is required	O
9	Programmable mirror image		O
10	Scaling		O
11	Coordinate rotation		B
12	Polar coordinate command		O
13	Automatic corner override	G62	O

No.	Item	Specification	Division
14	Exact stop	G09, G61 G64	B
15	Programmable data input	G10	B
16	Direct tapping	G741, G841	B
17	Label skip		B
18	Lenear acceleration/deceleration before cutting interpolation		O
19	Lenear acceleration/deceleration after cutting interpolation		O
20	Exponential acceleration/ deceleration after cutting interpolation		O
21	Pre reading of acceleration/ deceleration before interpolation	G611	O
22	Special fixed cycle by screen instruction type	Deephole drilling cycle, Hole pattern cycle, True circle cutting, Square type facing, Pocket cycle	O
Accuracy compensation of machine system			
1	Backlash compensation		B
2	Stored pitch error compensation		B
3	Uni directional positioning	G60	O
4	Inclination compensation		O
5	Straightness compensation		O
6	Thermal deformation compensation		O
Machine support function			
1	Built-in type PC		B
2	Axis interlock		B
3	External deceleration		B
Automatitization support function			
1	Skip function	High speed	O
2	Tool life management Spare tool call function		O
3	Cutting monitor	160m of program storage is required	O
4	Work checker function		O
5	High resolution detection I/F	0.1μm specifixation	O
6	DNC connection circiut		O
7	Macro print out function	By RS-232-C, Printer is required	O
8	Electronic absolute position detection		O

No.	Item	Specification	Di-vision
Safety, maintenance			
1	Emergency stop		B
2	Over travel		B
3	Stored stroke limit 1		B
4	Stored stroke limit 2 ~ 3		O
5	NC self diagnosis function		B
6	Door interlock		O

5. Major Dimensions



Chapter 3 INSTALLATION

1. Transport of Machine

This machine can be transfered only drsconnect power code because integrated construction of machine and electric is adopted.
Refer to the following page for fixed method of moving element and slinging.

1) Note of lifting work

Pay full attention for lifting work because one of the important procedure for transportation of machine.
Transportation of machine is executed by crane or chain block, so, noteworthy point for lifting is as follows:

(1) Wire lope should be used over 16mm dia..

(2) Protect wire lope and machine by putting soft pad on acute angle area.

(3) Sling the center of gravity should be located the center line of lifting angle.

(4) Do not use a wire rope which is rusted, untwisted or broken element.

(5) Lift gradually and stop once when wire rope becomes tight and check slinging. Lift it after recheck when apart from ground.
Down slowly and check just before touch the ground and down it.

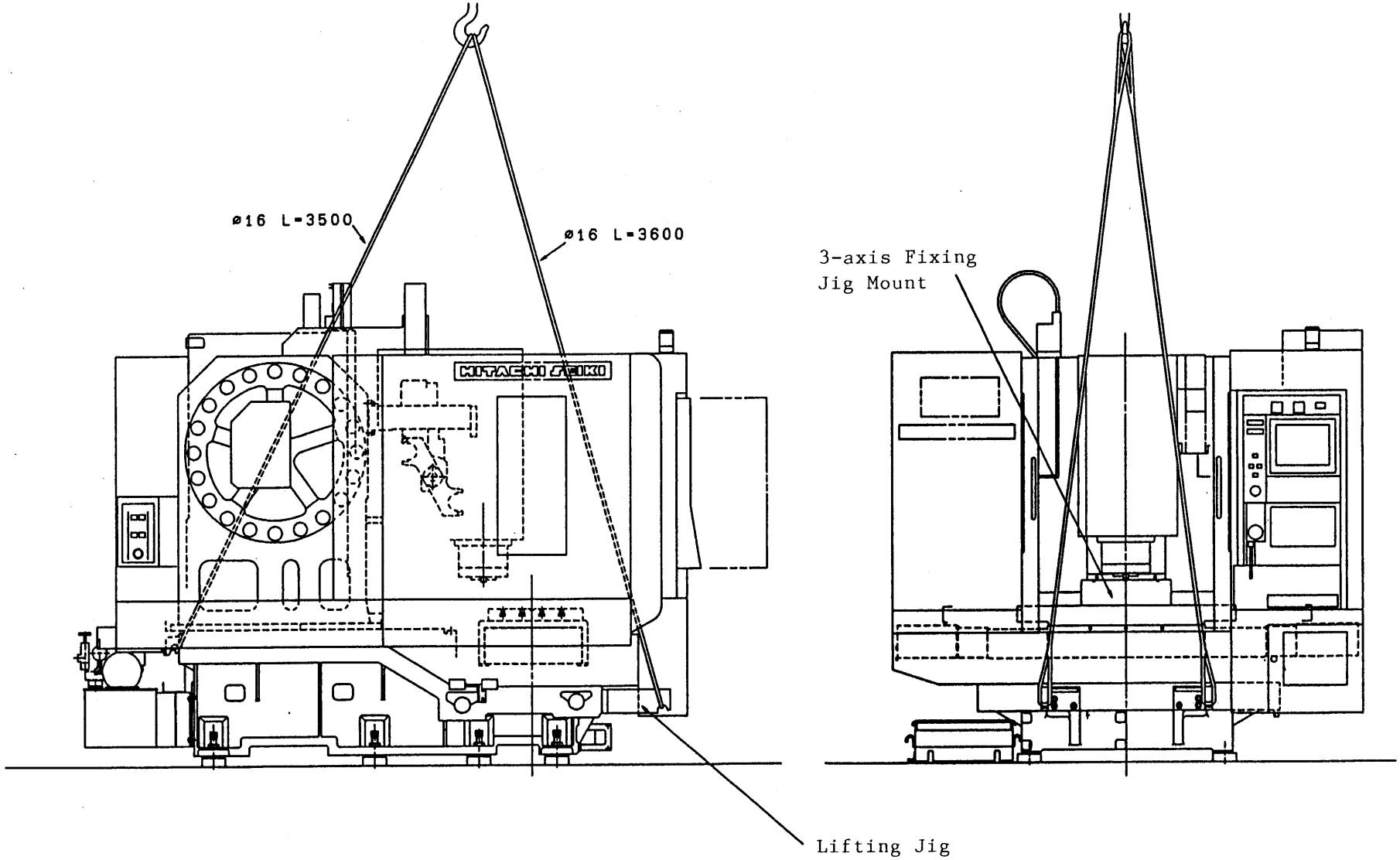
2) Note of fork lift work

(1) Select the fork lift having enough capacity to the machine weight.

(2) To protect the projected parts of circumference of the machine should be cooperated with supervisor.

(3) At the time to insert the fork, use casting groove for fork located left and right of the machine base.

(4) At the time of lifting, consider lifting to be executed at the most stable place of the center of gravity both cross and longitudinal direction by tentative lifting.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ø16 L=3600
3-axis Fixing
Jig Mount
Lifting Jig

2. Envionment of the Machine

Pay full attention to a room temperature, dust, vibrations, etc. in order to make use of the primary performance of the machine. High accuracy cannot be obtained in the environment where the room temperature greatly changes. Just a slight change of the room temperature partly affects the machine. Be fully careful of effects heat transfer from the direct sunshine, vent, heating unit, and so on.
Under the environment where the air is pulluted so much by dust, etc., the sliding sections and electric devices of the machine are greatly effected in their service lives.
Particularly, electrinic devices related to controls are susceptible to dust and humidity. Install the machine in the environment as clean as possible.

1. Installation environment of NC machine

In case that electric machines and appliances generating high frequency noise are installed or newly erected near by NC machines, keep to the following precautions.

1) Example of the electric machines and appliances generating high frequency noise.

(1) Arc welding machine
(2) Resistance welding machine
(3) High frequency drying machine
(4) Electric discharge machine
(5) Others

2) Installation form of NC machine

(1) Power supply line
The power supply line (AC200V) of NC machine must be separated line with that for electric machines and appliances.
If impossible, connect the line at the point more than 20m apart from the point where the power supply for electric machines and appliances is connected.

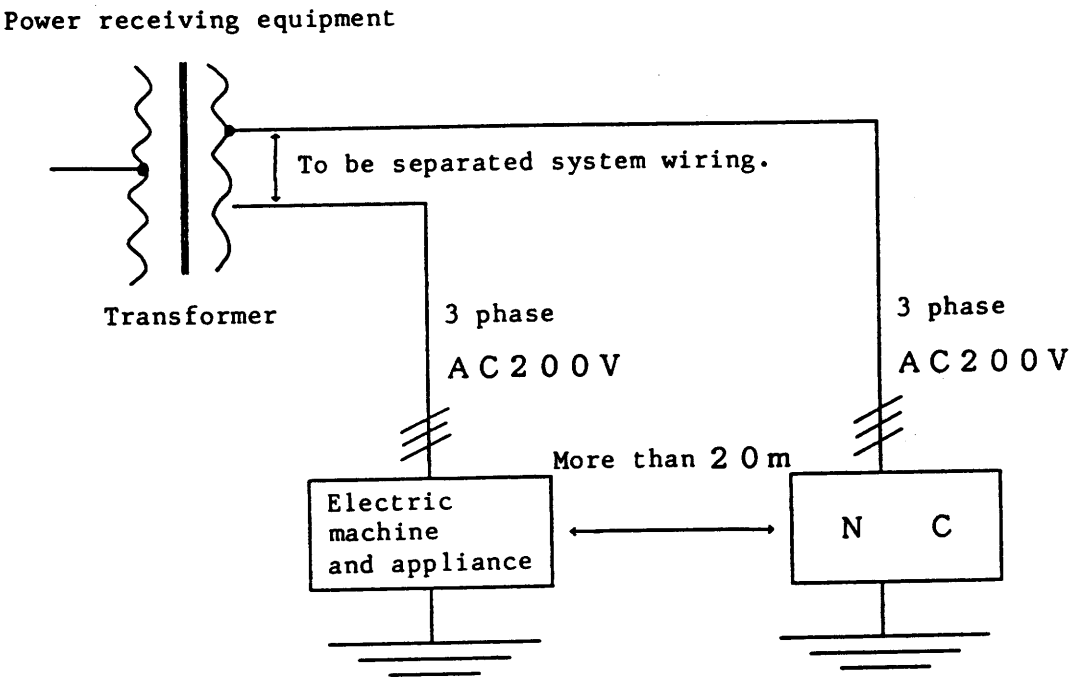
(2) Installation place of NC machine
NC machine must be installed more than 20m apart from electric machines and appliances.

(3) Earth of NC machine
The earth of NC machine must be grounded within 5m from NC machine separating from the ground of electric machines and appliances, and

make a ground work with not more than 100 or comply with the laws and regulations of the country.
Or the earth wire size must be not less than 14mm^2.

3) Example of earth of NC machine

The earth state of NC machine and electric machines and appliances illustrated as under.



3. Power Source and Pneumatic Source

1. Electric wiring

As the wiring provided for this machine connects between the machine proper and its attachments only, the user is requested to prepare the wiring from the supply power source to the control cabinet.
Though an electric wire used for this purpose is slightly different depending upon a distance from the power source to the control cabinet, it is necessary to connect with wire of which sectional area is more than $38mm^2$.

Power source : 200/220V(50/60Hz)±10%
Earth wire : More than $14mm^2$
Power capacity : 22KVA (Standard specifications)

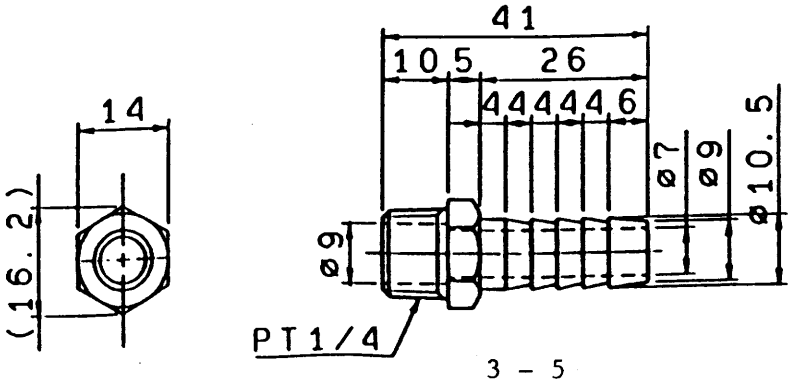
2. Pneumatic source

Provide pneumatic source for this machine, because it uses clean air to clean the spindle hole.tool, pallet coupling or oil mist device.

Pneumatic pressure : 0.5MPa {$5kg/cm^2$} (72 PSI)
Rate of flow : 350 Nℓ/min.

Connecting port on the machine side : PT1/4 female thread
An air filter/regulator is provided on the machine proper, that ensure to remove dust contained in the air and oversturated moisture.
Due to the nature of the air, as the air temperature of the pneumatic source increases higher than the temperature of the machine prpoper, it is cooled on the machine side and causes water drops more easily. If moist air is injected, it may rust the spindle hole and the tool shanks, thus its effects on machining accuracy and cutting surfaces. Therefore, the lower air temperature of the air source is, the better.
(Water and dust accumulating in the air filter is automatically drained. To manually drain them, see the descriptions on mechanical drain operation.)
When the temperature difference is bigger, attach an air dryer between the pneumatic source and the machine.

The following figure illustrates an example of an air inlet joint.



(It is required to manufacture an air inlet joint in accordance with the piping diameter of your factory.)

Principle of the movements of the automatic drain with manual discharger (W3000-8-F)

When no pressure acts upon the inside of the bowl, the valve ⑫ is forced up by the spring ⑩ to be in the state detached from the stem packing ⑤.

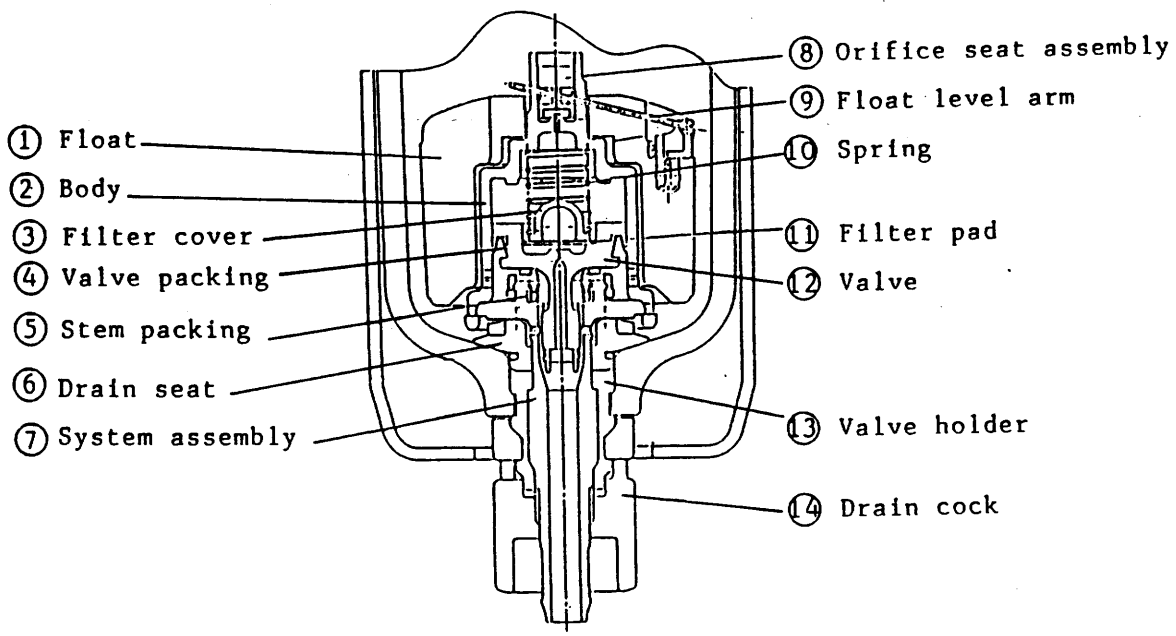
If more than 1 Kgf/cm^2 of pressure acts upon the inside of the bowl, the receiving pressure of the value ⑫ becomes larger than the force of the spring ⑩, and the value ⑫ is forced up and sealed with the stem packing ⑤. Next, when drain is accumulated in the bowl, the float ① is elevated and the Orifice seat assembly ⑧ is opened by the float level arm ⑨. Then, pressed air is guided into the upper chamber of the valve ⑫, and the valve becomes pressurized state. And the valve ⑫ is forced down, and when it parts from the stem packing ⑤, drain is discharged into the atomosphere through following the arrow mark.

When drain is discharged, the float ① is lowered and the Orifice seat assembly ⑧ is closed by the float level arm ⑨.

Then, pressurized air is discharged into the atomosphere through the Orifice of the valve ⑫.

Whereupon, the receiving pressure of the valve ⑫ from the lower part exceeds the force of the spring ⑩ and the valve ⑫ is lifted up and sealed with the stem packing ⑤. As a manual discharging device is built in this model of machine, it can be used as a manual drain.

The tube connected to the drain line shall be of ID ϕ6mm and within 5m long.

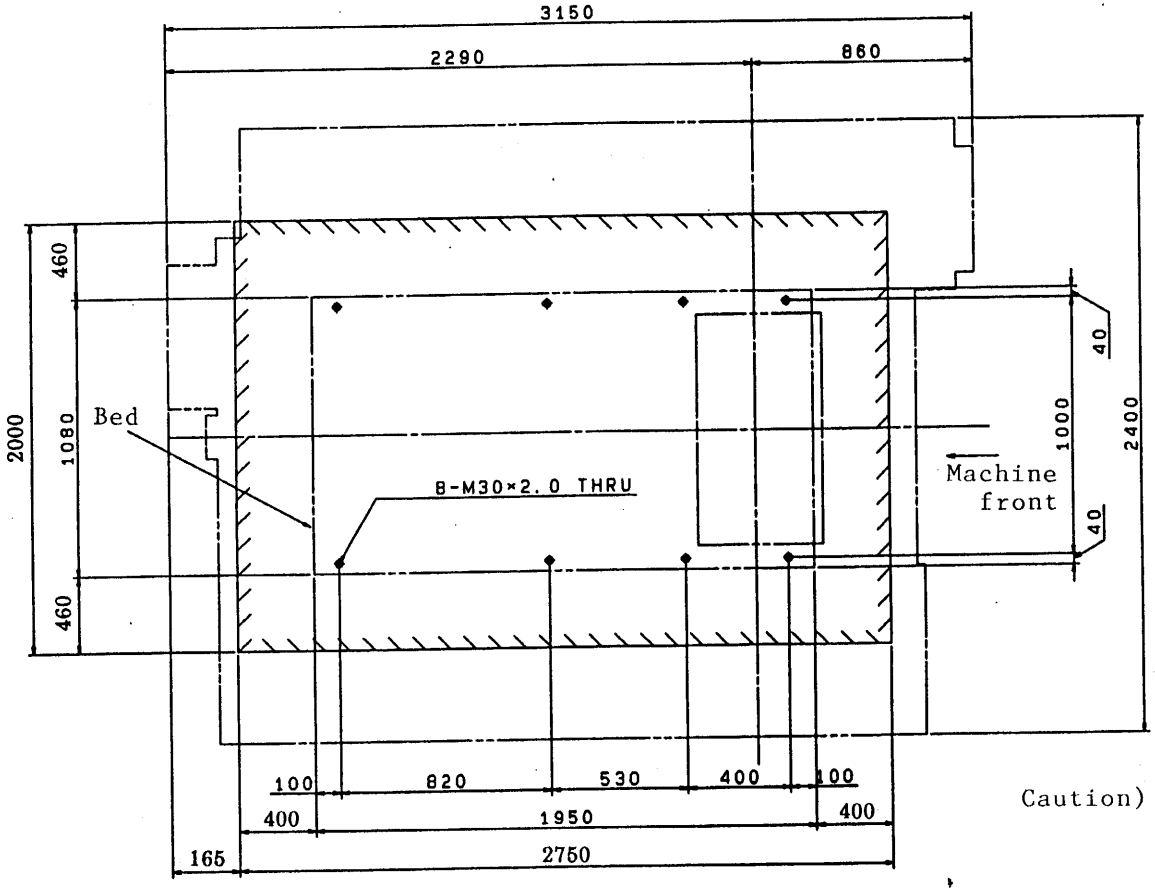


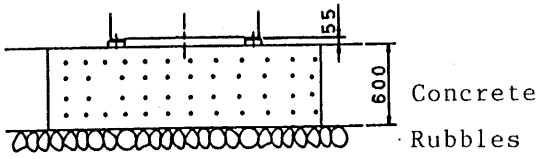
When the phenomena such as the below occur, replace it with a new parts (Bowl assemble F4-550178).

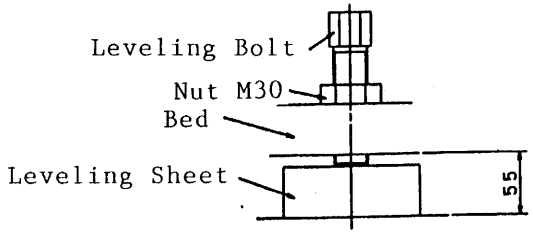
a. Drain is not discharged automatically.

b. Air is leaking ceaselessly from the drain port.

4. Foundation Plan







Caution) 1. A ground bearing force should be 5 tons/m² or more and thickness of the foundation should be 300mm or more.

2. An area of the foundation should be **2,000×2,750mm or more.**

3. Vibration-proof grooves, if any, should be installed along the outer periphery of the foundation.

4. When installing the APC, drill holes for M16 anchors before installing the machine.

5. Procedure of Installation Work

(1) Remove of fixture for transfer

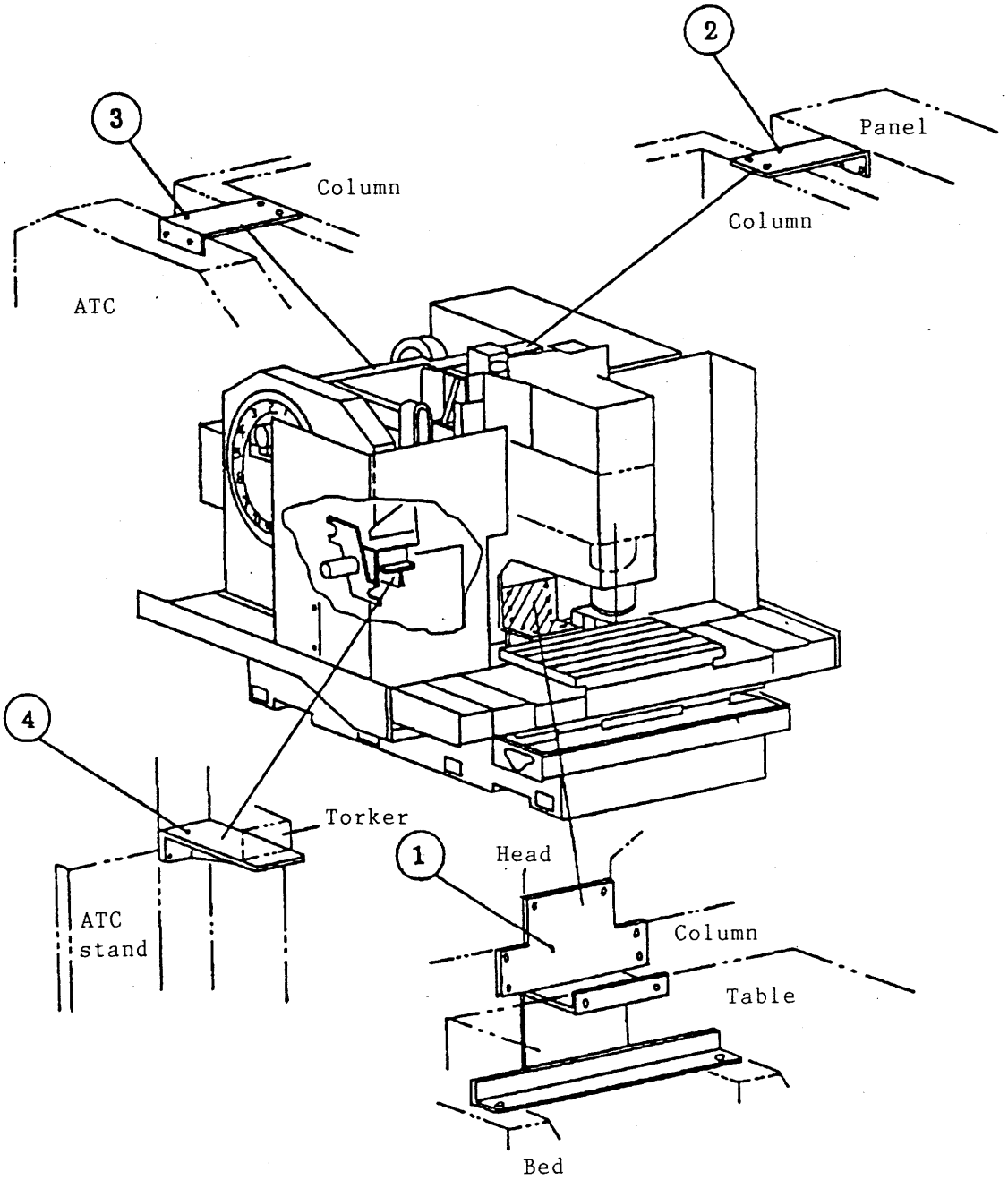
The following fixtures should be removed after the machine installed at decided position.

① For head, column, table

② For column, power cabinet

③ For column, ATC magazine stand

④ For ATC arm, ATC magazihe stand



(2) Installation

One of the element to decide the accuracy of the machine is a leveling. Since proper leveling of the machine is the most basic work not only the accuracy of machining part but also life of the machine, proceed carefully.

First of all, place leveling sheets at setting place and install the machine to put the leveling adjust bolts located machine leg.

Use the level with sensitivity of 0.02mm per meter (Length of level is about 200mm), the level for wordwork or construction is not sufficient.

Handle the level to keep the same direction keep the surface to be placed the level clean and avoid dust between the level and the surface.

- Procedure of installation and outline

① Adjustment of absolute level

Put the level on X and Z direction of the table as shown Fig. 3-1 ⓐ and measure at three places on each axis respectively.

Adjust by leveling bolt to keep the difference of reading within 0.04mm/m both X and Y directions.

② Adjustment of table motion level

Put the level at the center of the table and move X axis in full stroke.

At this time, adjust the difference of reading of the level within the following target value.

. By the level at X axis direction: 0.04mm/m

. By the level at Y axis direction: 0.02mm/m

③ Adjustment of column motion level

Move the spindle to the lowest limit of stroke and remove a cover on top of the spindle head.

Put the level on the horizontal surface of the spindle head shown in Fig. 3-1 ⓐ.

Move Y axis nearly full stroke and measure the X and Y direction of the difference of reading of the level and adjust to satisty the target value. In case of putting the level on the fixture mounted on the spindle (Fig. 3-1 ⓑ), execute the same procedure.

. By the level at X axis direction: 0.02mm/m

. By the level at Y axis direction: 0.04mm/m

④ Recheck above procedure 1 to 3 and execute fine adjustment if required.

⑤ In case of motion level above procedure 2 and 3 is not stable, possibly floor condition of machine installation is not sufficient, refer to foundation plan and execute check and inprovement.

Fig. 3-1 ⓐ

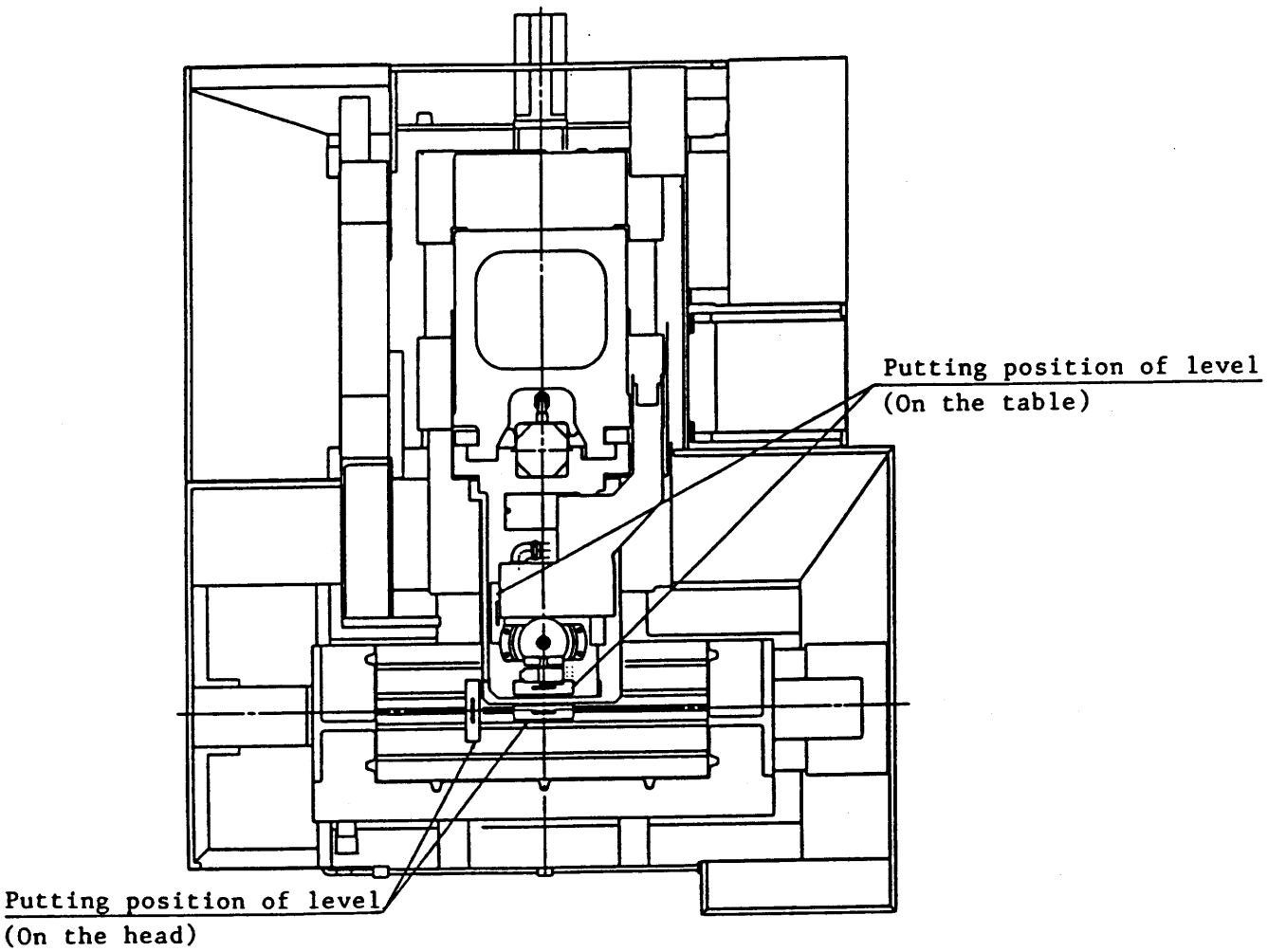
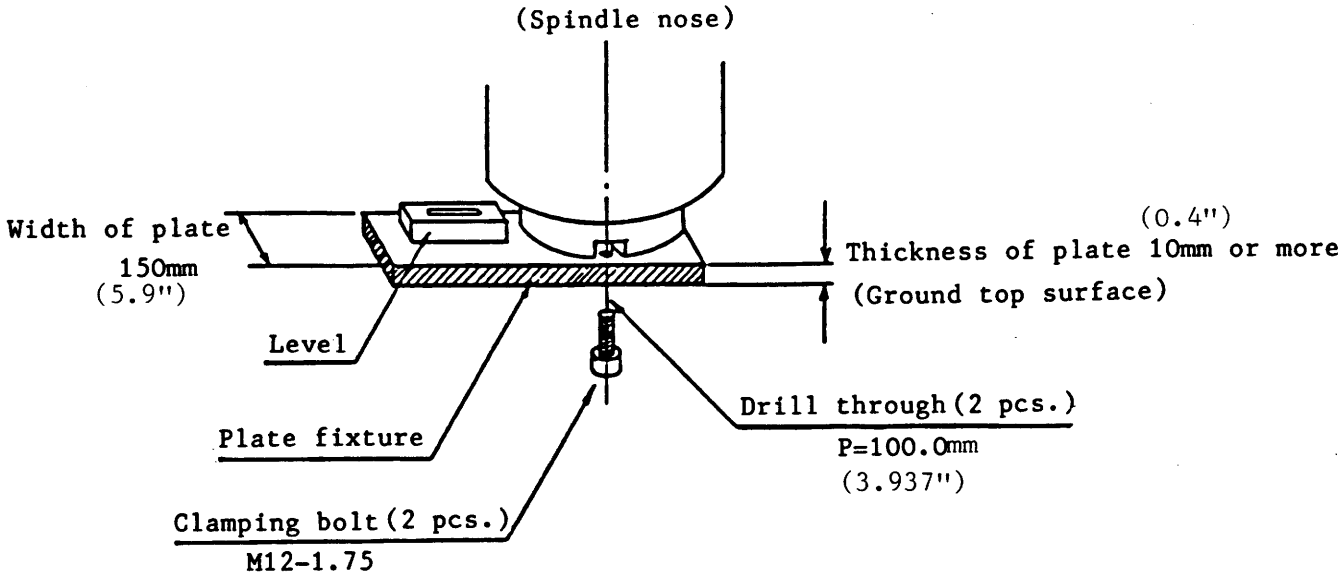


Fig. 3-1 ⓑ Application example for leveling fixture
(Measurement of column motion level)

Warning! Never rotate the spindle while fixture is used.



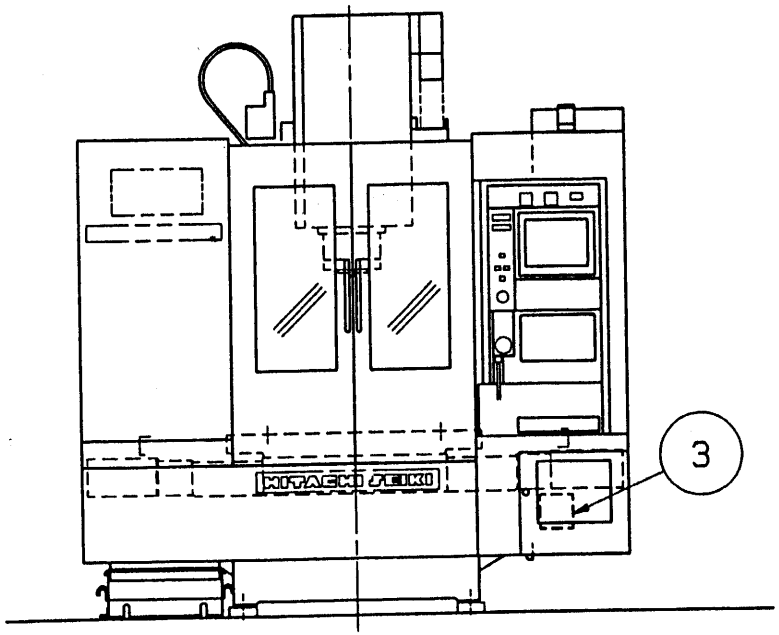
6. Lubrication and Oil Supply

When supplying oil, sufficient care must be taken to the following:

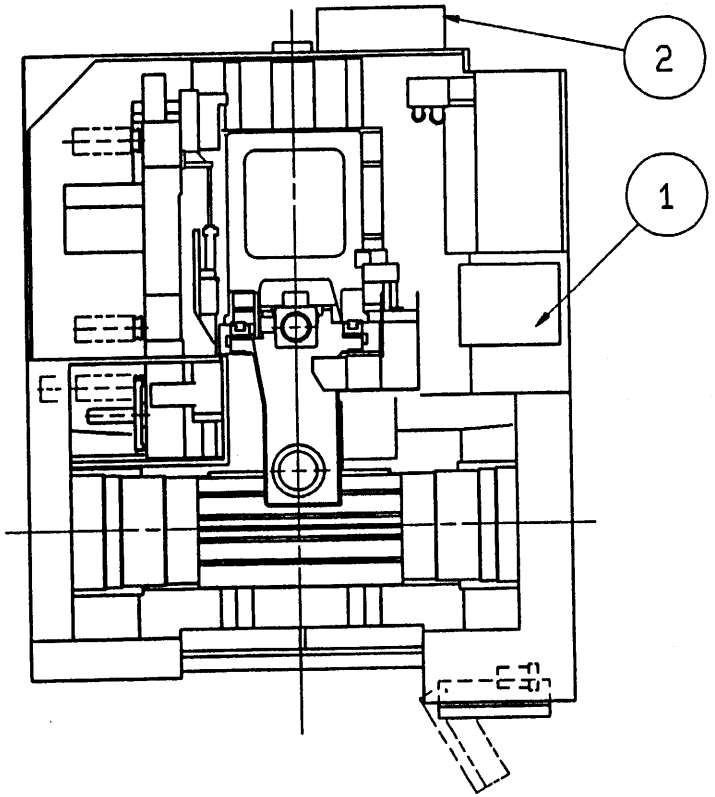
1. Supply specified oil by the specified amount. Do not supply a different type of oil or over the specified amount. Otherwise the machine may cause to a trouble.
2. Clean the oil inlet port etc. in advance, and pay close attention lest dust etc. should enter inside.
3. When supplying oil, use a filter in order to prevent foreign substances such as dust from entering into the tank. When the filter is not available, use a wire net of 150 mesh or more.
4. Whenever you supply oil, use new one. Do not mix with reproduced or old oil.
5. Even when a new oil can is opend, donot use all the oil in it, but leave some unused. This is necessary to eliminate moisture and deposits.

*As to oil supply spots, supply frequency, oil amounts and oil types, refer Fig. 3-1 and Table 3-1.

Front view



Right side view



	Supply spot	Method	Frequency	Q'ty	NIPPON OIL	IDEMITSU OIL	SHELL	MOBIL	MITSUBISHI OIL	ESSO	NOK CREWBA	ISO symbol
1	Spindle cooling	Trochoid pump	Replace every 2-years; replenish occasionally	20ℓ	NISSEKI MULPASS 32	DAPHNI MULTIWAY 32ER	Tetra oil 32	Mobil DTE oil light	DIAMOND TETRAT 32	Unipower MP32		CB32
2	Hydraulic unit	Piston pump	Replace every 6-month; replenish occasionally	40ℓ	NISSEKI MULPASS 32	DAPHNI MULTIWAY 32ER	Tetra oil 32	Mobil DTE oil light	DIAMOND TETRAT 32	Unipower MP32		CB32
3	Lubricating oil tank (Each slideway spindle bearing	Gear pump	Replenish occasionally	1.5ℓ	NISSEKI MULPASS 68	DAPHNI MULTIWAY 68ER	Tetra oil T68	Mobil vactra oil No.2	DIAMOND TETRAT 68	Febis K68		G-68

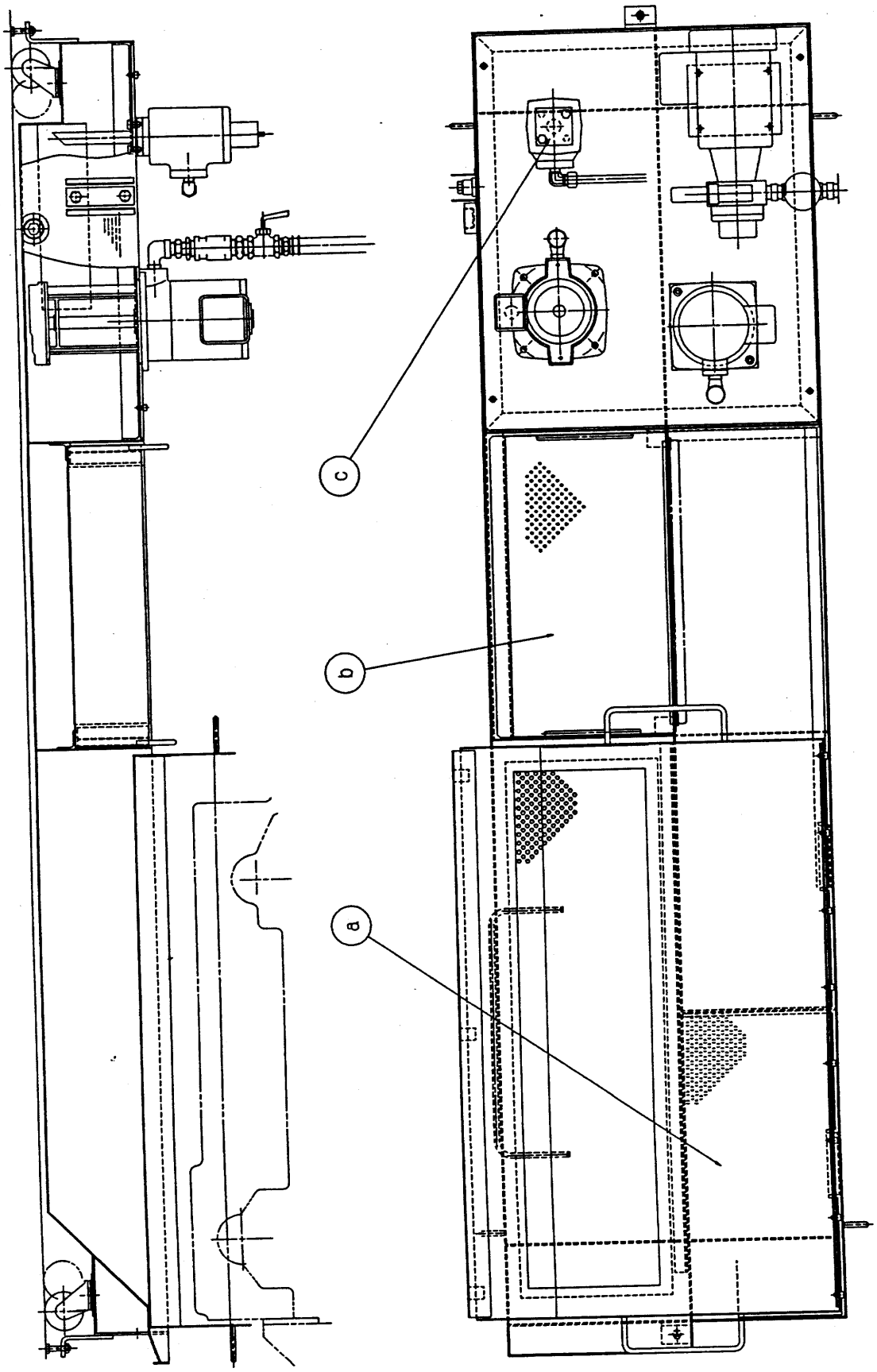
Table 3-1

2. Handling of Coolant Equipment

1) Maintenance(check, cleaning, etc.) of the coolant tank and accessories should be done in the following procedure:
When a side-discharge or back-discharge type external chip conveyor is attached, turn the leveling bolts of its legs to secure a clearance from the floor.
This allows you to pull out the coolant tank to the left side of the machine. At a stroke of approx. 600mm, there will be no overlap with the machine side.

2) Cleaning of the filters and replacement of the elements
When cleaning the mesh filter in the tank, remove the chip box ⓐ and take out the filter ⓑ. Also, hold the handle of the filter ⓒ and detach, eliminate the cutting chips, and then, remount the filter.
When a trochoid pump for oil hole is attached as an option, it is necessary to replace the suction filter ⓓ.

Coolant tank



4) How to control coolant fluid

The consistency of coolant fluid is changed depending upon the quality of water used, mixture of chips or forelgn substances and evaporation of moisture. And unless the maintenance of the coolant fluid is made for a long time, germs may be generated, that causes to break the filters, the pipings and the pump. Check the density of the fluid, and pH timely, replace the coolant fluid, and also clean the inside of the coolant tank in consideration of using conditions.
Since contaminated muddy clods may be generated when a different kind of coolant fluid is mixed up, remove completely the previous fluid through flushing the pipings, the tank and the equipment sufficiently, when changing the coolant fluid.

- Items to be checked periodcally

It is advised to check the following items periodically.

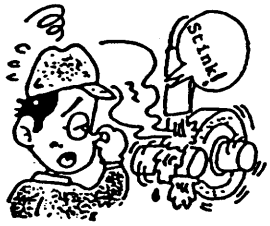
1. Liquid colour check

Observe the colour eyes.

When the colour is changed to blown, it is presumed that rust may generate. In case of FC and FCD, chips happen to become blown.
When the coolant fluid becomes black, it is presumed that it has been corroded. When the fluid becomes black and gives out a purrid smell on Monday morning or after a long period of holidays, the colour of the fluid may happen to return to the original colour in the afternoon. It is phenomena that the fluid changed through extinction of bacteria (anaerobic germs) by touching the fluid with air.
When it is not returned, it is required to replace the fluid, since the fluid is too purrid. In this case, replace all the coolant fluid and make flushing sufficiently. The remaining bacteria will cause to repeat the purrid consequently.

2. Check of the purrid smell

Special care must be taken to smell.



When the fluid is filled with purrid smell, the ingredient of the cutting fluid be destroyed by breeding of bacteria or eaten by bacteria as nutritive substance, that causes the change of its density, lowering of pH and outbreak of rust.
When the purrid smell is not faded away even after half a day in the status of operation, it is required to replace the coolant fluid.

3. Check of the filthiness of the fluid

Observe the filthiness of the fluid by eyes.

The filthiness of the fluid has influence on the machining accuracy, the dirt of the machined work and the dirt of the machine.
And the dirt of the machine makes hard to observe the state of machining from the outside.

4. Check of the quantity

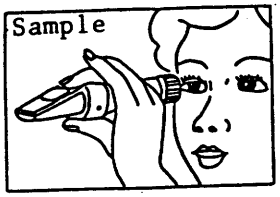
Check the level of the tank periodically.

Shortage of the fluid quantity causes to form bubbles or to disable the fluid to supply sufficiently to the machining point.
And also it will hasten the progress of the putrefaction.

5. Control of the density

It is the most importatant procedure to control the density of the fluid when soluble cutting oil is used.

It is the best way to measure the density by a refractometer.
If not available, it is possible to control to some extent the density of the fluid by calculating precisely the magnification at the time of dilution and also by calculating the magnification without fail when pouring some more fluid.
It is the most desirable mothod to check periodically the density by a density-meter, since there are various factors such as change of the ingredients by bacteria, decrease by taking out with the workpieces or viporization of the fluid.
When the density of the cutting fluid is low, serious problems such as bad smell by putrefaction, lowering ot the pH and rust promotion will occur. Generally the density of the cutting fluid is within the extent of 20 times through 30 times, but it will be different depending on the kind of cutting fluid. Comply with the maker's recommending value. Since it becomes impossible to measure the fluid when lots of rust preventive oil or lubrication oil is mixed.

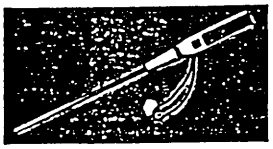


Read a scale watching through eye piece.

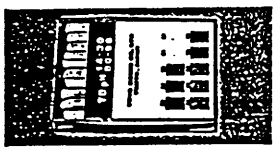
6. Control of the pH

Measure the pH by using either a litmus test paper or a simple pH measuring instrument.

pH checker



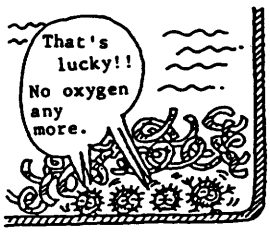
Litmus test paoer



When the pH value of the fluid is 7, the fluid is neutral. When the value is larger than 7, the fluid is alkaline and when it is smaller than 7, the fluid is acidic.
Generally pH8.5 through 9.5 is an ideal value. When the value becomes lager than this, alkaline becomes stronger, that causes the chapping of the skin of the hands.
When it becomes smaller, the fluid is acidulato, that causes hastening of rust. Especially when the pH value of the fluid becomes less than 8, care must be taken since rust is hastened rapidly. In this case, replace the fluid.

7. Check of the stagnant sludge

Check whether chips and/or sludge stagnates in the tank and the pipings.



Remove chips and/or sludge from the tank and the pipings by flushing as occassion calls.
And mixture of rust preventive oil and lubrication oil may become the nutritive elements, and the surface of the tank is covered with them, that causes the breeding of anaerobic germs. Remove the adultrated oil periodically.
It is recommendable to employ an eliminator such as skimmer.

5) Control of the waste oil

"Water Pollution Control Law" and "Sewage Water Law" are adapted to the waste oil of cutting fluid.

The substances more than 10 items of ingrodients contained in the cutting fluid are designated as orgnic substance, and they become the object of regulation items. Therefore, appropriate disposition such as disposal by the waste oil disposing system in the factory or taking-over by the waste oil treating trader is required.
The cost for waste oil disposal at the time of replacement of the fluid is directly related to the life of fluid, and 50% of cost-down can be attained by replacing the fluid once a year instead of twice a year.

Accordingly, conclusive control of the using fluid will mean development as a whole.

6) Kinds and selection of water soluble cutting fluid

Though the cutting fluid is used for various kinds of purposes, the following 2 points are basically important.

Lubrication: To diminish friction and prevent heat generation .... To smooth (Anti adhesion)

Cooling : To cool generated heat

Besides, stress tends to be laid on the problems of environments such as washability and chip removal, and it becomes necessary to take the safety factor into sufficient consideration.

The water soluble cutting fluid can be roughly classified to 3 kinds; emulsion type, soluble type and chemical solution type,

The following is a comparison table of respective features.

Type	Emulsion type	Soluble type	Chemical solution type
Feature	A) Since the particle diameter is comparatively large, 4 through 7um and the lubricity is good, it has been used widely and generally for cutting field. B) This type is the water soluble cutting fluid. C) Since it is lacking in safety factor, it is easy to be petrefied and sheds bad smell, that are week points.	A) Since the particle diameter is small, 0.1 through 0.03um, it is excellent in permeability. B) Though this type has been mainly used for grinding, it is currently used for cutting as well oeing to development of extreme pressure agent. C) It began to be used for system machines etc. by reason of washability and casy-to-deal. D) Since a lot of surface active agent is used, it is a problem that it is apt to exert a bad influence upon painting.	A) Though this type is mainly used grinding, it bigan to be used for cutting. B) Since it is excellent in permeability and washability, it is guessed that a chance to be used cutting will be increased. C) Low lubricity is deffect in this type. D) Since it is apt to act upon painting agent chemically, it is problem that it is apt to exert a bad influe influence upon painting.
Configuration	When dissolving it in water, it becomes milk-ly. (Resulted from the reflection of light due to large particle of oil in solution.)	When dissolving it in water, it becomes almost semitransparent. (Resulted from light passage due to extrmely small particle of oil in solution.)	Though it is generally transeparent as water, there are various kinds of oil according to maker's specification.
Lubricity	◎	○	×
Coolant power	△	○	◎
Rust prevention	○	○	◎
Putrefy resistence	×	○	◎
Washability	△	○	○
Paint resistence	○	×	×
Nonferrous	◎	○ (Some other time ×)	×
Permeability	△	○	◎
Environment	△	○	◎

Cutting fluid bringing results in HITACHI SEIKI

Name	Type	Manufacturer	Feature
S2000	Emulsion	Mitsui Oil Handling	Hard-to machine, Deep holes, Rolled tap
NEOS 45H	Emulsion	Neos	General cutting (Cast iron, Steel)
ML 0731	Emulsion	Dularon	General cutting, Serves for lubrication oil
UNISOBLE SC	Soluble	Nippon Sekiyu	General cutting
CEMICOOL SR5	Soluble	Chemic	Casr iron, Rust, Dirt
LUSOL 84	Chemical solution	Mitsui oil Handling	Wash, Dirt

Cutting fluid desired to contact at usage

Name	Type	Manufacturer	Feature
LUSOL 84	Chemical solution	Mitsui oil Handling	Sufficient control is required.
MICROCUT 5551-LH	M-emulsion	Nippon quaker chemical	Rust is apt to generate.
DUFFNY SEMICOOL ME	Anit-emulsion	Idemitsu Kosan	Influence to painting.

7. Check Before Trial Operation of the Machine

Before operating the machine at first, be sure to check each item in accordance with the following order.

1. Check the voltage of the power source. The power source isldifferent depending on the district.
   When checking the power source, measure the voltage between 3 phase respectively and the difference between each phase must be within a few voltage.

2. Turn on the breaker CB-1 in the power control cabinet and then check the phase rotation of the power source in accordance with the following. Pree the movable contact operating button in the magnetic switch (MS-1) for hydraulic motor with a driver and check that the pressure gauge for hydraulics turns up. When it doesn't turn up even pressing it for 5 to 10 seconds, turn off the braker (turn off the power on the factory side) because of different phase rotation and change the connection of either 2 of the power supply 3 lines.

3. Turn on the power source for the NC unit and check that the screen (TITLE) is displayed on the CRT.

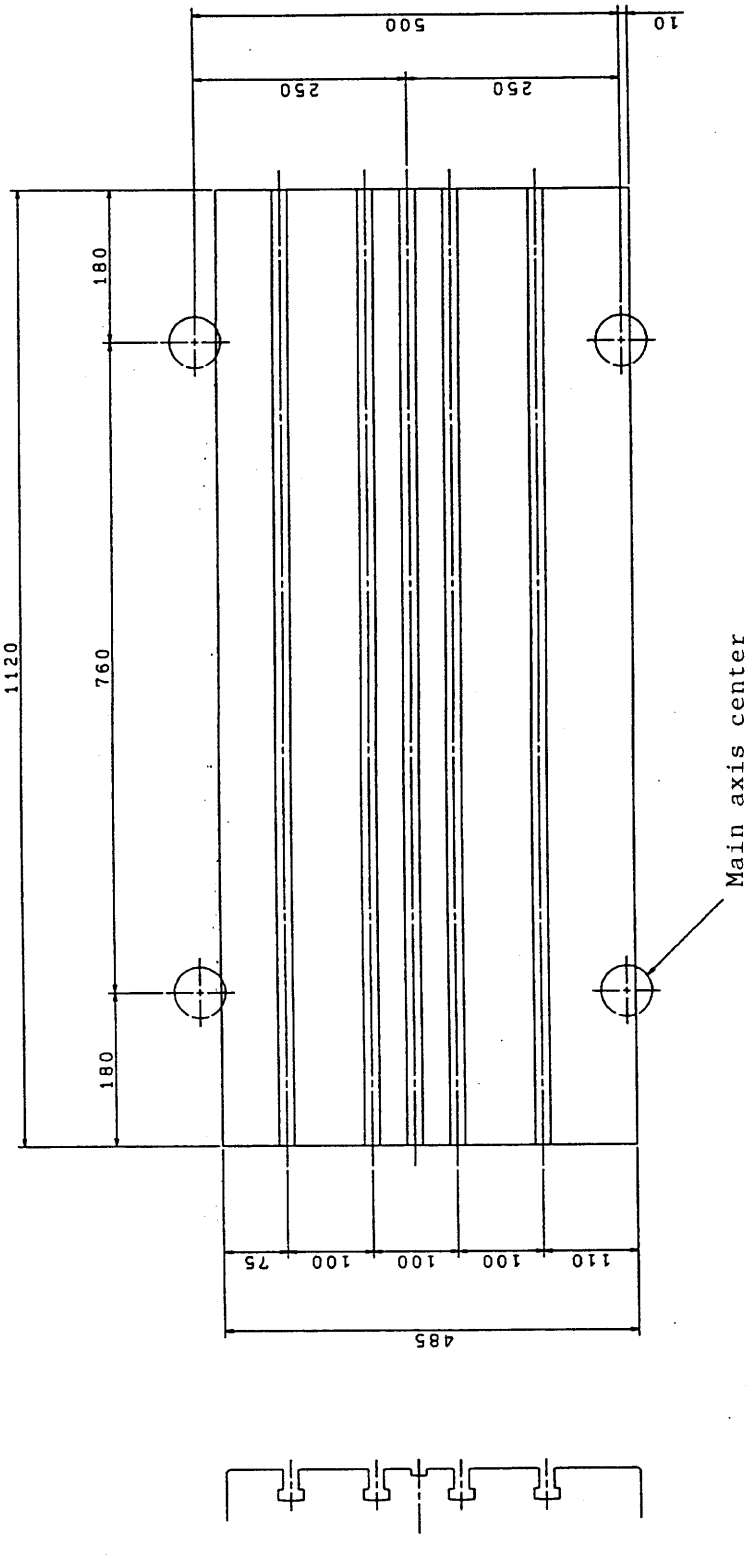
4. Set the mode selection switch to the manual (HANDLE or FEED).

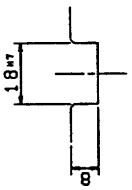
5. Check of the rotating direction of every motor.
   Rotate every motor by respective switch and check the rotating direction in accordance with the instruction of the rotating direction.
   When the rotating direction is reverse, change the connection of either 2 of the power supply 3 lines.
   (1) For hydraulic : To start by the "Standby" button.
   To stop by the "Power source" button OFF.
   (2) For lubrication oil: To start by the "Standby" button.
   (3) For spindle : To start by the spindle "Start" button.
   To stop by the "Stop" button.
   (4) For cutting fluid : To start by the coolant button.
   To stop by pressing the button again.
   (5) For chip conveyor : To start by the chip conveyor button.
   To stop by pressing the button again.

6. Adjust the pressure of the hydraulic unit to the setting pressure, 5Mpa {50kg/cm²}.

Chapter 4 REQUIRED DIMENSION FOR MACHINING

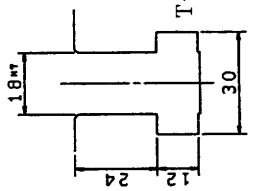
1. Table



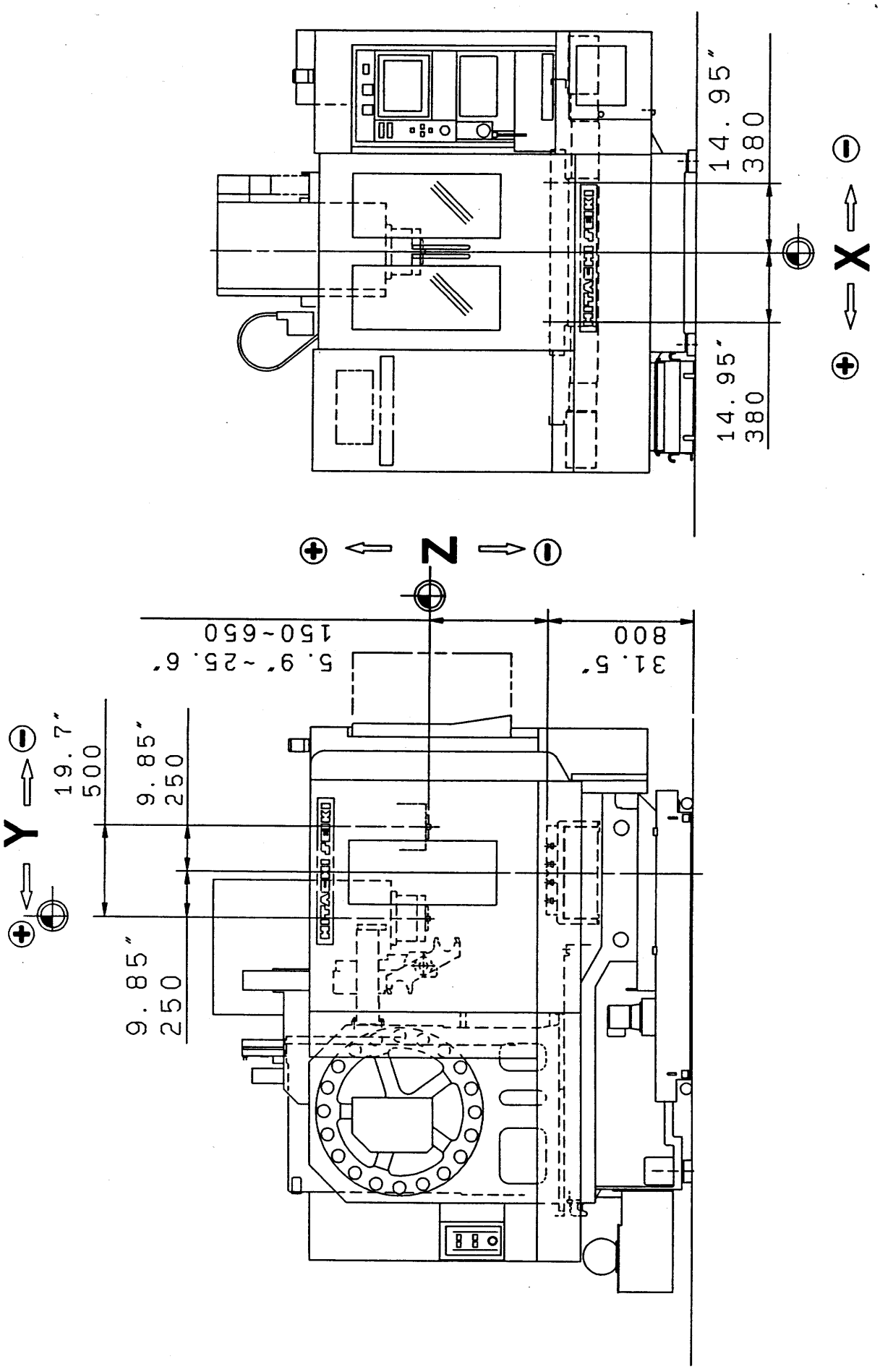


Key-shaped groove

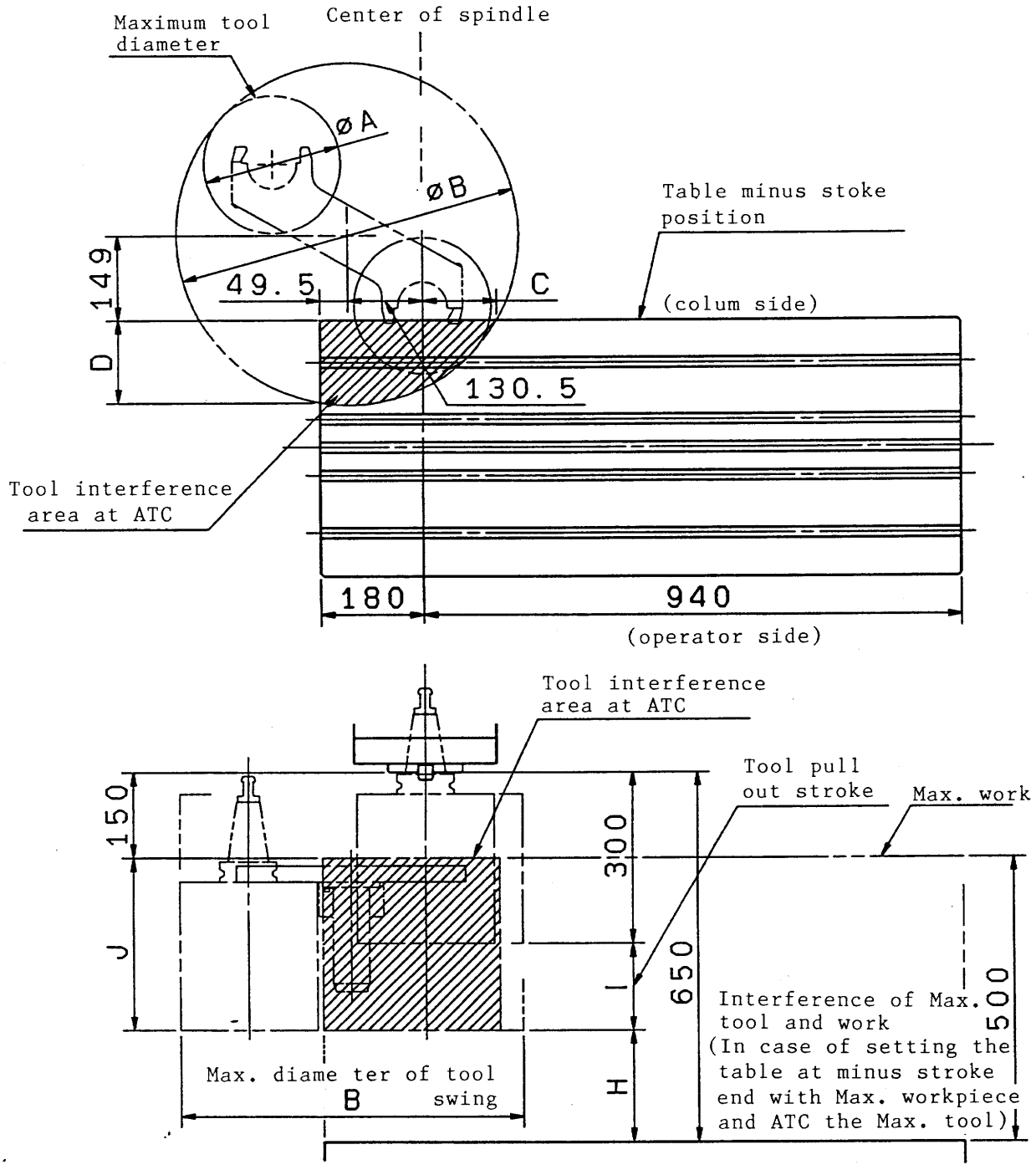
T-shaped groove



2. Stroke of Each Axis and Machine Original Point



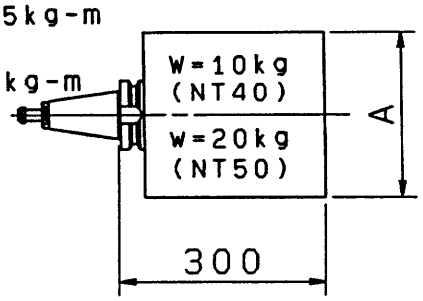
3. Relative Drawing of Work and ATC



	VK45-40	VK45-50
A Maximum	180	180
B **Maximum**	540	540
C	95	95
D	121	121
H Minimum	240	197
I From table top to spindle nose at ATC	110	153
J Tool and work interference area	260	303

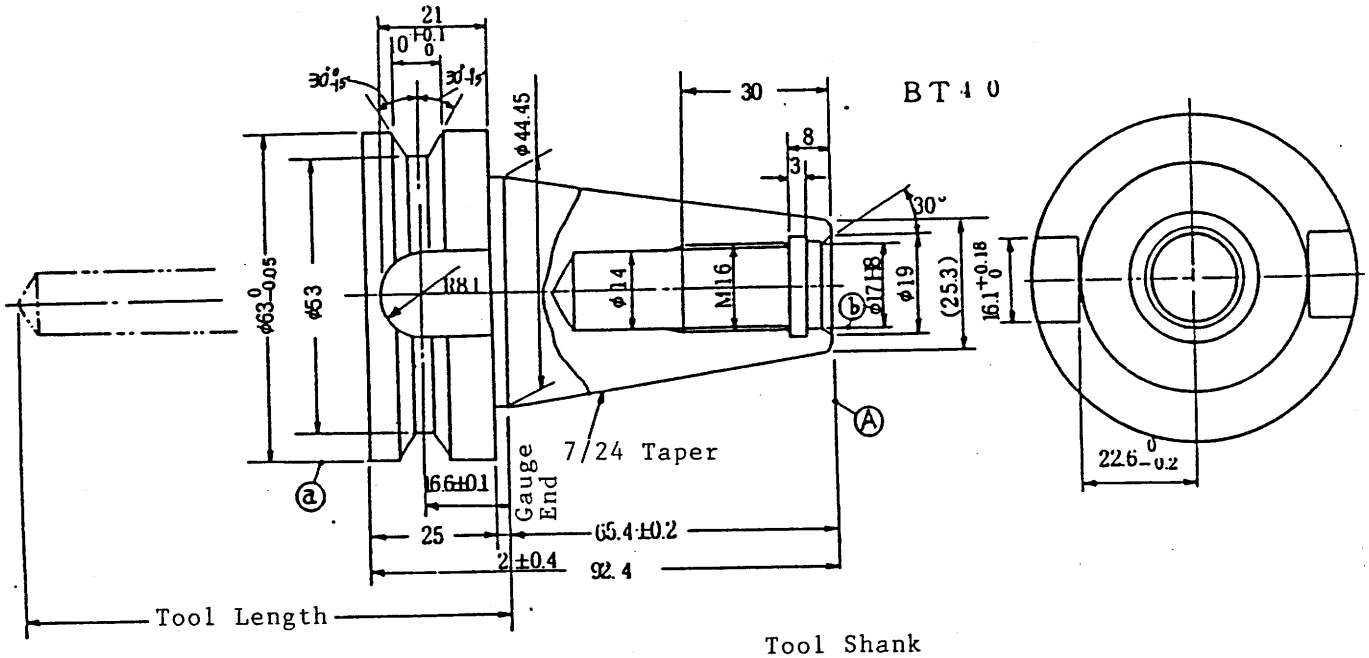
Max. moment of tool

NT40
1.35kg-m
NT50
2.3kg-m

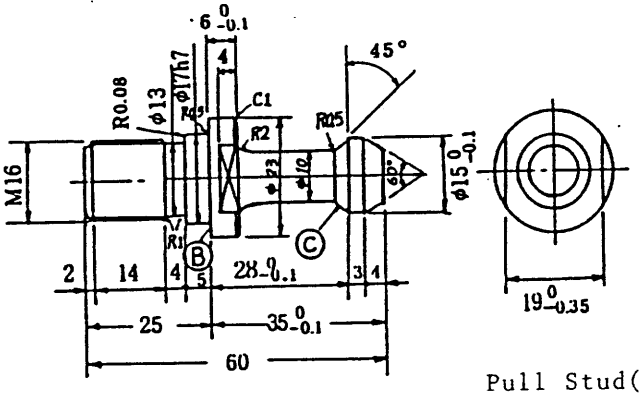


4. Tool Shank (BT40, 50)

Fig. 3-6 Tool Shank(BT-50) and Pull Stud Bolt



Tool Shank

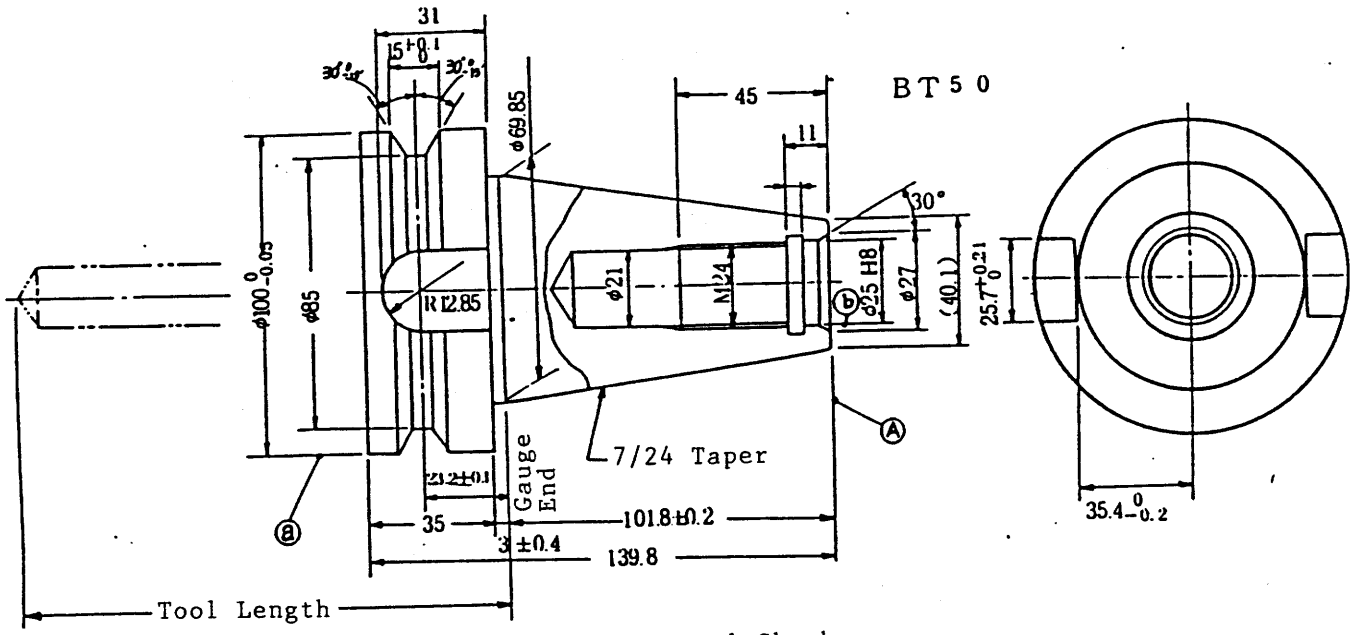


Pull Stud(I Type)

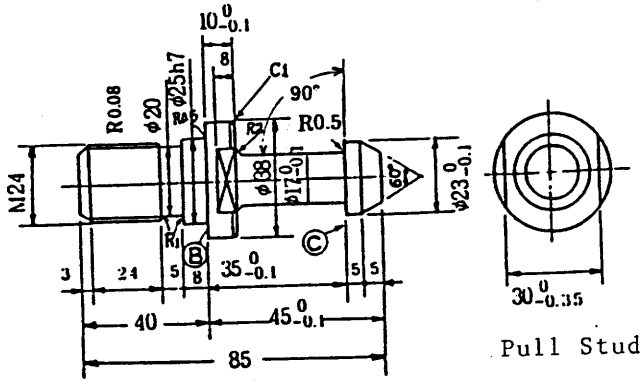
1. Concentricity of the taper shank to (a) and (b) should be 0.025mm.
2. Squareness of the taper shank to the surface A should be 0.015/100.
3. Offset to the center of the 16.1 groove should be 0.06mm.
4. Taper tolerance should be +0.000063 or 0(JIS B0612-1965, 4T).
5. Threads should conform to the JIS B0205-1968 and their accuracy should be Grade-2 of the JIS B0209-1968.
6. Squareness of the surface B and concentricity of the surface C to the center line of ϕ 17 h7.

4. Tool Shank (BT40, 50)

Fig. 3-5 Tool Shank(BT-40) and Pull Stud



Tool Shank



Pull Stud

1. Concentricity of the taper shank to (a) and (b) should be 0.025mm.
2. Squareness of the taper shank to the surface A should be 0.015/100.
3. Offset to the center of the 25.7 groove should be 0.06mm.
4. Taper tolerance should be +0.000063 or 0(JIS B0612-1965, 4T).
5. Threads should conform to the JIS B0205-1968 and their accuracy should be Grade-2 of the JIS B0209-1968.
6. Squareness of the surface B and concentricity of the surface C to the center line of ϕ_{25} h7.

5. Explanation of Each Commands

1. G Function

B: Standard O: Option

Code	Function	Group	Division
G00	Positioning	01	B
G01	Linear interpolation		B
G02	Circular arc/Helical interpolation CW		B/O
G03	Circular arc/Helical interpolation CCW		B/O
G04	Dwell	00	B
G05	High speed distribution machining		O
G07	Hypothetical axis interpolation		O
G09	Exact stop		B
G10	Data setting		B
G11	Data setting mode cancel		O
G15	Polar coordinate command cancel	20	O
G16	Polar coordinate command		O
G17	X - Y plane	02	B
G18	Z - X plane		B
G19	Y - Z plane		B
G20	Inch input	06	B
G21	Metric input		B
G22	Stored stroke check function ON	04	B
G23	Stored stroke check function OFF		B
G27	Reference point return check	00	B
G28	Reference point return		B
G29	Return from reference point		B
G30	2nd, 3rd, 4th reference point return		B
G31	Skip function		O
G33	Thread cutting	01	O
G34	Variable lead thread cutting		O

B: Standard O: Option

Code	Function	Group	Division
G37	Tool length automatic measurement	00	O
G38	Tool diameter compensation vector maintenance		O
G39	Tool diameter compensation corner circular arc		O
G40	Tool diameter compensation cancel / 3 dimentional tool diameter compensation cancel	07	B/O
G41	Tool diameter compensation left / 3 dimentional tool diameter compensation		B/O
G42	Tool diameter compensation right		B
G43	Tool length compensation +	08	B
G44	Tool length compensation -		B
G45	Tool position offset Extension	00	B
G46	Tool position offset Reduction		B
G47	Tool position offset Double extension		B
G48	Tool position offset Double reduction		B
G49	Tool length compensation cancel	08	B
G50	Scaling cancel	11	O
G51	Scaling		O
G52	Local coordinate system setting	00	B
G53	Machine coordinate system selection		B
G54	Work coordinate system Selection 1	14	B
G55	Work coordinate system Selection 2		B
G56	Work coordinate system Selection 3		B
G57	Work coordinate system Selection 4		B
G58	Work coordinate system Selection 5		B
G59	Work coordinate system Selection 6		B
G60	Uni-directional positioning	00	O
G61	Exact stop mode	13	B
G62	Automatic corner override mode		O
G63	Tapping mode		O
G64	Cutting mode		B

B: Standard O: Option

Code	Function	Group	Division
G65	Macro call	00	0
G66	Macro modal call	14	0
G67	Macro modal call cancel		0
G68	Coordinate rotation	16	0
G69	Coordinate rotation cancel		0
G70	Bolt hole cycle	00	0
G71	Arc cycle		0
G72	Line at angle cycle		0
G73	Peck drilling cycle	09	B
G74	Reverse tapping cycle		B
G76	Fine boring cycle		B
G77	Grid cycle	00	0
G80	Canned cycle cancel	09	B
G81	Drilling cycle, Spot boring		B
G82	Drilling cycle, Counter boring		B
G83	Peck drilling cycle		B
G84	Tapping cycle		B
G85	Boring cycle		B
G86	Boring cycle		B
G87	Back boring cycle		B
G88	Boring cycle		B
G89	Boring cycle		B
G90	Absolute command	03	B
G91	Incremental command		B
G92	Work coordinate system alteration		B
G93	Inverse time feed	05	O
G94	Feed per minute		B
G95	Feed per revolution		O

B: Standard O: Option

Code	Function	Group	Division
G96	Constant peripheral speed control	17	O
G97	Constant peripheral speed control cancel		O
G98	Canned cycle initial point level return	10	B
G99	Canned cycle R point level return		B
G113	Oscillation mode ON	21	O
G114	Oscillation mode OFF		O
G120	Polar coordinate interpolation mode cancel	22	O
G121	Polar coordinate interpolation mode		O
G130	Tool life management OFF	18	O
G131	Tool life management ON		O
G203	High speed machining program registeration start	00	O
G204	High speed machining program registeration end		O
G206	Setting of tool retraction		O
G232	Exponential function interpolation CW	01	O
G233	Exponential function interpolation CCW		O
G240	Machining plane Selection O (Maching plane selection cancel)	24	O
G241	Machining plane Selection 1		O
G242	Machining plane Selection 2		O
G243	Machining plane Selection 3		O
G244	Machining plane Selection 4		O
G245	Machining plane Selection 5 (Correspond to arbitray angle of horizontal or vertical)		O
G248	Axis change / 3 dimentional coordinate change ON	26	O
G249	Axis change / 3 dimentional coordinate change cancel		O
G251	Multi-buffer	00	B
G264	Tool nose reference check ON	25	O
G265	Tool nose reference check OFF		O
G271	Cylindrical interpolation	00	O
G301	Floating reference point return		O

B: Standard O: Option

Code	Function	Group	Division
G302	ID cutting of true circle CW	00	0
G303	ID cutting of true circle CCW		0
G304	OD cutting of true circle CW		0
G305	OD cutting of true circle CCW		0
G322	Outside cutting of square CW		0
G323	Outside cutting of square CCW		0
G324	Square plane		0
G325	One side sizing of square plane		0
G326	Both side sizing of square plane		0
G327	Inside of circle (Pocket cutting)		0
G328	Inside of square (Pocket cutting)		0
G329	Inside of track (Pocket cutting)		0
G330	Outside of circle (Pocket cutting)		0
G331	Outside of square (Pocket cutting)		0
G332	Outside of track (Pocket cutting)		0
G333	True circle (Pocket cutting)		0
G431	Tool length compensation of tool axis direction	08	0
G501	Programmable mirror image cancel	15	0
G511	Programmable mirror image		0
G540~ G599	Additional work coordinate system selection (60 sets)	12	0
G611	Acceleration/deceleration befor interpolation	00	0
G661	Macro moudal call B	14	0
G741	Reverse direct tapping cycle	09	0
G841	Direct tapping cycle		0
G921	Work coordinate system preset	00	0

Note 1 G code marked ◤ are set when the power is turned on, or reset. As to G22, G23, G22 is set when the power is turned on, and remain in the previous condition even after resetting. G20 and G21 is set before power cut-off, or before pushing reset button.

Note 2 The G codes of group 00 are non-modal and are effective only in blocks where they are specified.

Note 3 When commanding G code not listed in G code table, alarm is displayed (PS010). Or when G code without corresponding option is commaned, alarm is displayed.

Note 4 G code can be commanded in the same block if a different group. Any numbers of more than 2 G code in the same group are commanded, G code commanded last is in effect.

Note 5 Classification

B: Standard specification O: Optional specification

2. M Function

B: Standard O: Option

M code	Function	Division
000	PROGRAM STOP	B
001	OPTIONAL STOP	B
002	END OF PROGRAM	B
003	SPINDLE FORWARD	B
004	SPINDLE REVERSE	B
005	SPINDLE STOP	B
006	TOOL CHANGE (ATC)	B
007	MIST COOLANT START	O
008	FLOOD COOLANT START	B
009	COOLANT, MIST STOP	B
010	OIL MIST POSTURE NO.1	O
011	OIL MIST POSTURE NO.2	O
012	WORK COUNTER 1	O
013	SPINDLE FORWARD & COOLANT START	B
014	SPINDLE REVERSE & COOLANT START	B
015	SPINDLE & COOLANT STOP	B
016	MEASUREMENT AIR BLOW ON	O
017	MEASUREMENT AIR BLOW OFF	O
018	SPINDLE ORIENTATION FOR MEASURMENT	O
019	SPINDLE ORIENTATION	B
020		
021		
022		
023		
024		
025		
026	MELODIA SELECTION 1	B
027	MELODIA SELECTION 2	B
028		
029		
030	END OF TAPE	B
031	CHIP CONVEYOR	B
032		
033		
034		
035	AUTOMATIC START ON (AUTO. RETURN EFFECTIVE)	O
036	AUTOMATIC START OFF (AUTO. RETURN INEFFECTIVE)	O

B: Standard O: Option

M code	Function	Division
037		
038		
039		
040	TOOL NOSE AIR BLOW ON / TOOL LENGTH MEASUREMENT COVER OPEN	O
041	TOOL NOSE AIR BLOW OFF / TOOL LENGTH MEASUREMENT COVER CLOSE	O
042		
043		
044		
045	SPARE TOOL EXIST	O
046	SPARE TOOL NON	O
047	JET COOLANT START	O
048	FEED RATE OVERRIDE ENABLED	B
049	FEED RATE OVERRIDE 100%	B
050	OIL HOLE COOLANT ON (THROUGH COOLANT)	O
051	TOOL PREPARATION CHECK	O
052	TOOL BROKEN CHECK	O
053	CANCELING M54	O
054	TOOL LIFE/CUTTING MONITOR FUNCTION STOP	O
055	CANCELING M56	O
056	APPLING FEED HOLD ON RUNNING OUT TO TOOL LIFE	O
057	TOOL LIFE DATA SETTING START	
058	CUTTING MONITOR DATA SETTING START	
059	CANCELING M51	O
060	PALLET CHANGE (APC) DOOR OPEN	O
061	APC PALLET CARRY OUT	O
062	APC PALLET CARRY IN	O
063		
064		
065		
066	PALLET CLAMP	O
067	PALLET UNCLAMP	O
068	ADDITIONAL AXIS CLAMP (OPTIONAL CHARGE WITH M78)	O
069	ADDITIONAL AXIS UNCLAMP (OPTIONAL CHARGE WITH M78)	O
070	M70 OUTPUT	O
071	M71 OUTPUT, INDEXING STAND START	O
072	M72 OUTPUT	O
073	M73 OUTPUT	O

B: Standard O: Option

M code	Function	Division
074	SKIP SELECTION OFF	O
075	SKIP SELECTION ON	O
076		
077		
078	ADDITIONAL AXIS CLAMP	O
079	ADDITIONAL AXIS UNCLAMP	O
080	TOOL NOSE AIR BLOW ON	O
081		
082		
083		
084		
085		
086	MEASUREMENT NG TOOL BREAKAGE	O
087		
088	DOOR OPEN	O
089	DOOR CLOSE	O
090		
091		
092		
093		
094		
095		
096	CUSTOM MACRO INTERRUPTION EFFECTIVE	O
097	CUSTOM MACRO INTERRUPTION INEFFECTIVE	O
098	SUB PROGRAM CALL	B
099	MAIN PROGRAM CALL	B
122	CHIP CONVEYOR STOP	O
192	RIGHT PALLET CHECK	O
193	LEFT PALLET CHECK	O

Note) When the M code is altered owing to special specifications and other reasons, refer to the electric diagram.

3. Maintenance M Code

B: Standard O: Option

M code	Function	Division
900	TABLE CLAMP	O
901	TABLE UNCLAMP	O
902	PALLET CLAMP	O
903	PALLET UNCLAMP	O
904		
905		
906	APC DOOR OPEN	O
907	APC DOOR CLOSE	O
908		
909		
910	APC SHUTTLE APC SIDE	O
911	APC SHUTTLE M/C SIDE	O
912	APC CARRIER RIGHT TRAVEL	O
913	APC CARRIER LEFT TRAVEL	O
914		
915		
916		
917		
918		
919		
920	ATC ARM SWING IN SPINDLE SIDE	B
921	ATC ARM SLIDE SPINDLE SIDE	B
922	ATC DOUBLE ARM FORWARD & AIR BLOW	B
923	ATC DOUBLE ARM RIGHT TRAVEL	B
924	ATC DOUBLE ARM LEFT TRAVEL	B
925	ATC DOUBLE ARM RETRACT	B
926	ATC ARM SLIDE ZERO POSITION	B
927	ATC ARM SWING IN ZERO POSITION	B
928	ATC ARM SLIDE MAGAZINE SIDE	B
929	NOT USED	B
930	TOOL CLAMP	O
931	TOOL UNCLAMP	O
932	MAGAZINE PIN PUT	O
933	MAGAZINE PIN PULL	O
998	MAINTENANCE M CODE ON	B
999	MAINTENANCE M CODE OFF	B

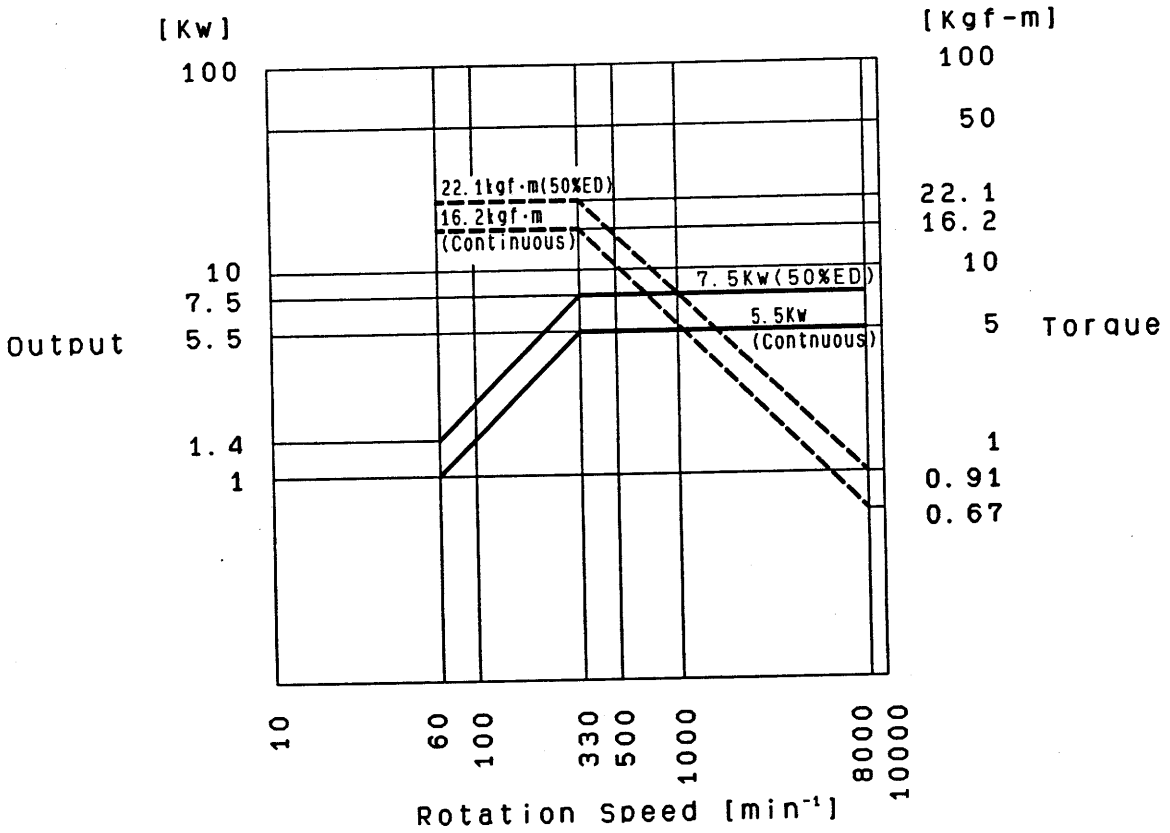
6. Command Value to NC

1. Basic address and range of command value

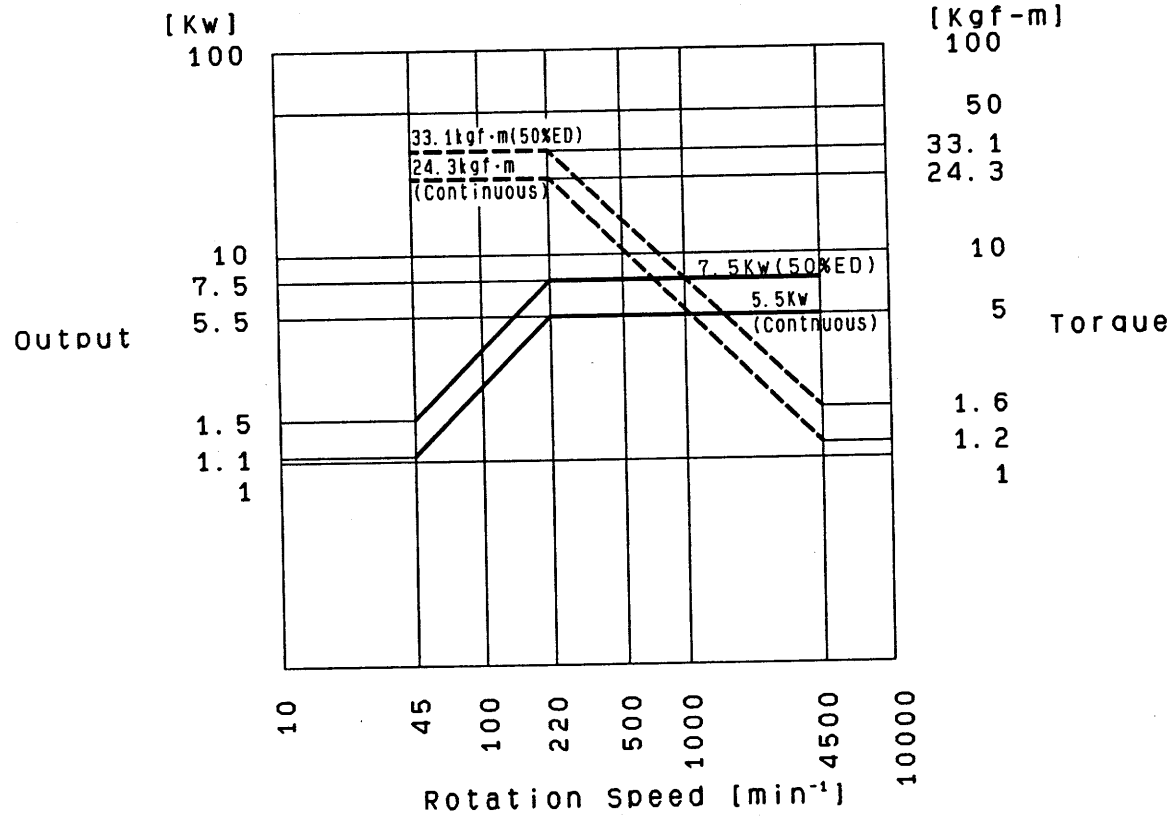
Function	Address	Range of command value
Program No.	O	1 ~ 99999999
Sequence No.	N	1 ~ 99999999
Dimension word	X, Y, Z, U, V, W, A, B, C, I, J, K, R, Q	±99999.999
Feed speed Rapid traverse Cutting feedrate	 X axis . Y axis Z axis F	 20000mm/min (790in/min) 15000mm/min (590in/min) 1~5000mm/min (0.01~200in/min)
Tool function	T	0 ~ 99 (Option 9999)
Spindle function	S	45 ~ 4500
Auxiliary function	M	0 ~ 99
Offset No.	D, H	0 ~ 99 (Option 200)
Dwell	P, X	0 ~ 99999.999 sec.
Repitive function	L	0 ~ 9999

7. Spindle Speed - Torque Diagram

NT40 Spindle[60~8000(min^{-1})]



NT50 Spindle[45~4500(min^{-1})]



Chapter 5 OPERATION OF MACHINE

1. Daily Maintenance

Maintenance performing by an operator is as follows.
These maintenance and check is important to prevent a trouble of machine previously and operate effectively.

