GE Fanuc Automation

Computer Numerical Control Products

Series 0 / 00 / 0-Mate

Maintenance Manual

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GFL-001

Warnings, Cautions, and Notes as Used in this Publication

Warning

Warning notices are used in this publication to emphasize that hazardous voltages, currents, temperatures, or other conditions that could cause personal injury exist in this equipment or may be associated with its use.

In situations where inattention could cause either personal injury or damage to equipment, a Warning notice is used.

Caution

Caution notices are used where equipment might be damaged if care is not taken.

Note

Notes merely call attention to information that is especially significant to understanding and operating the equipment.

This document is based on information available at the time of its publication. While efforts have been made to be accurate, the information contained herein does not purport to cover all details or variations in hardware or software, nor to provide for every possible contingency in connection with installation, operation, or maintenance. Features may be described herein which are not present in all hardware and software systems. GE Fanuc Automation assumes no obligation of notice to holders of this document with respect to changes subsequently made.

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SAFETY PRECAUTIONS

This section describes the safety precautions related to the use of CNC units. It is essential that these precautions be observed by users to ensure the safe operation of machines equipped with a CNC unit (all descriptions in this section assume this configuration).
CNC maintenance involves various dangers. CNC maintenance must be undertaken only by a qualified technician.
Users must also observe the safety precautions related to the machine, as described in the relevant manual supplied by the machine tool builder.
Before checking the operation of the machine, take time to become familiar with the manuals provided by the machine tool builder and FANUC.

Contents

1 DEFINITION OF WARNING, CAUTION, AND NOTE

This manual includes safety precautions for protecting the maintenance personnel (herein referred to as the user) and preventing damage to the machine. Precautions are classified into Warnings and Cautions according to their bearing on safety. Also, supplementary information is described as a Note. Read the Warning, Caution, and Note thoroughly before attempting to use the machine.

WARNING

Applied when there is a danger of the user being injured or when there is a danger of both the user being injured and the equipment being damaged if the approved procedure is not observed.

CAUTION

Applied when there is a danger of the equipment being damaged, if the approved procedure is not observed.

NOTE

The Note is used to indicate supplementary information other than Warning and Caution.

` **Read this manual carefully, and store it in a safe place.**

2 WARNINGS, CAUTIONS, AND NOTES RELATED TO CHECK OPERATION

WARNING

1. When checking the operation of the machine with the cover removed

(1) The user's clothing could become caught in the spindle or other components, thus presenting a danger of injury. When checking the operation, stand away from the machine to ensure that your clothing does not become tangled in the spindle or other components.

(2) When checking the operation, perform idle operation without workpiece. When a workpiece is mounted in the machine, a malfunction could cause the workpiece to be dropped or destroy the tool tip, possibly scattering fragments throughout the area. This presents a serious danger of injury. Therefore, stand in a safe location when checking the operation.

2. When checking the machine operation with the power magnetics cabinet door opened

(1) The power magnetics cabinet has a high–voltage section (carrying a ⚠ mark). Never touch the high–voltage section. The high–voltage section presents a severe risk of electric shock. Before starting any check of the operation, confirm that the cover is mounted on the high–voltage section. When the high–voltage section itself must be checked, note that touching a terminal presents a severe danger of electric shock.

(2) Within the power magnetics cabinet, internal units present potentially injurious corners and projections. Be careful when working inside the power magnetics cabinet.

3. Never attempt to machine a workpiece without first checking the operation of the machine. Before starting a production run, ensure that the machine is operating correctly by performing a trial run using, for example, the single block, feedrate override, or machine lock function or by operating the machine with neither a tool nor workpiece mounted. Failure to confirm the correct operation of the machine may result in the machine behaving unexpectedly, possibly causing damage to the workpiece and/or machine itself, or injury to the user.

4. Before operating the machine, thoroughly check the entered data.
Operating the machine with incorrectly specified data may result in the machine behaving unexpectedly, possibly causing damage to the workpiece and/or machine itself, or injury to the user.

5. Ensure that the specified feedrate is appropriate for the intended operation. Generally, for each machine, there is a maximum allowable feedrate. The appropriate feedrate varies with the intended operation. Refer to the manual provided with the machine to determine the maximum allowable feedrate. If a machine is run at other than the correct speed, it may behave unexpectedly, possibly causing damage to the workpiece and/or machine itself, or injury to the user.

6. When using a tool compensation function, thoroughly check the direction and amount of compensation. Operating the machine with incorrectly specified data may result in the machine behaving unexpectedly, possibly causing damage to the workpiece and/or machine itself, or injury to the user.

3 WARNINGS AND NOTES RELATED TO REPLACEMENT

WARNING

1. Always turn off the power to the CNC and the main power to the power magnetics cabinet. If only the power to the CNC is turned off, power may continue to be supplied to the serve section. In such a case, replacing a unit may damage the unit, while also presenting a danger of electric shock.
2. When a heavy unit is to be replaced, the task must be undertaken by two persons. If the replacement is attempted by only one person, the replacement unit could slip and fall, possibly causing injury.
3. After the power is turned off, the servo amplifier and spindle amplifier may retain voltages for a while, such that there is a danger of electric shock even while the amplifier is turned off. Allow at least twenty minutes after turning off the power for these residual voltages to dissipate.
4. When replacing a unit, ensure that the new unit has the same parameter and other settings as the old unit. (For details, refer to the manual provided with the machine.) Otherwise, unpredictable machine movement could damage the workpiece or the machine itself, and present a danger of injury.

4 WARNINGS AND NOTES RELATED TO PARAMETERS

WARNING

1. When machining a workpiece for the first time after modifying a parameter, close the machine cover. Never use the automatic operation function immediately after such a modification. Instead, confirm normal machine operation by using functions such as the single block function, feedrate override function, and machine lock function, or by operating the machine without mounting a tool and workpiece. If the machine is used before confirming that it operates normally, the machine may move unpredictably, possibly damaging the machine or workpiece, and presenting a risk of injury.

2. The CNC and PMC parameters are set to their optimal values, so that those parameters usually need not be modified. When a parameter must be modified for some reason, ensure that you fully understand the function of that parameter before attempting to modify it. If a parameter is set incorrectly, the machine may move unpredictably, possibly damaging the machine or workpiece, and presenting a risk of injury.

5 WARNINGS RELATED TO DAILY MAINTENANCE

WARNING

1. Memory backup battery replacement

When replacing the memory backup batteries, keep the power to the machine (CNC) turned on, and apply an emergency stop to the machine. Because this work is performed with the power on and the cabinet open, only those personnel who have received approved safety and maintenance training may perform this work.
When replacing the batteries, be careful not to touch the high–voltage circuits (marked ⚠ and fitted with an insulating cover).
Touching the uncovered high–voltage circuits presents an extremely dangerous electric shock hazard.

NOTE

The CNC uses batteries to preserve the contents of its memory, because it must retain data such as programs, offsets, and parameters even while external power is not applied.
If the battery voltage drops, a low battery voltage alarm is displayed on the machine operator's panel or CRT screen.
When a low battery voltage alarm is displayed, replace the batteries within a week. Otherwise, the contents of the CNC's memory will be lost.
To replace the battery, see the procedure described in Section 2.6 of this manual.

WARNING

2. Absolute pulse coder battery replacement

When replacing the memory backup batteries, keep the power to the machine (CNC) turned on, and apply an emergency stop to the machine. Because this work is performed with the power on and the cabinet open, only those personnel who have received approved safety and maintenance training may perform this work.

When replacing the batteries, be careful not to touch the high–voltage circuits (marked ⚠ and fitted with an insulating cover).

Touching the uncovered high–voltage circuits presents an extremely dangerous electric shock hazard.

NOTE

The absolute pulse coder uses batteries to preserve its absolute position.

If the battery voltage drops, a low battery voltage alarm is displayed on the machine operator's panel or CRT screen.

When a low battery voltage alarm is displayed, replace the batteries within a week. Otherwise, the absolute position data held by the pulse coder will be lost.

To replace the battery, see the procedure described in Section 2.6 of this manual.

WARNING

3. Fuse replacement

Before replacing a blown fuse, however, it is necessary to locate and remove the cause of the blown fuse.
For this reason, only those personnel who have received approved safety and maintenance training may perform this work.
When replacing a fuse with the cabinet open, be careful not to touch the high–voltage circuits (marked ⚠ and fitted with an insulating cover).
Touching an uncovered high–voltage circuit presents an extremely dangerous electric shock hazard.

PREFACE

Description of this manual

1. CRT/MDI display and operation

This chapter covers those items, displayed on the CRT, that are related to maintenance. A list of all supported operations is also provided at the end of this chapter.

2. Hardware

This chapter covers hardware–related items, including the hardware configuration, connection, and NC status indicated on printed circuit boards. A list of all units is also provided as well as an explanation of how to replace each unit.

3. Data input/output

This chapter describes the input/output of data, including programs, parameters, and tool compensation data, as well as the input/output procedures for conversational data.

4. Interface between the NC and PMC

This chapter describes the PMC specifications, the system configuration, and the signals used by the PMC.

5. Digital servo

This chapter describes the servo tuning screen and how to adjust the reference position return position.

6. Trouble shooting

This chapter describes the procedures to be followed in the event of certain problems occurring, for example, if the power cannot be turned on or if manual operation cannot be performed. Countermeasures to be applied in the event of alarms being output are also described.

APPENDIX

The appendix consists of a list of all alarms, as well as a list of maintenance parts.
This manual does not provide a parameter list. If necessary, refer to the separate PARAMETER MANUAL.

This manual describes all optional functions. Refer to the manual provided by the machine tool builder for details of any options with which the installed machine tool is provided.

Applicable models

The models covered by this manual, and their abbreviations are:

<table>
<tr><th>Product name</th><th colspan="4">Abbreviations</th></tr>
<tr><td>FANUC Series 0-TC</td><td>0-TC</td><td colspan="2" rowspan="7">Series 0-C</td><td rowspan="15">Series 0</td></tr>
<tr><td>FANUC Series 0-MC</td><td>0-MC</td></tr>
<tr><td>FANUC Series 0-TF</td><td>0-TF</td></tr>
<tr><td>FANUC Series 0-MF</td><td>0-MF</td></tr>
<tr><td>FANUC Series 0-TTC</td><td>0-TTC</td></tr>
<tr><td>FANUC Series 0-GCC</td><td>0-GCC</td></tr>
<tr><td>FANUC Series 0-GSC</td><td>0-GSC</td></tr>
<tr><td>FANUC Series 0-TD</td><td>0-TD</td><td rowspan="4">Series 0-D</td><td rowspan="8">Series 0-D</td></tr>
<tr><td>FANUC Series 0-MD</td><td>0-MD</td></tr>
<tr><td>FANUC Series 0-GCD</td><td>0-GCD</td></tr>
<tr><td>FANUC Series 0-GSD</td><td>0-GSD</td></tr>
<tr><td>FANUC Series 0-TD II</td><td>0-TD II</td><td rowspan="4">Series 0-D II</td></tr>
<tr><td>FANUC Series 0-MD II</td><td>0-MD II</td></tr>
<tr><td>FANUC Series 0-GCD II</td><td>0-GCD II</td></tr>
<tr><td>FANUC Series 0-GSD II</td><td>0-GSD II</td></tr>
<tr><td>FANUC Series 00-TC</td><td>00-TC</td><td colspan="2" rowspan="3">Series 00-C</td><td rowspan="3">Series 00</td></tr>
<tr><td>FANUC Series 00-MC</td><td>00-MC</td></tr>
<tr><td>FANUC Series 00-GCC</td><td>00-GCC</td></tr>
<tr><td>FANUC Series 0-Mate TC</td><td>0-Mate TC</td><td colspan="2" rowspan="3">Series 0-Mate C</td><td rowspan="3">Series 0-Mate</td></tr>
<tr><td>FANUC Series 0-Mate MC</td><td>0-Mate MC</td></tr>
<tr><td>FANUC Series 0-Mate MF</td><td>0-Mate MF</td></tr>
</table>

Related manuals

The table below lists manuals related to the FANUC Series 0/00/0–Mate. In the table, this manual is marked with an asterisk (*).

D Series 0/00/0–Mate C

List of related manuals

Manual name	Specification number	
FANUC Series 0/00/0-Mate DESCRIPTIONS	B-61392E	
FANUC Series 0/00/0-Mate DESCRIPTIONS (Suppelement for Remote buffer)	B-61392EN-1	
FANUC Series 0/00/0-Mate CONNECTION MANUAL (HARDWARE)	B-61393E	
FANUC Series 0/00/0-Mate CONNECTION MANUAL (FUNCTION)	B-61393E-2	
FANUC Series 0/00/0-Mate FOR LATHE OPERATOR'S MANUAL	B-61394E	
FANUC Series 0/00/0-Mate FOR MACHINING CENTER OPERATOR'S MANUAL	B-61404E	
FANUC Series 0/00/0-Mate MAINTENANCE MANUAL	B-61395E	*
FANUC Series 0/00/0-Mate OPERATION AND MAINTENANCE HANDBOOK	B-61397E	
FANUC Series 0/00/0-Mate FOR LATHE PARAMETER MANUAL	B-61400E	
FANUC Series 0/00/0-Mate FOR MACHINING CENTER PARAMETER MANUAL	B-61410E	
GRAPHIC CONVERSATION FOR MACHINING CENTER (Series 0-MC, Series 0-MF, Series 0-Mate MF) OPERATOR'S MANUAL	B-61434E	
FANUC PMC-MODEL K/L/M PROGRAMMING MANUAL (LADDER LANGUAGE)	B-55193E	
FANUC Series 0/0-Mate PROGRAMMING MANUAL (Macro Compiler / Macro Executer)	B-61393E-1	

D Series 0–D

List of related manuals

Manual name	Specification number	
FANUC Series 0-TD/MD DESCRIPTIONS	B-62542EN	
FANUC Series 0-TD/MD/PD/GCD/GSD CONNECTION MANUAL (HARDWARE)	B-62543EN	
FANUC Series 0-TD/MD/GCD/GSD CONNECTION MANUAL (FUNCTION)	B-62543EN-1	
FANUC Series 0-PD CONNECTION MANUAL (FUNCTION)	B-62973EN	
FANUC Series 0/00/0-Mate FOR LATHE OPERATOR'S MANUAL	B-61394E	
FANUC Series 0/00/0-Mate FOR MACHINING CENTER OPERATOR'S MANUAL	B-61404E	
FANUC Series 0-PD OPERATOR'S MANUAL	B-62974EN	
FANUC Series 0/00/0-Mate MAINTENANCE MANUAL	B-61395E	*
FANUC Series 0-PD MAINTENANCE MANUAL	B-62975EN	
FANUC Series 0-TD/GCD PARAMETER MANUAL	B-62550EN	
FANUC Series 0-MD/GSD PARAMETER MANUAL	B-62580EN	

Table of Contents

APPENDIX

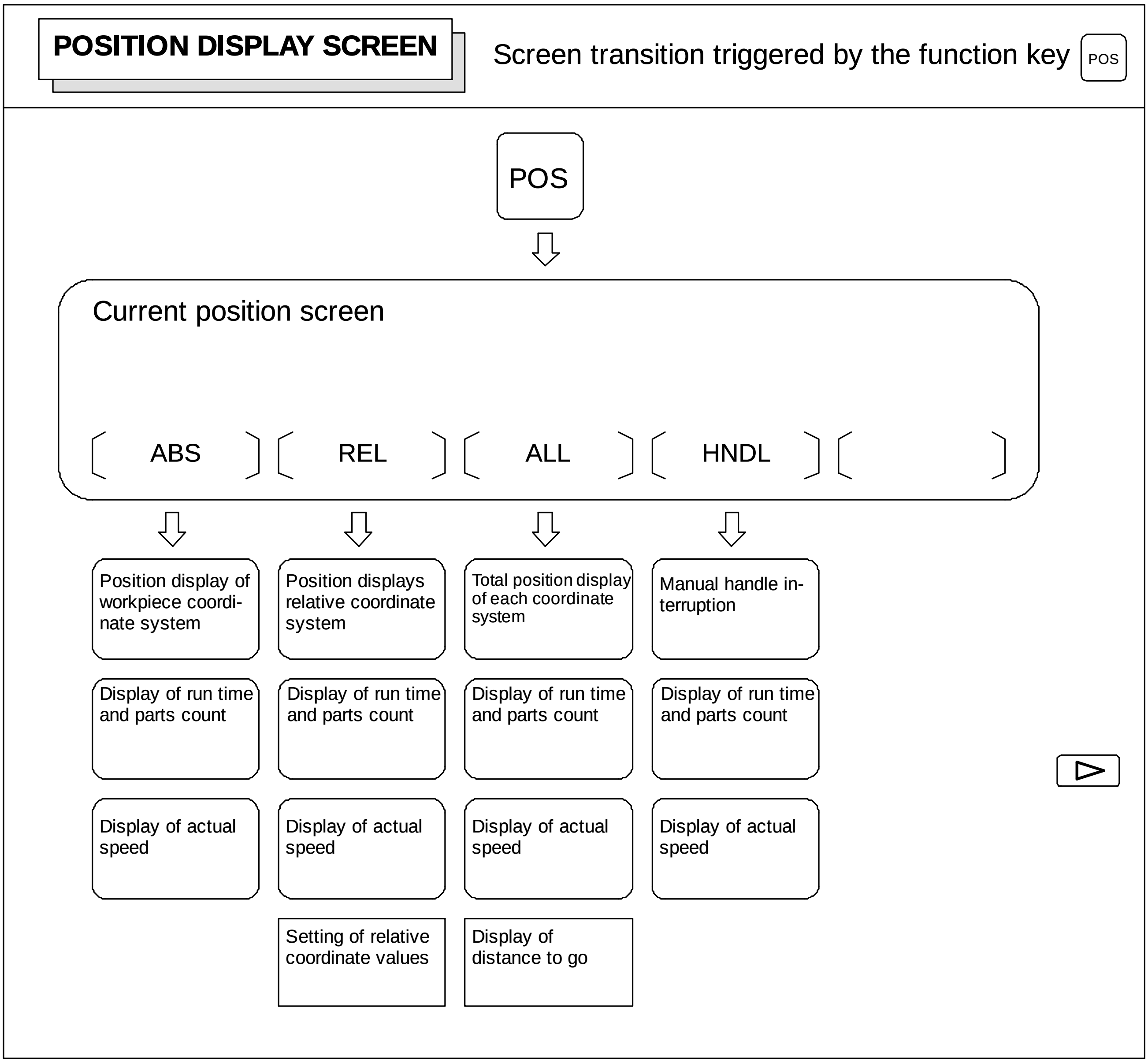
1 DISPLAY AND OPERATION OF CRT/MDI

This chapter describes how to display various screens by the function keys. The screens used for maintenance are respectively displayed.

1.1 FUNCTION KEYS AND SOFT KEYS

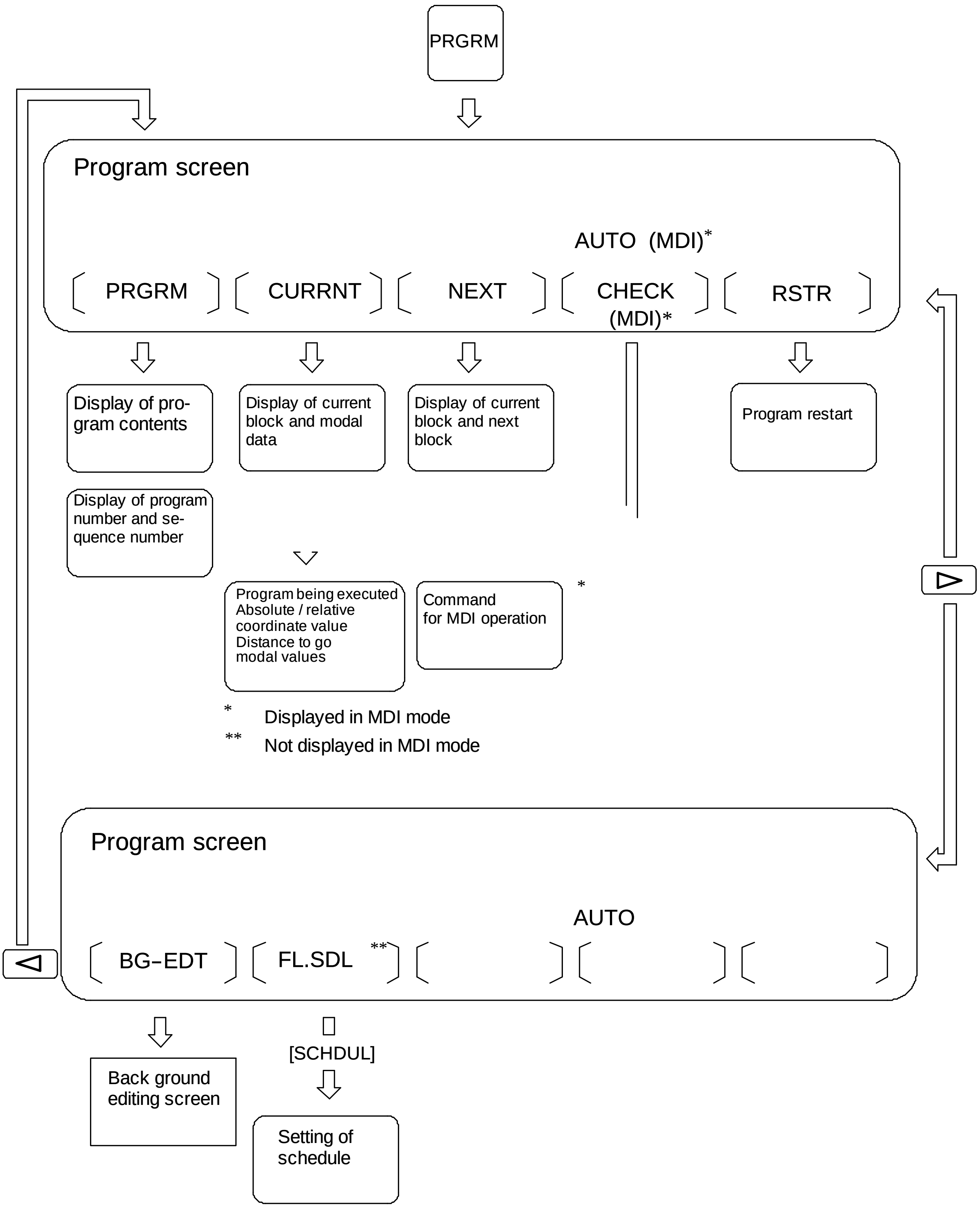
Operations and soft key display status for each function key are described below:

1.1.1 Screen Transition Triggered by the Function Key



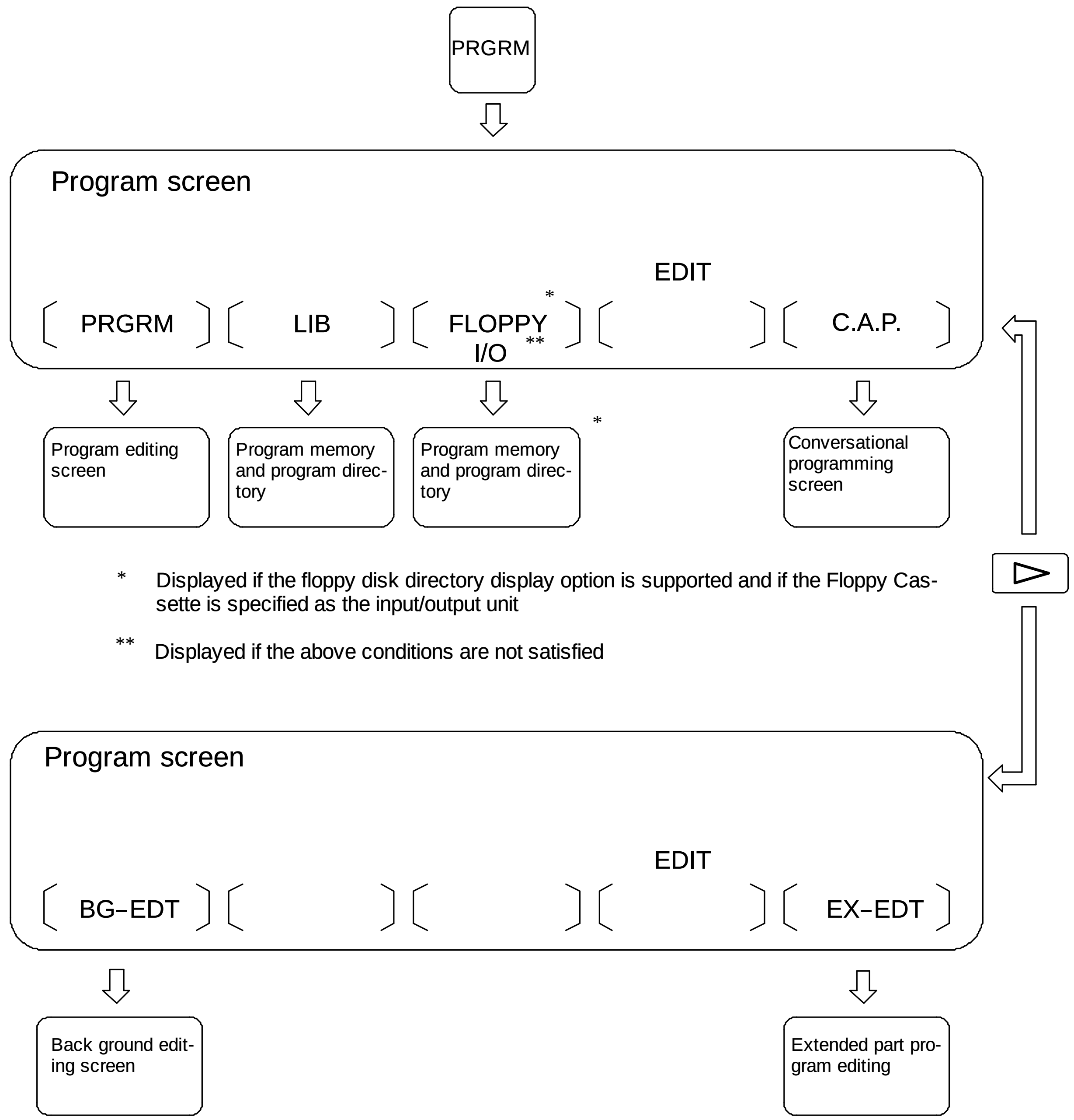
PROGRAM SCREEN

Screen transition triggered by the function key PRGRM in the AUTO or MDI mode



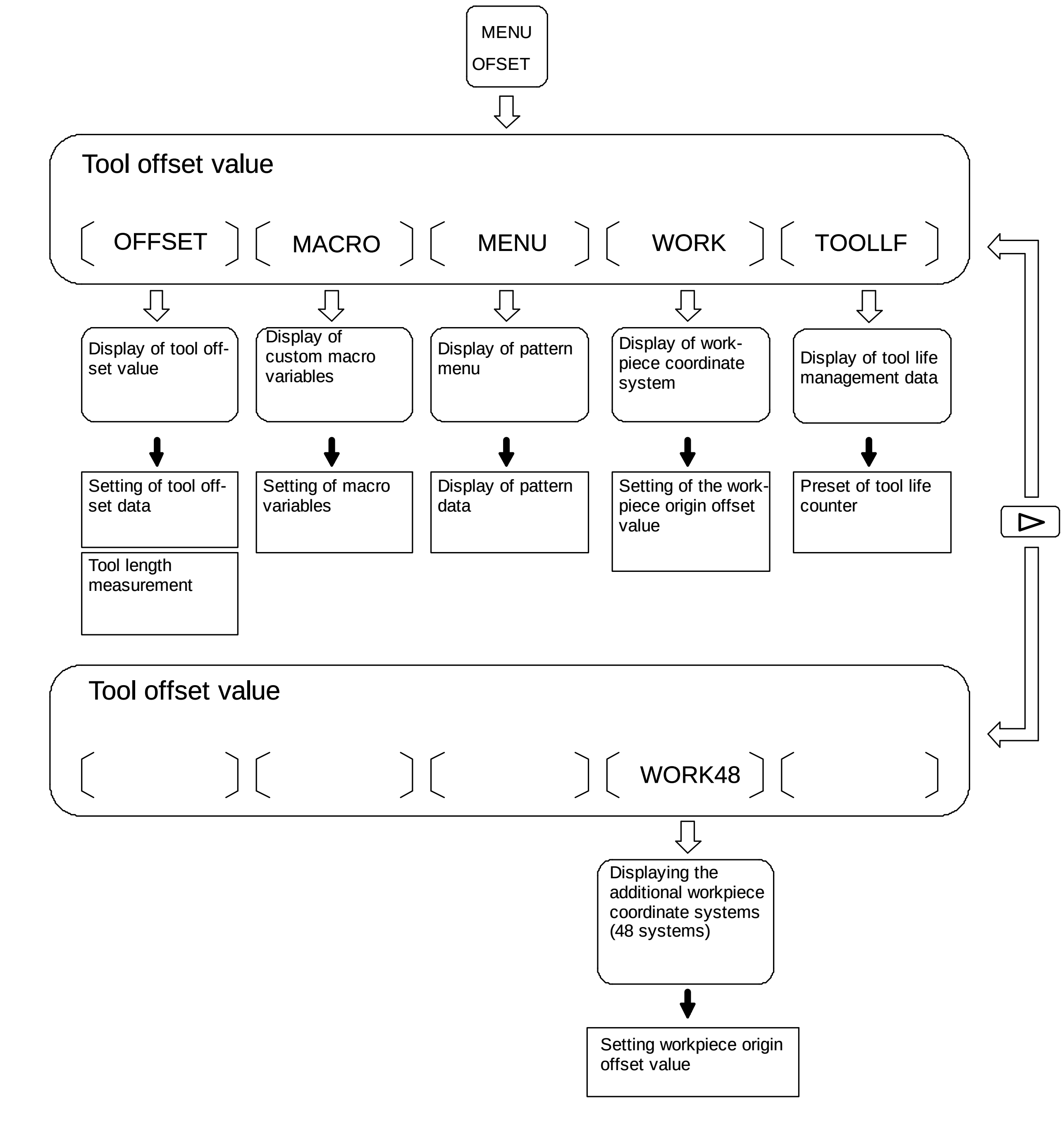
PROGRAM SCREEN

Screen transition triggered by the function key PRGRM in the EDIT mode



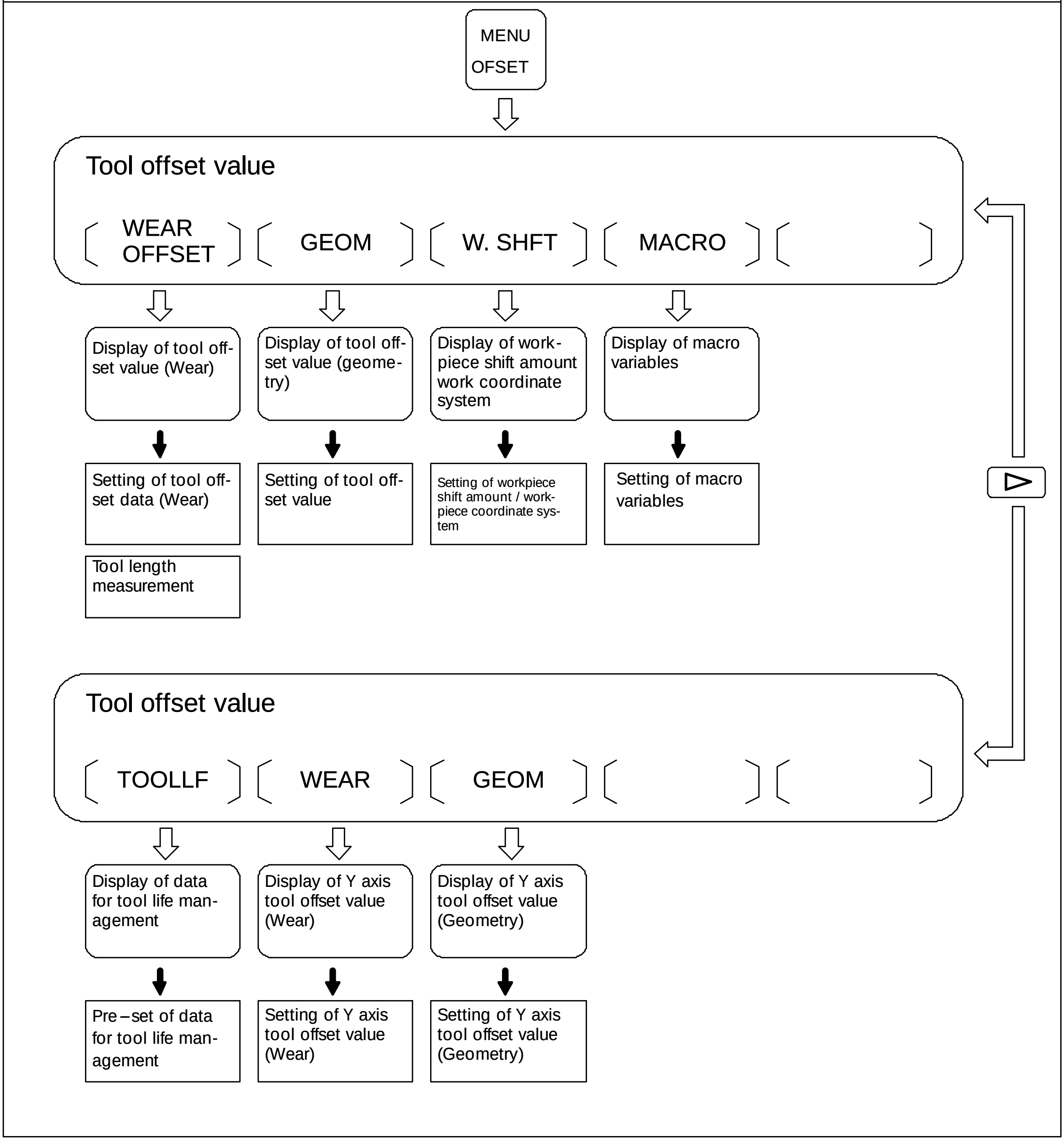
OFFSET SCREEN

Screen transition triggered by the function key MENU OFSET
(For Machining Center)



