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POS	ITEM	SETTING CONDITION						REMARKS
		VARIABLE RESISTOR	CHECK-PIN	SHORTING	SETTING AND CHECK			
6	TACHO-GENERATOR VOLTAGE COMPENSA-TION	RV4			1) NORMALITY 5 SCALES 2) USE FOR FINE ADJUSTING OF LOOP GAIN. REFER TO MAINTENANCE MANUAL OF NC.			
7	CURRENT LIMITER SETTING SEE NOTE 5	RV5			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 IS 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. *MARK IS TOTAL EDITION OF PCB.
5. CURRENT LIMITER FUNCTION IS APPLIED FOR PCB EDITION 02B OR LATER.
6. SETTING OF S15.

5 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

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Table 6.2.1 (c) Type of check terminal

CHECK TERMINAL	SYMBOL	MEANING		CHECK TERMINAL	SYMBOL	MEANING
CH 1		3/4X VCMD		CH11	PWA	PWM CKT OUTPUT FOR DRIVER A
2	TSA	TACHO-GENERATOR SIGNAL		12	PWB	PWM CKT OUTPUT FOR DRIVER B
3	OV	OV		13	PWC	PWM CKT OUTPUT FOR DRIVER C
4	OV			14	PWD	PWM CKT OUTPUT FOR DRIVER D
5		COMPENSATION C.K.T.		15	+24V	+24V
6				16	+15V	+15V
7	TRIANGLE WAVE		SEE FIG. 2.	17	-15V	-15V
8	CUR-RENT	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	DIS-CHARGE	DISCHARGE MONITOR SEE FIG. 3.				

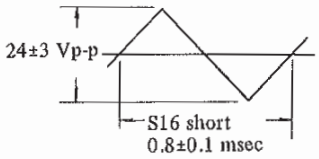


Fig. 2

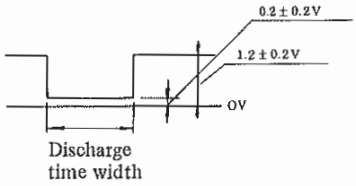


Fig. 3

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LED DISPLAY

NAME	MEANING
PRDY (GREEN LED)	POSITION CONTROL READY END 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) CONTINUITY CHECK: 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 BAD. 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 BAD.
OVC (RED LED)	OVERCURRENT ALARM (SET RV3) MOTOR LOAD IS TOO HEAVY.
TGLS (RED LED)	MOTOR RUNAWAY ALARM VELOCITY FEEDBACK SIGNAL IS LOST. 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.

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6.3 Setting and Adjustment on PCB for Velocity Control Unit for Analog Servo AC Servo Motor

6.3.1 Parts location on PCB

1) For AC servo motor Model 2-0 - Model 30R
   a) PCB A20B-1000-0560 (Edition number E)

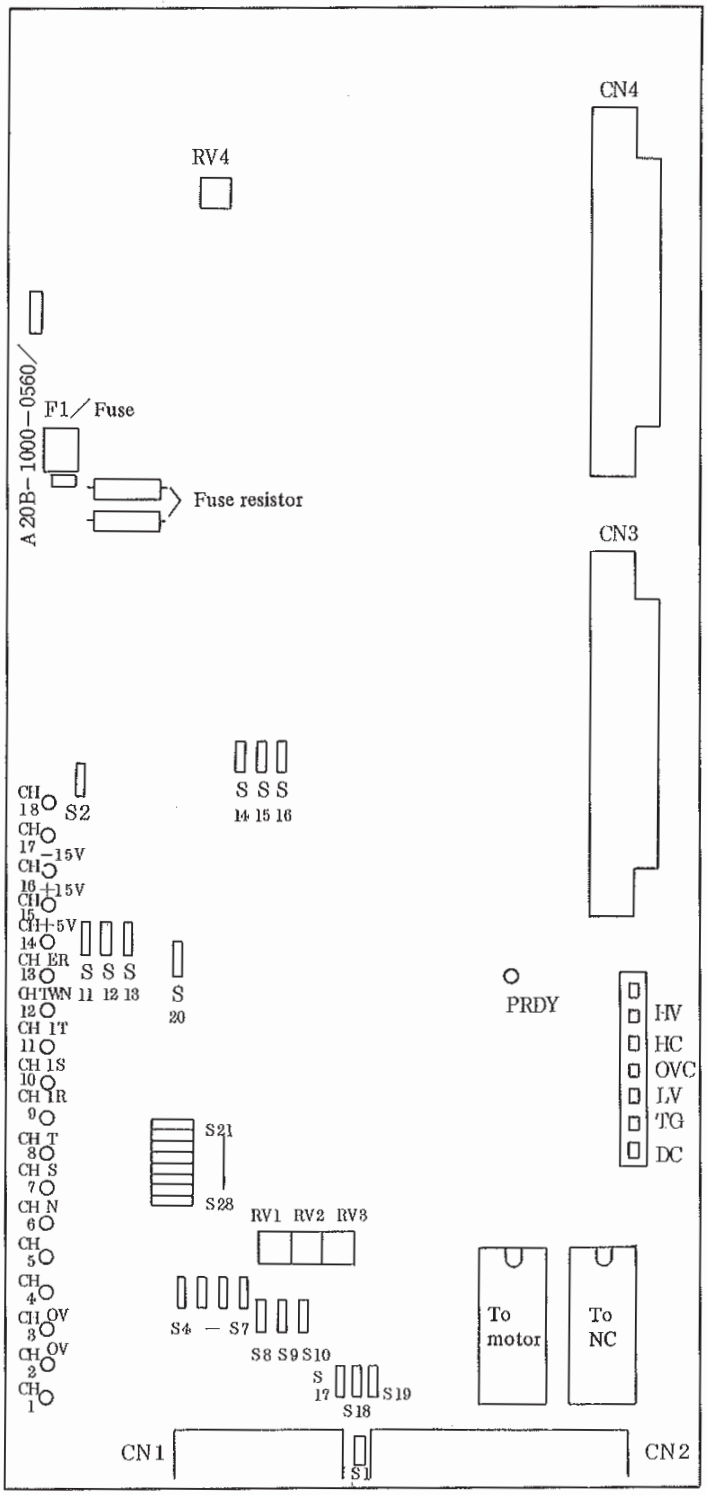


Fig. 6.3.1 (a) Parts location on the PCB A20B-1000-0560

Note) Parts location on PCB may be changed without notice.

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b) PCB A20B-1000-0560 (Edition number F or subsequent)

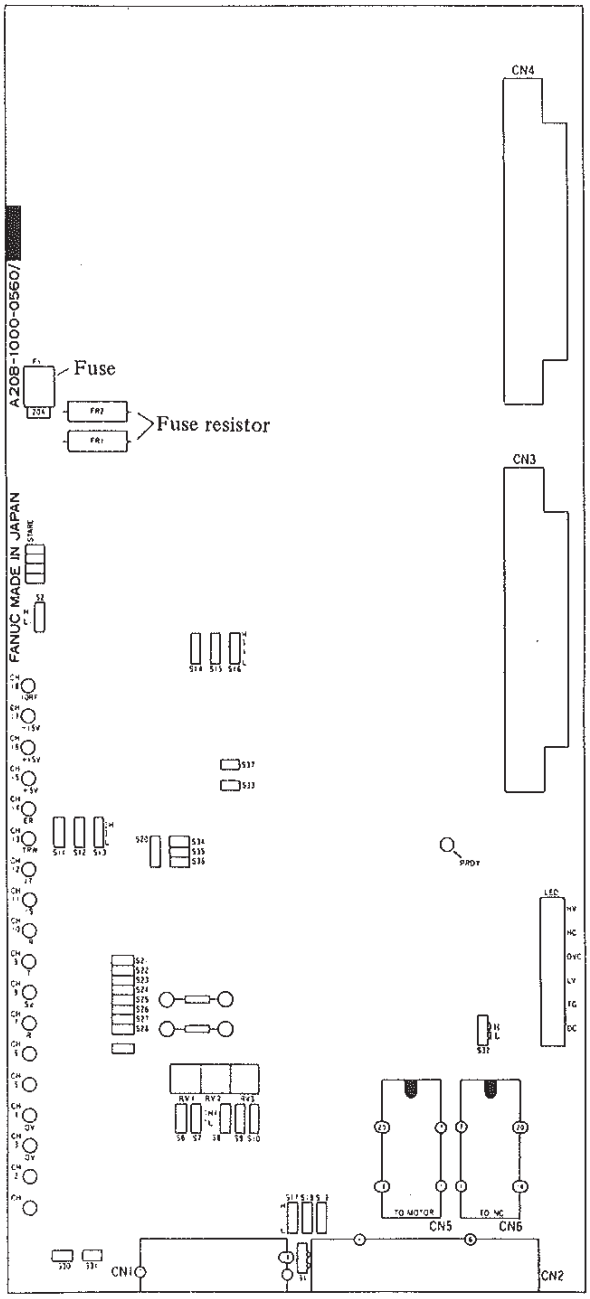


Fig. 6.3.1 (b) Parts location on the PCB A20B-1000-0560

Note) Parts location on PCB may be changed without notice.

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2) For AC servo motor Model 4-0, 3-0
   a) PCB A20B-1000-0590 (Edition number A)

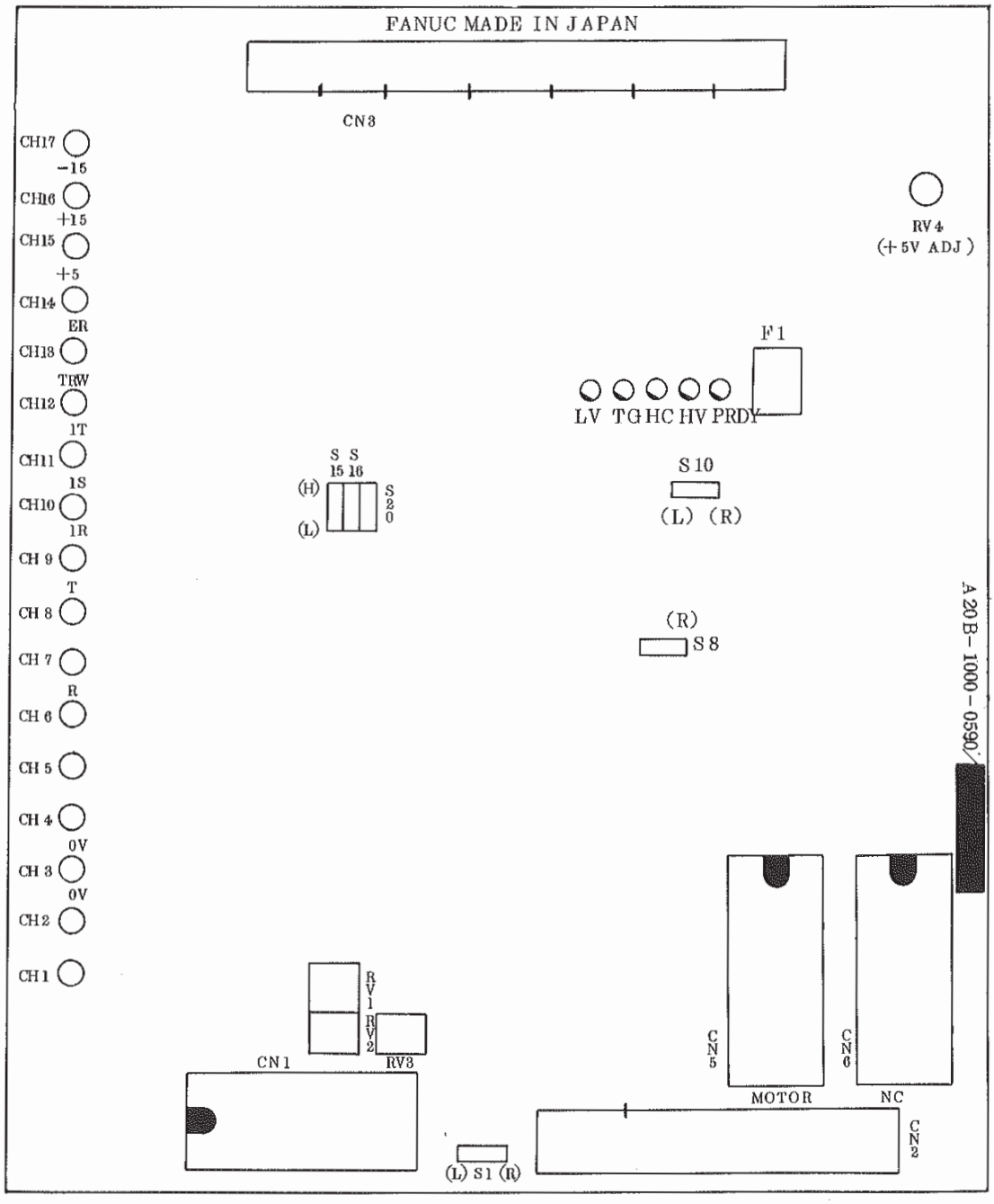


Fig. 6.3.1 (c) Parts location on the PCB A20B-1000-0590

Note) Parts location on PCB may be changed without notice.

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b) PCB A20B-1000-0590 (Edition number B or subsequent)

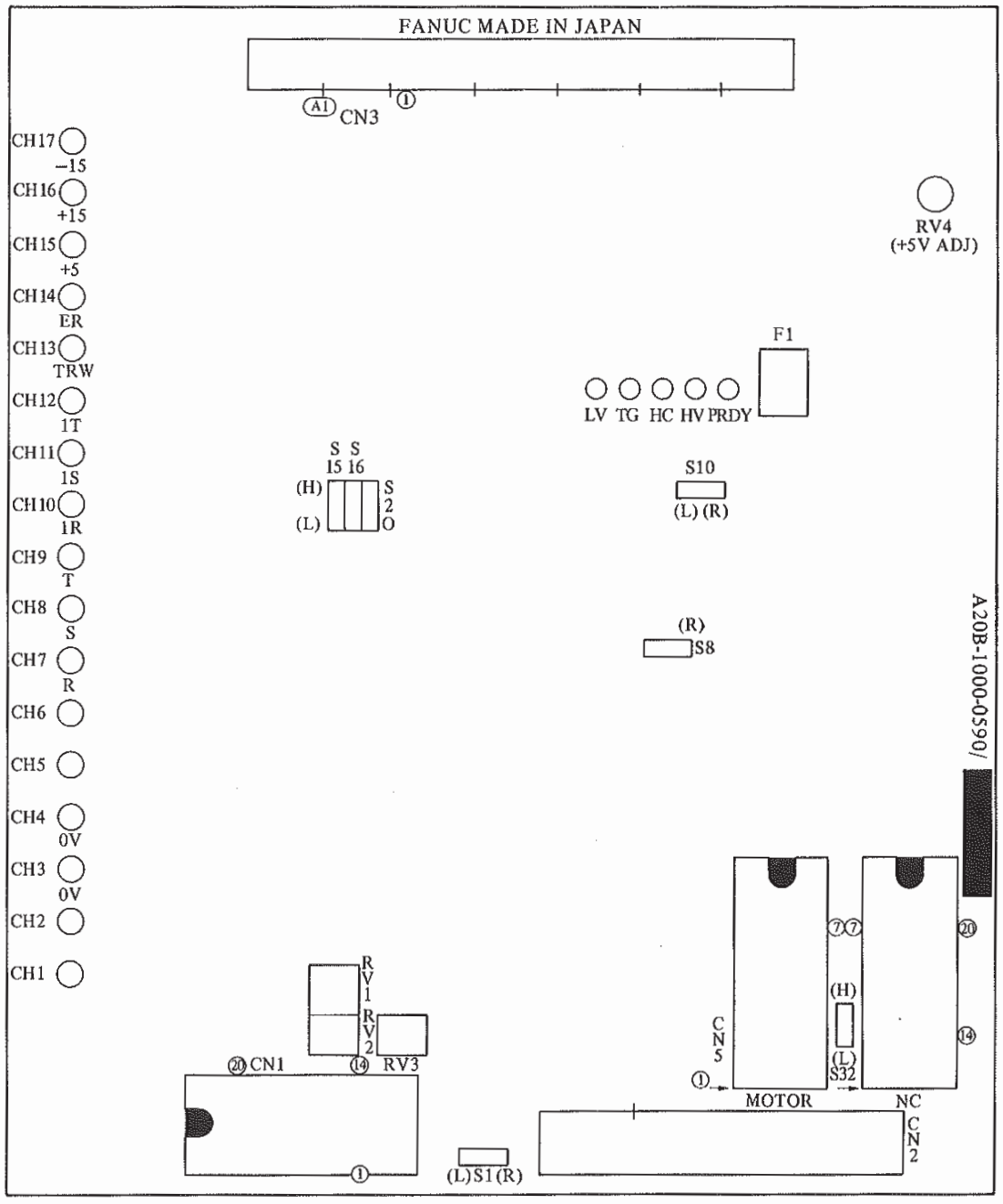


Fig. 6.3.1 (d) Parts location on the PCB A20B-1000-0590

Note) Parts location on PCB may be changed without notice.

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c) PCB A20B-1000-0600

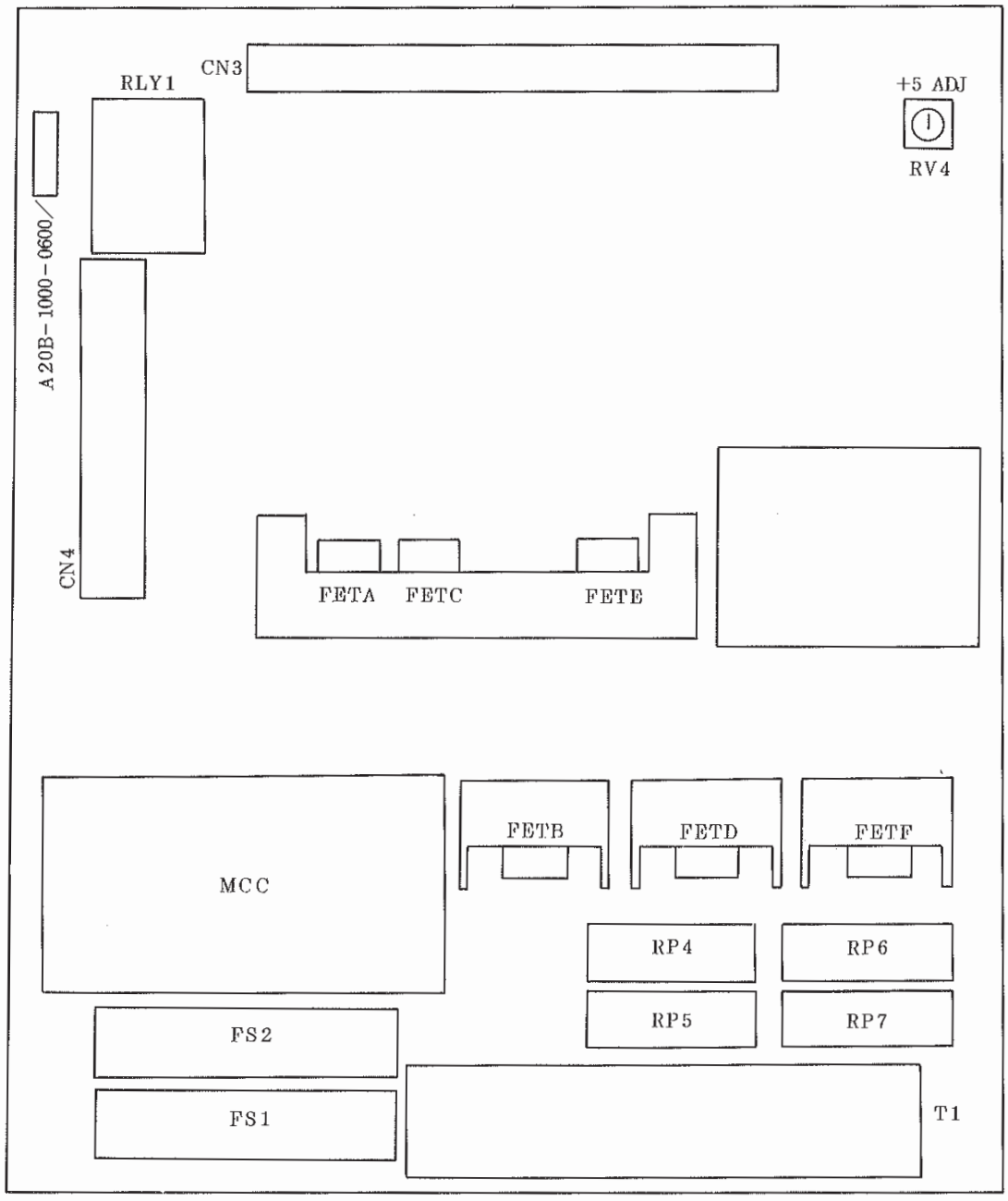


Fig. 6.3.1 (e) Parts location on the PCB A20B-1000-0600

Note) Parts location on PCB may be changed without notice.

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3) Model 5-0
a) PCB A20B-1001-0420

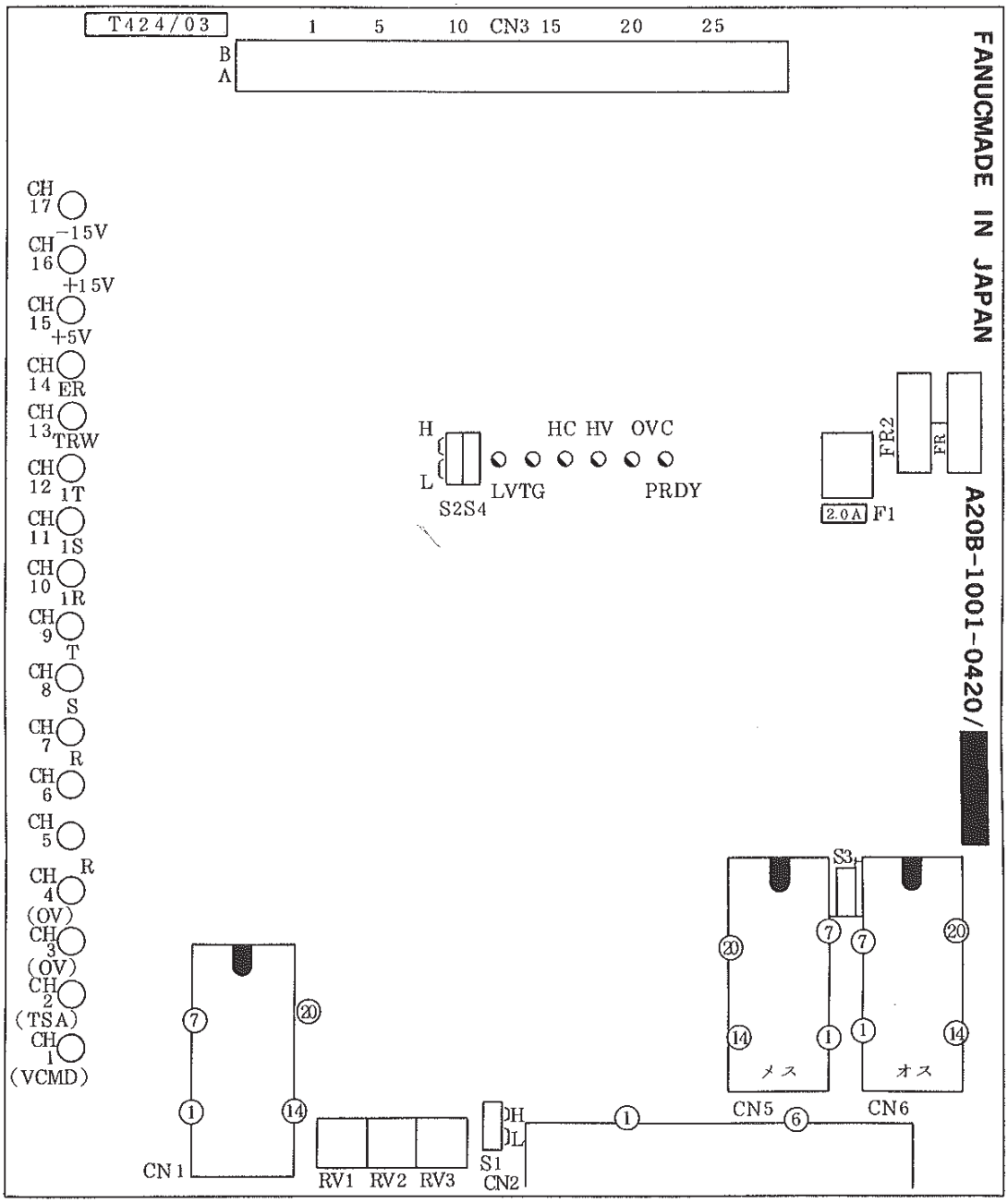


Fig. 6.3.1 (f) Parts location on the PCB A20B-1001-0420

Note) Parts location on PCB may be changed without notice.

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b) PCB A20B-1001-0410

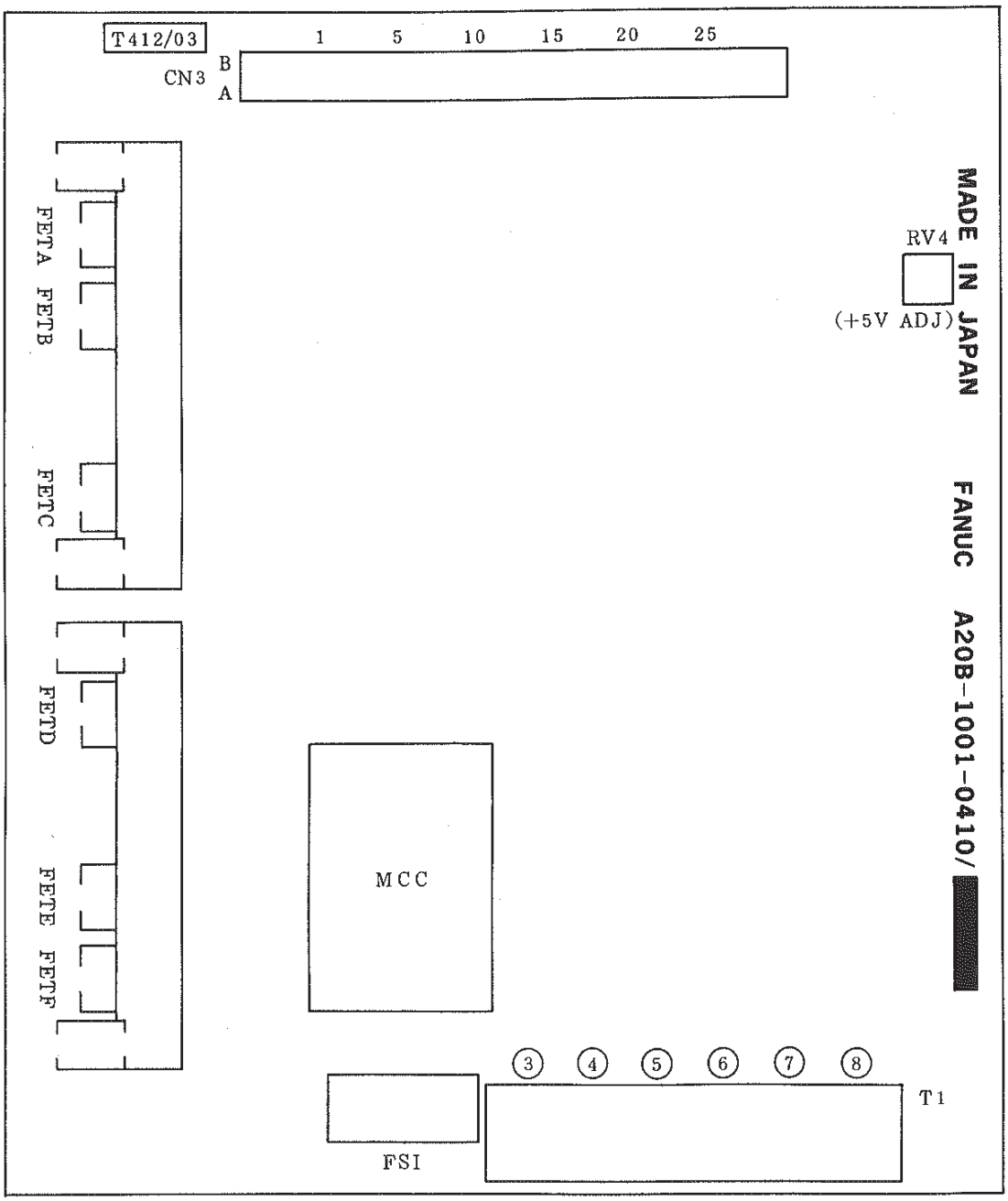


Fig. 6.3.1 (g) Parts location on the PCB A20B-1001-0410

Note) Parts location on PCB may be changed without notice.

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4) For 2-axis control AC servo unit (analog servo)
   a) A16B-1200-0520 (Mother board)

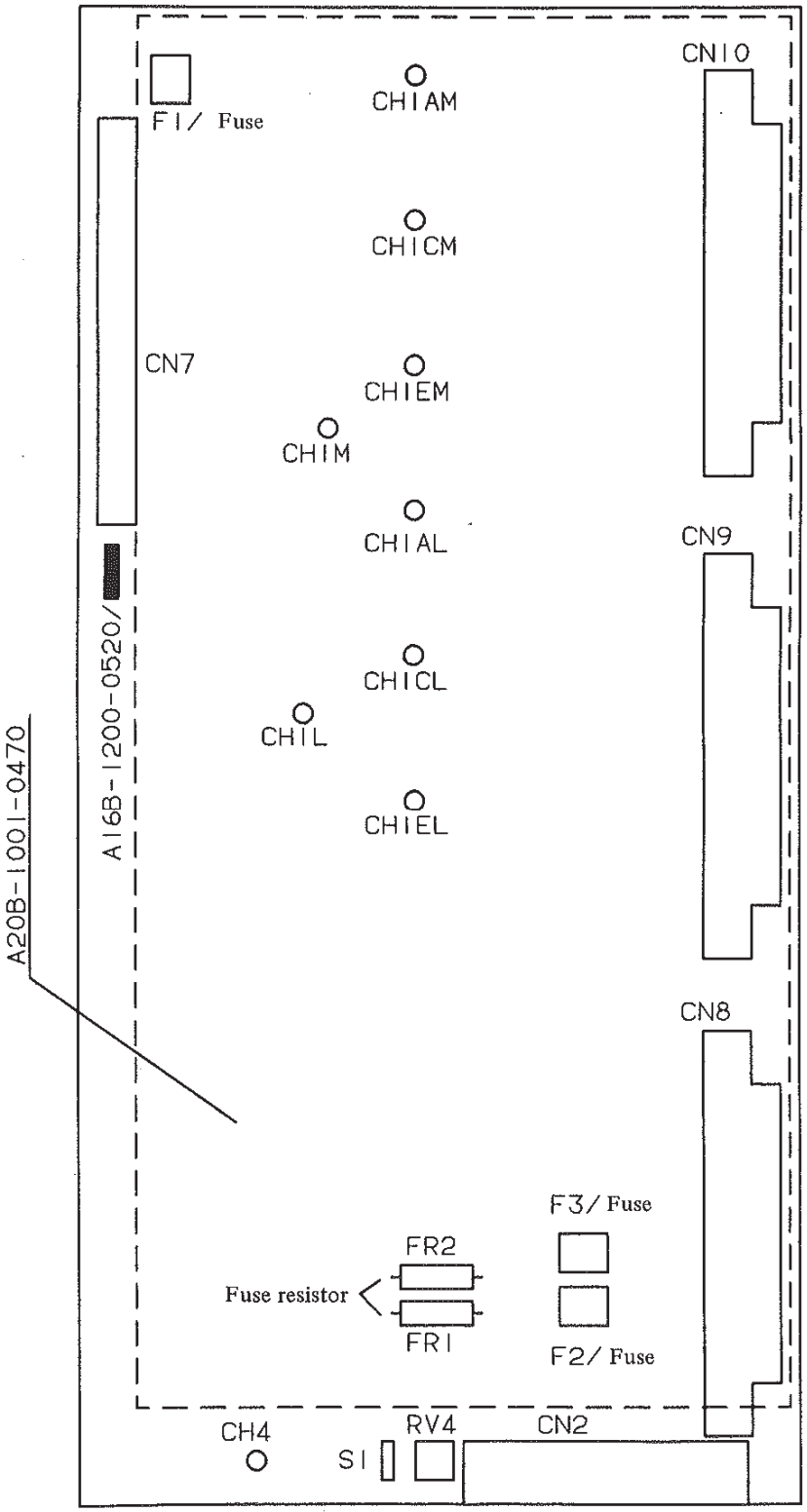
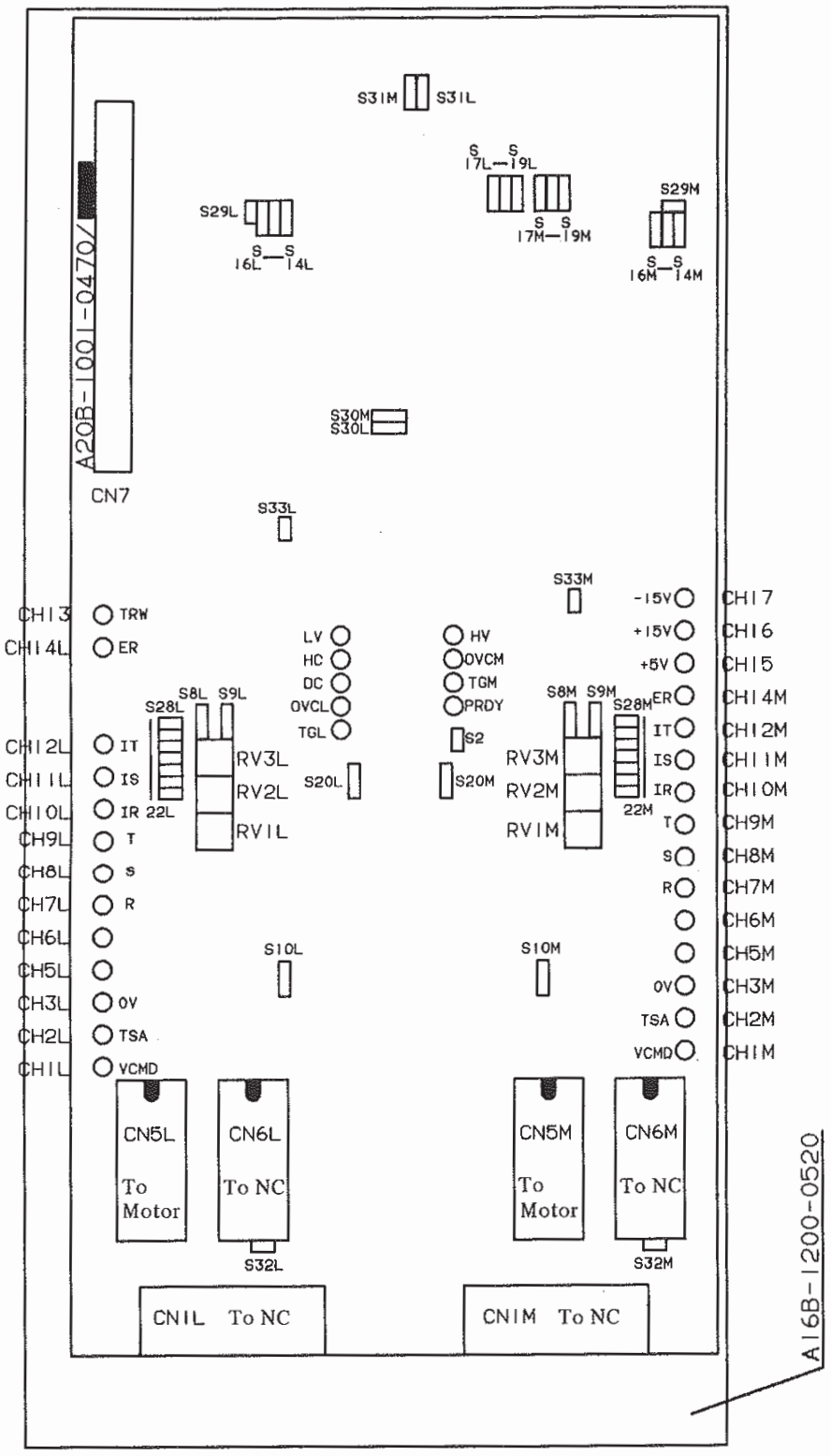


Fig. 6.3.1 (h) Parts location on the PCB A16B-1200-0520

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b) A20B-1001-0470 (Child board)



Note 1: Two PCB is 1 sets.
Note 2: Part location on PCB may be changed without notice.

Fig. 6.3.1 (i) Parts location on the PCB A20B-1001-0470

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5) For 3-axis control AC servo unit (analog servo)
   a) PCB A20B-1001-0770

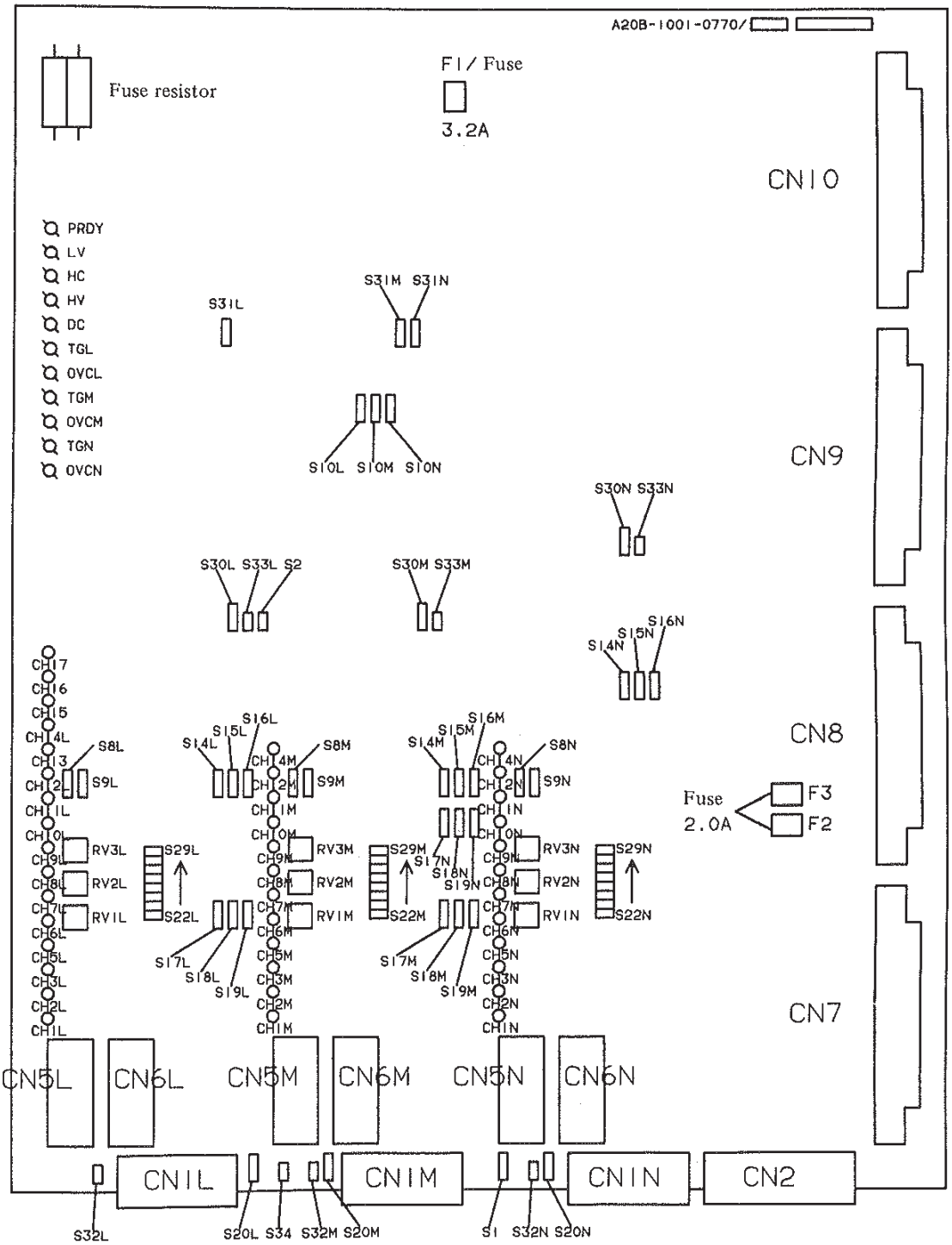


Fig. 6.3.1 (j) Parts location on the PCB A20B-1001-0770

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6.3.2 Setting terminal

1) For AC servo motor Model 2-0 to 30R
   a) PCB A20B-1000-0560 (Edition number F or subsequent)

Table 6.3.2 (a)

Setting terminal	Standard setting						Remarks
	2-0,1-0	0,5	10	20M	20,30	30R	
S 1	L	L	L	L	L	L	TOH setting (Note 1)
S 2	L	L	L	L	L	L	DC alarm setting (Note 2)
S 6	H	H	H	H	H	H	Compensation circuit setting
S 7	H	H	H	H	H	H	
S10	H	H	H	H	H	H	TG alarm enable (Note 3)
S11	H	H	L	L	L	H	Current loop gain setting
S12	H	H	L	L	L	H	
S13	H	H	L	L	L	H	
S17	H	H	H	H	H	L	Current limit setting
S18	H	L	L	L	H	H	
S19	H	H	H	H	H	H	
S20	H	H	H	H	H	H	Absolute code output enable (Note 4)
S32	L	L	L	L	L	L	Setting for absolute pulse coder (Note 5)

Setting terminal	2-0, 1-0, 0, 5, 10, 20M, 20, 30, 30R Pulse coder			Remarks
	2000P	2500P	3000P	
S 8	L	L	H	Pulse coder F/V gain setting
S 9	H	L	L	
S14	L	H	H	Pulse coder, pole number, and pulse number setting
S15	H	L	L	
S16	H	L	H	

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Setting terminal	Standard setting							Remarks
	2-0,1-0	0	5	10	20M	20,30	30R	
S21								Compensation circuit setting
S22	o	o	o	o	o	o	o	
S23	o	o	o					VCMD gain setting (Note 6)
S24	o	o	o	o	o	o	o	F/V circuit filter setting
S25	o	o	o	o	o	o	o	Compensation circuit setting
S26								
S27								
S28								
S29								
S30								External analog current limitter setting
S31								Connect CN1(19) pin and OV
S33		o						OVC alarm level setting
S34			o					
S35		o	o	o	o			Current feedback gain setting (Note 7)
S36		o	o	o	o			
S37								Speed feedback gain setting (Note 8)
S38		o	o	o	o			Compensation circuit setting

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b) PCB A20B-1000-0560 (Edition number E)

Table 6.3.2 (b)

Setting terminal	Standard setting					Remarks
	2-0,1-0	0,5	10,20M	20,30	30R	
S 1	L	L	L	L	L	TOH setting (Note 1)
S 2	L	L	L	L	L	DC alarm setting (Note 2)
S 4	L	L	L	L	L	Compensation circuit setting
S 5	L	L	L	L	L	
S 6	H	H	H	H	H	
S 7	H	H	H	H	H	
S10	H	H	H	H	H	TG alarm enable (Note 3)
S11	H	H	L	L	H	Current loop gain setting
S12	H	H	L	L	H	
S13	H	H	L	L	H	
S17	H	H	H	H	L	Current limit setting
S18	H	H	H	H	H	
S19	H	H	H	H	H	
S20	H	H	H	H	H	Absolute code output enable (Note 4)
S32	L	L	L	L	L	Setting for absolute pulse coder (Note 5)

Setting terminal	2-0, 1-0, 0, 5, 10, 20M, 20, 30, 30R Pulse coder			Remarks
	2000P	2500P	3000P	
S 8	L	L	H	Pulse coder F/V gain setting
S 9	H	L	L	
S14	L	H	H	Pulse coder, pole number, and pulse number setting
S15	H	L	L	
S16	H	L	H	

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Setting terminal	Standard setting					Remarks
	2-0,1-0	0,5	10,20M	20,30	30R	
S21						Compensation circuit setting
S22						
S23	o	o				VCMD gain setting (Note 6)
S24	o	o	o	o	o	F/V circuit filter setting
S25	o	o	o	o	o	Compensation circuit setting
S26						
S27						
S28						
S29						
S30						External analog current limitter setting

c) PCB A20B-1000-0560 (Edition number C or D)

Table 6.3.2 (c)

Setting terminal	Standard setting					Remarks
	2-0,1-0	0,5	10	20,30	30R	
S 1	L	L	L	L	L	TOH setting (Note 1)
S 2	L	L	L	L	L	DC alarm setting (Note 2)
S 4	L	L	L	L	L	Compensation circuit setting
S 5	L	L	L	L	L	
S 6	H	H	H	H	H	
S 7	H	H	H	H	H	
S10	H	H	H	H	H	TG alarm enable (Note 3)
S11	H	H	L	L	H	Current loop gain setting
S12	H	H	L	L	H	
S13	H	H	L	L	H	

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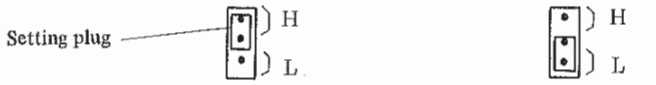
Setting terminal	Standard setting					Remarks
	2-0,1-0	0,5	10	20,30	30R	
S17	H	H	L	L	L	Current limit setting
S18	H	H	H	H	H	
S19	H	H	H	H	H	
S20	H	H	H	H	H	Absolute code output enable (Note 4)

Setting terminal	2-0, 1-0, 0, 5, 10, 20, 30, 30R Pulse coder			Remarks
	2000P	2500P	3000P	
S 8	L	L	H	Pulse coder F/V gain setting
S 9	H	L	L	
S14	L	H	H	Pulse coder, pole number, and pulse number setting
S15	H	L	L	
S16	H	L	H	

Setting terminal	Standard setting					Remarks
	2-0,1-0	0,5	10	20,30	30R	
S21						Compensation circuit setting
S22						
S23	o	o				VCMD gain setting (Note 6)
S24	o	o	o	o	o	F/V circuit filter setting
S25	o	o	o	o	o	Compensation circuit setting
S26						
S27						
S28						

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Note 1) If either power transformer or regenerative discharge unit is connected across terminals CN2 (4) and (5), set S1 to open (L side).
If neither power transformer nor regenerative discharge unit is connected across terminals CN2 (4) and (5), set S1 to short (H side).
2) Set S2 to open (L side), if the regenerative discharge unit is not mounted, and set it to short (H side), if the regenerative discharge unit is mounted.
3) Set S10 to L side, if it is needed to check with motor power cable disconnected.
4) If S20 is set at L side, absolute codes from the pulse coder is output to NC while VRDY is on. If VRDY is turned OFF, the alarm code is output. If S20 is set at H side, the alarm code is always output.
5) When the absolute value pulse coder is used, set S32 at H side.
6) If S23 is short-circuited, 7V/2000 rpm will be set. If it is open, 7V/1000 rpm will be set. If models 10, 20, and 30R are used over 1500 rpm, change the above settings and NC parameters (loop gain multipliers).
7) Models 0, 5, 10, and 20M only may be short-circuited. If S35 and S36 are short-circuited, conversion of current feedback signals (CH10, 11, 12) is 0.183 V/A.
8) If S37 is short-circuited, the rate feedback voltage is changed from 3V/1000 rpm to 1.5V/1000 rpm. Normally, set it in the open state.
9) The way of setting is shown as following figures.



(a) Setting of H side (b) Setting of L side

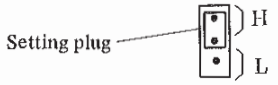
2) For Model 4-0, 3-0 (PCB A20B-1000-0590) (analog servo)

Table 6.3.2 (d)

Setting terminal	Pulse coder		Remarks
	2000P	2500P	
S 1	R		TOH setting (Note 1)
S 8	R	OPEN	Pulse coder F/V Gain
S10	L		TG alarm enable (Note 2)
S15	L	L	Pulse coder
S16	L	H	Pole number, pulse number setting
S20	L	L	
S32	L		For ABS pulse coder setting (Note 3)

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Note 1) If power transformer is connected across terminals CN2 (4) and (5), set S1 to open (R side).
If power transformer is not connected across terminals CN2 (4) and (5), set S1 to short (L side).
2) Set S10 to R side if it is needed to check with motor power cable disconnected.
3) If the absolute pulse coder is used set S32 at H side.
4) The way of setting is shown as following figures.



(a) Setting of H side



(b) Setting of L side



(c) Setting of L side



(d) Setting of R side

3) For Model 5-0 (analog servo)

Table 6.3.2 (e)

Terminal setting	Standard setting	Remarks
S 1	L	TOH setting (Note 1)
S 2	L	Pulse coder setting (Note 2)
S 3	L	Absolute pulse coder setting (Note 3)
S 4	L	TG, OVC alarm desable setting (Note 4)

Note 1) If the power transformer connected to CN2 (4) and (5), set S1 at L. If there is no connection, set S1 at H.
2) If the pulse coder is 1000P/rev, set S2 at L, and if 2000P/rev, set it at H.
3) If the absolute pulse coder is used, set S3 at H, and if not used set it at L.
4) If TG and OVC alarms are made invalid, set S4 at H.
5) If a 1000P/rev pulse coder is used, care should be taken in DMR setting. (DMR setting should be double that in a normal 2000P/rev pulse coder.)

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4) For 2-axis control AC servo unit (analog servo)
PCB A20B-1001-0470
A16B-1200-0520

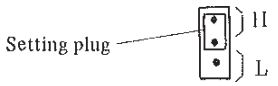
Table 6.3.2 (f)

Terminal setting	Standard setting		Remarks
	2-0,1-0	0,5	
S1	L	L	TOH setting (Note 1)
S2	x	x	DC alarm setting (Note 2)
S10L,M	H	H	TG alarm enable (Note 3)
S17L,M	H	H	Current limit setting
S18L,M	H	H	
S19L,M	H	H	
S20L,M	H	H	Absolute code output enable (Note 4)
S22L,M	o	o	Compensation circuit setting
S23L,M	o	o	VCMD gain setting (Note 5)
S24L,M	o	o	F/V circuit filter setting
S25L,M	x	x	Compensation circuit setting
S26L,M	x	x	
S27L,M	o	o	
S28L,M	x	x	
S29L,M	x	x	F/V input pulse width setting (Note 6)
S30L,M	Le	R	Current loop gain setting
S31L,M	H	H	TG alarm enable
S32L,M	o	o	Setting for absolute pulse coder (Note 7)
S33L,M	x	x	OVC alarm level setting

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Terminal setting	Pulse coder			Remarks
	2000P	2500P	3000P	
S 8L,M	L	L	H	Pulse coder F/V gain setting
S 9L,M	H	L	L	
S14L,M	L	H	H	Pulse coder pole number and pulse number setting
S15L,M	H	L	L	
S16L,M	H	L	H	

Note 1) If the power transformer is connected to terminals CN2 (4) and (5), set S1 at L side.
2) If the regenerative discharge unit is mounted, set S2 in the short-circuit state. If it is not mounted, set S2 in the open state.
3) If check is required without connection of the motor power cable, set S10 at L side.
4) If S20 is set at L side, absolute codes from the pulse coder is output to NC while VRDY is on. If VRDY is turned OFF, the alarm code is output. If S20 is set at H, the alarm code is always output.
5) If S23 is short-circuited, 7V/2000 rpm is set, and if it is open, 7V/1000 rpm is set.
6) If S29 is short-circuited, the velocity feedback voltage is changed from 3V/1000 rpm to 1.5V/1000 rpm. Normally, set it in the open state.
7) If ABS pulse coder is used, set S32 in the open state.
8) Setting operations are shown in the Fig. below.



(a) Setting of H side



(b) Setting of L side



(c) Setting of L side



(d) Setting of R side

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5) For 3-axis control AC servo unit (PCB A20B-1001-0770)

Table 6.3.2 (g)

Terminal setting	Standard setting		Remarks
	0/5	10	
S1	L	L	TOH setting (Note 1)
S2	x	x	DC alarm setting (Note 2)
S10L,M,N	H	H	TG alarm enable (Note 3)
S17L,M,N	H	H	Current limit setting
S18L,M,N	L	L	
S19L,M,N	H	H	
S20L,M,N	H	H	Absolute code output enable (Note 4)
S22L,M,N	o	x	Compensation circuit setting
S23L,M,N	o	x	VCMD gain setting (Note 5)
S24L,M,N	o	o	F/V circuit filter setting
S25L,M,N	x	x	Compensation circuit setting
S26L,M,N	x	x	
S27L,M,N	x	x	
S28L,M,N	x	x	
S29L,M,N	x	x	F/V input pulse width setting (Note 6)
S30L,M,N	L	L	Current loop gain setting
S31L,M,N	H	H	TG alarm enable
S32L,M,N	o	o	Setting for absolute pulse coder (Note 7)
S33L,M,N	x	x	OVC alarm level setting

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Terminal setting	Pulse coder			Remarks
	2000P	2500P	3000P	
S 8L,M,N	L	L	H	Pulse coder F/V gain setting
S 9L,M.N	H	L	L	
S14L,M,N	L	H	H	Pulse coder pole number and pulse number setting
S15L,M,N	H	L	L	
S16L,M,N	H	L	H	

Terminal setting	N system		Remarks
	0 series, 1 series 2 series, 3 series 6 series, 9 series	10/11/12/100/ 110/120 series	
S34	x	o	VRDY signal setting

Note 1) If the power transformer is connected to terminals CN2 (4) and (5), set S1 at L side.
2) If the regenerative discharge unit is mounted, set S2 in the short-circuit state. If it is not mounted, set S2 in the open state.
3) If check is required without connection of the motor power cable, set S10 at L side.
4) If S20 is set at L side, absolute codes from the pulse coder is output to NC while VRDY is on. If VRDY is turned OFF, the alarm code is output. If S20 is set at H, the alarm code is always output.
5) If S23 is short-circuited, 7V/2000 rpm is set, and if it is open, 7V/1000 rpm is set.
6) If S29 is short-circuited, the velocity feedback voltage is changed from 3V/1000 rpm to 1.5V/1000 rpm. Normally, set it in the open state.
7) If ABS pulse coder is used, set S32 in the open state.
8) Setting operations are shown in the Fig. below.



(a) Set at H side



(b) Set at L side

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6.3.3 Variable resistor

Table 6.3.3

Variable resistor	Standard setting	Remarks
RV1	40%	Gain setting
RV2	-	Offset voltage adjustment
RV3	-	Tachogenerator voltage adjustment
RV4	-	+5 V power supply fine adjustment

Note) RV2-RV4 have been adjusted at factory before the shipment.

6.3.4 Check terminals list

1) For 1-axis control AC servo unit

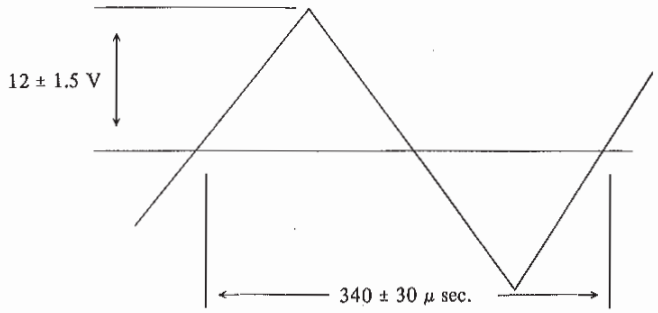
Table 6.3.4 (a)

Check terminal	Symbol	Description	
CH 1		a x velocity command voltage (Note 2)	
2		0.8 x tachogenerator voltage	
3	OV	OV	
4	OV	OV	
5		Compensation circuit	
6			
7	R	R-phase current command	
8	S	S-phase current command	
9	T	T-phase current command	
10	IR	R-phase current feedback	2.4V/A for motor 4-0,3-0 0.85V/A for motor 2-0,1-0 0.25V/A for motor 0,5,10 0.125V/A for motor 20,30 0.1V/A for motor 30R
11	IS	S-phase current feedback	
12	IT	T-phase current feedback	
13	TRW	Triangle wave (See Note 1)	
14	ER	Error voltage (Torque command)	
15	+5V	+5V	

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Check terminal	Symbol	Description
16	+15V	+15V
17	-15V	-15V
18	10RF	10V reference voltage

Note 1) Triangle wave
2) a = 0.344 when VCMD = 7 V/1000 rpm
a = 0.687 when VCMD = 7 V/2000 rpm



2) For 2-axis control AC servo unit

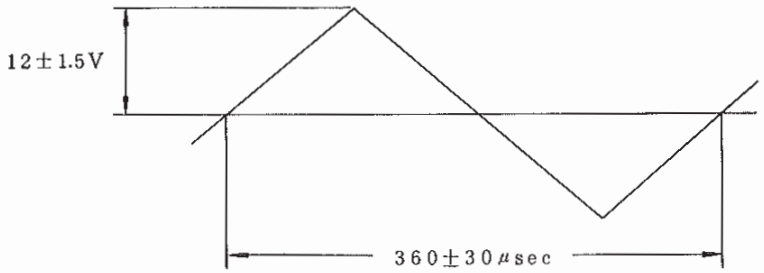
Table 6.3.4 (b)

Check terminal	Symbol	Description	
CH 1L,M	VCMD	a x velocity command voltage (Note 1)	
CH 2L,M	TSA	0.8 x velocity feedback voltage	
CH 3L,M	OV	OV	
CH 4	OV	OV	
CH 5L,M		Compensation circuit	
CH 6L,M			
CH 7L,M	R	R-phase current command	
CH 8L,M	S	S-phase current command	
CH 9L,M	T	T-phase current command	
CH10L,M	IR	R-phase current feedback	1.18 A/V (Motor 1-0, 2-0)
CH11L,M	IS	S-phase current feedback	
CH12L,M	IT	T-phase current feedback	4.00 A/V (Motor 0,5)

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Check terminal	Symbol	Description
CH13	TRW	Triangle wave (Note 3)
CH14L,M	ER	Error voltage (Torque command voltage) (Note 4)
CH15	+5V	+5V
CH16	+15V	+15V
CH17	-15V	-15V

Note 1) a = 0.344 when VCMD is 7V/1000 rpm
a = 0.687 when VCMD is 7V/2000 rpm
2) Setting terminal S4 is on the PCB A16B-1200-0520.
3) Waveform of triangle wave is as follows.



4) Motor load currents (peak values) can be monitored using the same conversion as CH10-12. Effective values can be obtain by multiplying $1/\sqrt{2}$.

3) For 3-axis control AC servo unit

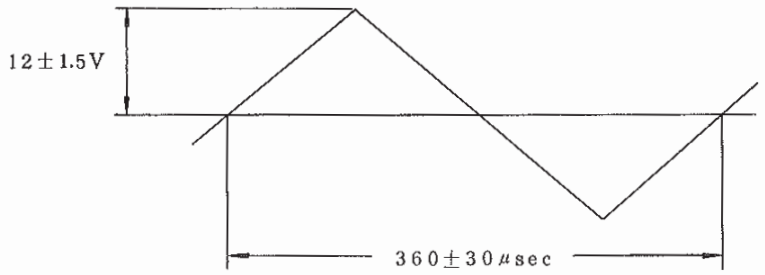
Table 6.3.4 (c)

Check terminal	Symbol	Description
CH 1L,M,N	VCMD	a x velocity command voltage (Note 1)
CH 2L,M,N	TSA	0.8 x velocity feedback voltage
CH 3L,M,N	OV	OV
CH 5L,M,N		Compensation circuit
CH 6L,M,N		
CH 7L,M,N	R	R-phase current command
CH 8L,M,N	S	S-phase current command

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Check terminal	Symbol	Description	
CH 9L,M,N	T	T-phase current command	
CH10L,M,N	IR	R-phase current feedback	5.45A/V (Motor 0, 5, 10)
CH11L,M,N	IS	S-phase current feedback	
CH12L,M,N	IT	T-phase current feedback	
CH13	TRW	Triangle wave (Note 2)	
CH14L,M,N	ER	Error voltage (Torquecommand)	
CH15	+5V	+5V	
CH16	+15V	+15V	
CH17	-15V	-15V	

Note 1) a = 0.344 when VCMD is 7V/1000 rpm
a = 0.687 when VCMD is 7V/2000 rpm
2) Waveform of triangle wave is as follows.



3) Motor load currents (peak values) can be monitored using the same conversion as CH10-12. The effective values can be obtained by multiplying $1/\sqrt{2}$.

