

FANUC SYSTEM 6M-MODEL B

MAINTENANCE MANUAL

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1. GENERAL

FANUC SYSTEM 6M-MODEL B is a high-accuracy, high-performance fixed-software CNC for milling machines, developed with FANUC's total power, meeting needs in the world's market. The control circuit fully utilizes high-speed microprocessors, custom LSIs, and semiconductors, raising reliability and significantly improving cost/performance ratio.

FANUC SYSTEM 6M-MODEL B is a closed-loop CNC using world's most excellent and widely FANUC DC servo motor series employing a high-performance pulse encoder, resolver or inductosyn as the transducer.

FANUC SYSTEM 6M-MODEL B incorporates a self-diagnostic function, providing very easy maintenance together with this maintenance manual.

- The microprocessor, monitoring the internal operating condition at all times, classifies the condition and displays it, and in addition, when a trouble occurs, displays alarm message at once and stops the NC, and furthermore, classifies the trouble in detail and displays it.
- All on/off signals input to and output from the NC can be displayed on the display unit.
- Any on/off signal output from the NC can be transmitted in bits via the MDI unit.
- The current values of various parameters such as acceleration/deceleration time constants, rapid traverse speeds, etc. can be checked on the CRT display.

This manual discusses the preventive maintenance; quick trouble-shooting for possible failures (Chapter 3); check points, adjustments, and parameters in detail at the installation time of the NC (Chapter 4.5.6); and finally various technical information (Appendixes).

The author recommends that this manual be read in the order of the 1, 2, 4, 5, 6, 3 chapters, referring to relevant appendixes, and with the OPERATOR'S MANUAL (B-54044E) and the CONNECTING MANUAL (B-54043E) as required.

For the maintenance of FANUC DC Spindle Servo Unit and of FANUC AC Spindle Servo Unit, refer to FANUC DC Spindle Servo Unit Maintenance Manual (B-51649E) and FANUC AC Spindle Servo Unit Maintenance Manual (B-53425E), respectively.

Terms frequently employed in NC

Least input increment	Minimum unit of a move command input to the NC.
Least command increment	Minimum unit of command given from NC to machine tools
Detection unit	Minimum unit to be able to detect the machine tool position
Command multiplier (CMR)	Constant to set the weight of NC command pulses to the weight of pulses from the detector.
Detection multiplier (DMR)	Constant to set the weight of NC command pulses to the weight of pulses from the detector

(Note) The least input increment, detection unit, CMR, and DMR are related to each other as shown below.

$$\text{Least input increment} = \text{CMR} \times \text{detection unit}$$

$$\text{Detection unit} = \frac{\text{Move amount per rotation of motor}}{\text{DMR} \times \text{number of pulses of detector per rotation of motor}}$$

MDI/CRT panel	This is the abbreviation of Manual Data Input & CRT panel. This operator's panel is used to input commands to NC and display NC conditions by depressing key switches.
Parameter	A value to be set to fully display functional characteristics of an NC machine tool to the maximum extent when NC is combined with the machine tool

1.1 Structure

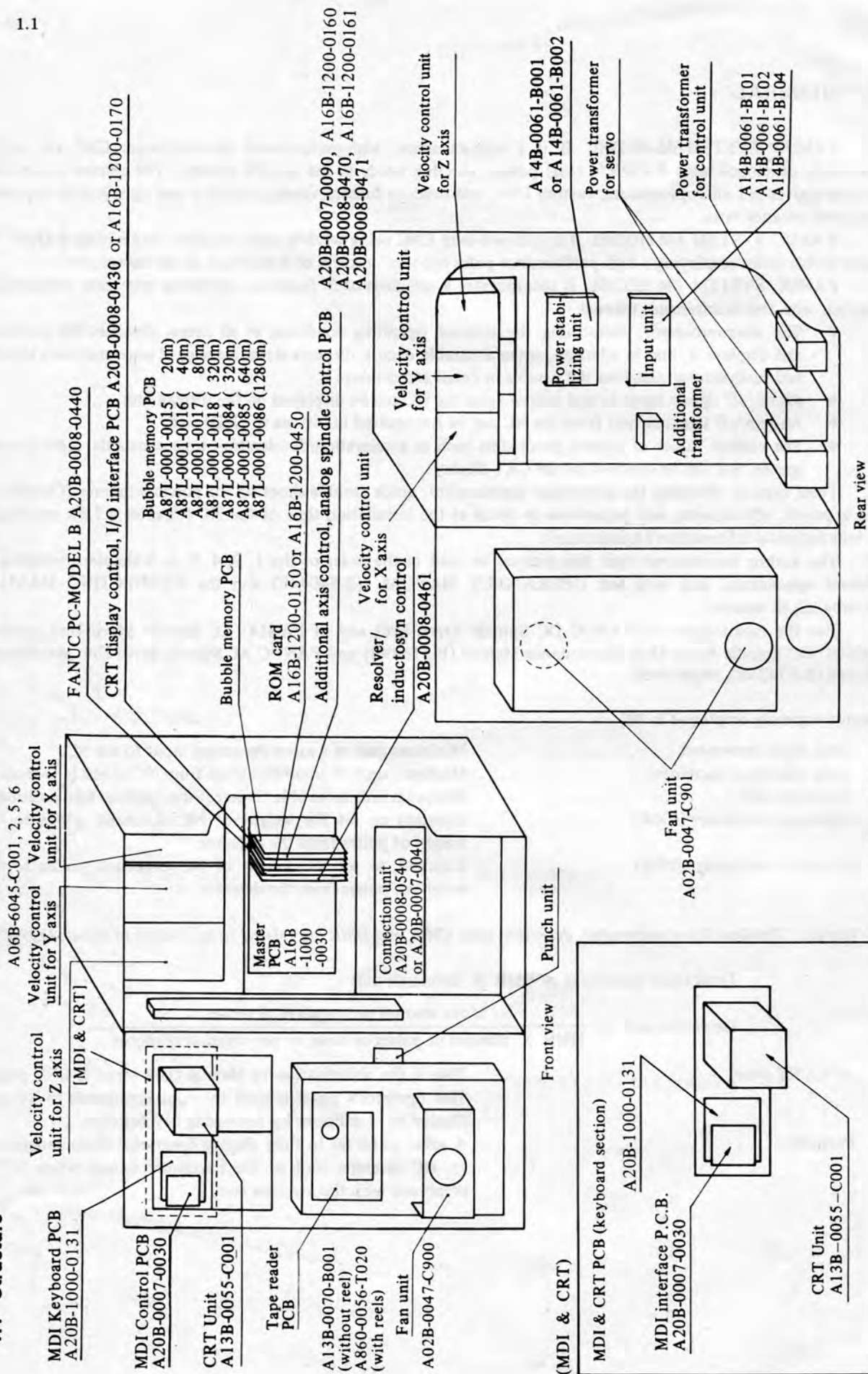


Fig. 1.1.1 Internal Layout of Free Standing Type Cabinet

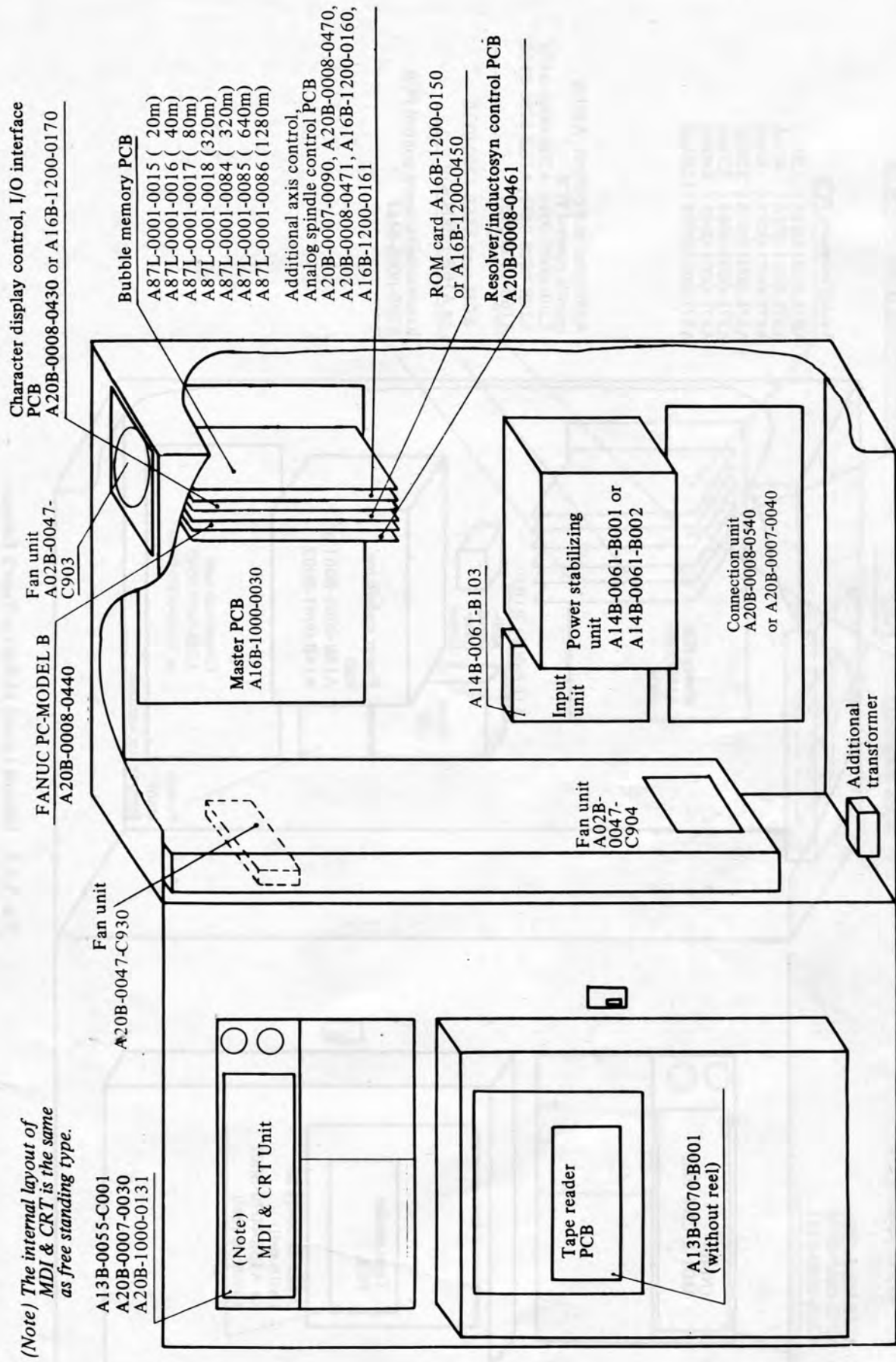


Fig. 1.1.2 Internal Layout of Built-in Type 1 Cabinet

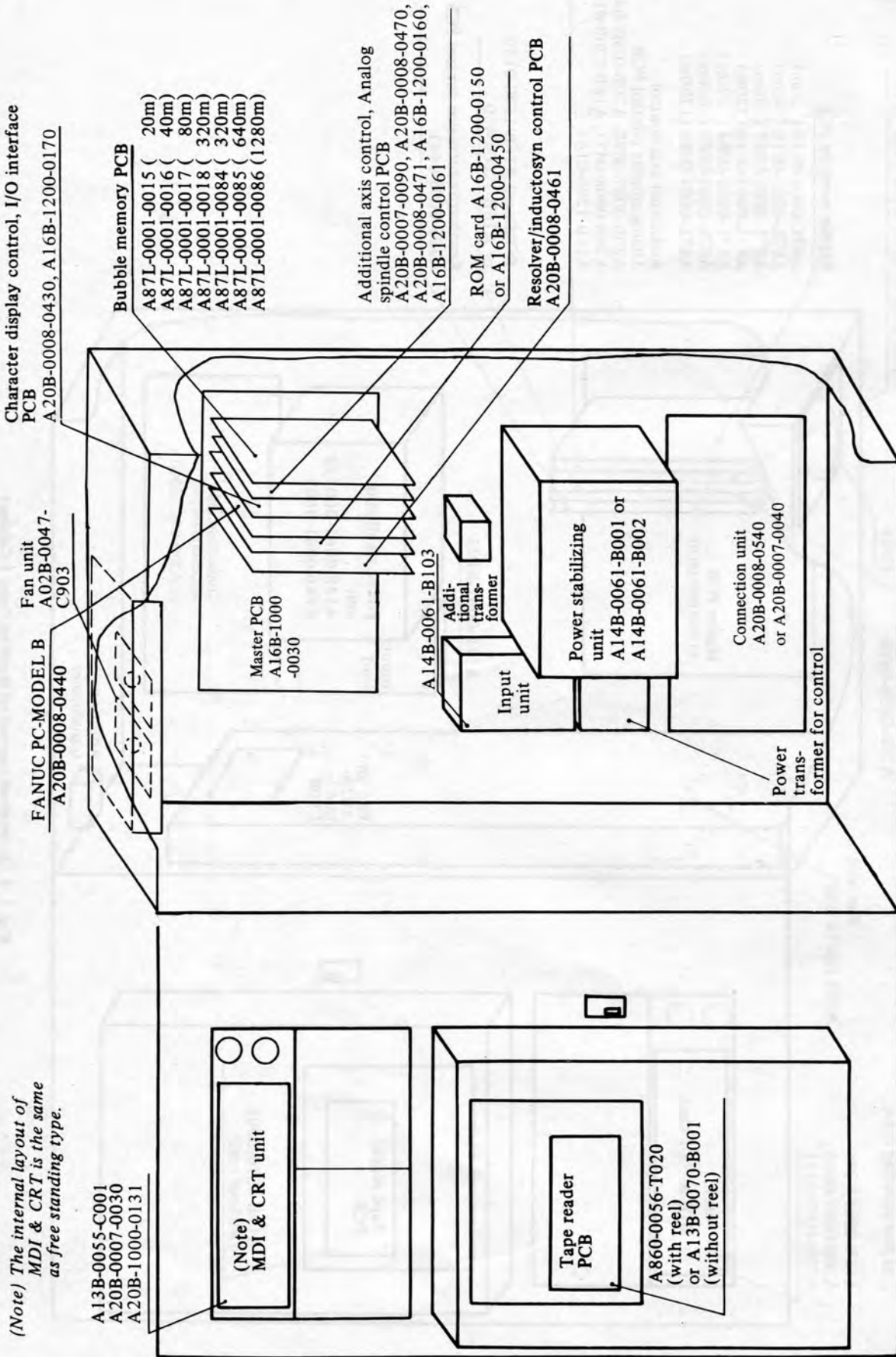


Fig. 1.1.3 Internal Layout of Built-in Type 2 Cabinet

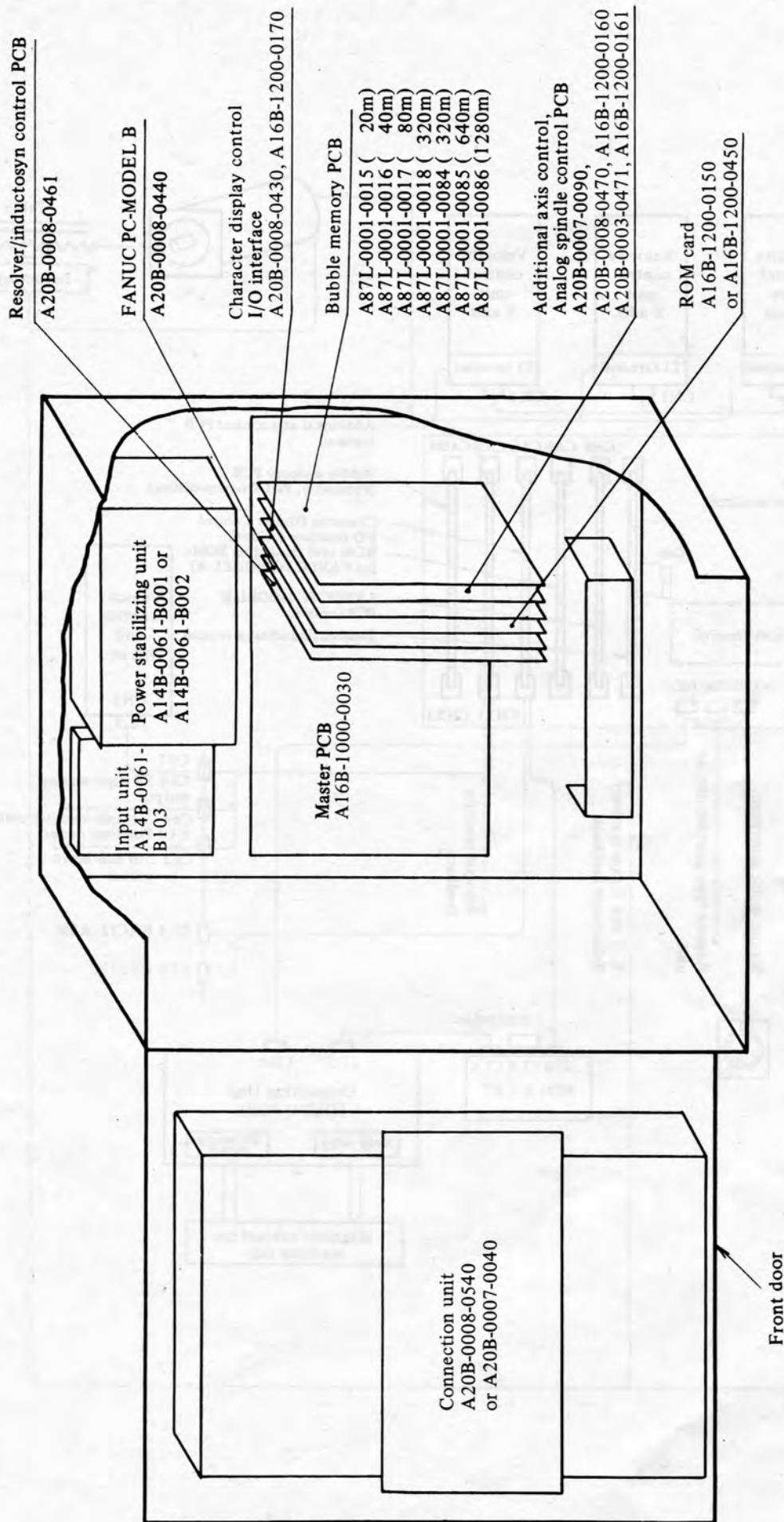
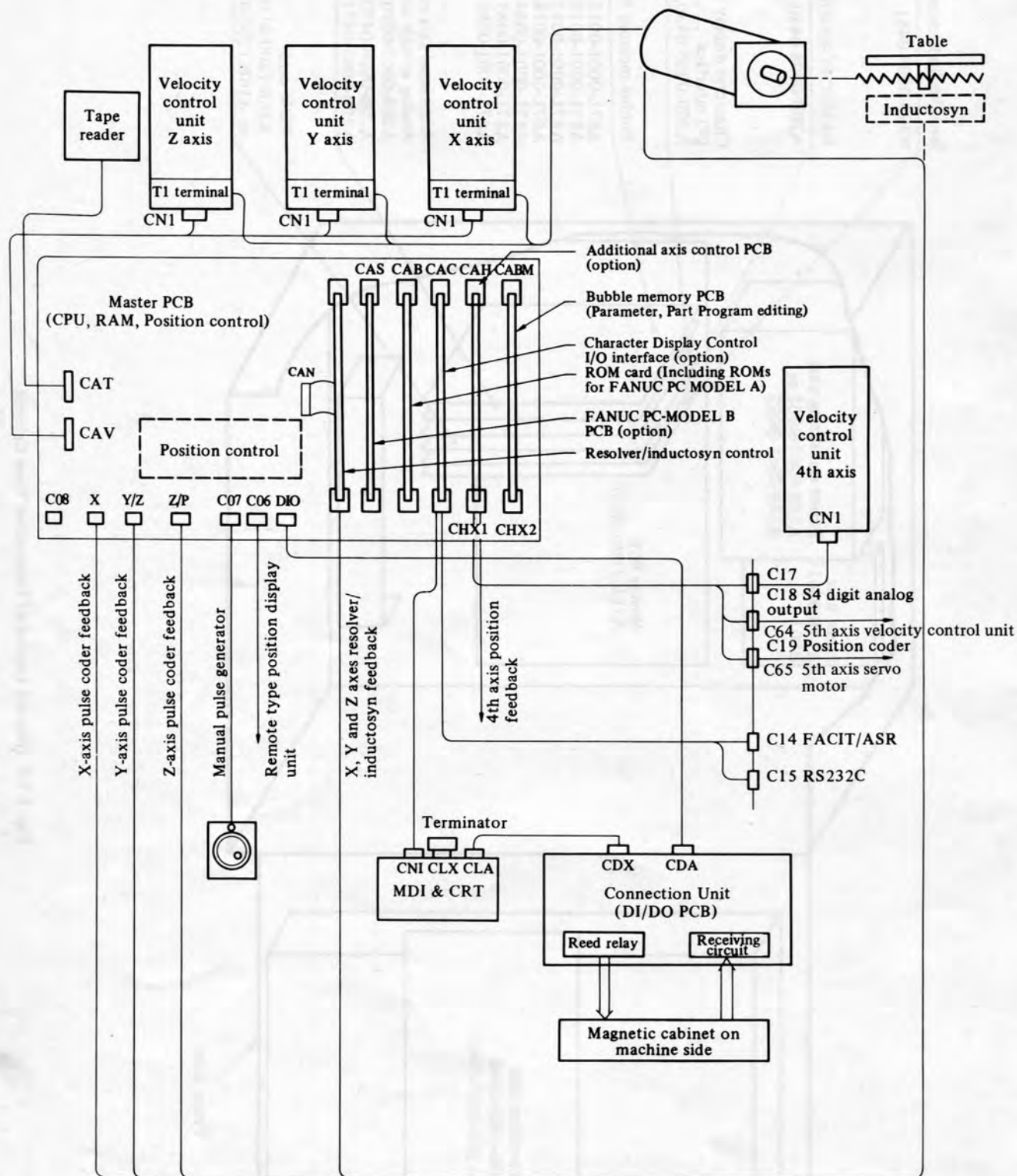


Fig. 1.1.4 Internal Layout of Unbundled Type Cabinet

1.2 Construction



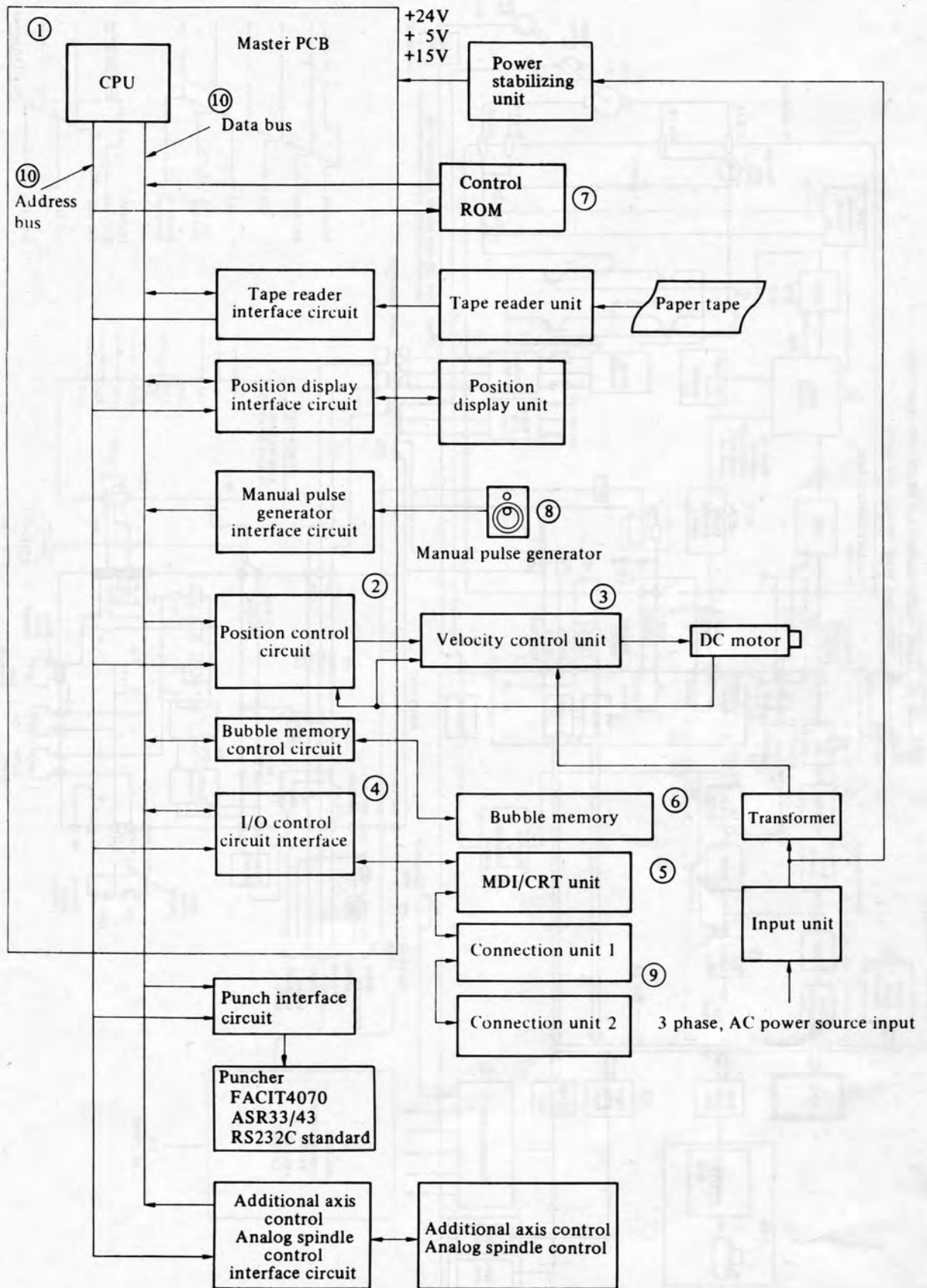
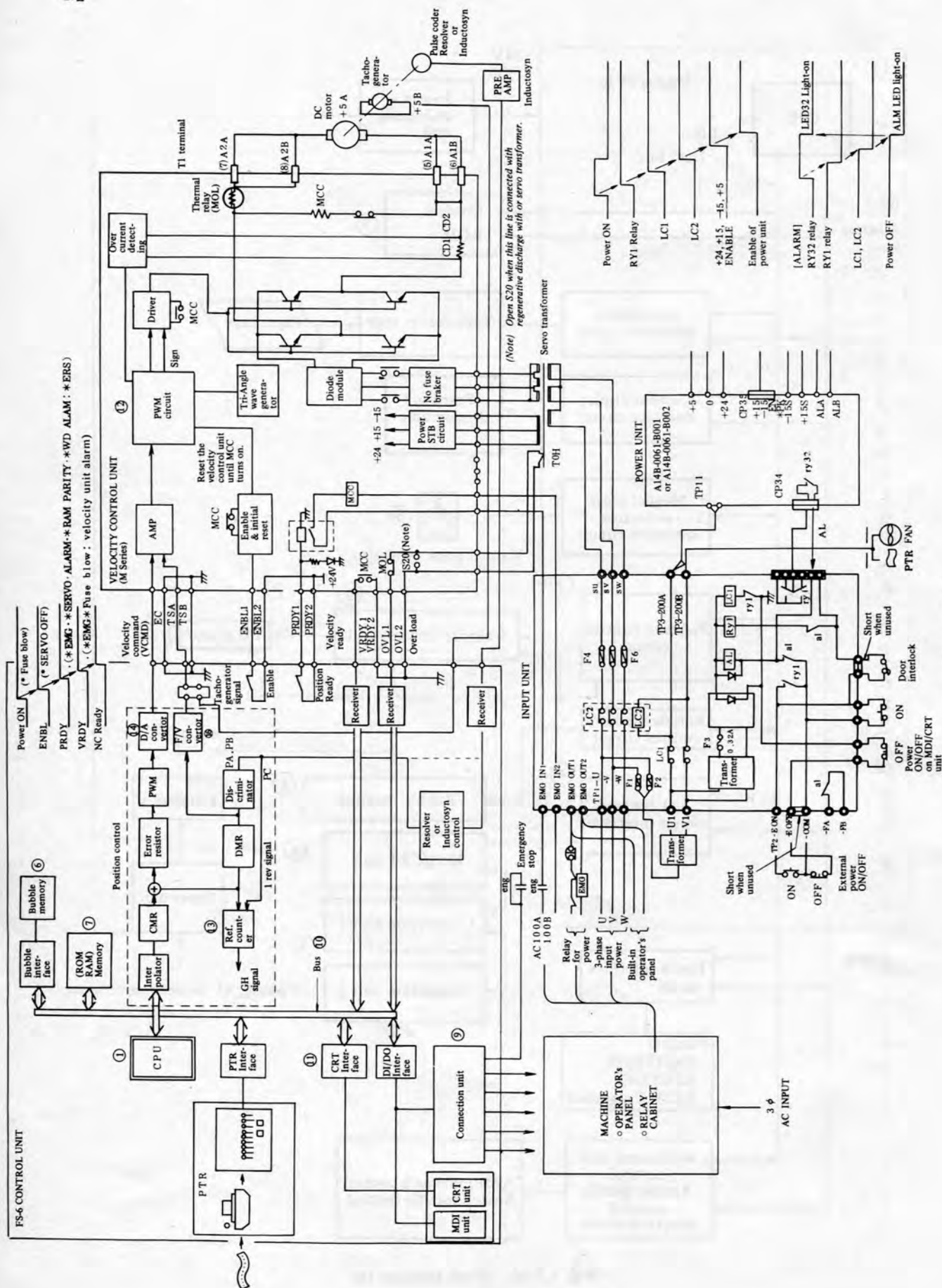


Fig. 1.2 (a) Block Diagram (a)



Explanation of Block Diagram

- ① **CPU: Central Processing Unit**
It controls each blocks through address bus and data bus by software write-in control ROM.
- ② **Position Control**
It controls velocity command voltage equalizing the command position from CPU with machine position detected by feedback pulses from position transducer.
- ③ **Velocity Control**
It controls the motor revolution speed comparing the velocity command value and velocity feedback value.
- ④ **I/O Control**
It controls the data transmission of input/output signals from machine side and MDI & CRT.
- ⑤ **MDI & CRT: Keyboard-type Manual Data Input & CRT Display**
- ⑥ **Bubble Memory**
It is one of memory elements utilizing magnetic bubble.
- ⑦ **ROM (Read Only Memory)**
No data can be written into this memory. ROM is exclusively used for read, and it normally stores control programs, constants, and other data.
RAM (Random Access Memory)
A storage device in which each element or cell is directly addressable at every moment or "at random" without preimposed order. This ensures equality of access time for all storage locations.
- ⑧ **Manual Pulse Generator**
This generator is graduated with 100 divisions per rotation, and it generates pulses by turning the handle. It is used for the fine feed adjustment.
- ⑨ **Connection Unit**
This unit controls I/O signals to and from the machine tool.
- ⑩ **Address bus/data bus**
These buses serve as memory address and data passages.
- ⑪ **CRT (Cathod Ray Tube):** Normally called Brown tube
- ⑫ **PWM (Pulse Width Modulation):** Converts error voltage into pulse width
- ⑬ **Reference Counter:** counts grid signal
- ⑭ **D/A converter (Digital to Analog converter)**
- ⑮ **F/V converter (Frequency to Voltage converter)**

Table 1.2 Main components

Name	Symbol	Specification	Remarks
Input unit		A14B-0061-B101	For free standing type cabinet, Capacity of servo unit fuse: 30A For Japan
		A14B-0061-B102	For free standing type cabinet, Capacity of servo unit fuse: 30A For export
		A14B-0061-B103	For built-in type 1, 2 and unbundled type cabinets
		A14B-0061-B104	For free standing type and built-in type 2 cabinets, Capacity of servo unit fuse: 40A For Japan and export
Power stabilizing unit		A14B-0061-B001 or A14B-0061-B002	
Power supply ON/OFF control PCB (Note 1)		A20B-0007-0340	Control circuit for power ON/OFF and external power ON/OFF (EON/EOF) Door interlock
Power stabilizing PCB (Note 1)		A20B-0007-0330 A20B-1000-0030	For stabilizing + 5V, $\pm 15V$ and + 24V power
Tape reader unit		A13B-0070-B001	Without reel
		A860-0056-T020	With reels
Master PCB	A	A16B-1000-0030	CPU, Memory (work RAM) Position control for 3 axes
Control ROM PCB	B	A16B-1200-0150 or A16B-1200-0450	ROM for control program, ROM for FANUC PC-MODEL A (option) (Note 2)
MDI & CRT control PCB	L	A20B-0007-0030	MDI control circuit (9" CRT)
		A20B-1000-0500	MDI control circuit (14" color CRT)
MDI & CRT keyboard PCB		A20B-1000-0131	Switch circuit (Data switch, Address switch . . .) (9" CRT)
		A20B-1000-0510	" (14" color CRT)
		A20B-1000-0380	" (14" color CRT)
Connection unit	D	A20B-0007-0040 or A20B-0008-0540	Control of I/O signals for the machine tool DI 96 signals { Contact receiver: 88 signals Proximity switch receiver: 8 signals DO 64 signals { Reed relay: 52 signals Photo coupler: 12 signals
Programmable controller (FANUC PC-MODEL B)	S	A20B-0008-0440	Control circuit for FANUC PC-MODEL B (option)
Inductosyn/resolver control	N	A20B-0008-0461	Inductosyn/resolver control (option)
CRT & I/O interface PCB	C	A20B-0008-0430 or A16B-1200-0170 or A16B-1200-0310	Control circuit for MDI & CRT unit I/O interface (FACIT, ASR, RS232C) (option)

Name	Symbol	Specification	Remarks	
14" color graphic control PCB	G	A20B-1000-0480	Figure generation of 14" color graphic	
Power for 14" color graphic		A20B-1000-0470		
Bubble memory PCB	BMU	A87L-0001-0015	Tape length: 20m	
		A87L-0001-0016	Tape length: 40m	
		A87L-0001-0017	Tape length: 80m	
		A87L-0001-0018	Tape length: 320m	
		A87L-0001-0084	Tape length: 320m	
		A87L-0001-0085	Tape length: 640m	
		A87L-0001-0086	Tape length:1280m	
Position display PCB1 (Display control section)	J	A20B-0007-0411 A20B-0007-0412 (for 4 Axes)	Data transmission Receiver circuit (option)	
Position display PCB2 (LED display section)		A20B-0007-0421 A20B-0007-0422 (for 4 Axes)	Used with PCB1 to light LEDs. (Note 2) (option)	
Velocity control unit (M series)		A06B-6047-H001	For model 00M	
		A06B-6047-H002	For model 0M, 5M	
		A06B-6047-H003	For model 10M, 20M	
		A06B-6047-H040	With separated type regenerative discharge circuit.	
		A06B-6047-H004	For model 30M	
		A06B-6047-H041	With separated type regenerative discharge circuit.	
		A06B-6047-H005	For model 30MH	
Velocity control PCB		A20B-0009-0320		
Additional axis control/ analog spindle output	H		4th axis	5th axis or S analog output
		A20B-0007-0090	Pulse coder	Pulse coder
			Pulse coder	S analog output
		A20B-0008-0470	Resolver	S analog output
		A20B-0008-0471	Inductosyn	S analog output
		A16B-1200-0160	Resolver	Resolver/inductosyn
		A16B-1200-0161	Inductosyn	Resolver/inductosyn

(Note 1) Power supply ON/OFF control PCB is included in the input unit and Power stabilizing control PCB is included in the Power stabilizing unit.

(Note 2) ROMs for PC-MODEL A are not mounted on A16B-1200-0450.

(Note 3) LED: Light Emitting Diode

2. PERIODICAL MAINTENANCE AND MAINTENANCE EQUIPMENT

FANUC SYSTEM 6M-MODEL B is given considerations in design from the view point of maintenance, such as reduction of regular check points to a minimum, easy adjustment, etc. On the other hand, it is important that the user should make the departments concerned fully know the concept of preventive maintenance to run the NC machine tool in a good condition for a long time.

Preventive maintenance needs the following:

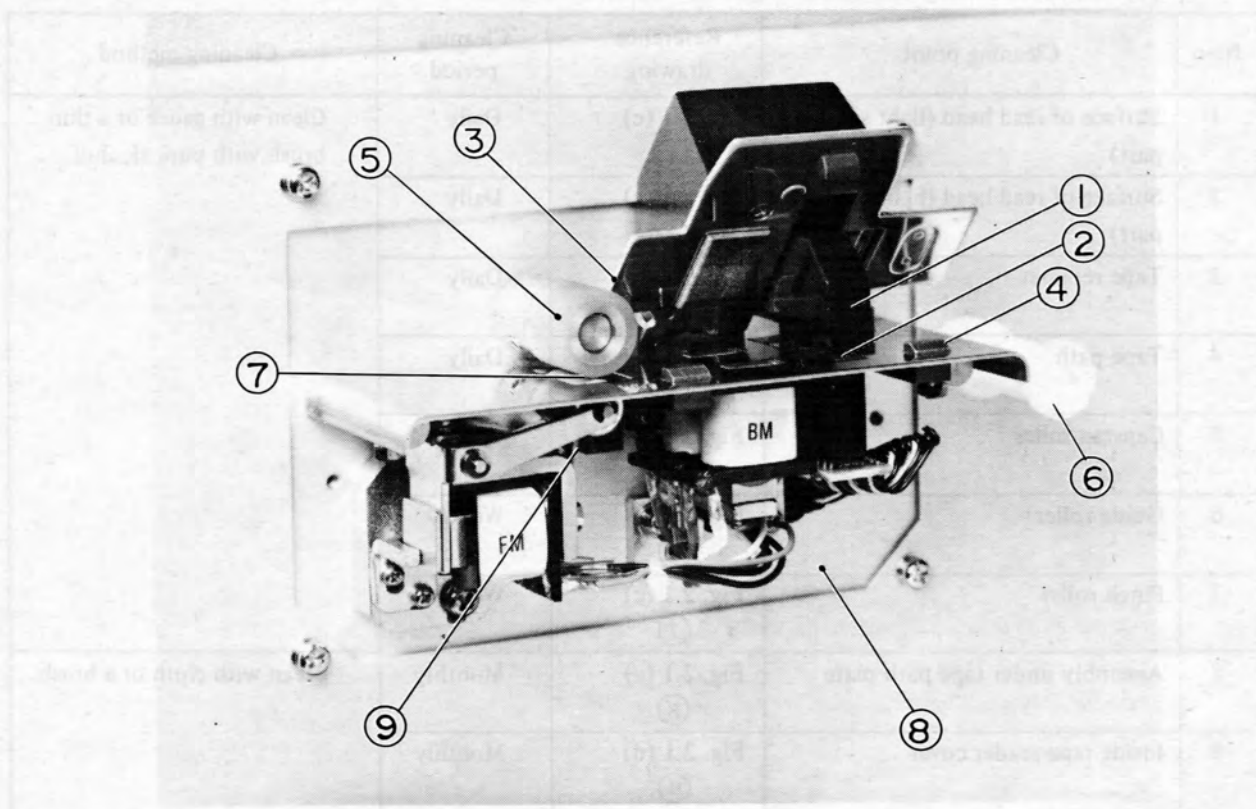
- Routine check and adjustment.
- Arrangement of maintenance tools.
- Main spare parts.

2.1 Periodical maintenance

(1) Tape reader cleaning

(a) Tape reader without reel

Item	Cleaning point	Reference drawing	Cleaning period	Cleaning method
①	Surface of read head (light sensing part)	Fig. 2.1 (a) ①	Daily	Clean with gauze or a thin brush with pure alcohol.
②	Surface of read head (light emitting part)	Fig. 2.1 (a) ②	Daily	
③	Tape retainer	Fig. 2.1 (a) ③	Daily	
④	Tape path	Fig. 2.1 (a) ④	Daily	
⑤	Capstan roller	Fig. 2.1 (a) ⑤	Weekly	
⑥	Guide roller	Fig. 2.1 (a) ⑥	Weekly	
⑦	Pinch roller	Fig. 2.1 (a) ⑦	Weekly	
⑧	Assembly under tape path plate	Fig. 2.1 (a) ⑧	Monthly	Clean with cloth or a brush.
⑨	Inside tape reader cover	Fig. 2.1 (b) ⑨	Monthly	



(A13B-0070-B001)

Fig. 2.1 (a) Tape reader without reel front view (with cover removed)

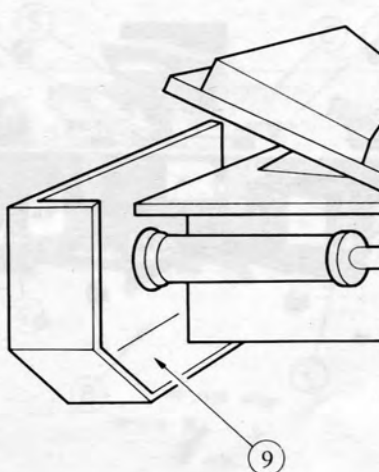


Fig. 2.1 (b) Tape reader side view

(b) Tape reader with reels

Item	Cleaning point	Reference drawing	Cleaning period	Cleaning method
1	Surface of read head (light sensing part)	Fig. 2.1 (c) ①	Daily	Clean with gauze or a thin brush with pure alcohol.
2	Surface of read head (light emitting part)	Fig. 2.1 (c) ②	Daily	
3	Tape retainer	Fig. 2.1 (c) ③	Daily	
4	Tape path	Fig. 2.1 (c) ④	Daily	
5	Capstan roller	Fig. 2.1 (c) ⑤	Weekly	
6	Guide roller	Fig. 2.1 (c) ⑥	Weekly	
7	Pinch roller	Fig. 2.1 (c) ⑦	Weekly	
8	Assembly under tape path plate	Fig. 2.1 (c) ⑧	Monthly	Clean with cloth or a brush.
9	Inside tape reader cover	Fig. 2.1 (d) ⑨	Monthly	

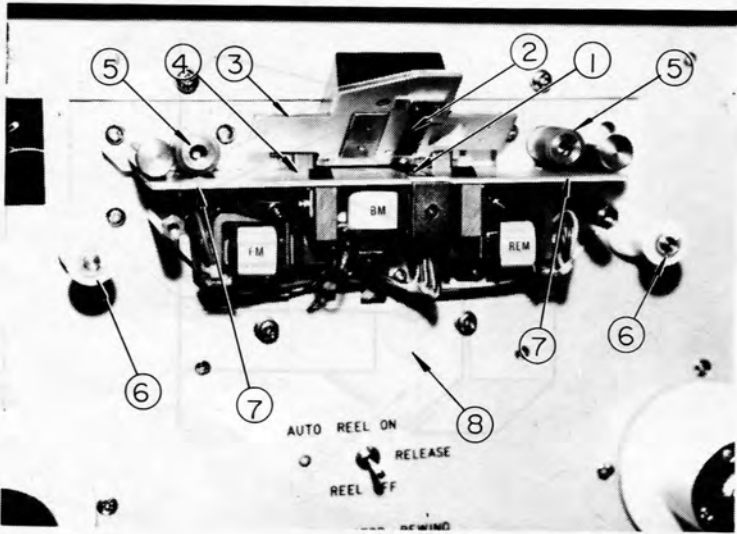


Fig. 2.1 (c) Tape reader with reels front view (with over removed)

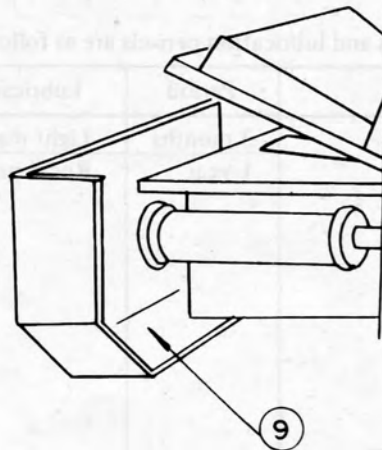
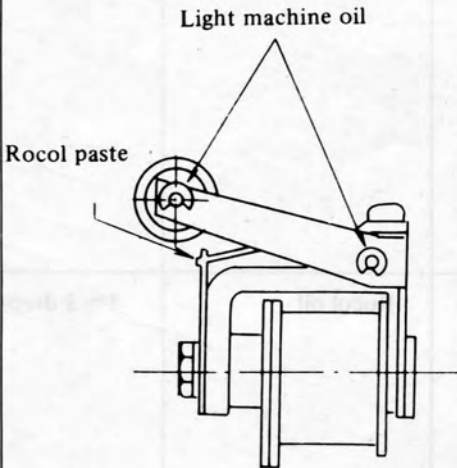


Fig. 2.1 (d) Tape reader side view

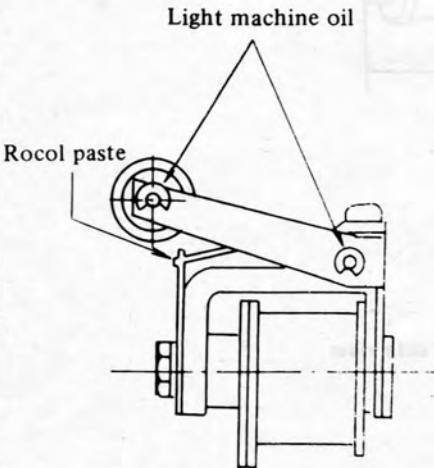
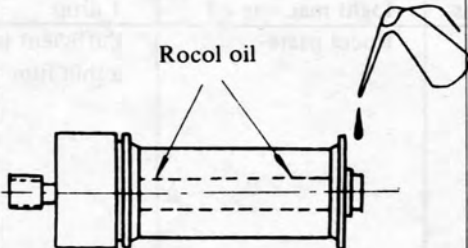
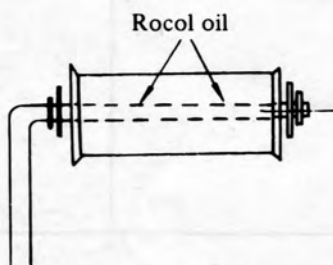
(2) Tape reader lubrication

(a) Tape reader without reel lubrication

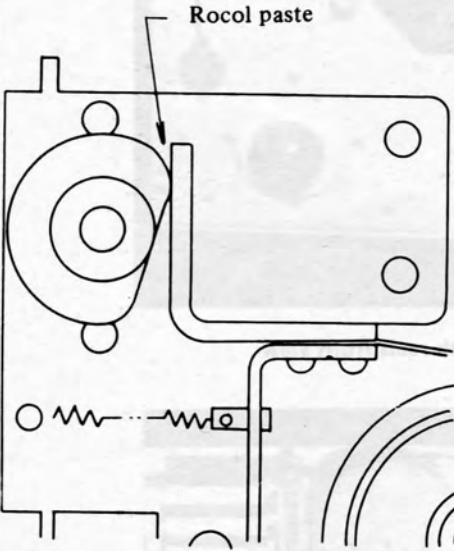
The routine lubrication points and lubrication periods are as follows:

Item	Lubrication point	Period	Lubricant (Note)	Amount
1	Magnet section	3 months	Light machine oil	1 drop
		1 year	Rocol paste	Sufficient to form a thin film
 See Fig. 2.1 (a) 5				

(b) Tape reader with reels
The routine lubrication points and lubrication periods are as follows:

Item	Lubrication point	Period	Lubricant (Note)	Amount
1	Magnet section	3 months	Light machine oil	1 drop
		1 year	Rocol paste	Sufficient to form a thin film
	 See Fig. 2.1 (e) ①			
2	Guide roller	6 months	Rocol oil	2 ~ 3 drops
	 See Fig. 2.1 (e) ②			
3	Tension arm guide roller	6 months	Rocol oil	2 ~ 3 drops
	 See Fig. 2.1 (f) ③			

Item	Lubrication point	Period	Lubricant (Note)	Amount
4	Cam	3 months	Rocol paste	Sufficient to form a thin film



See Fig. 2.1 (g) ④

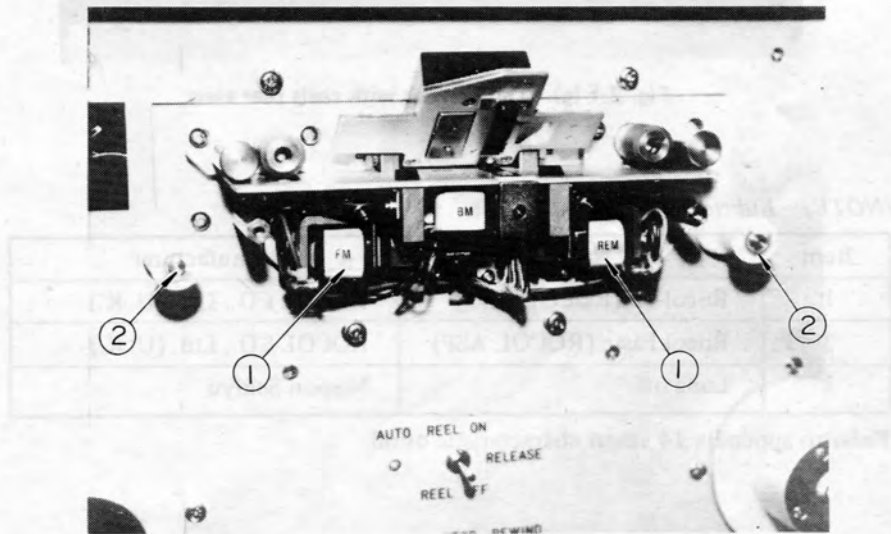


Fig. 2.1 (e) Tape reader with reels front view (with cover removed)



Fig. 2.1 (f) Tape reader with reels front view

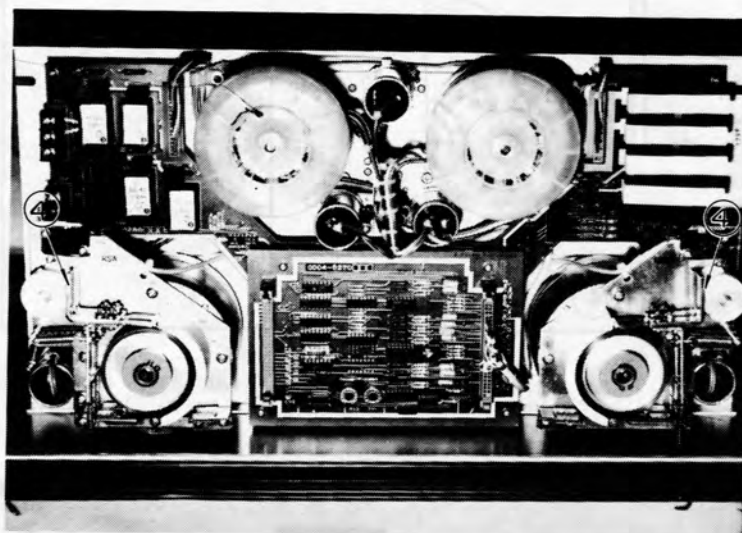


Fig. 2.1 (g) Tape reader with reels rear view

(NOTE) Lubrication

Item	Name	Manufacturer
1	Rocol oil (ROCOL ASO)	ROCOL CO., Ltd. (U. K.)
2	Rocol Paste (ROCOL ASP)	ROCOL CO., Ltd. (U. K.)
3	Luna oil	Nippon Sekiyu

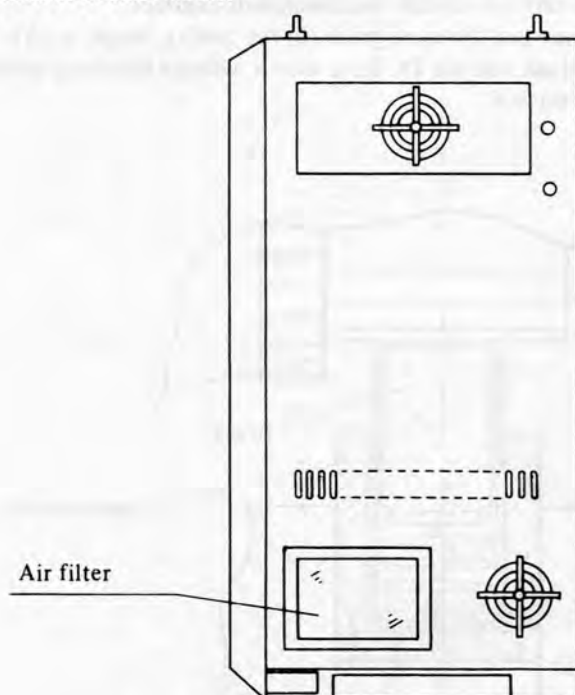
Refer to appendix 14 about characteristic of oil.

(3) Air Filter cleaning (For free standing type cabinet only)

When the air filter installed at the bottom rear of the equipment is dusty, the dust collection efficiency will drop, and the temperature in the equipment will rise. Therefore the filter must be cleaned weekly, as follows:

- (a) Remove the fastener, and remove the air filter from the bottom rear of the equipment.
- (b) Blow the air filter out with compressed air from the inside while shaking the filter lightly.
- (c) When the filter is very dirty, wash it in a neutral cleaner with pressure and then dry in the shade. (At this time, do not wash it with rubbing)

Wash it with pressure in the neutral cleaner and water (about 40°C or 104°F) (cleaner 5: water 95), then rinse it in clear water.



(Two servo power transformers of free standing type)

(4) Check and Cleaning of Motor Brush

- (a) Check and clean the motor brush in the way explained in the following. If the motor brush is abnormally worn because of forgetting the check, the motor can be damaged as the result, therefore, be sure to check the motor brush.
 - (i) Periodic check should be made at the intervals listed in the following as the standard.
 - In the case of a general machine tool (lathe, milling machine, machine center, or such): Every one year
 - In the case of a machine tool with a high frequency of acceleration/deceleration (turret punch press or such): Every two months
 However, it is recommended that the check interval be determined judging the actual wear situation of the motor brush.
 - (ii) Confirm that the power supply to the DC servo motor (machine) is OFF. Immediately after the DC servo motor has been operated, the brush may be hot. In such a case, make the check after the brush is completely cooled.
 - (iii) Remove the brush cap, as shown in Fig. A, using a screwdriver which fits to the slot.
 - (iv) After taking out the brush completely, measure (visually) the length of the brush (see Fig. B). If the length of the remaining brush is shorter than 10mm (5mm for model OOM), the brush cannot be used any more. Taking this fact into consideration, make a judgement as to whether the brush can be used until the next check time, and if necessary, replace the brush with a new one.
 - (v) Check the brush very carefully. If any deep groove or scar is found on the contact surface of the brush or if any mark of arcing is perceived on the brush spring, replace the brush with a new one. In this case, check the brush occasionally for about a month after the replacement, and if the same situation happens during this period, contact our nearest service station.

- (vi) Blow off the brush dust in every brush holder with compressed air (factory air), and the brush dust will come out through another brush holder. Before using the compressed air, confirm that the air does not contain iron dust or a large amount of moisture.
- (vii) After the check, put back the brush and tighten the brush cap fully. In this case, be careful that sometimes the brush spring is caught in between the conducting metal and brush holder and the brush cap cannot go as far as the depth. Confirm that all the brush caps are tighten into the respective brush holders to almost the same level. When putting the brush into the brush holder, sometimes the brush cannot smoothly slide due to the brush dust which adhered to the inside surface of the brush holder. In such a case, clean the inside surface of the brush holder with the tip of a screwdriver. (Take care not scratch the commutator surface.)
- (viii) When replacing the brush, use just the same brush (in the quality, shape, etc.) as the existing one. After replacement of the brush, run the DC servo motor without load for a while to fit the brush surface to the commutator surface.

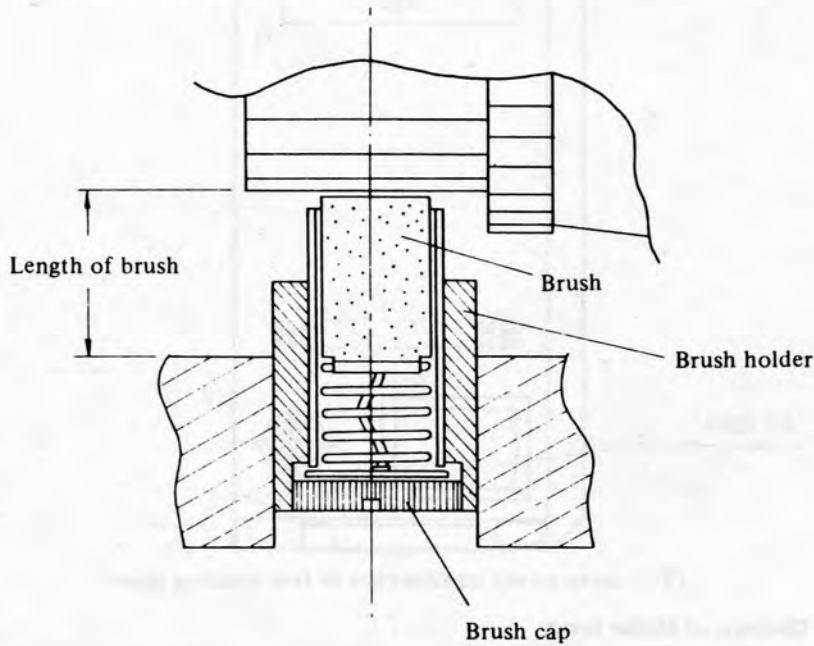
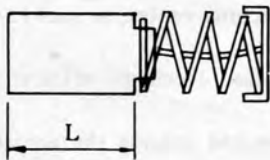


Fig. A Structure of Brush Holder



Moter model	Length of new brush	Usable length
Model 00M	1 0 mm	5 mm
Model 0L, 5L, 0M, 5M	1 9 mm	1 0 mm
Model 30, 10M, 20M, 30M, 30MH	1 9 mm	1 0 mm

Fig. B Brush Length

2.2 Maintenance equipment

The author recommends the following equipment.

(1) Measuring instruments

Instrument	Requirements	Usage
AC voltmeter	AC power-supply voltage can be measured with a tolerance of $\pm 2\%$ or downward.	Measurement of AC power-supply voltage
DC voltmeter	Maximum degree of 10V, 30V Tolerance of $\pm 2\%$ or downward (digital voltmeter may be required.)	Measurement of DC power-supply voltage
Phase rotation meter		Check of connection sequence of AC 3-phase input power
Oscilloscope	Frequency bandwidth of 5 MHz or upward, 2 channels	Adjustment of tape reader photoamplifier, etc.

(2) Tools

- ⊕ screw driver: large, medium and small
- ⊖ screw driver: large, medium and small

(3) Chemicals

Tape reader cleaning liquid (absolute alcohol) and oil.

2.3 Main spare parts

Always keep the following consumption goods.

- Fuses (see Appendix 14.)
- Motor brush (see Appendix 4) (Spec. A290-0601-V001)

As required, provide P.C.Bs and units.

- P.C.B. and unit (see Table 1.2)
- Primary parts of the velocity control unit (see Appendix 3.)

3. TROUBLE SHOOTING

3.1 Procedures

Trouble-shooting procedures are classified as below, according to the status of the failing NC.

- | | |
|---|----------------|
| (1) No power can be turned on | Section 3.3. 1 |
| (2) Operation is not normal after power is turned on | Section 3.3. 2 |
| (2)-1 Nothing is displayed on CRT screen | |
| (2)-2 Position display screen is not displayed | |
| (3) Trouble shooting by alarm | Section 3.3. 3 |
| (4) LEDs on the master PCB light | Section 3.3. 4 |
| (5) Jog operation is impossible | Section 3.3. 5 |
| (6) Manual pulse generator does not operate | Section 3.3. 6 |
| (7) Synchronous feed or feed per revolution is no good | Section 3.3. 7 |
| (8) Tape reader does not operate normally | Section 3.3. 8 |
| (9) Automatic operation is impossible | Section 3.3. 9 |
| (10) No S4-digit analog output is produced | Section 3.3.10 |
| (11) S4-digit analog output voltage linearity is not good | Section 3.3.11 |
| (12) FACIT 4070 does not operate normally | Section 3.3.12 |
| (13) ASR 33/43 does not operate normally | Section 3.3.13 |
| (14) RS-232C interface does not operate normally | Section 3.3.14 |
| (15) Stop position does not coincide with reference point in reference point return | Section 3.3.15 |
| (16) Power-supply voltage checking | Section 3. 4 |
| (17) Tape reader photo-amplifier adjustment | Section 3. 5 |
| (18) Connection diagram inside the NC | Section 3. 6 |
| (19) Status display by self-diagnostic function (DGN) | Section 3. 7 |
| (20) Block diagram and standard setting of servo system | Section 3. 8 |
| (21) Confirmation of connections between NC and servo unit | Section 3. 9 |
| (22) Confirmation of connections between NC and DC motor | Section 3.10 |
| (23) Trouble shooting for servo unit | Section 3.11 |

Survey on Trouble Phenomena

Inform FANUC Service Center of data on the following items checked, when a trouble occurred.

- (1) Phenomena
 - (i) Mode in which the trouble occurred
 - (ii) Position where the trouble occurred
 - (iii) Alarm number
 - (iv) Trouble frequency
 - (v) Error amount in positioning
 - (vi) Display of the position of trouble occurrence
- (2) Other information
 - (i) Software series and edition number displayed on the CRT when the power is turned on (see Section 3.3.2)
 - (ii) Parameter contents

Inform FANUC Service Center of the results of comparison between the parameter table attached to the NC and the parameters set in the NC.
 - (iii) Program contents and cutter compensation values for automatic operation
 - (iv) Contents of other items if checked

3.2 Alarm list

When an alarm occurs, the alarm message is automatically displayed on the CRT.

Classification	Alarm number	Remarks
Program errors, Operation errors, etc.	000 ~ 170	Refer to operator's manual and modify the program
Errors on stroke end limit switches	210 ~ 253	Refer to item 3.3
Errors on servo system	400 ~ 457	
Errors on Connection Unit, MDI & CRT or FANUC PROGRAMMABLE CONTROLLER	600 ~ 607	
Overheat of control section or motor	700 ~ 703	
Errors on memory (In this case, spare PCB is needed.)	900 ~ 999	

(i) Program errors or Operator's error

Number	Content	Remarks
000	Re-apply the power after the parameter has been input. Parameter numbers 012 ~ 018, 027 ~ 034 086 ~ 090, 124 ~ 134, 316	
001	TH alarm (A character with incorrect parity was input). Correct the tape.	Refer to Item 3.3.3
002	TV alarm (The number of characters in a block is odd). This alarm will be generated only when the TV check is effective. Correct the tape.	"
003	Data exceeding the maximum allowable number of digits was input.	Refer to appendix 10
004	A numeral or the sign (-) was input without an address at the beginning of a block.	Refer to operator's manual
005	The address was not followed by the appropriate data but was followed by another address or EOB code.	"
006	Sign " - " input error (Sign " - " was input after an address with which it can't be used. Or two " - " signs were input.)	"
007	Decimal point "." input error (A decimal point was input after an address with which it can't be used. Or two decimal points were input.)	"
008	The switch position of tape reader was not AUTO (without reel) or REEL ON/REEL OFF (with reels).	"
009	Unusable character was input. (E)	"
010	An unusable G code was commanded. (This alarm is generated also when a G code with which the control is not equipped as an option is commanded.)	"
011	Feedrate was not commanded at cutting feed or the feedrate was inadequate.	"
015	The number of the commanded axes exceeded that of allowable simultaneously controlled axes.	"
017	The move command of the additional axis was commanded without equipping with an optional additional axis.	"

Number	Content	Remarks
018	An additional axis was commanded with the other axes simultaneously.	Refer to operator's manual
021	The axis not included in the selected plane (by using G17, G18, G19) was commanded in circular interpolation.	"
022	In circular interpolation, radius designation was performed in the NC which is not equipped with the radius designation option.	"
023	In circular interpolation by radius designation, zero was commanded for address R.	"
027	Tool length compensation has been applied to an axis without cancelling former tool length compensation.	"
029	An offset value exceeded 6 digits. The offset value should be reset.	"
030	The tool offset number is too large for the D or H function.	"
031	In setting of offset amount by G10, the offset number following address P was excessive or it was not specified.	"
032	In setting of offset amount by G10, the offset amount was excessive.	"
033	• No intersection is decided in cutter compensation. • An intersection in an inside corner less than 90° was tried to be found in cutter compensation B.	"
034	Start-up or cancel of cutter compensation was specified in the G02 or G03 mode.	"
035	Skip cutting (G31) was commanded in cutter compensation mode.	"
036	G45 ~ G48 (Tool offset) was commanded in cutter compensation mode.	"
037	The plane selected (by using G17, G18, or G19) changed in cutter compensation mode.	"
038	Overcutting will occur in cutter compensation because the arc start point or end point coincides with arc center.	"
041	Overcutting will occur in cutter compensation.	"
044	One of G27 ~ G30 was commanded in canned cycle mode. An ATC cycle (M06) was commanded in canned cycle mode.	"
045	An ATC cycle (M06) was commanded for the NC which is not equipped with optional reference point return function.	"
046	Other than P2, P3 and P4 was specified in the 2nd, 3rd and 4th reference point return commands.	"
047	G27 to G30 was commanded for an axis which does not have a reference point.	"
048	G30 was commanded without performing reference point return after the power was turned on or after emergency stop. With stored stroke limit option, a movement was executed without performing reference point return after the power was turned on or after emergency stop.	"

Number	Content	Remarks
058	In 4-digit S code binary 12-bit/analog output A, a command was specified exceeding the maximum or minimum number of spindle revolutions.	Refer to operator's manual
059	No program for selected work number is found (external work number select A function).	"
060	Commanded sequence number was not found in the sequence number search.	"
065	Scaling magnification was specified as other than 1 ~ 99999.	"
066	Scaling was applied and as a result, movement value, coordinate value, circular arc radius, etc. exceed maximum programmable dimension.	"
067	G51 (scaling ON) was specified in cutter compensation mode.	"
070	The memory area is insufficient.	Refer to Item 3.3.3.
071	The address to be searched was not found.	Refer to operator's manual.
072	The number of programs to be stored exceeds 95 or 191. (191 is an option)	"
073	The program number has already been used.	"
074	The program number is other than 1 ~ 9999.	"
075	The program number or sequence number was not found at the start block of the program.	"
076	The address P was commanded in the block which includes M98 command.	"
077	The subprogram was called in triple.	"
078	The sequence number which was specified by address P in the block which includes a M98 or M99 was not found.	"
079	Memorized program and tape contents do not coincide.	"
084	The edit position is not correctly set in extended edit function. (1) The edit range start point, end point, or edit destination is not properly set. (2) The end point is set before the start point of edit range. (3) The edit destination is set between the start point and the end point of the edit range. (4) The setting conditions peculiar to the edit processing are not satisfied. (The program start should not be specified as the start point of edit range in merge and move processing.) (5) The program selected at edit execution is not equal to the edit destination program.	"
085	When storing data in the memory by using RS232C interface, an over-run or framing error was generated.	"
086	The signal level of RS232C interface was incorrect.	"
087	When storing data in the memory by using RS232C interface, the time required to store the data is insufficient.	"

Number	Content	Remarks
090	The reference point return cannot be performed normally because the reference point return start point is too close to the reference point or one revolution signal is not input owing to a fault in the pulse coder.	Refer to operator's manual.
091	Reference point return cannot be executed normally, because the feedrate is too low to synchronize the one revolution signal of the pulse coder with the reference counter.	"
092	The axis designated by G27 did not return to reference point.	"
094	No P type can be specified for program restart (because after program interruption, coordinate system setting or ORIGIN, etc. was executed.)	"
095	No P type can be specified for program restart (because after program interruption, external work zero point offset value changed.)	"
096	No P type can be specified for program restart (because after program interruption, work zero point offset value changed.)	"
097	No P type can be specified for program restart (because after power is turned on, no automatic operation has been executed.	"
098	When program restart was commanded with no reference point return after the power was turned on or after emergency stop or stroke limit alarm was released, and a G28 was found during block search by a program restart command.	"
099	A move command was performed in the MDI mode after the search for program restart.	"
100	The switch to set parameters is on. Push the reset button after turning off the switch.	"
101	The power was turned off while rewriting the contents of memory in the part program storage & editing operation. When this alarm is generated, you must turn on the power while pushing the DELET and RESET buttons to clear the memory.	"
103	Because abnormal end has occurred during TT command execution, the information required for the conversational automatic programming is not correctly stored in the bubble memory. Perform a program in which a TT command is specified again.	"
105	An attempt was made to punch out a password-encoded program when parameter 106 password is 0.	"
106	An attempt was made to input a program which is not included in the lock programs being set by parameter 169.	"
107	The password being output to tape does not coincide with the password specified in parameter 168.	"
110	Absolute value of data of fixed point representation exceeds the upper bound (99999999).	"
111	Exponent of data of floating point representation exceeds the upper bound.	"
112	Divisor is 0.	"

Number	Content	Remarks
113	A function that cannot be used by custom macro A is used.	Reference to operator's manual.
114	Format error except for 〈 Format 〉	''
115	Value not defined as variable number is assigned.	''
116	Left side of substituted sentence is a variable of prohibited substitution.	''
118	Nesting of brackets exceeds the upper limit (5).	''
119	Argument of SQRT is negative. Or argument of BCD is negative.	''
122	Nesting of macro exceeds the upper limit (4).	''
123	Macro control command is used in tape mode.	''
124	DO - END is not 1 : 1 corresponding.	''
125	Format error of 〈 Formula 〉	''
126	Not $1 \leq n \leq 3$ in DO n	''
127	NC command and macro command are mixed.	''
128	Not $0 \leq n \leq 9999$ in GO TO n	''
129	Unallowable address is used in 〈 Argument assignment 〉.	''
130	In external data input, greater-address data contains an error.	''
131	In external alarm message, five or more alarms have occurred.	''
132	In external alarm message, clear, no corresponding alarm number exists.	''
133	In external alarm message and in external operator message, smaller-address data contains an error.	''
134	The coordinate system rotation plane is not of arc or cutter compensation C.	''
140	The group No. exceeds the maximum value (16, 32, 64 or 128).	''
141	The tool group specified in the machining program is not set.	''
142	The number of tools in the group exceeds the maximum value that can be registered.	''
143	No T code is stored in the block of the program to set tool groups.	''
144	H99 or D99 was specified when not using tools of the group.	''
145	The T code following M06 does not match the T code corresponding to the tool group being used.	''
146	P and L were not specified at the beginning of the program to set the tool group.	''
147	The number of the tool groups exceeds the maximum value.	''
148	Parameter No. 333, 334, 335 is out of allowable range.	''

Number	Content	Remarks
149	Correct processing is not performed when the CONVERT software key is depressed. Possible causes are: (1) The cursor is not positioned under a macro body calling address (ZHxx, etc.). (2) No ; or , is included between the current cursor position and the program end. (This alarm will also be given when EOB ALTER are depressed and the condition (2) is satisfied.)	Refer to operator's manual.
160	An attempt was made to edit a program which is being used for machining or graphic drawing.	"
162	The number of software keys specified by PM command exceeds the limit. – For one parameter screen, software keys are allowed for up to 4 addresses. – Up to 8 software keys are allowed for one address.	"
164	When , INSRT operation has been performed, a format error has occurred.	"
168	In the tape mode, an address for macro body call (ZHxx, etc.) has been specified.	"
169	No end of cycle command (ZE99) has been specified at the end of hole position data.	"
170	Programs of numbers 8000 – 8999 and 9000 – 9899 are being edited. But this alarm occurs only when parameter setting inhibits these programs to be edited. (See parameters 318 – PRG-9, 319 – PRG-8.)	"
172	TT command, MN command, PM command, NC instruction and macro instruction are mixed in one program.	"
173	In TT command, a character not allowed for macro body call address is used. (Characters other than two alphabets starting with Z have been used.)(14" CRT) Character used by the TT instruction is not valid for key specification or macro call address. (9" CRT) • Invalid specification : G key or the same key as that set by parameter 684-651 for hole group. • Invalid macro call address: "SE" or same address as that for macro reserve word (for example, AB(S) or SI(N)).	"
174	An argument not allowed in PM command (0, 14" CRT or G, L, N, O, P, 9" CRT) has been used.	"
175	A program called by a macro body call address is not found.	"
176	Specification of the number of items set in PM command is incorrect.	"
180	A value lower than the decimal point has been specified when the decimal point is used for the axis B command. The specified angles is not an integer multiple of the least angle for indexing the index table.	"
181	Axis X, Y, or Z is specified simultaneously with axis B.	"
182	In the specification of dimension line indication I and II (G247, G248), X and Y are simultaneously specified or none of them are specified.	"
183	In the specification of the character string indication mode or cancel mode (G245, G246), format error is found.	"

Number	Content	Remarks
185	The number of TT commands, MN commands or PM commands exceeds the limit. TT command: up to 9 (hole pattern menu included) MN command: up to 18 (14" CRT) or 20 (9" CRT) (for one TT command) PM command: up to 19 (14" CRT) or 21 (9" CRT) (number of arguments)	Refer to operator's manual.
186	In TT command, MN command or PM command, some parameter exceeds in its maximum number of characters or digits.	"
187	Some TT command, MN command or PM command is defined in two ways.	"
188	In the internal code input of character string for TT command, MN command or PM command, format error is found.	"
189	In TT command, MN command or PM command, format error other than alarms 172-174 and 185-188 is found.	"
191	No address is specified in a graphic display program.	"
192	In the internal code input of character string in a graphic program, format error is found.	"

(ii) Error on Stroke limit switch

Number	Content	Remarks
210	The movable part of machine touched the X axis plus stroke limit switch.	Refer to Item 3.3.3.
211	The movable part of machine touched the X axis minus stroke limit switch.	"
212	While the X axis was moving in the plus direction, it entered the forbidden area of the stored stroke limit 1.	"
213	While the X axis was moving in the minus direction, it entered the forbidden area of the stored stroke limit 1.	"
214	While the X axis was moving in the plus direction, it entered the forbidden area of the stored stroke limit 2.	"
215	While the X axis was moving in the minus direction, it entered the forbidden area of the stored stroke limit 2.	"
220	The movable part of the machine touched the Y axis plus stroke limit switch.	"
221	The movable part of the machine touched the Y axis minus stroke limit switch.	"
222	While the Y axis was moving in the plus direction, it entered the forbidden area of the stored stroke limit 1.	"
223	While the Y axis was moving in the minus direction, it entered the forbidden area of the stored stroke limit 1.	"
224	While the Y axis was moving in the plus direction, it entered the forbidden area of the stored stroke limit 2.	"

Number	Content	Remarks
225	While the Y axis was moving in the minus direction, it entered the forbidden area of the stored stroke limit 2.	"
230	The movable part of machine touched the Z axis plus stroke limit switch.	"
231	The movable part of machine touched the Z axis minus stroke limit switch.	"
232	While the Z axis was moving in the plus direction, it entered the forbidden area of the stored stroke limit 1.	"
233	While the Z axis was moving in the minus direction, it entered the forbidden area of the stored stroke limit 1.	"
234	While the Z axis was moving in the plus direction, it entered the forbidden area of the stored stroke limit 2.	"
235	While the Z axis was moving in the minus direction, it entered the forbidden area of the stored stroke limit 2.	"
240	The movable part of the machine touched the 4TH axis plus stroke limit switch.	"
241	The movable part of the machine touched the 4TH axis minus stroke limit switch.	"
242	While the 4th axis was moving in the plus direction, it entered the forbidden area of the stored stroke limit 1	"
243	While the 4th axis was moving in the minus direction, it entered the forbidden area of the stored stroke limit 1	"
250	The movable part of the machine touched the 5th axis plus stroke limit switch.	"
251	The movable part of the machine touched the 5th axis minus stroke limit switch.	"
252	While the 5th axis was moving in the plus direction, it entered the forbidden area of the stored stroke limit 1.	"
253	While the 5th axis was moving in the minus direction, it entered the forbidden area of the stored stroke limit 1	"

(iii) Error on servo system

Number	Content	Remarks
400	The control received the X, Y, or Z axis overload signal.	Refer to Item 3.3.3.
401	The READY signal (VRDY) of the X, Y, or Z axis velocity control has turned off.	"
402	The control received the 4TH axis overload signal.	"
403	The READY signal (VRDY) of the 4TH axis velocity control has turned off.	"
404	The READY signal (VRDY) of the X, Y, or Z axis velocity control does not turn off even though the READY signal (PRDY) of the position control has turned off. The READY signal (VRDY) of velocity control already turn on even though the READY signal (PRDY) of the position control is off yet at power on condition.	"
405	Status of reference point signal is not correct, when reference point return completes.	"
407	The READY signal (VRDY) of the 5th axis velocity control unit has turned off.	"
410	The content of error register of the X axis is larger than the value allowed while the machine is stopped.	"
411	The content of error register of the X axis is larger than the value allowed while the machine is moving.	"
412	Drift on X axis is excessive. (Exceeds 500VELO)	"
413	The content of the error register of the X axis exceeded ± 32767 . Or the velocity command value of the DA converter is out of the range of +8191 ~ -8192. Incorrect settings will cause this alarm.	"
414	The resolver/inductosyn position detecting system of X axis is trouble.	"
415	A feedrate exceeding 511875 detection units/sec. was commanded in the X axis. An incorrect setting of CMR causes this error.	—
416	X axis pulse coder position feedback is abnormal. (Disconnection alarm)	—
417	X axis servo position LSI is faulty.	—
420	The content of the error register of the Y axis is larger than the value allowed while the machine is stopped.	Refer to Item 3.3.3.
421	The content of the error register of the Y axis is larger than the value allowed while the machine is moving.	"
422	Drift in the Y axis is excessive. (Exceeds 500VELO)	"
423	The contents of the error register of the Y axis exceeded +32767. Or the velocity command value of the DA converter is out of the range of +8191 ~ -8192. Incorrect settings will cause this alarm.	"
424	The DSCG position detecting system of Y axis is trouble.	"
425	A feedrate exceeding 511875 detection units/sec. was commanded in the Y axis. An incorrect setting of CMR causes this alarm.	—

Number	Content	Remarks
426	Y axis pulse coder position feedback is abnormal. (Disconnection alarm)	—
427	Y axis servo position LSI is faulty.	—
430	The content of the error register of the Z axis is larger than the value allowed while the machine is stopped.	Refer to Item 3.3.3.
431	The content of error register of the Z axis is larger than the value allowed while the machine is moving.	"
432	Drift in the Z axis is excessive. (Exceeds 500VELO)	"
433	The contents of the error register of the Z axis exceeded ± 32767 . Or the velocity command value of the DA converter is out of the range of $+8191 \sim -8192$. Incorrect setting will cause this alarm.	—
434	The resolver/inductosyn position detecting system of Z axis is trouble.	"
435	A feedrate exceeding 511875 detection units/sec. was commanded in the Z axis. An incorrect setting of CMR causes this alarm.	—
436	Z axis pulse coder position feedback is abnormal. (Disconnection alarm)	—
437	Z axis servo position LSI is faulty.	
440	The content of error register of the 4TH axis is larger than the value allowed while the machine is stopped.	Refer to Item 3.3.3.
441	The content of error register of the 4TH axis is larger than the value allowed while the machine is moving.	"
442	Drift of 4TH axis is excessive. (Exceeds 500 VELO)	"
443	The contents of the error register of the 4TH axis exceeded ± 32767 . Or the velocity command value of the DA converter is out of the range of $+8191 \sim -8192$. Incorrect setting will cause this alarm.	"
444	The resolver/inductosyn position detecting system of 4TH axis is trouble.	"
445	A feedrate exceeding 511875 detection units/sec. was commanded in the 4TH axis. An incorrect setting of CMR causes this alarm.	—
446	4th axis pulse coder position feedback is abnormal. (Disconnection alarm)	—
447	4th axis servo position LSI is faulty.	
450	The content of error register of the 5th axis is larger than the value allowed while the machine is stopped.	
451	The content of error register of the 5th axis is larger than the value allowed while the machine is moving.	
452	Drift of 5th axis is excessive. (Exceeds 500 VELO)	
453	The contents of the error register of the 5th axis exceeded ± 32767 . Or the velocity command value of the DA converter is out of the range of $+8191 \sim -8192$. Incorrect setting will cause this alarm.	
454	The resolver/inductosyn position detecting system of 5th axis is trouble.	

Number	Content	Remarks
455	A feedrate exceeding 511875 detection units/sec. was commanded in the 5th axis. An incorrect setting of CMR causes this alarm.	—
456	5th axis pulse coder position feedback is abnormal. (Disconnection alarm)	—
457	5th axis servo position LSI is faulty.	—

(iv) Connection alarm between each PCB

Number	Content	Remarks
600	Data transferring error took place in the connection unit .	Refer to Item 3.3.3
601	Slave relay was turned off. (Connections among connection unit, MDI/CRT and master PCB are trouble. Another case change connection unit.)	—
602	PC program has not yet been loaded.	—
603	The correspondence between NC and PC is incorrect or interrupted. Change programmable controller PCB or master PCB.	—
604	No hold is effective to FANUC PC-MODEL B side MPU.	Refer to Item 3.3.3
605	A system error has occurred in FANUC PC-MODEL B side MPU.	—
606	RAM/ROM parity has occurred in FANUC PC-MODEL B side MPU.	—
607	Data transferring error took place in MDI & CRT.	—

(v) Overheat alarm

Number	Content	Remarks
700	Overheat of the master PCB.	Refer to Item 3.3.3.
701	Overheat of additional axis PCB.	“
702	Overheat of DC motor for X, Y, Z axis	“
703	Overheat of DC motor for 4th axis.	“
704	Overheat of DC motor for 5th axis.	“

(vi) Errors on memory

Number	Content	Remarks
900	Fault in bubble device (Fault of input signal for bubble device)	Refer to Item 3.3.3.
901	Fault in bubble device (The initial point in the bubble was not detected immediately after power on.)	"
902	Fault in bubble device (Page size error, undefined command)	"
903	Fault in bubble device (Transfer missing, Page size over)	"
904	Fault in bubble device (Parity error)	"
905	Fault in bubble device (No marker)	"
906	Fault in bubble device (Many defect loops)	"
907	Fault in bubble device (Data cannot be written correctly)	"
908	Fault in bubble device (Software parity error)	"
909	Fault in bubble device (Bubble Device Stop)	"
910	RAM parity error (low byte)	"
911	RAM parity error (high byte)	"
912	Fault in bubble device (Abnormal signal is being issued.)	"
920	System error (watch dog timer alarm)	"
930	CPU error (0, 3, 4, type interrupt generation)	"
940	Offset amount error (Too large offset amount is set) Set correct offset amount.	"
960	System error (stuck over)	"
961	CPU error (INT command execution).	"
996	RAM is not mounted although an option which requires an additional RAM is equipped.	"
997	ROM parity error (PC MODEL A ROM)	"
998	ROM parity error (Basic ROM)	"
999	ROM pair error (No correspondence between high and low)	"

(vii) Conversational Contouring Alarm List

These alarms are displayed on the 14" Conversational Graphic Mode screen.

Number	Description	Remarks
001	Corner arcs or chamfering blocks are specified consecutively.	
002	The graphic form cannot be specified since the preceding block is not defined. (Graphic form using the information in the preceding and following blocks)	
003	Too many pending blocks	Pending possible for a maximum of 4 blocks
004	Output data too large	Maximum ±99999999
005	Contouring is terminated despite the presence of pending blocks	
006	Corner arc or chamfering is specified for the first graphic form (as data following the approach or starting point data)	
007	Graphic data is specified before the starting point data is set.	
008	Data is specified before approach data. No data is present before escape data.	
009	Approach/escape data (I, J, R) are incorrect.	
050	Modifier (e.g. TANGENT $\bigcirc$ FWD, etc.) is incorrect.	
051		
052		
060	Arc radius is negative.	
061	The crossing point between two straight lines cannot be obtained.	Two parallel lines
062	The crossing point between the circle and straight line cannot be obtained.	
063	The crossing point between two circles cannot be obtained.	Two circles are the same.
064	The crossing point between two circles cannot be obtained.	One circle is included in the other.
065	The straight line is not obtained.	Two points are located at one position.
066	The angle conflicts with the symbol ($\nearrow$)	
069	The corner arc, chamfering and graphic form cannot be obtained.	
128	The graphic form cannot be determined due to shortage of information.	
129 ? 160	Operation error (e.g. divided by zero, square root of negative data, data too large or too small)	Incorrect data entry
192	Storage overflow (for operation)	

3.3 Checking and Countermeasures

3.3.1 No power can be turned on

Item	Cause of trouble	Check procedure	Countermeasures
1	No input power supply is connected to NC.	1 See Sec. 3.4. Make sure that input unit pilot lamp PIL (green LED) is ON.	
		2 When PIL is OFF, make sure that input power is supplied at input unit power-supply terminal TP1.	
		3 When power is supplied at input unit TP1 and pilot lamp is OFF, see Sec. 3.4. Fuses F1, F2 or F3 is considered blown out.	Remove blowout causes and replace fuses.
2	Alarm lamp is ON.	1 See Sec. 3.4. Make sure that input unit alarm lamp ALM (red LED) is OFF. When ON, remove the cause (see Appx. 3 for details) and press POWER OFF button once. Then pressing POWER ON button will power on.	
3	OFF contact of external power-supply ON/OFF is faulty.	Make sure that EOF and COM are shorted at input unit terminal	
4	POWER OFF switch on MDI & CRT unit is faulty.	1 Make sure that POWER OFF button contact is closed.	
		2 Make sure that two pins  OFF  are shorted in input unit.	
5	POWER ON switch on MDI & CRT unit is faulty.	1 Make sure that pressing POWER ON button closes the contact.	
		2 Make sure that pressing POWER ON button short circuit two pins  ON  in input unit.	
6	Input unit is faulty.		Replace the input unit.

3.3.2 Operation is not normal after power is turned on**(1) Nothing is displayed on CRT screen****(a) In case of 9" monochrome CRT**

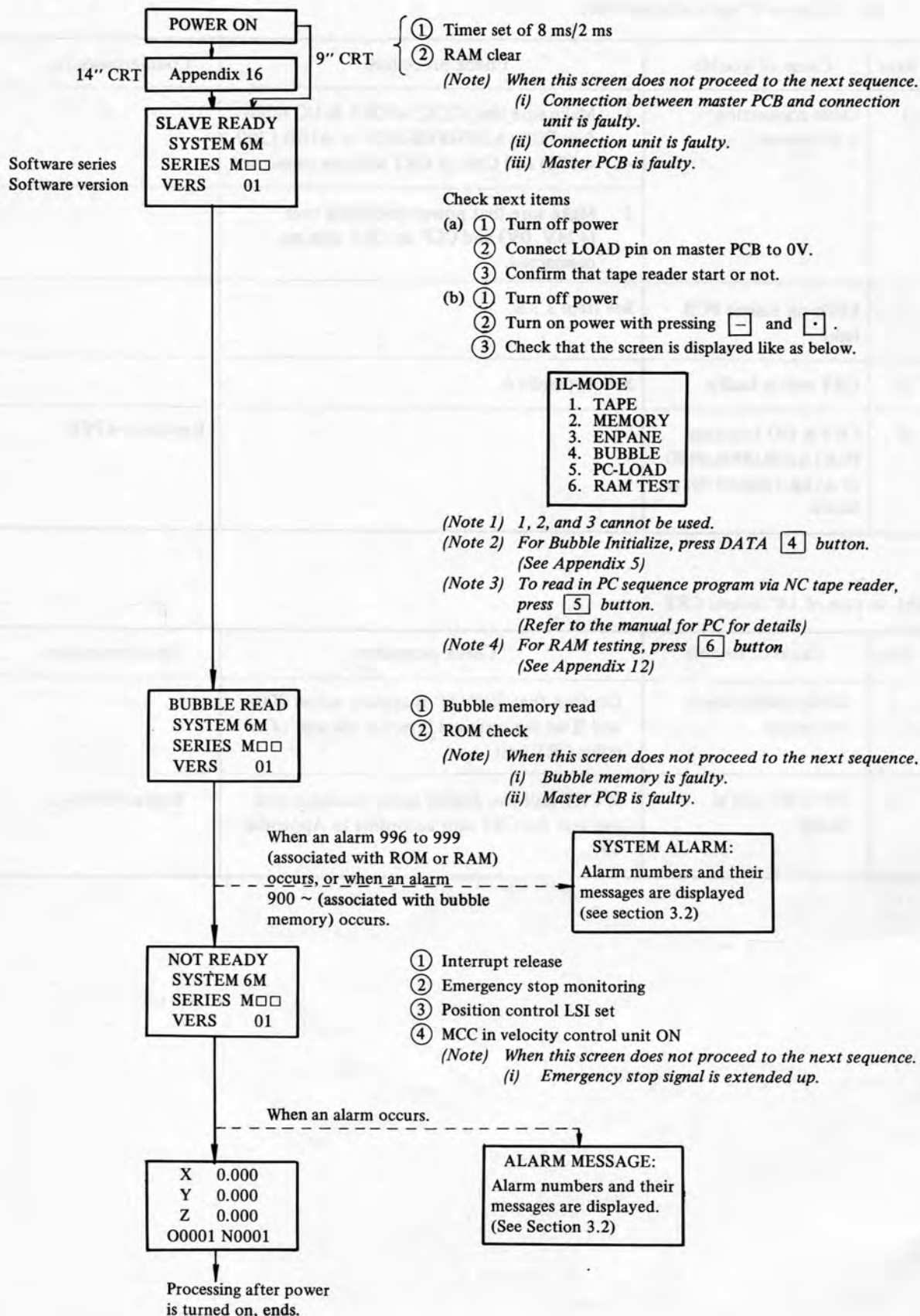
Item	Cause of trouble	Check procedure	Countermeasures
1	Cable connection is erroneous.	1 Make sure that CCX2 of CRT & I/O interface PCB (A20B-0008-0430 or A16B-1200-0170) and CN1 of CRT unit are connected.	
		2 Make sure that power stabilizing unit (+24V, 0V) and CCP on CRT unit are connected.	
2	LEDs on master PCB light.	See Item 3.3.6.	
3	CRT unit is faulty.	See Appendix 6.	
4	CRT & I/O Interface PCB (A20B-0008-0430 or A16B-1200-0170) is faulty.		Replace the PCB.

(b) In case of 14" colour CRT

Item	Cause of trouble	Check procedure	Countermeasures
1	Cable connection is erroneous	Confirm that 200VAC is applied across 200A and B on the terminal board at the rear of 14" color CRT unit	
2	14" CRT unit is faulty.	If CRT unit can display some messages, you can test the CRT unit according to Appendix 16.	Replace the unit.

(2) CRT becomes no position display screen

Display on MDI & CRT after power is turned on.



Causes and Remedies

- If the NC tape or the reading section of the tape reader is dirty, clean it.
- If the NC tape setting is error, correct the NC tape setting.
- If the NC tape is punched erroneously, correct the NC tape.

(2) Alarm number

002

TV alarm (Tape Vertical Alarm)

If in parity checking a block of NC tape in the vertical direction, an odd number of characters are in the block (from a character next to EOB), the control unit, will execute the preceding block, stops after completion of it. (The tape stops on the next character to the EOB of the erroneous block.)

"002" is displayed on the number indicator.

ALARM lamp goes out by reset.

Error block is ignored

This TV checking function can be made effective or ineffective by setting of MDI.

Remedies

- Something (a space symbol, for example) that is ignored by the NC should be punched before *(EOB) code for odd-numbered holes. The tape punched out by FANUC SYSTEM 6 already is checked TV check.
- Number of character in one block is made even number.
- If this lamp lights up with an even number of characters punched, the tape reader may be misreading. So clean the reading section of the tape reader or the nc tape.

(3) Alarm number

070

Memory area insufficient alarm

When the capacity of memory is overflow in storing the NC program, alarm 070 is occurred.

Remedies

- (a) Perform arrangement of memory, and then store the NC program again

Method of arrangement

- ① Select EDIT mode on the operator's panel.
- ② Release key switch (memory protection key)
- ③ Press **[CAN]** button
- ④ Press **[ORIGIN]** button

- (b) If 070 alarm occurred after arrangement, clear the program stored already, and store the new program.

(4) Alarm number

090

Reference point return cannot be performed normally because the one-revolution signal is not input.

091

Reference point return cannot be performed normally because the feedrate is too low.

Using a pulse coder, after turning on the power or resetting the emergency stop, the reference counter is synchronized with the one-revolution signal when the first reference point return is performed. At this time, the following conditions are required to catch the same edge of 1 revolution signal.

- (a) The position deviation should be 128 or more.
- (b) The one-revolution signal should be input at least once between the time that the axis passes the deceleration dog after position deviation exceeds 128.

If condition A is not satisfied, alarm 91 occurs. If condition B is not satisfied, alarm 90 occurs. The one-revolution signal is not used during the second or subsequent reference point return, also this alarm check is not made.

Item	Cause of trouble	Check procedure	Countermeasure
①	Feedrate is too low.	Perform reference point return under the same conditions in which the alarm occurred, and confirm that the position deviation is 128 or more by using the self-diagnostic function (DGN800~). The start point of the reference point return must not be on the deceleration dog.	Increase the feedrate. When the position gain is 30 sec^{-1} , a feedrate of at least 300 mm/min is necessary.
②	The start point of the reference point return is too close to the reference point.	Check the distance from the start point to the reference point.	The distance from the start point to the reference point must be equivalent to at least two motor revolutions.
③	Source voltage for the pulse coder is too low.	When the voltage at power checking terminals on the master PCB is adjusted to $5.0\text{V} \pm 0.05\text{V}$, the source voltage of the pulse coder should be 4.75V or more. (Remove the pulse coder cover and measure the source voltage at the + and - terminals on the pulse coder board.)	Cable loss must be 0.2V or less. The voltage at the +5V terminal on the master PCB should be adjusted within the range of 4.95 to 5.10 V.
④	Defective pulse coder.	Replace the pulse coder.	Replacement.
⑤	Defective master PCB.	Replace the master PCB.	Replacement.

(5) Alarm number

210 , 211 , 220 , 221 , 230 , 231 , 240 , 241 , 250 , 251

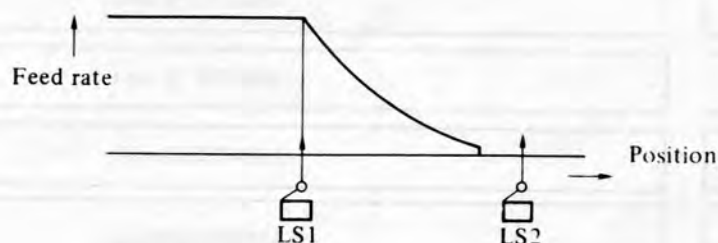
OT alarm (Over-Travel Alarm)

When the movable member of the machine tool reaches the stroke end, "210" "211" "220" "221" "230" "231" "240", "241", "250" or "251" is displayed on the CRT screen.

When this alarm occurred, movement of all axes stop in auto operation. In manual mode, axis that alarm occurred stops.

Two limit switches (LS1, LS2) are provided on each axis in each direction (+X, -X, +Y, -Y, +Z, -Z, +4th, -4th, +5th, -5th) as shown in the figure below, to stop the movable member of the machine tool.

For details, refer to the operator's manual published by the machine tool builder. This figure is an example.



- When LS1 operates, the feed is stopped after deceleration. 210, 211, 220, 221, 230, 231, 240, 241, 250, or 251 is displayed.
- When LS2 operates, the feed is emergency stopped. (LS2 operates only when LS1 malfunctions)

Causes and Remedies

- ① If the reference point setting is error, correct the program.
- ② If the program is error, correct the program.

Release

- (a) When only LS1 operates

Move the movable member of the machine tool by manual operation (Jog, Step or Handle) in the opposite direction (safe side) to separate it from the limit switch, and then push the RESET key on the MDI & CRT panel.

(Note) In this case, the movable member of the machine tool can be moved only in the opposite direction.

- (b) When both LS1 and LS2 operate

- (i) Set 2nd L.S. REMOVE button to ON on operator's panel.
- (ii) Do the same operation as in releasing LS1.

(Note) In the equipment in which LS1 is not in operation when LS2 is in operation, the movable member is movable in both directions by manual operation. Be careful of the direction in which it is to be moved when LS1 has malfunctioned.

(6) Alarm number

212 ~ 215 , 222 ~ 225 , 232 ~ 235 , 242 , 243 , 252 , 253

Stored Stroke limit alarm

When machine reaches stored stroke limit, one of these alarms is indicated on the CRT screen. When this alarm occurred movement of all axes stop in auto operation. In manual mode, axis that alarm occurred stops.

Causes

- (a) Program miss.
- (b) Setting of stored stroke limit is abnormal.

Remedies

- The movable member of the machine tool can be moved in the opposite direction.
 - If the movable member of the machine tool can not be moved, push the emergency stop button and command G23 (Stored Stroke Limit Function OFF).
- If the setting value is error, correct the setting value and return to reference point.

Confirm

Check the actual machine position by DGN 820, 821, 822, 823, 824
Distance from the reference point in the X, Y and Z axes in this order.

8	2	0	ABSMTX (X axis)
8	2	1	ABSMY (Y axis)
8	2	2	ABSMZ (Z axis)
8	2	3	ABSM4 (4th axis)
8	2	4	ABSM5 (5th axis)

Remedies

- (a) Correct programs
- (b) Set stored stroke limit again.

Release

- (a) Machine can be moved to only reverse direction of overtraveled direction.
- (b) Press emergency stop and release alarm, then input G23 (Stored Stroke limit OFF) from MDI and move machine by JOG to go out from inhibited area.

(7) Alarm number

400 , 402 Overload alarm

Item	Cause of trouble	Check procedure	Countermeasures
1	Confirmation	This alarm occurs in heavy cutting.	Power must be turned off for 30 minutes and press the reset button. See 2 or 7.
		This alarm occurs at power on.	Confirm the connection. See 4.
		This alarm occurs even if S20 is shorted on velocity control unit.	See 2.
		This alarm does not occur when the S20 is shorted on velocity unit.	See 7.
2	Overload	Check the motor current of troubled axis Model 00M, continuous rated current 4A Model 0M continuous rated current 7A Model 5M continuous rated current 9A Model 10M continuous rated current 12A Model 20M continuous rated current 18A Model 30M continuous rated current 24A	Reduce cutting condition. Measure the motor current in the low idling feed. If the current is close to the rated current of motor, readjust the machine.
3	Improper setting of thermal relay	Check whether setting is correct or not according to above value	Reset the setting
4	Connecting trouble	Check the connecting of overload signal (OVL) between CAV on the master PCB and CN1 on the velocity control PCB. Check contactor of thermal relay.	Refer to item 3.9.
5	Thermal relay trouble	Check whether trouble condition is reset or not by reset button	Replace the thermal relay.

Item	Cause of trouble	Check procedure	Countermeasures
6	Trouble in master PCB		Replace the thermal relay.
7	Over heat of transformer	Check the resistance between terminal 51 and 52 i) Resistance is 0 (Contact is close) ii) Resistance is infinity (Contact is open)	Power must be turned off for 30 minutes then press the reset button or connection trouble between thermal relay and CN2 on the velocity control unit. Thermostat is trouble. Replace a transformer.

- Note) How to see the table. (Common for all following tables).
- 1. Confirm the cause by "Confirmation" above.
 - 2. Jump to another item if item number is described in "counter measures"
 - 3. Trouble shooting ends up when you find = line.

(8) Alarm numbers

401

, 403

READY signal (VRDY) of velocity control unit is turned off.

Item	Cause of trouble	Check procedure	Countermeasures
1	Fault analysis	Check if green LED PRDY lights in velocity control unit PCB.	Proceed to 2 when LED PRDY lights. Proceed to 8, when it does not light.
2	Fault analysis	Check if alarm LED lights in velocity control unit PCB.	If this LED lights, locate and eliminate a cause of alarm (See (a) ~ (g)). Proceed to 3, when this LED does not light.
3	Fault analysis	Check if green LED VRDY lights in velocity control unit PCB.	Proceed to 8 when VRDY LED lights. Proceed to 4 when it does not light.
4	Fault analysis	Check if electromagnetic contactor MCC is turned on in velocity control unit.	Proceed to 9 when MCC is turned on. Proceed to 5 when it is not turned on.
5	Fault analysis	Check if 100V is applied across terminals (3) and (4) of terminal board T1 of velocity control unit.	Proceed to 7 when power is applied. Proceed to 6, if not applied.
6	Signals from machine tool	Check 100V power supply. Check if emergency stop signal is sent from machine tool or if the machine tool is ready for operation.	Restore to normal conditions.
7	Trouble in velocity control unit	Velocity control unit PCB or MCC is defective.	Replace.
8	Poor contact	Poor contact between velocity control unit and master PCB, or a trouble in master PCB.	Replace.
9	Poor contact	Poor contact inside velocity control unit or a trouble in velocity control unit PCB.	Replace.

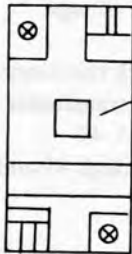
(a) TGLS alarm

Item	Cause of trouble	Check procedure	Countermeasures
1	The motor power cable is not connected to terminals (5), (6), (7) or (8) of terminal board T1 in the velocity control unit, or the power cable is broken.	If the TGLS alarm indicator goes on when a motion command is not input, the alarm cause described at the left should be checked.	Check the power cable connection.
2	PCB setting is improper.	Check the setting according to section 6.2.	Adjust the setting.
3	Velocity feedback voltage is not being applied or is intermittent.	Measure the velocity feedback voltage between check terminals CH2 (TSA) and CH3 (GND) with an oscilloscope. Confirm whether the voltage is being interrupted.	Repair the cable carrying the velocity feedback voltage. Repair the defective source (i.e., motor or control) of the velocity feedback voltage.

(b) OVC alarm

Item	Cause of trouble	Check procedure	Countermeasures
1	PCB is defective.	The OVC alarm indicator goes on if the power is turned on when the motor power cable is disconnected. (In this case, since the drive axis may fall down, it should be supported.) (The S23 terminal should be shorted so that the TGLS alarm indicator will not go on. After confirmation, the S23 connection should be opened.)	Replace the PCB.
2	PCB setting is improper.	Check the setting of variable resistor RV3 which is used to set the upper limit of the motor current (see section 6.2). (Generally, RV3 is set to 10, but the adjustment may differ with the machine tool.)	Change the RV3 setting.
3	Mechanical load is abnormal.	Observe the waveform between check terminals CH8 and CH3 with an oscilloscope. Check whether the current which is determined by RV3 flows for more than 600 msec or not.	Alleviate the mechanical overload.

(c) BRK alarm

Item	Cause of trouble	Check Procedure	Countermeasures
1	The circuit breaker operated.	The breaker is open when it is as shown below. See section 5.4 for the location of the breaker. 	Turn off power and reset the breaker. (If cannot be reset immediately, wait about ten minutes and try again.)
2	Diode module DS or some other part of the velocity control unit is defective.	The breaker operates again when power is restored after the countermeasures of item 1.	Replace diode module DS or the whole velocity control unit.
3	Mechanical load is excessive.	Observe the motor load current between terminals CH8 and CH3 on the PCB with an oscilloscope. Check whether it exceeds the rated current.	Alleviate the mechanical overload.
4	The PCB or the connection between the PCB and the velocity control unit is defective.	The BRK alarm occurs when the circuit breaker is not operating.	Replace the PC board or the velocity control unit.

(d) HVAL alarm

Item	Cause of trouble	Check Procedure	Countermeasures
1	The AC input power source voltage is too high.	Check the tap connection on the servo power transformer.	Change the tap connection.
2	The servo motor is defective.	Check the insulation resistance between the armature and the motor body.	Clean the brushes and commutator.
3	PCB is defective.	The HVAL alarm indicator is on although no trouble is found in items 1 and 2 above.	Replace the PCB.

(e) LVAL alarm

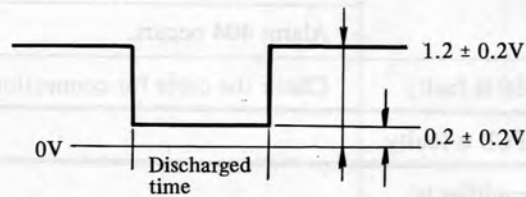
Item	Cause of trouble	Check procedure	Countermeasures
1	The AC input power source voltage is too low.	Check whether the wires for the AC input power source are connected to the correct taps on the servo transformer.	Change the tap connection.
2	The connection between the servo transformer and CN2 on PCB is defective.	Check the PCB control voltage (+24V and $\pm 15V$). (See Section 3.1.) Check the connection between the servo transformer terminals 41 through 43, 44 through 46, and 47 through 49 and the CN2 on PCB. (See Section 2.3.2.)	Change the connection.
3	The PCB is defective.	The LVAL alarm indicator is on although no trouble is found. in items 1 and 2 above.	Replace the PC board.

(f) HVAL alarm

Item	Cause of trouble	Check procedure	Countermeasures							
1	Improper motor power cable connection.	The HVAL alarm indicator does not go on when the power is turned on with the motor power cable is disconnected. (In this case, since the gravity axis may fall down, it should be supported. The S23 terminal on the PCB should be shorted so that the TGLS alarm indicator will not go on. The S23 connection should be opened after confirmation.)	Fix the motor power cable connection.							
2	The transistor module is defective.	The HVAL alarm indicator goes on when the motor power cable is disconnected. Turn off power and measure the resistance between the following terminals using a multi meter. If the measured value is 10 ohms or less, the transistor module is defective.	Replace the transistor module. <table><tr><td>o</td></tr><tr><td>C1</td></tr><tr><td>B1</td></tr><tr><td>E1, C2</td></tr><tr><td>B2</td></tr><tr><td>E2</td></tr><tr><td>o</td></tr></table> Confirm between C1-E1, C2. E1, C2-E2.	o	C1	B1	E1, C2	B2	E2	o
o										
C1										
B1										
E1, C2										
B2										
E2										
o										

(g) DCAL alarm

Item	Cause of trouble	Check procedure	Countermeasures
1	Transistor Q1 or the PCB is defective.	The DCAL alarm indicator goes on immediately after turning on power.	Replace transistor Q1. Replace PCB.
2	PCB setting is improper.	Terminal S26 is shorted although the separate regenerative discharge unit is used with the gravity axis.	Open terminal S26.
3	Machine tool counterbalance is improper.	The waveform shown in the following figure is measured at stated periods on check terminal CH10 while the counterbalanced axis is moving down at rapid travers speed.	Adjust the counterbalance.
4	The acceleration/deceleration rate is too high.	Check whether the positioning rate at rapid traverse speed exceeds 1 to 2 times per second. Check that this alarm indicator does not go on when the rate is decreased.	Use a dwell period and decrease the acceleration/deceleration rate.



(9) Alarm number

404 Velocity control ready signal is not good.

Item	Cause of trouble	Check procedure	Countermeasures
1	Confirmation	1 Turn OFF NC power supply. 2 Remove motor power line or motor. 3 Make setting pin S20 on servo amplifier open. 4 Turn ON NC power supply.	
		A MCC on Servo amplifier is OFF (see Sec. 3.8.3 to 3.8.5 for details).	Proceed to 2.
		A MCC Servo amplifier is ON.	Proceed to 5.
2	Ditto	1 Turn OFF NC power supply. 2 Remove cable-J50 master PCB-side connector (CAB). 3 Turn ON NC power supply.	
		No alarm 404 occurs.	Proceed to 3
		Alarm 404 occurs.	Proceed to 4.
3	Cable J50 is faulty.	Check the cable for connection (see Sec. 3.9.1)	Proceed to 5.
4	Master PCB is faulty.		Replace the PCB.
5	Servo amplifier is faulty.		Replace the servo amplifier.

(10) Alarm number

405 Reference Point Return motion is not good. (Refer to item 3.3.15 also)

Item	Cause of trouble	Check procedure	Countermeasures
1	X, Y, and Z axis	Position detector is pulse coder.	Replace the Master PCB.
		Position detector is resolver/inductosyn.	
2	Additional axis	Position detector is pulse coder.	Replace the PCB A20B-0007-0090.
		Position detector is resolver.	Replace the PCB A20B-0008-0470 or A16B-1200-0160
		Position detector is inductosyn.	Replace the PCB A20B-0008-0471 or A16B-1200-0161

(11) Alarm number

410 , 411 , 420 , 421 , 430 , 431 , 440 , 441 , 450 , 451

Position deviation excessive alarm

Item	Cause of trouble	Check procedure	Countermeasures
1	Miss setting of allowable error	Check parameter 074 ~ 105 (or 422 to 430 for 5th axis)	Correct the setting. Refer to adjustment of position control.
2	Overshoot	When enough current does not flow to motor in acceleration or deceleration, deviation value increase. Check waveform of CH1 on velocity control PCB and confirm whether overshoot is within 5% or not.	Increase the rapid traverse time constant. Increase gain (RV1) of velocity control. (Refer to Item 6.2.)
3	Drop of input power voltage	Check that input power voltage is within $\pm 10\%$ and -15%	Change the input tap of power transformer for servo. (Refer to Item 4.2.)
4	Voltage of power supply is abnormal	Check the voltage of control part.	Repair the fault.
5	Connection trouble	Check the power line of motor, tacho-generator signal, resolver signal, inductosyn signal etc.	Repair the fault.
6	Trouble in position control section in master PCB or/and velocity control unit	Check the trouble by changing when there is spare PCB.	Replace the PCB with spare one. (Refer to Item 6.1.)
7	Poor brush contact by loosened motor brush cap	Confirm the brush contact.	Tighten the brush cap.

(12) Alarm number

412

, 422

, 432

, 442

, 452

Drift excessive alarm

Item	Cause of trouble	Check procedure	Countermeasures
1	Connection trouble	Check the connection of power wires to servo motor. Check the connection between position detector and servo motor.	Repair the fault.
2	Setting miss of drift compensation value	Check whether the contents of parameter No. 124, 125, 126, 127 and 423 exceed 500 or not.	In emergency stop on condition, set 7th bit (ADFT) of parameter number 007 to '0' and set the contents of parameter No. 124, 125, 126, 127, 423 to '0', And then reset ADFT to "1" and release the emergency stop.
3	Trouble in velocity control unit or/and position control circuit	Check the trouble by changing with spair PCB, if provided.	Replace the PCB with spair one.

(13) Alarm number

413

, 423

, 433

, 443

, 453

Abnormal velocity command value.

These alarms occur when:

- (1) Positional deviation in the axis involved exceeds ± 32767 . When, however, positional deviation limits (parameters 074 ~ 077, 426) at stoppage or those (parameters 078 ~ 081, 427) during motion are set correctly, alarm 410, 411, 420, 421, 430, 431, 440, 441, 450 or 451 is displayed before any of the above-noted alarms. So they usually cannot occur on this condition.
- (2) D/A converter velocity command value is without the range of +8191 to -8192.
D/A converter velocity command value = $0.192 \times K \times G \times E \times 10^{-6}$

where K : servo loop gain multiplier (parameters 086, 087, 088, 089, 422)

G : servo loop gain 0.01 sec^{-1} (parameter 090)

E : position deviation

Can be verified by DGN 800 in X.

Can be verified by DGN 801 in Y.

Can be verified by DGN 802 in Z.

Can be verified by DGN 803 in 4th axis

Can be verified by DGN 804 in 5th axis

Theoretical value (when feed has become constant)

$$E = \frac{F}{60} \times \frac{1}{G} \times \frac{1}{\alpha} \times 10^2$$

where F : feed rate mm/min (inch/min)

 α : detection unit mm (inch)G : servo loop gain 0.01 sec^{-1}

Item	Cause of trouble	Check procedure	Countermeasures
1	Parameter setting is erroneous.	1) Check servo loop gain multiplier. Parameters 086 ~ 089, 422 2) Check servo loop gain. Parameter 090 3) Check CMR. Parameters 027 ~ 030, 414 4) Check DMR. Parameters 014 ~ 017, 410	
2	Positional deviation is great.	Compare theoretically calculated value with the following, by DGN 800 in X. by DGN 801 in Y. by DGN 802 in Z. by DGN 803 in 4th. by DGN 804 in 5th 1) Feed rate Rapid traverse rate: parameters 092 ~ 095, 428	
		Feed rate is right; positional deviation is also right.	Proceed to 6.
		Feed rate is right; positional deviation is not right.	Proceed to 3.
3	Machine tool does not move by a normal distance.	Issue a command (feed of several mm) causing no alarm to check if machine tool moves by a normal value.	
		Machine tool does not move by a normal value.	Proceed to 4.
		Machine tool moves by a normal value.	Proceed to 5.
4	Position detector is faulty.		Replace the position detector.
5	PCB is faulty.		For pulse coder, replace master PCB. For resolver/inductosyn, replace PCB A20B-0008-0461.
6	Master PCB is faulty.		Replace the master PCB.

(14) Alarm number

414 , 424 , 434 , 444 , 454 Position detecting system trouble. (Resolver/inductosyn)

Item	Cause of trouble	Check procedure	Countermeasures
1	Connection is faulty.	Check connector connection and cable signal line connection. Check if the signal line is shorted to the ground or to another line.	Repair erroneous connection.
2	Detected gain is not good.	See Sect. 6.1.6 for detected gain adjustment.	Adjust detected gain.
3	Phase shift is not good.	Check if phase shift value was initialized (parameter 013, bit 4, PHS = 0) at first field adjustment or after position detector replacement.	Initialize phase shift value.
4	PCB setting is erroneous.	Check inductosyn/resolver interface PCB for shorting. See Sect. 6.1.6 for alarms 414, 424, and 434, and Sect. 6.1.7 for alarms 444, 454	Correct erroneous setting.
5	Parameter setting is erroneous.	Check if DSCG-type parameters DSCGX, Y, Z, 4 and 5 (parameter 316, bits 0-4) are set to 1 for pulse coder-type position detection.	Set parameters correctly.
6	PCB adjustment is not good.	Check Fmin and Fmax adjustment on inductosyn/resolver interface PCB (see Sect. 6.1.6).	Adjust again.
7	Position detector is faulty.	Change fault axis to another axis for checking.	Replace the position detector.
8	Inductosyn gap is clogged with chips.	Insert a piece of paper in the gap. Check if scale-side signal and slider-side signal are insulated with NC-side cable removed.	Remove chips.
9	Inductosyn/resolver interface PCB is faulty.	Replace the PCB for checking.	Replace the PCB. A20B-0008-0461
10	Inductosyn pre-amplifier is faulty.	Replace the preamplifier for checking.	Replace the pre-amplifier.
11	Master PCB is faulty.	Replace the PCB for checking.	Replace the PCB.

(15) Alarm number

416 , 426 , 436 , 446 , 456 (Disconnection Alarms)

Item	Cause of trouble	Check procedure	Countermeasures
1	Cable connection is erroneous.	Check pulse-coder signals by DGN 713, 714 and 719 and pulse-coder feedback cable connection and wiring.	
2	PCB is faulty.		Replace the PCB.
3	Pulse coder is faulty.		Replace the pulse coder.

(16) Alarm number

600 : Data Transfer error from Connection Unit.

Item	Cause of trouble	Check procedure	Countermeasures
1	Cable connection is erroneous.	Check cable connection and wiring.	
2	Connection unit is faulty.		Replace the PCB.
3	Master PCB is faulty.		Replace the PCB.
4	MDI & CRT unit is faulty.		Replace the unit.
5	Terminator unit is faulty.	Check the terminator unit at the end of serial transfer line (Honda's 20-pin connector) for contact.	Replace the unit

(17) Alarm number

604 , **605** : FANUC PC-MODEL B PCB Is Faulty.

Item	Cause of trouble	Check procedure	Countermeasures
1	PCB A20B-0008-0440 is faulty.	Make sure that PCB setscrews are fastened.	Replace the PCB.
2	Master PCB is faulty.		Replace the PCB.
3	Other troubles	Inform FANUC Service Center of DGN 158/159 data.	

(18) Alarm number

606

(1) FANUC PC-MODEL B ROM faulty

ALARM MESSAGE:

606 ROM

(2) FANUC PC-MODEL B RAM (HIGH BYTE) Faulty

ALARM MESSAGE:

606 RAM HIGH

(3) FANUC PC-MODEL B RAM (LOW BYTE) Faulty

ALARM MESSAGE
606 RAM LOW

Item	Cause of trouble	Check procedure	Countermeasures
1	ROM is faulty.	Check DGN 160/161 data.	Inform FANUC Service Center. Replace PCB A20B-0008-0440.
2	RAM is faulty.		

(19) Alarm number

607 Data Transfer error from MDI & CRT

Item	Cause of trouble	Check procedure	Countermeasures
1	Cable connection is erroneous.	Check cable connection and wiring.	Replace the unit.
2	MDI & CRT unit is faulty.		Replace the unit.
3	Master PCB is faulty.		Replace the PCB.
4	Connection unit is faulty.		Replace the PCB.
5	Terminator unit is faulty.	Check the terminator unit (Honda's 20-pin connector) at the end of serial transfer line for contact.	Replace the unit.

(20) Alarm number

700

Over-Heat Alarm

“700” is displayed when the overheat of the control unit is detected.

Release

While this alarm is displayed, restart is impossible with reset button.

After the temperature is lowered, the alarm releases.

Item	Cause of trouble	Countermeasures
①	Ambient temperature too high.	Lower ambient temperature.
②	Air filter is too dusty.	Clean the air filter.
③	Motor Fan trouble	Replace the motor fan.

(21) Alarm number

702

703

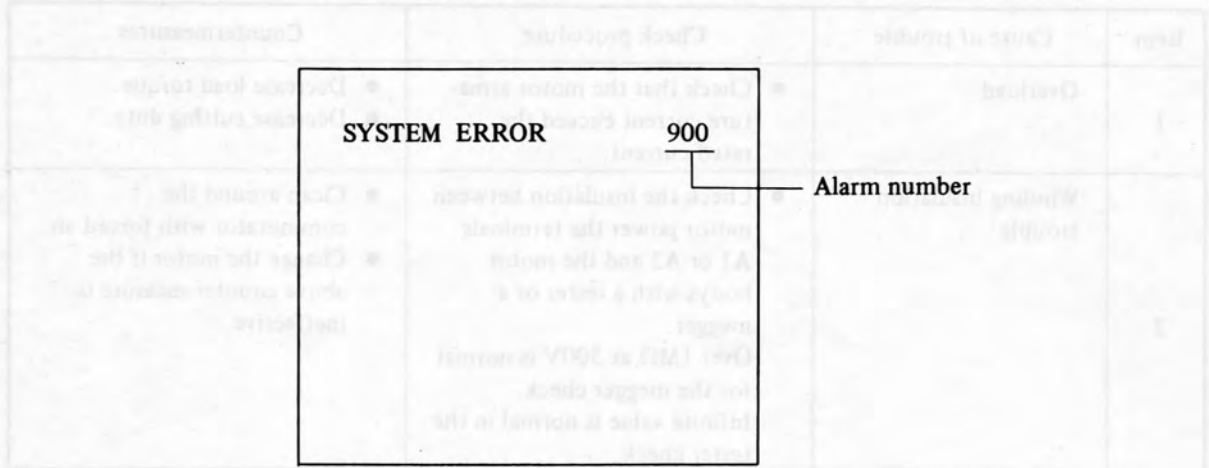
Overheat alarm of DC servo motor

Item	Cause of trouble	Check procedure	Countermeasures
1	Overload	Check that the motor armature current exceed the rated current.	- Decrease load torque. - Decrease cutting duty.
2	Winding insulation trouble	Check the insulation between motor power the terminals A1 or A2 and the motor bodys with a tester or a megger. Over 1MΩ at 500V is normal for the megger check. Infinite value is normal in the tester check.	- Clean around the commutator with forced air. - Change the motor if the above counter-measure is ineffective.
3	Shortcircuit in internal winding	Measure no-load current by removing the motor from the machine. If the current increases in proportion to the motor rotation rate, there is a short-circuit in an internal winding.	Clean around the commutator. The oil adheres to the surface of the commutator, this problem can easily occur.
4	Field system magnet demagnetization	Check that voltage is normal by measuring the motor terminal voltage between terminals A1 and A2.	Change the motor if terminal voltage is low or the motor is overheated.
5	Trouble in heat pipe fan operation	- Check the fan voltage or the wiring. - Check whether the fan touches a wire gauze. - Check the fan motor	- Rearrange the wiring. - Refix the wire gauze. - Replace the fan motor.
6	Trouble in heat pipe efficiency	The heat pipe is ineffective the attached motor is over heated, despite that all the above items concerning the trouble in the heat pipe fan operation are normal.	Replace the motor.
7	Brake trouble	- Check that the brake connection corresponds to the power source frequency. - Check that the voltage is 100V ± 10% (allowable value).	Replace the brake.
8	Connection trouble	Check whether a motor signal line is disconnected or a connector is loose. (Refer to Cable J5, J6, J7 in Appendix 1.)	Repair the fault.
9	Master PCB and/or additional axis control PCB is faulty.		Replace the PCB.

(22) Alarm number

900 ~ 909 , 912 Bubble memory alarm

The CRT displays the alarm number

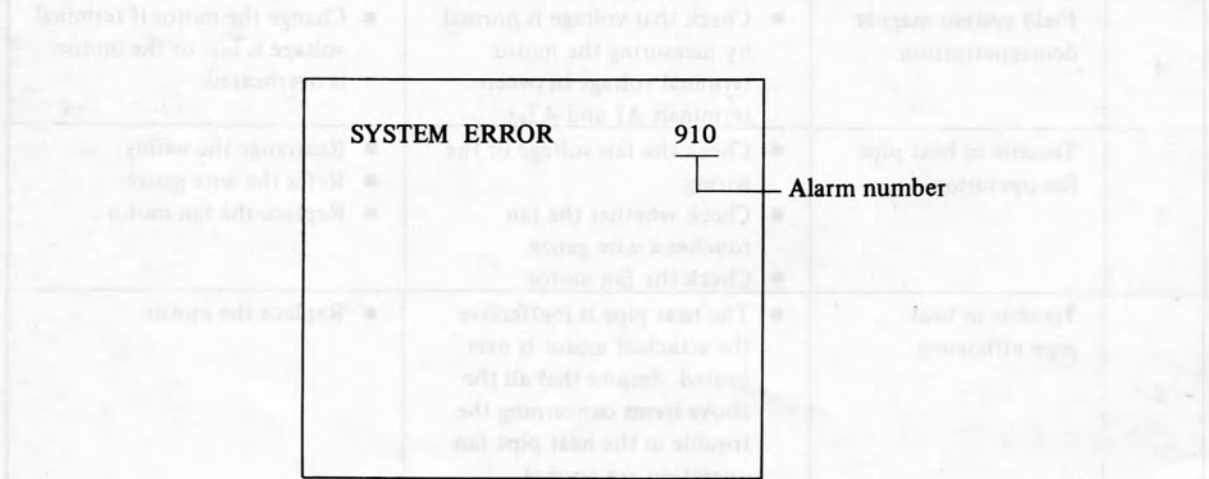


Please contact with the FANUC Service Center.

(23) Alarm number

910 , 911 RAM parity alarm

The CRT displays the alarm number



Please contact with the FANUC Service Center.

Item	Cause of trouble	Check procedure	Countermeasures
①	Master PCB is faulty.	See Appx. 12 to conduct RAM test.	Replace the PCB.

(24) Alarm number

920 System error (watch dog timer alarm)

Item	Cause of trouble	Check procedure	Countermeasures
1	Setting miss of parameter number 000 to 005 and 300 to 304	Refer to data sheet.	Clear the all parameter and reset it. Method of clear ① Set parameter enable switch to ENABLE side. ② Power on with pressing CAN and DELET Refer to item 5.3 about parameter. Offset amount and setting is also cleared. It is need to reset it.
2	Master PCB trouble	Change PCB if there is spare PCB. Check whether setting and adjustment of PCB are performed or not	Replace the PCB

(25) Alarm number

930 CPU error

Remedies

- Change PCB if there is spare PCB. Check whether setting and adjustment of PCB are performed or not.
- Please contact with FANUC service center.

(26) Alarm number

940 Memory alarm of offset amount

When initial setting amount of offset exceeds ± 999.999 mm, this alarm will occur.

Remedies

- Clear the offset amount and reset the normal amount.

Method of clear

- ① Set parameter enable switch to ENABLE side.
- ② Power on with pressing CAN and DELET

In this case parameters are also cleared, reset parameters.

(27) Alarm number

960 system error

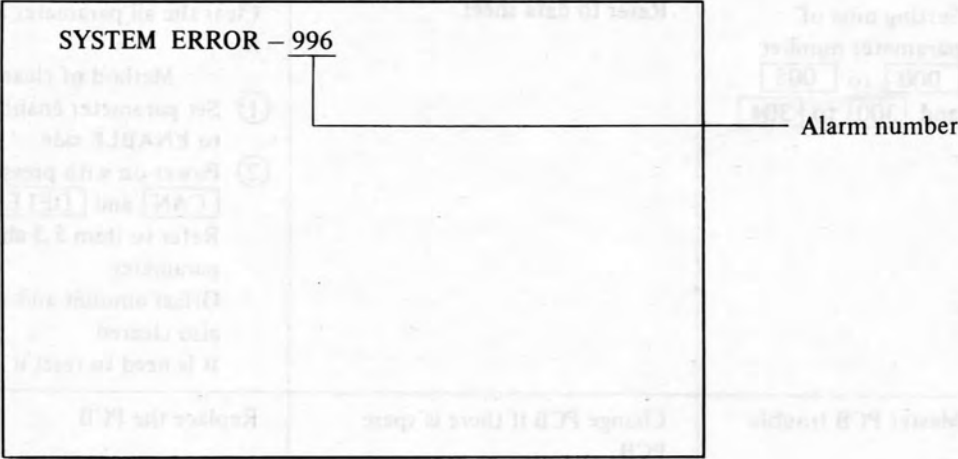
Master PCB or bubble memory PCB is trouble. Change PCB if there is spare PCB. Then setting and adjustment on the master PCB must be performed correctly.

(28) Alarm number

996

 Additional RAM installation error

Alarm number 996 appears on the CRT.

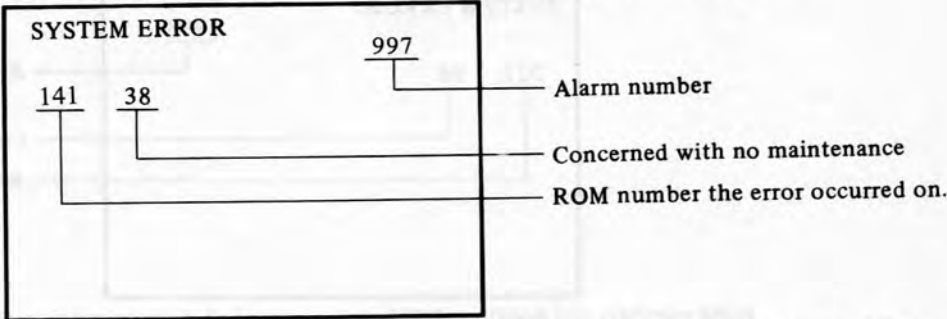


Item	Cause of trouble	Check procedure	Countermeasures
1	Additional RAM is not mounted irrespectively of the addition of an option which requires an additional RAM.	Additional RAM has not been mounted after replacing the master PCB.	Mount additional RAM.
		An option parameter requiring additional RAM is set by mistake.	Clear all parameters and reset them.
		Additional RAM is defective.	Replace.

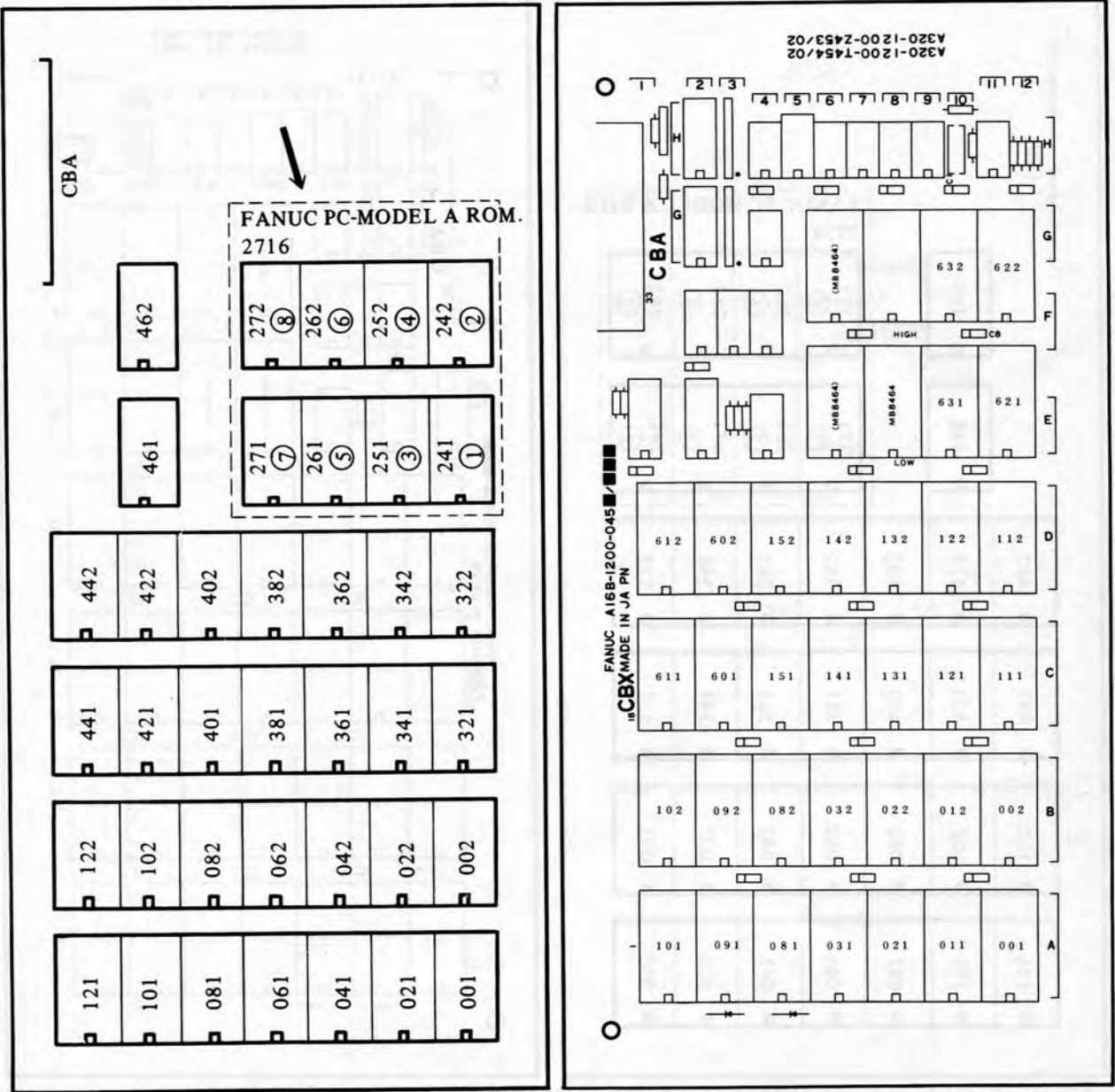
(29) Alarm number

997 FANUC PC-MODEL A ROM parity error

The CRT displays the alarm number and the number of ROM the error occurred on.



ROM numbers and positions ROMs are mounted at, correspond to each other as in the figure below.

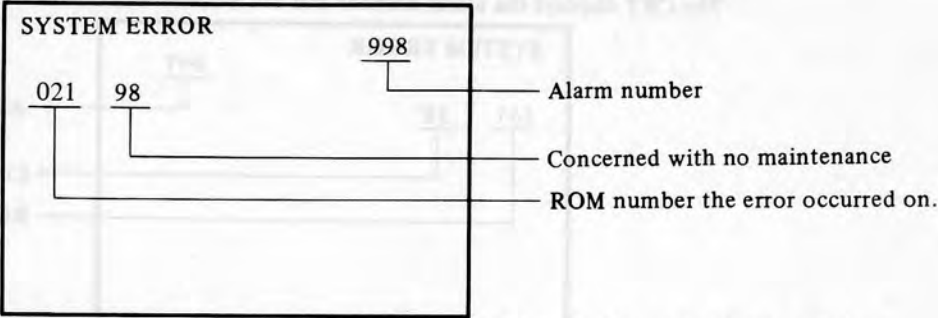


Countermeasures) Inform FANUC Service Center of the alarm number and the number of EROM the error occurred on.

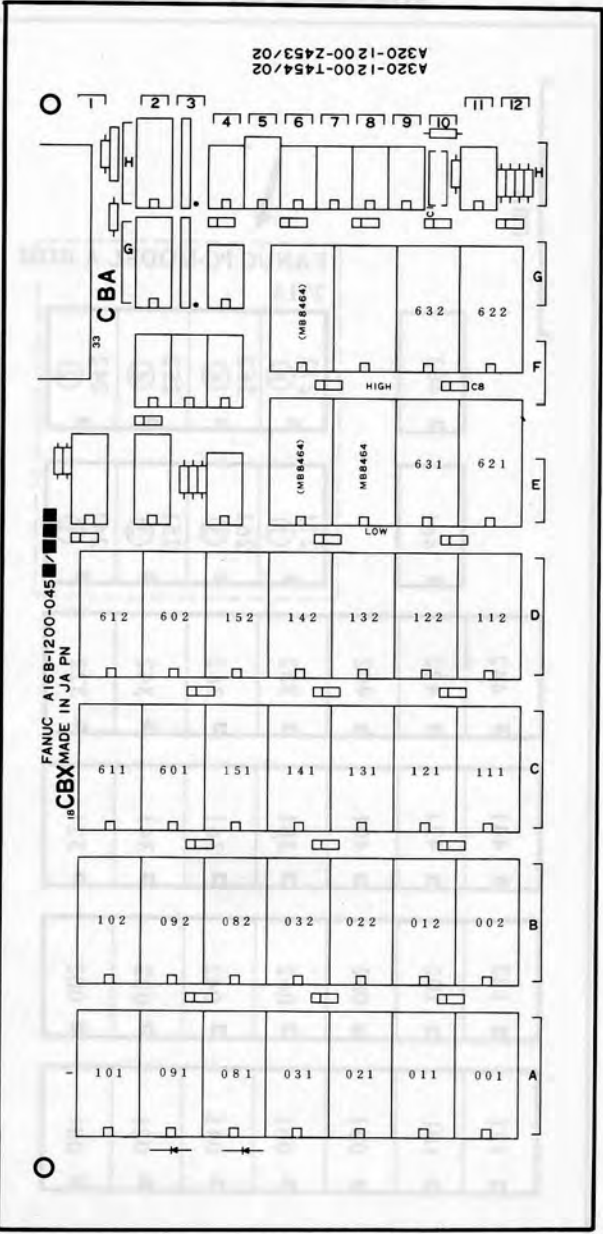
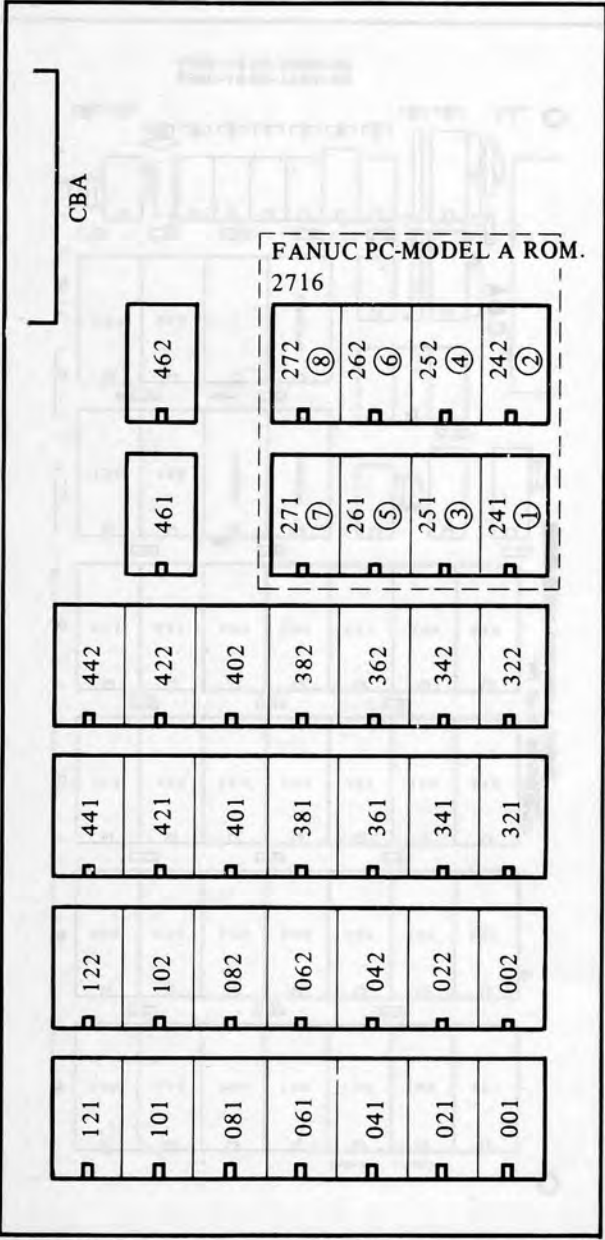
(30) Alarm number

998 Basic ROM parity alarm

The CRT displays the alarm number and the number of ROM the error occurred on.



ROM numbers and positions ROMs are mounted at, correspond to each other as in the figure below.

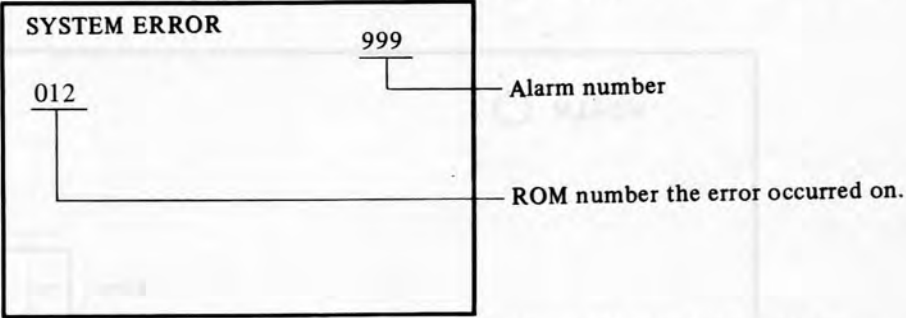


Countermeasures) Inform FANUC Service Center of the alarm number, the number of EROM the error occurred on, software series and software version according to item 3.3.2 (2).

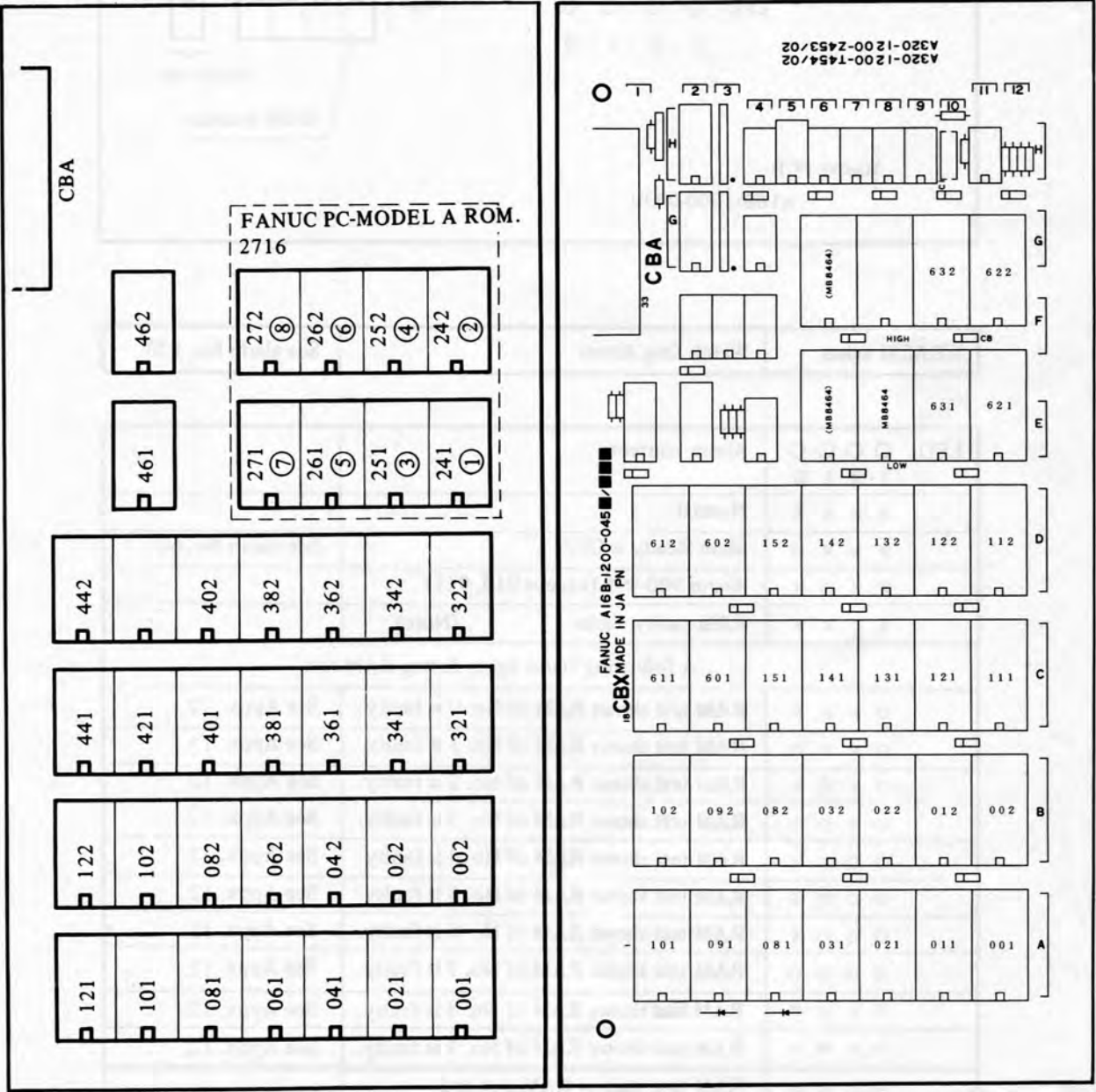
(31) Alarm number

999 ROM pair error

The CRT displays the alarm number and the number of ROM the error occurred on.



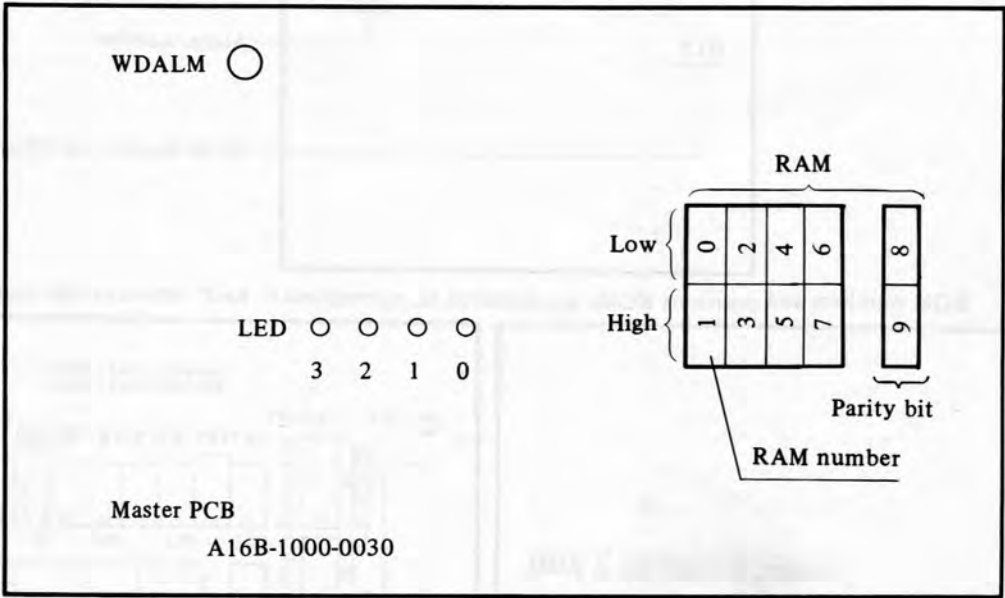
ROM numbers and positions ROMs are mounted at, correspond to each other as in the figure below.



Countermeasures) Inform FANUC Service Center of the alarm number, the number of EROM the error occurred on, software series and software version according to item 3.3.2 (2).

3.3.4 LEDs on the master PCB light

When an alarm occurs, usually the CRT display the alarm number, but in some cases it cannot display alarms for troubles associated with display functions. In such cases, the LEDs on the master PCB are made to display the alarm contents as in the figure below.