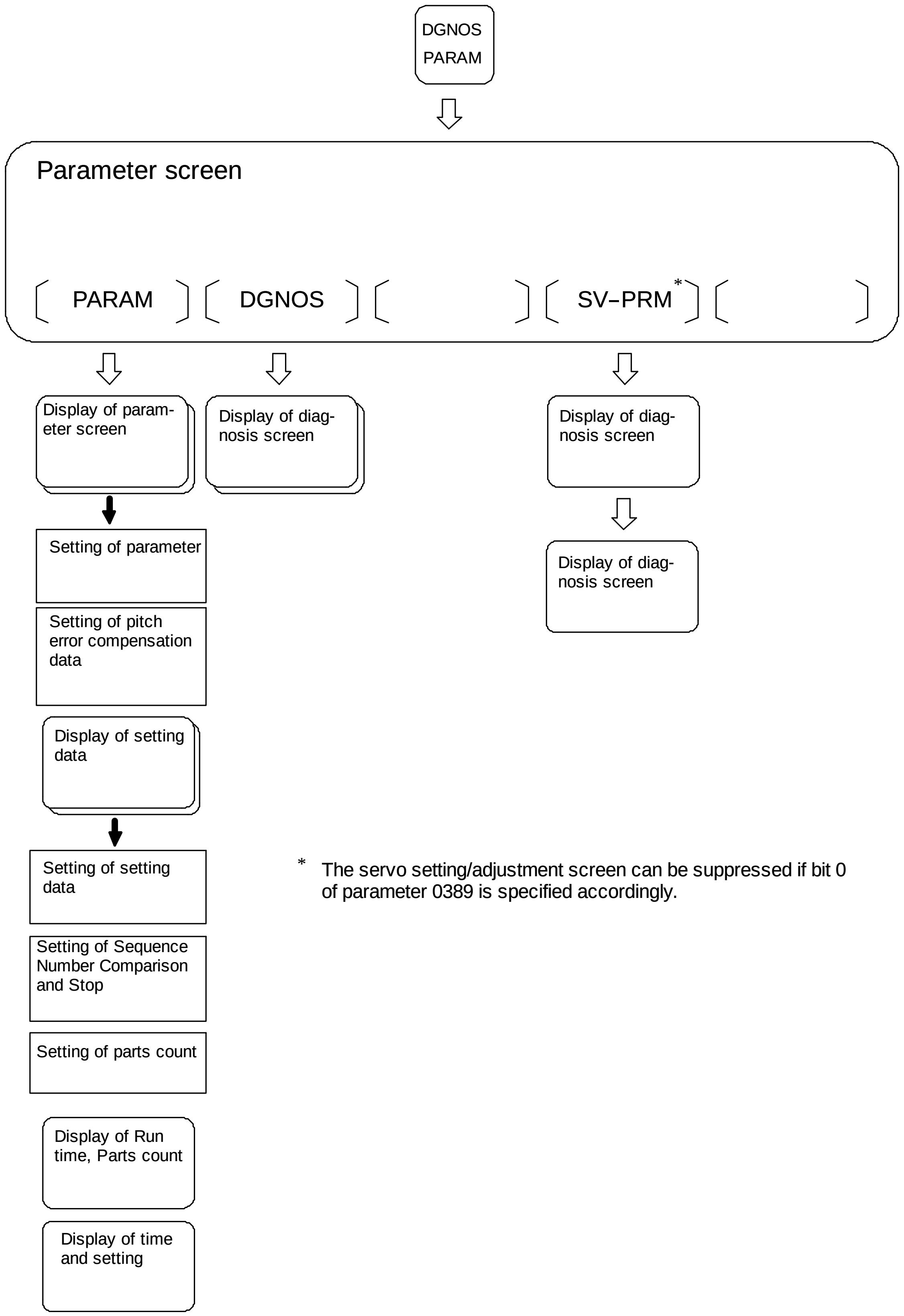
OFFSET SCREEN

Screen transition triggered by the function key MENU OFSET (For Lathe)



PARAMETER/DIAGNOSTIC SCREEN

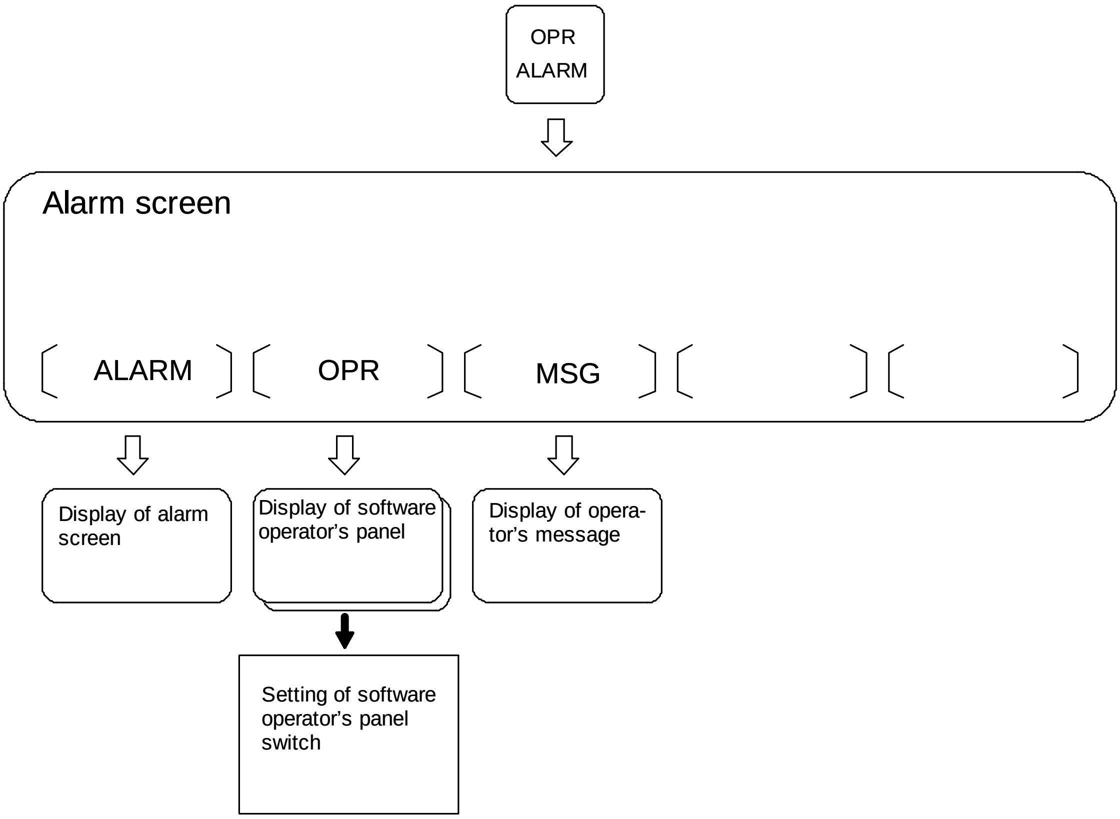
Screen transition triggered by the function key DGNOS PARAM



* The servo setting/adjustment screen can be suppressed if bit 0 of parameter 0389 is specified accordingly.

ALARM SCREEN

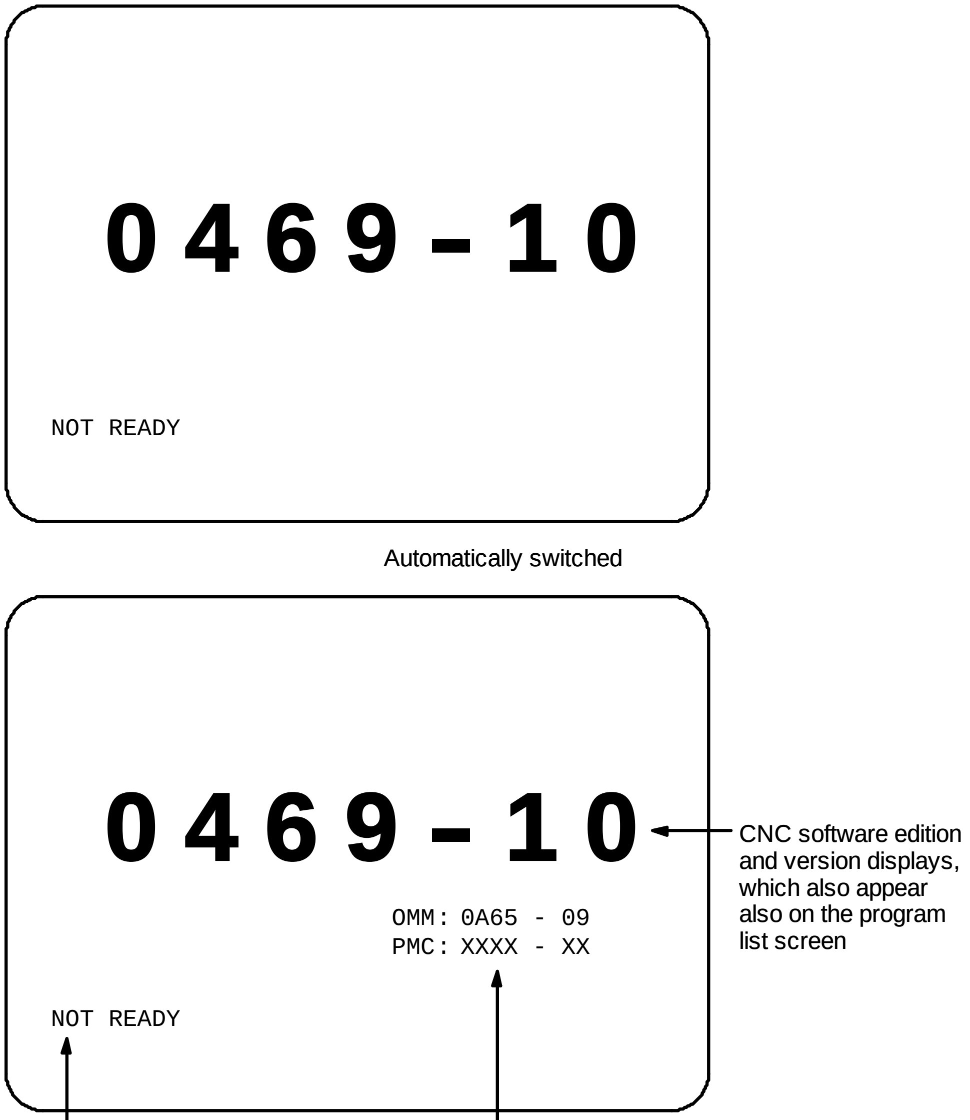
Screen transition triggered by the function key OPR ALARM



1.2 POWER-ON SCREEN DISPLAY

- The CRT screen displays differ slightly between the M and T series.
- The screen displays shown below are for reference purposes only. Some of these displays may not appear depending on the installed options and actual system configuration.

D Slot state screen



Indicates that the servo system is not ready to operate, that is, it is inoperable.

Type of other software in use
OMM : For macro ROM cassette or conversational automatic programming function
PMC : Sequence programs created by the machine tool builder
- This display does not appear if no other software is available.

- The displays shown above remain on the screen if the machine is brought to an emer gency stop.

An ordinary position display is restored when the machine is released from an emergency stop state.

1.3 DIAGNOSTIC FUNCTIONS

1.3.1 How to Display the Diagnosis Screen

(1) Press the DGNOS PARAM key several times, or the **[DGNOS]** soft key.

1.3.2 Display of the CNC Internal Status

If the CNC does not respond to a command, it is possible to determine the status of the CNC.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0700		CSCT	CITL	COVZ	CINP	CDWL	CMTN	CFIN

#6 CSCT The CNC is waiting for the spindle speed reached signal (SAR) to be turned on after cutting feed begins or an S command is read.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0120				SAR				

SAR 0 : The spindle speed has not reached the specified speed.

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0024						SCTO		

SCTO 1 : The spindle speed reached signal will be checked.

0 : The spindle speed reached signal will not be checked.

PRM	0110	Delay timer for checking the spindle speed reached signal [ms]

#5 CITL An interlock (disable axis movement) signal has been input.

[M series]

PRM 49#0	PRM 08#7	PRM 15#2	PRM 12#1	Signal name	DGN number
1	—	—	—	*□ MITX, Y, Z	142.0 to 142.7
—	1	—	—	*ITX, Y, Z, 4	128.0 to 128.3
—	0	0	0	*ILK (all axes)	117.0
—	0	0	1	*ILK (Z-axis only)	
—	0	1	0	*RILK (all axes)	008.5
—	0	1	1	*RILK (Z-axis only)	

[T series]

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0120							STLK	

STLK 1 : The start lock is in effect.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0128					IT4	IT3	ITZ	ITX

IT 1 : The start lock for the corresponding start lock is in effect.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0008			-MIT2	+MIT2	-MIT1	+MIT1		

***PRM** Valid only when bit 7 (EDILK) of PRM 024 = 1.

#4 COVZ The override signal is 0%.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0121					*OV8	*OV4	*OV2	*OV1

Override 0%

When bit 4 of PRM 003=0	1	1	1	1
When bit 4 of PRM 003=1	0	0	0	0

[M series] Manual feed override function (option)

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0104					JOV8	JOV4	JOV2	JOV1

Override 0%

0	0	0	0

– Refer to the Ladder chart from the machine tool builder for whether this function is in use.

#3 CINP A position check is being performed.

DGN 800 to [Positional deviation] > PRM 500 to [Effective area]

– Probable causes include errors in the servo circuit or machine load.

#2 CDWL A dwell command (G04) is being executed.

#1 CMTN An axis move command is being executed automatically.

#0 CFIN The M, S, T, or B function is being executed (has not been completed).

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0045	HSIF							

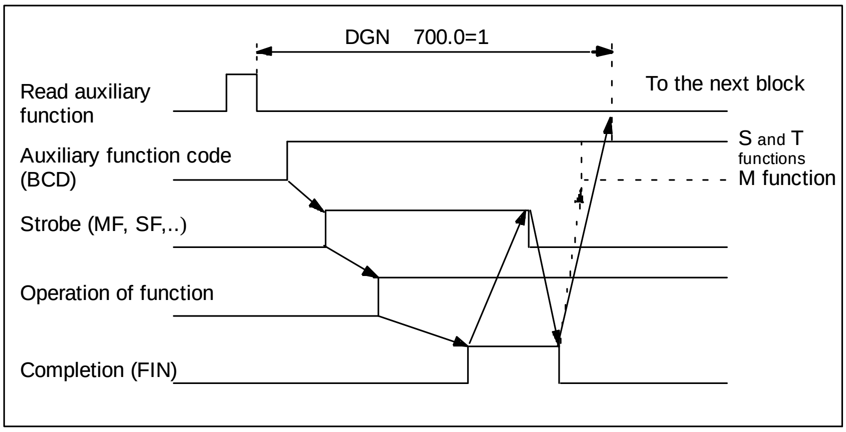
HSIF The M, S, T, and B code processing uses either of the following interfaces.

1 : High-speed interface

0 : Ordinary interface

[Ordinary interface]

D Operation sequence of auxiliary functions



DGN		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0150					TF	SF		MF

Strobe signals

DGN		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0157			MF3	MF2				

MF2, MF3 Strobe signal for multiple M functions per block

DGN		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0120					FIN			

FIN Auxiliary function completion (common to M, S, T and B)

[M function]

DGN		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0151	M28	M24	M22	M21	M18	M14	M12	M11
DGN	0157					M38	M34	M32	M31

– M31 to M38 are the BCD code corresponding to the third digit with the 3–digit M function.

[2–digit S function only]

DGN		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0152	S28	S24	S22	S21	S18	S14	S12	S11

– This signal is not used for the 4–digit S function.

[T function]

DGN		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0153	T28	T24	T22	T21	T18	T14	T12	T11
DGN	0156	T48	T44	T42	T41	T38	T34	T32	T31

– T31 to T48 are the BCD code corresponding to the fourth and third digits with the 4–digit T function.

[3–/6–digit B function (M series)]

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0150	BF1	BF2						

BF1 Strobe signal for the 3 low–order digits of the B code

BF2 Strobe signal for the 3 high–order digits of the B code

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0154					B38	B34	B32	B31
DGN	0155	B28	B24	B22	B21	B18	B14	B12	B11

– For the 6–digit B function, code signals are output for every three digits.

[8–digit B function (T series)]

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0150	BF							

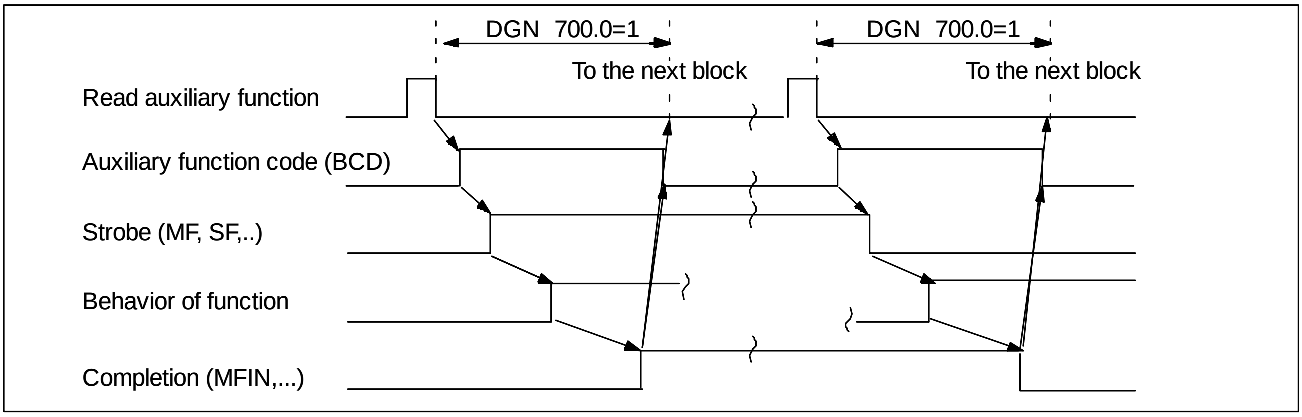
BF Strobe signal for the B code

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	276	B7	B6	B5	B4	B3	B2	B1	B0
DGN	277	B15	B14	B13	B12	B11	B10	B9	B8
DGN	278	B23	B22	B21	B20	B19	B18	B17	B16
DGN	279	B31	B30	B29	B28	B27	B26	B25	B24

The 8–digit B code is output in binary.

[High–speed interface]

D Auxiliary–function operation sequences



		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0150	BF1(BF)	BF2			TF	SF		MF
DGN	0115	BFIN1(BFIN)	BFIN2			TFIN	SFIN		MFIN

MFIN, SFIN, TFIN Function completion signals

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0701			CRST					

#5 CRST The emergency stop signal (*ESP), external reset signal (ERS), reset & rewind signal (RRW), or MDI reset button is on.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0021				*ESP				
DGN	0121	ERS			*ESP				
DGN	0104		RRW						

***ESP** 0 : The emergency stop signal is on.

ERS 1 : The external reset signal is on.

RRW 1 : The reset & rewind signal is on.

– There is no DGNOS display for the MDI reset button.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0712	STP	REST	EMS	RRW	RSTB			CSU

This diagnosis information is valid only if automatic operation is terminated when it should not be. The information indicates the reason why the cycle start lamp (STL) is off.

Table **1.3.2**

	#7	#6	#5	#4	#3	#2	#1	#0	Reason
	1	1	1	0	0	0	0	1	The emergency stop signal (*ESP) was input.
*(1)	1	1	0	0	0	0	0	0	The external reset (ERS) signal was input.
*(2)	1	1	0	1	0	0	0	0	The reset & rewind (RRW) signal was input.
	1	1	0	0	1	0	0	0	The MDI reset button was pressed.
	1	0	0	0	0	0	0	1	A servo alarm occurred.
	1	0	0	0	0	0	0	0	The feed hold (*SP) signal was input, or another manual mode was selected.
	0	0	0	0	0	0	0	0	The machine stopped in a single-function block.

- All these bits are cleared to 0 when the power is switched on.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0021				*ESP				
DGN	0121	ERS		*SP	*ESP				

***ESP** 0 : The emergency stop signal is on.

ERS 1 : The external reset signal is on.

***SP** 0 : The feed hold signal is on.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0104		RRW						

RRW 1 : The reset & rewind signal is on.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0116							SBK	

SBK 1 : The single block signal is on.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0122						MD4	MD2	MD1

Automatic operation (AUTO)	0	0	1
Manual data input (MDI)	0	0	0

- If the program ends with M02 or M03, the machine may enter state 1 or 2 in the Table 1.3.2 depending on the processing adopted by the machine tool builder.

1.4 NC STATUS DISPLAYS

```
ACTUAL POSITION (ABSOLUTE)      O0010 N0000

   X     123.456
   Y     363.233
   Z       0.000

                            PART COUNT    1
RUN TIME       0H  1M   CYCLE TIME  0H 1M33S
ACT.F     3000 MM/M            S    0 T
01:35:22                    BUF AUTO
[  ABS  ] [  REL  ] [  ALL  ] [ HNDL ] [      ]
```

(1) Current mode

MDI : Manual data input
AUTO : Automatic operation (memory– or tape–based operation)
EDIT : Memory editing
HNDL : Manual handle feed
JOG : Jog feed
TJOG : Teach–in jog feed
THND : Teach–in handle feed
STEP : Manual incremental feed
ZRN : Manual reference position return

(2) Alarm conditions

ALarM : Indicates the current alarm.
BAT : Indicates that the battery voltage is dropping.

(3) Current time

hh:mm:ss : Hours, minutes, and seconds

(4) Other status displays

Input : Indicates that data is being input.
Output : Indicates that data is being output.
SRCH : Indicates that a search is being carried out.
EDIT : Indicates that some other miscellaneous editing operation (such as insertion or modification) is under way.
COMPARE : Indicates that a program is being collated.
LSK : Indicates the state of label skipping during data input.
RSTR : Indicates that the program is being restarted.
BUF : Indicates that the next block to be executed has been read.
NOT READY : Indicates that the machine is in the emergency stop state.

1.5 LIST OF OPERATIONS

Reset

Function	Data protection key	Parameter write=1	Mode	Function button	Operation
Resetting run hour			-	POS	R → CAN
Resetting no. of machined parts			-	POS	P → CAN
Resetting OT alarm			At Power ON	-	P and CAN
Resetting alarm 100			-	-	CAN and RESET

Registration from MDI

Function	Data protection key	Parameter write=1	Mode	Function button	Operation
Inputting parameters		f	MDI	PRGRM	No → Parameter no.→ INPUT →Data→ INPUT → PWE =0 → RESET
Inputting offset values			-	OFSET	No → Offset number→ INPUT →Offset value→ INPUT
Inputting setting data			MDI	PRGRM	No → 0 → INPUT → Data→ INPUT
Input of PMC parameters	f	f	MDI	DGNOS	No → Diagnostic No. → DGNOS PARAM → INPUT →Data→ INPUT
Tool length measurement			JOG	POS # OFSET	POS (Displaying of relative coordinate system) Z → CAN → OFSET → To the measuremet position at tool → No → Offset number → INPUT → EOB and Z

Registration from tape

Function	Data protection key	Parameter write=1	Mode	Function button	Operation
Inputting parameters (tape→memory)		f	EDIT	PRGRM	INPUT
Input of PMC parameter	f	f	EDIT	DGNOS	INPUT
Inputting offset values			EDIT	OFFSET	INPUT
Registration of program	f		EDIT/ AUTO	PRGRM	INPUT

Punch out

Function	Data protection key	Parameter write=1	Mode	Function button	Operation
Punch of parameter			EDIT	PRGRM	OUTPUT
Punch of PMC parameter			EDIT	DGNOS	OUTPUT
Punch of offset			EDIT	OFSET	OUTPUT
Punch of all programs			EDIT	PRGRM	[O] → -9999 → [OUTPUT]
Punch of one program			EDIT	PRGRM	[O] →Program no.→ [OUTPUT]

Search

Function	Data protection key	Parameter write=1	Mode	Function button	Operation
Searching a program number			EDIT/ AUTO	PRGRM	[O] →Program no.→ [↓] (cursor key)
Searching a sequence number			AUTO	PRGRM	Program no. search→ [N] →Sequence number → [↓] (cursor key)
Searching an address word			EDIT	PRGRM	Data to be searched→ [↓] (cursor key)
Searching an address only			EDIT	PRGRM	Address to be searched→ [↓] (cursor key)
Searching an offset number			-	OFSET	[NO.] →Offset no.→ [INPUT]
Searching a diagnostic number			-	DGNOS	[NO.] →Diagnostic number→ [INPUT]
Searching a parameter number			-	PRGRM	[NO.] →Parameter no.→ [INPUT]

Edit

Function	Data protection key	Parameter write=1	Mode	Function button	Operation
Display of memory capacity used			EDIT	PRGRM	PRGRM
Deleting all programs	f		EDIT	PRGRM	O →-9999→ DELETE
Deleting a program	f		EDIT	PRGRM	O →Program no.→ DELETE
Deleting several blocks	f		EDIT	PRGRM	N →Sequence no.→ DELETE
Deleting a block	f		EDIT	PRGRM	EOB → DELETE
Deleting a word	f		EDIT	PRGRM	Searching a word to be deleted→ DELETE
Changing a word	f		EDIT	PRGRM	Searching a word to be changed→New Data→ ALTER
Inserting a word	f		EDIT	PRGRM	Searching a word immediately before a word to be searched→New Data→ INSERT

Collation

Function	Data protection key	Parameter write=1	Mode	Function button	Operation
Collating memory			EDIT/ AUTO	PRGRM	INPUT

Input/Output with FANUC Cassette

Function	Data protection key	Parameter write=1	Mode	Function button	Operation
Registeration of program	f		EDIT/ AUTO	PRGRM	N →File no.→ INPUT → INPUT
Output of all program			EDIT	PRGRM	O →-9999→ OUTPUT
Output of a program			EDIT	PRGRM	O →Program no.→ OUTPUT
Heading a file			EDIT/ AUTO	PRGRM	N →File no.→ INPUT
Deleting a file	f		EDIT	PRGRM	N →File no.→ OUTPUT
Collating a program			EDIT/ AUTO	PRGRM	N →File no.→ INPUT → INPUT

Play back

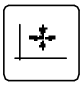
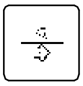
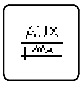
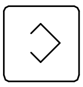
Function	Data protection key	Parameter write=1	Mode	Function button	Operation
Input of NC data			TECH-IN JOG/ HANDLE	PRGRM	Moving a machine ⇒ X , Y or Z ⇒ INSRT ⇒NC data⇒ INSRT ⇒ EOB ⇒ INSRT

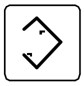
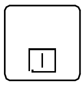
Clear

Function	Data protection key	Parameter write=1	Mode	Function key	Operation
Memory all clear			At power ON		RESET AND DELETE
Parameter clear		f	At Power ON		RESET
Clearing a program		f	At Power ON		DELETE
Sub-print board all clear			At Power ON		DELET AND S (On the main side, however, maintain a condition of PWE = 0.)

1.6 CORRESPONDENCE BETWEEN ENGLISH AND SYMBOLIC KEYS

In MDI units certified for the CE marking, keys are identified using symbols (symbolic keys) instead of letters (English keys). The following table lists the correspondence between the conventional English keys and the symbolic keys.