1. Checking before daily operation

1) Are there enough oil in the lubrication tank?

2) Cleaning of each operation panel.

3) Are there any leakage of oil or air?

4) Cleaning of spindle hole, hole of tool magazine pot, hole of standby pot, grip area of ATC arm.

5) Cleaning of chips over slide way cover.

6) Is setting pressure of hydraulic unit correct? 5Mpa {50kg f/cm²}

7) Are there sufficent oil in the hydraulic unit or spindle head?

8) Does cooling fan of control cabinet rotates?

9) Are there any abnormal noise or vibration?

10) Are there any abnormal display, e.g. battery alarm etc. on the CRT?

2. Monthly checking items

1) Checking of power source voltage.
Checking of secondary voltage within ±10% of standard value.
(200/220V 50/60Hz)

2) Cleaning and oil supply of each area of ATC arm.

3. Trimonthly checking items

1) Machine checking. Measure a backlash and compensation.

2) Measure a machine level and adjustment.

3) Cleaning of partition plate in coolant tank.

4) Looseness of moving part and clamping part of door and cover etc..

4. Semiannual checking items

1) Oil change of hydraulic unit and cleaning of inside of tank.

2) Cleaning of filter in hydraulic tank.

3) Oil change of spindle gear box (2ℓ in spindle head).

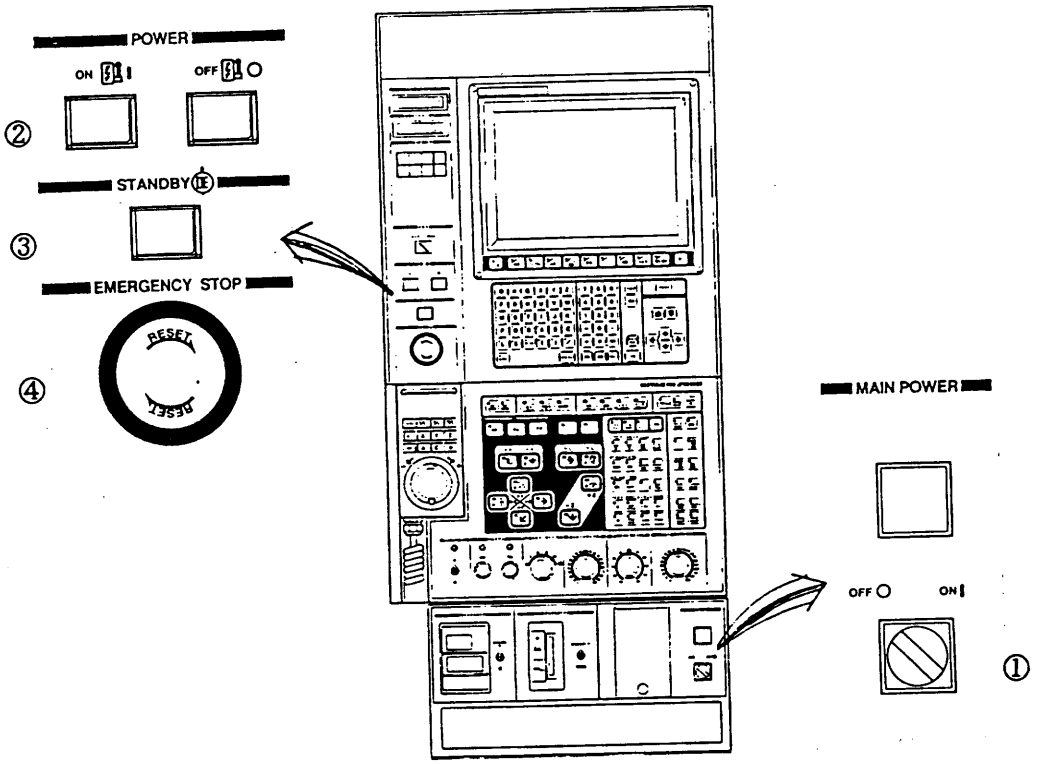
4) Cleaning of filter of spindle cooling unit and cooling unit above control cabinet.

5. Cleaning of tape reader (Option)

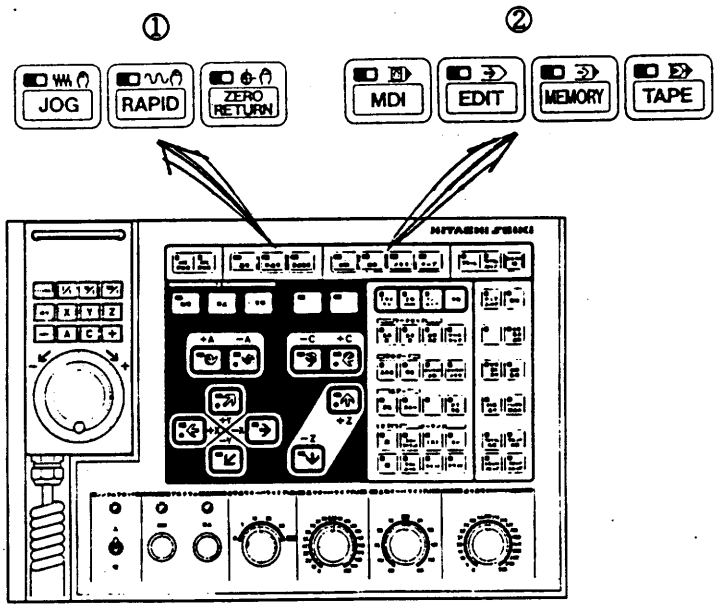
Item	Period	Cleaning part	Cleaning method
1	Daily	Surface of tape guide.	Clean by moist gauze with absolute alcohol.
2	Daily	Surface of reading head.	Clean by moist gauze or fine brush with absolute alcohol. A fine brush is effective to clean a cavity of reading head.
3	Weekly	Bottom of tape box.	Clean by clothes, brush or vacuum cleaner.
4	Weekly	Magnet parts for tape holder.	Clean by moist gauze with absolute alcohol. In case of sticking iron powder on ma magnet parts, remove cover at reading part and clean by adhesive tape.
5	Weekly	Passage part of tape (1) Tape holder (2) Stop shoe (3) Capstan roller (4) Pinch roller	Clean by moist gauze with absolute alcohol.

2. Explanation of Outline of Main and Sub Operation Panel

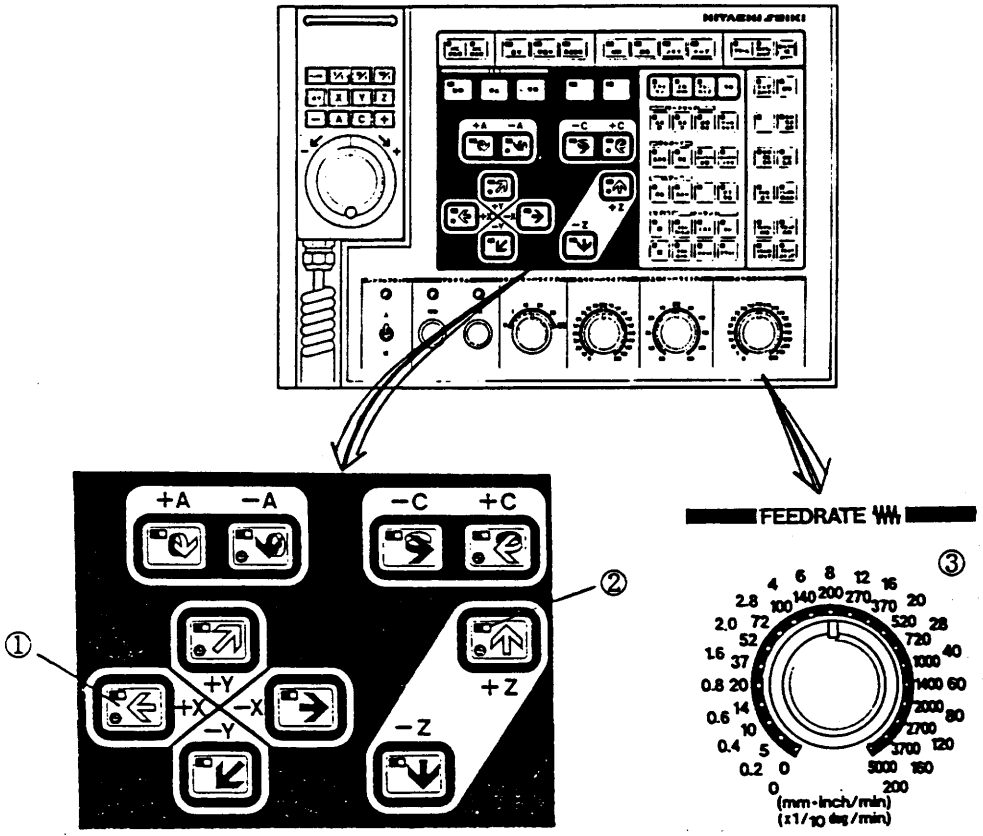
1. Main Operation Panel



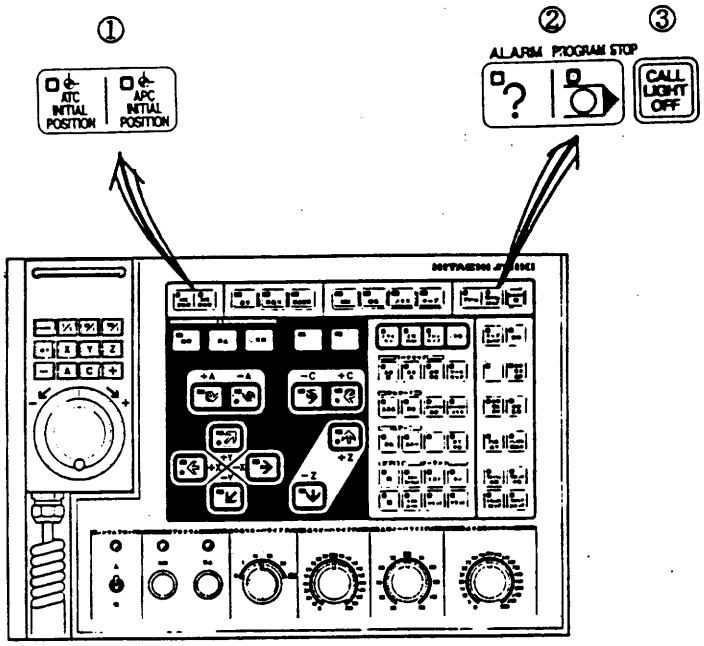
No.	Description	Function	Remark
①	MAIN POWER SOURCE	Power source of power cabinet is "ON".	
		Power source of power cabinet is "OFF".	
②	POWER SOURCE	Main power is "ON" and turn on the NC unit.	
		Main power is "OFF".	
③	READY	Hydraulic pump and lubrication pump go into action and becomes machine operable condition. (Green lamp is lit)	
④	EMERGENCY STOP (Main operation panel, Sub operation panel)	Machine becomes full stop condition. Stop all motors and NC unit becomes reset condition.	



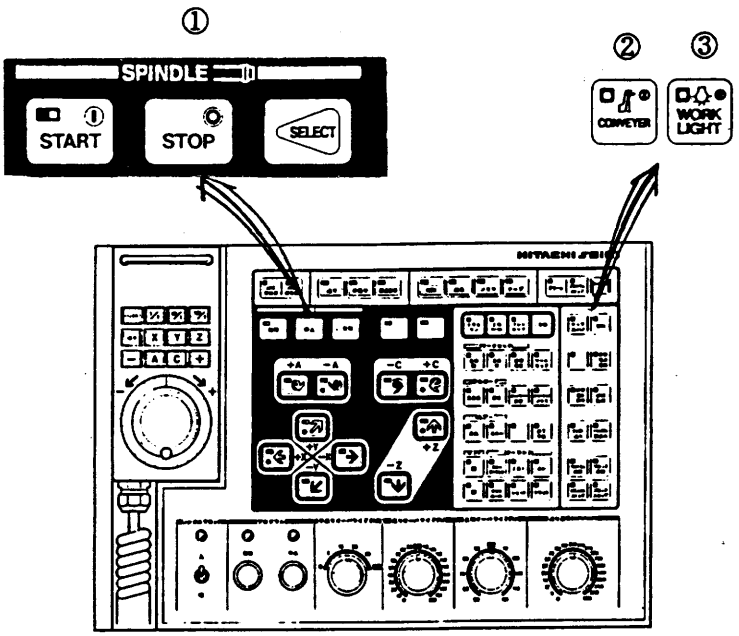
No.	Description	Function	Remark
①	MODE CHANGE (Manual mode)	perform the mode selection of "Feed", "Rapid", "Traverse", zero return.	
		"Feed" select at operation of manual continuous feed.	Feed of each axis (Refer to page 5-27.)
		"Rapid traverse" select at operation of rapid traverse.	Rapid traverse (Refer to page 5-29.)
		"Zero return" select at zero return.	Procedure of zero return (Refer to page 5-25.)
②	MODE CHANGE (Automatic mode)	Perform the mode selection of "MDI", "Edit", "Memory" or "Tape".	
		"MDI" select at operation by MDI input.	MDI operation (Refer to page 5-31.)
		"Edit" select at performing of program editing function. Also, select at storing or outputting a program into/ from memory.	Editing of program (Refer to page 5-42.) Registration of program (Refer to page 5-35.) Output of program (Refer to page 5-101.)
		"Memory" select at performing a program which is stored in the memory.	Automatic operation (Refer to page 5-72.)
		"Tape" select at in/out put a program by NC tape.	



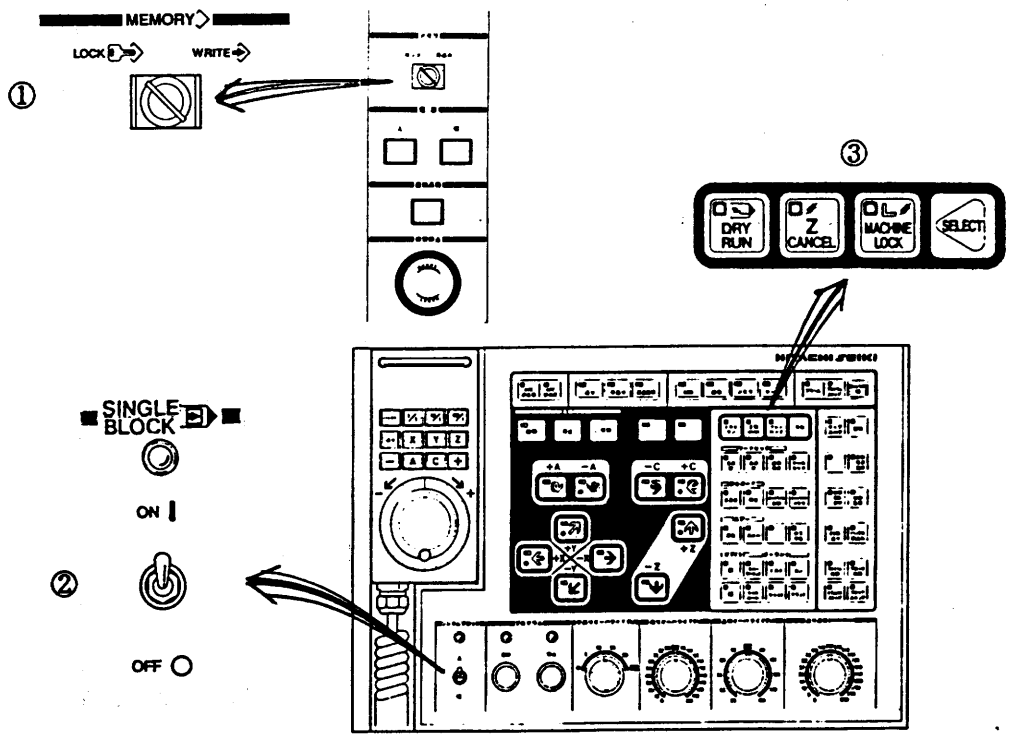
No.	Description	Function	Remark
①	AXIS MOVEMENT BUTTON	Move axis X, Y, Z, C (Option) and A (Option). Axis selection and moving direction depend each display on button. When executing zero return, keep pressing a zero (⊕) direction button until zero return lamp turn on.	Feed of each axis (Refer to page 5-27.) Procedure of zero return (Refer to page 5-25.)
②	ZERO RETURN LAMP	Turn of the lamp when an axis locating at machine zero point.	
③	FEEDRATE SWITCH	Select a feedrate at manual or dryrun operation.	0 ~ 5000mm/min (In case of C or A axis 10 ~ 1400deg/min)



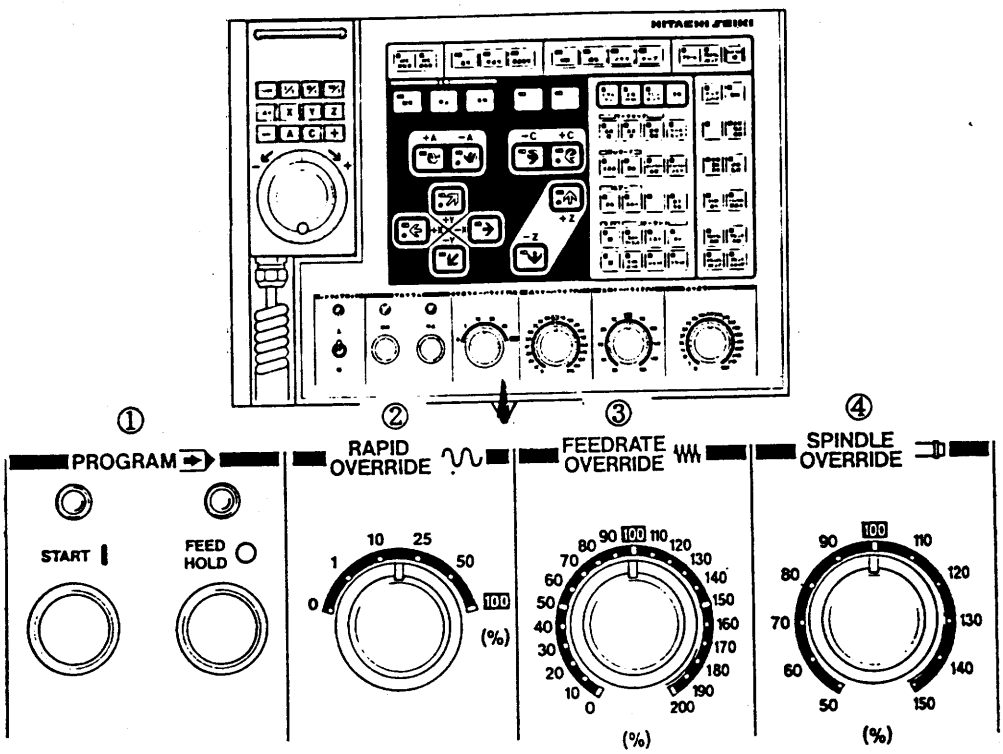
No.	Description	Function	Remark
①	ORIGINAL POSITION CONFIRMATION LAMP	"APC original position" at the time of command of automatic Pallet change (Option), it shows each machine part locates at fixed position.	
		"ATC original position" at the time of command of automatic Tool change (ATC), it shows each machine part locates at fixed position. The lamp flickers while executing ATC cycle.	
②	CONDITION DISPLAY LAMP	"Alarm" red lamp lights or flickes when alarm is generated.	
		"Program stop" red lamp lights when M00 or M01 is executed during operation in auto mode. Red lamp turns off by program start or restart.	
③	CALL LIGHT OFF	Turn off a lighting call light (Yellow light) and melodia.	



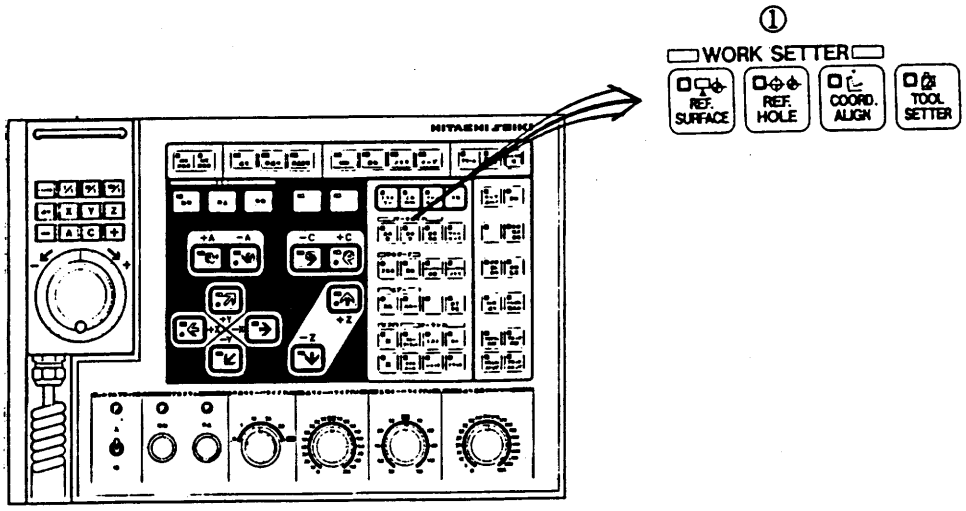
No.	Description	Function	Remark
①	SPINDLE ROTATION STOP BUTTON	"Start" spindle rotates when pressing start button with effective button simultaneously. (Command of spindle speed is required previously) "Stop" stop the spindle rotation.	Only in the manual mode.
②	CHIP CONVERYOR	Rotates spiral conveyor	
③	LIGHTING	Light the work light.	



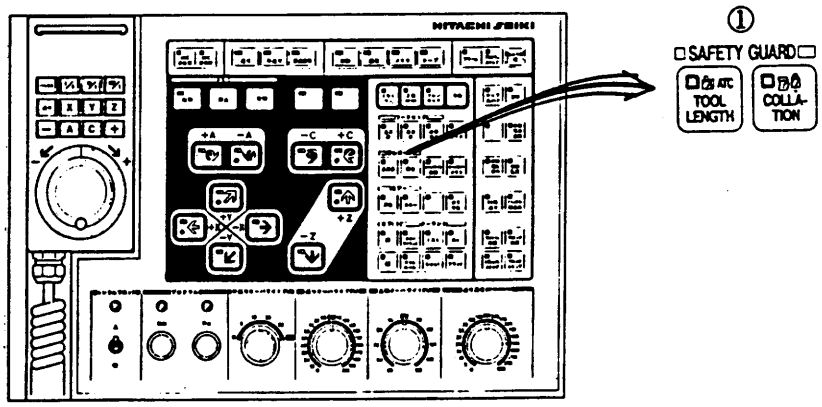
No.	Description	Function	Remark
①	MEMORY KEY	"Lock" protect the information stored in the memory of NC unit. Generally use the key at "Lock" side.	
		"Write" turn to "Write" side when writing or correcting an information of memory.	
②	SINGLE BLOCK SWITCH	Program command executes one block each. However, canned cycle executes one cycle each.	
③	FUNCTION SELECTION (Make effective a required function with pressing effective button)	"Z axis cancel" only Z axis becomes machine look condition.	Convenient to apply it at test run of the program.
		"Machine lock" omit axis movement of machine and only display proceeds.	Coordinate value can be checked without machine movement.
		"Dry run" ignore a feedrate commanded in the program and manual feedrate becomes effective.	



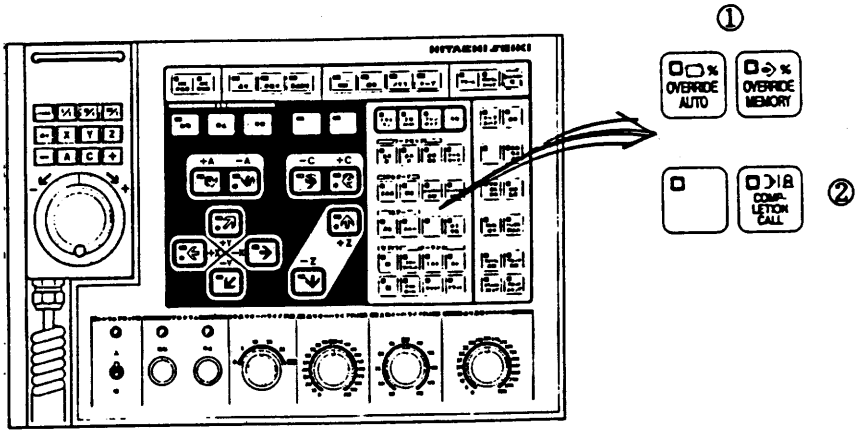
No.	Description	Function	Remark
①	PROGRAM START, HALT BUTTON	"Start" start a program at memory automatic operation and MDI mode. Lamp lights while running. "Halt" halt a program advance. Axis in movement stops and red light turns on. During motion of auxiliary function (M, S, T), a program advance stops after completion of remaining motion of each command.	
②	RAPID TRAVERSE OVERRIDE SWITCH	Override can be applied against prescribed rapid traverse speed. At the time of power on, it has set at 25% or less. At the time of manual operation, it is limited at 25% maximum.	100 : X, Y 20 Z 15 m/min 50 : 10 7.5 25 : 5 3.75 1 : 0.2 0.15 0 : No motion
③	FEEDRATE OVERRIDE SWITCH	Override can be applied on feedrate of automatic operation.	0 ~ 200% (Ignore it during tapping fixed cycle and becomes 100%).
④	SPINDLE OVERRIDE SWITCH	Override can be applied against the command of spindle speed.	50~150% (Ignore it during tapping fixed cycle and becomes 100%).



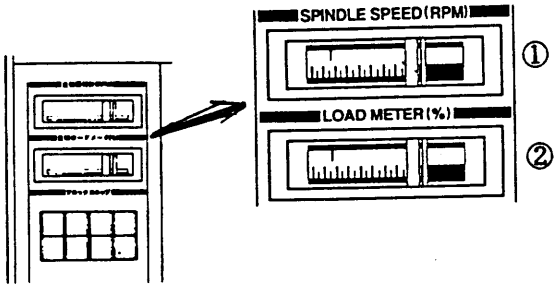
No.	Description	Function	Remark
①	WORK SETTER	"Tool setter" measure a tool length and diameter and set the offset amount in the offset memory automatically.	
		"Datum surface", "Datum hole" measure a shift amount of machine coordinate system for datum surface and hole against machine coordinate system and set it in coordinate system shift memory.	
		"Coordinate correction" by measuring three points on the right angle datum surface of a workpiece or fixture located on X-Y plane, calculate and store a difference of rotating angle from X-Y axis then coordinate value of program of X and Y axis is corrected.	

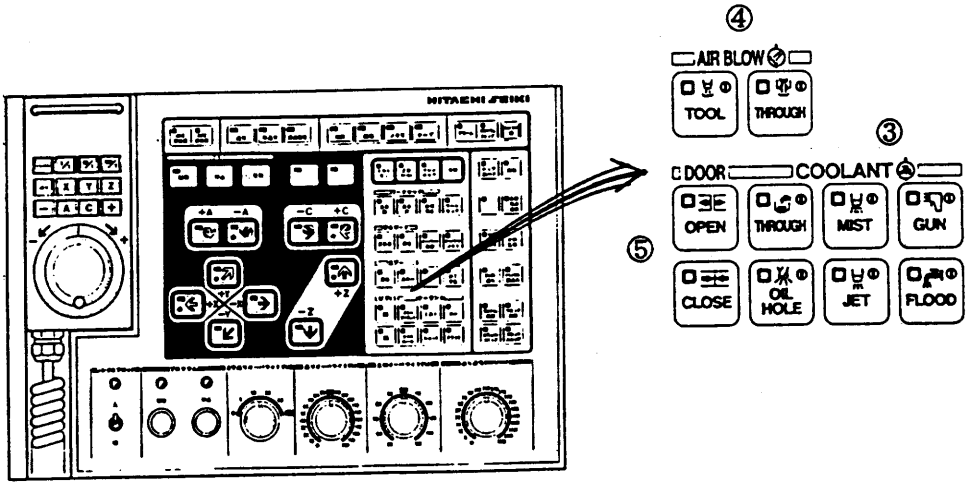


No.	Description	Function	Remark
①	SAFETY GUARD	Measure a machining tool length at the first program start. Measure an actual workpiece by standard touch tool on the spindle at the second program start. Performs interference check of workpiece and tool by Z axis approach command (G00) to add compensating amount of using tool to these two information.	
		"Tool length" measure and store a tool length to be used in the actual machining program.	
		"Collation" check interference between tool and workpiece at Z axis approach to execute machine operation by actual machining program with Z axis machine lock.	

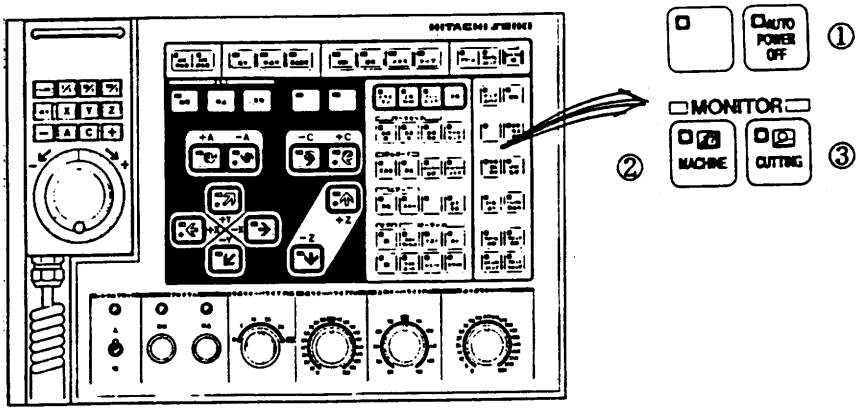


No.	Description	Function	Remark
①	OVERRIDE MEMORY	"Memory" memory the optimum override value fount at test cutting etc. to correspond using tool.	
		"Auto" override value which stored in the memory reflect program automatically.	
②	ADVANCE NOTICE OF COMPLETION	Give advance notice of program completion by lighting the call light before complete the machining program. Time of advance notice of completion can be set arbitrarily.	

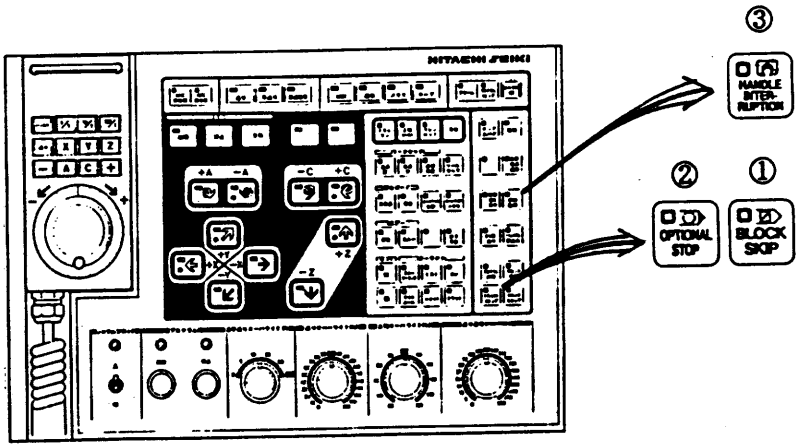




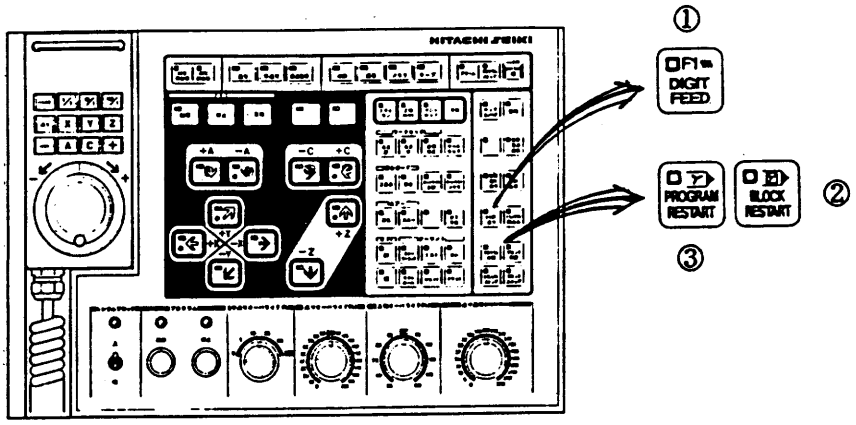
No.	Description	Function	Remark
①	SPINDLE TACHOMETER (Option)	Display a rotating spindle speed on the meter.	
②	SPINDLE LOAD METER (Option)	Display a load condition of spindle against rated power of motor.	
③	COOLANT BUTTON	Operate various coolant displayed at above push buttons. ON or OFF of each coolant can be done even if during automatic operation.	
④	AIR (Option)	"Tool tip" air blows from nozzle pointed to tool tip.	
		"Through" air blows through inside of main spindle.	
⑤	DOOR, WHEN INSTALLED APC (Option)	"Open" open the APC door.	
		"Close" close the APC door.	



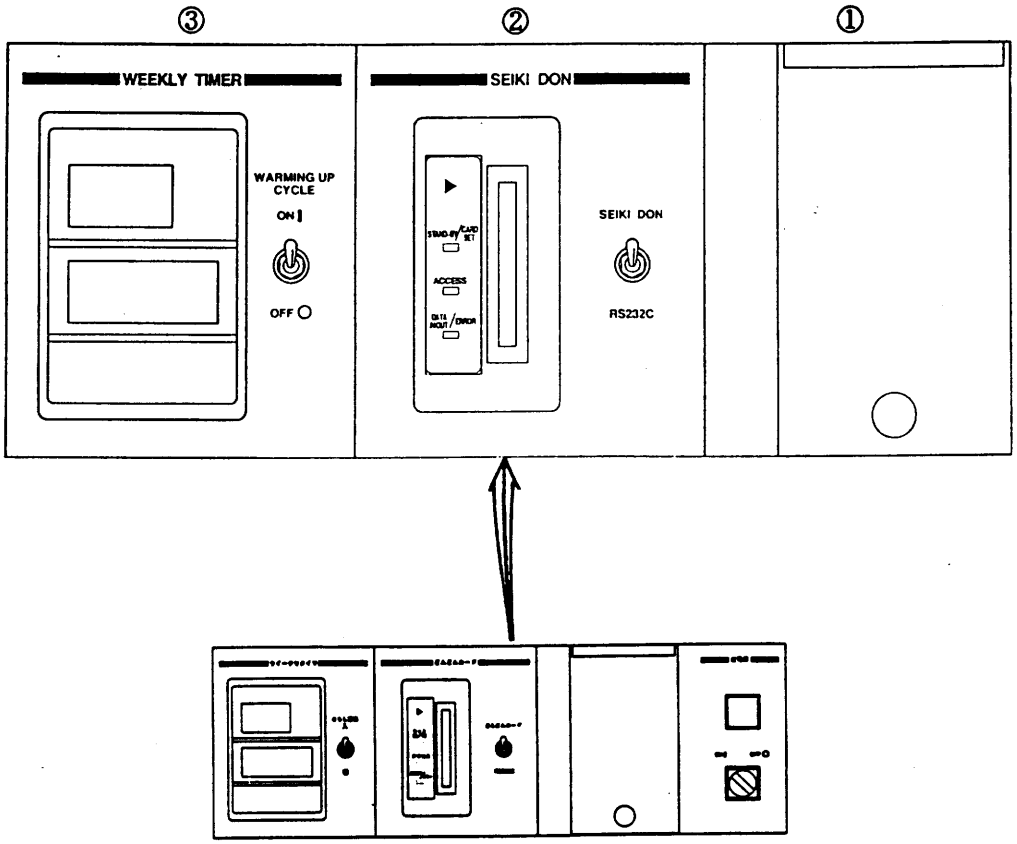
No.	Description	Function	Remark
①	AUTOMATIC POWER SHUT OFF BUTTON	Automatic power shut off function becomes effective. Automatically power shut off by M30(Alarm) in case of completion of machining cycle or unbachined pallet is not existence.	
②	CONDITION OK DISPLAY BUTTON	Spindle tool No. and angle of coolant nozzle etc. can be monitored. Setting of remaining time of lubricant can be corfirmed.	
③	CUTTING MONITOR BUTTON (Option)	Screen of cutting monitor can be monitored.	
④	CUTTING MONITOR SWITCH (Option)	"Automatic setting" monitoring data sets automatically by teaching cutting data. "Ineffective" cutting monitor becomes ineffective. "Effective" cutting monitor becomes effective.	



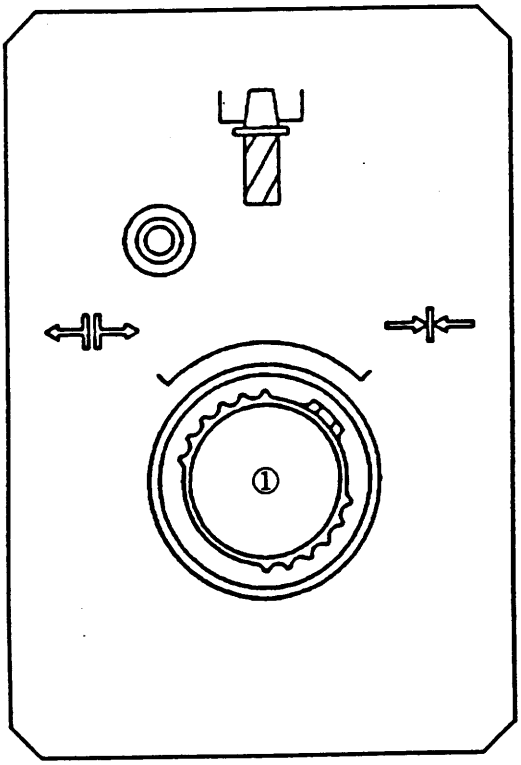
No.	Description	Function	Remark
①	BLOCK SKIP BUTTON	Block skip function by commanded in program becomes effective.	Skip a block with slash "/" in program.
②	OPTION STOP BUTTON	In case of existence of M1 in the program, automatic operation stops after completion of all command of that block. Pilot lamp light. Press program start button again to release.	
③	HANDLE INTERRUPTION (Option)	Axis other than the moving axis can be moved by manual pulse generator while automatic operation.	



No.	Description	Function	Remark
①	F1 DEGIT FEED BUTTON (Option)	F1 digit feed becomes effective and lamp lights.	F1 digit feed of NC option is required. F1~F9: Becomes setting feedrate correspond to the number. F0: Rapid traverse
②	BLOCK RESTART BUTTON (Option)	Block restart becomes effective and lamp lights.	"Block restart" of NC option is required.
③	PROGRAM RESTART BUTTON (Option)	Program restarts and lamp lights. Designate a sequence No. wanted to restart can be restarted from there by this function.	

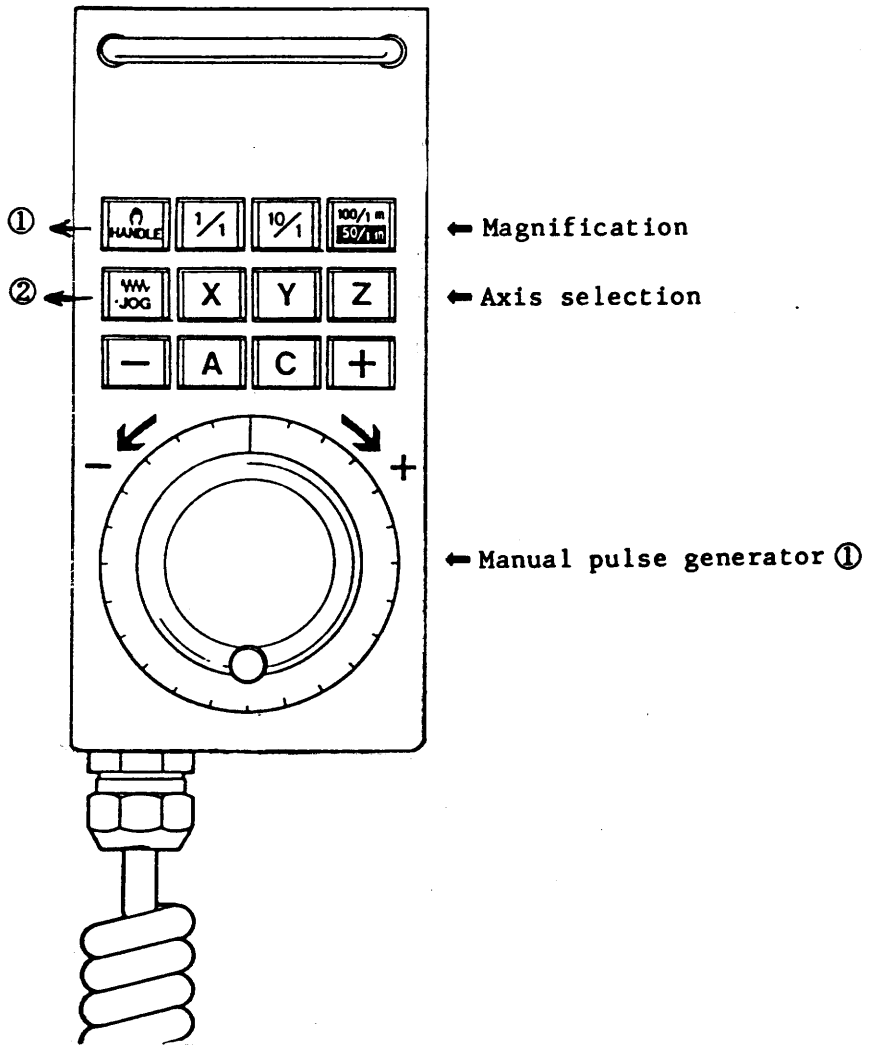


No.	Description	Function	Remark
①	INPUT/OUTPUT INTERFACE, RS-232C TERMINAL	Input and output is available for program, tool offset amount or parameter in the memory.	
②	FA CARD (SEIKE DON), READER, WRITER (Option)	Both input and output from/to FA card is available for program, tool offset amount or parameter.	
③	WEEKLY TIMER (Option)	It is possible to enable the machine to set to the standby state for the every day's operation time of the machine through automatically turning ON the NC unit hydraulic unit beforehand.	



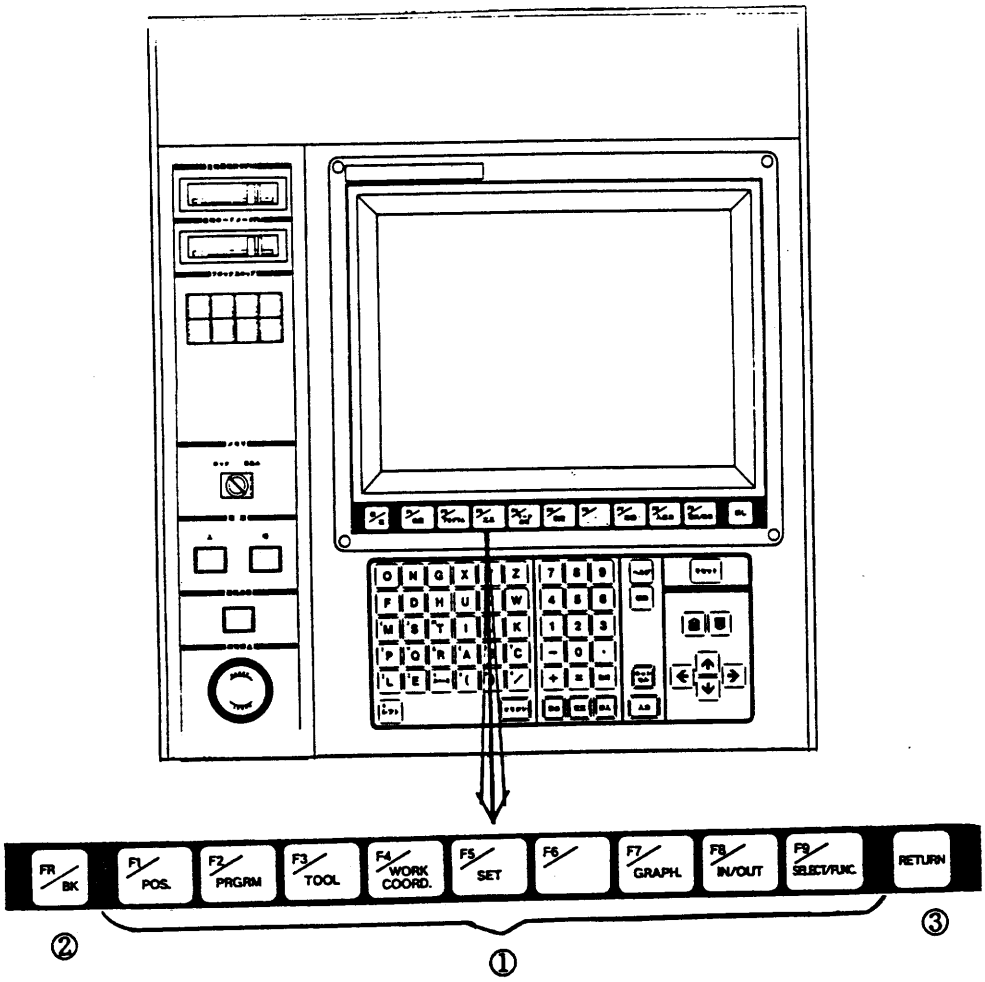
No.	Description	Function	Remark
①	TOOL CLAMP/ UNCLAMP SWITCH	"Clamp" clamp a tool in the spindle.	Manual mode only.
		"Unclamp" a tool can be removed from the spindle. When a tool is unclamp condition, yellow lamp is lit and the spindle ban not rotate.	Manual mode only.

2. Sub Operation Panel

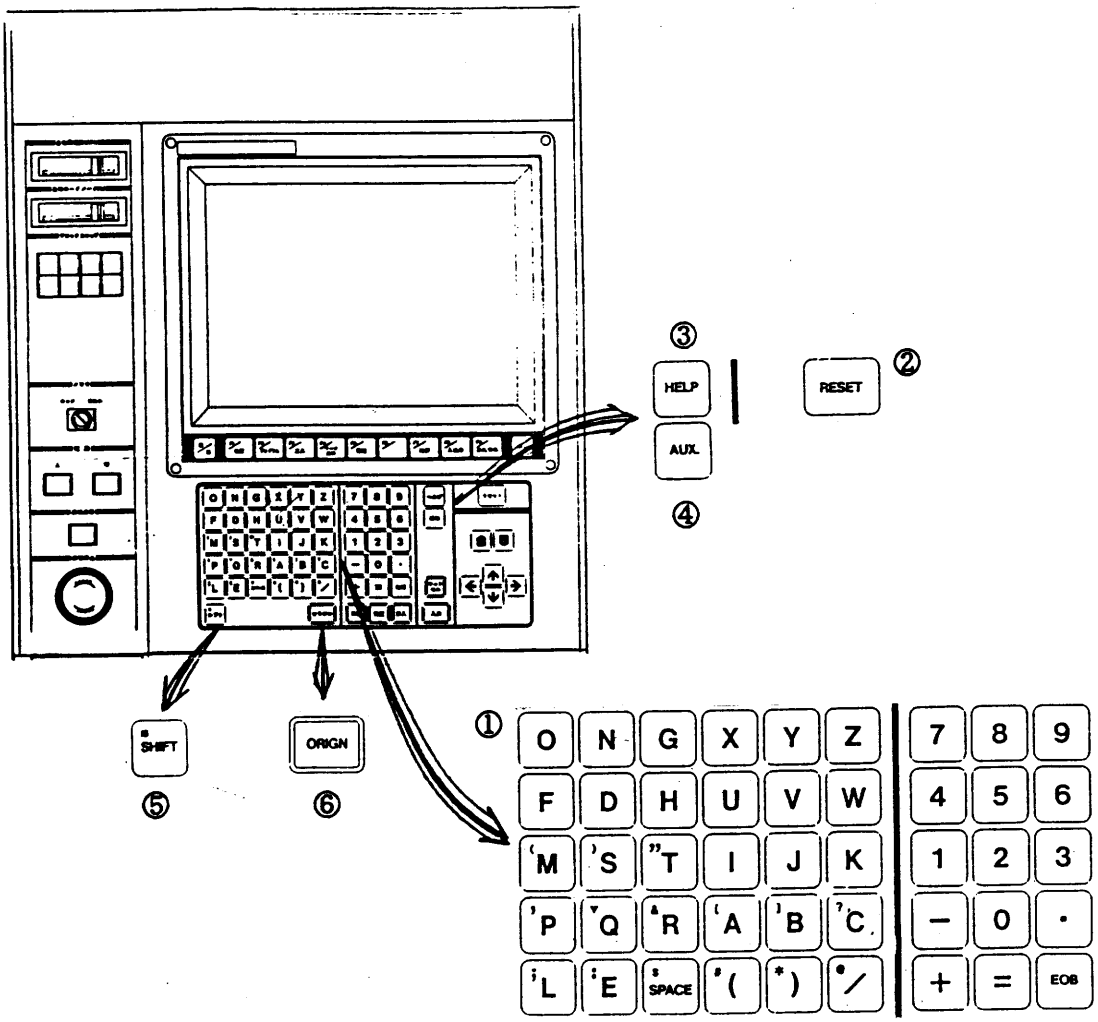


No.	Description	Function	Remark
①	MANUAL PULSE GENERATOR (Portable type) HANDLE	Axis selection : Select a feed axis. Magnification : Select for feed amount per one division of the handle. Manual pulse generator : Fine feed can be done per each division. Since this portable type, this can be used at any conveient place.	One hundred division per one revolution. Magnification 1/1 : 0.001mm/div 10/1 : 0.01mm/div. 100/1 : 0.1mm/div.
②	FEED	"FEED" : Each axis can be moved same as the main operation panel.	

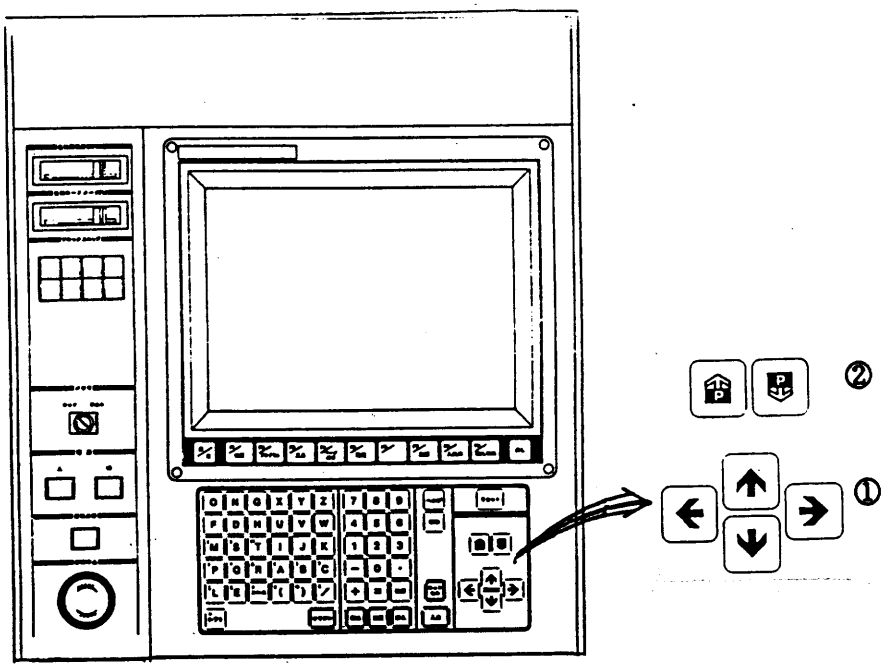
3. NC Operation Panel



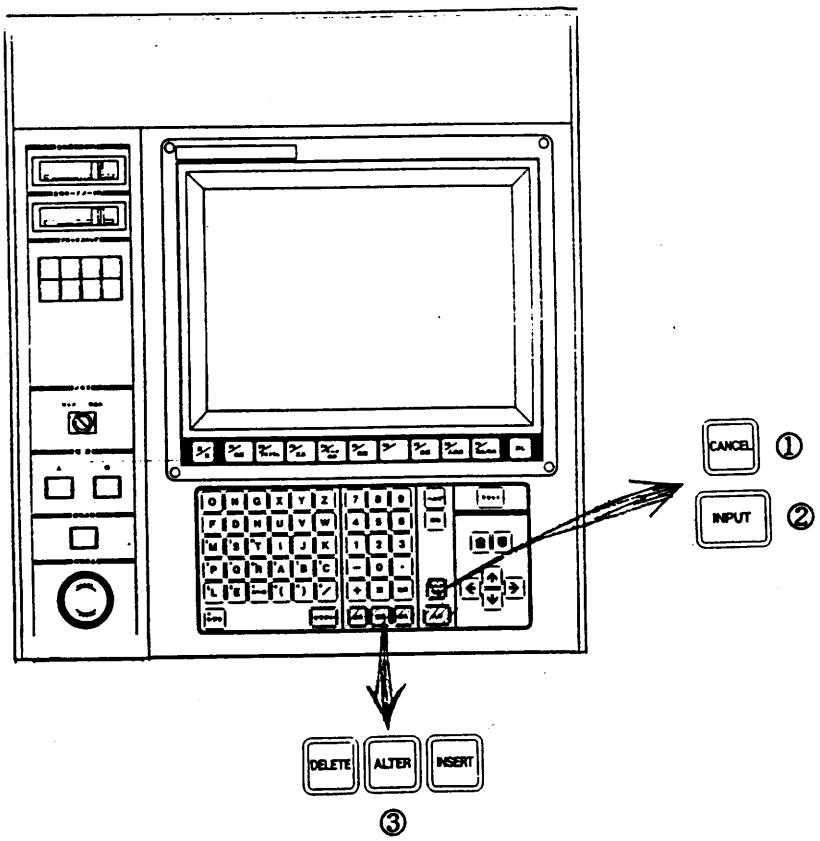
No.	Description	Use
①	FUNCTION KEY	When the function menu is displayed on the bollom line of the CRT, each key works as the displayed menu. If the menu is not displayed on the CRT, the key works as position, program, tool, work coordinate, setting drawing in/output respectively. When displaying the function menu on the screen is required, press the "Select/function" key.
②	FRONT/REVERSE KEY	When displaying the PC, alarm or maintenance screen, press this key. The function menu is displayed on the CRT by pressing the button once and the menu is disappeared by pressing the button again.
③	RETURN KEY	Press this button when returning screen to "Overall screen".



No.	Description	Use
①	ADDRESS/NUMERAL KEY	Use when inputting alphabet or numeral etc.
②	RESET	Press when releasing an alarm or resetting the NC.
③	HELP KEY	The key operation guid is displayed on program screen.
④	AUXILIARY KEY	Use when displaying the special screen. (For maintenance)
⑤	SHIFT KEY	Some of address key has two letters on one key. Upper left letter is inputted if pressing address key and shift key at the same time.
⑥	ORIGIN KEY	Use this key when clearing the cooedinate value to zero or drawing screen.



No.	Description	Use
①	CURSOR MOVE KEY	There are four kinds cursor move keys. ➡ : Use when moving a cursor each word unit. A cursor moves regular direction. ⬅ : A cursor moves opposite direction. ⬇ : Use when moving a cursor each block unit on the CRT screen. ⬆ : A cursor moves opposite direction.
②	TURN OVER PAGE KEY	There are two kinds of turn over page key. ⬇ : Use this key to turn over the page in regular direction of CRT screen. ⬆ : Use this key to turn over the page in opposite direction of CRT screen.



No.	Description	Use
①	CANCEL KEY	Press this key when removing a letter or sign which is inputted in the buffer of key input. Contents of the buffer of key input is displayed on the CRT and if press the address or numeral key, inserted position of these are shown by a cursor. If press cancel key, cancel the letter just before the cursor.
②	INPUT KEY	When pressing an address or numeral key, input it in the buffer of key input once and display it on the CRT. Press input key if want to set the data which is inputted in the buffer of key input actually.
③	DELETE, ALTER INSERT KEY	Use when to delete, alter or insert of editing of the program.

3. Procedure of Machine Operation

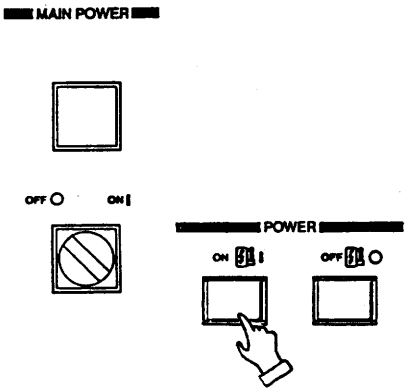
1. At the Time of Start

1) Turn on the power source switch.

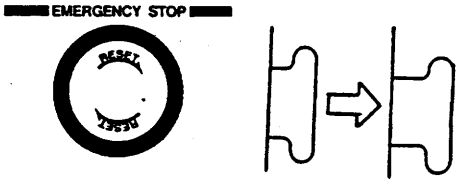
2) Turn on the main power source key at the bottom right of the operation panel.

3) Press the NC unit power on button at left of NC operation panel.

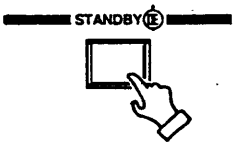
(Note) Main cabinet and NC unit is sealed type construction and avoid a mixture of outer air directly. Therefore, don't keep open the door long time of period during power on.
Check a display of CRT and running of cooling fan motor at in/out side of cabinet.



4) Turn right the emergency stop button.

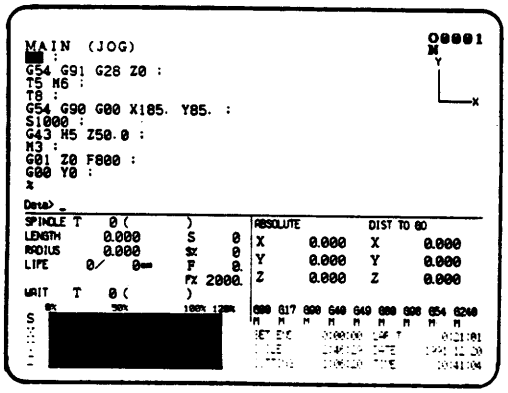


5) Press the ready button at left side of the NC operation panel. (Green lamp lights.)
Melody sounds about 12 seconds. (Press call light off if interruption is required.)
Check a setting pressure of hydraulic unit is 45Kg/cm^2 as fixed value.



6) Move X, Y and Z axes several times to lubracate each slide way before starting operation. (Pay attention to avoid over travel.)

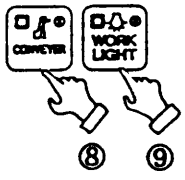
7) Return zero position for each axis.
(Refer to procedure of zero return on the next page.)
Basic machine coordinate system is set and stored stroke limit becomes effective by executing of zero return.



8) Turn on the switch for chip converyor.

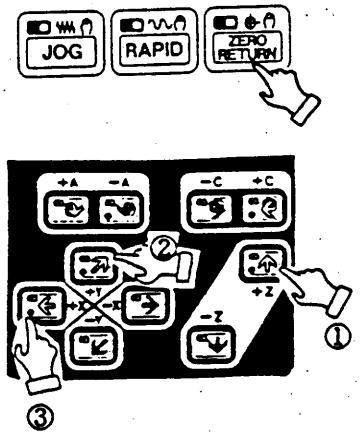
(Note) Don't run the chip converyor when a lot of chips is in the though.

9) Turn of the work light.



2. Procedure of Zero Return

Manual zero return should be done to set the basic machine coordinating system after turn on the power source.



1) Press the "Zero return" for mode select push button switch.
2) The NC unit is made to the reset status by the reset key.
3) Press the push button which has a mark of zero position for the axis to be returned zero.
4) Axis moves at rapid traverse (25% override) up to zero position.
   Motion stops at zero position and the zero position confirmation lamp is turned on.
5) Take a finger off from switch if lamp is turned on.

Proceed zero return for each axis by the above procedure.

※ Limited operations of APC type NC dividing head (for safety)

1) When the NC dividing head is not removed from machine, return the NC dividing head to the zero position before the automatic operation starts. If the head is not completely returned, the quick feeding speed of basic axis is limited 25%.
2) When the NC dividing head is located on the APC side, return it to the zero position after it is set in the machine, or return it to the zero position by the forced operation [refer to (4)].
3) The NC dividing head can be fixed by the axial interlock, if it is on the APC side.
4) Forced operation
   When the NC dividing head is on the APC side, the axial interlock is released as long as the spindle stop button is pushed in the zero position return mode or the manual mode or the handle mode.

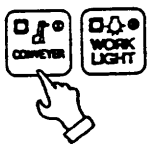
(Note) Execute zero return one axis each.
Start from Z axis for safety purpose.

(Note) In case of the axis to be returned zero locates near the zero position, move the axis about 50mm in opposite direction once, then move the axis to designated zero direction again.

(Note) 100% of override becomes effective after zero return.

3. At the End of Operation

1) Clean up the machine.
   Stop the chip converyor after all chips carried out from the converyor.

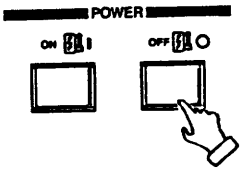


2) Confirm the machine stopped completely.
   - Spindle rotation
   - Program start/stop lamp
   - X, Y and Z axes
   - ATC
   - Coolant
   - Chip converyor

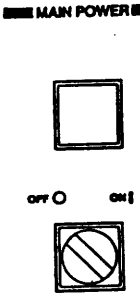
3) Move the axis to stop position.
   - X axis : Approximately middle of stroke
   - Y axis : Approximately middle of stroke
   - Z axis : Approximately middle of stroke

4) Press the emergency stop button at the NC operation panel.

5) Press power off button at the NC operation panel for control power off.



6) Turn off the main power key.



7) Turn off the power source.

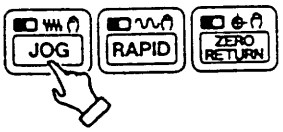
4. Manual Operation

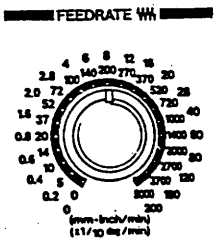
1. Feed of Each Axis

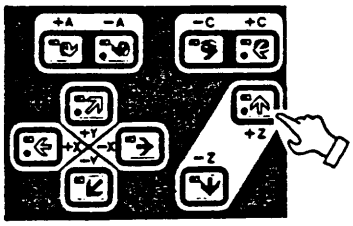
— In case of manual feed —

1) Press the "Feed" for mode select push button switch.
   Select the "Feed" on the manual pulse generator will do as well.

2) Set the manual feedrate rotary switch to suitable speed.
   Move the machine to desired direction by the manual feed direction push button switch.
   Take a finger off from the switch when reach to the fixed position.
   (The machine moves only when pressing the switch.)



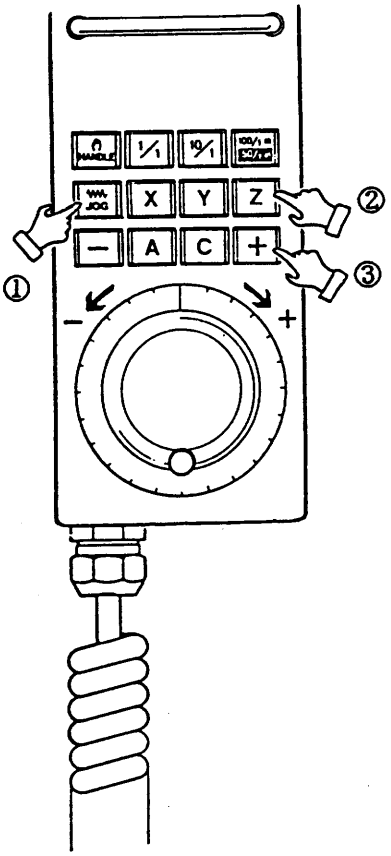




In case of manual pulse generator, operation can be done as the same way.

(Example of use)

- Warm up running
- In case of approach near the zero position.
- In case of cutting manually
- Setting work



Feed of each axis

— In case of the handle feed —

1) Press the "Handle" for mode select push button switch.

2) Select the axis by the axis push button switch.

3) Fine feed can be done by the manual handle.

. When select 1/1 : One division is 0.001mm

. When select 10/1 : One division is 0.01mm

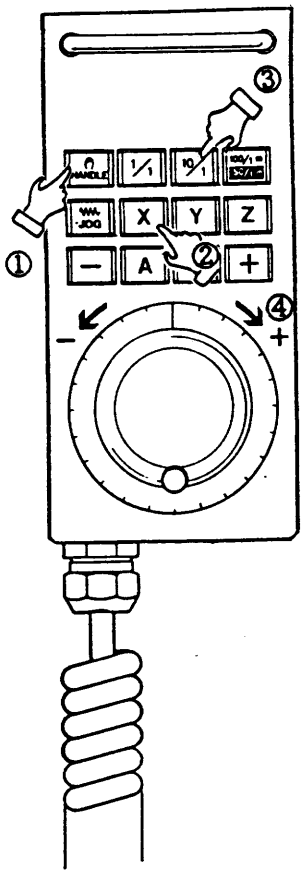
. When select 100/1 ; One division is 0.1mm

In case of B axis for the NC rotary table (Option), the unit is degree.

The least input increment is 0.01(deg).

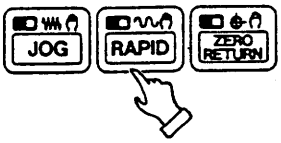
(Example of use)

. In case of fine movement such as finding zero position by centering the workpiece or fixture.

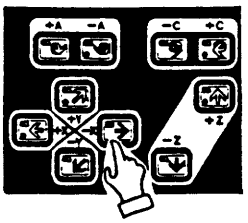


2. Rapid Traverse

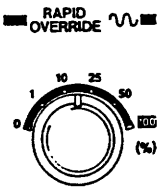
1) Press the "Rapid traverse" for mode select push button switch.



2) Press the push button switch of axis to be rapid traversed.
(Rapid traverse is executed while pushing the button.)



0, 1, 25, 50 or 100% of override is available for designated rapin traverse.

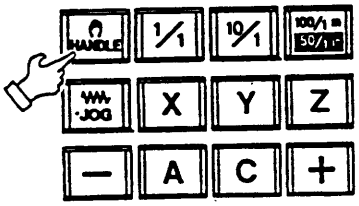


3) Rapid traverse is stopped if release the push button switch.

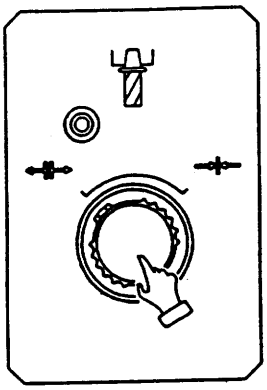
3. Mounting or Dismounting of Tool

1) Stop the spindle head at convenient position to work.

2) Select any one of the switch out of "Feed", "Rapid traverse", "Handle", "Zero return" of the manual feed for mode select push button.

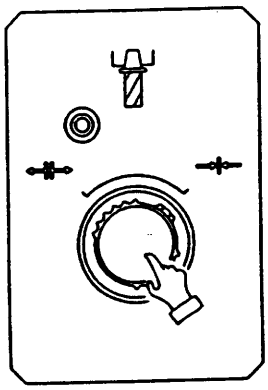


3) Hold the tool in the spindle firmly and shift the push button unclamp side ⊸ then press it.
In case of the tool is mounted in the spindle, tip of the draw bar pushes the tool shank by pressing the button and the tool releases from the spindle tapered hole. (Hold the tool firmly to avoid falling.)
Yellow lamp at the upper left of the push button lights during anclamp.



4) In case of mounting the tool, remove dust from tapered area of the tool shank completely.
Clean the tapered hole of the spindle by the cleaner provided.

5) Insert the tool shank into the spindle hole and shift the push button clamp side ⊸ then press it.
The tool attaches to the spindle automatically and the lamp turns off.



5. Operation by Manual Data Input (MDI)

1. Axis Movement by MDI

1) Set the mode selection to MDI mode.
CRT shows overall screen 【Overall (MDI)】 automatically.
Press "Return" key if other screen is displayed.
Display the 【Program (MDI)】 screen by pressing the function key "F2/program" will do as well.

2) Key input the program wanted to input by using address or numeral key.
If input the address function key is displayed automatically.
Input "CR/LF" in the end of the block.
When made a mistake during input disappear letters from the last input.

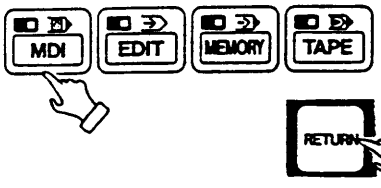
3) The program of buffer of key input transfer to the buffer memory for MDI operation and display on the CRT by pressing the "Insert" key.

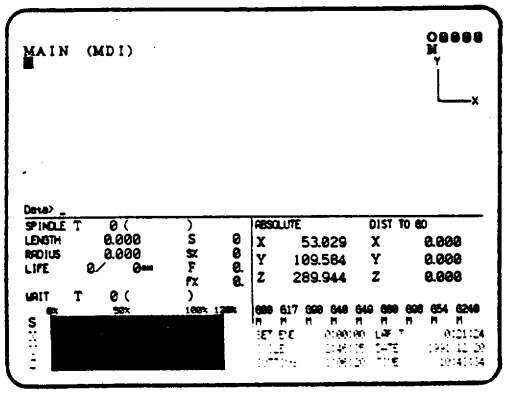
4) In case of input the program more, repeat procedure 2) ~ 3).
Capacity of memory is 200 charactors.

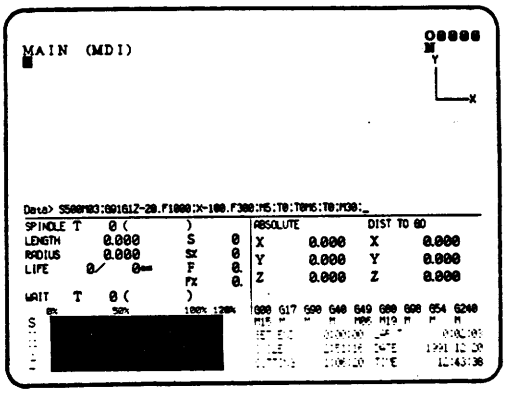
5) Press the program "Start" button.
During execution the "Start" lamp lights.

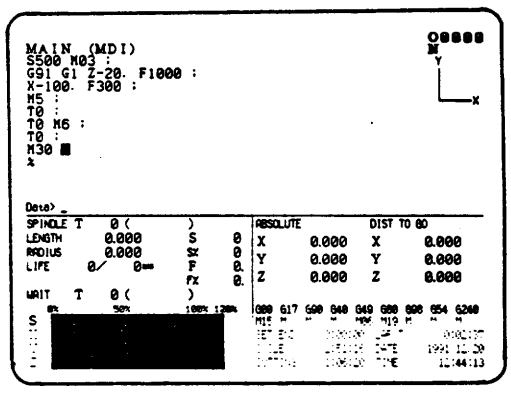
* The program of the MDI screen can edit same operation as the registered program in the memory.

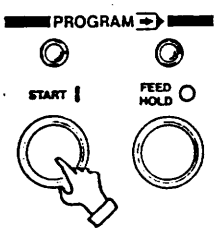
* The preceding program can be returned by 0⇩ (⇧, ⇦ or ⇨).











2. Coolant

1) Set the mode selection to MDI mode.
CRT shows overall screen 【Overall (MDI)】 automatically.
Press "Return" key if other screen is displayed.
Display the 【Program (MDI)】 screen by pressing the function key "F2/program" will do as well.

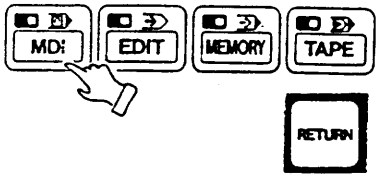
2) Press address key "M".

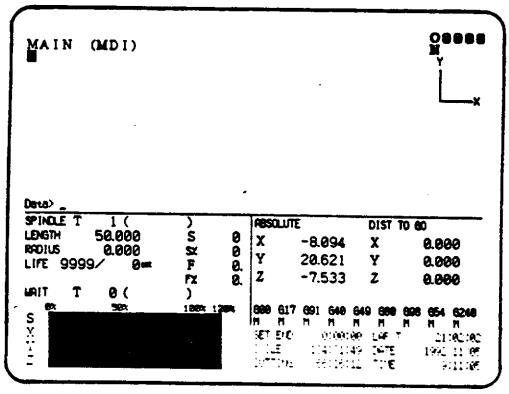
3) Input numeral "0" and "8" by data key and "CR/LF".

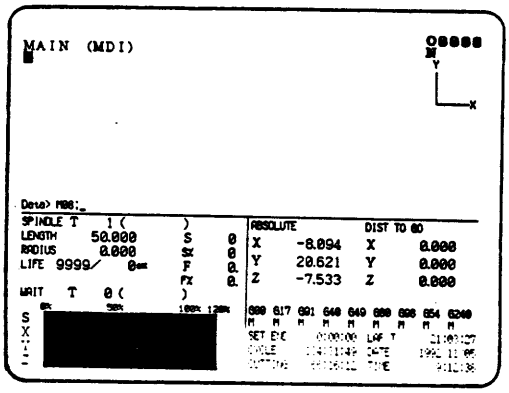
4) Press "Insert" key.

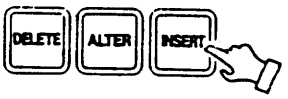
5) If pressing the program "Start" button, discharge coolant from the nozzle at the spindle head.

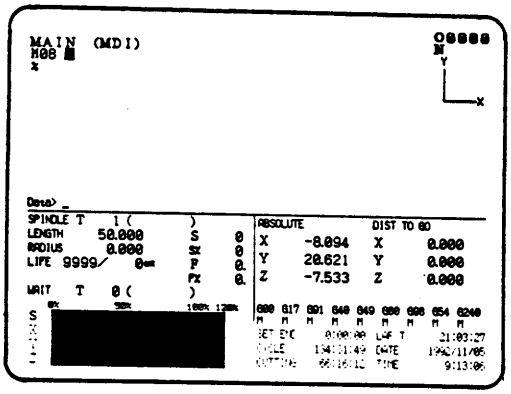
6) Coolant stops if commands M09 by same procedure mentioned above.

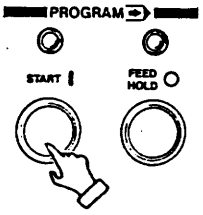






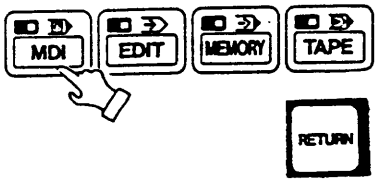






3. Speed Change and Rotation of Spindle

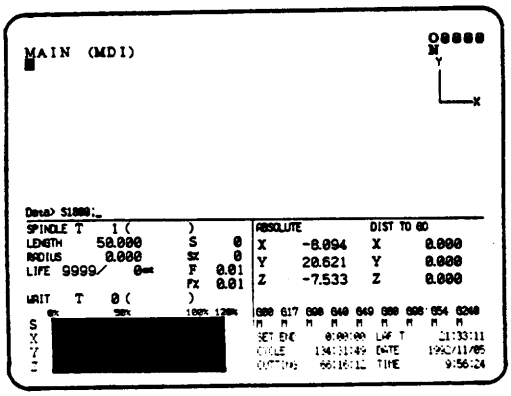
1) Set the mode selection to MDI mode.
CRT shows overall screen 【Overall (MDI)】 automatically.
Press "Return" key if other screen is displayed.
Display the 【Program (MDI)】 screen by pressing the function key "F2/program" will do as well.



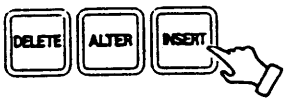
2) Press address key "S".

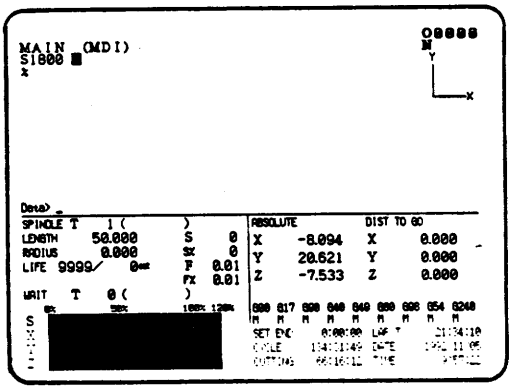
3) Input rotation number.

4) Press address key "CR/LF".



5) Press "Insert" key.

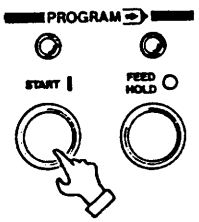




6) Input M code, M03 for forward rotation or M04 for reverse rotation.

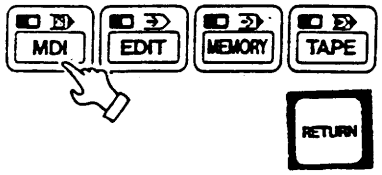
7) The spindle rotates by pressing the program "Start" button.

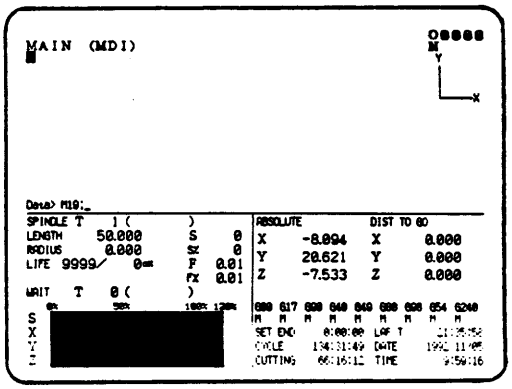
8) Command M05 by the same operation to stop.



4. Spindle Positioning

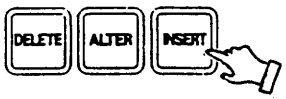
1) Set the mode selection to MDI mode.
   CRT shows overall screen【Overall (MDI)】automatically.
   Press "Return" key if other screen is displayed.
   Display the 【Program (MDI)】 screen by pressing the function key "F2/program" will do as well.



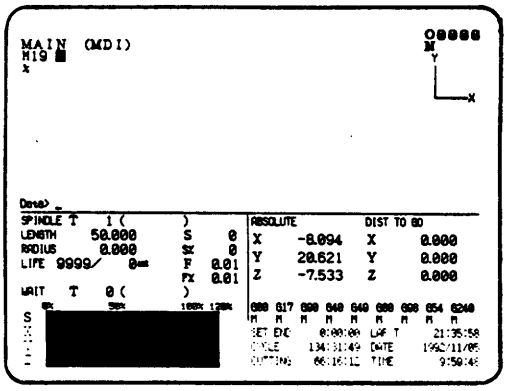


2) Press address key "M".

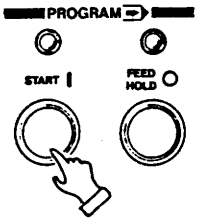
3) Input numeral 1 and 9 by data key and "CR/LF".



4) Press "Insert" key.



5) The spindle rotates slowly and stops at the fixed position if pressing the program "Start" button.



6. Registration of Program

1. Registration from CRT Screen

(1) Set the mode selection to edit mode.

(2) Shift to "Write" for memory key.

(3) Press "F2/program" key and make screen of program display.
【Overall (Editing)】screen as well.

(4) Key input the program number and press 【Insert】 key.
01008 【Insert】
Don't press 【CE/LF】 key.
The new program number is registered by above procedure.

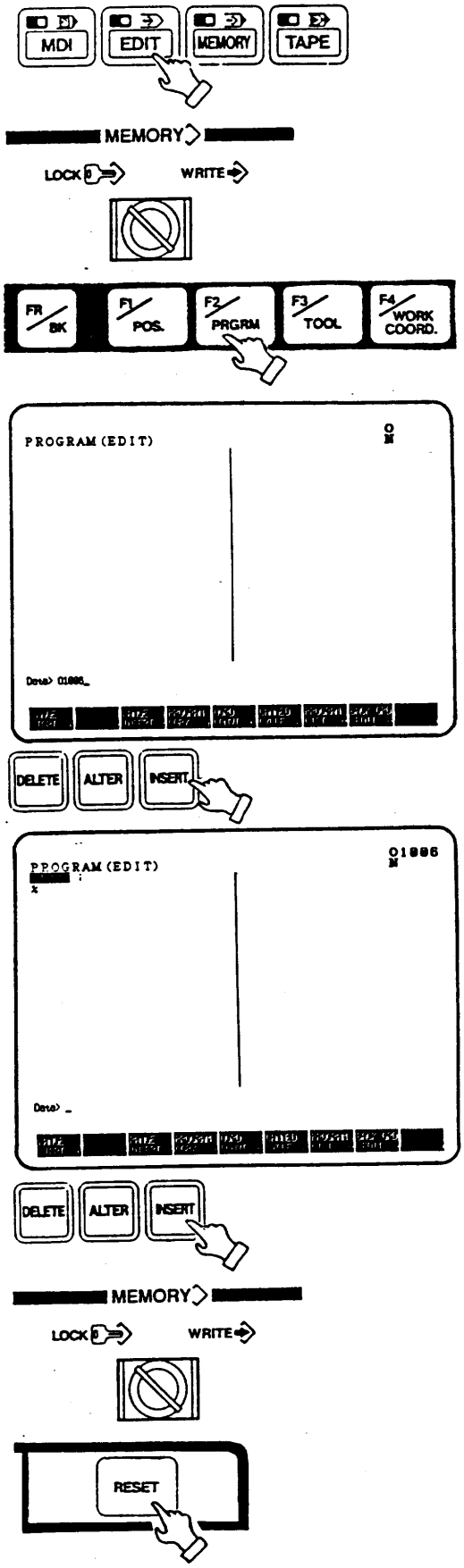
(5) Key in the program contents.
【Addres】, 【Date】, 【CR/LF】
The program keyed in is stored in the buffer of key input once.

(6) The program stored in the buffer of key input transfer to memory by pressing "Insert" key.

(7) In case of input the program more, repeat procedure (5) and (6).

(8) Return the memory key to "Lock".
To protect the program, the memory key should be returned to "Lock" side.

(9) Press the "Reset" button and make heading of the program.



2. Registration from Peripheral Equipment (SEIKI-DON)

(1) Connect the input equipment to RS-232-C terminal and make a transmittable condition.

(2) Set the mode selection to edit mode.

(3) Shift to "Write" for memory key.

(4) Press "F8/in and output" key.
【Data in and output】 screen is displayed.

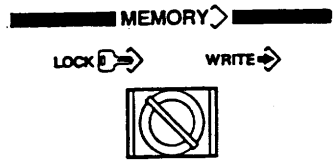
(5) Confirm and set the in and output data.
The data which has mark ● is selected.
In case of data setting, press F6/data setting and move a cursor to the list of in and output contents then move the guide line (Yellow frame) by the cursor ⬆ ⬇ and move the cursor by ➡⬅ and press "Input" key.

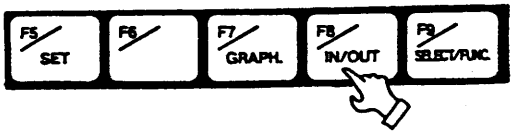
(6) Press "F6/program" list and return the cursor to program number list.

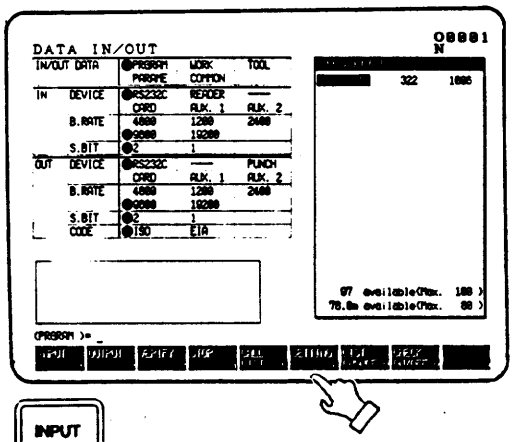
(7) Press "F1/input" key.
Program is read.
Press "F4/interrupt" key if interruption is required.
Alarm is displayed if the same number has been registered.
Delete the program number already registered or designate the new number (Key in the program number) then input.

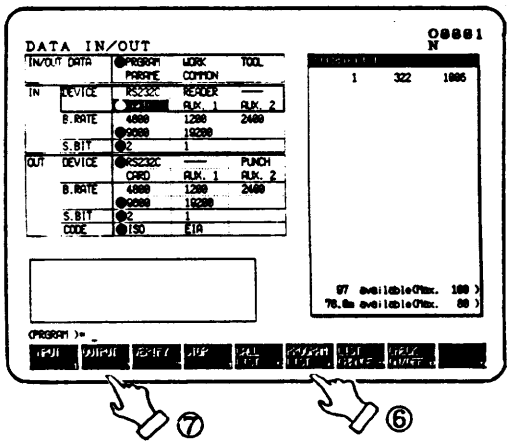
(8) Return the memory key to "Lock" side.

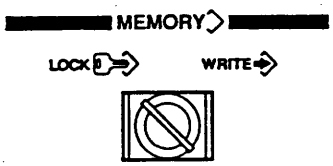
Refer to the instruction manual for SEIKI-DON







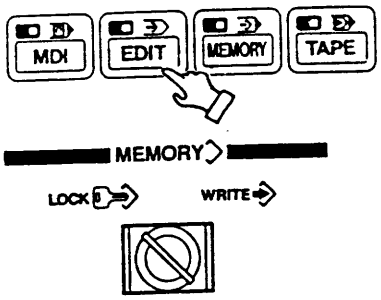




3. Registration from Tape Reader (Option) ** Not available at present. **

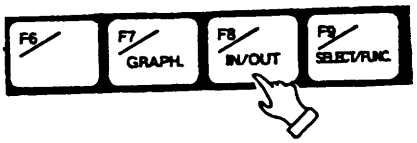
(1) Set the tape on the tape reader.

(2) Set the mode selection to edit mode.

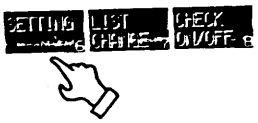


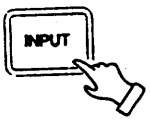
(3) Shift to "Write" for memory key.

(4) Press "F8/in and output" key.
【Data in and output】 screen is displayed.



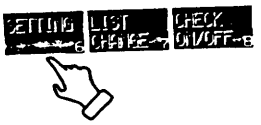
(5) Confirm and set the in and output data.
The data which has mark ● is selected.
In case of data setting, press F6/data setting and move a cursor to the list of in and output contents then move the guide line (Yellow frame) by the cursor ⬆⬇ and move the cursor by ➡⬅ and press "Input" key.

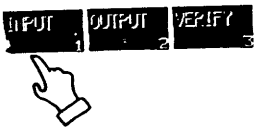




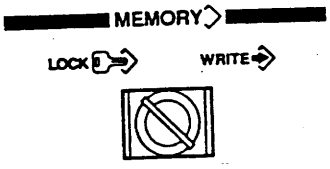
(6) Press "F6/program" list and return the cursor to program number list.

(7) Press "F1/input" key.
Program is read.
Press "F4/interrupt" key if interruption is required.
Alarm is displayed if the same number has been registered.
Delete the program number already registered or designate the new number (Key in the program number) then input.





(8) Return the memory key to "Lock" side.



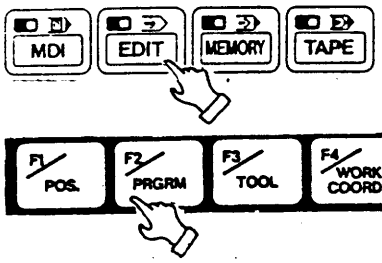
7. Program No. Search and Deletion of Program

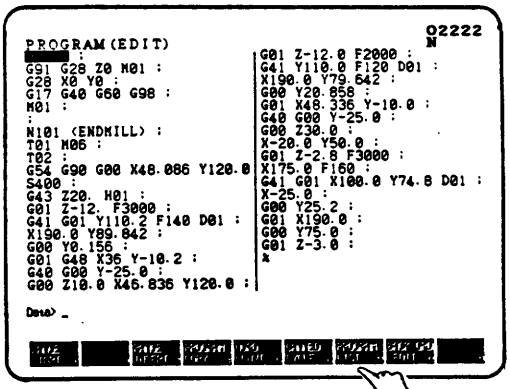
1. Program Call

A) Procedure through program list

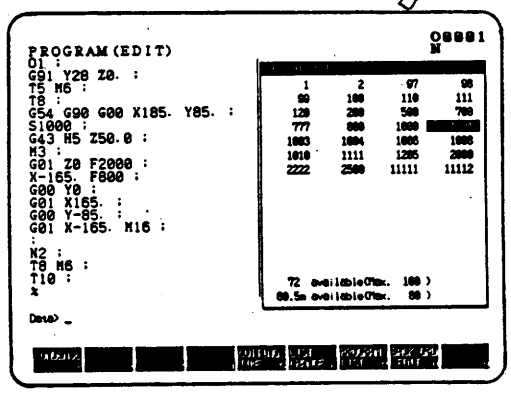
1) Set the mode selection to memory or edit mode.