WDALM lights	Watch Dog Alarm	See alarm No. 920.
--------------	-----------------	--------------------

LEDs ○ ○ ○ ○ 3 2 1 0	Alarm contents	
x x x x	Normal	
x x x ○	Slave Ready is OFF.	See alarm No. 601.
x x ○ x	Alarm 900-999 (except 910, 911)	
x ○ x x	RAM parity alarm (Note)	
A following alarm lights during RAM test.		
○ x x x	RAM test shows RAM of No. 0 is faulty.	See Appx. 12.
○ x x ○	RAM test shows RAM of No. 1 is faulty.	See Appx. 12.
○ x ○ x	RAM test shows RAM of No. 2 is faulty.	See Appx. 12.
○ x ○ ○	RAM test shows RAM of No. 3 is faulty.	See Appx. 12.
○ ○ x x	RAM test shows RAM of No. 4 is faulty.	See Appx. 12.
○ ○ x ○	RAM test shows RAM of No. 5 is faulty.	See Appx. 12.
○ ○ ○ x	RAM test shows RAM of No. 6 is faulty.	See Appx. 12.
○ ○ ○ ○	RAM test shows RAM of No. 7 is faulty.	See Appx. 12.
○ x x ■	RAM test shows RAM of No. 8 is faulty.	See Appx. 12.
○ x ■ x	RAM test shows RAM of No. 9 is faulty.	See Appx. 12.
■ x x x	RAM test wait or RAM test end	

○ : ON x : OFF ■ : Flickers

64

3.3.5 Jog operation is impossible

Item	Cause of trouble	Check procedure	Countermeasures
1	Confirmation	Check if position display changes in DLK OFF state. (display lock)	
		① Position display changes, but machine tool does not.	Proceed to 2 .
		② Neither position display nor machine tool moves.	Proceed to 5 .
2	MLK ON (Machine lock)	Make sure that Bit 7 of DGN 100 is 0.	
3	Servo off signal *SVFX/Y/Z/4/5 has been input.	Make sure that bit 6 of DGN 096 is 1 in X. Make sure that bit 6 of DGN 097 is 1 in Y. Make sure that bit 6 of DGN 098 is 1 in Z. Make sure that bit 6 of DGN 099 is 1 in 4th. Make sure that bit 6 of DGN 199 is 1 in 5th.	
4	Servo system is abnormal.	See Sect. 3.11.	
5	Interlock signal *ITX/Y/Z/4/5 has been entered.	Make sure that bit 4 of DGN 096 is 1 in X. Make sure that bit 4 of DGN 097 is 1 in Y. Make sure that bit 4 of DGN 098 is 1 in Z. Make sure that bit 4 of DGN 099 is 1 in 4th. Make sure that bit 5 of DGN 119 is 1 in 5th.	Confirm the connection
6	No mode signal has been input.	Check DGN 105 to make sure that only Jog mode signal is 1.	"
7	No axis selection signal (+X, -X,) has been input.	Make sure that DGN 96 ~ axis selection signal is input. Note: When axis command is input before J mode is selected, the axis does not move. Cutting the axis command once, then inputting it again, moves the axis.	"
8	Jog feed rate setting is erroneous.	Check parameter 91. When no rapid traverse is effected, check rapid traverse rate parameter 92 ~ .	
9	External reset ERS ON	Make sure that bit 7 of DGN 102 is 0.	Confirm the connection
10	Reference Point Return (ZRN) ON	Make sure that bit 7 of DGN 101 is 0.	"
11	LEDs on master PCB	See Sect. 3.3.4.	Replace the master PCB.

3.3.6 Manual pulse generator does not operate

Item	Cause of trouble	Check procedure	Countermeasures
1	Confirmation	Check if position display changes in display lock DLK OFF state.	
		① Position display changes, but machine tool does not move.	Proceed to 2 .
		② Neither position display nor machine tool moves.	Proceed to 5 .
2	Machine lock MLK ON	Make sure that bit 7 of DGN 100 is 0.	
3	Servo off signal *SVFX/Y/Z/4/5 has been input.	Make sure that bit 7 of DGN 096 is 1 in X. Make sure that bit 7 of DGN 097 is 1 in Y. Make sure that bit 7 of DGN 098 is 1 in Z. Make sure that bit 7 of DGN 099 is 1 in 4th. Make sure that bit 7 of DGN 119 is 1 in 5th.	
4	Servo system is abnormal.	See Sect. 3.11.	
5	Fixed parameter setting is erroneous.	Collate parameters 000 ~ 005 with the parameter table accompanying the NC.	
6	Interlock signal *ITX/Y/Z/4/5 has been input.	Make sure that bit 4 of DGN 096 is 1 in X. Make sure that bit 4 of DGN 097 is 1 in Y. Make sure that bit 4 of DGN 098 is 1 in Z. Make sure that bit 4 of DGN 099 is 1 in 4th. Make sure that bit 5 of DGN 119 is 1 in 5th.	
7	No mode signal has been input.	Check DGN 105 to make sure that only Handle mode signal is 1.	
8	No axis/selection signal HX/Y/Z/4/5 has been input.	Make sure that DGN 96/97/98/99/119 axis selection signal is input.	
9	External reset ERS ON	Make sure that bit 7 of DGN 102 is 0.	
10	Reference Point Return (ZRN) ON	Make sure that bit 7 of DGN 101 is 0.	
11	Manual pulse generator is faulty.	Make sure that turning the manual pulse generator turns ON/OFF bits 5 (*HB) and 4 (*HA) of DGN 714.	
12	LEDs on master PCB light.	See Sect. 3.3.4.	

3.3.7 Synchronous feed or feed per revolution is no good

Item	Cause of trouble	Check procedure	Countermeasures
1	Cable connection is erroneous.	Check NC and position coder for inter-connection.	
2	Number of spindle revolutions	Check the number of spindle revolutions displayed on CRT for coincidence with the then number of actual spindle revolutions. [Displaying the number of spindle revolutions] : ① Press COMND button. ② Keep pressing PAGE button until CURRENT BLOCK screen appears. ③ CURRENT BLOCK screen will display the number of spindle revolutions in SACT Note: The number of spindle revolutions is displayed by counting feedback signals from the position coder.	
3	Master PCB setting is erroneous.	See Item 6.1 to check setting	
4	Position coder is faulty.		Replace the position coder.
5	Master PCB is faulty.		Replace the master PCB.

3.3.8 Tape reader does not operate normally

Item	Cause of trouble	Check procedure	Countermeasures
1	Confirmation	① Pressing START button in tape mode, does not feed tape.	Proceed to 3 .
		② Pressing START button in tape mode, feeds tape but reads in no data normally.	Proceed to 10 .
		③ Pressing READ button in memory mode, does not feed tape.	Proceed to 2 .
		④ Pressing READ button in memory mode, feeds tape but reads in no data normally.	Proceed to 10 .
2	Setting is erroneous.	Let CRT be SETTING DATA 01 screen to make sure INPUT DEVICE 1 = 0 INPUT DEVICE 2 = 0 Operation: ① Press SET button. ② Keep pressing PAGE button until SETTING DATA 01 appears.	
3	No mode signal has been input.	Check DGN 105 to make sure that only MEM in memory mode or T in tape mode is 1	
4	Tape reader status display	Check DGN 703 to make sure that bits 4 and 6 are 1. Bit 4 is 1 when the toggle switch in tape reader is ready for automatic operation.	Check master PCB and tape reader for interconnection.
5	No start signal has been input (tape mode only).	Check DGN 101 to make sure that turning ON/OFF START button, makes bit 2 1/0.	
6	READ button is faulty (memory mode only).	It is difficult to directly check this signal. Therefore, indirectly check by seeing whether or not pressing START button in tape mode, feeds tape.	
		Tape is fed in tape mode.	READ button is faulty.
		Tape is not fed in tape mode.	Proceed to 7 .
7	No tape reader AC power is supplied.	Check whether or not tape reader motor is revolving. When not, no AC power is supplied.	
8	No tape reader DC power is supplied (+24V, +5V, 0V).	Turn the switch in tape reader to MANUAL to check if tape is fed. If not, check DC power supply on PC board in the tape reader.	
9	Tape reader is faulty.		Replace the tape reader.
10	Confirmation	Input tape code is EIA.	Proceed to 12 .
		Input tape code is ISO.	Proceed to 11 .
11	Fixed parameter setting is erroneous.	Collate the contents of parameters 000-005 with the parameter table accompanying the NC.	
12	Tape is loaded face downward.		
13	Tape is other than black. (In case using tape reader with reels)		Replace it by black one.
14	EOB punching is mistaken.	Check EOB code on paper tape.	

15	Tape reader adjustment is not good.	① See Sect. 3.5 to make sure that photo-amplifier LED (green) on PCB is lit.	To item 3.5.
		② See Sect. 3.5 to adjust the photo-amplifier.	
16.	LEDs on master PCB are on.	See Item 3.3.4.	
17	Cable connection is erroneous	Check the cable for connection.	
18	Tape reader is faulty.		Replace the tape reader.
19	Master PC board is faulty.		Replace the PC board.

3.3.9 Automatic operation is impossible

Item	Cause of trouble	Check procedure	Countermeasures
1	Confirmation	Turn ON/OFF the START button in automatic (T, D or MEM) mode.	
		① No STL lamp lights.	Proceed to 2 .
		② STL lamp lights but no axis moves.	Proceed to 7 .
2	No mode signal has been input.	Check DGN 105.	
3	No start signal has been input.	Make sure that turning START button ON/OFF, makes bit 2 of DGN 101 1/0.	
4	Feed hold signal (*SP) has been input.	Make sure that bit 5 of DGN 102 is 1.	
5	Reset signal has been input.	Make sure that bits 6 and 7 of DGN 102 are 0, and that bit 4 of DGN 102 is 1.	
6	LEDs on master PCB are on.	See Item 3.3.4.	
7	1 Override is set at 0%. 2 Interlock is ON. 3 In-position check is in effect. 4 Dwell is in execution. 5 M, S or T function is in execution. 6 Waiting for spindle arrive signal. 7 Tape reader is operating	Check DGN 700 and 701–712.	

3.3.10 No S4 digit analog output is produced

Item	Cause of trouble	Check procedure	Countermeasures
1	Confirmation	Issue S___ M03 command in MDI (press PAGE button to make sure on CURRENT BLOCK screen that this signal has been accepted). At that time, make sure that DGN 68, 69 causes R01 ~ R12 to establish the following equation. $R12 \times 2^{11} + R11 \times 2^{10} + \dots + R01 \times 2^0$ $= 0.8 \times \frac{S}{S_{\max}} \times \frac{S_{\text{ovr}}}{100} \times 4095$ where S: specified number of revolutions (rpm) S_{max}: maximum number of revolutions of the then selected gear (parameters 120 ~ 123) S_{over}: spindle override (%)	
		R01 ~ R12 are all 0.	Proceed to 2 .
		R01 ~ R12 differ from the above equation.	Proceed to 3 .
		R01 ~ R12 differ from the above equation, but no analog voltage is output.	Proceed to 9 .
2	Spindle stop signal (*SSTP) has been input.	Make sure according to the following that no *SSTP has been input. (1) When bit 4 of parameter 011 is 0, bit 7 of DGN 106 is 1. (2) When bit 4 of parameter 011 is 1, bit 7 of DGN 106 is 0.	
3	Only with S analog B, no gear select signal is input correctly.	Check DGN 114 for GRA/GRB.	
4	Upper and lower limits of output values to spindle motor are set erroneously.	Upper limit: parameter 136 Lower limit: parameter 135	
5	Spindle maximum feedrate setting is erroneous (parameter setting error).	Make sure that parameters 132, 133 (in case S4 digit output A) or 361 ~ 364 (in case S4 digit output B)	
6	S analog output gain setting is erroneous (parameter setting error).	Check if parameter 140 is 1000.	
7	Fixed parameter setting is erroneous.	Collate the contents of parameters 000-005 with the parameter table attached to the NC.	
8	LEDs on master PCB are lit.	See Item 3.3.4.	
9	Confirmation	Make sure by DGN 004, 005 that R01 ~ R12 are the same as by DGN 068, 069 (for the NC with Programmable Controller, however, may vary, according to its specifications).	

		Same condition, but no S analog voltage is output.	Proceed to 10 .
		Vary.	Proceed to 14 .
10	Cable connection is erroneous.	NC-side output connector is C18. Check the cable for connection.	
11	Load is abnormal.	Remove the cable connected to NC-side connector C18 and check the voltage between C18 connector pin 7 (VCMS) and pin 19 (ECS). <i>Note: VCMS voltage is:</i> $V = \frac{S}{S_{\max}} \times 10 \text{ (V)}$	
12	LEDs on master PCB light.	See Item 3.3.4.	
13	PCB is faulty.	PCB A20B-0008-0470 is faulty. PCB A20B-0008-0471 is faulty. PCB A20B-0007-0090 is faulty. or the cable in the NC, connecting C18 and CHX1, is faulty.	
14	Check specifications of Programmable Controller, if attached.	Check if signals from the machine tool clamp the S analog output on the Programmable Controller.	
15	LEDs on master PCB are lit.	See Item 3.3.4.	
16	Master PCB is faulty.	See Item 3.3.4.	

3.3.11 S4-digits analog output voltage linearity is not good

Item	Cause of trouble	Check procedure	Countermeasures
1	Parameter setting is erroneous.	1 Command S0 so that output voltage may become 0V. Then make sure that S analog voltage is 0V (offset adjustment). When not, set parameter 119 so that 0V may be output. 2 Command Smax so that output voltage may become 10V. Then make sure that S analog voltage is 10V (gain adjustment). When not, set parameter 140 according to the following equation, so that 10V may be output. $\frac{10.0}{\text{Measured voltage (V)}} \times 1000 = \text{Setting value}$	
2	Load is abnormal	See 11 of Item 3.3.10.	
3	PCB is faulty	See 13 of Item 3.3.10.	

3.3.12 FACIT 4070 does not operate normally

Item	Cause of trouble	Check procedure	Countermeasures
1	Confirmation	Let FACIT 4070 punch to check the following.	
		Does not punch. No EDIT is displayed below on CRT screen.	Proceed to 2 .
		Does not punch. EDIT is displayed below on CRT screen.	Proceed to 7 .
		Punch code differs.	Proceed to 13 .
2	Reset signal has been input.	Make sure that bits 6 and 7 of DGN 102 are 0, and that bit 4 of DGN 102 is 1.	
3	No mode signal has been input.	Check DGN 105 to make sure that only one of EDT and MEM modes is 1.	
4	Fixed parameter setting is erroneous.	Collate the contents of parameters 000 ~ 005 with the parameter table attached to the NC.	
5	LEDs on master PCB light.	See Item 3.3.4.	
6	Punch buttons are faulty.		Replace MDI & CRT unit.
7	Setting is erroneous.	Makes sure that No. 341 is 0 in setting (or that parameter 341 is 0).	
8	FACIT 4070 is operated wrongly (or is faulty).	Make sure that: ① Ready lamp is lit. ② Error lamp is not lit. on FACIT 4070	
9	Cable connection is erroneous.	Check cable connection and wiring.	
10	LEDs on master PCB are lit.	See Item 3.3.4.	
11	PCB A20B-0008-0430 is faulty.		Replace the PCB.
12	Master PCB is faulty.		Replace the PCB.
13	Setting is erroneous.	ISO/EIA code is considered to have been set irrelevantly. Check punched codes.	
		ISO codes are output, when EIA ones are to be.	Change to EIA by setting.
		EIA codes are output, when ISO ones are to be.	Change to ISO by setting. Check fixed parameters 000-005.
		Punched codes are nonsense.	Proceed to 9.

3.3.13 ASR 33/43 does not operate normally

Item	Cause of trouble	Check procedure	Countermeasures
1	Confirmation	Let ASR 33/43 punch to check the following	
		Does not punch. No EDIT is displayed below on CRT screen.	Proceed to 2 .
		Does not punch. EDIT is displayed below on CRT screen.	Proceed to 7 .
		Punched code differs.	Proceed to 14 .
2	Reset signal has been input.	Make sure that bits 6 and 7 of DGN 102 are 0, and that bit 4 of DGN 102 is 1.	
3	No mode signal has been input.	Check DGN 105 to make sure that only one of EDT and MEM modes is 1.	
4	Fixed parameter setting is erroneous.	Collate the contents of parameters 000-005 with the parameter table attached to the NC.	
5	LEDs on master PCB light.	See Item 3.3.4.	
6	Punch buttons are faulty.		Replace MDI & CRT unit.
7	Setting is erroneous.	Makes sure that NO 341 is 1 in setting (or that parameter 341 is 1).	
8	Baud rate setting is erroneous.	Check parameter 310 for setting. ① Baud rate: 110 for ASR33 I/O setting for ASR 43 ② Stop bit: two bits ③ Control code: not used.	
9	ASR 33/43 is operated wrongly (or is faulty).	Check if: ① AC is supplied. ② The unit is set in LINE.	
10	Cable connection is erroneous.	Check cable connection and wiring.	
11	LEDs on master PCB are lit.	See Item 3.3.4.	
12	PCB A20B-0008-0430 is faulty.		Replace the PCB.
13	Master PCB is faulty.		Replace the PCB.
14	Setting is erroneous.	ISO/EIA code is considered to have been set irrelevantly. Check punched codes.	
		ISO codes are output, when EIA ones are to be.	Change to EIA by setting.
		EIA codes are output, when ISO ones are to be.	Change to ISO by setting. Check fixed parameters 000-005.
		Punched codes are nonsense.	Proceed to 8 .

Item	Cause of trouble	Check procedure	Countermeasures
1	Confirmation	Neither punching nor reading is possible. As a result, no EDIT is displayed below on CRT screen.	Proceed to 2
		Neither punching nor reading is possible. But EDIT is displayed.	Proceed to 6
		Punching is possible, but reading is impossible.	Proceed to 13
		Reading is possible, but punching is impossible.	Proceed to 13
		Alarm occurs. (085 ~ 087)	Proceed to Item 3.2
2	Reset signal has been input.	Make sure that bits 6 and 7 of DGN 102 are 0, and that bit 4 of DGN 102 is 1.	
3	No mode signal has been input.	Check DGN 105 to make sure that only one of EDT and MEM modes is 1.	
4	Fixed parameter setting is erroneous.	Collate the contents of parameters 000-005 with the parameter table attached to the NC.	
5	LEDs on master PCB light.	See Item 3.3.4.	
6	Setting is erroneous.	Makes sure that No 340, 341 is 2, 3 or 4 in setting (or that parameter 340, 341).	
7	Baud rate setting is erroneous.	When this parameter is unusual, alarm 85/86 occurs. When No 340, 341 is 2 in setting, see parameter 311. When NO 341 is 3 in setting, see parameter 312. When NO 341 is 4 in setting, see parameter 313.	
8	I/O device is operated wrongly (or is faulty).	See the I/O device operation guide for correct operation.	
9	Cable connection is erroneous.	Check cable connection and wiring (signal connection is based on the specifications determined between machine tool builder and I/O device maker).	
10	LEDs on master PCB are lit.	See Item 3.3.4.	
11	PCB A20B-0008-0430 is faulty.		Replace the PCB.
12	Master PCB is faulty.		Replace the PCB.
13	Setting is erroneous.	ISO/EIA codes are considered to have been set irrelevantly. 1 Check setting. 2 Check fixed parameters 000-005. 3 Proceed to 9 .	

3.3.15 Stop position does not coincide with reference point in reference point return**1-grid deviation**

Item	Cause of trouble	Check procedure	Countermeasure
①	The deceleration dog position is not correct.	Move the machine tool from the reference point for the distance to the deceleration dog and check the deceleration signal with the diagnostic function. Read the distance between the reference point and the deceleration dog on the NC position display.	The distance between the deceleration dog and the reference point should be equivalent to one-half of a motor revolution.
②	The deceleration dog length is too short.	Use the procedure given in item ① above to read the length of the deceleration dog.	Replace the dog.

Random deviation

Item	Cause of trouble	Check procedure	Countermeasure
①	Noise	Check whether the shielding is grounded or not. Check that spark suppressors are connected to the solenoid coil, etc. Check whether the pulse coder cable and the power cable are in proximity.	Ground the shielding wire. Connect the spark killer. Separate the pulse code and power cables.
②	Source voltage to the pulse coder is too low.	When the voltage at power checking terminals on the master PCB is $5.0V \pm 0.05V$, the source voltage should be 4.75V or more. (Remove the pulse coder cover and measure the source voltage at the (+) and (−) terminals on the pulse coder board.)	Cable loss must be 0.2V or less. The voltage at +5V terminal on the master PCB should be within the range of 4.95 to 5.10 V.
③	Coupling between the servo motor and the machine tool is loose.	Mark the motor shaft and check the correspondence between the shaft and machine tool position.	Tighten the coupling.
④	Defective pulse coder.	Replace the pulse coder.	Replacement.
⑤	Defective master PC board.	Replace the master board.	Replacement.

Minute deviation

Item	Cause of trouble	Check procedure	Countermeasure
①	Broken cable or defective connector.	Check that the cable connector is tight. Check the solder connections and bends in the cable.	Repair the connection.
②	Variation in offset voltage. Defective master PCB or velocity control unit.	Release the drift compensation function with the parameter and check the position deviation using the diagnostic function. The offset value variation corresponds to the variation of the position deviation value. Replace the master PC board or the velocity control unit board to determine the source of the problem.	Replace the faulty board.

Checking method of reference point return operation and deceleration dog position.

(1) **Set the parameter according to the following table**

Set '0' to parameter 082 ~ 085 and 421.

Parameter number	Contents
010	When optional stored stroke limit is equipped with, manual rapid traverse is effective or not without performing the reference point return.
011	Deceleration signal (*DECX, *DECY, *DECZ, *DEC4, *DEC5) is "1" in reference point return shows deceleration or "0".
012	Reference point return method and direction.
014 ~ 017, 410	Capacity of reference counter for each axis.
020	Reference point return function is provided or not.
082 ~ 085, 412	Setting of grid shift amount of each axis.
114	Low feed rate for reference point return.
159 ~ 162, 435	Distance from second reference point to first reference point of each axis.
367 ~ 370, 438	Distance from third reference point to first reference point of each axis.
371 ~ 374, 439	Distance from fourth reference point to first reference point of each axis.

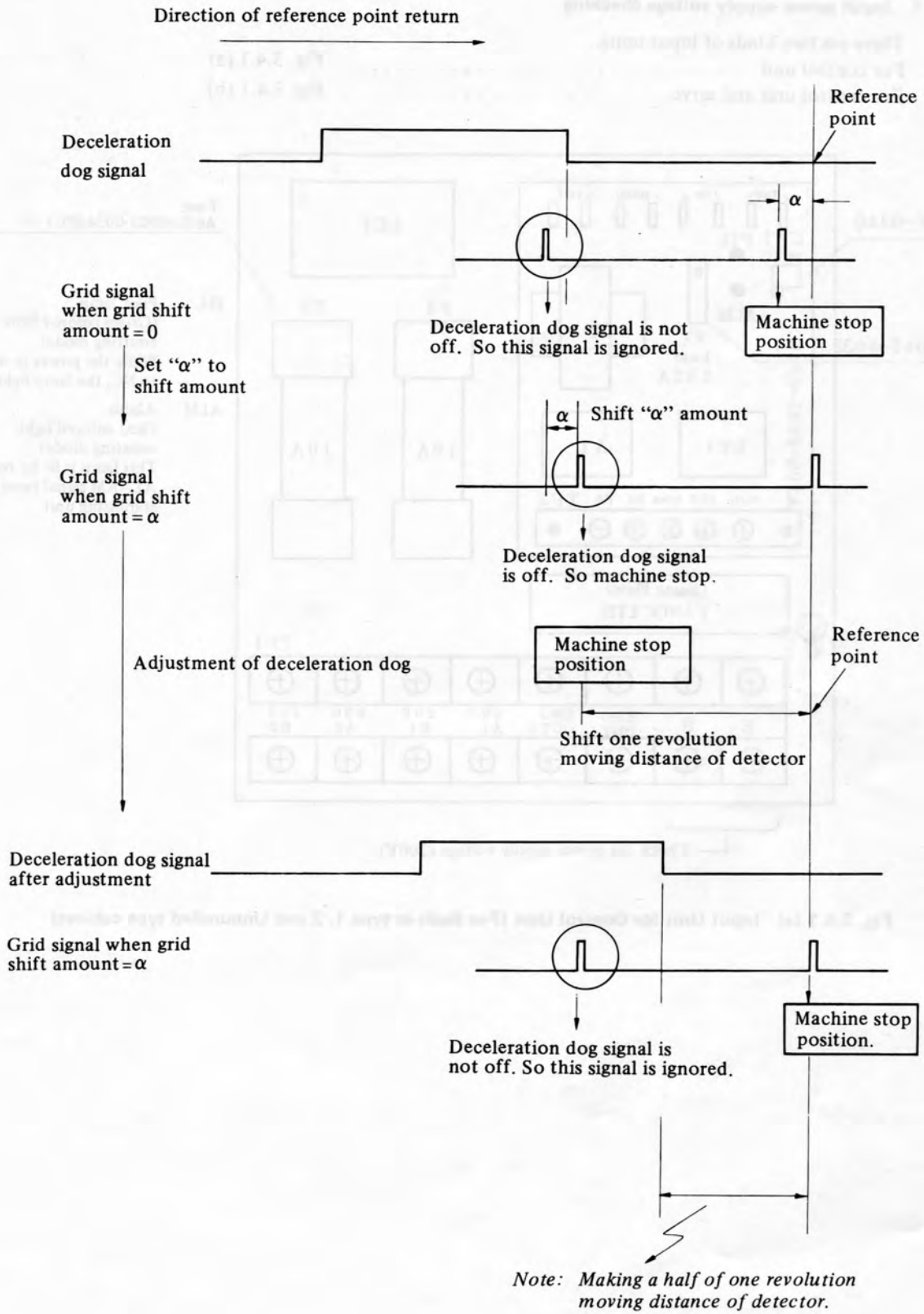
(2) Perform the reference point return and confirm the operation is correct.

In case reference point adjustment is needed.

- i) grid method Adjusted by grid shift amount (parameter 082 ~ 085, 421)
Then if reference point shifts a portion of 1 revolution of detector (pulse coder, resolver). Deceleration dog must be shifted.
- ii) magneswitch method Adjusted by position of proximity switch.

(3) Confirm the deceleration dog position. (only grid method)

- i) Perform reference point return.
- ii) Write down data of position display at reference point.
- iii) Check deceleration dog signal (*DECX, *DECY, *DECZ, *DEC4, *DEC5) in DGN 032 ~ 35, 048 and return the machine to DEC signal on position from reference point.
- iv) Calculate the distance from reference point to DEC signal on position by (ii) (iii) procedure. And make that distance a half of movement distance of detector 1-revolution by adjustment of Deceleration dog.



3.4 Power supply voltage checking

3.4.1 Input power supply voltage checking

There are two kinds of input units.

- (1) For control unit Fig. 3.4.1 (a)
- (2) For control unit and servo Fig. 3.4.1 (b)

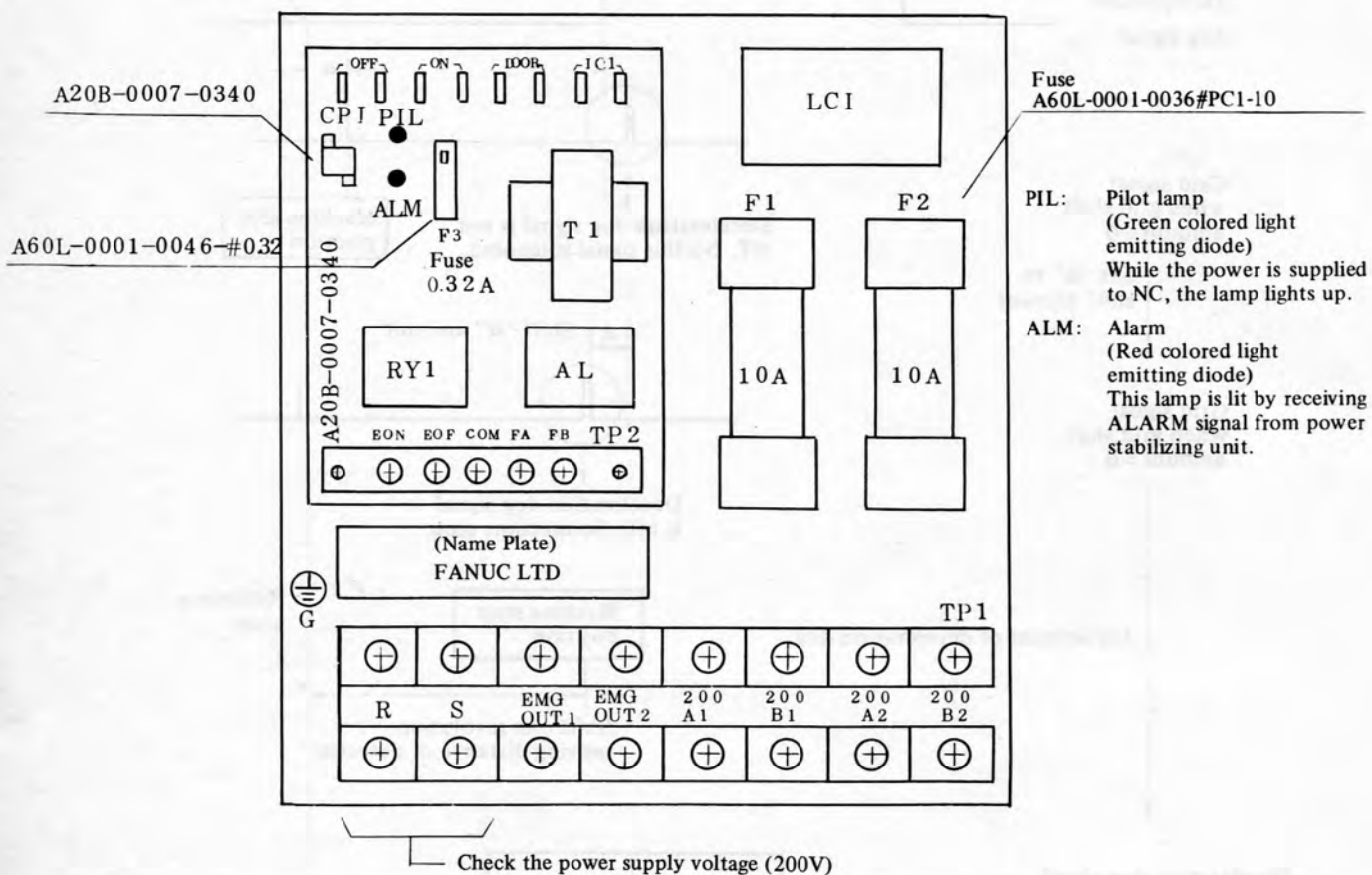


Fig. 3.4.1 (a) Input Unit for Control Unit (For Built-in type 1, 2 and Unbundled type cabinet)

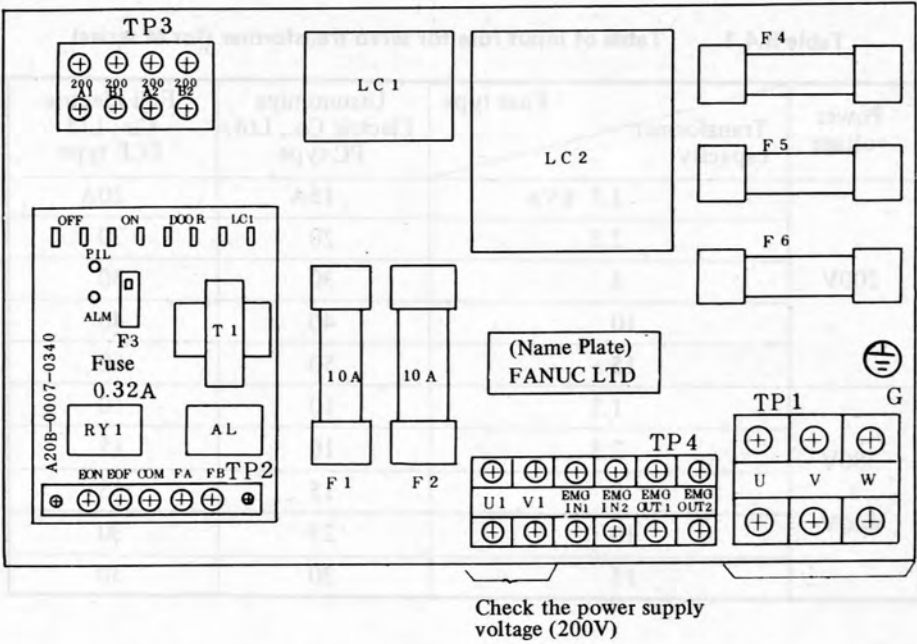


Fig. 3.4.1 (b) Input Unit for Control Unit and Servo (For Free-standing type cabinet)

- F1, F2 Input fuse for control unit 10A
F3 Fuse for power supply ON/OFF control circuit 0.32A
F4 ~ 6 Input fuse for servo transformer

The capacity differs from servo transformer in the Table 3.4.1.

Input voltage	Rated voltage	Rated current	Rated power
100V	100V	10A	1000W
200V	200V	10A	2000W
220V	220V	10A	2200W
240V	240V	10A	2400W
260V	260V	10A	2600W
280V	280V	10A	2800W
300V	300V	10A	3000W

Table 3.4.1 Table of input fuse for servo transformer (for M series)

Power voltage	Fuse type		Utsunomiya Electric Co., Ltd. PC type	Fuji Electric Co., Ltd FCF type
	Transformer capacity			
200V	1.5 KVA		15A	20A
	2.5		20	30
	5		30	30
	10		40	40
	15		50	50
380V と 440V	1.5		10	10
	2.5		10	15
	5		15	15
	10		25	30
	15		30	30

Power voltage	Fuse type	Utsunomiya Electric Co., Ltd. JG type	Fuji Electric Co., Ltd. Plug type
	Transformer capacity		
480V ~ 550V	1.5 KVA	10	10
	2.5	10	15
	5	15	20
	10	20	30
	15	25	30

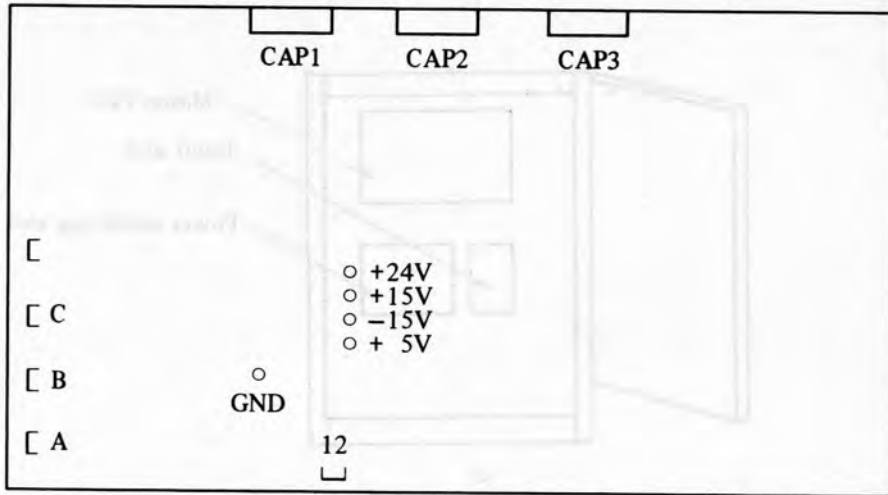
3.4.2 DC voltage checking

DC voltages supplied from the power unit must be measured at power checking terminals on the master PCB. Confirm that DC voltages are within the allowable range. Among these voltages, +5V can be adjusted with a variable resistor +5ADJ which is provided on the power stabilizer PCB.

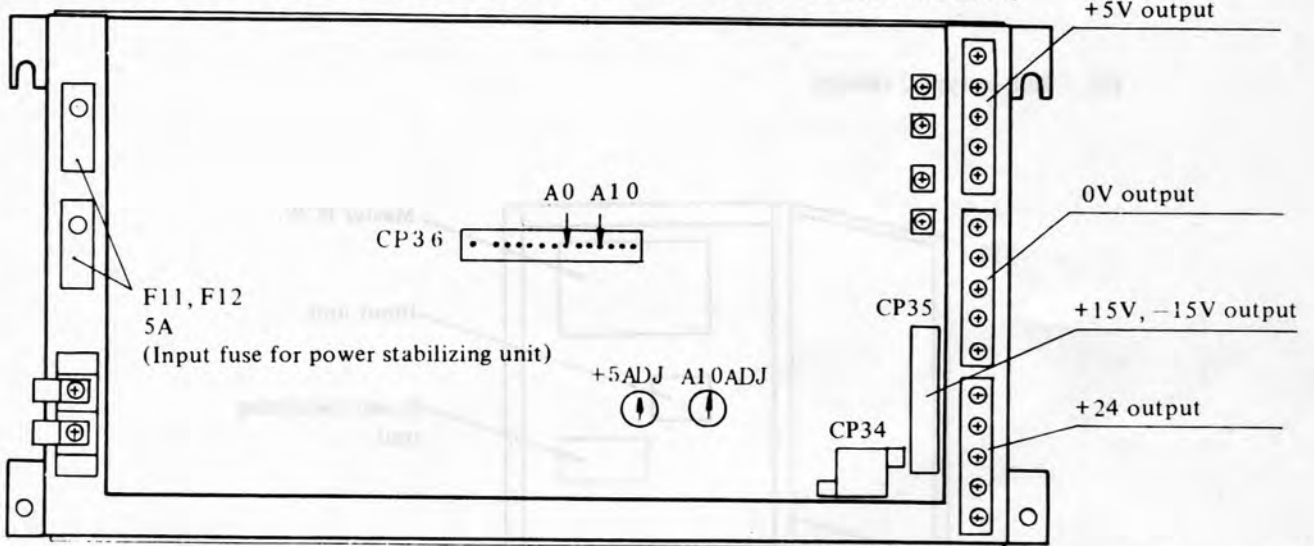
(1) Specification of power stabilizer

Terminal name	Rated voltage	Allowable fluctuation	Use
+5	+5V	±5%	Logical circuit Reed relay
+24	+24V	±10%	Taper reader, I/O signals Bubble memory, CRT
+15	+15V	±5%	Position control circuit
-15	-15V	±5%	Position control circuit Bubble memory
0	0V	—	—

Check point on master PCB



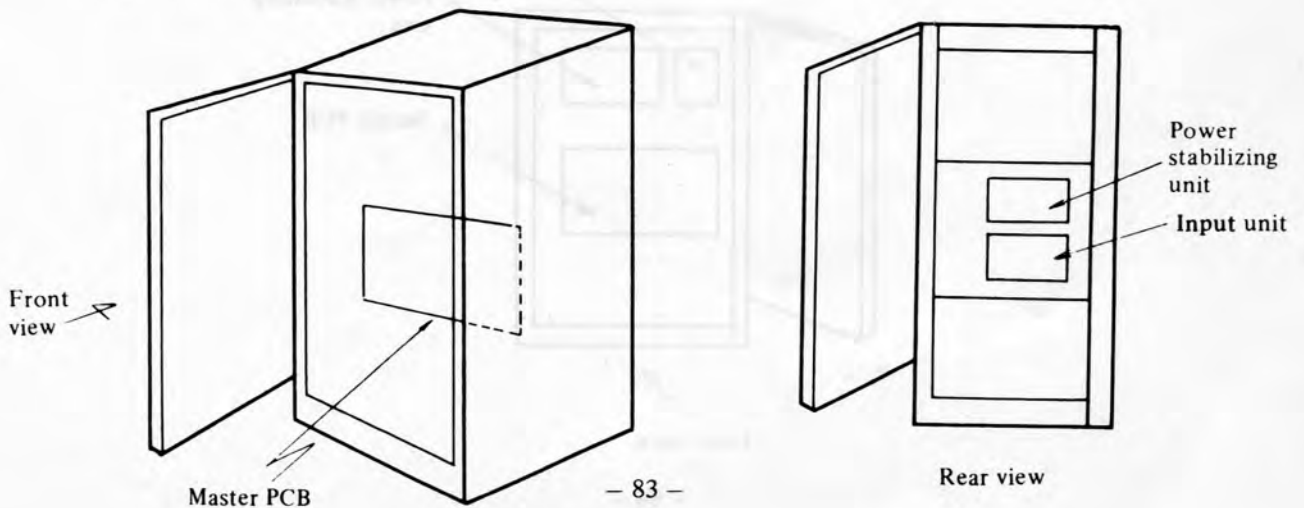
(2) Adjusting points on the power stabilizer PCB (A20B-0007-0330 or A20B-1000-0030)



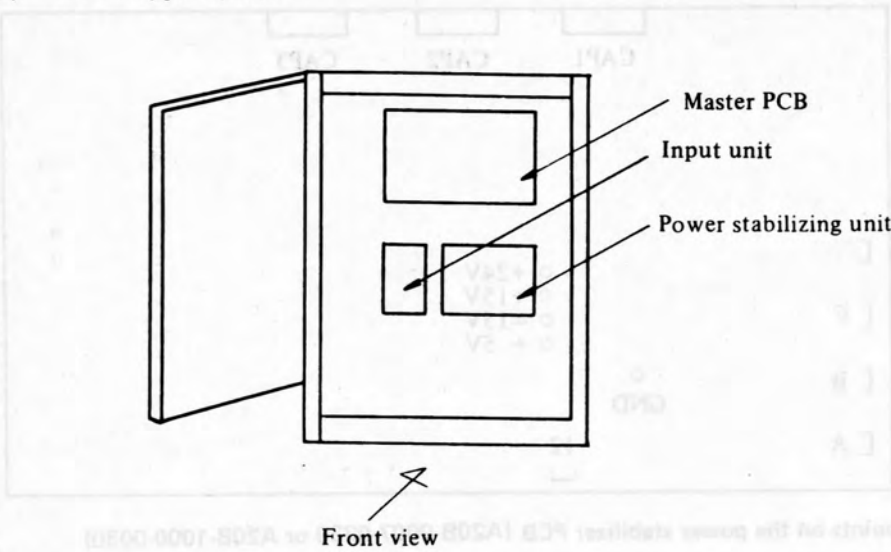
Although the standard voltage (+10V) does not normally need to be adjusted, a power supply alarm will generate when it is not within the allowable range. Adjust to 10.00V, measure the voltage between terminals A0 and A10 on the CP36. (Use a digital voltmeter.)

(3) Positions of the master PCB and the power stabilizer PCB.

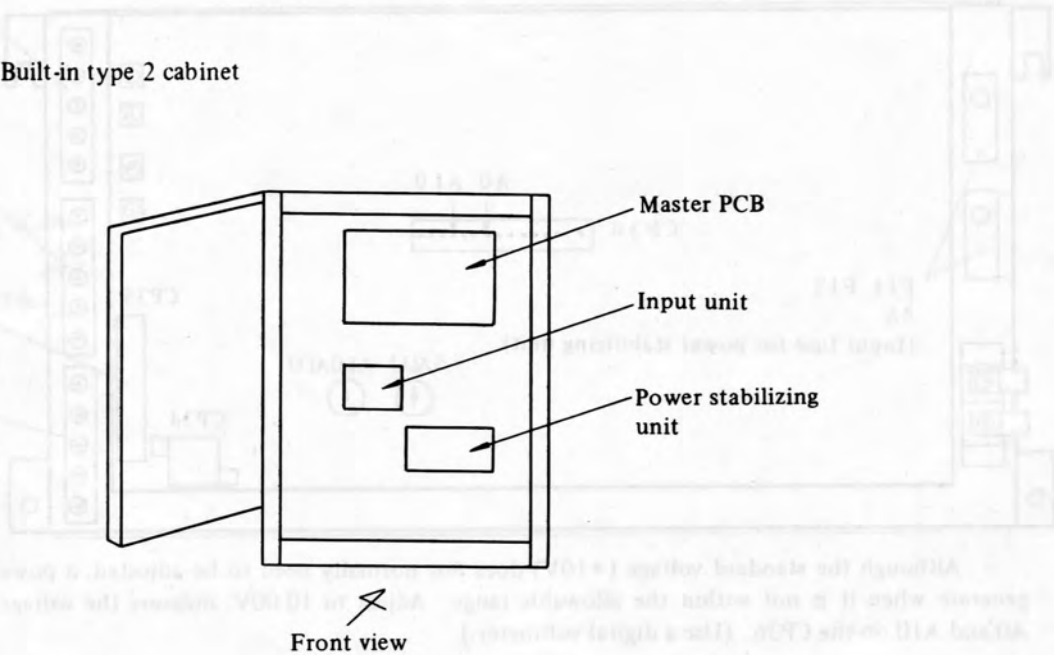
(a) Free standing type cabinet



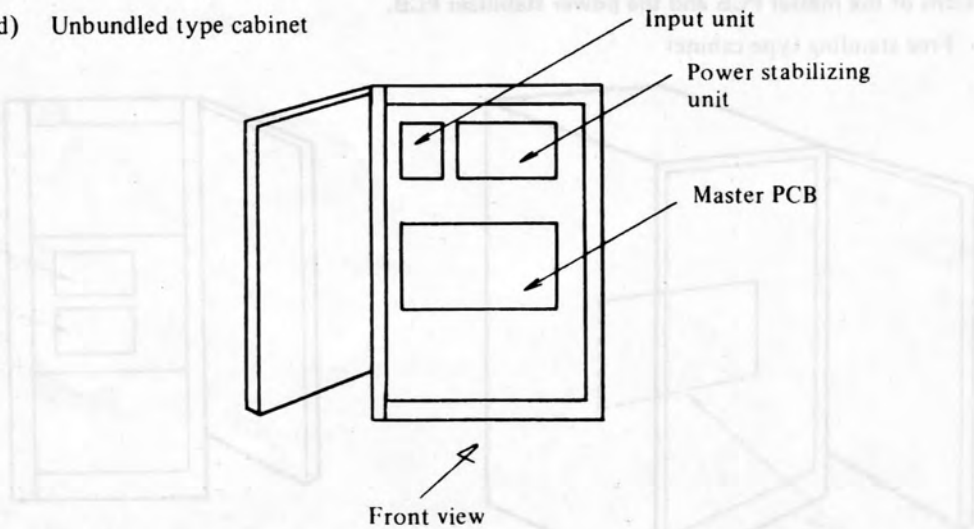
(b) Built-in type 1 cabinet



(c) Built-in type 2 cabinet

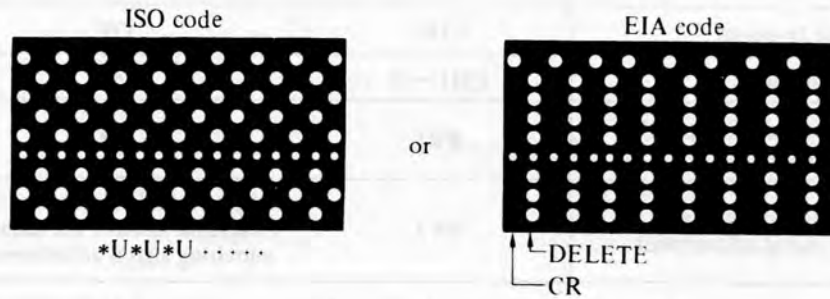


(d) Unbundled type cabinet

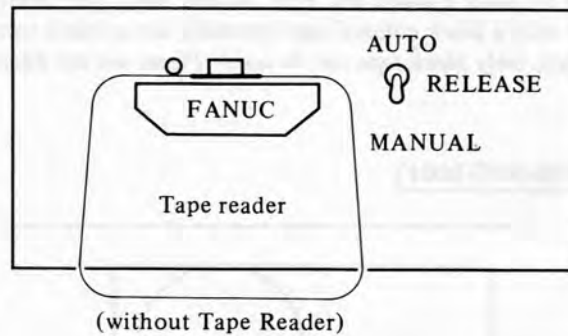


3.5 Tape reader photo-amplifier adjustment

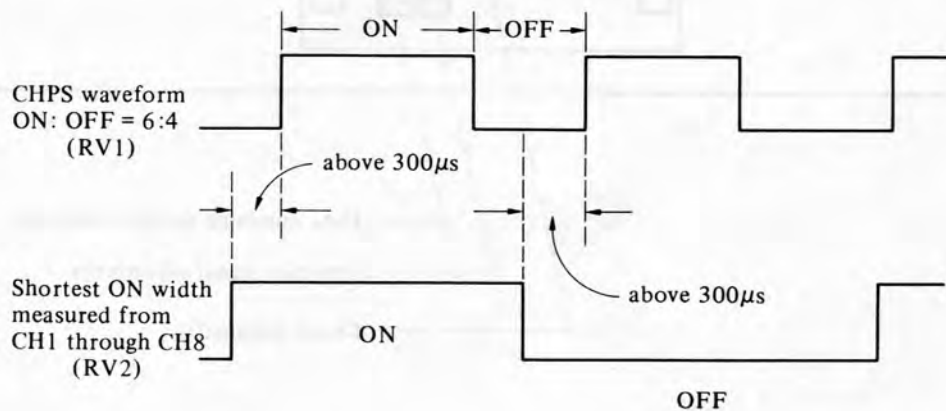
- (1) With paper tape, make an about 40cm test tape as illustrated below that alternates punching and non-punching and connect both ends to form an endless loop of tape. (See Note 2, Note 3)



- (2) Mount the test tape in the tape reader and turn the switch MANUAL to read the tape.



- (3) With an oscilloscope, measure the waveform between check terminals CHPS and CHG (ground) on the photo-amplifier. Adjust it with RV1 so that the ON/OFF timing ratio is 6:4.
- (4) Measure the waveforms at the check terminals CH1 through CH8 on the photo-amplifier using oscilloscope, and find the channel where the ON width is the shortest. (Use the terminal CHG for grounding.)
- (5) Measure the waveform where the ON width is the shortest among CH1 through CH8 and compare it with the waveform of CHPS. Adjust with RV2 so that the timing indicated in the diagram below is obtained.
- (6) Confirm that all the waveforms CH1 through CH8 satisfy the timing in the diagram below.



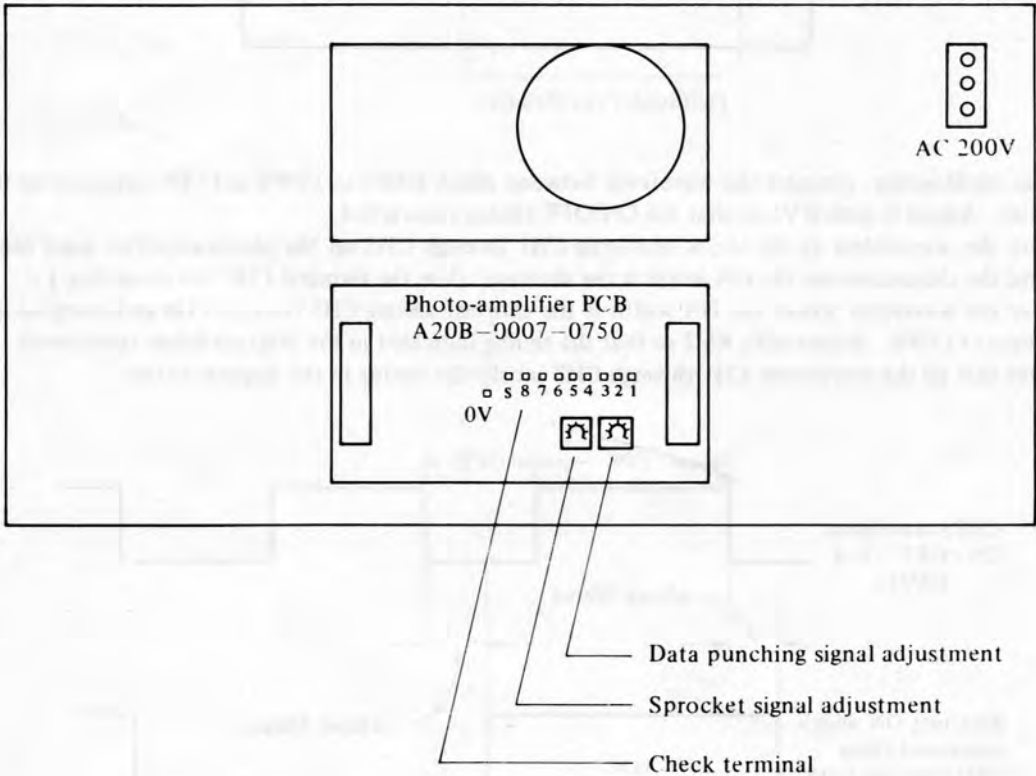
(Note 1) Check terminals and variable resistor for adjustment are as follows.

	A860-0055-T062	A13B-0070-B001
Check terminal	CHPS	S
Grounding terminal	CHG	OV
Check terminal	CH1 ~ 8	1 ~ 8
Variable resistor for sprocket signal adjustment	RV1	SP
Variable resistor for data punching signal adjustment	RV2	Right variable resistor of SP (Variable resistor for data punching signal adjustment)

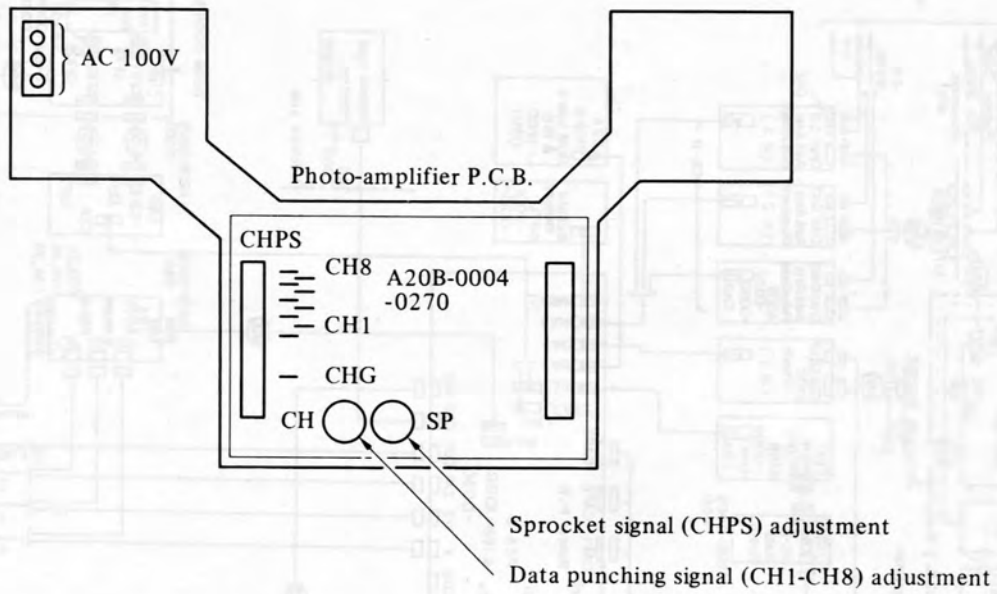
(Note 2) When operating output waveform adjustment of the photo amplifier of A13B-0070-B001, use a paper tape of the color of blue, white, pink, yellow, orange, etc., other than black, gray, to perform the adjustment. A use of the tape, colored blue, white, pink, etc., if applied to the tape reader with the adjustment processed by using a black and gray colored tape, may sometimes cause an error of read. And for the case only with a black colored tape normally use, a black tape may be used for adjustment.

(Note 3) In tape reader with reels, only black tape can be used. Please use the black tape for adjustment.

For tape reader without reel (A13B-0070-B001)



For tape reader with reels



Note: 4. Because a light sensing part and a light emitting part of the tape reader are combined to be assumed as one part, only either one of them cannot be replaced.

5. Use paper tape that conforms to the following standard:

Paper tape for data exchange JIS C6243-1970

Position and size of paper tape punch for data exchange JIS C6246-1971

6. A read error will occur if another tape is used after the tape reader was adjusted with a black tape.

3.6 Connection diagram inside the NC

3.6

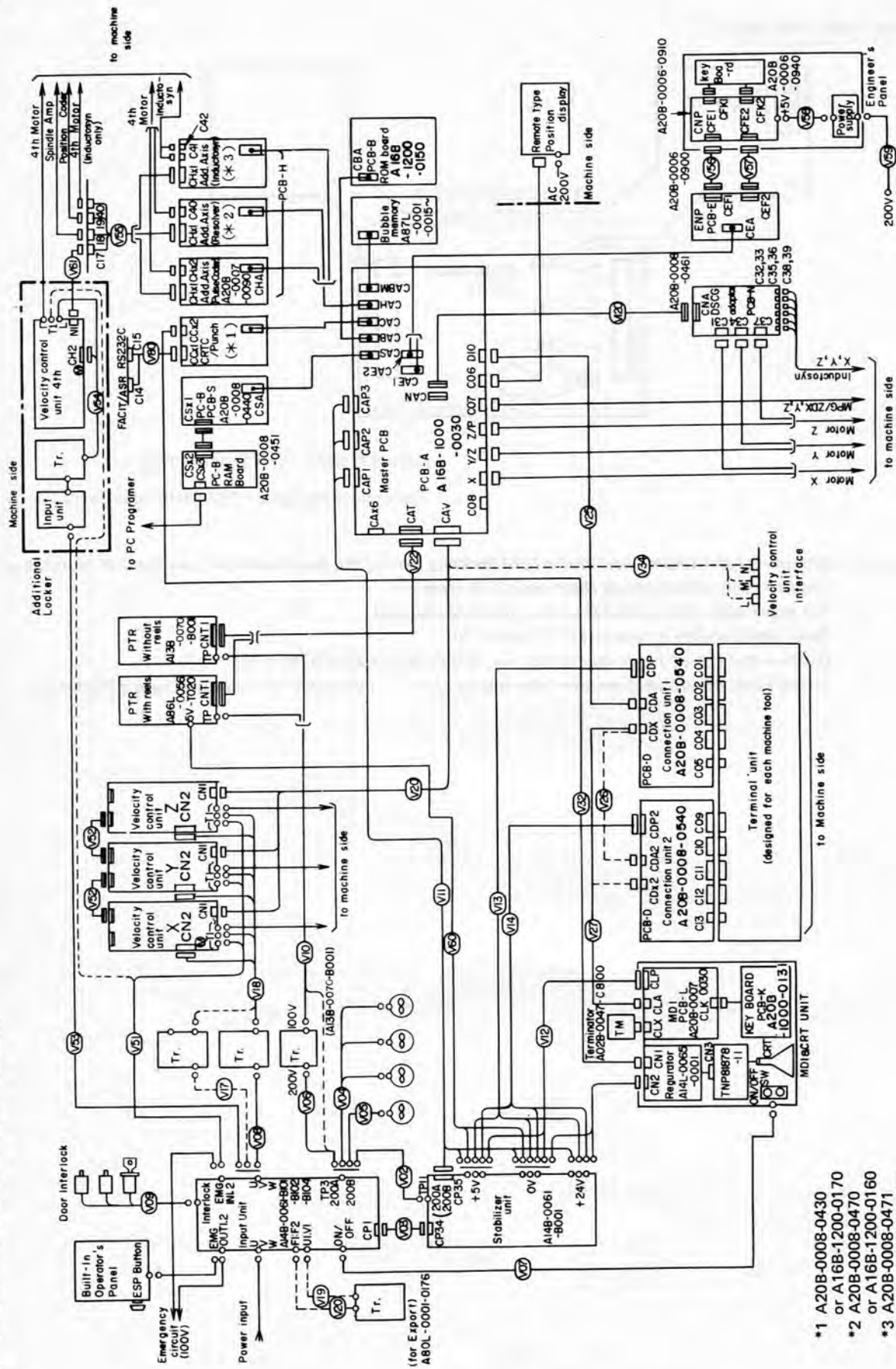


Fig. 3.6 (a) Total connection diagram for free standing type cabinet



Fig. 3.6 (b) Total connection diagram for built-in type 1 cabinet



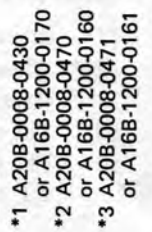


Fig. 3.6 (d) Total connection diagram for unbanded type cabinet

3.7 Status display by self-diagnostic function (DGN)

The status of the NC/machine tool interface and of the interior of the NC can be displayed on the MDI & CRT unit. Also output signals from the NC to the machine tool can be transferred in simulation.

3.7.1 Operational procedure

- (1) Press the function button **DGNOS**. Diagnostic data will be displayed on the screen.
 '0' on the screen means contact is close, '1' is open.
 To change the screen, follow one of the following two ways.
 1. Pressing PAGE **↓** moves the screen forward.
 Pressing PAGE **↑** moves the screen backward.
 2. Press ADDRESS **N**, then key in the **diagnose number** by DATA keys and press **INPUT**. That diagnose number will be displayed.

DIAGNOSTIC 06 : 00001 N0002			
NO.	DATA	NO.	DATA
0100	00000000	0110	00000000
0101	00000000	0111	00000000
0102	00110000	0112	00000000
0103	10011111	0113	00000000
0104	00010111	0114	00000000
0105	10100000	0115	00000000
0106	00000000	0116	00000000
0107	00000000	0117	00000000
0108	00000000	0118	00000000
0109	00000000	0119	00000000
N		LSK	INC

DGN screen (example)

The procedure to send output signals from NC to machine tool is as follows:

- (1) Select the MDI mode on the operator's panel.
- (2) Set '1' to 'DGNE' in parameter 11.
- (3) Let the diagnostic data to be output display by the above operation.
- (4) Move the cursor to the diagnostic number by using
 CURSOR **↑** or CURSOR **↓**
- (5) Press **P** and **I** and/or **O** via the DATA key as many times as to set 8 bit data.
 (Here 0 means output contact open; 1 output contact closed.)
 Pressing the **CAN** key cancell the set data.
- (6) Press **INPUT** key. The data will be issued.
- (7) If these checking are finished, return the parameter to previous data (DGNE = 0).

Notes on I/O signals

- (1) Signal output transmission is only possible when parameter No. 11 7th bit is 1.
- (2) When sending the output signals by using this function, group numbers from 064 to 095 should be used instead of from 000 to 031.
- (3) The condition of the output signal must be returned to the previous state.
- (4) The following output signals cannot be output by this function.
 - (i) "RWD" Rewind signal
 This signal is output by rewinding the reel of the tape reader.
 - (ii) "DST" MDI start signal
 This signal is output by actuating the START button on the MDI panel.

3.7.2 Display contents

DGN Table

Display contents		
DGN	Without Programmable Controller A or B	With Programmable Controller A or B
000~	Output signal to machine side	Output signal to machine side (Programmable Controller output signal)
032~	Input signal from machine side	Input signal from machine side (Programmable Controller input signal)
064~		Output signal to Programmable Controller
096~		Input signal from Programmable Controller
158	Programmable Controller B*(PC-B) control software version number	
159	Programmable Controller B (PC-B) operation flag	
160	Programmable Controller B (PC-B) ROM parity error contents	
161	Programmable Controller B (PC-B) ROM's presence check	
245	Programmable Controller type	
700	Status display when NC looks not operating during automatic operation	
701	Status display when NC looks not operating during automatic operation	
702	Status display concerning bubble memory	
703	Status display concerning tape reader	
706	External position display reset signal	
707	X/Y/Z-axis OH, OVL and servo ready signal. Resolver/inductosyn PCB's presence or absence	
708	RAM board for Programmable Controller A presence or absence	
709	Additional axis/S 4-digit analog output PCB's presence or absence	
712	Automatic operation stop/hold status display	
713	X/Y-axis DC motor feedback signal	
714	Z-axis DC motor feedback signal, Manual pulse generator input signal	
719	Additional-axis OH, OVL and servo ready signal	
800	X-axis position deviation	
801	Y-axis position deviation	
802	Z-axis position deviation	
803	4th-axis position deviation	
804	5th-axis position deviation	
805	X axis move distance by handle interrupt function	
806	Y axis move distance by handle interrupt function	
807	Z axis move distance by handle interrupt function	
808	4th axis move distance by handle interrupt function	
809	5th axis move distance by handle interrupt function	
820	Machine position from X-axis reference point	

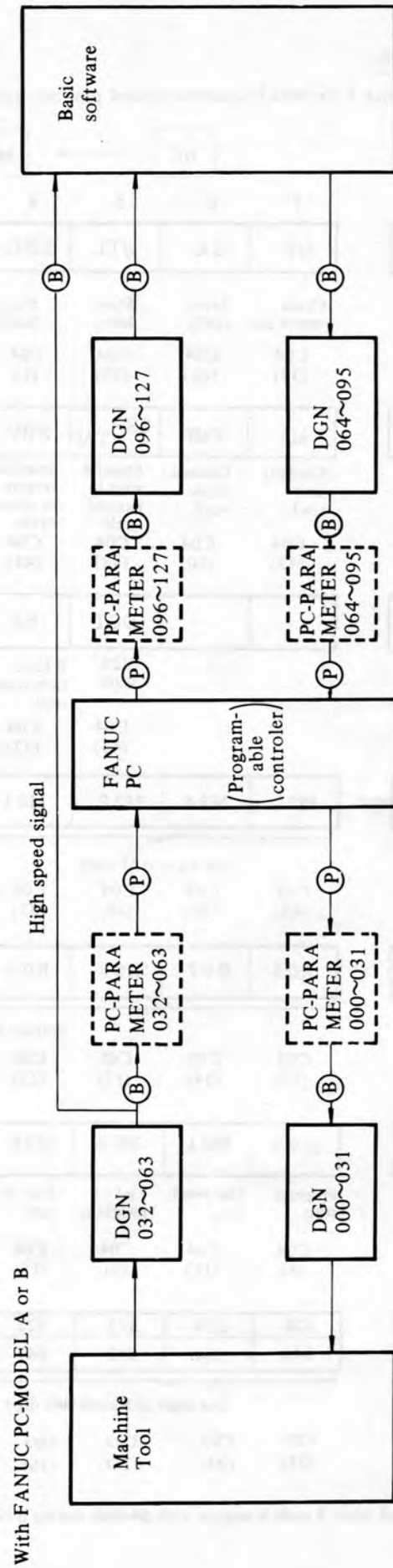
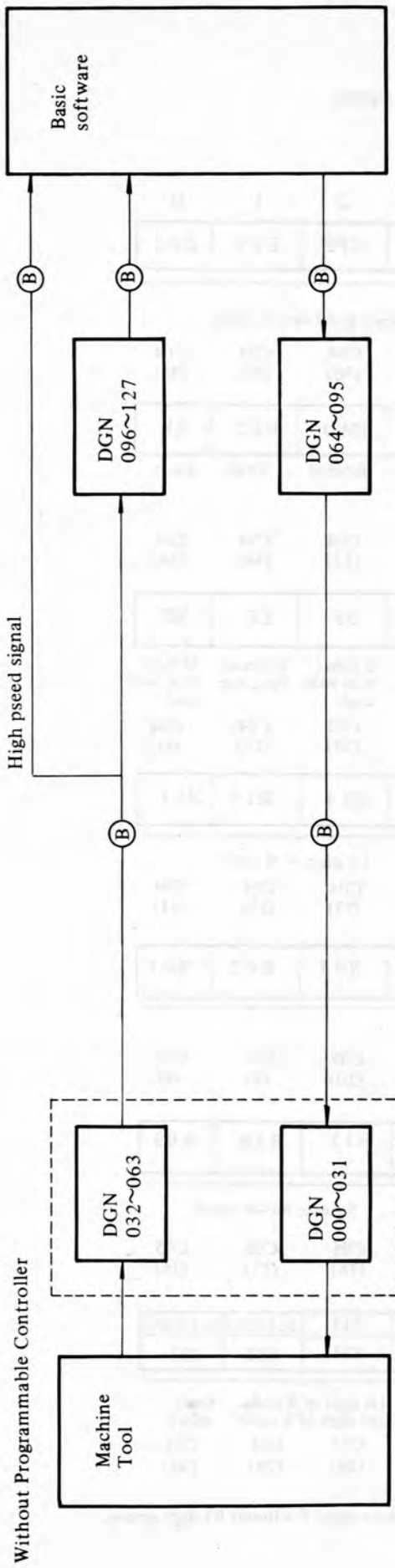
DGN	Display contents
821	Machine position from Y-axis reference point
822	Machine position from Z-axis reference point
823	Machine position from 4th-axis reference point
824	Machine position from 5th-axis reference point

* PC-B means FANUC PC-MODEL B (programmable controller)

PC-PARAMETER Display Contents (associated with Programmable Controller)

DGN	Display contents
000~	Output signal to machine side (Machine ← Programmable Controller)
032~	Input signal from machine side (machine → Programmable Controller)
064~	Input signal from NC (Programmable Controller ← NC)
096~	Output signal to NC (Programmable Controller → NC)
200 } 231 } 263	PC-MODEL A control relay status PC-MODEL B control relay status
560 } 596 } 639 } 735	PC-MODEL A nonvolatile memory status PC-MODEL B nonvolatile memory status

- Note 1: Refer to each Programmable Controller ladder diagram for details of the above display contents.
- 2: The above contents are displayed on PC-PARAMETER screen. Refer to Appendix 13 about operation.



Note 1) [] is provided only in the case of FANUC PC-MODEL B.

2) B → Shows the process by Basic Software.

3) P → Shows the process by PC (Programmable Controller) Software.

4) High speed signal includes emergency signal, overtravel signal, external deceleration, skip signal, deceleration signal for reference point return signal.

3.7.2

List of I/O signals

See appendix 1 for which connectors and pins are used for these signals.

NC

Machine

7

6

5

4

3

2

1

0

0

0

0

OP

SA

STL

SPL

ZP4

ZPZ

ZPY

ZPX

Cycle operation

Servo ready

Start lamp

Stop lamp

Reference point return finish

C04 (32)

C04 (45)

C04 (33)

C04 (1)

C04 (5)

C04 (36)

C04 (20)

C04 (35)

0

0

1

MA

FMF

SSP/TAP

SRV

DEN

RWD

RST

AL

Control unit ready

Canned cycle read

Spindle stop in canned cycle

Spindle reverse in canned cycle

Distribution end

Rewind

Reset

Alarm

C04 (43)

C04 (50)

C04 (49)

C04 (48)

C04 (26)

C04 (12)

C04 (44)

C04 (34)

0

0

2

DST

BF

TF

SF

EF

MF

MDI start

B function code read

T function code read

S function code read

External function

M function code read

C04 (46)

C04 (17)

C03 (49)

C03 (31)

C04 (27)

C04 (41)

0

0

3

M28

M24

M22

M21

M18

M14

M12

M11

2nd digit of M code

1st digit of M code

C04 (40)

C04 (39)

C04 (38)

C04 (37)

C04 (24)

C04 (23)

C04 (22)

C04 (21)

0

0

4

R08

R07

R06

R05

R04

R03

R02

R01

Spindle motor speed

C05 (15)

C05 (14)

C05 (13)

C05 (12)

C05 (11)

C05 (10)

C05 (9)

C05 (8)

0

0

5

M00

M01

M02

M30

R12

R11

R10

R09

Program stop

Optional stop

End of program

End of tape

Spindle motor speed

C04 (8)

C04 (11)

C04 (9)

C04 (10)

C05 (19)

C05 (18)

C05 (17)

C05 (16)

0

0

6

S28

S24

S22

S21

S18

S14

S12/HIG

S11/LWG

S48

S44

S42

S41

S38

S34

S32

S31

2nd digit of S code/4th digit of S code*

1st digit of S code
3rd digit of S code*

Gear select

C03 (23)

C03 (24)

C03 (25)

C03 (26)

C03 (27)

C03 (28)

C03 (29)

C03 (30)

* Used when S code is output with S4-digit analog B or S4-digit 12-bit output B without B3-digit option.

0	0	7	7	6	5	4	3	2	1	0
T28	T24	T22	T21	T18	T14	T12	T11			
2nd digit of T code				1st digit of T code						
C03 (41)	C03 (42)	C03 (43)	C03 (44)	C03 (45)	C03 (46)	C03 (47)	C03 (48)			
0	0	8	U07	U06	U05	U04	U03	U02	U01	U00
DO for custom macro										
C12 (32)	C12 (45)	C12 (33)	C12 (1)	C12 (5)	C12 (36)	C12 (20)	C12 (35)			
0	0	9	U015	U014	U013	U012	U011	U010	U09	U08
DO for custom macro										
C12 (43)	C12 (50)	C12 (49)	C12 (48)	C12 (26)	C12 (12)	C12 (44)	C12 (34)			
0	1	0	EREND		TLCHB	TLCHA	ESEND			
External data read end		New tool select		Tool change		External data search end				
C11 (17)		C12 (46)		C12 (16)		C11 (49)				
0	1	1	T48	T44	T42	T41	T38	T34	T32	T31
4th digit of T code				3rd digit of T code						
C12 (40)	C12 (39)	C12 (38)	C12 (37)	C12 (24)	C12 (23)	C12 (22)	C12 (21)			
0	1	2								
0	1	3							ZP25	ZP5
								5th-axis 2nd reference point return end C13 (17)		5th-axis reference point return end C13 (16)
0	1	4	B38	B34	B32	B31	B28	B24	B22	B21
3rd digit of B code				2nd digit of B code						
2nd digit of S code*1				1st digit of S code*1						
C11 (23)	C11 (24)	C11 (25)	C11 (26)	C11 (27)	C11 (28)	C11 (29)	C11 (30)			
0	1	5	B18	B14	B12	B11		ZP24	ZP2Z	ZP2Y
1st digit of B code				2nd reference point completion						
5th digit of S code*1										
C11 (41)	C11 (42)	C11 (43)	C11 (44)	C11 (45)	C11 (46)	C11 (47)	C11 (48)			

* Used when S code is output with S4-digit analog B or S4-digit 12-bit output B without B3-digit option.

Machine

NC

0	3	2
---	---	---

X-axis

7	6	5	4	3	2	1	0
HX	*SVFX	*DECX	*ITX	-X	+X	*-LX	*+LX
Manual handle feed axis	Servo off	Reference point return deceleration	Interlock	Jog & step feed axis select		Overtravel	
C02 (34)	C01 (28)	C02 (16)	C03 (34)	C02 (39)	C02 (24)	C02 (46)	C02 (45)

0	3	3
---	---	---

Y-axis

7	6	5	4	3	2	1	0
HY	*SVFY	*DECY	*ITY	-Y	+Y	*-LY	*+LY
Manual handle feed axis	Servo off	Reference point return deceleration	Interlock	Jog & step feed axis select		Overtravel	
C02 (35)	C01 (17)	C02 (17)	C03 (35)	C02 (38)	C02 (23)	C02 (48)	C02 (47)

0	3	4
---	---	---

Z-axis

7	6	5	4	3	2	1	0
HZ	*SVFZ	*DECZ	*ITZ	-Z	+Z	*-LZ	*+LZ
Manual handle feed axes	Servo off	Reference point return deceleration	Interlock	Jog & step feed axis select		Overtravel	
C02 (36)	C01 (26)	C02 (18)	C03 (36)	C02 (37)	C02 (22)	C02 (50)	C02 (49)

0	3	5
---	---	---

4th-axis

7	6	5	4	3	2	1	0
H4	*SVF4	*DEC4	*IT4	-4	+4	*-L4	*+L4
Manual handle feed axis	Servo off	Reference point return	Interlock	Jog & step feed axis select		Overtravel	
C01 (27)	C01 (42)	C01 (44)	C01 (46)	C01 (29)	C01 (41)	C01 (43)	C01 (45)

0	3	6
---	---	---

7	6	5	4	3	2	1	0
MLK	DLK	ZNG	OVC	SBK	BDT	DRN	AFL
Machine lock	Display lock	Z axis command neglect	Override cancel	Single block	Optional block skip	Dry run	Auxiliary function lock
C02 (9)	C02 (10)	C01 (16)	C01 (14)	C02 (27)	C02 (28)	C02 (7)	C01 (15)

0	3	7
---	---	---

7	6	5	4	3	2	1	0
ZRN	SRN	ABS	SAR	FIN	ST	MIY	MIX
Reference point return	Program restart	Manual absolute ON/OFF	Spindle speed arrival	Auxiliary function finish	Cycle operation start	Mirror image	
C02 (41)	C01 (50)	C02 (26)	C03 (38)	C02 (13)	C02 (1)	C01 (32)	C01 (30)

0	3	8
---	---	---

7	6	5	4	3	2	1	0
ERS	RRW	*SP	*ESP	GST	SPC	SPB	SPA
External reset	Reset & rewind	Feed hold	Emergency stop	gear shift	Spindle override		
C02 (14)	C03 (9)	C02 (2)	C02 (3)	C01 (47)	C01 (31)	C01 (48)	C01 (18)

0	3	9
---	---	---

7	6	5	4	3	2	1	0
RT	ROV2	ROV1	*JV16	*JV8	*JV4	*JV2	*JV1
Manual rapid traverse	Rapid traverse override		Jog feedrate				
C02 (8)	C03 (40)	C03 (39)	C02 (12)	C02 (11)	C02 (44)	C02 (43)	C02 (42)

0	4	0	7	6	5	4	3	2	1	0
			MP 4	MP 2	MP 1	*FV16	*FV8	*FV4	*FV2	*FV1
			Manual handle			Feedrate override				
			Incremental feed							
			C03 (10)	C03 (8)	C03 (7)	C03 (37)	C03 (22)	C03 (6)	C03 (5)	C03 (4)
0	4	1	KEY	EDT	MEM	T	D	J	H	S
			Memory protect	Part program editing	Memory operation	Tape operation	MDI operation	Jog feed	Handle feed	Step feed
			C02 (25)	C02 (40)	C02 (6)	C02 (20)	C02 (19)	C02 (5)	C02 (4)	C02 (21)
0	4	2	*SSTP	SOR	*-EDCZ	*-EDCY	*-EDCX	*+EDCZ	*+EDCY	*+EDCX
			Spindle stop	Spindle orientation	External deceleration					
			C03 (13)	C03 (14)	C03 (21)	C03 (20)	C03 (19)	C03 (3)	C03 (2)	C03 (1)
0	4	3	FID	SKIP	MI4	WN16	WN8	WN4	WN2	WN1
			F 1-digit select	Skip	4th axis mirror image	External work number search				
			C01 (20)	C01 (4)	C01 (2)	C01 (21)	C01 (36)	C01 (34)	C01 (3)	C01 (35)
0	4	4					UNIT	TL64	TL32	TL16
							Custom macro interrupt C10 (39)	Tool group number		
								C10 (24)	C10 (46)	C10 (45)
0	4	5	BDT7/ AGSTB	AG24	BDT6/ AG22	AG21	BDT5/ AG18	BDT4/ AG14	BDT3/ AG12	BDT2/ AG11
			Optional block skip/Angle select in manual arbitrary angle feed							
			C10 (35)		C10 (17)		C10 (38)	C10 (23)	C10 (48)	C10 (47)
0	4	6	TLSPK		TLRST		TL08	TL04	TL02	TL01
			Tool skip C10 (36)		Tool reset C10 (18)		C10 (37)	Tool group number		
								C10 (22)	C10 (50)	C10 (49)
0	4	7	UI7	UI6	UI5	UI4	UI3	UI2	UI1	UI0
			DI for custom macro							
			C09 (27)	C09 (42)	C09 (44)	C09 (46)	C09 (29)	C09 (41)	C09 (43)	C09 (45)
0	4	8	H5	*SVFS	*DEC5	*IT5	-5	+5	*-L5	*+L5
			Manual handle feed axis select C10 (09)	Servo off C10 (10)	Reference point return deceleration C09 (16)	Interlock C09 (14)	Feed direction C10 (27)		Overtravel C10 (07)	
							C10 (28)		C09 (15)	

			7	6	5	4	3	2	1	0
0	4	9								
0	5	0	5NG		BDT9/ AGJ	BDT8/ AGST			GRB	GRA
			5th axis neglect C10 (14)	Optional block skip/Manual arbitrary angle feed C10 (2) C10 (3)				Gear select signal C09 (48) C09 (18)		
0	5	1	4NG							
			4th axis neglect C10 (8)							
0	5	2	ED7	ED6	ED5	ED4	ED3	ED2	ED1	ED0
			External data input C11 (10) C11 (8) C11 (7) C11 (37) C11 (22) C11 (6) C11 (5) C11 (4)							
0	5	3	ED15	ED14	ED13	ED12	ED11	ED10	ED9	ED8
			External data input C10 (25) C10 (40) C10 (6) C10 (20) C10 (19) C10 (5) C10 (4) C10 (21)							
0	5	4	ESTB	EA6	EA5	EA4	EA3	EA2	EA1	EA0
			External data input C11 (13) C11 (14) C11 (21) C11 (20) C11 (19) C11 (3) C11 (2) C11 (1)							
0	5	5	UI15	UI14	UI13	UI12	UI11	UI10	UI9	UI8
			DI for custom macro C09 (20) C09 (4) C09 (2) C09 (21) C09 (36) C09 (34) C09 (3) C09 (35)							
0	6	4	OP	SA	STL	SPL	ZP4	ZPZ	ZPY	ZPX
			Cycle operation	Servo ready	Start lamp	Stop lamp	Reference point return finish			
0	6	5	MA	FMF	SSP/ TAP	SRV	DEN	RWD	RST	AL
			Control unit ready	Canned cycle read	Spindle stop in canned cycle	Spindle reverse in canned cycle	Distribu- tion end	Rewind	Reset	Alarm

0	6	6	7	6	5	4	3	2	1	0
			DST	BF	TF	SF	EF	MF		
			MDI start	B function code read	T function code read	S function code read	External function	M function code read		

0	6	7	M28	M24	M22	M21	M18	M14	M12	M11
			2nd digit of M code				1st digit of M code			

0	6	8	R08	R07	R06	R05	R04	R03	R02	R01
			Spindle motor speed							

0	6	9	M00	M01	M02	M30	R12	R11	R10	R09
			Program stop	Optional stop	End of program	End of tape	Spindle motor speed			

0	7	0	S28	S24	S22	S21	S18	S14	S12/HIG	S11/LWG
			S48	S44	S42	S41	S38	S34	S32	S31
			2nd digit of S code/4th digit of S code*				1st digit of S code 3rd digit of S code*		Gear select	

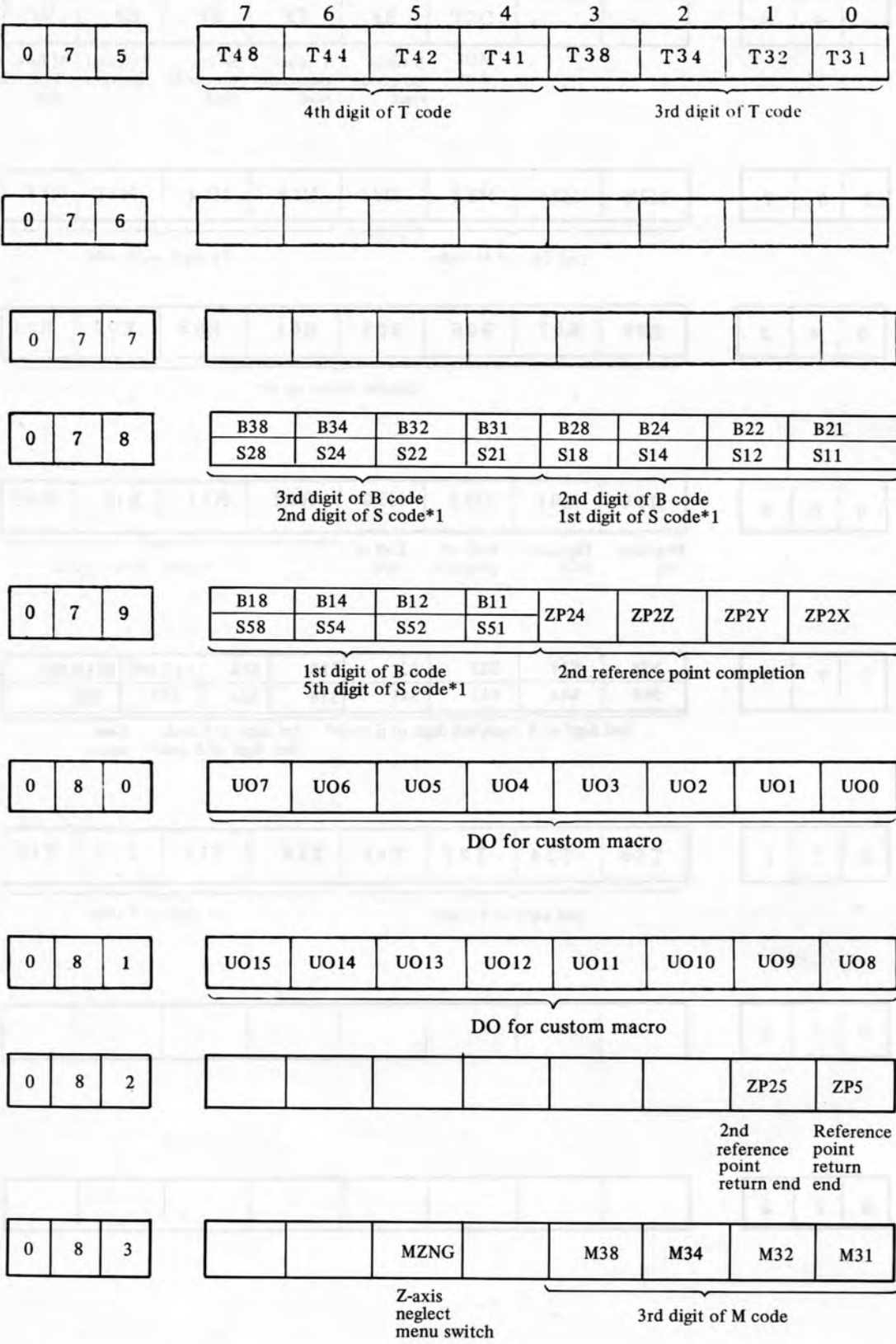
0	7	1	T28	T24	T22	T21	T18	T14	T12	T11
			2nd digit of T code				1st digit of T code			

0	7	2								
---	---	---	--	--	--	--	--	--	--	--

0	7	3								
---	---	---	--	--	--	--	--	--	--	--

0	7	4	EREND		TLCHB	TLCHA	ESEND			
			External data read end		New tool select	Tool change	External data search end			

* Used when S code is output with S4-digit analog B or S4-digit 12-bit output B without B3-digit option.



*1 Used when S code is output with S4-digit analog B or S4-digit 12 bit output B without B3-digit option.

0	8	4
---	---	---

7	6	5	4	3	2	1	0
MMLK	MDLK	MMI4	MMI5	MSBK	MBDT1	MDRN	MAFL
Machine lock	Display lock	4th axis mirror image	5th axis mirror image	Single block	Optional block skip 1	Dry run	Auxiliary function lock

Menu switch

0	8	5
---	---	---

		MBDT9	MBDT8			MMIY	MMIX
		Optional block skip 9	Optional block skip 8			Y axis mirror image	X axis mirror image

Menu switch

0	8	6
---	---	---

MBDT7		MBDT6		MBDT5	MBDT4	MBDT3	MBDT2
Optional block skip 7		Optional block skip 6		Optional block skip 5	Optional block skip 4	Optional block skip 3	Optional block skip 2

Menu switch

0	8	7
---	---	---

		MABS					
		Manual absolute Menu switch					

0	9	6
---	---	---

X-axis

HX	*SVFX		*ITX	-X	+X		
Manual handle feed axis	Servo off		Interlock	Jog & Step feed axis select			

0	9	7
---	---	---

Y-axis

HY	*SVFY		*ITY	-Y	+Y		
Manual handle feed axis	Servo off		Interlock	Jog & Step feed axis select			

0	9	8
---	---	---

Z-axis

HZ	*SVFZ		*ITZ	-Z	+Z		
Manual handle feed axis	Servo off		Interlock	Jog & Step feed axis select			

0	9	9
---	---	---

4th-axis

H4	*SVF4		*IT4	-4	+4		
Manual handle feed axis	Servo off		Interlock	Jog & Step feed axis select			

1	0	0					
MLK	DLK	ZNG	OVC	SBK	BDT1	DRN	AFL
Machine lock	Display lock	Z axis command neglect	Override cancel	Single block	Optional block skip	Dry run	Auxiliary function lock

1	0	1					
ZRN	SRN	ABS	SAR	FIN	ST	MIY	MIX
Reference point return	Program restart	Manual absolute ON/OFF	Spindle speed arrival	Auxiliary function finish	Cycle operation start	Mirror image	

1	0	2					
ERS	RRW	*SP	*ESP	GST	SPC	SPB	SPA
External reset	Reset & rewind	Feed hold	Emergency stop	gear shift	Spindle override		

1	0	3					
RT	ROV2	ROV1	*JB16	*JV8	*JV4	*JV2	*JV1
Manual rapid traverse	Rapid traverse override		Jog feedrate				

1	0	4					
MP4	MP2	MP1	*FV16	*FV8	*FV4	*FV2	*FV1
Manual handle feed			Override				
Incremental feed							

1	0	5					
KEY	EDT	MEM	-T	D	J	H	S
Program protect	Part program editing	Memory operation	Tape operation	MDI operation	Jog feed	Handle feed	Step feed

1	0	6					
*SSTP	SOR						
Spindle stop	Spindle orientation						

1	0	7					
FID		MI4	WN16	WN8	WN4	WN2	WN1
F 1-digit select		4th axis mirror image	External work number search				

			7	6	5	4	3	2	1	0
1	0	8	R08I	R07I	R06I	R05I	R04I	R03I	R02I	R01I

Spindle motor speed
(PC output)

1	0	9	SIND		R14I		R12I	R11I	R10I	R09I
---	---	---	------	--	------	--	------	------	------	------

Spindle
motor
rotation
command
effective

Spindle motor speed
(PC output)

1	1	0	TLSPK		TLRST		TL08	TL04	TL02	TL01
---	---	---	-------	--	-------	--	------	------	------	------

Tool
skip

Tool
reset

Tool group number

1	1	1								
---	---	---	--	--	--	--	--	--	--	--

1	1	2								
---	---	---	--	--	--	--	--	--	--	--

1	1	3								
---	---	---	--	--	--	--	--	--	--	--

1	1	4	5NG		AGJ/ BDT9	AGST/ BDT8			GRB	GRA
---	---	---	-----	--	--------------	---------------	--	--	-----	-----

5th axis
neglect

Optional block
skip/Manual
arbitrary angle
feed

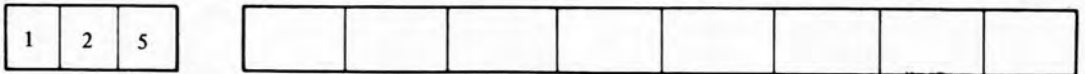
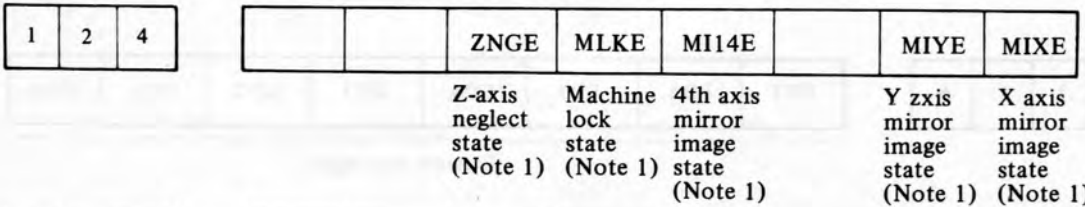
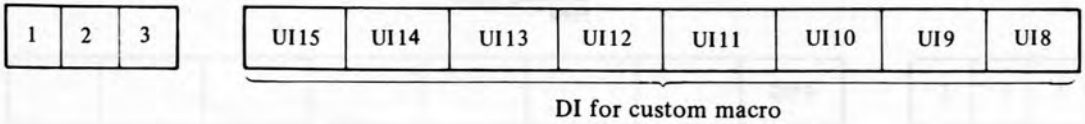
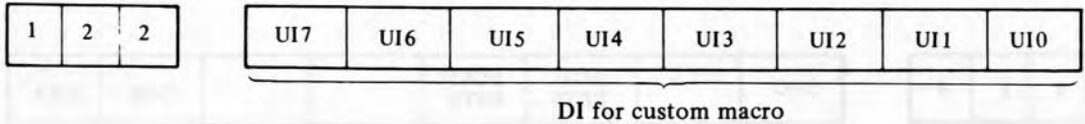
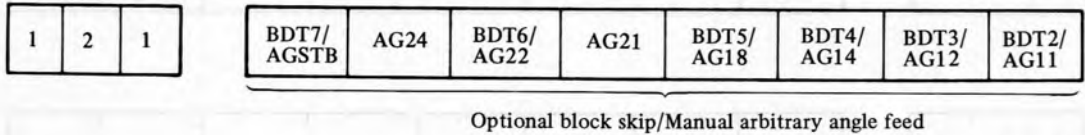
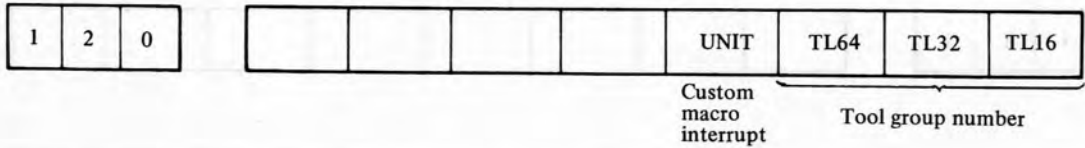
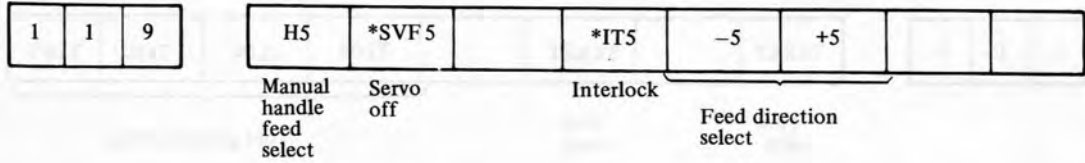
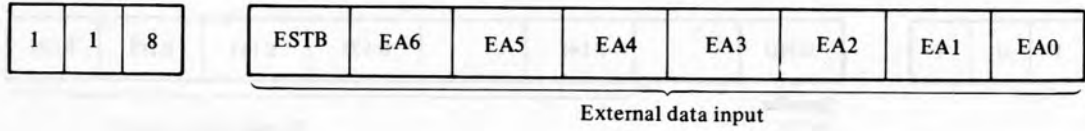
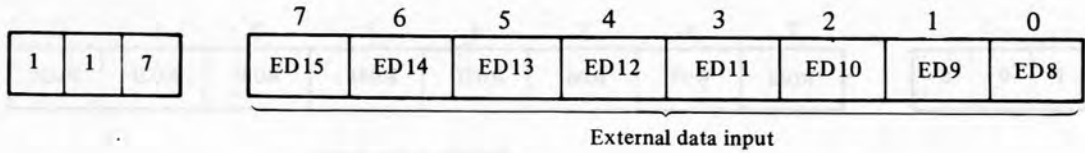
Gear select

1	1	5	4NG							
---	---	---	-----	--	--	--	--	--	--	--

4th axis
neglect

1	1	6	ED 7	ED 6	ED 5	ED 4	ED 3	ED 2	ED 1	ED 0
---	---	---	------	------	------	------	------	------	------	------

External data input



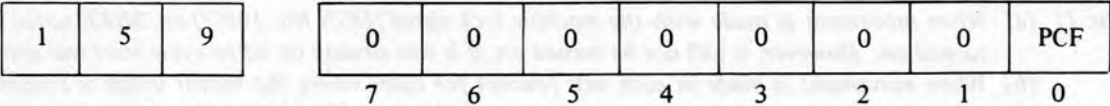
- (Note 1) (a) When movement is made with the machine lock signal (DGN No. 100-7) on, MIKE noted below is turned on. However, it will not be turned on, if it was already on when cycle start was applied.
 (b) When movement is made in each axis (except for cases where the mirror image is inoperative to axial movement) with the mirror image signal (MIX DGN 101-0/MIY DGN 101-1/M14 DGN 107-5) or the set mirror image on, MIXE/MIYE/M14E noted below is turned on, respectively.
 (c) When movement is made in Z with the Z-axis neglect signal (DGN No. 100-5) on, ZNGE noted below is turned on. However, it will not be turned on, if it was already on when cycle start was applied.
- (Note 2) One turned on, even if the signal is turned off or reset, the storage will not be turned off. The storage is cleared to zero when the power is turned on. In order to clear the storage without turning off the power, operate the DGNOS signal output in the MDI mode (PRM-011 bit 7 (DGNE) must be 1).
- (Note 3) Data displayed in DGN 068, 069 does not include gain from 04 version in 901 series of ROM edition number. So data are displayed same as S4 digit 12 bits output data.
 ex. If maximum speed command is given data in DGN 068, 069 becomes 4095 no relation with value of parameter PCGAIN (No. 140).
- (Note 4) If 7th bit (SIND) of DGN109 is 1, an analog voltage corresponding to R01I to R12I of number 108 and 109 is output.
 If 5th bit (R14I) of DGN109 is 1, a negative voltage is output and if it is 0, a positive voltage is output.
 When SIND = 0, R01I to R12I is ignored.

1	5	8
---	---	---

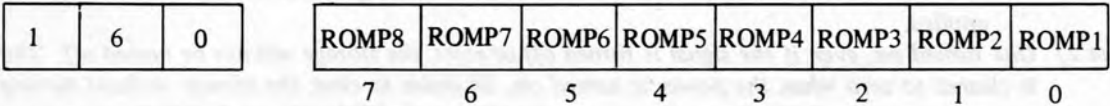
0	0	0	PCE4	PCE3	PCE2	PCE1	PCE0
7	6	5	4	3	2	1	0

PCE0-4: Edition numbers A ~ Z of FANUC PC-MODEL B control software are displayed with values of 1-26 (binary).

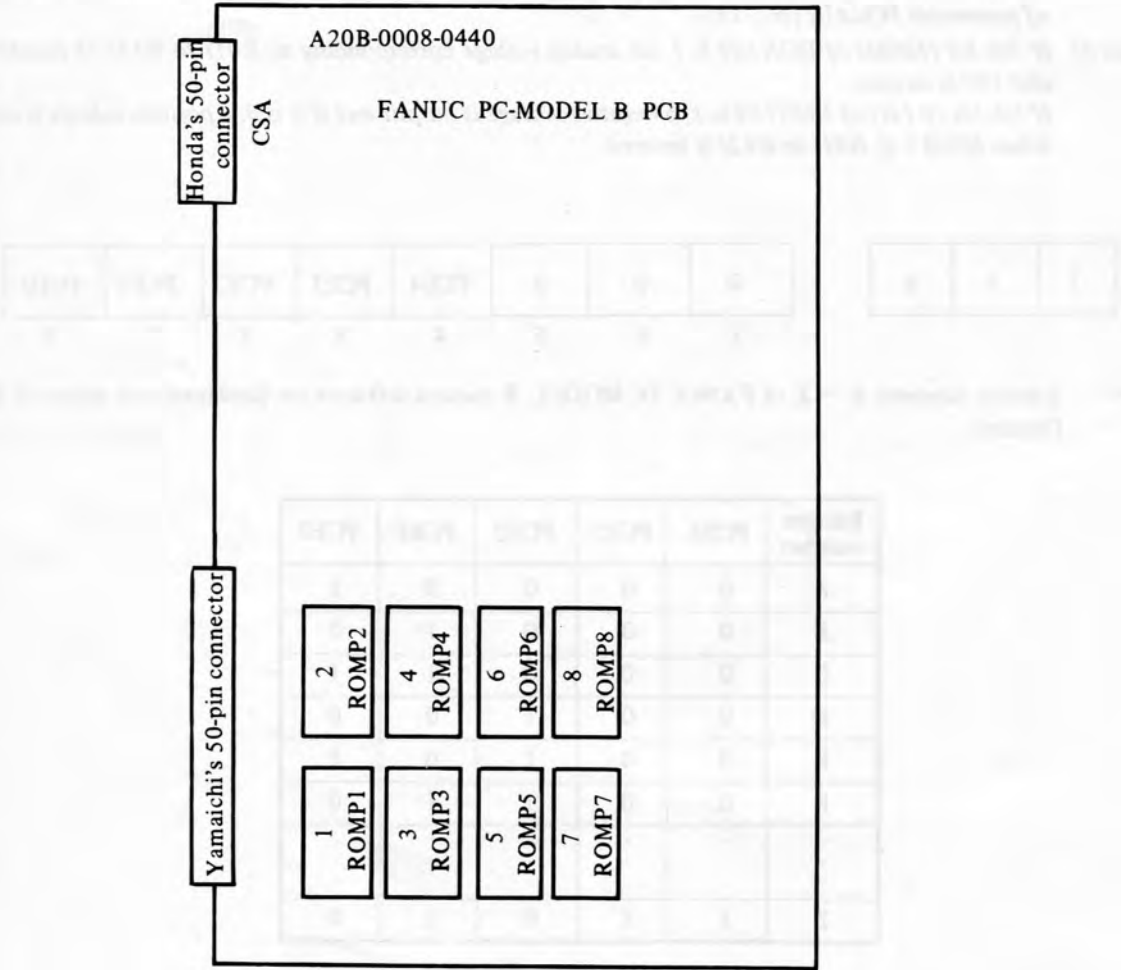
Edition number	PCE4	PCE3	PCE2	PCE1	PCE0
A	0	0	0	0	1
B	0	0	0	1	0
C	0	0	0	1	1
D	0	0	1	0	0
E	0	0	1	0	1
F	0	0	1	1	0
⋮	⋮	⋮	⋮	⋮	⋮
Z	1	1	0	1	0



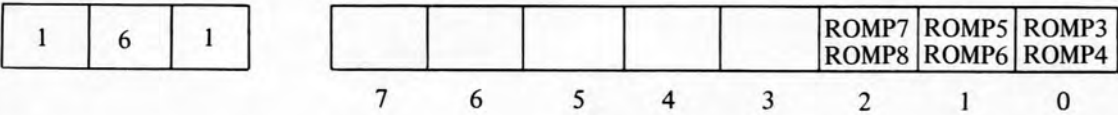
PCF: When FANUC PC-MODEL B control program operates after the power is turned on, this signal becomes 1.



ROMP8-1: When PC ROM parity is wrong in FANUC PC-MODEL B, the bit corresponding to the actual address becomes 1.



1 ~ 8 are indicated on the PCB.



ROM8-3: When a required ROM is not mounted in FANUC PC-MODEL B, the bit corresponding to a missing ROM becomes 1. Refer to the figure of diagnose number 160 for correspondence between ROM8-1 and the mounting positions.

	Mounting position
ROM3	3
ROM4	4
ROM5	5
ROM6	6
ROM7	7
ROM8	8

2	4	5								PCB	PCA
			7	6	5	4	3	2	1	0	

PCA~B: types of Programmable Controller

	PCB	PCA
Without Programmable Controller	0	0
With FANUC PC-MODEL A	0	1
With FANUC PC-MODEL B	1	0

7	0	0		CSCT	CITL	COVZ	CINP	CDWL	CMTN	CFIN
			7	6	5	4	3	2	1	0

When a digit is a 1, the corresponding status is effective.

CSCT : The control is waiting for the speed arrival signal of the spindle to turn on.

CITL : Interlock is on.

COVZ : Override is at 0%.

CINP : In-position check is being executed.

CDWL : Dwell is being executed.

CMTN : Move command in the cycle operation is being executed.

CFIN : M, S, or T function is being executed.

7	0	1			CRST					CTRD	
			7	6	5	4	3	2	1	0	

CRST : One of the following: emergency stop, remote reset, reset & rewind or the reset button on the MDI & CRT panel is on.

CTRD : The control is reading the NC command from the tape reader.

7	0	2		B256K	C1	C2					
			7	6	5	4	3	2	1	0	

B256K, C1, C2: bubble memory capacity

Bubble memory capacity	Specification	B256K	C1	C2
15m/20m	A02B-0047-H051	0	1	1
40m	A02B-0047-H052	0	0	1
80m	A02B-0047-H053	1	1	1
320m	A02B-0047-H054	1	0	0
320m	A02B-0047-H055	1	0	1
640m	A02B-0047-H056	0	1	0
1280m	A02B-0047-H057	1	1	0

7	0	3
---	---	---

SPT	*TERR	*RWT	RDT	*REEL	PWE		
7	6	5	4	3	2	1	0

- SPT:** Shows the status of a tape reader sprocket (feed hole) signal. Becomes 1 at the position a feed hole is punched.
- *TERR:** Becomes 0 when an alarm is detected in the tape reader (is unused at present and consequently, 1 at all times).
- *RWT:** Becomes 0 while the tape reader with reels is rewinding tape.
- RDT:** Shows that the tape reader is ready to operate. Must be 1 for the tape reader to be started. Also becomes 1 when the AUTO/MANUAL switch of the tape reader (without reels) or the Reel ON/OFF switch (with reels) is set for automatic operation.
- *REEL:** Becomes 0 with the tape reader with reels; 1 with the tape reader without. Allows the NC to discriminate between the tape reader with reels and the tape reader without.
- PWE:** Shows the status of the Parameter Write-in switch on the master PCB. Becomes 1 with the switch turned down to ENABLE and 0 with it turned down to DISABLE.

7	0	6
---	---	---

				*RS4	*RSZ	*RSY	*RSX
7	6	5	4	3	2	1	0

Reset signals of the external position display.

- *RS4:** 4th axis reset signal (becomes 0 during reset).
- *RSZ:** Z-axis reset signal (becomes 0 during reset).
- *RSY:** Y-axis reset signal (becomes 0 during reset).
- *RSX:** X-axis reset signal (becomes 0 during reset).

7	0	7
---	---	---

	OHMB	OVL	*VRDY	OH		MDLB	DSCG
7	6	5	4	3	2	1	0

- OHMB:** Becomes 1 when an overheat alarm is detected on the master PCB.
- OVL:** Becomes 1 when an overload alarm is detected in the X/Y/Z-axis velocity control unit.
- *VRDY:** Becomes 0 when the X-, Y-, and Z-axis velocity control units are ready.
- OH:** Becomes 1 when an overheat alarm is detected in X/Y/Z-axis DC motor.
- MDLB:** Is 1 at all times.
- DSCG:** Becomes 1 when the resolver/inductosyn control PCB (A20B-0008-0461) is mounted.

7	0	8
---	---	---

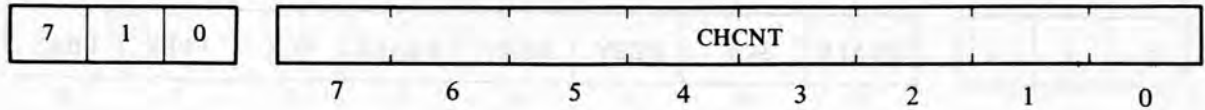
*RAM							
7	6	5	4	3	2	1	0

- *RAM** Becomes 0 when the RAM board of FANUC PC-MODEL A is mounted.

7	0	9
---	---	---

				*PCBH			
7	6	5	4	3	2	1	0

- *PCBH:** Becomes 0 when the additional-axis control PCB (A20B-0007-0090, A20B-0008-0470 or A20B-0008-0471) is mounted.



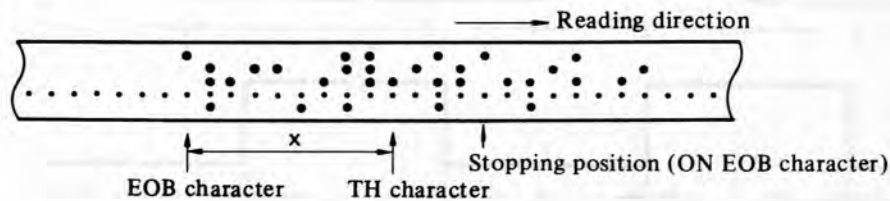
Data of the position of the character which caused the TH alarm when the TH alarm (No. 001) has generated.

If x is a decimal number which is converted from the binary number being displayed, the position of the character which caused the TH alarm is at the x th position from the EOB code which appears at first before the place where the tape is stopped.

Ex. Indication is as below

0	0	0	0	0	1	0	1
2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0

$$X = 2^2 \times 1 + 2^0 \times 1 = 5$$



7	1	1	P8	P7	P6	P5	P4	P3	P2	P1
7	6	5	4	3	2	1	0			

The code holes of the character which caused the TH alarm when the TH alarm (No. 001) was generated.

P1 corresponds to channel 1, P2 corresponds to channel 2 and so on. 0 means the hole is not punched. 1 means the hole is punched.

7	1	2	STP	REST	EMS	RRWD	RSTB			CSU
7	6	5	4	3	2	1	0			

The state during cycle operation stop or cycle operation pause is confirmed. This is used for troubleshooting. Each bit changes its status at the fall of signal STL (when cycle operating status changes cycle operation pause or stop status).

STP : The flag which stops the pulse distribution. This is set at the following conditions.

- External reset or reset & rewind has been turned on.
- Emergency stop has been turned on.
- Feed hold has been turned on.
- Reset button on the MDI & CRT is on.
- The mode has been changed to the manual mode (JOG, STEP, HANDLE).
- Alarm has been generated. (Some alarms may not set the flag.)

REST : This is set when one of the external reset, reset & rewind, emergency stop or reset button has been turned on.

EMS : This is set when the emergency stop has been turned on.

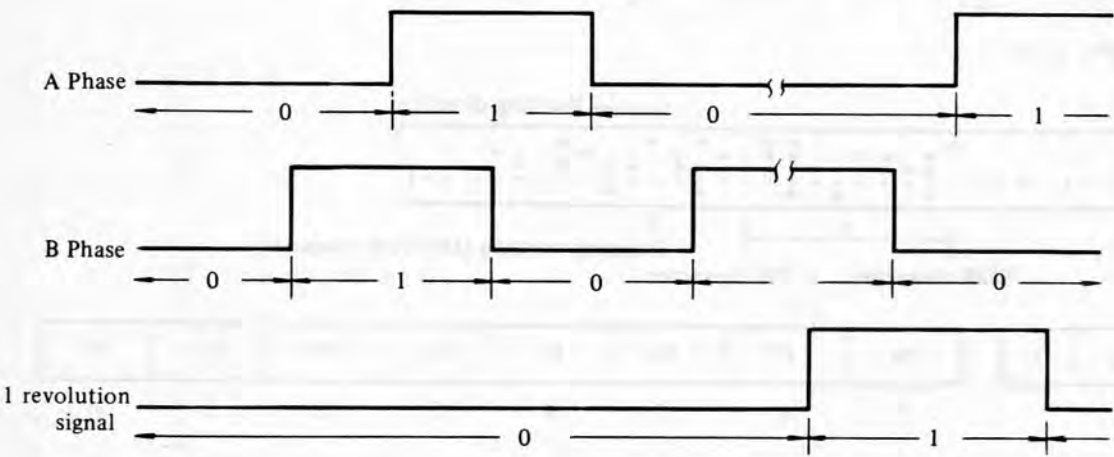
RRWD : This is set when the reset & rewind has been turned on.

RSTB : This is set when the reset button is on.

CSU : This is set when the emergency stop has been turned on or when the servo alarm has been generated.

7	1	3	WBALY	PCY	FBBY	FBAY	WBALX	PCX	FBBX	FBAX
			7	6	5	4	3	2	1	0

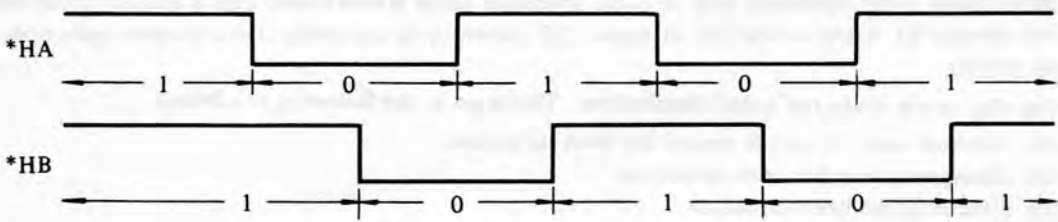
- WBALY: Becomes 1 when the Y-axis disconnection of pulse coder feedback signal check alarm occurs.
PCY: Y-axis pulse coder feedback one-rev signal.
FBBY: Y-axis pulse coder feedback signal phase B.
FBAY: Y-axis pulse coder feedback signal phase A.
WBALX: Becomes 1 when the X-axis disconnection of pulse coder feedback signal check alarm occurs.
PCX: X-axis pulse coder feedback one-rev signal (a or 0 according to the figure below).
FBBX: X-axis pulse coder feedback signal phase B (1 or 0 according to the figure below).
FBAX: X-axis pulse coder feedback signal phase A (1 or 0 according to the figure below).



The figure above shows A- and B-phase waveforms in forward connection for +commands (motor CCW rotation).

7	1	4			*HB	*HA	WBALZ	PCZ	FBBZ	FBAZ
			7	6	5	4	3	2	1	0

*HB, *HA: manual pulse generator input pulses (1 or 0 according to the following figure).



Both *HA and *HB are 1 at stoppage.
The figure above shows the waveforms when the manual pulse generator is turned in + direction.
When it is turned in - direction, the phases of *HA and *HB become reverse.

- WBALZ: Becomes 1 when the Z-axis disconnection of pulse coder feedback signal check alarm occurs.
PCZ: Z-axis pulse coder feedback one-rev signal (see diagnose 713 for 1 or 0).
FBBZ: Z-axis pulse coder feedback signal phase B (see diagnose 713 for 1 or 0).
FBAZ: Z-axis pulse coder feedback signal phase A (see diagnose 713 for 1 or 0).

7	1	5		PC5	FBB5	FBA5		PC4	FBB4	FBA4
---	---	---	--	-----	------	------	--	-----	------	------

PC5: Position coder (5th axis) feedback 1-rev signal
FBB5: Position coder (5th axis) feedback B-phase signal
FBA5: Position coder (5th axis) feedback A-phase signal
PC4: 4th-axis pulse coder feedback 1-rev signal
FBB4: 4th-axis pulse coder feedback B-phase signal
FBA4: 4th-axis pulse coder feedback A-phase signal

Scope

This function is applicable to the following edition numbers and subsequent PC boards.

A20B-0007-0090/05C (pulse coder)
 A20B-0008-0470/03B (resolver)
 A20B-0008-0471/02B (inductosyn)

7	1	9	WBA5	WBA4	OVL2	*VRDY2	OH2			
			7	6	5	4	3	2	1	0

WBA5: Becomes 1 when the 5th-axis pulse coder feedback signal disconnection check alarm occurs.
WBA4: Becomes 1 when the 4th-axis pulse coder feedback signal disconnection check alarm occurs.
OVL2: Becomes 1 when an overload alarm is detected in the additional-axis velocity control unit.
***VRDY2:** Becomes 0 when the additional-axis velocity control unit becomes ready.
OH2: Becomes 1 when an overheat alarm is detected in the additional-axis DC motor.

8	0	0	SVERRX (X axis)
8	0	1	SVERRY (Y axis)
8	0	2	SVERRZ (Z axis)
8	0	3	SVERRL (4th axis)
8	0	4	SVERRL (5th axis)

Position deviation value of X, Y, Z, 4th and 5th axes in order

8	0	5	X-axis move distance by handle interruption
8	0	6	Y-axis move distance by handle interruption

3.7.2

8	0	7	Z-axis move distance by handle interruption
8	0	8	4th-axis move distance by handle interruption
8	0	9	5th-axis move distance by handle interruption

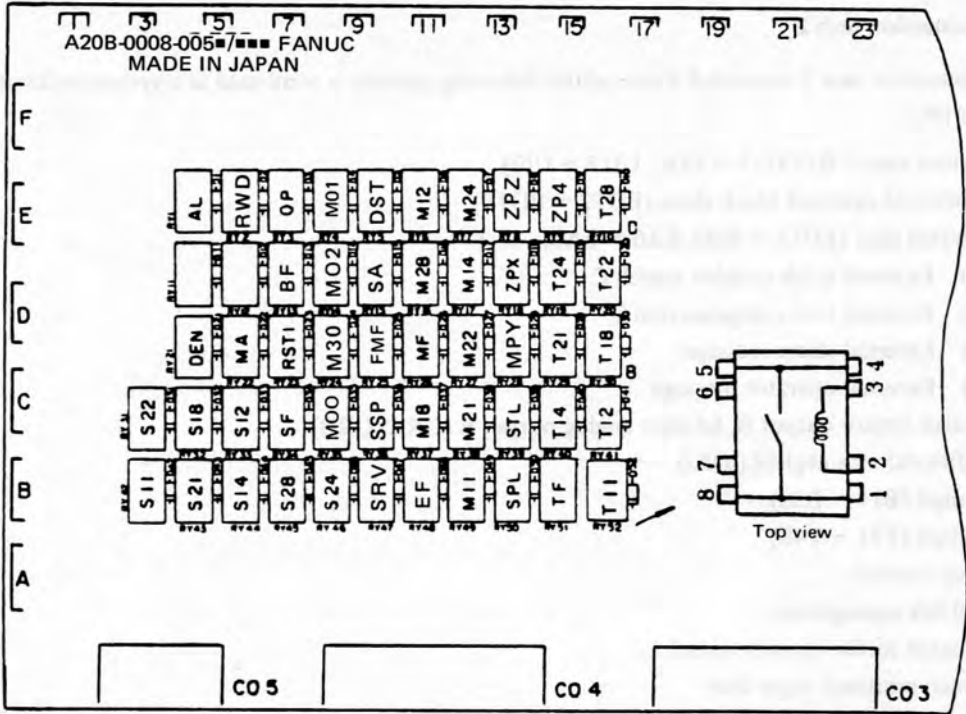
Unit 0.001 mm (metric input)
0.0001 inch (inch input)

Move distance is cleared to 0 by clear operation

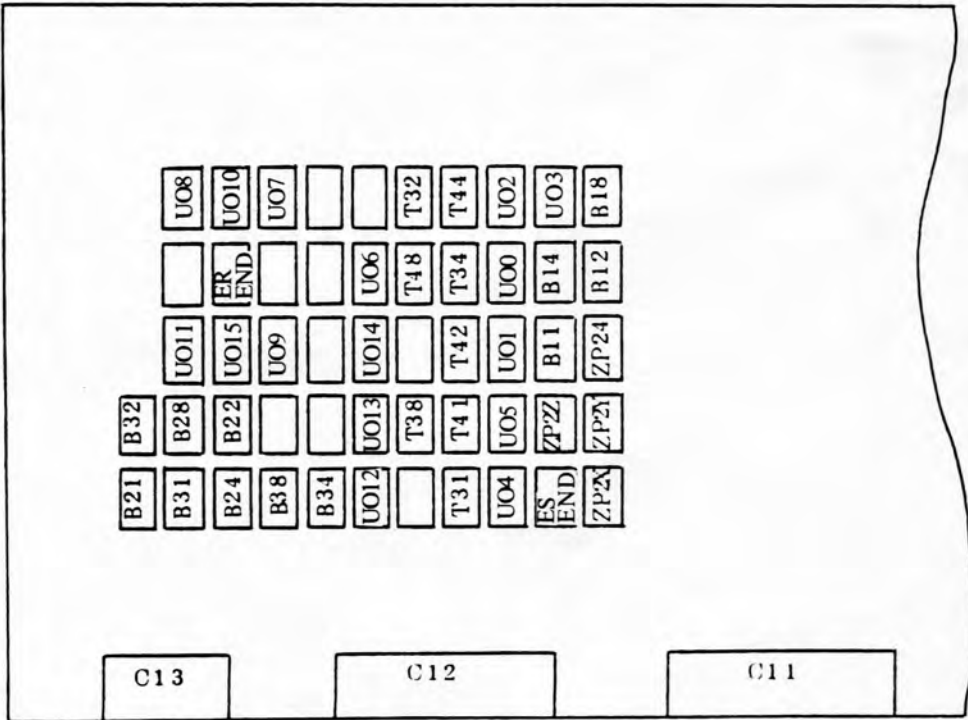
8	2	0	ABSMTX (X axis)
8	2	1	ABSMTY (Y axis)
8	2	2	ABSMTZ (Z axis)
8	2	3	ABSM4 (4th axis)
8	2	4	ABSM5 (5th axis)

Machine position from the reference point of X, Y, Z, 4th and 5th axes in order

8	9	0	Spare time for software processing
---	---	---	------------------------------------



Connection Unit 1 A20B-0008-0540



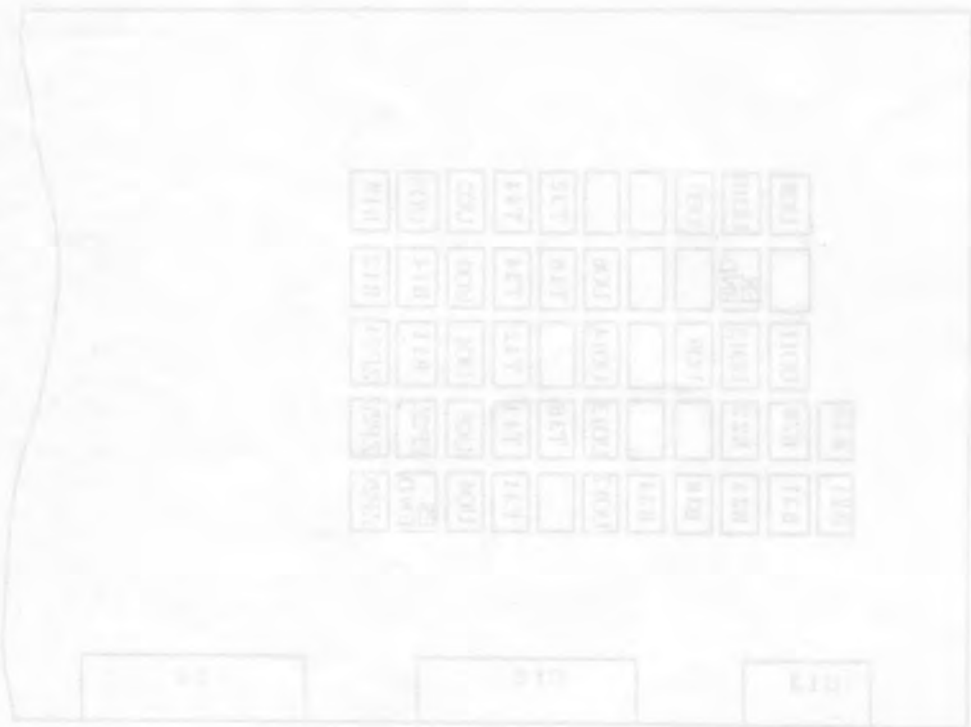
Connection Unit 2 A20B-0008-0540

Relay Assignment

About connection unit 2

Connection unit 2 is needed if one of the following options is combined in a system without programmable controller (PC).

- (1) Custom macro B (UO15 ~ UO0, UI15 ~ UI0)
- (2) Additional optional block skips (BDT2 ~ BDT9)
- (3) External data (BD15 ~ BD0, EA6 ~ EA0, . . .)
 - (i) External work number search C
 - (ii) External tool compensation C
 - (iii) External alarm message
 - (iv) External operator message
- (4) S4-digit binary output B, S4-digit analog output B (GRA, GRB)
- (5) Additional axis neglect (4NG)
- (6) B3-digit (B11 ~ B38)
- (7) T4-digit (T31 ~ T48)
- (8) 5-axis control
- (9) Tool life management
- (10) Constant surface speed control
- (11) Manual arbitrary angle feed

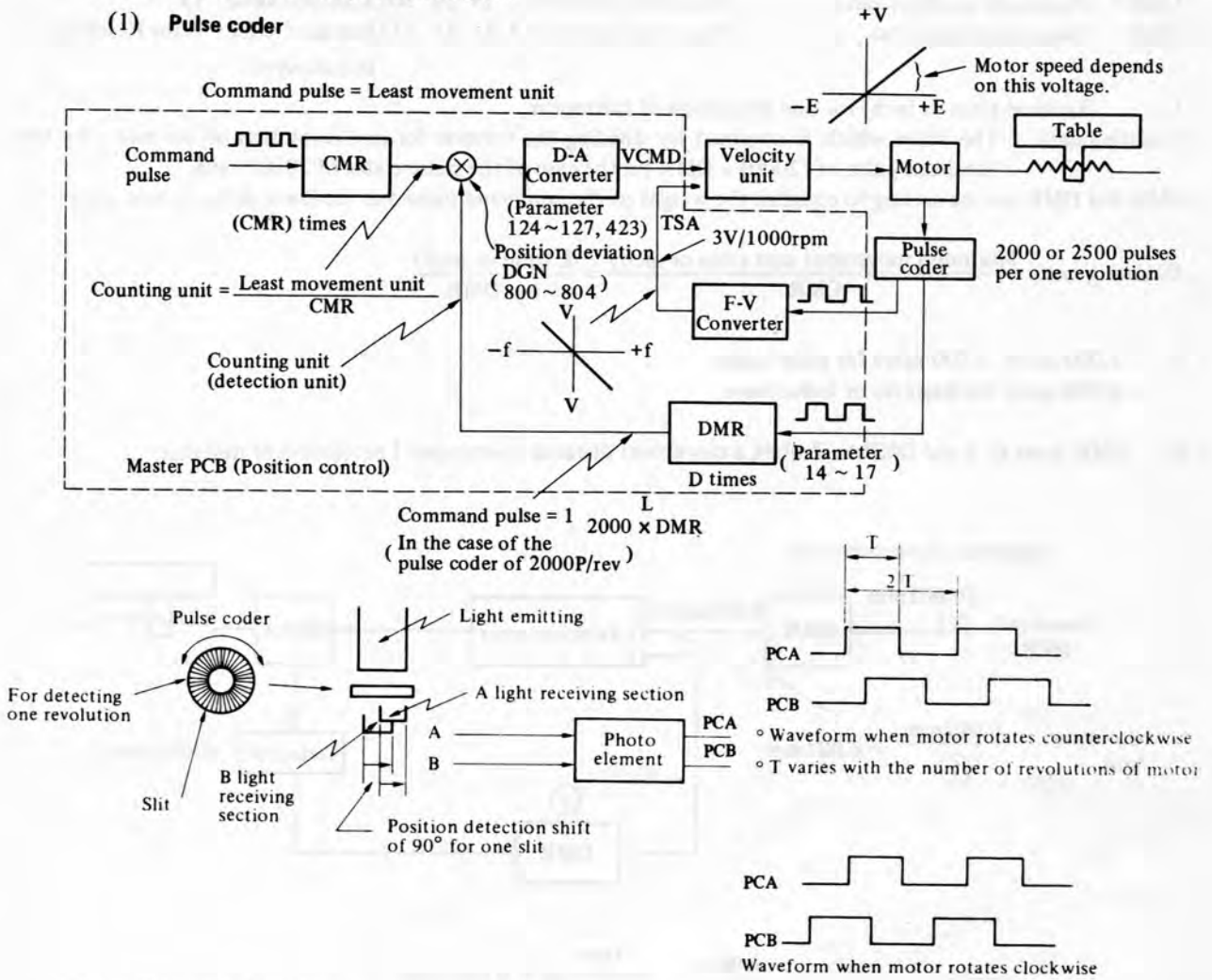


3.8 Block diagram of servo system

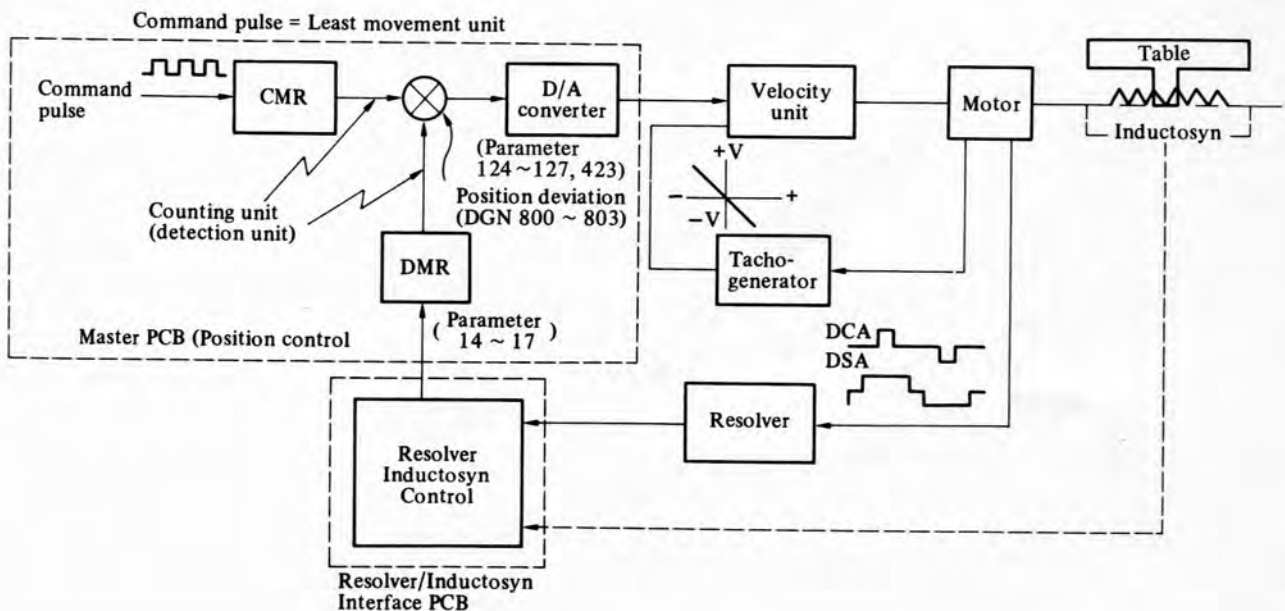
3.8.1 Block diagram of position control

(1) Pulse coder

CCW revolution viewed from spindle



(2) Resolver/Inductosyn



3.8.1

- CMR and DMR are the setting required to adjust the traverse of the table complying with the command pulse.

Command pulse: 0.001mm in metric system 0.0001 inch in inch system

CMR : Command multiply ratio Parameter number 27, 28, 29, 30 (Standard value: 1)

DMR : Detect multiply ratio Parameter number 14, 15, 16, 17 (Standard value: ½ for Resolver/
Inductosyn)

L : Traverse (mm or inch) for one revolution of the motor

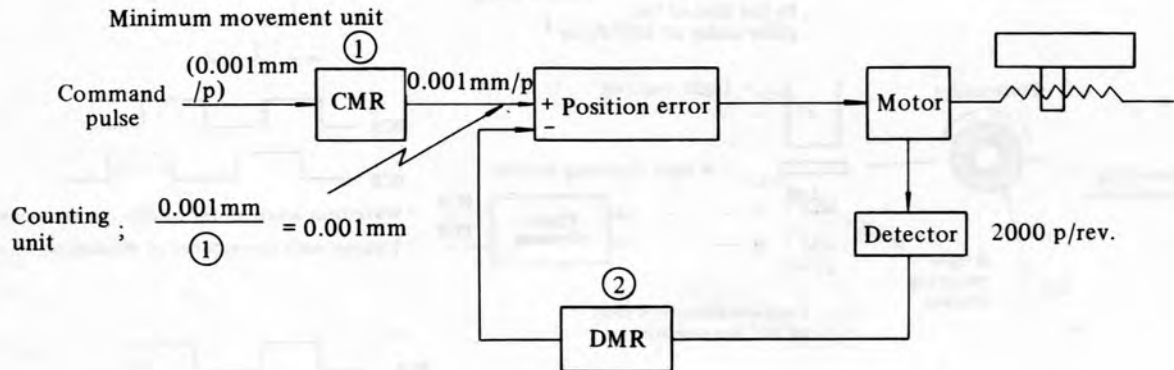
Counting unit: The value which is obtained by dividing the traverse for one revolution of the motor by the feedback pulse of (2000) × DMR (in the case of the pulse coder of 2000P/rev)

CMR and DMR are the setting to equalize the weight of the command pulse and feedback pulse for one pulse.

$$\text{Counting unit} = \frac{\text{Minimum movement unit (mm or inch)}}{\text{CMR}} = \frac{L \text{ (mm or inch)}}{\alpha \times \text{DMR}}$$

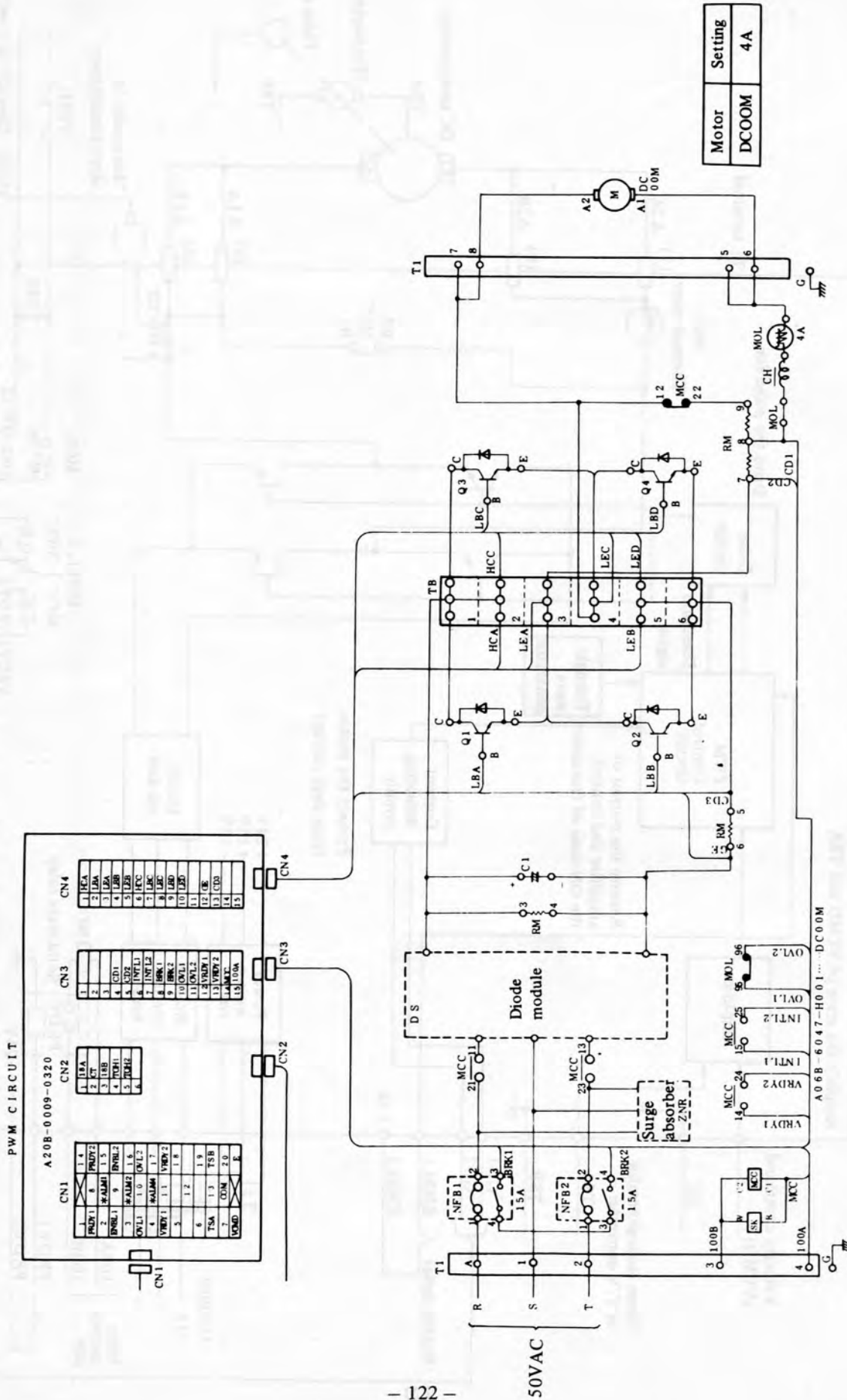
α : 2,000 p/rev, 2,500 p/rev for pulse coder
4,000 p/rev for Resolver or Inductosyn.

ex. CMR is set to 1 and DMR to 2 when a movement distance is 4mm per 1 revolution of detector.

