MACHINING CENTERS

MODEL VK45-40/-50 VK55-40/-50

INSTRUCTION MANUAL

SEIKI-SEICOS – MIII

9–1991

MORI SEIKI

THE MACHINE TOOL COMPANY

CONTENTS

INTRODUCTION

We are obliged to you for using our VK-type machining center.
This manual describes 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 thoroughly 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 caution plate 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 necessary:

1. Programming Manual
2. Parts List
3. Instruction Manual and Maintenance Manual for NC Unit
4. Electric Circuit Diagrams
5. Instruction Manual for Optional Functions

For adjustment/setting values lists 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. SAFETY PRECAUTIONS

In this chapter, the following precautions are provided to help protect an operator against accidents, as well as to protect the machine against damages. These precautions are applicable not only to this machine, but also to other machines, especially in their installation and operation. So, read this chapter carefully and observe its contents.

1-1 General Precautions

General precautions given below are helpful in providing safe working conditions and improving productivity.

1. Be sure to wear safety glasses.
2. Be sure to wear safety shoes.
3. Wear a work cap properly, and keep the sleeves and hems of your work uniform tight.
4. Do not operate the machine with gloves on.
5. Provide adequate lighting around the machine, and keep the perimeter of the machine dry, clean and in good order with no obstacles.
6. Remove dust and cutting chips on not only the machine proper, power control cabinet and NC unit, but also the floor around them. To do so, avoid using compressed air as much as possible.
7. Work benches set up around the machine must have sufficient rigidity and antislip surfaces.

1-2 Precautions for Machine Operation

Prior to starting the test operation of the machine, read and understand this manual thoroughly. Conduct the test operation in the presence of our operation instructor.

MAINTENANCE

1. An operator and maintenance personal shoud read the precautions on the caution plate fitted to the machine and keep them.
   Don't stain, stain or remove the caution plate. If the caution plate becomes hard to read, contact HITACHI SEIKI.
2. Close all the doors and covers except when adjusting work is made.
   As for the doors of the N/C unit and the power control cabinet, be sure to close them with care especially.
3. Don't remove or modify the limit switches for the stroke end for the traveling axes and the mechanism and the electric circuit employed for safety.
4. Use regular wrenches and spanners for adjusting or repairing work.

LUBLICATION

Since lubrication oil exerts a great influence on the durability of the machine and for maintaining the accuracy of the machine, care must be extremely used for maintenance of whole the lubricating device.

Exercise diligently prior check and maintenance for the following precautions.

1. Fill with specified oil described in the manual by specified amount.
2. Clear the oil port in advance and be fully careful so that foreign substances such as dust, water and chips may not enter into the tank.
3. Examine the bottom of the oil jug to check that dust, water, and chips etc. don't stay.
   Avoid mixing different kinds of oil for the oil jug and manage it extremely through discriminating by color and through setting the place to be preserved.
4. Check the using oil periodically and if admixture of foreign substances may be found, clean the inside of the tank promptly and replace it with new oil.
   Don't use all of the oil even in a new can and leave some final portion of the oil. It is necessary to leave it in order to remove water and semiment etc.
5. Though oil shortage of the lubrication oil tank is detected by a float switch to flash an alarm signal, check by taking a view whether the discharging is defective, as there are two cases, that is, the case that

oil in the tank is decreased extroadinarily fast, and the case that it is decreased too slow.

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 pipes of the lubrication piping has been bled when the machine is delivered, but when the piping is removed for maintenance works etc. after delivered, bleed air completely at the time of reassembly and operate the machine after checking the state of dischargingat the end.

COOLANT

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

1. In case of selecting soluble cutting fluid, take good care to use what lubrication, infiltration, rust prevention, bubble prevention, separability against oil and safety are considered.

2. Before the operation starts and after the 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 month and clean each slideway, X, Y, Z axes ball-screws, each limit switch and feed motors etc.

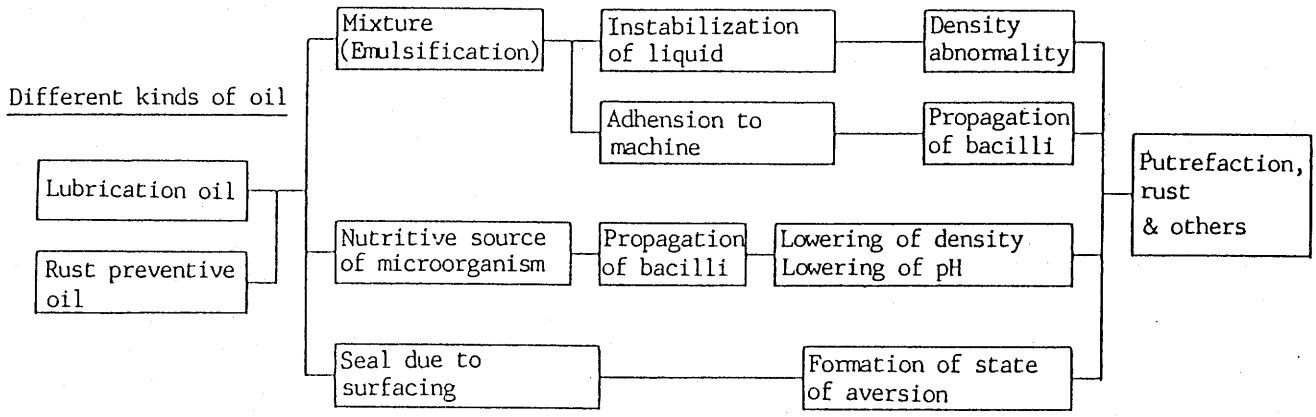
5. As soluble cutting oil is considered for rust prevention, it may be no problem when the products is wet. However, when it is dry, it is apt to rust. Therefore, it is recommendable to apply rust preventive oil before the product is not dried after finished machining.

6. Since soluble oil is alkalescent and strong at degreasing action, the operator ia apt to take dermatities. Therefore, the operator should do sanitation administration thoroughly.

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

8. Since there instances where lots of microorganism are detected in industrial water, it is recommendable either to check it before using as water for dilution and supply water service water.

9. The influence of different kinds of oil on coolant is as follows; Do fully administration for the state of putrefaction of coolant fluid.



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 it in accordance with the procedure described later.

3. During operation, keep the hands definitely away from the rotating sections and movable sections.

4. When disposing chips that wound round tooling and fell onto the table, it is dangerous to grasp them to pull. Further, When disposing 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.

OPERATION FINISH

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

1-3 Precautions for Electric Devices and NC Unit

When operating the machine or when carrying out maintenance and inspection work, take note of the following points as to handling the electric devices and NC unit:

1. Do not give a shock to the NC unit and power control cabinet.
2. Be sure to use a cord with a diameter specified in the instruction manual for the primary wiring of the machine. Do not use an unnecessarily long cord. When the primary wiring is inevitably placed on the floor, cover it lest it should be damaged by cutting chips, and so on.
3. Upon a test run, check in the presence of our authorized staff that various parameters have been properly set. Do not change the setting of the parameters other than those for backlash, unless inevitable.
4. Do not change the current set values of the thermal relays on the power control cabinet and the set values of various control knobs.
5. Do not apply an unnecessary force to the connectors of cannon plug, flexible tube and cabtyre cord.
6. When carrying out maintenance work for the electric devices, turn off the power of the NC unit, turn off the main switch of the power control cabinet, and then, turn off the power switch installed in the user's factory in that order. After checking that these switches have been turned off, proceed to maintenance work.
   If possible, lock the power swithces to OFF or put up notices around them. Also, put a similar notice on the operation panel of the machine to prohibit the machine from being operated.
7. Handle the electric devices of the machine proper with special care. Keep the devices away from moisture.
8. For electric devices, use our specified ones. Especially, use a specified fuse. Never use a copper wire or a fuse whose capacity exceeds the rating of the device.
9. Never leave the door of the NC unit open. If left open, a direct sunshine or flash rays of a camera may enter inside and damage devices there.

2. OUTLINE AND FEATURES OF MACHINE

2-1 Construction of Machine

As shown in Fig. 2-1, the standard configuration of this machine consists of the bed, column, table, spindle head, feed boxes and automatic tool changer.

2-1-1 Bed

The bed is widely designed with an emphasis put on a disposal of cutting chips. A cutting chips drop hole is provided at the center of the bed. The bed has 2 guides to enable its smooth movements. In addition, receiver gutters for coolant, cutting chips, lubricating oil, etc. are provided around the bed to prevent the perimeter of the machine from becoming dirty.

2-1-2 Column

The column moves back and forth along the slideways mounted on the bed, and the spindle head moves up and down vertical column slideways.

Since the column is movable, accessability of an operator to a workpiece is particularly superior. Furthermore, a heavy duty cutting capability has been greatly improved because a span between the column moving slideways is sufficiently wide.

2-1-3 Spindle Head

In order to improve operator's accessability to the machine and workpiece, a spindle head nose has a specially designed shape. Incorporated inside the head is a spindle speed High/Low changeover gear. On the spindle head, a spindle driving AC motor and a tool locking cylinder are installed.

A spindle hole is either NT #40 or NT #50 (JIS 6101). For a tool clamping system, a tool's pull stud is pulled in by a laminated disk spring.

2-1-4 Table and Saddle

The table, which is put on the bed, is smoothly driven by a ball screw set in the center of the guides.
On the top surface of the table, a wide groove is provided to allow coolant and cutting chips to smoothly flow.
T-slots are designed so that they can be used as a reference for jigs and fixtures. Since a table base size is wide enough compared with a table size, an overhang amount is minimized when the table moves in a traverse direction.

2-1-5 Feed Box

There are 3 feed boxes provided; one each at the rear end of the bed, on the top of the column and on the right side of the bed. Each box has a brushless feed motor mounted and drives a ball screw by means of a precisely machined coupling. The ball screw, which is protected with a cover, is dust-proof to maintain accuracy for a long time.

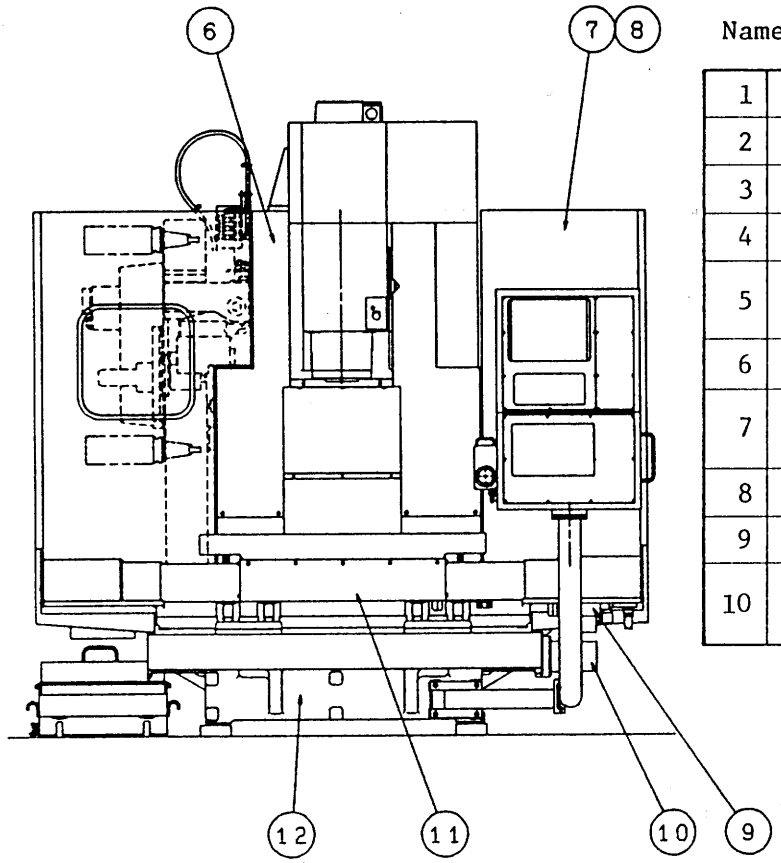
2-1-6 Sliding Section

Each sliding section for axial feed uses a precision ball guide having a special structure. Therefore, it is provided with superior dynamic performance which allows both low noises and power saving. These sliding sections are forcibly and automatically lubricated with a proper amount of oil occasionally.
Since an appropriate preload is given to the bearing of guideways in a radial direction, sufficient rigidity is secured even for heady duty cutting.

2-1-7 Automatic Tool Changer (ATC)

The ATC, which is mounted onto the column base, can change tools at the up end position of the head (reference point).
A tool magazine can store 20 tools as a standard. Due to employment of a fixed tool address call system, a secure tool change can be done by simple operation.
Its simple and compact structure greatly reduces interferences with a workpiece when changing tools.

Name of Component Units



Names of Component Units

1	ATC	11	Table and saddle
2	Z-axis feed motor	12	Bed
3	Spindle motor	13	Coolant tank
4	Spindle head	14	Cutting chips box
5	Main operation panel	15	Coolant pump
6	Column	16	Leveling bolt
7	Power control cabinet	17	Hydraulic unit
8	NC unit	18	Y-axis feed motor
9	X-axis feed motor	19	Spindle cooler
10	Spiral conveyor	20	ATC independent operation panel

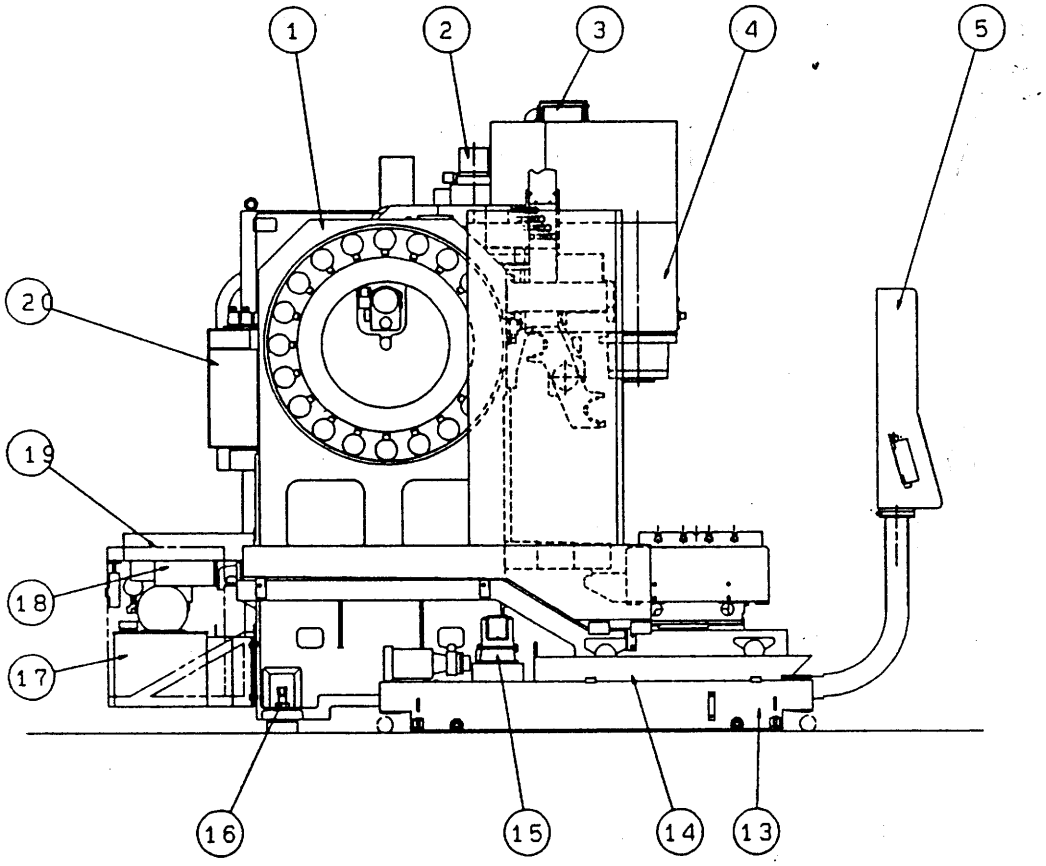


Fig. 2-1

3. SPECIFICATIONS

3-1 Specifications for Machine Proper

Values in parentheses show inch specifications.

	Specifications		VK45-40	VK45-50	VK55-40	VK55-50
Table	Work surface size (std. spec.)	mm (Inch)	900 × 485 (35.4 × 19)		1120 × 560 (44 × 22)	
	* (long-table spec.)	mm (Inch)	1120 × 485 (44 × 19)		1400 × 560 (55 × 22)	
	Crosswise stroke (X axis)	mm (Inch)	760 (30)		1000 (39)	
	Distance from the spindle nose to the table top	mm (Inch)	150 ∿ 600 (6 ∿ 24)		200 ∿ 760 (8 ∿ 30)	
	Distance from the spindle center to the column front	mm (Inch)	500 (20)		610 (24)	
	Allowable carrying capacity	Kgf (Lbs)	750 (1650)		1000 (2200)	
Spindle Head	Longitudinal stroke (Y axis)	mm (Inch)	450 (18)		560 (22)	
	Vertical stroke (Z axis)	mm (Inch)	450 (18)		560 (22)	
	Spindle nose shape		NT.40	NT.50	NT.40	NT.50
	Spindle speed (std. spec.)	rpm	60∿6000	45∿4500	60∿6000	45∿4500
	(high-speed spec.)	rpm	120∿12000	60∿6000	120∿12000	60∿6000
	(twin-spindle spec.)	rpm	60∿6000	45∿4500	60∿6000	45∿4500
	No. of spindle speed steps		Fully automatic and stepless			
Feed	Cutting feed rate	mm/min. (Inch/min.)	1 ∿ 5000 (0.04 ∿ 200)			
	Rapid traverse rate	mm/min. (Inch/min.)	15000 (590)		13000 (512)	
	Least input increment	mm/min. (Inch/min.)	0.001 (0.0001)			

Specifications			VK45-40	VK45-50	VK55-40	VK55-50
Motors	For the spindle (std. spec.)	KW	AC7.5		AC 11	
	(50% ED) (high-speed spec.)	KW	AC5.5	AC7.5	AC5.5	AC 11
	(twin-spindle spec.)	KW	AC7.5 × 1		AC 11 × 1	
	For the hydraulic unit (std. spec.)	KW	1.5 - 4P			
	(twin-spindle spec.)	KW	2.2 - 4P			
	For lubrication	W	4			
	For coolant (flood)	W	180 – 2P			
	*(jet)	W	400 – 2P 750 – 2P			
	*(gun)	W	180 - 2P			
	*(oil hole)	W	400 - 4P			
	*(magnet roller)	W	25			
	* For spindle cooling (single spindle)	W	200 - 4P, 300 - 2P, 15 - 4P			
	(twin-sindle spec.)	W	200 - 4P, 500 - 2P, 25 - 4P			
	For the chip conveyors A	KW	0.1 - 4P			
	*B	KW	0.1 - 4P			
	*C	KW	0.1 - 4P			
	Chip conveyors A : Special type on the column side, built in the bed B : Spiral type on the operator's side, built in the bed C : Flat type outside the machine					
Coolant	Fluid coolant	ℓ (Gal)	180(52) 440(128) 400(116)			

* denoted optional specifications.

Specifications				VK45-40	VK45-50	VK55-40	VK55-50
Axis Drive Motors	SEICOS spec.	X	(KW)	DFSM-2020-502A (2.0)		DFSM-3020-502A (3.3)	
		Y	(KW)	DFSM-2020-502A (2.0)		DFSM-3020-502A (3.3)	
		Z	(KW)	DFSM-3020B-502A (3.3)		DFSM-3020B-502A (3.3)	
	FANUC spec.	X	(KW)	MODEL 10M (1.1)		MODEL 20M (1.8)	
		Y	(KW)	MODEL 10M (1.1)		MODEL 20M (1.8)	
		Z	(KW)	MODEL 20MB (1.8)		MODEL 20MB (1.8)	
Machine weight (std. spec.)			Kgf	6300 (13860 lbs)		7800 (17160 lbs)	
(twin-spindle spec.)				7100 (15620 lbs)		8800 (19360 lbs)	

Specifications			BT40/CAT40	BT50/CAT50
ATC	No. of tools	pc.	20	
	Max. tool diameter	mm (Inch)	ϕ110 (Dia. 4)	ϕ110 (Dia. 4)
			ϕ160 mm (Dia. 6.3) (max.) with adjacent tools removed	
	Max. tool length	mm (Inch)	300 (12)	300 (12)
	Max. tool weight	Kgf (Lbs)	10 (4)	20 (9)
	Tool call system		Fixed address, one directional call	

3-2 Specifications of NC Unit

NC UNIT	SEICOS MIII	
	Standard specifications	
1	Controlled axes	3 axes simultaneous 3 axes
2	Interpolation function	Positioning, linear interpolation and circular interpolation
3	Commanding method	Absolute/incremental in commom use
4	Least input increment	0.001mm
5	Tape code	EIA/ISO automatic recognition
6	Each function	Preparatory function G3-digit Miscellaneous function M 4 digit Tool T 4 digit
7	Spindle speed command	S code Direct designation of spindle speed
8	Feedrate command	F code, Direct designation of feedrate
9	Feed override	0 ~ 200%
10	Override cancel	
11	Automatic override memory	
12	Rapid traverse override	0% 1% 25% 50% 100%
13	Manual feed function	Rapid traverse Jog feed Handle feed
14	Manual pulse generator	Magnification x 1 x 10 x 100 3 step change-over (INCH: x 50)
15	Tool position offset	G45 ~ 48
16	Tool length compensation	G43 G44 G49
17	Tool diameter compensation C	G40 ~ 42
18	Tool offset amount memory C	
19	No. of tool offset	32 pairs
20	CRT display	
21	Part program storage & editing	12"EL
22	Part program storage length	80m
23	Dack groud editing function	
24	Canned cycle	G73 G74 G78 G80 ~ 89
25	Reference point return	Manual Automatic G27 ~ 29
26	2nd reference point return	G30
27	Mirror image	CRT setting
28	Optional block skip	1 pc.
29	Stored stroke check type 1	
30	Stored pltch error compensation	
31	Coordinate system setting	G92

NC UNIT	SEICOS MIII	
Standard specifications		
32	Local coordinate system setting	G52
33	Work coordinate system selection	G54 ~ 59
34	Machine coordinate system setting	G53
35	I/O interface	RS232C *1
36	Registerable programs	100 pairs
37	Paet program collation	
38	Radius R designation arc	
39	Dwell	
40	Memory lock key	
41	Buffer resister	
42	Single block	
43	Cycle start/feed hold	
44	NC self diagnosis function	
45	Z axis command cancel	
46	Exact stop	G09 G61 G64
47	Decimal point input	
48	Dry run	
49	Dacklash compensation	
50	Program No. search	
51	Sequence No. search & collation stop	
52	Label skip	
53	Machine lock Auxiliary function lock	
54	Manual absolute	"ON" fixed
55	Optional stop	
56	Programmable data input	G10
57	True circle cutting (Spiral true circle cutting included)	
58	Arbitrary angle chamfering corner R	
59	Custom macro	Common variables 100
60	Machining finish notice	(Run hour display is indluded)
61	Follow-up	
62	Stroke check before travel	

*1. Only interface

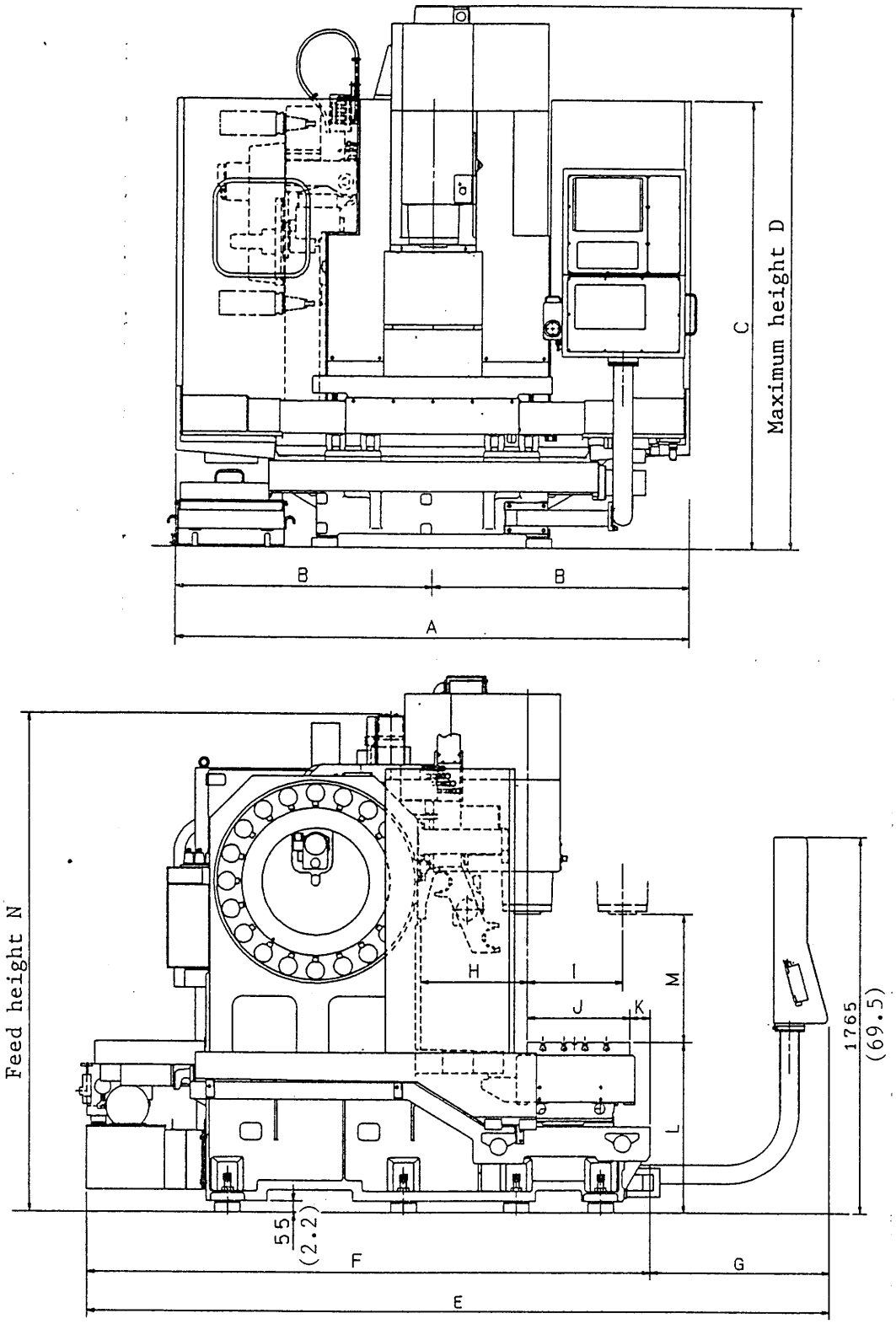
Connecting cables with the I/O equipment are not included.

NC UNIT	SEICOS MIII	
	Standard specifications	
63	Inch/metric conversion	
64	Chinese letter/English letter conversion	
65	Watch function	
66	Direct tapping	G741 G841
67	Tape reader without reel	(*1 For NC data input, for RS232C)
68	Screen induction type special canned cycle	QPR-II
	Deep hole drilling cycle	G73 G83
	True circle cutting	G302 G305
	Drilling pattern cycle	G70 ~ G72 G77
	Frame and surface cutting	G322 ~ G326
	Pocket cycle	G327 ~ G333

NC UNIT	SEICOS MIII	
	Option	
1	Additional 1 axis	Additional axis simultaneously controllable
2	Expanded part program editing	
3	Helical interpolation, available for the additional axes	
4	Skip function	High speed
5	Nypotherical axis interpolation	
6	Single direction positioning	
7	Dimensional tool offset	G40 G41
8	No. of tool offset	64 pairs
9	No. of tool offset	100 pairs
10	No. of tool offset	200 pairs
11	No. of tool offset	400 pairs
12	No. of registered program 200 pairs	Tape program storage length 320m required
13	No. of registered program 400 pairs	Tape program storage length 320m required
14	No. of registered program 800 pairs	Tape program storage length 1000m required
15	No. of registered program 1000 pairs	Tape program storage length 1000m required
16	Tape program storage length	Total 160m
17	Tape program storage length	Total 320m
18	Tape program storage length	Total 500m
19	Tape program storage length	Total 1000m
20	Tape program storage length	Total 2000m
21	Tape program storage length	Total 4000m
22	Manual pulse generator	
23	2nd auxiliary function B3 digit	Spec. to be investigated
24	3rd ~ 4th reference point return	
25	Stored stroke check 2	
26	Restart of block	
27	Program restart	
28	Machining interruption point return (Return release)	
29	Optional block skip addition	Total 9
30	External data input	Spec. to be investigated

NC UNIT	SEICOS MIII	
	Option	
31	Custom macro	Common variables 200
32	Custom macro	Common variables 300
33	Custom macro	Common variables 600
34	Interruption type custom macro	
35	Automatic corner override	
36	Skaling	
37	Programmable mirror image	
38	Coordinate rotation	
39	Polar coordinate command	
40	Polar coordinate interpolation	
41	Manual handle interruption	
42	Tool life management (Number is to be corresponding to number of tool offset)	
43	DNC connecting circuit	
44	High resolution detection L/F (0.1μ spec.) Spec. to be investigated	
45	Cylindrical interpolation	
46	Exponential interpolation	
47	Linear acceleration/deceleration before cutting feed interpolation	
48	Linear acceleration/deceleration after cutting feed interpolation	
49	Exponent type acceleration/deceleration after cutting feed interpolation	
50	Acceleration/deceleration before preread interpolation	
51	Work coordinate system	60 pairs
52	Tool offset selection by T code	
53	High speed machining function	G05
54	Macro print function (Printer required by RS232S)	
55	Retrace	
56	Cutting monitor function	

Fig. 3-1 Major Dimensions

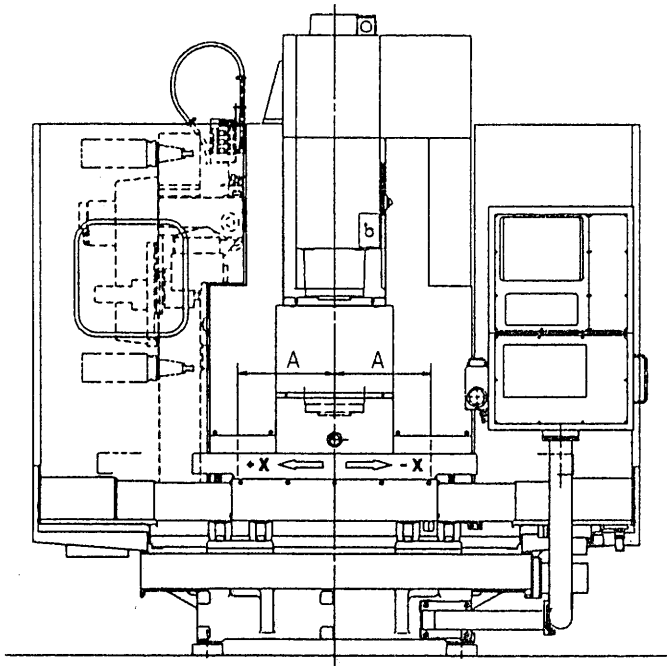


(Values in parentheses show inch dimensions.)

	VK45	VK55
A	2400 (94.5)	3000 (118.1)
B	1200 (47.3)	1500 (59.1)
C	2080 (81.9)	2080 (81.9)
D	2510 (98.8)	2807(110.5)
E	3475 (136.8)	3940 (155.1)
F	2645 (104.1)	2960 (116.5)
G	830 (32.7)	980 (38.6)
H	500 (19.7)	610 (24.0)
I	450 (18.0)	560 (22.0)

	VK45	VK55
J	485 (19.1)	560 (22.0)
K	95 (3.7)	95 (3.7)
L	800 (31.5)	900 (35.4)
M	150∿600(6.0∿24.0)	200∿760(8.0∿30.0)
	2345 (92.3)	2486 (97.9)

Fig. 3-2 Strokes and Machine Zero Point (⊕ : Machine Zero Point)



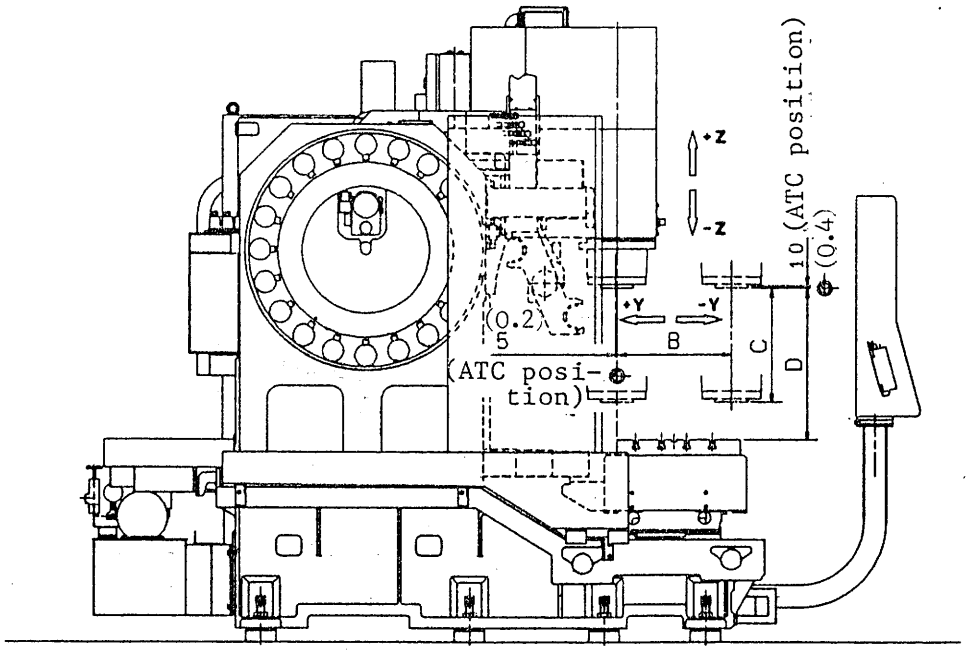
(Values in parentheses show in dimensions.)

X axis	VK45	VK55
Stroke	760 (30.0)	1000 (40.0)
A	380 (15.0)	500 (20.0)
Machine zero point	Stroke center	Stroke center
ATC position	Arbitrary	

Notes) 1. Machine zero point return command: Specify with G28.

2. ATC position (zero point) return command: Specify with G30.

3. An X-axis ATC position is an arbitrary one which is safe for operation.

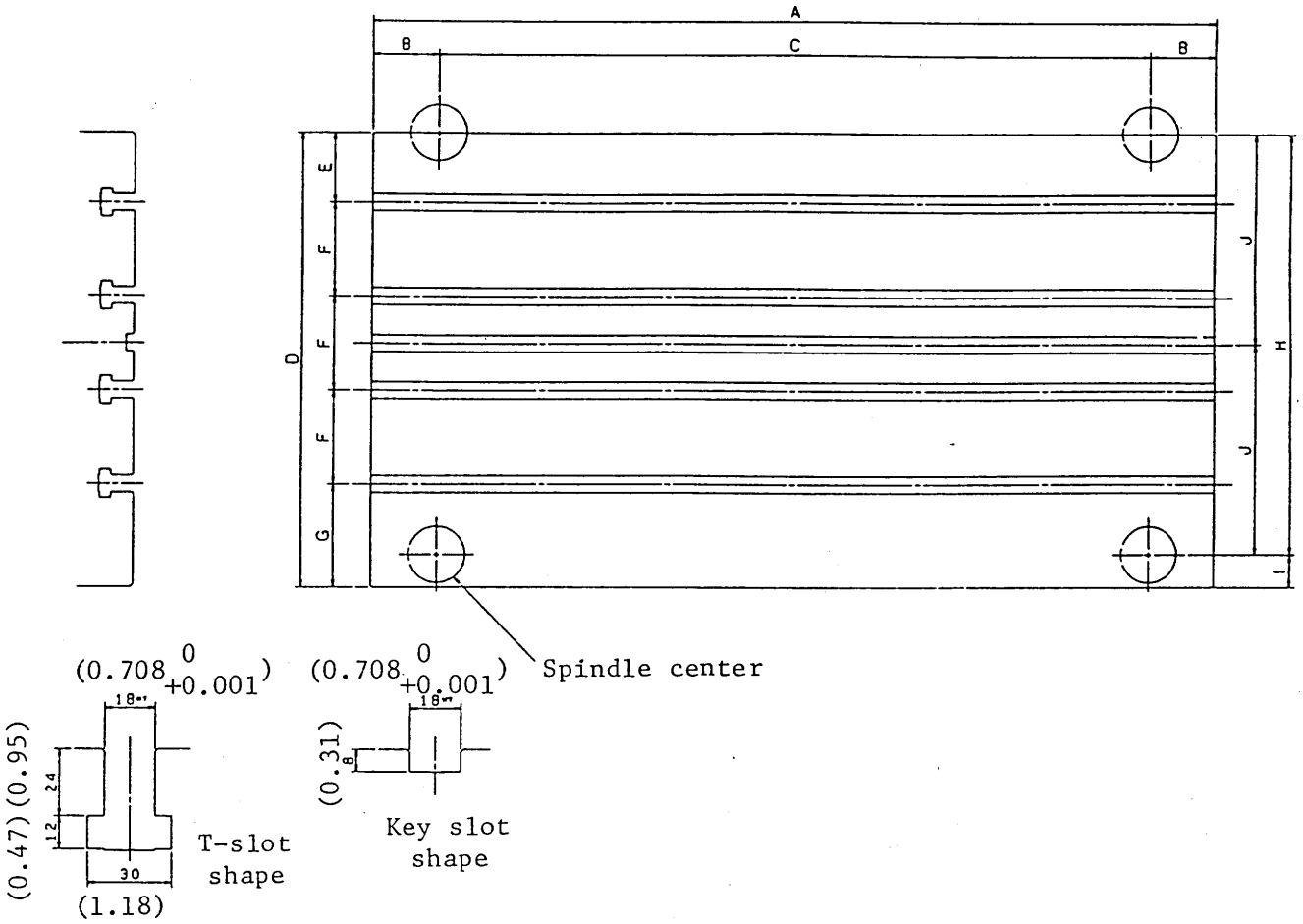


(Values in parentheses show inch dimensions.)

Z axis	VK45	VK55
Stroke C	450 (18.0)	560 (22.0)
D	150 ∿ 600 (6.0 ∿ 24.0)	200 ∿ 760 (8.0 ∿ 30.0)
Machine zero point	"+" end of the stroke	"+" end of the stroke
ATC position	About +10 mm from the machine zero point	About +10 mm from the machine zero point

Y axis	VK45	VK55
Stroke B	450 (18.0)	560 (22.0)
Machine zero point	"+" end of the stroke	"+" end of the stroke
ATC position	About +5 mm from the machine zero point	About +5 mm from the machine zero point

Fig. 3-3 Table Size

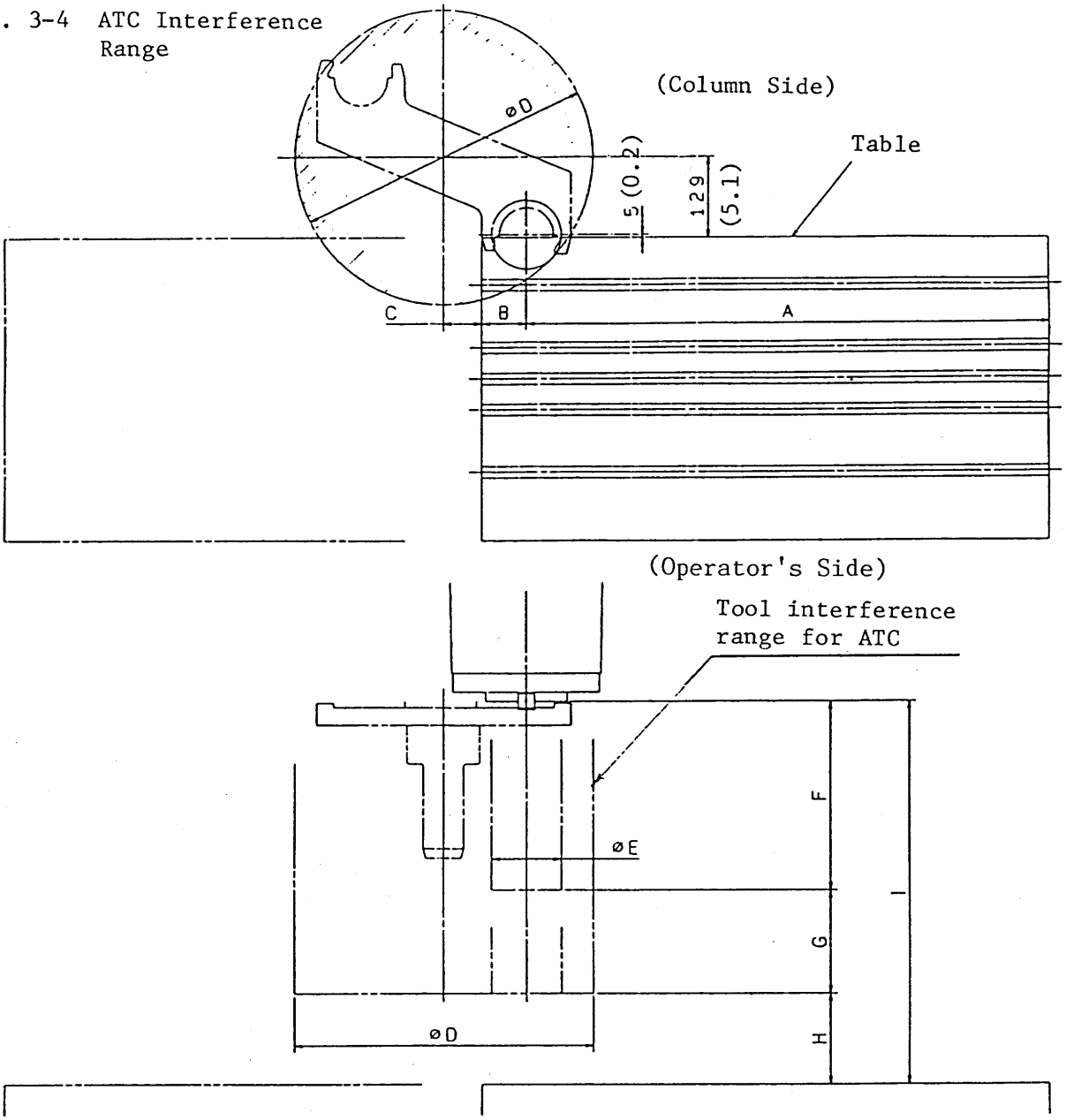


(Values in parentheses shown inch dimensions.)

	VK45	VK55
A	1200 (47.2)	1400 (55.1)
B	180 (7.1)	200 (7.9)
C	760 (30.0)	1000 (40.0)
D	485 (19.1)	560 (22.0)
E	75 (2.95)	80 (3.15)
F	100 (3.94)	100 (3.94)

	VK45	VK55
G	110 (4.33)	80 (3.15)
H	450 (18.0)	560 (22.0)
I	35 (1.1)	0 (0)
J	255 (9.0)	280 (11.0)
T-slot	4 streaks	5 streaks
Key slot	1 streak	None

Fig. 3-4 ATC Interference Range

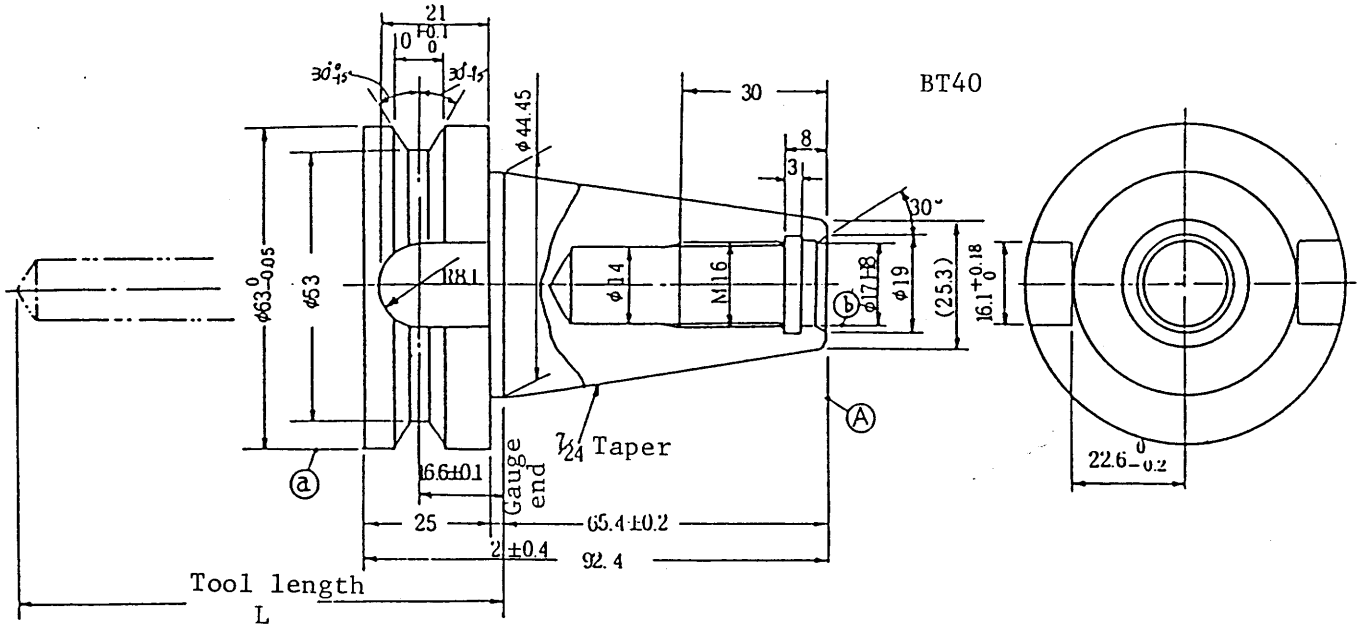


(Values in parentheses show inch dimensions.)

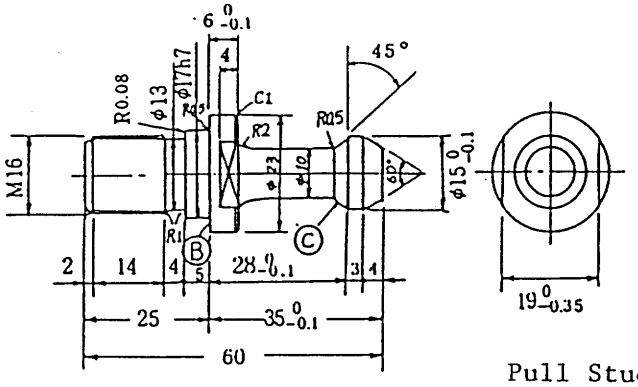
Note) D = 360 + E (D = 14.2 + E)
I = F + G + H

	VK45-40	VK55-40	VK45-50	VK55-50
A : Maximum	940 (37.0)	1200 (47.2)	940 (37.0)	1200 (47.2)
B : Minimum	180 (7.1)	200 (7.9)	180 (7.1)	200 (7.9)
C	49.5 (1.95)	69.5 (2.74)	49.5 (1.95)	69.5 (2.74)
D : Tool swing max. diameter	470 (18.5)		470 (18.5)	
E : Tool max. diameter	ϕ110 (4.33)		ϕ110 (4.33)	
F : Tool max. length	300 (11.8)		300 (11.8)	
G : Tool draw-out stroke	110 (4.33)		165 (6.50)	
H : Maximum	200 (7.9)	360 (14.2)	145 (5.71)	305 (12.0)
I : Distance from the table top to the spindle nose when the ATC is used.	610 (24.0)	770 (30.3)	610 (24.0)	770 (30.3)

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



Tool Shank



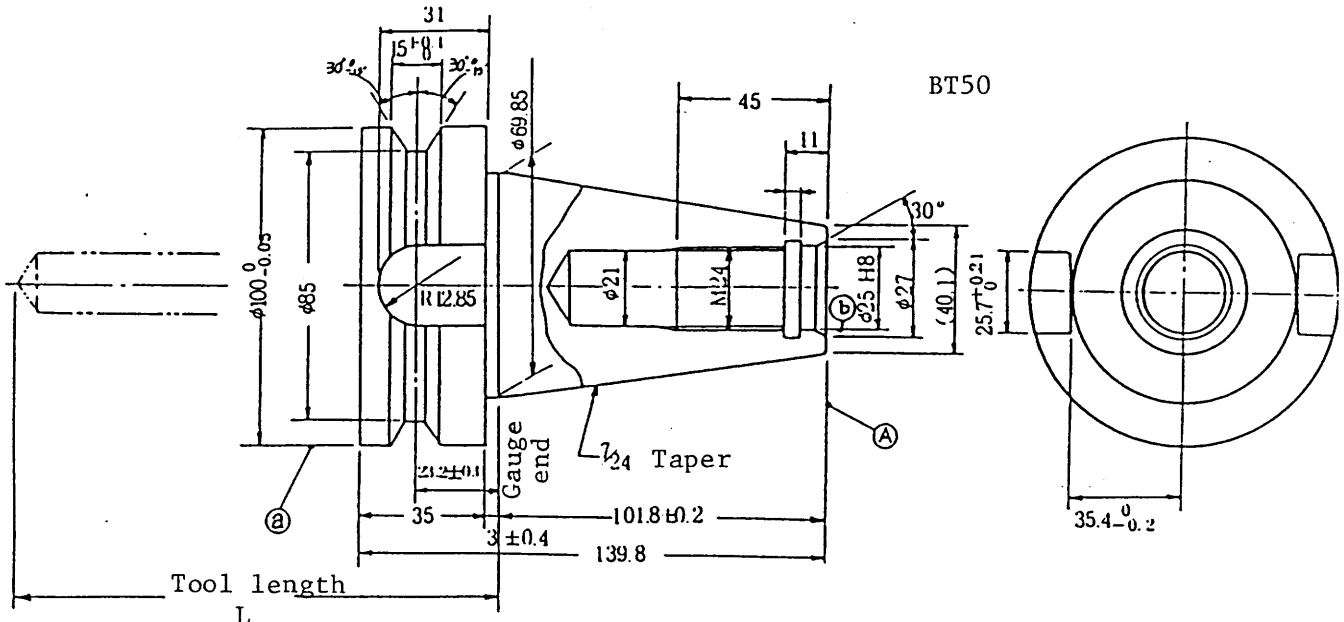
Pull Stud (45° Type)

1. The concentricity of (a) and (b) parts with the taper shank of a tool shall be 0.025 mm.
2. The squareness between the taper shank and face (A) shall be 0.015/100.
3. The deviation with a 16.1 mm wide groove shall be 0.06 mm in reference to the groove center.
4. The tolerance of taper shall be $^{+0.000063}_{0}$ (4T of JIS B0612-1965).

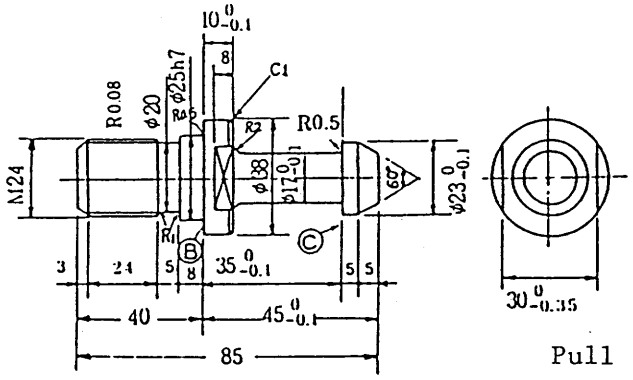
5. The applicable threads shall comply with JIS B0205-1968, and their accuracy shall meet the 2nd class requirements of JIS B0209-1968.

6. The squareness between the center line of 25 mmϕ h7 and face Ⓑ and the rectangular degree of the face Ⓒ with the center line shall be 0.01 mm, respectively.

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



Tool Shank



Pull Stud (90° Type)

1. The concentricity of (a) and (b) parts with the taper shank of a tool shall be 0.025 mm.
2. The squareness between the taper shank and face (A) shall be 0.015/100.
3. The deviation with a 25.7 mm wide groove shall be 0.06 mm in reference to the groove center.
4. The tolerance of taper shall be $^{+0.000063}_{0}$ (4T of JIS B 0612-1965).

5. The applicable threads shall comply with JIS B0205-1968, and their accuracy shall meet the 2nd class requirements of JIS B0209-1968.

6. The squareness between the center line of 17 mmϕ h7 and face Ⓑ and the concentricity of the face Ⓒ with the center line shall be 0.01 mm, respectively.

3-3 Major Attachments

Standard Accessories ..... 1 set each

1. Cutting chips guard around the table
2. In-machine X directional spiral cutting chips conveyor
3. Flood coolant system
4. Spindle speed meter
5. Spindle load meter
6. Call light (yellow)
7. Tape reader without reels
8. Automatic power shut-off device
9. Leak breaker
10. Leveling pads
11. Spanners and wrenches

Extra Accessories

1. Special coolant system
2. Mist coolant system
3. Splash guard
4. Indexer
5. Automatic pallet changer (APC)
6. Pallet pool line (PPL)
7. Spindle cooler
8. Tool presetter
9. Tool holders
10. Clamping jigs

* The accessories and attachments mentioned above are subject to change without prior notice due to manufacturing and handling conditions. If there is anything unclear, contact HITACHI SEIKI or our authorized dealer.

4. OPERATION OF MACHINE

4-1 Operation by Using the Main Operation Panel and Sub-operation Panel

Group No.	Name	Use	Operation method		Effective mode	
			Push button	Lamp	Auto.	Manual
Note : When you operated a function which the specifications do not allow, the lamp of that push button switch blinks, and the alarm lamp ⑧ and call light are turned on. Also, "NO OPTION" is displayed on the CRT.						
①	Mode selector switches	These are used for selecting operation modes: "MDI", "PROGRAM EDITING", "MEMORY AUTOMATIC OPERATION" and "TAPE AUTOMATIC OPERATION".	o	o	o	
②	Function selector switches (Push a necessary function switch with the "SELECT" switch pressed.)	CANCEL Z ... A machine lock condition is applied to the Z axis only. It is convenient if used for a program test run.	o	o	o	o
		MACHINE LOCK ... Only a display proceeds omitting axial moves of the machine. This function enables checking of program coordinate values without moving the axes.	o	o	o	o
		DRY RUN ... A manual jog feed rate become valid instead of a feed rate specified by the program.	o	o	o	
③	Spindle rotation effective key	These push button switches start and stop the spindle. (It is necessary to specify a spindle speed in advance.)	o	o		o

Grope No.	Name	Use	Operation method		Effective mode	
			Push button	Lamp	Auto.	Manual
④	Mode selector switches	These are used for selecting operation modes: "FEED", "RAPID TRAVERSE" and "ZERO RETURN".				
		FEED ... This mode enables a manual continouous feed. A feed axis and its direction are selected by the axis move push button switches ⑥, and a feed rate by the FEEDRATE ㉒ switches.	o	o		o
		RAPID ... This mode enables a rapid traverse. A rapid traverse axis and its direction are selected by the push button switches ⑥, and a rapid traverse rate (override) by the RAPID OVERRIDE push button switches ⑰.	o	o		o
		ZERO RETURN ... This mode enables zero return. An axis to be returned to the reference point is selected by the push button ⑥. An override of 25% is applied to the feed rate. In zero return operation, each axis shall be moved from its ⊖ direction to its ⊕ direction toward the reference point. When zero return is completed, the green lamp located at ⑥ lights up from flickering.	o	o		o

Grope No.	Name	Use	Operation method		Effective mode	
			Push button	Lamp	Auto.	Manual
⑤	Program START /STOP switches	START ... IN the AUTO or MDI mode, this push button switch start the program. While this push button switch is pressed and the program is running, a green lamp located above lights up.	o	o	o	
		STOP ... This push button switch suspends a program's progess. An axis being operated stops and a red lamp located above lights up. During operation by an auxiliary command (M, S or T), the program's progress stops after executing the remaining action of respective command.	o	o	o	
⑥	Axis move switches	These push button switches move the X, Y, Z and A (optional) axes respectively. Axis selection and its moving direction abide by the indication given on the respective push button switches. For a feed rate, select among the FEEDRATE switches ㉒. When performing zero return, keep pressing the relevant push button switch in the zero point direction ⊕ until a zero return lamp lights up.	o			o
⑦	Initial position check check	APC INITIAL POSITION ... This lamp indicates that each machine section is located at its specified position, when executing an automatic pallet change (APC) command.		o	o	

Grope No.	Name	Use	Operation method		Effective mode	
			Push button	Lamp	Auto.	Manual
		ATC INITIAL POSITION ... This lamp indicates that each machine section is located at its specified position, when executing an automatic tool change (ATC) command. During T cycle operates, this lamp lights up.		o	o	
⑧	Status display lamp	ALARM ... A red lamp lights up when an alarm occurred.		o	o	o
		PROGRAM STOP ... When M00 or M01 is executed during operation in an automatic mode, a red lamp lights up. It is lit off by starting or continuing the program.		o	o	
⑨	Automatic power shut-off switch	This makes the automatic power shut-off function effective. After machining cycle is completed, the power is automatically shut-off by M30 when no pallet exists.	o	o	o	
⑩	Call right off switch	This switches off the lighting call light (yellow lamp) melody.	o		o	o
⑪	Work setter	Makes the following functions effective, making use of a reference touch tool:				
		TOOL SETTER ... Measures a tool length and a tool diameter and automatically sets their offset amounts in the offset memory.	o	o		o

Grope No.	Name	Use	Operation method		Effective mode	
			Push button	Lamp	Auto.	Manual
		REF. SURFACE, REF. HOLE ... Measures the coordinate system shift amounts of the reference surface and hole against the machine coordinate system and sets them in the coordinate system shift memory.	o	o		o
		COORD ALIGN ... By measuring 3 points on the orthogonal or jig located on the X-Y plane, differences in rotation angle with the X and Y axes are calculated and stored, thus compensating X-axis and Y-axis program coordinate values.	o	o		o
⑫	Safety check	Measure a machining tool length by the 1st program start. Measure the workpiece at an actual machining position with the reference touch tool mounted to the spindle by the 2nd program start. A workpiece-tool interference check is made by Z-axis approach (G00) command, adding the tool offset amounts used for these two information.				
		TOOL LENGTH ... Measures and stores the length of the tool used for an actual machining program.	o	o	o	

Grope No.	Name	Use	Operation method		Effective mode	
			Push button	Lamp	Auto.	Manual
		COLLATION ... Sets the Z axis to a machine lock state, operates the machine with an actual machining program and checks whether there is an interference between the work-piece and tool when Z axis approaches.	o	o	o	
⑬	Completion call	Lights up the call lights before a machining program is completed and notifies you of a program end. Set arbitrarily a precompletion notification time.	o	o	o	
⑭	Override	MEMORY ... Memorizes optimum override values (feed rate, spindle speed) found in trial cutting, etc., making them corresponding to the tools used.	o	o	o	
		AUTO. ... The override values memorized are automatically input to a program.	o	o	o	
⑮	Feedrate override switches	These push button switches apply an override (ranging from 0 to 200%) to a feed rate in automatic (cycle) operation. During a canned cycle for tapping, the override is ignored ignored, resulting in 100%.	(Rotary switch)		o	
⑯	Spindle override switches	These push button switches apply an override (ranging from 50 to 150%) to a spindle speed command.	(Rotary switch)		o	o

Grope No.	Name	Use	Operation method		Effective mode	
			Push button	Lamp	Auto.	Manual
⑰	Rapid override switches	These push button switches apply an override(ranging from 0 to 100%) to a specified rapid traverse rate. When the power is turned ON, the override value becomes less than 25%. In the manual operation, the rapid traverse rate becomes 0 ~ 25%. Note) The manual feed is not available in 0%.	(Rotary switch)		o	o
⑱	F1 digit feed switch (Option)	The "F1 DIGIT FEED" becomes effective by pressing this switch and the indication lamp lights up. This becomes in-effective by repressing this switch and the indication lamp puts out. When the F1 DIGIT FEED" is not provided as option, this switch becomes ineffective and the indication lamp puts out. While the F1 digit feed is effective, when 1 digit number of 1 ~ 90 succeeding F is commanded, feed rate set corresponding to its number is obtained. When F0 is commanded, rapid traverse is obtained.	o	o	o	
⑲	Conveyor switch	Tis push button switch runs the chip conveyor.	o	o	o	o
⑳	Work light switch	This push button switch turns on a work light.	o	o	o	o

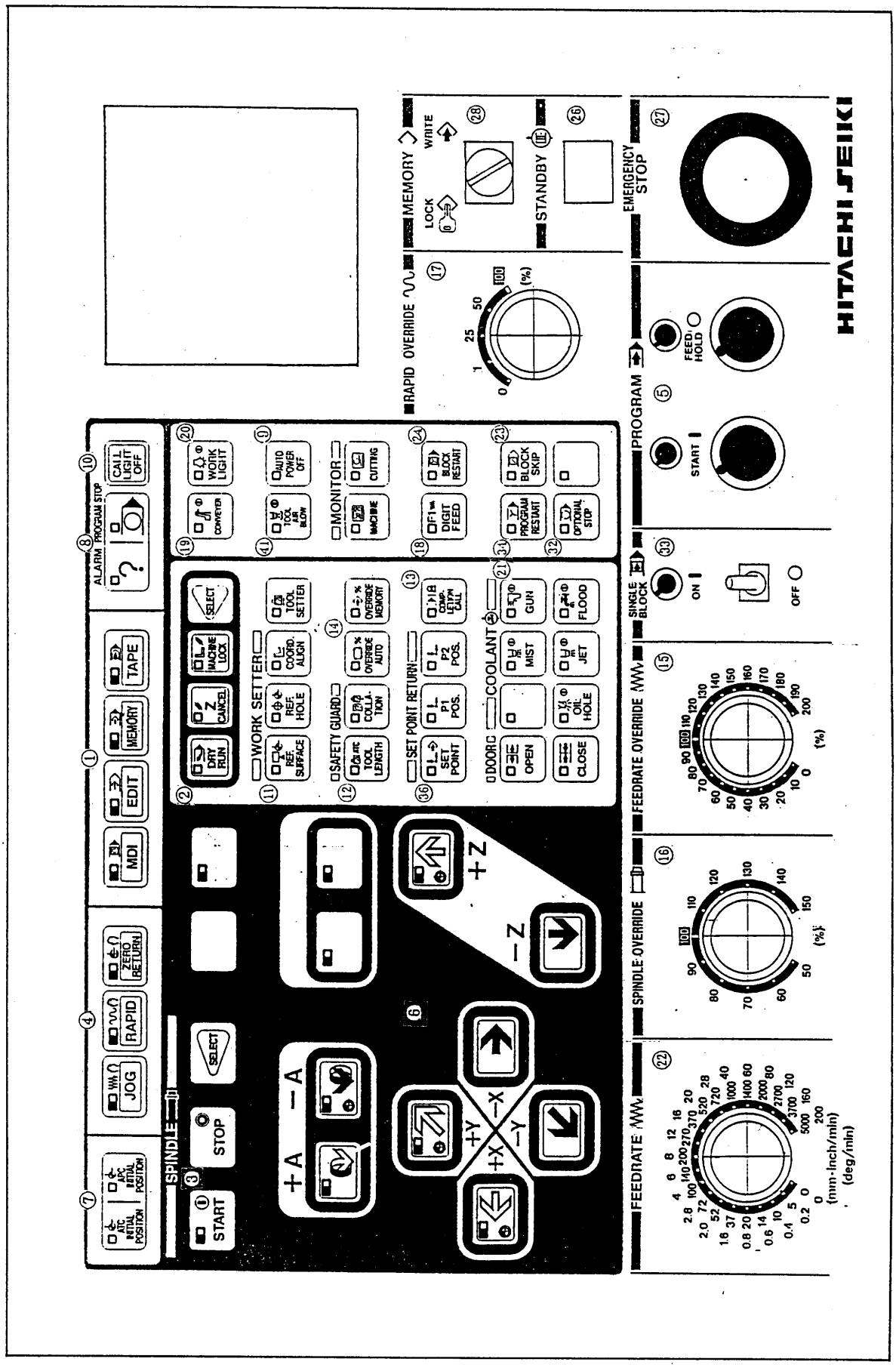
Grope No.	Name	Use	Operation method		Effective mode	
			Push button	Lamp	Auto.	Manual
㉑	Coolant switches	These push button switches work various kinds of coolant indicated on them respectively. Each kind of coolant can be turned ON/OFF manually even during automatic operation.	o	o	o	o
㉒	Feedrate switches	These push button switches select a manual jog feed rate between 0mm/min and 5,000 mm/min. (In case of the A-axis, it becomes between 10 deg/min and 1,400 deg/min.)	(Rotary switch)			o
㉓	Optional block skip	This switch makes the block skip function command by program effective. During programming, the slash "/" used.	o	o	o	
㉔	Restart of block (Option)	The RESTART OF BLOCK becomes effective by pressing this switch and the indication lamp lights up. This becomes ineffective by repressing this switch and the indication lamp goes out. When the RESET OF BLOCK is not provided as option, this switch becomes ineffective and the indication lamp puts out. Through designating a sequence No. that is not restarted by this function, the machining can be restarted from that block.	o	o	o	
㉕	Power	ON ... turns on the main power to the NC unit.	o			o
		OFF ... Turns off the main power.	o			o

Grope No.	Name	Use	Operation method		Effective mode	
			Push button	Lamp	Auto.	Manual
㉖	Standby	Turns on the hydraulic pump and lubricating oil pump to make the machine ready for operation.	o	o		o
㉗	Emergency stop (Main/Sub-operation panel)	Stops the machine completely. All motors are stopped and the NC unit is reset.	o		o	o
㉘	Memory	LOCK ... Protects the information stored in the NC unit. Normally, shift this switch to "LOCK".	(Key)		o	
		WRITE ... Shift this switch to "WRITE" when writing or correcting memory information.	(Key)		o	
㉙	Speed meter (Option)	Indicates a spindle speed.	(Meter)		o	o
㉚	Load meter (Option)	Indicates a spindle load to a motor's rated power in terms of percentage.	(Meter)		o	o
㉛	Tool clamp/ unclamp	CLAMP ... Clamp a tool to the spindle.	o			o
		UNCLAMP ... Unclamp the spindle tool. When the tool is unclamped, a yellow lamp lights up and you cannot run the spindle.	o	o		o
㉜	Optional stop	When M01 is commanded in the tape, tape operation stops after all the commands in the block are completed. The indication lamp lights up. This is released by repressing the START button and indication lamp puts out.	o	o	o	

Grope No.	Name	Use	Operation method		Effective mode	
			Push button	Lamp	Auto.	Manual
㉝	Single block	Program commands are executed one block by one block. However, canned cycles are executed one by one.	Toggle switch	o	o	
㉞	Program restart (Option)	The program restarts. The indication lamp lights up. This is released by repressing the button and the indication lamp puts out.	o	o	o	
㉟	Manual pulse generator (Removable)	Feed axis is selected by pressing the push button. The feed rate can be selected by either 1 pulse/graduation (1/1), 10 pulses/graduation (10/1) or 100 pulses/graduation (100/1). Upon selecting feed, an axis can be moved + or - direction at the speed shown in column 22 .	o	o		o
㊱	Return to set point (Option)	Return to set point is a function that moves the machine to the stored position by button command where a position has been stored beforhand. The X, Y and Z axes coordinate values of max. 2 positions are stored.	o	o		o
㊲	State OK indication	Information such as mode, override, interlock, and spindle tool No. necessary for machining can be monitored.	o	o	o	o
㊳	Cutting monitor	The screen of the cutting monitor can be monitored.				

Grope No.	Name	Use	Operation method		Effective mode	
			Push button	Lamp	Auto.	Manual
㊴	Cutting monitor	Monitoring data is automatically set by the "AUTOMATIC SETTING" teaching cutting data. Select switch INEFFECTIVE ... makes the cutting monitor function ineffective. EFFECTIVE ... makes the cutting monitor function effective.	Select switch		o	
㊵	Block skip	This makes the block skip 2 9 effective. "/(2 9)" is used in the program.	o	o	o	
㊶	Tool nose air blow (Option)	Air blows out from the nozzle directed to a tool nose. Even during operation, ON-OFF is available.	o	o	o	o
㊷	Magazine rotation (ATC)	The ATC magazine rotates to index tools. Forward rotation: CW Reverse rotation: CCW	o			o
㊸	Call selection (ATC)	In the manual mode, the CALL SELECTION lamp lights up.		o		o
㊹	Automatic return	This is a push button for making the restoration easy after emergency stop or power failure etc. during ATC.	o			o
㊺	Door (When ATC is provided.)	OPEN ... The ATC door is op opened.	o			o
		CLOSED ... The ATC door is closed.	o			o

Main operation panel



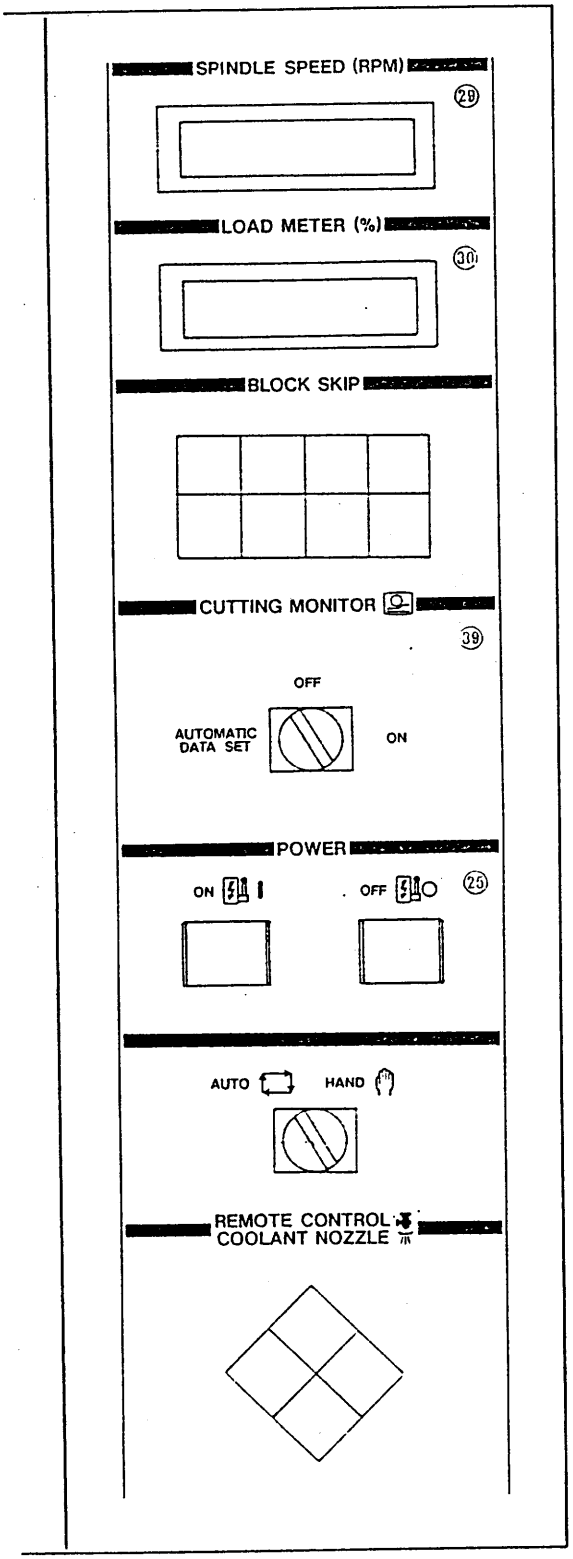

SPINDLE SPEED (RPM)
28
LOAD METER (%)
30
BLOCK SKIP
CUTTING MONITOR
39
OFF
AUTOMATIC DATA SET
ON
POWER
ON
OFF
29
AUTO
HAND
REMOTE CONTROL COOLANT NOZZLE

Fig. 4-2 Auxiliary operation panel (I)--- Spindle tool clamp/unclamp

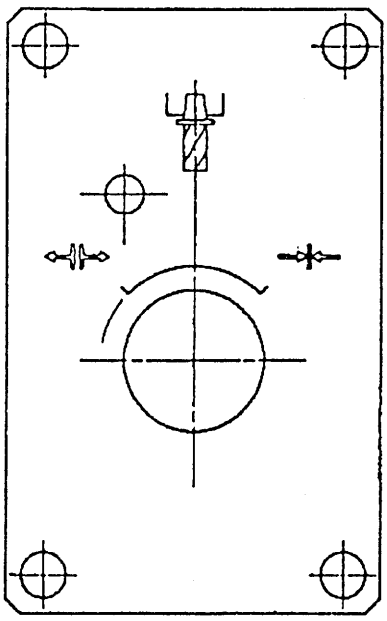


Fig. 4-3 Auxiliary operation panel (II)--- For ATC magazin swiveling

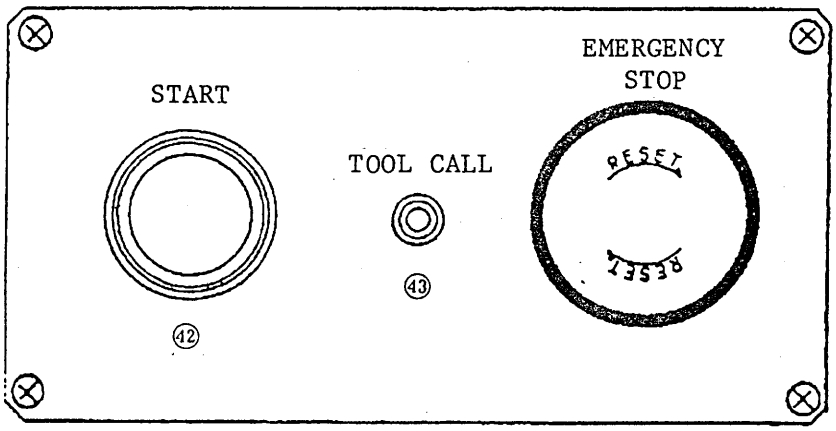
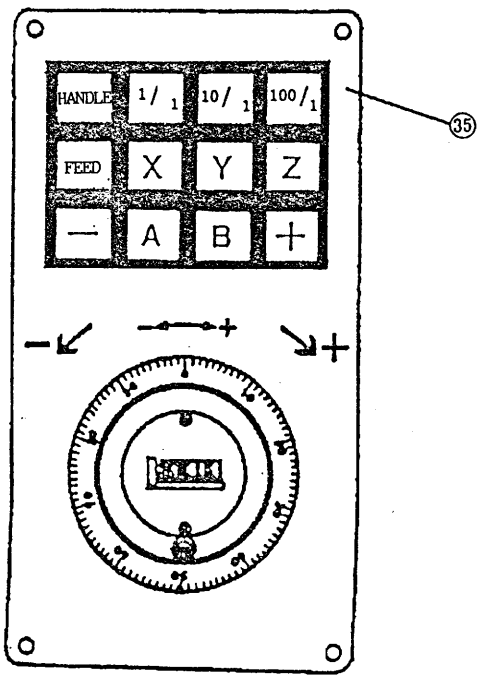


Fig. 4-4 Manual pulse generator

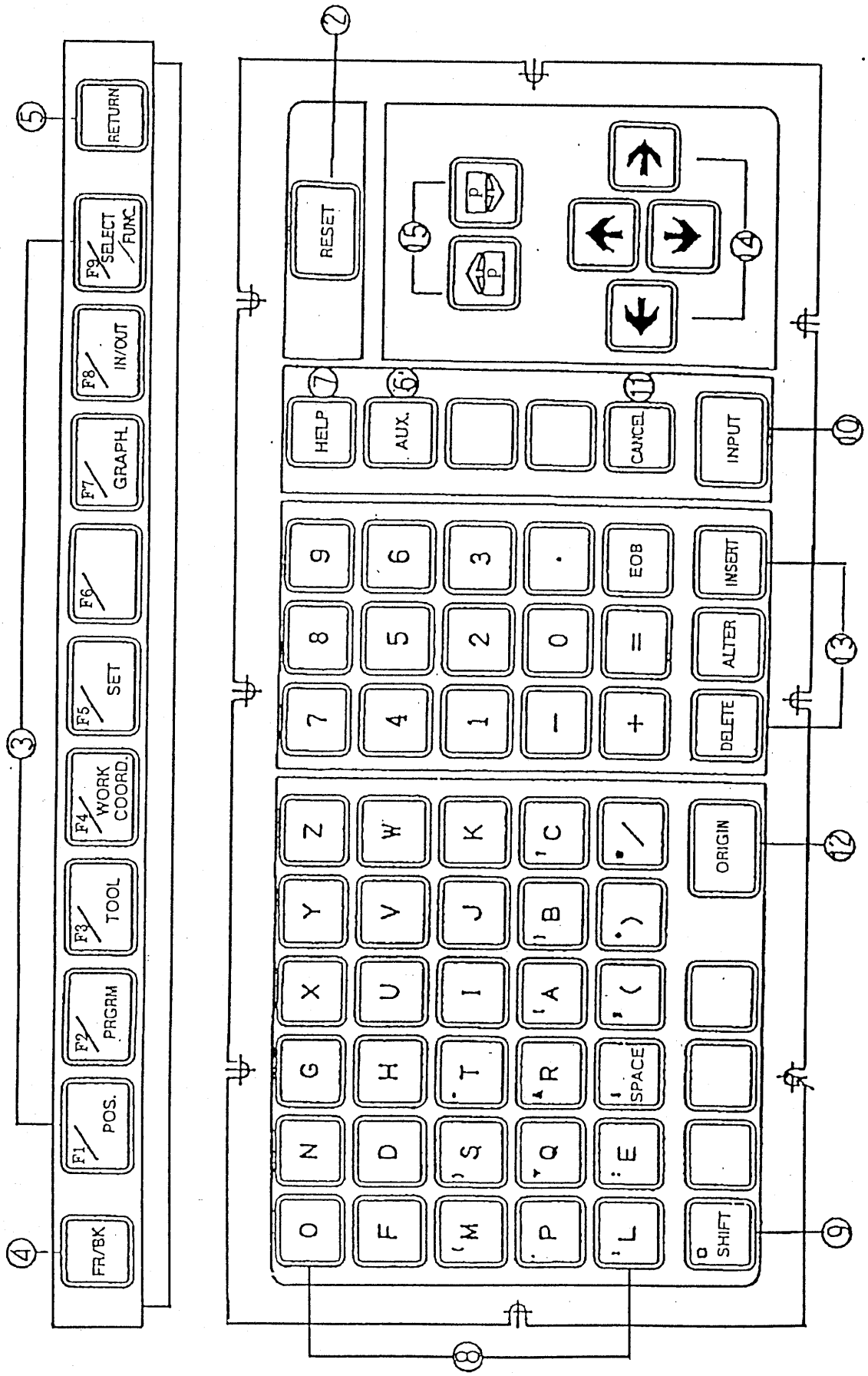


4-2 NC/PC Operation Key

No.	Name	Description
①	POWER ON/OFF button	This is used for turning ON/OFF the CNC power supply.
②	RESET key	Press this key when desiring to reset the CNC in order to release the alarm.
③	FUNCTION key	When the function menu is displayed on the lowest position of the CRT, this key becomes a key for selecting that menu. When the menu is not displayed, it becomes a key for selecting the screen of POSITION, PROGRAM, TOOL, WORK COORDINATE, SETTING, SKETCHING and I/O. Press the SELECTION/FUNCTION key when making the function menu display on the lowest position of the CRT.
④	FACE/BACK key	Press this key when making the screen of PC, ALARM, and MAINTENANCE etc. display. The function menu is displayed on the lowest position of the CRT by pressing the key once, and the menu is disappeared by pressing it once more.
⑤	RETURN key	Press this key when returning the screen to the total screen.
⑥	AUXILIARY key	This is used when displaying a specific screen.
⑦	HELP key	
⑧	ASSRESS/NUMERIC key	This key is used for entering ALPHABET and NUMERAL etc.
⑨	SHIFT key	This is an ADDRESS key, and there may be keys that two characters are stamped on one key. When the ADDRESS key is pressed after pressing the SHIFT key, the upper left character is entered.

No.	Name	Description
⑩	INPUT key	When either the ADDRESS or NUMERIC key is pressed, it is entered once in the key input buffer and displayed on the CRT. Press the INPUT key when desiring to set actually the data entered in the key input buffer.
⑪	CANCEL key	Press this key when desiring to cancel the characters and signs entered in the key input buffer.
⑫	ORIGIN key	This key is used to clear the coordinate value to 0 or to clear the SKETCH screen.
⑬	ERASE, ALTER, INSERT key	This key is used for erasing, altering an inserting the editing operation of the program.
⑭	CURSOR moving key	There are 4 kinds of keys and they are used for moving the cursor up/down and right/left.
⑮	PAGE changing key	There are 2 kinds of keys and they are used for changing pages in the forwardreverse direction.

Fig. 4-5 NC/PC operation box



4-3 Operational Procedures (With SEICOS-MIII)

Refer to the instruction manual 3-I "Fundamental Machine Operatios" for "SEIKI-SEICOS MIII/A" simultaneously.

4-3-1 When Starting the Machine

(1) Turn on the supply power switch.

(2) Turn on the power switch on the electric cabinet.

(3) Press the [POWER ON] push button switch located on the upper part of the main operation panel.

Note) The main panel and NC cabinet are enclosed lest the open air should enter directly. Therefore, do not leave each door open for a long time while the power is turned on.
Check on the display and that cooling fan motors.
inside and outside the cabinet are started.

(4) Press the [STANDBY] push button switch located at the upper right corner of the main operation panel. (A green lamp lights up.) Check that a hydraulic unit's set pressure is at 45 kg/cm^2 (specified pressure).

(5) Before starting daily operation, in order to lubricate each slideway, pull up the plunger of the lubrication pump and proceed pumping. Then reciplocate the X, Y and Z axes several times. (When this is done, be carefull not to cause their overtravel.)

(6) Return each axis to the zero point (refer to the description for zero return). By performing zero return, a basic machine coordinate system is set and stored stroke limits are made effective.

(7) Turn on the conveyor switch.

NOTE) Do not make operation under the state that massive chips are cast in the trough.

4-3-2 Zero Return Procedures

When you have to set the basic machine coordinate system again after turning on the power, perform manual zero return.

(1) Press the operation mode selector push button switch "ZERO RETURN".

(2) Of the push button switches for the axis you want to return to the zero point, press the one with a zero point mark (⊕).

(3) Move the axis to the zero point at a rapid traverse rate (override of 25%). After the axis completed zero return, its zero return lamp lights up.

(4) When the lamp is lit up, release the switch.

Now, zero return operation is completed.

Note) Return one axis to the zero point at a time.

Note) When the axis intended to make zero-point return is already near the zero-point, move it once to the reverse direction to that of zero-point about 50mm, then, newly move it to the designated direction for returning to the zero-point.

4-3-3 When Completing the Daily Operation

(1) Clean the machine.

After discharging the chips in the bed, stop the conveyor.

(2) Move each axis to its stop position.

X axis ..... Center of the stroke
Y axis ..... Ditto
Z axis ..... "Up" end of the head

(3) Check that the PROGRAM [START] lamp on the main operation panle is lit off.

(4) Press the [EMERGENCY STOP] push button switch on the main operation panel.

(5) Press the [POWER OFF] push button switch on the main operation panel to turn off the power to the NC unit.

(6) Turn off the power switch of the electric cabinet.

(7) Turn off the supply power switch.

4-4 Manual Operation (With SEICOS-MIII)

Refer to the instruction manual 3-I "Fundamental Machine Operations" for "SEIKI-SEICOS MIII/A" simultaneously.

4-4-1 Each Axial Feed

— In case of manual jog feed —

(1) Select the operation mode selector push button switch "JOG".

(2) Press the FEEDRATE push button switch to set an appropriate feed rate. Pressing the manual jog feed push button switch for a desired axis, move the machine in a desired direction. When it comes to a specified position, release the switch. (The machine moves only while the switch is pressed.)

Applications:
- Warming-up operation
- When bringing close to the zero point
- When cutting by manual operation

— In case of handle feed —

(1) Select the operation mode selector push button switch "SELECT".

(2) Select an axis with the axis selector push button switch.

(3) With the manual handle, you can move the machine by 0.001 mm (0.0001 inch) per graduation (when 1/1 is selected) or by 0.01 mm (0.001 inch) per graduation (when 10/1 is selected).

Applications:
- When moving the machine by a very fine amount, such as when setting the zero point by centering a workpiece or fixture

4-4-2 Rapid Traverse

(1) Select the operation mode selector push button switch "RAPID".

(2) Press the push button switch for the axis you want to move at a rapid traverse rate (rapid traverse is applied only while the push button switch is pressed). At this time, an override of 0, 1, 25 or 100% can be applied to a specified rapid traverse rate.

(3) Releasing the push button switch stops the rapid traverse.

4-4-3 Mounting and Dismounting the Tool

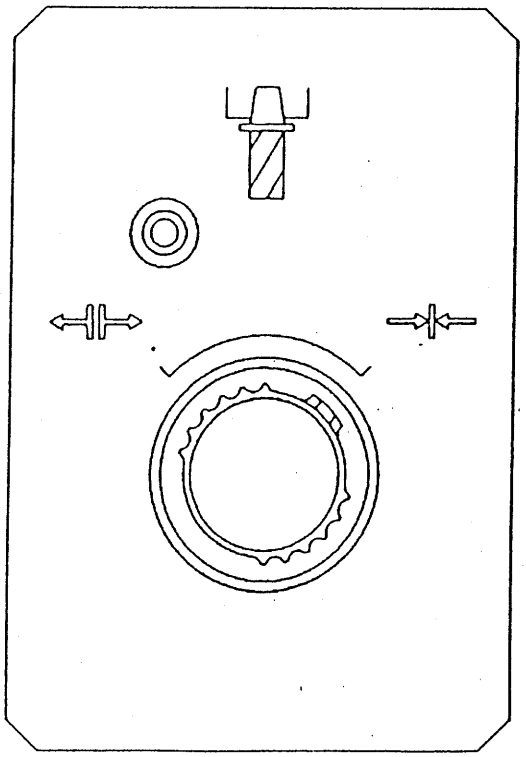
(1) Stop the spindle head at an arbitrary position.

(2) Select one of manual operation modes; JOG, RAPID, HANDLE or ZERO RETURN.

(3) Holding a tool firmly, shift to UNCLAMP the TOOL CLAMP/UNCLAMP selector push button switch, which is located on the front of the spindle head, and press it.
When the tool has been mounted, if the push button switch is released, the tip of the drawbar will push the tool shank, thus removing the tool from a spindle taper hole (hold the tool firmly lest it should drop). While the tool is unclamped, the yellow lamp located on the upper left part lights up.

(4) When mounting the tool, eliminate dust completely from the taper section of the tool shank. Clean the spindle taper hole properly with an accessory cleaner.

(5) Insert the tool shank into the spindle hole, and shift the TOOL CLAMP/UNCLAMP selector push button switch to CLAMP and press it. The tool is automatically mounted to the spindle and the yellow lamp lights off.



4-5 Manual Data Input (MDI) Operation (With SEICOS-MIII)

Refer to the instruction manual 3-I "Fundamental Machine Operations" for "SEIKI-SEICOS MIII/A" simultaneously.

4-5-1 Each Axial Feed

(1) Set the mode selector push button switch to "MDI".

(2) "PROGRAM(MDI)" is displayed on the screen of the NC operation panel.

(3) Select the axis, which you want to move, with the address keys, and input a sign and a numerical value with the data keys.

(4) Press the [INSRT] button.

(5) Repeating the steps (2) and (3), input one block worth of data.

(6) Press the PROGRAM [START] button.

4-5-2 Coolant

(1) Set the mode selector push button switch to "MDI".

(2) "PROGRAM(MDI)" is displayed on the screen.

(3) Press the address key [M].

(4) Press the data keys [0] and [8].

(5) Press the [INSRT] button, and then, the PROGRAM [START] button. Coolant is discharged from the nozzle at the spindle head.

(6) If you give M09 by similar operation, the coolant will stop.

4-5-3 Spindle Speed Chage and Spindle Revolution

(1) Set the mode selector push button switch to "MDI".

(2) "PROGRAM(MDI)" is displayed on the screen.

(3) Press the address key [S].

(4) Input a spindle speed with the data keys.

(5) Press the [INSRT] button.

(6) Similarly, input an M code for spindle forward revolution or reverse revolution.

(7) Press the PROGRAM [START] button.

(8) To stop the spindle, give M05 by similar operation.

Example 1)

[MDI] → [S] → [1][5][0][0] → [INSRT] → [M] → [0][3] → [INSRT] → PROGRAM [START]

Example 2)

[MDI] → [S] → [1][5][0][0] → [EOB] → [M] → [0][3] → [EOB] → [INSRT] → PROGRAM [START]

4-5-4 Spindle Positioning

(1) Set the mode selector push button switch to "MDI".

(2) "PROGRAM(MDI)" is displayed on the screen.

(3) Press the address key [M] .

(4) Press the data keys [1] and [9] .

(5) Press the [INSRT] button, and then, the PROGRAM [START] button. The spindle runs at a low speed and stops at its home position.

4-6 Automatic Operation

Refer to the instruction manual 3-I "Fundamental Machine Operations" for "SEIKI-SEICOS MIII/A" simultaneously.

4-6-1 When Machining the First Workpiece, Checking the Newly Created program

(1) Go through the steps (1) through (6) mentioned in 4-6-2 "Program Memory Operation".

(2) Turn on the SINGLE BLOCK switch. (When this is done, it is recommended to set a rapid override value to 25% for safety.)

(3) Press the PROGRAM [START] button.

(4) Check one block worth of functioning, press the PROGRAM [START] button again to sequentially advance a program.

4-6-2 Program Memory Operation

(1) Check that the ALARM lamp on the main operation panel is not lit up.

(2) Check and correct tool length and tool compensation data, if necessary.

(3) Set the mode selector switch to "MEMORY". For normal operation, at this time, turn off the DRY RUN, OPTIONAL STOP, MACHINE LOCK, BLOCK SKIP and SINGLE BLOCK switches, and set the FEEDRATE OVERRIDE, SPINDLE OVERRIDE and RAPID OVERRIDE switches to 100%.

(4) Press the [RESET] button on the setting operation panel.

(5) Select the relative coordinate system by the  keys on the operation panel after shifting the screen to the "POSITION" by the [POSITION] key. Make the X, Y and Z characters fliker by pressing the X, Y and Z keys, and shift the position display values of X, Y and Z to 0 by pressing the [ORIGIN] button. When setting them to number values other than 0, set them to the desred numeric values by the machine lock.
(After performing the MDI or the MANUAL operation, return it to the MEMORY or the "TAPE" again.)

(6) Call the PROGRAM AUTOMATIC to the display screen by pressing the [PROGRAM] button to check the initial state.

(7) When suspending the machine during its operation, press the PROGRAM [FEEDHOLD] button on the operation panel or turn on the SIGNAL BLOCK switch.
In case of emergency, press the [EMERGENCY STOP] button to immediately stop the machine on the operation panel.

4-6-3 When Inserting Manual Operation in Automatic Operation

(1) Press the PROGRAM [FEEDHOLD] push button switch (while program operation is suspended, a red lamp lights up.) or turn on the SINGLE BLOCK switch to suspend program operation.

(2) Select the operation mode selector push button switch either "HANDLE" or "JOG", and perform manual operation.

(3) After completing manual operation, return the operation mode to "AUTO".

(4) Press the PROGRAM [START] button to restart the program.

Note) Even when the PROGRAM [FEEDHOLD] button is pressed, the M, S and T functions continue until their actions are completed. Manual operation is available only after these actions are completed.

4-6-4 When Performing MDI Operation in Automatic Operation

(1) Turn on the SINGLE BLOCK switch on the operation panel.

(2) Shift the mode selection switch to "MDI" after the machine stops.

(3) Press the [PROGRAM] button, make "PROGRAM(MDl)" displayed on the screen.

(4) Enter necessary actions with the address keys and numerical keys, and press the [INSRT] button.

(5) Press the [PROGRAM START] button after confirming the data of one block has been input.

(6) To restart the automatic operation, shift the mode selector switch to "AUTO" and turn off the SINGLE BLOCK switch.

(7) Press the [PROGRAM START] button on the main operation box.