2) Press "F2/program " key of function key and display the program screen then press "F7/program list" key.

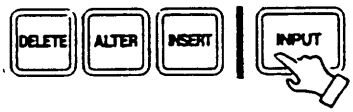




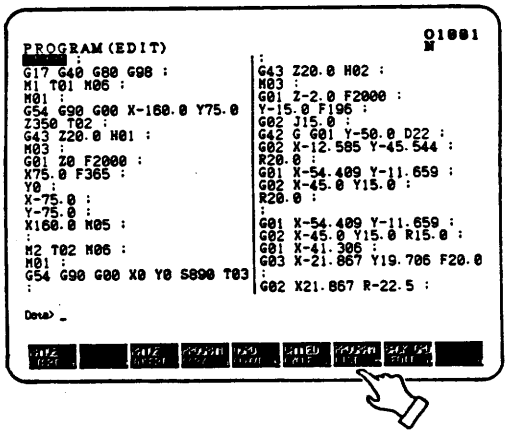
3) Set the cursor to the number wanted to search.



4) Press "Input" key.
The program pointed by the cursor is searched.



5) Return the screen to origin by pressing "F7/program list" key.



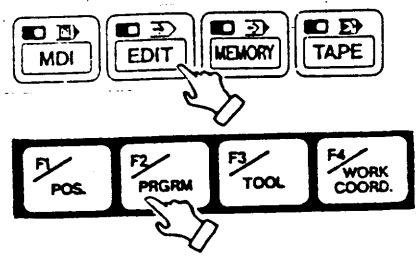
Note : O number search can be done by program screen. (Refer to the next page)

B) Procedure through program screen

1) Set the mode selection is memory or edit mode.

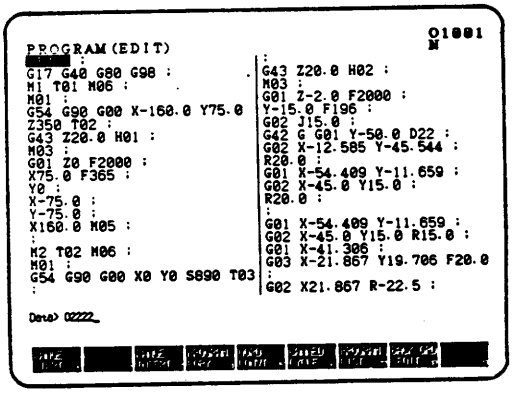
2) Press "F2/program " key of function key and dispkay the program screen.

【Overall (Editing)】screen as well.



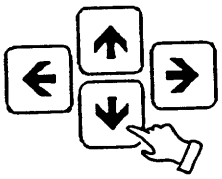
3) Input the program number wanted to search by key.

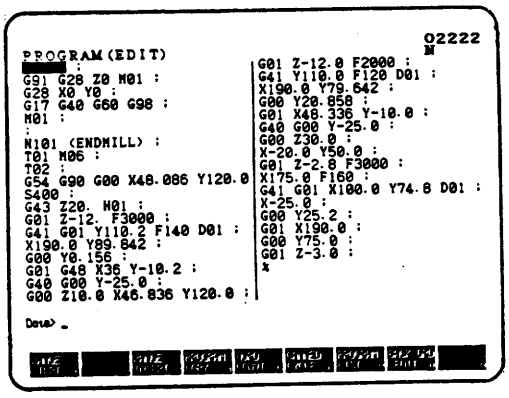
O * * * *



4) Press any one of cursor key

↓、↑、←、→ .





2. Deletion of Program

A) Procedure through program list

1) Set the mode selection to edit mode.

2) Shift to "Write" for memory key.

3) Press "F2/program" key of function key then "F7/program list" key.

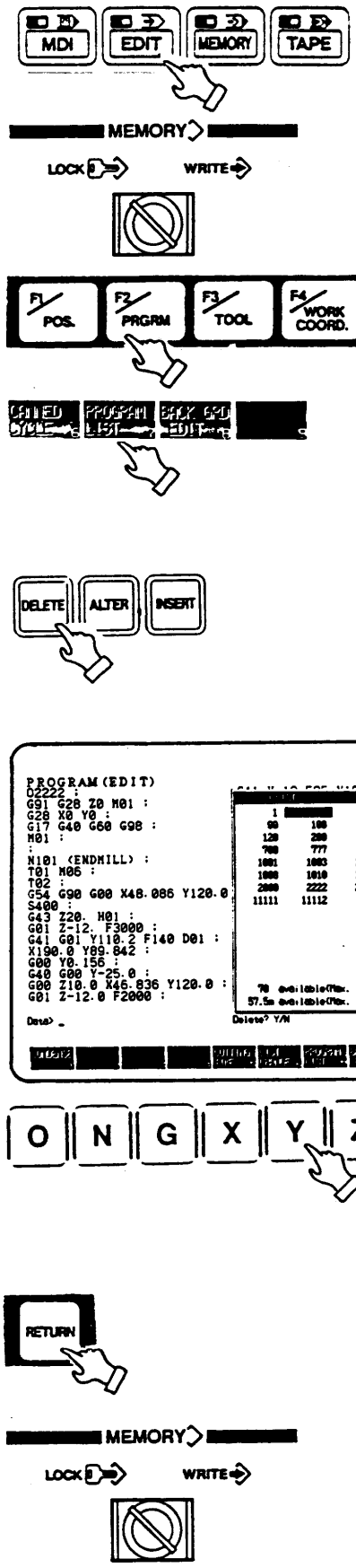
4) Set the cursor to the program number wanted to delete.

5) Press "Delete" key.
"May I delete it? Yes. No." is displated on the screen.

6) Press "Y" key.
The program number located the cursor is deleted.

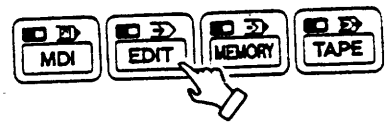
7) Return the screen to oigin pressing "Return" key.

8) Set the memory key to lock.

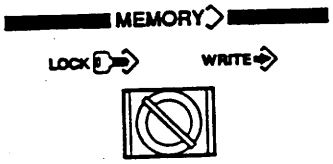


B) Procedure through program screen

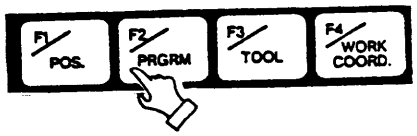
1) Set the mode selection to edit mode.



2) Shift to "Write" for memory key.



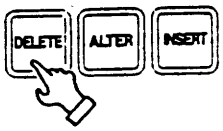
3) Press "F2/program" key of function key and display the program screen.
【Overall (Editing)】screen as well.

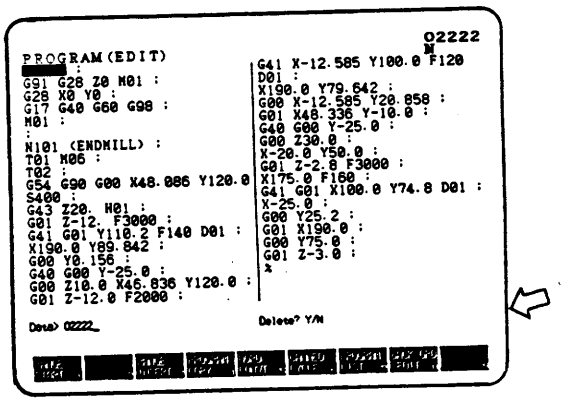


4) Input the program number wanted to delete by key.

O * * * *

5) Press "Delete" key.
"May I delete it? Yes. No." is displayed on the screen.

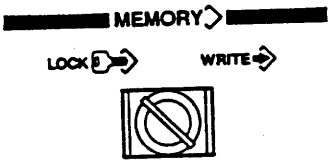




6) Press "Y" key.

O * * * * is deleted.

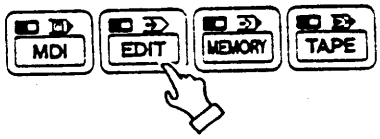
7) Set the memory key to lock.



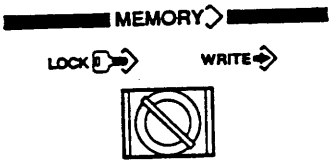
8. Editing of Program

1. Editing Method of Program

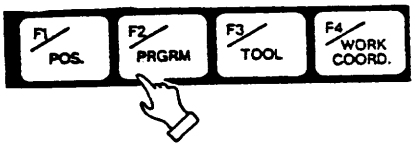
1) Set the mode selection to edit mode.



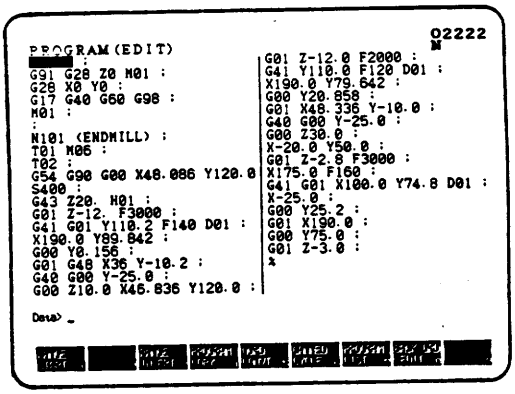
2) Shift to "Write" for memory key.



3) Press "F2/program" key and make the program screen.
Editing can be done through "Overall (Editing)" screen as well.



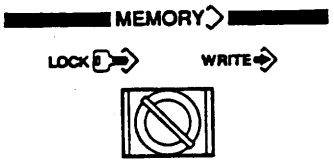
4) Call the program to be edited.



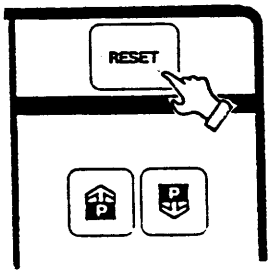
5) Search the word to be edited.
Refer to "2. Word Search" for procedure of word search.

6) Edit the program.
Refer to "4. Edit of Word", "Block editing".

7) Return the memory key to lock.



8) Press "Reset" button and return to the program head.
(To this is given the term of "Heading of program".



2. Word Search

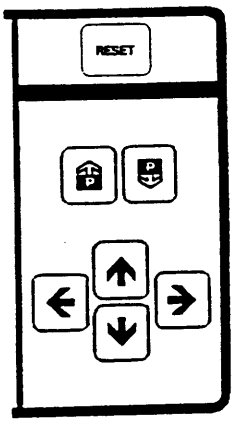
A) Procedure by page and cursor key.

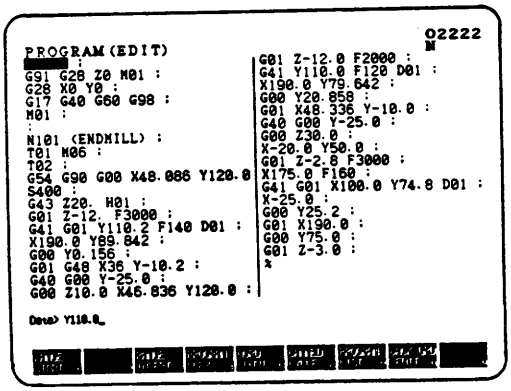
1) Press page key and display the page to be edited.

2) Press cursor key and move the cursor to the word to be edited.

The cursor moves in block unit by ↑ ↓ key.

The cursor moves in word unit by ← → key.





B) Procedure by word or address search.

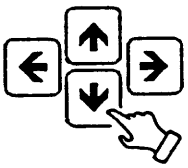
1) Input the word or address by key.

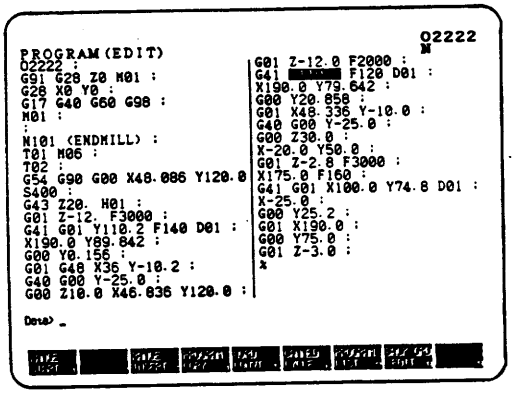
2) • In case of the part to be edited locates behind the current cursor position. (1) Press ↓ key.

• In case of the part to be edited locates front of the current cursor position. (1) Press ↑ key.

Reverse search cannot done for the word within the same block.

Search the inputted address or word in normal direction (↓) or reverse direction (↑) from the current cursor position and the cursor moves to the searched address or word after completion of search.





3. Sequence Number Search

1) Sequence number search can be done either memory or edit mode.

2) Method of search depend on "2. Word search B) Word, address search" in previous page.

. Input a sequence No. to be searched.
N****

. Search a word in back of the current position by cursor key "↓".

. Search a word in front of the current position by cursor key "↑".

At the time of the program edition interruption of halfway of machining. this can be used for sequence No. search even if return the cursor to the head of program by pressing reset button or the following procedure, since the sequence No. has read still remains on the screen.

• When want to return the cursor to the head of the program, press "Shift and "↑ P" at the same time, the cursor moves the head of the program.

4. Alteration (Replacement)

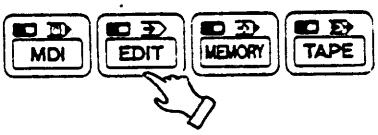
Alteration is available the followings :

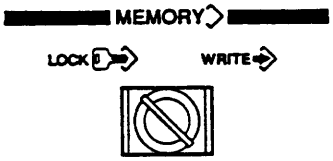
. Alteration from one word to one word.

. Alteration from one word to plural words.

. Alteration from one word to plural blocks.

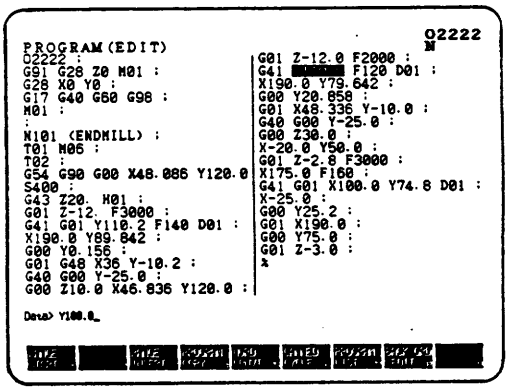
1) Make an available condition of the editing of program.
(Editing mode, Memory key "Write", completion of program search.)



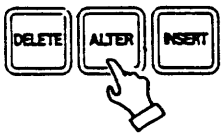


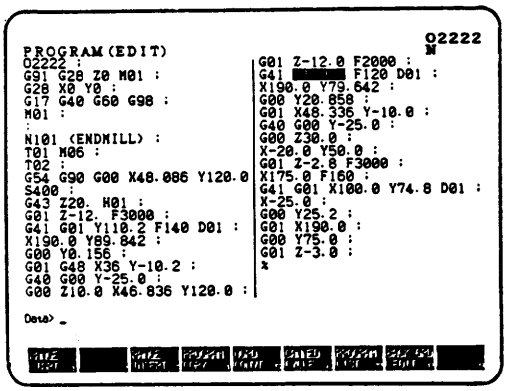
2) Move the cursor to the position to be edited.

3) (1) Key in one word for alteration from one word to one word.
(2) Key in plural words for alteration from one word to plural words.
(3) Key in plural blocks for alteration from one word to plural blocks.



4) Press "Alteration" key.
The word indicated by the cursor replaces to the letters keyed in.





* One character can be altered or erased by moving the cursor one by one as "Shift" ➡ , "Shift" ⬅ .

5. Insertion

Insertion is available the followings :

. Insertion of one word.

. Insertion of plural words.

. Insertion of plural blocks.

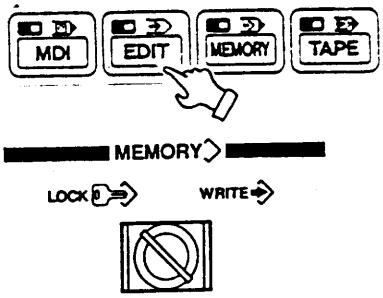
1) Make an available condition of the editing of program.
(Editing mode, Memory key "Write", completion of program search.)

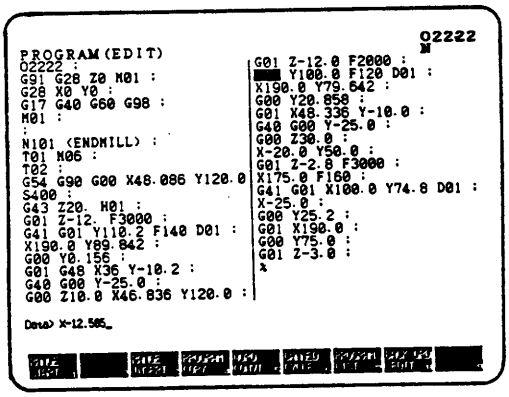
2) Move the cursor to the position to be edited.

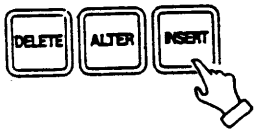
3) (1) Key in one word for insertion of one word.
(2) Key in plural words for insertion of plural words.
(3) Key in plural blocks for insertion of plural blocks.

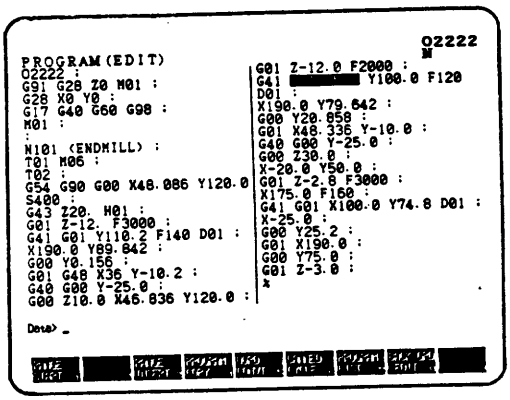
4) Press "Insertion" key.
The letters keyed in inserts the next of the word indicated by the cursor.

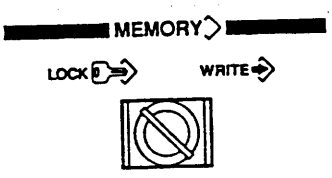
5) Set the memory key to lock.











6. Deletion

Deletion is available the followings :

. Deletion of one word.

. Deletion from the word indicated by the cursor to the end of block code of the same block.

. Deletion from the word indicated by the cursor to before the designated sequence number.

1) Make an available condition of the editing of program.
(Editing mode, Memory key "Write", completion of program search.)

2) Move the cursor to the position to be deleted.

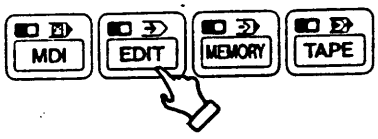
3) (1) In case of deletion for one word only, press "Delete" key.

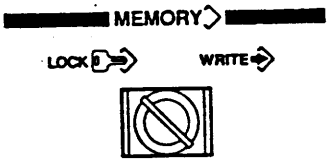
(2) In case of deletion from the word indicated by the cursor to the end of block code of the same block.
Key in ";" and press "Delete" key.

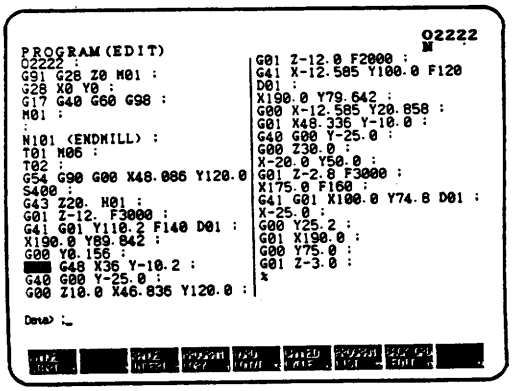
(3) In case of deletion from the word indicated by the cursor to before the designated sequence number.
Key in the sequence number and press "Delete" key.

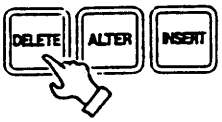
4) Set memory key to lock.

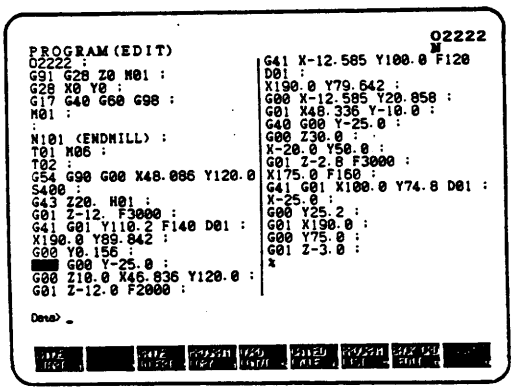
* One character can be altered or erased by moving the cursor one by one as "Shift" ➡ , "Shift" ⬅ .

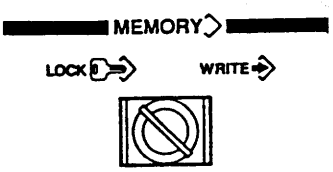












7. Background Editing (Available Only by Program Screen)

Normally, a program can not be watched and edited at any time during execution of it, and also other than an executing program can not be watched or edited at any time. Even like this case, a program other than a current executing one to be able to edit is so called as "background editing". An editing procedure of background editing is no different with normal editing.

Note) No editing is able on a executing program. Also, a program which is executing a background editing can not be executed.

(1) Start of background editing

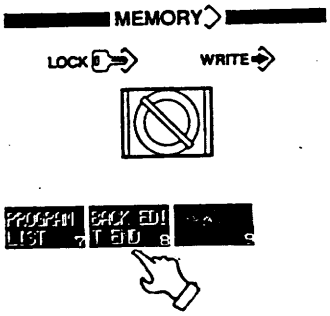
① Set the memory key to "Write".

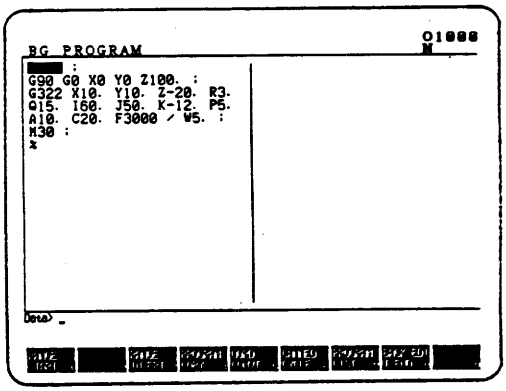
② Press "F8/background editing" key.
The screen title changes to the bachground edit program.
In such a condition, searching the program, moving the cursor or turning over the page does not affect the execution of program.

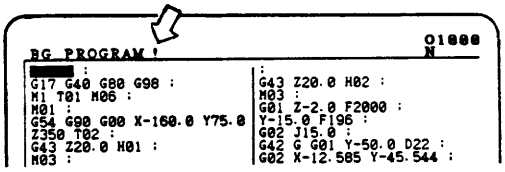
③ About concrete editing procedure of program (Insertion, Alteration or Deletion), refer to each items.
By the operation of editing, the title of screen becomes "Background editing program!" and becomes exclusive program for background editing which is not excutable of the NC.
If is displayed the number with an exclamation mark in the display of the program number list.

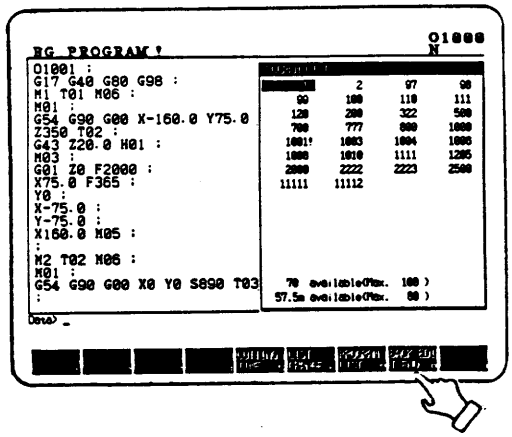
- If is released by searching the other program or finishing the background editing.

(2) End of background editing
Press "F8/background editing end" key.
The title of screen becomes "Program" and normal program display.









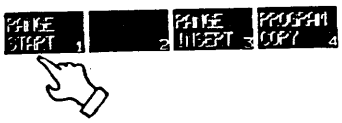
8. Expanded Editing (Option)

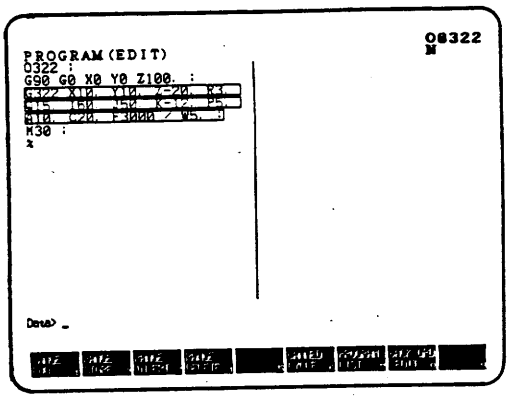
There are editing procedure of range designation, word altertion and fixed cycle editing in the expanded editing.

(1) Editing procedure of range designation.
(Available only by the program screen)

1) Make an available condition of the editing of program.
(Editing mode, Memory key "Write", completion of program search.)

o Designation of range
Press function key "F1/range".
A cursor becomes a frame.
If move this, the cursor has been changed to the frame increase. That is a range.

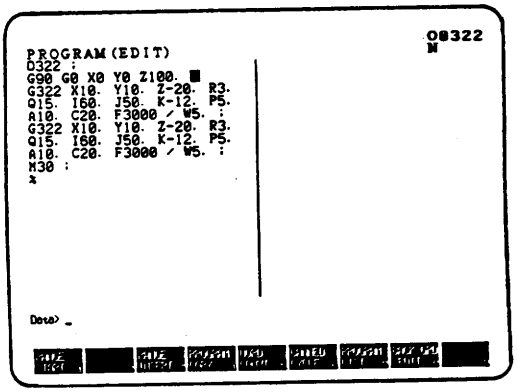




o Release of designation of range
Press function key "F1/range end".

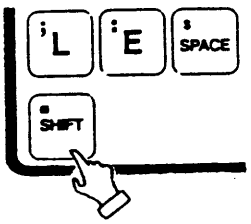
o Storage of range
Press function key "F2/range storage".
The parts of range is memorized.
If the sixe of range beyond 4096 charactors (About 10m of tape) display "Ronge exceed the limit" and is not stored. The range is stored in the memory until power cut off, any time it can be used by range insertion.

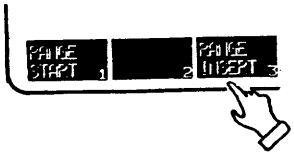
o Insertion of range
Press function key "F3/range insertion".
Stored parts by range storage is inserted after the cursor.



o Deletion of range
Press function key "F4/range deletion".
Range area is deleted.

• As auxiliary function, that data can be restored just after the deletion of range. Press "Shift" and "F3/range insertion". Take note of the position, the range inserts just after the cursor strictly.





(2) Alteration of word (available only by the program screen)

Search the designated word to be altered in the program and rewrite the other word.

There are two method to alter the word it is search and confirm one by one package (Or displaying the altering condition continuously).

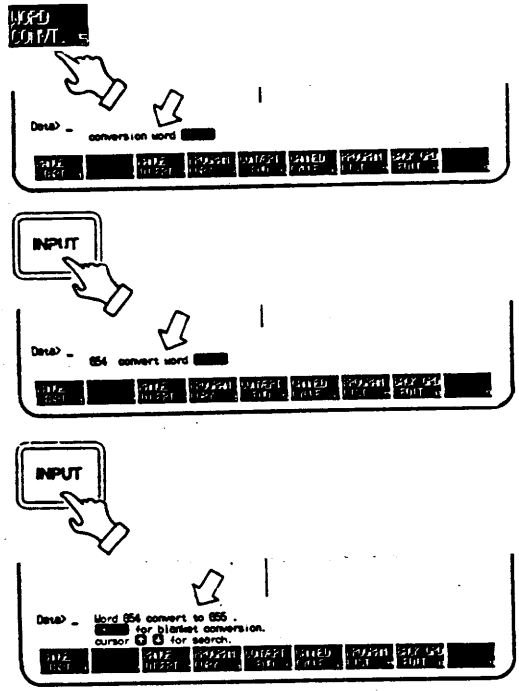
- The word to alter continuously is maximum 400000.

1) Make an available condition of the editing of program.
(Editing mode, Memory key "Write", completion of program search.)

2) Press function key "F5/word alteration".
The message "Input the word want to be altered" is displayed.

3) Input the word want to be altered and press "Input" key.
The message "Input the word to be altered with △△△ ." is displayed.

4) Input the word replace with and press "Input" key.
The following messages are displated.
"Alter the word △△△ to □□□ ."
"Package alteration by origin".
"Search by the cursor ⬆ ⬇".
A message "Word △△△ will be deleted." is displayed if input the word to be altered is omitted.



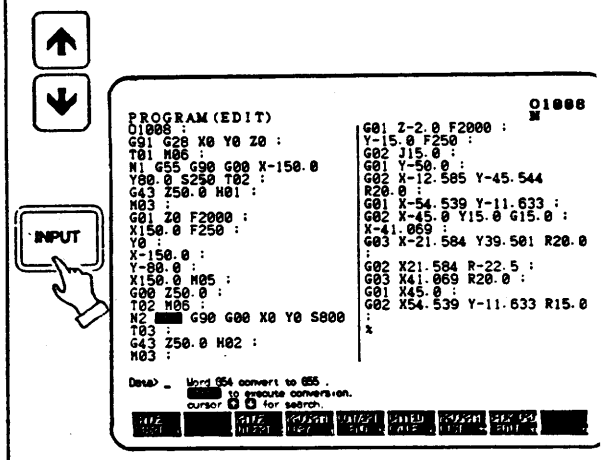
5) (1) In case of search one by one.

ⓐ Designate the searching direction by the cursor ⬆ ⬇.
If found, the following messages are displayed.
"Alter the word △△ to □□ ."
"Alter by input".
"Search by the cursor ⬆ ⬇.

ⓑ Alter by pressing "Input" key.

ⓒ In case of search again, repeat ⓐ and ⓑ.

ⓓ If pressing "Cancel" key, it come to the end.



(2) In case of pakage alteration

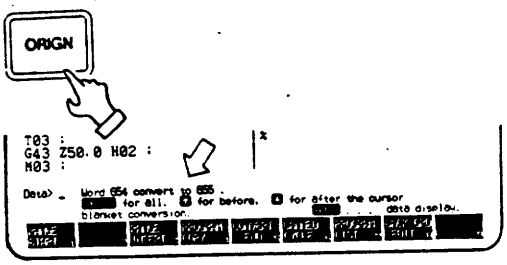
ⓐ Press "Origin" key.

The following messages are displayed.

"Alter the word △△ to □□."

"Package alteration, entirely by origin, front parts of the cursor by ⬆ and behind parts of the cursor by ⬇ ".

"If pressing anxiliary, display too".

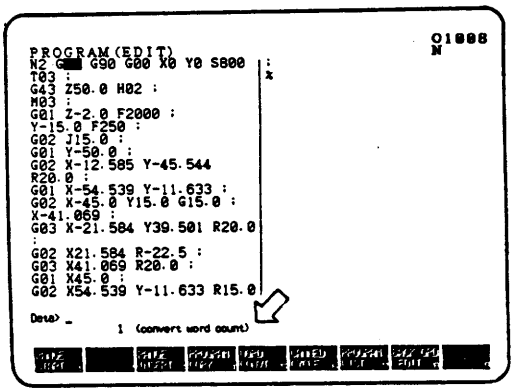


- When pressing "Anxiliary" key, it becomes display during alteration.
  This is effective to confirm the altering condition of the word.
  (Return to origin if pressing "Anxiliary" key again.)

ⓑ Start the packge alteration by pressing "Origin" key or ⬆ ⬇ key.

"Alter the word △△ to □□."

"Interrupt if pressing any key".



ⓒ In case of end of package alteration.

-- " ** word has altered".

o In case of not found.

-------- "Not found".

"0 word has altered"?

o When pressing the key middle of way.

-------- "Interrupt alteration".

"*** word has altered".

(3) Editing of fixed cycle (Available only by the program screen)

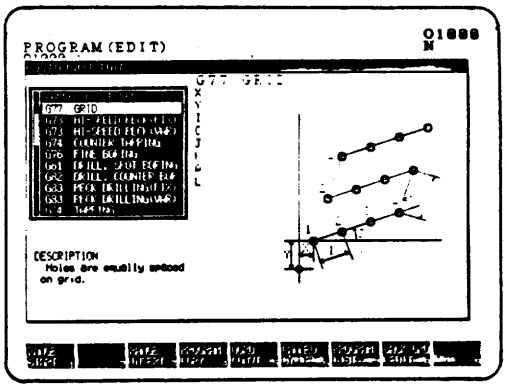
To make easy the command of fixed cycle, explanatory drawing and comment and necessary address is displayed and data can be set.

1) Make an available condition of the editing of program.
Editing mode, Memory key "Write", completion of program search.)

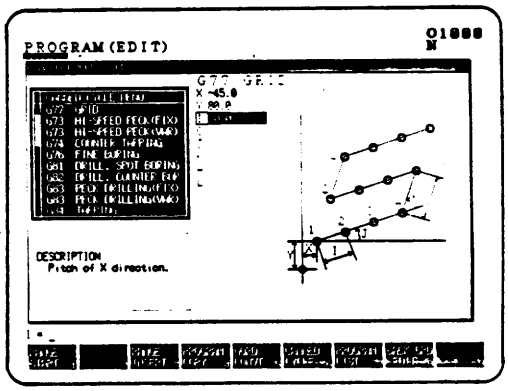
2) Move the cursor to the place of the program to be inserted.

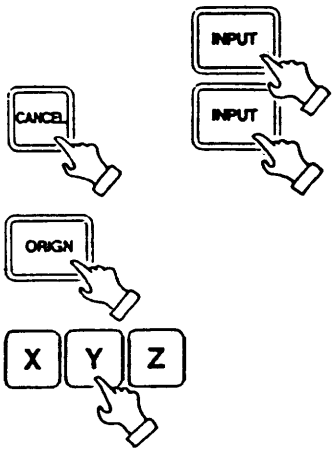
3) Press function key "F6/fixed cycle editing".

4) Select the fixed cycle to be used by the cursor ⬇ or ⬆ .



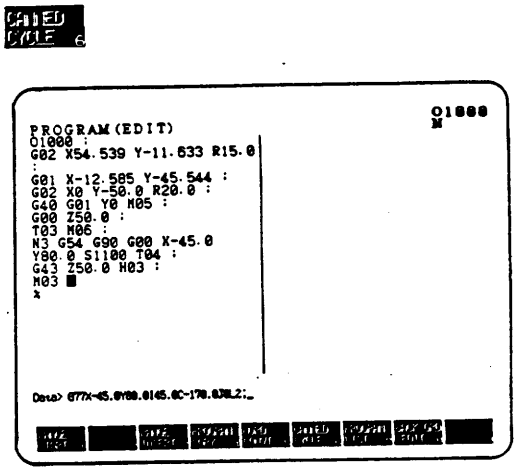
5) Input the data in address.
   ① Move the cursor right side by the cursor ➡ .
   ② Select each address by the cursor ⬇ or ⬆ .
   ③ Key in numerals in key input area and press "Input" key.



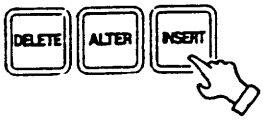


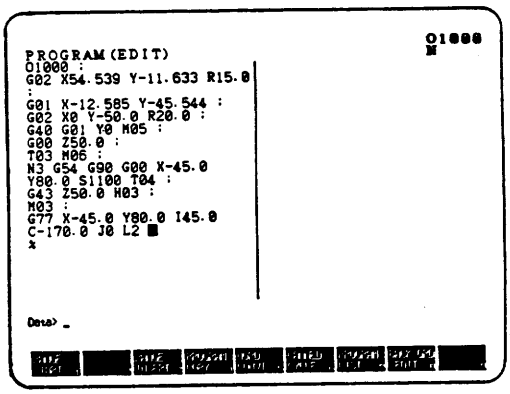
- When deleting the data has just inputted. Press "Cancel" and display "Blank" at key input area then press "Input" key.
- When deleting the whole data, press "Origin" key. The screen asks "May I delete whole (Blank)? Yes or No". Press "Y" key if it is right.

6) Make it to end by pressing "F6/fixed cycle editing " key.
The fixed cycle editing screen is disappeared and the data of the fixed cycle is displayed in the key input area as block style.

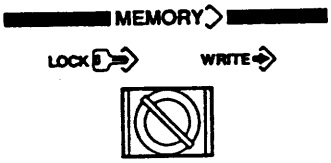


7) Insert into the program after confirmation by pressing "Insert" key.





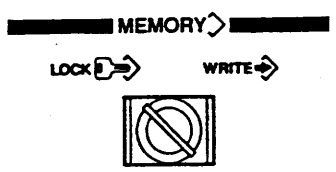
8) Set the memory key to lock.



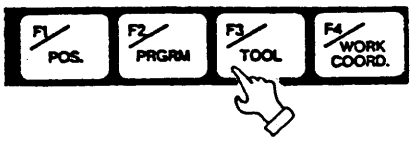
9. Setting of Tool Compensating Amount

1. Display and Setting

1) Set the memory key to "Write".



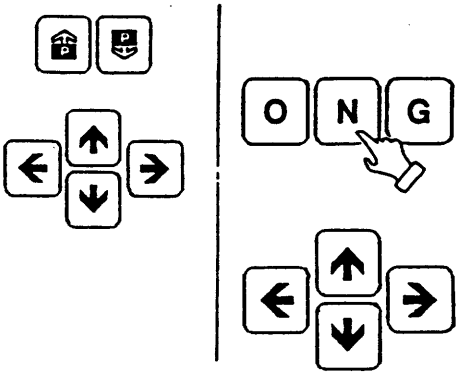
2) Press "F3/tool" key.
Tool (Offset) screen is displayed.



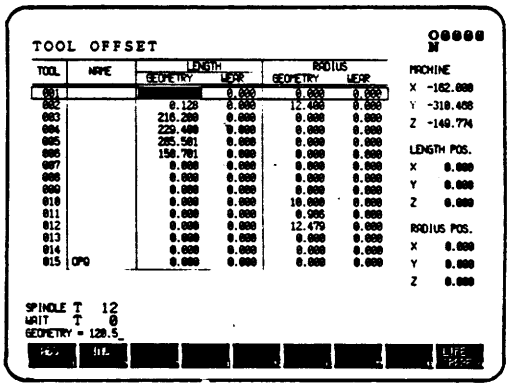
3) Set cursor to tool nimber.

1 Move the cursor to the tool number to be set by page key P↓, P↑ and cursor key ↓, ↑ .

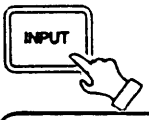
2 Key in "N" and "Tool number" then press any one of cursor key ↑, ↓, →, ← .

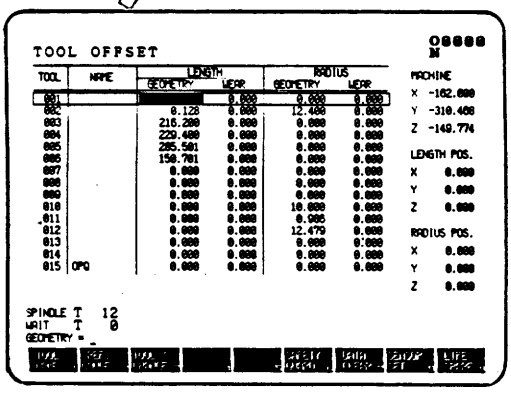


4) Set a compensating amount.
Geometry and wear offset can be set.
Key in compensating amount.
Absolute input:
Key in data is inputted as it is.
Incremental input:
Key in data add to original data is inputted.

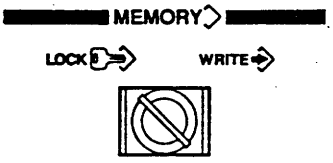


5) Key in data is inputted into a section, indicated by cursor, pressing the "Input" key.



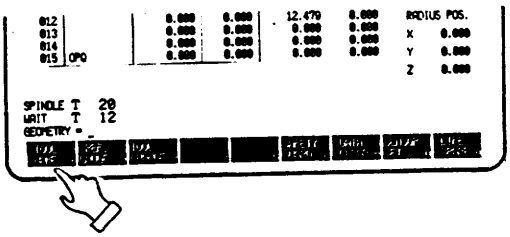


6) Set the memory key to lock.

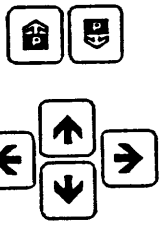


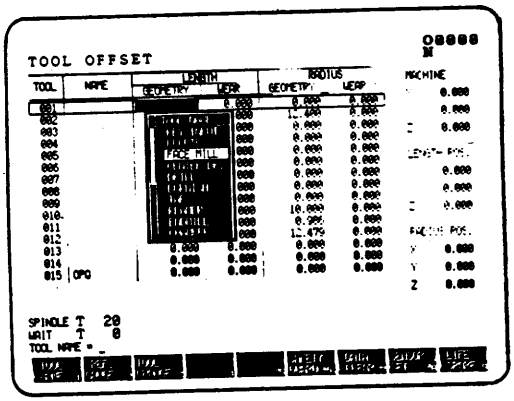
2. Setting of Description

1) Press "F1/tool description" key.



2) Select the position by cursor key ↑, ↓ or page key P↑, P↓ and determine it by pressing "Input" key.
Input can be done from key input area if "Alphabet, numeral input" is selected.
If dimension of tool is required, first determine the tool by cursor then set the description within ten characters by alphabet and numerical data and "Input" key.

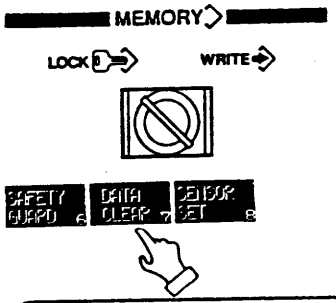




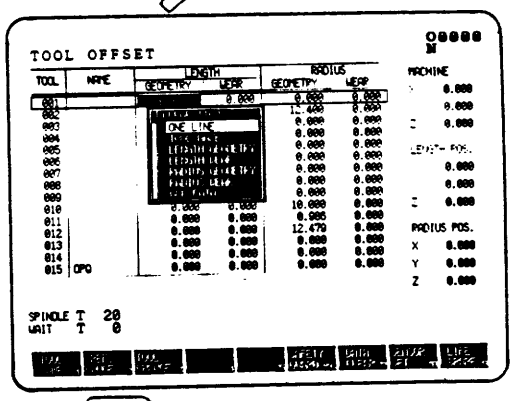
3. Deletion of Data

At the time to begin anew, delete a tool data designated by the cursor in a horizontal line or certain tool data in vertical line of all tools.

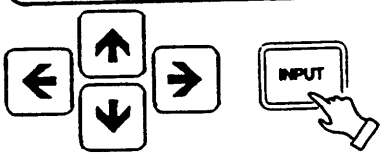
1) Set the memory key to "Write".

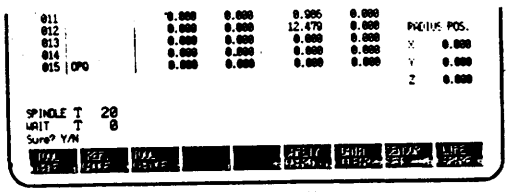


2) Press "F7/data deletion" key.
A window appears in the center of screen and display deletable data.

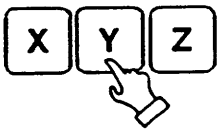


3) Select a data by the cursor ↑, ↓ and press the "Input" key.
The screen asks "Is it all right? Yes, No" if it's all right.

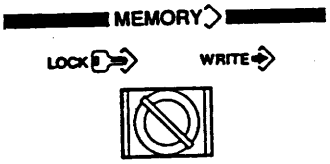




4) Press "Y" key.



5) Set the memory key to lock.



10. Setting of Work Coordinate

1) Set the memory key to "Write".

2) Press "F4/work coordinate" key.
Offset data screen of work coordinate is appeared.

3) Set the cursor to desired work coordinate offset number.
Select work coordinate by the page key $\overset{P}{\downarrow}$, $\overset{\uparrow}{P}$ or cursor key ↑, ↓, ←, →.

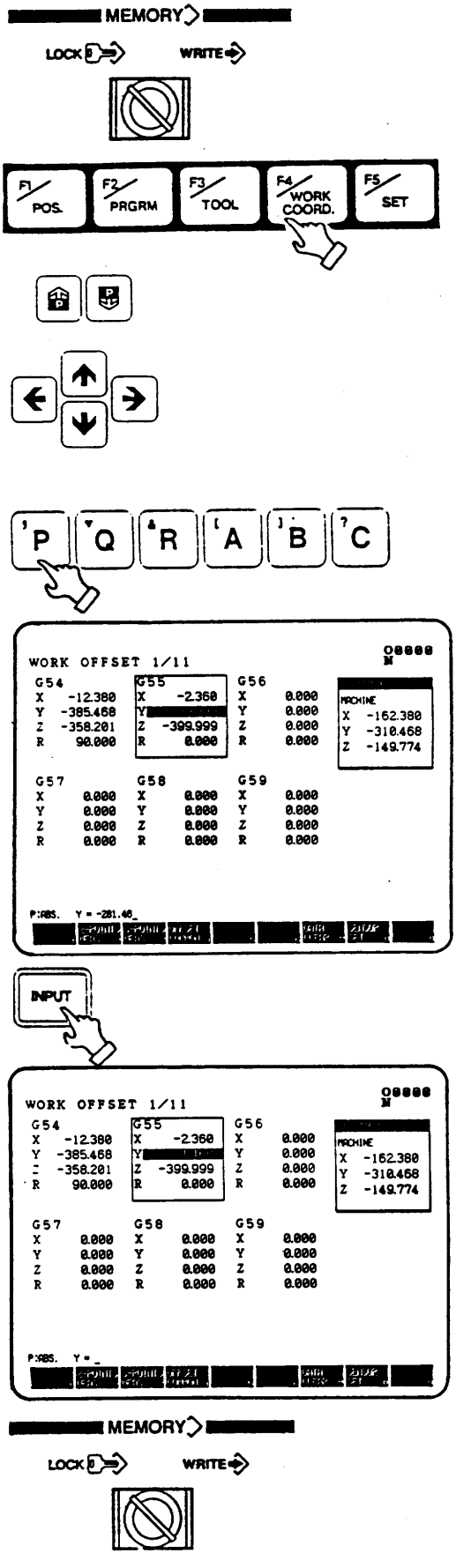
4) First of all, press "P" (Absolute input), "I" (Incremental input) or "J" (Coordinate rolating angle input).

5) Select the axis by the cursor or press the axis name.

6) Press "Numeral" and "Input".

7) Set the memory key to lock.

8) Execute zero return all 3 axes.



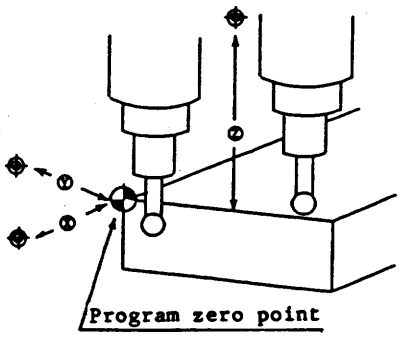
11. Operation of W Setter

Setting of tool offset and work coordinate can be written automatically by tonch sensor with simple manual operation.

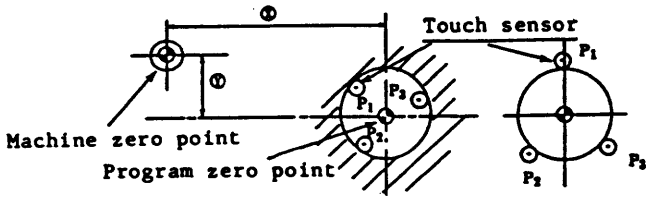
Note: Workpiece should be conductive material if the NIKKEN made touch sensor (HITACHI SEIKI specification) is used.
Align the datum by the fixture if workpiece is not conductive material.

- Work setter (Setting of offset value for work coordinate system)
  Datum surface,
  Datum bore,
  Coordinate correction
- Tool setter (Setting of tool length, tool diameter offset amount)

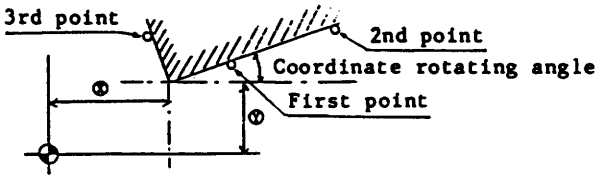
●Work setter



Datum surface

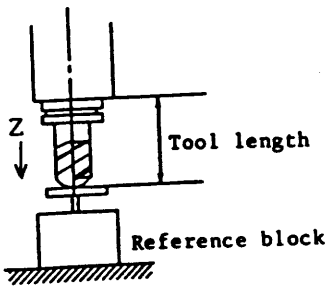


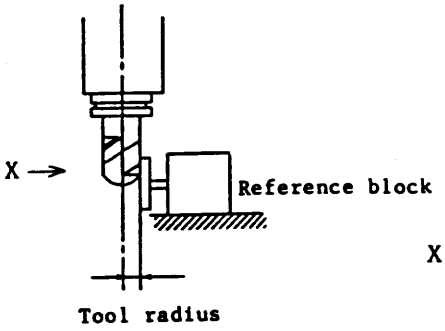
Datum bore

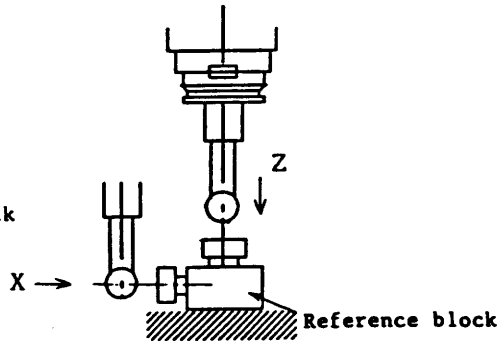


Coordinate correction

●Tool setter







1. Setting Procedure of Datum Surface of Work Setter

1) Set the touch sensor on the spindle.
   Input T20 M06 ; by MDI and execute it.
   (In case of the touch sensor T20)

2) Set to manual mode (Handle, feed or rapid traverse).

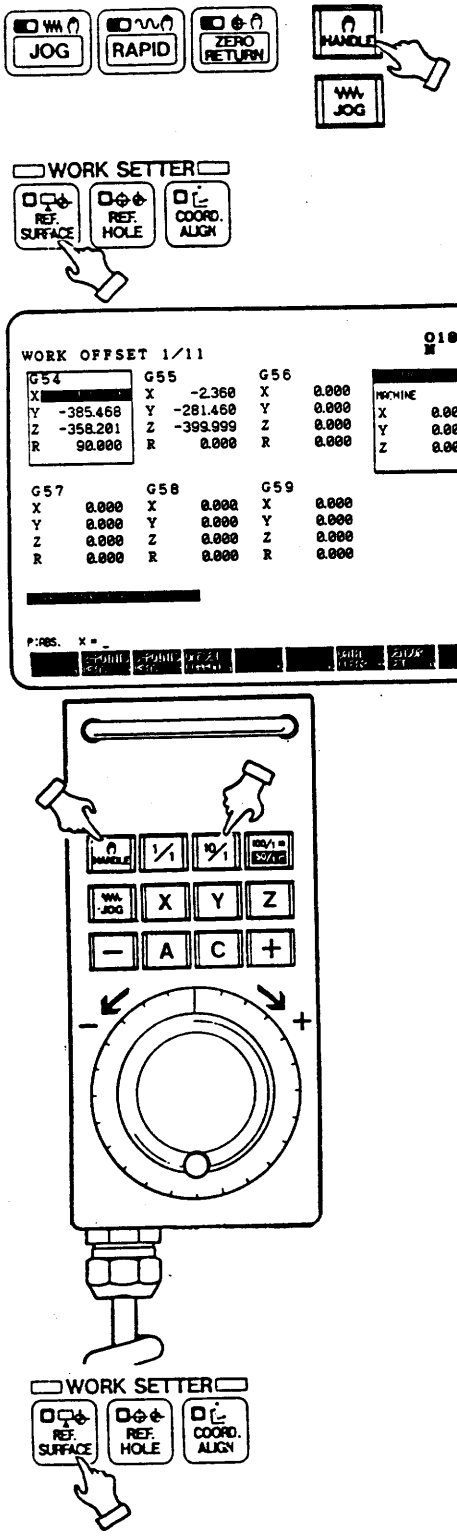
3) Press "Datum surface" key of work setter.
   (Lamp is lit)
   Work coordinate (Offset) screen is selected.

4) Move the cursor to the coordinate system G54 ~ G59 want to be set by cursor key.

5) Touch the touch sensor to the datum surface by handle (10/1) or manual feed (10mm/min). Feed stops automatically (Lamp of touch sensor is lit and sounds beep) and compensating amount of work coordinate is written.
   In the "Datum surface", the coordinate system that the surface with the touch sensor contacts becomes 0 is set.

6) Retract to opposite direction until sound stops.
   Execute each X, Y and Z axes respectively.

7) Press "Datum surface" key.
   (Lamp is turned off.)



2. Setting Procedure of Datum bore of Work Setter

1) Set the touch sensor on the spindle.(For T20)
   Input T20 M06 ; by MDI and execute it.

2) Set to manual mode (Handle, feed or rapid traverse).

3) Press "Datum bore" key of work setter. (Lamp is lit)
   Work coordinate (Offset) screen is selected. A comment "Measure the first point" is displayed.

4) Move the cursor to the coordinate system (G54 ~ G59) want to be set by cursor key.

5) Touch the touch sensor to the datum bore by handle (10/1) or manual feed (10mm/min). A lamp of touch sensor is lit and sound beep and feed stops automatically.
   A comment "Measure the 2nd point" is displayed.

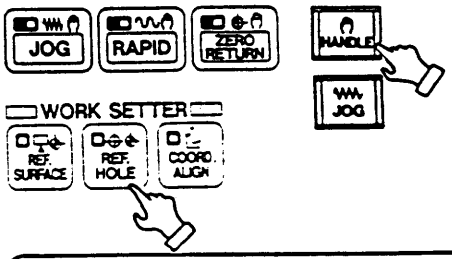
6) Retract the touch sensor to opposite direction.

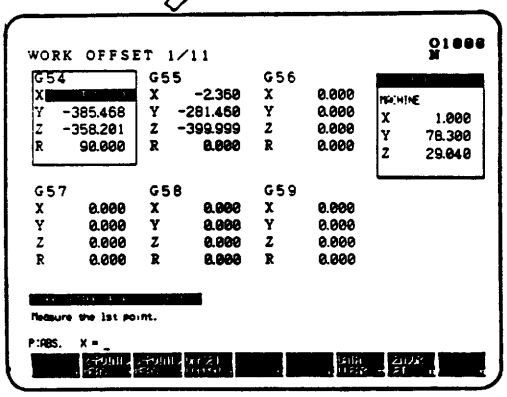
7) Touch the touch sensor to the 2nd point of datum bore. A comment "Measure the 3rd point → center of datum bore. F2 → center of two points" is displayed.

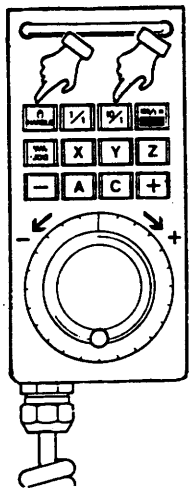
8) Coordinate system is written automatically if the touch sensor touch to the 3rd point of datum bore. Diameter of bore (boss) is displayed and a comment "Measure the first point" is displayed.

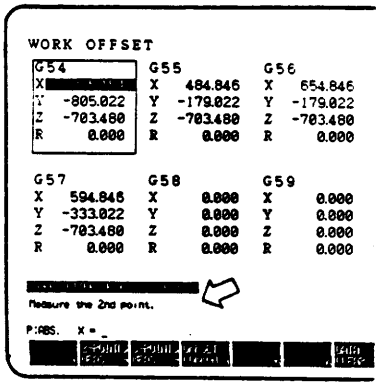
9) Move the touch sensor to opposite direction. On the screen, the setting in the Z-axis direction can be performed as well.

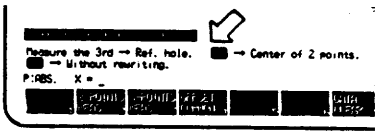
10) Press "Datum bore" key. (Lamp is turned off.)

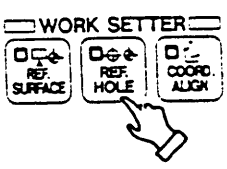










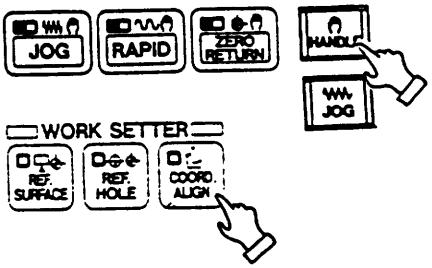


3. Setting Procedure of Coordinate Correction

1) Set the touch sensor on the spindle.(For T20)
   Input T20 M06 ; by MDI and execute it.

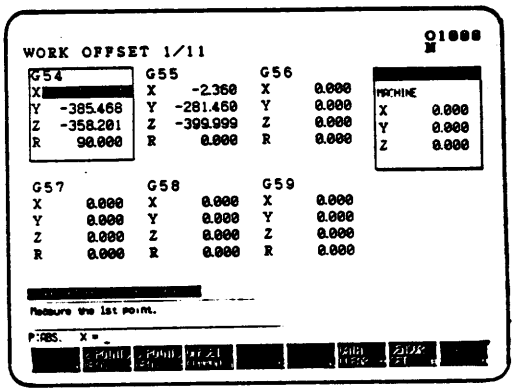
2) Set to manual mode (Handle, feed or rapid traverse).

3) Press "Coordinate correction" key.
   (Lamp is lit)
   Work coordinate (Offset) screen is selected. A comment "Measure the first point" is displayed.



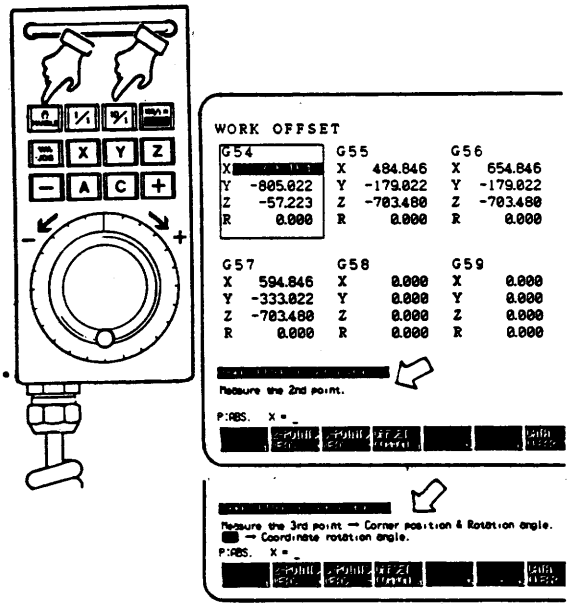
4) Move the cursor to the coordinate system (G54 ~ G59) want to be set by cursor key.

5) Touch the touch sensor to the datum surface by handle (10/1) or manual feed (10mm/min). A lamp of touch sensor is lit and sound beep and feed stops automatically.
   A comment "Measure the 2nd point" is displayed.



6) Retract the touch sensor to opposite direction.

7) Touch the touch sensor to the 2nd point of datum surface. A comment "Measure the 3rd point → corner point and rotating angle. F2 → rotating angle only" is displayed.

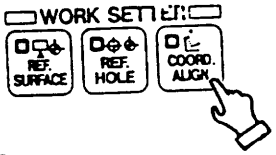


8) Retract the touch sensor to opposite direction.

9) Touch the sensor to the 3rd point on the surface perpendicular to the datum.
   X and Y coordinate of datum point and rotating angle is written.

10) Retract the touch sensor to opposite direction.

11) Press "Coordinate correction" key.
    (Lamp is turned off.)

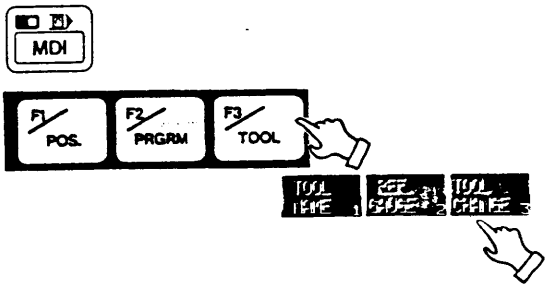


Note) To execute a modification of coordinate, command G68 in a program and make effective a coordinate rotation.

4. Operation of Tool Setter

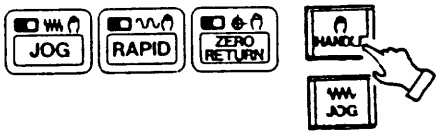
I Position measurement of reference block

1) Set the touch sensor on the spindle.(For T20)
   Press the "F3/tool" and "F3/tool change" keys in the MDI mode to input T20, and press the "Input" key.

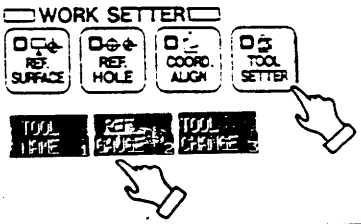


2) Set the reference block on the table.

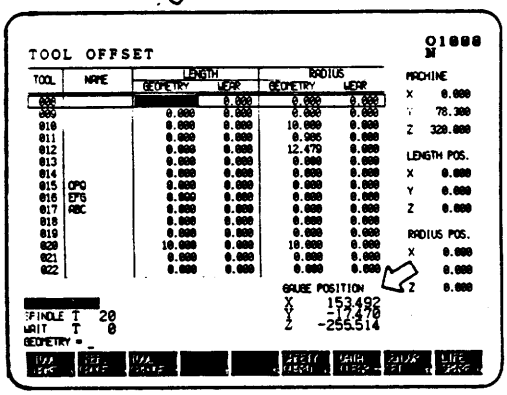
3) Set to manual mode (Handle, feed or rapid traverse).



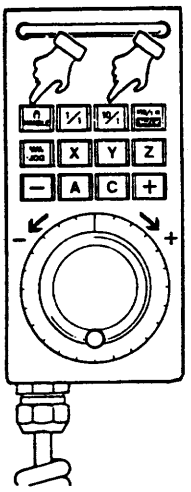
4) Press "Tool setter" key. (Lamp is lit)
   Tool (Offset) screen is selected.



5) Press function key "F2/reference gauge".
   Distance of reference gauge, former data of X, Y and Z is displayed on the bottom right of the screen.

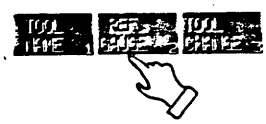


6) Touch the touch sensor to the datum surface by handle (10/1) or manual feed (10mm/min). Feed stops automatically (Lamp of touch sensor is lit and sounds beep) and reference gauge position is set.
   a) Touch to the top surface of the standard gauge by moving Z axis, the position of longitudinal direction is set.
   b) Touch to the side surface of standard gauge by moving X (or Y) axis, the position of diametral direction is set.



7) Move the touch sensor to opposite direction with direction to touch.

8) Press "F2/reference gauge" key.
   Display of distance of reference gauge, data of X, Y and Z on the bottom right of the screen is disappeared.



II Measuring procedure of tool length

1) Set the reference gauge position (Z axis direction) refer to former item.

2) Mount a measuring tool in the spindle.(For T10)
Press the "F3/tool" and "F3/tool change" keys in the MDI mode to input T10, and press the "Input" key.

3) Set to manual mode (Handle, feed or rapid traverse).

4) Press "Tool setter" key.
(Lamp is lit)
【Tool setter】 is displayed.

5) Move the cursor to the number to be set.

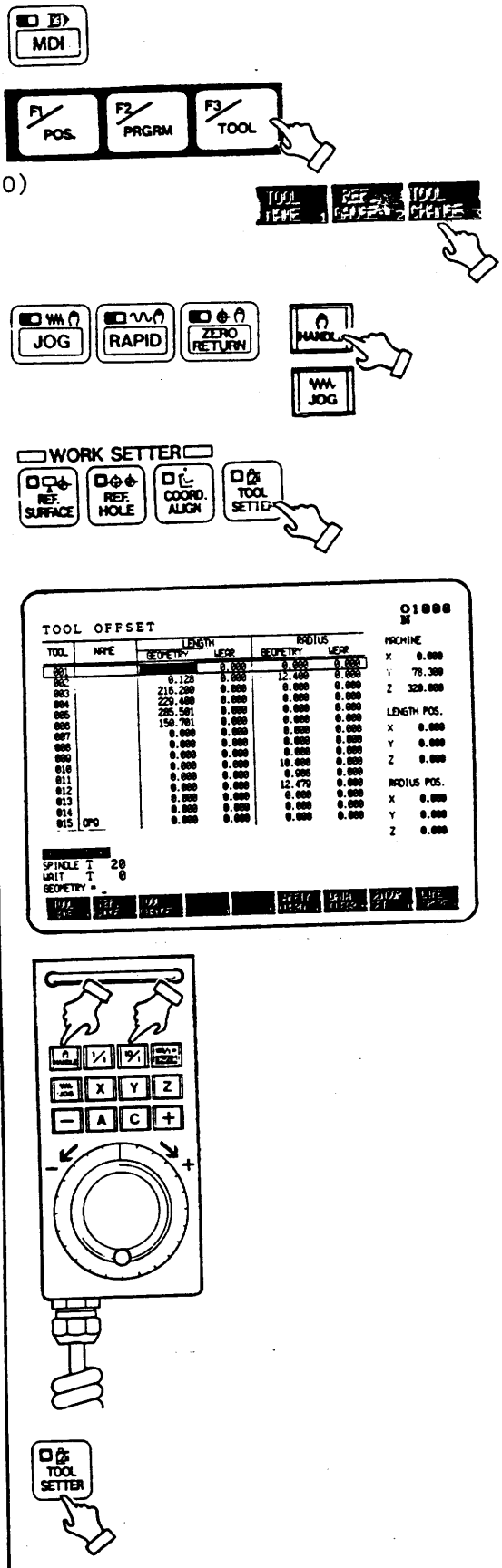
6) Move the Z axis minus direction by handle (10/1) or manual feed (10mm/min) and touch the tool to the reference gauge. Feed stops automacically (Sound beep) and tool compensating amount is written.

(Note) While moving the X-axis (or Y-axis), if it contacts, the tool diameter data are written.

7) Move the Z axis to plus direction and release the tool.

8) Change the tool and repeat 3 ~ 7.

9) Press "Tool setter" key.
(Lamp is turned off.)
【Tool setter】 screen is disappeared.



III Measuring procedure of tool radius

1) Set the reference gauge position (X or Y axis direction) refer to former item.

2) Mount a measuring tool in the spindle.(For T10)
Press the "F3/tool" and "F3/tool change" keys in the MDI mode to input T10, and press the "Input" key.
Return to [Overall] screen or [Program] screen after tool change, release a spindle positioning by designating a number of rotation as "S1000" by MDI.

3) Set the manual mode (Handle, feed or rapid traverse).

4) Press "Tool setter" key. (Lamp is lit)
[Tool setter] is displayed.

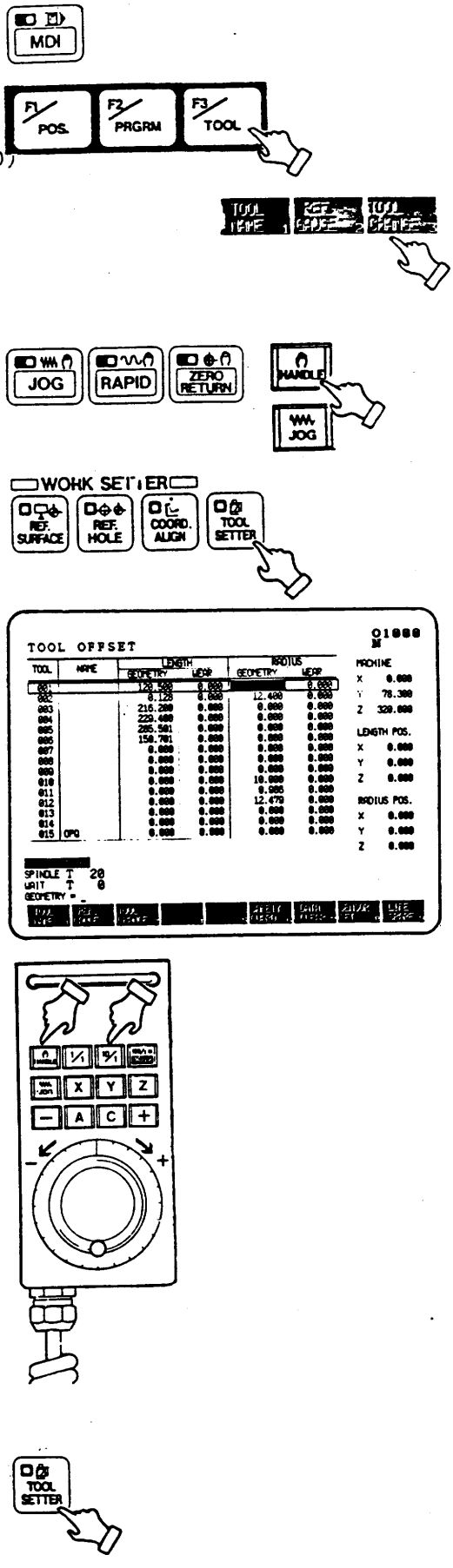
5) Move the cursor to the number to be set.

6) Move the X or Y axis by handle (10/1) or manual feed (10mm/min) and touch the tool to the side surface of the reference gauge.
Feed stop automatically (Sound beep) and tool compensating amount is written.
(Note) While moving the Z-axis, if it contacts, the tool length data are written.

7) Retract the tool opposite direction more than 3mm and turn the spindle a little by hand and repeat measurement several times. The miximum value is rewritten.

8) Move the Z axis plus direction and release the tool.

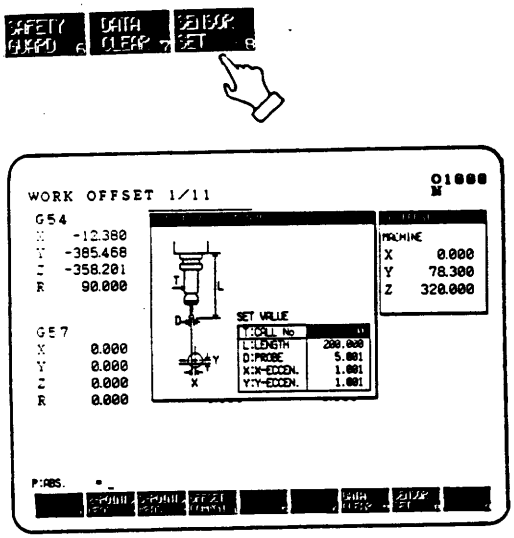
9) Press "Tool setter" key.
(Lamp is turned off.)
[Tool setter] screen is disappeared.



5. Reference

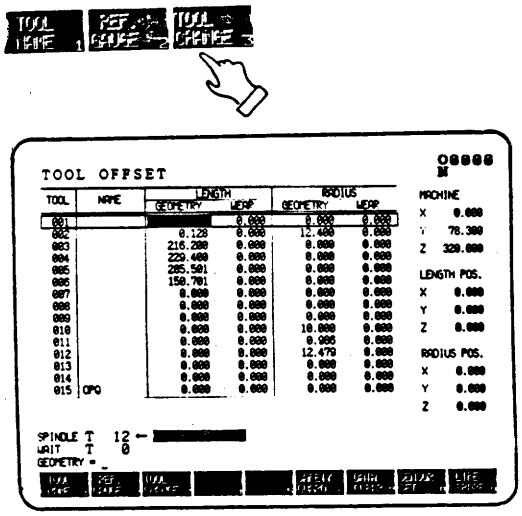
I Setting of sensor

1) Press "F8/sensor setting".
   A window appears center of screen and sensor setting for work setter is available.
   In case of [T : sensor call] , execute the same procedure as tool change.



II Tool change

1) Press "F3/tool change".
   Key in the tool nimber to be changed at MDI mode and execute the same procedure as MDI operation by "Input" key.



III Precautions when measuring in the handle operation

In case of measuring by the handle operations, since may happen to disable the axis to retreat (The axis becomes unmovable.) after touching, when bringing the sensor into contact with the workpiece in the following manners, care should be taken.

1) To bring the sensor into contact with the workpiece while turning the handle intermittently by a few inches.

2) To bring the sensor into contact with the workpiece while bringing the sensor into close distance or keeping it away from the workpiece (To turn the handle in the + and - directions in turns.).

3) To bring the sensor into contact with the workpiece in extremely slow speed.

When such a phenomenon presents, retreat the axis after pressing the reset button, and proceed the measurement again.

12. Safety Guard

This is the function to prevent the interference between the tool tip and material previously by the command G43 Z___ H__; (Z axis approach at positioning) at automatic operation for machining.

There are two functions, tool length and collation, as shown on the operation panel.

Tool length : Measure and memorize the tool length of the tool to be used by an actual machining program.

Collation : Execute an actual machining program in automatic mode as moving X and Y axes and machine lock for Z axis, and measure the workpiece shape (Z axis direction) and check on interference by any Z axis positioning block.

1. Procedure for Tool Length.

Measure and memorize the tool length of the tool to be used in automatic mode by an actual machining program.

1) Press "Editing" key.

2) Press function key "F2/program".

3) Search the machining program.
Check the block G43 Z__ H_ ; and T_; T_ M6; for ATC carefully.

4) Press "Reset" key and return the program to head (It calls "Heading").

5) Set the touch sensor to the spindle.

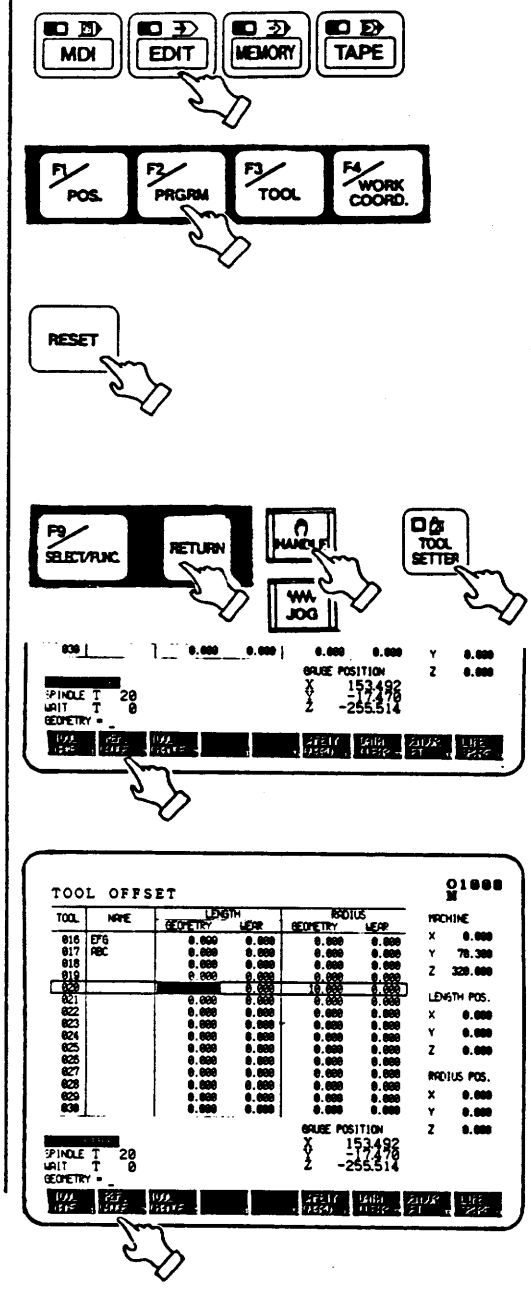
6) Set the reference block on the table.

7) Press "Return" key then press tool setter key by maual mode.
【Tool (Offset)】screen is displayed.

8) Press function key "F2/reference" gauge.

9) Touch the sensor to the top of the reference block and retract by the Z-axis moving (Feedrate 10mm/min or handle 10/1).
Reference point of Z axis and starting position of measurement (X and Y direction) is memorized.

10) Press "F2/reference gauge" key. Position display of the reference gauge on the screen is disappeared.



11) Return to zero point all three axes.

12) Press "Memory" and "F3/tool" key then press function key "F6/safety guard". A window of safety guard appears center of 【Tool (Offset)】 screen.

13) Press "Program start" button.
Execute T code, M6 and H code and ignore other command of the machining program,

① The first tool is mounted on the spindle by ATC motion.

② Move to the starting position of measurement (X and Y axes) by rapid traverse and stop then next tool is called to standby position.

14) Execute measurement.

① Approach the tool to the reference block by handle. (Feed for X and Y axes is available in automatic mode). Rapid traverse is not available. Alarm is issued if change to manual mode.

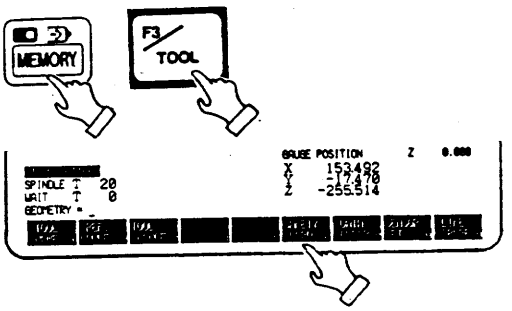
② Touch to the reference block by feed (10mm/min). (Handle 10/1 also available). Tool compensating amount for H code is written automatically.

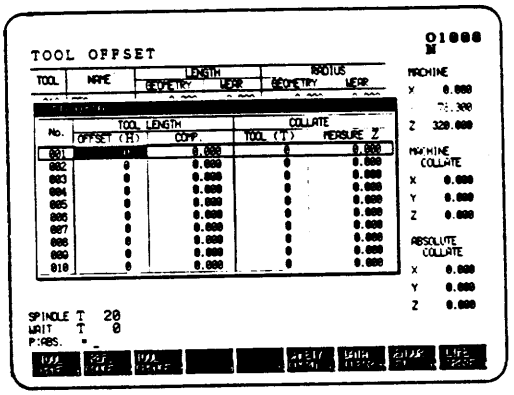
③ Release the tool a little from the reference block by handle.

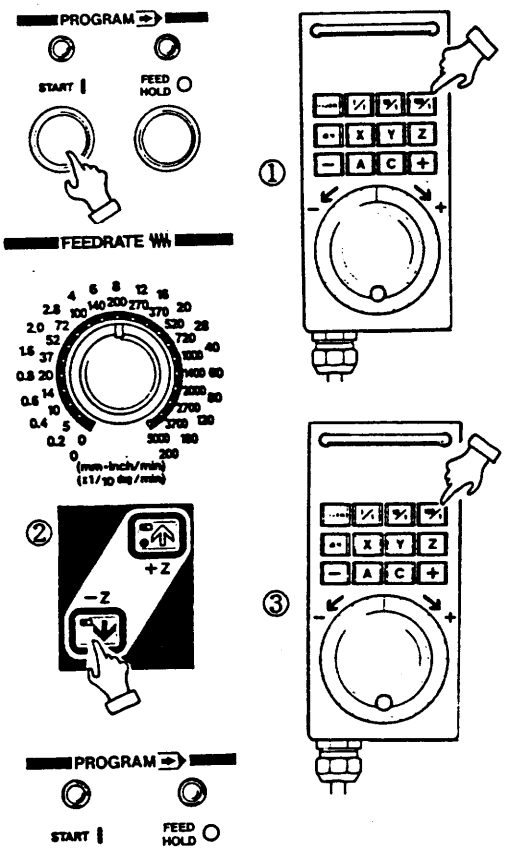
15) Press "Program start" button.
Z axis moves to ATC position by rapid traverse and execute ATC and mount the next tool on the spindle then move to starting position of measurement and stop.

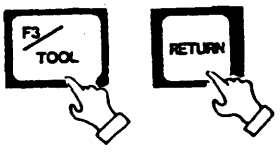
16) Execute measurement.
Repeat above procedure.

17) When complete the tool length measurement, press "F3/tool" key then "Return" button.









2. Program Example for Tool Length

【Press start button】

O1001

T01M6 ..... Execute T01 and M6 (Mount the T01 to the spindle)

N1 G54 G90 G00 X-150.0 Y80. S250 T02
..... Move to starting position of measurement (X, Y) by rapid traverse.
Execute T2 (Move the next tool to standby position)
Machine stop (Program stop lamp is lit)

G43 Z20. H1 ..... Execute H1 (Move the cursor to H1)
【Execute measurement】
Tool length is written automatically.
【Press start button】

M3
≀
(Machining program)
≀
} Ignore the program

T02 M6 ..... Execute T02 and M6. (Return to ATC position automatically and execute tool change.
(Mount the T02 to the spindle.)

Repeat above procedure

N2 G54 G90 G00 X0 Y9 S750 T03

G43 Z20. H2
≀
(Machining program)
≀
} Ignore the program

T03 M6

N3 G54 G90 G00 X-45. Y90. S800 T04

G43 Z20. H3
≀
(Machining program)
M30 End (Data of screen is cleared)
%

3. Collation Procedure

Execute an actual machining program in automatic mode as moving X and Y axes and machine lock for Z axis, and mesure the work shape (Z axis direction) by the block (G00Z__) for Z axis approach and check the interference with workpiece.

1) Set the touch sensor on the spindle.

2) Execute zero return all three axes.

3) Search the machining program in "Automatic" mode.

4) Press "Collation" button.

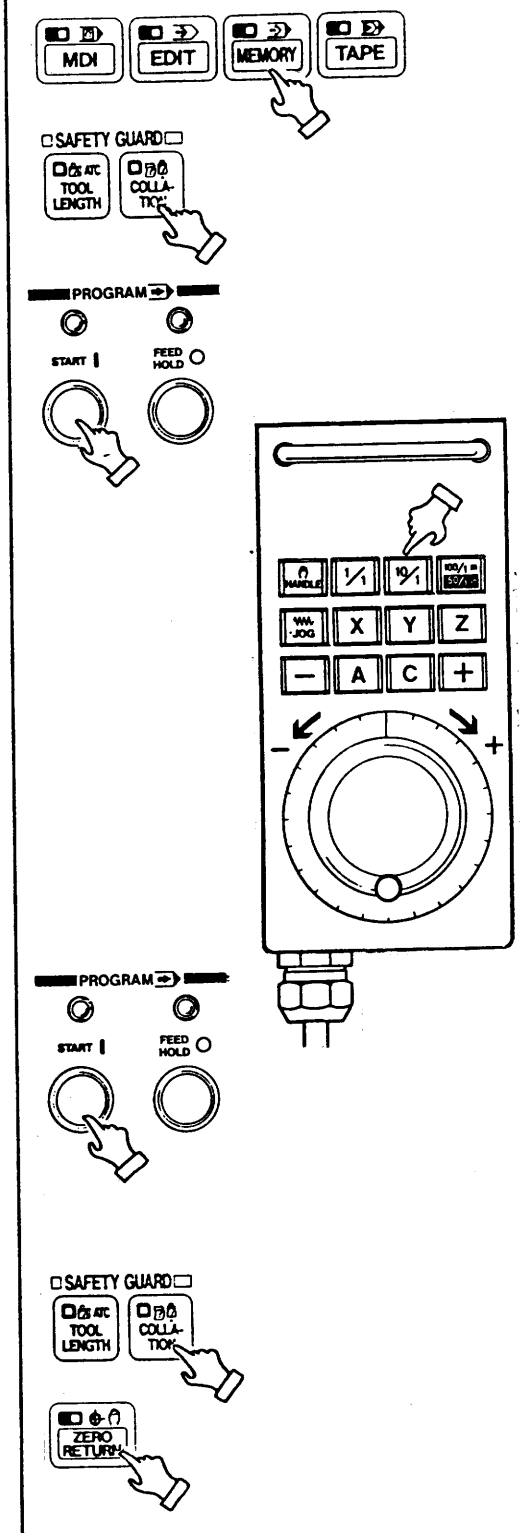
5) Press "Start" button.
Other block of G00Z** ;.
Ignore T_, T_ M6
Ignore S_, M_
Z axis is machine lock
Other axes are dry run
execute and program stop at the block G00Z** ;.

6) Put the block gauge equivalent to the safety point of Z axis (Z * *) on the datum surface of workpiece in Z axis direction (Z 0) and touch the touch sensor to the top surface of gauge by handle then retract a little.

7) Press "Start" button.
At this moment, mesaure the dimension of Z direction and move to next if interference is not arise.
If interference is occured alarm message is issued. Set the work coordinate system or confirm the setting of tool compensating amount and correct it.

8) If collation is completed, press "Collation" button.

9) Execute zero return.



2. Example of Collation Program

【Press start button】

```
O1001
T01M6 ..........................  Ignores
N1 G54 G90 G00 X-150. Y80. S250 T02
                ..............  Move to X-150. Y80. by dry run
                                Ignores S250. T02
                                Machine stops  (Program stop lamp is lit)
G43 Z20. H1 ....................  Contact the touch sensor to the top
                                surface of 20mm block.
                                【Measure a dimension of Z axis and check
                                 an interference with workpiece.】
                                【Retract the touch sensor from the block.】
                                【Press start button】
M03
 ≀                              } Ignore M3 and X and Y axes move by dry run.
(Machining program)
 ≀
T02 M6 .........................  Z axis moves to ATC position by rapid
                                travese and moves to the next block.
```

Repeat above procedure

```
N2 G54 G90 G00 X0 Y0 S750 T03
G43 Z20. H2
 ≀
(Machining program)
T03 M6
N3 G54 G90 G00 X-45. Y90. S800 T04
G43 Z20. H3
 ≀
(Machining program)
M30                             End (Data of screen is cleared)
%
```

Note Collation is not executed during special fixed cycle or fixed cycle mode or a command of G00 Z**; with fixed cycle cancel block.
If press the start button when alarm No.192 which is the machine enters prohibited zone by checking the safety guard is occurred, release an alarm and a program can be continued.

Note Execute a checking of safety guard at single block OFF.
Zero return must be performed after checking of safety guard.

- Alarm

No.147 Operation of tool length check of safety guard is wrong.

No.148 Operation of checking of safety guard.

No.192 The machine enters prohibited zone by checking the safety guard. (Alarm message)

No.197 Tool length/checking button of the safety guard is pressed incorrectly. (ALarm message)

13. Automatic Operation

1. In Case of Machining of the First Workpiece with Checking a New Program.

(Confirmation)

1) Confirmation of work coordinate system.

2) Setting of tool compensating amount.

3) Tools in the ATC magazine or spindle.

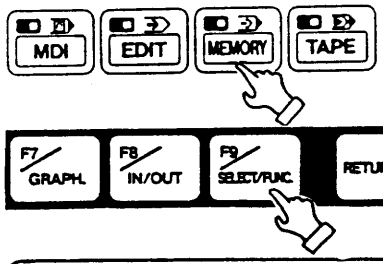
4) Clamping condition of workpiece.

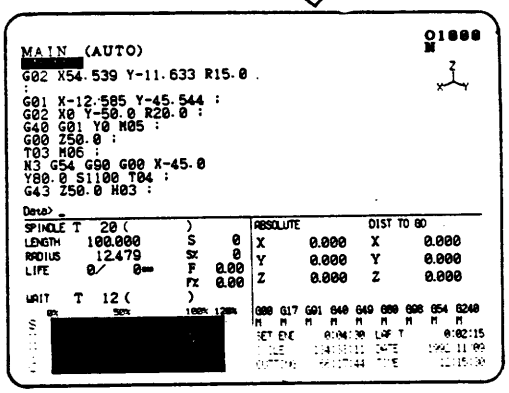
(Screen display)

1) Shift a mode to "Memory".

2) Press "Return" key and make on
【Overall (Automatic)】 screen.

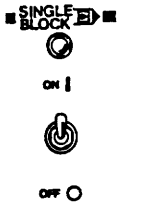
3) Call a program to be executed.



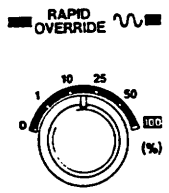


(Setting of each switch on the control panel)

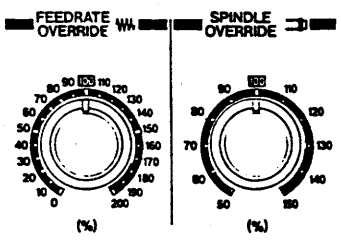
1) Turn "ON" the single block switch.



2) Set rapid traverse override at 25%.

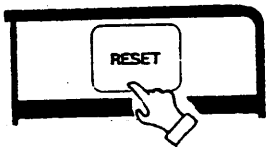


3) Set the override switch of feedrate and spindle speed at 100%.



4) Turn "OFF" the switches for dry run, Z axis cancel and machine lock. (Lamp is turned off.)

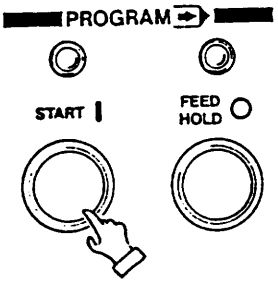
5) Press "Reset" button on the setting panel.



(Operation)

1) Check a content of a program to be executed, the cursor is located.

2) If nothing is wrong, press program "Start" button.

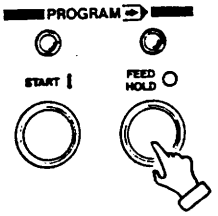


3) Check a motion of one block and proceed a program by pressing the program "Start" button again.

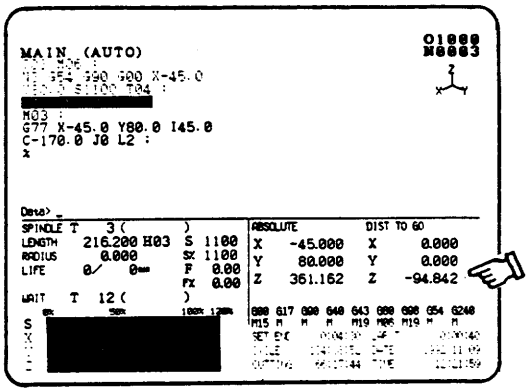
Note Prepare a hand to press the "Halt" button at any time.

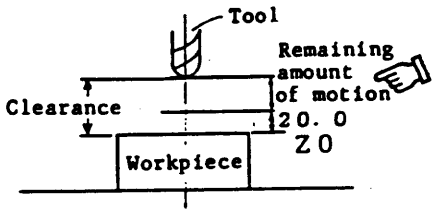
Remaining amount of motion is displayed as "How much move more from current position to commanded position".

4) Pay special attention to the block G43 Z20.0 H△△.
Execute checking operation by the following procedure.



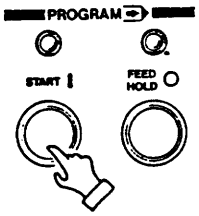
① Stop a middle of way once.
Compare a distance between [Remaining amount of motion] and [Tool and top surface of workpiece].



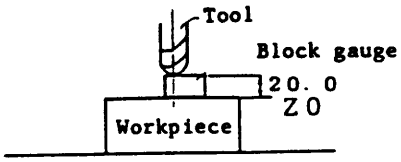


② Press the program "Start" button if clearance is larger.
Something is wrong, if clearance is smaller.