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6.4 Setting and Adjustment on PCB for Velocity Amplifier for AC Servo Motor

6.4.1 Parts location on PCB

1) For Model 2-0 - Model 30R (digital servo)
   a) A16B-1200-0670

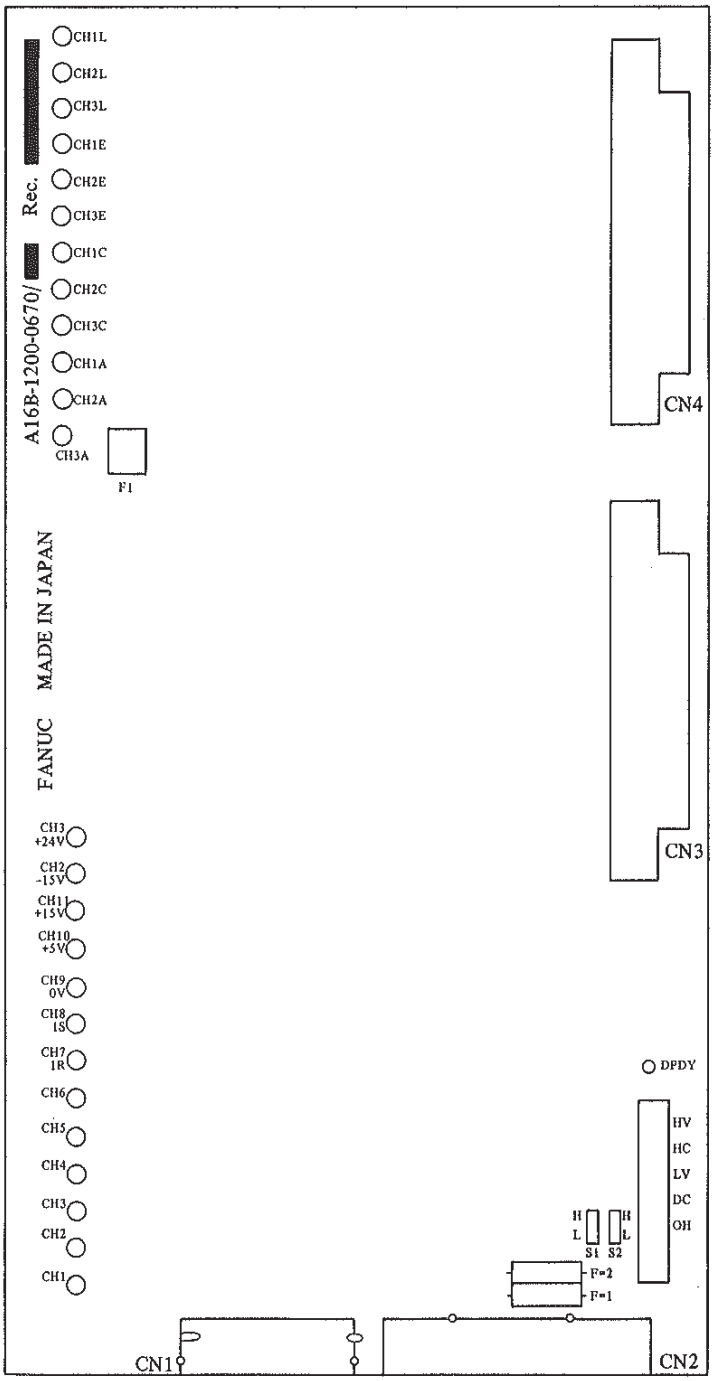
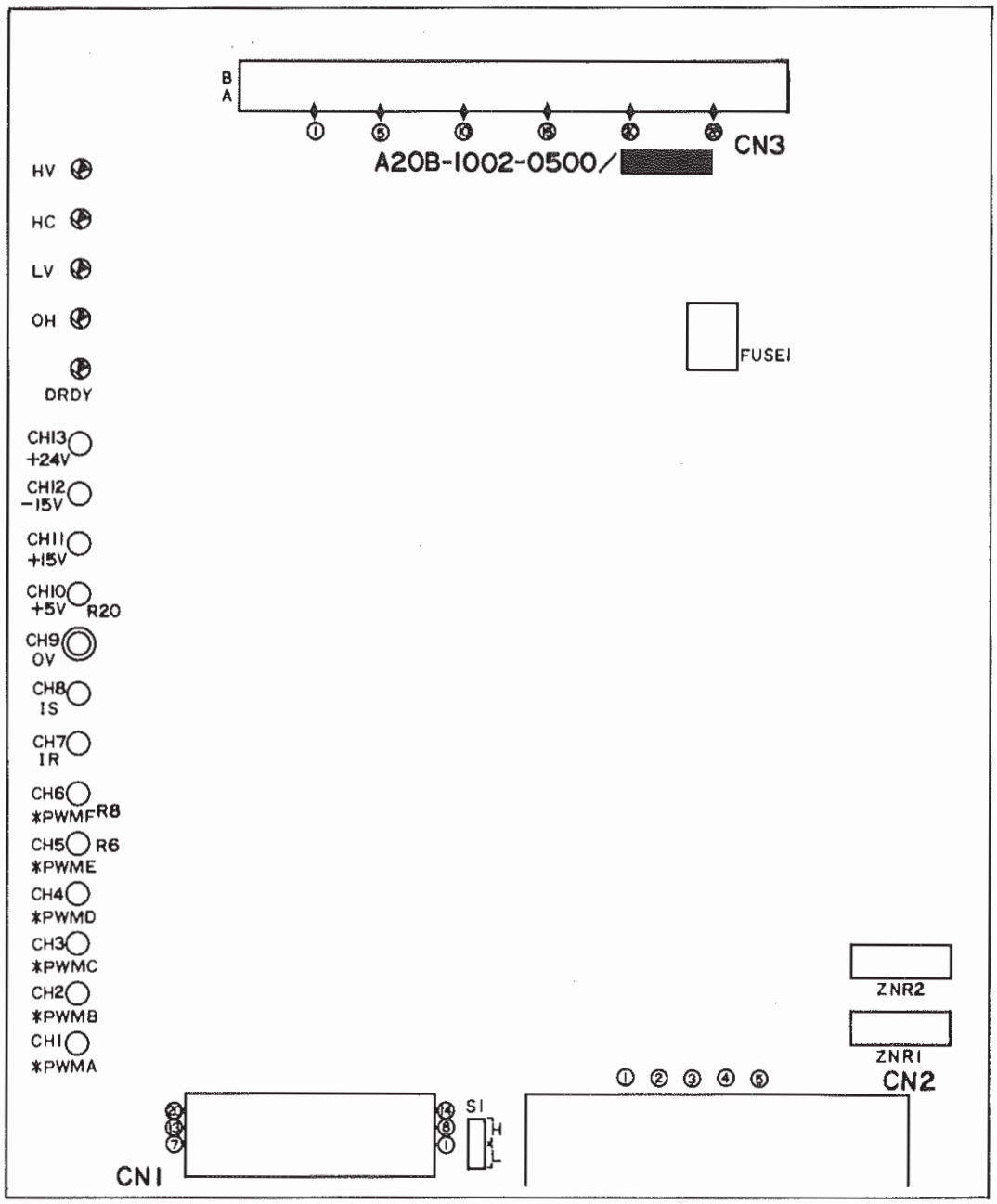


Fig. 6.4.1 (a) A16B-1200-0670

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2) For AC servo motor Model 4-0 and 3-0 (digital servo)
   a) A20B-1002-0500



A350-1002-T502/00
A350-1002-Z503/00

Fig. 6.4.1 (b) A20B-1002-0500

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b) For Model 4-0, 3-0 (A20B-1000-0600)

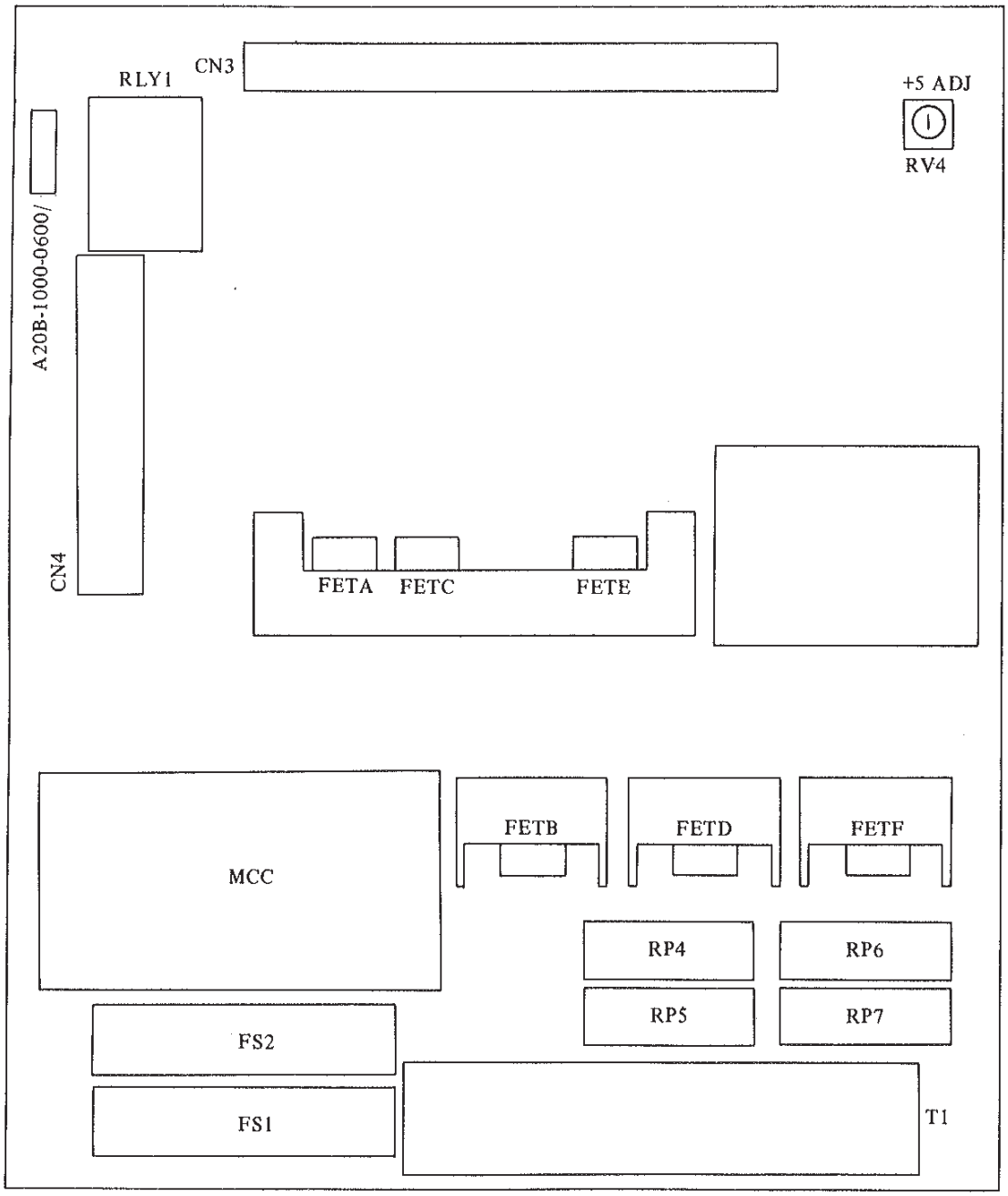


Fig. 6.4.1 (c) A20B-1000-0600

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3) For AC servo motor Model 5-0 (digital servo)
   a) A20B-1001-0430

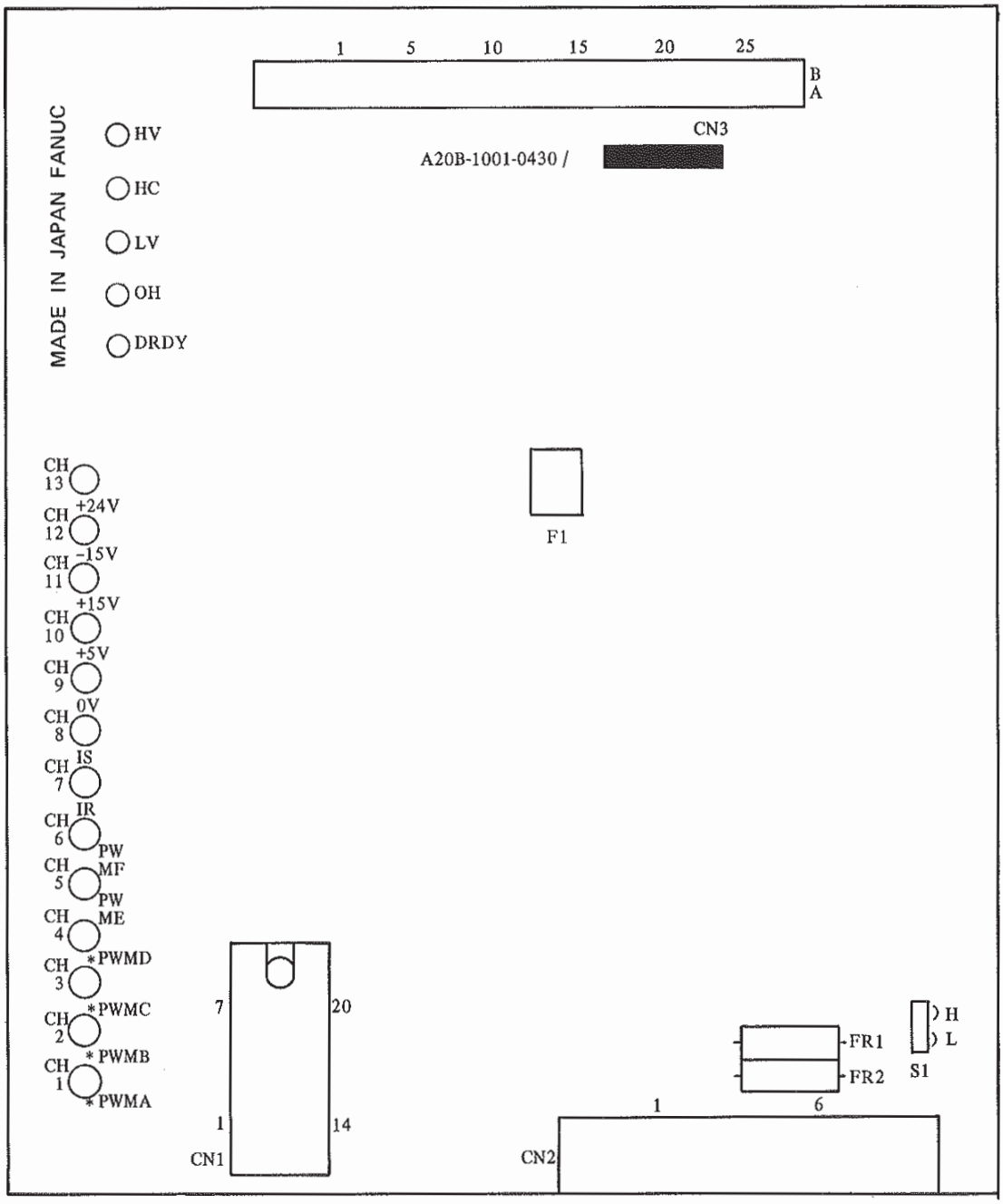


Fig. 6.4.1 (d) A20B-1001-0430

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4) Servo amplifier for 2-axis control
   a) A16B-1200-0680

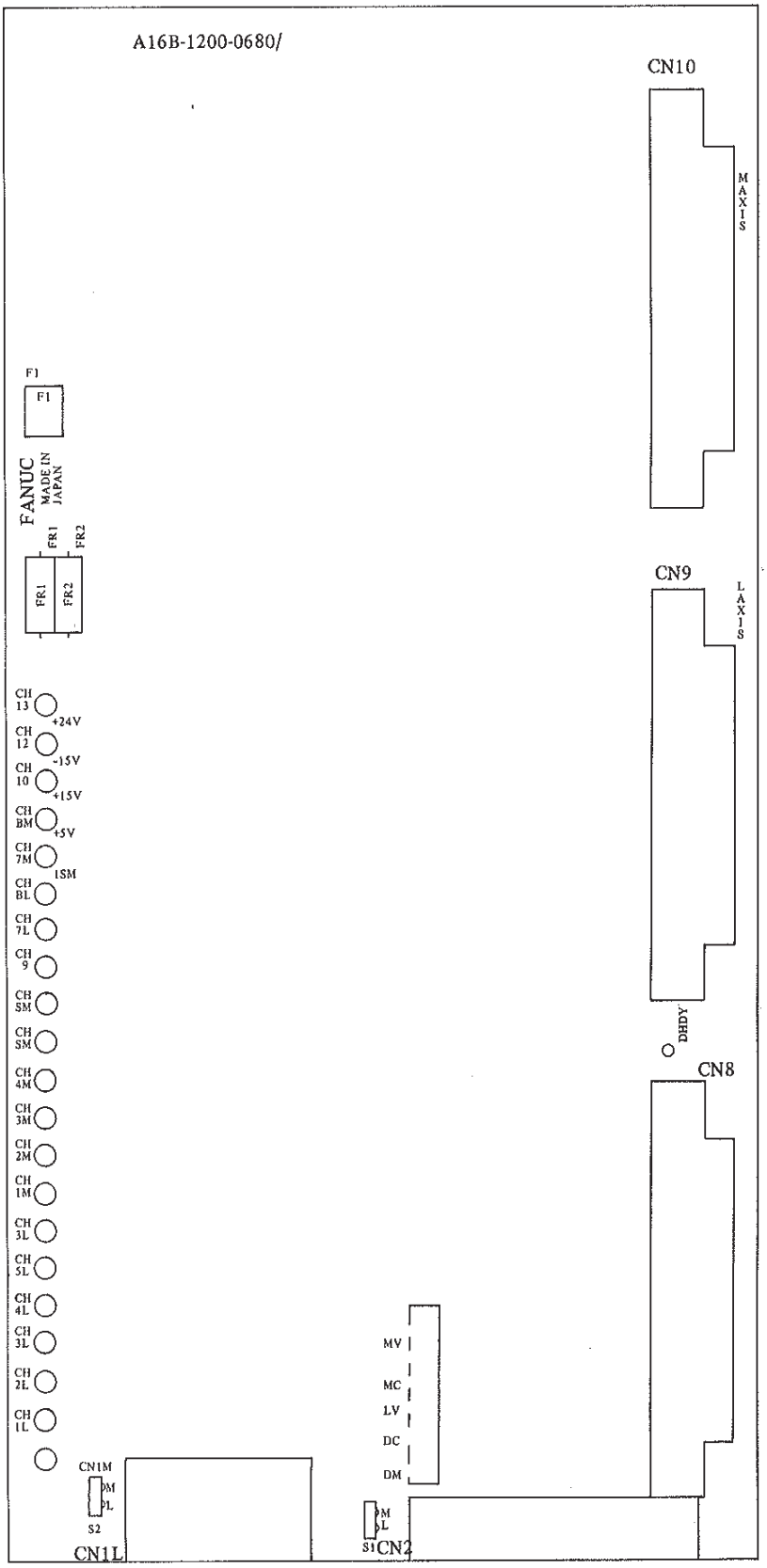


Fig. 6.4.1 (e) A16B-1200-0680

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5) Servo amplifier for 3-axis control
   a) A20B-1002-0280

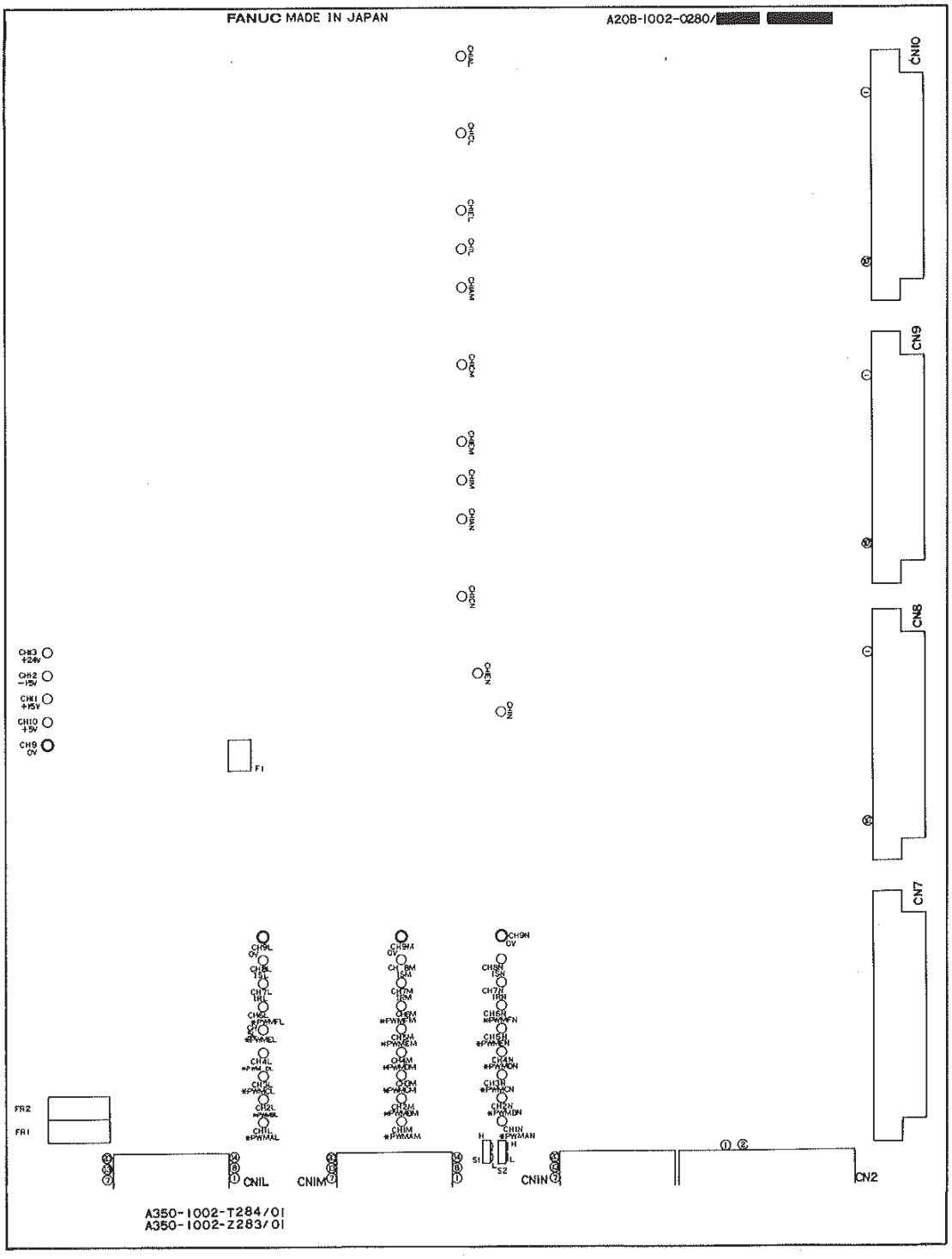


Fig. 6.4.1 (f) A20B-1002-0280

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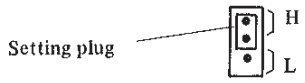
6.4.2 Setting terminal

1) For Model 2-0 - 30R, 5-0, 4-0, 3-0 and servo amplifier for 2 axes control (digital servo)
   Settings are S1 and S2 only for digital servo.

Setting terminal	Standard setting	
S1	L	TOH setting (See Note 1)
S2	L	DC alarm setting (See Note 2) This setting is not provided to servo amplifier for model 5-0.

Note 1) If either power transformer or regenerative discharge unit is connected across terminals CN2 (4) and (5), set S1 to open (L side).
If neither power transformer nor regenerative discharge unit is connected across terminals CN2 (4) and (5), set S1 to short (H side).

Note 2) Set S2 to open (L side), if the regenerative discharge unit is not mounted, and set it to short (H side), if the regenerative discharge unit is mounted.



(a) Setting of H side



(b) Setting of L side

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6.4.3 Check terminals list

1) Servo amplifier of digital
   ① For 1-axis
      i) For Model 5-0 P.C.B A20B-1001-0430
      ii) For Model 4-0, 3-0 P.C.B A20B-1002-0500
      iii) For Model 2-0 - 30R P.C.B A16B-1200-0670
   ② For 2-axis P.C.B A16B-1200-0680
   ③ For 3-axis P.C.B A20B-1002-0280

Table 6.2.4 (a)

Setting terminal	Standard setting	Remarks
S1	L	TOH setting (Note 1)
S2	L	DC alarm setting (Note 2)

Note 1) If either power transformer or regenerative discharge unit is connected across terminals CN2 (4) and (5), set S1 to open (L side).
If neither power transformer nor regenerative discharge unit is connected across terminals CN2 (4) and (5), set S1 to short (H side).

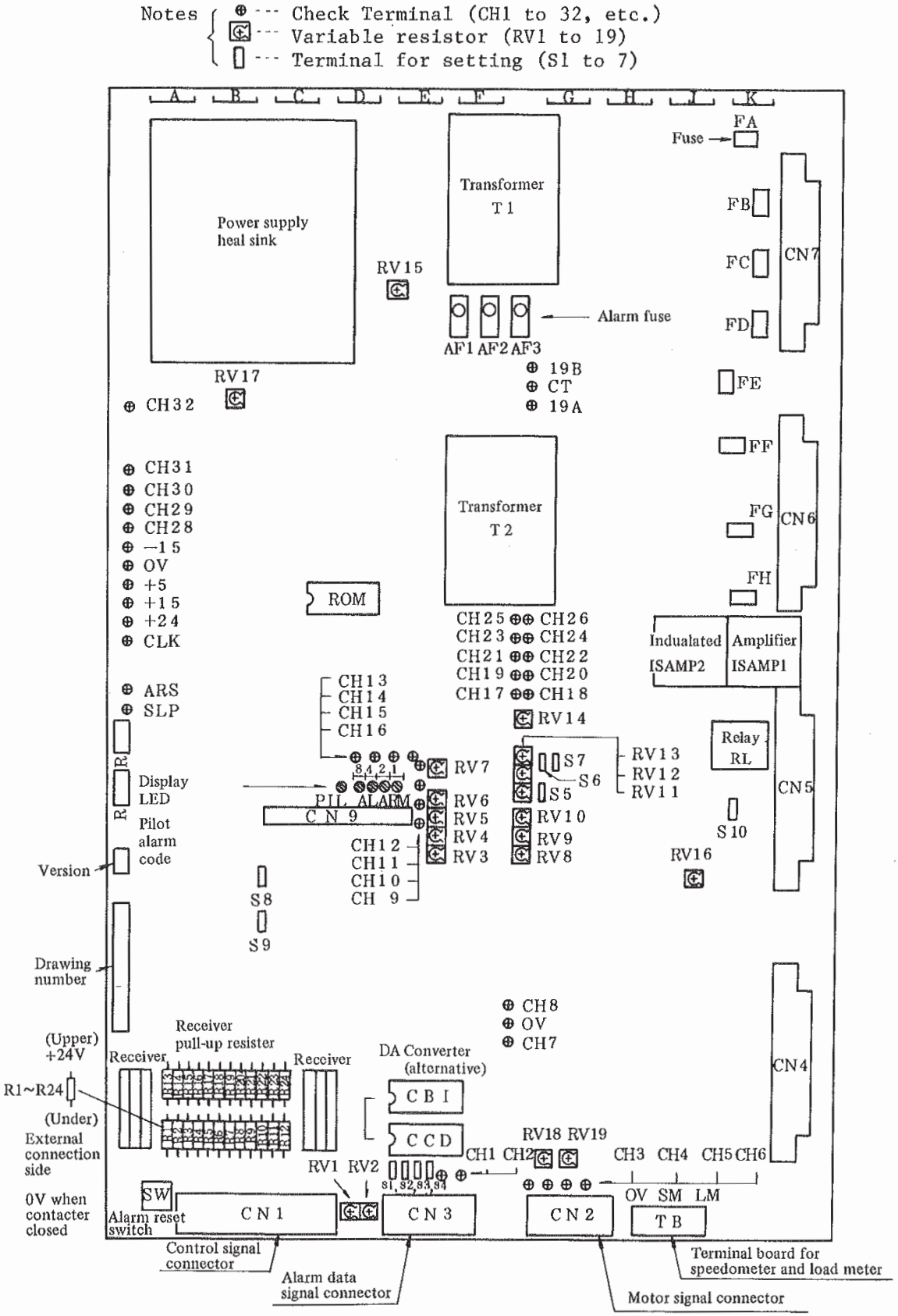
Note 2) Set S2 open (L side), if the regenerative discharge unit is not mounted, and set it to short (H side), if the regenerative discharge unit is mounted.

Note 3) The setting S2 is not mounted on the PCB for model 5-0 and for model 4-0 and 3-0.

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6.5 Setting and Adjustment for AC Spindle Servo Unit

6.5.1 PCB parts mounting diagram



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6.5.2 Main parts list for AC spindle servo unit for motor model 3～15

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	Fuse on PCB	A60L-0001-0075/3.2(3.2AS)				

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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				

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6.5.3 Adjustment of variable resistor on the PCB for AC spindle servo unit

Notes 1. This table is applicable to PCBs of versions A20B-0009-0530 to 0534.
2. Since the variable resistor, RV7, 8, 14 through 19, are adjusted by factory at shipment, they must not be readjusted by the user.

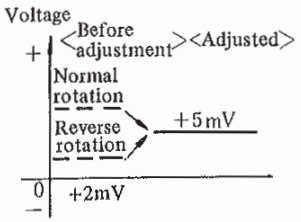
No.	Symbol	Item	Standard setting	Check terminals	Procedure
1	RV1	Velocity command voltage level		CH13-0V	See Subsection (1) on the next page.
2	RV2	Velocity command voltage offset		CH13-0V	See Subsection (1) on the next page.
3	RV3	Speed arrival detection level		CH10-0V	See Subsection (4)
4	RV4	Speed 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 10 V, the frequency is 200 ± 2 kHz.
8	RV8	Setting for speed detection circuit		CH18-0V	When the voltage between CH17 and 0 V, is 0.2 V, 2.2 ± 0.1 V.
9	RV9	Adjustment of forward motor speed		Number of motor revolutions	See Subsection (2)
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)
12	RV12	Velocity loop gain	5 scale		
13	RV13	Velocity loop offset		Spindle	See Subsection (3)

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No.	Symbol	Item	Standard setting	Check terminals	Procedure
14	RV14	Adjustment of loadmeter amplitude		LM-0M	10 ± 0.1V at acceleration (without torque limit)
15	RV15	Voltage adjustment of +5 V		+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 200 V AC, the frequency is 24 ± 0.2 kHz.
18	RV18	Adjustment of RA offset		CH5-0V	2.5 ± 0.05 V when 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 10 V, the motor rotates at the rated speed.

Item	Measuring terminals	Adjustment procedure
Offset	CH13-0V	Set the motor to 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	Supply a rated rotational command voltage of 10 V to the motor and adjust RV1 so that the voltage between the measuring terminals becomes +10 V ± 0.05 V when the spindle forward rotation command is issued.



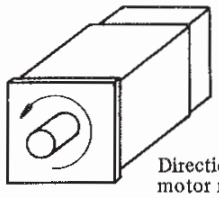
(Example) For example, if the voltage at CH13 is +5.0 mV when the spindle rotates forward and it is +5.0 mV ± 1.0 mV when the spindle rotates in reverse, the offset error of the velocity command voltage is ±1.0 mV.

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2) Rotational speed adjustment (RV9, RV11)
The number of motor revolutions can be adjusted accurately by the following procedure. 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.

(Example) 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.

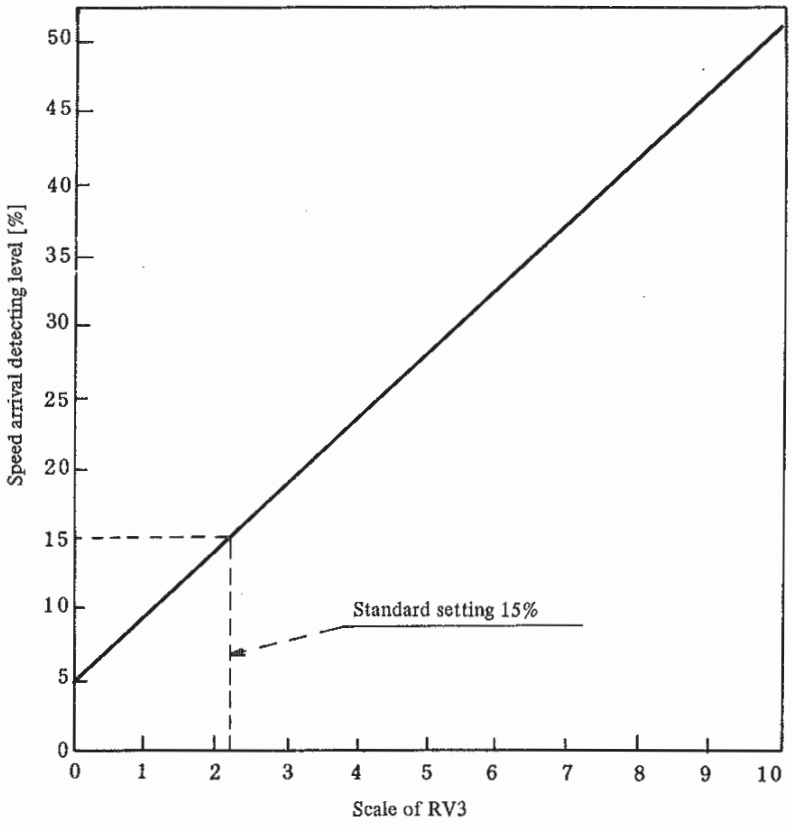


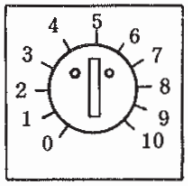
3) Velocity offset (RV13)
This adjustment is made so that the spindle will not rotate at low speed when a velocity command voltage of 0V is supplied. This should be performed after the previous adjustments.

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.

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4) Speed arrival detection level (RV3)
Setting of the speed arrival detection level can be performed by using the following graph.
Vertical axis is the percentage of motor speed to the rated value.

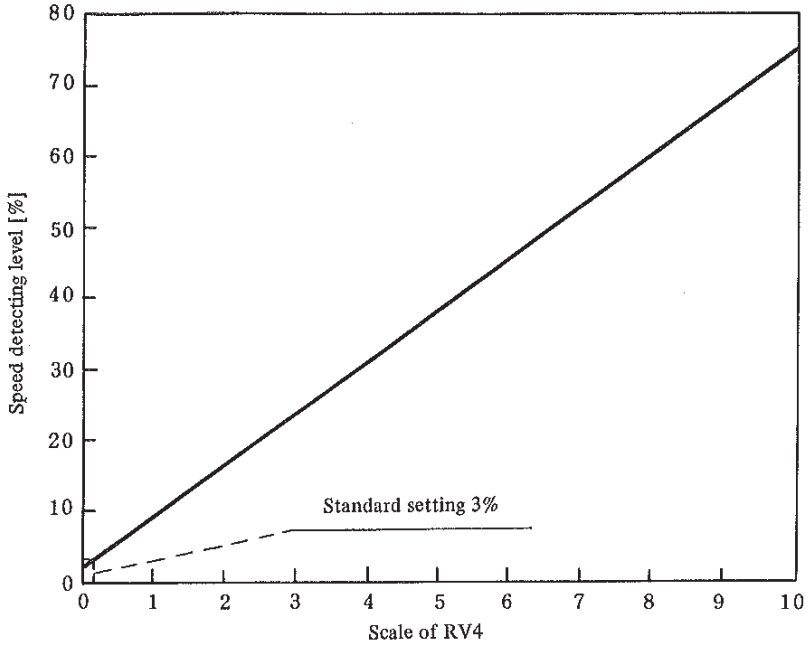




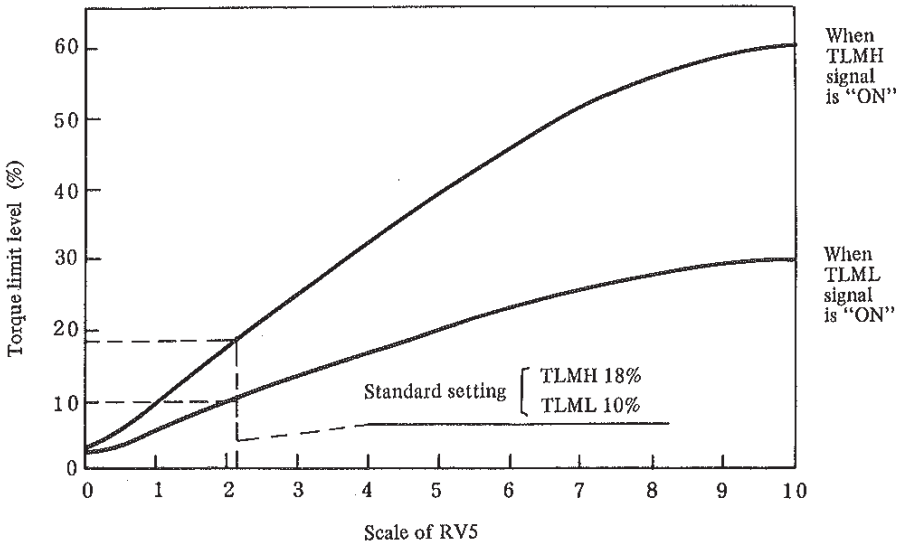
How to read the scale of potentiometer

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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%.



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6.5.4 Description of check terminal

Terminal name	Signal name	Contents	Remarks
CH1	DA2	Analog command voltage	0 - 10.0 V
CH2	DA1	Output voltage from D/A converter	0 - 10.0 V
CH3	PA	Phase A output from pulse generator	(2.5 V ± 5%) ± 0.2 V_{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 mA
CH6	RB	Reference voltage of phase B	Direct current of PB: ±25 mA
CH7	PSA	Phase A square weve	Duty 50% (at constant speed) ± 10%
OV	OV	OV of printed circuit board	
CH8	PSB	Phase B square wave	Duty 50% (at constant speed) ±10%
CH9	SDTRF	Speed detection level	Variable 0.14 V through 7.4 V by RV4
CH10	SARRF	Speed arrival level	Variable by RV3
CH11	BUZY	Acceleration/deceleration busy	"0" / "1" 1: During Acc/Dcc
CH13	VCMD	Velocity command voltage	0 - ±10.0 V + ; CCW, - CW
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 reverse rotation)
CH16	OV	OV of printed circuit board	
CH17	TS1	F/V output of velocity feedback	6000 rpm (CCW): -10 V
CH18	TS2	Low speed detection signal	120 rpm (CCW): -2.2 V
CH20	TSA	Velocity feedback signal	Rated rotational speed: ±10 V, CCW: -
CH21	LTRF	Output torque limitation voltage	Output = $-[(\lvert V_{CH21} \rvert + 1.8)/10]$ x Maximum output

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Terminal name	Signal name	Contents	Remarks
CH22	CRU	Phase U current detection signal	Current per 1V M3,6: 16.7A; M8: 25A; M12: 35.7A; M15: 50A
CH23	ERP	VF conversion output	CH28 10 V: 200 kHz width; 0.4 µs
CH24	CRV	Phase V current detection signal	V phase motor current detection signal
CH25	TRWF	Triangle wave signal	 10 Vp-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 +24 V	DC25.6 Vtyp, Ripple: 0.5 V_{p-p} 100 Hz
+15	15V	Power source voltage of +15 V	-15 V ±4%
+5	5V	Power source voltage of +5 V	+5V ±1% (Preadjusted by RV15)
OV	OV	OV of printed circuit board	OV, same as CH16
-15	-15V	Power source voltage of -15 V	-15 V ±4%
CH28	ER	Error voltage	0 - 10 V
CH29	UCM	Phase U command voltage	
CH30	VCM	Phase V command voltage	
CH31	WCM	Phase W command voltage	
CH32	24VP	Pulse signal	24 kHz at AC 200 V
19A	19A	Input voltage of 19 V AC	PCB Control power supply
CT	CT	OV	PCB Control power supply
19B	19B	Input voltage of 19 V AC	PCB Control power supply

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6.6 Adjustment of Spindle Orientation Control Circuit

6.6.1 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 repetition 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 methods of magnetizing element and sensor

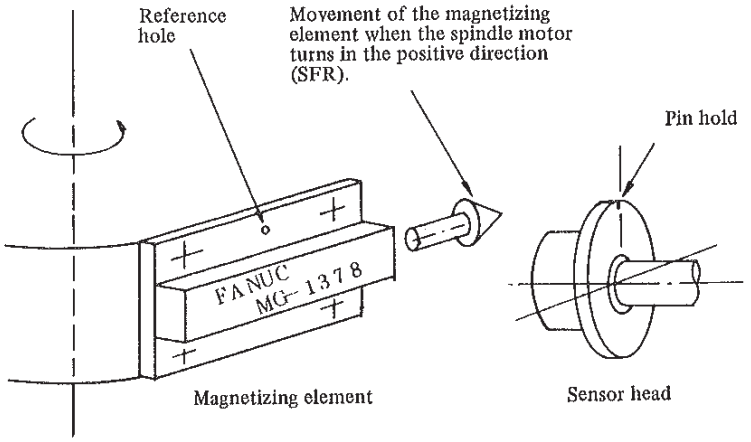
Item	Explanation
1	Mount the magnetizing element so that the reference hole moves and faces as shown in Figure 1 when the spindle rotates in the positive direction by the command of spindle motor CW rotation (SFR and VCMD positive).
2	Mount the magnetic sensor head so that the pin hole of the flange and the reference hole of the magnetizing element face in opposite directions.
3	The gap between the magnetizing element and sensor head should be minimum of 1.5 $\pm$ 0.5 mm.
4	

Fig. 1 Mounting magnetizing element

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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	/	o	Test mode (Note 2)	Connected only for adjustment
02	o	x	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 of SH03 takes priority of the setting on SH02. The setting on SH02 is effected only when SH03 1-2 is connected.
	x	**o**	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	**o**	**x**	Moves in the direction the spindle was turning just before the orientation instruction was issued.	The setting on SH02 becomes effective.
	x	o	The orientation direction is always CCW.	
	x	x	The orientation direction is always CW.	
04	**x**	**x**	Initial orientation speed is about 60 x spindle position loop gain Sec.$^{-1}$ 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.
	o	x	The initial rate of speed is limited to 1/3 the usual rate.	
	x	o	The initial rate of speed is limited to 2/3 the usual rate.	

Notes: (1) o indicates "close", x indicates "open".
(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 (LED7) is on in this mode.

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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 PCB of 01A edition).

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 ±10 V. 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° 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 ±1° of the adjustment position. When it lights while not in TEST MODE, the Orientation 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) Variable resistor setting
Set the variable resistor according to the following values followed by table before orientation adjustment. * will be reset at a later stage.

Settings

Variable resistor name	RV	1*	2*	3	4	5	6*	7*	8	9*	10*	11*
Variable resistor 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.

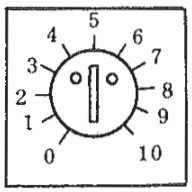
H (mm)	60 - 65	- 70	- 75	- 80	- 85	- 90	- 95	- 100	- 105	- 110
Scale position	7.0	6.0	5.0	4.0	3.0	2.5	2.0	1.5	1.0	0.5

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	7.5	8.0	9.0	9.5	10



Scale of variable resistor

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d) Variable resistor 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.

Variable resistor adjustment

The following adjustments should be performed in Test Mode by connecting SH01 pins.

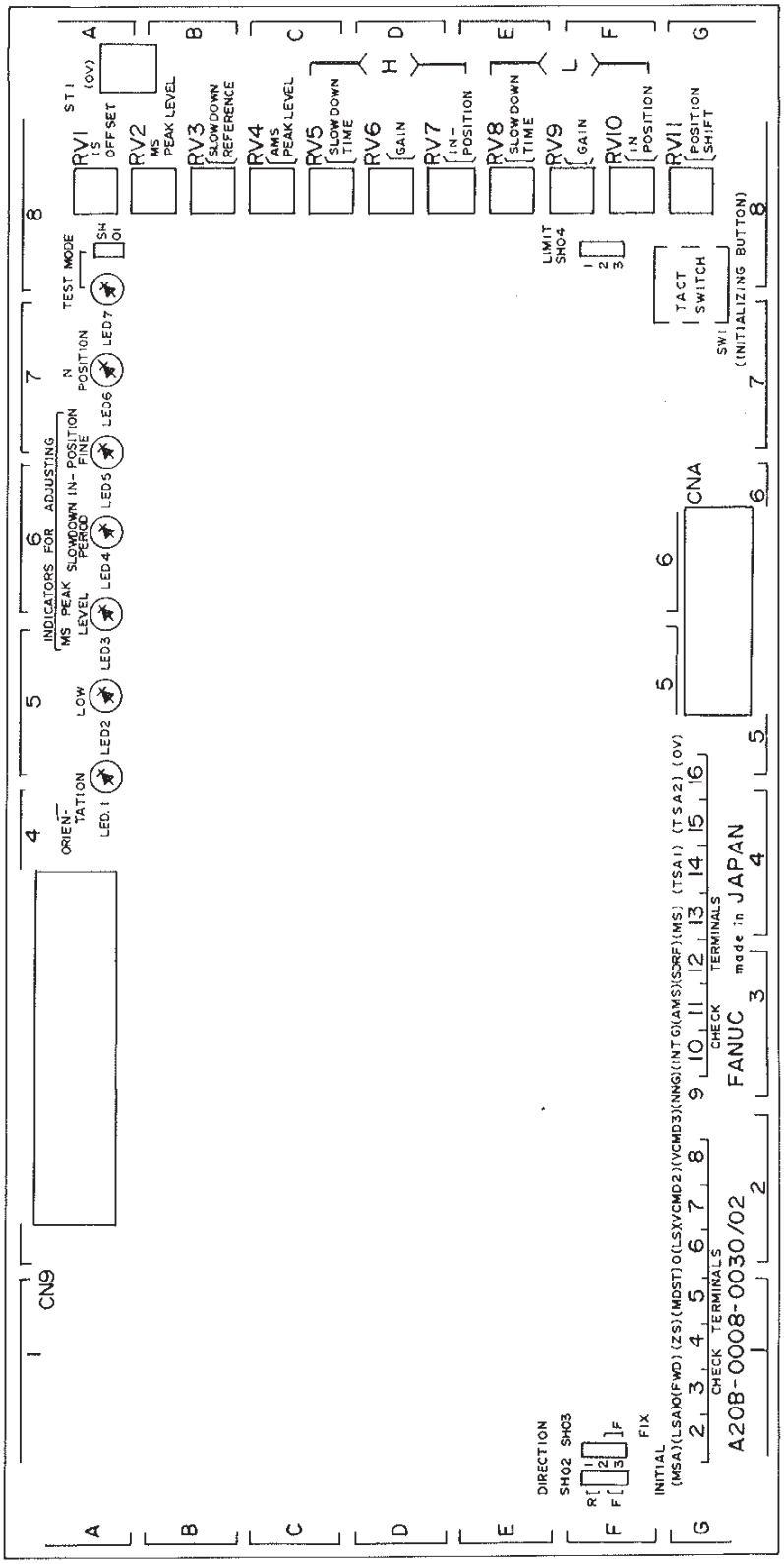
Term	Name	Adjustment	Condition	Adjustment method (Specification)
1	RV1	TS OFFSET	The spindle should be stopped.	Voltage across check 15 (TSA2) and 16(0V) should be within ±1.0 mV
2	RV2	MS PEAK LEVEL	Keep pressing SW1 (INITIALIZING BUTTON)	Adjust position until LED3 (MSPEAK LEVEL) begins to light.
3	RV3	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 (SLOWDOWN 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 to over-shoot when stopping.
7	RV7	IN-POSITION H	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 LED6 (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 over-shoot when stopping.

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Term	name	Adjustment	Condition	Adjustment method (Specification)
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).	LED5 (IN-POS. FINE) should be on when LED6 (IN-POSITION) is on.
11	RV11	POSITION SHIFT		The stop position can be finely adjusted to within ±1° of the spindle angle.

After adjustment, release the test mode and check that LED7 (red) is turned off.

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Adjusting position on the orientation circuit C PCB

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3) Setting and adjustment of three-spindle 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)
Same as in item 6.5.1 (2)-(a).
b) LED indicators

LED No.	Symbol	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 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$10 V.
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° of the adjustment position.
LED6	IN-POSITION	Green	Lights when orientation has been completed and the spindle is within $\pm$1° 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.

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c) Adjustments
The adjustments should be performed in the following sequence 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 CH15 (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 from 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 HIGH 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 ficker.
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.

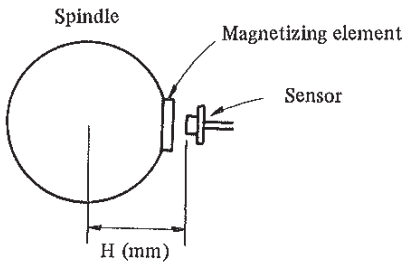
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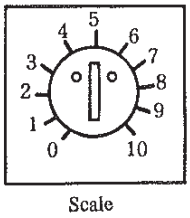
Item	Variable resistor	Adjustment item	Condition	Adjustment procedure
11	RV11	SLOWDOWN TIME MEDIUM Adjusting slow-down time	Shift the gear to the MEDIUM position and LED2M goes on. Turn SW1 on and off repeatedly.	Same as item 5 above.
12	RV12	GAIN MEDIUM Position loop gain.		Same as item 6 above.
13	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 ±1° 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.

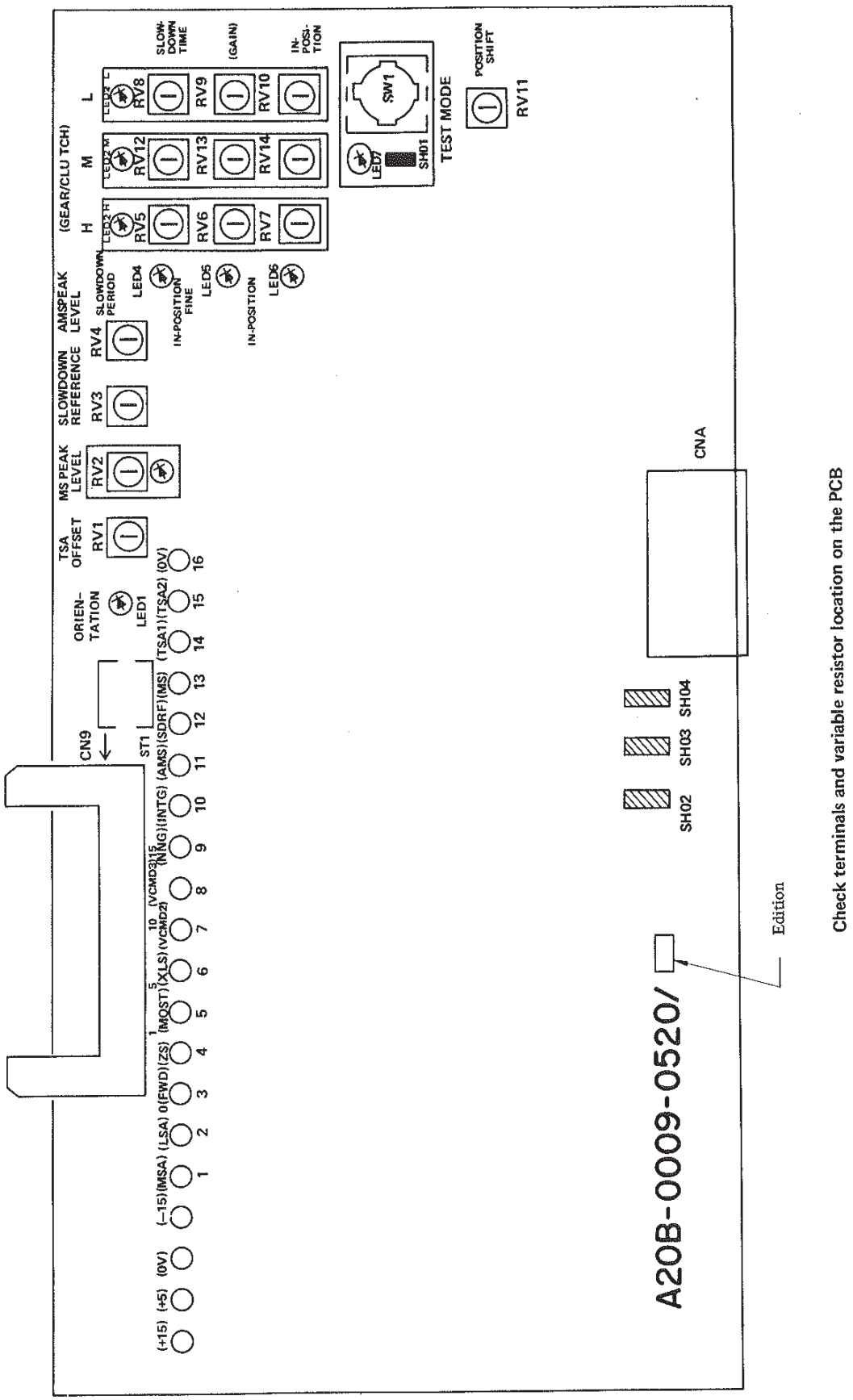
H (mm)	50	60	70	80	90	100	110	120
Position RV3, 4	9.5	6.5	4.5	3.0	2.2	1.5	1.0	0.5





Scale

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Check terminals and variable resistor location on the PCB

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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 conditions. 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: $K_{p(H \text{ or } L)} = N_{s(H \text{ or } L)} \div 55(\text{sec}^{-1})$, where $K_{p(H)}$: Position loop gain for spindle HIGH gear (clutch) $K_{p(L)}$: Position loop gain for spindle LOW gear (clutch)

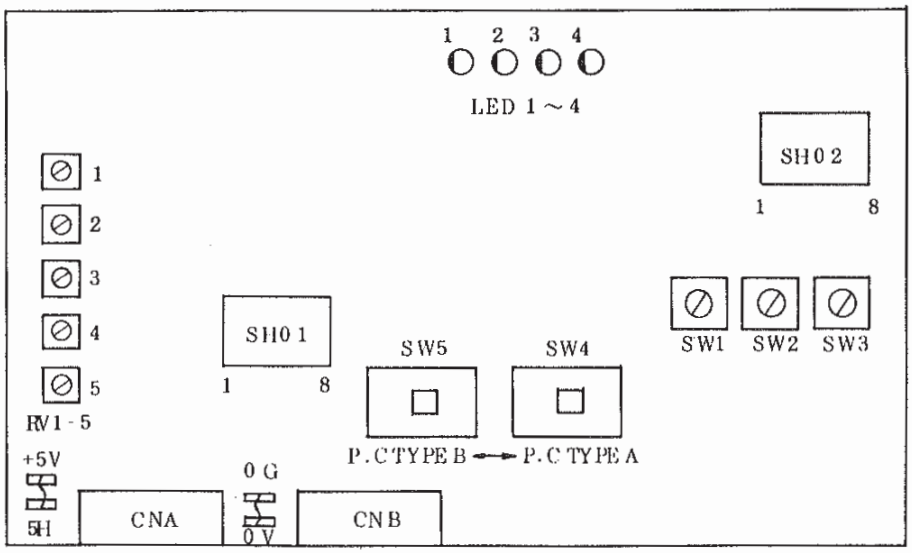
6.6.2 For position coder system

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.

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3) Setting



a) +5V - 5H When the power of +5V for position coder is supplied from
0G - 0V spindle amplifier, connect between +5V and 5H and between 0G and 0V. When the power of +5V is supplied from NC, open between +5V and 5H between 0G and 0V.

b) Setting of SW5 and SW4

Position coder	Type	SW4	SW5
Balanced type	Type A	Right	Right
Unbalanced type	Type B	Left	Left

c) Setting of SH01 and SH02
Follow the next table.

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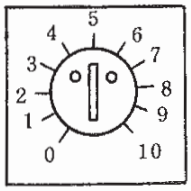
d) Setting of stop position SW1, 2, 3

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° = 1/4096 x 360° 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 variable resistor

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Table 1 Setting of SH01 and SH02

o: Connected x: Open

No.	Contents		SH01								SH02								Remarks
			1 o 16	2 o 15	3 o 14	4 o 13	5 o 12	6 o 11	7 o 10	8 o 9	1 o 16	2 o 15	3 o 14	4 o 13	5 o 12	6 o 11	7 o 10	8 o 9	
1	Initial orientation direction immediately after turning on power	CCW	o	x															(Standard)
		CW	x	o															
2	Orientation direction after initial orientation	CCW only			x	o													(Standard)
		CW only			x	x													
		Spindle rotational direction			o	x													(Standard)
3	Orientation speed which is set by position gain	1					x	x											
		2/3					o	x											
		1/3					x	o											
4	Rotational direction of spindle and position coder	Same direction							o	x									Different from machine tool to machine tool, Incorrect setting will cause hunting.
		Reverse direction							x	o									
5 (Note)	In-position width to issue orientation completion signal (ORAR 1, 2)	±2 pulses									o	o	o	o	o	o			±16 pulses correspond to ±1.3°
		±4 pulses										o	o	o	o	o			
		±8 pulses											o	o	o	o			
		±16 pulses												o	o	o			
		±32 pulses													o	o			
		±64 pulses														o			
6	Setting due to position coder hysteresis	No pulse															x	x	(Standard)
		+1 pulse															o	x	
		-1 pulse															x	o	

(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)

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7. REPLACING METHOD OF PCB AND UNITS

7.1 Replacing Method of Power Supply Unit

1) For 10/11/100/110 series

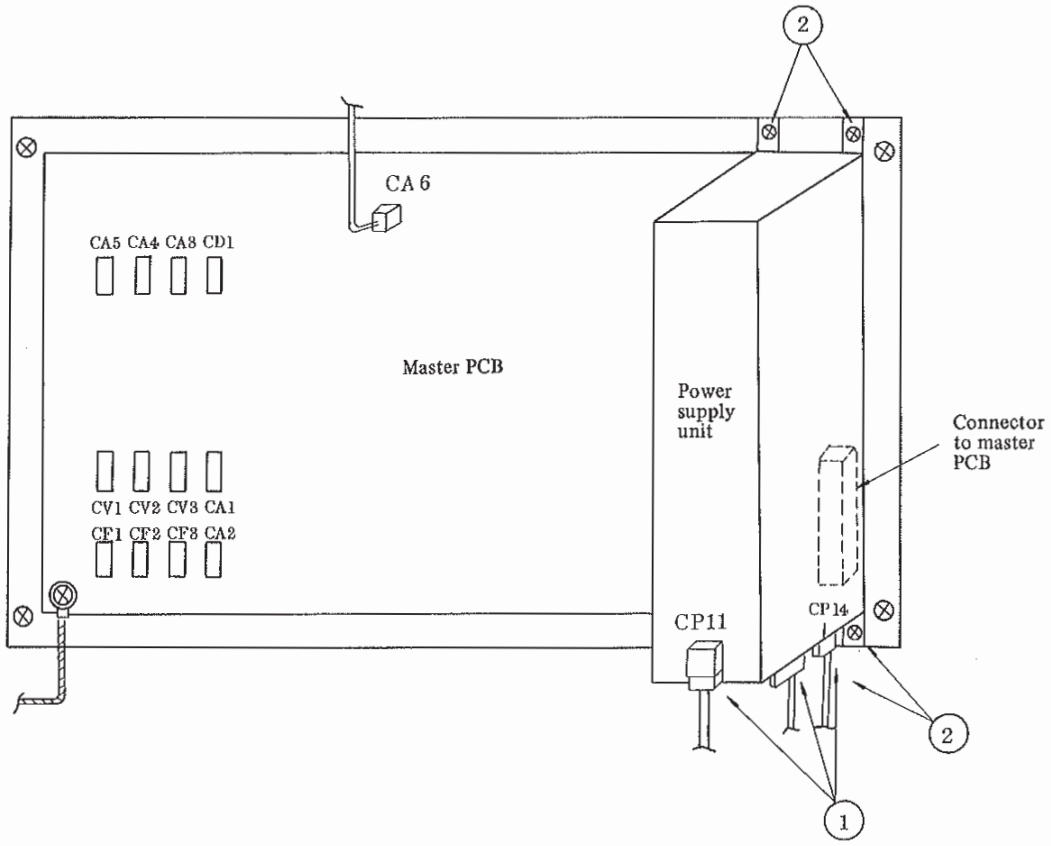
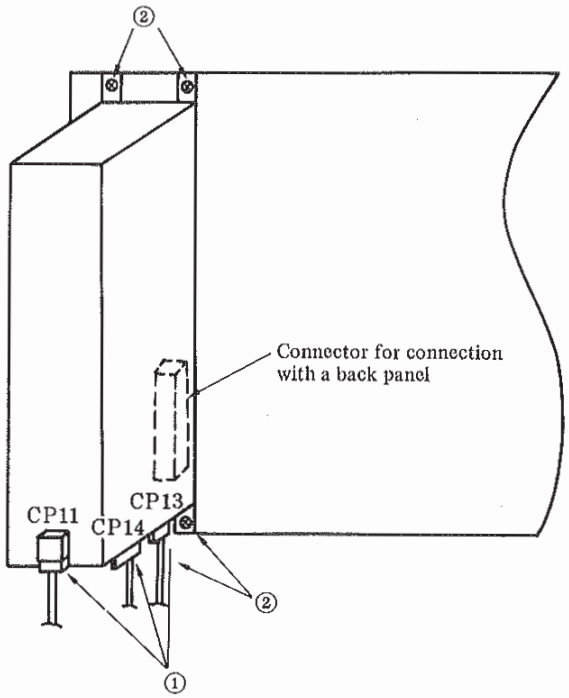


Fig. 7.1 (a) Power supply unit mounting position for 10 and 11 series

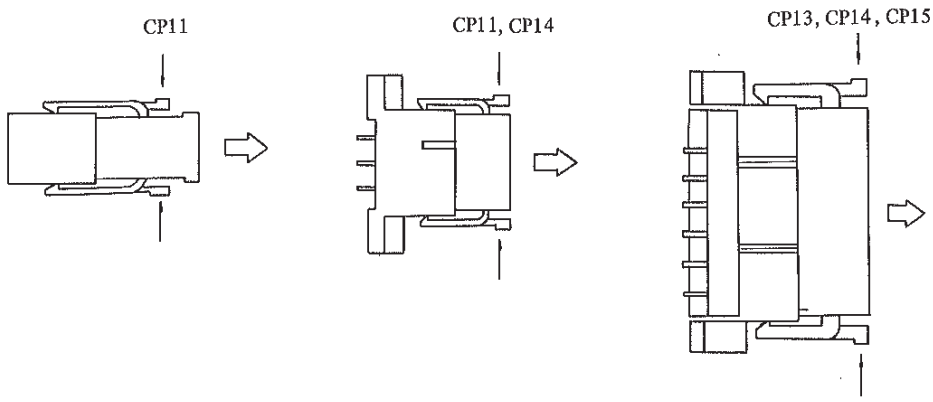
2) For 12/120 series



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7.1.1 Procedure

1) Disconnect cables of connectors CP11, CP13, CP14, and CP15 as illustrated below.