Note 1) When an auto command immediately before is a canned cycle and you specify an action other than the canned cycle by MDI operation, be sure to specify a necessary G code.

Note 2) When MDI operation is inserted in the state mensioned in Note 1, you must specify hole machining data preceding MDI insertion, if you want to execute the auto command again.

SAFETY PRECAUTION !

After you enter actions by MDI operation, if you forget to execute them (due to a certain reason such as leaving a work site) and restart automatic operation, the machine functions in an unexpected way and endangers you, because buffer contents for automatic operation have been replaced with unexecuted MDI buffer contents. Be fully aware of it.

4-7 Programming Format and Codes

4-7-1 Key Input Format (With SEICOS-MIII/A)

Refer to the instruction manual 2. "Specifications" for "SEIKI-SEICOS MIII/A".

4-7-2 List of G Codes

1. List of G code group (SEICOS-M III)

Group	Function	Remarks
00	Non-modal	
01	Positioning/Linear interpolation/Circular interpolation	
02	Plane selection	
03	Absolute command/Incremental command	
04	Stored stroke check	
05	Inverse time/Feed per minute/Feed per revolution	
06	Inch/Metric conversion	
07	Tool diameter compensation	
08	Tool length compensation	
09	Canned cycle	
10	Initial point return/R point return	
11	Scaling	
12	Selection of work coordinate system	
13	Cutting mode/Exact stop mode/Automatic corner override	
14	Macro modal call	
15	Programmable morror image	
16	Coordinate rotation	
17	Constnant surface speed control	
18	Tool life management	
19	Normal direction control	*1
20	Polar coordinate command	
21	Oscillation function	
22	Polar coordinate interpolation	*1
23	Spindle speed variation detection	*1
24	Selection of machining plane	
25	Tool nose interference check	
26	Axis chang/3 dimensional coordinate change	
27		*2
28		*2
29		*2
30		*2
31		*2

(Note) *1 Disabled to correspond by the reserved G codes now.

*2 It is the G group for function UP.

2. List of G codes (SEICOS-M III)

Code	Group	Function	Remarks
G00	01	Positioning	
G01		Linear interpolation	
G02		Circular interpolation/Helical interpolation CW	
G03		Circular interpolation/Helical interpolation CCW	
G04	00	Dwell	
G05		High speed distribution machining	
G07		Hypothetical axis interpolation	
G09		Exact stop	
G10		Data setting	
G11		Data setting mode cancel	
G15	20	Polar coordinate command cancel	
G16		Polar coordinate command	
G17	02	Xp Tp plane but Xp: X-axis or its parallel axis	
G18		Zp Xp plane Tp: Y-axis ot its parallel axis	
G19		Yp Xp plane Zp: Z-axis or its parallel axis	
G20	06	Inch input	
G21		Metric input	
G22	04	Stored stroke check ON	
G23		Stored stroke check OFF	
G25	23	Spindle speed variation detection OFF	*1
G26		Spindle speed variation detection ON	*1
G27	00	Reference point return check	
G28		Reference point return	
G29		Return from reference point	
G30		2nd, 3rd and 4th reference point return	
G31		Skip function	
G33	01	Thread cutting	
G34		Variable lead thread cutting	
G37	00	Tool length automatic measurement	
G38		Tool diameter compensation vector hold	
G39		Tool diameter compensation corner circular arc	
G40	07	Tool diameter compensation cancel/3 dimensional tool offset cancel	
G41		Tool diameter left/3 dimensional tool offset	
G42		Tool diameter compensation right	

Code	Group	Function	Remarks
G43	08	Tool length compensation +	
G44		Tool length compensation -	
G45	00	Tool position offset incfease	
G46		Tool position offset decrease	
G47		Tool position offset double increase	
G48		Tool position offset double decrease	
G49	08	Tool diameter compensation cancel	
G50	11	Skaling cancel	
G51		Scaling	
G52	00	Local coordinate system setting	
G53		Machine coordinate system selection	
G54	12	Selection of work coordinate system 1	
G55		Selection of work coordinate system 2	
G56		Selection of work coordinate system 3	
G57		Selection of work coordinate system 4	
G58		Selection of work coordinate system 5	
G59		Selection of work coordinate system 6	
G60	00	Uni-directional positioning	01 group by parameter change
G61	13	Exact stop mode	
G62		Automatic corner override mode	
G63		Tapping mode	
G64		Cutting mode	
G65	00	Macro call	
G66	14	Macro modal call	
G67		Macro modal call cancel	
G68	16	Coordinate rotation	
G69		Coordinate rotation cancel	
G70	00	Bolt hole cycle	
G71		Arc	
G72		Arc	
G73	09	Peg drilling cycle	
G74		Counter tapping cycle	
G76		Fine boring cycle	
G77	00	Grid cycle	

Code	Group	Function	Remarks
G80	09	Canned cycle cancel	
G81		Drilling cycle, Spot boring	
G82		Drilling cycle, Counter boring	
G83		Peg drilling cycle	
G84		Tapping cycle	
G85		Boring cycle	
G86		Boring cycle	
G87		Back boring cycle	
G88		Boring cycle	
G89		Boring cycle	
G90	03	Absolute command	
G91		Incremental command	
G92	00	Work coordinate system change/Max. spindle speed setting	
G93	05	Inverse time feed	
G94		Feed per minute	
G95		Feed per revolution	
G96	17	Constant surface speed control	
G97		Constant surface speed control cancel	
G98	10	Canned cycle initial lebel return	
G99		Canned cycle R point lebel return	
G113	21	Oscillation mode ON	
G114		Oscillation mode OFF	
G120	22	Polar coordinate interpolation mode cancel	
G121		Polar coordinate interpolation mode	
G130	18	Tool life management OFF	
G131		Tool life management ON	
G201	00	PMC data setting	*1
G203		High speed cutting register start	
G204		High speed cutting register end	
G206		Tool releasing amount setting	
G212	01	Circular arc therad cutting CW	*1
G213		Circular arc thread cutting CCW	*1
G216		Spline interpolation	*1

Code	Group	Function	Remarks
G222	01	Involute interpolation CW	*1
G223		Involute interpolation CCW	*1
G232		Exponential interpolation CW	
G233		Exponential interpolation CCW	
G240	24	Selection of machining plane 0 (Machining plane selection cancel)	
G241		Selection of machining plane 1	
G242		Selection of machining plane 2	
G243		Selection of machining plane 3	
G244		Selection of machining plane 4	
G245		Machining plane selection (Corresponding to a horizontal or vertical arbitrary angle)	
G248	26	Axis change/3 dimensional coordinate change ON	
G249		Axis change/3 dimensional coordinate change cancel	
G251	00	Multiple buffer	
G264	25	Tool nose interference check ON	
G265		Tool nose interference check OFF	
G271	00	Cylindrical interpolation	
G301		Floating reference point return	
G302		True circle cutting ID CW	
G303		True circle cutting ID CCW	
G304		True circle cutting OD CW	
G305		True circle cutting OD CCW	
G311		Multiple step skip function 1	*1
G312		Multiple step skip function 2	*1
G313		Multiple step skip function 3	*1
G314		Multiple step skip function 4	*1
G322		Square outer side face cutting CW	
G323		Square outer side face cutting CCW	
G324		Square plane	
G325		Square plane single sizing	
G326		Square plane doble sizing	
G327		Inner circle (Pocket cutting)	
G328		Inner square (Pocket cutting)	
G329		Inner truck (Pocket cutting)	
G330		Outer circle (Pocket cutting)	

Code	Group	Function	Remarks
G331	00	Outer square (Pocket cutting)	
G332		Outer truck (Pocket cutting)	
G333		True circle (Pocket cutting)	
◤G401	19	Normal direction control cancel mode	*1
G411		Normal direction control left side ON	*1
G421		Normal direction control right side ON	*1
◤G501	15	Programmable image cancel	
G511		Programmable image	
G540 ~G599	12	Additional work coordinate system selection (60 pairs)	
G611	00	Acceleration/deceleration before interpolation	
G653	00	High speed cutting program call	*1
G661	14	Macro modal B	
G721	00	Rotation copy	*1
G722		Parallel copy	*1
G741	09	Direct tapping cycle	
G841		Reverse direct tapping cycle	
G921	00	Work coordinate system preset	

(Note 1) *1 Disabled to correspond by the reserved G codes now.

(Note 2) ◤ mark is attached to each group.
The side marked with ◤ in the group is selected in the reset state.

4-7-3 List of M Codes

Code	Function
M00	Program stop
M01	Optional stop
M02	End of program
M03	Spindle forward rotation
M04	Spindle reverse rotation
M05	Spindle stop
M06	Tool change
M07	Oil mist coolant start (OP)
M08	Flood coolant
M09	Coolant stop
M10	Oil mist posture No.1 (OP)
M11	Oil mist posture No.2 (OP)
M12	Work count count (OP)
M13	Spindle forward rotation and coolant start simultaneously
M14	Spindle reverse rotation and coolant start simultaneously
M15	Spindle and coolant stop simultaneously
M16	Air blow for measurement ON (OP)
M17	Air blow for measurement OFF (OP)
M18	Spindle orientation for measurement (OP)
M19	Spindle orientation
M26	Melodia start
M27	Melodia start
M30	End of tape
M31	Chip converyor start (OP)
M35	Automatic start ON (OP)
M36	Automatic start OFF (OP)
M40	Tool nose air blow ON (OP)
M41	Tool nose air blow OFF (OP)
M42	X-axis mirror image (OP)
M43	Y-axis mirror image (OP)
M44	4th axis mirror image (OP)
M45	Spare tool offset effective (OP) for cutting minitor
M46	Spare tool offset ineffective (OP) for cutting monitor
M47	Jet coolant start (OP)
M48	Feedrate override effective
M49	Feedrate override ineffective

Code	Function
M50	Oil hole coolant ON (OP)
M51	Tool check before machining (OP) for cutting monitor
M52	Tool breakage detection (OP)
M55	M56 cancel (OP)
M56	Program hold by tool life expiry (OP)
M59	Tool check end before machining (OP) for cutting minitor
M60	APC transfer preparation check & APC door open (OP)
M61	APC pallet carry-out (OP)
M62	APC pallet carry-in (OP)
M68	Additional axis clamp (OP)
M69	Additional axis unclamp (OP)
M70	External output M code M70 (OP)
M71	External output M code M71 (OP)
M72	External output M code M72 (OP)
M73	External output M code M73 (OP)
M74	Skip selection OFF (OP)
M75	Skip selection ON (OP)
M78	Additional axis clamp
M79	Additional axis unclamp
M80	Tool nose air blow ON (OP)
M86	Measurement NG tool breakage (OP) tool breakage is informed from macro program.
M96	Custom macro interruption effective (OP)
M97	Custom macro interruption ineffective (OP)
M98	Sub-program call
M99	End of sub-program

(OP) means optional function.

4-8 Operation of Automatic Tool Changer (ATC)

4-8-1 Functioning of ATC and Its Operating Method

Depending on a command, the ATC operates as shown in Fig. 4-8 either independently or continuously.

(1) For independent operation (MDI and maintenance mode)
Operate the ATC as follows when an independent action is required due to test operation, maintenance and adjustment work, and so on:

1. Set each axis and the ATC arm to the "ATC initial position" in MDI mode. .....(G30G91Y0Z0)

2. Turn on the MAINT switch, which is for maintenance, located inside the power control cabinet.

3. M codes used for independent operations are as shown in the following table.

4. Be sure to close the door of the power control cabinet to avoid a danger.

	Operation		M code	Aux. manual operation	Remarks
1	Arm swing-in		M100		
2	Arm slide advance		M101		
3	Spindle tool unclamp		-	Manual push button	
4	Double arm DOWN		M102		
5	Double arm turn 180°	Right	M103		Right:The double arm turns to the right, facing the spindle.
		Left	M104		
6	Double arm UP		M105		
7	Spindle tool clamp		-	Manual push button	
8	Arm slide retreat		M106		
9	Arm swing-out		M107		
10	Double arm to left		M102		
11	Magazine turn		-	Manual push button	
12	Arm slide retract		M108		
13	Double arm to right		M105		

(Be sure to turn off the MAINT switch after using it.)

4-8-2 Turning the Tool Storage Magazine (INDEPENDENT Mode)

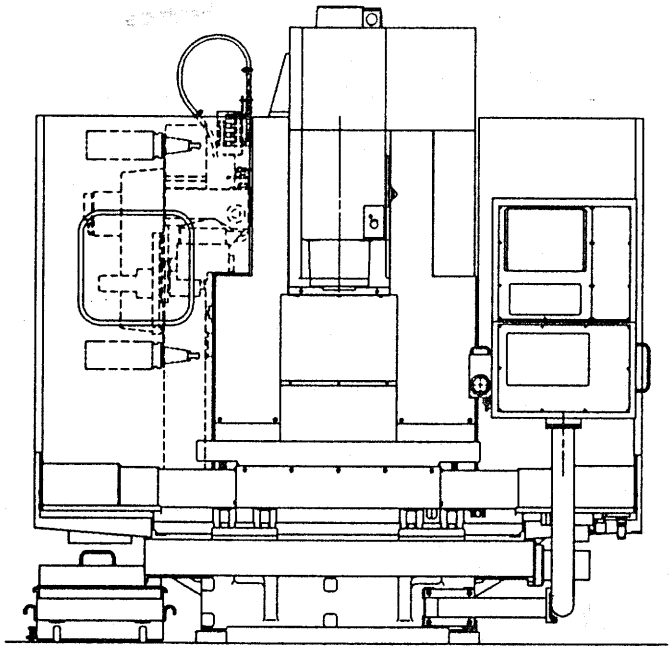
While pressing the push button switch located on the left side behind the magazine, the tool magazine turns. When a desired tool pot number approaches a specified position, release this push button switch. The magazine is decelerated and positioned there.

Note) * In the case of setting the oil hole tools that are over outside diameter ϕ110 mm on the condition that ATC magazine number are 50, 80, or 120 pieces, you can set effectually at an odd pot No. without emptying the adjacent pot of its content.

Provided that)

1. It is necessary to empty the adjacent larger No. side pot of its content, on the congition that ATC magazine number of VK45-50 are 50, 80, or 120 pieces.
2. It is not allowed over outside diameter ϕ110 mm of adjacent tool,
3. It is necessary to empty the adjacent larger No. side pot of its content, on setting at pot No. of an even number.

Fig. 4-6 Construction of ATC



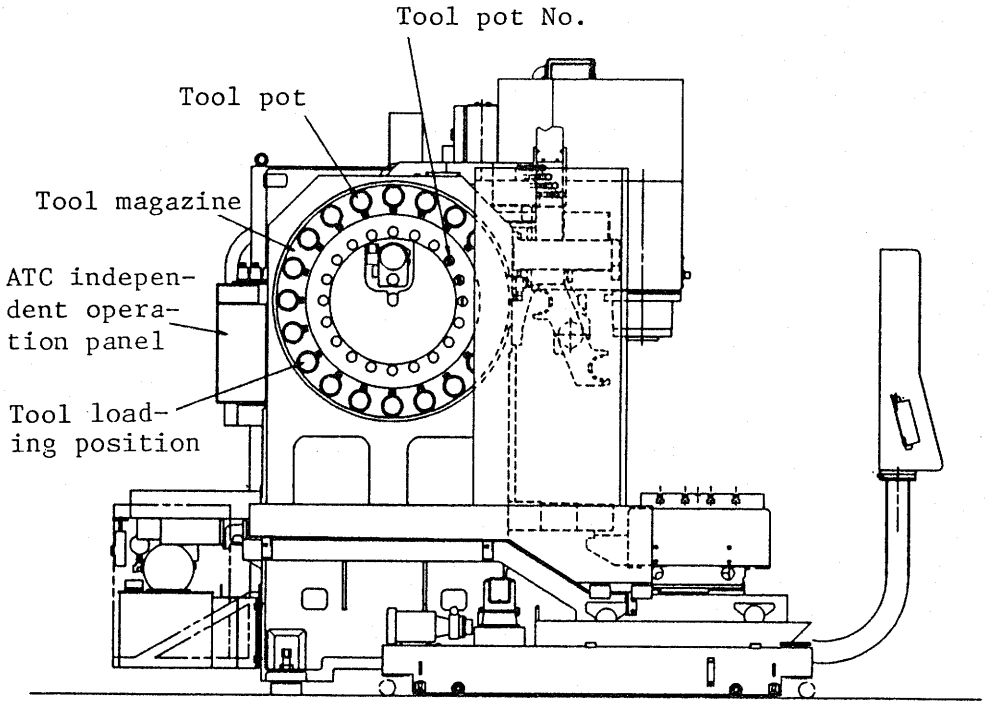
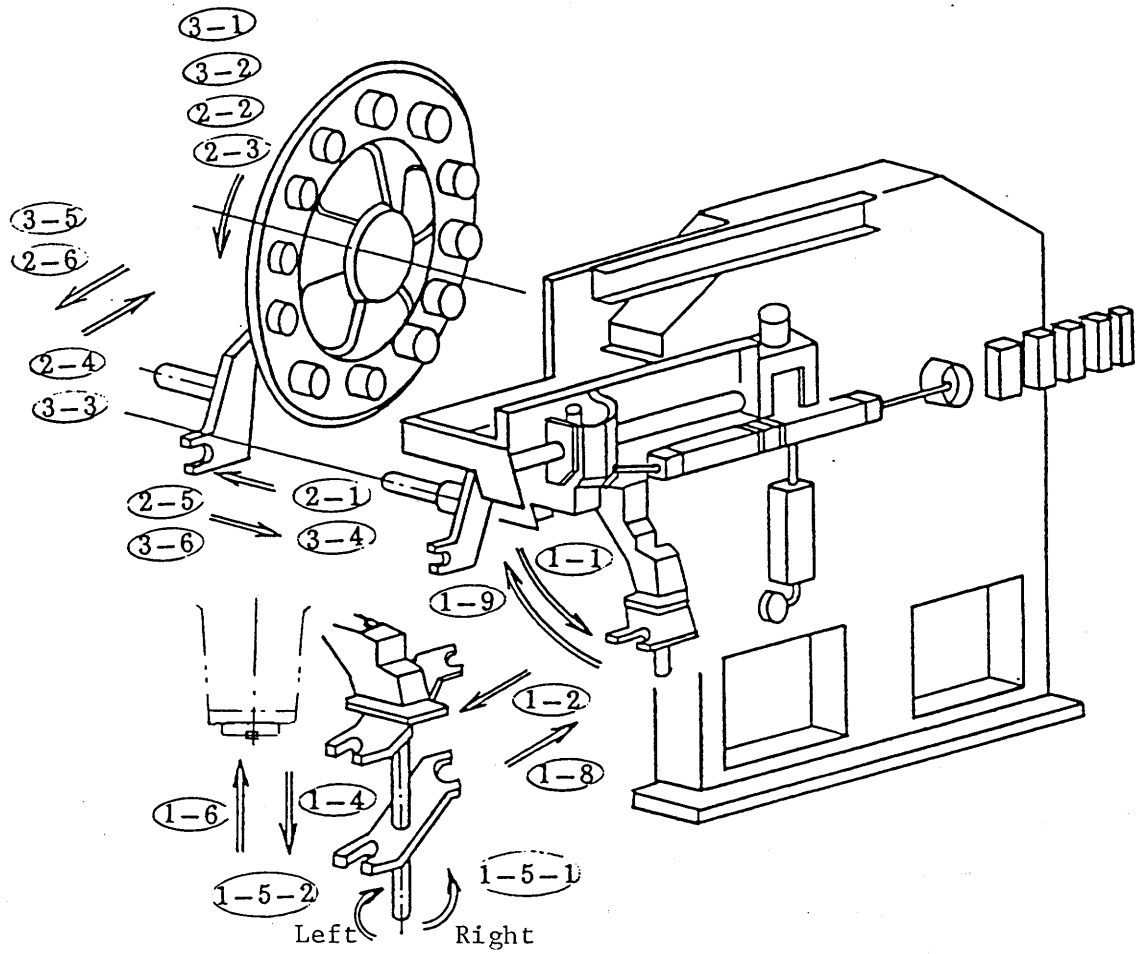


Fig. 4-7 Each Action Required for Calling and Changing the Tool



Function	Sequence	Operation	Function	Sequence	Operation
Tool Change (M06)	1-1	Arm swing-in		2-3	Magazine positioning
	1-2	Arm slide advance		2-4	Arm slide retreat
	1-3	(Spindle tool unclamp)		2-5	Double arm to right
	1-4	Double arm DOWN		2-6	Arm slide advance
	1-5	Double arm turn 180°	Tool Call	3-1	Magazine turn
	1-6	Double arm UP		3-2	Magazine positioning
	1-7	(Spindle tool clamp)		3-3	Arm slide retreat
	1-8	Arm slide retreat		3-4	Double arm to left
	1-9	Arm swing-out		3-5	Arm slide advance
Tool Return	2-1	Double arm to left		3-6	Double arm to right
	2-2	Magazine turn			

4-8-3 ATC Program Operation

(1) Block operation by the program (automatic mode)

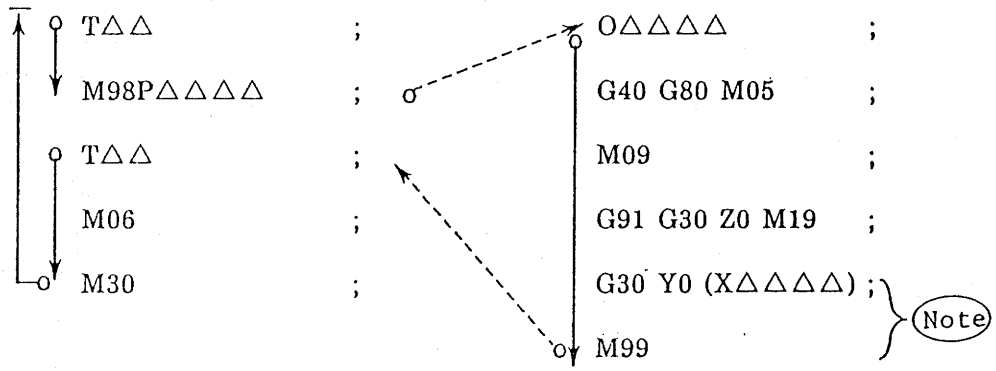
The ATC carries out the following block operations, depending on the program:

TΔΔ;	Calls the tool No. ΔΔ from the tool magazine to an arm "standby position".
M06;	Replace the tool in the spindle with that located at the arm standby position.
TΔΔM06;	Calls the tool No. ΔΔ from the magazine to the "spindle". (ATC canded cycle)
T00;	Returns to the tool magazine the tool located at the arm standby position.

(2) Arbitrary block suspension

If the "FEEDHOLD" push button switch is pressed while the ATC is being operated with M06, it will be temporarily stopped at an arbitrary position of independent operation shown in Fig. 4-7. Pressing the "CYCLE START" push button switch continues remaining operation.

(3) Program example of ATC test run



If the ATC canned cycle is used,
only T △ △ M06 should be commanded.

Note) Since the X axis does not have the ATC zero point (G30 X0), run the ATC after moving the X axis to a position where the double arm or tool does not interfere with the workpiece/jig on the table during ATC operation.

4-8-4 Condition Check During ATC Execution

1) .Tool No. on the spindle
.Tool No. at the ATC arm standby position
are displayed on the general screen. (Refer to Fig. 4-8)

2) .Tool No. commanded in a program is displayed on the commanded value screen. (Refer to Fig. 4-9)

3) .Pot No. at the standby position is displayed on the AB phase table count counter of the PC screen No.11.
(Refer to Fig. 4-10 and 11)

How to display each screen is as follows:

1) How to display the general screen

When pressing the [RETURN] key, the general screen (Fig. 4-8) appears.

2) How to display the commanded value screen

Display the general screen ⟶ Press the [F1/POSITION] key ⟶
Press the function key [F4/WORK COORDINATE] for commanded values ⟶
The commanded value screen (Fig. 4-9) appears.

3) How to display the A, B phase screen

Display the general screen ⟶ Press the [FRONT/BACK] key ⟶
Press the function key [F4/WORK COORDINATE] for commanded values ⟶
The system menu screen appears.
As the characters of MENU No. are displayed on the lower left of the screen, press the [6] [INPUT] keys. ⟶ The programmable controller screen (Fig. 4-10) appears.
As the characters of MENU No. are displayed, press the [1] [1] [INPUT] keys ⟶ The AB phase table screen (Fig. 4-11) appears.

Fig. 4-8 Integrated screen

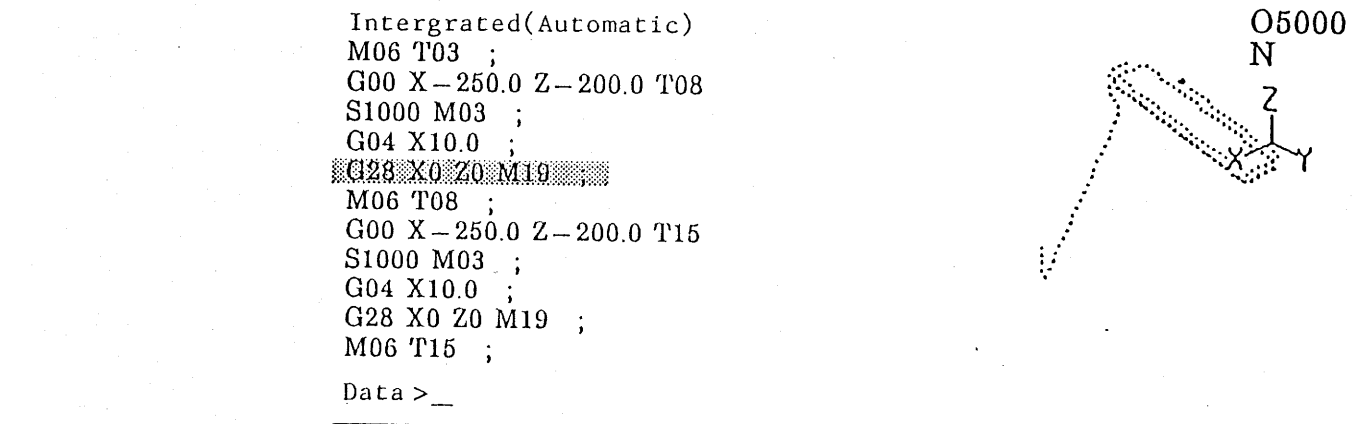


Fig. 4-9 Commanded value screen

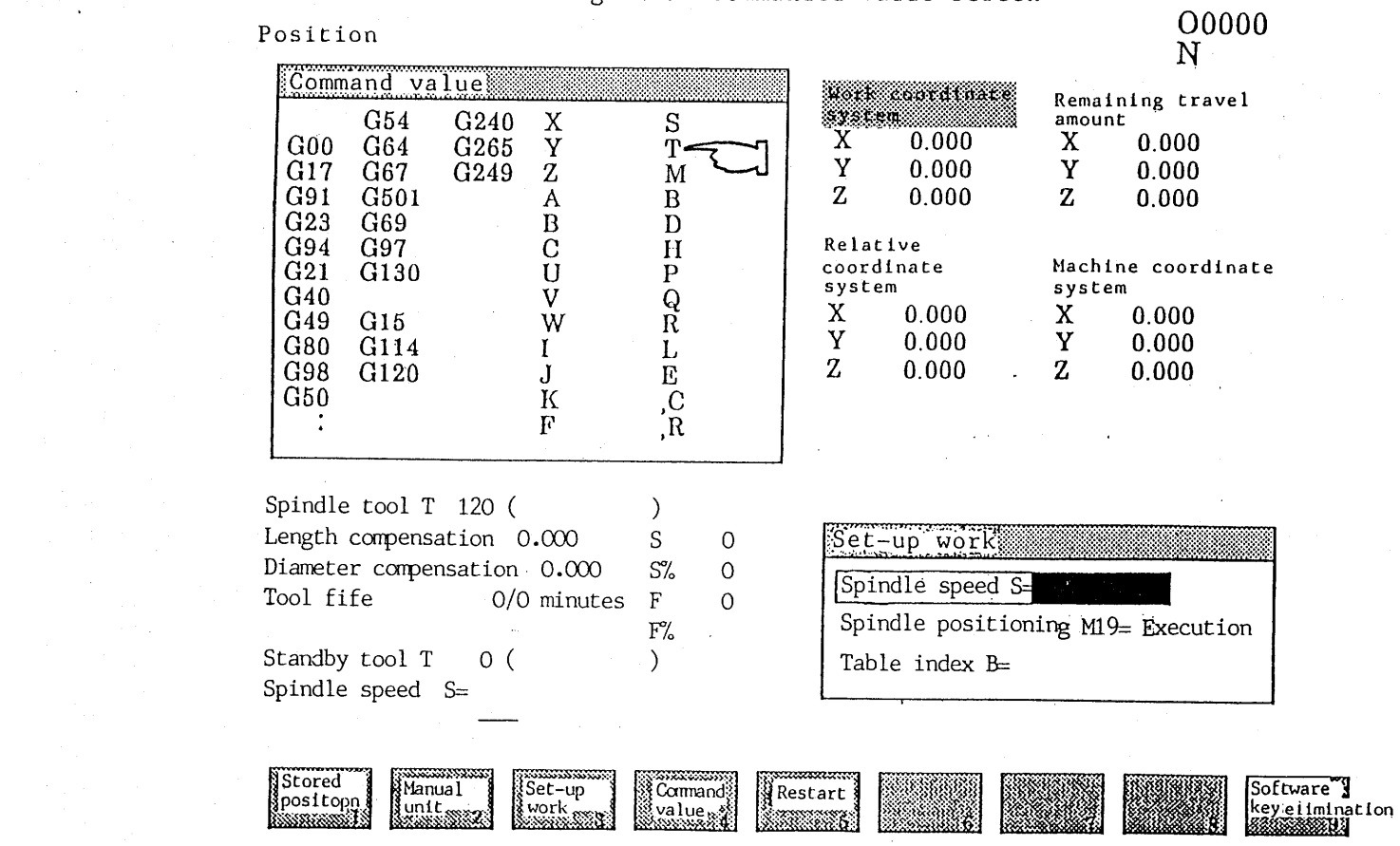


Fig. 4-10

PC RUN

Programmable controller

Mnue

1. Contact information	17. Ladder live line display
2. Work	18. Ladder program
3. Contact information & work	19. Logical analog
4. SLUBUS	20. Step ladder
5. Word table	21. AB phase measurement
6. Counter	22.
7. Timer	23.
8. System table	24.
9. System counter	25.
10. System timer	26.
11. AB phase table	27. ROM edition
12. Alarm diagnosis	28.
13.	29. Z-axis thermal displacement compensation function
14.	30. Yu-Yu memory
15. Pause screen	31. Comment sentence editing
16. User function	32. System parameter

Menu No. =

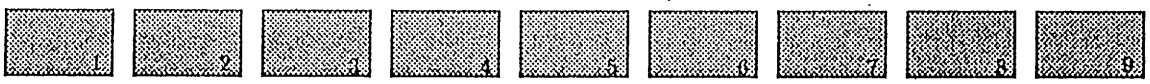
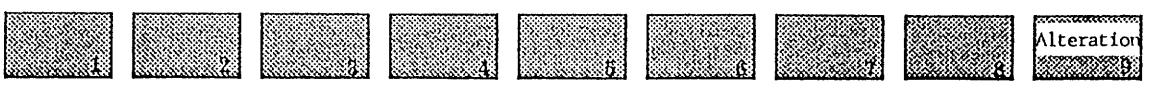


Fig. 4-11

PC RUN

AB phase table

No.	Ring counter	Current counter	Multi player	Distance	Set status	Current status
					(BA)	(BA)
01	0	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
08	0	0	0	0	00	00
09	0	0	0	0	00	00
0A	0	0	0	0	00	00
0B	0	0	0	0	00	00
0C	0	0	0	0	00	00
0D	0	0	0	0	00	00
0E	0	0	0	0	00	00
0F	0	0	0	0	00	00
10	0	0	0	0	00	00



5. TRANSPORTATION AND INSTALLATION OF MACHINE

5-1 Transportation of Machine

Since this machine has an integrated structure mechanically and electrically, it can be transported only by detaching its power cord. To fix its moving parts and pass wire ropes around the machine, refer to Fig. 5-1.

5-1-1 Precautions for Lifting Work

Pay proper attention to lifting work, because it is one of important steps when transporting the machine.
Since the lifting work for machine transportation is carried out with a crane or chain block, its precautions are listed below:

(1) Use a wire rope whose diameter is 16 mm (9/16 inch) or more.

(2) Apply a pad to an acute-angle part to protect the wire rope and machine.

(3) Pass the rope so that the center of gravity of a load will come over the center line of a lifting angle.

(4) Do not use a rusted wire rope, one which has been untwisted, or one whose core wire is broken.

(5) Lift the machine gradually. Stop it once when the wire rope became strained, and check a lifting condition. When the machined is lifted up from the floor, check again that there are no abnormalities with the lifting rope, and proceed with the lifting work. When lowering the machine, it is necessary to be careful that it is lowered down slowly. Stop lowering the machine immediately before it reaches the floor to check. Then, lower it down completely.

5-1-2 Precautions When Using the Fork Lift

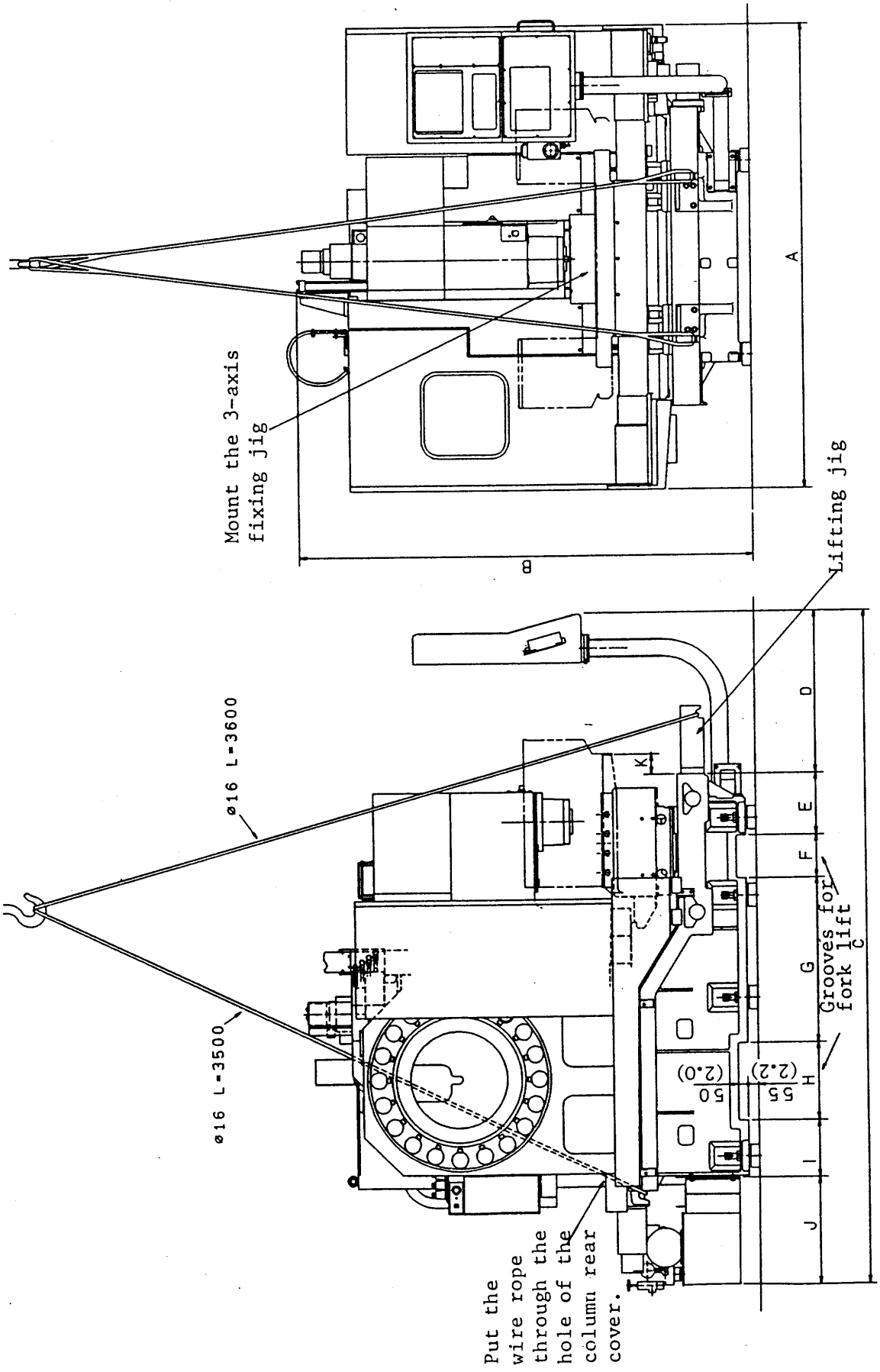
(1) Select a fork lift which has a sufficient capability to handle and endure a machine weight.

(2) In order not to damage the outer projected parts of the machine, it is necessary to carry out this work in cooperation with a watchman.

(3) When inserting the fork under the machine, use the right and left cast grooves provided for fork insertion under the base of the machine proper.

(4) When lifting the machine, be sure to carry out temporary lifting so that you can lift it with the center of gravity of the machine set at the stablest positions in both longitudinal and crosswise directions.

Fig. 5-1



	VK45	VK55
A	2400 (95)	2950 (116)
B	2340 (92)	2486 (98)
C	3475 (136.8)	3940 (155.2)
D	830 (32.7)	980 (38.6)
E	320 (12.6)	320 (12.6)

Values in parentheses show inch dimensions.

	VK45	VK55
F	220 (8.7)	270 (10.6)
G	855 (34)	1045 (41)
H	400 (16)	400 (16)
I	295 (11.6)	350 (14)
J	550 (21.6)	575 (22.6)

5-2 Environment for Machine Installation

Pay full attention to a room temperature, dust, vibrations, etc. in order to make use of the primary performance of the machine.
Needless to say that 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 polluted so much by dust, etc., the sliding sections and electric devices of the machine are greatly affected in their service lives.
Particularly, electronic devices related to controls are susceptible to dust and humidity. Install the machine in the environment as clean as possible.
Also, the machine must be installed at a place free from vibrations caused by other machines.

Install the machine in as clean as possible an environment because electronic devices for control are particularly susceptible to dust and moisture.
In addition, the machine must be installed at a place free from vibrations.

If any of the following electrical machines and appliance which generate high-frequency noise is currently installed or is to be installed near the NC unit, observe the following precautions:

1. Electrical machines and appliances generating high-frequency noise
   (1) Arc welding machine
   (2) Resistance welding machine
   (3) High-frequency dryer
   (4) Discharging machining unit
   (5) Others

2. Installing criteria of NC unit
   (1) Power supply line
   Separate the power supply line for NC (200 VAC) with the lines for the above electrical machine or appliance. If it is impossible to do this, obtain the power supply from a line at least 20 m away from the point where those machines and appliances are connected.

(2) Location of installation of NC

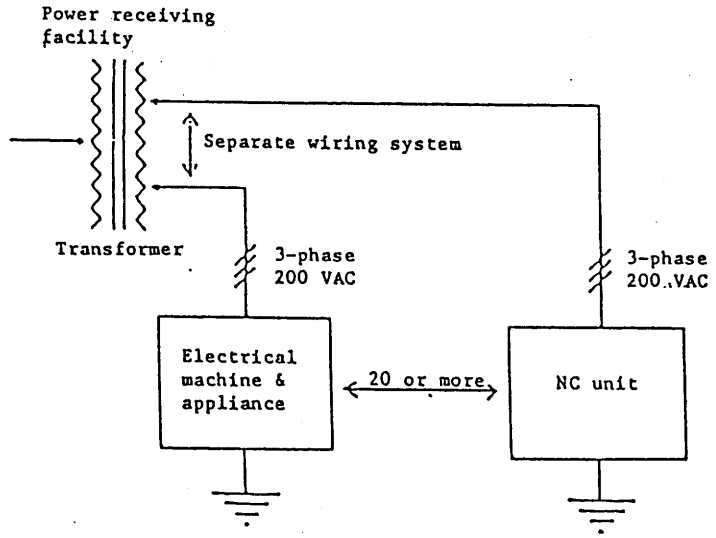
The NC unit should be installed at least 20 m away from those electrical machines and appliances.

(3) Grounding (earth) of NC

Ground the NC unit with the resistance less than 100 ohms at the place where the unit is within 5 m of the grounding point. The point should be different from those for grounding of the electrical machines and appliances. (Class 3 grounding construction) The thickness of the grounding wire should be more than 1.25 mm^2.

3. Sample of installation of NC unit

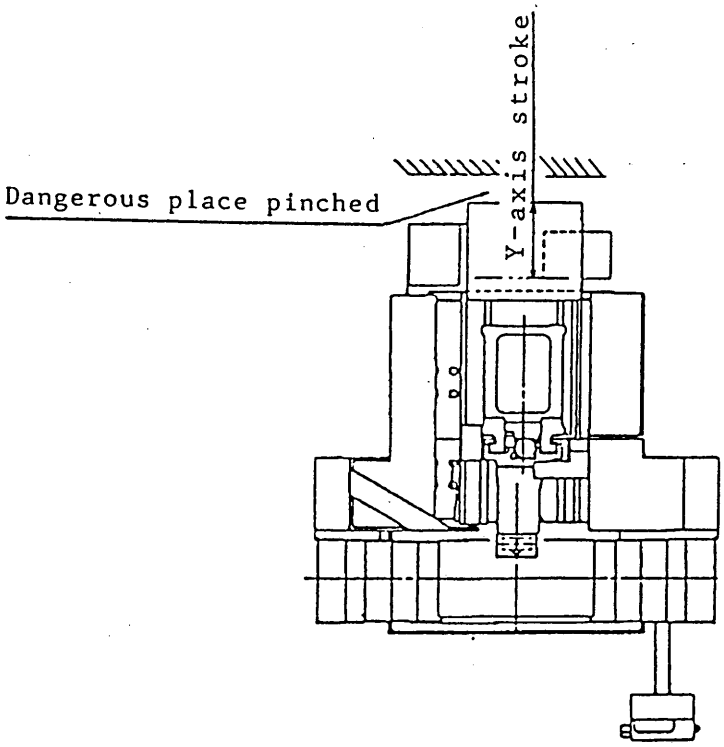
The following diagram shows the installation of the NC unit and the electrical machines and appliances.



Grounding: Class 3 construction within 5 m.
(Grounding resistance of 100ohms or less
Thickness of wire 1.25mm^2 or more)

5-3 Precaution for the Layout of the Machine

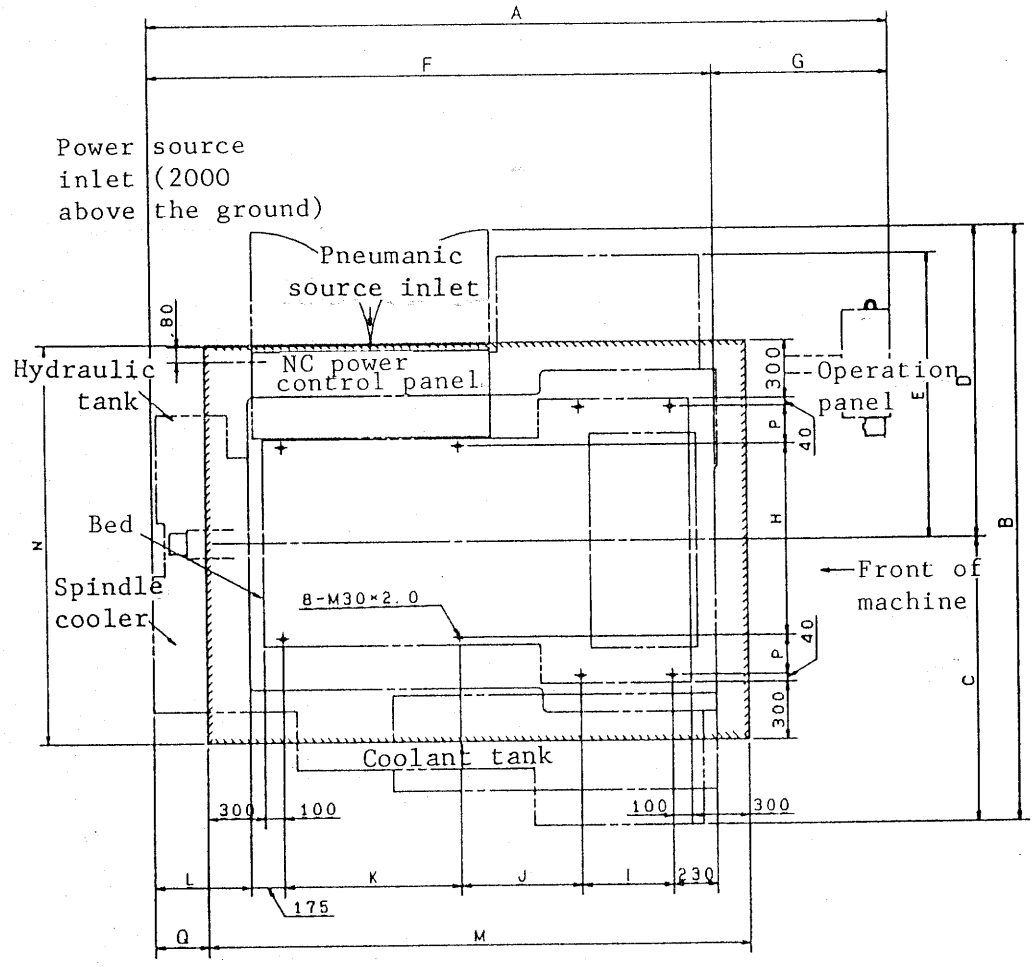
When there are wall etc. behind the machine, arrange the machine to keep a distance so that the step may not be pinched, because the step installed to the rear part of the column moves with the Y-axis movement.



5-4 Construction of Foundation

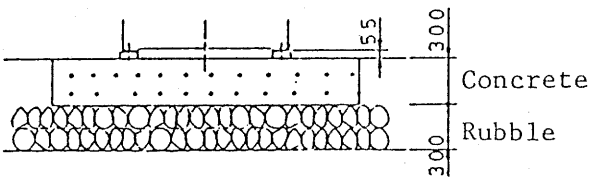
To make the machine exhibit its performance fully, construct the foundation for machine installation with a bearing capacity of soil of 5 tons/m^2 or more. For the foundation drawing and required floor dimensions, refer to Fig. 5-2.

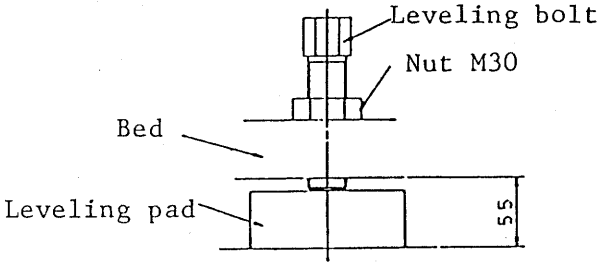
Fig. 5-2



	VK45	VK55
A	3495 (137.6)	3940 (155.1)
B	2825 (111.2)	3125 (123.0)
C	1200 (47.2)	1500 (59.1)
D	1625 (64.0)	1625 (64.0)
E	1200 (47.2)	1500 (59.1)
F	2665 (104.9)	2960 (116.5)
G	830 (32.7)	980 (38.6)
H	1000 (39.4)	1000 (39.4)
I	400 (15.7)	480 (18.9)
J	530 (20.9)	635 (25.0)
K	820 (32.3)	930 (36.6)
L	510 (20.1)	510 (20.1)
M	2550 (100.4)	2845 (112.0)
N	1680 (66.1)	2080 (81.9)
P	0	200 (7.9)
Q	285 (11.2)	285 (11.2)

Unit: mm (inch)





Notes:
1. The bearing capacity of soil and the thickness of the foundation should be 5 tons/m^2 or more and 300 mm or more, respectively.
2. A range of the foundation should be 300 mm or more around the bed.
3. When providing an anti-vibration groove, make it along the periphery of the foundation.
4. When installing the APC, drill holes for FISHER-ANKORS M16 before installing the machine.

5-5 Installation of Machine

5-5-1 Preparation for Installation

(1) Preparation Items

		VK45	VK55
Power source	Capacity (MIN)	21.5 KVA	28.5 KVA
	Voltage	200 / 220 V ± 10%	
	Grounding work	100 Ω or less	
Pneumatic source		5 Kg/cm^2 (75 lbs/in^2), 100ℓ/min (26 GAL/min)	
Hydraulic unit and lubricating oil		Refer to Table 5-3.	

a) Electric wiring

Wiring provided for this machine connects between the machine proper and its attachments only. The user is kindly requested to prepare wiring from the supply power source to the control cabinet. Although an electric wire used for this purpose slightly differs depending on a distance from the power source to the control cabinet, it is necessary to connect with the one whose sectional area is 22 mm^2 (AWG #3) or more.

b) Pneumatic source

Since this machine uses clean air to clean the spindle hole and tools, or as the mist coolant unit, prepare a pneumatic source. This pneumatic source must be naturally free from dust contained in the air and oversaturated moisture. Due to a nature of the air, as the air temperature of the pneumatic source increases higher than the temperature of the machine proper, it is cooled on the machine proper side and causes waterdrops more easily. If moist air is injected, it may rust the spindle hole and tool shank, thus having ill effects on machining accuracy and a cutting surface. Therefore, the better, the lower the air temperature of the pneumatic source is.

When there is a great temperature difference, attach an air dryer between the pneumatic source and the machine.

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

(You are kindly requested to manufacture an air inlet joint in accordance with your factory's piping diameter.)

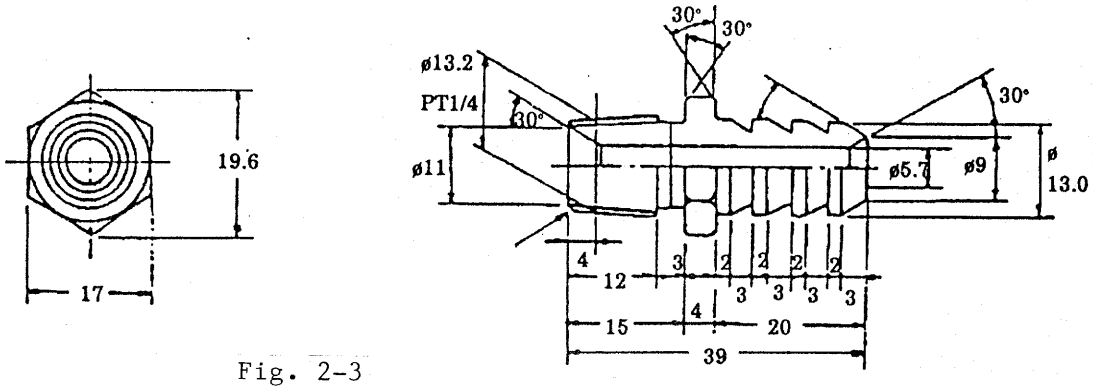


Fig. 2-3

c) Oil supply

When supplying oil, be fully aware of the following:

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

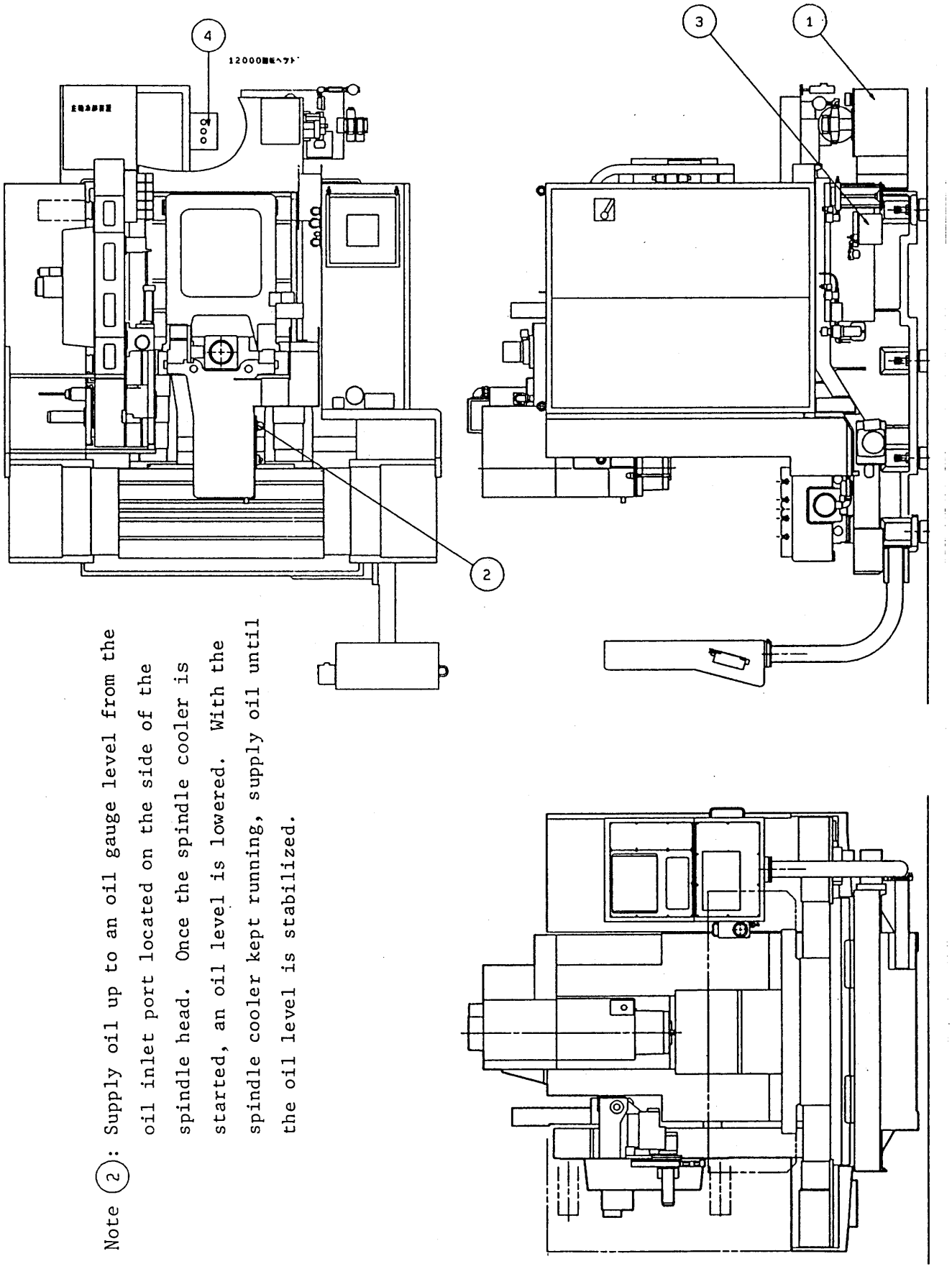
Refer to Fig. 5-3 and Table 5-3 and 5-4 as to oil supply spots, supply frequencies, oil amounts and oil types.

Table 5-3 List of Lubricating Oils (Refer to Fig. 5-3 Oil Supply Spots)

Supply spot		Method	Frequency	Quantity	CASTROL	SHELL	MOBIL	ESSO	ISO symbol
1	Hydraulic unit	Piston pump	Replace every 6 to 12 months and replenish occasionally.	40 ℓ (11 GAL)	CASTROL HYSPIN AWS32	SHELL TELLUS OIL 32	MOBIL DTE OIL LIGHT	TERESSO 32	CB-32
2	Spindle gear box	Trochoid pump	Replace every 6 to 12 months and replenish occasionally.	2.0 ℓ (0.6 GAL)	CASTROL HYSPIN AWS32	SHELL TELLUS OIL 32	MOBIL DTE OIL LIGHT	TERESSO 32	CB-32
3	Lubricating oil (each slideway)	Piston pump	Replenish occasionally	2.0 ℓ (0.6 GAL)	CASTROL MAGNA BD68	SHELL TONA OIL T68	VACTRA OIL NO. 2	FEBIS K68	G-68
4	Spindle cooler (option)	Trochoid pump	Replace every 6 to 12 months and replenish occasionally.	8 ℓ (2.1 GAL)	CASTROL HYSPIN AWS32	SHELL TELLUS OIL 32	MOBIL DTE OIL LIGHT	TERESSO 32	CB-32

* Use oils belonging to a "CB-26" calss during winter period when a night temperature falls to -10°C or less.

Fig. 5-3



Note (2): Supply oil up to an oil gauge level from the oil inlet port located on the side of the spindle head. Once the spindle cooler is started, an oil level is lowered. With the spindle cooler kept running, supply oil until the oil level is stabilized.

Table 5-4 List of New and Old Lubricating Oils

Maker / Symbol	ESSO	SHELL	MOBIL	CASTROL
CB32	(TERESSO 43) TERESSE 32	(SHELL TELLUS OIL 125) SHELL TELLUS OIL C32	MOBIL DTE OIL LIGHT	CASTROL HYSPIN AWS32
CB68	(TERESSO 52) TERESSO 68	(SHELL TELLUS OIL 133) SHELL TELLUS OIL C68	MOBIL DTE OIL HEAVY MEDIUM	CASTROL HYSPIN AWS68
CB150	(TERESSO 85) TERESSO 150	(SHELL TELLUS OIL 69) SHELL TELLUS OIL C150	MOBIL DTE OIL EXTRA HEAVY	CASTROL HYSPIN AWS150
CC150	(SPARTAN EP2) SPARTAN EP150	(SHELL OMALA OIL 69) SHELL OMALA OIL 150	MOBIL GEAR 629	CASTROL ALPHA SP150
CC320	(SPARTAN EP4) SPARTAN EP320	(SHELL OMALA OIL 75) SHELL OMALA OIL 32	MOBIL GEAR 632	CASTROL ALPHA SP320
CC460	(SPARTAN EP5) SPARTAN EP460	(SHELL OMALA OIL 77) SHELL OMALA OIL 460	MOBIL GEAR 634	CASTROL ALPHA SP460
FC 2		SHELL HIGH SPIN OIL C2	MOBIL VELOCITY OIL NO. 3	CASTROL MAGNA 2
FC10	(SPINESSO 34) SPINESSO 10	(SHELL TELLUS OIL 15) SHELL TELLUS OIL C10	MOBIL VELOCITY OIL NO. 6	CASTROL HYSPIN AWS10
FC22	(SPINESSO 38) SPINESSO 22	(SHELL TELLUS OIL 21) SHELL TELLUS OIL C22	MOBIL VELOCITY OIL NO. 10	CASTROL HYSPIN AWS22
G 68	(FEBIS K53) FEBIS K68	(SHELL TONA OIL 33) SHELL TONA OIL T68	MOBIL VECTRA OIL NO. 2	CASTROL MAGNA BD68
G220	(FEBIS K73) FEBIS K220	SHELL TONA OIL T220	MOBIL VECRA OIL NO. 4	CASTROL MAGNA CF220
HL32	(TERESSO 43) TERESSO 32	(SHELL TELLUS OIL 125) SHELL TELLUS OIL C32	MOBIL DTE OIL LIGHT	CASTROL HYSPIN AWS32
HL68	(TERESSO 52) TERESSO 68	(SHELL TELLUS OIL 133) SHELL TELLUS OIL C68	MOBIL DTE OIL HEAVY MEDIUM	CASTROL HYSPIN AWS68
HM32	(NUTO HP44) NUTO HP32	(SHELL TELLUS OIL 25) SHELL TELLUS OIL 32	MOBIL DTE 24	CASTROL HYSPIN AWS32
HM68	(NUTO HP52) NUTO HP68	(SHELL TELLUS OIL 33) SHELL TELLUS OIL 68	MOBIL DTE 26	CASTROL HYSPIN AWS68
HG32	(POWEREX DP44) POWEREX DP32	(SHELL TONA OIL 25) SHELL TONA OIL T32	MOBIL VACUORIN OIL 1405	CASTROL MAGNA GC32
HG68	(POWEREX DP54) POWEREX DP68	(SHELL TONA OIL 33) SHELL TONA OIL T68	MOBIL VACUORIN OIL 1409	CASTROL MAGNA BD68

Maker / Symbol	ESSO	SHELL	MOBIL	CASTROL
XM 1	LITHTAN 1	SHELL ALVANIA GREASE NO. 1	MOBIL LUX EP1	CASTROL SROFILE AP1
XM 2	LITHTAN 2	SHELL ALVANIA GREASE NO. 2	MOBIL LUX 2	CASTROL SROFILE AP2

Notee (1) Top oil names are old products and bottom oil names are new ones.

(2) Grease types have not been changed.

(3) MOBIL's product names have not been changed.

5-5-2 Installation Procedures

(1) Removing the fixtures for shipment transportation

After installing the machine at a specified place, be sure to remove the fixtures for shipment transportation shown in Fig. 5-4:

① Fixture for the bed, columns and table
② Fixture for the column and power control panel
③ Fixture for the columns and ATC magazine stand
④ Fixture for the ATC magazine stand and ATC arm

For the operation panel ⑤, draw it out in an arrow direction (operator side) as far as a position where it does not interfere with table movements and the splash cover, and then, fix it there.

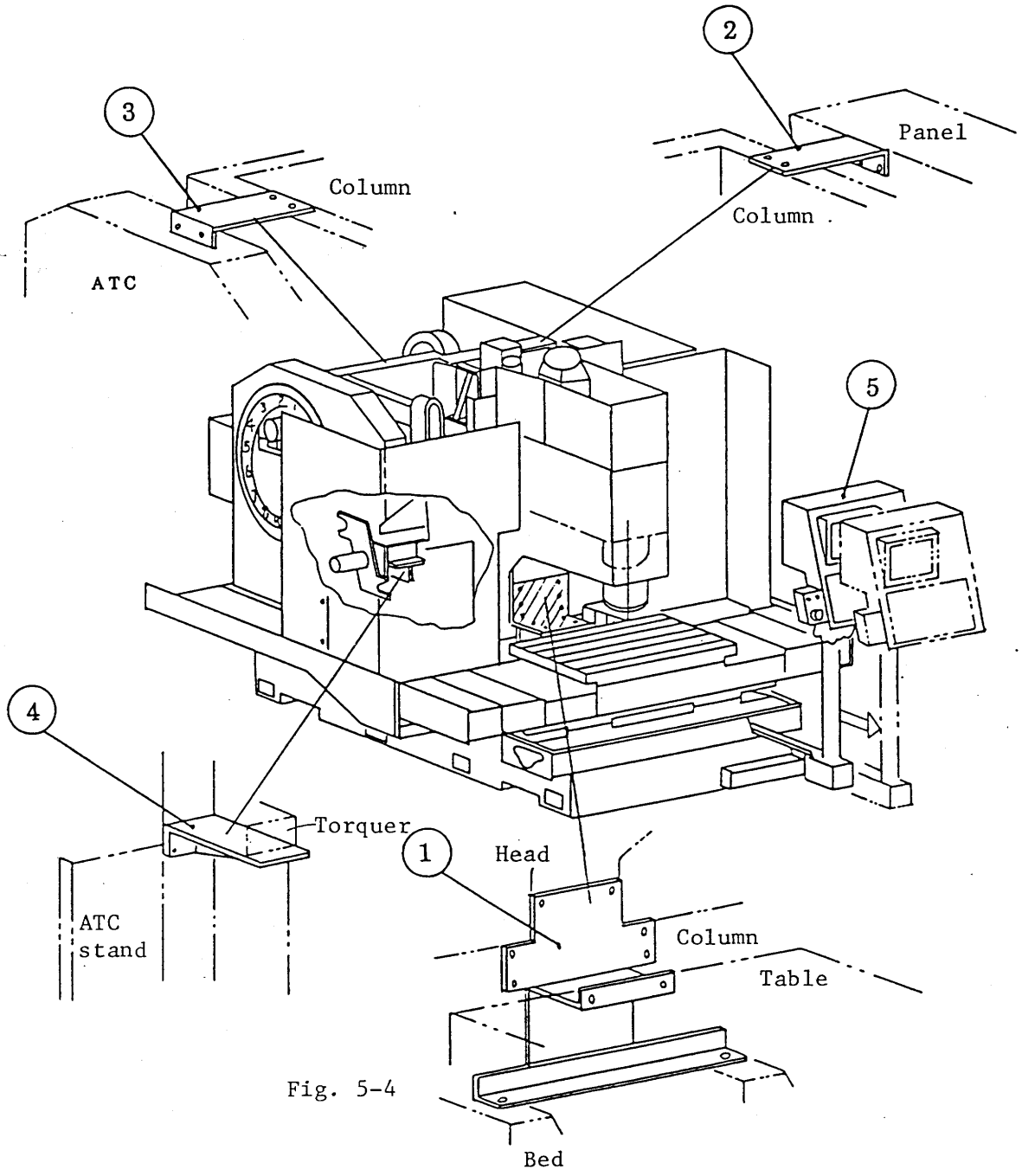


Fig. 5-4

(2) Installation

A leveling method is one of the factors which determine machine accuracy. Proper leveling of the machine is most fundamental. Carry it out carefully, because it affects not only machining accuracy, but also machine's service life.

First, put leveling pads at installation points on the floor. Install the machine so that the leveling adjust bolts attached to the machine legs will be placed on them. (Fig. 5-2)

Use precision levels whose sensitivity per graduation is about 0.02 mm/m (0.00025 in./ft.) and length is about 200 mm (8 in.). Levels used for woodworking/engineering are not recommendable.

Place the levels with the same end in the same direction.

Keep level-placing surfaces clean at any time lest dust, etc. should be caught under the levels.

Outline of Installation Work

① Adjusting the absolute level

As shown in Fig. 5-5(a), place levels on the table in parallel with the X and Y directions, and measure the level of the machine at 3 places in the X and Y directions, respectively. Adjust the level of the machine with the leveling bolts so that each difference in reading of the levels may be settled within 0.04 mm/m (0.0005 in./ft.) in both X and Y directions.

② Adjusting the table operating level

Place the levels at the center of the table and move the X axis almost over its full stroke. Make adjustment in such a way that each difference in reading of the levels at this time will meet within the following target values:

- For the level put in the X-axis direction: 0.04 mm/m (0.0005 in./ft.)
- For the level put in the Y-axis direction: 0.02 mm/m (0.00025 in./ft.)

③ Adjusting the column operating level

Move the spindle (Z axis) almost as far as the lower limit of its stroke and remove the cover above the spindle head.

As shown in Fig. 5-5(a), place the levels on the flat finished surface above the spindle head. Move the Y axis almost over its full stroke.

When this is done, measure each difference in reading of the levels in the X and Y directions respectively, and make adjustment so that the following target values are met.
Same procedure also applies when the levels are placed on the jig plate attached to the spindle (Fig. 5-5(b)).

- For the level put in the X-axis direction: 0.02 mm/m (0.00025 in./ft.)
- For the level put in the Y-axis direction: 0.04 mm/m (0.0005 in./ft.)

④ Reconfirm the above-mentioned steps ① through ③ and make fine adjustment, if necessary.

⑤ When the stable operating levels in ② and ③ cannot be obtained, it is likely that the condition of the floor, where the machine is installed, is improper. Check and improve it, referring to the foundation drawing. (Fig. 5-2)

Fig. 5-5(a)

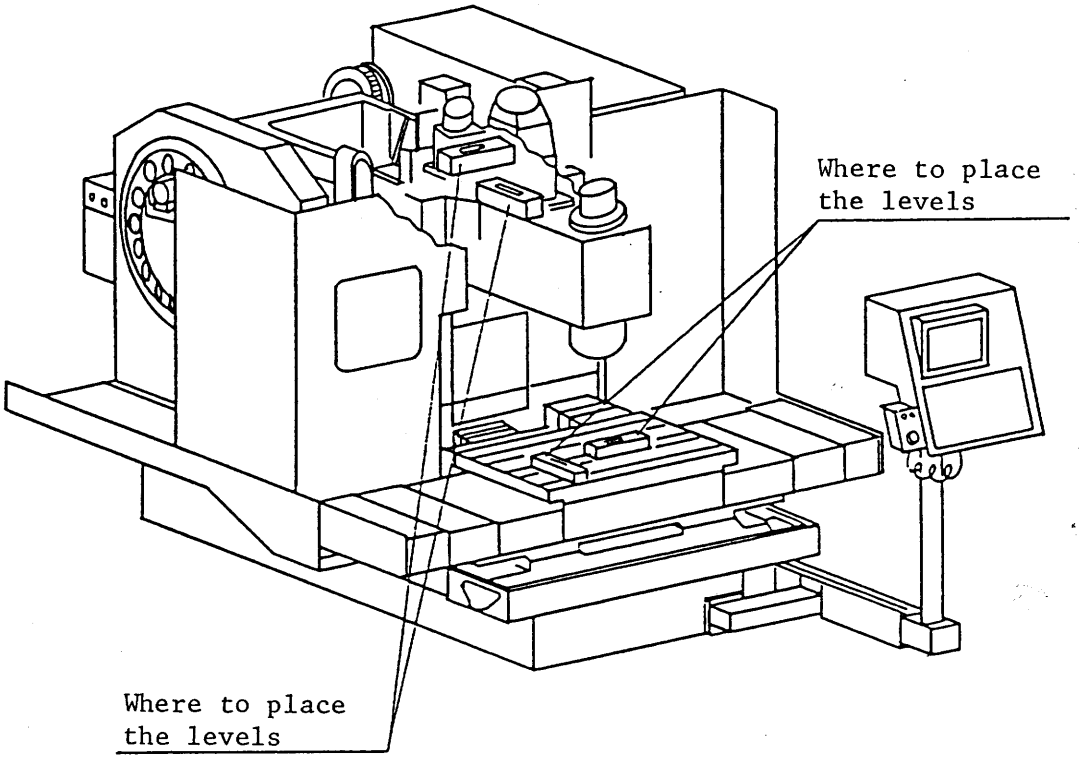
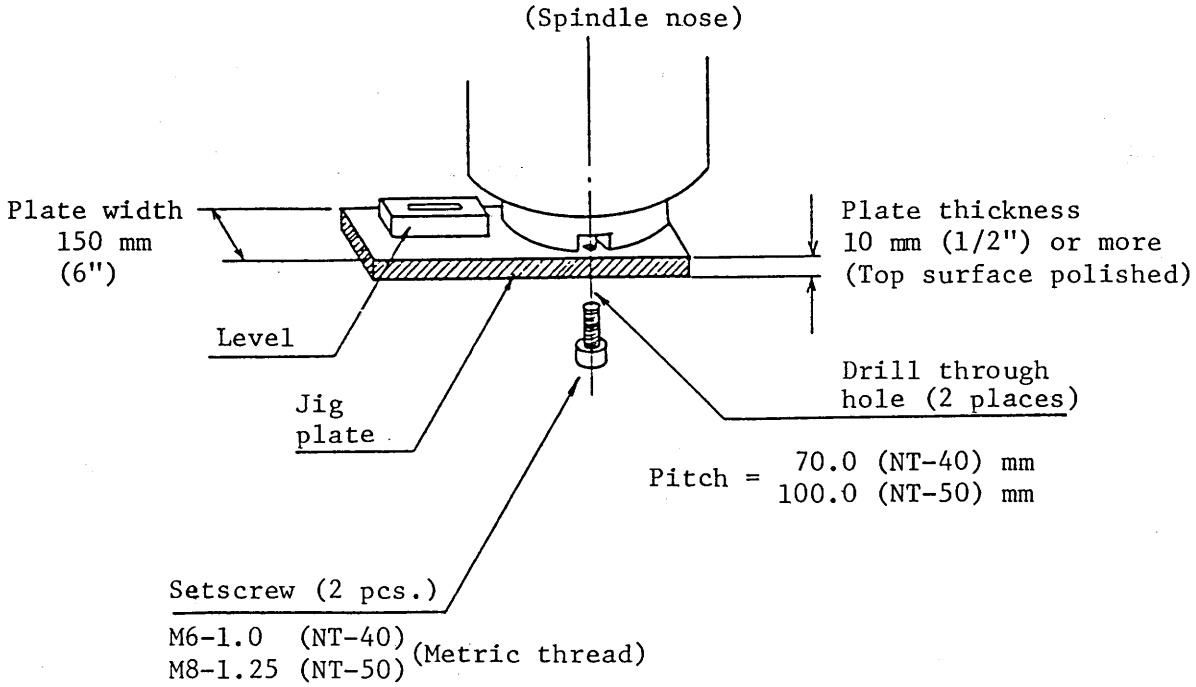


Fig. 5-5(b) When Using the Jig Plate (Measurement of Column Operating Level)

Caution !! Never run the spindle while using the jig plate.



6. INSPECTION AND ADJUSTMENT

6-1 Daily Inspection

The operator is supposed to do the following maintenance work.
To prevent a trouble and operate the machine efficiently, do not forget to check the following items.

6-1-1 Daily Inspection Items before Starting the Machine

(1) Whether or not an oil level in the lubricating oil tank is sufficient.

(2) Whether or not each operation panel has been cleaned.

(3) Whether or not there are any oil leaks or air leaks.

(4) Whether or not the spindle hole, tool magazine pot hole and ATC double arm's gripping part have been cleaned.

(5) Whether or not cutting chips have been removed from on the slideway cover.

(6) Whether or not a hydraulic pressure has been set to a proper value of 50 kg/cm^2 (720 $lbs/in.^2$).

(7) Whether or not a sufficient amount oil has been supplied to the hydraulic unit, gear box, etc.

(8) Whether or not the cooling fan for the control cabinet is running.

(9) Whether or not there are any abnormal sounds or vibrations.

(10) Whether or not any alarm messages are displayed on the CRT, such as a battery alarm, etc.

6-1-2 Monthly Inpsection Items

(1) Supply voltage check
Check whether or not a secondary voltage is within ±10% of a specified value. (200/220 V, 50/60 Hz)

(2) Cleaning of the cooling fans and fins inside and outside the power control cabinet

(3) Cleaning and lubrication of each part of the ATC arm

(4) Cleaning inside the coolant tank

6-1-3 Inspection Items Every 3 Months

(1) Measurement and compensation of machine backlash

(2) Measurement and correction of the machine level

(3) Looseness of screws for doors, covers and moving parts

6-1-4 Semiannual/Annual Inspection Items

(1) Replacement of hydraulic unit oil, cleaning inside the tank (oil amount: 40 ℓ (11 gallons)), and cleaning of the filter

(2) Replacement of spindle gear box oil (spindle head: 2 ℓ (0.6 gallon))

6-2 Remedy for Power Failure and Emergency Stop

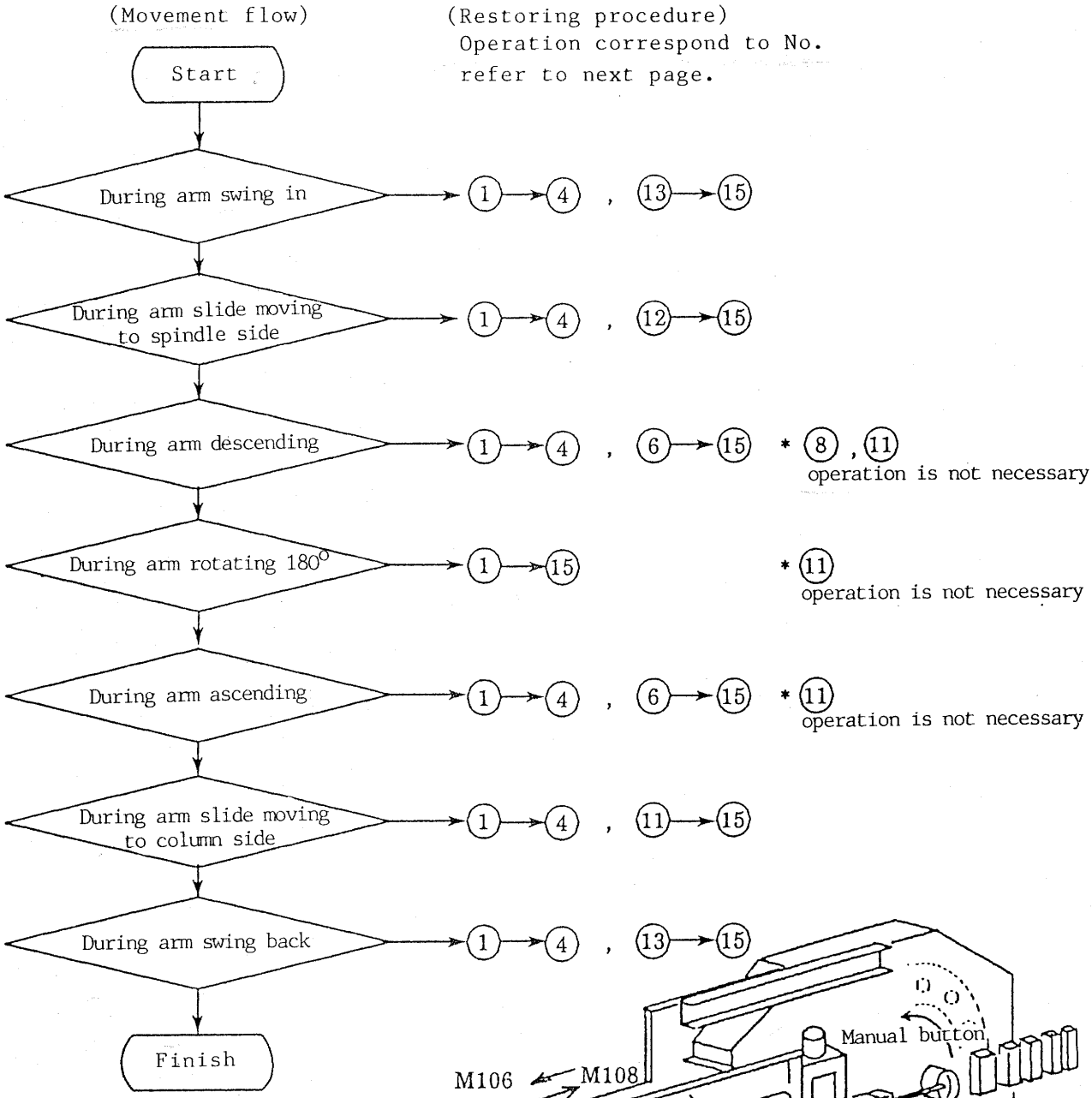
If a power failure or emergency stop occurs while operating the machine, not only machine (including the NC unit) operation enabling conditions are lost, but also almost all of storage and operation commands are cleared. Therefore, after restoring from a state of power failure or emergency stop, you must set the operation enabling conditions for the NC unit and machine in accordance with specified procedures.
Otherwise, you cannot operate the machine.
Be fully careful when you press the STANDBY button. Because, depending on a hydraulic circuit condition, the machine may move to complete an action which was suspended halfway due to the power failure.
When you restart machine operation in an automatic mode (MDI, MEMORY, TAPE), do so by the "program restart function" or from the beginning of the program after completely returning each axis to the reference point.

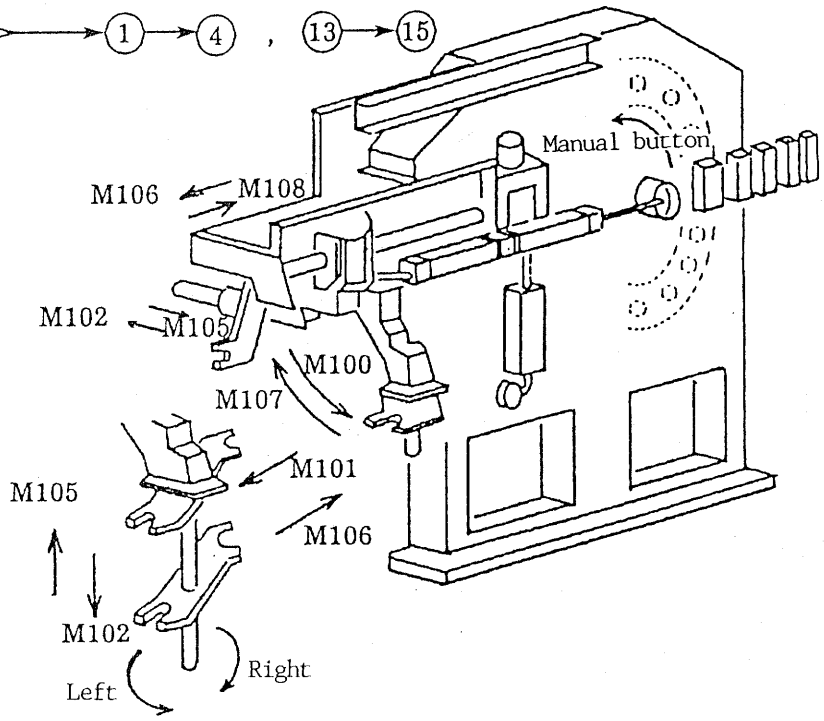
Treatment of ATC

(1) Restoring procedure of movement at spindle side is shown in the next page.

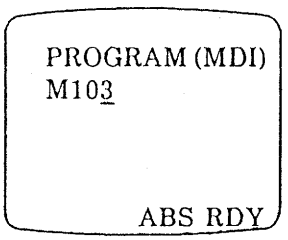
(2) Upon the movement at the magazine side refer to each movement and corresponding M function for tool calling and tool change in the page 4 - 31.

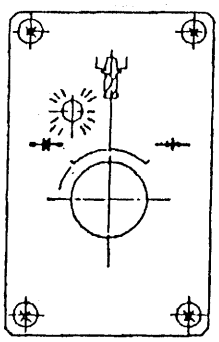
6-2-1 Restoring Procedure from Emergency Stop or Power Failure during ATC Movement





Restoring procedure from power failure or emergency stop during ATC movement

No.	Operation	Switch, Lamp
1	Turn on the NC power (Not necessary in a emergency).	
2	Press "STANDBY" button on the panel.	Melody horn sounds.
3	Turn on the "MAINT" switch in the cabinet.	
4	Shift the mode to MDI.	
5	Rotate W arm by key in [M][1][0][3] or [M][1][0][4] [INSRT] [START]. 	

No.	Operation	Switch, Lamp
6	Orientate the spindle by key in M 1 1 9 INSRT and START .	
7	Shift the mode to manual and make unclamp condition by selecting push button at front side of the spindle head.	
8	Shift the mode MDI and descend the arm by key in M 1 0 2 INSRT and START .	
9	Shift the mode to MDI and ascend the arm by key in M 1 0 5 INSRT and START .	
10	Shift the mode to manual and make clamp condi condition by selecting push button at front side of the spindle head.	
11	Shift the mode to MDI and move the arm to the spindle by key in M 1 0 1 INSRT and START .	
12	Shift the mode to MDI and move the arm to the column side (Direction apart from the spindle) by key in M 1 0 6 INSRT and START .	
13	Swing back the W arm by key in M 1 0 7 INSRT and START .	
14	Turn off the "MAINT" switch inside of the cabinet.	
15	Restore the condition immediate before the power failure or emergency stop.	

6-2-2 Measures to be Taken When Current Value of AB Phase Counter does not Correspond to Magazine Pot No. at Tool Change Position

In general, the current value of AB phase counter is corresponding to the magazine pot No. at the tool change position. However, it sometimes get different due to power failure during magazine rotation or a breakdown of the proximity switch for counting.

Upon such a time, the current value and the magazine pot No. at the tool change position have to be met togeter.

1) Check of current values

Depending upon the state of the NC general screen of SEICOS.

(1) [FRONT/BACK] ⟶ [F 4] : System ⟶ [6] : PC menu ⟶ [INPUT]

[1] [1] : When pressing the keys in order of the AB phase table and [INPUT], the following display appears. (It is when number of the magazine spot is 20. Check the xx value.)

AB phase table

No.	Ring counter	Current counter	Multiplier	Distance	Set status (BA)	Count status (BA)
1	20	××	1	0	00	00
2	0	0	0			
3						
4						
5						
6						
7						
8						
9						
0A						
0B						
0C						
0D						
0E						
0F						
10	0	0	0	0	00	00

2) Altoration of current values

(1) When the [F 9] : ALTER key in the status that the above screen appears, the "WRITE ENABLE SW ON!" : is displayed on the lower part of the screen. Turn ON (up side) the SW1 (Write enable switch) of the printed circuit boad in the control cabinet and the NC cabinet.

(2) Move the cursor to the position of No.1 current counter value by [→] [←] [↑] [↓] keys.

(3) Press the same numeric value key as the pot No. of the tool change position and press the [INPUT] key.

(4) Press the [F 10] : return key after the current counter value is entered. The "WRITE ENABLE SW OFF" is displayed on the lower part of the screen. Turn the SW1 (Write enable switch) OFF. The alteration is finished by the above procedures.

6-3 When the Call Light (Yellow Warning Lamp) is Lit Up (With SEICOS-MIII)

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.

6-3-1 Kinds of Alarms and Study and Measure of Causes of Obstacles

(See 7-1-3 Failure diagnosis and measure of MICON16-III as well.)

(1) Alarms related to the NC unit (NC alarm)

As the "ALARM NO." and the "ALARM MESSAGE" are displayed on the display screen, study the causes of alarms in accordance with the alarm lists in the instruction manual for "SEIKI-SEICOS MIII/A Instruction Manual (Maintenance Ed.)" and remove the obstacles.

(2) Alarms related to the equipment of the machine side and the PC control (machine alarm).

① Select the "PC" function by pressing the [FRONT/BACK] change-over button.

② Press the function key [F 3/TOOL] for the alarm diagnosis of the function menu on the display screen.

③ Search the causes of obstacles depending upon the contents of alarms and take measures for restoration.

(3) Battery alarms of the PC memory hold (battery alarm)

Refer to 7-1-4 Usual maintenance and check of MICON16-III.

Table 6-1 Machine alarm list(MICON-16II)

Alarm No. (Relay No.)	Conditions
2200	AC MOTOR OVERLOAD Over load on an AC motor
1	LUBRICATION OIL LACK Insufficient lubricant
2	SERVO AMP. OVER HEAT Over heat on a servo amplifier
3	SPINDLE LUBRICATION OIL PRESSURE LOW Insufficient lubricant pressure on the spindle
4	SPINDLE LUBRICATION PNEUMATIC PRESSURE LOW Insufficient air pressure on the spindle
5	GEAR CHANGE TOOL CLAMP ALARM Abnormality of tool clamp at gear shift
6	GEAR CHANGE ATC. ARM POSITION ALARM Abnormality of arm position ot gear shift.
7	GEAR CHANGE CYCLE TIME OVER Cycle time over at gear shift
2210	ORIENTATION TOOL CLAMP ALARM Abnormality of tool clamp at the spindle orientation
1	ORIENTATION ATC. ARM ALARM Abnormal position of ATC arm at the spindle orientation
2	ORIENTATION CYCLE TIME OVER Cycle time over at the spindle orientation
3	AUTO MODE ROTATION CHECK ALARM Rotation check alatm at auto mode
4	SPINDLE START CHECK ALARM Cycle time over at the spindle start
5	VDE. SPINDLE STOP ALARM VDE spindle stop
6	SPINDLE START S CODE ALARM No S-code at the spindle start
7	SPINDLE START ATC. ARM POSITION ALARM Abnormal position of ATC arm at the spindle start
2220	SPINDLE START TOOL CLAMP ALARM Abnormality of tool clamp at the spindle start
1	SPINDLE ROTATE ATC. ARM POSITION ALARM Abnormal position of ATC arm at the spindle rotation
2	SPINDLE ROTATE TOOL CLAMP ALARM Abnormality of tool clamp at the spindle rotation
3	MEASUREMENT SPINDLE SPEED OVER 1 Spindle over speed at measuring cycle 1
4	MEASUREMENT SPINDLE SPEED OVER 2 Spindle over speed at measuring cycle 2
5	MEASUREMENT AIR BLOW ALARM Abnormality of air blow at measuring cycle
6	SPINDLE DRIVE UNIT ALARM Abnormality of the spindle drive unit
7	LUBRICATION OIL PRESSURE LOW Insufficient pressure of lubricant

Alarm No. (Relay No.)	Conditions
2230	FIXTURE CLAMP ALARM Abnormality of fixture clamp
1	TOUCH SENSOR ALARM Abnormality of touch sensor
2	AIR PRESSURE LACK ALARM Insufficient air pressure
3	SOLID/DIRECT TAP COMMAND ALARM Abnormal command at solid/diyect tapping
4	FLAT CHIP CONVEYER OR MAGNET SEPARATOR OVERLOAD Over load of motor for flat chip converyor or magnet separator
5	READING TOOL NUMBER EXCESS ALARM Excessive number on calling tool
6	M06 START ALARM Abnormal start at M06
7	ATC. MAGAZINE INPOSITION ALARM Abnormal index of ATC magazine
2240	READING TF COMMAND, ATC. ARM POSITION ALARM Abnormal position of ATC arm at TF command
1	READING TF COMMAND, ATC. MAGAZINE POSITION ALARM Abnormal position ATC magazine at TF command
2	BACK TOOL MAGAZINE ROTATION TIME OVER Cycle time over at magazine index for returning tool
3	NEW TOOL MAGAZINE ROTATION TIME OVER Cycle time over at magazine index for new tool
4	MANUAL MAGAZINE ROTATION, ATC. ARM POSITION ALARM (LEFT SIDE) Abnormal position of ATC arm at manual index of magazine(left side)
5	READING TF COMMAND, ATC. CYCLE TIME OVER Cycle time over of ATC at TF command
6	READING M06 COMMAND, ATC. ARM POSITION ALARM Abnormal position of ATC arm at M06 command
7	READING M06 COMMAND, AXIS POSITION OF ATC. ALARM Abnormal position of ATC feed shaft at M06 command
2250	TOOL CLAMP TIME OVER Cycle time over at tool clamping
1	TOOL UNCLAMP TIME OVER Cycle time over at tool unclamping
2	ATC. ARM FORWARD TIME OVER Cycle time over at ATC arm forward
3	ATC. ARM RETRACT TIME OVER Cycle time over at ATC arm retract
4	ATC. ARM SWING TO SPINDLE SIDE TIME OVER Cycle time over at ATC arm swing in to the spindle side
5	ATC. ARM SWING BACK TIME OVER Cycle time over at ATC arm swing back
6	ATC. ARM SLIDE TO MAGAZINE SIDE TIME OVER Cycle time over at ATC arm slide to the magazine side
7	ATC. ARM SLIDE TO ORIGINAL POSITION TIME OVER Cycle time over at ATC arm slide to original position side

Alarm No. (Relay No.)	Conditions
2260	ATC. ARM GRASP SPINDLE TOOL TIME OVER Cycle time over at ATC arm slide to the spindle side
1	ATC. ARM TURN TIME OVER Cycle time over at ATC arm rotation
2	VDE. ATC. CYCLE STOP VDE ATC cycle stop
3	ATC. FUNCTION COMMAND CALCULATION ERROR Calculation error of ATC function command
4	ATC. NEGLECT PARAMETER ON No ATC parameter is set ON
5	TF START ALARM Abnormal start at TF
6	MANUAL MAGAZINE ROTATION, ATC. ARM POSITION ALARM (RIGHT SIDE) Abnormal position of ATC arm at manual index of the magazine(right side)
7	CALLING TOOL IN SPINDLE Spindle alarm on calling tool
2270	CYCLE TIME OVER Cycle time over
1	AC 100V BREAKER TRIP AC 100V breaker trip
2	SERVO POWER UNIT ALARM Abnormality of servo power unit
3	ATC. SEICOS LOCAL BUS FUSE OR 24V CUT OFF Fuse is blown for ATC SEICOS Local Bus or 24V
4	APC. SEICOS LOCAL BUS FUSE OR 24V CUT OFF Fuse is blown for ATC SEICOS Local Bus or 24V
5	SPINDLE FAN MOTOR OVER LOAD Over load of the spindle fan motor
6	SPINDLE COOLING UNIT START ALARM Abnormality at start of the spindle cooling unit
7	SPINDLE COOLING UNIT OIL PRESSUER LOW ALARM Insufficient pressure of the spindle cooling unit
2280	SERVO ALARM Servo alarm
1	TOOL BROKEN ALARM Tool breakage alarm
2	WARMING UP ALARM Abnormality at warming up
3	WARMING UP FUNCTION COMMAND CALCULATION ERROR Calculation error of command of warming up function
4	MEASUREMENT AIR BLOW FUNCTION COMMAND CALCULATION ERROR Calculation error of command of air blow function for measurement
5	N/C ALARM NC alarm
6	PANEL DISTRIBUTOR FUSE OR 24V CUT OFF Fuse is blown for panel distributor or 24V
7	PPL MAGAZINE INDEX COMMAND CONDITION ALARM Abnormal command condition of PPL magazine index

Alarm No. (Relay No.)	Conditions
2290	READING APC. COMMAND, AXIS POSITION ALARM Abnormal position of axis at APC command
1	READING APC. COMMAND, VDE. CONDITION ALARM VDE conditions are not ready at APC command
2	M60 PALLET CONDITION ALARM Abnormal pallet condition at M60 command
3	READING APC. COMMAND, APC. SLIDER POSITION ALARM Abnormal position os slider at APC command
4	READING APC. COMMAND, PALLET TURN POSITION ALARM Abnormal rotary position of pallet at APC command
5	APC. CYCLE TIME OVER Cycle time over at APC
6	APC. PALLET FITTING ALARM Inadequate fitness of pallet
7	CUTTING MONITOR ALARM Abnormality of cutting monitor
22A0	ATC (2). SEICOS LOCAL BUS FUSE OR 24V CUT OFF Fuse is blown for ATC (2) SEICOS Local Bus or 24V
1	PPL SEICOS LOCAL BUS FUSE OR 24V CUT OFF Fuse is blown for PPL SEICOS Local Bus or 24V
2	NO OPTION
3	M60 START CONDITION NOT READY Start condition is not ready for M60
4	PPL HYD. PUMP OVERLOAD Over load on hydraulic motor for PPL
5	AB PHASE ALARM Abnormality of AB phase condition
6	MANUAL DOOR INTERLOCK ALARM Abnormality of manual door interlock at M60 command
7	M60 TRANSFER NOT READY Transfer condition is not ready for M60.
22B0	OVER TRAVEL +X (RELEASE BY −X JOG FEED) Over travel at +X (can be released by jog feed -X)
1	OVER TRAVEL −X (RELEASE BY +X JOG FEED) Over travel at -X (can be released by jog feed +X)
2	OVER TRAVEL +Y (RELEASE BY −Y JOG FEED) Over travel at +Y (can be released by jog feed -Y)
3	OVER TRAVEL −Y (RELEASE BY +Y JOG FEED) Over travel at -Y (can be released by jog feed +Y)
4	OVER TRAVEL +Z (RELEASE BY −Z JOG FEED) Over travel at +Z (can be released by jog feed -Z)
5	OVER TRAVEL −Z (RELEASE BY +Z JOG FEED) Over travel at -Z (can be released by jog feed +Z)
6	PROGRAM NO. ZERO OR MORE THAN 16 (F/0) Inadequate input of program No. (zero or more than 16)
7	N/C UNIT SELECT ERROR Inadequate selection of NC unit

6-4 Parameters

Parameters are an important factor for determining the characteristics and functions of the machine.
The parameters are used for characterizing standard specifications and optional specifications, selecting specifications and functions in detail, and determining the capabilities of relevant functions and processing procedures.