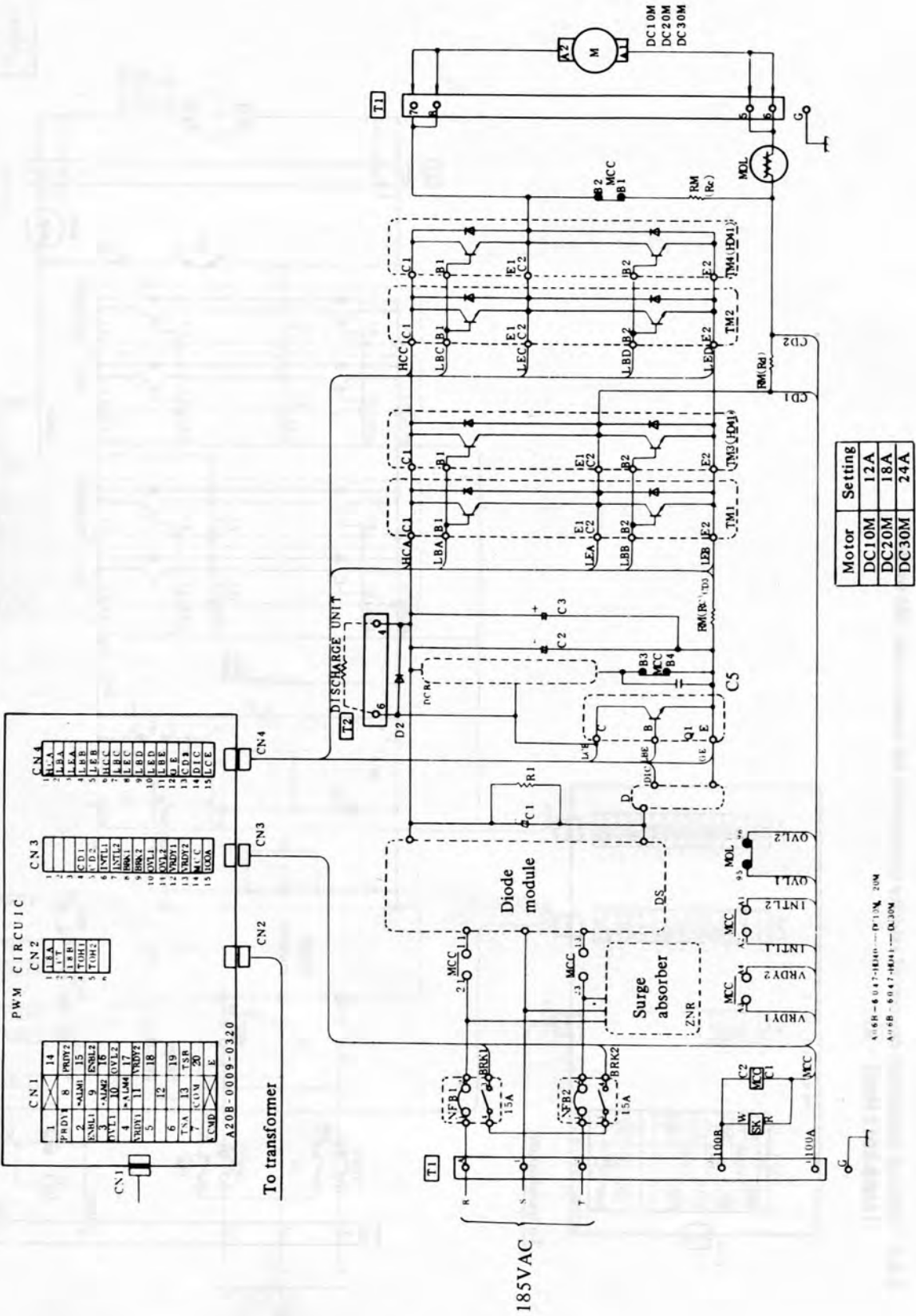


$$\text{detect unit ; } \frac{4\text{mm}}{2000 \times \textcircled{2}} = 0.001 \text{ mm}$$

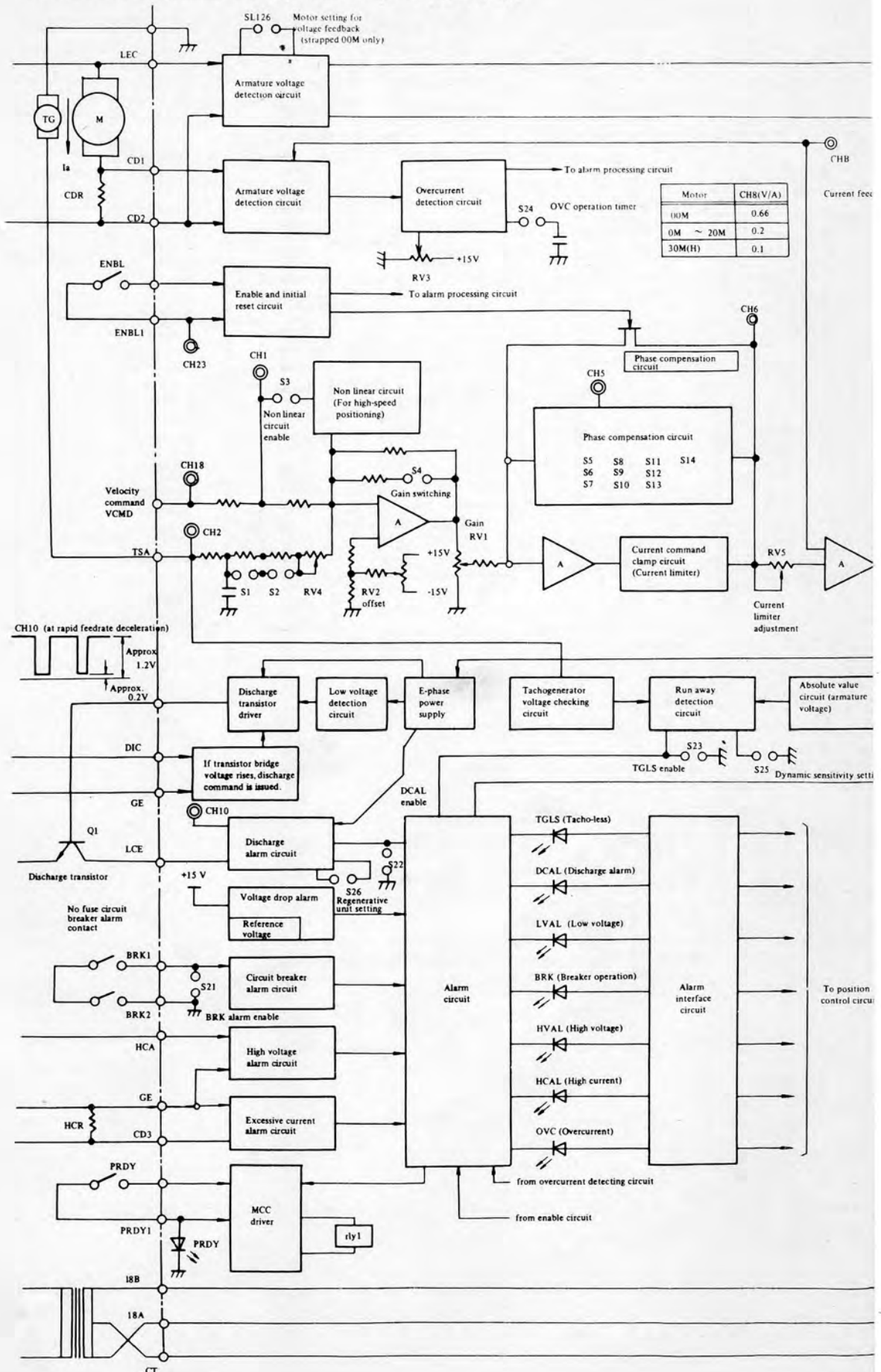
3.8.3 Internal connection diagram of velocity control unit for model 00M (A06B-6047-H001)

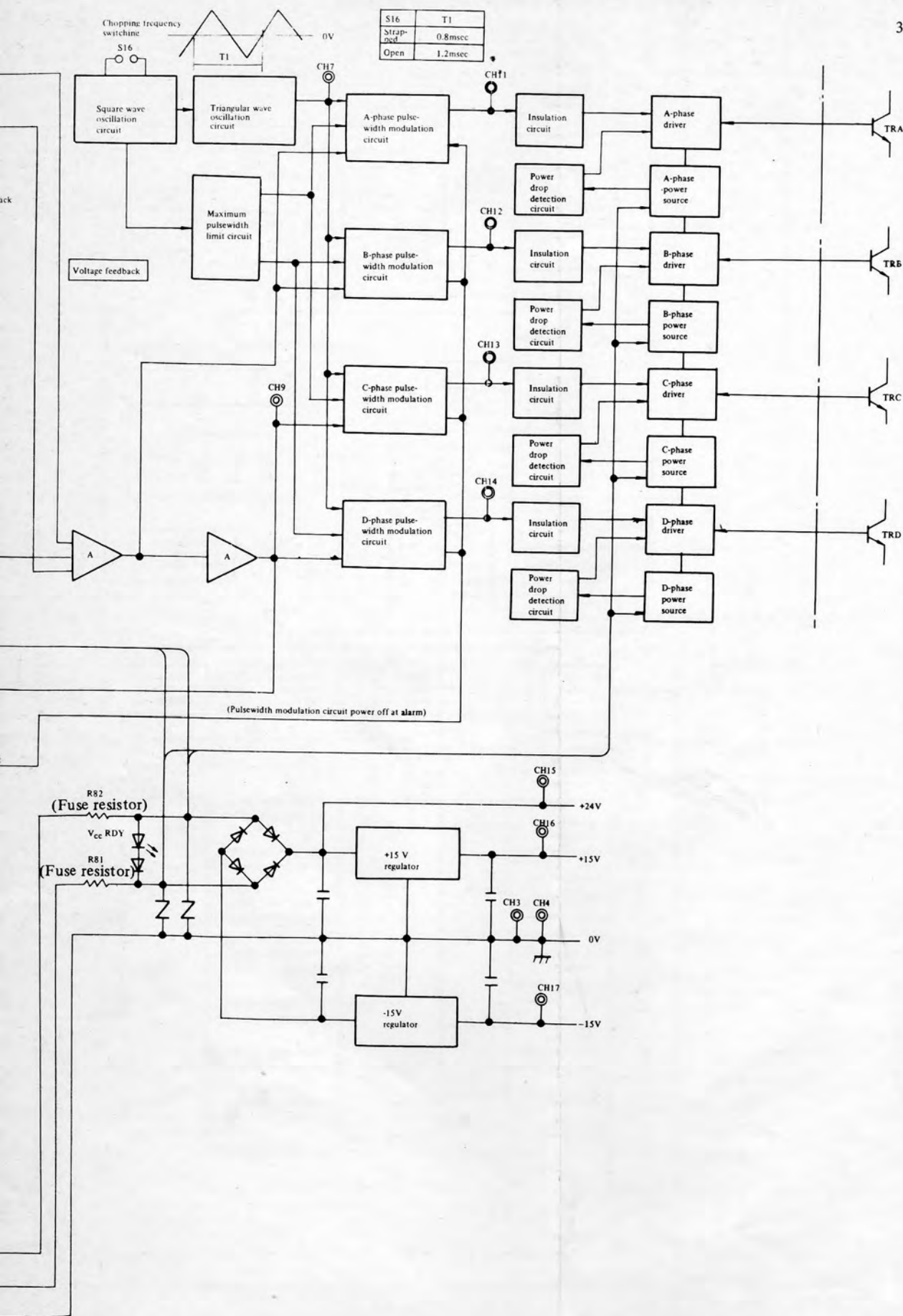


3.8.5 Internal connection diagram of velocity control unit for motor model 10M ~ 30M with separate discharge circuit (A06B-6047-H040, H041)



3.8.6 Block diagram of velocity control unit PCB (M series)





3.9 Confirmation of the connection between control and velocity control unit

3.9.1 Connection diagram

Control unit
CAV
MR-50RM

33		1
TSAL		VCMDL
34		2
TSAM	19	VCMDM
35		3
TSAN	20	VCMDN
36	ECM	4
ECN	21	ECL
37	SGM	5
SGN	22	SGL
38		6
	23	
39		7
	24	
40		8
	25	
41		9
	26	
42	VRDYM	10
VRDYN	27	VRDYL
43	E1M	11
E1N	28	E1L
44	OVLN	12
OVLN	29	OVLN
45	E2M	13
E2N	30	E2L
46	PRDYM	14
	31	
47	ENBLM	15
	32	
48	CRM	16
PRDYN		PRDYL
49		17
ENBLN		ENBLL
50		18
CRN		CRL



Velocity control unit for X axis
CN1 MR-20RM

14		1
CRL	8	PRDYL
15		2
CRL	9	ENBLL
16		3
E2L	10	OVLN
17		4
E1L	11	VRDYL
18		5
	12	
19		6
ECL	13	TSAL
20		7
ECL		VCMDL

Velocity control unit for Y axis
CN1 MR-20RM

11		1
CRM	8	PRDYM
15		2
CRM	9	ENBLM
16		3
E2M	10	OVLN
17		4
E1M	11	VRDYM
18		5
	12	
19		6
ECM	13	TSAM
20		7
ECM		VCMDM

Velocity control unit for Z-axis
CN1 MR-20RM

14		1
CRN	8	PRDYN
15		2
CRN	9	ENBLN
16		3
E2N	10	OVLN
17		4
E1N	11	VRDYN
18		5
	12	
19		6
ECN	13	TSAN
20		7
ECN		VCMDN

(Note)
Last characters of signal
name meaning are
L ... X axis
M ... Y axis
N ... Z axis

Fig. 3.9.1 (a) Connection of Cable
- 127 -

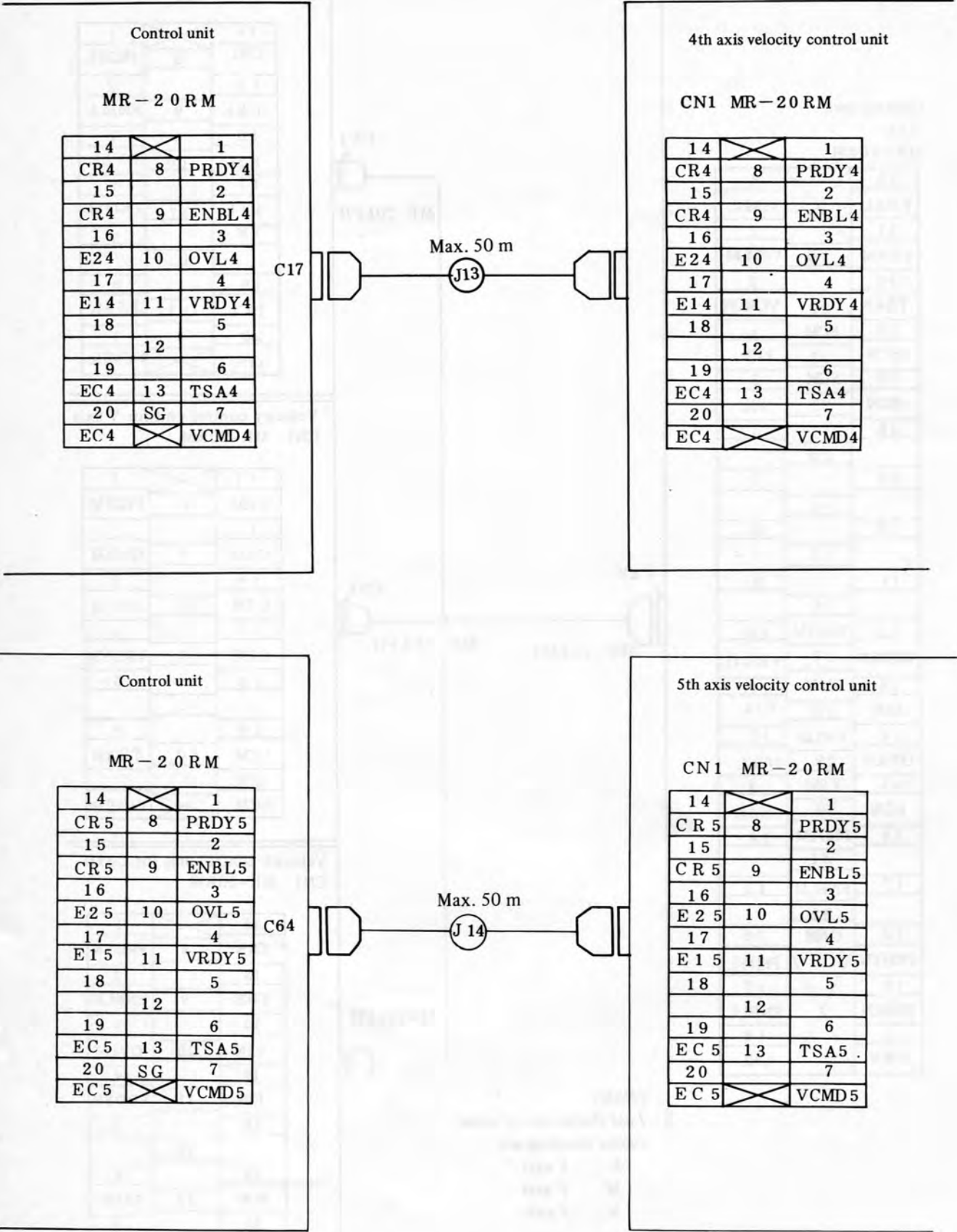


Fig. 3.9.1 (b)

132

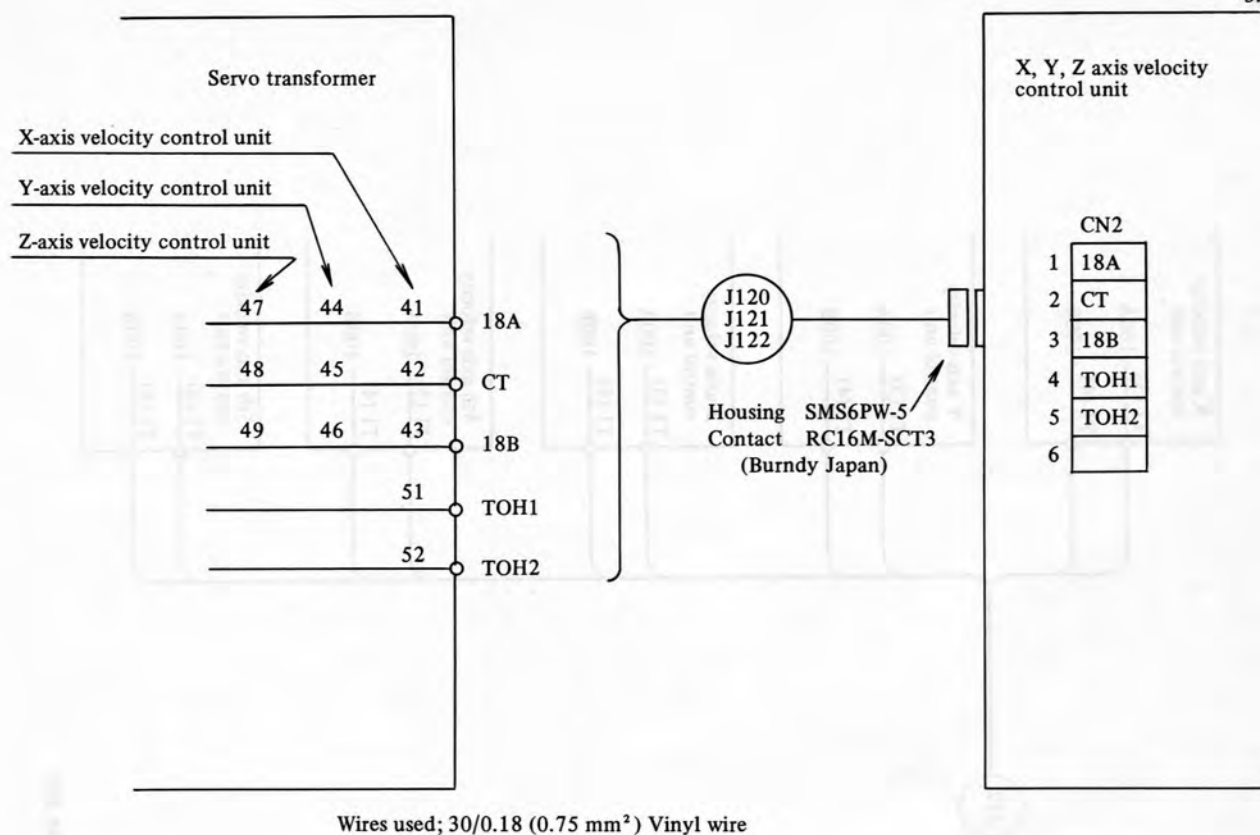


Fig. 3.9.1 (c) Connection of cable J120 to J122

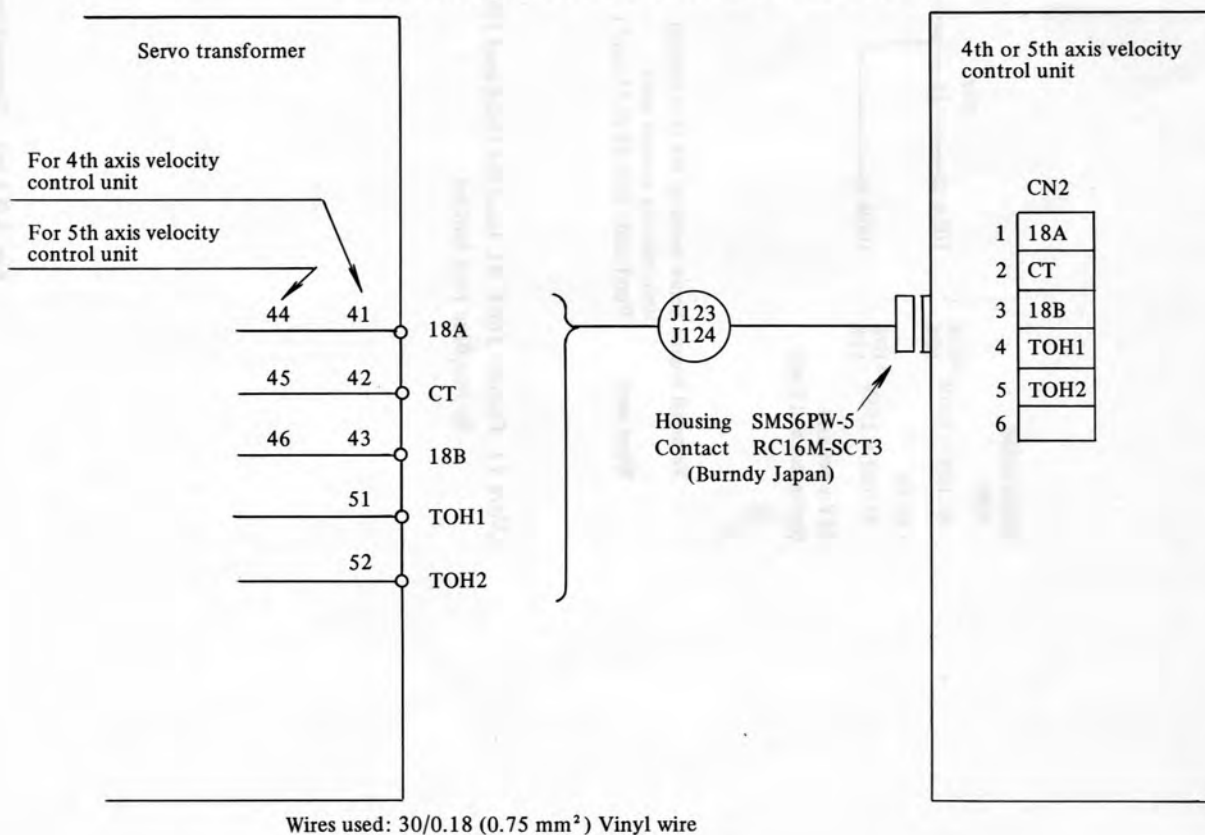
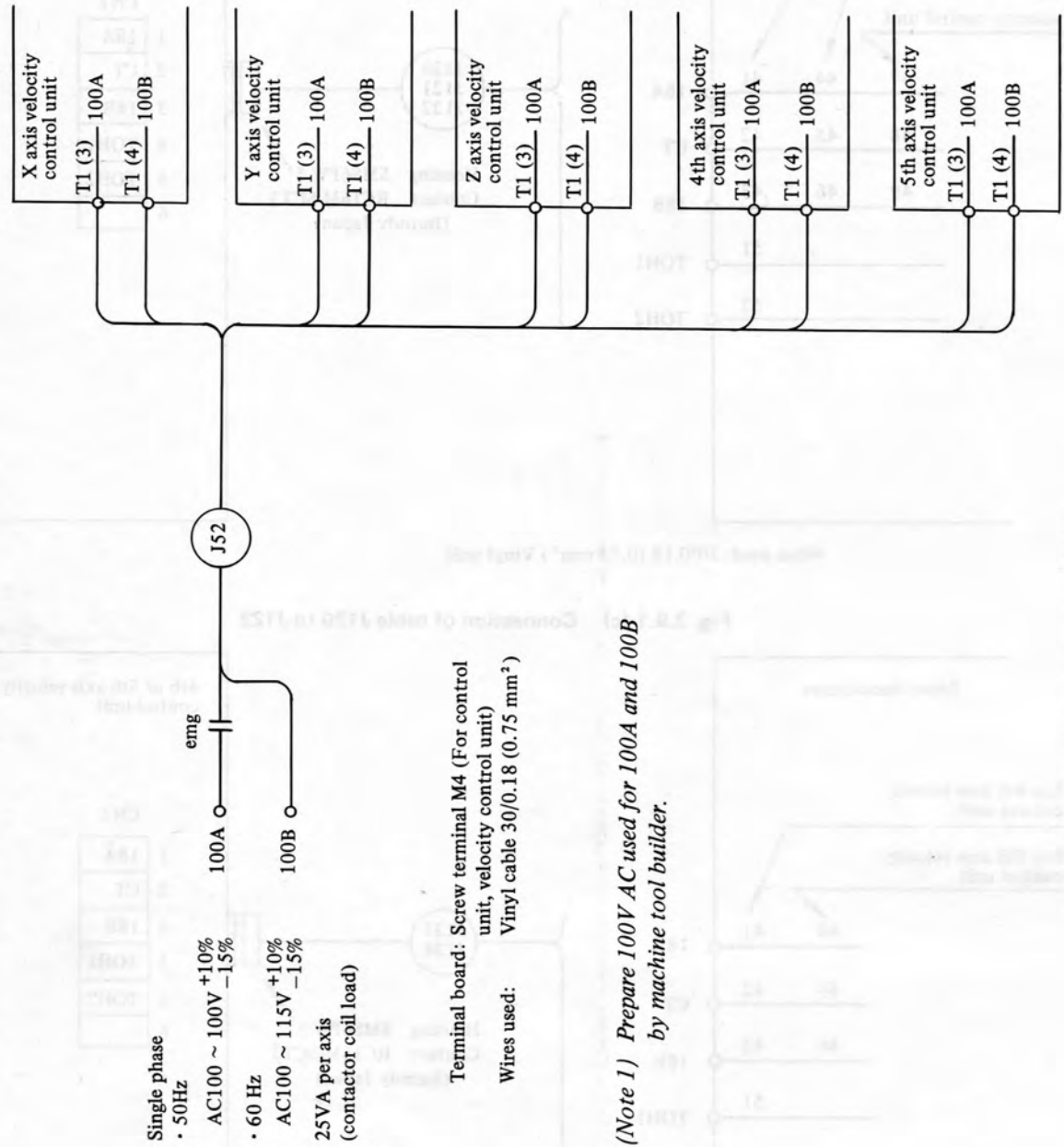


Fig. 3.9.1 (d) Connection of cables J123 and J124



(Note 1) Prepare 100V AC used for 100A and 100B by machine tool builder.

Fig. 3.9.1 (e) Connection of cable J52

3.9.2 Mounting position of connector and terminal on velocity control unit (M series)

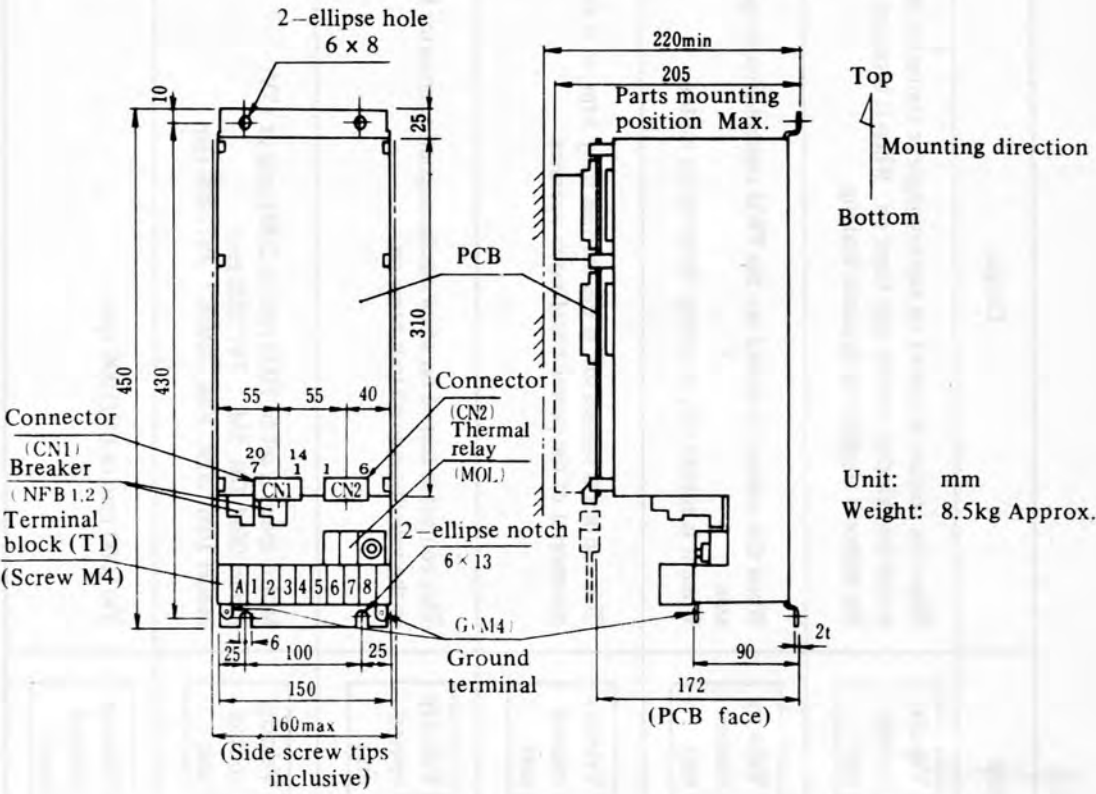


Fig. 3.9.2 (a) Without regenerative discharge circuit

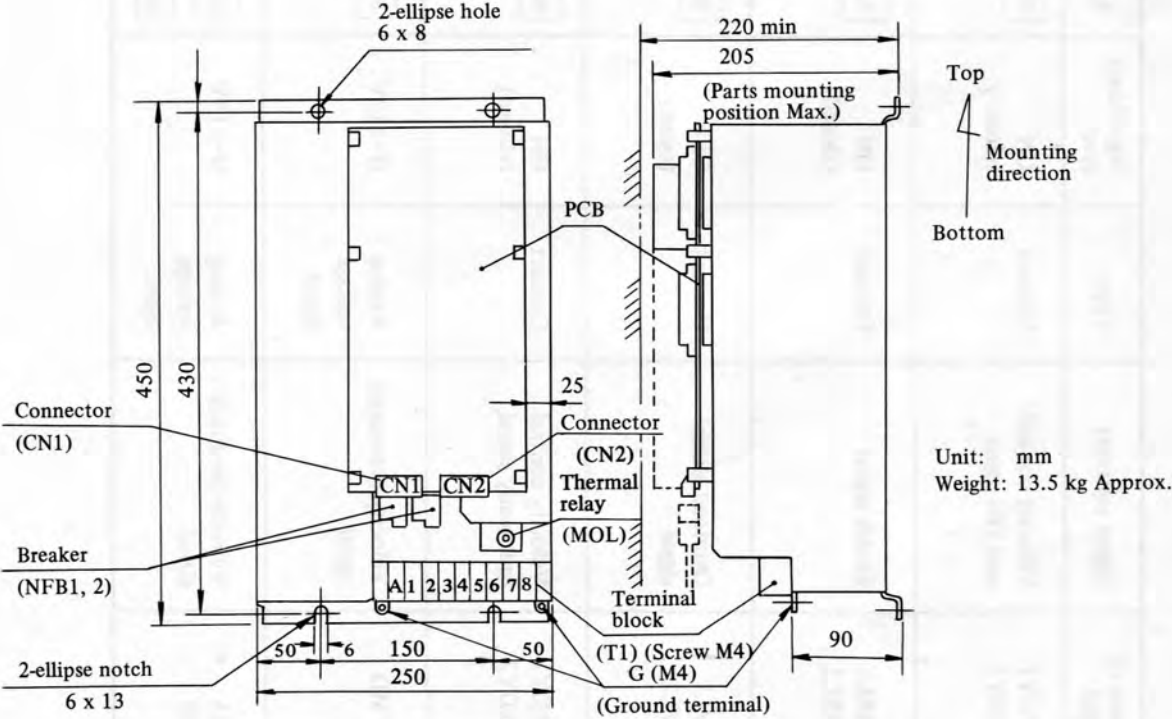


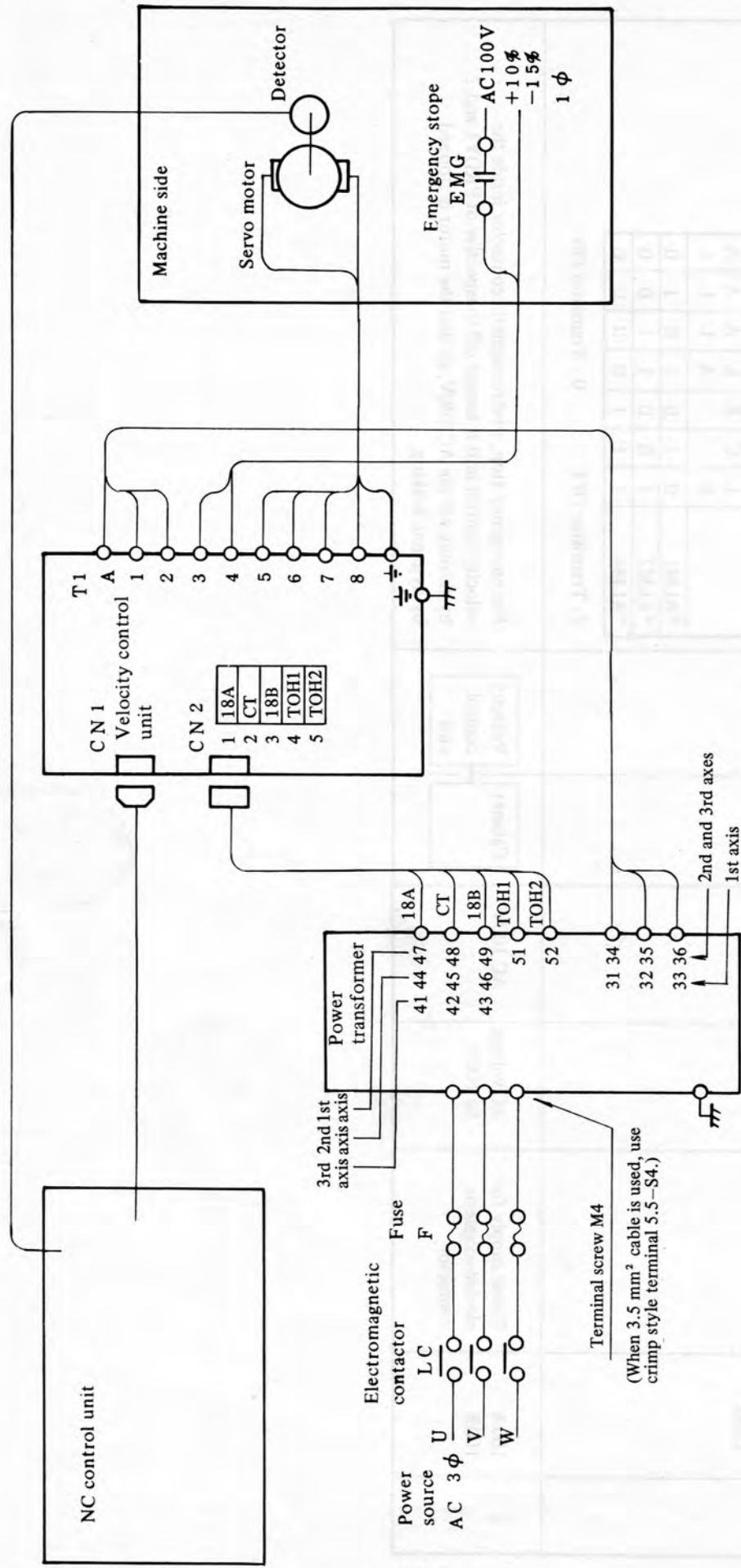
Fig. 3.9.2 (b) With regenerative discharge circuit

Table 3.9.3

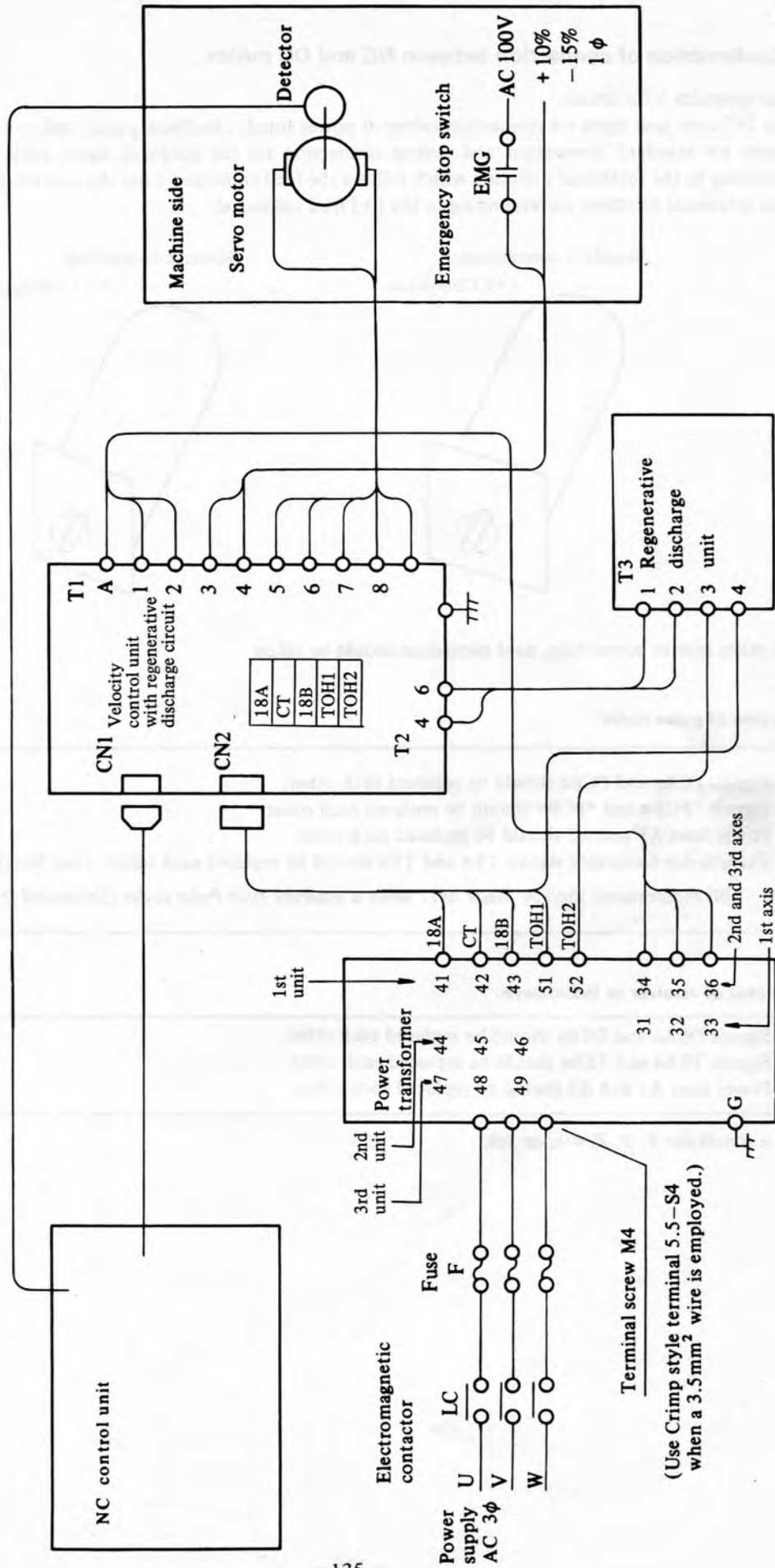
No.	Name of signal	Signal contents	Type	Significant level	Send direction		Details
1	PRDY1 PRDY2	Velocity control unit ON signal	Contact	ON (closed)	NC	Velocity control unit	When the contact is turned on electromagnetic contactor MCC inside the velocity control unit turns on. When it is turned off, the motor is stopped by dynamic braking.
2	ENBL1 ENBL2	Enable signal	Contact	ON (closed)	NC	Velocity control unit	When this contact is turned on, the PWM control circuit operates. When it is turned off, no power flows to the motor.
3	OVL1 OVL2	Overload alarm signal	Contact	OFF (open)	NC	Velocity control unit	This contact is turned off, if the thermal relay trips, or if the thermostat of the power transformer operates.
4	VRDY1 VRDY2	Velocity control unit ready signal	Contact	ON (closed)	NC	Velocity control unit	This contact is turned on when electromagnetic contactor MCC in the velocity control unit turns on.
5	VCMD EC	Velocity command signal	Analog voltage signal	0~±12V	NC	Velocity control unit	Motor speed is set to 1000 rpm or 2000 rpm at ±7V. Model 00M, 0M, 5M : 7V/2000 rpm Model 10M, 20M, 30M, 30MH : 7V/1000 rpm
6	TSA TSB	Velocity feedback signal	Analog voltage signal	0~±15V	NC Motor	Velocity control unit	3V/1000 rpm or 6V/1000 rpm

No.	Name of signal	Signal contents	Type	Significant level	Send direction	Details of contents																																																								
7	*ALM1 *ALM2 *ALM4 COM	Alarm interface signal	Photo-coupler signal	ON (transistor ON)	NC Velocity control unit	See 3.2 <table><tr><td></td><td>T</td><td>O</td><td>B</td><td>H</td><td>H</td><td>D</td><td>L</td></tr><tr><td></td><td>G</td><td>V</td><td>R</td><td>C</td><td>V</td><td>C</td><td>V</td></tr><tr><td></td><td>L</td><td>C</td><td>K</td><td>L</td><td>A</td><td>A</td><td>A</td></tr><tr><td></td><td>S</td><td></td><td></td><td>A</td><td>L</td><td>L</td><td>L</td></tr><tr><td>*ALM1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td></tr><tr><td>*ALM2</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td></tr><tr><td>*ALM4</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td></tr></table> 1 : Transistor OFF 0 : Transistor ON		T	O	B	H	H	D	L		G	V	R	C	V	C	V		L	C	K	L	A	A	A		S			A	L	L	L	*ALM1	0	1	0	1	0	1	0	*ALM2	1	0	0	1	1	0	0	*ALM4	1	1	1	0	0	0	0
	T	O	B	H	H	D	L																																																							
	G	V	R	C	V	C	V																																																							
	L	C	K	L	A	A	A																																																							
	S			A	L	L	L																																																							
*ALM1	0	1	0	1	0	1	0																																																							
*ALM2	1	0	0	1	1	0	0																																																							
*ALM4	1	1	1	0	0	0	0																																																							
8	100A 100B	Power supply for electro-magnetic contactor	AC voltage 1φ 100V	AC 100V	Cabinet Velocity control unit	For emergency stop, electromagnetic contactor inside the velocity control unit is turned off irrespective of PRDY1 and 2 by turning off the AC 100V, so that the motor is stopped by dynamic braking.																																																								

3.9.4 Connection diagram on servo system (for system without regenerative discharge unit)



3.9.5 Connection diagram on servo system (for system with regenerative discharge unit)



3.10 Confirmation of connection between NC and DC motor

See appendix 1 for details.

For DC servo unit there are connection cables of power supply, feedback signals and motor power.

There are standard connection and reverse connection for the feedback signal cable and motor power cable according to the rotational direction which follows the feed command from the control unit.

The rotational direction corresponding to the (+) feed command

Standard connection

[+] Command



Reverse connection

[+] Command



To make reverse connection, next procedure should be taken.

(1) In the case of pulse coder

- (1) Signals PCA α and PCB α should be replaced each other.
- (2) Signals *PCA α and *PCB α should be replaced each other.
- (3) Power lines A1 and A2 should be replaced each other.
- (4) Tachometer-Generator signals TSA and TSB should be replaced each other. (See Note)

(Note) This replacement shall be made only when a separate type Pulse coder (Separated from Motor) is used.

(2) In the case of resolver or inductosyn

- (1) Signals DSA α and DSB α should be replaced each other.
- (2) Signals TSA α and TSB α should be replaced each other.
- (3) Power lines A1 and A2 should be replaced each other.

(Note) α stands for X, Y, Z, 4th, or 5th.

3.11 Troubleshooting of Servo Unit

Troubles in the servo unit don't always cause an alarm depending upon cases. If an alarm appears on the CRT, observe corresponding procedures according to alarm numbers.

This paragraph summarizes troubleshooting procedures for such servo unit troubles as may not cause any alarm as major cases.

- (1) Machine tool runs away, irrespective of the absence of commands 3.11.1
- (2) Machine tool vibrates during movement or stopping 3.11.2
- (3) Poor positioning accuracy and machining accuracy 3.11.3
- (4) Methods of confirming the operation of velocity control unit and position control unit 3.11.4

3.11.1 Machine tool runs away

Item	Cause of trouble	Check procedure	Countermeasures
1	Signals from position detector are abnormal.	Check wiring. Check for positive feedback.	Reconnect wiring correctly.
2	Defect between motor and position detector.	Check by DGN. See 3.7. (DGN 800 ~ 804)	Reconnect them correctly.
3	Master PCB or velocity control unit PCB is defective.		Replace defective PCB.

3.11.2 Machine tool vibrates

Item	Cause of trouble	Check procedure	Countermeasures
1	Setting failure of position control system parameters.	Check according to 5.3.	Set parameters correctly.
2	Setting failure of velocity control unit PCB.	Check PCB according to 6.2. Check PCB for special setting (special number) according to data sheet.	Set PCB correctly.
3	Fault analysis	Check if vibration cycle changes in proportion to the feedrate.	Proceed to 6, if the vibration cycle changes in proportion to the feedrate. Proceed to 4, if the vibration cycle almost remains constant, irrespective of the feedrate.
4	Fault analysis	Check if vibrations are eliminated when velocity control unit CH5-CH6 are shorted by using a jumper wire during operation.	Proceed to 7, if vibrations are eliminated. Proceed to 5, if they are not eliminated.
5	Fault analysis	Short CH5-CH6, and check if vibrations are reduced when turning RV1 counterclockwise.	Proceed to 8, if reduced. Proceed to 9, if not reduced.

Item	Cause of trouble	Check procedure	Countermeasures
6	Machine tool, detector, or motor is defective. Interpolation accuracy is poor. Detection gain is excessively high.	Find the unit being synchronized with vibration cycle, and check it for defective parts. If interpolation accuracy is poor, the vibration cycle is once or twice per wavelength of the position detection signal. Vibrations often occur due to high detection gain in case of rotary inductosyn.	Replace or repair defective parts. Refer to the interpolation adjustment or detection gain adjustment (6.1.6).
7	Matching failure between servoamplifier setting and machine tool.	Short S9 and S11, and check if vibrations are reduced.	Change PCB setting. Contact FANUC service center.
8	Same as described above.	Check if vibration cycle ranges from several ten Hz to several hundred Hz.	Change PCB setting. Contact FANUC service center.
9	Velocity control unit PCB is defective.	Check the waveform at each part of velocity control unit PCB, or replace PCB.	Replace PCB.

3.11.3 Poor positioning accuracy or machining accuracy

(1) Overshoot

Item	Cause of trouble	Check procedure	Countermeasures
1	Short acceleration/ deceleration time.	Check if motor current is saturated.	Set the acceleration/ deceleration time longer.
2	Low rigidity or play at coupling flanges between motor and machine tool.	Check if this failure can be improved by decreasing the position loop gain.	Reduce the position loop gain. Improve the rigidity and play of machine tool.

(2) Poor 1-pulse feed accuracy

Item	Cause of trouble	Check procedure	Countermeasures
1	Fault analysis	Check if the positioning is correct at the detector position by DGN800 ~ 803.	Proceed to 2, if correct. Proceed to 3, if not correct.
2	Deflection, stick slip, or play in machine tool system.	Measure the positioning accuracy at each part of machine tool and motor shaft.	Adjust the machine tool.
3	Low gain of servo system.	Check if this poor accuracy is improved by turning RV1 in velocity control unit PCB clockwise by 2 ~ 3 divisions.	Readjust RV1. Contact FANUC service center.

(3) Poor positioning accuracy to correct commands

Item	Cause of trouble	Check procedure	Countermeasures
1	Fault analysis	Check if positioning is correct at the detector position by DGN800 ~ 803.	Proceed to 2, if correct. Proceed to 3, if not correct.
2	Deflection, stick slip, or play of machine tool system.	Measure the positioning accuracy at each part of machine tool and motor shaft.	Adjust the machine tool.
3	Position control unit is defective.	Replace PCB (Master PCB, etc.) containing the position control unit.	Replace defective PCB.
4	Position detector is defective.		Replace defective unit.
5	Velocity control unit PCB is defective.		Replace defective unit.

(4) Poor roundness of circle by 2-axis feed

Item	Cause of trouble	Check procedure	Countermeasures
1	Fault analysis	Measure the roundness and check if circle is distorted in the axial direction, or if it is deformed to be an ellipse in 45° direction.	Proceed to 2, if distorted axially. Proceed to 3 and 4, if deformed in 45° direction.
2	Fault analysis Poor positioning accuracy.	Unevenness at a change of quadrants. Measure positioning accuracy of each axis.	Proceed to 5 and 6. Adjust the machine tool about poor accuracy axis.
3	Maladjustment of position loop gain.	Perform simultaneous 2-axis 45° feed, and adjust RV4 of velocity control unit PCB so that the difference of the position deviation amounts is within $\pm 1\%$ between axes by DGN800 ~ 803.	Adjust position loop gain to eliminate gain difference between axes (See Note 1.)
4	Detection gain differs every axis.	A circle is deformed to be an ellipse in 45° direction even after adjustment in item No. 3.	Adjust the detection gain (6.1.6).
5	Adjustment failure of Fmin of inductosyn or resolver interface PCB.	Check Fmin adjustment.	Readjust Fmin. See 6.1.6.
6	Improper backlash or backlash compensation amount of machine tool.	Try changing the backlash compensation amount.	Adjust backlash or change backlash compensation amount.

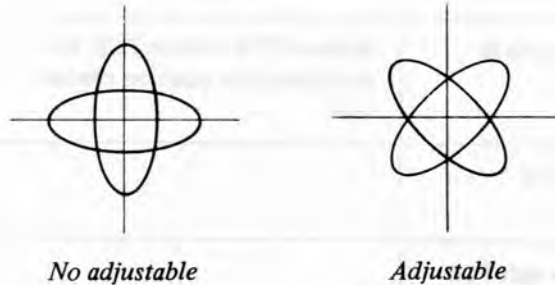
(Note) The position gain when X, Y, Z and 4th axes are moved in same direction by F4 digits feed from MDI operation can be obtained by calculation as below.

$$G = \frac{16.7F}{E}$$

F : Feed rate [mm/min], [0.1 inch/min], [degree/min]
 E : Position deviation [0.001 mm], [0.0001 inch] [0.001 degree]
 G : Position gain [sec⁻¹] (standard: 30 sec⁻¹)

And then check the servo position deviation from DGN 800 ~ 804. Adjust the position deviation with in $\pm 10\%$ of the target value by F/V converter voltage compensation adjustment variable resistor (RV4) in velocity control unit. However, difference between axes must be within $\pm 1\%$.

45° directional elipes can be adjusted by this method but X axis or Y axis directional elipes can't be adjusted by this method.



3.11.4 Method of confirming the operation of velocity control unit and position control unit

The servo system can roughly be divided into the position control unit, velocity control unit, DC motor, and detector.

Since these component units compose a closed loop, the entire servo system becomes defective, if one of these component units is in trouble, and it is sometimes difficult to identify the defective unit from others.

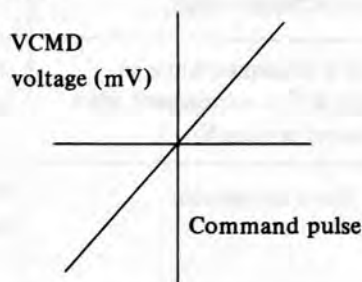
In such a case, check the operating conditions of the position control unit and velocity control unit by the following procedures.

1) Position control unit operation check

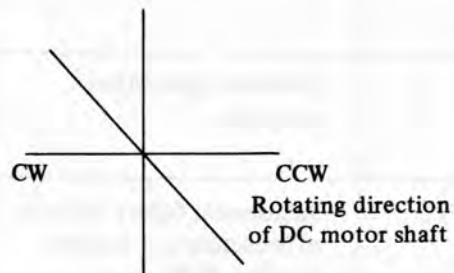
- Disconnect the power cable from the DC motor.
- Set a large value to parameter No. 077, 426.
- After turning on NC, apply pulses by handle, and check the output voltage of VCMD output signal of master PCB.
- Turn the motor shaft slightly by a certain method, and check the VCMD signal of master PCB.

(Note) If NC is turned on after disconnecting power cable from the DC motor, the table powers in case of the gravity axis. Insert suitable lumber or the like.

Decision



When a positive (+) pulse is applied from the handle, VCMD voltage should continuously changes from - voltage + voltage.



When turning the motor shaft counter-clockwise, the VCMD voltage should continuously change from + voltage to - voltage.

2) Velocity control unit operation check

Major circuits of the velocity control unit are mounted on its PCB. Accordingly, whether the velocity control unit is operating normally or not can be judged by exchanging its PCB with the PCB in a normal axis. Be careful with the following items when replacing PCB.

- * If an alarm lights inside the velocity control unit PCB, don't replace PCB at once, but eliminate the alarm first according to the alarm processing method.
- * When replacing PCB, place its internal setting and adjustment to the same values as before. If PCB has been optionally modified, it is not always replaceable. If any question arises, please contact your nearest FANUC service center.

19	Confirm that all functions of PCB are able to normally operate.	Refer to Item 4.1 (10)
18	Adjustment for zero setting	Refer to Item 4.1 (9)
17	Adjust movement of each axis to normal level	Refer to Item 4.1 (8)
16	Reset	Refer to Item 4.1 (7)
15	Command output given	Refer to Item 4.1 (6)
14	Reset	Refer to Item 4.1 (5)
13	Setting and confirmation should be made for each parameter and setting item	Refer to Item 4.1 (4)
12	Confirm operation with MC and monitor this	Refer to Item 4.1 (3)
11	Adjustment of photo stop output level of zero pulse	Refer to Item 4.1 (2)
10	Adjustment of velocity control unit	Refer to Item 4.1 (1)
9	Power on and check output voltage	Refer to Item 4.1 (0)
8	Confirmation is made for that output voltage is not coming with ground	Refer to Item 4.1 (0)
7	Confirmation for input power source voltage frequency and phase rotation	Refer to Item 4.1 (0)
6	Setting on control section PCB Setting on velocity control unit PCB Type of transmission	Refer to Item 4.1 (0)
5	Check the location position of connector and PCB	Refer to Item 4.1 (0)
4	Check external power source for MC "LIFT" against the power input cable	Refer to Item 4.1 (0)
3	External cable connection	Refer to Item 4.1 (0)
2	Check being perfect the connection of wire terminals	Refer to Item 4.1 (0)

4. ADJUSTMENT

4.1 Procedure of adjustment

This section shows adjustment procedure when the system is installed. Adjust your system according to the following items. Details of each item is described in the tables following the table below.

No.	Contents	Remarks
1	Check external view of control unit and servo unit.	Refer to Item 4.1 (1)
2	Check being perfect the connection of screw terminals.	Refer to Item 4.1 (2)
3	External cables connection	Refer to Item 4.1 (3)
4	As setting electrical power source for NC "OFF", connect the power input cable.	Refer to Item 4.1 (4)
5	Check the insertion position of connector and PCB.	Refer to Item 4.1 (5)
6	Confirmation for setting • Tap set of transformer • Setting on velocity control unit PCB • Setting on control section PCB	Refer to Item 4.1 (6)
7	Confirmation for input power source voltage, frequency and phase rotation.	Refer to Item 4.1 (7)
8	Confirmation is made for that output voltage is not shorted with ground.	Refer to Item 4.1 (8)
9	Power on and check output voltage	Refer to Item 4.1 (9)
10	Adjustment of velocity control unit	Refer to Item 4.1 (10)
11	Adjustment of photo Amp. output wave form of tape reader	Refer to Item 4.1 (11)
12	Confirm interface with NC and machine side	Refer to Item 4.1 (12)
13	Setting and confirmation should be made for each parameter and setting data.	Refer to Item 4.1 (13)
14	Power off	Refer to Item 4.1 (14)
15	Connect motor drive line	Refer to Item 4.1 (15)
16	Power on	Refer to Item 4.1 (16)
17	Check movement of each axis by manual feed	Refer to Item 4.1 (17)
18	Adjustment for servo system	Refer to Item 4.1 (18)
19	Confirm that all functions of NC are able to normally operate or not.	Refer to Item 4.1 (19)

(1) Check external view of control unit and servo-unit

Items
Check dirt and damage on external view of MDI/CRT unit, internal position display unit and internal manual operation board etc.
Check loosening fixture or being detached of PCB, tape reader unit and velocity control unit etc. within locker.
Check damage on cables and conduits etc. (Cover strippings etc.)

(2) Check being perfect the connection of screw terminals

Item
Terminal plate of input unit TP1 (U, V, W)
Terminal plate of input unit TP2 (EON, EOF, COM, FA, FB)
Terminal plate of input unit TP3 (200A, B)
Terminal plate of input unit TP4 (U1, V1, EMGIN 1, 2, EMGOUT1, 2)
Terminal block of power unit +5 V
Terminal block of power unit 0V
Terminal block of power unit +24 V
Power ON/OFF button of MDI & CRT unit
Terminal block of tape reader unit
Input transformer terminal block for export. (Primary and secondary side)
Power transformer terminal block for servo of first set. (Primary side, secondary side 100A, B TOH1, 2)
Power transformer terminal block for servo of second set. (Primary side, secondary side 100A, B TOH1, 2)
For the position where cover is made for an each terminal base, confirmation is required for being covered or not.

(3) External cables connection

In regard to following articles, confirmation should be made for every one set at the time of its installation.

Item
After stripping cable external cover, check for that the cable is connected to the earth plate by cramp metal or not.
If the external MDI & CRT is provided, check for that the terminal connector of serial transfer bus is fixed or not.
Check for that the enough large (more than 14 mm ²) protection earth cable is connected or not between NC and machine side magnetics cabinet.
Check for that the protection earth is being one point earth type or not as connecting from the machine side magnetics cabinet to the grounding earth.

In regard to following items, confirmation should be only made for the initial equipment and new maker.

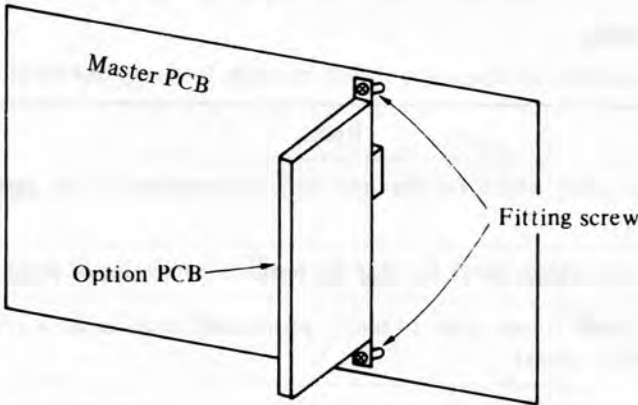
Item
Check for that all signal cables are made into one shield or not.
Cable specifications are as being designated by FANUC or not. (for DC motor signal).

Item
Cable specifications are as being designated by FANUC or not. (for DC motor drive).
Cable specifications are as being designated by FANUC or not (for velocity control unit interface).
Cable specifications are as being designated by FANUC or not (for position coder).
Cable specifications are as being designated by FANUC or not (for spindle analogue output).
Cable specifications are as being designated by FANUC or not (for manual pulse generator).
Cable specifications are as being designated by FANUC or not (for external position display).
Cable specifications are as being designated by FANUC or not (for external MDI & CRT).
Cable specifications are as being designated by FANUC or not (for tape puncher).
Cable specifications are as being designated by FANUC or not (for RS232C interface).

(4) As setting electrical power source for NC "OFF", connect the power input cable.

Item
Motor power cables are left as being disconnected.
Short short bar S23 on the velocity control unit.

(5) Check the insertion position of connector and PCB.

Items
Are cramp screws for HONDA connector firmly tightened?
Are nail type fixtures fitted with flat cable connector?
Are nail type fixtures fitted with brown connector for power source?
Are screws not loosened for option print plate fixture?

Are ROMs exactly mounted with IC socket on ROM card.
Are ROMs exactly mounted with IC socket on PCB for FANUC PC MODEL B.

(6) Confirmation for setting

In regard to Items from a to d, setting shall be made every unit.

(a) Tap set of transformer (See Item 4.2)

Items
Tap setting of servo power transformer.
Tap setting of tape reader power transformer (AC 200/220V) (For only tape reader with reel)
Tap setting of input transformer for export.

(b) Setting on control section PCB. (Refer to Item 6.1)

(c) Setting on velocity control PCB. (Refer to Item 6.2)

(d) Setting on DC spindle servo unit PCB. (Refer to Item 6.3)

(e) Setting on AC spindle servo unit PCB. (Refer to item 6.4)

(7) Confirmation for input power source voltage, frequency and phase rotation

Items
In case of common use for power source of control unit and servo unit, confirm the input is applied as following or not. AC 200/220V $\begin{smallmatrix} +10\% \\ -15\% \end{smallmatrix}$, 50/60Hz ± 1 Hz, 3 ϕ (However, combination with 220V and 50Hz is disapproved.)
Power source input for control unit only is applied as followings or not. AC 200/220V $\begin{smallmatrix} +10\% \\ -15\% \end{smallmatrix}$, 50, 60Hz $\pm 3\%$, 1 ϕ (However, combination with 220V and 50Hz is disapproved.)
Power source input for servo unit only is applied as followings or not. AC 200/220V $\begin{smallmatrix} +10\% \\ -15\% \end{smallmatrix}$, 50, 60Hz ± 1 Hz 3 ϕ (However, combination with 220V and 50Hz is disapproved.)
In case of using transformer for export, power source input is applied as followings or not. AC 200/220/230/240/380/415/440/450/480/550V $\begin{smallmatrix} +10\% \\ -15\% \end{smallmatrix}$
Input power source capacity is enough or not for consumption electric power of control unit and servo unit.
Phase rotation of power source transformer primary side middle tap for servo is right or not.
Phase rotation of power source transformer secondary side is in order R $\rightarrow$ S $\rightarrow$ T or not.

(8) Confirm that output voltage is not shorted with ground

Items
Power unit output +5V is shorted with 0V or not.
Power unit output +24V is shorted with 0V or not.
Power unit output +15V is shorted with 0V or not.
Power unit output -15V is shorted with 0V or not.

(9) Power on and check output voltage

Items		
Fans in locker operate or not.		
At the check terminal on master P.C.B., confirm that output voltage is applied within the ranges as described in the right side table. In regard to +5V, adjustment should be made to enter within the range shown in right side table by the variable resistor +5 ADJ on power unit P.C.B.	+5V (C12)	+4.75 ~ +5.25V
	+24V (C12)	+21.6 ~ +26.4V
	+15V (C12)	+14.25 ~ +15.75V
	-15V (C12)	-14.25 ~ -15.75V
Confirm each voltage at check terminal on velocity control P.C.B. of X axis, Y axis, Z axis, 4th axis and 5th axis.	CH15 (+24V)	22 ~ 27V
	CH16 (+15V)	14.55 ~ 15.45V
	CH17 (-15V)	-14.55 ~ -15.45V

(10) Adjustment of velocity control unit

Items
Confirm servo offset
(a) Set RV2 on velocity control PCB to 50% (In case of pulse coder feedback) Set RV2 so that voltage between CH6 and CH3 be within $\pm 0.5V$ while shorting between CH1 and CH3 and between CH2 and CH3.
<i>Note 1: When machine move during adjustment, position deviation error at stop condition or drift excessive error will occur. In that case, set approx. 5000 to inposition limit and position deviation limit. After adjustment, reset normal data. If the large data is set to inposition limit, automatical drift compensation is not performed.</i>
<i>Note 2: Don't short CH2 (TSA) and CH3 (0V) or CH2 and CH4 (0V) on velocity control PCB. If it shorted, hybrid IC on master PCB will be damaged (This note applies to a system with pulse coder feedback)</i>

(11) Adjustment of photo Amp. output wave form of tape reader (Refer to Item 2.17)

Items
After setting endless tape repeating respectively punching and non punching, and send the tape by setting switch for MANUAL.
(1) With an oscilloscope, measure the waveform between check terminals CHPS and CHG (ground) on the photo-amplifier. Adjust it so that the ON/OFF timing ratio is 6:4. (2) Measure the waveform between check terminals CH1 and CH8 on the photo-amplifier using oscilloscope, and find the channel where the ON width is the shortest. (3) Measure the waveform where the ON width is the shortest between CH1 and CH8 and compare it with the waveform of CHPS. Adjust so that the timing indicated in the diagram below is obtained. (4) Confirm that the waveforms CH1 and CH8 satisfy the timing in the diagram below.
CHPS waveform ON: OFF = 6:4 Above 300µs Shortest ON width measured between CH1 and CH8 ON OFF Above 300µs
Note) Names of check terminal and variable resistor for tape reader (A13B-0070-B001) are changed as below. CHPS → S (CH1 ~ CH8 → 1 ~ 8 CHG → 0V RV1 → RV2 → right side volume of SP.

(12) Confirm interface with NC and machine side

Items
Refer to the self diagnostic function table (See item 3.7)

(13) Setting and confirmation should be made for each parameter and setting data

Items
Refer to the parameter table. (Refer to Item 5.3)
Set parameter ADFT (PRM, 007, upper bit) to "1".
Set parameter PHS (Parameter No. 013) to 0 when the system employs a resolver or an inductosyn as a transducer.

(14) Power off

(15) Connect motor drive line

Open S23.

4.1

(16) Power on

Items
When alarm occurred, it should be processed according to alarm table.
Motor rotates little bit when MCC in velocity control PCB is on. But motor shaft returns position by automatic drift compensation function. Initial and after that, motor shall not rotate by power ON/OFF condition. Confirm that motor shall not rotate by power ON/OFF or emergency condition.

(17) Check movement of each axis by manual feed

Items
To try to move every 10 μ m by manual feed or incremental feed. At this time, confirm that machine movement is correctly following or not by indication the machine current position (DGN X: 820 Y: 821 Z: 822) with MDI/CRT.
Move a machine by JOG feed in low override and operate the limit switch mounting the machine, check that machine exactly stops at the time of over travel alarm detection.
Move a machine by JOG feed and manual rapid traverse and check that error excessive alarm does not occur in maximum feed rate.

(18) Adjustment for servo system

Items
Move a machine by F4 digit feed in MDI mode, at this time observe the position deviation value by MDI/DPL unit (DGN X: 800 Y: 801 Z: 802). The position gain is obtained from the following formula. $G = \frac{16.7F}{E}$ where F: Feed rate [mm/min], [0.1 in/min], [deg./min] E: Position deviation [0.001 mm] [0.0001 in.], [0.001 deg.] G: Position gain [S ⁻¹] Adjust the position gain within +10% of the target value by the tachogenerator compensation adjustment variable resistor (RV4) in the velocity control unit. However, difference between axes must be within 1%. (Consider initial value of position deviation)
In case of having inconvenience at the standard setting of velocity control unit (deposit feeding, swell, hunting, overshoot, oscillations and noise etc.), it is necessary to perform setting so as to match mechanical characteristics.
Perform the adjustment and setting for inductosyn/resolver interface PCB. (Refer to item 6.1.6)

(19) Confirm that all functions of NC are able to normally operate or not

Items
Perform a reference point return. Perform setting of grid shift amount. This performance shall not become effective otherwise power goes off once and power goes on again. Function confirmation is necessarily required.
By the test tape being made to match machine, running is made.

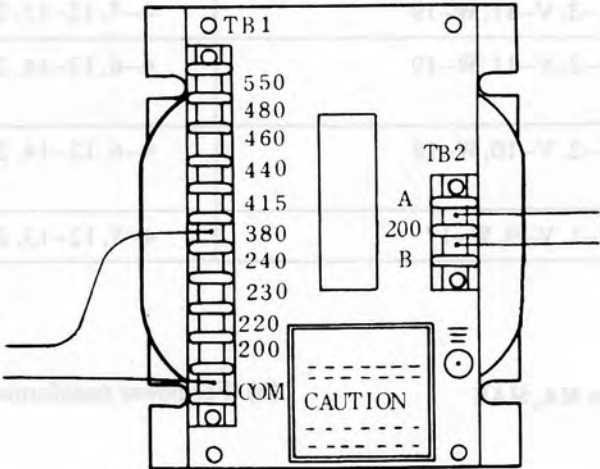
4.2 Connection of power supply

4.2.1 Tap change of control power transformer

A control power transformer is required when the input power supply is other than AC200V 50/60Hz or AC 220V 60Hz.

This transformer can be installed in the free standing type cabinet. As a power transformer is mounted in the machine tool when the other type cabinets are used, refer to the manual issued by the machine tool builder.

Check the transformer tap, and confirm that the voltage (at the NC power supply terminal) is within +10% and -15% of the tap voltage. If the voltage is outside this range, the tap must be changed.



Tap connection for 380V

4.2.2 Connections of servo power transformer (M series)

(1) Primary connections

(a) For power transformers MA ~ MC (for Japan)

Power voltage	Connection of transformer primary terminals
200V	U-2, V-4, W-6
220V	U-1, V-3, W-5

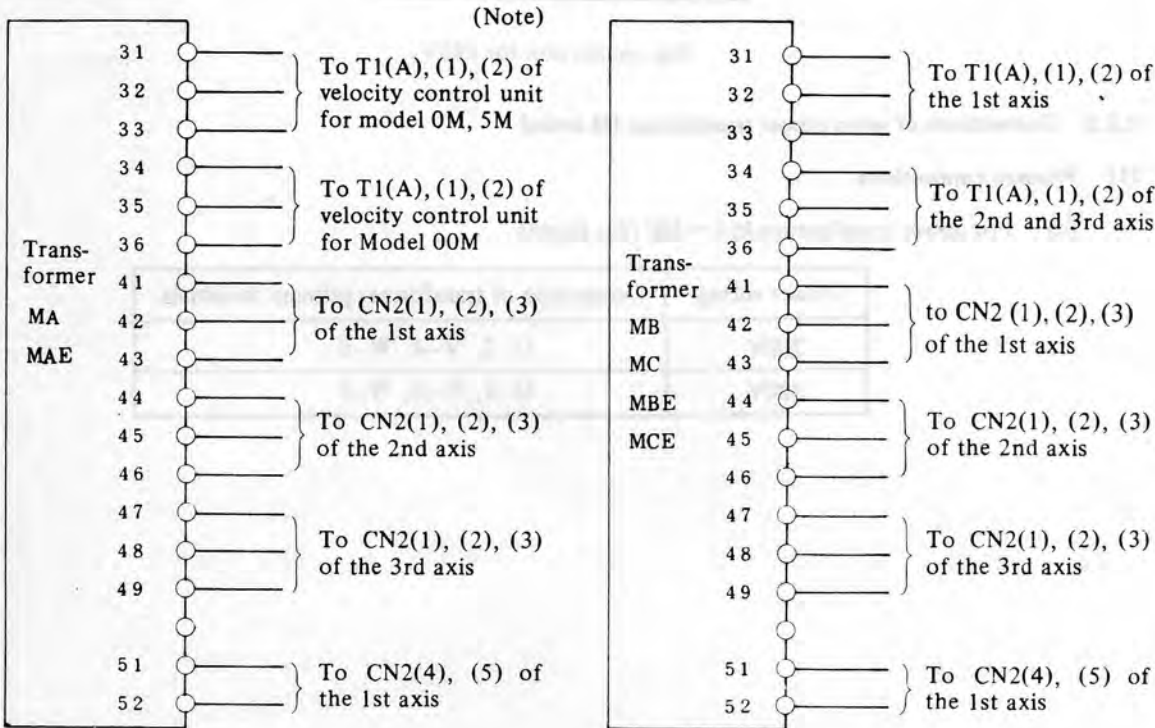
(b) For power transformers MAE ~ MCE (for countries other than Japan)

Power voltage	Connection of transformer primary terminals	
	Connection of power cables U, V, W	Jumper between transformer terminals
190V (Common to 200V)	U-3-7, V-11-15, W-19-23	4-8-12-16-20-24
230V (Common to 220V)	U-2-6, V-10-14, W-18-22	
380V	U-3, V-11, W-19	4-7, 12-15, 20-23, 8-16-24
420V (Common to 415V, 440V)	U-3, V-11, W-19	4-6, 12-14, 20-22, 8-16-24
460V (Common to 480V)	U-2, V-10, W-18	4-6, 12-14, 20-22, 8-16-24
550V	U-1, V-9, W-17	4-5, 12-13, 20-21, 8-16-24

(2) Secondary connections

(a) For power transformers MA, MAE

(b) For power transformers MB, MC, MBE, MCE



Note:

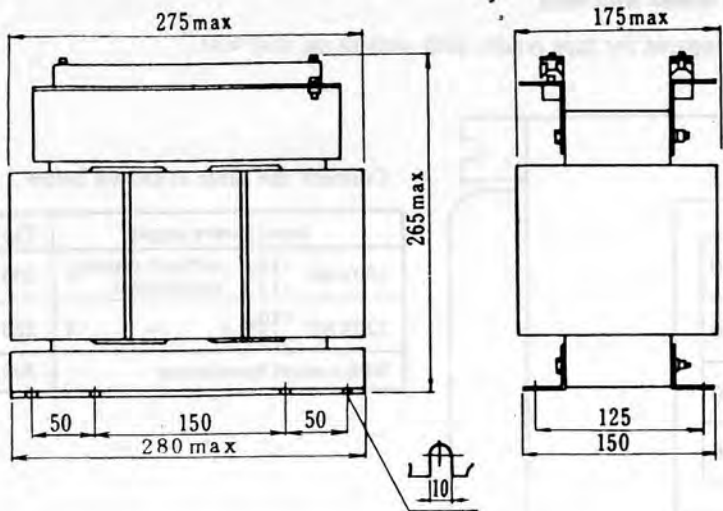
The output voltage of the power transformer differs for Model 00M.

(The voltage lower than the voltages for other motors is employed)

If the power transformer for other motors should be connected to the velocity control unit for Model 00M by mistake, it causes a trouble. Particularly be careful with connection, accordingly.

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(3) External dimensions of power transformer

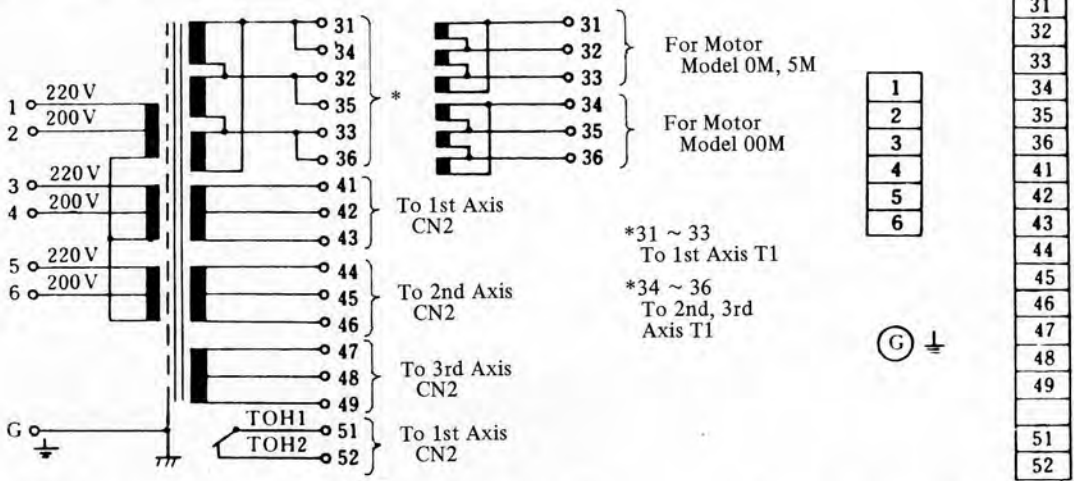


Power transformer	Weight
MA MAE	About 20kg
MB MBE	About 30kg
MC MCE	About 36kg

Connection diagram of power transformer MA ~ MC
Connections of MA 31 ~ 36 are as shown in the right figure.

Connections of power transformer MA 31 ~ 36

Terminal layout of power transformers MA ~ MC
(Screw M4)



Connection diagram of power transformers MAE ~ MCE
Connections of MAE 31~36 are as shown in the right figure.

Connections of power transformer MAE 31~36

Terminal layout of power transformers MAE ~ MCE

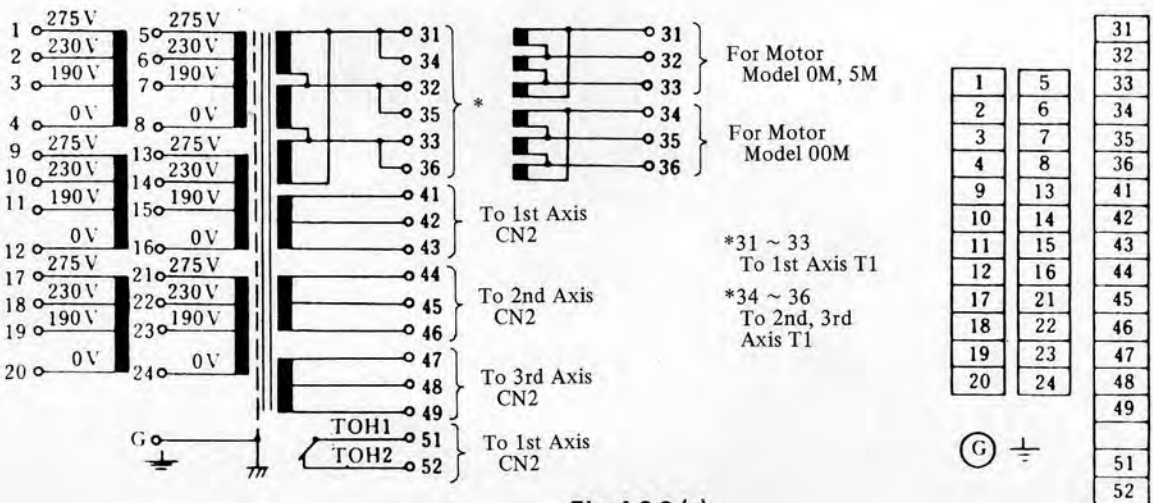
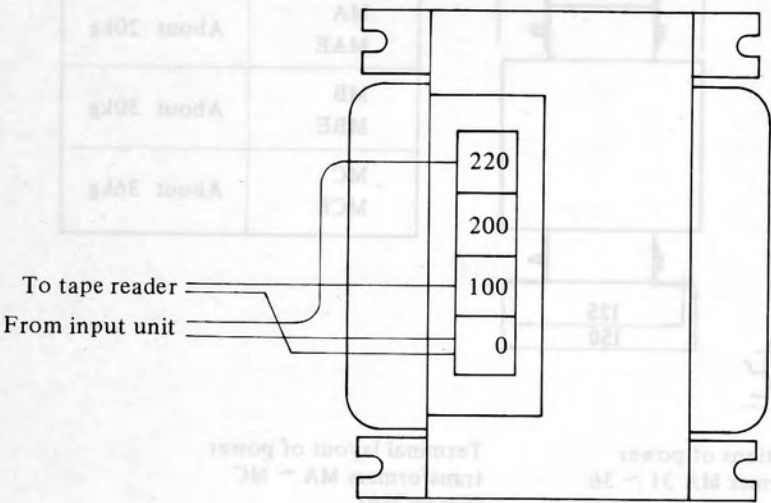


Fig. 4.2.2 (e)
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4.2.3

4.2.3 Tap change of transformer for tape reader with reels

The following power transformer is prepared for tape reader with reels to use 100 VAC.



Connect the cable as shown below.

Input power supply	Tap
200VAC $\begin{matrix} +10\% \\ -15\% \end{matrix}$ (without control transformer)	200
220VAC $\begin{matrix} +10\% \\ -15\% \end{matrix}$ (")	220
With control transformer	200

Tap change of transformer
for tape reader with reels
(In case input voltage is AC 220VAC)

5 SETTING OF PARAMETERS

When connecting NC with machine tool, set the parameters to make the machine exhibit the best-performance. Parameters depend on machine tool. Refer to parameter table made by machine tool builder.

5.1 Procedure of display of parameters

- (1) Push the **PARAM** button on the MDI & CRT unit.

Parameters are displayed on the screen.
There are following 2 methods to change the screen.

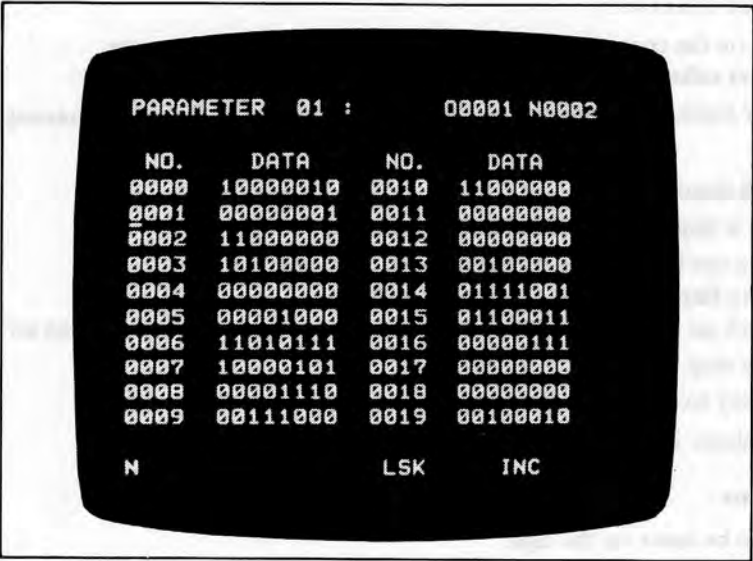
Method 1

Pressing the PAGE **↓** button displays changes in the forward direction.

Pressing the PAGE **↑** button displays changes in the reverse direction.

Method 2

Press the **N** key, parameter number via the DATA key, then **INPUT** key. The Corresponding parameter number is displayed.



Example of parameter display

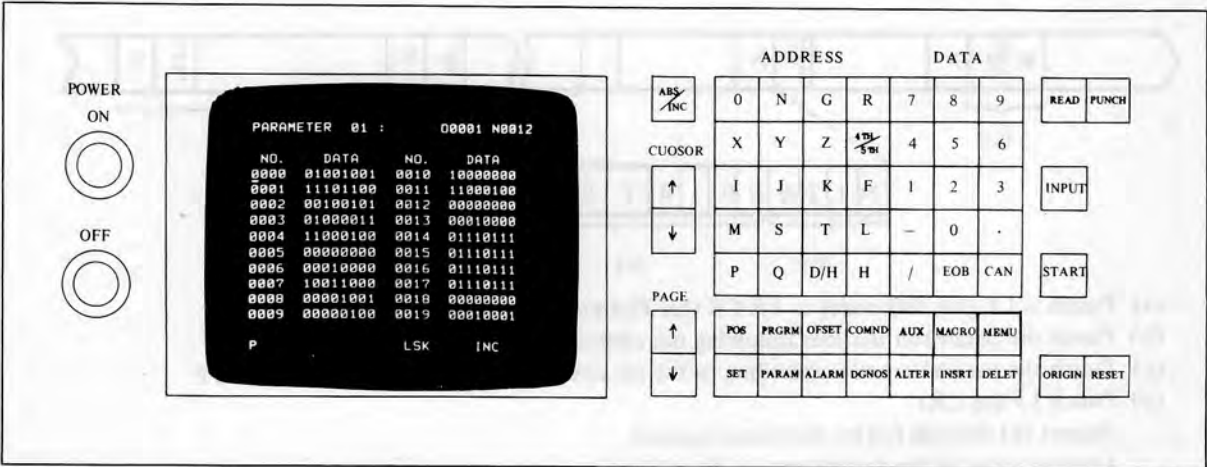
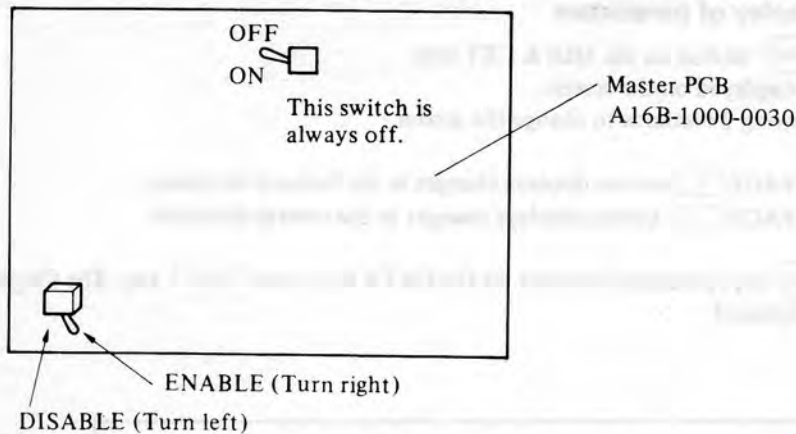


Fig. 5.1 MDI/CRT unit

5.2 Procedure of setting of parameters

5.2.1 Setting via the MDI

- (1) Set a selector switch on the master PCB to ENABLE. The alarm number 100 is displayed.



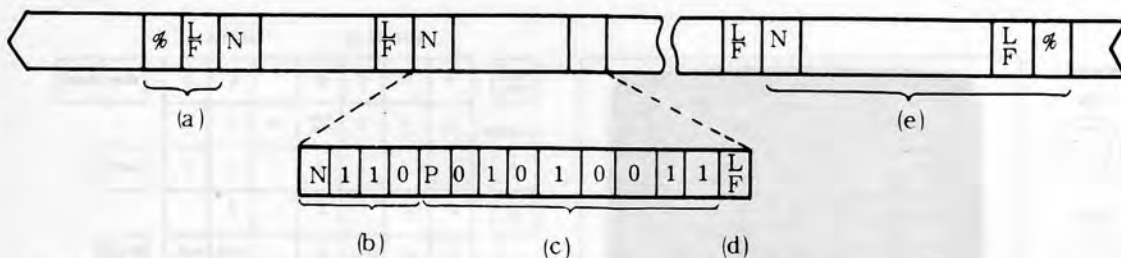
- (2) Set MODE switch on the control panel to MDI or set to Emergency stop state.
- (3) Display a parameter referring to item 5.1.
- (4) Select a parameter number by **CURSOR** button or by pressing **N** followed by pressing parameter number and **INPUT** key.
- (5) Press **P** key, then input data.
The keyed-in data is displayed at the button on the screen.
The erroneous data can be cancelled by the push of **CAN** key.
- (6) Press **INPUT** key to finish a setting. Confirm your setting.
- (7) Set a selector switch on the master PCB to DISABLE after all parameters have been set.
- (8) Release emergency stop if it is on.
- (9) Push the **RESET** key to release the alarm status (No. 100).
- (10) Turn power off if alarm No. 000 is displayed.

5.2.2 Setting via the tape

Parameters can also be input via the tape.

(1) Preparation

Prepare the tape for parameter as follows.



- (a) Punch % LF (for ISO code) or ER CR (for EIA code) at the start of tape
- (b) Punch the parameter number following the address N after the LF (or CR) code.
- (c) Punch the parameters corresponding to the parameter number following the address P.
- (d) Punch LF (or CR)
- Repeat (b) through (d) by the times required.
Leading zeros of the parameters can be omitted.
- (e) Punch LF % (or CRER) at the end.

Parameters not punched on the tape do not change after the tape is read into the NC. So you can prepare several tapes; one is for backlash compensation data, one is for pitch error compensation data, etc.

(2) Procedures

A parameter tape is read into the NC by the following procedures:

- ① Set a selector switch on the master PCB to ENABLE. The "ALM" characters are displayed in CRT.
- ② Set a parameter tape in the tape reader.
- ③ Push the EMERGENCY STOP button.
- ④ Select the Page of parameter in MDI/CRT unit.
- ⑤ Input **P** and -9999 by the DATA key in MDI/CRT unit.
- ⑥ Push the **READ** button. A parameter tape is read into automatically.
- ⑦ Set a selector switch to DISABLE, after terminating of reading.
- ⑧ Release emergency stop and push the RESET button to release the
- ⑨ Tern power off if alarm No. 000 is displayed.

(Note 1) If the following alarm is detected, reading operation is interrupted, but the alarm is not indicated.

(i) TH check and TV check (when TV check is effective).

(ii) An address other than N or P is commanded.

(iii) Data following address N or P is improper.

(Note 2) Press the RESET button to stop reading-in of parameter tape.

Some parameter need power OFF/ON procedure after setting by MDI or tape.

5.2.3 Punch-out of parameter

- (a) Make punch unit ready to punching.
- (b) Set the punching code, EIA or ISO.
- (c) Set the MODE SELECT switch to EDIT mode.
- (d) Select the page of parameter in MDI/CRT unit.
- (e) Input **P** **-** **9** **9** **9** **9** **PUNCH** in MDI/CRT unit.

5.3 Parameter table

5.3.1 Parameter table for each number

Number	Contents
0000-0005	Fixed parameters
0006-0011	Various parameters
0012	Reference Point Return method, direction.
0013	Gear ratio between spindle and position coder, resolver/inductosyn. Phase shift
0014-0017	DMR, reference counter capacities
0018	Backlash compensation pulse frequency, input unit, interpolation unit
0019	MF, SF, TF, BF and FIN time width
0020	Reference point Return function's presence or absence
0021	Associated with S4-digits and with external deceleration
0022	Associated with canned cycles
0023	External zero point offset
0024-0026	Various parameters
0025	Parameters on custom macro interrupt function
0027-0030	CMR
0031-0034	VCMD minimum clamp values
0035-0036	Nonbuffering M codes
0037	Number of spindle motor revolutions at spindle gear shift
0038	Number of spindle revolutions at spindle orientation
0039-0042	Pitch-error origins
0043-0052	M codes to call custom macro
0053	An M code to make custom macro interruption effective
0054	An M code to make custom macro interruption ineffective
0057-0059	Operating time
0060	Least angle in index table indexing
0061	Feed-rate change per manual pulse generator degree in F1-digit feed
0062	Spindle speed arrival signal timer
0063	Parameters on 5th axis
0064	To make scaling function effective or not on each axis
0065-0066	Upper-limit feed rate in F1-digit feed
0067	Relief amount in G73
0068	Cutting start point in G83
0069	Move amount ignored at close-to-90° acute angle in cutter compensation
0070-0073	In-position width
0074-0077	Limit values of position deviation at stoppage
0078-0081	Limit values of position deviation during move
0082-0085	Grid shift amounts
0086-0089	Servo loop gain multipliers
0090	Loop gain
0091	Jog feed rate
0092-0095	Rapid traverse rates

Number	Contents
0096-0099	Linear acceleration/deceleration time constants
0100-0103	Manual feed acceleration/deceleration time constants
0105	Cutting feed acceleration/deceleration time constant
0106	Cutting-feed upper-limit feed rate
0107	External deceleration feed rate
0108	Cutting-feed lower-limit feed rate in acceleration/deceleration
0109-0112	Manual-feed lower-limit feed rate in acceleration/deceleration
0113	Rapid traverse override minimum feed rate (F0)
0114	Low feed rates in Reference Point Return
0115-0118	Backlash amounts <i>3 - 0 - 1 - 0</i>
0119	Spindle offset compensation value (S analog output)
0124-0127	Drift compensation values
0128-0131	Phase shift amounts (resolver/inductosyn)
0132	Maximum number of spindle revolutions at low-speed gear
0133	Maximum number of spindle revolutions at high-speed
0134	Lower-limit number of spindle revolutions at high-speed gear
0135	Lower-limit output value to spindle motor
0136	Upper-limit output value to spindle motor
0140	Spindle speed gain adjustment (S analog output)
0141-0142	Operating-time presetting
0143-0157	Stroke-limit setting
0159-0162	2nd reference points
0163-0166	Intervals of pitch error compensation
0167	Z axis stroke limit (negative direction only)
0168	A secret number which locks some programs
0171-0179	F 1-digit feed rates
0300-0304	Fixed parameters
0305	Approach direction for single direction positioning Whether it is parallel axis or not with 5th axis (NC/TC)
0306-0308	Various parameters
0309	Automatic coordinate system setting effective/ineffective Tool group (Tool life management)
0310-0313	I/O device's bad rates
0314, 0315	Various parameters
0316	Associated with resolver/inductosyn
0317	Code corresponding to # (custom macro)
0318	Custom macro
0319	Associated with custom macros
0320-0322	M codes calling custom macros
0323-0332	G codes calling custom macros
0333-0335	Parameters on automatic corner override
0336-0339	Approach distance for single direction positioning

Number	Contents
0340	Input device selection
0341	Output device selection
0342	Skipped cutting low feed rate
0343-0347	Minimum spindle speed during constant surface speed control
0355, 0356	Decelerated distance on automatic corner override.
0357-0360	External work zero offset values
0361-0364	GR 1-4 maximum number of spindle revolutions
0367-0370	3rd reference points
0371-0374	4th reference points
0375-0378	Automatic coordinate system settings at mm input
0379-0382	Automatic coordinate system settings at inch input
0383-0386	1st work zero offset values
0387-0390	2nd work zero offset values
0391-0394	3rd work zero offset values
0395-0398	4th work zero offset values
0399-0402	5th work zero offset values
0403-0406	6th work zero offset values
0410-0488	Parameters on 5th axis, Parameters on Multi-axis manual handle feed
0618-0722	Parameters on conversational automatic programming function
1000-1127	X-axis pitch error compensation values
2000-2127	Y-axis pitch error compensation values
3000-3127	Z-axis pitch error compensation values
4000-4127	4th-axis pitch error compensation values
5000-5127	5th-axis pitch error compensation values

5.3.2 Parameter table for each function

(1) Servo

Parameter number	Contents
006	Servo-off signal is effective or not.
007	Automatic drift is compensated or not.
"	In-position check is performed or not.
013	Phase shift amount is set automatically or not.
014 ~ 017, 410	Detect multiply ratio setting.
026	Servo alarm is generated or not if VRDY is on before PRDY is output.
027 ~ 030, 414	Command multiply ratio setting.
031 ~ 034, 415	Clamp of feed command value setting.
070 ~ 073, 425	Width of inposition.
074 ~ 077, 426	Limitation value of position deviation amount.
078 ~ 081, 427	Limitation value of position deviation amount during movement.
082 ~ 085, 421	Grid shift amount.
086 ~ 089, 422	Servo loop gain multiplier.
090	Servo loop gain.
124 ~ 127, 423	Compensation amount of drift.
128 ~ 131, 424	Servo phase shift amount.
316	Frequency check of DSCG feed back is performed or not.
"	Position detecting system is resolver or inductosyn or pulse coder.

(2) Spindle servo

Parameter number	Contents
006	Spindle speed arrival signal "SAR" checking.
009	M code is not output in canned cycle, but "SSP" and "SRV" is output.
010	Output signal of the S4-digit (analog output).
"	Setting of spindle override function (SOV, SOVC)
011	Switching of normal close or normal open for spindle stop signal (*SSTP).
021	Gear change signal "SF" is output or not in 12-bit output A or S4-digit analog output A.
037	Spindle motor rev. at spindle gear shift.
038	Spindle speed at spindle orientation.
062	Delay timer in checking the spindle speed arrival signal.
119	Spindle speed offset compensation value (for S4-digit analog output A/B).
132	Max. spindle speed for low speed gear (for 12-bit output A, S4-digit analog output A).
133	Max. spindle speed for high speed gear (for 12-bit output A, S4-digit analog output A).
134	Lower limit of spindle speed for high speed gear (for 12-bit output A, S4-digit analog output A).
135	Lower limit of output value for spindle motor (for 12-bit output A/B, S4-digit analog output A/B).
136	Upper limit of output value for spindle motor (for 12-bit output A/B, S4-digit analog output A/B).
140	Gain adjustment of S4-digit analog output A/B.
306	Alarm is occurred when S command exceeding lower limit or upper limit of output to spindle motor is executed in 12-bit output A, S4-digit analog output A).
307	Gear change signal "SF" is output or not in 12-bit output B or S4-digit analog output B).
361 ~ 364	Setting of the main spindle Max. speed for Gear 1, 2, 3, 4: (for 12-bit output B or S4-digit analog output B).

(3) Reference point return function.

Parameter number	Contents
010	When optional stored stroke limit is equipped with, manual rapid traverse is effective or not without performing the reference point return.
011	Deceleration signal (*DECX, *DECY, *DECZ, *DEC4) is "1" in reference point return shows deceleration or "0".
012	Reference point return method and direction.
014 ~ 017, 410	Capacity of reference counter for each axis.
020	Reference point return function is provided or not.
082 ~ 085, 421	Setting of grid shift amount of each axis.
114	Low feed rate for reference point return.
159 ~ 162, 435	Distance from second reference point to first reference point of each axis.
367 ~ 370, 438	Distance from third reference point to first reference point of each axis.
371 ~ 374, 439	Distance from fourth reference point to first reference point of each axis.

(4) Tool offset

Parameter number	Contents
010	When the offset value is changed in G43 or G44 mode it is effective from the next block or next appearing H/D code.
"	Is offset amount specified by address D or H?
011	When the program protection key is closed, MDI setting operation is effective or not.
"	Are start-up and cancel A type or B type in tool compensation C?
"	Whether or not cutter compensation vector is specified by I, J and K.
022	Is offset amount for G43, G44 cancel or not by RESET?
069	When tool moves along the outside of acute angle close to 90° at cutter compensation, limitation on ignoring a small movement amount.
307	Whether G43 and G44 apply to other than Z axis.

(5) Backlash

Parameter number	Contents
012	Initial backlash direction when turning on the power.
018	Backlash compensation pulse frequency. (Always set to 256 kHz)
115 ~ 118, 432	Backlash amount of each axis.

(6) Canned cycle

Parameter number	Contents
009	Is M code or SSP, SRV signal output in canned cycle?
“	Is FMS signal sent out once or twice in canned cycle?
“	Are travels on X and Y axes rapid traverse or by 01 group G code?
“	Is initial level changed or not by reset or origin button?
021	Setting of method A or method B in canned cycle (G74, G84).
022	Setting of different parameters for canned cycle.
067	Retract amount in high speed peck drilling cycle (G73).
068	Setting the distance where feedrate changes from rapid traverse to cutting feed before cutting in peck drilling cycle (G83).

(7) Custom macro

Parameter number	Contents
025	Parameters on custom macro interrupt
043 ~ 052	M codes to call custom macro (10 pieces)
053	An M code to make custom macro interrupt effective
054	An M code to make custom macro interrupt ineffective
306	Is custom macro called or not by T code
308	Setting of different parameters for custom macro
317	It registers the code corresponding to “#” used in custom macro
318	Setting of different parameters for custom macro
319	Setting of different parameters for custom macro
320 ~ 322	Setting of three kinds of M code to call custom macro
323 ~ 332	Setting of ten kinds of G code to call custom macro

(8) Pitch error compensation

5.3.2

Parameter number	Contents
024	Magnification for pitch error compensation
039 ~ 042, 416	Pitch error compensation zero point for each axis
163 ~ 166, 436	Pitch error compensation interval on each axis
1000 ~ 1127, 2000 ~ 2127, 3000 ~ 3127, 4000 ~ 4127, 5000 ~ 5127	Pitch error compensation amount on each axis

(9) F1-digit feed function

Parameter number	Contents
061	A constant to determine the variation of feedrate when a manual pulse generator is rotated by one scale.
065	Upper limit of F1 to F4
066	Upper limit of F5 to F9
171 ~ 179	Initial amount of feedrate for F1 to F9.

(10) Constant surface speed control

Parameter number	Contents
0315	• Whether the minimum spindle speed to be clamped is set on all gears in common or individually on each gear. • Whether the surface speed is calculated based on the end point of the block or the current position of the tool in a rapid traverse block. • Selection of an axis for which constant surface speed control is performed.
343 ~ 346	Minimum spindle speed for each gear in constant surface speed mode (G96).
347	Minimum spindle speed in constant surface speed mode (G96).

5.4 Details of parameters

Note 1: Refer to the parameter table attached to the NC for the contents of parameters 0000-0005 and 0300-0304, which vary from machine tool to machine tool.

Note 2: Set 0 to parameters which are not mentioned here.

Note 3: Set 0, 1 or binary number to parameters with mark

--	--	--

 and

--	--

 in the following table. Set a decimal number to parameters with mark

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Note 4: When the parameter has no sign, do not set “-”

Note 5: Set 0 for an inhibited parameter.

	0	0	6				
ORWD	SCTO	EENB	OTCS	FMIC	MDL	MIC	SCW
7	6	5	4	3	2	1	0

ORWD 1: The rewind signal is output only when a tape is rewound by the reset & rewind signal.

0: The rewind signal is output for a certain time (100 ms) even when tape is not rewound by the reset & rewind signal.

SCTO 1: Spindle speed arrival signal “SAR” is confirmed while changing rapid traverse to cutting feed.

0: Spindle speed arrival signal “SAR” is not confirmed.

EENB 1: Servo-off signal is effective.

0: Servo-off signal is ineffective.

OTCS 1: When over travel occurred, machine stops instantly. (Machine position is cleared. Therefore, reference point return must be done.)

0: When over travel occurred, machine stops gradually. (Machine position is not cleared.)

FMIC 1: Least input increment of feed rate for metric input is 0.1mm/min.

0: Least input increment of feed rate for metric input is 1 mm/min.

MDL 1: Least display increment of position display unit for metric input (inch input) is 0.01 mm (0.0001 inch).

0: Least display increment of position display unit for metric input (inch input) is 0.001 mm (0.0001 inch).

MIC 1: Least input increment for metric input (inch input) is 0.01 mm (0.0001 inch).

0: Least input increment for metric input (inch input) is 0.001 mm (0.0001 inch).

SCW 1: Least command increment is 0.0001 inch.
(Machine Tool: inch system)

0: Least command increment is 0.001 mm.
(Machine Tool: metric system)

Refer to parameter 062.

Refer to operator's manual.

	0	0	7				
ADFT	EOM	CINP	DCS	CLER	TVC	PPD	RDRN
7	6	5	4	3	2	1	0

ADFT 1: Automatic drift is compensated.

0: Automatic drift is not compensated.

EOM 1: In memory operation, when an M30 is commanded, the M30 is output to the machine side and then if the NC receives a FIN signal, execution returns to the start of the program and continues. And if the machine does not output the FIN signal but output the external reset signal to the

Refer to parameter 124, 125, 126, 127.

NC, the execution returns to the start of the program and the NC enters into the reset status.

- CINP

0: In memory operation, when an M30 is commanded, the M30 is output to the machine side but the execution does not return to the start of the program unless the NC receives the reset & rewind signal.
1: An execution proceeds to the next block after the feedrate decelerates to zero and after it is confirmed that the machine position enters into a certain range against the commanded position (This confirmation is called in-position check) at the interference of two blocks except for two blocks composed of cutting feed command.
0: An execution proceeds to the next block after the feedrate decelerates to zero (no in-position check) at the interference of two blocks except for two blocks composed of cutting feed command.
- DCS

1: Pushing the START button on the MDI & CRT unit makes start the NC operation. (only MDI made)
0: Pushing the START button on the MDI & CRT unit issues a signal DST to the machine side.
- CLER

1: NC becomes Clear state by Reset button or External Reset.
0: NC becomes Reset state by Reset button or External Reset.
- TVC

1: TV check of the information in comment zone is effective.
0: TV check of the information in comment zone is ineffective.
- PPD

1: Position display unit is preset by G92.
0: Position display unit is not preset by G92.
- RDRN

1: Dry run is effective for rapid traverse.
0: Dry run is not effective for rapid traverse.

Refer to parameter
071, 072, 073, 074.

Normary: 0

Refer to appendix
11.
Only in ISO codes.

Same condition as
ORIGIN button.

	0	0	8	ICR		GSP	G44	G90	G95	G43	G00
				7	6	5	4	3	2	1	0

- ICR

1: An LF code is punched as an end of block code (EOB) in ISO code.
0: "LF CR CR" codes are punched as an EOB in ISO code.
- GSP

1: Special G codes are used.
0: Standard G codes are used.
- G90

1: Initial G code of group 03 is G90. (at turning the power on or in clear status)
0: Initial G code of group 03 is G91.
- G95

1: Initial G code of group 05 is G95.
0: Initial G code of group 05 is G94.
- G00

1: Initial G code of group 01 is G00.
0: Initial G code of group 01 is G01.
- G44, G43

Standard setting: '0'.

Standard	Special
G20	G70
G21	G71

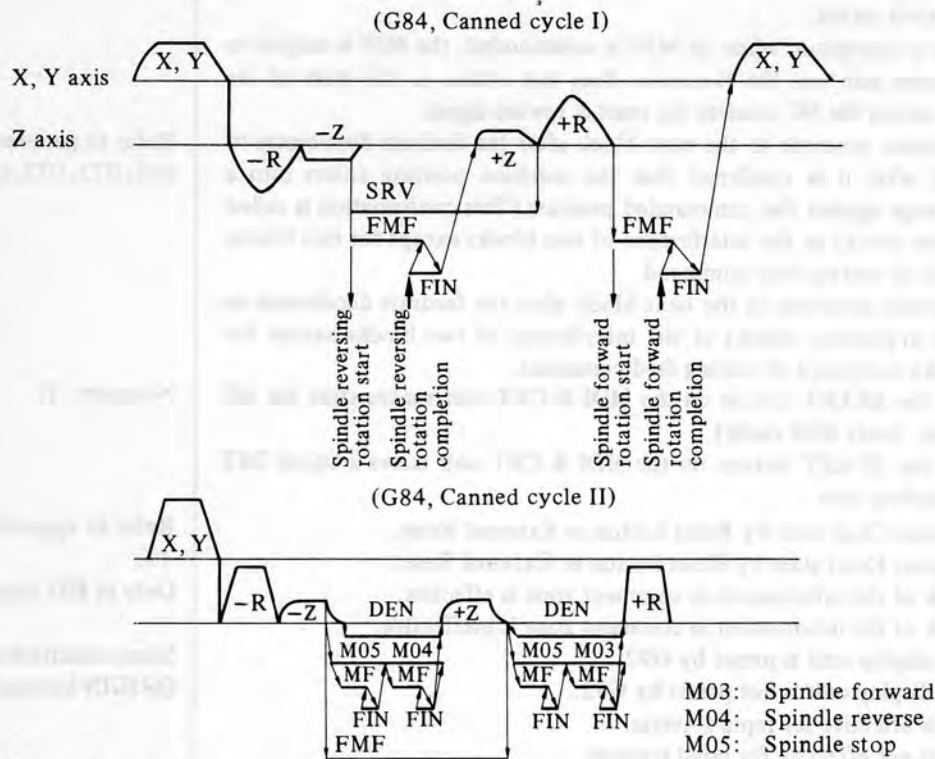
Parameter setting		Initial G code of group 08
G44	G43	
1	0	G44
0	1	G43
0	0	G49

	0	0	9	FIX2	RWL	MCF	FMFS	FCUT	ILVL	EFR1	TDRN
				7	6	5	4	3	2	1	0

- FIX2

1: M code is output in canned cycle. (Canned cycle II)
0: Signals SSP, and SRV are output in canned cycle. (Canned cycle I)

Refer to operator's
manual Item 7.



- RWL 1: Forbidden area of stored stroke limit 2 is outside.
0: Forbidden area of stored stroke limit 2 is inside.
- MCF 1: The external function signal (EF) is output in canned cycle G81.
0: The EF is not output in canned cycle G81.
- FMFS 1: FMF signal is sent out twice to the machine side in canned cycle.
0: FMF signal is sent out once.
- FCUT 1: Travels on X and Y axes are changed by G code in canned cycle.
0: Travels on X and Y axes are always positioning at rapid traverse.
- ILVL 1: Initial level point can be changed by using RESET or ORIGIN button.
0: Initial level point cannot be changed by using RESET or ORIGIN button.
- EFR1 1: The EF signal is output through photo coupler. (Not use)
0: The EF signal is output through reed relay.
- TDRN 1: Dry run is effective for thread cutting.
0: Dry run is ineffective for thread cutting.

0	1	0	TCW	CWM	SOV	TLCC	OFSD	SOVC	REDT	ISOT
7	6	5	4	3	2	1	0			

TCW, CWM The output signal of the S-4 digit (analog output)

Parameter		Output Signal	
TCW	CWM	M03	M04
0	0	+	+
0	1	-	-
1	0	+	-
1	1	-	+

- SOV 1: Spindle override is effective.
0: Spindle override is ineffective.
- TLCC 1: When the offset value is changed in G43 or G44 mode, it is effective from the next block.

With S4-digit Analog Output or 12 bit binary output option.

- 0: When the offset value is changed in G43 or G44 mode, it is effective from the next appearing H/D code.
- OFSD 1: Offset amount is specified by address D in G45 to G48 mode.
0: Offset amount is specified by address H in G45 to G48 mode.
- SOVC 1: Spindle override is clamped at 100% during tapping.
0: Spindle override is not clamped at 100% during tapping.
- REDT 1: Storage of program to memory is started by pressing the cycle start button in EDIT mode.
Storage of program can be performed automatically in REMOT operation or unmaned operation.
0: Storage of program to memory is not started by pressing the cycle start button in EDIT mode.
- ISOT 1: When optional stored stroke limit is equipped with, manual rapid traverse is effective without performing the reference point return.
0: When optional stored stroke limit is equipped with, manual rapid traverse becomes effective only after completion of reference point return.

With S4-digit Analog Output or 12 bit binary output option.

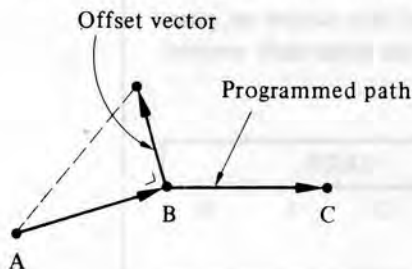
0: It become jog feed rate

	0	1	1		DGNE	SETE	DECI	SSPB	NPRD	VCT	SUPM	ADLN
					7	6	5	4	3	2	1	0

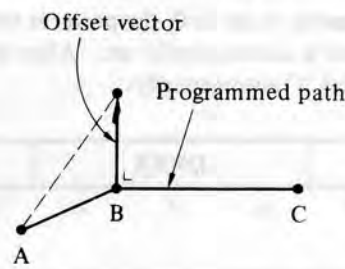
- DGNE 1: Data output is effective in DIAGNOSE.
0: Data output is ineffective in DIAGNOSE.
- SETE 1: MDI setting operation is effective even when the program protection key is closed.
0: MDI setting operation is not effective when the program protection key is closed.
- DECI 1: Deceleration signal (*DECX, *DECY, *DECZ, *DEC4) "1" in reference point return shows deceleration.
0: Deceleration signal "0" in reference point return shows deceleration.
- SSPB 1: The spindle stop signal (*SSTP) (Input signal) is actuated with contact open. (Normal close)
0: The spindle stop signal is actuated with contact close. (Normal open)
- NPRD 1: Input and display of decimal point is impossible.
0: Input and display of decimal point is possible.
- VCT 1: Cutter compensation vector can be specified by address I, J or K. (Must not be used.)
0: Cutter compensation vector cannot be specified by addresses I, J and K. (Always calculated automatically.)
- SUPM 1: B type is effective for start up and canceling in offset C.
0: Start-up A type is effective for start up and canceling in offset C.

Normally: 0

Standard setting: '0'



Start-up B type



Start-up A type

- ADLN 1: 4th axis is used as linear axis.
0: 4th axis is used as rotary axis.

	0	1	2	ZGM4	ZGMZ	ZGMY	ZGMX	ZM4	ZMZ	ZMY	ZMX
				7	6	5	4	3	2	1	0

ZGMX, ZGMY, ZGMZ, ZGM4

Reference point return method for each axis.

- 1: Magneswitch method
- 0: Grid method

ZMX, ZMY, ZMZ, ZM4

Reference point return direction and initial backlash direction when turning on the power for each axis.

- 1: Reference point return direction and the initial backlash direction are minus.
- 0: Reference point return direction and the initial backlash direction are plus.

Note: 1. For the axis with the reference point return, the reference point return direction and the initial backlash direction are same. For the axis without the reference point return, this parameter specifies only the initial backlash direction.

Note: 2. After turning on the power and the axis is moved in the opposit direction to the specified direction, backlash compensation for that axis is performed.

Refer to Item 4.1 and parameter number 82 ~ 85.

	0	1	3	PSG2	PSG1		PHS				
				7	6	5	4	3	2	1	0

PSG2, PSG1

Gear ratio of spindle and position coder

Magnification	PSG2	PSG1
× 1	0	0
× 2	0	1
× 4	1	0
× 8	1	1

Magnification = $\frac{\text{Number of spindle rotation}}{\text{Number of position coder rotation}}$

PHS

Initial setting of phase shift amount in Resolver/inductosyn method.

- 1: Not set automatically.
- 0: If this parameter is set to 0, the power is turned off then turned on, phase shift amount is automatically set. After setting the phase shift amount, this data is set '1' automatically.

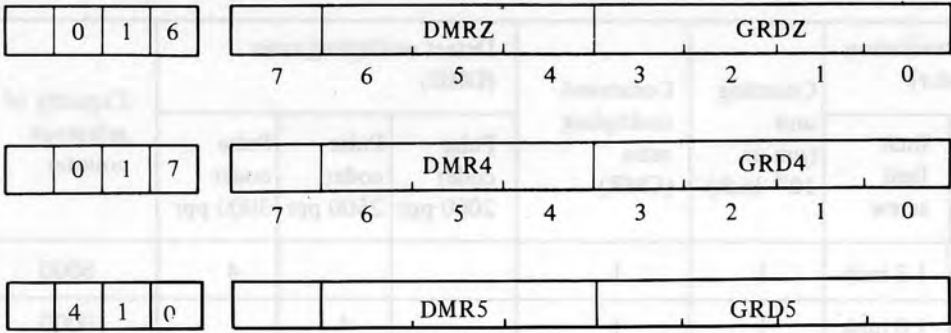
See parameter No. 128 to 131.

	0	1	4
--	---	---	---

				DMRX				GRDX			
	7	6	5	4	3	2	1	0			

	0	1	5
--	---	---	---

DMRY							GRDY				
7	6	5	4	3	2	1	0				



DMRX, DMR4, DMR5
Detect multiply ratio for each axis.

Setting code			Multiply ratio	
6	5	4	Pulse coder	Resolver/inductosyn
0	0	0	1/2	1/8
0	0	1	1	1/4
0	1	0	1	1/4
0	1	1	2	1/2
1	0	0	3/2	3/8
1	0	1	3	3/4
1	1	0	2	1/2
1	1	1	4	1

Standard setting
code is 110 for
resolver/inductosyn.

GRDX, GRDY, GRDZ, GRD4, GRD5
Capacity of reference counter for each axis.

$$\left(\begin{array}{l} \text{Capacity of} \\ \text{reference counter} \end{array} \right) = \left(\begin{array}{l} \text{Detect} \\ \text{multiply ratio} \end{array} \right) \times 2000$$

(for 2000 ppr pulse coder)

$$= \left(\begin{array}{l} \text{Detect} \\ \text{multiply ratio} \end{array} \right) \times 2500$$

(for 2500 ppr pulse coder)

Setting code				One cycle capacity
0	0	0	1	2000
0	0	1	0	3000
0	0	1	1	4000
0	1	0	0	5000
0	1	0	1	6000
0	1	1	1	8000
1	0	0	1	10000

Standard setting
code is 0001 for
resolver/inductosyn.

Note 1. If the code other than codes in the above table is set, capacity is set to 8000.
Note 2. This parameter is set in binary.

(1) Pulse coder

Move distance per revolution of motor (pulse coder)			Counting unit (μm or 10^{-4} inch)	Command multiplying ratio (CMR)	Detect multiplying ratio (DMR)			Capacity of reference counter
Metric feed screw	Rotary axis	Inch feed screw			Pulse coder 2000 ppr	Pulse coder 2500 ppr	Pulse coder 3000 ppr	
12mm	12°	1.2 inch	1	1			4	6000
10mm	10°	1.0 inch	1	1		4		10000
8mm	8°	0.8 inch	1	1	4			8000
6mm	6°	0.6 inch	1	1	3		2	6000
5mm	5°	0.5 inch	1	1		2		5000
4mm	4°	0.4 inch	1	1	2			4000
3mm	3°	0.3 inch	1	1	1.5		1	3000
2.5mm	2.5°	0.25 inch	0.5	2		2		5000
2mm	2°	0.2 inch	1	1	1			2000
1.5mm	1.5°	0.15 inch	0.5	2			1	3000
1mm	1°	0.1 inch	0.5	2	1			2000

Note 1) Data in above table is standard. Command and detect multiply ratio can be changed, but in that case there is a limit for maximum feed rate.

(2) Resolver/Inductosyn (Metric, Inch system)

Moving distance per 1 revolution of detector	Counting unit	Command multiply ratio (CMR)	Detect multiply ratio (DMR)	Capacity of reference counter
2 mm	1	1	0.5	2000
0.2 inch	1	1	0.5	2000

(3) Multipole resolver

Metric system

Moving distance per 1 revolution of motor	Kind of resolver	CMR	DMR	Counting unit (μm)	Capacity of reference counter	Loop gain multiplier	
						7V/2000 rpm	7V/1000 rpm
10 mm	5X	1	1/2	1	2000	717	1434
8 mm	4X	1	1/2	1	2000	896	1792
6 mm	3X	1	1/2	1	2000	1792	2389
5 mm	5X	2	1/2	0.5	2000	717	1434
4 mm	4X	2	1/2	0.5	2000	896	1792
3 mm	3X	2	1/2	0.5	2000	1195	2389

Inch system

Moving distance per 1 revolution of motor	Kind of resolver	CMR	DMR	Counting unit (μm)	Capacity of reference counter	Loop gain multiplier	
						7V/2000 rpm	7V/1000 rpm
0.5 inch	5X	2	1/2	0.5	2000	717	1434
0.4 inch	4X	2	1/2	0.5	2000	896	1792
0.3 inch	3X	2	1/2	0.5	2000	1195	2389

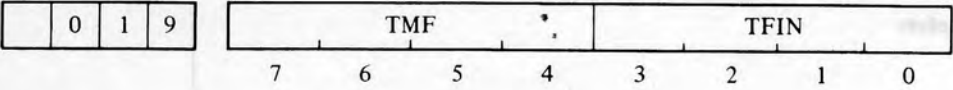
	0	1	8			DIC	IPL2	CPF2	CPF1
						3	2	1	0

- DIC 1: Input unit 1/10
 0: Input unit 1/1
- IPL2 1: Interpolation unit 1/2 (0.0005 mm, 0.00005 inch)
 0: Interpolation unit 1/1 (0.001 mm, 0.0001 inch)

CPF2, CPF1 Backlash compensation pulse frequency (common to all axes.)

Frequency kHz	CPF2	CPF1
32	0	0
64	0	1
128	1	0
256	1	1

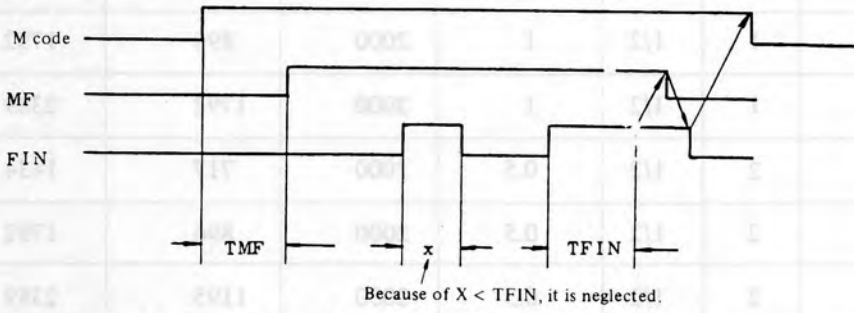
Always set to 256 kHz.



TMF Time interval from M, S, T code issue to MF, SF, TF issue.
16 ~ 256 m sec (16 m sec increment).

TFIN Time of reception width of FIN.
16 ~ 256 m sec (16 m sec increment).

ZTNX, ZTNY, ZT



$TMF \text{ or } TFIN = 16 \times (N + 1) \text{ ms} \quad N = 0 \sim 15$

TMF		TFIN		Parameter setting			
16 (m sec)	More than 16 (m sec)	0	0	0	0	0	0
32	" 32	0	0	0	0	1	1
48	" 48	0	0	1	0	0	0
64	" 64	0	0	1	1	1	1
80	" 80	0	1	0	0	0	0
96	" 96	0	1	0	0	1	1
112	" 112	0	1	1	0	0	0
128	" 128	0	1	1	1	1	1
144	" 144	1	0	0	0	0	0
160	" 160	1	0	0	0	1	1
176	" 176	1	0	1	0	0	0
192	" 192	1	0	1	1	1	1
208	" 208	1	1	0	0	0	0
224	" 224	1	1	0	1	1	1
240	" 240	1	1	1	1	0	0
256	" 256	1	1	1	1	1	1

0	2	0	CLSI		*	ZTN5	ZTN4	ZTNZ	ZTNY	ZTNX
			7	6	5	4	3	2	1	0

CLSI 1: Servo position LSI is not checked.
0: Servo position LSI is checked.

ZTNX, ZTNY, ZTNZ, ZTN4, ZTN5

Provision of reference point return function for each axis.

1: Provided
0: Not provided.

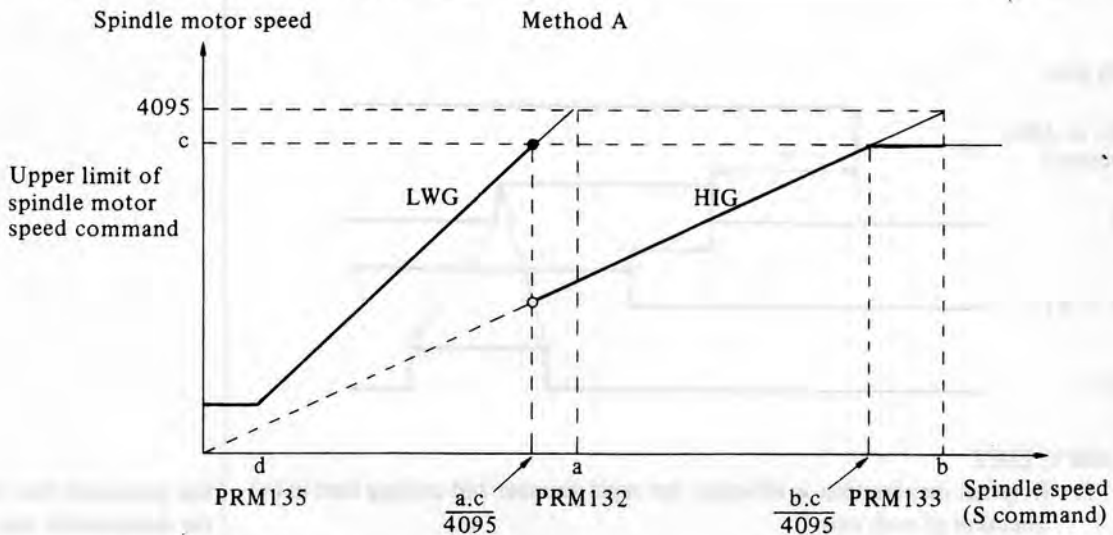
0	2	1	G84S	SFOU	EDMZ	EDMY	EDMX	EDPZ	EDPY	EDPX
			7	6	5	4	3	2	1	0

G84S 1: Method B is used for S-12 bit output or S4 digit analog output during canned cycle G74 or G84 (tapping cycle).
0: Method A is used for S-12 bit output or S4 digit analog output during canned cycle G74 or G84 (tapping cycle).

[Example]

Binary code 12-bit output A

R01, R02, R03, R04, R05, R06, R07, R08, R09, R10, R11, R12, HIG, LWG, SF. By specifying any of S0 to S9999 by tape, MDI or memory command, the control unit outputs the command for the spindle motor speed with a binary code of 12-bit. The gear select signal is also output simultaneously. The speed range is set by a parameter beforehand and is selected between High and Low.



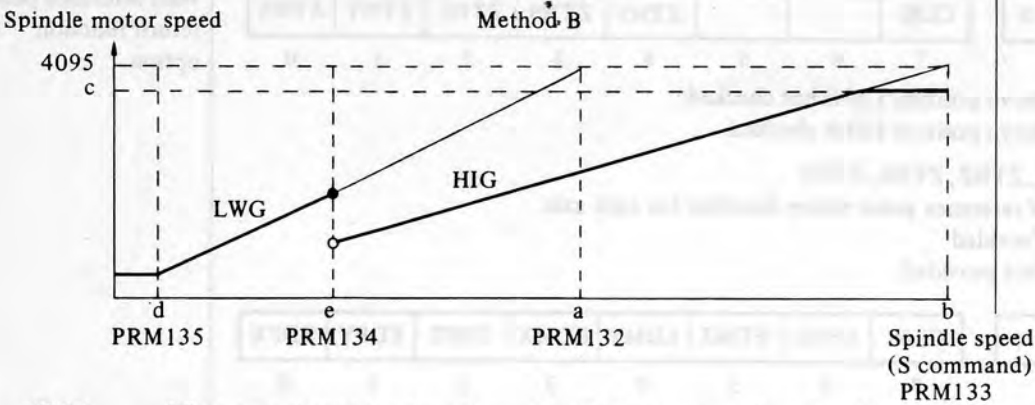
The following items should be set by parameters:

- 1) Upper limit of spindle motor speed "c".
- 2) Spindle speed at the max. speed of the spindle motor under the low gear "a".
- 3) Spindle speed at the max. speed of the spindle motor under the high gear "b".
- 4) Lower limit of spindle speed under the low gear "d".

A command for the spindle motor speed (R01 ~ R12) and a gear select signal (HIG, LWG) are output for a given S code by using above data s shown in the figure above.

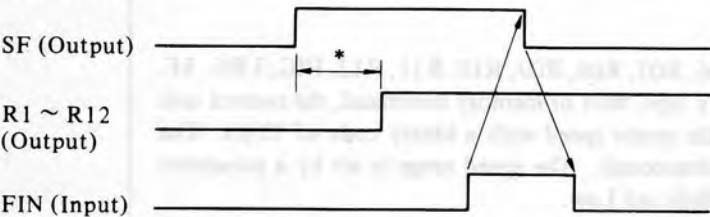
The relation between S code and spindle speed becomes as shown below when the tapping cycle (G84) is commanded. "e" is the lower limit of spindle speed under high gear.

With reference point return function option.



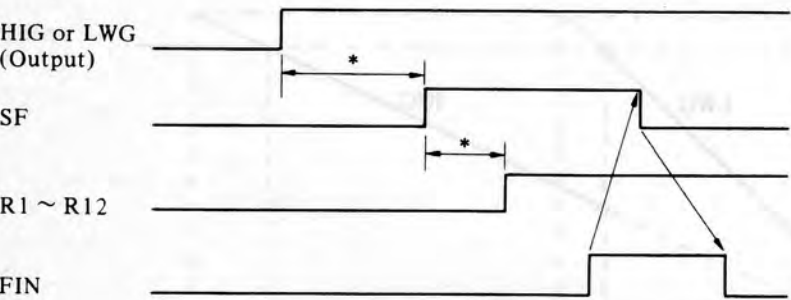
SFOU When gear change is not performed in S-12 bit output A or S analog output A.
1: SF signal is output.
0: SF signal is not output.

a) Without gear



Note
Term of * mark is
set by parameter 19.

b) With gear



EDPX, EDPY, EDPZ

- 1: External deceleration is effective for rapid traverse and cutting feed in (+) direction of each axis.
- 0: External deceleration is effective only for rapid traverse in (+) direction.

See parameter No. 107
for deceleration rate.

EDMX, EDMY, EDMZ

- 1: External deceleration is effective for rapid traverse and cutting feed in (-) direction of each axis.
- 0: External deceleration is effective only for rapid traverse in (-) direction.

0	2	2	SIJ	PMXY2	PMXY1	RS43	FXCD	TAPSG	FXCS
7	6	5	4	3	2	1	0		

SIJ

Retracting methods in G76 and G87 mode of canned cycle.

- 1: Addresses I and J specify the retracting direction and amount.
- 0: Address Q specifies the amount and the parameters PMXY1 and PMXY2 specify the direction.

Canned cycle type II

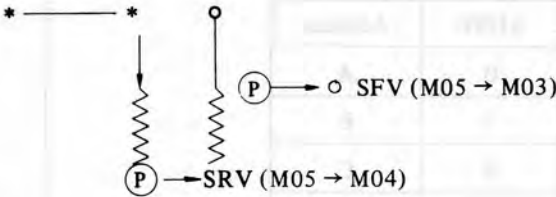
PMXY1, PMXY2

Setting of the direction for getting tools off in G76 or G87 of canned cycle.
(These parameters are effective only when the parameter SIJ is zero)

PMXY2	PMXY1	Getting off direction
0	0	+ X
0	1	- X
1	0	+ Y
1	1	- Y

- RS43 1: Offset amount for G43, G44 is not cleared by RESET.
 0: Offset amount for G43 or G44 is cleared by RESET. (Always set "0")
- FXCD 1: Dwell command is effective in G74 or G84 mode of canned cycle.
 0: Dwell command is not effective in G74 or G84 mode of canned cycle.
- TAPSG 1: Tapping signal is output in canned cycle G84.
 (This setting is effective only when the parameter FIX2 is one)
 0: Tapping signal is not output.

Refer to parameter 009.



- FXCS 1: Spindle reverse or spindle forward is performed without M05 in G74 or G84 mode of canned cycle. (only when FX2 = 1)
 0: Spindle reverse or spindle forward is performed after output M05 in G74 or G84 mode of canned cycle.

0	2	3	HIPRP	EX10D	HEIAN						
			7	6	5	4	3	2	1	0	

- HIPRP 1: When very small blocks continue, their paths are not displayed but processing rate is increased. (Must not be used)
 0: Their paths are displayed normally.
- EX10D 1: Unit of external zero point offset amount is multiplied by 10.
 0: It is not multiplied by 10.
- HEIAN: This specifies whether the system must display the titles etc. on the menu or the parameter screen in alphabetic or KANA characters.
 = 1 Kana
 = 0 Alphabetic characters

M53 series

0	2	4	PML2	PML1	DLME	RDAL	ADW2	ADW1	ADW0	
			7	6	5	4	3	2	1	0

PML2, PML1

Magnification for pitch error compensation
 Compensation value that are set to parameter 1000 to 4127 are multiplied by the value shown in the table.

PML2	PML1	Magnification
0	0	× 1
0	1	× 2
1	0	× 4
1	1	× 8

(Common to all axes)

This magnification should be set as small as possible to reduce the setting error.

- DLME 1: When store a program to the memory, all stored programs are canceled automatically.
 0: When store a program to the memory, all stored programs are not canceled automatically.

- RDAL 1: When store a program to the memory, all programs always are stored.
 0: When store a program to the memory, whether one program is stored or all programs are stored is selected by operation of MDI.

(Operation is

0	-	9	9	9	9
---	---	---	---	---	---

 READ)

ADW0, ADW1, ADW2

Address setting for additional axis in punching out or in displaying on CRT when the additional axis is provided.

ADW2	ADW1	ADW0	Address
0	0	0	A
0	0	1	B
0	1	0	C
0	1	1	U
1	0	0	V
1	0	1	W

	0	2	5				
MUSR		MSUB	MPRM				TSE
7	6	5	4	3	2	1	0

- MUSR 1: Custom macro interrupt function is used.
 0: Custom macro interrupt function is not used.
 MSUB 1: Subprogram type custom macro interrupt.
 0: Macro type custom macro interrupt.

(Note) Values of local variables used in called macro program do not change by custom macro interrupt on subprogram type custom macro interrupt.
 Values of local variables used in called macro program differ from those used in the current program by custom macro interrupt on macro type custom macro interrupt.

- MPRM 1: Two M codes used to make custom macro interrupt effective and ineffective are set by parameters.
 0: M96 and M97 are used for custom macro interrupt.
 TSE 1: Status trigger method is used for custom macro interrupt.
 0: Edge trigger method is used for custom macro interrupt.

(Note) Macro interruption is made as long as interrupt signal is input on status trigger method.
 Macro interruption is made only when interrupt signal is turned on with edge trigger method.

0	2	6		FHDL	NGMP	OFFVY	FAST	OGE		CKIM
			7	6	5	4	3	2	1	0

FHDL 1: Movement amount per one scale of manual pulse generator is fixed to 0.01 mm/0.001 inch and is not influenced by signals of MP1, MP2.

0: Movement amount per one scale of manual pulse generator varies according to MP1, MP2.

Standard setting: '0'

NGMP Movement amount per one scale of manual pulse generator is as follows.

Standard setting: '0'

NGMP	MP2	MP1	Movement amount
0	0	0	0.001 mm/0.0001 inch
0	0	1	0.01 mm/0.001 inch
0	1	0	0.1 mm/0.01 inch
0	1	1	0.1 mm/0.01 inch
1	0	0	0.01 mm/0.001 inch
1	0	1	0.001 mm/0.0001 inch
1	1	0	0.1 mm/0.01 inch
1	1	1	0.1 mm/0.01 inch

OFFVY 1: Servo alarm is not generated, even if VRDY is on before PRDY is output.

0: Servo alarm is generated, if VRDY is on before PRDY is output.

MA1/MA3 series

FAST 1: Input mode of password programs from tape reader

0: Normal input mode

OGE 1: Memory arrangement is not done during program search.

0: It is done during program search

M93/M97 series

CKIM 1: Ignores the turning on or off of the machine lock/Z-axis neglect signal during automatic operation. (Keeps the same state when cycle start was applied.)

0: Makes the machine lock/Z-axis lock signal valid immediately.

(The machine lock/Z-axis lock signal is always made valid in the manual mode.)

0	2	7	CMRX
---	---	---	------

Standard setting
code is 2 for
resolver/industosyn.
or pulse coder

0	2	8	CMRY
---	---	---	------

See parameter Nos. 14
to 17, 410.

0	2	9	CMRZ
---	---	---	------

0	3	0	CMR4
---	---	---	------

	4	1	4	CMR5
--	---	---	---	------

CMRX, CMRY, CMRZ, CMR4, MCR5
Command-multiplying ratio for each axis

Refer to parameter
014 ~ 017, 410

- (1) When parameter 0316 ACMR = 0 (Standard specification)

Setting code	Multiply
1	0.5
2	1
4	2
10	5
20	10

Refer to table mentioned in
parameter 014 ~ 017, 410
for setting value.

(Note)
If the code not listed in this table
is set, the multiply is 1.

- (2) When parameter 0316 ACMR = 1 (Arbitrary command multiply)
(i) Setting method when command multiply ratio ranges from 1/2 to 1/27

Setting value = $\frac{1}{\text{Command multiply ratio}} + 100$

- (ii) Setting method when command multiply ratio ranges from 2 to 48

Setting value = 2 × (Command multiply ratio)

(Note) Set such a value that command multiply ratio be an integer in case
of (ii) above.

Applied to
M01
M03
M05
M51
M53
M55

	0	3	1	VLOCX
--	---	---	---	-------

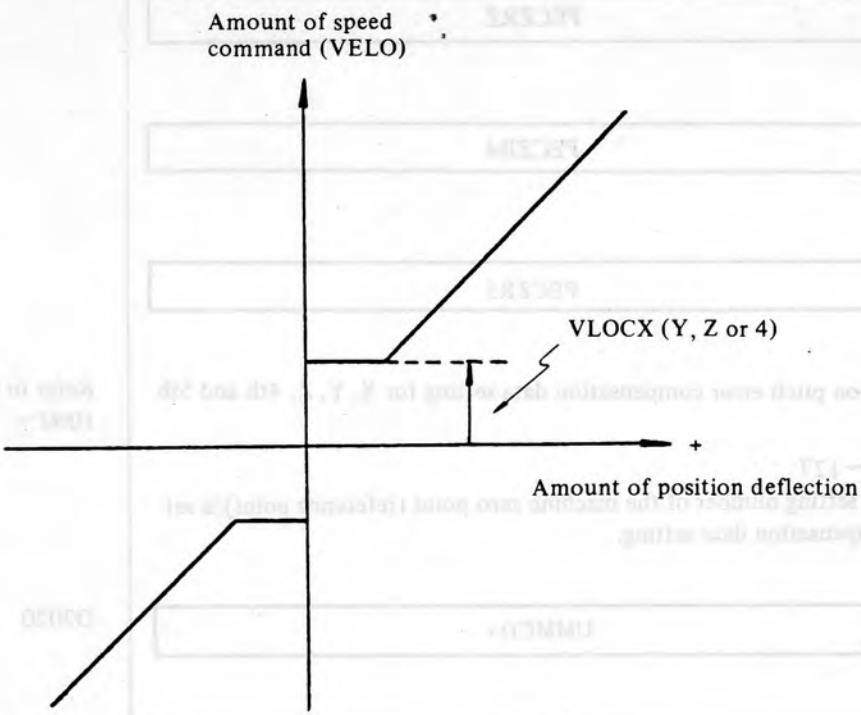
	0	3	2	VLOCY
--	---	---	---	-------

	0	3	3	VLOCZ
--	---	---	---	-------

	0	3	4	VLOC4
--	---	---	---	-------

	4	1	5	VLOC5
--	---	---	---	-------

VLOCX, VLOCY, VLOCZ, VLOC4, VLOC5
Clamp of feed command value of each axis.
Setting amount 0 ~ 7 VELO
0 is usually set.



	0	3	5
--	---	---	---

MBUF1			
-------	--	--	--

	0	3	6
--	---	---	---

MBUF2			
-------	--	--	--

MBUF1, MBUF2
Up to two M codes which when read, does not enter an immediately following block in the buffer storage are set.
Setting amount 03 ~ 97 (except M00, M01, M02, and M30)

	0	3	7
--	---	---	---

SPGST			
-------	--	--	--

SPGST Spindle motor rev. at spindle gear shift. (For S4 digits 12 bits output A/B or analog output A/B)
Setting amount 0 ~ 255.
$$\text{Setting value} = \frac{\text{Gear shift spindle motor rev. number}}{\text{Spindle motor maximum rev. number}} \times 4095$$

	0	3	8
--	---	---	---

SPSOR			
-------	--	--	--

SPSOR Spindle speed (rpm) at spindle orientation. (For S4 digits 12 bits output A/B or analog output A/B)
Setting amount 0 ~ 255 (Unit: rpm)

	0	3	9
--	---	---	---

PECZRX			
--------	--	--	--

	0	4	0
--	---	---	---

PECZRY			
--------	--	--	--

	0	4	1		•PECZRZ
--	---	---	---	--	---------

	0	4	2		PECZR4
--	---	---	---	--	--------

	4	1	6		PECZR5
--	---	---	---	--	--------

PECZRX ~ 5

Zero point setting on pitch error compensation data setting for X, Y, Z, 4th and 5th axis

Refer to Parameter 1000 ~

Setting amount 0 ~ 127

In this setting, the setting number of the machine zero point (reference point) is set on pitch error compensation data setting.

	0	4	3		UMMCD4
--	---	---	---	--	--------

O9020

	0	4	4		UMMCD5
--	---	---	---	--	--------

O9021

	0	4	5		UMMCD6
--	---	---	---	--	--------

O9022

	0	4	6		UMMCD7
--	---	---	---	--	--------

O9023

	0	4	7		UMMCD8
--	---	---	---	--	--------

O9024

	0	4	8		UMMCD9
--	---	---	---	--	--------

O9025

	0	4	9		UMMCD10
--	---	---	---	--	---------

O9026

	0	5	0		UMMCD11
--	---	---	---	--	---------

O9027

	0	5	1		UMMCD12
--	---	---	---	--	---------

O9028

09029

	0	5	2		UMMCD13
--	---	---	---	--	---------

UMMCD4 ~ UMMCD13
An M code to call custom macro. (Ten M codes)
(Argument assignment can be used.)
Setting value 01 to 97

	0	5	3		MACINTON
--	---	---	---	--	----------

MACINTON
An M code to make custom macro interrupt effective.
Setting value 03 ~ 97
This parameter is effective only when parameter 025MPRM = 1.

	0	5	4		MACINTOF
--	---	---	---	--	----------

MACINTOF
An M code to make custom macro interrupt ineffective.
Setting value 03 ~ 97
This parameter is effective only when parameter 025 MPRM = 1.

	0	5	7		TMHOR (Hour)
--	---	---	---	--	--------------

(Option)

	0	5	8		TMMIN (Minute)
--	---	---	---	--	----------------

	0	5	9		TMSEC (Second)
--	---	---	---	--	----------------

TMHOR, TMMIN, TMSEC
It sets and displays run hour (Time when STL lamp is lighting) in the units of hour, min. and sec.
TMHOR; Hour representation: 0 ~ 225 (1 hour step)
TMMIN; Min. representation: 0 ~ 59 (1 minute step)
TMSEC; Sec. representation: 0 ~ 58 (2 sec. step)
Run hour is held in nonvolatile memory even if power is turned off. The run hour is written into memory every 6 minutes, so that value which is less than 6 minutes is cleared on power off condition. Normal setting operation should be performed if it is preset.
Settable by also setting.

	0	6	0	IDXUNT
--	---	---	---	--------

IDXUNT Least angle for indexing the index table

Set Value 1 to 255
Unit deg

This is significant only when parameter 314-5 (IFIX) is 1. If, at this time, a distance which is not an integer multiple of the value specified in IDXUNT, a PS alarm occurs (No. 180). Also, if the value specified by the coordinate system setting (G92), automatic coordinate system setting parameter value, or work zero point offset parameter value is not an integer multiple of the value specified in IDXUNT, a PS alarm occurs (No. 180) when the value is used.

	0	6	1	F1DN
--	---	---	---	------

F1DN A constant to determine the variation of feedrate when a manual pulse generator is rotated by one scale in F1-digit command.

$$\Delta F = \frac{F_{maxi}}{100n} \quad (i = 1, 2)$$

Set the value *n* in the above expression. The value *n* is the number of rotations which causes the feedrate to become *Fmaxi*.

Setting value: 1 ~ 127

In the above expression, *Fmaxi* is the upper limit of the feedrate is F1-digit command, and is set to parameter 065 and 066.

Fmax 1 Upper limit of feedrate for F1 to F4. (065)

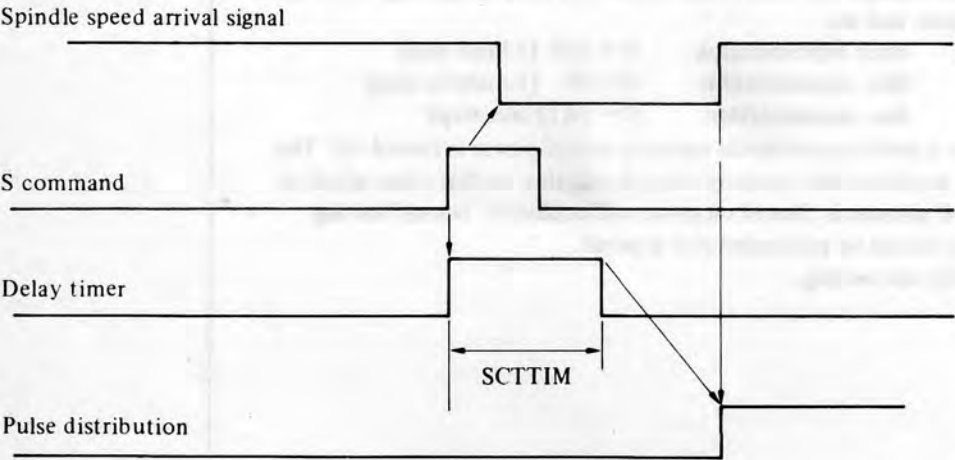
Fmax 2 Upper limit of feedrate for F5 to F9. (066)

	0	6	2	SCTTIM
--	---	---	---	--------

SCTTIM Setting for delay timer in checking the spindle speed arrival signal.
Set the time from S function execution to spindle speed arrival signal checking.
Setting amount 0 ~ 255 (unit msec)

(Option)
See parameters
No. 171 to 179.

See parameter
SCTO (No. 006)



	0	6	3				ADL5	EX5NG	HIR5	AP5	G605
				7	6	5	4	3	2	1	0

- ADL5 1: 5th axis is linear axis.
0: 5th axis is rotary axis.
- EX5NG 1: 5th axis neglect signal is effective.
0: 5th axis neglect signal is ineffective.
- HIR5 1: 5th axis handle interruption is effective.
0: 5th axis handle interruption is ineffective.
- AP5 1: 5th axis automatic coordinate system setting is effective.
0: 5th axis automatic coordinate system setting is ineffective.
- G605 1: 5th axis single direction positioning approach direction is minus.
0: It is plus.

	0	6	4						SCLZ	SCLY	SCLX
				7	6	5	4	3	2	1	0

- SCLX, Y, Z
Scaling function is:
1: Effective
0: Ineffective

	0	6	5								F1DMAX1
--	---	---	---	--	--	--	--	--	--	--	---------

Refer to parameter 061.

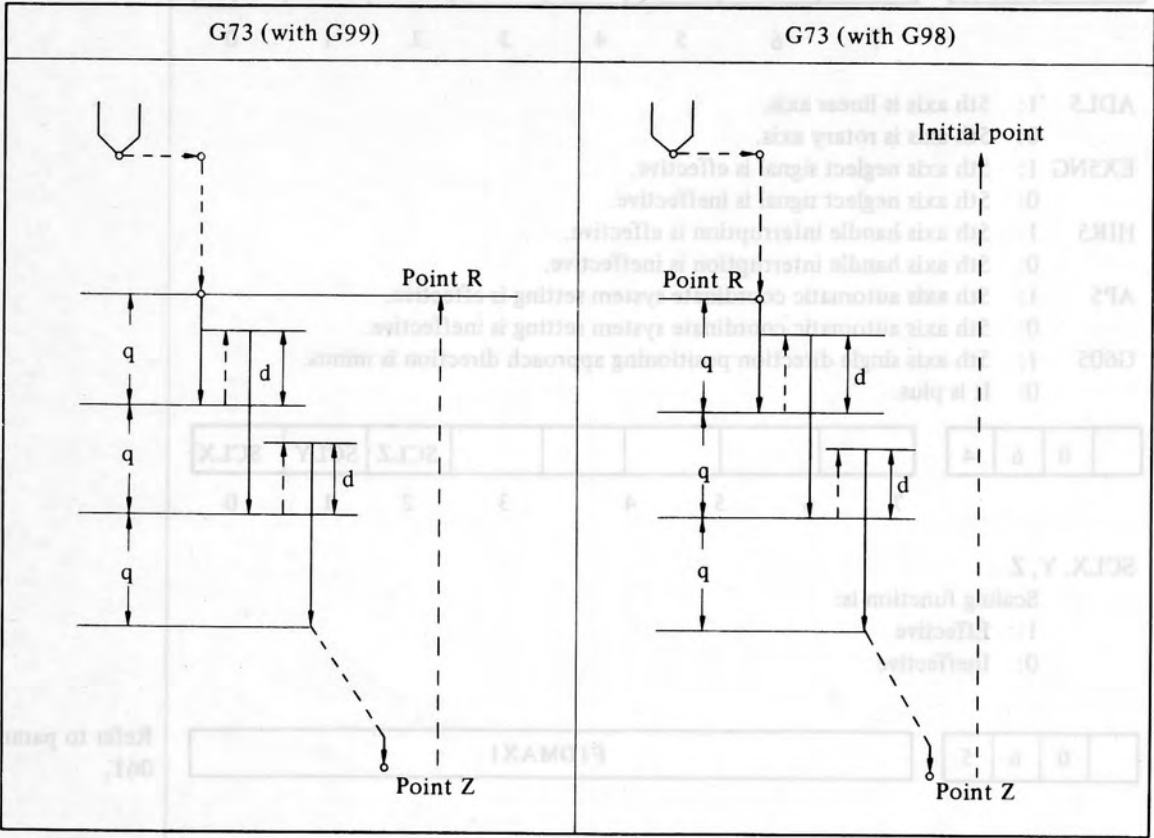
	0	6	6								F1DMAX2
--	---	---	---	--	--	--	--	--	--	--	---------

- F1DMAX1 Upper limit of F1 to F4 in F1-digit.
- F1DMAX2 Upper limit of F5 to F9 in F1-digit.
Setting range 0 ~ 15000 mm/min (metric system)
0 ~ 6000 0.1 inch/min (inch system)
Refer to parameter 061.

	0	6	7								CYCR
--	---	---	---	--	--	--	--	--	--	--	------

- CYCR Retract amount in high speed peck drilling cycle (G73).
Setting amount
Metric input 0 ~ 32767 (unit 0.001 mm)
Inch input 0 ~ 32767 (unit 0.0001 inch)
This value can also be set through MDI panel (at address SET).

G73 (High speed peck drilling cycle)



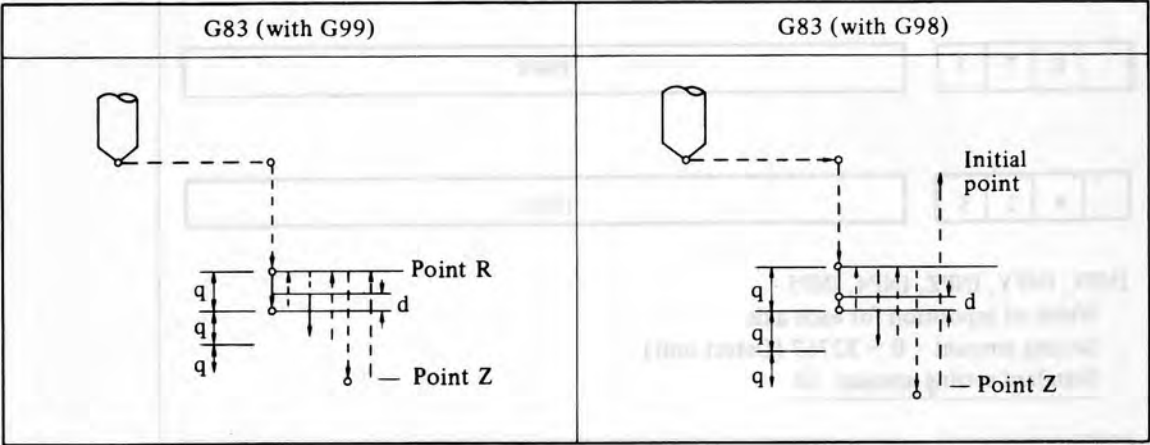
The “d” value is set by a parameter setting (CYCR).

Highly efficient hole machining can be performed, making removal of chips easier and keeping relief motions to a minimum. The relief motion is effected at the rapid traverse rate.

	0	6	8		CYCD
--	---	---	---	--	------

CYCD Setting the distance that feed rate is changed rapid traverse to cutting feed before cutting in peck drilling cycle (G84)
Setting amount
Metric input 0 ~ 32767 (unit 0.001 mm)
Inch input 0 ~ 32767 (unit 0.0001 inch)
This value can also be set through MDI panel (at address SET).

G83 (Peck drilling cycle)

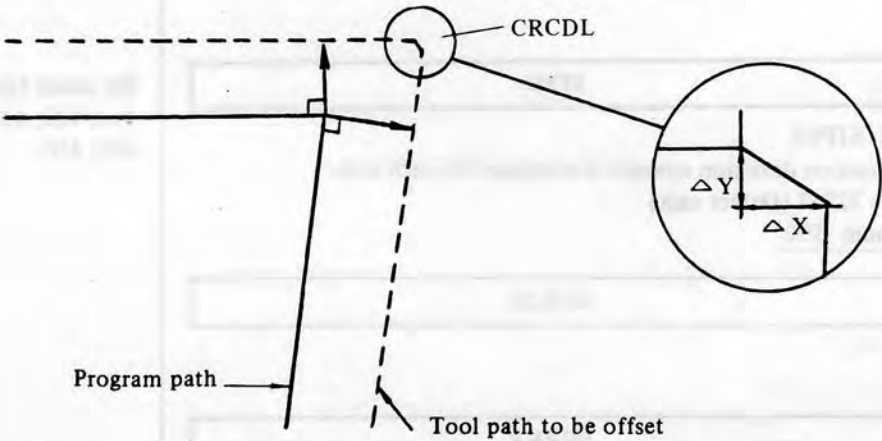


G83 X — Y — Z — Q — R — F — ;

Q represents the depth of cut at each time, and is always expressed as an incremental value. Rapid traverse changes to cutting feed at the distanced d inches (or mm) above the position where the immediately preceding cut ended. Specify the value Q with a positive number. Even if it is specified with a negative number, the sign is omitted. The distance d is set by parameter (CYCD).

	0	6	9		CRCDL
--	---	---	---	--	-------

CRCDL When tool moves along the outside of acute angle close to 90° with cutter compensation C, limitations on ignoring a small movement amount.
Setting amount mm input 0 ~ 16383 (Unit: 0.001 mm)
inch input 0 ~ 16383 (Unit: 0.0001 inch)



If $\Delta X \leq \text{CRCDL}$ and $\Delta Y \leq \text{CRCDL}$, the small movement is ignored. It prevents the workpiece from being affected by stepping the tool at the corner.

0	7	0	INPX
---	---	---	------

Refer to parameter
007 "CINP"

0	7	1	INPY
---	---	---	------

0	7	2	INPZ
---	---	---	------

0	7	3	INP4
---	---	---	------

4	2	5	INP5
---	---	---	------

INPX, INPY, INPZ, INP4, INP5

Width of inposition for each axis.

Setting amount 0 ~ 32767 (Detect unit)

Standard setting amount 10

0	7	4	STPEX
---	---	---	-------

0	7	5	STPEY
---	---	---	-------

0	7	6	STPEZ
---	---	---	-------

0	7	7	STPE4
---	---	---	-------

4	2	6	STPE5
---	---	---	-------

STPEX, STPEY, STPE4, STPE5

Limitation value of position deviation amount at stoppage for each axis.

Setting amount 0 ~ 32767 (Detect unit)

Standard setting amount 500

See alarm Nos.
410, 420, 430,
440, 450

0	7	8	SERRX
---	---	---	-------

0	7	9	SERRY
---	---	---	-------

0	8	0
---	---	---

SERRZ		
-------	--	--

0	8	1
---	---	---

SERR4		
-------	--	--

4	2	7
---	---	---

SERR5		
-------	--	--

SERRX, SERRY, SERRZ, SERR4, SERR5
Limitation value of position deviation amount during movement for each axis.
Setting amount 0 ~ 32767 (Detect unit)

$$SERR = 1.2 \times \frac{\text{Rapid traverse feed rate (m/min)}}{60 \times \alpha \text{ (mm)}} \times \frac{10^3}{\text{Servo loop gain (sec}^{-1}\text{)}}$$

 α : Detecting unit Standard: 0.001 mm
Servo loop gain Standard: 30 sec⁻¹ (parameter number 90)

See alarm No. 411, 421, 431, 441, 451

0	8	2
---	---	---

GRDSX		
-------	--	--

0	8	3
---	---	---

GRDSY		
-------	--	--

0	8	4
---	---	---

GRDSZ		
-------	--	--

0	8	5
---	---	---

GRDS4		
-------	--	--

4	2	1
---	---	---

GRDS5		
-------	--	--

GRDSX, GRDSY, GRDSZ, GRDS4, GRDS5
Setting of grid shift amount of each axis.
Setting amount 0 ~ ±32767 (Detect unit)
When the reference point is shifted in the negative direction, the sign of this parameter is negative.