	English key	Symbolic key
RESET key	RESET	
PAGE UP key	↑ PAGE	
PAGE DOWN key	PAGE ↓	
SHIFT key	SHIFT	
POSITION key	POS	
PROGRAM key	PRGRM	
MENU key	MENU	
OFFSET key	OFSET	
MENU/OFFSET key	MENU OFSET	
DIAGNOS/ PARAM key	DGNOS PARAM	
OPRATION/ ALARM key	OPR ALARM	
AUXILIARY/ GRAPHIC key	AUX GRAPH	
MACRO key	MACRO	

	English key	Symbolic key
ALTER key	ALTER	
INSERT key	INSRT	
INPUT key	INPUT	
OUTPUT/START key	OUTPT START	
DELETE key	DELET	
CANCEL key	CAN	

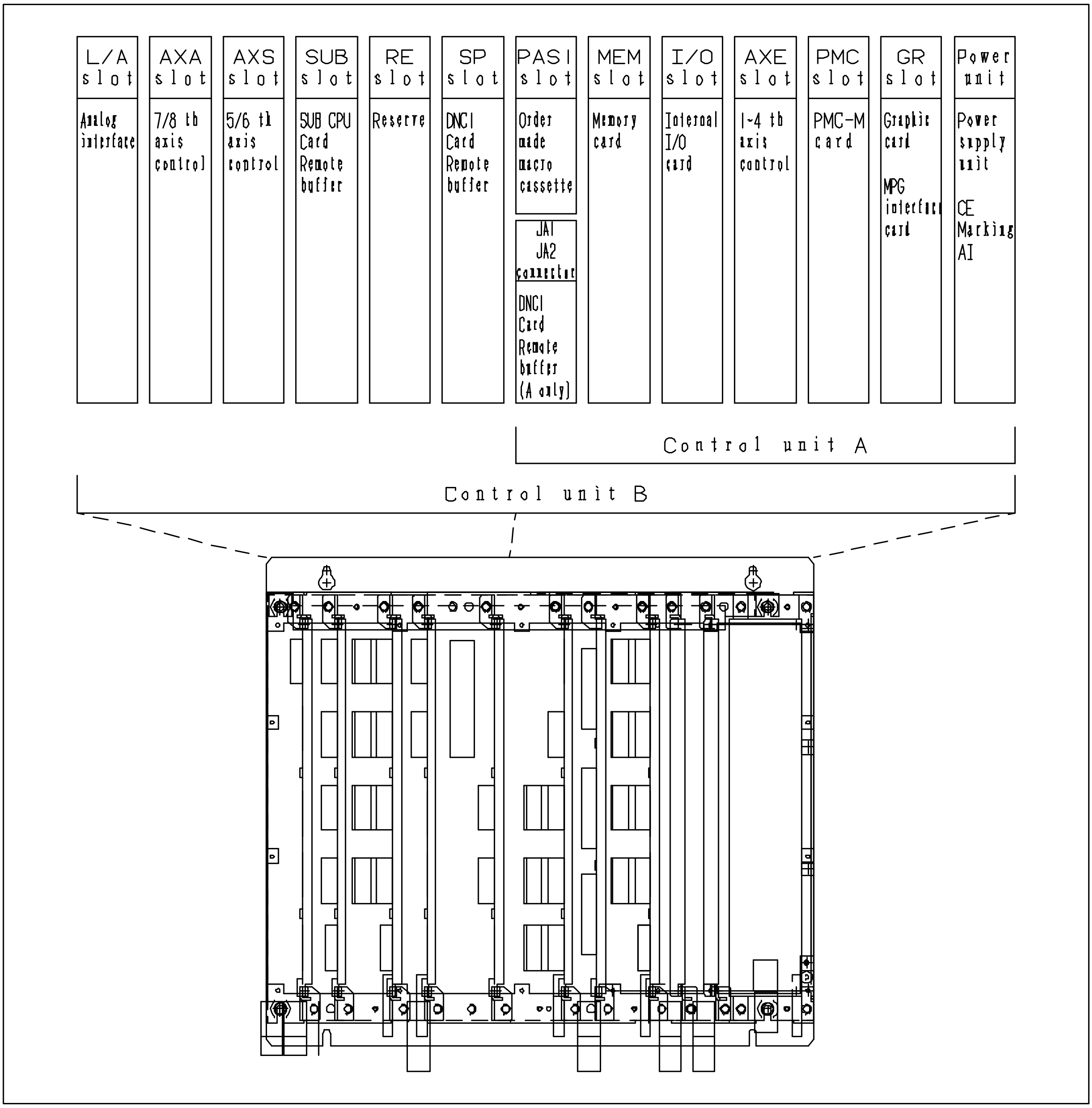
2 HARDWARE

This chapter describes structure of CNC control section, connection of units and the functions of PCBs and modules mounted on PCBs.

2.1 CONTROL UNIT

2.1.1 Configuration of the Control Unit

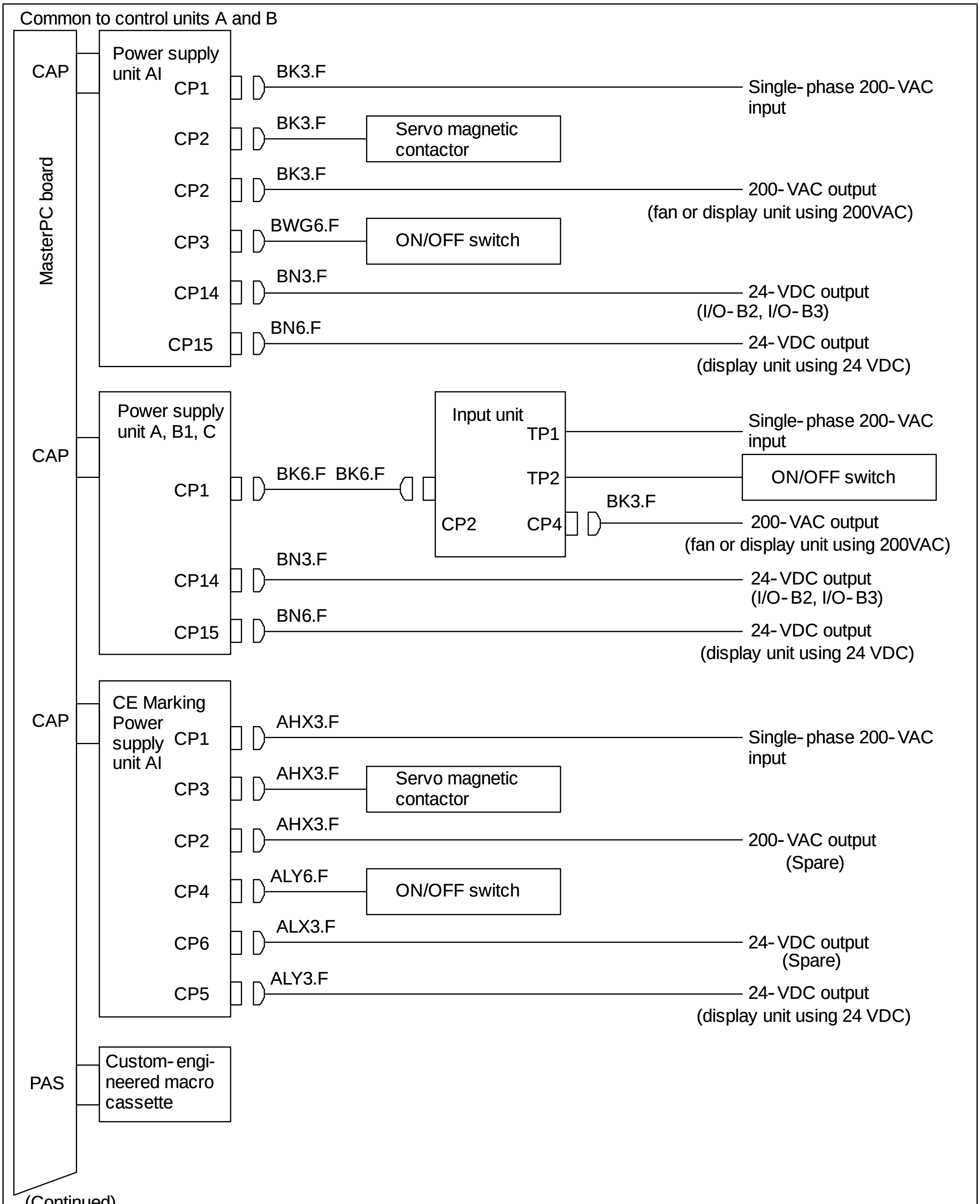
Each control P.C.B. of Series 0 is mounted in the slot as follows.
Available series is in parenthesis.



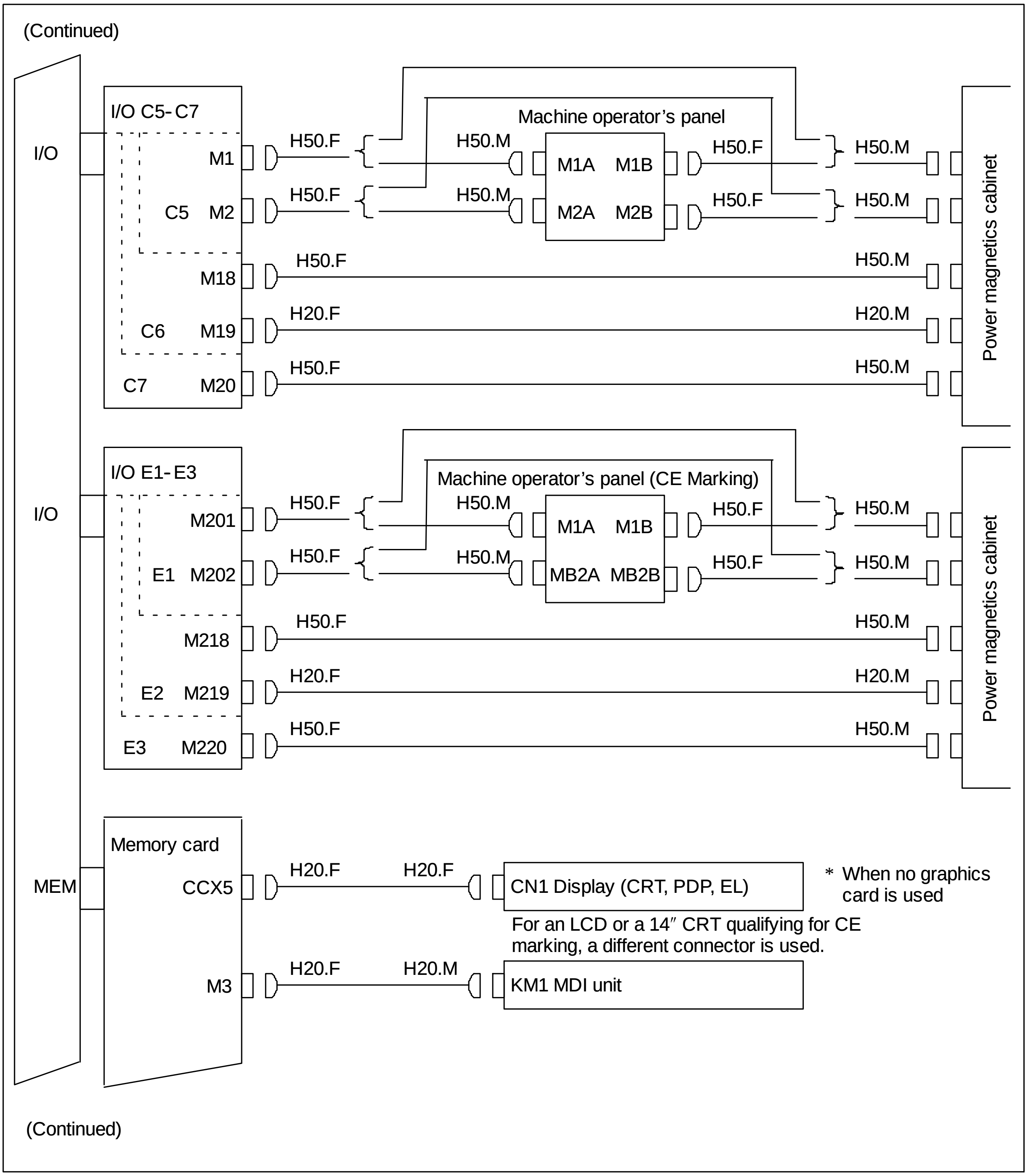
NOTE

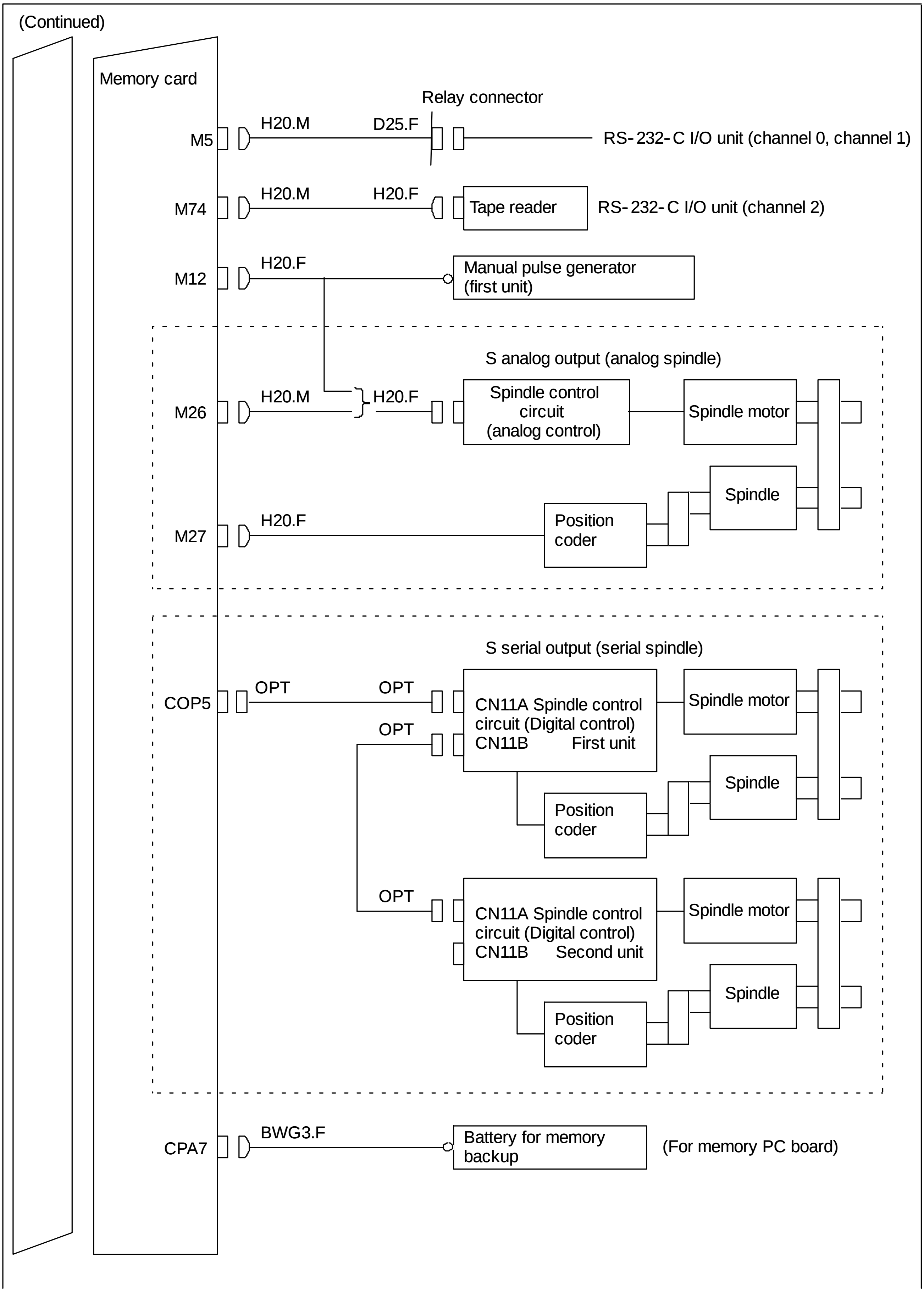
Connection position of this figure are depended on each printed board.

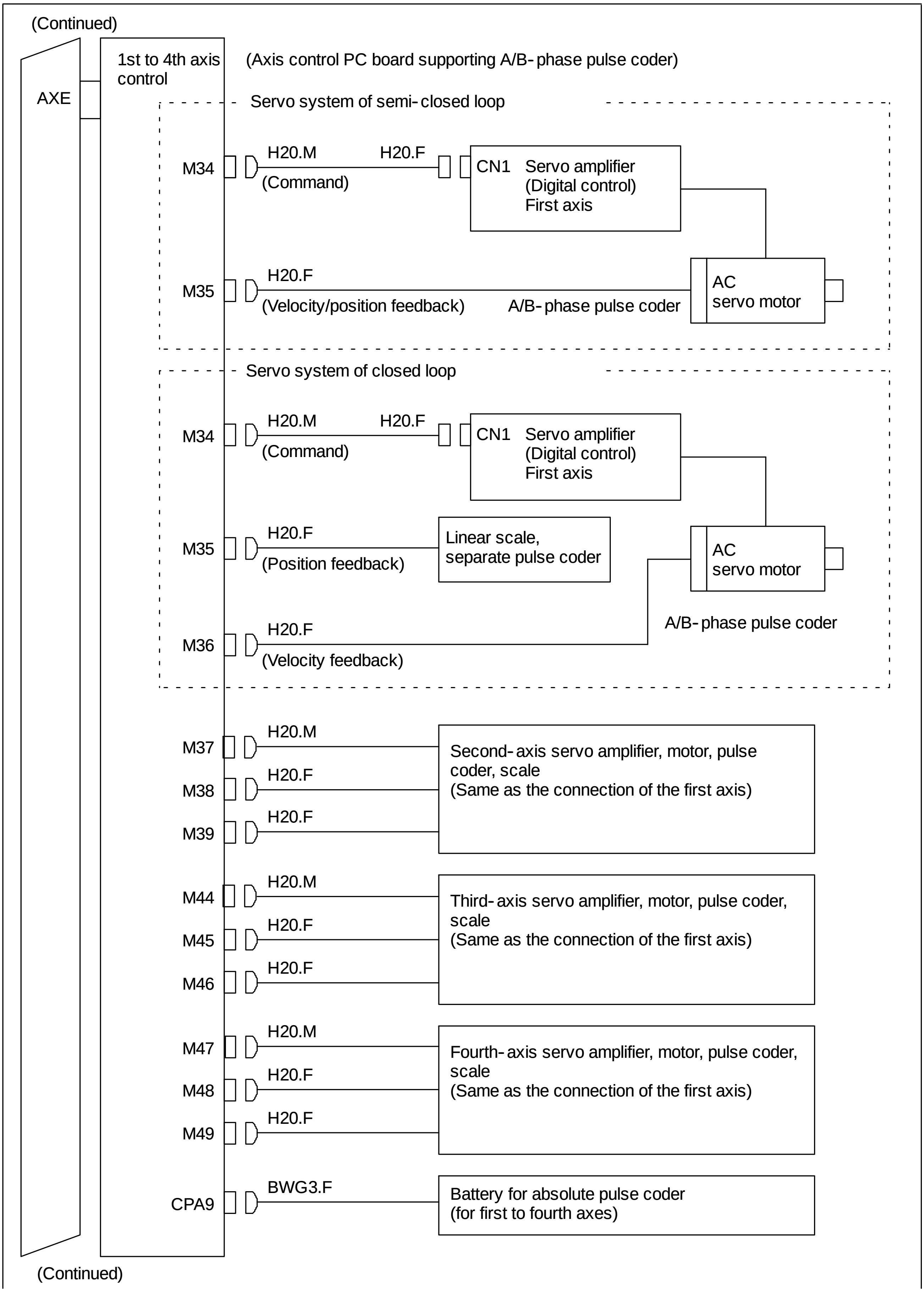
2.2 COMPLETE CONNECTION DIAGRAM



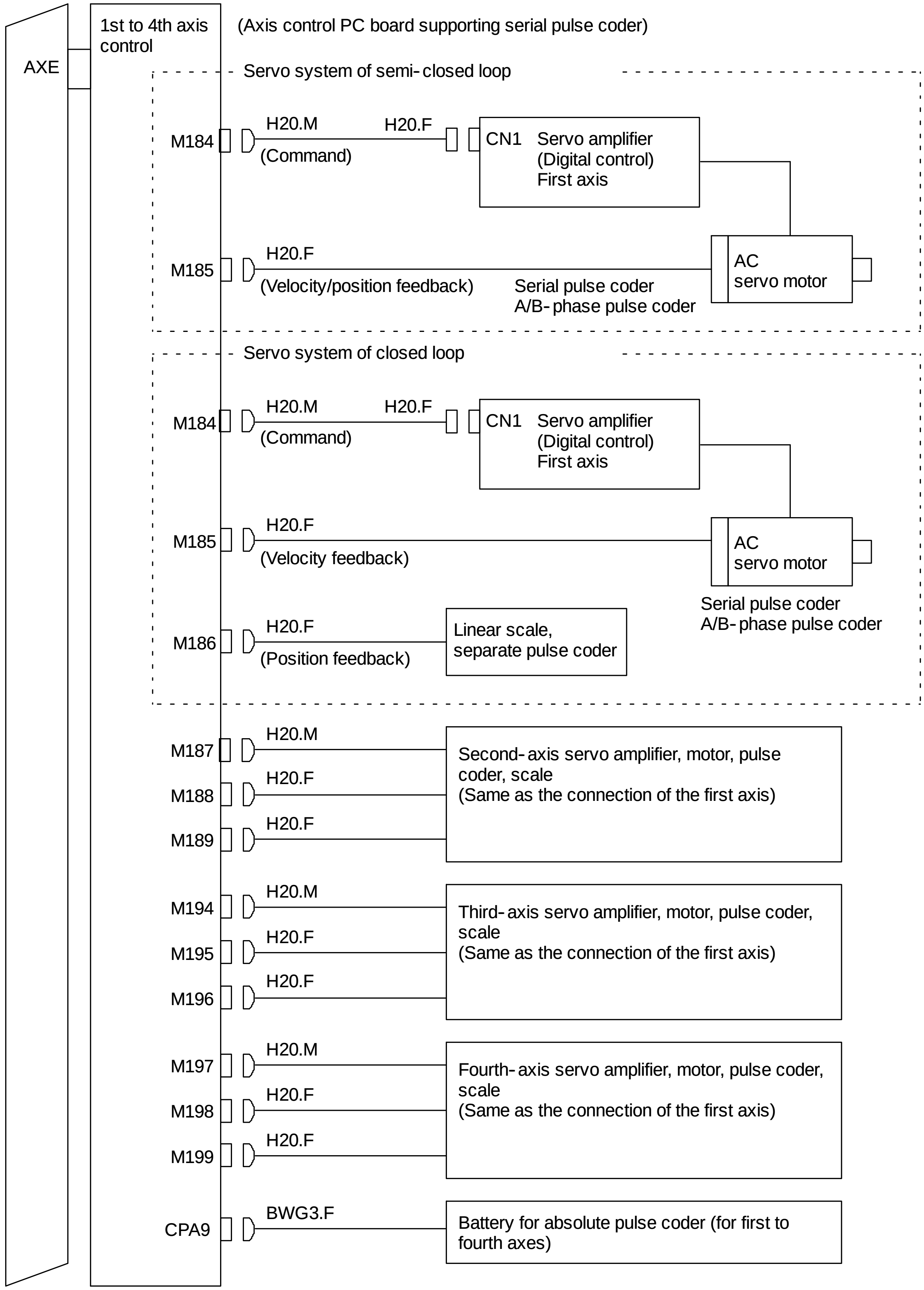
(Continued)


(Continued)
I/O
I/O C5-C7
M1
C5 M2
M18
C6 M19
C7 M20
H50.F
H50.M
Machine operator's panel
M1A M1B
M2A M2B
H20.F
H20.M
Power magnetics cabinet
I/O
I/O E1-E3
M201
E1 M202
M218
E2 M219
E3 M220
Machine operator's panel (CE Marking)
MB2A MB2B
Power magnetics cabinet
MEM
Memory card
CCX5
M3
CN1 Display (CRT, PDP, EL)
* When no graphics card is used
For an LCD or a 14″ CRT qualifying for CE marking, a different connector is used.
KM1 MDI unit
(Continued)

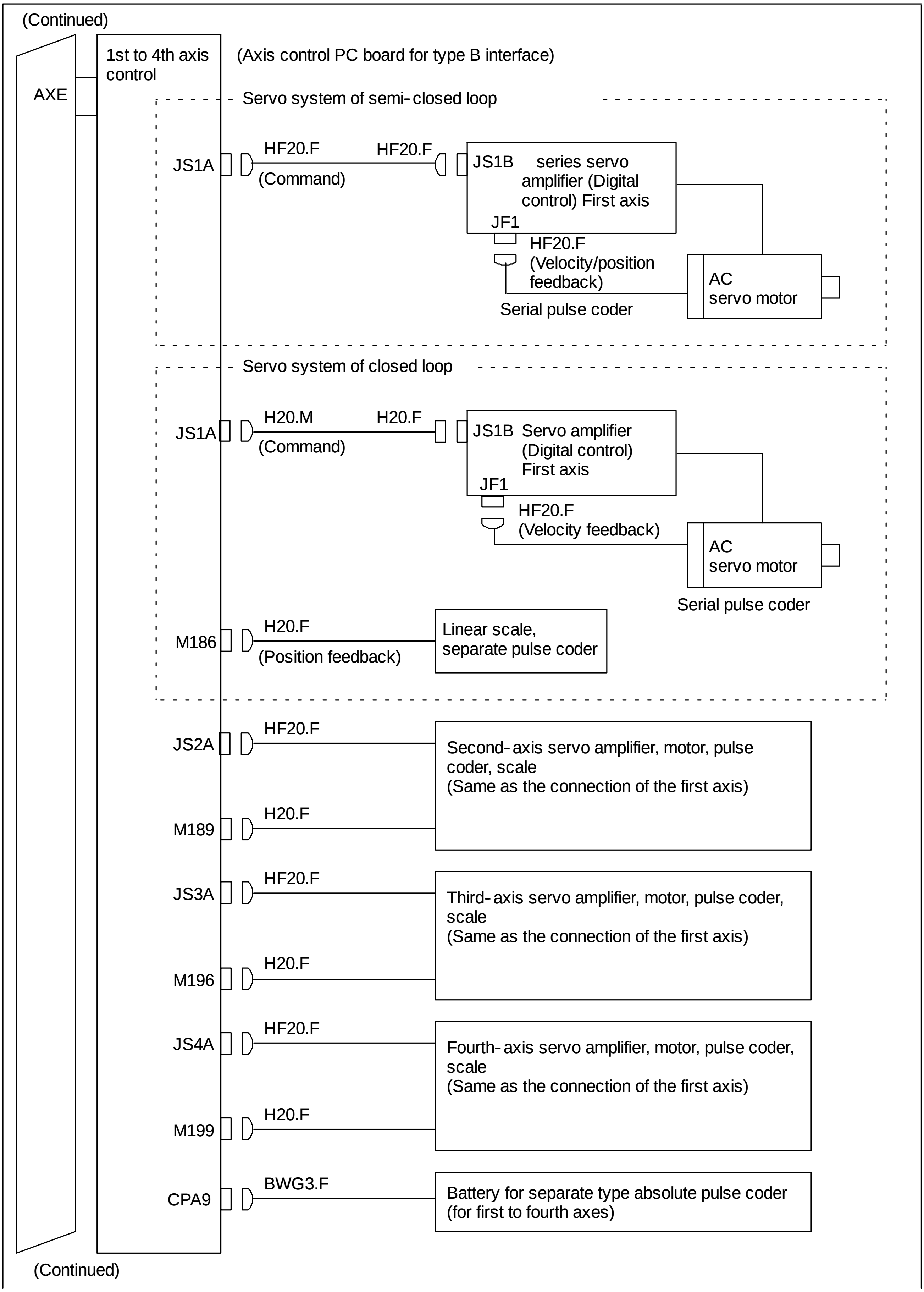

(Continued)
Memory card
Relay connector
M5
H20.M
D25.F
RS-232-C I/O unit (channel 0, channel 1)
M74
H20.M
H20.F
Tape reader
RS-232-C I/O unit (channel 2)
M12
H20.F
Manual pulse generator (first unit)
S analog output (analog spindle)
M26
H20.M
H20.F
Spindle control circuit (analog control)
Spindle motor
Spindle
M27
H20.F
Position coder
S serial output (serial spindle)
COP5
OPT
OPT
CN11A Spindle control circuit (Digital control) CN11B First unit
Spindle motor
OPT
Spindle
Position coder
OPT
CN11A Spindle control circuit (Digital control) CN11B Second unit
Spindle motor
Spindle
Position coder
CPA7
BWG3.F
Battery for memory backup
(For memory PC board)


(Continued)
AXE
1st to 4th axis control
(Axis control PC board supporting A/B-phase pulse coder)
Servo system of semi-closed loop
M34
H20.M
H20.F
(Command)
CN1
Servo amplifier
(Digital control)
First axis
M35
H20.F
(Velocity/position feedback)
A/B-phase pulse coder
AC
servo motor
Servo system of closed loop
M34
H20.M
H20.F
(Command)
CN1
Servo amplifier
(Digital control)
First axis
M35
H20.F
(Position feedback)
Linear scale,
separate pulse coder
AC
servo motor
A/B-phase pulse coder
M36
H20.F
(Velocity feedback)
M37
H20.M
M38
H20.F
M39
H20.F
Second-axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis)
M44
H20.M
M45
H20.F
M46
H20.F
Third-axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis)
M47
H20.M
M48
H20.F
M49
H20.F
Fourth-axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis)
CPA9
BWG3.F
Battery for absolute pulse coder
(for first to fourth axes)
(Continued)