6-4-1 Types of Parameter and Their Description

(1) NC parameters

Refer to Table 6-3 "List of NC Parameters".
Detailed description is provided in the Instruction Manual for the NC Unit.

(2) PC parameters

Refer to Table 6-4 "List of PC Parameters".
Detailed description and respective setting values are provided in chapter 7.

6-4-2 Parameter Handling

Since respective parameter values (data) set by a machine's manufacturer, the user does not have to modity them, unless there is a special reason to do so. (excluding a user macro area and a backlash/pitch error compensation area)
Lists of actual NC/PC parameter values (setting data) are packed with the machine upon shipment. Store them carefully for later maintenance.

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

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

Parameter	7	6	5	4	3	2	1	Bit 0
No. F25C	APC	Completion call	Alarm	M27	M26	M30	M02	Ready
	1/0	1/0	1/0	1/0	1/0	1/0	1/0	1/0

0 : Enabled 1 : Disabled

(3) Melody horn can be turned off by pressing the CALL LIGHT OFF button and PROGRAM START button.

(4) Adjust a volume with the control knob (VR) on the melody horn PCB.

(5) A playing time can be altered by the PC timer No. 48. (12 seconds as standard)

(6) IC mounting positions on the PCB

Position		IC name	Numbers
IC1	——	7910CS	(Amaryllis, #40 by Mozart)
IC2	——	7910CE	(Nocturne, Menuette)
IC3	——	7910CF	(Für Eliese, La Priére)

PiPiPi and Bin-Bon are provided in addition to the ICs above.

(7) Alteration of parameter setting for the melody horn

① [FRONT/BACK] → [F 4] : System → [6] : PC menu [INPUT]
[8] : 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
F 2F0	XXXXXXXX
1	
2	
3	
4	
5	
6	
7	
8	
9	
A	
B	
C	
D	
E	
F	

XXXXXXXX= (YYYYYYYY)

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 F25C 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.

(8) Alteration of the timer setting for melody horn

① [FRONT/BACK] → [F 4] : System → [6] : PC menu [INPUT]
[1] [0] : Press in order of the system timer [INPUT] .
The timer screen 1/16 is displayed. Set the below screen in page 2/16 by [P⇩] ([P⇧]) .

2/16

Timer (Unit S: 0.1 second, M: 0.1 minute H: 0.001 second)

No.	Unit	Setting	Remaining time	UP	No.	Unit	Setting	Remaining time	UP
40	X	YYYY			60	X	YYYY		
1					1				
2					2				
3					3				
4					4				
5					5				
6					6				
7					7				
50					70				
1					1				
2					2				
3					3				
4					4				
5					5				
6					6				
7					7				

② [F 9] : Pree the ALTER key. The character 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 LSPC printed circuit board in the NC cabinet.

④ Move the cursor to the UNIT of No.57, SETTING by [↑] [↓] [→] [←] keys, and when wanting to alter from 12 seconds to 10 seconds:
Press the keys for juding the [S] [INPUT] at the place of UNIT and the [1] [0] [0] [INPUT] at the place of setting.

⑤ Press the [RETURN] key. The characters of the "WRITE ENABLE SW OFF!" is displayed. Turn the SW1 OFF. The alteration is finished by the above procedures.

Table of PC system parameter

No.	Setting	Setting status	Contents
1	20	00100000	Limit of alarm message
2	F2	11110010	Leading address : F220
3	0C	00001100	Limit of alarm message
4	00	00000000	Bit number : C(Hex)
5	50	01010000	Limit of bit table
6	F2	11110010	Leading address : F250
7	10	00010000	Limit of bit table
8	00	00000000	Bit number : 10(Hex)
9	00	00000000	Limit od back up (latch)
10	F2	11110010	Leading address : F200
11	10	00010000	Limit of back up (latch)
12	00	00000000	Bit number :10(Hex)

Table of word #1 (sexadecimal)

JOG feedrate setting

No.	Address	Setting data	Rotary SW POS	Rotary SW Feedrate (mm/min)	Data of left column Decimal →Sexadecimal
1	D000	FFFF	0	0	0
2	2	FFFA	1	5	5
3	4	FFF5	2	10	A
4	6	FFF1	3	14	E
5	8	FFFB	4	20	14
6	A	FFDA	5	37	25
7	C	FFCB	6	52	34
8	E	FFB7	7	72	48
9	D010	FF9B	8	100	64
10	2	FF73	9	140	8C
11	4	FF37	10	200	C8
12	6	FEF1	11	270	10E
13	8	FE8D	12	370	172
14	A	FDF7	13	520	208
15	C	FD2F	14	720	2D0
16	E	FC17	15	1000	3E8
17	D020	FA87	16	1400	578
18	2	F82F	17	2000	7D0
19	4	F573	18	2700	A8C
20	6	F18B	19	3700	E74
21	8	EC77	20	5000	1388

① Standard JOG feedrate of NC will be 1000(mm/min).
PRM No.

② Set the turgat speed of data from decimal to sexadecimal and make the complement of that figure.

③ When confirming the data, sometime it shows a decimal figure. Please convent from decimal to sexadecimal and refer it.

Table of word #2 (decimal)

No.	(Address)	Setting data	Contents
1	D030		Tool No. in spindle
2	2		Tool No. at standby
3	4		Reading T number
4	6		Call position of magazine
5	8		
6	A		
7	C		
8	E		
9	D040		Warm up speed of spindle
10	2		Warm up speed of spindle
11	4		Maximum spindle speed
12	6		Maximum spindle speed
13	8		Maximum spindle speed in low range
14	A		Spindle shift speed Conversion factor 40 rpm.
15	C		S-code constant
16	E		Maximum rpm. on air supply of measurment
17	D050		Program number of warm up
18	2		Program number of evacuation (for tapping)
19	4		Program number of evacuation (other than tapping)
20	6		Low speed data for Renishaw
21	8		High speed data for Renishaw
22	A		Display of rotation data
23	C		
24	E		Calling pot number

Table of woed #3 (decimal)

Nozzle control

No.	(Address)	Setting data	Contents
1	D080		Present value of nozzle position
2	2		Command value of nozzle position
3	4		Backlash compensation value nozzle
4	6		M270 Target value of nozzle position
5	8		M271 Target value of nozzle position
6	A		M272 Target value of nozzle position
7	C		M273 Target value of nozzle position
8	E		M274 Target value of nozzle position
9	D090		M275 Target value of nozzle position
10	2		M276 Target value of nozzle position
11	4		M277 Target value of nozzle position
12	6		M278 Target value of nozzle position
13	8		M279 Target value of nozzle position

Setting screen for SLBUS table

No.	LOC#	Type	Slave name	Classi-fi-cation	Leading CH Baffer	CH No. Size	High speed bit		Bit number		Address	
							Input	Output	Input	Output	Input	Output
01	01	1	OPIO-MC	I/O	00	00	00	00	10	0D10	F0	F0
02	02	0	PANEL	I/O	00	00	02	00	0C	07	00	00
03	03	0	ATC	I/O+AB	01	01	00	00	03	03	0C	12
04	(04)	0	ATC2	I/O+AB								
05	(05)	0	APC	I/O	00	00	00	00	03	02	0F	16
06	(06)	0	PPL	I/O+AB	04	04	00	00	06	06	15	26
07	(08)	0	KEISOKU	I/O	00	00	00	00	01	00	20	00
08	(0B)	0	MPG-3	I/O	00	00	00	00	04	01	1B	37
09	(0C)	0	ADD AXIS	I/O	00	00	00	00	02	00	1E	00
10	(0D)	0	ROT TABL	I/O+AB	02	02	02	02	02	02	23	83
11	(07)	0	KANSHI	A/D	01	01	00	00	00	00	00	00
12	FF											
13	FF											
14	FF											
15	FF											
16	FF											

Note) Shown with ( ) in LOC# column are option.
Set 00 when option is not selected.

Table of phase AB

	*	**	*		*		
No.	Ring counter	Current counter	Multiplier	Diatance	Setting statue (BA)	Current status (BA)	
01					00		(ATC)
02							(ROT. TAP)
03							
04							(PPL)
05							
06							
07							
08							

Note) (1) Items with mark * are fixed by setting.

(2) Items with mark ** are changed by machine movement after setting.

PARAMETER TABLE

NO.	7	6	5	4	3	2	1	0 bit	ADDRESS
1									F250- F250

bit	data	CONTENTS	NC
0	0		
	1		
1	0		
	1		
2	0		
	1		
3	0		
	1		
4	0		
	1		
5	0		
	1		
6	0		
	1		
7	0		
	1		

PARAMETER TABLE

NO.	7 6 5 4 3 2 1 0 bit	ADDRESS
2		F251- / F251

bit	data	CONTENTS	NC
0	0	Rotation of spindle at manual start is forward	
	1	Rotation of spindle at manual start is reverse	
1	0	Direction of spindle motor is forward	
	1	Direction of spindle motor is reverse	
2	0	Direction of spindle motor is forward	
	1	Direction of spindle motor is reverse	
3	0	Spindle speed override, provided	
	1	Spindle speed override, not provided	
4	0	Detection of M70 cycle time over, not provided	
	1	Detection of M70 cycle time over, provided	
5	0	Detection of M71 cycle time over, not provided	
	1	Detection of M71 cycle time over, provided	
6	0	Detection of M72 cycle time over, not provided	
	1	Detection of M72 cycle time over, provided	
7	0	Detection of M73 cycle time over, not provided	
	1	Detection of M73 cycle time over, provided	

PARAMETER TABLE

NO.	7	6	5	4	3	2	1	0 bit	ADDRESS
3									F252- F252

bit	data	CONTENTS	NC
0	0	Coolant off by M05, ineffective	
	1	Coolant off by M05, effective	
1	0	Oil mist, needle and one shot coolant, not provided	
	1	Oil mist, needle and one shot coolant, provided	
2	0	One shot mist start with axis movement simultaneously, not provided	
	1	One shot mist start with axis movement simultaneously, provided	
3	0		
	1		
4	0		
	1		
5	0	M codes for additional axis clamp and unclamp are M78 and M79	
	1	M codes for additional axis clamp and unclamp are M68 and M69	
6	0	Internal completion by M75	
	1	External completion by M75 (for Valenite)	
7	0	Y02.0 Air blow for detector by M40 and M41	
	1	Y02.0 Air blow for cutting edge by M80 and M09	

PARAMETER TABLE

NO.	7 6 5 4 3 2 1 0 bit	ADDRESS
4		F253-
		F253

bit	data	CONTENTS	NC
0	0	Turn on program stop light at program end, ineffective	
	1	Turn on program stop light at program end, effective	
1	0	Pause of coolant, ineffective	
	1	Pause of coolant, effective	
2	0	Pause of coolant (for VDE), ineffective	
	1	Pause of coolant (for VDE), effective	
3	0	Energy saving timer for gun coolant, not provided	
	1	Energy saving timer for gun coolant, provided	
4	0	Chip conveyor, individual motion	
	1	Chip conveyor, simultaneous motion	
5	0	Flat chip conveyor, continuous motion	
	1	Flat chip conveyor, interrupted motion	
6	0	Chip conveyor stop by M02, M30, ineffective	
	1	Chip conveyor stop by M02, M03, effective	
7	0	Completion of M00, M01 at cycle start	
	1	Completion of M00, M01 after pause	

PARAMETER TABLE

NO.	7	6	5	4	3	2	1	0 bit	ADDRESS
5									F254- F254

bit	data	CONTENTS	NC
0	0	APC selection (refer to other table)	
	1	PPL selection (refer to other table)	
1	0	Pallet fit confirmation for APC, PPL, not provided	
	1	Pallet fit confirmation for APC, PPL, provided	
2	0		
	1		
3	0	APC selection (refer to other table)	
	1	PPL selection (refer to other table)	
4	0	Unclamp by 4th axis energizing (SOL)	
	1	Clamp by 4th axis energizing	
5	0	APC selection (refer to other table)	
	1	PPL selection (refer to other table)	
6	0		
	1		
7	0	Prohibition of screen change for alarm, not provided (at test mode)	
	1	Prohibition of screen change for alarm, provided	

PARAMETER TABLE

NO.	7	6	5	4	3	2	1	0 bit	ADDRESS
6									F255-
									F255

bit	data	CONTENTS	NC
0	0		
	1		
1	0		
	1		
2	0		
	1		
3	0		
	1		
4	0		
	1		
5	0		
	1		
6	0		
	1		
7	0		
	1		

PARAMETER TABLE

NO.	7 6 5 4 3 2 1 0 bit	ADDRESS
7		F256- F256

bit	data	CONTENTS	NC
0	0	Dual spindle specification, not provided	
	1	Dual spindle specification, provided	
1	0	Arbitrary rotation of ATC magazine, not provided	
	1	Arbitrary rotation of ATC magazine, provided	
2	0	Spindle alarm for call tool, provided	
	1	Spindle alarm call tool, not provided	
3	0	Pause at ATC single motion, provided	
	1	Pause at ATC single motion, not provided	
4	0		
	1		
5	0		
	1		
6	0		
	1		
7	0		
	1		

PARAMETER TABLE

NO.	7	6	5	4	3	2	1	0 bit	ADDRESS
8									F257-
									F257

bit	data	CONTENTS	NC
0	0		
	1		
1	0		
	1		
2	0		
	1		
3	0	Direct tapping, not provided (MITSUBISH)	
	1	Direct tapping, provided	
4	0	Old amplifier for WACO touch sensor	
	1	New amplifier for WACO touch sensor	
5	0		
	1		
6	0		
	1		
7	0	Gear change for spindle, provided	
	1	Gear change for spindle, not provided	

PARAMETER TABLE

NO.	7 6 5 4 3 2 1 0 bit	ADDRESS
9		F258- F258

bit	data	CONTENTS	NC
0	0	Orientation at maintenance mode, reguired	
	1	Orientation at maintenance mode, ignored	
1	0		
	1		
2	0		
	1		
3	0		
	1		
4	0		
	1		
5	0	Status display, provided	
	1	Status display, not provided	
6	0		
	1		
7	0		
	1		

PARAMETER TABLE

NO.	7	6	5	4	3	2	1	0 bit	ADDRESS
10									F259- F259

bit	data	CONTENTS			NC
0	0	NC unit	2 1 0		
	1	NC unit	0 0 0	SEICOS	
1	0	NC unit			
	1	NC unit			
2	0	NC unit			
	1	NC unit			
3	0				
	1				
4	0				
	1				
5	0				
	1				
6	0				
	1				
7	0				
	1				

PARAMETER TABLE

NO.	7	6	5	4	3	2	1	0 bit	ADDRESS
11									F25A-
									F25A

bit	data	CONTENTS	NC
0	0	Work setter, safe guard, override memory, completion notice, provided	
	1	Work setter, safe guard, override memory, completion notice, not provided	
1	0	Additional optional block skip, not provided	
	1	Additional optional block skip, provided	
2	0	Block restart, not provided	
	1	Block restart, provided	
3	0	Door, not provided	
	1	Door, provided	
4	0	Work light, provided	
	1	Work light, not provided	
5	0	Oil hole coolant, not provided	
	1	Oil hole coolant, provided	
6	0	Oil mist, not provided	
	1	Oil mist, provided	
7	0	Gun coolant, not provided	
	1	Gun coolant, provided	

PARAMETER TABLE

NO.	7 6 5 4 3 2 1 0 bit	ADDRESS
12		F25B- F25B

bit	data	CONTENTS	NC
0	0	Jet coolant, not provided	
	1	Jet coolant, provided	
1	0		
	1		
2	0	Set point, not provided	
	1	Set point, provided	
3	0	Program restart, not provided	
	1	Program restart, provided	
4	0		
	1		
5	0		
	1		
6	0		
	1		
7	0		
	1		

PARAMETER TABLE

NO.	7 6 5 4 3 2 1 0 bit	ADDRESS
13		F25C- F25C

bit	data	CONTENTS	NC
0	0	Melody horn at machine ready, not provided	
	1	Melody horn at machine ready, provided	
1	0	Melody horn by M02, not provided	
	1	Melody horn by M02, provided	
2	0	Melody horn by M30, not provided	
	1	Melody horn by M30, provided	
3	0	Melody horn by M26, not provided	
	1	Melody horn by M26, provided	
4	0	Melody horn by M27, not provided	
	1	Melody horm by M27, provided	
5	0	Melody horn by alarm, not provided	
	1	Melody horn by alarm, provided	
6	0	Melody horn by completion notice, not provided	
	1	Melody horn by completion notice, provided	
7	0	Melody horn while transfering of APC, PPL, not provided	
	1	Melody horm while transfering of APC, PPL, provided	

PARAMETER TABLE

NO.	7	6	5	4	3	2	1	0 bit	ADDRESS
14									F25D- F25D

bit	data	CONTENTS	NC
0	0		
	1		
1	0	Screw conveyor, provided	
	1	Screw conveyor, not provided	
2	0		
	1		
3	0		
	1		
4	0		
	1		
5	0		
	1		
6	0		
	1		
7	0		
	1		

PARAMETER TABLE

NO.	7 6 5 4 3 2 1 0 bit	ADDRESS
15		F25E- F25E

bit	data	CONTENTS	NC
0	0		
	1		
1	0		
	1		
2	0	External reset by M02 (Heading of memory)	
	1	FIN by M02	
3	0		
	1		
4	0		
	1		
5	0		
	1		
6	0		
	1		
7	0		
	1		

PARAMETER

7	6	5	4	3	2	1	0 bit

ADDRESS

F207-
F207

ラッチエリア使用

bit	data	CONTENTS	NC
0	0		
	1		
1	0		
	1		
2	0		
	1		
3	0	Detection PS for insufficient air pressure, not provided	
	1	Detection PS for insufficient air pressure, provided	
4	0		
	1		
5	0	Remote maintenance alarm A, ineffective	
	1	Remote maintenance alarm A, effective	
6	0	Remote maintenance alarm B, ineffective	
	1	Remote maintenance alarm B, effective	
7	0	Remote maintenance alarm C, ineffective	
	1	Remote maintenance alarm C, effective	

7. REFERENCE DATA FOR MAINTENANCE AND ADJUSTMENT

- This chapter mainly covers data necessary for the maintenance and the adjustment, whose important points are further explained.
- As for detailed operations and adjustments, either refer to the instruction manual separately available or contact our service department.
- All inquiries on the parts of equipment concerned are kindly requested to be made directly to Service Dept. of HITACHI SEIKI.

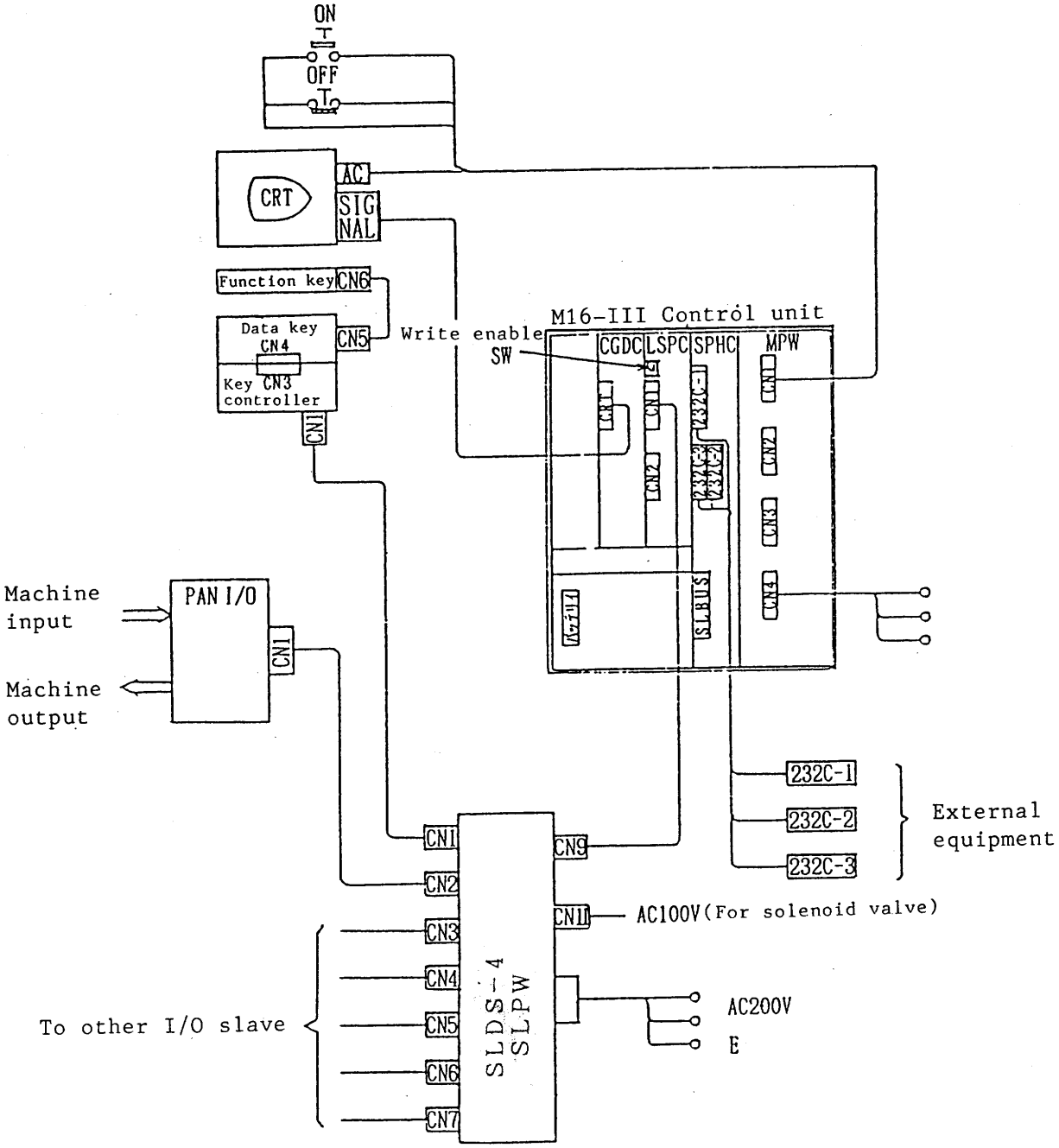
7-1 Sequence Controller MICON16-II

7-1-1 System Construction

M16-III consists of a control unit, a screen key board, a SLBUS distibutor (SLDS-4) and an I/O slave. Max. 31 sets of I/O slaves can be mounted. A key board is regarded as 1 set of I/O slave and monopolize the location No.31.

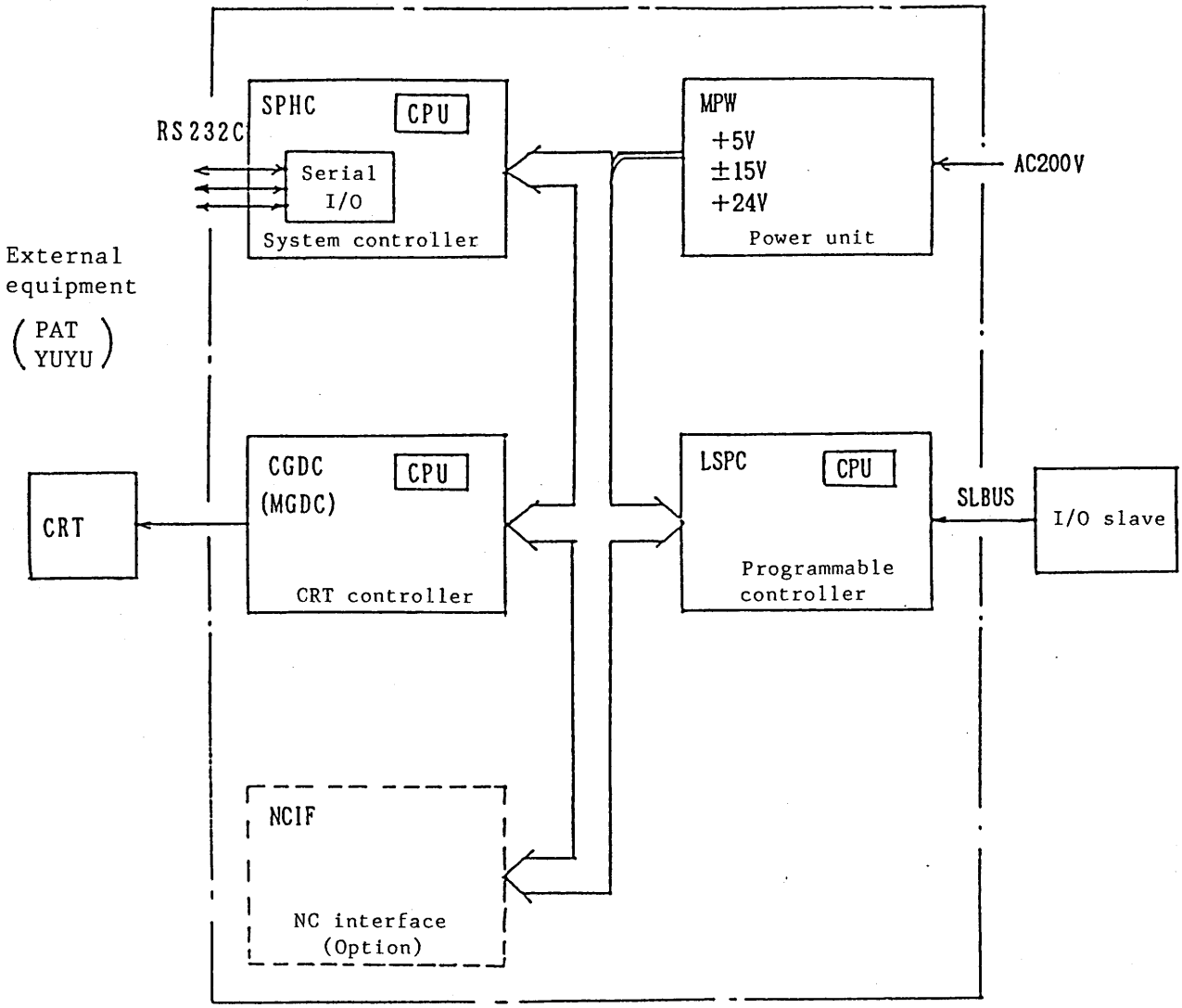
Accordingly, 1 ~ 30 can be allocated to general I/O slave.

The following diagram shows the construction of M16-III system.



1) Inner systematic diagram

The unit construction block diagram of the control unit is shown in the below.



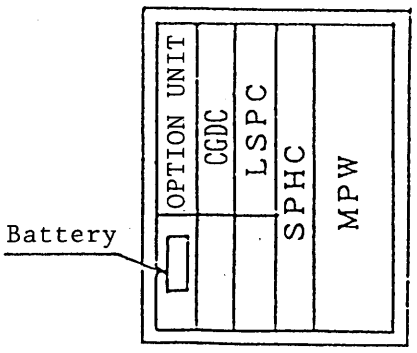
2) List of the construction units

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		Optional unit for 1 slot
Power unit	MPW	5V, +15V, -15V, 24V
System control unit	SPHC	System Peripheral equipment control
PC unit	LSPC	Ladder program control
Colour graphic unit	CGDC	Colour graphic display

(2) Actual installation diagram of units

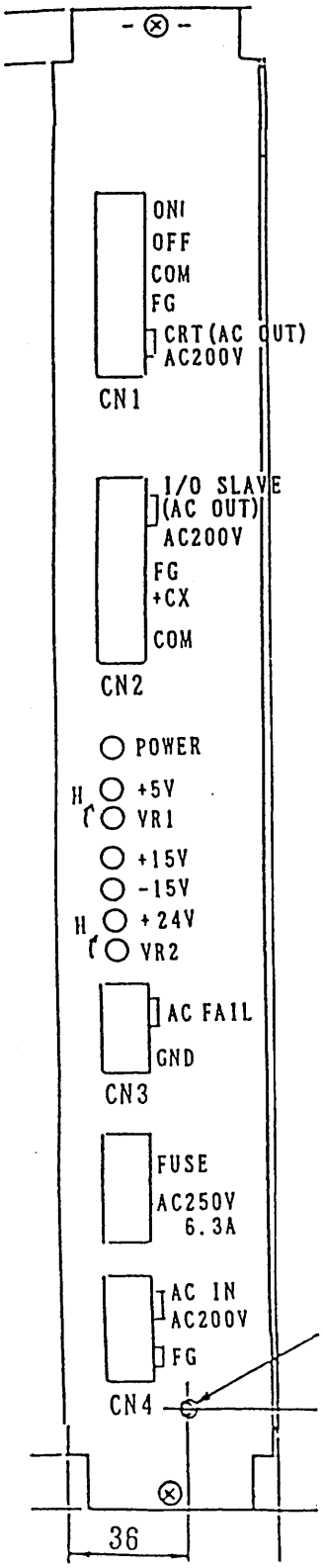


7-1-2 Function of the Control Unit and Its Handling

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



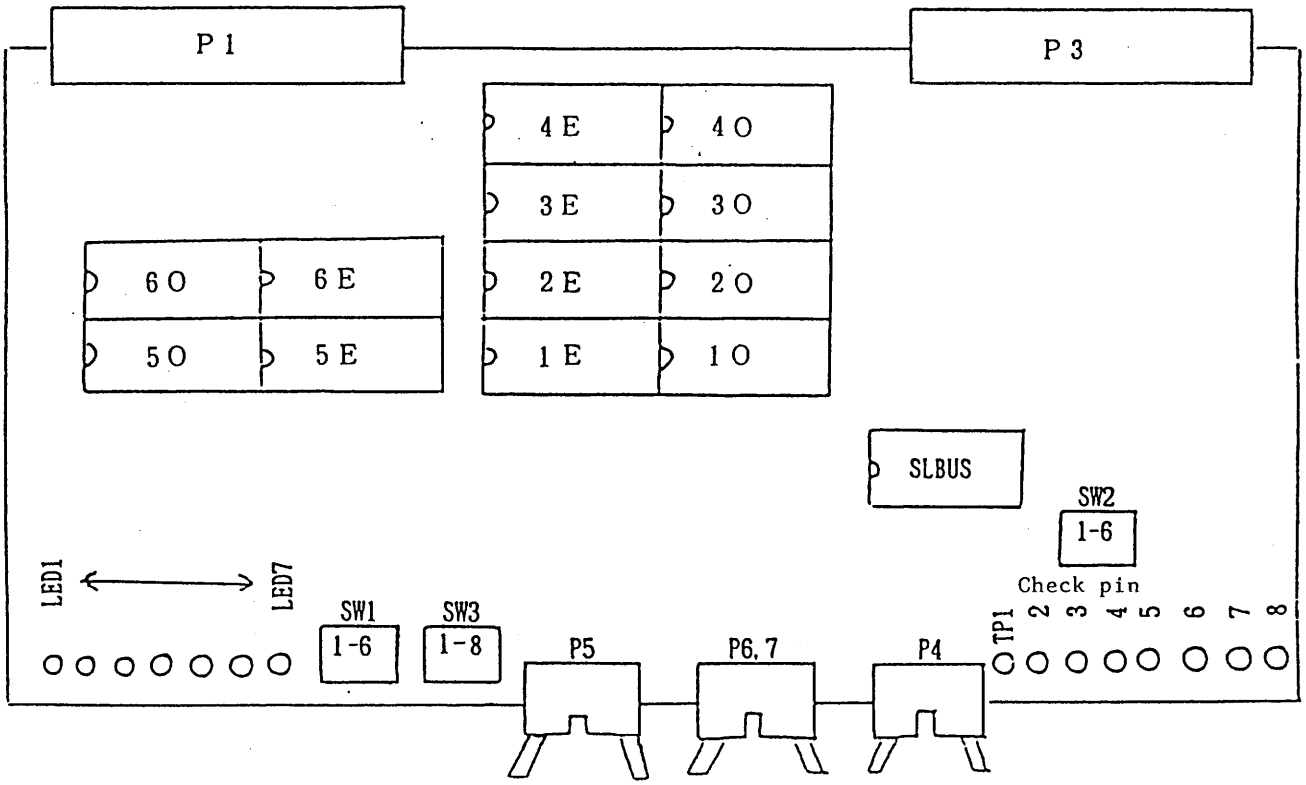
Item		CH1	CH2	Ch3	CH4
Rated voltage		5V	15V	-15V	24V
Rated current		3 ~ 30A	0.1 ~ 1A	0.1 ~ 1A	0.1~1A
Ripple voltage (P-P)		50mV	150mV	150mv	250mV
Overall variation		±100mV	±450mV	±450mV	±840mV
Over current protaction	Method	Pendency intermit tent	フ character	フ character	フ character
	Operating value	32A ~	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 boaed CH3 (Substrate)

2)-2 Check pin

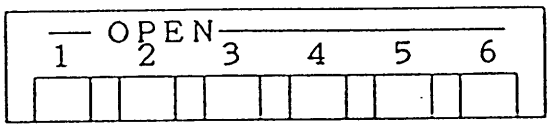
Sign	Name	Contents
TP1	G	Logic ground (Black)
2	+5V	Logic power supply 5V
3	+12V	RS232C driver power supply +12V
4	-12V	RS232C driver supply -12V
5	+24V	General I/O power supply 24V (Main board in not used)
6	TP	SLBUS signal (+)
7	TN	SLBUS signal (-)
8	TEX	SLBUS transmit/receive inverting signal H : Transmission L : Receive

2)-3 LED indicator

Sign	Name	Colour	Contents
LED1	RDY	G	Light up at nomal
2	RUN	G	Light up at CUP RUN
3	SLBUS	G	Flicker at SLBUS communication
4	FAIL	R	Light up at board abnormal
5	WDT1	R	Light up at watch dig timer time out
6	PERR	R	Light up at system RAM battery error
7	BAT	R	Light up at battery voltage down (under 2.8V)

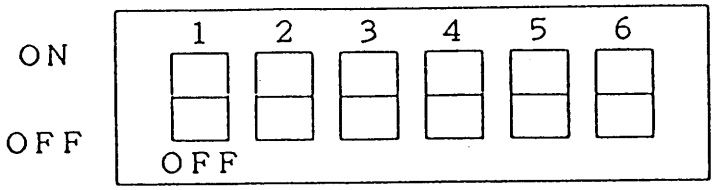
2)-4 Setting of the dip switch

(1) SW1 ..... Setting of the system start-up mode



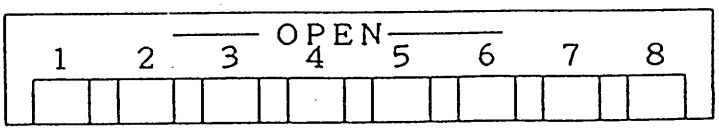
Bit	Contents	Setting at ROM mode
1	System start-up mode designation	Closed
2	DOS start-up ..... Open by all 1, 2 and 3 bits	Open
3	ROM start-up ..... Closed by 1 bit only	Open
4	DOS start-up mode designation	Open
5	System console data format designation	Open
6	Not used	Open

(2) SW2 ..... SLBUS mode setting



Bit	ON	OFF	Std.
1			OFF
2			OFF
3			OFF
4			OFF
5			OFF
6			OFF

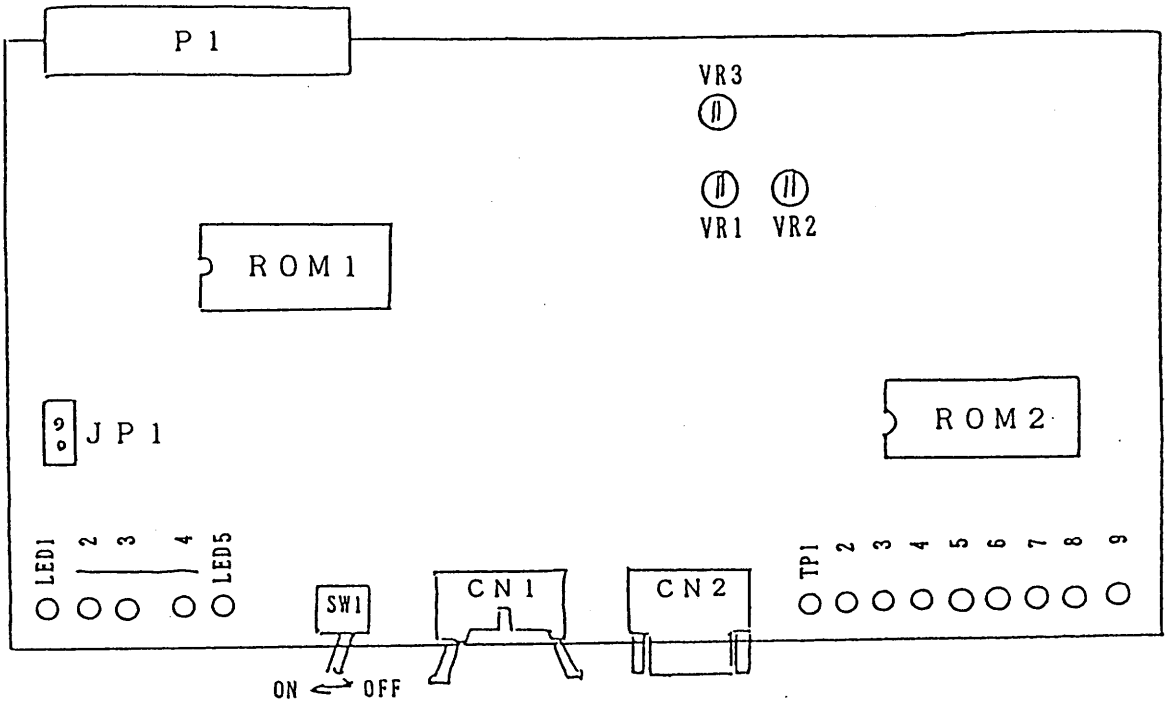
(3) SW3 ..... System mode setting



Bit	Contents	
	Open	Closed
1		
2		
3		
4		
5		
6		
7		
8	S-III mode	M16-III mode

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	(G)	Light up at nomal
2	RUN	(G)	Light up at ladder program comminucation
3	SLBUS	(G)	Light on/off at SLBUS normal comminucation
4	WDT180	(R)	Light up at CUP64180 watch dog timer time out
5	WDT31	(R)	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

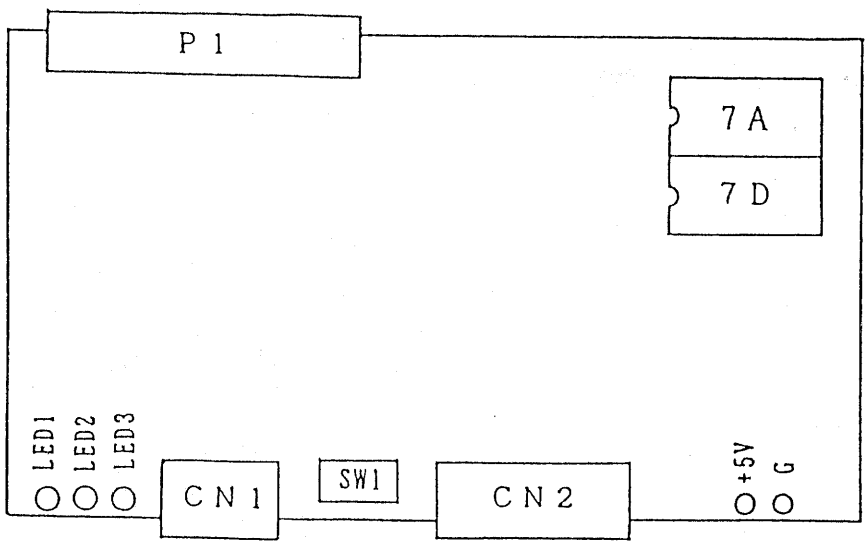
Sign	Name	ON	OFF
SW1		Memory write enabled	Memory write disabled

.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

4) CRT control unit (MGD board)



4)-1 Connector

Sign	Name	Contents
P1 CN1 CN2		System-bus CRT connection Floot display

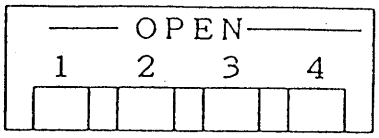
4)-2 Check pin

Sing	Name	Contents
	5V	Logic power supply 5V (White)
	G	Logic groud (Black)

4)-3 LED indicator

Sign	Name	Colour	Contents
LED1	RDY	(G)	Light up at normal
2	ACC	(G)	Light up at screen data comminucation
3	EDT	(R)	Light up at watch good timer time out

4)-4 Setting of the dip switch



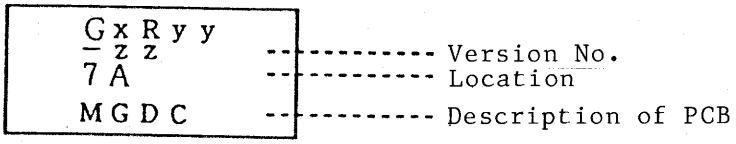
Bit	Contents	Standard designation
1		Open
2		Open
3		Open
4		Open

.Be sure to used switch openly.

4)-5 Actual mounting of system ROM

Label of ROM is shown as below:

Mount it to designated location.



7-1-3 Table Diagnosis and Its Measure

When a trable occurs, check that it occurs "When", What operation is being mode" and "What kinds of contents" or "How offen" etc..

1) Chase by the alarm screen

When an alarm occurs during operation, alarm No. and simple message are displayed on the left corner of the CRT.

There are 2 kinds of alarm display

.White character display on red field —— It shows that the alarm is serious and the machine immediately stops and the screen is automatically shifted to the alarm maintenance scree.

.Blue character display on yellow field —— It is an alarm for calling operator's attention. The machine doesn't stop and the screen is not shifted.

2) Chase by the monitor LED on the control unit

A monitor LED is actually provided on each unit of the control unit and the status of each unit can be checked.

When it is normal:

.All green LED are checked and is displayed lightly.

.All red LED are flickering.

The unit that either the red LED lights or the green LED flickers, is abnormal.

Table of LED

	○RDY ○ACC ○WDT CGDC	○RDY ○RUN ○SLBUS ○WDT180 ○WDT31 LSPC	○RDY ○RUN ○SLBUS ○FAIL ○WDT ○PERR ○BAT	 ○POWER ○+5V
				○+15V ○-15V ○+24V
			SPHC	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
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.

7-1-4 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

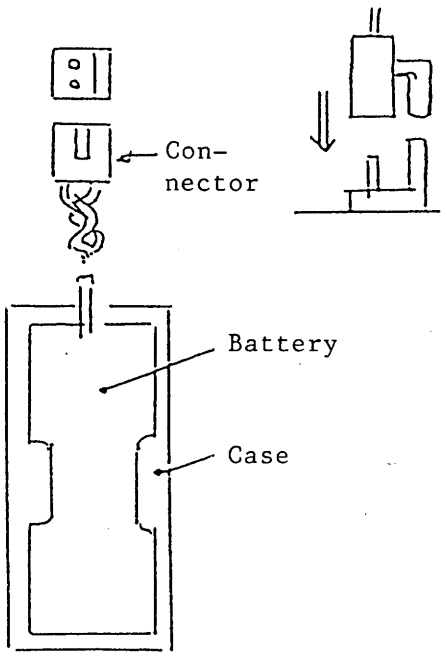
Use a battery with the following specifications

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



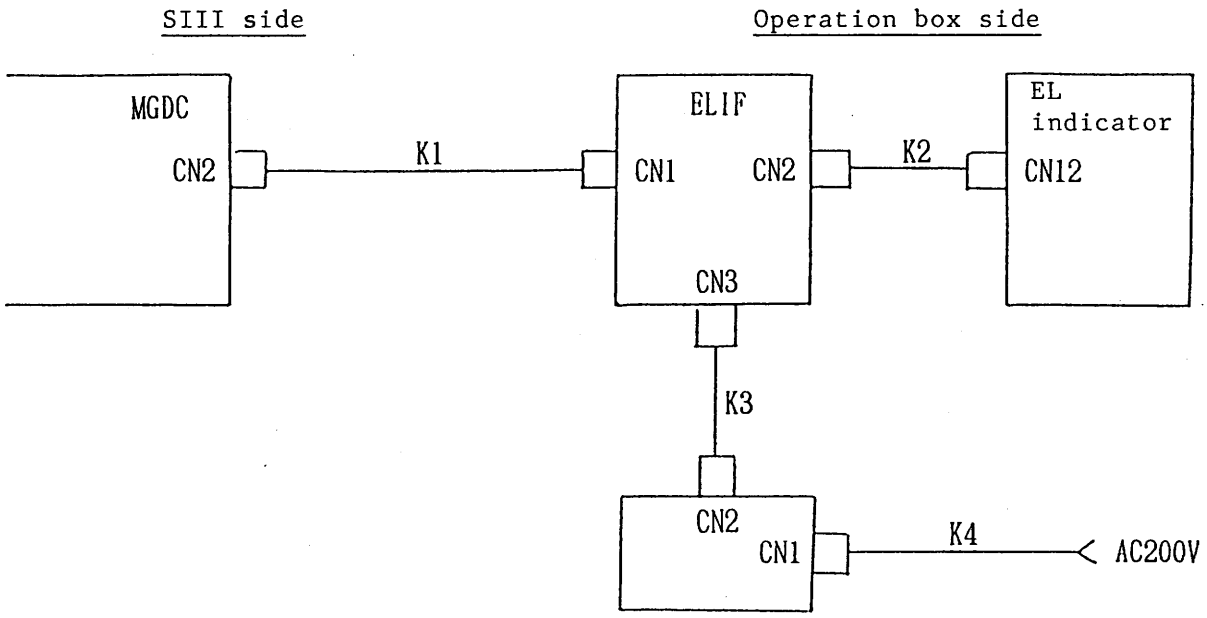
1. Switch the power off.
2. Pull the connector out and remove the battery.
3. Equip a new battery in the case and adjust the direction of the connector to meet and connect it.
4. Switch the power on and check if the BAT LED on the SPHC put out.
5. Clear the BAT alarm indication.
6. Finish the replacing 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.

7-1-5 EL Indicator

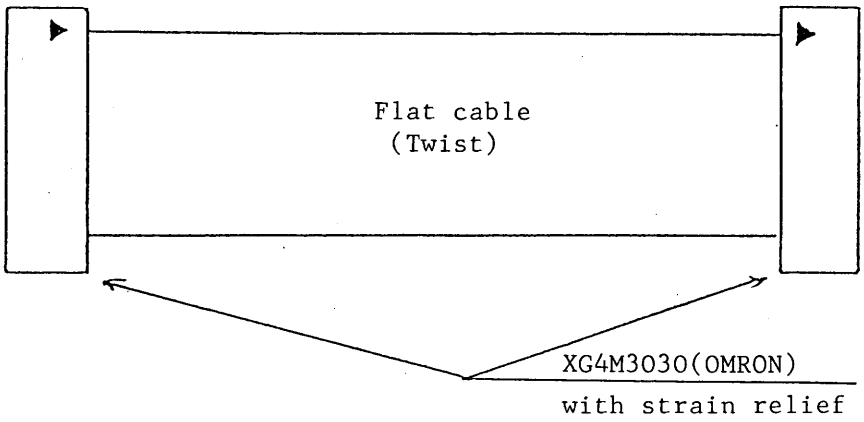
1) Connecting composition



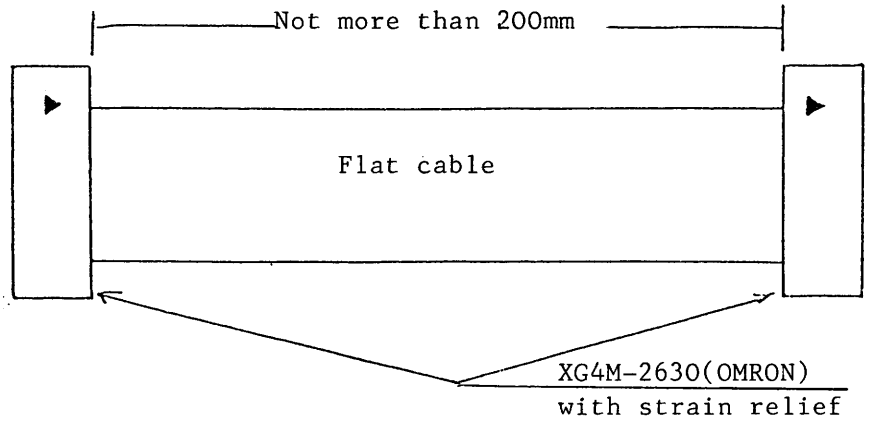
Power supply LW30 type A

2) Cable diagram

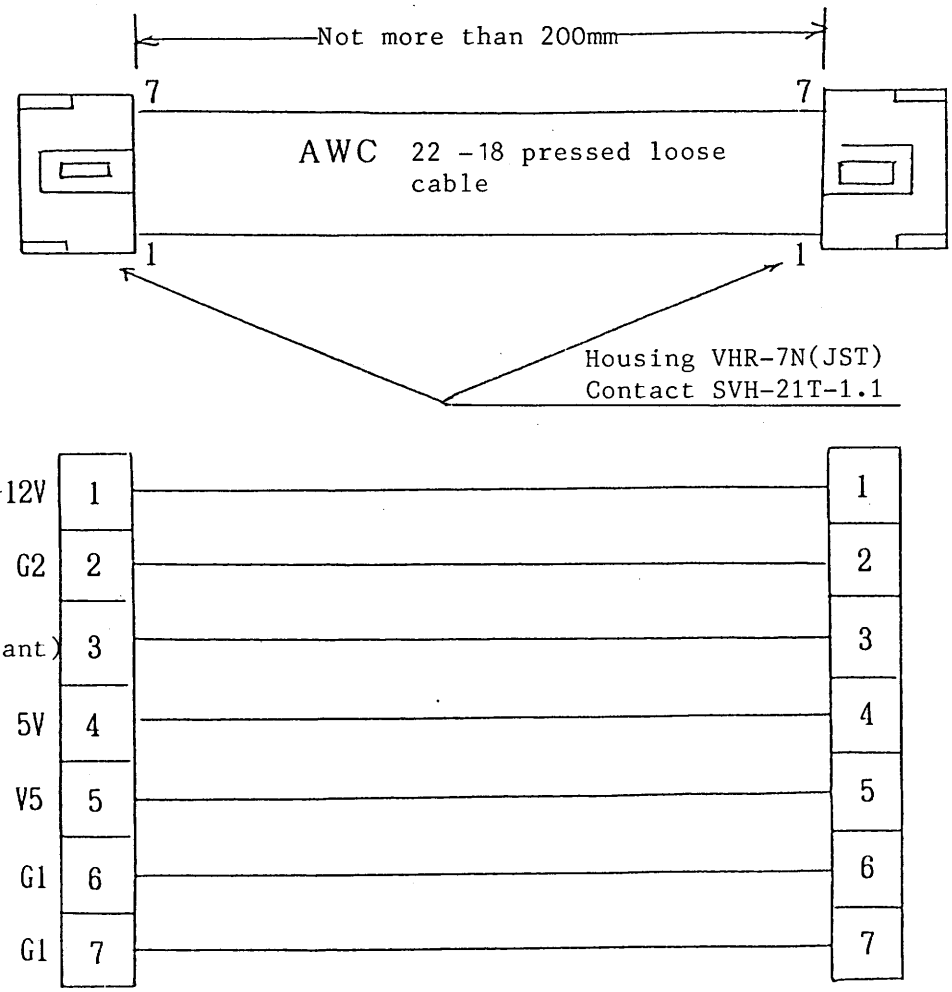
(1) K1 cable



(2) K2 cable

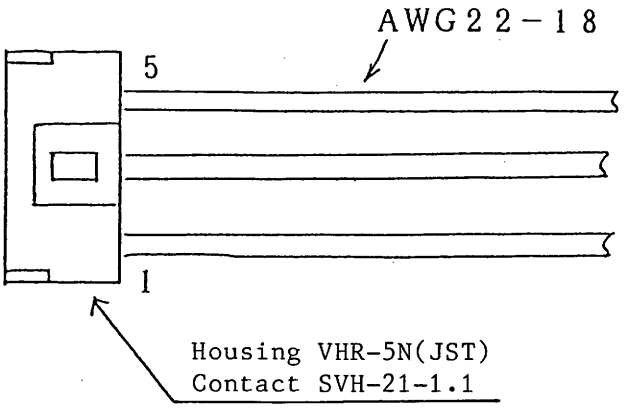


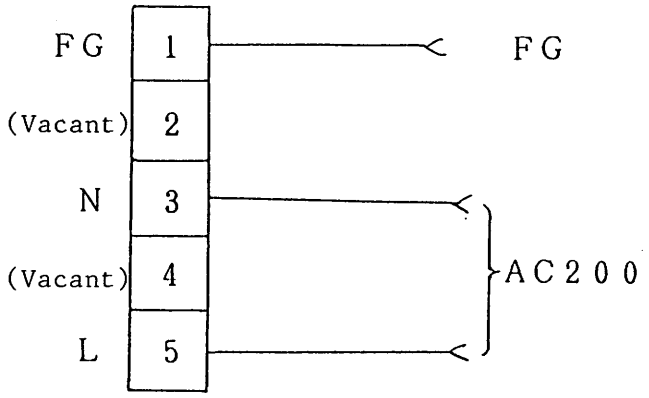
(3) K3 cable



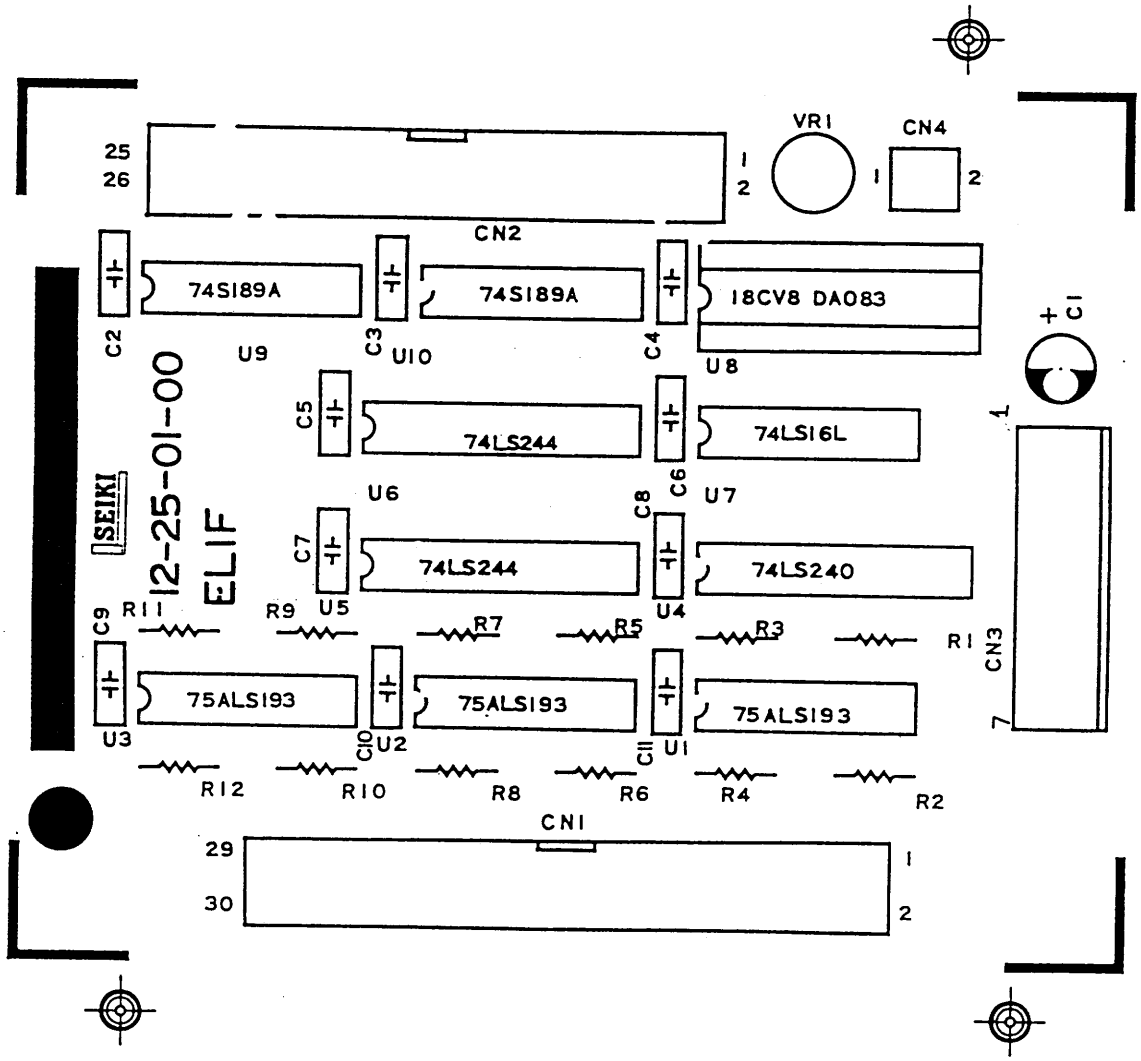
Pin No. is described on the housing.

(4) K4 cable


AWG22－18
5
1
Housing VHR-5N(JST)
Contact SVH-21-1.1

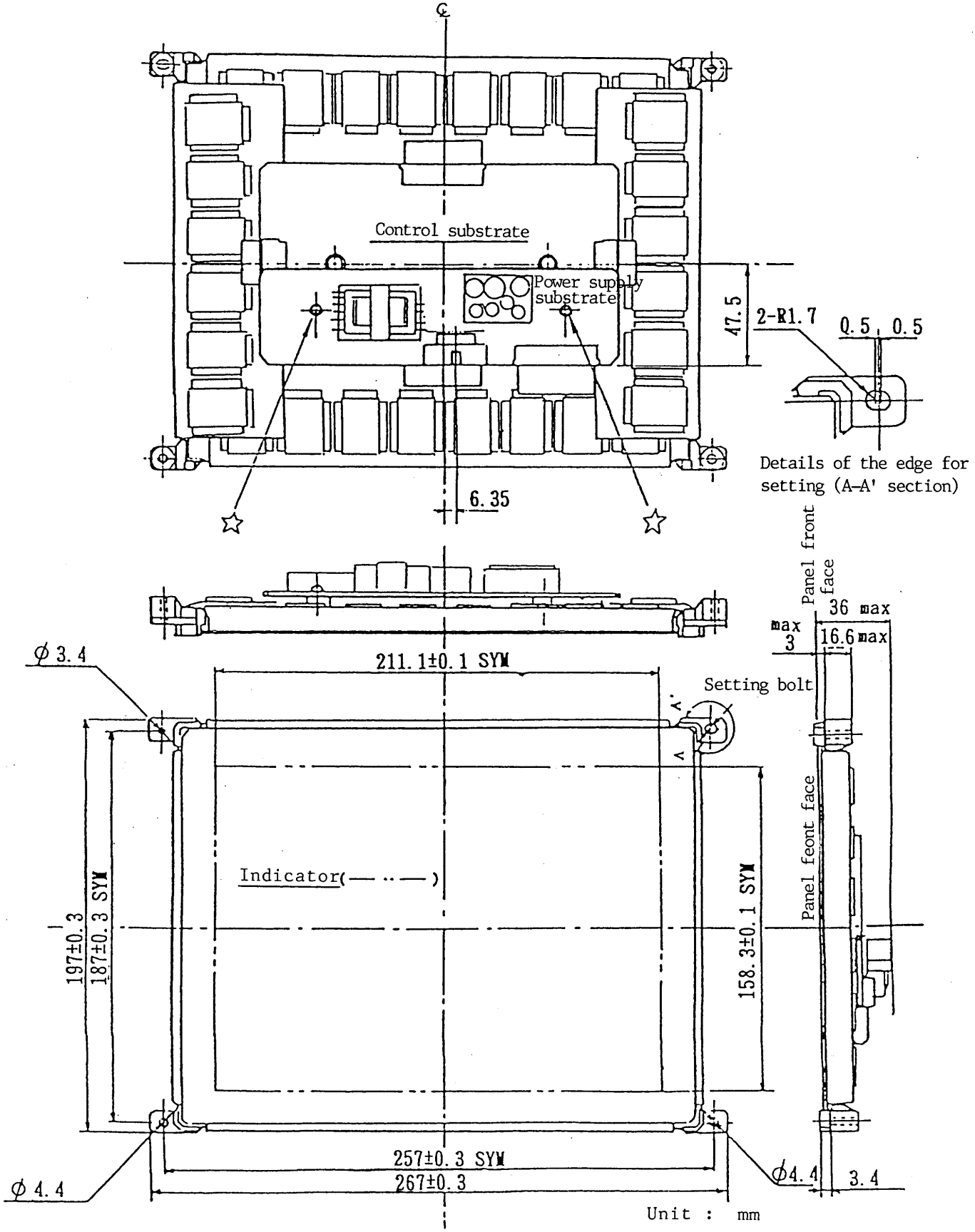

FG
1
FG
(Vacant)
2
N
3
(Vacant)
4
AC200
L
5

3) Part surface silk



4) External shape of the unit

This unit has been assembled as the below figure to delivery.



5) Connector pin assign

P1 AXD296411 (MATSUMOTO)

Pin No.	a	b	c
1	D00		D08
2	D01		D09
3	D02		D10
4	D03		D11
5	D04		D12
6	D05		D13
7	D06		D14
8	D07		D15
9	GND		GND
10	SYSCLK	BG3IN*	SYSFAIL*
11	GND	BG3OUT*	
12	DS1*		SYSRESET*
13	DS0*		
14	WRITE*		
15	GND		
16	DTACK*	AM0	
17	GND	AM1	
18	AS*	AM2	
19	GND	AM3	
20		GND	
21	IACKIN*		
22	IACKOUT*		
23	AM4	GND	A15
24	A07		A14
25	A06		A13
26	A05		A12
27	A04		A11
28	A03		A10
29	A02		A09
30	A01		A08
31			
32	+5V	+5V	+5V

CN1 XM3B-0922-112 (OMRON)

5	4	3	2	1
VSYNC	HSYNC		VIDEO	

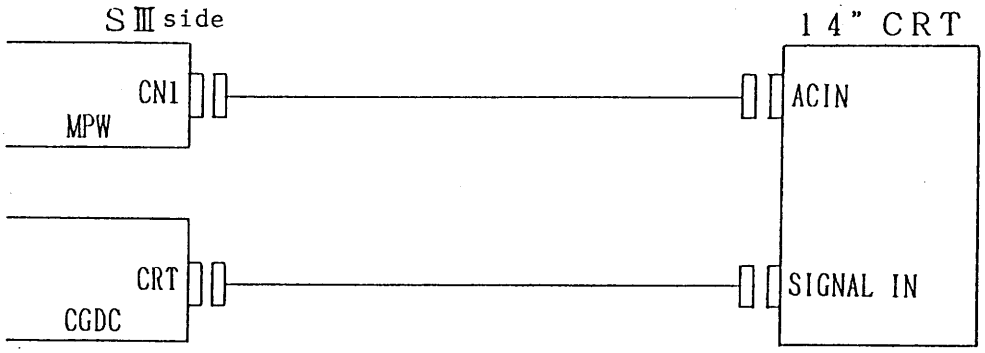
9	8	7	6
GND	GND	GND	GND

▽ CN2 XG4A-3034 (OMRON)

1	3	5	7	9	11	13	15	17	19	21	23	25	27	29
DA0	DA1	DA2	DA3	DB0	DB1	DB2	DB3	DATEN	CLK OUT	VSYNC	HSYNC		GND	GND
2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
$\overline{DA0}$	$\overline{DA1}$	$\overline{DA2}$	$\overline{DA3}$	$\overline{DB0}$	$\overline{DB1}$	$\overline{DB2}$	$\overline{DB3}$	$\overline{DATEN}$	$\overline{CLK\ OUT}$	$\overline{VSYNC}$	$\overline{HSYNC}$		GND	GND

7-1-6 14" Color CRT Display

1) Connection structure



2) Cable diagram

MPW CN1

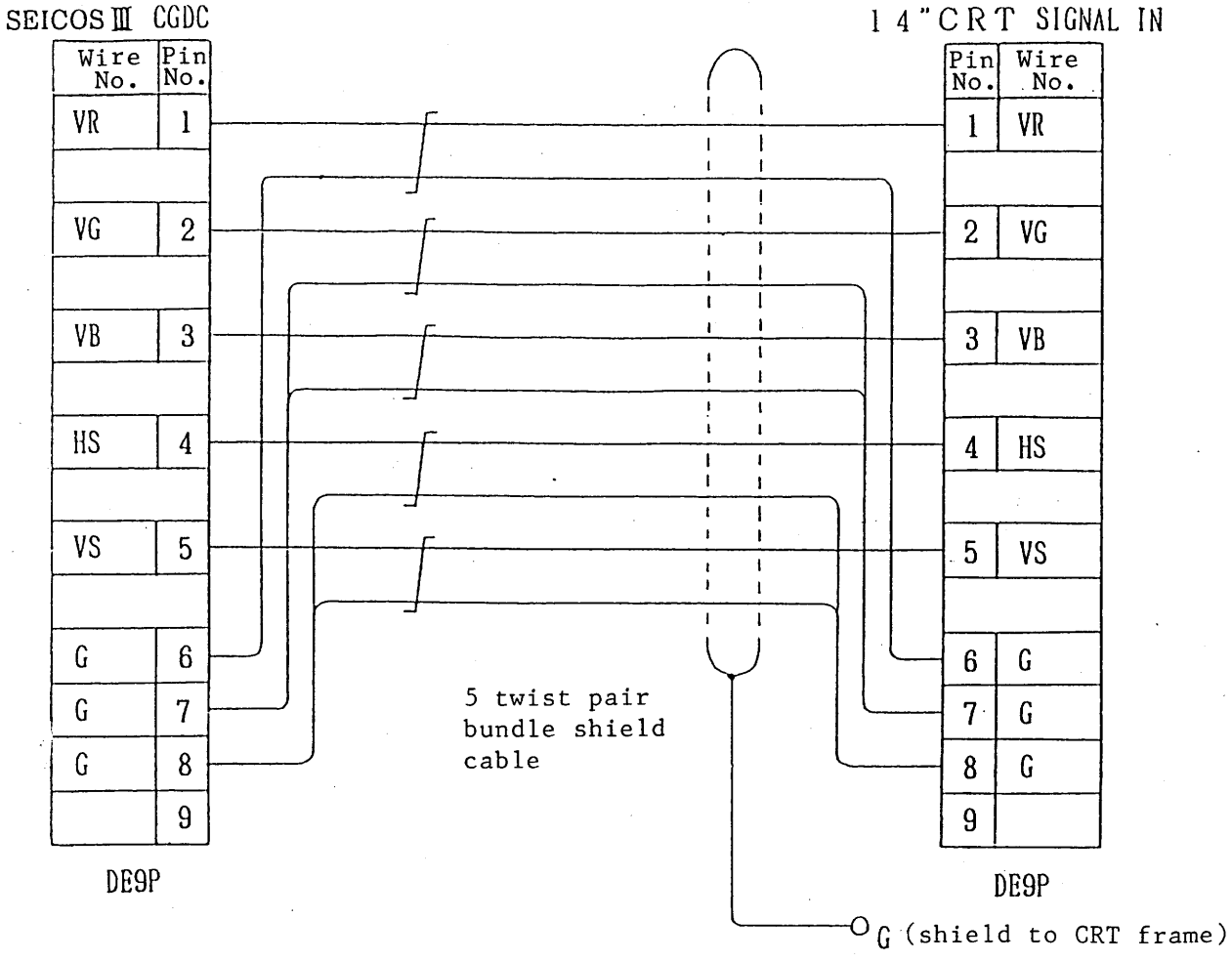
1	2	3	4	5	6
1P	3P	2P	G	AC51	AC63

(SMS6P-3)

CRT ACIN

1	2	3	4
AC51		AC63	G

(350779-1)



3) Specifications of color display monitor

(1) Application

This specifications are applied 14" color CRT display.

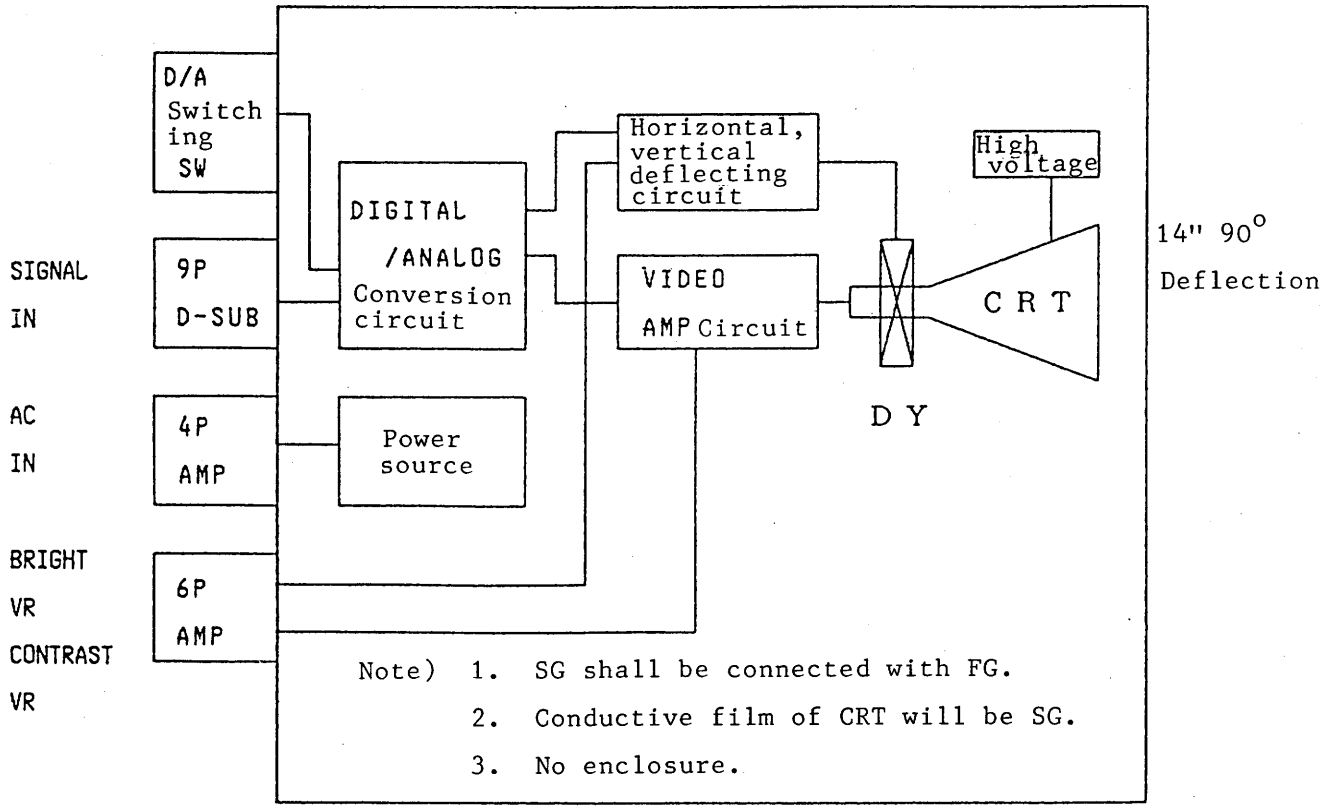
Not stated on this specifications shall be discussed separately.

(2) External dimension, weight

Application	○				
Inclination of CRT	0^{o}	2.5^{o}	5^{o}	7.5^{o}	10^{o}
Heigth	287mmMAX	286.9mmMAX	286.7mmMax	285.7mmMAX	284.3mmMax
Width	346mmMAX	←	←	←	←
Depth	370.5mmMAX	372.6mmMAX	374.0mmMax	374.7mmMAX	374.7mmMAX
Weight	10.0KgTYP.	←	←	←	←

(3) Structure

① General structure

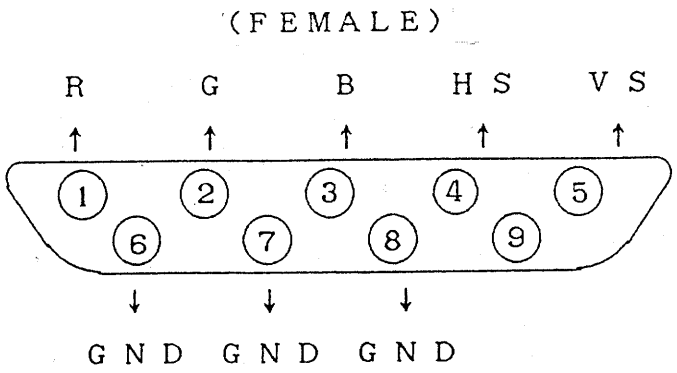


② Connection os signal connector

9P D-SUB Connector parts

JAPAN AVIATION ELECTRONICS INDUSTRIES mode or equivalent

Part No. for monitor side : DELC-J9SAF-10L9 (M2.6 Lock washer)



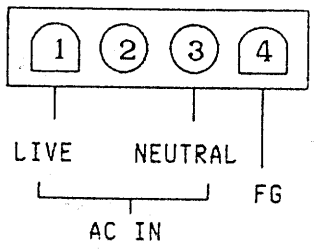
(SIGNAL IN)

Pin No.	Input signal	Classification of input cable
1	Image signal (R)	Coaxial cable
2	Image signal (G)	Coaxial cable
3	Image signal (B)	Coaxial cable
4	Horizontal synchronous signal (HS)	AWG26, twist pair cable
5	Vertical synchronous signal (VS)	AWG26, twist pair cable
6	GND	Coaxial cable GND, twist pair cable GND
7	GND	Coaxial cable GND, twist pair cable GND
8	GND	Whole shield cable
9	NC	

* Whole shield shall be connected with connector cover.

③ Connection of AC IN, BRIGHT VR, CONTRAST VR

③-1 AC IN



Applicable connector (AMP mode, Universal MATE-N-LOCK connector)

Monitor side ... 4 poles cap housing :350780-1

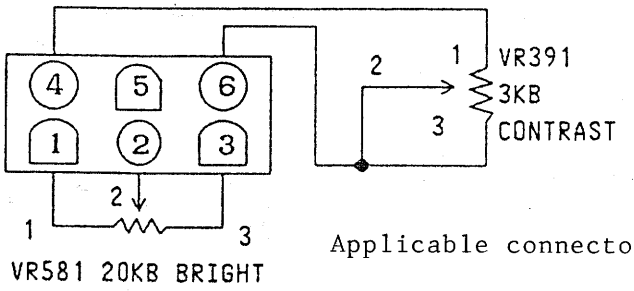
Objective side ... Pin contact :350561-1 (Link type)

Objective connector :350779-1

Objective contact :350570-1 (Link type)

350689-1 (Loose type)

③-2 BRIGHT VR, CONTRAST VR



Applicable connector (AMP mode, Universal MATE-N-LOCK connector)

Monitor side ... 6 poles cap housing :350781-1

Objective ... Pin contact :350561-1 (Link type)

Objective connector :350715-1

Objective contact 350689-1 (Loose type)

Capacity of volume controller

	CONTRAST VR	BRIGHT VR
Resistance value	3KΩ, B characteristic	20KΩ, B characteristic
Rated power	0.2W or more	0.2W or more
Rated voltage	24V or more	63V or more

Note) Connector, volume controller and cable related with signal IN, AC IN, Contrast VR, Bright VR shall be provided by customer's side.

④ Adjustment

④-1 External adjustment

No.	Function	Drawing No.
1	CONTRAST	VR391 (External mount)
2	BRIGHT	VR581 (External mount)
3	ANALOG-TTL Conversion SW*	SW301

* Setting is analog side at shippment.

④-2 Internal adjustment

No.	Function	Drawing No.
1	V. HOLD	VR401
2	V. SIDE	VR402
3	V. LIN	VR403
4	H. HOLD	VR501
5	H. PHASE	VR502
6	H. WIDTH	VR503
7	V. POSI	VR404
8	V. PCC	VR701
9	+B ADJ	VR801
10	R. DRIVE	VR311
11	G. DRIVE	VR321
12	B. DRIVE	VR331
13	R. LOW-LIGHT	VR351
14	G. LOW-LIGHT	VR352
15	B. LOW-LIGHT	VR353
16	SCREEN	T551 (FBT)
17	FOCUS	T551 (FBT)
18	ABL	VR582
19	R. GAIN	VR312
20	G. GAIN	VT322
21	B. GAIN	VR332

⑤ Power source

	Item	Standard
1	AC Input voltage	AC180 ~ 264V
2	Tregnency	50/60Hz (47 ~ 63Hz)
3	Power consumption	70W or less (Indication on name plate shall be 57W.)
4	Input current	0.6Arms or less
5	Rush current	50Aop or less (Note)
6	High voltage	25KV TYP. (When beam current is OmA)

o Environment will be normal temperature and humidity.

Note) Above data are based on AC 264V, Ta=25°C and cold start.
Parts related with rush current (power source switch, etc.) should be selected 70 Aop or more.

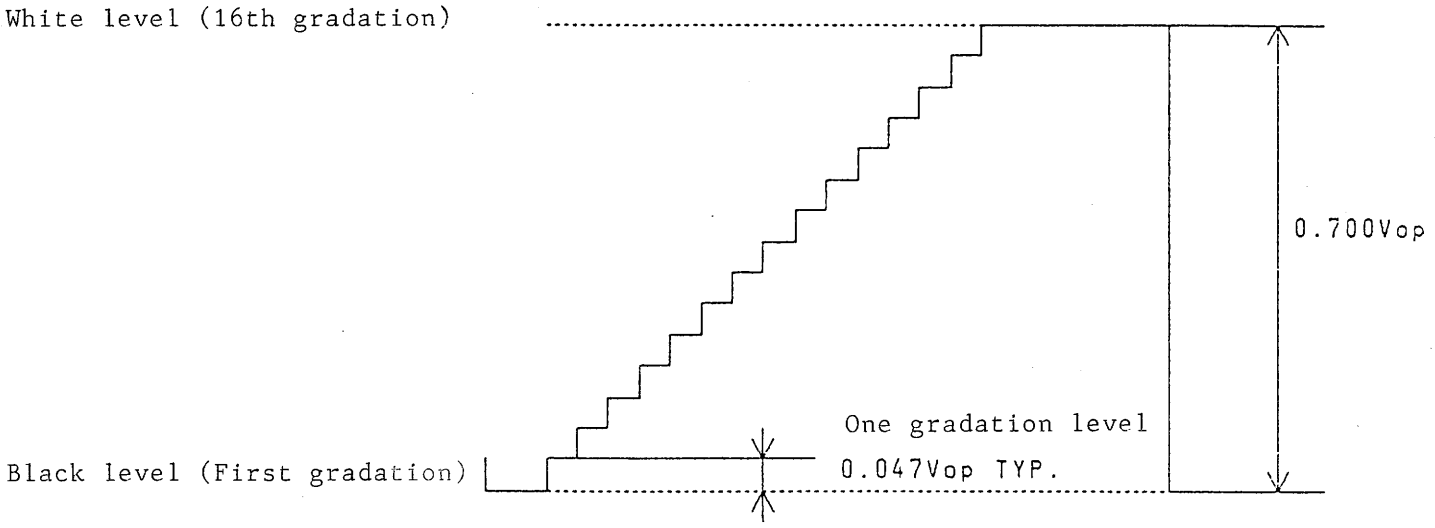
⑥ Input signal

	Signal name	Polarity	Signal level	Pulse width	Frequency
1	Video signal	Positive	0~0.7Vop, 75Ω or TTL level	---	25.1750MHz
2	Horizontal synchronous signal	* Posi or Nega.	TTL level	3.813μs	31.4688KHz
3	Vertical synchronous signal	* Posi or Nega.	TTL level	0.064ms	59.9405Hz

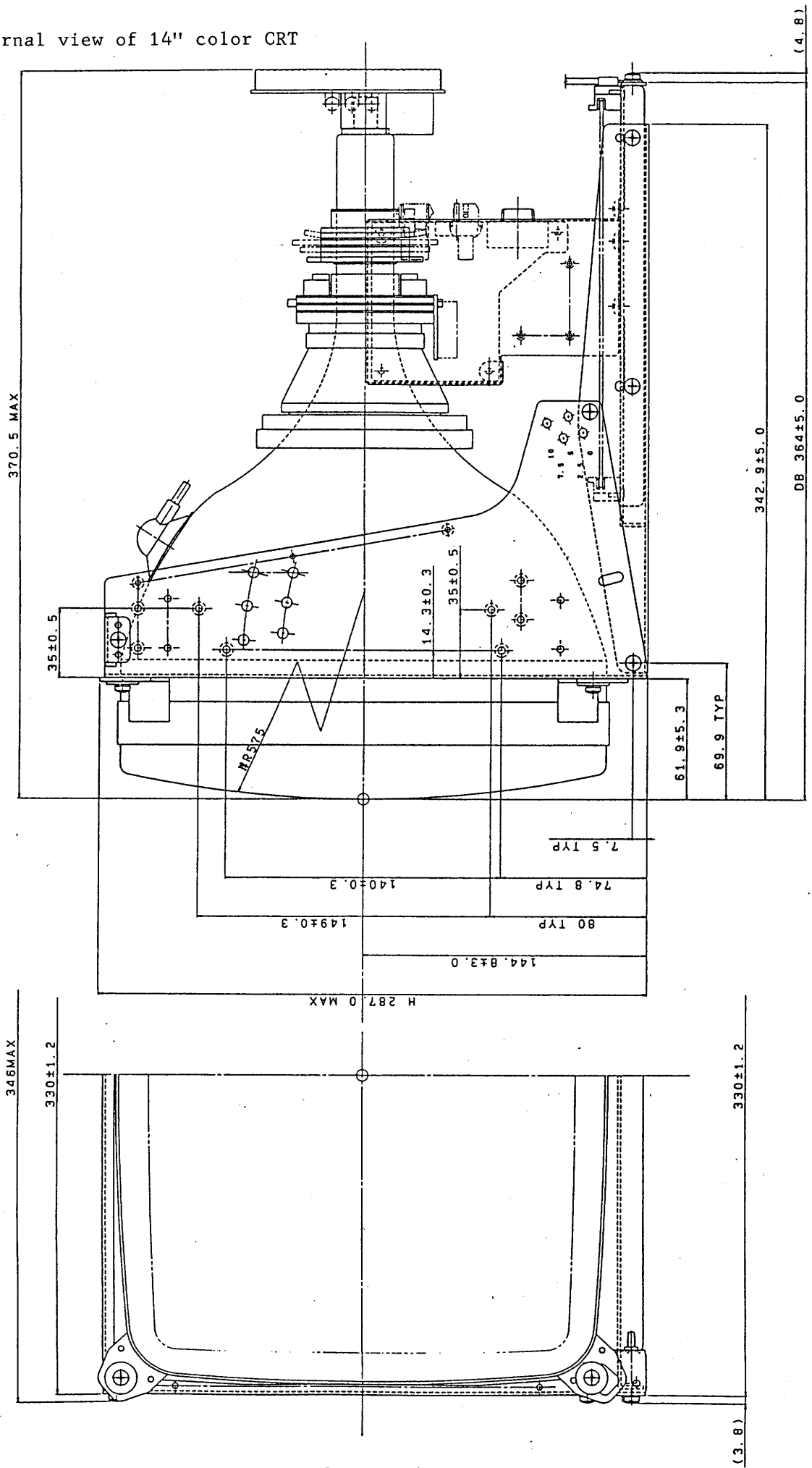
* Polarity of synchronous signal shall be synchronized regardless of positive or negative.

1) Signal timing at shipment refer to page 17.

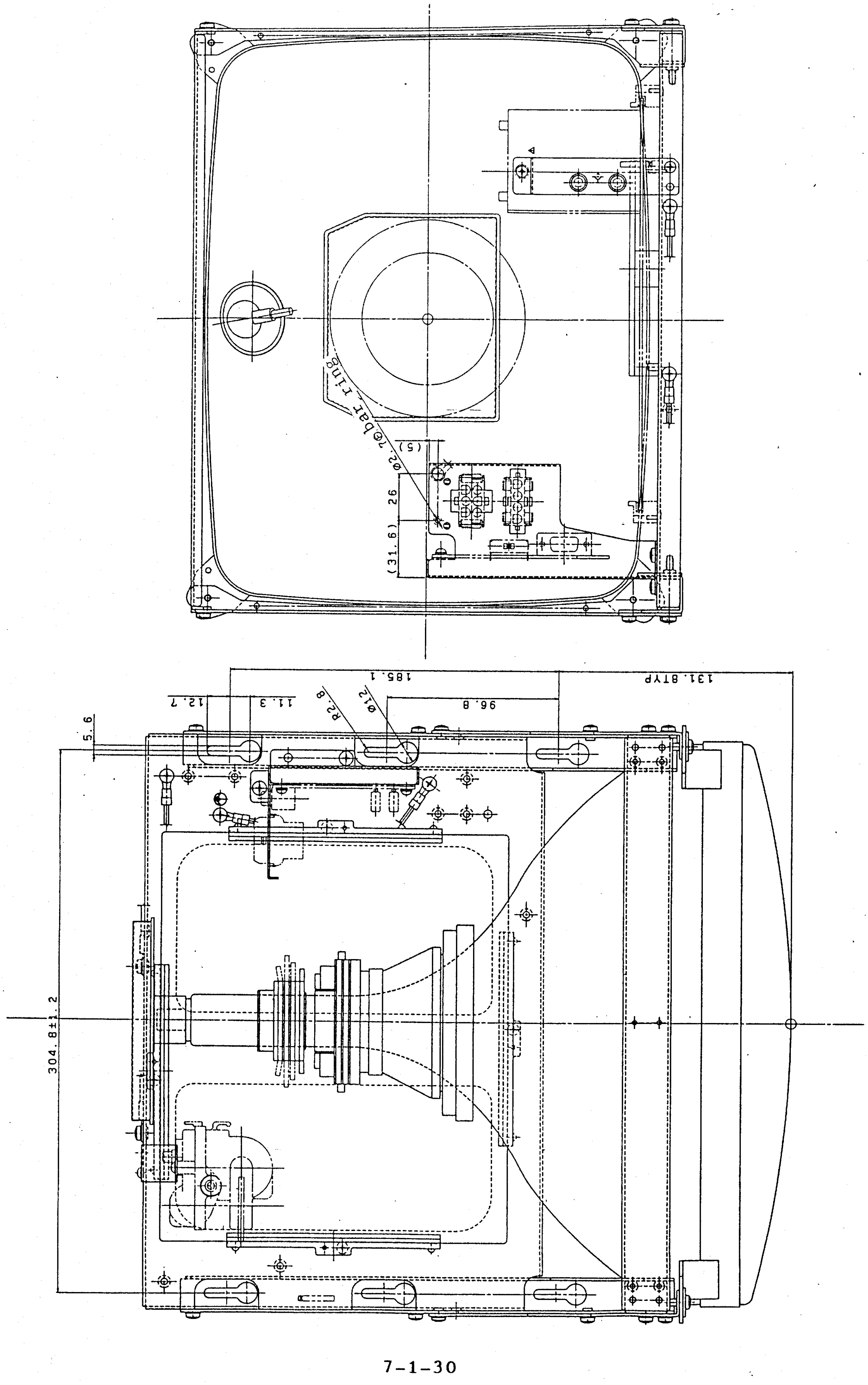
2) Input level of analog signal.



⑦ External view of 14" color CRT



CRT TILT	H MAX	H ±3.0	D TYP	DB ±5.0
0°	287.0	144.8	131.8	364.0
2.5°	286.9	147.7	125.6	357.8
5°	286.7	150.3	119.5	351.7
7.5°	285.7	152.7	113.2	345.4
10°	284.3	154.8	106.8	339.0


φ2.7bar ring
(5)
26
(31.6)
185.1
131.8TYP
12.7
11.3
96.8
R2.8
φ12
5.6
304.8±1.2

7-1-6 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	(Refer to IV. ladder editing operation)
18	Ladder program	Ladder editing (Refer to IV. ladder editing operation)
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.

7-1-7 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.

7-1-8 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)

7-1-9 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.)

7-1-10 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 (COOOH~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.)

F1	F2	F3	F4	F5	F6	F7	F8	F9
						SLBUS Table		

. 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)

7-1-11 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)

7-1-12 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)

7-1-13 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)

F1	F2	F3	F4	F5	F6	F7	F8	F9
								Alter-ation

. 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)

F1	F2	F3	F4	F5	F6	F7	F8	F9
							Total data E rasure	Refer-ence

. F8 ..... Erasure of the timer (16 pcs. from the head) area.

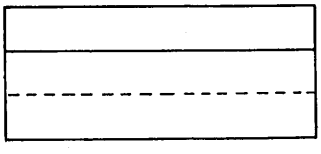
Range (E000H ~ E02FH E700H ~ E72FH)

. F9 ..... Reference mode

3) Memory format

(1) Timer data (3 bytes x 16)

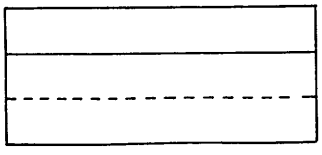
E00H



Unit (S,M,N)
Setting time (LOW)
Setting time (HIGH)

(2) Timer work (3 bytes x 16)

E700H



Status
Time-up time (LOW)
Time-up time (HIGH)

7-1-14 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.