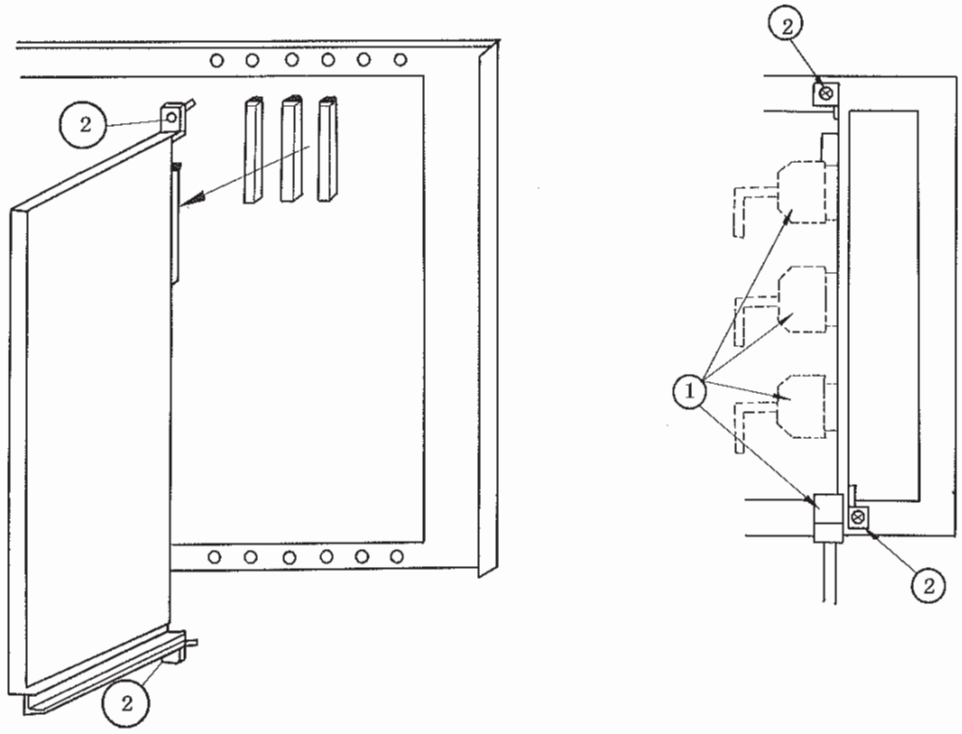
2) Detach the power supply unit by removing the four screws. The power supply unit is connected to the master PCB or back panel by the connector shown by a dotted line in the fig. 7.1 (a).
3) For mounting new power supply unit, reverse the above procedure 2) → 1).

7.2 Replacing Methods of Option PCB (for 10/11/100/110 series) and control PCB (for 12/120 series)

Replacement of the following PCBs connected to the master PCB or back panel is described.

. Option card 1	For 10/110 series
. Additional axis + additional memory PCB (analog servo)	
. I/O card A1 - A3	
. ROM/RAM board (digital servo)	
. Optical fiber interface PCB	
. Bubble memory	For 11/110 series
. Conversational function card	
. ROM/RAM card	
. Additional axis card (analog servo)	
. Resolver/inductosyn interface	
. Axis control PCB (digital servo)	Common to 10/11/ 100/110 series
. CRT/MDI adapter (100/110/120 series)	
. All control PCB	For 12/120 series

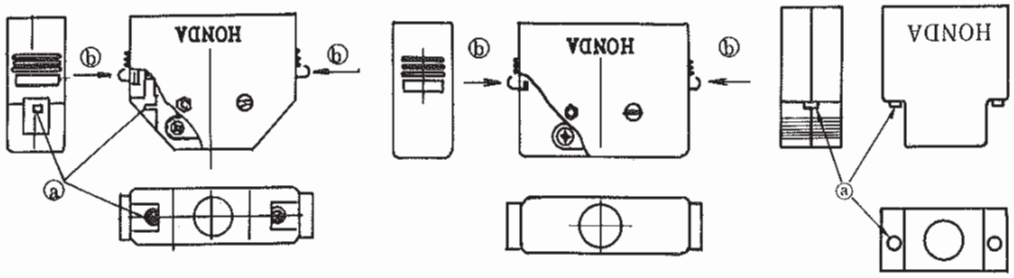
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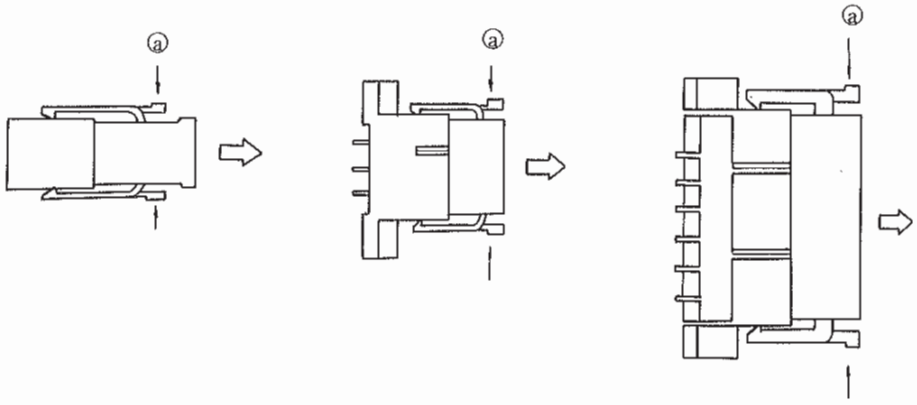
1) Procedure

(1) Disconnect cables from PCBs.

i) Disconnect HONDA connector by pushing part (b) after loosening two screws (a) as shown in the following figure.

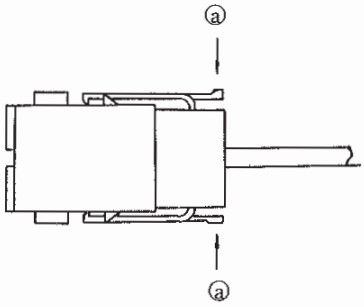


ii) Disconnect NIHON BURNDY connector in the arrow (⇨) direction by pushing part (a) as illustrated below.



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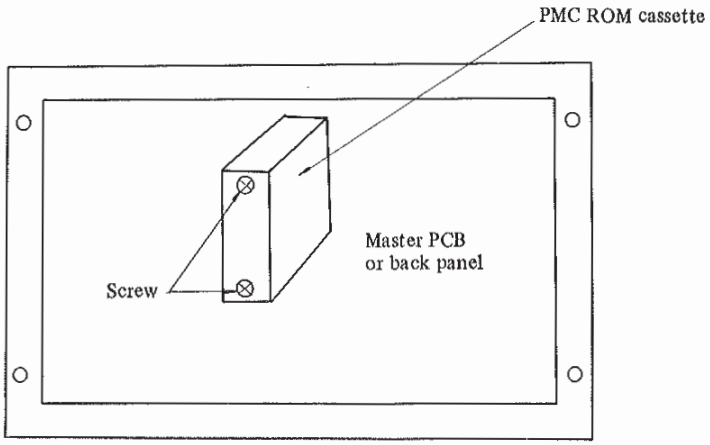
iii) Disconnect the optical fiber cable by pushing part a as illustrated below.



② Detach PCB by loosening two screws ②.
③ For mounting new PCB, reverse the above procedure ② → ①.

2) Setting
Set new PCB in the same way as in PCB before exchange.
3) Cautions
a) Additional axis + additional memory PCB
Check the number of mounted ROM and RAM, ROM No., and edition number.
b) Conversational PCB and ROM/RAM board
Check the number of mounted ROM and RAM, ROM number, and edition number.
c) Axis CPU PCB, Sub CPU PCB, main buffer PCB
Spindle control PCB ... Check the ROM number and edition number.
CRT/MDI adapter
d) Bubble memory PCB
* Check the specifications of bubble memory PCB.
* Clear all bubble memory and reset parameters, NC data, and other setting data without fail whenever the bubble memory PCB is replaced.
If resetting of parameters is neglected, an alarm may occur.

7.3 Replaceing Methods of PMC ROM Cassette



Detach the PMC ROM cassette after loosening the two screws in back.
Make sure that the same contents used in the old cassette are written into new ROM cassette.

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7.4 Replacing Methods of Master PCB

1) Procedure
   ① Remove the power supply unit according to Sec. 7.1.
   ② Remove the option PCB according to Sec. 7.2
   ③ Remove the PMC ROM cassette according to Sec. 7.3.
   ④ Disconnect all cables from master PCB.

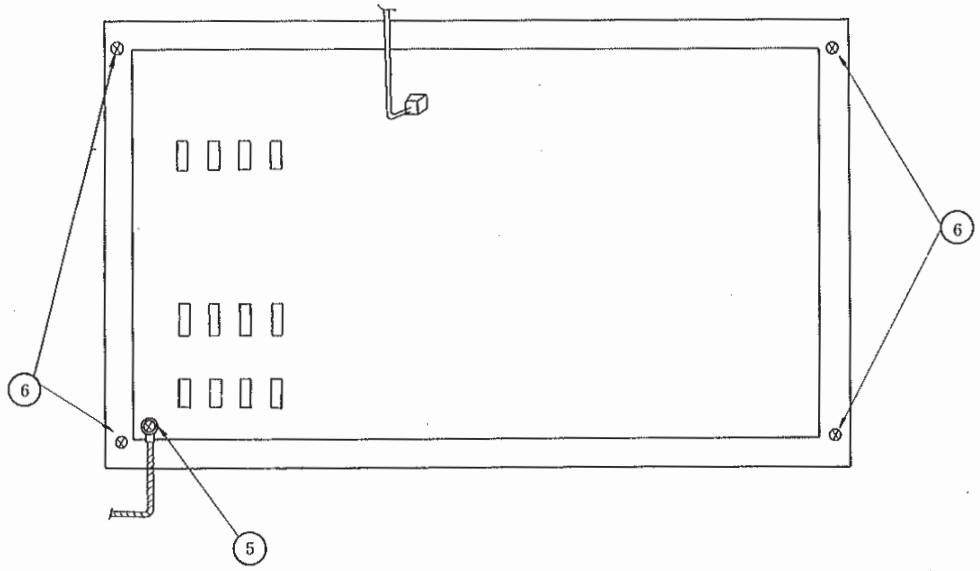


Fig. 7.4 (a) 10 series master PCB

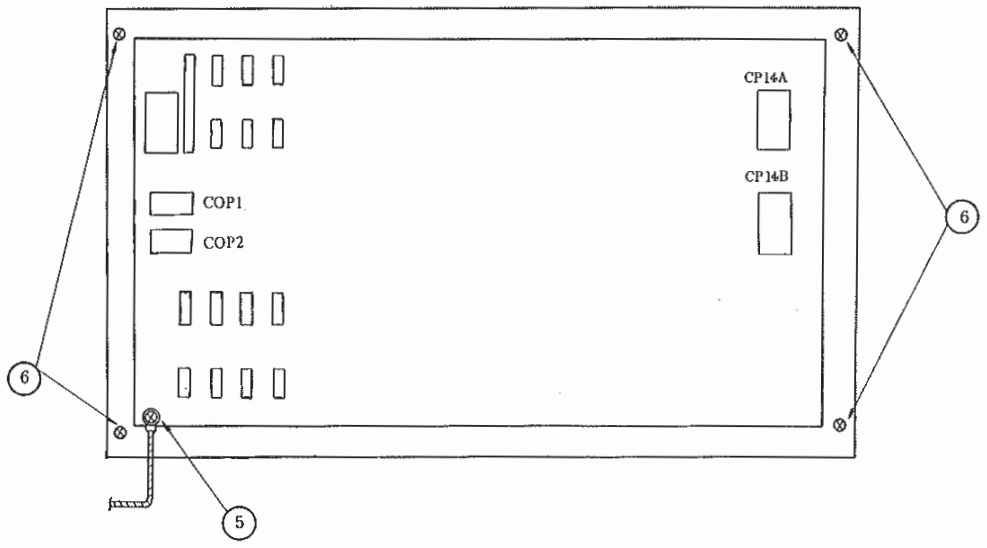
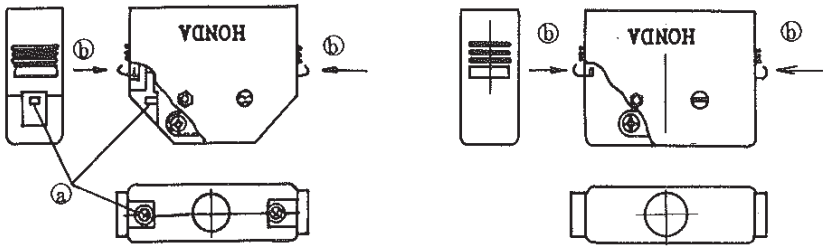


Fig. 7.4 (b) 11 series master PCB

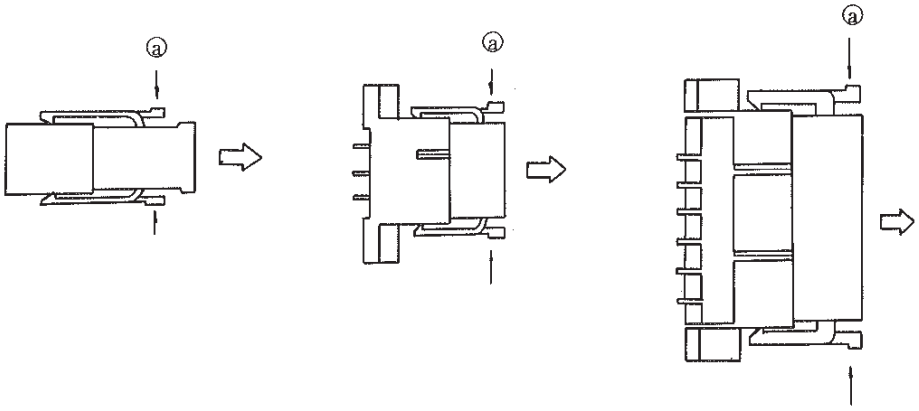
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Disconnect cables by the following procedures.

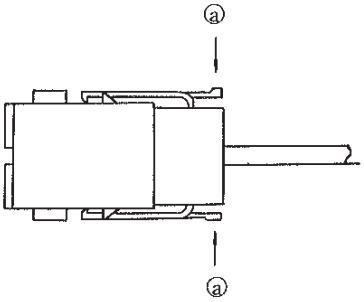
i) Disconnect HONDA connector by pushing part (b) after loosening two screws (a) as illustrated below.



ii) Disconnect NIHON BURNDY connector in the arrow (⇨) direction by pushing part (a) as illustrated below.

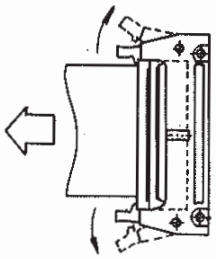


iii) Disconnect optical fiber cable by pushing part (a) as illustrated below.



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iv) Disconnect connector CAT cable in the arrow direction after unlocking it as illustrated below.



(Note) For connecting the cable, push it in the direction opposite to ⟸ after setting it to mark ▼ of the connector under the unlocked condition, and then, lock the cable. In this case, push the connector forcibly, or else the cable cannot be locked. The left figure shows the locked condition.

⑤ Disconnect the ground wire.
⑥ The master PCB can be removed by loosening the four screws shown in ⑥.
⑦ For mounting new PCB, reverse the above procedure ⑥ → ①.

2) Setting
① Setting on new PCB should be same as that on old PCB before exchange.
② For 10/100 series, check position control LSI, OPC (in case of small CRT/MDI), character generator (in case of small CRT/MDI), and ROM for normal mounting conditions.
③ For 11/110 series, check the position control LSI for normal mounting
④ condition.
For 10/100 series, a memory parity alarm occurs after replacing the master PCB. Reset parameters after clear the memory.

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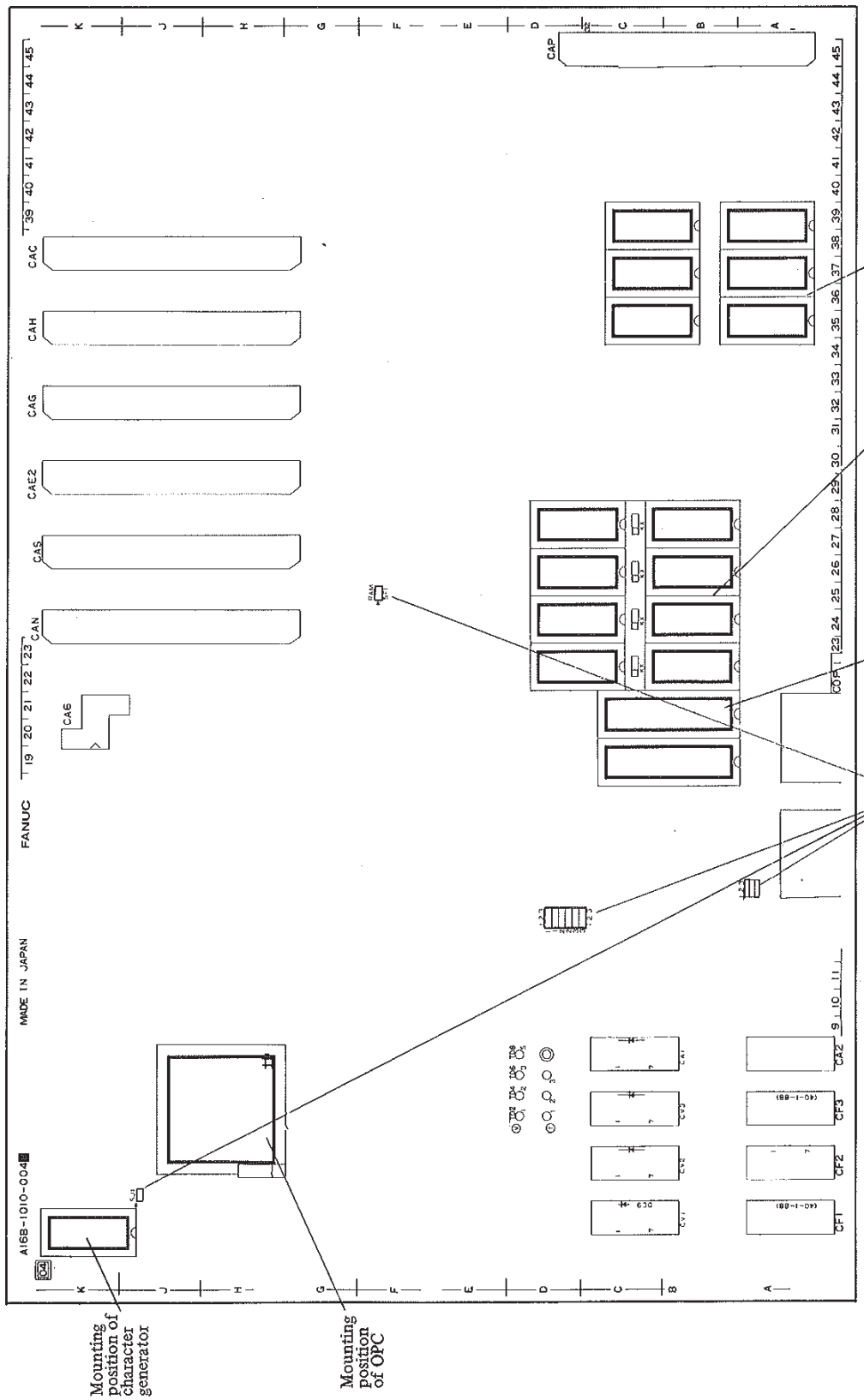


Fig. 7.4 (c) Check positions after replacing analog servo 10 series master PCB

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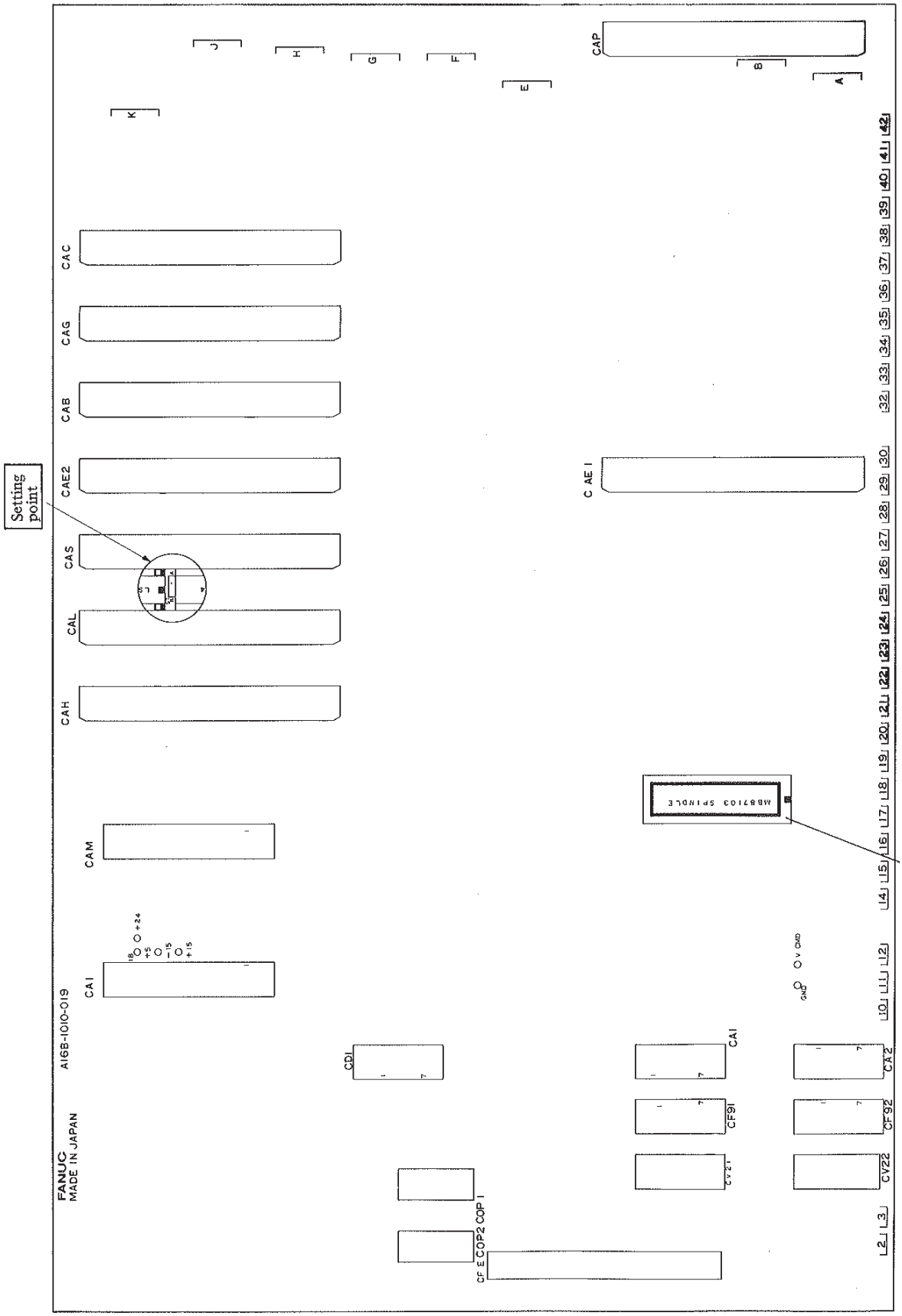


Fig. 7.4 (d) Check positions after replacing digital servo 10 series master PCB

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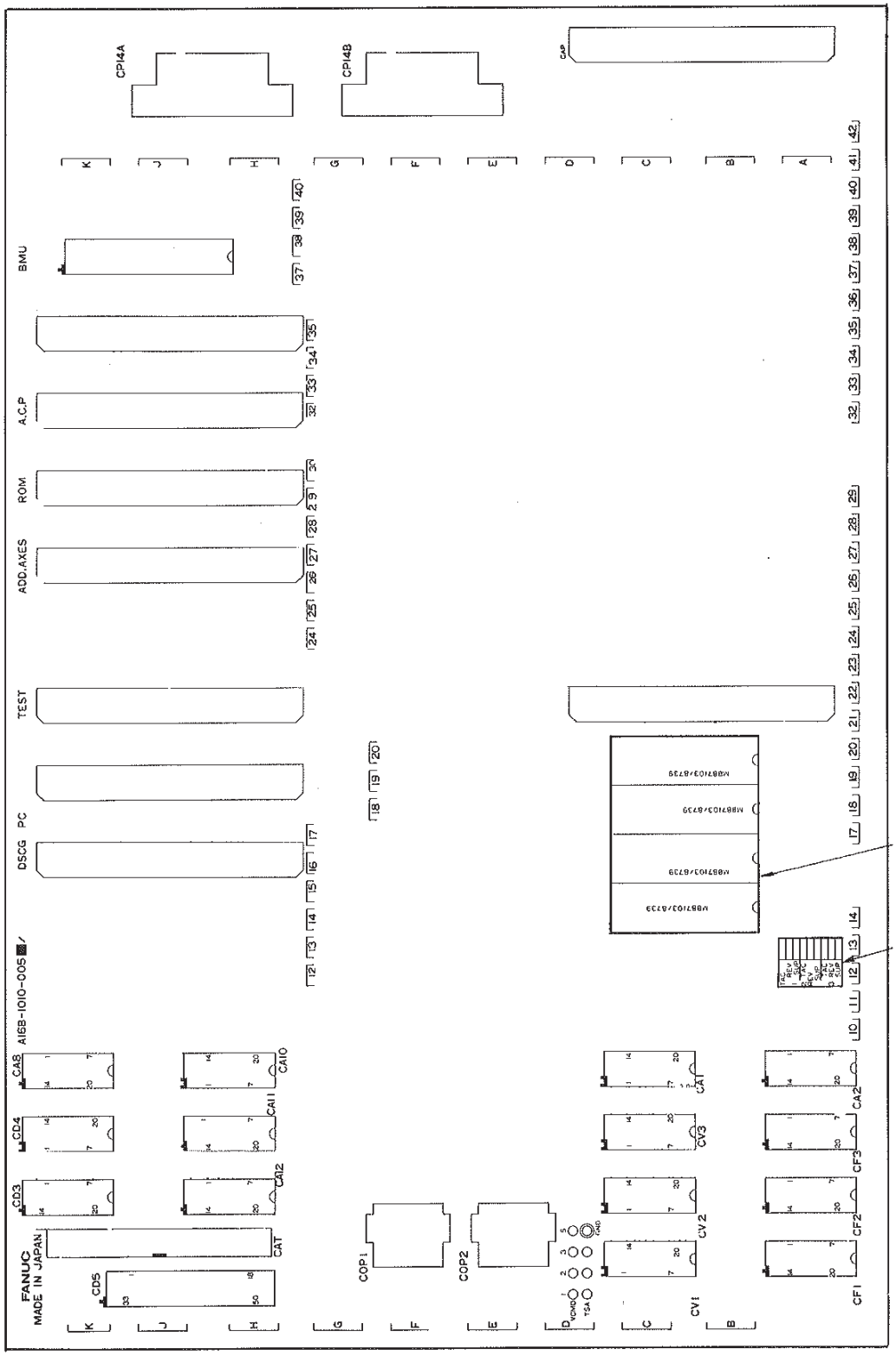


Fig. 7.4 (e) Check positions after replacing analog servo 11 series master PCB

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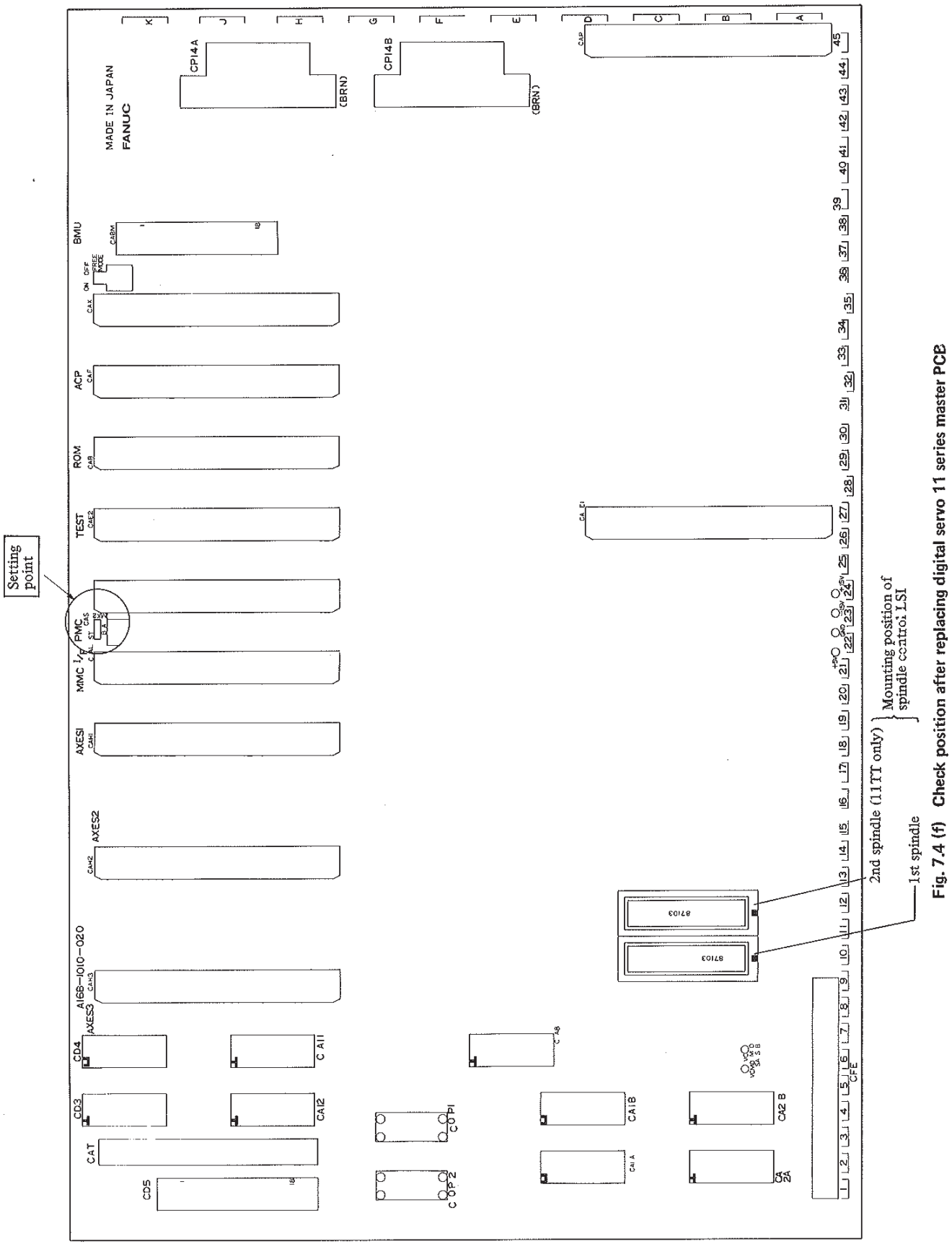


Fig. 7.4 (f) Check position after replacing digital servo 11 series master PCB

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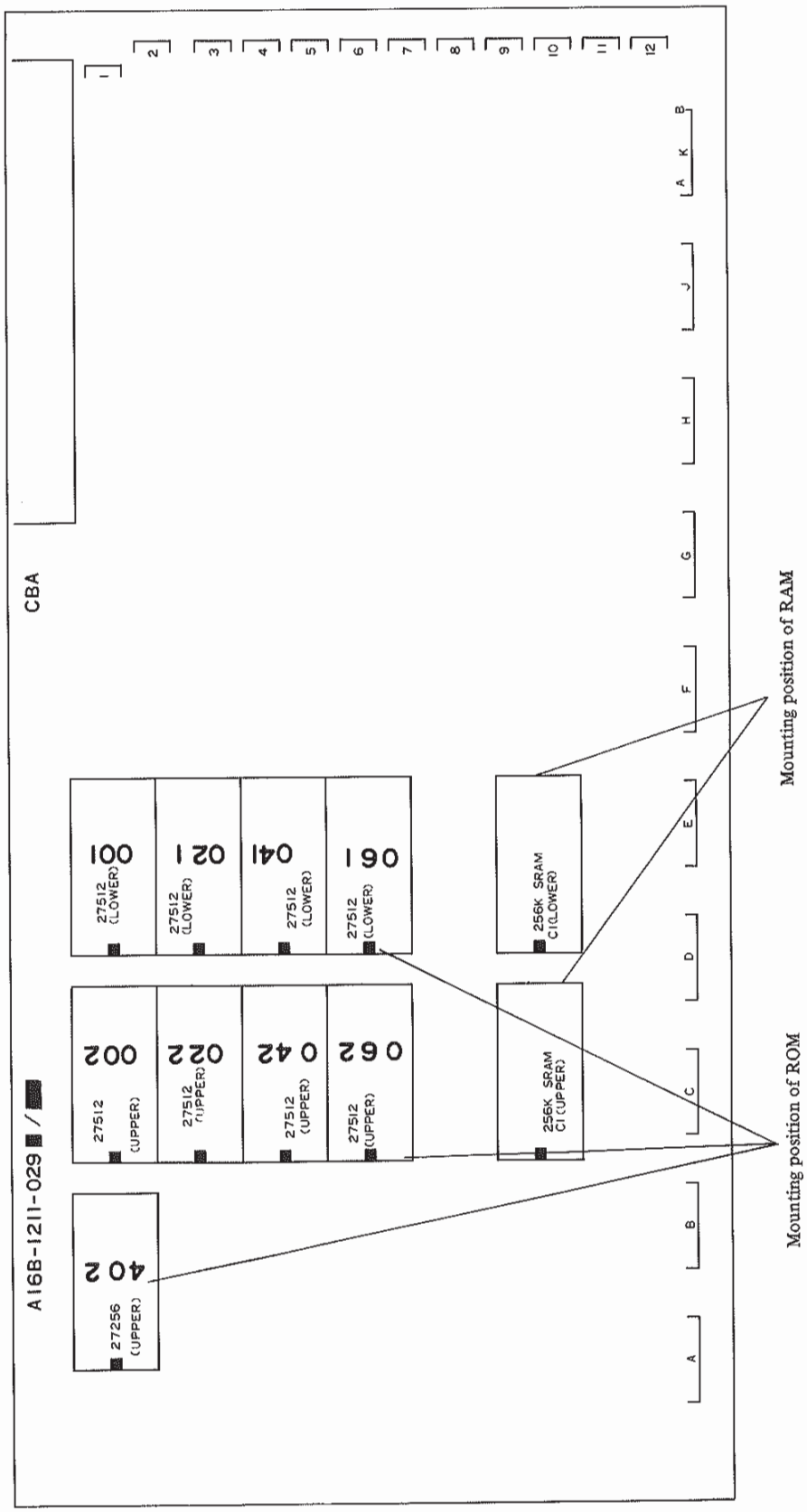


Fig. 7.4 (h) Check position after replacing digital servo 11 series ROM/RAM board

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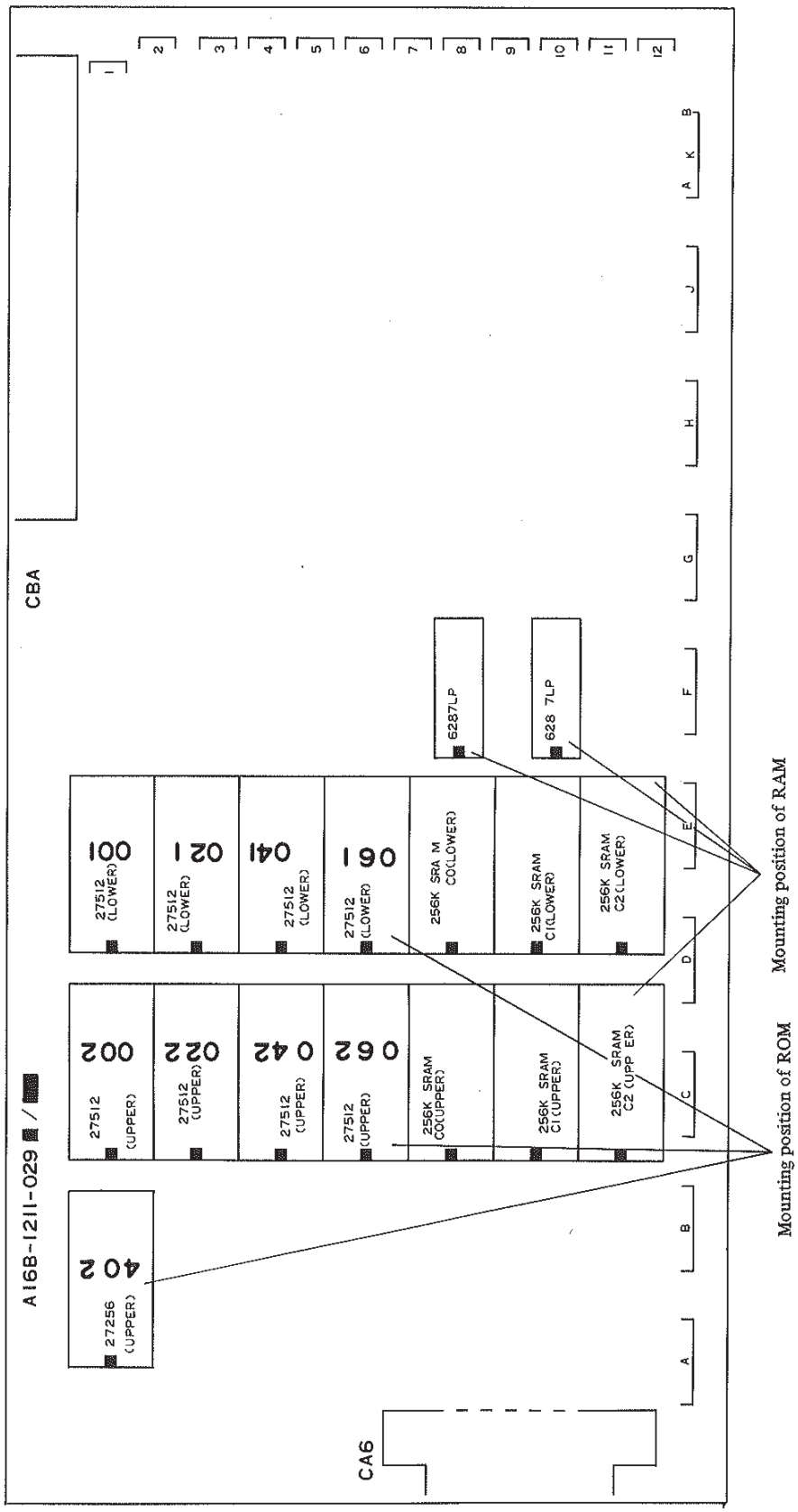


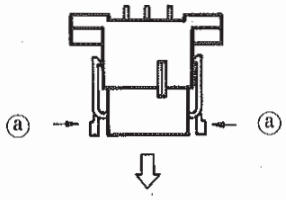
Fig. 7.4 (g) Check position after replacing digital servo 10 series ROM/RAM board

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7.5 Replacing Method of 12/120 Series Back Panel

1) Procedure

① Remove the power unit according to 7.1.
② Remove the control PCB according to 7.2.
③ Remove the PMC ROM cassette according 7.3.
④ Disconnect the cable connected to connector CNG in the arrow direction (⟹) shown below pushing part ⓐ.

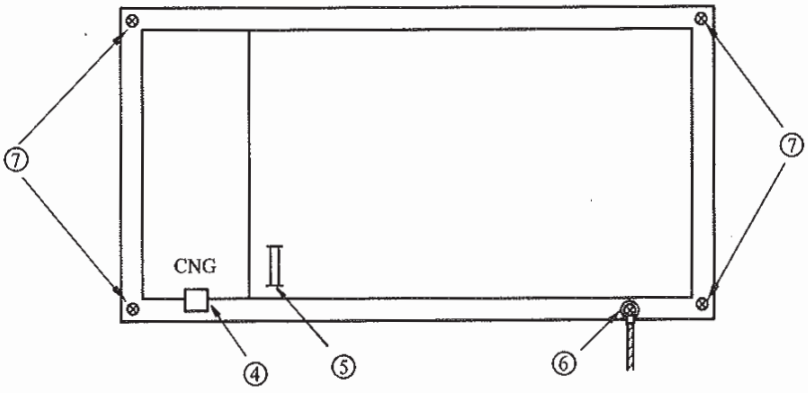


⑤ Disconnect the connector CAT ⑤ cable in the arrow direction after unlocking it as illustrated below.

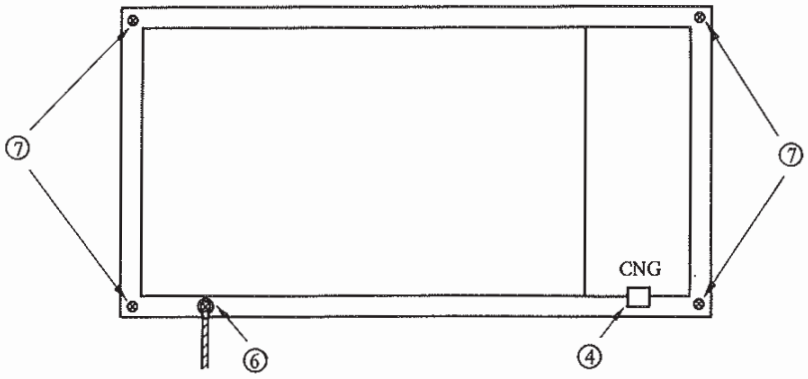
(Note) For connecting the cable, push it in the direction opposite to ⟸ after setting it to mark ▼ of the connector under the unlocked condition; lock the cable. In this case, push the connector forcibly, or else the cable cannot be locked. The left figure shows the locked condition.

⑥ Disconnect the earth cable.
⑦ The back panel can be detached by removing the four screws.
⑧ For mounting new back panel, reverse the procedure ⑥→ ①.

Basic back panel

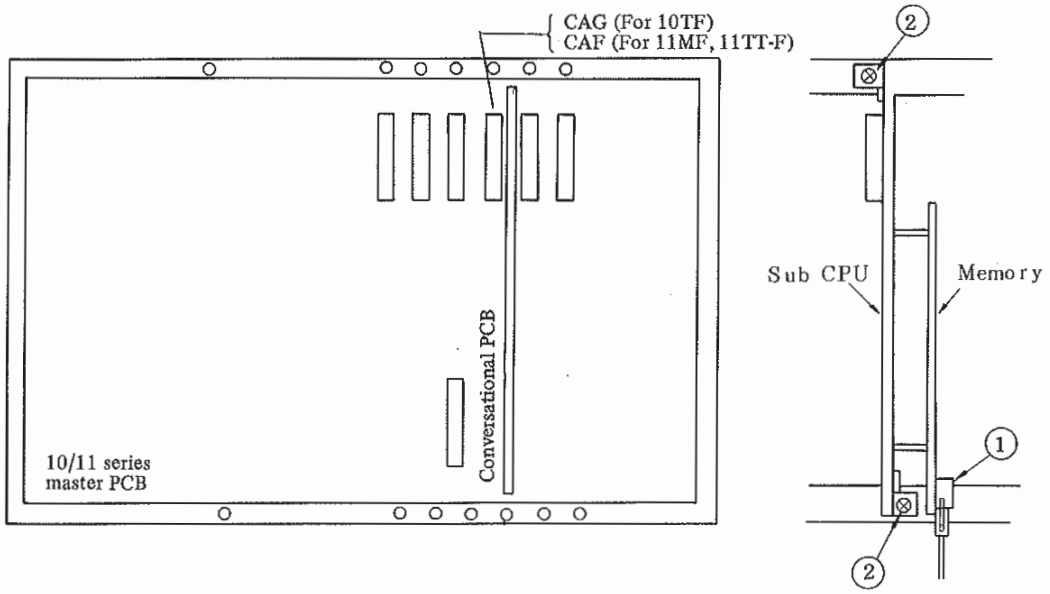


Additional back panel



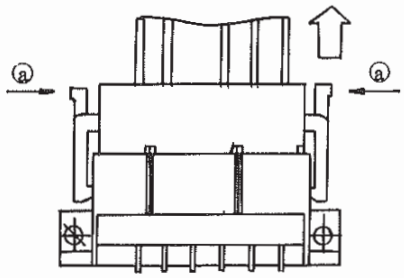
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7.6 Replacing Methods of 10TF, 11MF, 11TT-F Conversational PCB



1) Replacement of both sub CPU PCB and memory PCB

① Disconnect the connector cable ① by pushing part ⓐ as illustrated.



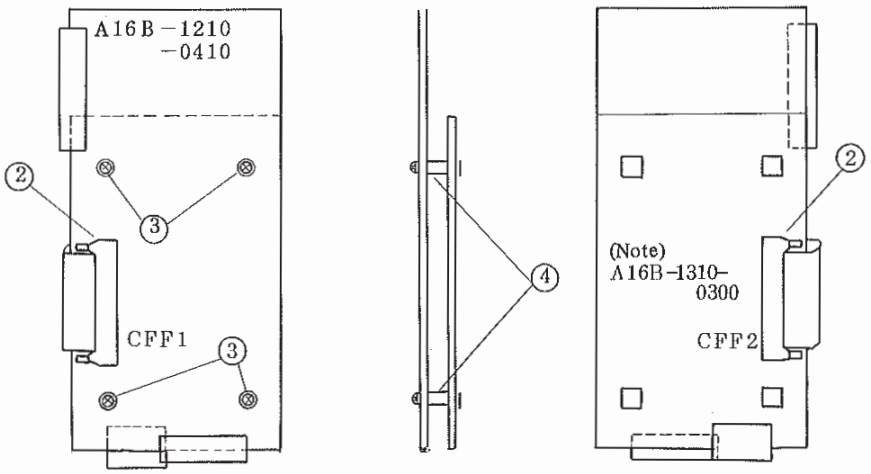
② Draw out PCB by loosening two screws ②.
③ For mounting new PCB, reverse the above procedure ② → ①.

(Caution)
1) Check the number of mounted ROM/RAM, ROM NO., and edition number.
2) In case 10T-F or 11TT-F, a conversational memory parity alarm occurs after replacing PCB.
Clear all submemory.

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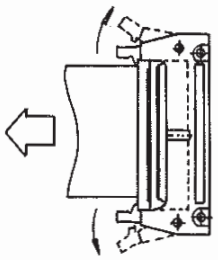
2) Replacement of either sub CPU PCB or memory PCB

① Detach PCB from the master PCB in the same way as described above.



Note) The memory PCB specification is different depend on kind of NC and it's option.

② Disconnect the connector CFF1/CFF2 ② cable in the arrow direction after unlocking it as illustrated below.

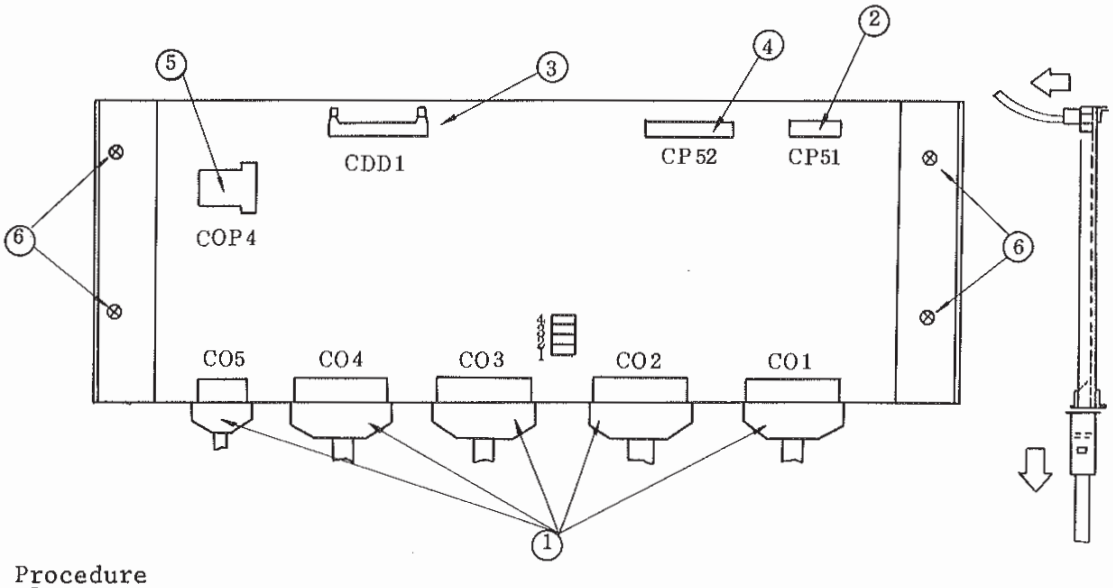


(Note) For connecting the cable, push it in the direction opposite to ⟸ after setting it to mark ▼ of the connector under the unlocked condition; then, lock the cable. In this case, push the connector forcibly, or else the cable cannot be locked.
The left figure shows the locked condition.

③ Sub CPU PCB can be detached by removing four screws ③.
④ Memory PCB can be detached by removing four spacers ④.
⑤ For mounting new PCB, reverse the above procedure ④ → ①.

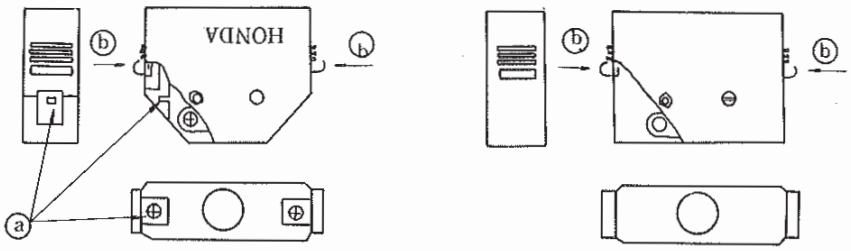
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7.7 Replacing Methods of Connection Unit 1

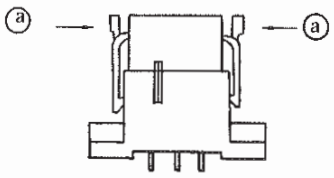


1) Procedure

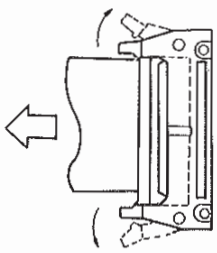
① Disconnect CO1 - CO5 connector cables by pushing part ⓑ after loosening two screws ⓐ as illustrated below.



② Disconnect CP51 connector cable by pushing ⓐ as illustrated below.



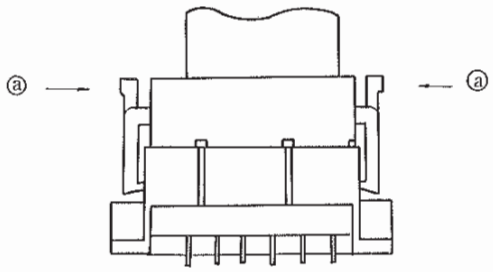
③ If connection unit 2 is mounted, disconnect connector CDD1 cable in the arrow direction after unlocking it as illustrated below.



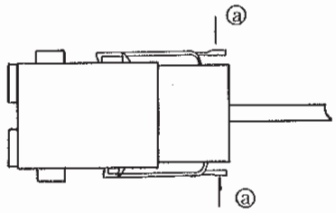
For connecting the cable, push it in the direction opposite to ⇦ after setting it to mark ▼ of the connector under the unlocked condition, then, lock the cable. In this case, push the connector forcibly, or else the cable cannot be locked.
The left figure shows the locked condition.

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④ If connection unit 2 is provided, disconnect the CP52 connector cable by pushing ⓐ as illustrated below.



⑤ Disconnect the COP4 connector cable by pushing ⓐ as illustrated below.

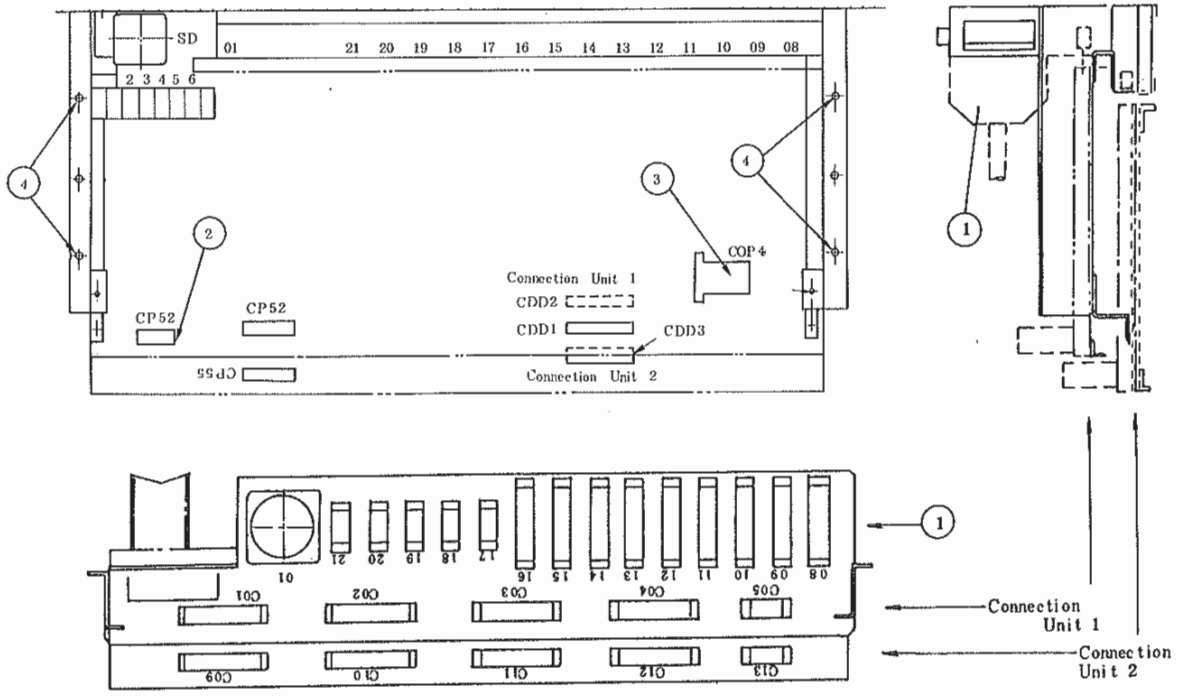


⑥ The connection unit is detached by removing the four screws shown in ⑥.

⑦ For mounting new PCB, reverse the above procedure ⑥ → ①.

2) Setting
Perform setting (1 - 4) of new PCB in the same way as in old PCB before exchange.

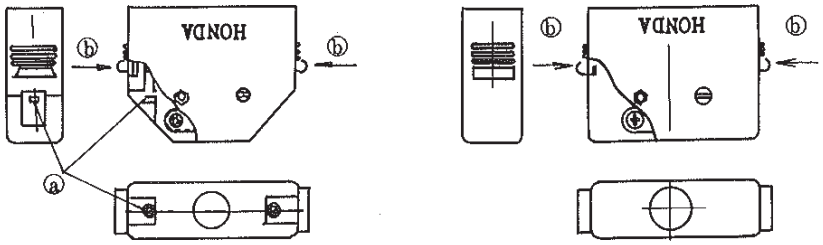
7.8 Replacing Methods of Connection Unit (with Connecting Board)



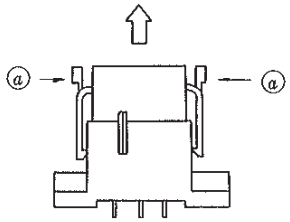
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1) Procedure

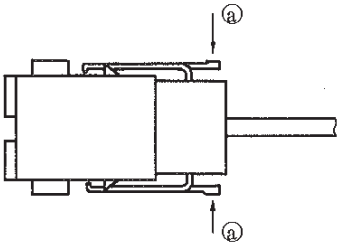
① Disconnect connector cables 08 - 21 by pushing ⓑ after loosening two screws ⓐ as illustrated below.



② Disconnect the CP51 connector cable by pushing ⓐ as illustrated below.



③ Disconnect connector COP4 cable by pushing ⓐ as illustrated below.



④ The unit can be detached by removing four screws ④.
⑤ Put the unit on the board as illustrated below.

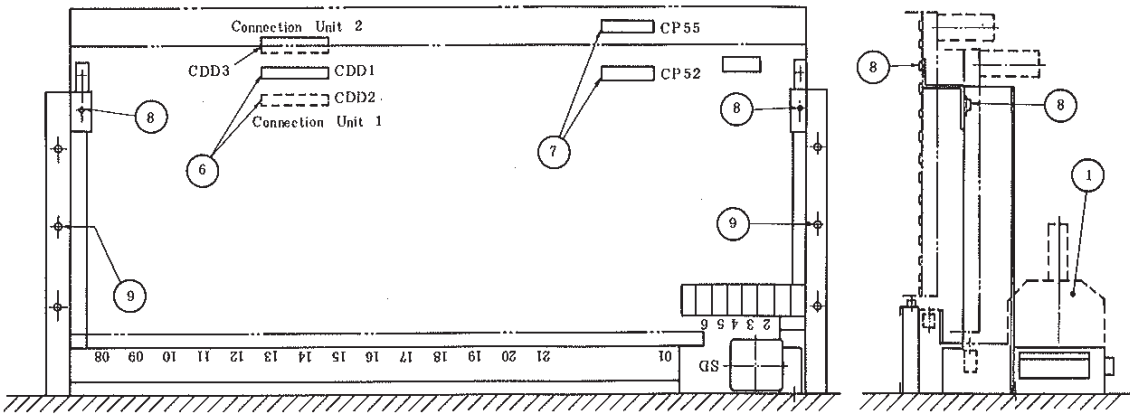
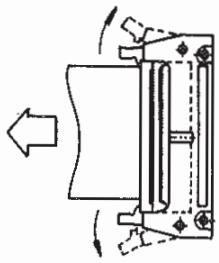


Fig. 2

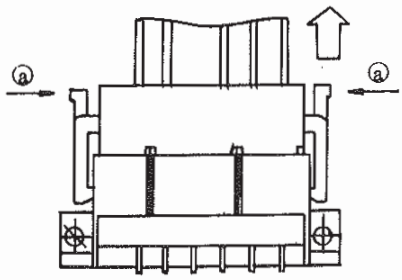
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⑥ Disconnect connector CDD1/CDD2 cable in the arrow direction after unlocking it as illustrated below.

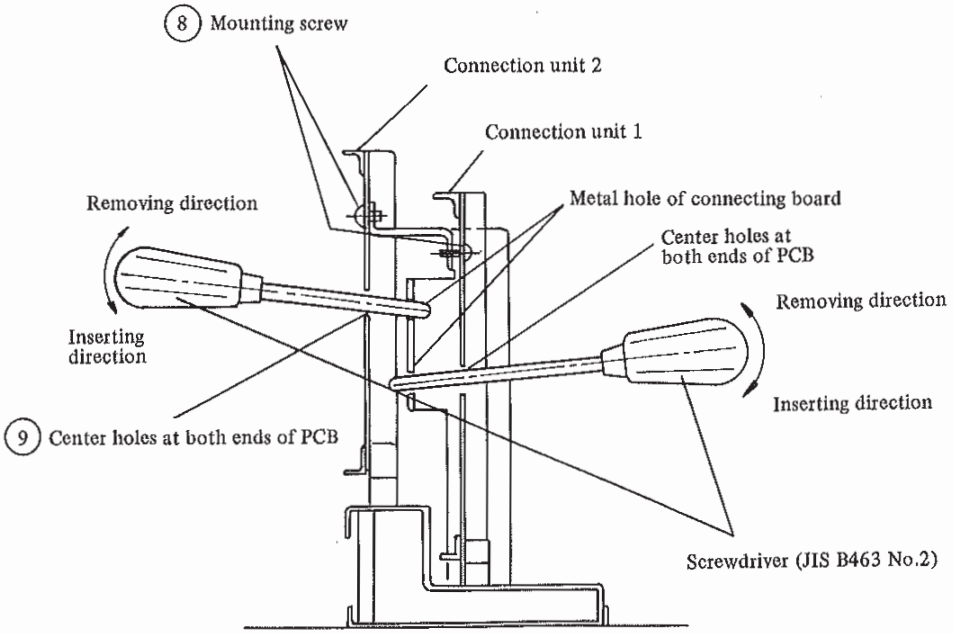


(Caution)
For connecting the cable, push it in the direction opposite to ⇐ after setting it to mark ▼ of the connector under the unlocked condition, then, lock the cable. In this case, push the connector forcibly, or else the cable cannot be locked.
The left figure shows the locked condition.

⑦ Disconnect the CDP connector cable by pushing ⓐ as illustrated below.



⑧ After removing the two right and left mounting screws ⑧ in the connection unit, insert screwdrivers into center holes ⑨ at both ends of the connection unit, and detach the connection unit by alternately lifting screwdrivers.

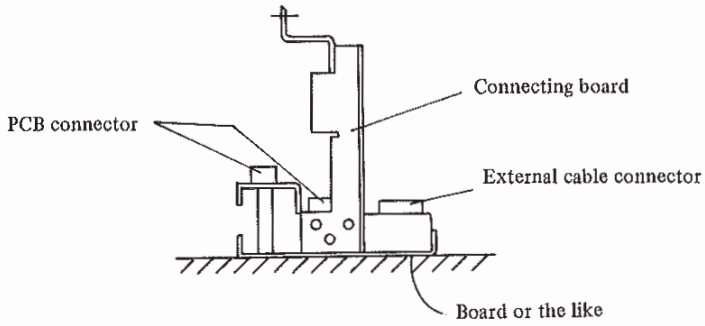


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2) Setting

Perform setting on new PCB in the same way as in old PCB before exchange.
Mounting Methods
For mounting PCB (for DI/DO) used on the connecting board, observe the following procedure.

① Put the disconnecting board on a board or the like as illustrated below.



② Make sure the inserting directions of PCB connector and PCB connector on the disconnecting board; lightly push these connectors after positioning.

③ Insert a screwdriver into the center holes (ϕ8) at both ends of PCB and the hole (ϕ7) on the connecting board metal, and insert PCB by pushing the right and left of PCB downward alternately 2 - 3 times by means of lever. Fix the PCB by mounting screws ⑧ after inserting the connector.