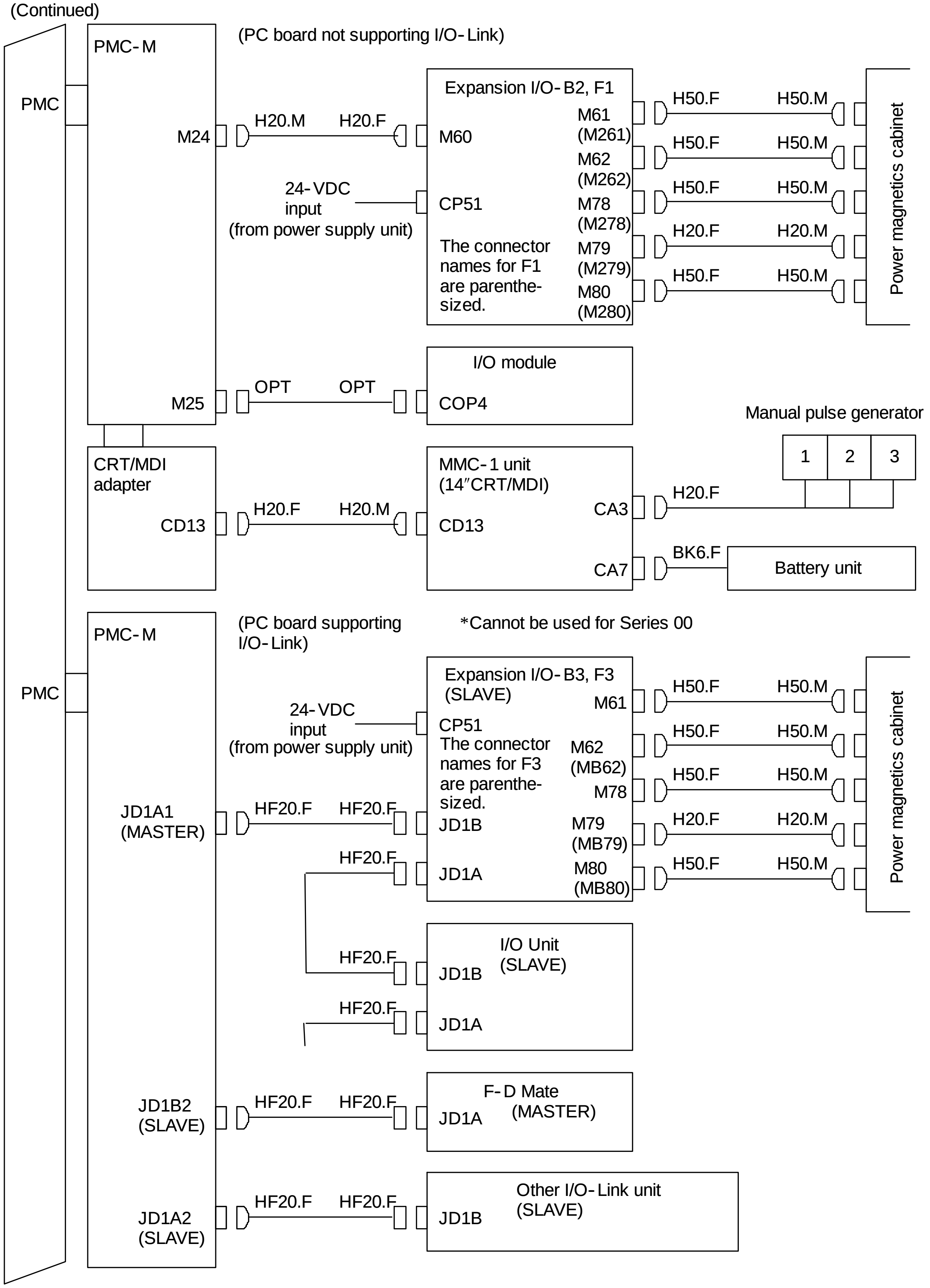
(Continued)



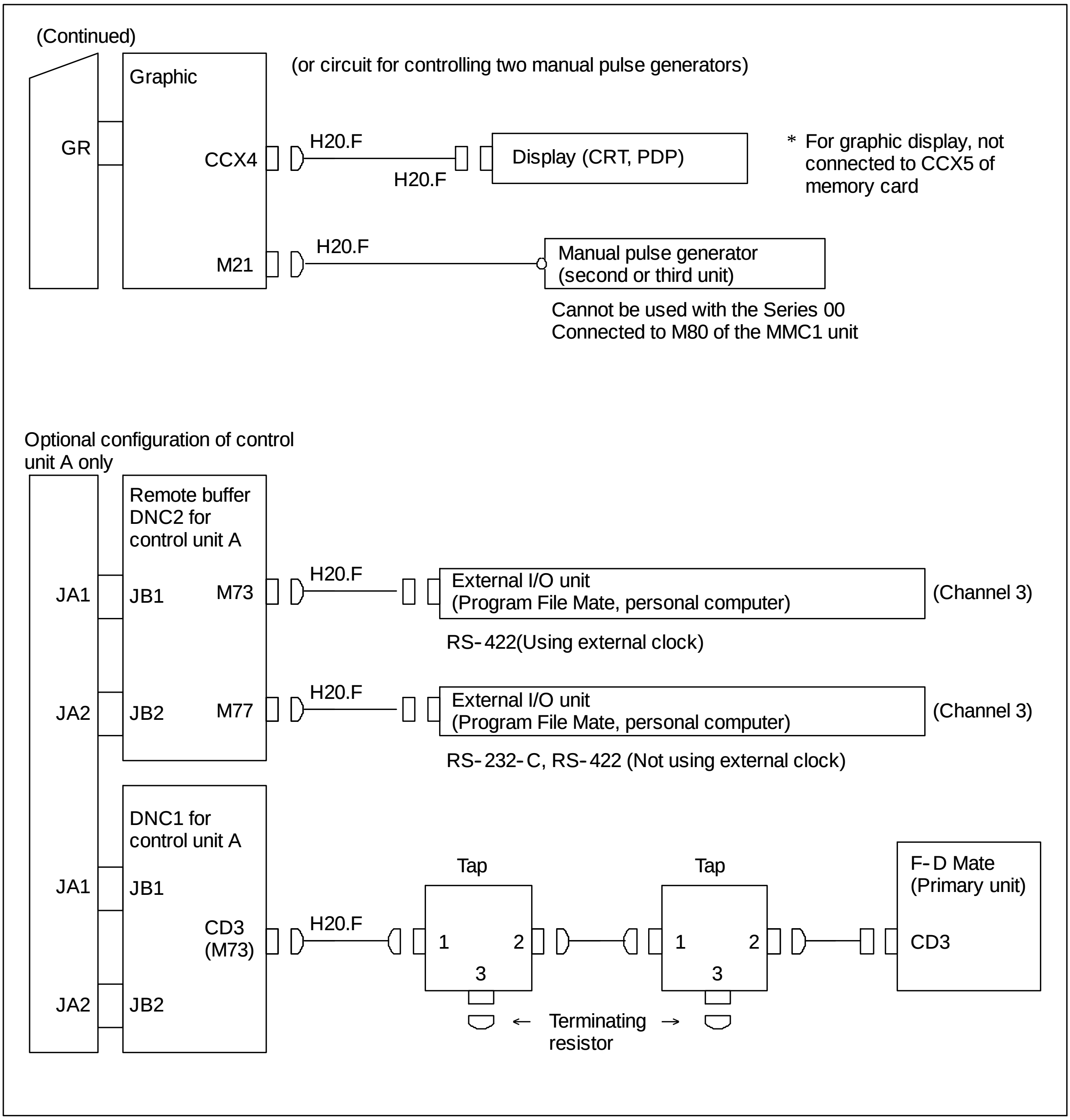
(Continued)

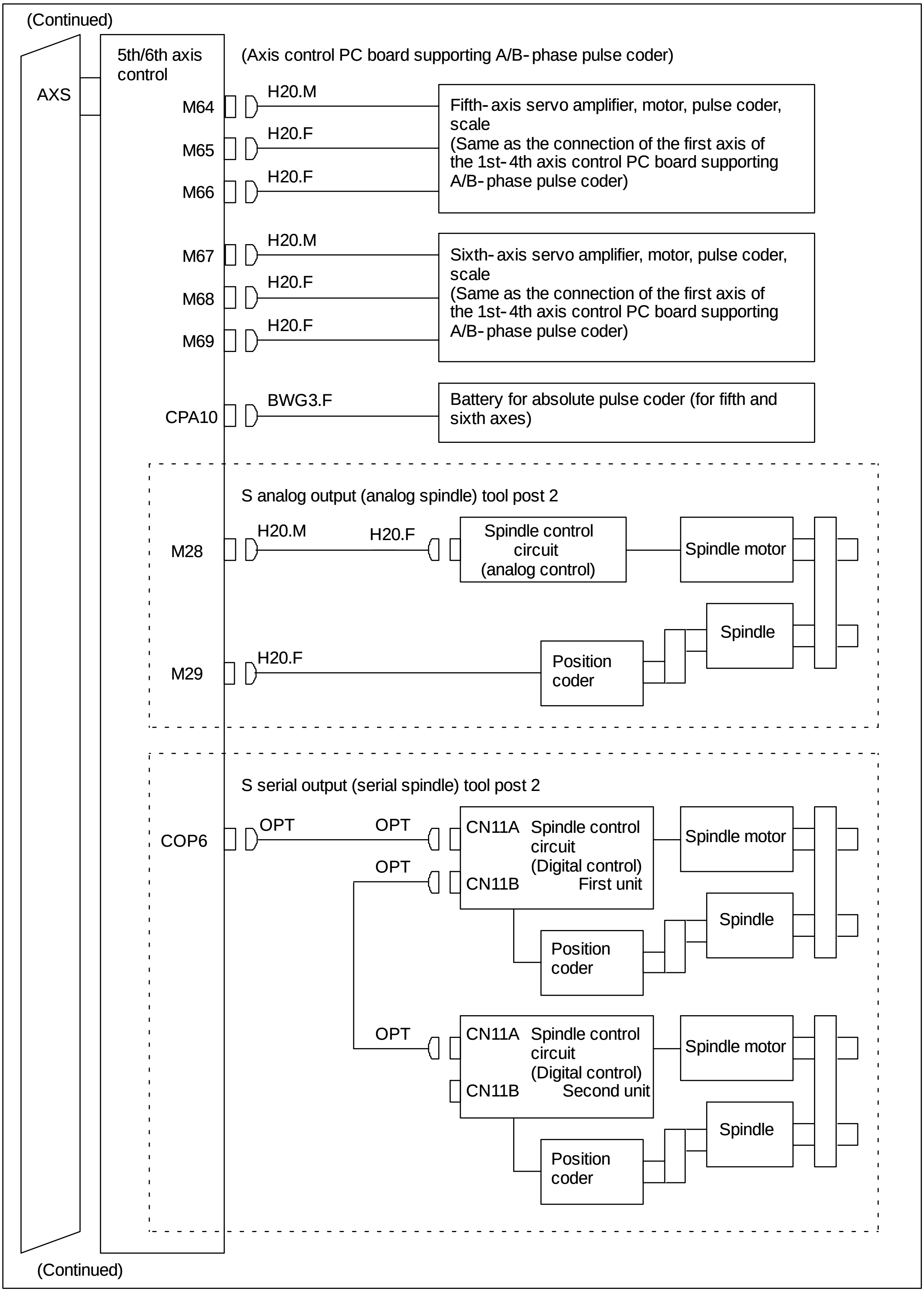

(Continued)
AXE
1st to 4th axis control
(Axis control PC board for type B interface)
Servo system of semi-closed loop
JS1A
HF20.F
HF20.F
(Command)
JS1B series servo amplifier (Digital control) First axis
JF1
HF20.F
(Velocity/position feedback)
AC servo motor
Serial pulse coder
Servo system of closed loop
JS1A
H20.M
H20.F
(Command)
JS1B Servo amplifier (Digital control) First axis
JF1
HF20.F
(Velocity feedback)
AC servo motor
Serial pulse coder
M186
H20.F
(Position feedback)
Linear scale, separate pulse coder
JS2A
HF20.F
Second-axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis)
M189
H20.F
JS3A
HF20.F
Third-axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis)
M196
H20.F
JS4A
HF20.F
Fourth-axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis)
M199
H20.F
CPA9
BWG3.F
Battery for separate type absolute pulse coder (for first to fourth axes)
(Continued)

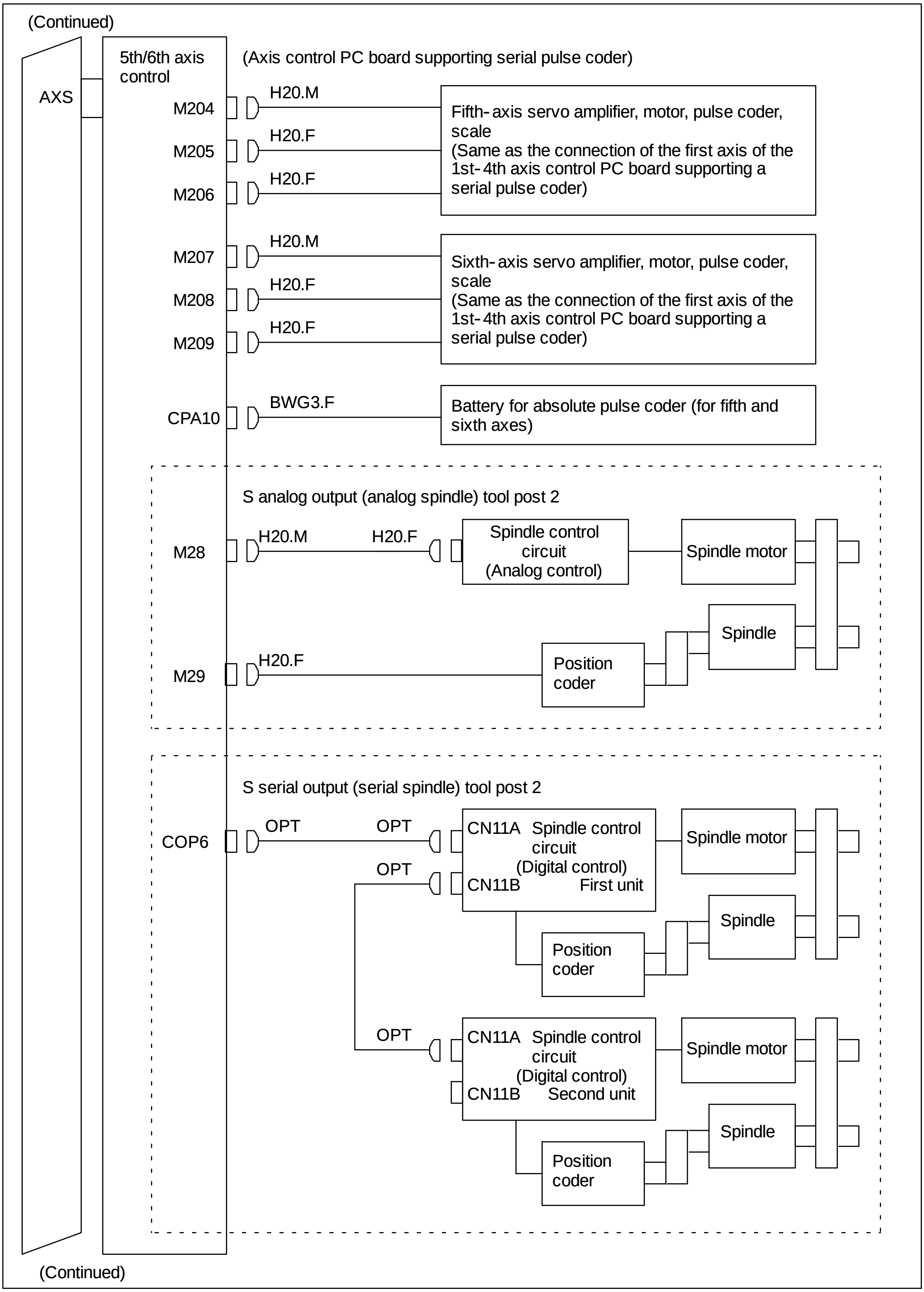
(Continued)



(Continued)

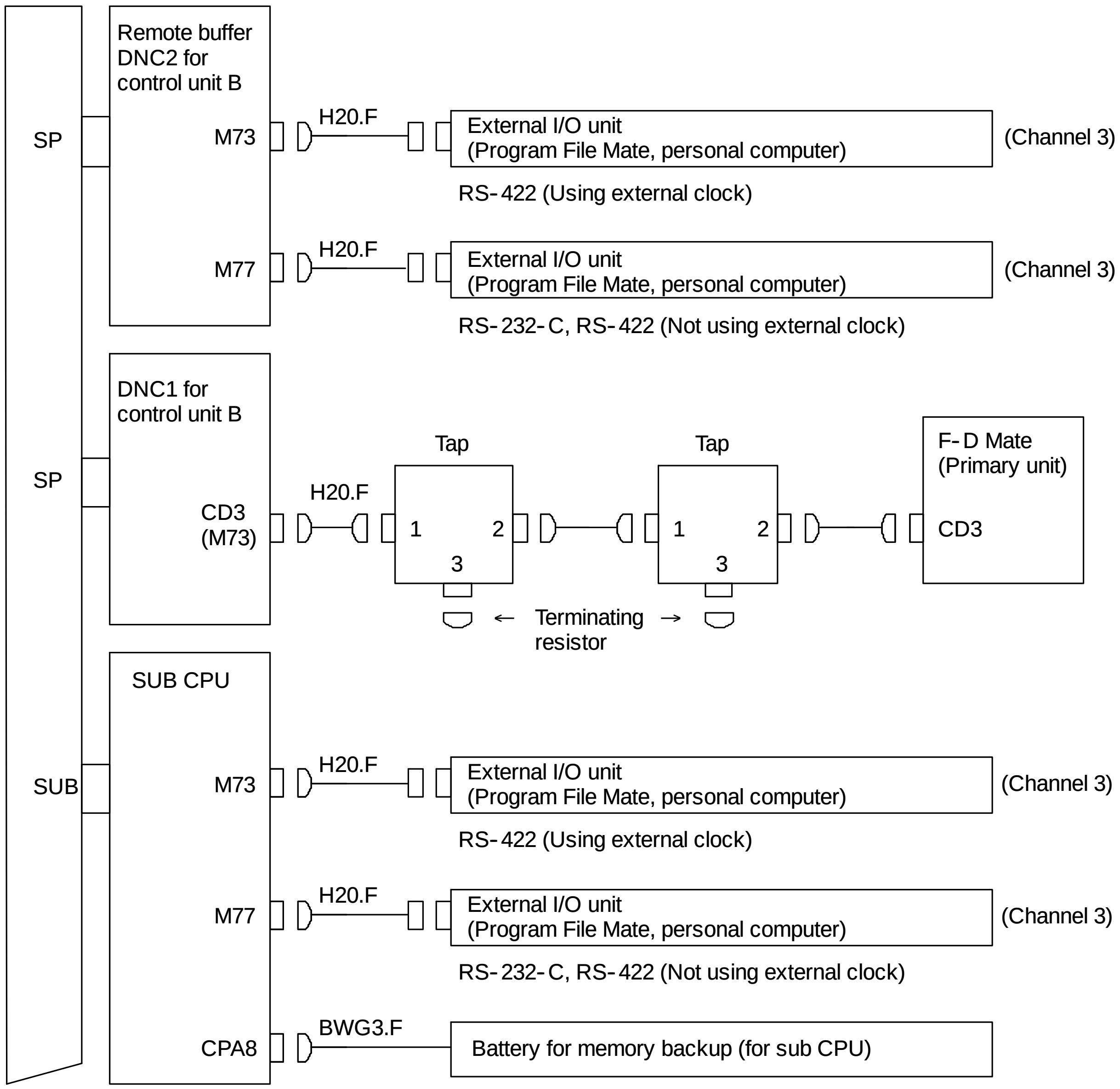

(Continued)
GR
Graphic
CCX4
M21
(or circuit for controlling two manual pulse generators)
H20.F
H20.F
Display (CRT, PDP)
* For graphic display, not connected to CCX5 of memory card
H20.F
Manual pulse generator (second or third unit)
Cannot be used with the Series 00
Connected to M80 of the MMC1 unit
Optional configuration of control unit A only
JA1
JA2
JA1
JA2
Remote buffer DNC2 for control unit A
JB1
M73
JB2
M77
H20.F
External I/O unit (Program File Mate, personal computer)
(Channel 3)
RS-422(Using external clock)
H20.F
External I/O unit (Program File Mate, personal computer)
(Channel 3)
RS-232-C, RS-422 (Not using external clock)
DNC1 for control unit A
JB1
CD3 (M73)
JB2
H20.F
Tap
1
2
3
Tap
1
2
3
F-D Mate (Primary unit)
CD3
Terminating resistor


(Continued)
AXS
5th/6th axis control
(Axis control PC board supporting A/B-phase pulse coder)
M64
H20.M
M65
H20.F
M66
H20.F
Fifth-axis servo amplifier, motor, pulse coder, scale (Same as the connection of the first axis of the 1st-4th axis control PC board supporting A/B-phase pulse coder)
M67
H20.M
M68
H20.F
M69
H20.F
Sixth-axis servo amplifier, motor, pulse coder, scale (Same as the connection of the first axis of the 1st-4th axis control PC board supporting A/B-phase pulse coder)
CPA10
BWG3.F
Battery for absolute pulse coder (for fifth and sixth axes)
S analog output (analog spindle) tool post 2
M28
H20.M
H20.F
Spindle control circuit (analog control)
Spindle motor
Spindle
M29
H20.F
Position coder
S serial output (serial spindle) tool post 2
COP6
OPT
OPT
CN11A
Spindle control circuit (Digital control)
CN11B
First unit
Spindle motor
OPT
Spindle
Position coder
OPT
CN11A
Spindle control circuit (Digital control)
CN11B
Second unit
Spindle motor
Spindle
Position coder
(Continued)

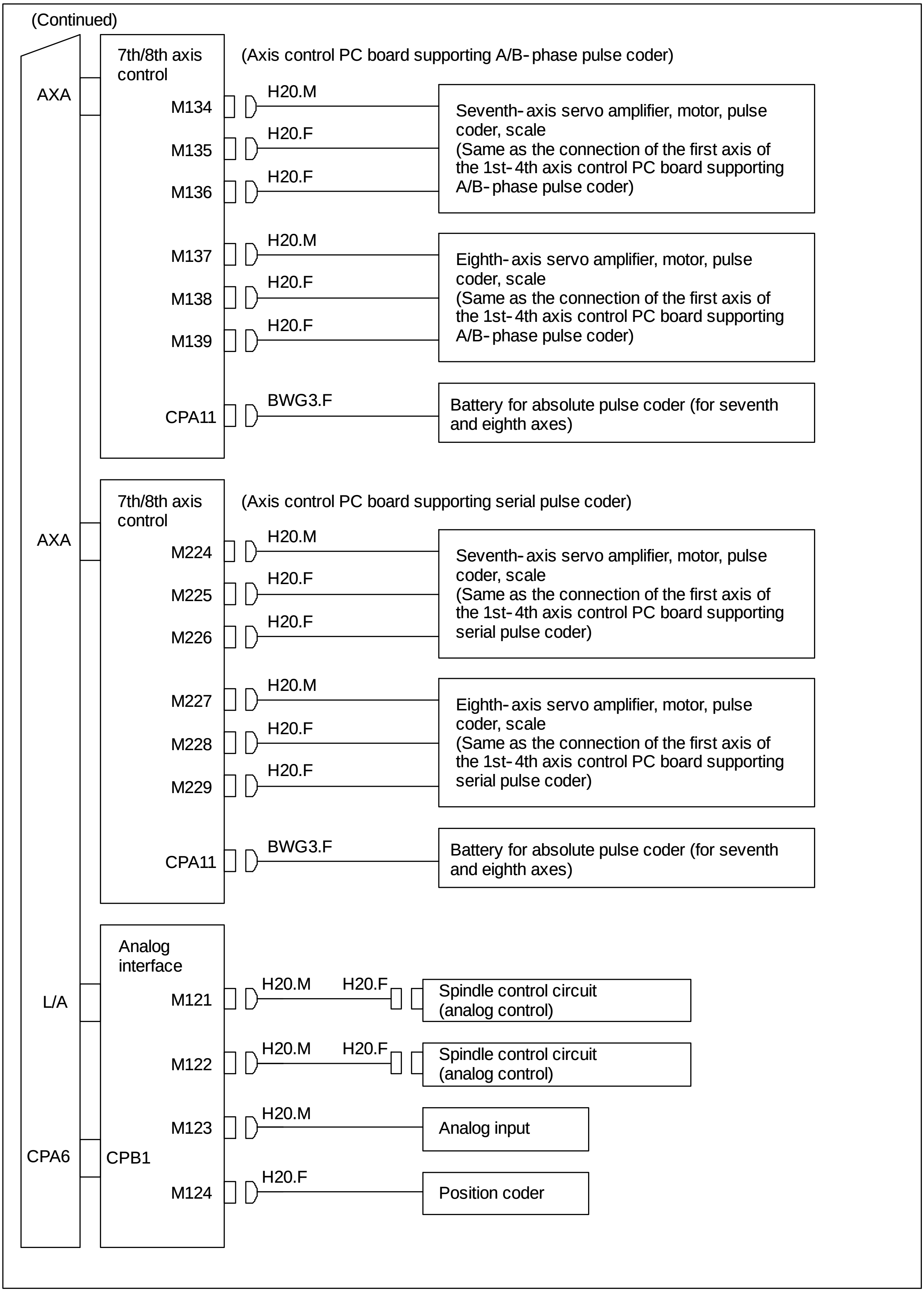

(Continued)
AXS
5th/6th axis control
(Axis control PC board supporting serial pulse coder)
M204
H20.M
M205
H20.F
M206
H20.F
Fifth-axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis of the 1st-4th axis control PC board supporting a serial pulse coder)
M207
H20.M
M208
H20.F
M209
H20.F
Sixth-axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis of the 1st-4th axis control PC board supporting a serial pulse coder)
CPA10
BWG3.F
Battery for absolute pulse coder (for fifth and sixth axes)
S analog output (analog spindle) tool post 2
M28
H20.M
H20.F
Spindle control circuit (Analog control)
Spindle motor
Spindle
M29
H20.F
Position coder
S serial output (serial spindle) tool post 2
COP6
OPT
OPT
CN11A
Spindle control circuit (Digital control)
CN11B
First unit
OPT
Spindle motor
Spindle
Position coder
OPT
CN11A
Spindle control circuit (Digital control)
CN11B
Second unit
Spindle motor
Spindle
Position coder
(Continued)

(Continued)

Optional configuration of control unit B only



(Continued)


(Continued)
AXA
7th/8th axis control
(Axis control PC board supporting A/B-phase pulse coder)
M134
H20.M
M135
H20.F
M136
H20.F
Seventh-axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis of the 1st-4th axis control PC board supporting A/B-phase pulse coder)
M137
H20.M
M138
H20.F
M139
H20.F
Eighth-axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis of the 1st-4th axis control PC board supporting A/B-phase pulse coder)
CPA11
BWG3.F
Battery for absolute pulse coder (for seventh and eighth axes)
AXA
7th/8th axis control
(Axis control PC board supporting serial pulse coder)
M224
H20.M
M225
H20.F
M226
H20.F
Seventh-axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis of the 1st-4th axis control PC board supporting serial pulse coder)
M227
H20.M
M228
H20.F
M229
H20.F
Eighth-axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis of the 1st-4th axis control PC board supporting serial pulse coder)
CPA11
BWG3.F
Battery for absolute pulse coder (for seventh and eighth axes)
L/A
Analog interface
M121
H20.M
H20.F
Spindle control circuit (analog control)
M122
H20.M
H20.F
Spindle control circuit (analog control)
M123
H20.M
Analog input
CPA6
CPB1
M124
H20.F
Position coder

2.3 INTER-MACHINE CONNECTION

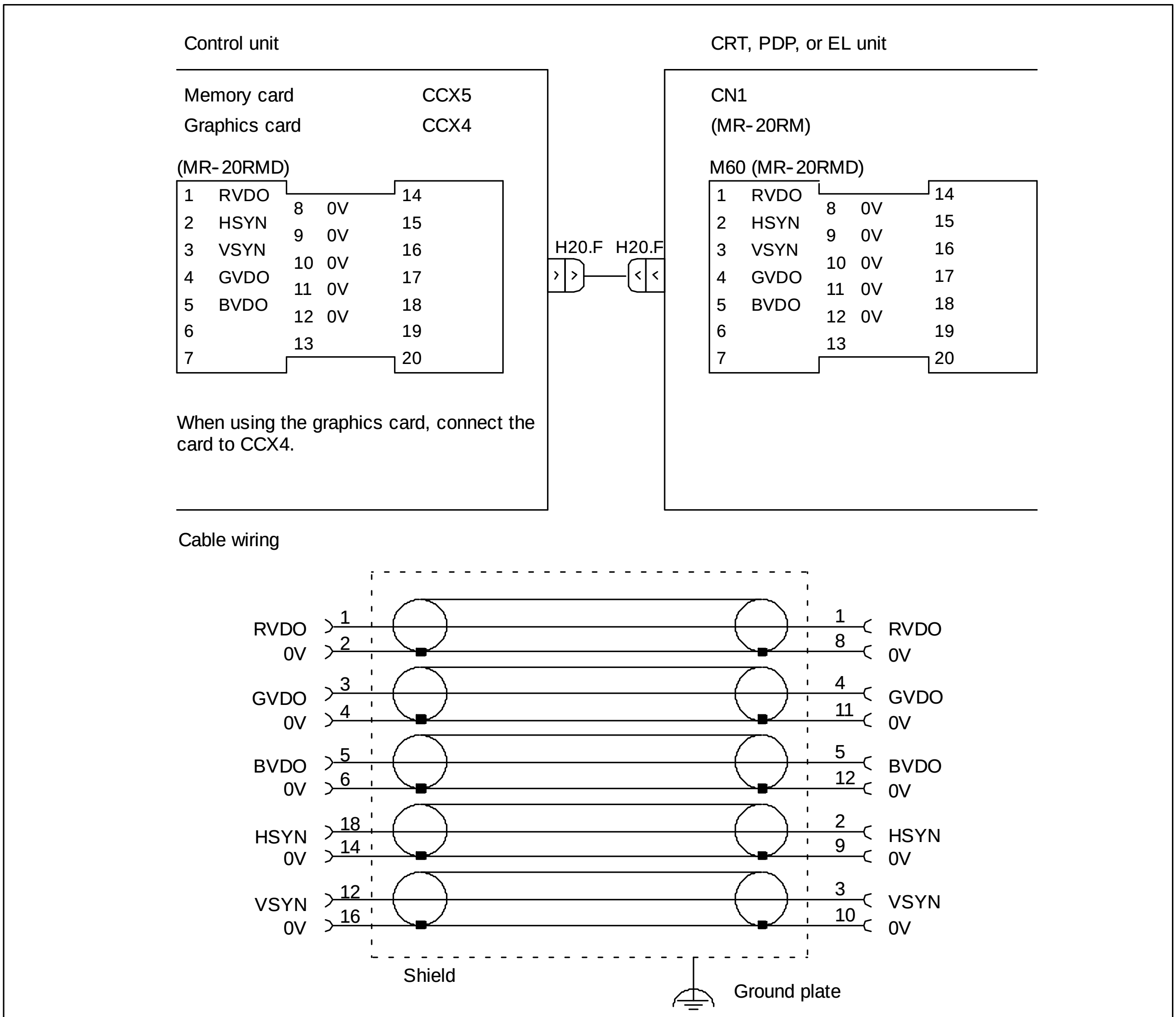
2.3.1 CRT/MDI Unit

Video signal interface

For each display unit, either of the following two video signal interfaces is used:

Type	Display unit
A	CRT unit, PDP unit, EL unit
B	LCD unit

(1) Type A

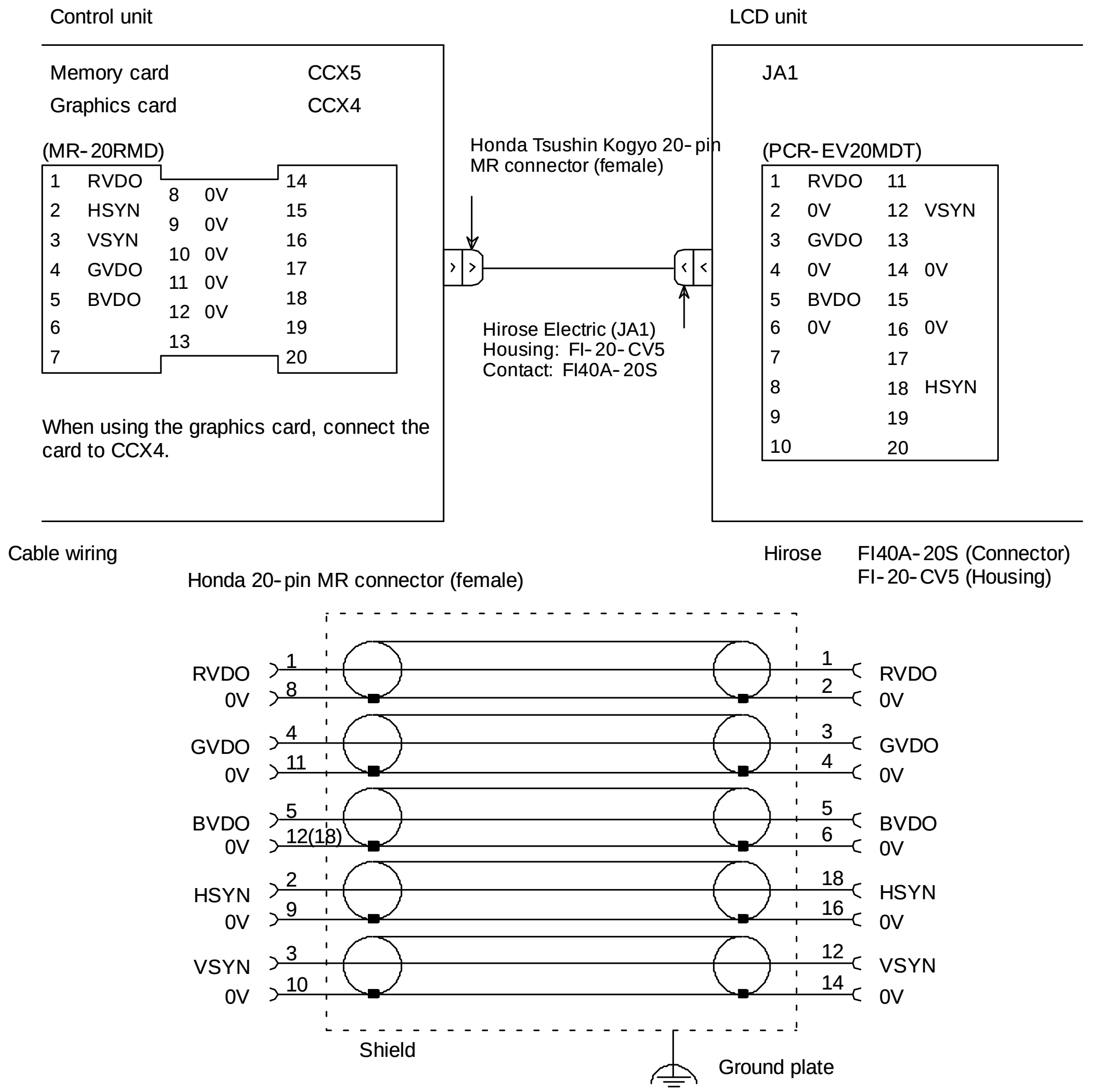


Maximum cable length: 50 m

Recommended cable material : A66L-0001-0371 coaxial cable

Recommended cable order number: A02B-0098-K871 (7 m)

(2) Type B



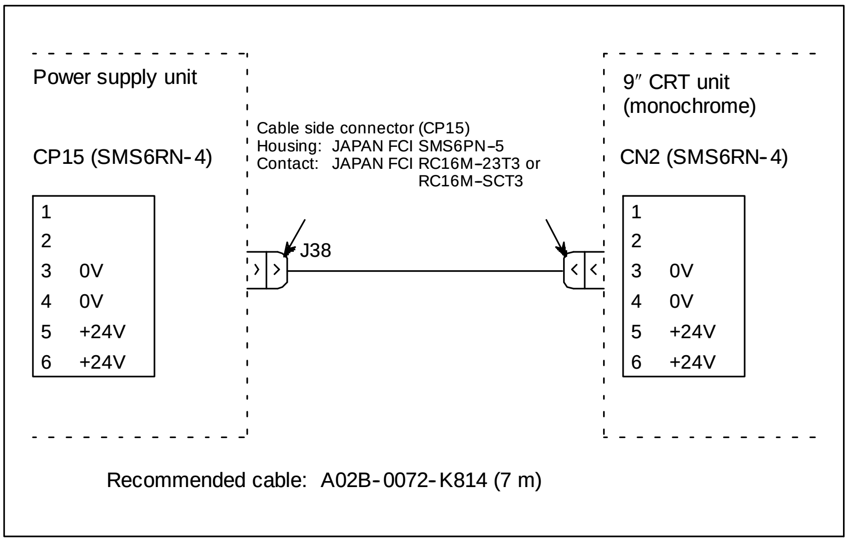
Maximum cable length : 50 m
Recommended cable kit : A02B-0098-K870 (5m)
Recommended cable material : A66L-0001-0371 coaxial cable
Recommended cable order number : A02B-0120-K888 (200m)
The Hirose Electric connector can be provided together with the housing.
Connector kit order number : A02B-0120-K305 (Hirose code: FI40A-20S-CV5)

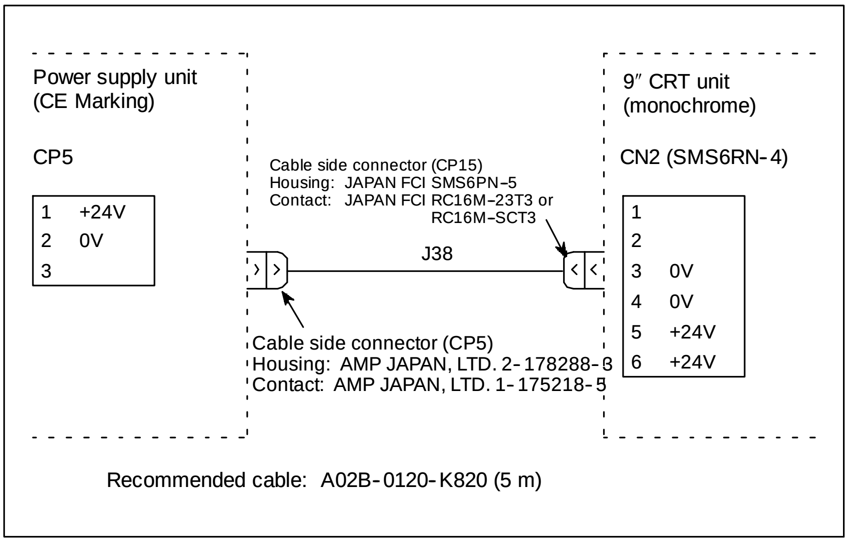
D Connecting the display unit power supply

The required supply voltage varies with the display unit. Also, some display units, while requiring the same supply voltage, may use different connectors.

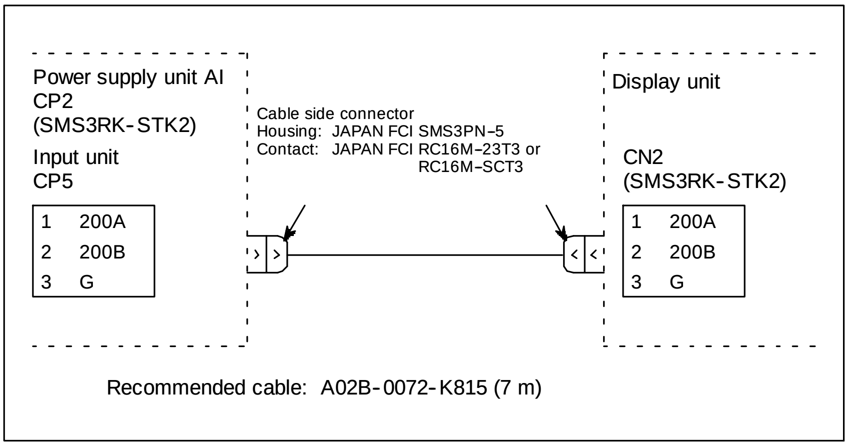
Use a power cable containing conductors of 30/0.18 (0.8 mm^2) or greater.

(1) 9″ monochrome CRT

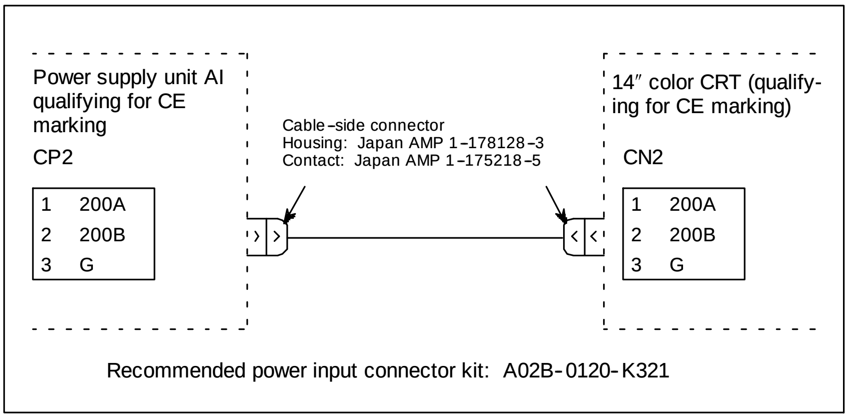




(2) 9″ color CRT, 14″ color CRT (standard type), PDP (standard type), and EL

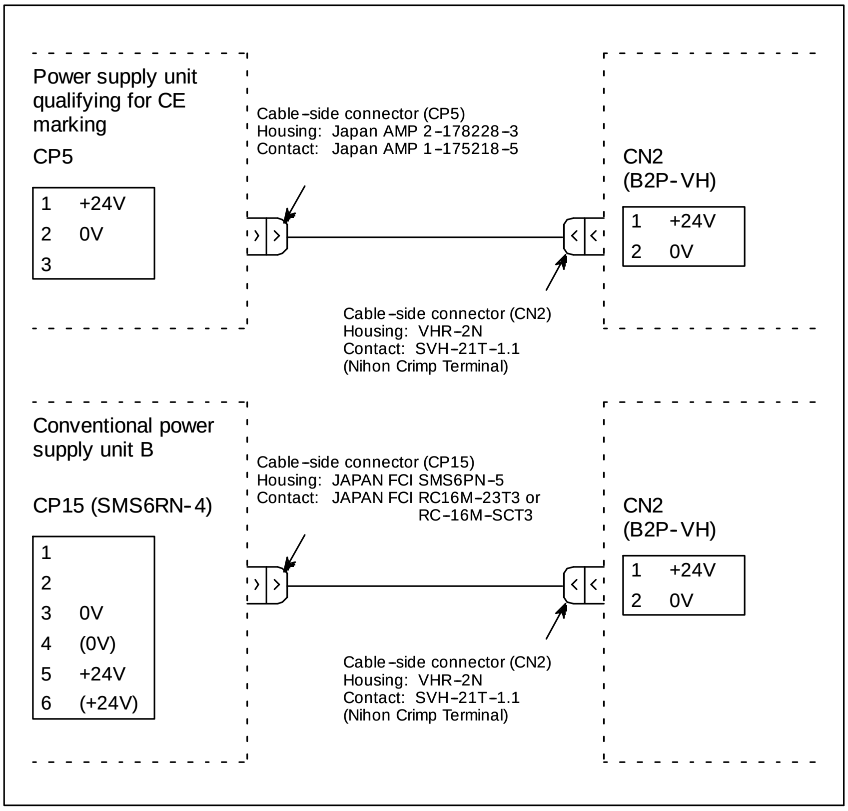


(3) 14″ color CRT (CE marking type)



(4) PDP (CE marking type)

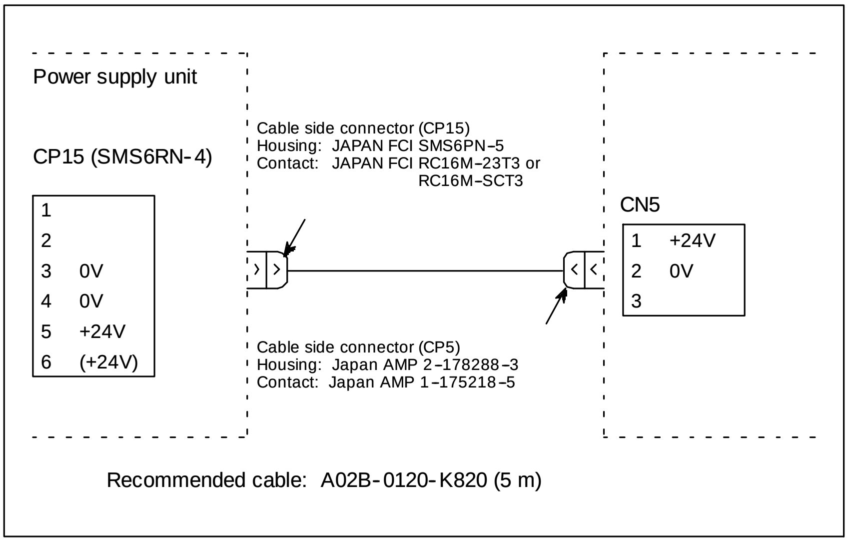
The power supply unit AI qualifying for CE marking, or the power supply unit B2 can be used. The power supply unit A and power supply unit AI cannot be used because they do not provide 24 VDC.



NOTE

For the cable connector (CN2) on the PDP-unit side, use swaging tool YC-16 available from Nihon Crimp Terminal.

(5) LCD



Connecting the soft key cable of a separate display unit

Some separate display units have soft keys. These units have flat cables for the soft keys. Connect the soft key cable to connector KM2 of a separate MDI unit.

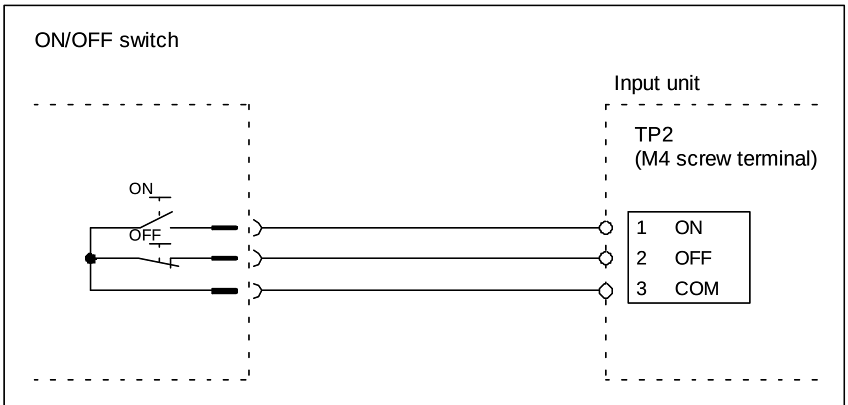
The flat cable is about 500 mm long.

ON/OFF switch on the display unit

The 9″ CRT/MDI unit, 9″ PDP/MDI unit, 7.2″ LCD/MDI unit of full–key type, and 14″ CRT/MDI unit all have an ON/OFF switch for turning the control unit on and off. The control unit can be turned on or off by pressing the ON/OFF switch when the switch is connected to the input unit or power supply unit AI (input unit built–in type).

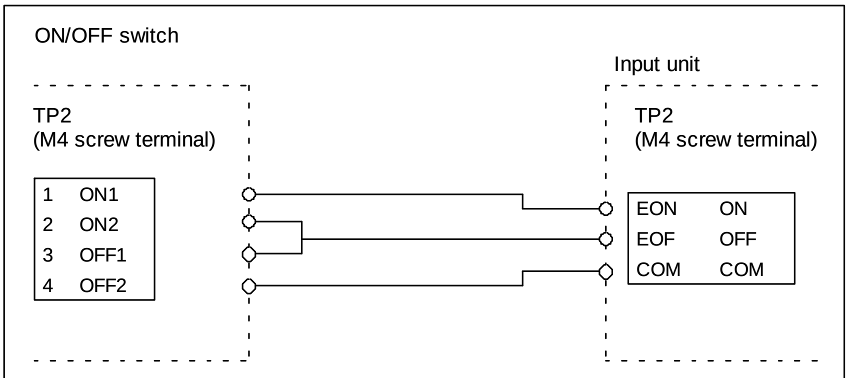
(1) Connecting to the input unit

9″ CRT/MDI unit, 9″ PDP/MDI unit, 7.2″ LCD/MDI unit of full–key type



Soldering tab terminal (#110)

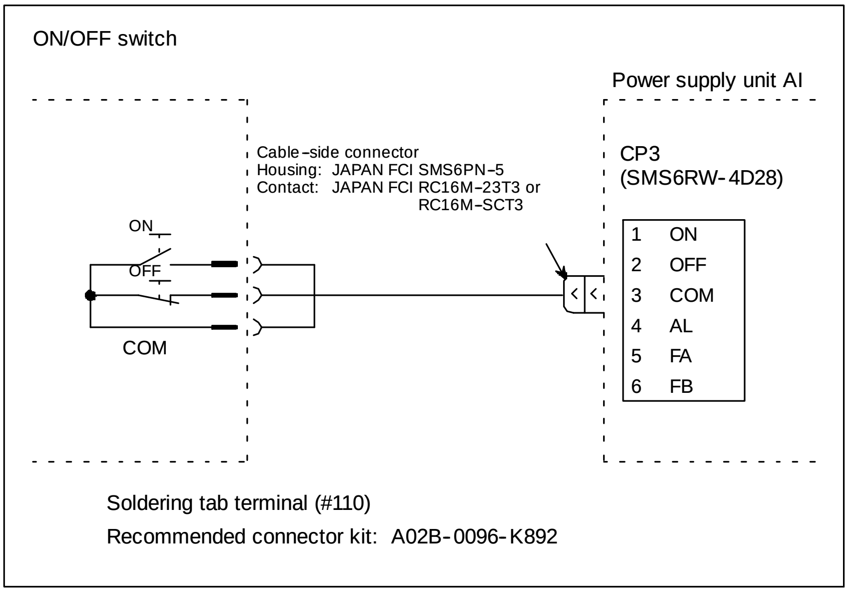
14″ CRT/MDI unit



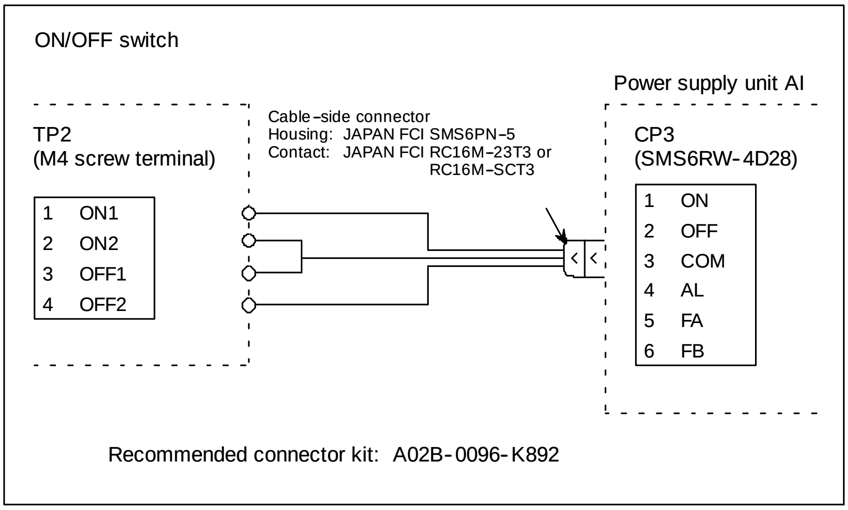
When connecting the cable to the input unit, remove the metal jumper connecting EOF and COM.

(2) Connecting to the power supply unit AI

9″ CRT/MDI unit, 9″ PDP/MDI unit, 7.2″ LCD/MDI unit of full-key type

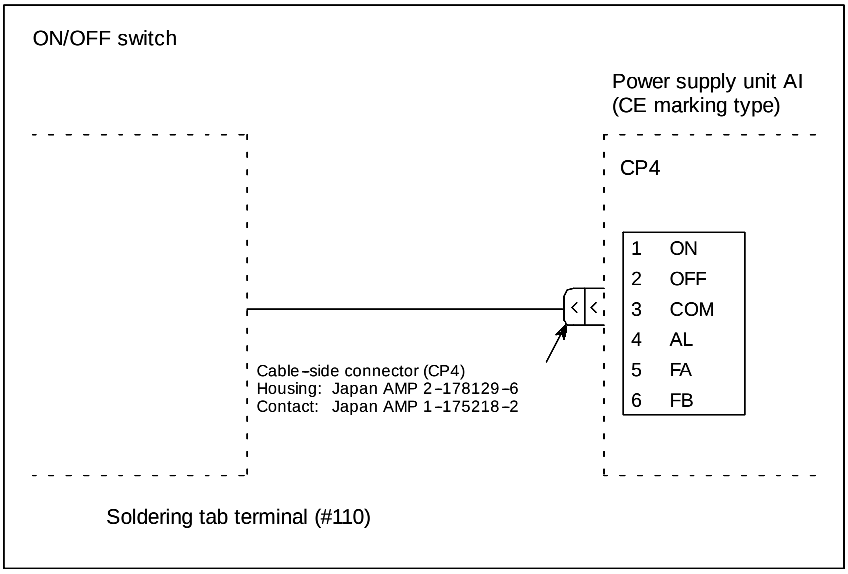


14″ CRT/MDI unit

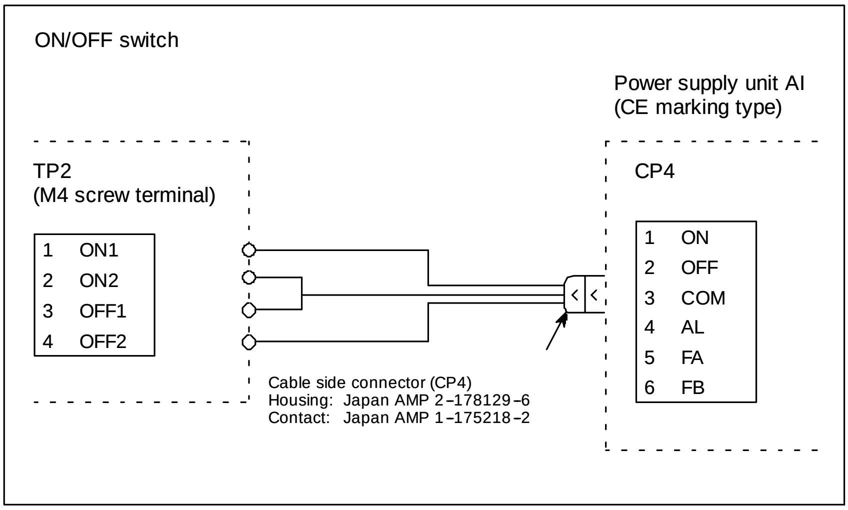


(3) Connecting to the power supply unit AI (CE marking type)

9″ CRT/MDI unit, 9″ PDP/MDI unit, 7.2″ LCD/MDI unit of full-key type



14″ CRT/MDI unit



D Adjusting the LCD

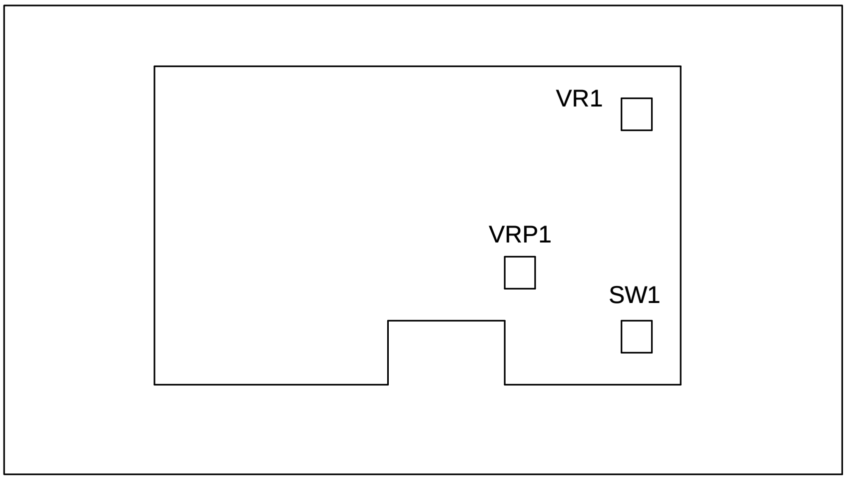
The LCD has controllers for fine adjustment of the video signal.

The controllers are required for eliminating slight disagreements between the NC unit and LCD. The controllers must be adjusted at installation or when the display circuit hardware of the NC, display unit, or cable is replaced to eliminate an error.

Never adjust any controllers other than those described below.

(1) Adjusting the 7.2” LCD

(a) Adjustment positions (viewed from the rear of the display)



(b) Adjustment

(i) Setting the mode and the horizontal position

By adjusting SW1, the mode and the horizontal position can be changed as indicated in the table below. In inverted mode, black characters are displayed on a white background. The default setting is 9.

Mode		8-level gray scale	4-level gray scale	Inverted 8-level gray scale	Inverted 4-level gray scale
Horizontal position	1 dot to the right	0	4	8	C
	Standard	1	5	9	D
	1 dot to the left	2	6	A	E
	2 dots to the left	3	7	B	F

(ii) Setting the contrast

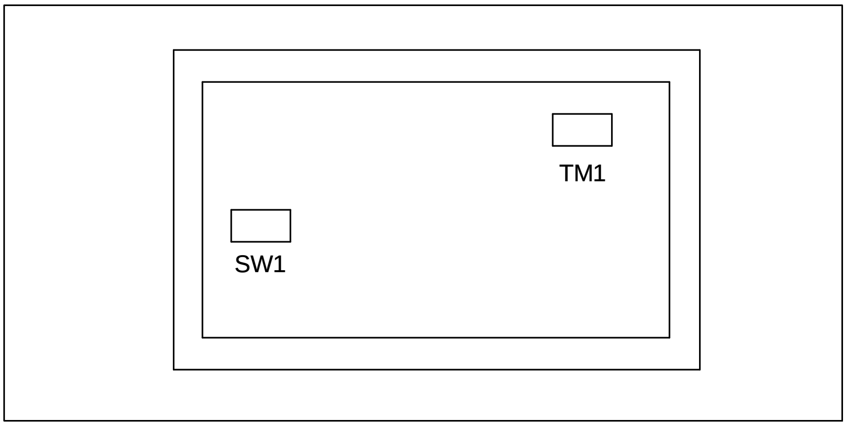
The contrast is adjusted by using VRP1.

(iii) Eliminating flicker

Flicker eliminated by adjusting VR1. Do not adjust VR1 if no flicker is apparent.

(2) Adjusting the 8.4” LCD

(a) Adjustment positions (viewed from the rear of the display)



(b) Adjustment

(i) Setting the horizontal position

- By adjusting SW1, the horizontal position can be changed as described below:

  When SW1 is turned to the next position in the + direction, the screen shifts to the right by one dot.

  When SW1 is turned to the next position in the – direction, the screen shifts to the left by one dot.

- The entire screen can be displayed.

  The entire screen display can be obtained by a single setting.

(ii) Eliminating flicker

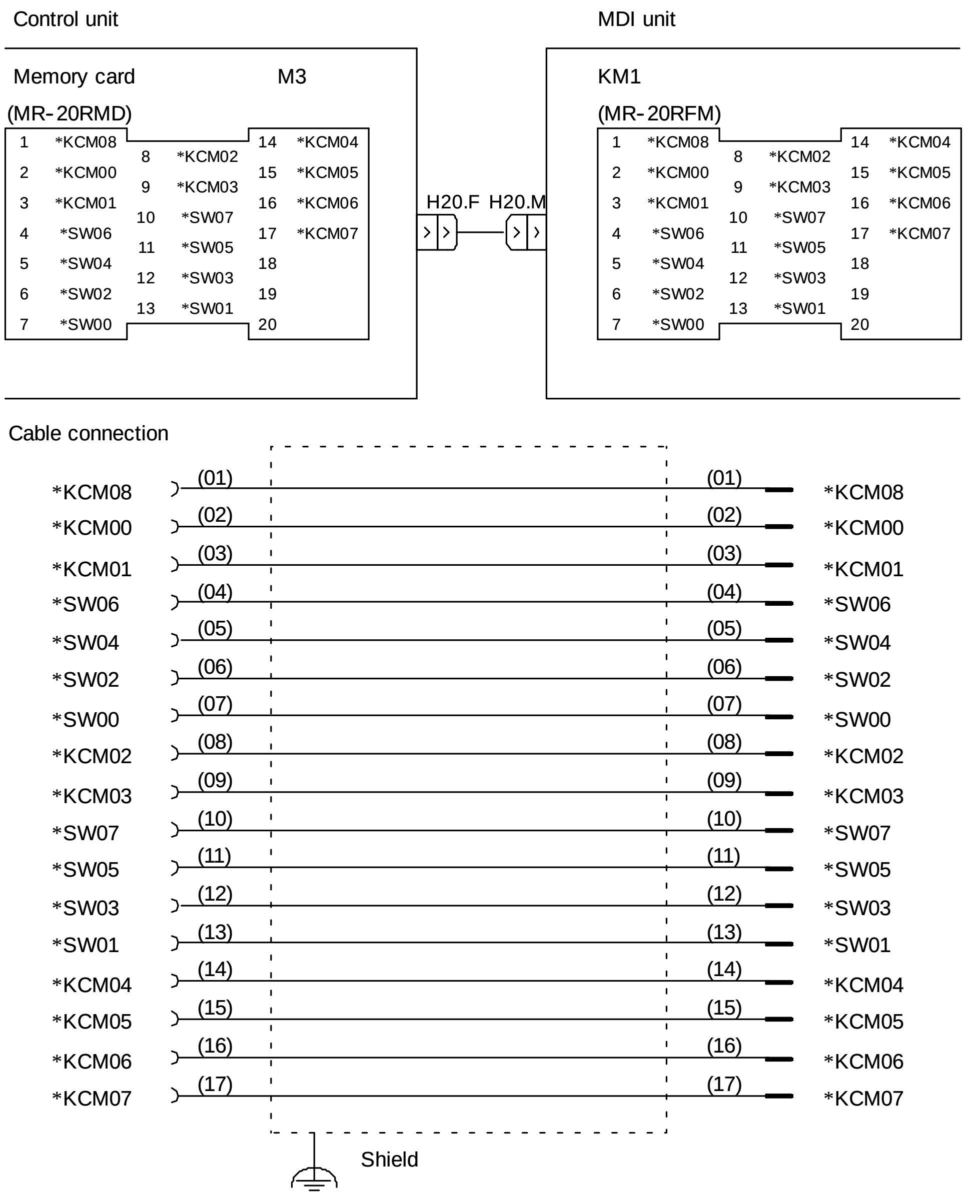
Flicker adjustment pin TM1 is used. Adjustment pin TM1 can be set to either of positions A and B. Adjustment pin TM1 is factory–set to the B position. If flicker is apparent, set adjustment pin TM1 to the A position.

Brightness of the monochrome LCD

When the ambient temperature is low, the brightness of the LCD decreases. (In particular, the LCD screen immediately after power–on is dark.) This is not a failure but a property of the LCD. As the ambient temperature rises, the LCD screen becomes brighter.
The monochrome LCD provides a function for adjusting its brightness. For an explanation of how to adjust the brightness, refer to the maintenance manual or operator’s manual of the Series 21*i*/210*i*.