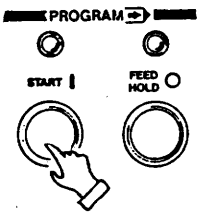
a) Is tool offset No. correct?
b) Is tool compensating amount correct?
c) Is setting of work coordinate system correct?



③ Check if dimension Z20.0 is correct with using a block gauge etc. after motion of this block is completed.



④ Press the program "Start" button and execute the following block.

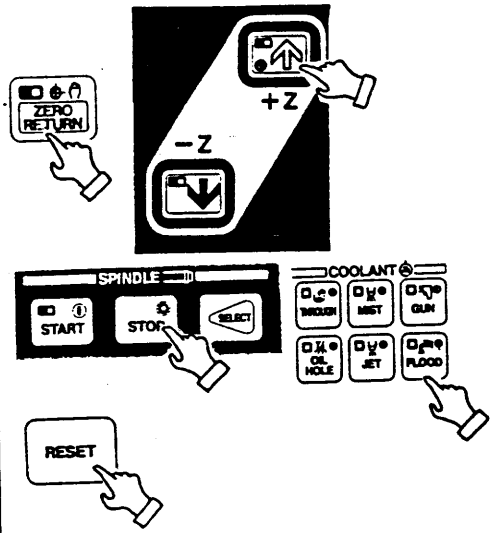


2. Start from Middle of a Program

Operation method in case of program edit and restart when a program is stopped by an alarm etc..

1) Retract the tool from the workpiece (Handle or feed), perform "Zero return" of Z axis.

2) Stop a spindle and coolant and confirm the ATC magazine is not rotating then press "Reset" button.
The "Reset" button should be pressed after Z axis zero return.
If pressing the "Reset" button at machining position of Z axis or middle of motion, becomes cause of trouble.

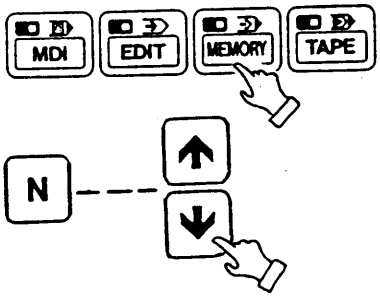


3) Check a cause of an alarm and treat it.

4) Heading the program on the 【Overall】 screen.
(Press the reset button.)

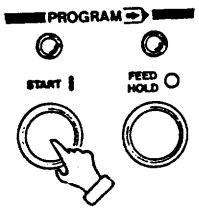
5) Shift to "Memory" mode and call the sequence No. which is displayed upper right of screen and "Start" it.

Restart from the beginning of process.
Start from middle of machining is not available.



Note 1. Don't touch the tool by hand during spindle rotation.

Note 2. Press program "Stop" or "Emergency stop" button if the machine moves unexpected direction or unexpected condition is occurred.



3. Memory Operation of Program

1) Set each switch on the operation panel.

① Turn "OFF" the single block switch.

② Set the rapid traverse override at 100%.

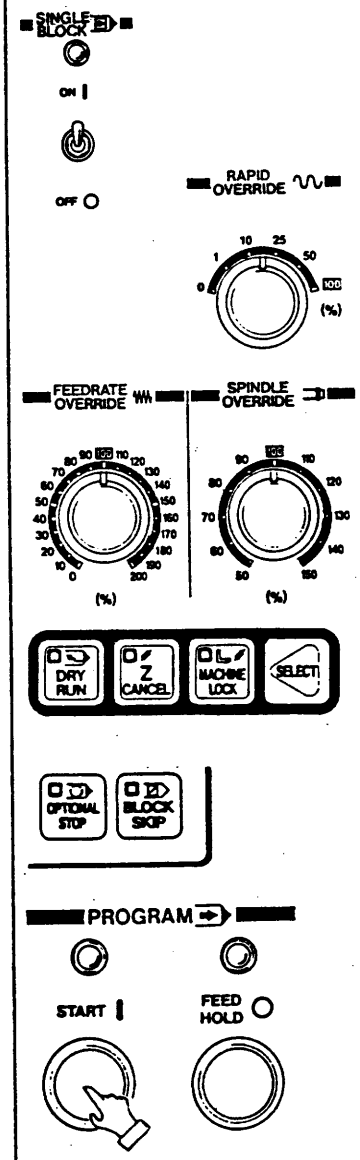
③ Set the override switch of feedrate and spindle at 100%.

④ Turn off dry run, Z axis cancel and machine lock. (Lamp is turned off)

⑤ Set the switch of optional stop or block skip if necessary.

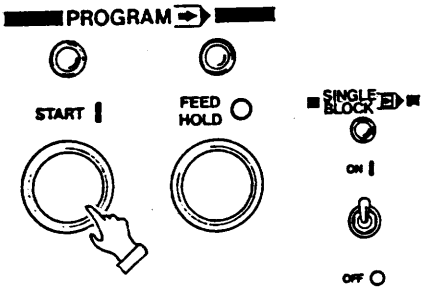
2) Press program "Start" button.

In case of temporary stop is required during operation, press program "Halt" button or turn "ON" single block switch. Also, if unexpected condition occurs, press "Emergency stop" button and stop the machine immediately.

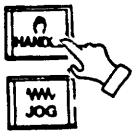


4. In case of Insertion of Manual Operation During Automatic Operation

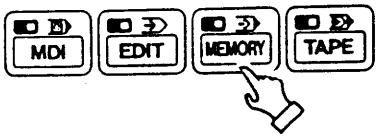
1) Press program "Halt" button and stop the machine temporarily (Red lamp, upper right of halt button, is it) or stop by turn "ON" single block switch.



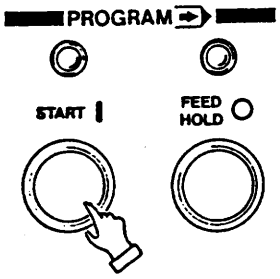
2) Shift a mode switch to "Handle" or feed and execute manual operation.



3) Return mode to "Memory" after completion of manual operation.



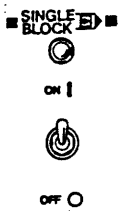
4) If pressing the program "Start" button, the program restarts.



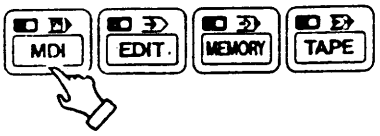
(Note) When pressing the program "Halt" button, action of M, S and T function is continued until end of the motion.
If motion is not completed, manual operation is not available.

5. In Case of MDI Operation in Middle of Automatic Operation

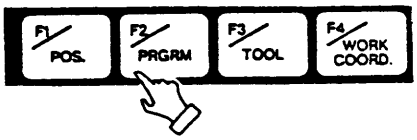
1) Turn "ON" the single block switch on operation panel.

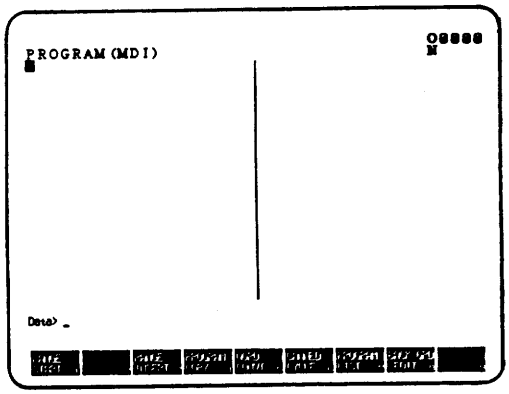


2) Shift a mode to MDI after machine motion is stopped.

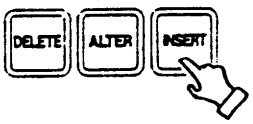


3) Press "F2/program" key and make the program (MDI) screen.

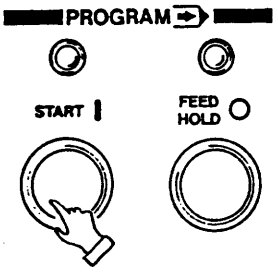




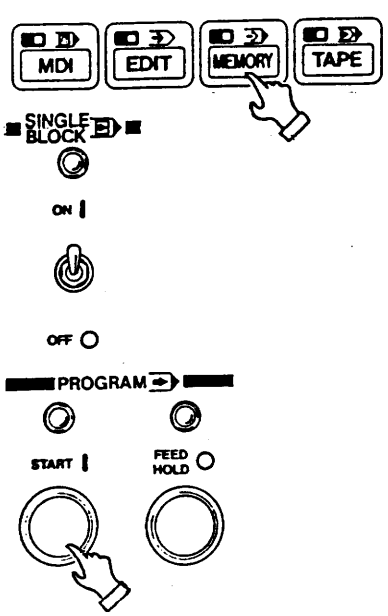
4) Input required motion by address and numeral key and press "Insert" key.



5) Press the program "Start" button after confirmation of input data of MDI.



6) To restart automatic operation, shift a mode to "Memory" and turn "OFF" single block switch.



7) Press the program "Start" button.

Note 1 In case of commanding other than a fixed cycle by MDI immediately after the fixed cycle, necessary G code should be designated.

Note 2 In case of insertion of MDI operation at the above condition, when execute the program again, hole machining data should be commanded before insertion of MDI operation.

Caution:
If continue an automatic operation after inputting only by MDI and not executed it, unexpected motion may occur due to contents of buffer by automatic operation is replaced with unexecuted buffer contents of MDI. Pay attention to danger.

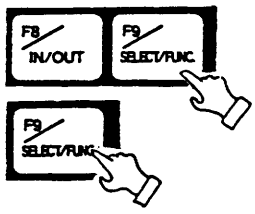
6. Advance Notice of End

If input an expected time of program end, notice by call light at the time reaches end of machining time expected.
Expected time of program end is the time from the start of automatic operation to the time of advance notice of program end.

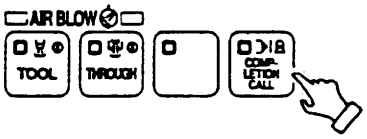
1) Change to 【Overall (Automatic)】 screen. In case of the other screen is displayed, press "Return" key.

2) Press "F9/selection/function" key.
The cursor moves to bottom of screen.

3) Press "F9/selection/function" key again.
A frame moves to the right.

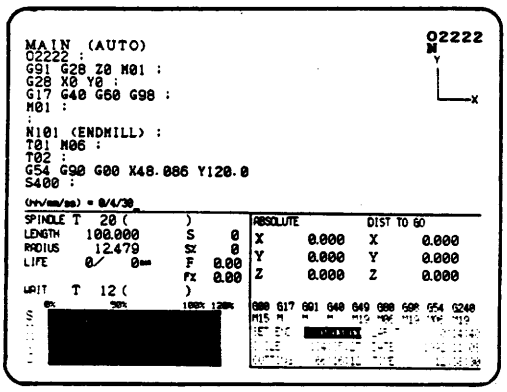


4) Press "Advance notice of end".



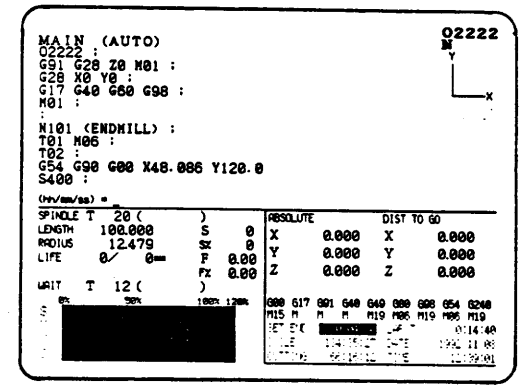
5) Set the cursor to the expected and input the time.

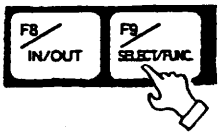
(Hr./min./sec.) = 0 (Set to 0)
(Hr./min./sec.) = 1 (Set to 1:00:00)
(Hr./min./sec.) = 1/2 (Set to 1:02:00)
(Hr./min./sec.) = 1/2/3 (Set to 1:02:03)



Machining time can be designated by zero setting of machining time before machining of the first workpiece, then set it before the machining of the second piece.

6) Press "F9/selection/function" key.



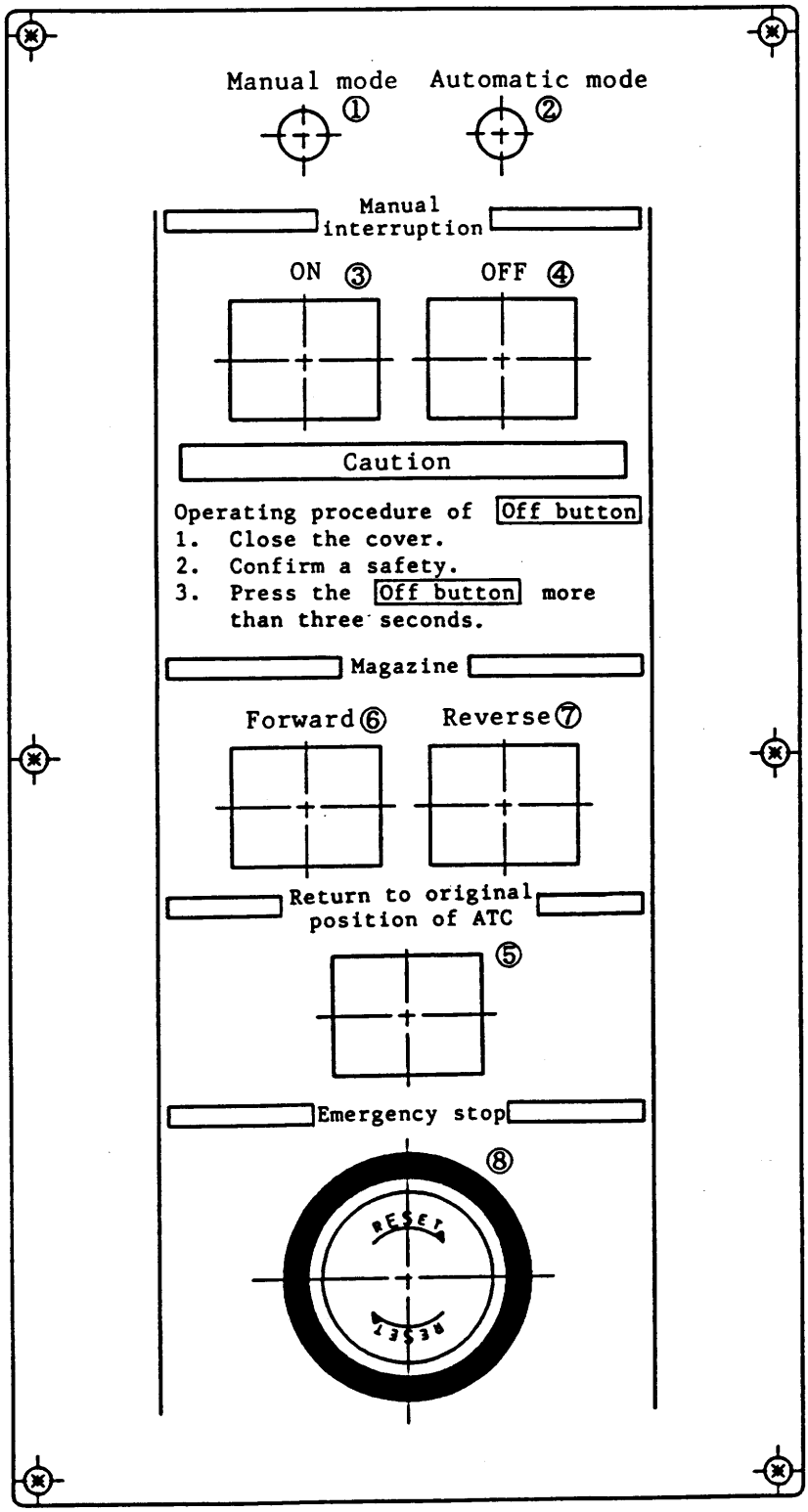


14. ATC (Automatic Tool Changer)

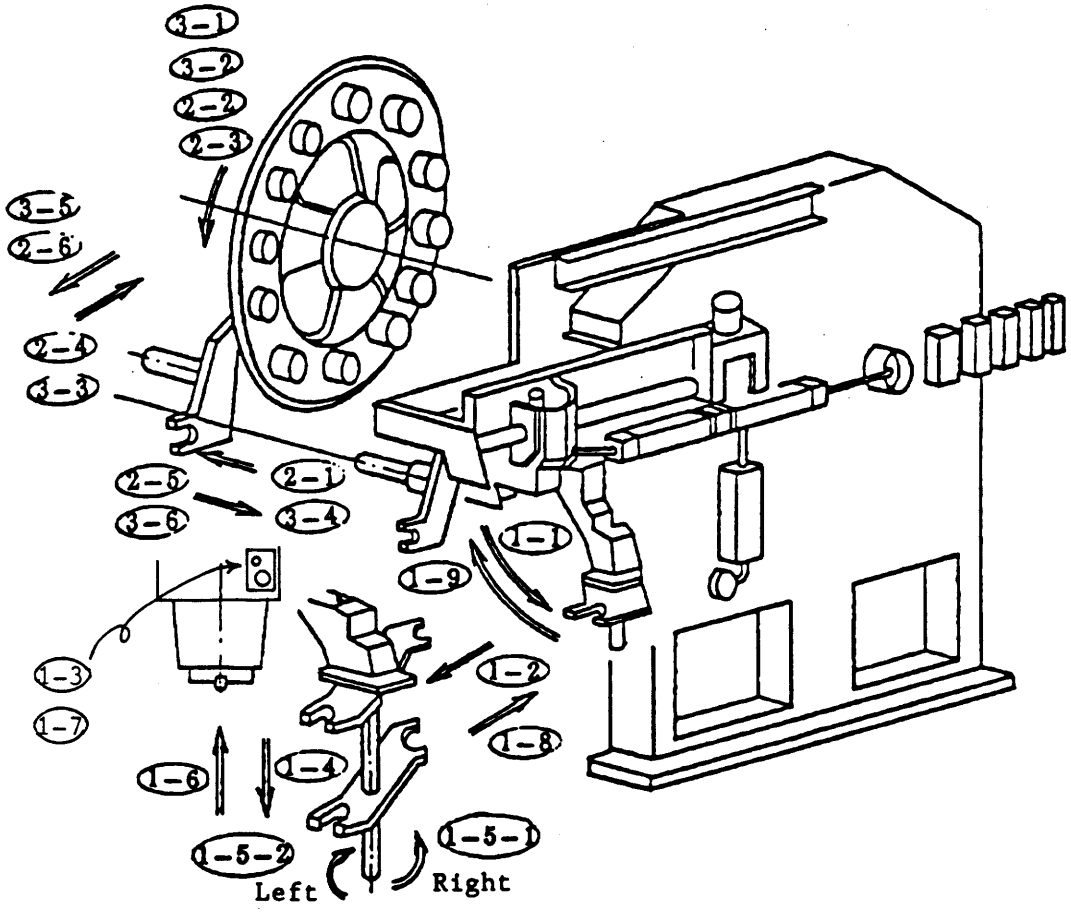
1. Individnal Operation Panel of ATC

No.	Description	Purpose
①	Lamp indication of manual mode	When mode switch on the main operation panel is set manual operation mode (Handle, feed, rapid traverse, zero return), lamp is lit.
②	Lamp indication of automatic mode	When mode switch on the main operation panel is set automatic operation mode (MDI, memory, tape), lamp is lit.
③	Manual interruption ON	When pressing the push button becomes manual interruption mode and lamp is lit, and rotation of magazine is available during automatic operation manually. Note If reading a T command during interruption mode, flicker the lamp and notice the temporary stop at automatic operation.
④	Manual interruption OFF	When press the push button more than three seconds after stopping the magazine rotation, manual interruption mode is end.
⑤	Return to original position of ATC	A push button to ease the restoration after emergency stop during ATC or power failure etc.. Operating procedure 1) Set a mode on the main operation panel to manual (Handle, feed, rapid traverse, zero return.) 2) Press "Return" button on the ATC operation panel. Flicker the lamp during ATC returning cycle and the lamp lights if return to original operation of ATC.
⑥	Magazine forward rotation	The magazine rotates clockwise during the push button is kept pressing.
⑦	Magazine reverse rotation	The magazine rotates counter clockwise during the push button is kept pressing.
⑧	Emergency stop	Execute full stop that same as an emergency stop of main operation panel.

Individual operation panel of ATC (ATC area at behind of machine)



2. Explanation of ATC Motion



Function	Sequence	Motion	M function
Tool change (M06)	1-1	Arm swing in	M920
	1-2	Arm slide advance	M921
	1-3	Spindle tool unclamp	.....
	1-4	W arm descent	M922
	1-5₁	W arm left turn 180°	M923
	1-5₂	W arm right turn 180°	M924
	1-6	W arm ascent	M925
	1-7	Spindle tool clamp	.....
	1-8	Arm slide retract	M926
	1-9	Arm swing back	M927
Tool return	2-1	W arm left travel	M22
	2-2	Magazine turn	.....
	2-3	Magazine positioning	.....
	2-4	Arm slide retract	M928
	2-5	W arm right travel	M925
	2-6	Arm slide advance	M926
Tool call	3-1	Magazine turn	.....
	3-2	Magazine positioning	.....
	3-3	Arm slide retract	M928
	3-4	W arm left travel	M922
	3-5	Arm slide advance	M926
	3-6	W arm right travel	M925

* The M functions can be used in the maintenance mode.

Refer to the ATC operations in page 5-86.

3. Mount or Dismount of Tool

Mount or dismount of tool can be done at any position of the magazine. Pay attention for safety.

* Rotation of magazine

Rotation of magazine is executed by the selected button for forward or reverse of magazine at individual operation panel of ATC.
Rotate one pitch each by inching.
Rotate continuously if keep pressing the button.
If release a push button when desired pot No. approaches to certain position, a magazine decelerates and stops with positioning.

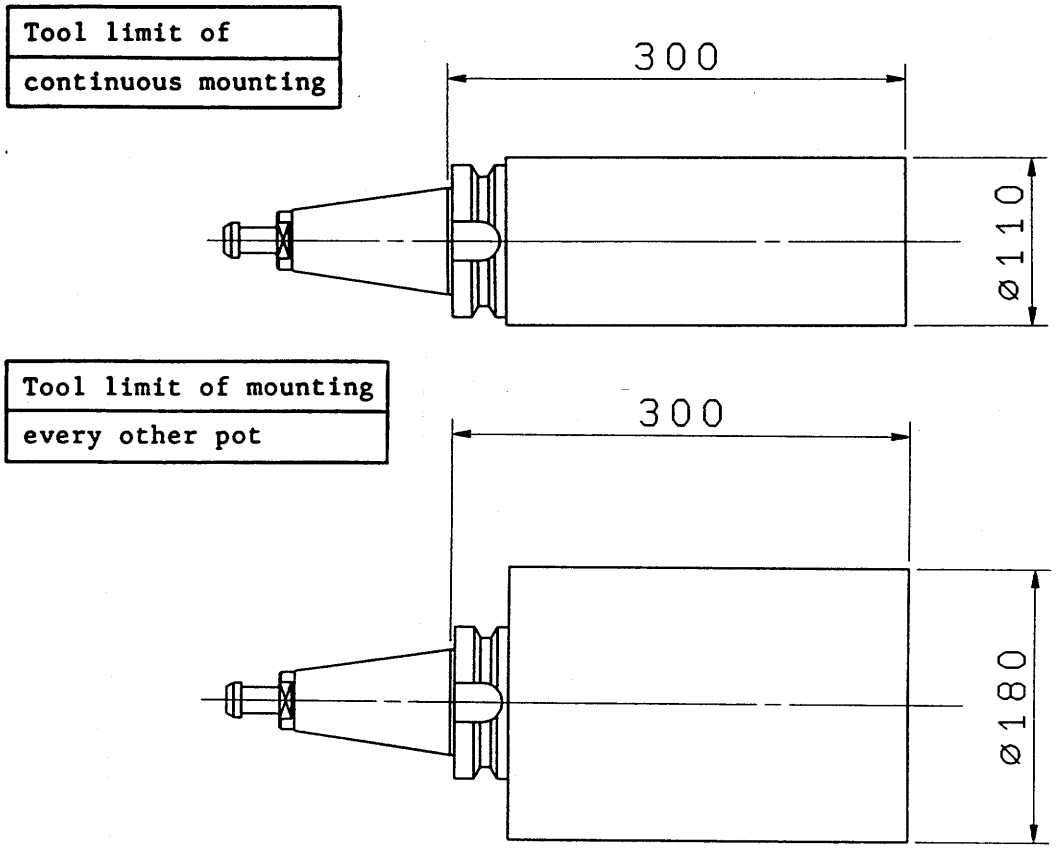
* Note at using oil hole tool

In case of sticking of chips at oil hole block side, insertion or positioning of pilot plunger of the tool may occur a problem when oil hole tool is applied.
Whether manual or automatic operation, execute tool change after cleaning the block by oil hole coolant "ON" or idle blowing of coolant by command of M50 before mounting the oil hole tool to the spindle.

4. Limitation of Tool

Maximum tool length	300mm (12")
Maximum tool weight (Maximum moment)	20Kg (2.3Kgf.m)
Maximum tool diameter (Refer detail of tool limit drawing)	
In case of mounting tool consecutively	ϕ110mm (ϕ4.4")
In case of removing adjacent tool	ϕ 180mm (ϕ 7.08″)

Tool limit drawing



5. ATC Operation

1) Contents of motion and operating procedure.

ATC operation is executed by contents of command individually or continuously.

(1) Individual motion (When MDI or maintenance mode) when individual motion is required for test run or maintenance adjustment procedure is as follows:

① Place each axis and ATC arm to original "Position of ATC".

② Input M19 for the spindle positioning by MDI and execute it.

③ Turn on the "MAINT" switch (SW1) for maintenance in the power cabinet.

④ M codes for individual motion is as follows.

⑤ Turn "OFF" the "MAINT" switch after all operation is finished.

No.		Description of motion		M code	Manual assistance	Remark
1	Tool change on the spindle side	Arm swing in spindle side		M920		
2		Arm slide advance		M921		
3		Spindle tool unclamp		....	Manual push button	
4		W arm descent		M922		Tool out from spindle
5		W arm turn 180°	Left	M923		Right: Right turn of W arm view from top of the spindle
			Right	M924		
6		W arm ascent		M925		The tool inserts to the spindle.
7		Spindle tool clamp		....	Manual push button	
8		Arm slide retract		M926		
9		Arm swing back magazine side		M927		ATC arm home position
10	A tool in the standby position returns to the magazine pot.	W arm left travel		M922		
11		Magazine turn		....	Manual push button	
12		Arm slide retract		M298		
13		W arm right travel				Tool back to the magazine
14		Arm slide advance		M926		ATC arm home position

* Upon referent to the movement diagram in page 5-83, operate it before operating in the maintenance mode.

(Note) The door of power cabinet should be closed to avoid danger.

2) Rotation of tool storage magazine (In case of individual mode).

The magazine rotates during keep pressing the button at magazine side. When desired pot No. closing the fixed position, release the push button switch and the magazine decelerates and stops at the position.

6. Motion of ATC Program

1) Block motion by program (When automatic mode)

The following block motion is executed according to the content of program.

T△△ ;	Call the tool No.△△ in the magazine to aem "Standby position".
M06;	Replace the tool in the magezine and spindle.
T△△M06;	Call the tool No.△△ in the magazine to the "Spindle". (ATC fixed cycle)
T00;	Return the tool in the arm standby position to the magazine.
M06; T00;	Return the tool in the spindle to the magazine.

※ In case of execution of T△△M06 or M06, the spindle should be in the ATC position. (Execute G91 G30 Z0; G30 X0 Y0; and the lamp should be lit.)

※ In case of using an ATC fixed cycle, command T△△M06 only is enough. (The ATC canned cycle becomes effective by the parameter 9009 0 bit 1.)

2) Single block stop of ATC

When at the condition of single block ON, the arm stops once at the "Twin arm swing in position at spindle side" by M06, then proceed to the "Arm original position" and stop by pressing the "Program start" button again.

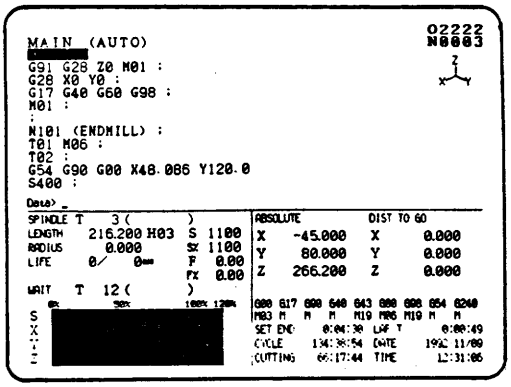
3) Halt at arbitrary block of ATC

When pressing the "Program halt" push button switch during ATC motion by T△△ or M06, stop at the stop position of individual motion once then continue the remaining motion by pressing the "Program start" button.

7. Condition Check During ATC Execution

1) .Tool No. in the spindle.
   .Tool No. in the arm standby position is displayed on the 【Overall】 screen.

   ① Press "Return" key.

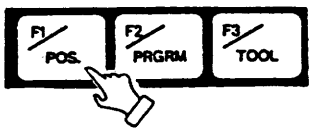


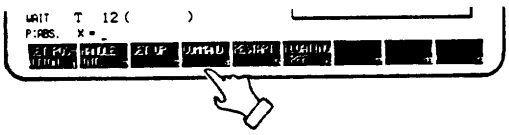
2) .Tool No. commanded by program is displayed on the 【Command value】 screen.

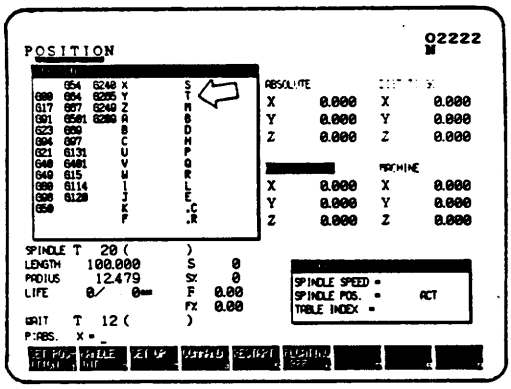
   ① Press "Return" key.

   ② Press "F1/position" key.

   ③ Press function key "F4/Command value".



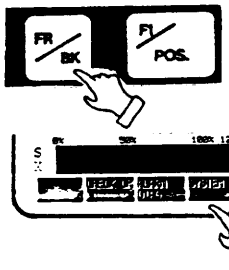




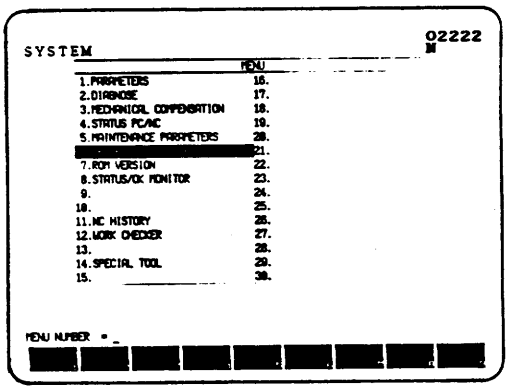
3) .Pot No. of standby position is displayed at 【AB phase table counter on No.11 of PC screen】.

① Press "Return" key.

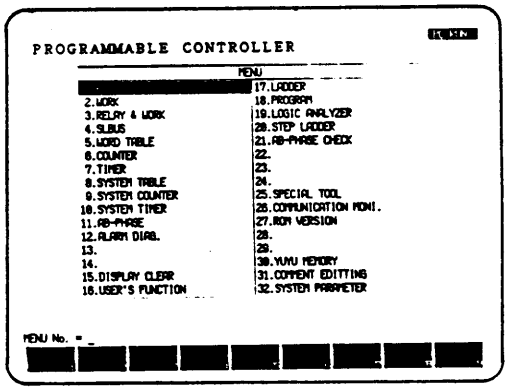
② Press "Back/front" key.



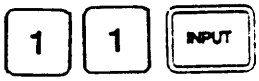
③ Press function key "F4/system".
System menu screen is displayed.



④ Press "6" and "Input".
Programmable controller screen is displayed.



⑤ Menu No. = is displayed then press "1" "1" "Input" key.
AB phase table screen is displayed.
AB phase table



PC RUN

AB-PHASE TABLE

No	RING.	CURRENT	MULTI.	DISTANCE	SET STAT. (BA)	CUR.STAT. (BA)
01	100	0	0	0	00	00
02	0	0	0	0	00	00
03	0	0	0	0	00	00
04	0	0	0	0	00	00
05	0	0	0	0	00	00
06	0	0	0	0	00	00

15. Display and Setting Method of Data Setting

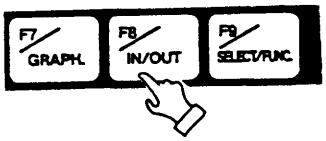
There are following three kinds of data setting.

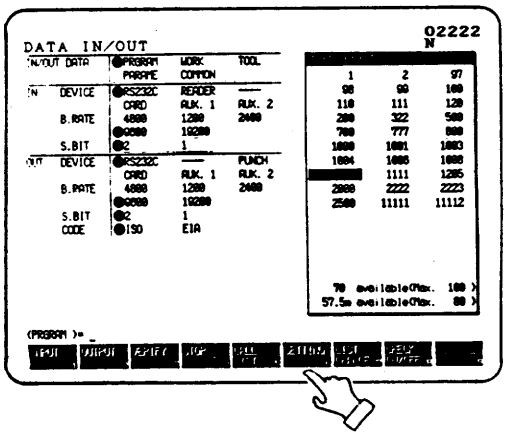
1. Data Setting Regarding In/output.
2. Setting of Parameter.
3. Setting of Automatic Override.

1. Data Setting Regarding In/outpit

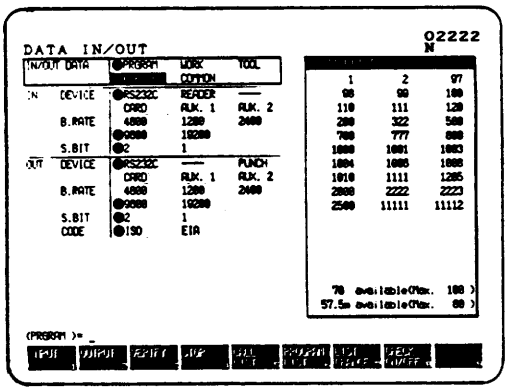
Setting of content of In/output and hardware at the time of In/output can be done.

1) Press "F8/In/output" key.
【Data In/output】 screen is displayed.
Selected item hasa mark ● respectively.

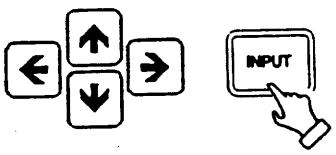




2) Press function key "Data setting".
Guide line (Yellow frame) moves to In/output side.



3) Set the guide line (Yellow frame) to desired item by the cursor ⬆, ⬇ and move by the cursor ➡, ⬅ then press "Input" key.



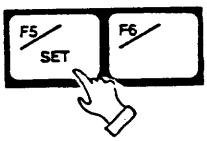
2. Setting of Parameter

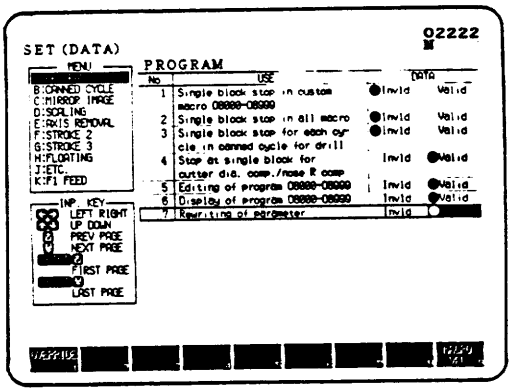
The parameters offen use can be set easily by gathering items or purposes separately.

The items of option are not displayed if option is not provided.

1) Press "F5/setting" key

【Setting (Data)】 screen is displayed.



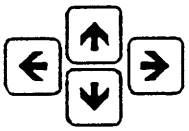


2) Press page key ↑ P, P ↓ or alphabet key corresponding the menu at the left of screen and select a desired item.

Number search also available.

In case of selection such as "Execute/Not execute" selected side has a mark ●.

Standard of HITACHI SEIKI is left side.



3) In case of change

(1) Selection of "Execute/Not execute".

① Select the item by the cursor key ↑, ↓. Move the data with a mark ●.

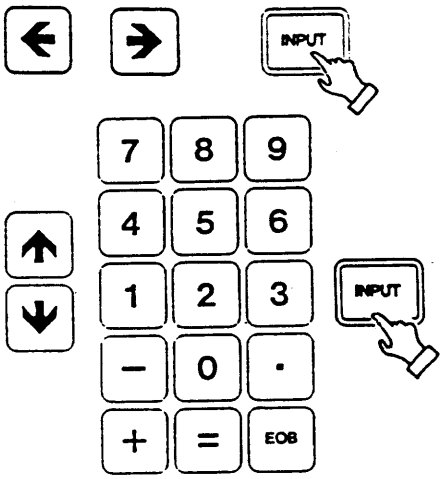
② Set the cursor by →, ← and press "Input" key.

(2) In case of change of numeral data

① Select the item by the cursor ↑, ↓.

② Input numerat to be change by key and press "Input" key.

Change should be done with full care because input restriction is not provided such as write key.



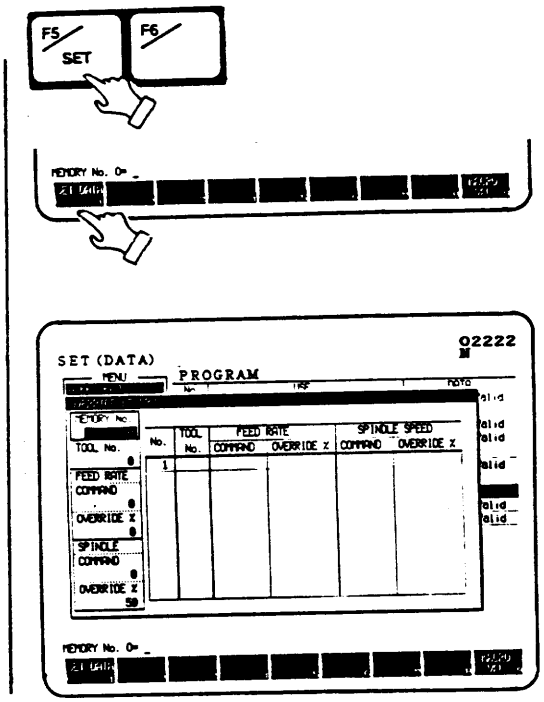
3. Setting of Automatic Override

At the time of test cutting, the function memorize an override corresponding actual cutting conditions against cutting feedrate, spindle speed commanded by the program, influence the subsequent machining automatically.

Tool capacity is available up to 60 pcs..

1) Press "F5/setting" key and 【Setting (Date)】 screen is displayed.

2) Press function key "F1/override" key and 【Override memory】 screen is displayed.



Memory No. (O) ..... The number which is memorized an override. (Designate the O number of machining program.)

Tool No. ..... Tool No. memorized and displayed as sequencially designated in the program.

Commanded value of feedrate.. Feedrate (F code) commanded in the program is displayed.

Feedrate override ..... Feedrate override is displayed.

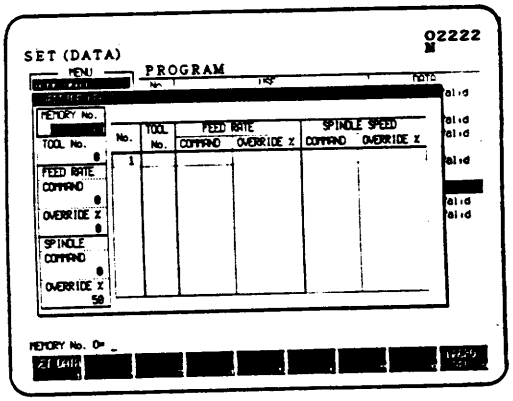
Commanded value of spindle speed ..... Spindle rotating number (S code) commanded in the program is displayed.

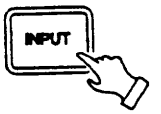
Spindle speed override ..... Override of spindle rotating number is displayed.

Tool No., Feedrate, Feedrate override, spindle speed and spindle speed override shown at right side of screen are displayed as currently selected memory figure.

3) In case of preparation of new program

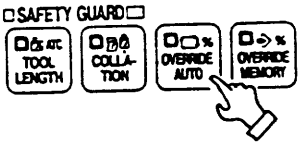
① Key in the program No. to be machined and press "Input" key.
All data in the screen is cleared and O number keyed in now is set.



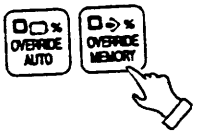


② Press the "Override auto" key on operation panel.

③ Start machining.
T code commanded during machining memorize at the tool No. on the memory and also feedrate, feedrate override, spindle speed and spindle speed override respectively then display in the frame with cursor.



④ Execute cutting and press "Override memory" key on operation panel if rewriting of override is required.



⑤ Press "Override auto" key after cutting is finished.
Memory function is released and automatic override function becomes effective.

⑥ Start machining.
Machining is executed with override memorized. At this time override on the operation panel is ignored.

4) Editing of override memory

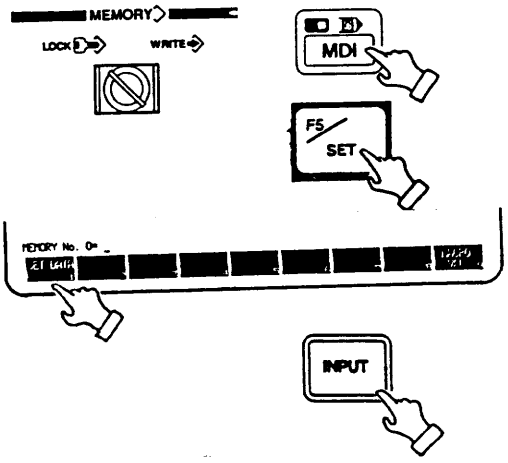
① Turn the "Memory" key to "Write".

② Set the "MDI" mode.

③ Make an 【Override memory】 screen.

④ Set the cursor to the data wanted to change by the cursor key ↑ ↓ → ← .

⑤ Key in the data and press "Input" key.



16. Display

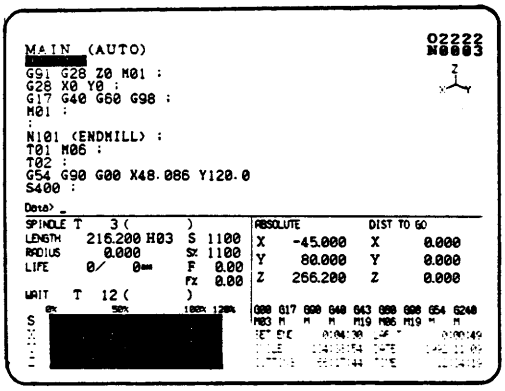
1. Display of Program

1) Procedure by 【Overall】 screen.

① Press "Return" key.

【Overall (Automatic)】 screen is displayed.

Necessary data for operation are displayed together.



- o Program
- o Drawing of tool path
- o Spindle tool No., standby tool No.
- o Data for spindle tool
  Setting and applied value of tool length and tool radius compensation and tool life.
- o H and D code
- o Value of S, S%, F and F%
- o Remaining seconds of dwell
- o Load meter of each axis
- o Work coordunate system,
  remaining amount of travel
- o G and M codes of following group
  01 (Position), 02 (Plane designation), 03 (Absolute/incremental), 07 (Tool radius compensation), 08 (Tool length compensation), 09 (Fixed cycle), 10 (Return point), 12 (Work coordinate system), 5 M code of group
- o Exepecting time of program end, machining time, cutting time, lap time of tool
- o Date and time

Following items can be done on this screen.

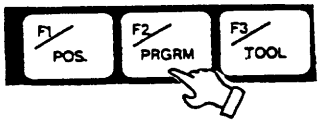
- o Program search
- o Program editing
- o Rewrite of tool length and radius compensation
- o Rewrite of expecting time program end, machining time, cutting time and lap time of tool
- o Setting of data and time

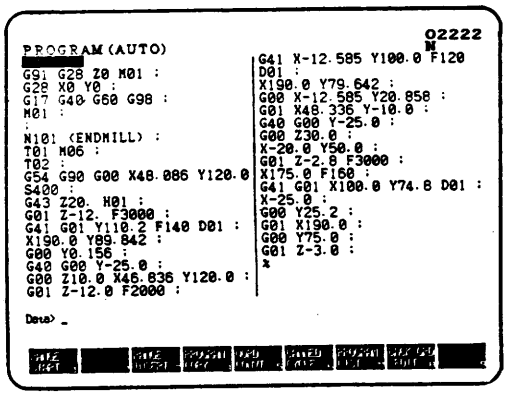
Displaying color is changed at the executing time of program

Green;	The block has executed.
Reversal yellow;	The block being executed or start executing.
Yellow;	The block has read in advance.
Reversal white;	The block to be executed next. Or turget area of editing
White;	The block after this

Note) A color is explained by color display. In case of the monochrome CRT, light and shade conform with color code No. is displayed.

2) Procedure by 【Program】 screen





① Press "F2/program" key.
【Program】 screen is displayed.
Following items can be done on this screen.

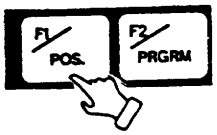
- o Program search
- o Editing
- o Preparation
- o Deletion
- o Display of executing program
- o Back ground editing

Displaying color is changed at the executing time of program.

Green;	The block has executed.
Reversal yellow;	The block being executed or start executing.
Yellow;	The block has read in advance.
Reversal white;	The block to be executed next. Or turget area of editing
White;	The block after this

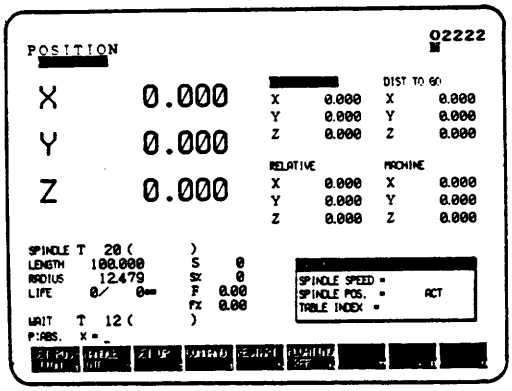
2. Position Display

① Press "F1/position" key.



【Position】 screen is displayed.

- Display regarding the position and rewrite can be done.
  1) Display of work coordinate system, remaining amount of travel, relative coordinate system, machine coordinate system
  2) Rewrite of relative coordinate system



1) Display of work coordinate system, remaining amount of travel, relative coordinate system, machine coordinate system

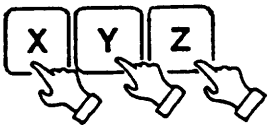
Desired one out of four coordinate system shown at right side can be enlarged and displayed at left side of screen by pressing the page key.

2) Rewriting of relative coordinate system

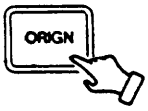
Only relative coordinate system can be rewritten out of four coordinate systems.

(1) Procedure of zero setting

① Press an address key want to be zero. (Press X, Y and Z if all axes want to be zero at once.)
Pressed address lamp flickers.
Press a key other than address and flickering lamp stops if made mistake.

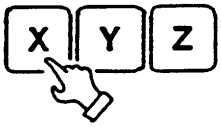


② Press "Origin" key.



(2) Procedure of numeral input

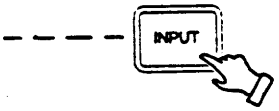
① Press an address key want to input.



② Input numeral and press "Input" key.

Example

P: Absolute value X = 1.234 "Input"
(1.234 is inputted in X)



I: Incremental value
Z = 10 "Input"
(10.0 is added on Z)

- Following items are displayed other than position.

  o Display of spindle tool and standby tool No..

  o Display of following data of spindle tool.

    Setting and applied value of tool length and tool radius compensation and tool life

  o Display of value of S, S%, F and F%

  o Remaining seconds of dwell

  o Display of memorized position (Option)

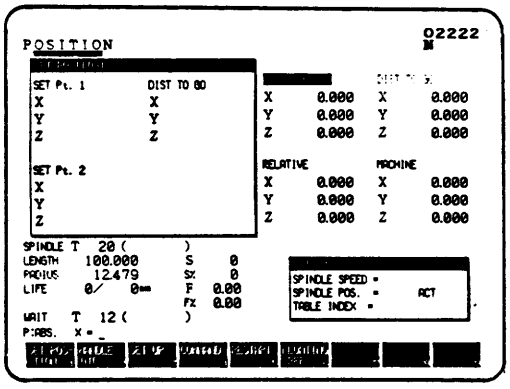
  o Set up work

- Following display or work can be done by pressing function key.

(1) Memorized position (Option)

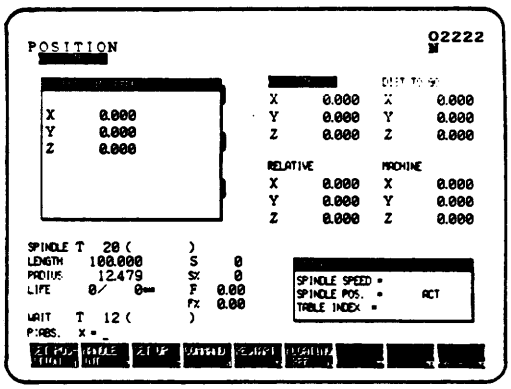
① Press "F1/memorized" position.

Up to two positions can be memorized and an ⬅ mark is displayed at selected side.



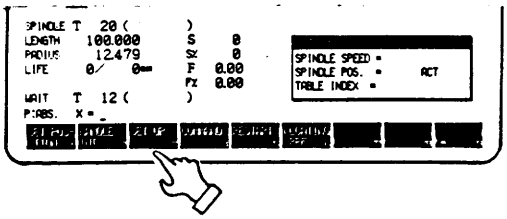
(2) Manual interruption (Option)

① Press "F2/manual" interruption.



(3) Set up work

① Press "F3/set up work".
Data input becomes available at set up side.

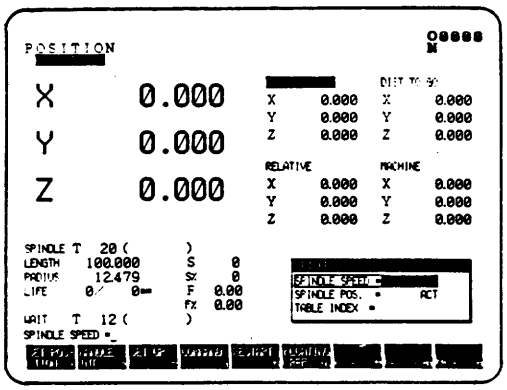


② Set the mode to "MDI".

③ Select spindle speed, spindle positioning and table index by the cursor key ⬆, ⬇.

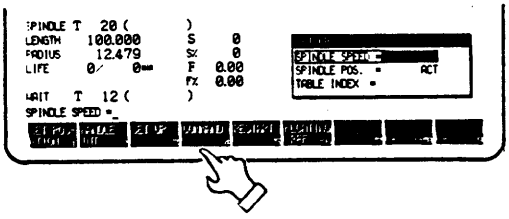
④ Key in the data and press "Input" key.
Input of plural data is not available at one time.

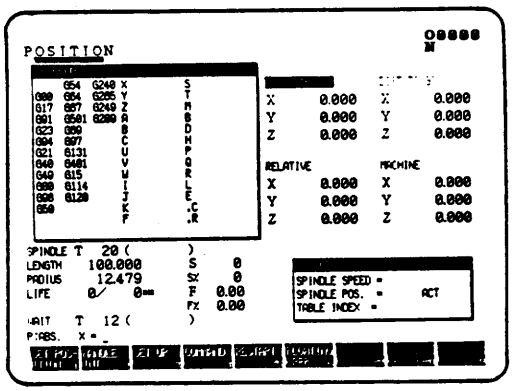
⑤ Press "F3/set up work".
The cursor returns position side.



(4) Display of command value

① Press "F4/command value".
Commanded data is displayed by program or MDI operation.





3. Display of Alarm Message

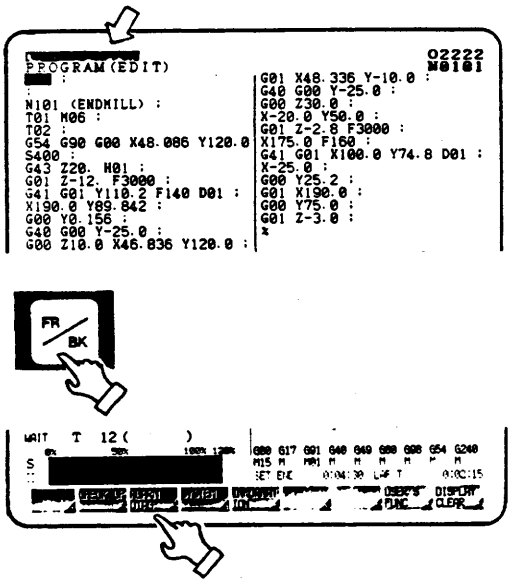
Alarm message has the following three kinds.

1) Alarm related to NC unit (NC alarm).

2) Alarm related to machine side equipment or PC controller (Machine alarm).

3) Battery alarm to maintain memory data of PC (Battery alarm).

"Alarm No." and "Alarm message" is displayed at upper left of screen.
Only first alarm is displayed if plural number of alarms are issued at the same time.
Refer to alarm diagnosis screen if details are required.



- In case of display with white letter on red background (Red background flickers), it indicates serious alarm.
  At that time, the machine stops and change to alarm diagnosis screen forcibly.
- In case of display with blue letter on yellow background, this alarm gives warning to an operator.
  Machine stop or screen change is not executed.
- In case of display with blue letter on white background, it means PC alarm.

1) Alarm related to NC unit (NC alarm).

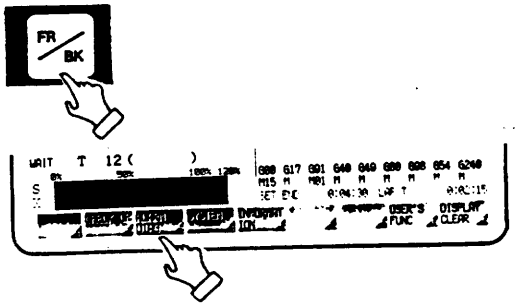
Check a cause of alarm and remove a trouble by alarm list of SEIKI-SEICOS MIII/A Instruction manual maintenance section.

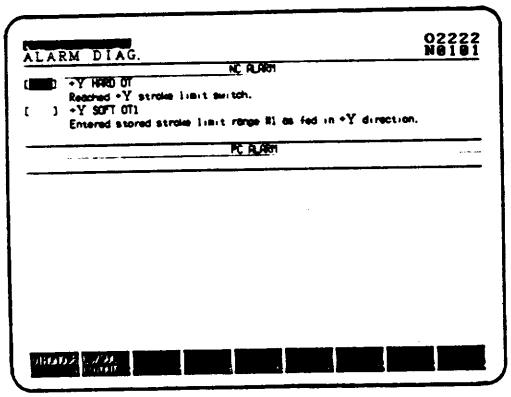
Note) A color is explained by color display. In case of the monochrome CRT, light and shade conform with color code No. is displayed.

2) Alarm related to machine side quipment or PC controller (Machine alarm).

① Press "Rear/front" key.

② Press function key "F3/alarm diagnosis". 【Alarm diagnosis】 screen is displayed.





③ Search a cause of trouble by alarm contents and remedy it.

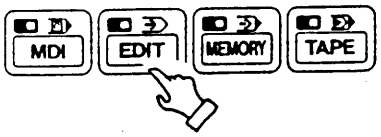
3) Battery alarm to maintain memory data of PC (Battery alarm).
Refer to MICON 16-III daily maintenance and check then replace a battery.

17. Output of Program

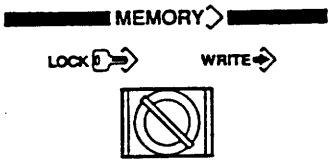
(1) Connect an output equipment to contactor of RS-232-C and make a receivable condition.

Refer to the instruction manual for SEIKI-DON

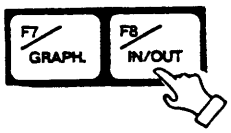
(2) Make a mode selection to edit mode.

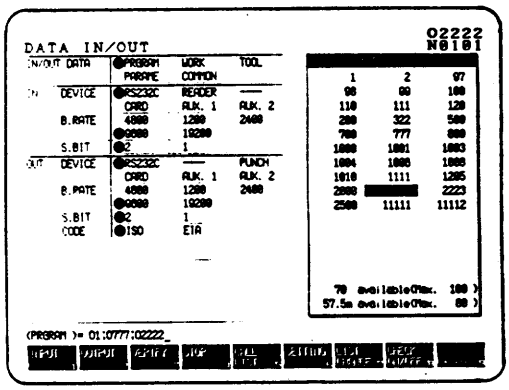


(3) Turn the memory key to "Write".



(4) Press "F8/In/output" key.
【Data In/output】 screen is displayed.





(5) Confirm output data and set it.

With mark ● side is selected.
In case of data setting, press "F6/data setting" key and move the cursor to the list of in/output contents then set the guide line by cursor ⬆ ⬇ and move it by the cursor ➡⬅ then press "Input" key.

(6) Press "F6/program list" and return the cursor to program No. list.

(7) Key in the program No..
Move the cursor to the number of program list and press "Input" key and the number (O No.) is stored in the key input area.

When designate plural number of program:

Divide by ";" Example: 02; 04; 011 ... Designate 02; 04; and 011

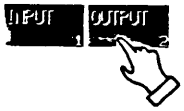
Divide by "-" Example: 01 - 099 ..... Designate from 01 to 099

0-099999999 ... All programs are designated.

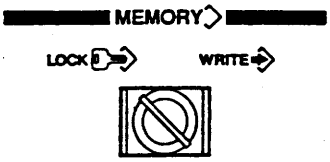
(8) Press "F2/output" key.

Program is outputted.

When interrupt the middle of way, press "F4/interruption" key.



(9) Turn memory key to "Lock".



Chapter 6 STAF FUNCTION

1 Preface

In developing the SEICOS III system, various functions, developed until recently to improve the productivity of the customers, were revised and were further made user-friendly.

The developments were then put together in one production assistance system known as STAF (SEIKI TECHNOLOGY ASSISTANCE FUNCTION).

1. Revision of the Current Functions

The current functions were revised as shown in Fig-1. Revision of the Current Functions

			carried over to the SEICOS
1	Work Setter	:	M III model as an NC function
2	Safety guard	:	ditto
3	Set point return	:	ditto
4	Machining finish advance notice	:	ditto
5	Automatic measuring	:	carried over to the SEICOS M III model as macro and PC functions
6	Tool breakage	:	ditto
7	Status display	:	adopted in the STAF system as the Status / OK
8	OK monitor	:	ditto
9	Cutting monitor	:	upgraded and adopted in the STAF Tool Management
10	T4 digit function	:	ditto
11	ID tool	:	ditto
12	P. P. L, A. W. C Scheduler	:	upgraded and adopted in the STAF schedulers
13	Alarm diagnosis	:	upgraded, and adopted in the STAF Alarm Diagnosis

Fig-1

P. P. L Pallet Pool Line
A. W. C Automatic Work Changer
F. F. C Free Float Conveyor

2. STAF Structure

The STAF is realized through the programmable controller (PC) supported by the human interface of the SEICOS M III system. Thus, this function can be used with the NC equipments of other manufacturers. However, the tool management function is not the same as that of the SEICOS system due to the interface with the NC.

The STAF structure is shown in Fig-2. Each function consists of one screen from which one can easily enter other menus by pressing the function key.

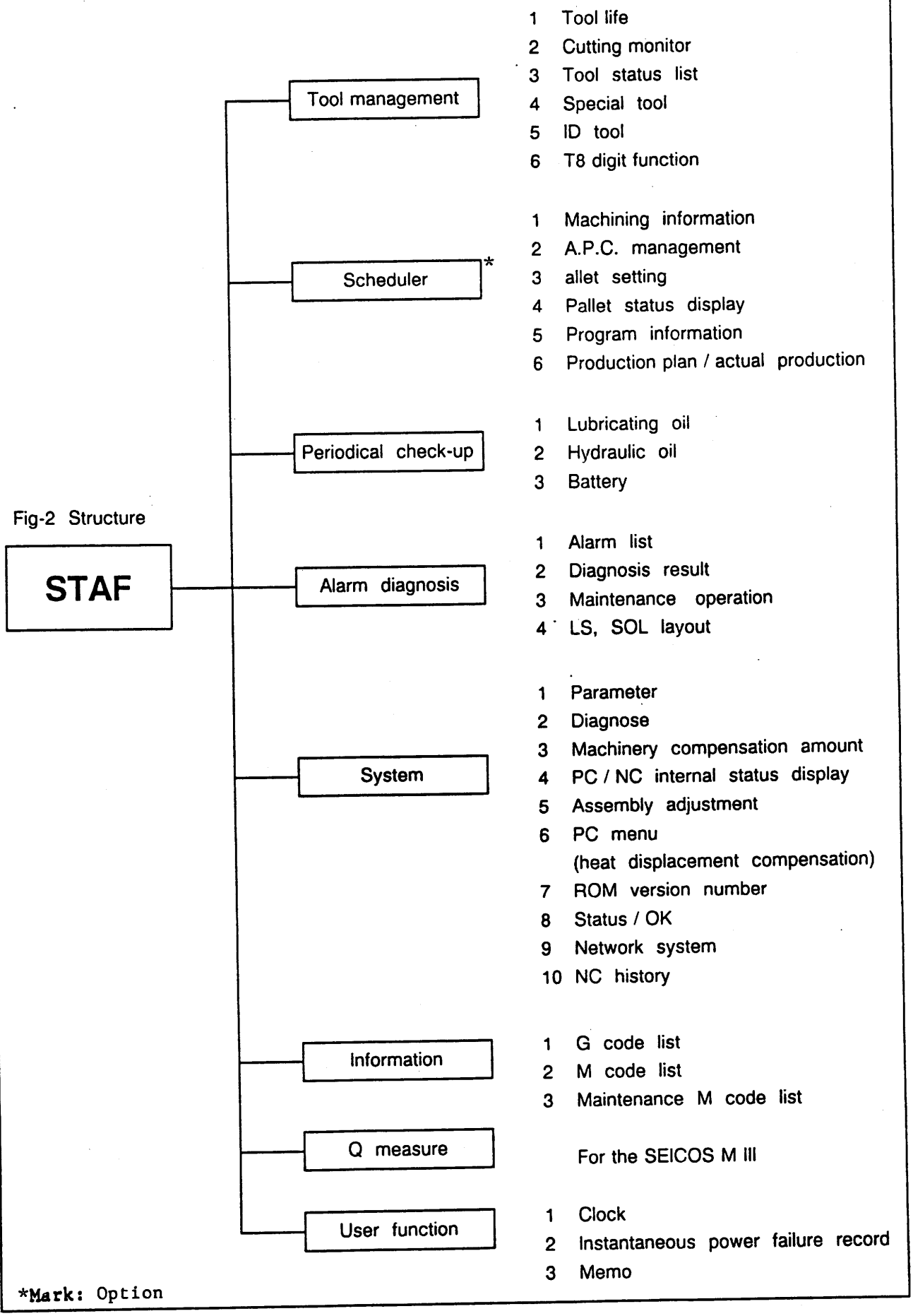


Fig-2 Structure

2 Periodic Check

Periodic check 93.10.15

	Item	Checking interval	Checking date	Next checking date	Condition
1	Lubricant	85 hrs.	93.10.15		85 hrs, left over
2	Collecting method of lubricant				
3	Hydraulic unit oil	6 mons.	93.10.15	94.04.15	
4	Spindle cooling oil	6 mons.	93.10.15	94.04.15	
5	NC battery	4 yrs.	93.10.15	97.10.15	
6					
7					
8					
9					
10					

Set 3 digits numeral follow the unit. (Y: year, M: month, D: day, H: hour)

>Y100_

Detail /1						Checking hour setting /7	Checking date setting /8	Soft key delation /9

Standard time setting of VK45Ⅱ

1.	Lubricant	85 hrs.
3.	Hydraulic unit oil	6 mos.
4.	Spindle cooling oil	6 mos.
5.	NC battery	4 yrs.

1. Main Screen Explanation
   - Current date is displayed on the upper left of the screen.
   - ITEM:
     Check-up item.
     The number and contents of the items vary depending on the model.
   - TIME (check-up time) :
     Life. Its units are in years, months, days, or hours.
   - DATE (check-up date) :
     The date when the actual check-up was made.
   - APPOINT (next check-up date) :
     The date when the next check-up must be made.
   - STATUS:
     On the item of lubricating oil, the life remaining is displayed. If any of the items goes unchecked on its appointed date, a REPLACE message is displayed.

2. Main Screen Function Explanation
   - F1 : Detail
     The detail screen is displayed.
   - F7 : Setting the check-up time
     Press the F7 key, and the following message appears: "SET A THREE DIGIT NUMBER FOLLOWING THE UNIT (Y: YEAR, M: MONTH, D: DATE, H: HOUR)." Move the cursor to the item to be set and set a three-digit number following Y, M, D, or H. Press the INPUT key, and the check-up time is set.
     (Note) Item 1 is lubricating oil and its unit is in hours only.
   - F8 : Setting the check-up date
     Move the cursor to the item to be checked-up. Press the F8 key, and the current date is set as the check-up date (DATE) and the following date when a check-up should be done is set as the next check-up date (APPOINT). The REPLACE message simultaneously disappears.
     (Note) Item 1 is lubricating oil and its unit is in hours only. Thus, its next check-up date is not displayed.

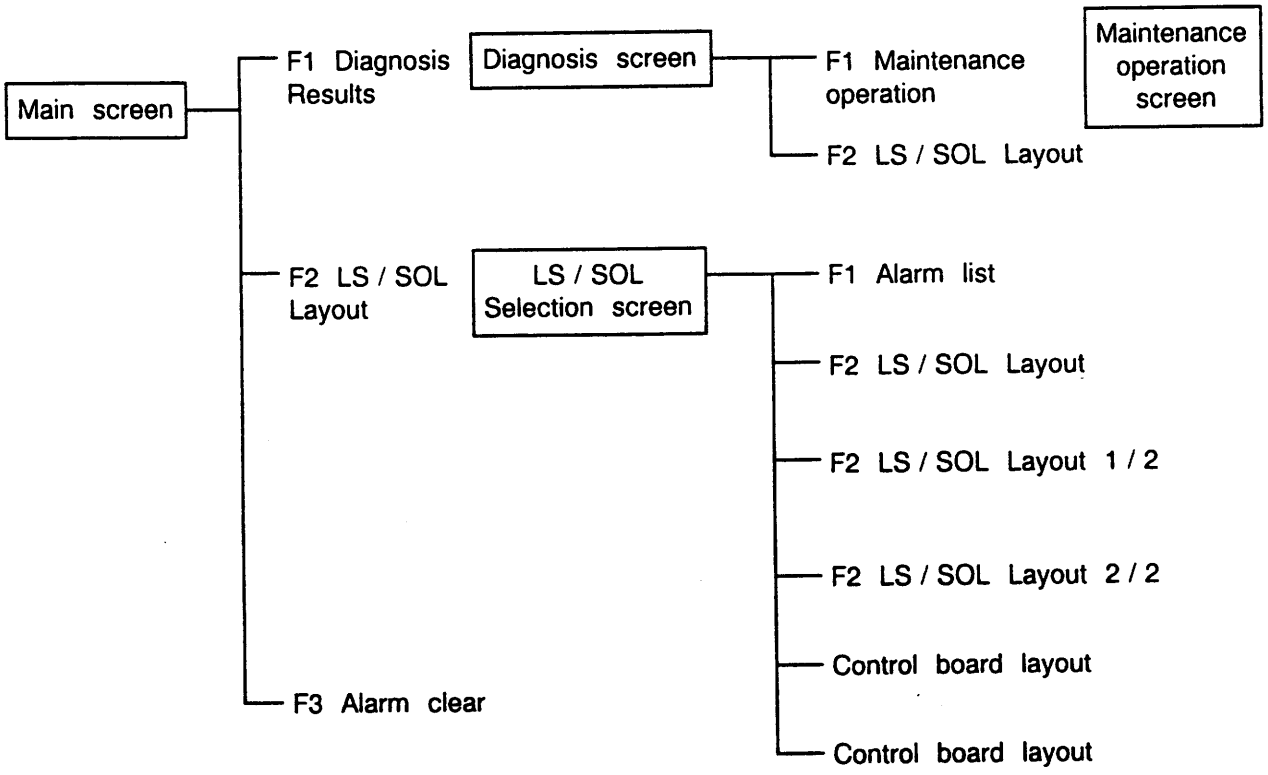
3. Detail Screen Explanation
   The locations to be checked-up or replaced are explained.
   - F1 : Information
     The information screen is displayed.
   - F2 : Periodical check-up return
     The main screen is displayed.

4. Information Screen Explanation
   The contents of the check-up or replacement are displayed.
   - F1 : Periodical check-up return
     The main screen is displayed.
   - F2 : Detail
     The detail screen is displayed.

3 Alarm Diagnosis

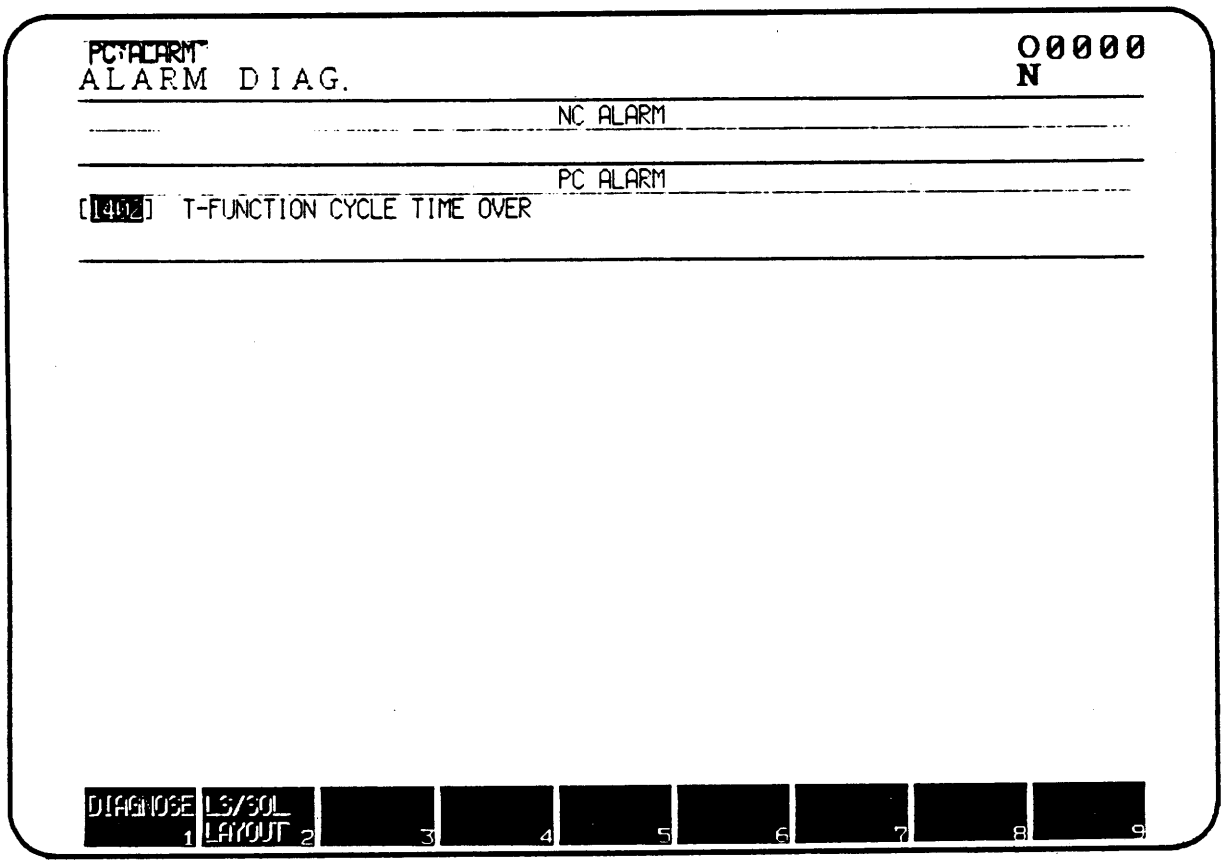
When an M16 III system, NC, or PC alarms occurs, the alarm diagnosis displays the contents of the alarm, and diagnoses the abnormal part. The alarm diagnosis also displays the layout of the limit switch, solenoid, and internal components of the control board.

1. Screen Configuration



2. Main Screen Explanation

Fig-1 Main Screen

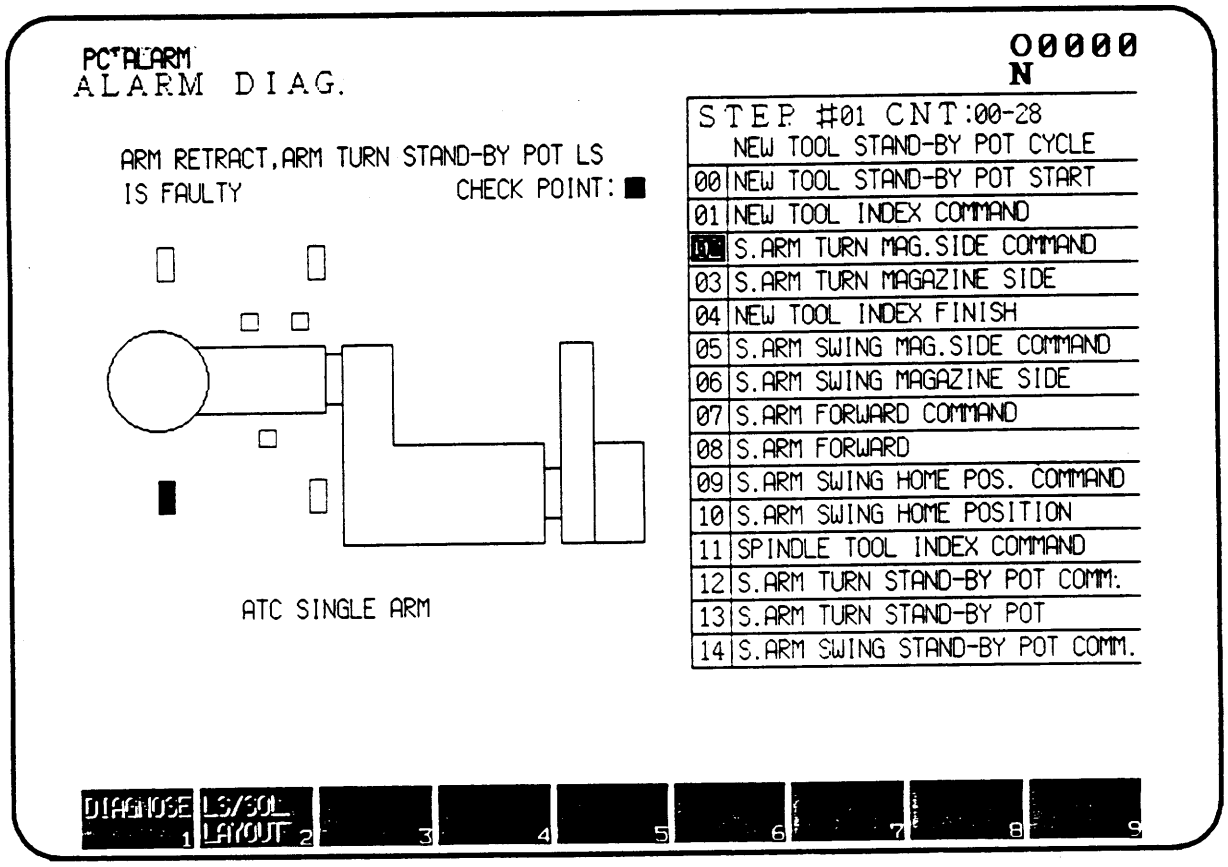


The main screen displays a list of the number and message of the current alarm.

- ═══ NC alarm ═══ : displays an NC alarm.
- ═══ PC alarm ═══ : displays the machine alarm created in the ladder sequence.
- F1 Diagnosis results : Align the cursor with the alarm number using the [↑] and [↓] keys. Press the [F1] key and the diagnosis screen will appear. When the screen of the diagnosis result is not available, a NO DIAGNOSIS SCREEN message will appear.
- F2 LS / SOL Layout : The LS / SOL Selection screen is displayed.
- F3 Alarm clear : The ═══ SYSTEM ═══ alarm is cleared (reset). However, if the alarm status still prevails, the alarm is not cleared. Likewise, the PC alarm is not cleared.

3 Diagnosis Screen Explanation

Fig-2 Diagnosis screen

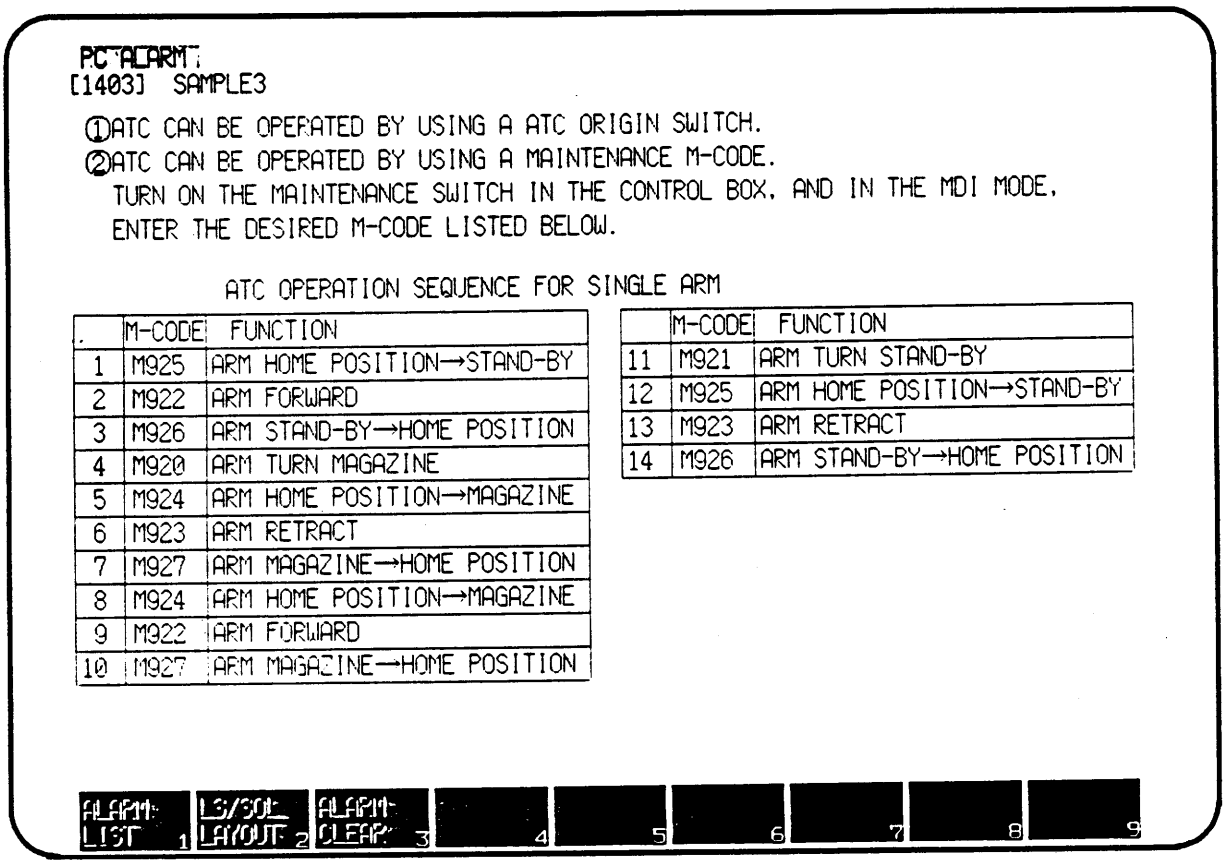


The diagnosis screen displays the location where the alarm occurred and, as a supplement, explains the alarm message. When an alarm occurs during an ATC cycle, a step ladder is displayed at the right half of the screen to show at which operation step during the cycle the alarm occurred. Select F1 Maintenance operation to be released from the alarm status. Select F2 LS / SOL Layout to know where the displayed limit switch is located in the machine.

- F1 Maintenance operation : The Maintenance operation screen is displayed.
- F2 LS / SOL Layout : The LS / SOL Selection screen is selected.

4. Maintenance Operation Screen Explanation

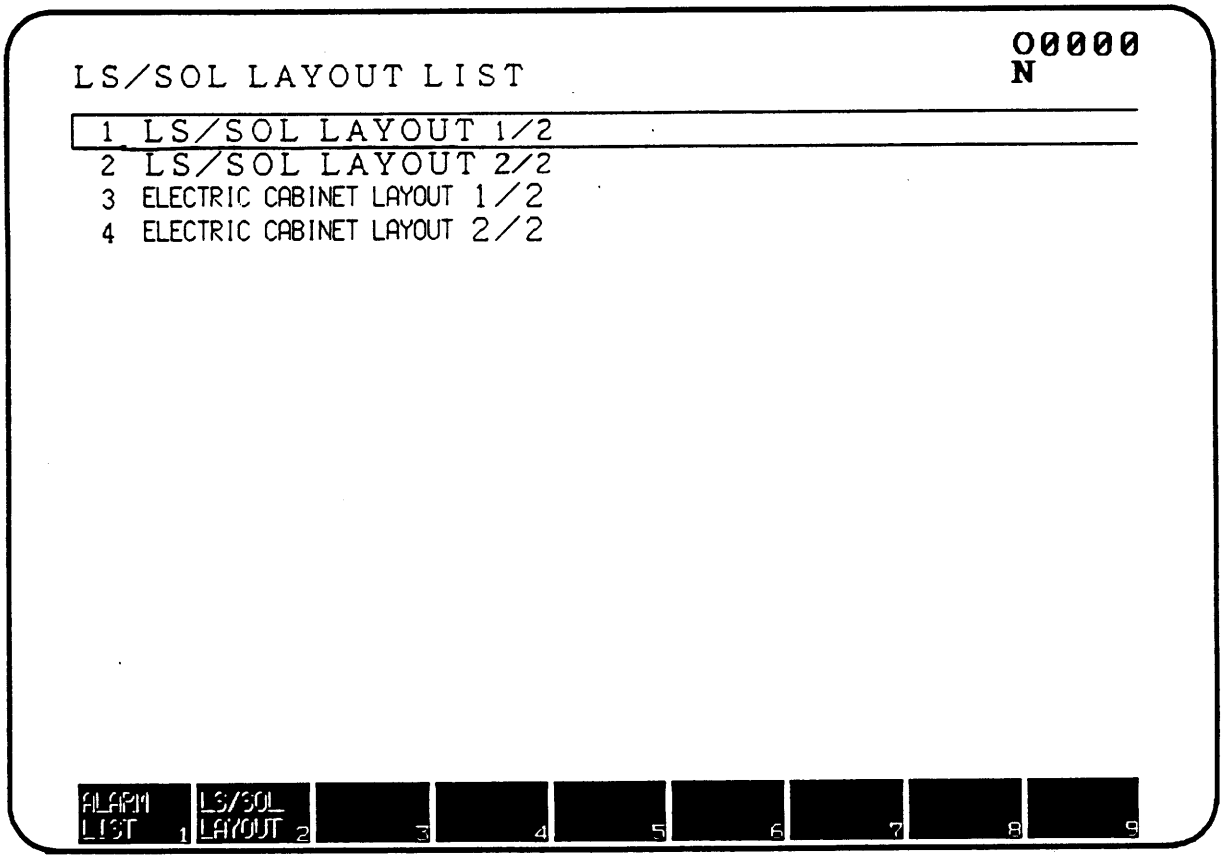
Fig-3 Maintenance Operation Screen



The Maintenance operation screen, effected by the Maintenance M code, displays the release procedure from the alarm status (when the release operation cannot be effected with the automatic reset switch). Since the location where the operation stopped can be determined through the step ladder on the Diagnosis screen, execute the succeeding operations using the Maintenance M code.

5. LS / SOL Selection Screen Explanation

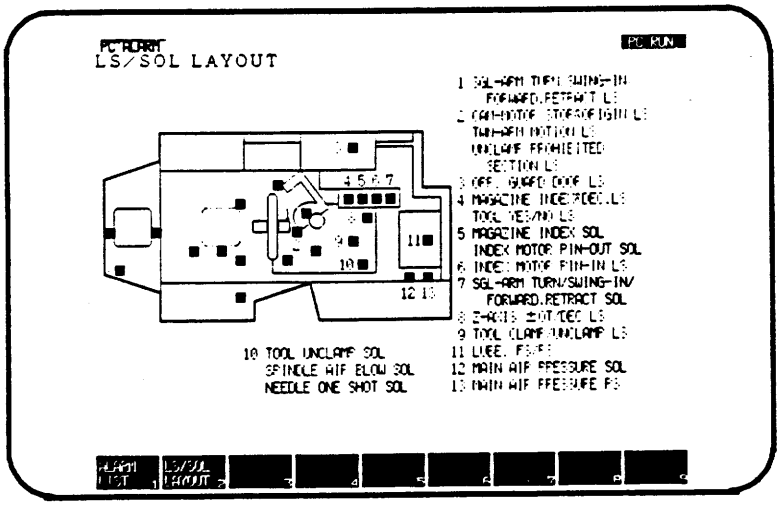
Fig-4 LS / SOL Selection Screen



Move the part enclosed by the frame with the ↑ and ↓ keys. Set the frame on the desired item, and press either the ALARM or F2 key. The following will then appear on the screen. (Example: Fig-5)

- F1 Alarm list : Returns to the main screen.

Fig-5 LS / SOL Layout Example



4 Status / OK Monitor Screen

Operation Procedure

Press the STATUS / OK button on the operation panel.

STATUS/OK MONITOR

STATUS		OK MONITOR	
SPINDLE R.P.M.	3600	MODE	AUTO
SPINDLE TOOL	10	SPINDLE OVERRIDE	100%
STANDBY TOOL	11	FEEDRATE OVERRIDE	150%
TABLE POS.	5	RAPID TR. OVERRIDE	100%
PALLET NO.	2	SINGLE BLOCK	OFF
WORK NAME	ABCDEFGH	MACHINE LOCK	OFF
COOLANT NOZZLE POS.	8	DRY RUN	ON
		Z AXIS CANCEL	OFF
		AXIS INTERLOCK	X, Y, Z 4, 5, 6 7
		ATC ORIGIN	OK
		APC/PPL ORIGIN	OK
		TABLE ORIGIN	OK
		DOOR INTERLOCK	NG

								SOFT KEY DELATION/9

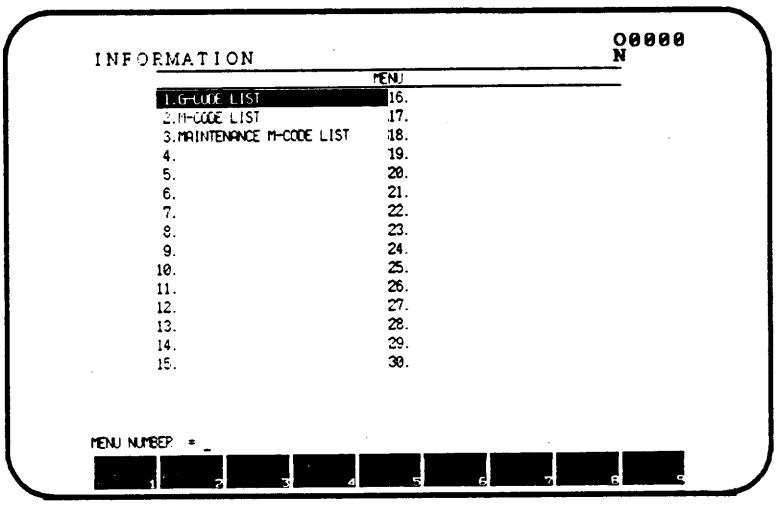
The machine status display will appear.

Note) The following displays are optional: Table position, Pallet Number, Work Name, Coolant Nozzle Position, Original APC / PPL Position, Original Table Position, and Door Interlock.

5 Information

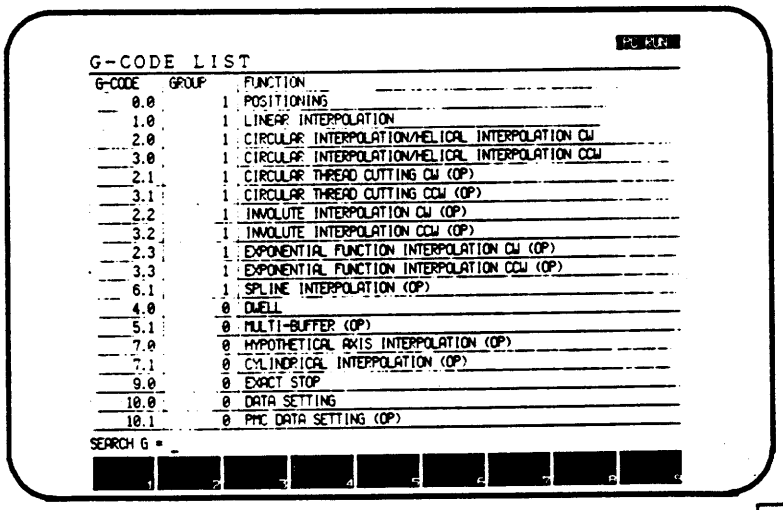
This function displays the machine's G, M, and Maintenance M codes (provided as the standards). It does not display special specifications.

Fig-1 Menu Screen



Key in the number of the desired item, and the menu number will appear at the lower left part of the screen. Otherwise, move the Black / White Reversal item using the [↑] and [↓] keys. Press the [RETURN] key and the G-code (or M-code) list will appear.

Fig-2 G-code List Screen



The Scroll (or Page Feed) of the screen can be executed with the [↑P] [P↓] [↓] [↑] keys. Press the [RETURN] key, and the initial screen will return.

G-code search example: searching for G28

- Key in [2] and [8], and SEARCH G=28 will appear at the lower left part of the screen.
- Press the [↓] key, and G28 will be placed at the head of the G-code list.

6 User's Function

This manual describes the support screen "User's Function" of the Type III (S-III, M-III).