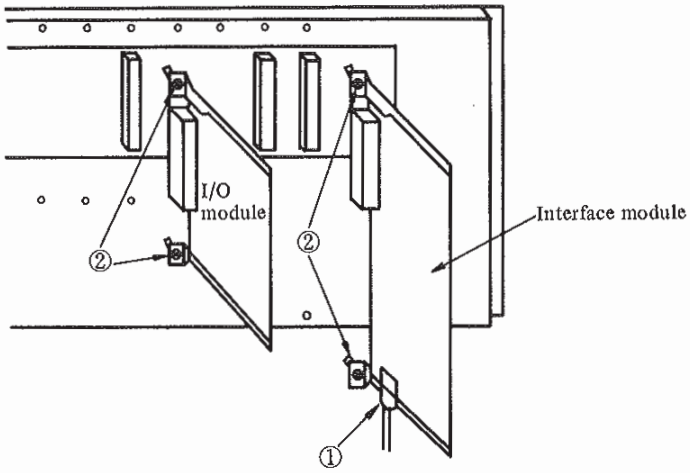
(Caution)
Confirm the inserting direction of the connector, and check to see if the connector has been securely connected by lightly pushing it before starting the work, otherwise the connector may be broken.

④ Mount the unit to NC by reversing the dismounting procedure ⑦ → ①.

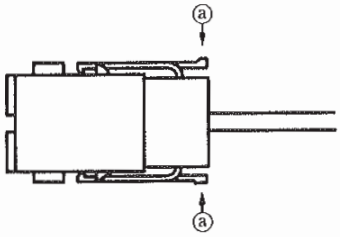
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7.9 Replacing Method of Built-in Type I/O Unit PCB (12/120 series only)

7.9.1 Replacing method of interface and I/O module



1) Procedure
   ① Detach the optical fiber cable for interface module the cable pushing part ⓐ as illustrated below.



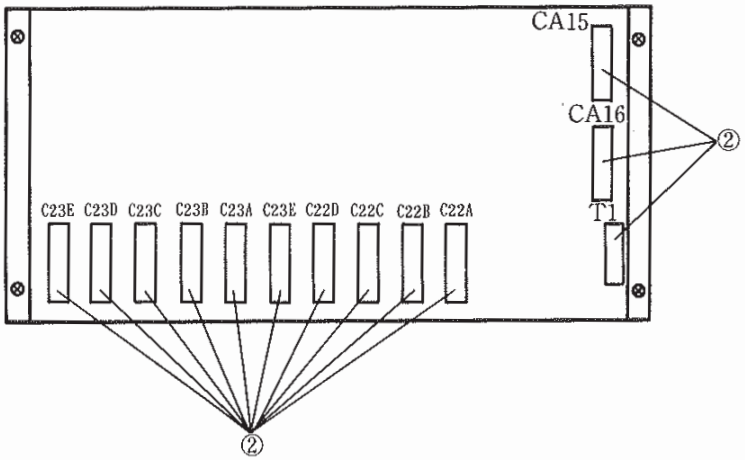
   ② The PCB can be detached by loosing two screws.
   ③ For mounting new PCB, reverse the above procedure ② → ①.
2) Setting
   ① Setting on new module should be same as that in an old interface module for exchange.

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7.9.2 Replacing method of I/O base unit

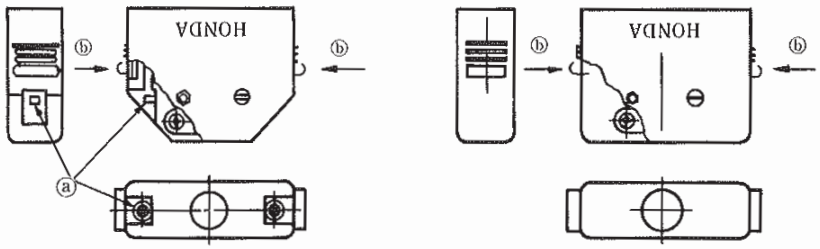
1) Procedure

① Detach the interface module and I/O module according to 7.9.1.
② Remove all cables connected to the I/O base unit.

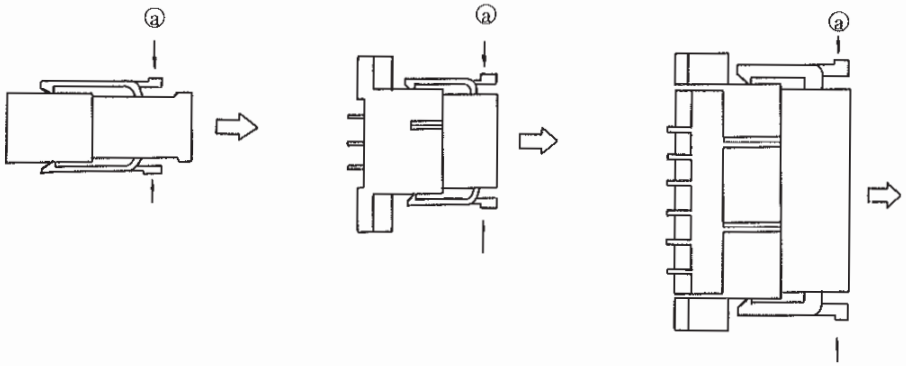


Disconnect cables using the following procedure.

i) Disconnect HONDA connector by pushing part ⓑ after loosing two screws as illustrated below.



ii) Disconnect NIHON BURNDY connection in the arrow (⇒) direction by pushing part ⓐ as illustrated below.



③ I/O base unit can be detached by unscrewing four screws Ⓐ.
④ For mounting new I/O base unit, reverse the above procedure ③ → ①.

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7.10 Exchange Methods of I/O Unit

7.10.1 Exchange method of power supply module

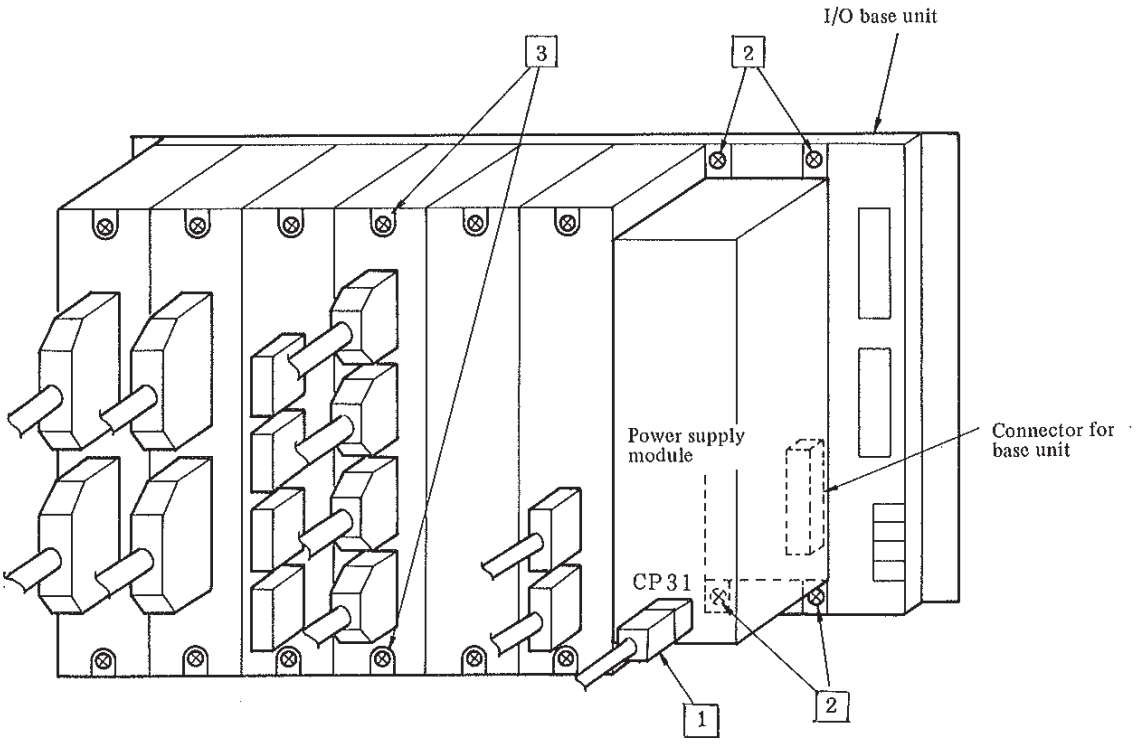
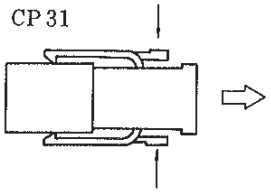


Fig. 7.10.1 Installation diagram of module

1) Procedure
   ① Draw out the connector CP31 cable [1] according to the illustrated procedure.



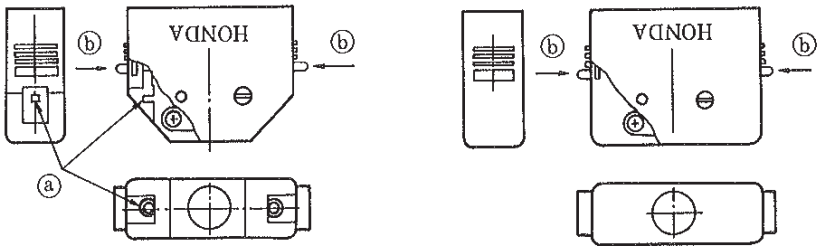
   ② Remove the power supply module by loosening four screws [2].
   The power supply unit is connected to the base unit by the connector shown by the dotted line in the figure 7.1.
   ③ Reverse the above procedure (② → ①) when mounting new module.

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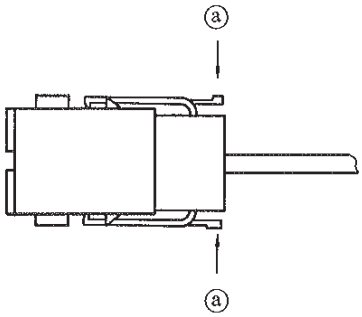
7.10.2 Exchange method of main control module and I/O module

1) Procedure
Replace these modules according to the following procedure, referring to Fig. 7.10.1.

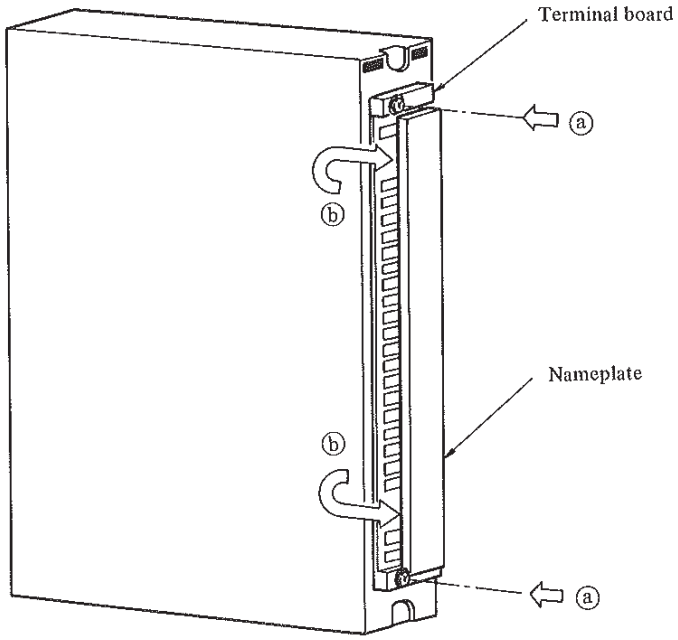
1 Disconnect cables from the modules (if connected).
Loosen two screws a and draw them out by pressing b in the case of the HONDA connector as shown below.



Draw out the optical fiber cable while pushing part a as illustrated below.



For the terminal board connection, remove the entire terminal board by drawing it toward you while holding its upper and lower ends after loosening the two screws a shown below.
For disconnecting the wiring, open the nameplate.
The nameplate is opened by drawing it toward you while applying your fingers to parts b shown in the following figure.



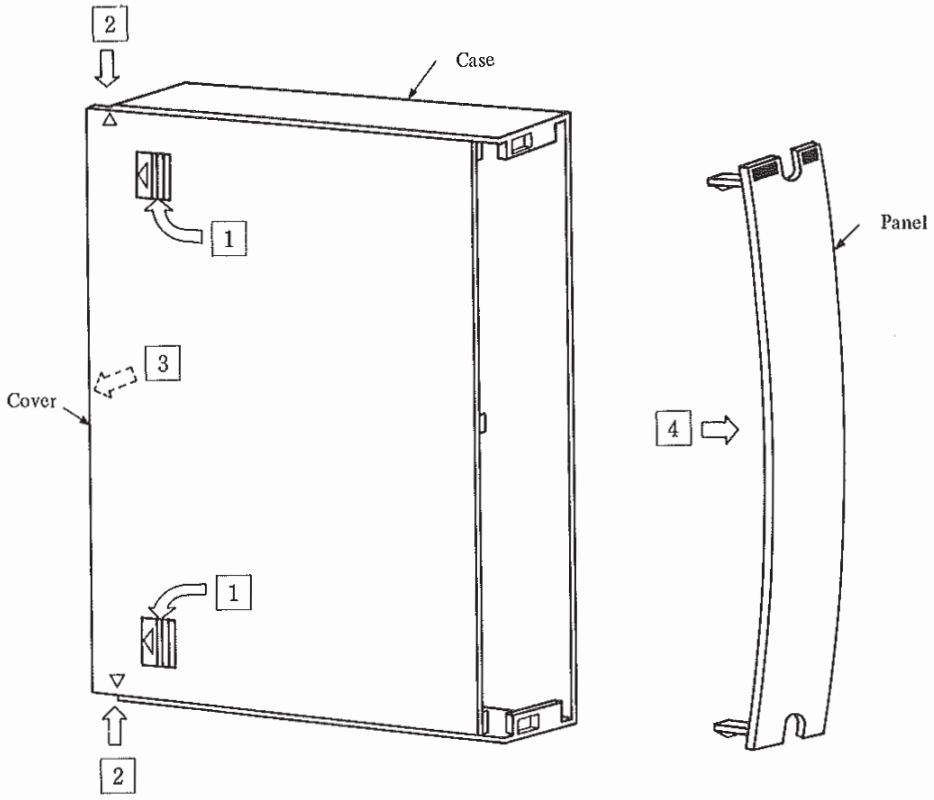
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② Draw out each module after loosening the two screws shown in Fig. 7.1. Each module is connected to the base unit in the same way as in the power supply module.
③ Reverse the procedure (② → ①) when mounting new modules.

2) Setting
Set the new modules in the same way as in modules before exchange.

3) Cautions
a) Positioning module ... Check the mounting number of ROM (1 pce), the ROM number and edition number. Check the positioning control LSI.
b) Module for terminal board wiring
Detach the terminal board mounted on the module for replacement. Mount the detached terminal board on the module thats terminal board has been removed. (Return these modules with terminal boards mounted.)

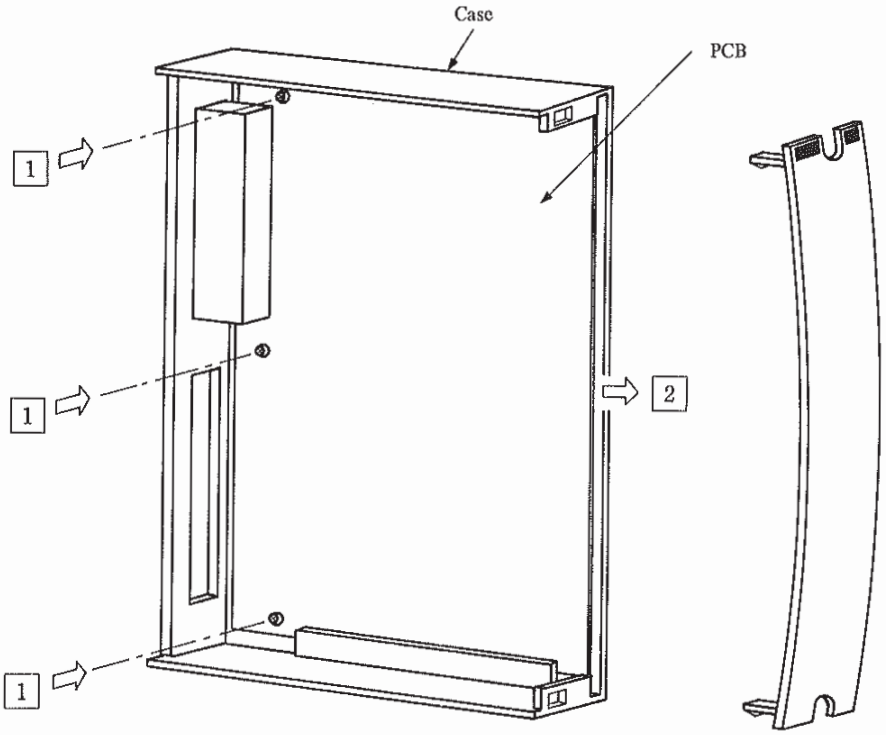
4) Plastic case disassembly method



① Push the positions shown by [1] on the cover using both thumbs towards the ▽ marks [2] at the extreme left of the case.
② Remove the cover by pushing the center of the left end of the cover shown by [3] from the rear side.
③ The panel can be detached by pushing the center of the panel (direction [4] until it is curved.

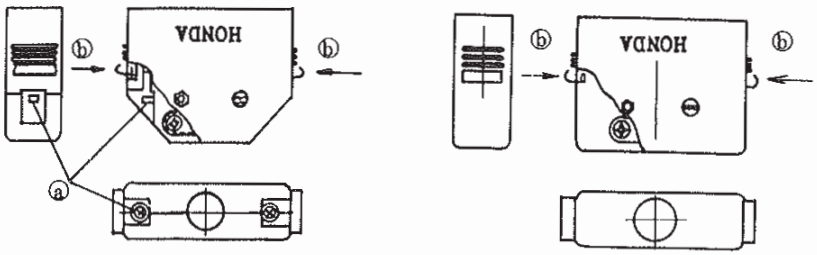
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Observe the following procedure when detaching the PCB from the plastic case.



① Remove PCB mounting screws [1] .
② Draw the PCB out of the case in direction [2] .

Disconnect each cable as follows:
Disconnect HONDA connector by pushing part ⓑ after loosening the two screws ⓐ shown in the following figure.

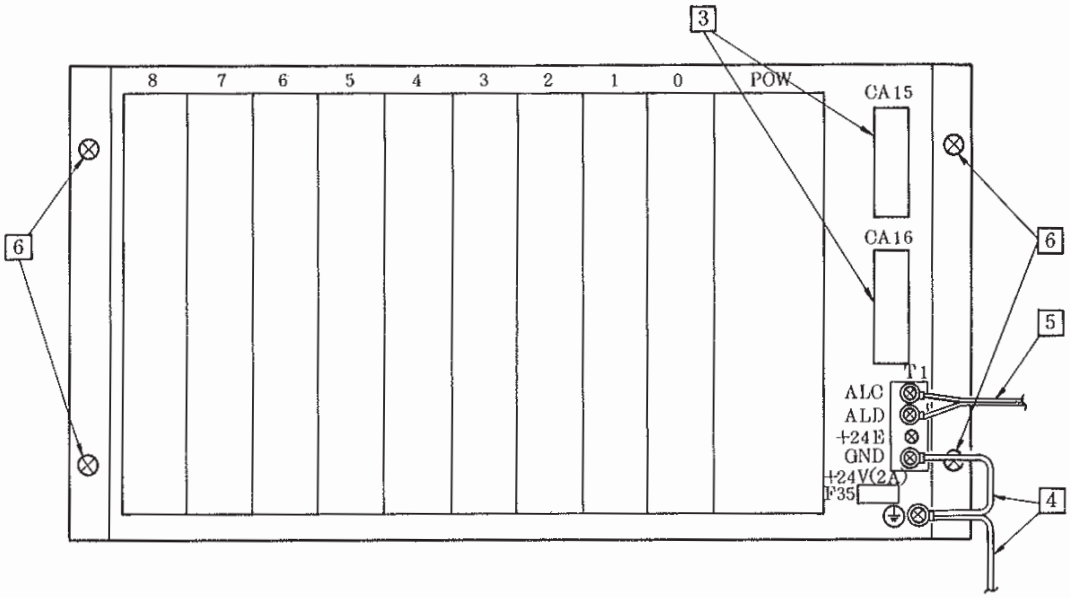


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7.10.3 Exchange method of base units

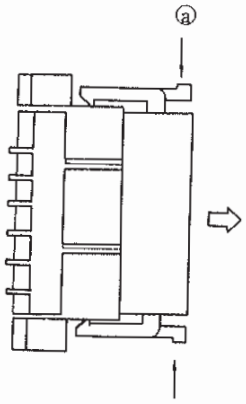
1) Procedure

① Remove the power supply module according to 7.1
② Remove each module according to 7.2
③ Disconnect all cables from the base units shown by [3] .



I/O unit

Disconnect NIHON BURNDY connector in the arrow (⇒) direction while pushing parts ⓐ shown in the following figure.



④ Disconnect the ground wires shown in [4] .
⑤ Disconnect the power alarm signal cables shown in [6] . (This wiring is not always connected.)
⑥ The base unit can be detached by loosening the four screws shown in [6] .
⑦ Reverse the procedure ([6] - [1]) when mounting new units.

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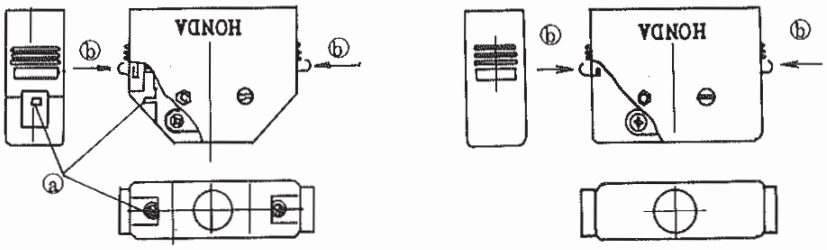
2) Caution
Reset parameters after replacing the main unit.

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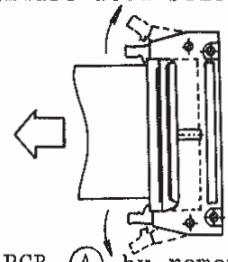
7.11 Replacing Methods of Small CRT/MDI PCB

7.11.1 Replacement of PCB A (keyboard PCB)

① Disconnect connector CA9 cable by pushing part ⓑ after loosening the two screws a as illustrated below.



② Disconnect the connector CKK1 cable in the arrow direction after unlocking it as illustrated below.



(Caution)
To connect the cable, push it in the direction opposite to ⟸ after setting it to mark ▼ of connector under the unlocked condition, then lock the cable.

③ Detach PCB Ⓐ by removing six nuts ③.
In case of a sheet switch, detach PCB A by removing the sheet from the front.

④ To mount new PCB, reverse the above procedure ③ z ①.

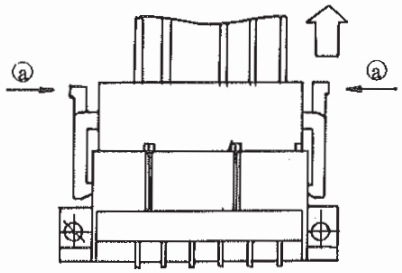
7.11.2 Replacement of PCB B (soft key PCB)

It is necessary when replacing PCB B to detach the CRT unit. It is recommended to detach the CRT/MDI unit from the panel as described below.

① Disconnect connector CN1 cable in the same way as in disconnecting the CA9 cable.

② Disconnect connector CKK1 cable in the same way as described in ② of 7.8.1.

③ Disconnect connector CN2 cable by pushing ⓐ as illustrated below.

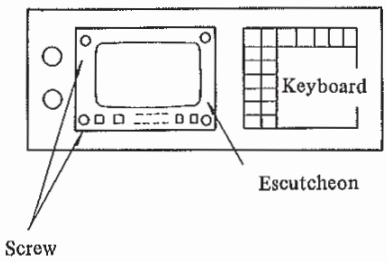


④ Detach the CRT/MDI unit by removing the eight screws from the front panel.

⑤ The CRT unit can be detached by removing four screws D by inserting a screwdriver from the rear part of the CRT unit.

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⑥ Remove the soft key PCB together with escutcheon by unscrewing the four screws on the front panel.

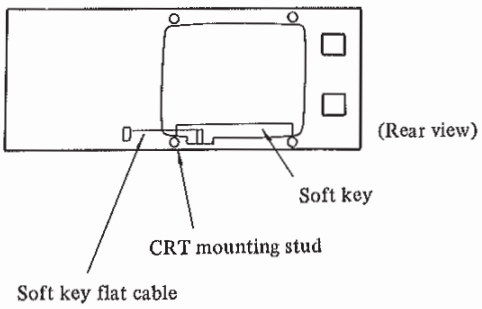


Detach the soft key PCB together with CRT escutcheon because they are assembled into a unit.

⑦ Remove the soft key PCB by unscrewing the two screws from the rear side of the escutcheon.

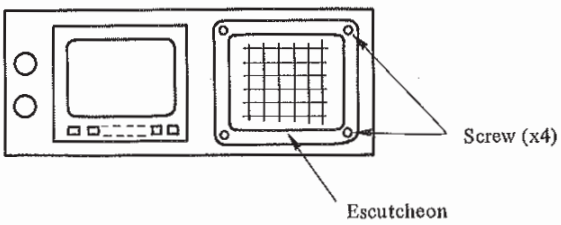
⑧ Assemble PCB by reversing the above procedure ⑦ → ①.

(Note) Assembly of soft key



Mount CRT by passing the flat cable of soft key through the position above the CRT mounting stud bolts.

⑨ Replace the key sheet. (In case of sheet switch on CRT/MDI)



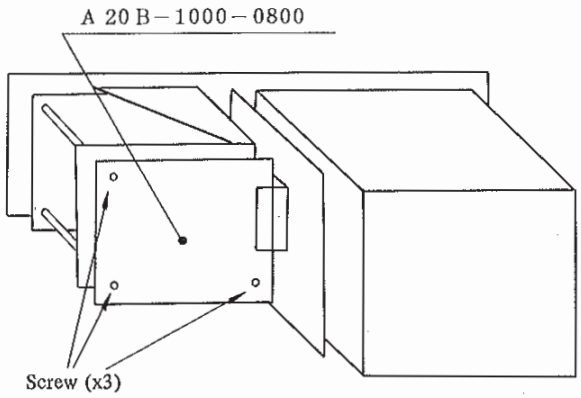
Remove the screws to detach the escutcheon. Then remove the sheet.

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7.12 Replacing Methods of 9'' Standard CRT/MDI Unit PCB

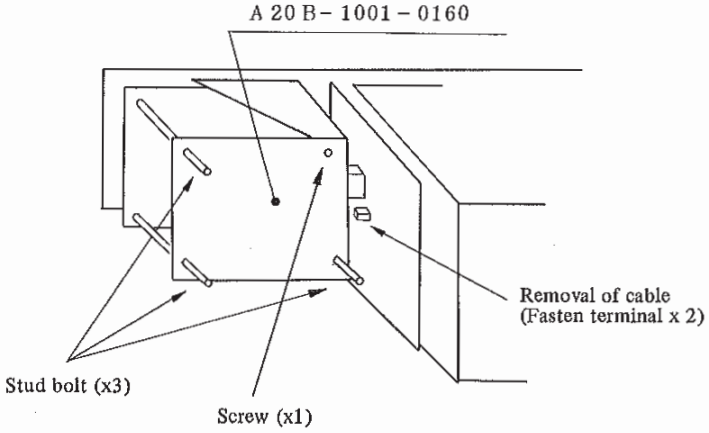
(The following description covers the horizontal CRT/MDI, but also applicable to the vertical type, accordingly)

1) Control PCB



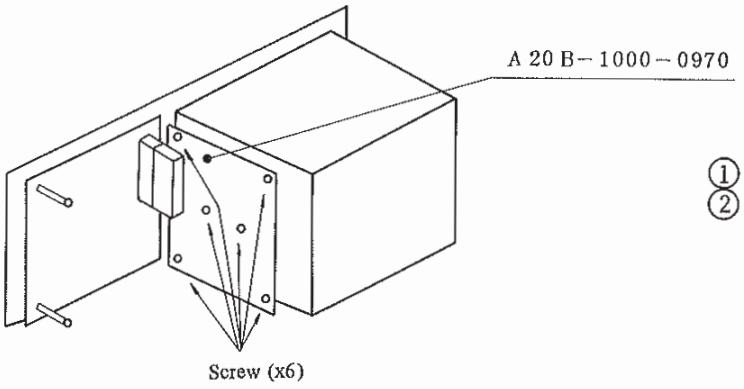
① Disconnect PCB cable.
② Remove screws.
③ Remove the PCB from the connector.

2) Power supply PCB



① Disconnect the cable (fasten terminal).
② Remove stud bolts and screws.
③ Remove PCB from the connector.

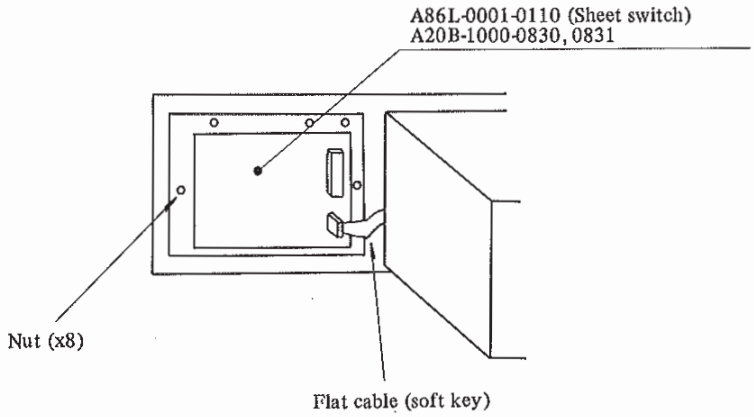
3) Backboard PCB



① Remove screws.
② Remove PCB from the connector.

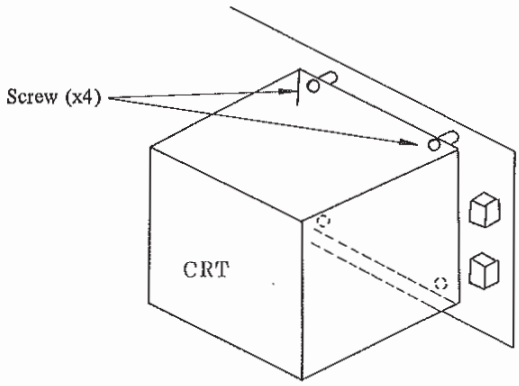
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4) Keyboard PCB



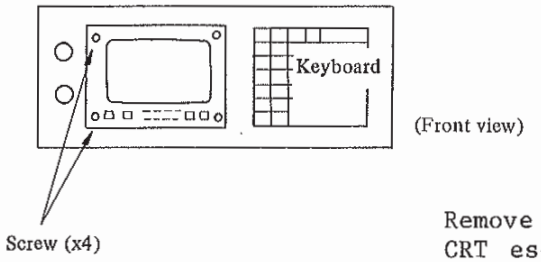
① Disconnect the flat cable from keyboard PCB.
② Remove the nuts from the keyboard fixing plate and detach the keyboard PCB together with the fixing plate.
(The fixing plate and PCB are assembled.)
③ In the case of a sheet switch, remove the PCB after sheet switch is detached.

5) CRT



Remove CRT fixing screws.

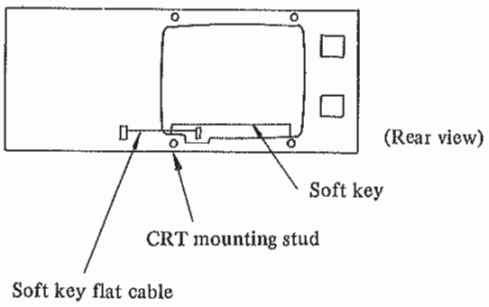
6) Soft key



Remove the soft key PCB together with CRT escutcheon because they are assembled into a unit.

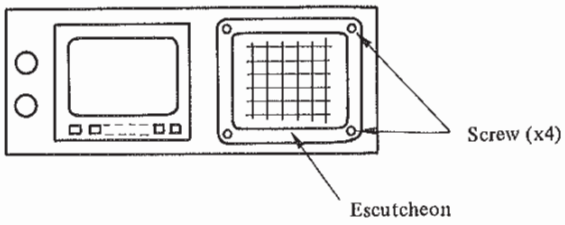
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(Note) Assembly of soft key



Mount CRT by passing the flat cable of soft key through the position above the CRT mounting stud bolts.

7) Replace the key sheet. (In case of sheet switch on CRT/MDI)



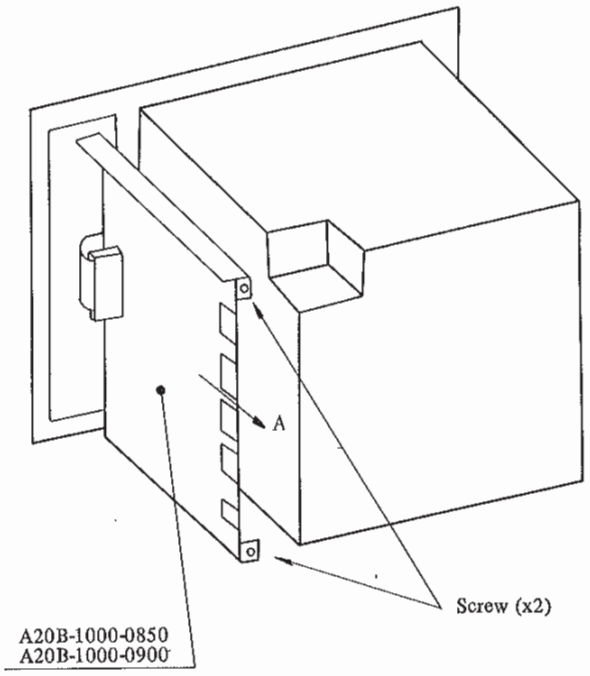
Remove the screws to detach the escutcheon. Then remove the sheet.

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7.13 Replacing Methods of 14" Color CRT/MDI (horizontal type) PCB

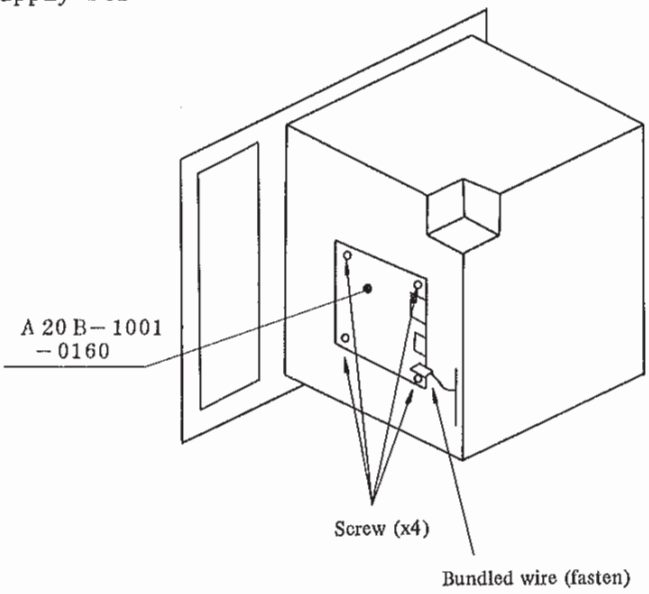
7.13.1 10/11/12 series

1) Control PCB



① Disconnect all connector cables from PCB.
② Remove PCB by sliding it in the Ⓐ direction after removing screws.

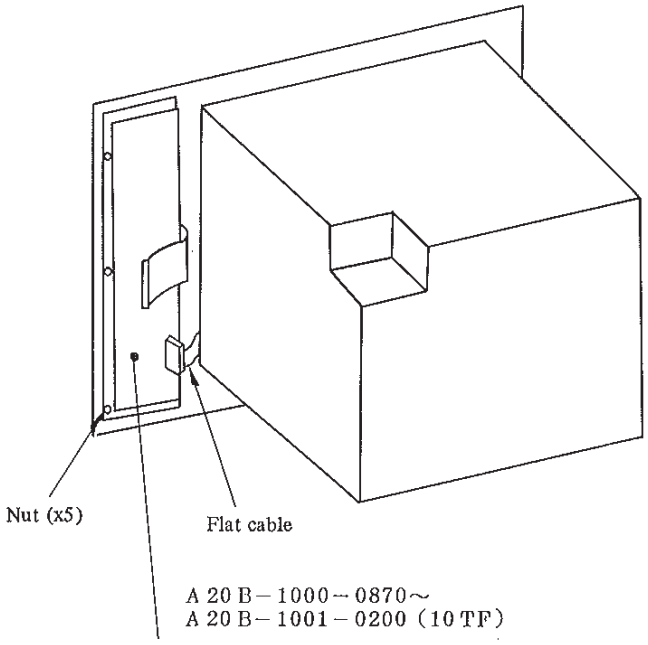
2) Power supply PCB



① Disconnect the bundled wire (fasten).
② Remove PCB by unscrewing screws.

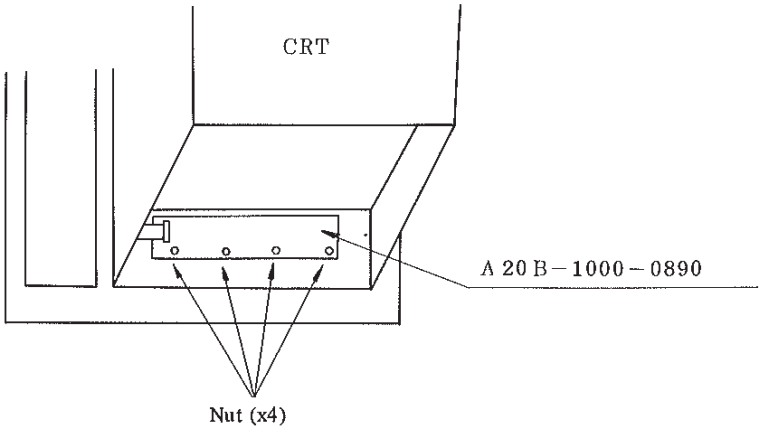
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3) Keyboard PCB



① Disconnect the flat cable of soft key from PCB.
② Remove nuts; then remove together with the fixing plate.

4) Soft key PCB

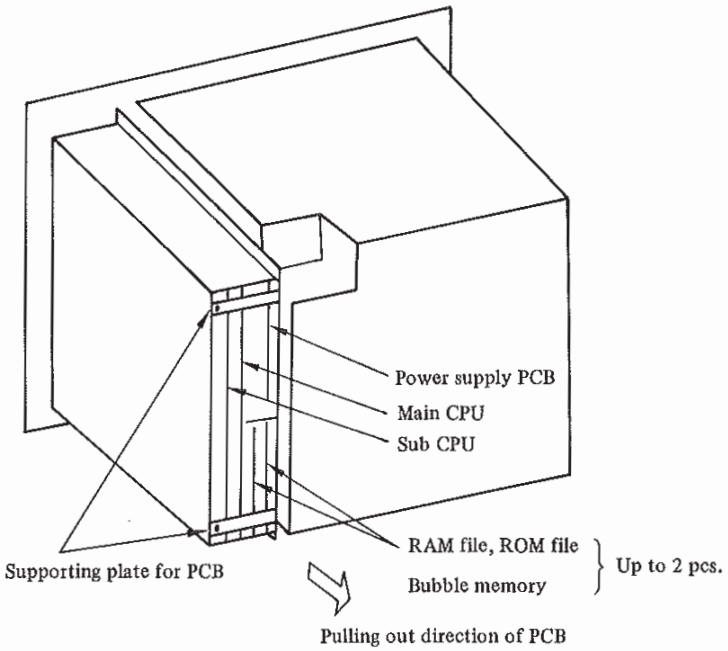


1) Remove nuts. Remove the soft key PCB together with the fixing board.

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7.13.2 100/110/120 series

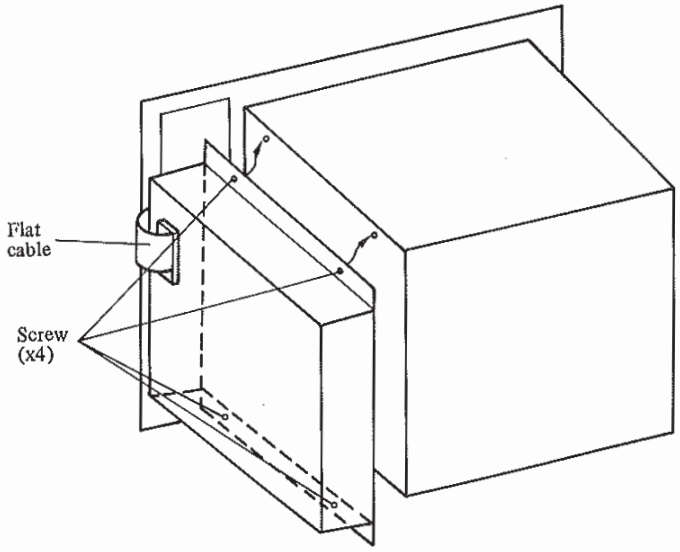
1) Main and sub CPU, Power supply PCB, ROM/RAM file, Bubble memory



① Remove the supporting plate for PCB after removing two screws (up and down) on its.
② Each one of main-CPU, sub CPU, power supply unit, RAM/ROM file and bubble memory can be pulled out along to a rail after rising up the ejector.

2) Keyboard PCB

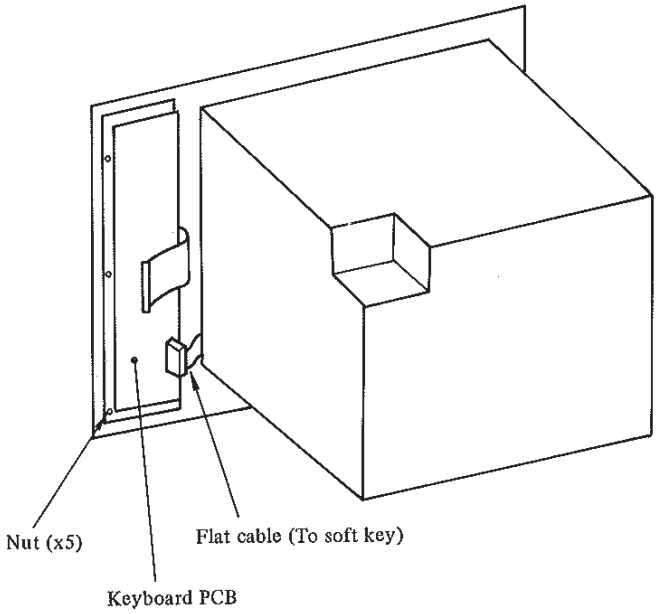
1 Removing of control



Disconnect the cable connected to PCB and flat cable for keyboard signal, then control section can be remove by removing the above four screws.

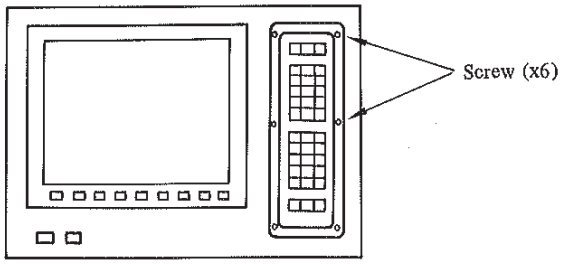
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② Removing of keyboard



Remove the keysheet from front, then remove the keyboard PCB.

3) Replacement of key sheet



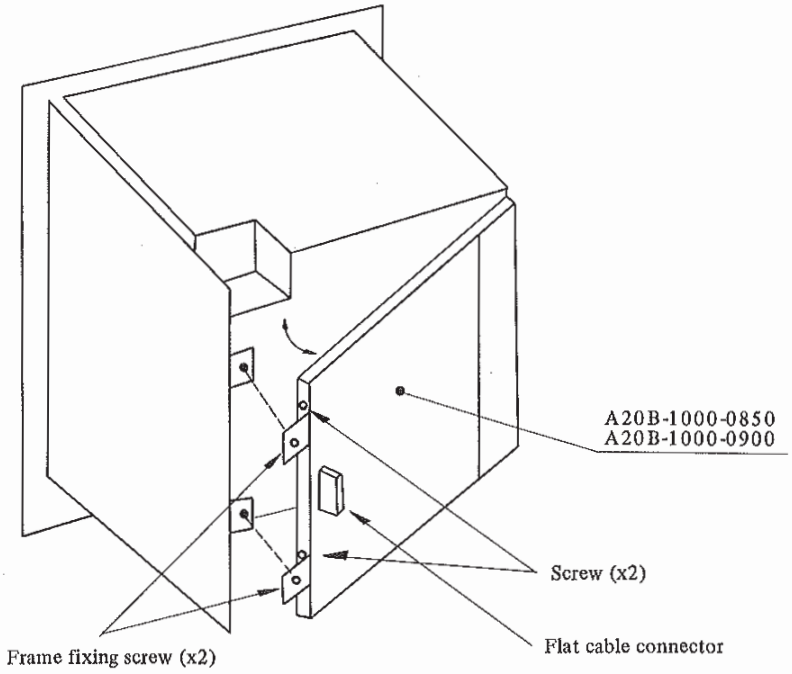
① Remove the screw to detach the escutcheon. Then remove the escutcheon and sheet and replace the new sheet.

4) Softkey PCB
The procedure is same as 14" CRT/MDI for 10/11/12 series.

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7.14 Replacing Methods of 14" CRT/MDI Graphic Unit (vertical type) PCB (10/11/12 series)

1) Control PCB



1) Disconnect the flat cable from keyboard.
2) Remove the frame fixing screws and open the PCB metal.
3) Remove screws and detach PCB.

2) Power supply PCB A20B-1001-0160

Keyboard PCB A20B-1000-0880 -
A20B-1001-0270 (10TF)

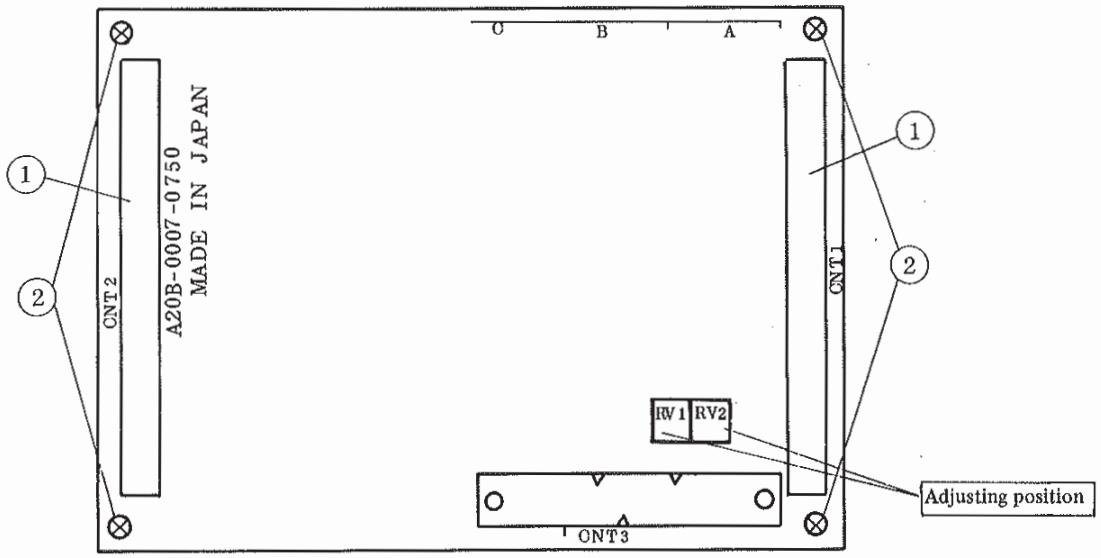
Soft key PCB A20B-1000-0891

These PCBs can be replaced using the same procedure as in vertical type in 7.10.

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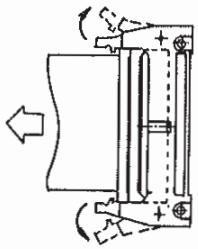
7.15 Replacing Methods of PCB and Others Referred to Tape Reader

7.15.1 Replacement of PCB of tape reader without reels photoamplifier



1) Procedure

① Disconnect connectors CNT1, CNT2 in the arrow direction by unlocking them as shown below.



② Remove PCB by unscrewing four screws.

③ Mount new PCB by reversing the above procedure ② → ①.

2) Adjustment

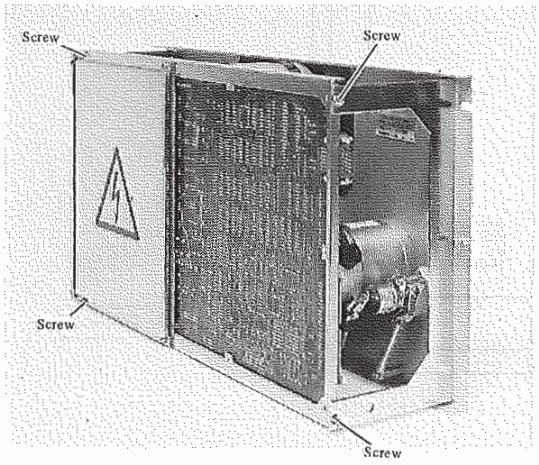
Adjust RV1 and RV2 according to the maintenance manual (B-54815E).

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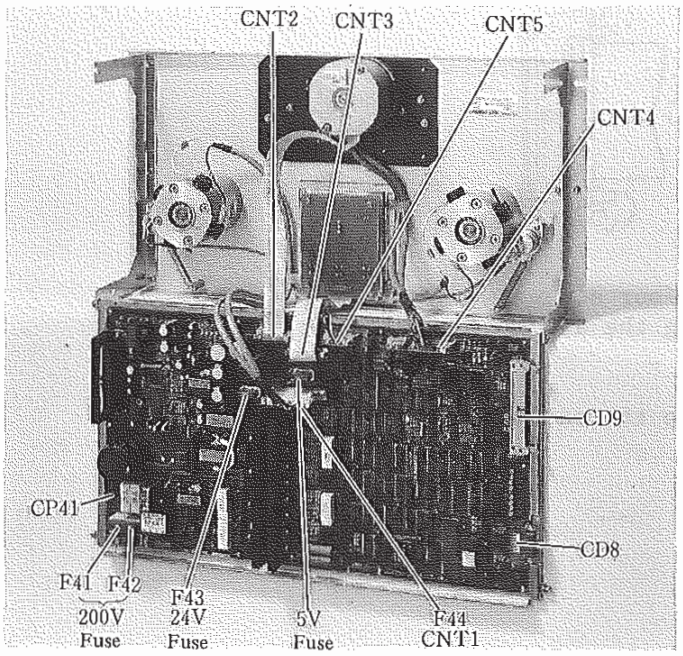
7.15.2 Replacing methods of tape reader with reels PCB and fuses

1) Procedure

① Disconnect connectors CD9 (CD8) and CP41.
② Loosen the four screws on sides of the rear panel of the tape reader.
③ Detach PCB from the metal by pulling it upward as illustrated in the figure below.
④ Disconnect PCB cables from connectors (CTN2 - CTN5).
⑤ Remove PCB by unscrewing screws.



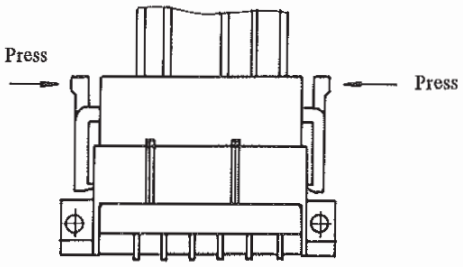
(Adjustment)
Adjust the photoamplifier after replacing it.



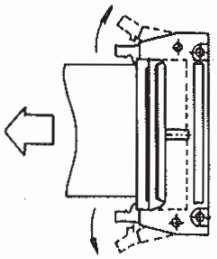
(Replacement of fuses)
Replace fuses after eliminating the cause of blowout.

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How to remove CNT1 and CP41 (3 pins)



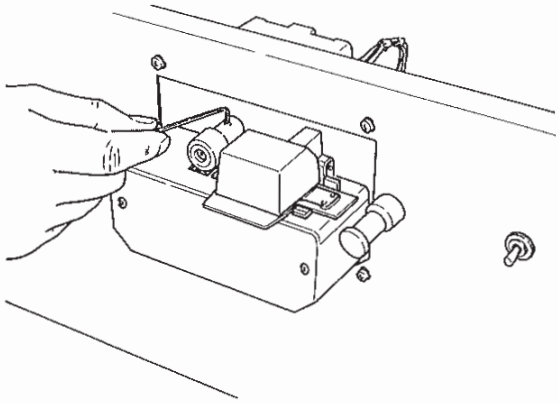
How to remove CD9, CNT2, CNT3, CNT4, and CNT5

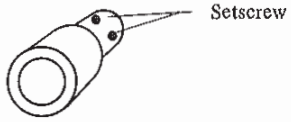


(Note) When connecting a cable push it in the direction opposite ⟸ after setting it to mark ▼ of the connector under the unlocked condition, then lock the cable.
In this case, push the connector forcibly, otherwise the cable cannot be locked.
The left figure shows the locked condition.

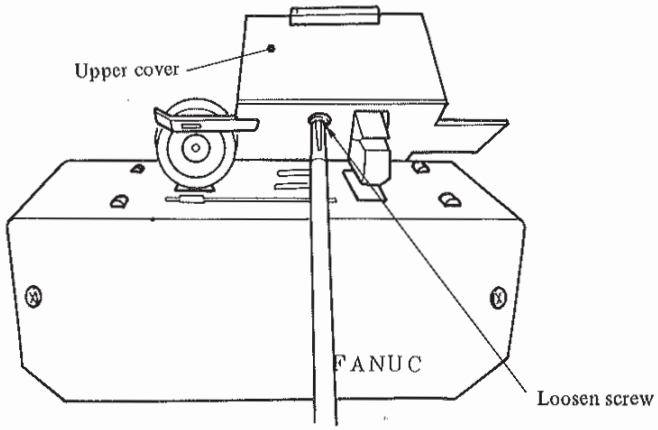
7.15.3 Replacement of capstan roller of tape reader without reels

Loosen the two set screws of capstan roller, and detach the capstan roller from the motor shaft.



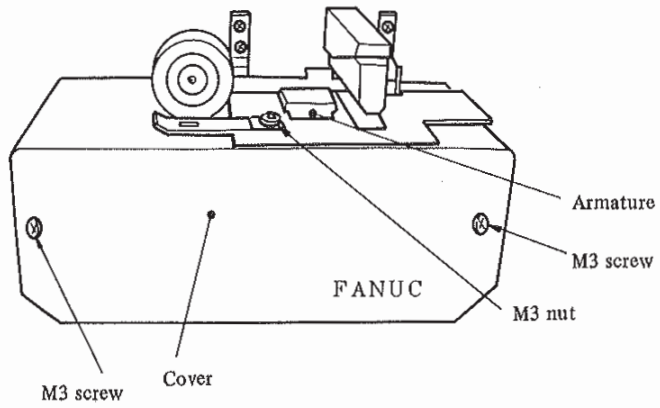


7.15.4 Replacement of capstan roller of tape reader with reels



① Remove the upper cover.

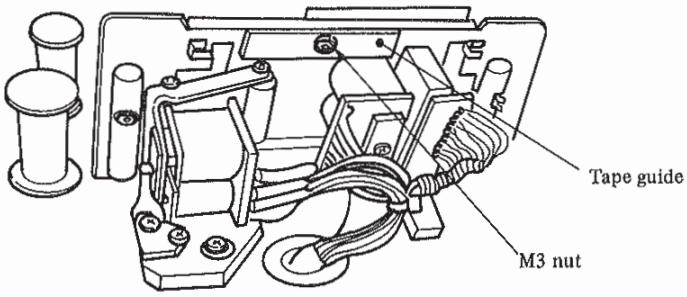
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② Remove the armature.

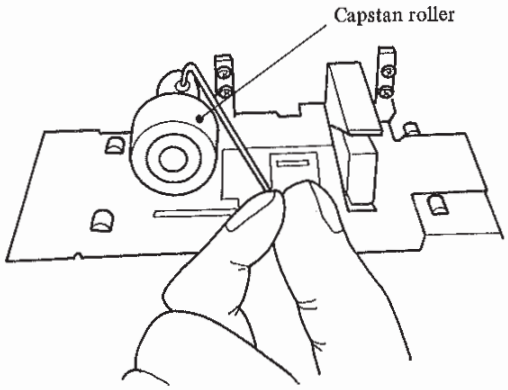
③ Remove the tape guide by loosening M3 nuts.

④ Remove the cover by loosening M4 screws.



⑤ Remove the tape guide by loosening M3 nuts.

Interior of cover as viewed from the bottom

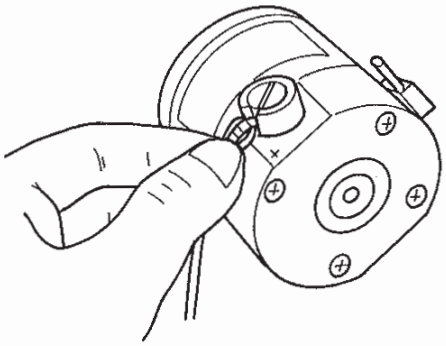


⑥ Remove the capstan roller by loosening two setscrews.

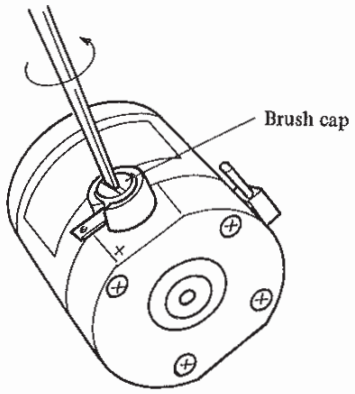


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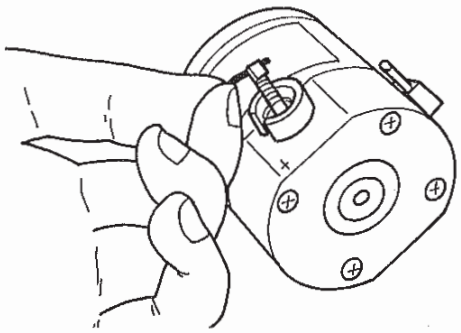
7.15.5 Replacement of brushes of tape reader with reels sole motor



① Four brushes are mounted in one motor.
② Disconnect cables from these brushes.



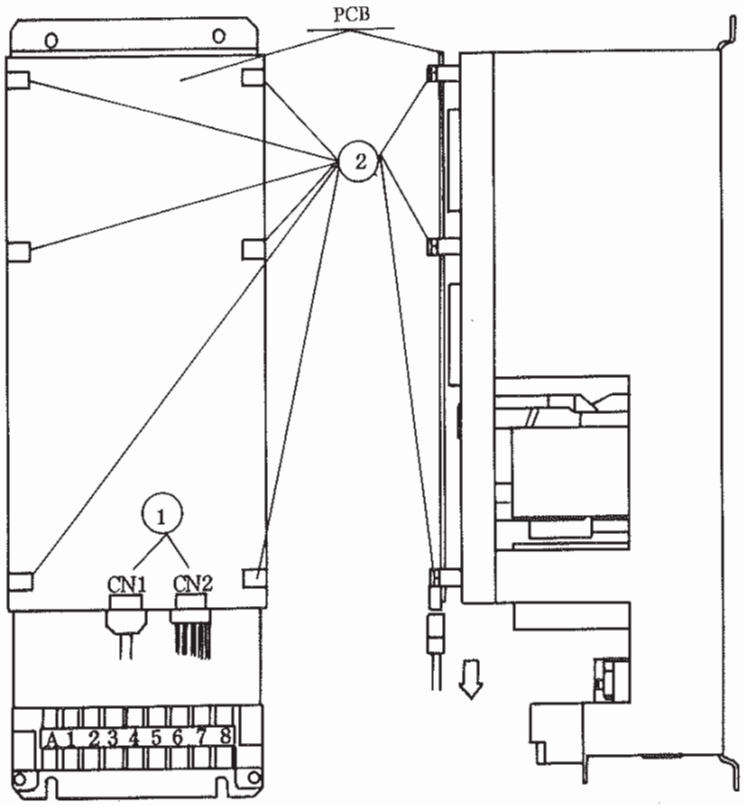
③ Remove the brush caps.



④ Remove brushes.
⑤ Assemble brushes after replacement by reversing the above procedure.
⑥ Securely connect cables to the same place as before, otherwise the rotating direction is reversed and will cause an alarm.

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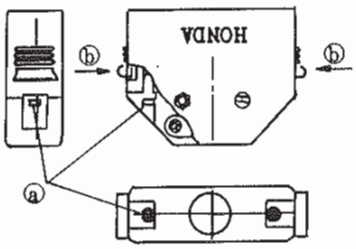
7.16 Replacement of PCB for Velocity Control Unit and AC Servo Amplifier



1) Procedure

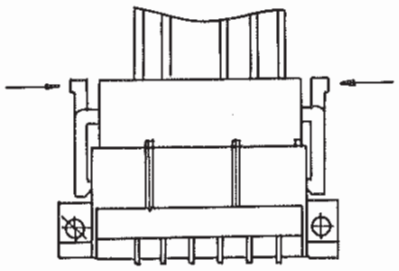
① Disconnect the cables from connectors CN1 and CN2.

(CN1)



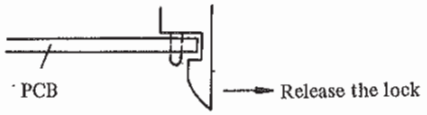
Loosen screw ⓐ, and pull out the connector by pushing ⓑ.

(CN2)



Pull out the connector by pushing the arrow-marked position.

② Pull the PCB forward by opening the locks with your finger, and the PCB can be removed.