D Connection to MDI unit

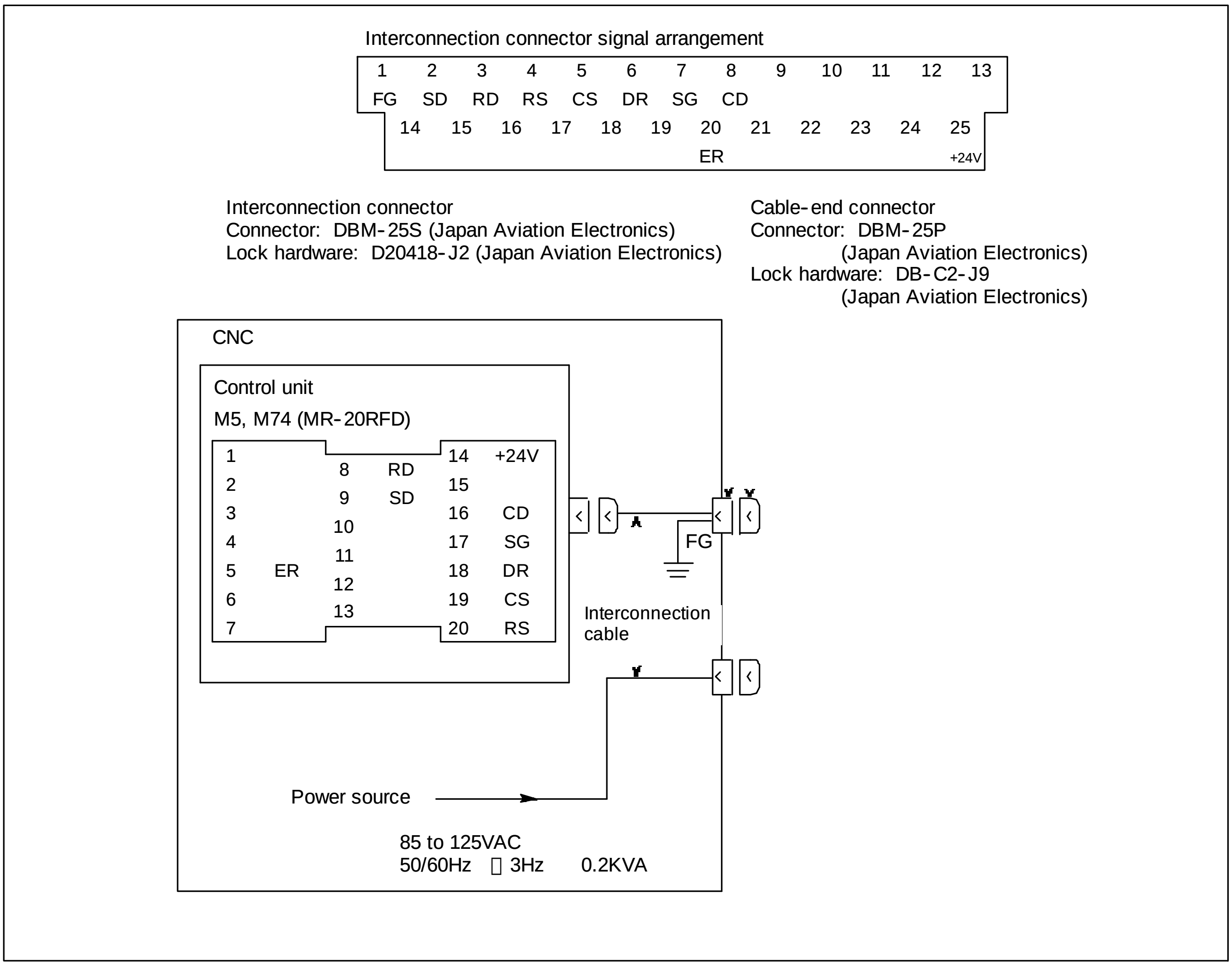
MDI unit interface



Use unified shield cable and the length is 50m or less.

Recommended cable : A02B-0050-K803 (7m) or A02B-0098-K803 (7m)
Recommended cable material : A66L-0001-0041 (7/0. 18, 20 core)

2.3.2 Reader/Puncher Interface



NOTE

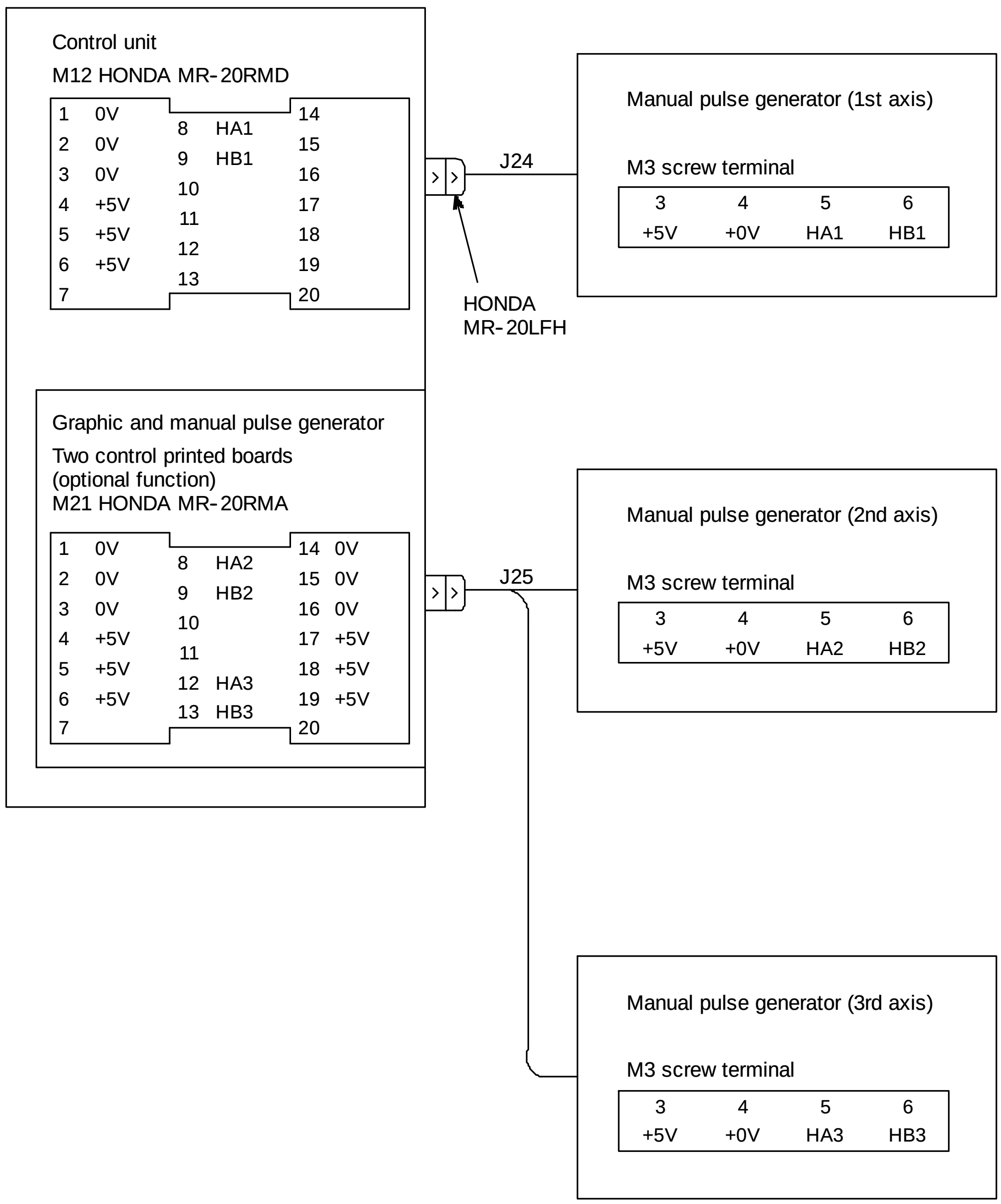
1 The machine tool builder is requested to provide the interconnection connectors and cables.

2 The machine tool builder is also requested to provide a power source for the PPR.

3 Use a common shielded cable for the signal cable.
Recommended cable specification: A66L-0001-0041

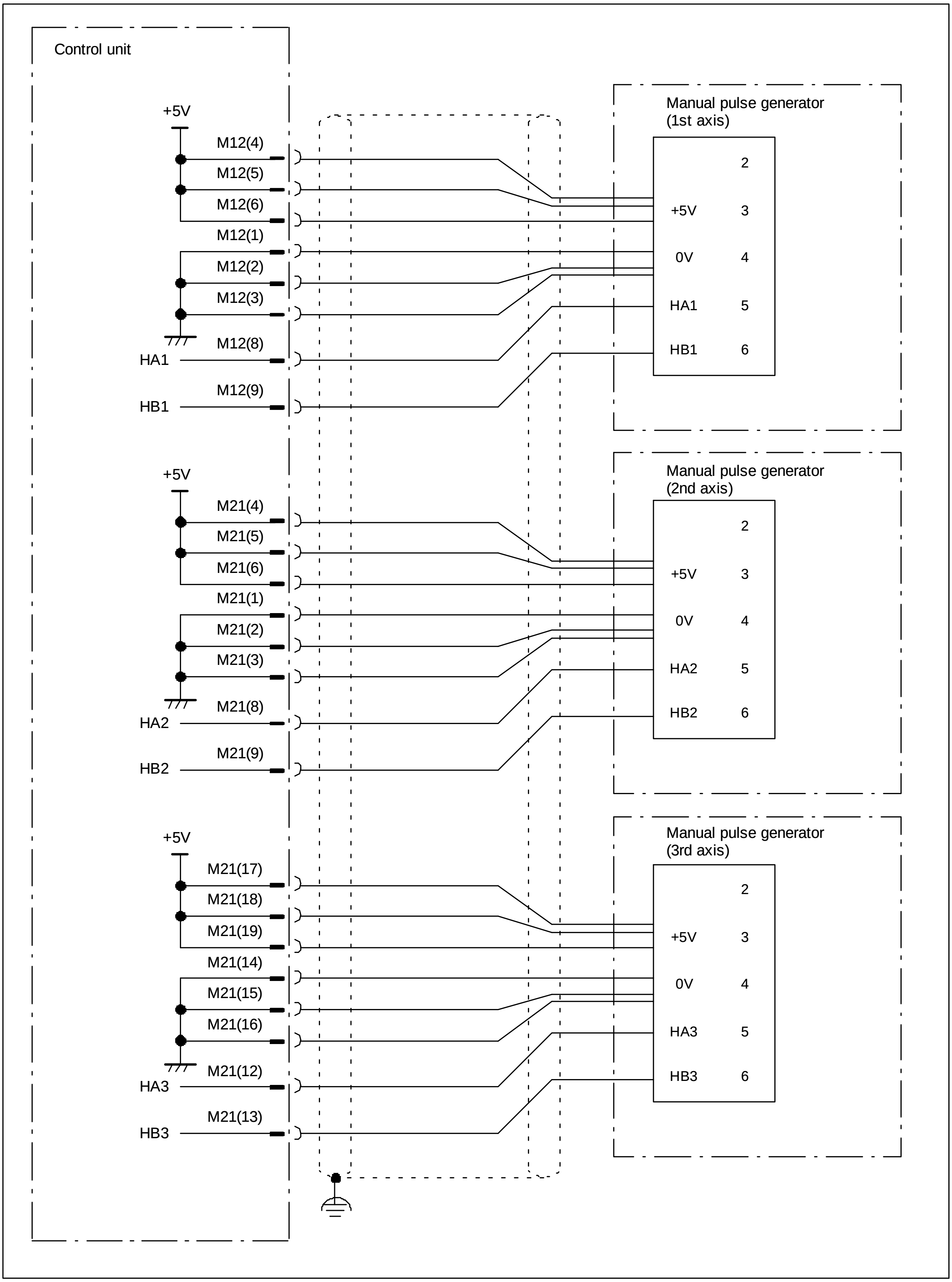
4 When the PPR is connected, set parameters so that the reader/punch interface becomes usable. The interface is at 4800 baud.

2.3.3 Manual Pulse Generator



Cable spec. : 7/0.18 (0.2mm^2) or more unified shielded cable
Recommended cable spec : A66L-0001-0041

A02B-0050-K802 (7m) can be used for J24.


Control unit
+5V
M12(4)
M12(5)
M12(6)
M12(1)
M12(2)
M12(3)
M12(8)
HA1
M12(9)
HB1
+5V
M21(4)
M21(5)
M21(6)
M21(1)
M21(2)
M21(3)
M21(8)
HA2
M21(9)
HB2
+5V
M21(17)
M21(18)
M21(19)
M21(14)
M21(15)
M21(16)
M21(12)
HA3
M21(13)
HB3
Manual pulse generator
(1st axis)
2
+5V 3
0V 4
HA1 5
HB1 6
Manual pulse generator
(2nd axis)
2
+5V 3
0V 4
HA2 5
HB2 6
Manual pulse generator
(3rd axis)
2
+5V 3
0V 4
HA3 5
HB3 6

Manual pulse generator cable

Similarly to the pulse coder, the manual pulse generator is designed to operate on 5 VDC. So, any voltage drop relative to the supply voltage must be kept to within 0.2 V (total drop through the 0 V and 5 V lines). Namely:

$$0.2 \geq \frac{0.1 \times R \times 2L}{m}$$

where
0.1 : Current required by the manual pulse generator
R : Wire resistance per unit length [Ω/m]
m : Number of wires in the 0 V or 5 V cable
L : Cable length [m]

Thus,

$$L \leq \frac{m}{R}$$

2.3.4 I/O Link

D Configuration of the I/O Link (Eg)

The figure below illustrates a typical I/O Link configuration.

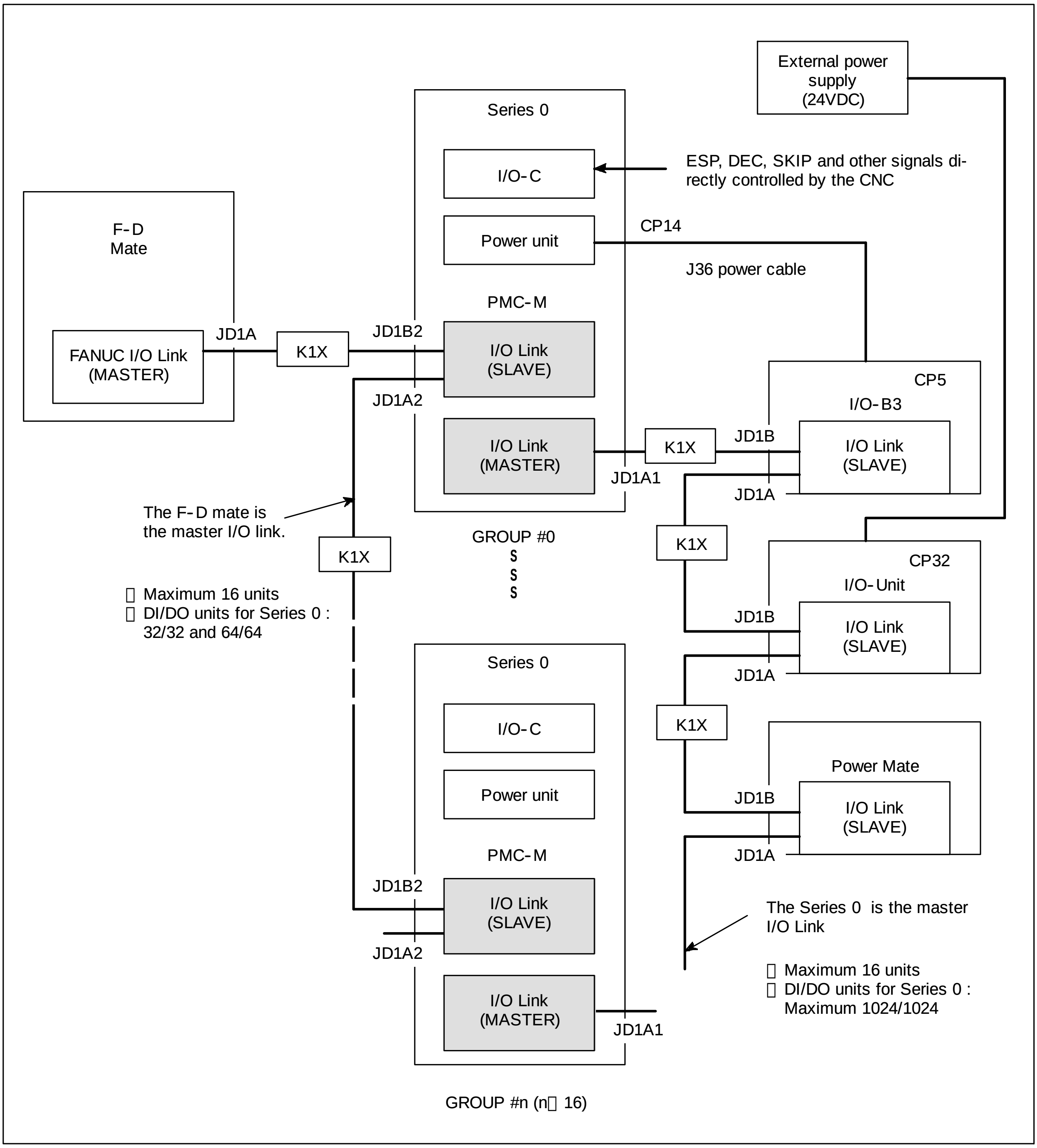


Fig. 2.3.4 (a) Typical I/O Link configuration

D Signal cable connections

Details of the K1X cable shown in the connection diagram are given below.

(1) When FD–Mate is master and Series 0 is slave

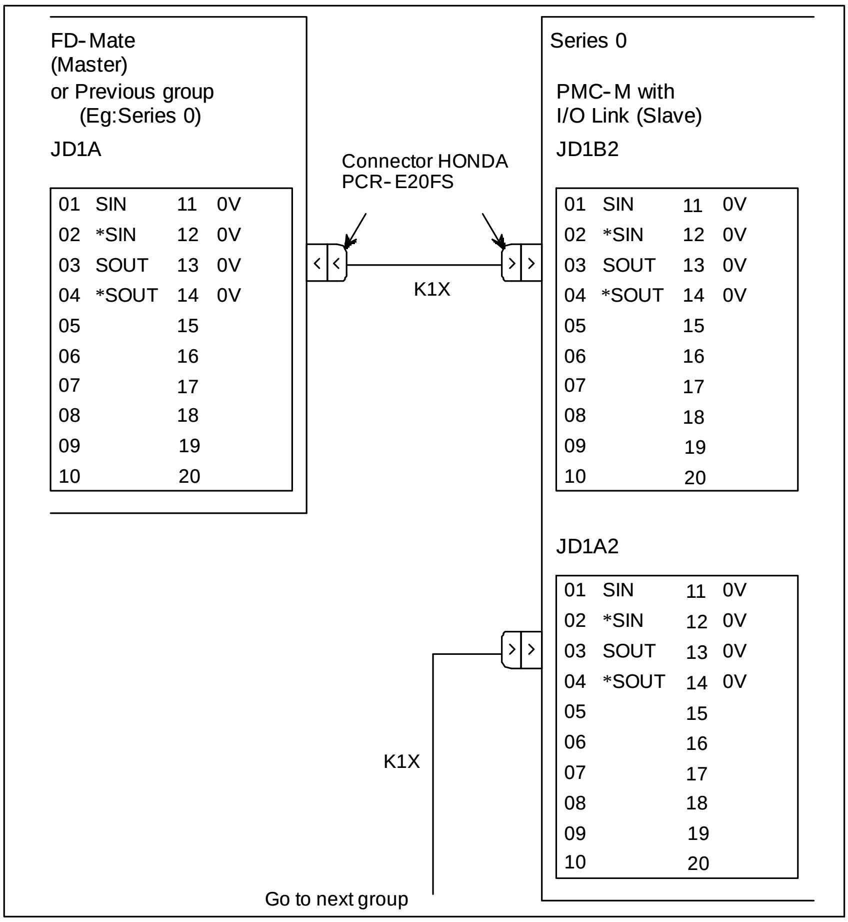


Fig. 2.3.4 (b)

(2) When Series 0 is master and I/O–B3, Power Mate and I/O unit are slaves

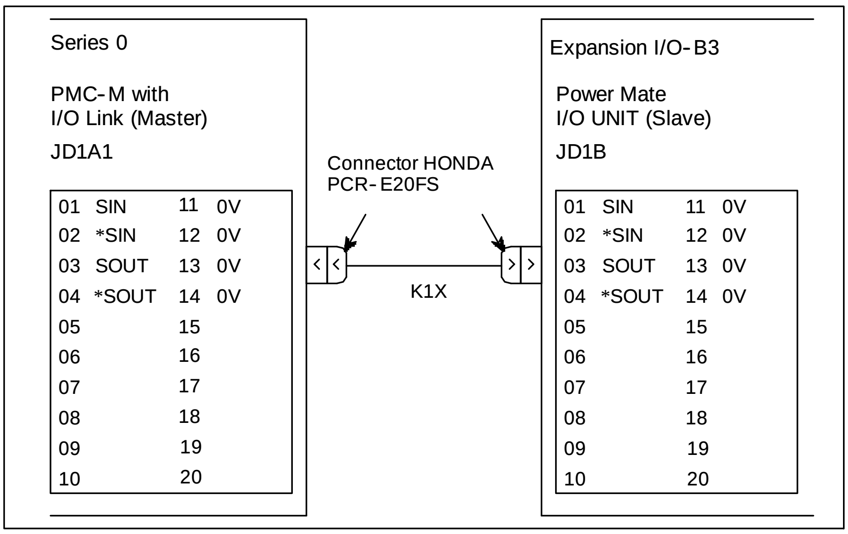


Fig. 2.3.4 (c)

(3) Expansion I/O-B2, B3, F1, F3 and F4 power cable connection (J36)

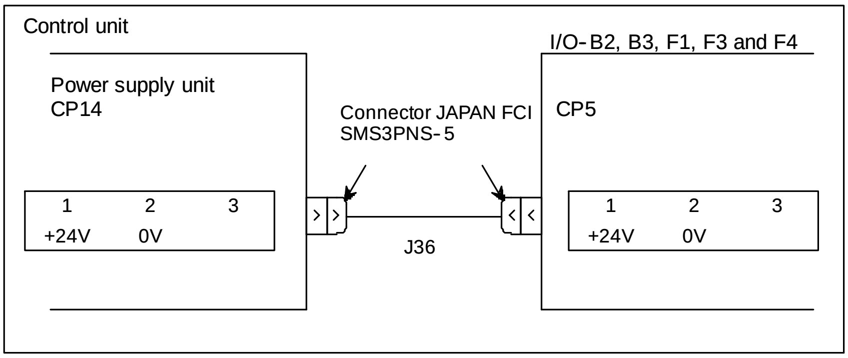


Fig. 2.3.4 (d)

(4) I/O Unit-MODEL A power cable connection

Prepare a power supply other than the Series 0 power unit and use the interface module (AIF01A) connector CP32 to make the required connections.

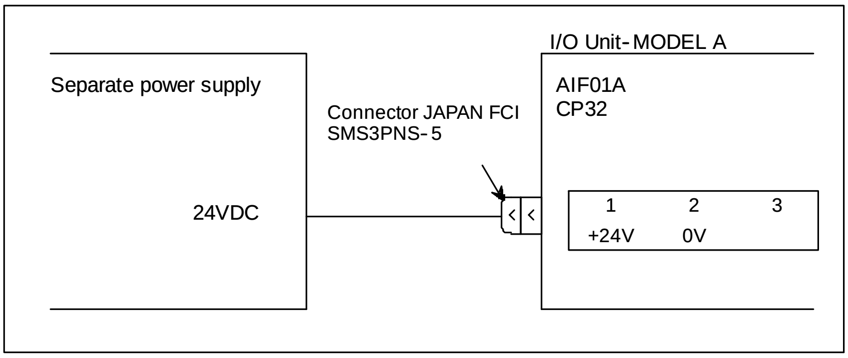


Fig. 2.3.4 (e)

(5) Cable K1X details

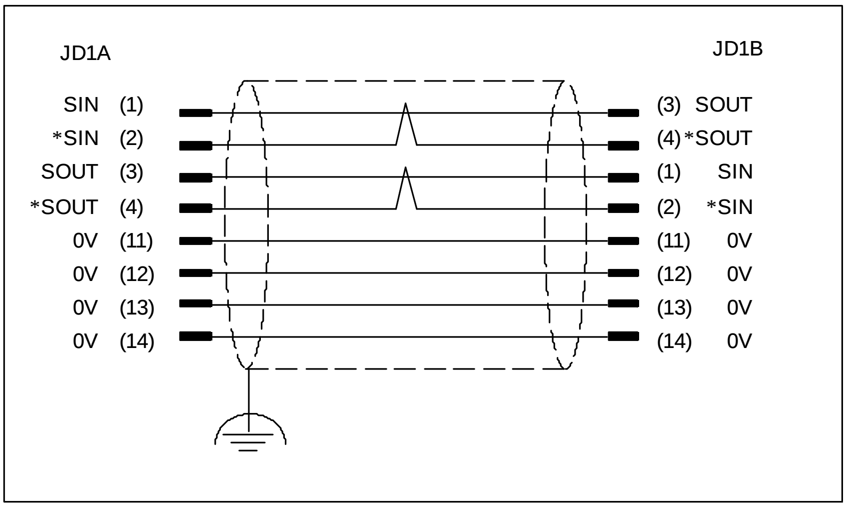


Fig. 2.3.4 (f)

- The SIN, *SIN and SOUT, *SOUT signals must be connected by twisted pair cable.
- Recommended cable: A66L–0001–0284#10P (single shield twisted pair)
- The cable shield should be clamped with a cable clamp to the cabinet earth plate on the JD1A side.
- Maximum cable length: 10m

• To turn the power on

In cases where the FANUC I/O Link slave power supply selected is neither the 24VDC supply used with the Series 0 nor the 200VAC Series 0 power supply input unit, then it is essential that the power be switched on to all slave units before it is switched on to the Series 0. In other words the Series 0, which is in this case the master, must come last.

• To turn the power off

If the power supply to any one of the slave units connected by the FANUC I/O Link is cut off then all units connected by the I/O Link, including the Series 0 itself, will assume abnormal status. To restore normal operating status all the units must be switched off and then started up again one by one in the appropriate order.

2.3.5 Servo Interface

This section describes the servo interface between the Series 0 and the digital control AC servo amplifier and servo motor.

The Series 0 supports three types of axis control cards according to the type of the pulse coder built into the servo motor or type of the servo interface.

For an explanation of each servo amplifier unit and servo motor, refer to the relevant manual.

- Axis control card for A/B–phase pulse coders (Type A interface)
- Axis control card for serial pulse coders (Type A interface)
- Axis control card for type B interface

Axis control cards for serial pulse coders can also be connected to an A/B–phase pulse coder.

NOTE
In a closed loop system using a separate pulse coder, the axis control cards for the A/B–phase pulse coders and those for serial pulse coders use different connectors for their feedback cables.

D Connector names

Table 2.3.5 (1/2)

Axis name	Axis control card for A/B-phase pulse coders				Axis control card for serial pulse coders			
	Command	Semi-closed loop	Closed loop		Command	Semi-closed loop	Closed loop	
		Feedback	Position feedback	Velocity feedback		Feedback	Position feedback	Velocity feedback
1st axis	M34	M35	M35	M36	M184	M185	M186	M185
2nd axis	M37	M38	M38	M39	M187	M188	M189	M188
3rd axis	M44	M45	M45	M46	M194	M195	M196	M195
4th axis	M47	M48	M48	M49	M197	M198	M199	M198
5th axis	M64	M65	M65	M66	M204	M205	M206	M205
6th axis	M67	M68	M68	M69	M207	M208	M209	M208
7th axis	M134	M135	M135	M136	M224	M225	M226	M225
8th axis	M137	M138	M138	M139	M227	M228	M229	M228

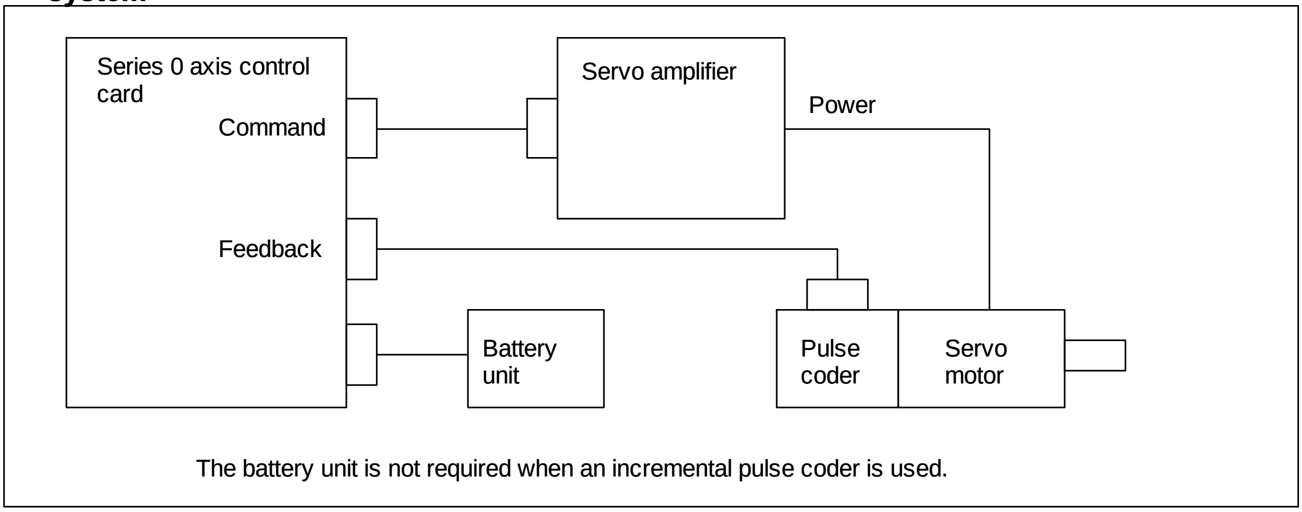
Table 2.3.5 (2/2)

Axis name	Axis control card for type B interface			
	Command	Semi-closed loop	Closed loop	
		Feedback	Position feedback	Velocity feedback
1st axis	JS1A	JFn	M186	JFn
2nd axis	JS2A	JFn	M189	JFn
3rd axis	JS3A	JFn	M196	JFn
4th axis	JS4A	JFn	M199	JFn
5th axis	Not used type B interface			
6th axis				
7th axis				
8th axis				

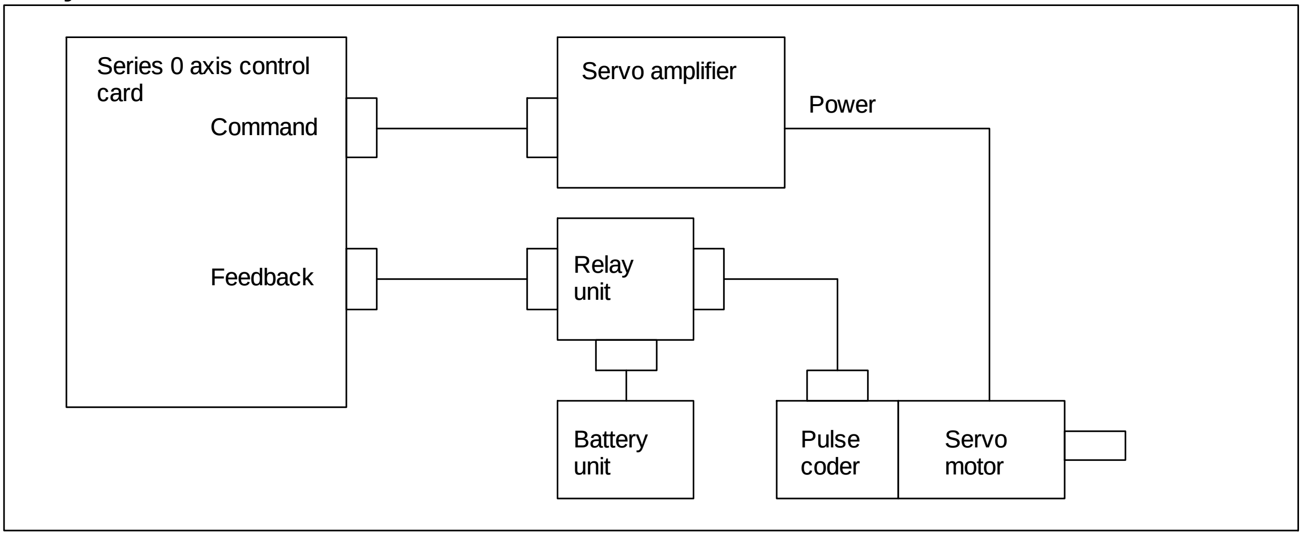
For the 0–TTC, the first and second axes for tool post 2 correspond to the fifth and sixth axes in the above table.