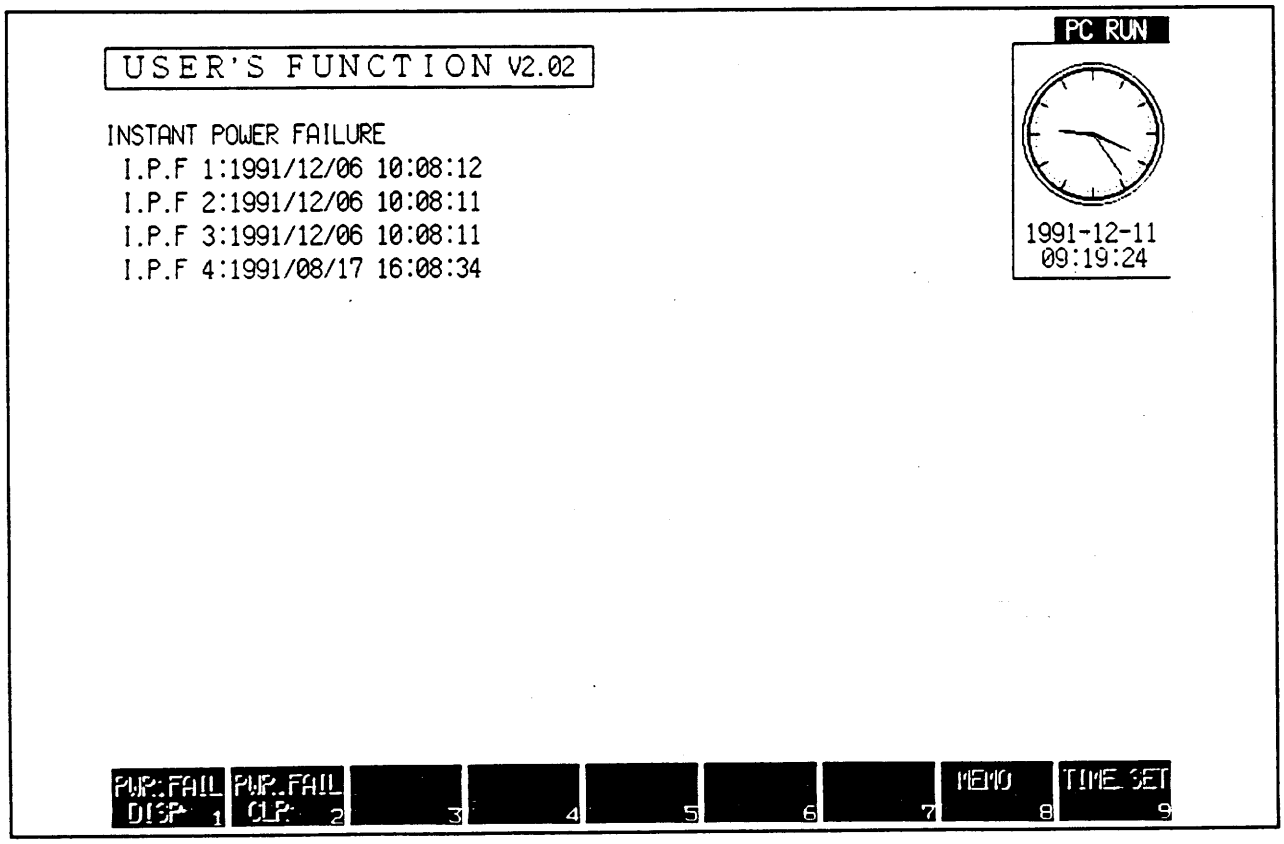
1. Specifications

Objective : To aggregate convenient functions.

Function :

- To display records of instantaneous power failure time
- To clear recorded data of instantaneous power failure time
- Memo function (message function)
- To set and display the clock

Select the "User's Function" menu, and the initial screen below will appear. The current time is displayed all the time at the right side of the screen, with the real time displayed in the form of an analog clock. If the hands of the clock are stationary, the clock is abnormal.



User's Function Screen Menu (An Example of Instantaneous Power Failure Time Display)

2. Displaying and Deleting Records of Instantaneous Power Failure Time

- Press the F1 key ("Instant Power Failure Display").

  ① The current record of instantaneous power failure time is displayed as follows:

```
INSTANT POWER FAILURE
   I. P. F.   1:1991/05/19   03:21:05
   I. P. F.   2:1991/05/19   05:15:12
   I. P. F.   3:1991/05/19   12:00:04
   I. P. F.   4:None
```

  ② Press the F1 key again to clear the display.

3. Clearing Recorded Data of Instantaneous Power Failure Time

- Press the F1 key ("Instant Power Failure Clear").

  ① The following message will appear:

  "POWER FAILURE History data can be Cleared? Y / N"

  ② Press the Y key to clear the display.

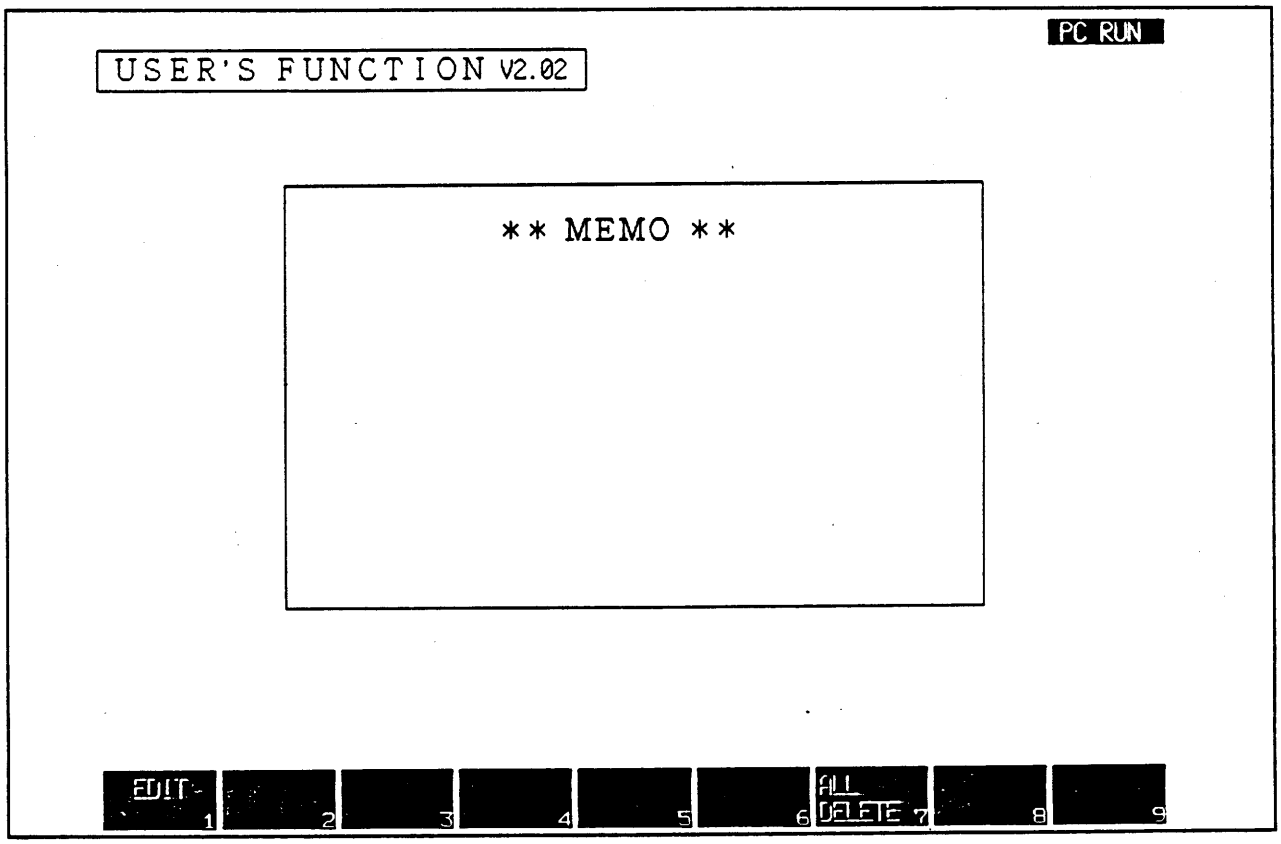
  As the contents of the records are cleared by the Y key, all the displays of the records' contents will be changed to "None."

```
INSTANT POWER FAILURE
   I. P. F.   1:None
   I. P. F.   2:None
   I. P. F.   3:None
   I. P. F.   4:None
```

4. Using a Memorandum Function

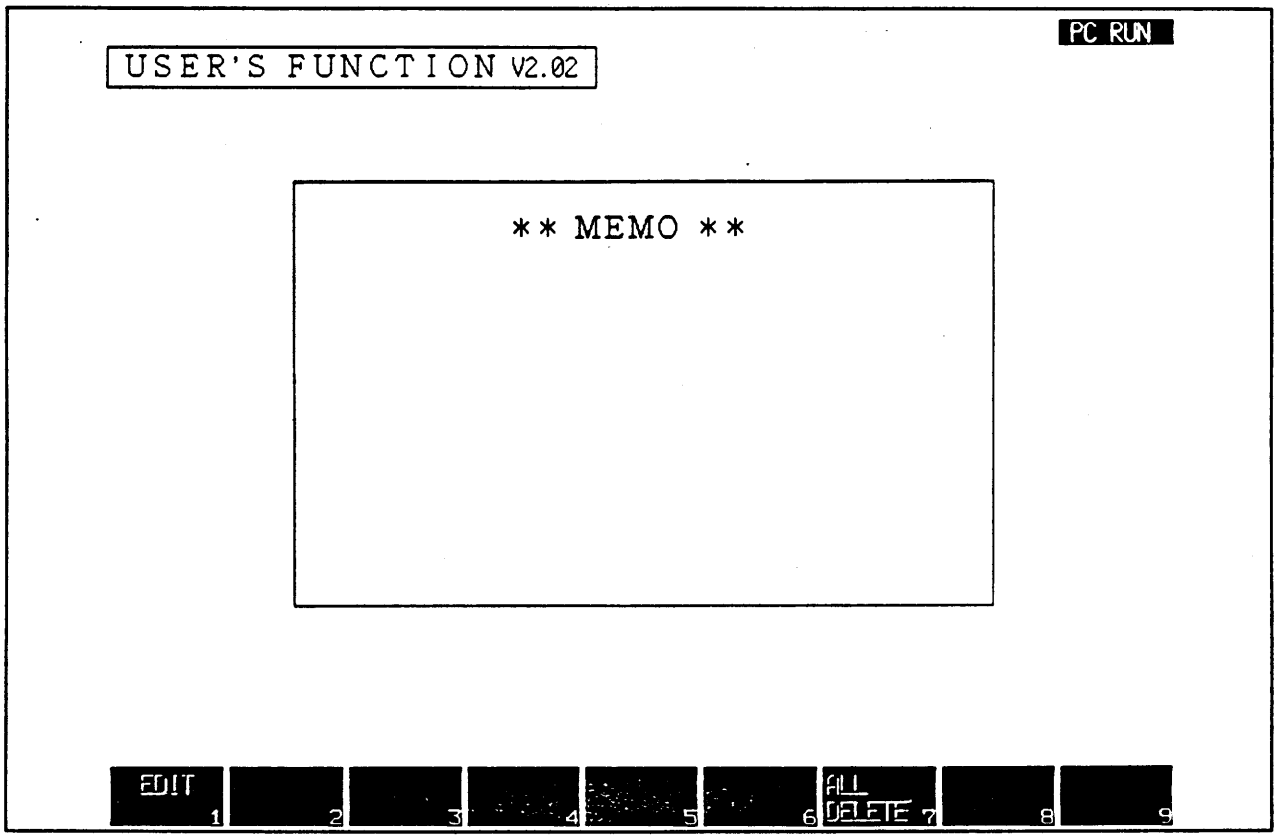
This function is convenient for leaving messages.

- Press the F8 key ("Memo"), and the message board figure below will appear.



Memo Initial Menu

- Press the RETURN key to return to the initial screen of the User's Function.



1. Mode Selection

(1) [F01] : Edit mode ····· used for editing documents (details on the next page).

※ The cursor is displayed, allowing for key input (" ↵ " represents line feed [RETURN]).

(2) [F07] : Delete mode ····· used for deleting documents.

※ When a verification message is displayed, select either one of the following symbols:

Y: to continue processing (deletes all documents)

N: to stop processing

(3) [RETURN] : Processing end ····· used for terminating the Memo processing.

2. Rules on Editing

(1) 48 characters (or 24 full-size characters) can be input in one line.

(2) A maximum of 10 lines can be input.

(3) Pressing the RETURN key feeds one line and "↵" displays the symbol.

(4) When more than 481 characters are input, an error message is displayed.

(5) Inputting can be done at any position within the cursor's movable area. However, pressing the RETURN key when the "↵" symbol appears in all lines causes an overflow in the editing buffer. As a result, an error message is displayed.

※ The error message is cleared by pressing any key.

(6) Since @ is treated as a special character, it cannot be input.

3. Character Input

F1	F2	F3	F4	F5	F6	F7	F8	F9
Half-size	Katakana	Hiragana	SJIS	Non-conversion (half-size)	Non-conversion (full-size)	Registration	Insert / Substitute	End

3-1 Conversion key

(Example) AIUEO

(1) [F1] : Half-size ····· AIUEO

(2) [F2] : Katakana ····· AIUEO

(3) [F3] : Hiragana ····· AIUEO

(4) [F4] : SJIS ····· does not convert (details on the next page)

(5) [F5] : Non-conversion (half-size) ····· AIUEO

(6) [F6] : Non-conversion (full-size) ····· AIUEO

※ Pressing any key other than the [NON-CONVERSION] key after inputting the non-convertible character or code will not cause conversion.

※ In case a series of full-size characters (including full and half-size" dakuon" characters) runs for more than 2 lines, the last character of the line becomes a blank space and that character move to the next line.

3-2 Shift JIS Key

When Kanji characters are necessary, it can be input using the Shift JIS code.

(Example) 93FA97A790B88B40

[F4] SJIS ····· 日立精機

※ The Shift JIS code cannot be converted if it is not properly input.

3-3 Function Key

(1) [F7] : Registration ····· data is registered

※ When a verification message is displayed, select either one of the following symbols

Y : to continue processing (contents of the Edit screen is registered into memory).

N : to stop processing (Edit mode is continued).

(When data is not input, messages are not displayed and the Edit mode is terminated.)

(2) [F8] : Insert / Substitute ····· Insert and Substitute modes are switched.

(3) [F9] : End ····· Edit mode is terminated.

※ When a verification message is displayed, select either one of the following symbols:

Y : to continue processing (contents of the Edit screen is not registered into memory).

N : to stop processing (Edit mode is continued).

(When data is not input, messages are not displayed and the Edit mode is terminated.)

3-4 Other Keys

(1) ENTER : Line feed ····· displayed in the Edit screen with the " ↵ "

※ Select this key and the " ↵ " symbol is displayed at the cursor's position; the cursor moves to the first column of the next line.

※ Likewise, use this key to separate data into two lines.

(2) DELETE : Deletion of one ····· character one character is deleted from the Edit screen.

※ Select this key when the cursor is on the " ↵ " symbol, and the data in the next line moves to the front. (Data is connected to the preceding line.)

※ Likewise, use this key to separate data into two lines.

(3) CANCEL : Cancellation ····· Input data is cancelled.

This key does two types of processing:

A. After data conversion, data before conversion can be displayed and reconverted.

B. Before data conversion, data is cancelled.

(4) INSERT : Insert / Substitute ····· Insert and Substitute modes are switched.

(5) P↑ : The cursor moves to the first column of the first line.

(6) P↓ : The cursor moves to the 48th column in the 10th line.

(7) ↓ ↑ ← → : The cursor moves to the left and right, up and down.

5. Setting the Clock

This is a function that sets the time of the clock on the SPHC board. The real time is displayed all the time at the right end of the screen.

- Press the F9 key ("Clock Setting").
  ① Input data within their respective setting ranges with respect to the following inquiries.
  The input item returns to the preceding item by pressing the CANCEL key. However, pressing the CANCEL key in the "Year in A. D. " item terminates the operation. If the data input is not within its range, the inquiry appears again and an error tone rings.

Year in A. D. (two digits)	··· 1990 to 2089	↑ Returns by pressing the CANCEL key.
Month	1 to 12	
Date	1 to 31	
Time (24-hour cycle)	0 to 23	
Minute	0 to 59	
Second	0 to 59	

  ② Set the specified time to the SPHC timer by inputting the "Second" item last.
  ③ End.
  ④ Check the real time clock at the left end of the screen.

Chapter 7 MAINTENANCE AND ADJUSTMENT

1. At the Time of the Alarm Lamp (Call Light, Yellow Rotary Light) is Turned On

In the following cases, the call light is lit up:

1) When the machine is stopped (suspended) by a program stop code (M00, M01, M02, M03, etc.) while executing the program.

2) When the ALARM lamp (red) on the operation panel is lit up: When the ALARM lamp is lit up, the machine comes "standstill" indicating that a trouble occurred.

1. Variety of alarm lamp and investigation and remedy of cause of trouble.

(1) Alarm related to the NC unit (NC alarm)
On the CRT screen of the NC unit, an alarm number and an alarm message are displayed. Referring to the NC Error Codes (Alarms) List, check and remove its cause.

Refer to "SEICOS MIII/A".

(2) Alarm related to the machine's devices or PC controls (machine alarm)

① Press the [RETURN] key on the operation box located at the machine side and the PC control.

② Press the [F4] key (alarm diagnosis) on the operation box in order to display the alarm content on the CRT.

③ The currently occurred alarm is displayed on the CRT.

In case of addition or alteration of alarm, it shows in the electric schematics.

2. Parameters

The parameter is an important factor to determine the characterics and functions of the machine. There are various types of parameters which characterize standard specifications and optional specifications, select the contents of specifications and the functions in details, and determine the capabilities of relevant functions and processing procedures.

1. Types of parameters and their contents

(1) NC parameters

Refer to NC Parameters List.

Their detailed contents are described in "SEICOS MIII/A".

(2) PC parameters

2. Handling of parameters

Since respective parameters have been set to proper values (data) by a machine manufacturer, the user normally does not have to change them. (However, a user macro area and a backlash/pitch error compensation area are excluded.)

Upon shipment of the machine, an actual NC/PC parameter values (setting data) list is packed together with the machine. Keep and make use of it when required for maintenance.

3. Alteration of PC parameter setting

① [RETURN] → [FRONT/BACK] → [F6] : System → [4] : PC menu [INPUT]
[F8] : System table [INPUT] → [F 5] : Press the keys in order of Bit

The following table is displayed.

Data setting (Bit table)

Address	7 6 5 4 3 2 1 0	Address	7 6 5 4 3 2 1 0
F 2 E 0	X X X X X X X X	F 2 F 0	X X X X X X X X
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
A		A	
B		B	
C		C	
D		D	
E		E	
F		F	

X X X X X X X X = (Y Y Y Y Y Y Y Y)

② [F 9] : Press the ALTER key. The characters of the "WRITE ENABLE SW ON" are displayed on the lower part of the screen.

③ Turn ON the SW1 (Write enable switch) on the LSP printed circuit board in the NC cabinet.

④ Move the cursor to F2F0 by the ↑, ↓, →, ← keys.

⑤ Enter the value wanted to be altered by YY .... Y and press the [INPUT] key.

XX .... X : Current parameter value.
YY .... Y : Value wanted to be altered.

⑥ Press the [RETURN] key after the alteration is completed.

⑦ The characters of "WRITE ENABLE SW OFF" is displayed.
Turn the SW1 OFF. The alteration is finished by the above procedures.

4. Data setting of melody horn

By PC parameter setting, a melody horn function can be selectively enabled or disabled for the following 8 kinds of use. The numbers selected for respective uses and their playing time are as shown in the table below:

(1)

	Start condition	Time	Number
①	While an alarm is ON	During alarm	"Bim-Bon" (Chime)
②	After the machine is set ready for operation	12 sec.	Amaryllis
③	After M30 is read	12 sec.	#40 by Mozart
④	While machining completion is notified	During notification	Beep
⑤	After M02 is read	12 sec.	Nocturne
⑥	While the APC is in operation	During operation	Menuette
⑦	After M26 is read*	12 sec.	La Piére
⑧	After M27 is read*	12 sec.	Für Eliese

* It is possible to use it for an arbitrary block in programming.

(2) The 8 number above can be enabled/disabled by setting of the PC parameter.

Parameter	7	6	5	4	3	2	1	Bit 0
F2F0	M27	M26	APC	M02	Completion call	M30	Ready	Alarm
	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0

1 : Disabled
0 : Enabled

(3) The melody can be shut by pressing the "Call light OFF" button.

(4) Adjust the volume with the variable resistor on PC board.

5. Parameters that an operator can select

As shown under, an operation can be selected by changing the parameter. Select to use in accordance with operation such as machining way and chip carrying-out way. (As to the changing way, refer to page 7-3.)

PARAMETER TABLE

No.	7	6	5	4	3	2	2	1	bit	ADDRESS
08										F2E7
										02E7

bit	data	CONTENTS	NC
0	0	Coolant hold function is ineffective.	
	1	Coolant hold function is effective.	
1	0	Coolant hold VDE is ineffective.	
	1	Coolant hold VDE is effective.	
2	0	M05 coolant stop is ineffective.	
	1	M05 coolant stop is effective.	
3	0	Gun coolant energy saving timer is ineffective.	
	1	Gun coolant energy saving timer is effective.	
4	0	Flat conveyor continuous operation	
	1	Flat conveyor intermittet operation	
5	0	M02/M30 flat convyor stop is ineffective.	
	1	M02/M30 flat conveyor stop is effective.	
6	0	Oil mist continous operation	
	1	Oil mist pulse operation	
7	0	One-shot mist is ineffective.	
	1	One-shot mist is effective.	

PARAMETER TABLE

No.	7	6	5	4	3	2	2	1	bit	ADDRESS
09										F2E8
										02E8

bit	data	CONTENTS	NC
0	0	Mist posture control is ineffective.	
	1	Mist posture control is effective.	
1	0		
	1		
2	0	Chip conveyor stop M122 is ineffective.	
	1	Chip conveyor stop M122 is effective.	
3	0		
	1		
4	0		
	1		
5	0		
	1		
6	0		
	1		
7	0	Chip cleaning door interlock is ineffective.	
	1	Chip conveyor door interlock is effective.	

3. List of Limit Switch Number

*Mark : Option

	LS No.	Use	Model	Manu-facturer	Location
			Machine		
	LS 1A	X-axis - Over-travel	SL1-A	Yamatake	Head
	LS 1B	X-axis + Over-travel	SL1-A	Yamatake	Head
	LS 2A	X-axis reference point return deceleration	SL1-A	Yamatake	Head
*	LS 75A	X-axis external deceleration	SL1-A	Yamatake	Head
*	LS 75B	X-axis external deceleration	SL1-A	Yamatake	Head
	LS 6A	Y-axis - Over-travel	LDV-5412	Yamatake	Head
	LS 6B	Y-axis + Over-travel	LDV-5412	Yamatake	Head
	LS 7A	Y-axis reference point return deceleration	LDV-5412	Yamatake	Head
*	LS 76A	Y-axis external deceleration	LDV-5412	Yamatake	Head
	LS 10A	Z-axis - Over-travel	LDV-5412	Yamatake	Head
	LS 10B	Z-axis + Over-travel	LDV-5412	Yamatake	Head
	LS 11A	Z-axis reference point return deceleration	LDV-5412	Yamatake	Head
*	LS 77A	Z-axis external deceleration	LDV-5412	Yamatake	Head
	PS-1	Air source pressure	PE-2T	CKD	Front side of machine
	PS-9	Lubrication oil pressure switch		LUBE	Lubrication tank
	FS-1	Lubrication float switch		LUBE	Lubrication tank
			Head		
	LS 16B	Tool unclamp	SL1-H	Yamatake	Head
	LS 16A	Tool clamp	SL1-H	Yamatake	Head
	PS-6	Air for OL lubricating	PE-4T	CKD	Head
	PS-8	Oil for OL lubricating	SPS-8T	Showa	Head
	FS-11	Reservoir for spindle cooling	OLV-2B-2	Showa	Head
*	LS145A	Tool contact check		Wako	Head

*Mark : Option

	LS No.	Use	Model	Manu-facturer	Location
	Detection check				
	LS 31A	Tool contact check	T-20B-14-16F	Metrol	Saddle
	Splash cover				
*	LS 32A	Operator side door Open (Safety measure)	1LS1-J	Yamatake	Splash cover
*	LS 32B	Operator side door Closed (European safety measure)	DIN43694 31ZS1-C	Honeywel	Splash cover
*	LS 32A	Operator side door Open (European safety measure)	DIN43694 31ZS1-C	Honeywel	Splash cover
*	LS400A	Operator side door Closed (European safety measure)	TZFS-24VDC	SSR(Elan)	Splash cover
*	LS400B	Operator side door Open ... ... Left door (European safety measure)	DIN43694 31ZS1-C	Honeywel	Splash cover
*	LS400C	Operator side door Open ... ... Right door (European safety measure)	DIN43694 31ZS1-C	Honeywel	Splash cover
	Coolant				
*	FS-2	Coolant tank float switch			Coolant tank
*	PS-7	Oil hole indicator	ED-02	Taisei	Coolant tank
	LS-200	Clogging of line filter (Through coolant)	G-51-06 -20μW-EV	Taisei	Rear side of machine

*Mark : Option

	LS No.	Use	Model	Manu-facturer	Location
	ATC				
	LS 43A	Double arm Forward	FL7M-3J6HD -L10	Yamatake	ATC
	LS 43B	Double arm Reverse	FL7M-3J6HD -L10	Yamatake	ATC
	LS 47A	Double arm Advance	FL7M-3J6HD -L10	Yamatake	ATC
	LS 47B	Double arm Retract	FL7M-3J6HD -L10	Yamatake	ATC
	LS 48A	Swing-in arm Spindle side	FL7M-3J6HD -L5	Yamatake	ATC
	LS 48B	Swing-in arm Magazine side	FL7M-3J6HD -L5	Yamatake	ATC
	LS 49A	Magazine Right turn	FL7M-3J6HD -L5	Yamatake	ATC
	LS 49B	Magazine Left turn	FL7M-3J6HD -L5	Yamatake	ATC
	LS 52B	Magazine index motor Pin OUT	SL1-D	Yamatake	Index motor
	LS 57A	Arm slide Magazine side	FL7M-3J6HD -L5	Yamatake	ATC
	LS 55B	Arm slide Original position	FL7M-3J6HD -L5	Yamatake	ATC
	LS 56A	Arm slide Spindle side	FL7M-3J6HD -L5	Yamatake	ATC
	LS 54A	Tool Presence	FL7M-3J6HD -L5	Yamatake	ATC
	LS 48C	M06 Completion	FL7M-3J6HD -L5	Yamatake	ATC
*	LS146A	Safety guard door Open	1LS1-J	Yamatake	ATC
*	LS412A	Magazine door Closed (European safety measure)	TZFS-24VDC (Built-in LS)	SSR(Elan)	ATC
*	LS412B	Magazine door Open (European safety measure)	DIN43694 -31ZS1-C	Yamatake	ATC

4. List of Solenoid Valves

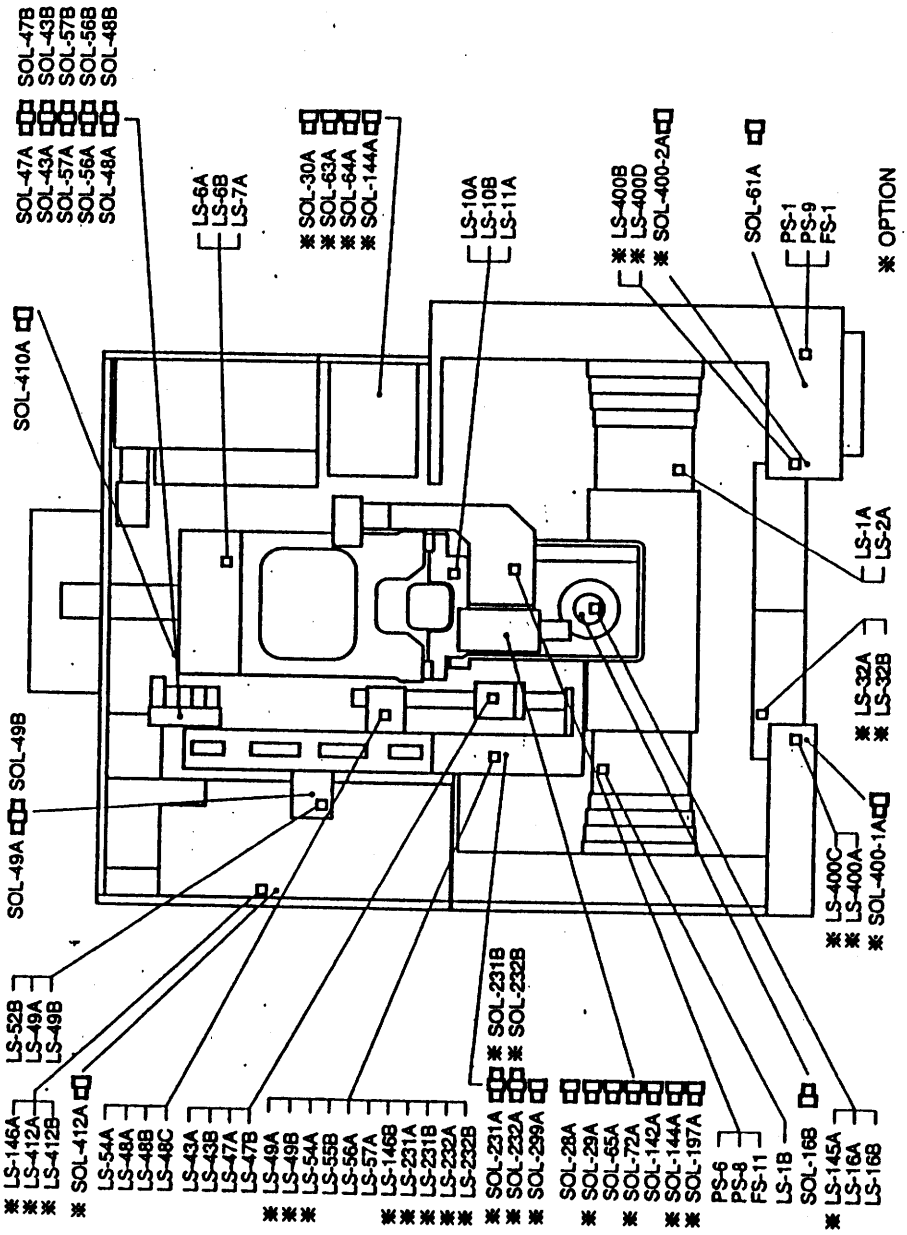
*Mark : Option

	SOL No.		Use		Model	Manu-facturer	Location
	Machine						
	SOL61	A	Air source pressure	IN	AB41-02-5-02G -AV100V	CKD	Front side of machine
*	SOL199	A	RENISHAW receiving section Air blow	IN	AB41-02-5-02G -AC100V	CKD	Splash cover
*	SOL400	A	Splash cover door Lock (European safety measure)	IN	TZFS-24VDC	SSR (Elan)	Splash cover
*	SOL410	A	Air blow to prevent clogging of filter in the coolant tank (European safety measure)	IN	AB41-02-5-02G -AC100V	CKD	Rear side of machine
*	SOL339	A	Air blow for air curtain at front door	OUT	AB41-02-5-02G -AC100V	CKD	Splash cover
	Head						
	SOL16	B OFF	Tool	Un-clamp Clamp	KSO-G02-2BA-10-N (Single SOL)	Daikin	Head
	SOL28	A	Spindle air blow	OUT	AB41-02-5-02G -AC100V	CKD	Head
*	SOL144	A	Needle One shot	OUT	AB21-01-1-02G -AC100V	CKD	Right side of machine
*	SOL28	A	Spindle through Air blow	OUT	AB41-02-5-02G -AC100V	CKD	Head
*	SOL197	A	DIN spindle through Air blow	OUT	AB41-02-5-02G -AC100V	CKD	Head
*	SOL29	A	Measurement Air blow	OUT	AG43-02-4-02G -AC100V	CKD	Head
*	SOL30	A	Mist coolant	OUT	AG31-01-1-02G -AC100V	CKD	Right side of machine
	SOL65	A	Air for OL lubricating	OUT	AB41-02-5-02G -AC100V	CKD	Head

*Mark : Option

	SOL No.		Use		Model	Manu-facturer	Location
*	SOL63		2-position mist coolant nozzle direction limit upper		AG31-01-1-02G -AC100V	CKD	Right side of machine
*	SOL64		2-position mist coolant nozzle direction limit lower		AG31-01-1-02G -AC100V	CKD	Right side of machine
*	SOL72	A	Tool noze aie blow	OUT	AB41-02-5-02G -AC100V	CKD	Head
	SOL142	A	Air for OL lubricating	OUT	VXD2130-02-1DS-B	CKD	Head
	ATC						
	SOL43	A	Double arm Turn	Forward	KSO-G02-2CA -10-N	Daikin	ATC
		B		Reverse			
	SOL47	A	Double arm Befor and behind	Advance	KSO-G02-2CA -10-N	Daikin	ATC
		B		Retract			
	SOL48	A	Arm swing-in	Spindle side	KSO-G-2-2CA -10-N	Daikin	ATC
		B		Magazine side			
	SOL49	A	Magazine Turn	Right	KSO-G02-4CA -10-N	Daikin	ATC
		B		Left			
	SOL56	A	Arm slide	Magazine side	KSO-G02-2CA -10-N	Daikin	ATC
		B		Original position			
	SOL57	A		Spindle side	KSO-G02-2CA -10-N	Daikin	ATC
	SOL412	A	ATC magazine interlock (European safety measure)	IN	TZFS-24VDC	SSR (Elan)	ATC
	Detection checking device						
	SOL189	A	Breakage detection sensor air blow	OUT	AB41-02-5 -02G-AC100V	CKD	Saddle

5. Layout of Limit Switches and Solenoid Valves



6. Listd of Motors

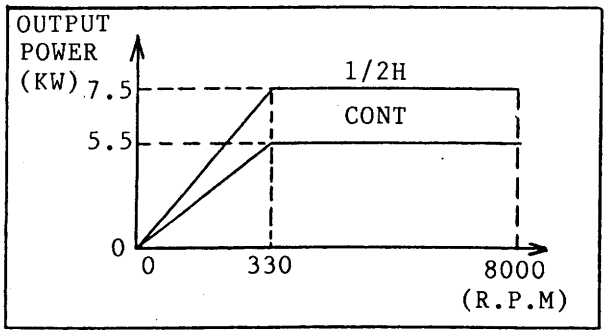
6.1

Use	Model	Output (KW)		Pole number Revolution	Voltage (V)	Frequency (Hz)	Location
		Continuous	%ED				
For spindle NT40	SJ-2B4606K	5.5	7.5 50% ED	60～8000	AC 200		Head
For spindle NT50	SJ-2B4606K	5.5	7.5 50% ED	45～4500	AC 200		Head (Option)
For X-axis feed	DFSM-2030 502A NEC	2.3		Max.3000	AC 200		X-axis head
For Y-axis feed	DFSM-2030 502A NEC	2.3		Max.3000	AC 200		Y-axis head
For Z-axis feed	DFSM-3020 502A NEC	3.3		Max.2000	AC 200		Z-axis head

6.2 Spindle drive unit

Type FR-SF-2-7.5KP-DC/FR-SF-2-11KP-DC [NT40/NT50]

min^{-1}	330/220	8000/4500
CONT(KW)	5.5/5.5	5.5/5.5
1/2(KW)	7.5/7.5	7.5/7.5
VOLT	Max 200V	
AMP	Max 77A/97A	

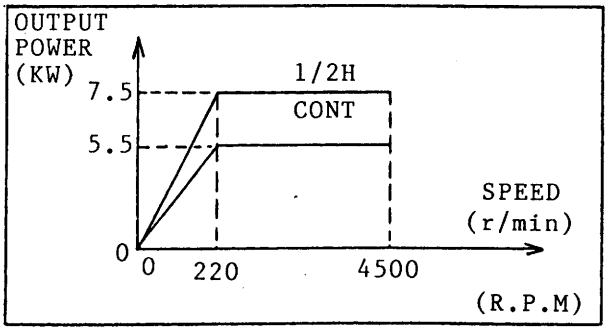


NT40 Stationary time:

Output - Speed characteristics

6.3 Amplifier of axis drive

AC servo amplifier ADU-20F2S	1	X-axis, Y-axis 20A output
AC servo amplifier ADU-20FIX	1	Z-axis 35A output
Power source of direct device PCU05	1	5KW output
Resister of regene regeneration BPR-05L	1	XY-axis 100W
Resister of regene regeneration BPR-05	2	Z-axis 200W



NT50 Stationary time:

Output - Speed characteristics

Motors

Model	Use Manufacture	Output(KW) Cont.	Output(KW) %ED	Pole number Revolution	Voltage(V)	Frequence (Hz)	Current(A)	Location	Remarks
For outside machine chip conveyor	SM20GCED400-R Tsubakimoto-Emerson	0.1		4P	AC200 /200 220	50/60	0.65 /0.6 0.6	Left side of machine	Option
For inside machine chip conveyor	GFM-18-50-010 Nissei Kogyo	0.1		4P	AC200 /200 220	50/60	0.63 /0.57 0.58	Column, Worker side	
Magnetic separator	41K25GKST2 4GK180K Oriental Motors	25W		4P	AC200 /200 220	50/60	0.25	Coolant tank	Option
For hydrauli tank	Daikin	1.5	CONT	4P	AC200 /200 220	50/60	6.8 6.2 6.3	Hydraulic tank	
For lubricat ing tank	Ryube	20W		2P	100	50/60	0.83 /0/64	Lubricat-ing tank	
For spindle cooling compressor	806 323 83 Kanto Seiki	0.3		2P	AC200 /200 220	50/60	MAX 2.4	Right side of machine	
Circulation pump of cooling device	2MY200-208 HAEMVK Kanto Seiki	0.2		4P	AC200 /200 220	50/60	MAX 1.6	Right side of machine	
For flood coolant	LSW15A0.18 Kyokuto	0.18		2P	AC200 /200 220	50/60	1.1 /1.2	Coolant tank	
For oil hole coolant	TOP02MY400 208HWMCP-VBE5K -10 NOP	0.4		4P	AC200 /200 220	50/60	2.2 /1.93 1.91	Coolant tank	Option
For gun coolant	VKP073A Fujidenki	0.18		2P	AC200 /200 220	50/60	0.85 /1.0	Coolant tank	Option
For jet coolant (cleaning in the machine)	LPS401A-0.75 Kyokuto	0.75		4P	AC200 /200 220	50/60	3.5 /3.3 3.2	Coolant tank	Option

7. How to Manage at Power Failure

(It is the same when charging an emergency stop during operating.)

When a power failure occurs while the machine is operating, the N/C unit and the main control cabinet of the machine are totally turned "OFF", and the commands stored in the N/C unit and the electric commands given by the manual operation button are totally cleared. And the machine stops instantly. Even after restoring from the status of power failure, the N/C unit and the control circuit of the machine cannot be operated, unless the power supply [ON] of the N/C unit and the [STANDBY] button are pressed again.
Be extermely careful when pressing the [STANDBY] button. Because the machine mat operate to complete the remaining movements which were operating before the power failure, depending on the circuit hydraulic.

Operation or status immediately before power failure	Status or movements when the control circuit is energized after restoring from power failure	Operation after restoring from power failure
In spindle rotation	Stop	
In spindle stop	Stop	
In spindle change speed	Stop	Command S4 digits by MDI
In spindle orientation	Stop	Command M19 by MDI
Tool clamp	Tool clamp	
Tool unclamp	Tool clamp	
X. Y. Z axes	Stops in the status immediately before power failure	
In coolant discharging	Stop	
In mist discharging	Stop	
In chip conveyor	Stop	

1. Power failure or emergency stop while the ATC is operating.

- ATC reference point return function

  This is a function for making easier to restore after an emergency stop or a power failure in ATC.

1) Operation method

   ① Set the mode of the main operation box to the manual.

   (Feed, repaid traverse, reference point return and manual pulse generator etc.)

   ② Press the ATC reference point return" button on the ATC operation box.

   The lamp lights up while the ATC return cycle is performing.

2) Status and moving procedures while it stops

Item	Stop status	Restoration procedure
ATC arm magazine side		
1	a Double arm right end b Arm slide between retract and original position c Arm swing-in magazine side	Arm slide original position
2	a Double arm left end/ Double arm between left and right b Arm slide retract end c Arm swing-in magazine side	Double arm left → Arm slide advance → Double arm right
3	a Double arm left end b Arm slide between retract and original position c Arm swing-in magazine side	Arm slide advance → Double arm right
4	a Double arm between left and right b Arm slide original position c Arm swing-in magazine side	Double arm right

Item	Stop status	Restoration procedure
ATC arm spindle side		
1	a Double arm ascent end b Arm slide original position c Arm swing-in between magazine and spindle d Double arm turn end	Arm swing-in magazine side
2	a Double arm ascent end b Arm slide advance end/ Arm slide between advance and original position c Arm swing-in spindle side d Double arm turn end	Arm slide retract → Arm swing-in magazine side
3	a Double arm descent end/ Double arm between descent and ascent b Arm slide advance end c Arm swing-in spindle side d Double arm turn end	Double arm descent → Tool clamp → Spindle positioning → Tool unclamp → Double arm ascent → Tool clamp → Arm slide retract → Arm swing-in magazine side
4	a Double arm descent end b Arm slide advance end c Arm swing-in spindle side d Double arm turning	Double arm turn → Tool clamp → Spindle positioning → Tool unclamp → Double arm ascent → Tool clamp → Arm slide retract → Arm swing-in magazine side

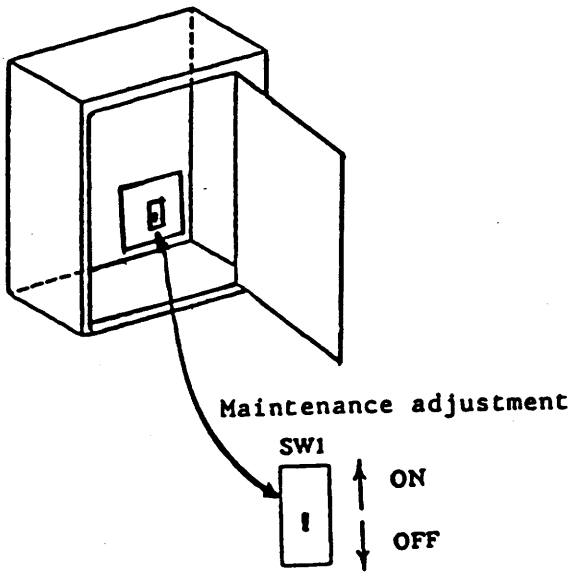
If ATC original position return is not executed completely, execute individual motion by maintenance M code.

(Refer to the movement diagram in page 5-83.)

2. Adjustment switch on control cabinet

SW No.	Name	Use
SW 1	Maintenance	Individual motion of ATC or APC can be done by executing the maintenance M code at this switch is ON.

* As the switch 1 above is for adjustment, turn off unless it is required.



8. ATC Retry Function

1. ATC retry function and retry record

1) Retry function

The retry function is a function the solenoid on the opposite side is exited to return and the solenoid commanded again is exited when the unit of each movement is not turned ON for the exite of the solenoid through checking the limit switch etc. though a fixed time (about 7 seconds) has passed.

No.	Name	Retry movement	Remarks
1	Double arm advance	Double arm advance → Retract → Advance again	
2	Double arm retract	Double arm retract → Advance → Retract again	
3	Arm swing-in magazine side		
4	Arm swing-in spindle side	Arm swing-in spindle side → Magazine side → Spindle side again	
5	Arm slide original position	① Movements from the arm swing-in magazine side Arm slide original position → Magazine side → Original position again ② Movements from the arm swing-in spindle side Arm slide original position → Spindle side → Original position position again	
6	Arm slide magazine side	Arm slide magazine side → Original position → Magazine side again	
7	Arm slide spindle side	Arm slide spindle side → Original position → Spindle side again	
8	Tool clamp	Tool clamp → Tool unclamp → reclamp	
9	Tool unclamp	Tool unclamp → Tool clamp → reunclamp	

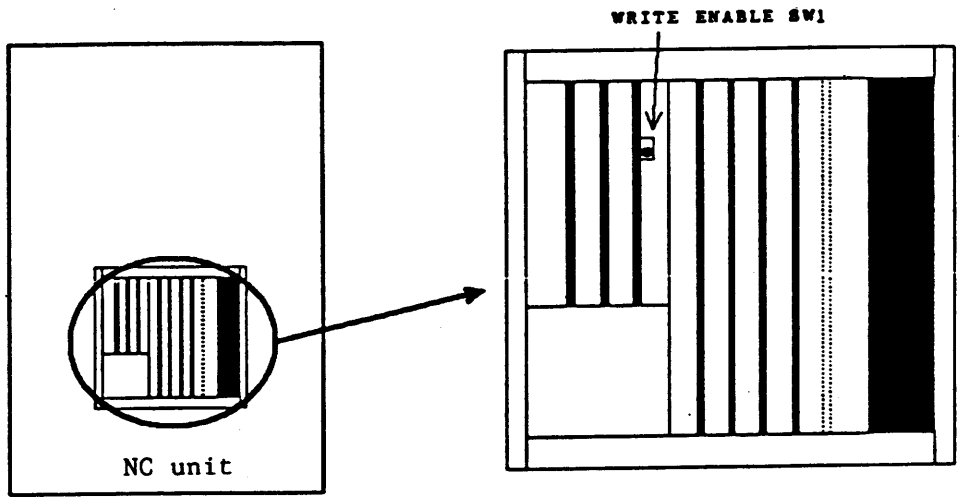
2. Correction of pot No. of ATC tool magazine

When the registered storage Nos. for the pot No. goes wrong, correct it in accordance with the following procedures.

① Set the machine to the state of the emergency stop (NC ON, hydralics ON) by pressing the "Emergency stop" posh button.

② Enter the following data in turn by pressing the function key and the numeric key; "Return" (General screen) → "Front/rear" → "F4/work coordinate" (System) → "F6" (PC menu) → "Input" → "11" (AB phase table) → "Input" → "F9" (Alterration).

③ The "WRITE ENABLE SW ON" is displayed on the lower part of the screen. Turn ON (Upper side) the SW1 (Write enable switch) on the "LSPC" Substrate in the NC unit.



Rear side of the door of control cabinet

AB phase table

No.	Ring counter	Current counter	Multiplier	Distance	Set status	Count status
01	*A 20	*B 1	0	0	00	00
02	0	0	0	0	00	00
03	0	0	0	0	00	00
04	0	0	0	0	00	00
05	0	0	0	0	00	00
06	0	0	0	0	00	00
07	0	0	0	0	00	00

*A: Total number of magazine pot (At 20 tools)

*B: Pot No. standby position

④ Set the cursor to the "CURRENT COUNTER" No.1 and enter the same No. as the pot No. of the standby position.
Since the magazine pot No. and the register are correctly set by this process, the pot No. counting since then will be correctly performed corresponding to the pot No..

⑤ The "WRITE ENABLE SW OFF" is displayed on the lower part of the screen by pressing the "Return" key.
Turn OFF (Lower side) the switch SW1 that was turned ON a little while age.

⑥ Press the "Return" key to return to the general screen.

Correction of the tool number at the spindle/standby position

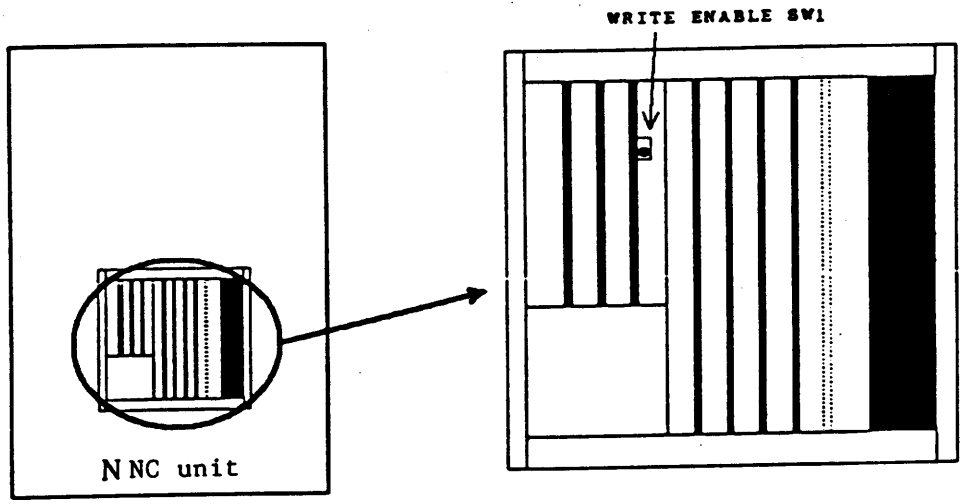
When the spindle tool T/standby tool T and the tool No. of the spindle/standby position on the left lower part of the general screen go wrong, correct them in accordance with the following procedures.

① Set the machine to the state of the emergency stop (NC ON, hydraulics OFF) by pressing the "Emergency stop" push button.

② When "Return" (General screen) → "Front/rear" → "F4/work coordinate" (System) → "F6" (PC menu) → "Input" → "8" (System table) → "Input" are entered in turn by pressing function key and the numeric key, the screen for the system table will be displayed.

③ Press the "F9/selection/function" (Alteration) key.
The "WRITE ENABLE SW ON" is displayed.

④ Turn ON (Upper side) the SW1 (Write enavle switch) on the "LSPC" substrate in the NC unit.



Raer side of the door
of control cabinet

⑤ Make the spindle position tool No. and the standby position tool No. coincide with respective number register address for spindle/standby. Press the "F3/tool" (WORD decimal).

System table

D000	65535	D020	58535	D040		D060	0
D002	65510	D022	55535	D042		D062	0
D010	65035	D030	------	D050	*a--	D070	0
D012	64835	D032	------	D052	0	D072	0
D014	64535	D034	------	D054	*b--	D074	0
D016	64185	D036	0	D056	0	D076	0
D018	63685	D038	0	D058	0	D078	0

*a: Spindle tool No. data

*b: Standby tool No. data

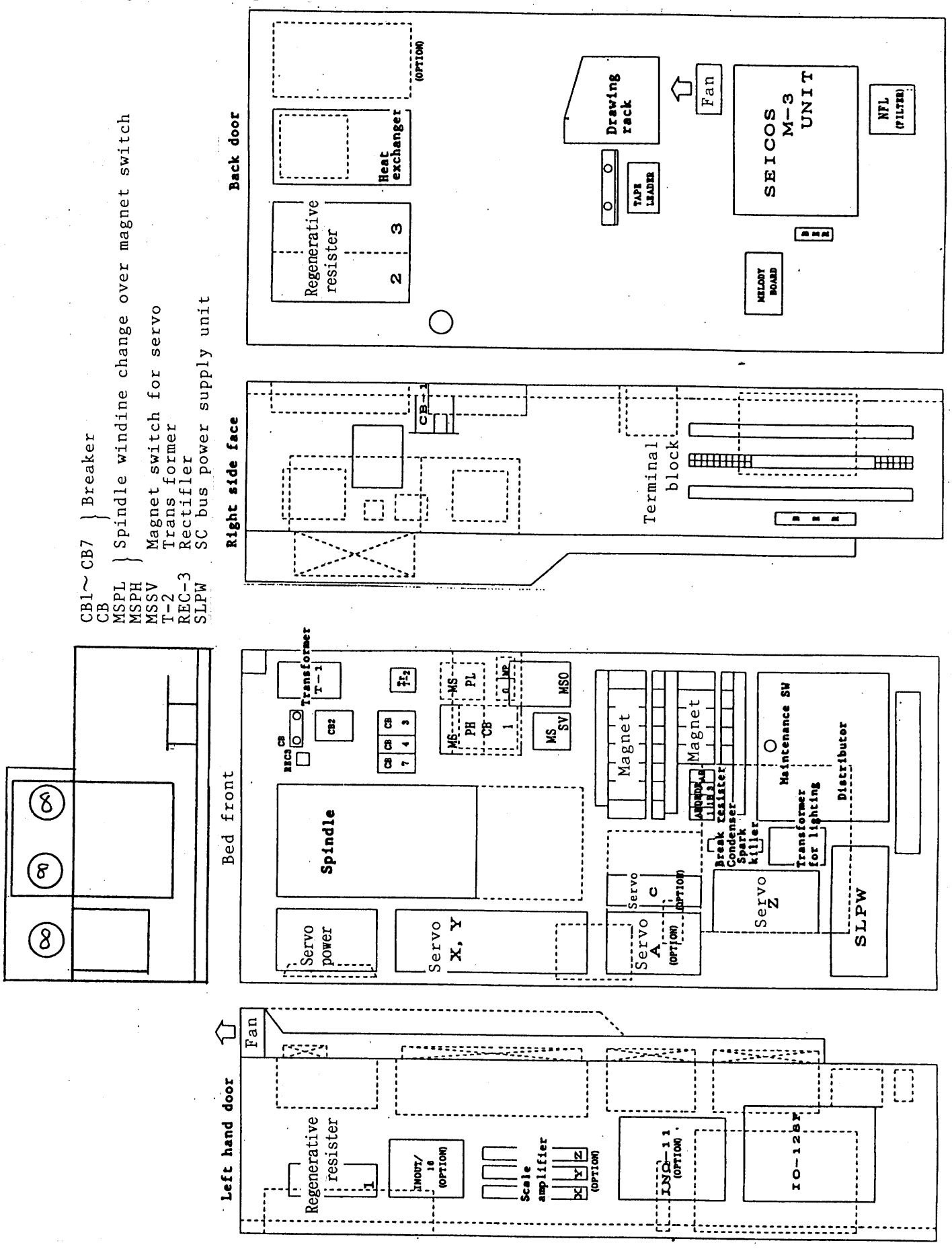
⑥ Set the cursor to the above mentioned address key, enter the tool number located at the spindle/standby position by the numeric key and press the "Input" key.
Since the spindle/standby tool No. and the registered data have been correctly set through this procedure, the subseqent operations are correctly performed.

⑦ When the "Return" key is pressed, the "WRITE ENABLE SW OFF" is displayed on the lower part of the screen.
Turn OFF (Lower side) the SW1 that was turned ON previously.

⑧ Press the "Return" key to return to the general screen.

⑨ Switch OFF the power supply once and switch it ON again.
At this time, check that the spindle/standby tool T on the left lower part of the general screen is correct.

9. Layout Diagram in the Control Cabinet



10. Maintenance and Control of the Heat Exchanger

Though the construction of the heat exchanger is very simple, and it consists of a few parts is easy to make its maintenance, proceed periodically the following matters.

① Daily check

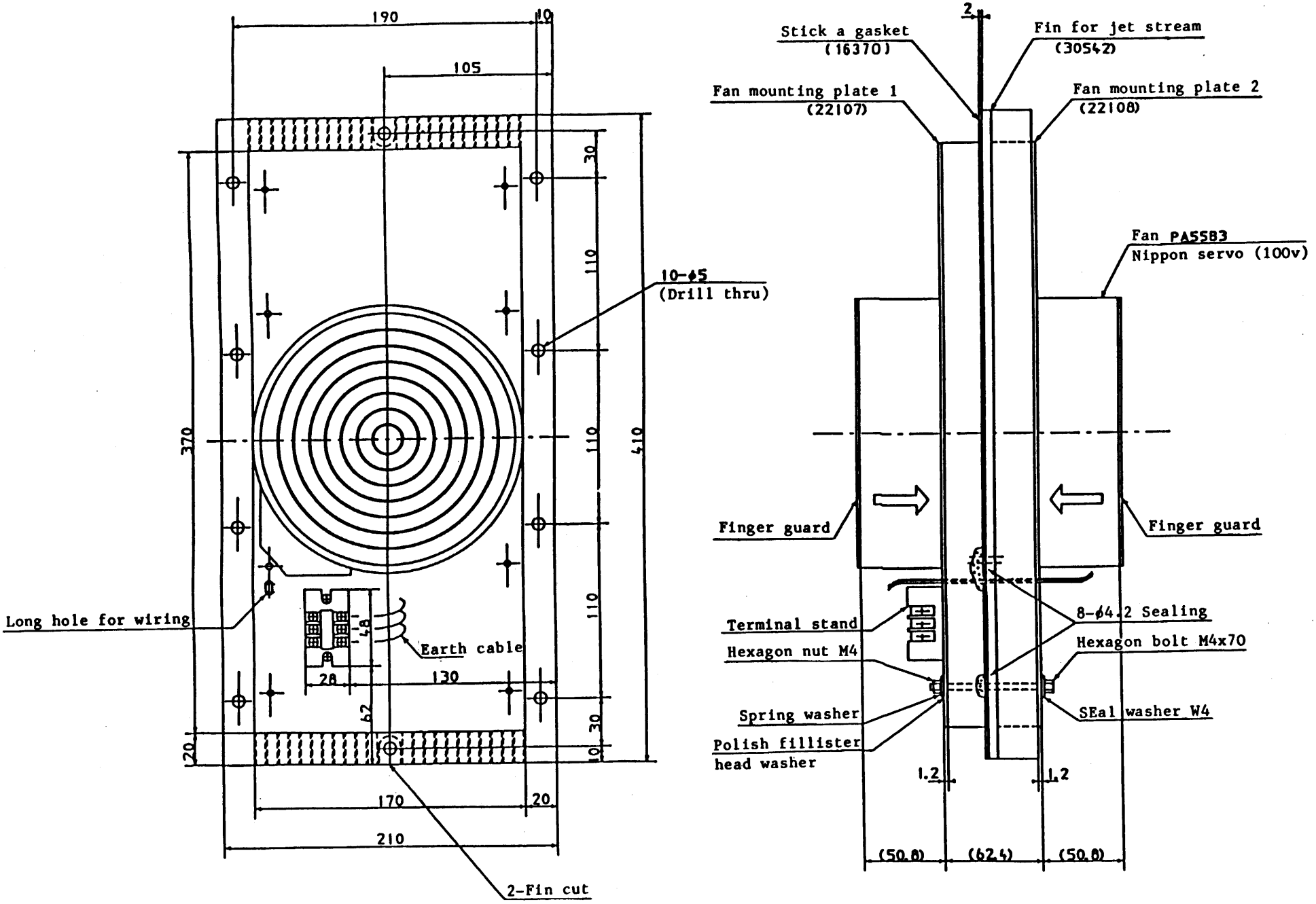
Check whether the fan operates normally and whether or not nose is heard.

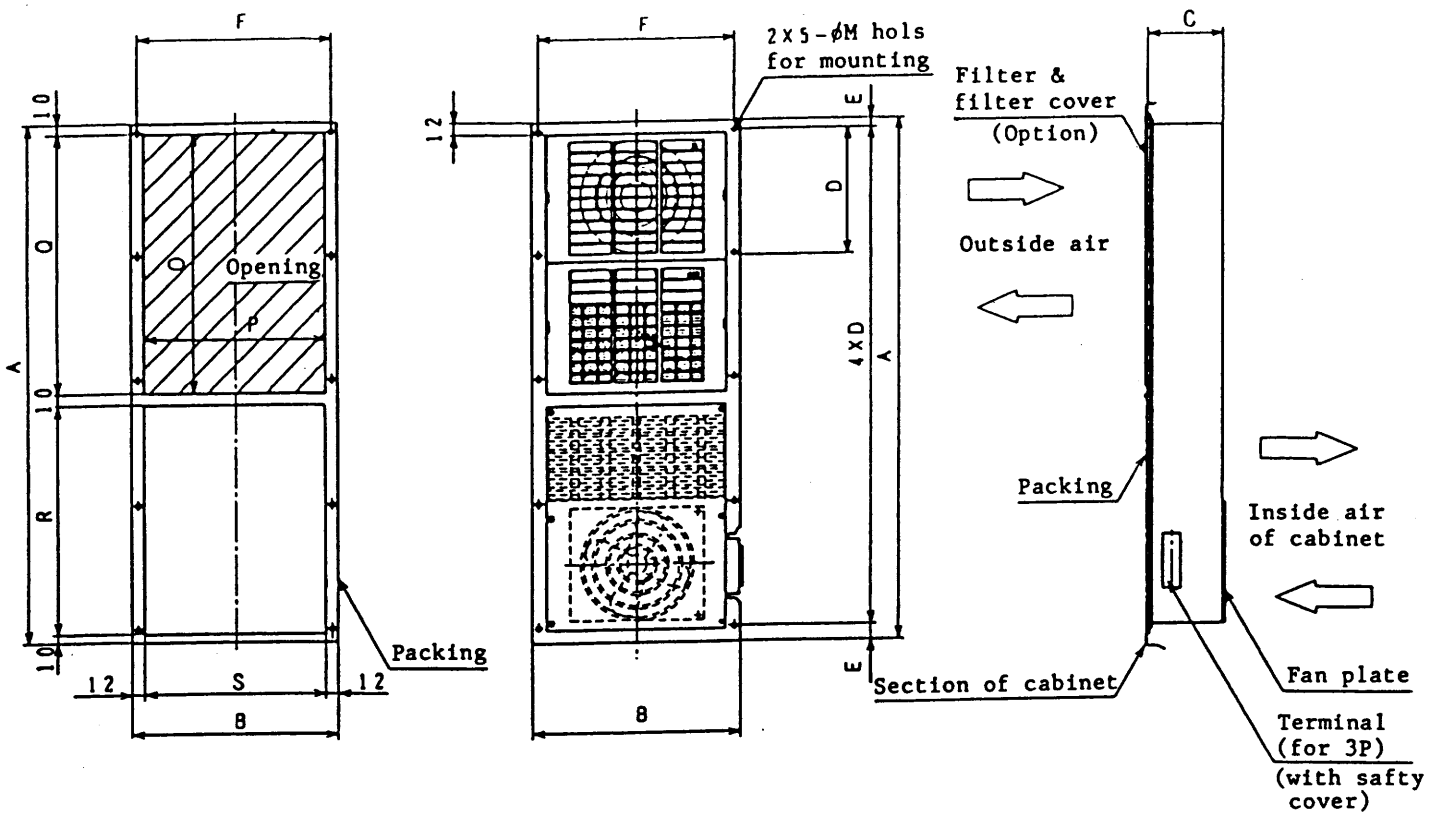
② Periodical check (Check twice a month.)

ⓐ Check whether or not the fixed bolts of each part, the wiring and the connected sections are loosen or normal.

ⓑ When the filter is soiled, detach it and take off its clogging by washing fluid and warm water.

ⓒ Check whether or not the heat exchanger is attached with dust and and is soiled.
Clean it timely according to a degree of dirt.
Take off the dirt by air blow, or by a vacuum cleaner, and wipe it by a wet cloth.


190
10
105
30
110
110
110
30
10
370
410
20
10-φ5
(Drill thru)
Long hole for wiring
Earth cable
48
28
130
62
170
20
210
2-Fin cut
2
Stick a gasket
(16370)
Fin for jet stream
(30542)
Fan mounting plate 1
(22107)
Fan mounting plate 2
(22108)
Fan PA5583
Nippon servo (100v)
Finger guard
Finger guard
Terminal stand
Hexagon nut M4
Spring washer
Polish fillister
head washer
8-φ4.2 Sealing
Hexagon bolt M4x70
SEal washer W4
1.2
1.2
(50.8)
(62.4)
(50.8)



Maintenance and Checking

Since moving section in this cooling unit is a fan only, minimal maintenance is required, however, apply a maintenance and checking following items periodically.

Period	Checking part	Checking point	Remedy
Daily (Starting time)	Upper and lower fan	Is the blade of fan rotate normally ? Are there any noise or vibration occurred ?	Check a cause if it is abnormal and replace a fan.
Every week or monthly	Filter	Clogging	① In case of light clogging Remove the filter and clean it by vacuum cleaner or tapping and mount it. ② In case of heavy clogging with grease Clean with a neutral detergent and rins with water then dry it thoroughly and mount it.
Semiannually or annually (Stop time)	Fin (Outside)	Dirt of surface of fin	① Remove the filter and fan and clean it by air blow etc. properly.

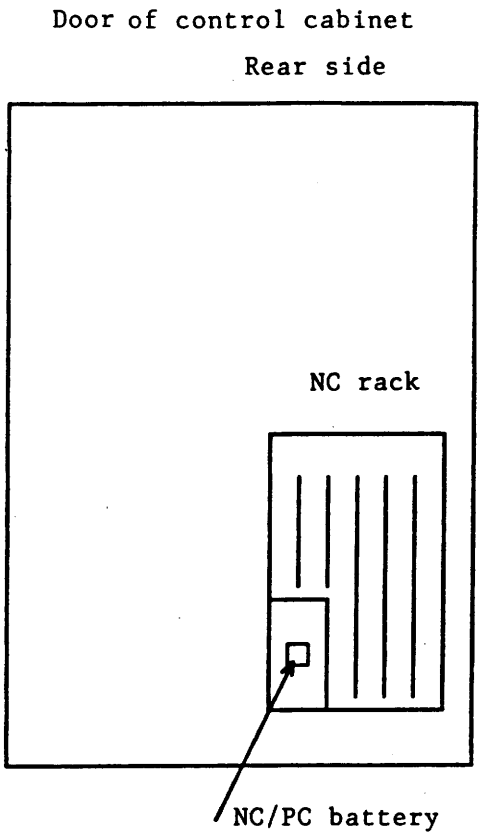
Adjust properly the period of cleaning for the filter and fin according to the degree of dirt.

11. Replacing Method of the Battery

1. Replacement of NC/PC Battery

Specifications of the battery

Manufacturer	Toshiba
Model	ER6C
Capacity	2000mAH



Replacing procedures

① Switch OFF the NC power supply.
② Pull out the connector and remove the battery.
③ Put a new battery into the case and set the direction of the connector to connect.
④ Turn on the power and check that an alarm went off after resetting.

Note:

Finish the replacing work within an hour.
If leaving dischange as it is, the inner data will be broken.

12. Display and Setting of PC Data

1. Word Table

The PC data such as feedrate, calling program No. (Option), ATC and maintenance switch are displayed and set.
The following word tables are prepared for VG45.

- No.01: Feedrate data
- No.02: Calling program No. data
- No.03: ATC data
- No.04: Maintenance switch set
- No.10: List of ATC retry history

Note) The contents of the word tables subject to change or add depending upon specifications.

The display and setting of the word tables are performed in accordance with the following procedures.

① Press the "Return" key of the function key to display the general screen.

② Press the "Front/back" key and then press the "F4/work coordinate" (System) key.

③ Select the "F6 : PC menu" by either the numeric key or the cursor key and then press the "Input" key.

④ Select the "F5 : Word table" in the same way and then press the "Input" key.

⑤ The screen for the word table 1 (Feed rate data) is displayed.

⑥ When desiring to display data other than the feedrate data, press the "F5/setting" (Table search) key and enter the number of data desired to watch. And it is possible to search by the page key as well.

⑦ When changing the data, press the "F9/selection · function" (Change) key and then move the cursor to the position desired to change.

⑧ Press the "F9/selection · function" (Reference) key.

Note) It is impossible to change No.01 through No.03 on this screen. In case of changing these, perform it on the system table.

VK45Ⅱ Word table No.01 Feedrate data

No.	Address	Setting (Hexadecimal)	Setting (Decimal)	Contents	Remarks
01	D000	FFFF	65535	RS0 position feedrate	
02	D002	FFE6	65510	RS1 position feedrate	
03	D004	FFCD	65485	RS2 position feedrate	
04	D006	FFB9	65465	RS3 position feedrate	
05	D008	FF9B	65435	RS4 position feedrate	
06	D00A	FF46	65350	RS5 position feedrate	
07	D00C	FEFB	65275	RS6 position feedrate	
08	D00E	FE97	65175	RS7 position feedrate	
09	D010	FE0B	65035	RS8 position feedrate	
10	D012	FD43	64835	RS9 position feedrate	
11	D014	FC17	64535	RS10 position feedrate	
12	D016	FAB9	64185	RS11 position feedrate	
13	D018	F8C5	63685	RS12 position feedrate	
14	D01A	F5D7	62935	RS13 position feedrate	
15	D01C	F1EF	61935	RS14 position feedrate	
16	D01E	EC77	60535	RS15 position feedrate	
17	D020	E4A7	58535	RS16 position feedrate	
18	D022	D8EF	55535	RS17 position feedrate	
19	D024	CB43	52035	RS18 position feedrate	
20	D026	B7BB	47035	RS19 position feedrate	
21	D028	9E57	40535	RS20 position feedrate	

It is impossoble to change the data on this screen.

VK45Ⅱ Word table No.02 Call program No. data

No.	Address	Setting (Hexadecimal)	Setting (Decimal)	Contents	Remarks
01	D030	----	----	At tapping Automatic return 0 No.	Range 1 ~ 65535
02	D032	----	----	At non-tapping Automatic return 0 No.	
03	D034	----	----	Warming-up operation 0 No.	
04	D036				
05	D038				
06	D03A				
07	D03C				
08	D03E				

It is impossible to change the data on this screen.

VK45Ⅱ Word table No.03 ATC data

No.	Address	Setting (Hexadecimal)	Setting (Decimal)	Contenta	Remarks
01	D050	----	----	Spindle tool No.	Current tool No.
02	D052	----	----	(Spindle tool No.)	Not used
03	D054	----	----	Standby position tool No.	Current Tool No.
04	D56	----	----	(Standby position tool No.)	Not used
05	D058				
06	D05A				
07	D05C				
08	D05E				

It is impossible to change the data on this screen.

VK45Ⅱ Word table No.04 Maintenance switch set

No.	Address	Setting (Hexadecimal)	Setting (Decomal)	Contents	Remarks
01	D060	0000	0	Maintenance M code effective(0001)	
02	D062	0000	0	Maintenance 2	Not used
03	D064	0000	0	Maintenance 3	Not used
04	D066	0000	0	Assembly abjustment effective (0001)	
05	D068	0000	0	Maintenance 5	Not used
06	D06A	0000	0	Maintenance 6	Not used
07	D06C	0000	0	Maintenance 7	Not used
08	D06E	0000	0	Maintenance 8	Not used

Perform manually to set in the manual mode on this screen.

And when turning off the power, this data are cleared to 0.

VK45Ⅱ Word table No.10 List of ATC retry history

No.	Address	Setting (Hexadecimal)	Setting (Decimal)	Contents	Remarks
01	D200	----	----	ATC double-arm forward	
02	D202	----	----	ATC double-arm retract	
03	D204	----	----	(ATC arm swing-in magazine side)	Not used
04	D206	----	----	ATC arm swing-in spindle side	
05	D208	----	----	ATC arm slide home position (From MG side)	
06	D20A	----	----	ATC arm slide home position (From SP side)	
07	D20C	----	----	ATC arm slide spindle side	
08	D20E	----	----	ATC arm slide MG side	
09	D210	----	----	Tool clamp	
10	D212	----	----	Tool unclamp	

2. Counter

The display and setting of the variable counter are performed.
The following variable counter is prepared for VG45.
. No.00: Spindle lubrication start time

Note) The contents of the counter subject to change or add depending upon the specifications.

The display and setting of the counter are performed in accordance with the following procedures.

① Press the "Return" key of the function key to display the general screen.

② Press the "Front/back" key and then press the "F4/work coordinate" (System) key.

③ Select the "F6 : PC menu" by either the numeric key or the cursor key and then press the "Input" key.

④ Select the "6 : Counter" in the same way and then press the "Input" key.

⑤ The screen for the counter is displayed.

⑥ When cganging the data, press the "F9/selection · function" (Change) key and then move the cursor to the number desired to change.
Change of the set data is:
Change of the maximum value (Count up value).
The current value can be changed.
In case of changing this data.
It is impossible to onter a value larger than the maximum value.

⑦ Press the "F9/selection · function" (Reference) key after the change is completed.

VK45Ⅱ Counter

No.	Max. value	Current value	Contents	Remarks
00	0900	----	Spindle lubrication start time	Set as 1 second per one count
01				
02				
03				
04				
05				
06				
07				
10				
11				
12				
13				
14				
15				
16				
17				

The change of data setting is to be recommended to perform in the status of an emergency stop as much as possible.

3. Timer

The display and setting of the variable timer are performed.

The following variable timers are prepared for VG45.

- No.00: Lubrication start time
- No.01: Lubrication operation start time
- No.02: Flat conveyor start time (Option)
- No.03: Flat conveyor hold time (Option)
- No.06: Oil mist one shot time (Option)
- No.07: Gun coolant start time
- No.10: Standby completion check delay time
- No.12: Lubrication start time for slide way (Unused)
- No.13: Lubrication cycle time for slide way (Unused)

Note) The contents of the timers subject to change or add depending upon the specifications.

The display and setting of the timers are performed in accordance with the following procedures.

① Press the "Return" key of the function key to display the general screen.

② Press the "Front/back" key and then press the "F4/work coordinate" (System) key.

③ Select the "6 : PC menu" by either the numeric key or the cursor key and then press the "Input" key.

④ Select the "7 : Timer" in the same way and then press the "Input" key.

⑤ The screen for the time is displayed.

⑥ When changing data, press the "F9/selection · function" (Change) key and then move the cursor to the number desired to change.

The unit of time becomes:

H: 0.01 second

M: 0.1 minute

S: 0.1 minute

Next, cnter the setting times.

When the unit is S, 10 becomes 1 second.

⑦ Press the "F9/selection · function" after changing.

No.	Setting unit	Setting time	Contents	Remarks
00	S	0700	Lubrication start time	*1
01	M	0200	Lubrication cycle time	*1
02	S	0100	Flat converyor start time	*2
03	M	0010	Flat converyor hold time	*2
04				
05				
06	S	0020	Oil mist one shot time	*3
07	M	0200	Gun coolant start time	*4
08	S	0002	Standby completiion check delay time	
11				
12	S	0500	Lubrication start time for slide way	Unused
13	M	0200	Lubrication cycle time for slide way	Unused

The change of data setting is to be recommended to perform in the status of an emergency stop as much as possible.

*1 : The customer is requested to get in contact with HITACHI SEIKI when changing the lubrication changing time and lubrication operating time.

*2 : The lubrication start time and lubrication operating cycle time become effective when the chip conveyor of the PC parameter is intermittent. The intermittent operation is performed of 1 of F2E7 4 bits of the PC parameter. (Refer to the alteration way in page 7-3.)

*3 : Use the oil mist one-shot time after selecting either the continuation of the PC parameter or the one-shot.
The one-shot is effective at 0 of F2E7 7 bits of the PC parameter.

*4 : When the gun coolant start time is longer time than M0200, the motor is heated and the alarm 0015, gun coolant overload, occurs.
And it is effective at 1 of F2E7 3 bits of the PC parameter.

4. Step Rudder

A step rudder is utilized for controlling ATC (APC) for VG45.
The order for respective operations and the current operation state can be checked by the status of the step rudder.

The display of the step rudder is performed in accordance with the following procedures.

① Press the "Return" key of the function key to display the general screen.

② Press the "Front/back" key and then press the "F4/work coordinate" (System) key.

③ Select the "6 : PC menu" by either the numeric key or the cursor key and then press the "Input" key.

④ Select the "20 : Step rudder" in the same way and then press the "Input" key.

⑤ The screen for the step rudder (Monitor) is displayed.

⑥ While the step rudder is in operation for No.00 through No.19, the display luminance of coments is varied.
And the details of respective operations can be watched.
In No.20 through No.59, only count number is displayed while the step rudder is operating, and the details cannot be seen. (This is not used for VG45.)

⑦ As to the details of the step rudder, press the "F7/drawing" (Search) key and then enter the number of operation desired to watch.

⑧ The name of functions is introduced every step, and the place of the working function is displayed by the frame of the cursor while the step rudder is in operation.

VK45Ⅱ Step rudder (Monitor)

No.	Coments
00	Old tool storage cycle
01	New tool call cycle
02	Spindle tool change cycle
03	ATC home position return (Tool call)
04	ATC home position return (Main tool change)
05	APC carry-out cycle (Option)
06	APC carry-in cycle (Option)
07	APC home position return (Option)
08	
09	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	

No.	Counter
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
31	
32	
33	
34	
35	
36	
37	
38	
39	

No.	Counter
40	
41	
42	
43	
44	
45	
46	
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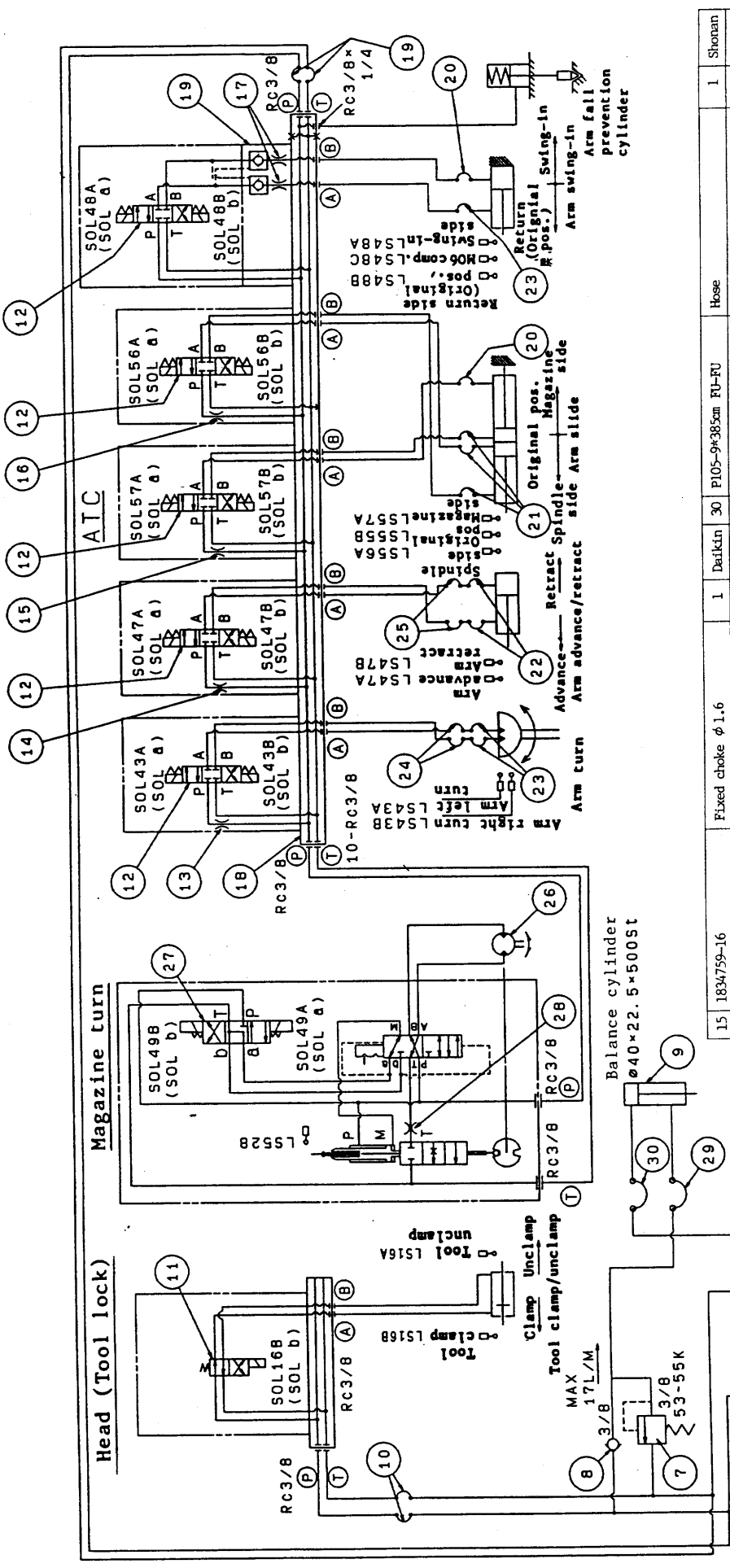
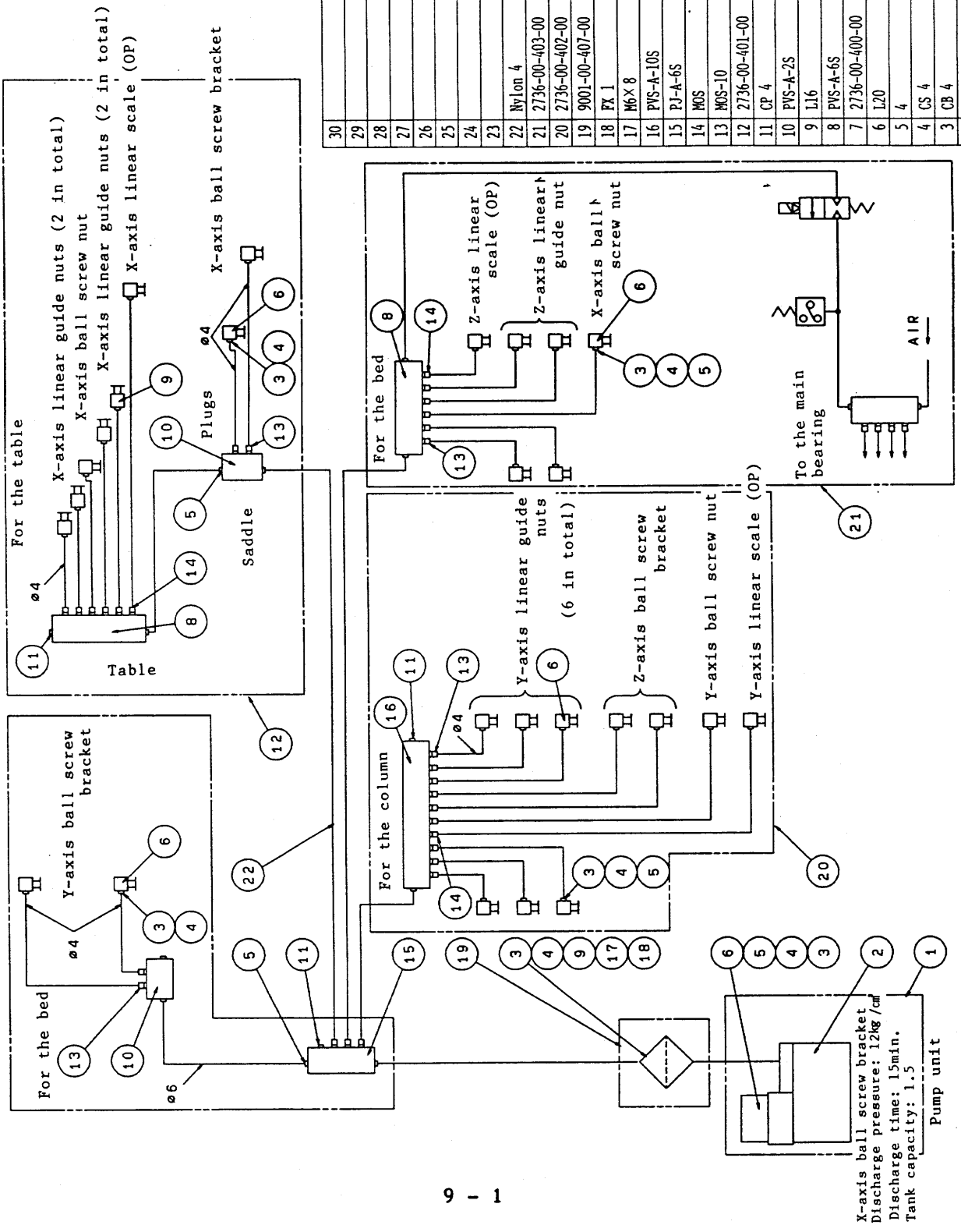
Chapter 8 HYDRAULIC CIRCIT DIAGRAM



No	PART NUMBER	PART NAME	Q'ty	MAKER
15	1834759-16	Fixed choke φ1.6	1	Daikin
14	1834759-24	Fixed choke φ2.4	1	Daikin
13	1834759-14	Fixed choke φ1.4	1	Daikin
12	KSO-G02-2CA-10-N	Solenid valve	5	Daikin
11	KSO-G02-2BA-10-N	Solenid valve	1	Daikin
10	P105-9*470cm FU-FU	Hose	2	Shonan
9	2732-05-099-00	Balance cylinder	1	
8	HDIN-T03-05	Check valve	1	
7	SR-T03-05	Relief valve	1	
6	SPA1/4B, φ60	Pressure gange	1	
5	M15AIX-2-50	Motor pump	1	
4	DHA-06-150	Sunction strainer	1	
3	FA-35	Oil inlet pot and air blezer	1	
2	KLA-80A	Oil level gauge	1	
1	40L	Tank	1	

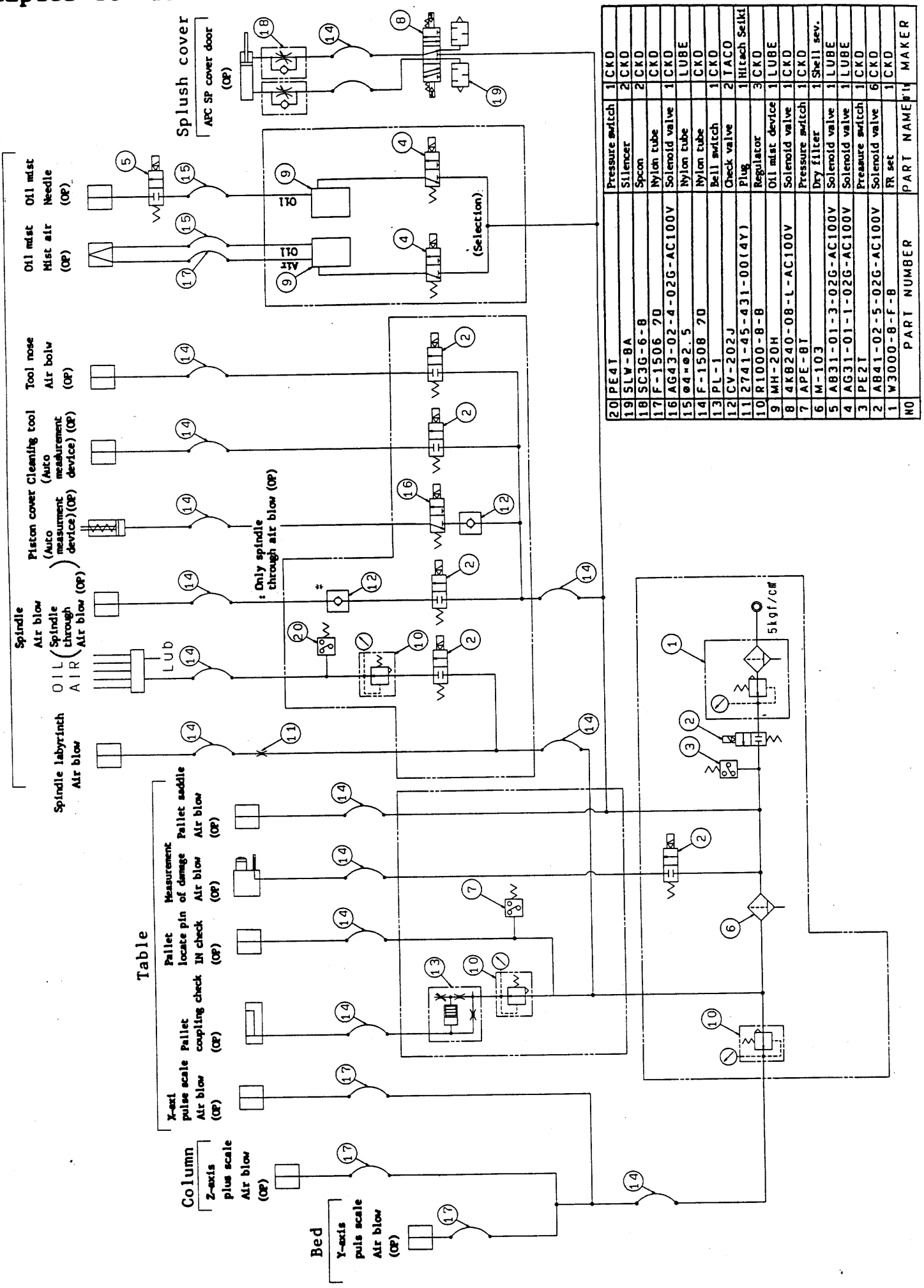
No	PART NUMBER	PART NAME	Q'ty	MAKER
30	P105-9*385cm FU-FU	Hose	1	Shonan
29	P105-9*500cm FU-FU	Hose	1	Shonan
28	9001-79-008-00	Fixed choke φ2.2	1	Shonan
27	KSO-G02-4CA-10-N	Solenoid valve	1	Daikin
26	ORB-S-160-2FC	ORB mark motor	1	NOP
25	P105-9*200cm FU-FU W/WB	Hose	2	Shonan
24	P105-9*187cm FU-FU W/WB	Hose	2	Shonan
23	P105-9*148cm FU-FU W/WB	Hose	3	Shonan
22	P105-9*145cm FU-FU W/WB	Hose	2	Shonan
21	P105-9*140cm FU-FU W/WB	Hose	3	Shonan
20	P105-9*125cm FU-FU W/WB	Hose	2	Shonan
19	P105-9*280cm FU-FU W/WB	Hose	2	Shonan
18	9001-68-005-00	Manifold	1	Shonan
17	1834759-18	Fixed choke φ1.8	2	Daikin
16	1834759-20	Fixed choke φ2.0	1	Daikin

Chapter 9
LUBRICATING SYSTEM DIAGRAM



NO	PART NUMBER	PART NAME	Q'ty	MAKER
30				
29				
28				
27				
26				
25				
24				
23		Nylon tube	1	
22	Nylon 4	Lubrication device	1	LUBE
21	2736-00-403-00	Lubrication device	1	LUBE
20	2736-00-402-00	Line filter	1	LUBE
19	9001-00-407-00	Line filter fitting board	1	LUBE
18	FX 1	Pan-head machine screw (cross slot)	2	LUBE
17	M6X 8	Junction	1	LUBE
16	PVS-A-10S	Junction	1	LUBE
15	PJ-A-6S	Plug assembly	3	LUBE
14	MOS	Quantitative valve	26	LUBE
13	MOS-10	Lubrication device	1	LUBE
12	2736-00-401-00	Closure valve	4	LUBE
11	CP 4	Junction	2	LUBE
10	PVS-A-2S	Straight adapter	6	LUBE
9	L16	Junction	2	LUBE
8	PVS-A-6S	Lubrication device	1	LUBE
7	2736-00-400-00	Elbow adapter	22	LUBE
6	L20	Tube insert	59	LUBE
5	4	C.sleeve	61	LUBE
4	CS 4	C.bushing	61	LUBE
3	CB 4	Pump	1	LUBE
2	AMO-150SA-18CP-P	Lubrication device	1	LUBE
1	9001-00-406-00			

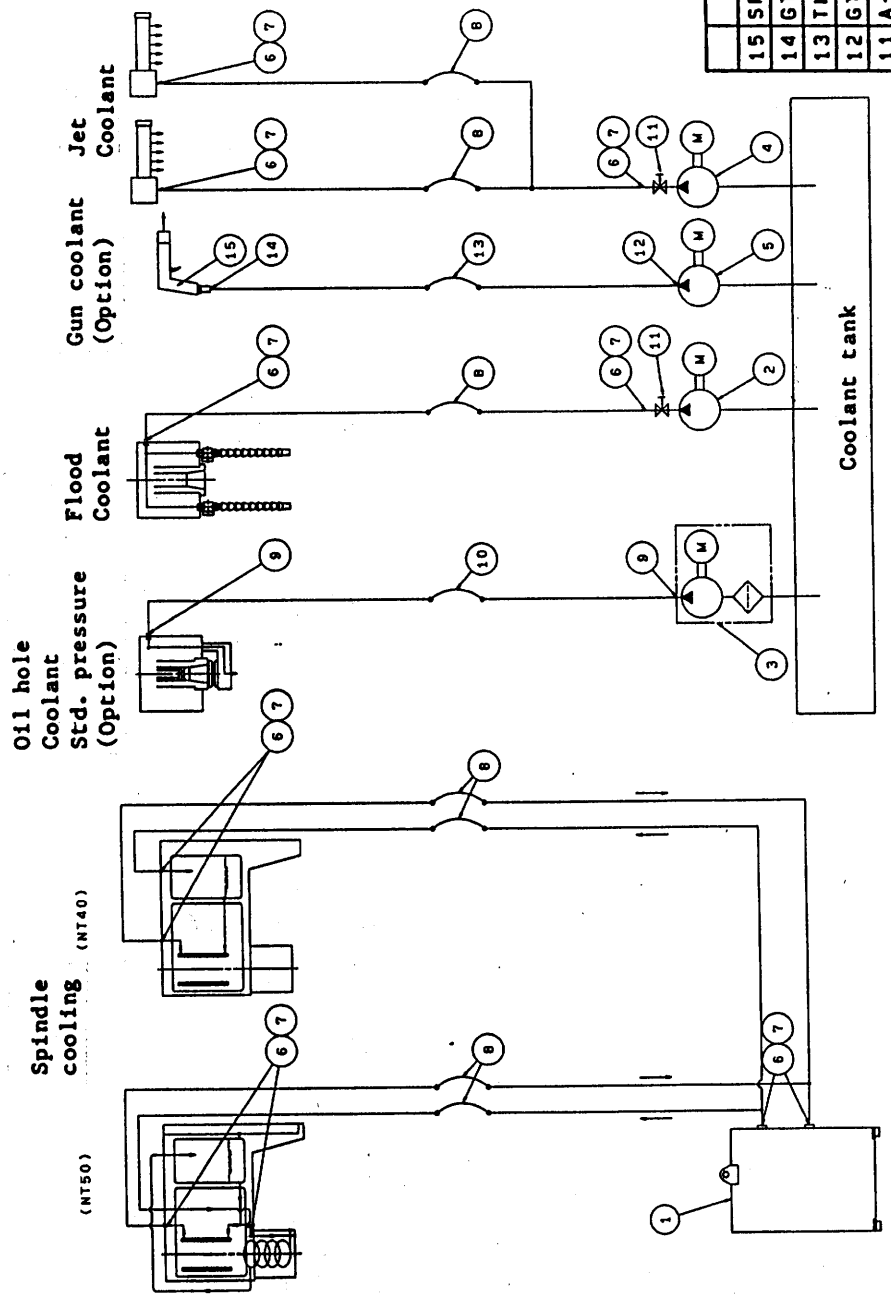
Chapter 10 PNEUMATIC CIRCUIT DIAGRAM



NO	PART NUMBER	PART NAME	Q'TY	MAKER
20	PE4T	Pressure switch	1	CKD
19	SLW-8A	Silencer	2	CKD
18	SC3G-6-8	Spcon	2	CKD
17	F-1506 20	Nylon tube		CKD
16	AG43-02-4-02G-AC100V	Solenoid valve	1	CKD
15	ø4-ø2.5	Nylon tube		LUBE
14	F-1508 20	Nylon tube		CKD
13	PL-1	Bell switch	1	CKD
12	CV-202J	Check valve	2	TACO
11	2741-45-431-00(4Y)	Plug	1	Hitach Seiki
10	R1000-8-B	Regulator	3	CKD
9	MH-20H	Oil mist device	1	LUBE
8	4KB240-08-L-AC100V	Solenoid valve	1	CKD
7	APE-8T	Pressure switch	1	CKD
6	M-103	Dry filter	1	Shell sev.
5	AB31-01-3-02G-AC100V	Solenoid valve	1	LUBE
4	AG31-01-1-02G-AC100V	Solenoid valve	1	LUBE
3	PE2T	Preasure switch	1	CKD
2	AB41-02-5-02G-AC100V	Solenoid valve	6	CKD
1	W3000-8-F-B	FR set	1	CKD

Chapter 11 COOLANT
SPINDLE, COOLING,
PIPING SYSTEM DIAGRAM

NO	PART NUMBER	PART NAME	Q'TY	MAKER
15	SP100	Coolant gun	1	Kurita
14	GTO-92	Hose nipple	1	Chiyoda
13	TH-3(8×12)	Urethan hose	1	Chiyoda
12	GT-11	Hose socket	1	Chiyoda
11	A-18	Stop valve	2	Kitazawa
10	P105-19×700CM Fu-fu w/Nut	Hose	1	Shonan
9	90TF12	Elbow	2	
8	SO-25	Vinyl hose	1	Toyox
7	STG-W2 25-40/9	Hose band	11	Norma
6	WHN-36	Male thread connector	11	Niwa Mfg.
5	LSW15A0.18	Coolant pump	1	Kyoiku
4	LSW25A0.4	Oil pump	1	Kyoiku
3	TOP-2MY400-208 HYMCP-VBE15K-10	Torochid pump	1	NOP
2	LSW15A0.18	Coolant pump	1	Kyoiku
1	KTC-5C-B3	Oil controller	1	Daikin



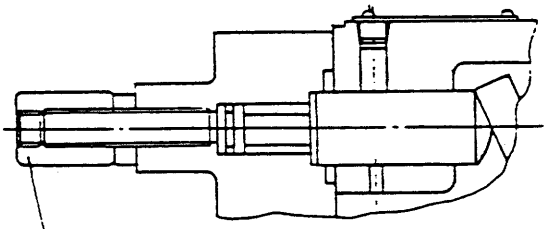
Chapter 12 REFERENCE DATA

1. Hydraulic Tank

1.1 Construction

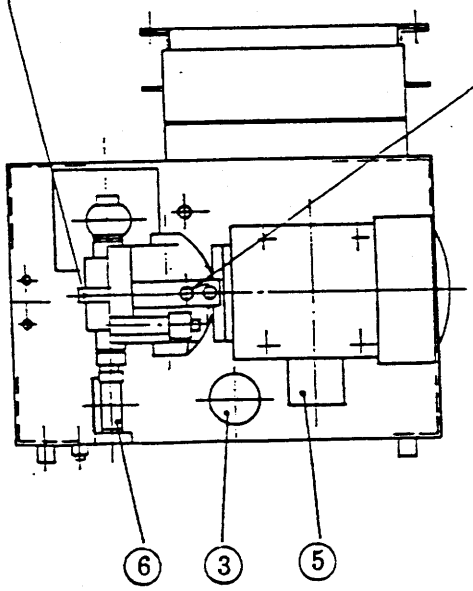
No.	Part	Type	Q'ty
1	Oil tank	40ℓ	1
2	Oil gauge	KLA-80A	1
3	Oil inlet port-cum-breather	PA-35	1
4	Suction strainer	DHA-06-150	1
5	Motor pump	M15A1X-2-50	1
6	Pressure gauge	SPA1/4V φ60 16/cm² 49-51 green	1
7	Relief valve	SR-T03-1-10	1
8	Check valve	HDIN-T03-05	1

Details of Discharge Rate Control Shaft



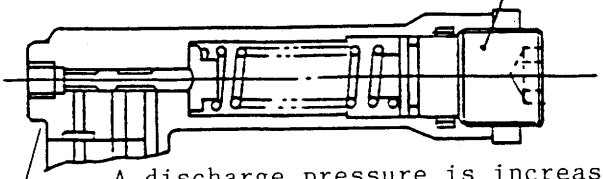
A discharge rate is decreased/increased by turning the adjusting screw to the right/left.