③ Mount the new PCB according to procedure ② and ①.

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2) Setting and adjustment
   ① Set the PCB in the same way as on the old one.
   ② Make adjustments as required according to maintenance manual.

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APPENDIX 1 CONNECTION DIAGRAMS

1.1 10 Series

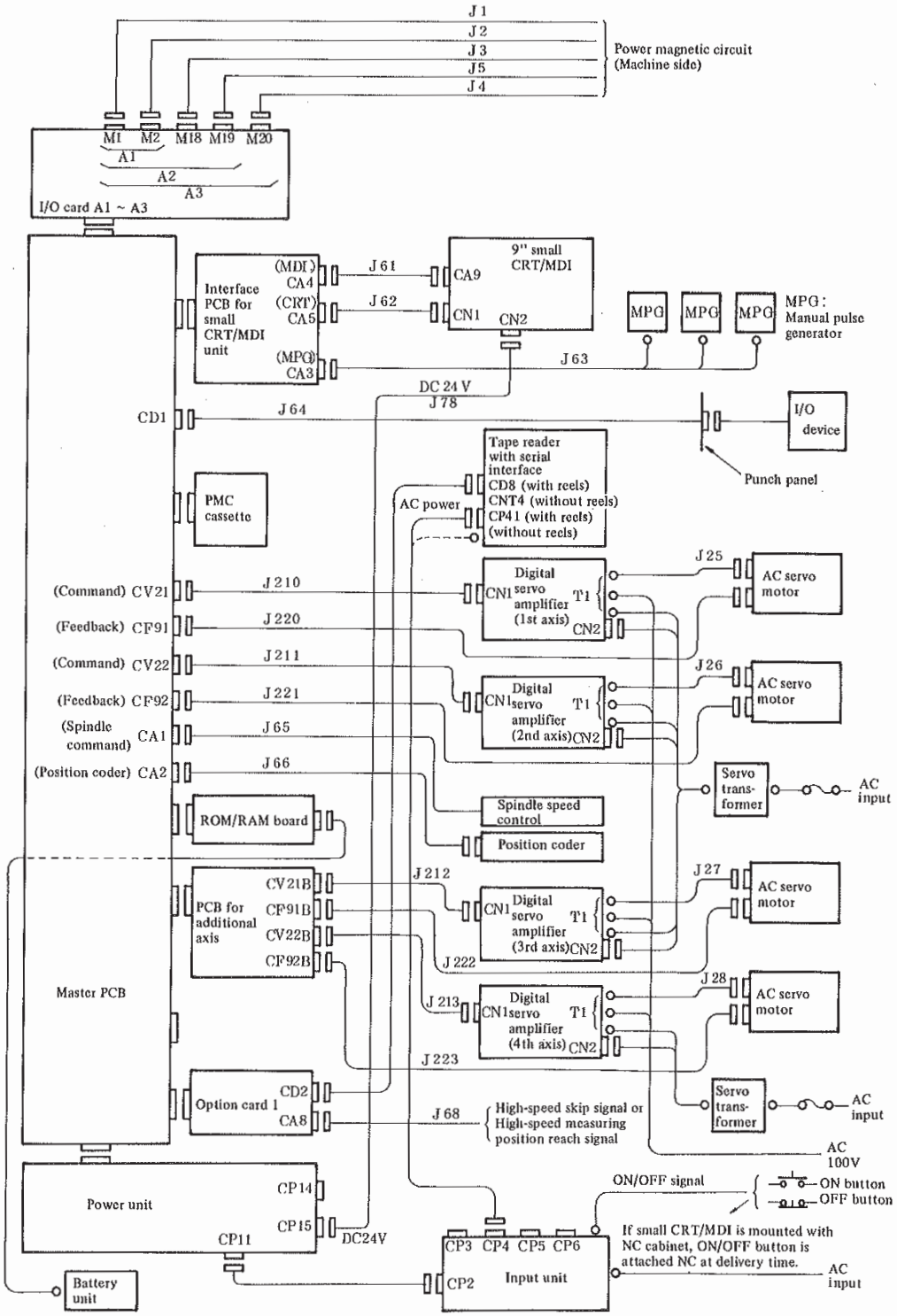


Fig. 1.1 (a) 10TA/10MA total connecting diagram (Digital servo, 9" small CRT/MDI and I/O card A1 ~ A3 are used.)

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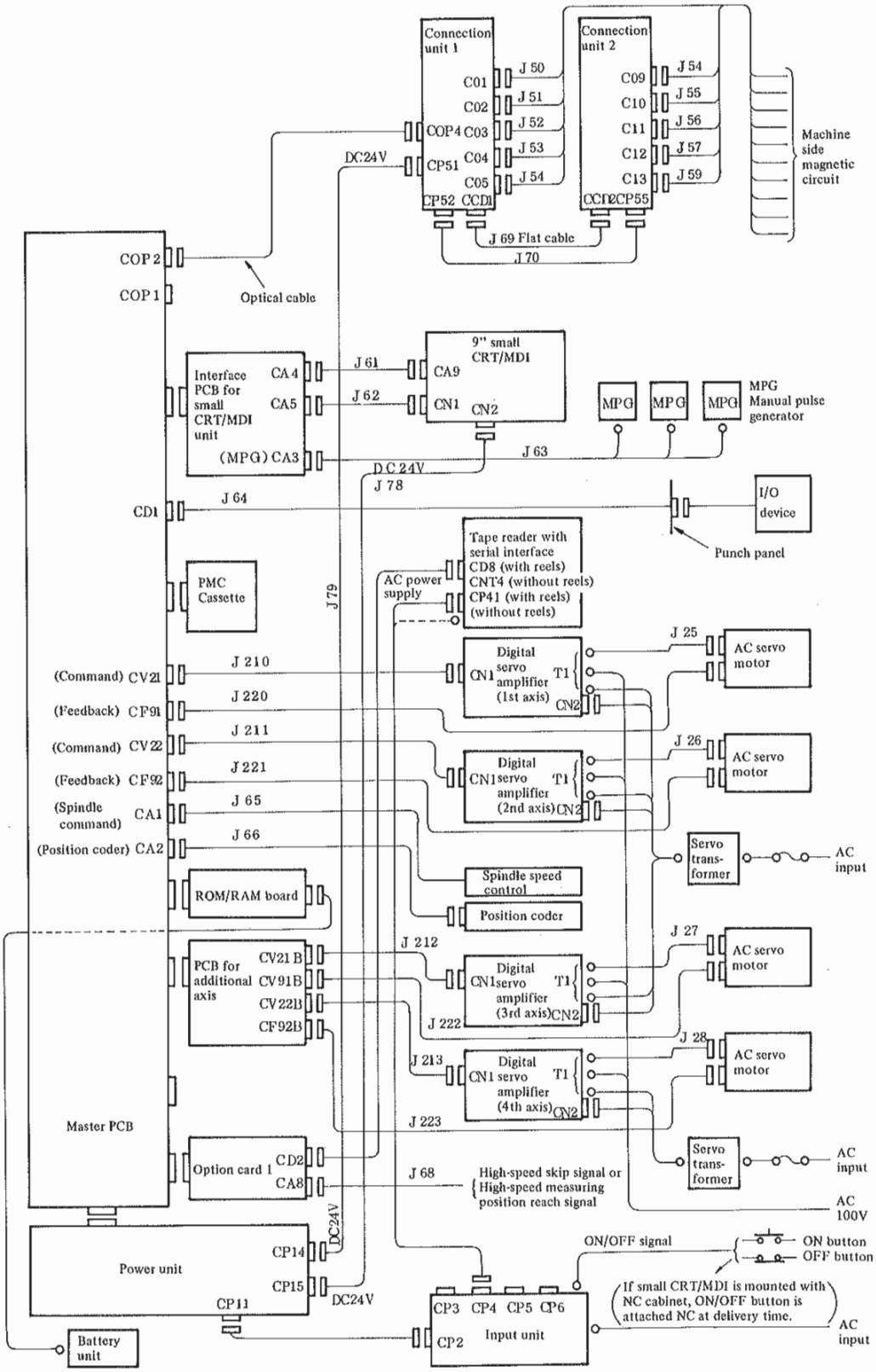


Fig. 1.1 (b) 10TA/10MA total connecting diagram (Digital servo, 9" small CRT/MDI and connection unit are used.)

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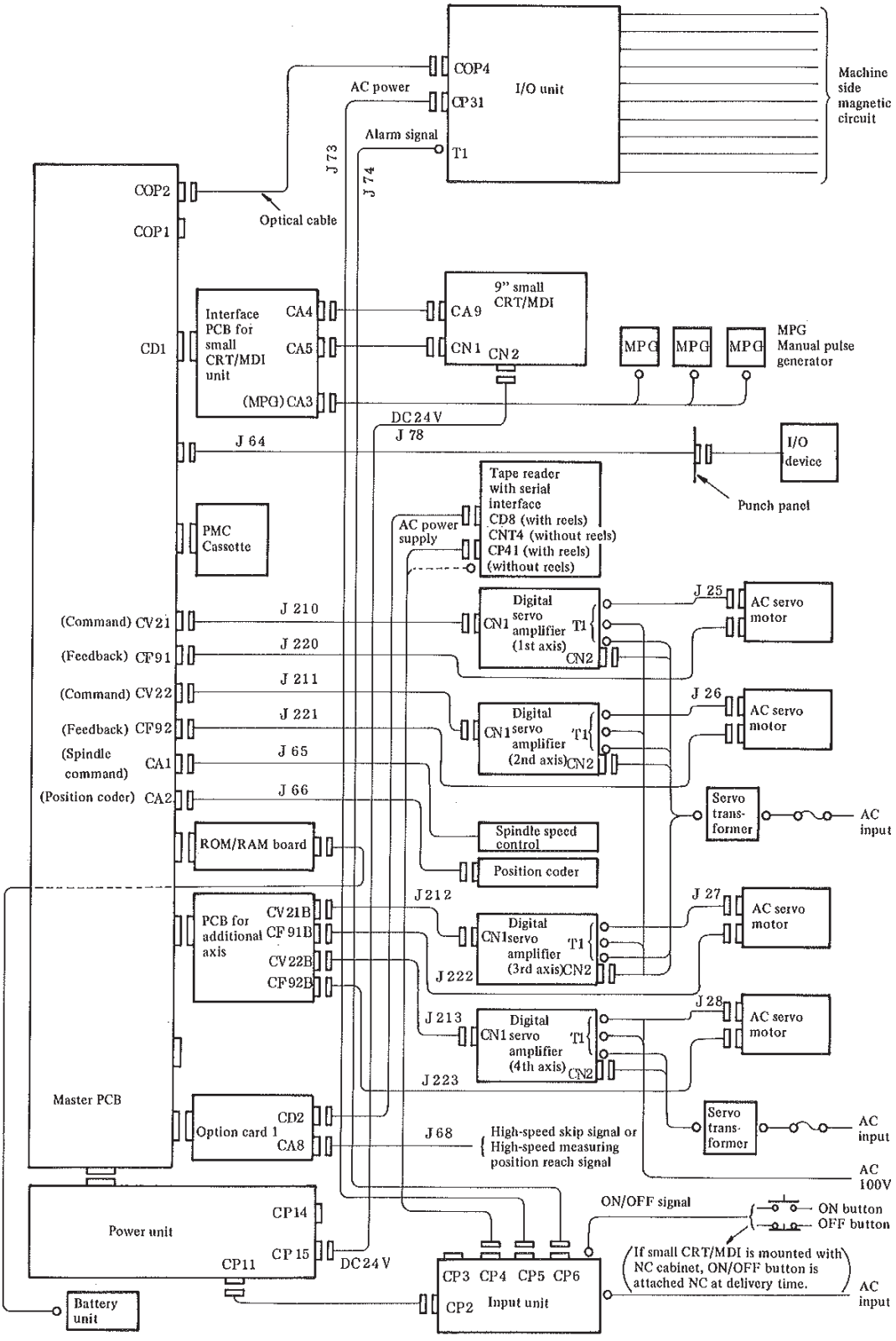


Fig. 1.1 (c) 10TA/10MA total connecting diagram (Digital servo, 9" small CRT/MDI and I/O unit)

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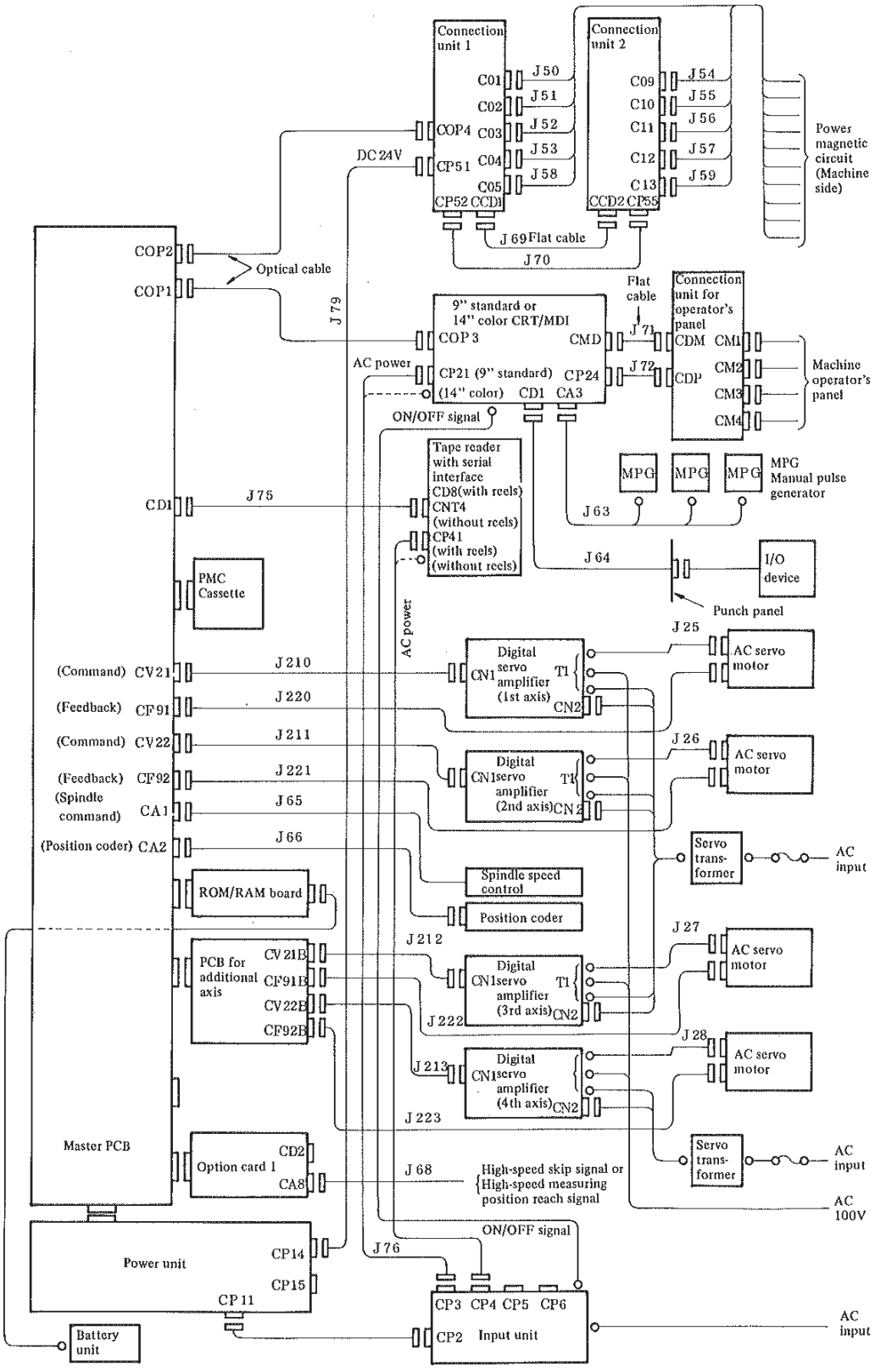


Fig. 1.1 (d) 10TA/10MA total connection diagram (Digital servo, 9" standard or 14" color CRT/MDI and connection unit are used.)

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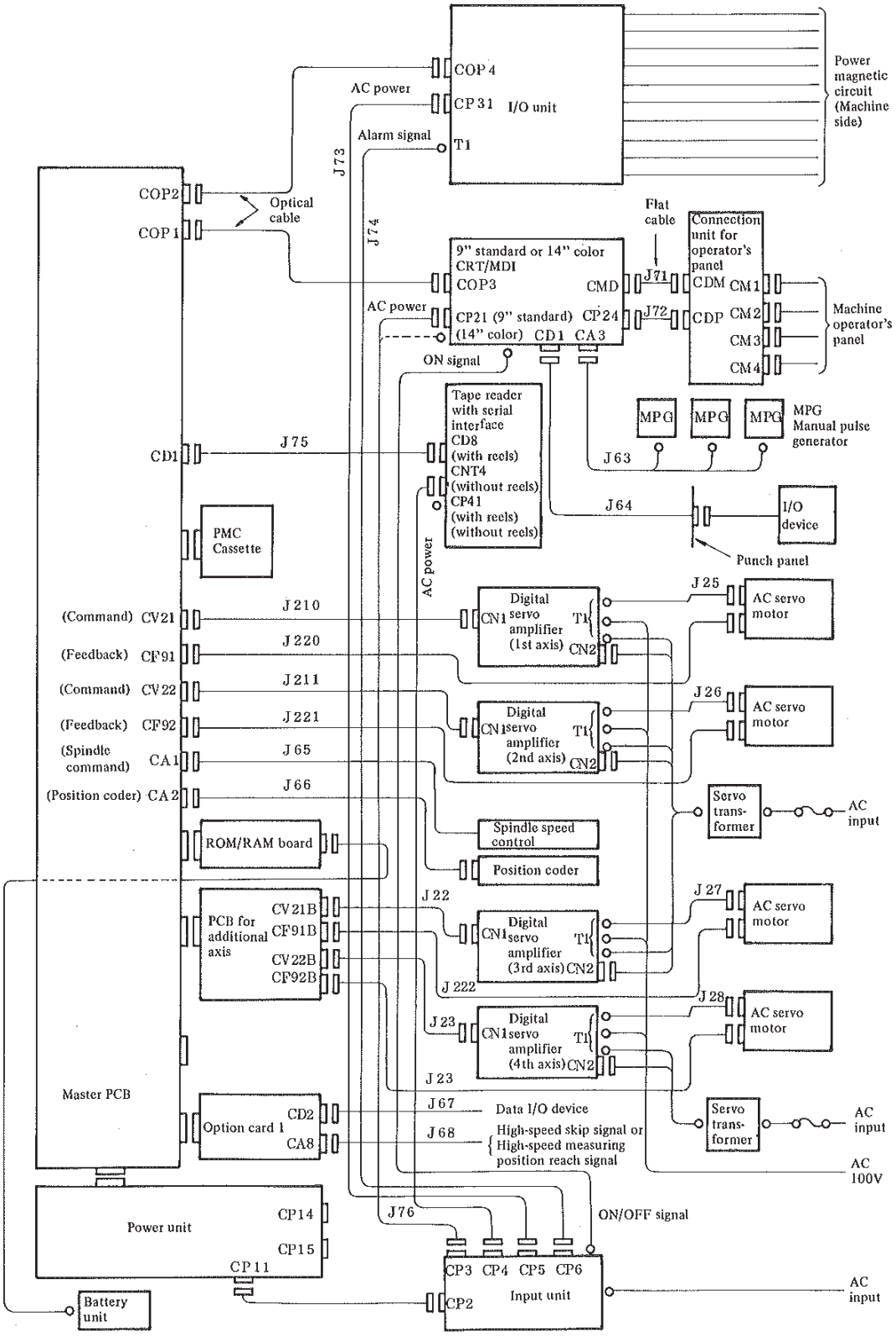


Fig. 1.1 (e) 10TA/10MA total connecting diagram (Digital servo, 9" standard or 14" color CRT/MDI and I/O unit are used.)

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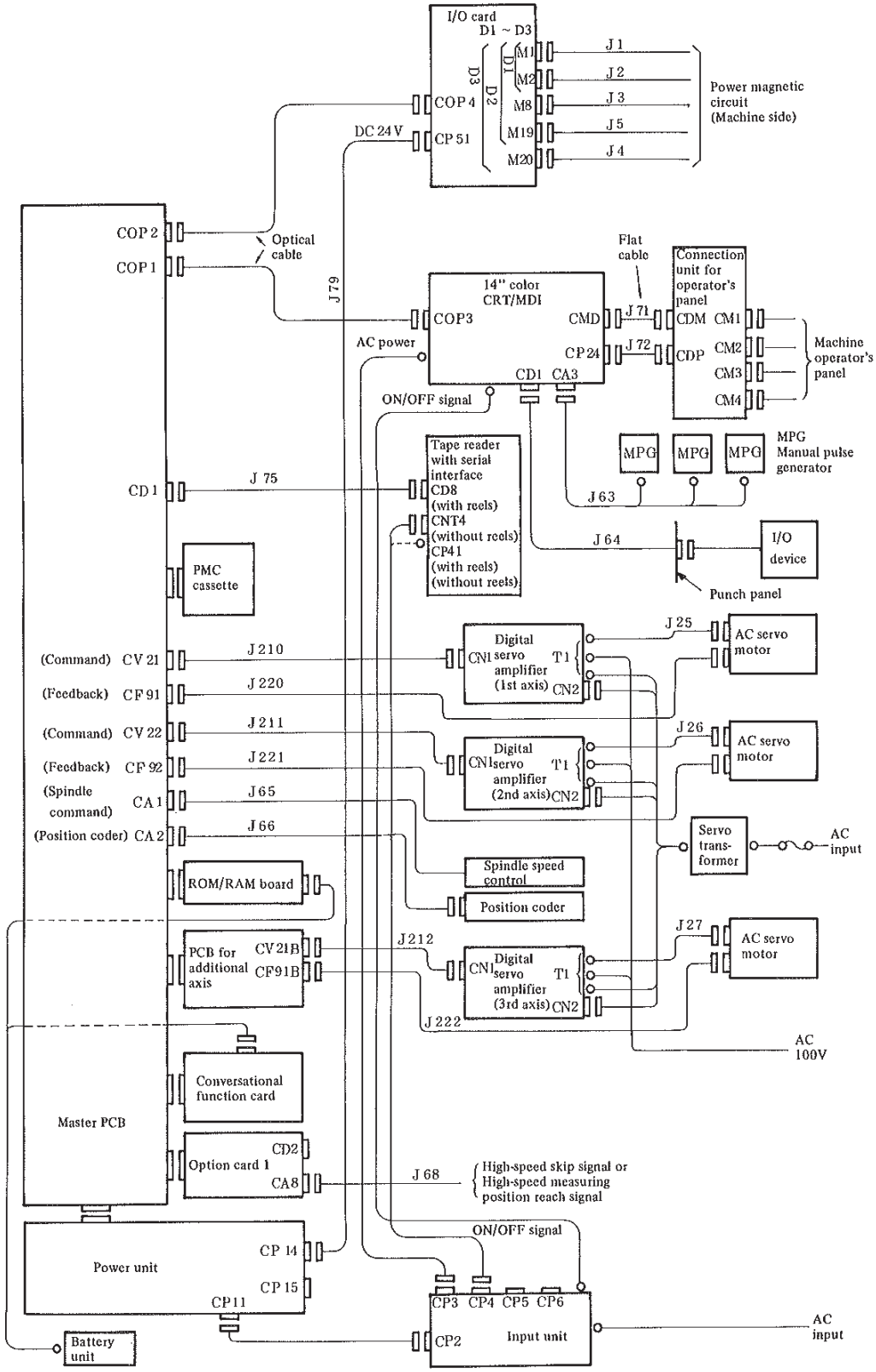


Fig. 1.1 (f) 10TF total connecting diagram (Digital servo, 14" color CRT/MDI, and I/O card are used.)

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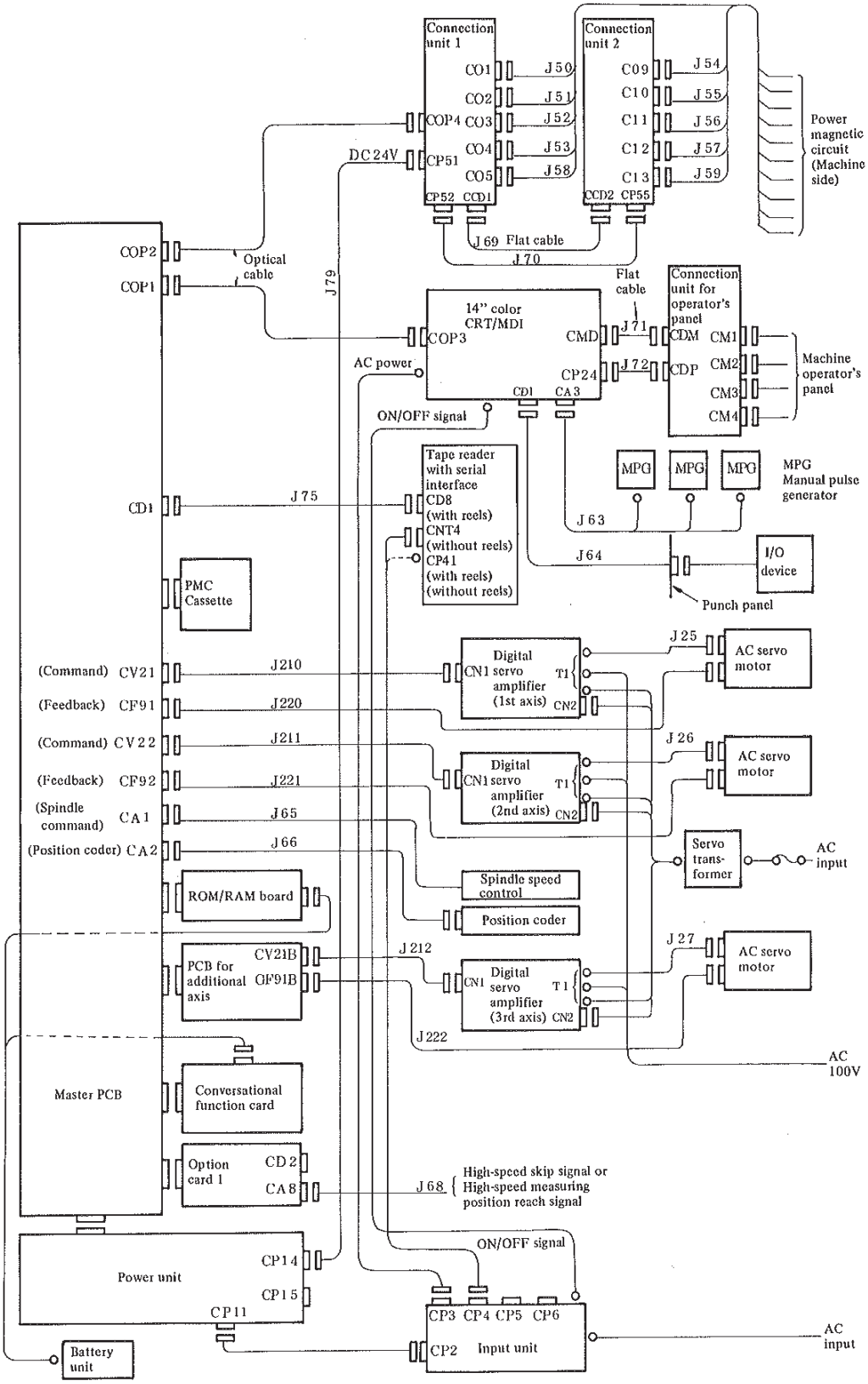


Fig. 1.1 (g) 10TF total connecting diagram
(Digital servo, 14" color CRT/MDI, and connection unit are used.)

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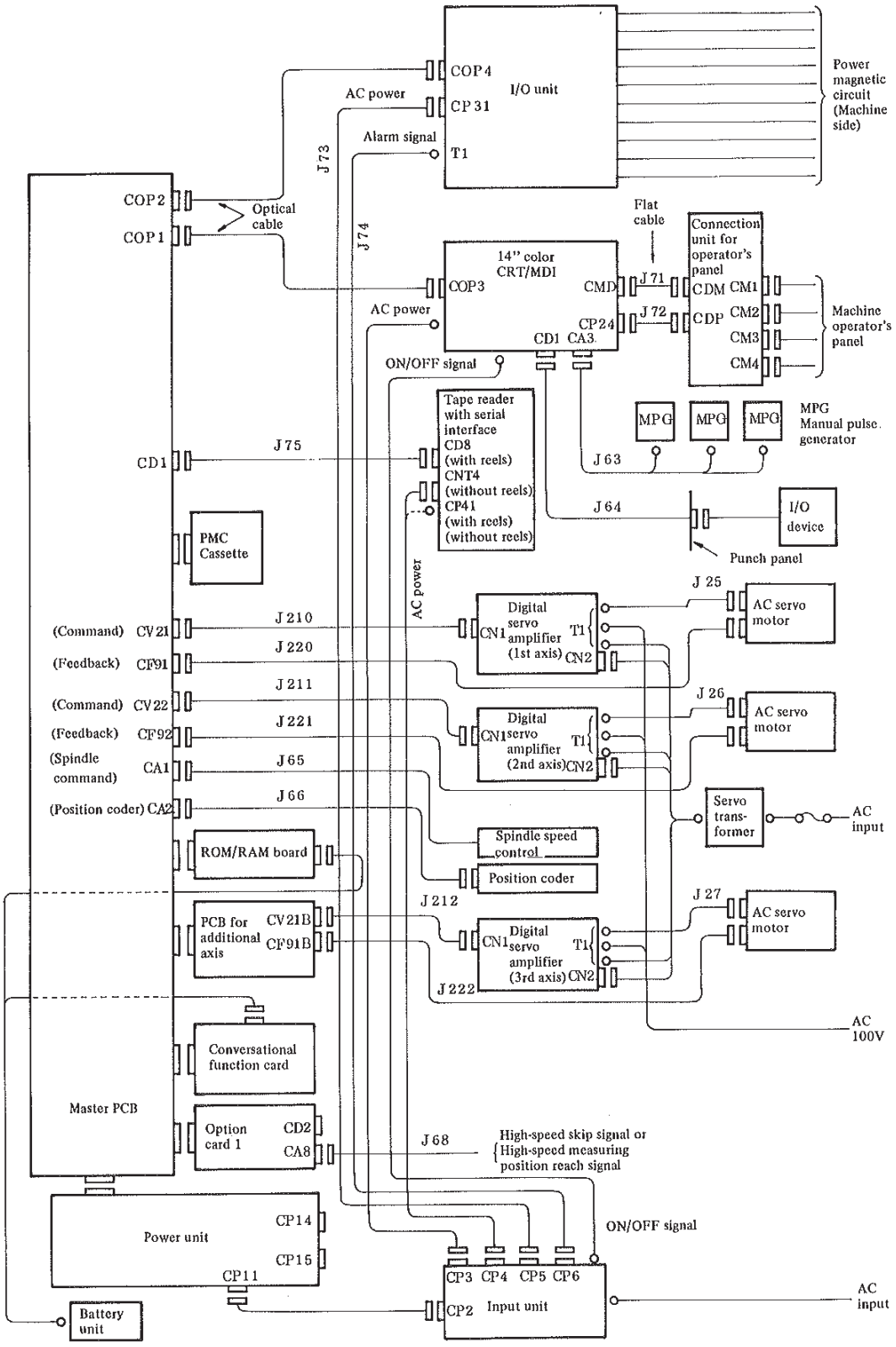


Fig. 1.1 (h) 10TF total connecting diagram (Digital servo, 14" color CRT/MDI, and I/O unit are used.)

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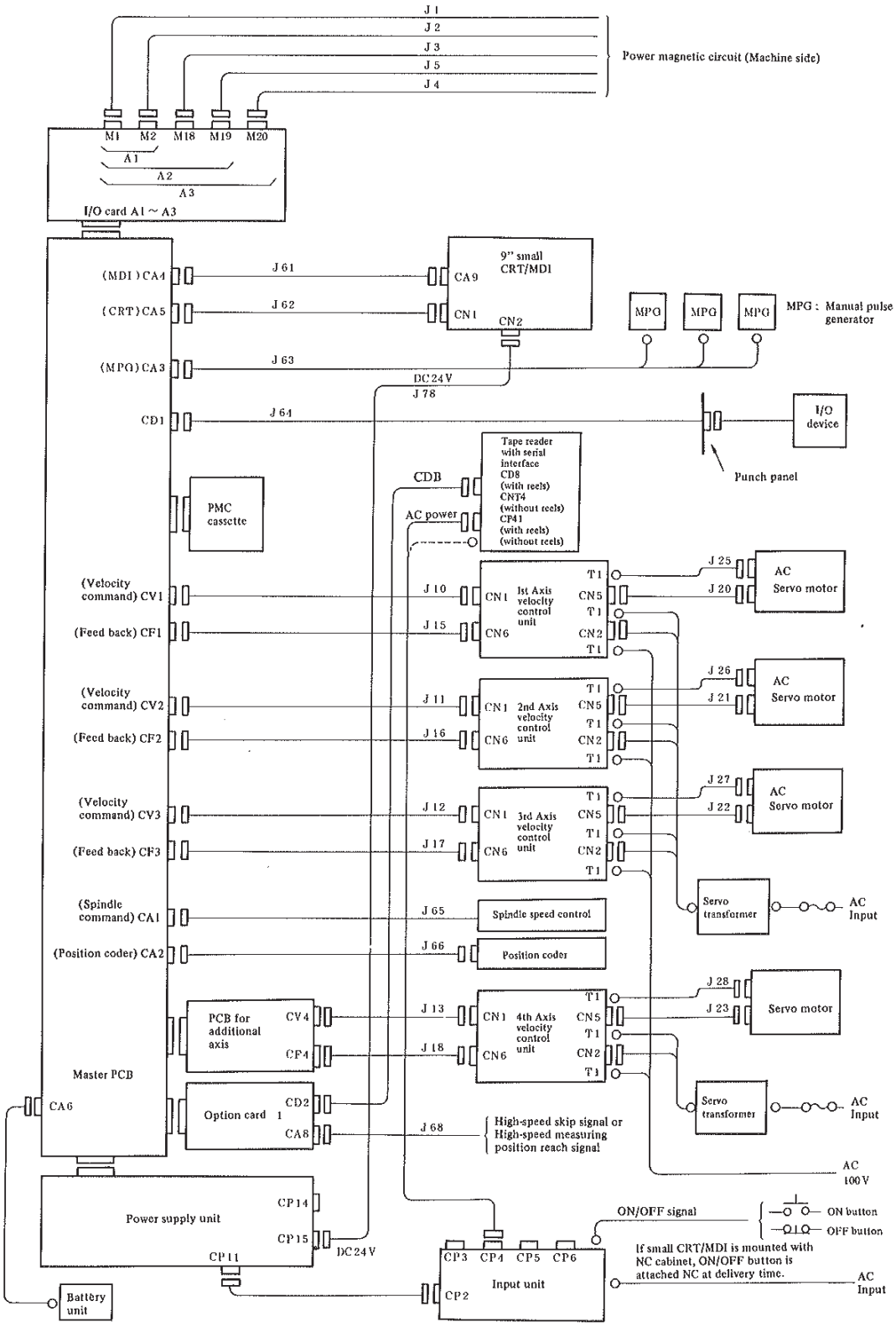


Fig. 1.1 (i) 10TA/10MA total connecting diagram (Analog servo, 9" small CRT/MDI and I/O card A1 ~ A3 are used.)

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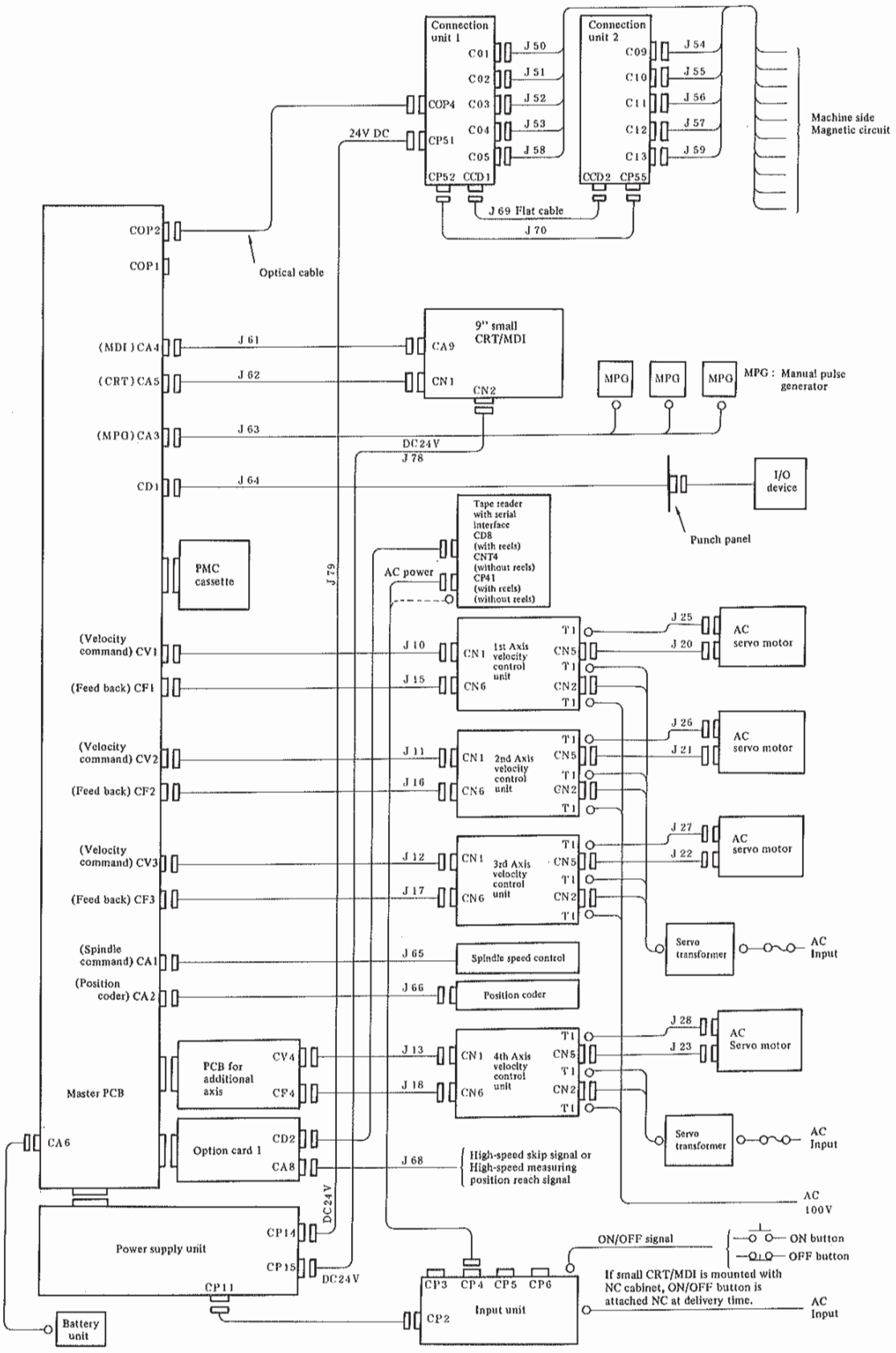


Fig. 1.1 (j) 10TA/10MA total connecting diagram (Analog servo, 9" small CRT/MDI and connection unit are used.)

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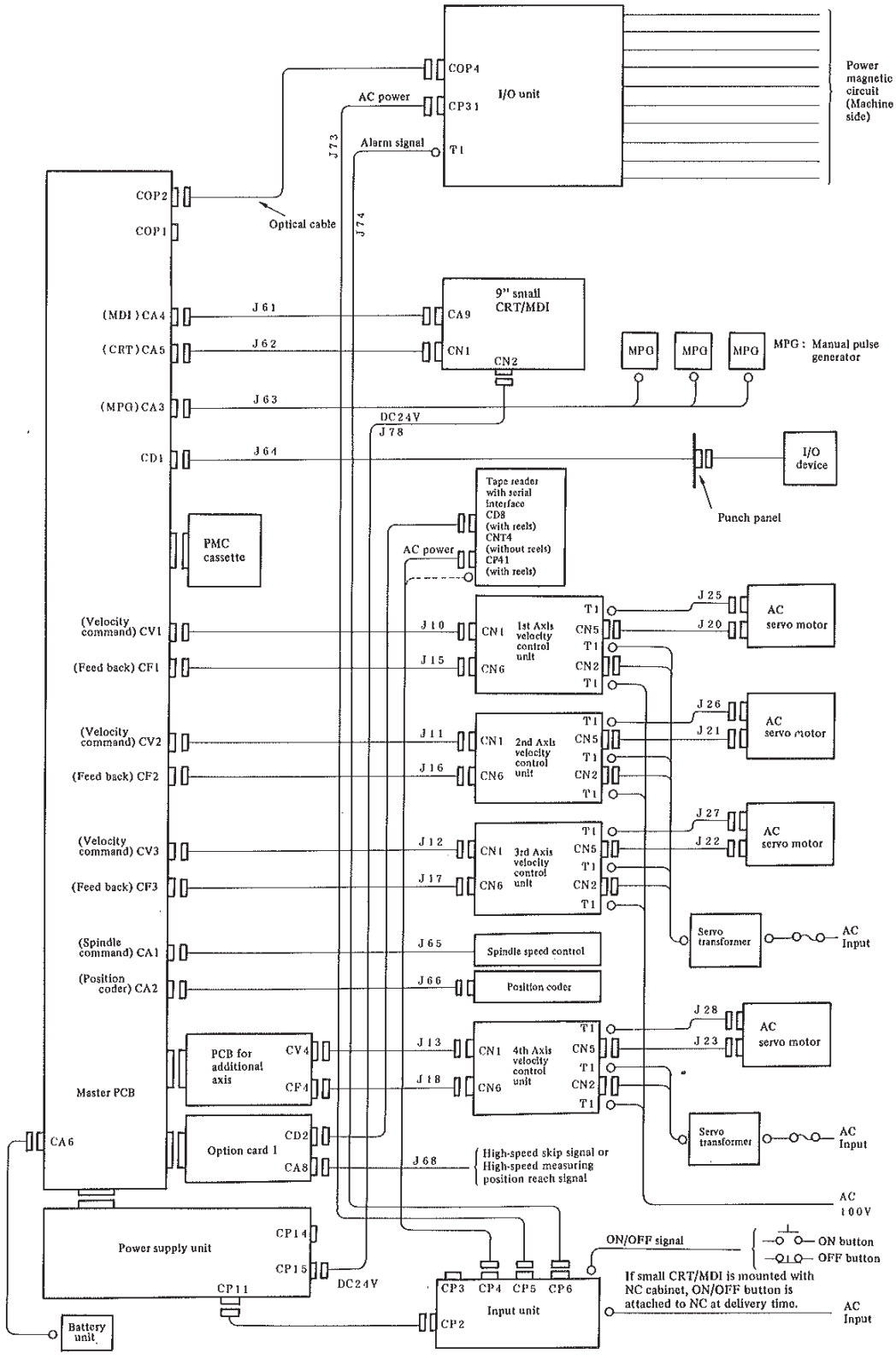


Fig. 1.1 (k) 10TA/10MA total connecting diagram (Analog servo, 9" small CRT/MDI and I/O unit are used.)

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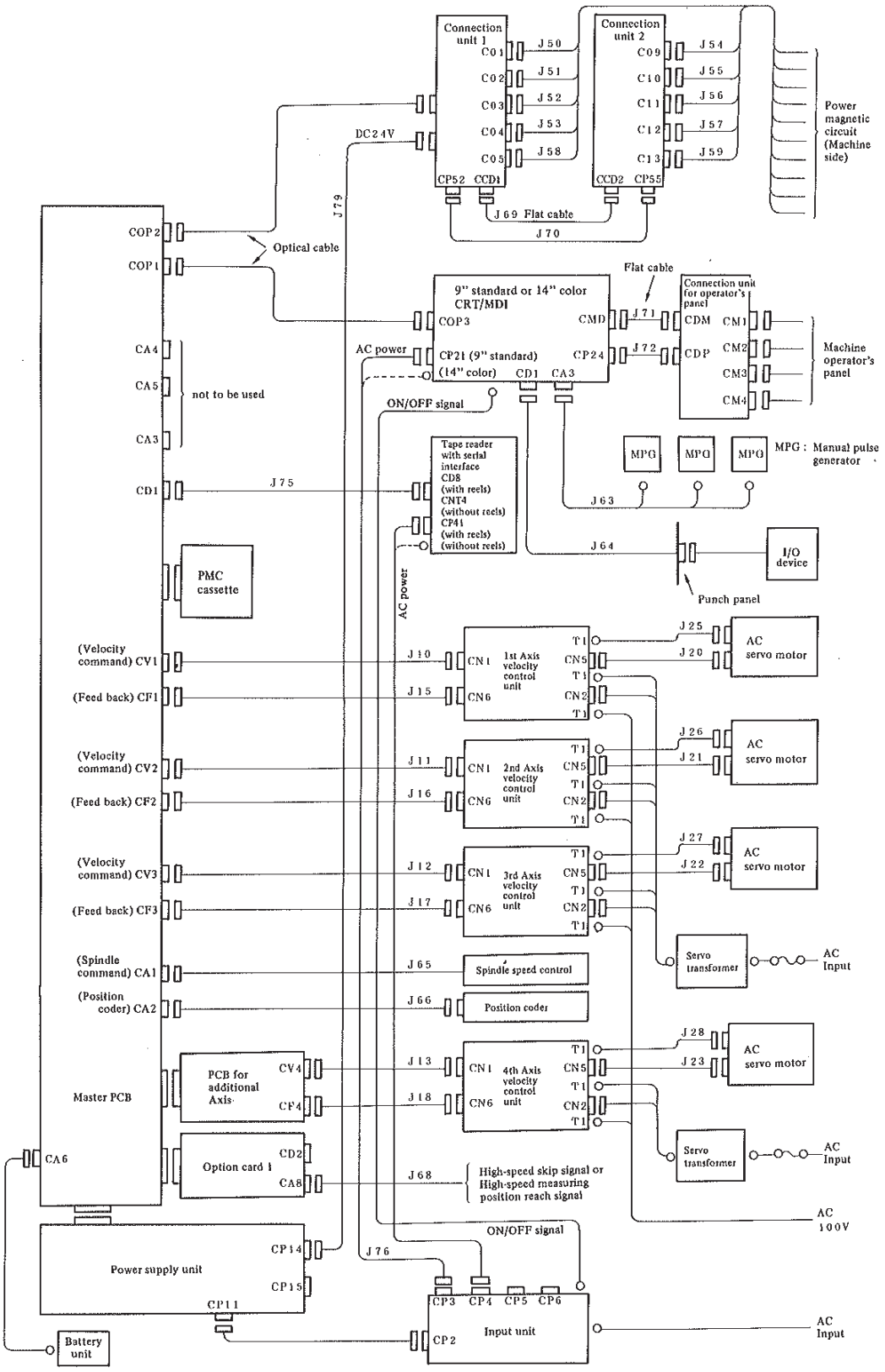


Fig. 1.1 (I) 10TA/10MA total connecting diagram (Analog servo, 9" standard or 14" color CRT/MDI and connection unit are used.)

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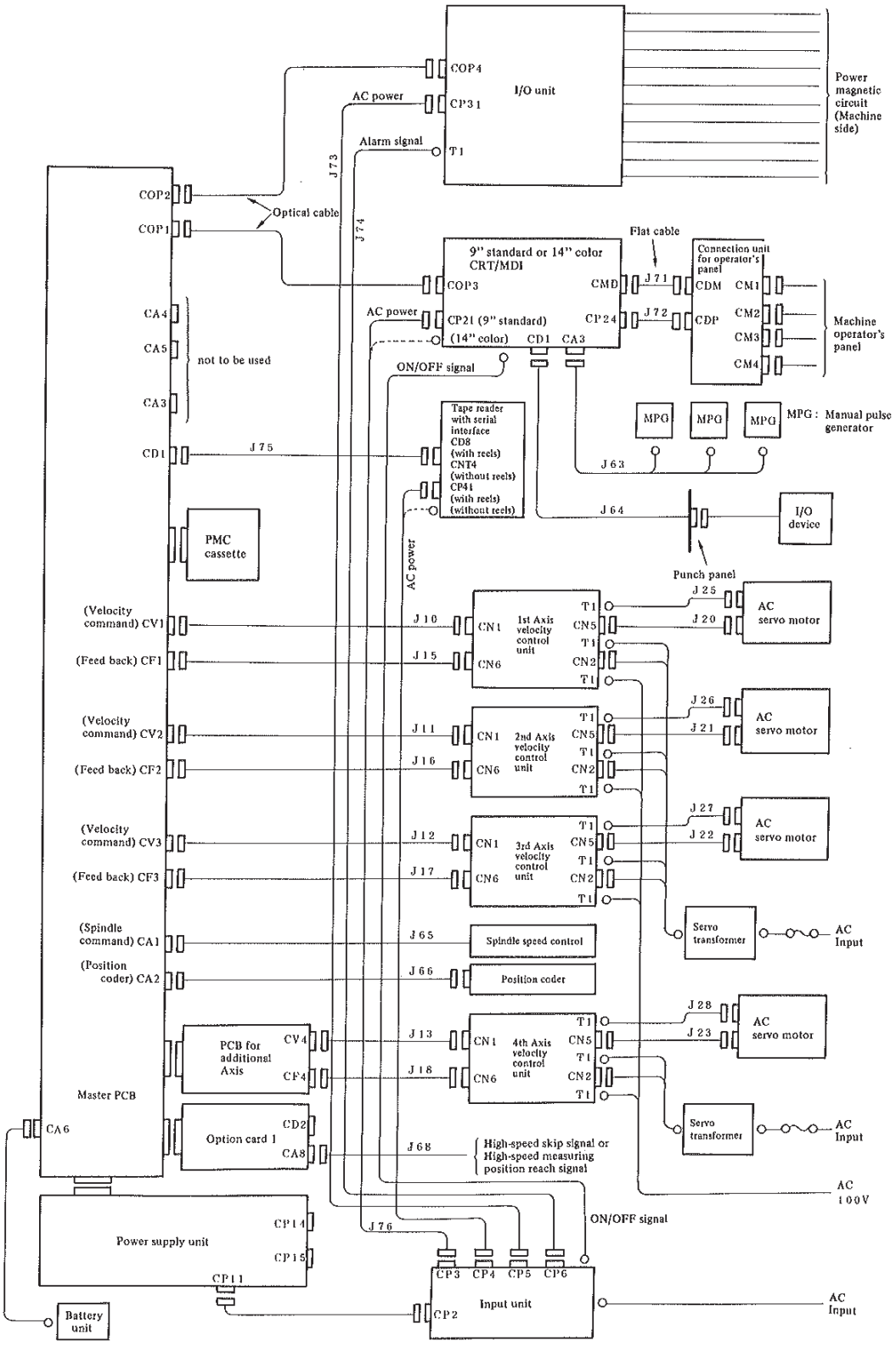


Fig. 1.1 (m) 10TA/10MA total connecting diagram (Analog servo, 9" standard or 14" color CRT/MDI and I/O unit are used.)

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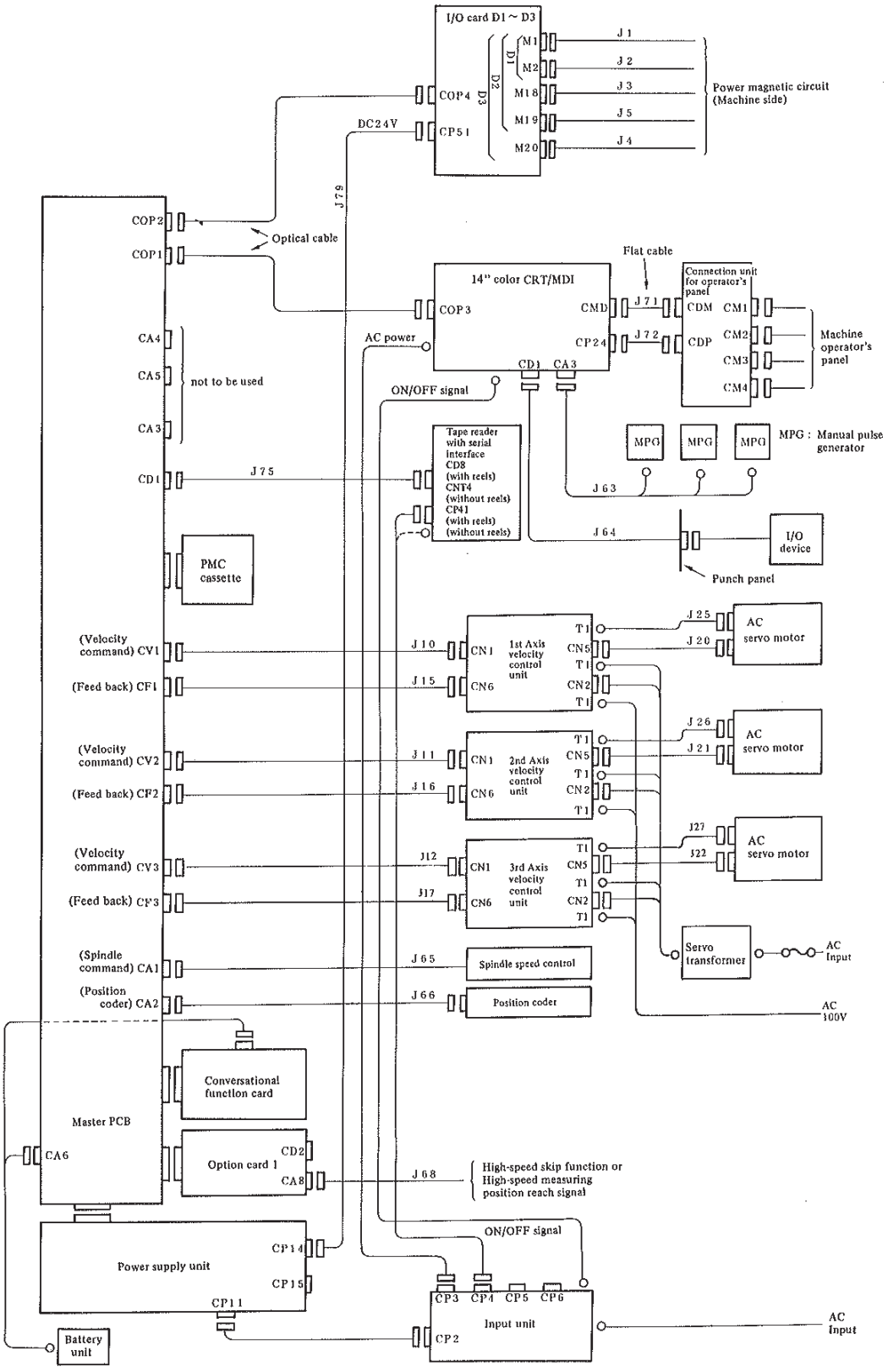


Fig. 1.1 (n) 10TF total connecting diagram (14" color CRT/NDI and I/O card D1 ~ D3 are used.)

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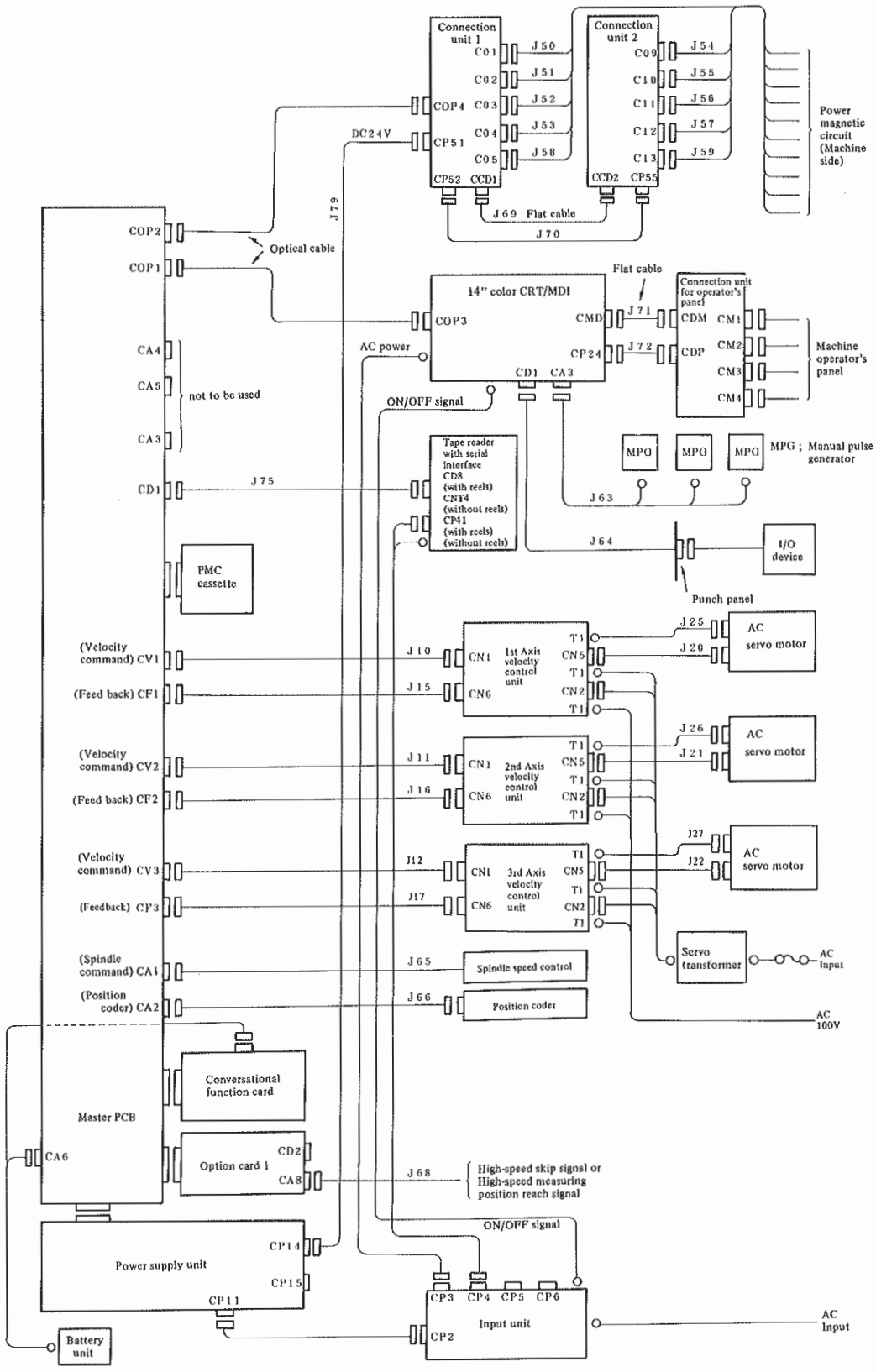


Fig. 1.1 (o) 10TF total connecting diagram (14" color CRT/MDI and connection unit are used.)

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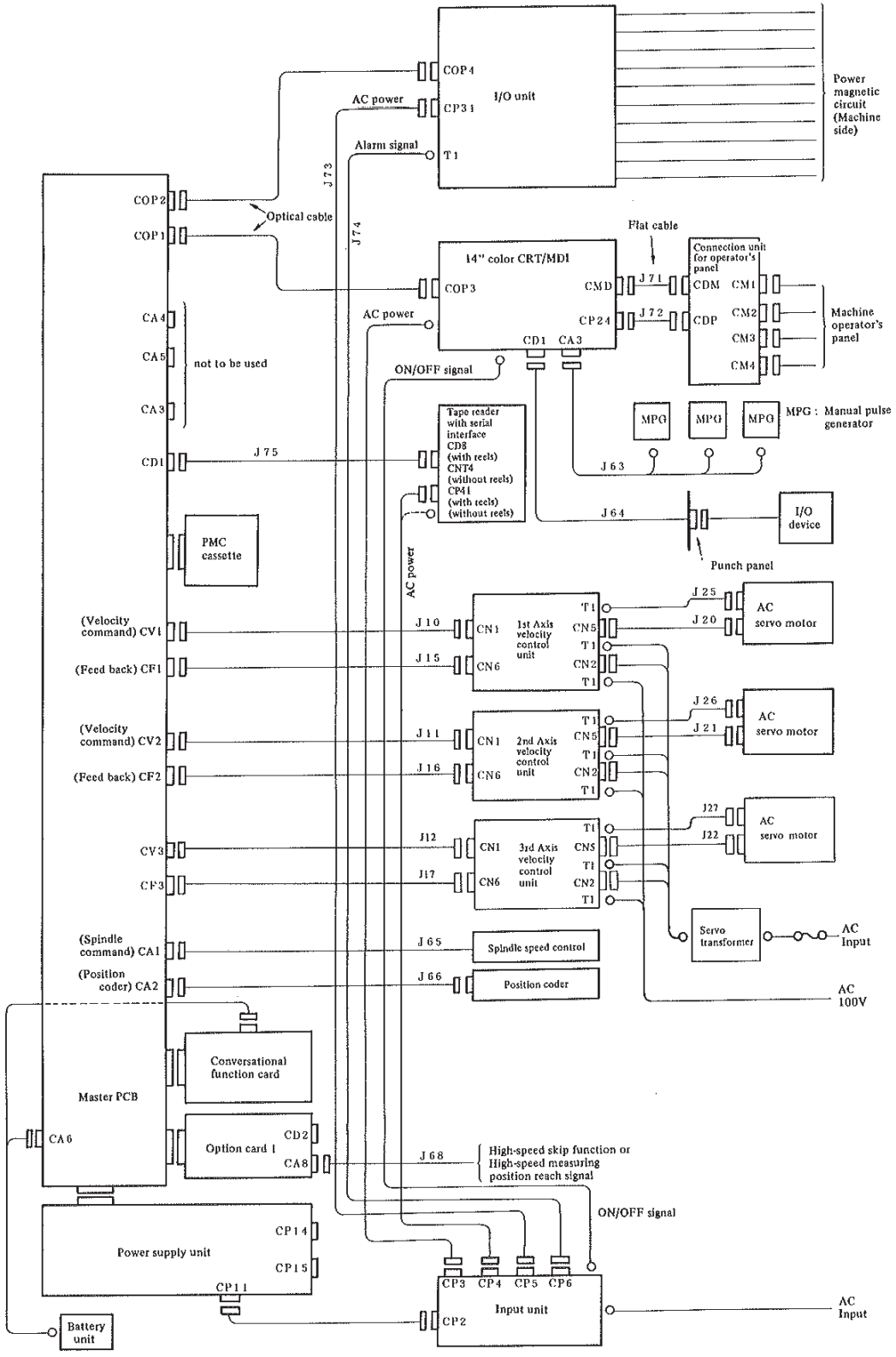


Fig. 1.1 (p) 10TF total connecting diagram (14" color CRT/MDI and I/O unit are used.)