7-1-15 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

F1	F2	F3	F4	F5	F6	F7	F8	F9
								Alter-ation

. F9 ..... Alteration mode (WRITE ENABLE SWITCH ON)

2) Alteration of counter values

.Maximum value .. 0 ~ 9999 (Decimal input)

.Minimum value .. 0 ~ 9999 (Decimal input)

F1	F2	F3	F4	F5	F6	F7	F8	F9
							Data Erasure	Refer-ence

. F8 ..... Erasure of the counter area
Range (E600H ~ E67FH ED00H ~ 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)

ED00H

Min. value of the counter (LOW)
Min. value of the counter (HIGH)

7-1-16 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

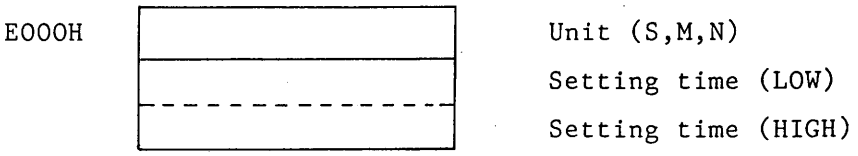
. F1 ..... Timer search (0 ~ 3F7)

. F8 ..... Erasure of the timer area

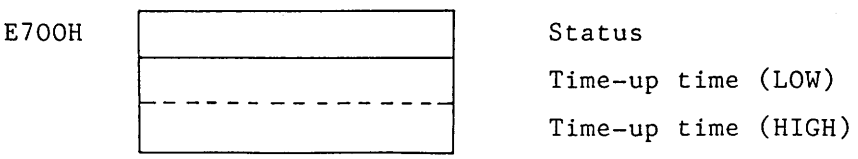
. F9 ..... Reference mode (WRITE ENABLE SWITCH OFF)

3) Memory format

(1) Timer data (3 bytes x 512)



(2) Timer work (3 bytes x 512)



7-1-17 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

F1	F2	F3	F4	F5	F6	F7	F8	F9
								Alter-ation

. [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)

F1	F2	F3	F4	F5	F6	F7	F8	F9
							Data Erasure	Refer-ence

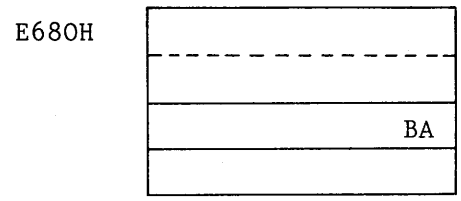
. [F8] ..... Erasure of the AB phase table area

Range (E680H ~ E6BFH ED80H ~ EDBFH)

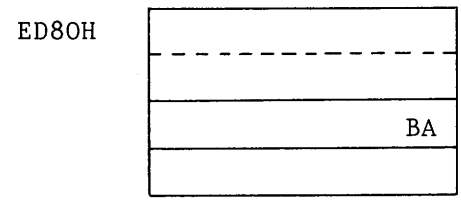
. [F9] ..... Reference mode (WRITE ENABLE SWITCH OFF)

3) Memory format

(1) AB phase data (4 bytes x 16)



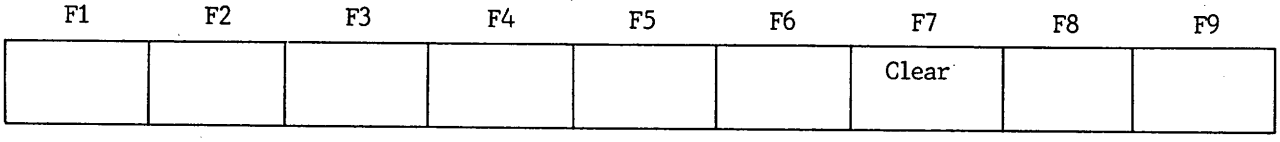
(2) AB phase work (4 bytes x 16)



7-1-18 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).



· 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)

7-1-19 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)

7-1-20 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	70*20	000~3F7	XXXXX	XXXXX
	Counter	30*1	0-7, 10-17	XXXXX	XXXXX
	Timer	30*1	0-7, 10-17	XXXXX	XXXXX
	Table	30*65	1 ~ 16(D)	XXXXX	XXXXX
	Step ladder	30*51	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)

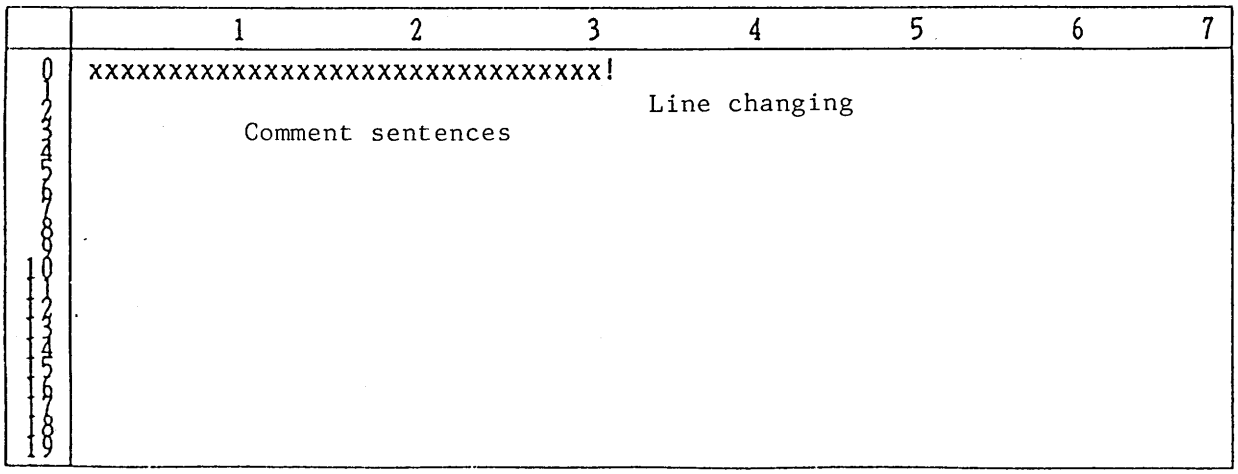
(2) Regulations for editing

	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
[2200]  ERROR 00
        ERROR 01
        ERROR 02
[2201]  ERROR 10
        ERROR 11
[2215]  ERROR 150
        ERROR 151
[2217]  ERROR 170
        ERROR 171
```

0
1
2
3
4
5
6
7