See parameter No. 14 ~ 17.
Set a value within the reference counter range.

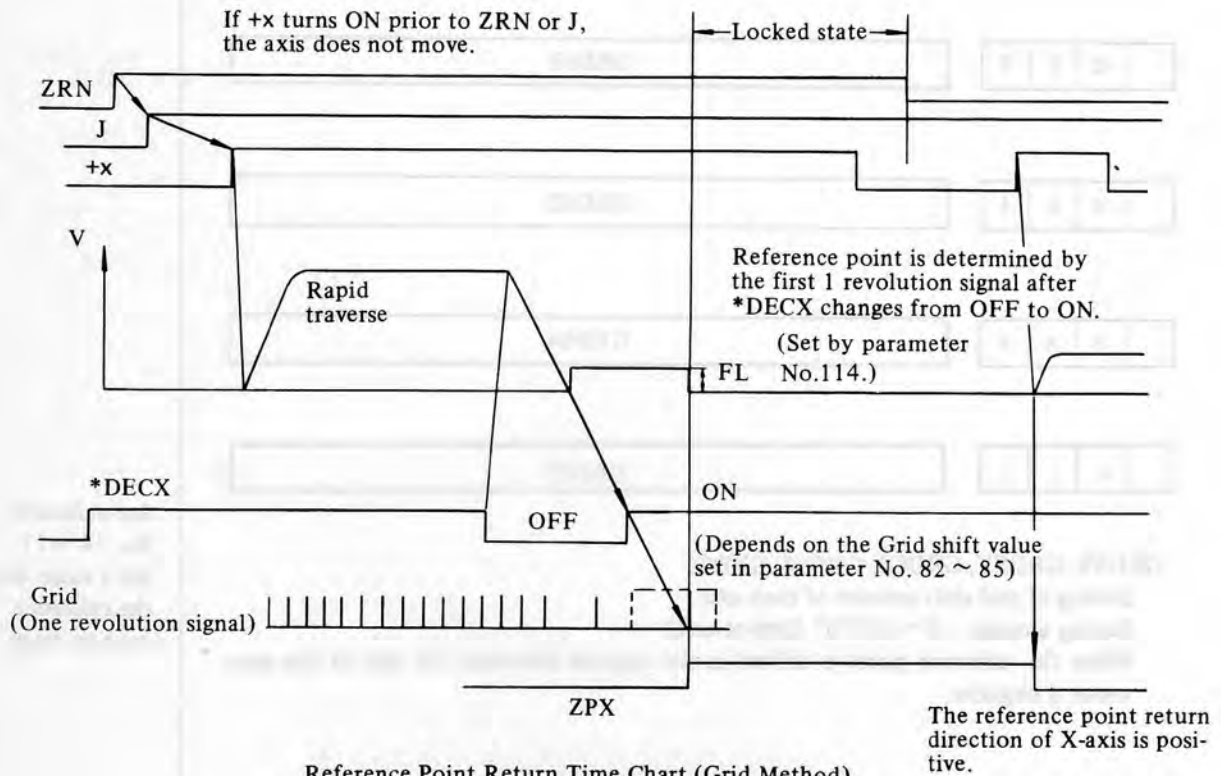
(1) Reference point return by grid method

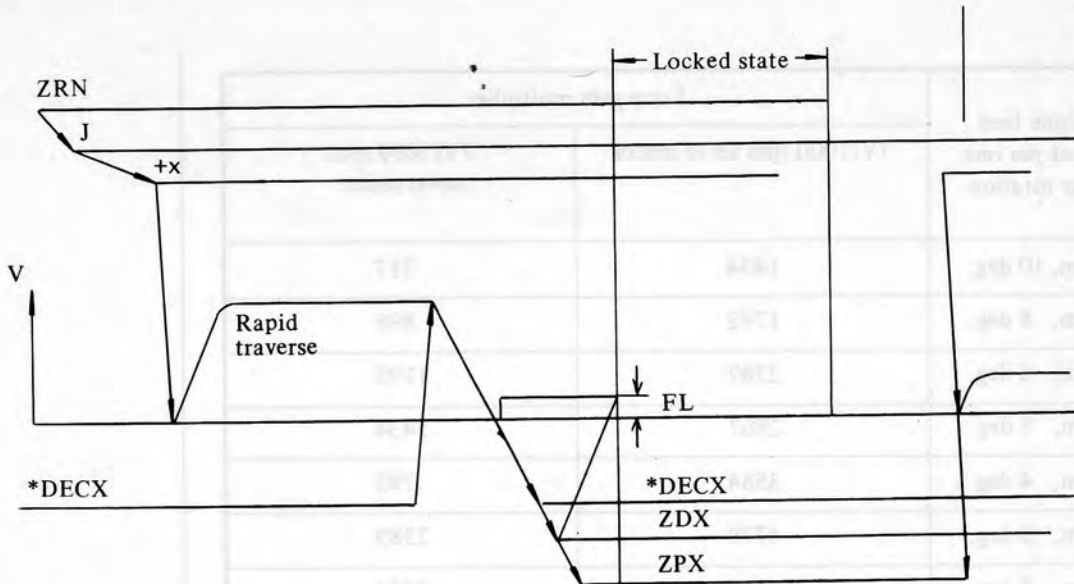
The movable member of a machine moves at rapid traverse by selecting JOG MODE (J), turning ON ZRN (connects with +24N) and by pressing JOG FEED button to move the movable member in the direction of the reference point. By pressing the deceleration limit switch for one of the reference return deceleration signals (*DECX, *DECY, *DECZ, *DEC4), the feedrate decelerates and after completion of deceleration the movable member continues moving at a constant low feedrate. When the deceleration limit switch is switched back to its original position and the movable member of a machining comes to an electrical grid point, feeding stops and the NC issues reference point return completion signal ZPX, ZPY, ZPZ or ZP4.

The return direction can be set for each axis independently. If the reference point return is performed from one direction, once the movable member passes over the reference point, it moves in the reverse direction and returns to the reference point. Once reference point return is completed and the relevant signal ZPX, ZPY, ZPZ or ZP4 is issued, the axis cannot be moved by manual feed command until the ZRN signal turns off.

(2) Reference point return by magneswitch method

In the magneswitch method for reference point return, the procedure is same as the grid method except for the following. Feeding stops when the ZDX, ZDY or ZDZ signal is issued and then the reference point return completion signal ZPX, ZPY or ZPZ is issued.





Reference Point Return Time Chart (Magneswitch Method)

0	8	6	LPGMX
0	8	7	LPGMY
0	8	8	LPGMZ
0	8	9	LPGM4
4	2	2	LPGM5

LPGMX, LPGMY, LPGMZ, LPGM4, LPGM5

Setting of servo loop gain multiple of each axis.

$$\text{Setting amount} = 2048 \times \frac{E}{L} \times \alpha \times 1000$$

$$E = \begin{cases} 7 \text{ [v]} & \text{(For motor with 7V at 1000 rpm) (Model 10M, 20M, 30M)} \\ 3.5 \text{ [v]} & \text{(For motor with 7V at 2000 rpm) (Model 0M, 5M)} \end{cases}$$

L : Machine movement amount per motor revolution (mm or inch)

 α : Detect unit (mm or inch)

(Example) 2 mm per motor revolution at 1000 rpm/7V

$$\text{Setting value} : 2048 \times \frac{7}{2} \times 0.0005 \times 1000 = 3584$$

(At detect unit 0.0005 mm)

Machine feed amount per one motor rotation	Loop gain multiplier	
	7V/1000 rpm servo motor	7V/2000 rpm servo motor
10mm, 10 deg.	1434	717
8mm, 8 deg.	1792	896
6mm, 6 deg.	2389	1195
5mm, 5 deg.	2867	1434
4mm, 4 deg.	3584	792
3mm, 3 deg.	4779	2389
2mm, 2 deg.	7168	3584
1mm, 1 deg.	7168	3584

Machine feed amount per one motor rotation	Loop gain multiplier	
	7V/1000 rpm servo motor	7V/2000 rpm servo motor
0.5 inch	2867	1434
0.4 inch	3584	1792
0.3 inch	4779	2389
0.25 inch	5734	2867
0.2 inch	7168	3584
0.15 inch	9557	4779
0.1 inch	7168	3584

0	9	0
---	---	---

LPGIN

LPGIN Setting of servo loop gain
Setting amount 1 ~ 9999 (Unit: 0.01 sec⁻¹)
Standard setting 3000

0	9	1
---	---	---

JOGF

JOGF JOG feed rate at rotary switch position 10.
Setting amount 1 ~ 150 Unit: mm/min, deg/min. (mm output)
 1 ~ 60 Unit: 0.1 inch/mm, 0.1 deg/min. 1 deg/min
 (inch output)
Standard setting 20
Rotary axis movement unit (0.1 deg/min or 1 deg/min) is selected by
parameter ROT 10 (No. 306)

See parameter
ADNW (318),
JOGFAD (348)

(Example) Set 20mm/min to parameter No. 91.

Position	Feed rate override	Manual	
		MM	INCH
0	0%	0mm/min.	0 in/min.
1	10	1.0	0.02
2	20	1.4	0.03
3	30	2.0	0.04
4	40	2.7	0.06
5	50	3.7	0.08
6	60	5.2	0.10
7	70	7.2	0.14
8	80	10	0.2
9	90	14	0.3
10	100	20	0.4
11	110	27	0.6
12	120	37	0.8
13	130	52	1.0
14	140	72	1.4
15	150	100	2
16	160	140	3
17	170	200	4
18	180	270	6
19	190	370	8
20	200	520	10
21	200	720	14
22	200	1000	20
23	200	1400	30
24	200	2000	40

Note: 1. The feed rate mentioned above is 20 mm/min by geometric series at override signal 100%. By setting the feed rate at the override 100% by a parameter, feed rates other than that in the table are obtained.

2. The velocity error is $\pm 3\%$ in this table.

0

9

2

RPDFX

0

9

3

RPDFY

0

9

4

RPDFZ

0

9

5

RPDF4

	4	2	8		RPDF5
--	---	---	---	--	-------

RPDFX, RPDFY, RPDFZ, RPDF4, RPDF5

Rapid traverse rate of each axis.

Setting amount 30 ~ 15000 Unit: mm/min (mm output)
 30 ~ 6000 Unit: 0.1 inch/min (inch output)
 30 ~ 15000 Unit: deg/min (rotary axis)

	0	9	6		LINTX
--	---	---	---	--	-------

	0	9	7		LINTY
--	---	---	---	--	-------

	0	9	8		LINTZ
--	---	---	---	--	-------

	0	9	9		LINT4
--	---	---	---	--	-------

	4	2	9		LINT5
--	---	---	---	--	-------

LINTX, LINTY, LINTZ, LINT4, LINT5

Constant time of linear acceleration/deceleration of each axis. (for rapid traverse)

Setting amount 8 ~ 4000 (Unit: msec.)

Standard setting amount 100

	1	0	0		EXPTX
--	---	---	---	--	-------

	1	0	1		EXPTY
--	---	---	---	--	-------

	1	0	2		EXPTZ
--	---	---	---	--	-------

	1	0	3		EXPT4
--	---	---	---	--	-------

	4	3	0		EXPT5
--	---	---	---	--	-------

EXPTX, Y, Z, 4, 5

Exponential acceleration/deceleration time constant in manual feed for each axis

Setting amount 8 ~ 4000 (Unit: msec.)

	1	0	5
--	---	---	---

FEEDT

(Option)

FEEDT Exponential acceleration/deceleration time constant in cutting feed.
Setting amount 8 ~ 4000 (Unit: msec.)

	1	0	6
--	---	---	---

FEDMX

FEDMX Upper speed of cutting feed. (Available for all axes)
(A type)

See parameter No. 306
2nd bit

In case ADNW=0 (Parameter No. 318)

This parameter is common to all axis. Tangential speed is clumped at this data.
Setting amount 6 ~ 15000 Unit: mm/min, deg/min (metric output)
6 ~ 6000 Unit: 0.1 inch/min, 0.1 deg/min, 1 deg/min
(inch output)

(B type)

In case ADNW=1

This parameter is effective for X, Y, Z axes. Each axis speed is clumped at this data in case of linear interpolation. But for circular interpolation tangential speed is clumped at this data.

Set clump data for additional axis to parameter number 366.

Setting amount 6 ~ 15000 Unit: mm/min (metric output)
6 ~ 6000 Unit: 0.1 inch/min (inch output)

	1	0	7
--	---	---	---

EXDEC

(Option)

See parameter 021.

EXDEC External deceleration feed rate. (Available for all axes)
Setting amount 6 ~ 15000 Unit: mm/min (metric output)
6 ~ 6000 Unit: inch/min (inch output)

	1	0	8
--	---	---	---

FEDFL

FEDFL Lower limit in deceleration of cutting feed.
Setting amount 6 ~ 15000 Unit: mm/min
6 ~ 6000 Unit: 0.1 inch/min
Usually set "0".

	1	0	9
--	---	---	---

JGFLX

	1	1	0
--	---	---	---

JGFLY

	1	1	1
--	---	---	---

JGFLZ

1 1 2	JGFL4
---	-------

4 3 1	JGFL5
---	-------

JGFLX, Y, Z, 4, 5

Lower limit in deceleration of manual feed for each axis.

Setting amount 6 ~ 15000 Unit: mm/min

6 ~ 6000 Unit: 0.1 inch/min

1 1 3	RPDFL
---	-------

RPDFL Least speed of rapid traverse override (Fo) (Common to all axes)

Setting amount 6 ~ 15000 Unit: mm/min, deg/min (metric output)

6 ~ 6000 Unit: 0.1 inch/min, 0.1 deg/min (inch output)

6 ~ 6000 Unit: deg/min (inch output)

1 1 4	ZRNFL
---	-------

ZRNFL Low feed rate for reference point return (FL) (Common to all axes)

Setting amount 6 ~ 15000 Unit: mm/min (metric output)

6 ~ 6000 Unit: 0.1 inch/min, 0.1 deg/min, 1 deg/min
(inch output)

1 1 5	BKLX
---	------

1 1 6	BKLY
---	------

1 1 7	BKLZ
---	------

1 1 8	BKL4
---	------

4 3 2	BKL5
---	------

BKLX, BKLY, BKLZ, BKL4, BKL5

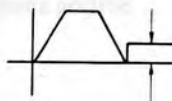
Backlash amount of each axis

Setting amount 0 ~ 255 Unit: 0.001 mm (metric output)

Unit: 0.0001 inch (inch output)

(Note) If parameter 316 ACMR = 1 (Arbitrary command multiply), unit of backlash amount is detection unit.

Refer to parameter 306

Refer to parameter
082 ~ 085, 306Refer to parameter
018

1	1	9	SPDLC
---	---	---	-------

SPDLC Set spindle speed offset compensation value, that is, compensation value of zero offset of spindle speed command voltage.
Setting amount 0 ~ ±8191

1	2	4	DRFTX
---	---	---	-------

1	2	5	DRFTY
---	---	---	-------

1	2	6	DRFTZ
---	---	---	-------

1	2	7	DRFT4
---	---	---	-------

4	2	3	DRFT5
---	---	---	-------

DRFTX, DRFTY, DRFTZ, DRFT4, DRFT5

Compensation amount of drift generated in servo loop of each axis

Setting amount 0 ~ ±500

In case of automatic compensation, this amount is changed automatically.

1	2	8	PHAZX
---	---	---	-------

1	2	9	PHAZY
---	---	---	-------

1	3	0	PHAZZ
---	---	---	-------

1	3	1	PHAZ4
---	---	---	-------

4	2	4	PHAZ5
---	---	---	-------

When parameter ADFT (007) is set to 1.

Refer to parameter 13 "PHS".

For resolver or inductosyn feedback.

PHAZX, Y, Z, 4, 5

Servo phase shift amount, in DSCG method for each axis. Data corresponding to the phase of the position detector signal can be automatically set. (For resolver/inductosyn)
Setting amount 0 ~ 500 VELO.

	1	3	2		GRLMAX
--	---	---	---	--	--------

GRLMAX Max. spindle speed for low speed gear in S4 digits (binary 12-bit output A or analog output A) (option). (Set the spindle speed in rpm when speed command voltage of spindle motor is 10V.)
Setting amount 1 ~ 9999 (Unit: rpm)

	1	3	3		GRHMAX
--	---	---	---	--	--------

GRHMAX Max. spindle speed for high speed gear in S4 digits (binary 12-bit output A or analog output A) (option). (Set the spindle speed in rpm when speed command voltage of spindle motor is 10V.)
Setting amount 1 ~ 9999 (Unit: rpm)

	1	3	4		GRHMIN
--	---	---	---	--	--------

GRHMIN Lower limit of spindle speed for high speed gear in S4 digits (binary 12-bit output A or analog output A) (option).
Setting amount 1 ~ 9999 (Unit: rpm)

	1	3	5		SPDMIN
--	---	---	---	--	--------

SPDMIN Lower limit of output value for spindle motor in S4 digits (binary 12-bit output A, B or analog output A, B) (option)
$$\frac{\text{Lower limit of spindle motor speed}}{\text{Max. spindle motor speed}} \times 4095$$

Setting amount 1 ~ 4095

	1	3	6		SPDMAX
--	---	---	---	--	--------

SPDMAX Upper limit of output value for spindle motor in S4 digits (binary 12-bit output A, B or analog output A, B) (option)
$$\frac{\text{Upper limit of spindle motor speed}}{\text{Max. spindle motor speed}} \times 4095$$

Setting amount 1 ~ 4095

	1	4	0
--	---	---	---

• PSANGN

PSANGN Data for gain adjustment of S analog output A, B.
Set the data for gain adjustment of S analog output A, B.
Setting range 700 ~ 1250
Standard setting amount 1000
[Method of adjustment]
1) Set standard amount (1000)
2) Give the max. command of S analog.
3) Measure output voltage.
4) Preset PSANGN according to below formula
$$\frac{10.00}{\text{Measuring voltage}} \times 1000 = \text{Setting value}$$

Ex. In case measuring voltage is 9.7V
$$\frac{10.00}{9.70} \times 1000 = 1031 \text{ (Parameter value)}$$

5) After setting new data, check whether output voltage is maximum voltage (10V) or not.

	1	4	1
--	---	---	---

TIME1

TIME1 Preset time for use.
Setting amount 0 ~ 32767 (Unit: 0.1 H)
SETTING is also effective.

	1	4	2
--	---	---	---

TIME2

TIME2 Preset time for use.
Setting amount 0 ~ 99999999 (Unit: 0.1 H)

	1	4	3
--	---	---	---

LT1X1

	1	4	4
--	---	---	---

LT1Y1

	1	4	5
--	---	---	---

LT1Z1

	1	4	6
--	---	---	---

LT141

	4	3	3
--	---	---	---

LT151

	1	4	7
--	---	---	---

LT1X2

1	4	8	LT1Y2
---	---	---	-------

1	4	9	LT1Z2
---	---	---	-------

1	5	0	LT142
---	---	---	-------

4	3	4	LT152
---	---	---	-------

1	5	1	LT2X1
---	---	---	-------

1	5	2	LT2Y1
---	---	---	-------

1	5	3	LT2Z1
---	---	---	-------

1	5	5	LT2X2
---	---	---	-------

1	5	6	LT2Y2
---	---	---	-------

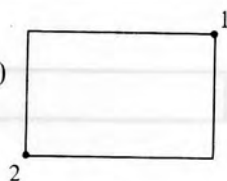
1	5	7	LT2Z2
---	---	---	-------

LT

↑ Represent nth top in square zone (See the figure right)

↑ Represent axis (4: 4th, 5: 5th axis)

↑ Represent nth stroke limit



Set stroke limit mentioned above.

Setting amount 0 ~ ±99999999 (Unit: 0.001 mm or 0.0001 inch)

SETTING is also effective in the range of 151 ~ 157.

1	5	9	REF2X
---	---	---	-------

1	6	0	REF2Y
---	---	---	-------

1	6	1	REF2Z
---	---	---	-------

	1	6	2	REF24
--	---	---	---	-------

	4	3	5	REF25
--	---	---	---	-------

REF2X, REF2Y, REF2Z, REF24, REF25

Distance from second reference point to first reference point of each axis.

Setting amount 0 ~ ±99999999 (Unit: 0.001 mm or 0.0001 inch or 0.001 deg.)

	1	6	3	PECINTX
--	---	---	---	---------

	1	6	4	PECINTY
--	---	---	---	---------

	1	6	5	PECINTZ
--	---	---	---	---------

	1	6	6	PECINT4
--	---	---	---	---------

	4	3	6	PECINT5
--	---	---	---	---------

PECINTX, Y, Z, 4, 5

Pitch error compensation interval on each axis.

Setting amount 8000 ~ 20000000 (Unit: 0.001 mm)

4000 ~ 20000000 (Unit: 0.0001 inch)

(Maximum compensation distance = setting distance × 127)

Note 1. If 4th axis is used for rotary axis, "6000" must be set to this parameter.

Note 2. Rapid traverse of rotary axis must be used blow 110000 deg/min (312 rpm).

	1	6	7	ATCLZV
--	---	---	---	--------

ATCLZV: Z-axis stroke limit in the negative direction

Setting range 0 to ±99999999 Unit 0.001 mm (Metric output)

0 to ±99999999 Unit 0.0001 inch (Inch output)

	1	6	8	MASKA
--	---	---	---	-------

MASKA

Register a secret number to be locked in advance.

Setting range: 1 to 99,999,999

Note 1: Whenever parameter 168 is zero, an unlocked state is provided. Turning off/on the NC power does not effect locking. Note that any number other than zero should not be set in parameter 168 for programs not to be locked.

<table><tr><td></td><td>1</td><td>7</td><td>1</td></tr></table>		1	7	1	<table><tr><td>F1D1</td></tr></table>	F1D1
	1	7	1			
F1D1						
$\wr$	$\wr$					
<table><tr><td></td><td>1</td><td>7</td><td>9</td></tr></table>		1	7	9	<table><tr><td>F1D9</td></tr></table>	F1D9
	1	7	9			
F1D9						

See parameter No. 061.

F1D1 Initial amount of feed rate for F1 in F1-digit command
F1D9 Initial amount of feed rate for F9 in F1-digit command
Setting range 0 ~ 15000 Unit: 1 mm/min. (mm input)
0 ~ 6000 Unit: 0.1 inch/min. (inch input)
These feed rates can also be set as setting parameter. Also, in F 1-digit command, if the feed rate is changed by turning the manual pulse generator, the value of this parameter is also changed according to it.

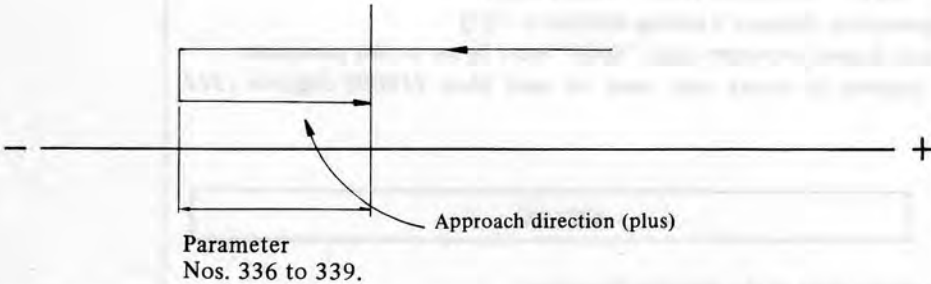
	3	0	5
--	---	---	---

FL4	FLZ	FLY	FLX	G604	G60Z	G60Y	G60X
7	6	5	4	3	2	1	0

FLX, Y, Z, 4
Whether the axis is parallel with the 5th axis or not.
(NC/TC option)
1: Parallel axis
0: Not parallel axis

G60X, Y, Z, 4
The approach direction by single direction positioning of X axis, Y axis, Z axis and the 4th axis in order.
1: The approach direction is the minus direction.
0: The approach direction is the plus direction.

Refer to parameter 336 ~ 339
See parameter G605/No. 063 for 5th axis.



	3	0	6				
SKPF	CHR		SFRV	NEOP	ROTIO	TMCR	SALM
7	6	5	4	3	2	1	0

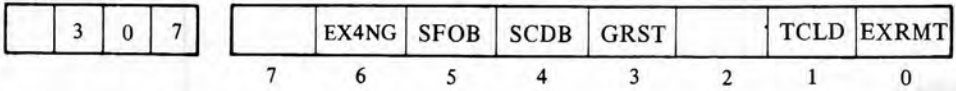
SKPF 1: On skip cutting command (G31), the feed rate comes to FL speed subjected to parameter (No. 342) setting.
0: On skip cutting command (G31), the feed rate follows F code.
CHR 1: Feedrate is limited to rapid traverse during handle interruption.
0: It is not limited to rapid traverse.
SFRV 1: The polarity of analog output voltage in G84 or G74 is changed by SRV.
0: The polarity of analog output voltage in G84 or G74 is not changed by SRV.
This parameter is effective with S4-digit analog output A/B option.

When parameter TCW (010) is set to 1.

- NEOP 1: When a program is stored in memory by tape, M02, M30, and M99 are not counted as the program end.
0: When a program is stored in memory by tape, M02, M30, and M99 are counted as the program end.
- ROT 10 1: Unit of parameter 091, 106, 113 and 114 is 1 deg/min in inch output.
0: Unit is 0.1 deg/min.
- TMCR 1: Custom macro is called by T code.
0: No custom macro is called by T code.
- SALM 1: Alarm is occurred when S command exceeding lower limit or upper limit of output to spindle motor is executed in S4-digit binary 12 bit output A/analog output A.
0: Alarm is not occurred and the value of lower limit or upper limit is cramped.
- Refer to parameter 135 and 136, too.

Set for additional axis (rotaly axis).

O9000

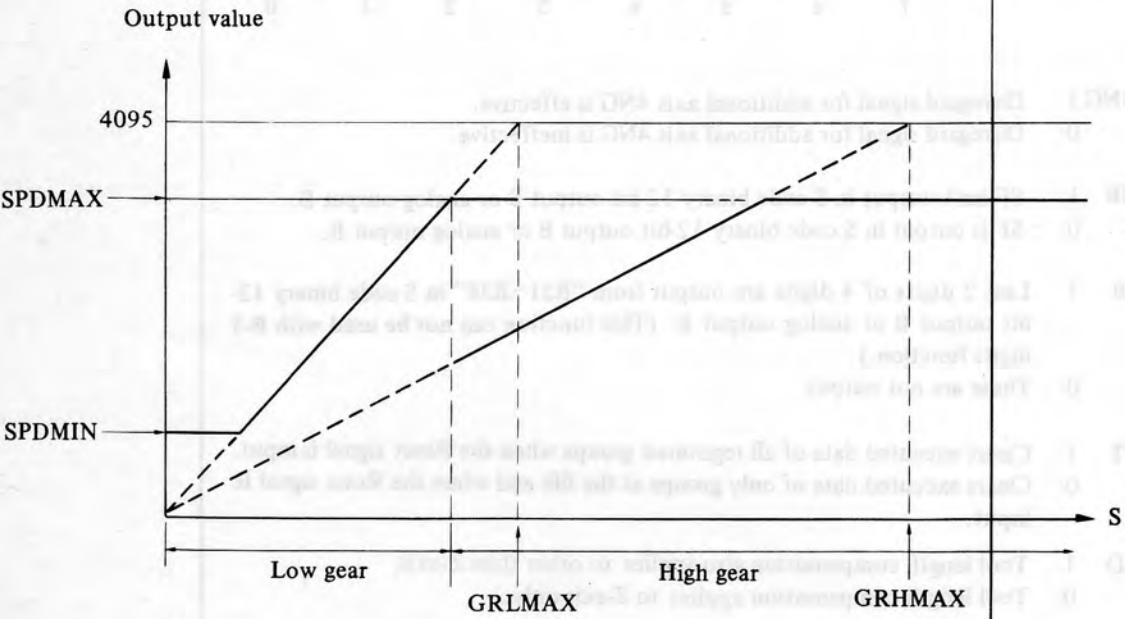


- EX4NG 1: Disregard signal for additional axis 4NG is effective.
0: Disregard signal for additional axis 4NG is ineffective.
- SFOB 1: SF isn't output in S code binary 12-bit output B or analog output B.
0: SF is output in S code binary 12-bit output B or analog output B.
- SCDB 1: Last 2 digits of 4 digits are output from "B21~B38" in S code binary 12-bit output B or analog output B. (This function can not be used with B-3 digits function.)
0: These are not output.
- GRST 1: Clears executed data of all registered groups when the Reset signal is input.
0: Clears executed data of only groups at the life end when the Reset signal is input.
- TCLD 1: Tool length compensation also applies to other than Z-axis.
0: Tool length compensation applies to Z-axis only.
- EXRMT 1: Selection between RMT and PTR is possible from machine tool.
0: Selection between RMT and PTR is impossible from machine tool.

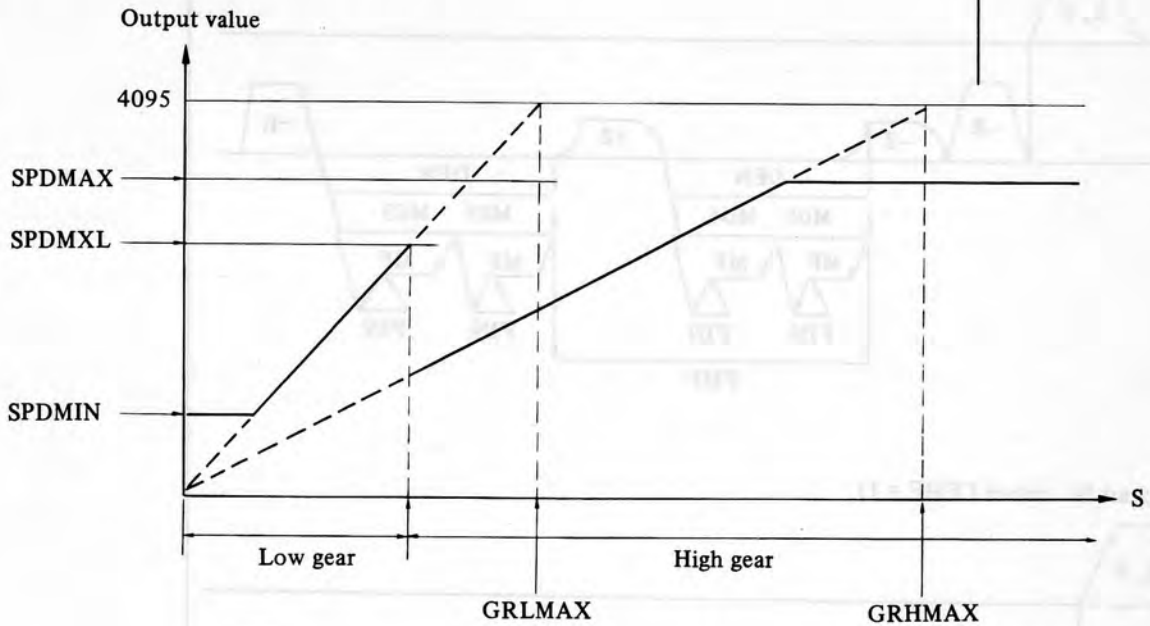
	3	0	8	DIOM	MSFT	LGCM	MANP	RSTB	UWKZ	CFMF	
				7	6	5	4	3	2	1	0

- DIOM 1: DI and DO can be read and written by macro variables. (not used)
0: They can not be read and written by macro variables.
- MSFT 1: When the option of custom macro is equipped with on key input from MDI, the shift key is valid.
0: On key input from MDI, the shift key is invalid.
- LGCM 1: Specifies the value of parameter SPDMXL (No. 365) for the number of revolutions for low gear/high gear switching (Method B).
0: Specifies the low gear maximum number of revolutions for low gear/high gear switching.
(Method A)
(Valid with S-12 bit output A/S analog output A)

Method A (when parameter LGCM = 0)



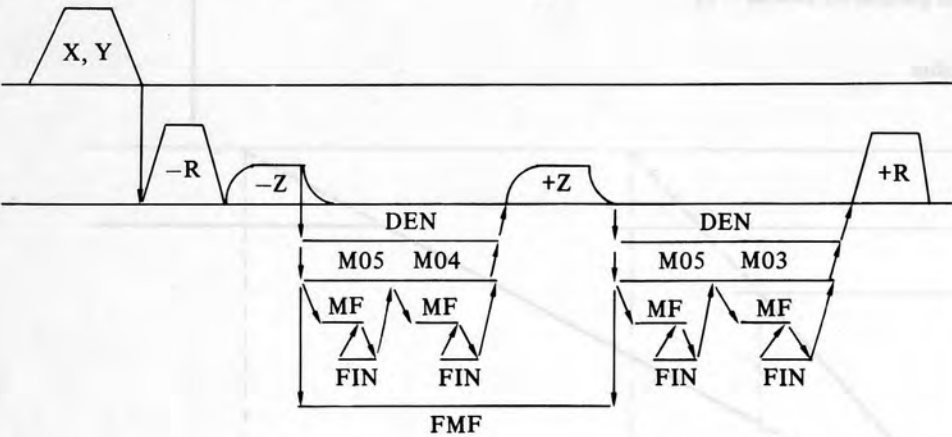
Method B (when parameter LGCM = 1)



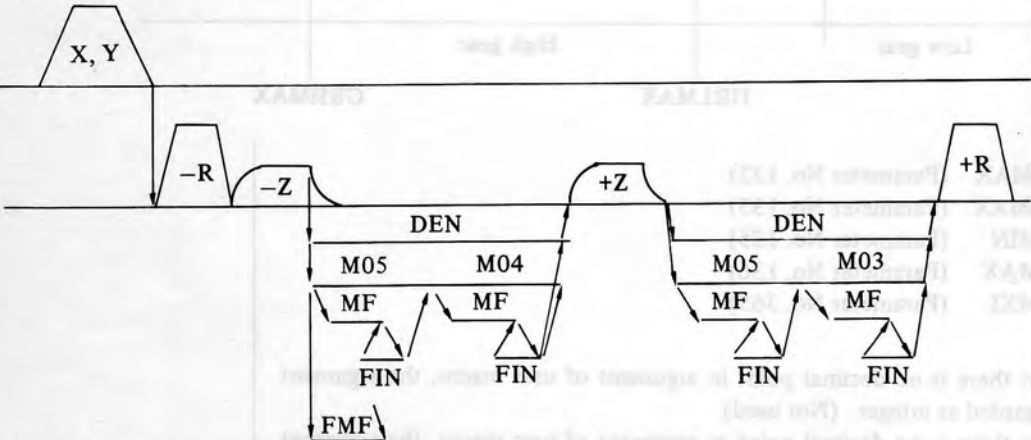
GRLMAX (Parameter No. 132)
 GRHMAX (Parameter No. 133)
 SPDMIN (Parameter No. 135)
 SPDMAX (Parameter No. 136)
 SPDMXL (Parameter No. 365)

- MANP 1: When there is no decimal point in argument of user macro, the argument is regarded as integer. (Not used)
 0: When there is no decimal point in argument of user macro, the argument is regarded as value with decimal point obeyed the regulations.
- RSTB 1: On resetting by an emergency stop, external reset, or reset & rewind, no resetting signal is issued during the reset.
 0: On resetting by an emergency stop, external reset, or reset & wind, a resetting signal is issued during the reset.
- UWK2 1: When work zero point offset value is changed, absolute coordinate value is charged immediately. (Must not be used).
 0: When it is changed, absolute coordinate value is changed at the first preprocessing.
- CFMF 1: Turns off FMF by M05 FIN in G84 and G74 in canned cycle type II. (Time chart B)
 0: Holds FMF up to the R point level in G84 and G74 in canned cycle type II. (Time chart A)

Time chart A (when CFMF = 0)



Time chart B (when CFMF = 1)



- Note 1: When parameter FXCS (No. 022-0) = 1, M05 is not output, but M04 or M03 is output directly.
- Note 2: In the case of G74, M04 and M03 are reversed.

3	0	9	TLSK	GST2	GST1	LCTM	AP4	APZ	APY	APX
			7	6	5	4	3	2	1	0

TLSK = 1: inputs group No. for tool skip.
0: inputs no group No.

GST1, GST2: specify the number of groups that can be registered.

GST1	GST2	Number of groups
0	0	1 ~ 16
0	1	1 ~ 32
1	0	1 ~ 64
1	1	1 ~ 128

LCTM = 1: specifies tool life by time.
0: specifies tool life by frequency.

ATPX, Y, Z, 4

Automatic coordinate system setting (option) for X, Y, Z and 4th axes are effective or ineffective in order.

- 1: Automatic coordinate system setting is effective.
- 0: Automatic coordinate system setting is ineffective.

Refer to parameters 375 ~ 382, too.

	3	1	0	NFED1		RSCB1	STP21		BAD1	3	
	3	1	1	NFED2		RSCB2	STP22		BAD2	1	
	3	1	2	NFED3		RSCB3	STP23		BAD3		
	3	1	3	NFED4		RSCB4	STP24		BAD4		
				7	6	5	4	3	2	1	0

NFED 1, 2, 3, 4

On I/O devices 1, 2, 3, 4 in order, feed is executed or not.

- 1: executed
- 0: not executed

RSCB1, 2, 3, 4

On I/O devices 1, 2, 3, 4 in order, whether control codes (DC1 ~ DC4) are used or not.

- 1: The control codes are not used.
- 0: The control codes are used.

STP21, 2, 3, 4

On I/O devices 1, 2, 3, 4 in order, the stop bit is to be 2 bits/1 bit.

- 1: The stop bit is to be 2 bits.
- 0: The stop bit is to be 1 bit.

BAD 1, 2, 3, 4

It sets a baud rate on I/O devices 1, 2, 3, 4 in order.

Baud rate	BAD1, 2, 3, 4			
	3	2	1	0
50	0	0	0	0
100	0	0	0	1
110	0	0	1	0
150	0	0	1	1
200	0	1	0	0
300	0	1	0	1
600	0	1	1	0
1200	0	1	1	1
2400	1	0	0	0
4800	1	0	0	1
9600	1	0	1	0

Refer to parameter
340, 341.
ASR33: 110 baud
ASR43: 300 baud
(110 baud)
Bubble cassette
= 4800 bands

(Note 1) Parameter 313 is used for data transfer between NC and Robot when Robot interface option is provided.

	3	1	4	IM15	MINT	IFIX	IRND	H4	HZ	HY	HX
				7	6	5	4	3	2	1	0

- IM15 1: Commands for axis B are always regarded as absolute commands whether in G90 mode or in G91 mode, and the rotation direction is positive. When M15 is specified, the rotation direction is negative.
0: Commands for axis B are regarded as absolute or incremental commands, respectively, depending on whether the mode is G90 or G91. The rotation direction is determined as either positive or negative in the same way as for linear axis; M15 is not significant in this case.
- MINT 1: Assigned NC statement is executed after the current block is completed. (Custom macro interrupt type II)
0: Assigned NC statement is executed immediately. (Custom macro interrupt type I)
- IFIX 1: When the specified angle is not an integer multiple of the least angle for indexing the index table, a PS alarm occurs. (Parameter 060 must also be specified.)
0: Commands for axis B can be issued independently of the least angle for indexing the index table.
- IRND 1: The axis B absolute coordinate value is rounded to 360°.
0: The axis B absolute coordinate value is not rounded to 360°.
- HX, Y, Z, 4 Handle interruption is
1: effected
0: not effected

	3	1	5	PRT	SLOW	BDEG	IDXB	SSCR	SSCA2	SSCA1	SSCA0
				7	6	5	4	3	2	1	0

- PRT 1: Leading zeros are not output by DPRNT command.
0: Space codes are output for leading zeros by DPRNT command.
- SLOW 1: Minimum spindle speed clamp value is set to all gears in common during constant surface speed control (No. 347)
0: Minimum spindle speed clamp value is set to each gear individually during constant surface speed control. (No. 343, 344, 345, 346)

- IDXB 1: Index table indexing sequence B
 0: Index table indexing sequence A
- BDEG 1: B axis input unit 0.001° (B1 = 0.001°)
 0: B axis input unit 1° (B1 = 1°)
- SSCR 1: Surface speed is calculated based on the end point of the current block in a rapid traverse block.
 0: Surface speed is calculated based on the current position of the tool in a rapid traverse block.

SSCA2, SSCA1, SSCA0

An axis for which constant surface speed control is performed.

SSCA2	SSCA1	SSCA0	Axis
0	0	0	X
0	0	1	Y
0	1	0	Z
0	1	1	4
1	0	0	5

	3	1	6
--	---	---	---

CDSCG		ACMR	DSCG5	DSCG4	DSCGZ	DSCGY	DSCGX
7	6	5	4	3	2	1	0

Refer to item 6.1.5

- CDSCG 1: It performs no frequency check of DSCG feedback (Resolver, Inductosyn)
 0: It performs frequency check of DSCG feedback (Resolver, Inductosyn)
 (After detecting gain adjustment, this parameter should always be set to "0".)

- ACMR 1: Setting of arbitrary command multiply (CMR).
 0: Setting of standard command multiply (CMR).

(Note) Set backlash compensation values and pitch error compensation values with detection unit when arbitrary command multiply is selected.

See parameter
 027 ~ 030, 414

DSCGX, Y, Z, 4, 5

It sets the type of a position detecting system of X axis, Y axis, Z axis, 4th axis and 5th axis in order.

- 1: Resolver or Inductosyn.
 0: Pulse coder.

(Note) Pulse coder and resolver/inductosyn cannot be mixed among X, Y and Z axis.
 Pulse coder and resolver/inductosyn cannot be mixed between 4th and 5th axes.

	3	1	7
--	---	---	---

UM#8	UM#7	UM#6	UM#5	UM#4	UM#3	UM#2	UM#1
7	6	5	4	3	2	1	0

- UM#1 – 8 On EIA code, it registers the code corresponding to “#” used in custom macro.

Example: UM#8 ~ UM#1 = 00001110

The code having a hole in channels 2, 3 and 4 is counted as “#” of the EIA code. Address code which has been used can not be set.

(UM#8 ~ UM#1 = 00000000 mean that “#” is not used.)

	3	1	8	PRG9	MSC9	MPD9	*		NSRH	RSTL	ADNW
				7	6	5	4	3	2	1	0

- PRG9 1: Program numbers 9000 ~ 9899 can not be edited.
0: Program numbers 9000 ~ 9899 can be edited.
- MSC9 1: If the mode is single block mode during execution of program numbers 9000 ~ 9899, single block stop is effective in executing macro format of custom macro.
0: Even if the mode is single block mode during execution of program numbers 9000 ~ 9899, single block stop is ineffective in excuting macro format of custom macro.
- MPD9 1: The contents of the program is not displayed during execution of pro-gram numbers 9000 ~ 9899.
0: The contents of the program is displayed during execution of program numbers 9000 ~ 9899.
- NSRH 1: "OP" signal is not output in sequence number search.
0: "OP" signal is output.
- RSTL 1: "STL" signal is not output at registration of program in EDIT mode.
0: "STL" signal is output.
- ADNW 1: Select B type for feed rate.
0: Select A type for feed rate.

[B type]

- (1) **JOG feed rate**
JOG feed rate of rotary axis can be set to parameter (No. 348). When an additional axis is moved with another axis by JOG or additional axis is linear axis (parameter 011-ADLN, 063-ADL5 is 1), feed rate is the same as that of another axes (parameter 091).
- (2) **Cutting feed upper limit feed rate**
When command linear interpolation (G01), clamp each axis feed rate at setting value in parameter that clamp value can be set to another parameter for addition-al axis and X, Y, Z axes. In circular interpolation, tangential speed is clamped at parameter value.

[A type]

- (1) **JOG feed rate**
JOG feed rate of additional axis is common to other axes as value of parameter (No. 091).
- (2) **Cutting feed upper limit feed rate**
Tangential speed is clamped at parameter value for all axis.

	3	1	9	PRG8	MCS8	MPD8*	DPSW					MCS7
				7	6	5	4	3	2	1	0	

These parameter can also be set as setting parameter.

- PRG8 1: Program numbers 8000 ~ 8999 can not be edited.
 0: Program numbers 8000 ~ 8999 can also be edited.
- MCS8 1: If the mode is single block mode during execution of program numbers 8000 ~ 8999, single block stop is effective in excuting macro format of custom macro.
 0: Even if the mode is single block mode during execution of program numbers 8000 ~ 8999, single block stop is ineffective in excuting macro format of custom macro.
- MPD8 1: The contents of the program is not displayed during execution of program numbers 8000 ~ 8999.
 0: The contents of the program is displayed during execution of program numbers 8000 ~ 8999.
- DPSW 1: A comment following a macro call address is displayed on the program screen.
 0: It is not displayed.
 Example:
 ZI01 (INITIAL SET)
 └─ This is displayed or not.
- MCS7 1: If the mode is single block mode during execution of program numbers 0001 ~ 7999, single block stop is effective in excuting macro format of custom macro.
 0: Even if the mode is single block mode during execution of program numbers 0001 ~ 7999, single block stop is ineffective in excuting macro format to custom macro.

M97 series
 MA3 series

	3	2	0	UMMCD1	O 9001
	3	2	1	UMMCD2	O 9002
	3	2	2	UMMCD3	O 9003

UMMCD1, 2, 3
 It sets up to three kinds of M code to call custom macro.
 Setting amount 01 ~ 97
 (With M00 the custom macro can not be called. Even when 00 are set, it is equivalent to no setting.)

	3	2	3	UMGCD0	O 9010
--	---	---	---	--------	--------

3 2 4	UMGCD1	O 9011
3 2 5	UMGCD2	O 9012
3 2 6	UMGCD3	O 9013
3 2 7	UMGCD4	O 9014
3 2 8	UMGCD5	O 9015
3 2 9	UMGCD6	O 9016
3 3 0	UMGCD7	O 9017
3 3 1	UMGCD8	O 9018
3 3 2	UMGCD9	O 9019

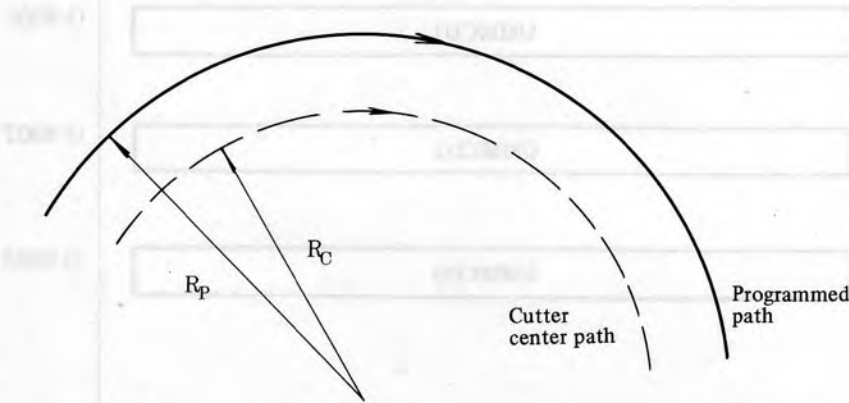
UMGCD0, 1, . . . , 9

It sets up to ten kinds of G code to call custom macro.
Setting amount 01 ~ 99
(G00 can not call the custom macro. Even when 00 is set, it is equivalent to no setting.)

3 3 3	AOVMDR
--	--------

AOVMDR Least deceleration ratio of inner circular cutting speed.
Range 1 to 100% Standard setting 1

If $AOVMDR \geq \frac{R_c}{R_p}$, feedrate is $F \times AOVMDR$



3 3 4	AOVOR
--	-------

AOVOR Deceleration ratio of inner corner automatic override.
Range 1 to 100% Standard setting 50
Inner corner override

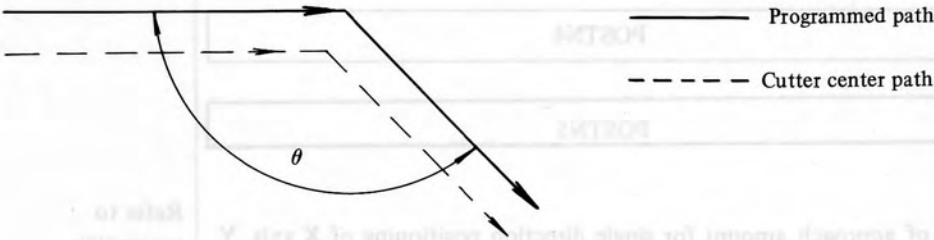
	3	3	5
--	---	---	---

AOVTH

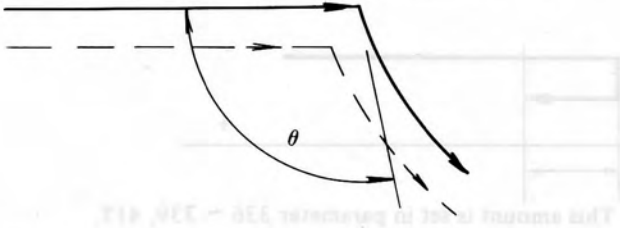
AOVTH Inner angle of inner corner automatic override.
Range 1 to 179° Standard setting 91
Set a limit angle of inner corner

If $\theta \leq \theta_p$, the corner is regarded as inner corner ($\theta_p = \text{AOVTH}$)

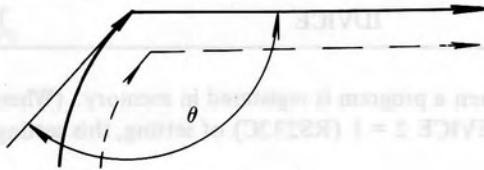
(i) Linear → Linear



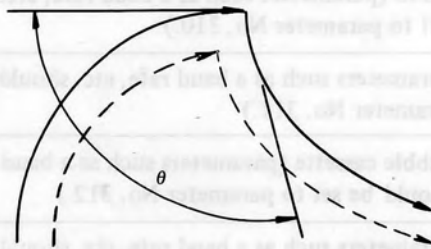
(ii) Linear → Circular



(iii) Circular → Linear



(iv) Circular → Circular



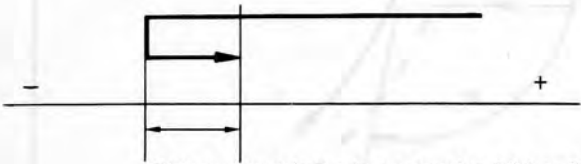
<table><tr><td></td><td>3</td><td>3</td><td>6</td></tr></table>		3	3	6	POSTNX
	3	3	6		
<table><tr><td></td><td>3</td><td>3</td><td>7</td></tr></table>		3	3	7	POSTNY
	3	3	7		
<table><tr><td></td><td>3</td><td>3</td><td>8</td></tr></table>		3	3	8	POSTNZ
	3	3	8		
<table><tr><td></td><td>3</td><td>3</td><td>9</td></tr></table>		3	3	9	POSTN4
	3	3	9		
<table><tr><td></td><td>4</td><td>1</td><td>7</td></tr></table>		4	1	7	POSTN5
	4	1	7		

POSTNX, Y, Z, 4, 5

Setting of approach amount for single direction positioning of X axis, Y axis, Z axis, 4th axis and 5th axis in order.

Setting amount 0 ~ 255 Unit: 0.01mm (mm output)
 0 ~ 255 Unit: 0.001 inch (inch output)

Refer to
parameter
305, 063



This amount is set in parameter 336 ~ 339, 417.

	3	4	0
--	---	---	---

IDVICE	2
--------	---

IDVICE It selects an input device when a program is registered in memory. (When it has been set as INPUT DEVICE 2 = 1 (RS232C) of setting, this setting becomes valid.)

See parameter
No. 310 to 313.

0	Tape reader
1	ASR33/ASR43 (parameters such as a baud rate, etc. should be set to parameter No. 310.)
2	RS232C (parameters such as a baud rate, etc. should be set to parameter No. 311.)
3	RS232C, bubble cassette (parameters such as a baud rate, etc. should be set to parameter No. 312.)
4	RS232C (parameters such as a baud rate, etc. should be set to parameter No. 313. Also used for Data transfer when Robot interface option is provided.)

3

4

1

ODVICE

ODVICE It selects an output device on punching out.

0	FACIT PUNCHER 4070
1	ASR33/ASR43 (parameters such as a baud rate, etc. should be set to parameter No. 310.)
2	RS232C (parameters such as a baud rate, etc. should be set to parameter No. 311.)
3	RS232C, bubble cassette (parameters such as a baud rate, etc. should be set to parameter No. 312.)
4	RS232C (parameters such as a baud rate, etc. should be set to parameter No. 313. Also used for Data transfer when Robot interface option is provided.)

Above parameters can also be set as setting parameter.

3

4

2

PSKPFL

See parameter No. 306.

PSKPFL FL speed of skip cutting (common to all axes)
Setting amount 6 ~ 1500 Unit: 1mm/min (mm output)
6 ~ 600 Unit: 0.1 inch/min (inch output)

3

4

3

GRMIN1

3

4

4

GRMIN2

3

4

5

GRMIN3

3

4

6

GRMIN4

GRMIN1 ~ 4
Minimum spindle speed for each gear in the constant surface speed control mode.
Setting value 0 to 9999 Unit: RPM
Effective when parameter 315 SLOW = 0.

3

4

7

LOWSP

LOWSP Minimum spindle speed in the constant surface speed control mode. (Common to each gear).
Setting value 0 to 9999 Unit: RPM
Effective when parameter 315 SLOW = 1

	3	4	8
--	---	---	---

• JOGFAD

JOGFAD JOG feed rate of additional axis (rotary axis) at rotary switch position 10
 Setting amount 0 ~ 150 Unit: deg/min
 Refer to parameter 091 (JOGF)

B specification
 Refer to
 parameter
 No. 318.

	3	5	5
--	---	---	---

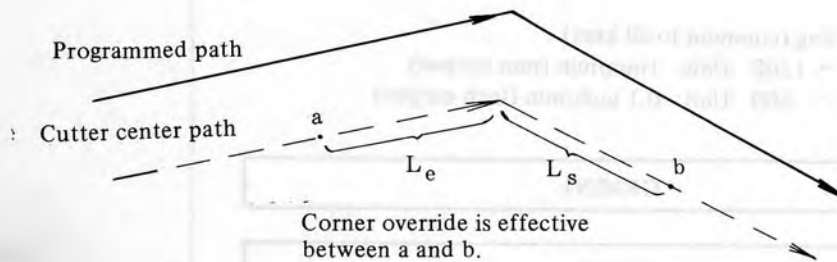
AOVLE

AOVLE Deceleration distance L_e of inner corner automatic override.
 Range 0 to 3999 Unit: 0.1 mm Metric input
 0.01 inch Inch input
 This data can be set by setting operation.

	3	5	6
--	---	---	---

AOVLS

AOVLS Deceleration distance L_s of inner corner automatic override.
 Range 0 to 3999 Unit: 0.1 mm Metric input
 0.01 inch Inch input
 This data can be set by setting operation.



	3	5	7
--	---	---	---

EXOFSX

(Option)

	3	5	8
--	---	---	---

EXOFSY

	3	5	9
--	---	---	---

EXOFSZ

	3	6	0
--	---	---	---

EXOFS4

	4	4	2
--	---	---	---

EXOFS5

EXOFSX, Y, Z, 4, 5

The external work zero point offset amount of X axis, Y axis, Z axis, the 4th axis and 5th axis in order.

Setting amount 0 ~ ±7999 Unit: 0.001mm (mm input)
 0 ~ ±7999 Unit: 0.0001 inch (inch input)

This parameter is normally automatically set by the input from the machine side. (External data input function)

3	6	1	PGMAX1
3	6	2	PGMAX2
3	6	3	PGMAX3
3	6	4	PGMAX4

PGMAX1, 2, 3, 4

Setting of the main spindle MAX. speed when Gears 1, 2, 3, 4 are selected in order (for S 12 bit output B, S4-digit analog output B). It sets the main spindle speed when the speed command voltage is 10V.
Setting amount 1 ~ 9999 rpm
When gears are not used, set max. spindle speed to parameter 361.

3	6	5	SPDML
---	---	---	-------

SPDML Specifies $4,095 \times \frac{\text{Allowable maximum spindle motor speed}}{\text{Maximum spindle motor speed}}$

(the allowable maximum spindle motor speed at low gear).
The setting range is 0 to 4,095.
This setting is significant only when parameter LGCM (No. 308-5) = 1.

3	6	6	FEDMXAD
---	---	---	---------

FEDMXAD Upper speed of cutting feed (available for 4th and 5th axes)
Effective only if ADNW = 1 (parameter 318)
Setting amount 6 ~ 15000 Unit: deg/min (rotary axis)
6 ~ 15000 Unit: mm/min (metric output)
6 ~ 6000 Unit: inch/min (inch output)

3	6	7	REF3X
3	6	8	REF3Y
3	6	9	REF3Z
3	7	0	REF34

(Option)

4	3	8
---	---	---

REF35

REF3X, Y, Z, 4, 5

The distance of the 3rd reference point from the 1st reference point of X axis, Y axis, Z axis, 4th axis, 5th axis in order.

Setting amount 0 ~ ±99999999 Unit: 0.001mm (mm output)
0 ~ ±99999999 Unit: 0.0001 inch (inch output)

3	7	1
---	---	---

REF4X

3	7	2
---	---	---

REF4Y

3	7	3
---	---	---

REF4Z

3	7	4
---	---	---

REF44

4	3	9
---	---	---

REF45

REF4X, Y, Z, 4, 5

The distance of the 4th reference point from the 1st reference point of X axis, Y axis, Z axis, 4th axis and 5th axis in order.

Setting amount 0 ~ ±99999999 Unit: 0.001mm (mm output)
0 ~ ±99999999 Unit: 0.0001 inch (inch output)

3	7	5
---	---	---

PPRTMX

3	7	6
---	---	---

PPRTMY

3	7	7
---	---	---

PPRTMZ

3	7	8
---	---	---

PPRTM4

4	4	0
---	---	---

PPRTM5

PPRTMX, Y, Z, 4, 5

The coordinates for automatic coordinate system setting on mm input of X axis, Y axis, Z axis, 4th axis, 5th axis in order. It sets the distance from the zero point of the coordinate system to be set to the 1st reference point in the metric system.

Setting amount 0 ~ 99999999 Unit: 0.001mm

When inch/metric conversion option is equipped with, parameter Nos. 379 ~ 382, 441 should be also set.

Only the axis that is set to be effective for automatic coordinate system setting in parameter 309, 063 is effective.

3	7	9	PPRTIX
3	8	0	PPRTIY
3	8	1	PPRTIZ
3	8	2	PPRTI4
4	4	1	PPRTI5

PPRTIX, Y, Z, 4, 5

The coordinates for automatic coordinate system setting on inch input of X axis, Y axis, Z axis, 4th axis, 5th axis in order. It sets the distance from the zero point of the coordinate system to be set to the 1st reference point in the inch system.

Setting amount 0 ~ 99999999 Unit: 0.0001 inch

When inch/metric conversion option is equipped with, parameter Nos. 375 ~ 378, 440 should be also set.

Only the axis that is set to be effective for automatic coordinate system setting in parameter 309, 063 is effective.

3	8	3	ZOFS1X
3	8	4	ZOFS1Y
3	8	5	ZOFS1Z
3	8	6	ZOFS14
4	4	3	ZOFS15

ZOFSIX, Y, Z, 4, 5

The 1st work zero point offset amount of X axis, Y axis, Z axis, 4th axis and 5th axis in order. (G54)

Setting amount 0 ~ 99999999 Unit: 0.001mm (mm input)

0 ~ 99999999 Unit: 0.0001 inch (inch input)

Settable also by selecting **OFFSET** function button (Refer to reference 1 in item 5.4)

3	8	7	ZOFS2X
3	8	8	ZOFS2Y

3	8	9	ZOFS2Z
---	---	---	--------

3	9	0	ZOFS24
---	---	---	--------

4	4	4	ZOFS25
---	---	---	--------

ZOFS2X, Y, Z, 4, 5

The 2nd work zero point offset amount of X axis, Y axis, Z axis, 4th axis, 5th axis in order (G55).

Setting amount 0 ~ 99999999 Unit: 0.001mm (mm input)

0 ~ 99999999 Unit: 0.0001 inch (inch input)

Settable also by selecting **OFSET** function button. (Refer to reference 1 in item 5.4)

3	9	1	ZOFS3X
---	---	---	--------

3	9	2	ZOFS3Y
---	---	---	--------

3	9	3	ZOFS3Z
---	---	---	--------

3	9	4	ZOFS34
---	---	---	--------

4	4	5	ZOFS35
---	---	---	--------

ZOFS3X, Y, Z, 4, 5

The 3rd work zero point offset amount of X axis, Y axis, Z axis, 4th axis, 5th axis in order (G56).

Setting amount 0 ~ 99999999 Unit: 0.001mm (mm input)

0 ~ 99999999 Unit: 0.0001 inch (inch input)

Settable also by selecting **OFSET** function button. (Refer to reference 1 in item 5.4)

3	9	5	ZOFS4X
---	---	---	--------

3	9	6	ZOFS4Y
---	---	---	--------

3	9	7	ZOFS4Z
---	---	---	--------

3	9	8	ZOFS44
---	---	---	--------

4	4	6	ZOFS45
---	---	---	--------

ZOFS4X, Y, Z, 4, 5

The 4th work zero point offset amount of X axis, Y axis, Z axis, 4th axis, 5th axis in order (G57).

Setting amount 0 ~ 99999999 Unit: 0.001mm (mm input)

0 ~ 99999999 Unit: 0.0001 inch (inch input)

Settable also by selecting **OFFSET** function button. (Refer to reference 1 in item 5.4)

3	9	9	ZOFS5X
---	---	---	--------

4	0	0	ZOFS5Y
---	---	---	--------

4	0	1	ZOFS5Z
---	---	---	--------

4	0	2	ZOFS54
---	---	---	--------

4	4	7	ZOFS55
---	---	---	--------

ZOFS5X, Y, Z, 4, 5

The 5th work zero point offset amount of X axis, Y axis, Z axis, 4th axis and the 5th axis in order (G58).

Setting amount 0 ~ 99999999 Unit: 0.001mm (mm input)

0 ~ 99999999 Unit: 0.0001 inch (inch input)

Settable also by selecting **OFFSET** function button. (Refer to reference 1 in item 5.4)

4	0	3	ZOFS6X
---	---	---	--------

4	0	4	ZOFS6Y
---	---	---	--------

4	0	5	ZOFS6Z
---	---	---	--------

4	0	6	ZOFS64
---	---	---	--------

	4	4	8
--	---	---	---

ZOF65									
-------	--	--	--	--	--	--	--	--	--

ZOF6X, Y, Z, 4, 5

The 6th work zero point offset amount of X axis, Y axis, Z axis, 4th axis and the 5th axis in order (G59).

Setting amount 0 ~ 99999999 Unit: 0.001mm (mm input)
 0 ~ 99999999 Unit: 0.0001 inch (inch input)

Settable also by selecting **OFSET** function button. (Refer to reference 1 in item 5.4)

	4	0	7
--	---	---	---

SCRATE									
--------	--	--	--	--	--	--	--	--	--

SCRATE Scaling rate
Set value 1 to 9999 Unit: 0.001

	4	0	8
--	---	---	---

Lock/Unlock									
-------------	--	--	--	--	--	--	--	--	--

Entering the same number as that of parameter 168 effects unlocking. Entering a different number effects locking.

	4	1	1
--	---	---	---

						ZGM5	ZM5
						1	0

ZGM5 5th axis reference point return method
1: Magneswitch method
0: Grid method

ZM5 1: Reference point return direction and backlash initial direction on the 5th axis is minus.
0: They are plus.

	4	1	2
--	---	---	---

	ADW52	ADW51	ADW50	AD5B	AD5A	AD4B	AD4A	
	7	6	5	4	3	2	1	0

ADW52, 1, 0

5th-axis-address when punching out and displaying on the CRT

ADW52	ADW51	ADW50	Used character
0	0	0	A
0	0	1	B
0	1	0	C
0	1	1	U
1	0	0	V
1	0	1	W

AD4A, AD4B, AD5A, AD5B

Parallel axis with 4th or 5th axis.

5th axis		4th axis		Basic axes parallel with 4th or 5th axis
AD5B	AD5A	AD4B	AD4A	
0	0	0	0	X axis
0	1	0	1	Y axis
1	0	1	0	Z axis
1	1	1	1	None

	4	1	3
--	---	---	---

							SELB	SEL
7	6	5	4	3	2	1	0	

- SEL 1: Axes can move only if the contacts of handle axis selection signals are closed.
 Set 1 for specs B and C and also A if the axis selection signals are to be made
 valid.
 0: Handle axis selection signals are invalid.
- SELB 1: Spec B
 0: Spec A or C

	4	1	8
--	---	---	---

HXNO + HDCNT									
--------------	--	--	--	--	--	--	--	--	--

- HDCNT: The number of the MPGs to be used. Must be specified for all the specs A, B,
 and C.
 Setting value: 2 or 3
- HXNO: When using Spec B, specify the MPG number (n-th) to be used for X-axis.
 Setting value: 1, 2 or 3

Specify HXNO for the second order position and HDCNT for the first order
position.
(Example) If X-axis is operated by the 1st MPG and the number of MPGs is 3:
Specify 13.

	4	1	9
--	---	---	---

HZNO + HYNO									
-------------	--	--	--	--	--	--	--	--	--

- HYNO : In case of Spec B, specify the MPG number (n-th) for Y-axis.
 Setting value: 1, 2 or 3.
- HZNO : In case of Spec B, specify the MPG number (n-th) for Z-axis.
 Setting value: 1, 2 or 3.
 Specify NZNO for the second order position, and HYNO for the first order
 position.
 (Example) If Y-axis is to be operated by the 2nd MPG and Z-axis is to be
 operated by the 3rd MPG:
 Specify the value 32.

	4	2	0
H5N0 + H4N0			

- H4N0 : In case of Spec B, specify the MPG number (n-th) for the 4th axis.
Setting value: 1, 2 or 3.
- H5N0 : In case of Spec B, specify the MPG number (n-th) for the 5th axis.
Setting value: 1, 2 or 3.
Specify H5N0 for second order position, and H4N0 for the first order position.
(Example) If the 4th axis is to be operated by the 1st MPG and the 5th axis is to be operated by the 3rd MPG: Specify 31.

	6	1	8				
UM@8	UM@7	UM@6	UM@5	UM@4	UM@3	UM@2	UM@1
7	6	5	4	3	2	1	0

- UM@1-8 For EIA code, codes corresponding to '@' used in the custom macro instructions are registered.
Example:
UM@8-UM@1 = 10100100
Codes having holes at channels 3, 6 and 8 are assumed as '@' of EIA code.
Address codes which have already been used cannot be specified.
(UM@8-UM@1 = 00000000 indicates that '@' of EIA code is not used.)

	6	1	9
--	---	---	---

UM=8	UM=7	UM=6	UM=5	UM=4	UM=3	UM=2	UM=1
7	6	5	4	3	2	1	0

For EIA code, codes corresponding to '=' used in the custom macro instruction are registered.
Registration method is the same as that for 618 (UM@1-8).

Note: If UM=8-UM=1=00000000, ', '(comma) is regarded as '='.

	6	2	0
</			

- MCSW1-8 Whether macro instructions are called or not by the custom macro instruction calling address registered by TT command.
1: Macro instructions are not called
2: Macro instructions are called
Example:
If MCSW8-MCSW1 = 00010010, macro instructions are not called when the custom macro instruction calling addresses registered by the 2nd and 5th TT command are executed.
Standard setting:
If the FANUC standard program for the conversational automatic programming function is used as it is, set as follows:
MCSW8-MCSW1 = 00100000
Then, macro instructions are not called by ZN (NC language).

M53 series
M57 series
MA1 series

M53 series
M57 series
MA1 series

	6	2	1		RDOT	RCOL			GDBG	MZRN				G28G
					7	6	5	4	3	2	1	0		

Parameters for graphic functions

- RDOT

1: Rapid traverse is drawn in dotted line.
0: Rapid traverse is drawn in solid line.
- RCOL

1: Color specification is effective even for rapid traverse.
(It is recommended to specify RDOT = 1 in order to distinguish from cutting feed.)
0: Color specification is not effective for rapid traverse.
(Specification of the parameter 675 is effective.)
- GDBG

1: Macro variables for drawing are displayed.
0: Macro variables for drawing are not displayed.
- MZRN

1: The mark of the intermediate point in the reference point return is displayed.
0: The mark of the intermediate point in the reference point return is not displayed.
- G28G

1: Validates parameters 720, 721, 722.
(A move specified in parameter 720, 721 and 722 is drawn from an intermediate point during G28 and G30)
0: Invalidates parameters 720, 721, 722
(No move is drawn from an intermediate point)
- M97 series
MA3 series

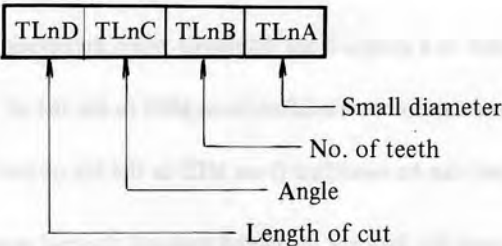
	6	2	2		TL2D	TL2C	TL2B	TL2A	TL1D	TL1C	TL1B	TL1A
					7	6	5	4	3	2	1	0

	6	2	3		TL4D	TL4C	TL4B	TL4A	TL3D	TL3C	TL3B	TL3A
					7	6	5	4	3	2	1	0

	6	2	4		TL6D	TL6C	TL6B	TL6A	TL5D	TL5C	TL5B	TL5A
					7	6	5	4	3	2	1	0

	6	2	5		TL8D	TL8C	TL8B	TL8A	TL7D	TL7C	TL7B	TL7A
					7	6	5	4	3	2	1	0

TLnA-TLnD When tool names added to the tool file, whether or not the cursor skips such items as small diameter, number of tooth, angle and length of cut is specified.



- TLnA-D = 1 The item is skipped.
- = 0 The item is not skipped.

M97 series
MA3 series

	6	2	6		ADP4	ADP3	ADP2	ADP1	CAL	L20	CTL	EBED
					7	6	5	4	3	2	1	0

M97 series
MA3 series

ADP1-ADP4

- 1: The data of additional items 1-4 in the tool file are in real numbers.
 - Unit of 0.1 mm for metric input
 - Unit of 0.01 inch for inch input
- 0: The data of additional items 1-4 in the tool file are in integer numbers.
- CAL 1: Calculation inputs are allowed for the conversational parameter screen.
- 0: Calculation inputs are not allowed for the conversational parameter screen.
- L20 1: Parameters are indicated beginning at the 4th line in the conversational parameter screen. (Same indication method as that for M95 series)
- 0: Parameters are indicated beginning at the 3rd line in the conversational parameter screen. (Indication method for M97 series)
- CTL 1: A special processing is not done for address T on the conversational parameter screen.
(Same indication method as that for M95 series)
- 0: A special processing is done for address T on the conversational parameter screen.
(Same indication method as that M97)
- EBED 1: For the substitution operation for the tool ID number, the 1st tool ID number is substituted for the last tool ID number.
- 0: 0000 is substituted for the last tool ID number.

	6	2	7		DHSQ	MBED	CCLT	LOCR	TITG	COMC		ODMS
					7	6	5	4	3	2	1	0

MA3 series

- DHSQ 1: D and H codes which are used in a selected program are displayed when preparing a list of used tool
- 0: D and H codes which are set in a tool file are displayed when preparing a list of used tool
- MBED 1: T, D and H codes which are used in a selected program are displayed when preparing a list of used tool.
Substitution of tool ID number is done for address M.
- 0: T, D and H codes which are set in a tool file are displayed when preparing a list of tool used.
Substitution of tool ID number is done for address T.
(Always set this parameter to 0)
- CCLT 1: Tool ID numbers registered in F, S file are displayed when preparing a list of used tool.
- 0: Tool ID numbers commanded in a program are displayed when preparing a list of used tool.
- LOCR 1: Offset values displayed in red cannot be modified from MDI in the list of tool used.
- 0: Offset values displayed in red can be modified from MDI in the list of tool used.
- TITG 1: Tool file, tool list and pre-tool list data are displayed without decimal point
- 0: They are displayed with decimal point.

- COMC 1: Common variables (#100 ~ #149) are not cleared to (vacant) by reset operation when parameter 007/CLER = 1.
0: Common variables (#100 ~ #149) are cleared to (vacant) by reset operation when parameter 007/CLER = 1.
- ODMS 1: For the specification of macro alarm messages, Kanji and Hiragana cannot be used as before.
0: For the specification of macro alarm messages, Kanji and Hiragana can be used. However “@” cannot be specified in a message.

	6	2	8
--	---	---	---

PRMSKP	TDISP	TFP2	SKPT	APBK	ERP		PICT
7	6	5	4	3	2	1	0

M97 series
MA3 series

PRMSKP

- 1: Enables the parameter (PRM629 – 632) on the cursor movement of the standard tool contained in tool file.
0: Disables the parameter (PRM629 – 632)

TDISP

- 1: The tool file item display is special
“Small diameter” changed to “Small diameter/pitch”
“Angle” changed to “Angle/fixed value”
0: The tool file item is standard.

TFP2

- 1: The least input increment of tool file data with decimal point is 0.01 (mm input) or 0.001 (inch input).
0: The least input increment of tool file data with decimal point is as specified conventionally.
0.1 (mm input)
0.01 (inch input)

SKPT

- 1: Cursor shifts when data are input to address T in conversational parameter CRT screen.
0: Cursor does not shift when data are input to address T in conversational parameter CRT screen. (TOOL AUTO, F, S AUTO remains displayed on the software key)

APBK

- 1: Even when **EOB** and **ALTER** are keyed in after data are input, if original NC statement ends with , , it is the same operation as **, ALTER** .
0: It is not the same as **, ALTER** .

ERP

- 1: When an alarm has generated during execution of a conversational macro program, the program is displayed when a program screen is selected.
0: When an alarm has generated during execution of a conversational macro program, the main program is displayed when a program screen is selected.

PICT

- 1: Figures displayed on a conversational parameter screen will be erased when **TOOL AUTO** or **F, S AUTO** software key is depressed.
0: It is not erased.
(This parameter is effective when data determined and displayed by pressing **TOOL AUTO** or **F, S AUTO** software key overlaps the figure previously shown, making the screen unreadable.)

TFP2 ~ ERP are
for MA3 series
only.

	6	2	9		7	6	5	4	3	2	1	0
				TL24	TL23	TL22	TL21	TL14	TL13	TL12	TL11	
	6	3	0	TL44	TL43	TL42	TL41	TL34	TL33	TL32	TL31	
	6	3	1	TL64	TL63	TL62	TL61	TL54	TL53	TL52	TL51	
	6	3	2	TL84	TL83	TL82	TL81	TL74	TL73	TL72	TL71	

M97 series
MA3 series

TLn1 to TLn4

Determine whether or not the cursor should skip “small diameter”, “No. of teeth”, “angle” and ”length of cut” of the n-th tool among eight standard tools.

TLn4	TLn3	TLn2	TLn1
Tool length	Angle	Number of teeth	Small diameter

- TLn1 to 4 = 1 Skips the item.
- TLn1 to 4 = 0 Does not skip the item.

These parameters are effective only when parameter PRMSKP = 1 of number 628.

	6	3	3	ROTR						LKTI	NGRP	
				7	6	5	4	3	2	1	0	

MA3 series

- ROTR 1: Whether R value is absolute or incremental depends on G90 and G91.
- 0: Angle value specified in R is of absolute in coordinate system rotation function.
- LKTI 1: F, S file, tool file data cannot be modified from MDI.
- 0: They can be modified.
- NGRP 1: Figure display is not done in conversational parameter CRT screen.
- 0: Figure display is done in conversational parameter CRT screen.

(This parameter can also be set by setting operation.)

	6	3	4								ZE9	
				7	6	5	4	3	2	1	0	

- ZE9 1: “ZE99” is entered when

CYCLE
END

 software key is pressed.
- 0: “ZE99;” is entered when

CYCLE
END

 software key is pressed.

	6	3	5								NGKEY	
				7	6	5	4	3	2	1	0	

- NGKEY 1: Memory protect key is ineffective when tool file or F, S file data are input from tape.
- 0: Memory protect key is effective when tool file or F, S file data are input from tape.

6 4 8	LGKEY 1
6 4 9	LGKEY 2
6 5 0	LGKEY 3
6 5 1	LGKEY 4

M93 series

LGKEY 1 – 4

These set the keys to be used when loading hole groups. If you press the **MENU** key after the keys set by LGKEY 1 – 4, the screen will display the hole group menu.

Key	Set value	Key	Set value
O	12	M	25
N	13	I	26
G	14	J	27
X	15	K	28
Y	16	R	29
Z	17	L	30
U	18	D	31
V	19	H	32
W	20	P	33
E	21	Q	34
F	22	A	35
S	23	B	36
T	24	C	37

FANUC standard programs use L, I, J, and K keys. Set these as follows:

648 = 26 (I)

469 = 27 (J)

650 = 28 (K)

651 = 30 (L)

	6	7	2	P672
	6	7	3	P673
	6	7	4	P674
	6	7	5	P675

M97 series

- P672 – P675 A color to draw tool path is specified.
- P672 A color for cutting feed for drawing during machining
- P673 A color for rapid traverse for drawing during machining
- P674 A color for cutting feed for drawing during program check
- P675 A color for rapid traverse for drawing during program check

Available colors:
0: White, 1: Red, 2: Green, 3: Yellow, 4: Blue,
5: Purple, 6: Light Blue, 7: White

Standard settings:
P672 = 5
P673 = 1
P674 = 5
P675 = 1

	6	8	6	PNOCUTC
--	---	---	---	---------

M97 series
MA3 series

- PNOCUTC A custom-macro program number initiated when the **F, S AUTO** software key in the conversational parameter screen is depressed. If its content is 0, no macro instruction will be initiated.
- Set value: 0-9999

	6	8	7	PNOTOOL
--	---	---	---	---------

M97 series
MA3 series

- PNOTOOL A custom-macro program number initiated when the **TOOL AUTO** software key in the conversational parameter screen is depressed. If its content is 0, no macro instruction will be initiated.
- Set value: 0-9999

	6	9	0
--	---	---	---

GRAPDI

MA3 series

GRAPDI Sets a value read by #1032 by a decimal number during drawing. 0 ~ 255
In #1000 ~ #1015, binary numbers obtained by converting set values are read in correspondence to bits.

(Example) When GRAPDI = 85;
#1032 = 85
#1000, #1002, #1004, #1006 = 1
Others = 0
0000000001010101 = 85
 ↑ ↑
 #1015 #1000

	7	0	0
--	---	---	---

ANGINT

M97 series
MA3 series

ANGINT Parameter for graphic function.
Initial angle for horizontal rotation is specified.
Set value: 0-360 (in degrees)

	7	0	1
--	---	---	---

ANGVT

M97 series
MA3 series

ANGVT Parameter for graphic function.
Initial angle for vertical rotation is specified.
Set value: 0-360 (in degrees)

	7	0	4
--	---	---	---

ROTAX

MA3 series

Setting value	Name of axis
1	X
2	Y
3	Z
4	4th
5	5th
-1	B3 digit

	7	0	6
--	---	---	---

NOPRTCT

M97 series
MA3 series

NOPRTCT Area to protect common variables (#500 to #559) stored in bubble memory.
Setting value: 0 to 60
Specify the number of variables to be protected as counted from #559 in the descending order.
Example:
If NOPRTCT = 10, ten common variables of #549 to #559 are protected and these values can be made not to be altered by macro substitution statement or by MDI operation.

	7	1	3
--	---	---	---

DAPRCH									
--------	--	--	--	--	--	--	--	--	--

M97 series
MA3 series

DAPRCH The distance between approach auxiliary point and approach end point is set on contour approach.
Setting value: 1 to 99999999
Unit: 0.001 mm (mm input) or
0.0001 inch (inch input)

	7	1	6
--	---	---	---

RTANGL									
--------	--	--	--	--	--	--	--	--	--

MA3 series

RTANGL Angle of rotation in "Coordinate System Rotation"
Setting value: 0 ~ 360000 Unit: 0.001 deg.
This value becomes effective when R is not specified in G68 block.
Setting is also possible.

	7	2	0
--	---	---	---

G28X									
------	--	--	--	--	--	--	--	--	--

MA3 series

	7	2	1
--	---	---	---

G28Y									
------	--	--	--	--	--	--	--	--	--

	7	2	2
--	---	---	---

G28Z									
------	--	--	--	--	--	--	--	--	--

G28X, Y, Z Incremental amounts for drawing are set from intermediate points of X, Y, Z axes respectively.
Setting amount: -99999999 ~ 99999999
(Input unit)
(If an excessively large value is set, it overflows the drawing range.)

(Note) Effective only when parameter 621/G28G = 1.

294

1	0	0	0
---	---	---	---

}

Pitch error compensation amount

}

5	1	2	7
---	---	---	---

Pitch error compensation amount

1000 ~ 1127	Pitch error compensation amount for X axis
2000 ~ 2127	Pitch error compensation amount for Y axis
3000 ~ 3127	Pitch error compensation amount for Z axis
4000 ~ 4127	Pitch error compensation amount for 4TH axis
5000 ~ 5127	Pitch error compensation amount for 5TH axis

Setting amount $0 \sim \pm 7$

If -9999 is set, all the compensation for that axis become zero.

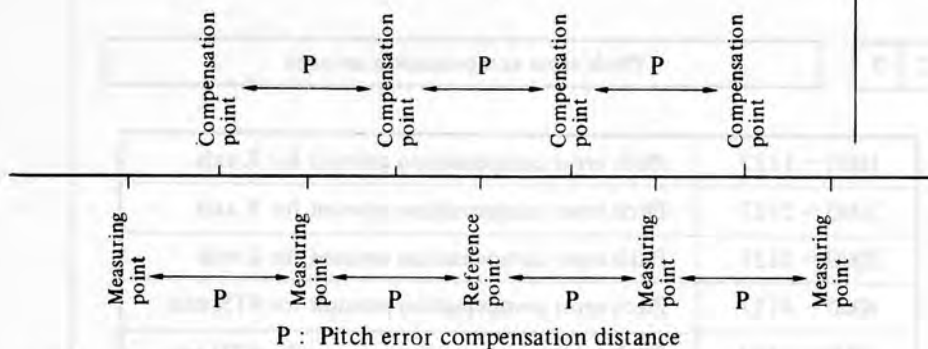
Refer to parameter
024, 039 ~ 042, 416,
163 ~ 166, 436.

(Note 1) Pitch error compensation becomes effective after completion of reference point return for each axis. Even if parameter setting for pitch error compensation is performed, the compensation does not become effective unless reference point return is performed. These parameter setting must be done before completion of reference point return.

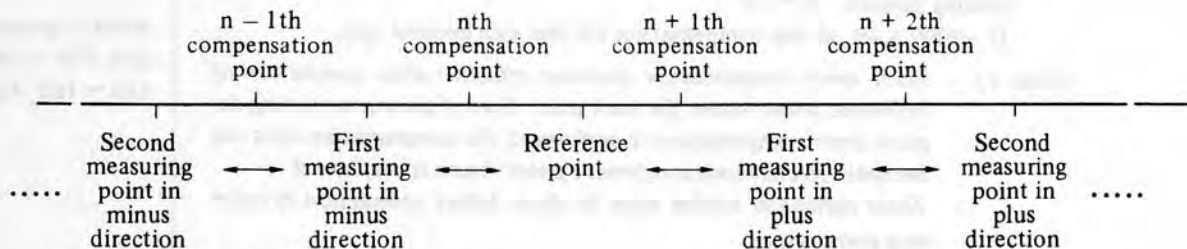
This parameter amount multiplied by compensation magnification (parameter 024) is actual compensation amount.

(Note 2) Setting unit of pitch error compensation values becomes detection unit when parameter No. 316 ACMR = 1 (Arbitrary command multiply).

Each distance of compensation point in pitch error compensation is same. Set that pitch for each axis. Compensation points are 128 points (0 ~ 127) in each axis.



There to minimum limit in pitch error compensation distance.



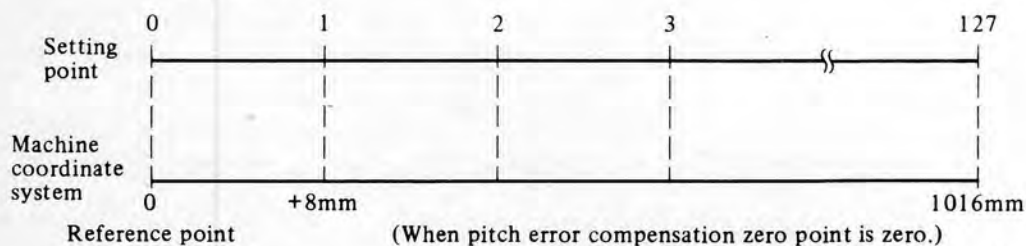
Measure the pitch error by every same distance of measuring point (parameter 163) from reference to plus direction and set the error amount of first measuring point to the $(n + 1)$ th compensation point amount. The error amount of second measuring point, third measuring point ... are set to $n + 2, n + 3 \dots$ so on.

In minus direction, same as above procedure

In case sign of data is plus, the pitch error compensation is performed same direction to current movement direction.

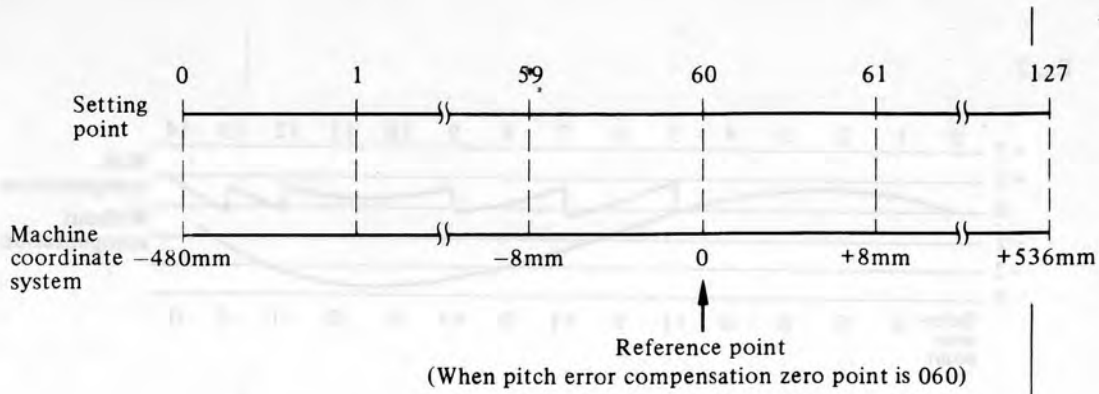
If sign is minus, it is performed reverse direction to current movement direction.

For instance, if assumed 0 for pitch error zero point, the set point 1 is in position of +8.000 mm and the set point 127 is in position of +1016.000 mm. Thus, compensation can be made from 0 to the position of +1016.000 mm.



And, when pitch error compensation zero point is set to 60, 61st setting point is +8 mm position, setting zero point is -480 mm position, and 127th setting point is +536 mm position.

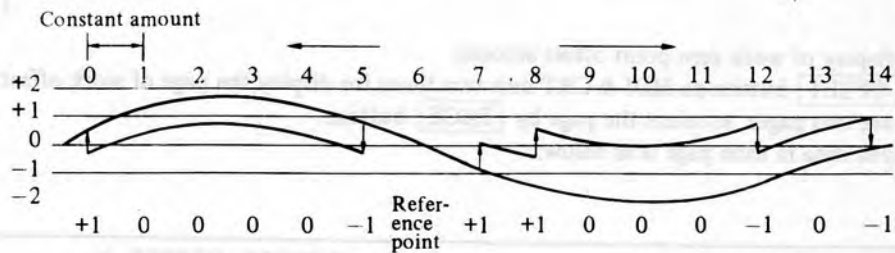
So, the compensation can be performed in the range from -480 to +536 mm.



Pitch error zero point should be set according to the machine stroke and reference point. Parameter numbers from 039 to 042 and 416 are used for these setting.

Ex. 1

Error on position



Pitch error compensation amount are set by increment amount. Sign means direction of compensation. When axis reach at compensation point in +direction.

- error means + compensation
- + error means - compensation.

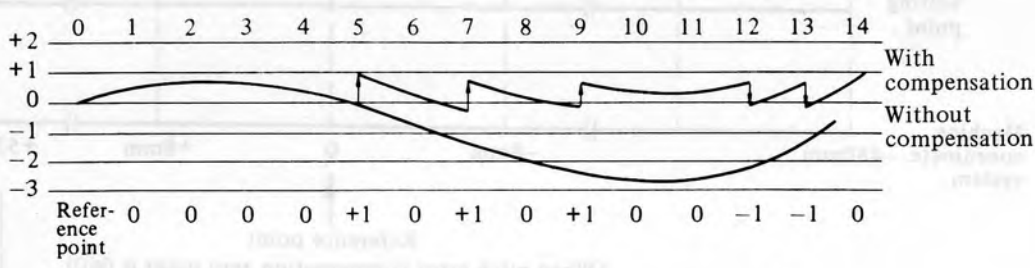
When axis reach at compensation point in - direction

- error means - compensation
- + error means + compensation.

Parameter number 024 : multiply ratio

- 039 : Setting zero point of pitch error for X axis
- 040 : Setting zero point of pitch error for Y axis
- 041 : Setting zero point of pitch error for Z axis
- 042 : Setting zero point of pitch error for 4th axis
- 416: Setting zero point of pitch error for 5th axis.
- 163 ~ 166, 436: Pitch error compensation interval.
- 1000 ~ 1127: Pitch error compensation amount for X axis.
- 2000 ~ 2127: Pitch error compensation amount for Y axis.
- 3000 ~ 3127: Pitch error compensation amount for Z axis.
- 4000 ~ 4127: Pitch error compensation amount for 4th axis.
- 5000 ~ 5127: Pitch error compensation amount for 5th axis.

Ex. 2



Note: Sign of compensation amount is changed by moving direction, but it doesn't have relation with zero position.

The Number indicated in the table below should be set on number indicator.

Reference 1

Setting and display of work zero point offset amount.

- (1) Press **OFFSET** button on MDI & CRT unit two times for display the page of work offset.
- (2) There are two pages, so select the page by **PAGE** button.
- (3) Displayed data in each page is as below.

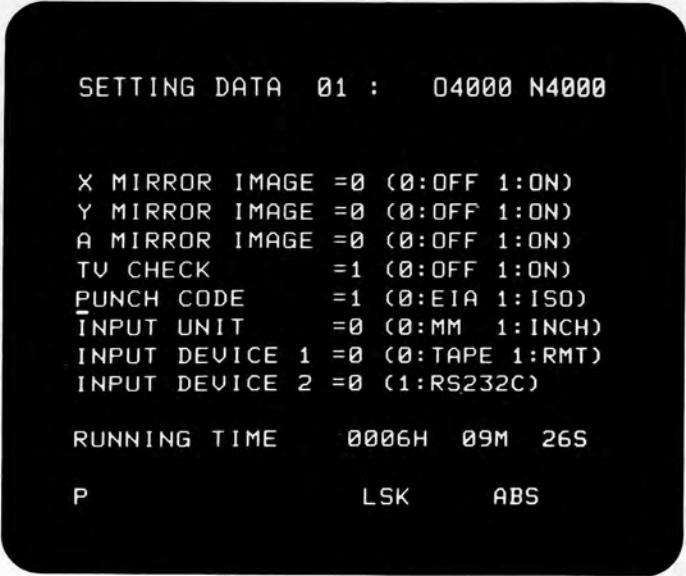
Page 1 (WORK OFFSET 1)	Page 2 (WORK OFFSET 2)
0 0 : Work coordinate system shift amount.	0 4 : The 4th work zero point offset amount. (G57)
0 1 : The 1st work zero point offset amount (G54).	0 5 : The 5th work zero point offset amount. (G58)
0 2 : The 2nd work zero point offset amount (G55).	0 6 : The 6th work zero point offset amount. (G59)
0 3 : The 3rd work zero point offset amount. (G56)	

Reference 2

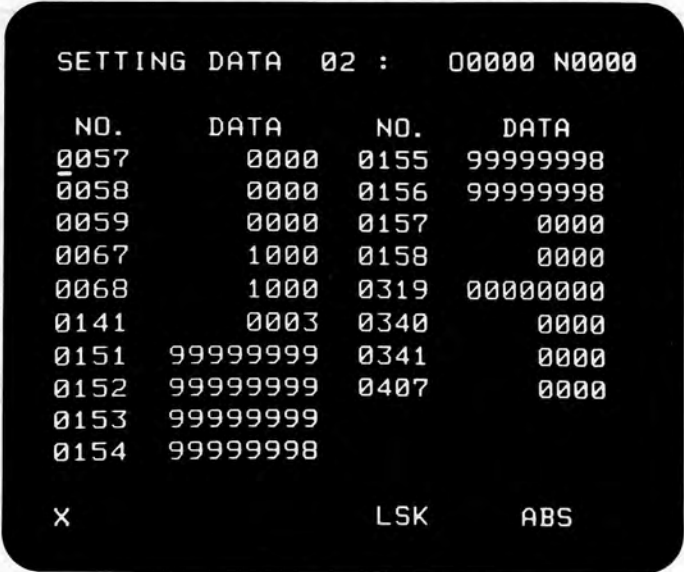
Setting and display by page of setting.

Data No.	Contents
000	Setting for Input/Output interface (RS232C, RMT, INCH, ISO, TVON, REV4, REVY, REVX).
057*	Run hour (1 hour step) (TMHOR)
058*	Run hour (1 minute step) (TMMIN)
059*	Run hour (2 sec. step) (TMSEC)
067*	Retract amount in high speed peck drilling cycle (G73) (CYCR)
068*	Cutting depth in peck drilling cycle (G83) (CYCD)
141*	Run hour (TIME 1)
151*	Stored stroke limit 2, 1st top square zone X axis value.
152*	Stored stroke limit 2, 1st top square zone Y axis value.
153*	Stored stroke limit 2, 1st top square zone Z axis value.
154*	Not used.
155*	Stored stroke limit 2, 2nd top square zone X axis value.
156*	Stored stroke limit 2, 2nd top square zone Y axis value.
157*	Stored stroke limit 2, 2nd top square zone Z axis value.
158*	Not used.
171* 179*	F1-digit feed rate.
180	Sequence number where execution is to be stopped in sequence number comparison and stop.
319*	Various settings (PRG8, MCS8, MPD8, MCS7).
340*	Selection of an input device when a program is registered in memory. (IDVICE)
341*	Selection of an output device on punching out (ODVICE)
355*	Deceleration distance Le of inner corner automatic override.
356*	Deceleration distance Ls of inner corner automatic override.

- Blank is displayed in numbers except mentioned above.
- Number with * can be set as same number in page of parameter
- Select page of setting.
- Refer to same parameter number about its contents.



Display for number 000 in setting mode



Display for number 0057 ~ 407 in setting mode

Contents of number 000 in setting mode

Item \ Display	0	1
X MIRROR IMAGE	No	Yes
Y MIRROR IMAGE	No	Yes
4th axis MIRROR IMAGE	No	Yes
TV CHECK	No	Yes
PUNCH CODE	EIA	ISO
INPUT UNIT	MM	INCH
INPUT DEVICE 1	NC tape	RMT
INPUT DEVICE 2	INPUT DEVICE= 1, when registering program tape into memory	Input device by data number 340, when registering program tape into memory

5.5 Parameter initial setting data

Parameters are set to NC as the following table at shipping time. Set suitable values to NC according to each specification at the completion of on-site adjustments.

FANUC SYSTEM 6M PARAMETER TABLE (1)

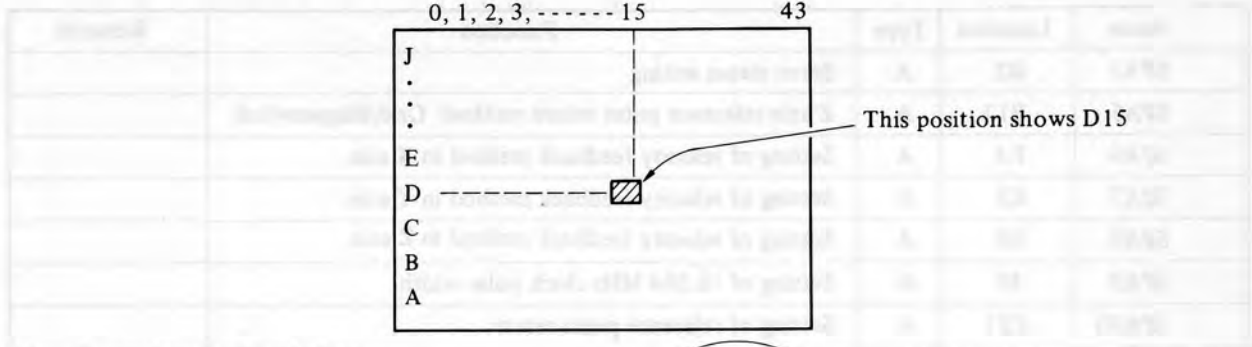
NO	7	6	5	4	3	2	1	0	NO	7	6	5	4	3	2	1	0	NO	7	6	5	4	3	2	1	0
0	Refer to Data sheets								55	-	-	-	-	-	-	-	0	110	-	-	-	-	-	-	-	0
1	-	-	-	-	-	-	-	-	56	-	-	-	-	-	-	-	0	111	-	-	-	-	-	-	-	0
2	-	-	-	-	-	-	-	-	57	-	-	-	-	-	-	-	0	112	-	-	-	-	-	-	-	0
3	-	-	-	-	-	-	-	-	58	-	-	-	-	-	-	-	0	113	-	-	-	-	-	4	0	0
4	-	-	-	-	-	-	-	-	59	-	-	-	-	-	-	-	0	114	-	-	-	-	-	2	0	0
5	-	-	-	-	-	-	-	-	60	-	-	-	-	-	-	-	0	115	-	-	-	-	-	-	-	0
6	0	0	0	0	0	0	0	0	61	-	-	-	-	-	4	0	0	116	-	-	-	-	-	-	-	0
7	1	1	0	0	0	0	0	1	62	-	-	-	-	2	5	5	0	117	-	-	-	-	-	-	-	0
8	0	0	0	0	0	0	0	0	63	-	-	-	-	-	-	0	0	118	-	-	-	-	-	-	-	0
9	0	0	0	0	0	0	0	0	64	-	-	-	-	-	-	0	0	119	-	-	-	-	-	-	-	0
10	0	0	1	0	0	0	0	0	65	-	-	-	-	4	0	0	0	120	-	-	-	-	-	-	-	0
11	0	0	0	0	0	0	0	0	66	-	-	-	-	4	0	0	0	121	-	-	-	-	-	-	-	0
12	0	0	0	0	0	0	0	0	67	-	-	-	-	1	0	0	0	122	-	-	-	-	-	-	-	0
13	0	0	0	0	0	0	0	0	68	-	-	-	-	1	0	0	0	123	-	-	-	-	-	-	-	0
14	0	1	1	1	0	1	1	1	69	-	-	-	-	-	5	0	0	124	-	-	-	-	-	-	-	0
15	0	1	1	1	0	1	1	1	70	-	-	-	-	-	1	0	0	125	-	-	-	-	-	-	-	0
16	0	1	1	1	0	1	1	1	71	-	-	-	-	-	1	0	0	126	-	-	-	-	-	-	-	0
17	0	1	1	1	0	1	1	1	72	-	-	-	-	-	1	0	0	127	-	-	-	-	-	-	-	0
18	0	0	0	0	0	0	1	1	73	-	-	-	-	-	1	0	0	128	-	-	-	-	-	-	-	0
19	0	1	0	0	0	1	0	0	74	-	-	-	-	5	0	0	0	129	-	-	-	-	-	-	-	0
20	0	0	0	0	1	1	1	1	75	-	-	-	-	5	0	0	0	130	-	-	-	-	-	-	-	0
21	0	0	1	1	1	1	1	1	76	-	-	-	-	5	0	0	0	131	-	-	-	-	-	-	-	0
22	0	0	0	0	0	0	0	0	77	-	-	-	-	5	0	0	0	132	-	-	-	9	9	9	9	0
23	0	0	0	0	0	0	0	0	78	-	-	-	-	6	0	0	0	133	-	-	-	9	9	9	9	0
24	0	0	0	0	0	0	0	0	79	-	-	-	-	6	0	0	0	134	-	-	-	-	9	9	9	0
25	0	0	0	0	0	0	0	0	80	-	-	-	-	6	0	0	0	135	-	-	-	-	4	1	1	0
26	0	0	0	0	0	0	0	0	81	-	-	-	-	6	0	0	0	136	-	-	-	4	0	9	5	0
27	-	-	-	-	-	-	-	2	82	-	-	-	-	-	-	0	0	137	-	-	-	-	-	-	-	0
28	-	-	-	-	-	-	-	2	83	-	-	-	-	-	-	0	0	138	-	-	-	-	-	-	-	0
29	-	-	-	-	-	-	-	2	84	-	-	-	-	-	-	0	0	139	-	-	-	-	-	-	-	0
30	-	-	-	-	-	-	-	2	85	-	-	-	-	-	-	0	0	140	-	-	-	1	0	0	0	0
31	-	-	-	-	-	-	-	0	86	-	-	-	-	1	7	9	2	141	-	-	-	-	-	-	-	0
32	-	-	-	-	-	-	-	0	87	-	-	-	-	1	7	9	2	142	-	-	-	-	-	-	-	0
33	-	-	-	-	-	-	-	0	88	-	-	-	-	1	7	9	2	143	9	9	9	9	9	9	9	9
34	-	-	-	-	-	-	-	0	89	-	-	-	-	1	7	9	2	144	9	9	9	9	9	9	9	9
35	-	-	-	-	-	-	-	0	90	-	-	-	-	3	0	0	0	145	9	9	9	9	9	9	9	9
36	-	-	-	-	-	-	-	0	91	-	-	-	-	-	2	0	0	146	-	-	-	-	-	-	-	0
37	-	-	-	-	-	-	5	0	92	-	-	-	-	8	0	0	0	147	-9	9	9	9	9	9	9	9
38	-	-	-	-	-	-	5	0	93	-	-	-	-	8	0	0	0	148	-9	9	9	9	9	9	9	9
39	-	-	-	-	-	-	-	0	94	-	-	-	-	8	0	0	0	149	-9	9	9	9	9	9	9	9
40	-	-	-	-	-	-	-	0	95	-	-	-	-	4	0	0	0	150	-	-	-	-	-	-	-	0
41	-	-	-	-	-	-	-	0	96	-	-	-	-	1	0	0	0	151	9	9	9	9	9	9	9	9
42	-	-	-	-	-	-	-	0	97	-	-	-	-	1	0	0	0	152	9	9	9	9	9	9	9	9
43	-	-	-	-	-	-	-	0	98	-	-	-	-	1	0	0	0	153	9	9	9	9	9	9	9	9
44	-	-	-	-	-	-	-	0	99	-	-	-	-	1	0	0	0	154	-	-	-	-	-	-	-	0
45	-	-	-	-	-	-	-	0	100	-	-	-	-	-	5	0	0	155	9	9	9	9	9	9	9	8
46	-	-	-	-	-	-	-	0	101	-	-	-	-	-	5	0	0	156	9	9	9	9	9	9	9	8
47	-	-	-	-	-	-	-	0	102	-	-	-	-	-	5	0	0	157	9	9	9	9	9	9	9	8
48	-	-	-	-	-	-	-	0	103	-	-	-	-	-	5	0	0	158	-	-	-	-	-	-	-	0
49	-	-	-	-	-	-	-	0	104	-	-	-	-	-	-	0	0	159	-	-	-	-	-	-	-	0
50	-	-	-	-	-	-	-	0	105	-	-	-	-	-	5	0	0	160	-	-	-	-	-	-	-	0
51	-	-	-	-	-	-	-	0	106	-	-	-	-	4	0	0	0	161	-	-	-	-	-	-	-	0
52	-	-	-	-	-	-	-	0	107	-	-	-	-	1	0	0	0	162	-	-	-	-	-	-	-	0
53	-	-	-	-	-	-	-	0	108	-	-	-	-	-	-	0	0	163	-	-	-	8	0	0	0	0
54	-	-	-	-	-	-	-	0	109	-	-	-	-	-	-	0	0	164	-	-	-	8	0	0	0	0

FANUC SYSTEM*6M PARAMETER TABLE (2)

NO	7	6	5	4	3	2	1	0	NO	7	6	5	4	3	2	1	0	NO	7	6	5	4	3	2	1	0
165	-	-	-	-	8	0	0	0	341	-	-	-	-	-	-	3	396	-	-	-	-	-	-	-	-	0
166	-	-	-	-	8	0	0	0	342	-	-	-	-	-	1	0	0	397	-	-	-	-	-	-	-	0
167	-	-	-	-	-	-	-	0	343	-	-	-	-	-	-	0	398	-	-	-	-	-	-	-	-	0
168	-	-	-	-	-	-	-	0	344	-	-	-	-	-	-	0	399	-	-	-	-	-	-	-	-	0
169	-	-	-	-	-	-	-	0	345	-	-	-	-	-	-	0	400	-	-	-	-	-	-	-	-	0
170	-	-	-	-	-	-	-	0	346	-	-	-	-	-	-	0	401	-	-	-	-	-	-	-	-	0
171	-	-	-	-	-	1	0	0	347	-	-	-	-	-	-	0	402	-	-	-	-	-	-	-	-	0
172	-	-	-	-	-	1	0	0	348	-	-	-	-	-	-	0	403	-	-	-	-	-	-	-	-	0
173	-	-	-	-	-	1	0	0	349	-	-	-	-	-	-	0	404	-	-	-	-	-	-	-	-	0
174	-	-	-	-	-	1	0	0	350	-	-	-	-	-	-	0	405	-	-	-	-	-	-	-	-	0
175	-	-	-	-	-	1	0	0	351	-	-	-	-	-	-	0	406	-	-	-	-	-	-	-	-	0
176	-	-	-	-	-	1	0	0	352	-	-	-	-	-	-	0	407	-	-	-	-	1	0	0	0	
178	-	-	-	-	-	1	0	0	353	-	-	-	-	-	-	0										
179	-	-	-	-	-	1	0	0	354	-	-	-	-	-	-	0										
									355	-	-	-	-	-	-	0										
300	Refer to Data sheets								356	-	-	-	-	-	-	0										
301	-	-	-	-	-	-	-	-	357	-	-	-	-	-	-	0										
302	-	-	-	-	-	-	-	-	358	-	-	-	-	-	-	0										
303	-	-	-	-	-	-	-	-	359	-	-	-	-	-	-	0										
304	-	-	-	-	-	-	-	-	360	-	-	-	-	-	-	0										
305	0	0	0	0	0	0	0	0	361	-	-	-	9	9	9	9										
306	0	0	0	0	0	0	0	0	362	-	-	-	9	9	9	9										
307	0	0	0	0	0	0	0	0	363	-	-	-	9	9	9	9										
308	0	0	0	0	0	0	0	0	364	-	-	-	9	9	9	9										
309	0	0	0	0	0	0	0	0	365	-	-	-	-	-	-	0										
310	0	0	1	1	0	0	1	0	366	-	-	-	-	-	-	0										
311	0	0	0	1	1	0	0	1	367	-	-	-	-	-	-	0										
312	0	0	0	1	1	0	0	1	368	-	-	-	-	-	-	0										
313	0	0	0	1	-	-	-	-	369	-	-	-	-	-	-	0										
314	0	0	0	0	0	0	0	0	370	-	-	-	-	-	-	0										
315	0	0	0	0	0	0	0	0	371	-	-	-	-	-	-	0										
316	0	0	0	0	Refer to Data sheets				372	-	-	-	-	-	-	0										
317	0	1	0	0	1	0	0	1	373	-	-	-	-	-	-	0										
318	0	0	0	0	0	0	0	0	374	-	-	-	-	-	-	0										
319	0	0	0	0	0	0	0	0	375	-	-	-	-	-	-	0										
320	-	-	-	-	-	-	-	0	376	-	-	-	-	-	-	0										
321	-	-	-	-	-	-	-	0	377	-	-	-	-	-	-	0										
322	-	-	-	-	-	-	-	0	378	-	-	-	-	-	-	0										
324	-	-	-	-	-	-	-	0	379	-	-	-	-	-	-	0										
325	-	-	-	-	-	-	-	0	380	-	-	-	-	-	-	0										
326	-	-	-	-	-	-	-	0	381	-	-	-	-	-	-	0										
327	-	-	-	-	-	-	-	0	382	-	-	-	-	-	-	0										
328	-	-	-	-	-	-	-	0	383	-	-	-	-	-	-	0										
329	-	-	-	-	-	-	-	0	384	-	-	-	-	-	-	0										
330	-	-	-	-	-	-	-	0	385	-	-	-	-	-	-	0										
331	-	-	-	-	-	-	-	0	386	-	-	-	-	-	-	0										
332	-	-	-	-	-	-	-	0	387	-	-	-	-	-	-	0										
333	-	-	-	-	-	-	-	0	388	-	-	-	-	-	-	0										
334	-	-	-	-	-	-	-	0	389	-	-	-	-	-	-	0										
335	-	-	-	-	-	-	-	0	390	-	-	-	-	-	-	0										
336	-	-	-	-	2	5	5	5	391	-	-	-	-	-	-	0										
337	-	-	-	-	2	5	5	5	392	-	-	-	-	-	-	0										
338	-	-	-	-	2	5	5	5	393	-	-	-	-	-	-	0										
339	-	-	-	-	2	5	5	5	394	-	-	-	-	-	-	0										
340	-	-	-	-	-	-	-	2	395	-	-	-	-	-	-	0										

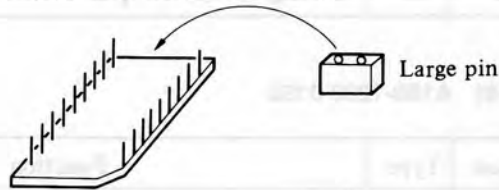
6. SETTING OF PCB

- (1) Setting position is shown as below

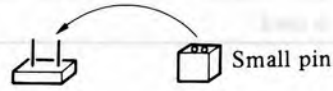


- (2) Type of setting is as below.

A: Large pin



B: Small pin



C: Terminal



This terminal has been fixed with soldering and normally needs not to be changed.

V: Variable



- (3) Edition number of function in PCB is printed as below on the PCB.

Ex. A16B-1000-0030/02B

→ This shows edition number 02B of function.

6.1 Setting and adjustment for control section PCB

Contents	Items
Setting table for control section	6.1.1
Setting on master PCB A16B-1000-0030	6.1.2
Setting on ROM card A16B-1200-0150	6.1.3
Setting on connection unit PCB A20B-0008-0540	6.1.4
Setting on additional axis control (Pulse coder) A20B-0007-0090	6.1.5
Inductosyn/resolver interface PCB A20B-0008-0461	6.1.6
Additional-axis (Resolver/inductosyn) PCB A20B-0008-0470, 471	6.1.7
Master PCB A16B-1000-0030 mounting diagram	6.1.8
ROM card A16B-1200-0150 mounting diagram	6.1.9
Connection unit A20B-0008-0540 mounting diagram	6.1.10
Additional axis (pulse coder) A20B-0007-0090 mounting diagram	6.1.11
Resolver/inductosyn interface PCB A20B-0008-0461 mounting diagram	6.1.12
Additional axis control PCB A20B-0007-0470, 471 mounting diagram	6.1.13
FANUC PC-MODEL B A20B-0008-0440 mounting diagram	6.1.14

6.1.1

6.1.1 Setting table for control section

(1) Master PCB (PCB-A) A16B-1000-0030

Name	Location	Type	Function	Remarks
SPA1	B2	A	Servo status setting	
SPA5	B12	A	Z axis reference point return method: Grid/Magneswitch	
SPA6	F3	A	Setting of velocity feedback method in X axis	
SPA7	E3	A	Setting of velocity feedback method in Y axis	
SPA8	D3	A	Setting of velocity feedback method in Z axis	
SPA9	J8	A	Setting of 16.384 MHz clock pulse width	
SPA10	C11	A	Setting of reference point return	

(2) ROM card (PCB-B) A16B-1200-0150

Name	Location	Type	Function	Remarks
SPB	F4	B	Set "Enable": Set "Disable" only when PC-A RAM PCB is used	

(3) Connection with (PCB-D) A20B-0007-0040, -0041 or A20B-0008-0540

Name	Location	Type	Function	Remarks
S1	E45	A	Setting of connection unit (1, 2)	
S2	E15	A	Selection of output	

(4) Additional axis (pulse coder) PCB-H A20B-0007-0090

(a) When functional version 05C ~ 08E

Name	Location	Type	Function	Remarks
SPH1	A4	A	Motor overheat, overload, VRDY detection method, velocity feedback method	
SPH4	G8	A	4th-axis pulse coder pulse number	
SPH5	F8	A	5th-axis pulse coder pulse number	
SPH7	C9	A	4th-axis reference point return method	

(b) When functional version 09F or later

Name	Location	Type	Function	Remarks
SPH1	A4	A	Overload detection method Velocity feedback method	
SPH4	G8	A	4th-axis pulse coder pulse number	
SPH5	F8	A	5th-axis pulse coder pulse number	
SPH7	C9	A	Motor overheat VRDY detection system Reference point return method	

(5) 9" monochrome graphic control (PCB-C) A16B-1200-0170

Name	Location	Type	Function	Remarks
SPC01	K8	A	Cannot be set or modified	

(6) 14" color graphic control (PCB-G) A20B-1000-0480

Name	Location	Type	Function	Remarks
SPG01	B3	A	Cannot be set or modified	

(7) Resolver / inductosyn control PCB A20B-0008-0461.

Name	Location	Type	Function	Remarks
SPN1X SPN1Y SPN1Z	F3 F8 F11	A	Detected gain range switching	
SPN2X SPN2Y SPN2Z	B5 B9 B13	A	Switching between resolver and inductosyn. Division accuracy adjustment's presence or absence.	
GAIN (VR1X) (VR1Y) (VR1Z)	F3 F8 F11	V	Detected gain adjustment	
FMIN (VR2X) (VR2Y) (VR2Z)	J2 J5 J8	V	DSCG method Fmin adjustment	
FMAX (VR3X) (VR3Y) (VR3Z)	J3 J6 J9	V	DSCG method Fmax adjustment	
BALANCE (VR4X) (VR4Y) (VR4Z)	B3 B7 B11	V	Adjustment of inductosyn division accuracy.	

(8) Additional axis PCBs

(i) Additional 1-axis PCB (resolver control) A20B-0008-0470

Name	Location	Type	Function	Remarks
SPH6	A9	A	Detected gain range switching	
GAIN (VR1H)	B10	V	Detected gain adjustment	
FMIN (VR2H)	D10	V	DSCG method Fmin adjustment	
FMAX (VR3H)	E10	V	DSCG method Fmax adjustment	

(ii) Additional 1-axis PCB (inductosyn control) A20B-0008-0471

Name	Location	Type	Function	Remarks
SPH6	A9	A	Detected gain range switching Division accuracy adjustment's presence or absence	
GAIN (VR1H)	B10	V	Detected gain adjustment	
FMIN (VR2H)	D10	V	DSCG method Fmin adjustment	
FMAX (VR3H)	E10	V	DSCG method Fmax adjustment	
BALANCE (VR4H)	A10	V	Inductosyn division accuracy adjustment	

(iii) Additional 2-axis PCB (resolver control) A16B-1200-0160

Name	Location	Type	Function	Remarks
SPH6	B6	A	Detected gain range switching	
GAIN (VR14, VR15)	C12	V	Detected gain adjustment	
FMIN (VR24, VR25)	D12	V	DSCG method F min adjustment	
FMAX (VR34, VR35)	E12	V	DSCG method F max adjustment	
SPH1	C1	A	Motor overheat, VRDY, overload detection system	

(iv) Additional 2-axis PCB (inductosyn control) A16B-1200-0161

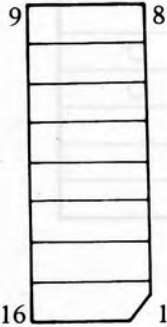
Name	Location	Type	Function	Remarks
SPH6	B6	A	Detected gain range switching Division accuracy adjustment's presence or absence.	
GAIN (VR14, VR15)	C12	V	Detected gain adjustment	
FMIN (VR24, VR25)	D12	V	DSCG method F min adjustment	
FMAX (VR34, VR35)	E12	V	DSCG method F max adjustment	
BALANCE (VR44, VR45)	B12	V	Inductosyn division accuracy adjustment	
SPH1	C1	A	Motor overheat, VRDY, overload detection system	

6.1.2 Setting on master PCB (A16B-1000-0030)

(1) SPA1 (B2)

Y or Z-axis VRDY, OVL or OH is inhibited by mounting a respective short plug as shown below.

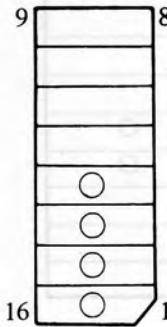
This setting is fixed.
(Without setting)



	Y Axis			Z Axis		
	VRDY	OVL	OH	VRDY	OVL	OH
9 – 8						
10 – 7				○		
11 – 6					○	
12 – 5						○
13 – 4						
14 – 3	○					
15 – 2		○				
16 – 1			○			

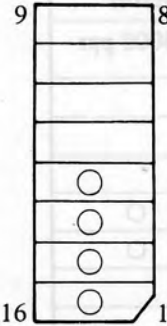
(2) SPA4 (B9)

This setting is fixed as below:



(3) SPA5 (B12)

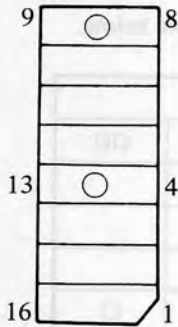
This setting is fixed as below.



	Grid method	Magneswitch method
9 – 8		○
10 – 7		○
11 – 6		○
12 – 5		
13 – 4	○	
14 – 3	○	
15 – 2	○	
16 – 1	○	

(4) SPA6 (F3)

X axis velocity feedback

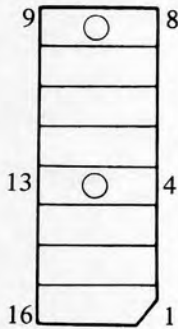


Pulse coder
2000 ppr

	Tacho-generator	Pulse coder + F/V convertor		
		2000 ppr	2500 ppr	3000 ppr
9 – 8		○		
10 – 7				
11 – 6	○		○	
12 – 5				○
13 – 4		○	○	○
14 – 3	○			
15 – 2				
16 – 1				

(5) SPA7 (E3)

Y axis velocity feedback

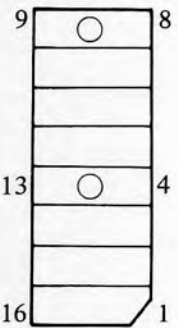


Pulse coder 2000 ppr.

	Tacho-generator	Pulse coder + F/V convertor		
		2000 ppr	2500 ppr	3000 ppr
9 – 8		○		
10 – 7				
11 – 6	○		○	
12 – 5				○
13 – 4		○	○	○
14 – 3	○			
15 – 2				
16 – 1				

(6) SPA8 (D3)

Z axis velocity feedback

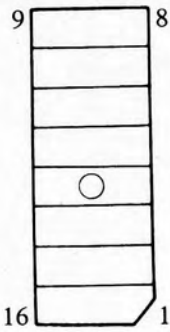


Pulse coder
2000 ppr.

	Tacho-generator	Pulse coder + F/V convertor		
		2000 ppr	2500 ppr	3000 ppr
9 – 8		○		
10 – 7				
11 – 6	○		○	
12 – 5				○
13 – 4		○	○	○
14 – 3	○			
15 – 2				
16 – 1				

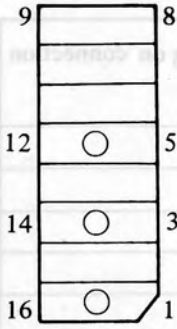
(7) SPA9 (J8)

This setting is fixed. (Setting of clock *C16M pulse for position control)



(8) SPA10 (C11)

Reference point return method.



Grid method
for X, Y and
Z axes

	Z axis	
	Grid method	Magneswitch method
11 - 6		○
12 - 5	○	

	Y axis	
	Grid method	Magneswitch method
13 - 4		○
14 - 3	○	

	X axis	
	Grid method	Magneswitch method
15 - 2		○
16 - 1	○	



9-8 } not use.
10-7 }

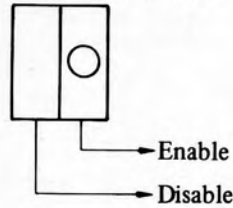
(9) Setting pin at G9 is for spare.

Note) "Magneswitch" in the tables means magneswitch signal from machine side is input to Connector C07 ZDX ~ ZDZ.
In case that magneswitch signal is converted and is input as pulse coder 1 revolution signal, please set as "Grid" in the tables above.

6.1.3 Setting on ROM card (A16B-1200-0150).

(1) SPB (E4)

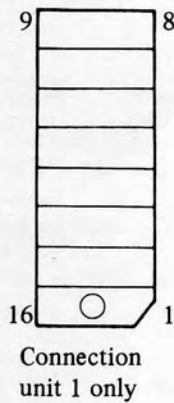
Always set to Enable irrespective of with/without FANUC PC-MODEL A.
Should be set to Disable when RAM board of FANUC PC-MODEL A is used.



(Note) There is no setting on the ROM card A16B-1200-0450.

6.1.4 Setting on connection unit PCB (A20B-0008-0540)

(1) S1 (E45) Connection Unit 1 or 2



	Setting on connection unit 1		Setting on connection unit 2
	Connection unit 1 only	Connection unit 2 is also used.	
9 – 8			
10 – 7			
11 – 6			
12 – 5			
13 – 4			
14 – 3			
15 – 2			
16 – 1			

(2) S2 (E15) Change of common for lamp

9

8

Mark

16

1

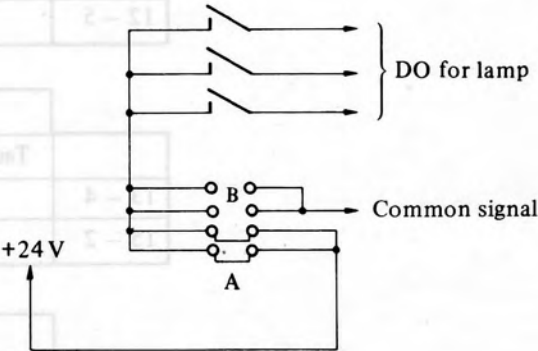
Without PC

	Setting on connection unit 1		Setting on connection unit 2
	Without PC	With PC	
9 – 8		○	○
10 – 7		○	○
11 – 6			
12 – 5			
13 – 4			
14 – 3			
15 – 2	○		
16 – 1	○		

Setting A

Setting B

A: Common is connected to +24N in the NC.
B: Common is connected to machine side.

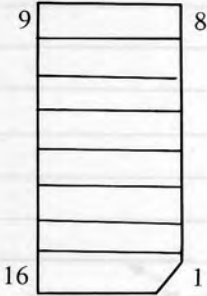


6.1.5 Setting on additional axis control PCB (pulse coder) A20B-0007-0090

(1) When functional edition of the PCB is 05C to 08E (A20B-0007-0090/05C-08E)

(a) SPH1 (A4)

Motor overheat, overload, VRDY detection system, velocity feedback system



Motor overheat detection system		
	4th axis only	Both 4th, 5th axes
10 – 7	☐	

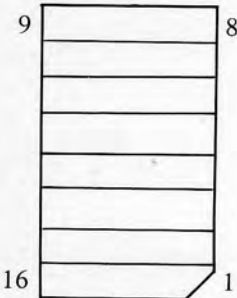
Overload detection system		
	4th axis only	Both 4th, 5th axes
11 – 6	☐	

VRDY detection system		
	4th axis only	Both 4th, 5th axes
12 – 5	☐	

5th axis velocity feedback		
	Tachogenerator	Pulse coder
13 – 4	☐	
15 – 2		☐

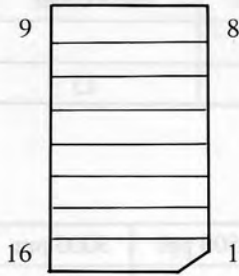
4th axis velocity feedback		
	Tachogenerator	Pulse coder
14 – 3	☐	
16 – 1		☐

(b) SPH4 (G8) 4th axis pulse coder pulse number



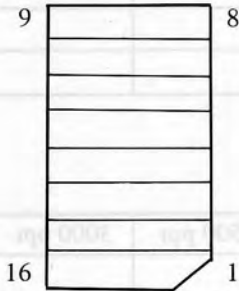
	2000 ppr	2500 ppr	3000 ppr
9 – 8	☐		
10 – 7			
11 – 6		☐	
12 – 5			☐
13 – 4			
14 – 3			
15 – 2			
16 – 1			

(c) SPH5 (F8) 5th axis pulse coder pulse number



	2000 ppr	2500 ppr	3000 ppr
9 - 8	○		
10 - 7			
11 - 6		○	
12 - 5			○
13 - 4			
14 - 3			
15 - 2			
16 - 1			

(d) SPH7 (C9) Reference point return method

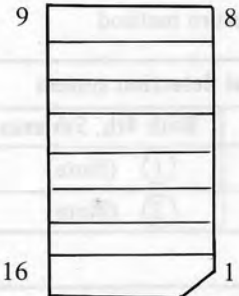


4th-axis reference point return method		
	Grid	Magneswitch
15 - 2		○
16 - 1	○	

(Note) On the PCBs of edition 05C ~ 08E (A20B-0007-0090/05C ~ 08E), the 5th axis reference point return method is fixed as grid method.
If magneswitch method is to be applied to the 5th, use PCB of edition 09 or later (A20B-0007-0090/09F ~).

(2) When functional edition of PCB is 09F or later (A20B-0007-0090/09F ~)

(a) SPH1 (A4) Overload detection method, velocity feedback method

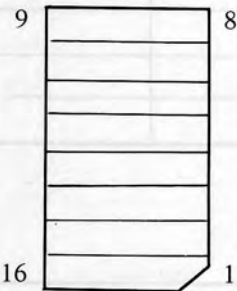


Overload detection system		
	4th axis only	Both 4th, 5th axes
9 - 8		○
10 - 7		
11 - 6	○	

5th-axis velocity feedback system		
	Tachogenerator	Pulse coder
13 - 4	○	
15 - 2		○

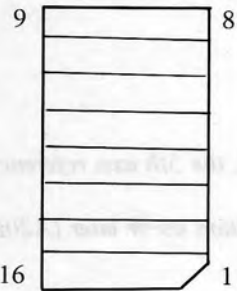
4th-axis velocity feedback system		
	Tachogenerator	Pulse coder
14 – 3	○	
16 – 1		○

(b) SPH4 (G8) 4th-axis pulse coder pulse number



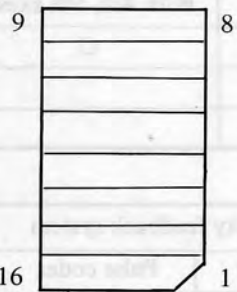
	2000 ppr	2500 ppr	3000 ppr
9 – 8	○		
10 – 7			
11 – 6		○	
12 – 5			○
13 – 4			
14 – 3			
15 – 2			
16 – 1			

(c) SPH5 (F8) 5th axis pulse coder pulse number



	2000 ppr	2500 ppr	3000 ppr
9 – 8	○		
10 – 7			
11 – 6		○	
12 – 5			○
13 – 4			
14 – 3			
15 – 2			
16 – 1			

(d) SPH7 (C9) Motor overheat, VRDY detection system, Reference point return method



Motor overheat detection system		
	4th-axis only	Both 4th, 5th axes
9 – 8		① (Note)
10 – 7	○	② (Note)

VRDY detection system		
	4th-axis only	Both 4th, 5th axes
11 – 6		① (Note)
12 – 5		② (Note)



5th-axis reference point return method		
	Grid method	Magneswitch method
13 – 4		○
14 – 3	○	

4th-axis reference point return method		
	Grid method	Magneswitch method
15 – 2		○
16 – 1	○	

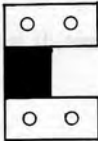
(Note) Note the following items on the settings of motor overheat, VRDY detection system.

(i) Set to ① side (9–8 or 11–6) when replacing with a PCB (A20B-0007-0090) of edition 08E or former.

(ii) Set to the same setting as before when replacing from a PCB to another if both of which are of edition 09F or later.

6.1.6 Inductosyn/resolver interface PCB (A20B-0008-0461)

- (1) Kind of setting and adjustment
- (a) SPN1X (F3) X-axis detection gain range
- SPN1Y (F8) Y-axis detection gain range
- SPN1Z (F11) Z-axis detection gain range

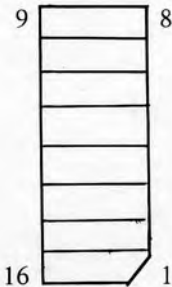


Detection gain range	
High	Low

(Note) Detection gain range shall be changed when an adjustment value is out of the range adjustable by variable resistor VR1α mentioned in (c).

Since detection gain greatly changes if detection gain range was changed, adjust detection gain again using variable resistor.

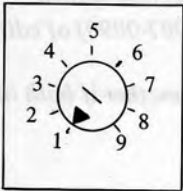
- (b) SPN2X (B5) X-axis inductosyn division accuracy adjustment, position detector
- SPN2Y (B9) Y-axis inductosyn division accuracy adjustment, position detector
- SPN2Z (B13) Z-axis inductosyn division accuracy adjustment, position detector



Inductosyn division accuracy adjustment		
	Effective	Ineffective
10 – 7	○	
11 – 6		○

	Position detector	
	Inductosyn	Resolver
12 – 5		○
13 – 4		○
14 – 3		○
15 – 2		○
16 – 1		○

- (c) VR1X (F3) X-axis detection gain
VR1Y (F8) Y-axis detection gain
VR1Z (F11) Z-axis detection gain



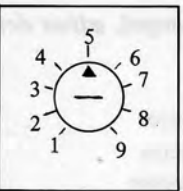
Clockwise → Gain increases
Refer to (2) for adjustment method.

- (d) VR2X (J2) X-axis F min
VR2Y (J5) Y-axis F min
VR2Z (J8) Z-axis F min



Clockwise → F min lowers
Refer to (3) for adjustment method.
This setting has been adjusted at the time of shipment. It is not required to be adjusted.

- (e) VR3X (J3) X-axis F max
VR3Y (J6) Y-axis F max
VR3Z (J9) Z-axis F max



Clockwise → F max increases
Refer to (3) for adjustment method.
This setting has been adjusted at the time of shipment. It is not required to be adjusted.

- (f) VR4X (B3) X-axis inductosyn division accuracy
VR4Y (B7) Y-axis inductosyn division accuracy
VR4Z (B11) Z-axis inductosyn division accuracy



Clockwise → Sine component increases
Refer to (4) for adjustment method.

(2) Adjustment of detected gain

The resolver and the inductosyn excite the primary coil and detect positional information from the secondary-coil output signal. The voltage transfer ratio between the primary and secondary coils varies with the resolver type, the inductosyn type, and the gap distance, whereby the secondary-coil output level varies as well. Also, since the output impedance varies with the inductosyn scale length, the secondary-coil output level is also affected. The detected gain need be adjusted according to the secondary-coil output level, but when no abnormal alarms (414, 424, 434, 444, 454) occur in the resolver/inductosyn position detector, usually the detected gain need not be adjusted.

1	Power OFF, then ON. (When DSCG alarm does not disappear, another trouble has occurred.)
2	Perform Reference Point Return. (Observe TP1 to GND: high-level pulse width of up to 0.5 pulse also will do.)
4	Move the machine tool by 100MM000 wavelength. (When Detect Multiply is 1, detection unit is 100; when 1/3, 20.)
5	Set the parameter. CDSCG = 0 (316, bit 7th)
6	Power OFF.
7	Jump to TP2-GND. (Input of detected pulse to position ISI stops.)
8	Power ON. (DSCG alarm) alarm 414, 424, 434, 444 or 454 must always occur.)
9	Observe TP2-GND on the oscilloscope to adjust detected gain. (when frequency is low, detected gain becomes low.)
	
10	Open TP2 and set parameter PHS to 0 (013, bit 4th).
11	Power OFF, then ON.
12	Set parameter PHS to 1 (013, bit 4th).
13	Repeat steps 6-12 to make sure that adjustment is correct.
14	Restore the parameter. GRD = original value (083-082, 431) CDSCG = 0 (316, bit 7th)

(b) A rule of thumb for adjustment
With an inductosyn, this rule of thumb may vary according to the motor and to the gap distance.

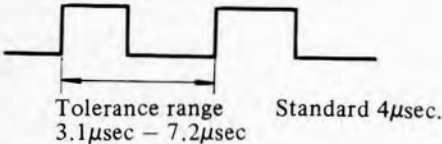
Position transducer		Setting	Variable resistor
Linear inductosyn	Multi-pole resolver (built-in M error monitor)	Standard resistor (motor built-in type)	
		Scale length of up to 1m	
		Scale length of over 1m	
	Type of narrow inductosyn	Scale length of up to 1m	
		Scale length of over 1m	
		More than 2m	
Rotary inductosyn	Common	11 inches, 100 poles	25k
		12 inches, 720 poles	45k
	Differential	7 inches, 100 poles	10k
		7 inches, 720 poles	20k

259

6.1.6

(a) Adjusting procedure of detected gain

Prepare a synchroscope and a jumper with clips (10 cm or more).

Step	Operation
1	Set the parameters: PHS = 1 (013, bit 4) GRD α = 0 (082-085, 421), where α = X, Y, Z, 4, 5 CDSCG = 1 (316, bit 7)
2	Power OFF, then ON. (When DSCG alarm does not disappear, another trouble has occurred.)
3	Perform Reference Point Return. (Observe TP11 α -GND: high-level pulse width of up to 0.5 μ sec also will do.)
4	Move the machine tool by 100/4000 wavelength. (When Detect Multiply is 1, detection unit is 100; when 1/2, 50.)
5	Set the parameters: CDSCG = 0 (316, bit 7th)
6	Power OFF.
7	Jumper TP9-GND. (Input of detected pulse to position LSI stops.)
8	Power ON. (DSCG abnormal alarm 414, 424, 434, 444 or 454 must always occur.)
9	Observe TP5 α -GND on the oscilloscope to adjust detected gain. (when frequency is low, detected gain becomes low.) 
10	Open TP9 and set parameter PHS to 0 (013, bit 4th).
11	Power OFF, then ON.
12	Set parameter PHS to 1 (013, bit 4th).
13	Repeat steps 6-12 to make sure that adjustment is correct.
14	Restore the parameters. GRD = original value (082-085, 421) CDSCG = 0 (316, bit 7th)

(b) A rule of thumb for adjustment

With an inductosyn, this rule of thumb may vary according to the maker and to the gap distance.

Position transducer		Setting	Variable resistor
Standard resolver (motor built-in type)		Dis- connect	0%
Multipole resolver (built-in M series motor)			60%
Linear inductosyn	Scale length of up to 2m		0%
	Scale length of over 2m		More than 0%
Tape or narrow inductosyn	Scale length of up to 2m		65%
	Scale length of over 2m		More than 65%
Rotary inductosyn	12 inches, 360 poles	Connect	0%
	12 inches, 720 poles		65%
	7 inches, 360 poles	Dis- connect	0%
	7 inches, 720 poles		50%

- (3) Adjustment of resolver/inductosyn Fmin and Fmax
Adjust with the Emergency stop button ON.

Item	Adjustment
Fmin	This item has been adjusted at shipment from the factory: usually it need not be readjusted. Use a frequency counter or oscilloscope for adjustment. Jumper TP8 α -GND. Observe TP5 α -GND. Adjusting volume: FMIN Frequency range: 1.67 kHz $\pm$ 150 Hz (Frequency: 0.6 msec $\pm$ 0.06 msec)
Fmax	This item has been adjusted at shipment from the factory: usually it need not be readjusted. Use a frequency counter (not a oscilloscope, which provides no exact adjustment). Jumper TP8 α and -15V. Observe TP5 α -GND. Adjusting volume: FMAX Frequency range: 850 kHz $\pm$ 20 kHz (Frequency: 1.18 μ s $\pm$ 0.045 μ s)

(4) **Adjustment of inductosyn division accuracy**

With division accuracy adjustment set absent, usually a fairly good accuracy can be attained. When division accuracy adjustment set present, adjustment need be made at all times.

(a) **Simple method**

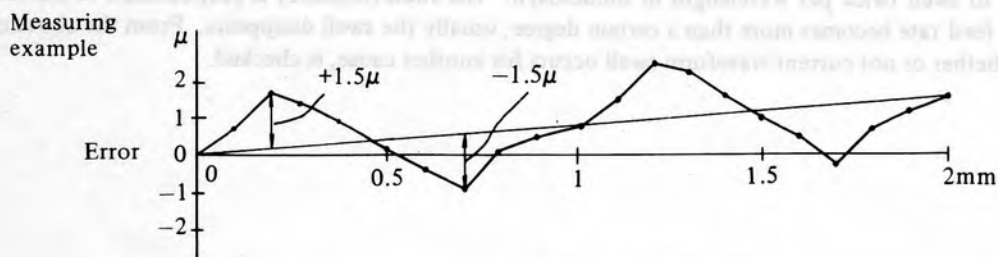
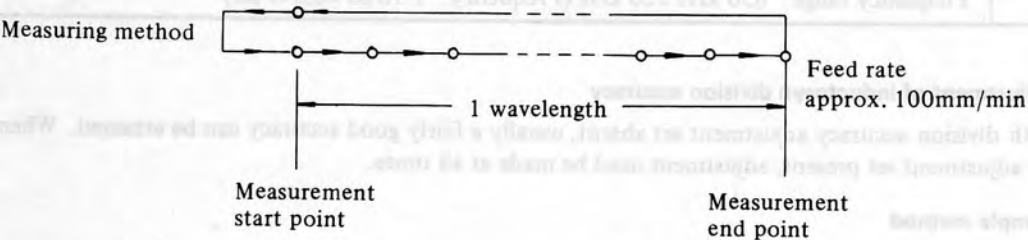
Feed the machine tool at low speed and observe motor-current waveforms on a oscilloscope to adjust volume BALANCE so that current-waveform swell may be smallest. But a division error will cause current waveforms to swell twice per wavelength of inductosyn. The swell frequency is propotionate to the feed rate and as the feed rate becomes more than a certain degree, usually the swell disappears. From the above characteristics, whether or not current-waveform swell occurs for another cause, is checked.



(b) **Strict method**

Adjustment is made by actually measuring the machine tool position, using a high-precision, high-resolution measuring instrument, such as a laser measuring machine. One wavelength of an inductosyn is divided by the NC and the position is detected in resolutions of 1/4000. The accuracy that one wavelength is divided is called the division accuracy. The accuracy within one wavelength is strongly affected by the NC position detector circuit and the position accuracy of an integral multiple of one wavelength depends primarily on the scale accuracy.

The division accuracy is checked by dividing one wavelength into 1/10 or 1/20, measuring the positioning accuracy, writing the error on a graph, and viewing the distance of each division point from a straight line connecting the both ends of the one wavelength.



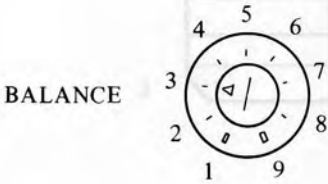
Division error 3 μ wide.

Adjusting volume BALANCE

Measure their respective division accuracy at degrees 2 and 3 on the volume, and write the errors on a graph. Rotate the volume by another one degree in the direction to the smaller error, measure the division accuracy, and observe the condition of the error. The error develops with its peak and valley positioned reversely between when the volume is rotated too much and when it is rotated too little. When it is not found clearly where the peak and the valley are, the volume is set at an optimum position.

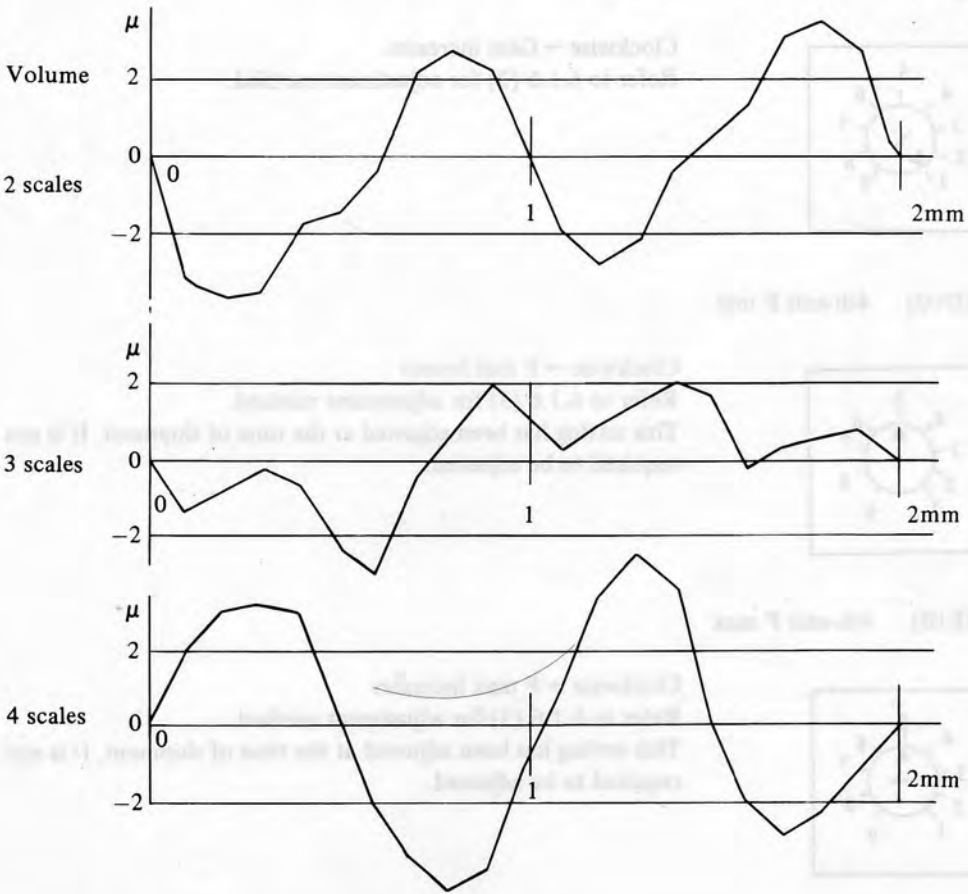
A division error having a two-cycle swell per wavelength of inductosyn, can usually be improved by this adjustment. But a division error having a one-cycle swell or an irregular error cannot be improved by this adjustment. Examine other causes on inductosyn mounting, gap adjustment, slider replacement, etc.

Scale on the volume
Example: 3 scales



Adjusting example

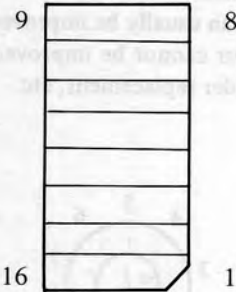
The figure below suggests that about degree 2.8 is an optimum position for the knob to be set.



6.1.7 Additional axis (resolver/inductosyn) PCB

(1) Additional one axis (resolver, inductosyn) PCB
A20B-0008-0470, 0471

(a) SPH6 (A9) Detection gain range, inductosyn division accuracy adjustment



4th axis detection gain range		
	High	Low
9 – 8		○

4th-axis inductosyn division accuracy adjustment		
	Effective	Ineffective
10 – 7	○	
11 – 6		○

(Note) Detection gain range shall be changed when an adjustment value is out of the range adjustable by variable resistor VR1H mentioned in (b).
Since detection gain greatly changes if detection gain range was changed, adjust detection gain again using variable resistor.

(b) VR1H (B10) 4th-axis detection gain



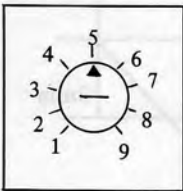
Clockwise → Gain increases
Refer to 6.1.6 (2) for adjustment method.

(c) VR2H (D10) 4th-axis F min



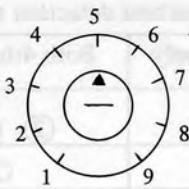
Clockwise → F min lowers
Refer to 6.1.6 (3) for adjustment method.
This setting has been adjusted at the time of shipment. It is not required to be adjusted.

(d) VR3H (E10) 4th-axis F max



Clockwise → F max increases
Refer to 6.1.6 (3) for adjustment method.
This setting has been adjusted at the time of shipment. It is not required to be adjusted.

(e) VR4H (A10) 4th-axis inductosyn division accuracy



Clockwise → Since component increases
Refer to 6.1.6 (4) for adjustment method.

(Note) PCB A20B-0008-0470 does not have VR4H.

(Reference) Either PCB A20B-0008-0470 or A20B-0008-0471 is selected according to the following.