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1.2 11 Series

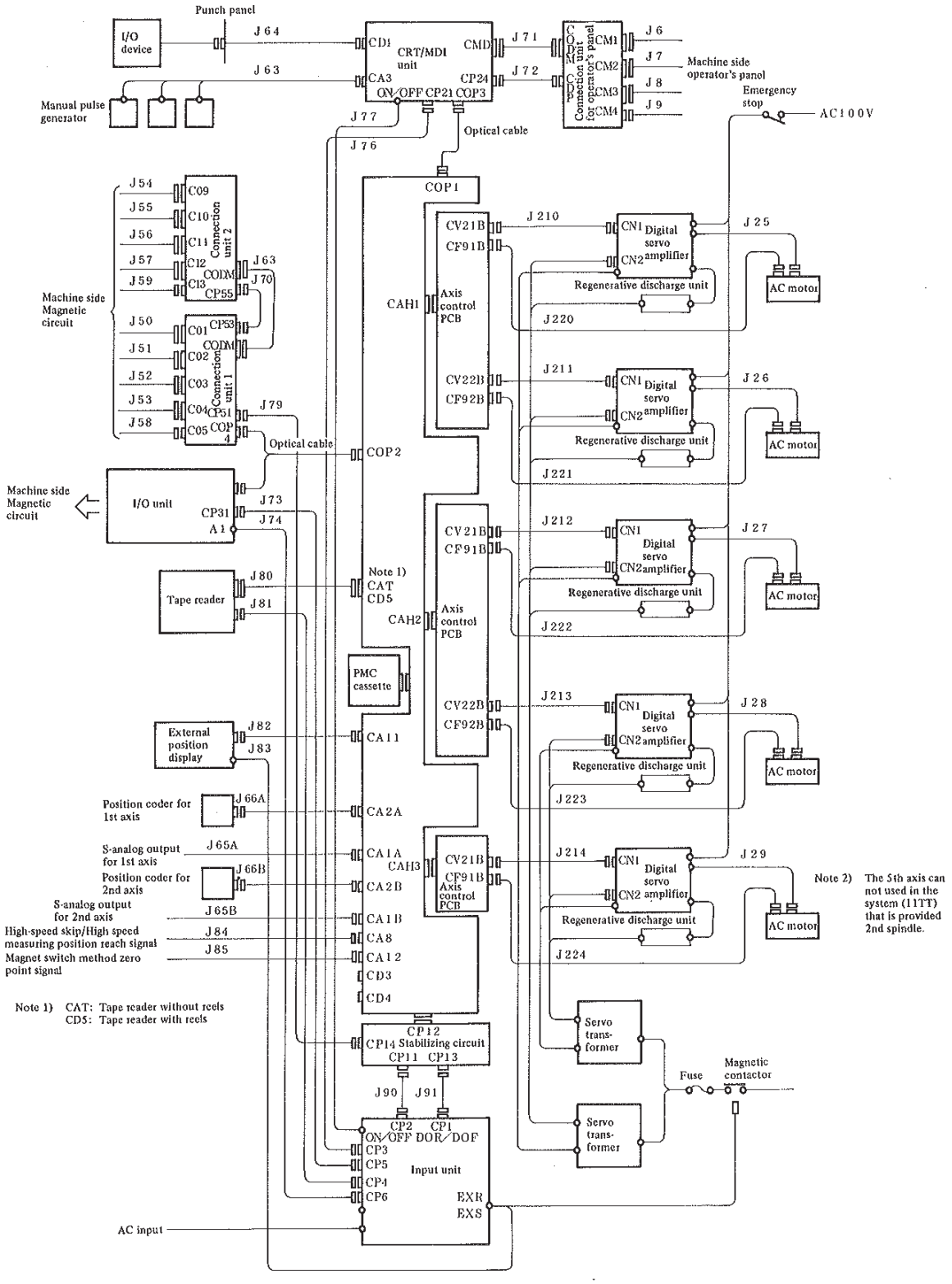


Fig. 1.2 (a) 11 series total connecting diagram (Digital servo without separated pulse coder)

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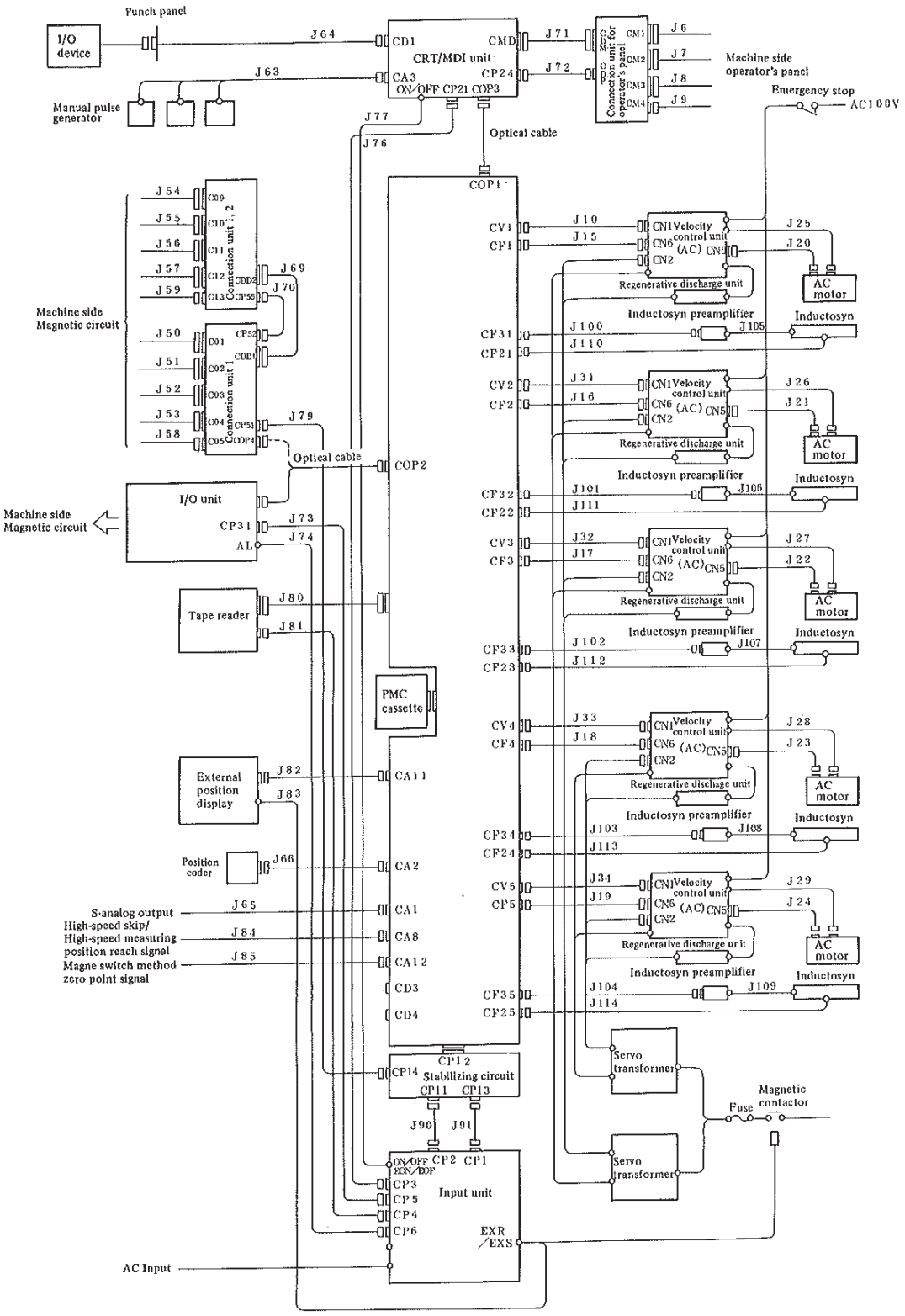


Fig. 1.2 (b) 11 series total connecting diagram (for Analog servo without separate type pulse coder)

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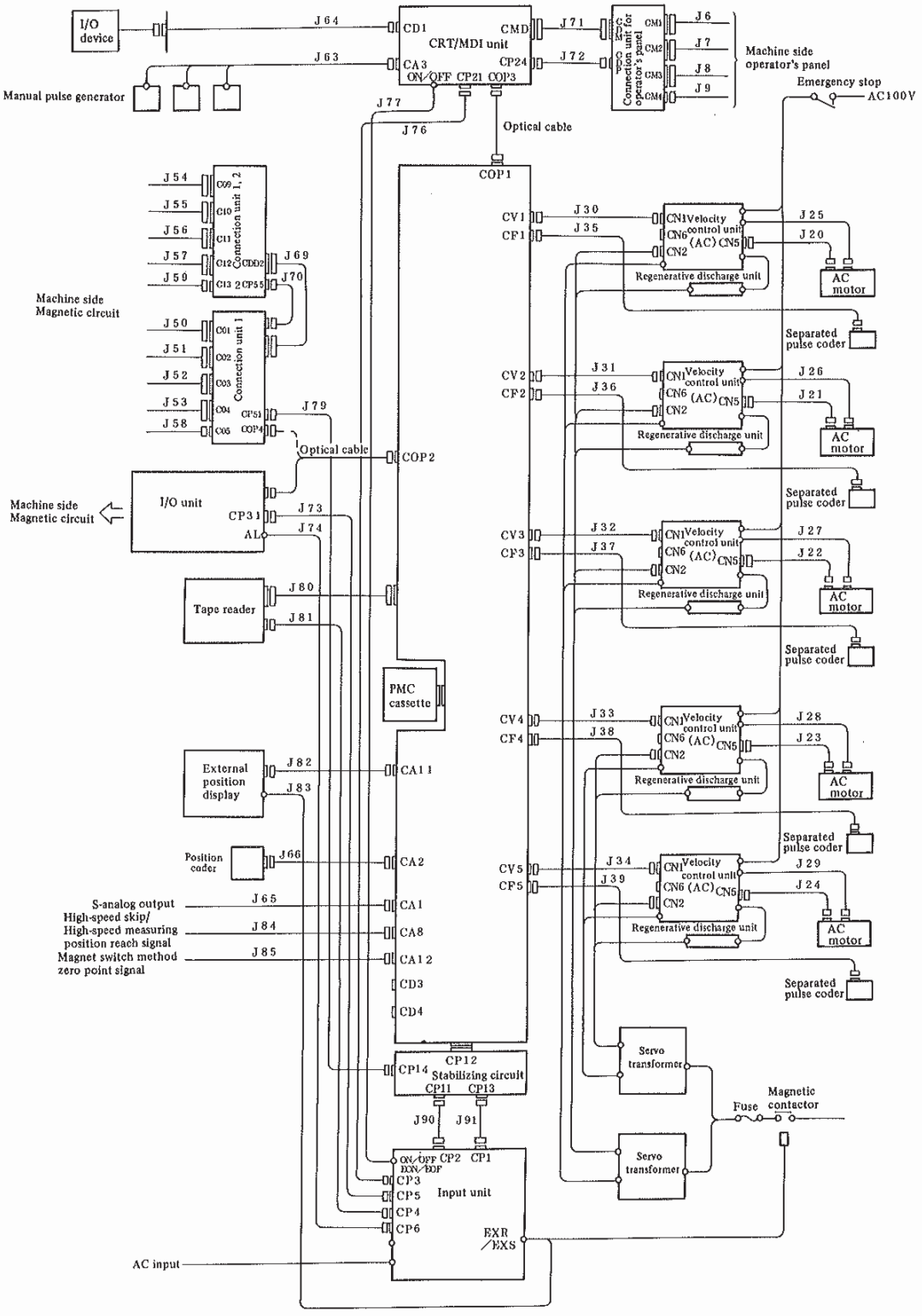


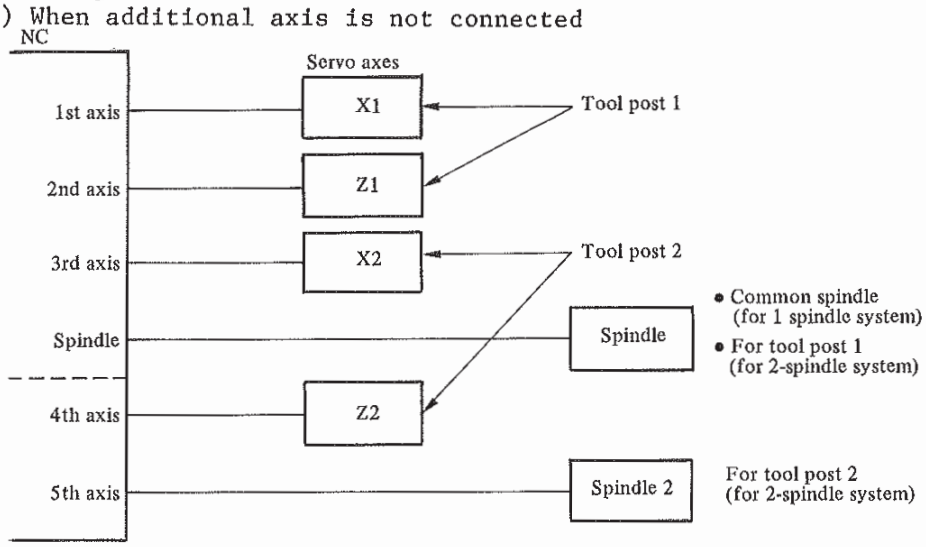
Fig. 1.2 (c) 11 series total connecting diagram (for analog servo with separate type pulse coder)

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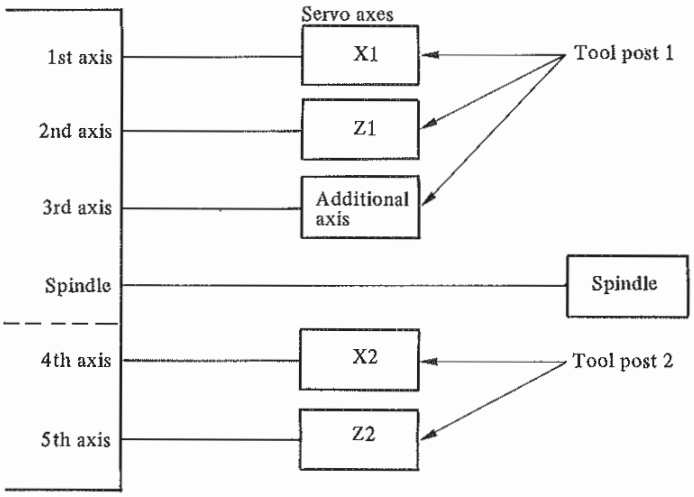
1) 11TT servo axes and spindle connection diagram

a) For analog servo

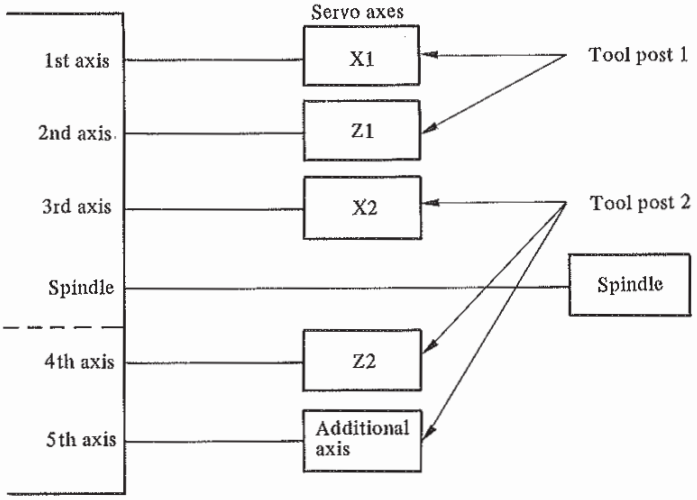
i) When additional axis is not connected



ii) When additional axis is connected to tool post 1

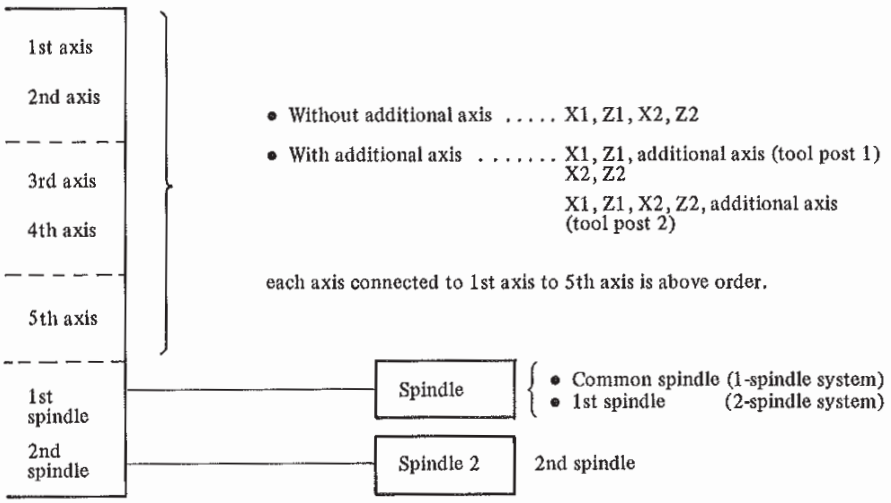


iii) When additional axis is connected to tool post 2



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b) For digital servo

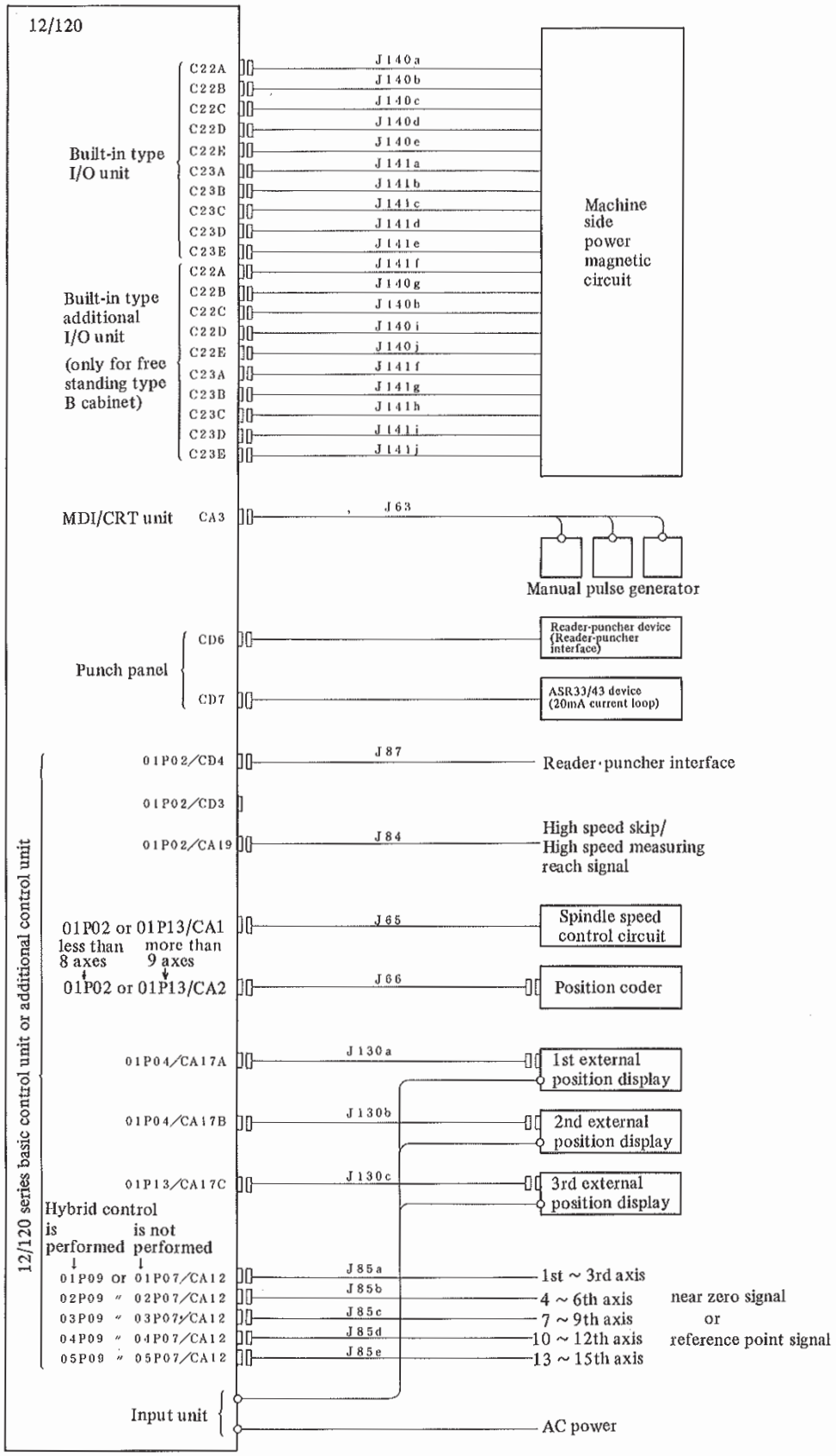


(Note) The additional axis can not be used when 2nd spindle is provided.

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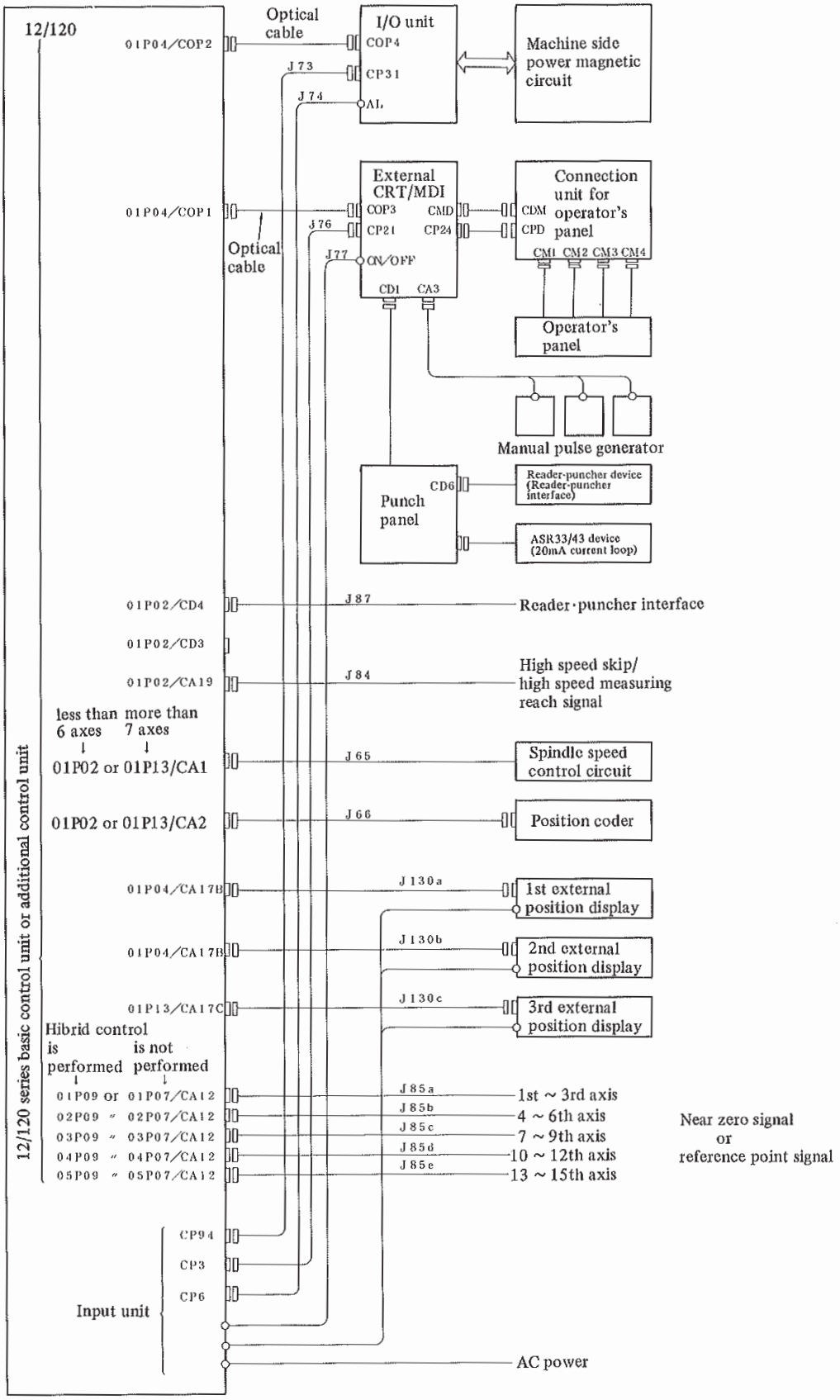
1.3 12/120 Series

1) 12/120 series total connection diagram
(Connection other than servo system; Internal CRT/MDI and Built-in type I/O unit are used.)



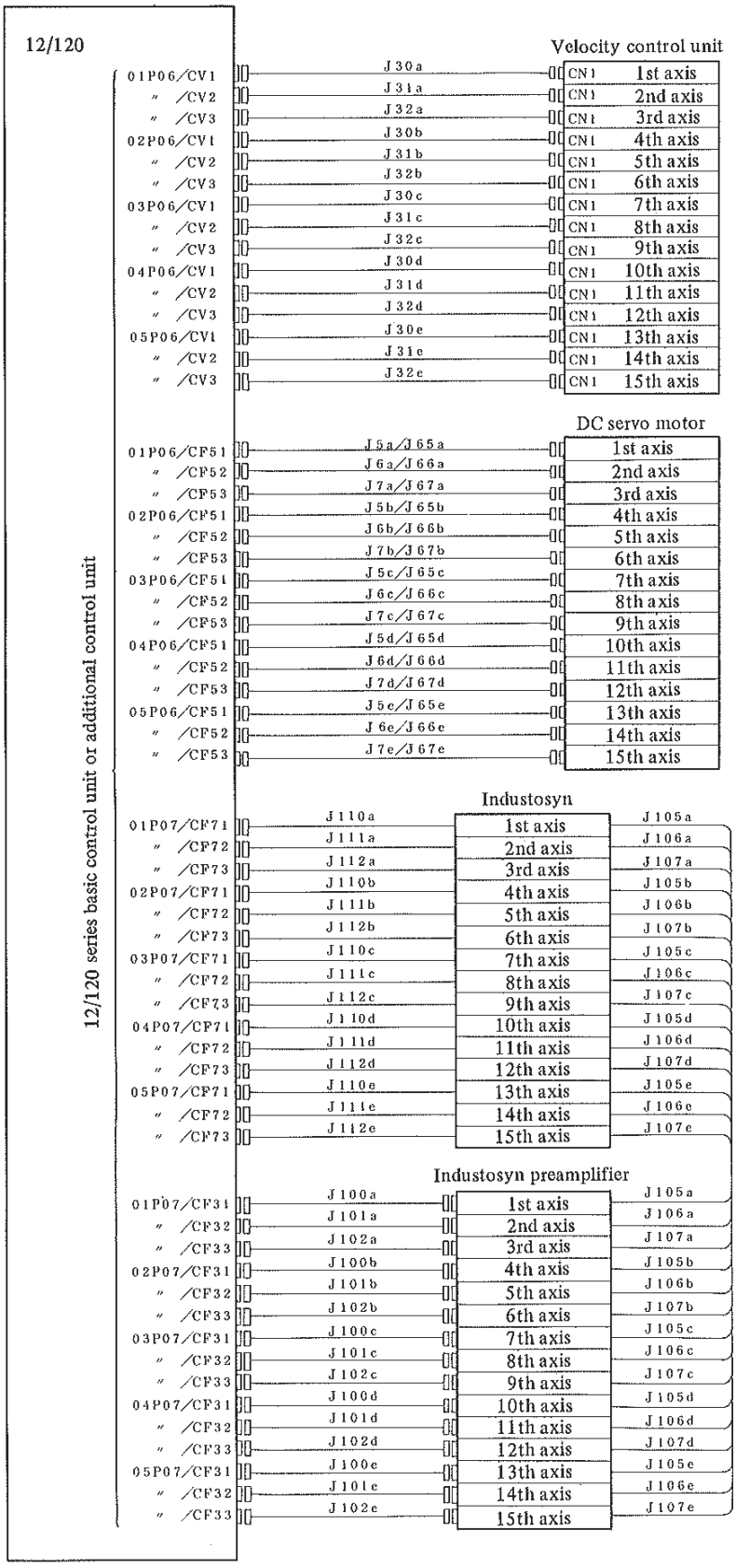
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2) 12/120 series total connecting diagram
(Connection other than servo system; External CRT/MDI and Separate I/O unit are used.)



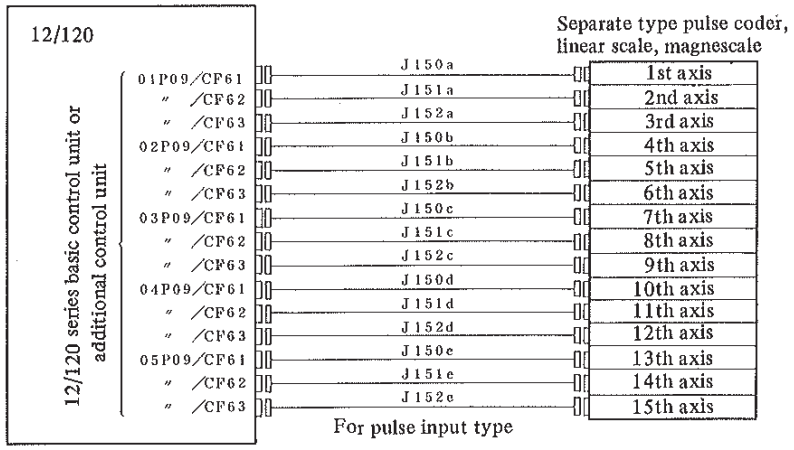
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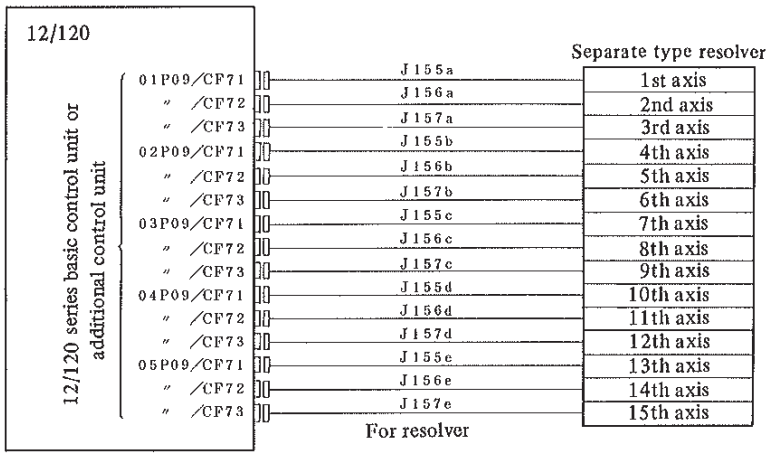
3) 12/120 series total connecting diagram
(Servo system signal connection; when a pulse coder, a resolver and an inductosyn are used in DC servo motor.)

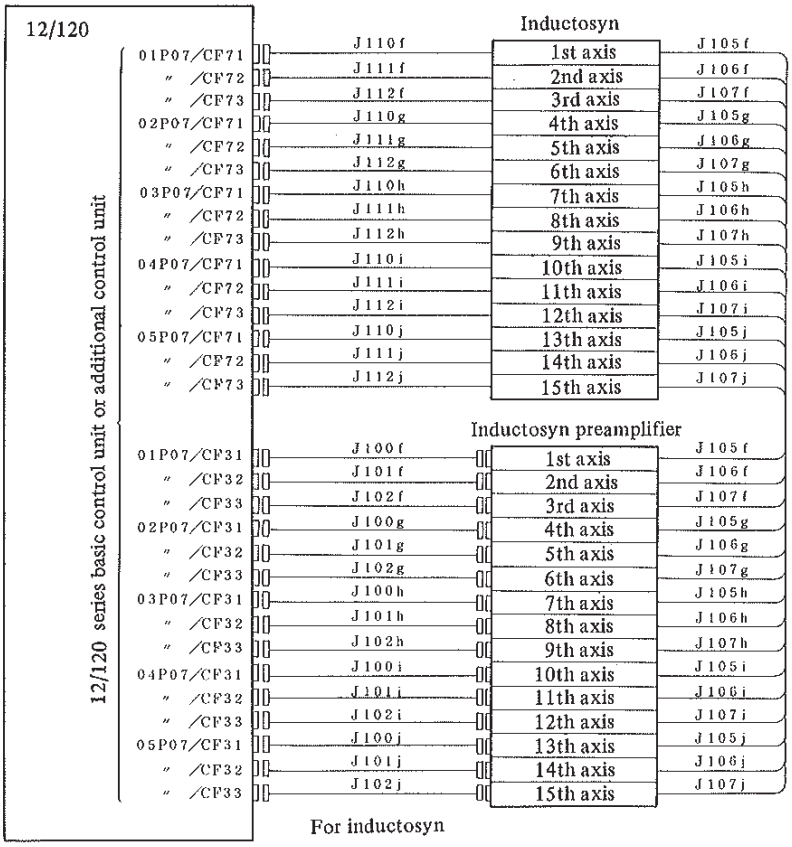


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4) 12/120 series total connecting diagram
(Additional detector connection)

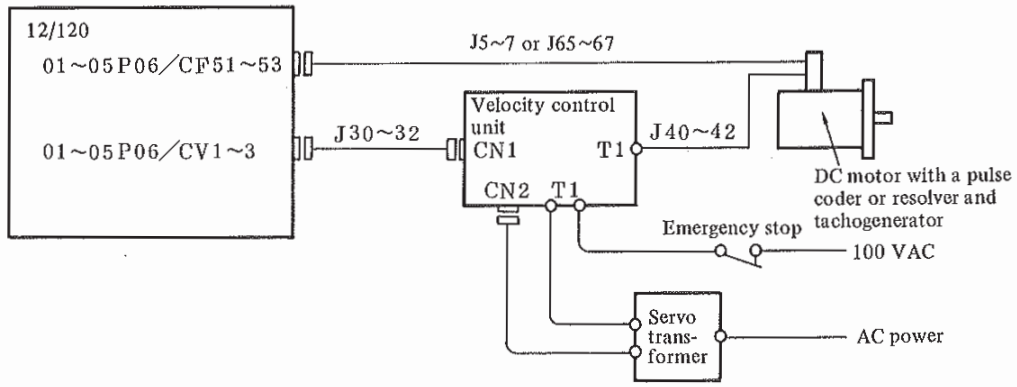




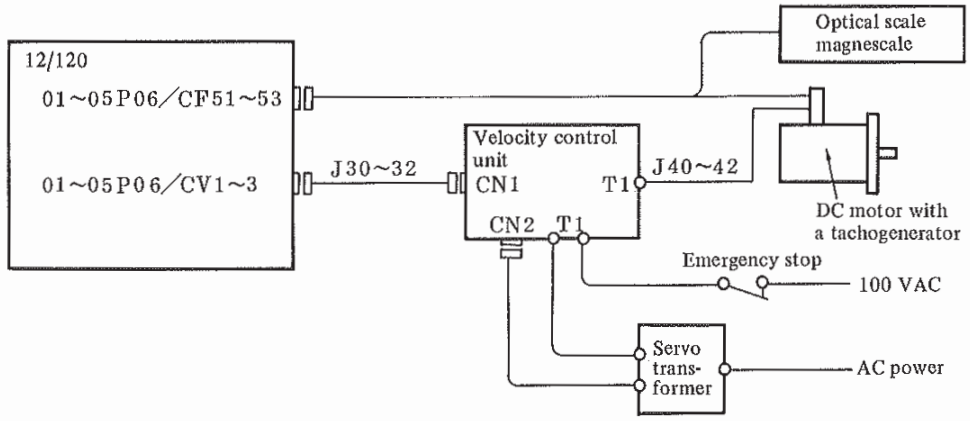


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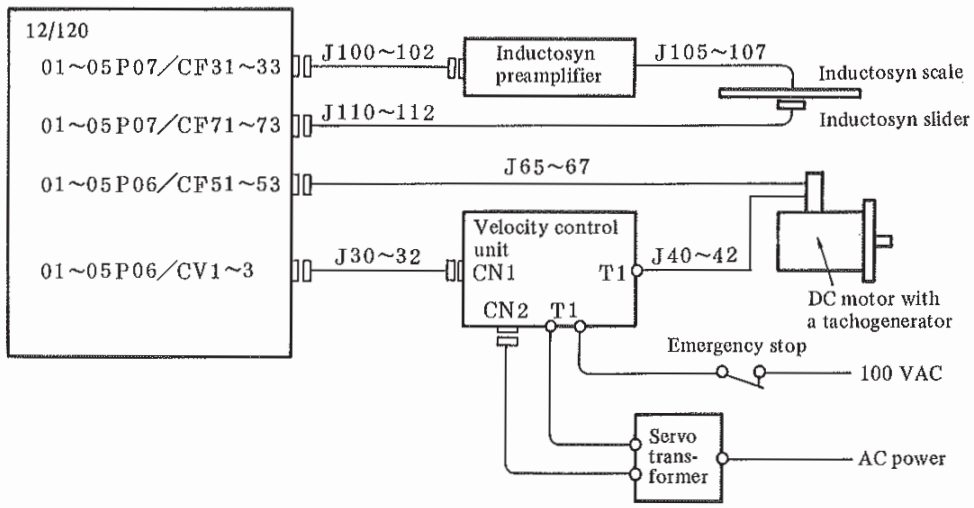
5) 12/120 series servo system connecting diagram
(When DC motor is used.)



Pulse coder or resolver is used as a position detector.



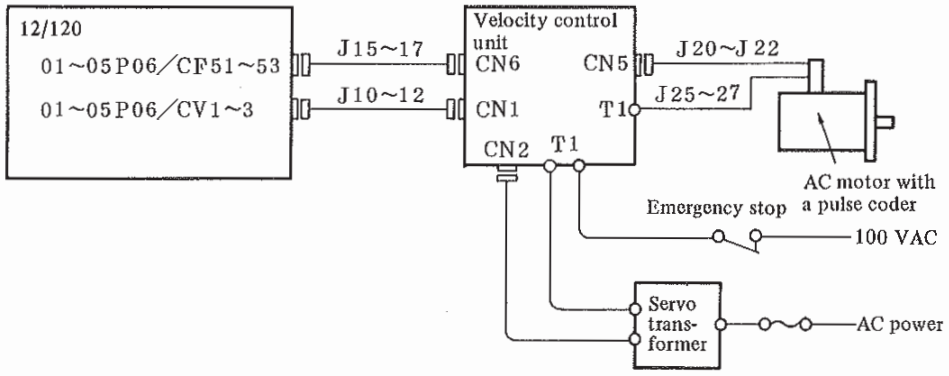
Optical scale or magnescale is used as a position detector.



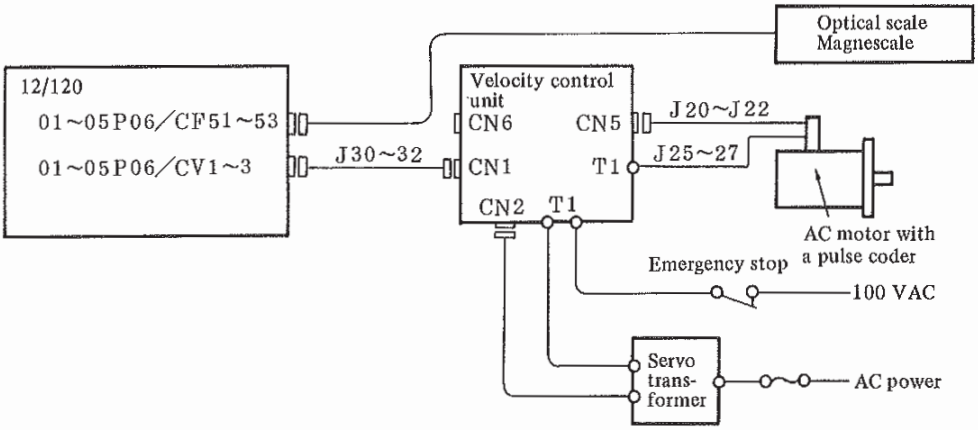
Inductosyn is used as a position detector.

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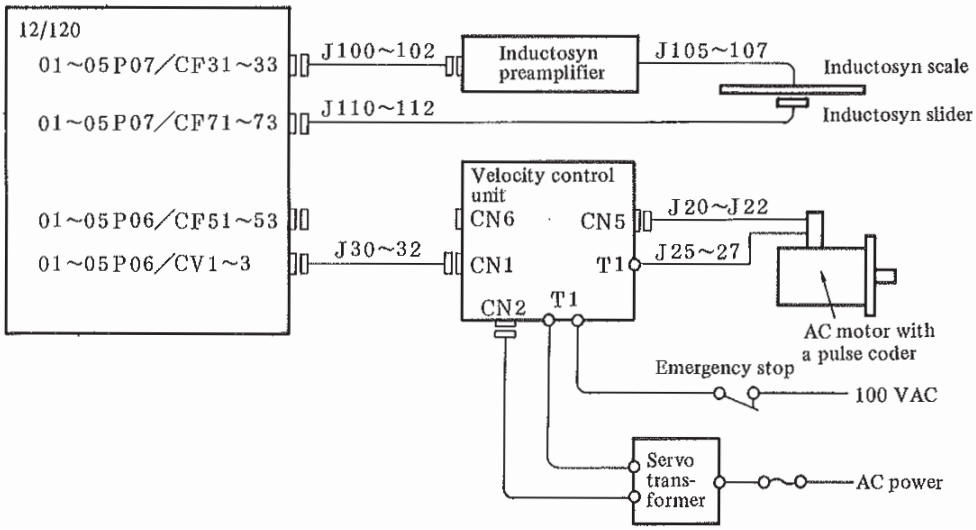
6) 12/120 series servo system connection diagram
(When AC motor is used.)



Pulse coder is used as a position detector.



Optical scale or magnescale is used as a position detector.



Inductosyn is used as a position detector.

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1.4 100 Series

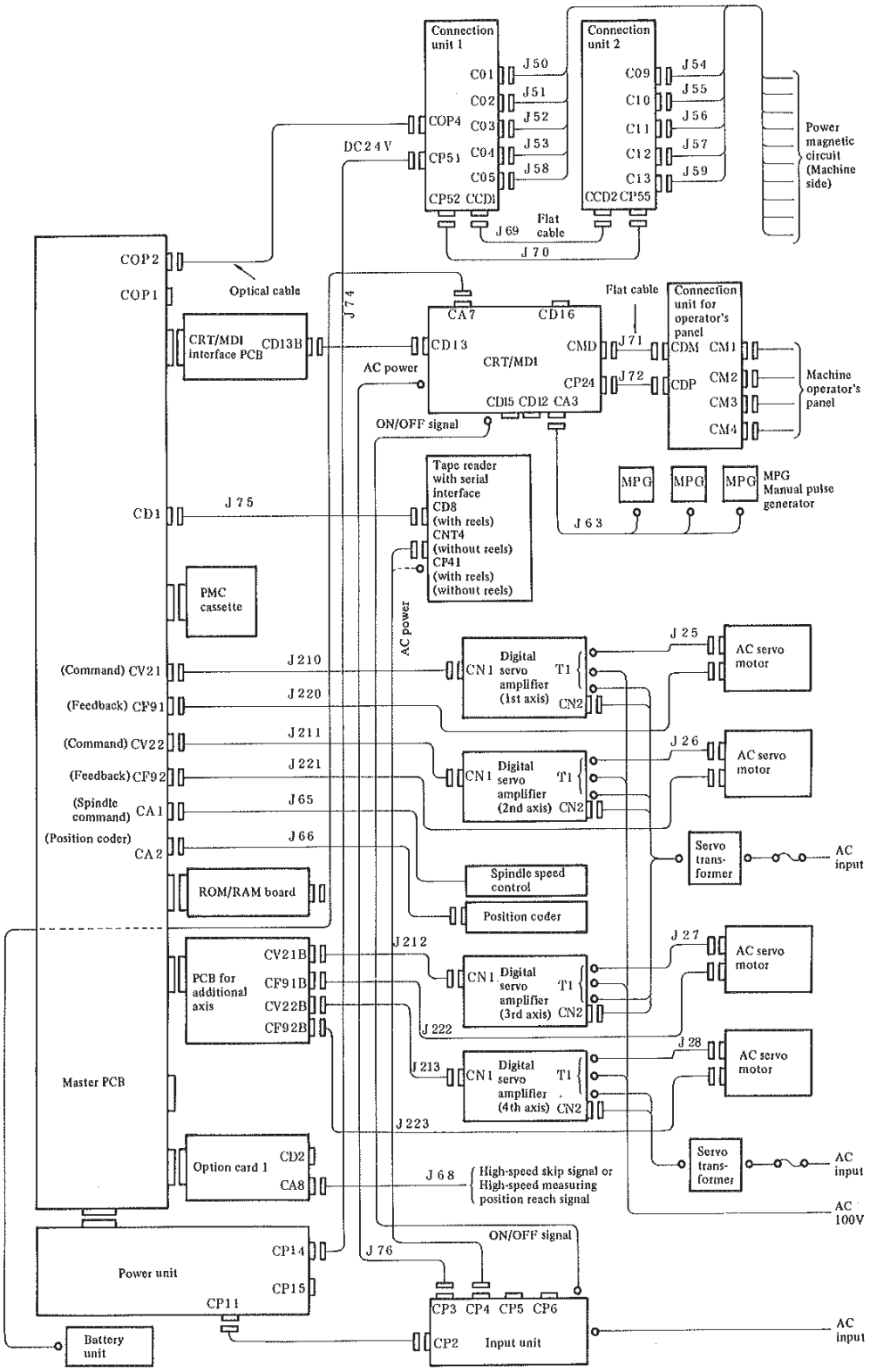


Fig. 1.4 (a) 100T/100M total connection diagram (Digital servo and connection unit are employed)

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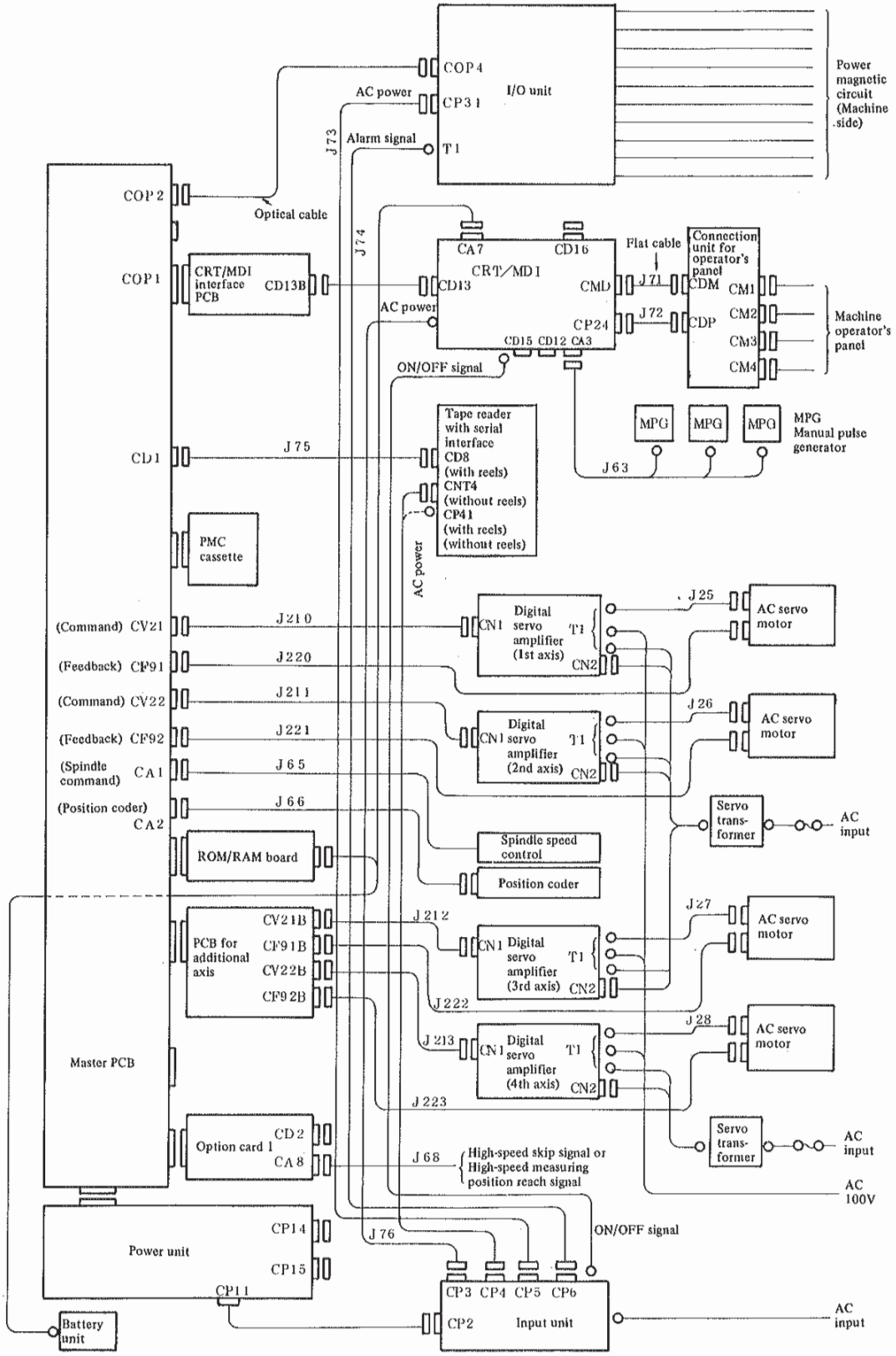


Fig. 1.4 (b) 100T/100M total connecting diagram (Digital servo and I/O unit are employed)

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1.5 110 series

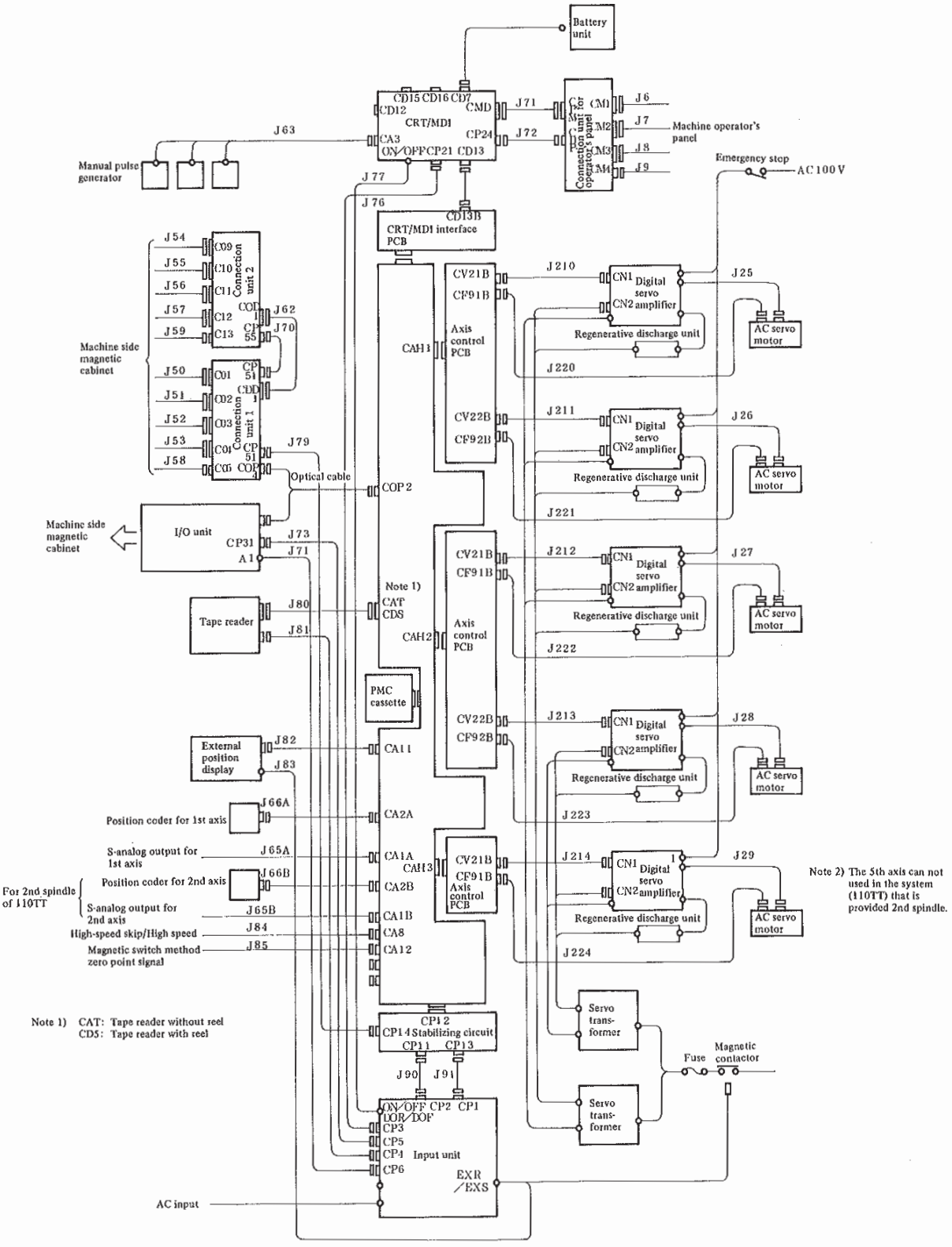
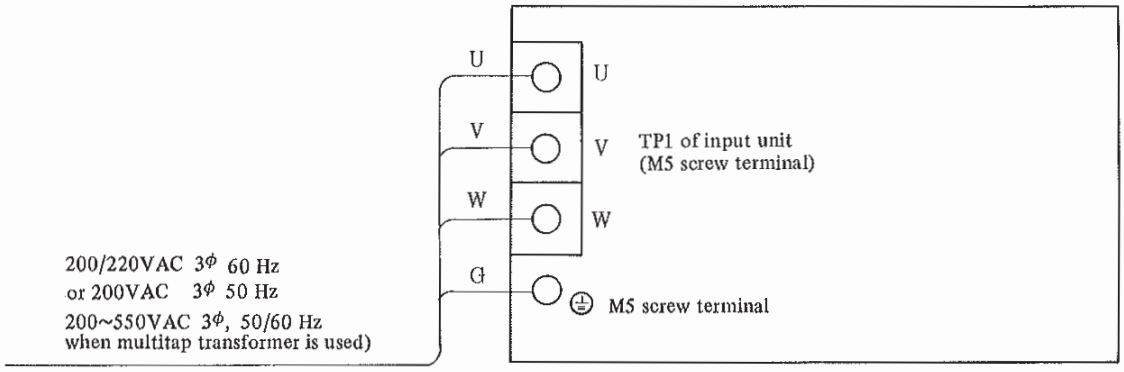


Fig. 1.5 110 series total connecting diagram (Digital servo without separated pulse coder)

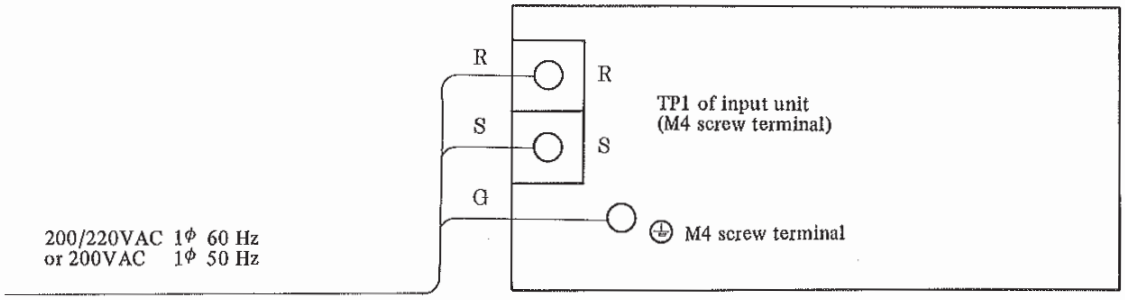
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1.6 Connecting of Input Power Supply

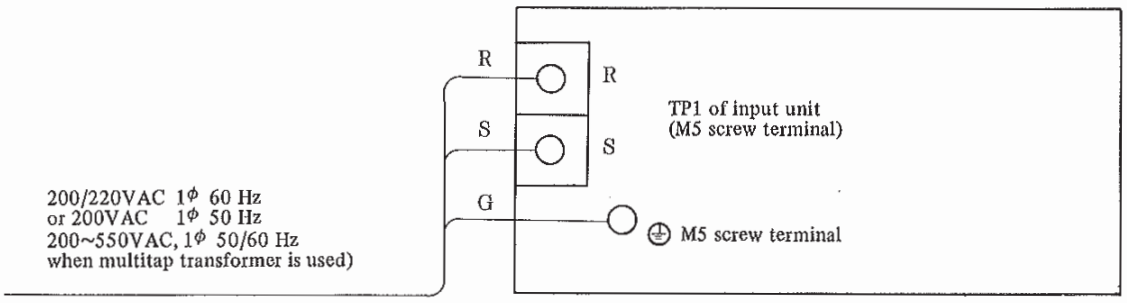
1) In case of free-standing type



2) T series/M series built-in type 1, M series built-in type 2-2, built-in type 3, and unbundled type

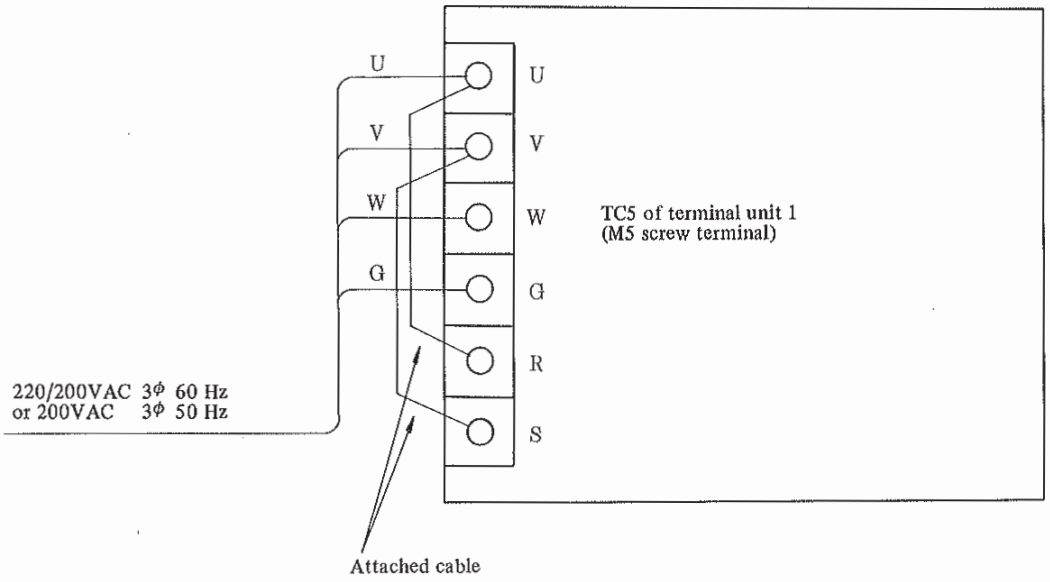


3) In case of M series built-in type 2

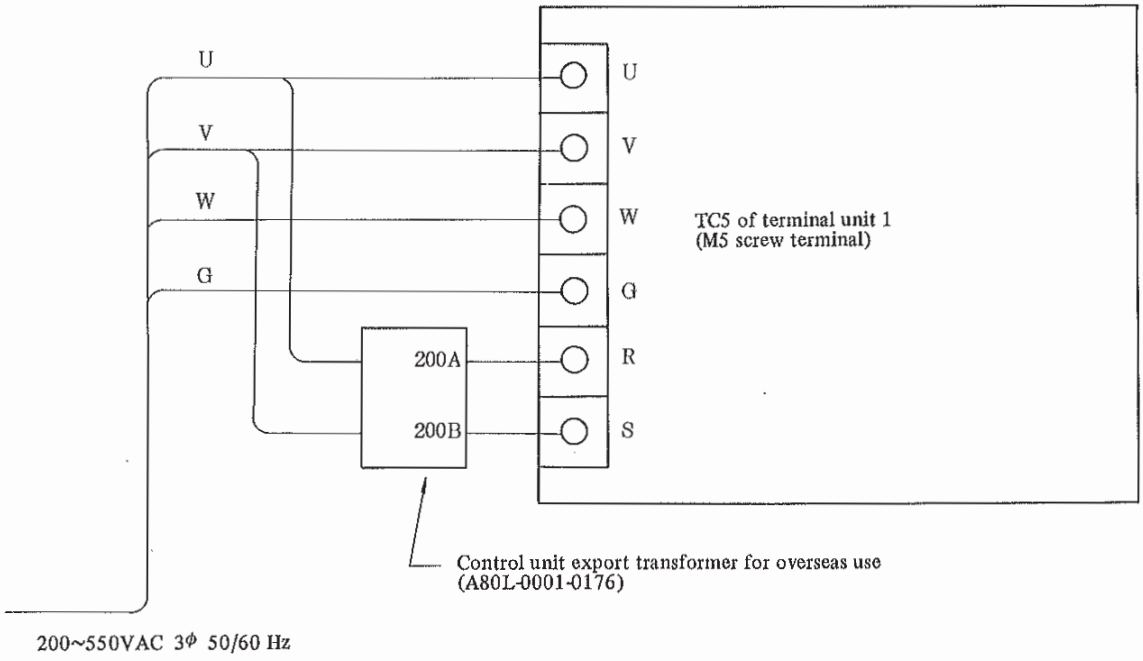


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4) In case of T series built-in type 2 (for domestic use)



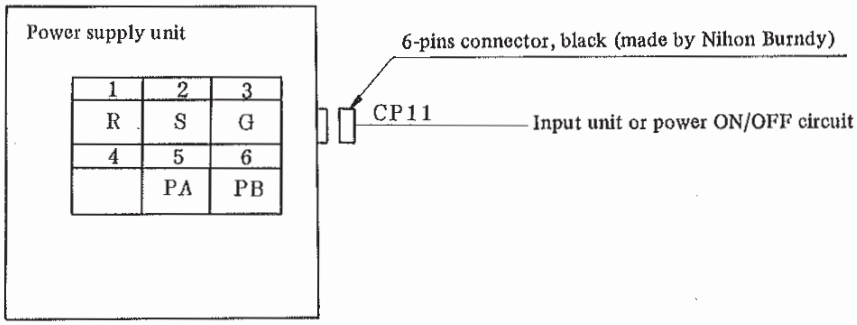
5) In case of T series built-in type 2 (for countries other than Japan)



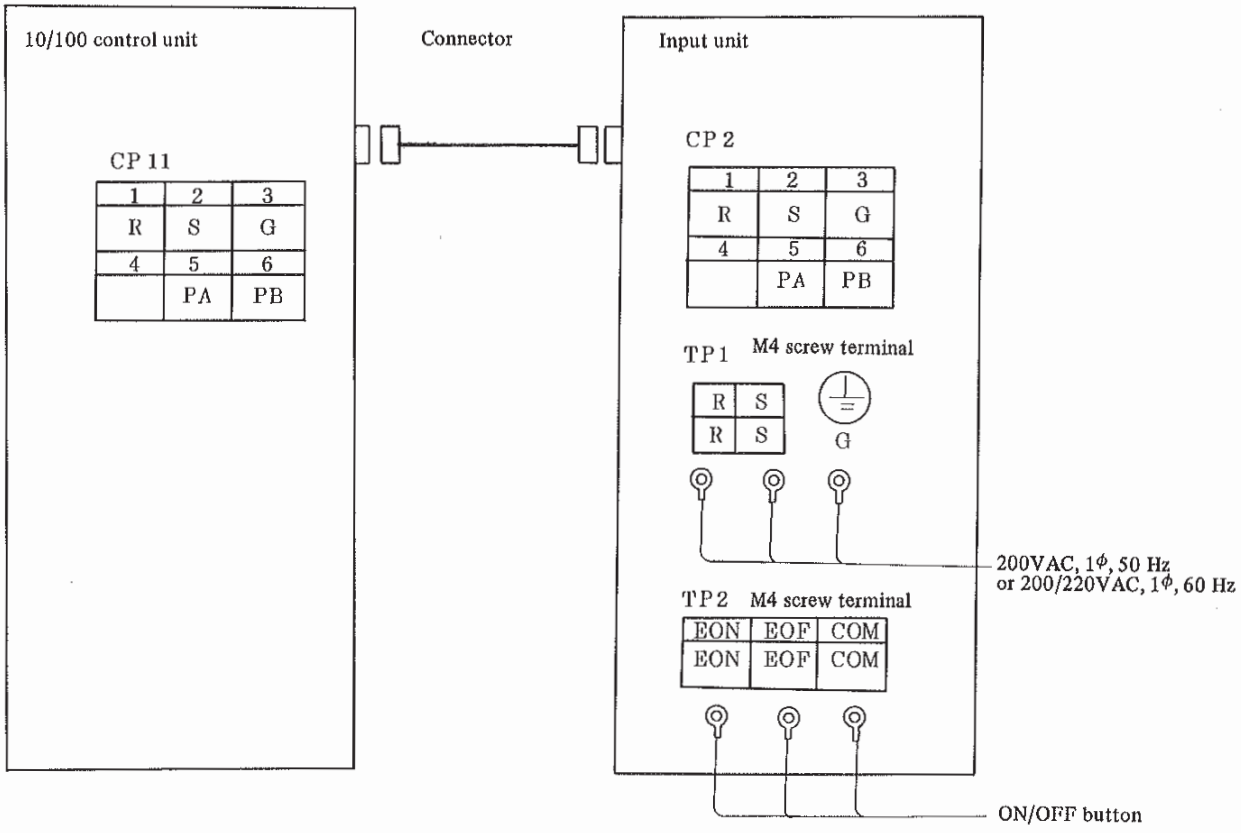
(Note) Connect the control unit transformer as shown in this figure, if the export transformer does not satisfy the power supply condition shown in (4). Then remove the attached cable.