```
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
```

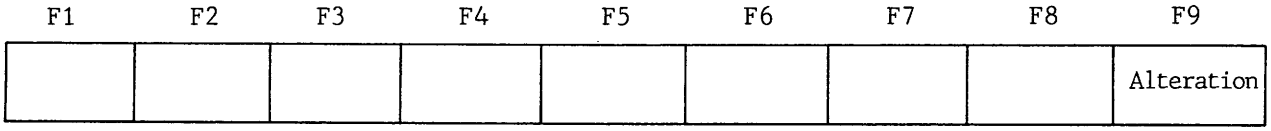
7-1-21 System Parameter

. 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

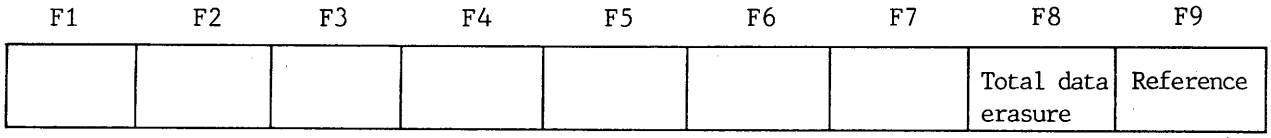
. No.1 through 64 are displayed in HEXADECIMAL and BINARY by byte.



. [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)

7-1-22 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.

	Alarm	Free mode alarm	Travel status
	2002	WENB. SW Free	PC RUN

7-1-23 PC Logical Analog Operation

This manual describes operating method about the PC menu items "LOGICAL ANALOG" of SEICOS-III.

CONTENTS

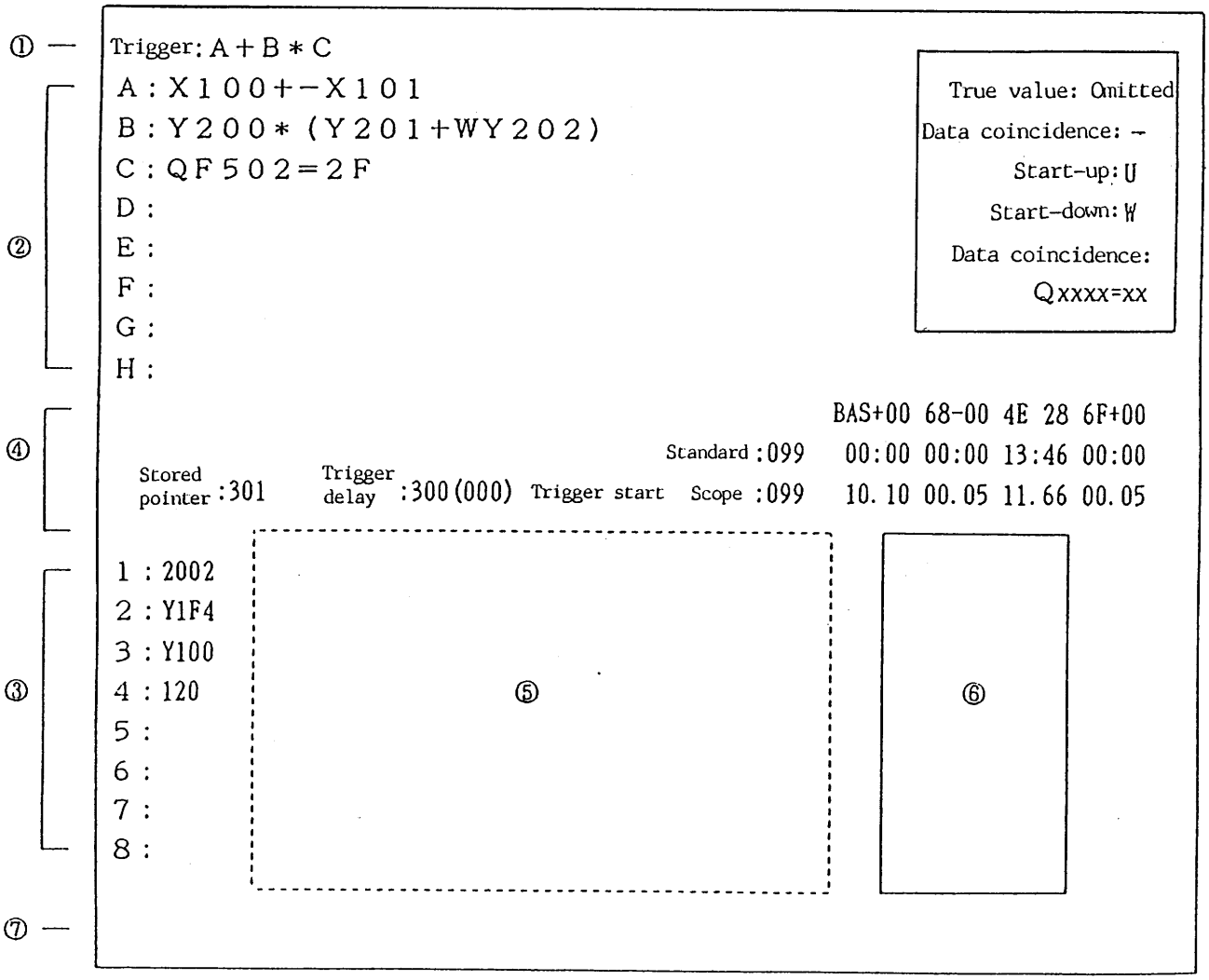
0. Outline

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.

1. Logical Analog Screen Composition

The logical analog screen consits of the following items.

①	Trigger condition expression	Describes the arithmetic formula of the trigger parts A through H.
②	Trigger part condition expression ..	Describes the arithmetic formula of the 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 magnification diagram	Magnified wave form diagram of a part 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. Grammar 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 WY021

.Priority .....T31*U100+UY1F2+Y40U*-2003U

(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)

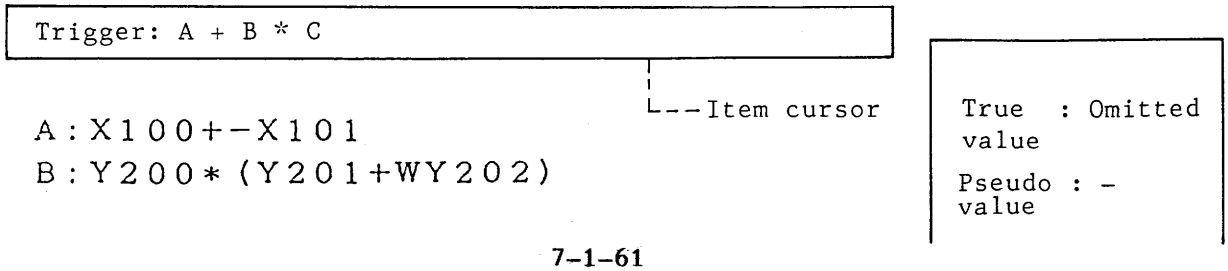
(Example)

Q520D=A2 .... Whether the contents of the address A0520DH is A2H.

3. 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.

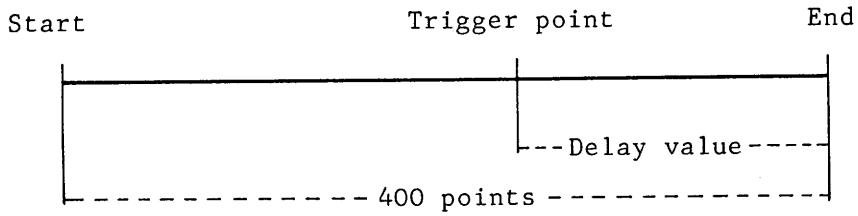
① Trigger .... Max. 60 characters. A~H, ( ) +*
Described by the arithmetic formula of the trigger pares. Example : A*(B*(C+D)+E)

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.

4. 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.

5. 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.

6. 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,

7. Sample Status

There are three function that can monitor during sampling in the status area.

① Store pointer ② Trigger delay ③ Sample completion

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.

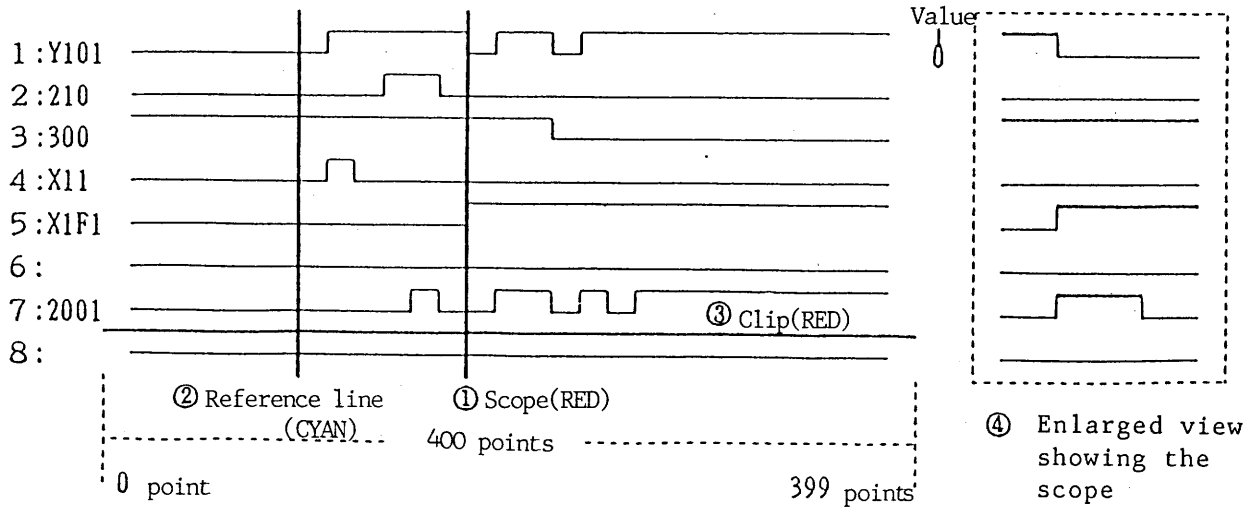
"TRIGGER ON" : The trigger is engaged. The display is blinking.

"SSAMPLE COMPLETION" : The sampling is completely proceeded upto the delay value.

8. Sample Data 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).... [illegible]+30 .... Day

O'clock .... 18:11 .... Minute

Second .... 19.92 .... 10ms

9. 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.

7-2 SLBUS

1. SLBUS distribution board

SLBUS distribution board is located between master board and each I/O slave, and distribute SLBUS signal etc..

SLBUS Distribution board snpplies transmission signal of SLBUS to each I/O slave, and also power source (+7.5V) for I/O slave, (+24V) for interface and (AC100V) for solenoid drive to each I/O slave.

One set of SLBUS distribution board can be connected with seven (7) sets of I/O slave at maximum.

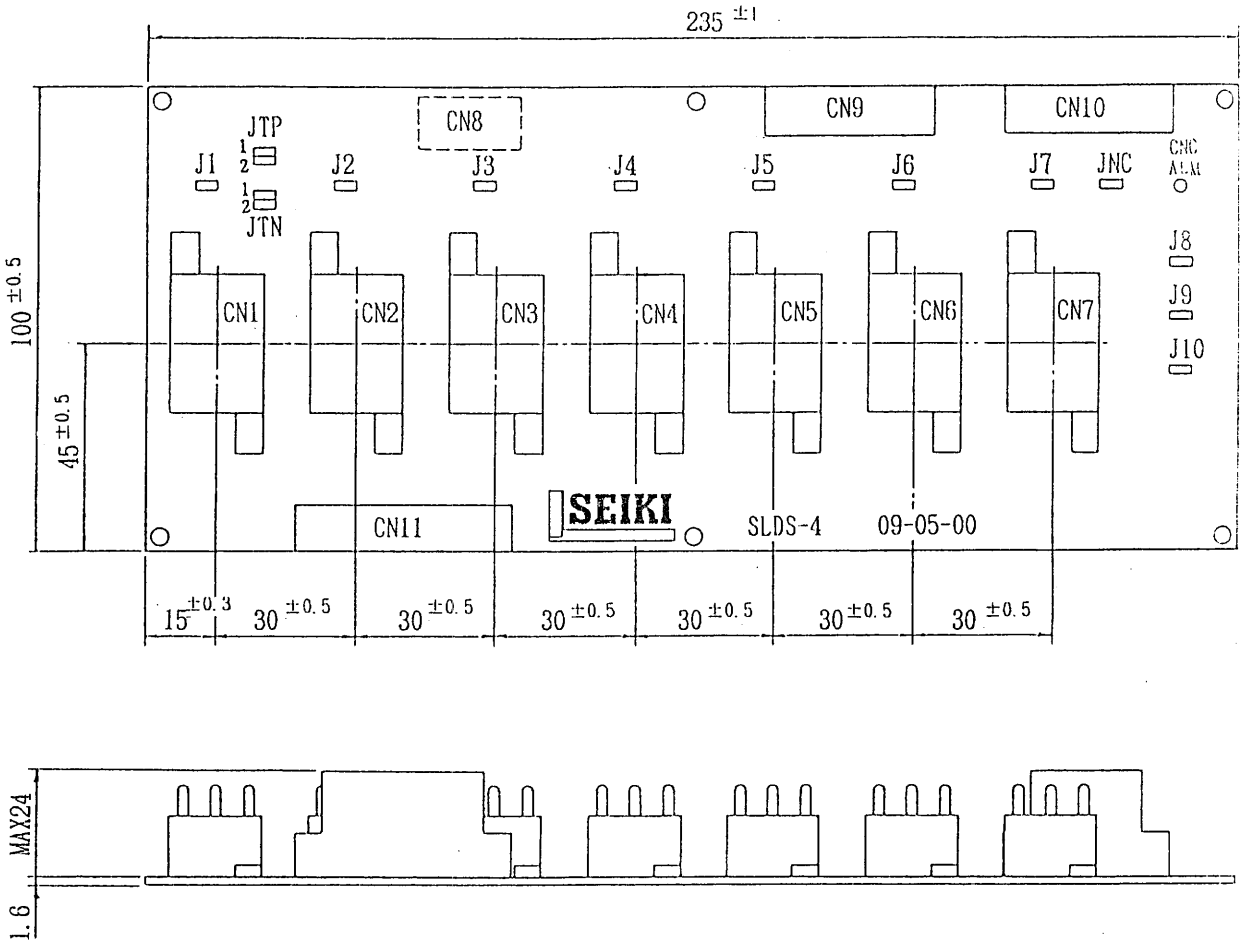
Fig. 7-2-2 is shown external view of SLBUS distribution board and J1 ~ J7 in the drawing are short pins which bypass emergency stop push button circuit input to I/O slaves connected with C1 ~ C7.

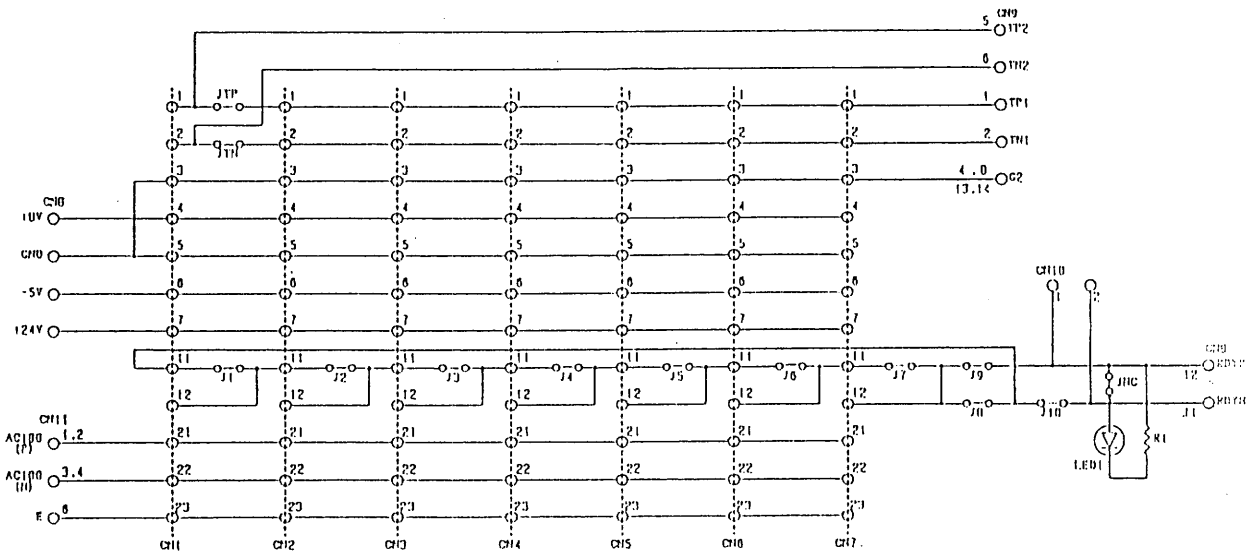
JPC and JNC are short pins which bypass PC ready contact and NC ready contact for emergency stop circuit as well.

Power source for solenoid drive (AC100V) are distributed from SLBUS distribution board to I/O slave respectively.

However, pay attention to limit of maximum current capacity, 6A for each slave and 20A for whole SLBUS distribution board.

Fig. 7-2-1 External view od SLBUS distribution board





2. SLBUS distribution Board (SLDS) and I/O unit

Between SLBUS distribution board and each I/O slave unit are connected by common connectors and cables.
There are SLBUS transmitting signal between SLDS and I/O slave, also power sources for logic circuit of I/O slave, interface, solenoid drive and direct distribution signal.

. Transmitting signal of SLBUS : TP, TN, G2
  Transmission of SLBUS is done through interface circuit, EIA RS-485 standard.
  Transmitting signal TP and TN are balancing circuit and G02 is a common.
  TP and TN are connected by shielded twist pair cable.
. Power source of I/O slave unit logic circuit : VIN, G2
  7.5V is supplied as VIN and prepares 5V for power source of logic circuit by series regulator mounted in I/O slave unit.
. Power source of I/O slave unit interface circuit : -5V, +24V, G2
  This source supplies a current to contactor of limit switch for input signal of M III system and also supplies 24V for power source of output signal relay or SSR drive.
  Power source -5V is used for level change circuit of contact point circuit.
. Power source of solenoid drive : AC100V, E
  AC100V is used as power source of SSR drive solenoid.
  Ground work for solenoid is connected to earth line E.

(a) Connection cable and connector

The cable used here is a compound cable which consists of the above mentioned signal lines from (1) to (5).
The connector used here and pin assignment are shown in Fig. 7-2-8, and specification of cable is shown in Fig. 7-2-9.

Fig. 7-2-2 Connection cable between SLBUS distributor and slave

Connector pin assignment

SLBUS distributor (SLDS) — Slave

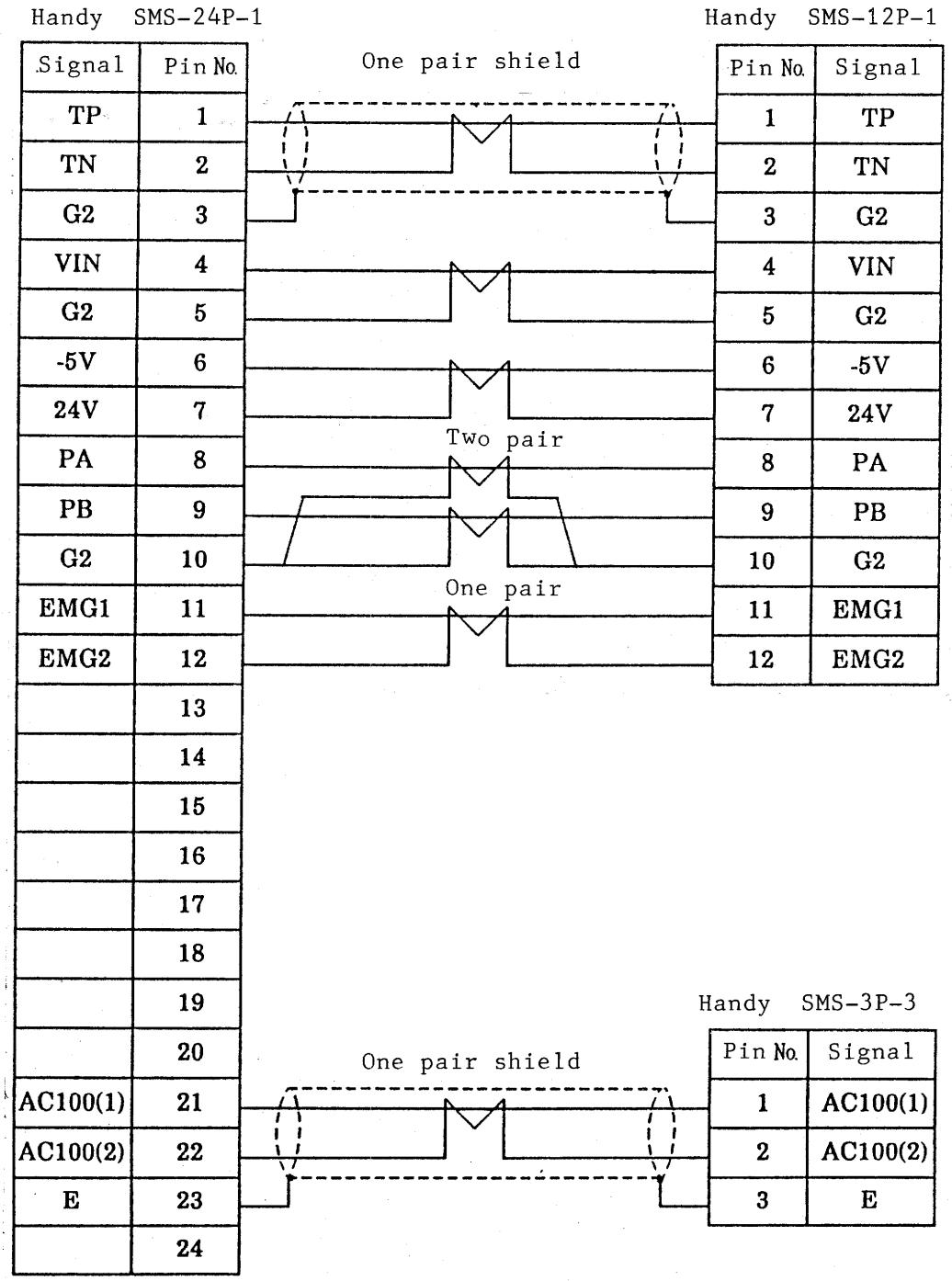
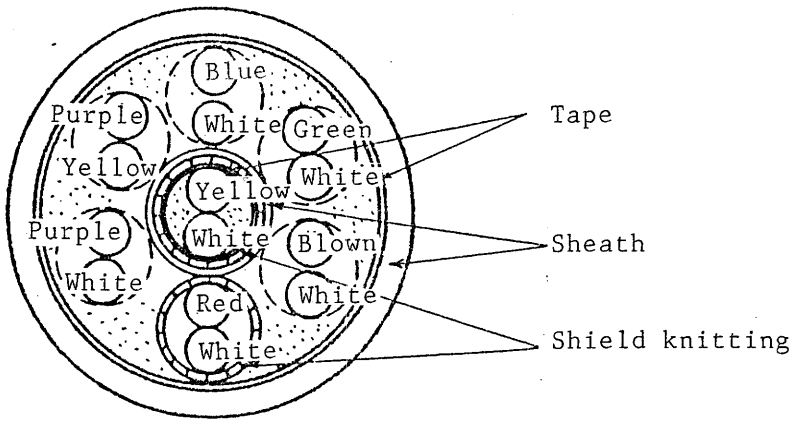


Fig. 7-2-3 Specifications of 7 Composite Cables

Item		Unit	Standard value		
Wire type		-	F-CO-VV-SX		
No. of lines		-	1P	5P	1P
Conductor	Size	mm^2	0.75	0.75	0.75
	Construction	no./mm	67/0.12	67/0.12	67/0.12
	Material	-	Tinning annealed copper wire		
	Outside diameter	mm	1.1	1.1	1.1
Insulator	Material	-		Vinyl	
	Thickness	mm	0.4	0.4	0.6
	Outside diameter (approx.)	mm	1.9	1.9	2.3
Outside diameter of twisted		mm	3.8	3.8	4.6
Shield	Strand (Material)	mm	0.10 (Tinning annealed copper wire)	-	0.10 (Tinning annealed copper wire)
	Density (approx.)	%	70	-	70
	Thickness (approx.)	mm	0.25	-	0.25
	Outside diameter (approx.)	mm	4.4	-	5.1
Internal sheath	Material (color)	-	Vinyl (black)	-	-
	Thickness	mm	0.3	-	-
	Outside diameter (approx.)	mm	5.0	-	-
Strand outer diameter (approx.)		mm	13.8		
Winding tape thickness		mm	0.05		
Sheath	Material (color)	-	Vinyl (black)		
	Thickness	mm	1.0		
	Outside diameter (approx.)	mm	15.9 (MAX 16.4)		
Electric characteristic	Conductor resistance (20°C)	Ω/Km	29.6		
	Withstand voltage (A.C)	V/min.	1000		
	Insulation resistance (20°C)	MΩ/Km	10		
Rough weight		Kg/Km	270		
Standard length		m	100		
Packing type		-	Bundle		

Remarks: Appropriate tape can be provided, if necessary, underneath the shield.

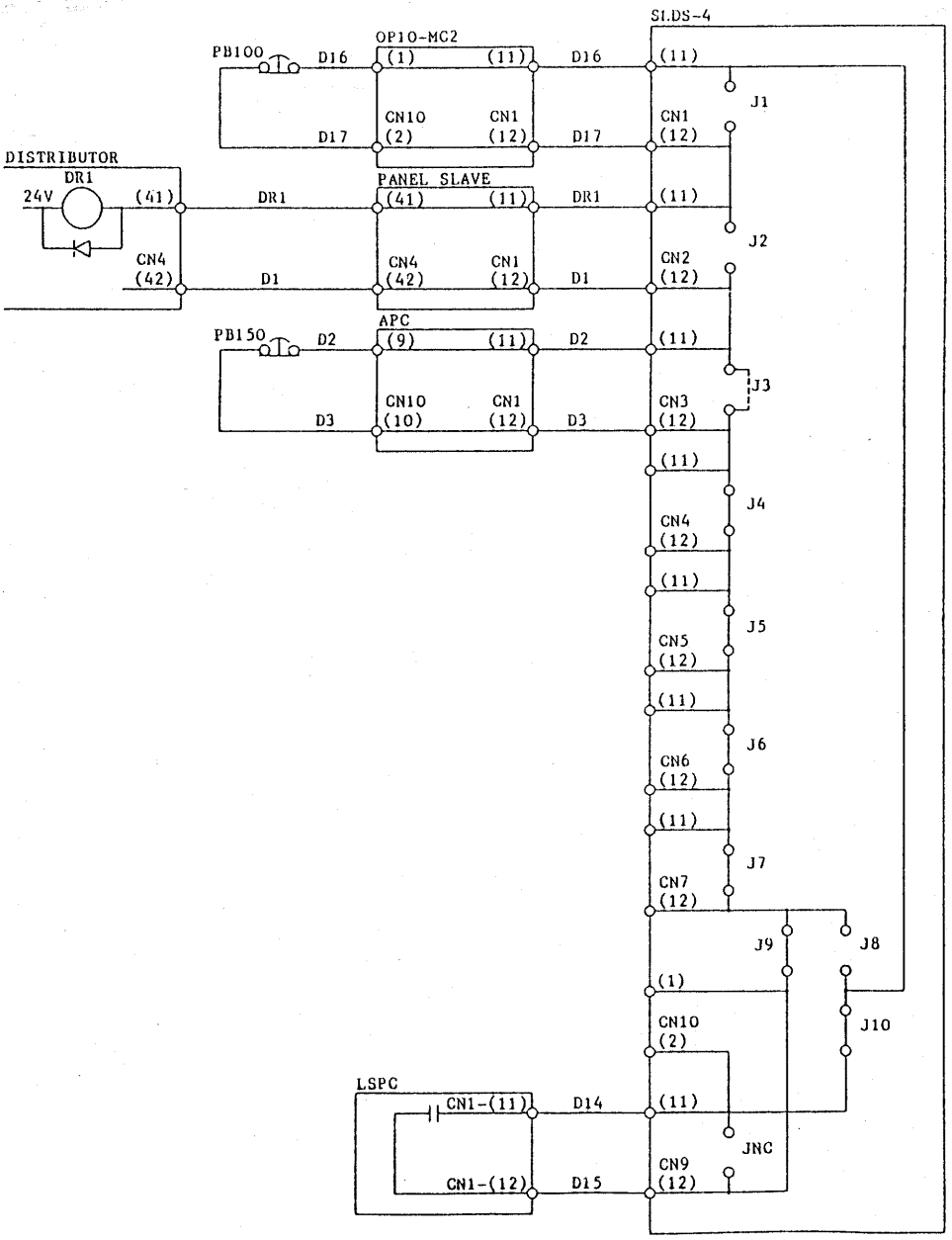


3. Emergency stop

Control of emergency stop shall be effective nuder any circumstances. Therefore, B contact points of all emergency stop push button are connected in series each other so that emergency stop becomes effective if any one of B contact point is opened.
Contact condition of emergency stop push button connect in series inside of SLDS after all connection cable of I/O slave unit gather to SLDS board.

Fig. 7-2-4 is shown one example of emergency stop circuit.
CN1 ~ CN7 have been provided for connection of emergency stop push button, therefure, apply short circuit pin on J1 ~ J7 if emergency button is not used.

Fig. 7-2-4 Example of emergency stop circuit



4. SLBUS table

M III uses I/O slave unit system with SLBUS.
Therefore, parameter for I/O slave unit must be set accordingly.
Setting parameters are shown below and it called as SLBUS table.

. Location No. of I/O slave unit which construct the system.

. Byte number of input data for each I/O slave unit.

. Byte number of output data for each I/O slave unit

. Byte number of high speed input data for each I/O slave unit.

. Byte number of high speed output data for each I/O slave unit.

. Actual address in sequencer of input data for each I/O slave unit.

. Actual address in sequencer of output data for each I/O slave unit.

. Phase A.B number of counter for processing I/O slave if applied.

M III controlls SLBUS by meams of judgement of both hardware and functional construction of SLBUS system by SLBUS table.
SLBUS table is stored in the battery back-uped memory and once data is set it will be kept even if power failure is occured.

(a) Screen of SLBUS table

Setting of SLBUS table is proceeded by means key board and CRT of M III.
Setting is done by function key in DATA SET MODE as shown below.

[HEAD/TAIL] → [F4] :System → [6] :PC menu → [INPUT] →
[4] :SLBUS → [INPUT]

SLBUS mode screen consists of two pages.
SLBUS table shall be set by sexadecimal, and input FF if data is not set.

Fig. 7-2-5 Setting screen of SLBUS table

SLBUS table (HEX)

PC RUN
1/2 Page

No.	LOC#	Type	Slave name	Classification	Leading CH Buffer#	CN No. Size	High speed byte Input	High speed byte Output	Byte No. Input	Byte No. Output	Address Input	Address Output
01	01	0	IO-128/1	I/O	00	00	00	00	10	10	00	00
02	02	0	IO-128/2	I/O	00	00	00	00	10	10	10	10
03	03	1	OPIO-L	I/O	00	00	00	00	0E	0E	20	20
04	FF	0			00	00	00	00	00	00	00	00
05	FF	0			00	00	00	00	00	00	00	00
06	FF	0			00	00	00	00	00	00	00	00
07	FF	0			00	00	00	00	00	00	00	00
08	FF	0			00	00	00	00	00	00	00	00
09	FF	0			00	00	00	00	00	00	00	00
10	FF	0			00	00	00	00	00	00	00	00
11	FF	0			00	00	00	00	00	00	00	00
12	FF	0			00	00	00	00	00	00	00	00
13	FF	0			00	00	00	00	00	00	00	00
14	FF	0			00	00	00	00	00	00	00	00
15	FF	0			00	00	00	00	00	00	00	00
16	FF	0			00	00	00	00	00	00	00	00

1 2 3 4 5 6 SLBUS ERROR 7 8 CHANGE 9

. LOC#

Loction No. of I/O slave unit, setting value is limited within 01 ~ OE.

. Byte No. of input (INBYT)

Byte No. of input data will be set in each LOC#.

. Byte No. of output (OUTBYT)

Bute No. of output data will be set in each LOC#.

. Byte No. of high speed input (HIINBYT)

Byte No. of high speed input data will be set in each LOC#. Setting value in here is not larger than INBYT, value of leading HIINBYT in INBYT becomes byte No. of high speed input.

. Byte No. of high speed output (HIOUTBYT)

Byte No. of high speed output data will be set in each LOC#.
Setting value in here is not larger than OUTBYT mentioned above, value of leading HIOUTBYT value in OUTBYT becomes byte No. of high speed output.
Set 00 if high speed output data is not exist.

. Input address (INADRS)

Actual address of slave input data will be set in this column.
Setting value will be set by leading address.

. Output address (OUTADRS)

Actual address of slave output data will be set in this column.
Setting value will be set by leading address.

(b) Setting of SLBUS table

Setting of SLBUS table in proceeded by means of key board into screen shown in Fig. 7-2-5.
LOC# can be used freely within 01 ~ 0E, however, allocate from 01 in order for more simple. 0F is reserved by key board.
Usually, LOC# 01 is set correspond to POLNO "1" and follows in order.
It is not neccesary coincide POLNO with LOC#.

(c) Setting example of SLBUS table

Fig. 7-2-6 is shown one example of SLBUS system.
Key board is not appeared in Fig. 7-2-6 because it is allocated to LOC#0F automatically.

Fig. 7-2-6 Example, SLBUS system

Setting screen of SLBUS table

No.	LOC#	Type	Slave name	Classification	Leading CH Buffer	CN No. Size	High speed byte Input	High speed byte Output	Byte No. Input	Byte No. Output	Address Input	Address Output
01	01	1	OPIO-MC	I/O	00	00	00	00	10	0D10	F0	F0
02	02	0	PANEL	I/O	00	00	02	00	0C	07	00	00
03	03	0	ATC	I/O+AB	01	01	00	00	03	03	0C	12
04	(04)	0	ATC2	I/O+AB								
05	(05)	0	APC	I/O	00	00	00	00	03	02	0F	16
06	(06)	0	PPL	I/O+AB	04	04	00	00	06	06	15	26
07	(08)	0	KEISOKU	I/O	00	00	00	00	01	00	20	00
08	(0B)	0	MPG-3	I/O	00	00	00	00	04	01	1B	37
09	(0C)	0	ADD AXIS	I/O	00	00	00	00	02	00	1E	00
10	(0D)	0	ROT TABL	I/O+AB	02	02	02	02	02	02	23	83
11	(07)	0	KANSHI	A/D	01	01	00	00	00	00	00	00
12	FF											
13	FF											
14	FF											
15	FF											
16	FF											

(Note) Shown with ( ) in LOC# column are option. Set 00 when option is not selected.

According to FF setting in LOC# of POLNO.12 controller recognize as no slave exist after POLNO.12. FF must be set to all LOC# of POLNO. if data is not set on the table.

(d) Setting of SLBUS table and start up of system

When initial start up of M III system, naturally a status of SLBUS table is not set.

Key board allocates slave #0F, however, key input is possible because M III master board always polls slave #0F even if SLBUS table is not set

After all information is input to SLBUS table as shown in Fig. 7-2-6, once shut off power and power on, M III polls the number according to setting data in SLBUS table.

(e) Setting of I/O slave

Each slave shall be set location No., byte No. of input data and existence of phase A.B by means of dip switch.

Contents of setting shall be coincided with SLBUS table.

If not coincided "SLBUS TABLE ERROR" will occure at the time of power on.

All setting is performed through dip switch on transmit control unit (SMCN or SMCN-2).

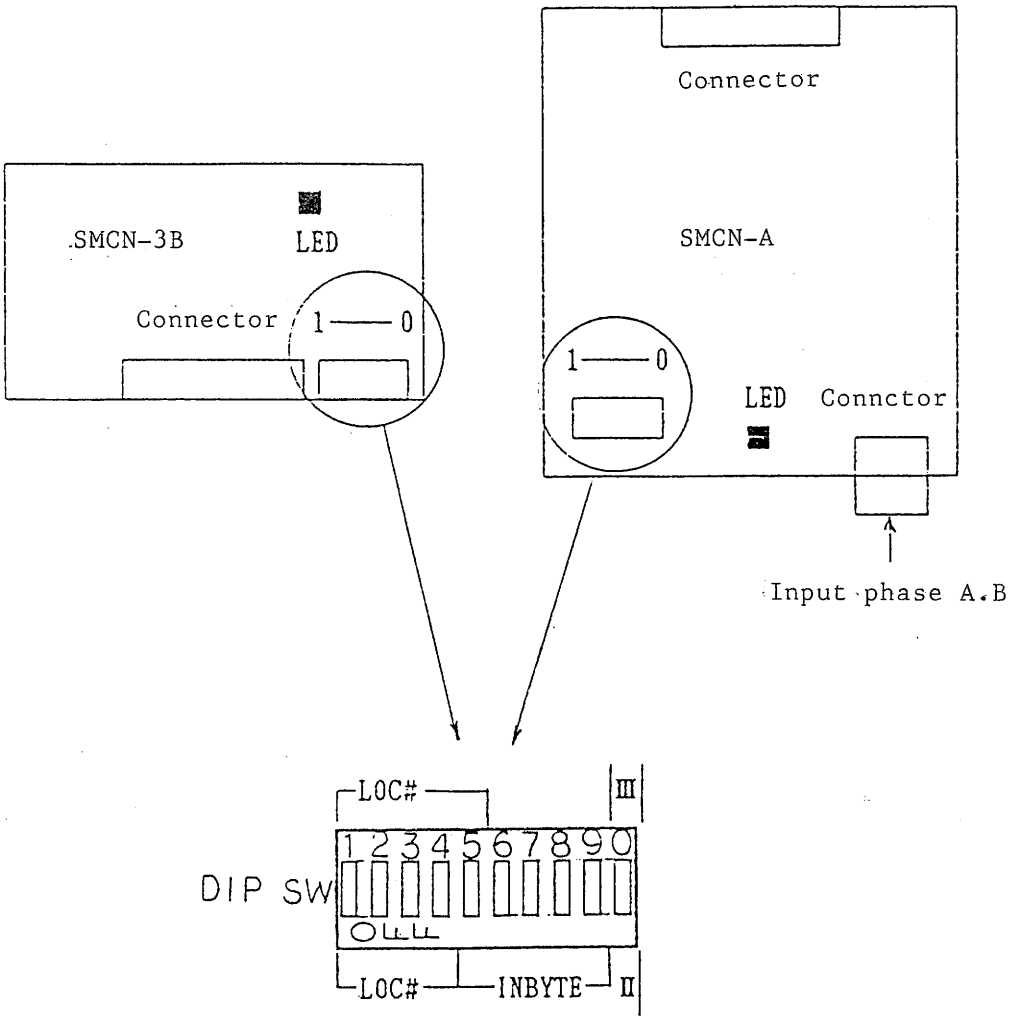
Setting procedure is shown in Fig. 7-2-7.

5. Setting of dip switch

Dip switch is mounted on SMCN-3B and SMCN-A board

Location of dip switch on board is shown in Fig. 7-2-7.

Fig. 7-2-7 Setting of dip switch



Classification of system

Setting	SWO
Model II	OFF
Model III	ON

Setting of loaction No.

In case of model II data setting is used by SW1 ~ SW4 and for model III it uses SW1 ~ SW5.

Correspondence of location No. and setting of switches are shown in table 4 and 5.

Setting of location No. in model II system

Location No.	SW1	SW2	SW3	SW4
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	ON	ON	OFF	OFF
4	OFF	OFF	ON	OFF
5	ON	OFF	ON	OFF
6	OFF	ON	ON	OFF
7	ON	ON	ON	OFF
8	OFF	OFF	OFF	ON
9	ON	OFF	OFF	ON
10	OFF	ON	OFF	ON
11	ON	ON	OFF	ON
12	OFF	OFF	ON	ON
13	ON	OFF	ON	ON
14	OFF	ON	ON	ON
15	Reserved by key board.			

Setting of location No. in model III system

Location No.	SW1	SW2	SW3	SW4	SW5
1	ON	OFF	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	OFF
3	ON	ON	OFF	OFF	OFF
4	OFF	OFF	ON	OFF	OFF
5	ON	OFF	ON	OFF	OFF
6	OFF	ON	ON	OFF	OFF
7	ON	ON	ON	OFF	OFF
8	OFF	OFF	OFF	ON	OFF
9	ON	OFF	OFF	ON	OFF
10	OFF	ON	OFF	ON	OFF
11	ON	ON	OFF	ON	OFF
12	OFF	OFF	ON	ON	OFF
13	ON	OFF	ON	ON	OFF
14	OFF	ON	ON	ON	OFF
15	ON	ON	ON	ON	OFF
16	OFF	OFF	OFF	OFF	ON
17	ON	OFF	OFF	OFF	ON
18	OFF	ON	OFF	OFF	ON
19	ON	ON	OFF	OFF	ON
20	OFF	OFF	ON	OFF	ON
21	ON	OFF	ON	OFF	ON
22	OFF	ON	ON	OFF	ON
23	ON	ON	ON	OFF	ON
24	OFF	OFF	OFF	ON	ON
25	ON	OFF	OFF	ON	ON
26	OFF	ON	OFF	ON	ON
27	ON	ON	OFF	ON	ON
28	OFF	OFF	ON	ON	ON
29	ON	OFF	ON	ON	ON
30	OFF	ON	ON	ON	ON
31	Reserved by key board				

Setting of INBYTE

I/O input point will be set by byte as unit.
In case of model II the data will be set by SW5 ~ SW9 which value has been set in table of SLBUS.
In case of model III data setting is not required, because data are transmitted from master board to each I/O slave as initial data at the time of start up of system.

Setting of input point (INBYTE) (only for model II)

Input point (Byte)	SW5	SW6	SW7	SW8	SW9
0	OFF	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF	OFF
2	OFF	ON	OFF	OFF	OFF
3	ON	ON	OFF	OFF	OFF
4	OFF	OFF	ON	OFF	OFF
5	ON	OFF	ON	OFF	OFF
6	OFF	ON	ON	OFF	OFF
7	ON	ON	ON	OFF	OFF
8	OFF	OFF	OFF	ON	OFF
9	ON	OFF	OFF	ON	OFF
10	OFF	ON	OFF	ON	OFF
11	ON	ON	OFF	ON	OFF
12	OFF	OFF	ON	ON	OFF
13	ON	OFF	ON	ON	OFF
14	OFF	ON	ON	ON	OFF
15	ON	ON	ON	ON	OFF
16	OFF	OFF	OFF	OFF	ON
17	ON	OFF	OFF	OFF	ON
18	OFF	ON	OFF	OFF	ON
19	ON	ON	OFF	OFF	ON
20	OFF	OFF	ON	OFF	ON
21	ON	OFF	ON	OFF	ON
22	OFF	ON	ON	OFF	ON
23	ON	ON	ON	OFF	ON
24	OFF	OFF	OFF	ON	ON
25	ON	OFF	OFF	ON	ON
26	OFF	ON	OFF	ON	ON
27	ON	ON	OFF	ON	ON
28	OFF	OFF	ON	ON	ON
29	ON	OFF	ON	ON	ON
30	OFF	ON	ON	ON	ON

Setting for ineffective of power monitor

This is a function to be ineffective on power monitor which is monitoring +24V and -5V used for power source of I/O slave interface.
During a shift term to model III, it will be used I/O slave or operation board corresponds to model II.
Those I/O board is not integrated power source detecting circuit, therefore, if those unit apply to model III, it should be ineffective on power monitor.
Setting will be done by dip switch SW9.
In case of model II, there is no monitoring function, so please note SW9 is used for setting of INBYTE.

Setting for ineffective of power monitor (only for model III)

Setting	SW9
Monitor, effective	OFF
Monitor, ineffective	ON

7-3 Diagnosis of NC Input Signal

Status of internal NC unit and I/O condition of sequencer is displayed on CRT screen.

Signal condition of control circuit can be diagnosed by means of this diagnostic function.

(Refer to SEIKI-SEICOS M III/A maintenance manual.)

7-4 Stored Type Pitch Error Compensation

1) Function

It is possible to compensate the pitch error compansation every axis in least incremental unit.
This function becomes effective for every axis after reference point return.

2) Specifications

The value to be compensated for every compensation interval is set by a parameter through regarding the position where returning to the reference point as the compensation reference point.

(1) Axis that can be compensated : All axes
(2) Compensating point umber : Max. 128 points for each axis
(3) Range of compensation amount : 0~±32000 per a compensation point
(4) Compensation interval : Parameter setting
(5) Compensating method : Inner inserted type

3) Parameter setting

It is necessary to set the following parameters by the same operations as those of other parameter setting in case of the parameter related to the pitch error compensation.

Parameter No.5410 Interval of the pitch error compensation every axis.
No.5411 Internally inserted parameter 1 for the pitch error compensation every axis.
No.5412 Internally inserted parameter 2 for the pitch error compensation every axis.
No.5413 Max. point No. of the pitch error compensation every axis.
No.5414 Reference point No. of the pitch error compensation every axis.
No.5416 Start No. of the pitch error compensation.

Note) When desiring to alter the parameter related to the pitch error compensation, execute the low speed type reference point return once again after perform the emergency stop once.

4) Pitch error compensation data

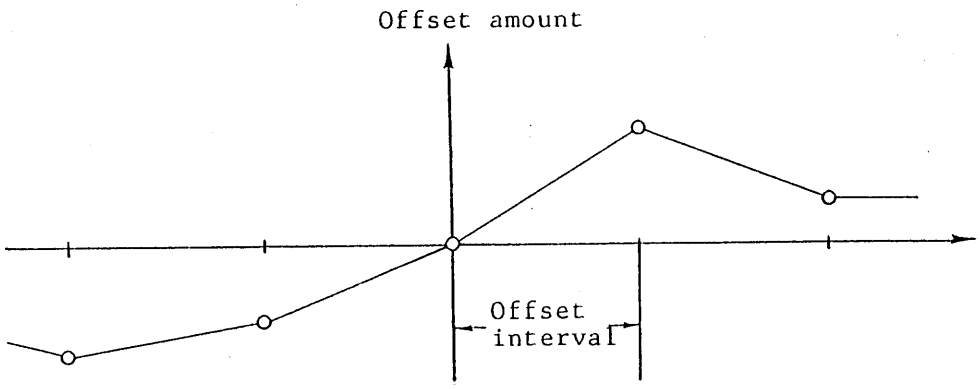
Select the setting of machine system compensation amount on the system scree.

Set compensation data corresponding to the data No. of the stored type pitch error compensation.

Note) When desiring to alter the pitch error compensation data, execute the low speed type reference point return once again after performing the emergency stop once.

5) Internally inserted system

Insert internally an offset amount with straight line and perform smooth pitch error compesation.



When executing the internally inserted system, set the parameters, 5411 and 5412.

(Example of setting)

When the offset interval (Parameter 5410) is 10000;

$$\text{Parameter } 5412 = [10 g_2 \ 10000)_{\text{Raise}} = 14$$

$$\text{Parameter } 5411 = \left[\frac{2^{14+14}}{10000} \right]_{\text{Round}} = 26844$$

When the internally inserted system is not performed, set the parameters 5411 and 5412 to 0.

6) Example of parameter setting

When the offset data of the data No.20 through 29 are used and the reference point is data No.24, set parameters as below.

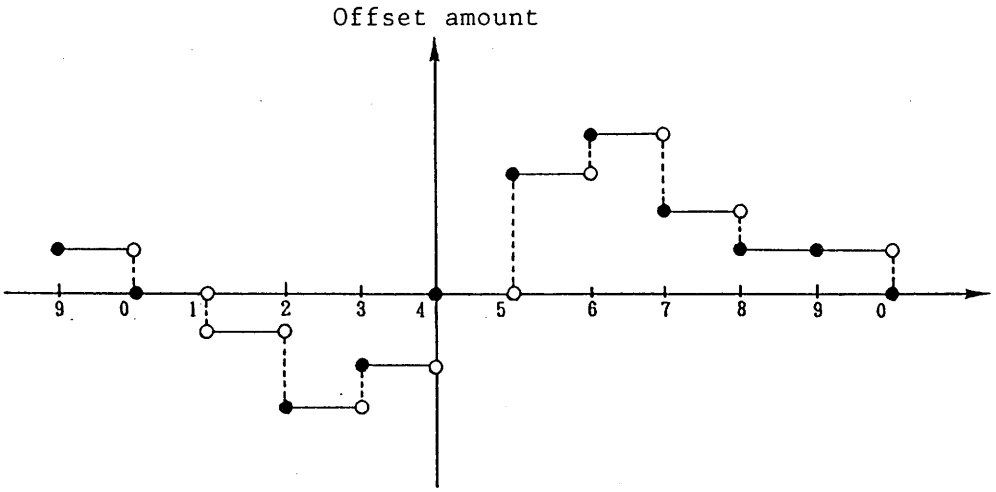
Parameter 5413 = 9

Parameter 5414 = 4

Parameter 5415 = 20

Offset point	0	1	2	3	4	5	6	7	8	9
Data No.	20	21	22	23	24	25	26	27	28	29
Offset data	-1	-1	-2	1	2	3	1	-2	-1	0

When inter insertion is not preformed



7-5 Axis Servo System

7-5-1 AC Servo Motor Specifications

1) List of composition

VK45

No.	Name	Q'ty	Specifications
1	AC servo motor		
	DFSM-2020-502A	1	X/Y axes 2.0kW, 2000rpm, 5000P/R
	DFSM-3020B-502A	1	Z-axis with brake 3.3kW, 2000rpm, 5000P/R
2	AC servo amplifier		
	ADU20F1X	3	20A output
3	AC servo power supply		
	PCU05	1	5kW OUTPUT
4	Regeneration resister		Common use to 3 axes
	BPR05L	1	100W 15Ω

List of composition

VK55

No.	Name	Q'ty	Specifications
1	AC servo motor		
	DFSM-3020-502A	2	X/Y axes 3.3kW, 2000rpm, 5000P/R
	DFSM-3020B-502A	1	Z-axis with brake 3.3kW, 2000rpm, 5000P/R
2	AC servo amplifier		
	ADU20F1X	3	20A output
3	AC servo power supply		
	PCU05	1	5kW OUTPUT
4	Regeneration resister		Common use to 3 axes
	BPR05L	1	100W 15Ω

List of composition

Index table

Index table maker	Model	AC servo motor	Stand	AC servo amplifierr	Stand	Remarks
Tsudakoma	RNCM251R	DFSM-0520-502A	1	ADU-05F1X	1	0.5KW
	RNCM301R	DFSM-1020-502A	1	ADU-05F1X	1	1.0KW
	RNCM401R	DFSM-2020-502A	1	ADU-20F1X	1	2.0KW
	RNCM501R	DFSM-2020-502A	1	ADU-20F1X	1	2.0KW
Nikken	CNC200R	DFSM-0520-502A	1	ADU-05F1X	1	0.5KW
	CNC250R	DFSM-0520-502A	1	ADU-05F1X	1	0.5KW
	CNC320R	DFSM-2020-502A	1	ADU-20F1X	1	2.0KW
	CNC400R	DFSM-2020-502A	1	ADU-20F1X	1	2.0KW
	CNC500R	DFSM-2020-502A	1	ADU-20F1X	1	2.0KW
	NST300	DFSM-0520-502A	1	ADU-05F1X	1	0.5KW
	5AX-230	DFSM-0520-502A	1	ADU-05F1X	1	0.5KW (Rotary axis)
		DFSM-1020-502A	1	ADU-05F1X	1	1.0KW (Tilting axis)
	5AX-300	DFSM-1020-502A	1	ADU-05F1X	1	1.0KW (Tilting axis)
		DFSM-0520-502A	1	ADU-05F1X	1	0.5KW (Rotary axis)
Matsumoto	MDH200R	DFSM-0520-502A	1	ADU-05F1X	1	0.5KW
	MD300R	DFSM-1020-502A	1	ADU-05F1X	1	1.0KW
	MD400R	DFSM-2020-502A	1	ADU-20F1X	1	2.0KW

2) Motor specifications

VK45

Item	Model		DFSM-2020-502A	DFSM-3020B-502A	
	Symbol	Unit	—	—	
Max. continous output *	Pc	KW	2.3	3.3	
Max. rotation speed	Nm	rpm	2000	2000	
Max. continous torque *	Tc	Kgf·cm	120	220	
Max. instant torque *	Tp	Kgf·cm	420	700	
Max. continous armature current *	Ic	Arms	10.5	19	
Max. instant armarture current *	Ip	Arms	39	63	
Roter inertia	JM	Kgf·cm·s^2	0.07	0.114	
Armature resister (Phase)	Ra	Ω	0.48	0.25	
Armature inductance (Phase)	La	mH	3.3	2.1	
Stail friction torque	TF	Kgf·cm	3.2	4.2	
Induced voltage constant (Phase)	KE	V/rpm	0.047	0.0476	
Torque constant	KT	Kgf·cm/Arms	13	13.2	
Mecanical time constant	tm	ms	5.8	4.7	
Heat time constant	th	min	60	65	
Encorder pulse number	—	Pulse/rev	5000	5000	
Gross weight	—	Kg	24	40	
Hold brake specification		Spring operated, electro magnetic released type			
Static friction torque		Kgf·cm	-	400	
Exiting voltage *		V(DC)	-	90	
Exiting current *		A(DC)	-	0.28	
Inertia		Kgf·cm·s^2	-	0.01	
Designation		-	824-126017-018	824-126017-026	
Applicable amplifier		-	ADU20F	ADU20F	

Note 1) Item marked * shows value after temperature up.
The others are the values at 20°C.

Motor specifications

VK55

Item	Model		DFSM-3020-502A	DFSM-3020B-502A	
	Symbol	Unit	—	—	
Max. continous output *	Pc	KW	3.3	3.3	
Max. rotation speed	Nm	rpm	2000	2000	
Max. continous torque *	Tc	Kgf·cm	220	220	
Max. instant torque *	Tp	Kgf·cm	700	700	
Max. continous armature current *	Ic	Arms	19	19	
Max. instant armarture current *	Ip	Arms	63	63	
Roter inertia	JM	Kgf·cm·s^2	0.114	0.114	
Armature resister (Phase)	Ra	Ω	0.25	0.25	
Armature inductance (Phase)	La	mH	2.1	2.1	
Stail friction torque	TF	Kgf·cm	4.2	4.2	
Induced voltage constant (Phase)	KE	V/rpm	0.0476	0.0476	
Torque constant	KT	Kgf·cm/Arms	13.2	13.2	
Mecanical time constant	tm	ms	4.7	4.7	
Heat time constant	th	min	65	65	
Encorder pulse number	—	Pulse/rev	5000	5000	
Gross weight	—	Kg	40	40	
Hold brake specification		Spring operated, electro magnetic released type			
Static friction torque		Kgf·cm	-	400	
Exiting voltage *		V(DC)	-	90	
Exiting current *		A(DC)	-	0.28	
Inertia		Kgf·cm·s^2	-	0.01	
Designation		-	824-126017-019	824-126017-026	
Applicable amplifier		-	ADU20F	ADU20F	

Note 1) Item marked * shows value after temperature up.
The others are the values at 20°C.

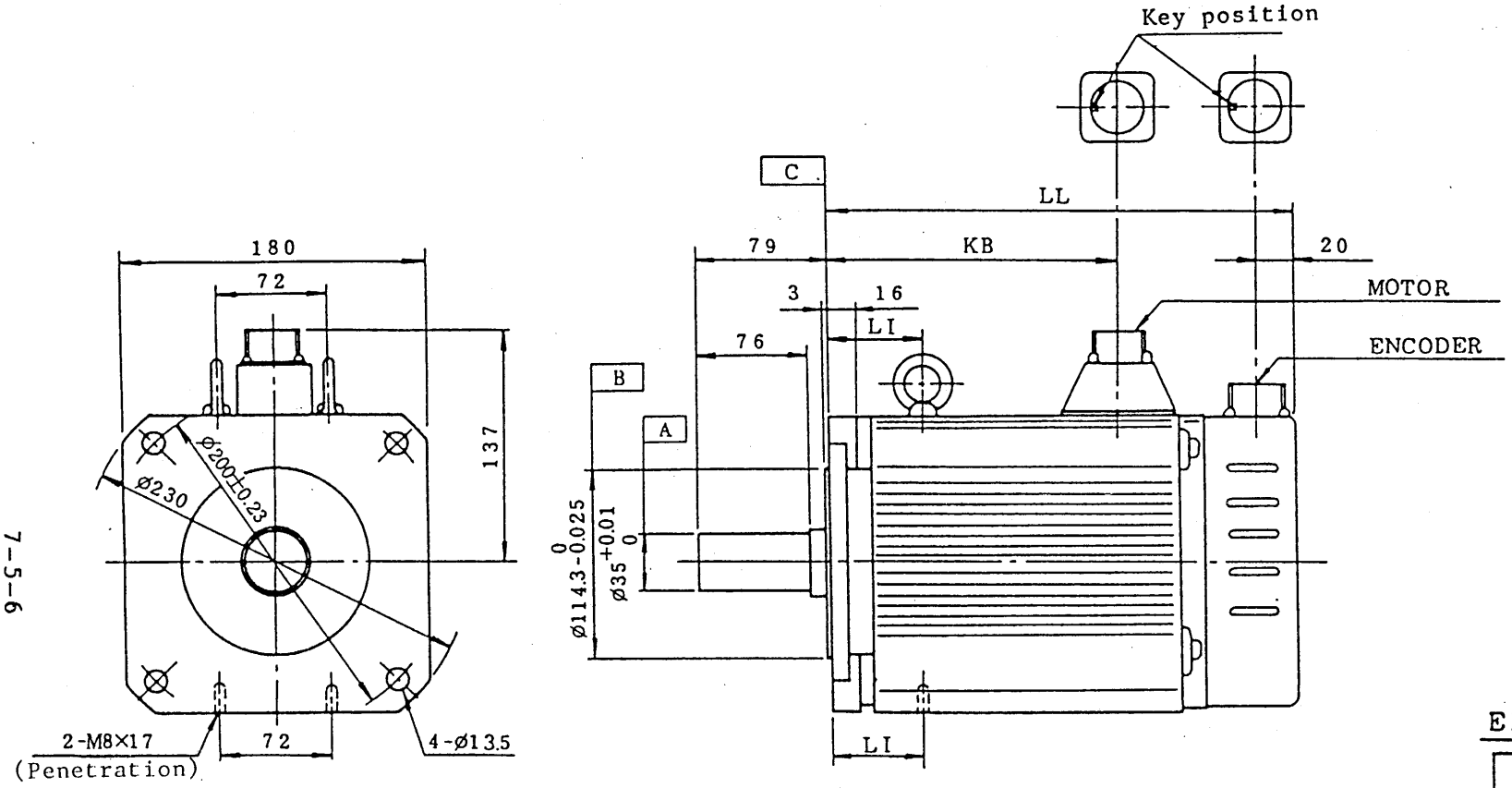
Motor specifications

Index table

Item		Model	DFSM-0520-502A	DFSM-1020-502A	DFSM-2020-502A
	Symbol	Unit	—	-	-
Max. continous output *	Pc	KW	0.5	1.0	2.0
Max. rotation speed	Nm	rpm	2000	2000	2000
Max. continous torque *	Tc	Kgf·cm	30	60	120
Max. instant torque *	Tp	Kgf·cm	100	155	420
Max. continous armature current *	Ic	Arms	3.4	5.1	10.5
Max. instant anmarture current *	Ip	Arms	12	13	39
Roter inertia	JM	Kgf·cm·s^2	0.011	0.023	0.07
Armature resister (Phase)	Ra	Ω	2.0	1.53	0.48
Armature inductance (Phase)	La	mH	7.0	6.0	3.3
Stail friction torque	TF	Kgf·cm	1.8	3.2	3.2
Induced voltage constant (Phase)	KE	V/rpm	0.0358	0.0478	0.0470
Torque constant	KT	Kgf·cm/Arms	10	13.3	13
Mecanical time constant	tm	ms	6.4	5.7	5.8
Heat time constant	th	min	45	50	60
Encorder pulse number	—	Pulse/rev.	5000	5000	5000
Gross weight	—	Kg	10	15	24
Hold brake specification		Spring operated, electro magnetic released type			
Static friction torque		Kgf·cm	-	-	-
Exiting voltage *		V(DC)	-	-	-
Exiting current *		A(DC)	-	-	-
Inertia		Kgf·cm·s^2	-	-	-
Designation		-	824-126017-016	824-126017-017	824-126017-018
Applicable amplifier		-	ADU-05F1X	ADU-05F1X	ADU-20F1X

Note 1) Item marked * shows value after temperature up.
The others are the values at 20°C.

3) DFSM-2020-502A
DFSM-3020-502A
DFSM-2030-502A
DFSM-3030-502A
Outside view drawing



Unit:mm

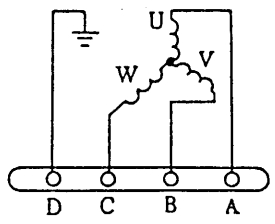
MODEL	LL	KB	LI	Weight(kg)
DFSM-2020-502A DFSM-2030-502A	256	151	102	24
DFSM-3020-502A DFSM-3030-502A	322	217	145	32

Note 1. Runout at the shaft end [A] is to be within 0.02mm.

2. Eccentricity of the flange [B] is to be within 0.04mm TIR TIR against [A] .

3. Squareness of the flag [C] is to be within 0.04mm TIR against [A] .

MOTOR



MS3102A22-22P

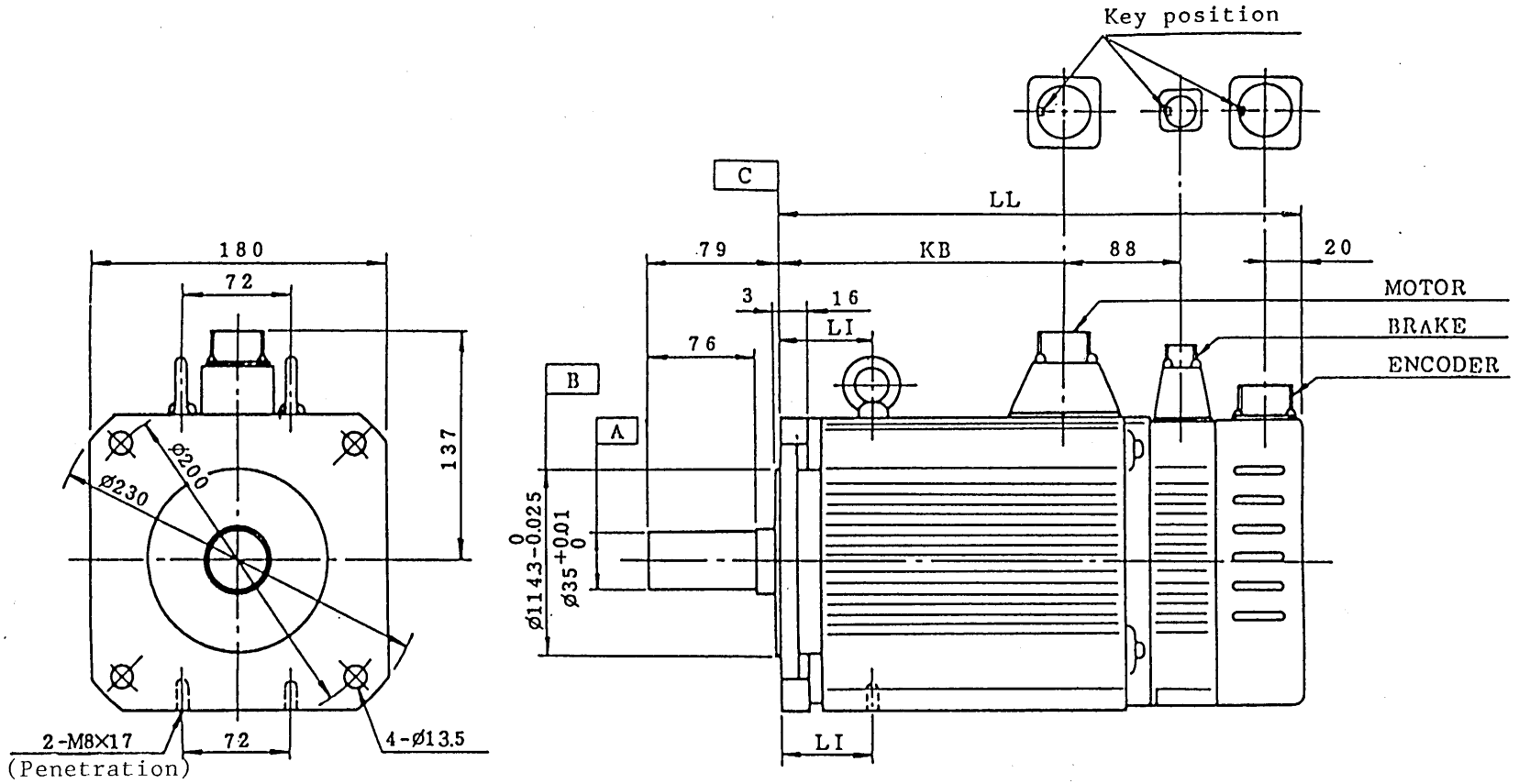
ENCODER

A	PA	K	ON
B	Vacant	L	PV
C	$\overline{PA}$	M	PW
D	PZ	N	$\overline{PB}$
E	Vacant	P	PZ
F	PB	R	PU
G	$\overline{PV}$	S	$\overline{PU}$
H	OG	T	$\overline{PW}$
J	+5N		

MS3102A20-29P

4) DFSM-3020B-502A

Outside view drawing



Unit:mm

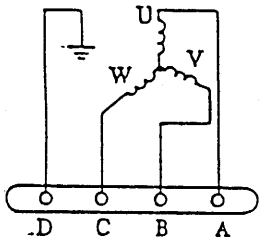
MODEL	LL	KB	LI	Weight (Kg)
DFSM-3020B-502A	414	217	145	40

Note 1. Runout at the shaft end [A] is to be within 0.02mm.

2. Eccentricity of the flange [B] is to be within 0.04mm TIR TIR against [A] .

3. Squareness of the flag [C] is to be within 0.04mm TIR against [A] .

MOTOR

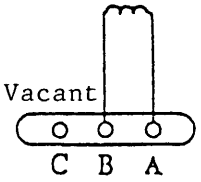


MS3102A22-22P

BRAKE Exiting open

Exiting voltage: 90V(DC)±10%

Exiting current: 0.28(DC)



MS3102A14S-7P

ENCODER

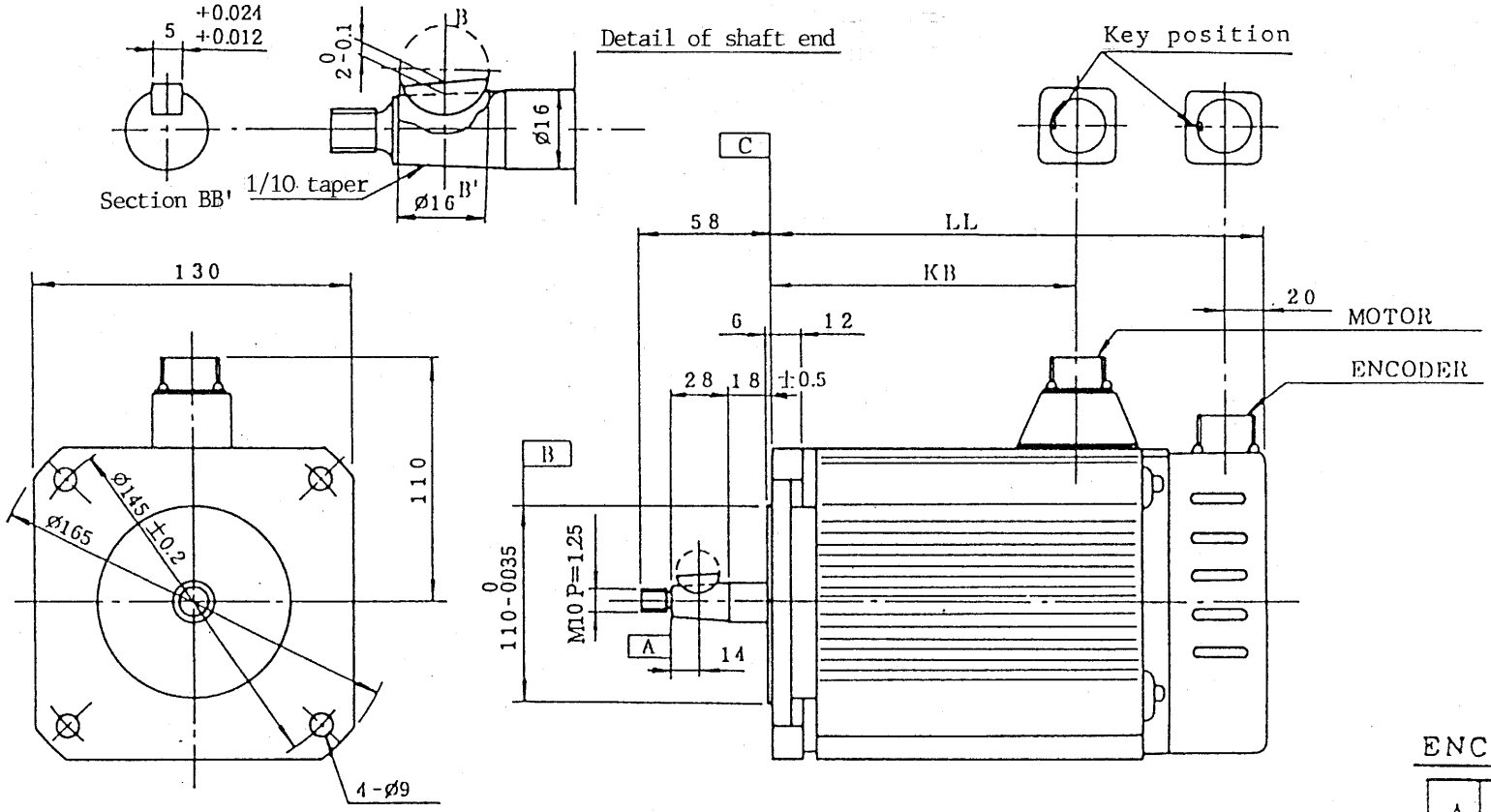
A	PA	K	ON
B	Vacant	L	PV
C	$\overline{PA}$	M	PW
D	PZ	N	$\overline{PB}$
E	Vacant	P	$\overline{PZ}$
F	PB	R	PU
G	$\overline{PV}$	S	$\overline{PU}$
H	OG	T	$\overline{PW}$
J	+5N		

MS3102A20-29P

5) DFSM-0520-502A

DFSM-1020-502A

Outside view drawing



Unit:mm

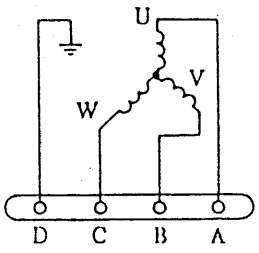
MODEL	LL	KB	Weight(kg)
DFSM-0520-502A	197	103	10
DFSM-1020-502A	260	171	15

Note 1. Runout at the shaft end [A] is to be within 0.02mm.

2. Eccentricity of the flange [B] is to be within 0.04mm TIR TIR against [A] .

3. Squareness of the flag [C] is to be within 0.04mm TIR against [A] .

MOTOR



MS3102A18-10P

ENCODER

A	PA	K	ON
B	Vacant	L	PV
C	$\overline{PA}$	M	PW
D	PZ	N	$\overline{PB}$
E	Vacant	P	$\overline{PZ}$
F	PB	R	PU
G	$\overline{PV}$	S	$\overline{PU}$
H	OC	T	$\overline{PW}$
J	+5N		

MS3102A20-29P

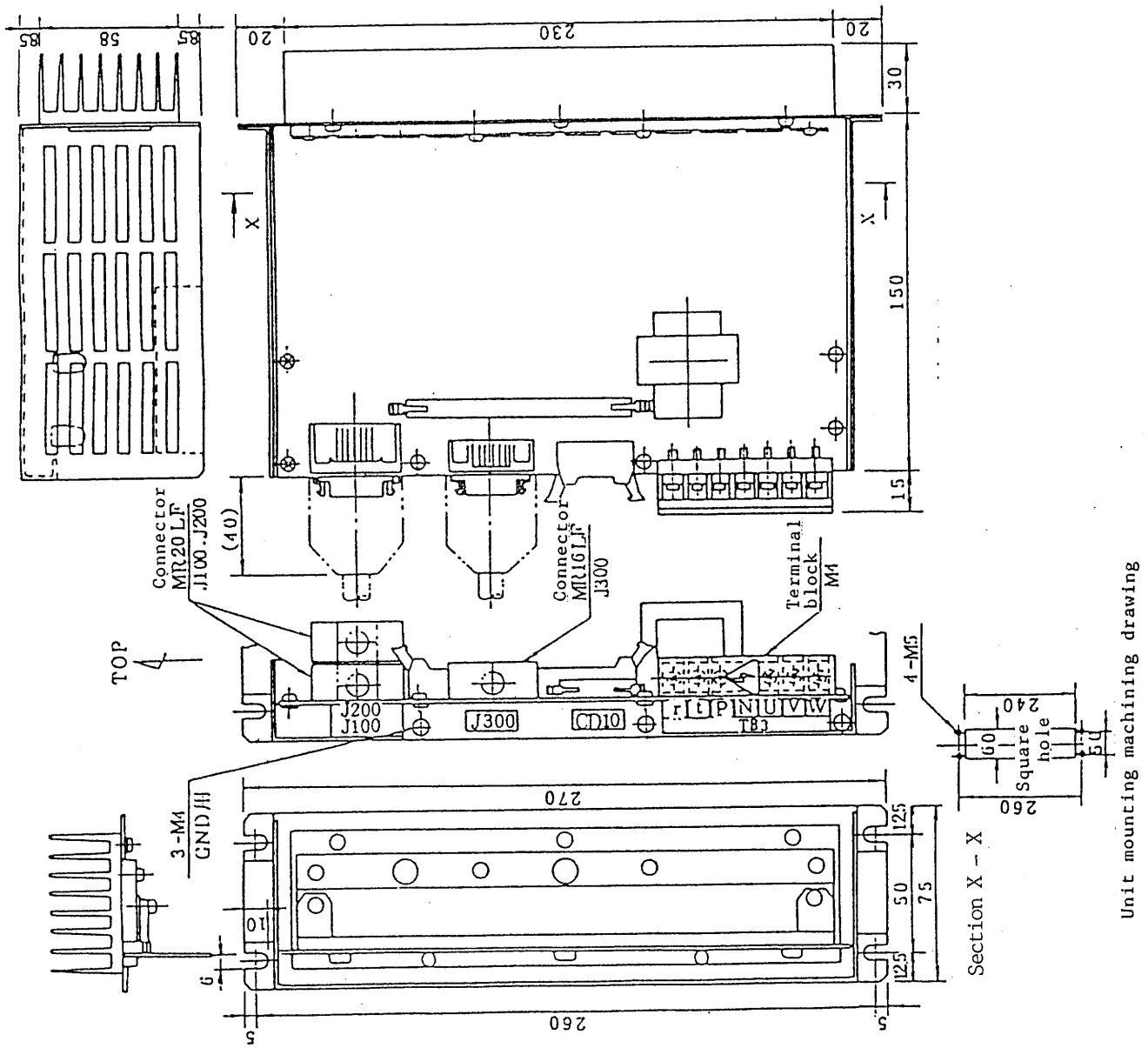
6) ADU-Ø5F1X

Outside view drawing

Note 1 In case of inner and outer air package type (system increasing radiant efficiency by exposing the rectifier heat sink part to the open air), expose the rectifier heat sink part from the square hole part of the above mounting hole machining drawing.

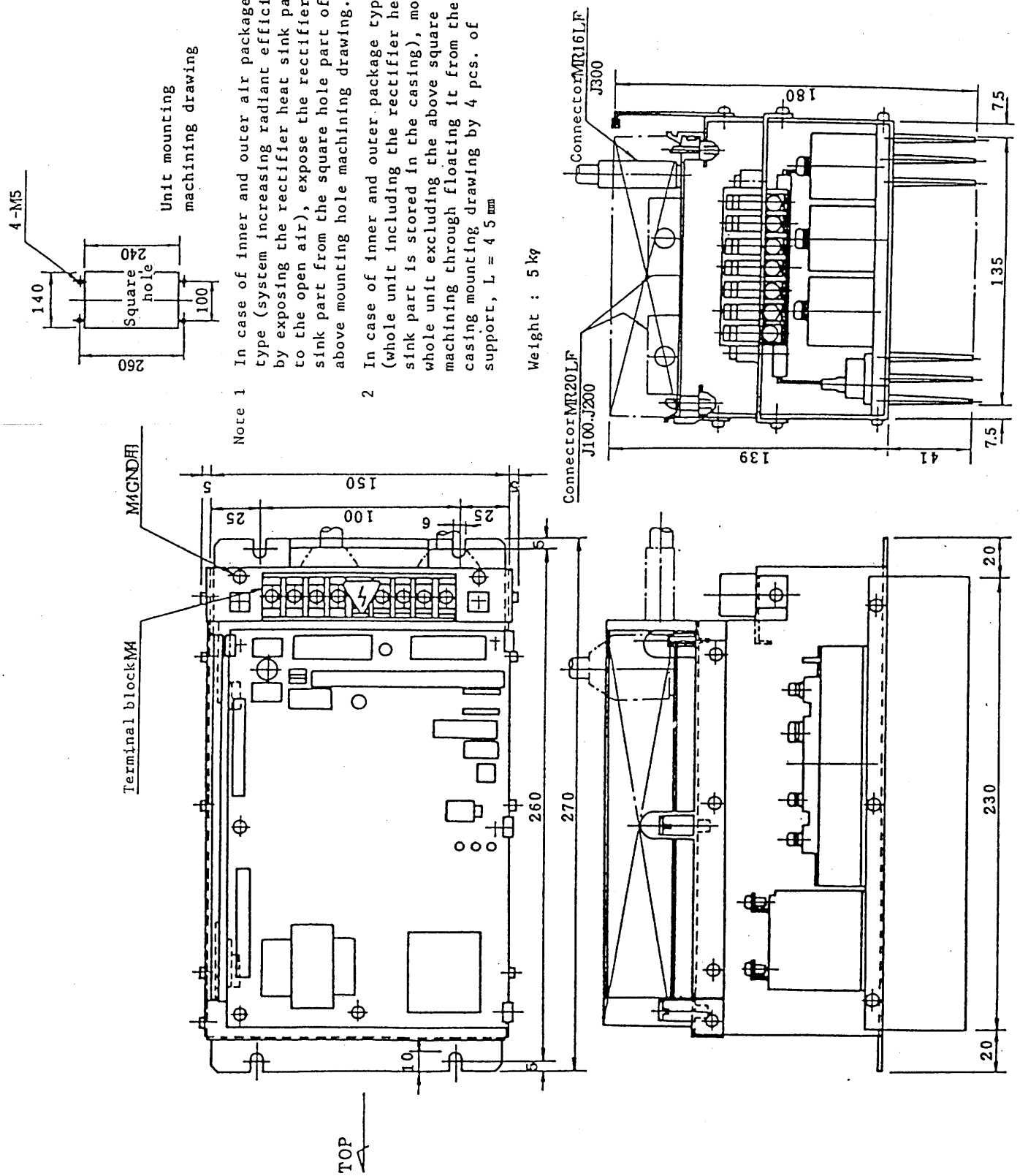
2 In case of inner and outer package type (whole unit including the rectifier heat sink part is stored in the casing), mount whole unit excluding the above square hole machining through floating it from the casing mounting drawing by 4 pcs. of support, L = 35mm.

Weight : 2.1kg

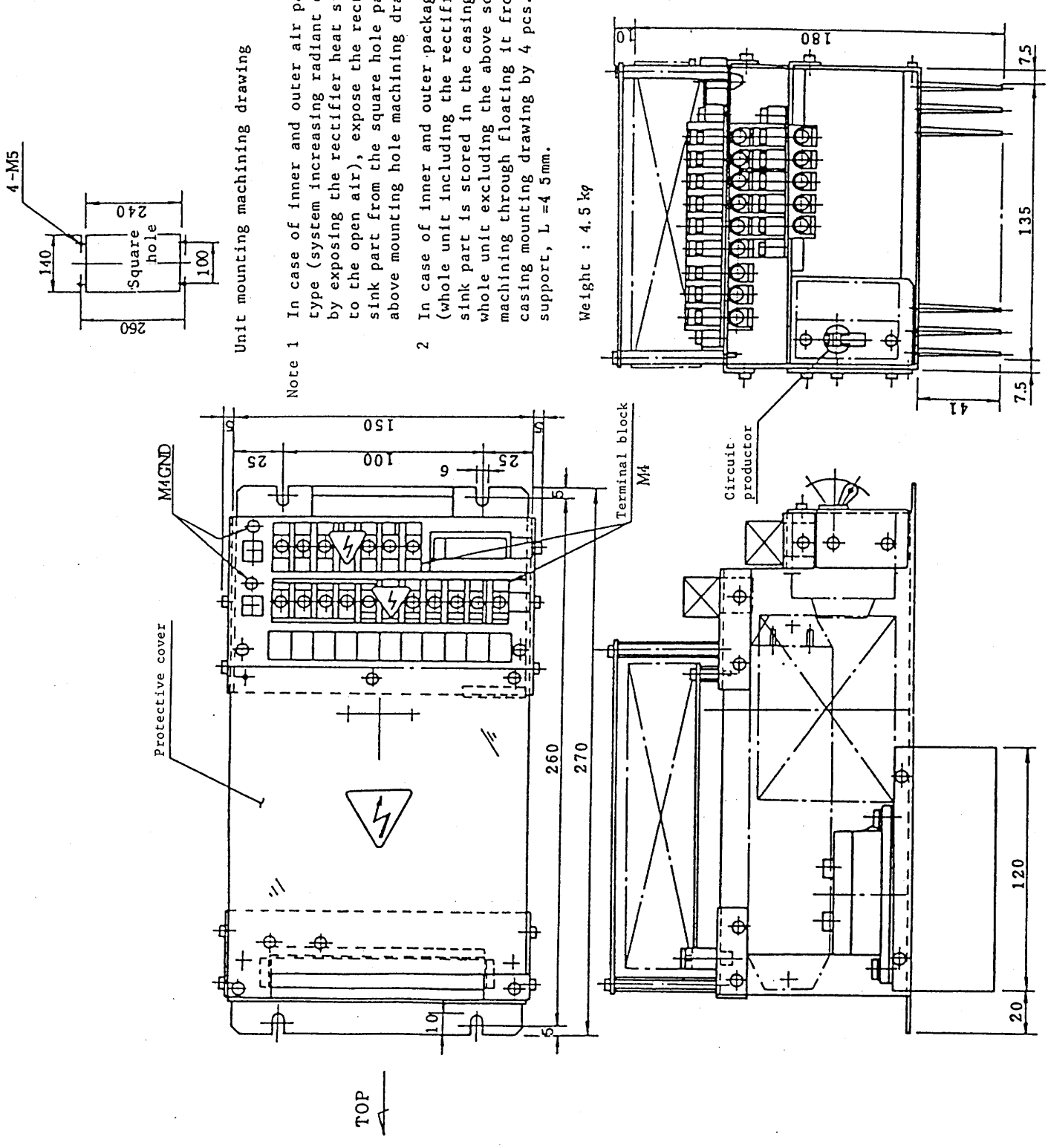


7) ADU-20F1X

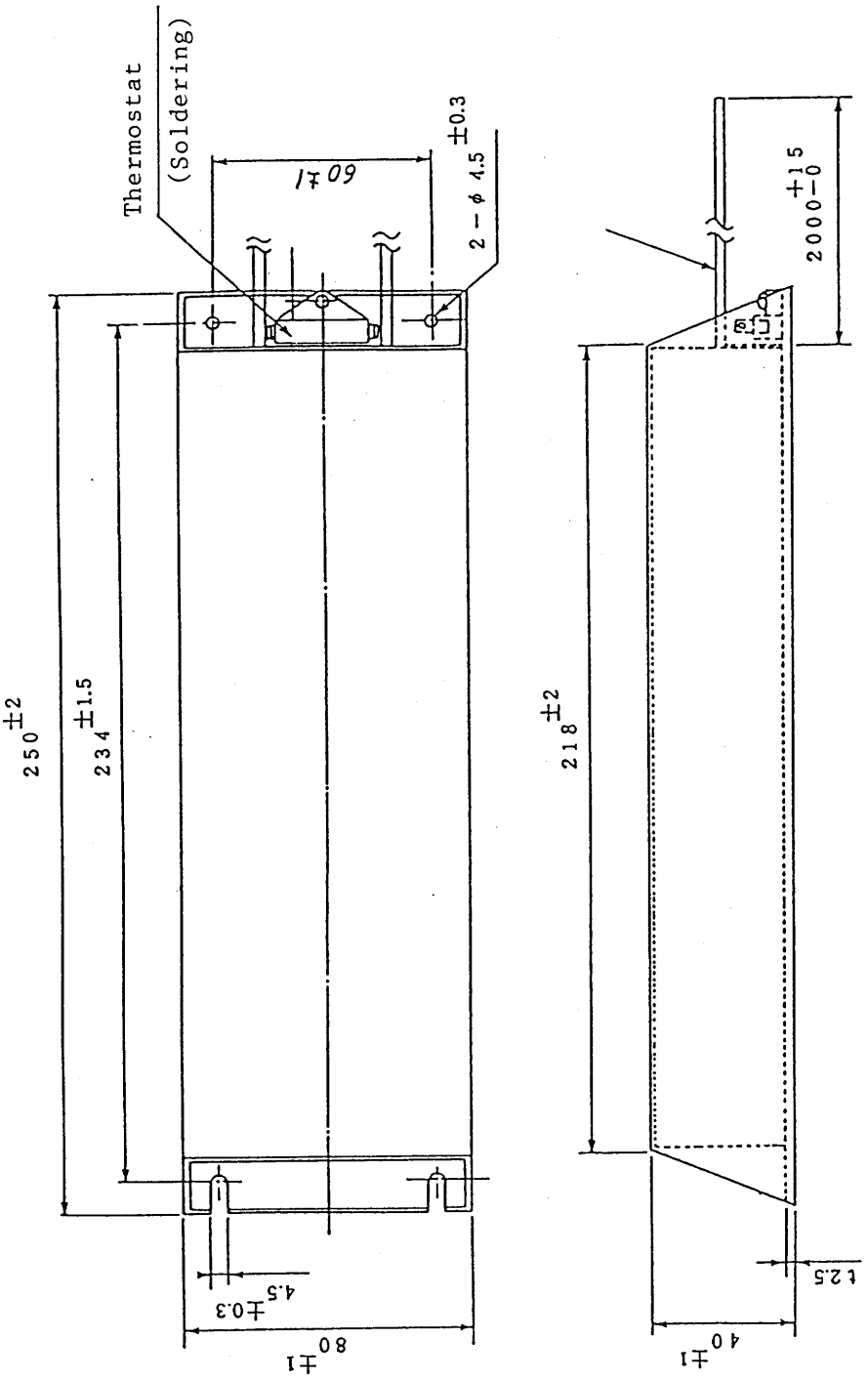
Outside view drawing

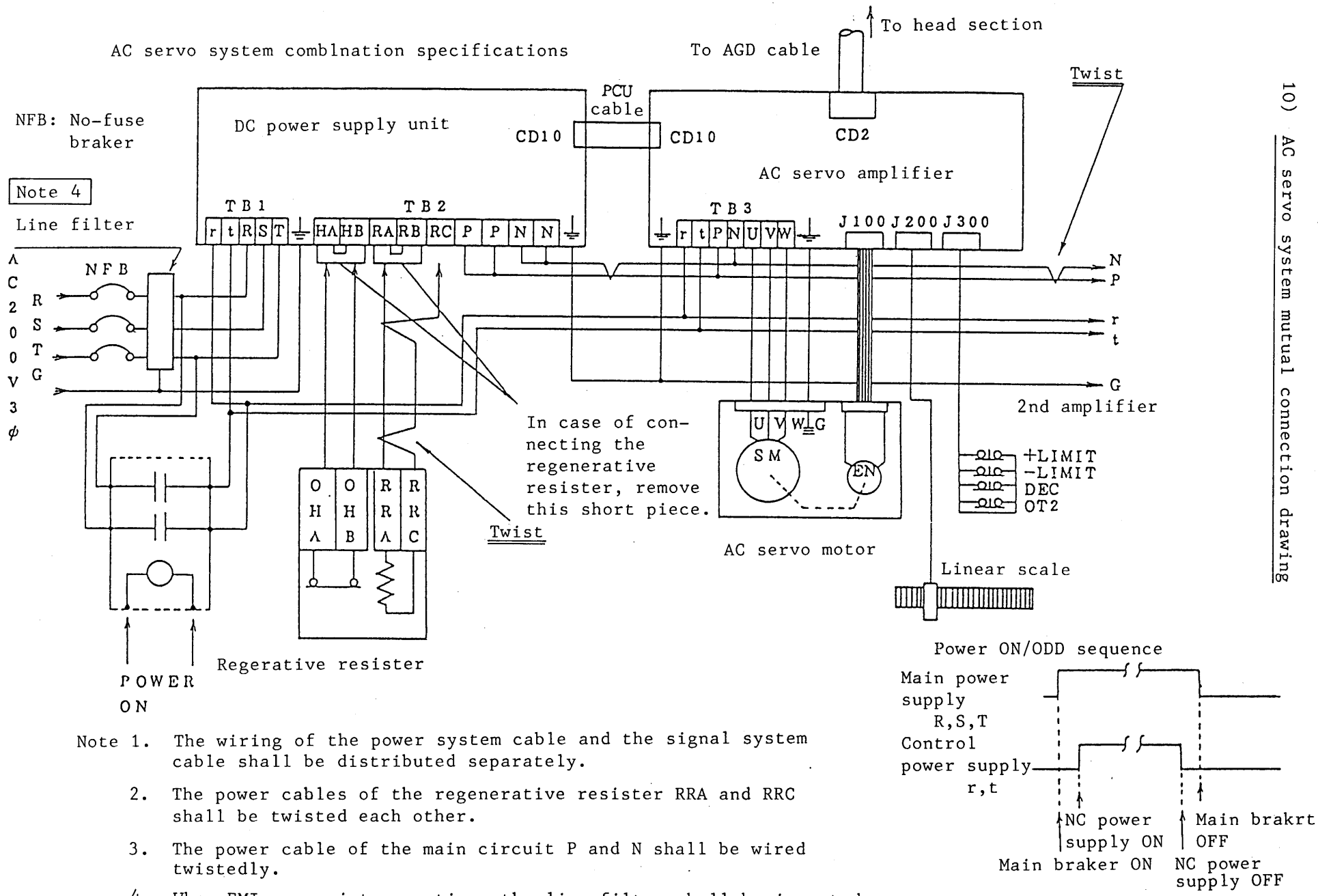


8) PCU－5 Outside view drawing



9) BPR-05L Outside view drawing





Note 1. The wiring of the power system cable and the signal system cable shall be distributed separately.

2. The power cables of the regenerative resister RRA and RRC shall be twisted each other.

3. The power cable of the main circuit P and N shall be wired twistedly.

4. When EMI comes into question, the line filter shall be inserted.

7-5-2 Outline of the Power System Connection Terminal

1) DC power supply unit (TB1. TB2)

The outline of the DC power supply unit, TB1 and TB2 is shown in the table 1 and 2.

Table 1 Outline of the terminal TB1

Terminal symbol	Terminal name	Outline
r, t	Control power supply input terminal	AC single phase 200/220V+10% -15% 50/60Hz
R, S, T	Main power supply input terminal	AC 3 phase 200/220V+10% -15% 50/60Hz

Table 2 Outline of the terminal TB2

Terminal symbol	Terminal name	Outline
HA, HB	Thermal contact connection terminal	Connect the thermal point of the regenerative resister. When the regenerative resister is not used, it is shorted.
RA, RB, RC	Regenerative resister connection terminal	Connect the regenerative resister between RA and RC. When the regenerative resister is used, short between RA and RB.
P, N	DC power supply output terminal	DC voltage of the main circuit is output.

2) AC servo amplifier (TB3)

The outline of the AC servo amplifier is shown in table 3.

Table 3 Outline of the terminal TB3

Terminal symbol	Terminal name	Outline
r, t	Control power supply input terminal	AC single phase 200/220V+10% -15% 50/60Hz
P, N	DC power supply output terminal	DC voltage of the main circuit is input.
U, V, W	Motor connection terminal	Connect U and the motor U terminal, V and the V terminal and W and the motor W terminal.

⏚ : Earth terminal

3) AC amplifier, DC power supply unit and LED display

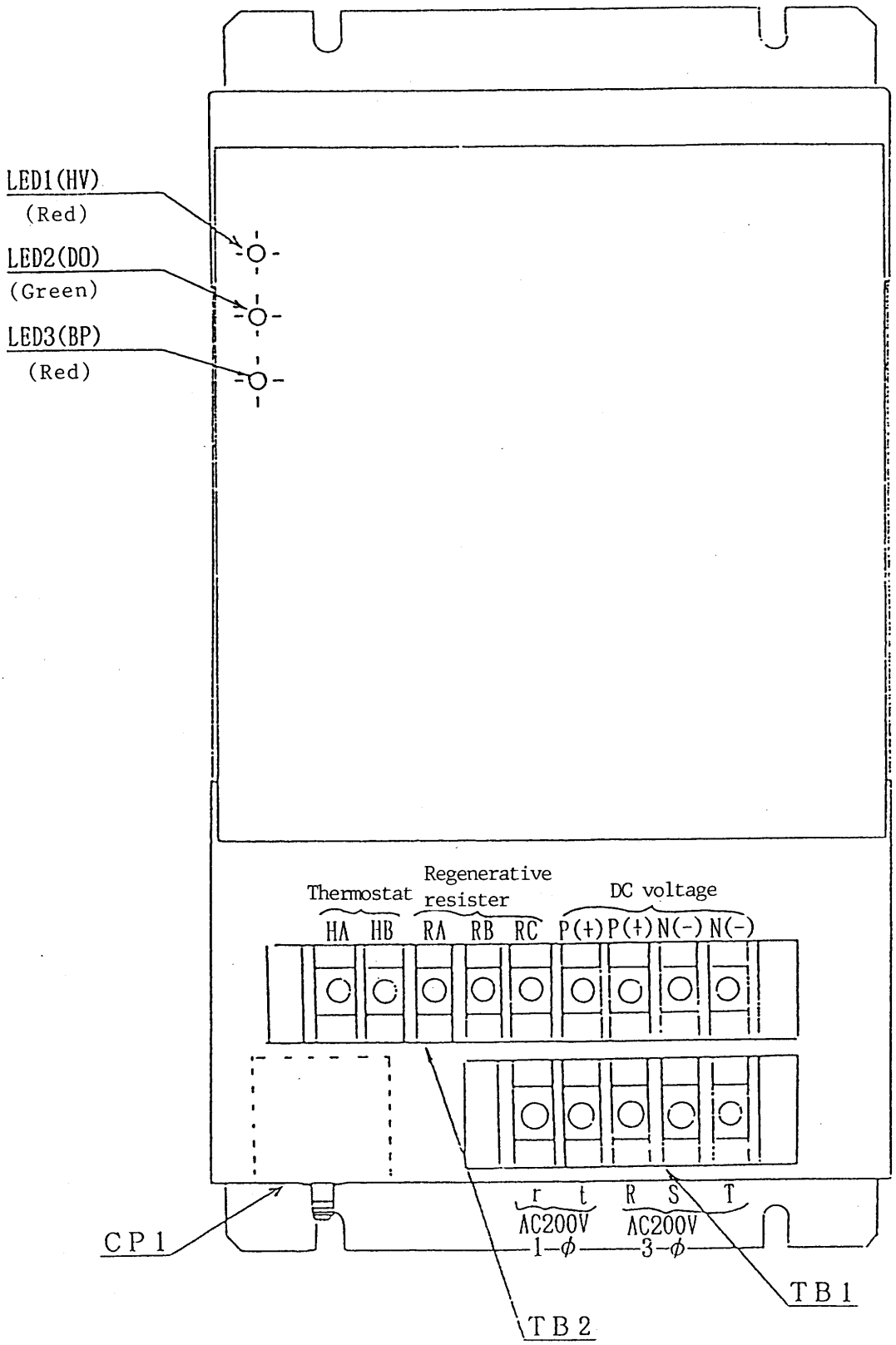
3)-1 AC amplifier

LED name	Colour	Meaning	Contents
LED1 (S.V)	Green	SERVO ON	The "SVON" from the head section lights up in the low level at SW1 "ON" side.
LED2 (P.W)	Red	POWER	It lights up when the control power supply AC200V 1 ϕ is input.

3)-2 DC power supply unit

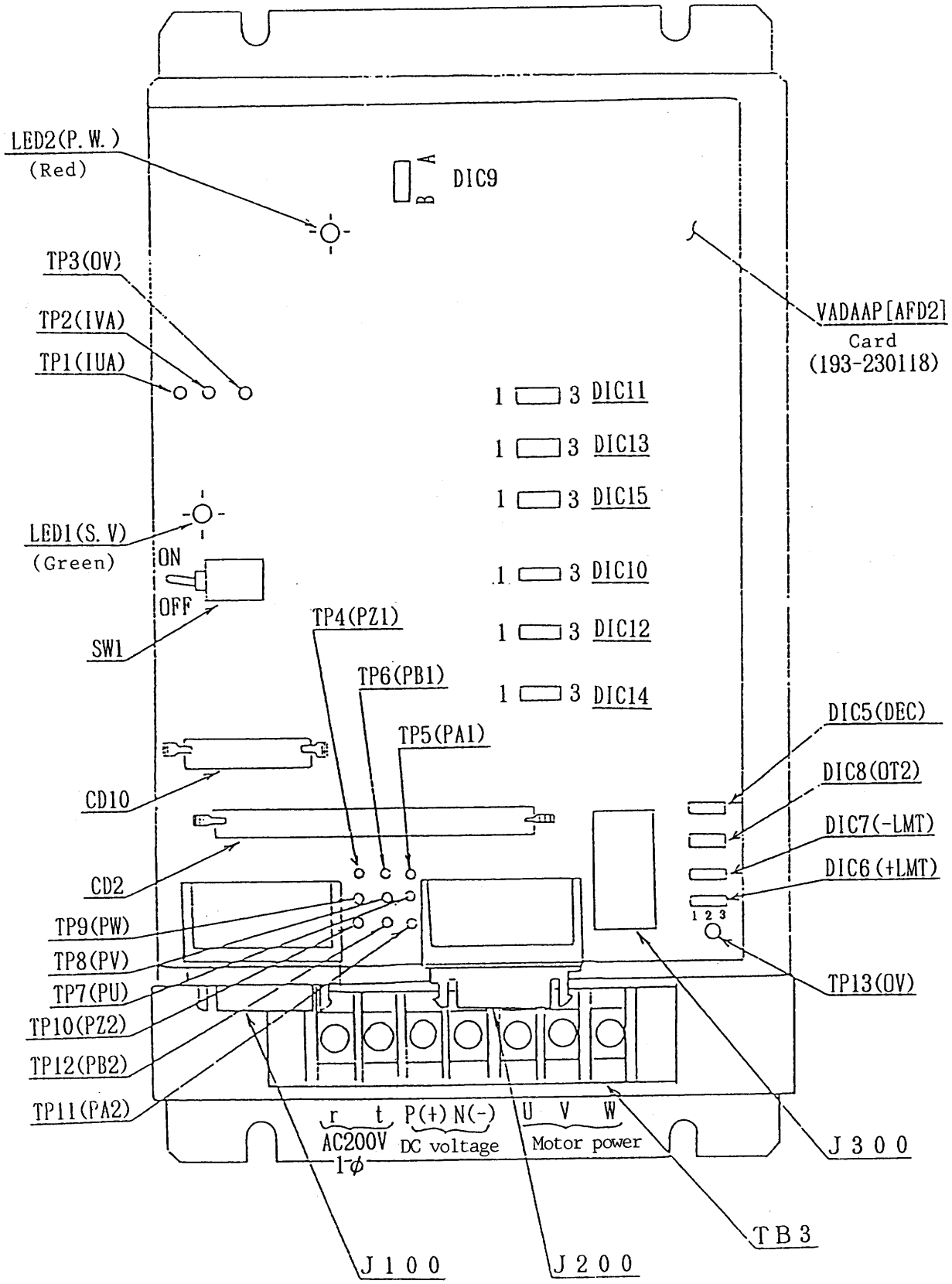
LED name	Colour	Meaning	Contents
LED1 (H.V)	Red	HIGHT VOLT	It lights up when the main power supply AC200V 3ϕ is input.
LED2 (D.O)	Green	DC ON	It light up when DC voltage becomes outputting status after 1.2 sec ~ 1.8 sec since the "DCON" signal from the head section becomes low level.
LED3 (B.P)	Red	BACK POWER	It lights up while the regenerative power is absorbed.

3)-3 PCU-05 Unit



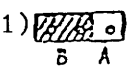
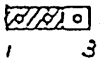
4) ADU20FIX Unit

(1) When the VADAAP (AFD2) card is used.



(2) ADU20FIX (In case of AFD2 card)

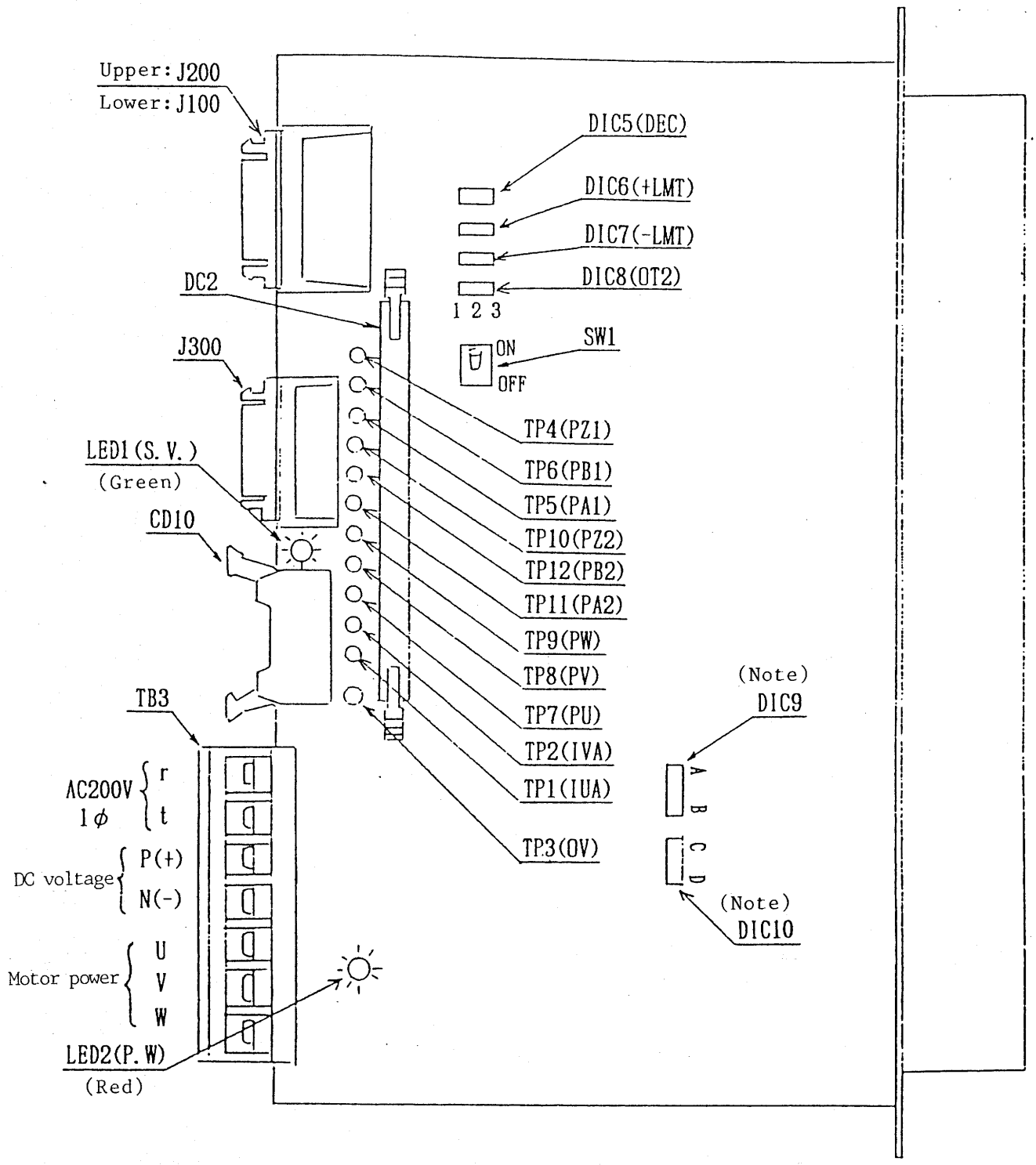
(○: Standard setting ×: Setting prohibited)

DIC No.	Name	Setting	Function	Standard setting
DIC5	DEC		Reference point dog (DEC) signal is effective.	
			Reference point dog (DEC) signal is ignored.	○
DIC6	+LMT		+ stroke limit signal is effective.	
			+ stroke limit signal is ignored.	○
DIC7	-LMT		- stroke limit signal is effective.	
			- stroke limit signal is ignored.	○
DIC8	OT2		2nd limit signal is effective.	
			2nd limit signal is ignored.	○
DIC9	Over current level setting (Note 1)		OC level for the motor DFMS-2020	
			OC level for the motor DFSM-1225/DFSM-3020	
(Note 2) DIC10 ~ DIC15	Gate resister		Gate resister 82 setting	○
			Gate resister 41 setting	×

Note 1: It is applied after the card COMP "D" version.
It is on the setting A side of DIC9 until COMP "C" version.

Note 2: There card that DIC10 ~ DIC15 are not packaged.

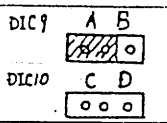
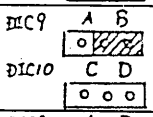
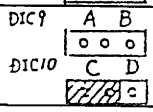
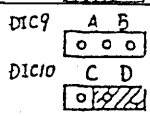
5) ADU05FIX Unit



Note) Etched card, version 3, are applied on DIC9, DIC10.

ADU05FIX

(○: Standard setting ×: Setting prohibited)

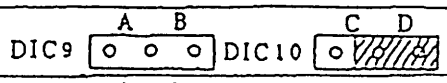
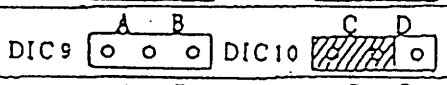
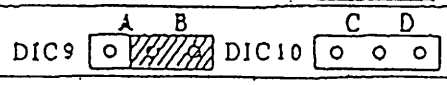
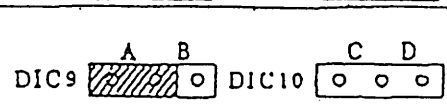
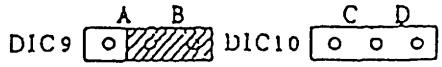
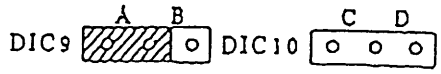
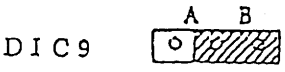
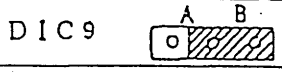
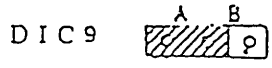
DIC No.	Name	Setting	Function	Standard setting
DIC5	DEC		Reference point dog (DEC) signal is effective.	
			Reference point dog (DEC) signal is ignored.	○
DIC6	+LMT		+ stroke limit signal is effective.	
			+ stroke limit signal is ignored.	○
DIC7	-LMT		- stroke limit signal is effective.	
			- stroke limit signal is ignored.	○
DIC8	OT2		2nd limit signal is effective.	
			2nd limit signal is ignored.	○
(Note) DIC9 DIC10	Over current checking level setting		OC level for motor DFSM-1020	
			OC level for motor DFSM-0520	
			OC level for motor DFSM-0420	
			Setting prohibited.	×

Note) Etched card, version 3, are applied on DIC9, DIC10.

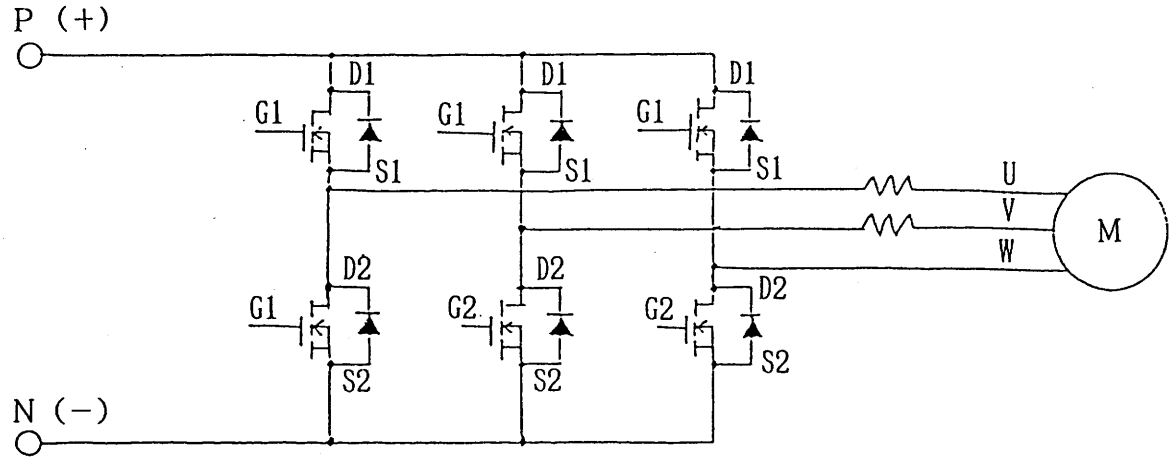
6) AC amplilier check pin

Check pin No.	Signal name	Contents
TP1	IUA	Motor U phase current
TP2	IVA	Motor V phase current
TP3	OV	OV common
TP4	PZ1	PZ (Marker) signal of J200 linear scale
TP5	PA1	PA (90^{o} phase defference A) signal of J200 linear scale
TP6	PB1	PB (90^{o} phase defference B) signal of J200 linear scale
TP7	PU	PU (Roter angle U phase) signal of J100 encoder
TP8	PV	PV (Roter angle V phase) signal of J100 encoder
TP9	PW	PW (Roter angle W phase) signal of J100 encoder
TP10	PZ2	PZ (Marker) signal of J100 encoder
TP11	PA2	PA (90^{o} phase defference A) signal of J100 encoder
TP12	PB2	PB (90^{o} phase defference B) signal of J100 encoder
TP13	OV	OV common

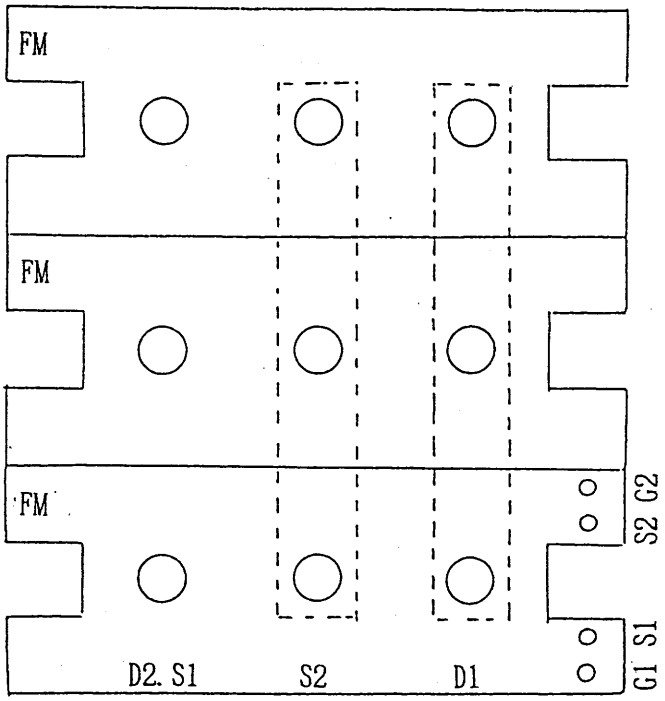
7) List of AC servo amplifier over current setting

No.	Moter type	DIC SETTING	OC level (rms value)	Amplifier type
1	DFSM-R530		1.6A	ADU02F1X
2	DFSM-0130		3.0A	
3	DFSM-0230		5.3A	
4 5	DFSM-0330 DFSM-0420		7.1A	
6 7	DFSM-0430 DFSM-0520		12A	ADU05F1X
8 9 10 11	DFSM-0530 DFSM-0925 DFSM-1020 DFSM-1020Y		16A	
12 13 14 15 16 17	DFSM-1030 DFSM-1225 DFSM-1420 DFSM-1720 DFSM-1820 DFSM-2020		40A	ADU20F1X
18 19	DFSM-2030 DFSM-3020		62A	
20	DFSM-4520		73A	ADU35F1X
21 22	DFSM-3030 DFSM-5015		105A	

8) Driving section of the servo amplifier (ADU)



Outside view of the transister module



Transister checking method

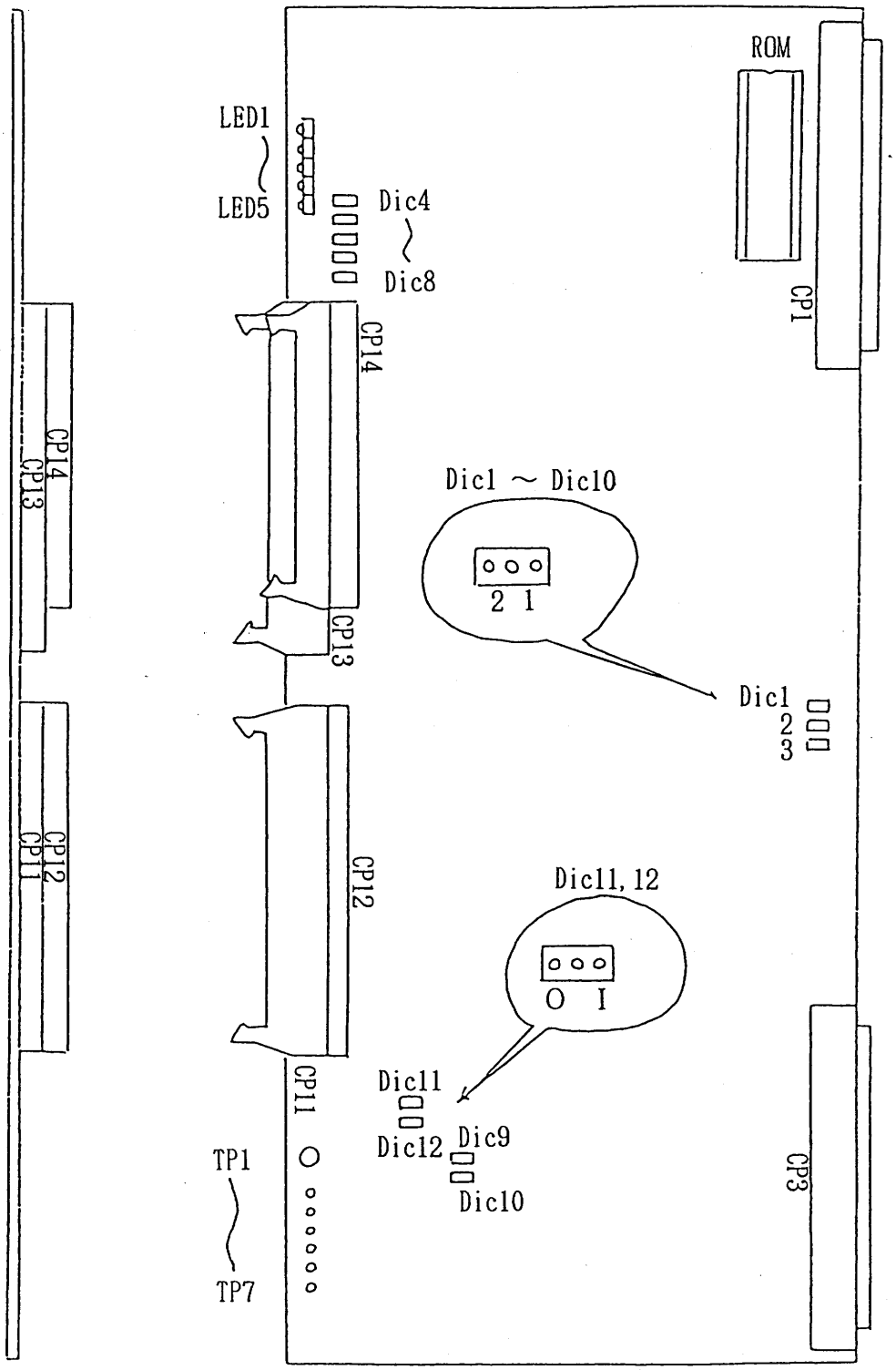
① Use the resister range (1Ω) of the analog tester.

② Check that there is no conduct between G and S.

③ When the - side (+ voltage) of the tester bar is brought into contact with S side and the + side (- voltage) with G side, the transister is turned OFF. Check that D1 - S1 and D2 - S2 are OPEN (The opposite side is conducted by diode.).

④ Bring the - side into contact with G and bring the + side into contact with S to turn the transister ON. Check that D1 - S1 and D2 - D2 are condacted.

9) SAMS unit (SASS unit)



SAMS unit ... Main substrate packaging 1 pc. of AIP and 1 pc. of ASV, and controlling 2 axes.

SASS unit ... Sub-substrate for increment of axis controlling 2 axes under the SAMS unit, packaging 1 pc. of ASV.

(Note) The patterns of the SASS is the same as that of the SAMS unit, and the parts of the AIP section remain unpackaging.

9)-1 Connector

Symbol	Name	Contents
CP1	Servo local BUS	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	Option interface	Unused

9)-2 Check pin

Symbol	Contents
TP1	Logic ground
TP2	Servo monitor 1
TP3	Servo monitor 2
TP4	+ 5V
TP5	+ 15V
TP6	- 15V
TP7	+24V

(Note) Only TP1 ~ TP3 are packaged to the SASS unit.

9)-3 LED display

Symbol	Color	Operation status	
		Light up	Light off
LED1	G	Normal operations of DSP for AIP	When the DSP for AIP is abnormal, it flickers.
LED2	G	Normal operations of DSP for ASV	When the DSP for ASV is abnormal, it flickers.
LED3	R	Hard alarm of AIP section	The AIP section is normal.
LED4	R	Hard alarm of ASV section	The ASV section is normal.
LED5	R	In program down-load	Down-load is completed.

(Note) Only LED2 and LED4 are packaged to the SASS unit.

9)-4 Short circuit pin

Symbol	Name	Contents
DIC1	AIP change-over	Set either AIP1 or AIP2. 2 AIP1 setting (Standard) 1 (Or OPEN) .... AIP2 setting
DIC2 DIC3	ASV change-over	Set either 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) Whether either AIP1 or 2 may be set is decided depending on DICI setting. OPEN is same as 2.
DIC4 DIC5 DIC6	AIP function change-over	Currentry unused. (Note) Not packaged to the SASS unit.
DIC7	Test mode	1 Standard setting 2 Test mode (Note) Not packaged to the SASS unit.
DIC8	Skip signal change-over	1 Internal skip signal 2 External skip signal (Note) Not packaged to the SASS unit.
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 detector) ... Standard 2 Analog output

7-5-3 Alarm Diagnosis and Measures

1) Precaution for maintenance

When touching the terminal block of the AC servo unit or dismantling unit,

(1) Turn OFF the control power supply and the main power supply.

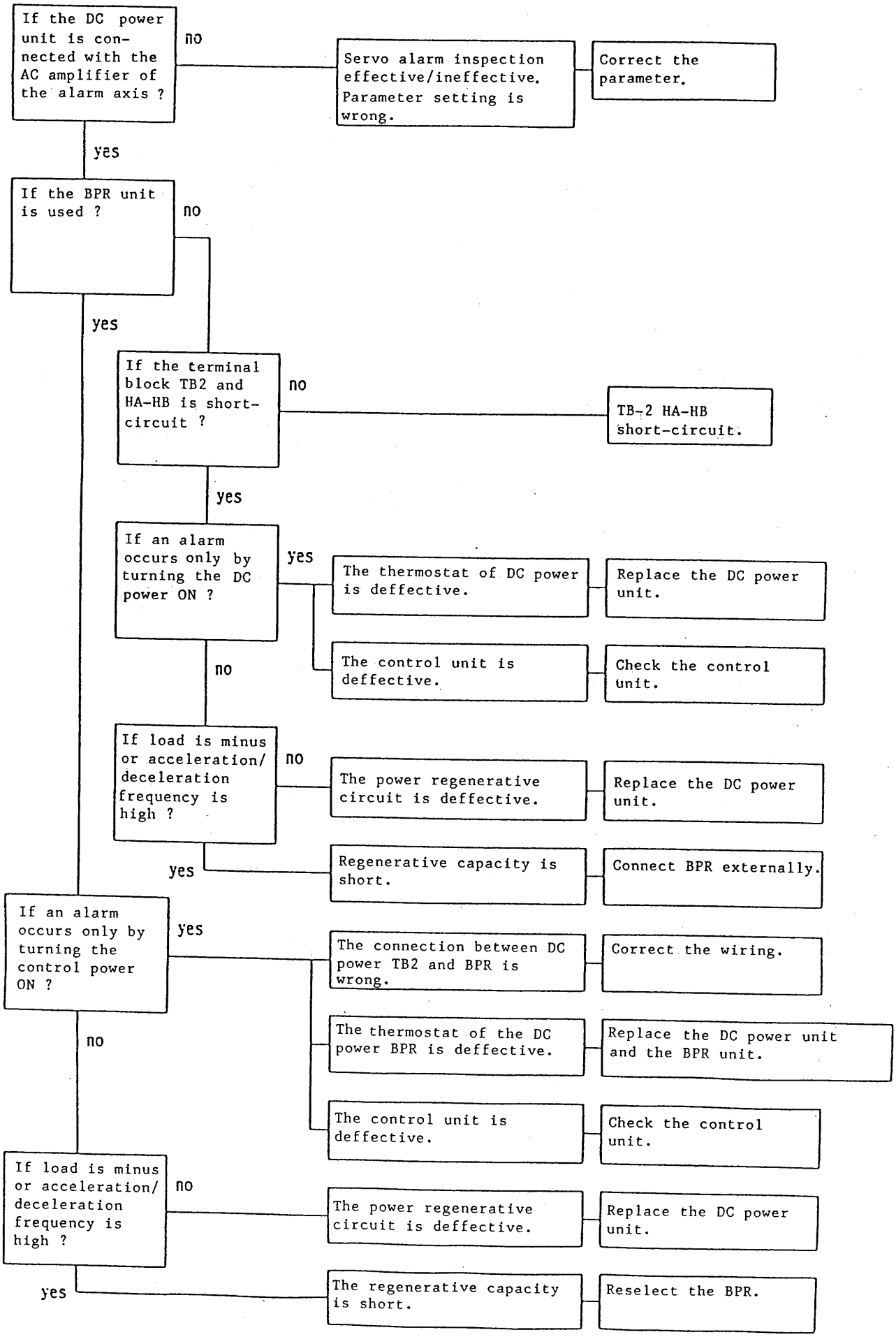
(2) In order to make the remaining electric load of the DC power unit 0, leaving it more than 10 minutes after turning the power OFF and make P - N of the terminal block short-circuit once, and then start operations.

2) Alarm diagnosis and measures

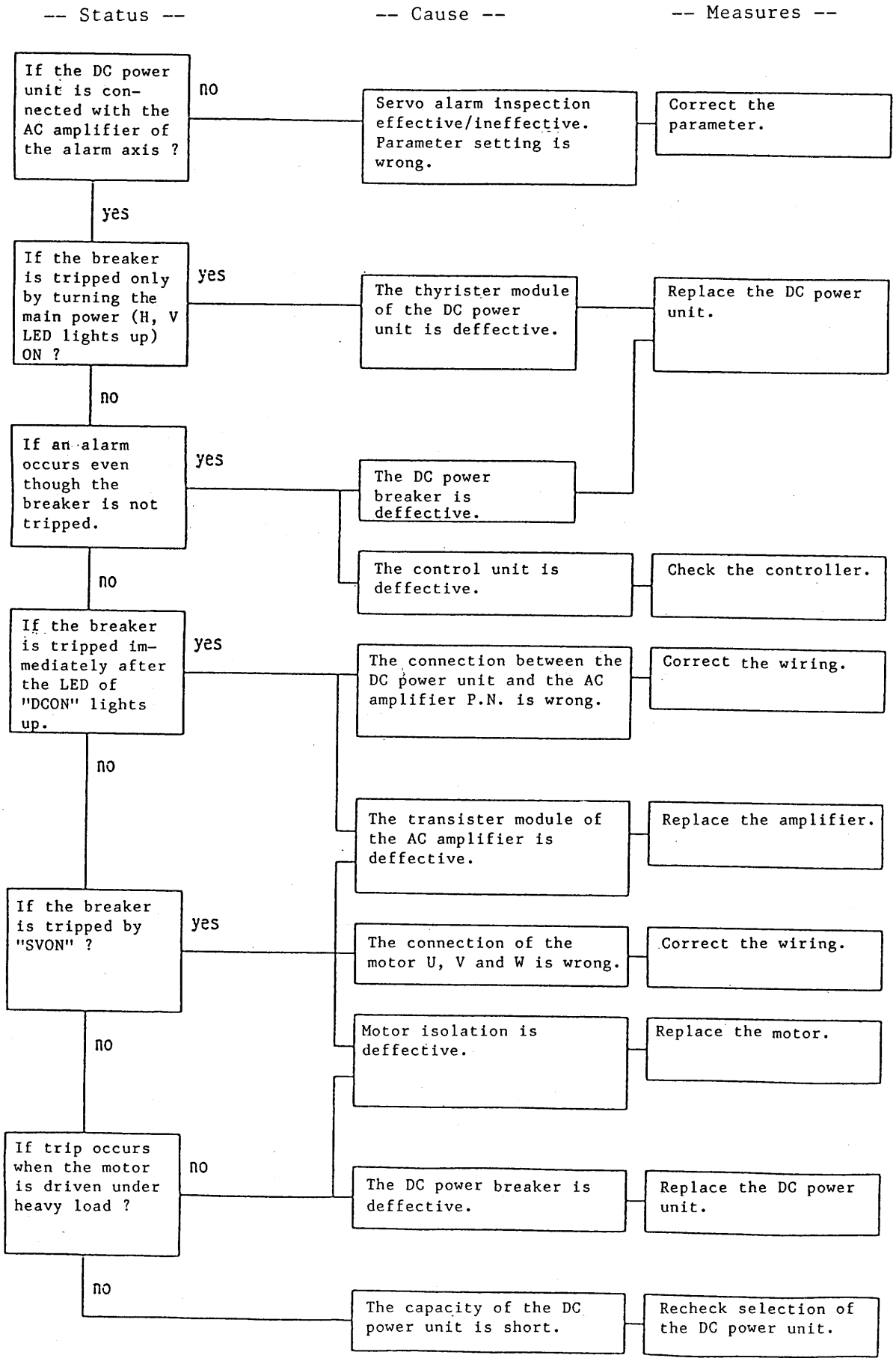
List of alarm items

No.	Alarm item	Remarks
1	Regenerative resister over-heat (OHR) alarm	
2	PCU circuit protector (CP2) OFF alarm	
3	ADU circuit protector (CP1) OFF alarm	
4	2nd limit (OT2) alarm	
5	Instant current over (OC) alarm	
6	Transister over-heat (OHT) alarm	

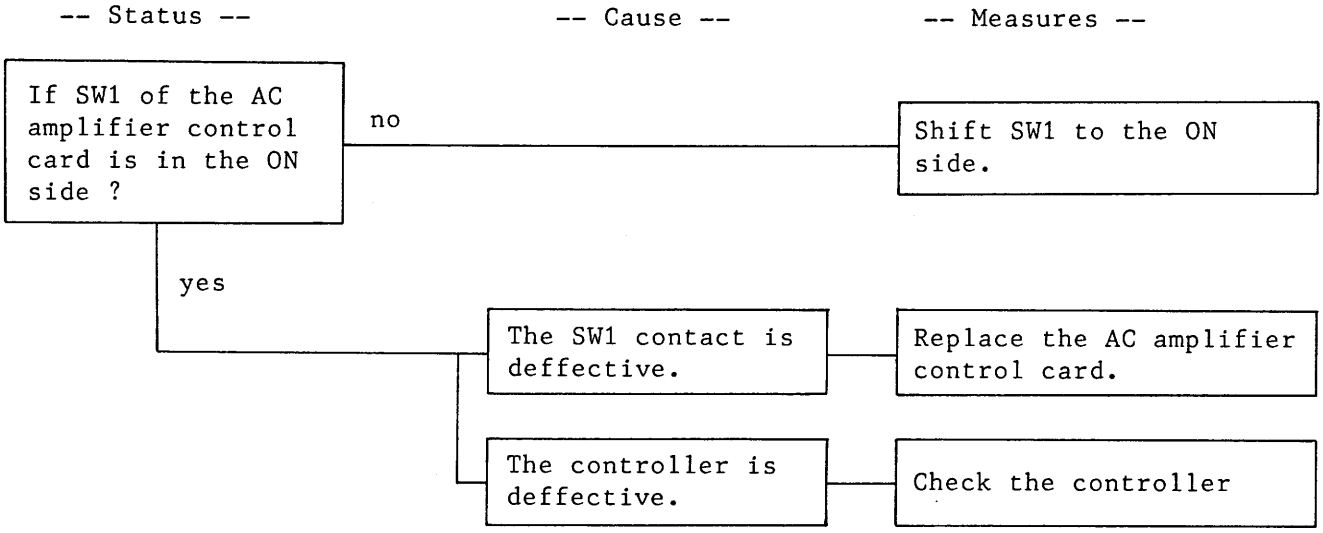
(1) Alarm for regenerative resister over heat



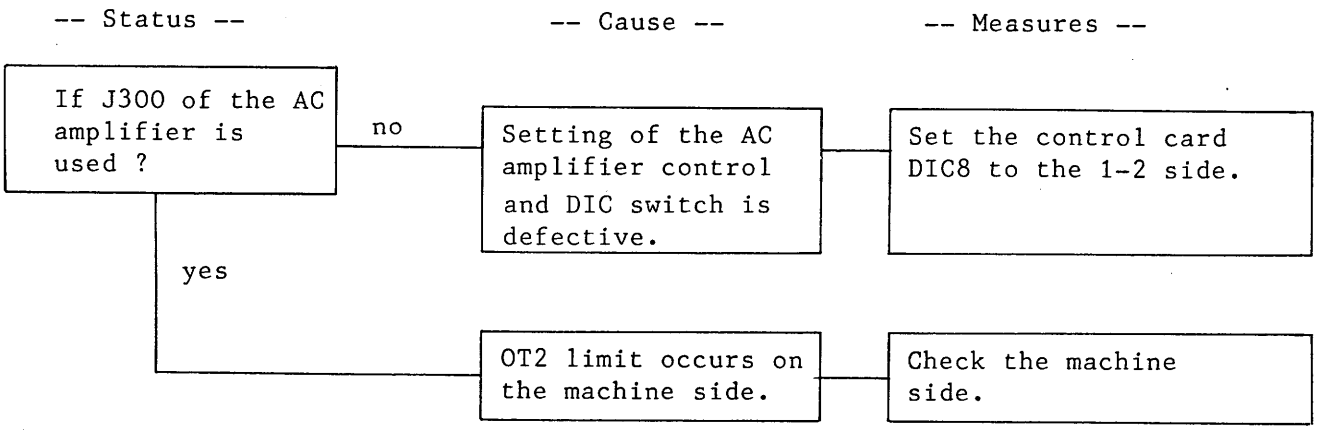
(2) PCU circuit protector OFF alarm



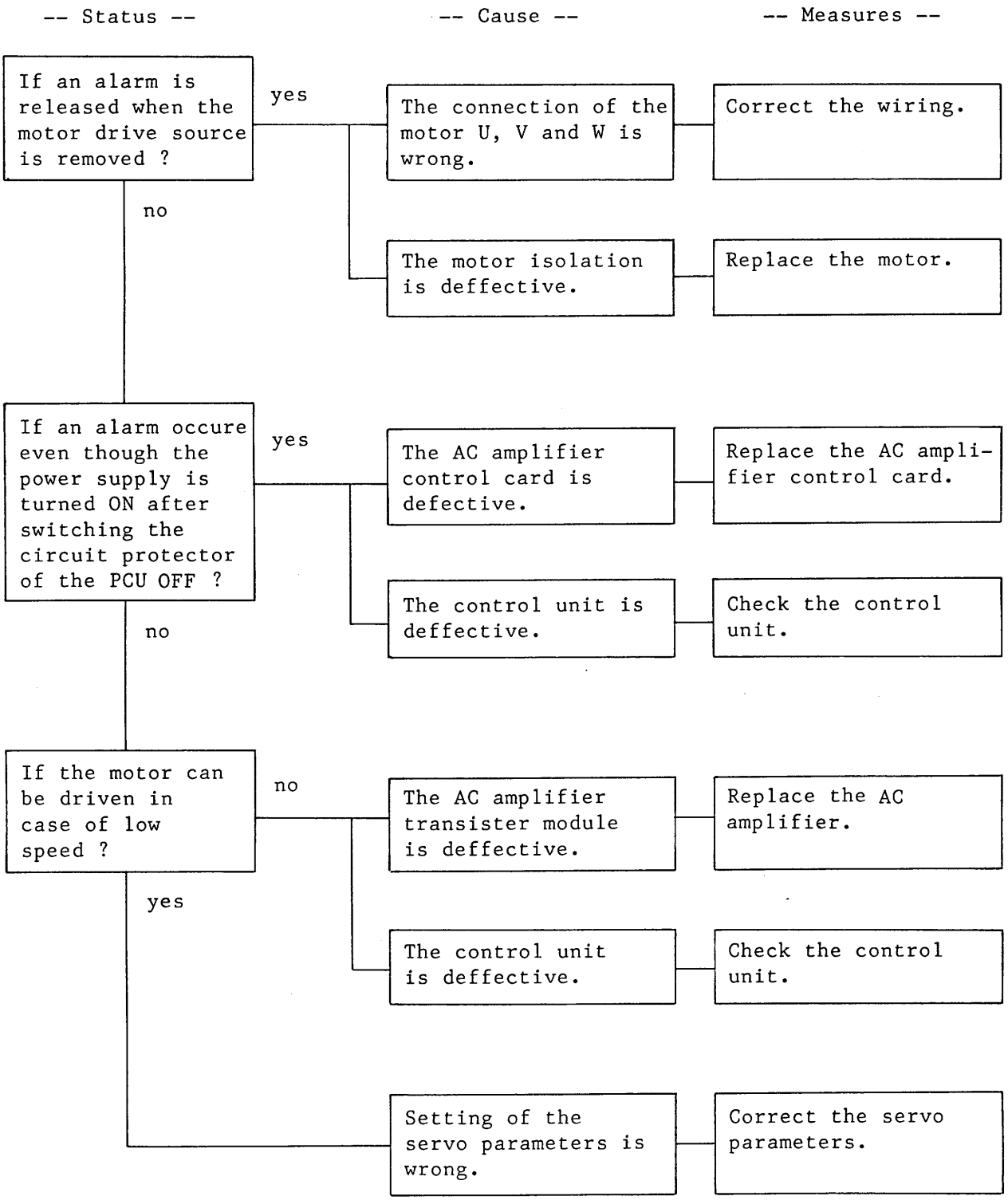