Prior to test run, remove the plug and supply working oil.

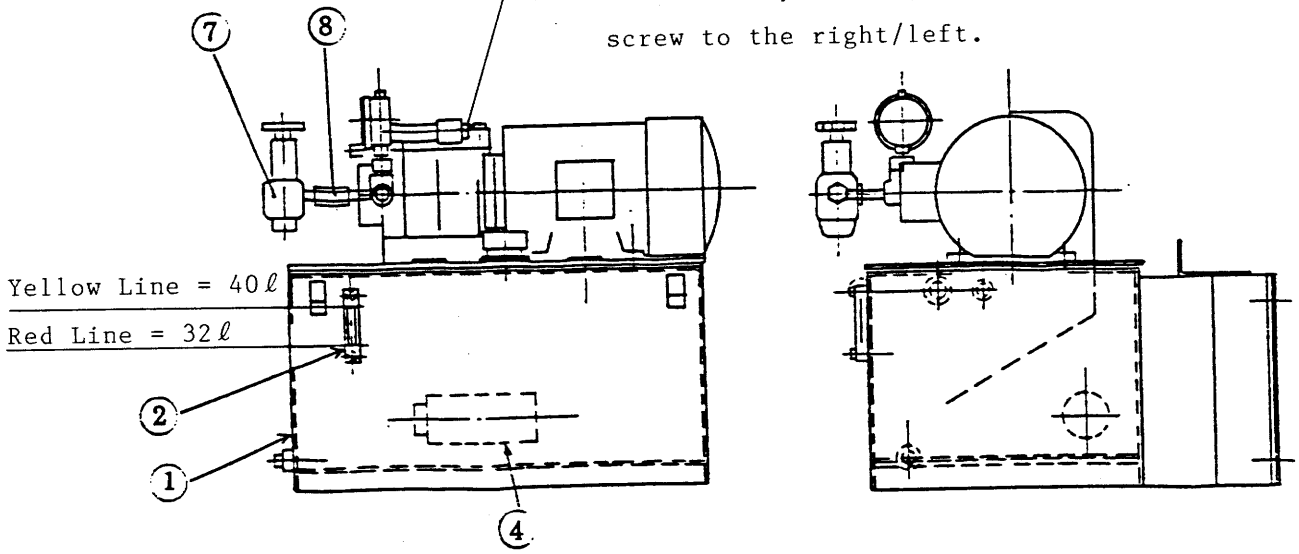


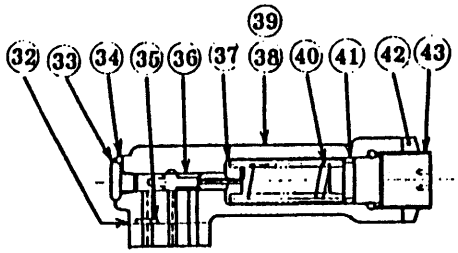
Discharge Pressure Adjusting Screw

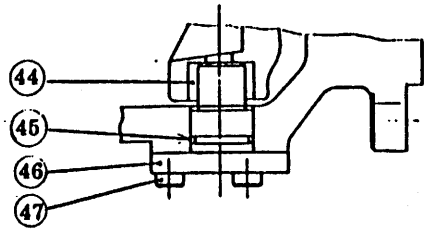
Details of Pressure Control Shaft

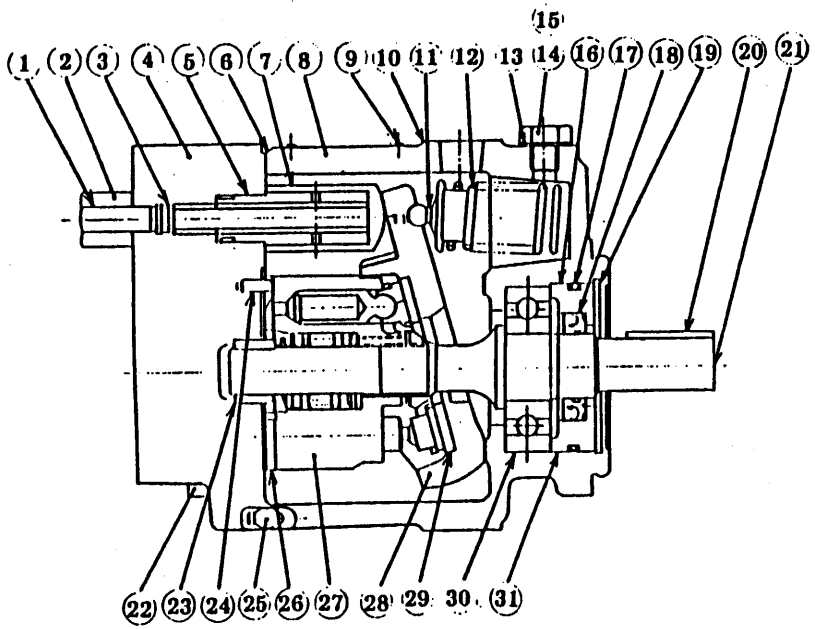


A discharge pressure is increased/ decreased by turning the adjusting screw to the right/left.

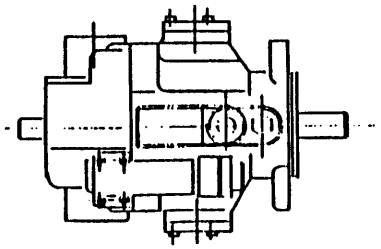








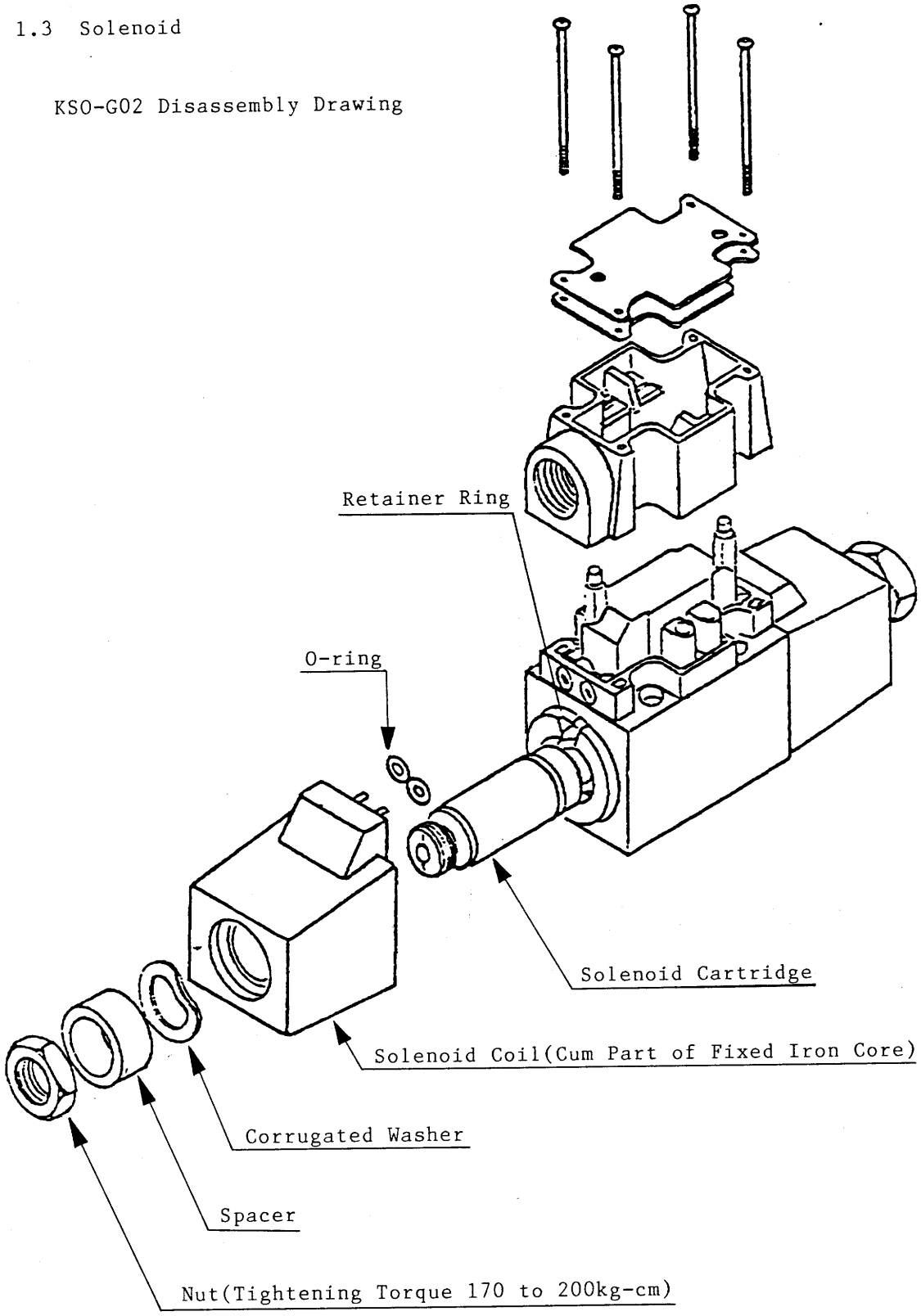
No.	Name	Q'ty	No.	Name	Q'ty	No.	Name	Q'ty
1	Discharge rate adjusting screw	1	21	Shaft	1	41	O-ring	1
2	Cap	1	22	Hexagon socket head bolt	4	42	Lock nut	1
3	O-ring	1	23	Bearing(needle)	1	43	Pressure adjusting screw	1
4	End cap	1	24	Pin	2	44	Journal bearing	2
5	Cylinder rod	1	25	Pin	1	45	O-ring	2
6	Gasket	1	26	Plate(valve)	1	46	Trunnion	2
7	Control cylinder	1	27	Cylinder block kit	1	47	Hexagon socket head bolt	6
8	Name plate	1	28	Swash plate	1			
9	Name plate mounting	2	29	Plate(thrust)	2			
10	Housing	1	30	Bearing(ball)	1			
11	Spring holder	1	31	C-type retainer ring(for shaft)	1	No.	Size	Q'ty
12	Yoke spring	1	32	Gasket	1	3	JISB2401 one kind A 1'8	1
13	Seal washer	1	33	Plug	1	17	JISB2401 one kind A G55	1
14	Plug	1	34	O-ring	1	34	AR1'5508-903 3/8-24	1
15	Pasting name plate	1	35	O-ring	1	35	JIS B240T one kind B PG	1
16	Seal holder	1	36	Spool	1	41	JIS B240T one kind B P14	1
17	O-ring	1	37	Spring Holder	1	45	JIS B240T one kind A P18	2
18	Oil seal	1	38	Valve body	1		Oil seal	
19	C-type retainer ring(for hole)	1	39	Hexagon socket head bolt	4	4	TCV type 24408	1
20	Key	1	40	Spring	1			



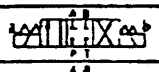
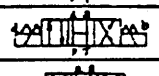
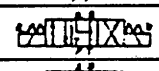
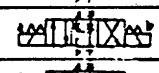
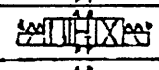
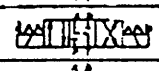
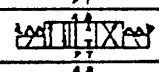
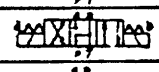
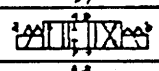
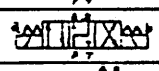
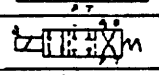
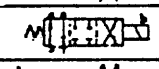
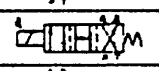
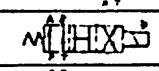
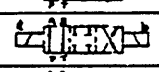
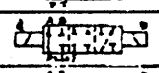
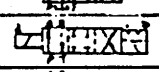
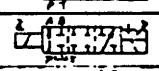
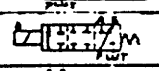
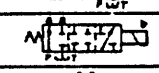
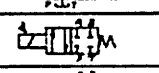
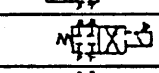
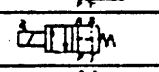
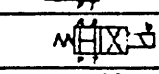
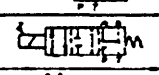
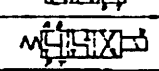
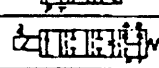
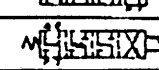
Theoretical discharge rate	14.8cc/rev.
Maximum pressure	210kgf/cm²
Rated pressure	140kgf/cm²
Rotation frequency range	500～1800r.p.m
Allowable degree of vacuum	-125mmHg
Applicable filter	Return line 25μ
	Suction line 150 meshes
Hydraulic oil	ISO VG32, 46,56 or equivalent
Oil temperature	0～60℃
Weight	kg
Case internal pressure	Normal 0.35kgf/cm² or less
	Maximum 0.7kgf/cm² or less

1.3 Solenoid

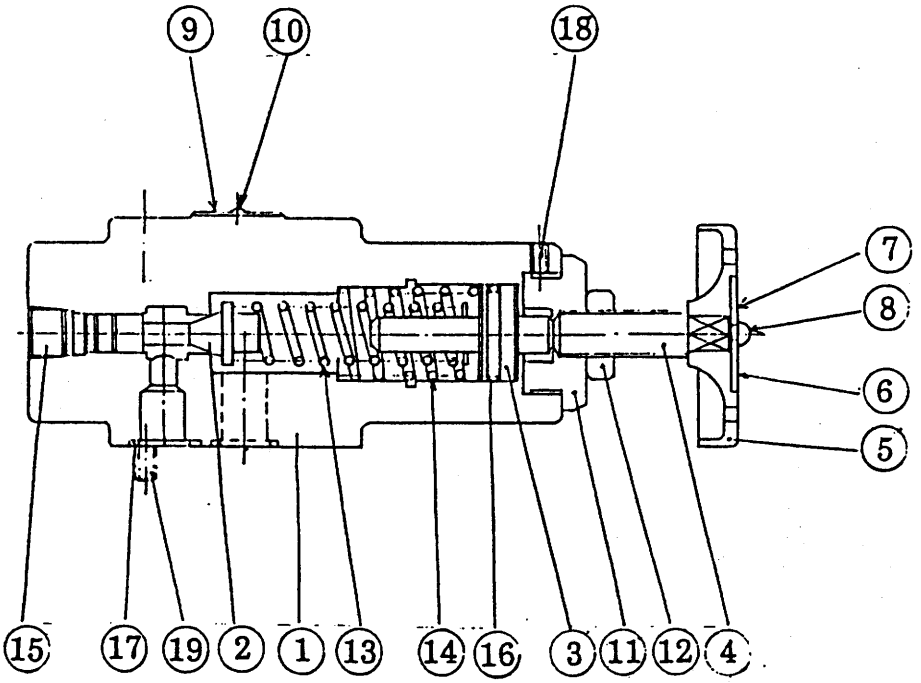
KSO-G02 Disassembly Drawing



1.3.1 Models List

Model No.	JIS Symbol	Power Source	Pressure vs. Flow Rate Characteristic (Refer to Grapn)			Pressure Drop (Refer to Graph)		
						P→A P→B	A→T B→T	P→T
KSO-G02-2C		AC	A	b	b	4	2	—
		DC	A	a	a			
-3C		AC	D	D	D	4	1	5
		DC	D	D	D			
-4C		AC	B	d	d	5	2	—
		DC	C	c	c			
-44C		AC	G	d	d	5	2	—
		DC	H	c	c			
-5C		AC	E	f	f	6	8	7
		DC	F	f	f			
-55C		AC	E	f	f	6	8	7
		DC	F	f	f			
-7C		AC	A	e	e	4	3	—
		DC	A	e	e			
-8C		AC	B	d	d	5	2	—
		DC	C	c	c			
-9C		AC	K	e	b	4	2	—
		DC	K	e	a		3	
-51C ※		AC	E	f	f	6	8	7
		DC	F	f	f			
-81C ※		AC	B	d	d	5	2	—
		DC	C	c	c			
-91C ※		AC	A	b	e	4	3	—
		DC	A	a	e		2	
-2A ※		AC	L	h	e	4	6	—
		DC	K	g	e			
-2B		AC	L	e	h	4	6	—
		DC	K	e	g			
-3A ※		AC	N	m	L	4	2	—
		DC	D	L	L			
-3B		AC	N	L	m	4	2	—
		DC	D	L	L			
-2N		AC	A	l	l	3	4	—
		DC	J	k	k			
-20N		AC	—	l	l	3	—	—
		DC	—	k	k			
-2D		AC	M	j	j	3	4	—
		DC	I	i	i			
-20D		AC	—	j	j	3	—	—
		DC	—	i	i			
-20A ※		AC	—	h	e	4	—	—
		DC	—	g	e			
-20B		AC	—	e	h	4	—	—
		DC	—	e	g			
-2A-H2 ※		AC	A	b	—	4	2	—
		DC	A	a	—			
-2B-2T ※		AC	A	—	b	4	2	—
		DC	A	—	a			
-3A-H3 ※		AC	D	D	—	4	1	5
		DC	D	D	—			
-3B-3T ※		AC	D	—	D	4	1	5
		DC	D	—	D			
-81A-H4 ※		AC	B	d	—	5	2	—
		DC	C	c	—			
-8B-4T ※		AC	B	—	d	5	2	—
		DC	C	—	c			
-81A-H44 ※		AC	G	d	—	5	2	—
		DC	H	c	—			
-8B-44T ※		AC	G	—	d	5	2	—
		DC	H	—	c			

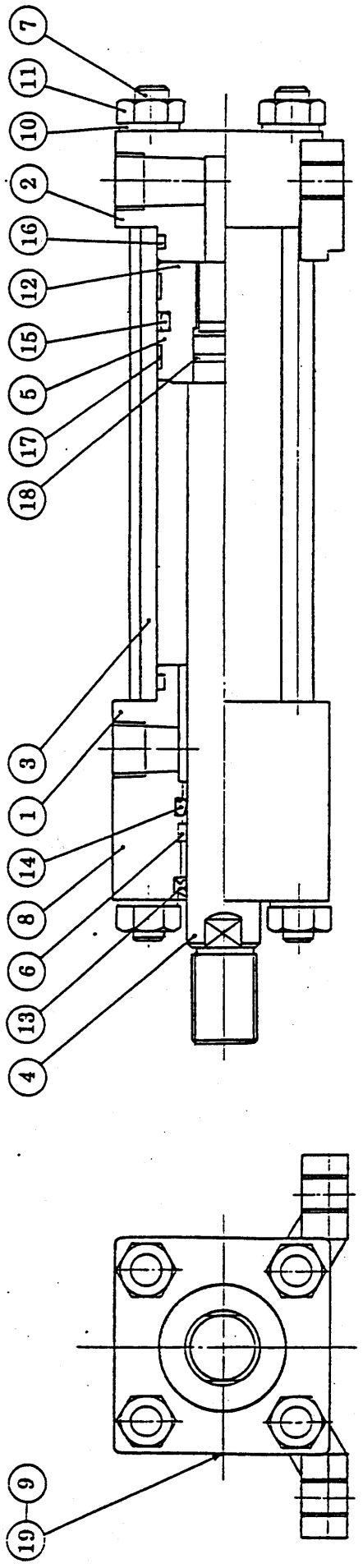
1.4 Relief Valve(SR G03-1-11)



DPF NO.	PARTS NAME	MODEL / QTY	DRWG No & SPECIFICATION			REMARKS
			SRG3			
1	Body					
2	Piston					
3	Plunger					
4	Adjusting screw					
5	Knob					
6	Notice plate					
7	Plain washer					
8	Machine screw					
9	Drive screw					
10	Name plate					
11	Retainer					
12	Hexagon nut					
13	Spring	SWP-B	1843142			
14	Spring	SWP-B	1843143			
15	Taper plug	SCM-3	1/4T			
16	"O" ring	NBR	1A P22			JISB2401
17	"O" ring	NBR	1A P15			JISB2401
18	Set screw					
19	Socket head bolt	SCM3	M6× 65			JISB1176

1.5 Balance Cylinder(For Spindle Head)

1. Structural drawing



2. Specifications

- Type : LA40B35N710
- Cylinder bore : ϕ 40mm
- Stroke : 710mm
- Rod diameter : ϕ 22.4mm
- Rated pressure : 35 kgf/cm²
- Test pressure : 70 kgf/cm²
- Cushion : None

Remarks 1. Hard chrome plating 2/100 used for the A-marked part

2. Lock nut M16 x 1.5, Class-3, 2 pieces

3. Parts List

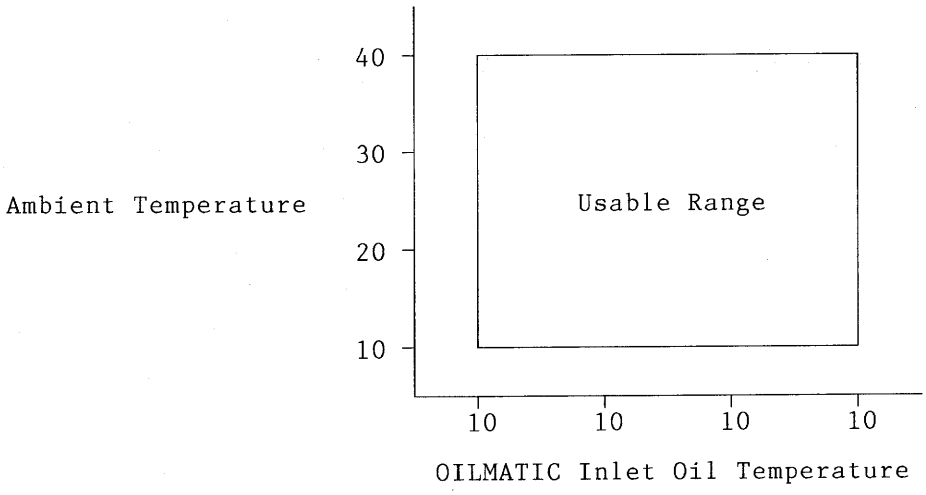
19	Cap gasket	NBR	2	P.8
18	Piston gasket	NBR	1	P.14
17	Piston wear ring	Phenol resin	2	SWA-40
16	Tube gasket	Phenol resin	2	G.35
15	Piston packing	Teflon / NBR	1	(ST-40)
14	Rod packing	NBR	1	SKY-22.4
13	Dust wiper	NBR	1	SDR-22.4
12	Hexagon socket head setscrew	SCM435	1	M4
11	Hexagonal nut	S25C	8	M10 Class-1
10	Spring washer	SWRH57	8	10 No.2
9	Cap	S25C	2	
8	Flange	SS41	1	
7	Tie rod	S45C	4	
6	Sleeve	Polyamide resin	1	WRB-22.4
5	Piston	FC25	1	
4	Piston rod	S45C	1	
3	Cylinder tube	STKM13C	1	
2	Head cover	SS41	1	
1	Rod cover	SS41	1	
No.	Name	Material	Q'ty	Remarks

2. SPINDLE COOLING UNIT

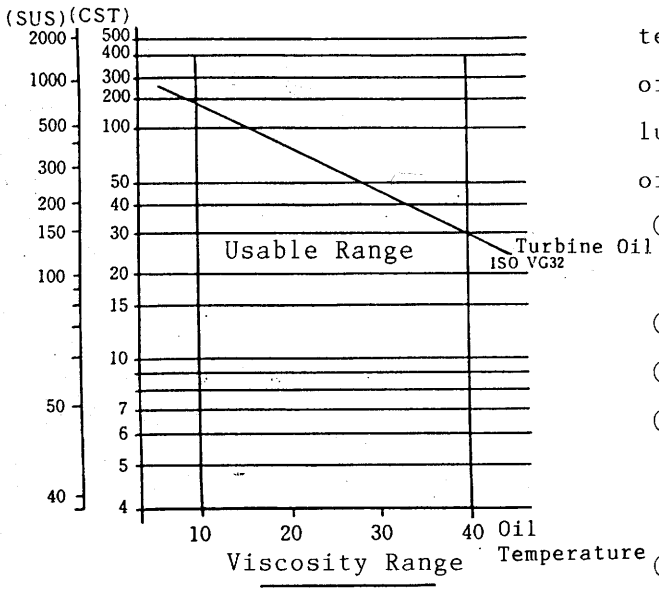
2.1 General Precautions

(1) Usable range

OILMATIC incorporates a refrigerator to cool. The usable range of an ambient temperature and oil temperature is limited. Use it within the range shown in the figure below.



(2) Oil used



The KTC type OILMATIC is an oil temperature controller for mineral oil system working oil and lubricating oil. The following oils(liquids) are not available:

① Coolant(liquid) and grinding oil(liquid)

② Water and water soluble liquids

③ Chemicals and food liquids

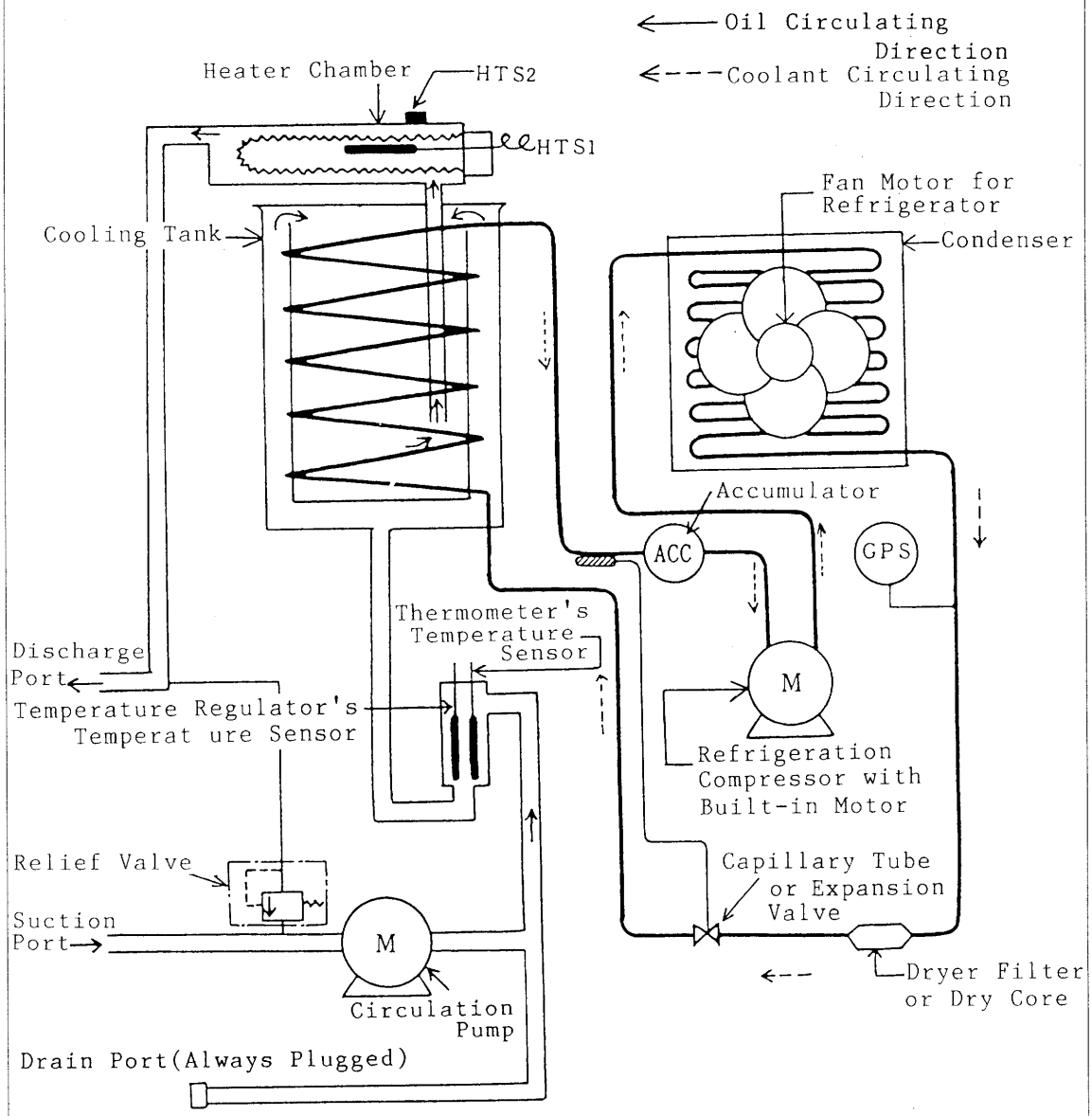
④ Highly volatile liquids with low lubrication capability such as gasoline, thinner, etc.

⑤ Flame resisting hydraulic working oils Phosphoric ester system, Water + guaiacol system, O/W emulsion system, Chlorinated hydrocarbon system

(3) Safety work upon inspection/repair

When inspection or repair is required by any chance, turn off the start switch to stop OILMATIC and be sure to turn off the power switch.

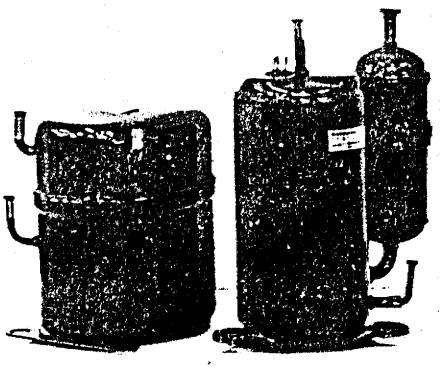
Refrigerant and Oil Circulation Circuit Drawing



Some models have the relief valve integrated with the pump.

● Refrigeration compressor with built-in motor

This is to compress a refrigerant gas to increase a pressure in order to facilitate liquefaction at a normal temperature.
In order to prevent a leakage of the refrigerant gas, the compression mechanism and drive motor are enclosed in a steel plate case.
When the refrigeration compressor stops, if the refrigerant gas is cooled down and liquefied, liquid compression may occur and damage the valve of the cylinder head at start time. To prevent this, a crank case heater has been installed for the compressors with larger capacity than the Model KTC-22(nominal capacity 2.2kW).



Refrigeration Compressor with Built-in Motor

● Fan motor and fan for the refrigerator

They are to supply cooling air to the condenser. A suction type propeller fan is used.(Some models use a blow-off type.)
(For the Model KTC-5A, a fan drive motor doubles as a pump motor.)

● Condenser

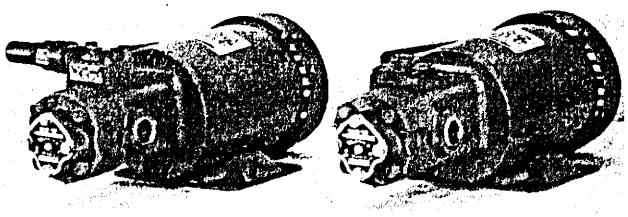
This is a heat exchanger to cool down and liquefy the refrigerant gas turn to a high temperature and high pressure by the refrigeration compressor. A standard type uses the forced air cooling method by means of a fan. Some models uses a water cooled condenser as an option.

● Cooling tank(heat exchanger)

Heat exchanger to deprive the oil of its heat through evaporation of the refrigerant. It has an enclosed structure and incorporates an evaporator(made of copper pipe).

● Circulation pump and relief valve

The circulation pump circulates the oil into the cooling tank at a constant flow rate. OILMATIC uses a trochoid gear pump directly connected to a motor.
The relief valve is activated when the pressure in the oil circuit exceeds a specified pressure to protect the component parts of the oil circuit.

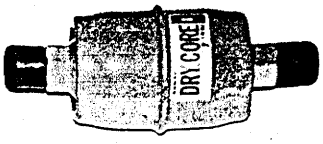


Relief Valve Integrated Type | Relief Valve Separate Type

Circulation Pump and Motor

● Dryer filter and dry core

Moisture or foreign substances in the refrigerant gas will have a bad effect on each part of the refrigerator. To avoid this, these devices are used to adsorb moisture and collect the foreign substances.



Dry Core

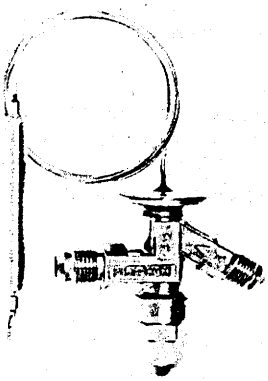
● Capillary tube and temperature type automatic expansion valve

These are to have the high-pressure liquid refrigerant heat-insulated and expanded to a low temperature and low pressure by throttling.

○ Capillary tube

Used for smaller-capacity models than KTC-11.

Throttled with a small I.D. steel pipe.



Temperature Type Automatic Expansion Valve

○ Temperature type automatic expansion valve

Used for larger-capacity models than KTC-15.

In order to obtain a stable cooling capability against fluctuations of a thermal load in the cooling tank, this valve automatically adjusts the opening of the throttle valve, following up a temperature change at the evaporator outlet, to control a flow rate of the refrigerant liquid.

● Heater chamber

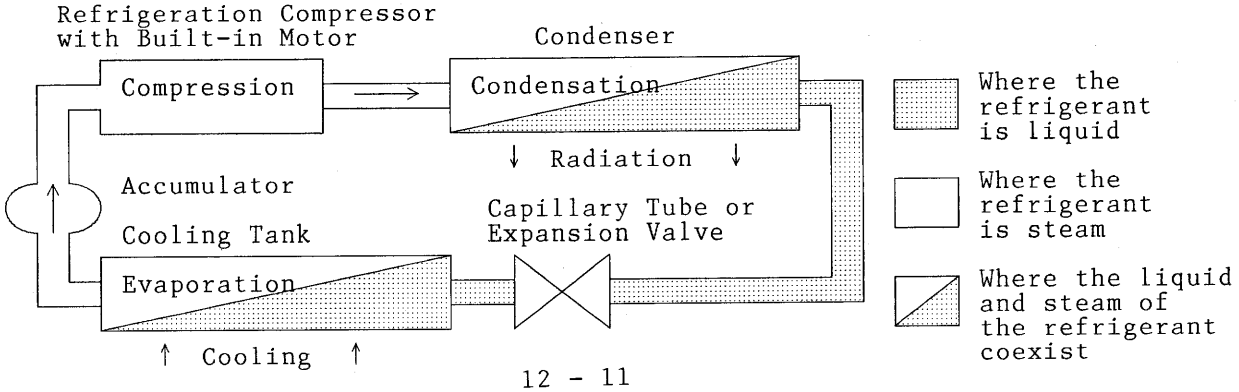
It incorporates a sheath heater and heats the oil, circulating the oil by the the circulation pump.

In order to prevent quality change and deterioration of the oil, power density of the heater surface has been designed low.

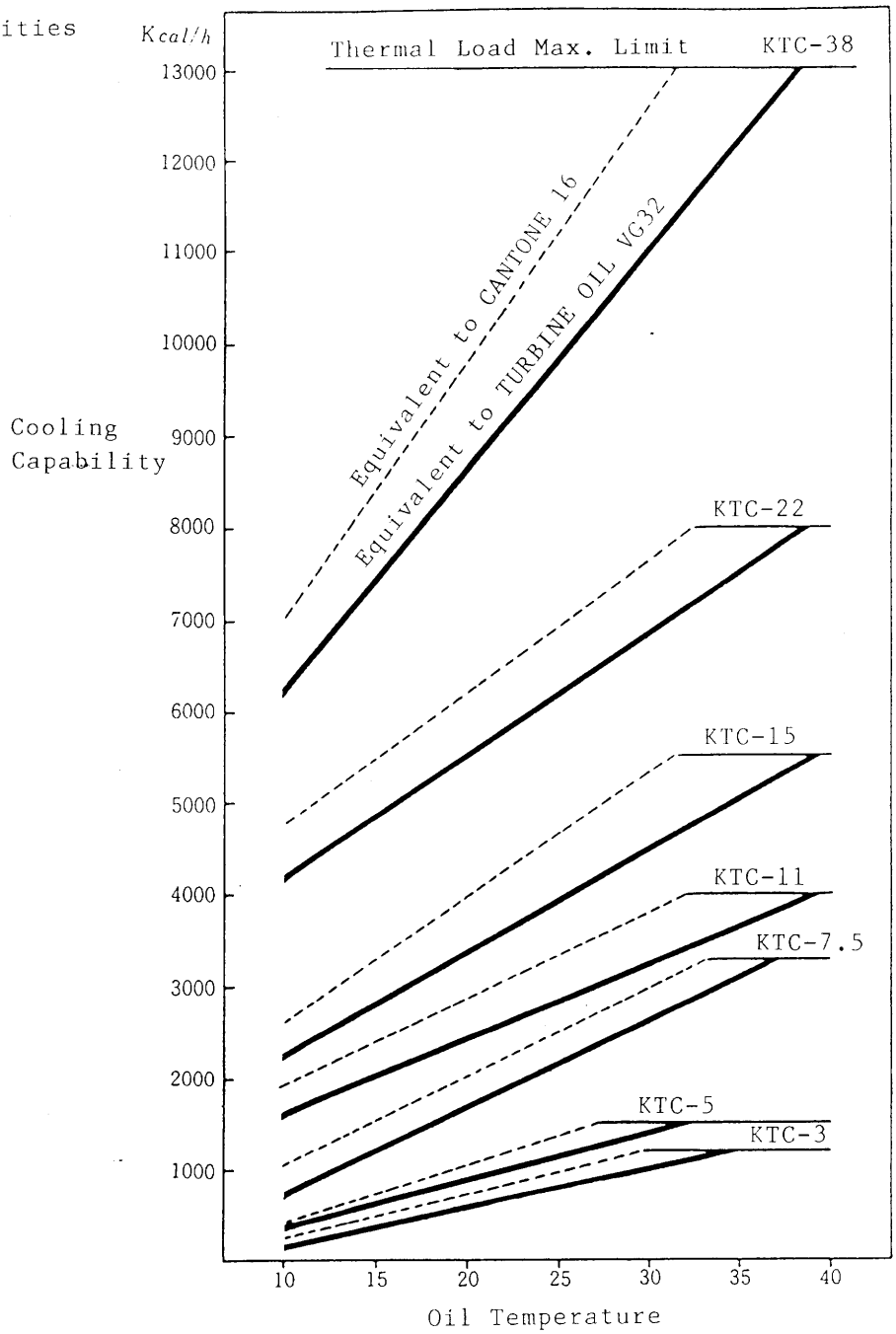
● Accumulator

The accumulator is a vessel to be attached to the piping between the cooling tank and compressor, and when the refrigerant liquid is mixed with the sucked gas, it separates the liquid and has the compressor suck only the steam to prevent liquid compression and protect the compressor.

Refrigeration Cycle and Condition Change of Refrigerant



2.3 Cooling Capabilities



Notes) 1. The above chart shows the capabilities when an ambient temperature is 35° C and the power source is of 65Hz.

2. The characteristic curves in the above chart are envelopes of multiple characteristic curves with different refrigerant charging amounts. The characteristic curve for a single unit assumes a convex curve outside the design temperature range.

3. The above chart shows the OILMATIC's capabilities and a range of set temperature. The cooling capabilities greatly change depending on whether an oil temperature is high or low, even if the output of the compressor is the same. Even at the same temperature, they change depending on dynamic viscosity of the oil.

4. With the standard model, a liquid temperature should be 10 to 40° C (oil equivalent to turbine oil VG32 in terms of viscosity).

2.4 Installation

A. Transportation

When transporting the OILMATIC, do not incline it back/forth or left/right over an angle of 40°. Inclination over the limit causes the compressor to go out of order. Also, do not give a strong shock or vibrations. The gas(refrigerant) may leak.

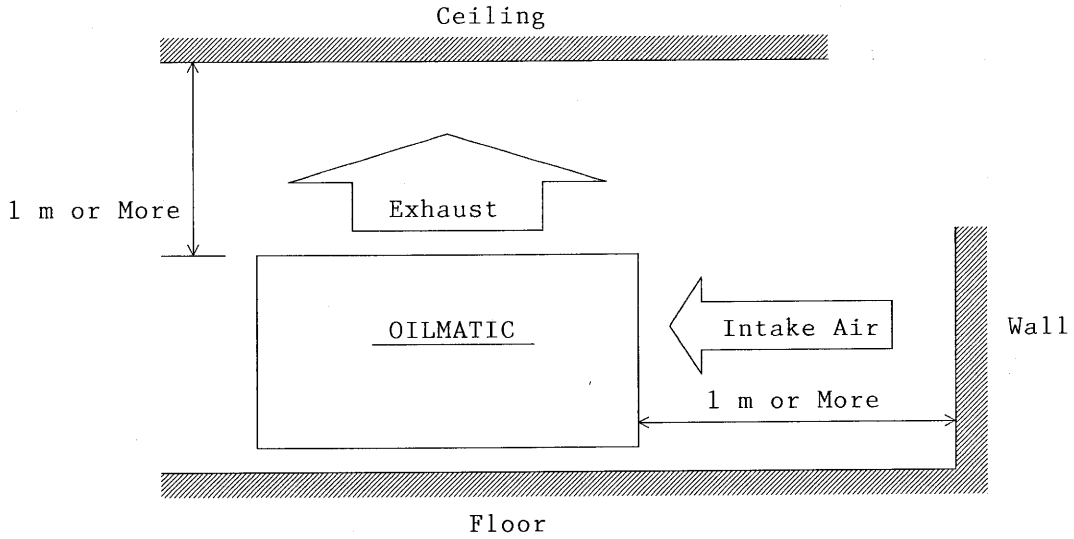
Note that any of the above cases cannot be repaired on the spot.

B. Installation Place

(1) Install the unit horizontally in a place free from direct sunshine and vibrations.

(2) The OILMATIC takes in the air through the condenser(refer to the appearance drawing). See to it that it can let in as low-temperature and clean air as possible through this suction port. When there is a heat generating unit nearby, think of using a screen, etc.
Secure a distance between the suction port and an obstacle as shown in the below figure, taking maintenance and inspection into account.

(3) Hot air is discharged from the exhaust port(refer to the appearance drawing) of the OILMATIC. Keep a good air flow in the exhaust direction so that heat will not hang over around it.
Spaces in the exhaust direction should be secured as much as shown in the below figure, taking maintenance and inspection into account.



(4) For the standard OILMATIC, an ambient temperature should be 40° C or less. When using at 40° C or more, it will be of optional specifications.

Note 1) If any one of the above conditions is not met, not only refrigeration capabilities go down, but also the refrigeration compressor will be overloaded and a protective device will be activated to stop it.

C. Piping Connection

The pump built in the OILMATIC is a constant flow rate type pump (trochoid gear pump) in order to obtain stable heat exchange capabilities.

Due to relations between the OILMATIC internal structure and pump motor's output, the OILMATIC should be used within a discharge pressure of 3.5kg/cm² (5kg/cm² when the discharge port is fully closed and all is relieved) and suction pressure limit of -0.3kg/cm² (-230mmHg). When the discharge pressure comes to 3.5 kg/cm² or more, the relief valve(refer to the circulation system diagram) is activated to decrease an oil feed rate and lower cooling capabilities, and the pump produces more noise. When the suction pressure exceeds -0.3kg/cm², the pump noise becomes loud, a flow rate decreases, and cooling capabilities go down. Also, it causes violent vibrations and incurs a trouble.

Even under the same piping conditions, a pressure loss due to piping resistance increases as oil viscosity goes up, or a temperature becomes lower even with the same oil(generally, oil viscosity goes up as a temperature becomes lower).

Therefore, piping should be installed taking into account the low-temperature condition in winter. From the above, the piping for the OILMATIC must have its piping resistance minimized.

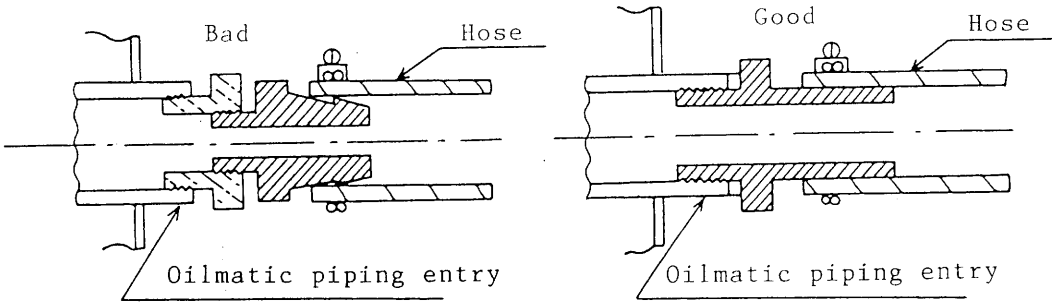
(1) Thickness of the piping

The piping from the OILMATIC to a load should use a gas pipe of the size listed in the table or a hose with an equivalent or larger inner diameter. When using a hose, since the suction side has a negative pressure, use the one which is not crushed(for example, wire blade hose).

Model	Piping Diameter(Gas Pipe Size)	
	Suction Side	Discharge Side
KTC-38 KTC-22	1-1/4 B	1 B
KTC-15	3/4 B	3/4 B
KTC-11	3/4 B	3/4 B
KTC-7.5	3/4 B	3/4 B
KTC-5	3/4 B	1/2 B
KTC-3	1/2 B	1/2 B

(2) Piping joint

Minimize the number of piping joins used. Some piping joints have an extremely narrow inner diameter. Do not use those joints. Note that when using the hoses, the inner diameter of a joint tends to be particularly narrow.



(3) Use of the valves

When using the valves halfway the piping, be sure to use sluice valves(gate valves). Do not use stop valves(globe valves) because they have a high resistance.

(4) Length of the suction piping

Minimize the length of the suction piping, referring to the below table.

Model	Piping Diameter (For SGP)	Maximum Length of Suction Piping	
		Turbine Oil ISO VG32, at 10°C (180cSt)	Turbine Oil ISO VG68, at 10°C (550cSt)
KTC-38	1-1/4 B(I.D. 35.7)	3.0	1.2
KTC-22	1-1/4 B(I.D. 35.7)	4.0	1.6
KTC-15	3/4 B(I.D. 21.6)	1.0	0.4
KTC-11	3/4 B(I.D. 21.6)	1.0	0.4
KTC-7.5	3/4 B(I.D. 21.6)	1.5	0.6
KTC-5	3/4 B(I.D. 21.6)	2.0	0.8
KTC-3	1/2 B(I.D. 16.1)	1.0	0.4

(5) Piping work

The piping on the suction side may suck the air. A piping connection should be done elaborately.

(6) Use of the filter

When using a suction filter or line filter for the suction-side or discharge-side piping of the OILMATIC, attach it in such a way that you can easily inspect/clean it periodically to avoid an increase of resistance due to clogging.

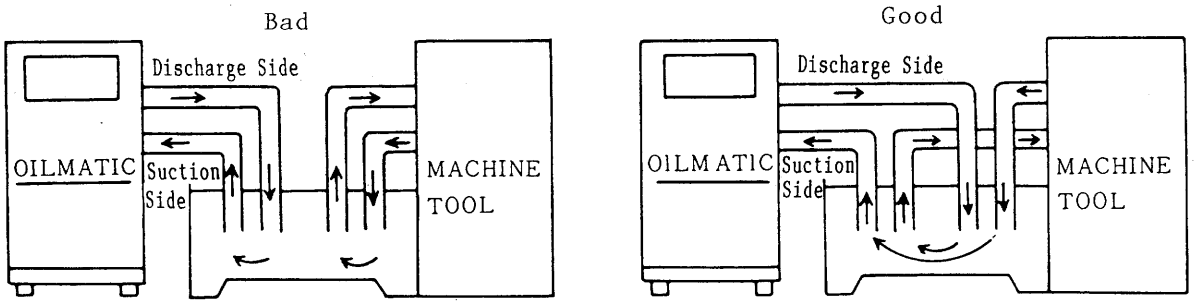
Note 2) The above-mentioned is necessary to reduce a resistance halfway the piping and minimize a pressure loss. If the pressure loss is high, a heat value caused by it cannot be ignored.

Note 3) When operating the OILMATIC, be sure to firmly plug the drain port(DRAIN) so that the oil will not leak from it.

Note 4) As mentioned above, the trochoid gear pump is used as an oil pump. If a solid foreign substance is sucked, it will get caught by the trochoid gear and disable rotation. If this is the case, you cannot restart the pump unless you disassemble the pump and eliminate the foreign substance.

(7) Layout of the piping(when piping to the oil tank)

In order to feed the oil with little temperature change to the machine, the suction and discharge pipings should be installed as shown in the right figure.



D. Power Connection

(1) Power capacity

Determine a power capacity, referring to the specifications list and wiring diagram.

(2) Rotating direction

The power source must be connected so that the oil pump and fan motor in the OILMATIC will rotate in the forward direction.

The input terminals of the power switch of the OILMATIC are for the phases R, S, and T respectively, from the left. Connect the phases R, S, and T of the 3-phase power source respectively to rotate in the forward direction.

When the phases R, S, and T of the power source are not known, it is necessary to make a temporary connection to check for the rotating direction. Check for the rotating direction as follows.

Model	Rotating Direction Checking Method	
	When Checking with Oil Pump	When Checking with Exhaust Direction of Fan
KTC-38A type KTC-3B type KTC-5A type	• Check with suction/discharge of the oil • Check for the motor rotating direction through the rotating direction inspection window.	• Sucks from the rear of the OILMATIC and exhausts upward. (The fan does not rotate unless the refrigerator is running.)
KTC-5C type KTC-7.5A type KTC-7.5 type KTC-7.5D KTC-11A type KTC-15B type KTC-22A type	Since a negative-phase protective relay has been installed, they do not start at negative phase time.	

Note 5) If the oil pump is idled(rotated without oil) or rotated reversely for a long time, the oil seal of the pump will be damaged. In order to check for the rotating direction, do not keep on idling or rotating reversely for a long time. (Complete within several seconds)

Note 6) Even when the phases R, S, and T of the power source are unknown, only the phase S(grounding-side wire) can be easily identified with an electric pen(detector).
Connect only the phase S to the central terminal S among the power source grounding terminals.
If the phase S of the power source has been connected to the terminal S, the circuit can be protected and its malfunctioning can be avoided, even if the control circuit has a grounding trouble.

E. Cooling Water Piping of OILMATIC with Water Cooled Condenser(Option)

When using the OILMATIC with water cooled condenser, the cooling water piping is also required for the condenser. The following table lists the cooling water piping diameters and cooling water required flow rates. Refer to the appearance drawing in the Specifications separately provided and install the cooling water piping.

When installing the piping, attach sluice valves to the cooling water inlet and outlet of the OILMATIC in order to facilitate maintenance such as cleaning of the water cooled condenser, and so on.

Model	Cooling Water Piping Diameter		Cooling Water Inlet Temperature	Cooling Water Required Flow Rate
	Inlet	Outlet		
KTC-38 type	1 B	1 B	At 25° C	30
			At 34° C	60
KTC-22 type	3/4 B	3/4 B	At 25° C	19
			At 34° C	42
KTC-15 type KTC-11 type	3/4 B	3/4 B	At 25° C	13
			At 34° C	30
KTC-7.5 type KTC-5 type	1/2 B	1/2 B	At 25° C	7.5
			At 34° C	18

2.5 Operation

A. Start

Before turning on the power switch, check the piping for any abnormality. When there is a valve halfway the piping, be sure to fully open it.

Note 7) If the suction-side(IN) piping of the OILMATIC is closed by a valve or the oil pump is rotated reversely under a high piping resistance, the oil seal of the pump will be turned up by a counter pressure and the oil will leak. Therefore, after installing as mentioned above, you must check the piping, and then, start the OILMATIC at the time of initial starting operation.

After completing the above-mentioned preparations, turn on the power switch, and then, turn on the start switch.

Start switch ON → Start lamp ON → Oil pump started

When the oil pump starts rotating, the oil on the load side is sucked into the cooling tank of the OILMATIC through its suction port(IN) and circulated to the load side through the discharge port(OUT).

※ When you have the OILMATIC with water cooled condenser, be sure to confirm a through passage of the cooling water.

Note 8) The heat exchanger inside the OILMATIC and piping require the following amount of oil. Note that the oil level of the oil tank will decrease by that amount.

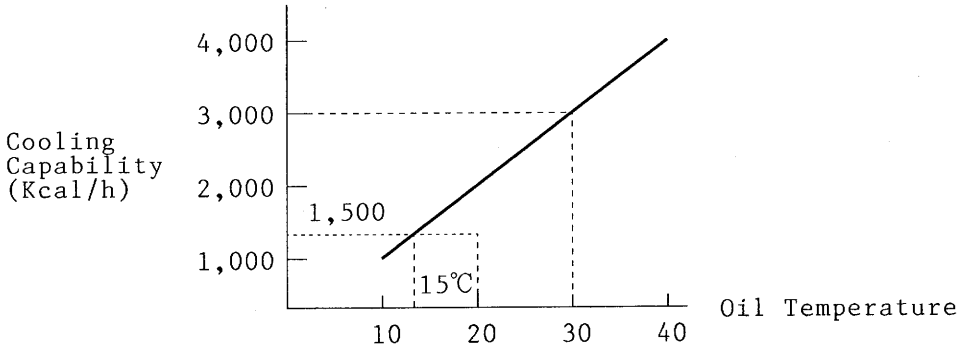
KTC-3 type : Approx. 4 ℓ	KTC-5 type : Approx. 8 ℓ
KTC-7.5 type: Approx. 12 ℓ	KTC-11 type: Approx. 15 ℓ
KTC-15 type : Approx. 25 ℓ	KTC-22 type: Approx. 30 ℓ
KTC-38 type : Approx. 55 ℓ	

B. Oil Temperature Adjustment

Upon starting the OILMATIC, an oil temperature is higher than the set temperature of the temperature regulator, the cooler is activated to start cooling. When the oil temperature is lowered to the set value, the cooler stops automatically. Functioning of the cooler can be confirmed by lighting of the cooler lamp. When the oil temperature at start time is lower than the set value, the cooler does not function. When the OILMATIC is provided with a heater, however, the heater will be activated(heater lamp turned on) to increase the oil temperature, and when it reaches the set temperature, the heater will stop automatically.

When heat generation is started by operating the machine and the oil temperature is about to change, the temperature regulator will adjust the oil temperature to your desired temperature by automatically turning on/off the cooler/heater.

Note 9) The cooling capability of the OILMATIC change depending on the oil temperature. Suppose you set to 20° C the temperature setting of the temperature regulator of the OILMATIC which has the cooling capability as shown in the right figure. When a thermal load is 3,000 kcal/h, the oil temperature will become 30° C without going down to 20° C. When the thermal load is 1,500 kcal/h, the oil temperature can be lowered to 15° C, but it is adjusted to 20° C through on/off control of the temperature regulator.



(1) Constant electronic temperature regulator (A)

The graduations of the liquid temperature setting dial indicate a temperature as they are. Set the dial to your desired temperature graduation.

(2) Reference temperature follow-up electronic temperature regulator (B, C)

When a room temperature is assumed to be a reference temperature, setting the graduation of the liquid temperature setting dial to 0, this temperature regulator causes the liquid temperature to follow up the room temperature. If set to -5(or 3), the temperature regulator works to adjust the liquid temperature to the room temperature -5° C(or + 3° C). a target temperature should be kept in a range of 10 to 40° C.(Standard)

When using the temperature regulator over the above range, we will discuss it upon your ordering.

C. Using the Timer(When the Timer Has Been Attached)

(1) When setting the current time, be sure to turn the center knob of the clock unit in the arrow direction(right).

● The timer will go out of order if you forces the knob in the opposite direction or turn the dial to set the time.

(2) When setting the operation time, shift a desired time's setter to inside the dial. Then, the equipment will be turned on at that time. (A red color appears on the periphery of the dial) If the setter is kept shifted to inside the dial, the ON state continues for the number of setters x 15 minutes.

- The setter should be shifted sufficiently until it clicks.
- If the setting is shifted to outside the dial, the equipment will be turned off at that time.(The red color on the periphery of the dial disappears)

(3) If the manual switch is set to AUTO, the output will be turned on/off according to the setting of the operation time with the setter.

- When turned to ON, the ON state takes effect regardless of the setting of the operation time.

(4) For AC frequency setting, operate the frequency selector switch located on the upper right of the front with a regular screwdriver, etc.

2.6 Protective Devices

A. Oil Circulation Circuit

OL_1 (thermal relay for the pump motor)

This is activated when the circulation pump has a fault and the pump motor is overloaded. To reset it, eliminate a cause and press the reset button of the thermal relay proper in the control box.

B. Refrigerant Circuit

When the refrigerant circuit has a fault, the following protective devices are activated.

- OL_{21} (thermal relay for the fan motor) KTC-11 or above
- OL_2 (thermal relay for the refrigeration compressor)
  It is activated when a current flowing to eachmotor increases.
  To reset it, eliminate a cause and press the reset button of the thermal relay proper.
- GPS Refrigeration circuit pressure switch (KTC-15 or above)
  To reset it, eliminate a cause and press the reset button on the upper part of the pressure switch.
  ※ All models with water cooled condenser have high and low pressure switches. They are activated respectively when a gas pressure increases or decreases excessively.
- ITS(internal thermostat) KTV-15, KTC-38
  It is embedded in the motor windings inside the refrigeration compressor and activated by a temperature increase.
  Activated at 105 ± 5°C or more
  Reset at 81 ± 11°C or less
- Although it is an automatic reset type, it may take some time to be reset after it is activated.(Up to about 40 minutes)
- THP(thermal protector) KTC-5, KTC-7.5, KTC-11, KTC-22
  It is activated by an excessive temperature rise of the refrigeration compressor's dome.
  Although it is an automatic reset type, it may take scores of minutes to be reset.

C. Danger Prevention of Heater(When the Heater Has Been Attached)

If the heater is turned on with the oil not circulating(flowing) in the OILMATIC or with no oil supplied in the OILMATIC, an oil temperature around the heater will become high locally or the heater will be turned on with no load applied, thus leading to a danger as well as trouble. We recommend you to install one of the following protective devices.

- HTS_1 : (No-load heater operation preventive thermostat)
  It is attached to the heater surface. It is activated when a heater's surface temperature increases abnormally with no oil contained in the heater chamber.
- HTS_2 : (No-load heater operation preventive bimetal switch)
  It is attached to the heater surface. It is activated when a heater's surface temperature comes to 50° C or more.

Note 11) Both HTS_1 and HTS_2 are reset automatically. Eliminate a fault cause, wait for automatic reset, and then, restart operation.

D. Buzzer

When the OILMATIC has a fault, an alarm buzzer keeps on sounding.

- ○ When the pump motor has a fault and OL_1 is acttivated, all functions of the OILMATIC stop and the buzzer keeps on sounding.
- ○ When the refrigeration circuit has a fault and the above-mentioned protective device is activated, the circulation pump keeps on operating, the refrigerator stops, and the buzzer keeps on sounding.

In either case, turning off the start switch(SSI) stops the buzzer. Eliminate a fault cause and reset the manual resetting block. For the automatic resetting block, wait for automatic reset and restart operation. For the fault causes, refer to 2.8 Troubles and Their Causes.

2.7 Maintenance and Inspection

Be sure to carry out the following maintenance and inspection so that you can use the OILMATIC efficiently and without troubles.

● Cleaning the Condenser and Air Filter

If much dust adhered to the condenser, a heat exchange capability will go down. If it is operated as it is, the refrigeration compress or will be overloaded, protective circuits(OL2, GPS, ITS, MP, etc.) will be, activated, and the cooler will stop. When the conditions are bad, the refrigeration compressor will go out of order and make it difficult to repair it on the spot.

Therefore, inspect and clean the condenser and air filter periodically in accordance with an amount of dust in the air.

The condenser uses the suction type forced air cooling method. Since dust adheres to the outer surface of the air filter and condenser, inspection and cleaning can be easily done.

[Cleaning Method]

Remove the air filter from the outer surface of the condenser and eliminate dust with an air gun or vacuum cleaner. When dust is sticky due to oil, etc., wash away with neutral detergent plus water or lukewarm water.

When the air filter is detached, eliminate dust from the surface of the internal condenser fins, using the air gun, wire brush, etc.

Note 12) When cleaning the condenser fins, be careful not to bend or break them. Also, avoid using a hard wire brush or pointed metal, because they may damage the copper pipe inside the condenser. If the copper pipe is damaged and the gas leaks, it is impossible to repair on the spot.

● Cleaning the water cooled condenser(option)

If fur or scale adheres to the internal cooling water circuit of the water cooled condenser, a heat exchange capability will go down.

If it is operated as it is, the refrigeration compressor will be overloaded, as with the above-mentioned standard air cooled condenser.

An amount of fur or scale and their natures differ depending on the quality of the cooling water, examine the water quality and clean periodically(at least once a year) using a cleaning agent suitable for the water quality.

If you have any questions about the cleaning agent and cleaning method, contact our office for the information.

2.8 Troubles and Their Causes

We believe that you will be always satisfied with the OILMATIC as far as it is given the normal power and operated under an adequate load. If there is a fault by any chance, inspect and eliminate a trouble cause, referring to the following table. If you have any questions, contact the service headquarters at our plant(phone: 0272-51-5585).

When you request for a repair, look at the name plate attached to the upper right side of the OILMATIC body and let us know the following information:

1. Manufacture number 2. Model number 3. Trouble(in details) 4. Site of operation(address, phone number)

Trouble	Faulty Device	Direct Cause	Check Point and Remedy
A. Even if the start switch is turned on, the start lamp does not go on.		a. The normal power is not supplied.	• With a voltmeter, check a voltage between each of the terminals R, S, and T in the control box.
	F	b. The fuse for the control circuit is gone.	• Check the fuse in the control box. If it is gone, replace it by a new one. When it goes again, the circuit may be short-circuited. Check each part of the wiring.
		c. Faulty contact or snapping at the connection of the wiring	• Check the connection of each wiring for faulty contact or snapping.
	PL1	d. Faulty lamp	• Remove a lamp lens cap from the front of the operation panel and replace it by a good one.
B. Although the start lamp is turned on, the circulation pump does not start.	OL1	a. Since the oil pump motor M1 is overloaded, the thermal relay OL1 for the electromagnetic switch MS1 is being activated.	① Check if the piping for the oil circuit is not too fine or long, or if a flow path is not closed by a valve, etc. ② Check if oil viscosity is not too high. If high-viscosity oil is circulated at low temperature, the pump motor will be overloaded. Start it after an oil temperature increased, or use low-viscosity oil. ③ Check if a solid foreign substance is not caught inside the pump, by manually rotating in one of the following methods: (a) For the models which uses one motor to drive the pump and fan, rotate the fan manually. (Models KTC-5A and KTC-7.5A) (b) For the other models, remove the end cover of the motor and rotate the motor fan manually. In the above methods, when you felt fan rotation abnormally heavy or cannot rotate the fan, disassemble the pump and eliminate the internal foreign substances. ④ Check if the motor or pump bearing is not broken. As with ③, rotate manually, and when the bearing is faulty, replace the bearing by a good one.
C. The pump is noisy.		a. Piping resistance of the oil circuit	① The piping resistance on the suction side(circuit through which the oil enters the OILMATIC) or discharge side is too high. ② Oil viscosity is too high or an oil temperature is too low. } (Refer to 2.4-C Piping Connection) ③ Clogging of the relief valve with dust or trouble If it is clogged with dust, disassemble and clean.
		b. Suction of the air	• The air is sucked through the piping joint, etc. on the suction side.
		c. Trouble of the pump	• Breakage of the pump or motor bearing, or breakage of the coupling between the pump and motor. Replace by a good one.

Trouble	Faulty Device	Direct Cause		Check Point and Remedy
D. Although the oil temperature increases, the cooler does not work. (The cooler lamp is not turned on.)	ITS THP	An excessive increase of the dome temperature of the refrigeration compressor and motor coil temperature due to an insufficient amount of the circulating refrigerant		① Check if the air flow conditions for the air intake and exhaust ports are adequate, and if an air intake temperature for the condenser is not too high; the standard working limit of the air intake temperature is 40° C. Where the heat hangs over, improve ventilation, using an industrial fan, etc.(Refer to 2.4-B Installation Place. ② Check the condenser for adhesion of dust and an air flow effect. (Refer to 2.7 Maintenance and Inspection) ③ Check if the fan is rotating in the forward direction. ④ Check if the OILMATIC was not started at a high oil temperature, or if the oil temperature is high because of too high a thermal load. ⑤ The refrigeration compressor is out of order. Seizure of the cylinder due to oil shortage Breakage of the discharge pipe or crank shaft Burnout, snapping, etc. of the motor coil } In these cases, it is necessary to replace the refrigeration compressor. They cannot be repair on the spot. Contact our office. ⑥ Insufficient refrigerant. Exhaust from the exhaust port is not warm and close to or equal to a room temperature. The refrigerant may be short due to a leak from a crack caused when a shock was given. Consult our office because it may not be repaired on the spot. ⑦ ※ OILMATIC with water cooled condenser ○ The cooling water is not passing through, or a condensation capability is insufficient because a flow rate is low. ○ The condensation capability is insufficient because of adhesion of fur, etc. to the internal cooling water circuit of the water cooled condenser.(Refer to 2..7 Maintenance and Inspection)
	CPS	Abnormal refrigerant pressure due to insufficient condensation capability and overloaded refrigeration circuit	Models above KTC-15	
	OL21	Overloaded fan motor due to eccentricity of the fan, etc.	Models above KTC-11	
	OL2	Overloaded refrigeration compressor		
E. Even if the oil temperature increases, the cooler does not work. (The cooler lamp is not turned on.)	CTC or ATA	The temperature regulator is out of order.		Short-circuit the temperature regulator's circuit, and if the refrigeration compressor is activated, The temperature regulator is out of order. Replace by a good one. For the electronic temperature regulator, refer to 2.9 Troubleshooting of Electronic Temperature Regulator on the next page.
F. The cooler is working (cooler lamp ON), but the cooling capability is insufficient.		a. A thermal load is too high.		If hot air is coming out of the exhaust port, it is likely that the cooler is working normally, but a thermal load is too high. Calculate the cooling capability(Q) of the OILMATIC, using the following formula. $Q=V \cdot \gamma \cdot Cp \cdot \triangle t$ Q: Cooling capability(kcal/h) △t: Temperature difference between incoming and outcoming oils from the OILMATIC V: Oil feed rate(m^3/h) γ : Speific gravity of the oil(kg/m^3) Cp: Specific heat of the oil(kcal/kg° C) } γ • Cp for petroleum oil is approx. 400 kcal/m^3° C. When the cooling capability is normal and the oil temperature still increases, use the OILMATIC with higher cooling capability.

Trouble	Faulty Device	Direct Cause	Check Point and Remedy
F. The cooler is working (cooler lamp ON), but the cooling capability is insufficient.		b. An oil circulation rate is low or the oil is not circulating.	If the refrigeration circuit is normal, but an oil circulation rate goes down, a heat exchange rate will decrease and the cooling capability may become insufficient. ① Since the lift of the oil circuit is too big or a piping resistance is excessive, the relief valve is actuated and a circulation rate has decreased. (Refer to 2.4-C Piping Connection) ② The motor-pump coupling is broken and the motor is idling. (Replace the coupling or pump motor) ③ The trochoid gear of the pump has been worn out and a discharge rate has decreased. (Replace the pump) ④ The pump is running in the reverse direction. (Refer to 2.4-D Power Connection) ⑤ Clogging of the relief valve with dust or trouble of the relief valve itself. (When it is clogged with dust, disassemble and clean. When it is out of order, replace by a good one)
		c. Insufficient refrigerant	Due to shortage ofthe refirgerant, each protective device would not be activated, but the cooling capability may run short. Find a refrigerant leakage, repair it, and replenish the refrigerant gas. Consult our office because the fault may not be repaired on the spot.
C. The oil temperature does not increase when heated. (When the heater has been attached) (The heater lamp is not turned on, or it is turned on, but goes off soon)	HTS1 HTS2	a. The overheat preventive thermostat(HTS1) has been turned off. The overheat preventive bimetal switch(HTS2) has been turned off.	① A temperature of the heater chamber increased too much due to F-b. ② There is no oil. ③ The device proper is out of order.
	CTC or ATA	b. The temperature regulator is out of order.	Make sure that the refrigeration circuit is turned off. Short-circuit the heater side of the temperature regulator. Then, if the heater can be turned on, the temperature regulator is out of order. (Replace by a good one) For the electronic temperature regulator, refer to 2.9 Trouble shooting of Electronic Temperature Regulator on the next page.
	OH	c. The heater is snapped.	Check with a tester. If there is no normal continuity between each phase, the heater is snapped. (Replace by a good one)
H. Others			When functioning of the OILMATIC is electrically faulty, check if each component part of the electric circuit is defectless, wirings are clamped tight, or they are not snapped, depending on the troubles.

Note 1. The protective devices for each model have the resetting mechanisms as shown in the right table. When there is a fault, they stop automatically and issue an error signal. Turn off the start and power switches and eliminate a cause. Manually reset the devices, if they are manually resettable. For those automatically reset, wait for them to be reset automatically, and then, restart.

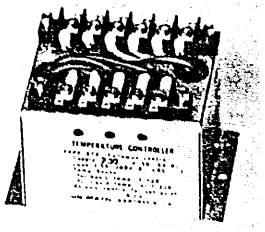
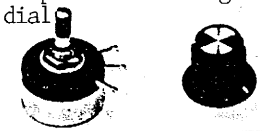
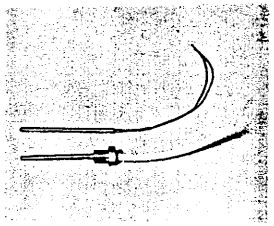
Note 2. When the circulation pump has a fault, although this applies to every model, all functions of the OILMATIC will stop.

Symbol	Activating Condition	Reset
MP	Turned off by excessive temperature increase of the refrigeration compressor's dome + overcurrent	Auto
ITS	Turned off by excessive temperature increase at the motor windings of the refrigeration compressor (Off at 105± 5° C or more)	Auto
GPS	Off by excessive increase of the refrigerant pressure(Off at the set pressure of 26kg/cm² or more)	Manual
OL	Off by a current over the set value	Manual

Symbol	Activating Condition	Reset
HTS2	Off at the heater chamber surface temperature of 50° C or more	Auto
HTS1	Off by an excessive temperature increase of the heater proper	Auto
THP	Turned off by excessive temperature increase of the refrigeration compressor's dome	Auto

2.9 Troubleshooting of Electronic Temperature Regulator

When you referred to "Troubles and Their Causes" and has figured out that the temperature regulator was out of order, refer to the following table and check each part of the temperature regulator.

Device Checked	Diagnostic Procedure	Remedy
A. Controller 	a) When the refrigerator does not start, short-circuit ATA or CTC, load contact for the refrigerator, in the control circuit, and check if the refrigerator can start. (Short-circuit the contact in the control circuit diagram, shown as left.) When the refrigerator still does not start even after short-circuiting, other part than the temperature regulator is defective. b) With the terminal block of the controller body, Short-circuiting A_4 and A_5 starts the refrigerator. Short-circuiting A_5 and A_6 does not start the refrigerator. When the OILMATIC has a heater attached to it, the heater is turned on. If the above functionings are met, the controller is defectless.	① When the controller body is defective, replace it. ② Refer to the label pasted onto the controller body and let us know the model number of the controller as well.
B. Potentiometer, Oil(liquid) temperature setting dial 	Disconnect the lead wire terminals A_1, A_2, and A_3 of the potentiometer from the terminal block of the controller body. Turning the oil(liquid) temperature setting dial in the KΩ range, measure a resistance value between each terminal. The resistance value between A_2 and A_3 changes to 0 to approx. 2KΩ (changes to 0 to approx. 1KΩ.) The resistance value between A_3 is constant at approx. 2KΩ (1KΩ). If normal, the measured values will be as shown above. The resistance values in parentheses are effective when the set range is 5 to -5°C.	① When the resistance value has an error or there is a faulty contact, replace the potentiometer.
C. Thermistor 	Disconnect the lead wire A_4, A_5, and A_6 of the oil(liquid) temperature detection thermistor and room temperature(reference temperature) detection thermistor* from the terminal block of the controller body. a) In the KΩ range of the tester, measure a resistance value between the terminals A_4 and A_5, and A_5 and A_6. A normal resistance value of the thermistor is about 5KΩ when a temperature at the thermistor is 20°C. (The resistance decreases as the temperature increases.) When the resistance value is o or ∞, the thermistor is either shortcircuited or snapped. It is also likely that the wiring from the terminal block to the thermister is short-circuited or snapped. Check the wiring as far as the connection of the thermistor. (The connection may have a faulty contact.) b) Disconnect the thermistor's wiring from the terminal block of the controller body, and measure an insulation resistance value between the thermistor's wiring and OILMATIC body earthing conductor(E-terminal), using an insulation resistance tester. It is normal if the value is 2 MΩ or more at 500V.	When the thermistor body is improperly insulated or snapped or shortcircuited, replace it. Operating conditions of the refrigeration circuit when the thermistor is snapped or short-circuited Oil(liquid) temperature detection thermistor is short-circuited or room temperature detection thermistor is snapped — Continuous operation Oil(liquid) temperature detection thermistor is snapped or roomtemperature detection thermistor is short-circuited — Stop
D. Others	a) When the refrigerator does not start, the protective device may be functioning. Check each protective device as well. b) For the OILMATIC with low-temperature protective thermostat(optional), when an oil temperature is too low(10°C or less), the protective thermostat is activated and the refrigerator may not start. c) When the set oil temperature differs from the indication of the OILMATIC's thermostat, the following causes are possible. ① The thermometer is out of order(the indication error of the thermostat is normally within ±2°C). ② A room temperature(reference temperature) detection thermistor is exposed to hot air and detects a temperature higher than an ambient temperature. ③ A setscrew for the oil temperature setting dial has been loosened and the dial does not indicate a specified temperature.	Refer to the electric control circuit. c)- ② Think of using a cover, screen, etc. to protect against the hot air. c)- ① It is necessary to readjust the zero point.

Equipment Replacement Standards

(1) Equipment with an insulation resistance of not more than 0.2 megohm should be replaced.

(2) Instruments(Pressure gages, thermometers, etc.):
When an instrument shows an indication error of one scale point or more, it should be replaced.

(3) Main Equipment(refrigeration compressors, expansion valves, pumps, heaters, motors, etc.):
Equipment operating for 5 years or 10,000 hours or less should be replaced or overhauled.
Frequent ON-OFF relays and refrigeration compressor relays should be replaced.

* Users are requested to judge the timing of replacement according to the conditions of maintenance and use.

* We recommend replacement of OILMATIC which has been operating for eight years or less.

Electric Circuit Component Parts

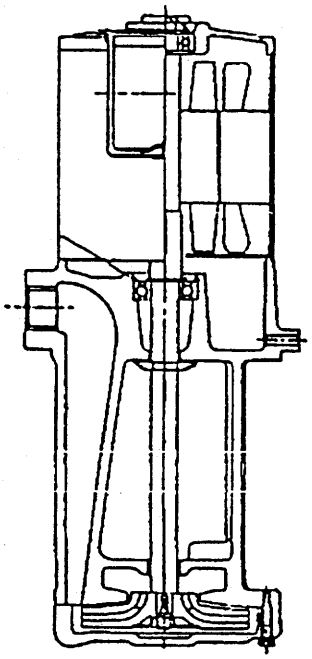
Symbol	Name	Specification	Q'ty	Type	Maker	Remarks
ATA1	Temperature regulator	Ref. temperature follow-up type, Ref. temperature ±5°C	1	KT2-F05-200	KANTO SEIKI	
CB	Circuit breaker	3P AC220V 10A	1	E30C-3P 10A	TOSHIBA	
CR1	Auxiliary relay	2ab contact 200/220V 50/60Hz	1	MY2 200V PYF08A	OMRON	
F1	Fuse	Cartridge fuse 1A	1	F-7111(holder)	SATO PARTS	
F2	Fuse	Cartridge fuse 1A	1	F-7111(holder)	SATO PARTS	
M1	Pump motor	200Q4P 200V 50/60Hz 220V 60Hz3φ	1	TOP-2MY200	NOP	
M2	Compressor	Nominal capacity 500W 2P 200V 50/60Hz	1	C-R53H3W	SANYO ELECTRIC	
M21	Fan motor	12W4P 200V 50/60Hz 220V 60Hz1φ	1	BP-12S-255B	SHIBAURA SS	
MS1	Thermal relay	Auxiliary contact 1a.200V 50/60Hz 220V60Hz	1	M11A-W 200V	TOSHIBA	
OL1	Thermal relay	Set value 1.6 A, 3-pole 2-element, manual reset type	1	Integrated with MS1		
MS2	Electromagnetic switch	Auxiliary contact 1a.200V 50/60Hz 220V60Hz	1	M11A-W 200V	TOSHIBA	
OL2	Thermal relay	Set value 3.0 A, 3-pole 2-element, manual reset type	1	Integrated with MS2		
PL1	Operation indicator lamp	200-220V AC, white neon globe	1	LMU-6H 220V W	SAKAZUME SS	
PL2	Operation indicator lamp	200-220V AC, white neon globe	1	LMU-6H 220V W	SAKAZUME SS	
RP	Negative-phase protective relay	3ph 200V 50/60Hz "OFF" at negative phase	1	RDR-S-1	SANYO ELECTRIC	
SK	Spark killer	Rated voltage 350VAC(0.1μF+120Ω)	3	953M500310411	MATSUO DENKI	
SK3	Spark killer	Rated voltage 250VAC(0.47μF×3)	2	RFM2E145KPD	MARUKON DENSHI	
SS1	Start switch	Selector switch, 2-notch(1a contact)	1	ASS210N	IZUMI DENKI	
TH1	Liquid temperature detection thermistor	PT screw mounting type PT1/8" 5KΩ	1	TCA25P5KPT	KANTO SEIKI	
TH2	Ref. temperature detection thermistor	Mold type(temperature regulator accessory)	1	502AT-1NW		
THP	M2 thermal protector	Off by excessive increase of the dome temperature, automatic reset	1	Attached to M2		
VR	Temperature setting VR	(Temperature regulator accessory)	1	BIKΩ		

Oil Circuit Component Parts

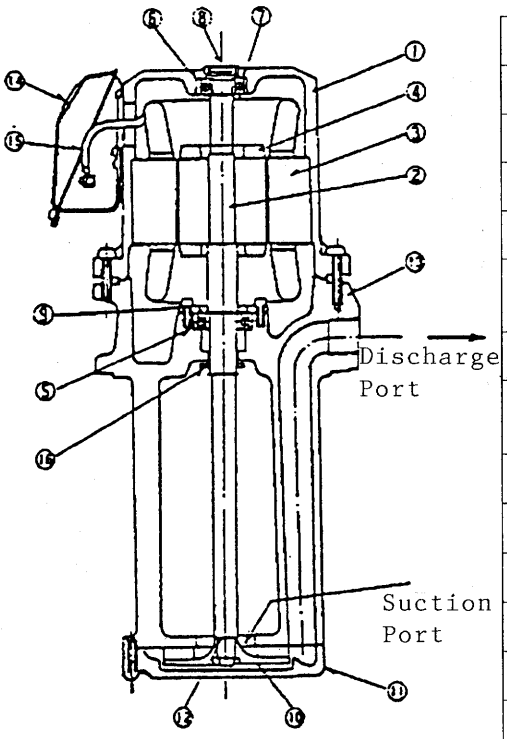
Symbol	Name	Specification	Q'ty	Type	Maker
000	Compressor(ass'y)	Nominal capacity 500W 2P 200V 50/60Hz	1	806 503 83	SANYO ELECTRIC
011	Condenser	4-row 13-stage, Type 5	1	01108	KANTO SEIKI
020	Cooler(enclosed type)	Type 5C	1	02002	KANTO SEIKI
051	Trochoid gear pump motor	200W set pressure 5kg/cm²	1	2MY200-208HAEMVK	NOP
081	Fan motor	12W4P 200V 50/60Hz 220V 60Hz1φ	1	BP-12S-255B	SHIBAURA SS
203	Dryer	For 500W, 140mm(for capillary)	1	KC-6476-00	KAWAMURA SEIKAN
204	Service valve	Pressure resistance 30kgf/cm² G	1	ZVH-W	NICHIDEN
380	Capillary tube	Type 5	1	38007	KANTO SEIKI
431	Sensor	Thermistor φ5×50 PT1/8	1	TCAT25P5KPT-01M	KANTO SEIKI

3. COOLANT PUMP

3.1 Flood Coolant Pump(Standard Attachment) LSW 15A 0.18 and Gun Coolant Pump(Optional Attachment) VKP-071A



LSW15A0.18



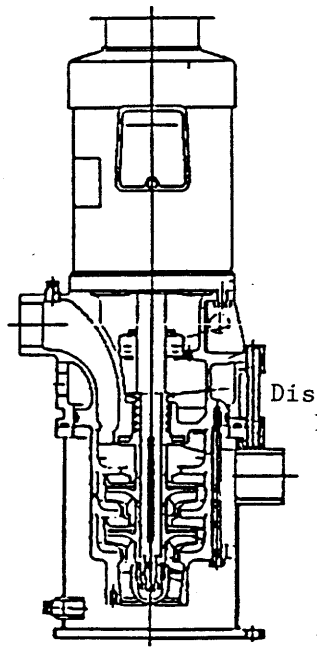
VKP−071A

Parts List

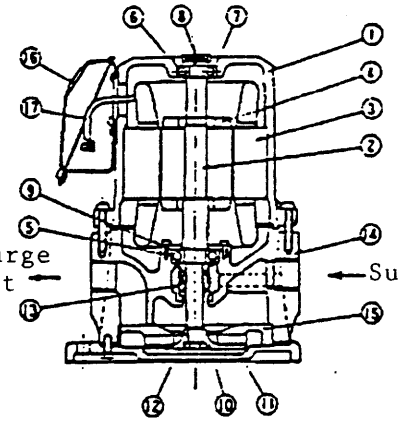
1	Frame
2	Shaft
3	Stator
4	Rotor
5	Operationside bearing
6	Non-operation-side bearing
7	Corrugated washer
8	Rotating direction inspection window
9	End cover
10	Runner
11	Spiral box
12	Adjusting washer
13	Pump leg
14	Terminal box
15	Terminal cable
16	Oil thrower

Specification \ Type	LSW15A0.18		VKP071A	
Application	For flood coolant		For gun coolant	
Output [W]	180		180	
Rated voltage [V]	200	200, 220	200	200, 220
Frequency [Hz]	50	60	50	60
Rated current [A]	1.1	1.2	0.85	1, 1
Discharge rate [ℓ /min]	10～60		75	100
Total lift [m]	9～5	13～8	3	
Working viscosity limit [Redwood second]	150(CST)	75(CST)	1200	600
Standard piping diameter	1/2		1/2	
Painting color [PS]	Munsell 7.5B 5/7.5		Dark green FM	
Pump standard			JEM1242	
Rough weight [Kg]	13	14	10.2	
Remarks				

3.2 Jet Coolant Pump (Optional Attachment) VKN 91A, LPS 40A



LPS40A



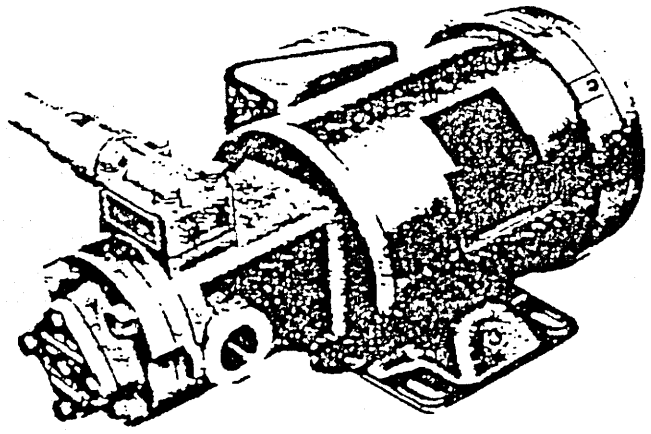
VKN91A

1	Frame
2	Shaft
3	Stator
4	Rotor
5	Operation-side bearing
6	Non-operation-side bearing
7	Corrugated washer
8	Rotating direction inspection window
9	End cover
10	Runner
11	Bottom plate
12	Adjusting washer
13	Mechanical seal
14	Casing
15	Spiral box
16	Terminal box
17	Terminal cable

Specification \ Type	VKN91A		LPS40A	
Application	For flood coolant		For gun coolant	
Output [W]	400		750	
Rated voltage [V]	200	200, 220	200	200, 220
Frequency [Hz]	50	60	50	60
Rated current [A]	2.4	2.5, 2.4	3.2	3.3, 3.0
Discharge rate [ℓ /min]	140	200	75	100～300
Total lift [m]	5		10～5	15～8
Max. suction pipe length[m]	0.7		0.7	
Working viscosity limit [Redwood second]	800	300	32(CST)	
Standard piping diameter [PS]	1		1-1/2	
Painting color	Dark green FM			
Pump standard	—			
Rough weight [Kg]	12.6		41	
Remarks				

3.3 Oil Hole Coolant Motor and Pump (Optional Attachments)

TOP-2MY-400-206-HWM-VB5

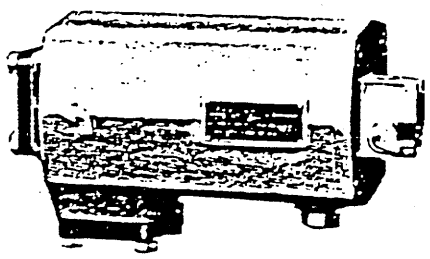


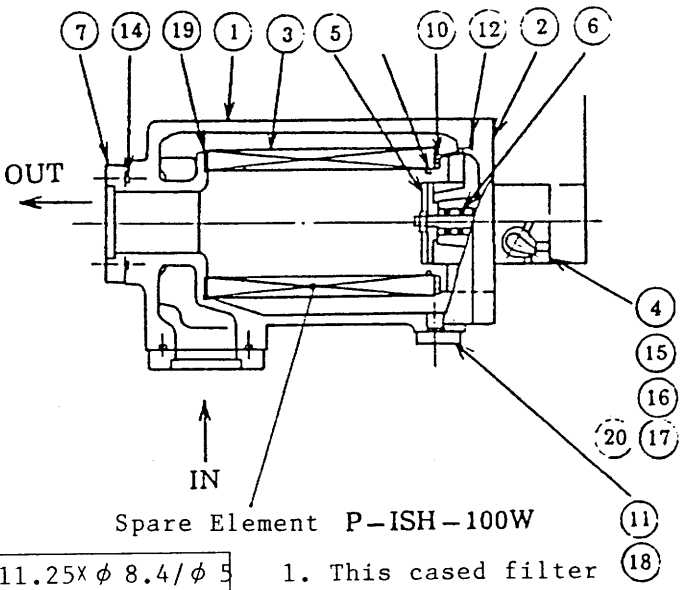
Motor Used YASUKAWA ELECTRIC MFG.