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6) In case of 10/100 series panel-mount Type



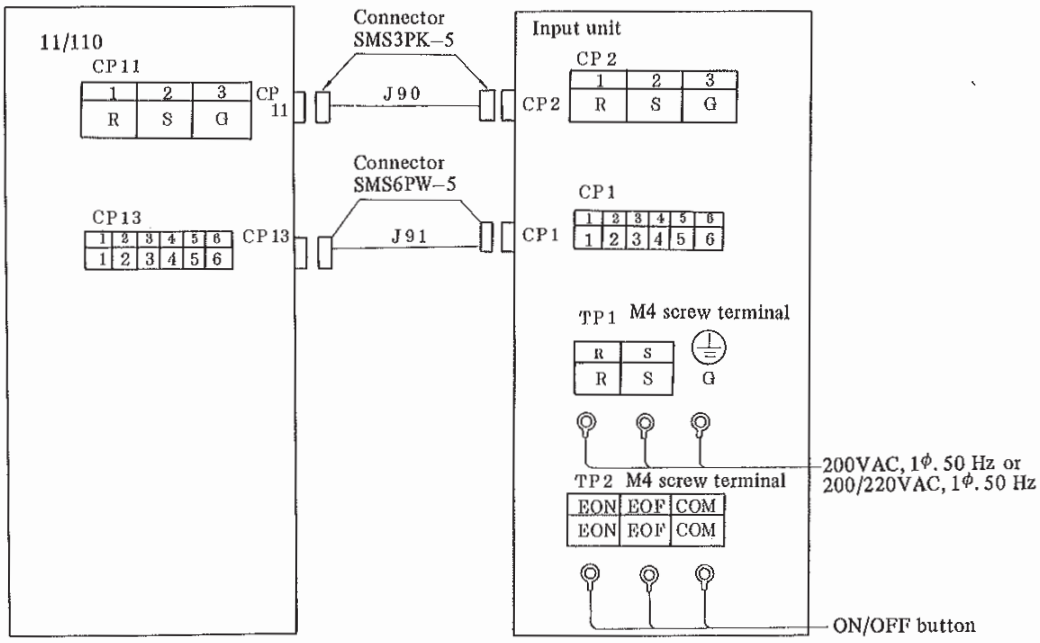
Connection diagram with input unit used



For details of input unit, see 8).

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7) In case of 11/110 series panel-mount type
Unlike 10/100 series, our input unit should be used.

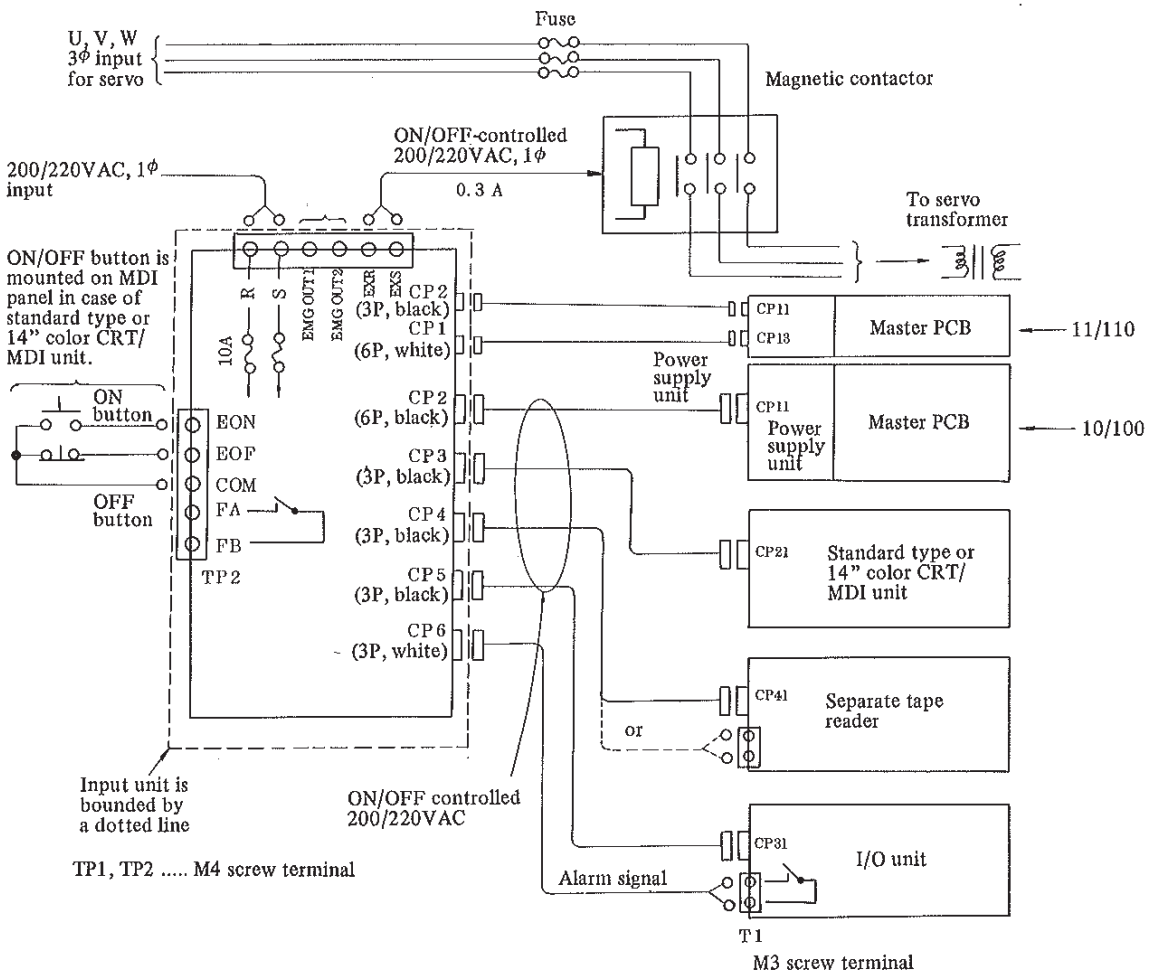


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8) Input unit

The input unit receives AC input power signal and ON/OFF button signal. It feeds the ON-OFF controlled AC power to the control unit and peripheral units.

i) Connection block diagram



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ii) Power system connector terminal layout

a) CP2 (10/100 series),
CP11 (11/110 series), CP31 ..... 6-pin connector, black
(made by Nihon Burndy)

1	2	3
R	S	G
4	5	6
	PA	PB

PA, PB power ready signals

b) CP2 (10/100 series) CP3, CP4, CP5,
CP11 (11/110 series), CP21, CP41 .. 3-pin connector, black
(made by Nihon Burndy)

1	2	3
R	S	G

c) CP6 ..... 3-pin connector, white
(Nihon Burndy)

1	2	3
ALA	ALB	

(ALA/ALB receive an alarm signal from I/O unit and turn off the system power supply.

d) CP1 ..... 6-pin connector, white
(made by Nihon Burndy)

1	2	3	4	5	6
1	2	3	4	5	6

CP1 control signal connector is used for turning the 11/110 series stabilizing power unit on and off. Connect it with power supply unit as a pair.

iii) How to control servo transformer input power supply ON/OFF

The ON/OFF-controlled 200/220 VAC, 1ϕ power supply can be obtained from EXR/EXS terminals of terminal board TP1 of the input unit as shown in the block diagram.

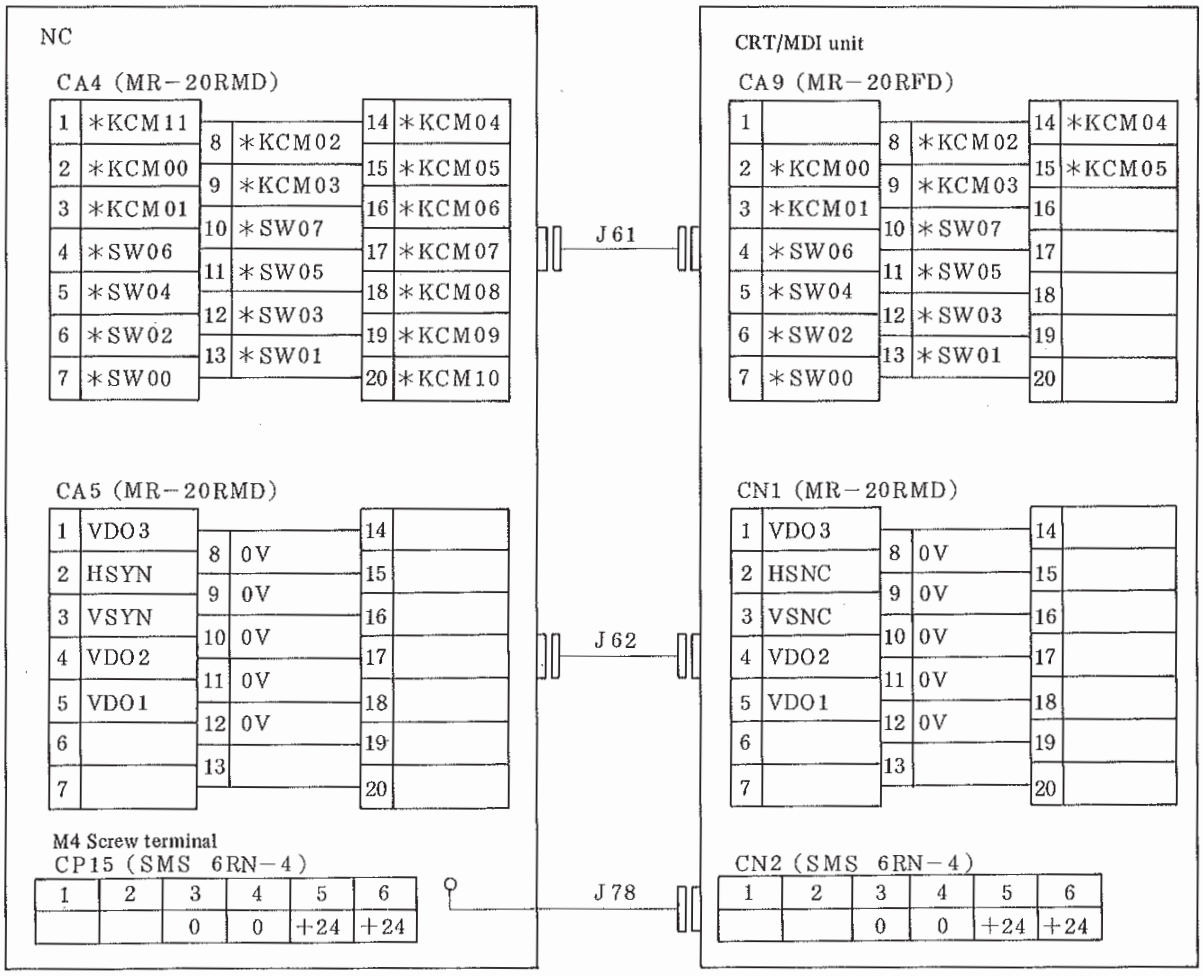
By connecting an electromagnetic contactor (to be prepared by machine tools builder) to these terminals, the servo power supply can be turned on and off in synchronization with the NC power supply.

Suppress the current to be lower than 0.3A.

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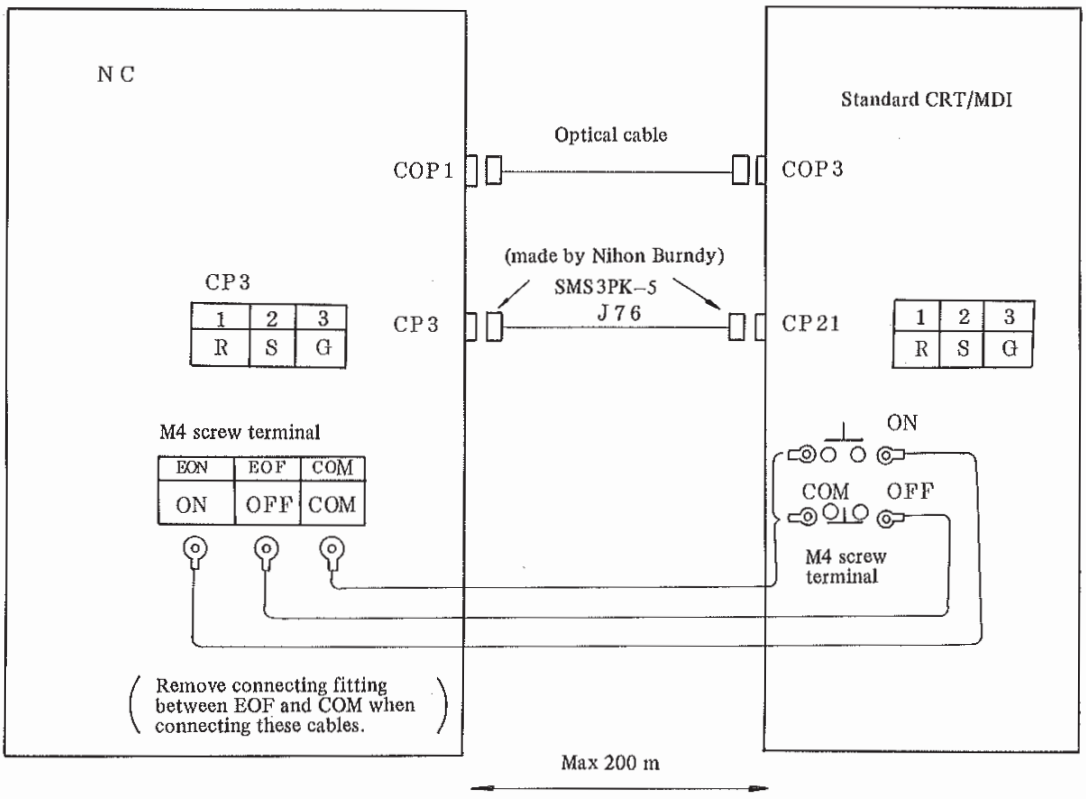
1.7 Connection Diagram for Each Unit

1) Connection to small CRT/MDI unit (10 series only)



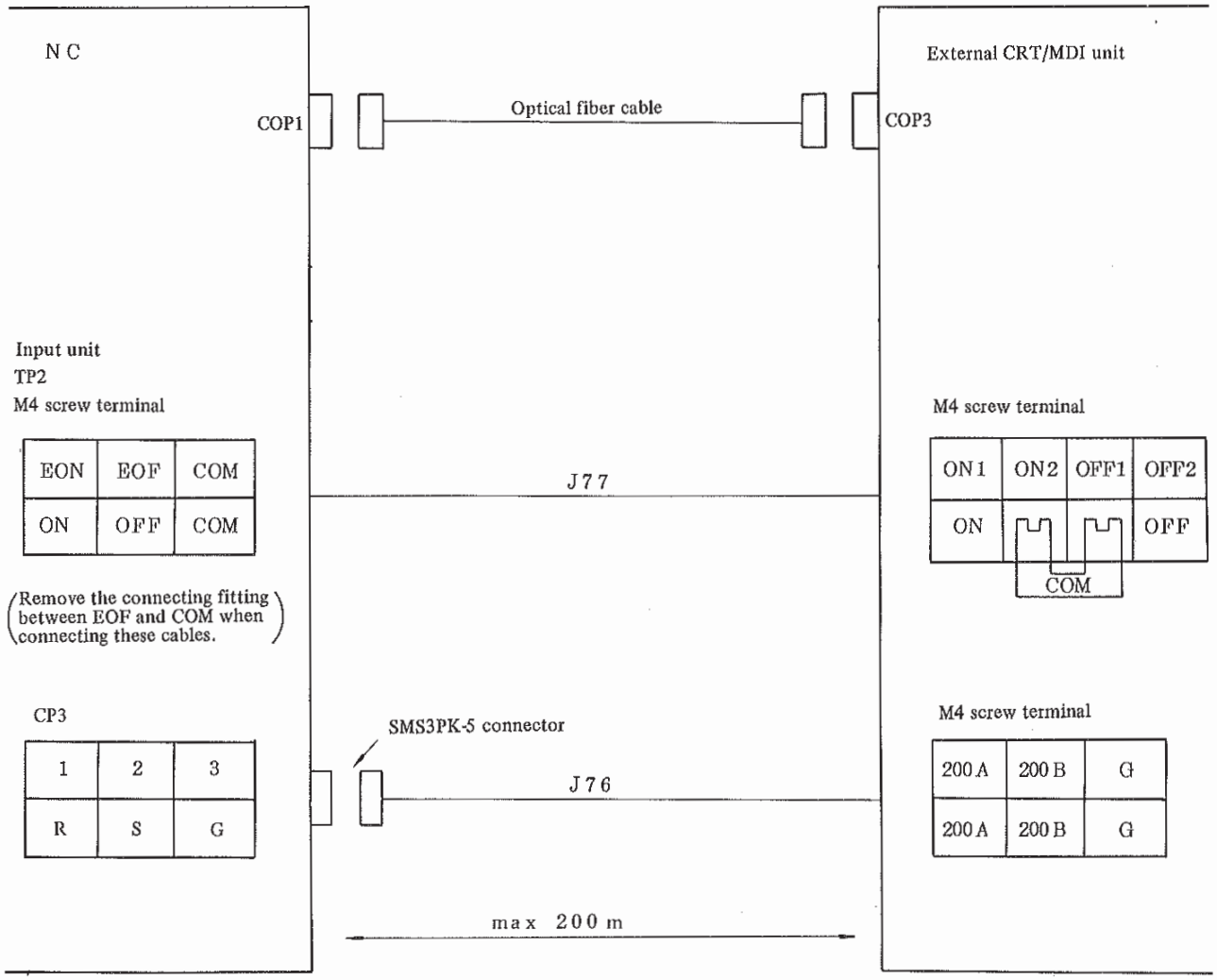
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2) Connection to standard CRT/MDI unit (10/11/12 series)



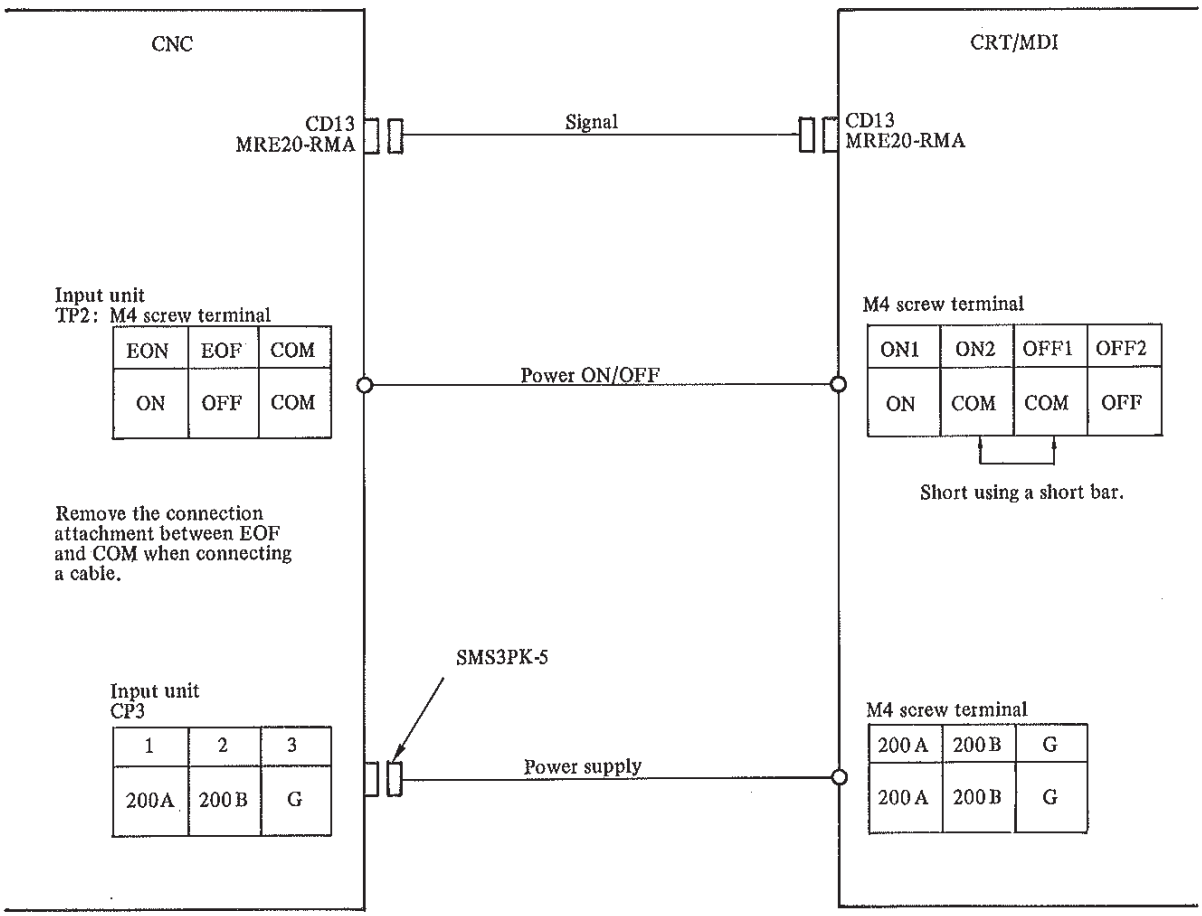
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3) Connection to 14" color CRT/MDI unit
   a) 10/11/12 series



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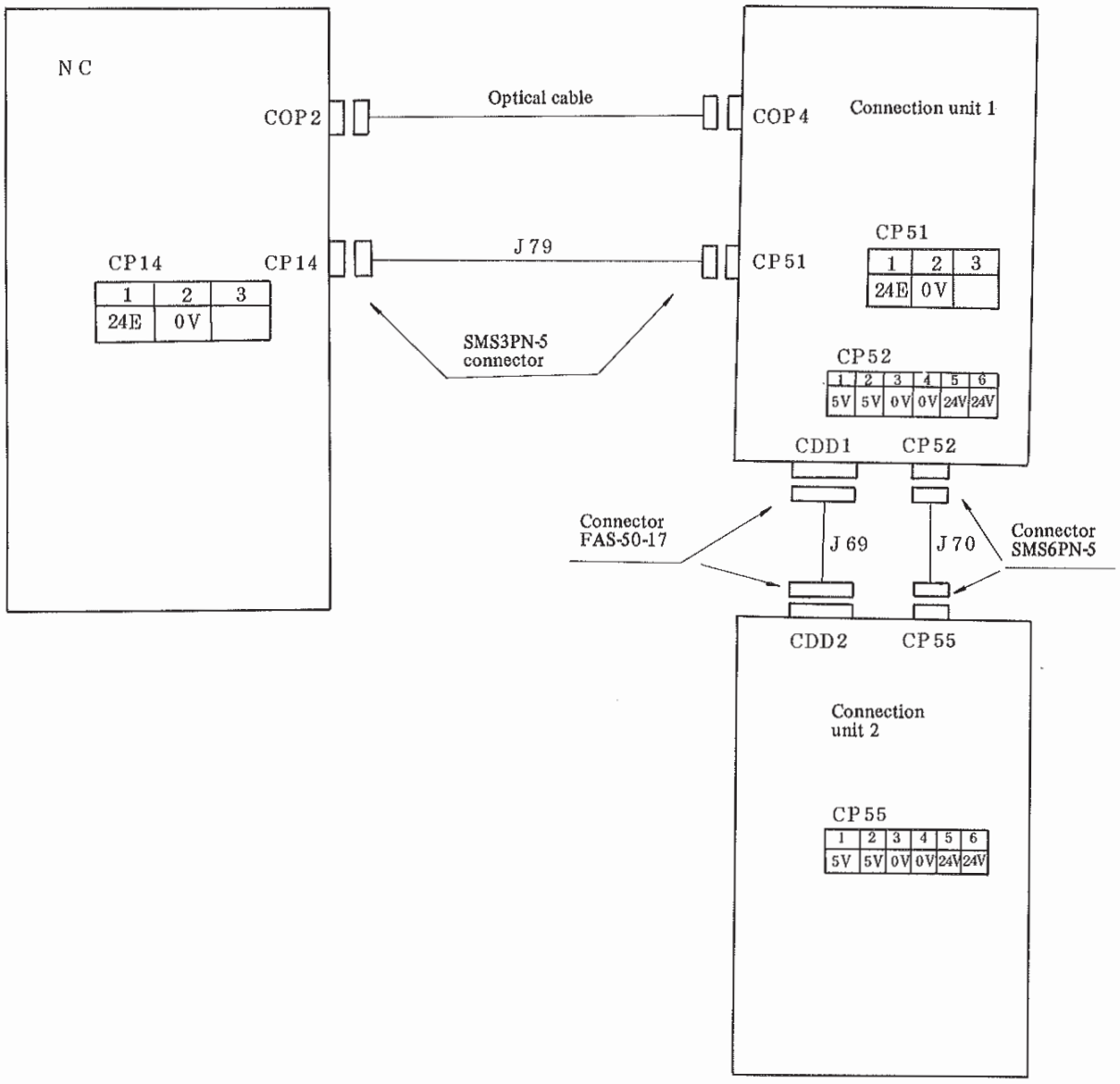
b) 100/110/120 series



(Note 1) A power cable 30/0.18 (0.75 mm^2) and over in gauge should be used.
(Note 2) For the signal cable, see the next page.

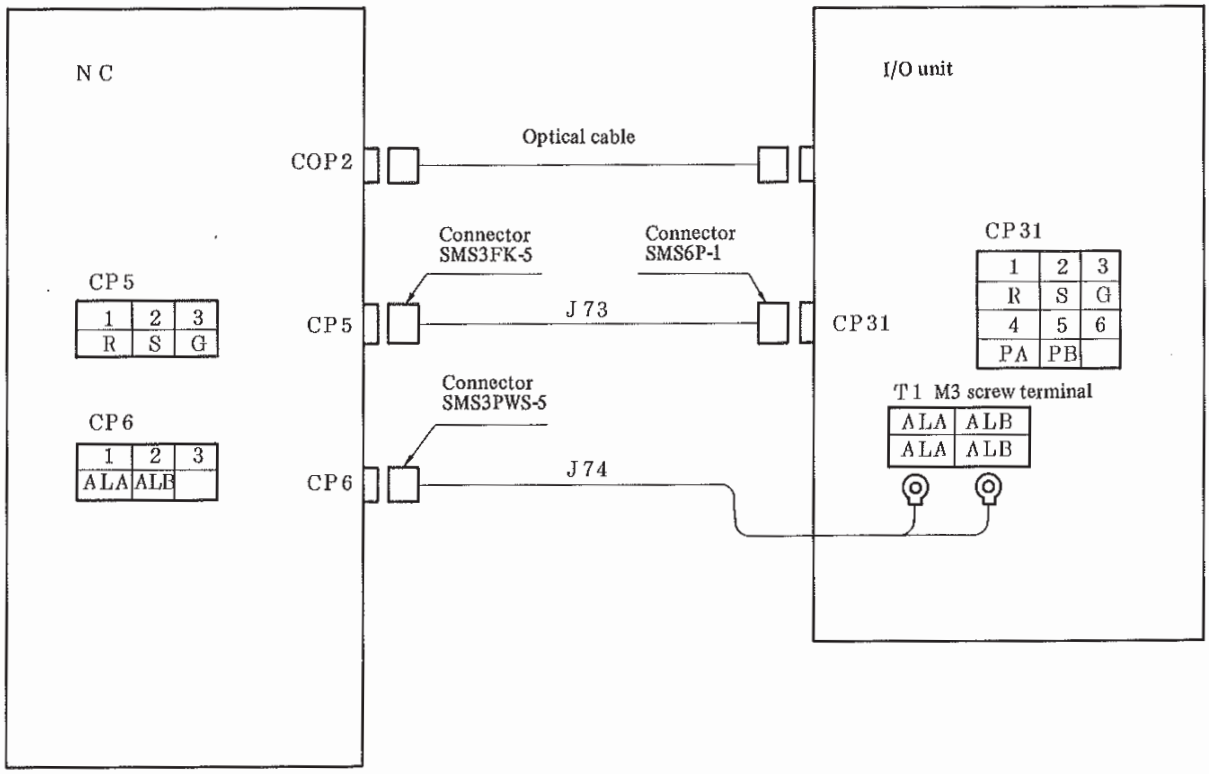
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4) Connection to connection unit



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5) Connection to I/O unit



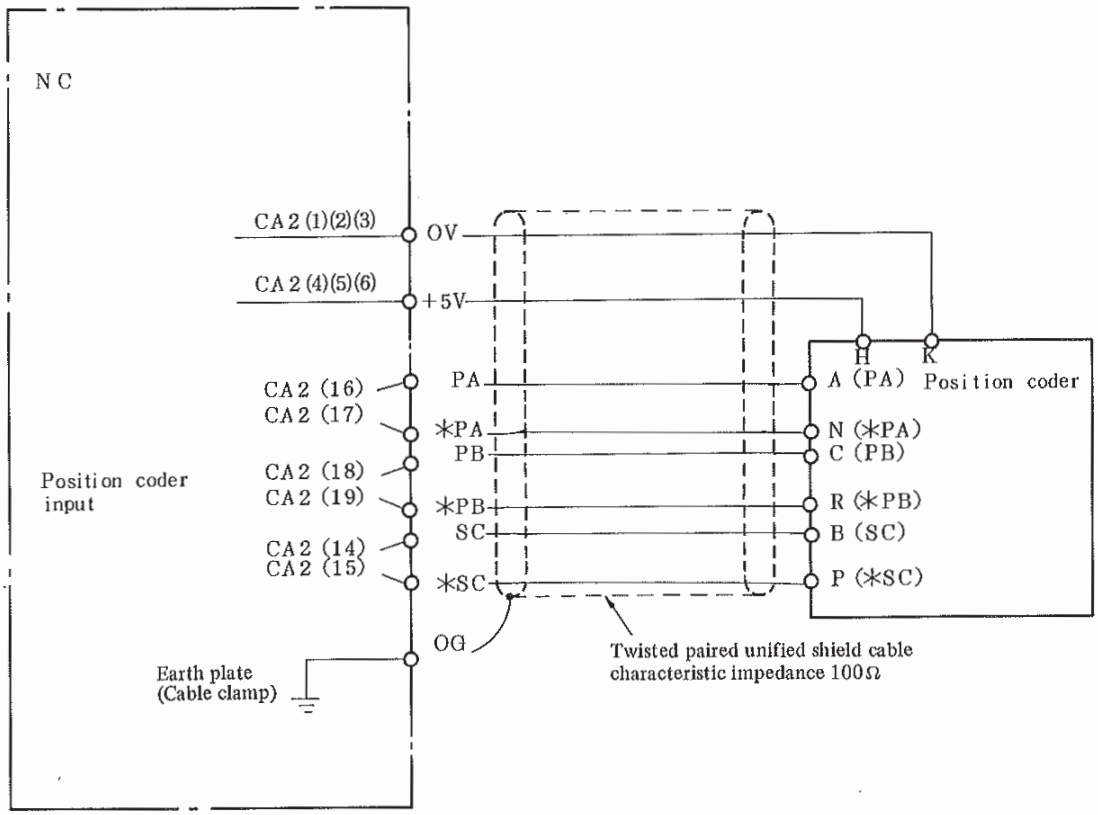
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6) Connection to position coder

CA2 MRE20-RMD
Note) (CA2A, CA2B)

1	0V	8	14	SC
2	0V		15	*SC
3	0V	9	16	PA
4	+5V	10	17	*PA
5	+5V	11	18	PB
6	+5V	12	19	*PB
7		13	20	

Name of signal	Contents
SC, *SC	Position coder C-phase signal
PA, *PA	Position coder A-phase signal
PB, *PB	Position coder B-phase signal



(Note) In case of digital servo
The position coder of 11/110 series and 11TT 1st spindle is connected to CA2A, that of 11TT 2nd spindle is connected to CA2B.

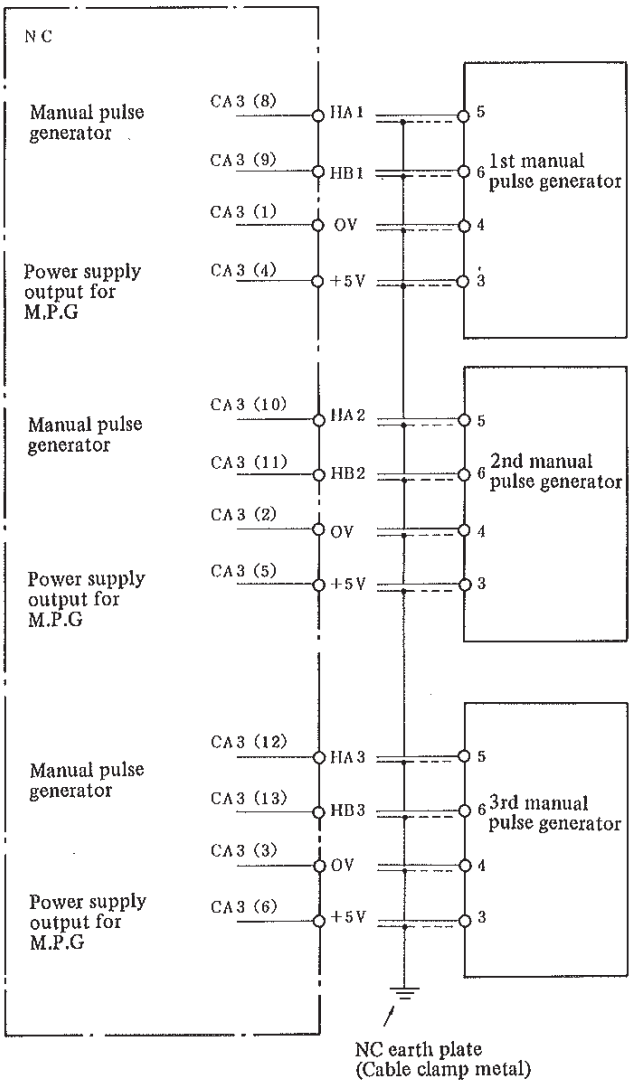
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7) Connection to manual pulse generator

CA3 MRE20-RMD

1	OV			14	
2	OV	8	HA1	15	
3	OV	9	HB1	16	
4	+5V	10	HA2	17	
5	+5V	11	HB2	18	
6	+5V	12	HA3	19	
7		13	HB3	20	

Name of signal	Contents
HA1∿3	Manual pulse generator A-phase signal
HB1∿3	Manual pulse generator B-phase signal



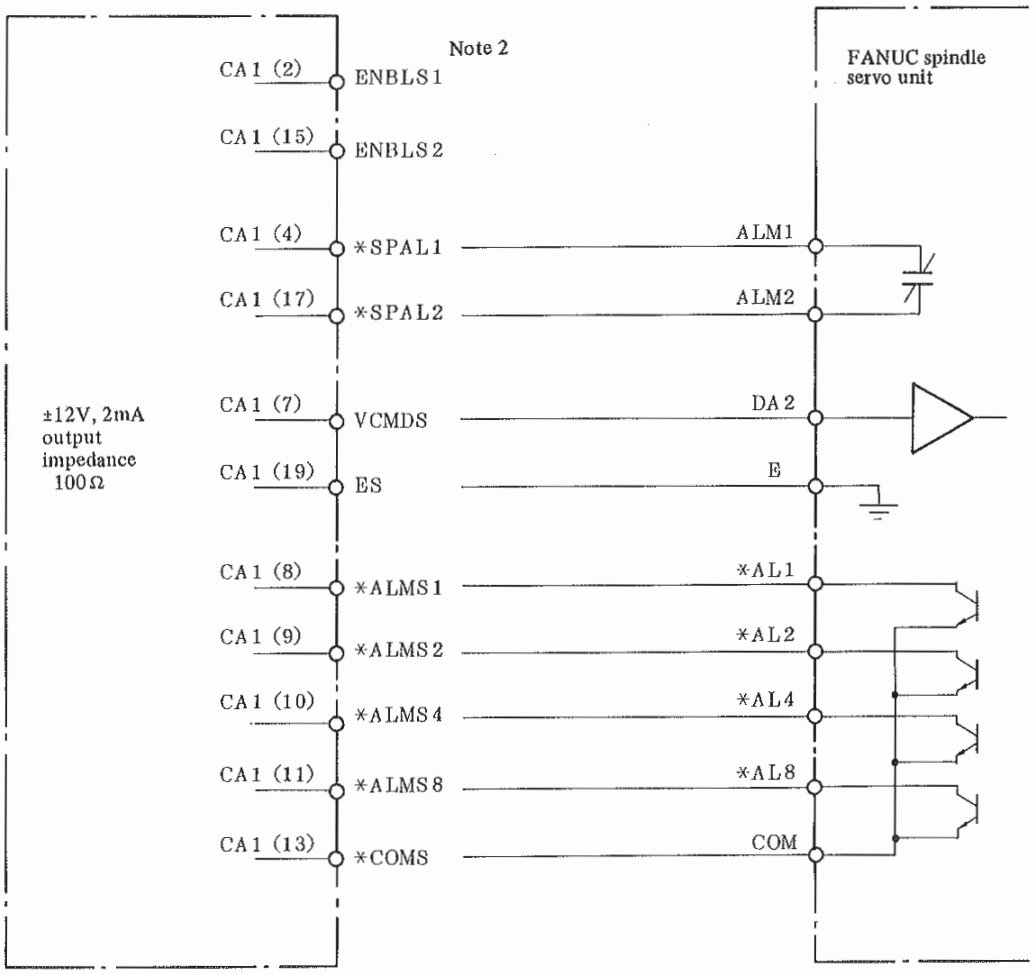
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8) Connection to spindle amplifier

CA1 MRE20-RFD
Note 1) (CA1A, CA1B)

1				14	
2	ENBLS1	8	*ALMS1	15	ENBLS2
3		9	*ALMS2	16	
4	*SPAL1	10	*ALMS4	17	*SPAL2
5		11	*ALMS8	18	
6		12		19	ES
7	VCMDS	13	*COMS	20	

Name of signal	Contents
ENBLS1, ENBLS2	Spindle enable
*SPAL1, *SPAL2	Spindle alarm
VCMDS, ES	Spindle command voltage and common
*ALMS1∿ S8 *COMS	Alarm code signal and common

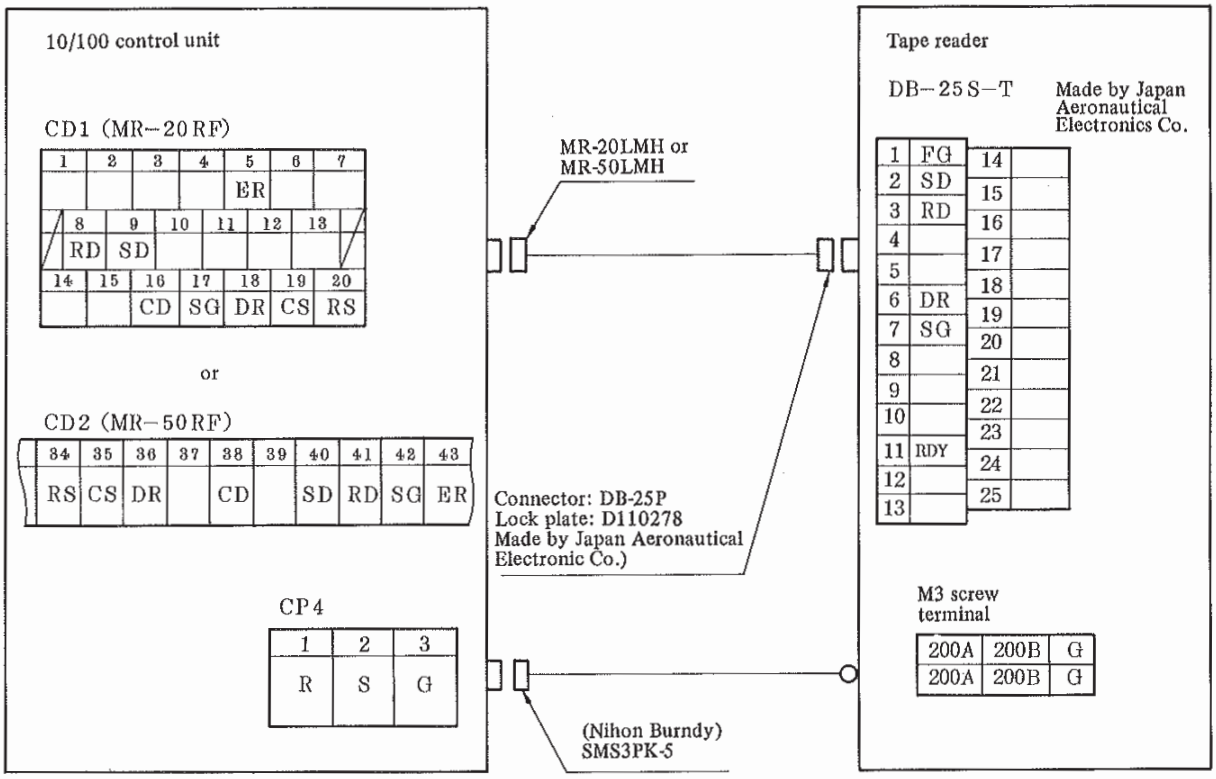


(Note 1) In case of digital servo,
CA1A is used for 11/110 series and 11TT 1st spindle
CA1B is used for 11TT 2nd spindle

(Note 2) ENBLS1 and ENBLS2 signals are turned on when the spindle command voltage is effective. These NEBLS1 and NEBLS2 signals are not used when FANUC spindle servo unit is used.

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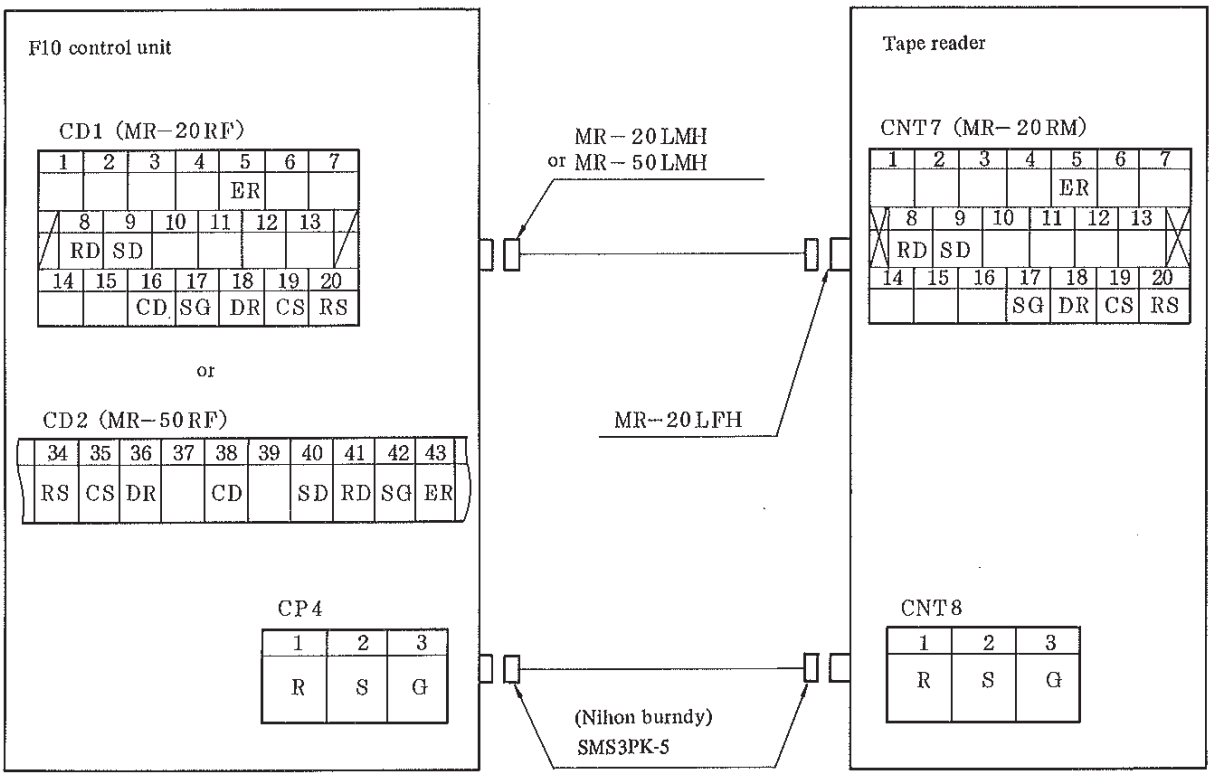
9) Connection to separate tape reader
   a) Connection between 10/100 series and tape reader without reels with Reader/puncher interface



(Note 1) Connector CD1 is mounted on master PCB.
(Note 2) Connector CD2 is mounted on option card 1.
(Note 3) Connector CP4 is mounted on input unit.

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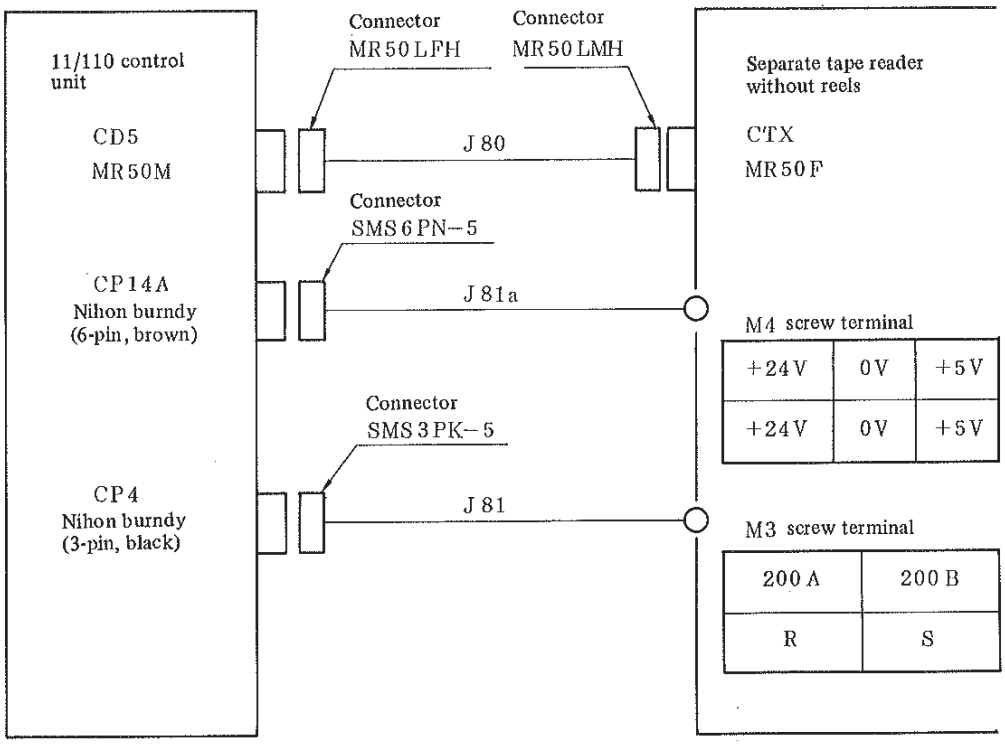
b) Connection between 10/100 series and tape reader with reels



(Note 1) Connector CD1 is mounted on master PCB.
(Note 2) Connector CD2 is mounted on option card 1.
(Note 3) Connector CP4 is mounted on input unit.

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c) Connection between 11/110 and tape reader without reels with parallel interface

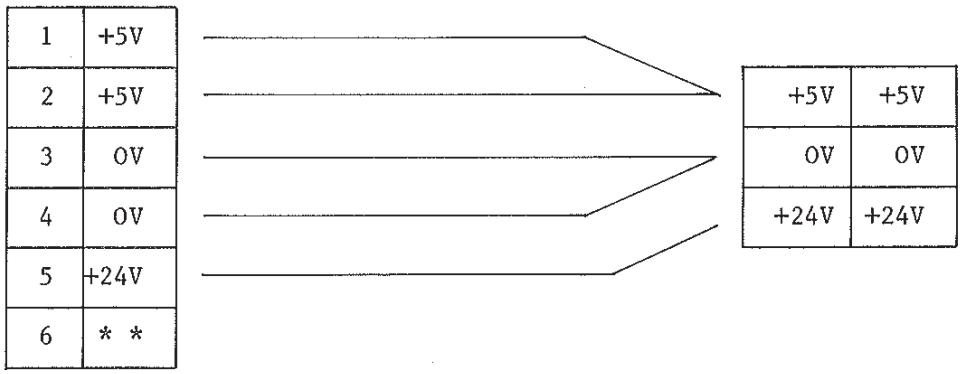


(Note 1) CP14A is mounted on the master PCB below the stabilizing power circuit. Disconnect the stabilizing power circuit once and connect CP14A.

(Note 2) CP4 is mounted on the input unit.

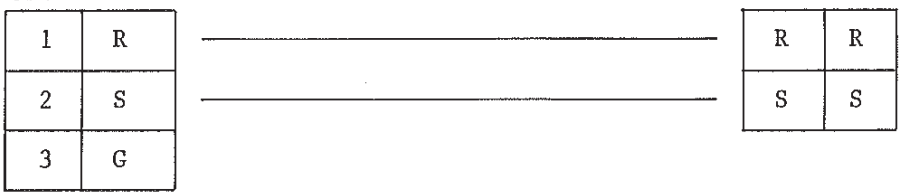
(Note 3) Connection of J81a

CP14A — Tape reader



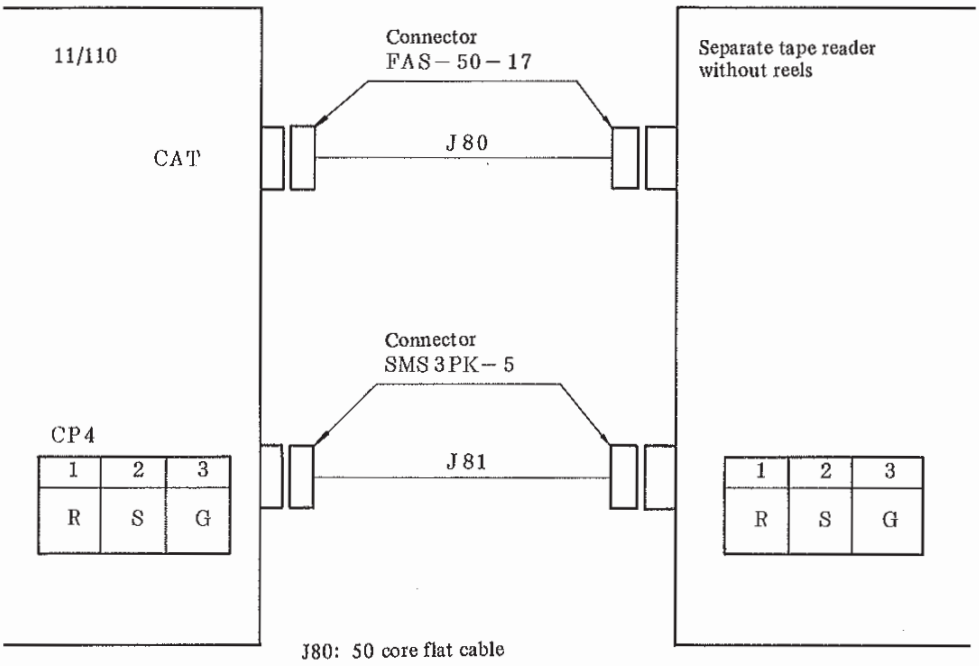
(Note 4) Connection of J81

CP4 — Tape reader



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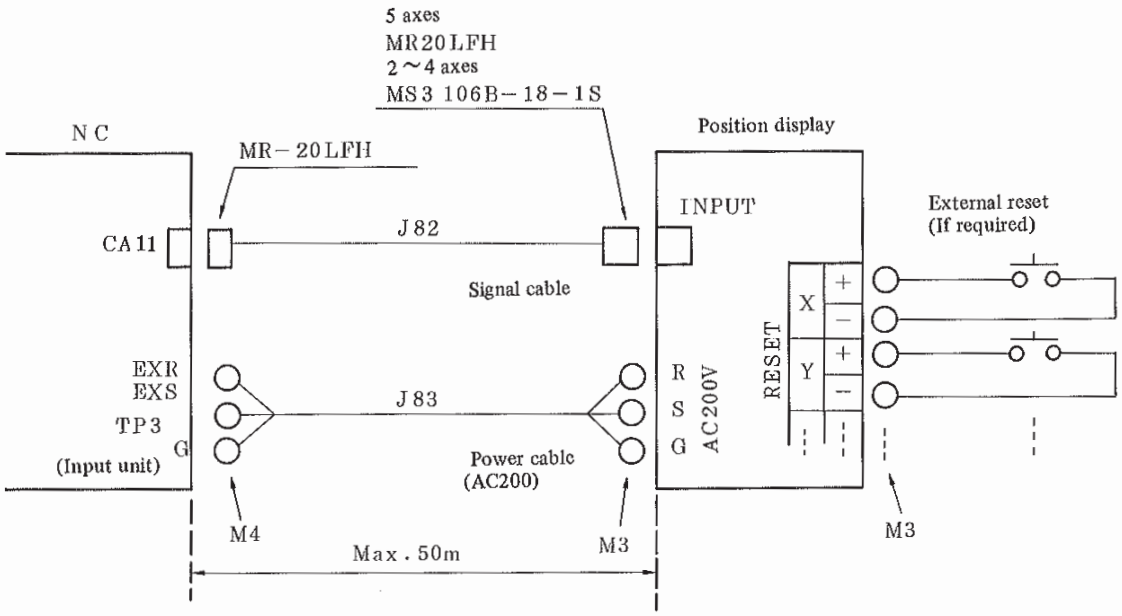
d) Connection between 11/110 series and tape reader with reels
The separate tape reader with reels is connectable via I/O interface. It is also directly connectable to the master PCB in 11/110 series.



J80: 50 core flat cable

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10) Connection to external position display (11/110 series)
The external position display is provided for 2 axes, 3 axes, 4 axes, and 5 axes. The connection of signal cable more or less differs among 2/3 axes, 4 axes and 5 axes types, as shown below.