4th axis	(5th axis)	
R	S4A/PC	A20B-0008-0470
I	S4A/PC	A20B-0008-0471

R: Resolver
I : Inductosyn
S4A: S4-digit analog output
PC: Position coder (Threading)

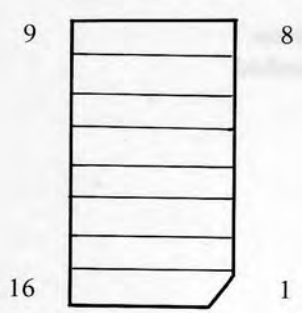
(2) Additional two axes (resolver, inductosyn) PCB
A16B-1200-0160, 0161

(a) SPH1 (C1) Motor overheat, VRDY, overload detection system

(i) In case of functional edition of 01A

9		8	Motor overheat detection system	
			4th axis only	Both 4th, 5th axes
			9 – 8	○
			14 – 3	○
16		1	VRDY detection system	
			4th axis only	Both 4th, 5th axes
			10 – 7	○
			15 – 2	○
			Overload detection system	
			4th axis only	Both 4th, 5th axes
			11 – 6	○
			16 – 1	○

(ii) In case of functional edition of 02B or later



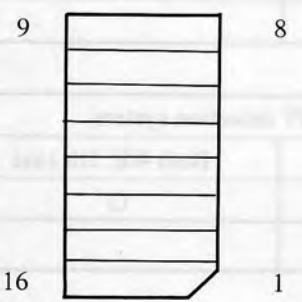
Motor overheat detection system		
	4th axis only	Both 4th, 5th axes
11 – 6	○	② (Note)
12 – 5	○	○
13 – 4		① (Note)

VRDY detection system		
	4th axis only	Both 4th, 5th axes
14 – 3		① (Note)
15 – 2	○	○
16 – 1	○	② (Note)

Overload detection system		
	4th axis only	Both 4th, 5th axes
9 – 8	○	
10 – 7		○

(Note) Note the following items on the settings of motor overheat, VRDY detection system
(i) Set to ① side when replacing with a PCB of edition 01A (A16B-1200-0160, 0161/01A)
(ii) Set to the same setting as before when replacing from a PCB to another if both of which are of edition 02B or later (A16B-1200-0160, 0161/02B ~).

(b) SPH6 (B6) Detection gain range, inductosyn division accuracy adjustment



4th axis detection gain range		
	High	Low
9 – 8		○

4th-axis inductosyn division accuracy adjustment		
	Effective	Ineffective
10 – 7	○	
11 – 6		○

5th axis detection gain		
	High	Low
12 – 5		○

5th-axis inductosyn division accuracy adjustment		
	Effective	Ineffective
13 – 4	○	
14 – 3		○

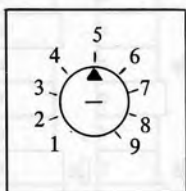
(Note) Detection gain range shall be changed when an adjustment value is out of the range adjustable by variable resistor VR14, VR15 mentioned in (c).
Since detection gain greatly changes if detection gain range was changed, adjust detection gain again using variable resistor.

(c) VR14, VR15 (C12) Detection gain



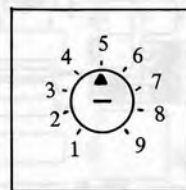
VR14: 4th axis detection gain
VR15: 5th axis detection gain
Clockwise → Gain increases
Refer to 6.1.6 (2) for adjustment method.

(d) VR24, VR25 (D12) F min



VR24: 4th axis F min
VR25: 5th axis F min
Clockwise → F min lowers
Refer to 6.1.6 (3) for adjustment method.
This setting has been adjusted at the time of shipment. It is not required to be adjusted.

(e) VR34, VR35 (E12) F max



VR34: 4th-axis F max
VR35: 5th-axis F max
Clockwise → F max increases
Refer to 6.1.6 (3) for adjustment method.
This setting has been adjusted at the time of shipment. It is not required to be adjusted.

(f) VR44, VR45 (B12) Inductosyn division accuracy



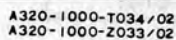
VR44: 4th-axis inductosyn division accuracy
VR45: 5th-axis inductosyn division accuracy
Clockwise → Sine component increases
Refer to 6.1.6 (4) for adjustment method.

(Note) PCB A16B-1200-0160 does not have VR4H.

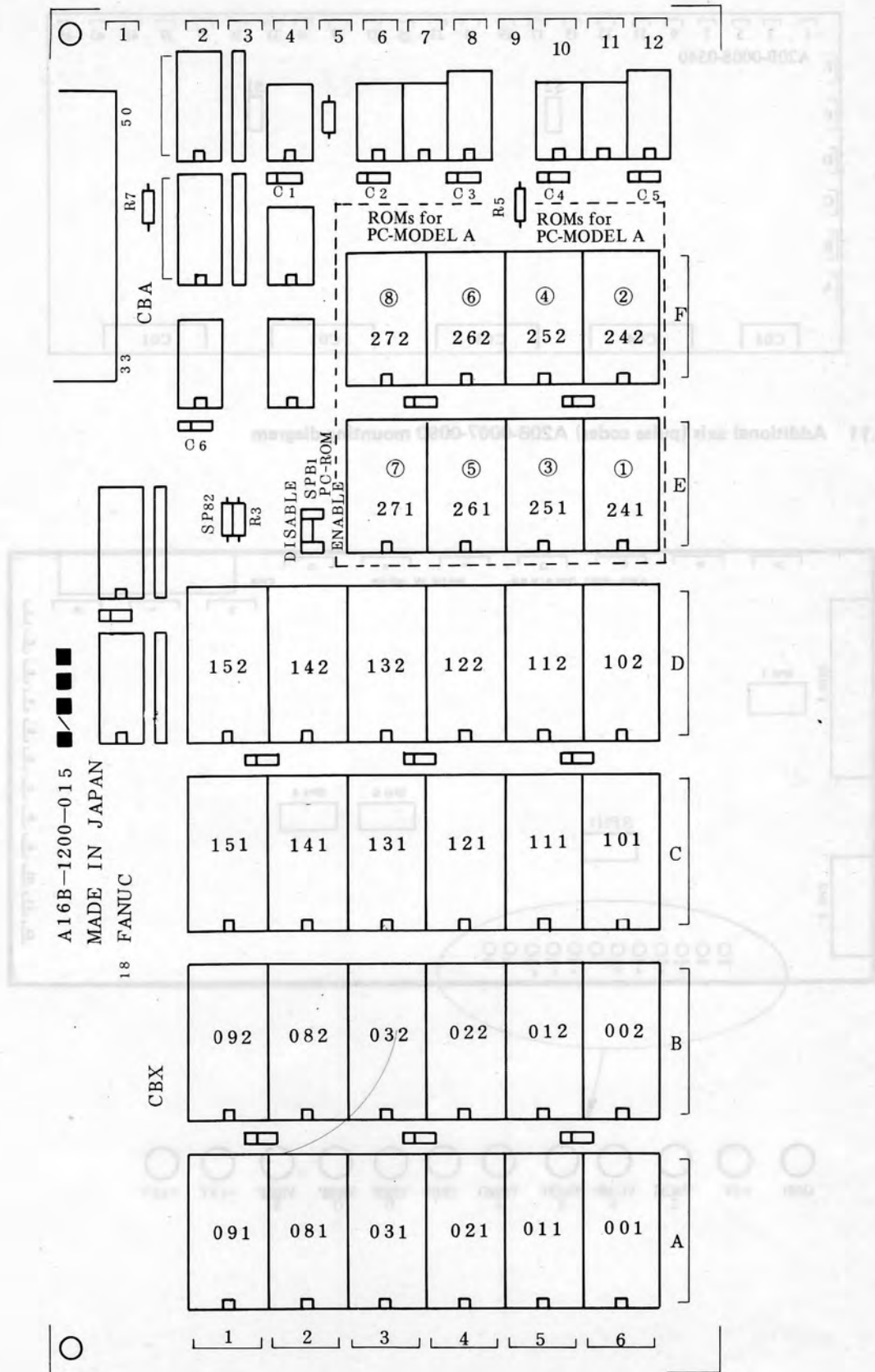
(Reference) Either PCB A16B-1200-0160 or A16B-1200-0161 is selected according to the following.

4th axis	5th axis	PCB
R	R	A16B-1200-0160
R	I	" -0160
I	R	" -0161
I	I	" -0161

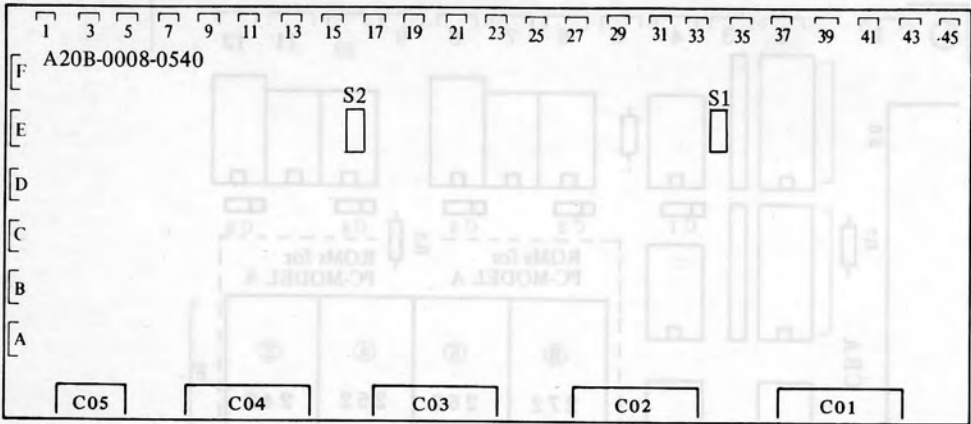
6.1.8 Master PCB (PCB-A) A16B-1000-0030 mounting diagram



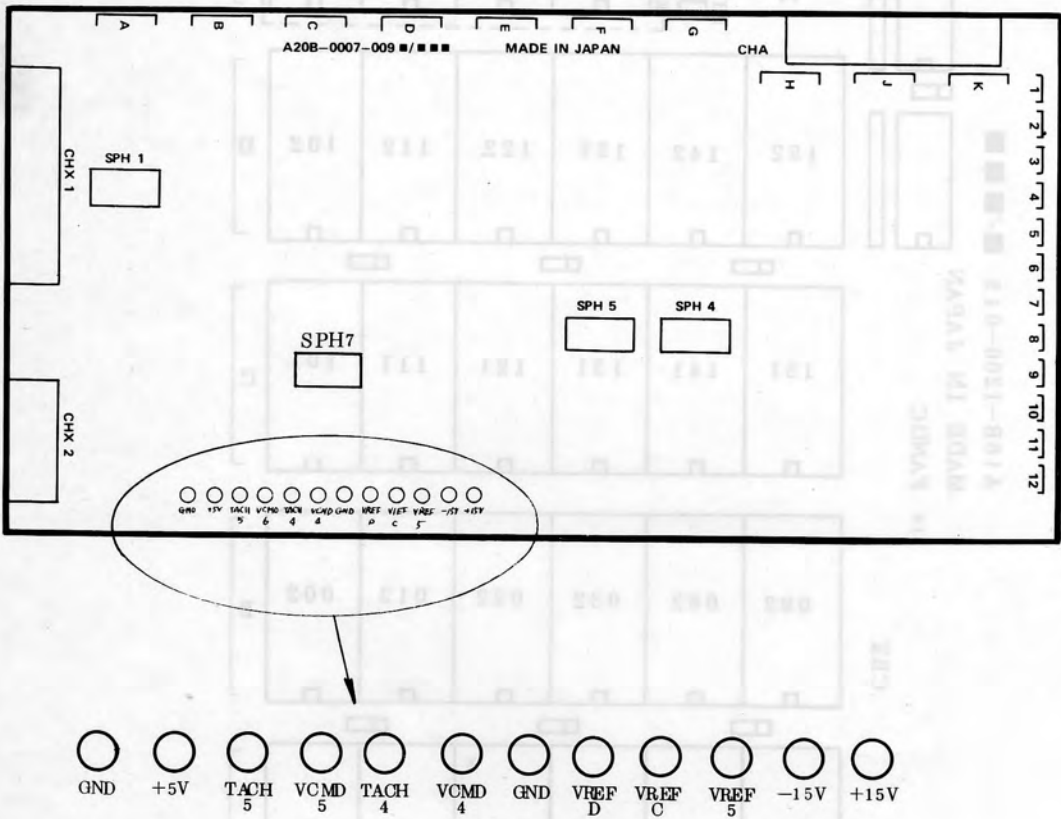
6.1.9 ROM card A16B-1200-0150 mounting diagram



6.1.10 Connection unit A20B-0008-0540 mounting diagram

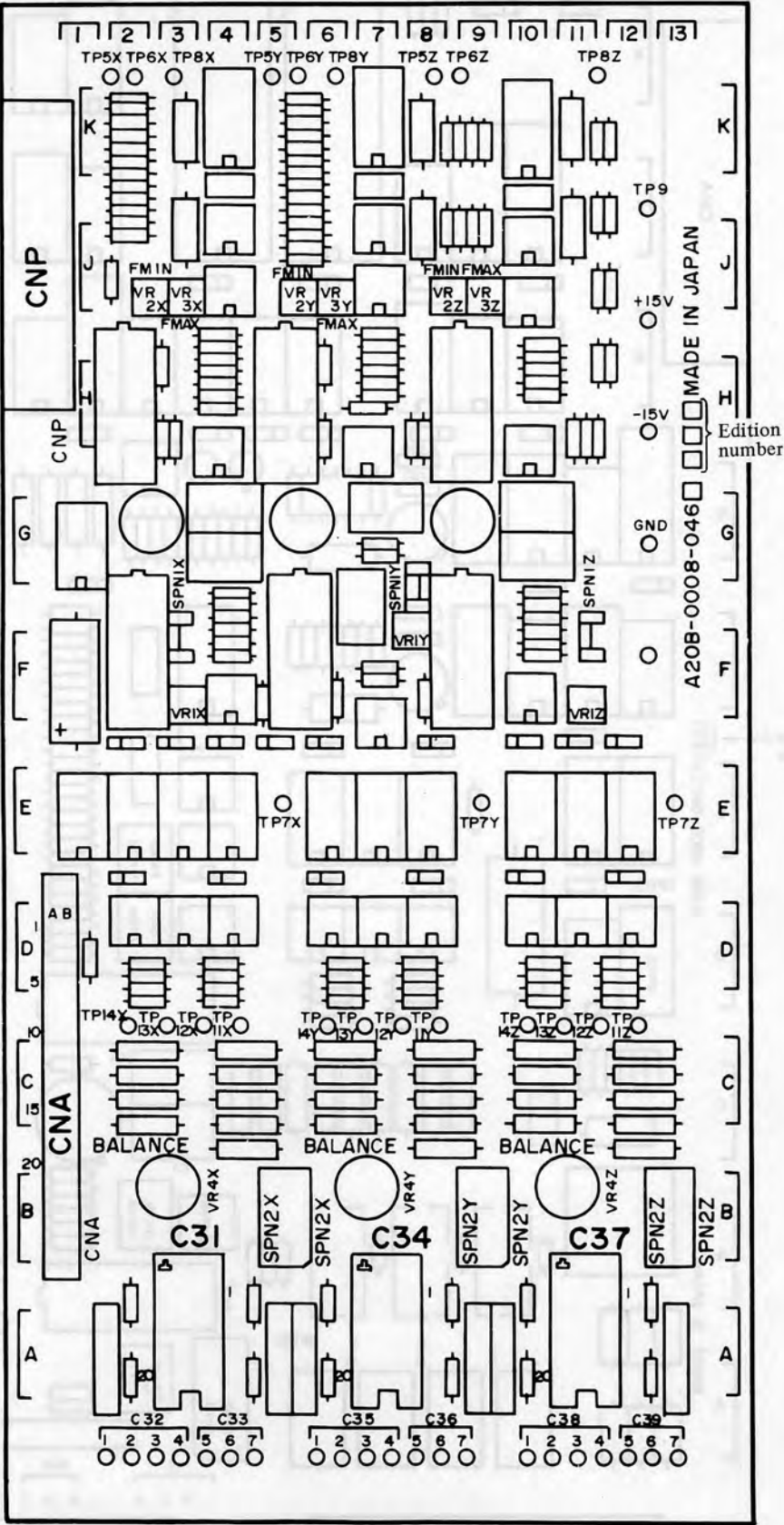


6.1.11 Additional axis (pulse coder) A20B-0007-0090 mounting diagram



6.1.12 Resolver/Inductosyn interface PCB A20B-0008-0461 mounting diagram

A20B-0008-0461



MADE IN JAPAN

A20B-0008-047

SPH3

SPH6

D9

D10

D11

C41

C42

C40

CHX1

TP14H

TP13H

TP12H

TP11H

TP8H

TP6H

TP5H

TP9H

FMIN

FMAX

VR2H

VR3H

VR4H

VR5H

VR6H

VR7H

VR8H

VR9H

VR10H

VR11H

VR12H

VR13H

VR14H

VR15H

VR16H

VR17H

VR18H

VR19H

VR20H

VR21H

VR22H

VR23H

VR24H

VR25H

VR26H

VR27H

VR28H

VR29H

VR30H

VR31H

VR32H

VR33H

VR34H

VR35H

VR36H

VR37H

VR38H

VR39H

VR40H

VR41H

VR42H

VR43H

VR44H

VR45H

VR46H

VR47H

VR48H

VR49H

VR50H

VR51H

VR52H

VR53H

VR54H

VR55H

VR56H

VR57H

VR58H

VR59H

VR60H

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VR71H

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VR74H

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VR106H

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VR108H

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VR346H

VR347H

VR348H

VR349H

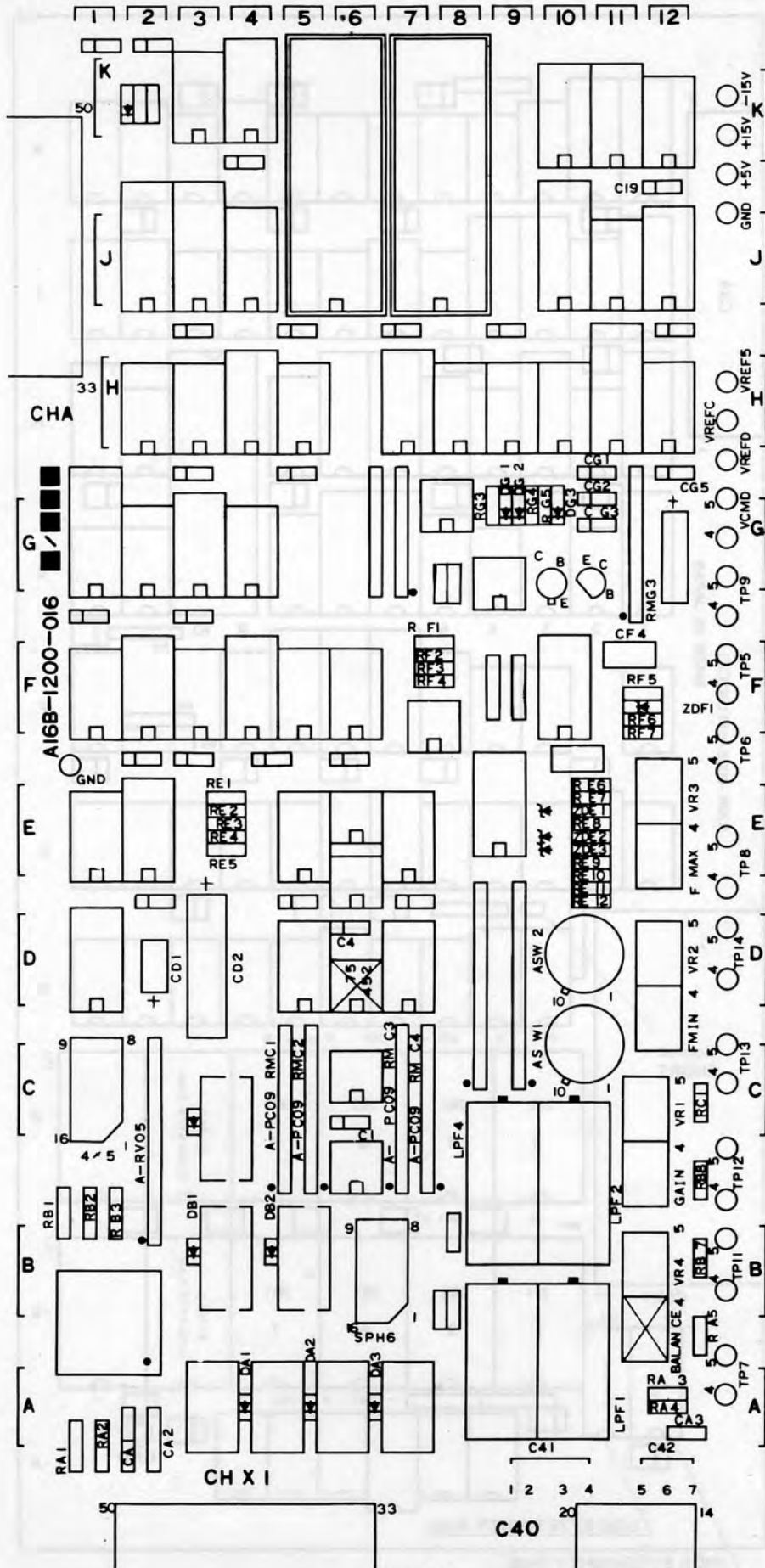
VR350H

VR351H

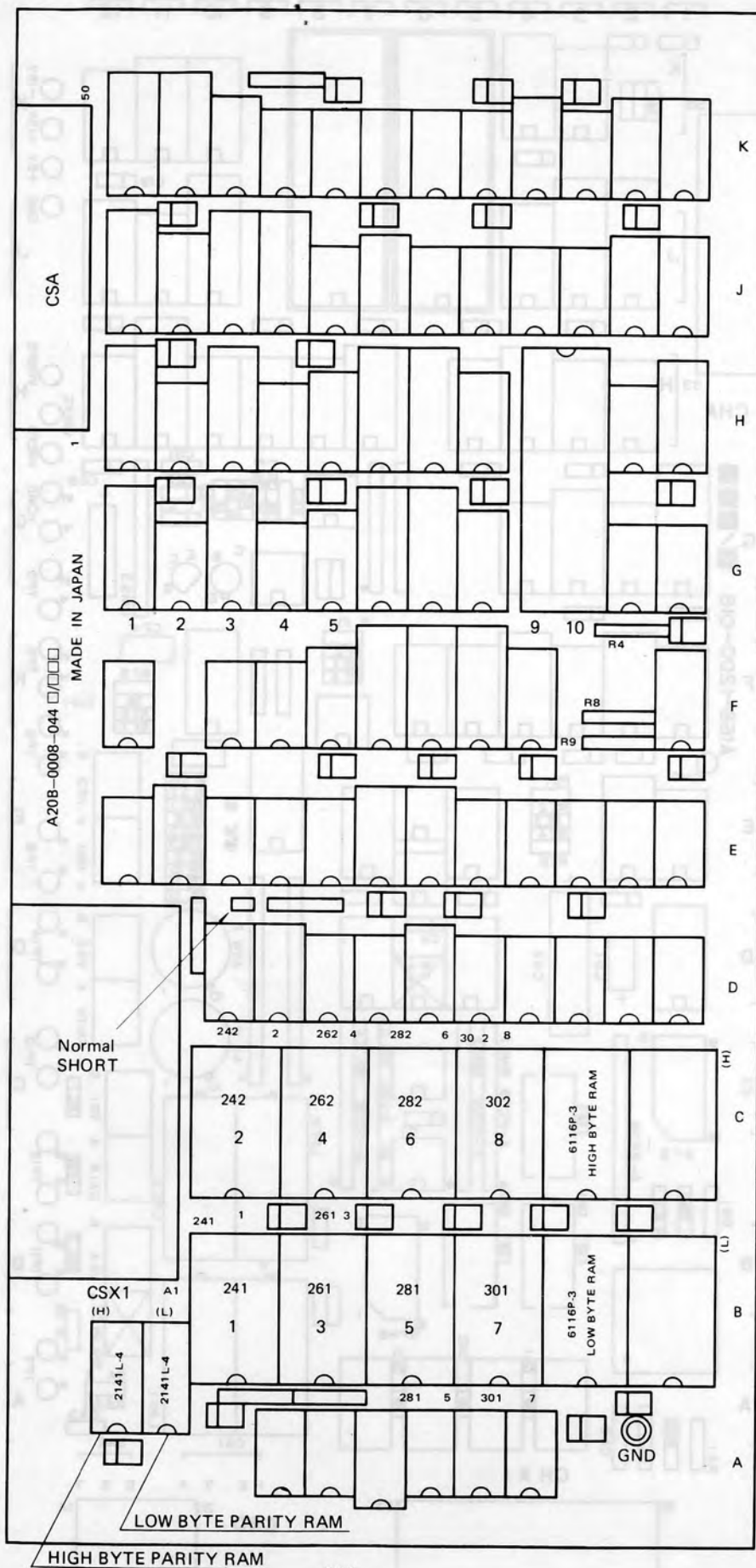
VR352H

VR3

(2) Additional 2-axis (A16B-1200-0160, 0161)



6.1.14 FANUC PC-MODEL B A20B-0008-0440 mounting diagram



6.2 Setting and adjustment for velocity control unit

6.2

6.2.1 Setting and adjustment on velocity control unit PCB (A20B-0009-0320)

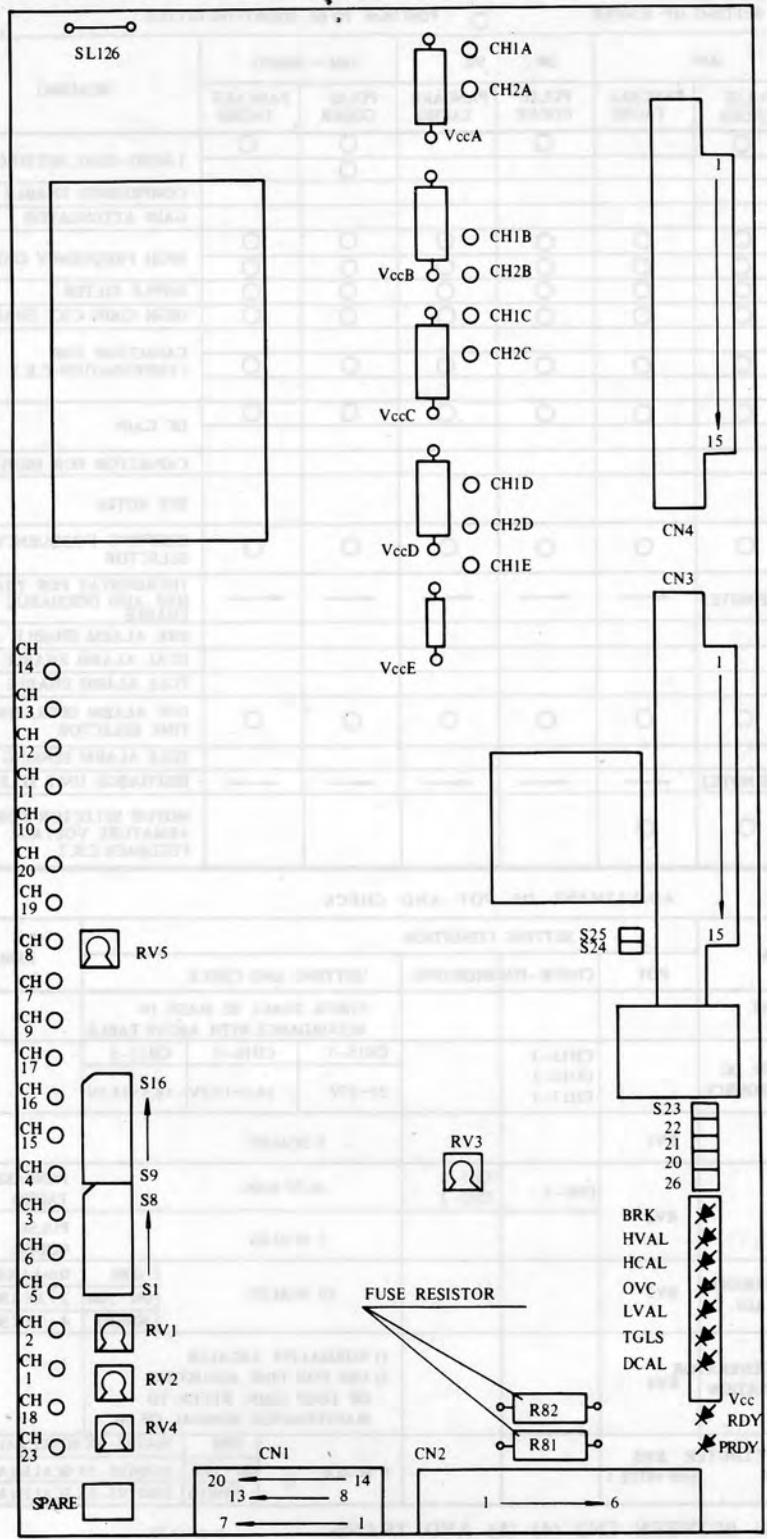
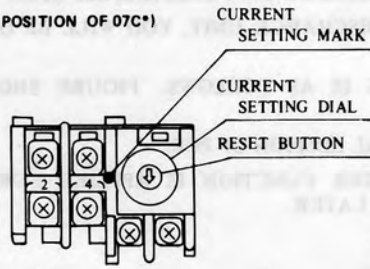


FIG. 1 (PARTS POSITION OF 07C*)

SETTING OF THERMAL RELAY

MOTOR MODEL	CURRENT
00M	4A
0M	6A
5M	9A
10M	12A
20M	18A
30M	24A
30MH	36A



SETTING OF JUMPER							○ : POSITION TO BE SHORTCIRCUITED
JUMPER	00M		0M	5M	10M ~ 30M(H)		MEANING
	PULSE CODER	PANCAKE TACHO	PULSE CODER	PANCAKE TACHO	PULSE CODER	PANCAKE TACHO	
S 1	○		○		○	○	TACHO-GENE. SETTING
2					○		COMPRESSOR ENABLE
3							GAIN ATTENUATOR
4							
5	○	○	○	○	○	○	HIGH FREQUENCY GAIN
6	○	○	○	○	○	○	RIPPLE FILTER
7	○	○	○	○	○	○	HIGH-GAIN C.KT. ENABLE
8	○	○	○	○	○	○	
9							CAPACITOR FOR COMPENSATION C.K.T.
10	○	○	○	○	○	○	
11							DC GAIN
12	○	○	○	○	○	○	
13							CAPACITOR FOR HIGH-GAIN
14							
15							SEE NOTE6
16	○	○	○	○	○	○	CHOPPING FREQUENCY SELECTOR
20	SEE NOTE1	←	←	←	←	←	THERMOSTAT FOR TRANSFORMER AND DISCHARGE UNIT ENABLE
21							BRK ALARM ENABLE
22							DCAL ALARM ENABLE
23							TGLS ALARM ENABLE
24	○	○	○	○	○	○	OVC ALARM OPERATING TIME SELECTOR
25							TGLS ALARM SENSING LEVEL
26	SEE NOTE2	←	←	←	←	←	DISCHARGE UNIT SELECTOR
126	○	○					MOTOR SELECTOR FOR ARMATURE VOLTAGE FEEDBACK C.K.T.

ADJUSTMENT OF POT AND CHECK						
POS	ITEM	SETTING CONDITION				REMARKS
		POT	CHECK-PIN	SHORTING	SETTING AND CHECK	
1	CHECK AT JUMPER				CHECK SHALL BE MADE IN ACCORDANCE WITH ABOVE TABLE	
2	CHECK OF DC POWER SOURCE		CH15-3 CH16-3 CH17-3		CH15-3 22~27V CH16-3 14.5~15.5V CH17-3 14.5~15.5V	
3	GAIN	RV1			5 SCALES	
4	OFFSET	RV2	CH6-3	CH1-3 CH2-3	±0.5V MAX	PANCAKE TACHO
					5 SCALES	PULSE CODER
5	OVERCURRENT ALARM ADJ.	RV3			10 SCALES	00M 0.6+1.1 X SCALE(A) 0M~20M 2 + 3.8 X SCALE(A) 30M(H) 4 + 7.5 X SCALE(A)
6	TACHO-GENERATOR COMPENSATION	RV4			1) NORMALITY 5 SCALES 2) USE FOR FINE ADJUSTING OF LOOP GAIN. REFER TO MAINTENANCE MANUAL OF NC.	
7	CURRENT LIMITER SETTING	RV5 SEE NOTE 5			9 SCALE	00M 564/(93-5X SCALE)(A) 0M~20M 1880/(93-5X SCALE)(A) 30M(H) 3760/(93-5X SCALE)(A)

- Note 1. IF CONNECTION BETWEEN CN2 (4) (5) AND TRANSFORMER OR DISCHARGE UNIT EXISTED, S20 OPEN
2. IF YOU USED DISCHARGE UNIT, YOU WILL BE OPEN-CIRCUIT AT S26.
3. VOLUME SCALE IS AS FOLLOWS. FIGURE SHOWS 8 SCALES.
4. *MARKS IS TOTAL EDITION OF PCB.
5. CURRENT LIMITER FUNCTION IS APPLIED FOR PCB EDITION 02B OR LATER.
6. SETTING OF S15.

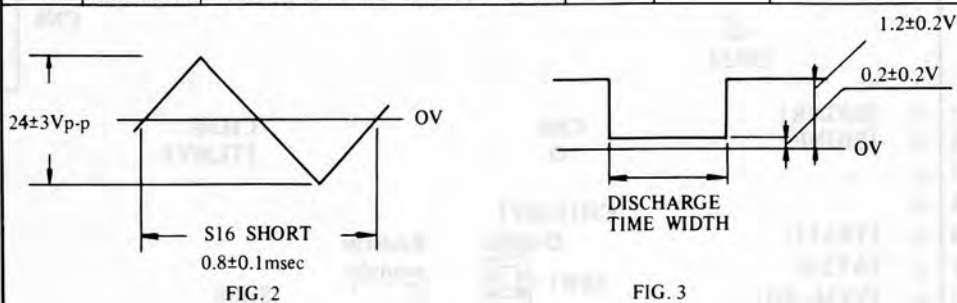
5 SCALES



0 10 SCALES

01A*	CURRENT LIMITER SETTING
02B*03B*	NO CONNECTION
04B*05B*	CHOPPING FREQUENCY SELECTOR
07C*~	0.022μF INTO HIGH FREQ. GAIN DO NOT SHORT S14, S15 TOGETHER

SYMBOL		MEANING OF CHECK TERMINAL SYMBOL			
CH 1		3/4 X VCMD	CH11	PWA	PWM CKT OUTPUT FOR DRIVER A
2	TSA	TACHO-GENERATOR SIGNAL	12	PWB	" B
3	OV	OV	13	PWC	" C
4	OV		14	PWD	" D
5		COMPENSATION C.K.T.	15	+24V	+24V
6			16	+15V	+15V
7	TRIANGLE WAVE	SEE FIG. 2.	17	-15V	-15V
8	CURRENT	00M 0.66V/A	18	VCMD	VELOCITY COMMAND
		0M~20M 0.2V/A	19	VFB1	ARMATURE VOLTAGE FEEDBACK SIGNAL
		30M(H) 0.1V/A	20	VFB2	
9	ER	INPUT SIGNAL OF PWM C.K.T.	23	ENBL	DRIVER ENABLE
10	DISCHARGE	DISCHARGE MONITOR. SEE FIG. 3.			



LED DISPLAY

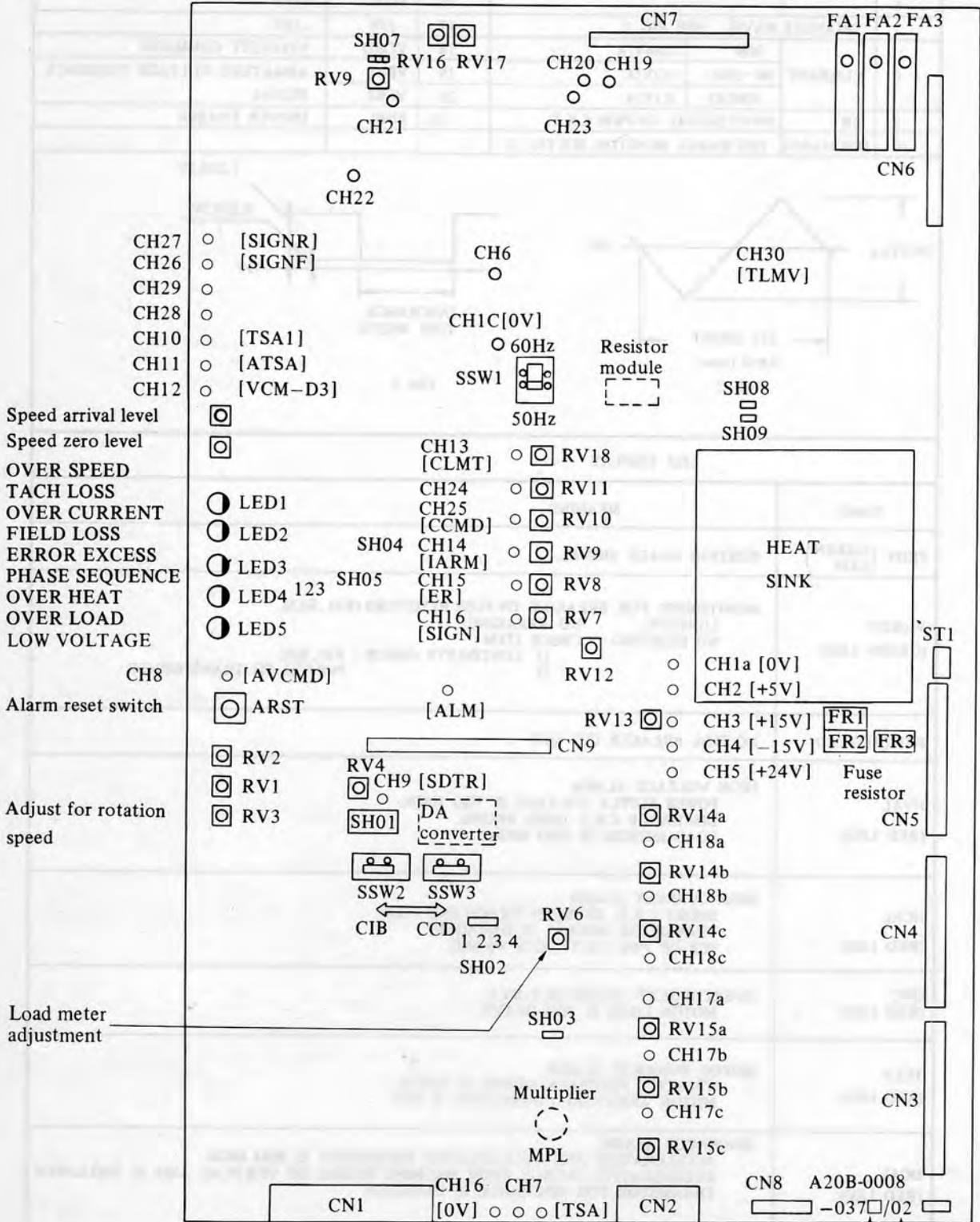
NAME	MEANING
PRDY (GREEN LED)	POSITION READY SIGNAL.
VccRDY (GREEN LED)	MONITORING FOR BREAKING OF FUSE RESISTORS (R81, R82). LIGHTING : NO-BREAKING NO LIGHTING : CHECK ITEM 1) CONTINUITY CHECK : R81, R82 2) PCB CN2 TO TRANSFORMER
BRK (RED LED)	NO FUSE BREAKER CUT OFF
HVAL (RED LED)	HIGH VOLTAGE ALARM POWER SUPPLY VOLTAGE IS TOO HIGH. DISCHARGE C.K.T. GOES WRONG. LOAD INERTIA IS TOO HIGH.
HCAL (RED LED)	HIGH CURRENT ALARM SHORT C.K.T. BETWEEN T1(5)(6) AND (7)(8). TRANSISTOR MODULE IS DAMAGED. PCB OF PWM C.K.T. GOES WRONG.
OVC (RED LED)	OVERCURRENT ALARM (SET RV3) MOTOR LOAD IS TOO HEAVY.
TGLS (RED LED)	MOTOR RUNAWAY ALARM VELOCITY FEEDBACK SIGNAL IS LOSED. MOTOR ARMATURE CONNECTION IS OFF.
DCAL (RED LED)	DISCHARGE ALARM ACCELERATION AND DECELERATION FREQUENCY IS TOO HIGH. REGENERATIVE ENERGY FROM MACHINE WEIGHT OF VERTICAL AXIS IS TOO LARGE. TRANSISTOR FOR DISCHARGE IS DAMAGED.
LVAL (RED LED)	POWER SUPPLY VOLTAGE DROP ALARM. POWER SUPPLY VOLTAGE IS TOO LOW. FAULTY PCB.

6.3 Setting and adjustment for DC spindle servo unit PCB

6.3.1 Setting and adjustment for spindle servo unit (A20B-0008-0371 ~ 7)

(1) Mounting diagram

Alarm fuse
S.Fab 250/402AP413

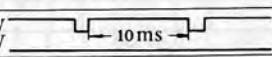


1: For Model 15
2: For Model 12
3: For Model 8
4: For Model 6
5: For Spindle Head
6: For Model 3
7: For Model 4

EDITION No.

(2) List of check terminals

6.3.1

Name	Symbol	Signal name	Contents
TSA		Tacho-generator	Tacho-generator output is checked.
ALM		Alarm terminal	1 when alarm LED1, 2 or 3 lights
CH1a-c	0V	0V level	PC board 0V potential
CH2	+5V	+5V power supply	+5.0V $\pm 3\%$
CH3	+15V	+15V power supply	+15.0V $\pm 3\%$
CH4	-15V	-15V power supply	-15.0V $\pm 3\%$
CH5	+24V	+24V power supply	+24V $\begin{matrix} +10\% \\ -15\% \end{matrix}$
CH6	Field Loss	Field loss alarm	1 at field loss
CH7	DAC OUTPUT	DA converter output voltage	10.0V at Full bits ON
CH8	AVCMD	External feed rate command voltage	Command from outside can be checked.
CH9	SDTR	Feed rate detection voltage	0.3V is set at for gear change.
CH10	TSA1	Normalized feed rate feedback voltage	$\pm 10.0V$ at maximum number of revolutions
CH11	ATSA	Absolute value feed rate feedback voltage	+10.0V at maximum number of revolutions
CH12	VCMD3	Feed rate command voltage	0V $\pm 10mV$ when there is no rotation command.
CH13	*CLMT	Current command limit voltage	-6.2V usually
CH14	IARM	Normalized current feedback voltage	$\pm 4.0V$ (average value) at maximum current
CH15	ER	Phase angle command voltage	0.5-9.5V, approx. 2.7V (50Hz), approx. 4.0V (60Hz)
CH16	SIGN	Direction	+6.2V or -0.6V
CH17a-c	SYNCa-c	Synchronous signal	+10V 0V 
CH18a-c	PHASE a-c	Firing angle display pulse	
CH19	FLDC	Field current feedback voltage	6.8A $\Rightarrow$ -6.2V, 2.8V $\Rightarrow$ -2.5V at stoppage
CH20	AV	Armature voltage feedback voltage	220V $\Rightarrow$ -6.2V
CH21	FER	Field phase angle command voltage	0~6.8V
CH22	SYNCf	Field synchronous signal	Same as CH17
CH23	PHASEf	Field firing angle display pulse	Same as CH18
CH24	IARM	Current feedback voltage	Current value is known. 5mV/1AT.
CH25	CCMD	Current command voltage	$\pm 8V$ at maximum command
CH26	*SIGNF	Forward gate release	Forward (F) thyristor ON at 0
CH27	*SIGNR	Reverse gate release	Reverse (R) thyristor ON at 0
CH28	USRF	Feed rate arrive level	1.5V = 15%
CH29	ZSRF	Zero feed rate level	75mV = 0.75%, 150mV = 1.5%
CH30	CCMD	Current command	$\pm 2.6V$ = maximum current, check at torque limit

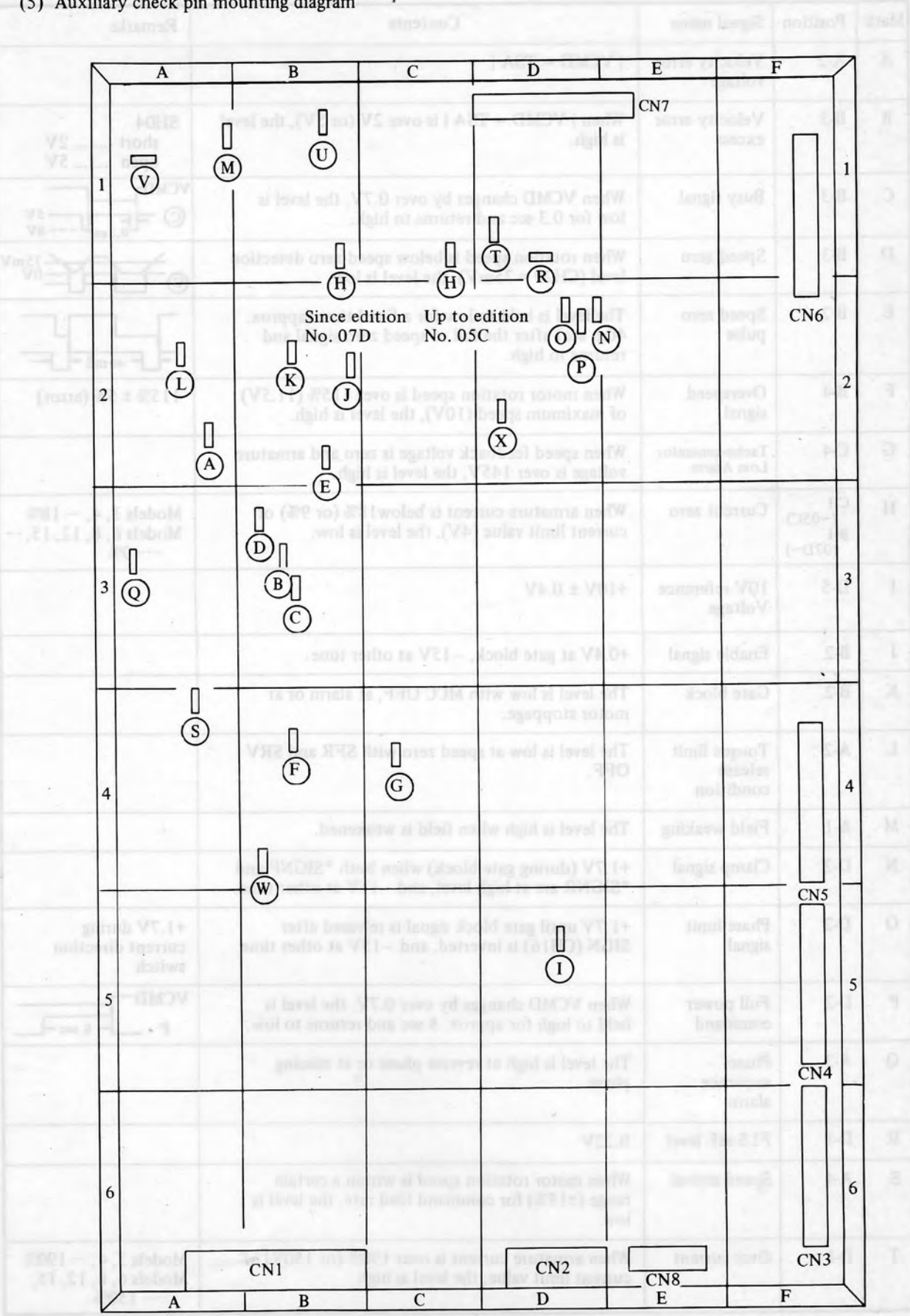
No.	Contents	SLIDE SWITCH SSW1 SSW2 SSW3	SH01 01 02 03 04 05 06 07 08 16 15 14 13 12 11 10 09	SH02 1 2 3 4	SH 03 04	SH05 1 2 3	SH 06 07 08 09	A8 B8 A9 B9 A11 B11 A13 B13
1	Frequency 60Hz 50Hz	↑ Up ↓ Down						
2	DA converter Binary 12 bits BCD 2-digits	↔ Left → Right						
3	CSSC is provided		○					
4	Tapping function is provided		X					
5	Machine ready signal is not used			○				
6	Spindle override function is not used							
7	Limitation of override of spindle 100% 120%			X X				
8	External velocity command is used			X				
9	Speed detector Position corder Blashless Tacho 4500 rpm Tacho 3500 rpm			X X X				
10	Output control (option) is not used				○			
11	Limitation of speed error ±20% ±50%							
12	Release method of torque limit Release with condition Direct release MODEL 15, 8					○ X		
13	Limitation of motor current MODEL 3,4,6 12, spindle head					X ○		
14	Setting by input voltage AC 200V AC 220/230V						○	
15	Setting of over current MODEL 6,8,12, 15 MODEL 3,4 Spindle head						○	
16	Setting of current zero MODEL 6,8,12,15 MODEL 3,4 Spindle head						X	
17	Electric spindle orientation							

(4) Adjustment

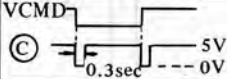
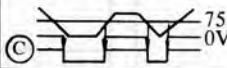
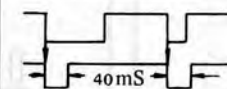
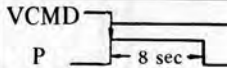
No.	Trimmer	Item	Observation	Adjusting Standard	Standard (motor model)							○ : Necessary to adjust		
					15	12	8	6	Spindle Head	3	4	FANUC	Machine Tool Builder	User
1	RV1	Velocity command voltage gain	CH8	Full bits ON 10.0V					45 ~ 55%			Performed		
2	RV2	Velocity command voltage offset	CH8	Full bits OFF 0 ± 5 mV					50%			Performed		
3	RV3	Revolution speed	Motor or Spindle	Command and Revolution speed must coincide.					Max. 3,500 rpm		Max. 4,500 rpm		○	
4	RV4	Speed detecting level	CH9	Gear 0.3V Clutch 3.0V					0.3V 10%			Performed	If necessary ○	
5	RV6	Calibration of Load meter	LM	Continuous Rated: 5.0V	30 } 40 }	45 } 50 }	50 } 55 }	40 } 45 }		35 } 45 }	40	Performed		*
6	RV7	Velocity loop offset	CH25	Motor doesn't rotate.					50 ~ 65%			Performed	If necessary ○	
7	RV8	Velocity loop gain		No vibration			70%				50%	Performed		
8	RV9	Torque limit	Motor current	Depends on machine					15A				If necessary ○	
9	RV10	Current detect offset	CH14	0 ± 20 mV					50 ~ 80%			Performed	Necessary when PCB is replaced. ○ ○	
10	RV11	Current limit setting	CH24	Depends on motor model	50%	62%	77%	25%	70%	42%	25%	Performed	Necessary when PCB is replaced.	
11	RV12	Current loop phase compensation							50 ~ 60%		30%	Performed		
12	RV13	Current loop gain							50%			Performed		
13	RV14 a,b,c	Adjustment of minimum pulse width	CH18 a,b,c	Short +15 and TSA 50Hz 1.0 ms 60Hz 1.2 ms								Performed		
14	RV15 a,b,c	Synchronous pulse balance	CH18 a,b,c	Vibration within ±0.1 ms					45 ~ 65%			Performed		
15	RV16	Armature voltage	A-H	at Max. speed with within 220V DC					70 ~ 95%			Performed		

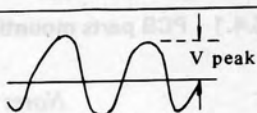
No.	Trimmer	Item	Observation	Adjusting Standard	Standard							○ : Necessary to adjust			
					15	12	8	6	Spindle Head	3	4	FANUC	Machine Tool Builder	User	
16	RV17	Field current adjustment	Series to J	1000 rpm 6.8A	75 ~ 95%							Performed			
17	RV18	Output limit circuit	CH13	6.2V (standard) Use 1/2 output	10%	100%							Performed		
18	RV19	Armature voltage clamp	A-H	AC 210V DC220V AC 200V DC 210V	35 ~ 45%							Performed			
19	RV20	Speed arrival detect level	CH28	(±15%) 1.5V (standard)								Performed	If necessary ○		
20	RV21	Speed zero detect level	CH29	0.75% 1.5% (150mV)	10 ~ 15% 20 ~ 30%							Performed	If necessary ○		

(5) Auxiliary check pin mounting diagram



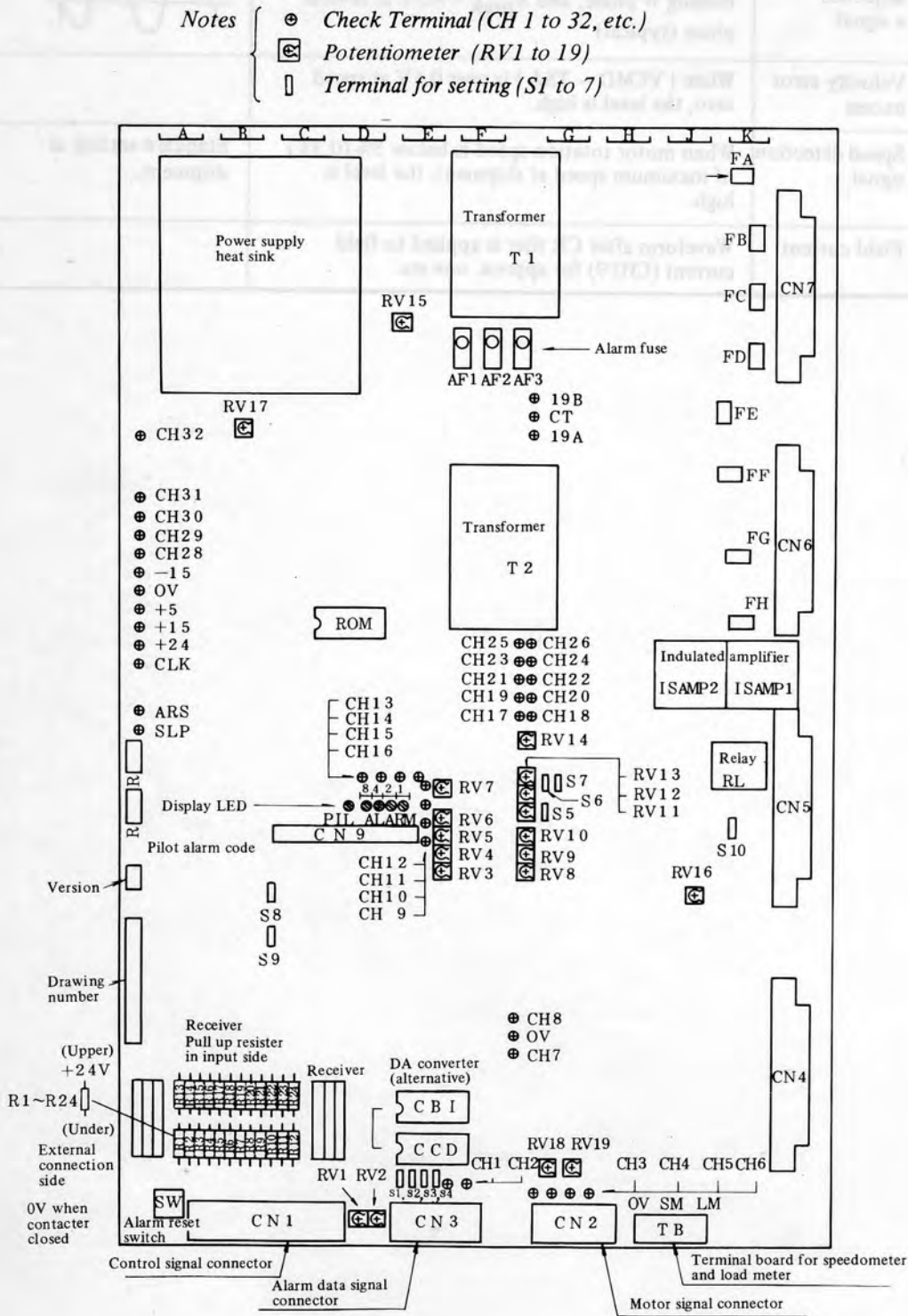
(6) List of auxiliary check pin

Mark	Position	Signal name	Contents	Remarks
A	A-2	Velocity error voltage	VCMD – TSA	
B	B-3	Velocity error excess	When VCMD – TSA is over 2V (or 5V), the level is high.	SH04 short 2V open 5V
C	B-3	Busy signal	When VCMD changes by over 0.7V, the level is low for 0.3 sec and returns to high.	VCMD 
D	B-3	Speed zero	When rotation speed is below speed zero detection level (CH29 = 75mV), the level is low.	
E	B-2	Speed zero pulse	The level is held to low for a fixed time (approx. 40m sec) after the fall of speed zero signal and returns to high.	
F	B-4	Overspeed signal	When motor rotation speed is over 115% (11.5V) of maximum speed (10V), the level is high.	115% ± 5% (error)
G	C-4	Tacho-generator Loss Alarm	When speed feedback voltage is zero and armature voltage is over 145V, the level is high.	
H	C-1 (~05C) B-1 (07D~)	Current zero	When armature current is below 18% (or 9%) of current limit value (4V), the level is low.	Models 3, 4, ... 18% Models 6, 8, 12, 15, 9%
I	D-5	10V reference Voltage	+10V ± 0.4V	
J	B-2	Enable signal	+0.4V at gate block, –15V at other time.	
K	B-2	Gate block	The level is low with MCC OFF, at alarm or at motor stoppage.	
L	A-2	Torque limit release condition	The level is low at speed zero with SFR and SRV OFF.	
M	A-1	Field weakening	The level is high when field is weakened.	
N	D-2	Clamp signal	+1.7V (during gate block) when both *SIGNF and *SIGNR are at high level, and –15V at other time.	
O	D-2	Phase limit signal	+1.7V until gate block signal is released after SIGN (CH16) is inverted, and –15V at other time.	+1.7V during current direction switch
P	D-2	Full power command	When VCMD changes by over 0.7V, the level is held to high for approx. 8 sec and returns to low.	VCMD P 
Q	A-3	Phase sequence alarm	The level is high at reverse phase or at missing phase.	
R	D-1	FLS ref. level	0.22V	
S	A-4	Speed arrival	When motor rotation speed is within a certain range (±15%) for command feed rate, the level is low.	
T	D-1	Over current	When armature current is over 190% (or 150%) of current limit value, the level is high.	Models 3, 4, ... 190% Models 6, 8, 12, 15, 150%

Mark	Position	Signal name	Contents	Remarks
U	B-1	Phase sequence a signal	$V_{\text{peak}} = 0.7\text{V}$ at normal time, $V_{\text{peak}} = 4.5\text{V}$ at missing W phase, and $V_{\text{peak}} = 8.5\text{V}$ at reverse phase (typical)	
V	A-1	Velocity error excess	When $ VCMD - TSA $ is over 0.5V at speed zero, the level is high.	
W	B-4	Speed detection signal	When motor rotation speed is below 3% (0.3V) of maximum speed at shipment, the level is high.	Standard setting at shipment.
X	D-2	Field current	Waveform after CR filter is applied to field current (CH19) for approx. one sec.	

6.4 Setting and Adjustment for AC Spindle Servo Unit PCB

6.4.1 PCB parts mounting diagram



6.4.2 Main parts list

(1) Fuses and surge absorbers

Item	Symbol	Name	Specification				
			Model 3	Model 6	Model 8	Model 12	Model 15
1	F1 ~ 3	Fuse	A60L-0001-0127/25FH75		A60L-0001-0145	A60L-0001-0149	
2	F4	Fuse		A60L-0001-0031/5A			
3	F5, 6	Fuse	A60L-0001-0036/PC1-20		A60L-0001-0036/PC1-30		
4	F7	Fuse	A60L-0001-0147		A60L-0001-0145	A60L-0001-0149	
5	Z1 ~ 4	Surge absorber		A50L-0221-0062/441-12			
6	AF1	Fuse on PCB		A60L-0001-0046/3.2 (3.2A)			
7	AF2, 3	"		A60L-0001-0075/3.2 (3.2AS)			

(2) Main parts

Item	Symbol	Name	Specification				
			Model 3	Model 6	Model 8	Model 12	Model 15
1	P.C.B.	Printed circuit board	A20B-0009-0530	A20B-0009-0531	A20B-0009-0532	A20B-0009-0533	A20B-0009-0534
2	ROM	Memory element	J10	J11	J02	J03	J04
3	TM1 ~ 11	Transistor module			A50L-0001-0096		
4	SM1 ~ 3	SCR module		A50L-5000-0029/30		A50L-5000-0029/50	
5	DM1 ~ 3	Diode module		A50L-2001-0138		A50L-2001-0146	
6	D1 ~ 3	Diode			A50L-2001-0103/12JH11		
7	D4 ~ 6	Diode			A50L-2001-0103/12JG11		
8	D7	Diode			A50L-2001-0081/60		
9	D8	Diode			A50L-2001-0097/U06G		
10	C1 ~ 3	Capacitor			A42L-0001-0103		
11	MCC	Electromagnetic contactor		A58L-0001-0094/200V1A1B		A58L-0001-0092/A	
12	TF	Transformer			A80L-0001-0276		
13	FAN	Cooling fan			A90L-0001-0099/A		
14	TH	Thermostat			A57L-0001-0028		
15	SW	Switch			A57L-0001-0030/2		

6.4.3 Adjustment of potentiometers on PCB

Notes 1. This table is applicable to PCBs of versions
A20B-0009-0530 to 0534.

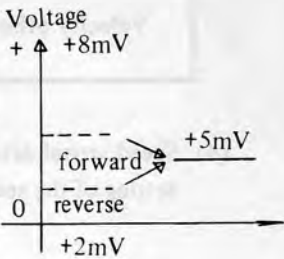
2. Since the potentiometers, RV7, 8, 14 through 19, are adjusted by FANUC at shipment, they must not be readjusted by the user.

No.	Symbol	Item	Standard setting	Check terminals	Procedure
1	RV1	Velocity command voltage level		CH13-0V	See Subsection (1) on the next page.
2	RV2	Velocity command voltage offset		CH13-0V	See Subsection (1) on the next page.
3	RV3	Speed arrival detection level		CH10-0V	See subsection (4)
4	RV4	Speed detection level		CH9-0V	See subsection (5)
5	RV5	Torque limitation level			See subsection (6)
6	RV6	Regenerated power limitation	3 scale		See item 5.1.5.
7	RV7	VF conversion level (1)		CH23-0V	When the voltage between LM and OM is 10V, the frequency is 200 ± 2 kHz.
8	RV8	Setting for speed detection circuit		CH18-0V	When the voltage between CH17 and 0V is 0.2V, 2.2 ± 0.1 V.
9	RV9	Adjustment of forward motor speed		Number of motor revolutions	See Subsection (2) on the next page.
10	RV10	Speed detection offset		CH17-0V	When the spindle is stopped, the offset voltage must be within ± 2 mV.
11	RV11	Adjustment of reverse motor speed		Number of motor revolutions	See Subsection (2) on the next page.
12	RV12	Velocity loop gain	5 scale		
13	RV13	Velocity loop offset		Spindle	See Subsection (3) on the next page.
14	RV14	Adjustment of loadmeter amplitude		LM-0M	10 ± 0.1 V at acceleration (without torque limit)
15	RV15	Voltage adjustment of +5V		+5V-0V	5 ± 0.05 V
16	RV16	Regenerated voltage limitation level	4 scale		
17	RV17	VF conversion level (2)		CH32-0V	When input voltage is 200V AC, the frequency is 24 ± 0.2 kHz.
18	RV18	Adjustment of RA offset		CH5-0V	2.5 ± 0.05 V in the state that CN2 is open.
19	RV19	Adjustment of RB offset		CH6-0V	Same as the above.

(1) Velocity command voltage (RV1, RV2),

When the velocity command voltage is 10V, the motor rotates at the rated speed.

Item	Measuring terminals	Adjustment procedure
Offset	CH13-0V	Set the motor in operating status and supply a velocity command voltage of 0V (equivalent to S00) to the motor. Adjust RV2 so that the voltage between the measuring terminals will not change when forward rotation and reverse rotation commands are issued alternately. See the following NOTE.
Level	CH13-0V	Next, supply a rated rotational command voltage of 10V to the motor, and adjust RV1 so that the voltage between the measuring terminals becomes $+10V \pm 0.05V$ when the spindle forward rotation command is issued.



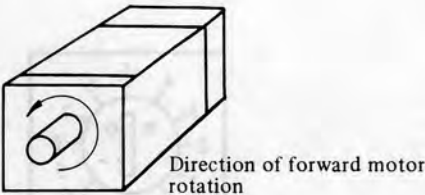
(NOTE) For example, if the voltage at CH13 is $+5.0mV$ when the spindle rotates forward and it is $+5.0mV \pm 1.0mV$ when the spindle rotates in reverse, the offset error of the velocity command voltage is $\pm 1.0mV$.

(2) Rotational speed adjustment (RV9, RV11)

The number of motor revolutions can be adjusted accurately by the following procedure. At this time, the number of motor revolutions should be measured directly using a stroboscope or tachometer.

Item	Measuring point	Adjusting procedure
Number of forward motor revolutions	Spindle	Supply the rated velocity command voltage to the motor. Adjust RV9 so that the motor rotates at the rated speed when a forward rotation (SFR) command is issued.
Number of reverse motor revolutions	Spindle	Adjust RV11 so that the motor rotates at the rated speed when a reverse rotation (SRV) command is issued.

(NOTE) The forward rotation means that the AC spindle motor rotates counterclockwise (forward rotation) as seen from the shaft. Thus, it may not correspond to the forward rotation of the machine spindle.



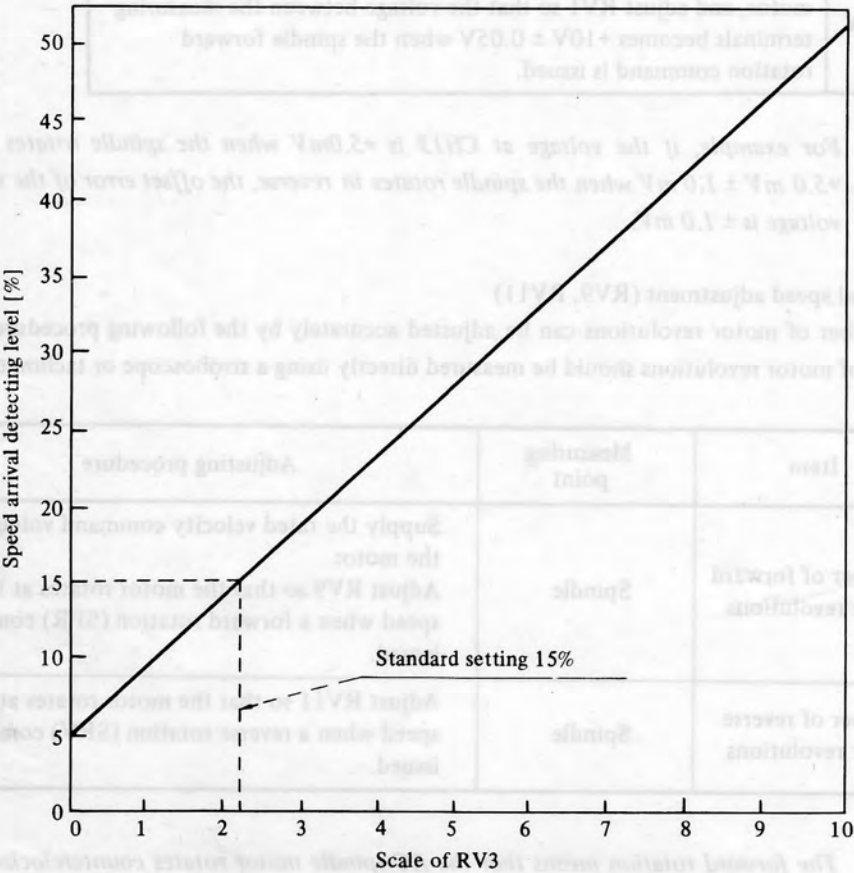
(3) Velocity offset (RV13)

This adjustment is made so that the spindle will not rotate at low speed when a velocity command voltage of 0V is supplied. This should be performed after the previous adjustments.

Item	Measuring point	Adjusting procedure
Velocity offset	Spindle (or Motor)	Supply a velocity command voltage of 0V. Adjust RV13 so that the spindle will not rotate when forward or reverse rotation commands are issued.

(4) Speed arrival detection level (RV3)

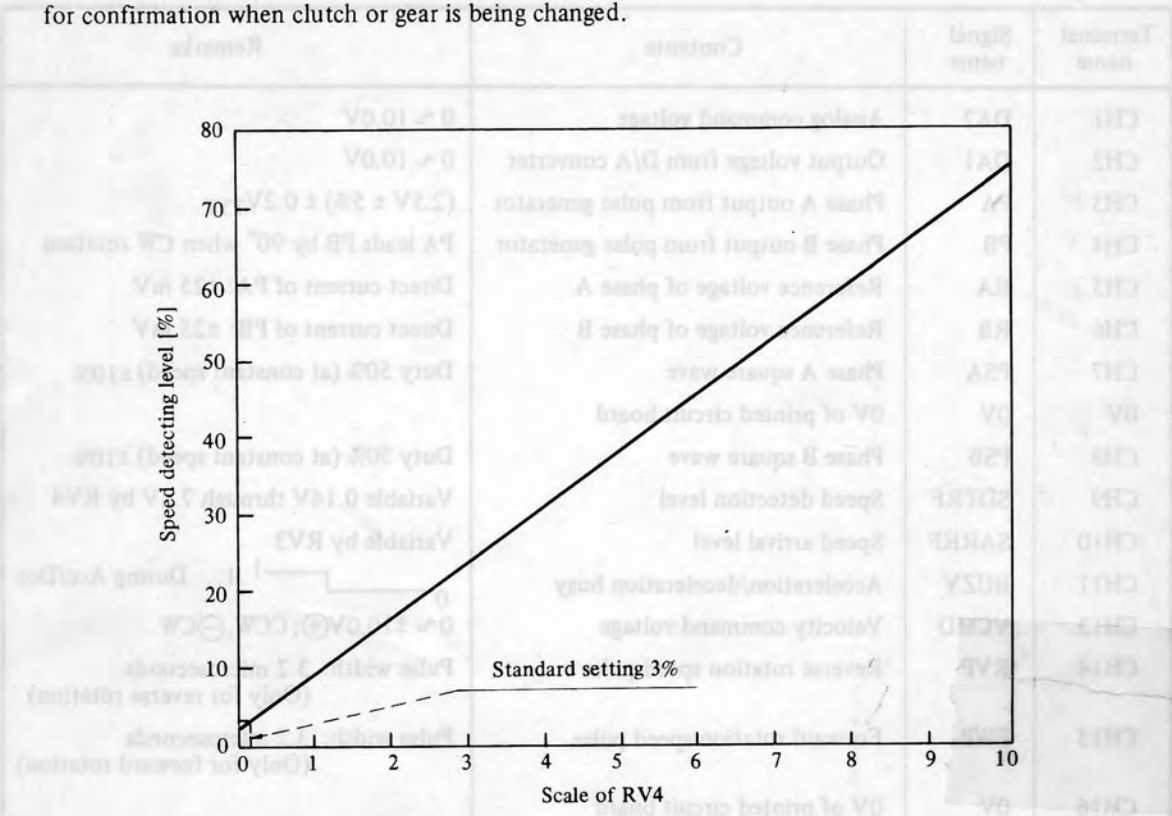
Setting of the speed arrival detection level can be performed by using the following graph.



How to read the scale of potentiometer

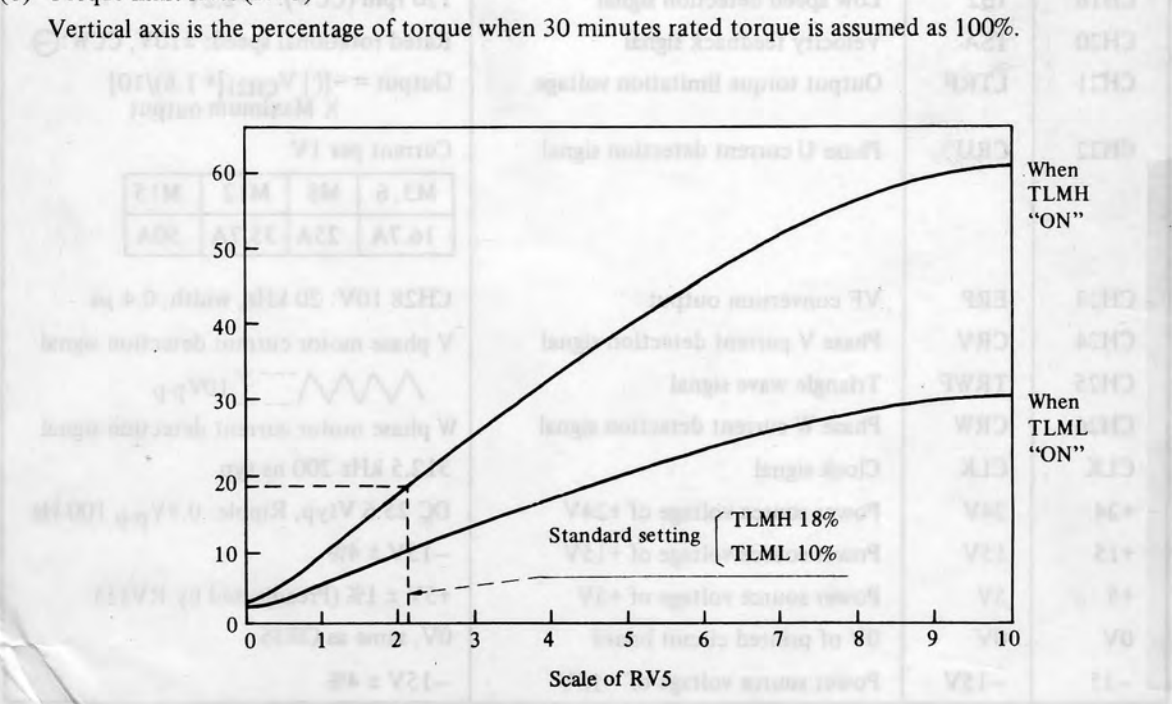
(5) Speed detecting level (RV4)

Vertical axis is the percentage of motor speed when rated value is assumed as 100%. This signal can be used for confirmation when clutch or gear is being changed.

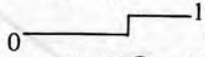


(6) Torque limit level (RV5)

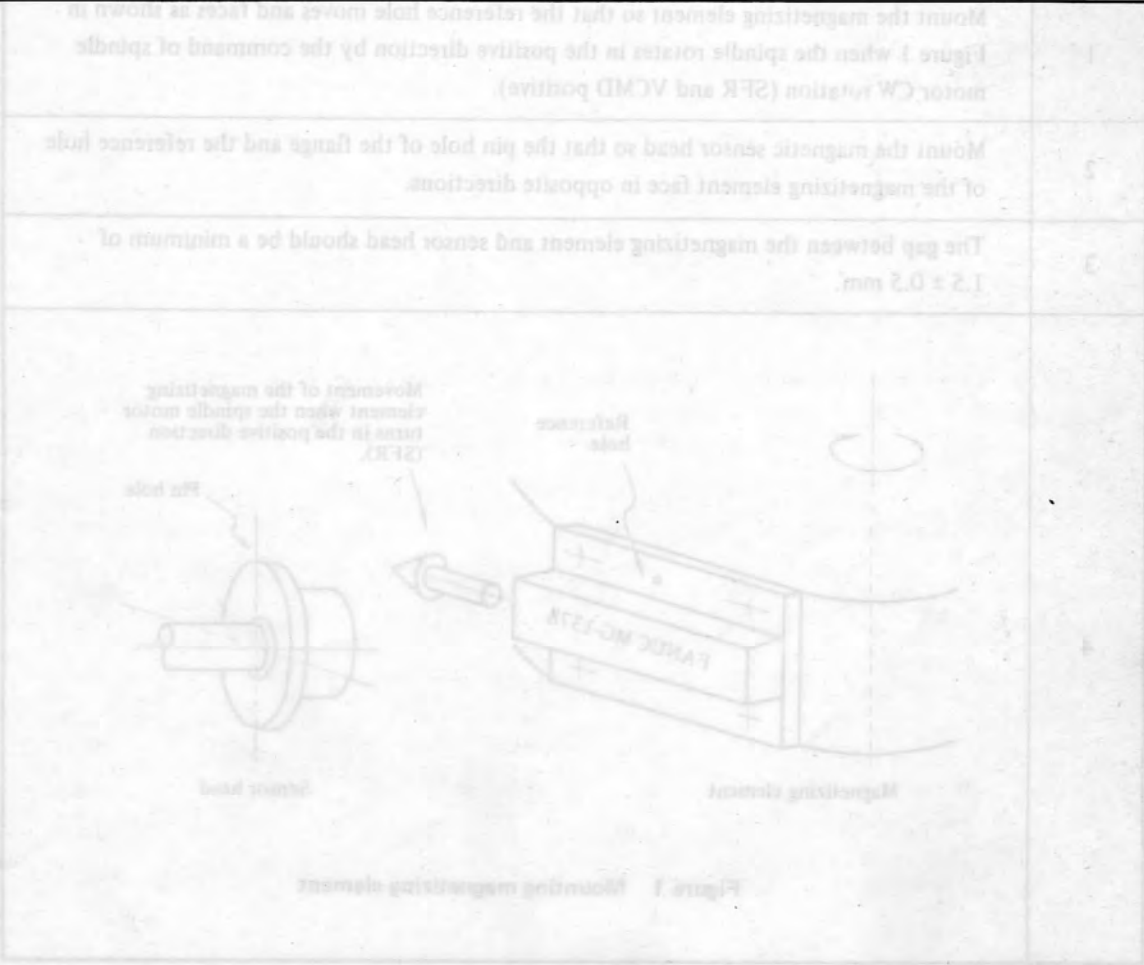
Vertical axis is the percentage of torque when 30 minutes rated torque is assumed as 100%.



6.4.4 Description of check terminals

Terminal name	Signal name	Contents	Remarks								
CH1	DA2	Analog command voltage	0 ~ 10.0V								
CH2	DA1	Output voltage from D/A converter	0 ~ 10.0V								
CH3 ✓	PA	Phase A output from pulse generator	(2.5V ± 5%) ± 0.2V _{Typ} .								
CH4 ✓	PB	Phase B output from pulse generator	PA leads PB by 90° when CW rotation								
CH5 ✓	RA	Reference voltage of phase A	Direct current of PA: ±25 mV								
CH6 ✓	RB	Reference voltage of phase B	Direct current of PB: ±25 mV								
CH7	PSA	Phase A square wave	Duty 50% (at constant speed) ±10%								
0V	0V	0V of printed circuit board									
CH8	PSB	Phase B square wave	Duty 50% (at constant speed) ±10%								
CH9	SDTRF	Speed detection level	Variable 0.14V through 7.4V by RV4								
CH10	SARRF	Speed arrival level	Variable by RV3								
CH11	BUZY	Acceleration/deceleration busy	 1: During Acc/Dcc 0 ~ ±10.0V⊕; CCW, ⊖ CW								
CH13	VCMD	Velocity command voltage									
CH14	RVP	Reverse rotation speed pulse	Pulse width: 3.2 microseconds (Only for reverse rotation)								
CH15	FWP	Forward rotation speed pulse	Pulse width: 3.2 microseconds (Only for forward rotation)								
CH16	0V	0V of printed circuit board									
CH17	TS1	F/V output of velocity feedback	6000 rpm (CCW): -10V								
CH18	TS2	Low speed detection signal	120 rpm (CCW): -2.2V								
CH20	TSA	Velocity feedback signal	Rated rotational speed: ±10V, CCW: ⊖								
CH21	LTRF	Output torque limitation voltage	Output = -[(V _{CH21} + 1.8)/10] × Maximum output								
CH22	CRU	Phase U current detection signal	Current per 1V <table border="1"> <tr> <td>M3, 6</td><td>M8</td><td>M12</td><td>M15</td></tr> <tr> <td>16.7A</td><td>25A</td><td>35.7A</td><td>50A</td></tr> </table>	M3, 6	M8	M12	M15	16.7A	25A	35.7A	50A
M3, 6	M8	M12	M15								
16.7A	25A	35.7A	50A								
CH23	ERP	VF conversion output	CH28 10V: 20 kHz, width; 0.4 μs								
CH24	CRV	Phase V current detection signal	V phase motor current detection signal								
CH25	TRWF	Triangle wave signal	 10Vp-p								
CH26	CRW	Phase W current detection signal	W phase motor current detection signal								
CLK	CLK	Clock signal	312.5 kHz 200 ns typ								
+24	24V	Power source voltage of +24V	DC 25.6 V _{typ} , Ripple: 0.5V _{p-p} 100 Hz								
+15	15V	Power source voltage of +15V	-15V ± 4%								
+5 ✓	5V	Power source voltage of +5V	+5V ± 1% (Preadjusted by RV15)								
0V	0V	0V of printed circuit board	0V, same as CH16								
-15	-15V	Power source voltage of -15V	-15V ± 4%								

Terminal name	Signal name	Contents	Remarks
CH28	ER	Error voltage	0 – 10V
CH29	UCM	Phase U command voltage	
CH30	VCM	Phase V command voltage	
CH31	WCM	Phase W command voltage	
CH32	24VP	Pulse signal	24KHz at AC200V
19A	19A	Input voltage of 19V AC	Control power supply
CT	CT	0V	"
19B	19B	Input voltage of 19V AC	"



6.5 Adjustment for Spindle Orientation Control Circuit

6.5.1 Adjustment of magnetic sensor system spindle orientation

(1) Mounting magnetizing element and magnetic sensor

Determine the mounting direction for the magnetizing element and magnetic sensor as follows. Incorrect mounting may cause repeating of clockwise and counterclockwise rotation of spindle without stopping during positioning, hunting, and the end of the magnetizing element and sensor head to stop in the opposite position.

Mounting magnetizing element and sensor

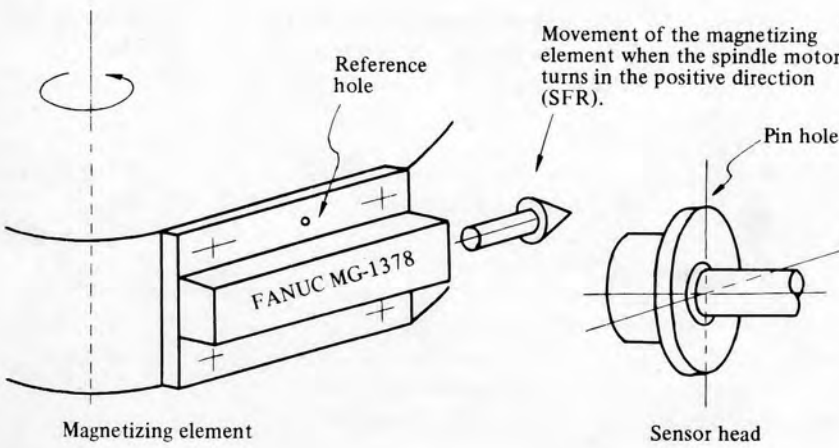
Item	Explanation
1	Mount the magnetizing element so that the reference hole moves and faces as shown in Figure 1 when the spindle rotates in the positive direction by the command of spindle motor CW rotation (SFR and VCMD positive).
2	Mount the magnetic sensor head so that the pin hole of the flange and the reference hole of the magnetizing element face in opposite directions.
3	The gap between the magnetizing element and sensor head should be a minimum of 1.5 ± 0.5 mm.
4	 Reference hole Movement of the magnetizing element when the spindle motor turns in the positive direction (SFR). Pin hole Magnetizing element Sensor head

Figure 1 Mounting magnetizing element

(2) Setting and adjustment of two speed steps type

Spindle orientation circuit C A06B-6041-J120

Orientation circuit C PCB A20B-0008-0030

(a) Setting and function of jumper terminal (SH)

The connection and function of jumper terminals (SH) which can be freely selected, are listed below. SH01 should be connected after the power is on since it is used only for adjustment and testing. It should be disconnected after adjustment making sure that LED7 goes off.

Connection and functions of jumper terminals (SH)
(A double outline indicates the standard setting)

(Note 1) Status			Function	Remarks
SH	1-2	2-3		
01		○	Test mode (Note 2)	Connected only for adjustment.
02	○	×	When an orientation instruction is issued after power is turned on and before driving the spindle, the motor shaft end rotates in a clockwise direction.	The setting on SH03 takes priority of the setting on SH02. The setting on SH02 is effected only when SH03 1-2 is connected.
			When an orientation instruction is issued after power is turned on and before driving the spindle, the motor shaft end rotates in a counterclockwise direction.	
03			Moves in the direction the spindle was turning just before the orientation instruction was issued.	The setting on SH02 becomes effective.
	×	○	The orientation direction is always CCW.	
	×	×	The orientation direction is always CW.	
04			Initial orientation speed is about $60 \times [\text{spindle position loop gain } s^{-1}]$ r.p.m. of the spindle. (usual rate)	Since spindle position loop gain is generally close to 5 sec.^{-1} , the usual rate is about 300 r.p.m.
	○	×	The initial rate of speed is limited to 1/3 the usual rate.	
	×	○	The initial rate of speed is limited to 2/3 the usual rate.	

Notes: (1) ○ indicates connected, × indicates not connected.

(2) When in Test Mode

(a) The orientation instruction is issued.

(b) Orientation end signal (ORAR 1,2) is not transferred.

(c) The spindle turns at the initial speed while SW1 (INITIALIZING BUTTON) is pressed. When it is released, the spindle stops at a fixed position.

(d) The red light emitting diode (LED 7) is on in this mode.

(b) LED indicators

Seven display lamps (LED 1 – 7), indicating the meanings listed below, are mounted on this option board.
(LED 1 and LED 2 are not mounted on board 01A.)

LED indicators

LED	Meaning	Color	Explanation
1	ORIENTATION	Green	Lights during execution of an orientation instruction. (ORCM 1 and 2 are connected: ON)
2	CLUTCH (gear) LOW	Green	Lights when the clutch (gear) LOW signal is on, (*CTH 1 and 2 are connected: ON)
3	MS PEAK LEVEL	Green	Lights while the peak value of the magnetic flux detection signal (MS) is out of the range of $\pm 10V$. Adjustment indicator.
4	SLOWDOWN PERIOD	Green	Lights during the low turning speed period when the spindle position approaches the stop position during orientation.
5	IN-POSITION FINE	Green	Lights when the value of MS output approaches within $+0.1^\circ$ of the spindle angle. Sometimes lights when the sensor is not on the magnetizing element.
6	IN-POSITION	Green	Lights when orientation has been completed and the spindle is within $\pm 1^\circ$ of the adjustment position. When it lights while not in TEST MODE, the Orienta- tion Completion signal is transmitted. (ORAR 1 and 2 are connected: ON)
7	TEST MODE	Red	Lights when SH01 pins are connected. In this mode, the Adjustment Completion signal is not transmitted and ORCM is on. The orientation motion can be repeatedly confirmed by pressing SW1.

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(c) Potentiometer (POT) setting

Set the POT according to the following values followed by table before orientation adjustment. * will be reset at a later stage.

Potentiometer settings

POT name	RV	1*	2*	3	4	5	6*	7*	8	9*	10*	11*
POT scale position		5.0	6.0	①	①	②	2.0	5.0	③	2.0	5.0	5.0

① RV3 and RV4 settings

Set RV3 and RV4 according to the distance H between the turning axis of the magnetizing element and the center of the sensor head.

H (mm)	60 ~ 65	~70	~75	~80	~85	~90	~95	~100	~105	~110
Scale position	7.0	6.0	5.0	4.0	3.0	2.5	2.0	1.5	1.0	0.5

② RV5 setting

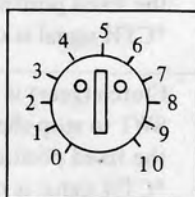
Set RV5 according to the number of revolutions (N_{HM}) when the spindle rotates at rated speed.

N_{HM} (rpm)	2,000 ~ 2,200	~2,500	~2,700	~3,100	~3,500	~4,000	~4,500	~5,000	~5,500	~6,000
Scale position	7.5	6.5	5.5	4.5	3.5	2.5	2.0	1.5	1.0	0.5

③ RV8 setting

Set RV8 according to the transmission ratio of $R_{H/L}$ of spindle HIGH/LOW.

$R_{H/L}$	~2.0	~2.2	~2.5	~2.8	~3.2	~3.7	~4.4	~5.3	~6.0	~7.0
Scale position	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	9.5	10



Scale of potentiometer

(d) Potentiometer adjustment

Adjust RV1 ~ RV11 according to the following table. Adjustment of orientation PCB must be performed after the adjustment of spindle control PCB. Orientation position may be shifted if the adjustment of RV12 or RV13 on spindle control PCB is altered.

Potentiometer adjustment

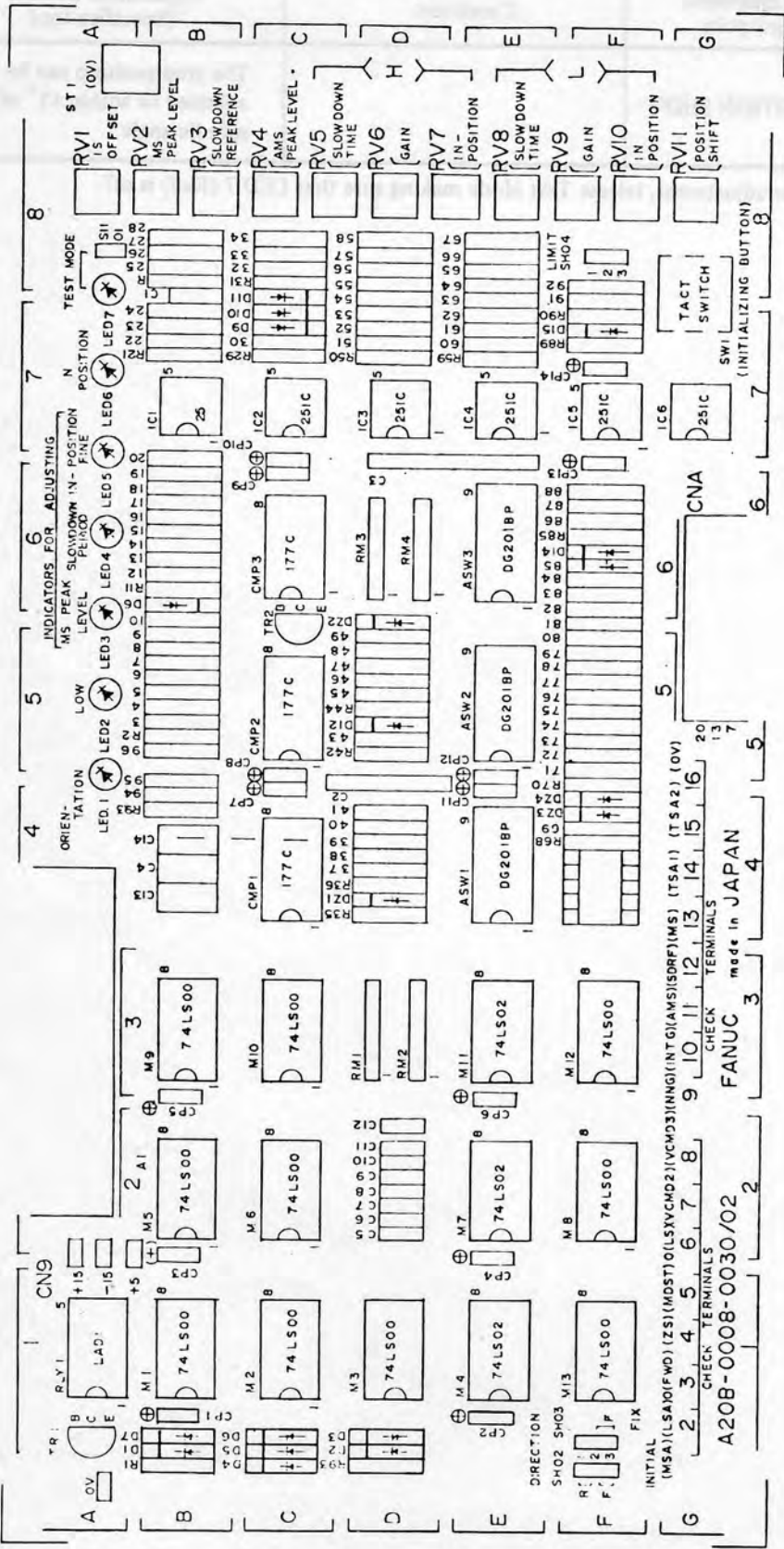
The following adjustments should be performed in Test Mode by connecting SH01 pins.

Term	POT name	Adjustment purpose	Condition	Adjustment method (Specification)
1	RV1	TS OFFSET	The spindle should be stopped.	Voltage across check 15 (TSA2) and 16 (OV) should be within ± 1.0 mV.
2	RV2	MS PEAK LEVEL	Keep pressing SW1 (INITIALIZING BUTTON)	Adjusted position until LED3 (MS PEAK LEVEL) begins to light.
3	RV3	SLOWDOWN REFERENCE		According to the setting terms.
4	RV4	AMS PEAK LEVEL		According to the setting terms.
5	RV5	SLOWDOWN TIME IN HIGH MODE	Clutch (gear) is HIGH. Press SW1 to stop the spindle at the fixed position. The *CTH signal is off (open).	Just before stopping LED4 (SLOW DOWN PERIOD) should immediately light up clearly.
6	RV6	GAIN [H]	Clutch (gear) is HIGH. Press SW1 to stop the spindle at the fixed position. The *CTH signal is off (open).	Turn in the CW direction being careful not overshoot when stopping.
7	RV8	IN-POSITION	Clutch (gear) is HIGH. Press SW1 to stop the spindle at the fixed position. The *CTH signal is off (open).	LED5 (IN-POS. FINE) should light while LED 6 (IN-POSITION) is on.
8	RV8	SLOWDOWN TIME IN LOW MODE	Clutch (gear) is LOW. Press SW1 to stop the spindle at the fixed position. The *CTH signal is on (closed).	LED4 (SLOWDOWN PERIOD) should immediately light up clearly just before stopping. (See term 5)
9	RV9	GAIN [L]	Clutch (gear) is LOW. Press SW1 to stop the spindle at the fixed position. The *CTH signal is on (closed).	Turn in the CW direction being careful not to overshoot when stopping.
10	RV10	IN-POSITION [L]	Clutch (gear) is LOW. Press SW1 to stop the spindle at the fixed position. The *CTH signal is on (closed).	LED 5 (IN-POS. FINE) should be on when LED 6 (IN-POSITION) is on.

Term	POT name	Adjustment purpose	Condition	Adjustment method (Specification)
11	RV11	POSITION SHIFT		The stop position can be finely adjusted to within $\pm 1^\circ$ of the spindle angle.

After adjustment, release Test Mode making sure that LED 7 (Red) is off.





Parts mounting diagram

Location of check terminals and potentiometers.

(3) Setting and adjustment of three speed steps type

Orientation circuit D A06B-6041-J121

Orientation circuit D

PCB drawing number A20B-0009-0520

The spindle speed range is as listed below.

	Spindle speed range
High	4000 – 8000 rpm
Medium	1000 – 2000 rpm
Low	250 – 667 rpm

- (a) Setting and function of jumper terminal (SH)
See 2.2.1

- (b) LED indicators

LED No.	Meaning	Color	Contents
LED1	ORIENTATION	Green	Lights during execution of an orientation command.
LED2H	GEAR/CLUTCH	Green	Lights when the gear/clutch is shifted to high position.
LED2M			Lights when the gear/clutch is shifted to middle position.
LED2L			Lights when the gear/clutch is shifted to the low position.
LED3	MS PEAK LEVEL	Green	Lights when the peak value of the MS signal sent from the magnetic sensor is out of the range of $\pm 10V$.
LED4	SLOWDOWN PERIOD	Green	Lights during low turning speed and goes out when the magnetizing element reaches the sensor.
LED5	IN-POSITION FINE	Green	Lights when orientation has been completed and the spindle is within $\pm 0.1^\circ$ of the adjustment position.
LED6	IN-POSITION	Green	Lights when orientation has been completed and the spindle is within $\pm 1^\circ$ of the adjustment position. When it lights while not in TEST mode, the orientation completion signal is transmitted.
LED7	TEST MODE	Red	Lights when terminals 01 and 02 of SH01 are shorted.

(c) Adjustments

The following adjustments should be performed in TEST mode after turning on the power.

Item	Variable resistor	Adjustment item	Condition	Adjustment procedure
1	RV1	TSA OFFSET Tachogenerator offset	The spindle should be stopped.	Voltage across check terminals CH1 5 (TSA2) and 16 (0V) should be within 0 ± 1.0 mV.
2	RV2	MS PEAK LEVEL Amplitude adjustment of MS signal	SW1 should be kept pressed.	Adjust the position until LED3 begins to light.
3	RV3	SLOWDOWN REFERENCE Setting of the slowdown level	Measure the distance form the center of the spindle to the sensor head	See NOTE 1.
4	RV4	AMS PEAK LEVEL Amplitude value of AMS signal		
5	RV5	SLOWDOWN TIME Adjusting slowdown time	Shift the gear to the HIGH position and LED2H goes on. Turn SW1 on and off repeatedly.	Just before stopping, LED4 should immediately light up clearly (about 0.2 sec.)
6	RV6	GAIN [HIGH] Position loop gain		Turn clockwise to increase the gain being careful not to overshoot when stopping.
7	RV7	IN-POSITION [H] Adjusting the spindle stop position		Adjust so that LED5 lights while LED6 is on. LED5 may flicker.
8	RV8	SLOWDOWN TIME [LOW] Adjustment of slowdown time	Shift the gear to the LOW position and LED2L goes on. Turn SW1 on and off repeatedly.	Same as item 5 above.
9	RV9	GAIN [LOW] Position loop gain		Same as item 6 above.
10	RV10	IN-POSITION [LOW] Adjusting the spindle stop position		Same as item 7 above.
11	RV11	SLOWDOWN TIME [MEDIUM] Adjusting slowdown time	Shift the gear to the MEDIUM position and LED2M goes on. Turn SW1 on and off repeatedly.	Same as item 5 above.
12	RV12	GAIN [MEDIUM] Position loop gain.		Same as item 6 above.
13	RV13	IN-POSITION [MEDIUM] Adjusting the spindle stop position		Same as item 7 above.
14	RV14	POSITION SHIFT Shifting of spindle stop position	The stop position can be finely adjusted within a range of $\pm 1^\circ$ of the spindle angle.	Match the key position of the ATC arm to the groove position of the spindle.

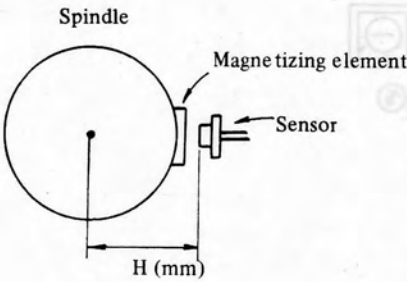
After adjustment, release test mode making sure that LED7 (Red) is off.

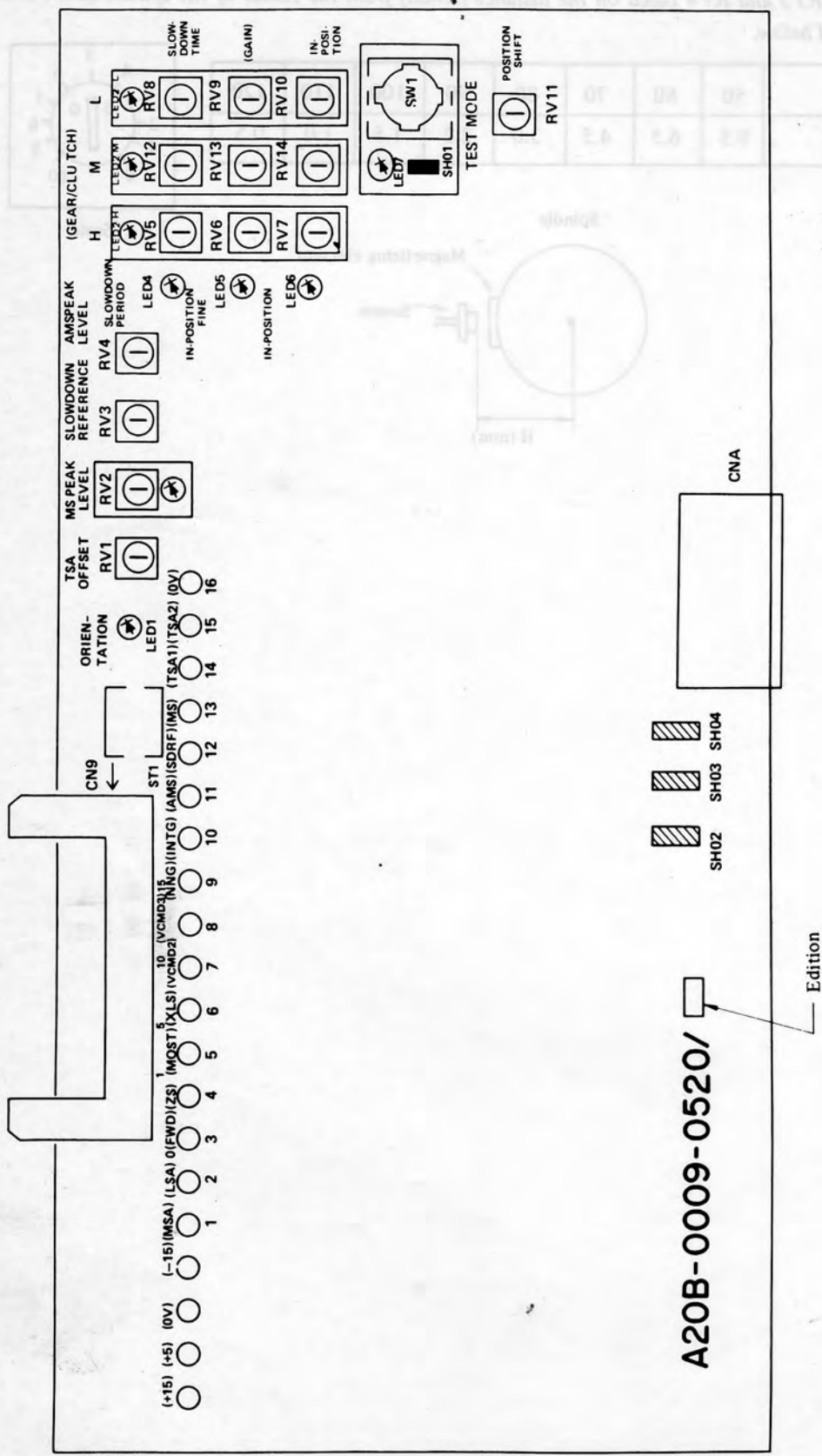
(NOTE 1) Adjust RV3 and RV4 based on the distance (Hmm) from the center of the spindle to the sensor as listed below.

H (mm)	50	60	70	80	90	100	110	120
Position RV3, 4	9.5	6.5	4.5	3.0	2.2	1.5	1.0	0.5



Scale



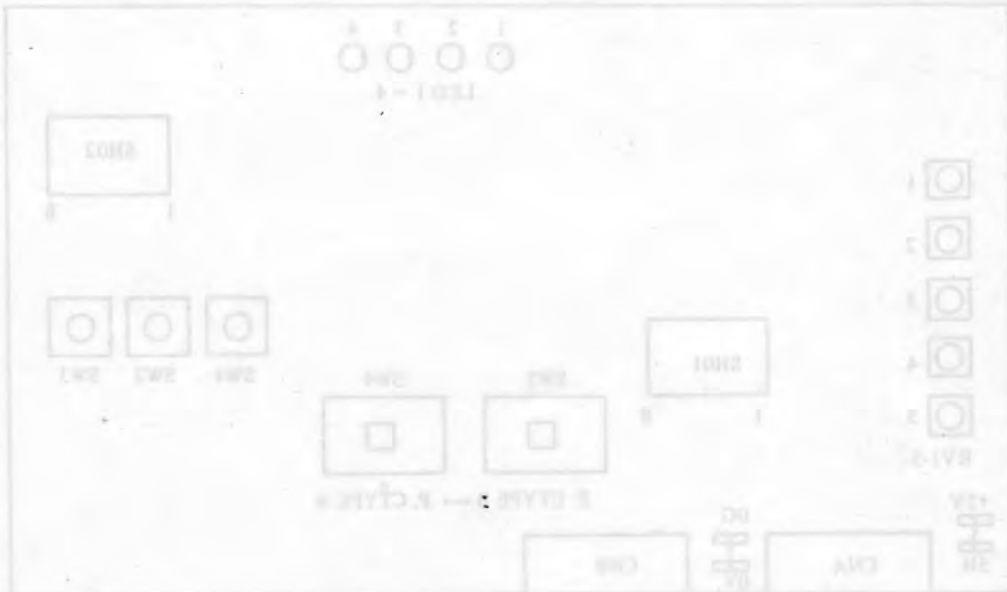


Location of check terminals and potentiometers.

(4) Confirmation of the spindle position loop gain

The spindle position loop gain should be tested after orientation stop control circuit adjustment by using the procedure outlined in the next table.

Spindle position loop gain	
Procedure	
1	Connect SH01 pins, to enter Test Mode (LED7 goes on).
2	Disconnect SH04 1-2 and 2-3 pins to remove limits.
3	Measure the number of spindle revolutions $N_{S(H)}$ and $N_{S(L)}$ (r.p.m) when SW1 (INITIALIZING BUTTON) is on, for each of the following condition. Spindle clutch (gear) HIGH (*CTH1 and 2 not connected) Spindle clutch (gear) LOW (*CTH1 and 2 connected)
4	The spindle position loop gain can be determined using the following equations: $K_{p(H \text{ or } L)} = N_{S(H \text{ or } L)} \div 55 \text{ (sec}^{-1}\text{)}, \text{ where}$ $K_{p(H)}$: Position loop gain for spindle HIGH gear (clutch) $K_{p(L)}$: Position loop gain for spindle LOW gear (clutch)



6.5.2 For position coder system

(1) Printed circuit board

Spindle control circuit		A20B-0009-0530 ~ 0534
Position coder method spindle orientation control circuit		
(a)	Stop position internal setting	A20B-0008-0240
(b)	Stop position external setting	A20B-0008-0241

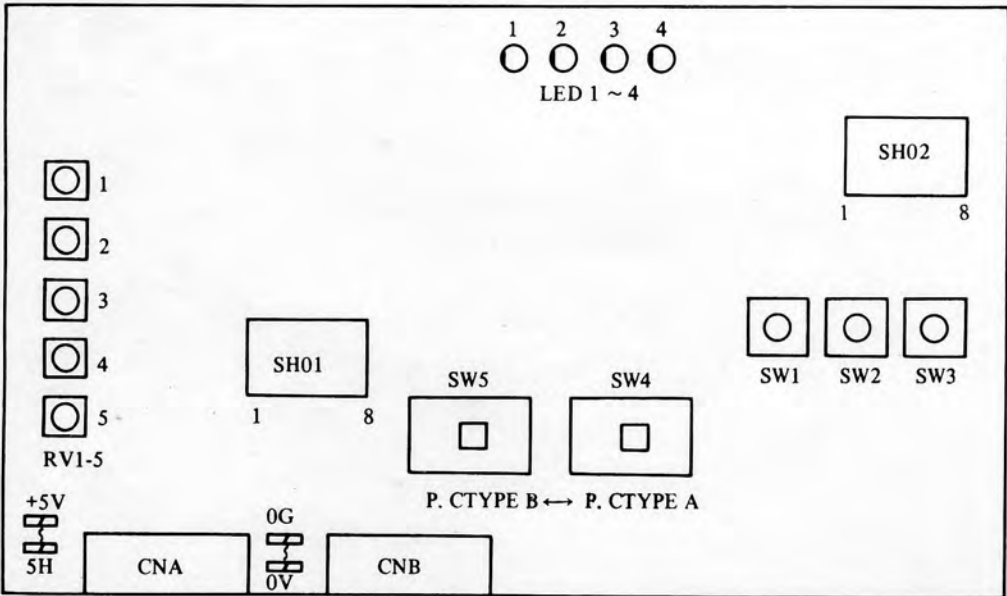
(2) Display

Light emitting diode

LED1 ORIENTATION	Lights when orientation command (ORCM1, 2 ON) is issued.
LED2 LOW	Lights when the contact of clutch change signal *CTH is closed. Lighting indicates that clutch LOW is selected.
LED3 IN-POSITION OUT	Lights when orientation completion signal ORAR 1-2 is issued.
LED4 IN-POSITION ADJUST	Lights when spindle enters within one pulse of orientation position.

Stop position can be the same at HIGH and LOW by adjusting POT RV3/RV5 for OFFSET adjustment so that this LED lights at gear HIGH/LOW.

(3) Setting



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Table 1 Setting of SH01, SH02

○: Connected ×: Open

No.	Contents		SH01								SH02								Remarks
			1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	
			16	15	14	13	12	11	10	9	16	15	14	13	12	11	10	9	
1	Initial orientation direction immediately after turning on power	CCW	○	×															(Standard)
		CW	×	○															
2	Orientation direction after initial orientation	CCW only			×	○													(Standard)
		CW only			×	×													
		Spindle rotational direction			○	×													(Standard)
3	Orientation speed which is set by position gain	1					×	×											
		2/3					○	×											
		1/3					×	○											
4	Rotational direction of spindle and position coder	Same direction							○	×									Different from machine tool to machine tool. Incorrect setting will cause hunting.
		Reverse direction							×	○									
5 (Note)	In-position width to issue orientation completion signal (ORAR 1, 2)	±2 pulses									○	○	○	○	○	○			±16 pulses correspond to ±1.3°
		±4 pulses										○	○	○	○	○			
		±8 pulses											○	○	○	○			
		±16 pulses												○	○	○			
		±32 pulses													○	○			
		±64 pulses														○			
6	Setting due to position coder hysteresis	No pulse															×	×	(Standard)
		+1 pulse															○	×	
		-1 pulse															×	○	

(Note) The condition (c) of issue of orientation completion signal
c = (Spindle is within the in-position width) and (Velocity zero signal is ON) and (ORCM is ON)

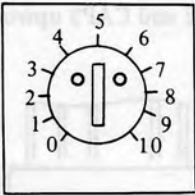
(d) Setting of stop position SW1, 2, 3

Switch	Contents
SW1 (16 positions)	1 position is $4096/16 = 256$ pulses, equivalent to 22.5° .
SW2 (16 positions)	1 position is $256/16 = 16$ pulses, equivalent to 1.4° .
SW3 (16 positions)	1 position is $16/16 = 1$ pulse, equivalent to 0.088° .

An arbitrary position in a rotation can be positioned by the unit of $0.088^\circ = 1/4096 \times 360^\circ$ by setting in the order of SW1, 2 and 3.

(4) Adjustment

No.	Item	Variable resistor	Measuring point	Standard Adjustment	Note
1	Velocity feedback offset	RV1	TSA2 CH14	5 scale	The voltage at TSA2 should be ± 1 mV.
2	Position gain at gear High	RV2	Do not let spindle overshoot	3~4 scale	
3	Offset at gear High	RV3	Let LED4 ADJUST light	About 5 scale	Gleaming of the LED is sufficient.
4	Position gain at gear Low	RV4	Do not let spindle overshoot	3~6 scale	
5	Offset at gear Low	RV5	Let LED4 ADJUST light	About 5 scale	

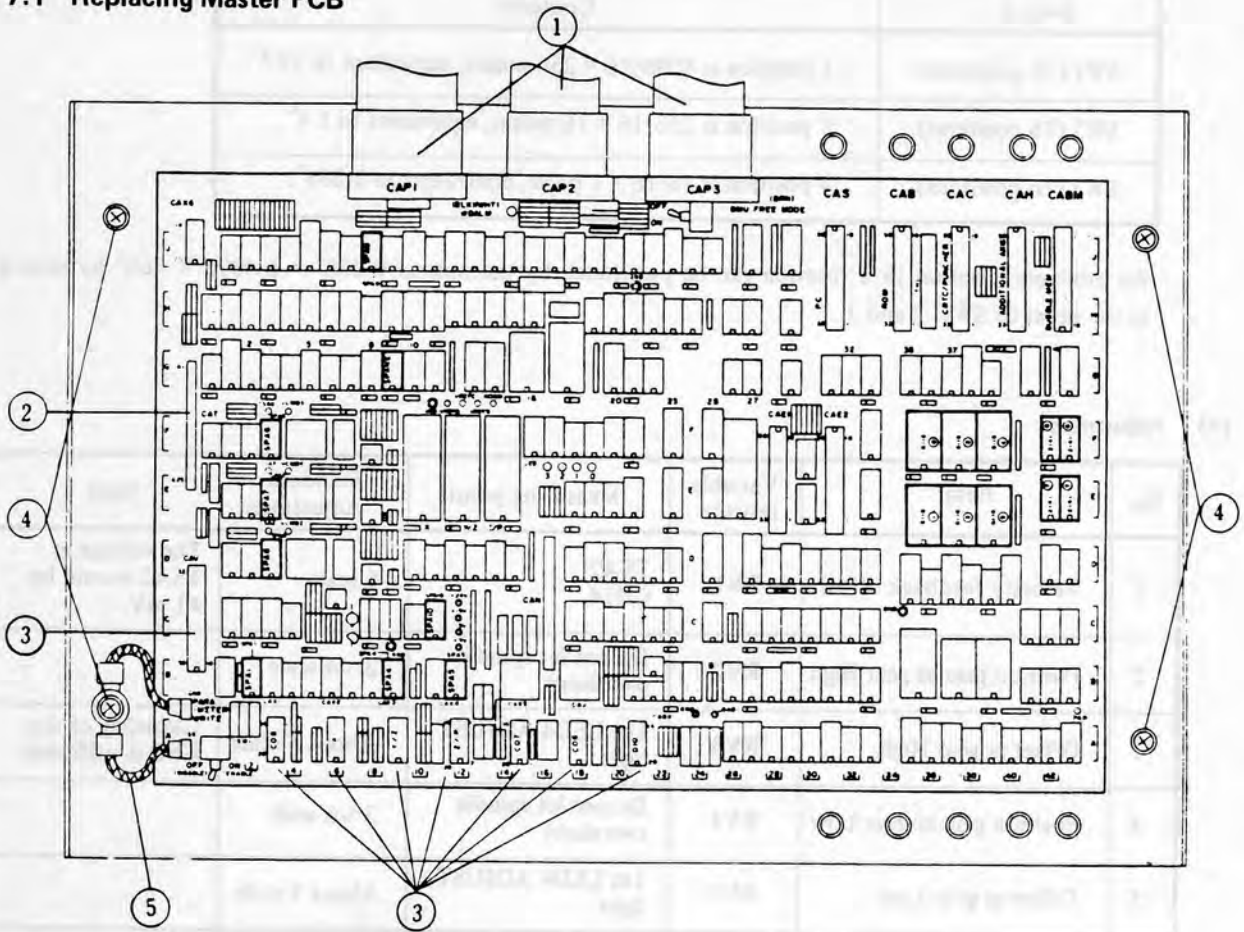


Scale of potentiometer

7.

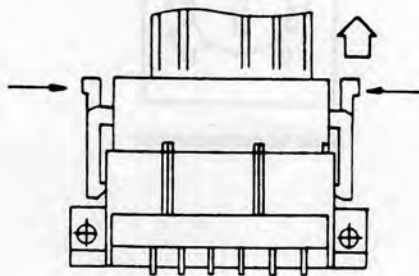
7. REPLACING PRINTED CIRCUIT BOARDS

7.1 Replacing Master PCB

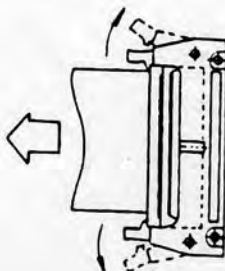


7.1.1 Procedure

- (1) Pull the cables at connectors CAP1, CAP2 and CAP3 upwards by applying pressure at the positions marked with arrows in the following figure.

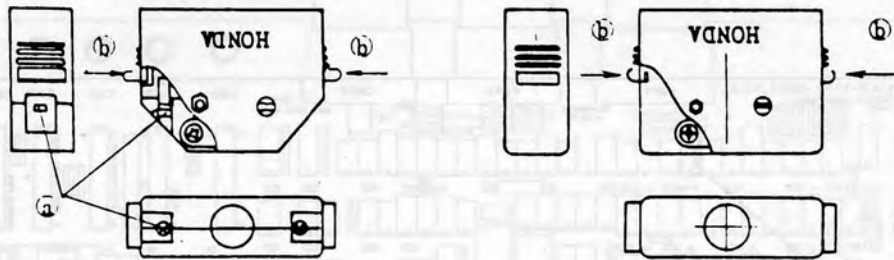


- (2) Pull out cables from connector CAT by unlocking in the arrow direction as illustrated below:

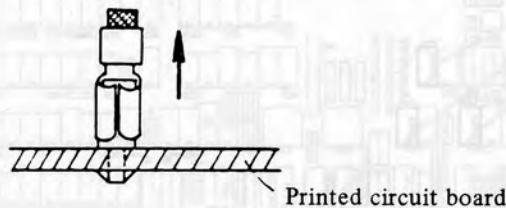


(Note) To connect the cables, release the lock, and set the connector to "▼". Press the connector in the direction opposite to "↖", and engage the lock. If the connector is not pushed enough, the lock cannot be engaged. The left sketch shows the locked position.

- (3) Pull out all HONDA connector as shown in ③.
Before that, loosen the two screws (a), and pull out the connector while pushing section (b).



- (4) Remove four screws, and the master PCB can be removed.
(5) Disconnect the grounding wire.
This wire is to be connected to the new printed circuit board.



- (6) Follow procedures ⑤ through ① to mount the new printed circuit board.

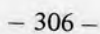
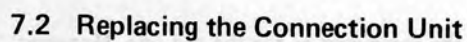
7.1.2 Setting and adjustment (See 6.)

- (1) The settings for the new printed circuit board should be made in the same way as for the old one. However, the setting on SPA9 remains unchanged.
(2) According to "6", adjust variable resistors VR1 through VR3.

(Note) VR1 through VR3 may not be provided, depending on the version of the printed circuit board.

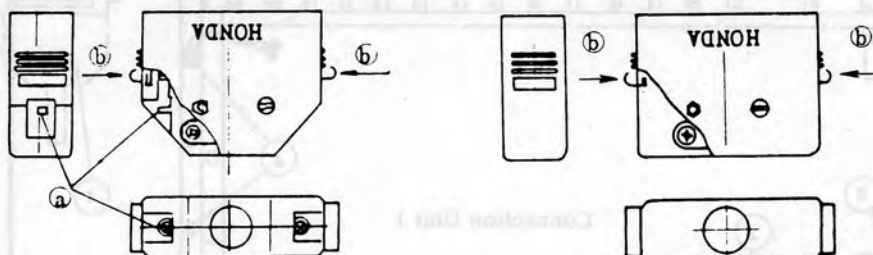
- (3) Also check the number of IC RAMs installed.
No problem occurs if the number of IC RAMs installed is greater than that of the old printed circuit boards. If not, a Memory Alarm will occur.
(4) If Memory Alarm occurs after replacing the printed circuit board, clear the memory and again set the parameters.

7.1.3 Locations for setting and adjustment

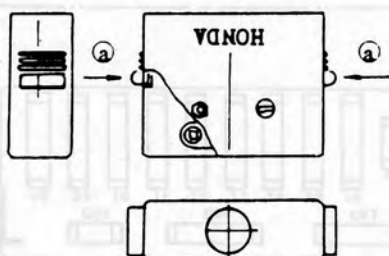


7.2.1 Procedure

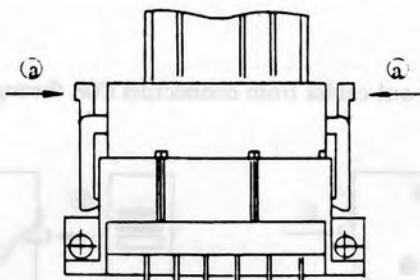
- (1) Loosen two screws (a) and pull out cables from connectors C01 through C05 while pushing (b), as illustrated below:



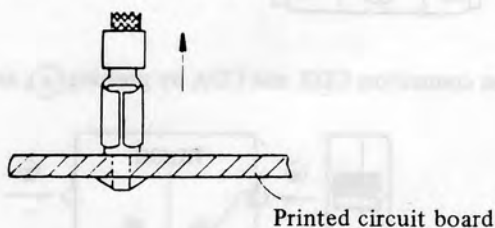
- (2) Pull out cables from connectors CDX and CDA by pushing (a), as illustrated below.



- (3) Pull out the cable from connector CDP by pressing (a), as illustrated below:



- (4) Remove four screws in (4), and the connection unit can be removed.
 (5) Disconnect the ground wire, and connect it to the replaced printed circuit board.

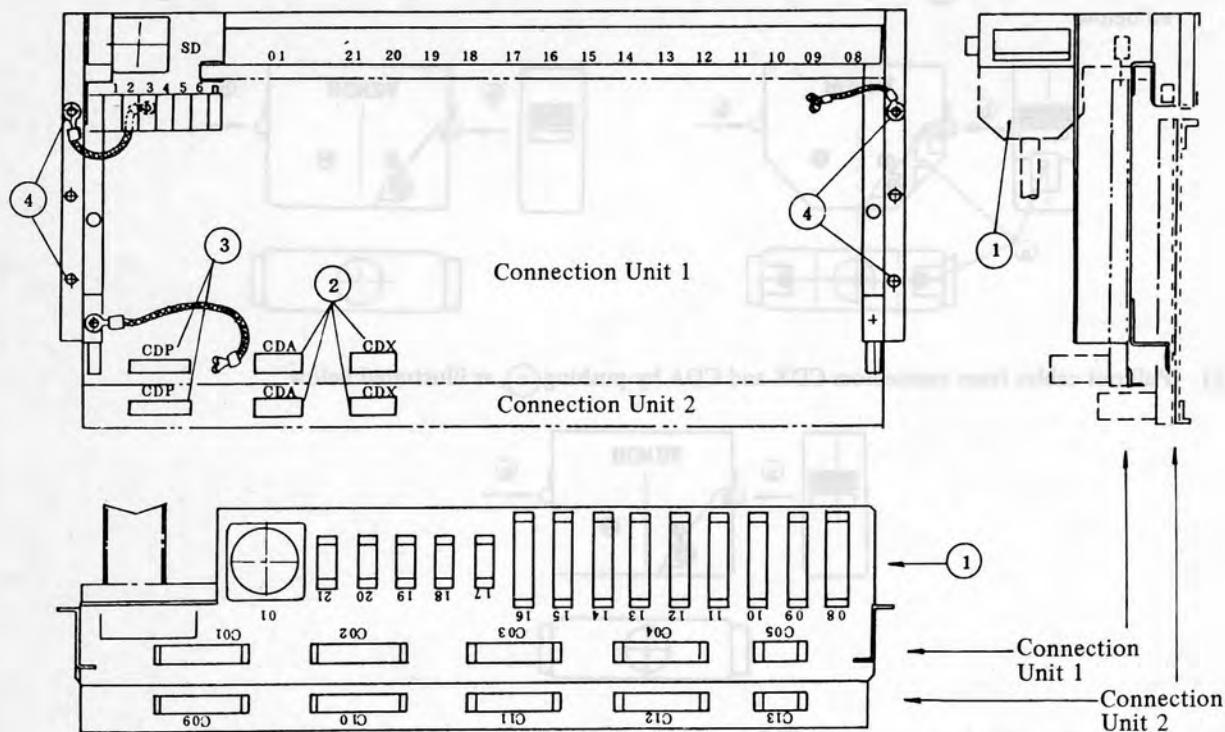


- (6) When mounting a new printed circuit board, follow procedures (5) through (1).

7.2.2 Setting

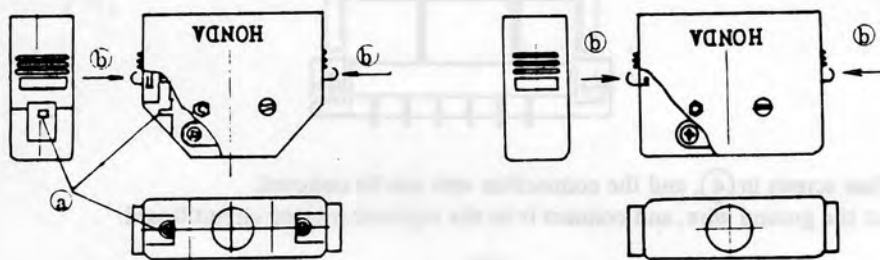
Installing the new printed circuit board set S1 and S2 on the new printed circuit boards in the same way as the old ones.

7.3 Replacing Connection Unit with Terminal Board

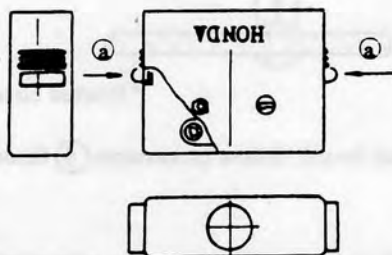


7.3.1 Procedure

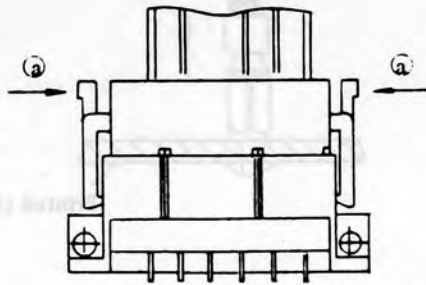
- (1) Loosen two screws (a) and pull out cables from connectors C08 through C21 while pushing (b), as illustrated below:



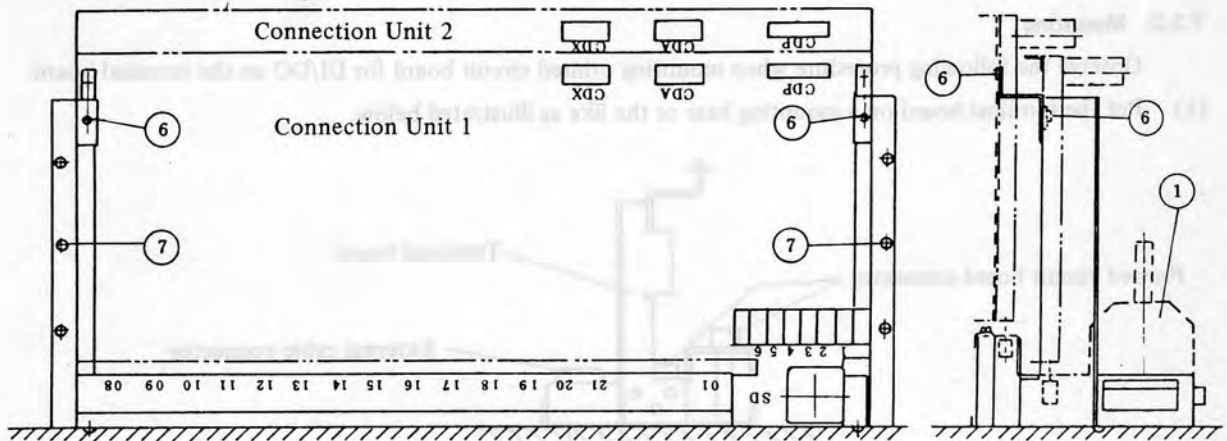
- (2) Pull out cables from connectors CDX and CDA by pushing (a), as illustrated below.



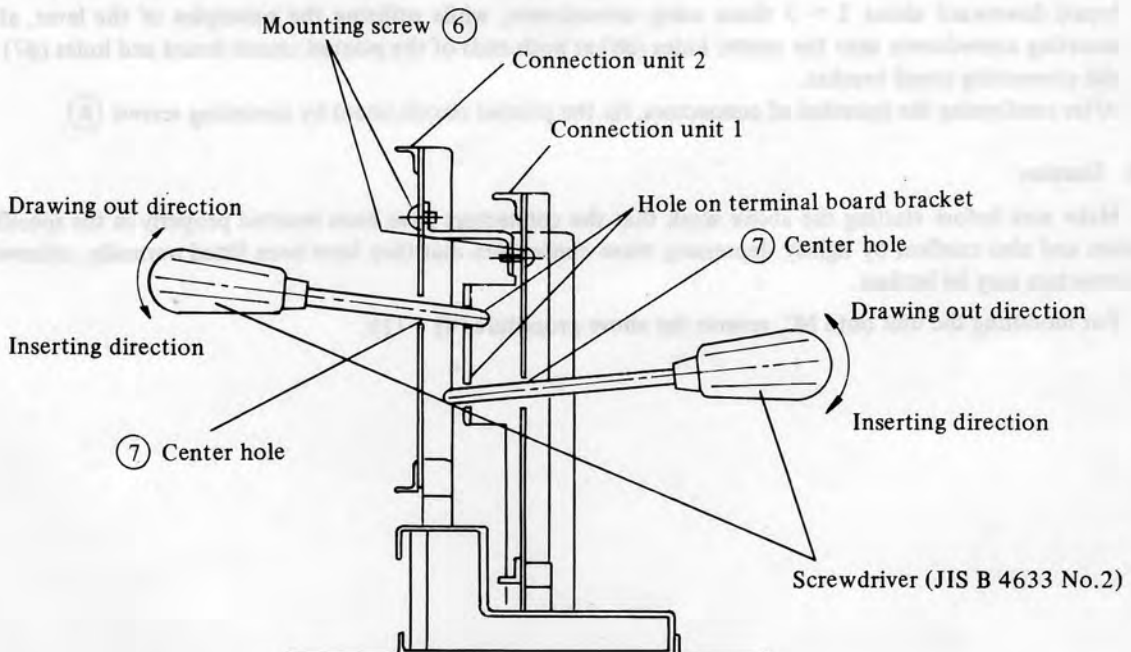
- (3) Pull out the cable from connector CDP by pressing (a), as illustrated below:



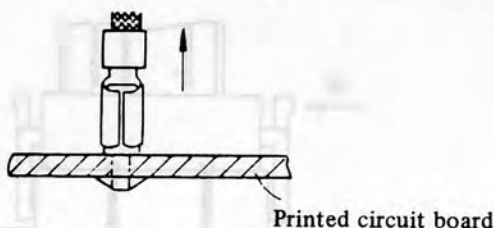
- (4) Remove four screws in (4), and the connection unit can be removed.
 (5) Place the connection unit on the stand.



- (6) After removing two right and left connection unit mounting screws (6), insert a screwdriver into center holes (7) at both ends of the connection unit, and then, draw out the connection unit by alternately lifting the right and left screwdrivers upward.



- (7) Disconnect the ground wire, and connect it to the replaced printed circuit board.



7.3.2 Setting

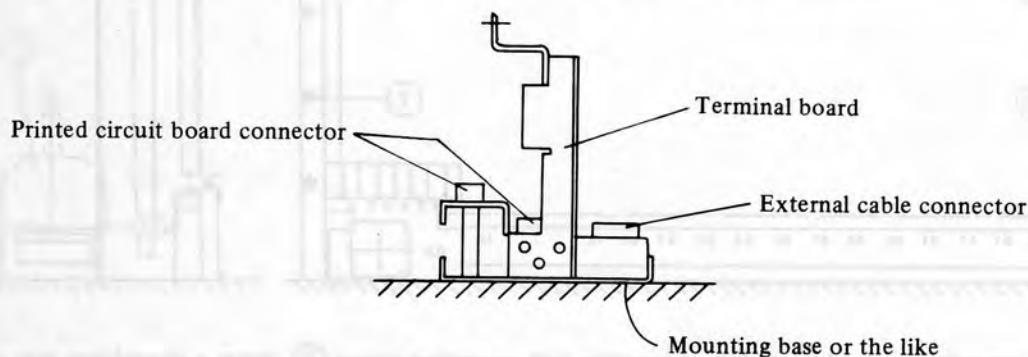
Installing the new printed circuit board set S1 and S2 on the new printed circuit boards in the same way as the old ones.

- (8) For the mounting method, refer to 7.3.3.

7.3.3 Mounting

Observe the following procedure when mounting printed circuit board for DI/DO on the terminal board.

- (1) Put the terminal board on a mounting base or the like as illustrated below.



- (2) After confirming the printed circuit board connectors, terminal board connectors and their inserting directions, meet these connectors, and lightly insert them.
- (3) These connectors can be inserted by alternately depressing the right and left sides of the printed circuit board downward about 2 ~ 3 times using screwdrivers, while utilizing the principles of the lever, after inserting screwdrivers into the center holes ($\phi 8$) at both ends of the printed circuit board and holes ($\phi 7$) on the connecting board bracket.

After confirming the insertion of connectors, fix the printed circuit board by mounting screws (6).

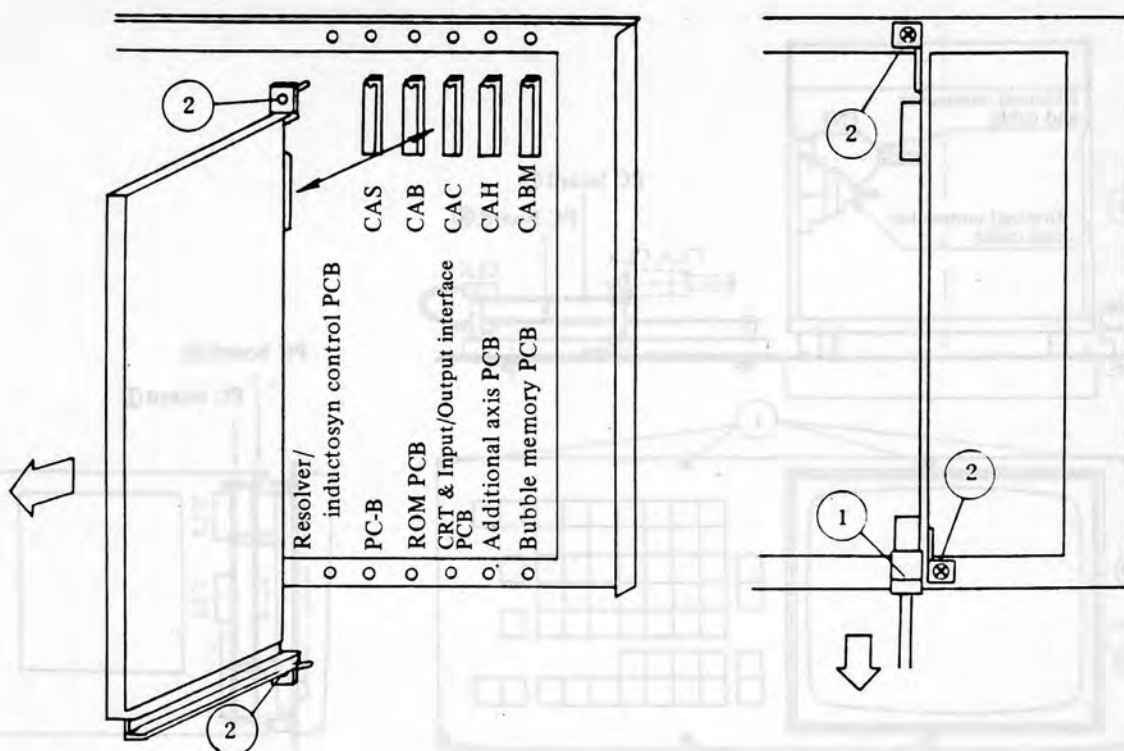
7.3.4 Caution

Make sure before starting the above work that the connectors have been inserted properly in the specified direction and also confirm by lightly depressing these connectors that they have been fitted normally, otherwise the connectors may be broken.

- (4) For mounting the unit onto NC, reverse the above procedure (4) → (1).

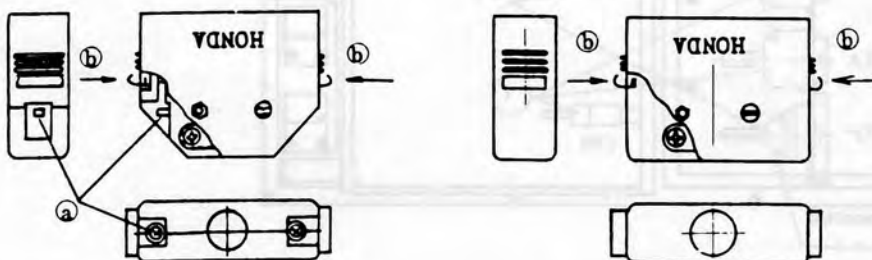
7.4 Replacing Printed Circuit Boards for ROM, CRT & INPUT/OUTPUT Interface, Bubble Memory, PC-MODEL B, Additional Axis and Resolver/Inductosyn Control

7.4



7.4.1 Procedure

- (1) Loosen the two screws (a) and pull out the cable from the connector (1) by pushing section (b).
- (2) Loosen two screws (2), and pull them out.



- (3) Mount the new printed circuit boards in the order of (2) and (1).

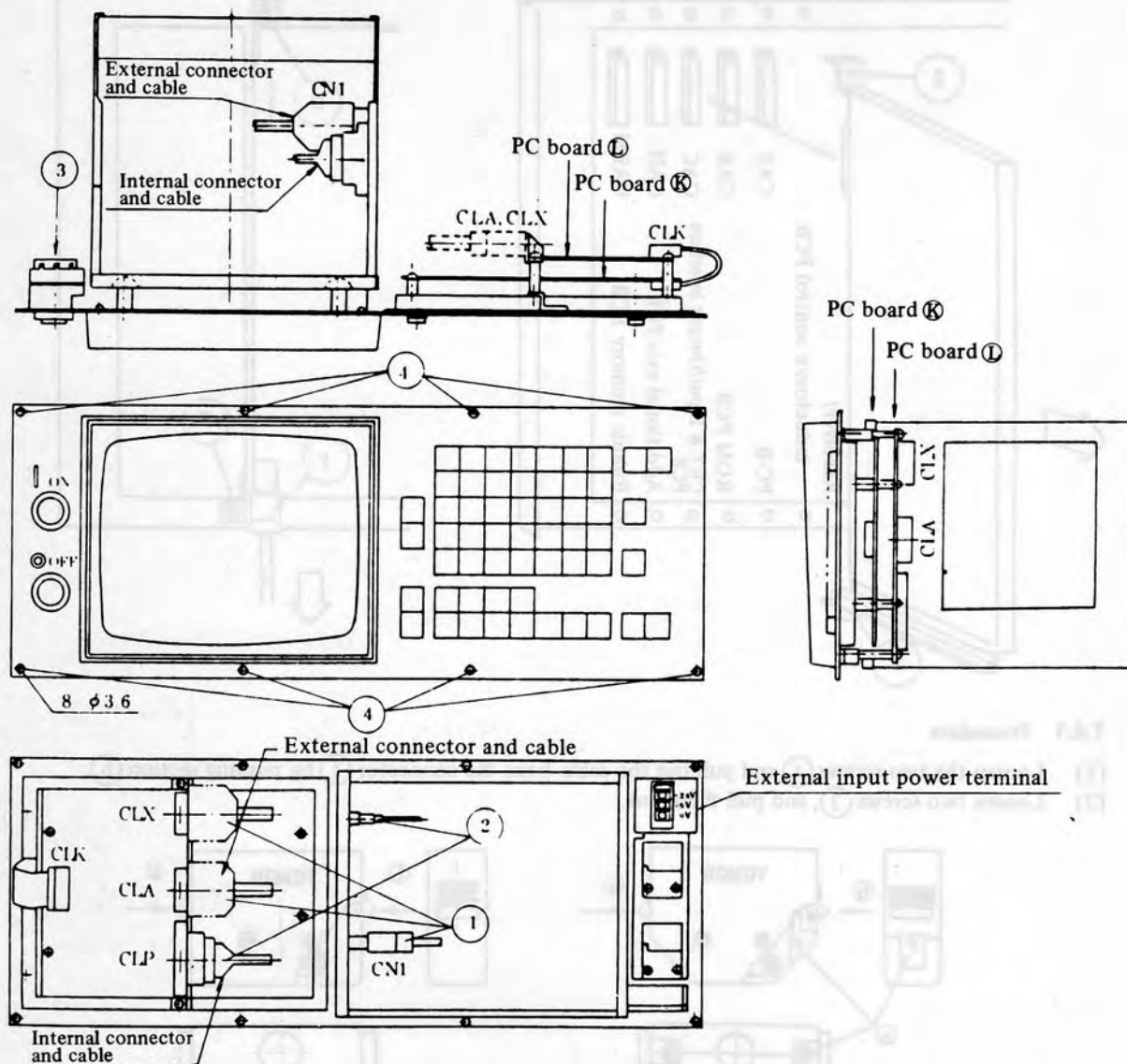
7.4.2 Setting and Adjustment

- (1) Set on new printed circuit boards in the same way as on the old ones.
- (2) Make adjustment as required, according to "6".

7.4.3 Precautions

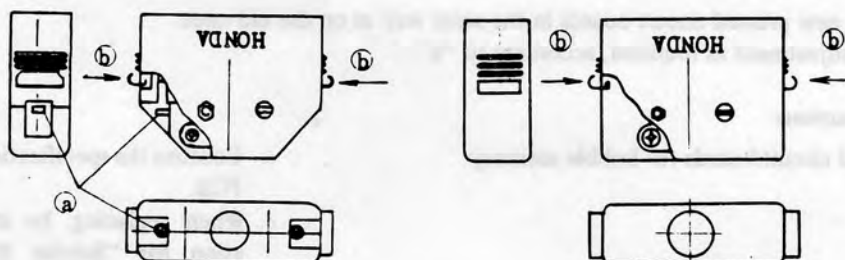
- (1) Printed circuit boards for bubble memory
 - Confirm the specifications of bubble memory PCB.
 - When replacing, be sure to perform operation for "Bubble Memory ALL Clear", then set the parameters, NC data and other required data. If the parameters are not reset "an alarm" may occur.
- (2) ROM Printed Circuit Board
 - Check the number of the mounted EROMs, EROM number and version number.
- (3) Additional axis Printed Circuit Board
 - Confirm position control LSI (k5, k7).

7.5 Replacement of MDI/CRT Unit

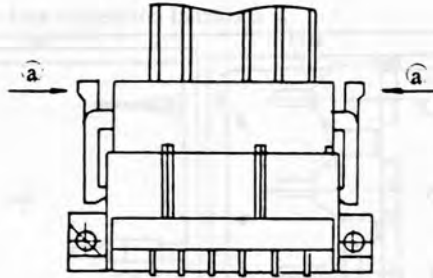


7.5.1 Replacement of MDI/CRT unit

- (1) Loosen two screws (a) and pull out the cables from connectors CN1, CLX and CLA by pushing (b).



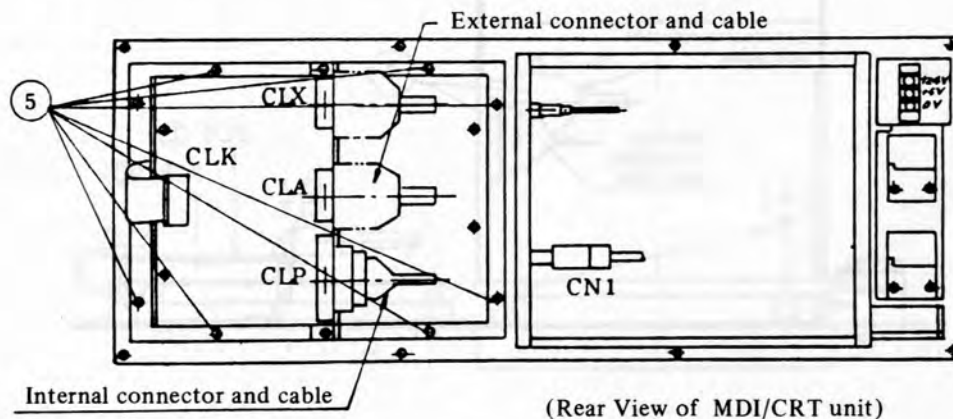
- (2) Pull out the power-line connector by pushing (a).



- (3) Loosen the screw and disconnect the wire from the power ON/OFF pushbutton.
(Mark the wire to ensure correct wire connection.)
(4) Remove eight screws (3.6mm diam.), and the MDI/CRT unit can be removed forward.
(5) Mount the new MDI/CRT unit according to procedure (4) through (1).
(6) The CLX is normally connected with the terminator. After replacing the unit, be sure to connect the terminator.

7.5.2 Replacing the MDI unit

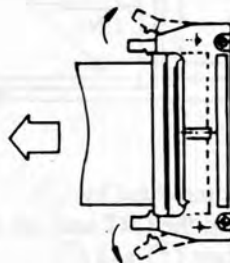
- (1) Remove cables from connectors CLX, CLA and CLP.
(2) Remove eight nuts (5), and the MDI unit can be removed.



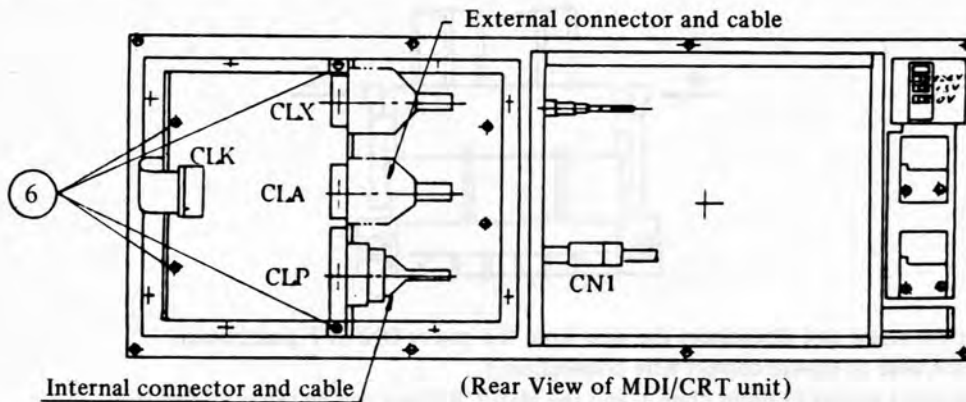
- (3) Mount the MDI unit in the procedure (2) and (1).
(4) The CLX is normally connected with the terminator. After replacing the unit, be sure to connect it.

7.5.3 Replacement of printed circuit board (L)

- (1) Remove cables from connectors CLX, CLA and CLP.
(2) Unlock connector CLK and pull it out, as illustrated.