When an axis control card for a type B interface is used, the JFn connector on the servo amplifier side is used as the feedback or velocity feedback connector. n varies with the servo amplifier being used. A type B interface can be used for the first to fourth axes, but not for the fifth to eighth axes.

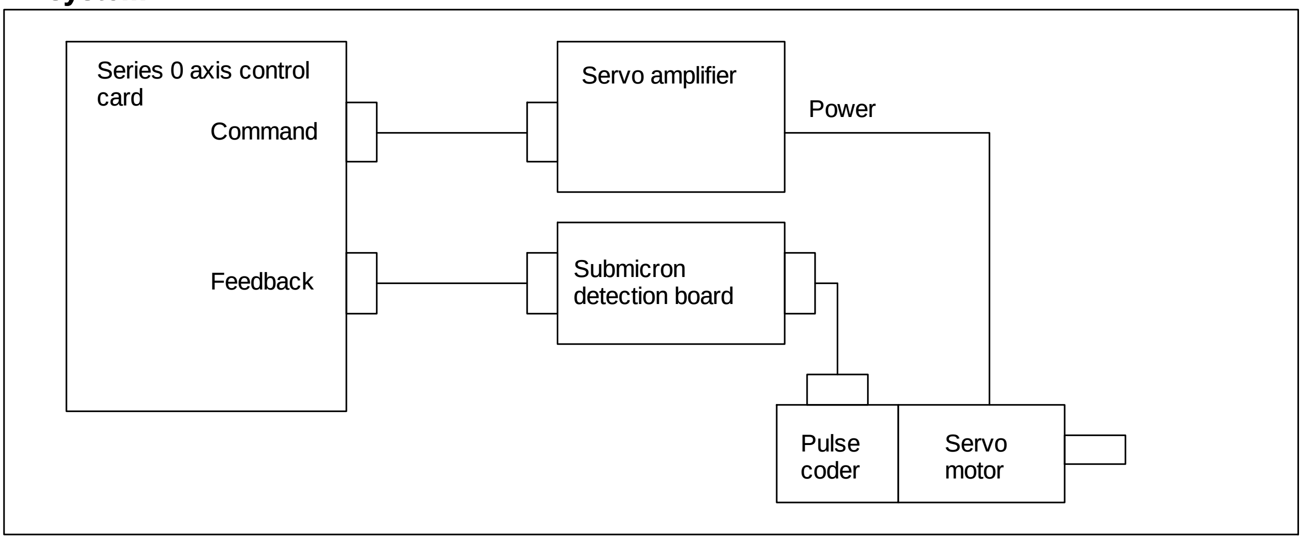
D Semi–closed loop system



D Semi–closed loop system (when an absolute pulse coder and relay unit are used)

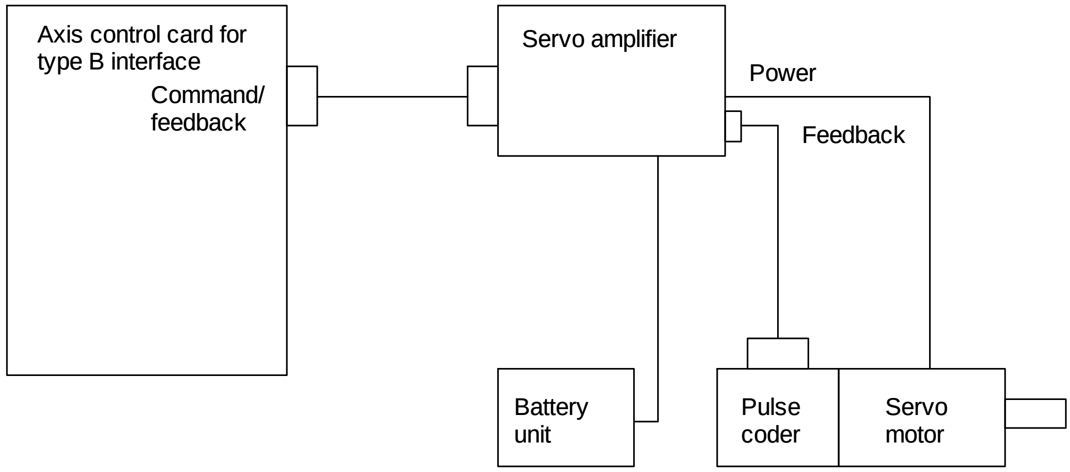


D Semi–closed loop system (when a high–speed, high–resolution A/B–phase pulse coder is used)



D Semi-closed loop system

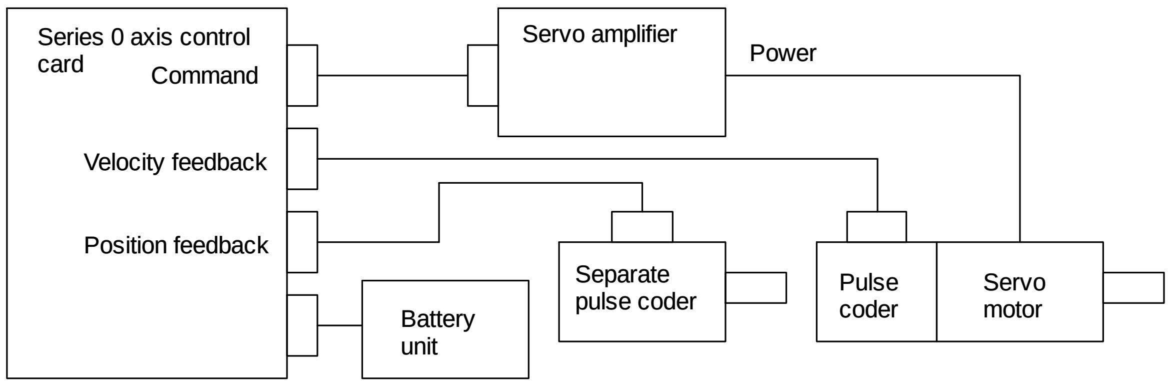
(when a type B interface is used)



The battery unit is not required when an incremental pulse coder is used.

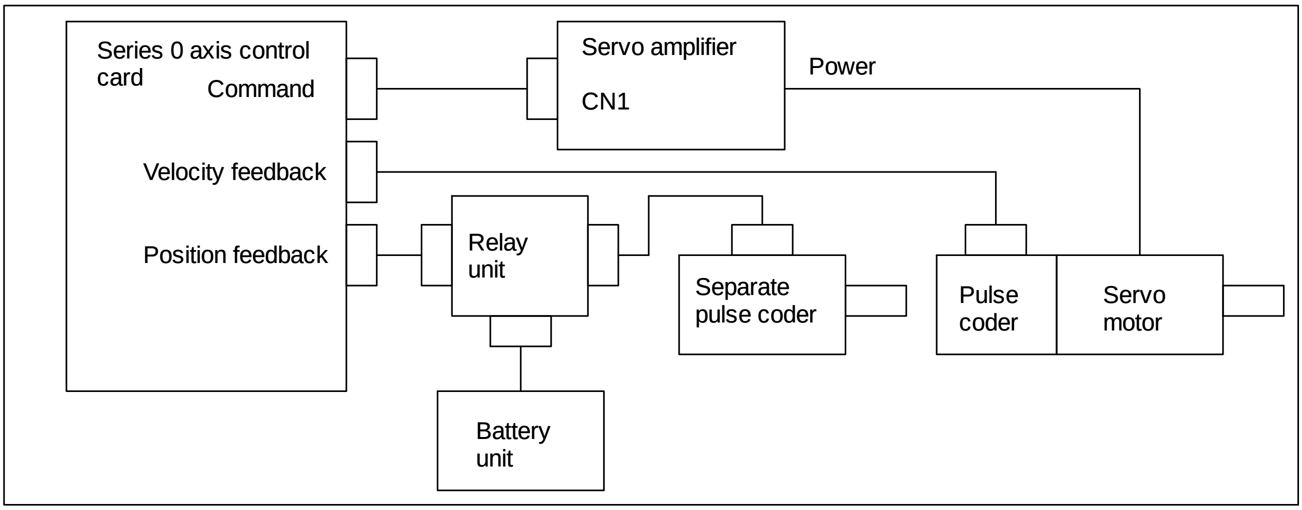
Use a servo amplifier that supports a type B interface. When a servo amplifier which supports both types of interface is used, set it to use the type B interface.

D Closed loop system

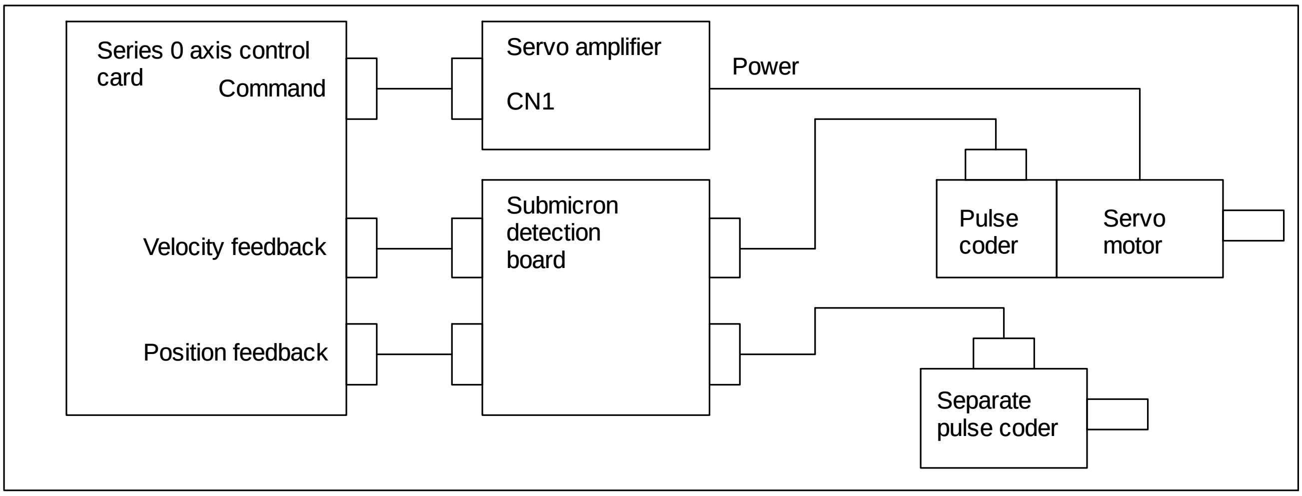


The battery unit is not required when an incremental pulse coder is used.

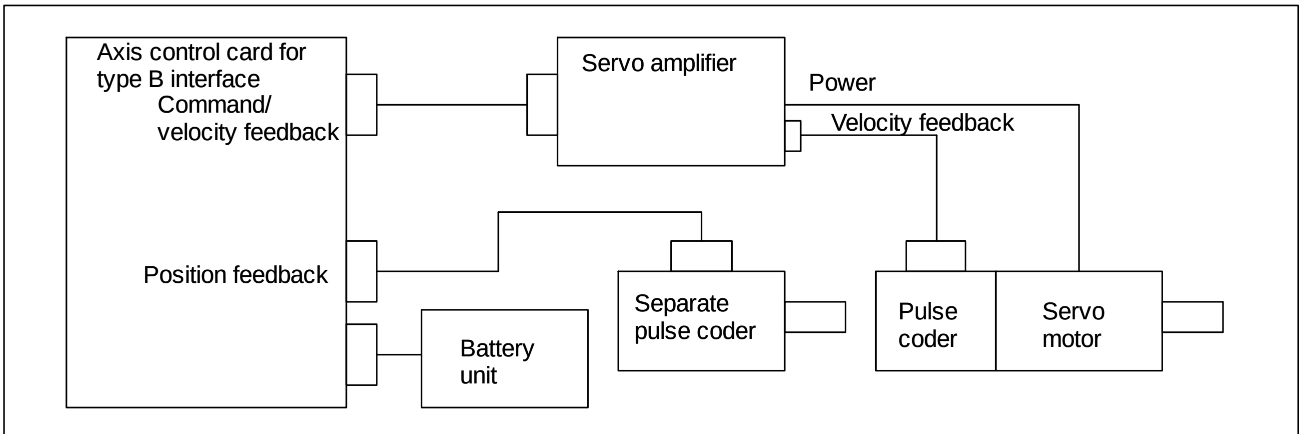
D Closed loop system (when an absolute pulse coder and relay unit are used)



D Closed loop system (when a high–speed, high–resolution A/B–phase pulse coder is used)



D Closed loop system (when a type B interface is used)

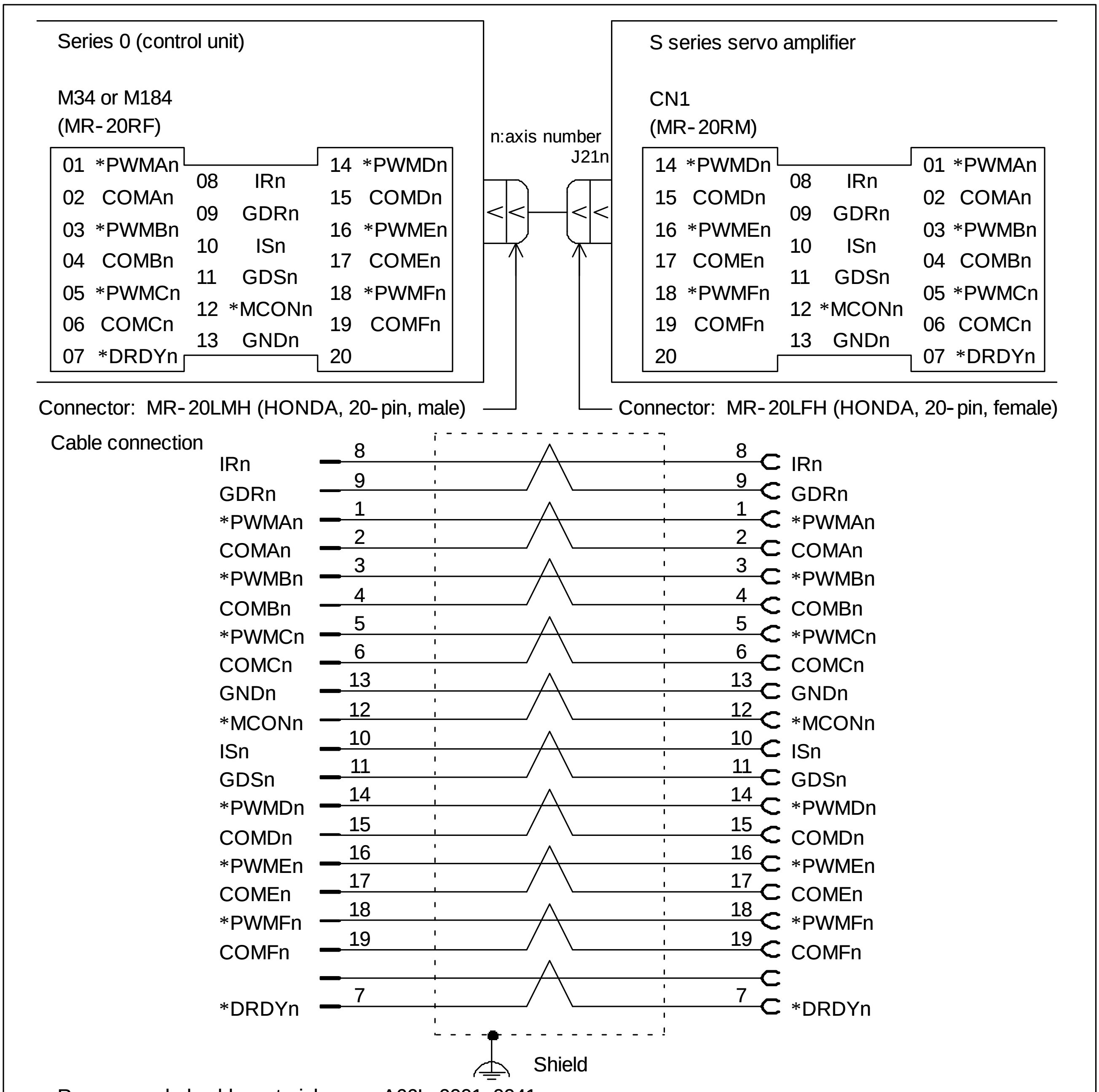


The battery unit is not required when a separate type incremental pulse coder is used.

Servo amplifier interface

This section describes each servo amplifier interface, taking that for the first axis as an example.

D S series servo amplifier



Recommended cable material A66L-0001-0041

Recommended cable specification A02B-0074-K801 (5m) or A02B-0098-K821 (5m)

NOTE

To protect the signals from external noise, assign the cable's central pairs to each pair of current feedback signal and ground signal (i.e., IRn and GDRn, and ISn and GDSn). Otherwise, external noise may result in uneven feed or abnormal sound.

D C series servo amplifier and α servo amplifier module (type A interface)

Series 0 (control unit)
M34 or M184
(MR-20RF)

01	*PWMAn			14	*PWMDn
		08	IRn		
02	COMAn			15	COMDn
		09	GDRn		
03	*PWMBn			16	*PWMEn
		10	ISn		
04	COMBn			17	COMEn
		11	GDSn		
05	*PWMCn			18	*PWMFn
		12	*MCONn		
06	COMCn			19	COMFn
		13	GNDn		
07	*DRDYn			20	

n: axis number

α servo amplifier module
JV1B (L-axis), JV2B (M-axis)
C series servo amplifier
CN1

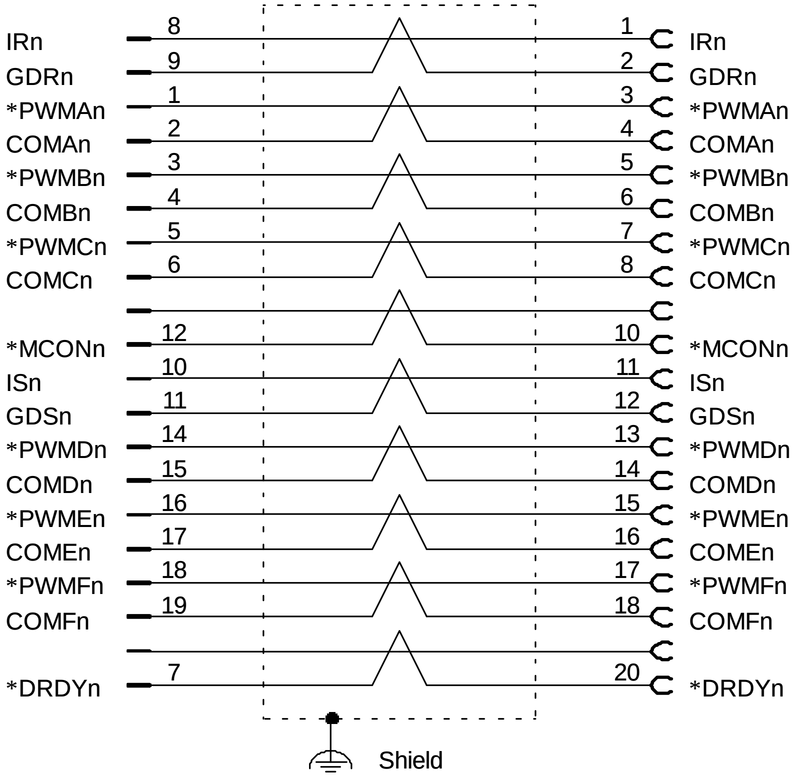
01	IRn	11	ISn
02	GDRn	12	GDSn
03	*PWMAn	13	*PWMDn
04	COMAn	14	COMDn
05	*PWMBn	15	*PWMEn
06	COMBn	16	COMEn
07	*PWMCn	17	*PWMFn
08	COMCn	18	COMFn
09		19	
10	*MCONn	20	*DRDYn

Connector: MR-20LMH (HONDA, 20-pin, male)

Connector: PCR-E20FA (HONDA, 20-pin, half-pitch) or equivalent

For a C series servo amplifier, connect the cable to M34 or M184.
For an α series servo amplifier, connect the cable to M184. It cannot be connected to M34.

Cable connection



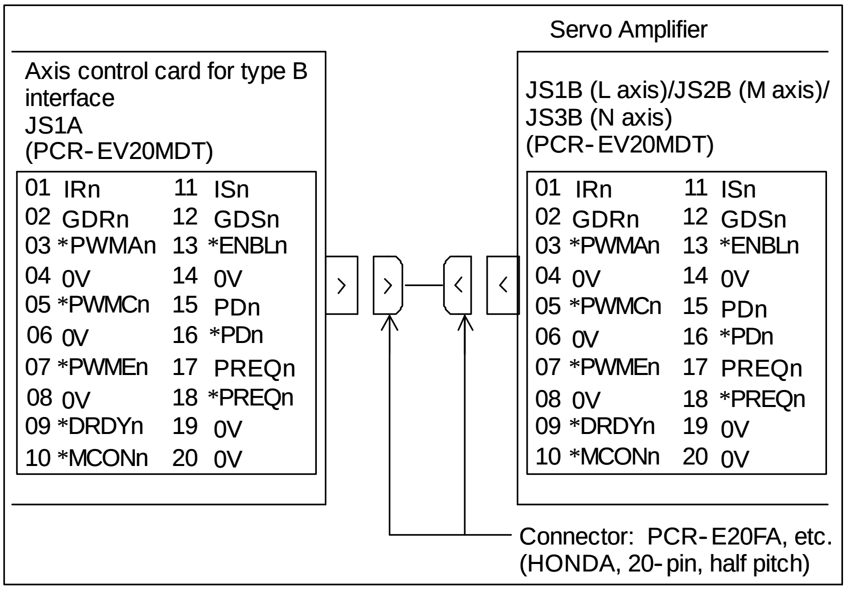
Recommended cable material A66L-0001-0284#10P (#28AWG 10pairs)

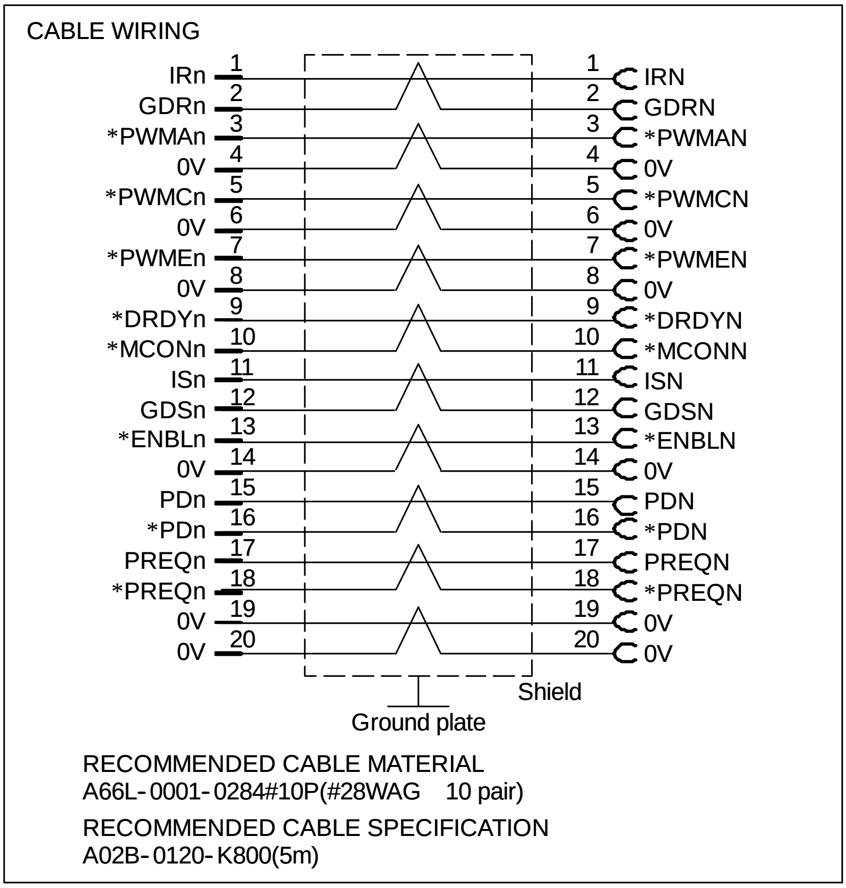
Recommended cable specification A02B-0098-K841 (5m)

NOTE

To protect the signals from external noise, assign the cable's central pairs to each pair of current feedback signal and ground signal (i.e., IRn and GDRn, and ISn and GDSn). Otherwise, external noise may result in uneven feed or abnormal sound.

D servo amplifier module (type B interface) and servo amplifier module





NOTE

1 The total length of the cable between the CNC and amplifier and that between the amplifier and motor shall not exceed 50m.

2 As the current feedback lines (IRn and ISn), use the middle twisted pair of the recommended cable. If any other pair is used, abnormal noise or oscillation may occur.

3 Use a servo unit which supports the type-B interface. When using a servo unit which supports both the type-A and type-B interfaces, select the type-B interface. For details, refer to the manual supplied with the servo unit. If the interface setting is incorrect, a servo alarm (AL401 V READY OFF) will be issued.

A/B phase pulse coder interface

D Low-resolution A/B phase pulse coder (2000P to 3000P) (built-in incremental pulse coder)

Series 0 (control unit)
M35 or M185
(MR-20RM)

01	0V			14	PCZn
		08	OHnA		
02	0V			15	*PCZn
		09	OHnB		
03	0V			16	PCAn
		10	Cn8		
04	+5V			17	*PCAn
		11	Cn4		
05	+5V			18	PCBn
		12	Cn2		
06	+5V			19	*PCBn
		13	Cn1		
07				20	

n: axis number
J22n

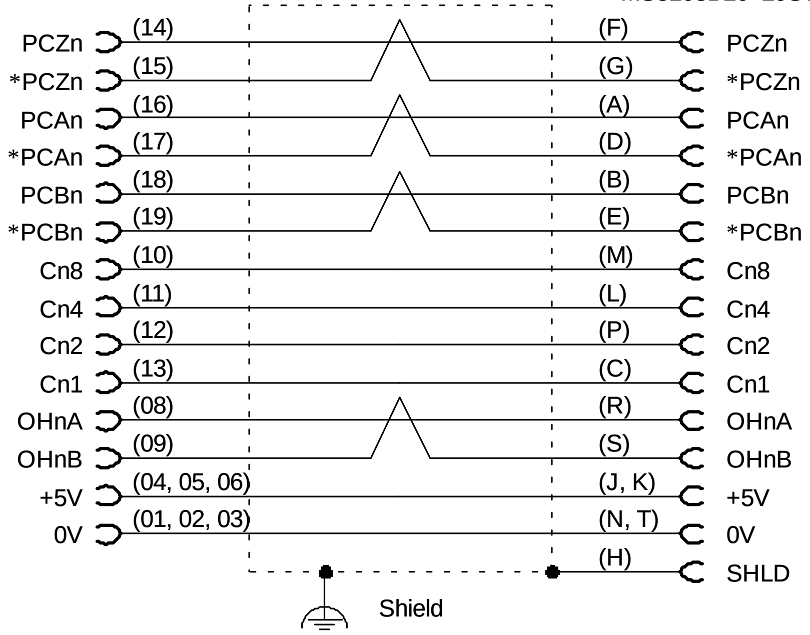
Low-resolution A/B-phase pulse coder
(built-in incremental pulse coder)
(MS3102A-20-29PW)

A	PCAn	B	PCBn	C	Cn1
D	*PCAn	E	*PCBn	F	PCZn
G	*PCZn	H	SHLD	J	+5V
K	+5V	L	Cn4	M	Cn8
N	0V	P	Cn2	R	OHnA
S	OHnB	T	0V		

Connector: MR-20LFH (HONDA, 20-pin, female)

Connector: MS3106B20-29SW (straight)
MS3108B20-29SW (elbow)

Cable connection

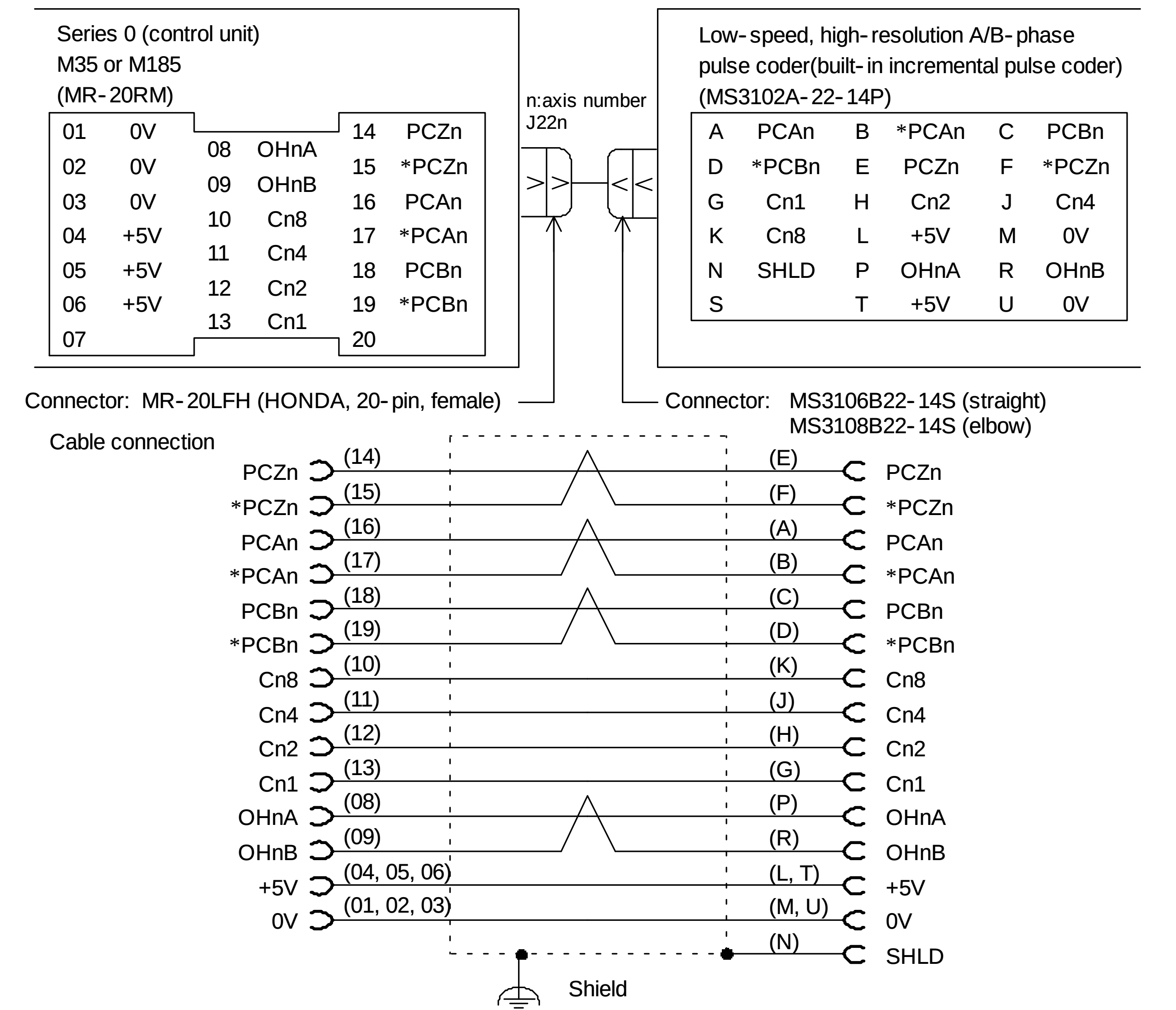


Cable material : +5V, 0V——For each, six or more vinyl-coated wires each having a cross-sectional area of 0.2 mm^2
: Cn1 to Cn8——Vinyl-coated wires each having a cross-sectional area of at least 0.2 mm^2
: Others——Unified shield twisted pair wires each having a cross-sectional area of at least 0.1 mm^2

Recommended cable specification Straight type A02B-0074-K802 (14m) or A02B-0098-K822 (14m)
Elbow type A02B-0074-K803 (14m) or A02B-0098-K823 (14m)

NOTE
The voltage resistance for +5 V must not exceed 0.5Ω, total for both ways.