(3) ADU circuit protector OFF alarm



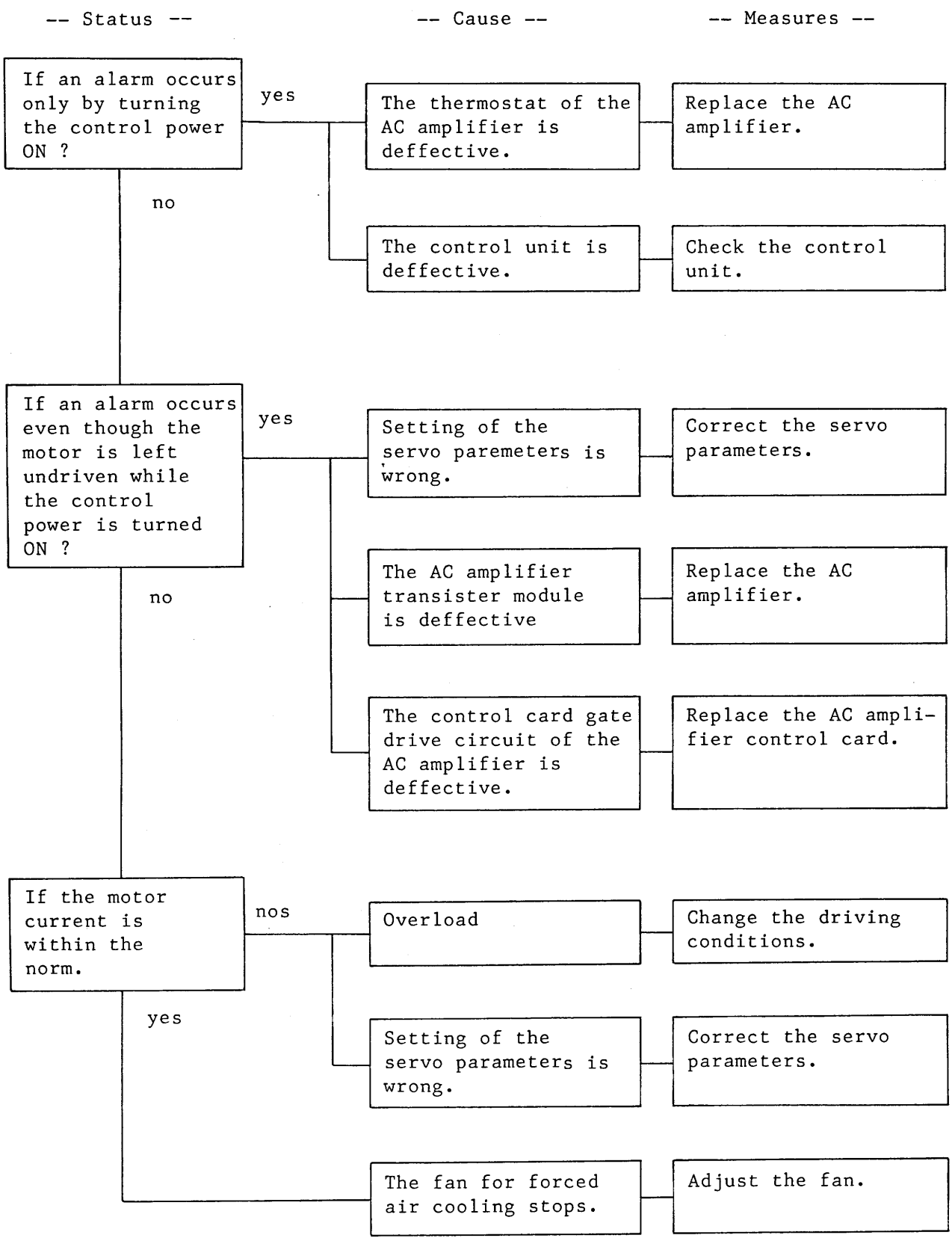
(4) 2nd limit alarm



(5) Instant current over (OC) alarm



(6) Transister overheat (OHT) alarm



7-6 Maintenance and Adjustment of Spindle Drive Unit

1. NC parameter of spindle

Parameter No.	Contents	NT40 6000rpm (Standard)	NT50 4500rpm (Standard)	NT40 12000rpm (High speed)	NT50 6000rpm (High speed)	NT40 6000rpm (2SP)
5620	Min. clamp speed of spindle motor	0	0	0	0	0
5621	Max. clamp speed of spindle motor Max. spindle speed/ Spindle speed at Max. output x 8191	7167 6000 6857	8066 4500 4570	8191	8191	7151 6000 6873
5630	Max. spindle speed at gear 1	1278	891	12000	1013	1281
5631	Max. spindle speed at gear 2	6857	4570	12000	6000	6873
5634	Max. speed of spindle motor	6000	6000	12000	6000	6000
5635	Inching speed of spindle motor at gear shift	40	40	0	40	40
5636	Spindle speed at Renishaw system ON-OFF	500	500	500	500	500
5638	Spindle speed at gear shift 1-2	1118	877	12000	1013	1118
5639	Spindle speed at gear shift 2-3	6000	4500	12000	6000	6000

2. Spindle speed and spindle motor speed

	NT40 6000rpm (Standard)	NT50 4500rpm (Standard)	NT40 12000rpm (High speed)	NT50 6000rpm (High speed)	NT40 6000rpm (2SP)
Max. spindle speed at high gear	6000	4500	12000	6000	6000
Max. spindle speed at low gear	1118	877	—	1013	1118
Motor speed at Max. spindle speed	5250	5908	12000	6009	5238

3. Spindle drive unit for FANUC

3-1 Variable resistor (for analog servo unit)

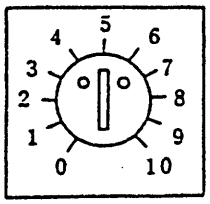
Adjustment of variable resistors RV1 ~ RV9 on PCB for spindle control circuit have been completed by FANUC prior to shipment and readjustment is not required in principle, however, setting value can be changed if neccessary. If any fine adjustment is required for offset, spindle speed etc. proceed readjustment after power on. Adjustment of PCB used in each unit for AC spindle servo unit is shown on the table below.
However, do not change the value on variable resistor RV7, 8, 14 ~ 19 and 25A ~ D, since they have been adjusted by FANUC prior to shipment.

Model 1/2/small model 3 ... A16B-1100-0080, A168B-1100-0090~0092
Model 2 ~ 12 ... A20B-1000-0690~0693
Model 15 ~ 22 ... A20B-0009-0534~0539
Model 30, 40 ... A20B-1000-0700, 0701

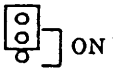
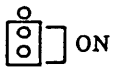
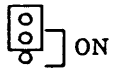
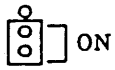
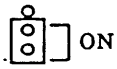
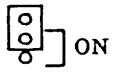
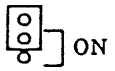
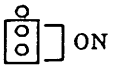
No.	Symbol	Item of adjustment	Standard setting	Observation point	Adjustment procedure
1	RV1	Voltage level of speed command		CH13-0V	Refer to (1)
2	RV2	Voltage offset of speed command		CH13-0V	Refer to (1)
3	RV3	Detection level of speed arrival		CH10-0V	Refer to (4)
4	RV4	Detection level of speed		CH 9-0V	Refer to (5)
5	RV5	Limit level of Torque		Refer	Refer to (6)
6	RV6	Limit of regenerative power	Division 3		
7	RV7	VF conversion level (1)		CH23-0V	200±2kHz at 10V for LM-0M
8	RV8	Setting of speed detection circuit		CH18-0V	1.38V±0.03V at 45rpm of CW
9	RV9	Adjustment of forward rpm		Motor rpm	Refer to (2)
10	RV10	Offset of speed detection		CH17-0V	±2mV or less at spindle stop
11	RV11	Adjustment of reverse rpm		Motor rpm	Refer to (2)

No.	Symbol	Item of adjustment	Standard	Observation point	Adjustment procedure
12	RV12	Speed loop gain	Division 3		
13	RV13	Speed loop offset		Spindle rotation	Refer to (3)
14	RV14	Amplitude adjustment of load meter		LW-OM	10±0.1V at acceleration time
15	RV15	+5V voltage adjustment		+5V-OV	5±0.05V
16	RV16	Limit level of regenerative voltage	Division 4		
17	RV17	VF conversion level (2)		CH32-OV	24.5kHz at AC200V input
18	RV18	Adjustment of RA offset		CH5-OV	Adjust ON ratio to be 50% at CH7.
19	RV19	Adjustment of RB offset		CH6-OV	Adjust ON ratio to be 50% at CH8.
20	RV20	Adjustment of time constant for start/ stop by software	Division 0	CH13-OV	Range of time constant can be changed by setting of short pin S11. S11 : A (0.6~0.8 sec.) S11 : B (3.5~40 sec.) It will be confirmed when start or stop by ware form at CH13 (VCMD).
21	RV25A -D	Offset adjustment for current/voltage detector		CRU,CRV IDC, VDC-OV	0±2.5mV at spindle stop

(Note) How to read the scale on a variable resistor



3-2 Set Terminals (for Analog servo unit)

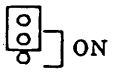
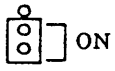
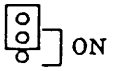
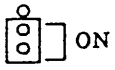
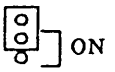
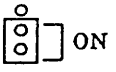
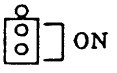
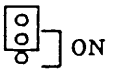
<table>
<tr><th>Set terminal No.</th><th colspan="2">Description</th><th>Setting</th><th>Reference setting</th></tr>
<tr><td>S1</td><td>Use/nonuse of Machine Ready Signals</td><td>Use</td><td>OFF  ON</td><td rowspan="2">OFF</td></tr>
<tr><td></td><td></td><td>Nonuse</td><td>ON  ON</td></tr>
<tr><td>S2</td><td>Use/nonuse of Analog Override</td><td>Use</td><td>OFF  ON</td><td rowspan="2">ON</td></tr>
<tr><td></td><td></td><td>Nonuse</td><td>ON  ON</td></tr>
<tr><td>S3</td><td>Same as above</td><td>Use</td><td>ON  ON</td><td rowspan="2">OFF</td></tr>
<tr><td></td><td></td><td>Nonuse</td><td>OFF  ON</td></tr>
<tr><td>S4</td><td>Speed command signal</td><td>Use of external analog voltage command</td><td>OFF  ON</td><td rowspan="2">OFF</td></tr>
<tr><td></td><td></td><td>Use of R01-R12 commands</td><td>ON  ON</td></tr>
<tr><td rowspan="6">S5
Reduced size model 1/2 3
Model 3 ∿ 40</td><td rowspan="6">Setting Speed Feedback Volume to rated command</td><td>4000, 8000 rpm, 4500 rpm</td><td>A,B: OFF  A B</td><td rowspan="6">Set to the ratings of a motor in use (NOTE 1)

A : ON</td></tr>
<tr><td>6000 rpm</td><td>B : ON  A B</td></tr>
<tr><td>20000 rpm</td><td>A : ON  A B</td></tr>
<tr><td>4500 rpm</td><td>B : ON  B A</td></tr>
<tr><td>6000 rpm</td><td>A : ON  B A</td></tr>
<tr><td>8000 rpm</td><td>A,B: OFF  B A</td></tr>
<tr><td>S6</td><td rowspan="2">Speed control positional compensation</td><td>S6</td><td rowspan="2">Differs by motors and the number of ROM versions. Refer to Table 5.1(c).</td><td rowspan="2"></td></tr>
<tr><td>S7</td><td>S7</td></tr>
</table>

(NOTE 1) S5 setting differs in Model 1/2 reduced size and Models 3 ∿ 40.

For A20B-1000-0690 0693

Applicable motor	ROM		Setting	
	Type	No. of versions	S6	S7
Model 3	J10	001E and after	OFF	ON
Model 6	J11	001E and after	OFF	ON
Model 8	J02	001G and after	OFF	ON
Model 12	J03	001G and after	OFF	ON

Set terminal No.	Description		Setting	Reference setting
S8	Delay time till cutting off excitation	0 sec./Special	OFF 	ON (NOTE 2)
		0.2 sec./Standard	ON 	
S9	Function of Machine ready signal	Cut-off of MCC	OFF 	ON
		No cut-off of MCC	ON 	
S10	Overcurrent detecting level	Labelled	OFF 	Refer to the label on Unit (NOTE 3)
		Not labelled	ON 	
S11	Soft start/stop time constant range changeover (Adjusted at RV20)	0.6 ↔ 8 sec.	A 	A
		3.5 ↔ 40 sec.	B 	
S15	Speed zero detecting level	Max. revolution 10000∿20000 rpm	ON 	Set to the ratings of a motor. (NOTE 4)
		Max. revolution 10000 rpm	OFF 	

(NOTE 2) Be sure to insert a short pin even on OFF setting.

(NOTE 3) For S10 setting, set ON the unit only when it is directed to do so by the label on the print board installing place.

(NOTE 4) S15 is only used for AC Spindle Servo Unit Model 1/2 Reduced Size Model 3.

Set pin	Use of override		Nonuse of override
	Override range Max. 120%	Override range Max. 100%	
S2	OFF	OFF	ON
S3	ON	OFF	OFF

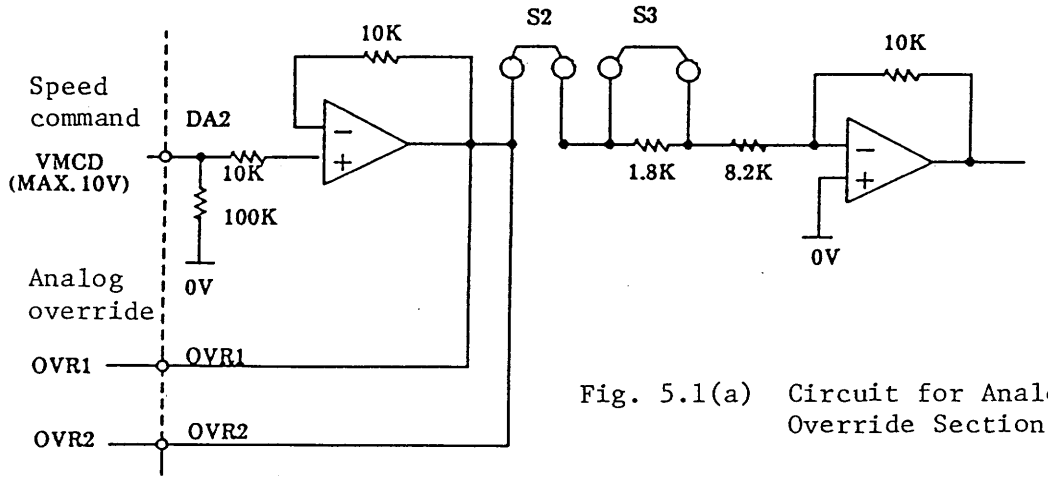
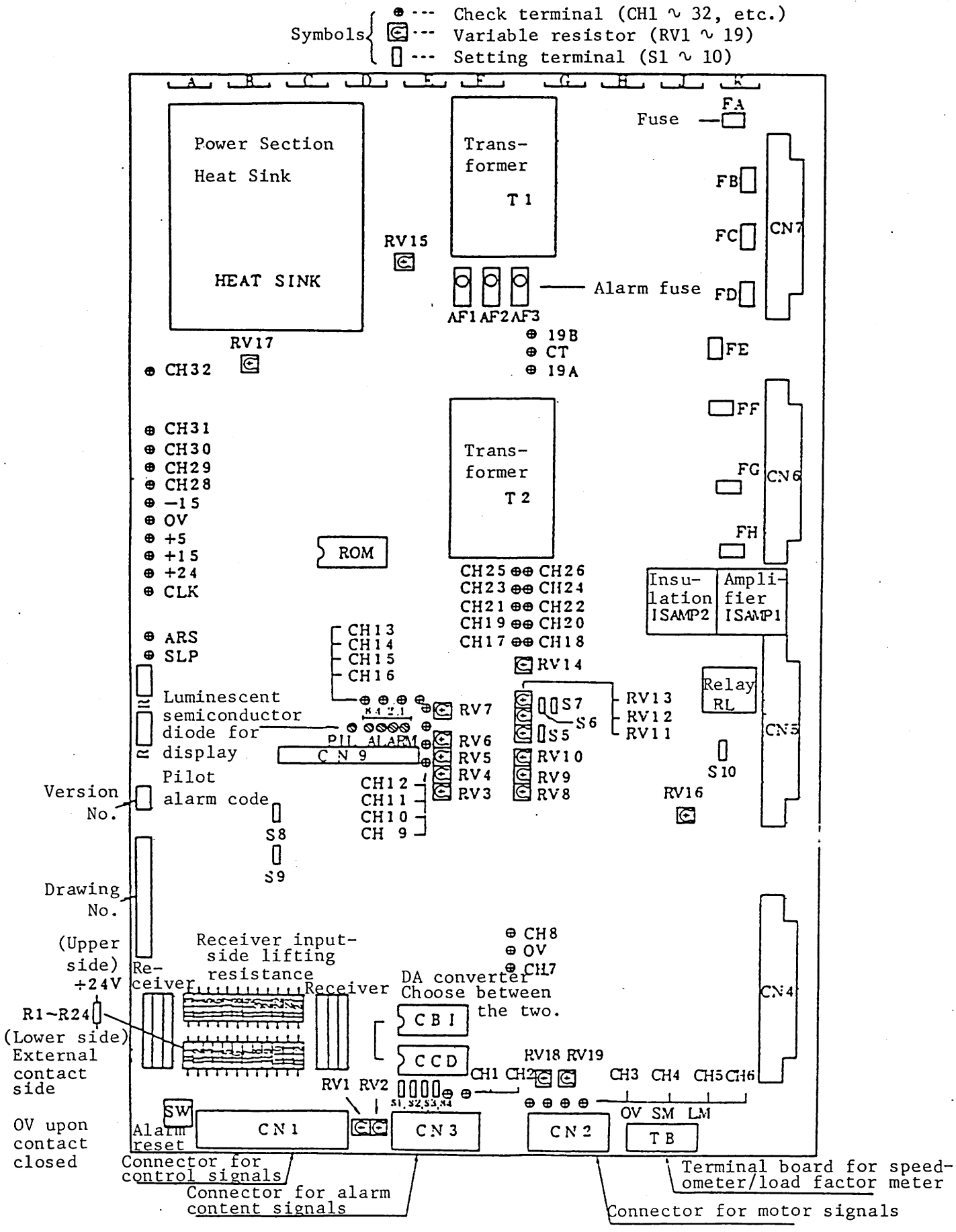


Fig. 5.1(a) Circuit for Analog Override Section

Models 3 ∿ 22 (for Analog servo unit)



3-3 Parameter Setting of AC Spindle Unit (for Digital servo unit)

1. Parameter for which adjustment is not needed.

Parameter	Description	No. 40 6000 RPM	No. 50 4500 RPM	No. 40 12000 RPM	No. 50 6000 RPM	No. 40 ZSP 6000 RPM
F-15	Motor revolution of 100 at speed command 10V	53	59	120	60	53

2. Parameter for which adjustment is needed.

Perform setting while adjusting F10, -11, -13, -14, -29 and -30.

(REFERENCE) Setting data table

3. Digital A.C. Spindle drive unit

Setting data table

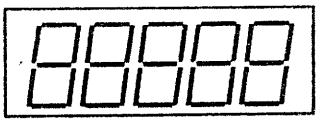
Model: VK

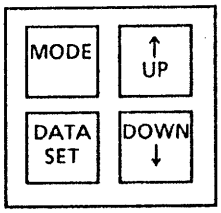
Mode No.	Data	Description
F-00	*	Display of Spindle motor rpm
F-01	0001	0 : Machine Ready Signal not used. 1 : Machine Ready Signal used.
F-02	0000	0 : Speed override not used. 1 : Speed override used.
F-03	0000	0 : 100% for Override upper limit 1 : 120% for Override upper limit
F-04	0000	0 : External analog voltage is used for Speed command. 1 : Internal D/A convertor is used.
F-05	0001	0 : Motor max. rpm is 5000, 10000 1 : Motor max. rpm is 6000, 12000
F-06	0000	0 : No output limitation 1 : Output limited only at acceleration/deceleration
F-07	0100	Max. rated output × (set value)%
F-08	0005	Time length from Speed zero detection to Motor power cut-off Delay time = (set value) × 40mS
F-09	0000	0 : Motor power cut-off by Machine Ready signal (MRDY) not used.
F-10	* ----	Speed error off-set at rotation command Motor not rotated at SOM3 Command
F-11	* ----	Speed error off-set at reverse rotation command Motor not rotated at SOM4 Command
F-12	0126	Change this set value when ORT.Pt. IN-POSITION FINE LED lamp is not lit even by VR adjustment
F-13	* ----	Adjustment of rpm at rotation command
F-14	* ----	Adjustment of rpm at reverse rotation command
F-15	* ----	Set the motor rpm/100 at speed command 10V. (Decimal point input not available.)
F-16	0015	Detecting range of Speed Reach Signal Detecting Range = Command rpm × within ± (set value)%

Mode No.	Data	Description
F-17	0003	Detecting range of Speed Detect Signal Detecting Range = Max. rpm × (set value)% and less
F-18	0050	Setting Torque Limit Value Torque Limit Value = Max. Rated Torque × (set value)%
F-19	0010	Time setting during acceleration/deceleration (acceleration time of 5 sec. or more) Set value = acceleration time (sec.) × 2
F-20	0060	Limitation of regenerative power (Adjusting deceleration time) Set so that it becomes equal to acceleration time.
F-21	0050	Setting Speed Control Phase Compensation P (High gear) (Change setting if any gear noise)
F-22	0050	Setting Speed Control Phase Compensation P (Low gear) (Change setting if any gear noise)
F-23	0020	Setting Speed Control Phase Compensation P at ORT time (High gear)
F-24	0020	Setting Speed Control Phase Compensation P at ORT time (Low gear)
F-25	0030	Setting Speed Control Phase Compensation I (High gear)
F-26	0030	Setting Speed Control Phase Compensation I (Low gear)
F-27	0010	Setting Speed Control Phase Compensation I at ORT time (High gear)
F-28	0010	Setting Speed Control Phase Compensation I at ORT time (Low gear)
F-29	* ----	Speed detect offset (Set so that TS3-OV becomes 0mV at motor halt.)
F-30	* ----	Set so that F-00 (Motor rpm) display becomes equal to the motor rpm.
F-31	0000	Setting Rigid Tap Mode 0 : Torque limit signal is for conventional torque limit
F-32	0010	Setting Motor voltage at normal operation Standard setting = 10
F-33	0010	Setting Motor voltage at ORT time Standard setting = 10
F-34	0100	Setting Motor voltage at Rigid Tap Mode Standard setting = 100 (effective at F-31=1)
F-35	0075	Range of Zero Speed Detection Range = Max. RPM × $\left(\frac{\text{set value}}{100}\right)$ (%)

3-4 Setting Procedure of Parameter

Setting switch and display are mounted on printed circuit board as shown below.
Confirmation and change of setting in each mode can be done by this switch as shown next page.

Display 

Setting switch 

(1) In case of confirmation of current mode

(1-1) Spindle speed (rpm) is displayed (in 5 digits) on the display in general.

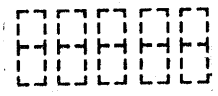
MODE When the mode switch on, current mode No. is displayed.

Mode No. is displayed in 2 digits as "F-XX"

(2) In case of confirmation of setting data

(2-1) Select the mode (parameter) of data to be confirmed in the following procedures.

(2-2) Keep four switches MODE ↑ UP DOWN ↓ DATA SET ON one sec. or more simultaneously.

(2-3) Display shows from blank  to  .

(2-4) Turn all switched OFF.

(2-5) MODE When the mode switch on, current mode No. is displayed.

(2-6) MODE In the mode ON condition ↑ UP switch ON and mode No. is incresed by one

(2-7) MODE In the mode ON condition ↑ UP switch keep ON and mode No. is increased continuously.

(2-8) MODE In the mode ON condition DOWN ↓ switch ON and mode No. is decreased by one.

(2-9) MODE In the mode ON condition DOWN ↓ switch keep ON and No. is decreased continuously.

(2-10) MODE Data will be displayed (4 digits) approx. 0.5 sec. after mode switch off.

(2-11) Approx. 10 sec. after display the data, rpm will be displayed. When all switches off under any mode and rpm will be displayed finally.

(3) In case of changing data

(3-1) Select the wanted mode (parameter) as following procedure (2-2) to (2-9).

(3-2) MODE Data will be displayed approx. 0.5 sec. after mode switch off.

(3-3) ↑ UP Switch ON and data No. is increased by one.

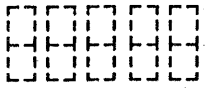
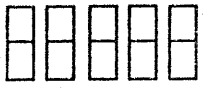
(3-4) ↑ UP Switch keep ON and data No. is increased continuously.

(3-5) DOWN ↓ Switch ON and data No. is decreased by one.

(3-6) DOWN ↓ Switch keep ON and data No. is decreased continuously.

(3-7) Motor will be controlled by the data displated.

(3-8) In case of replacement to change data keep DATA SET ON over one second.

(3-9) Display shows from blank  to  and data change is completed.

(3-10) In case of change the data again, follow the procedure from (3-1).

(3-11) Approx. 10 sec. after all switches off, rpm will be displayed automatically, however, after approx. 2 sec. rpm will be displayed on mode F-13, F-14 and F-30.

3-5 Spindle Orientation by Magnetic Sensor (With FANUC AC Drive)

1. Outline

Spindle orientation by magnetic sensor is a non contact method to stop the spindle at the fixed position by means of position feedback by the magnetic sensor connected with the machine spindle directly.

2. Features

. Applicable ti high speed spindle

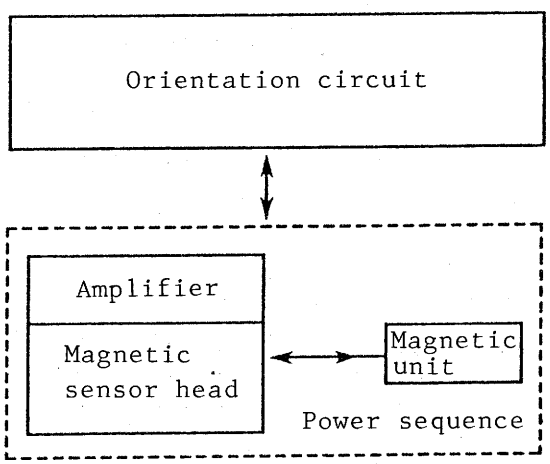
. Direct orientation is available from high speed rotation, because position control is performed by control circuit of AC spindle motor connected with spindle and magnetic sensor and orientation circuit.

3. Structure

Spindle orientation by magnetic sensor (option) consist of the following components.

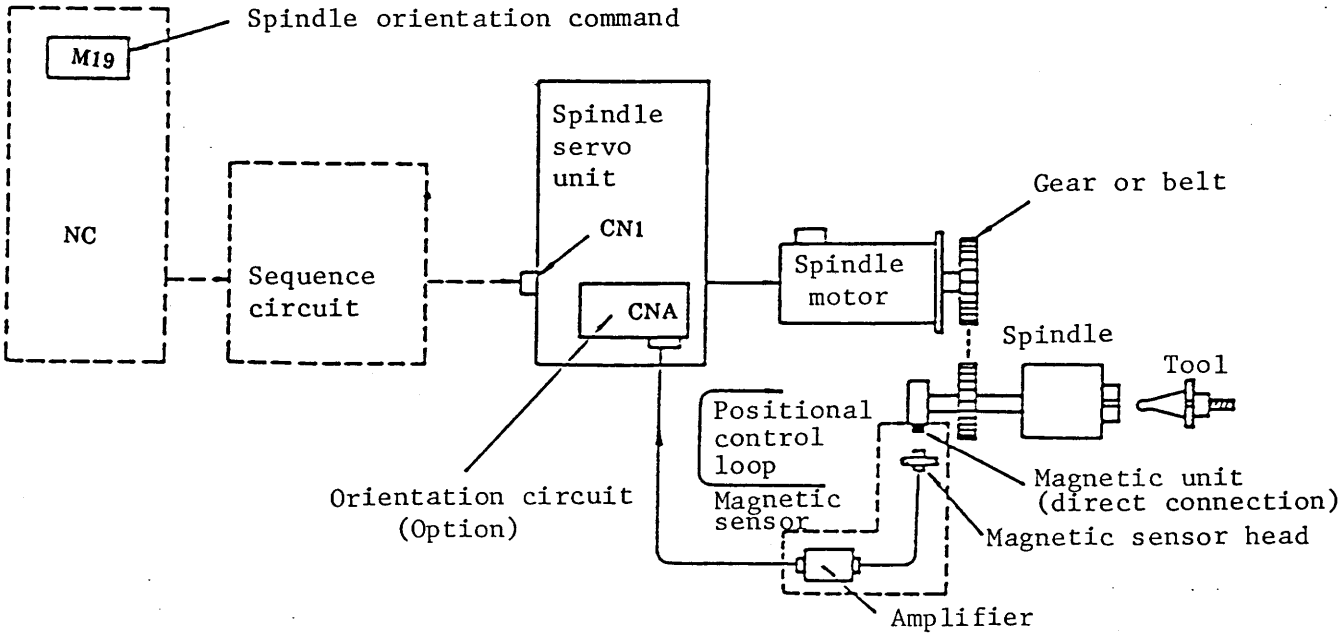
(1) Orientation circuit

(2) Magnetic sensor



[REFERENCE]

System configuration for the whole system including Magnetic Sensor System • Spindle Orientation is shown below.



4. Specification Number

(1) Orientation Circuit

Name	Specification No.		
	For Models 3 ∿ 40	For Model 1,2 and Reduced sized model 3	Applicable Magnetic Sensor
Orientation circuit C Variable speed stages: 2 and less Spindle rpm: 8,000 rpm and less	A06B-6041-J120	A06B-6052-J120	Magnetic sensor N,P
Orientation circuit D Variable speed stages 3 Spindle rpm: 8,000 rpm and less	A06B-6041-J121	———	Magnetic sensor N,P
Orientation circuit G Variable speed stages: 2 and less Spindle rpm: 12,000 rpm and less	A06B-6041-J122	A06B-6052-J122	Magnetic sensor N,P
Orientaion circuit H Variable speed stages: 2 and less Spindle rpm: 20,000 rpm and less	A06B-6041-J123	A06B-6052-J123	Magnetic sensor Q,R, S,T

(2) Magnetic Sensor

Name	Specification No.	Remarks
Magnetic sensor N Spindle rpm:up to 12,000 rpm	A57L-0001-0037/N	Applied even without /N designation.
Magnetic sensor P Spindle rpm:up to 12,000 rpm	A57L-0001-0037/P	Reduced type
Magnetic sensor P Spindle rpm:up to 20,000 rpm	A57L-0001-0037/Q	Cylindrical high speed type of inside diameter of 40ϕ.
Magnetic sensor R Spindle rpm:up to 20,000 rpm	A57L-0001-0037/R	Cylindrical high speed type of inside diameter of 50ϕ.
Magnetic sensor S Spindle rpm:up to 15,000 rpm	A57L-0001-0037/S	Cylindrical high speed type of inside diameter of 60ϕ.
Magnetic sensor T Spindle rpm:up to 15,000 rpm	A57L-0001-0037/T	Cylindrical high speed type of inside diameter of 70ϕ.

5. Specifications

(1) General Specifications

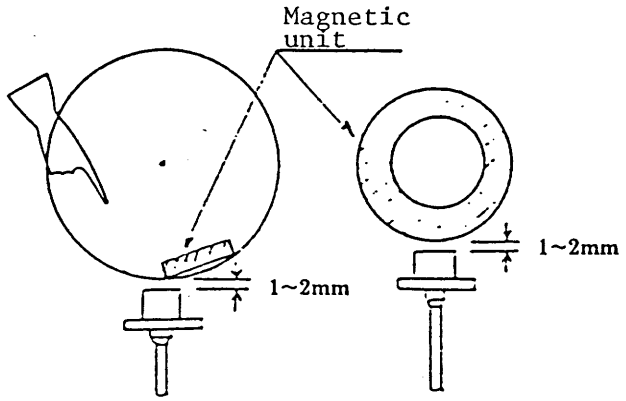
Item	Specifications
Repetitive positioning accuracy	±0.2° and less Those for mechanical error factors are excluded.
Stop position	Position where the center of Magnetic Sensor Head and Stop position referring scale of Magnetic Unit facing oppositely.
Retaining torque at orientation	Continuous rated torque of AC spindle motor
Recovering range at orientation	Spindle ±240° to orientation stop position
Rigidity at orientation	Spindle displacement when stationary load torque within continuous rated torque is imposed is as follows. ±0.1° and less However, with any instantaneous load fluctuation, Spindle temporarily shows a large displacement.

(2) Magnetic Sensor

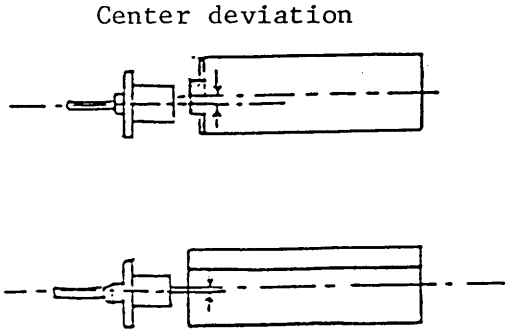
Item	Unit	Sensor N	Sensor P	Sensor Q	Sensor R	Sensor S	Sensor T
Spindle Max. rpm	r.p.m	12,000 r.p.m		20,000 r.p.m		15,000 r.p.m	
Magnetic unit weight	g	33 ±1.5	14.8 ±0.7	315 ±10	460 ±10	770 ±15	1000 ±20
Allowable centrifugal force	Kg	255	130	———			
Mounting semidiameter from Spindle center to Magnetic unit	mm	40 ∿ 110		20	25	30	35
Gap length between Magnetic unit and Sensor (Note 1)	mm	1.0 ∿ 2.0					

Item	Unit	Sensor N	Sensor P	Sensor Q	Sensor R	Sensor S	Sensor T
Deviation of Magnetic unit center and Sensor center (Note 2)	mm	0 ∿ ±2.0					
Applied temperature range	°C	0 ± +50					

(Note 1)



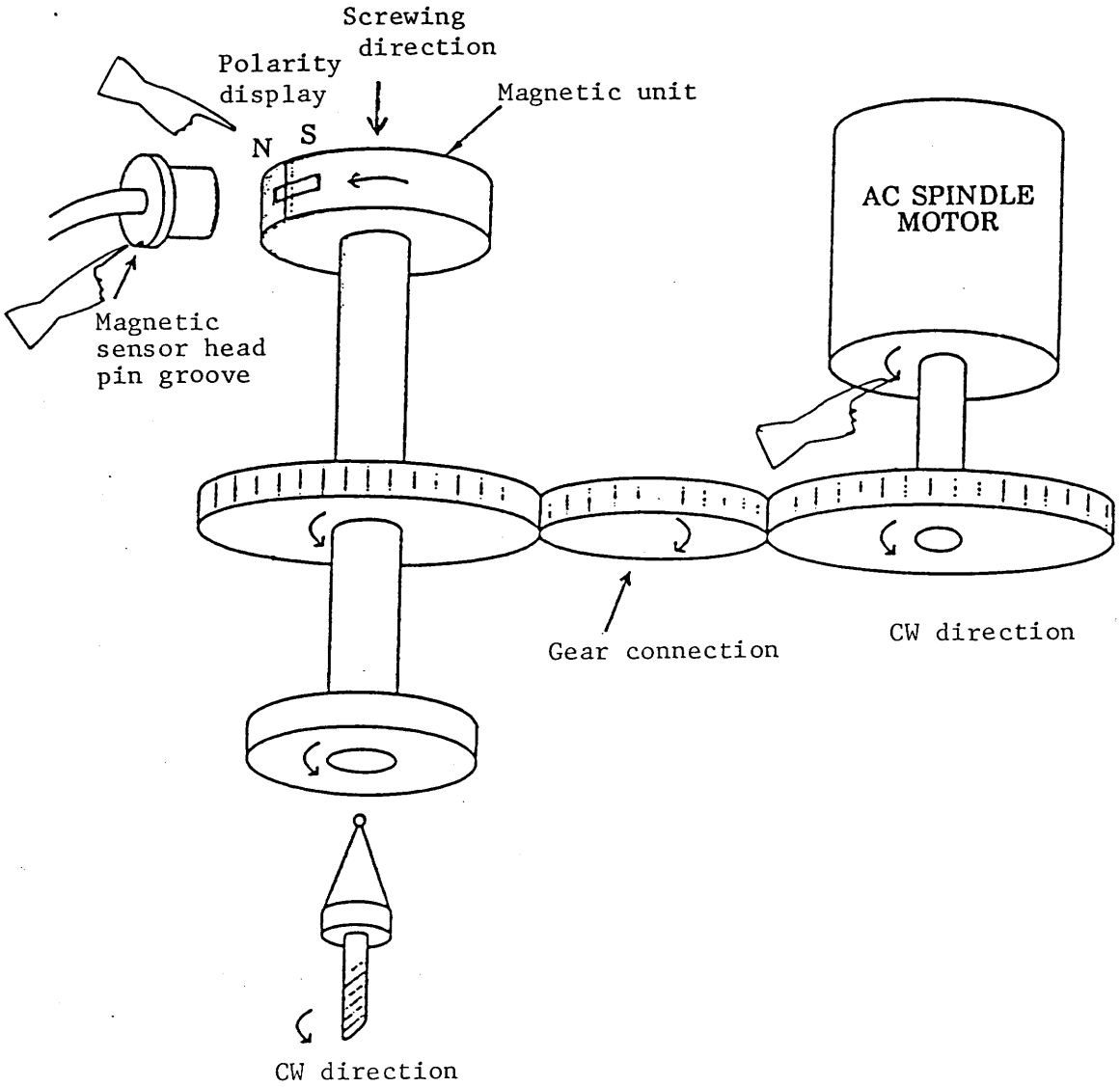
(Note 2)



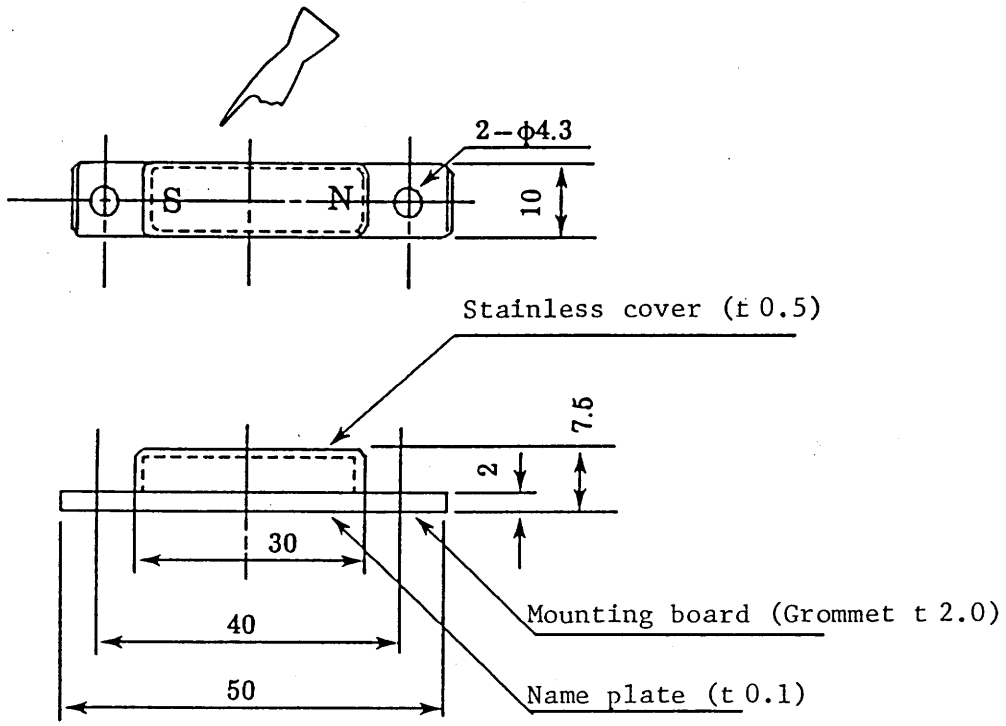
(3) Orientation Circuit

No.	Item		Circuit C	Circuit D	Circuit G	Circuit H
1	Allowable range of Spindle rpm Note 3)	High speed	2000 ∿ 8000 r.p.m	4000 ∿ 8000 r.p.m	6000 ∿ 12000 r.p.m	8000 ∿ 20000 r.p.m
		Inter-mediate speed	———	1000 ∿ 2000 r.p.m	———	———
		Low speed	400 ∿ 2000 r.p.m	250 ∿ 667 r.p.m	1200 ∿ 6000 r.p.m	1200 ∿ 6000 r.p.m
2	Allowable range of variable speed ratio High speed H/ Low speed L		2 ∿ 5		2 ∿ 5	2 ∿ 5
	High speed H/ Intermediate speed M Intermediate speed M/Low speed L			3 ∿ 4		

Note 3) When Spindle max. rpm for each gear stage is out of the allowable range, the orientation time gets longer, leading to an operational problem. Be sure to use within the above-mentioned range.

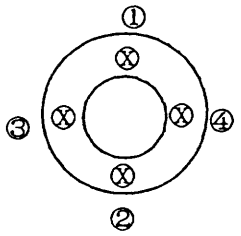

Screwing direction
Polarity display
Magnetic unit
N
S
AC SPINDLE MOTOR
Magnetic sensor head pin groove
Gear connection
CW direction
CW direction

(4) Outline Drawing of Magnetic Unit for Magnetic Sensor



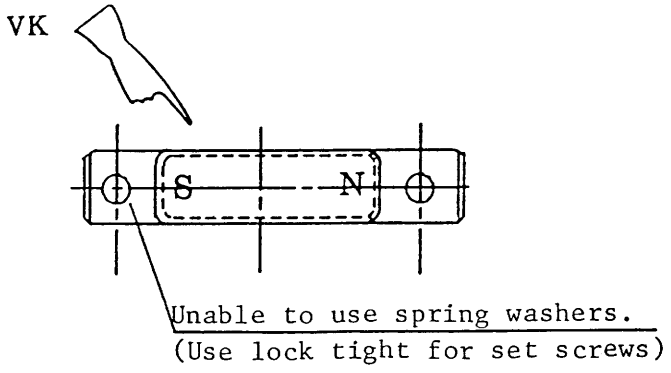
(5) Special Remarks on Use

(1) Ring Fender being used in Magnetic Unit, evenly tighten 4 bolts.



Tighten from (1) to (4) in order gradually and repeatedly.

(2) Relation between Discriminatory Reference Hole and the magnet polarity is as follows.



(3) Setting Orientation

Setting and Functions of Setting Terminals (SH)

Setting and Functions of Setting Terminals (SH) (Standard setting is shown in a double frame.)				
Setting (Note 1)			Function	Remarks
SH	1-2	2-3		
01		o	Enters Test Mode (Note 2)	Set only at adjustment
02	o	×	Rotates in CW direction at motor shaft end when an orientation command is given prior to Spindle driving after input of power.	Setting of SH03 is prior to the others. Effective only for the short circuit between SH03:1 and 2.
	×	o	Rotates in CCW direction at motor shaft end when an orientation command is given prior to Spindle driving after input of power.	
03	o	×	Orientates in the rotating direction which Spindle was taking just before an orientation command had been given.	SH02 setting becomes effective
	×	o	Orientation direction should always be CCW.	
	×	×	Orientation direction should always be CW.	
04	×	×	Orientation initial speed should be approx. 60 × [Spindle position loop gain sec^{-1}] rpm at Spindle	Positional loop gain of Spindle is, in general, around 5 sec^{-1}. It is around 300 rpm when without limitation.
	o	×	The initial speed is limited to 1/3.	
	×	o	The initial speed is limited to 2/3.	
05	o	×	For DC Spindle Servo Unit	
	×	o	For AC Spindle Servo Unit	

(Note 1) "o" shows short and "×" shows open.

(Note 2) Method of using Test Mode

(1) Turn on Spindle Orientation Command.

(2) Spindle Orientation Completion Signal (ORAR 1, 2) is not sent out.

(3) Spindle rotates in the orientation initial speed, while SW1 (Initializing Button) is kept pushed. Upon releasing the button, it is stopped.

(4) During this mode, red-colored luminescent semi-conductor diode is lit.

(4) Adjusting Variable Resistor

Adjust RV1 - 12, 12DC and 12AC according to the following table. Adjustment of the orientation circuit should be done after completing adjusting each offset and gain of the print board of Spindle Control Circuit. Especially, changing RV12 or 13 on the print board of Spindle Control Circuit may deviate the stop position.

Adjustment of Variable Resistor

Carry out the adjustment below in Test Mode, after shorting between pins of SH01.

Item	Name	Item to be adjusted	Condition	Adjusting method (Specifications)
1	RV 1	TS OFFSET (Compensation of difference between normal and reverse rotations at Slow Down time)	Orientate from normal/reverse rotating directions, after completing main adjustments, to compare Slow Down time.	Reference setting is 5 scales. Set so that the difference of Slow Down time form normal/ reverse rotating directions is 0.1 sec. and less.
2	RV 2	MS PEAK LEVEL	Keep pushing SW1 (Initial Setting button).	Set where LED3 (MS PEAK LEVEL) starts blinking. 5.5 scales
3	RV 3	SLOWDOWN REFERENCE		7 scales
4	RV 4	AMS PEAK LEVEL		7 scales
5	RV 5	SLOWDOWN TIME IN HIGH MODE	Make Clutch (gear) HIGH. Push SW1 to stop it at the fixed position. *CTH signal is OFF.	LED4 (SLOW DOWN PERIOD) should be lit up for a moment just prior to stopping. 0.5 scale

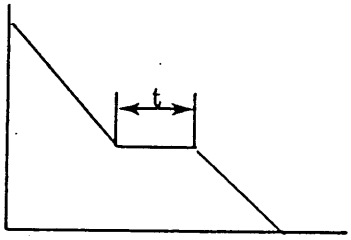
Item	Name	Item to be adjusted	Condition	Adjusting method (Specifications)
6	RV 6	GAIN [H]	Make Clutch (gear) HIGH. Push SW1 to stop it at the fixed position. *CTH signal is OFF.	Turn to CW direction so much as not to cause overshoot on stopping. 4 scales
7	RV 7	IN-POSITION [H]	Same as above	LED5 (IN-POS.FINE) must be lit while LED6 (IN-POSITION) is lighting. 4.5 scales
8	RV 8	SLOWDOWN TIME IN LOW MODE	Make Clutch (gear) LOW. Push once SW1 to stop it at the fixed position. *CTH signal is ON.	LED4 (SLOWDOWN PERIOD) should be lit up for a moment just prior to stopping. 8 scales
9	RV 9	GAIN [L]	Same as above	Turn to CW direction so much as not to cause overshoot on stopping. 6.5 scales
10	RV10	IN-POSITION [L]	Same as above	LED5 (IN-POS.FINE) should be lit while LED (IN-POSITION) is lighting. 4 scales
11	RV11	POSITION SHIFT		Fine adjustment of Stop Position is available within ±1° range at Spindle angle. 5.5 scales
12	RV12DC	HIGH GAIN DC	Adjustment when using DC Spindle Servo Unit	Reference Adjustment Value : 0 scale
13	RV12AC	HIGH GAIN AC	Adjustment when using AC Spindle Servo Unit.	Reference Adjustment Value : 8 scales

Upon completing adjustment, release Test Mode and confirm that LED7 (red) has been turned off.

① RV6/9 adjustment

Should be no overshoot

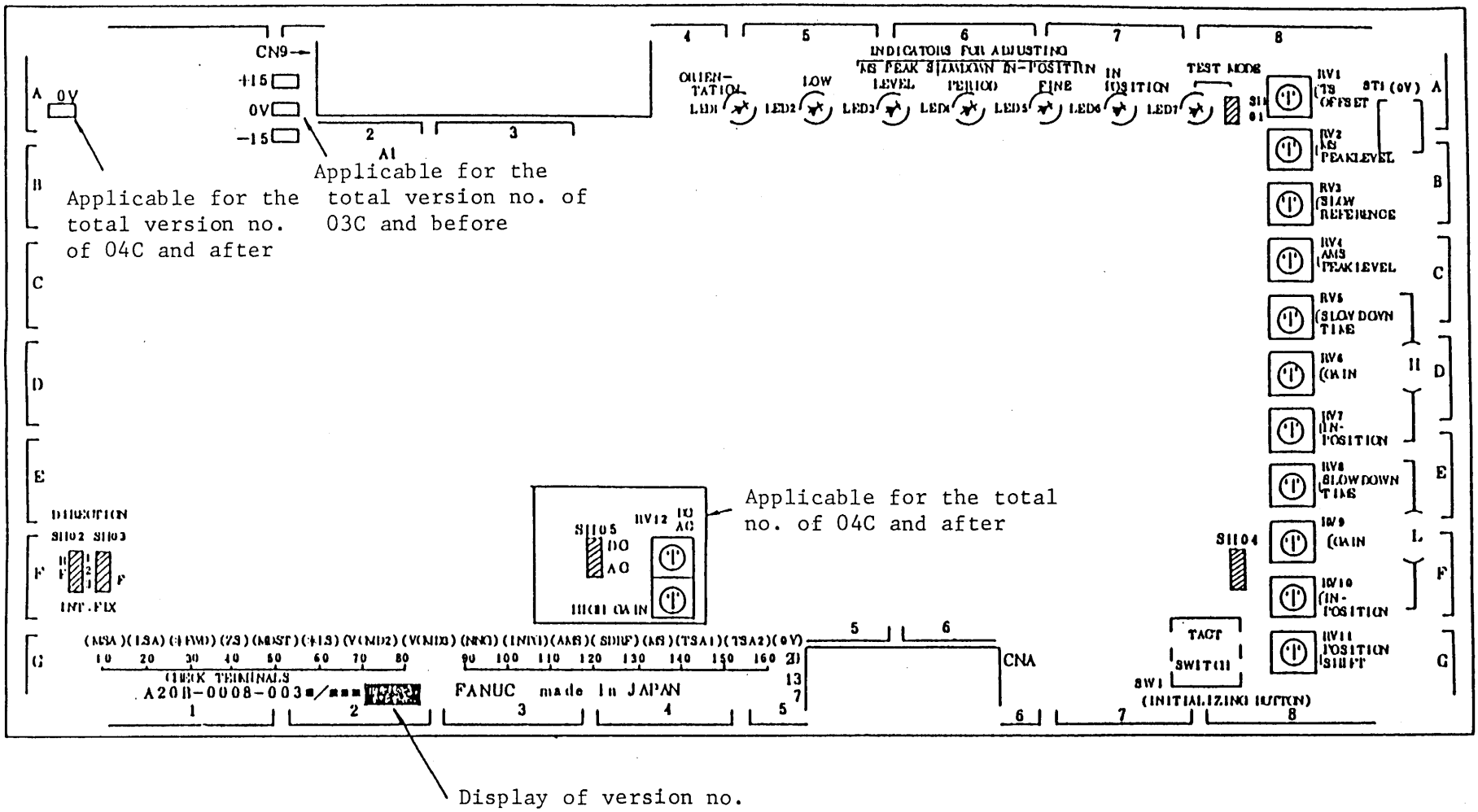
② RV5/8 adjustment



Set to 0.0 ∿ 0.2 sec.

Check terminal

TSA2-OV



Display of version no.

Mounting Positions of Check Terminal, Variable Resistor, Set Pin and Luminescent Semiconductor Diode (PCB Drawing No. A20B-0008-0030)

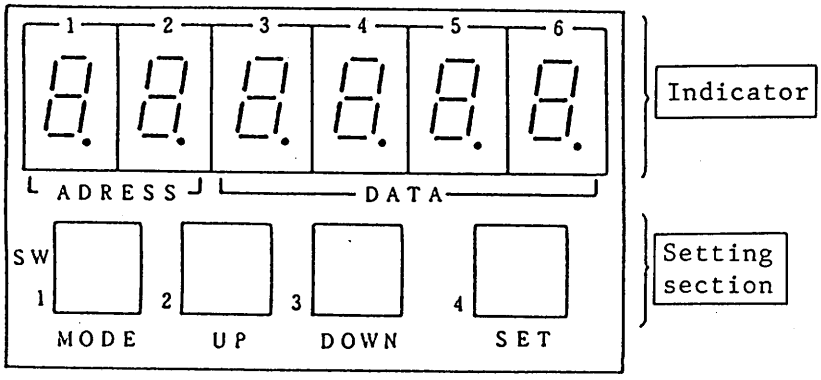
4. MITSUBISHI Spec. Spindle Drive Unit

4-1 Status Indication and Parameter Setting

1) In case of using FR-SF indicator

Status indication and parameter setting are performed with the indicator and the setting switch on the SF-CA card.
When connecting M300 series with the bus line, the statud indication and a part of parameter setting can be performed on the NC screen.

1)-1 Indicator and setting switch (Located on the SF-CA card)



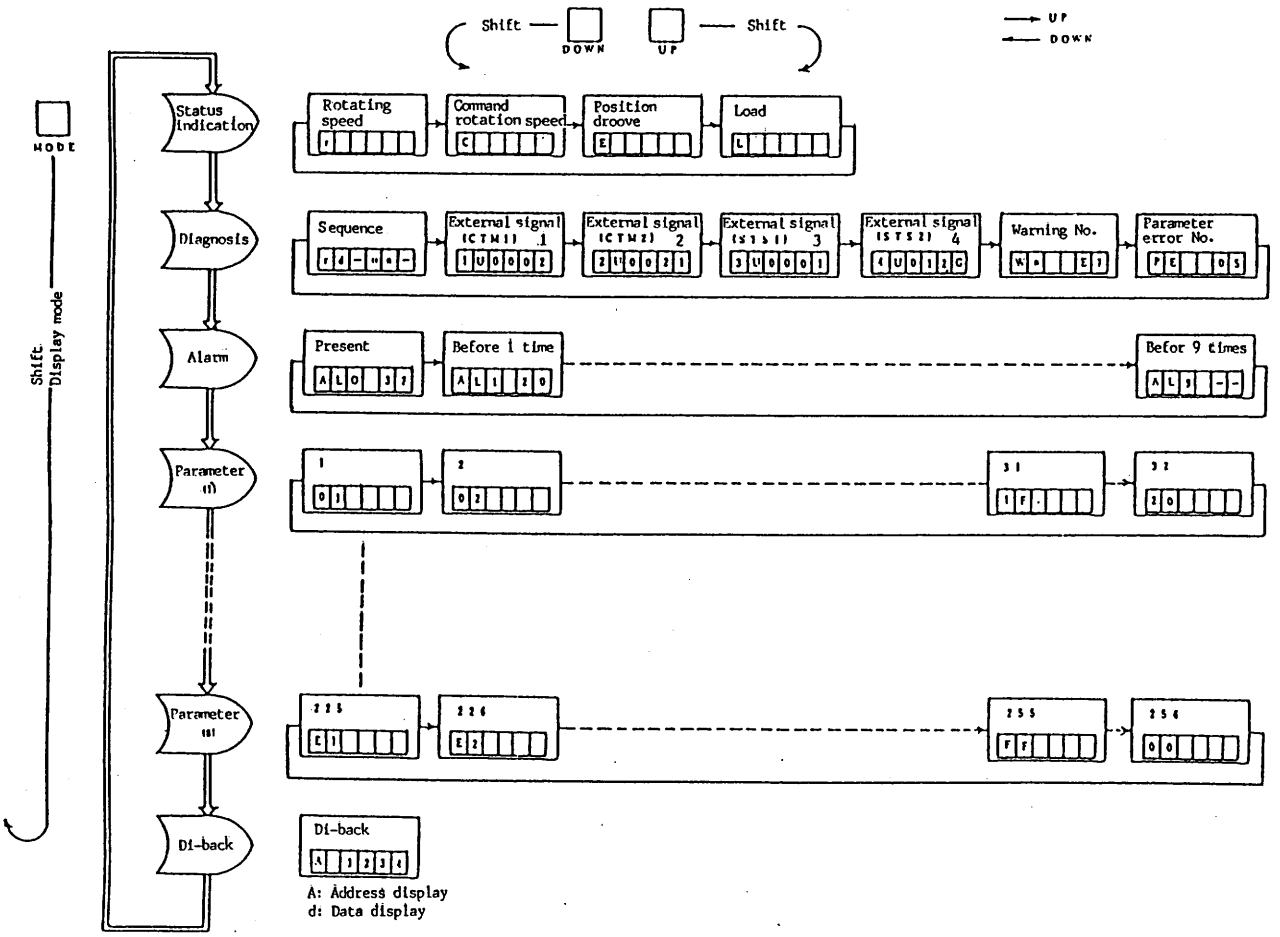
On SF-CA card

The status indication, diagnosis, alarm indication, parameter (1) through (8) and the contents of debug are displayed by the LED of 7 segments.

Set by the below switches
Mode: Alteration of display mode
UP: Increases the numeric value of the indicator (ADDRESS. DATA).
DOWN: Decreases the numeric value of the indicator.
SET: Stores the setting data of parameters.

a) The display mode is generally classified into 12 modes such as status indication, diagnosis, alarm indication, parameter (1) through (8) and debug.
b) Unless alarm factors exsist, the indicator on the setting panel becomes an indicator of the rotating speed for the status display mode after the power is turned ON.
c) When an alarm occurs, it becomes the alarm display mode.
d) Alteration of the display mode can be executed by pressing the MODE switch.
e) As to the transition of the display mode and the display contents shall be refered to the display mode of the indicator in the next page.

1)-2 Display mode of the indicator



FR-SF LED DISPLAY FUNCTION

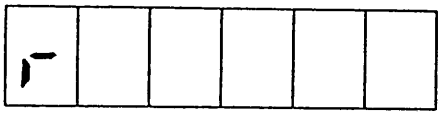
- The modes such as status indication, diagnosis, alarm and parameter(1), etc. are shifted by pressing the MODE switch.
- Display alteration in the same mode is made by the switch UP/DOWN.

1)-3 Parameter setting method

Perform the parameter setting in the status that the machine standby (SET1. SET2) is turned OFF.

Power ON

. Without alarm factors, the indicator of the setting panel becomes the status display mode and the indication of rotating speed (Fig. 1).



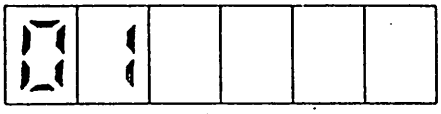
ADD DATA

Fig. 1 Indication of rotating speed

Mode selection

. The mode is proceeded step by step by pressing the switch.

(Example) If the MODE switch is pressed three times in the status of Fig. 1, the parameter (1) display mode, Fig. 2 will appear.



ADD DATA

Fig. 2

Address selection

. It is possible to select an address in the same mode by pressing the UP · DOWN switches. And the data corresponding its address are displayed.

(Example) . When the UP switch is pressed in the status of Fig. 2, 02 appears. And when pressed once again, 03 appears. (Fig. 3)

. When the switch is pressed in the status of Fig. 3, DOWN appears. pressed once again, 01 appears. (Fig. 2)

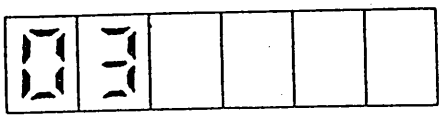


Fig. 3

Data rewrite

. It is possible to rewrite the data by pressing the SET switch. In this case, the LED for address display flickers, that shows that REWRITE is enable.

. Data are selected by pressing the UP · DOWN switches. In data value in creases by pressing the UP switch and decreases by the DOWN switch. And if the switch is succeedingly pressed, data will be changed continously.

. When the SET switch is pressed once again, DATA REWRITE is completed. And the LED for address display returns from flickering to lighting.

Data set completion

. Press the PB 1 switch to rest the FR-SF. And turn the power OFF once and turn it ON again.

The data setting is completed by this procedure.

1)-4 List of status display

In the status display mode, the contents of below name is displayed.

Name	Abbreviation	Unit	Contents
Rotating speed	r-	rpm	Rotation speed of the motor is displayed.
Commanded rotation speed	C	rpm	Commanded rotation speed of the motor is displayed.
Position droove	E	Pulse	Pooled pulse of the deviation counter is displayed. For the pulse (negative) on the reverse rotation side, all decimal points light up.
Load	L	%	Regarding 30 minutes rate output as 100%, loading status is displayed.

1)-5 List of diagnosis display

In the diagnosis mode, the contents of sequence, external signal, warning No.. parameter error No. and alarm No. are displayed.

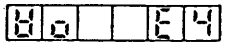
Sequence

Name	Display	Contents
Sequence	r d - 0 n - (ADD. / DATA)	It means the standby status.
	r d - 0 F F (ADD. / DATA)	It means no standby status.

External signal The following descriptions are meant by corresponding to the bit of display, I/O signals can be checked.

Name		Display . Contents															
		F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
CTM1	1U ADD (Input signal)		CTM Gear selection	CTL Gear selection					TAP In tapping		ORC Orientation command	Reverse Index	Forward Index	TL2 Torque limit 2	TL1 Torque L	SRI Reverse rotation	SRN Forward rotation
CTM2	2U ADD (Input signal)								PCHG Parameter change	DFIN, Data setting completion			N. RST NC reset			SVON Servo ON	RDY Ready ON
STS1	3U ADD (Output signal)								In parameter changing	In torque limit	In-position	Z phase pass		In alarm	In emergency stop	Servo ON	Ready ON
STS2	4U ADD (Output signal)					FRI Phase order (Reverse "1")		In reverse rotation	In forward rotation		OFIN Orientation completion	LTS Speed reach	ZS Zero speed	ALM In alarm	SD Speed detection	CD Current detection	

Warning No.

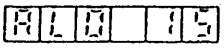
Name	Display	Contents
Warning No.		Parameter error warning
		Emergency stop. Warning

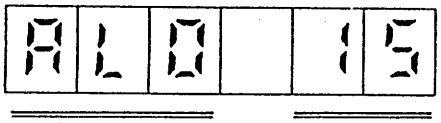
Parameter error No.

Name	Display	Contents
Parameter error No.		Parameter error No. is displayed.

1)-6 Alarm display

Alarm No.

Name	Display	Contents
Alarm No.		Alarm No. is displayed.



Alarm No. is being displayed.

As to the contents of alarm No., refer to Appendix 1, List of alarm warning.

Alarms occurred simultaneously are displayed on AL0 ~ AL9.

1)-7 List of parameter

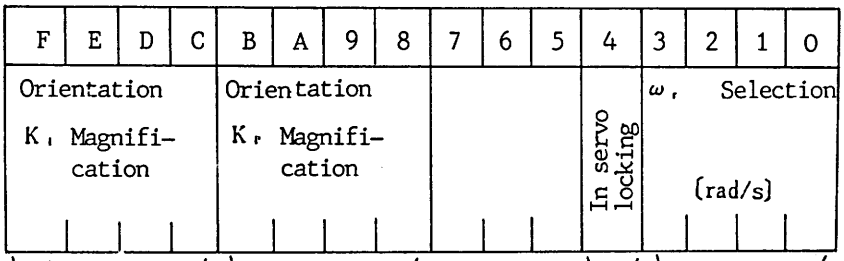
#	Item		Contents	Setting range(Unit)
01	NOX	Motor classification	Set in accordance with motor specifications. 0: Standard. Semi-standard specifications 1: When a standard or semi-standard motor is used as wide range output specifications. 2: Other special specifications	Decimal
02	MSL	Motor selection	Adaptive motor constant is selected according to kinds motor. (0~63)	Decimal
03	PLG	Encoder type for position loop	It is set by pulse motors of encorder. 0: 1024 pulses (Encoder orientation. syncronized tapping) 1: 90000 pulses (For C-axis control)	Decimal
04	MOD	External interface mode selection	It is set by the interface with the external (NC). 0: DIO (Same specifications as those of FR-SE) 2: BUS line connection with M300 at 2 port BUS)	Decimal
05	DSR	Speed command	Type of the speed command input is selected. #04 It is effective when MDO is 0. 0: 12bit BINARY 1: 12bit with code BINARY 2: BCD (2 digits) 3: BCD (3 digits) In case of analog speed command, either 0 or 1 is selected. In case of digital speed command, either, 0~3 can be selected.	Decimal
06	MON	Output monitor monitor selection	The contents of the load meter output (analog voltage) on the SF-CA card are set. 0: Load meter 1: Torque meter Standard value 0	Decimal

#	Item		Contents	Setting range(Unit)
07	01SL		Unused Set 0.	
08	02SL		Unused Set 0.	
09	11SL	Auxiliary/ Selection	The functions of TL1 and TL2 are selected. 0: Torque control input 1: Index orientation input	Decimal
0A	12SL		Unused Set 0.	
0B	VOP	Speed command Offset adjustment	Set on offset value at the time when using the analog command. Standard value 0	Decimal with mark (−999≦ ≦+999)
0C	VON		Unused Set 0.	
0D	VGP	Speed command Gain adjustment	Set the gain for the speed command. The actual speed command is what an external speed command is multiplied by set data, regrarding 1000 as 1 multification. Standard value 1000	Decimal (0≦ ≦1150)
0E	VGN		Unused Set 0.	
0F	CSN2	2nd cushon Time constant	Unused Set 0.	
10	DTYP	Data type	Set whether the data of the parameter #11 through #20 are effective or not. 0: Ineffective 1: Effective as data for the speed setting device. When setting to "1", the data set to the parameter #11 through #20 for the input signal of the connector CONC of the SF-OR card, become effective as a speed command.	Decimal
11 12 13 14 15 16 17 18 19 1A 1B 1C	DT01 DT02 DT03 DT04 DT05 DT06 DT07 DT08 DT09 DT10 DT11 DT12	Data 1 Data 2 Data 3 Data 4 Data 5 Data 6 Data 7 Data 8 Data 9 Data 10 Data 11 Data 12	These become effective when #10 data type parameter is "1". Set a speed command selected by the speed selecting signal to each datum. The data to be set are set by the rotation speed of motor, and can be set within the range not exceeding maximum motor speed set by #31 TSP.	Decimal

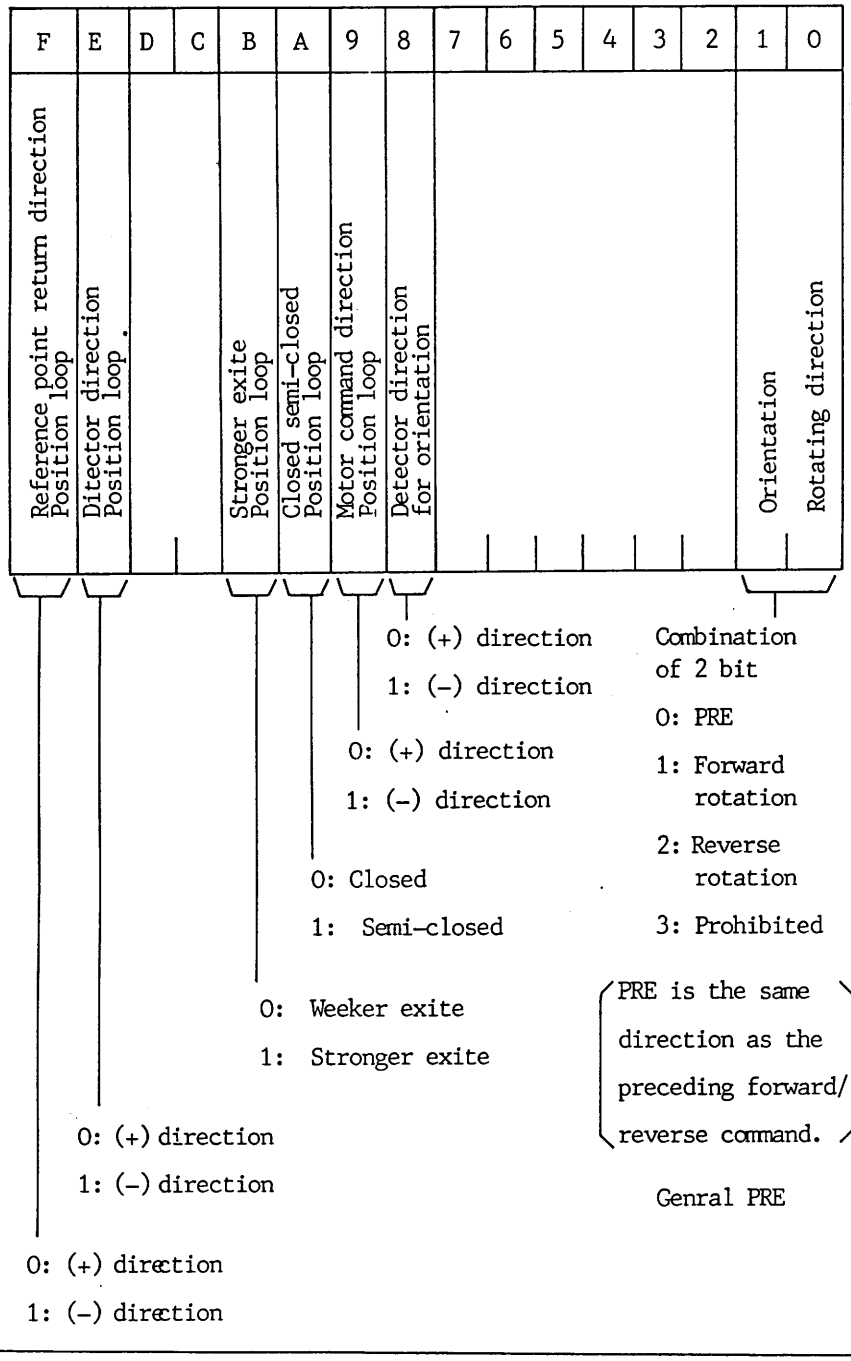
	#	Item		Contents	Setting range(Unit)	
	1D	DT13		Unused Set 0.		
	1E	DT14		Unused Set 0.		
	1F	DT15		Unused Set 0.		
	20	DT16		Unused Set 0.		
*	21	PG1	Orientation 1st deceleration point	Encorder orientation An angle entering into creeping speed is set. Standard value 180 Magnesensor orientation After passing the linear zone, time till entering into the creeping speed is set. Standard value 133	Encoder 0 ~359 (degree)	Magnesensor 0 ~500ms
*	22	PG2	Orientation 2nd deceleration point	An angle that the creeping speed of the orientation enters into the position loop is set. Standard value 20		0 ~40 (degree)
*	23	PGC	Synchronized tapping Position of C-axis control	Synchronized tapping Aposition loop gain of the spindle at C-axis control is set. Standard value 40 (Standard value on the NC screen : 10.00)	1 ~ 512(1/4rad/s) However, the parameters on the NC screen is 0.01 ~ 999.99(rad/s)	
*	24	ZRZ	Orientation In-position range	The range of position error that the orientation completion signal is output is set. Encoder orientation: Standard value 16 Magnesensor orientation: Standard value 80 (Standard value on the NC screen : 1.00)	Encoder 1 ~5760 (1/16 degree) However, the parameters on the NC screen is 0 ~359 (degree)	Magnesensor 1 ~512 (1/16 degree) 0 ~39 (degree)
*	25	OSP	Orientation speed	The orientation speed is set. Standard value 220	0 ~1000rpm	
*	26	CSP	Creep speed	The creep speed is set. Standard value 20	0 ~1000rpm	
*	27	PST	Position shift	The stop position of orientation is set. Encoder: The value that 360 is divided by 4096 is set. Magnesensor: -5 ~ +5 are divided by 1024 and regard 0 as 2048. Standard value 2048	Encoder 0 ~4095	Magnesensor 1536~2560

	#	Item		Contents	Setting range(Unit)
*	28	BRC		Unused Set 0.	
*	29			Unused Set 0.	
	2A			Unused Set 0.	
	2B			Unused Set 0.	
	2C			Unused Set 0.	
	2D			Unused Set 0.	
	2E			Unused Set 0.	

The parameters marked * are parameters set from the NC side when M300 seies is connected with the BUS line.

#	Item		Contents	Setting range (Unit)
* 2F	ORS1	Orientation Stop control 1	 Conbination of 4 bit Conbination of 4 bit Conbination of 4 bit 0 : 0.6 (Times) 0 : 0.6 (Times) 0 : Delay/Gain 0 : 0.55 (rad/s) 1 : 0.7 1 : 0.7 1 : PI 1 : 1.1 2 : 0.8 2 : 0.8 2 : 1.65 3 : 0.9 3 : 0.9 3 : 2.2 4 : 1 4 : 1 4 : 2.75 5 : 1.2 5 : 1.2 5 : 3.3 6 : 1.4 6 : 1.4 6 : 3.85 7 : 1.6 7 : 1.6 7 : 4.4 8 : 1.8 8 : 1.8 8 : 4.95 9 : 2 9 : 2 9 : 5.5 A : 2.2 A : 2.2 A : 6.05 B : 2.4 B : 2.4 B : 6.6 C : 2.6 C : 2.6 C : 7.15 D : 2.8 D : 2.8 D : 7.7 E : 3 E : 3 E : 8.25 F : 3.2 F : 3.2 F : 8.8 Standard value 7701	Hexa-decimal

The parameters marked * are parameters set from the NC side when M300 series is connected with the BUS line.

#	Item		Contents	Setting range (Unit)
* 30	ORS2	Orien-tation Stop control 2		Hexa-decimal

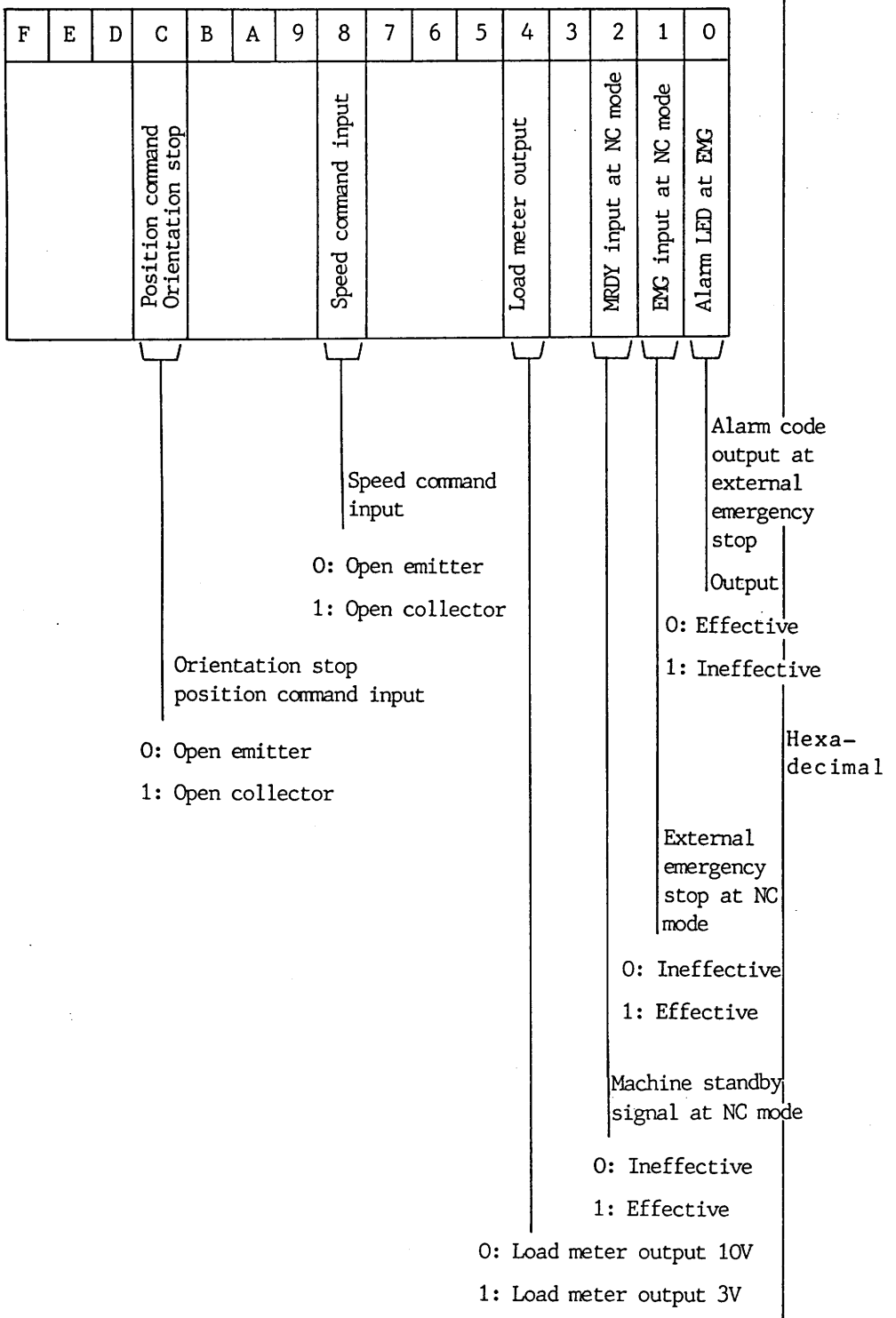
The parameter marked * are parameters set from the NC side when M300 series is connected with the BUS line.

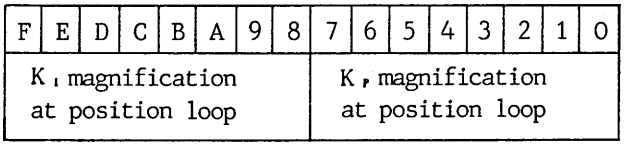
	#	Item		Contents	Setting range (Unit)
*	31	TSP	Max. motor speed	Max. motor speed is set.	1~3276 (10rpm) However, the parameters on the NC screen are 10~32760 (rpm)
*	32	ZSP	Zero speed	The rotation speed outputting zero speed is set. Standard value; 50	1~1000(rpm)
*	33	CSN	Acceleration time constant	The time constant for the speed commands from 0 till maximum speed is set. (It is ineffective at the position loop.) Standard value; 30 (Standard value on the NC screen; 300)	2~3276 (10sec) However, the parameters on the NC screen are 20~32760sec
*	34	SDT	Speed detection rate	The speed outputting speed detection for the maximum speed of motor is set by parcentage. Standard value; 10	0~100 (%)
*	35	TLM	Torque limit	The limit rate of the torque limit signal TL2 (TLH) ia set. Standard value; 10	0~120 (%)
*	36	VKP	Speed loop portional gain	The proportional gain of the speed loop is set. If it is increased (about 100~150), response becomes much sensitive, but virbration and sound becomes bigger. Standard value; 63	0~1000 (rad/s)
*	37	VKI	Speed loop integral gain	The integral gain of the speed loop is set. It should be set so that the rate for the proportional gain VKP of the speed loop becomes almost contant. Standard value; 60	0~1000 (1/10rad/s)
*	38	TYP	Position loop IN-type	The processing at the time when converted from the speed loop to the position loop is set. 0: The position loop IN after orientation. 1: The position loop IN instantly. When reference point return is required, set "0", and when not required, set "1". Standard value; 0 In case of C-axis control 0: Reference point return by the encoder. 1: It becomes dog type reference point return.	Decimal

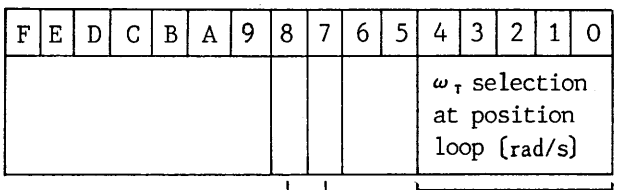
The parameters marked * are parameters set from the NC side when M300 series is connected with the BUS line.

	#	Item		Contents	Setting range (Unit)
*	39	GRA1	Spindle side gear	The spindle side tooth number against the gear 00 is converted to hexadecimal number to set.	1~7FFF (HEX) However, the NC screen is 1~32767 (Decimal), and it is not necessary to convert to hexadecimal. The gear ratio is set by the tooth number of the spindle side and that of the motor shaft side. Spindle x $\frac{\text{Spindle side tooth number (GRA1~4)}}{\text{Motor side tooth number (GRB1~4)}}$ = Motor speed This relations are composed.