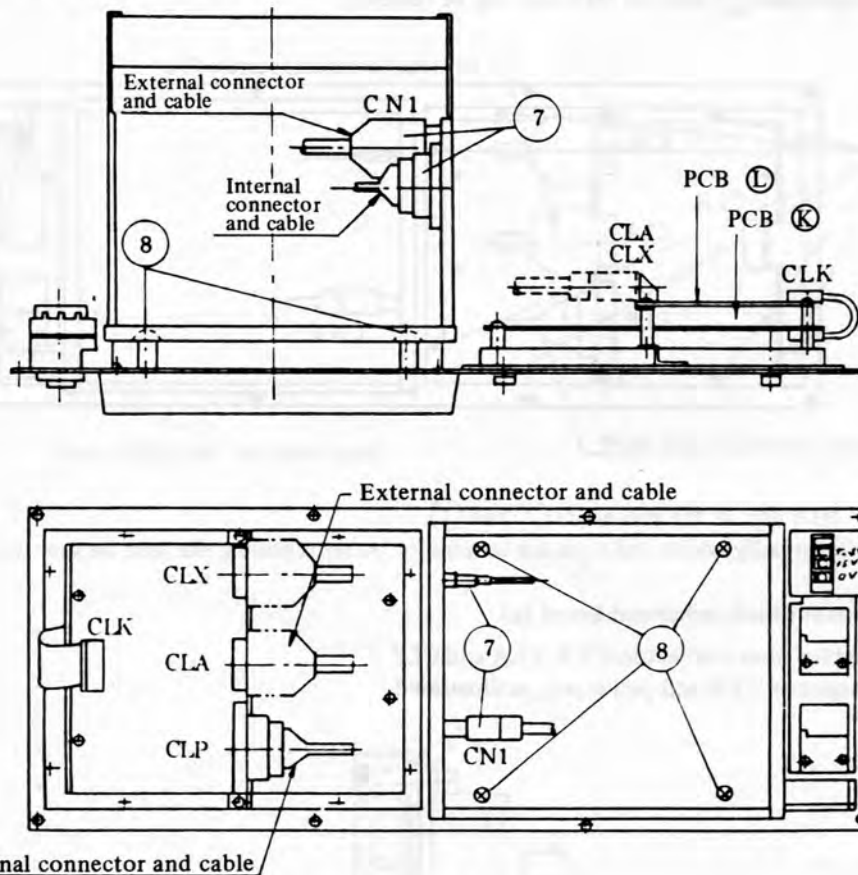


- (3) Remove four screws (6) and printed circuit board (L) can be removed.



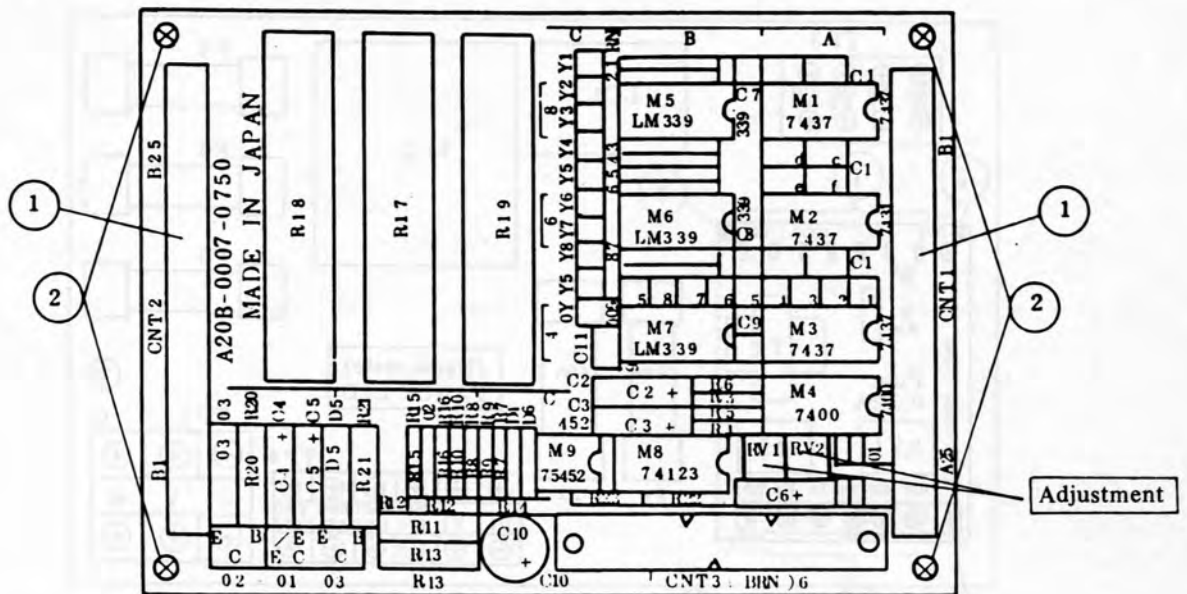
- (4) Mount the new printed circuit boards according to the procedures (3) through (1).
 (5) The CLX is normally connected with the terminator. After replacing the printed circuit board, be sure to connect it.

7.5.4 Replacement of the CRT unit



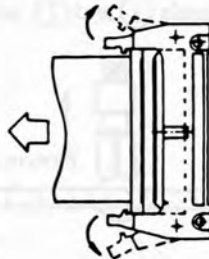
- (1) Disconnect the cable from the connector indicated by (7).
 (2) Remove four screws indicated by (8), and the CRT unit can be removed.
 (3) Mount the new unit according to procedure (2) and (1).

7.6 Replacement of Printed Circuit Boards for Tape Reader Photoamplifier



7.6.1 Procedure

- (1) Release the lock in the arrow direction and disconnect the connectors CNT1 and CNT2.

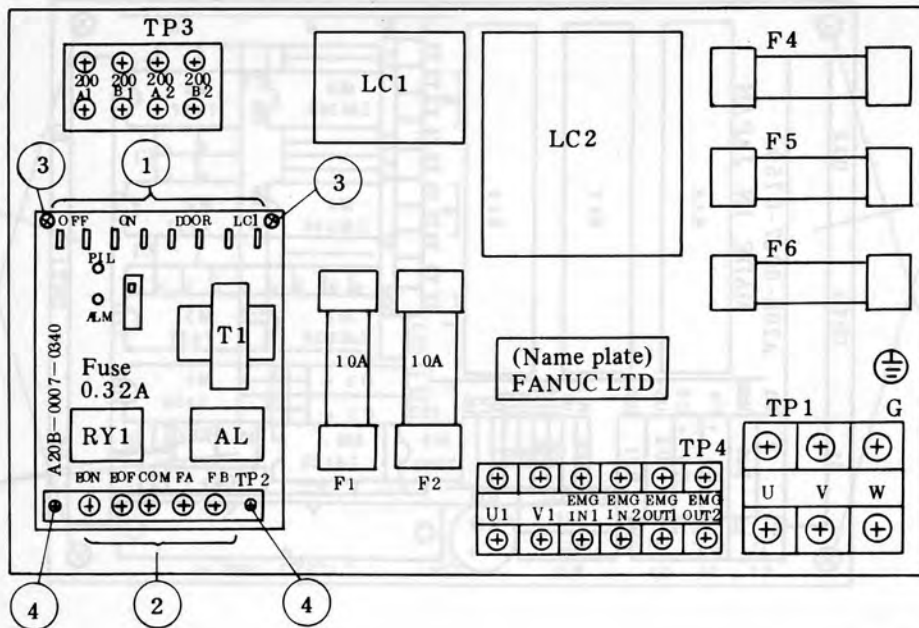


- (2) Remove the four screws, and the printed circuit board can be removed.
- (3) Mount the new printed circuit board according to procedures (2) and (1).

7.6.2 Adjustment

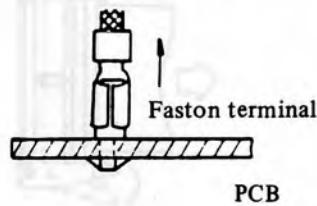
Adjust RV1 and RV2 according to "3.5".

7.7 Replacing Power ON/OFF Control PCB (In case of free standing type cabinet)

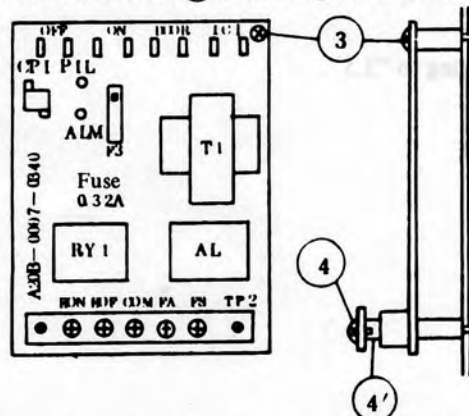


7.7.1 Procedure

- (1) Disconnect the cables from Faston terminals ① and ②, and screw terminal TP2.



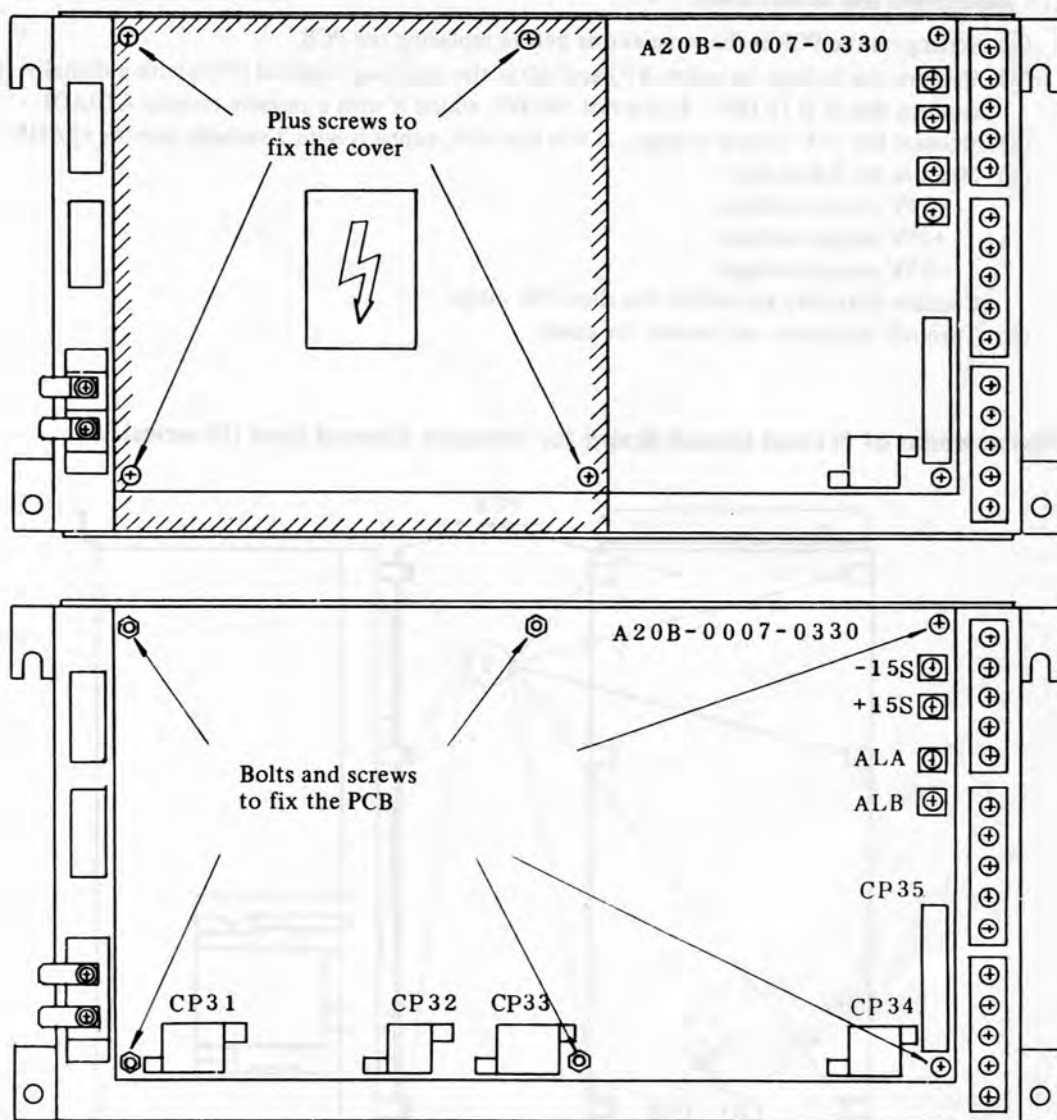
- (2) Remove the four screws ③ and ④.
For screw ④ of the TP2 terminal, remove only the plastic cover.
- (3) Remove the screw ④' below the screw ④, and the printed circuit board can be removed.



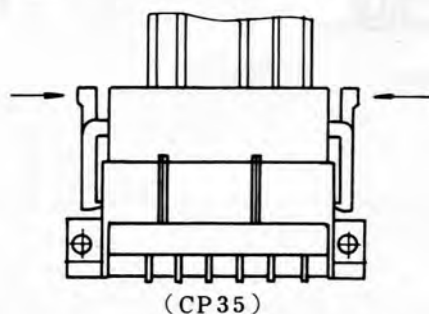
- (4) Mount the new printed circuit board according to the procedure ③, ② and ①.

7.8 Replacing the Printed Circuit Board for Power ON/OFF Control

7.8



- Turn off the power and remove the cover  which is fixed with four plus screws.
- Remove the connections at the connector CP31 ~ 35. Also when there are the cables connected at the terminals +15S, -15S, ALA, ALB, etc. remove then.
Since the connector is locked, draw it by pressing from both sides.

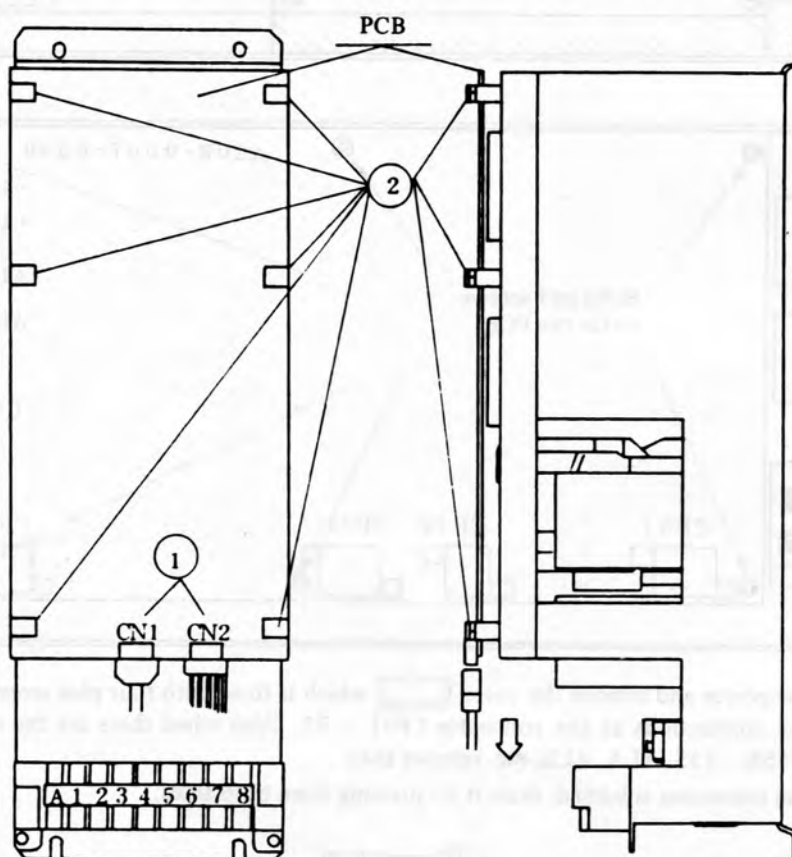


- Remove the printed circuit board (A20B-0007-0330) which is fixed with four bolts and two screws and mount the new one.
- Connect the connectors CP31 ~ 35.
Connect the cables to the terminals +15S, -15S, ALT and ALB, if these cables exist.

7.8.1 Adjustment and confirmation

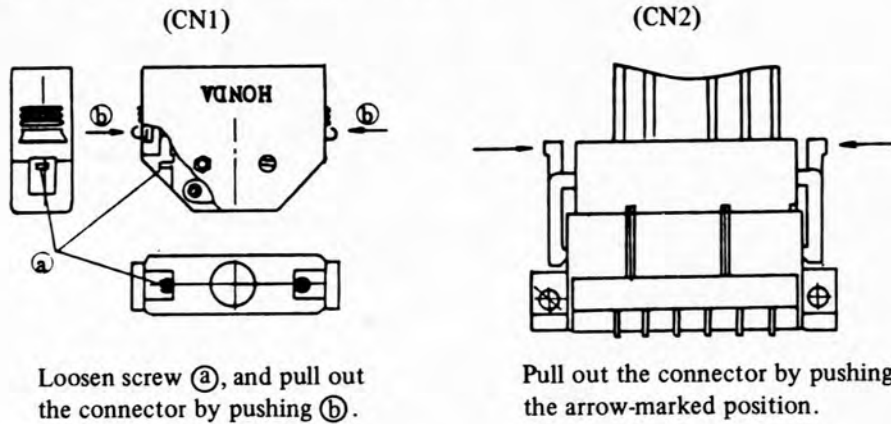
- ① Setting on the PCB is the same as one before replacing the PCB.
- ② Measure the voltage between A10 and A0 at the checking terminal CP36 with a digital voltmeter. And confirm that it is 10.00V. If it is not 10.00V, adjust it with a variable resistor A10ADJ.
- ③ Measure the +5V output voltage. If it is not +5V, adjust it with a variable resistor +5ADJ.
- ④ Measure the followings:
 - +24V output voltage
 - +15V output voltage
 - 15V output voltage
 Confirm that they are within the allowable range.
- ⑤ Turn off the power and mount the cover.

7.9 Replacement of Printed Circuit Board for Velocity Control Unit (M series)

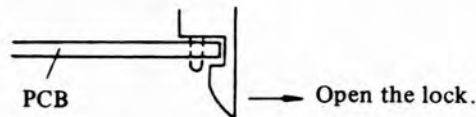


7.9.1 Procedure

- (1) Disconnect the cables from connectors CN1 and CN2.

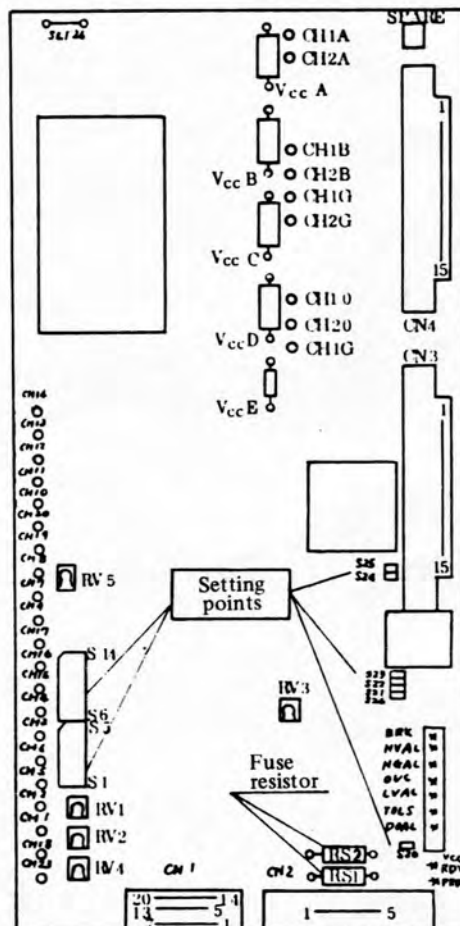


- (2) Pull the printed circuit board forward by opening the locks (2) with your finger, and the printed circuit board can be removed.



- (3) Mount the new printed circuit board according to procedure (2) and (1).

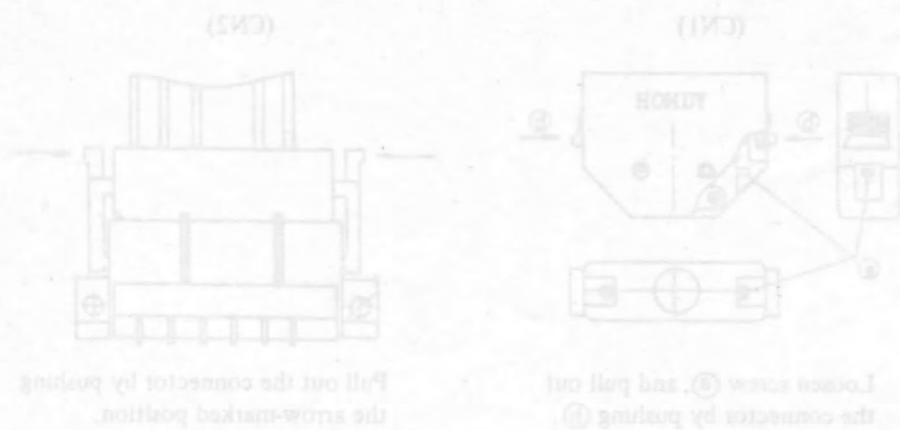
7.9.2 Setting and adjustment



- (1) Set on the printed circuit board in the same way as on the old one.
- (2) Make the adjustment as required.

7.3.1 Procedure

- (1) Disconnect the cables from connectors (CN1) and (CN2).

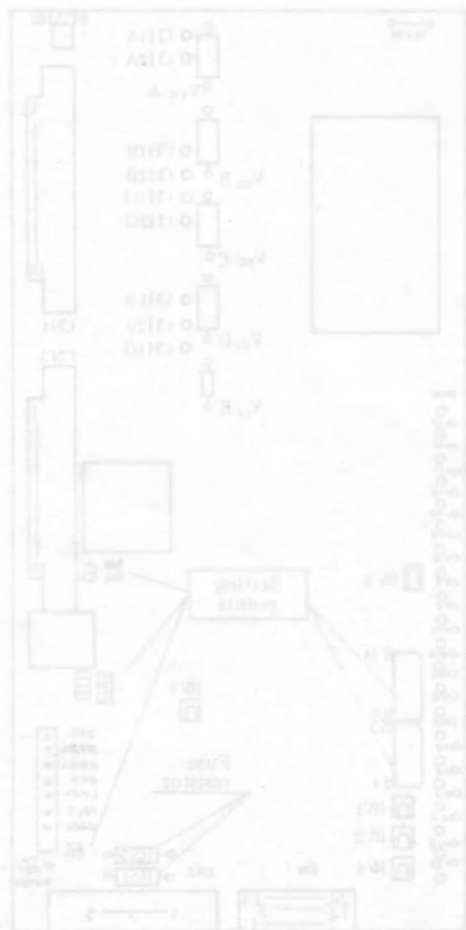


- (2) Pull the printed circuit board forward by opening the lock (5) with your finger, and the printed circuit board can be removed.



- (3) Mount the new printed circuit board according to procedure (2) and (1).

7.3.2 Setting and adjustment



- (1) Set on the printed circuit board in the same way as on the old one.
- (2) Make the adjustment as required.

APPENDIX

APPENDIX

Appendix 1

(2) Resolver feedback

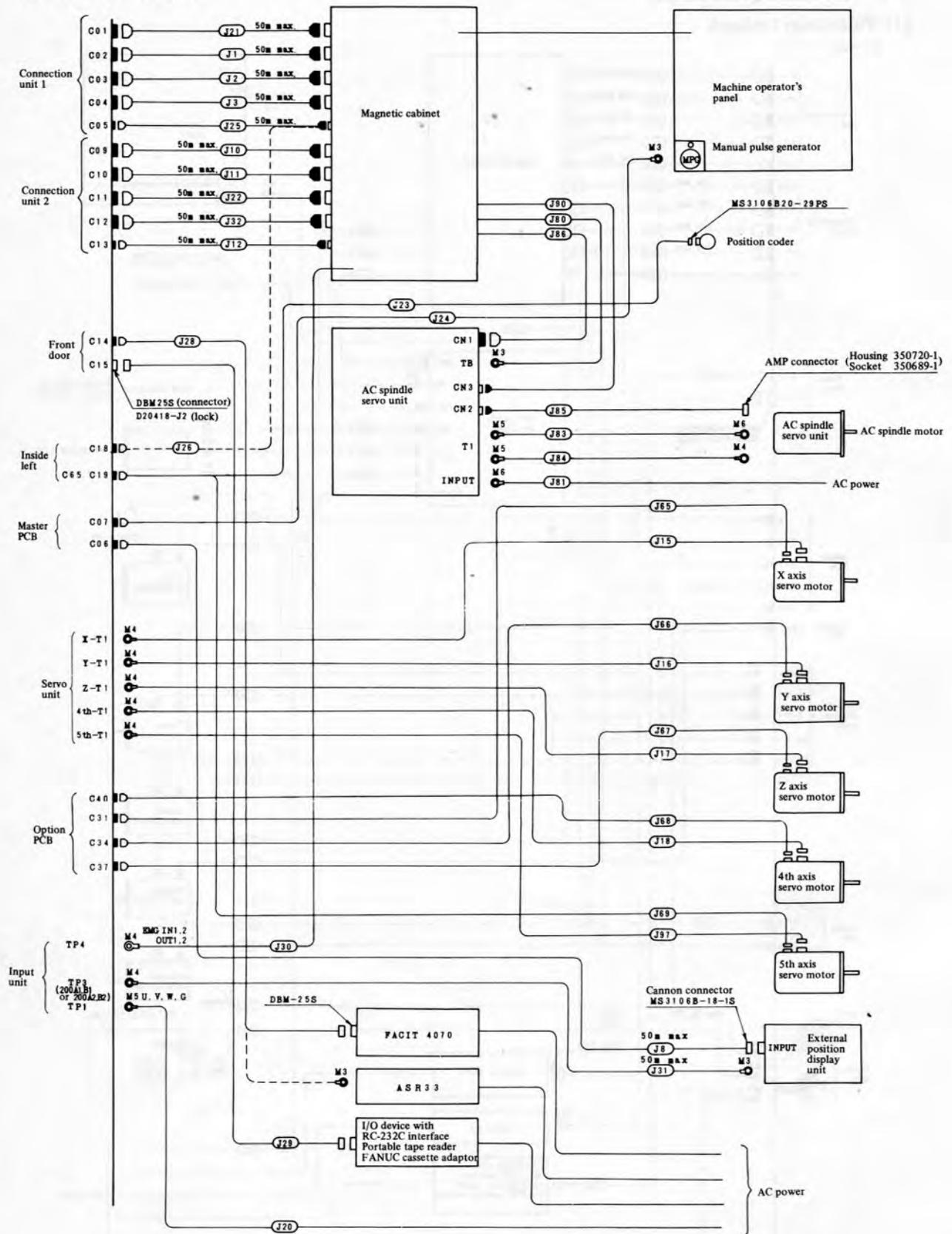


Fig. 1.1 (b) Total connection diagram of free standing type cabinet (Resolver feedback)

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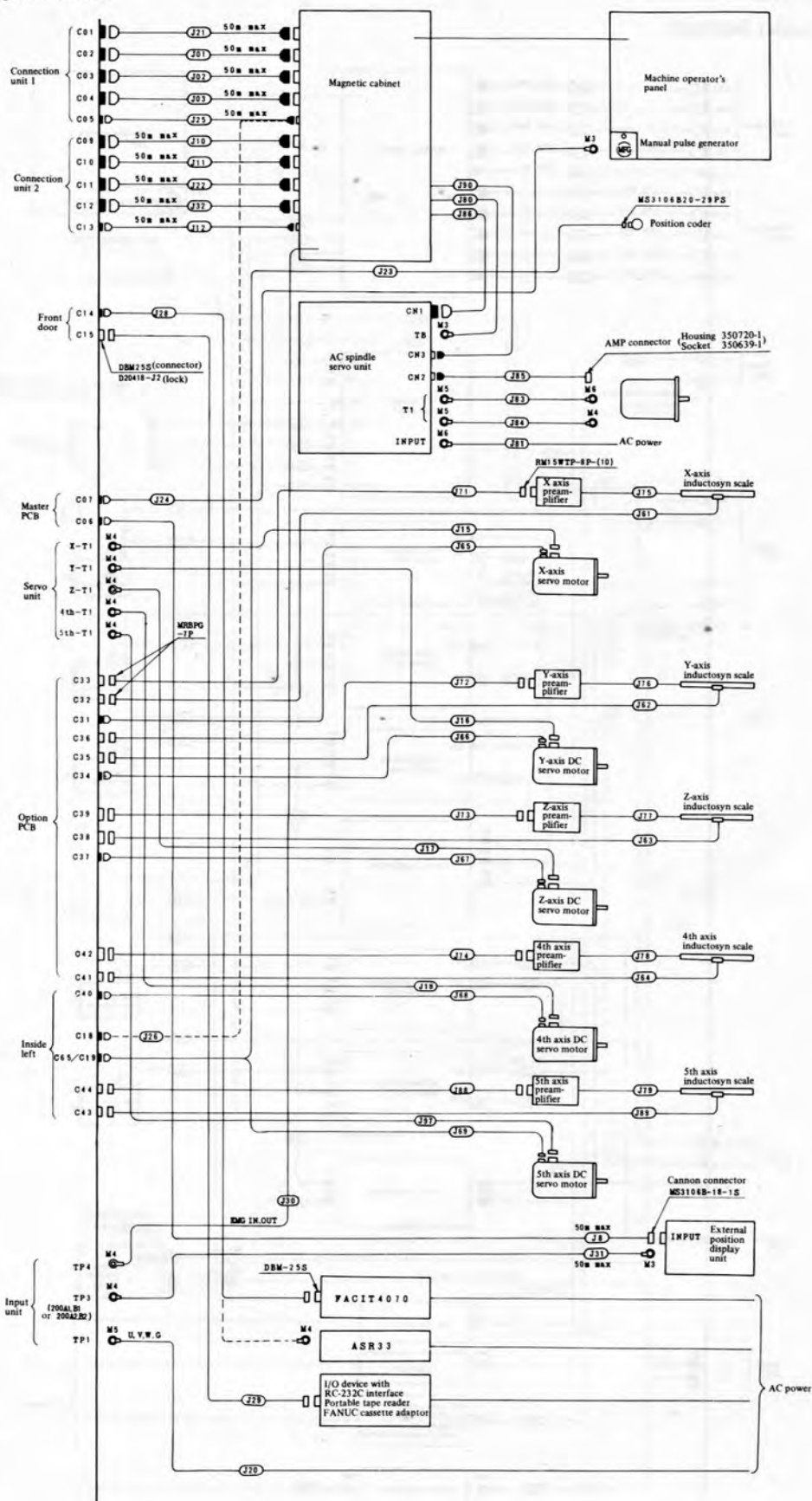


Fig.1.1 (c) Total connection diagram of free standing type cabinet (Inductosyn feedback)

1.2 Built-in type 1 cabinet

(1) Pulse coder feedback

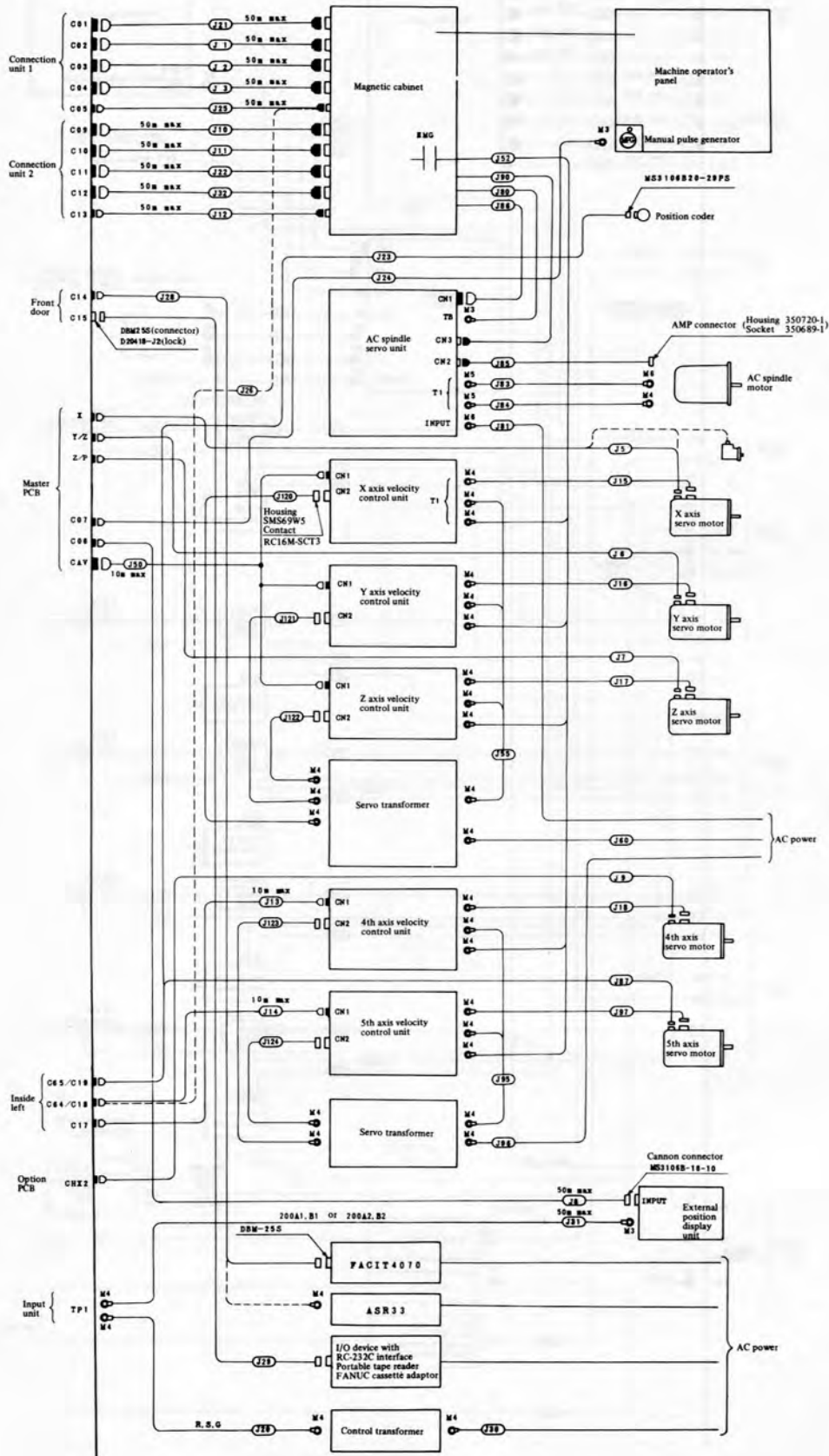


Fig.1.2 (a) Total connection diagram of built-in type 1 cabinet (Pulse coder feedback)

(2) Resolver feedback

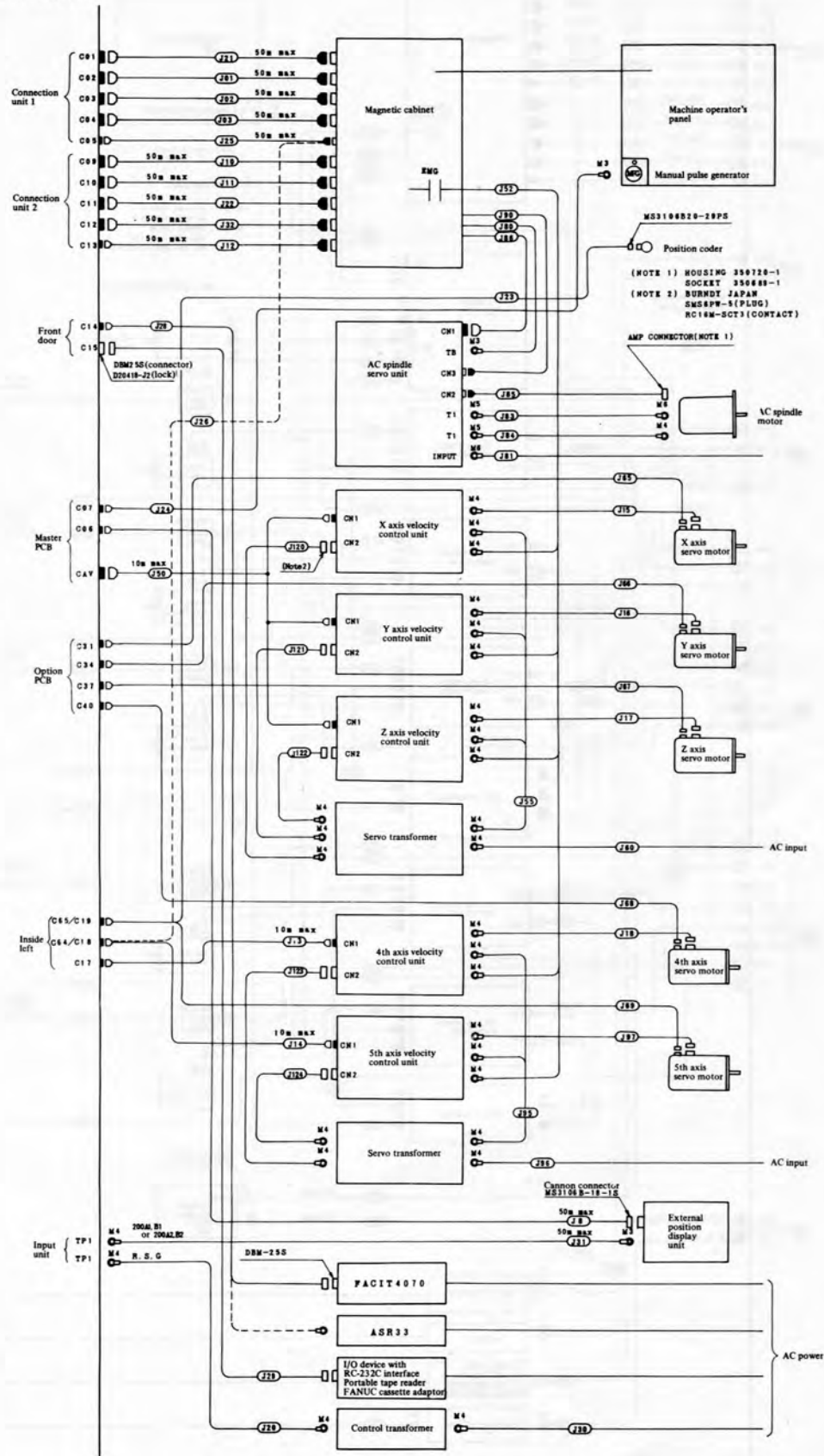


Fig.1.2 (b) Total connection diagram of built-in type 1 cabinet (Resolver feedback)

Appendix 1

(3) Inductosyn feedback

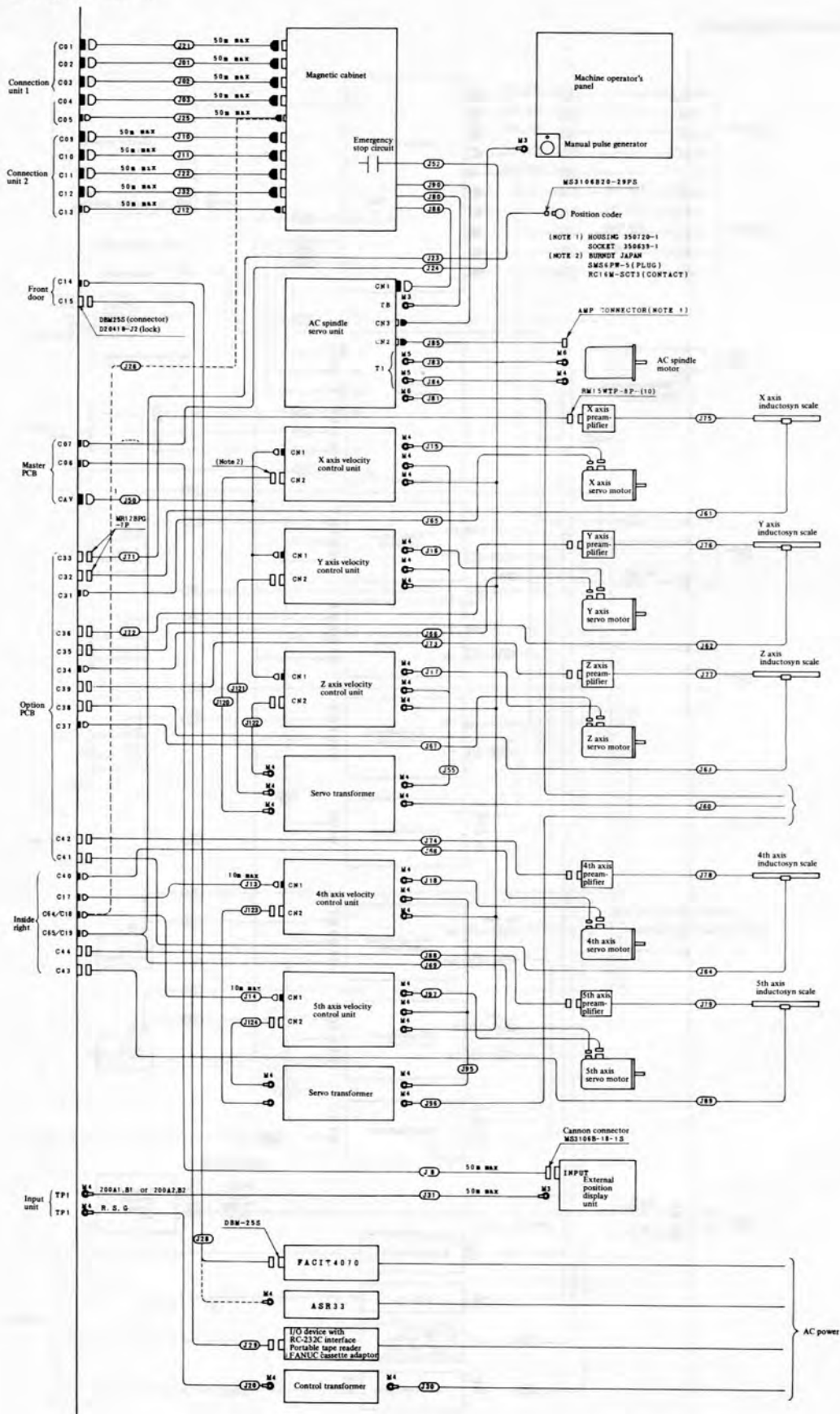


Fig.1.2 (c) Built-in type 1 cabinet (Inductosyn feedback)

1.3 Built-in type 2 cabinet

(1) Pulse coder feedback

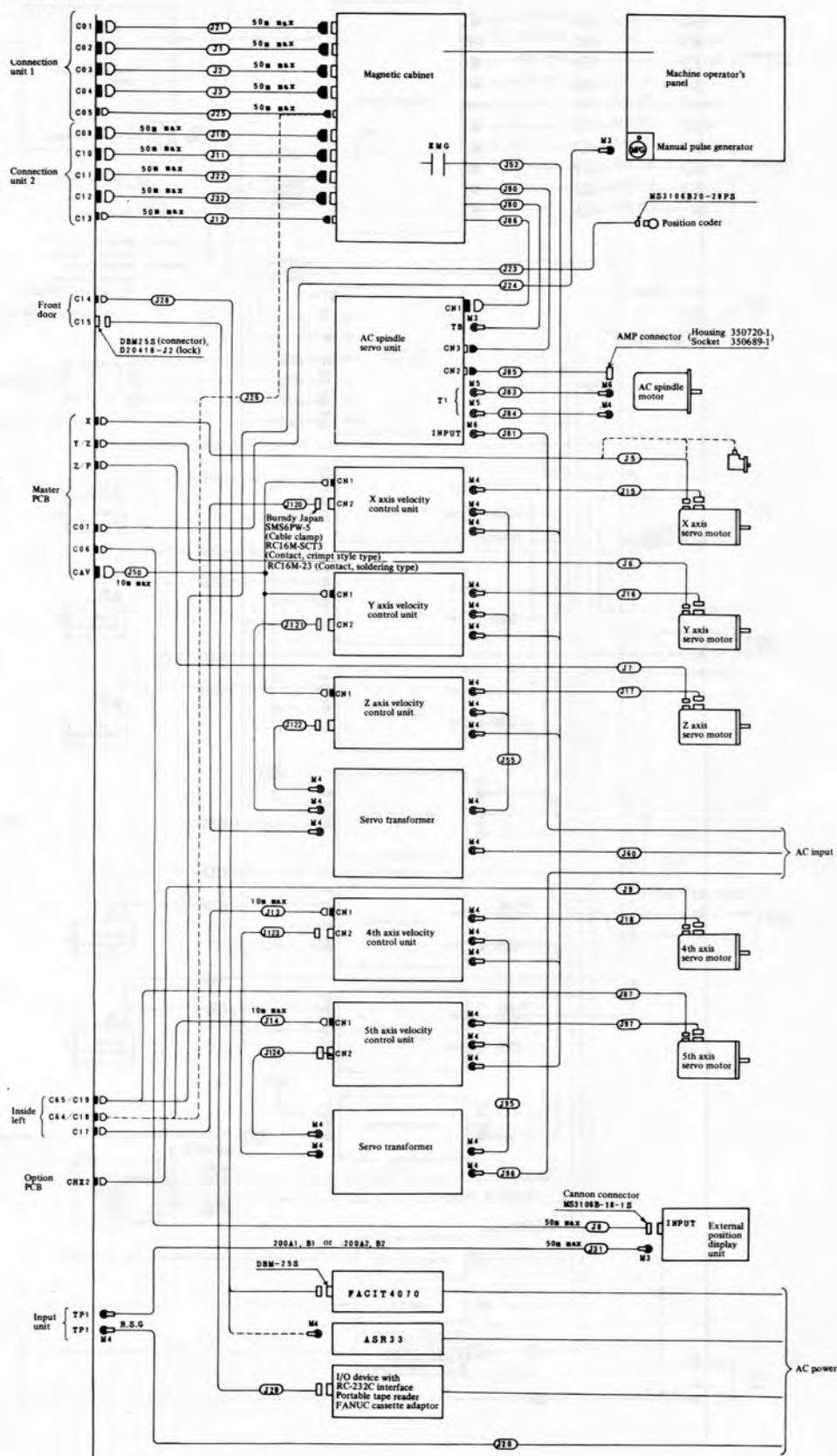


Fig. 1.3 (a) Total connection diagram of built-in type 2 cabinet (Pulse coder feedback)

(2) Resolver feedback

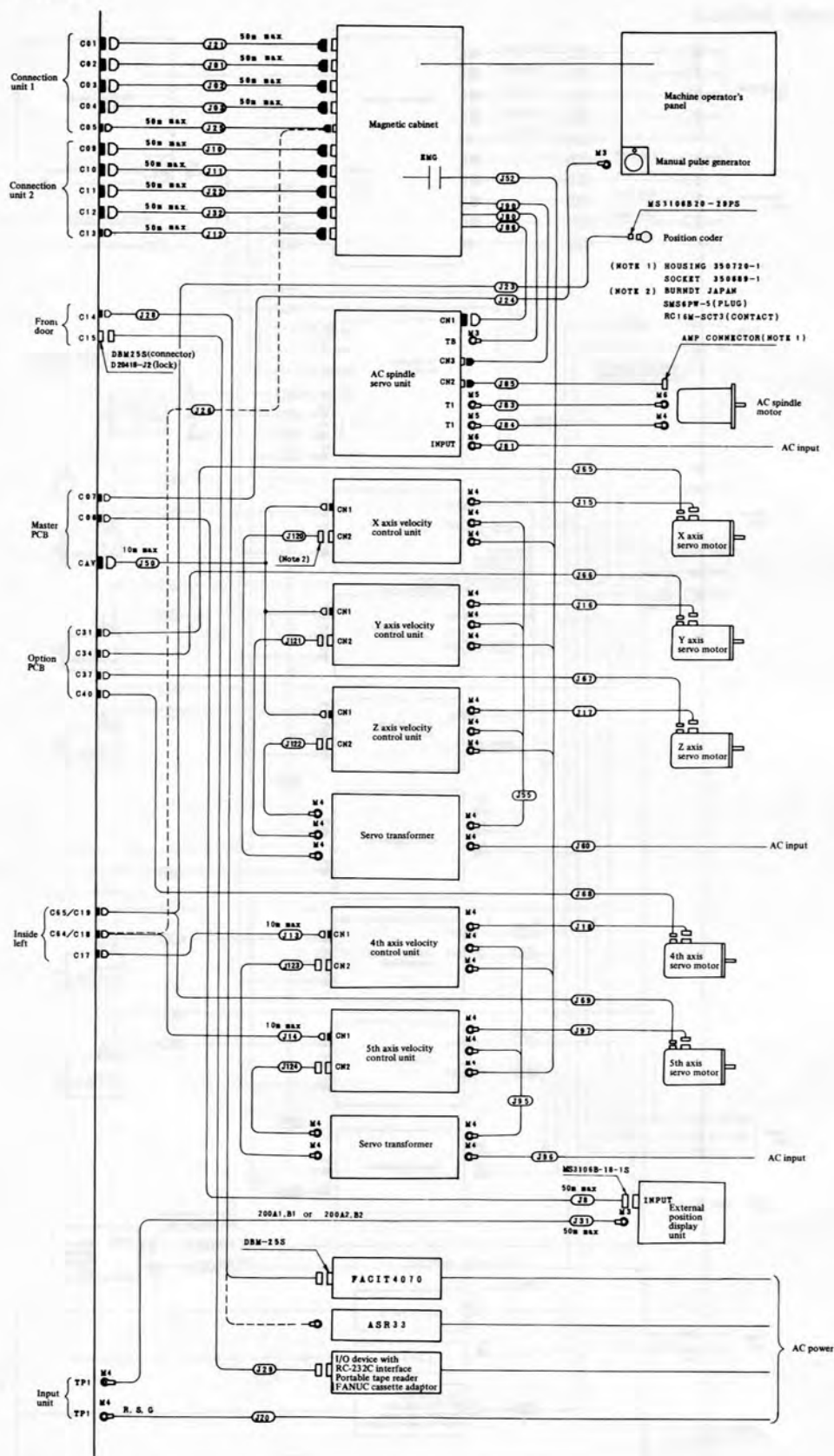


Fig. 1.3 (b) Total connection diagram of built-in type 2 cabinet (Resolver feedback)

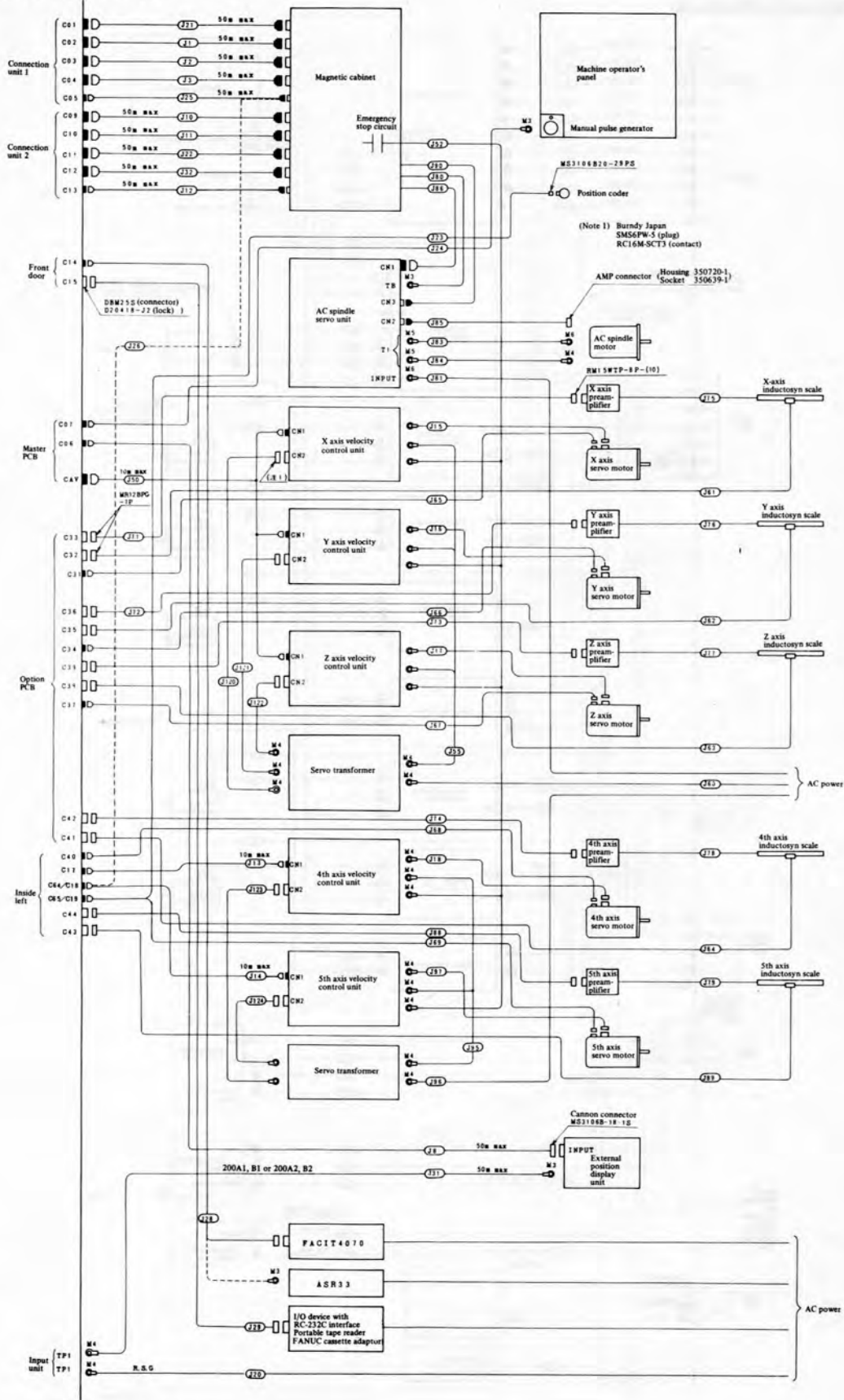


Fig. 1.3 (c) Total connection diagram of built-in type 2 cabinet (Inductosyn feedback)

Appendix 1

1.4 Unbundled type cabinet

(1) Pulse coder feedback

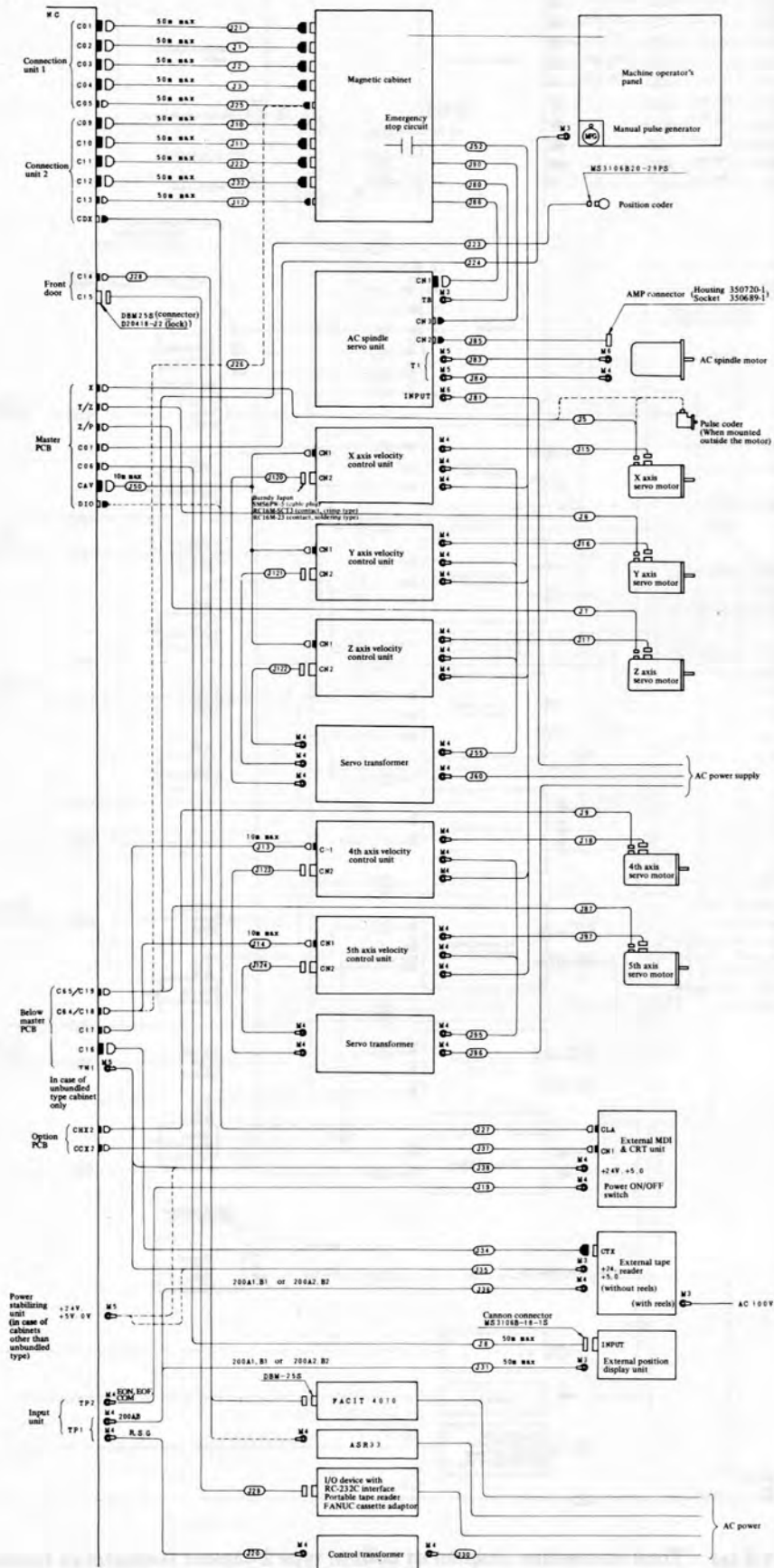


Fig. 1.4 (a) Total connection diagram of unbundled type cabinet (Pulse coder feedback)

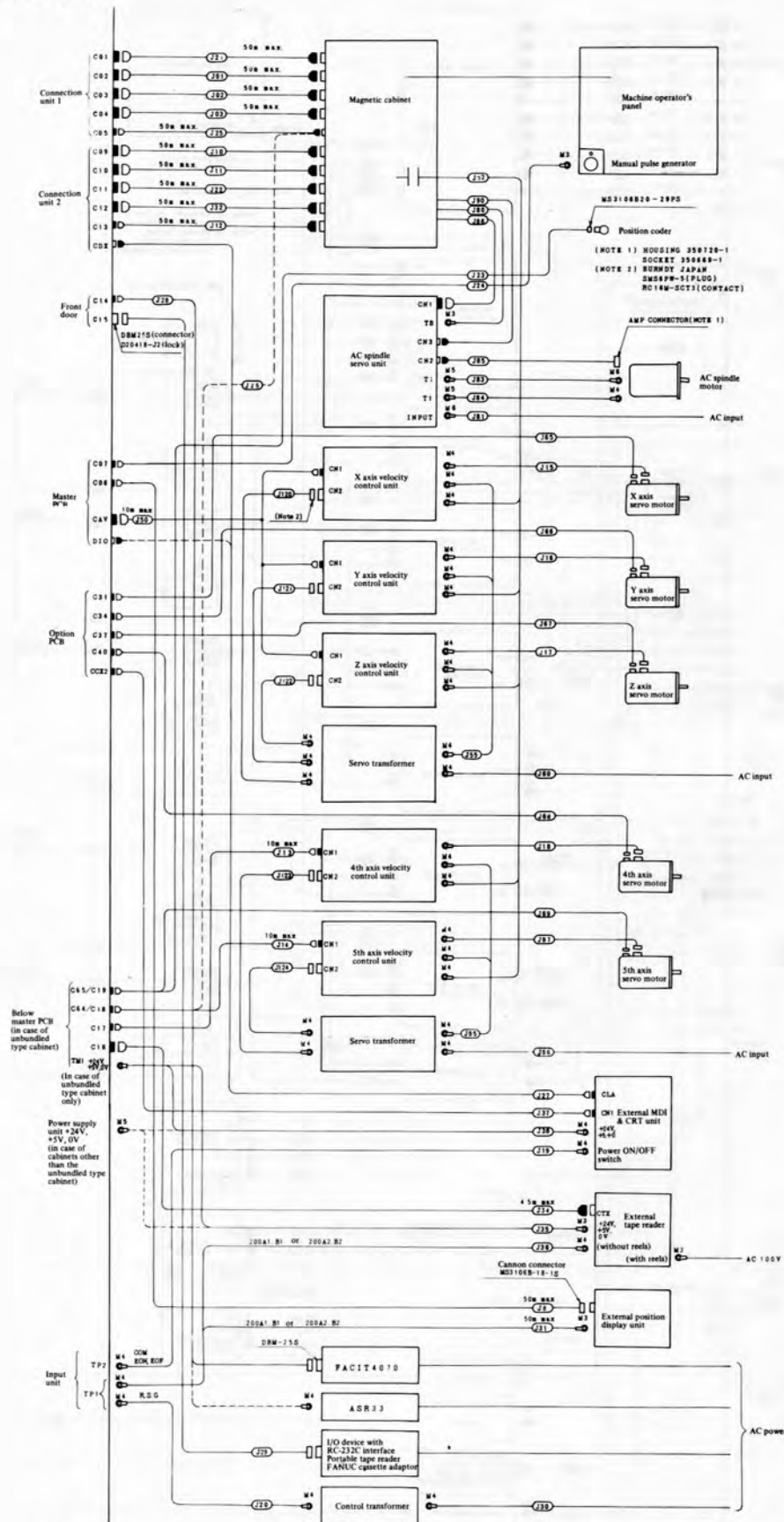


Fig.1.4 (b) Total connection diagram of unbundled type cabinet (Resolver feedback)

Appendix 1

(3) Inductosyn feedback

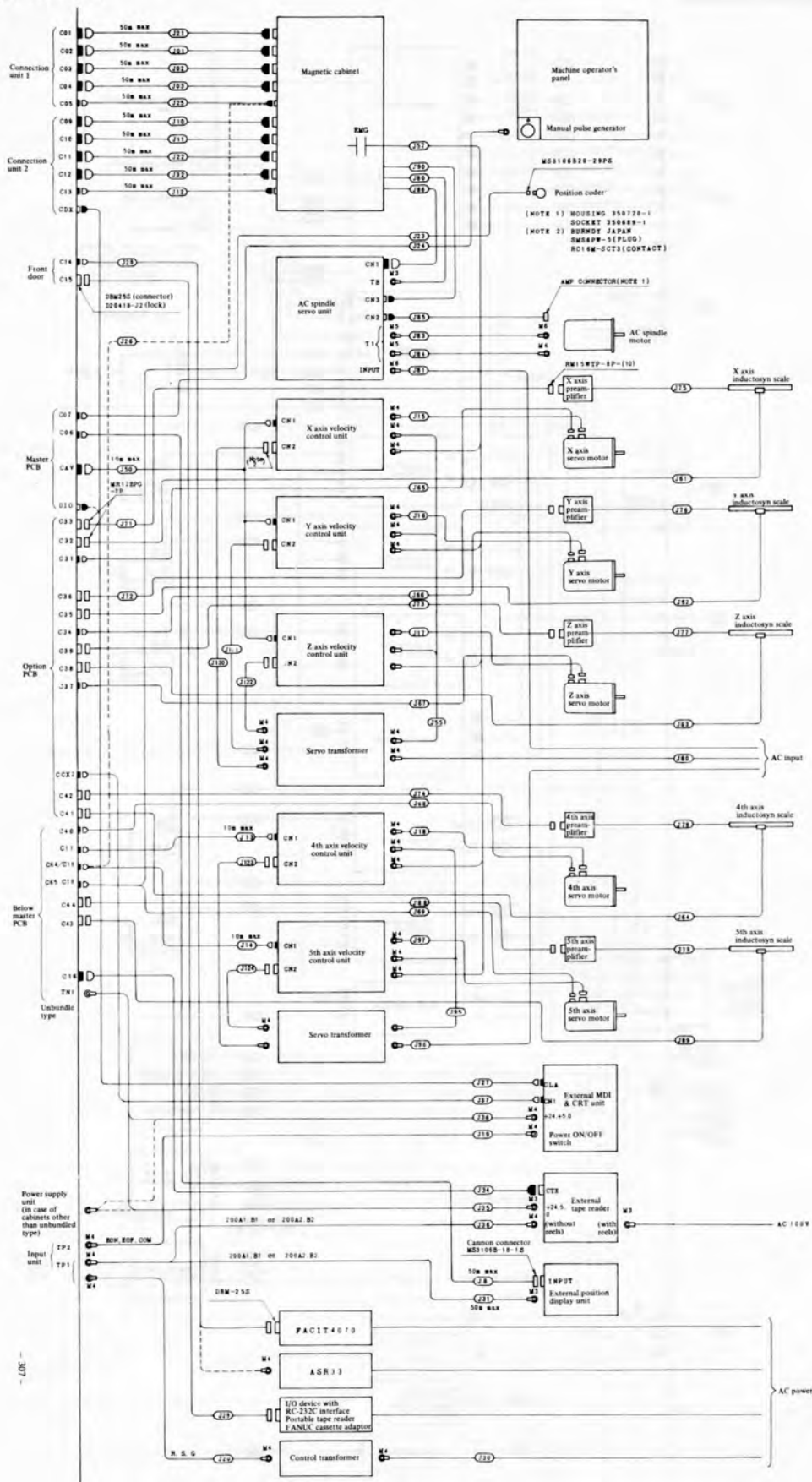


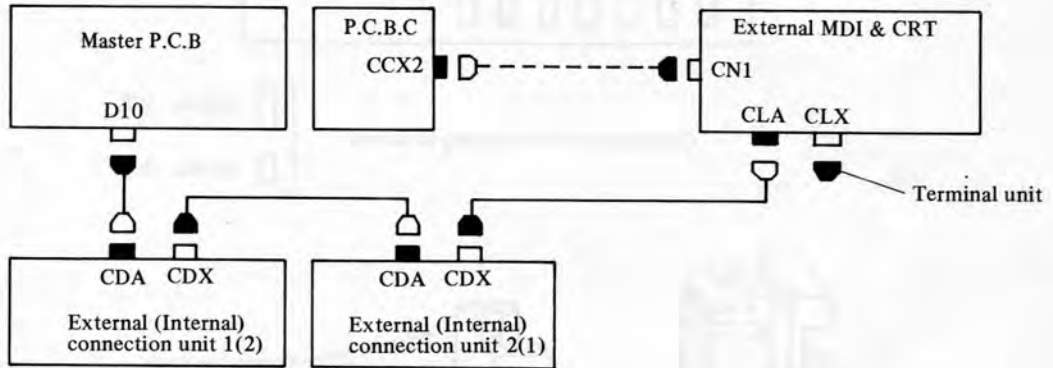
Fig. 1.4 (c) Total connection diagram of unbundled type cabinet (Inductosyn feedback)

- (Note 1) Cables and the connectors attached to them are not included in the NC basic control unit.
- (Note 2) When designing the machine side circuit, be sure that wires connected to the NC are separated from wires connected with other units. A spark killer must be attached to an inductive load such as electromagnetic contactors in the electric circuit of the machine side.
- (Note 3) Use shielded wire for cables J23 ~ J29. These cables must also be shielded on the machine. The shield must not be connected to the ground on the machine tool.
- (Note 4) The symbols of connectors represent as follows, if not specified otherwise.

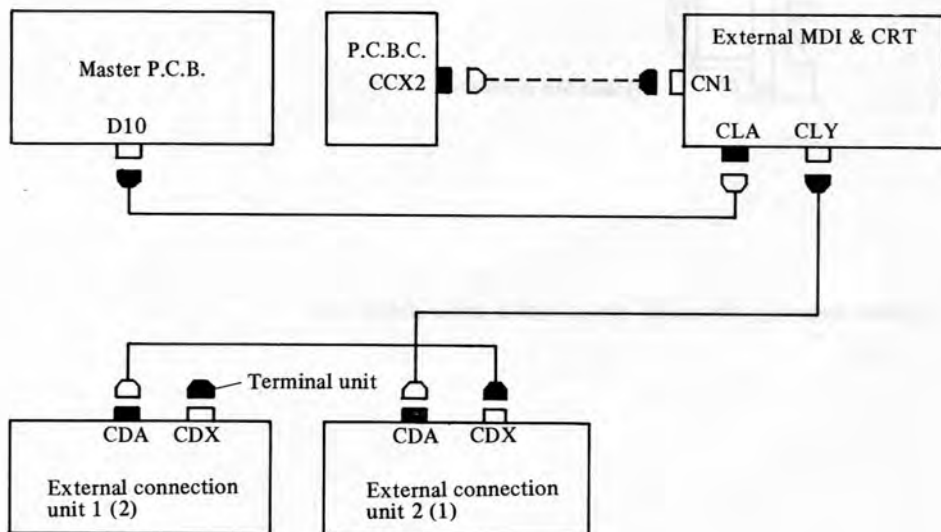
		HONDA 50 pins male			HONDA 20 pins female
		Crimp style terminal			

- (Note 5) When a cable more than max. length shown above diagram needs to use, consult us beforehand.
- (Note 6) The connection between external MDI & CRT, external connection unit and NC should be made as follows:

i) When external MDI & CRT unit is connected at the end.



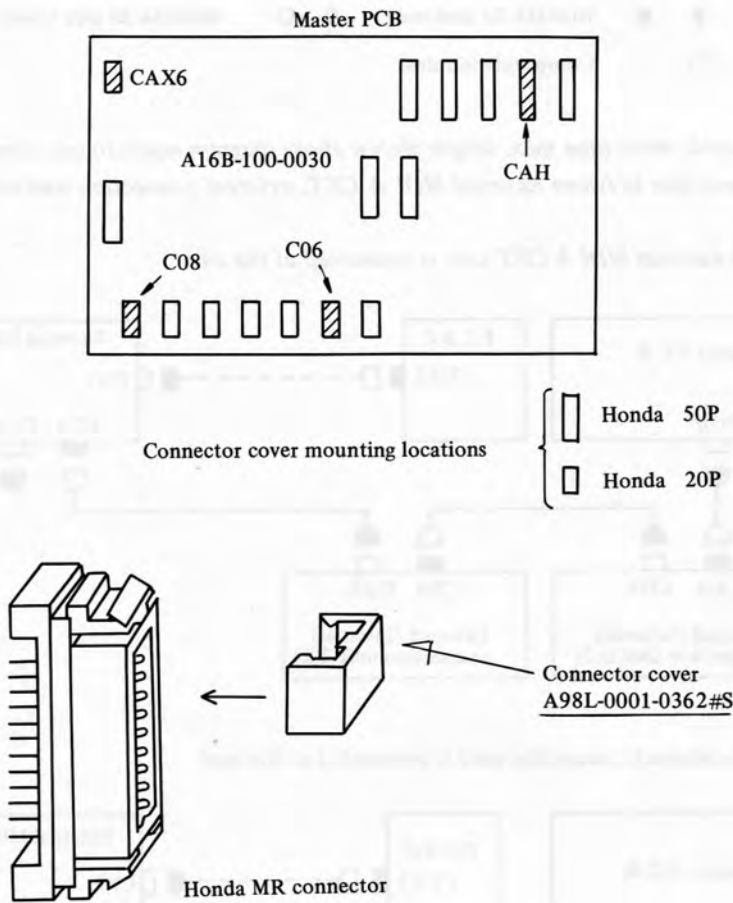
ii) When external connection unit is connected at the end.



(Note 7) Connector Cover for Preventing Irrelevant Connection

If irrelevant PCBs or devices are connected to connector CAH, C06, C08 or CAX6 of the master PCB, the irrelevant PCBs or devices may be damaged. Therefore, FANUC attaches connector covers to vacant connectors among mentioned connectors at shipment. When machine tool builder uses any of the connectors, remove them.

Irrelevant connection to other connectors may also cause malfunctioning, and in some cases, may damage the devices. Carefully check the connector names before connecting them.



* When removing the cover, pry it with a screw driver, etc.

1.5 Signal allocation of each connector

(1) Connection unit 1

C01 MR-50RMA

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	MI4	WN2	SKIP										OVC	AFL	ZNG	*SVFY	SPA
	19	20	21	22	23	24	25	26	27	28	29	30	31	32			
	OL	FID	WN16					*SVFZ	H4	*SVFX	-4	MIX	SPC	MIY			
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+24N	WN4	WN1	WN8	COMW				+4	*SVF4	*-L4	*DEC4	*+L4	*IT4	GST	SPB		SRN

C02 MR-50RMA

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
ST	*SP	*ESP	H	J	MEM	DRN	RT	MLK	DLK	*JV8	*JV16	I-IN	ERS		*DECX	*DECY	*DECZ
	19	20	21	22	23	24	25	26	27	28	29	30	31	32			
	D	T	S	+Z	+Y	+X	KEY	ABS	SBK	BDT1							
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+24N	HX	HY	HZ	-Z	-Y	-X	EDT	ZRN	*JV1	*JV2	*JV4	*+LX	*-LX	*+LY	*-LY	*+LZ	*-LZ

C03 MR-50RMA

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
*+ED CX	*+ED CY	*+ED CZ	*FV1	*FV2	*FV4	MP1	MP2	RRW	MP4			*SSTP	SOR				
	19	20	21	22	23	24	25	26	27	28	29	30	31	32			
	*-ED CX	*-ED CY	*-ED CZ	*FV8	S28/ (S48)	S24/ (S44)	S22/ (S42)	S21/ (S41)	S18/ (S38)	S14/ (S34)	S12 (HIG)/ (S32)	S11 (LWG)/ (S31)	SF	OS			
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+24N	*ITX	*ITY	*ITZ	*FV16	SAR	ROV1	ROV2	T28	T24	T22	T21	T18	T14	T12	T11	TF	OT1

C04 MR-50RMA

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
SPL	OL	OL	OL	ZP4		OMR	M00	M02	M30	M01	RWD1	RWD2			OB1	BF	OP2
	19	20	21	22	23	24	25	26	27	28	29	30	31	32			
	AL2	ZPY	M11	M12	M14	M18	OM	DEN1	EF	MB	RST2	SB	DST2	OP1			
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
STL	AL1	ZPX	ZPZ	M21	M22	M24	M28	MI	DEN2	MA	RST1	SA	DST1	OF	SRV	SSP (TAP)	FMF

C05 MR-20RMA

1	2	3	4	5	6	7
OR	OR					
	8	9	10	11	12	13
	R01	R02	R03	R04	R05	R06
14	15	16	17	18	19	20
R07	R08	R09	R10	R11	R12	OG

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(2) Connection unit 2

C09 MR-50RMA

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	UI13	UI9	UI14										*ITS	*+L5	*DEC5	AG24	GRA
	19	20	21	22	23	24	25	26	27	28	29	30	31	32			
	OL	UI15	UI12						UI7		UI3						
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+24N	UI10	UI8	UI11	COMU				UI2	UI6	UI1	UI5	UI0	UI4		GRB		

C10 MR-50RMA

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	BDT9/ AGJ	BDT8/ AGST	ED9	ED10	ED13	*-L5	4NG	H5	*SVF5				SNG			BDT6/ AG22	TLRST
	19	20	21	22	23	24	25	26	27	28	29	30	31	32			
	ED11	ED12	ED8	TL04	BDT4/ AG14	TL64	ED15		-5	+5							
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+24N		BDT7/ AGSTB	TL SKIP	TL08	BDT5/ AG18	UNIT	ED14					TL16	TL32	BDT2/ AG11	BDT3/ AG12	TL01	TL02

C11 MR-50RMA

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
EA0	EA1	EA2	ED0	ED1	ED2	ED5	ED6		ED7			ESTB	EA6			ERE ND	OER
	19	20	21	22	23	24	25	26	27	28	29	30	31	32			
	EA3	EA4	EA5	ED3	B38/ (S28)	B34/ (S24)	B32/ (S22)	B31/ (S21)	B28/ (S18)	B24/ (S14)	B22/ (S12)	B21/ (S11)		OB2			
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
+24N		AG21		ED4				B18/ (S58)	B14/ (S54)	B12/ (S52)	B11/ (S51)	ZP24	ZP2Z	ZP2Y	ZP2X	ESE ND	OB3

C12 MR-50RMA

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
UO4	OL	OL	OL	UO3	OUA						UO10	OUF			TL CHA2	TL CHA1	UUC
	19	20	21	22	23	24	25	26	27	28	29	30	31	32			
	0UD	UO1	T31	T32	T34	T38	OT2	UO11		OU1	OUF	0UB	TL CHB2	UO7			
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
UO5	UO8	UO0	UO2	T41	T42	T44	T48		0UG	UO15	UO9	UO6	TL CHB1	OUH	UO12	UO13	UO14

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(3) Master PCB

DIO MR-20RFD

1	2	3	4	5	6	7
SDO	*SDO	STB	*STB	STA	*STA	OV
	8	9	10	11	12	13
					OV	OV
14	15	16	17	18	19	20
MSRDY	*MSRDY	SLRDY	*SLRDY	SD1	*SD1	

C07 MR-20RMD

1	2	3	4	5	6	7
OH	OH	OH	+5H	+5H	+5H	
	8	9	10	11	12	13
	HA	HB	ZDX	ZDY	ZDZ	
14	15	16	17	18	19	20
						OG

Y/Z:MR-20RMA

1	2	3	4	5	6	7
OV	OV	OV	+5V	+5V	+5V	
	8	9	10	11	12	13
	OH1Y	OH2Y				
14	15	16	17	18	19	20
PCZY	*PCZY	PCAY	*PCAY	PCBY	*PCBY	OG

C06 MR-20RMD

1	2	3	4	5	6	7
OV	OV	*RSX	*RSY	*RSZ	*RS4	OV
	8	9	10	11	12	13
	OV	DD1	DD2	DD4	DD8	DWT
14	15	16	17	18	19	20
OV	+5V	+5V	+5V	+5V	+5V	

Z/P:MR-20RMA

1	2	3	4	5	6	7
OV	OV	OV	+5V	+5V	+5V	
	8	9	10	11	12	13
	OH1Z	OH2Z				
14	15	16	17	18	19	20
PCZZ	*PCZZ	PCAZ	*PCAZ	PCBZ	*PCBZ	OG

X:MR-20RMA

1	2	3	4	5	6	7
OV	OV	OV	+5V	+5V	+5V	
	8	9	10	11	12	13
	OH1X	OH2X				
14	15	16	17	18	19	20
PCZX	*PCZX	PCAX	*PCAX	PCBX	*PCBX	OG

(4) Optional PCBs

CHX2:MR-20RM

1	2	3	4	5	6	7
OV	OV	OV	+5V	+5V	+5V	
	8	9	10	11	12	13
	OH14	OH24	TSA4	TSB4		
14	15	16	17	18	19	20
PCZ4	*PCZ4	PCA4	*PCA4	PCB4	*PCB4	SG

C40:MR20RM (In case of resolver)

1	2	3	4	5	6	7
OH14	OH24				TSA4	TSB4
8	9	10	11	12	13	
14	15	16	17	18	19	20
DSA4	DSB4	DCA4	DBB4	RSB4	RSA4	

C41:RM12BRB-7S

1	2	3	4	5	6	7
DCA4	DCB4	DSB4	DSA4			

C42:RM12BRB-7S

1	2	3	4	5	6	7
				+5V	RSA4	RSB4

CCX2 MR-20RMA

1	2	3	4	5	6	7
VIDEO	HSYNC	VSING				
	8	9	10	11	12	13
	OV	OV	OV	OV	OV	
14	15	16	17	18	19	20
CLKNH	EXCLKI	DTC2	EXCLKO			SG

C31:MR20RM

1	2	3	4	5	6	7
OH1X	OH2X				TSAX	TSBX
8	9	10	11	12	13	
14	15	16	17	18	19	20
(DSAX)	(DSBX)	(DCAX)	(DCBX)	(RSEBX)	(RSAX)	

Signals in parentheses are used only for resolver feedback.

C32:RM12BRB-7S

1	2	3	4	5	6	7
DCAX	DCBX	DSBX	DSAX			

C33:RM12BRB-7S

1	2	3	4	5	6	7
				+5V	RSAX	RSBX

Appendix 1

C34 : MR20RM

1	2	3	4	5	6	7
OH1Y	OH2Y				TSAY	TSBY
8	9	10	11	12	13	X
14	15	16	17	18	19	20
(DSAY)	(DSBY)	(DCAY)	(DCB4)	(RSBY)	(RSAY)	

Signals in parentheses are used only for resolver feedback.

C35 : RM12BRB-7S

1	2	3	4	5	6	7
DCAY	DCBY	DSBY	DSAY			

C36 : RM12BRB-7S

1	2	3	4	5	6	7
				+5V	RSAY	RSBY

C37 : MR20RM

1	2	3	4	5	6	7
OH1Z	OH2Z				TSAX	TSBX
8	9	10	11	12	13	X
14	15	16	17	18	19	20
DSAZ	DSBZ	DCAZ	DCBZ	RSBZ	RSAZ	

(5) Front door

C14 MR-20RMH

1	2	3	4	5	6	7
PR	TE	ERR	TTY3	+6V	TTY2	TTY1
X	8	9	10	11	12	13
	OG	SD	OV	CH1	CH2	CH3
14	15	16	17	18	19	20
CH4	CH5	CH6	CH7	CH8	CH9	PI

(Lock D20418-J2 made by Japan Aviation Electronic Industry Ltd.)

1	2	3	4	5	6	7	8	9	10	11	12	13
FG	SD	RD	RS	CS	DR	SG	CD					
X	14	15	16	17	18	19	20	21	22	23	24	25
							ER					+24V

When input and output interface option is equipped, both connector C14 and connector C15 are incorporated on the front of the cabinet.

(6) Inside left (Free standing type, Built-in type 2), Inside right (Built-in type 1), Bottom (Unbundled type)

C17 MR-20RM

1	2	3	4	5	6	7
PRDY4	ENBL4	OVL4	VRDY4		TSA4	VCMD4
X	8	9	10	11	12	13
						SG
14	15	16	17	18	19	20
CR4	CR4	E24	E14		EC4	EC4

C18 MR-20RM

1	2	3	4	5	6	7
	ENB1			(Note 2)		VCMS
X	8	9	10	11	12	13
	*	*	*	*	*	
14	15	16	17	18	19	20
	ENB2				EC S	OV

(Note 1) Wires can be connected to the pins marked with *. But no wire is allowed to connect to the pins with no mark.

(Note 2) Signal position of ZD4 is C28 (5) if additional 2-axis control is provided.

C19 MR-20RM

1	2	3	4	5	6	7
OH	OH	OH	+5H	+5H	+5H	
X	8	9	10	11	12	13
14	15	16	17	18	19	20
SC	*SC	PA	*PA	PB	*PB	

(Note 3) No terminal for shield is provided with connector C18 and C19. Connect the shield to cable clump metal fixture.

C16 MR-50RMD

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	P1	OV	P2	OV	P3	OV	P4	OV	P5	OV	P6	OV	P7	OV	P8	OV	
X	19	20	21	22	23	24	25	26	27	28	29	30	31	32	X		
	PS	OV		*TER	OV		RDT	OV		*RWT	OV		FDT	OV			
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
	OPT	OV		*RMDT	OV	*CLT	OV	*REEL	OV	OV	OV	OV	OV	OV	OV	OV	

C40 MR-20RMA (In case of inductosyn)

1	2	3	4	5	6	7
OH14	OH24				TSA4	TSB4
X	8	9	10	11	12	13
14	15	16	17	18	19	20

C41 : RM12BRB 7S

1	2	3	4	5	6	7
DCA4	DCB4	DSB4	DSA4			

C64 MR-20RM

1	2	3	4	5	6	7
PRDY5	ENBL5	OVL5	VRDY5		TSA5	VCMD5
X	8	9	10	11	12	13
						SG
14	15	16	17	18	19	20
CR5	CR5	E25	E15		EC5	EC5

C42 : RM12BRB-7S

1	2	3	4	5	6	7
				+5V	RSA4	RSB4

C65 MR-20RM

In case of resolver or inductosyn

1	2	3	4	5	6	7
OH15	OH25				TSA5	TSB5
X	8	9	10	11	12	13
14	15	16	17	18	19	20
(DSA5)	(DSB5)	(DCA5)	(DBB5)	(RSB5)	(TSA5)	

(Note) Signals in parentheses are used only for resolver feedback.

C65 MR-20RM

In case of pulse coder

1	2	3	4	5	6	7
0V	0V	0V	+5V	+5V	+5V	
X	8	9	10	11	12	13
	OH15	OH25	(TSA5)	(TSB5)		
14	15	16	17	18	19	20
PCZ5	*PCZ5	PCA5	*PCA5	PCB5	*PCB5	

(Note) Signals in parentheses are used when pulse coder is mounted outside the motor.

(7) Input unit

(A) Free Standing Cabinet

TP1 Screw terminal M5

U	V	W	G
---	---	---	---

Connect the earth line (G)
to the mark 

TP2 Screw terminal M4

EON	EOF	COM	FA	FB
-----	-----	-----	----	----

TP3 Screw terminal M4

200 A1	200 B1	200 A2	200 B2
-----------	-----------	-----------	-----------

TP4 Screw terminal M4

U1	V1	EMG IN1	EMG IN2	EMG OUT2	EMG OUT2
----	----	------------	------------	-------------	-------------

(B) Built-in Type I, II Cabinets, unbundled Type Cabinet.

TP1 Screw terminal M4

Connect the earth line (G) to the mark 

G	R	S	EMG OUT1	EMG OUT2	200 A1	200 B1	200 A2	200 B2
---	---	---	-------------	-------------	-----------	-----------	-----------	-----------

TP2 Screw terminal M4

EON	EOF	COM	FA	FB
-----	-----	-----	----	----

(8) Power supply unit

(a) For free standing type and Built-in type I, II cabinets

+5V	0V	+24V
-----	----	------

(b) For unbundled type cabinet

TN1

+24V	0V	0V	5V	5V
------	----	----	----	----

(9) Motor

(a) Pulse coder feedback

① Pulse coder built-in type

For model 00M
RM15WTR-4P

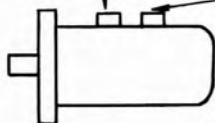
1	2
A 1 α	A 2 α
3	4
G	

For model 0M, 5M
MS3102A-18-10P

A	B
A 1 α	A 2 α
C	D
	G

For model 10M, 20M, 30M
MS3102A-28-20P

A	B	C	D	E
		A 1 α	A 1 α	
F	G	H	J	K
A 2 α	A 2 α			B C A α
L	M	N	P	
B C B α			G	

(Note) α : X, Y, Z, 4, 5DC motor
M seriesFor model 00M ~ 30M
MS3102A-20-29P

A	B	C	D	E	F
P C A α	P C B α	+5 V	*P C A α	*P C B α	P C Z α
G	H	J	K	L	M
*P C Z α	O G	+5 V	+5 V		
N	P	R	S	T	
O V	O V	O H 1 α	O H 2 α	O V	

② Pulse coder separate type

MS 3 1 0 2 A - 2 0 - 2 9 P

A	B	C	D	E	F
P C A α	P C B α	+ 5 V	* P C A α	* P C B α	P C Z α
G	H	J	K	L	M
* P C Z α	O G	+ 5 V	+ 5 V		
N	P	R	S	T	
O v	O v			O v	

(Note) α : X, Y, Z, 4, 5



Pulse coder

For model 00M
RM1 5WTR-4P

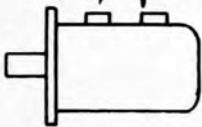
1	2
A 1 α	A 2 α
3	4
G	

For model 0M, 5M
MS 3 1 0 2 A - 1 8 - 1 0 P

A	B
A 1 α	A 2 α
C	D
	G

For model 10M, 20M, 30M
MS 3 1 0 2 A - 2 8 - 2 0 P

A	B	C	D	E
		A 1 α	A 1 α	
F	G	H	J	K
A 2 α	A 2 α			B C A α
L	M	N	P	
B C B α			G	



DC motor

For model 00M

RM1 5WTR-10 P (HIROSE)

1	2	3	4
T S A α	T S B α	O G	
5	6	7	8
9	10		
O H 1 α	O H 2 α		

For model 0M to 30M

MS 3 1 0 2 A - 2 0 - 2 9 P

A	B	C	D	E	F
T S A α	T S B α				
G	H	J	K	L	M
	O G				
N	P	R	S	T	
		O H 1 α	O H 2 α		

(Note) α : X, Y, Z, 4, 5

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(b) Resolver Feedback

For model 00M
RM1 5WTR-4 P

1	2
A1 α	A2 α
3	4
G	

For model 0M, 5M
MS 3102A-18-10 P

A	B
A1 α	A2 α
C	D
	G

For model 10M, 20M, 30M
MS 3102A-28-20 P

A	B	C	D	E
		A1 α	A1 α	
F	G	H	J	K
A2 α	A2 α			BCA α
L	M	N	P	X
BCB α				

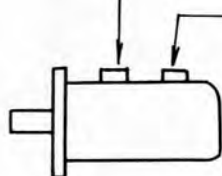
(Note) α : X, Y, Z, 4, 5

For model 00M
RM1 5WTR-10 P

1	2	3	4
TSA α	TSB α	DSA α	DSB α
5	6	7	8
DCA α	DCB α	RSA α	RSB α
9	10	X	
OH1 α	OH2 α		

For model 0M to 30M
MS 3102A-20-29 P

A	B	C	D	E	F
TSA α	TSB α		DSA α	DSB α	DCA α
G	H	J	K	L	M
DCB α	OG	RSA α	RSB α		
N	P	R	S	T	X
		OH1 α	OH2 α		



(c) Inductosyn Feedback

For model 00M
RM1 5WTR-4 P

1	2
A1 α	A2 α
3	4
G	

For model 0M, 5M
MS 3102A-18-10 P

A	B
A1 α	A2 α
C	D
	G

For model 10M, 20M, 30M
MS 3102A-28-20 P

A	B	C	D	E
		A1 α	A1 α	
F	G	H	J	K
A2 α	A2 α			BCA α
L	M	N	P	
BCB α				

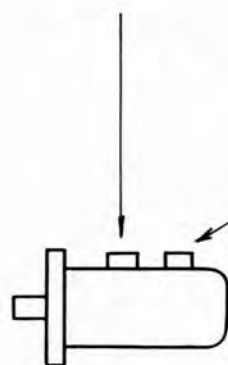
(Note) α : X, Y, Z, 4, 5

For model 00M
RM1 5WTR-10 P (HIROSE)

1	2	3	4
TSA α	TSB α	OG	
5	6	7	8
9	10		
OH1 α	OH2 α		

For model 0M to 30M
MS 3102A-20-29 P

A	B	C	D	E	F
TSA α	TSB α				
G	H	J	K	L	M
	OG				
N	P	R	S	T	
		OH1 α	OH2 α		



(10) Velocity Control Unit

CN1 (MR-20RMA)

1	2	3	4	5	6	7
PRDY1 α	ENBL1 α	OVL1 α	VRDY1 α		TSA α	VCMD α
X	8	9	10	11	12	13
14	15	16	17	18	19	20
PRDY2 α	ENBL2 α	OVL2 α	VRDY2 α		TSB α	EC α

CN2 (SMS6RW-3)

1	2	3	4	5	6
18A	CT	18B	TOH1	TOH2	

T1 (M4 screw terminal)

A	1	2	3	4	5	6	7	8	G
185U 50U	185V 50V	185W 50W	100A	100B	A1 α	A1 α	A2 α	A2 α	⊕

(Note) α : X, Y, Z, 4, 5

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3. Connection Diagram with Each Equipment

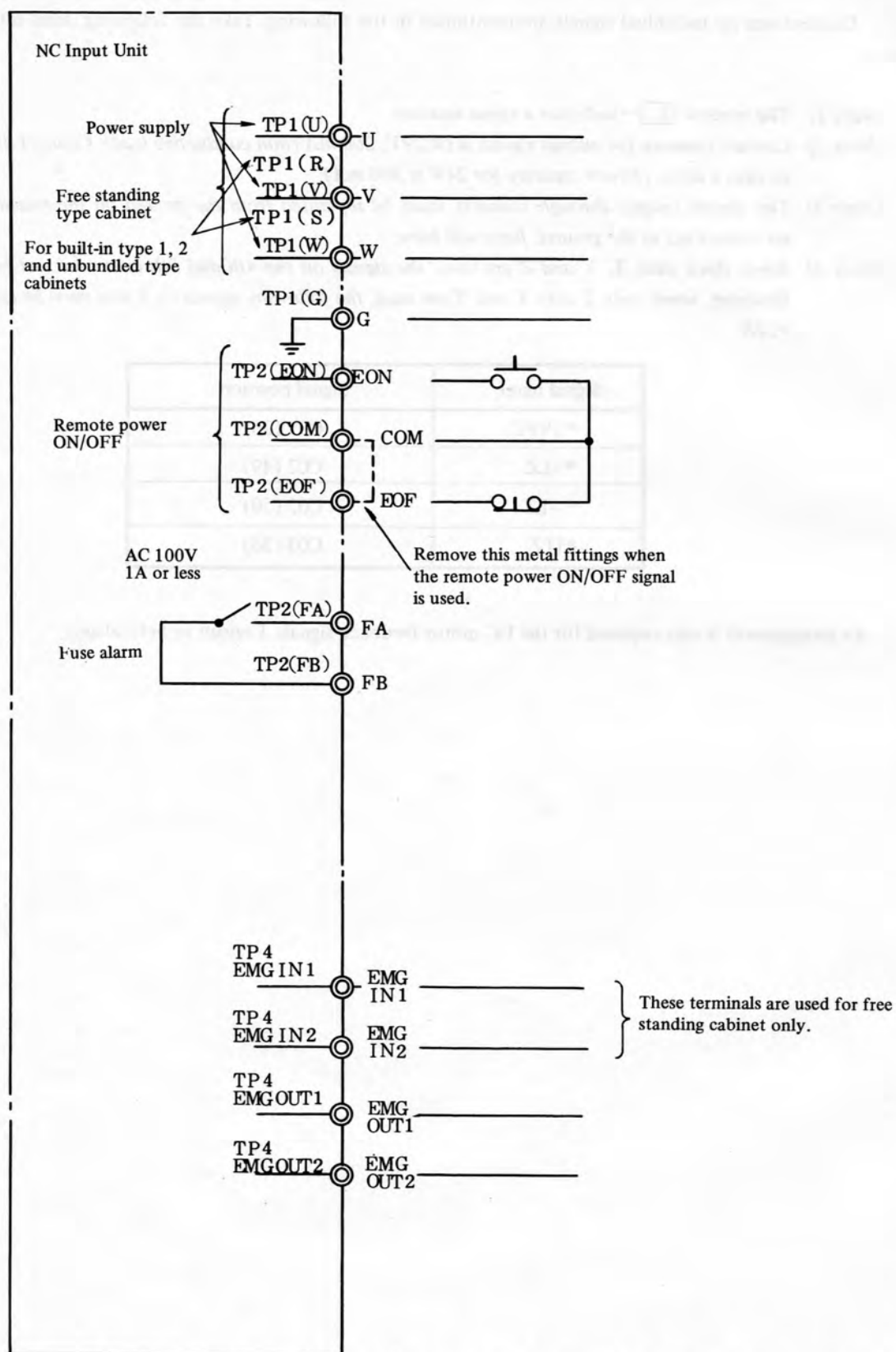
Connections on individual signals are mentioned in the following. Take the following items into consideration.

- (Note 1) The symbol  indicates a signal receiver.
- (Note 2) Contact capacity for output signals is DC24V, 200 mA (non conductive load). Connect dim resistors to light a lamp. (Power capacity for 24V is 300 mA)
- (Note 3) The signals output through contacts must be separated from the ground on the machine. If they are connected to the ground, fuses will blow.
- (Note 4) When three axes X, Y and Z are used, the signals on the 4th and 5th axes need not be arranged. However, when only 2 axes X and Y are used, the following signals on Z axis must be connected to +24N.

Signal name	Signal position
*SVFZ	C01 (26)
*+LZ	C02 (49)
*-LZ	C02 (50)
*ITZ	C03 (36)

An arrangement is also required for the DC motor feedback signals. Consult us beforehand.

3.1 Connection with power supply



(Note 1) The cable connected to the terminal G should be 5.5 mm^2 or more and the ground resistance should be less than 100Ω .

3.2 Connection with magnetic cabinet

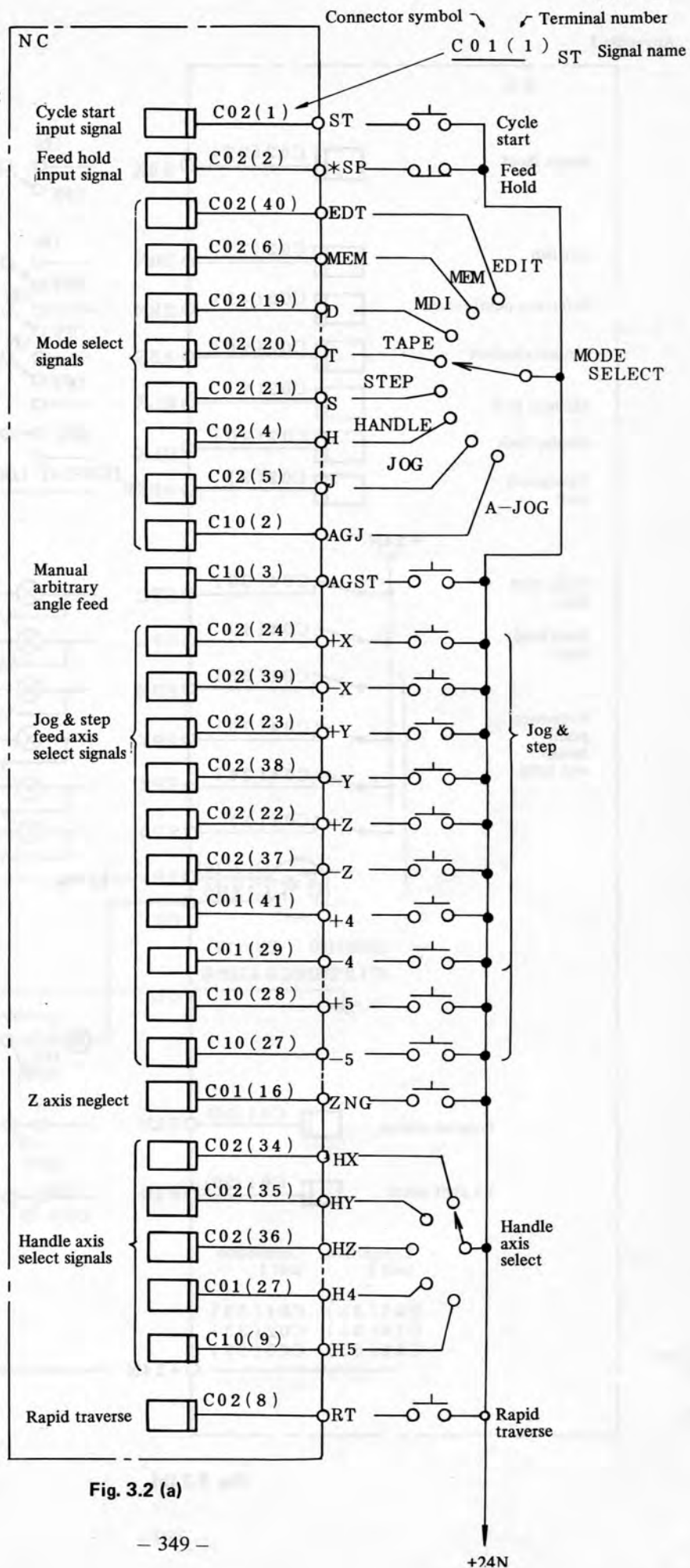


Fig. 3.2 (a)

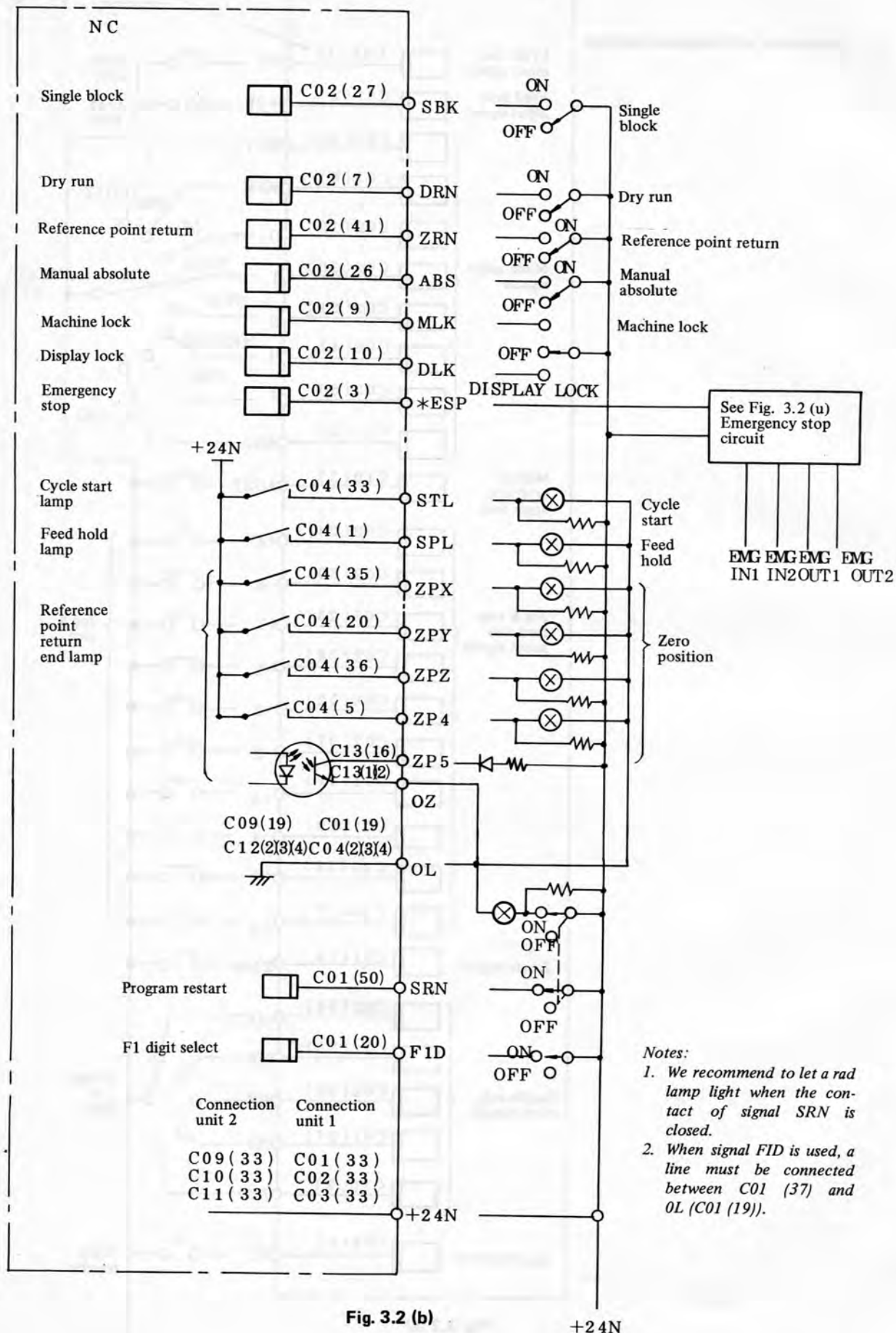


Fig. 3.2 (b)

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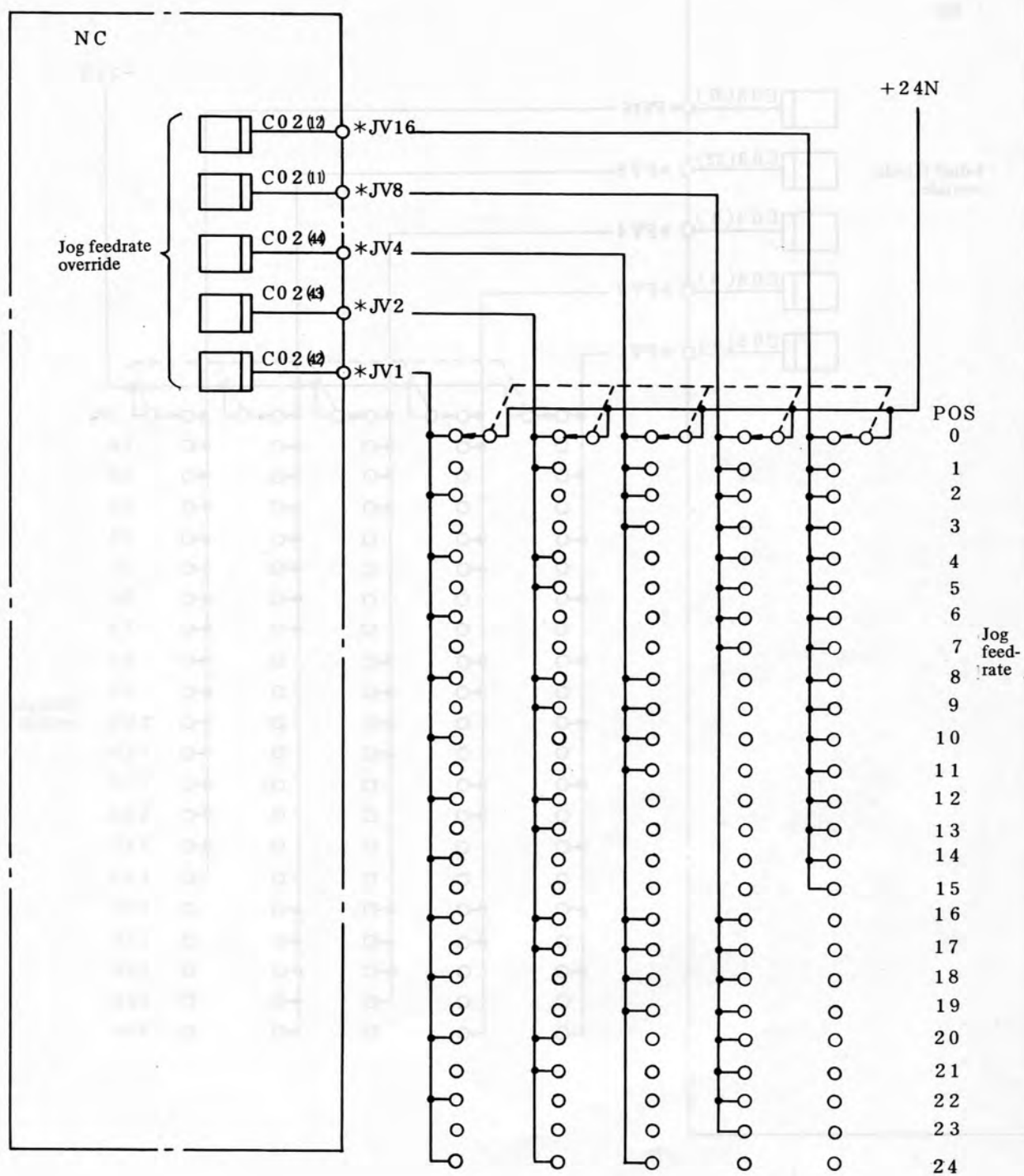


Fig. 3.2 (c)

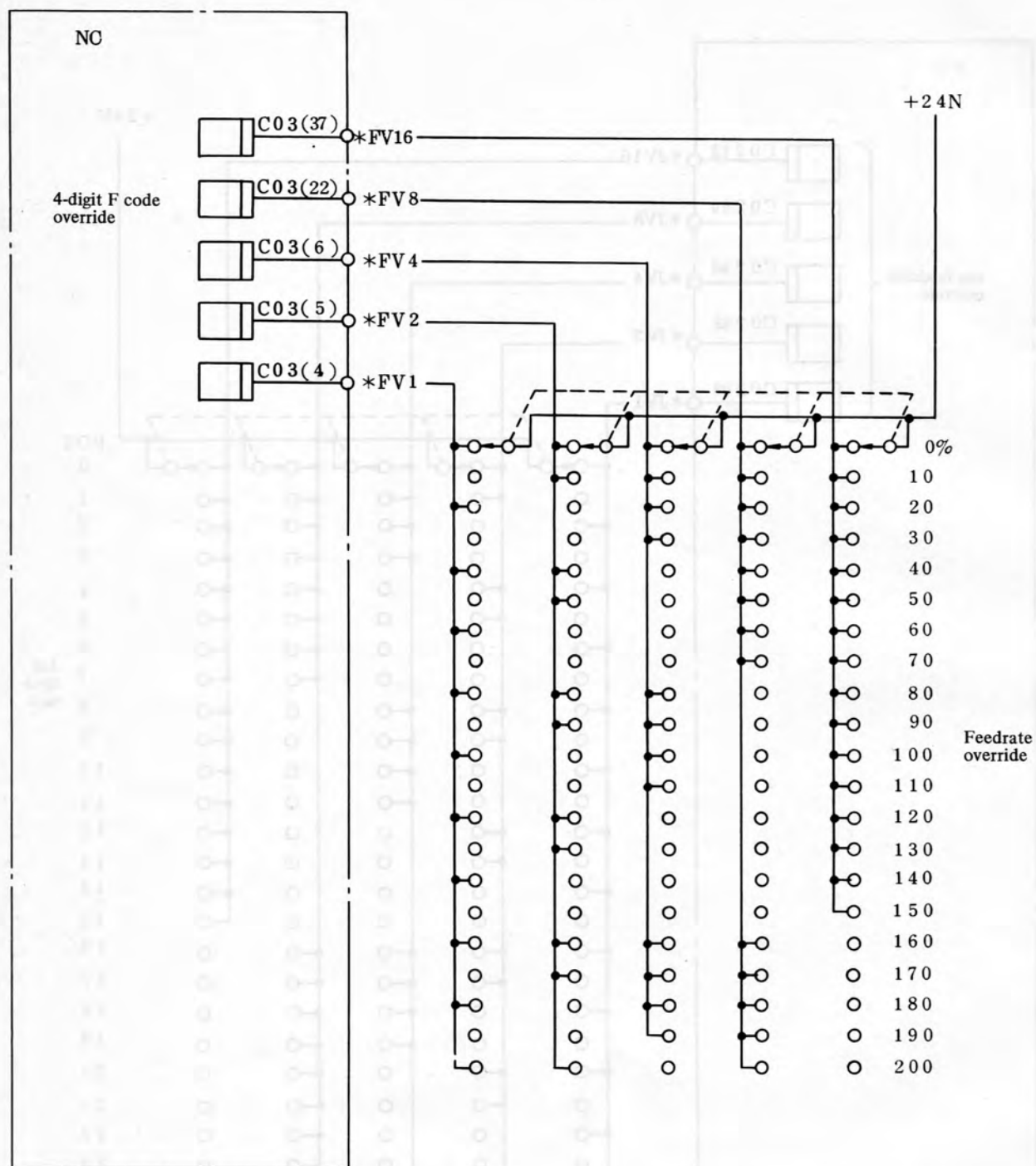
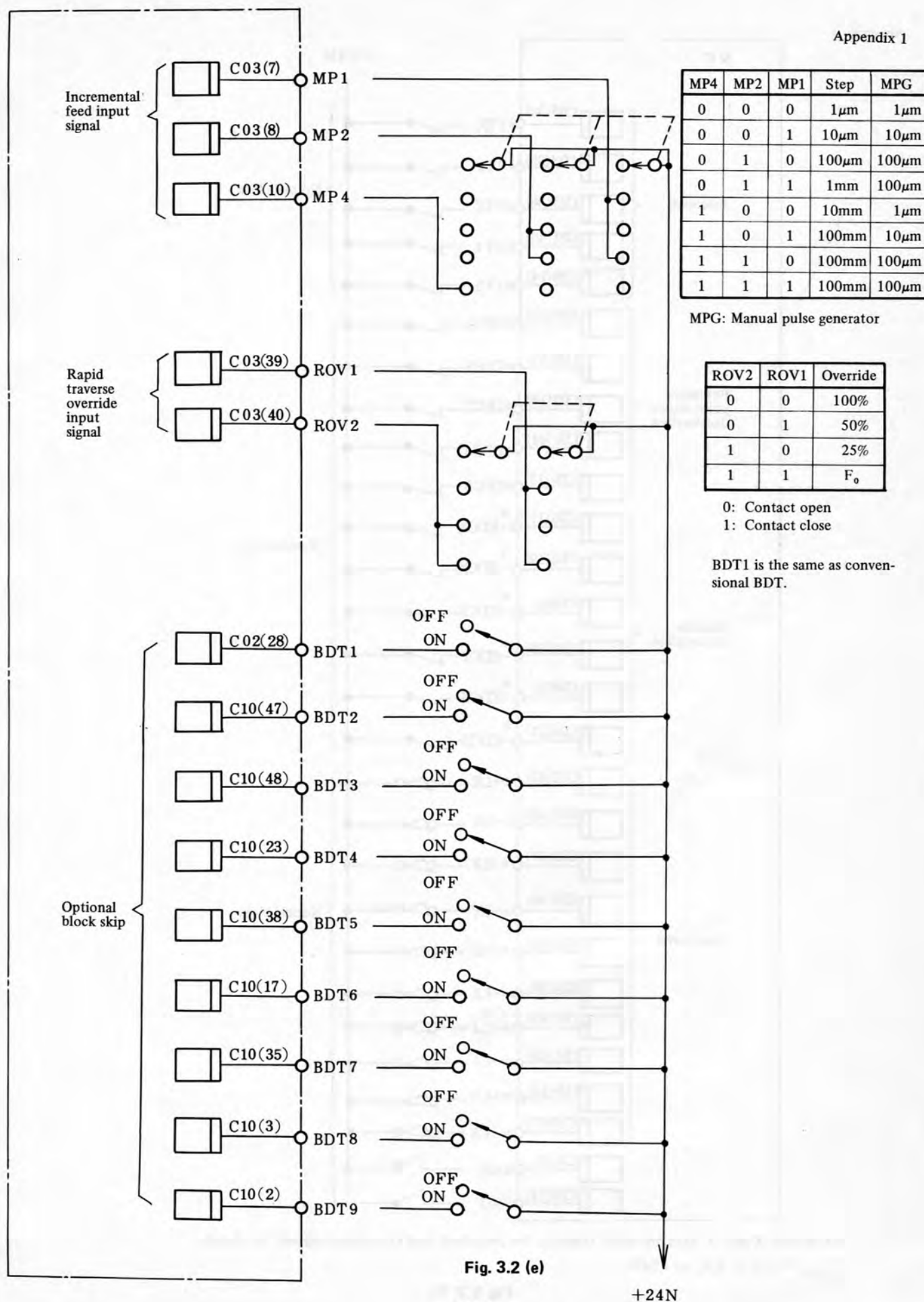
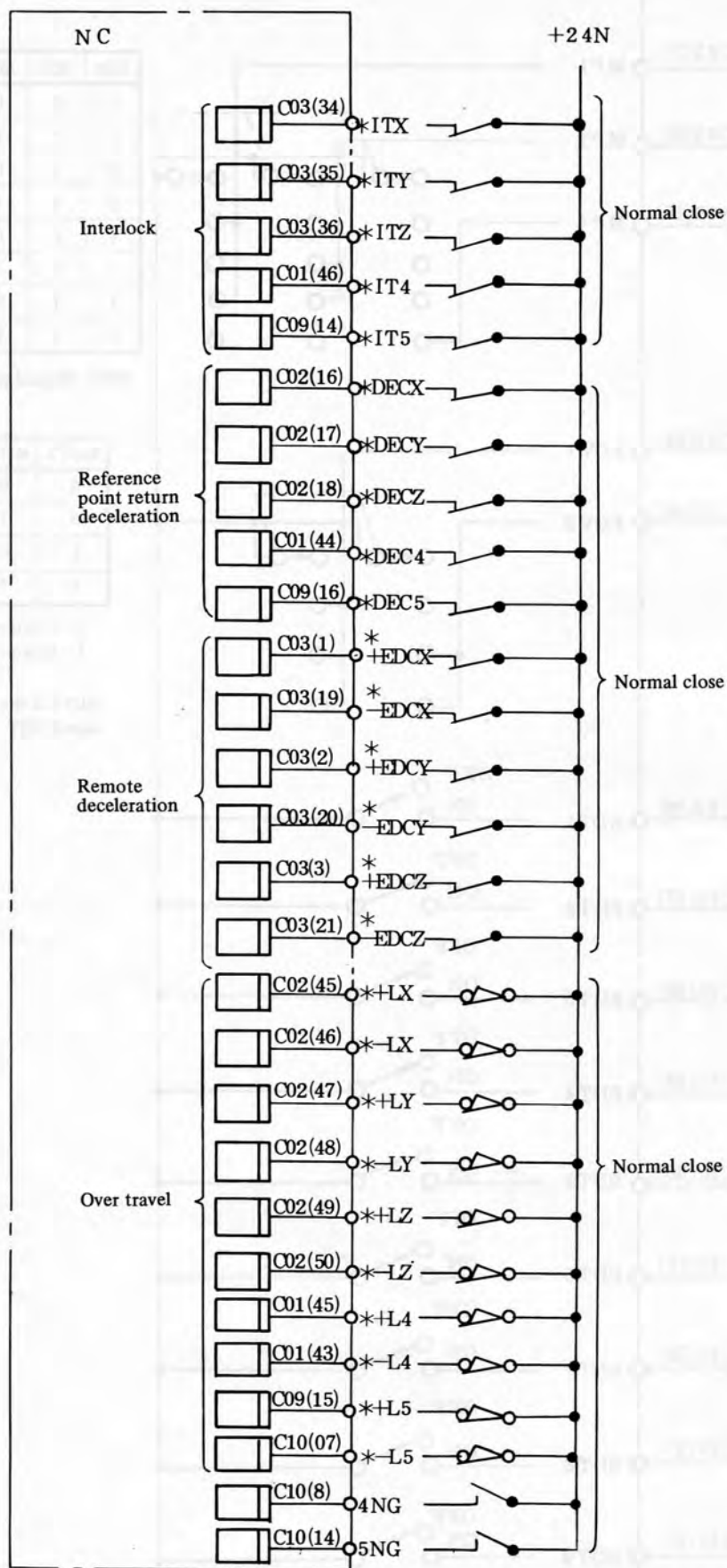


Fig. 3.2 (d)





When only X and Y axes are used, connect the Interlock and Overtravel signals for Z-axis (*ITZ, *+LZ, *-LZ) to +24N.

Fig. 3.2 (f)

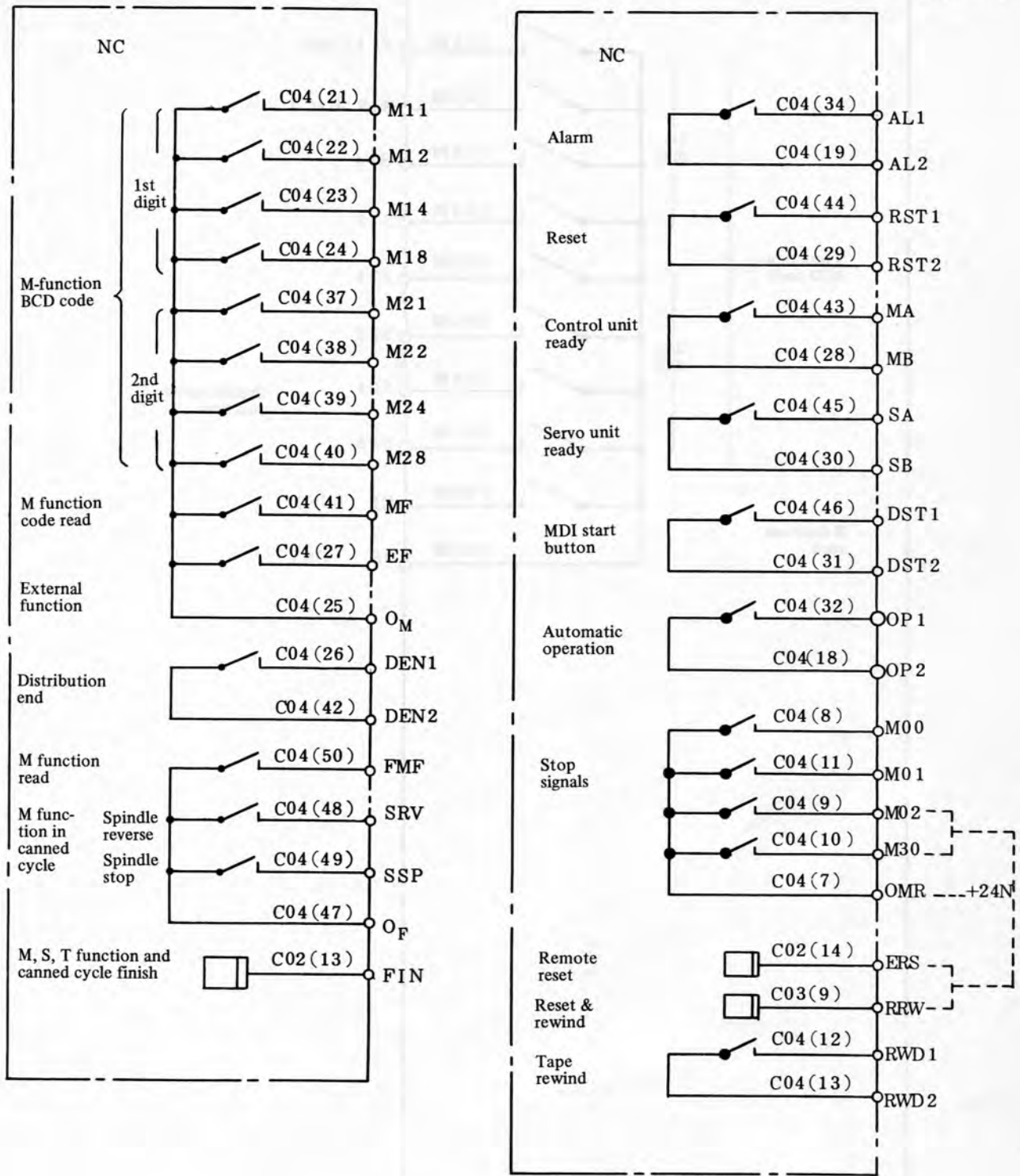


Fig. 3.2 (g)

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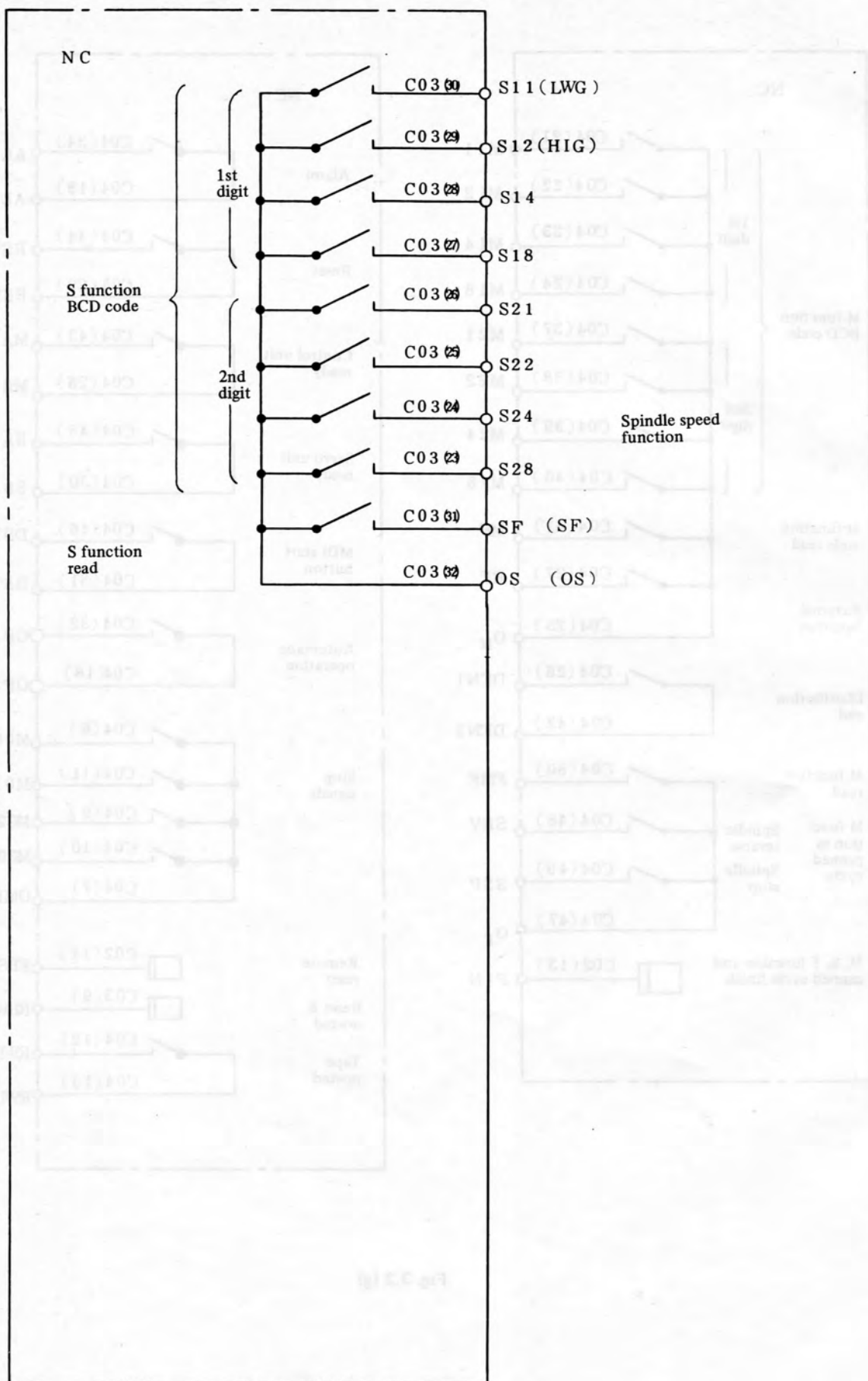


Fig. 3.2 (h)

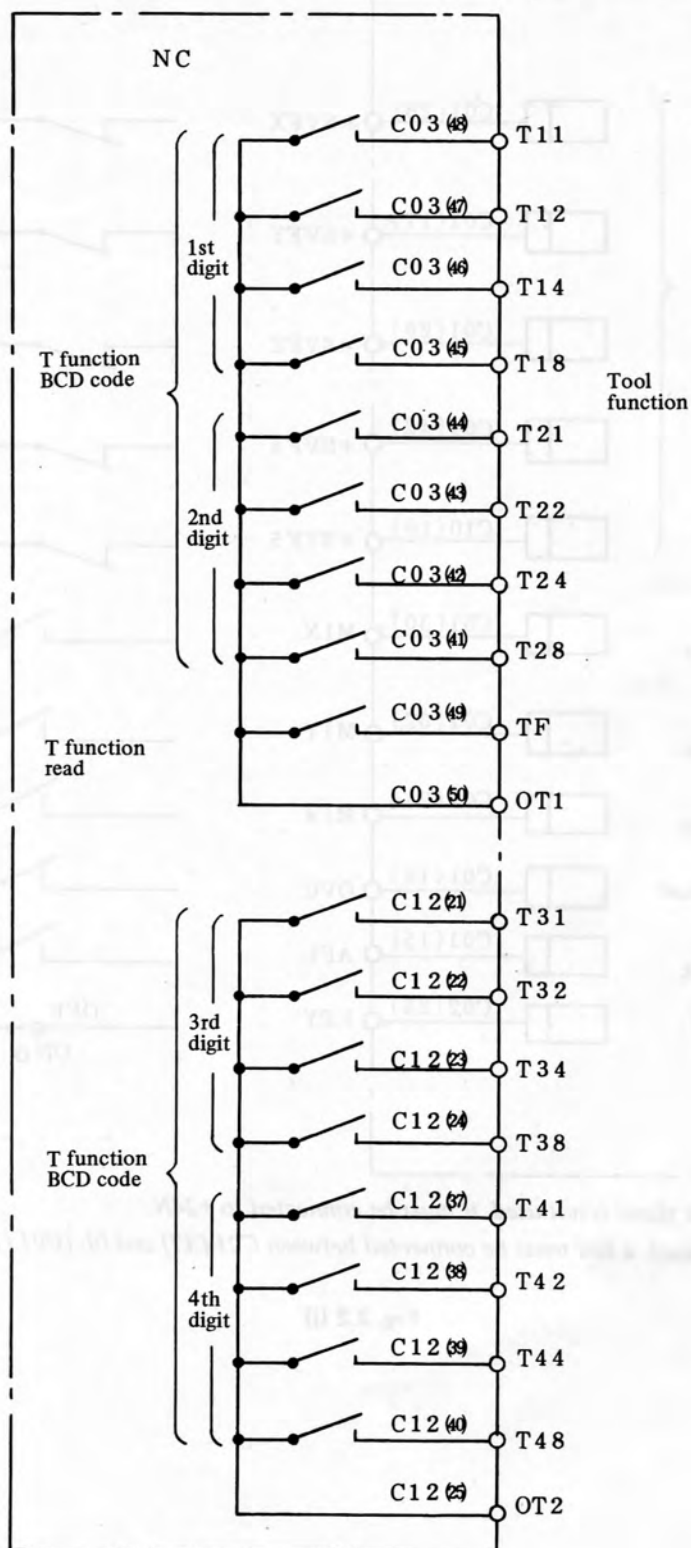
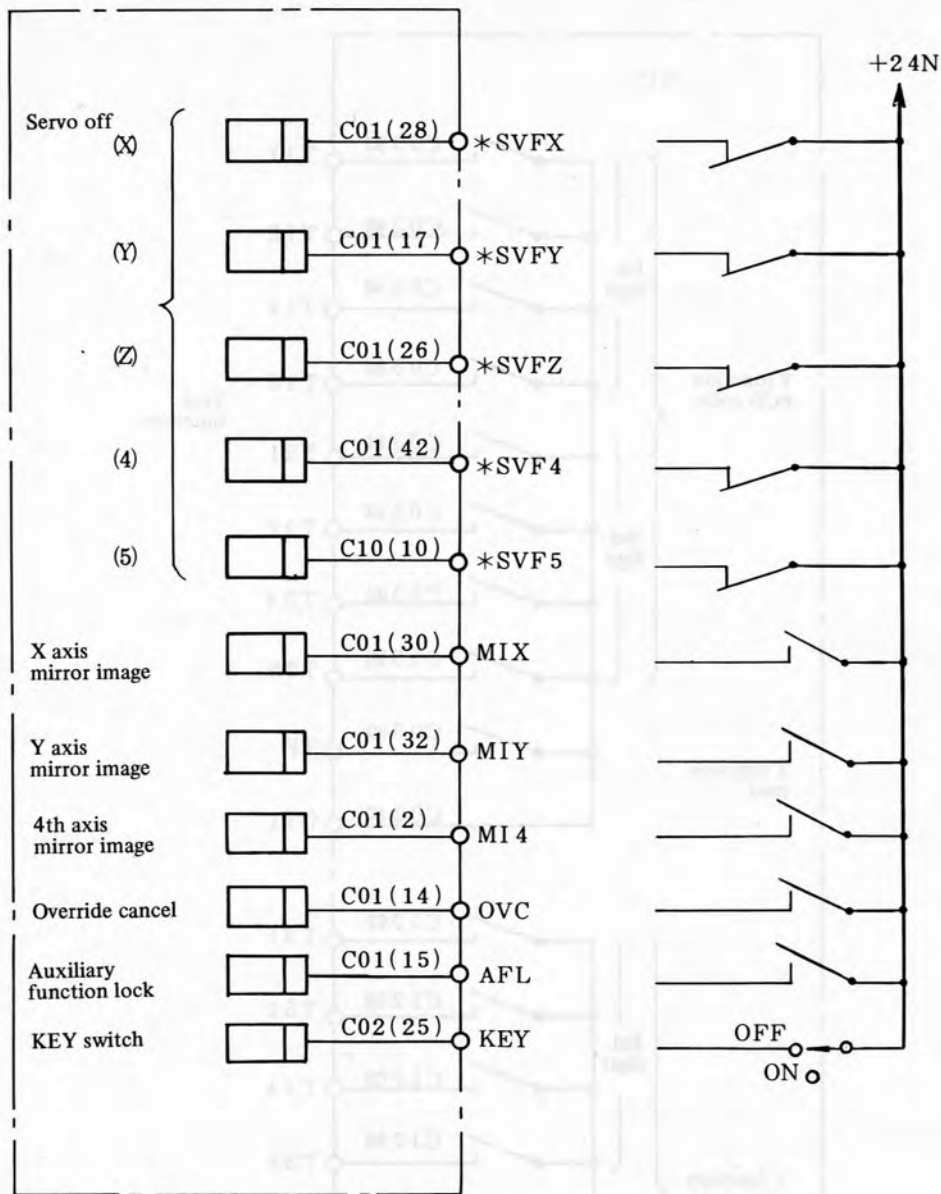


Fig. 3.2 (i)



- (Note 1) If KEY switch signal is not used, it must be connected to +24N.
- (Note 2) When MI4 is used, a line must be connected between C01 (37) and 0L (C01 (19)) of NC side.

Fig. 3.2 (j)

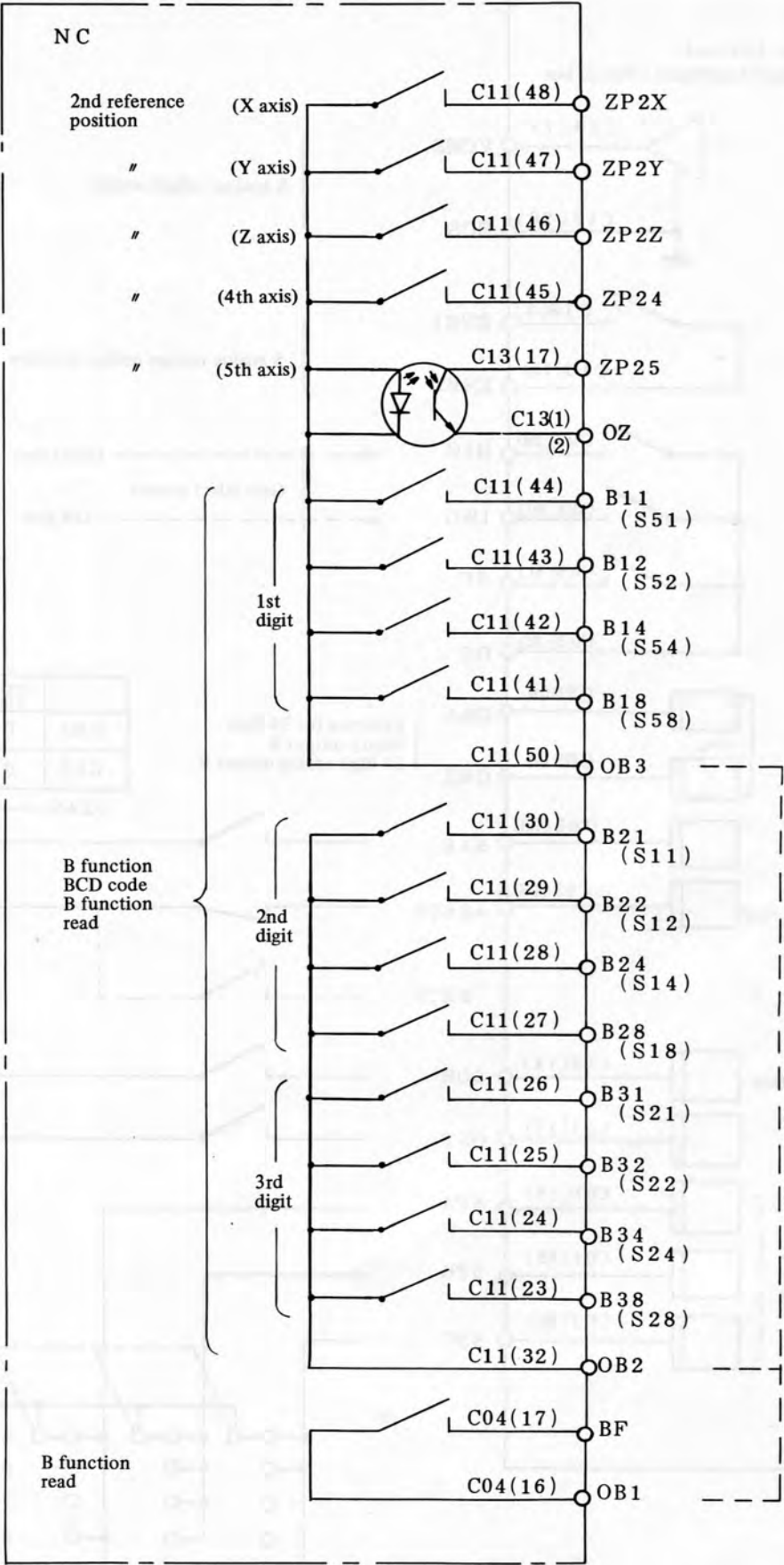


Fig. 3.2 (k)

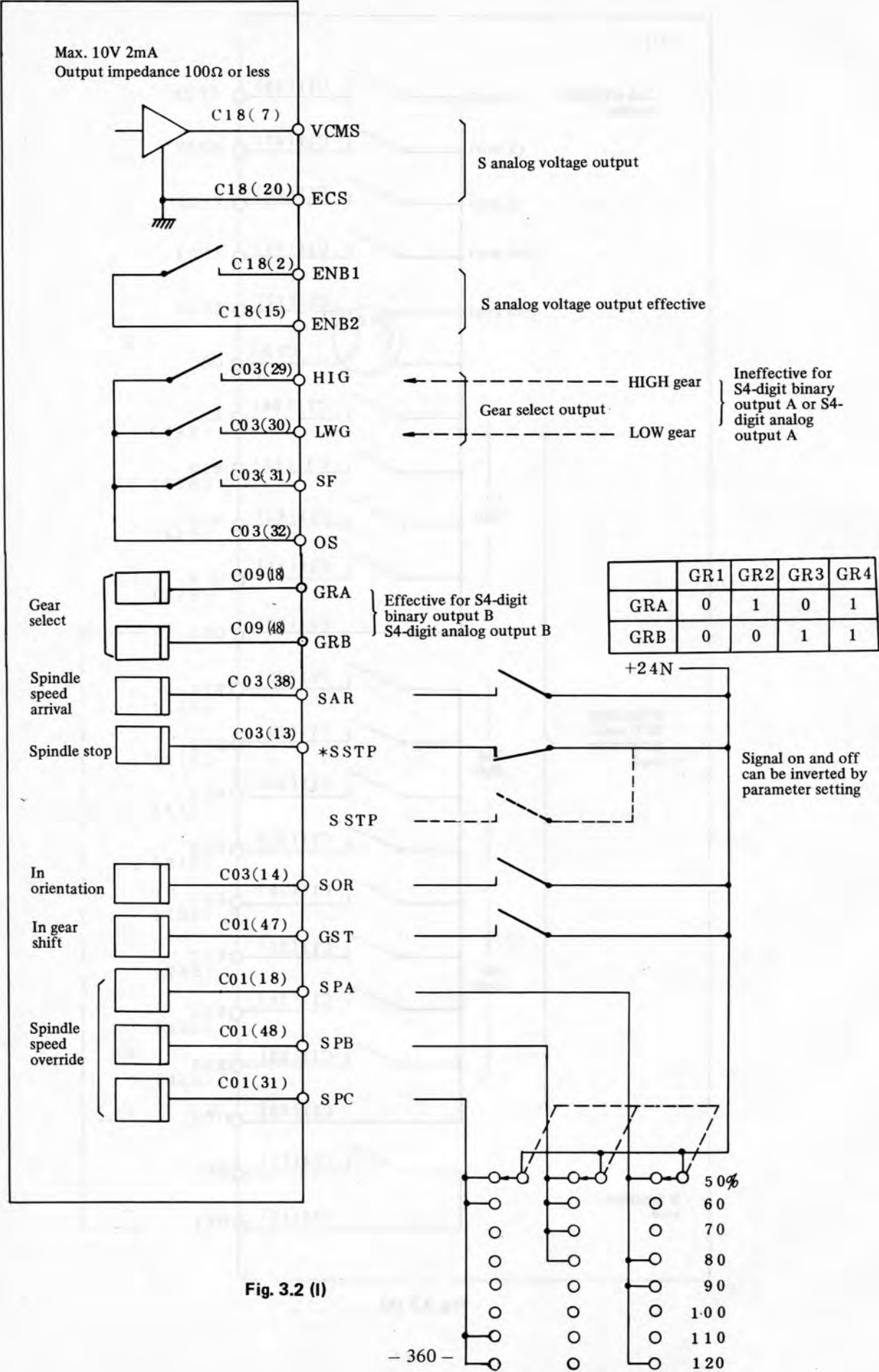


Fig. 3.2 (I)

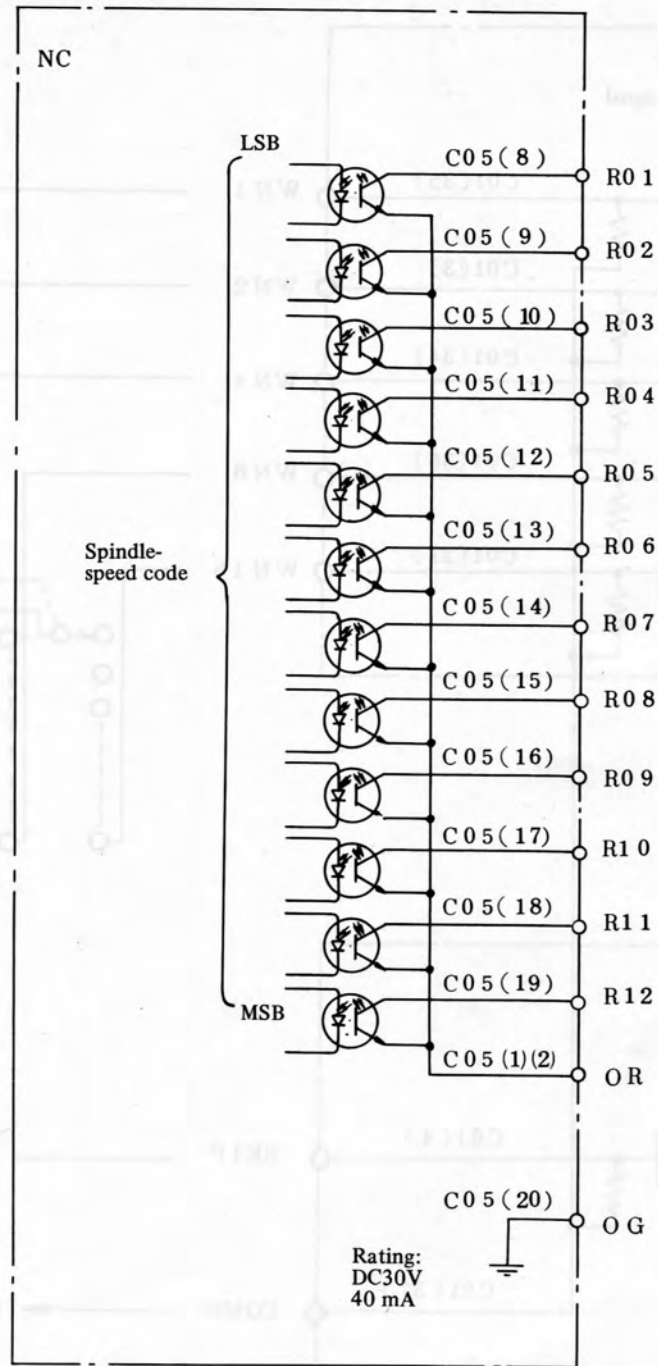
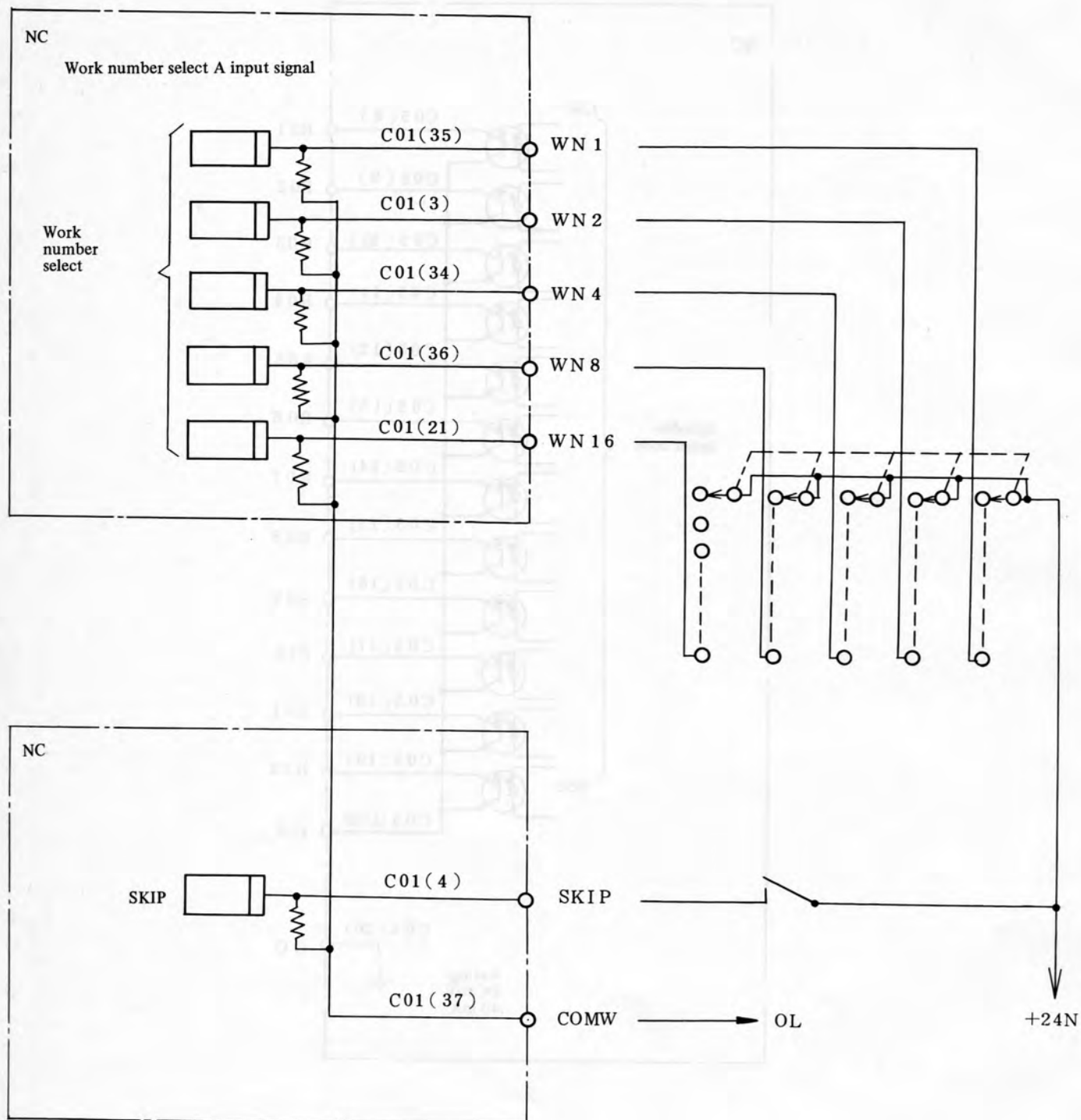


Fig. 3.2 (m)

Appendix 1



(Note) When signals WN1 ~ 16 or SKIP is used, a line must be connected between C01 (37) and OL.