Output (W)	Type	Frame No.	Poles (P)	Rating	Voltage	Frequency	Rotation Freq.	Current	Weight
→ 400	FEL-8	71HTB	4	Continuous	200 200 220	50 60 70	1430 1710 1730	2.2 2.1 2.1	10.0

Pump type	50Hz 4p(1500rpm)					60Hz 4p(1800rpm)				
	Discharge rate ℓ /min	Max. output to motor output				Discharge rate ℓ /min	Max. output to motor output			
		200W	400W	750W	1500W		200W	400W	750W	1500W
→ TOP-206HWM	9.0	3.0	10.5	25.0		10.8	2.0	7.0	23.5	25.0

Filter Unit ISH-04-100W





Spare Element P-ISH-100W

Parts List for ISH-04-100W

No.	Name	Material	Q'ty	Remarks
20	Backup ring	Teflon	1	11.25×φ8.4/φ5
19	Packing	NBR	1	
18	O-ring	NBR	1	〃
17	O-ring	NBR	1	〃
16	O-ring	NBR	1	〃
15	O-ring	NBR	1	〃
14	O-ring	NBR	2	〃
13	O-ring	NBR	1	〃
12	O-ring	NBR	1	JISB2401•1A
11	Drain plug	SCM3	1	
10	Flat spring	SK5	1	
9	Hexagon socket head bolt	SCM3	4	
8	Bolt	SS41	8	
7	Phase flange	SS	2	
6	Spring	SWPA	1	
5	Relief valve	BSC	1	
4	Indicator		1 set	
3	Element	SUS304 SPCC	1 set	P-ISH-04-100W
2	Lid	AC2B	1	
1	Main body	AC2B	1	

O-rings and Packings List

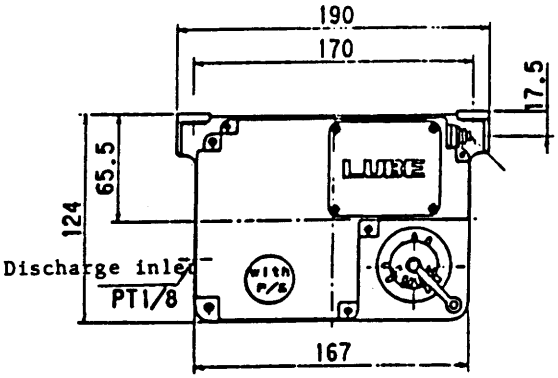
Type \ No.	12	13	14	15	16	17	18	19
ISH-03	G65	G35	G30	P15	P14	P5	P11	12×φ65/φ40
ISH-04								
ISH-06	G90	G45	G45					12×φ85/φ55
ISH-08								
ISH-10	G100	G65	G55				P14	12×φ100/φ70
ISH-12								
ISH-16	G125	G80	G70					12×φ120/φ85
ISH-20	G145	G100	G95					12×φ140/φ105
ISH-24								

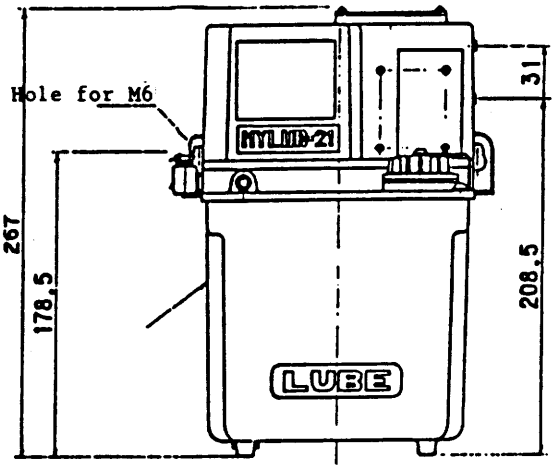
1. This cased filter is very light and solid. It consists of a aluminum alloy housing, stainless element, indicator, and relief valve.
2. Since it is a horizontal type filter, the element can be pulled out in the horizontal direction even if there is no space above.
3. The element uses stainless wire nets of 60, 100, 150, and 200 meshes as standard specifications.
4. Clogging of the filter element can be confirmed with the indicator.
5. The built-in relief valve prevents a danger caused by clogging.

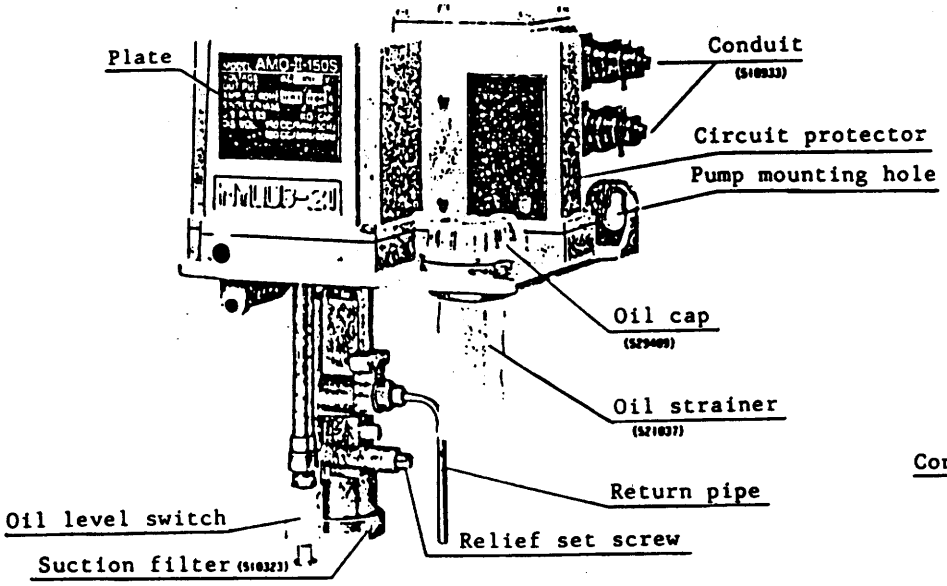
4. Lubrication Pump

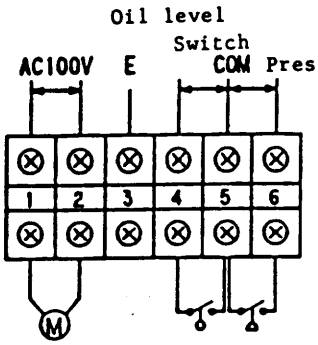
AMO-II-150S Model pump

Model	AMO-150SA-18LP-P
Code No.	202562
Motor	AC100V 20W 50/60Hz 0.83/0.64 A (50/60Hz)
Discharge volume	150cc/min 50Hz 180cc/min 60Hz
Discharge pressure	12Kgf/cm^2(Relief setting pressure)
Range of applicable viscosity	68 ~ 1800cSt
Range of applicable temperature	-5°C ~ +40°C
Oil level switch	Applicable Max. voltage : AC, DC200V Contactor type : A (ON at lower limit) Contactor capacity : 30W or 0.5A (Resistance load) Whichever smaller one.
Pressure switch	Capacity : AC120/240V-125VA AC, DC28V-2A Model : A Operating pressure : 11Kgf/cm^2 ON Resumed pressure : 6Kgf/cm^2 OFF
Tank	Full capacity : 1.8 ℓ Effective capacity : 1.5ℓ (H-O/L)









Connecting diagram of terminal

Note 1. Lubricant should be used recommended clean one.

2. A suction filter should be replace or clean once a year or more.

3. Avoid a use of this pump in the atmosphere with high produce of corrosive gas, dust, lmmidity (Within 35 ~ 85%HR).

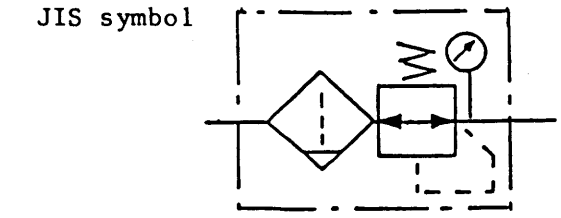
5. Pneumatic Devices

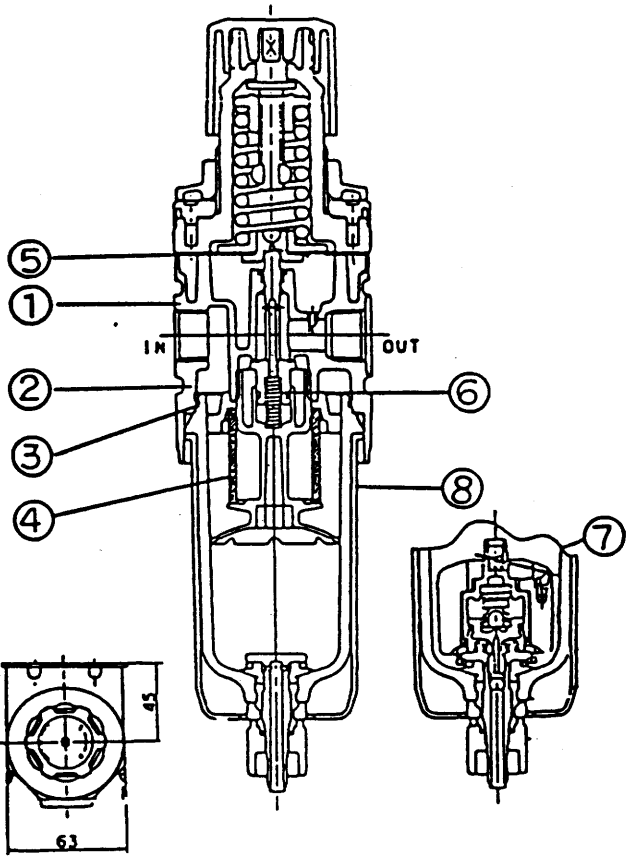
Air filter/regulator unit

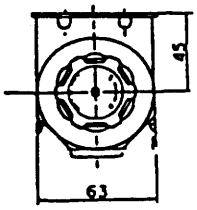
Outline and features

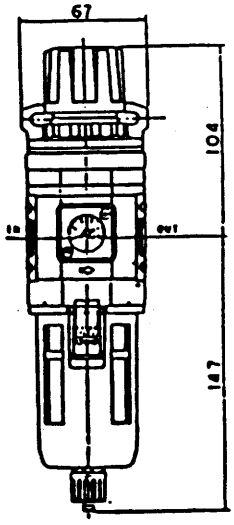
SELEX FR unit (W3000) is a unit type combined with a filter F3000 which has high eliminating effect of drip and dust and a regulator R3000 which has accurate and steady pressure setting capability. It is the most suitable at narrow space.

JIS symbol









No.	Part name	Material	Part No.
1	Plate cover	ABS	
2	Body	ADC	
3	O-ring	SP. NBR	F4-550349
4	Element	PP	F4-550350
5	Diaphram assembly	ZDC.NBR	F4-550464
6	Valve assembly	C3604.NBR	F4-550477
7	Bowl assembly	PC.POM.PUR	F4-550478
8	Bowl guard	PA	F3-550425

Precaution of use

.Keep away from direct sunlight.

.Avoid use of chemicals and in the atmosphere such as thinner, carbon tetrachloride, alcohol, chloroform, ethylene trichloride, ester acetate, sulfuric acid or lye, because material of bowl is poly carbonate.

.To clean a bolw element, use a neutral detergent for household then linse it by fresh water.

.Use a pipe with 6mm or more for inside diameter and less than 5m of length and avoid rise up piping.

.Do not handle with adjusting knob to transfer the commodity or swing around.

Principle of the movements of the automatic drain with manual discharger (W3000-8-F)

When no pressure acts upon the inside of the bowl, the valve ⑫ is forced up by the spring ⑩ to be in the state detached from the stem packing ⑤.

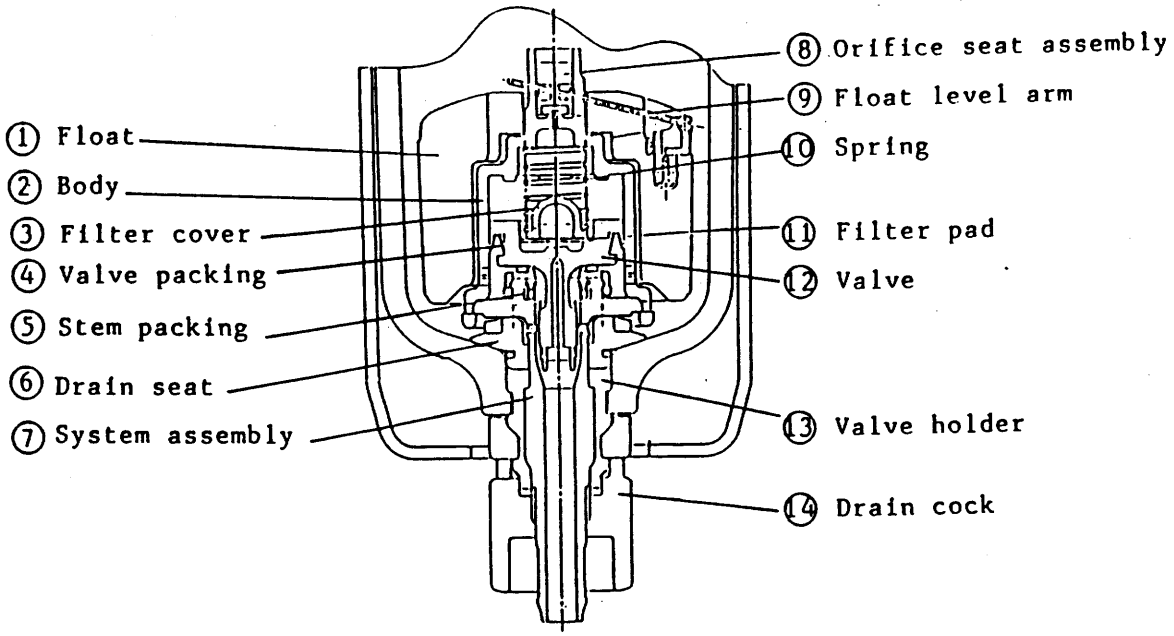
If more than 1 Kgf/cm^2 of pressure acts upon the inside of the bowl, the receiving pressure of the value ⑫ becomes larger than the force of the spring ⑩, and the value ⑫ is forced up and sealed with the stem packing ⑤. Next, when drain is accumulated in the bowl, the float ① is elevated and the Orifice seat assembly ⑧ is opened by the float level arm ⑨. Then, pressed air is guided into the upper chamber of the valve ⑫, and the valve becomes pressurized state. And the valve ⑫ is forced down, and when it parts from the stem packing ⑤, drain is discharged into the atomosphere through following the arrow mark.

When drain is discharged, the float ① is lowered and the Orifice seat assembly ⑧ is closed by the float level arm ⑨.

Then, pressurized air is discharged into the atomosphere through the Orifice of the valve ⑫.

Whereupon, the receiving pressure of the valve ⑫ from the lower part exceeds the force of the spring ⑩ and the valve ⑫ is lifted up and sealed with the stem packing ⑤. As a manual discharging device is built in this model of machine, it can be used as a manual drain.

The tube connected to the drain line shall be of ID ϕ6mm and within 5mm long.

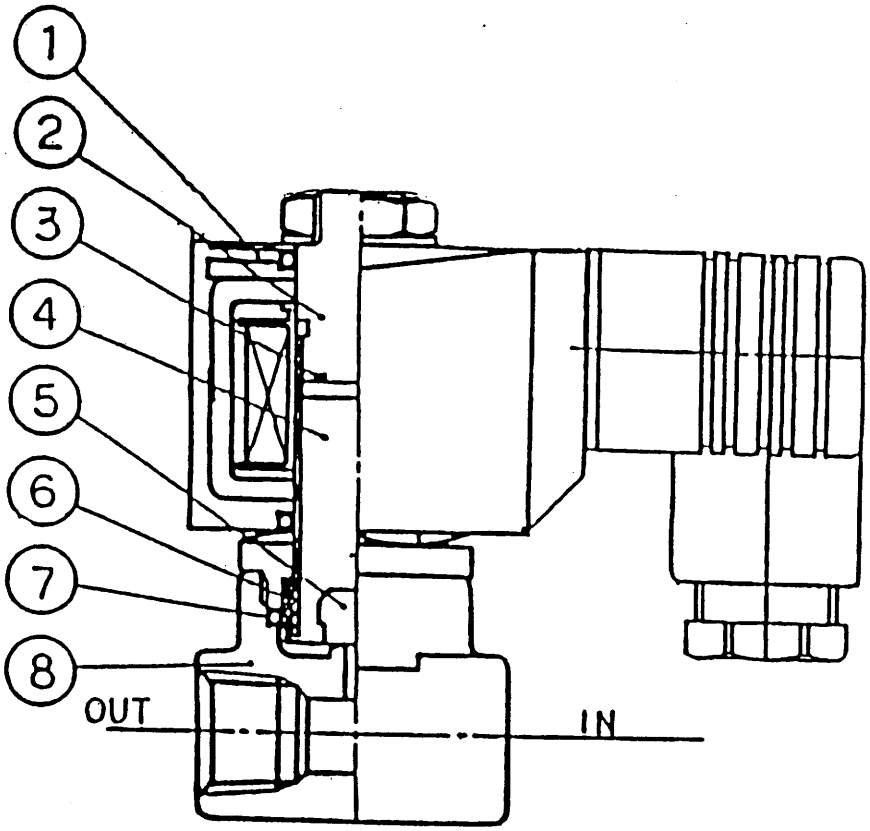


When the phenomena such as the below occur, replace it with a new parts (Bowl assemble F4-550178).

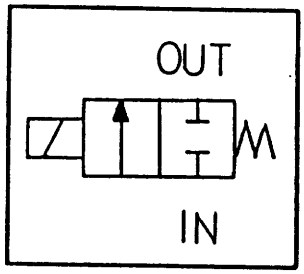
a. Drain is not discharged automatically.

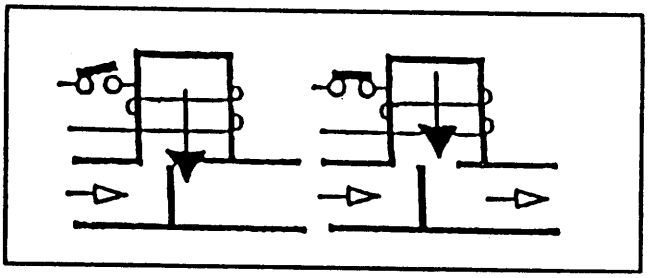
b. Air is leaking ceaselessly from the drain port.

AB41－02－5－02G－AC100V



JIS symbol





No.	Part name	Material
①	Coil	Resin
②	Core assembly	SUS405, 316L. 403
③	Shudding coil	Cu
④	Plunger	SUS405
⑤	Seal	NBR
⑥	Spring	SUS304
⑦	O-ring	NBR
⑧	Body	C3771

Chapter 13 REFERENCE DATA FOR MAINTENANCE & ADJUSTMENT

- In this chapter, the data necessary for the maintenance and adjustment of the SEICOS III, and only the point is described.
- As to the detailed operations and adjustments, refer to the instruction manual or inquire to out service department.
- As to the parts of the device described, inquire to our service department.

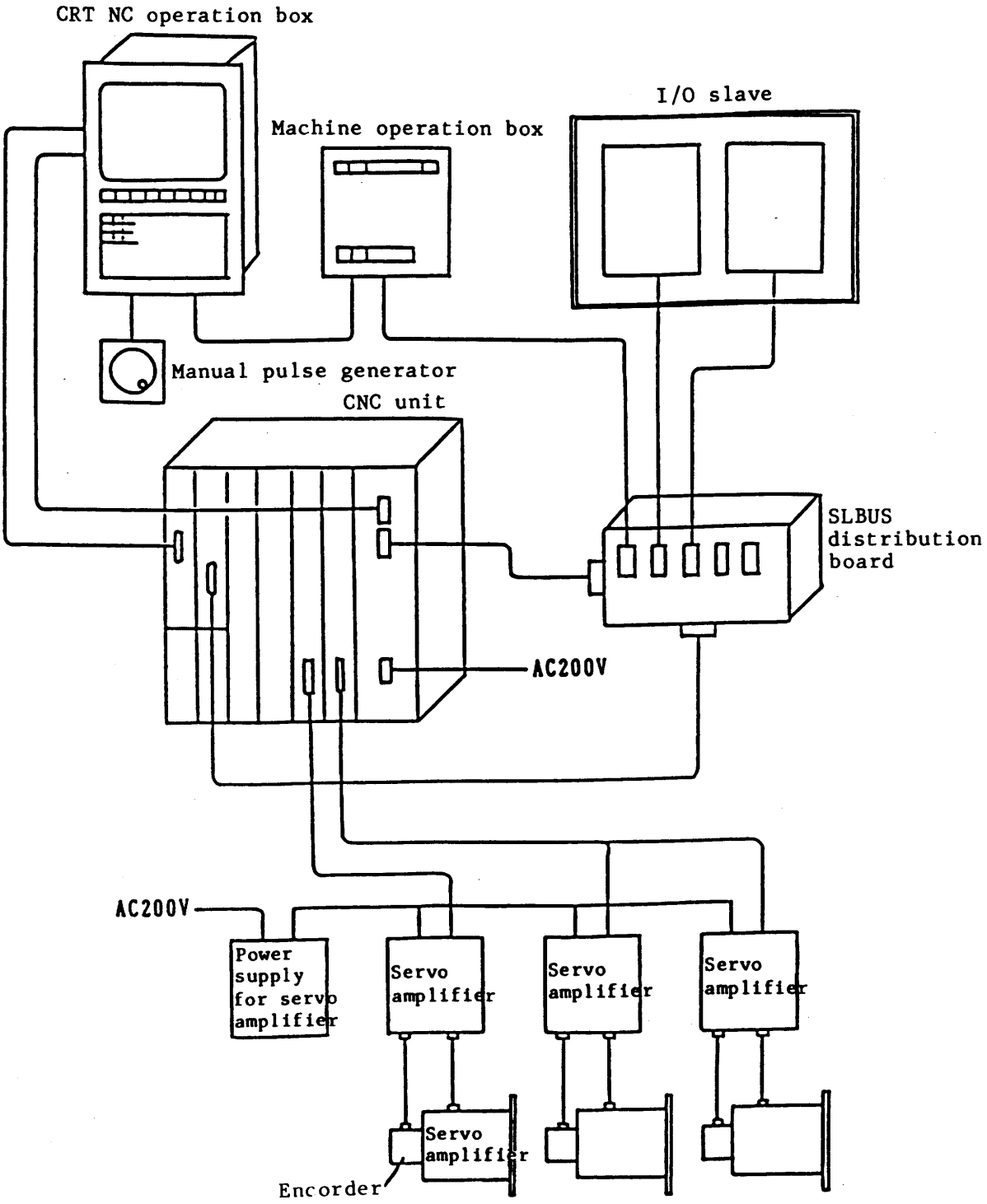
1. Sequence Controller

1-1 Outline

Model SEICOS III/A CNC unit is a product materializing high speed and high accuracy through adopting 32 bits of micro-processor.
And complete digitalization of the servo amplifier the reliability and maintenability of the product.

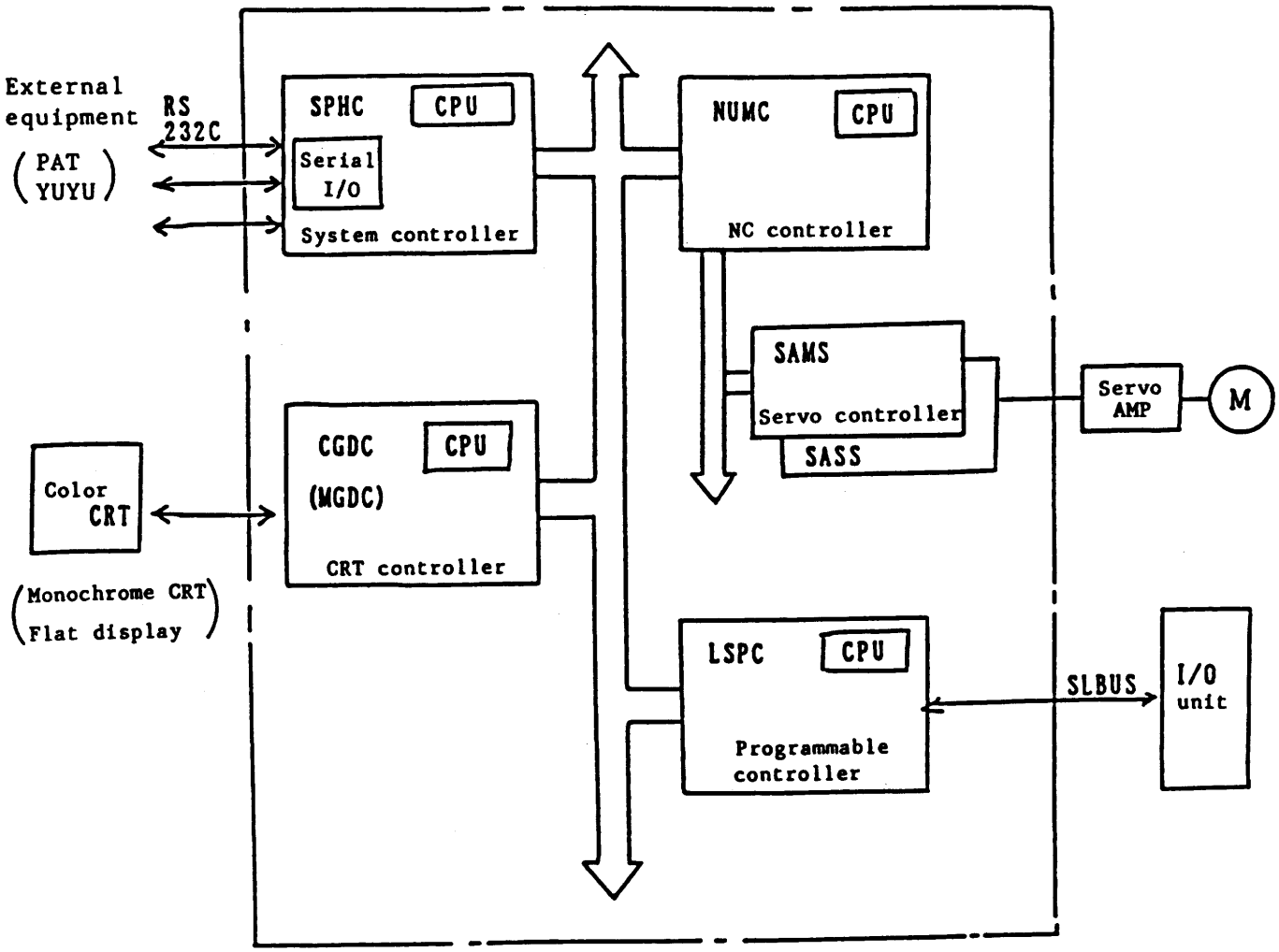
1) System construction

The following diagram shows example of the SEICOS III/A CNC unit using system.



2) Inner systematic diagram

The unit construction block diagram of the control unit is shown in the below.



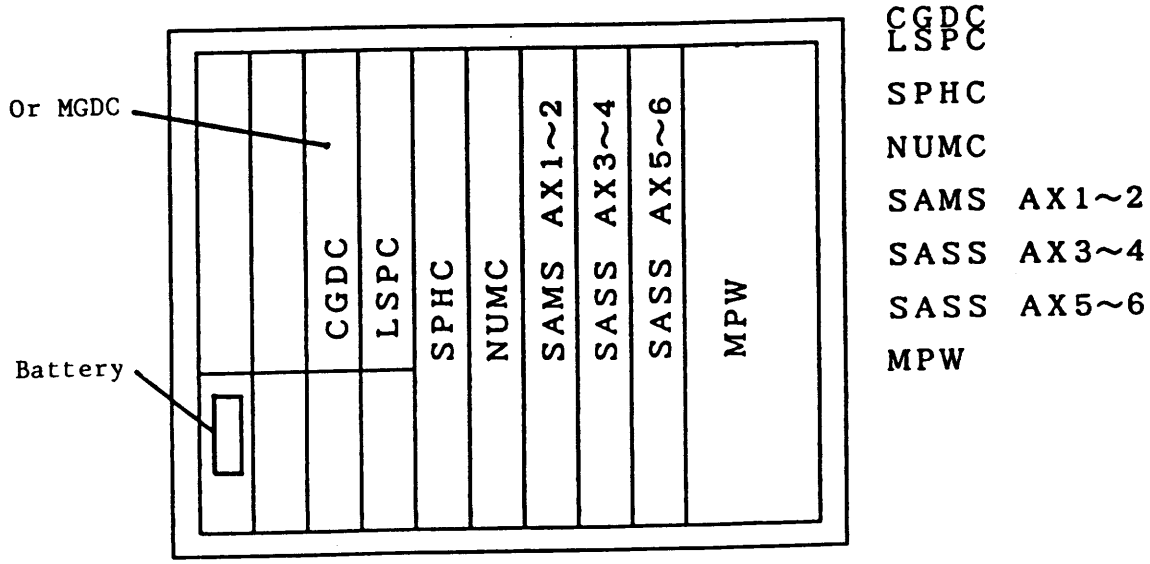
3) List of the construction units

The construction units of the control unit is shown in the below table. The actual installed position is fixed as shown in the diagram of the actual installation.
All the units are of plug-in type and can be replaced easily.

(1) List of the units

Name	Abbreviation	Function . Use
Sub-rack		For servo 6 axes control
Power unit	MPW	5V-30A +15V-1A, -15V-1A, 24V-1A
System control unit	SPHC	System . peripheral equipment control
PC unit	LSPC	Ladder program control
Color graphic unit	CGDC	Color graphic display
NC unit	NUMC	Numerical control
Servo main unit	SAMS	Servo main control, Servo 2 axes control
Servo sub unit	SASS	Servo 2 axes control
Monochrome graphic unit	MGDC	Flat display indication Monochrome CRT

(2) Actual installation diagram of units



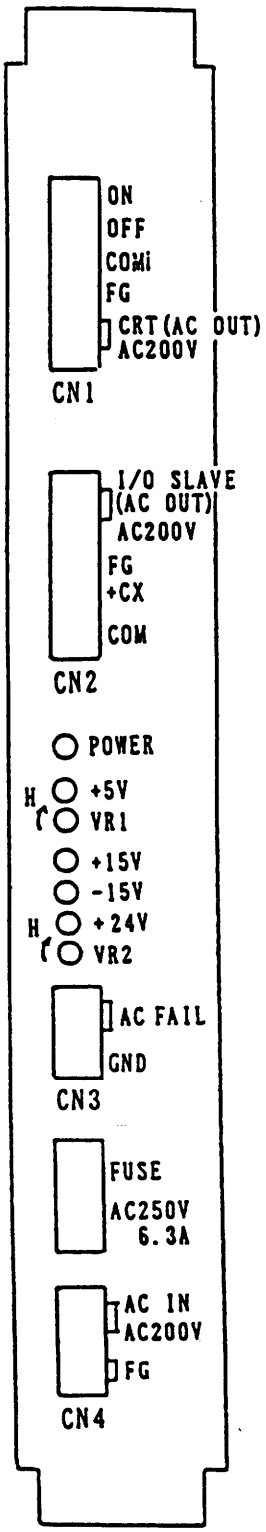
Note) The actual setting positions of the respective unit are fixed as shown in the above diagram.

1-2 Function of the Control Unit and Its Handling

1) Power unit (MPW)

This is DC power supply for each control unit and generates 4CH voltage of +5V, +15V, -15V and +24V, and powerful signals.

(1) Output



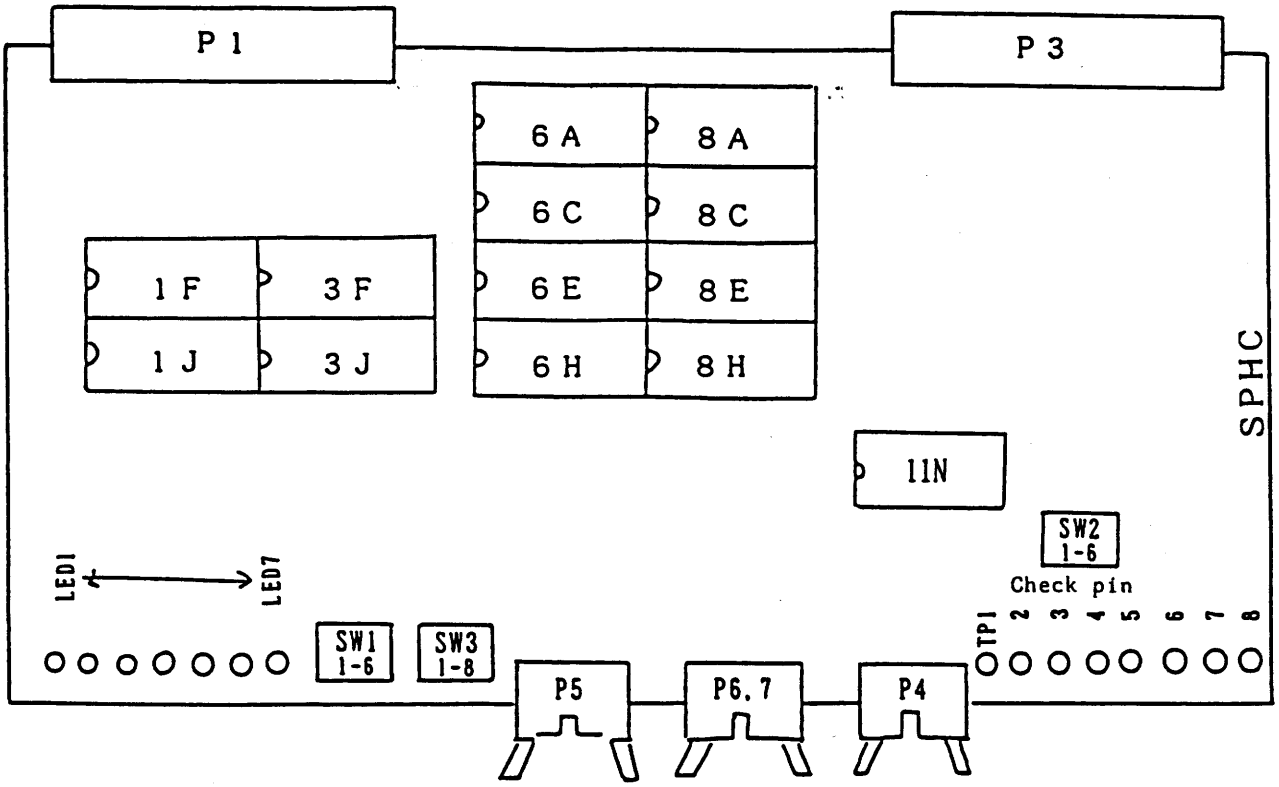
Item		CH1	CH2	Ch3	CH4
Rated voltage		5V	15V	-15V	24V
Rated current		3 ~ 30A	0.1 ~ 1A	0.1 ~ 1A	0.1-1A
Ripple voltage (P-P)		50mV	150mV	150mv	250mV
Overall variation		±100mV	±450mV	±450mV	±840mV
Over current protection	Method	Pendency intermit tent	フ character	フ character	フ character
	Operating value	32A ~	1.2A ~	1.2A ~	1.2A ~
	Returning method	Input reenter	Automatic	Automatic	Automatic
Over voltage protection	Method	Shut-off	—	—	—
	Operating value	5.6 ~ 7V	—	—	—
	Returning method	Input reenter	—	—	—
Output variable		Enabled (VR1)	Disabled	Disabled	Disabled
Output monitor indication (At nomal time)		Light up	Light up	Light up	Light up

(2) Input

Item	Specification
Input voltage	170 ~ 264V
Input inrush voltage	Less than 30A
ACFAIL	Contact that is turned OFF at under 120V input voltage.

2) System control unit (SPHC board)

This is the CPU board monitoring control unit totally.



2)-1 Connector

Sign	Name	Contents
P1		System bus
P3		Local bus
P4	SLBUS	SLBUS
P5	RS232C1	RS232C board CH1
P6	RS232C2	RS232C board CH2
P7	RS232C3	RS232C board CH3 (Substrate)

2)-2 Check pin

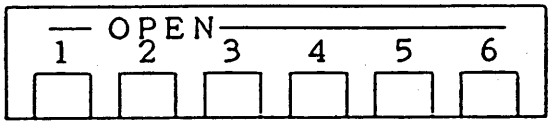
Sign	Name	Contents
TP1	G	Logic ground (Black)
2	+5V	Logic power supply 5V
3	+12V	RS232C driver power supply +12V
4	-12V	RS232C driver power supply -12V
5	+24V	General I/O power supply 24V (Main board in not used)
6	TP	SLBUS signal (+)
7	TN	SLBUS signal (-)
8	TEX	SLBUS transmit/receive inverting signal H : Transmission L : Receive

2)-3 LED indicator

Sign	Name	Colour	Contents
LED1	RDY	Green	Light up at nomal
2	RUN	Green	Light up at CUP RUN
3	SLBUS	Green	Flicker at SLBUS communication
4	FAIL	Red	Light up at board abnormal
5	WDT1	Red	Light up at watch dog timer time out
6	PERR	Red	Light up at system RAM battery error
7	BAT	Red	Light up at battery voltage down (under 2.8V)

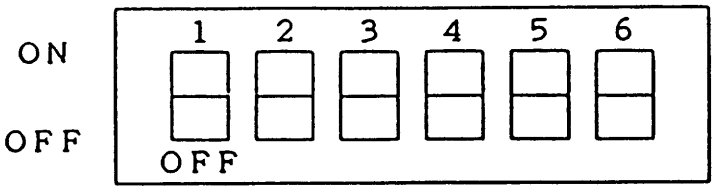
2)-4 Setting of the dip switch

(1) SW1 ..... Setting of the system start-up mode



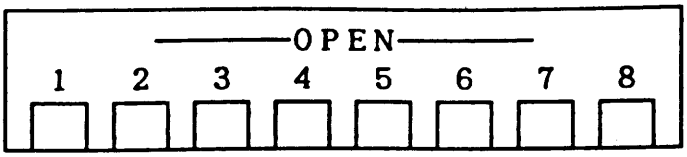
Bit	Contents	Setting at ROM mode
1	System start-up mode designation	Closed
2	DOS start-up ..... Open by all 1, 2 and 3 bits	Open
3	ROM start-up ..... Closed by 1 bit only	Closed
4	DOS start-up mode designation	Open
5	System console data format designation	Open
6	Not used	Open

(2) SW2 ..... SLBUS mode setting



Bit	ON	OFF	Std.
1			OFF
2			OFF
3			OFF
4			OFF
5			OFF
6			OFF

(3) SW3 ..... System mode setting



Bit	Contents		
	Open	Closed	
1	When all are open, color CRT.	Plasma display	When both bits of 1 and 2 bits are closed, the EL display is gradation.
2		8 colors liquid crystal	
3			
4			
5			
6			
7		Board initialize	
8	S-III mode	M16-III mode	

2)-5 Package of the system ROM

(1) Main CPU program memory

The ROM label is to be mentioned as shown in the below figure.

Make package in conformity with the location.

```
   SxRyy
   -zz      ..... Version
>  6A       ..... Location
   SPHC     ..... Substrate name
```

(2) Program memory for SLBUS

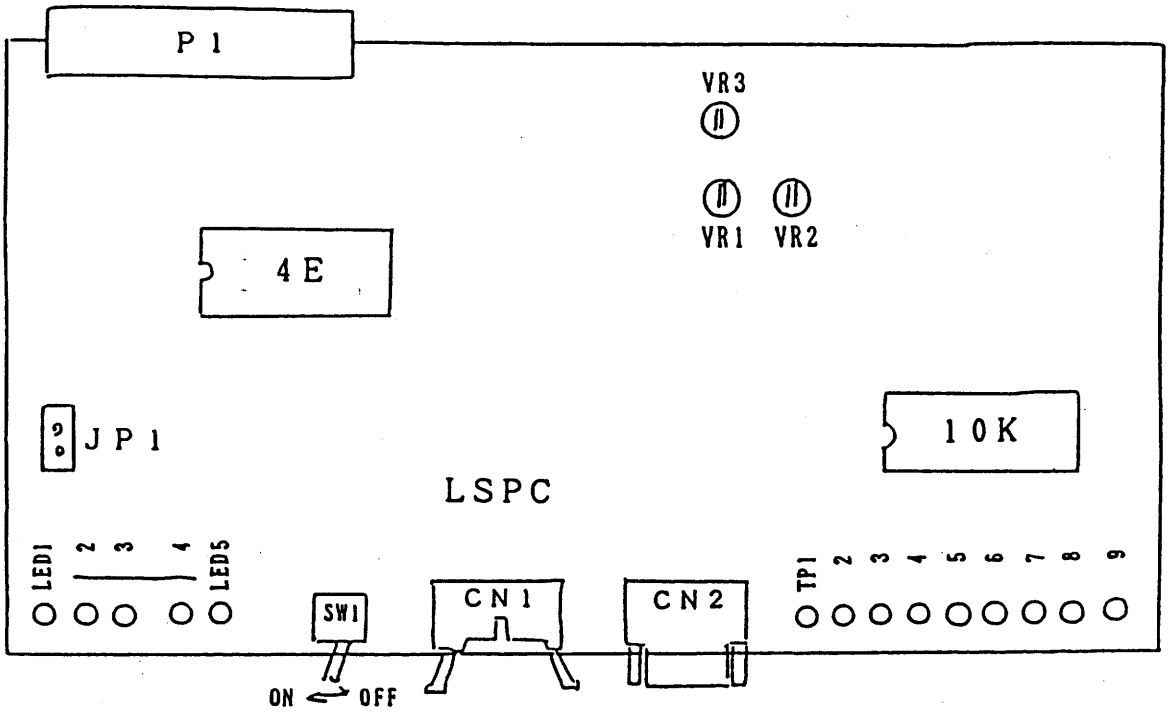
The ROM label is to be mentioned as shown in the below figure.

Make package in conformity with the location.

```
   YxRyy
   -zz      ..... Version
>  11N      ..... Location
   SPHC     ..... Substrate name
```

3) Programmable control unit

The is a board controlling the machine sequence



3)-1 Connector

Sign	Name	Contents
P1		System bus
CN1	SLBUS	SLBUS
CN2	D/A	D/A output for spindle control

3)-2 Check pin

Sign	Name	Contents
TP1	TAP	SLBUS signal positive
2	TNA	SLBUS signal negative
3	TXEA	SLBUS transmit/receive inverting signal L : Recive H : Transmission
4	D/A	D/A converter output
5	G	Logic ground
6	TPB	Key system SLBUS signal positive
7	TNB	Key system SLBUS signal negative
8	TXEB	Key system SLBUS transmit/receive inverting signal L : Receive H : Transmission
9	B5V	Memory back-up power supply

3)-3 LED indicator

Sign	Name	Colour	Contents
LED1	RDY	Green	Light up at nomal
2	RUN	Green	Light up at ladder program RUN
3	SLBUS	Green	Light on/off at SLBUS normal comminucation
4	WDT180	Red	Light up at CUP64180 watch dog timer time out
5	WDT31	Red	Light up at CUP8031 watch dog timer time out

3)-4 Short circuit pin

Sign	Name	Short	Open
JP1		WDT180 ineffective	WDT180 effective

The standard is open when the machine is actually installed.

3)-5 Memory protect switch

Sign	Name	ON	OFF
SW1		Memory write enabled	Memory write disabled

It is OFF when used usually.

3)-6 Variable register .... D/A output adjustment

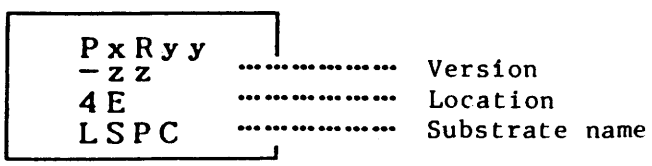
Sign	Name	Contents
VR1		Gain adjustment
2		Offset adjustment
3		Negative offset adjustment

3)-7 Package of the system ROM

(1) Main CPU program memory

The ROM label is to be mentioned as shown in the below figure.

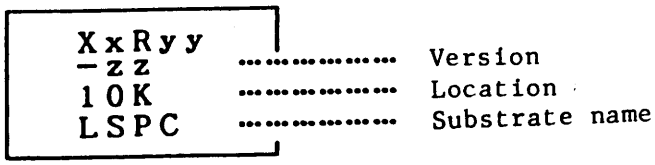
Make package in conformity with the location.



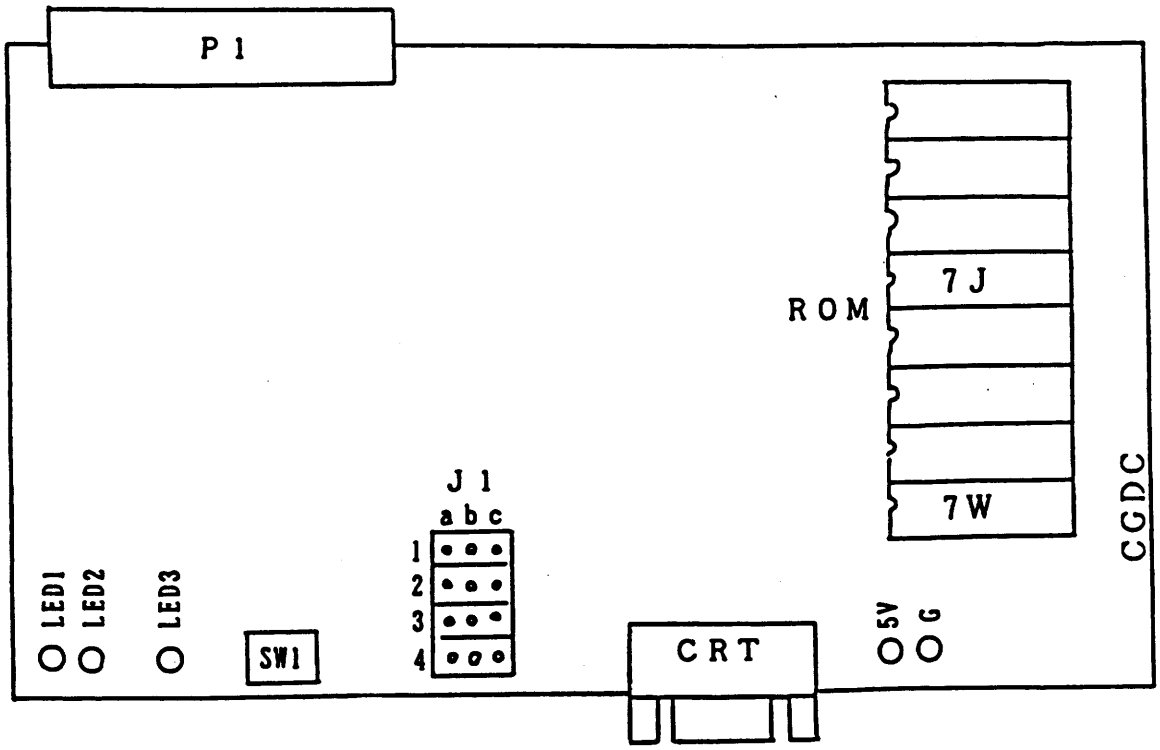
(2) Program memory for SLBUS

The ROM label is to be mentioned as shown in the below figure.

Make package in conformity with the location.



4) Color graphic control unit (CGD board)



4)-1 Connector

Sign	Name	Contents
P1		System bus
CRT	CRT	For CRT connection

4)-2 Check pin

Sign	Name	Contents
	5V	Logic power supply 5V (White)
	G	Logic groud (Black)

4)-3 LED indicator

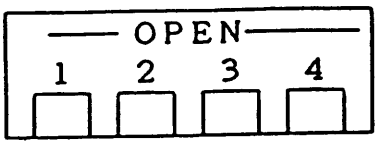
Sign	Name	Colour	Contents
LED1	RDY	Green	Light up at normal
2	ACC	Green	Light up at screen data comminucation
3	WDT	Red	Light up at watch dog timer time out

4)-4 Short circuit pin

Sign	Name	a-b Short	b-c Short
JI-1		H-SYNC negative polarity	H-SYNC positive polarity
-2		V-SYNC negative polarity	V-SYNC positive polarity
-3		V-SYNC normal	V-SYNC ground
-4		H-SYNC normal	(H-SYNC)-(V=SYNC) synchronized

J1-1 ~ 4 are totally used a-b short.

4)-5 Setting of the dip switch



Bit	Contents	Standard designation
1		Open
2		Open
3		Open
4		Open

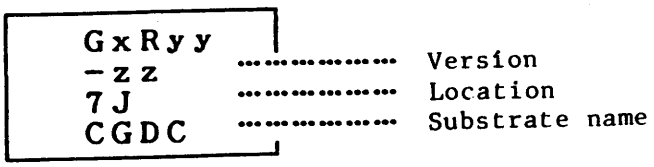
Be sure to used switch openly.

4)-6 Package of the system ROM

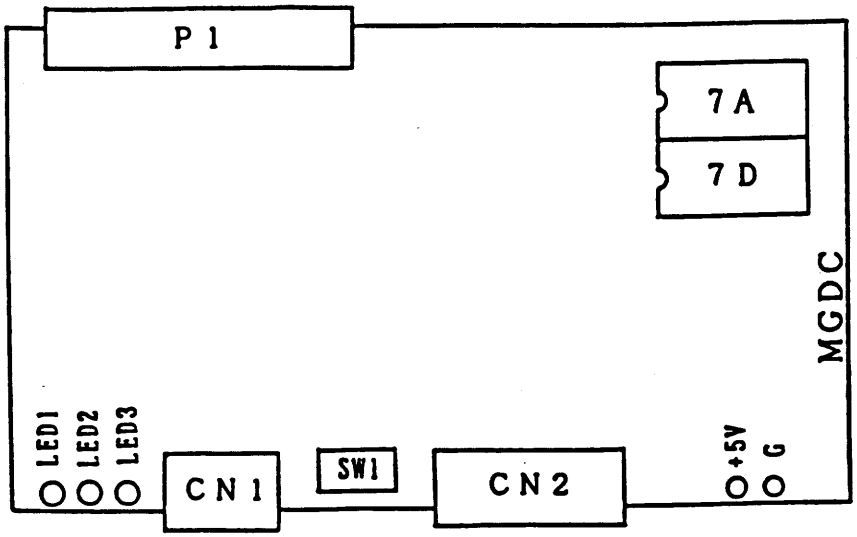
(1) Main CPU program memory

The ROM label is to be mentioned as shown in the below figure.

Make package in conformity with the location.



5) Monochrome graphic control unit (MGDC board)



5)-1 Connector

Sign	Name	Contents
P1		System bus
CN1		Monochrome CRT
CN2		Flat display

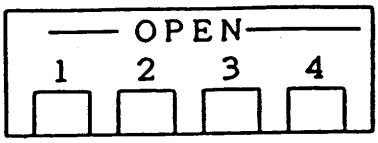
5)-2 Check pin

Sign	Name	Contents
	5V	Logic power supply 5V (White)
	G	Logic groud (Black)

5)-3 LED indicator

Sign	Name	Colour	Contents
LED1	RDY	Green	Light up at normal
2	ACC	Green	Light up at screen data comminucation
3	WDT	Red	Light up at watch dog timer time out

5)-4 Setting of the dip switch



Bit	Contents	Standard designation
1		Open
2		Open
3		Open
4		Open

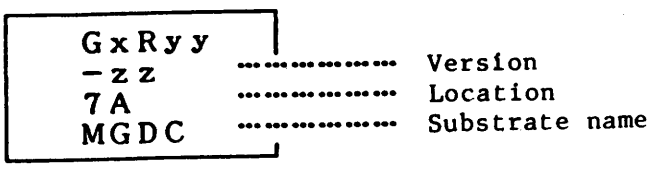
Be sure to used switch openly.

5)-5 Package of the system ROM

(1) Main CPU program memory

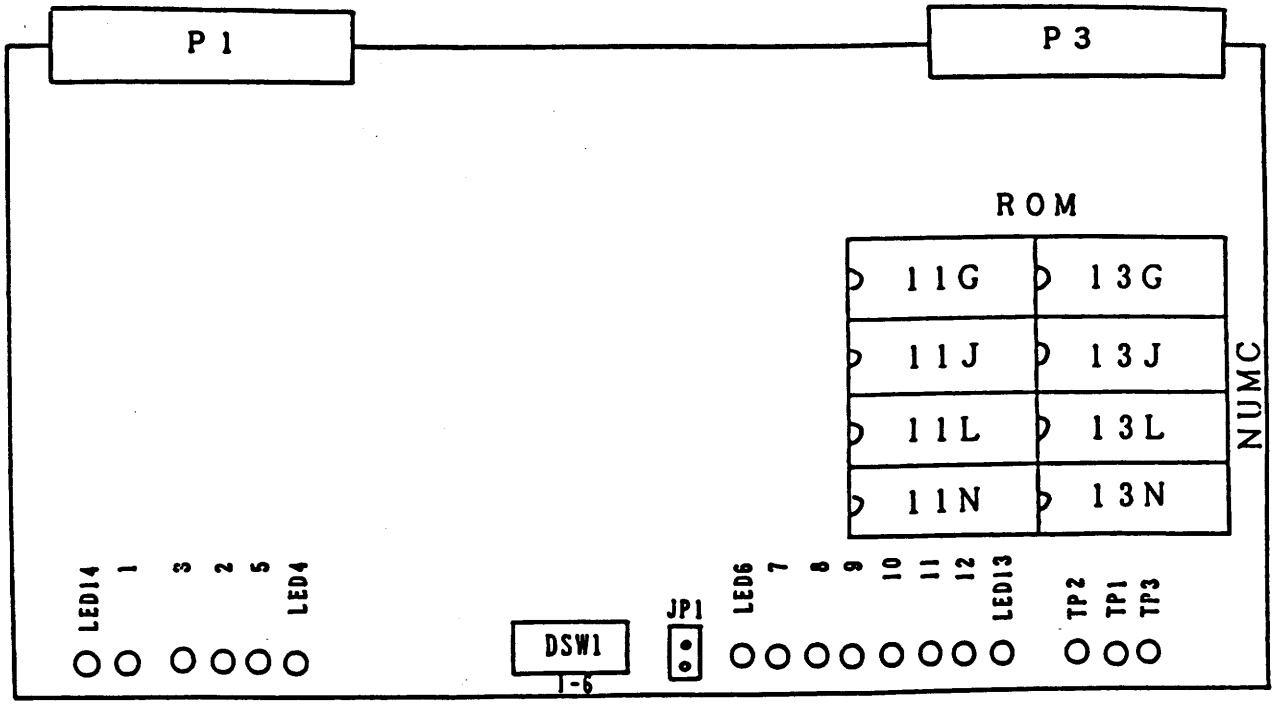
The ROM label is to be mentioned as shown in the below figure.

Make package in conformity with the location.



6) NC unit (NCMC)

Numerical control main CPU board



6)-1 Connector

Sign	Name	Contents
P1		System bus
P3		Local bus

6)-2 Check pin

Sign	Name	Contents
	5V	Logic power supply 5V (White)
	G	Logic ground (Black)
	BATT	Battery voltage

6)-3 LED indicator

(1) Status indication

Sign		Name	Color	Contents
LED1	4	RDY	Green	Light up at normal
	1	CPURUN	Green	Lights up when the CPU is in RUN.
	3	FAIL	Red	Lights up when the board is abnormal.
	2	WDT	Red	Lights up when the watch dog timer is in time-out.
	5	SOFTALM	Red	Lights up when an abnormal status is detected in software.
	4	SVALM	Red	Lights up when an abnormal status of the servo unit is detected.

(2) General purpose monitor indication

. When the power is turn ON.

No.	L6	L7	L8	L9	L10	L11	L12	L13	Contents
1	—	—	—	—	○	○	●	●	ROM check 1
2	—	—	—	—	○	○	●	●	ROM check 2
3	—	—	—	—	○	○	○	●	RAM check
4	—	○	○	●	○	○	○	○	Monitor initialization
5	○	○	●	○	○	○	○	○	NC initialization
6	○	●	○	○	○	○	○	○	Standby for SYS FAILA release
7	●	○	○	○	○	○	○	○	Standby for PC RUN

L···LED ○···Swich OFF ●···Light up —···Unstable

. NC operations

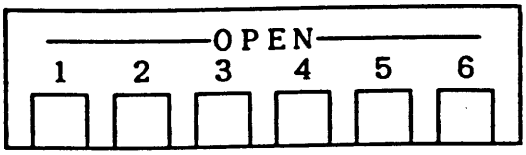
Symbol	Contents
LED 6	
7	
8	
9	
10	
11	Flickers at the normal operations. (Main loop)
12	Flickers at the normal operations.(50ms scheduled process)
13	Flickers at the normal operations.(10ms scheduled process)

. When the NC is abnormal

No.	L6	L7	L8	L9	L10	L11	L12	L13	Contents
1	○	○	○	○	○	○	●	○	Bus error
2	○	○	○	○	○	○	●	●	Address error
3	○	○	○	○	○	●	○	○	Unreasonable command
4	—	○	○	○	○	●	○	●	Subtraction by 0
5	○	○	○	○	●	○	●	○	Non-packaging command
6	○	○	○	○	●	○	●	●	Non-packaging command
7	○	○	●	○	○	○	○	○	Monitor alarm
8	○	○	●	○	○	○	○	●	Monitor alarm

L···LED ○···Switch OFF ●···Light up —···Unstable

6)-4 Setting of the dip switch



Bit	Contents	Open	Closed
1	System start-up mode designation	Shift to the NC mode.	The test mode is not made.
2	ROM check		
3	Not used		
4	Used at debug		
5	Not used		
6	Not used		

. All are to be open at the general use.

. Since the SW5 was proviously used as RAM clear at switching ON, be sure to be open.

6)-5 Short circuit pin

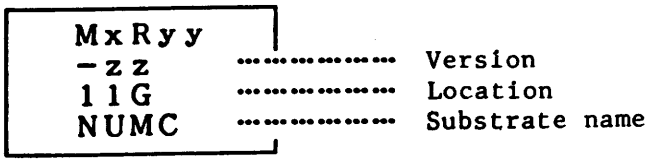
Sign	Name	Short	Open
JP1		Watch dog timer ineffective	Watch dog timer effective

6)-6 Package of the system ROM

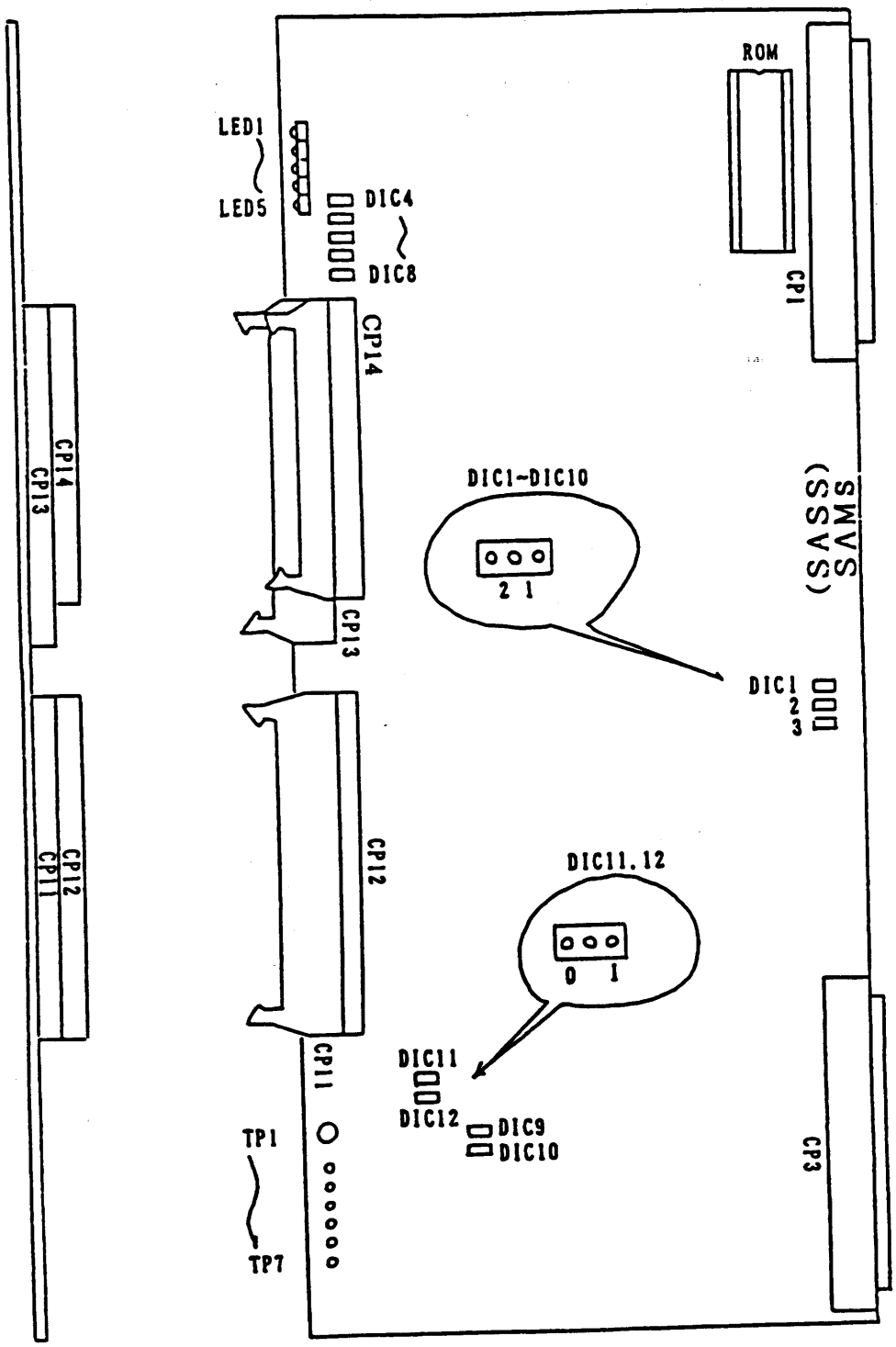
(1) Main CPU program memory

The ROM label is to be mentioned as shown in the below figure.

Make package in conformity with the location.



7) SAMS unit (SASS unit)



SAMS unit .... A main substrate packaging 1 piece of AIP and 1 piece of ASV, and controlling 2 axes.

SASS unit .... A substrate packing 1 piece of ASV, and for increasing the axis controlling 2 axes under the SAMS unit.

Note) The patern of the SASS unit is the same as that of the SAMS unit, and the parts of the AIP section becomes unpackaged.

7)-1 Connector

Sign	Name	Contents
CP1	Servo local pass	Interface between AIP and ASV
CP3	NC bus	Interface with NUMC
CP11	ADU interface	Interface with the servo drive unit
CP12	ADU interface	
CP13	External I/O interface	Interface with SPGX2 and SKIP etc.
CP14	Optional interface	Not used

7)-2 Check pine

Sign	Contents
TP1	Logic ground
TP2	Servo monitor 1
TP3	Servo monitor 2
TP4	+5V
TP5	+15V
TP6	-15V
TP7	+24V

Note) The SASS unit is packaged for only TP1 through TP3.

7)-3 LED indication

Sign	Color	Operation status	
		Switch ON	Switch OFF
LED1	Green	The DSP of the AIP operates normally.	Flickers when the DSP of the AIP operates abnormally.
LED2	Green	The DSP of the ASV operates normally.	Flickers when the DSP of the ASV operates abnormally.
LED3	Red	An alarm occurs on the hardware of the AIP section.	The AIP section is normal.
LWD4	Red	An alarm occurs on the hardware of the ASV section.	The ASV section is normal.
LED5	Red	The program is in down-loading.	Down-load is complete.

Note) The SASS unit is packaged for only LED2 and LED4.

7)-4 Short circuit pin

Sign	Name	Contents
DIC1	AIP change-over	Set either AIP1 or AIP2. 2 (or open) .... AIP1 setting (Standard) 1 .... AIP2 setting
DIC2 DIC3	ASV change-over	Set either of ASV-1, -B, -C or -D. DIC2 DIC3 2 2 .... ASV-A setting 2 1 .... ASV-B setting 1 2 .... ASV-C setting 1 1 .... ASV-D setting Note) It is decided to be set to either AIP1 or 2 by setting DIC1. Open is the same as 2.
DIC4 DIC5 DIC6	AIP function change-over	Currently not used. Note) It is unpackaged for SASS.
DIC7	Test mode	1 Standard setting 2 Test mode Note) It is unpackaged for SASS.
DIC8	Skip signal change-over	1 Internal skip signal 2 External skip signal Note) It is unpackaged for SASS.
DIC 9 10	Encoder change-over	DIC9 (Corresponding to CP11) DIC10 (DP12) 1 Absolute encoder 2 Incremental encoder
DIC 11 12	Analog signal I/O change-over	DIC11 (Corresponding to CP11) DIC12 (DP12) 1 Analog input (Current detection) ... . Standard 2 Analog output

1-3 Failure Diagnosis and Its Countermeasures

When a trouble occurs, check "When it occurred.", "What an operation was proceeded.", "What kind of failure occurred.", and "How often it occurred." in order to make an appropriate judgement.

1) Pursuit by the alarm screen

When an alarm occurs in operation, an alarm message is displayed on the uppermost part of the screen.

SYSTEM FALL	POWER SUPPLY ALARM	RUDDER ALARM	LSP STATUS

(1) System fail

When a trouble that causes the system fail on the main unit (board) composing the master unit occurs, an alarm is displayed in this area. The board name that a trouble occurred is invertedly displayed in red. The kinds of the messages are as shown in the below table, the indications with "-W" show that a watch dog error occurred simltaneously. Up to maximum 3 kinds can be displayed at a time.

NCIF	SPHC	CGDC	LSPC
NCIF-W	SPHC-W	CGDC-W	

When it is impossible to specify the defective board, the "SYSFAIL" is displayed.

(2) Power supply failure

When a trouble occurs in the power supply for the master unit, it is displayed on the fixed position. The displaying color is in red invertedly.

+24V	-15V	+15V	BATTERY	INSTANT STOP

(3) Rudder alarm

When an alarm bit stands by the rudder, the specific alarm no. is displayed. When the plural number is standing, its representative number is displayed. The displaying color is in red invertedly.

(4) LSPC status

The status of the LSPC board executing the rudder sequence operations is displayed on this area.

1 In the normal status (Green invertedly)

PC RUN	:	The rudder is in proper running.

2 In the special status (Yellow invertedly)

AB INIT	:	The AB phase is in initializing.
PC PAUSE	:	The rudder is in stopping instantly.
AB SCAN	:	The AB phase is in measuring.

3 In the trouble (Red invertedly)

PC STOP	:	The rudder is in stopping (Especially no error exists.).
LDsum err	:	The rudder has some check error.
PCsum err	:	Whole the PC has some check error.
SLBUS err	:	SLBUS error
non END	:	No END command exists.
non I-END	:	No high speed END command exists.
180 INT err	:	Non definition interruption (64180CPU) occurs.
NMI err	:	NMI interruption occurs.
non L-END	:	No logic analog command exists.
31sum err	:	8031CPU has ROM some check error.
31RAM err	:	8031CPU has external RAM error.
SLRAM err	:	The dual port for SLBUS has RAM error.
SLTBL err	:	SLBUS table has an error.
STOP [XX]	:	The error status other than the specifications is displayed as it is.
PC ???	:	The operation status other than specifications occurs.
PC DEAD	:	The RUN/STOP command to the PC that is given when the light enable switch is operated does not go well.

2) Pursuit by the monitor LED of the control unit

A monitor LED is packaged in the respective units in the control unit, and the status of each unit can be checked.

In the proper status, the status becomes as follows;

. All green LED are lit up and flickered to display.

. All red LED are lit OFF.

The unit whose red LED lit up or whose green LED is lit OFF shows abnormal.

List of LEDs

	○RDY ○ACC ○WDT CGDC	○RDY ○RUN ○SLBUS ○WDT180 ○WDT31 LSPC	○RDY ○RUN ○SLBUS ○FAIL ○WDT ○PERR ○BAT SPHC	○RDY ○RUN ○FAIL ○WDT ○SOFT ALM ○SV ALM ○LED6 ○LED7 ○LED8 ○LED9 ○LED10 ○LED11 ○LED12 ○LED13 NUMC	○LED1 ○LED2 ○LED3 ○LED4 ○LED5 SAMS	○ LED2 ○ LED5 SASS	 ○POWER ○+5V ○+15V ○-15V ○+24V MPW

Unit name	LED name	Status		Error contents	Factor and measures
		Normal	Abnormal		
CGDC	RDY(G)	○	×	Unit ready	The CPU unit doesn's RUN properly. Replace the unit
	ACC(G)	○△		Data in comminucation	Light up at drawing alteration (Status)
	WDT(R)	×	○	Watch dog alarm	Replace the unit
LSPC	RDY(G)	○	×	Unit ready At power start-up	PC STATUSERROR FACTOR are displayed on the left corner of the display Factorl: 1: Some check error (Ladder) 2: Some check error (Other than ladder) 3: SLBUS error 4: No END command 5: No high speed END command 6: No logic/analogue END 7: 8031 ROM some check error 8: 8031 External RAM error 9: SLBUS 2P-RAM error 10: SLBUS table error Measure: 1~6,10 unitsinitializing operation Replace 7~9 units
				In operation	Watch dog alarm Replace the units
	RUN(G)	○	×	Ladder RUN	When a SLBUS error occurs, refer to the error slave by the SLBUS error table.
	SLBUS (G)	△		SLBUS RUN	When a SLBUS commuication error occurs, flickering is late. Refer to the error slave by the SLBUS error table.
	WDT180 (R)	×	○	64180 Watch dog alarm	Replace the unit
	WDT31	×	○	8031 Watch dog alarm	Replace the unit

Unit name	LED name	Status		Error contents	Factor and measures
		Normal	Abnormal		
SPHC	RDY(G)	○	×	Unit ready	When a watch dog alarm occurs, replace the unit.
	RUN(G)	○	×	CUP RUN	At CUP HALT Replace the unit
	SLBUS (G)	○		SLBUS RUN	Not used
	FAIL (R)	×	○	Unit file	Typical error message of the unit 1. At DRAM battery error 2. At power voltage down Not more than 24V ⟶ 18V Not more than +15V ⟶ 10V Not more than -15V ⟶ 9V 3. When a watch dog alarm occurs: Measures: Replace the unit fin item 1 and 3. Check other units item 2.
	WDT(R)	×	○	Watch dog alarm	Replace the unit
	PERR (R)	×	○	Battery error	Replace the unit
	BAT(R)	×	○	Battery alarm	Replace the battery
NUMC	RDY(G)	○	×	Unit ready	Watch dog alarm When a system file ocuurs, replace unit.
	RUN(G)	○	×	Hardware abnormal	At CUP HALT Replace the unit
	FAIL (G)	×	○	NC system abnormal	NC initialize is not completed at the main power ON. The software alarm occurs when the NC unit is operating. Replace the unit
	WDT(G)	×	○	Watch dog alarm	At a watch dog time over Replace the unit
		×	○	Software alarm	At a software alarm Replace the unit
		×	○	Servo alarm	

Unit name	LED name	Status		Error contents	Factor and measures
		Normal	Abnormal		
Power supply	POWER (G)	○	×	Input power alarm	1. AC200V is impressed. 2. The unit fuse is blown out. Measures: Check the AC input circuit. Replace the fuse.
	+5V	○	×	+5V shut off	1. Over load current 2. Deffective power Measures: 1. Remove the other unit to check. 2. Replace the unit
	+15V	○	×	+15V shut off	
	-15V	○	×	-15V shut off	
	+24V	○	×	+24V shut off	

Note 1) (G) and (R) stand for the LED colour green and the LED colour red respectively in the table.

2) ○, △ and × mean LED lighting LED flickering and LED switching off respectively in the table.

1-4 Usual Maintenance and Check

1) Maintenance of the back-up battery

A ruthenium battery that has durability and rellabilty is used for the IC memory back-up.
Its durable years are about 4 years (at 25°C).
The time to be replaced is shown through lighting of the BAT and LED on the SPHC unit of the control cabinet and is displayed on the CRT. Replace it within one week after displayed.

(1) Specifications of the battery

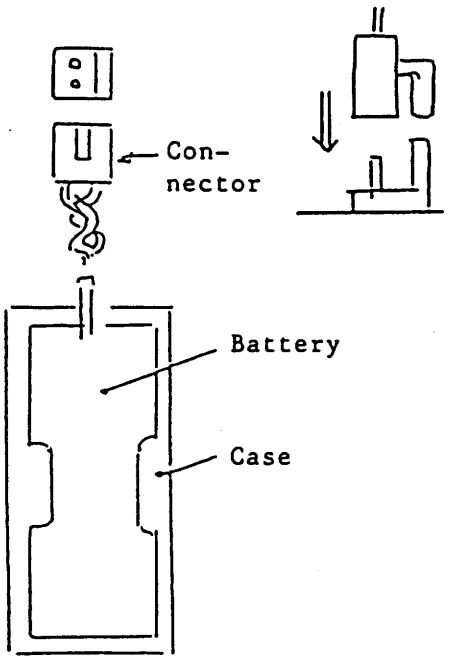
Use a battery with the following specifications

Manufacturer: Toshiba Battery Co., Ltd.
Model: ER6C
Capacity: 2000mAH

(2) The units required back-up are as below.

SPHC ... For real time lock
LSPC ... IC memory (Ladder program etc.)

(3) Replacing procedures



1. Switch the power off.
2. Pull the connector out and remove the battery.
3. Equip a new battery in the case and adjust the direction of the connector to meet and connect it.
4. Switch the power on and check if the BAT LED on the SPHC put out.
5. Clear the BAT alarm indication.
6. Finish the replacing work within one hour.

2) Adjustment of the real time lock

The real time lock is built in the SPHC unit. Though it has been set at the time of delivery, about 30 seconds error may occur monthly. Reset it every six month. The real time lock is used managing the time when an alarm etc. occur.

1-5 Programmable Controller (Menu Screen)

Shift the processing to the selected screen either by selecting with the cursor or by entering numbers after the PC menu is displayed.

	Item	Outline of processing
1	Contact information	Display of each contact (Dummy, X, Y, T, N and M) and setting of Y contact
2	Work	Display and clear of the work area
3	Contact and work	Selected display of the contact and work (16 pcs. each)
4	SLBUS	Data setting of each slave and display of the SLBUS error
5	Ward table	Data setting of work clear by group
6	Counter	16 pcs. of the counter from the top (Comments are given)
7	Timer	16 pcs. of the timer from the top (Comments are given)
8	System table	The words in the work area, binary display, data setting
9	System counter	64 pcs. of counter setting
10	System timer	512 pcs. of timer setting
11	AB phase table	16 channels of AB phase setting
12	Alarm	PC alarm display and clear
13		
14		
15		
16		
17	Ladder live wire display	
18	Ladder program	Ladder editing
19	Logic analog	The logic analog of the ladder (Refer to the V. PC logic analog operation)
20	Step ladder	Status display of the step ladder
21	AB phase measurement	Display of the AB phase wave from and variable time
22		
23		
24		
25		

	Item	Outline of processing
26		
27		
28		
29		
30	YUYU memory	YUYU/DON-DON input
31	Comment editing	Editing of each comment
32	System parameter	Setting of variable etc..

1. When the F10 key at each screen, the menu screen is displayed.

1-6 Reference of the Contact Information and Contact Output

1) Reference of each contact

F1	F2	F3	F4	F5	F6	F7	F8	F9
Dummy	X Contact	Y Contact	T Contact	N Contact	M Contact			Address Search

. [F1] Dummy contact F000H ~ F3FFH
(F000H = Specific contact F300H ~ F3FFH = for PC and NC)

. [F2] X contact (Input) FC00H ~ FCFFH

. [F3] Y contact (Output) FE00H ~ FEFFH

. [F4] T contact (Timer output) F480H ~ F4BFH

. [F5] N contact (Counter) F4C0H ~ F4C7H

. [F6] M contact (M function) F400H ~ F47FH

*The M contact displays the contact numbers that the bit is 1 up to Max. 10 points as the characters of "ON BIT = 0001 0002 ...." below the table.

. [F9] Address search : Within the range of each contact.

2) Manual mode

When entering "MANUAL" at the Y contact (Output), the contact can be changed.
When shifting to the manual mode, the ladder is stopped, and when cancelled, it rins again.

1-7 Work Data Display Screen

Reference of the work data and work data clear

(Range : 8000H~FFFDH)

1) Reference of data

F1	F2	F3	F4	F5	F6	F7	F8	F9
BYTE Declmal	BYTE Hexa-decimal	WORD Decimal	WORD Hexa-decimal					Address Search

. F1 ..... Byte display of the work data in decimal

. F2 ..... Byte displat of the work data in hexadecimal

. F3 ..... Word display of the work data in decimal

. F4 ..... Word display of the work data in hexadecimal

. F9 ..... Address serch (8000H ~ FFFEH)

2) Work data clear (WRITE ENABLE SWITCH ON)

When the "CLEAR" is entered, the function menu is shifted to the clear mode.

F1	F2	F3	F4	F5	F6	F7	F8	F9
Dummy	Work	Total Data	Range Desig-nation					Cancel

. F1 ..... Dummy contact (F000H ~ F3FFH)
(F000H = Specific contact F300H ~ F3FFH = for PC and NC)

. F2 ..... Work (F500H ~ FBFFH)

. F3 ..... Total data (8000H ~ FFFDH)

. F4 ..... Range designation (Enters the start address and the end address (5 digits))
However, the following addresses are not cleared.
(D600-D7FF, DFFE-DFFF, FFFE-FFFF, Not more than 7FFF, More than A80000)

. F9 ..... Cancel the clear mode (WRITE ENABLE SWITCH OFF)

1-8 Contact Work

Reference of each contact and work data

1) Contact

Max. 16 pcs. of the addresses for each contacts can be selected and their data are displayed in binary.

F1	F2	F3	F4	F5	F6	F7	F8	F9
Dummy	X Cintact	Y Contact	T Contact	N Contact	M Contact	Cancel		Work

. [F1] ..... Dummy contact (000H ~ 3FFH)
(000H = Specific contact 300H ~ 3FFFH = for PC and NC)

. [F2] ..... X contact (00H ~ FFH)

. [F3] ..... Y contact (00H ~ FFH)

. [F4] ..... T contact (00H ~ 3FH)

. [F5] ..... N contact (0 ~ 7)

. [F6] ..... M contact (00H ~ 7FH)

. [F7] ..... Cancel the address (Move the cursor)

. [F9] ..... Move the cursor to the work (3-2)

2) Work

.Max. 16 pcs. of the addresses for works can be selected, and their data are displayed in HEX.

.The address input is HEX input. (0~7FFFFH)

F1	F2	F3	F4	F5	F6	F7	F8	F9
								Contact

. [F9] ..... Move the cursor to the contact (3-1)

. [P↑] ..... The address of the position where the cursor is located is UP.

. [P↓] ..... The address of the position where the curcor is located is DOWN.

*If the "LSEIKI" is entered when the cursor is located at the last position of the work, the cursor moves to the data position and it is possible to enter.
(This mode continues until the power is turned off.)

1-9 SLBUS Table Setting Screen (HEX)

.Reference of the SLBUS and data setting

1) Reference mode

.Slave No. ..... Location No.

.Type ..... Type of slave

.Slave name ..... Comment

.Classification ..... Classification of slave

.Head channel ..... AB phase or head channel of A/D

.Channel No. ..... AB phase or using channel No. of A/D

.Buffer No. ..... Buffer No. of the text

.Buffer size ..... Text buffer size

.High speed input byte number .... High speed data number to the master

.High speed output byte number ... High speed data number from the master

.Input byte number ... Data number to the master

.Output byte number .. Data number from the master

.Input address ..... 0 ~ FFH

.Output address ..... 0 ~ FFH

F1	F2	F3	F4	F5	F6	F7	F8	F9
						SLBUS Error		Alter-ation

. [F7] ..... SLBUS transmission error display

. [F9] ..... Alteration mode (WRITE ENABLE SWITCH ON)

2) Alteration mode

.Slave No. ..... 1 ~ 1EH

.Type ..... 1 : Key system 0 : Default

.Slave name ..... 8 characters of English numeric

.Classification ..... (Select finctions)

.Head channel 1 ~ 10H

.Channel No. ..... 1 ~ 10H

.Buffer No. ..... 1 ~ 4

.Buffer size ..... 1 ~ FEH

.High speed input byte number .... 0 ~ 4

.High speed output byte number ... 0 ~ 4

.Input byte number ... 0 ~ FFH

.Output byte number ... 0 ~ FFH

.Input address ..... 0 ~ FFH

.Output adress ..... 0 ~ FFH

F1	F2	F3	F4	F5	F6	F7	F8	F9
I/O	TEXT	A/D	AB	I/O +AB			Total data Erasure	Refer- ence

F1	F2	F3	F4	F5	F6	F7	F8	F9
							Total data Erasure	Refer- ence

. [F8] ..... Total erasure of the SLBUS table (C000H~C2FFH)

. [F9] ..... Reference mode (WRITE ENABLE SWITCH OFF)

3) Memory format

(1) Slave information

		7 6 5 4 3 2 1 0	
C000H	0		Location No. (7 bits are of slave type)
	1		Classification
	2		Head channel or buffer No.
	3		Channel number or buffer size
	4		High speed input number (1 digit)
	5		High speed output number (1 digit)
	6		Input byte number
	7		Output byte number
	8		Input address (HIGH)
	9		Input address (LOW)
	A		Output address (HIGH)
	B		Output address (LOW)
	C		
	D		
	E		
	F		

(2) Slave name

C200H	8 bytes x 32 pcs.

4) SLBUS error

(1) Display format

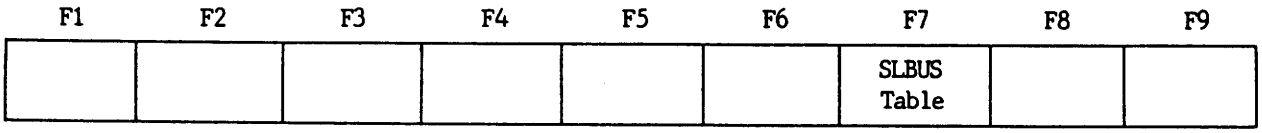
.No. ..... Slave location No.

.Contents ..... Error contents (4-4-(2))

.Date ..... Date of error occurrence

.Time ..... Time of error occurrence

*The error information is displayed from the latest one in orfer. (Up to 63 pcs.)



. F7 ..... SLBUS table (4-1)

(2) Error contents

0 : Error restoration

1 : Time over

2 : Header non-coincidence

3 : Power supply error

4 : IN-BYTE non-coincidence

5 : Chacksome error

6 : Transmission error

7 : Control code error

(3) Error buffer clear

When alteration of the SLBUS table is made, the error buffer is cleared.

(Range : D500H ~ D5FFH)

1-10 Word Table

.Reference of the word table classified by group and data setting.

.Maximum group number is 16.

.Whether the head address, data number and write protect is provided or not is set by ladder. (When the data are altered, whether the WRITE ENABLE SWITCH is checked or not.)

1) Reference of the word table classified by group

.Group No. ..... 1 ~ 16

.Group name ..... If group names have been resistered, they are displayed. (Refer to 31)

.Address ..... Addresses are displayed from the head address of group in word unit.

.Data ..... Word data (The initial screen is displayed in decimal.)

.Comment ..... When comment sentences are resistered, they are displayed. (Refer to 31)

F1	F2	F3	F4	F5	F6	F7	F8	F9
Decimal	Hexa-decimal							Alter-ation

. [F1] ..... The word table is displayed in decimal.

. [F2] ..... The word table is displayed in hexadecimal.

. [F9] ..... Alteration mode (WRITE ENABLE SWITCH ON, if necessary)

2) Data alteration of the word table classified by group

.In case of decimal display, it is entered in decimal (Within 5 digits)

.In case of hexadecimal display, it is entered in hexadecimal (Within 4 digits)

F1	F2	F3	F4	F5	F6	F7	F8	F9
Decimal	Hexa-decimal						Total data Erasure	Refer-ence

. [F1] ..... Decimal display of the word table

. [F2] ..... Hexadecimal display of the word table.

. [F8] ..... Cleared from the head address classified by group by data number.

. [F9] ..... Reference mode (WRITE ENABLE SWITCH OFF)

1-11 Counter

.Reference of the counter (16 pcs. from the head) and data setting

.When setting data, the WRITE ENABLE SWITCH is not checked

1) Display of counter values

.Maximum value .. Counter Maximum value

.Minimum value ... Counter Minimum value

.Comment ..... When comment sentences has been resistered, they are displayed (Refer to 31)

F1	F2	F3	F4	F5	F6	F7	F8	F9
								Alter-ation

. [F9] ..... Alteration mode

2) Alteration of the counter (Decimal input)

.Maximum value .. 0 ~ 9999

.Minimum value .. 0 ~ 9999

F1	F2	F3	F4	F5	F6	F7	F8	F9
							Total data Erasure	Refer-ence

. [F8] ..... Erasure of the counter (16 pcs. from the head) area.

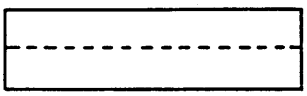
Range (E600H ~ E61FH EDOOH ~ ED1FH)

. [F9] ..... Reference mode

3) Memory format

(1) Counter data (2 bytes x 16)

E600H

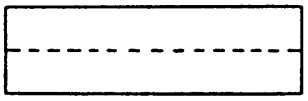


Max. value of the counter (LOW)

Max. value of the counter (HIGH)

(2) Counter work (2 bytes x 16)

EDOOH



Min. value of the counter (LOW)

Min. value of the counter (HIGH)

1-12 Timer

.Reference of the timer (16 pcs. from the head) and data setting

.When setting data, the WRITE ENABLE SWITCH is not checked

1) Display of the timer value

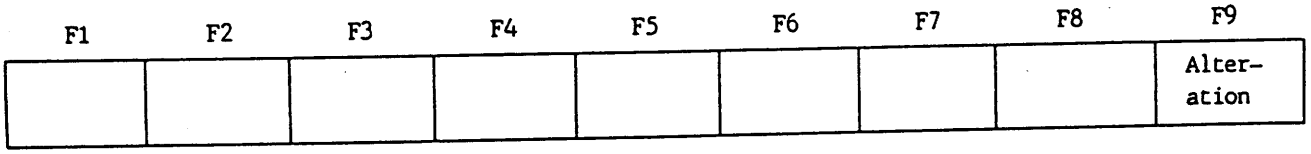
.Unit ..... Unit of the timer (As to the details, refer to 7-2)

.Setting ..... Time of the time-out

.Remaining time .. Time till the time-out (It is displayed by the SET flag ON)

.UP ..... At time-out, "U" is displayed (It is displayed by the UP flag ON)

.Comment ..... When comment sentences has been resistered, they ate displayed (Refer to 31)

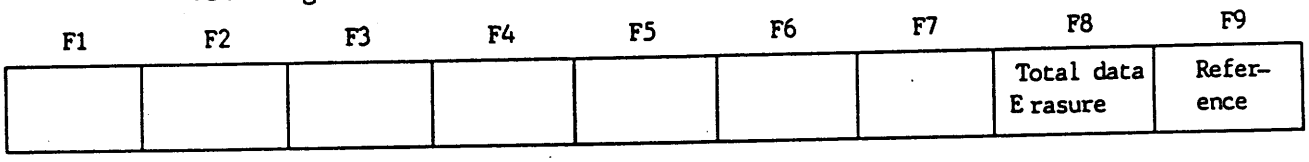


. F9 ..... Alteration mode

2) Alteration of the timer value

.Unit ..... "S" (0.1 second) "M" (0.1 minute)
"H" (0.01 second)

.Setting time ... 0 ~ 9999 (Decimal input)



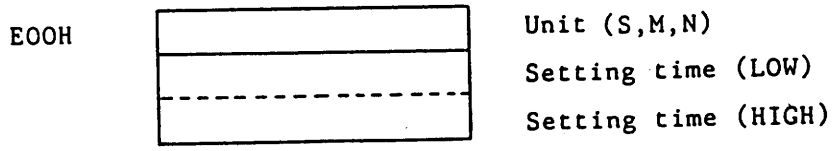
. F8 ..... Erasure of the timer (16 pcs. from the head) area.