*	3A	GRA2		The spindle side tooth number against the gear 01 is converted to hexadecimal number to set.	
*	3B	GRA3		The spindle side tooth number against the gear 10 is converted to hexadecimal number to set.	
*	3C	GRA4		The spindle side tooth number against the gear 11 is converted to hexadecimal number to set.	
*	3D	GRB1	Motor side tooth	The motor side tooth number against the gear 00 is converted to hexadecimal number to set.	1~7FFF (HEX) However, the NC screen is 1~32767 (Decimal), and it is not necessary to convert to hexadecimal. The gear ratio is set by the tooth number of the spindle side and that of the motor shaft side. Spindle x $\frac{\text{Spindle side tooth nomber (GRA1~4)}}{\text{Motor side tooth number (GRB1~4)}}$ Motor speed This relations are composed.
*	3E	GRB2		The motor side tooth number against the gear 01 is converted to hexadecimal number to set.	
*	3F	GRB3		The motor side tooth number against the gear 10 is converted to hexadecimal number to set.	
*	40	GRB4		The motor side tooth number against the gear 11 is converted to hexadecimal number to set.	
	41	OSL	Orientation type	The orientation type is set. 0: Motor built-in encoder 1: Encoder 2: Magnesensor	Hexadecimal

The parameters marked * are parameters set from the NC side when M300 series is connected with the BUS line.

#	Item		Contents	Setting range (Unit)
42	BSL	Selection corresponding to bit		Hexadecimal

<table>
<tr><th>#</th><th colspan="2">Item</th><th>Contents</th><th>Setting range (Unit)</th></tr>
<tr><td>43</td><td>CPI</td><td></td><td>Unused Set 0.</td><td></td></tr>
<tr><td>44</td><td>CPI</td><td>Position loop
K_P, K_I magnification</td><td>When 1 is set to bit 8 of #45 CWT, this is effective. Synchronized tapping, C-axis, other K_P, K_I magnification different from orientation is set.
 

K_I magnification and K_P magnification can be set up to 1/16 through 15 times, regarding 10_H (16_D) as 1 times. Though response for impact load become more sensitive when magnification is ralsed, gear sound becomes higher.
Set by 1~2 times (1010_H ~ 2020_H).
Usually, K_I magnification and K_P magnification shall be the same value.</td><td>Hexadecimal
Example of setting
When desiring to set both K_I and K_P to 1.5 times.
$CPI=\frac{18}{K_I}\ \frac{18_H}{K_P}$</td></tr>
<tr><td>45</td><td>CWT</td><td>At position loop
K_P, K_I, ω_T Setting classified by control method
Change over effective/ ineffective</td><td> 

At position loop
Control method
1: Delay/gain
1: PI
Combination of 5 bit
0:0.55 10:9.4
1:1.1 11:10.0
2:1.65 12:10.55
3:2.2 13:11.10
4:2,75 14:11.65
5:3.3 15:12.2
6:3.85 16:12.8
7:4.4 17:13.35
8:4.95 18:13.9
9:5.5 19:14.45
A:6.05 1A:15.05
B:6.6 1B:15.6
C:7.15 1C:16.15
D:7.7 1D:16.75
E:8.25 1E:17.3
F:8.85 1F:17.85
#44, #45 parameter setting
Change over effective/ ineffective
0: Ineffective
K_P, K_I, ω_T control method becomes the value set by #2F ORS1.
1: Effective
At the position loop, K_P, K_I, ω_T control method becomes the value set by #44 and 45 45.</td><td></td></tr>
</table>

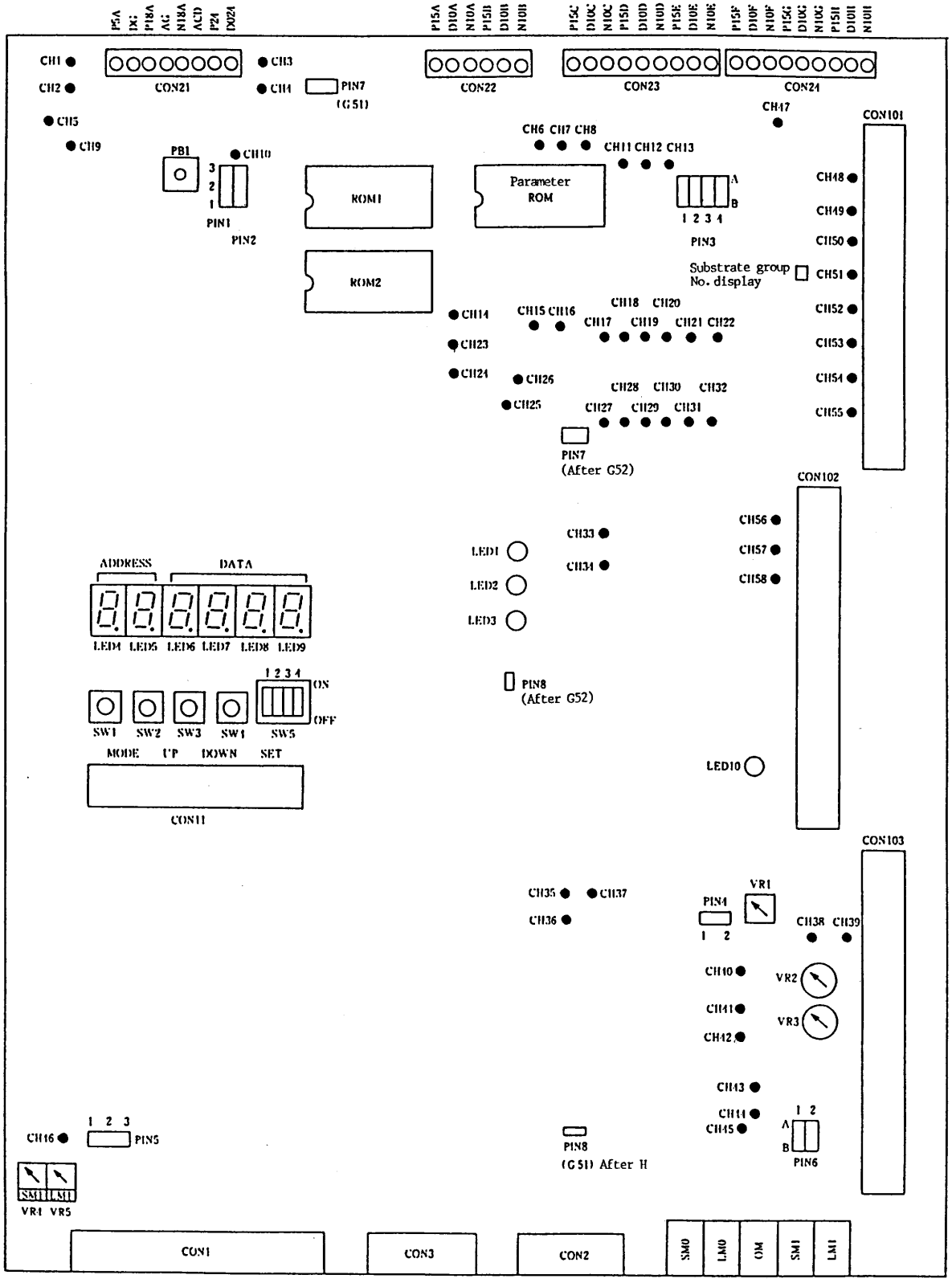
#	Item		Contents	Setting range (Unit)	
46			Unused Set 0.		
47			Unused Set 0.		
48			Unused Set 0.		
49	GAH1	Auxiliary gear tooth number at the spindle side	When the value of gear tooth number exceeds the setting range of general gear number parameter (GRA1~4, GR1~4). Rogarding gear tooth number = X x Y, X is set to the parameter of general gear tooth number and Y is set data to the parameter of auxiliary gear tooth number. However, auxiliary gear tooth number is set when setting up semi-closed position loop that accurate gear ratio is required. In case of the full closed loop, an approximate value accepted to the parameter of general gear tooth number is set and auxiliary gear tooth number is set to 0. The parameter GAH1~4 correspond to GRA1 ~4, and GBH1~4 correspond to GRB1~4.	1~7FFF (hexadecimal)	
4A	GAH2				
4B	GAH3				
4C	GAH4				
4D	GBH1				
4E	GBH2	Auxiliary gear tooth number at the motor side			
4F	GBH3				
50	GBH4				
59	SVSP	Servo travel rate	When the speed loop is changed over to the position loop, spindle speed is set. Standard value; 40	10~200 (rpm)	
5A	PDT	Reference point return decelerating point	A decelerating point is set at the time when decelerating from the servo travel rate to the stop point. If the spindle is swung at the time of stopping, increase the value. Stendard value; 88	1~2000 (Pulse)	
5B	IPOS	Position loop in-position width	The width outputting the position loop in-position is set. Standard value; Synchronized tapping 10 C-axis 3E8	Hexadecimal	
5C	PZSF L	Reference point return shift amount of the position loop (Low Byte)	A shift amount is set from 2 phase of the reference point return position at the time when the speed loop is changed over to the position loop. Standard value; 0	Syncronized tapping (Tapperless)	C-axis
5D	PZSF	Reference point return shift amount of the position loop (High Byte)		0~FFF"	57E40"

#	Item		Contents	Setting range (Unit)
5E	DCSN	Dual cushon	This is the setting for changing cushon against the varied amount of the speed command. 0: Ineffective 1: Effective Gear sound is restrained at gaer changing. Standard value; 1	Decimal
5F	PYX	Variable excite	A variable excite rate is set. Though small value is selected when gear sound is large, large value is effective for the impact load response. Standard value; 0 0: 50% 1: 25% 2: 75% 3: 100%	
C1 C2	OM1	Gear classi-fication PG1 Magifi-cation	A magnification for #21PG1 classified by gear (orientation 1st deceleration point) is set. F 87 0 C1 | Gear 01 | Gear 00 | F 87 0 C2 | Gear 11 | Gear 10 | 10_H (16_D) becomes 1 times. When desiring to adjust orientation every gear, it is set. When 0 is set, it becomes 1 times.	$\frac{1}{16}$ ~ 15 times (16 times)
C3 C4	OM2	Gear classi-fication PG2 Magnifi-cation	A magnification for #22PG2 classified by gear (orientation 1st deceleration point) is set. F 87 0 C3 | Gear 01 | Gear 00 | F 87 0 C4 | Gear 11 | Gear 10 | 10_H (16_D) becomes 1 times. When desiring to adjust orientation every gear, it is set. When 0 is set, it becomes 1 times.	$\frac{1}{16}$ ~ 15 times (16 times)

4-2 Card Check

1) SF-CA card

Note1) A card should be given to the point that the arrangement of PIN7 and PIN8 is different between the substrate group No. G51 and after G52.



(1) List of dip switch

○ : Dip switch "ON" setting

× : Dip switch "OFF" setting

<table>
<tr><th>Switch No.</th><th>Name</th><th>Description</th></tr>
<tr><td>SW5-1 ~3</td><td>Test mode selection</td><td>The test mode is selected.

<table>
<tr><th>1</th><th>2</th><th>3</th><th></th></tr>
<tr><td>×</td><td>×</td><td>×</td><td>..... General setting</td></tr>
<tr><td>○</td><td>×</td><td>×</td><td>..... NC parameter is ignored.</td></tr>
<tr><td>×</td><td>○</td><td>×</td><td rowspan="8">..... Internal parameter comes into effect.
.Test aging
Test mode
.Parameter transfer
.E² ROM initialize</td></tr>
<tr><td>○</td><td>○</td><td>×</td><td>.....</td></tr>
<tr><td>×</td><td>×</td><td>○</td><td>.....</td></tr>
<tr><td>○</td><td>×</td><td>○</td><td>.....</td></tr>
<tr><td>×</td><td>○</td><td>○</td><td>.....</td></tr>
<tr><td>○</td><td>○</td><td>○</td><td>.....</td></tr>
</table></td></tr>
<tr><td>SW5-4</td><td>Meter calibration</td><td>
<table>
<tr><th>4</th><th></th></tr>
<tr><td>○</td><td>..... Meter full scale output</td></tr>
<tr><td>×</td><td>..... Meter general mode</td></tr>
</table>
This is for the full scale calibration of the speed meter and the load meter.
Since the meter full scale voltage is output when the SW5-4 is ON, the volume of the speed meter (VR4) and the load meter (VK5) is adjusted.</td></tr>
</table>

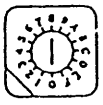
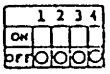
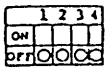
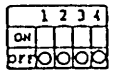
(2) List of push button switches

No.	Name	Description
SW1	MODE	The display mode of LED is changed over. The display of LED is changed over to each mode, status display → Alarm → Parameter (1) → ..... → Parameter (8) → Debug, every one pushing.
SW2	UP	This is a button for transmitting to the next page in the MODE. In the parameter mode, if the "UP" button is pressed after pushing the SET SW, the DATA of parameters are incremented.
SW3	DOWN	This is a button for transmitting to the previous page in the MODE. In the parameter mode, if the "DOWN" button is pressed after pushing the SET SW, the DATA of parameters are decremented.
SW4	SET	This is a button for rewriting parameter, In the parameter, the DATA of parameters flickers if the SET SW is pressed. Therefore, if the DATA REWRITE SET button is pressed, the parameter of E²PROM is rewritten.
PB1		This is the master reset of the CPU. Press it after the parameter is rewritten . Don't reset while the motor is rotating.

(3) List of setting pins

No.	Name	Setting	Description
PIN1 PIN2	BUS interface setting *Set the parameter simultaneously (#04MOD)		When BUS connection with M300 series is not made.
			The paremeter #04 MOD is set to 0.
			When BUS connection with M300 series is made.
			The parameter #04 MOD is set to 1.
PIN3	UP/DOWN short-circuit protection time setting		A UP/DOWN short-circuit protection time is set. Since the alteration of setting causes to damage, confirm that it is in accordance with the setting in the order list.
PIN4	Test pin for converter check		This is a test pin for testing at the delivery. Use it in the status that the pin is not inserted.
PIN5	Analog speed command change-over *Set the parameter simultaneously (#05DSR)		When the unipolar (0~+10V) is input. When the offset voltage near by 0V becomes a problem, use by the bipolar (-10~+10V).
			The parameter #05 DSR is set to 0.
			When the bipolar (-10~+10V) is input.
			The parameter #05 DSR is set to 1.
PIN6	Test pin for the control circuit		This is a tast pin for testing at the delivery. When 1A - 1B is shorted, an alarm for CONTROL OVER-HEAT can be extinguished, and when 2A - 2B is shorted, an alarm for BRAKER TRIP can be extinguished.
PIN7	Current loop gain change-over		When the capacity of the FR-SH is 5.5 kw~15kw.
			When the capacity of the FR-SF is 18.5kw~.
PIN8			(Not used.)

Short pin switch setting (In the card)

		1. As for PIN setting in the list, ▨ mark shows PIN insertion and ▯ mark PIN OUT. 2. SW5 shall be set at the ○ mark side. 3. CS1 is the setting value of the rotary switch encireled with ○ mark. Notch No. 
Card Name	Card No.	
SF-CA card	G51	 PIN1 PIN2 /  PIN3 /  PIN4 (For test) /  PIN5 /  PIN6 (For test) / PIN7 / — / — / — / — /  SW5
	G52	 PIN1 PIN2 /  PIN3 /  PIN4 (For test) /  PIN5 /  PIN6 (For test) / PIN7 /  PIN8 / — / — / — /  SW5
	Adter G53	 PIN1 PIN2 /  PIN3 /  PIN4 (For test) /  PIN5 /  PIN6 (For test) / PIN7 /  PIN8 / PIN 9 /  PIN 10 PIN 11 /  SPARE /  SW5
SF-CA card	Adter G51	 PIN3 /  PIN4 PIN5

(4) List of light emitting diode

No.	Description
LED1	It lights up when the converter is regenerative.
LED2	It lights up when the base of the inverter and converter transister is shut off.
LED3	Watched alarm It light up after the power is turned ON and after resetting. When NC is connected with BUS, it lights up until the start-up initializer of NC is completed.
LED4 〉 LED9	Status display and alarm indication.
LED10	It lights up when the converter voltage is changed.

(5) List volumes

No.	Description
VR1	Adjustment of the converter voltage gain Refer to P.37 CH35
VR2	Zero adjustment of the U phase current feed-back Refer to P.37 CH40
VR3	Zero adjustment of the V phase current feed-back Refer to P.37 CH41
VR4	Adjustment of the speed meter Refer to P.5
VR5	Adjustment of the load meter Refer to P.5

(6) List of check terminals

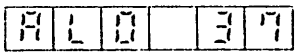
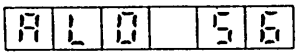
No.	Common	Description
CH1	DG	+5V
CH2		OV, DG (Digital ground)
CH3		OV, DO24 (+24V ground)
CH4	DO24	+24V
CH5	AG	+15V
CH6	AG	U phase voltage command
CH7	AG	V phase voltage command
CH8	AG	W phase voltage command
CH9		OV, AG (Analog ground)
CH10	AG	-15V
CH11	AG	V phase Waveform PWM modulation
CH12	AG	W phase Waveform PWM modulation
CH13	AG	U phase Waveform PWM modulation
CH14	AG	V phase Reference sinusoidal wave
CH15	AG	W phase Reference sinusoidal wave
CH16	AG	W phase Current detection at the inverter side
CH17	AG	U phase Base amplifier driving signal
CH18	AG	V phase Base amplifier driving signal
CH19	AG	W phase Base amplifier driving signal
CH20	AG	$\overline{U}$ phase Base amplifier driving signal
CH21	AG	$\overline{V}$ phase Base amplifier driving signal
CH22	AG	$\overline{W}$ phase Base amplifier driving signal
CH23	AG	U phase Reference sinusoidal wave
CH24	AG	Triangle wave Carrier
CH25	AG	Current amplitude command
CH26	AG	-10N reference voltage
CH27	AG	R phase Base amplifier driving waveform
CH28	AG	S phase Base amplifier driving waveform
CH29	AG	$\overline{T}$ phase Base amplifier driving waveform
CH30	AG	$\overline{R}$ phase Base amplifier driving waveform
CH31	AG	$\overline{S}$ phase Base amplifier driving waveform
CH32	AD	$\overline{T}$ phase Base amplifier driving waveform
CH33	DG	In regeneration current limit - H level
CH34	AG	Regeneration overcurrent - L level
CH35	AG	Converter voltage 10V at 400V

No.	Common	Description
CH36	AG	Power supply voltage peak rectification
CH37	AG	AD converter input (Speed feedback and voltage command detection)
CH38	AG	+10V reference voltage
CH39	AG	Regeneration converter current detection 10V at 200%
CH40	AG	U phsae current detection 2.5V at 100%
CH41	AG	V phase current detection 2.5V at 100%
CH42	AG	Converter DC current detection 10V at 200%
CH43	AG	Whole wave rectification waveform of the inverter U, V, W phase current 10V at 200%
CH44	AG	Speed feedback B phase
CH45	AG	Speed feedback A phase
CH46	AG	Analog speed command input
CH47	CON24.2	Inverter base amplifier output U phase
CH48	CON24.6	Inverter base amplifier output V phase
CH49	CON24.10	Inverter base amplifier output W phase
CH50	CON22.2	Inverter base amplifier output $\overline{U}$ phase
CH51	CON22.2	Inverter base amplifier output $\overline{V}$ phase
CH52	CON22.2	Inverter base amplifier output $\overline{W}$ phase
CH53	CON23.2	Inverter base amplifier output R phase
CH54	CON23.6	Inverter base amplifier output S phase
CH55	CON23.10	Inverter base amplifier output T phase
CH56	CON22.5	Inverter base amplifier output $\overline{R}$ phase
CH57	CON22.5	Inverter base amplifier output $\overline{S}$ phase
CH58	CON22.5	Inverter base amplifier output $\overline{T}$ phase

4-3 Trouble Shooting

We are describing phenomena which occurs when the machine is combined.

Phenomena	Factors	Countermeasures
7 segments of the indicator are not indicated at all.	The control power doesn't operate. (The LED of the SF-PW doesn't light up either.)	Check if the fuse on the control circuit has blown.
		Remove the external connector to turn the power ON again, and check if the power is shorted externally.
		If the LED of the SF-PW lights up for an instant when removing the P-board to turn the power ON, the SF-PW is normal. Replace the P-board. If the LED doesn't light up, replace the SF-PW.
	In the manual mode that M300 series are not connected with the BUS line, the clock is supplied from the NC.	Check if PIN1 and PIN2 on the SF-CA card are shorted at 2 or 3 places.
When M300 series is connected with the BUS line,  remains as it is and doesn't start up.	The axis number of the SF-TL card is selected incorrectly. (Set in CS1)	In case of the C-axis specifications, set the axis number of the C-axis. When it is used as the spindle in M320 and M330, set "6".
	The connectors CN1A and CH1B of the SF-TL card are connected incorrectly.	Check the connection. Especially check if terminated resistor is connected with CN1B.
	The printed circuit board is deffective.	Replace the SF-CA card and the SF-TL card to check.

Phenomena	Factors	Countermeasures
Parameter error  is displayed.	There is a parameter exceeding the setting range in the spindle parameters on the NC screen.	If check if they are not different from the parameter list in the order list.
		In the parameter No. indication in the diagnosis mode of the FR-SF, chack the parameter No. which an alarm occurred. However, the parameter error No. is not displayed by the parameter No. on the NC screen, but by the parameter No. on the SF.
		Turn ON the SW5-1 of the SF-CA card and press the master reset button PB1. The parameters from the NC are ignored through the above operations, and the internal parameters on the FR-SF set at the time of delivery become effective. If it is possible to operate in this status, it can be operated by the internal parameter temporary.
	Some of the parameters inside the FR-SF exceeds the setting range.	Check if the parameter No. that an alarm occurred by the parameter error No. display in the diagnosis mode of the FR-SF coincides with the list of parameter setting sticked on the unit.
	An alarm occurs on the servo axis.	Check if an alarm doesn't occur on the servo axis, and remove the factor for the alarm of the servo axis.
	The cable of the CAM11 is connected incorrectly.	The CAM11 cable and the terminated resister are incorrectly connected with the connector CN1A and CN1B on the SF-TL card. As the CN1A becomes the input side of the signal and the output side of the CN1B, connect the terminated resister to the CN1B.
	The terminated resister is deffective.	The terminated resister that is connected to the CN1B on the SF-TL card is deffective. Replace the terminated resister.

Appendix 1 List of alarms and warning

Alarm No.	Abbreviation	Name	Contents	Movements (Note)
10	UV		When the input power supply voltage sags under the guranteed value of the specifications or when temporary power failure more than 15ms occurs.	A
12	ME1	Memory abnormal 1	When the internal memory for the controller control is neither read not written normally. (Check it when the power supply for the controller is turned ON).	A
13	CE	External clock abnormal	On the occasion of connecting M300 series CNC with the BUS line, when the access time of 2 port goes wrong due to the external lock abnormal during operation in the NC mode.	A
15	ME2	Memory abnormal 2	On the occasion of connecting M300 series CNC with the BUS line, when 2 port mrmory for communication is not operated normally.	A
17	BE	Substrate abnormal	When parts on the printed circuit board for control is not operated normally.	A
20	NS1	No signal 1 (PLG)	When signals from the detector (Motor built-in encoder) attached to the motor are not on the normal level.	A
21	NS2	No signal (Spindle ENC.)	Signals from the encoder for orientation is not entered. Or it is not on the normal level.	A
22	NSS	IC MAC 012 abnormal	The part IC MAC 012 on the printed circuit board for control is not operated normally.	A
23	OSE	Speed deviation over	When the difference between commanded speed and the motor speed exceeds the prescribed value.	A
24	BRT	Breaker trip	When current exceeding the prescribed value flows in the main circuit.	A
25	COC	Convertor over current	When current exceeding the prescribed value flows in the convertor.	A

Alarm No.	Abbrevi-ation	Name	Contents	Movements (Note)
26	PL	Power open-phase	When more than 1 phase among 3 phase becomes open-phase.	A
27	CPUE	CUP abnormal (Deduction error)	When a devision error occurs on the operation of the CUP due to wrong setting of parameters.	A
31	OS	Over speed	The motor speed exceeds 115% of the maximum speed.	A
32	OC	Invertor over current	When current exceeding the pre-scribed value flows in the controller.	A
33	OV	Over voltage	When the voltage of the main circuit condensor elevates more than the prescribed value due to regenerative energy at motor deceleration.	A
34	DP	Data parity	On the occasion of connecting M300 series CNC with the BUS line, when a parity error occurs.	A
35	DE	Data abnormal	On the occasion of connecting M300 series CNC with the BUS line, when a prescribed abnormal travel command is given from the CNC.	A
36	TE	Transfer abnormal	On the occasion of connecting M300 series CNC with the BUS line, when the normal data transfer is not performed.	A
37	PE	Parameter error	When a parameter value other than allowable range has been set. (Check when the power supply for the controller is turned ON.)	A
40	TKCE	FR-TK Unit change-over abnormal	At the time of using the FR-TK unit, when the process of the change-over signal is different.	A
41	TKTE	FR-TK Unit communi-cation abnormal	At the time of using the FR-TK unit, communication between the FR-TK is not performed normally.	A

Alarm No.	Abbrevi-ation	Name	Contents	Movements (Note)
45	OHF	Controller over-heat	When the peripheral temperature is abnormal or when the main circuit element is over-heated due to over-load or cooling fan stop.	A
46	OHM	Motor over-heat	When the motor is over-heated due to over-load or motor cooling blower stop.	A
52	OD	Excessive error	When the position follow-up error exceeds the prescribed value in the position loop operations.	A
56	OA	Other axis abnormal	On the occassion of connecting M300 series CNC with the BUS line, when some abnomality occurs on other servo axis.	A
57	OPE	Option card error	When those signals enter into the controller that hasn't functions for synchronized tapping, C-axis control and indexing.	A
E0	IPE	Temporary warning	Warning when the voltage of the power supply is temporary down.	C
E4	WPE	Parameter warning	Warning when parameters other than allowable range are set.	C
E7	NCE	Emergency stop, warning	.Warning when the emergency stop signal is enter from the CNC, on the occassion of connecting M300 series CNC with the BUS line. .Warning when the emergency stop signal is enter from external equipment on the occassion that the external emergency stop signal becomes effective by BSL setting.	B

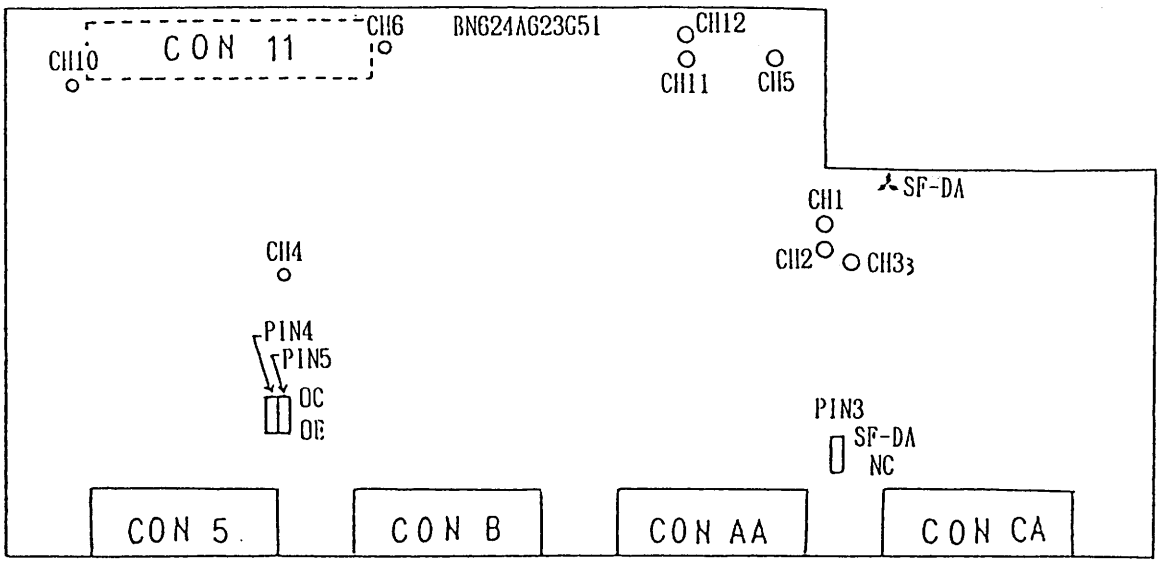
(Note) When the above mentioned protection functions are operated, alarm No. is displayed on the 7 segment and the following operations are performed.

Operation A —— The controller is shut off besically, the main circuit contactor is turned OFF and the motor is stopped through free running. And the failure signal contacts FA-FC become open.

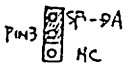
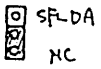
Operation B ——

In this case, whether the failure signal contacts FA-FC should be opened or not can be selected by parameter setting.

Operation C —— Only warning is displayed and operations are contined.



(1) List of setting pins

No.	Name	Setting	Description
PIN3	Encoder power supply for orientation		No supply from NC
			No supply from NC
PIN4	Orientation position command Interface setting Digital speed command & auxiliary input interface setting		Sink drive (Open collector)
			Source drive (Open emitter)
PIN5	Orientation position command Interface common output change-over Digital speed command & auxiliary input interface setting		CON Regarding CA-14 as DGA. CON Regarding 5-13 as DGA.
			CON Regarding CA-14 as 24V. CON Regarding 5-13 as 24V.

(2) List of check terminals

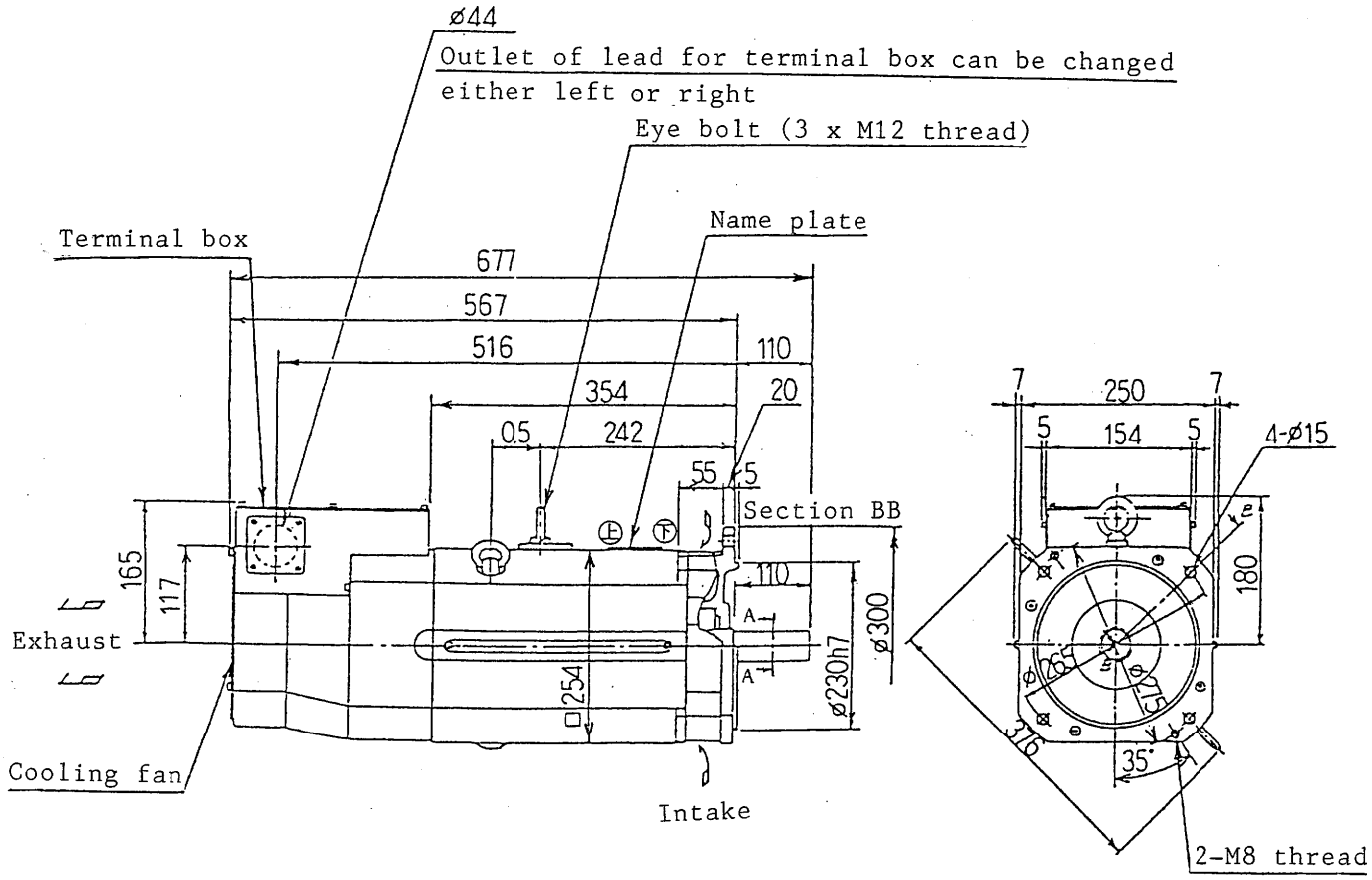
No.	Common	Description
CH 1	DGA	Position feedback A phase
CH 2	DGA	Position feedback B phase
CH 3	DGA	Position feedback Z phase
CH 4	AGA	Magnesensor output
CH 5	DGA	Magnesensor linear zone output
CH 6	-	Digital common (DGA)
CH 10	-	Relay common (RG)
CH 11	DGA	Speed feedback A phase Spare wave
CH 12	DGA	Speed feedback B phase Spare wave

2) VK55 SJ-11A

Totally enclosed forced ventilation type with flange

Squirrel-cage rotor with sealed ball bearing

Frame No. B132F Flange No. FF265

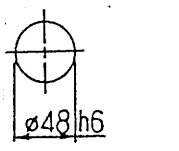


. Make space 30mm or more between cooling fan and wall.

. This motor can be installed vertically shaft side down.

. Plug thread holes by bolts etc. when remove the eye bolts.

. Length of plug bolts should be kept within thread dia. x 1.5.



Section AA

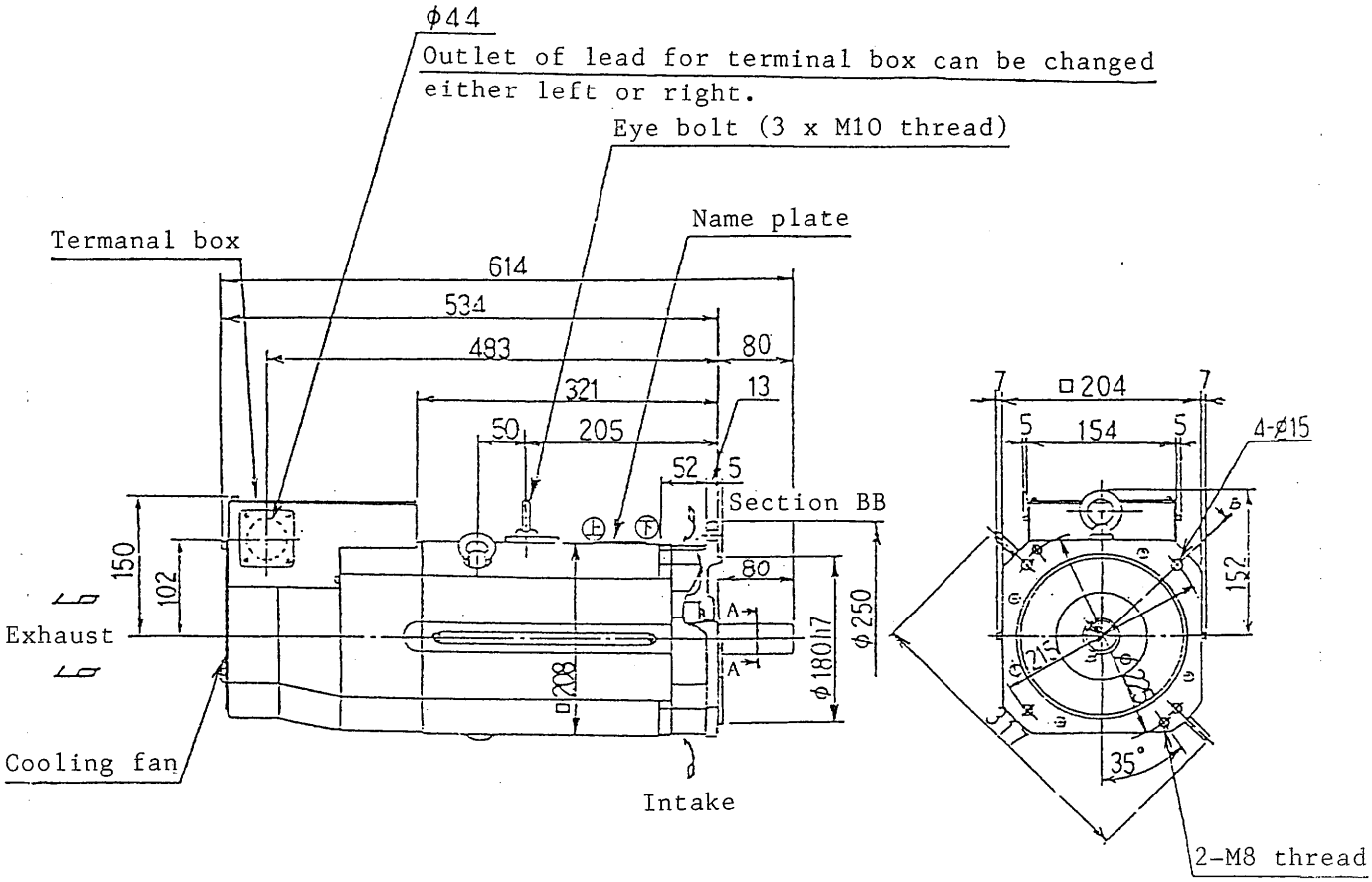
4-5 Spindle Motor (MITSUBISHI)

1) VK45 SJ-7.5A

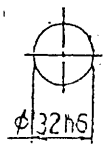
Totally enclosed forced ventilation type with flange

Squirrel-cage type with sealed ball bearing

Frame No. B112F Flange No. FF215



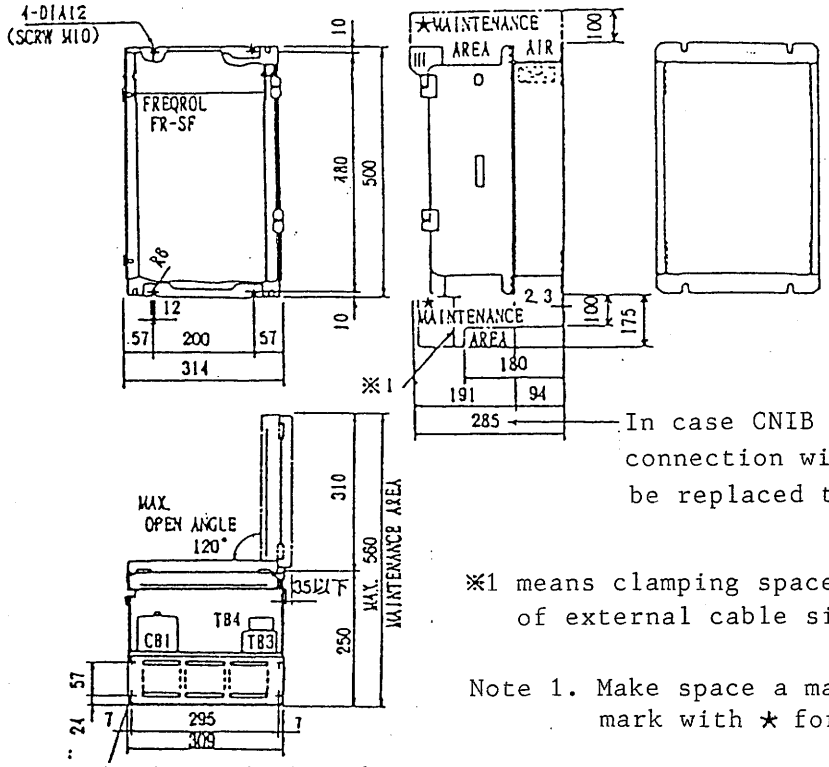
- Make space 30mm or more between cooling fan and wall.
- This motor can be installed vertically shaft side down.
- Plug thread holes by bolts etc. when remove the eye bolts.
- Length of plug bolts should be kept within thread dia. x 1.5.



Section AA

3) Control unit

Internal cabinet mounting type FR-SF-2-3.7K~11K



In case CNIB is used for BUS connection with 300 285mm will be replaced to 305mm.

※1 means clamping space for connector CON1-3 of external cable side.

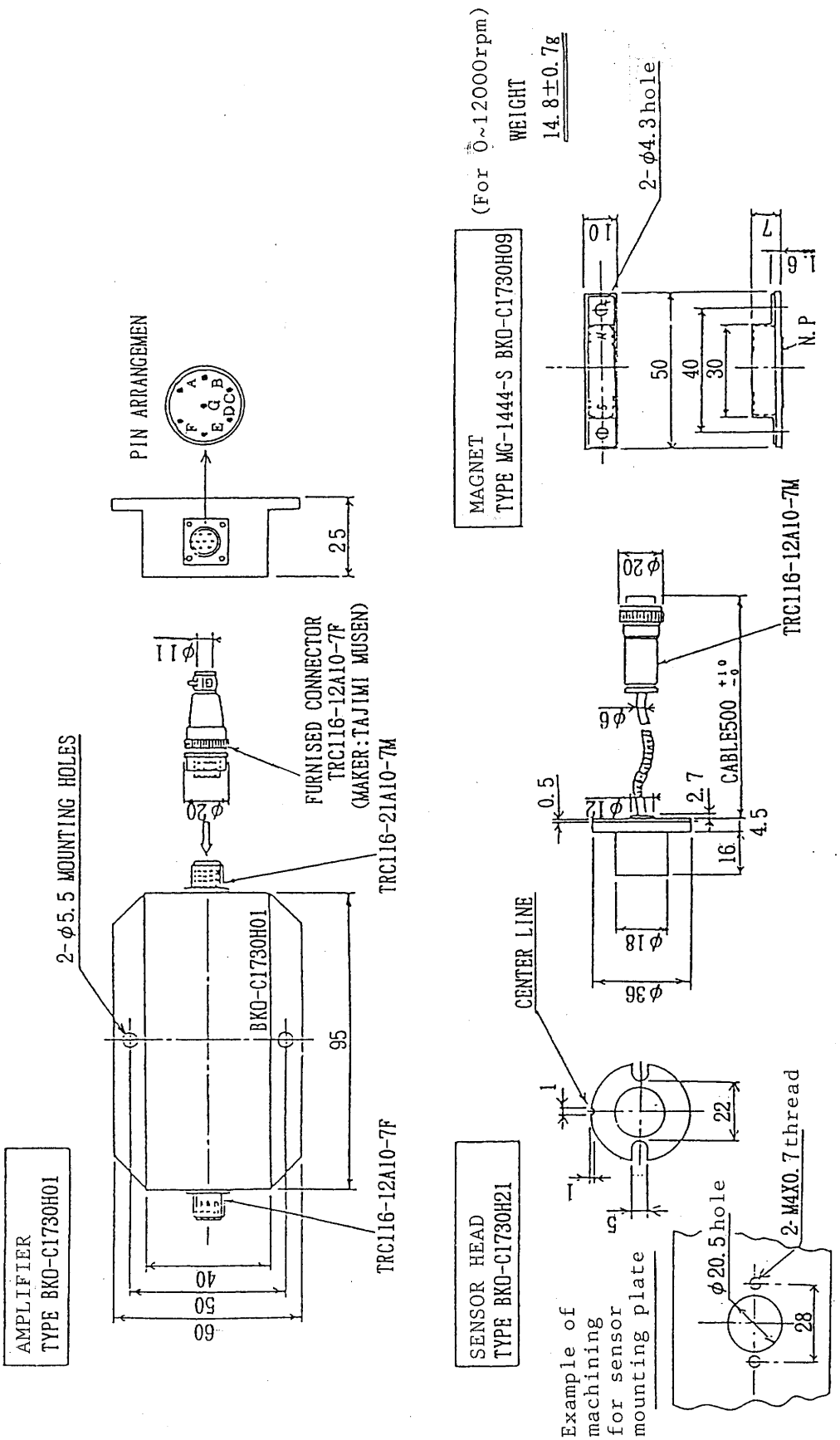
Note 1. Make space a maintenance area shown mark with ★ for wiring and radiating.

2 x 4-M5 x 0.8 thread
Threads are provided on top surface

Thread size of terminal

Capacity	CB1	T33	T32	T34	EARTH
FR-SF-2-3.7X~7.5X	M5	M6	M3	M3.5	M9
FR-SF-2-11X	M5	M5	M3	M3.5	M8

4) Orientation sensor



7-7 Lists of Spindle Motor

1. FANUC AC Inverter Motor

SPECIFICATION			VK45-40	VK45-50	VK55-40	VK55-50
FOR SPINDLE (30 MINIUTES ED)	(STANDARD)	KW	(MODEL 6) AC 7.5		(MODEL 8) AC 11	
	(HIGH SPEED)	KW	(MODEL 3, H. SPEED) AC 5.5	(MODEL 6) AC 7.5	(MODEL 3, H. SPEED) AC 5.5	(MODEL 8) AC 11
	(2-SPINDLE)	KW	(MODEL 6) AC 7.5×1		(MODEL 8) AC 11×1	

Model No. and Specifications

ITEM \ TYPE	MODEL 3 (H. SPEED)	MODEL 6	MODEL 8
OUTPUT COMTINUOUS RATING (KW)	3.7	5.5	7.5
OUTPUT 50%ED RATING (KW)	5.5	7.5	11
CURRENT 50%ED RATING (A)	31	33	48
MOTOR BAS SPEED (RPM)	1500	1500	1500
SP. MAX. SPEED (RPM)	12000	4500 6000	4500 6000
AT MAX. SPEED OF SPINDLE (RPM)	12000	5908 5250	5908 5250
MOTOR	A06B-1003-B306 #0215	A06B-1006-B700	A06B-1008-B700
CONTROL UNIT	A06B-6044-H169	A06B-6044-H008	A06B-6044-H308
FUSE A COMPLETE SET	A06B-6044-K033	A06B-6044-K033	A06B-6044-K025
ORIENTATION	A06B-6041-J120	A06B-6041-J120	A06B-6041-J120

2. MITSUBISHI AC Inverter Motor

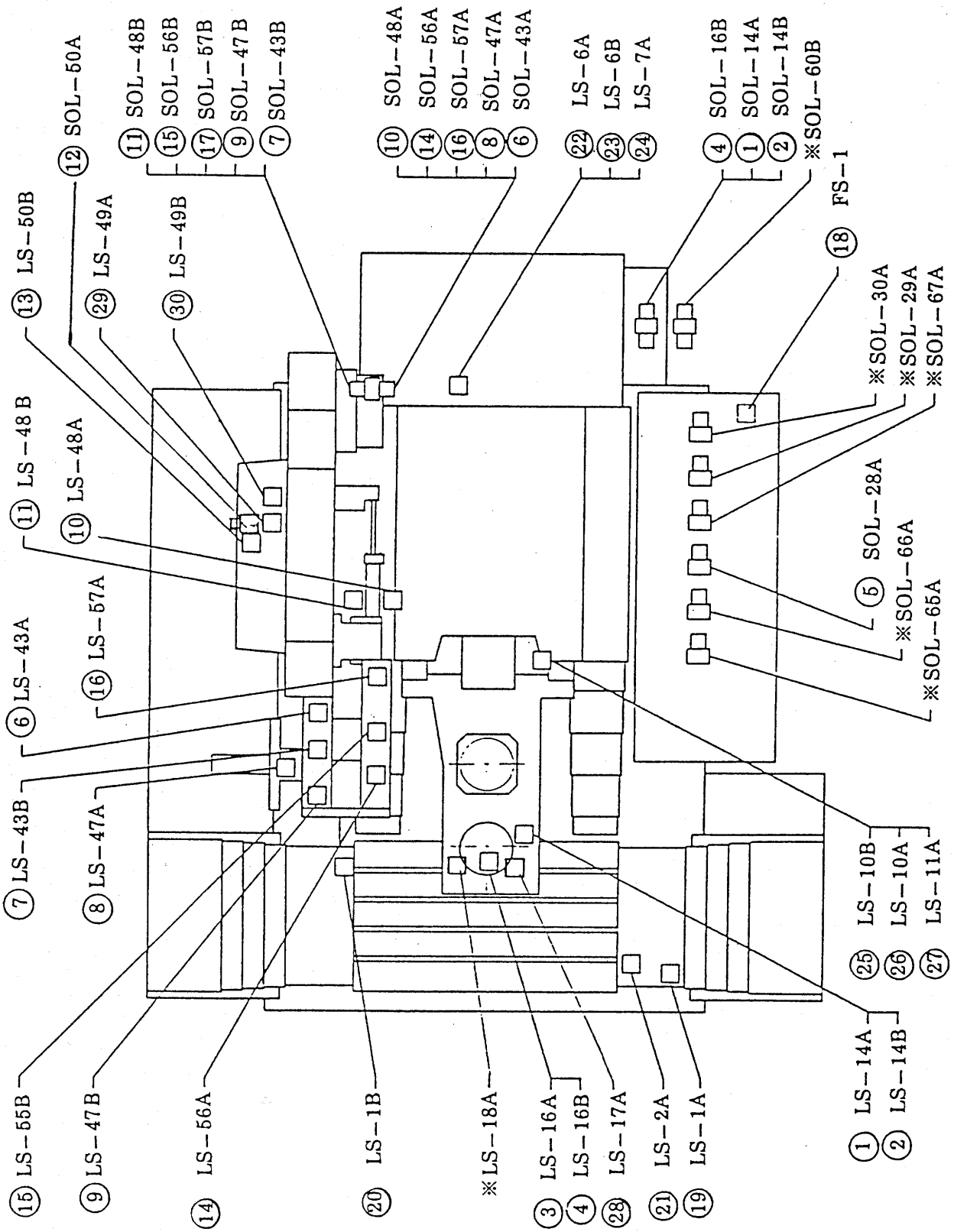
Specification

ITEM \ TYPE	VK45	VK55
OUTPUT COMTINUOUS RATING (KW)	5.5	7.5
OUTPUT 50%ED RATING (KW)	7.5	11
CURRENT 50%ED RATING (A)	37	60
MOTOR BAS SPEED (RPM)	1500	1500
SP. MAX. SPEED (RPM)	4500 6000	4500 6000
AT MAX. SPEED OF SPINDLE (RPM)	5908 5250	5908 5205
MOTOR	ST-7.5A	SJ-11A
CONTROL UNIT	FR-SF-2-7.5K-D	FR-SF-2-11K-D

7-8 SOL/LS Arrangement Plan and Table of Function and Use

(Mark * are for optional function)

1. SOL/LS Arrangement plan



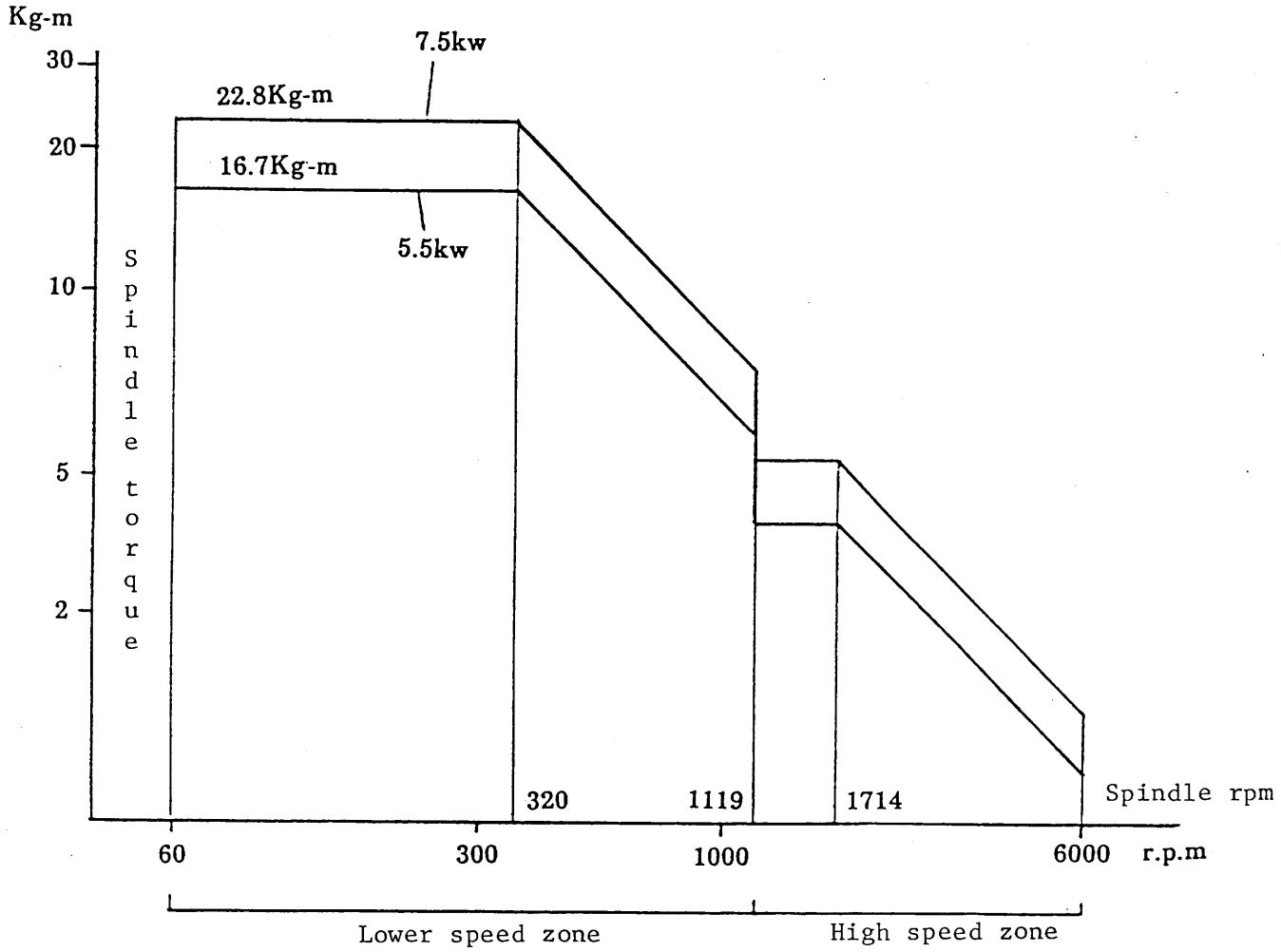
2. SOL/LS Table of function and use

(Refer to SOL/LS arrangement plan for actual mounting)

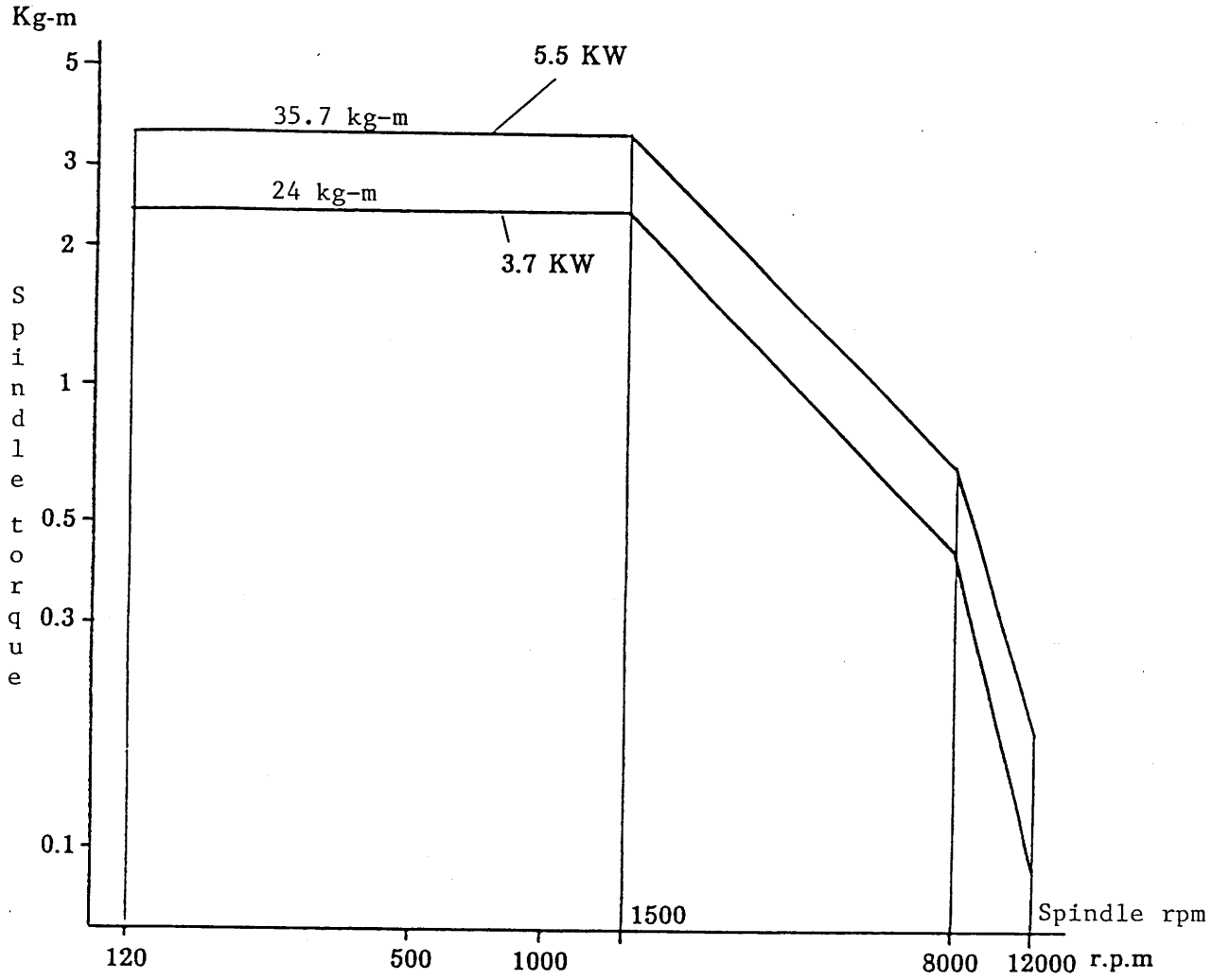
Item No.	Function/Application (SOL, LS)	Standard specification SOL	Standard specification LS	Note
1	Spindle gear shift, high range	14A	14A	
2	Spindle gear shift, low range	14B	14B	
3	Spindle tool clamp	——	16A	
4	Spindle tool unclamp	16B	16B	
5	Spindle air blow, ON	28A	——	
6	Warm rotation, right	43A	43A	
7	Warm rotation, left	43B	43B	
8	Warm left/descent	47A	47A	
9	Warm right/ascent	47B	47B	
10	Arm swing-in	48A	48A	
11	Arm swing-back	48B	48B	
12	Magazine index pin, pull out	50A	——	
13	Magazine index pin, insert	——	50B	
14	Arm slide 1, spindle side	56A	56A	Advance
15	Arm slide 1, magazine side	56B	56B	Retract
16	Arm slide 2, magazine side	57A	57A	
17	Arm slide 2, spindle side	57B	——	Original position
18	Insufficient lubricant	——	FS-1	
19	X axis ⊖ stroke end	——	1A	
20	X axis ⊕ stroke end	——	1B	
21	X axis deceleration of zero return	——	2A	
22	Y axis ⊖ stroke end	——	6A	
23	Y axis ⊕ stroke end	——	6B	
24	Y axis deceleration of zero return	——	7A	
25	Z axis ⊖ stroke end	——	10A	
26	Z axis ⊕ stroke end	——	10B	
27	Z axis deceleration of zero return	——	11A	
28	Spindle orientation	——	17A	
29	Tool index count, phase A	——	49A	
30	Tool index count, phase B	——	49B	

7-9 Spindle Speed and Power Diagram

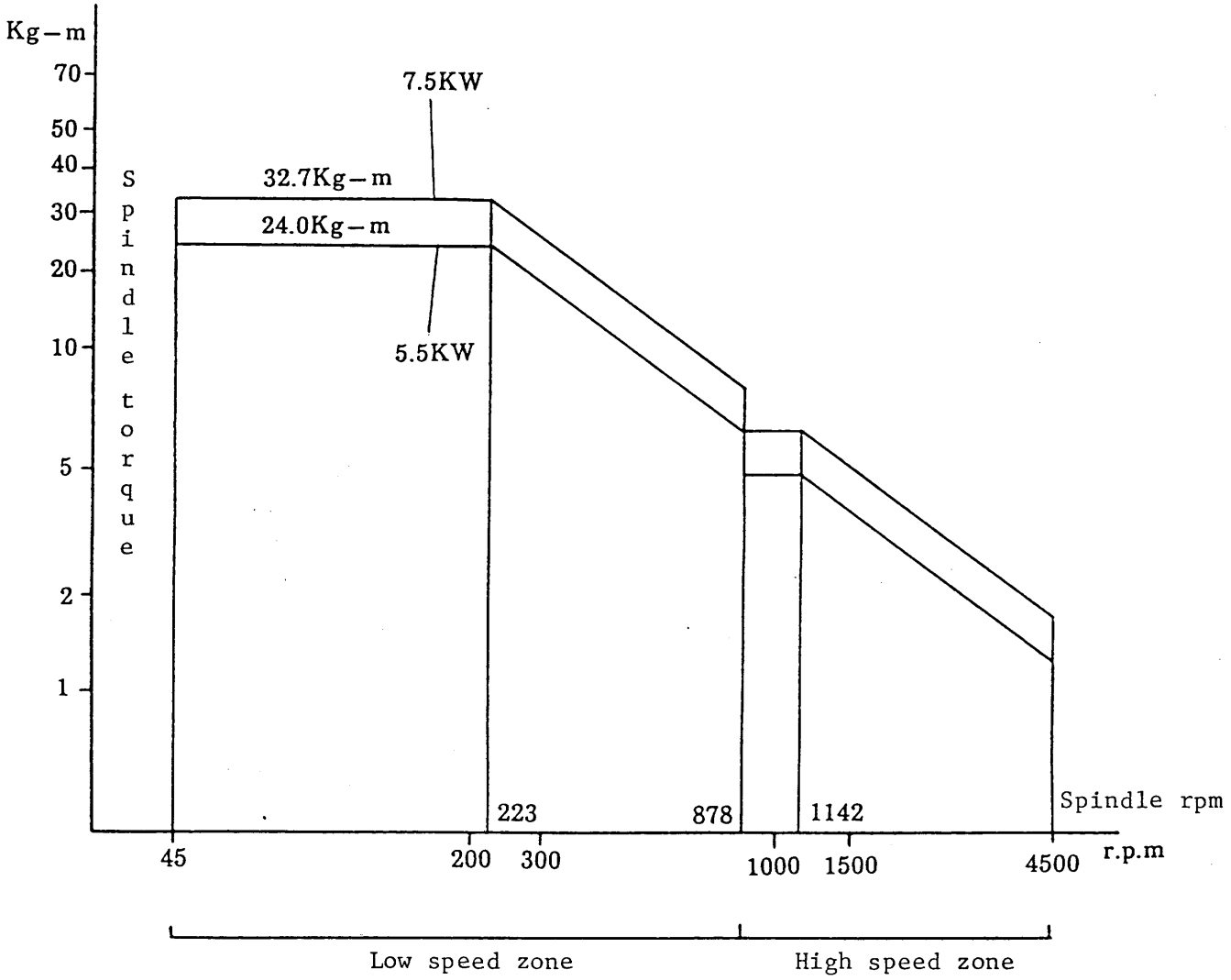
1. VK45-40 Reference 6000 rpm 5.5/7.5 KW



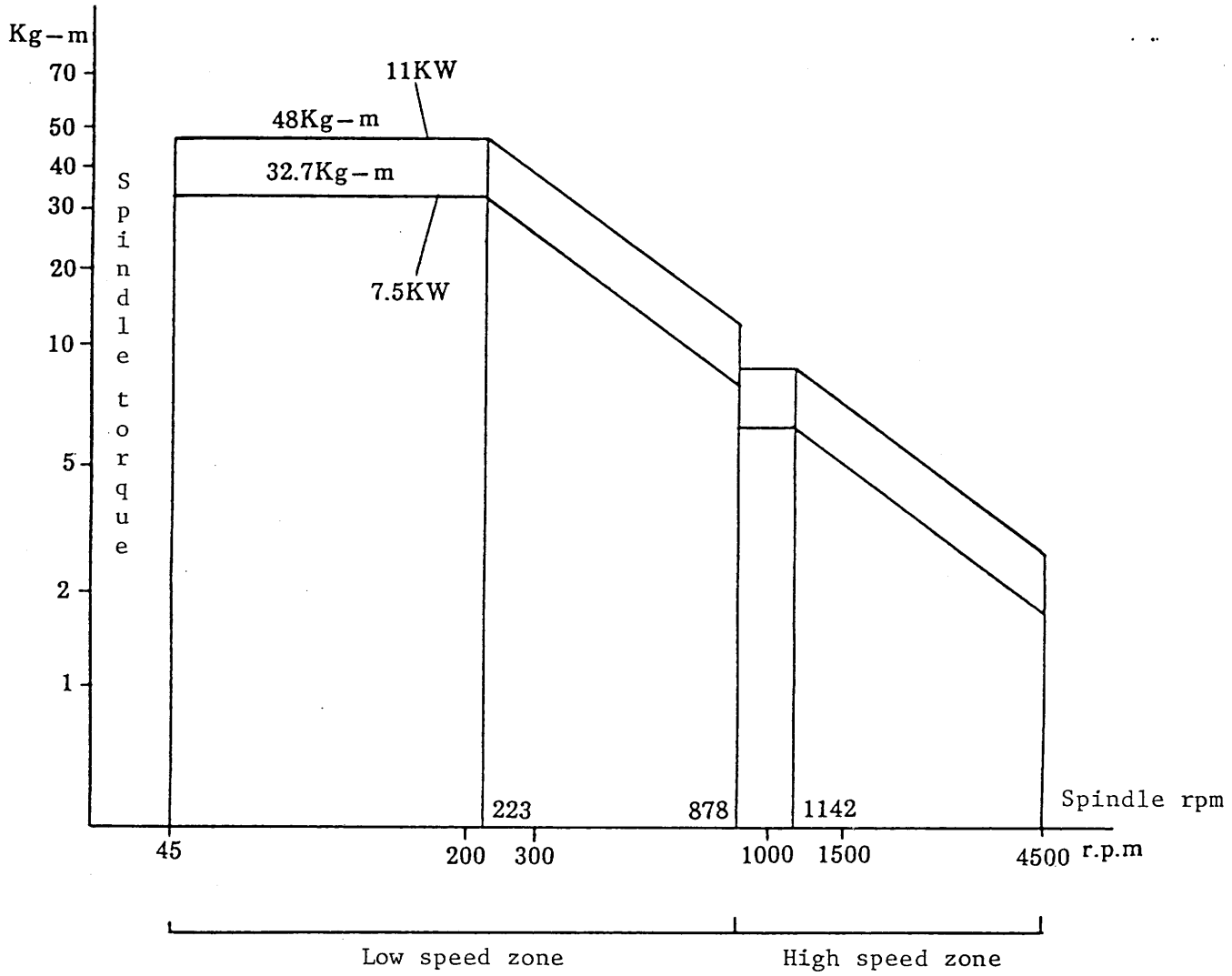
2. VK45-40, VK55-40 High speed type 12000 rpm 3.7/5.5 KW



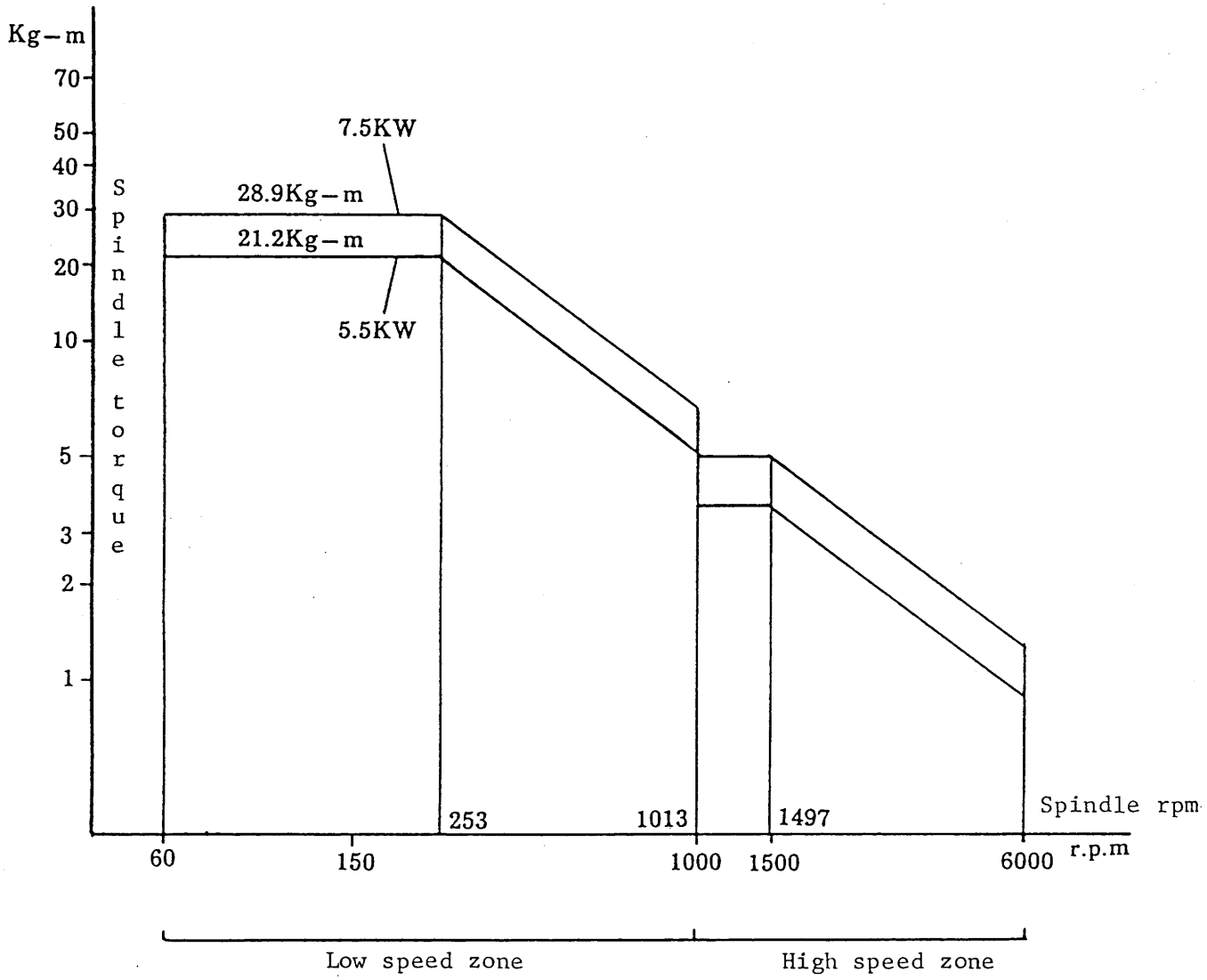
3. VK45-50 Reference 4500 rpm 5.5/7.5 KW



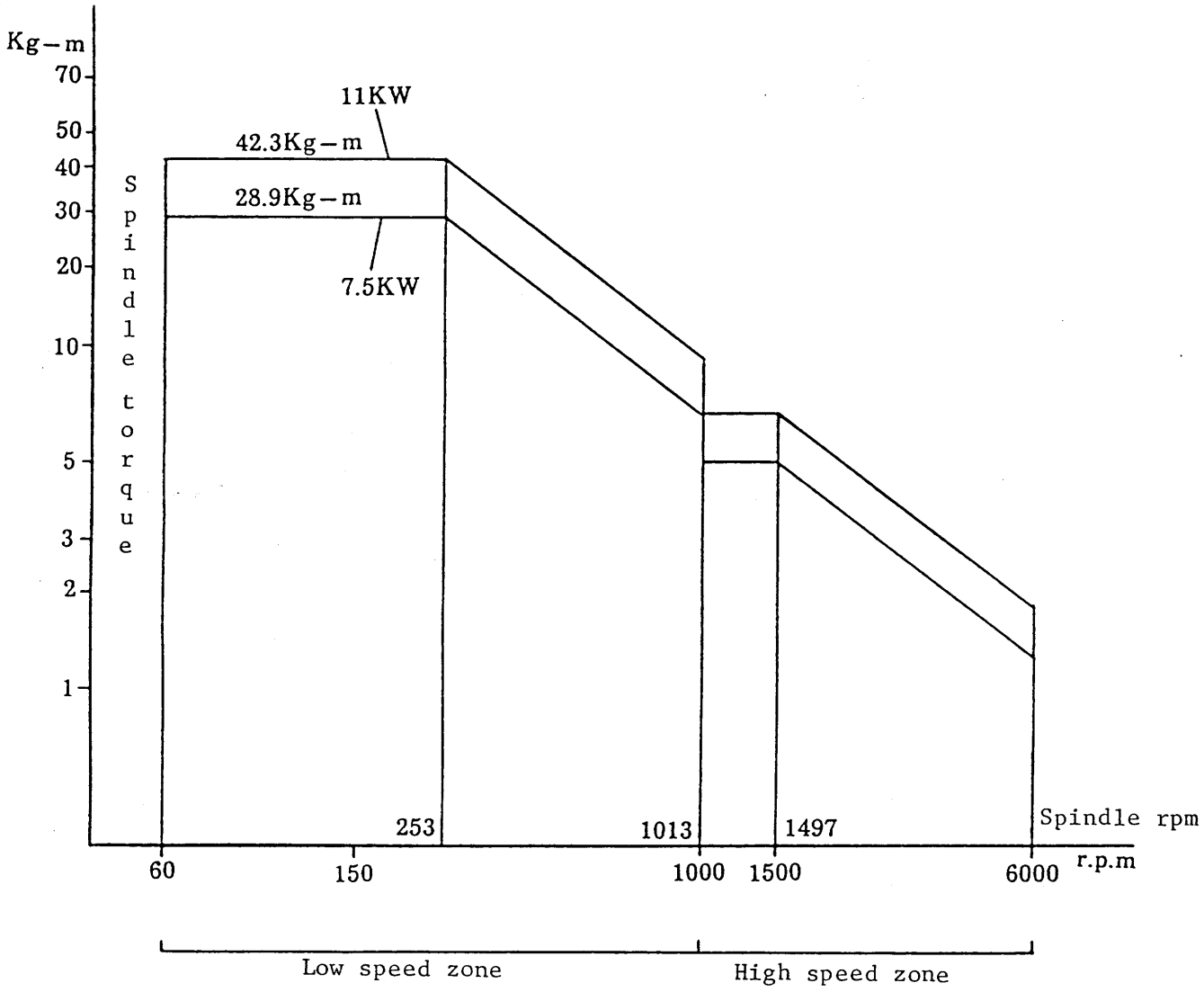
4. VK55-50 Reference 4500 rpm 7.5/11 KW



5. VK45-50 High speed 6000 rpm 5.5/7.5 KW

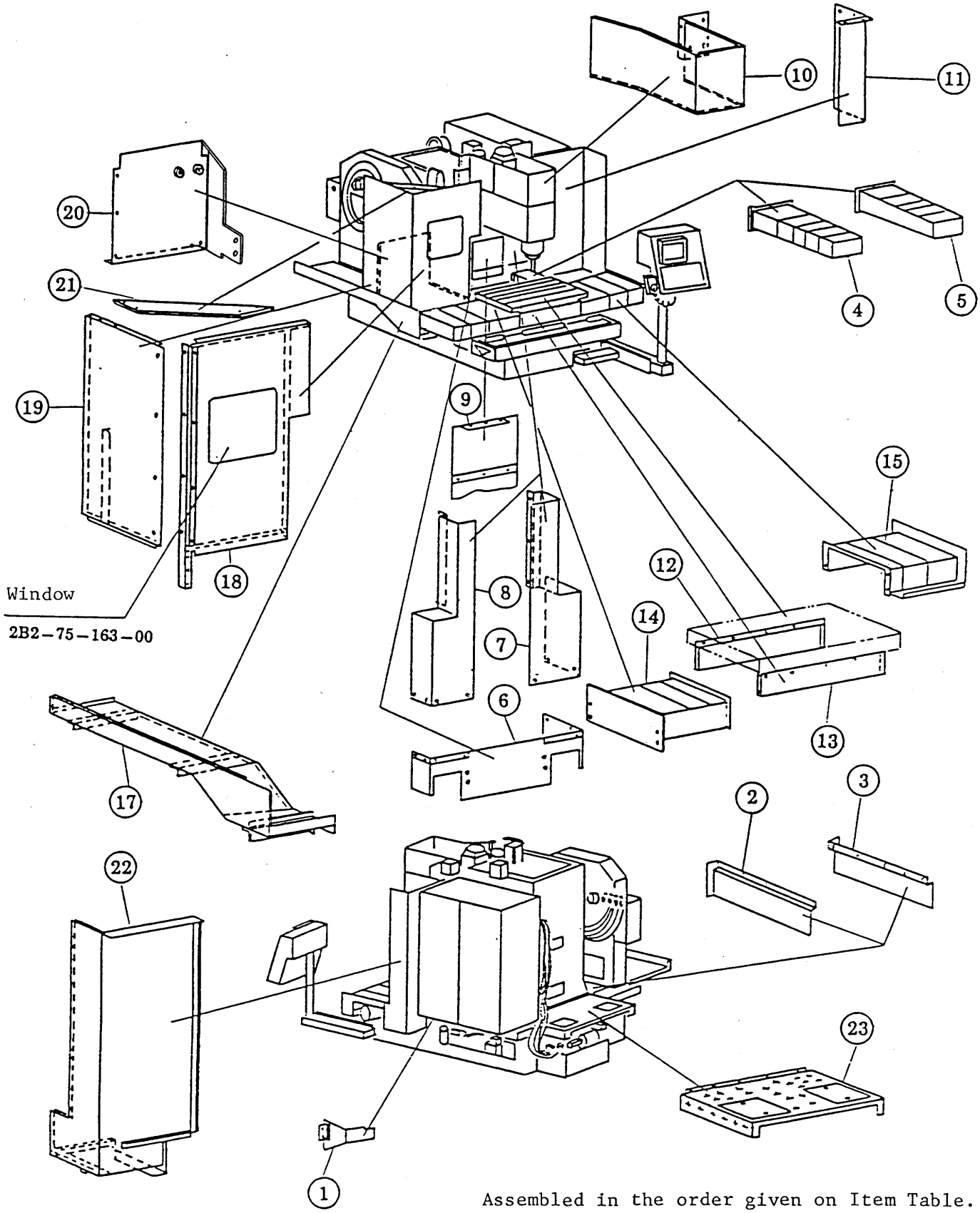


6. VK55-50 High speed 6000 rpm 7.5/11 KW



7-10 Mounting Covers Etc.

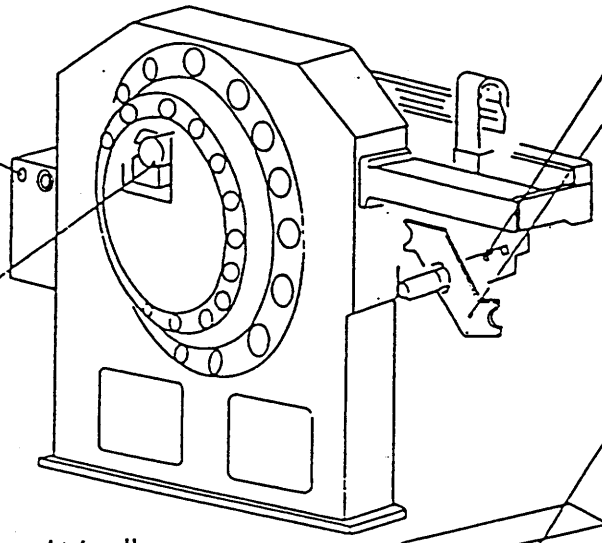
1. Standard equipment cover



Assembled in the order given on Item Table.

7-11 ATC Maintenance and Adjustment

1. Outline and Function of Drive



Arm advance/retract proximity switch

Arm advance/retract are confirmed here.

Double arm for tool replacement

Provided with tool lock mechanism on arm swivel.

Magazine swivel push-button

Tool dividing is carried out in manual mode.

Arm fall prevention cylinder

Falling of arm is prevented by spring and pins upon oil pressure OFF.

Index motor

Magazine swivel deceleration and positioning are carried out.

Solenoid valve

1. Arm swing in
2. Arm slide Spindle side
3. Arm slide Magazine side
4. Arm swivel
5. Arm advance/retract

Arm slide "Reference position" "Spindle side" "Magazine side" proximity switch

Confirmation is carried out for Arm slide when tool is shifted from Magazine to Spindle.

W-arm swivel right/left turn proximity switch

Confirmation is carried out when replacing old/new tool on Spindle side.

Cylinder for W-arm advance (descending)/retract (ascending)

Tool is taken out from pot or Spindle.

Arm swing in proximity switch

Swing-in operation of arm is confirmed.

Arm swing in equipment

Arm is swung in and back by ball spline via lever from cylinder.

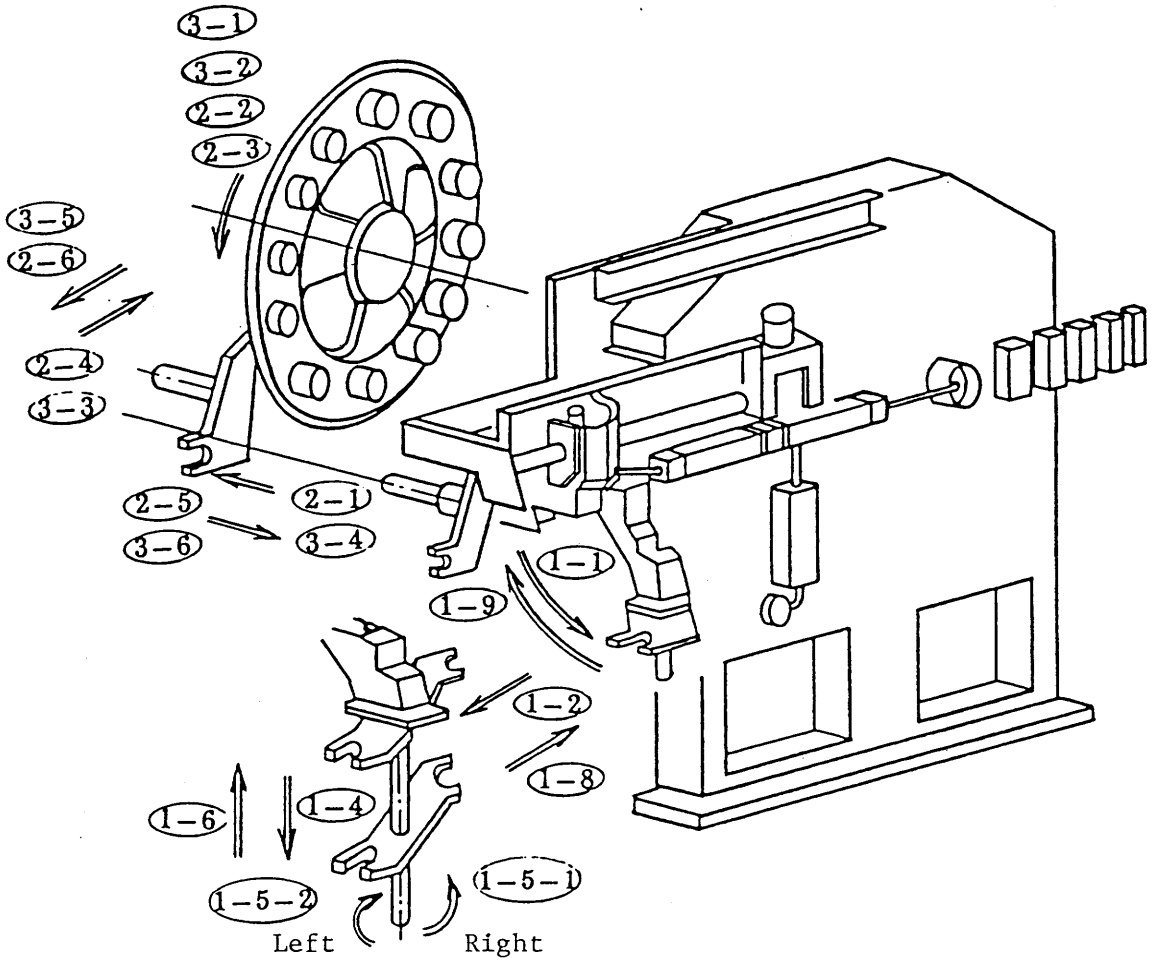
Cylinder for arm slide

Two cylinders are gathered into one to be shifted to "Arm reference position", "Spindle side", "Magazine side"

Cylinder for arm swing in

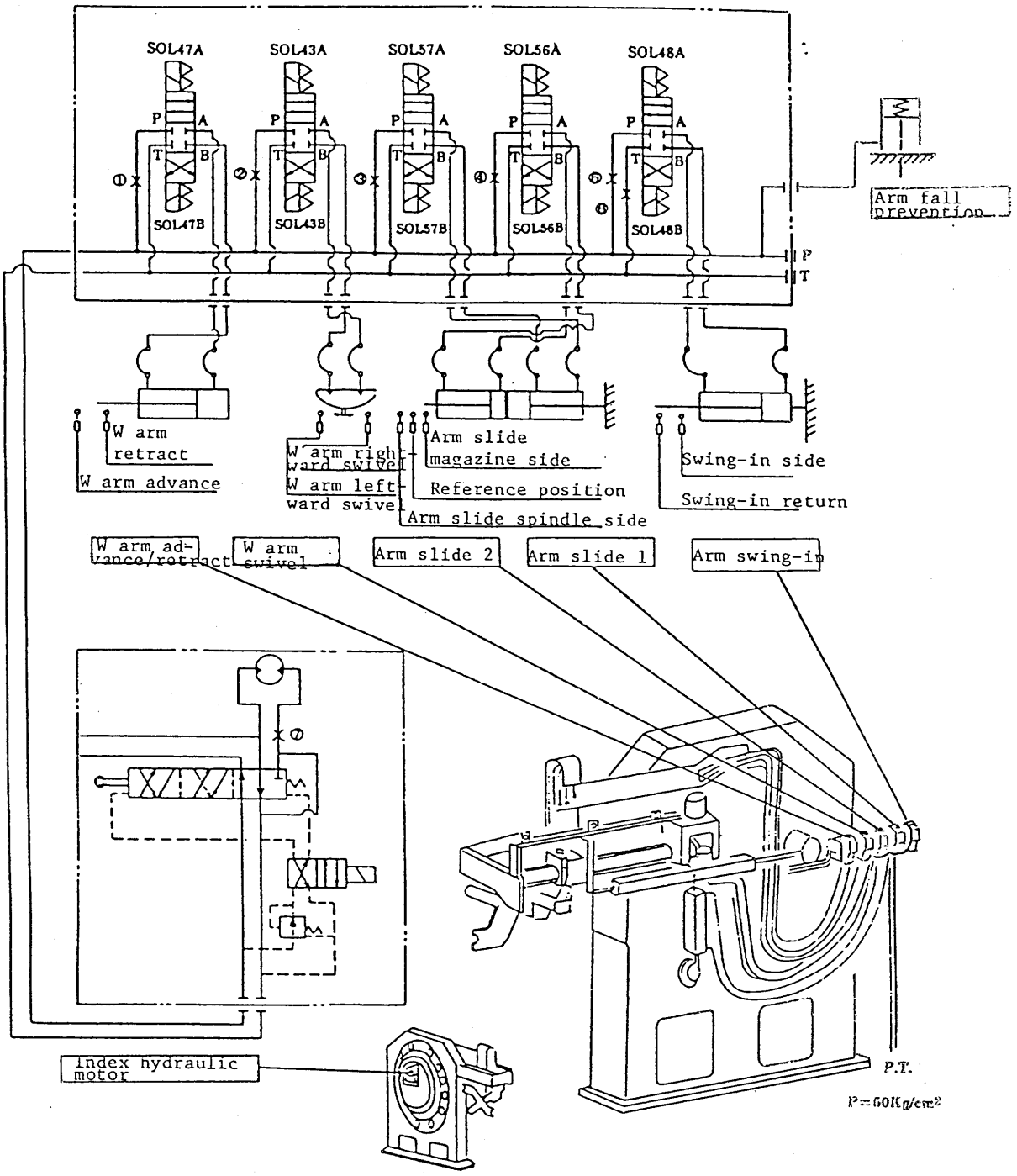
Swing-in from reference position to Spindle side, and swing-back in the opposite direction

2. Tool Call/Replace of Each Operation



Function	Order	Operation	Function	Order	Operation
Tool replace (M06)	1-1	Arm swing in		2-3	Magazine positioning
	1-2	Arm slide advance		2-4	Arm slide retract
	1-3	(Spindle tool unclamp)		2-5	W arm right going
	1-4	W arm descending		2-6	Arm slide advance
	1-5	W arm swivel 180°	Tool calling	3-1	Magazine swivel
	1-6	W arm ascending		3-2	Magazine positioning
	1-7	(Spindle tool clamp)		3-3	Arm slide retract
	1-8	Arm slide retract		3-4	W arm left going
	1-9	Arm swing back		3-5	Arm slide advance
Tool return	2-1	W arm left going		3-6	W arm right going
	2-2	Magazine swivel			

3. Hydraulic Circuit Diagram



◎ Table of fixed diaphragm's orifice size

No.	Name of equipment	Manufacturer	Provided No.	VK45-40	VK45-50
1	Fixed diaphragm	DAIKIN	1	φ2.0 mm	φ2.0 mm
2	" "	"	1	φ1.6 mm	φ1.2 mm
3	" "	"	1	φ1.6 mm	φ1.6 mm
4	" "	"	1	φ2.0 mm	φ2.0 mm
5	" "	"	1	φ2.0 mm	φ1.8 mm
6	" "	"	1	φ2.0 mm	φ1.8 mm
7	" "	"	1	φ1.6mm(φ2.5mm)	

( ) shows 30 tools ATC.

4. ATC Operation and Command Equipment

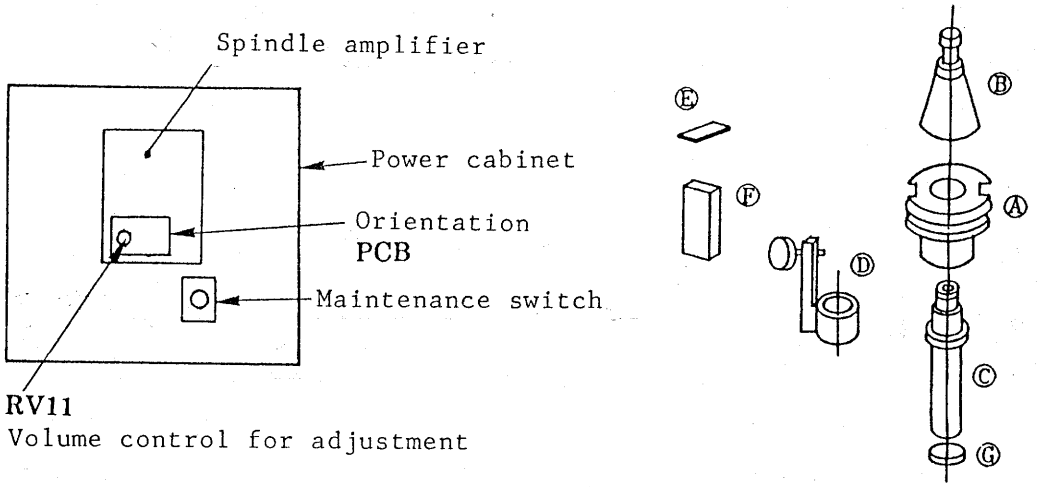
	Function	Each operation			Maintenance remarks	
		Order	Item	Operation/Purpose	SOL(LS)	M-code
1	Tool replace	1-1	Arm swing	Swing-in, to Spindle side	48A	100
		1-2	Arm slide	Advance, Spindle tool clamp	56A/57B	101
		1-3	Spindle tool	Uncalmp	16B	(Push button)
		1-4	W arm	Descending tool taking-out	47A	102
		1-5-1	Arm swivel	Right, 180°, Tool replace	43A	103
		1-5-2	Arm swivel	Left, 180°, Tool replace	43B	104
		1-6	W arm	Ascending, New tool inserted	47B	105
		1-7	Spindle tool	Clamp	(LS-16A)	(Push button)
		1-8	Arm slide	Retract, to Reference place	56B/57B	106
		1-9	Arm swing	Swing-back, to left-ward	48B	107
2	Old tool return	2-1	W arm	Left-going	47A	102
		2-2	Magazine: Pin extraction, dividing	Pot call for tool returning	50A	120
		2-3	Magazine decele-ration, Pin IN	Positioning, Stop	(LS-50B)	121
		2-4	Arm slide	Retract, to Magazine side	56B/57B	108
		2-5	W arm	Right-going, Tool return	47B	105
		2-6	Arm slide	Advance, to Reference position	56B/57B	106
3	Next tool calling	3-1	Magazine: Pin extraction dividing	Next tool calling	50A	120
		3-2	Magazine decele-ration, Pin IN	Positioning, Stop	(LS-50B)	121
		3-3	Arm slide	Retract, to Magazine side	56B/57B	108

	Function	Each operation			Maintenance remarks	
		Order	Item	Operation/Purpose	SOL(LS)	M-code
		3-4	W arm	Left-going, Tool extraction	47A	102
		3-5	Arm slide	Advance, to Reference position	56B/57B	106
		3-6	W arm	Right-going, to Standby position	47B	105
4	ATC possible condtions (Standby position)		ATC Reference position lamp	Lighting	(OC-565)	-
			Spindle tool	Clamp	(LS-16A)	-
			Spindle position	Positioning completion	(ORAR-1)	After Arm swing-in 119
			Arm swing	Swing-back, Left	(LS-48B)	-
			Arm slide	Reference position	(LS-55B)	-
			W arm	Right-going, IN	(LS-47B)	-

5. Procedure for alignment of ATC arm (with SEICOS-M III)

Maintenance switch
and
Volume controll for orientation adjustment

Alignment jig of ATC
These jig are available on order basis.



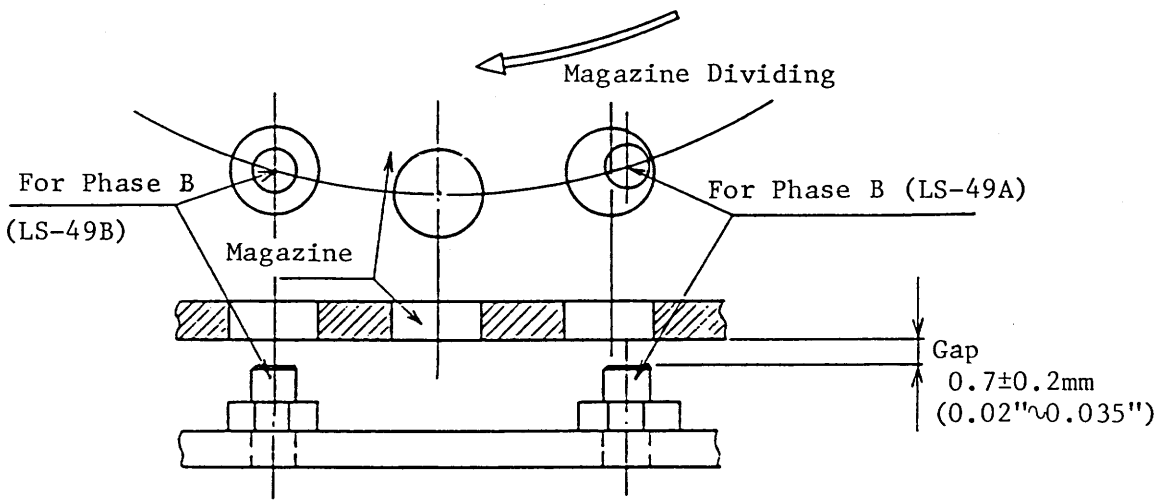
Procedure for adjustment (example for VK-45)

Align the spindle and the ATC arm according to the following procedures.

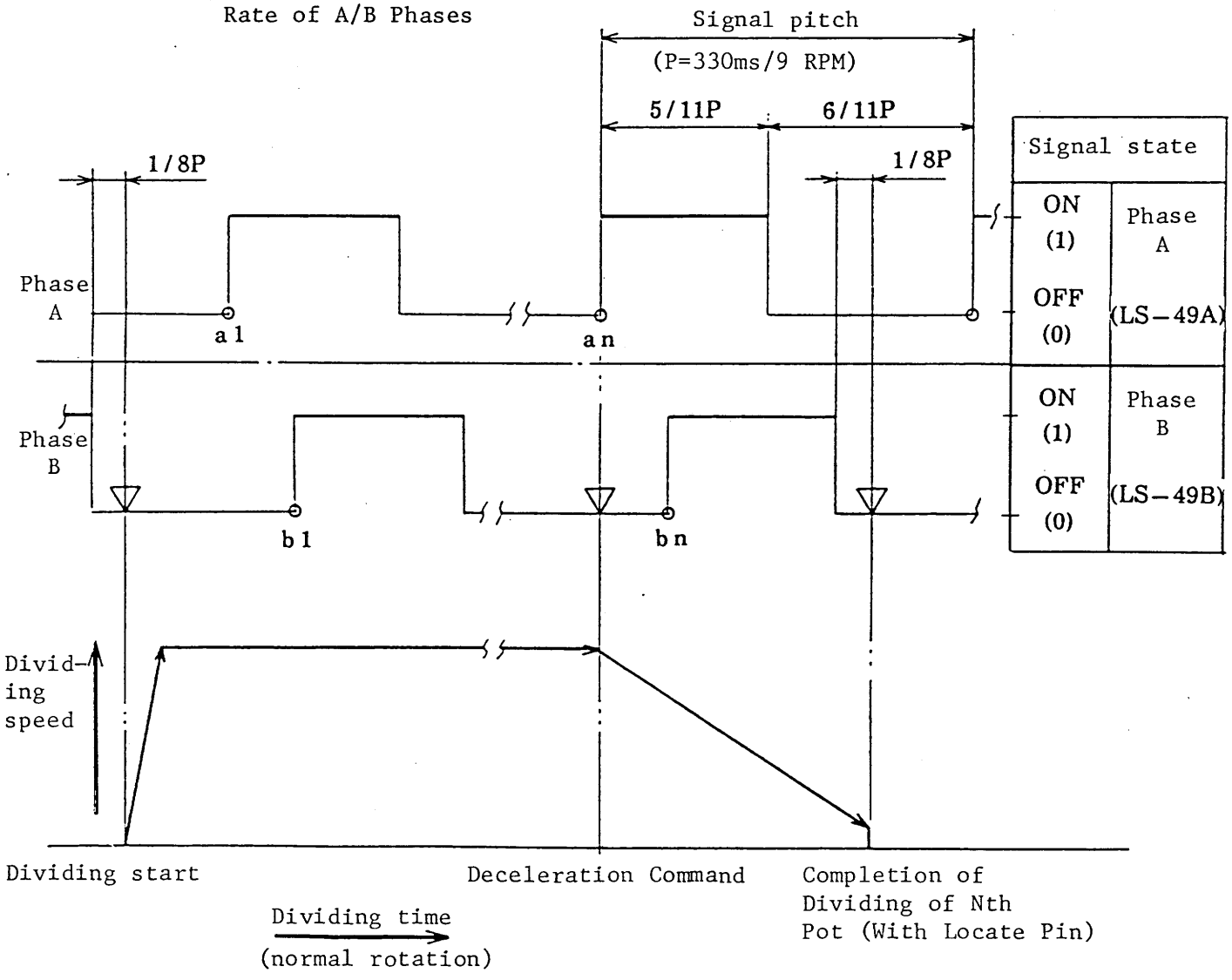
1. Prepare the above mentioned ATC aligning jig.
2. To set a temporary ATC original position, input the 2nd reference point data for ATC of each axis into parameter. (X-380.0,Y+5.0, Z10.0mm)
   *For each parameter NO. refer to "Adjustment for each axis stroke and original position".
3. Input "G91 G30 ... Y0 Z0" by MDI and move each axis to the temporary ATC original position.
4. Turn on the maintenance switch in the power cabinet.
5. Execute "M100" (arm swing-in) by MDI.
6. Apply JIG Ⓐ to the arm and execute "M101" by MDI.
7. Change manual mode and clamp JIG Ⓑ to spindle.
8. Assemble JIG Ⓒ, Ⓓ and Ⓖ and insert into Ⓑ.
9. Measure and keep record the offset amount in X, Y direction by JIG Ⓓ and Ⓐ.
10. Reset the current position display (RELATIVE) of CRT counter X, Y and Z axes to 0.
11. Change to "Handle mode" and move X and Y axes to align Ⓓ and Ⓐ with keep pressing "Spindle stop button".
12. Adjust the clearance between JIG Ⓐ and Ⓑ to the following value and measure it by JIG Ⓔ.
    (Clearance of direction Z = 2.0mm/VK45-40, 3.0mm/VK45-50)
13. Read the adjusting result on the CRT and input to parameters for shiftting ATC origin reference point as origin compensation value.
14. To align the spindle nose key and W arm key, adjust the "Spindle orientation position" by RV11 on the PCB for parameter so that key gange F properly fits the key way.
    (In case of the MITSUBISHI, set the data on parameter 27, refer to paramater setting for MITSUBISHI)

6. Adjustment of ATC Magazine A/B Phases

1) Mounting Position of Proximity Switch



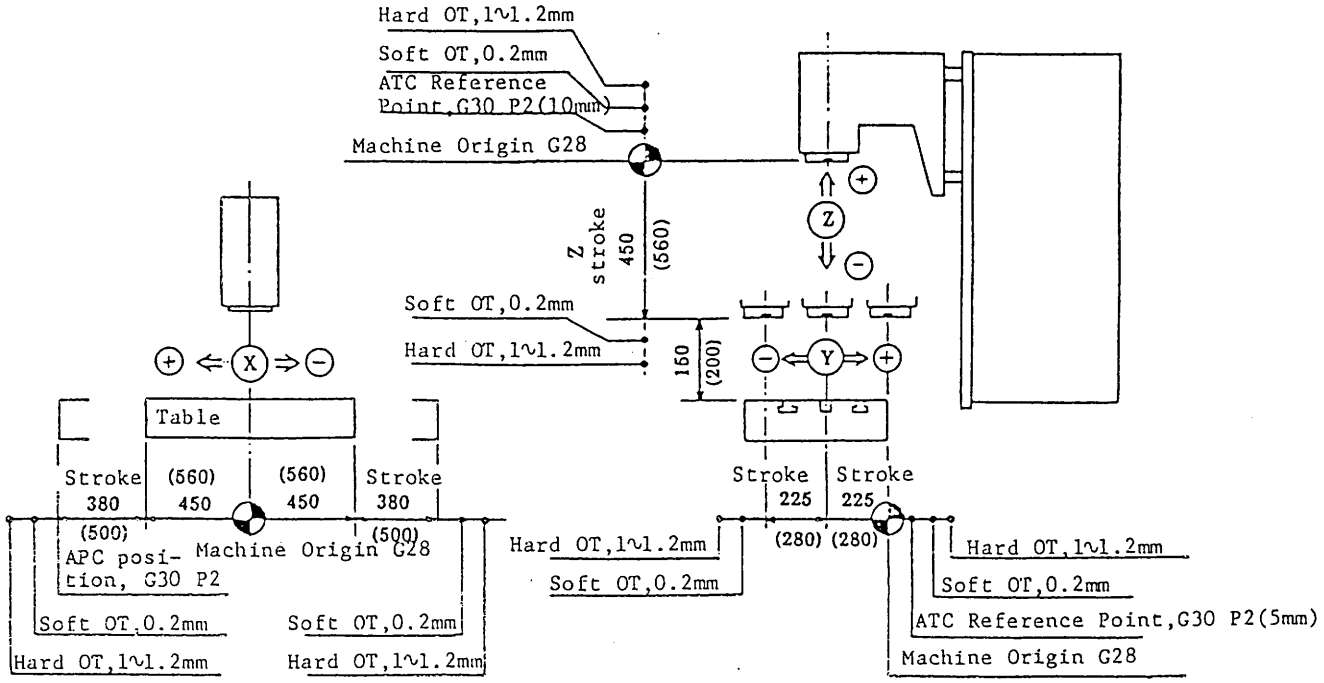
2) Relational Chart and Dividing Rate of A/B Phases



7-12 Stroke of Each Axis and Adjustment of Reference Point

1. Stroke of Each Axis

   Stroke inside ( ) is for VK55.



2. Parameter No. for adjustment and contents (Refer to SEIKI-SEICOS M III/A Instruction book (Maintenance editing))

NC PRM No.	Description	NC PRM No.	Description	NC PRM No.	Description
5203	+X software OT	1026	X axis 2nd reference point	1830	X axis zero shift amount
5203	+Y "	1026	Y "	1830	Y "
5203	+Z "	1026	Z "	1830	Z "
5203	+4th "	1026	4th "	1830	4th "
5024	-X "	1027	X axis 3rd reference point		
5024	-Y "	1027	Y "		
5024	-Z "	1027	Z "		
5024	-4th "	1027	4th 2		

3. Diagnostic No. for adjustment and contents (for SEICOS M III)

Contact point	7	6	5	4	3	2	1	0
X00	-LZ	+LZ	DECY	-LY	+LY	DECX	-LX	+LX
X01								DECZ

How to display X contact point

[HEAD/TAIL] → [F4] : System → [6] : PC menu → [INPUT] → [1]

: Information of contact point [INPUT] → [F2] : X contact point

4. Procedure for adjustment of zero point

① Mount the dog for speed deceleration.

② Set the origin shift amount for parameter to zero.

③ Confirm stop position Ⓐ by manual zero return.

④ Reset the counter at stop position 3. to zero.

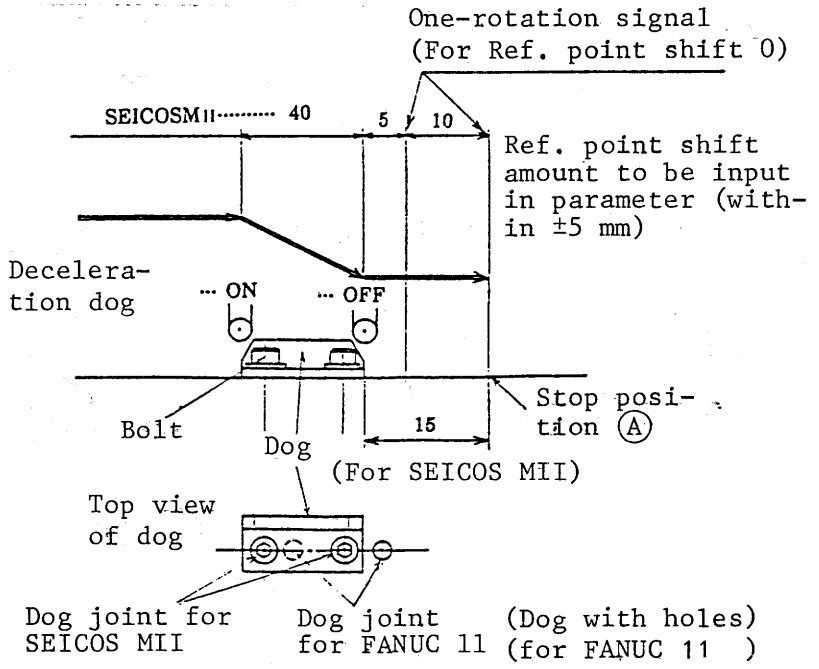
⑤ Move the table 15mm in opposite direction from zero return.

⑥ Display X contact point on the CRT screen.

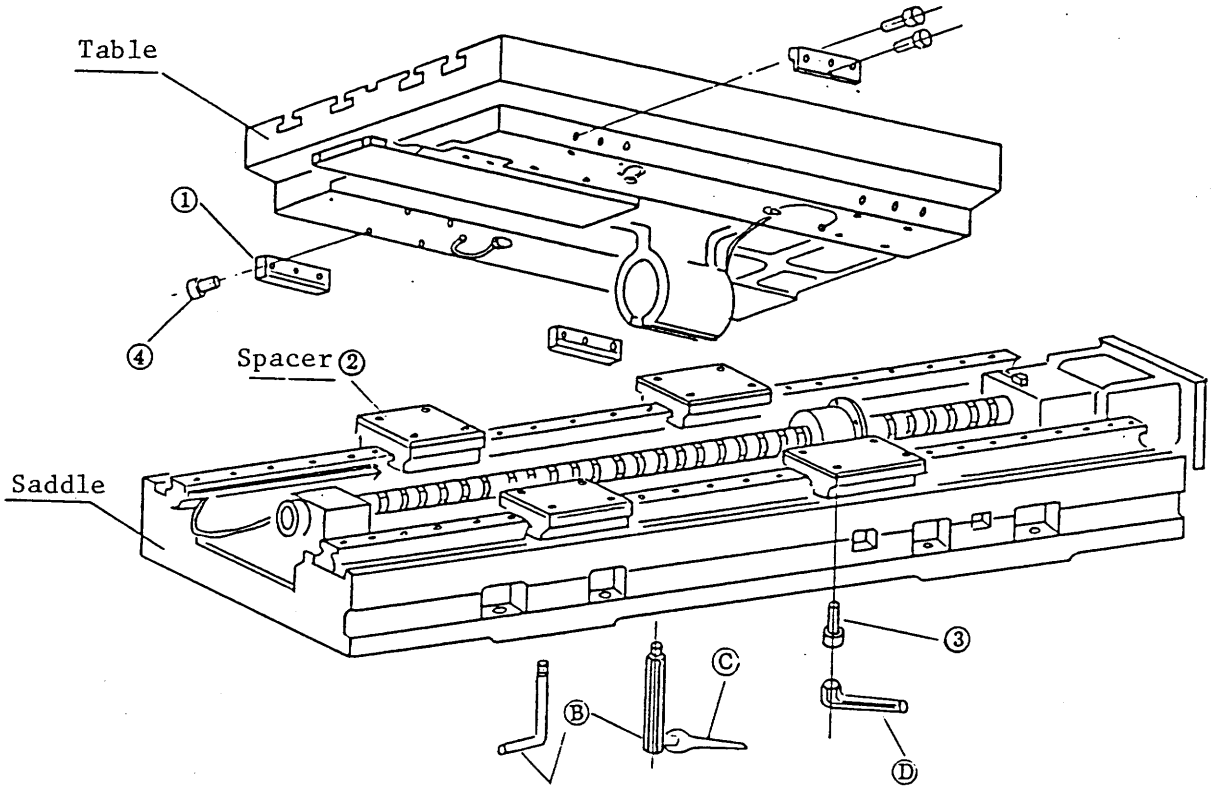
⑦ Loose the dog for speed deceleration and set it at the point of the DGN signal on X00, X01 column from 0 to 1.

⑧ Input the difference between machine origin and this stop position as the origin shift amount to PRM.
Must be input sign +, - with unit by micrometer. (unit : μ)

Note : When Magnescale (SONY made) is applied, sensor for one revolution signal should be off 10mm before stop position.



7-13 Table Saddle and Feed Shaft



1. Table Dismantling Procedure

   (1) Take off Telesco-cover, remove bolts to B/S nuts and detach connection between Table and B/S.

   (2) Release L/M Guide Bearing and Table Fixing Bolt (3) to lift up Table. The L/M side of Bolt (3) is released with a L-shaped long wrench applied under Saddle.
   Note) Do not forget to take off the lubricant pipe joint.

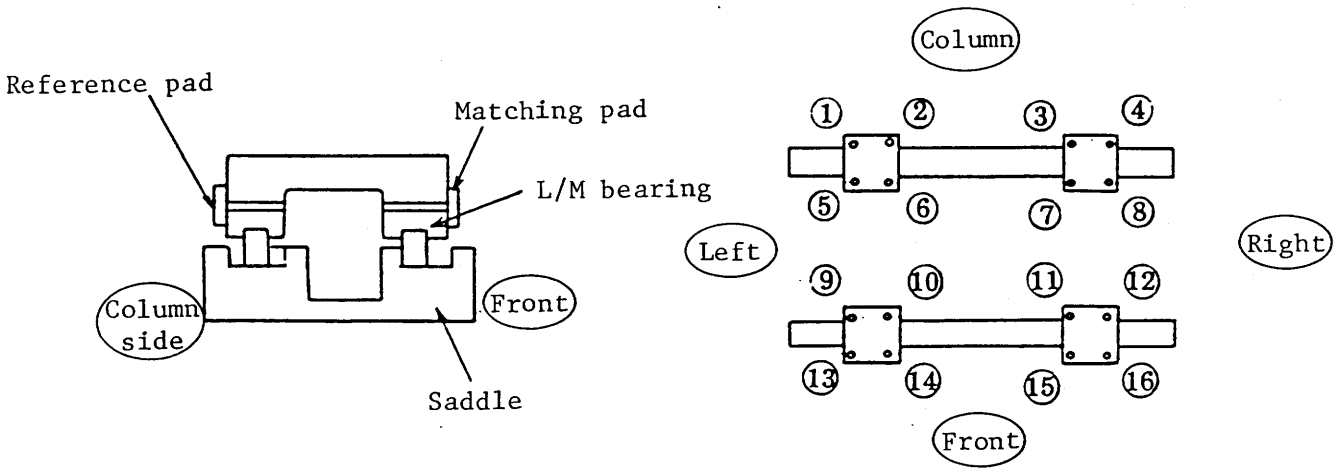
2. Table Assembling Procedure

   (1) Place 4 spacers of the equal size on Saddle L/M Bearing.

   (2) Install Pad (1) Reference side to Table, lift it up and place it on L/M Bearing of Item 1).

   (3) Closely fit Pad (1) to L/M Bearing Reference Plane and tighten Bolt (3) in the order mentioned in the right drawing.

   (4) Adjust the push-margin of Matching pad.



3. Dismantling Procedure of Feed Shaft

(1) Take off the cover so that Motor (4), Bracket (8), Bracket (13) are exposed.