Fig. 3.2 (n)

External Data Input

- The following are included:
- External work number select C
 - External input tool compensation C
 - External alarm message
 - External operator message
 - External work coordinate system shift

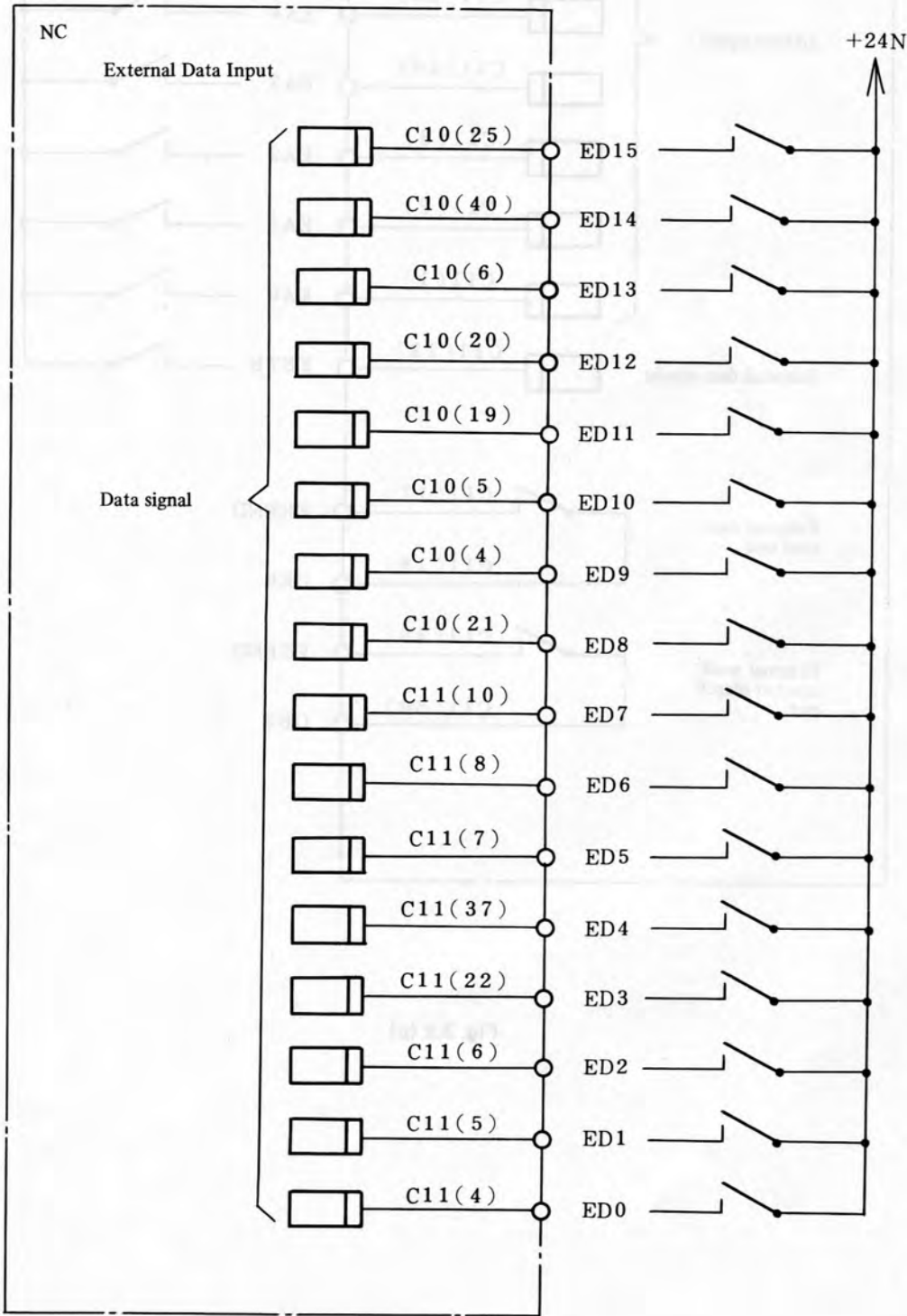


Fig. 3.2 (o)

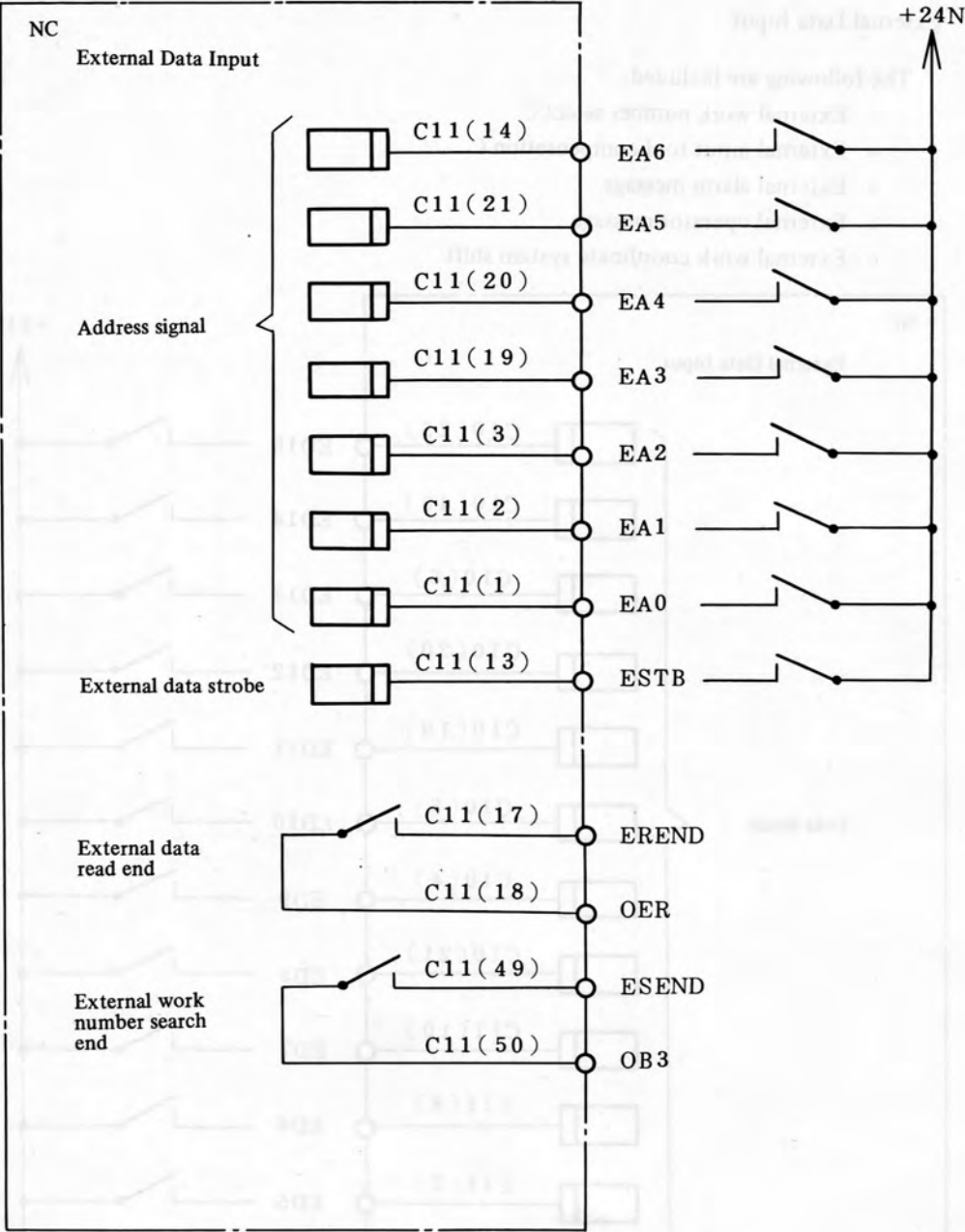


Fig. 3.2 (p)

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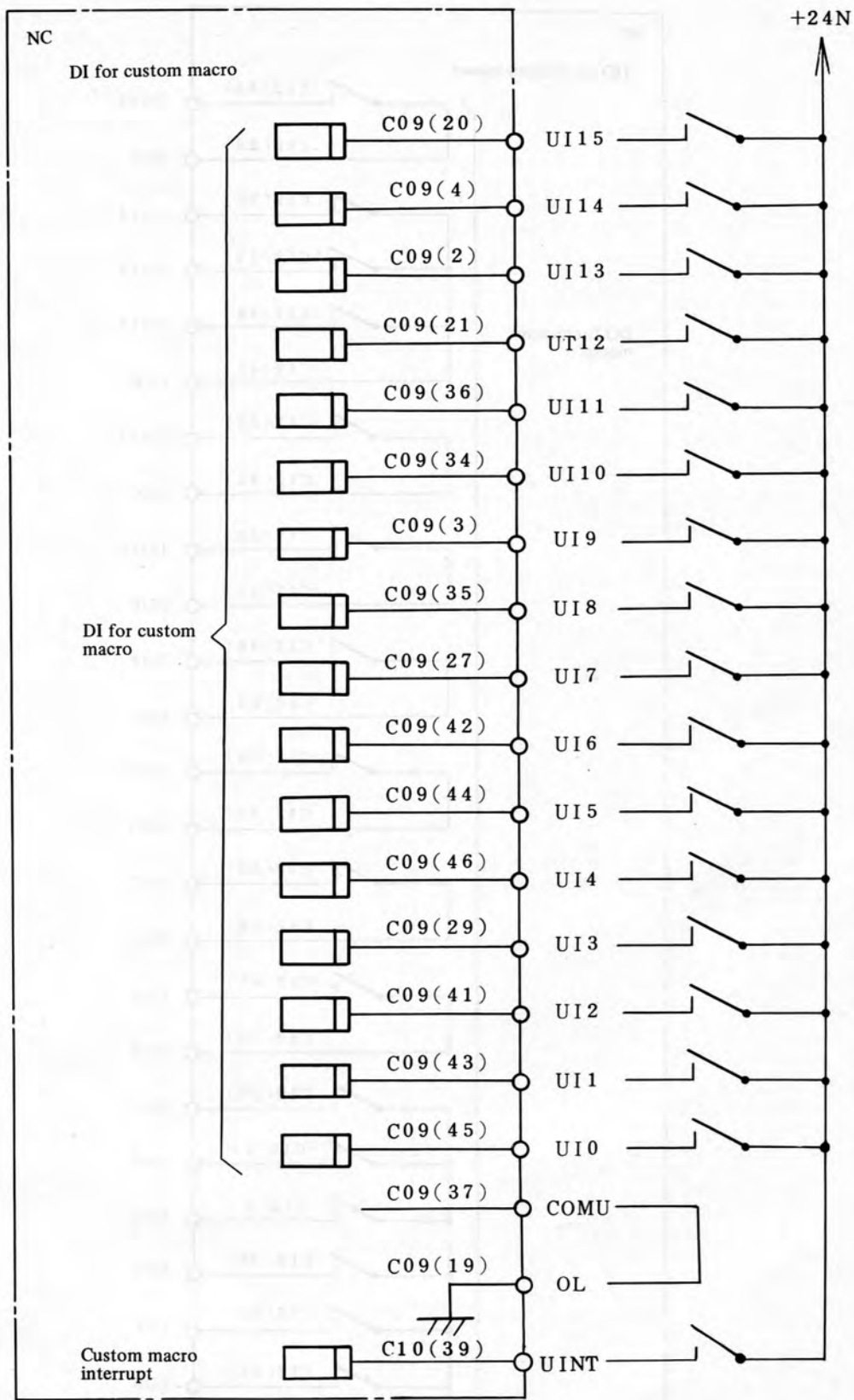


Fig. 3.2 (q)

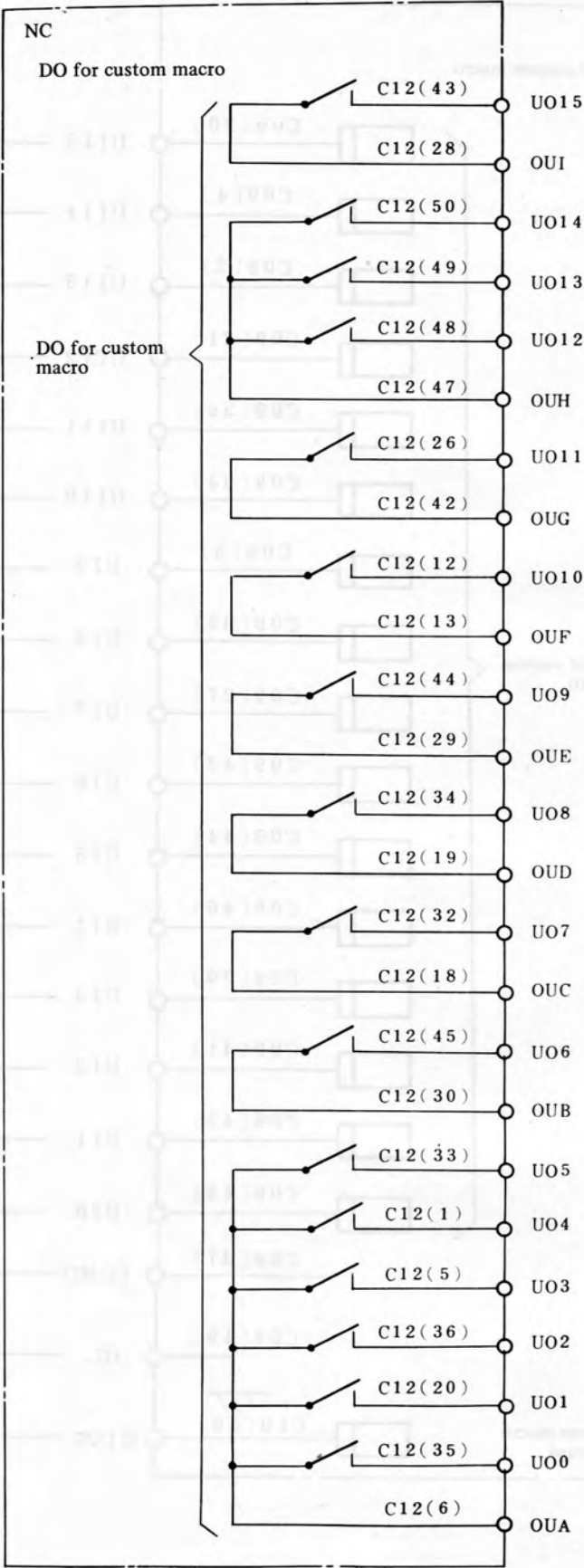


Fig. 3.2 (r)

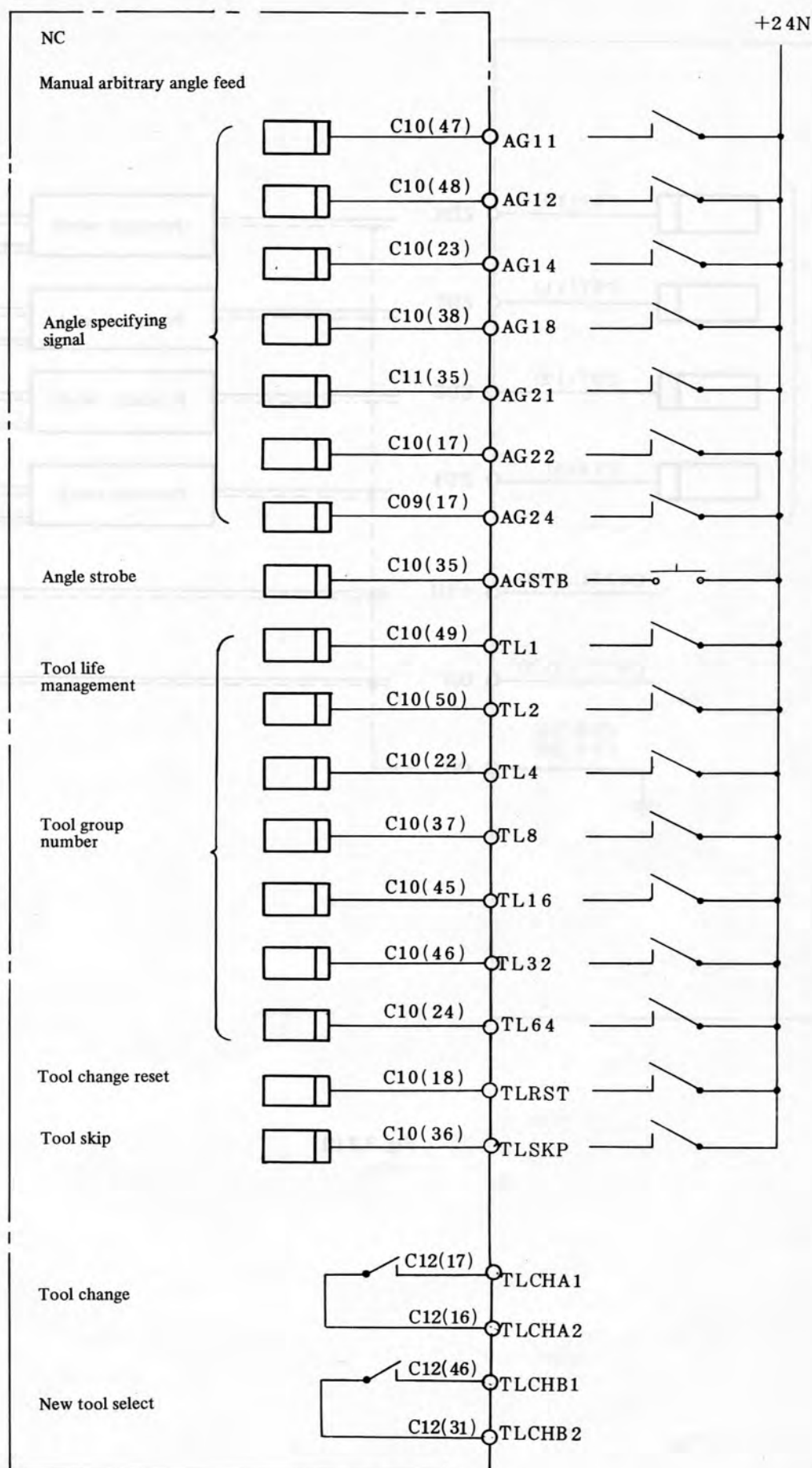


Fig. 3.2 (s)

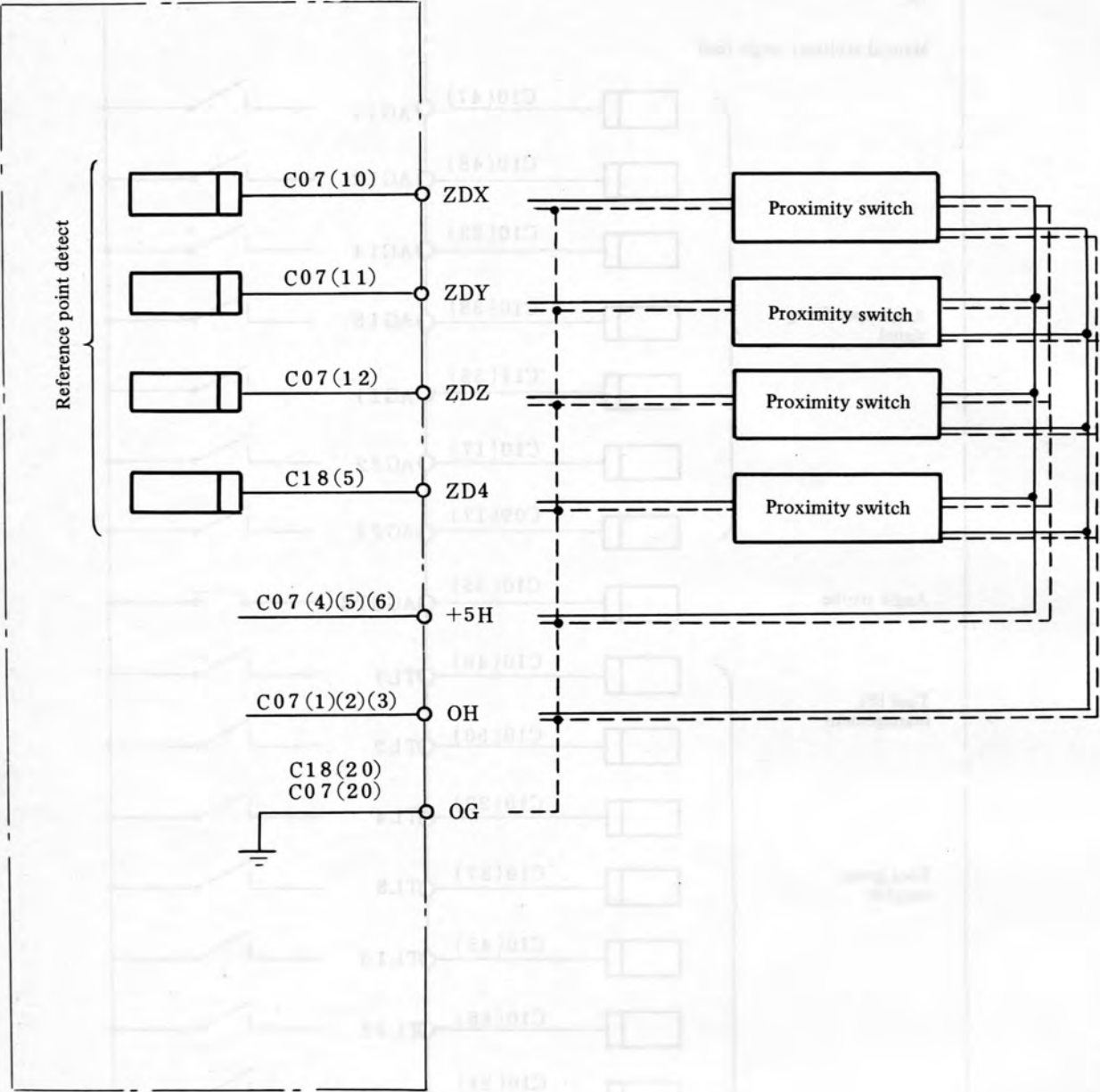


Fig. 3.2 (t)

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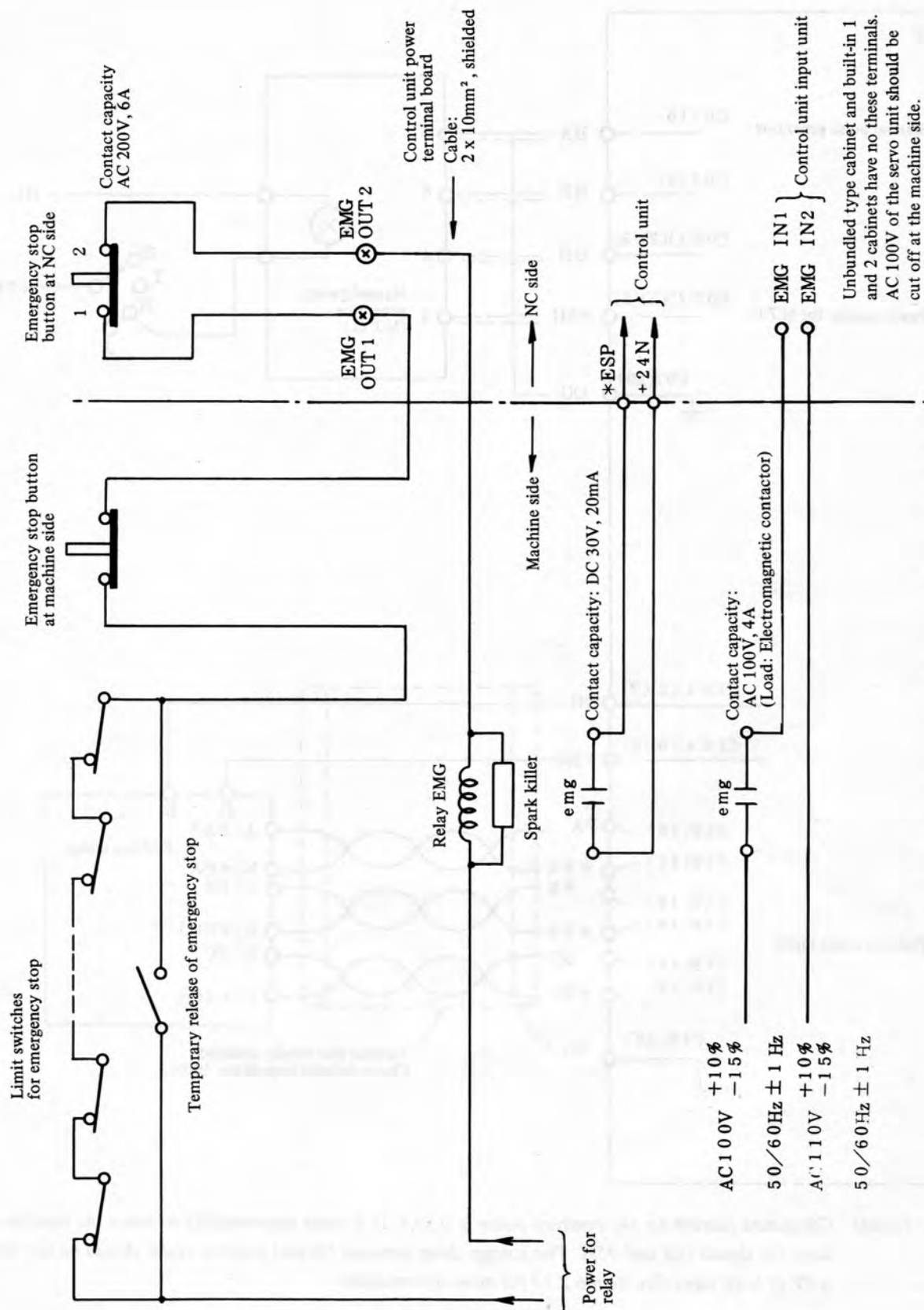
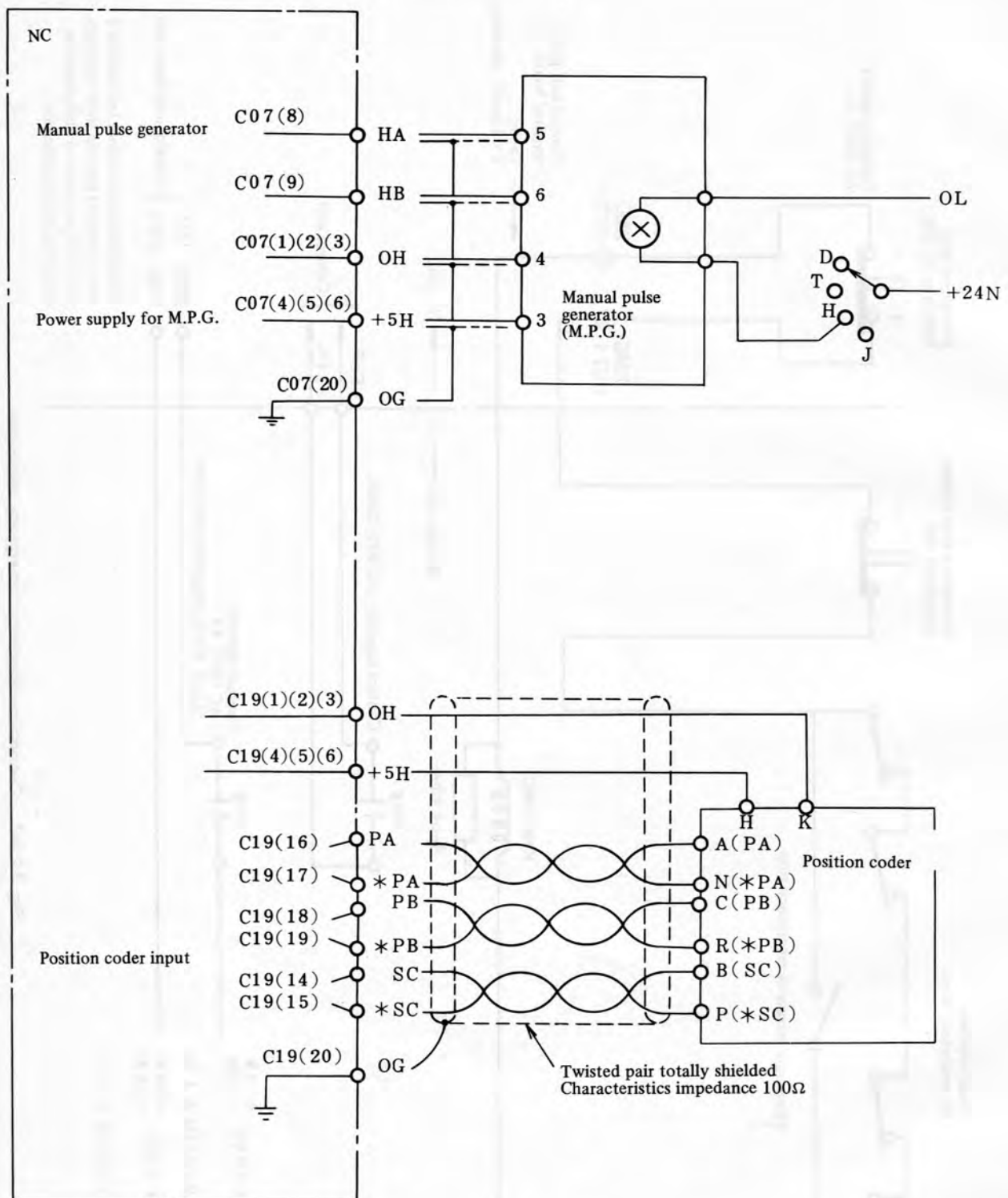


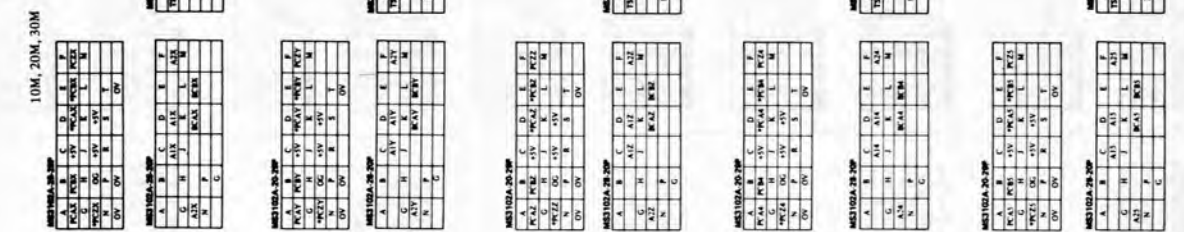
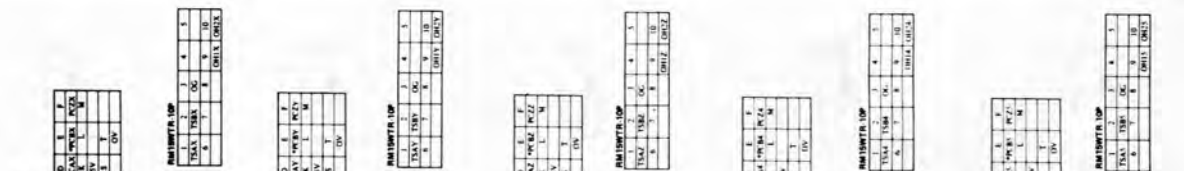
Fig. 3.2 (u) Connection diagram of emergency stop signal

3.3 Connection with manual pulse generator and position coder



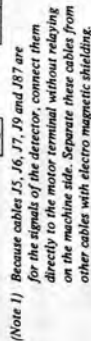
(Note) Consumed current by the position coder is 0.35A. It is your responsibility to select the number of lines for signals OH and +5H. The voltage drop between NC and position coder should be less than 0.1V in both ways. See item 6.2.53 for more information.

(1) Pulse coder feedback



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DOM



3.4 (b) Connection with motor (Pulse coder incorporate type)

C19/C65: MR-20RMA							
	1	2	3	4	5	6	7
OV	OV	OV	OV	+5V	+5V	+5V	
	8	9		10	11	12	13
	OH1S	OH2S					
	14	15		17	18	19	20
PZ5	*PZ5	PCAS		PCF5	PCF5	*PCB5	

G: M4 Screw				S.T1: M4 Screw terminal			
	U			1	6	7	8
	V			A1A5	A1B5	A2A5	A2B5
	W						

M15WTR-4P	1	2
	A15	A25
	3	4
	C	

A	B
A15	A25
C	D
	E

A	B	C
G	H	A

E	F
	A25
L	M

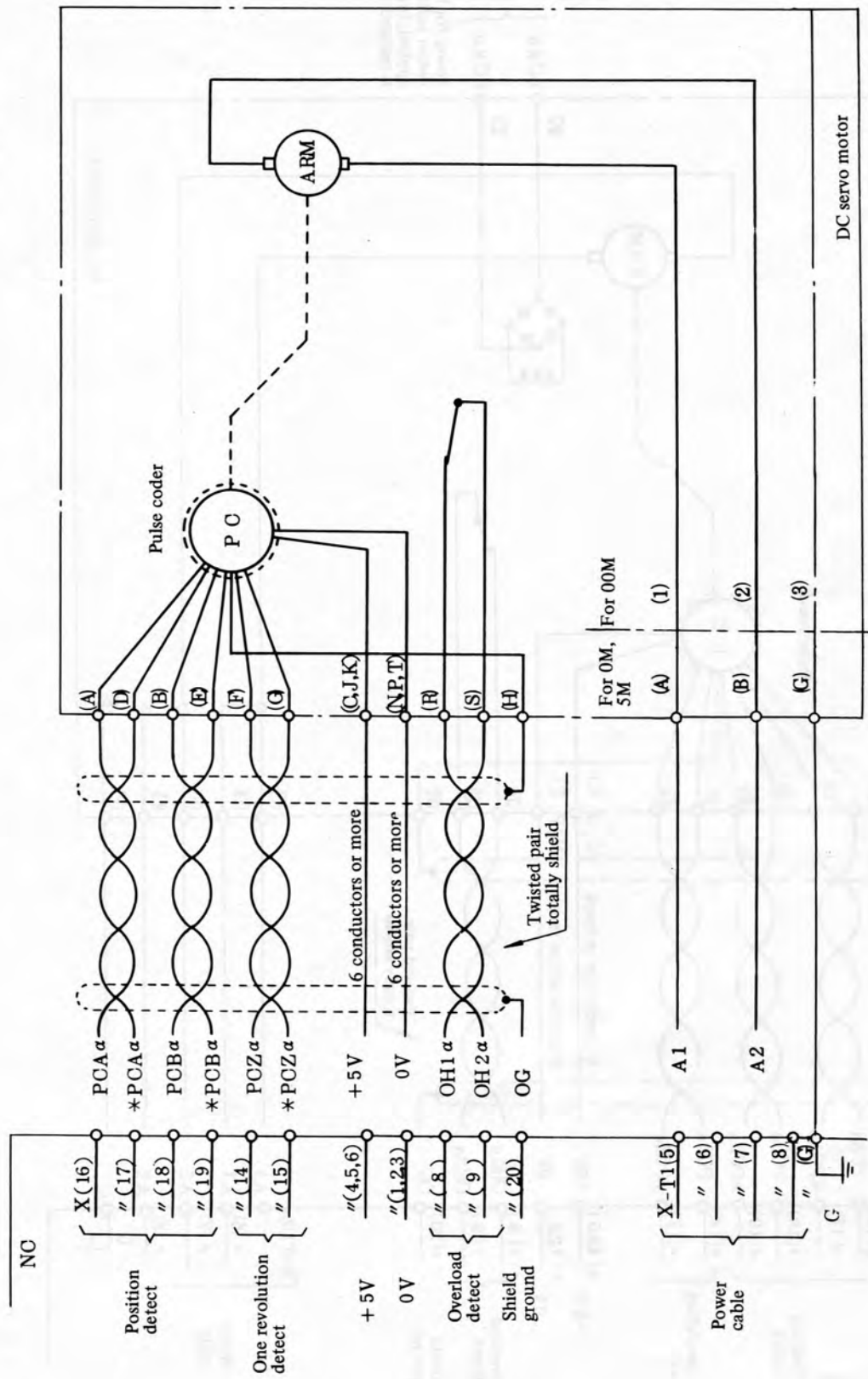
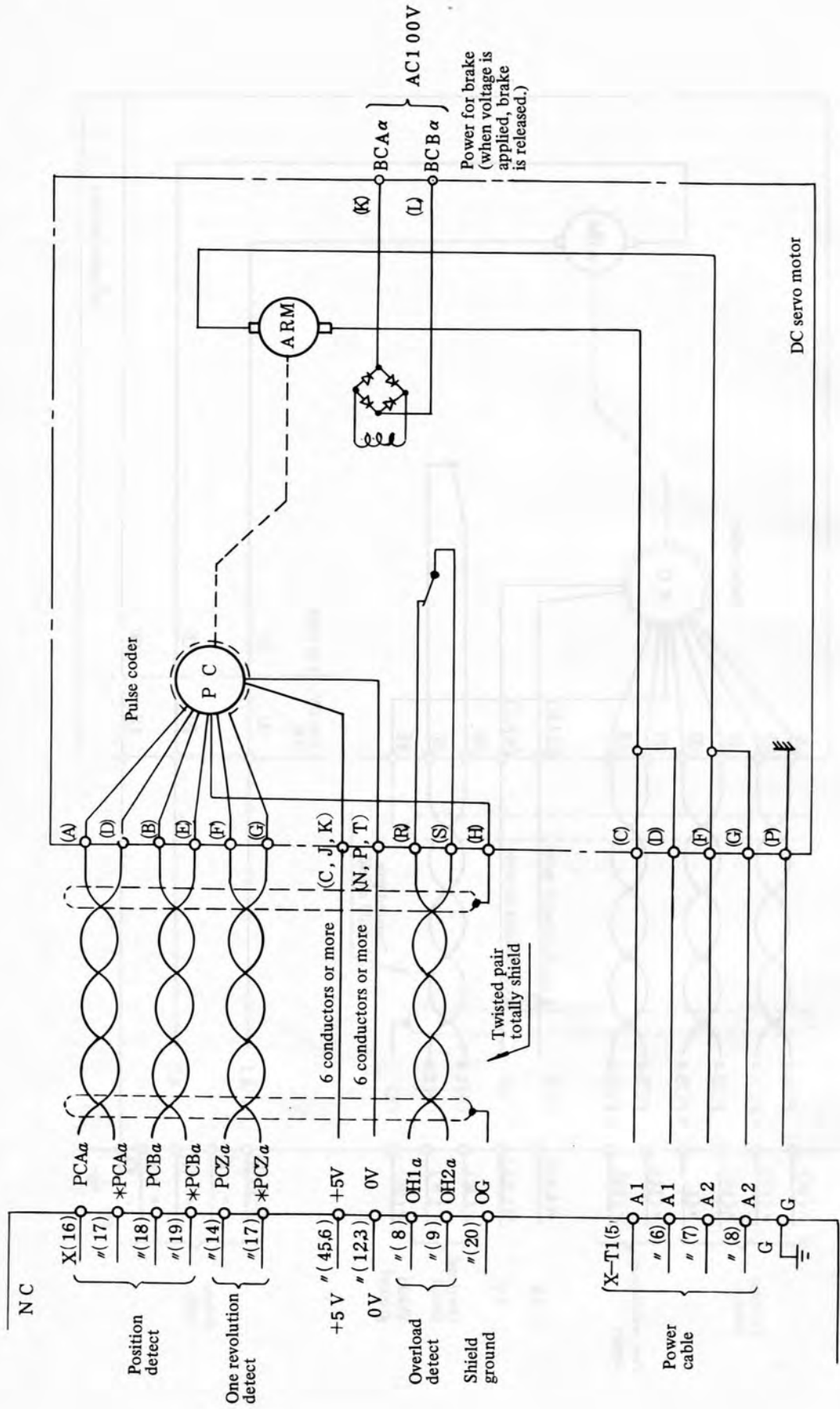


Fig. 3.4 (c) Connection with motor (for model 00M, 0M, 5M)

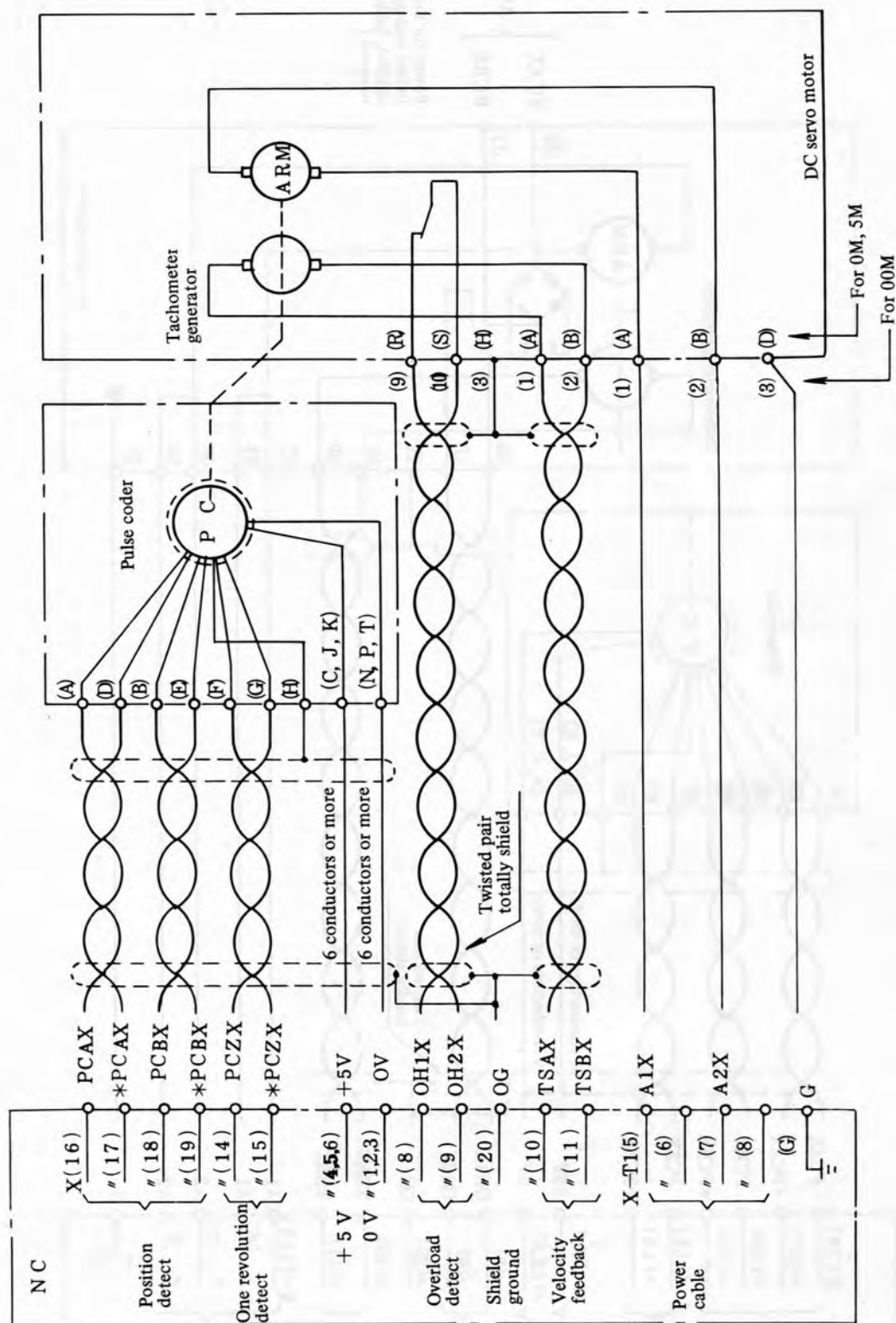
(Note) The figure is for X axis.

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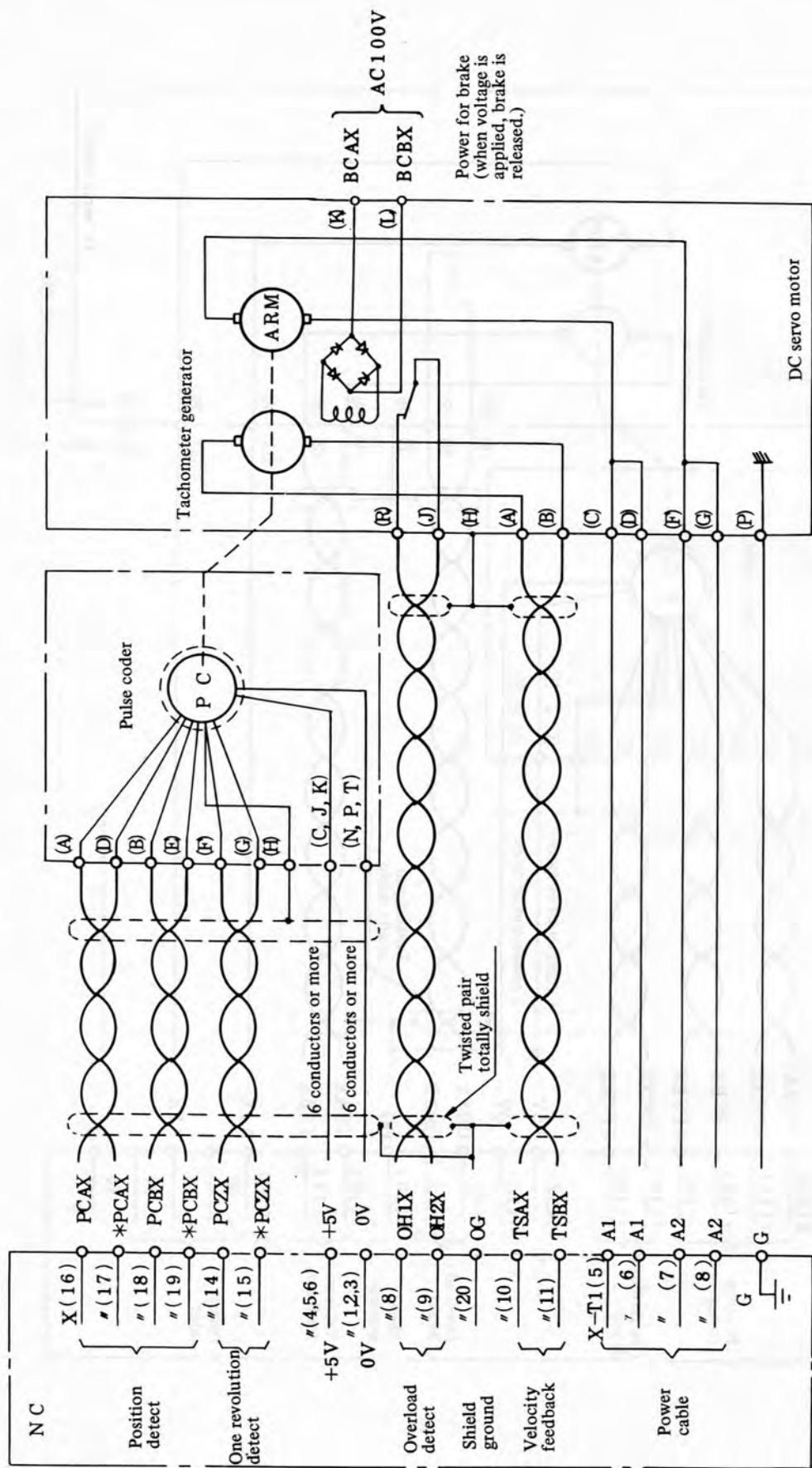
(Note) The figure is for X axis.

Fig. 3.4 (d) Connection with motor (for model 10M, 20M, 30M)



(Note) The figure is for X axis.

Fig. 3.4 (e) Connection with motor (for model 00M, 0M, 5M)



(Note) The figure is for X axis.

Fig. 3.4 (f) Connection with motor (for model 10M, 20M, 30M, 30MH)

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(Note 1) Connecting cable for the pulse coder

If the cable has few +5V and 0V conductors, the pulse coder may malfunction from cable voltage drop. Determine the number of conductors according to the following equation under the following conditions.

Determining the number of conductors

Equation:

$$m \geq 0.0035 \times A \times \ell$$

where m : number of +5V and 0V
conductors each

A : resistance of wire (Ω/km)

ℓ : cable length (m)

Conditions:

(1) Pulse coder current consumption

Max. 350 mA

(2) Voltage drop (return)

Up to 0.2V

Example:

If 7/0.18 wire ($A = 110\Omega/\text{km}$) is used and $\ell = 14$ m,

$$m \geq 0.0035 \times 110 \times 14 = 5.39$$

Thus, $m = 6$,

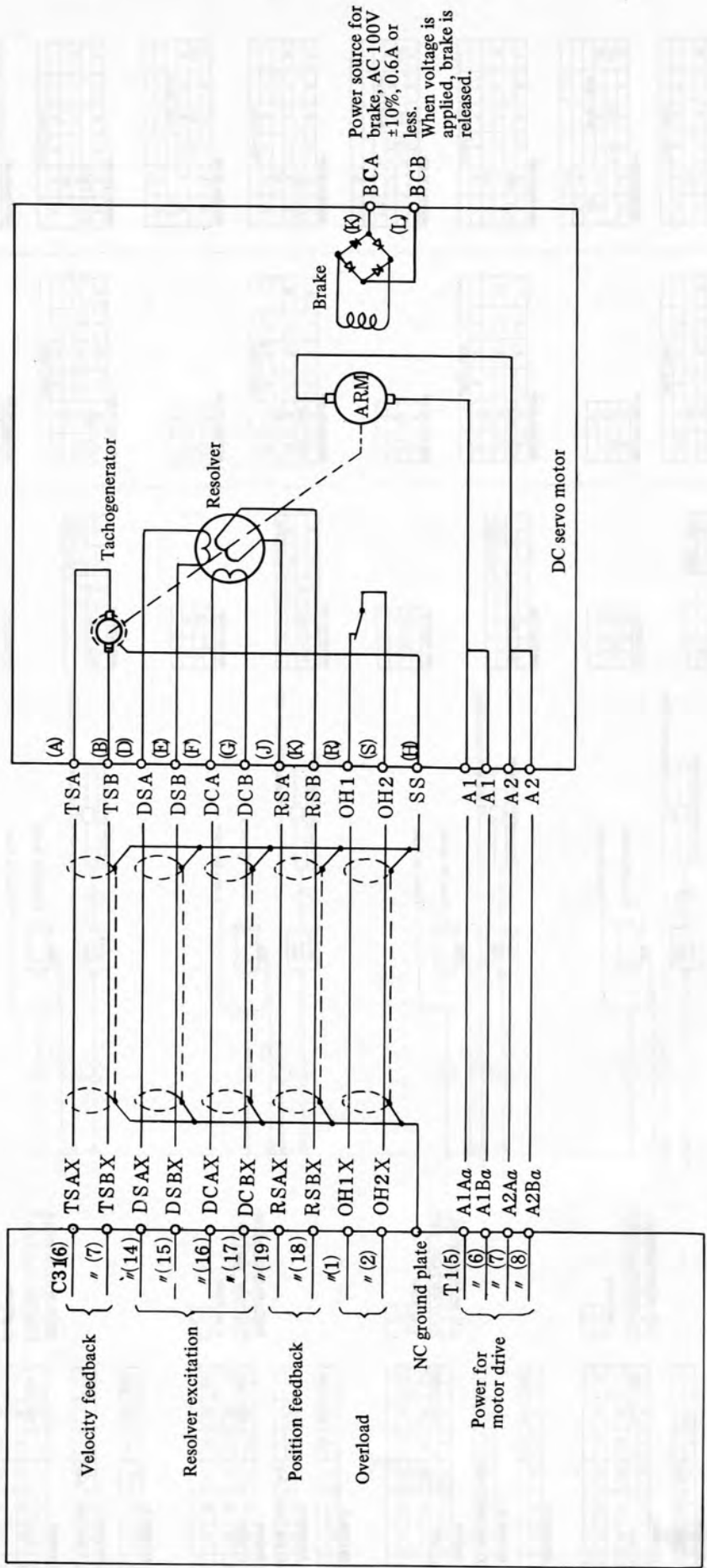
- The NC-side connector have 3 pins for +5V and 0V each, and therefore connect 2 conductors per pin.
- Standard interface cable-A (10-pair: A66L-0001-0041) wire is 7/0.18.
- Cable resistance (for reference)

7/0.18' 110 Ω/km

12/0.18 60 Ω/km

20/0.18 40 Ω/km





(Note) The figure is for X axis.



2 cores, twisted pair shielded wire 0.5 mm²

Fig. 3.4 (h) Connection of servo motor with resolver

(3) Inductosyn feedback

C30: RM12BRB-7S

1	2	3	4	5	6	7
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX

C32: RM12BRB-7S

1	2	3	4	5	6	7
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX

C31: MIP20RM

1	2	3	4	5	6	7
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX

C36: RM12BRB-7S

1	2	3	4	5	6	7
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX

C35: RM12BRB-7S

1	2	3	4	5	6	7
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX

C34: MIP20RM

1	2	3	4	5	6	7
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX

C38: RM12BRB-7S

1	2	3	4	5	6	7
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX

C37: MIP20RM

1	2	3	4	5	6	7
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX

C39: RM12BRB-7S

1	2	3	4	5	6	7
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX

C42: RM12BRB-7S

1	2	3	4	5	6	7
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX

C41: RM12BRB-7S

1	2	3	4	5	6	7
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX

C40: MIP20RM

1	2	3	4	5	6	7
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX

C44: RM12BRB-7S

1	2	3	4	5	6	7
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX

C43: RM12BRB-7S

1	2	3	4	5	6	7
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX

C45: MIP20RM

1	2	3	4	5	6	7
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX

C46: RM12BRB-7S

1	2	3	4	5	6	7
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX

C47: MIP20RM

1	2	3	4	5	6	7
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX

BT: RM15WTR-10P

1	2	3	4	5	6	7	8
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX	TSBX

BT: RM15WTR-10P

1	2	3	4	5	6	7	8
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX	TSBX

BT: RM15WTR-10P

1	2	3	4	5	6	7	8
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX	TSBX

BT: RM15WTR-10P

1	2	3	4	5	6	7	8
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX	TSBX

BT: RM15WTR-10P

1	2	3	4	5	6	7	8
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX	TSBX

BT: RM15WTR-10P

1	2	3	4	5	6	7	8
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX	TSBX

BT: RM15WTR-10P

1	2	3	4	5	6	7	8
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX	TSBX

BT: RM15WTR-10P

1	2	3	4	5	6	7	8
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX	TSBX

BT: RM15WTR-10P

1	2	3	4	5	6	7	8
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX	TSBX

BT: RM15WTR-10P

1	2	3	4	5	6	7	8
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX	TSBX

BT: RM15WTR-10P

1	2	3	4	5	6	7	8
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX	TSBX

BT: RM15WTR-10P

1	2	3	4	5	6	7	8
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX	TSBX

BT: RM15WTR-10P

1	2	3	4	5	6	7	8
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX	TSBX

BT: RM15WTR-10P

1	2	3	4	5	6	7	8
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX	TSBX

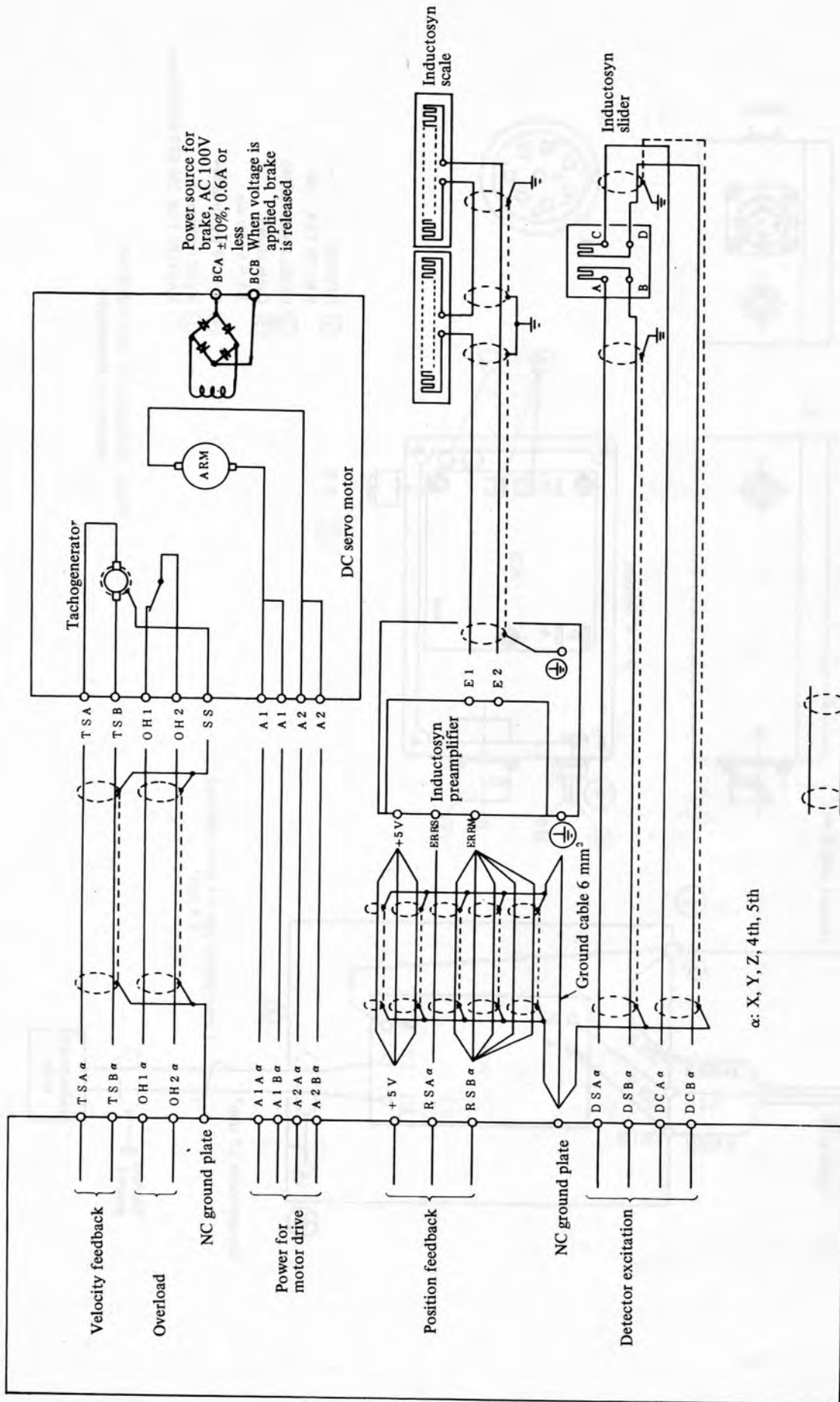
BT: RM15WTR-10P

1	2	3	4	5	6	7	8
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX	TSBX

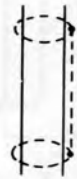
BT: RM15WTR-10P

1	2	3	4	5	6	7	8
TSAX	TSBX	OG	TSAX	TSBX	OG	TSAX	TSBX

Fig. 3.4 (i) Connection with motor (Inductosyn feedback)



α : X, Y, Z, 4th, 5th



2 cores, twisted pair shielded wire 0.5 mm²

Fig. 3.4 (j) Connection of servo motor and inductosyn scale

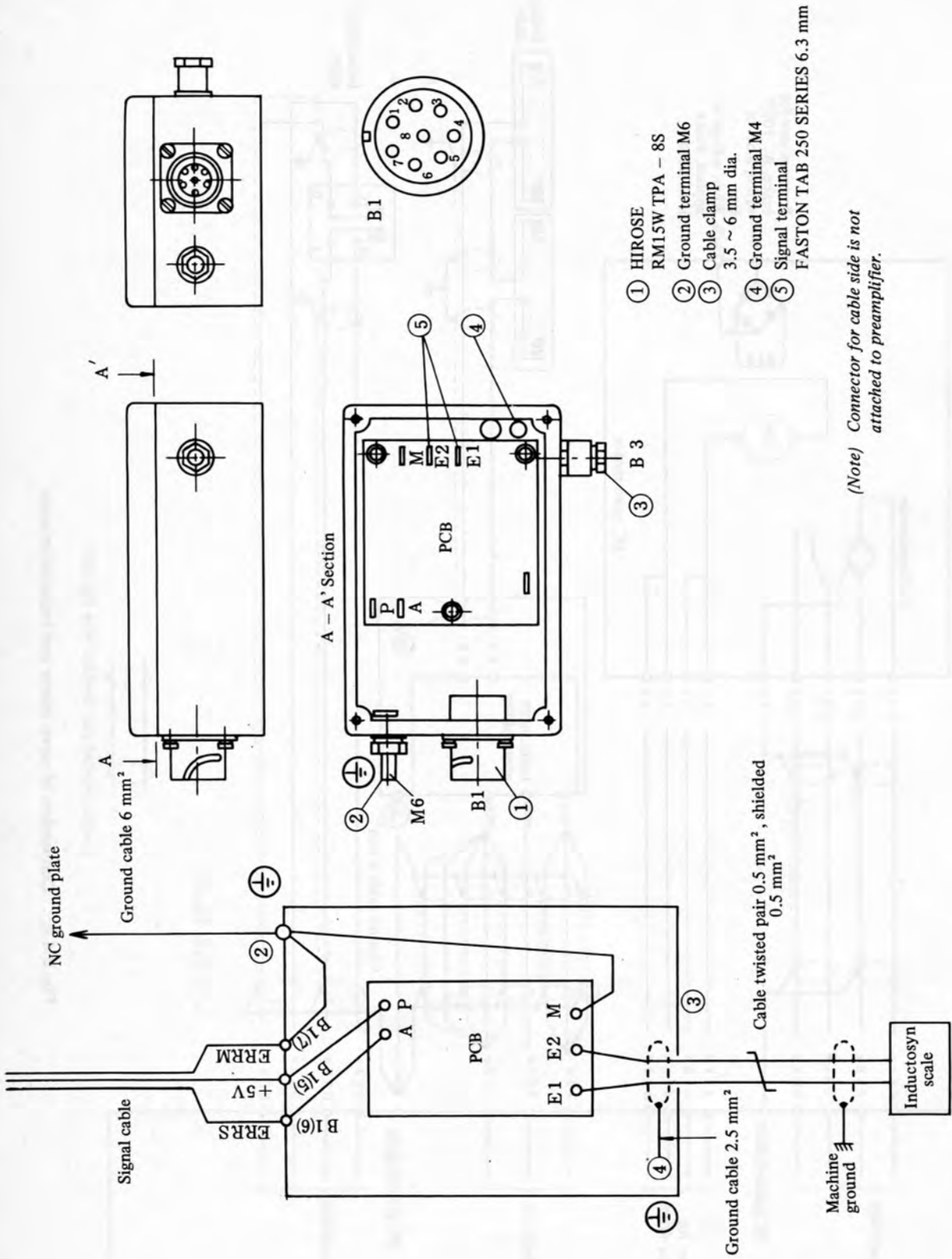


Fig. 3.4 (k) Inductosyn Preamplicifier Cable Connections

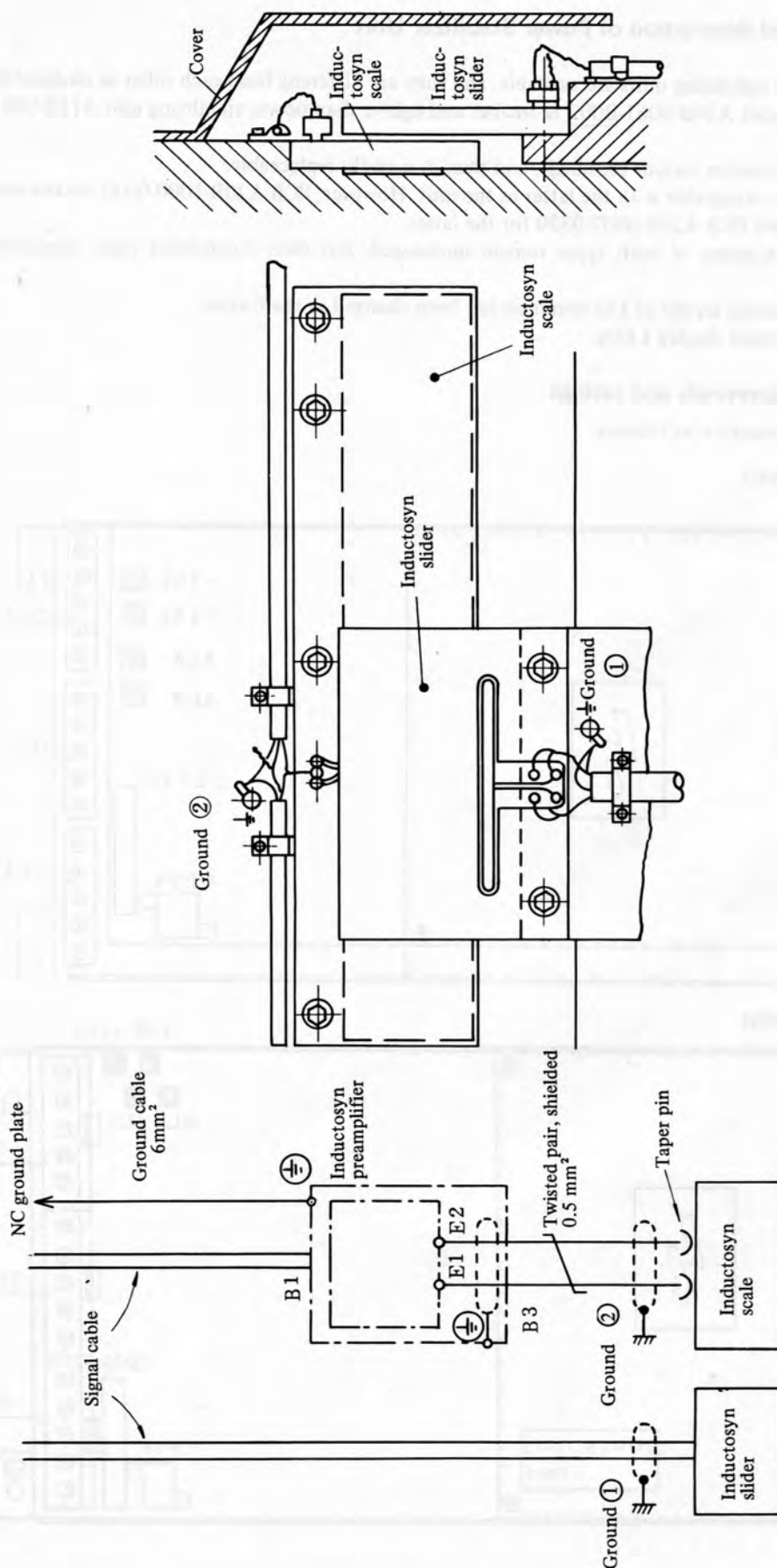


Fig. 3.4 (I) Inductosyn Cable Connections

Appendix 2 Detailed description of Power Stabilizer Unit

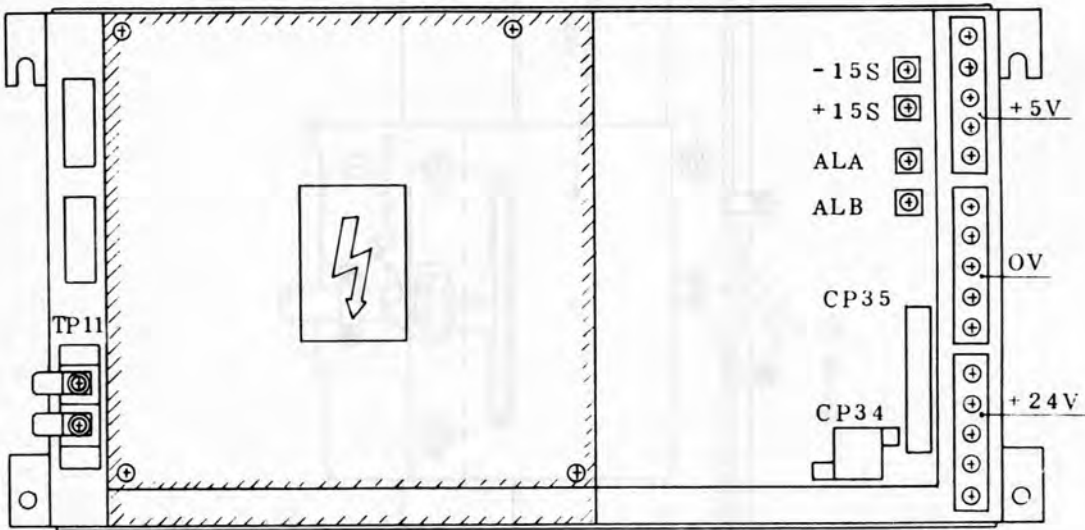
Two types of power stabilizing units are available, and they are different from each other as outlined below.

- (1) Power stabilizing unit A14B-0061-B002 is smaller and lighter than power stabilizing unit A14B-0061-B001 by about 40%.
- (2) The former has connector output terminals, and thus, it is easily replaceable.
- (3) The former is interchangeable with the latter as the unit. However, PCB A20B-1000-0030 for the former is not interchangeable with PCB A20B-0007-0330 for the latter.
- (4) The basic circuit systems of both types remain unchanged, but their component parts considerably differ between the two.
- (5) A part of the mounting layout of I/O terminals has been changed in the former.
- (6) The former has deleted display LEDs.

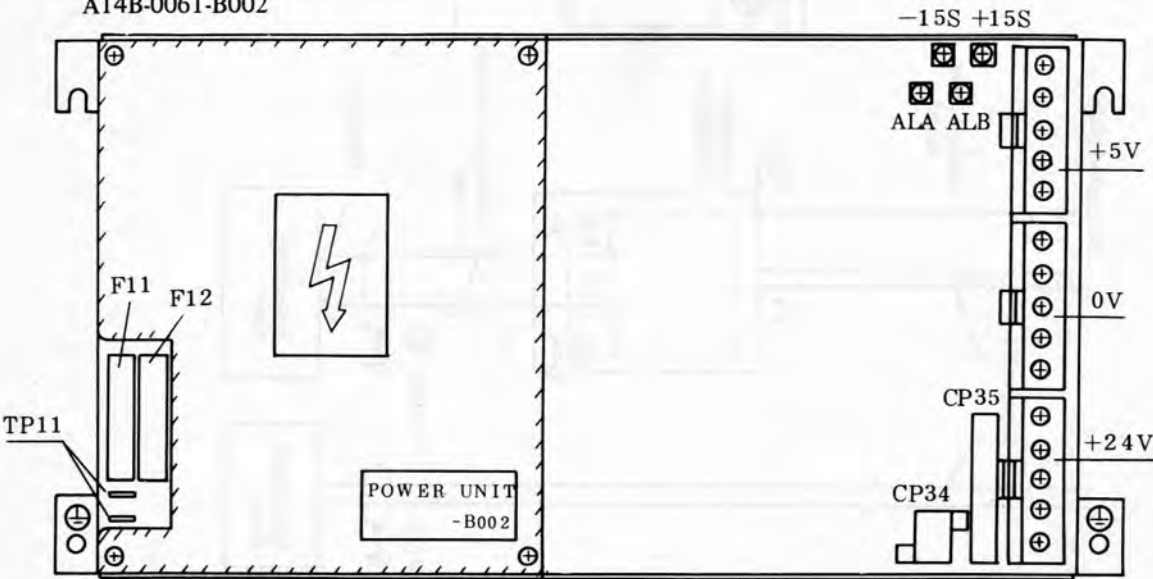
1. Location of I/O terminals and ratings

Location of I/O terminals is as follows:

A14B-0061-B001



A14B-0061-B002



(1) AC input terminals and their ratings

TP11-1	} or	AC 200V	+10% -15%	50 or 60 Hz
TP11-2		AC 220V	+10% -15%	50 or 60 Hz

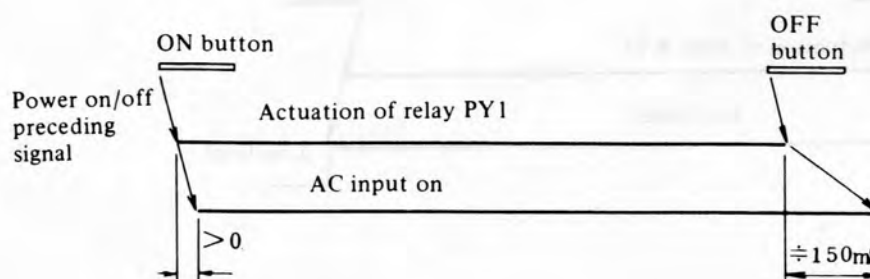
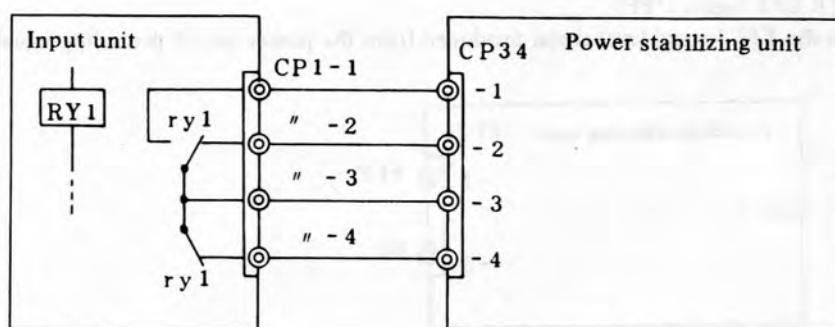
(2) Output terminals and their ratings

Terminal name	Nominal voltage	Allowable range	Use
+5V	+5V	±5%	Logic circuit Reed relay
+24V	+24V	±10%	Tape reader Bubble memory, CRT I/O signals
CP35-1 +15S	+15V	±5%	Position control circuit
CP35-6 -15S	-15V	±5%	Position control circuit, bubble memory
CP35-2, 5 0V	0V	—	—

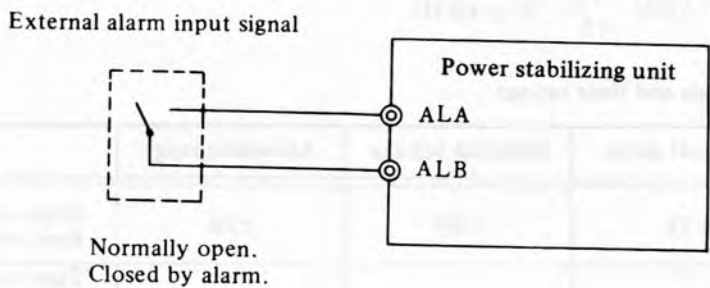
(3) Descriptions of input signals

① Power on/off preceding signal

This signal is given from the input unit through contacts preceding the AC input which is input by the normal power on/off button (NC on/off button or external on/off button).

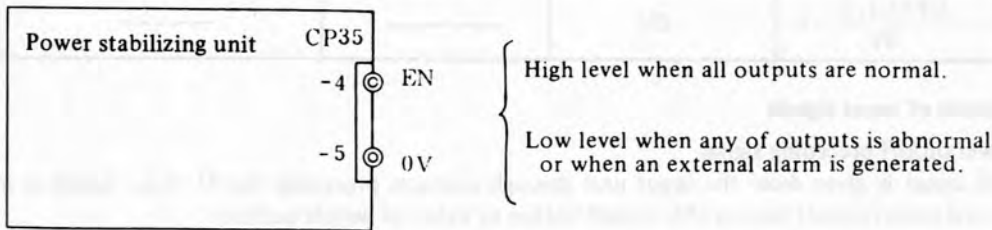


- ② External alarm input signal
The power stabilizing unit receives alarm signals from outside (for example from additional power source) and does the same processes as for the alarms generated in the power stabilizing unit.

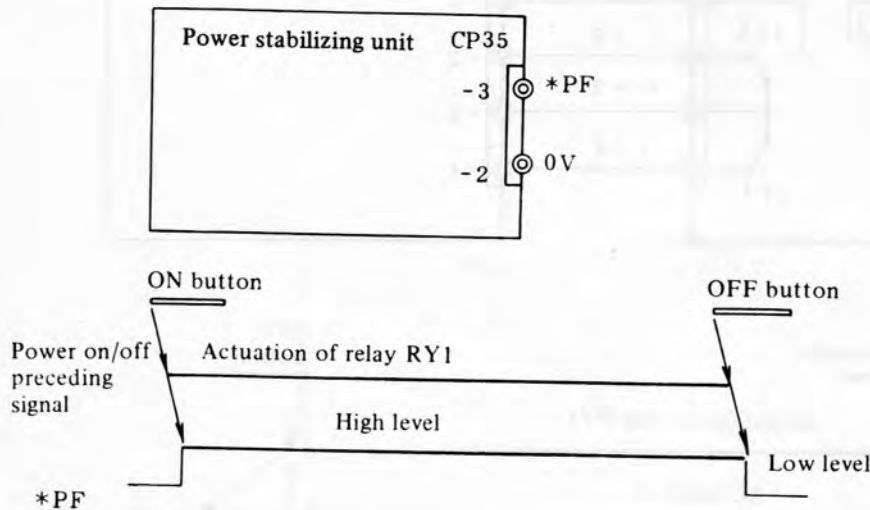


(4) Descriptions of output signals

- ① ENABLE signal (EN)
This is the TTL logical level signal to indicate whether all DC outputs are being issued normally or not. This signal becomes Low when an output abnormality is detected in any circuits or when the power stabilizing unit receives an external alarm.



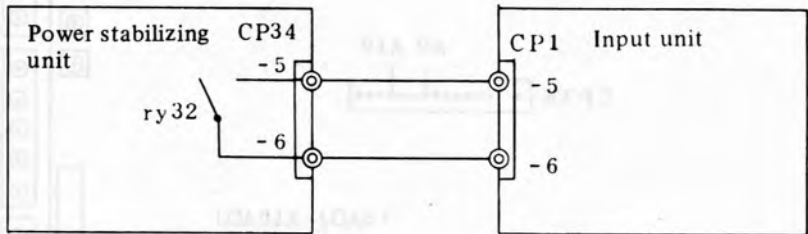
- ② POWER OFF signal (*PF)
This is the TTL logical level signal produced from the power on/off preceding signal.



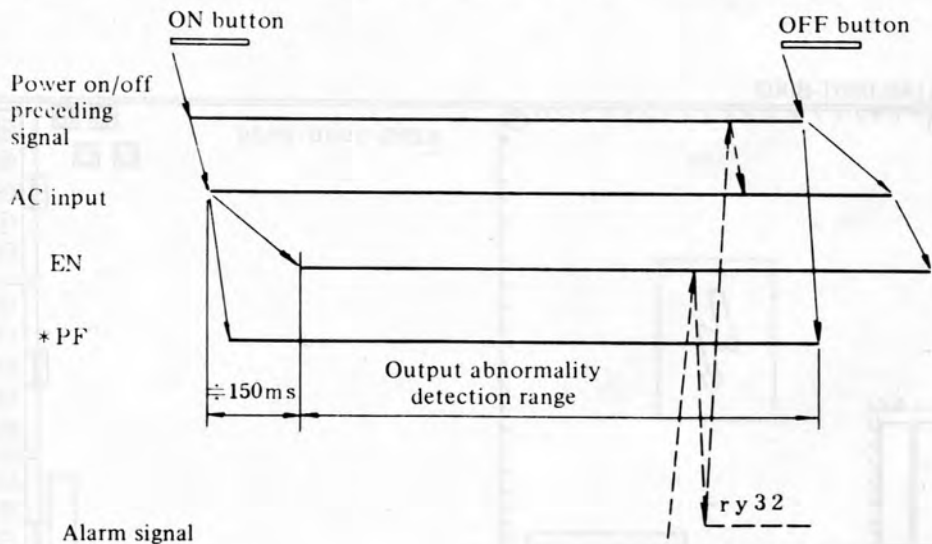
③ Alarm signal

This signal is output through contacts to the input unit when the signal EN becomes Low level or the power stabilizing unit receives an external alarm signal in the output abnormality detection range which is shown in the time chart below.

If this signal is output, the signal is held by a relay inside the input unit and AC power is cut off. (Power OFF due to alarm).



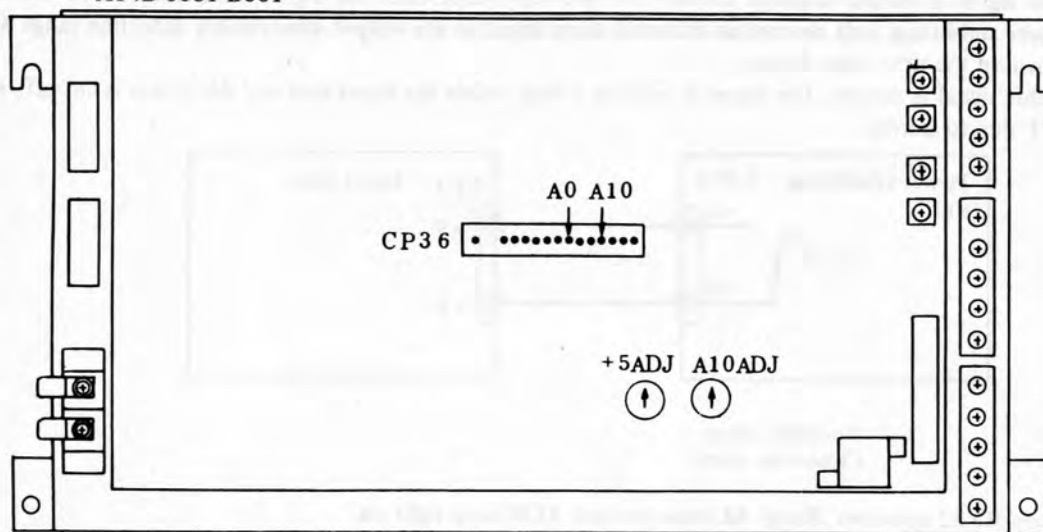
When RY32 operated, Relay AL make on and ALM lamp light on.



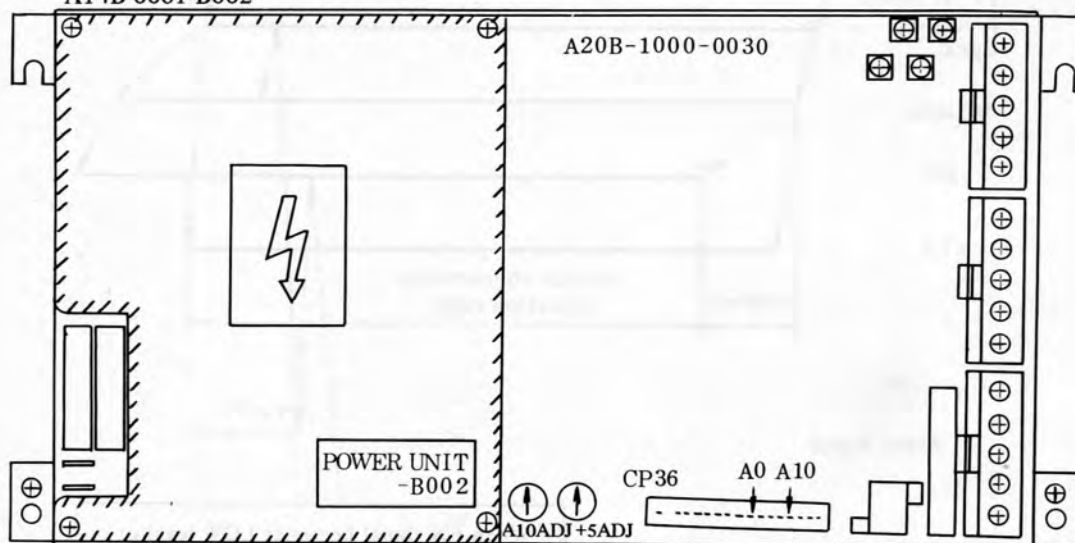
When EN signal becomes LOW level or receiving an external alarm signal.

2. Check Points

A14B-0061-B001



A14B-0061-B002



(1) Adjustment of nominal voltage

Measure the voltage between A10 and A0 in the connector CP36 with a digital voltmeter and confirm that it is 10.00V. When it is out of 10.00V, adjust it with the variable resistor A10ADJ. The voltage increases by rotating A10ADJ in the clockwise direction (↻).

(2) Adjustment of +5V output voltage

The +5V output voltage is adjusted by the variable resistor +5ADJ. The voltage increases by rotating +5ADJ in the clockwise direction (↻).

3. Voltage monitor circuit

Each output voltage and auxiliary power supply voltages are always monitored. If an abnormality is detected, the EN signal turns off, an alarm signal is issued to the input unit and the power is turned off.

Abnormality detection level and major causes of abnormality occurrence in the voltage monitor circuit are explained in the table 3.1.

Each voltage monitor circuit has a short-circuit plug S1 ~ S7, which determine the abnormality detection effective or not. Normally all plugs S1 to S7 are inserted (All are effective). If any of plugs S1 to S7 are removed, the corresponding voltage monitor circuits become ineffective.

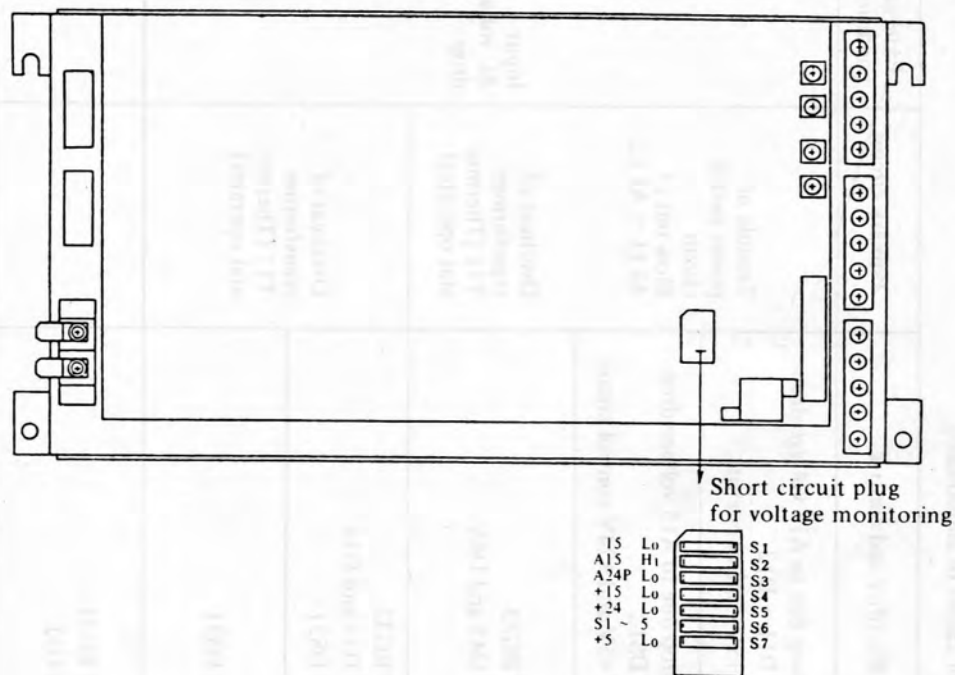


Table 3.1 (a) (A14B-0061-B001)

Voltage monitor circuit and abnormality detection level (Absolute value)		Major causes of abnormality			External conditions	Symbols of the shorting plugs
		Actuation of OVP and OCL	Rectifier and control	Primary circuit		
+5V	Less than 97%	+5V circuit OVP actuation +5V circuit OCL actuation Primary circuit OCL actuation	Switching stop due to A15 voltage drop Trouble of D11 ~ D12 Trouble of +5V control circuit	Trouble of power switch circuit Blow out of AF11 ~ AF12	Input AC voltage drop	S7
+24V	Less than 19.2 to 20.5V	+24V circuit OVP actuation +24V circuit OCL actuation Primary circuit OCL actuation	Switching stop due to A15 voltage drop Trouble of DS12 Trouble of +5V and +24V control circuit			
+15V	Less than 12.9 to 13.7V	+15V and +24V circuits OVP actuation +15V and +24V circuits OCL actuation	Trouble of RG33 Trouble of D45 and D46	Overheat of transformer T11 (Thermo-stat operates)		S5
-15V	Less than -11.6 ~ -13.5V	-15V circuit OVP actuation -15V circuit OCL actuation	Trouble of RG32 Trouble of D33 and D34 Trouble of DS31	Overheat of transformer T11 (Thermo-stat operates)		S4
A24P (Auxiliary power supply)	Less than 16.5 ~ 17.5V	—	Trouble of DS31			S1
A15 (Auxiliary power supply)	More than 16.8 ~ 17.8V	—	Trouble of RG31 Trouble of D31	—		S3
						S2
S6 (= S1 ~ S5)						

OVP: Over voltage protecting function
OCL: Over current limiting function

Removing of S6 is equivalent to removing all S1 to S5.

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Table 3.1 (b) (A14B-0061-B002)

Voltage monitor circuit and abnormality detection level (Absolute value)		Major causes of abnormality					Symbols of the shorting plugs
		Actuation of OVP and OCL	Rectifier and control	Primary circuit	External conditions	Others	
+5V	Less than 97%	+5V circuit OVP actuation +5V circuit OCL actuation Primary circuit OCL actuation	Switching stop due to A15 voltage drop Trouble of DS13 ~ DS15 Trouble of +5V control circuit (M12, M13, etc.)	Trouble of power switch circuit Blow out of AF11 ~ AF12	Input AC voltage drop	Trouble of voltage monitor circuit (M13, M14, etc.)	S7
+24V	Less than 19.2 to 20.5V	+24V circuit OVP actuation +24V circuit OCL actuation Primary circuit OCL actuation	Switching stop due to A15 voltage drop Trouble of DS12 Trouble of +5V and +24V control circuit (M12, M13, etc.)				S5
+15V	Less than 12.9 to 13.7V	+15V and +24V circuits OVP actuation +15V and +24V circuits OCL actuation	Trouble of RG33 Trouble of D45 and D46				S4
-15V	Less than -12.0 to -13.0V	-15V, +5V circuit OVP actuation -15V, +5V circuit OCL actuation	Trouble of RG12 Trouble of D36				S1
A15 (Auxiliary power supply)	More than 17.5 to 18.7V	—	Trouble of auxiliary power supply (M11, etc.)	—	—		S2

OVP: Over voltage protecting function
OCL: Over current limiting function

Removing of S6 is equivalent to removing all S1 to S5.

4. OVP and OCL functions

Each circuit is provided with the OVP and OCL functions, which operate at levels as in the table. When the OVP operates, the output terminal thyristor turns on, the output shorts and the over voltage is absorbed. When the OCL operates, the output voltage drops according to the degree of over current. So both OVP and OCL become error causes in voltage monitor circuits.

A14B-0061-B001

	OVP operating level (Absolute value)	OCL operating level
+5V	6.0 ~ 6.5V	28 ~ 30A
+24V	29 ~ 34V	5 ~ 6A
+15V	16 ~ 19V	Approx. 1.5A
-15V	16 ~ 19V	Approx. 2A
Primary circuit	—	5.4 ~ 5.7A

A14B-0061-B002

	OVP operating level (Absolute value)	OCL operating level
+5V	6.3 ~ 6.8V	31 ~ 35A
+24V	29 ~ 32V	4.5 ~ 5.5A
+15V	16 ~ 18V	Approx. 1.2A
-15V	16 ~ 18V	Approx. 1.7A
Primary circuit	—	5.5 ~ 6.4A (Peak value)

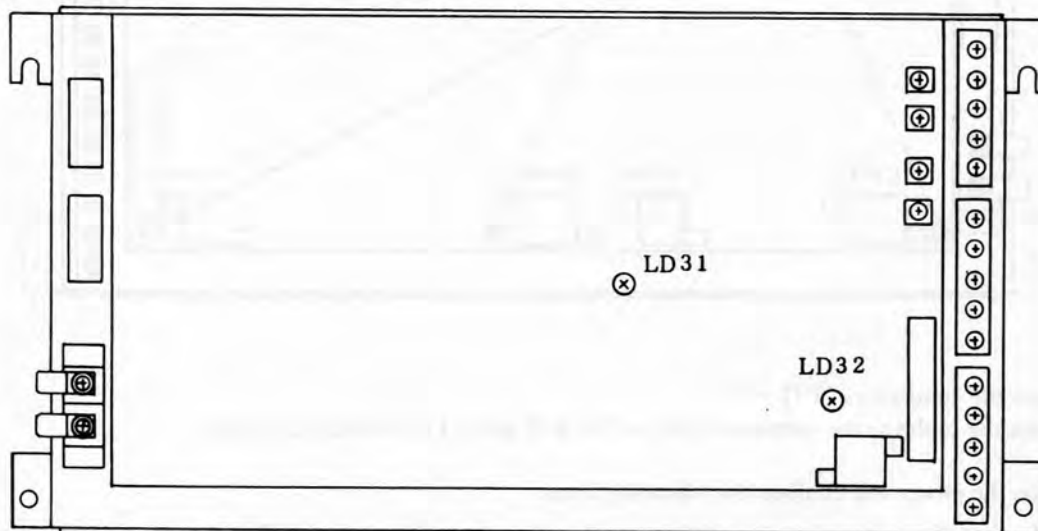
5. LEDs (LD31, LD32) (Applied to A14B-0061-B001 only)

The printed circuit board contains two light emitting diodes of LD31 and LD32.

LD31 lights while OCL function of primary circuit is operating. LD32 lights when the alarm signal output is issued to the input unit.

LD31 may light temporally when turning on power owing to the actuation current.

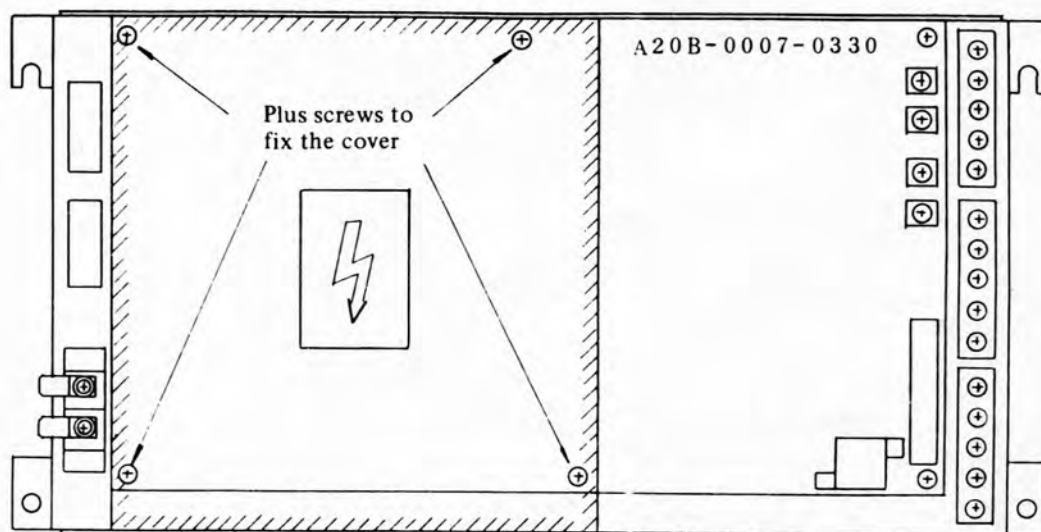
When LD32 lights on, AL Relay operate and ALM lights on.

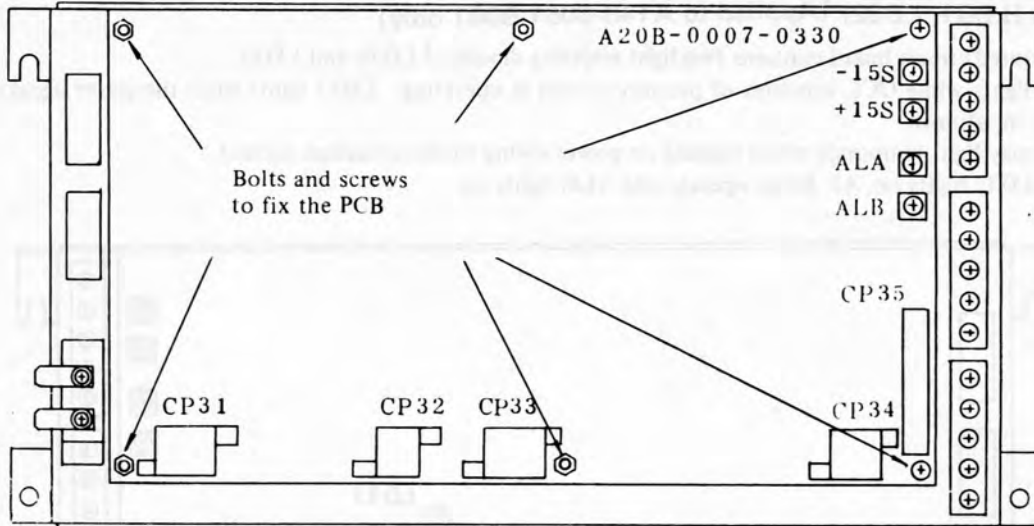


6. Replacing the Printed Circuit Board

(1) A14B-0061-B001

- (a) Turn off the power and remove the cover  which is fixed with four plus screws.
- (b) Remove the connections at the connector CP31 ~ 35.
Also, when there are the cables connected at the terminals +15S, -15S, ALA, ALB, etc, remove them.
- (c) Remove the printed circuit board (A20B-0007-0330) which is fixed with four bolts and two screws and mount the new one.

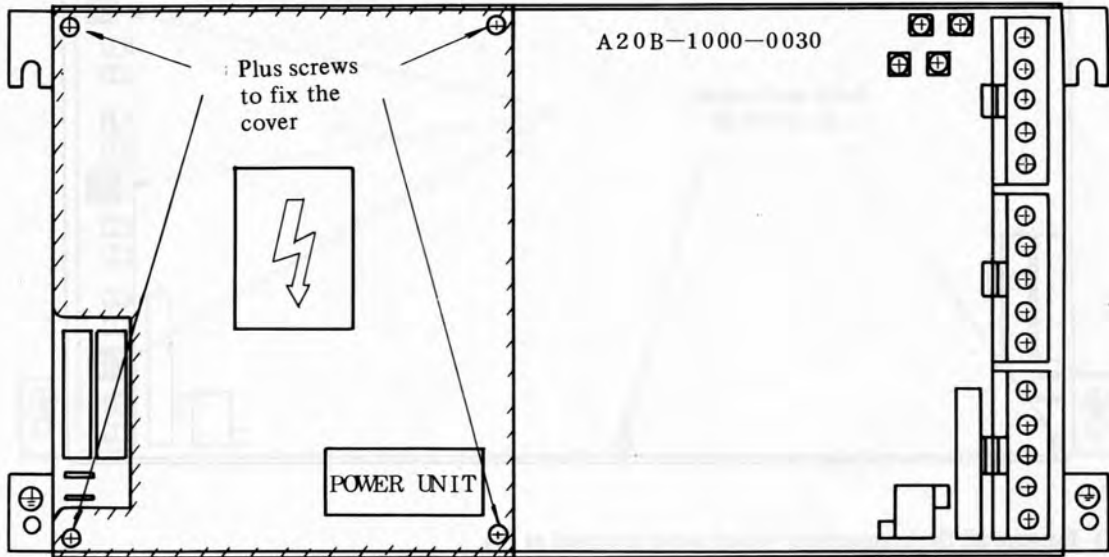




- (d) Connect the connectors CP31 ~ 35.
Connect the cables to the terminals +15S, -15S, ALT and ALB, if these cables exist.
- (e) Turn on the power and confirm the following items.
 - ① Measure the voltage between A10 and A0 at the checking terminal CP36 with a digital voltmeter. And confirm that it is 10.00V. If it is not 10.00V, adjust it with a variable resistor A10ADJ.
 - ② Measure the +5V output voltage. If it is not +5V, adjust it with a variable resistor +5ADJ. (When the measuring point and adjusting value for +5V are regurated, conform them.)
 - ③ Measure the followings:
 - +24V output voltage
 - +15V output voltage
 - 15V output voltage
 Confirm that they are within the allowable range:
- (f) Turn off the power and mount the cover.

(2) A14B-0061-B002

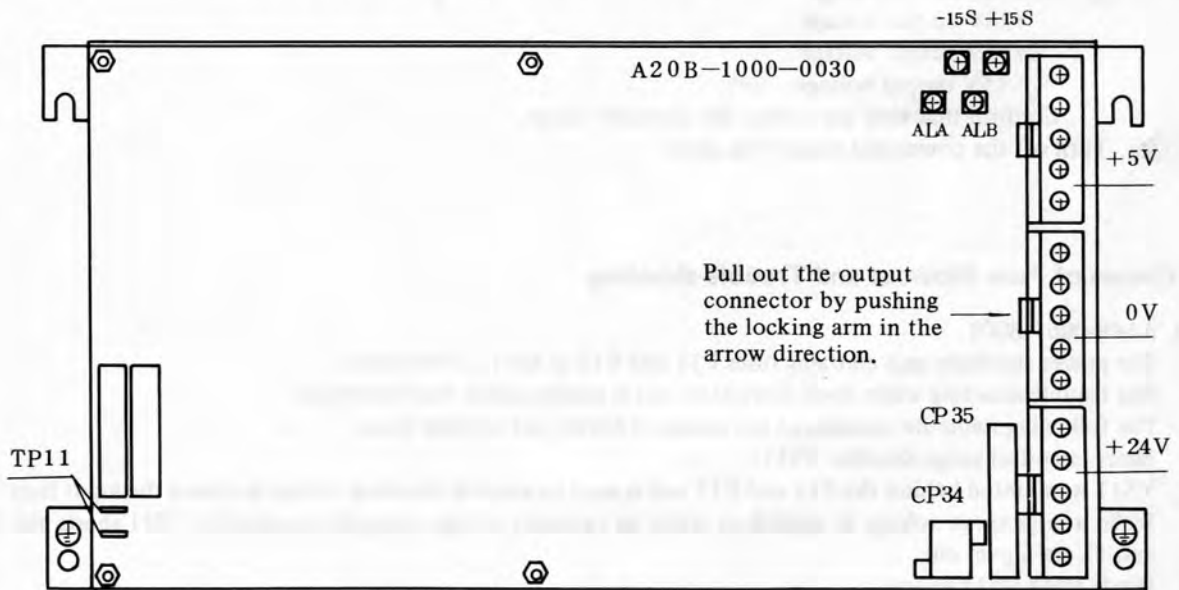
- (a) Turn off the power and remove the cover  which is fixed with four plus screws.



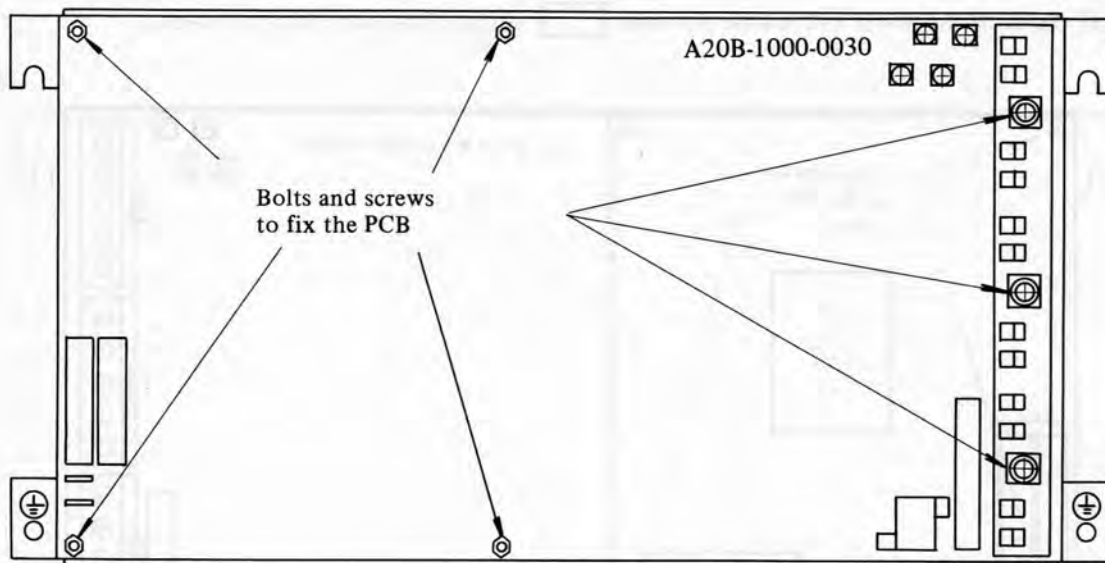
- (b) Remove the connections at faston terminal TP11.

Remove the connections at connectors CP34, CP35, +5V, 0V and +24V.

Also, when there are the cables connected at terminals +15S, -15S, ALA and ALB, etc., remove them.



- (c) Remove the printed circuit board (A20B-1000-0030) which is fixed with four bolts and three screws and mount the new one.



- (d) Restore all the connections which were removed at (b).
Secure the connectors tightly so that they are locked.
- (e) Turn on the power and confirm the following items.
 - ① Measure the voltage between A10 and A0 at the checking terminal CP36 with a digital voltmeter. And confirm that it is 10.00V. If it is not 10.00V, adjust it with a variable resistor A10ADJ.
 - ② Measure the +5V output voltage. If it is not +5V, adjust it with a variable resistor +5ADJ.
(When the measuring point and adjusting value for +5V are regulated, conform them.)
 - ③ Measure the followings:
 +24V output voltage
 +15V output voltage
 -15V output voltage
 Confirm that they are within the allowable range.
- (f) Turn off the power and mount the cover.

7. Causes of Fuse Blowout and Trouble-shooting

(1) A14B-0061-B001

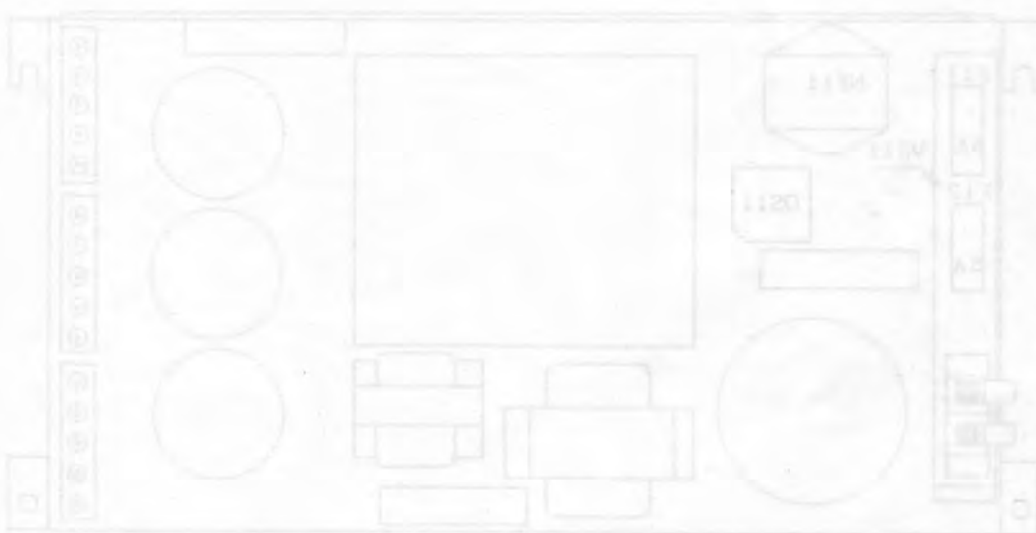
The power stabilizer unit contains fuses F11 and F12 at the input terminal.
The trouble-shooting when these fuses blow out is mentioned in the followings:
The following items are considered the causes of blown out of these fuses.

- (a) Short-circuit of surge absorber VS11
VS11 is mounted behind the F11 and F12 and is used to absorb the surge voltage between the input lines.
When a large surge voltage is applied or when an excessive voltage is applied constantly, VS11 shorts and F11 and 12 are blown out.
- (b) Diode stack DS11 shorts
- (c) Switching transistors Q49 and 50 short between C and E.
- (d) Diodes D71 and D72 short.
- (e) Contact of the wiring and/or parts of the primary circuit with the cabinet.

Trouble shooting

- (a) Remove the cover and PCB referring to the items 6 (1) (a) to (c).
- (b) Disconnect the DS11 faston terminal. Thus because VS11 and DS11 are separated from other circuit, check them for continuity with a tester whether they short or not.
- (c) If VS11 and DS11 are normal, check Q49 ~ 50 and D71 ~ 72 in the printed circuit board.

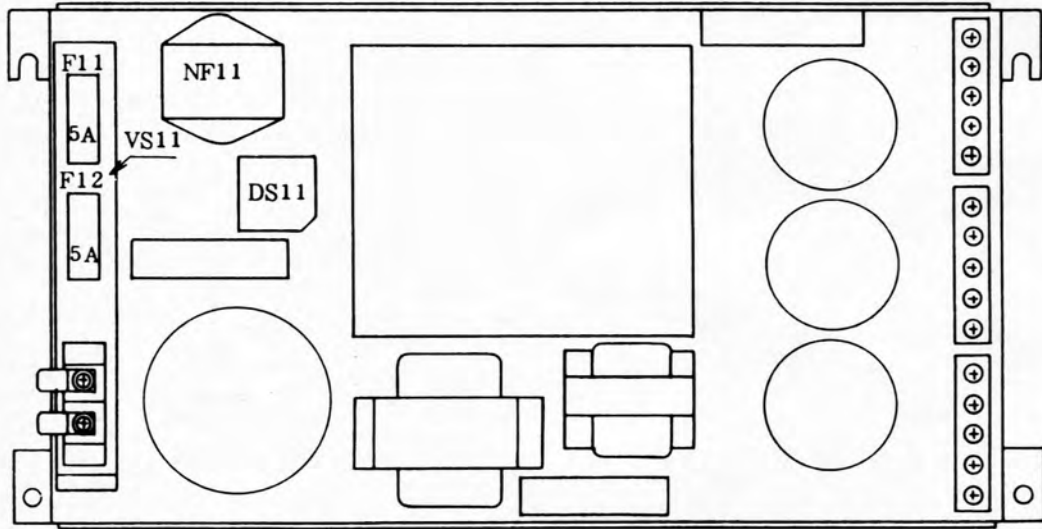
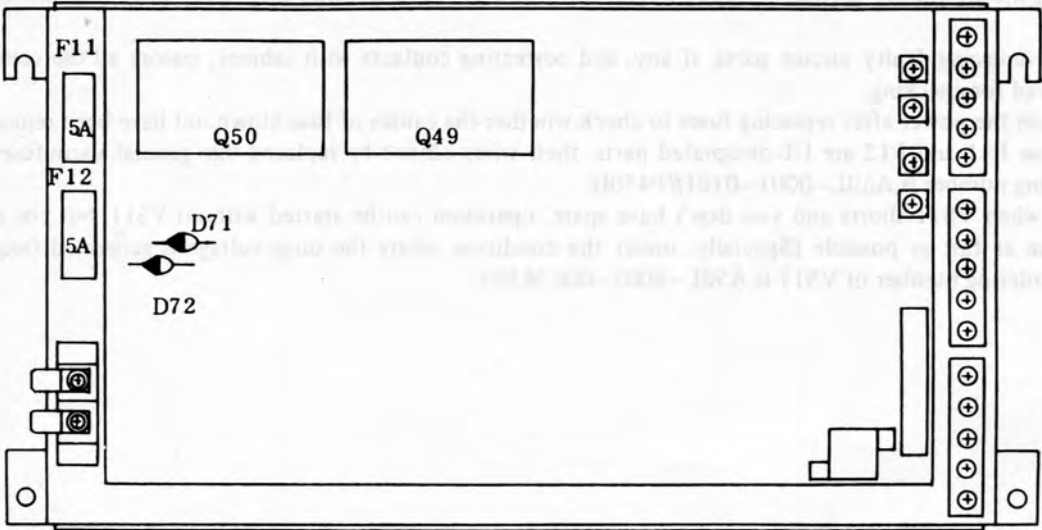
- (d) Check the continuity between primary circuit and frame to check whether they short when there are no faulty parts.
- (e) After replacing faulty circuit parts, if any, and correcting contacts with cabinet, restore all the connections removed for checking.
- (f) Turn on the power after replacing fuses to check whether the causes of fuse blown out have been removed. Because F11 and F12 are UL-designated parts, their wires cannot be replaced like general alarm fuses. Their ordering number is A60L-0001-0101#P450H.
- (g) Even when VS11 shorts and you don't have spare, operation can be started without VS11, but you must get a spare as fast as possible (Specially, under the condition where the surge voltage is generated frequently.) The ordering number of VS11 is A50L-8001-0067#391.



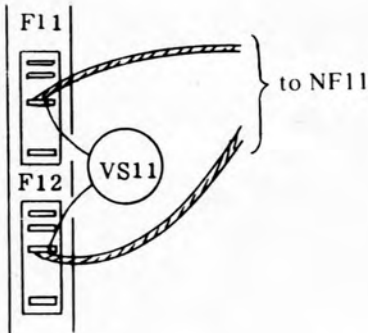
REVERSE SIDE OF THE BOARD



REVERSE SIDE OF THE BOARD



With PCB unit removed



VS11 is mounted behind F11 ~ 12 as shown above.

(2) A14B-0061-B002

The power stabilizer unit contains fuses F11 and F12 at the input terminal.

The trouble-shooting when these fuses flow out is mentioned in the followings:

The following items are considered the causes of blown out of these fuses.

(a) Short-circuit of surge absorber VS11

VS11 is mounted to absorb the surge voltage between the input lines. When a large surge voltage is applied or when an excessive voltage is applied constantly, VS11 shorts and F11 and F12 are blown out.

(b) Diode stack DS11 shorts.

(c) Capacitor C12 or C13 shorts.

(d) Power hybrid IC M11 for auxiliary power shorts.

(e) Switching transistor Q14 or Q15 shorts.

(f) Diode D24 or D25 shorts.

(g) Contact of the primary circuit wiring and parts with the cabinet.

(h) When surge absorber VS11 absorbs momentary high voltage, only F11 or F12 may blow out.

Momentary high voltage is caused by lighting surge or in the poor installation site of power.

Trouble shooting

(a) Remove the cover and PCB referring to items 6 (1) (a) to (c).

Confirm that the primary circuit wiring or parts does not contact with the cabinet.

(b) Parts are separated two groups by pulling up short plug SH11. One group is composed of VS11, DS11, C12, C13, M11 and the other group is composed of Q14, Q15, D24 and D25.

Check with a tester whether the trouble belongs to which group and which part.

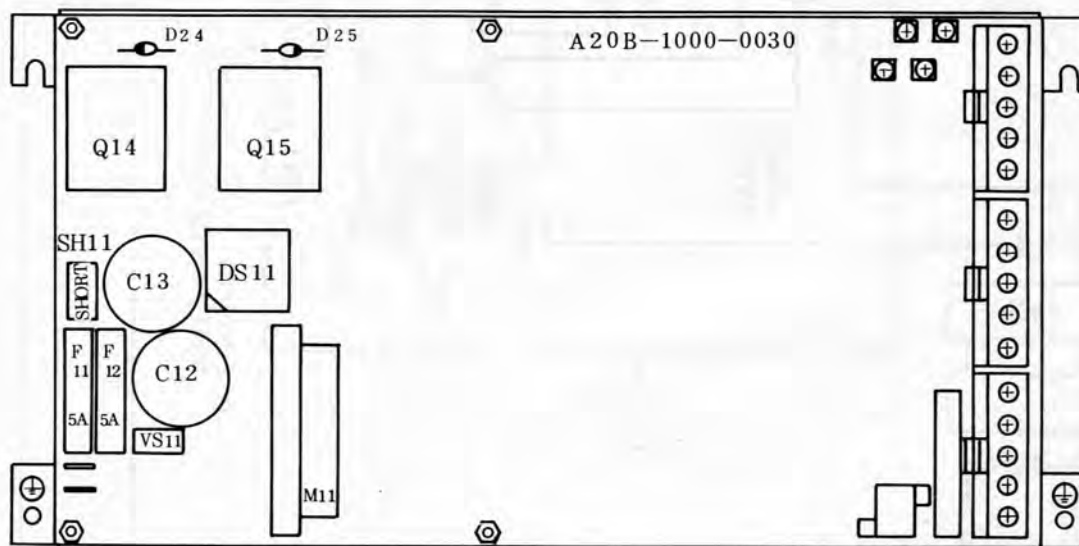
(c) After replacing faulty circuit parts, if any, and correcting contacts with cabinet, restore all the connections removed for checking.

(d) Turn on the power after replacing fuses to check whether the causes of fuse blown out have been removed. Because F11 and F12 are UL-designated parts, their wires cannot be replaced like general alarm fuses.

Their ordering number is A60L-0001-0101#P450H.

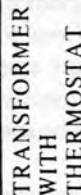
(e) Even when VS11 shorts and you don't have spare, operation can be started without VS11, but you must get a spare as fast as possible (Specially, under the condition where the surge voltage is generated frequently.)

The specification number of VS11 is A50L-8001-0067#391 and A50L-8001-0077.

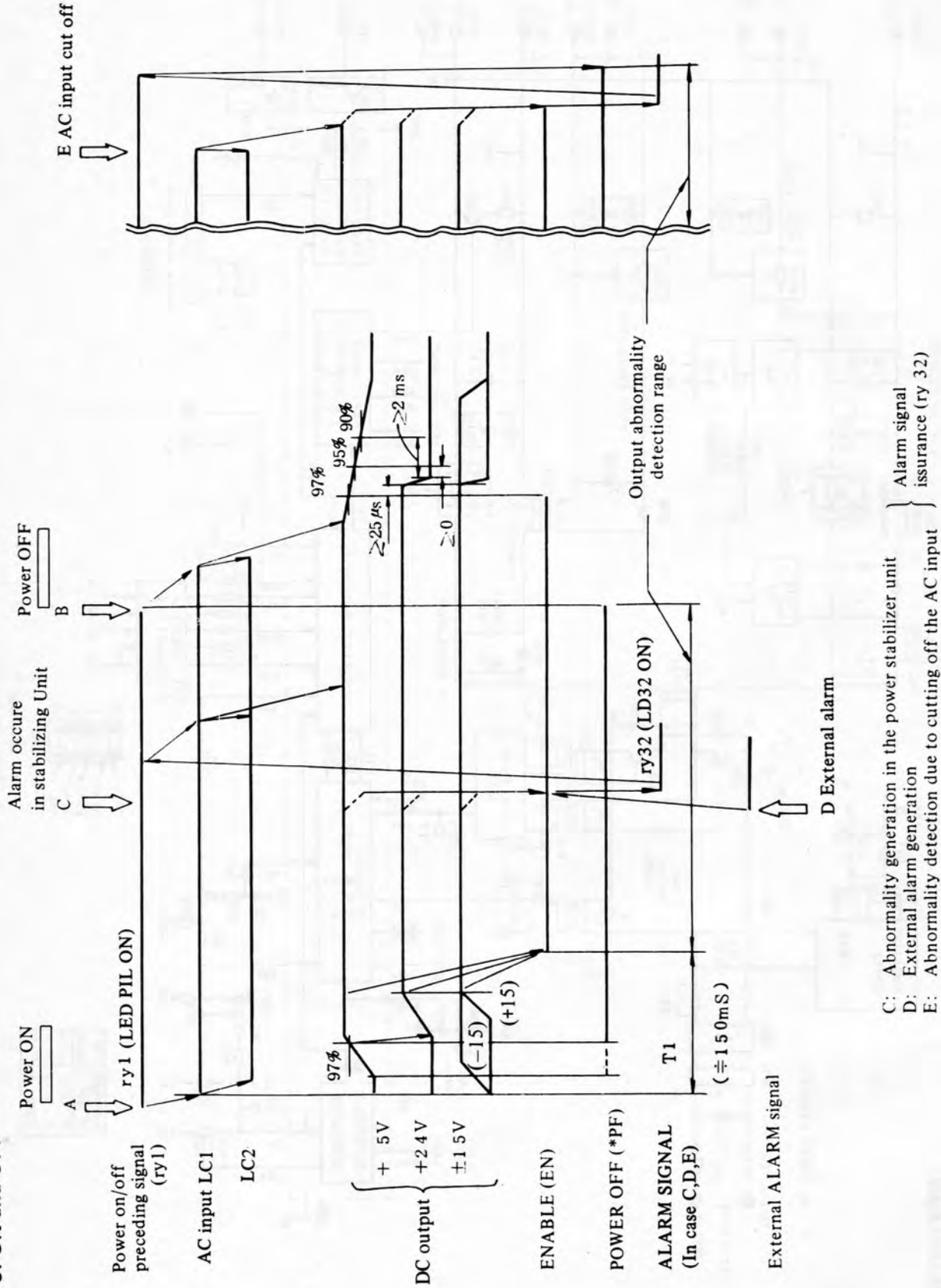


Primary circuit main parts layout (with cover removed)

(1) A14B-0061-B001



Timing of ON and OFF



9. Power input unit

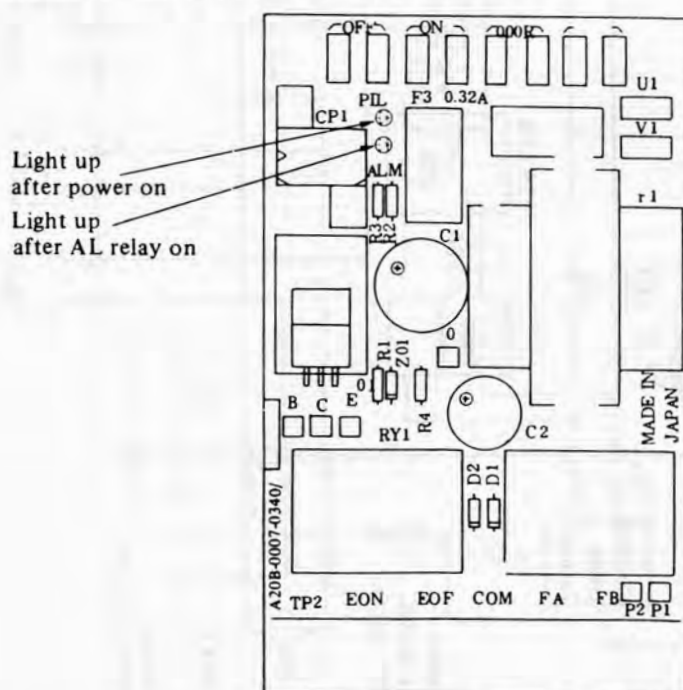
- (1) There are following four kinds of power input units.
They are classified into two types of for free standing type cabinet and for built-in and unbundled type cabinets.

- ① A14B-0061-B101 (Free standing type and built-in type 2, servo fuse: less than 30A, domestic use)
- ② A14B-0061-B102 (Free standing type and built-in type 2, servo fuse: less than 30A, export use)
- ③ A14B-0061-B104 (Free standing type and built-in type 2, servo fuse: less than 40A, for both domestic and export uses.)
- ④ A14B-0061-B103 (Built-in type 1 and unbundled type)

Fig. 9.1 shows the connection diagram on power supply for the free standing cabinet and built-in type 2 cabinet. Fig. 9.2 shows the connection diagram on power supply for the built-in type 1 and unbundled type cabinets. The export use input for free standing type cabinet is provided with a MULTI-TAP TRANSFORMER.

- (2) The PCB (A20B-0007-0340) in the power input unit is common for all input units.
The maintenance procedure on this PCB is mentioned below.

- ① Two LEDs of PIL and ALM are provided with this PCB. PIL (Green LED) lights while the power is supplied to the power input terminal board TP1.
ALM (Red LED) lights when this PCB receives an alarm signal from the power stabilizer unit. When ALM lights, NC line contactors LC1 and LC2 turn OFF. NC power cannot be turned on under this condition.
To reset this condition power supply must be once cut off or the POWER OFF button (Either NC POWER OFF button or external POWER OFF button) must be pushed.
- ② Even when NC power is off, the power has been supplied to the circuit before the line contactors LC1 (and LC2) while PL1 lights. When you touch some units inside the power input unit, confirm that PIL is not lighting.
- ③ Check the voltage for relays in the PCB unit between (0) and (E). 21 to 22V is normal.
- ④ When it is desired not to cut off the power with an alarm at trouble-shooting by ALM lighting, connect check pins between P1 and P2. However, the time taken for trouble-shooting must be as short as possible and you must disconnect the check pins immediately after the trouble shooting.
- ⑤ The fuse F3 (0.32A) will blow out by short-circuiting of parts within the PCB.
Replace the fuse after trouble-shooting.
The ordering number of F3 is A60L-0001-0046#0.32.



Power input unit PCB (A20B-0007-0340)

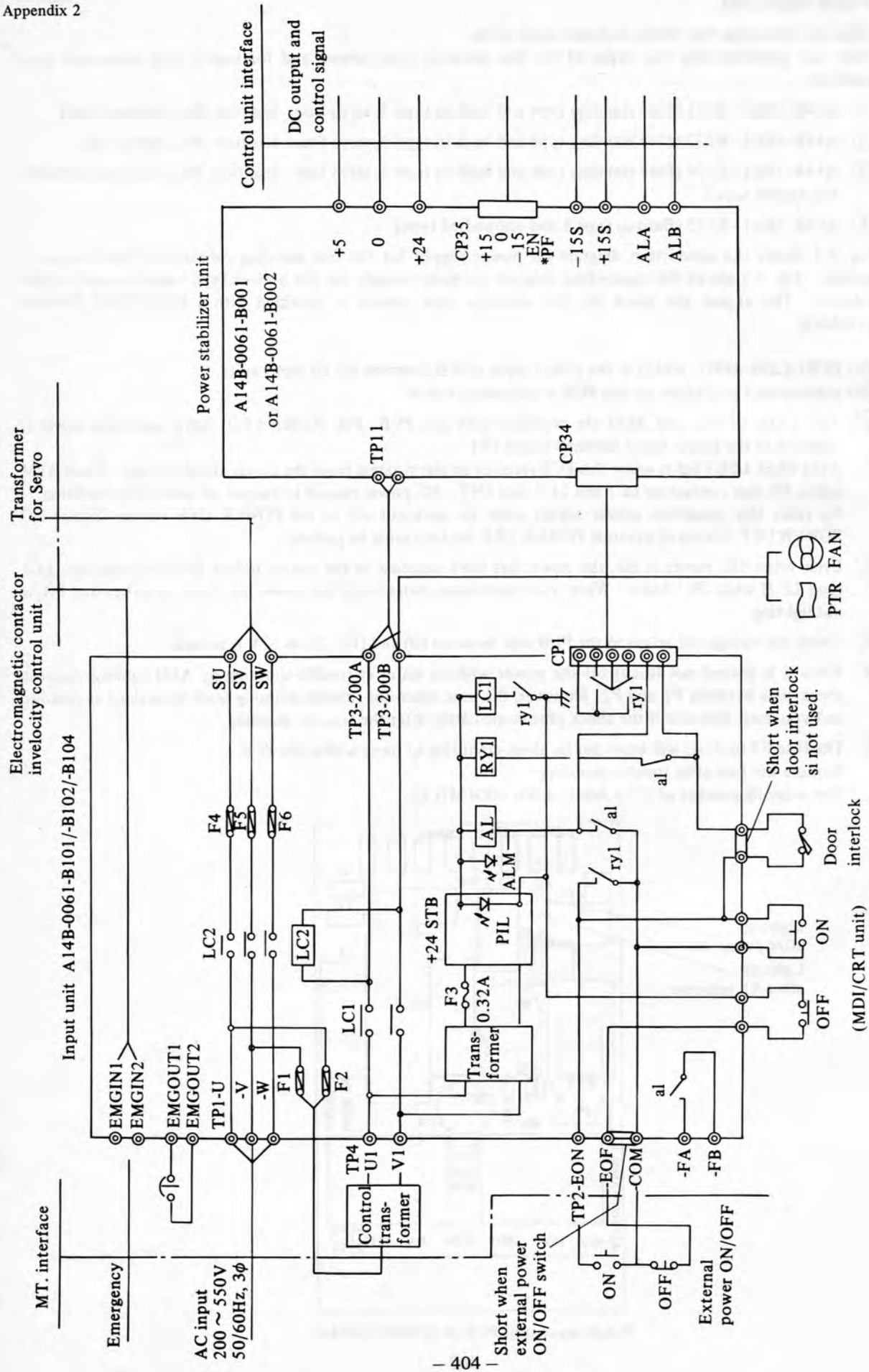


Fig. 9.1 Connection Diagram on Power Supply (For self-standing type cabinet and built-in type 2 cabinet)

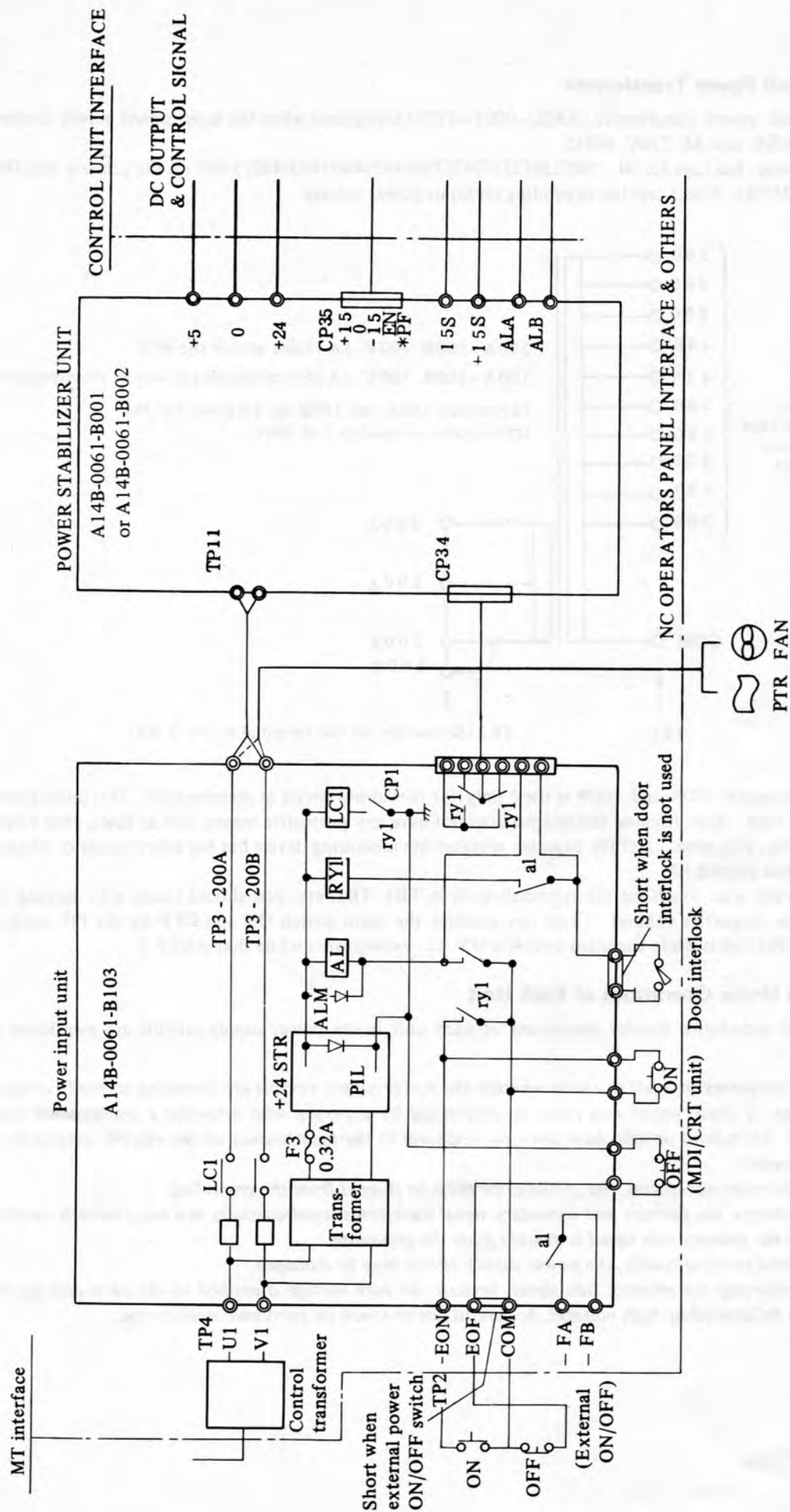
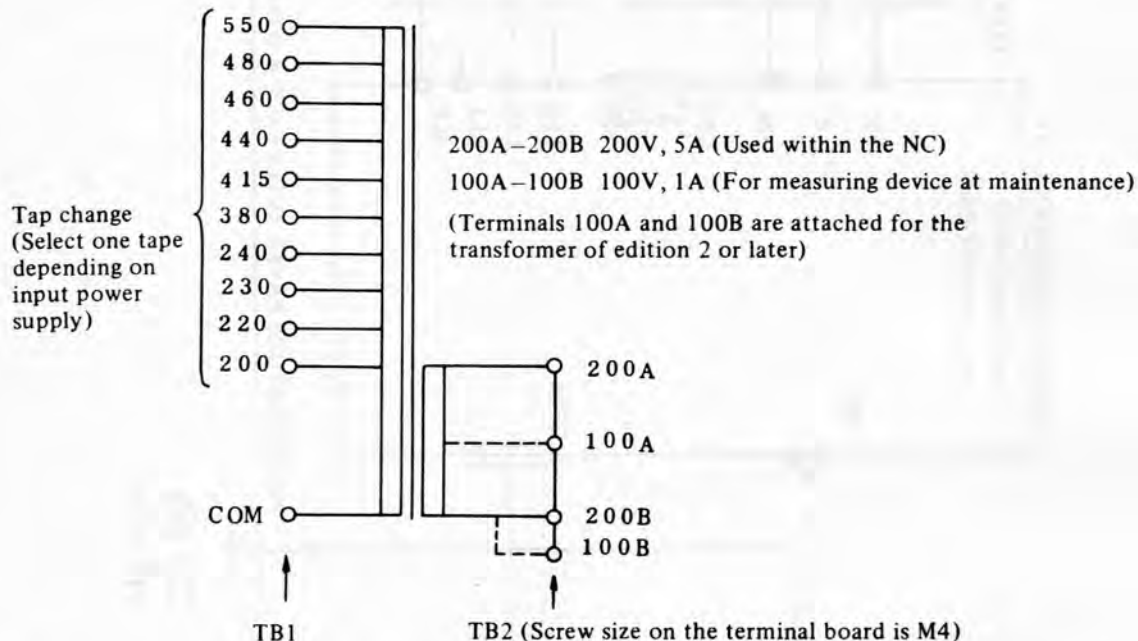


Fig. 9.2 Connection Diagram on Power Supply (Built-in type 1 cabinet and Unbundled type cabinet)

10. Control Unit Power Transformer

A control unit power transformer (A80L-0001-0176) is required when the input power supply is other than AC 200V, 50Hz, 60Hz and AC 220V, 60Hz.

This transformer has taps for AC 200/220/230/240/380/415/440/460/480/550V on the primary side (MULTI-TAP TRANSFORMER). Select one tap depending on input power voltage.



An output between 100A and 100B is used only for measuring device at maintenance. This output must not be used for a long time. Also, because this output does not have any protective means such as fuses, even when used for measuring device, you must carefully examine whether the measuring device has the short-circuit or whether the load current does not exceed 1A.

Moreover, when you touch on the terminals such as TB1, TB2, etc, you should touch after turning off the main switch of the magnetics cabinet. (You can confirm the main switch ON and OFF by the PIL lamp in the power input unit. PIL lights while the main switch is ON, but extinguishes while that is OFF.)

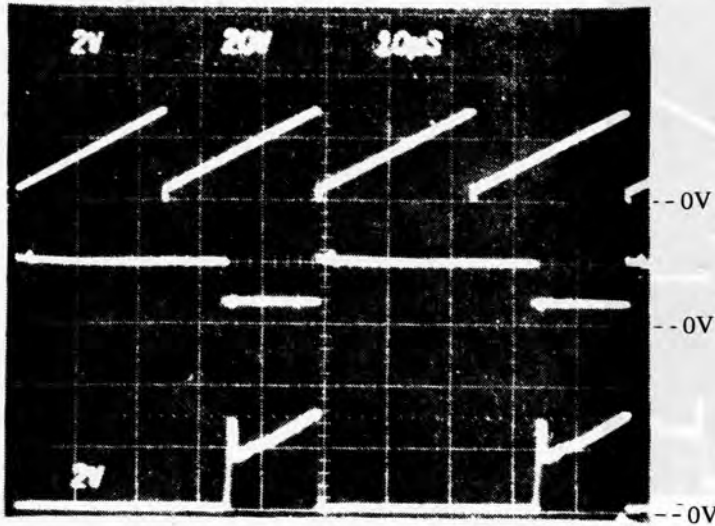
11. Waveforms Under Operations of Each Unit

The standard waveforms under operations of each unit in the power supply circuits are mentioned in the followings.

- Notes:
1. These waveforms are used to check whether the power supply circuits are operating normally or not.
 2. Checking of these waveforms must be performed by a person who attended a maintenance cause of FANUC NC school or who have been participating in the maintenance of the electric devices for more than 2 years.
 3. When checking waveforms, the oscilloscope must be floated from the grounding.
 4. Never observe the primary and secondary signal waveforms simultaneously in a two channels oscilloscope because the primary side signal is floated from the grounding.
If observed simultaneously, the power supply circuit may be damaged.
 5. When observing the primary side signal, because the high voltage is applied to the parts and the oscilloscope is influenced by high voltages, be careful not to touch on parts and oscilloscope.

(1) For A14B-0061-B001

Input: 200V 50Hz
 Load: Rated load +5, 23A
 +24, 4A
 +15, 0.7A
 -15, 0.7A

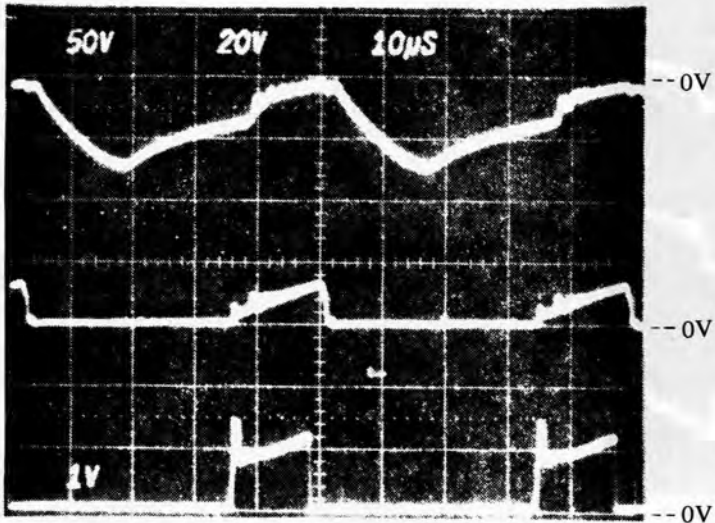


f (2V/div)

CTP1 (2V/div)

Time scale: 10μs/div

CTP2 (20V/div)

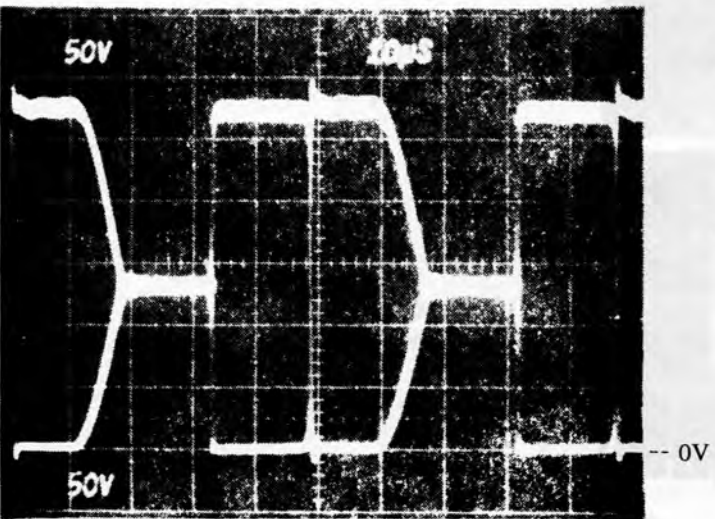


MAC (50V/div)

IC (1V/div)

Primary circuit current
 limit operates for the
 voltage more than
 approx. 1.8V.