CA11 MR20RM

1	OV	8	OV	14	OV
2	OV	9	DD1	15	
3	RS1	10	DD2	16	
4	RS2	11	DD4	17	
5	RS3	12	DD8	18	
6	RS4	13	DWT	19	RS5
7	OV			20	

Name of signal	Contents
DD1∿DD8	Data
DWT	Data strobe
RS1∿RS5	Reset input

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- Interface on position display side

2/3-axis position display
INPUT

A	B	C	D
DD1	DD2	DD4	DD8
E	F	G	H
DWT	RSX	RSY	RSZ
I	J		
OV	OV		

4-axis position display
INPUT

A	B	C	D
DD1	DD2	DD4	DD8
E	F	G	H
DWT	RSX	RSY	RSZ
I	J		
OV	PSB		

Connector: CANNON MS3102A-18-1P

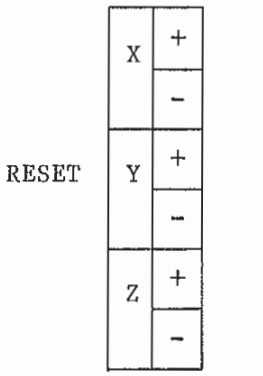
- 5-axis position display

MR20RM

1	OV	8	OV	14	OV
2	OV	9	DD1	15	
3	RS1	10	DD2	16	
4	RS2	11	DD4	17	
5	RS3	12	DD8	18	
6	RS4	13	DWT	19	RS5
7	OV			20	

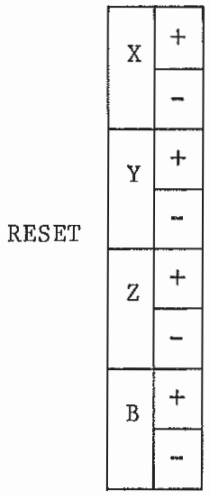
- Position display external reset input

2/3-axis position display



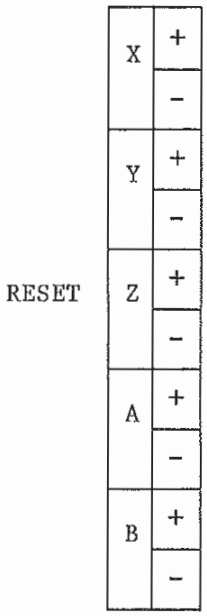
M3 screw terminal

4-axis position display



M3 screw terminal

5-axis position display



M3 screw terminal

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11) Connection of high-speed skip signal and high-speed measuring position arrival signal

In case of 11/110 series
CA8 MR20RM

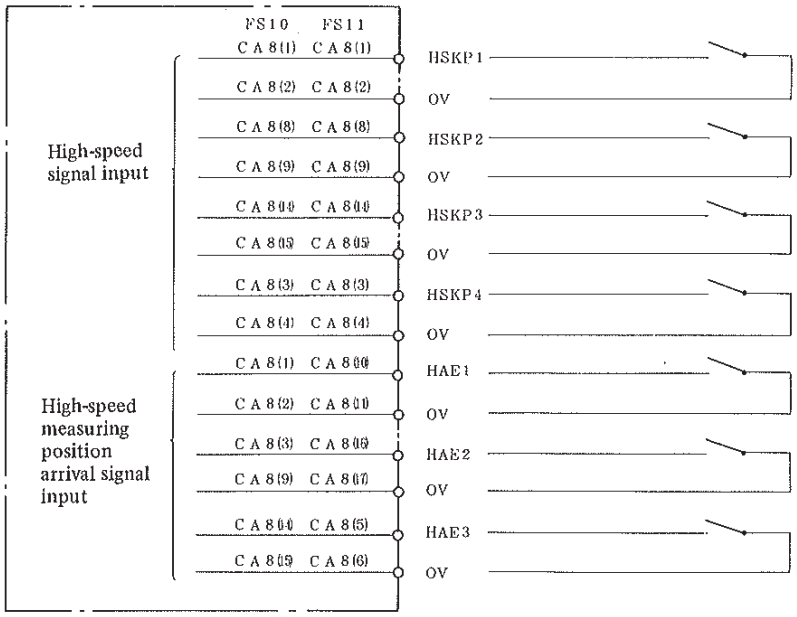
1	HSKP1			14	HSKP3
2	OV	8	HSKP2	15	OV
3	HSKP4	9	OV	16	HAE2
4	OV	10	HAE1	17	OV
5	HAE3	11	OV	18	
6	OV	12		19	
7		13		20	

Name of signal	Contents
HSKP1∿4	High-speed skip signal
HAE1∿3	High measuring position arrival signal

In case of 10/100 series
CA8 MRE20-RMD

1	HS01			14	HS03
2	OV	8	HS02	15	OV
3	HS04	9	OV	16	
4	OV	10		17	
5		11		18	
6		12		19	OV
7		13		20	OV

Name of signal	Contents
HS01∿03	High-speed skip signal (HSKP1∿3) or high-speed measuring position arrival signal (HAE1∿3)
HS04	High-speed signal (HSKP4)

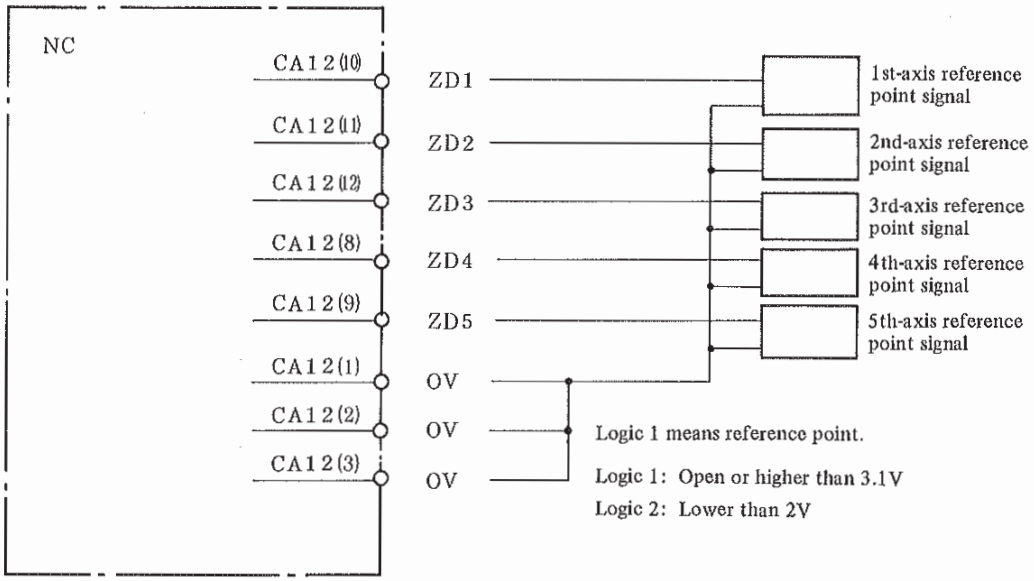


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12) Connection of magnetic switch system reference point signal (11 series)
CA12 MR20RM

1	OV			14	
2	OV	8	ZD4	15	
3	OV	9	ZD5	16	
4		10	ZD1	17	
5		11	ZD2	18	
6		12	ZD3	19	
7		13		20	

Name of signal	Contents
ZD1∿ZD5	Magnetic switch system reference point signal



13) 20mA current loop

CD7 (when punch panel is used)

1		14
	8	
2		15
	9	
3		16
	10	
4	OV	17
TTY3	11	
5		18
	12	
6		19
TTY2	13	
7		20
TTY1		

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1.8 Connecting of I/O Unit

1) I/O unit signal connection diagram (In case of one group)

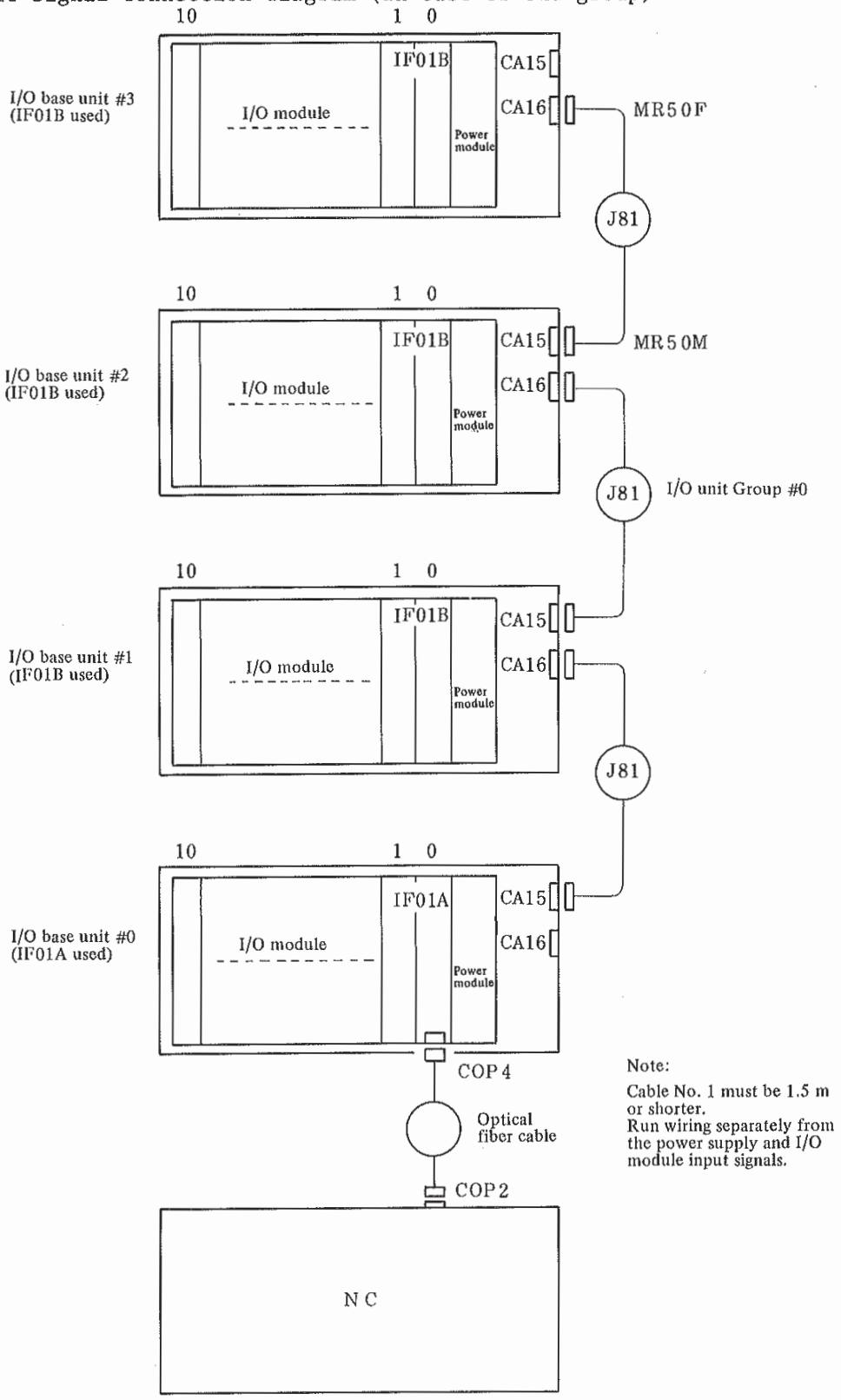
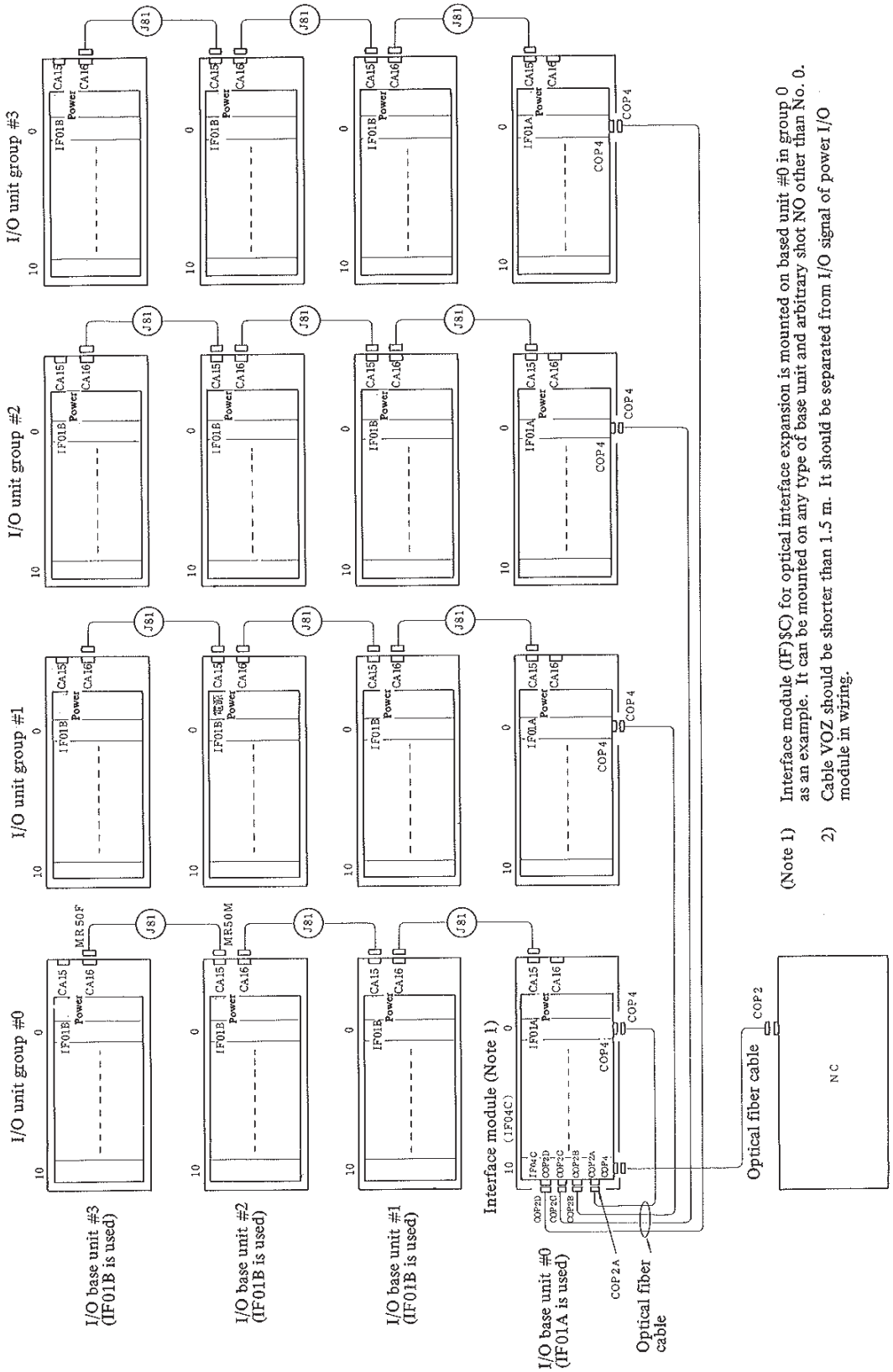


Fig. 1.8 (a) I/O unit signal connection diagram (1) (In case of one group)

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2) I/O unit signal connection diagram (In case of several groups)



(Note 1) Interface module (IF)$C) for optical interface expansion is mounted on based unit #0 in group 0 as an example. It can be mounted on any type of base unit and arbitrary shot NO other than No. 0.

2) Cable VOZ should be shorter than 1.5 m. It should be separated from I/O signal of power I/O module in wiring.

Fig. 1.8 (b) I/O unit signal connecting diagram (2) (When several groups are used)

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3) I/O units connecting signal cable

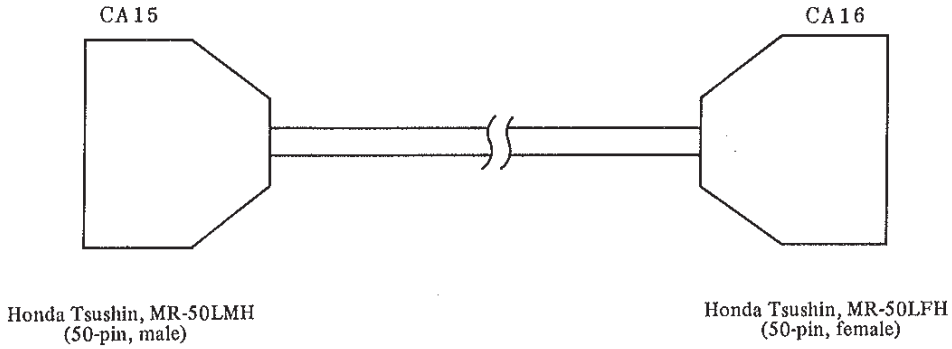


Fig. 1.8 (c) Connector for I/O units connecting signal cable (V02)

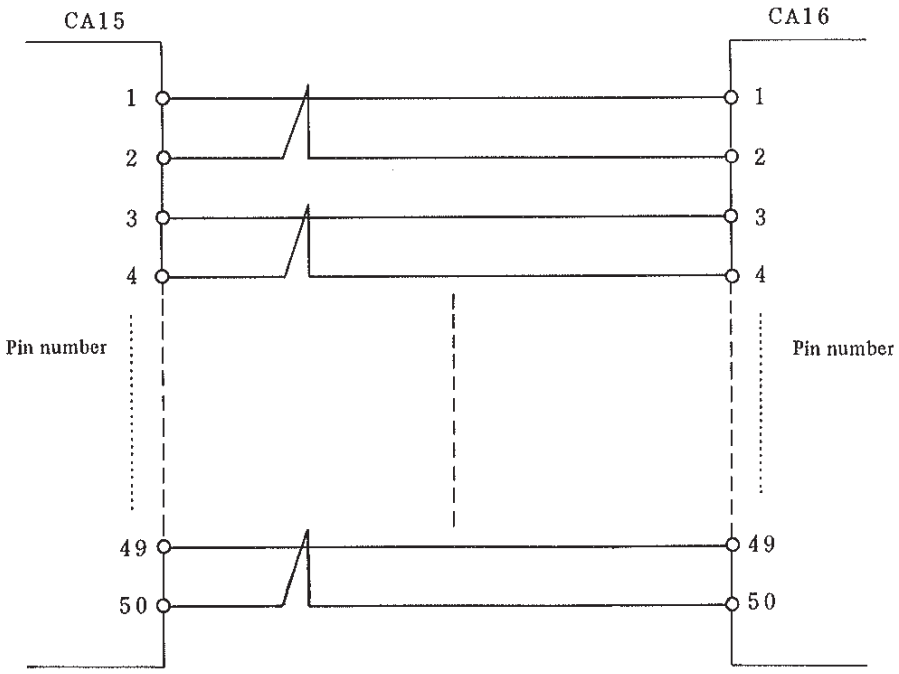
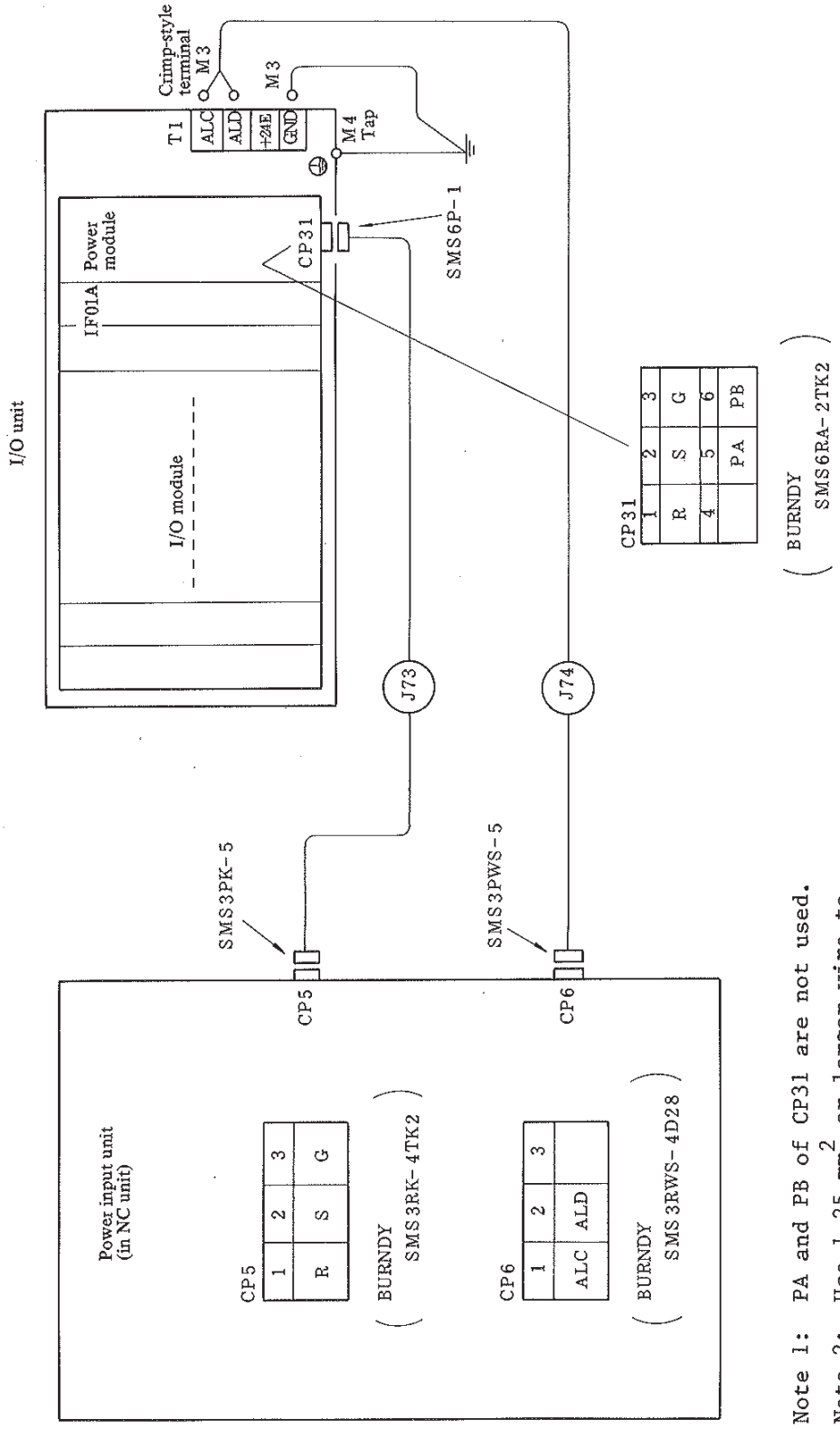


Fig. 1.8 (d) Signal cable connection diagram between main unit and I/O unit

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4) I/O unit power connection diagram (In the case of one I/O base unit)



Note 1: PA and PB of CP31 are not used.

Note 2: Use 1.25 mm^2 or larger wire to ground for GND terminal of T1.

Note 3: Use 30/0.18 (0.75 mm) or larger wire for J73 and J74.

Fig. 1.8 (e) I/O unit power connection diagram (In the case of one I/O unit)

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5) I/O unit power connection diagram (In the case of several I/O base units)

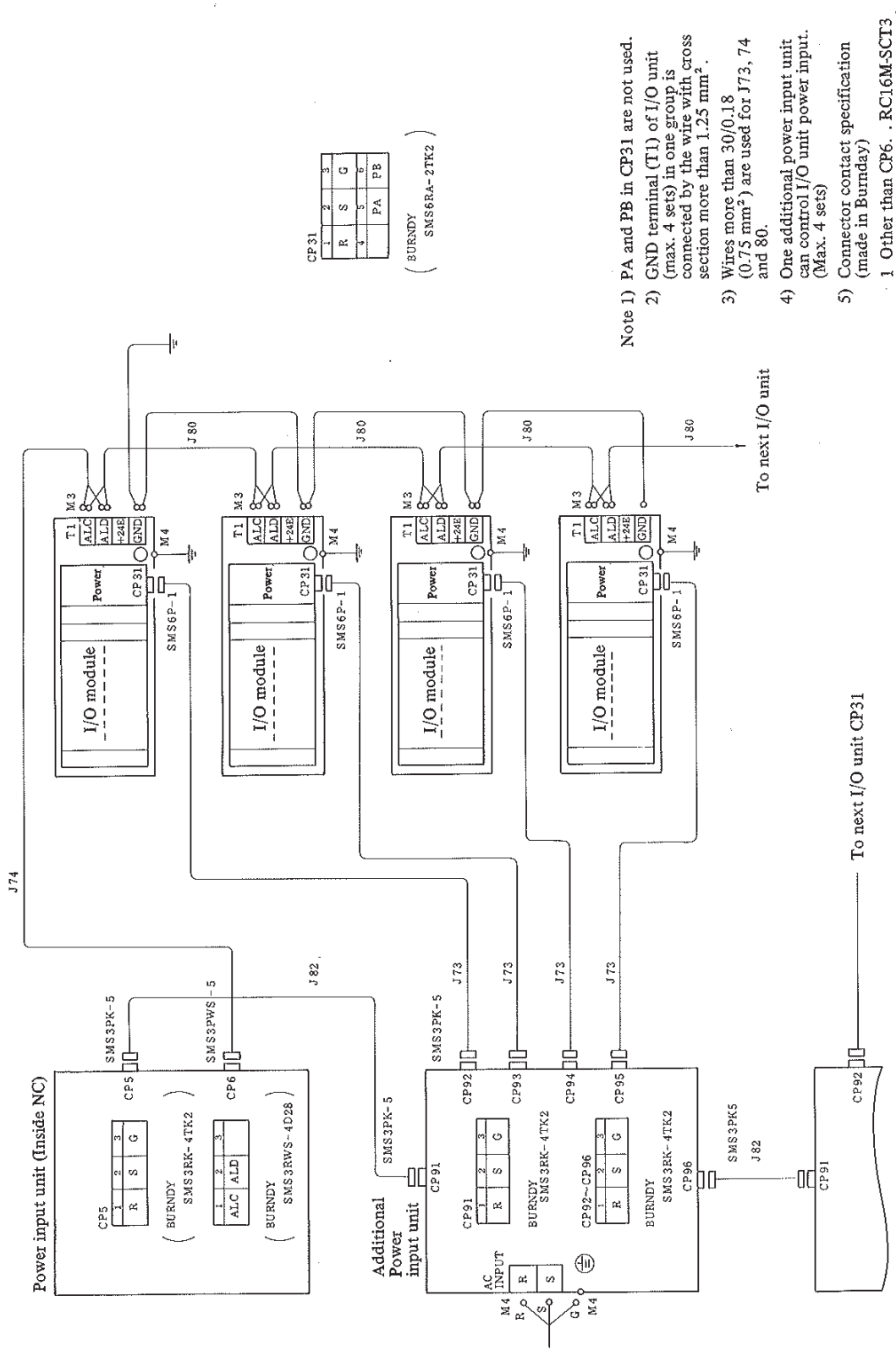


Fig. 1.8 (f) I/O unit power connection diagram (When several I/O units are employed)

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6) Analog input module connection

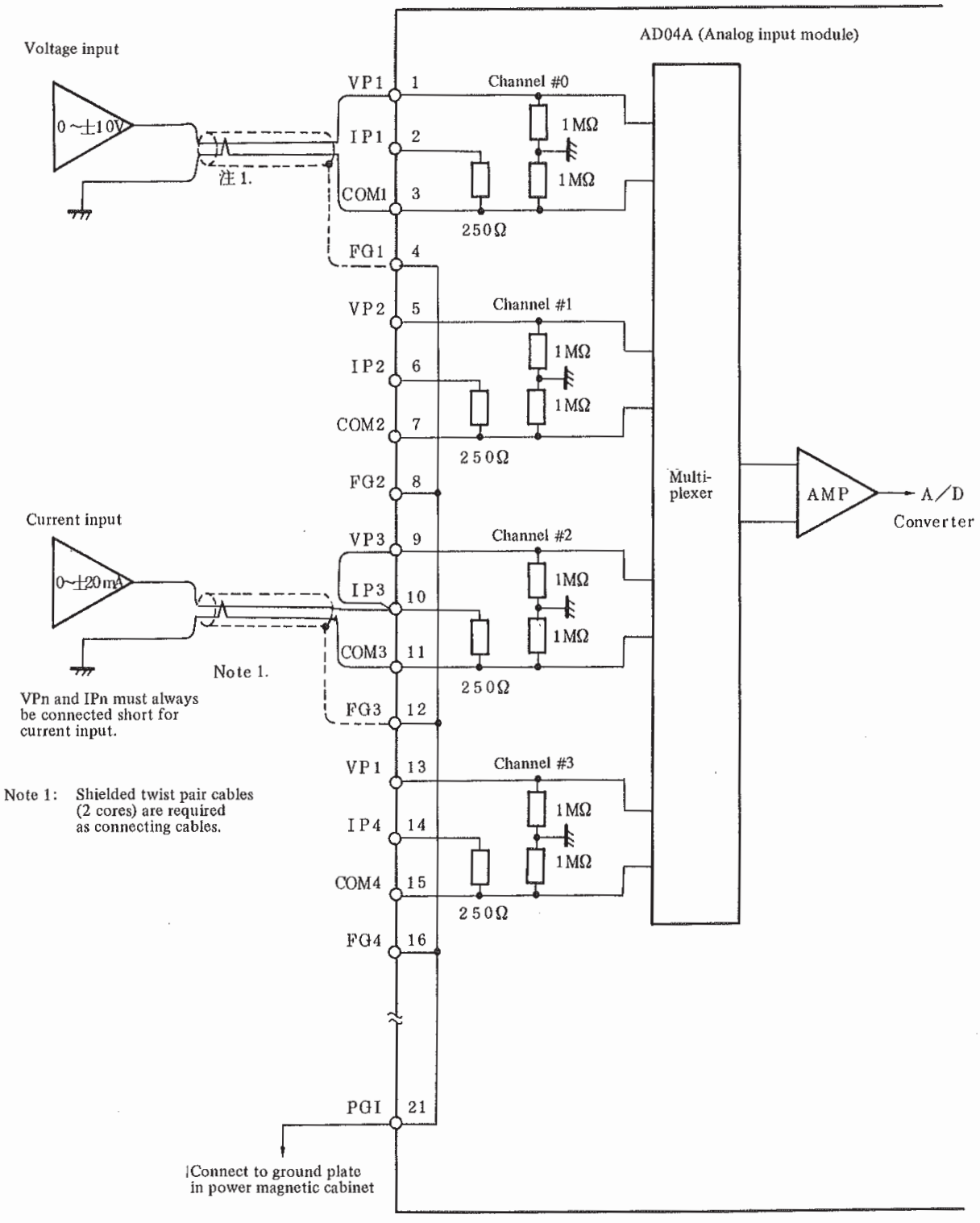
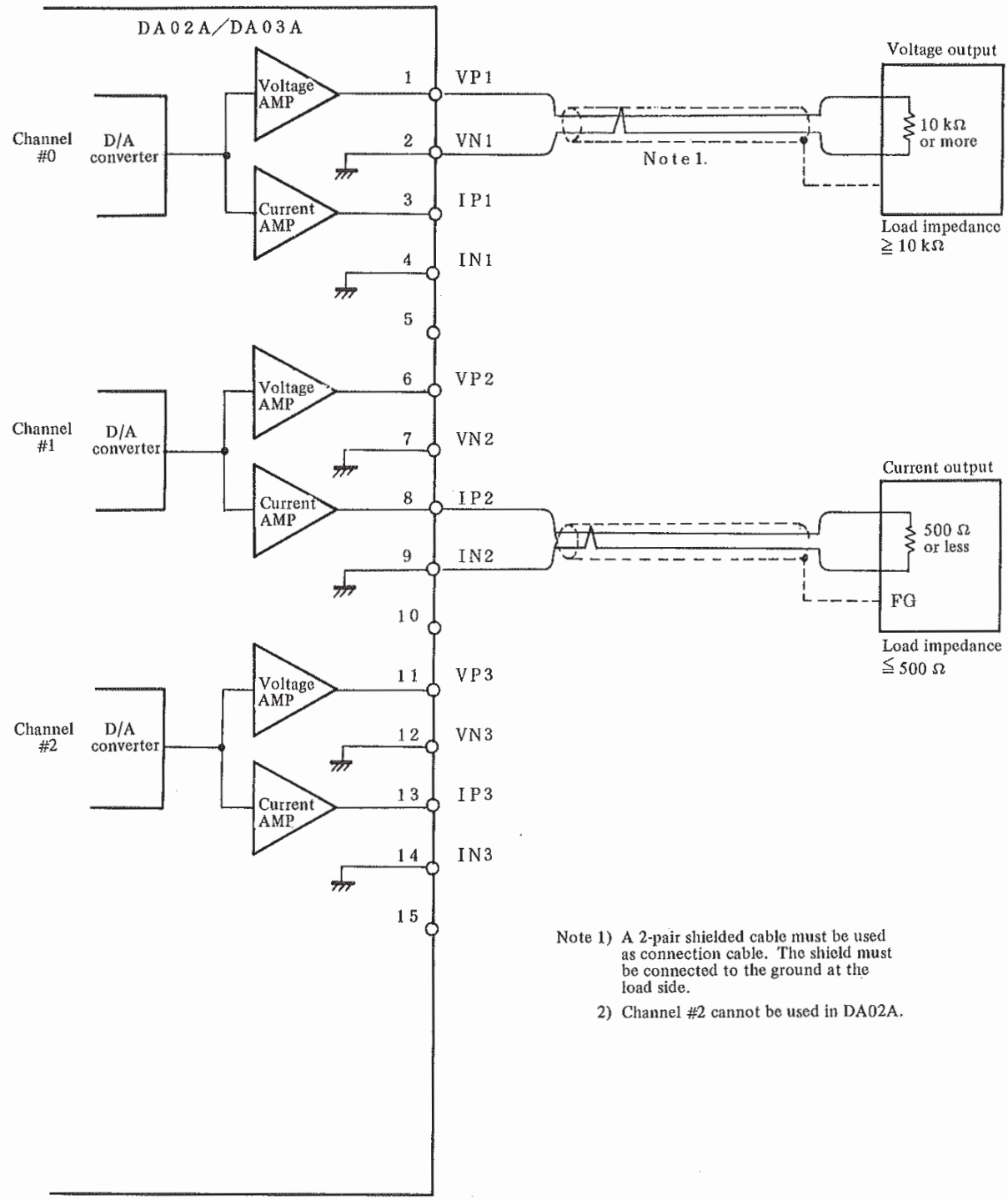


Fig. 1.8 (g) Analog input module connection

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7) Analog output module connection



Note 1) A 2-pair shielded cable must be used as connection cable. The shield must be connected to the ground at the load side.

2) Channel #2 cannot be used in DA02A.

Fig. 1.8 (h) Analog output module connection

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8) Positioning module connection
a) Total connecting block diagram (For DC servo motor)

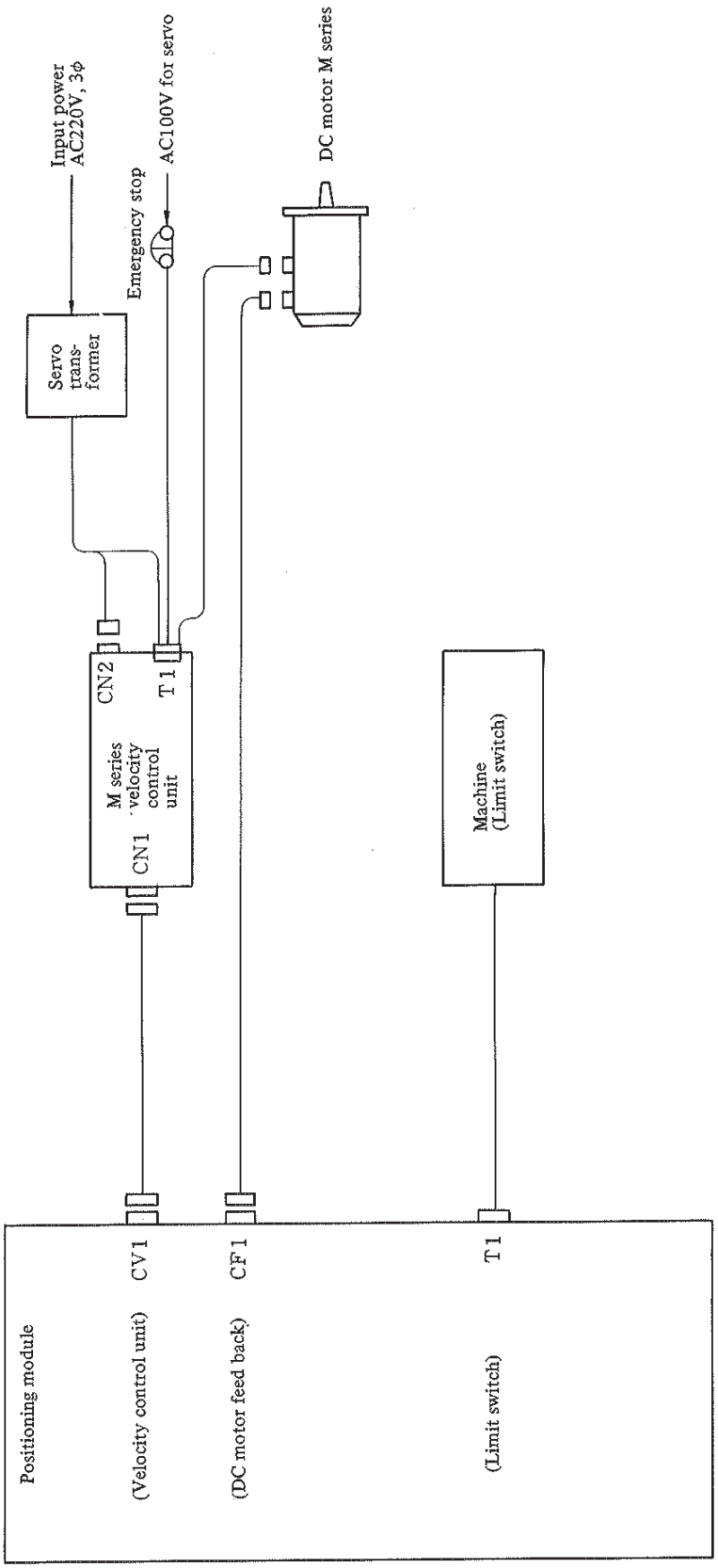


Fig. 1.8 (i) Positioning module total connecting block diagram (For DC sevo motor)

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b) Total connection diagram

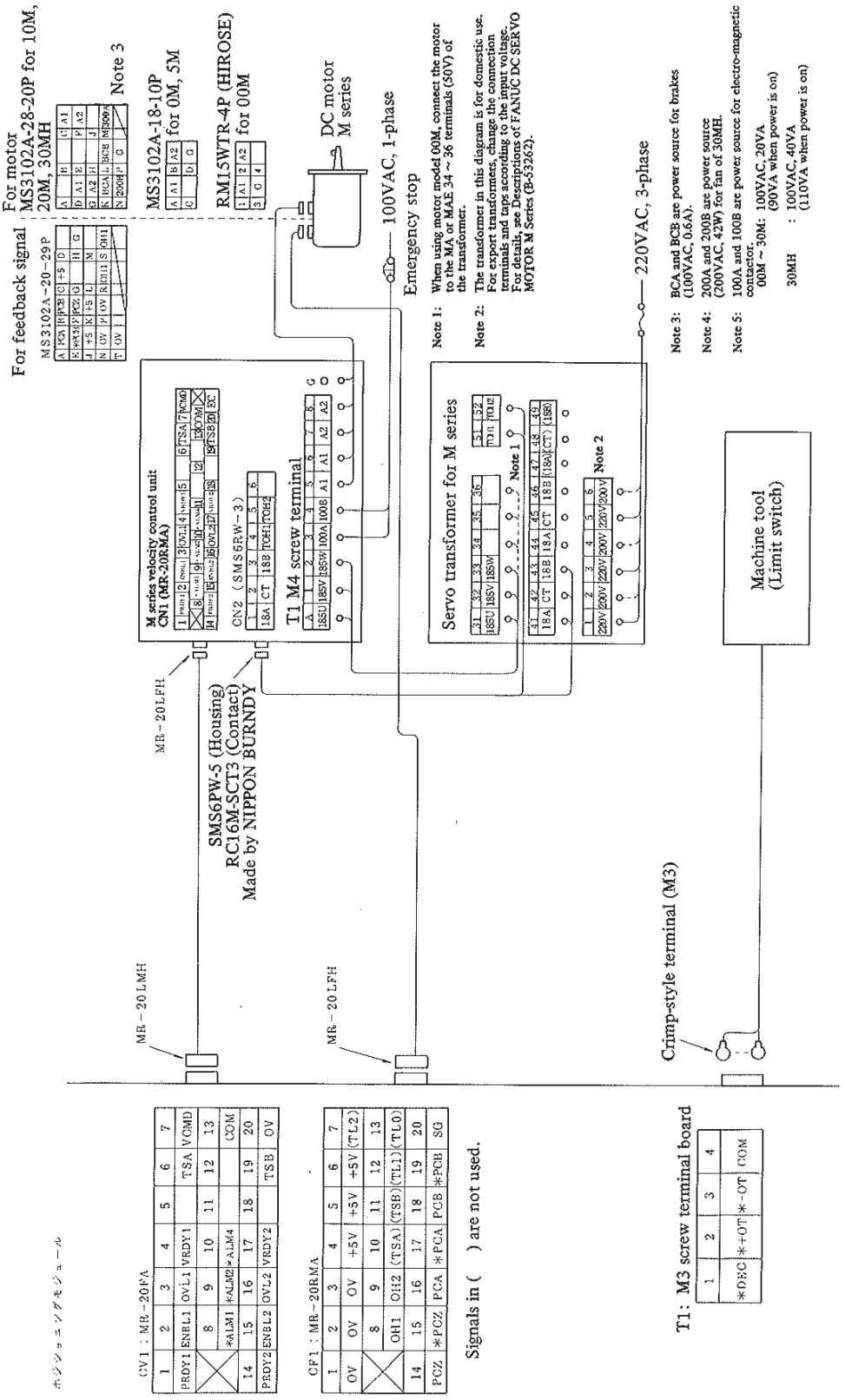


Fig. 1.8 (j) Total connection diagram of the positioning module

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c) Total connection block diagram (when AC servo motor is used)

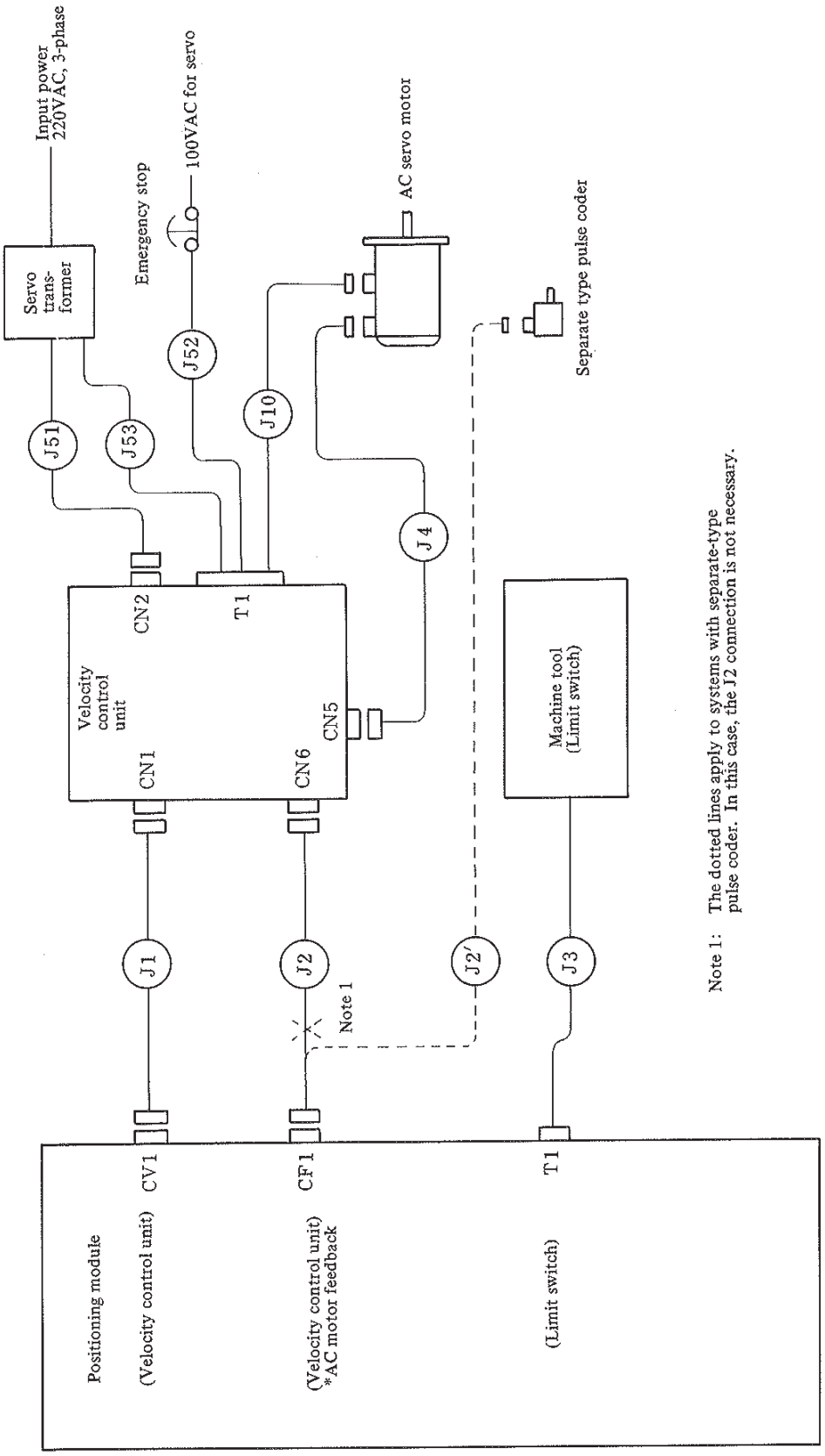


Fig. 1.8 (k) Total connecting block diagram of the positioning module (When AC servo motor is used)

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d) Total connection diagram (For AC servo motor)

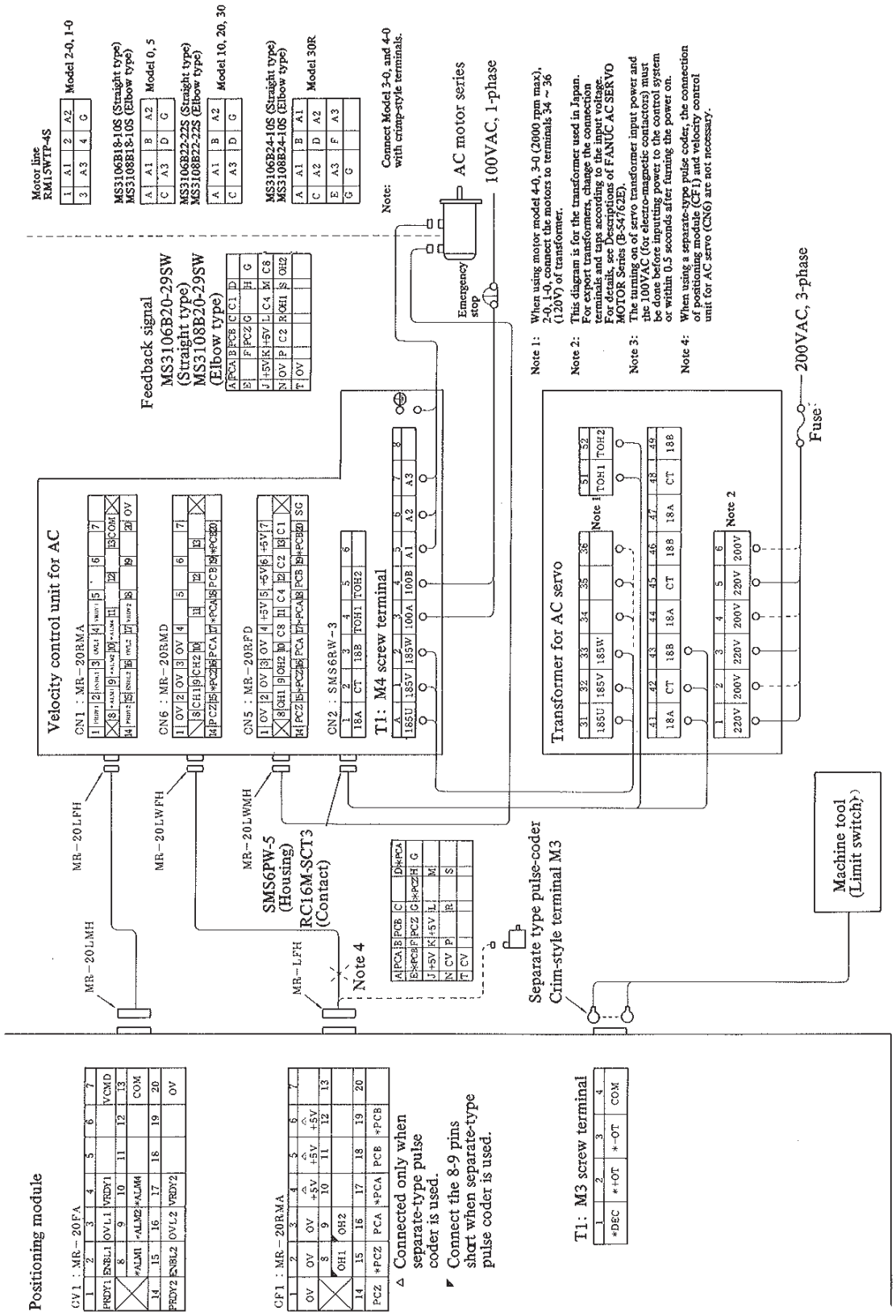


Fig. 1.8 (l) Total connection diagram of the positioning module

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e) Machine tool connection (limit switch)

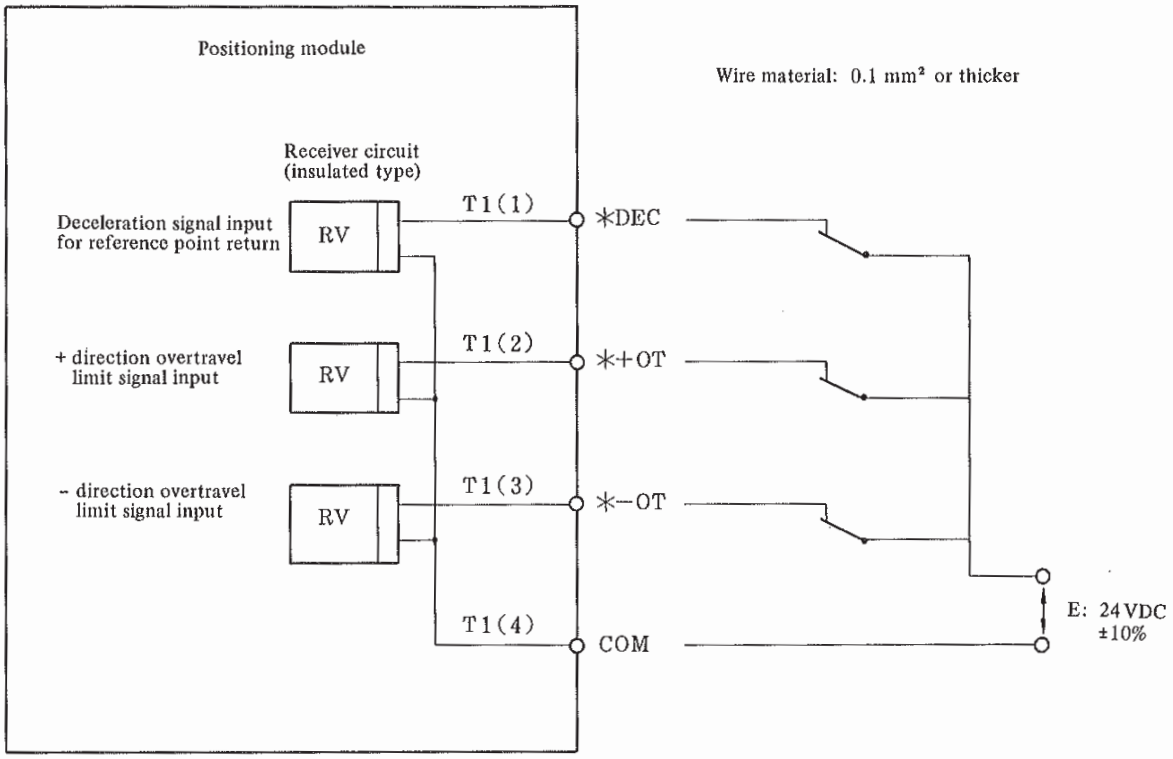


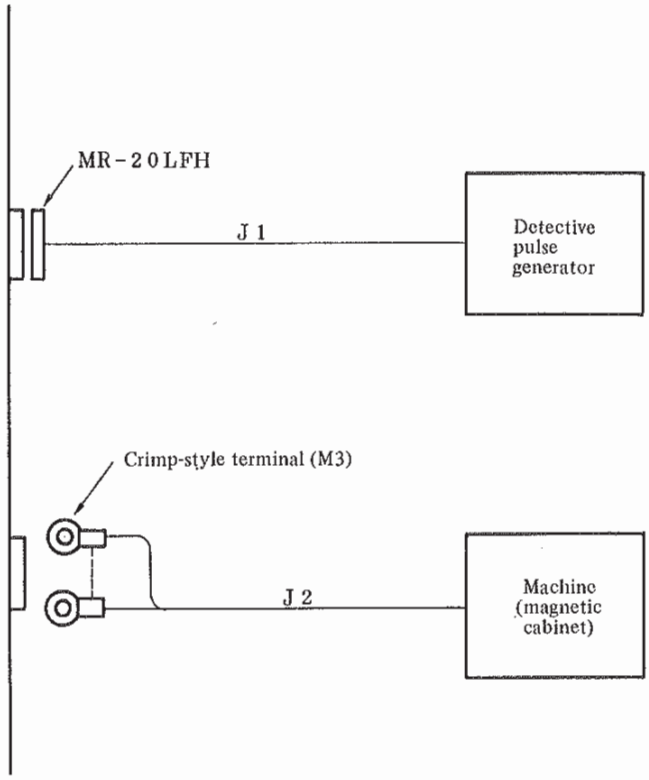
Fig. 1.8 (m) Machine tool connection diagram

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9) Pulse counter module connection
   a) Total connection diagram

CA14 : MR-20RMA

1	2	3	4	5	6	7
0V	0V	0V	Note 2 (+5V)	Note 2 (+5V)	Note 2 (+5V)	
	8	9	10	11	12	13
	Note 1 +P	Note 1 *+P	Note 1 -P	Note 1 *-P		
14	15	16	17	18	19	20
MKS	*MKS	PAS	*PAS	PBS	*PBS	

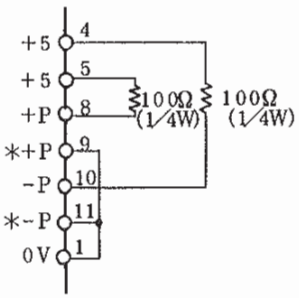


T1: M3 screw terminals

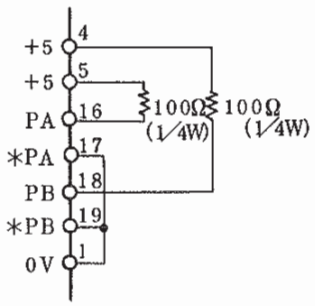
1	2	3	4	5	6	7
CMPA	CMPB	CMPC	COM2	ME	CSP	COM1

Note 1) Connect either +/- pulse (+P.*+P, +P.*P) or phase A/B pulse (PAS.*PAS, PBS.*PBS) of the detection pulse generator to the pulse counter module. The pulse which is not used must be connected as follows:

A. When +/- pulse is not used



B. When phase A/B pulse is not used.

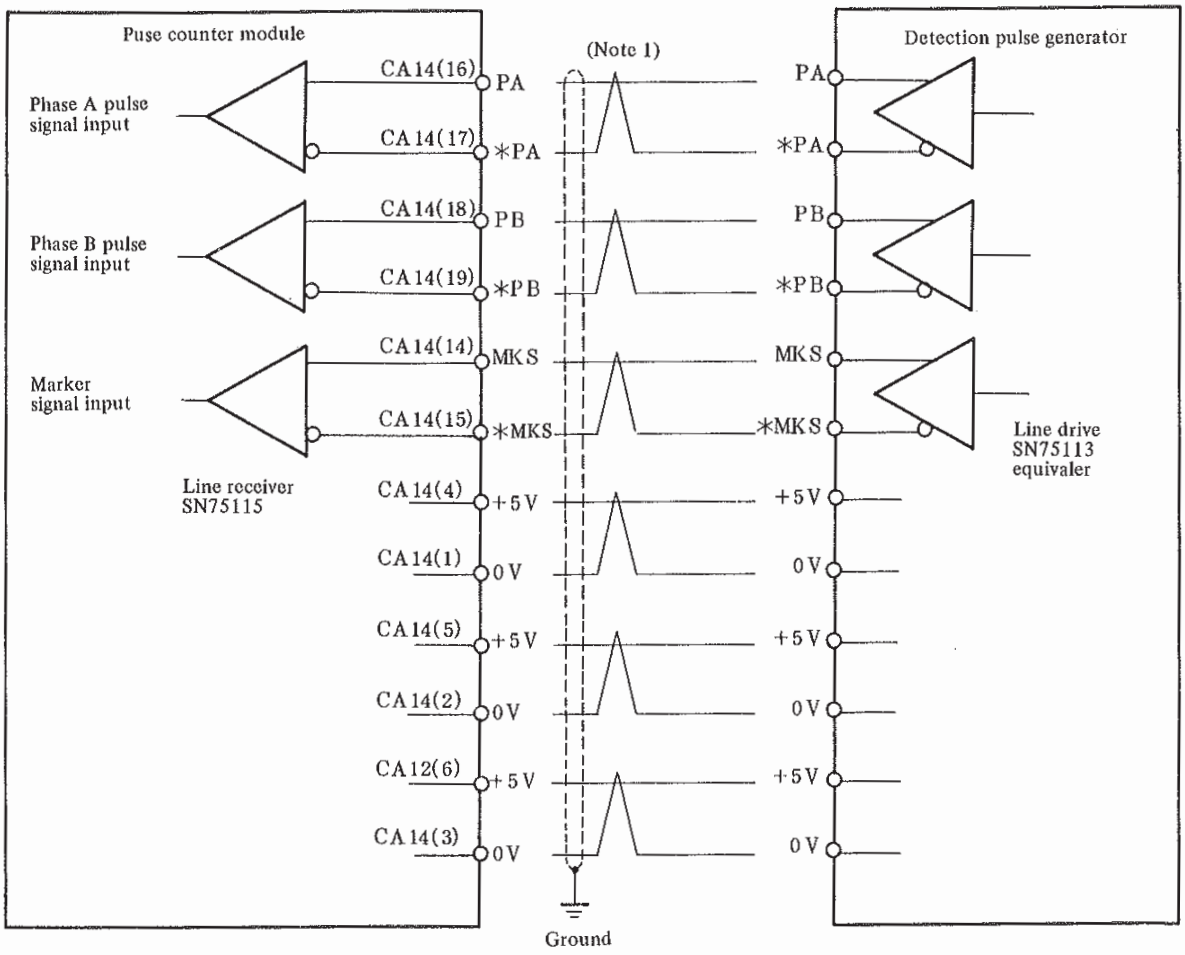


Note 2) When using the +5V for the detection pulse generator, the capacity maximum is 350 mA. In case it exceeds 350 mA, the power supply must be prepared at the machine tool builder.

Fig. 1.8 (n) Pulse counter module total connecting diagram

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b) Connection between the detection pulse generator and pulse counter module (when phase A/B pulse is used)

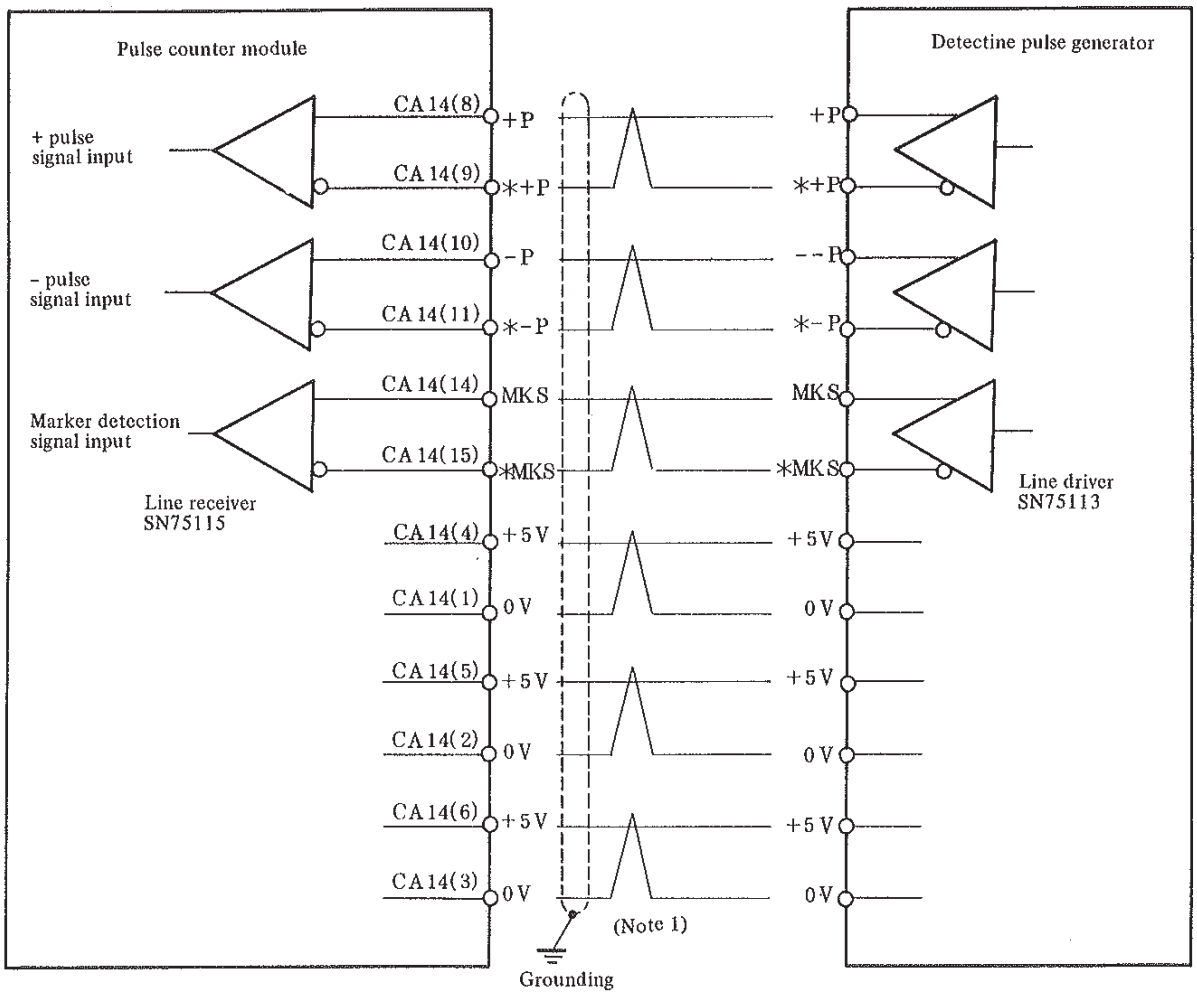


Note 1) Twisted pair unified shield wire
Recommended cable: A66L-0001-0041
Connect at least 6 lines thicker than 0.18 mm^2 for the +5V, 0V lines.
(The three terminals of +5V, 0V will have two each.)

Fig. 1.8 (o) Connection between the detection pulse generator and pulse counter module (When phase A/B pulse is used)

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c) Connection between detective pulse generator and pulse counter module (for +/- pulse)



Note 1) Twisted pair unified shield wire
Recommended cable specification: A66L-0001-0041
More than 6 pieces of wire should be connected to +5V and 0V (each 0.18 mm^2 or more).

Fig. 1.8 (p) Connection between detective pulse generator and pulse counter module (for +/-pulse)

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