(2) X axis ball screw is replaced with Table on the left side, Y axis ball screw with Column on the front and Z axis with Column on the front, using a jack on the upper surface of Table to support Head.

(3) Cut off power. However, only Z Axis Motor being provided with brake, connect the brake releasing jumper cord.

(4) In order to remove Motor (4), first take off Cover (1) and release Bolt (2). Linking between Motor and Ball Screw is then disengaged with a click.

(5) Release Bolt (3) and extract Motor set with coupling (4) [Bolt (2), Retainer (22), Ring Fender (26), Coupling (23), Ring Fender (25), Retainer (24) and Bolt (27)].

(6) Take off Nut (7) to remove Straight Pin (5) and Bolt (6). Bracket (8) is taken out with Radial Ball Bearing (19), Collar (20) and Thrust Ball Bearing (21) still attached.

(7) Shifting Column Head Table until Bracket (13) is clearly seen, take off Nut (12) to remove Straight Pin (11) Bolt. Loosen, then, Bolt (16), take off Retainer (17) and Collar (15) to take out Bracket (13) together with Angular Ball Bearing (18).

(8) Loosen Bolt (9) and remove Ball Screw (14). Extract X-axis Ball Screw rightwardly, Y-axis Ball Screw backwardly, Z-axis Ball Screw downwardly.

4. Assembling Procedure of Feed Shaft

(Reverse procedure of that for dismantling. The following cares should be taken upon assembling.)

(1) On replacing Angular Bearing ⑱, be sure to match Retainer ⑰.

(2) On replacing Bracket ⑧ ⑬, closely place against the reference plane, tighten with Bolt ⑪ and reset Straight Pin ⑩. Also, installing Dials Ⓒ Ⓓ, adjust the parallelism against the reference plane.

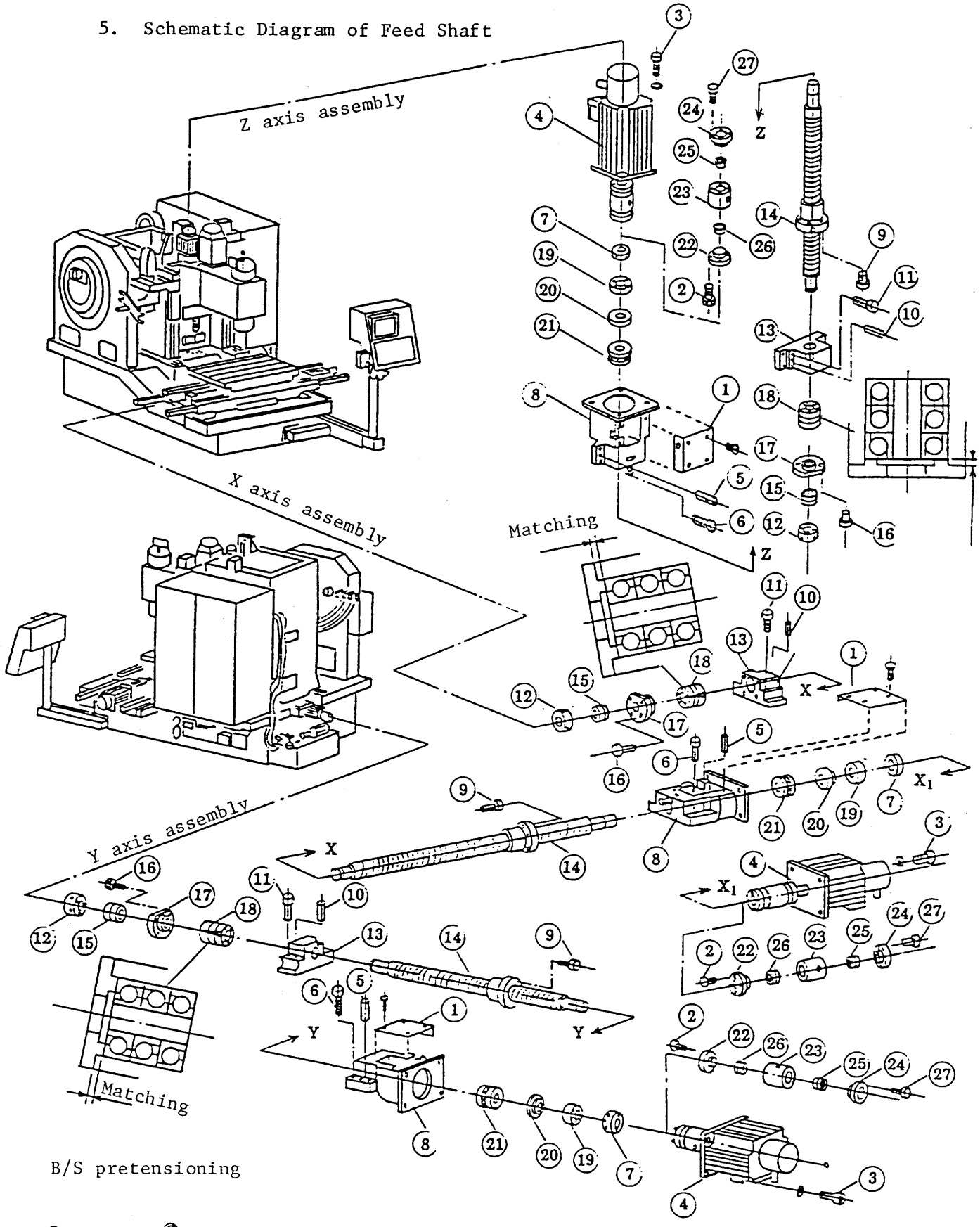
(3) On exchanging a motor, adjust the size from the motor flange to the coupling end as 121.5 mm, remove coupling deflection and use 140 kgf·cm torque to evenly tighten the tightening bolts of the Fender.

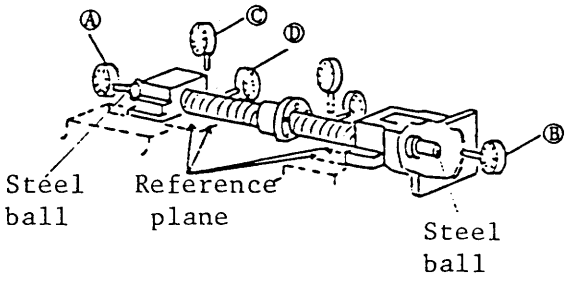
(4) On replacing Ball Screws, Angular Bearings etc., be sure to carry out pretension adjustment. First, tightening ⑭, ⑬, ⑱, ⑰, ⑯, ⑮ and Nut ⑫ with the fixed torque, tightly fix the ball screw with Nut ⑫ and adjust with Nut ⑦. Also, applying steel ball to the ball screw end and fitting Dial Gauge Ⓐ Ⓑ, tighten in Nut ⑦ to adjust the difference of Ⓐ and Ⓑ.

(5) After pretensioning, measure the deflection of the ball screw. Applying the dial to the ball screw as in Ⓔ and Ⓕ, lightly pat the outer circumference of Nut ⑫ ⑦ where having large deflection in order to restore.

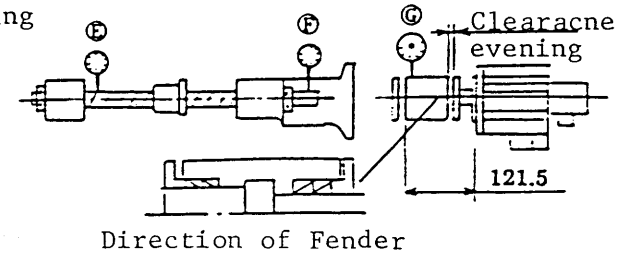
(6) On dismantling the feed shaft, it is necessary to adjust reference points of relating axes and to correct ATC Reference Point.

5. Schematic Diagram of Feed Shaft





B/S deflection measurement & mounting motor coupling



7-14 Spindle Head and Bearing

1. Procedure to Replace Spindle and Angular Bearing
   (Refer to Schematic Diagram of Head)

   (1) Mount Tool on Spindle.

   (2) Disengage Tool Lock 1. Fit a plug to a hydraulic hose using Bolt (2).

   (3) Loosen the machine screw of Nut (3), remove Nut (3) while inserting and pressing the guide key bar into Spindle nose key groove.

   (4) Take off Ring (4) (with Sensor (5)), Key (6), Nut (7), Washer (8), Collar (9), O-ring (10), Bolt (11), Ring (12) and Collar (14) in this order.

   (5) By loosening and taking off Cover (18), Cover (20) and (19) and (17), Collar (16) is exposed. Removing Split Pin (24), Pin (25), Shifter (23), loosening Bolt (21), disengage Shifter Shaft (22). Push, then, up the neck of Collar (16) with a plastic bar and take out Radial Bearing (15) together with Collar (16).

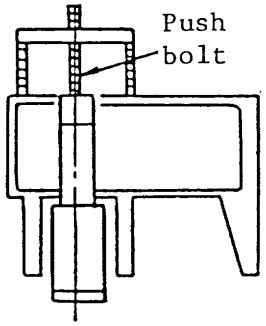
   (6) Placing a jack on Table and applying it against the tool installed on Spindle (26), support Spindle.

   (7) Loosen Bolt (27) to remove Cover (28).

   (8) Gradually releasing the jack, push the upper side of Spindle with Bolt shown in the right figure.
   When Spindle is removed from Head, place it carefully on the work table.

   (9) Take off Key (29), Nut (30), Collar (31), O-ring (32), Collar (33), O-ring (34) and Sleeve (35).

   (10) Holding Spindle upside down and applying shock on aluminum material, Bearing (36), Collar (37), Collar (38), Bearing (39), (40) are all extracted.



2. Mounting Angular Bearing and Spindle

   (1) Clean a new angular bearing. (Use white kerosene as washing oil.) After thoroughly dried, apply grease for high speed rotation.
   Types of grease: ISO FLEX NBU-15.

(2) Mount, paying attention to fitting directions of angular bearings and matching mark line. (40), (39), (38), (37), and (36)

(3) Fit (35), (34), (33), (32) and (31) in this order and temporarily tighten with Nut (30). Adjust the circumferential deflection of the bearing and the collar to be within 0.01 and tighten Nut (30). For NT#40, use tightening torque of 9 kg-m/clamp force 1 ton and for NT#50, use tightening torque of 25.6 kg-m/clamp force of 2 tons. Following tightening, reconfirm the circumferential deflection of the bearing and the collar. Clean Gear Holes (41) and (42).

(4) Put in Key (29) and insert Spindle (26) into Spindle Head with a jack to carry out Cover (28) matching. Be sure to carry out this matching upon replacing an angular bearing.

(5) Restore (28), (27), (16), (15), (14), (13), (12), (11), (10), (9), (8), (7), (6), (5), (4), (3), (1) and (2) in this order.

(6) Following restoring, fit a test bar to Spindle hole to measure the hole deflection. (Deflection; within 0.015/300 tip)

(7) Adjust the push margin of the tool (0.25 ∿ 0.3 mm) with Tool lock device. Be sure, also, to confirm Z-axis reference point adjusting ATC position.

NOTE: For tightening the nut under Item 3) of Mounting Angular Bearing and Spindle, it is also possible to tighten it by using Spindle nose key, after inserting Spindle into Head and fixing the nut inside Head.

3. Procedure for Replacing Drawbar Dish Spring

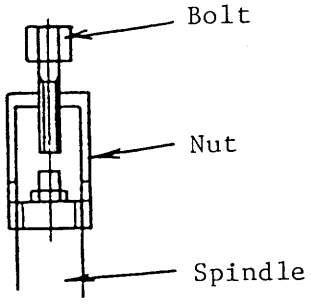
(1) Install Tool to Spindle.

(2) Loosen Bolt (2) and remove Tool Lock.

(3) Loosen the set machine screw and, while inserting and pressing the guide bar into Spindle nose key, take off Nut (3).

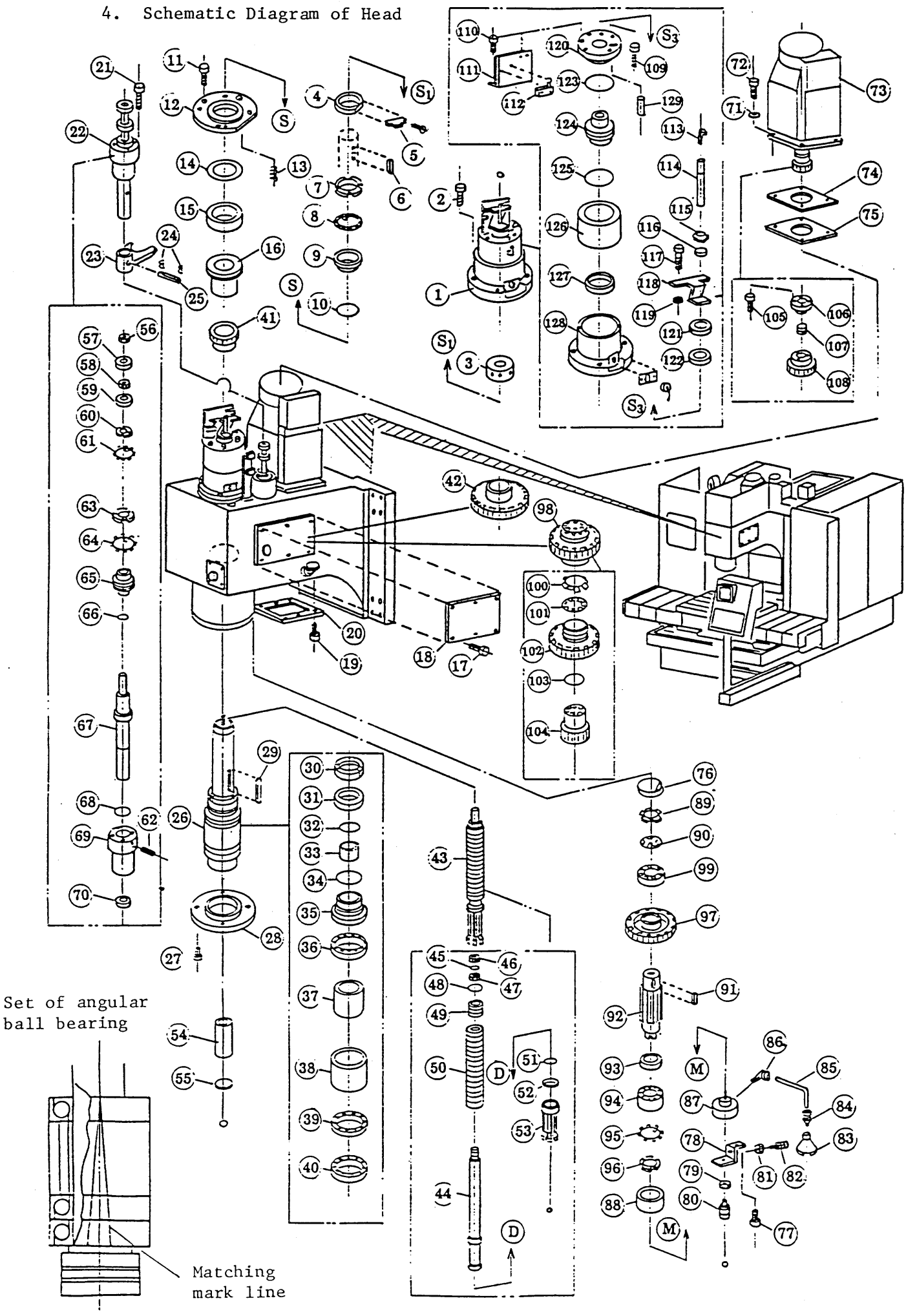
(4) Installing the nut of the right figure and pushing the drawbar with the installation bolt, extract the tool having been fitted beforehand. Loosen the bolt and take off the nut to extract Drawbar (43) from Spindle.

(5) Pressing Rod (44) with a wrench, loosen Nut (45), Washer (46) and Nut (47) to take put O-ring (48), Collar (49) and Initially coned disc spring (50).



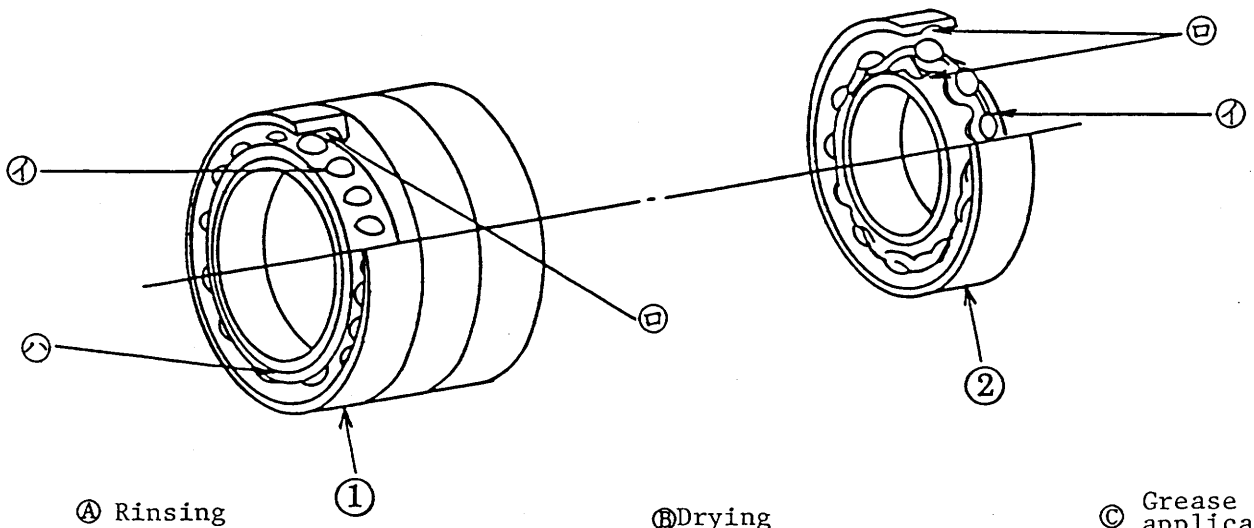
(6) Open Collet (53) and dismantle it from Rod (44).
(52) is O-ring and (54) Packing.
Bush (54) is dismantled by taking out Snap ring (55).

4. Schematic Diagram of Head



5. Handling Spindle Bearing

Name of grease: ISOFLEX NBU15 by Kluver



Rinsing and Grease Application

(1) Bearing (1) is rinsed as in (A) to be dried.
(2) Following rinsing, leave it in a drying box for about one hour.
(3) Prepare ISOFLEX grease.
(4) Evenly apply ISOFLEX grease. After application, turn it two-three times.
(5) Apply it on (2) in the same manner.

6. Replacing O-ring of Tool Lock Device

(1) Remove Bolt (109), Bolt (110), Stand (111), LS (112), Joint (113), Bolt (114), Nut (115), Washer (116), Bolt (117), Stay (118), Nut (119), Retainer (120), Dust seal (121), Packing (122), O-ring (123), Piston (124), O-ring (125), Cylinder (126), Packing (127) and Straight pin (129) in this order. Leave, however Holder (128).
(2) Replace O-ring, packings etc..

7. Mounting Procedure of Seal Lock Device

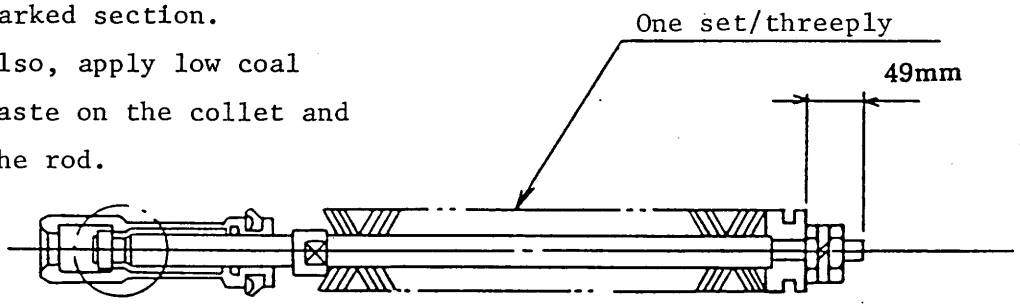
(1) Follow the reverse procedure of that for dismantling.
(2) Adjust the tool push margin (0.25 ∿ 0.3 mm) following mounting, adjust push margins of the tool clamp and unclamp. After LS being turned on, tighten in the 1/4 rotation screw.

8. Mounting Procedure of Drawbar

(1) Apply lubricant on the spring/dish and mount them combined as in the right figure.

(2) Inserting Collar (49) and O-ring (48) with Nut (47) until to reach the size in the right figure. After confirming the size, fix them with Washer (46) and Nut (45).

(3) Open the collet until it enters the groove of "0" marked section. Also, apply low coal paste on the collet and the rod.

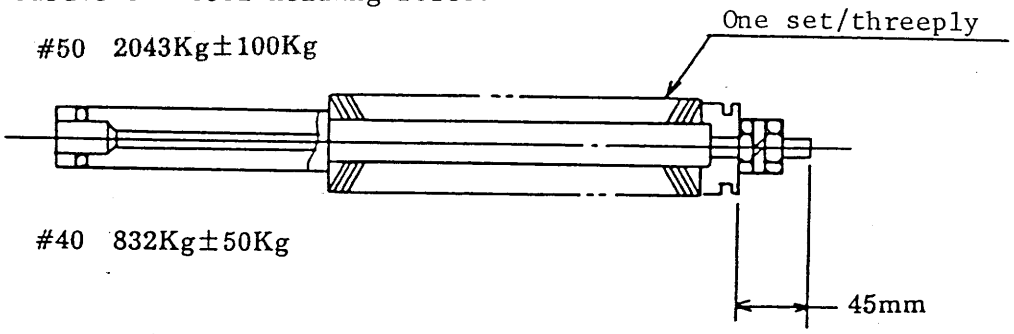


(4) Before mounting to Spindle hole, to eliminate unevenness of the initially coned disc spring, reshape the circumference using a plastic hammer. Then, mount to Spindle hole.

(5) Screwing in the nut used on the drawbar dismantling, push it until the tool is entered by the bolt. Upon entering, loosen the bolt, dismantle the nut, install Nut (3) flat head and tighten the tool lock device with Bolt (2) to restore it. Upon restoration, measure the tool holding force.

#50 2043Kg±100Kg

#40 832Kg±50Kg



9. Replacing High/Low Speed Cylinder O-ring

(1) Loosen Bolt (17) and remove Cover (18).

(2) Taking off Split Pin (24) and Pin (25), loosen Bolt (21) to remove High/Low Speed Cylinder (22).

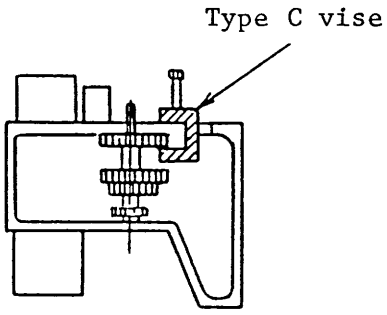
(3) Remove Nut (56), Doc (57), Nut (58), Doc (59), Nut (60), Washer (61), Set machine screw (62), Nut (63), Washer (64), Retainer (65), Packing (66), Rod (67), O-ring (68), Cylinder (69) and Packing (70) in this order to replace O-ring packing.

10. Mounting Procedure of High/Low Speed Cylinder

(1) Follow the reverse procedure of that for dismantling. Properly position Set machine screw (62). Excessive tightening may cause nonfunctioning of the rod.

11. Replacing Procedure of Intermediate Shaft Radial Bearing

(1) Loosening Bolt (71) and Washer (72), lift up Spindle Motor (73).



(2) Dismantle Retainer (76), Bolt (77), Stay (78) [Nut (79), Bolt (80), Nut (81), Bolt (82)] Trochoide Pump (87) [Filter (83), Joint (84), Pipe (85), Joint (86)] and Retainer (88) in this order.

(3) Hold Gear (97) with a vise as it is shown in the right figure. Disengaging Nut (89) and Washer (90), extract Shaft (92) halfway to take off Key (91). Further, extract Shaft (92) together with Collar (93), Bearing (94), Washer (95), and Nut (96).

(4) Replace Bearings (99) and (94).

(5) The high/low speed gear consists of Nut (100), Washer (101), Gear 102 , Spring/Torque (103) and Gear (104).

12. Mounting Procedure of Intermediate Shaft

(1) Follow the reverse procedure of that for dismantling. Pay attention not to overtighten.

(2) Upon replacing the bearing, match Retainer (76).

13. Replacing Procedure of Spindle Motor

(1) Loosen Bolt (71) and Washer (72) to lift up the motor.

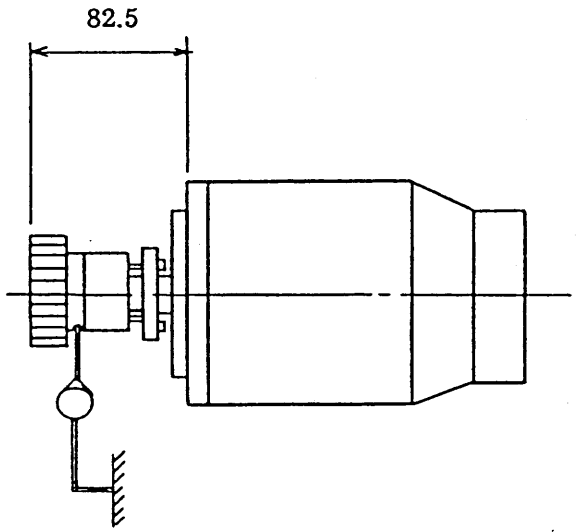
(2) Take out Bolt (105), Retainer (106), Fender (107) and Gear (108) in this order.

(3) Replace the motor.

14. Mounting Procedure of Spindle Motor

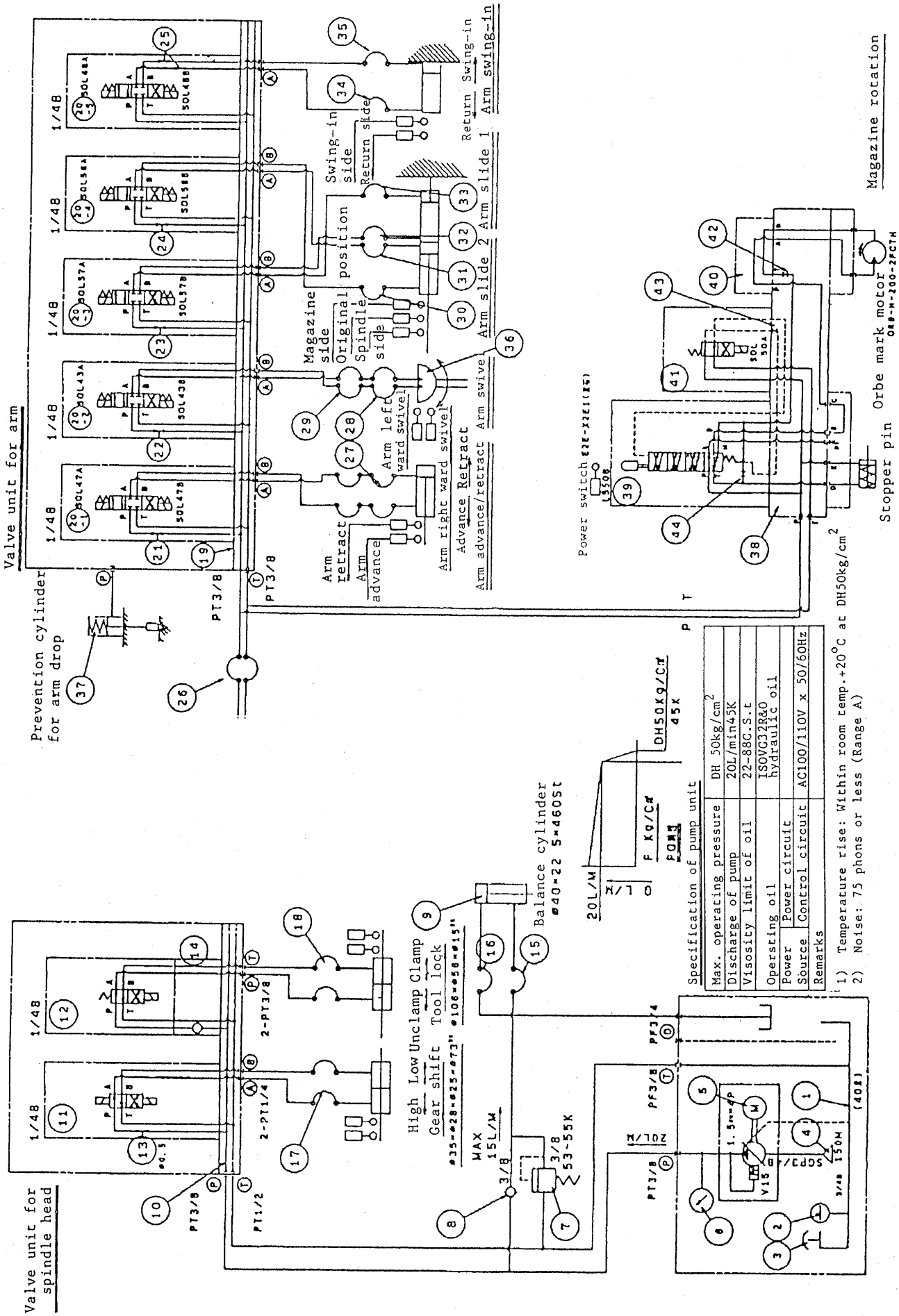
(1) Upon mounting (105), (106), (107) and (108) using the sizes shown in the right figure, evenly tighten Bolt (105) for tightening the fender so as to eliminate the deflection of Gear (108).

(2) Adjusting backlash between the intermediate shaft and the motor gear, tighten the motor.



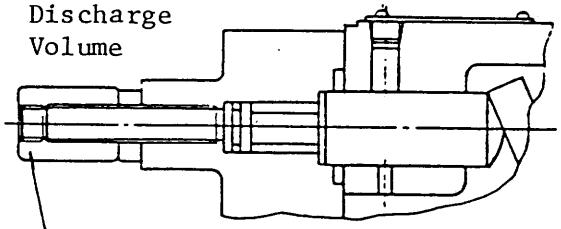
7-15 Hydraulically Driven Equipment

1. Hydraulic Circuit Diagram



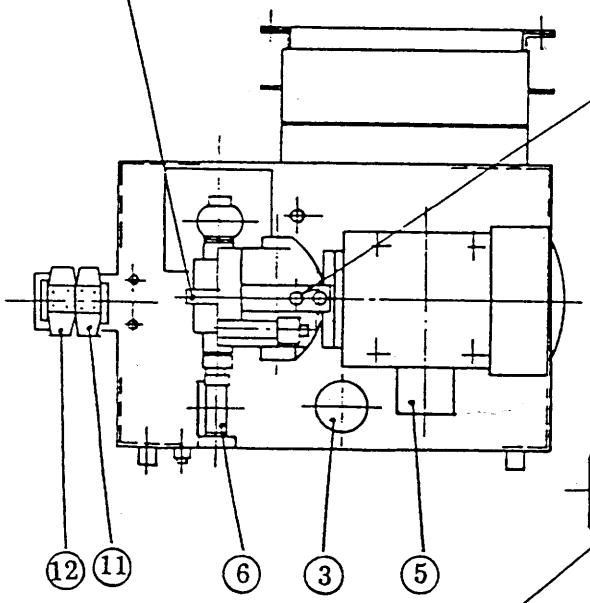
2. Adjusting Hydraulic Tank

Details of Adjusting Discharge Volume



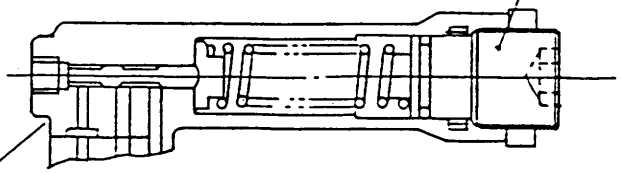
Turning the adjusting screw rightwardly, the discharge volume is decreased. Turning it leftwardly, the volume is increased.

Prior to test running, take off the plug and supply hydraulic operating fluid.

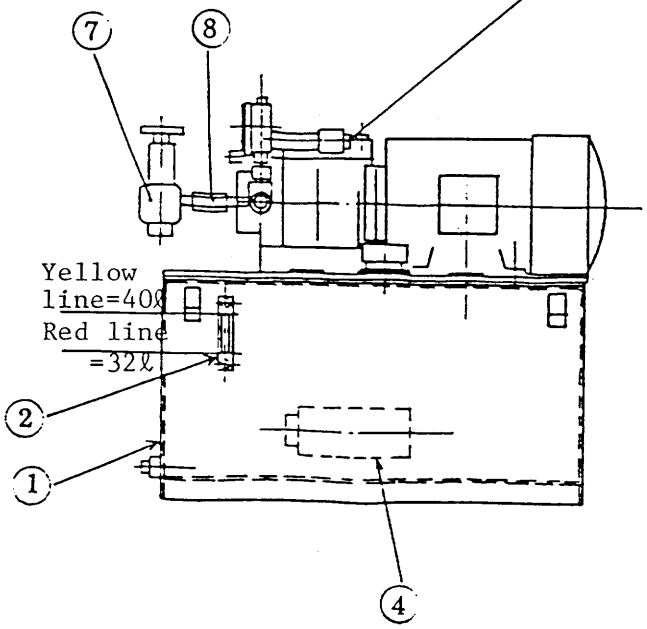


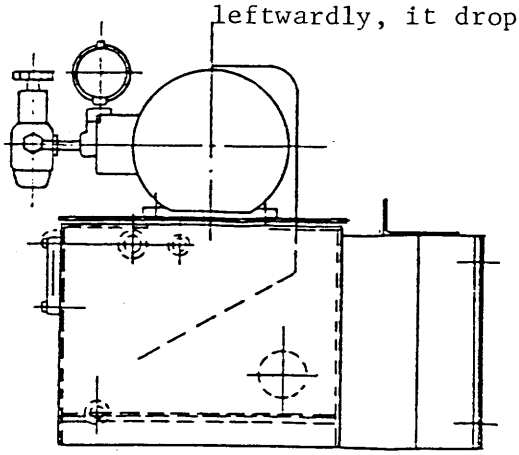
Discharging pressure adjusting screw

Details of Pressure Adjustment



Turning the adjusting screw rightwardly, the discharge pressure is increased. Turning leftwardly, it drops.

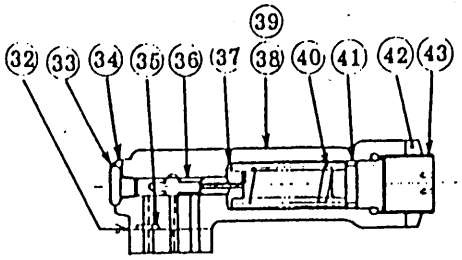


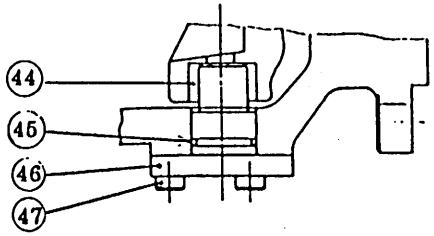


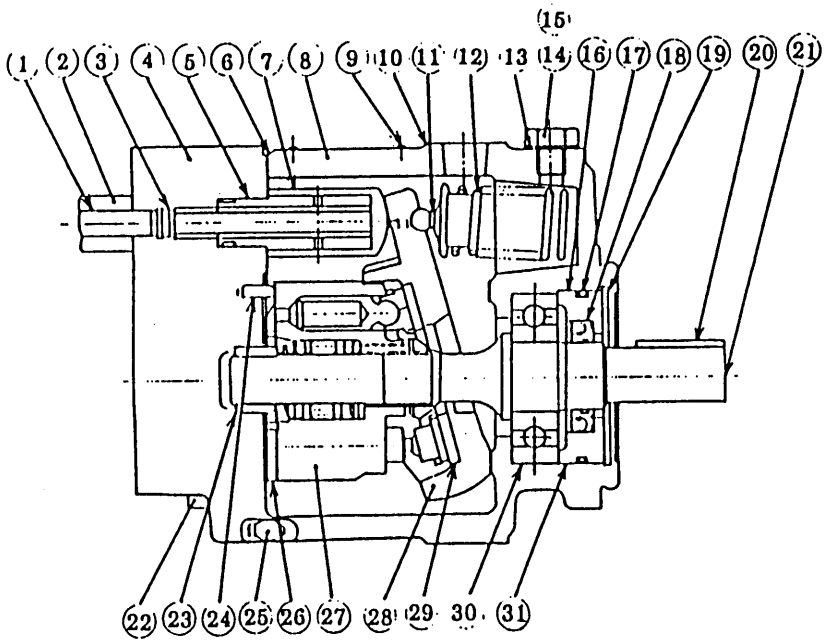
3. Major parts list of hyraulic circuit

(Refer to Item No. for previous item 7-15, 1 & 2)

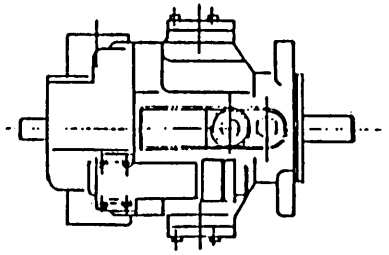
No.	Description	Model	Q'ty
1	Oil tank	40ℓ	1
2	Oil gauge	KLA-80A	1
3	Inlet and breather	FA-35	1
4	Suction strainer	DHA-05-150	1
5	Motor pump	M15A1X-2-50	1
6	Pressure gauge	SPA1/4B, ϕ60 x 1500 1b/cm^{2}49.51k x 100K (green)	1
7	Relief valve	SR-T03- 1-10	1
8	Check valve	HDIN-T03-05	1
9	Balance cylinder	2732-05-099-00	1
10	Bass block	M1	1
11	Electromagnetic valve	KSO-G02-2NA-20-N	1
12	Electromagnetic value	KSO-G02-2BA-20-N	1
13	Fixed choke	ϕ0.5	1
14	P port check valve	MC-02P-05-50	1
15	Nylon hose	P105 x 9 x 500cm	1
16	Nylon hose	P105 x 9 x 450cm	1
17	Nylon hose	P105 x 6 x 470cm	2
18	Nylon hose	P105 x 9 x 470cm	2
19	Base block	BT502-S	1
20	Electromagnetic valve	KSO-G02-2CA-20-N	1
21	Fixed choke	ϕ20	1
22	Fixed choke	ϕ1.2 (NT50) ϕ1.6 (NT40)	1
23	Fixed choke	ϕ1.6	1
24	Fixed choke	ϕ2.0	1
25	Fixed choke	ϕ1.8 (NT50) ϕ2.0 (NT40)	1
26	Hose	P105-9 x 280cm	2
27	Hose	P105-9 x 125cm	2
28	Hose	P105-9 x 122cm	2
29	Hose	P105-9 x 200cm	4
30	Hose	P105 x 9 x 170cm	1
31	Hose	P105 x 9 x 150cm	1
32	Hose	P105 x 9 x 140cm	1
33	Hose	P105 x 9 x 120cm	1
34	Hose	P105 x 9 x 160cm	1
35	Hose	P105 x 9 x 140cm	1
36	Torque actuator	MFC-Z13-1V-180 27327006000	1
37	Cylinder	Spring return	1
38	Manifold	MBL-103-0	1
39	Cam actuated valve	A-2732-49-008-00	1
40	Bypass block	BH-02	1
41	Electromagnetic valve	KSO-G02-28A-20-N	1
42	Fixed orifice	ϕ1.6	1
43	Orifice	ϕ1.0	1
44	ϕ0.8 orifice	6000-85-011-00	1







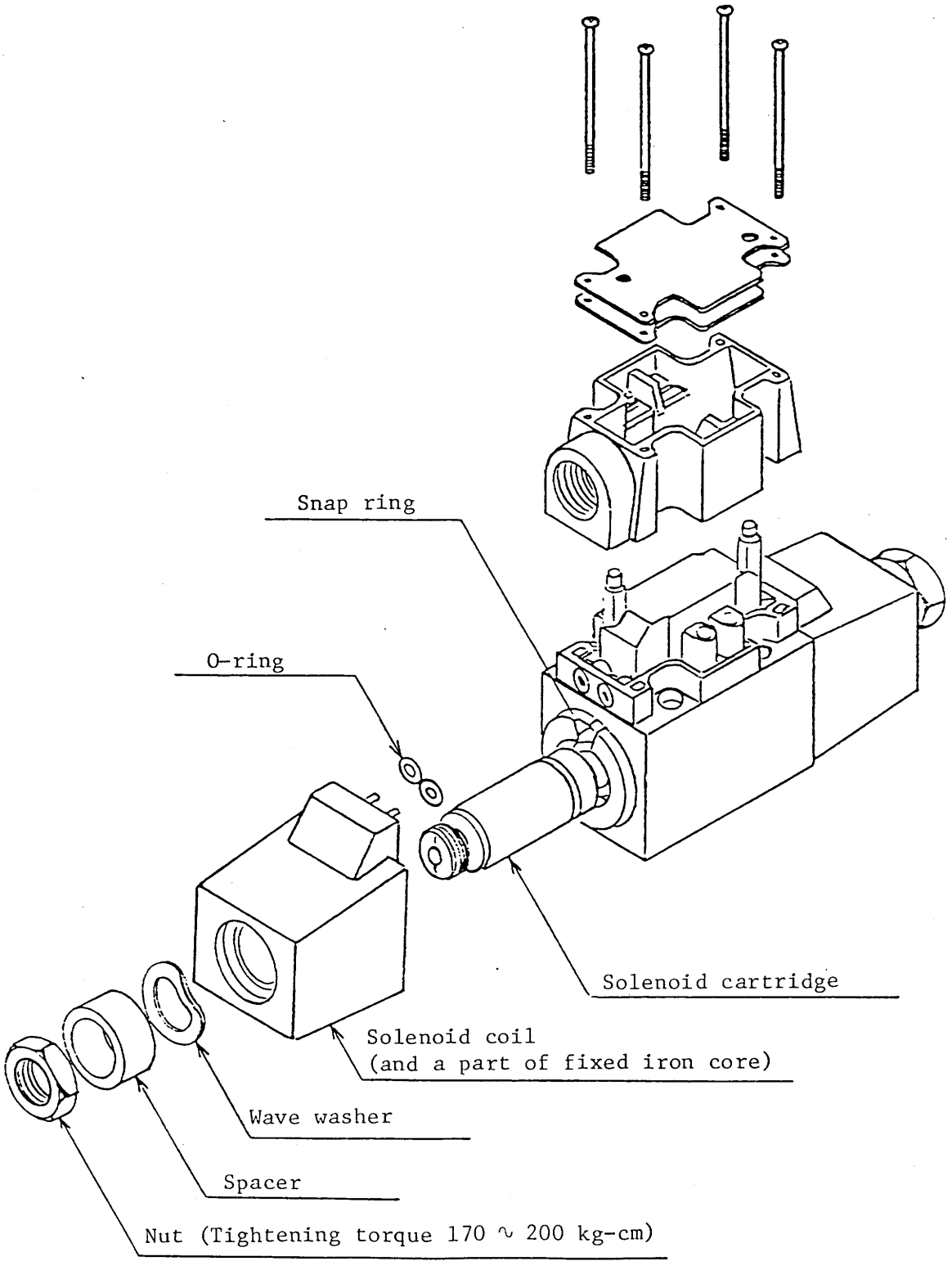
No.	Name	Q'ty	No.	Name	Q'ty	No.	Name	Q'ty
1	Adjusting screw, discharge	1	21	Shaft	1	41	O-ring	1
2	Cap	1	22	Socket head screw	4	42	Lock nut	1
3	O-ring	1	23	Bearing (needle)	1	43	Adjusting screw, pressure	1
4	End cap	1	24	Pin	2	44	Journal bearing	2
5	Cylinder rod	1	25	Pin	1	45	O-ring	2
6	Gasket	1	26	Plate (valve)	1	46	Trunnion	2
7	Control cylinder	1	27	Cylinder block kit	1	47	Socket head screw	2
8	Nome plate	1	28	Swash plate	1			
9	Driving screw, nome plate	2	29	Plate (thrust)	2			
10	Housing	1	30	Bearing (Ball)	1			
11	Spring retainer	1	31	C-type snap ring, shaft	1	No.	Size	Q'ty
12	York sping	1	32	Gasket	1	3	JISB2401 classA P8	1
13	Seal washer	1	33	Plug	1	17	" " G55	1
14	Plug	1	34	O-ring	1	34	ARI'5G8.903 3/8.24	1
15	Name plate	1	35	O-ring	1	35	JISB240T classB P6	1
16	Seal retainer	1	36	Spool	1	41	" " P14	1
17	Oring	1 1	37	Spring retainer	1	45	" classB P18	2
18	Oil seal	1	38	Valve body	1		Oil seal	
19	C-type snap ring, bore	1	39	Socket head screw	4	4	TCV type 24408	1
20	Key	1	40	Spring	1			



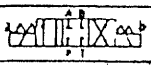
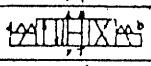
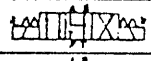
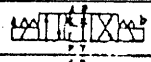
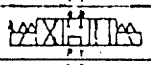
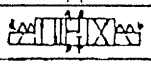
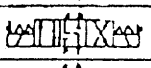
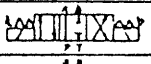
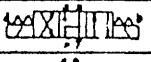
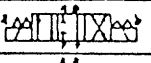
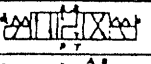
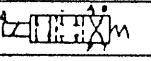
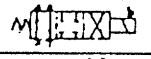
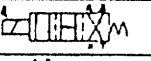
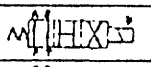
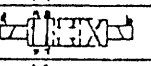
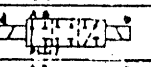
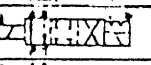
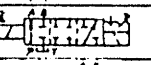
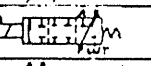
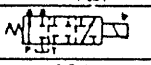
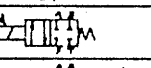
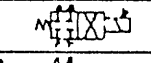
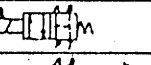
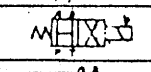
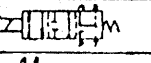
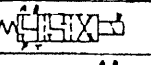
Theoritical discharge	14.8 cc/rev.
Max. pressure	210 kgf/cm^2
Rated pressure	140 kgf/cm^2
Revolution range	500 ∿ 1800 r.p.m
Allowable vacuum degree	-125 mmHg
Applicable filter	Return line 25 micron Suction line 150 mesh
Hydraulic oil	ISO VG32, 46.56
Oil temperature	0 ∿ 60 °C
Oil amount	kg
Inside-case pressure	Normal: 0.35 kgf/cm^2 and less Max. 0.7 kgf/cm^2 and less

5. Solenoid

KSO-G02 Disassembly Sketch Drawing

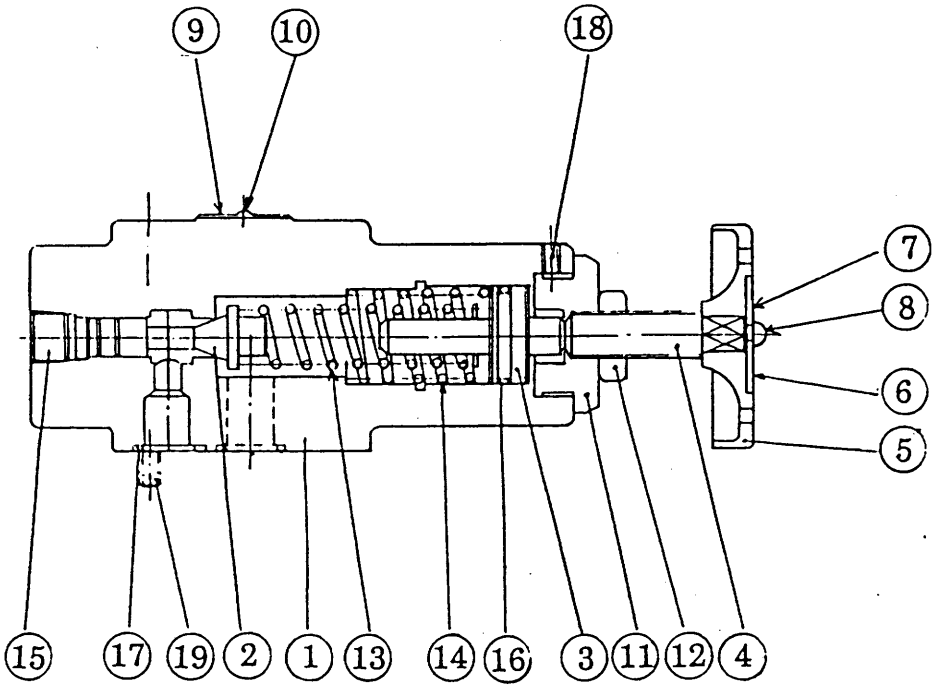


6. Table of solenoid valve

Model symbol	JIS symbol	Power source	Pressure-volume characteristic (refer to graph)			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			
-66C		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 3	—
		DC	K	e	a			
-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 2	—
		DC	A	a	e			
-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			

7. Relief Valve

(SR G 03-1-11)



REF. No.	Parts name	MOD EL / Q'ty	Drawing 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

8. Magazine index motor VK.ATC-20

(1) Operation Description

① Upon hydraulic power ON stopper pin is pulled out, index roller pin is able to move.

② SOL50A, ON by index command.

③ The spool on mechanical valve ② is moved by SOL50A ON, then roller pin is pulled out and cam plate is able to rotate and output shaft is rotated by oil motor.

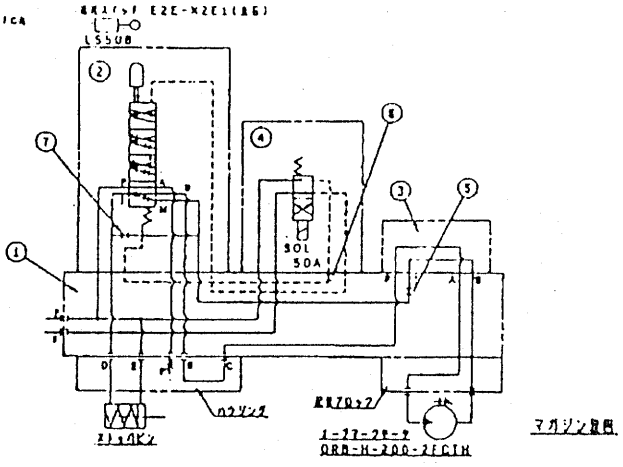
④ SOL50A, OFF by index stop command.

⑤ The spool on mechanical valve ② is pushed out by spring and hydraulic pressure. Then roller is pressed against cam plate and decelerated the oil motor depend on the profole of cam.

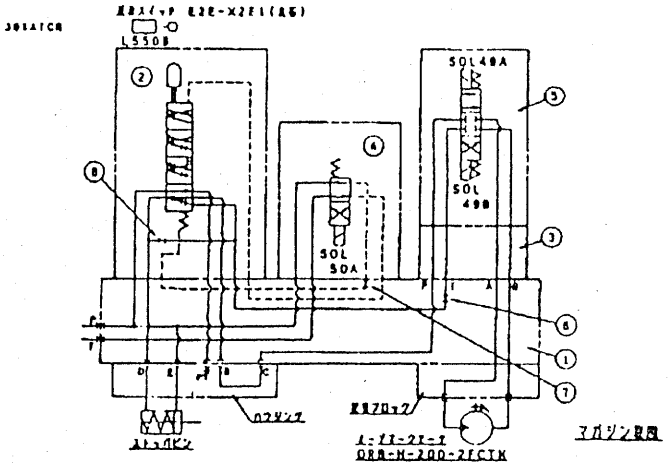
⑥ Roller get into index groove and indexing is completed, and oil motor is stopped by mechanical valve ② at the same time.

⑦ Roller is pushed up on the cam groove by spring and hydraulic pressure while hydraulic power ON, and holding the magazine.

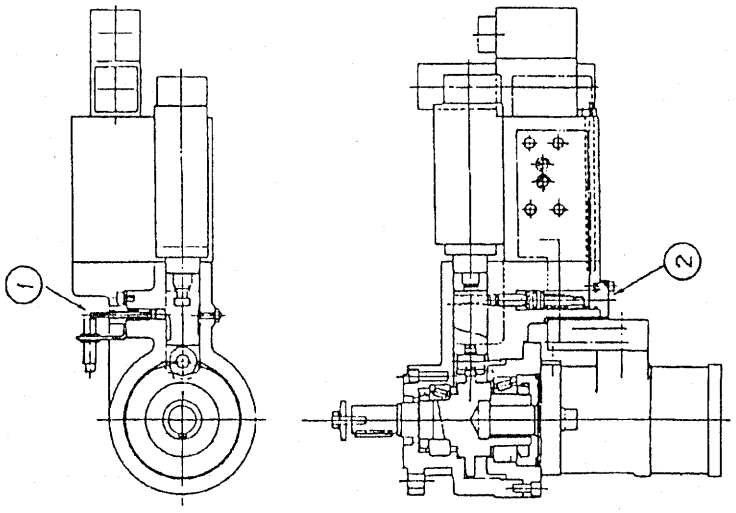
⑧ Upon hydraulic power OFF push up force (80kgf) of roller is released, the mechanism prevent retruction of roller pin by wedge of stopper pin.



No.	PART NUMBER	PART NAME	Q'ty	MAKER
7	8000-85-011-00	ϕ0.8 orifice	1	SHONAN
6	ϕ1.0	Orifice	1	SHONAN
5	ϕ1.6	Fixed orifice	1	SHONAN
4	JSO-G02-2BA-20-N	Solenoid valve	1	DAIKIN
3	BH-02	Bypass block	1	DAIKIN
2	A-2732-4D-008-00	Cam operated valve	1	SHONAN
1	MBL-103-0	Manifold	1	SHONAN



No.	PART NUMBER	PART NAME	Q'ty	MAKER
8	8000-85-011-00	ϕ0.8 orifice	1	SHONAN
7	ϕ1.0	Orifice	1	SHONAN
6	ϕ2.5	Fixed orifice	1	
5	JSO-G02-2CA-20-N	Solenoid valve	1	DAIKIN
4	JSO-G02-2BA-20-N	Solenoid valve	1	DAIKIN
3	8G-2PT-50	Spacer	1	DAIKIN
2	A-2732-49-008-00	Cam operated valve	1	SHONAN
1	MBL-103-0	Mainifold	1	SHONAN



① Gain adjustment

② Initial adjustment

(2) Troubleshooting

Phenomenon	Possible cause	Counter measure
1) Not rotating in either directions	• Hydraulic unit not functioning • Reverse piping (PT) • Valve not operating (Direction switching valve, Pilot valve) • Motor abnormality • Any external brake • No wiring to solenoid • Pilot valve not functioning properly	• Restore the hydraulic unit function • Restore proper piping • Replace with proper valve (Disassemble and wash the valve) • Replace the rotor • Release the brake • Make proper wiring (Measure voltage between solenoid terminals.) • Disassemble, wash and replace by other valve
2) Rotating only in one direction	• Direction switch valve having been wired with only one side. • Direction switch valve functioning only in one side.	• Correct to normal wiring • Disassemble and rinse. Replace by other valve
3) Overrunning (abnormal position)	• Delay of pilot valve signal • Delay of pilot valve functioning • Improper gain adjustment	• Adjusting deceleration signal timing • Disassemble, rinse and replace by other valve • Readjusting gain (Refer to Item "Gain Adjustment")
4) Hesitating to stop	• Improper adjustment of gain • Excessive motor load (GD^2)	• Adjusting gain • Re-selecting motor capacity
5) Short running (abnormal positioning)	• Improper gain adjustment • Switching off of the direction switch valve signal being too early	• Readjusting gain • Adjusting control circuit etc.

① Gain adjustment

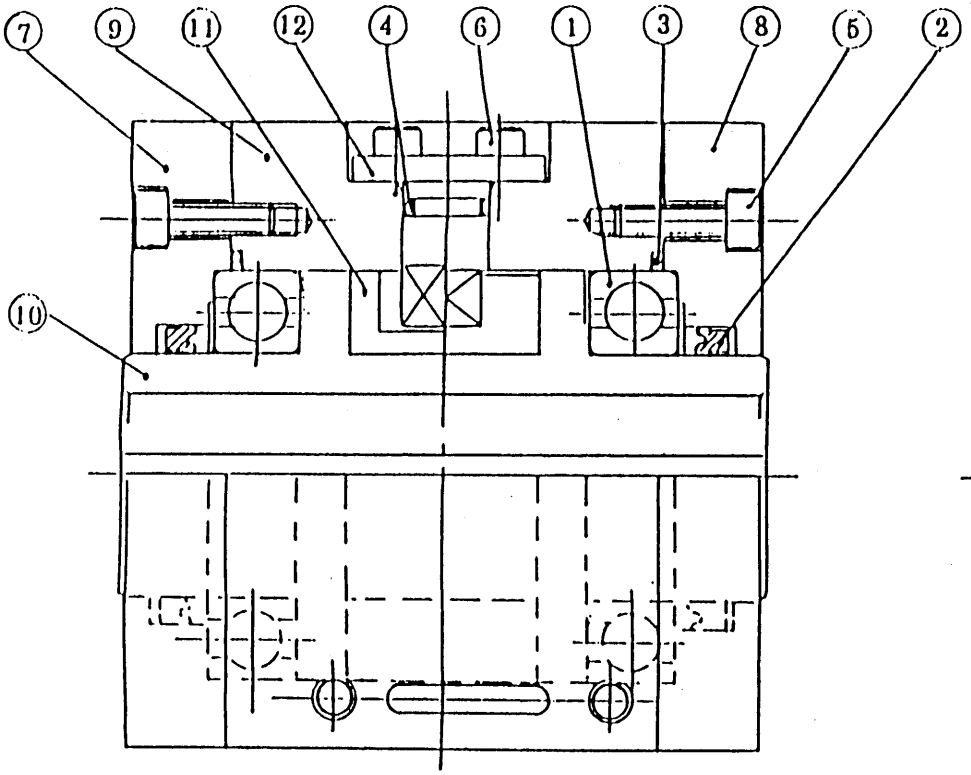
a) When provided with a limit switch, either loosen the initial section and bearing nut or shift limit switch.

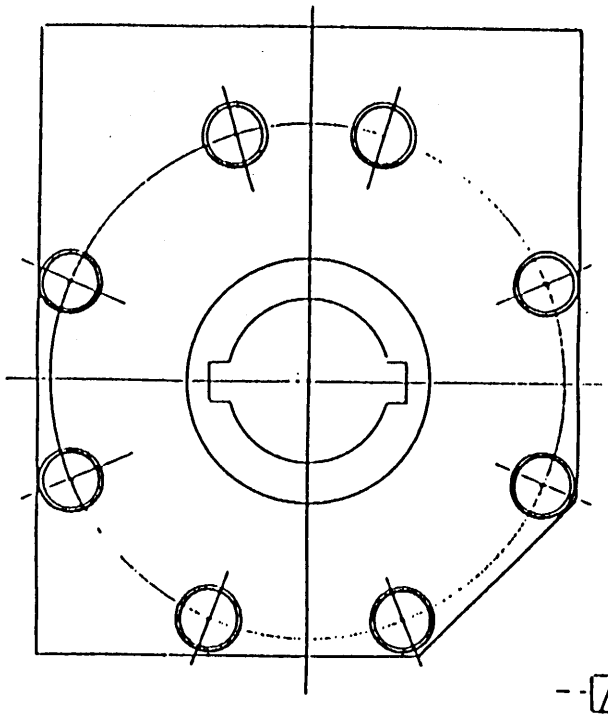
b) Loosen M6 nut and turn adjustable throttle using a minus screw driver.

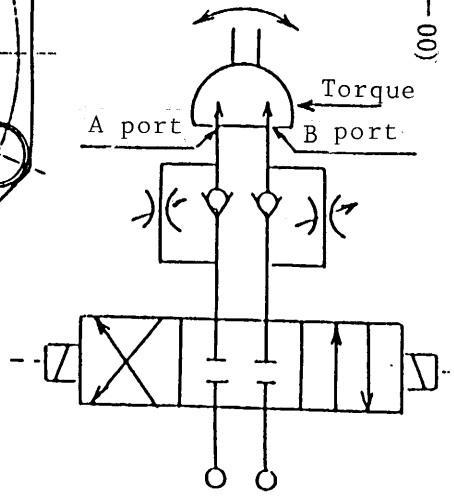
c) After adjusting, tighten M6 nut, place the limit switch to its original position and fix it in position.

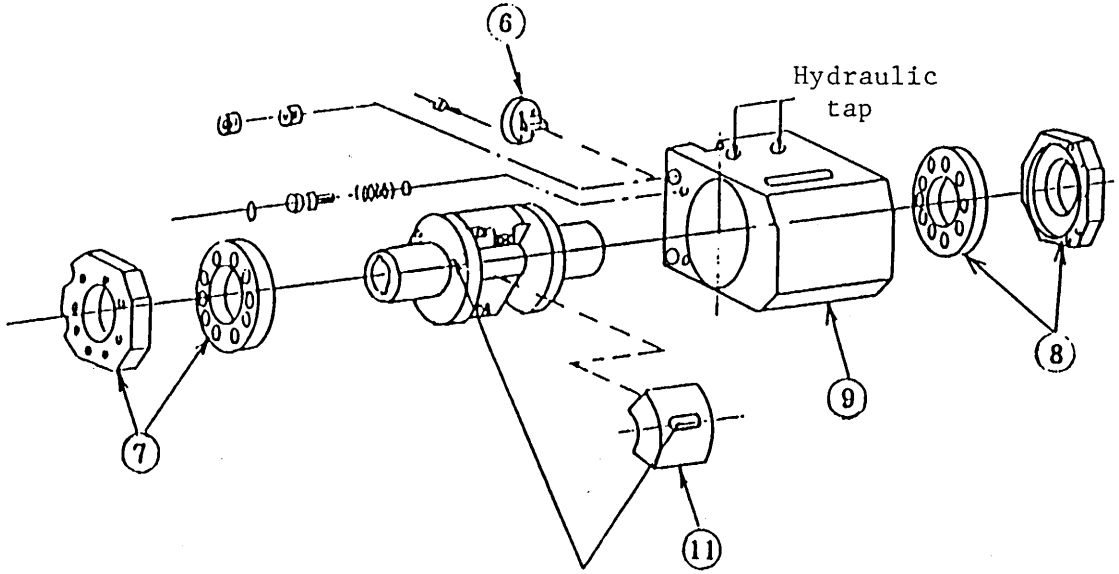
② Initial adjustment

It has been adjusted so as to give the maximum torque prior to shipment. Therefore, customer should not touch it.







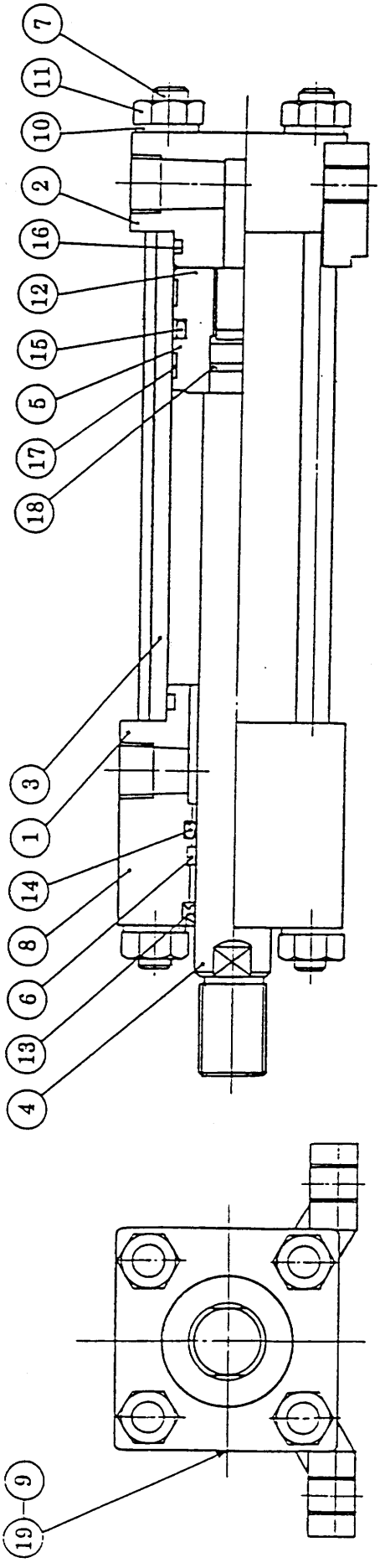


Matching the stamps

No.	Parts	Q'ty	Remarks
12	Cored bar	1	
11	Stopper	1	
10	Rotor shaft	1	
9	Cylinder	1	
8	End flange	1	
7	Flange	1	
6	↑	4	M5 × 12
5	Hexagon socket head cap screw	16	M6 × 20
4	↑	2	P12
3	O-ring	2	S80
2	SKY packing	2	SKY45(BRJ7)
1	Ball bearing	2	#6009

7-16 Balance Cylinder (for Spindle Head)

1. Structural Drawing



2. Specifications

Model	LA40B35N710
Cylinder inside diameter	ϕ40 mm
Stroke	710 mm
Rod diameter	ϕ22.4 mm
Rated pressure	35 kgf/cm^2
Test pressure	70 kgf/cm^2
Cushion	None

Remarks 1. A sealed section being hard chromium plated 2/100.

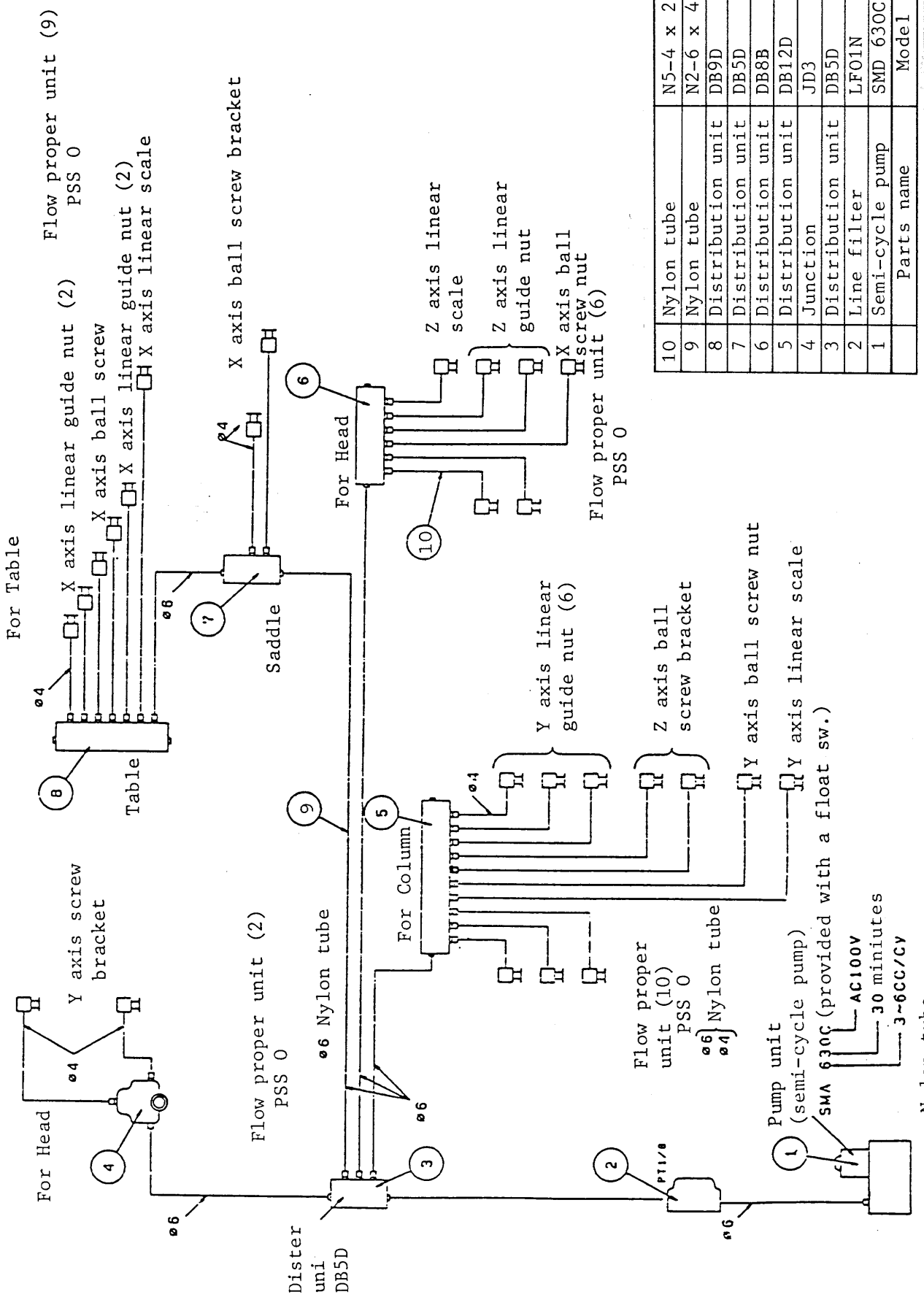
2. Lock Nut M16 × 1.5 3 types, 2 each

3. Parts List

No.	Name	Material	Q'ty	Remarks
19	Cap gasket	NBR	2	P. 8
18	Piston gasket	NBR	1	P. 14
17	Piston wearing	Phenol resin	2	SWA-40
16	Tube gasket	NBR	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 screw	SCM435	1	M4
11	Hexagon nut	S25C	8	M10 1 type
10	Spring washer	SWRH57	8	10 No. 2
9	Cap	S25C	2	
8	Flange	SS41	1	
7	Tie rod	S45C	4	
6	Esleeve	Polyamide	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	

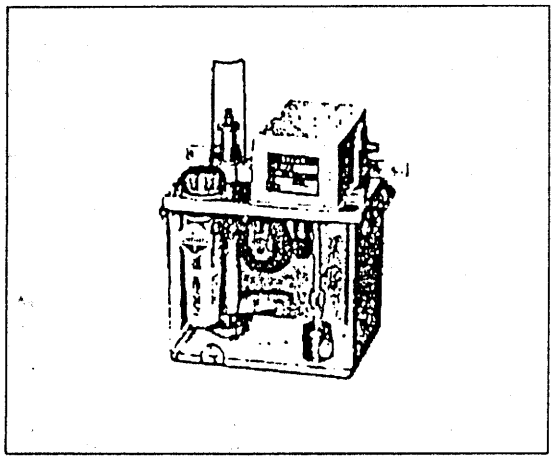
7-17 Lubrication

1. Parts and Cricuit Diagram



10	Nylon tube	N5-4 x 2
9	Nylon tube	N2-6 x 4
8	Distribution unit	DB9D 1
7	Distribution unit	DB5D 1
6	Distribution unit	DB8B 1
5	Distribution unit	DB12D 1
4	Junction	JD3 1
3	Distribution unit	DB5D 1
2	Line filter	LF01N 1
1	Semi-cycle pump	SMD 630C 1
	Parts name	Model Q'ty

2. Semi-cycle pump (Model SMD) SMD630C3



This model is a sister product of SMA, the specification of pump motor is equivalent to model SMA, however, having various features.

☐ Description of model symbol

SMD 6 30 C *

- SMD — Basic model
- 6 — Discharge 3 : 1~3cc/cy, 6 : 3~6cc/cy — Adjustable type
- 30 — Intermittent time
  5.5min 15: 15min 60: 60min
  10: 10min 30: 30min 120: 120min
- C — Voltage symbols
  C : Single phase AC100V
  D : Single phase AC110V
  F : Single phase AC200V
  G : Single phase AV220V
- * — Option symbol 01 ~ 30
  EX.26 : Terminal, filter, chain, cover with
  30 : With full option

This intermittent discharging accumulator type pump, covering a wide range of performance of a cycle pump, exhibits the most rational and efficient functions with the least less. 12 variations are available covering the cycle time with the largest demands.
The discharge can be adjusted in a wide range between 1~3cc and 3~6cc.

■ Cycle time and discharge

12 types of pumps have been provided, which are divided by the discharge into type 3 = 3cc/cy. and type 6 = 6cc/cy. choose any type which is most suitable to your application.

Upon ordering, let us know the model and the cycle time (for example, for the discharge of 3cc and 15min. cycle time, SMA315).

Adjusting discharge is easily done by setting the discharge scale of the gauge fitted on the reference plane of the instand button section, which changes the stroke.

After adjusting the discharge, securely lock with set screw to prevent from getting loose.

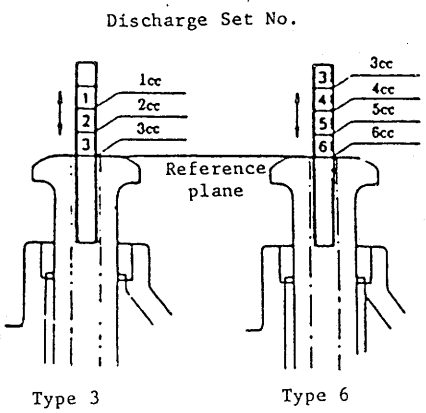
Discharge has been set to 2cc for type 3 and 5cc for type 6 upon shipment.

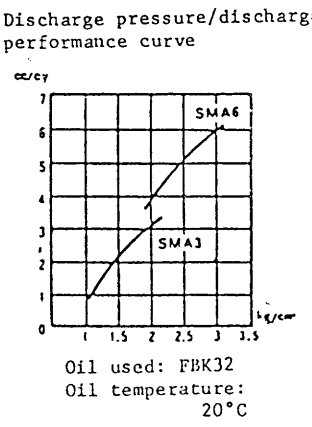
■ Description of operation

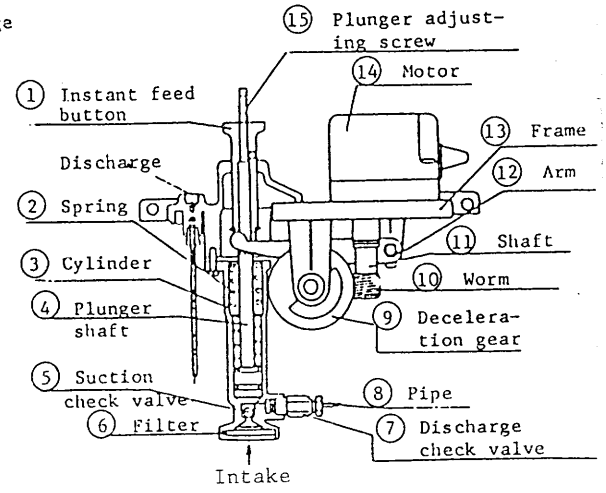
As the motor rotates, the gear which is engaged with the drive worm is rotated. The cam on the same shaft pushes up the arm at a speed decelerated to the designated cycle time. Upon the arm being push up, the plunger is lifted up to compress the sping.

When the plunger is lifted up, oil pushes up the suction check valve through the suction head and, the fixed quantity of strokes being sucked into the cylinder, thus, it is prepared for discharge.

Next, the gear rotates to disengage the cam, where oil in the cylinder, by restoring pressure of the compressed spring, makes the suction check valve close by the plunger and is forcedly sent into the main pipe.

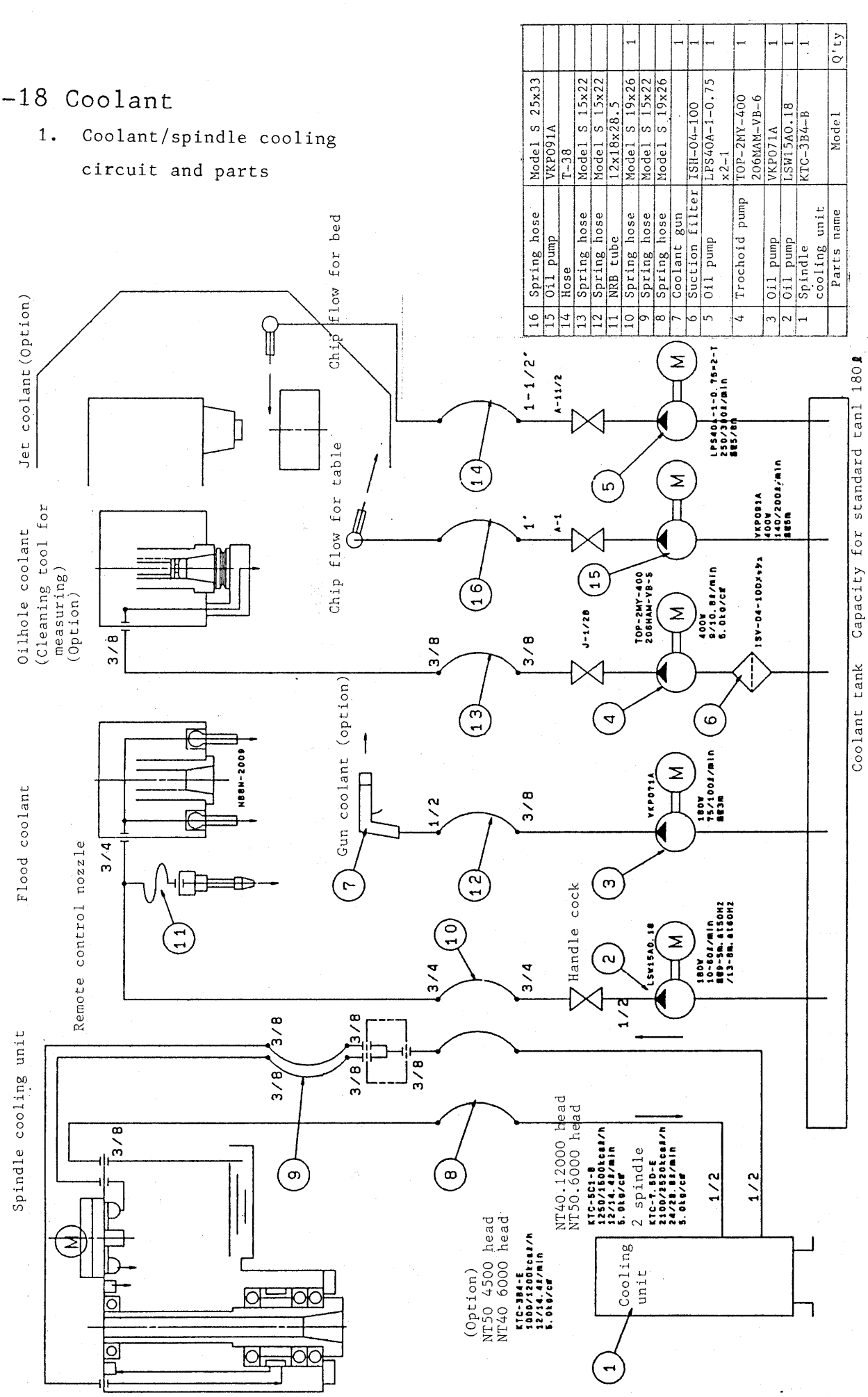






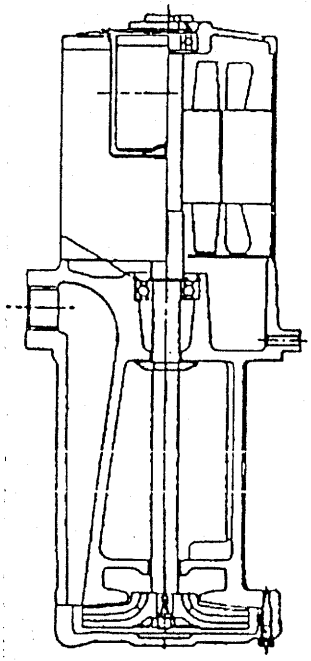
7-18 Coolant

1. Coolant/spindle cooling circuit and parts

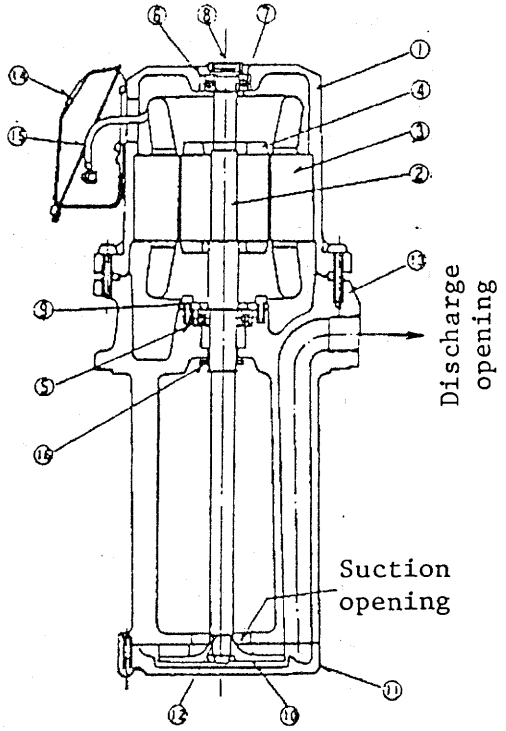


16	Spring hose	Model S 25x33	
15	Oil pump	VKP091A	
14	Hose	T-38	
13	Spring hose	Model S 15x22	
12	Spring hose	Model S 15x22	
11	NRB tube	12x18x28.5	
10	Spring hose	Model S 19x26	1
9	Spring hose	Model S 15x22	
8	Spring hose	Model S 19x26	
7	Coolant gun		1
6	Suction filter	ISH-04-100	1
5	Oil pump	LPS40A-1-0.75 x2-1	1
4	Trochoid pump	TOP-2MY-400 206NAM-VB-6	1
3	Oil pump	VKP071A	1
2	Oil pump	LSW15A0.18	1
1	Spindle cooling unit	KTC-3B4-B	1
	Parts name	Model	Q'ty

2. Flood Coolant (standard accessory) LSW 15A 0.18 and
Gun Coolant (special accessary) VKP－071A



LSW15A0.18



VKP－071A

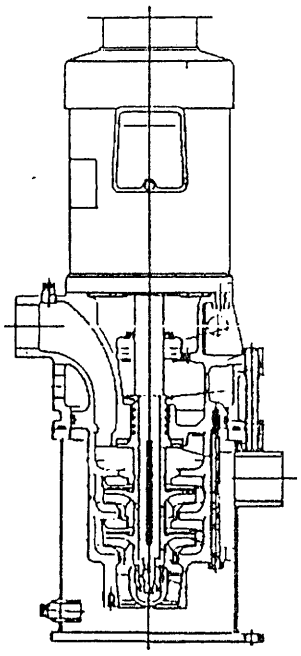
Parts List

1	Frame
2	Shaft
3	Stator
4	Rotor
5	Drive side bearing
6	Non-drive side bearing
7	Wave washer
8	Rotation direction inspection window
9	End cover
10	Impeller
11	Volute box
12	Adjusting washer
13	Pump leg
14	Terminal box
15	Terminal cable
16	Oil strainer

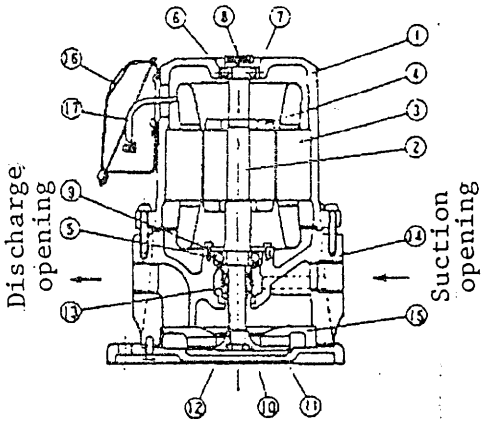
Specifications ＼ Model	LSW15A0.18		VKP071A	
Application	For Flood coolant		For Gun coolant	
Output [W]	180		180	
Rated voltage [V]	200	200 220	200	200 220
Frequency [Hz]	50	60	50	60
Rated current [A]	1.1	1.2	0.85	1 1
Discharge [ℓ/min]	10~60		75	100
Total head [m]	9~5	13~8	3	
Applied viscosity limit [Redwood sec.]	150(CST)	75(CST)	1200	600
Standard pipe diameter [PS]	1/2		1/2	
Paint color	Mancel 7.5B 5/7.5		Dark green FM	
Pump rating			JEM1242	
Rough weight [Kg]	13	14	10.2	
Remarks				

3. Jet Coolant (Special accessory)

VKN 91A, LPS 40A



LPS40A



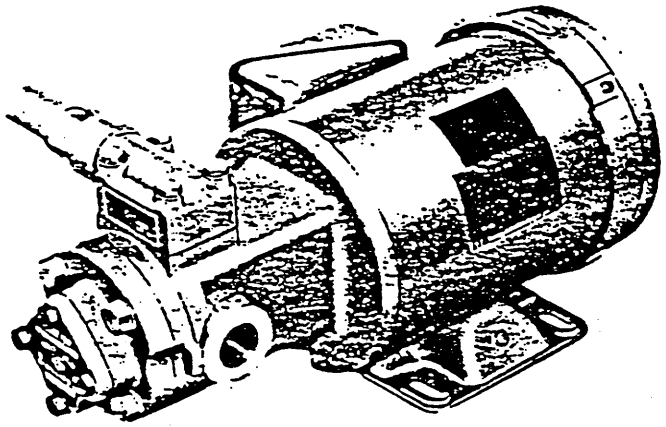
VKN91A

1	Frame
2	Shaft
3	Stator
4	Rotor
5	Drive side bearing
6	Non-drive side bearing
7	Wave washer
8	Rotation direction inspection window
9	End cover
10	Impeller
11	Bottom plate
12	Adjusting washer
13	Mechanical seal
14	Casing
15	Volute box
16	Terminal box
17	Terminal cable

Specifications \ Model	VKN91A		LPS40A	
Application	For Jet Coolant		For Jet 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 [ℓ/min]	140	200	80~250	100~300
Total head [m]	5		10~5	15~8
Max. suction pipe length [m]	0.7		0.7	
Applied viscosity limit [Redwood sec.]	800	300	32(CST)	
Standard pipe diameter [PS]	1		$1\,1/2$	
Paint color	Dark green FM			
Pump rating	——			
Rough weight [Kg]	12.6		41	
Remarks				

4. Oil Hole Coolant Motor and Pump (Special accessory)

TOP-2MY-400-206-HAM-VB5

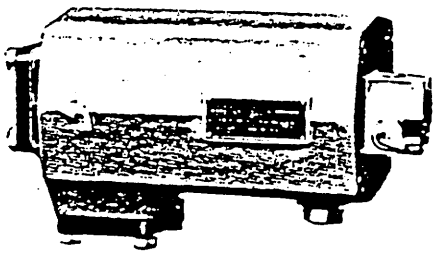


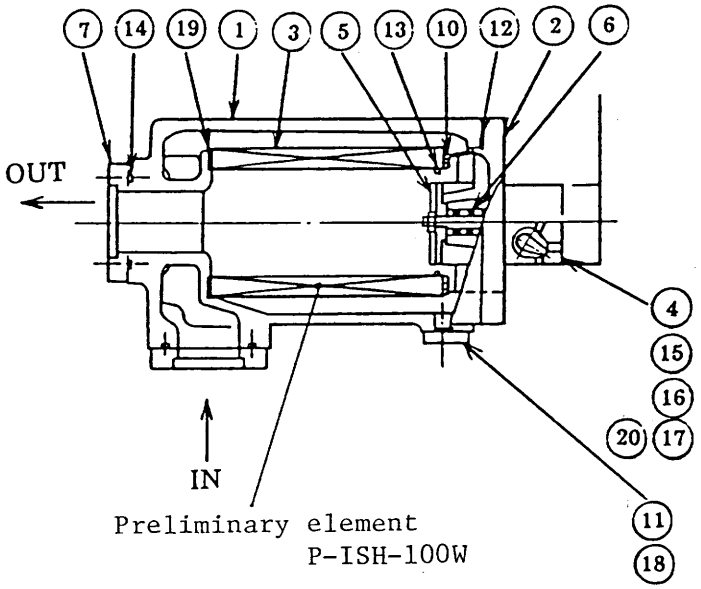
Motor provided (made by Yasukawa Electric Co., Ltd.)

Output (W)	Model	Frame No.	No. of polarity (P)	Rating	Voltage (V)	Frequency (Hz)	RPM	Current (A)	Weight (Kg)
→ 400	FEL-8	71HTB	4	Contin-uous	200 200 220	50 60 60	1430 1710 1730	2.2 2.1 2.1	10.0

Pump model	50Hz 4p (1500 rpm)					60Hz 4P (1800 rpm)				
	Discharge ℓ/min	Max. pressure to motor output (Kgf/cm^2)				Discharge ℓ/min	Max. pressure to motor output (Kgf/cm^2)			
		200W	400W	750W	1500W		200W	400W	750W	1500W
→ TOP-206HAM	9.0	3.0	10.5	25.0		10.8	2.0	7.0	23.5	25.0

Filter Unit ISH-04-100W





Parts List ISH-04-100W

No.	Name	Material	Q'ty	Remarks
20	Packup 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	Leaf spring	SK5	1	
9	Hexagon socket head cap screw	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	1 set	P-ISH-04-100W
		SPCC		
2	Lid	AC2B	1	
1	Main body	AC2B	1	

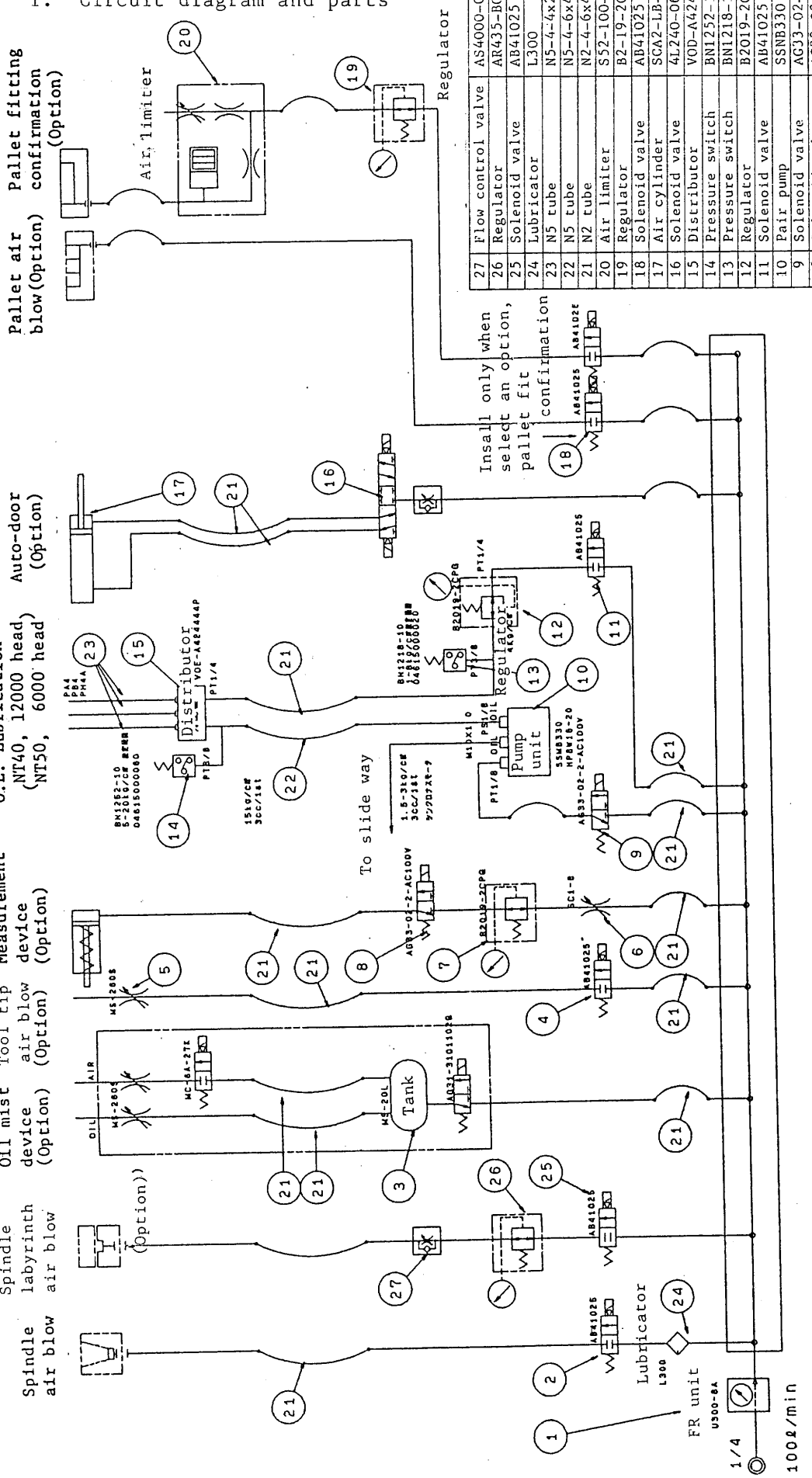
1. A very lightweight and yet very rigid filter with a case consisted of an aluminum alloy housing, stainless steel elements, an indicator and relief valve.
2. Being a horizontal type, an element can be extracted horizontally, even if there is no space above the unit.
3. Elements use, as the standard, stainless steel screen of 60, 100, 150 and 200 mesh.
4. Clogging of a filter element can be checked by the indicator.
5. A relief valve being installed, risk caused by excessive loading is prevented.

O-ring Packing Table

Part No. / Model	12	13	14	15	16	17	18	19
ISH-03	G 65	G 35	G 30	P15	P14	P5	P11	12×ϕ65/ϕ40
ISH-04								
ISH-06	G 90	G 45	G 45					12×ϕ85/ϕ55
ISH-08								
ISH-10	G100	G 65	G 55				P14	12×ϕ100/ϕ70
ISH-12								
ISH-16	G125	G 80	G 70					12×ϕ120/ϕ85
ISH-20	G145	G100	G 95					12×ϕ140/ϕ105
ISH-24								

7-19 Pneumatic

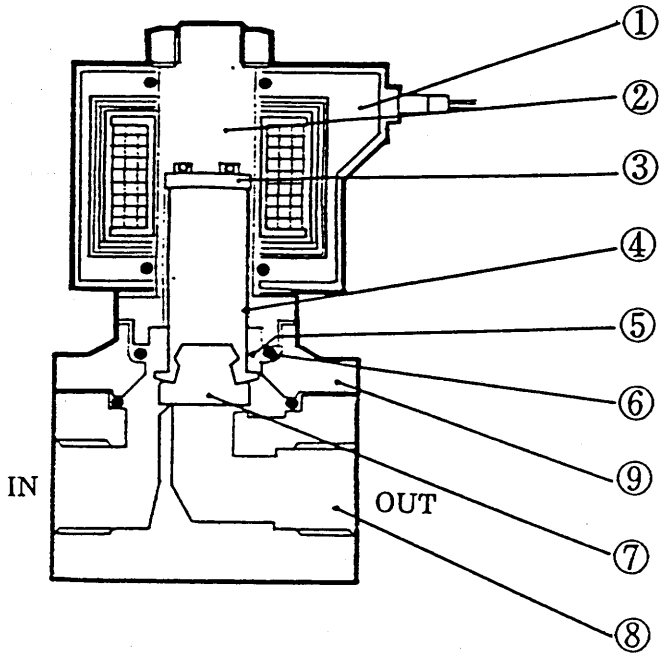
1. Circuit diagram and parts



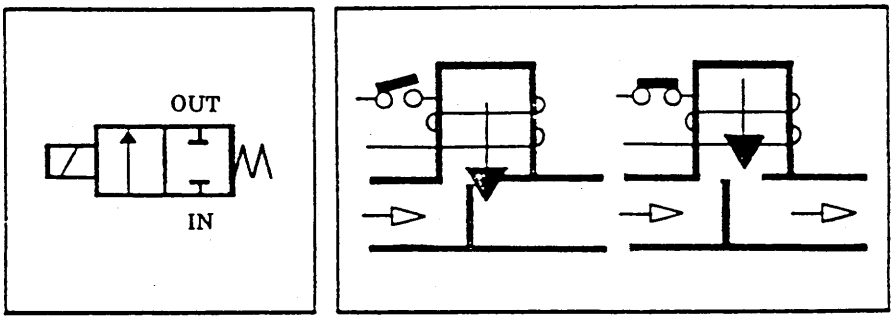
	Parts name	Model	Q'ty
27	Flow control valve	AS4000-02	1
26	Regulator	AR435-BG-02	1
25	Solenoid valve	AB41025	1
24	Lubricator	L300	1
23	N5 tube	N5-4-4x2	
22	N5 tube	N5-4-6x4	
21	N2 tube	N2-4-6x4	
20	Air limiter	S52-100-1013	1
19	Regulator	B2-19-2C-PB	1
18	Solenoid valve	AB41025	1
17	Air cylinder	SCA2-LB-40D-1126-K	1
16	Solenoid valve	4L240-06-F-AC100V	1
15	Distributor	VOD-A424444P	1
14	Pressure switch	BN1252-10	1
13	Pressure switch	BN1218-10	1
12	Regulator	B2019-2CPG	1
11	Solenoid valve	AB41025	1
10	Pair pump	SSNB330 NPSW16-20	1
9	Solenoid valve	AG33-02-2-AC100V	1
8	Solenoid valve	AG33-02-2-AC100V	1
7	Regulator	B2019-2CPG	1
6	Flow control valve	SC-8	1
5	Nozzle	MS2605	1
4	Solenoid valve	AB41025	1
3	Oil mist unit	MS-20L	1
2	Solenoid valve	AB41025	1
1	FR unit	U300-8A-FGB	1

2. Pneumatic Solenoid for Spindle Air-blow (Standard accessory)

AB 41025-02G-AC100V



JIS symbol



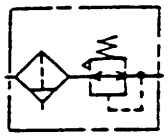
No.	Product name	Material
①	Coil	Resin, tape when class H
②	Core assembly	SUS405.316L.L.403
③	Shading coil	Cu, Ag when body made of SUS
④	Plunger	SUS405
⑤	Spring	SUS304
⑥	O-ring	Nitrile, Biton, Teflon AS568.019
⑦	Seal	NBR, Biton teflon
⑧	Body	C3771 or SUS303
⑨	Stuffing	C3771

3. Air Filter/Regulator Unit (High-speed Spindle Specifications)

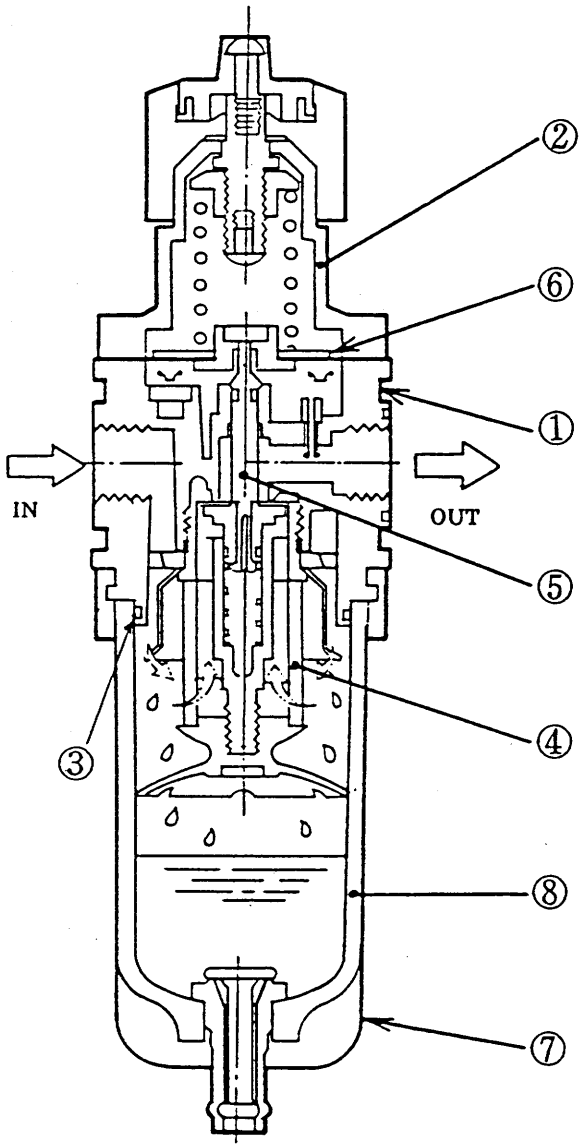
Outline and Features

Selex F.R Unit (U300) combines high water drop/dust eliminating effect which Filter F300 has and the accurate and stable pressure setting capacity which is held by Regulator R300. It is especially suitable for use in a small space.

JIS symbol



Internal Structure and Essential Parts: Parts List



U-300-8A-FGB

No.	Essentail part: Material			
①	Body ZDC2			
②	Cover ZDC2			
Parts List				
No.	Part name	Material	Product No.	Remarks
③	O-ring	NBR	78-5083	
④	Element	PP	85-5101	5μm
		Cotton	85-5000	3μm
		Cotton, Filter	85-5145	0.3μm
⑤	Valve seat	NBR, C3604	15-5349	
⑥	Diaphragm Assembly	-	15-5348	
⑦	Bowl guard	SPCE	11-5045	
⑧	Bowl Assembly	PC	15-5346	E type
			15-5362	F type

Special Remarks for Use

Note 1: Since the bowl is made of polycarbonate, avoid use of chemicals such as thinner, carbon tetrachloride, alcohol, chloroform, trichloroethylene, acetate, sulfuric acid, alkali solution etc.. Avoid, also, the use in the above environment.

Note 2: Use neutral detergent for domestic use to clean the bowl.

Note 3: Drainage accumulated in the bowl should not exceed the upper limit level of the drain.

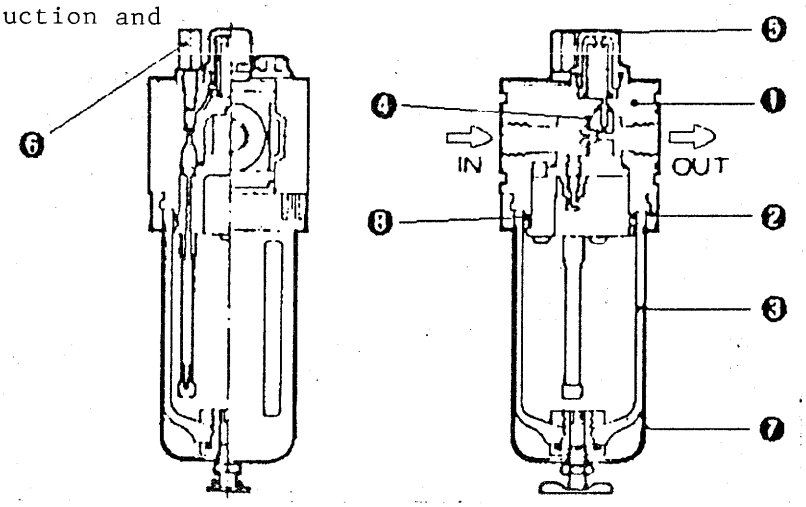
4. Lubricator

Outline and features

Lubricator (L300) built in variable flow control mechanism (Flow guide), supply fine oil mist to the air compresser, under minimal flow. Mounting/dismounting bowl and oil supply can be done under pressure for easy maintenance.

Modular type to easy mount on the other equipment.

Internal construction and parts list



No.	Description	Material	No.
①	Body	ZDC2	
②	Clamp ring	ZDC2	
③	Bowl Ass'y	PC	15-5350
④	Flow guide	NBR	79-5013
⑤	Sight dome	PC	19-5029
⑥	Adjusting screw	C3604	30-5406
⑦	Bowl guard	SPCE	11-5045
⑧	O-ring	NBR	78-5083

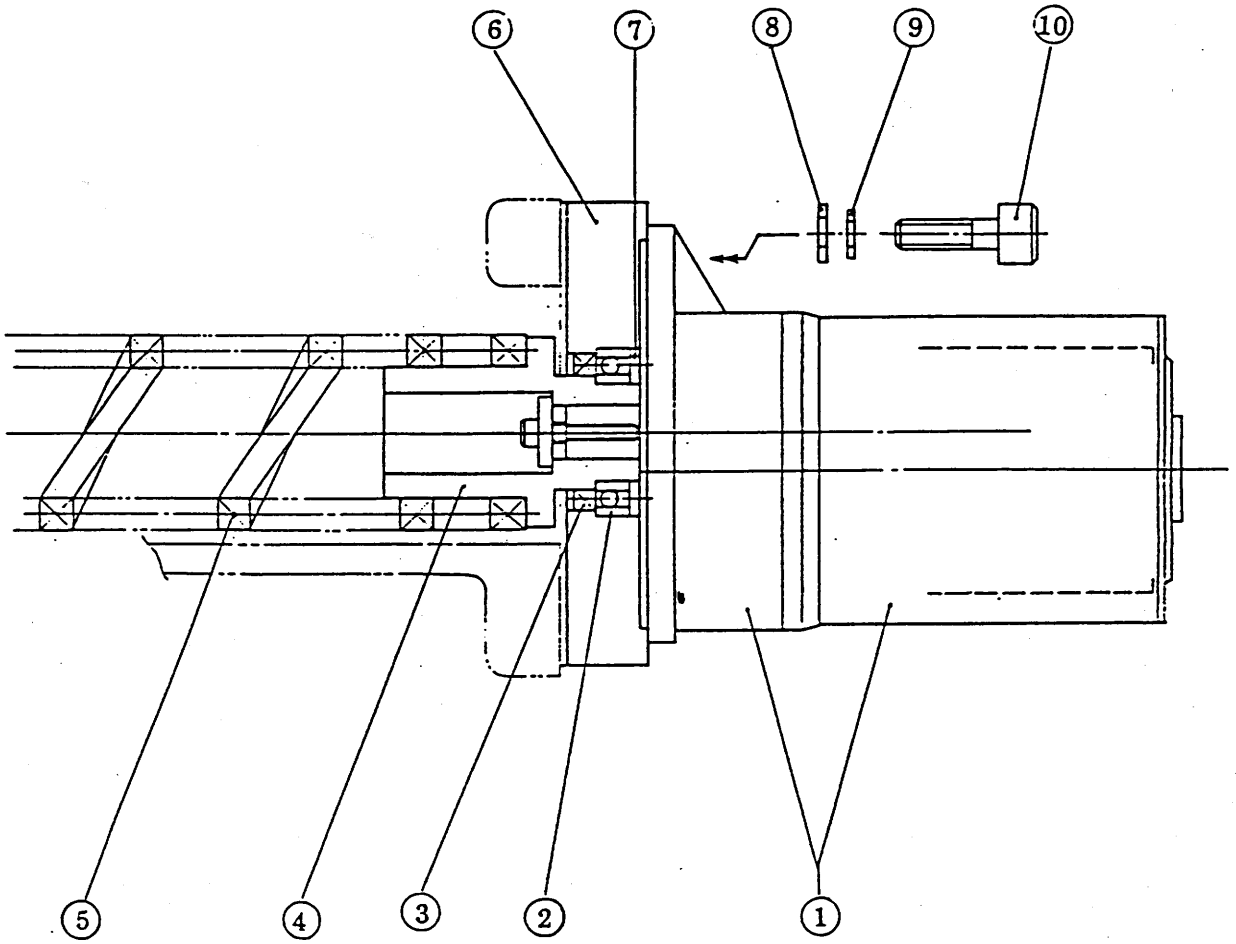
Special note for use

Note 1: Since the bowl is made of polycarbonate, avoid use of chemicals such as thinner, carbon tetrachloride, alcohl, chloroform, trichloroethylene, acetate, sulfuric acid, alkali solution etc.. Avoid also the use in the above environment.

Note 2: Oil dropping not available when insufficient air flow. Conhirm required minimal air flow to dropping.

Note 3: Use neutral detergent for domestic use to clean the bowl.

7-20 Spiral Conveyer (Standard Accessory)



TA 2-1974

No.	Parts name	Parts No.	Quantity	
①	Deceleration motor	GFM-18-50-010(T)	1	0.1KW-4P-1/50
②	Bearing	6007 · DDU	1	
③	Oil seal	AC 2365 EO	1	
④	Coil retainer	ϕ50-1974	1	
⑤	Coil spring	□12 × ϕ72 × P60	1	
⑥	Housing	160 × 230-1974	1	
⑦	Retainer	ϕ62	1	
⑧	Plain washer	1W-12	4	
⑨	Spring washer	2W-12	4	
⑩	Bolt	4B1250	4	

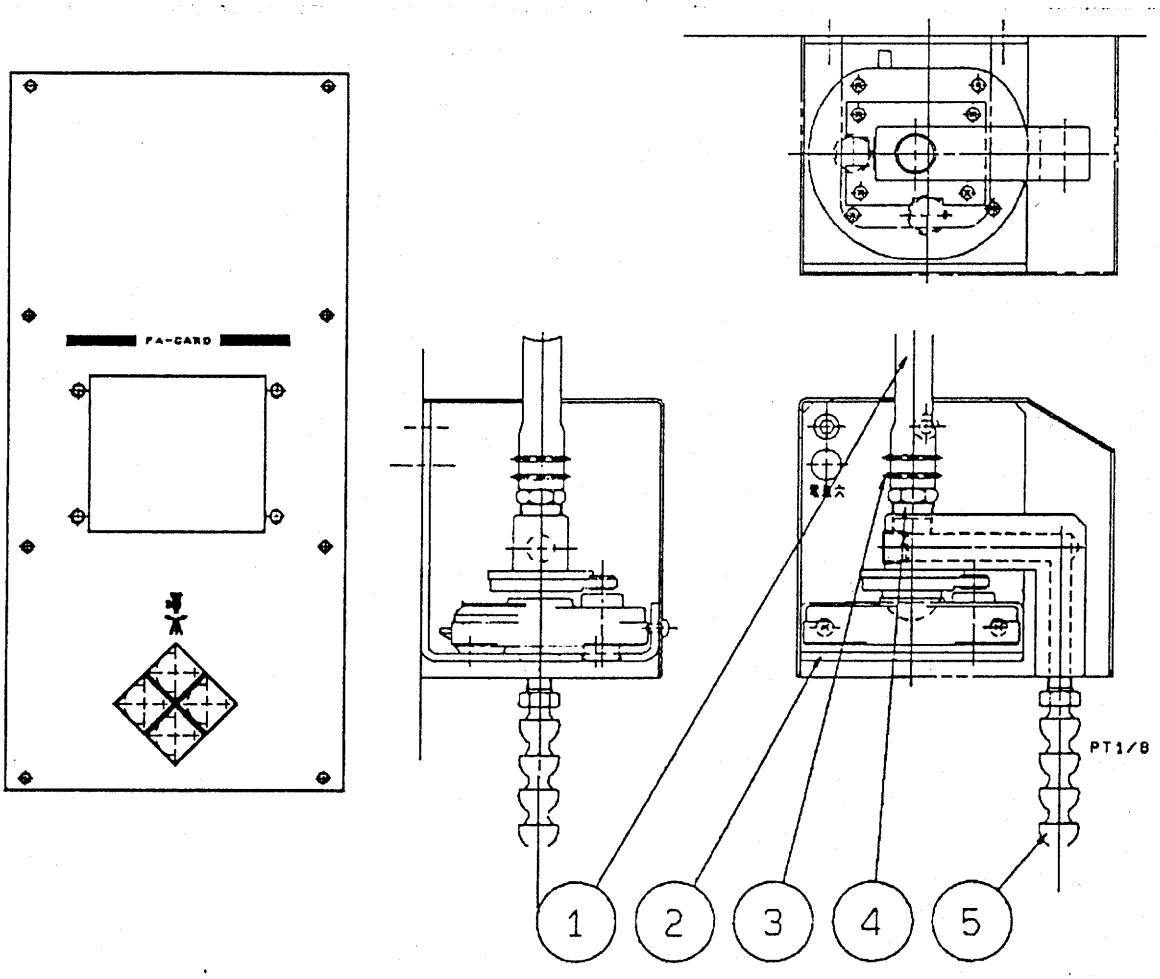
7-21 Handling of Remote Control Nozzle

Direction of nozzle driven by two small motors built in the plastic body. Operating direction is 20° in front and rear, left and right. Pay attention to operate the unit as follows.

o Upon reaching nozzle direction to limit, stop push button operation.

o Adjusting plastic nozzle direction, perform holding base by hand.

o Take care of pulling and forced shift of nozzle cause damage.

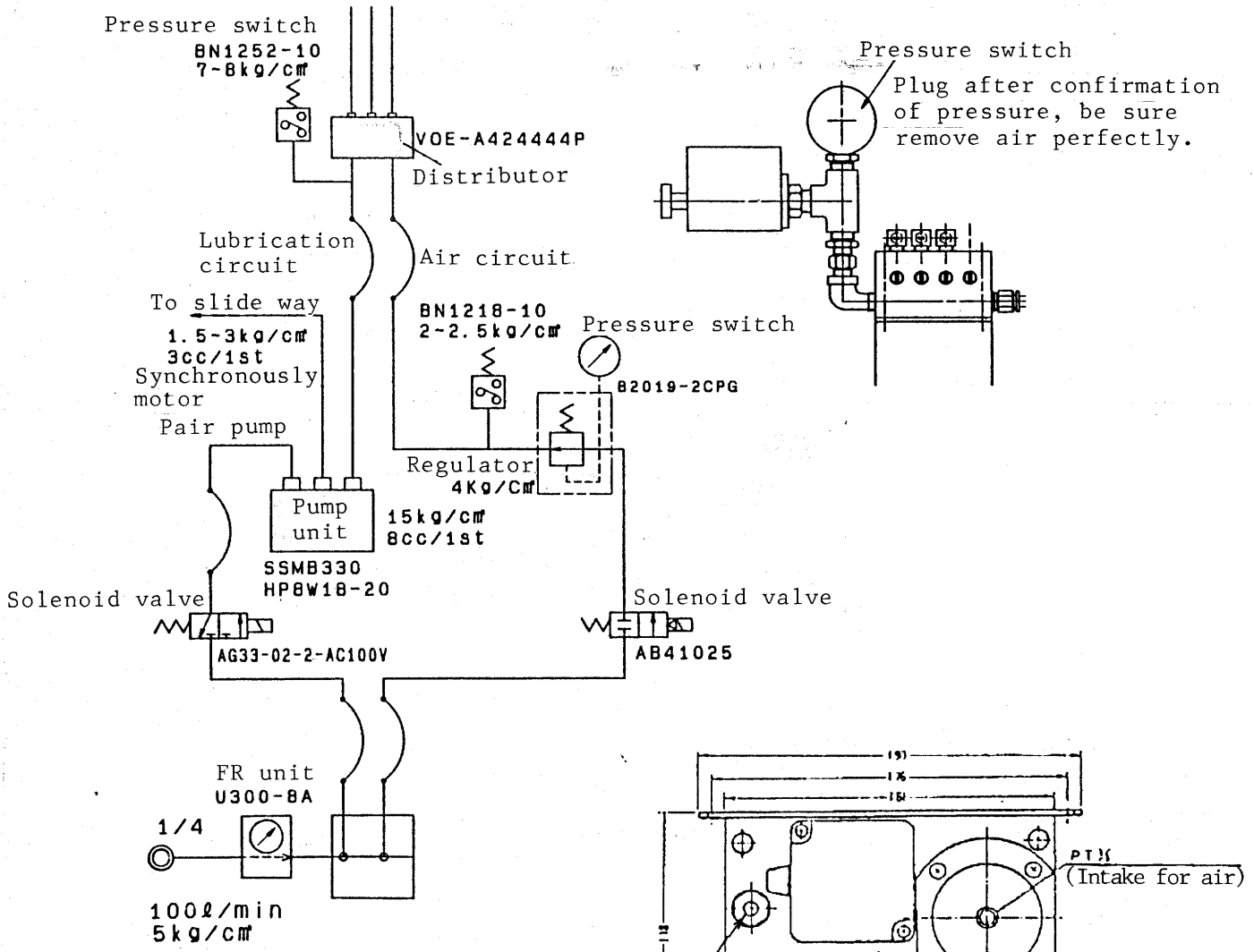


5	Coolant nozzle	40413. ϕ6.35ID
4	Joint, male thread	BSO-11
3	Wire clamp	AK-1017
2	Remote control unit	Motor unit for VK45
1	Rubber tube	NBR tube 12x17x285CM
	Description	Model

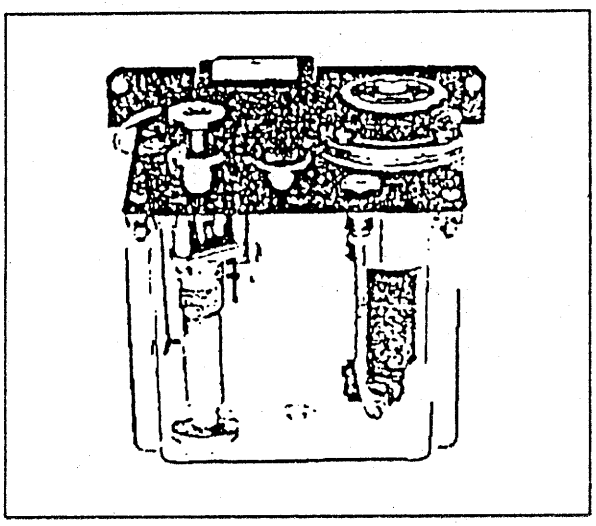
Oil-air lubrication diagram

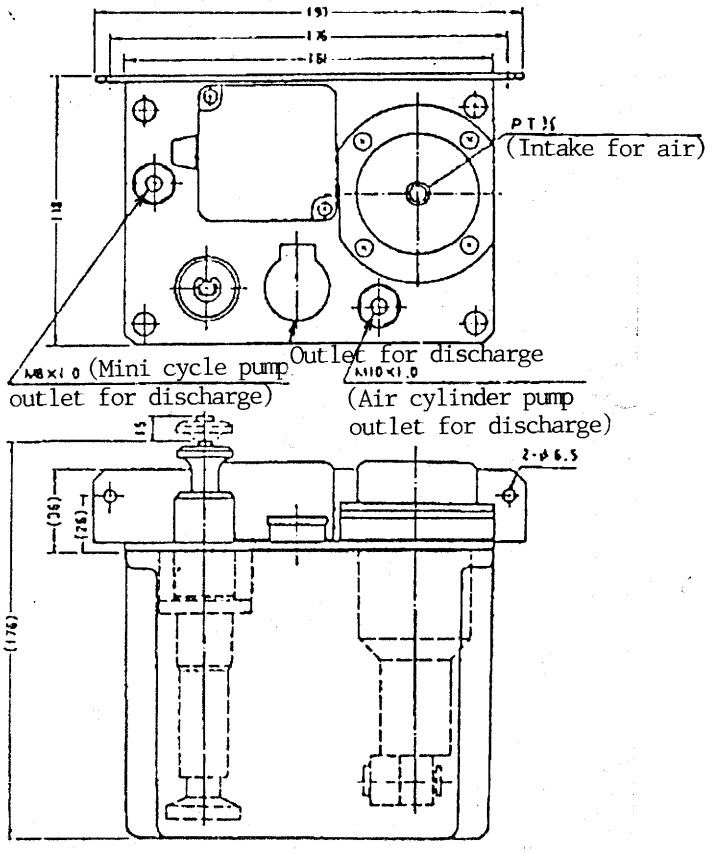
NT40. 12000 head

NT50. 6000 head



Pair pump (for high speed head)





☐ Description of model symbol

○ Mini cycle pump　　○ Air cylinder pump

SSMB　　HP

With releasing pressure system

Discharge pressure 16:16kg/cm^2, 18:18kg/cm^2
standard at air pressure 5kg/cm^2

Providing mini cycle pump by electricity and air cylinder pump by air, most sufficient pump for requiring two system in one unit.

* Possible varius combenation of mini cycle pump and air cylinder pump.

Tank	Capacity	2.0ℓ
	Effective capacity	1.5ℓ

☐ Specification

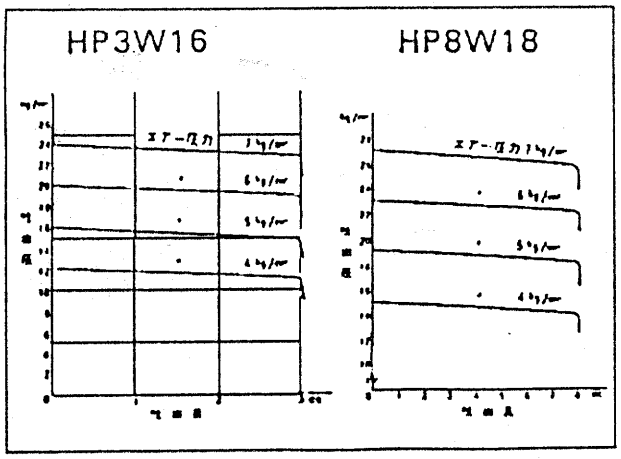
Model		HP8W18
Operating air pressure		4~7 kg/cm^2
Discharge		8cc/cy
Discharge pressure at 7kg/cm^2		26kg/cm^2
Discharge pressure at 4kg/cm^2		14kg/cm^2
Operating temperature limit (^{o}C)		-25-+70
Operating viscosity limit (cSt)		1~2000
Max. discharge frequency	35cSt	30 times/min.
	2000cSt	20 times/min.

*Max. discharge frequency based on open condition at discharge point.

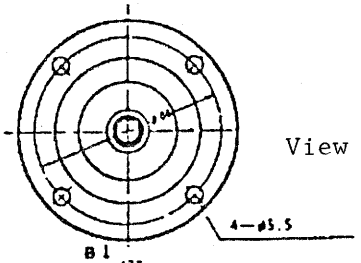
☐ Description of motion (refer to sketch below)

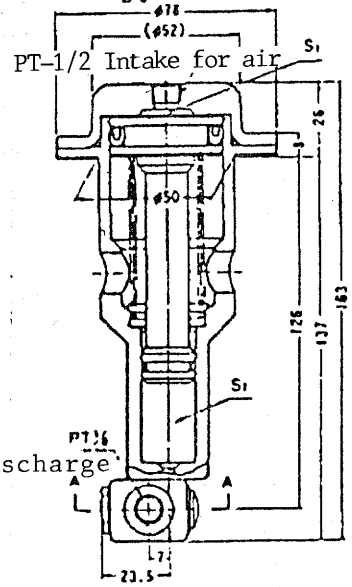
Lubricant is discharged by descenting piston when suppling air pressure to S_1. At this time necessary pressure is obtained by different area of piston S_1 and S_2. Pelease air pressure prepare next discharge by recovering force of spring. Releasing pressure of discharge side by releasing system at the same time.

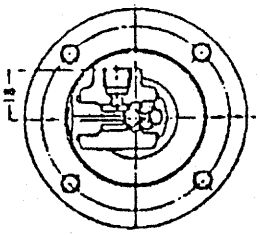
Characteristic of discharge and pressure



HP8W18







A-A section

7-22 Oil-air Lubrication for High Speed Head

1. Lubrication diagram (refer to Fig. 3)

   Pressure setting of PR unit is 5kg/cm^2. Setting pressure of regulator in air circuit is for NT50 is 3kg/cm^2, for NT40 is 4kg/cm^2.
   Adjustment has been done on lubrication circuit based on onr long experience of reserch and result. Occurring trouble on lubricating circuit cause frozen bearing, contact our CE center to adjust the unit.

2. Supplying motion of oil-air lubrication (refer to Fig. 4)

   Upon machine ready ON air is discharged, stop at OFF.
   Upon machine ready ON lubricant is discharged by cylinder operation inside of pair pump while solenoid energizes several seconds.
   After 15 minntes, upon spindle rotating solenoid energizes same as above and repeatedly discharged. Without spindle rotation lubricant is not supplied even if passing time.
   Distributor not working without proper pressure. Pressure switch is provided in circuit, stop machine with alarm if pressure is not reached to fixed value.
   Reason of no pressure, possible air get into circuit, remove air following under mentioned points.
   Mounting pressure gauge to confirm pressure on connector for pressure switch by distributor. ON and OFF the machine ready button repeatedly, remove air at connection area of pressure switch dischargin lubricant continuously.
   Place pressure switch downward at air removing perfectly.
   Consuming air volume in this air circuit per one distributor is 12 ~ 13 ℓ /min.

7-23 Jet Coolant

This coolant equipment is provided for large volume supply of coolant for cutting area on top of the table and flush out chip from inside of cutting area to outside.

Each nozzle is provided flow control valve and controls coolant flow according to cutting conditions and generating conditions of chips.

Inside of coolant tank provides three-ply strainer to prevent get chips into the pump.

Take care of handling of coolant tank as follows.

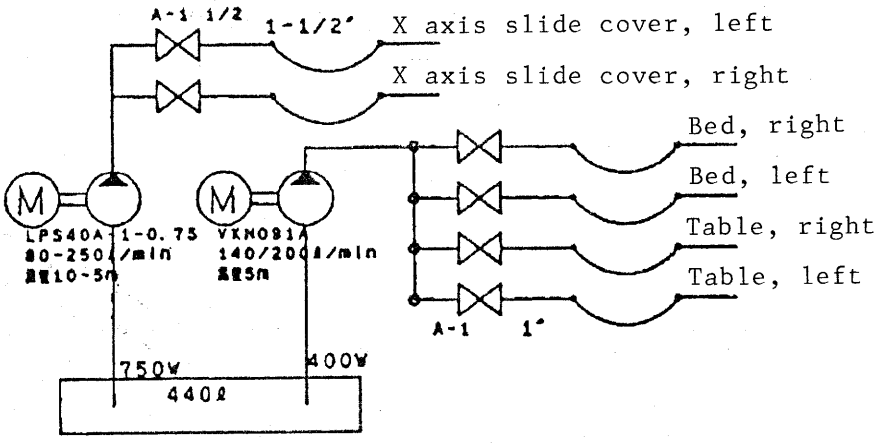
o Amount of coolant should be kept within the limit of oil gange.
  Oil level lowered beyond limit, cause trouble air get into the pump.

o Periodical check is required for clogging strainer.
  Severe clogging caused over flow oil on the floor due to no circulation the coolant to tank and the pump sucking air.

Further, if provided chip conveyor, should be stopped conveyor and check the equipment or dean the strainer.

Handling or checking conveyor, refer to instruction manual provided by mannfacturer.

Jet coolant circuit



Jet coolant tank (rear discharge)