CTP (20V/div)



OT1 - (-V)
 (50V/div)

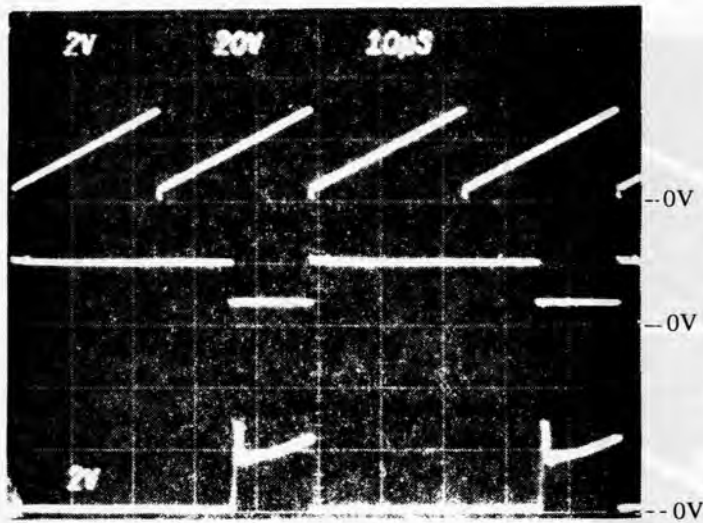
OT2 - (-V)
 (50V/div)

T

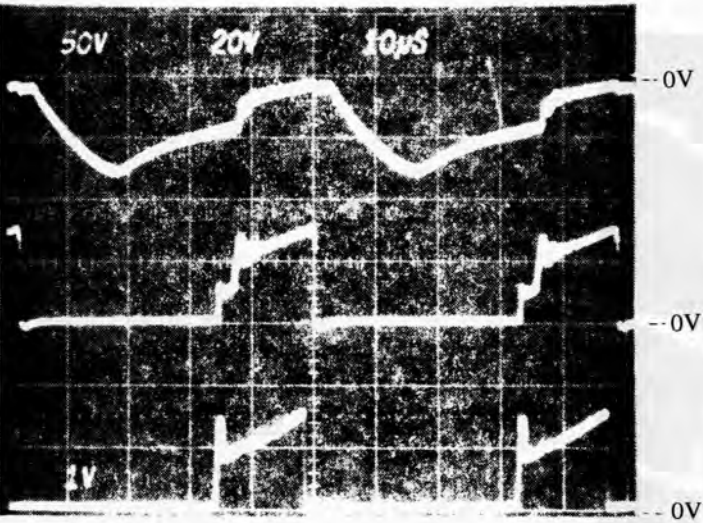
T = 45 ~ 50μs

- 407 -

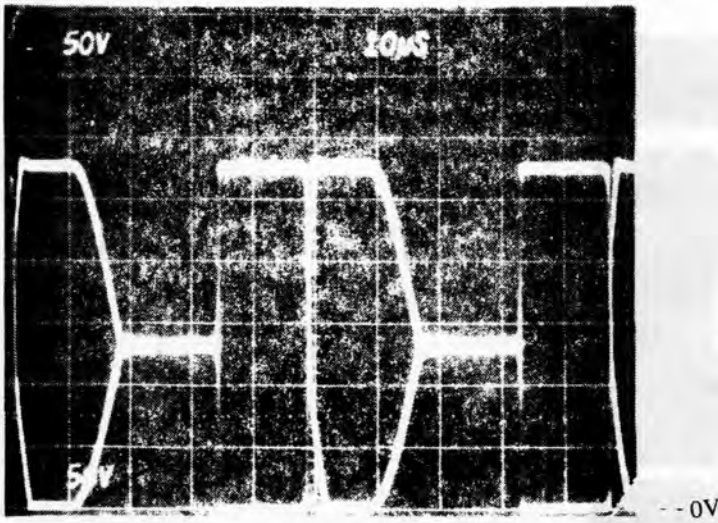
Input: 200V, 50 Hz
Load: Light board +5, 10A
 +24, 1A
 +15, 0.1A
 -15, 0.1A



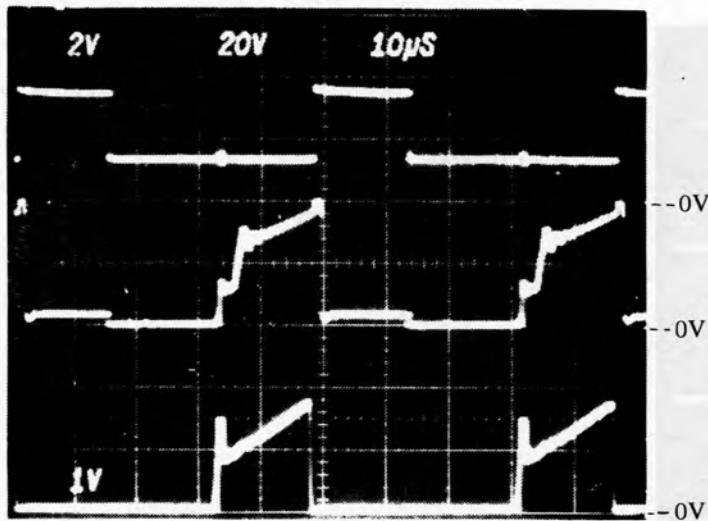
f (2V/div)
CTP1 (2V/div) Time scale: 10µs/div
CTP2 (20V/div)



MAC (50V/div)
IC (1V/div)
CTP2 (20V/div)



OT1 - (-V) (50V/div)
OT2 - (-V) (50V/div)
Same as that for rated load



Input: 200V 50Hz
 Load: Overload +5, 28.5A
 +24, 5.3A
 +15, 0.7A
 -15, 0.7A

SP (2V/div)

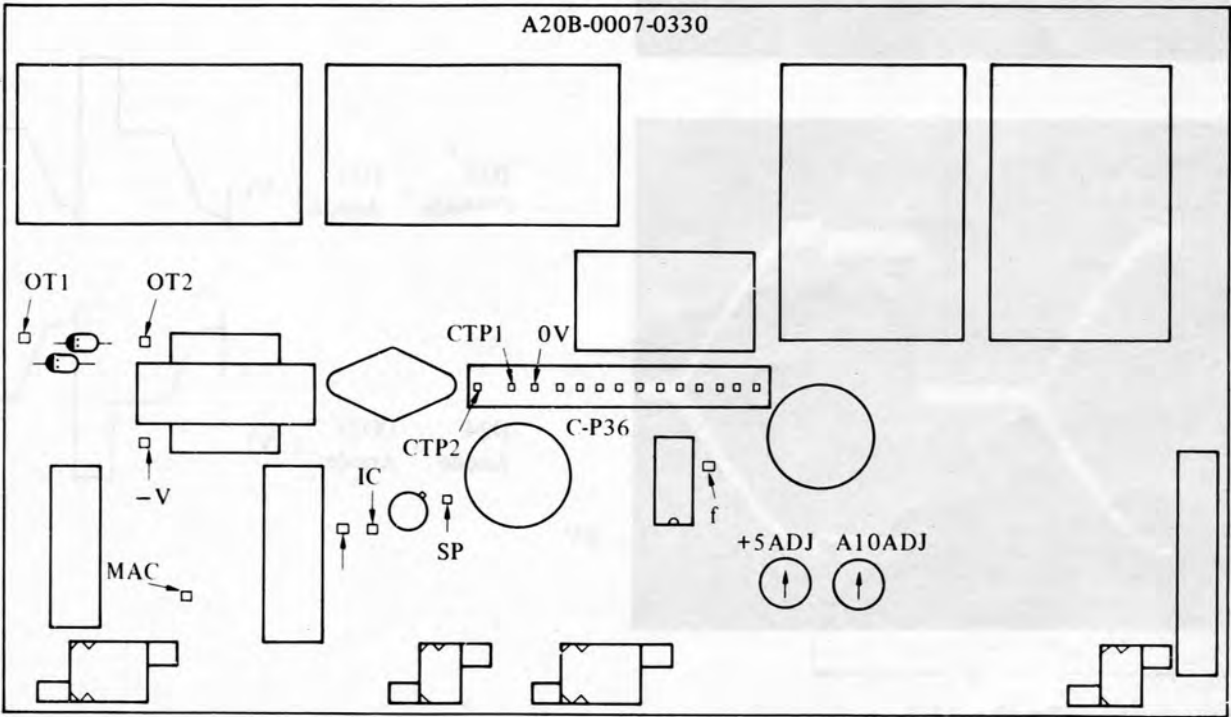
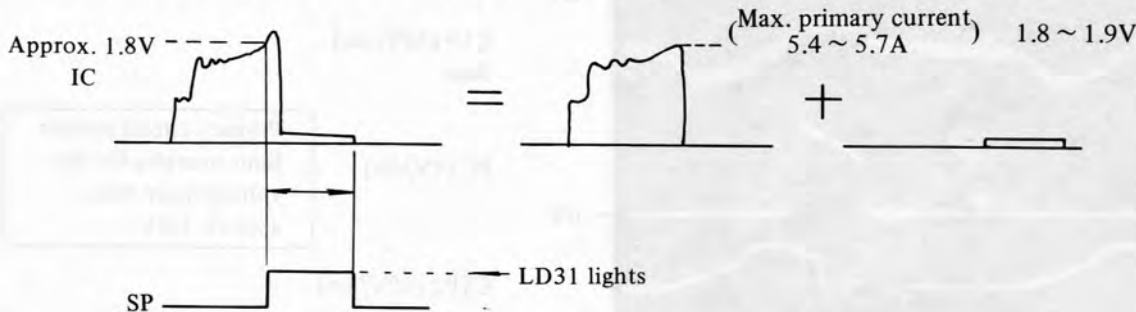
IC (1V/div)

Time scale: 10μs/div

CTP2 (20V/div)

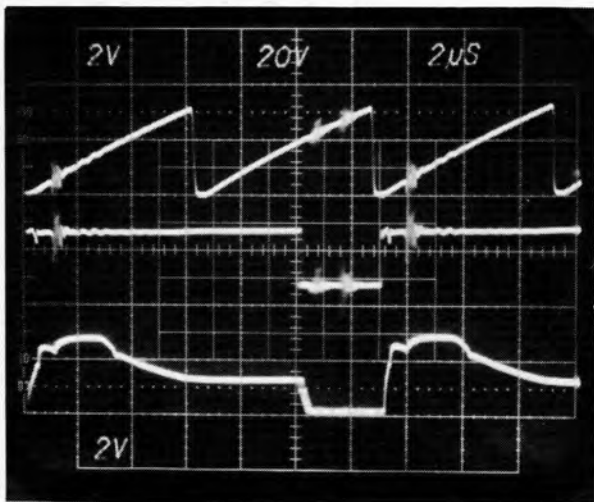
The waveform above shows that when the primary circuit current limitation is operating because of the overload of +5 and +24.

The part of the IC waveform indicated by the sign (↔) in the figure below is generated due to the current which flows from R99 to D56 to R98 and to 97 because of output of M32 becoming High level.



Appendix 2

(2) For A14B-0061-B002



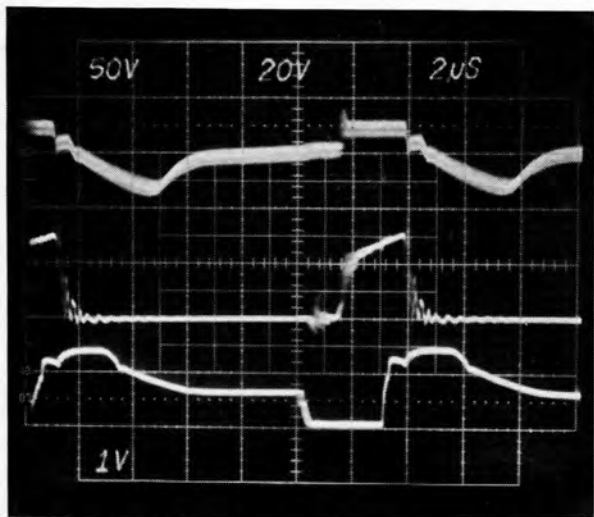
Input: 200V 50Hz
Load: Rated load +5, 23A
 +24, 4A
 +15, 0.7A
 -15, 0.7A

f (2V/div)

Time scale: 2μs/div

CTP1 (2V/div)

CTP2 (20V/div)

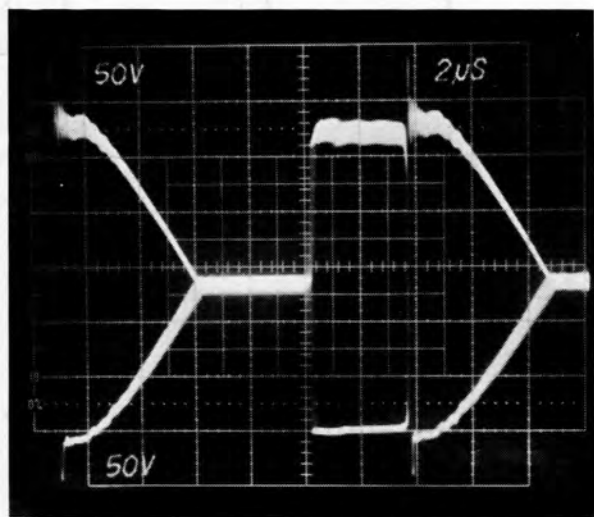


Q19 (50V/div)
Base

PC (1V/div)

CTP2 (20V/div)

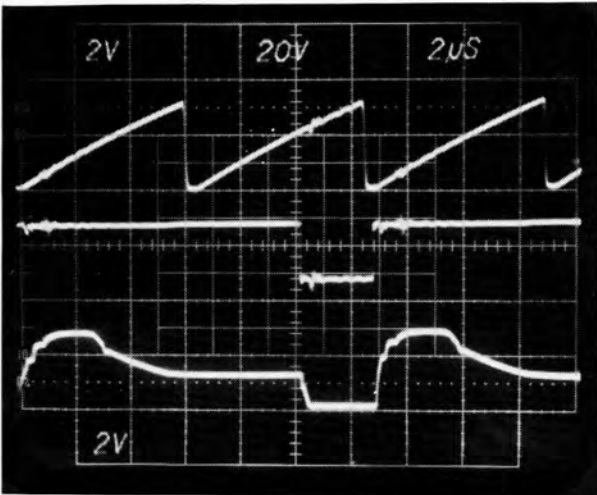
Primary circuit current
limit operates for the
voltage more than
approx. 1.8V.



D25 Cathode - D25 Anode (-V)

D24 Anode - DD25 Anode (-V)

T = 12 ~ 13μs

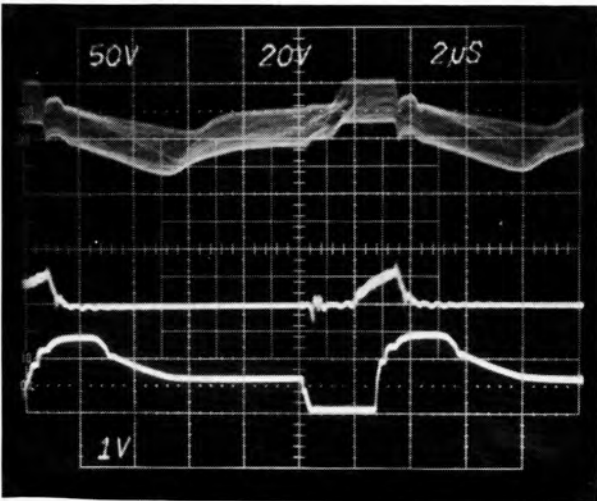


Input: 200V 50Hz
Load: Light load +5, 10A
+24, 1A
+15, 0.1A
-15, 0.1A

f (2V/div)
Time scale: 2μs/div

CTP1 (2V/div)

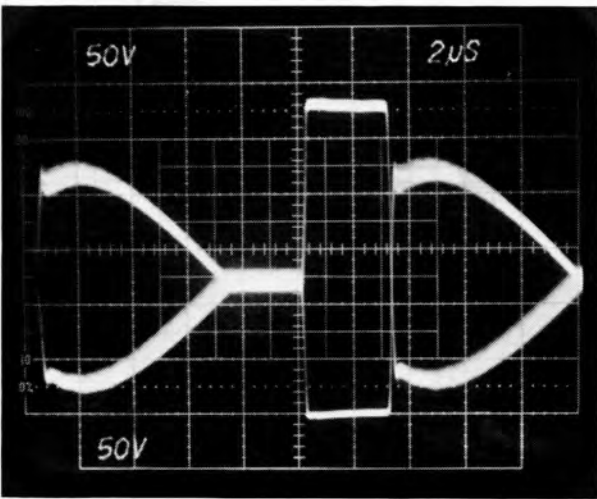
CTP2 (20V/div)



Q19 (50V/div)
Base

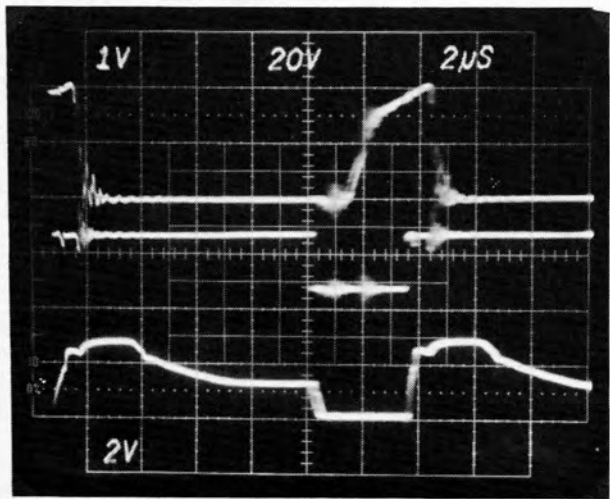
PC (1V/div)

CTP2 (20V/div)



D25 Cathode - D25 Anode (-V)
(50V/div)

D24 Anode - D25 Anode (-V)
(50V/div)



Input: 200V 50Hz
Load: Overload +5, 36A
+24, 4.5A
+15, 0.8A
-15, 0.8A

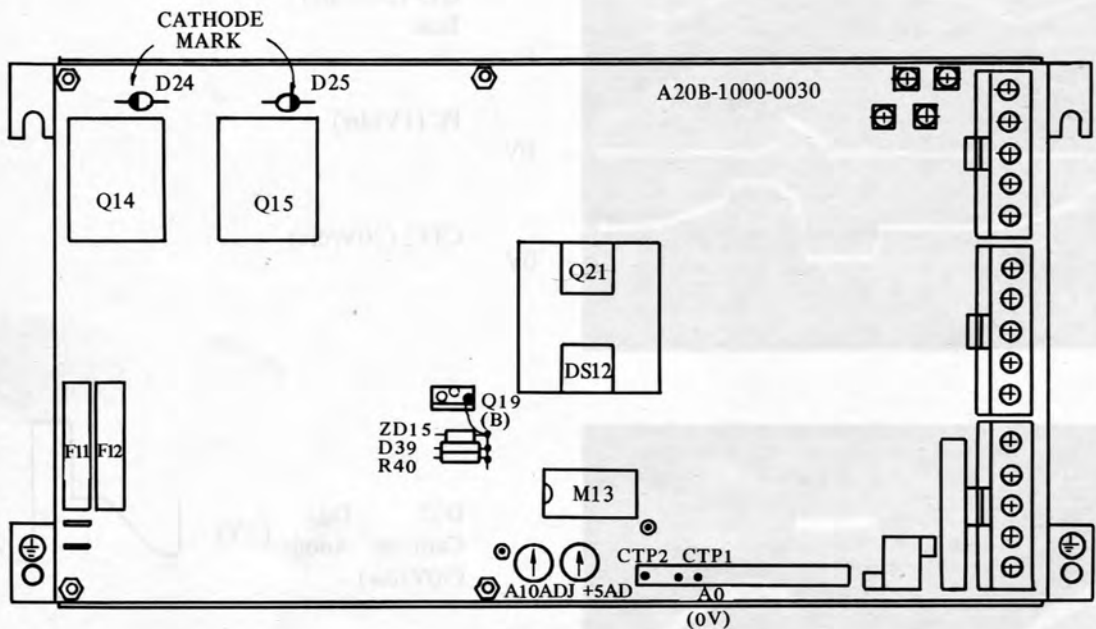
PC (1V/div)

Time scale: 2μs/div

CTP1 (2V/div)

CTP2 (20V/div)

The waveform above shows that when the primary circuit current limitation is operating because of the overload of the output. (+5V OVC is inhibited.)



Appendix 3 Parts Specification of Velocity Control Unit**(1) MODEL 00M velocity control unit A06B-6047-H001**

Symbol	Name	Specification
PWB	Printed Circuit Board	A20B-0009-0320
MCC	Magnetic Contactor	A58L-0001-0158
MOL	Thermal Relay	A58L-0001-0148/5
NFB1, 2	Circuit breaker	A60L-0001-0143/15A
RM	Resistor Module	A40L-0001-0103/B
Q1 ~ Q4	Transistor	A50L-0001-0092
DS	Diode Module	A50L-2001-0134
C1	Capacitor	A42L-0001-0095/102
ZNR	Surge absorber	A50L-2001-0139

(2) MODEL 0M, 5M velocity control unit

A06B-6047-H002

Symbol	Name	Specification
PWB	Printed Circuit board	A20B-0009-0320
MCC	Magnetic Contactor	A58L-0001-0151/15N
MOL	Thermal Relay	A58L-0001-0148/6
NFB1, 2	Circuit Breaker	A60L-0001-0143/15A
RM	Resistor Module	A40L-0001-0103/A
DCR	Discharging Resistor	A40L-0001-0114/A
TM1, 2	Transistor Module	A50L-0001-0091
Q1	Discharging Transistor	A50L-0001-0092
DS	Diode Module	A50L-2001-0134
D	Diode	A50L-2001-0135
C1	Capacitor	A42L-0001-0095/121
C2	Capacitor	A42L-0001-0095/102
ZNR	Surge Absorber	A50L-2001-0139

(3) MODEL 10M, 20M velocity control unit

A06B-6047-H003
A06B-6047-H040

Symbol	Name	Specification
PWB	Printed Circuit Board	A20B-0009-0320
MCC	Magnetic Contactor	A58L-0001-0151/15N
MOL	Thermal Relay	A58L-0001-0148/12
NFB1, 2	Circuit Braker	A60L-0001-0143/15A
RM	Resistor Module	A40L-0001-0115/A
DCR	Discharging Resistor	A40L-0001-0114/A
TM1, 2	Transistor Module	A50L-0001-0091
Q1	Discharging Transistor	A50L-0001-0092
DS	Diode Module	A50L-2001-0134
D	Diode	A50L-2001-0135
C1	Capacitor	A42L-0001-0095/121
C2, C3	Capacitor	A42L-0001-0095/102
ZNR	Surge Absorber	A50L-2001-0139

(4) MODEL 30M velocity control unit

A06B-6047-H004
A06B-6047-H041

Symbol	Name	Specification
PWB	Printed Circuit Board	A20B-0009-0320
MCC	Magnetic Contactor	A58L-0001-0151/15N
MOL	Thermal Relay	A58L-0001-0148/18
NFB1, 2	Circuit Braker	A60L-0001-0143/15A
RM	Resistor Module	A40L-0001-0115/B
DCR	Discharging Registor	A40L-0001-0114/A
TM1 ~4	Transistor Module	A50L-0001-0091
Q1	Discharging Transistor	A50L-0001-0092
DS	Diode Module	A50L-2001-0134
D	Diode	A50L-2001-0135
C1	Capacitor	A42L-0001-0095/121
C2, 3	Capacitor	A42L-0001-0095/102
ZNR	Surge Absorber	A50L-2001-0139

Appendix 4 DC Servo Motor Maintenance

1. Outline

Proper maintenance inspection, such as check of the brush, is necessary to insure continued satisfactory operation of the DC servo motor used for driving the NC machine tool.

It is recommended that the concrete maintenance plan be made, referring to this manual, on the basis of the operating environment and operating condition in order to perform the proper maintenance inspection.

2. Reception and storage

Immediately upon receipt of the DC servo motor, check the following items.

- o Whether the DC servo motor is exactly the specified one (check the type, detector type).
- o Whether there is any mechanical damage sustained in transit or not.
- o Whether the rotating part can be normally turned by hand.
- o In the case of the DC servo motor with brake, whether the brake is normal.
- o Whether there is any loosened screw or play.

Every DC servo motor undergoes strict inspection before shipment, therefore any special receipt inspection may not be required as a rule. If the receipt inspection is particularly needed, however, it is advisable to refer to the specifications regarding the wiring of DC servo motor and detector, current, and voltage so as to make the inspection without any mistake. Don't leave the received DC servo motor outdoors, but preserve it indoors as soon as possible. Avoid storing it in the place with an extremely high or low humidity, a radical change of temperature, and dust.

If the DC servo motor is to be stored for more than one year, the brush should be removed from the DC motor. Because if the brush is left contacting the same place of the commutator for a long time, rusting and corrosion can take place from that place, which may cause poor commutation and noise.

3. Mounting

Note the following points when mounting the DC servo motor.

- (1) The place where the DC servo motor is mounted should be so structured that check and replacement of the brush can easily be made. As the brush must be checked periodically, the structure which facilitates the check work is inevitably required.
- (2) In the case of the DC servo motor with a heat pipe (with a fan motor), design the structure of the mounting place so as to easily check and clean the cooler.
- (3) The water-proof structure of the DC servo motor is not so strict. If cutting oil, lubricating oil, etc. penetrate into the inside of the DC servo motor, these may cause poor insulation, short-circuit of the coil, defective commutator surface due to poor commutation, or abnormal wear of the brush. Therefore, due care should be taken so that the motor body will be kept away from such liquids as cutting oil and so on.
- (4) When mounting the DC servo motor on the gear box where liquid lubrication is performed, use the DC servo motor with oil seal on the output shaft. If the lip of the oil seal is always exposed to oil, there is a possibility that the oil may penetrate little by little into the inside of the motor in the course of a long time. Therefore the height of the oil level must be lower than the oil seal lip. When the DC servo motor is mounted with the output shaft upward, mount another oil seal than the one on the motor shaft so as to make the structure where the oil which passed through the first oil seal can directly flow outside. The oil seals used for the respective DC servo motors are listed in the following.

- o The DC servo motors equipped with the oil seal as the standard parts.

DC motor model	Oil seal specification
00M	AC0382A0 (SC type)
0M, 5M	AB1017F0 (SB type)

- o The DC servo motors having no oil seal as the standard parts. If the oil seal is necessary, the oil seal flange should be specially specified, or the oil seal should be furnished at the machine side.

DC motor model	Oil seal specification
10M, 20M, 30M, 30MH	AC2057A0 (SC type)

The oil seals used for the DC servo motors are the products of JAPAN OIL SEAL INDUSTRY Co., Ltd.

- (5) The DC servo motor is coupled with the load through the direct coupling, gears, timing belt or such. In any case the force exerted on the motor shaft must not exceed the values shown in the following table, therefore due care should be taken for the operating condition, mounting method, and mounting accuracy.

DC motor model	Permissible radial load	Permissible axial load
00M	25 kg	8 kg
0M, 5M	75 kg	20 kg
10M, 20M, 30M, 30MH	450 kg	135 kg

- o The values of permissible radial loads are the ones when the load is imposed on the end of the shaft. The values in this table indicate the maximum permissible loads which are the sum of the constant force always exerted on the shaft owing to the mounting method (e.g., the force given by the tension of the belt when the belt coupling is used) and the force generated by the load torque (e.g., the force transmitted from the gear face).

- (6) Make the wiring between the DC servo motor and the control circuit without any mistake, just as specified in the specifications. (See the connection diagram of the machine.) A mistake made in the wiring may cause runaway or abnormal oscillation and may give damage to the motor or the machine. When the DC servo motor is run by the open loop, the relations between the signals at the respective terminals and the rotating direction are as follows.

- i) Motor power line terminals (A1 and A2).
When the positive voltage is applied to terminal A1, the DC servo motor turns clockwise when viewed from the output shaft.
- ii) Tachogenerator terminals (G1 and G2)
When the motor rotates clockwise when viewed from the shaft, the positive voltage generates on the G1 side.
- iii) Resolver terminals (S1, S3 ; S2, S4 ; R1, R3)
When the excitation is made by applying Cosin across terminals S1 and S3 and by applying Sin across terminals S2 and S4, thus the motor is turned clockwise, the phase of output of R1 and R3 changes to negative.

iv) Pulse coder terminals (A, $\bar{A}$; B, $\bar{B}$; Z, Z)

When the DC motor turns clockwise when viewed from the shaft, the rectangle wave whose phase leads 90° from that of the rectangle wave on terminal B is outputted from A. The signals at terminals A and B have phases respectively inverse to those of A and B.

When the wiring is completed, measure the insulation between the power line and the motor frame before turning on the power. The measurement should be made with a 500V megger on a multi-tester. Further, check the insulation between the signal lines and the motor frame with a multi-tester. Be sure not to use a megger especially for measuring the insulation of the signal lines for the pulse coder.

4. Maintenance and cleaning

4.1 Check and cleaning of motor brush

Check and clean the motor brush in the way explained in the following. If the motor brush is abnormally worn because of forgetting the check, the motor can be damaged as the result, therefore, be sure to check the motor brush.

- (1) Periodic check should be made at the intervals listed in the following as the standard.
 - o In the case of a general machine tool (lathe, milling machine, machining center, or such) Every one year.
 - o In the case of a machine tool with a high frequency of acceleration/deceleration (turret punch press or such) Every two months.

However, it is recommended that the check interval be determined judging the actual wear situation of the motor brush.

- (2) Confirm that the power supply to the DC servo motor (machine) is OFF. Immediately after the DC servo motor has been operated, the brush may be hot. In such a case, make the check after the brush is completely cooled.
- (3) Remove the brush cap, as shown in Fig. 5 (a), using a screwdriver which fits to the slot.
- (4) After taking out the brush completely, measure (visually) the length of the brush (see Fig. 5 (b)). If the length of the remaining brush is shorter than 10mm (5mm in the case of Model OOM), the brush cannot be used any more. Taking this fact into consideration, make a judgement as to whether the brush can be used until the next check time, and if necessary, replace the brush with a new one.
- (5) Check the brush very carefully. If any deep groove or scar is found on the contact surface of the brush or if any mark of arcing is perceived on the brush spring, replace the brush with a new one. In this case, check the brush occasionally for about a month after the replacement, and if the same situation happens during this period, contact our nearest service station.
- (6) Blow off the brush dust in every brush holder with compressed air (factory air), and the brush dust will come out through another brush holder. Before using the compressed air, confirm that the air does not contain iron dust or a large amount of moisture.
- (7) After the check, put back the brush and tighten the brush cap fully. In this case, be careful that sometimes the brush spring is caught in between the conducting metal and brush holder and the brush cap cannot go as far as the depth.

Confirm that all the brush caps are tighten into the respective brush holders to almost the same level. When putting the brush into the brush holder, sometimes the brush cannot smoothly slide due to the brush dust which adhered to the inside surface of the brush holder. In such a case, clean the inside surface of the brush holder with the tip of a screwdriver. (Take care not to scratch the commutator surface.)

- (8) When replacing the brush, use just the same brush (in the quality, shape, etc.) as the existing one. After replacement of the brush, run the DC servo motor without load for a while to fit the brush surface to the commutator surface.

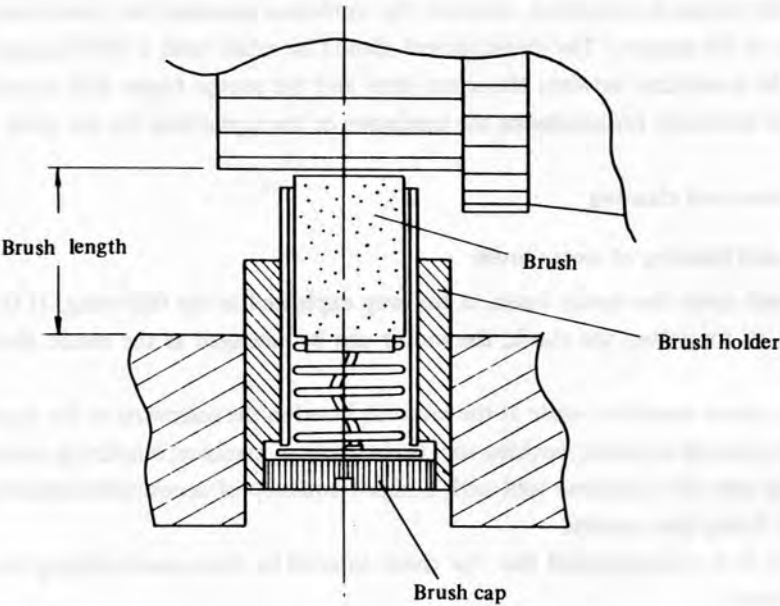


Fig. 5(a) Structure of Brush Holder

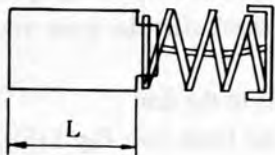


Fig. 5 (b)

DC motor model	Length of	Length of usable brush
00M	10 mm	5 mm
0M, 5M	19 mm	10 mm
10M, 20M, 30M, 30MH	19 mm	10 mm

4.2 Cleaning of heat-pipe cooling section (In the Case of MODEL 30MH)

A large amount of dust accumulated on the net and fin of the heat-pipe cooling section lowers the capability of the heat pipe, and causes troubles due to the generated heat.

- (1) When dust is accumulated on the net, which disturbs the ventilation, remove the net and clean it.
- (2) When a large amount of dust is accumulated on the fin (made up of many aluminum discs), clean the fin by blowing compressed air (factory air) to it. If the dust cannot be removed in this way, remove it with a thin rod or something like that.
- (3) Since the dirtiness at the cooling section is largely dependent on the environment conditions, the frequency of periodic cleaning should be properly determined according to the operating environment.
(Periodic check at every six months is the standard.)

4.3 Check of tachogenerator

The tachogenerator currently used for the DC servo motors is pancake type. It can be cleaned without disassembling it by blowing compressed air from outside. Check the tachogenerator if any such troubles as described in the following is found.

(i) Troubles caused by tachogenerator

If a failure occurs in the tachogenerator the trouble described below occurs.

Movement of machine wobbles at rapid traverse.

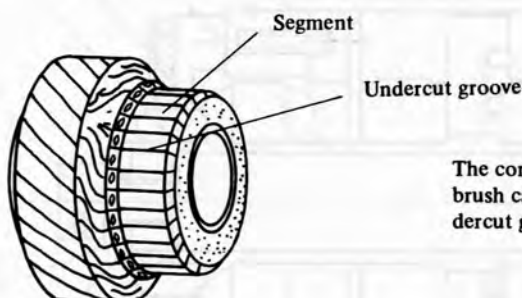
In most cases the vibration period is one or four times per one turn of the motor.

Generally these troubles appear when the motor is running at high speed.

In most cases these troubles are caused by the defective at the brush contact of the tachogenerator.

The characteristic of the tachogenerator which has been used for a long time will sometimes be degraded by the influence of the brush dust. The actual aspects of this kind of troubles are as follows.

- 1) Adjacent commutator segments are short-circuited one another by the brush dust.



The commutator's segments are shorted when brush carbon dust has accumulated in the undercut groove.

- 2) The brush cannot slide smoothly in the brush holder due to the brush dust, thereby the contact between the brush and commutator is unstable.
- 3) The contact resistance is increased due to a carbon film which thickly adheres to the commutator surface, as a result the ripple in the output increases.
- 4) The contact resistance is increased due to oil, such as cutting oil, which adheres on the commutator surface, as a result the ripple in the output increases.

The above-mentioned four examples are the typical defectives, and the troubles caused by these defectives can be removed by cleaning the tachogenerator. However, in the case of the defective described in 4) if a large amount of oil penetrates into the tachogenerator, the oil cannot be perfectly removed without disassembling and cleaning the tachogenerator. In such a case, therefore, clean the tachogenerator temporarily and replace it with a new one without leaving a long period.

(ii) **Cleaning of the tachogenerator**

The tachogenerator is mounted on the DC servo motor with multipole resolver as illustrated in Figure 5.C.

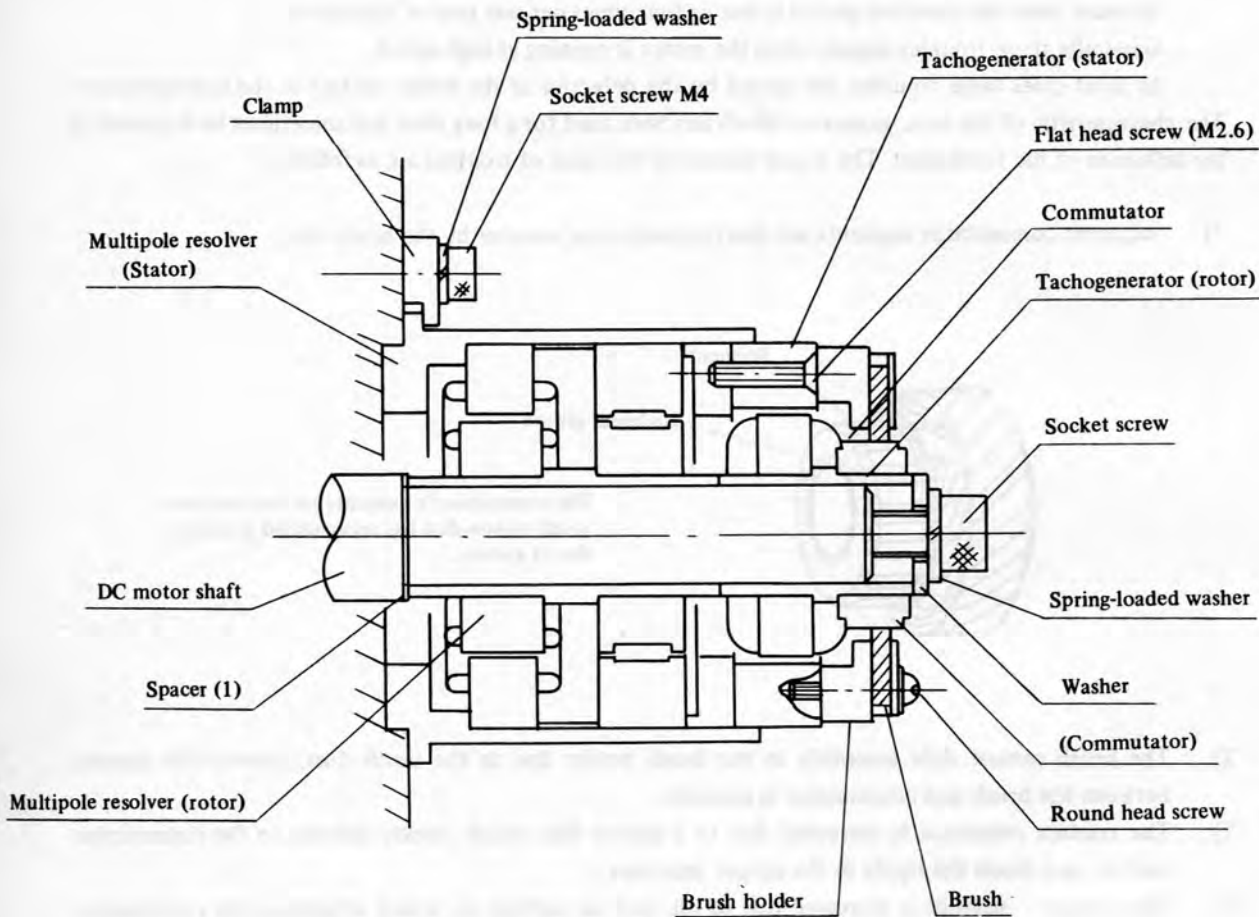


Fig. 5.C. Pancake-type tachogenerator

The figure without multipolar resolver is basically equal to that using a multipolar resolver except that a spacer mechanism (instead of the multipolar resolver) is included in the tachogenerator.

Remove the back cover from the DC servo motor when the tachogenerator is cleaned. Be careful not to load the lead wires with the back cover when the back cover is removed from the DC servo motor.

- (1) Blow dry air to the commutator surface. Most of the defectives caused by the brush dust can be remedied by this.
If the trouble cannot be remedied by this work, perform further the following cleaning.
- (2) Remove the brush holder after removing two small pan-head screws, check whether the movement of the brush is smooth. If the brush can not slide smoothly, remove the brush dust adhering to the brush guide section, and burr, etc. with a thin screwdriver or something like that.

- (3) Take out the rotor, and carefully remove the dust in the segment grooves. Then check the resistance between every one of the adjacent segments.

When the measured resistance is 20 to 30 ohm over the whole circumference, it is normal. If any measured resistance is extremely high (e.g., several hundred ohms), the winding is open somewhere between the segments.

In such a case, replace the tachogenerator with a new one. If any measured resistance is lower than 20 ohm, there is a short circuit between the segments, therefore clean further the segment grooves. The cleaning should be made with a piece of rather thick paper (Don't use any metal piece).

- (4) When the commutator surface is covered with a thick carbon film, wipe it off using a piece of cloth wet with alcohol.
- (5) If the commutator surface is rough, the tachogenerator cannot be used any more, therefore replace it with a new one.
- (6) Reassemble in reverse order of disassembly.

At assembling the brush holder if it is mounted as it is, the brush will be hit by the side of the commutator and will be broken. Push in the brush to the depth with the point of an automatic pencil or something like that, thus the spring pushes the side of the brush, and the brush stays at the depth. Then mount the brush holder in this state. By pushing the brush at its back, the brush comes out again to contact the commutator. Precisely align the matchmark between the brush holder and the magnet before tightening the mounting screws of the brush holder. Set the brush holder at the position where the length of the protrusions of the four brushes from the brush holder look almost even (concentrically).

If the alignment is not precise, the ripple may increase.

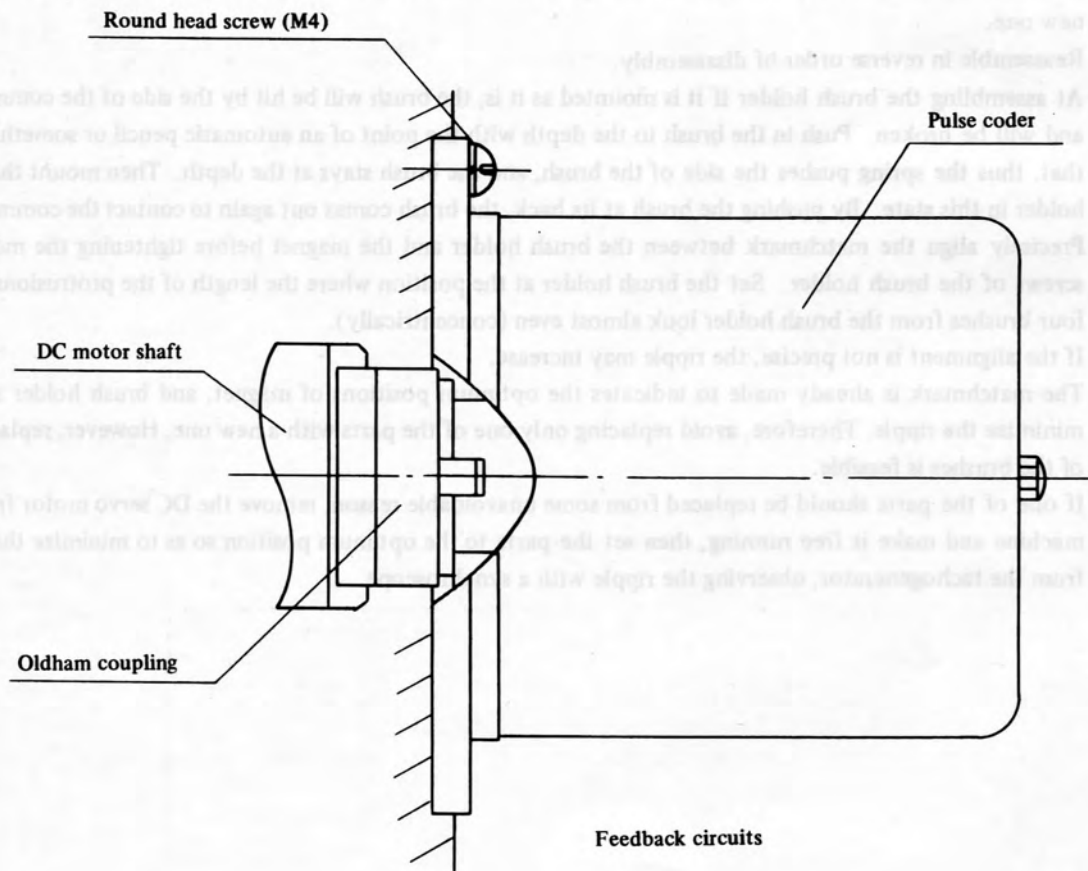
The matchmark is already made to indicate the optimum positions of magnet, and brush holder so as to minimize the ripple. Therefore, avoid replacing only one of the parts with a new one. However, replacement of the brushes is feasible.

If one of the parts should be replaced from some unavoidable reason, remove the DC servo motor from the machine and make it free running, then set the parts to the optimum position so as to minimize the ripple from the tachogenerator, observing the ripple with a synchroscope.

4.4 Replacing method for pulse coder

(1) Replacing process

- (a) Remove M4 + screw.
- (b) Remove the lead wires from the cannon connector by soldering.
- (c) Remove the pulse coder.
- (d) Mount the new pulse coder and tighten M4 screw.



Wiring

Signal	Color	Cannon connector
A	Black	A
$\bar{A}$	Black / White	D
B	Blue	B
$\bar{B}$	Blue / White	E
Z	Green	F
$\bar{Z}$	Green White	G
0V	Gray and Gray / White	N, P, T
5V	Red and Red / White	C, J, K

4.5 Cautions

(1) Motor with pulse coder

Since a glass disc is employed in the pulse coder, don't give an extreme impact to the motor by hammering.

4.6 Spare parts

The user should have at least one set of DC motor brushes on hand.

DC motor model	Number of spare brushes per set	Brush specification
00M	2	A290-0632-V001
0M, 5M	4	A290-0641-V001
10M, 20M, 30M, 30MH	4	A290-0651-V001

Appendix 5 Bubble memory initialize

1 Introduction

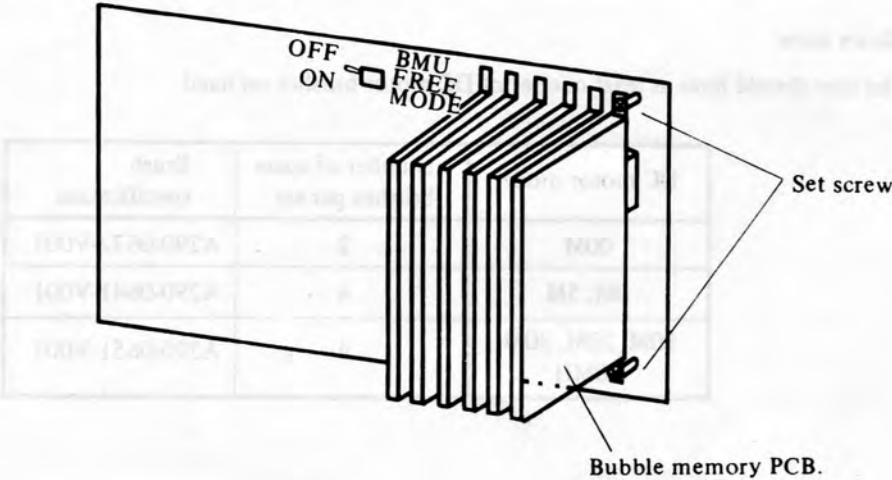
When one of the following alarms occurs in FANUC SYSTEM 6, it suggests that a great error has occurred. The bubble memory must be initialized according to the following operational procedure.

Number	Contents
901	No Marker error occurs when power is turned on.
905	No Marker error occurs.
906	Many Defect Loop error occurs.

Note: Bubble memory initialize is to clear all contents of a bubble memory and rewrite data of the marker bit, defect loop, etc. in the bubble memory.

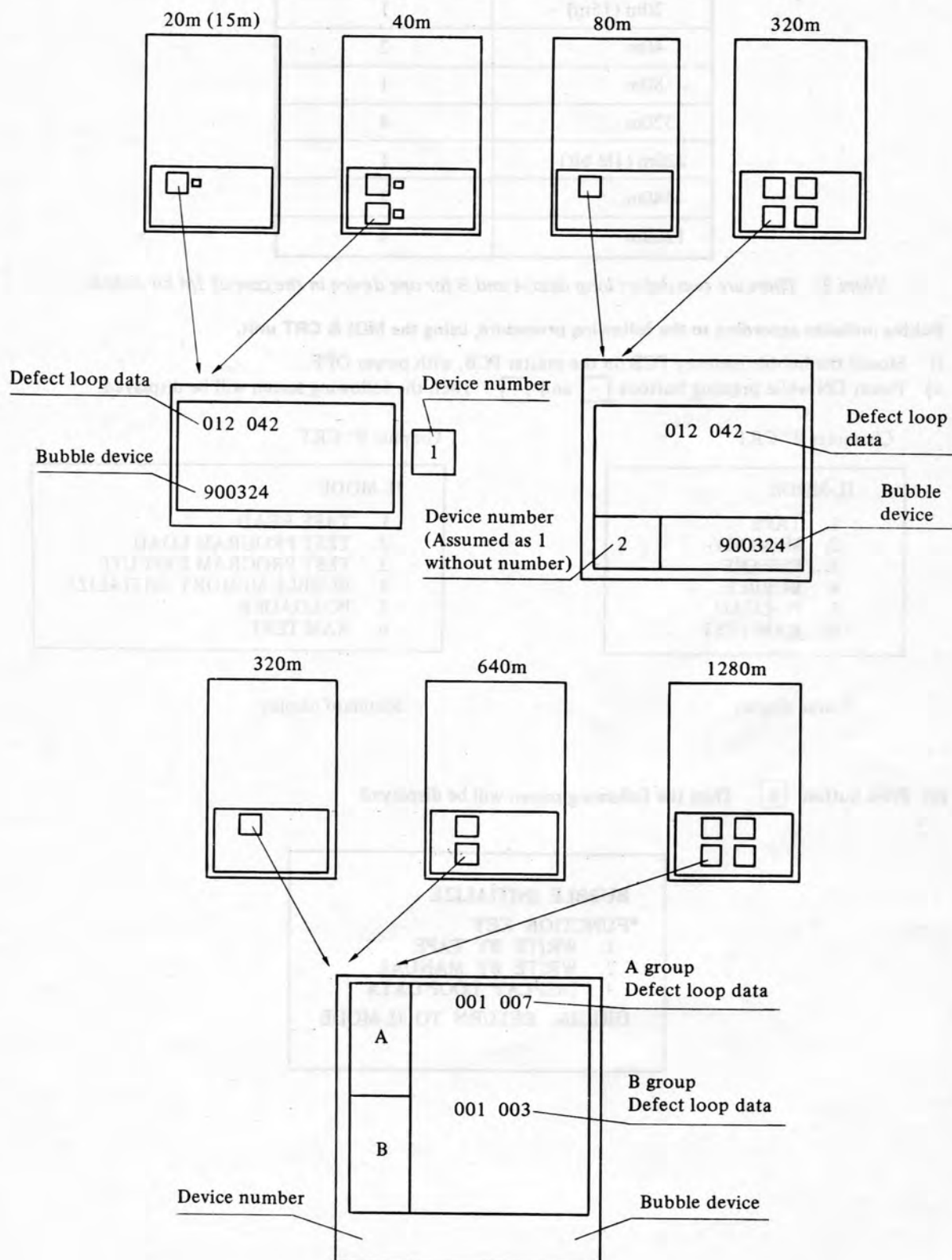
2 Operational Procedure

- (1) **Record defect loop data.**
Defect loop data of the bubble memory is indicated on its PCB. Read this according to the following procedure.
- i) Power off the NC.
 - ii) Remove the bubble memory PCB from the NC master PCB.



iii) Read defect loop data indicated on the bubble memory PCB.

a) Defect loop data is indicated in the following location.



(Note 1) The number of defect loops is indefinite and differs from device to device.

(Note 2) The number of devices differs as below, according to the memory capacity.

Memory capacity	Number of devices
20m (15m)	1
40m	2
80m	1
320m	4
320m (1M bit)	1
640m	2
1280m	4

(Note 3) There are two defect loop data A and B for one device in the case of 1M bit bubble.

(2) Bubble initialize according to the following procedure, using the MDI & CRT unit.

- i) Mount the bubble memory PCB on the master PCB, with power OFF.
- ii) Power ON while pressing buttons  and  . Then the following screen will be displayed.

Character 9" CRT

IL-MODE
1. TAPE
2. MEMORY
3. ENPANE
4. BUBBLE
5. PC-LOAD
6. RAM TEST

3-time display

Graphic 9" CRT

IL-MODE
1. TAPE READ
2. TEST PROGRAM LOAD
3. TEST PROGRAM EXECUTE
4. BUBBLE MEMORY INITIALIZE
5. PC-LOADER
6. RAM TEST

Standard display

- iii) Press button  . Then the following screen will be displayed.

BUBBLE INITIALIZE
*FUNCTION KEY
1: WRITE BY TAPE
2: WRITE BY MANUAL
3: DISPLAY LOOP-DATA
ORIGIN: RETURN TO IL-MODE

- iv) Press button **2** . Then the following screen will be displayed. (Proceed to v) when switch BMU is ON.)

BUBBLE INITIALIZE
MAKE BMU-SWITCH ON

(Note 1) When button **1** is pressed in screen iii), bubble initialize can be performed by tape. But usually, perform it on the MDI & CRT unit.

(Note 2) When button **3** is pressed in screen iii) in a state no bubble-associated alarm has occurred, the screen proceeds to iv). Set switch BMU ON. Then the bubble defect loop will be displayed on the screen ((screen vi) is displayed.)

- v) Set the master PCB switch BMU ON. Then the following screen will be displayed.

BUBBLE INITIALIZE
STEP-1

INPUT =

INPUT: INPUT LOOP DATA
DELET: CLEAR ALL DATA
START: WRITE BUBBLE

- vi) Key in defect loop data of DEVICE1 by DATA keys and press button **INPUT** . Repeat the above operation for two or more of defect loop data.

(When keyed-in defect loop data has an error, press button **DELET** . Then all keyed-in defect loop data will be cleared. After that, enter it again. If you input **CAN INPUT** , last input data is deleted.)

After defect loop data of DEVICE1 has been entered, press button **START** . Then defect loop data will be written in DEVICE1 (taking tens of seconds).

When the data is not written correctly, the following screen is displayed.

BUBBLE INITIALIZE
DEVICE 1
ALARM 01

Alarm number

When it is written correctly, if DEVICE2, 3, and/or 4 is present, the screen proceeds to v). Enter defect loop data as in vi). When all DEVICES have been entered with, the screen will be displayed as below. Collate the entered data with the screen to make sure that the data has been written correctly. If it is erroneous, press button RESET. Then the screen will go back to iii). Repeat the operation from iv).

BUBBLE INITIALIZE				
DEVICE 1	013	067		
DEVICE 2	039	052	068	

Defect loop data of DEVICE 1
Defect loop data of DEVICE 2

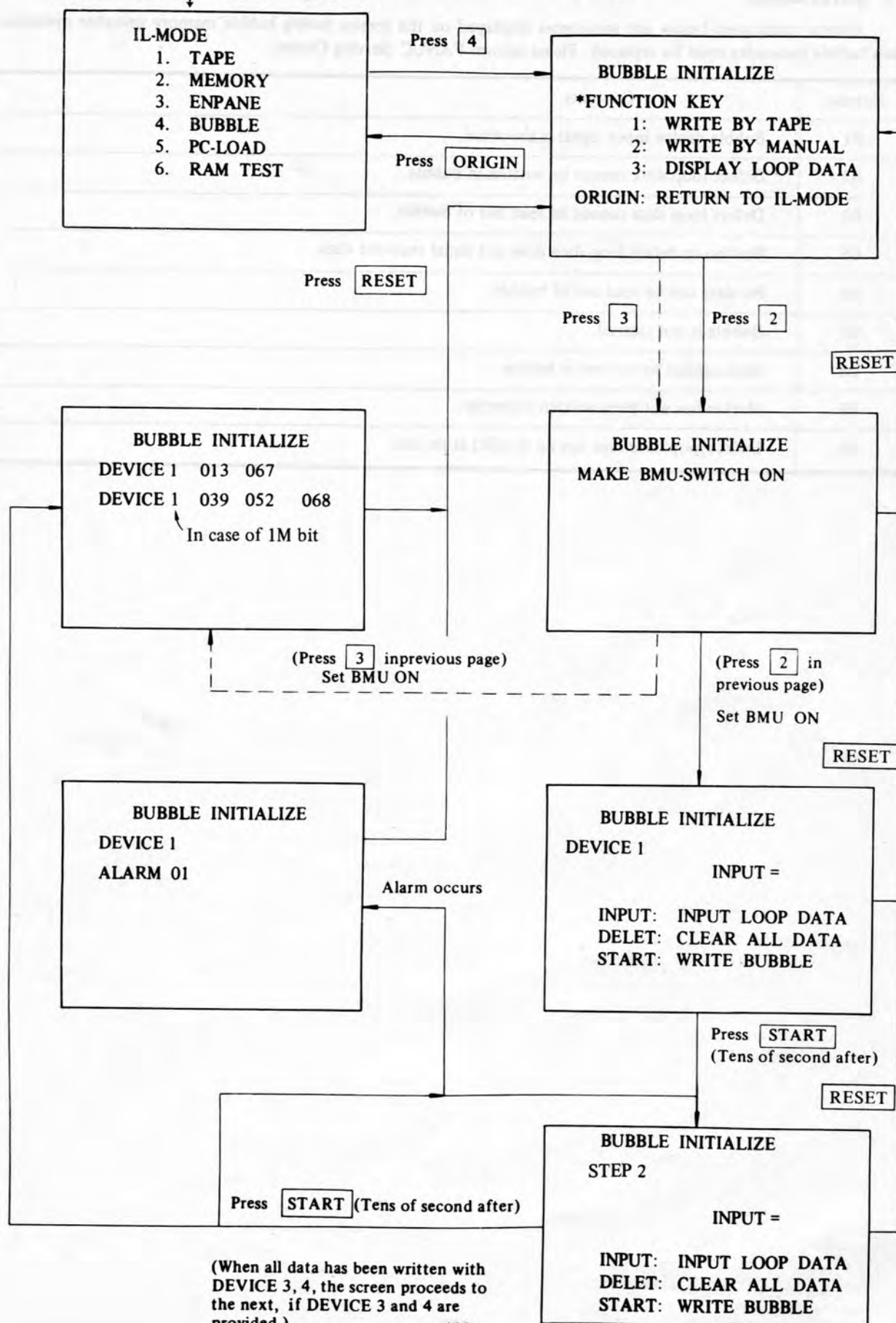
BUBBLE INITIALIZE				
DEVICE 1	001	013		← A's data
DEVICE 2	008028049			← B's data

vii) Set switch BMU OFF and turn power OFF. Then turn power ON again and enter parameters again.

Or press **RESET** (the screen in iii) will appear), then press **ORIGIN** to display the screen in ii) and press **RESET** button, thus usual power-on sequence is obtained.



Power ON with pressing ☐ and ☐ Bubble initialize operational procedure



(3) List of Alarms

Alarms mentioned below are sometimes displayed on the screen during bubble memory initialize operation. Then bubble memories must be replaced. Please inform FANUC Service Center.

Number	Contents
01	Bubble device input signal is abnormal.
03	Defect loop data cannot be written in bubble.
04	Defect loop data cannot be read out of bubble.
05	Written-in defect loop data does not equal read-out data.
06	No data can be read out of bubble.
07	Bubble is not cleared.
08	Data cannot be written in bubble.
09	Marker has not been written correctly.
10	Defect loop data tape has no % (ER) at its end.

Appendix 6 Maintenance for Character Display Unit

(1) Adjustment

In general, an adjustment of character display is not required. However, for the adjustment of brightness and contrast when required, variable resistors are provided in the side panel of display unit with an indication as shown brightness (B) and contrast (C). Perform the adjustment of these two resistors. (Refer to Fig. 1. 1)

(Note 1) The display unit, being applied a high voltage of 10 to 11 kV, should be taken care when the power is ON.

(Note 2) In the case when a signal cable is disconnected, picture face becomes fully white.

Brightness (BRIGHT)

Brightness of the full portion of picture can be adjusted, and the adjustment must be normally made in such manner with the back-ground darkened when displaying the character.

- Raster (scanning line) is made not visible in the background for the contrast at maximum. (with the character becoming brightest)
- Raster must be made not visible in the background for the contrast at minimum. (with the character becoming darkest)
- Being affected by a condition of peripheral brightness, the raster must be made not visible when becoming dark.

And for the operation of above adjustment, which is made for providing a better contrast, a trick of the work is to adjust the brightness immediately before the raster is seen.

Contrast (CONTRAST)

- The contrast, a difference of brightness, becomes an adjustment of character brightness, because the back-ground has been made to zero brightness by the above described adjustment.

Make adjustment to easy-to-see brightness. Care should be taken not to excessively raise the contrast that may deform a figure of the character.

(Note) According to the parts of the character display unit, there are two adjusting places.

	Adjusting place	
	Fig. 1.1(a)	Fig. 1.1(b)
Character display unit	A13B-0055-C001 *1	
CRT display unit	A61L-0001-0072	A61L-0001-0076 *2
Regulator unit	A14L-0065-0001	_____

*1 Character display unit is composed of CRT display unit, regulator unit and the other parts.

*2 Regulator unit is included.

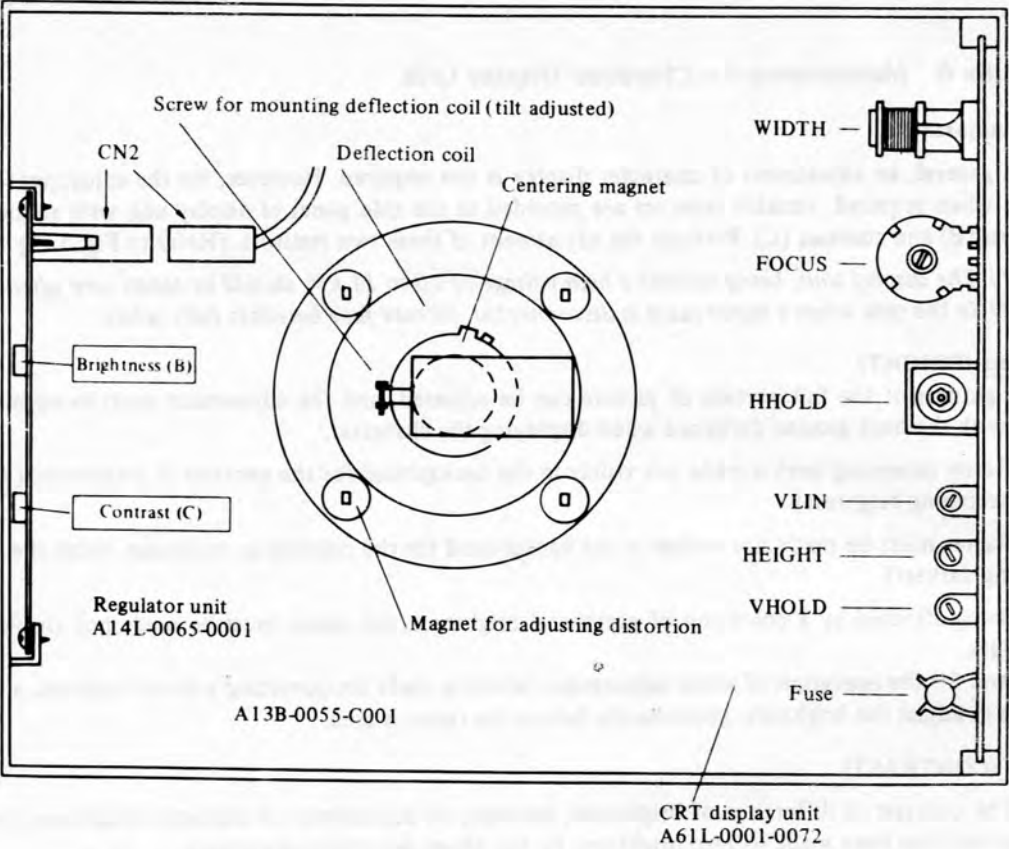


Fig. 1.1 (a) Adjustment point (As viewed from rear of the display unit)

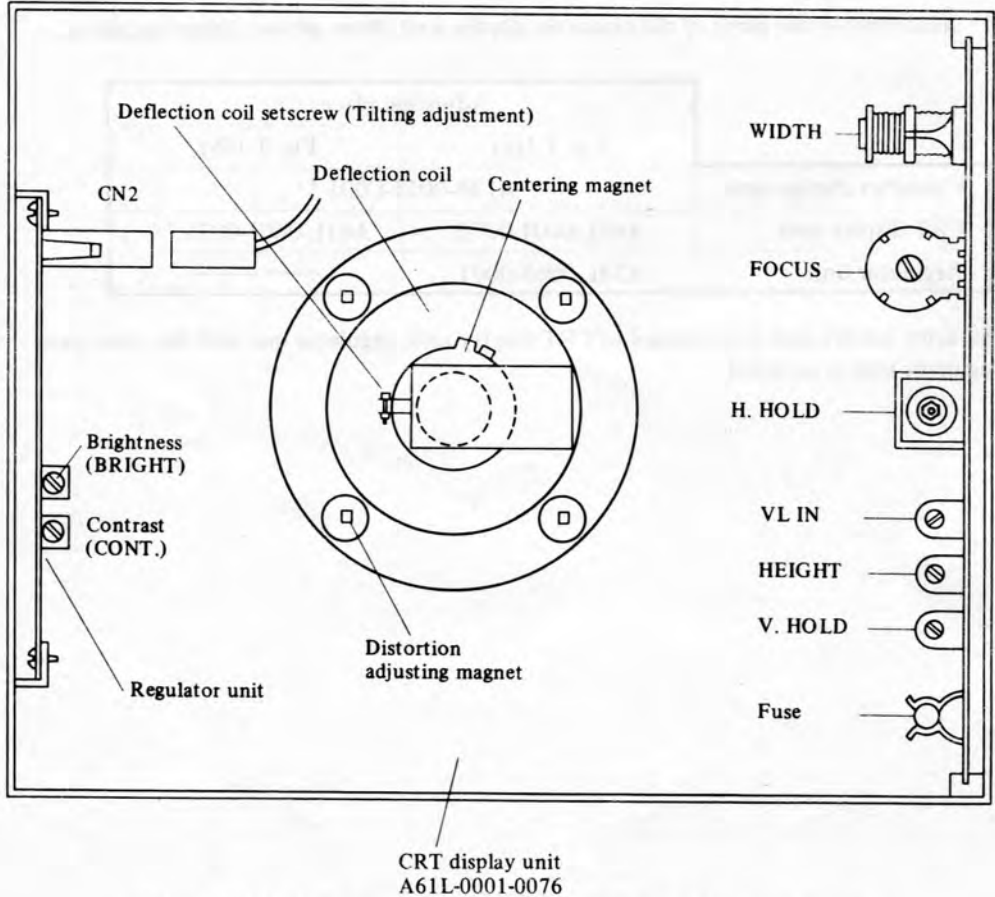


Fig. 1.1 (b) Adjustment position (Rear side view of display unit)

(2) Particular adjustment

For repairing defects of the picture, flowing, distorted, tilted, etc., the following adjustment points are provided in the CRT display unit side. The adjustment is normally not required but becomes necessary after the replacement of CRT and deflection coil and the like.

(a) Picture distortion and position adjustment

The adjustment must be made by a distortion adjusting magnet, centering magnet, and the screw for mounting deflection coil.

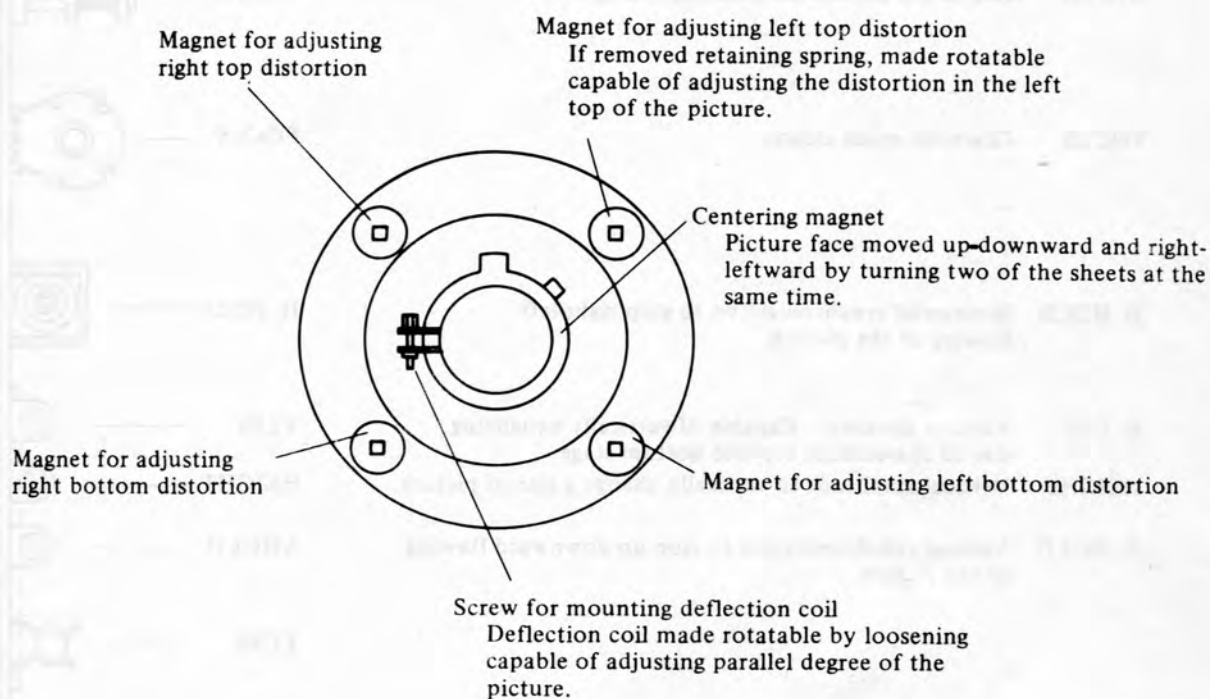


Fig. 1.2 (Deflection coil when as viewed from the rear of CRT)

Appendix 6

(b) Adjustment of synchronization, focus, linearity, etc.

Adjustment must be made by a use of variable resistor, coil, etc. on PCB in the CRT display unit.

WIDTH Size of the picture horizontally changed.

FOCUS Character made clearer.

H. HOLD Horizontal synchronization to stop right-left flowing of the picture.

V. LIN Vertical linearity. Capable of vertically equalizing size of character in top and bottom stage.

HEIGHT Vertical amplitude to vertically change a size of picture.

V. HOLD Vertical synchronization to stop up-downward flowing of the picture.

WIDTH

FOCUS

H. HOLD

VLIN

HEIGHT

VHOLD

FUSE

Edge connector

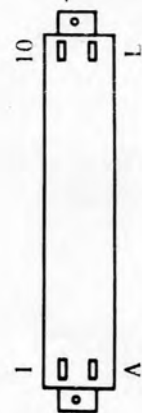


Fig. 1.3

(c) Fuse

The fuse for CRT display unit power source
1.6A 125V Rush durable type

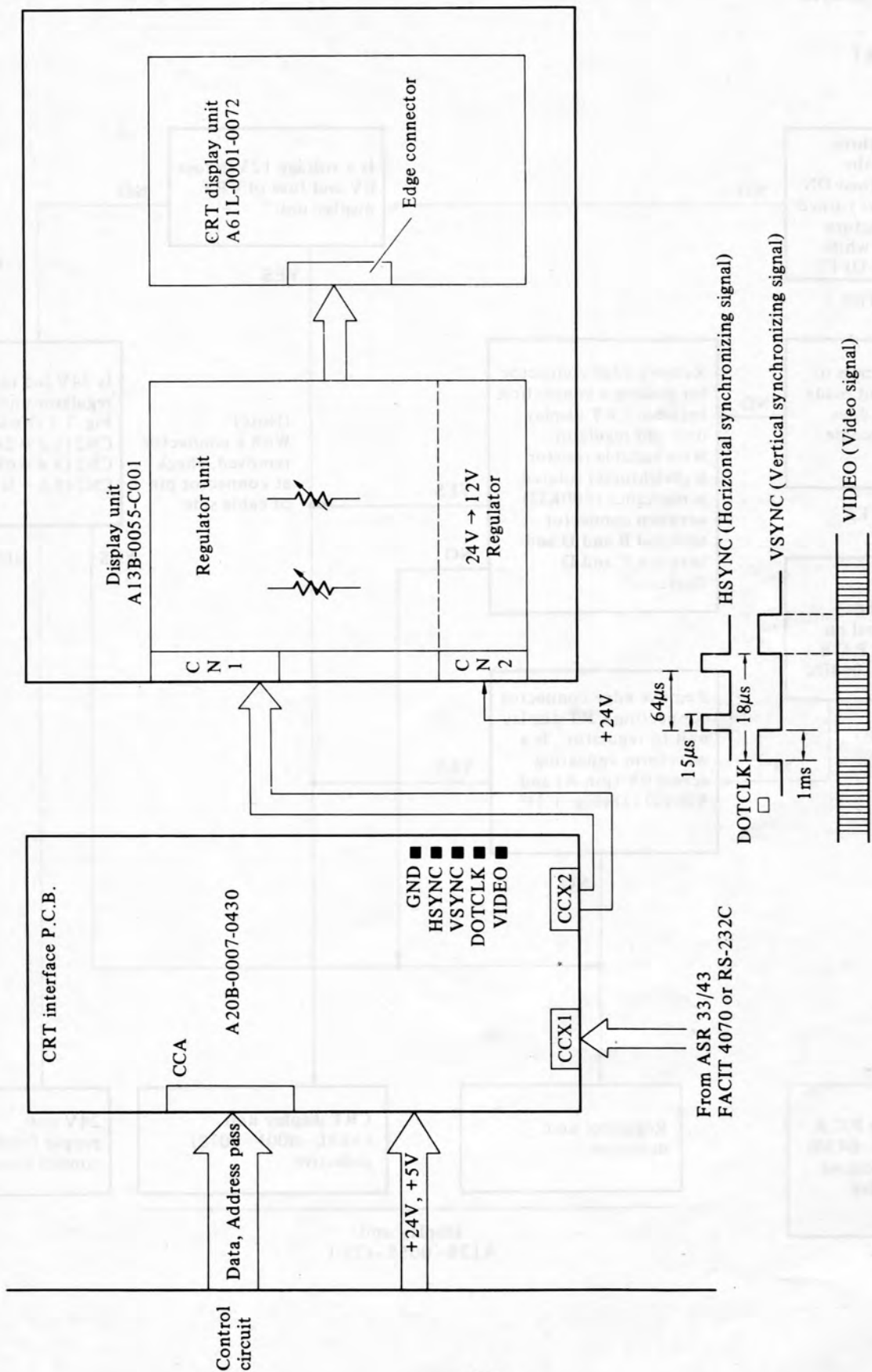
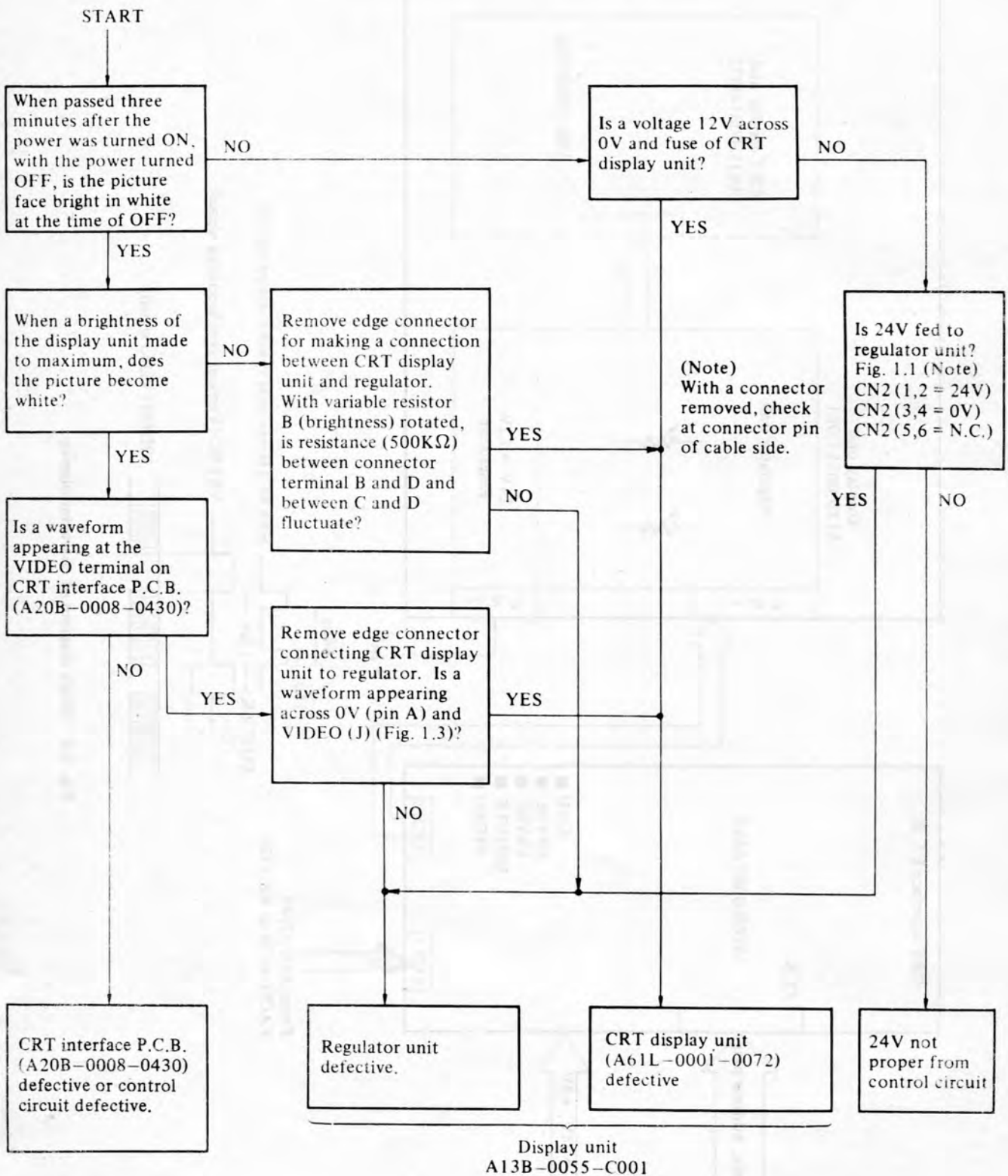


Fig. 1.4 Block diagram of character display

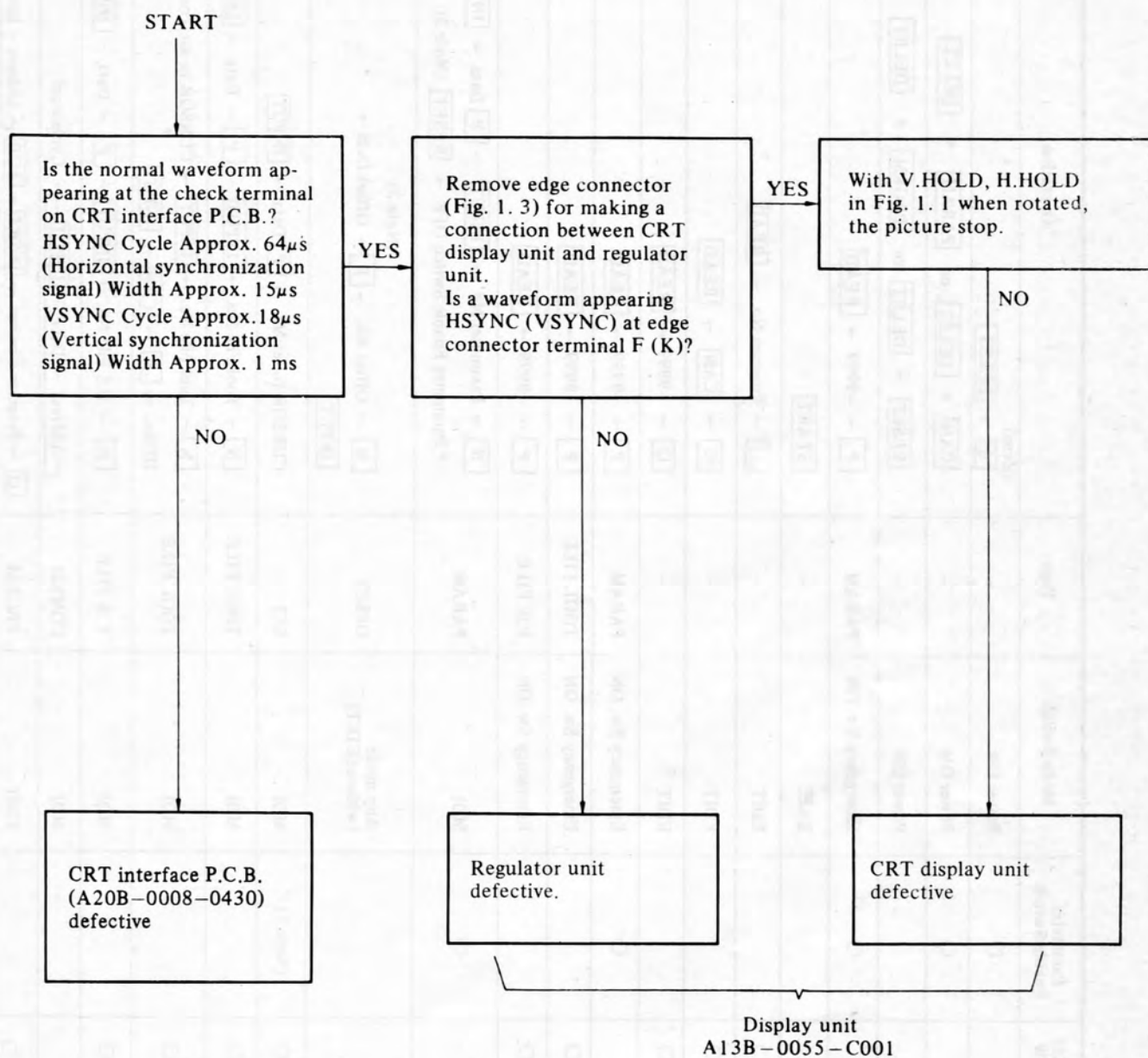
435

(3) Flow chart of trouble shooting

(a) Not displayed



(b) Flowing the picture



Appendix 7 Operation Table

Classification	Function	Key SW	Parameter Enable Switch	Mode Switch	Page	Operation
Clear	Bubble Memory All Clear		○	Power ON	-	(Zero) [O] + [DELET]
	Clearing Parameter		○	Power ON	-	[CAN] + [DELET] or [PARAM] + [DELET]
	Clearing Stored Program			Power ON	-	[RESET] + [DELET] or [PRGRM] + [DELET]
Data Input from Tape	Parameter		○	Emergency Sw. ON	PARAM	[P] → -9999 → [READ]
	Offset value			TAPE	-	[START]
	Program input	○		EDIT	-	[O] → Program No. → [READ]
(Note 4)	Add Program	○		EDIT	-	[O] → [CAN] → [READ]
	All Program Registration	○		EDIT	-	[O] → -9999 → [READ]
	Pitch Error Compensation		○	Emergency Sw. ON	PARAM	[P] → -9999 → [READ]
(Note 4)	Tool File Data	○		Emergency Sw. ON	TOOL FILE	[P] → -9999 → [READ]
(Note 4)	Machining Condition	○		Emergency Sw. ON	F.S. FILE	[P] → -9999 → [READ]
Data Input from MDI	Parameter		○	MDI	PARAM	[N] → Parameter No. → [INPUT] → [P] Data → [INPUT] → * * Parameter Enable Switch OFF → [RESET] (Note 2)
	Offset value			Any mode (without EDIT)	OFFSET	(Note 3) [N] → Offset No. → [P] → Offset Data → [INPUT]
	Setting Data	○	(Note 1)	MDI	SET	CURSOR to set No. → [P] Data → [INPUT]
(Note 4)	Tool File Data	○		MDI	TOOL FILE	[N] → Tool File No. → [INPUT] → [P] → Data → [INPUT]
	Reset of Tool File Data	○		MDI	TOOL FILE	[N] → Tool File No. → [INPUT] → CURSOR to set Tool ID No. → [P] → [CAN] → [INPUT]
	Machining Condition	○		MDI	F, S FILE	[N] → F.S File No. → [INPUT] → [P] → Data → [INPUT]
	1 Block of Data			MDI	COMND	[Address] → Data → [INPUT] → Cycle start
	Program	○		EDIT	PRGRM	[O] → Program number → [INSRT] → [EOB] → Address → Data → [EOB]

Classification	Function	Key SW	Parameter Enable Switch	Mode Switch	Page	Operation
Tape Punch	Parameter			EDIT	PARAM	$\boxed{P} \rightarrow -9999 \rightarrow \boxed{PUNCH}$
	Offset value			EDIT	OFFSET	$\boxed{P} \rightarrow -9999 \rightarrow \boxed{PUNCH}$
	Pitch Error Compensation parameters			EDIT	PARAM	$\boxed{P} \rightarrow -9998 \rightarrow \boxed{PUNCH}$
	All Program			EDIT	-	$\boxed{O} \rightarrow -9999 \rightarrow \boxed{PUNCH}$
	One Program			EDIT	-	$\boxed{O} \rightarrow \text{Program No.} \rightarrow \boxed{PUNCH}$
(Note 4)	Tool File Data			EDIT	TOOL FILE	$\boxed{P} \rightarrow -9999 \rightarrow \boxed{PUNCH}$
(Note 4)	Machining Condition			EDIT	F.S FILE	$\boxed{P} \rightarrow -9999 \rightarrow \boxed{PUNCH}$
Search	Program No. Search (MEMORY mode only)			EDIT	PRGRM	$\boxed{O} \rightarrow \text{Program No.} \rightarrow \boxed{\downarrow}$ (CURSOR)
	Sequence No. Search (MEMORY mode only)			MEMORY	PRGRM	Program No. Search $\rightarrow \boxed{N} \rightarrow \text{Sequence No.} \rightarrow \boxed{\downarrow}$ (CURSOR)
	Sequence No. Search (Tape mode)			TAPE	PRGRM	$\boxed{N} \rightarrow \text{Sequence No.} \rightarrow \boxed{\downarrow}$ (CURSOR)
	Address word search			EDIT	PRGRM	Searching Address and Data $\rightarrow \boxed{\downarrow}$ (CURSOR)
	Address search			EDIT	PRGRM	Searching Address $\rightarrow \boxed{\downarrow}$ (CURSOR)
Program Editing	Deletion of all programs	○		EDIT	PRGRM	$\boxed{O} \rightarrow -9999 \rightarrow \boxed{DELET}$
	Deletion of a program	○		EDIT	PRGRM	$\boxed{O} \rightarrow \text{Program No.} \rightarrow \boxed{DELET}$
	Deletion of several blocks	○		EDIT	PRGRM	$\boxed{N} \rightarrow \text{Sequence No.} \rightarrow \boxed{DELET}$
	Deletion of a block	○		EDIT	PRGRM	Search a block to be Deleted $\rightarrow \boxed{EOB} \rightarrow \boxed{DEDELETE}$
	Deletion of a word	○		EDIT	PRGRM	Search a word to be Deleted $\rightarrow \boxed{DEDELETE}$
	Alternation of a word	○		EDIT	PRGRM	Search a word to be Altered $\rightarrow \text{Address} \rightarrow \text{Data} \rightarrow \boxed{ALTER}$
	Insertion of a word	○		EDIT	PRGRM	Search a word before the place in the program $\rightarrow \text{Address} \rightarrow *$ * Data $\rightarrow \boxed{INSRT}$

Classification	Function	Key SW	Parameter Enable Switch	Mode Switch	Page	Operation
Program Editing	Arrangement of memory	○	-	EDIT	(PRGRM)	[CAN] → [ORIGIN] (After arrangement, unstored memory area is displayed by character number.)
	Insertion of a block	○		EDIT	PRGRM	→ Address → Data → [EOB] → [INSERT]
	Insertion of a program	○		EDIT	PRGRM	[O] → Program No. → [INSERT] → [EOB] → [INSERT] → (Same as insertion of a Block)
Graphic (Note 3)	Graphic only			EDIT	GRAPH	[GRAPH PARAM] (Parameter set) → [ERASE] → [STOP] → [START]
	Drawing during machining			T/D/MEM	GRAPH	[GRAPH PARAM] (Parameter set) → [ERASE] → [STOP] → [START MACHIN] → Cycle start
	Graphic only			EDIT	AUX	(Parameter set) → [AUX] → [T] [S]
	Drawing during machining			T/D/MEM	AUX	(Set Program No. = -1 in Parameter) → [AUX] → [T] [S] → Cycle Start
Comparison	Comparison in Memory with Tape			EDIT	(PRGRM)	[/] → [READ]
	Comparison from Current position			EDIT	(PRGRM)	[EOB] → [READ]
FANUC cassette	Heading of cassette			EDIT mode	PRGRM	[N] → 0 (zero) → [INPUT]
	Next file			EDIT mode	PRGRM	[N] → -9999 → [INPUT]
	Automatic heading of next file			EDIT mode	PRGRM	[N] → -9998 → [INPUT] (Modal)
	File No. designation			EDIT mode	PRGRM	[N] → File No. → [INPUT]
	Deletion of file	○		EDIT mode	PRGRM	[N] → File No. (k) → [START] File No. (k+1) ~ n → k ~ (n-1)
	Output of one program			EDIT mode	PRGRM	[O] → Program No. → [PUNCH]
	Output of all programs			EDIT mode	PRGRM	[O] → -9999 → [PUNCH]

Classification	Function	Key SW	Parameter Enable Switch	Mode Switch	Page	Operation
FANUC cassette	Loading of programs			EDIT mode	—	Heading of file → ☐ O → -9999 → ☐ READ
	Output of offset data			EDIT mode	OFFSET	☐ P → -9999 → ☐ PUNCH
	Input of offset data			EDIT mode	—	Heading of file → ☐ O → Program No. → ☐ READ → Program Execution
	Output of parameters			EDIT mode	PARAM	☐ P → -9999 → ☐ PUNCH
	Input of parameters		☐ O	Emergency stop ON	PARAM	Heading of file → ☐ P → -9999 → ☐ READ

(Note 1) Whether program protect key is effective or not is selected by a parameter.

(Note 2) Turn off and on power as required.

(Note 3) Available with graphic function option.

(Note 4) Available with conversational automatic programming function option.

Appendix 8 Tape code used for Programming

ISO code									EIA code									Meaning
Character	8	7	6	5	4	3	2	1	Character	8	7	6	5	4	3	2	1	
0			○	○		○			0			○			○			Numeral 0
1	○		○	○		○		○	1						○			" 1
2	○		○	○		○	○		2						○	○		" 2
3			○	○		○	○	○	3			○			○	○	○	" 3
4	○		○	○		○	○		4						○	○		" 4
5			○	○		○	○		5				○		○	○		" 5
6			○	○		○	○		6				○		○	○	○	" 6
7	○		○	○		○	○	○	7						○	○	○	" 7
8	○		○	○	○				8					○	○			" 8
9			○	○	○			○	9			○	○	○			○	" 9
A		○				○		○	a		○	○			○			Address A
B		○				○		○	b		○	○			○			" B
C	○	○				○		○	c		○	○	○		○		○	" C
D		○				○	○		d		○	○			○	○		" D
E	○	○				○	○	○	e		○	○	○		○	○	○	" E
F	○	○				○	○	○	f		○	○	○		○	○	○	" F
G		○				○	○	○	g			○	○		○	○	○	" G
H		○			○	○			h		○	○		○	○			" H
I	○	○			○	○		○	i		○	○	○	○			○	" I
J	○	○			○	○		○	j		○		○		○		○	" J
K		○			○	○		○	k		○		○		○		○	" K
L	○	○			○	○	○		l		○				○	○	○	" L
M		○			○	○	○	○	m		○		○		○	○		" M
N		○			○	○	○	○	n		○				○	○	○	" N
O	○	○			○	○	○	○	o		○				○	○	○	Not used at significant data zone in ISO code. Assumed as address 0 at EIA code.
P		○		○		○			p		○		○		○	○	○	Address P
Q	○	○		○		○		○	q		○		○	○				" Q
R	○	○		○		○		○	r		○			○	○		○	" R
S		○		○		○		○	s			○	○		○		○	" S
T	○	○		○		○	○		t			○			○		○	" T
U		○		○		○	○	○	u			○	○		○	○		" U
V		○		○		○	○	○	v			○			○	○	○	" V
W	○	○		○		○	○	○	w			○			○	○	○	" W
X	○	○		○	○				x			○	○		○	○	○	" X
Y		○		○	○		○	○	y			○	○	○				" Y
Z		○		○	○		○		z			○		○			○	" Z
DEL	○	○	○	○	○	○	○	○	Del		○	○	○	○	○	○	○	* Delete (cancel erroneous hole)
NUL						○			Blank						○			* No holes. Not used at significant data zone is EIA code.
BS	○				○	○			BS			○		○	○		○	* Back space
HT					○	○		○	Tab			○	○	○	○	○	○	* Tabulator
LF or NL					○	○		○	CR or EOB	○					○			End of block
CR	○				○	○	○											* Carriage return
SP	○	○				○			SP					○		○		* Space
%	○		○			○	○	○	ER						○	○	○	Absolute rewind stop
(			○		○	○			(2-4-5)					○	○	○	○	Control out (start of comment)
)	○		○		○	○		○	(2-4-7)	○				○	○		○	Control in (end of comment)
+			○		○	○		○	+			○	○	○				* Plus sign
-			○		○	○	○	○	-			○			○			- Minus sign
:			○	○	○	○		○										Assumed as program number in ISO code.
/	○		○		○	○	○	○	/				○	○		○		Optional block skip
.			○		○	○	○	○	.			○	○		○	○	○	Decimal point
#	○	○				○		○										* Sharp
\$			○			○	○											* Dollar symbol
&	○	○				○	○	○	&					○	○	○	○	* Ampersand
'			○			○	○	○										* Apostrophe
*	○	○			○	○		○										* Asterisk
,	○	○			○	○	○		,			○	○	○	○		○	* Comma
;	○		○	○	○	○		○										* Semicolon
<			○	○	○	○	○											* Left angle bracket
=	○		○	○	○	○	○	○										* Equal mark
>	○		○	○	○	○	○	○										* Right angle bracket
?			○	○	○	○	○	○										* Question mark
@	○	○				○												* Commercial at mark
"			○			○		○										* Quotation mark

- (Note 1) The codes with asterisk are read in the tape memory only when it is in the comment section. They are ignored in other significant information sections.
- (Note 2) The codes with question mark are read in tape memory only when it is in comment. They generate an alarm if used in other significant information sections.
- (Note 3) With a custom macro option attached, in addition, the following codes can be used in significant information.
- (,), #, *, =, E in ISO
() & , codes by parameter setting
- (Note 4) Codes not included in this table and with correct parity are always ignored.
- (Note 5) The code without correct parity generate a TH alarm. But it is ignored in a comment section and the TH alarm. But it is ignored in a comment section and the TH alarm is not generated.
- (Note 6) A character with all eight holes punched is allowed in either ELA or ISO codes, however it will be ignored in either codes. Additionally in EIA this code will be read, but as parity error (TH) alarm.

Appendix 9 G function table

The following G codes are available.

G code	Group	Function	Basic or option
G00	01	Positioning (Rapid traverse)	B
G01		Linear interpolation (Feed)	B
G02		Circular interpolation CW	O
G03		Circular interpolation CCW	O
G04	00	Dwell	B
G07		Imaginary axis designation	O
G09		Exact stop check	B
G10		Offset value setting	O
G17	02	XY plane selection	O
G18		ZX plane selection	O
G19		YZ plane selection	O
G20	06	Input in inch	O
G21		Input in mm	O
G22	04	Stored stroke limit ON	O
G23		Stored stroke limit OFF	O
G27	00	Reference point return check	O
G28		Return to reference point	O
G29		Return from reference point	O
G30		Return to 2nd, 3rd and 4th reference point	O
G31		Skip cutting	O
G33	01	Thread cutting	O
G40	07	Cutter compensation cancel	B
G41		Cutter compensation left	O
G42		Cutter compensation right	O
G43	08	Tool length compensation + direction	O
G44		Tool length compensation – direction	O
G49		Tool length compensation cancel	O
G45	00	Tool offset increase	O
G46		Tool offset decrease	O
G47		Tool offset double increase	O
G48		Tool offset double decrease	O
G50	11	Scaling off	O
G51		Scaling on	O
G52	00	Local coordinate system setting	O

G code	Group	Function	Basic or option
G54	14	Work coordinate system 1 select	O
G55		Work coordinate system 2 select	O
G56		Work coordinate system 3 select	O
G57		Work coordinate system 4 select	O
G58		Work coordinate system 5 select	O
G59		Work coordinate system 6 select	O
G60	00	Single direction positioning	O
G61	15	Exact stop check mode	B
G64		Cutting mode	B
G65	00	Custom macro simple call	O
G66	12	Custom macro modal call	O
G67		Custom macro modal call cancellation	O
G68	16	Coordinate system rotation ON	O
G69		Coordinate system rotation OFF	O
G73	09	Peck drilling cycle	O
G74		Counter tapping cycle	O
G76		Fine boring	O
G80		Canned cycle cancel	O
G81		Drilling cycle, spot boring	O
G82		Drilling cycle, counter boring	O
G83		Peck drilling cycle	O
G84		Tapping cycle	O
G85		Boring cycle	O
G86		Boring cycle	O
G87		Back boring cycle	O
G88		Boring cycle	O
G89		Boring cycle	O
G90	03	Absolute programming	B
G91		Incremental programming	B
G92	00	Programming of absolute zero point	B
G94	05	Per minute feed	B
G95		Per revolution feed	O
G96	13	Constant surface speed control	
G97		Constant surface speed control cancel	
G98	10	Return to initial point in canned cycle	O
G99		Return to R point in canned cycle	O

(Note 1) The G codes marked  are initial G codes in turning power on or after pushing the reset button.
For G00, G01, G43, G44, G49, G94 and G95, the initial G codes can be selected by parameter setting.

For G20 and G21, the G code before turning power off or pushing the reset button remains.

(Note 2) The G codes of groupe 00 are not modal.

They are effective in the commanded block.

(Note 3) If a G code not listed in the table is commanded, an alarm (No. 010) is displayed. If an option is not provided and the corresponding G code is commanded, an alarm (No. 010) is displayed. However, G38 and G39 are ignored.

(Note 4) A number of G codes can be specified in the same block. When a number of G codes of the same group are specified, the G code specified later is effective.

(Note 5) If the G code of group 01 is commanded in the canned cycle mode, the canned cycle is automatically cancelled (G80).

However, G codes of group 01 are not affected by the G codes of canned cycles.

G00	00	Fast feed
G01	01	Linear interpolation
G02	02	Circular interpolation clockwise
G03	03	Circular interpolation counter-clockwise
G04	04	Dwell
G05	05	High speed feed
G06	06	Variable speed feed
G07	07	Constant surface speed
G08	08	Constant surface speed control
G09	09	Constant surface speed control
G10	10	Set work coordinate system
G11	11	Set work coordinate system
G12	12	Set work coordinate system
G13	13	Set work coordinate system
G14	14	Set work coordinate system
G15	15	Set work coordinate system
G16	16	Set work coordinate system
G17	17	Set work coordinate system
G18	18	Set work coordinate system
G19	19	Set work coordinate system
G20	20	Set units to inches
G21	21	Set units to millimeters
G22	22	Set units to millimeters
G23	23	Set units to millimeters
G24	24	Set units to millimeters
G25	25	Set units to millimeters
G26	26	Set units to millimeters
G27	27	Set units to millimeters
G28	28	Set units to millimeters
G29	29	Set units to millimeters
G30	30	Set units to millimeters
G31	31	Set units to millimeters
G32	32	Set units to millimeters
G33	33	Set units to millimeters
G34	34	Set units to millimeters
G35	35	Set units to millimeters
G36	36	Set units to millimeters
G37	37	Set units to millimeters
G38	38	Set units to millimeters
G39	39	Set units to millimeters
G40	40	Set units to millimeters
G41	41	Set units to millimeters
G42	42	Set units to millimeters
G43	43	Set units to millimeters
G44	44	Set units to millimeters
G45	45	Set units to millimeters
G46	46	Set units to millimeters
G47	47	Set units to millimeters
G48	48	Set units to millimeters
G49	49	Set units to millimeters
G50	50	Set units to millimeters
G51	51	Set units to millimeters
G52	52	Set units to millimeters
G53	53	Set units to millimeters
G54	54	Set units to millimeters
G55	55	Set units to millimeters
G56	56	Set units to millimeters
G57	57	Set units to millimeters
G58	58	Set units to millimeters
G59	59	Set units to millimeters
G60	60	Set units to millimeters
G61	61	Set units to millimeters
G62	62	Set units to millimeters
G63	63	Set units to millimeters
G64	64	Set units to millimeters
G65	65	Set units to millimeters
G66	66	Set units to millimeters
G67	67	Set units to millimeters
G68	68	Set units to millimeters
G69	69	Set units to millimeters
G70	70	Set units to millimeters
G71	71	Set units to millimeters
G72	72	Set units to millimeters
G73	73	Set units to millimeters
G74	74	Set units to millimeters
G75	75	Set units to millimeters
G76	76	Set units to millimeters
G77	77	Set units to millimeters
G78	78	Set units to millimeters
G79	79	Set units to millimeters
G80	80	Set units to millimeters
G81	81	Set units to millimeters
G82	82	Set units to millimeters
G83	83	Set units to millimeters
G84	84	Set units to millimeters
G85	85	Set units to millimeters
G86	86	Set units to millimeters
G87	87	Set units to millimeters
G88	88	Set units to millimeters
G89	89	Set units to millimeters
G90	90	Set units to millimeters
G91	91	Set units to millimeters
G92	92	Set units to millimeters
G93	93	Set units to millimeters
G94	94	Set units to millimeters
G95	95	Set units to millimeters
G96	96	Set units to millimeters
G97	97	Set units to millimeters
G98	98	Set units to millimeters
G99	99	Set units to millimeters

Appendix 10 Table of range of command value

	Address	Input in mm Output in mm	Input in inch Output in mm	Input in mm Output in inch	Input in inch Output in inch
Least input increment		0.001 mm	0.0001 inch	0.001 mm	0.0001 inch
Maximum stroke (value from machine zero position)		± 99999.999 mm	± 99999.999 mm	± 3937.0078 inch	± 9999.9999 inch
Maximum programmable dimension	X, Y, Z, I, J, K, R, A, B, C	± 99999.999 mm	± 3937.0078 inch	± 99999.999 mm	± 9999.9999 inch
At cutting feed rate override 100%		1 ~ 15000 mm/min	0.01 ~ 600.00 inch/min	1 ~ 15000 mm/min	0.01 ~ 600.00 inch/min
At cutting feed rate 1/10 (parameter setting)		0.1 ~ 15000.00 mm/min	0.01 ~ 600.00 inch/min	0.1 ~ 15000.0 mm/min	0.01 ~ 600.00 inch/min
Rapid traverse rate (separate for each axis)		30 ~ 15000 mm/min	30 ~ 15000 mm/min	3.0 ~ 600.0 inch/rev	3.0 ~ 600.0 inch/min
Upper limit of value of cutting feed rate					
Manual rapid traverse rate		1 ~ 15000 mm/min	1 ~ 15000 mm/min	0.1 ~ 600.0 inch/min	0.1 ~ 600.0 inch/min
Fo					
Manual jog feed rate		1 ~ 2000 mm/min	0.04 ~ 78.7 inch/min	0.5 ~ 1016 mm/min	0.02 ~ 40 inch/min
Maximum revolutions of spindle		5000 rpm	5000 rpm	5000 rpm	5000 rpm
Coordinate value of 2nd reference point (value from reference point)		0 ~ ± 99999.999 mm	0 ~ ± 99999.999 mm	0 ~ ± 3937.0078 inch	0 ~ ± 9999.9999 inch
Tool offset amount	P	0 ~ ± 999.999 mm	0 ~ ± 99.9999 inch	0 ~ ± 999.999 mm	0 ~ ± 99.9999 inch
Minimum value in incremental feed		0.001 mm	0.0001 inch	0.001 mm	0.0001 inch
Backlash compensation amount		0 ~ 0.255 mm	0 ~ 0.255 mm	0 ~ 0.0255 inch	0 ~ 0.0255 inch
Area of stored stroke limit (value from reference point)		± 99999.999 mm	± 99999.999 mm	± 3937.0078 inch	± 9999.9999 inch
Dwell	X, P	0 99999.999 sec	0 99999.999 sec	0 99999.999 sec	0 99999.999 sec
Program number	: (ISO) 0 (EIA)	1 ~ 9999	Same as left	"	"
Sequence number	N	1 ~ 9999	"	"	"
Preparatory function	G	0 ~ 99	"	"	"

	Address	Input in mm Output in mm	Input in inch Output in mm	Input in mm Output in inch	Input in inch Output in inch
Spindle function	S	0 ~ 9999	Same as left	"	"
Tool function	T	0 ~ 9932	"	"	"
Miscellaneous function	M	0 ~ 99	"	"	"
Designation of program number	P	1 ~ 9999	"	"	"
Repeat time	L	1 ~ 9999	"	"	"
Offset number	D, H	0 ~ 64	"	"	"
2nd miscellaneous function	B	0 ~ 999	"	"	"

Appendix 11 Status at turning power on and at reset

○: The status is not changed or the movement is continued.

x: The status is canceled or the movement is interrupted.

	Item	At turning power on	At reset
Setting data	Offset value	○	○
	Data SETTING	Initial value (INCH/MM setting is not changed)	○
	Parameter	○	○
Data	Program in the memory	○	○
	Content in the buffer	x	x
	Display of the sequence number	x	○
	One-shot G code	x	x
	Mordal G code	Initial code (G20/G21 is not changed.)	No change (However, it can be changed by parameter setting) G22 and G23 are not changed.
	F function	Zero	It is not changed However, it can be changed by parameter setting)
	S, T, M function	x	○
	Address L (Repetitive count)	x	x
Coordinate system	Work coordinate value	Zero	○
Executing movement	Movement	x	x
	Dwell	x	x
	Sending of M, S or T code	x	x
	Tool offset	x	x
	Tool nose radius compensation	x	x
	Memorization of called subprogram number	x	x (Note 1)
	Rewind	x	x
Display LED	Alarm LED	If there is no alarm, extinguishes	Same as left
	READY LED	○	○ (x in emergency stop)
	LABEL SKIP LED	Lights	In MDI mode, ○ In other modes, lights
	BUFFER LED	It is extinguished	In MDI mode, ○ In other modes, extinguishes

Item		At turning power on	At reset
Output signals	Reference point return LED	x	○ (x in emergency stop)
	S and T code	x	○
	M code	x	x
	M, S and T strobe signal	x	x
	Spindle revolution signal (S-12 bit/S analog signal)	○	○
	NC ready signal	ON	○
Outputs signals	Servo ready signal	ON (Other than servo alarm)	ON (Other than servo alarm)
	CYCLE START LED	x	x
	FEED HOLD LED	x	x

(Note 1) When the NC is reset during the subprogram execution, the control returns to the start of the main program. The subprogram cannot be executed from the middle of it.

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Appendix 12 RAM Test

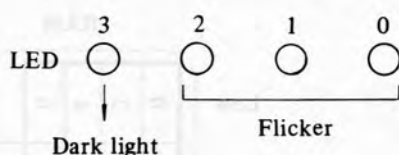
1 Introduction

When a RAM-associated alarm occurs, RAM testing displays the faulty RAM on the LED on the master PCB. Whether or not a RAM is normal, can also be diagnosed in IL-Mode after the power is turned on.

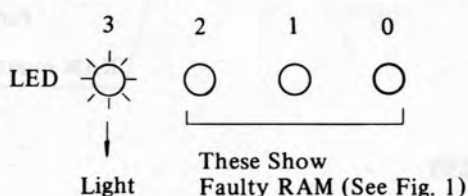
2 Operation

2.1 An alarm has occurred.

- i) Check LEDs on master PCB first of all. Because RAM is used for CRT display, some RAM associated alarms may not be displayed on the CRT screen.
- ii) Press the START button. The RAM test will begin.
 - RAMs are under test (which takes approx. two seconds.)

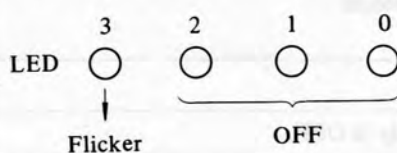


- Faulty RAMs have been detected.



Press the START button. RAM test will continue.

- Faulty RAMs have not been detected.



Press the START button. The test will be conducted again from the beginning of the RAMs.

- iii) Do not operate for purposes other than RAM test, until the power is turned off.

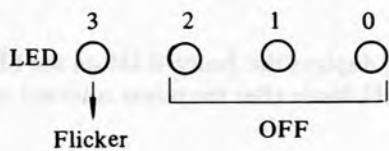
2.2 RAM test is to be conducted after the power is turned on.

- i) Power on while pressing the and buttons. The following screen will be displayed.

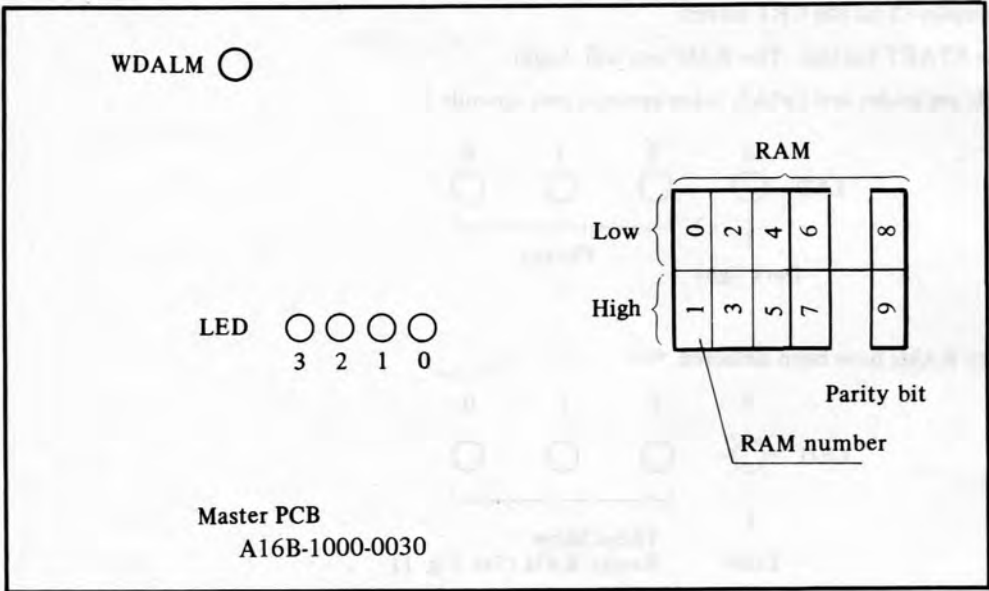
IL-MODE

1. TAPE
2. MEMORY
3. ENPANE
4. BUBBLE
5. PC-LOAD
6. RAM TEST

ii) Press the **6** DATA key. The LEDs will flicker.



- iii) Press the **START** button. The sequence will enter into 2.1, ii
- iv) Press the **RESET** button. The sequence will be an ordinary software one.



WDALM lights	Watch Dog alarm occurs.
LED 3 2 1 0	Alarm contents
x x x x	Normal
x x x o	Slave Ready is OFF.
x x o x	Alarms 900-999 occur (except 910, 911).
x o x x	RAM parity alarm occurs. (Note)
o x x x	RAM test shows RAM 0 to be faulty.
o x x o	RAM test shows RAM 1 to be faulty.
o x o x	RAM test shows RAM 2 to be faulty.
o x o o	RAM test shows RAM 3 to be faulty.
o o x x	RAM test shows RAM 4 to be faulty.
o o x o	RAM test shows RAM 5 to be faulty.
o o o x	RAM test shows RAM 6 to be faulty.
o o o o	RAM test shows RAM 7 to be faulty.
o x x □	RAM test shows RAM 8 to be faulty.
o x □ x	RAM test shows RAM 9 to be faulty.
□ x x x	RAM Test Wait or RAM Test End

o ON
x OFF
□ Flickers

Appendix 13 Displaying and setting PC-related signals and data

1. PC screen selection (for both PC-A and PC-B)

To output the PC screen, press the MDI or CRT PARAM key. If the screen is not output, press the key again. The following will be displayed at the top of the screen.

PC PARAMETER 01:			
NO.	DATA	NO.	DATA

2. PC screen format

2.1 For PC-A

Only one data item is displayed on a single screen.

2.2 For PC-B

A single data item or 20 data items can be displayed on a single screen.

- (1) When the PC screen is first selected, 20 data items are displayed.
- (2) To change to a single data item displayed at the upper left side of the screen, press the PAGE key continuously for several seconds. Display a single data item for a quickly changing signal. Display a 20 data item screen to slow down screen changes.
- (3) To change back to the 20 data item display, hold down the PAGE key for several seconds.

3. Signal display

To display signals (I/O signals, control relays, etc.), entered in the ladder diagram address table, on the CRT screen, perform the following operations.

3.1 For PC-A

- (1) Press the key. 20 data items will be displayed on the CRT screen.
- (2) Press the key.
- (3) Use the DATA key to set the address of the desired signal.
- (4) Press the key. The data item whose address is input in (3) is displayed.

(Note) Signals in the address table can also be displayed on the PC-PARAMETER screen described in Section 1.

3.2 For PC-B

- (1) Press the key to output the PC screen. (Refer to Sections 1 and 2.)
- (2) Press the key.
- (3) Use the DATA key to set the address of the desired signal.
- (4) Press the key. The data item whose address is input in (3) is displayed.

(Note) PC $\Rightarrow$ NC and PC $\Rightarrow$ MT signals can also be seen on the DIAGNOSE screen. Control relay and hold-type memory address signals can only be seen on the PC screen.

4. PC $\rightarrow$ MT output signals

This function, using a RAM card as a PC memory, sets the output signals to the machine to "1"s or "0"s. It is effective only when the PC programmer is already connected to the RAM board. Operations described below are the same for both PC-A and PC-B.

- (1) First set the NC parameter DGNE (FS6T: parameter number 10 7th bit, FS6M: parameter number 11 7th bit) to "1".
- (2) Set the NC operation mode to MDI mode.

- (3) Stop PC execution. (This is done by the PC programmer.)
- (4) Display the screen that contains the address of the signal to be output. This operation is the same as Section 3.1 in appendix 16.
- (5) Move the cursor to the address of the desired signal.
- (6) Press the ADDRESS key P.
- (7) Within the 8-bit signal for the specified address, set "1" in the bits for which output is to be "on" and "0" in the other bits.
- (8) Press the INPUT key. The data set in (7) are output.

5. Setting the timer tabe

Number of timers and timer intervals to be set differ for PC-A and BC-B. (See the following table.)

Table 5-1

PC type	Timer number set by the program	Timer number set by MDI and CRT	Minimum interval setting	Maximum interval setting
PC-A	1, 2	1001, 1002	50 msec	3276.7 sec
	3 ~ 18	1003 ~ 1018	50 msec	12.7 sec
PC-B	1 ~ 8	1001 ~ 1008	50 msec	3276.7 sec
	9 ~ 40	1009 ~ 1040	8 msec	524.2 sec

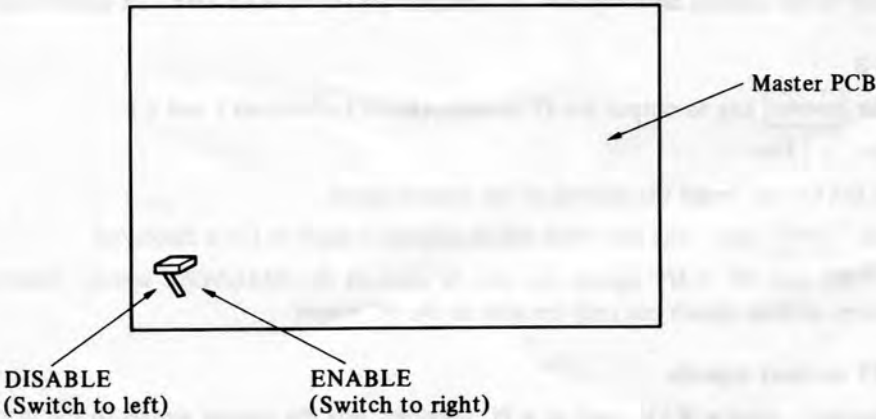
(Note) Timer numbers set by MDI and CRT are formed by adding 1000 to timer numbers set by the program.

5.1 Timer interval table (for both PC-A and PC-B)

- (1) Select the PC screen. (Refer to Section 1.)
- (2) Press the N key.
- (3) Use the DATA key to set the timer number (number + 1000)
- (4) Press the INPUT key. The timer number is displayed in the NO. field of the screen, and the time interval is displayed in the DATA field. The time interval units are msec.

5.2 Setting the timer interval (for both PC-A and PC-B)

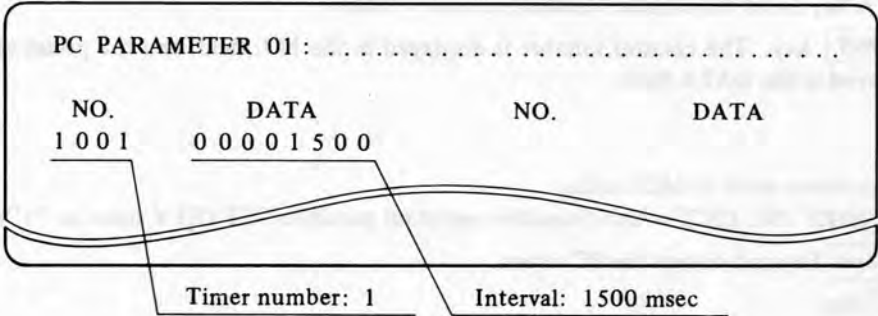
- (1) Set the NC operation mode to MDI mode.
- (2) Set the NC parameter write switch to ENABLE.



- (3) Select the PC screen. (Refer to Section 1.)
- (4) Press the N key.

- (5) Use the DATA key to set the timer number.
- (6) Press the key. The screen set in (5) is output.
- (7) If a 20 data item screen is displayed (for PC-B), move the cursor to the desired timer number.
- (8) Press the key.
- (9) Use the DATA key to set the timer interval to an integral multiple of the minimum interval setting in Table 5-1. The fractional part is truncated.
- (10) Press the key. The specified interval is set for the specified timer number.

[Example]



- (11) Return the parameter set switch to DISABLE.

6. Setting and displaying the counter's preset value and integrated value

The following tables show numbers to specify in order to set and display intervals and counter numbers specified by the program.

For FANUC PC-MODEL A

Number to specify for CRT display Counter number specified by the program	Preset value		Integrated value	
	Decimal display	BCD bit pattern display	Decimal display	BCD bit pattern display
1	2001	596, 597	2101	604, 605
2	2002	598, 599	2102	606, 607

For FANUC PC-MODEL B

Number to specify for CRT display Counter number specified by the program	Preset value		Integrated value	
	Decimal display	BCD bit pattern display	Decimal display	BCD bit pattern display
1	2001	560, 561	2101	580, 581
2	2002	562, 563	2102	582, 583
3	2003	564, 565	2103	584, 585
4	2004	566, 567	2104	586, 587
5	2005	568, 569	2105	588, 589
6	2006	570, 571	2106	590, 591
7	2007	572, 573	2107	592, 593
8	2008	574, 575	2108	594, 595
9	2009	576, 577	2109	596, 597
10	2010	578, 579	2110	598, 599

- (Note 1) Note that the number to specify in order to display the preset value is 2000 greater than the counter number specified by the program, and the number to specify in order to display the integrated value is 2100 greater than the counter number.
- (Note 2) The number to specify in order to display the BCD bit pattern is the address number specified by the program.

6.1 Display

- (1) Press the **PARAM** key and output the PC screen.
Refer to Secitons 1 and 2 for details.
- (2) Press the **N** key.
- (3) Use the DATA key to set the counter number(number + 2000)
- (4) Press the **INPUT** key. The counter number is displayed in the NO. field, and the preset value or integrated value is displayed in the DATA field.

6.2 Setting

- (1) Set the NC operation mode to MDI mode.
- (2) Turn the MEMORY PROTECT switch (machine operation panel) to OFF (KEY signal to “1”).
- (3) Press tha **PARAM** key and output the PC screen.
- (4) Press the **N** key.
- (5) Use the DATA key to set the counter number (number + 2000).
- (6) Press the **INPUT** key.
- (7) Press the **P** key.
- (8) Use the DATA key to set the desired numerical value.
- (9) Press the **INPUT** key. The numerical value set in (8) is set in the specified counter number.
- (10) Turn the MEMORY PROTECT switch (machine operation panel) to ON (KEY signal to “0”).

7. Setting and didplaying the keep relay, sequence control section parameter, and table control data

7.1 Display

These data are displayed by specifying the address used by the program as described in Section 3 “Signal display”.

7.2 Setting

The setting method is the same as described for the timer in Section 5. However, specify the bit pattern.
The following table shows the correspondence between the address used in the program and the number to specify for the setting.

Address specified by the program		Number specified for CRT display
PC-A	PC-B	
600	600	3001
601	601	3002
602	602	3003
603	603	3004
	604	3005
	605	3006
	606	3007
	607	3008
	608	3009
	609	3010
	610	3011
	611	3012
	612	3013
	613	3014

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8. Setting and displaying the data table

The data table is generally used to store random ATC pot and tool number correspondence tables.

8.1 Clearing the data table

- (1) Set the NC operation mode to MDI mode.
- (2) Turn the MEMORY PROTECT switch (machine operation panel) to OFF (KEY signal to "1").
- (3) Press the **PARAM** key and output the PC screen.
- (4) Press the **N** key.
- (5) Use the DATA key to set 4999.
- (6) Press the **INPUT** key.
- (7) Press the **P** key.
- (8) Use the DATA key to set 9999.
- (9) Press the **INPUT** key. The above operations clear the entire data table to zeros.
- (10) Turn the MEMORY PROTECT switch (machine operation panel) to ON (KEY signal to "0").

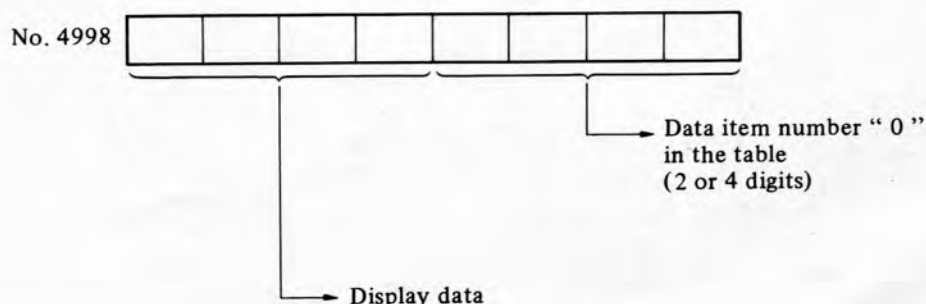
8.2 Setting and displaying operations

These operations are the same as the ones in Section 6 "Setting and displaying the counter". However, the number to specify for CRT display is 4000 greater than the number in the table. The following table shows these numbers.

	Number specified on MDI & CRT	Number in the table	Address
PC-A	4000	0	608
	4001	1	609
	⋮	⋮	⋮
	4030	30	638
PC-B For BCD 2 digits	4000	1	614
	4001	1	615
	⋮	⋮	⋮
	4099	99	713
PC-B For BCD 4 digits	4000	0	614, 615
		1	616, 617
	⋮	⋮	⋮
	4060	60	734, 735

8.3 Special display

By specifying No. 4998 on the PC screen, the data table display data and contents of number "0" in the table are:



Appendix 14 Fuse specifications

Location	Symbol	Rate (A)	Apecification	Remarks
Input unit	F1, F2	10	A60L-0001-0036#PC1-10	
			A60L-0001-0042#JG1-10	
	F3	0.32	A60L-0001-0046#0.32	
	F4 ~ 6	15	A60L-0001-0036#PC1-15	Value depends on transformer specification
		20	A60L-0001-0036#PC1-20	
		30	A60L-0001-0036#PC1-30	
	F7 ~ 9	40	A60L-0001-0042#JG1-40	
Stabilizing unit	F11, F12	5	A60L-0001-0101#P450H	
Velocity control unit	F7 ~ 9	1	A60L-0001-0046#1.0	On the firing PCB. For X axis, 4th axis.
	F1 ~ 3	15	A60L-0001-0118	For DC motor model 0.5
		30	A60L-0001-0036#PC1-30	For DC motor model 10, 20, 30, 10H
		40	A60L-0001-0036#PC1-40	For DC motor model 20H, 30H
	F4 ~ 6	1, 3	S. Fab 250#402A P413	For DC motor model 10, 20, 30, 10H, 20H, 30H,

Each unit uses same symbol (F1 - - -). So please take care of each symbol.

Appendix 15 Lubrication oil of tape reader**PROPERTY OF ROCOL OIL (ROCOL ASO)**

Appearance		Black Fluid
Specific Gravity	15/4°C	0.91
Reaction		Neuter
Flash Point	°C	196
Viscosity (cst)	38.7°C	100
	98.9°C	9.5
Viscosity Index		75
Pour Point	°C	Below -25
Total Acid Value	mg KOH/Gr	0.02
Residual Carbon	Wt%	0.14
Corrosion, Cu 100°C for 3Hr		pass
Base oil		Mineral oil
SAE Viscosity Standard		SAE #30
Pressure Prrof Test (four-ball tester)	kg/cm ²	4.5
Ditto Abrasion	mm	1.07

PROPERTY OF ROCOL PASTE (ROCOL A.S.P.)

Appearance		Black
Specific Gravity		1.43
Miscibility	60W/25°C	280 ~ 300
Dropping point	°C	more than 70
Volatile matter 100°C X24Hr Wt%		0.40
Corrosion, Cu		> Ia
Waterproof	38°C X1Hr Wt%	4.35
Oxidation Stability 100°C X100Hr kg/cm ²		0.80
Pressure Proof test (four-ball tester)	kg/cm ²	9.0
Ditto Abrasion	mm	1.45

Base oil of ROCOL PASTE (ROCOL ASP)

Viscosity	100°F	45 ~ 55 cst
	210°F	6 ~ 7 cst
Flash Point	°C	192
Pour Point	°C	-37.5

PROPERTY OF LAUNA-OIL

Item \ Brand No.	Launa-20	Launa-40	Launa-100
Reaction	neuter	neuter	neuter
Specific Gravity 15/4 °C	0.8993	0.9095	0.9081
Flash Point °C	173	211	216
Viscosity cst	@30°C	20.65	36.70
	@50°C	10.44	17.04
	@100°F	15.50	26.46
	@210°F	3.54	5.06
Viscosity Index	124	134	117
Pour Point °C	-32	-40	-40
Volatile Matter wt% 98°C for 5Hr	0.04	0.03	0.02
Color Union	1 1/2 (-)	1 1/2 (-)	1 1/2
Total Acied Value mg KOH/g	0.21	0.20	0.10
Corrosion, Cu 100°C for 3Hr	1A	1A	1A
Friction Value	0.14	0.13	0.14
Rust Preventing Characteristics h	24 up	24 up	24 up
Thermal Stability 140°C for 6Hr	pass	pass	pass
Angle of Contact 30°C for 24Hr	11.4	16.4	18.2

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Appendix 16 SELF-DIAGNOSTIC FUNCTION OF 14" COLOR GRAPHIC UNIT

1. Self Diagnosis

- (1) The following are always tested when the power is on:

- (a) EROM test
- (b) Character RAM test
- (c) Check of interface with NC control unit
- (d) Work RAM test

The result of each test and the content of an error, if any, are displayed on the CRT.

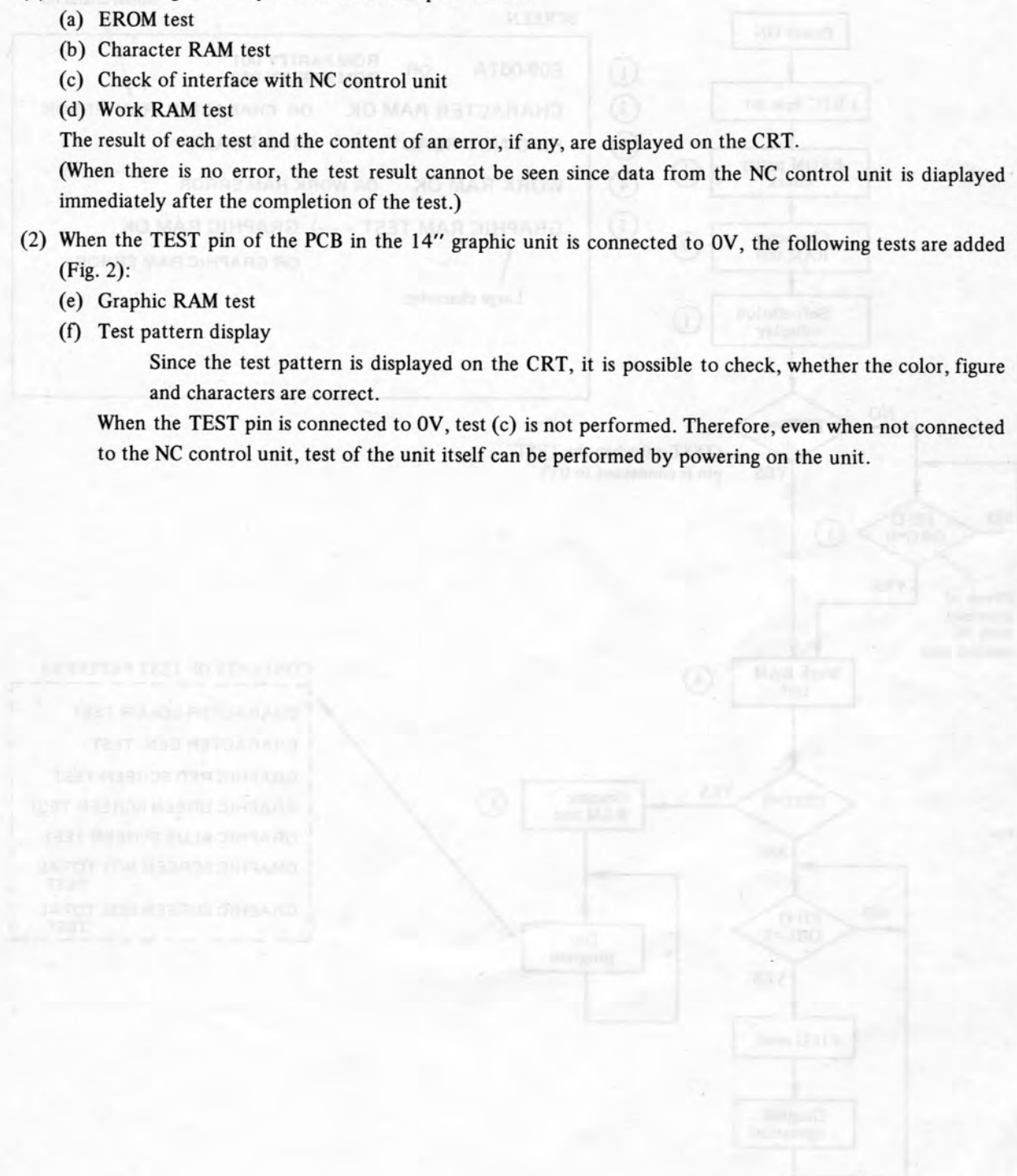
(When there is no error, the test result cannot be seen since data from the NC control unit is displayed immediately after the completion of the test.)

- (2) When the TEST pin of the PCB in the 14" graphic unit is connected to 0V, the following tests are added (Fig. 2):

- (e) Graphic RAM test
- (f) Test pattern display

Since the test pattern is displayed on the CRT, it is possible to check, whether the color, figure and characters are correct.

When the TEST pin is connected to 0V, test (c) is not performed. Therefore, even when not connected to the NC control unit, test of the unit itself can be performed by powering on the unit.



2. Flow Chart and Contents Displayed

The flow chart and contents displayed are shown in Fig. 1.

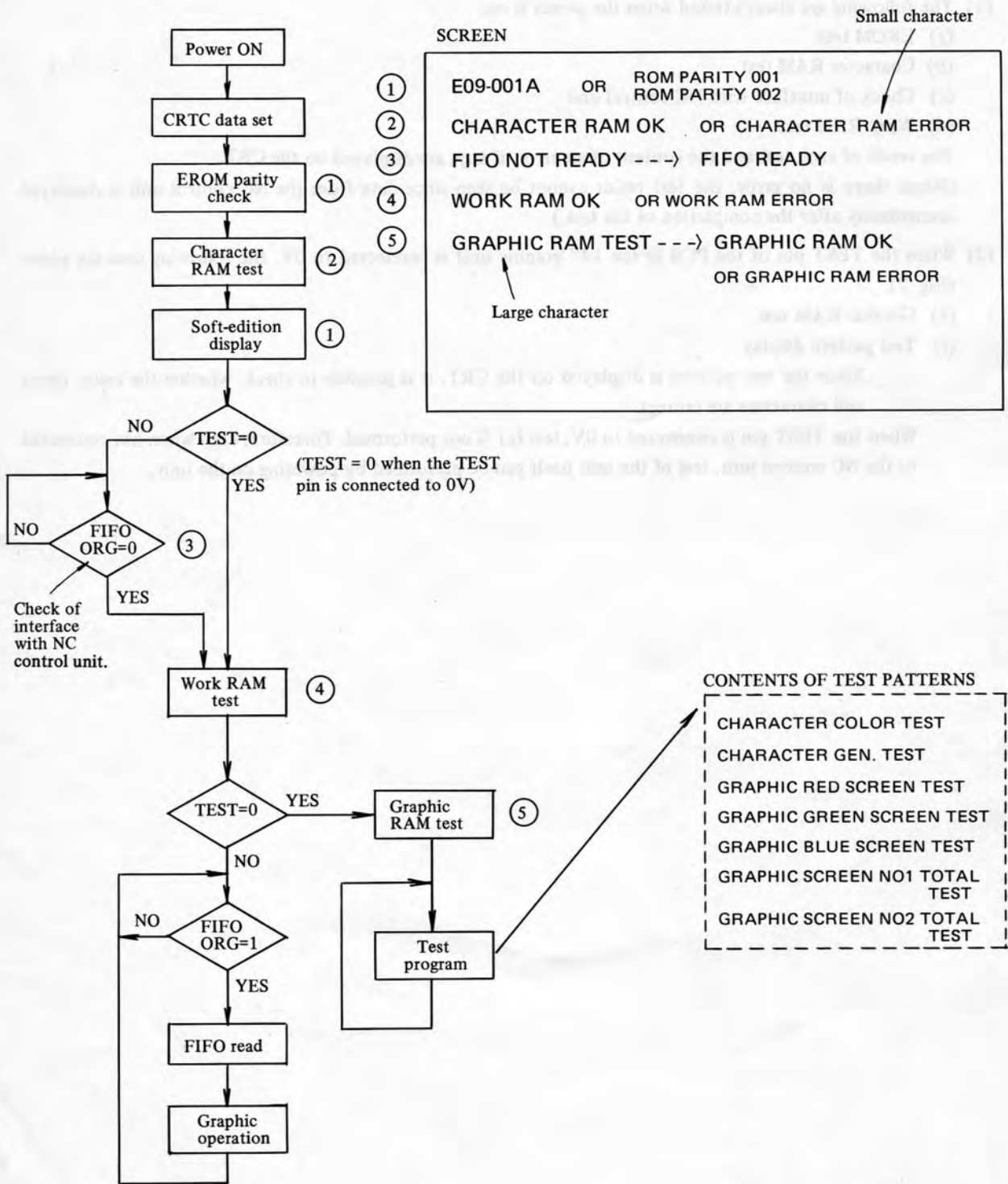
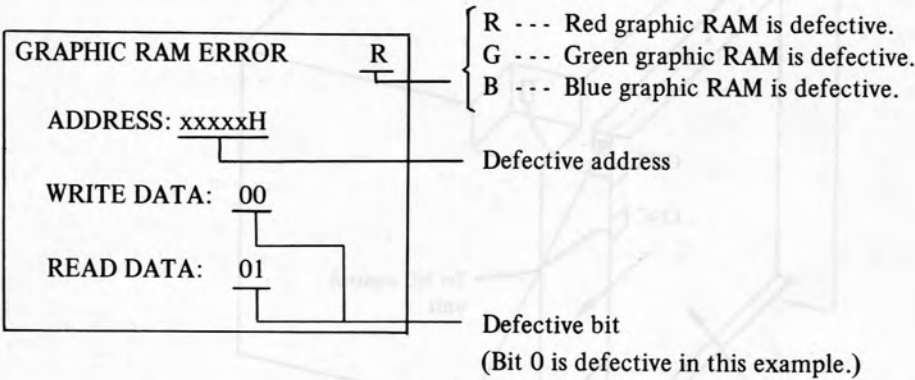


Fig. 1

3. Descriptions on Error Display

ROM PARITY 001 ----- E09001 EROM is defective.
ROM PARITY 002 ----- E09002 EROM is defective.
CHARACTER RAM ERROR --- Character RAM is defective.
WORK RAM ERROR ----- Work RAM is defective.

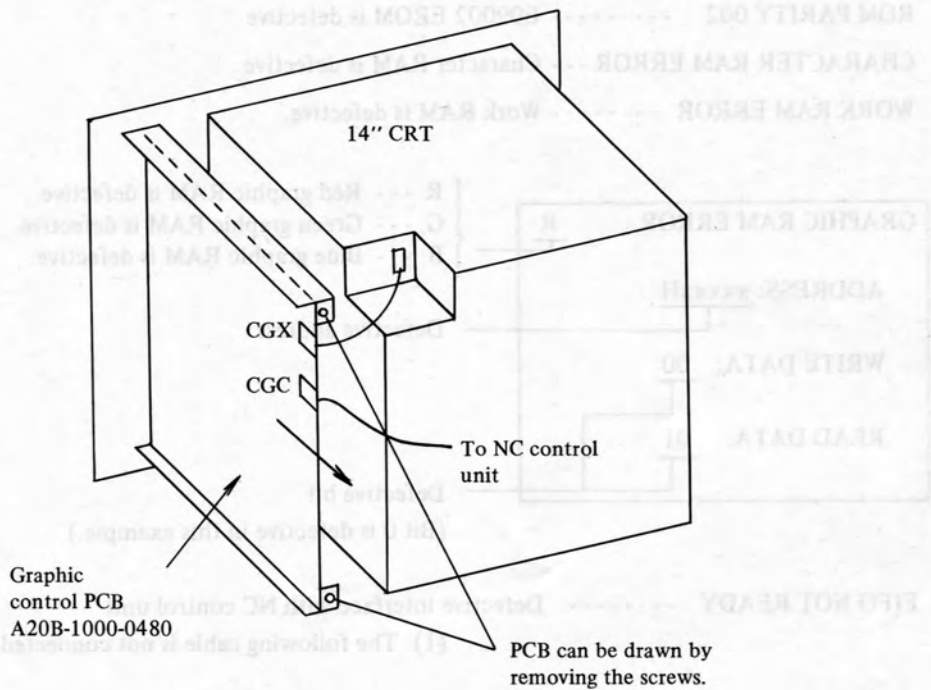


FIFO NOT READY ----- Defective interface with NC control unit
(1) The following cable is not connected or is defective.

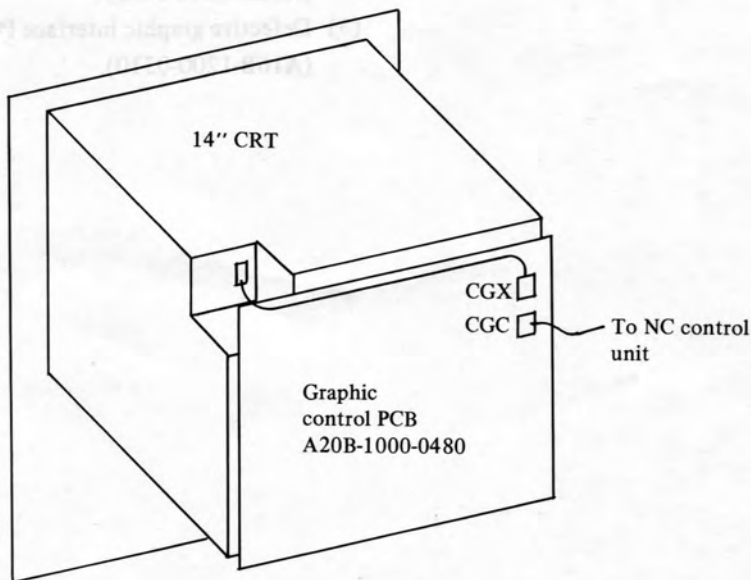


- (2) Defective graphic control PCB (A20B-1000-0480)
- (3) Defective graphic interface PCB (A16B-1200-0310)

4. PCB Mounting Positions



Horizontal 14" color graphic unit



Vertical 14" color graphic unit

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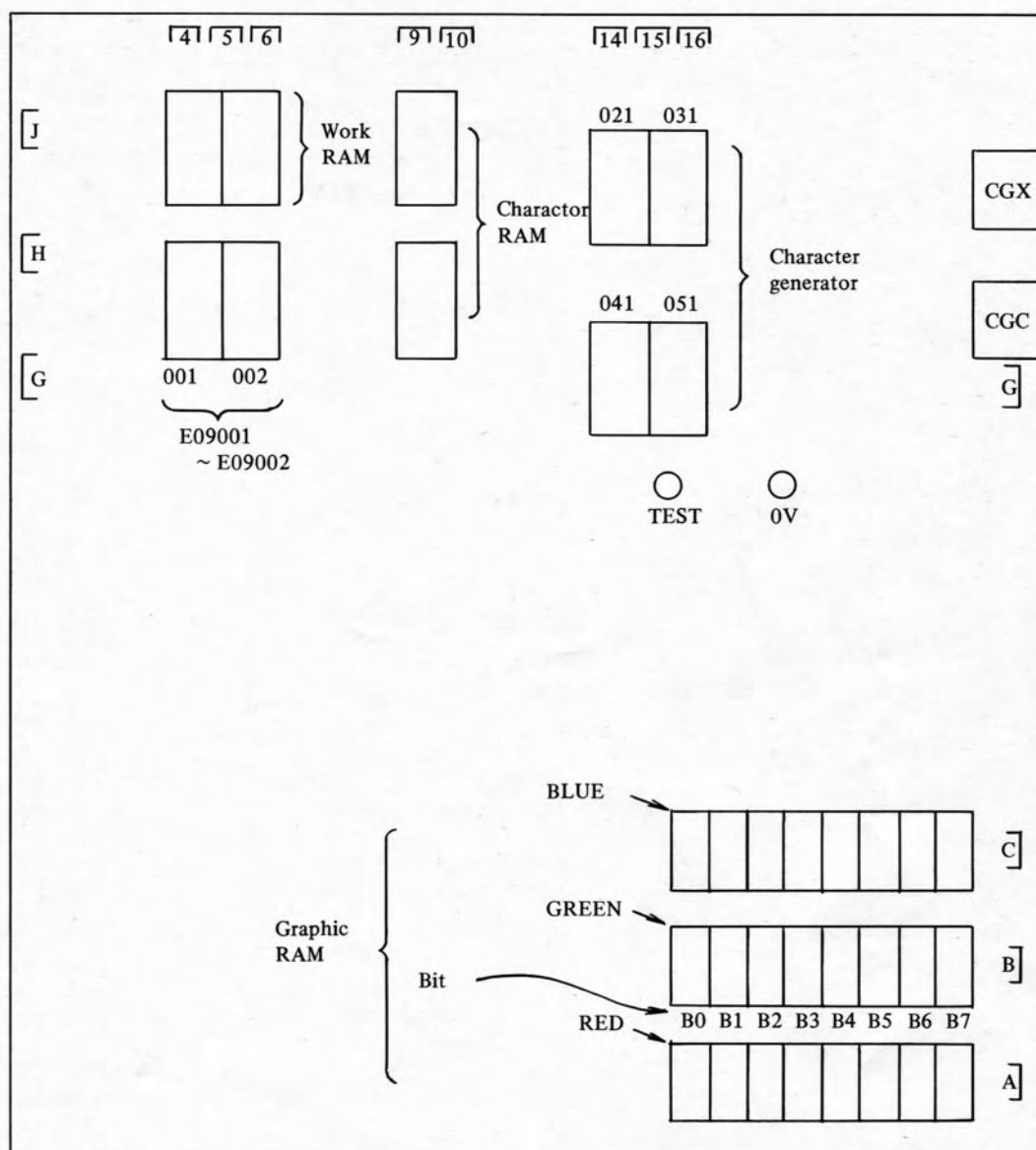


Fig. 2 Mounting diagram for graphic control PCB
(A20B-1000-0480)

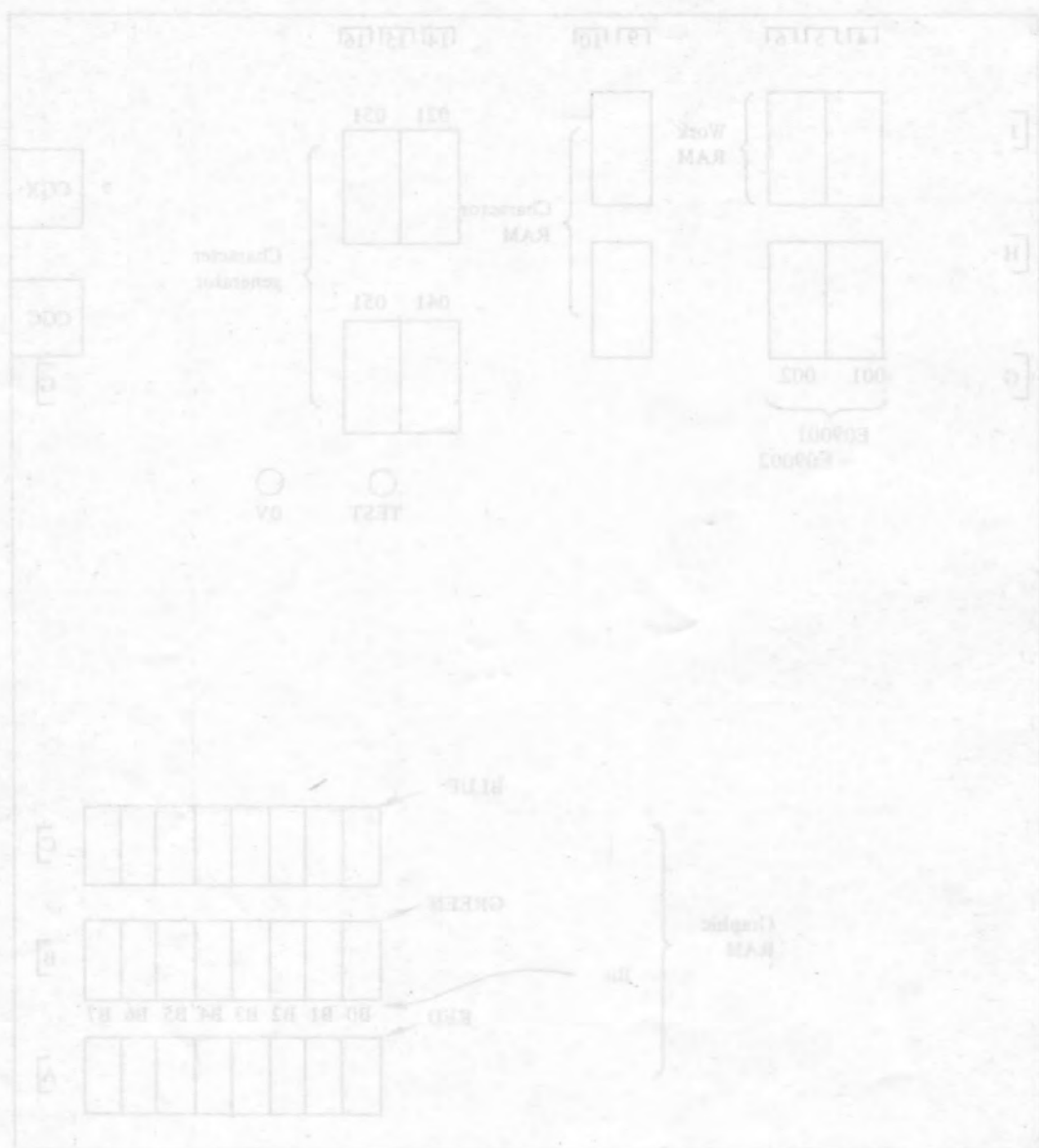


Fig. 5 Mounting diagram for graphic control PCB
[A308-1000-0180]

Revision Record

FANUC SYSTEM 6M-MODEL B MAINTENANCE MANUAL (B54045E)

02	'84, 01		- Parameters and alarms on conversational programming function and multi-handle function have been added. - Setting on additional axis PCB has been updated. - Replacing method of PCBs has been explained in 7. - Bubble memory initializing method has been explained in Appendix 5. - Maintenance of 9" character display unit has been updated. 14" color CRT self-diagnostic function has been added in Appendix 16.			
01	'82, 11		_____			
Edition	Date		Contents	Edition	Date	Contents

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