Range (E000H ~ E02FH E700H ~ E72FH)

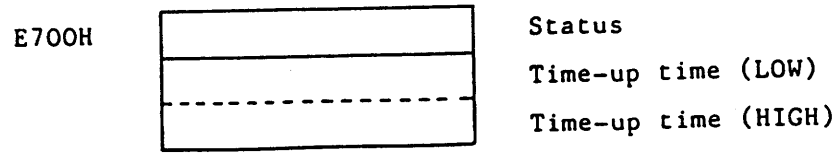
. F9 ..... Reference mode

3) Memory format

(1) Timer data (3 bytes x 16)



(2) Timer work (3 bytes x 16)



1-13 System Table

1) Reference of table and data setting

F1	F2	F3	F4	F5	F6	F7	F8	F9
		WORK Decimal	WORD Hexa-decimal	BIT			Selection	Alteration (Reference)

. [F3] ..... The word table is displayed in decimal
Address range
(D000H ~ D2FFH)

. [F4] ..... The word table is displayed in hexadecimal

. [F5] ..... The bit table is displayed (The head address and data number are set by the system parameter)

. [F8] ..... Tables other than the word table are selected. (As to the details, refer to 8-2)

. [F9] ..... The reference mode and alteration mode are changed over.

*When the alteration mode is set, turn the WRITE ENABLE SWITCK ON.

2) Selection of table

F1	F2	F3	F4	F5	F6	F7	F8	F9
BYTE Decimal	BYTE Hexa-decimal	WORD Decimal	WORD Hexa-decimal	BIT		Setting	Table	Alteration (Reference)

. [F1] ..... Decimal display in BYTE

. [F2] ..... Hexadecimal display in BYTE

. [F3] ..... Decimal display in WORD

. [F4] ..... Hexadecimal display in WORD

. [F3] ..... Binary display in BYTE

. [F7] ..... Setting of the address and data number (As to the details, refer to 8-3)

. [F8] ..... Word table display (As to the details, refer to 8-1)

. [F9] ..... The reference mode and alteration mode are changed over.

*When the alteration mode is set, turn the WRITE ENABLE SWITCH ON.

3) Setting (Address and data number)

.Address Range (8000H ~ FFFDH)

.Data number MAX. 400H (1024 pcs.)

*The set address and data number are not erased even if the power is turned OFF.

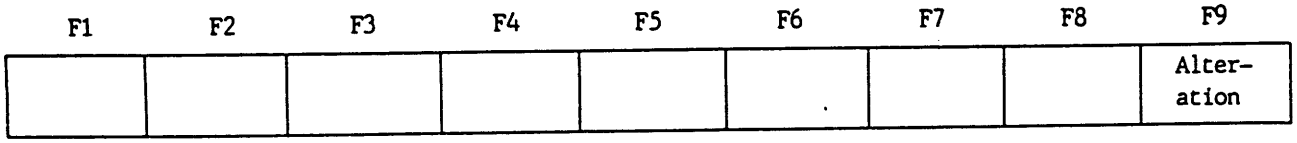
1-14 System Counter

.Reference of 64 pcs. of system counter and data setting

1) Display of counter values

.Maximum value .. Maximum value of the counter

.Minimum value .. Minimum value of the counter

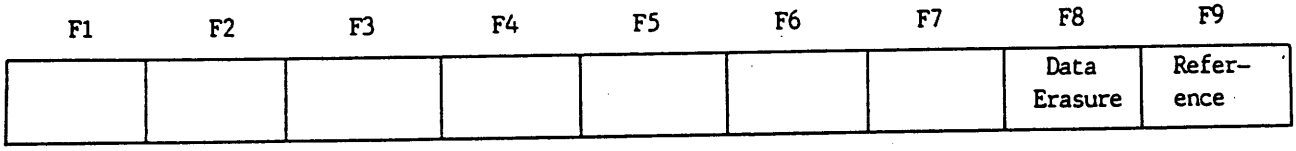


. F9 ..... Alteration mode (WRITE ENABLE SWITCH ON)

2) Alteration of counter values

.Maximum value .. 0 ~ 9999 (Decimal input)

.Minimum value .. 0 ~ 9999 (Decimal input)



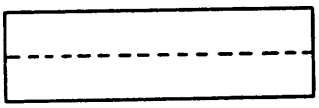
. F8 ..... Erasure of the counter area
Range (E600H ~ E67FH EDOOH ~ ED7FH)

. F7 ..... Reference mode (WRITE ENABLE SWITCH OFF)

3) Memory format

(1) Counter data (2 bytes x 64)

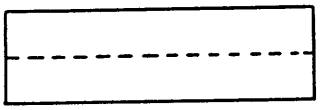
E600H



Max. value of the counter (LOW)
Max. value of the counter (HIGH)

(2) Counter work (2 bytes x 64)

EDOOH



Min. value of the counter (LOW)
Min. value of the counter (HIGH)

1-15 System Timer

.Reference of 512 pcs. of system timer and data setting

1) Display of timer values

.Unit ..... Unit of the timer (As to the details, refer to 10-2)

.Setting time ... Time of the time-out

.Remaining time .. Time till the time-out (It is displayed by the SET flag ON)

.UP ..... At time-out, "U" is displayed (It is displayed by the UP flag ON)

F1	F2	F3	F4	F5	F6	F7	F8	F9
Timer Search								Alter-ation

. F1 ..... Timer search

. F9 ..... Alteration mode (WRITE ENABLE SWITCH ON)

2) Alteration of timer values

.Unit ..... "S" (0.1 second) "M" (0.1 minute)
"H" (0.01 second)

.Setting time ... 0 ~ 9999 (Decimal input)

F1	F2	F3	F4	F5	F6	F7	F8	F9
Timer Search							Data Erasure	Refer-ence

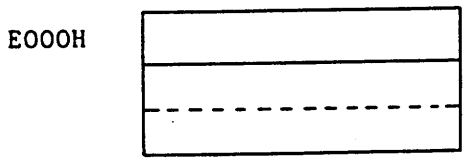
. F1 ..... Timer search (0 ~ 3F7)

. F8 ..... Erasure of the timer area

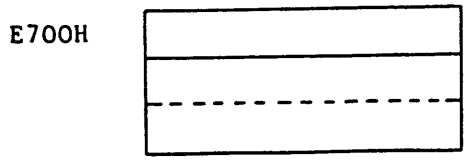
. F9 ..... Reference mode (WRITE ENABLE SWITCH OFF)

3) Memory format

(1) Timer data (3 bytes x 512)



(2) Timer work (3 bytes x 512)



1-16 AB Phase Table

.Reference and setting of 16 channels data of AB phase

.Whether the AB phase is used or not is set on the SLBUS table

1) AB phase table display

.Ring counter ... Max. value of the AB phase

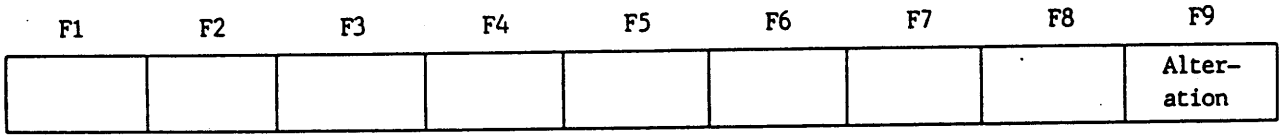
.Current counter . Current value of the AB phase

.Multiplier ..... Set whether the pot is provided every n number of the AB phase counter

.Distance-to-go .. Remaining number to the multiplier value

.Current status .. Phase status of the current AB phase

.Set status ..... Phase status of the AB phase increasing/ decreasing the current counter



. [F9] ..... Alteration mode (WRITE ENABLE SWITCH ON)

2) Alteration of the AB phase counter (Decimal input)

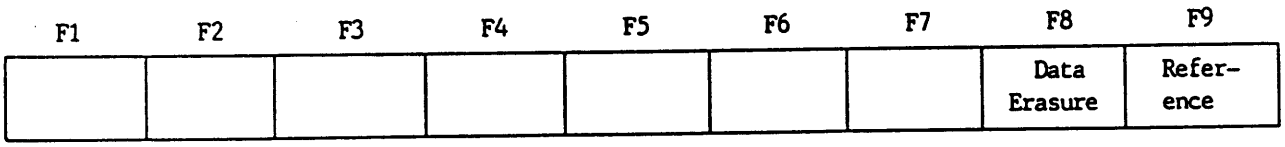
.Ring counter ... 0 ~ 16383 (3FFFH)

.Current counter .. 0 ~ 16383 (3FFFH)

.Multiplier ..... 0 ~ 255 (FFH)

.Distance-to-go .. -127 ~ 128 (80H)

.set status ..... 00, 01, 10, 11 (BIT of phase and B phase)

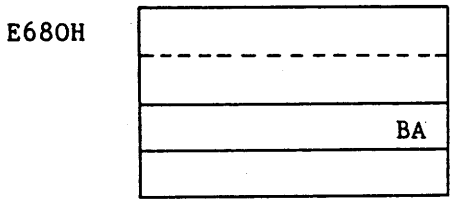


. [F8] ..... Erasure of the AB phase table area
Range (E680H ~ E6BFH ED80H ~ EDBFH)

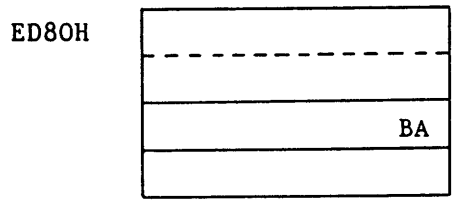
. [F9] ..... Reference mode (WRITE ENABLE SWITCH OFF)

3) Memory format

(1) AB phase data (4 bytes x 16)



(2) AB phase work (4 bytes x 16)



1-17 Alarm

(1) Contact No. of the PC alarm is displayed.

(2) When the message for the contact No. is resistered in the alarm message area, its contents ate displayed (Refer to 31).

F1	F2	F3	F4	F5	F6	F7	F8	F9
						Clear		

. [F7] ..... The PC alarm is cleared

(3) Address for alarm

The addressws and the byte number are set by the system parameter.

(Range : F000H ~ F3FFH)

1-18 Step Ladder

The status of the step ladder is displayed.

1) Step ladder (Momitor)

(1) The comments for the step ladder that No.0 ~ No.19 are used are displayed.

(2) The step count of the step ladder that No.20 ~ No.59 are used are displayed.

(No comments for the step ladder of No.20~ No.59 exist.)

*Ladder in operation (coment and counter) is displayed in red or similar colour.

F1	F2	F3	F4	F5	F6	F7	F8	F9
						Search		

. F7 ..... The step ladders, 0 ~ 19 (detailed) are searched

2) Details of the step ladder

(1) The details of each step ladder are displayed.

(2) 30 pcs. per page (When there are more than 30 pcs., pages are displayed).

(3) When the step ladder being displayed is in operation, the counter in operation is enclosed with a frame.

F1	F2	F3	F4	F5	F6	F7	F8	F9
						Search		Initial Screen

. F7 ..... The step ladders, 0 ~ 19 (detailed) are searched

. F9 ..... Returns to the step ladder (Monitor) (20-1)

3) Address

(1) Max. value (1 ~ 50)

A10000H ~ (No.00 ~ No.12)

A20000H ~ (No.13 ~ No.19)

(2) Work area (EF00H ~ EFFFH)

1 data 2 bytes

	7	6	5	4	3	2	1	0	
EF00H	Flag								(1 : execution 0: Stop)
	Step count								(Step counter in operation)

1-19 Comment Sentence Editing

Editing of the comment sentence such as alarm, counter, timer and table.

1) Screen of selection

●	Item	Max. character number for 1 data	Data range	Memory using number	Memory remaining number
	Alarm	70x20	000~3F7	XXXXX	XXXXX
	Counter	30x1	0-7, 10-17	XXXXX	XXXXX
	Timer	30x1	0-7, 10-17	XXXXX	XXXXX
	Table	30x65	1 ~ 16(D)	XXXXX	XXXXX
	Step ladder	30x51	0 ~ 19(D)	XXXXX	XXXXX

Results after data input

" ● " is moved and editing items are selected.

2) Comment sentence display

If the comment sentence for the items selected is resistered in one line, the characters, "*** message not found ***" are displayed when the comment sentence is not displayed.

F1	F2	F3	F4	F5	F6	F7	F8	G9
Editing	Duplicate	Exchange	Delete			Erasure		End

. [F1] ..... Editing of each comment sentence (As to the details, refer to 31-3)

. [F2] ..... Some comment sentence are duplicated to others (As to the details, refer to 31-4)

. [F3] ..... The comment sentence is exchanged (As to the details, refer to 31-5)

. [F4] ..... The comment sentence is deleted (As to the details, refer to 31-6)

. [F7] ..... The comment sentence for the selected items is cleared (As to the details, refer to 31-7)

. [F9] ..... Returns to the select screen (As to the details, refer to 31-1)

*The relations between the number when the data is made and the actual data (address or number), refer to (31-8).

3) Editing mode

(1) Move the cursor to the number desired to edit and either press the input key or enter the number.

.Alarm	4 digits input (Hexadecimal for the upper 3 digits, octal for the latter 1 digit)
.Counter	2 digits octal input (0 ~ 7, 10 ~ 17)
.Timer	2 digits octal input (0 ~ 7, 10 ~ 17)
.Table	2 digits decimal input (1 ~ 16)
.Step ladder	2 digits decimal input (0 ~ 19)

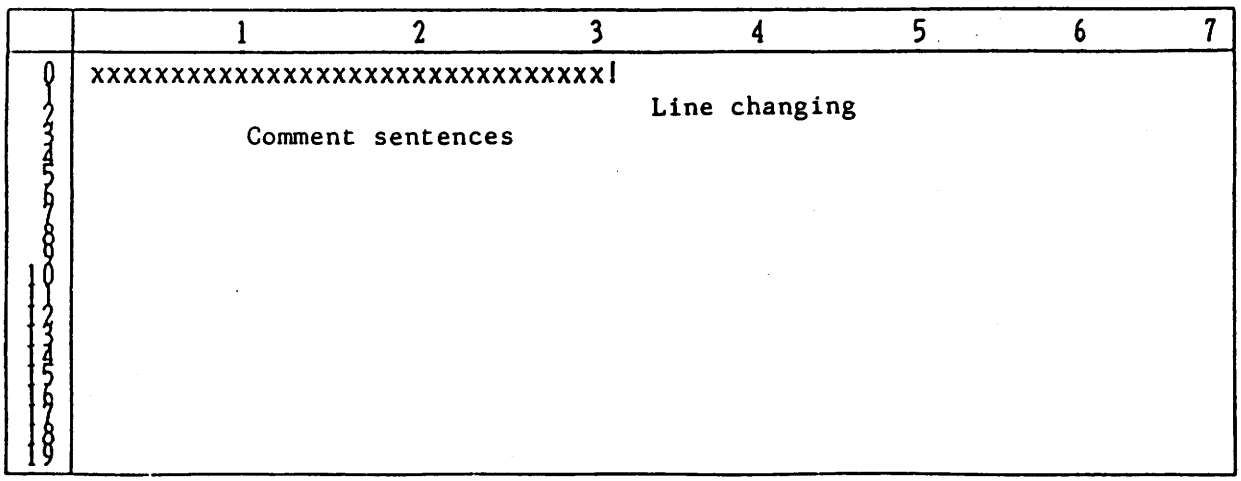
(2) Regulations for editing

	Max. character	Max. No. of line	Data
Alarm	70	20	Alarm message
Counter	30	1	Name of counter
Timer	30	1	Name of timer
Table	30	65	Group name in 1st line Details after 2nd line
Step ladder	30	51	Step name in 1st line Details after 2nd line

*If more than Max. characters × Max. lines are entered, characters, "EDITING BUFFER OVER" are displayed.
(If making a new line is entered, it is regarded as one line is entered.)

(3) When the number entered has been already resistered, all the comment sentences of that number are displayed.
(The parts which are not displayed on one screen are displayed when the role key or the arrow key is pressed.)

Editing screen No. xxxx



(4) Roman letter input of comment sentences

F1	F2	F3	F4	F5	F6	F7	F8	F9
Half Size	Kata kana	Hira gana	SJIS	Not Con-verted (Half Size)	Not Con-verted (Whole Size)	Regis-ter		End

(Example) AIUEO

F1 Half size --- ｱｲｳｴｵ

F2 Katakana --- アイウエオ

F3 Hiragana --- あいうえお

F4 SJIS --- Not converted (Converted by entering the shift JIS code)

F5 Not converted --- AIUEO
(Half size)

F6 Not converted --- ＡＩＵＥＯ
(Whole size)

*Even if romam letters which is disable to convert are entered, and keys other than NOT CONVERT is pressed, it is not converted.

*When whole sized characters are ranged 2 lines, the last one character of the line becomes space, that character moves to the next line.

(5) Other keys

F7	Register	----	The contents of the editing screen is registered in the memory.

*When this key is selected, a message is displayed. If a process is executed, enter "Y" and if it is stopped, enter other key.

F9	End	----	The editing screen is cancelled. (The memory is not change.)

*When this key is selected, a message is displayed. If a process is executed, enter "Y" and if it is stopped, enter other key.

INPUT	Making a new line	----	This is displayed by "!" on the editing screen.

*When this key is selected, "!" is displayed at the position of the cursor and the cursor moves the head of the next line. (If it is the last line, it is the head of the first line.) This is used when data are wanted to be divided to two lines.

REASURE	One character is erased	----	One character is erased from the screen being edited.

*When the corsor is located at "!", if this key is selected, the data in the next line moves forward. (The data are connected to the forward line.)

CANCEL	Cancellation	----	The input data before alteration are cancelled.

This key makes two processes.

(1) If it is after alteration of the data, the data before alteration are displayed, and realteration can be done.

(2) If it is before alteration, that data are cancelled.

4) Duplication

(1) The number of the duplicating origin and the number of the duplicated matter are entered by the purport of editing number.

(2) The number of the duplicating origin is to be registered.

(3) A new number of comment sentence can be made up.
(During duplicating, the memory is filled up, the data are cut on the way.)

5) Exchange mode

(1) No.1 and NO.2 to be exchanged are entered by the purport of deiting number. (31-3-(1))

(2) No.1 and No.2 are to have already registered.

6) Elimination mode

(1) Enter the number to be eliminated with the purport of the editing number. (31-3-(1))

7) Erasure mode

(1) This is used when desiring to erase all the registered numbers.
(Only the data of the items selected in (31-1) becomes object.)

*When the above modes are selected, the message is displayed.
If executing the process, enter "Y" and if stopping it, enter the other key.

8) Corresponding table of comment sentences and data

(1) Alarm

F200H (Head address)

0 0 0 0 0 0 1 1	0
1 0 1 0 0 0 0 0	1
0 0 0 0 0 0 0 0	2
0 0 0 0 0 0 0 0	3
	4
	5
	6
	7

Alarm display screen

Alarm		0
[2200]	ERROR 00	1
	ERROR 01	2
	ERROR 02	3
[2201]	ERROR 10	4
	ERROR 11	5
[2215]	ERROR 150	6
	ERROR 151	7
[2217]	ERROR 170	
	ERROR 171	

Alarm editing

0000	ERROR 00
1	ERROR 01
2	ERROR 02
0001	ERROR 10
1	ERROR 11
0005	ERROR 50
1	ERROR 51
0007	ERROR 70
1	ERROR 71
0010	ERROR 100
1	ERROR 101
2	ERROR 102
0015	ERROR 150
1	ERROR 151
0017	ERROR 170
1	ERROR 171

(2) Comment timer

	Comment	Timer
0		
1		
2		
16		
17		

Comment(Timer) editing

0000	xxxxxxxxxx
0001	xxxxxxxxxx
0003	xxxxxxxxxx
0016	xxxxxxxxxx
0017	xxxxxxxxxx

(3) Table

```
Table    No.01  XXXXXXXXXX
  1      XXXXXXXXXX
  2      XXXXXXXXXX
  3      XXXXXXXXXX
  4      XXXXXXXXXX
```

```
Table    No.02  XXXXXXXXXX
  1      XXXXXXXXXX
  2      XXXXXXXXXX
  3      XXXXXXXXXX
  4      XXXXXXXXXX
```

```
Table editing
 0001  XXXXXXXXXX
    1  XXXXXXXXXX
    2  XXXXXXXXXX
 0002  XXXXXXXXXX
    1  XXXXXXXXXX
 0003  XXXXXXXXXX
    1  XXXXXXXXXX
 0016  XXXXXXXXXX
    1  XXXXXXXXXX
```

(4) Step ladder

```
Step ladder (Monitor)
Step-00  XXXXXXXXXX
   00    XXXXXXXXXX
   01    XXXXXXXXXX
   02    XXXXXXXXXX
```

```
Step ladder (Monitor)
Step-19  XXXXXXXXXX
   00    XXXXXXXXXX
   01    XXXXXXXXXX
   02    XXXXXXXXXX
```

```
Step ladder editing
 0000  XXXXXXXXXX
    1  XXXXXXXXXX
    2  XXXXXXXXXX
 0001  XXXXXXXXXX
    1  XXXXXXXXXX
 0002  XXXXXXXXXX
    1  XXXXXXXXXX
 0019  XXXXXXXXXX
    1  XXXXXXXXXX
```

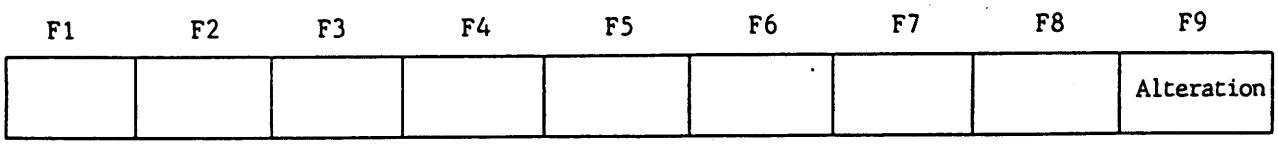
1-20 System Parameter

. Reference and setting of the system parameter data

. Max. 64 pcs. of variable address and byte numbers etc. can be set.

1) Reference of parameters

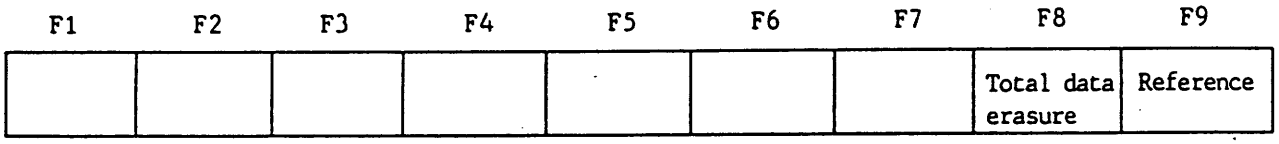
. No.1 through 64 are displayed in HEXADECIMAL and BINARY by byte.



. [F9] ..... Alteration mode (WRITE ENABLE SWITCH ON)

2) Alteration of parameters

. No.1 through 64 are entered in HEXADECIMAL by byte.



. [F8] ..... The system parameter area is erased.
Range (C3C0H ~ C3FFH)

. [F9] ..... Reference mode (WRITE ENABLE SWITCH OFF)

1-21 PC Status

The following status is displayed on the PC status area at the uppermost stage of the screen.

① Travel status

PC STOP ..... In ladder stop
AB INIT ..... AB phase initial
PC RUN ..... In ladder travel
PC PAUSE ..... In ladder pause
AB SCAN ..... In AB phase measurement

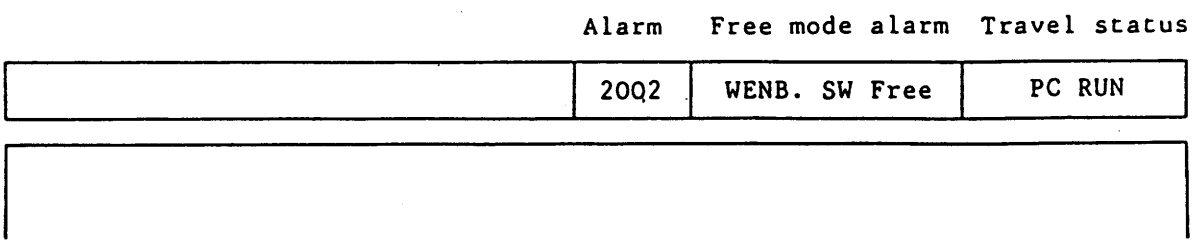
LDsum err ..... Sum check error of the ladder program
PCsum err ..... Sum check error of other than the ladder
SLBUS err ..... SLBUS error
non END ..... No END code
non I-END ..... No constant period ladder END code
180INT err ..... None definition interruption (64180)
NMI err ..... NMI interruption
non L-END ..... No logic analog END code
31sum err ..... 8031ROM sum check error
31RAM err ..... 8031 external RAM error
SLRAM err ..... SLBUS 2P-RAM error
SLTBL err ..... SLBUS Table error
STOP(Error No.) ..... Errors other than the above

② WRITE ENABLE SW, Free mode alarm

When 55H is written in the address AOD629H on the HI board, the free mode that the WRITE ENABLE SW operations can be omitted is set when the PC contents are rewritten.
When this WRITE ENABLE SW is in free mode, the characters "WENB. SW Free" are always alarmed on the upper stage of the screen.

③ Alarm No.

When the alarm contact stands, the youngest No. of them is displayed.



2. PC Logical Analog Operation

This manual describes operating method about the PC menu items "LOGICAL ANALOG" of SEICOS-III.

2-1 Outline

The logical analog of the PC ladder can monitor the sequence status of Max. 8 contacts during ladder travel.
The trigger conditions that acts as the monitor start point can combine Max. 8 conditions.
In even each condition, a chance that consists of the combination of several contact status can be set.
The variation status of the monitor contact data sampled is expressed in wave form diadram plainly.

2-2 Logical Analog Screen Composition

The logical analog screen consits of the following items.

① Trigger condition ..... Describes the arithmetic formula of the expression — trigger parts A through H.

② Trigger part condition .. Describes the arithmetic formula of the expression — contact giving trigger. Max. 8.

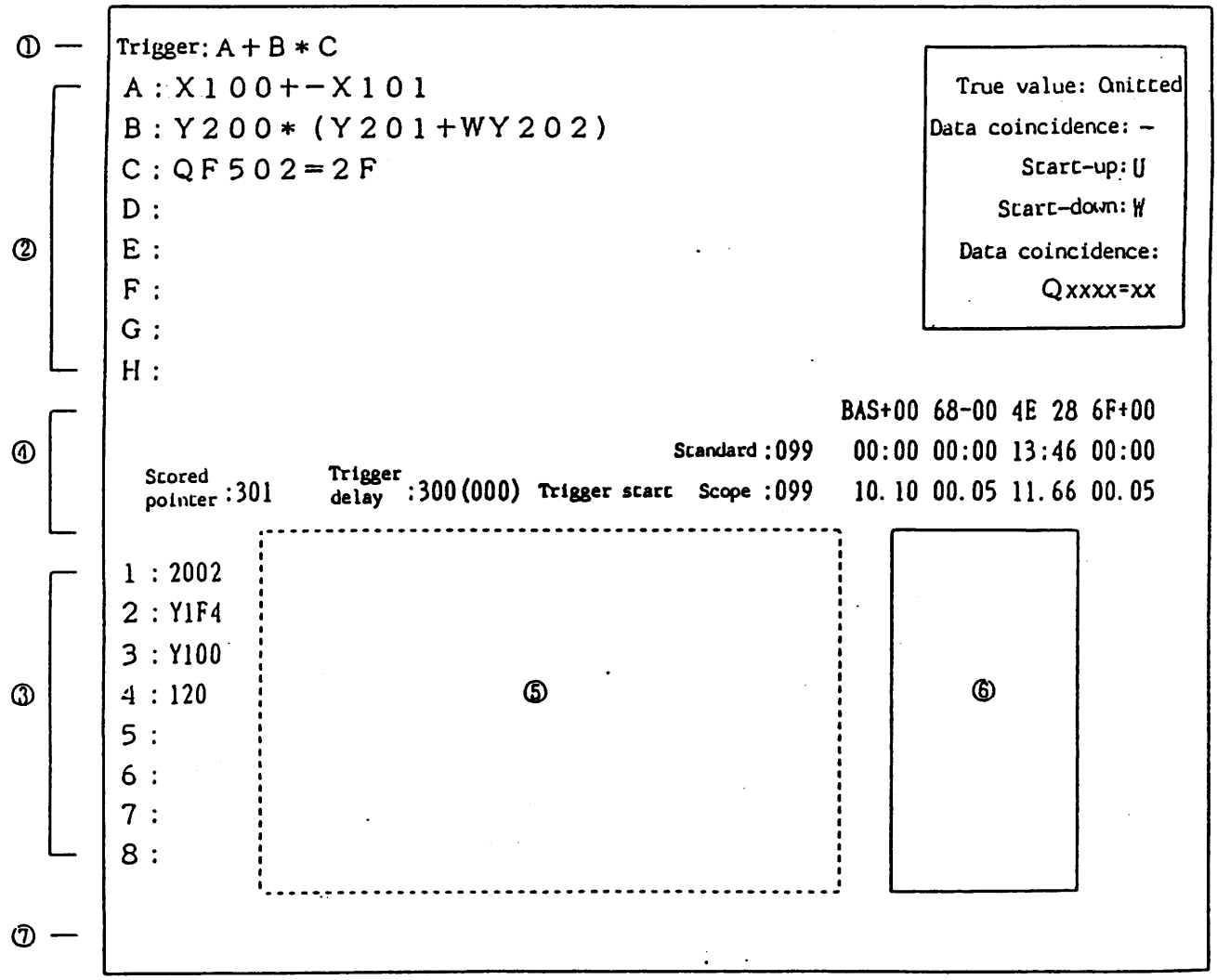
③ Monitor contact No. ..... Describes the monitoring contact No.. Max. 8.

④ Status area ..... Displays various sampling status and sample time.

⑤ Sample data diagram ..... Wave form diagram of Max. 400 of sample data.

⑥ Sample data magnifi- .... Magnified wave form diagram of a part cation diagram — of data.

⑦ Data input erea ..... Input erea of the condition expression.



GO 1	Stop 2	Std. set 3	Condition setting 4	Delay 5	6	7	8	Live L ladder 9

Screen 1 and F menu 1

2-3 Grammer of Trigger Condition Expression

(1) General condition expression

The condition expression of trigger and trigger parts is the same as general four rules of arithmetic in principle.

The operator and priority are shown in the following table.

Priority	Operator
High	Monadic operator .... Pseudo value : - Start-up : U Start-down : W
|	Priority ..... Parenthesis ( )
|	AND ..... *
Low	OR ..... +

(Example)

.Pseudo value contact ...X120(Concept of B contact)

.Start-up contact U21

.Start-down contact Y021

.Priority .....T31*100+Y1F2+Y40*-2003

(2) Coincidence condition expression

The coincidence condition expression is a special condition expression that becomes true when a specified address content coincides with the comparision value.

As it is of fixed type, it is impossible to coexist with the arithmetic formula of the previous item (1).

Coincidence condition expression Qxxxx=x

- Comparison value 2 digits (Hexadecimal description)
- Address 4 digits (Hexadecimal description)

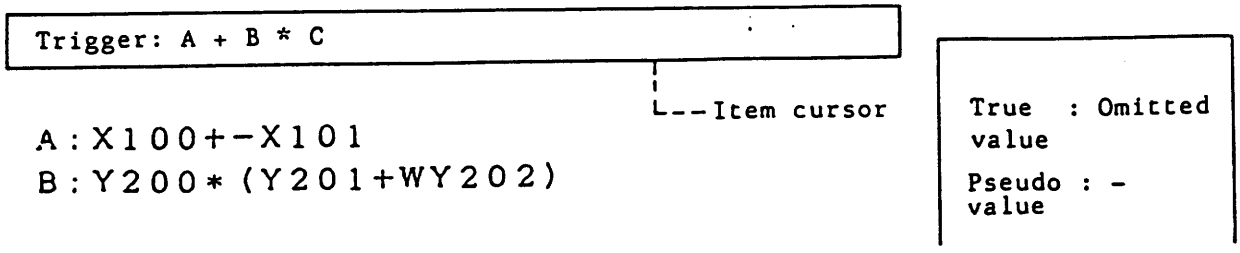
(Example)

Q520D=A2 .... Whether the contents of the address A0520DH is A2H.

2-4 Editing of the Condition Expression

(1) Editing procedures

① When F menu 1 "4. CONDITION SETTING" is pressed, F menu 2 is set.



A+B+C_ (Eimination : Erasure key)

+ 1	* 2	(3	) 4	= 5	Line clear 6	Condition clear 7	All clear 8	9

F menu 2

② Red framed item cursor is displayed on the condition item.

③ If there are defined describing contents, they are invertedly displayed on the data input area.

④ An editing cursor with pink under bar appears in the last of data. The data editing is of screen editing type correcting while moving the editing cursor.

⑤ Returns of F menu 1 by the "RETURN" key.

(2) Editing key

General characters are always entered by the insert mode.
Special keys other than that have the following functions.

↑ ↓ : The condition item cursor moves.

← → : The edting cursor moves

ERASURE : The characters of the cursor is eliminated and the right adjacent charactor line is shifted to the left.

INPUT : Input characters are defined.

SPACE : It is possible to use in order to make easier to see. It doens't influence upon the grammar formula.

F5 : The "LINE CLEAR" erases all the contents of the data input erea.

F6 : The "CONDITION CLEAR" erases all trigger and trigger part condition expression.
It doesn't influence upon the monitor contact No..

F7 : The "ALL CLEAR" erases all the condition expression. (Including the monitor contact No.)

(3) Input charactor limit

Characters are limited depending on condition items.

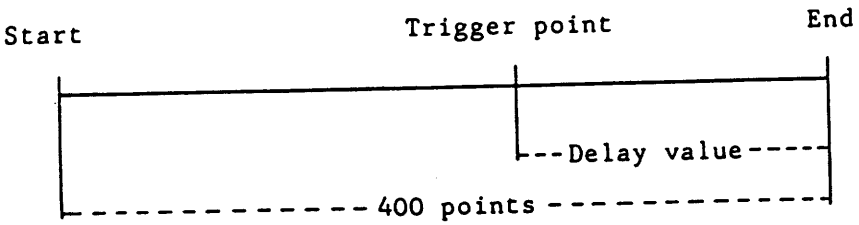
① Trigger .... Max. 60 characters. A~H, ( ) +*
Described by the arithmetic formula of the trigger pares. Example : A*(B*(C+D)+E)

② Trigger parts ... Max. 60 characters 0~9, A~H,
( )+*,Q=, Contact terminal XYTNM
Arithmetic formula of contact No. name or coincidence codition expression.
Example : X100*(X101+2031),QF201=34

③ Monitor contact No. ... Max. 4 characters. 0~9, A~F,
Contact terminal XYTNM
The current contents are once cleared by reentering just after item travel or just after definition, or by entering contact terminal XYTNM.

2-5 Setting of the Delay Value

The storage capacity of the sample data is Max. 400 points.
It is a delay value that designates sample amount among them after trigger point.



① When pressing F menu 1 "5. DELAY", it becomes standby for entering a value.
Triggrt value (1~400)
(Suspension : Cancel Correction : Erasure) ... ?

② Enter a value. When the value is unsuitable, the "DELAY VALUE ERROR" is displayed.

③ The input value is displayed on the trigger delay item at the status area of the screen.

2-6 Sampling Start

① Press F menu 1 "1. GO".
When the PC ladder is stopped, an alarm occurs and it is ineffective.
When it is already in sampling, it is ineffective as well.

② The "IN SAMPLING ..." display starts blinking.

③ Whether the trigger is provided or not is displayed on the status area of the monitor.

④ The sampling is completed upto the delay value, it ends automatically.

⑤ The sampling data diagram is displayed.

2-7 Sampling Stop

This is used when desiring to stop sampling forcedly.

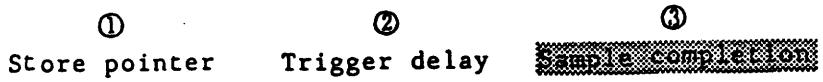
① Press F menu 1 "2. STOP".
When it is not in sampling, it is ineffective.

② The "STOP" is displayed.

③ A sampling data diagram upto halfway is displayed,

2-8 Sampling Status

There are three function that can monitor during sampling in the status area.



① Store pointer .... 000~399. It indicates the store pointer in sampling.
If some variation occurs in sample data, data are stored and the store pointer increases by one.
The number next to 399 is varied to 0 and rotary.

② Trigger delay .... Delay setting value and remaoning numbers in parenthesis.
The remaining numbers are decreasing toward 0 from the setting value.
When this becomes 0, the sampling is completed.

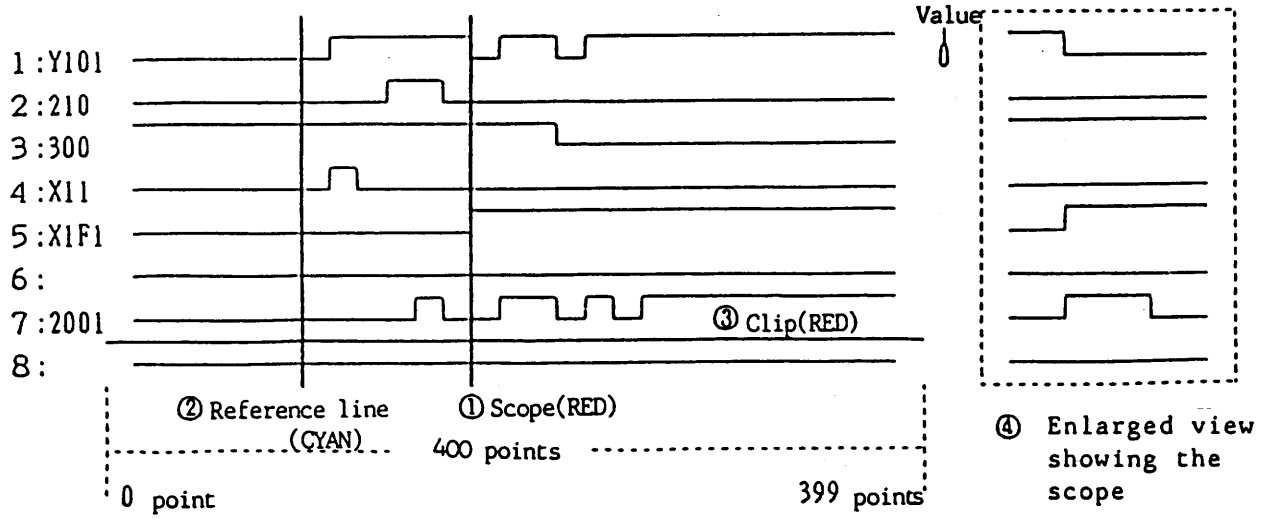
③ Trigger status ....

"NO DATA"	: The status that the sampling data are completely cleared,
"TRIGGER STANDBY"	: The status that the trigger is not engaged yet.
"TRIGGER ON"	: The trigger is engaged. The display is blinking.
"SSAMPLE COMPLETION"	: The sampling is completely proceeded upto the delay value.

2-9 Sample Date Diagram

The sample data diagram is a wave form diagram that Max. 400 points portions of sample data are visualized. Sampling is taken only when the data are varied. Since the before and after sampling data are not in proportion to the time due to this, time difference is indicated as supplement on the data diagram.

			⑦ Time difference between scop and reference	⑥ Scope Time difference	⑤ Scope Time	⑥ Scope +1 Time difference
			BAS+00	[illegible]-00	[illegible] 28	[illegible]+00
		Reference:099	00:00	00:00	13:46	00:00
Store:302 point	Trigger:300(000) delay	Sample completion	Scope 10.10	00.05	11.66	00.05



Name of each part and its function are shown.

① Scope (Red) .... An indicator presenting the enlarged wave form view.

The current point number is displayed on the status are "SCOPE".
It moves point to point to the left and right by ← → keys.
However, when the clip described later exists, it moves to the start-up and start-down point next to the clip data in high speed.

② Reference line (Cyan) .... A reference line for measuring the time difference between scopes.

The current point is displayed on the status area "REFERENCE".
Though at first it is located at the trigger point, the current scope is redefined as the reference line by F menu 1, "3. REFERENCE SET".
When no trigger is provided, it is located at 399 point where the latest data prepared.

③ Clip (Red) .... A noticeable contact number bar for moving the scope in high speed.

Though at first, the clip is not displayed, it moves with every contact number by the ↑ ↓ keys.
Though the travel is rotary, the crip can be erased at the turning point.
However, when the clip exists, it moves to the start-up and start-down point next to the clip data in high speed.

④ Enlarged view .... A enlarged wave form view of the scope and the before and after sample data.

⑤ Scope time .... It presents the sampling time value showing the scope.

⑥ Time difference between before and after .... It presents the sampling time difference between the before and after data of scope.

⑦ Time difference with the before and after .... It presents the sampling time difference between the scope and the data of the reference line.

Refer to the below example.

(Example) 18 o'clock 11 minutes 17.92 seconds on 32
Sample data value (Hexadecimal).... [redacted]+30 .... Day
O'clock .... 18:11 .... Minute
Second .... 19.92 .... 10ms

2-10 Logical Analog Ladder

There is the logical analog ladder in addition to general PC ladder in the PC ladder.

The sampling of the trigger condition expression and the monitor contact are made with the logical analog, and that ladder circuit is generated at the time of editing of the condition expression.

(The descriptions about the exclucive logical analog contact etc. are omitted.)

When F menu 1, "9. ACTIVE LINE L LADDER" key is pressed, the logical analog ladder as well as the general active line can be refered.

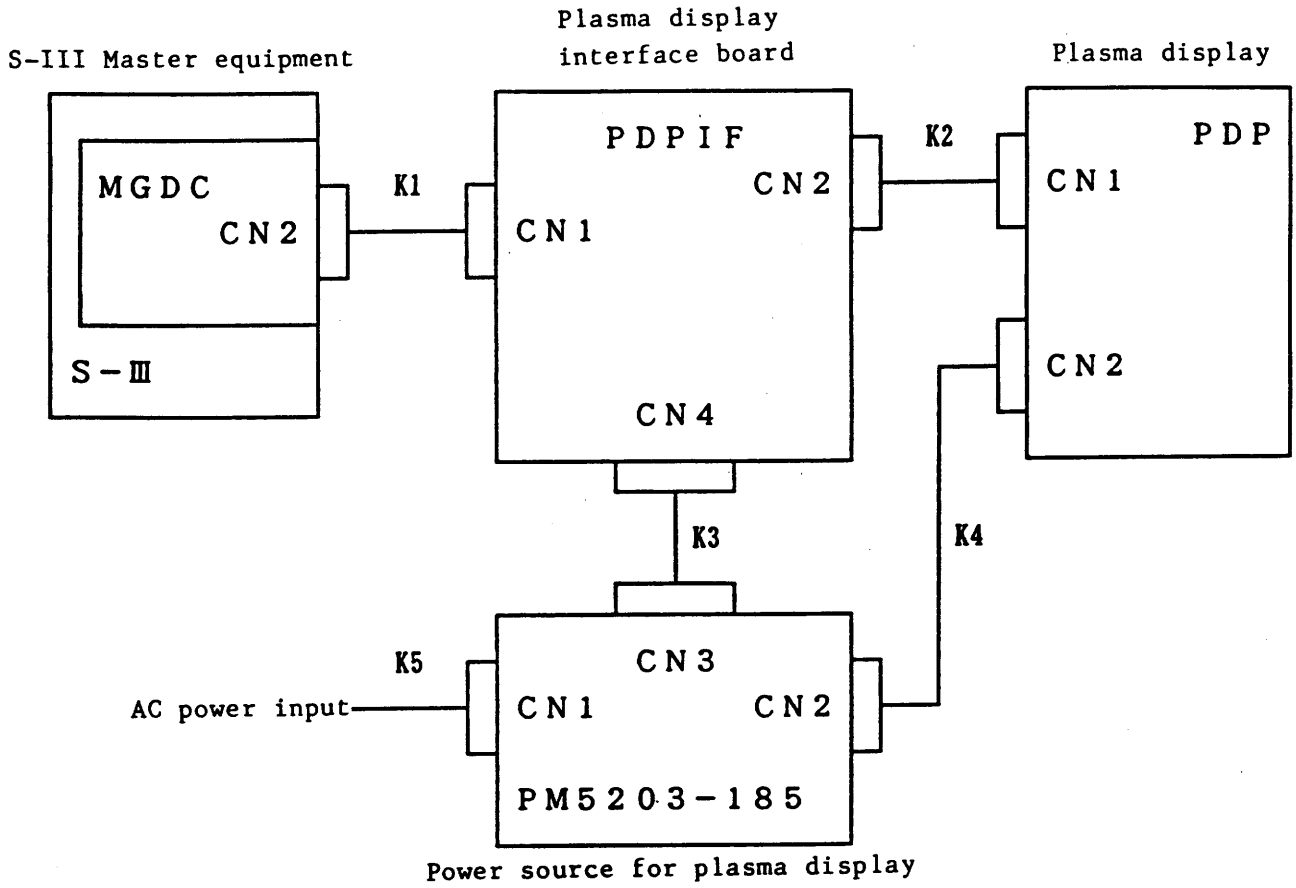
The active line can be refered even in sampling.

3. Plasma Display

1. Outline

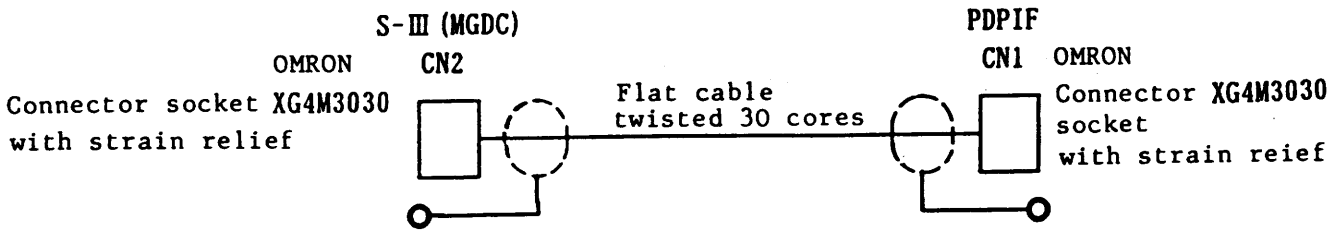
This specification contains a reference to the connection of the plasma display (PG640480RJ16-3) made by OKI ELECTRIC CO. and SEICOS III system.

2. Block diagram

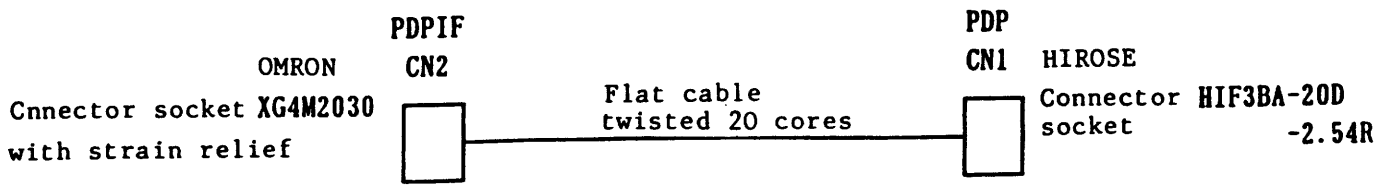


3. Manufacturing drawing for cable

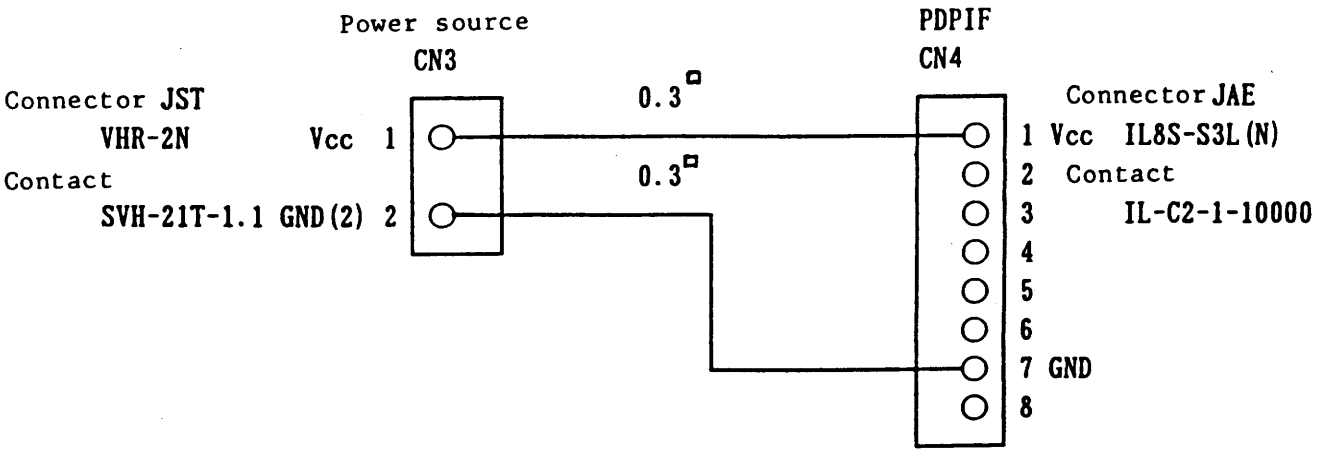
(1) K1



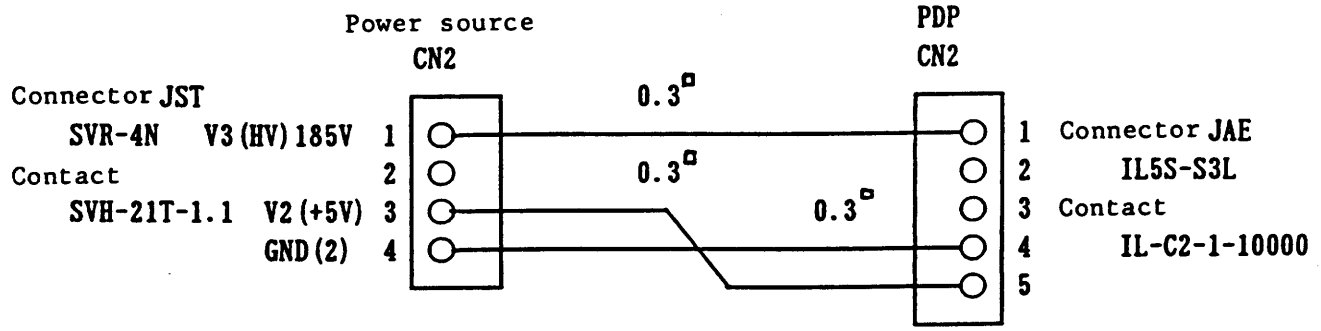
(2) K2



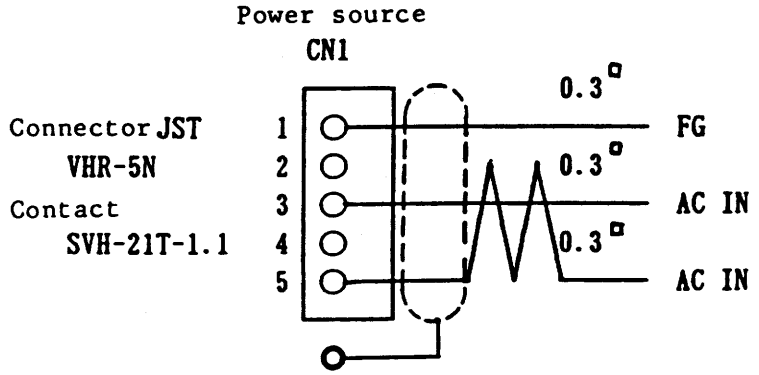
(3) K3


Power source
CN3
PDPIF
CN4
Connector JST
VHR-2N
Contact
SVH-21T-1.1
Vcc 1
GND(2) 2
0.3□
0.3□
Connector JAE
1 Vcc IL8S-S3L(N)
2 Contact
3 IL-C2-1-10000
4
5
6
7 GND
8

(4) K4


Power source
CN2
PDP
CN2
Connector JST
SVR-4N
Contact
SVH-21T-1.1
V3(HV)185V 1
2
V2(+5V) 3
GND(2) 4
0.3□
0.3□
0.3□
1 Connector JAE
2 IL5S-S3L
3 Contact
4 IL-C2-1-10000
5

(5) K5


Power source
CN1
Connector JST
VHR-5N
Contact
SVH-21T-1.1
1
2
3
4
5
0.3□
0.3□
0.3□
FG
AC IN
AC IN

4. Outline

PG640480RJ16-3 is a DC type display unit corresponding to IBM PS/2 display specification as 640 x 480 dots and 16 euphony.

Interface conform to VGA.

5. Optical characteristics

Item	Standard	Unit
Effective display area	211.2(H) x 158.4(V)	mm
No. of dots	640(H) x 480 (V)	dot
Pitch of dots	0.33 (H) x 0.33(V)	mm
Dot size	0.2(H) x 0.2(V)	mm
Display of euphony	16 (With γ compensation)	Euphony
Brightness of area	* 76 Min.	cd/m^2
Contrast ratio	* 1:150 Typ. (HIGH CONT.)	—
Luminous color	Neon orange (570-980 nm)	—
Angle of visual field	100 Typ.	Degree

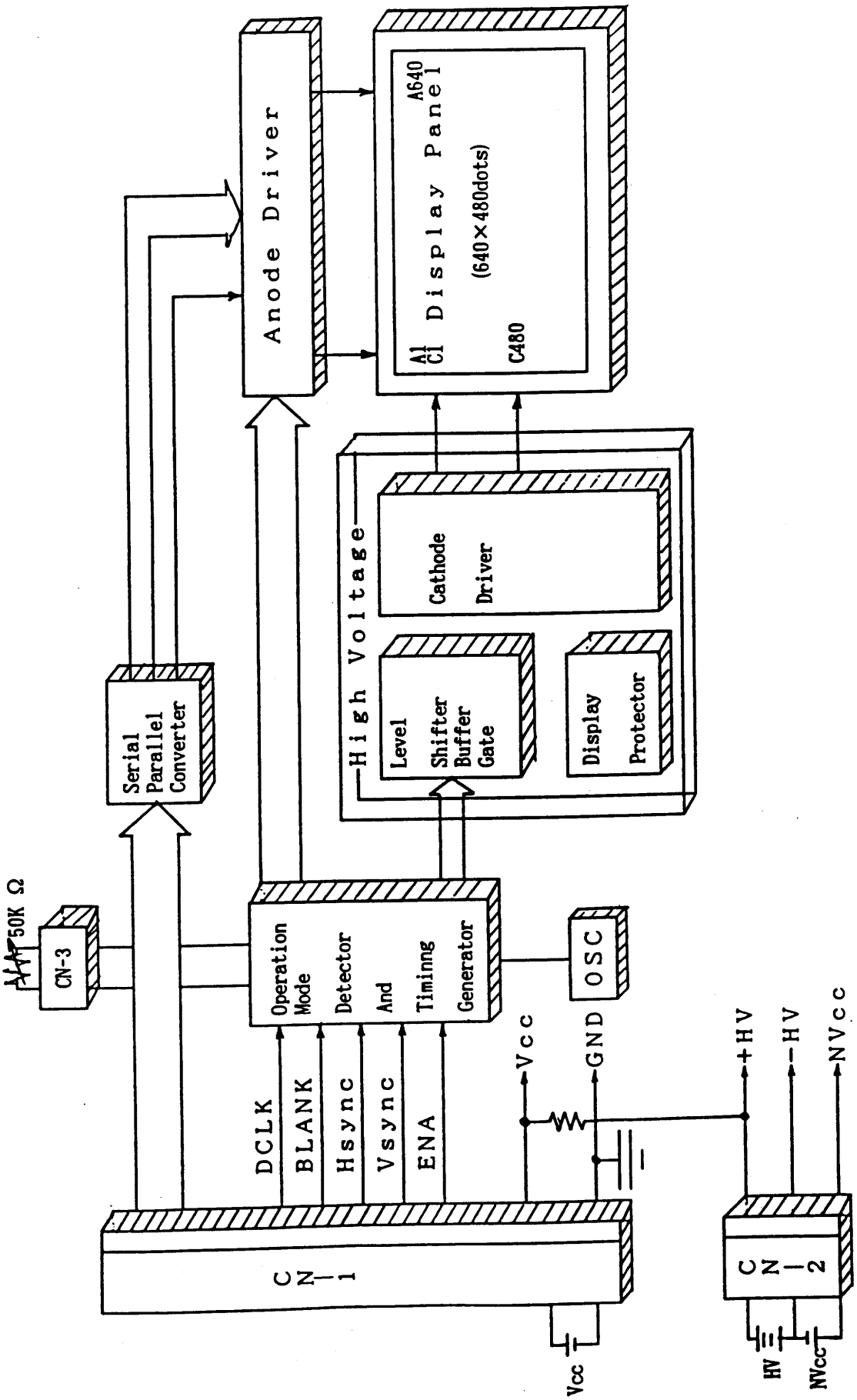
*Ta=25°C, Duty=1/525, Brightness meter: 1° by TOPCON BM-5, Measuring range ϕ21mm

6. Mechanical characteristics

6-1 Mechanical characteristics

Item	Standard	Unit
External dimension	294(H) x 198(V) x 21(D)	mm
Weight	About 850 (Without filter)	g

6-2 Block diagram



6-3 Interface Signal List

CN1: HIF3BA-20PA-2.54DS (HIROSE)

Pin No.	Symbol	Effective level	Explanation
1	Vcc	--	+5V (Logic power source)
2	Vcc	--	+5V (Logic power source)
3	ENA	H	H: Normal motion L: Display evases forcedly. (Built-in 100KΩ pull up resister)
4	BACKG	H/L	H: Contrast ratio 1 : 150 L: Contrast ratio 1 : 10
5	V_{SYNC}	H/L	Vertical synchronous signal
6	GNC	--	GND
7	H_{SYNC}	H/L	Horizontal synchronous signal
8	GND	--	GND
9	/BLANK	L	Blank signal
10	GND	--	GND
11	DCLK	L → H	Take in signal of display data. Display data is taken in at start up.
12	GND	--	GND
13	DATA0	H/L	Display data (The lowest rank bit)
14	GND	--	GND
15	DATA1	H/L	Display data
16	GND	--	GND
17	DATA2	H/L	Display data
18	GND	--	GND
19	DATA3	H/L	Display data (The highest rank bit)
20	GND	--	GND

Applicable female connector: Equivalent to HIF3BA-20D-2.54R (HIROSE)

CN2: IL-5P-S3FP2(JAE)

Pin No.	Symbol	Explanation
1	HV	Plus side of power source for discharge
2	N.C	—
3	N.C	—
4	-HV	Power source for discharge Minus side of low level power source
5	NV	Plus side of low level power source

Applicable female connector: Equivalent to IL-5S-S3L(JAE)

CN3: 008263021100000(ELCO)

Pin No.	Symbol	Elplanation
1	VR1	Terminal of brightness adjustment
2	VR2	Range of brightness adjustment 40 ~ 100% (Terminal for external resister)

External resister: 50K Ω,0.01W

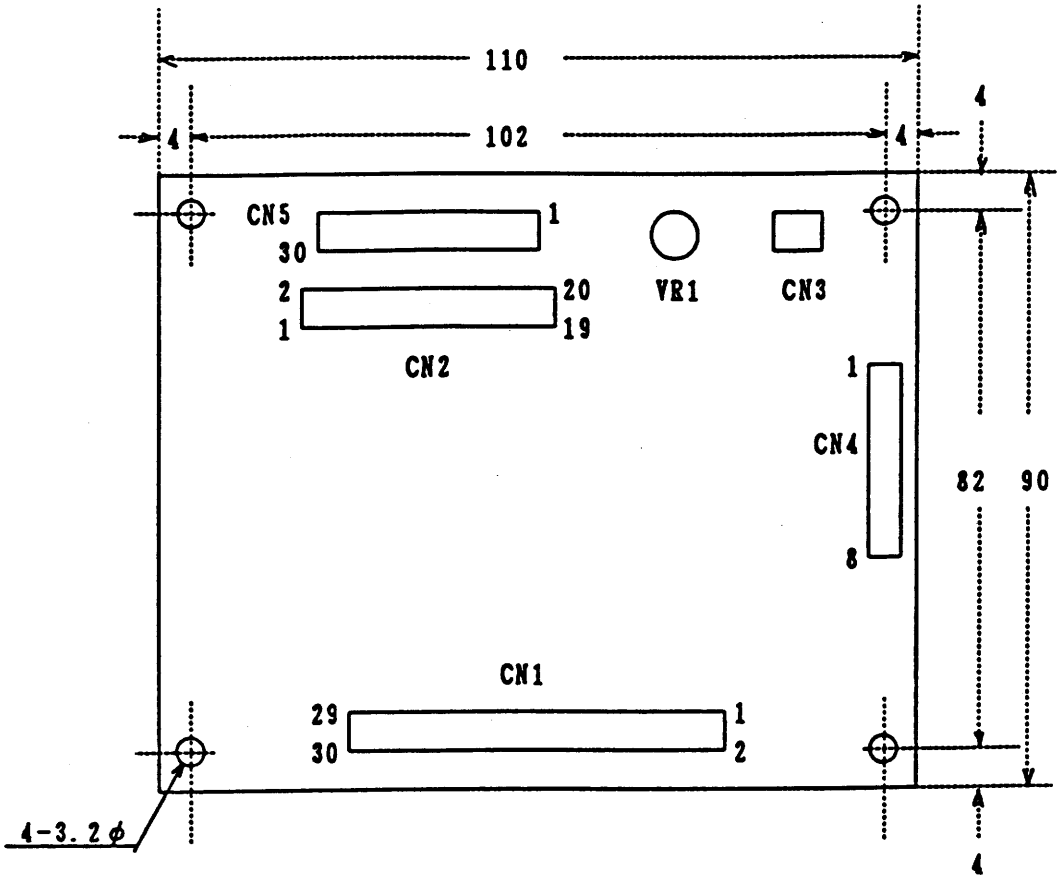
Applicable female connector: Equivalent to 608263302815(ELCO)

6-4 Jumper setting

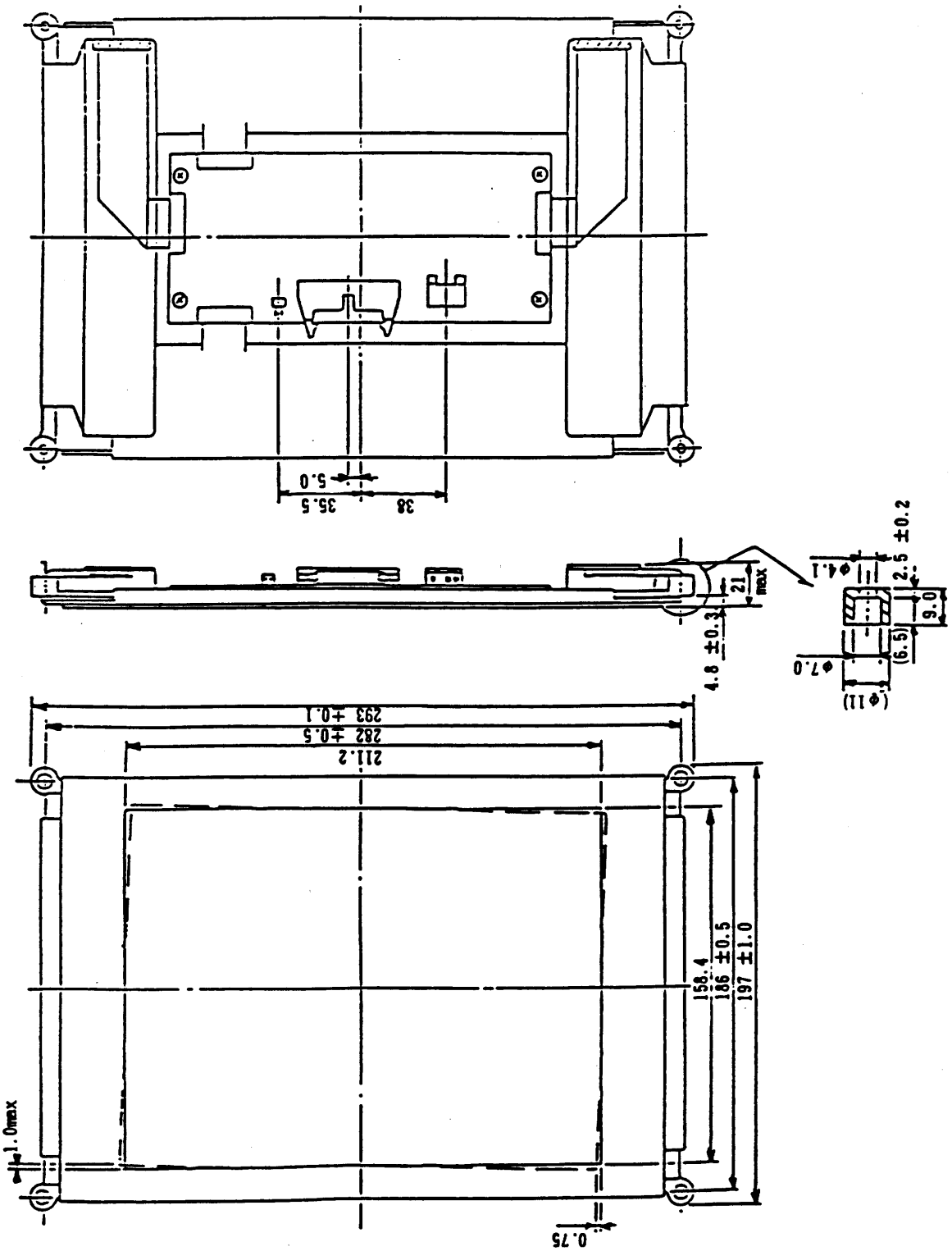
Terminal name of jumper	③ - ④	④ - ⑤	Initial setting
J1	At the time of display mode 360 x 400, 720 x 350, 720 x 400, right hand 80 dots is not displayed. Left hand 640 dots displayed only.	At the time of display mode 360 x 400, 720 x 350, 720 x 400, apace dots between characters are deleted automatically, therefore, all characters are displayed at the text mode.	④-⑤

7. External dimensions

(1) External dimension of plasma display interface board (P D P I F)



(2) External dimension of plasma display



8. Power Source Unit of Plasma Display

8-1 Electric characteristics

Primary AC200V 0.4A

No.	Item	Standard	Condition . Remarks
1	Rated power source voltage	AC120V/AC240V	AC85 ~ 132V/AC180 ~ 263V
2	Rush current	Less than 50A	60HZ 120V, 240V non-repetition (At the time of cold start)
3	Efficiency	More than 65%	At the time of rated In/out put

No.	Item		Vcc1	Vcc2	Vcc3
4	Output voltage		+5V	+5V	+185V
5	Rated output current		3A	0.1A	160mA *2
6	Range of output current		0.1 ~ 3A	0 ~ 0.1A	160mA *2
7	Ripple noise *2	Ripple	Less than 100mVp-p	Less than 100mVp-p	Less than 500mVp-p
		Spike	Less than 150mVp-p	Less than 220mVp-p	Less than 500mVp-p
8	Setting deviation of output Against input fluctuation Against load fluctuation Termal drift Initial drift		±5%	±5%	180 ~ 190V
9	Protection of overcurrent		Resist against short circuit less than 200mΩ.		
10	Start up time		Within 200msec	Within 200msce	Within 500msec
11	Output form		Floating	Floating *3	Floating *3
12	Insulation resistance		More than 100MΩ	Measure at DC500V Primary ↔ F.G, secondary	
13	Resisting pressure		Should not be abnormal	AC1.5KV one minute, sensitivity 10mA primary ↔ F.G, secondary	

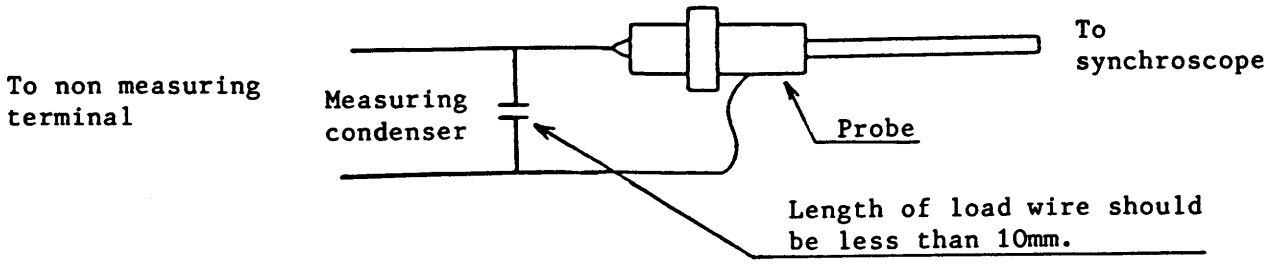
*2: +VH output shold be satisfied the standard and nornal condition even if give a load current 200mA at 20 seconds.

*3: HV and ground system Vcc2 and Vcc1 should be separated.

*4: All output should be no trouble with no load.

*5: Measurement of ripple noise is dine by the following measurement curcuit.

*6: Condenser for measurement is 47uF, 25V for Vcc1 and Vcc2 circuit, add 10000PF, 630V for HV circuit.



8-2 Mechanical specification

1) Weight : 980g

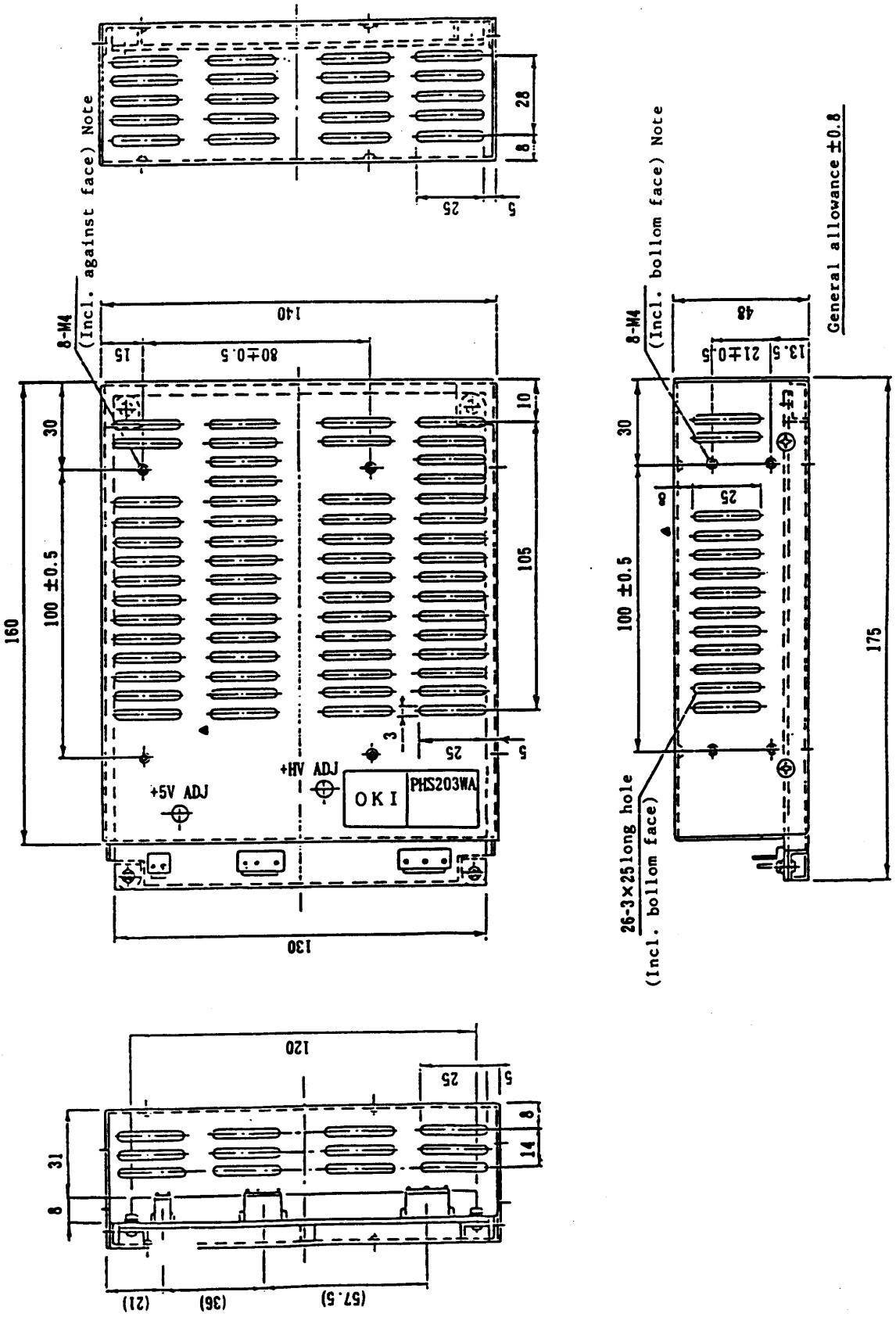
2) In/Output connector

Symbol	Item	Pin No.	Signal name	Voltage	Part name of connector
CN1	Input of alternating current	1 2 3 4 5	GND ——— AC1 (N) ——— AC2 (L)	 AC200V (AC100V) AC200V (AC100V)	 B3P5-V (JST
CN2	Input of direct current	1 2 3 4	VH ——— Vcc2 0V	+185V +5V	B4P-V (JST
CN3		1 2	Vcc1 0V	+5V	B2P-V (JST

3) Anti vibration

Fix the power unit on the vibration stand and electric and mechanical abnormality should not be found at no load operation of rated input voltage.

9. External dimension



Note) Screw to be used at M4 tap for mounting, should not be intrude more than 5mm from the frame surface. (16 places)

Chapter 14 ALARM LIST

VG45 Alarm list

Alarm No.	Contents
2A00	NC SYSTEM CONTROL ABNORMAL
2A01	NC SERVO CONTROL ABNORMAL
2A02	OVER TRAVEL
2A03	NC SERIAL IF CONNECTION BAD
2A04	NC PROGRAM/OPERATION BAD
2A05	NC ALARM
2A06	CB-4 BREAKER TRIP
2A07	CABLE DISTRIBUTOR FUSE BLOWN
2A10	M. S. T. B. CYCLE TIME OVER
2A11	HYDRAULIC MOTOR OVER LOAD
2A12	FLOOD COOLANT MOTOR OVER LOAD
2A13	SPIRAL CONVEYOR MOTOR OVER LOAD
2A14	OIL HOLE COOLANT MOTOR OVER LOAD
2A15	GUN COOLANT MOTOR OVER LOAD
2A16	JET COOLANT MOTOR OVER LOAD
2A17	FLAT CONVEYOR OVER LOAD
2A20	CHECK A COOLANT OF SPINDLE COOLER
2A21	COLLECT A LUBRICANT
2A22	ATC ARM IS NOT NORMAL POSITION
2A23	SPINDLE ORIENTATION COULD NOT COMMAND FOR UNCLAMP
2A24	SPINDLE ORIENTATION COULD NOT COMMAND FOR ATC ARM TO ORIGIN
2A25	SPINDLE COULD NOT ORIENTATION
2A26	SPINDLE DRIVE UNIT ABNORMAL
2A27	SPINDLE ZERO SPEED DETECT ABNORMAL
2A30	SPINDLE UP TO SPEED DETECT ABNORMAL
2A31	SPINDLE ORIENTATION DETECT ABNORMAL

Alarm No.	Contents
2A32	DIRECT TAP M CODE UNSUITABLE
2A33	SPINDLE COOLING UNIT ABNORMAL
2A34	SPINDLE COOLING UNIT PRESSURE LOW
2A35	START SPINDLE ROTATION
2A36	TOOL CLAMP INCOMPLETE
2A37	LS TOOL UNCLAMP ABNORMAL
2A40	LS TOOL CLAMP ABNORMAL
2A41	SOL TOOL UNCLAMP ABNORMAL
2A42	FRONT DOOR CLOSE INCOMPLETE
2A43	SPINDLE TOOL BROKEN (CUTTING MONITOR)
2A44	SPINDLE TOOL LIFE OVER (CUTTING MONITOR)
2A45	PRE-CUTTING CHECK ABNORMAL (CUTTING MONITOR)
2A46	RENISHAW AMP. ABNORMAL
2A47	TOOL LENGTH DETECT ABNORMAL
2A50	SPINDLE STOP INCOMPLETE
2A51	CHANGE M74-MODE
2A52	LUB. OIL LOW PRESSURE
2A53	SPINDLE LUBRICATION DISTRIBUTOR PRESSURE LOW
2A54	SPINDLE LUBRICATION TANK PRESSURE LOW
2A55	LACK LUBRICATION OIL
2A56	AIR PRESSURE LOW
2A57	INSPECT LUBRICATION OIL
2A60	INSPECT HYDRAULIC OIL
2A61	INSPECT NC-PC BATTERY
2A62	NO OPTION
2A63	MAINTENANCE MODE ON
2A64	MAINTENANCE S.T.B. COMMAND UNSUITABLE
2A65	OIL PRESSURE OF LUBRICANT FOR SLIDE WAY IS DROPPED

Alarm No.	Contents
2A66	LUBRICANT FOR SLIDE WAY IS INSUFFICIENT
2A67	FORMAT IS WRONG (CUTTING MONITOR)
2A70	Y-AXIS NOT IN 2ND REF. POSITION
2A71	Z-AXIS NOT IN 2ND REF. POSITION
2A72	RETURN ATC ORIGIN
2A73	NO COMMAND TOOL
2A74	UNABLE SEARCH COMMAND TOOL IN SPINDLE
2A75	SPINDLE ORIENTATION INCOMPLETE
2A76	MAGAZINE INDEX ABNORMAL
2A77	TOOL IN RESTORE POT
2A80	ATC ARM TURM INCOMPLETE
2A81	ATC ARM RETRACT INCOMPLETE
2A82	ATC ARM SLIDE NOT ORIGIN
2A84	ATC SET UP DOOR CLOSE INCOMPLETE
2A85	LS ATC ARM FORWARD ABNORMAL
2A86	LS ATC ARM RETRACT ABNORMAL
2A87	SOL ATC ARM FORWARD ABNORMAL
2A90	SOL ATC ARM RETRACT ABNORMAL
2A91	LS ATC ARM SWING TO MAGAZINE SIDE ABNORMAL
2A92	LS ATC ARM SWING TO SPINDLE SIDE ABNORMAL
2A93	LS ATC ARM SWING TO ORIGIN ABNORMAL
2A94	SOL ATC ARM SWING TO SPINDLE SIDE ABNORMAL
2A95	SOL ATC ARM SWING TO MAGAZINE SIDE ABNORMAL
2A96	LS ATC ARM SLIDE TO MAGAZINE SIDE ABNORMAL
2A97	LS ATC ARM SLIDE TO ORIGIN ABNORMAL
2AA0	LS ATC ARM SLIDE TO SPINDLE SIDE ABNORMAL
2AA1	SOL ATC ARM SLIDE TO MAGAZINE SIDE ABNORMAL
2AA2	SOL ATC ARM SLIDE TO ORIGIN ABNORMAL

Alarm No.	Contents
2AA3	SOL ATC ARM SLIDE TO SPINDLE SIDE ABNORMAL
2AA4	LS ATC ARM CW ABNORMAL
2AA5	LS ATC ARM CCW ABNORMAL
2AA6	SOL ATC ARM CW ABNORMAL
2AA7	SOL ATC ARM CCW ABNORMAL
2AB0	FILTER OF THRONG COOLANT IS CLOGGED
2AB1	SOL FRONT DOOR CLOSE ABNORMAL
2AB2	FIXTURE IS NOT CLAMPED
2AB3	LS FRONT DOOR CLOSE ABNORMAL
2AB4	X-AXIS NOT IN 2ND REF. POSITION
2AB5	LS FRONT DOOR OPEN ABNORMAL
2AB7	VDE FEED CONDITION INCOMPLETE
2AC0	RELEASE CONDITION OF DOOR LOCK IS INCOMPLETED
2AC1	RELEASE CONDITION OF DOOR LOCK FOR ATC IS INCOMPLETED
2AC2	AMOUNT OF OIL IN THE HYDRAULIC TANK IS INSUFFICIENT
2AC3	HYDRAULIC PRESSURE IS BEING DROPPED
2AC4	PALLET IS NOT CLAMPING CONDITION
2AC5	FUSE OF APC SLAVE UNIT HAS BLOWN
2AC6	MAKE ZERO RETURN FOR APC
2AC7	COMPLETION COMMAND OF TRANSFER PREPARATION IS INCOMPLETED
2AD0	APC DOOR IS NOT CLOSED
2AD1	PALLET POSITIONING PIN IS NOT INSERTED
2AD2	PALLET SHUTTLE IS NOT LOCATED AT MACHINE SIDE
2AD3	APC CARRIER IS NOT LOCATED NORMAL POSITION
2AD4	APC SHUTTLE IS NOT LOCATED AT APC SIDE
2AD5	APC DOOR IS NOT OPENED
2AD6	PALLET POSITIONING PIN IS NOT PULL OUT
2AD7	LS OF APC DOOR OPEN IS ABNORMAL

Alarm No.	Contents
2AE0	LS OF APC DOOR CLOSE IS ABNORMAL
2AE1	SOL OF APC DOOR OPEN IS ABNORMAL
2AE2	SOL OF APC DOOR CLOSE IS ABNORMAL
2AE3	LS OF INSERTION OF PALLET POSITIONING PIN 1 IS ABNORMAL
2AE4	LS OF PULL OUT OF PALLET POSITIONING PIN 1 IS ABNORMAL
2AE5	LS OF INSERTION OF PALLET POSITIONING PIN 2 IS ABNORMAL
2AE6	LS OF PULL OUT OF PALLET POSITIONING PIN 2 IS ABNORMAL
2AE7	PALLET FITTING IS ABNORMAL
2AF0	EXITATION OF ATC SOLENOID IS ABNORMAL
2AF1	SOL OF INSERTION OF PALLET POSITIONING PIN IS ABNORMAL
2AF2	SOL OF PULL OUT OF PALLET POSITIONING PIN IS ABNORMAL
2AF3	LS OF MACHINE SIDE OF APC SHUTTLE IS ABNORMAL
2AF4	LS OF APC SIDE OF APC SHUTTLE IS ABNORMAL
2AF5	SOL OF MACHINE SIDE OF APC SHUTTLE IS ABNORMAL
2AF6	SOL OF APC SIDE OF APC SHUTTLE IS ABNORMAL
2AF7	LS OF RIGHTWARD SIDE OF APC CARRIER IS ABNORMAL
2B00	LS OF LEFTWARD SIDE OF APC CARRIER IS ABNORMAL
2B01	SOL OF RIGHTWARD SIDE OF APC CARRIER IS ABNORMAL
2B02	SOL OF LEFTWARD SIDE OF APC CARRIER IS ABNORMAL
2B03	NO.1 PALLET IS ABNORMAL
2B04	NO.2 PALLET IS ABNORMAL
2B05	SET UP STATION DOOR OF APC VDE IS NOT CLOSED
2B30	INDEX COMMAND VALUE OF ATC MAGAZINE IS ABNORMAL
2B31	CURRENT VALUE OF ATC MAGAZINE IS ABNORMAL
2B32	MOTION OF INSERTION OF ATC MAGAZINE PIN IS ABNORMAL
2B33	MOTION OF PULL OUT OF ATC MAGAZINE PIN IS ABNORMAL
2B34	SOL OF INSERTION OF ATC MAGAZINE PIN IS ABNORMAL
2B35	SOL OF PULL OUT OF ATC MAGAZINE PIN IS ABNORMAL

Alarm No.	Contents
2B36	MANUAL INDEX OF ATC MAGAZINE CAN NOT EXECUTED
2B37	AUTOMATIC INDEX OF ATC MAGAZINE CAN NOT EXECUTED
2B40	INDEXING DEVICE OF ATC MAGAZINE IS ABNORMAL
2B41	SERVO FOR INDEX OF ATC MAGAZINE IS ABNORMAL
2B42	DOOR IS OPENED DURING ZERO RETURN OF ATC MAGAZINE
2B43	DOOR IS OPENED DURING INDEX OF ATC MAGAZINE
2B44	TOOL PUSHER IS WORKING

VK45Ⅱ Main Body Standard Consumable Parts List

No	Code No.	Part Name	Type	Q'ty	Remarks
	Column				
1	2736-01-434-01	Cover		1	
2	03999007812	Angular ball	BST30X62-1BP4	3	NTN
3	02341300760	Limit switch	LDV-5312	1	YAMATAKE
	Bed				
1	03999007812	Angular ball	BST30X62-1BP4	3	NTN
2	2736-00-505-00	Slide cover	For Y-axis	2	ISOBE
	Table				
1	02341201450	Limit switch	SL1-A	3	YAMATAKE
2	03999007812	Angular ball	BST30X62-1BP4	3	NTN
3	2736-00-503-00	Slide cover	For X-axis right	1	ISOBE
4	2736-00-504-00	Slide cover	For X-axis left	1	ISOBE
	NT40 Head				
1	02341300760	Limit switch	LDV-5312	1	YAMATAKE
2	2764-00-310-00	Angular ball	ACH015CA-1DBB2	1	KOYO
3	2764-00-307-00	Deep-groove ball	6011C2	1	KOYO
4	2000-91-193-00	Spring/coil		8	
5	04133108210	Solenoid valve	AB41025-02G-AC100V	1	CKD
6	04999003420	Solenoid valve	VXD2130-02-1DS-B	1	SMC
	NT50 Head				
1	02341300760	Limit switch	LDV-5312	1	YAMATAKE
2	2732-00-316-00	Angular ball	7018CEX10BT/G4P4	1	NTN
3	03600900120	Deep-groove ball	6215CG10P5	1	NSN
4	2764-06-434-00	Spring/coil		12	
5	04133108210	Solenoid valve	AB41025-02G-AC100V	1	CKD
6	04999003420	Solenoid valve	VXD2130-02-1DS-B	1	SMC
	NT40 Tool Lock				
1	06315109000	O-ring	15L90	1	
2	04824440100	packing	SKY-80	1	SAKAGAMI
3	04824430010	Packing	SKY-30	1	SAKAGAMI
4	02341201470	Limit switch	SL1-H	2	YAMATAKE
5	04999025435	Solenoid valve	KSO-G02-2BA-10-N	1	DAIKIN
	NT50 Tool Lock				
1	06315108500	O-ring	15L85	1	
2	06315101200	O-ring	15L12	1	
3	06326045000	Dust seal	26L45	1	
4	02341201470	Limit switch	SL1-H	2	YAMATAKE
5	04824430160	Packing	SKY-45	1	SAKAGAMI

No	Code No.	Part Name	Type	Q'ty	Remarks
	NT50 Tool Lock				
6	04824440150	Packing	SKY-85	1	SAKAGAMI
7	04999025435	Solenoid valve	KSO-G02-2BA-10-N	1	DAIKIN
	NT40 Drawbar				
1	04824420310	Packing	SKY-17255	1	SAKAGAMI
2	04824430010	Packing	SKY-30	1	SAKAGAMI
3	2752-05-490-00	Spring/Coil		1	
4	04829030390	Wear ring	S55906-400-47A	1	CAPTAIN
5	2752-00-507-11	Spring/C-coil	THS909-1	1	TOKYO HATSUJO
	NT50 Drawbar				
1	06315104500	O-ring	15L45	2	
2	06315104800	O-ring	15L48	1	
3	03999004039	Wear ring	S55906-540-47A	1	CAPTAIN
4	04824420170	Packing	SKY-25	1	SAKAGAMI
5	04824430030	Packing	SKY-40	1	SAKAGAMI
6	2741-00-574-00	Coil spring	TB50*300 special	1	TOKYO HATSUJO
	Flood Coolant				
1	2761-00-222-00	Coolant pump	LSW15AO.18MR	1	KYOKUTO
2	2732-47-239-00	Cover	NBR	1	
	ATC				
1	06315100900	O-ring	15L9	8	
2	06315101200	O-ring	15L12	1	
3	06315102000	O-ring	15L20	1	
4	06315102400	O-ring	15L24	1	
5	2711-70-506-00	Spring/C-coil		2	
6	2732-49-191-00	Spring/C-coil		2	
7	2732-70-175-12	Plate	(Spring steel 0.3 thick)	1	
8	2732-70-177-10	Spring/C-coil		1	
9	2732-70-413-00	Roller		2	
10	2741-70-500-01	Spring/C-coil		2	
11	2772-49-431-10	Hose ass'y		1	SHOUNAN
12	2772-70-431-00	Spring/plate	(SUS)	1	
13	2736-71-433-00	Spring/C-coil	(Arm for NT40)	2	
14	02999052462	Proximity switch	FL7M-3J6HD-L5	8	YAMATAKE
15	02999052479	Proximity switch	FL7M-7J6HD-L5	1	YAMATAKE
16	02999055650	Proximity switch	FL7M-3J6HD-L10	4	YAMATAKE
17	03660144000	Deep-groove ball	6014ZZ	2	
18	03660202000	Deep-groove ball	6020Z	2	
19	03662094000	Deep-groove ball	6209ZZ	3	

No	Code No.	Part Name	Type	Q'ty	Remarks
	ATC				
20	03668187000	Deep-groove ball	6818VV	1	NSK
21	03669090000	Deep-groove ball	6909	2	
22	03821115010	Roller follower	NA2202LL	1	NTN
23	03865119040	Cam follower	CF8UUR	2	IKO
24	03913112150	Bush	70B-1215	1	Oiless
25	03913220150	Washer	70W-2015	4	Oiless
26	03990000400	Spherical bearing	GE 20EC	2	IKO
27	04824420460	Packing	SKY-14	2	SAKAGAMI
28	04824820090	SER scraper	SER-14	2	SAKAGAMI
29	04824420080	Packing	SKY-18	2	SAKAGAMI
30	04824520140	SDR scraper	SDR-18	1	SAKAGAMI
31	04824820120	SER scraper	SER-18	1	SAKAGAMI
32	04824430160	Packing	SKY-45	2	SAKAGAMI
33	04829020330	Wear ring	S55904-300-47A	3	CAPTAIN
34	04999008906	O-ring	S85	2	NOK
35	04999025774	Solenoid valve	KSO-G02-2CA-10-A	5	DAIKIN
36	2772-70-445-00	Spring/C-coil	(Arm for NT50)	2	
	Splash Guard				
1	02999021329	Fluorescent lamp	JF21220/FZ20111800 Task light	1	MATSUSHITA
2	03660005000	Deep-groove ball	6000LLU	4	NTN
3	05902200010	Bearing	NBM-6 6*24*12	4	OCHIAI

Revision history

Version		Date	Contents of change
01		93. 03.	① Alteration of drawing such as foundation plan or major dimension drawing, etc. (due to alteration shape)
			② Alteration of lubrication system (Addition of line filter)
01		94. 11	Supply penumatic souce Rate of flow 750 → 350 Nℓ/min
		5. 1995	Revise "Relative Drawing of Work and ATC"
		7−1996	Alteration "Motor Specification"