D Low-speed, high-resolution A/B phase pulse coder (10000P to 25000P) (Built-in incremental pulse coder)



Cable material : +5V, 0V——For each, six or more vinyl-coated wires each having a cross-sectional area of 0.2 mm²
: Cn1 to Cn8——Vinyl-coated wires each having a cross-sectional area of at least 0.2 mm²
: Others——Unified shield twisted pair wires each having a cross-sectional area of at least 0.1 mm²

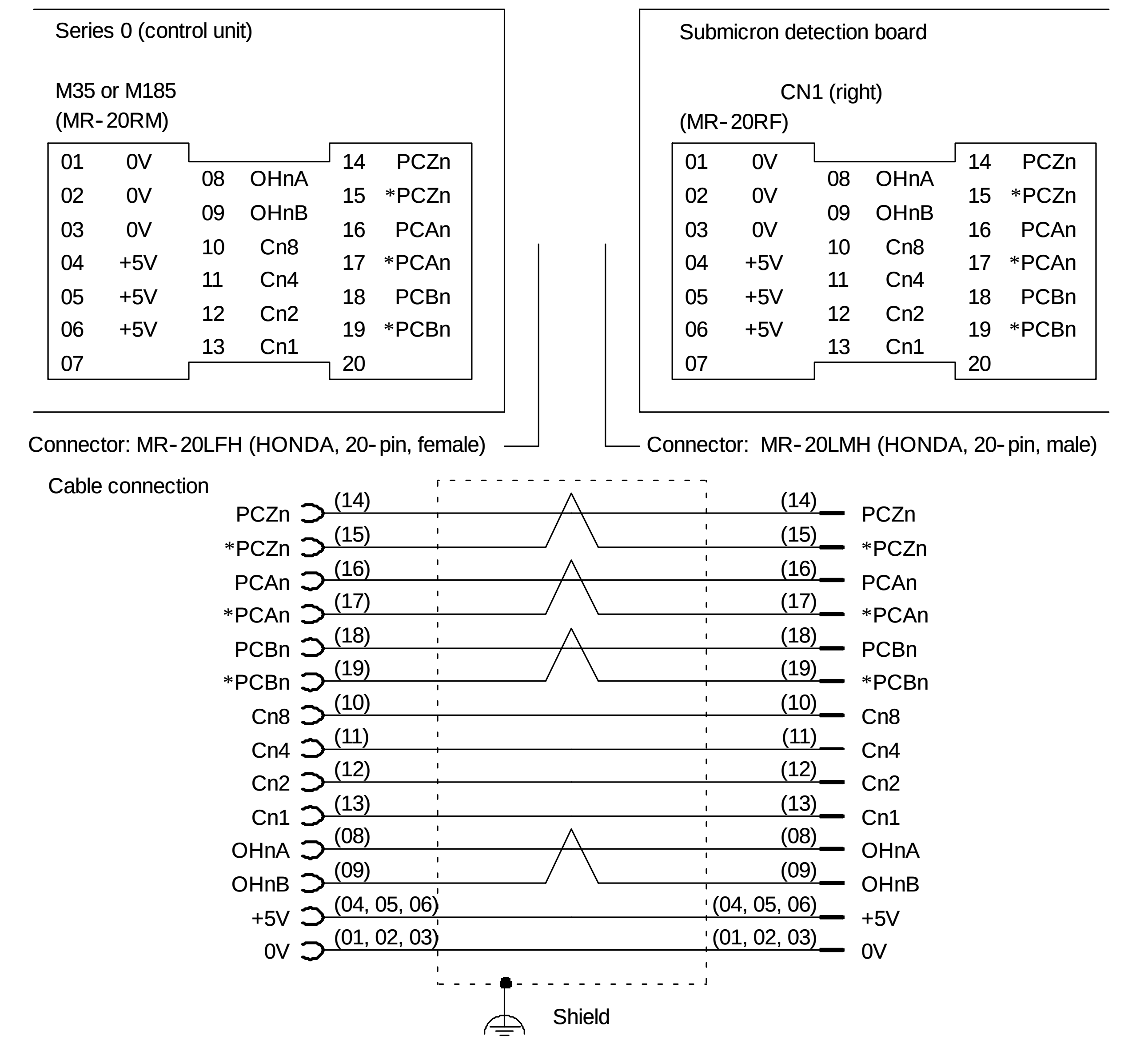
Recommended cable specification Straight type A02B-0074-K807 (14m) or A02B-0098-K827 (14m)
Elbow type A02B-0074-K808 (14m) or A02B-0098-K828 (14m)

NOTE
The voltage resistance for +5 V must not exceed 0.5Ω, total for both ways.

D High-speed, high-resolution A/B phase pulse coder (20000P to 30000P, 24 m/min) (built-in incremental pulse coder)

Connect a high-speed, high-resolution A/B-phase pulse coder via a submicron detection board.

(1) Connection between Series 0 and submicron detection board

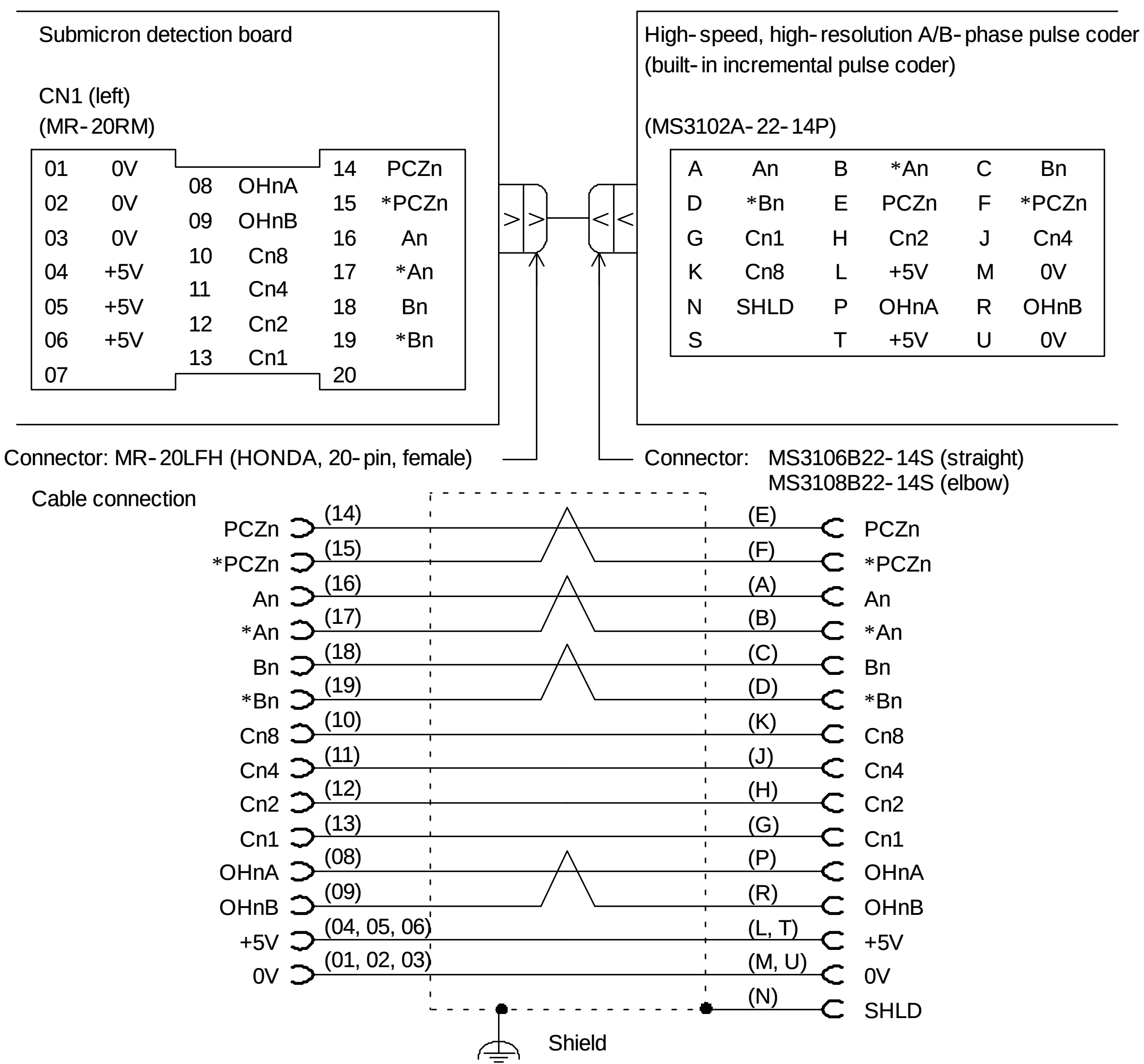


Cable material : +5V, 0V——For each, six or more vinyl-coated wires each having a cross-sectional area of 0.2 mm^2
: Cn1 to Cn8——Vinyl-coated wires each having a cross-sectional area of at least 0.2 mm^2
: Others——Unified shield twisted pair wires each having a cross-sectional area of at least 0.2 mm^2

Recommended cable material A66L-0001-0199

The cable length must not exceed 2 m.

(2) Connection between submicron detection board and high-speed, high-resolution A/B-phase pulse coder



Cable (when the cable length is 14 m or less)

Cable material : +5V, 0V——For each, six or more vinyl-coated wires each having a cross-sectional area of 0.2 mm^2
: Cn1 to Cn8——Vinyl-coated wires each having a cross-sectional area of at least 0.2 mm^2
: Others——Unified shield twisted pair wires each having a cross-sectional area of at least 0.2 mm^2

Recommended cable material A66L-0001-0199

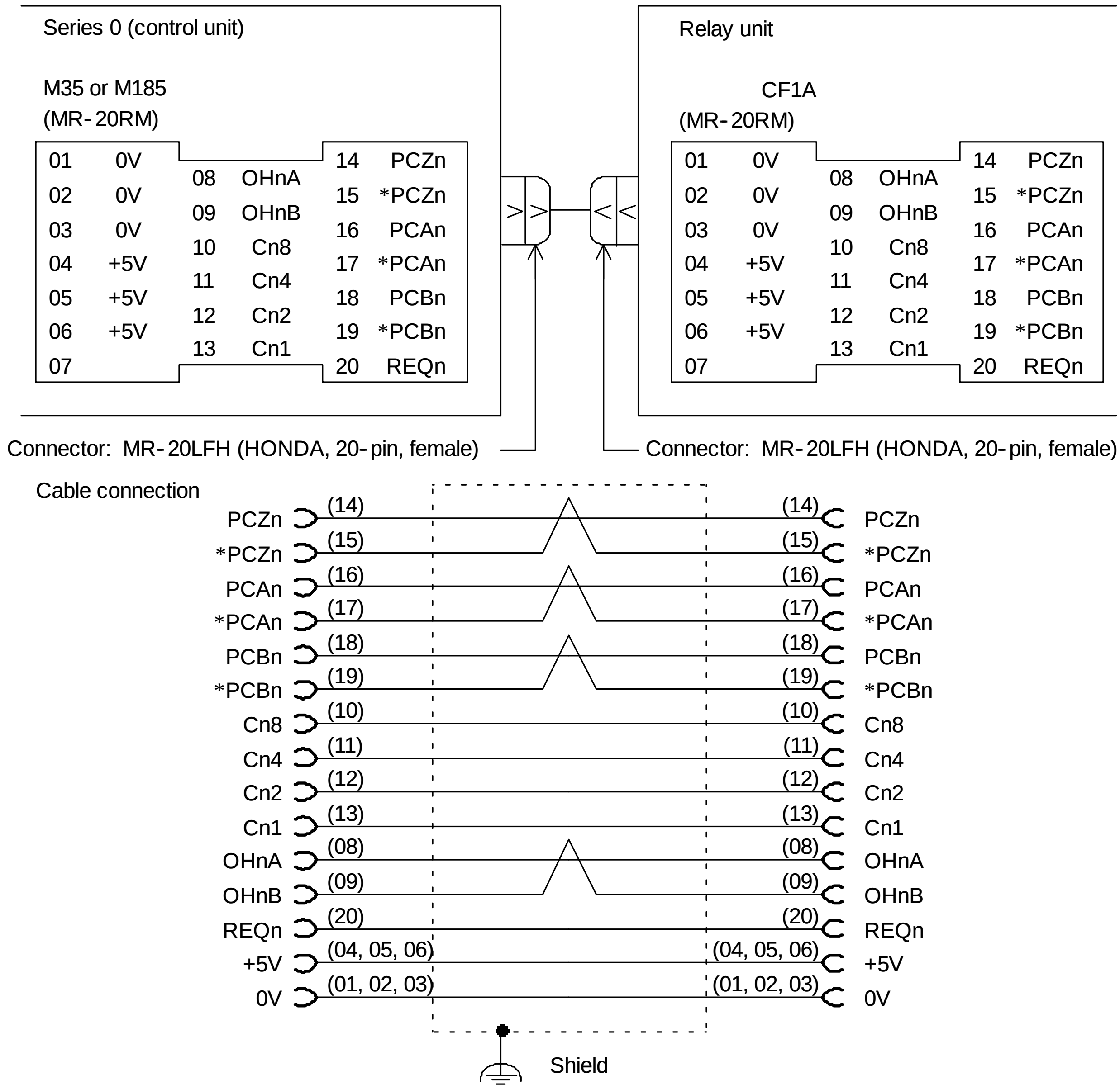
NOTE
The voltage resistance for +5 V must not exceed 0.5Ω, total for both ways.

D A/B phase pulse coder (built-in absolute pulse coder)

An A/B-phase absolute pulse coder can be connected to the Series 0 in either of two ways: via the relay unit of the absolute pulse coder battery unit, or directly.

(1) When using the relay unit

(a) Connection between Series 0 and relay unit



Cable material : +5V ——— Three or more vinyl-coated wires each having a cross-sectional area of 0.5 mm^2
: 0V ——— Three or more vinyl-coated wires each having a cross-sectional area of 0.5 mm^2
: Cn1 to Cn8 ——— Vinyl-coated wires each having a cross-sectional area of at least 0.18 mm^2
: Others ——— Unified shield twisted pair wires each having a cross-sectional area of at least 0.18 mm^2

The cable length must not exceed 2 m.

Recommended cable specification A02B-0074-K804 (2m)

(b) Connection between relay unit and A/B–phase pulse coder

Relay unit

CF1B
(MR-20RM)

01	0V			14	PCZn
02	0V	08	OHnA	15	*PCZn
03	0VA	09	OHnB	16	PCAn
04	+5V	10	Cn8	17	*PCAn
05	+5V	11	Cn4	18	PCBn
06	+6VA	12	Cn2	19	*PCBn
07		13	Cn1	20	REQn

J8n

A/B-phase pulse coder
(built-in absolute pulse coder)

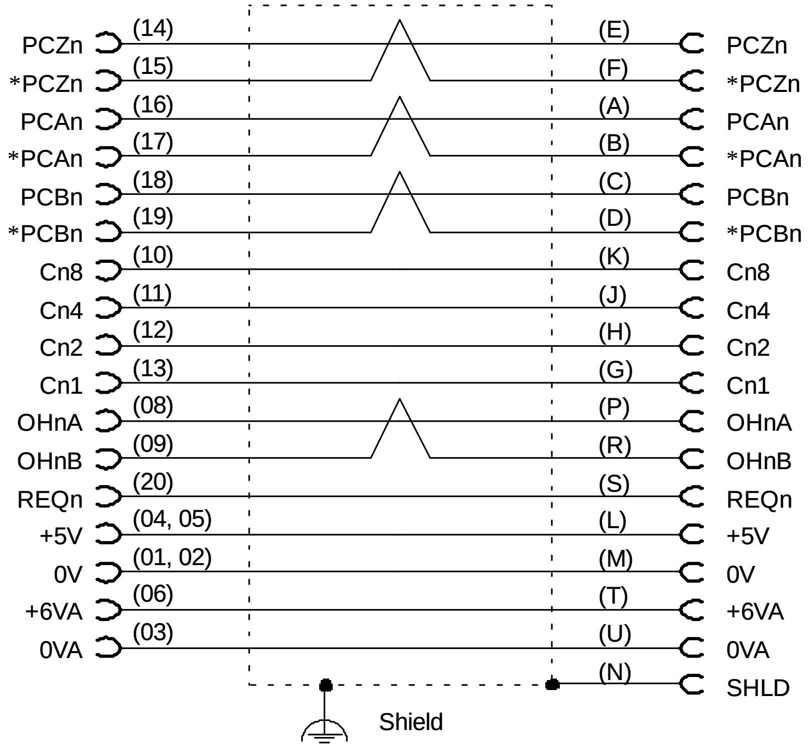
(MS3102A-22-14P)

A	PCAn	B	*PCAn	C	PCBn
D	*PCBn	E	PCZn	F	*PCZn
G	Cn1	H	Cn2	J	Cn4
K	Cn8	L	+5V	M	0V
N	G	P	OHnA	R	OHnB
S	REQn	T	+6VA	U	0VA

Connector: MR-20LFH (HONDA, 20-pin, female)

Connector: MS3106B22-14S (straight)
MS3108B22-14S (elbow)

Cable connection



Cable material : +5V, 0V——For each, two or more vinyl-coated wires each having a cross-sectional area of 0.5 mm^2
: +6VA, 0VA——For each, one or more vinyl-coated wires each having a cross-sectional area of 0.5 mm^2
: Cn1 to Cn8——Vinyl-coated wires each having a cross-sectional area of at least 0.18 mm^2
: Others——Unified shield twisted pair wires each having a cross-sectional area of at least 0.18 mm^2

Recommended cable specification Straight type A06B-6050-K055 (14m)
Elbow type A06B-6050-K056 (14m)

NOTE

The total voltage resistance for +5 V and 0 V must not exceed 0.5Ω, total for both ways, including the cable between the axis control card and the relay unit.

(2) Direct connection

Series 0 (control unit)

M35 or M185
(MR-20RM)

01	0V			14	PCZn
		08	OHnA		
02	0V			15	*PCZn
		09	OHnB		
03	0VB			16	PCAn
		10	Cn8		
04	+5V			17	*PCAn
		11	Cn4		
05	+5V			18	PCBn
		12	Cn2		
06	+5V			19	*PCBn
		13	Cn1		
07	+6VB			20	REQn

n: axis number

J22nB

A/B-phase pulse coder
(built-in absolute pulse coder)

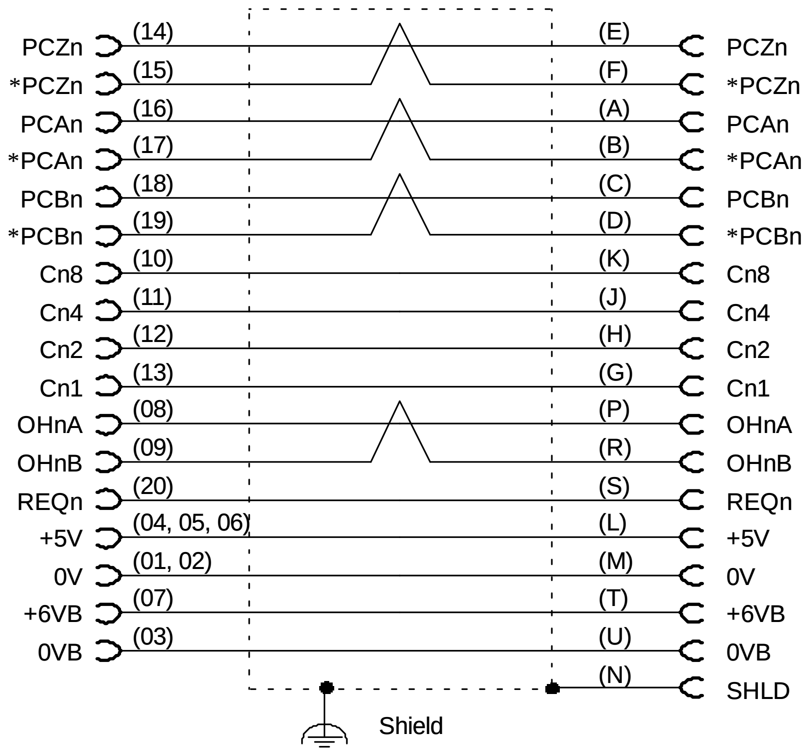
(MS3102A-22-14P)

A	PCAn	B	*PCAn	C	PCBn
D	*PCBn	E	PCZn	F	*PCZn
G	Cn1	H	Cn2	J	Cn4
K	Cn8	L	+5V	M	0V
N	SHLD	P	OHnA	R	OHnB
S	REQn	T	+6VB	U	0VB

Connector: MR-20LFH (HONDA, 20-pin, female)

Connector: MS3106B22-14S (straight)
MS3108B22-14S (elbow)

Cable connection



Cable material : +5V, ——— Two 0.5-mm^2 wires
: +6VB ——— One 0.5-mm^2 wire
: 0V ——— Two 0.5-mm^2 wires
: 0VB ——— One 0.5-mm^2 wire
: Cn1 to Cn8 ——— Vinyl-coated wires each having a cross-sectional area of at least 0.18 mm^2
: Others Unified shield twisted pair wires each having a cross-sectional area of at least 0.18 mm^2

Recommended cable specification Straight type A02B-0096-K801 (14m)
Elbow type A02B-0096-K802 (14m)

NOTE
The voltage resistance for +5 V must not exceed 0.5Ω, total for both ways.

D Low-resolution A/B phase separate pulse coder (2000P to 3000P) (separate incremental pulse coder)

(1) Velocity feedback connection

Series 0 (control unit)

M36 or M185
(MR-20RM)

01	0V	08	OHnA	14	
02	0V	09	OHnB	15	
03	0V	10	Cn8	16	PCAn
04	+5V	11	Cn4	17	*PCAn
05	+5V	12	Cn2	18	PCBn
06	+5V	13	Cn1	19	*PCBn
07				20	

Connector: MR-20LFH (HONDA, 20-pin, female)

n: axis number
J24n

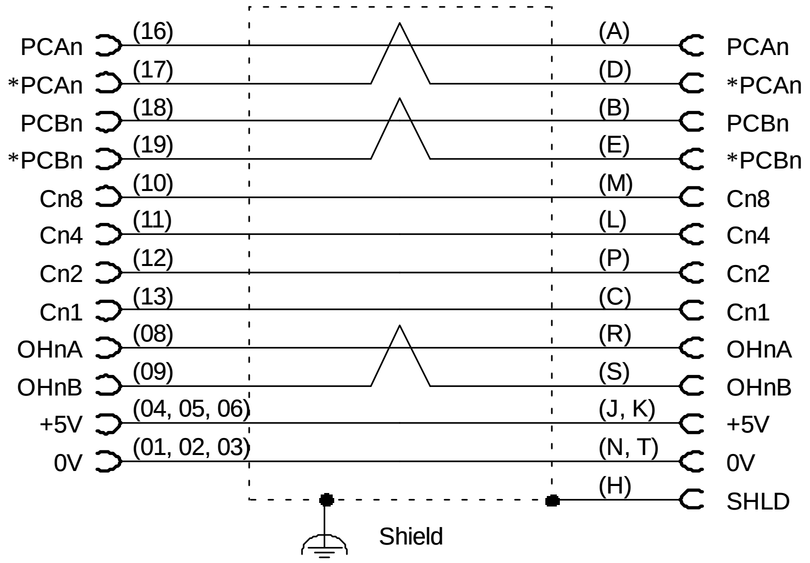
A/B-phase pulse coder
(motor built-in pulse coder)

(MS3102A-20-29PW)

A	PCAn	B	PCBn	C	Cn1
D	*PCAn	E	*PCBn	F	
G		H	SHLD	J	+5V
K	+5V	L	Cn4	M	Cn8
N	0V	P	Cn2	R	OHnA
S	OHnB	T	0V		

Connector: MS3106B20-29SW (straight)
MS3108B20-29SW (elbow)

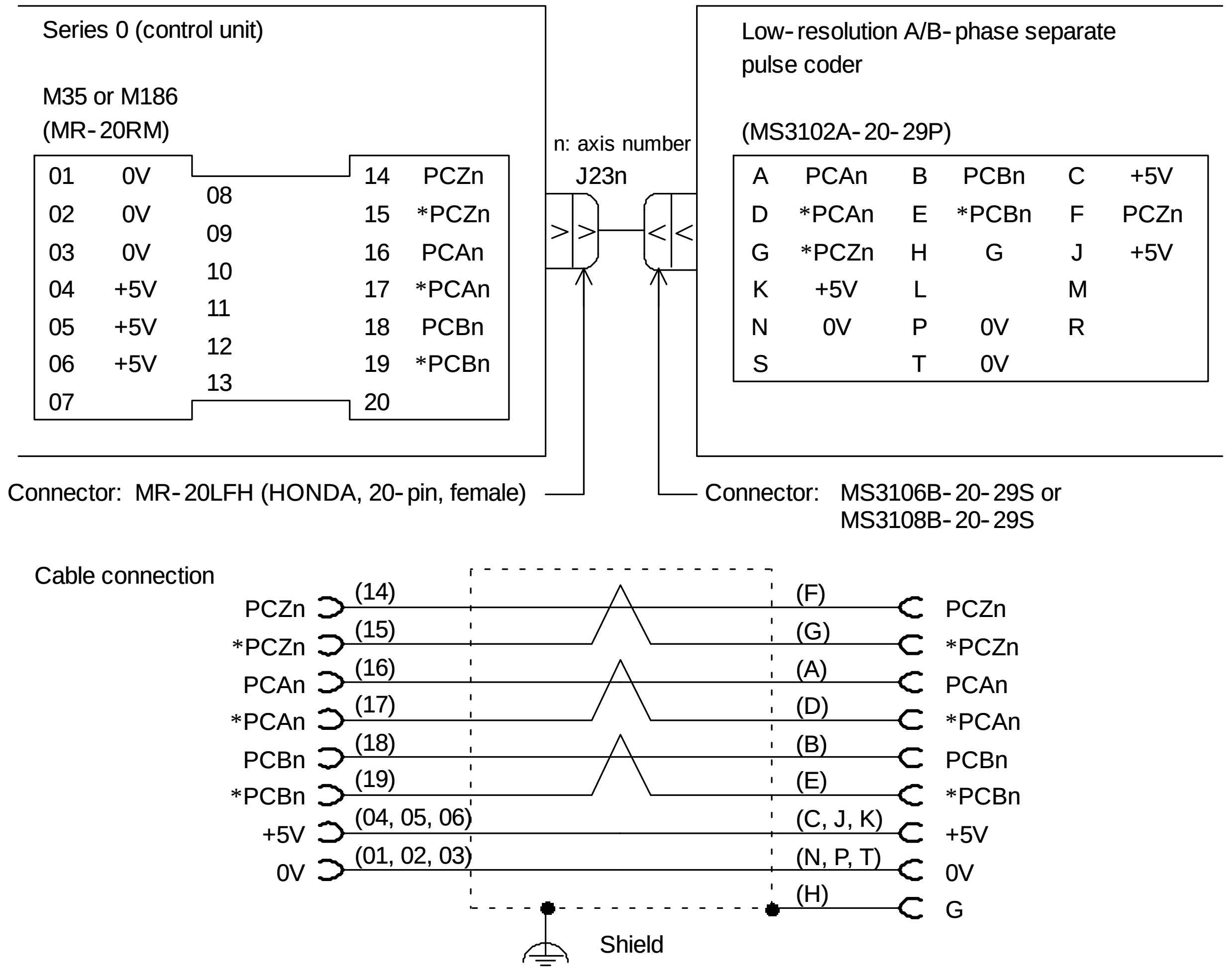
Cable connection



Cable material : +5V, 0V —— For each, six or more vinyl-coated wires each having a cross-sectional area of 0.2 mm^2
: Cn1 to Cn8 —— Vinyl-coated wires each having a cross-sectional area of at least 0.2 mm^2
: Others Unified shield twisted pair wires each having a cross-sectional area of at least 0.1 mm^2

NOTE
The total voltage resistance for +5 V and 0 V must not exceed 0.5Ω, total for both ways.

(2) Position feedback connection



Cable material : +5V, 0V — For each, six or more vinyl-coated wires each having a cross-sectional area of 0.2 mm^2

: Others — Unified shield twisted pair wires each having a cross-sectional area of at least 0.1 mm^2

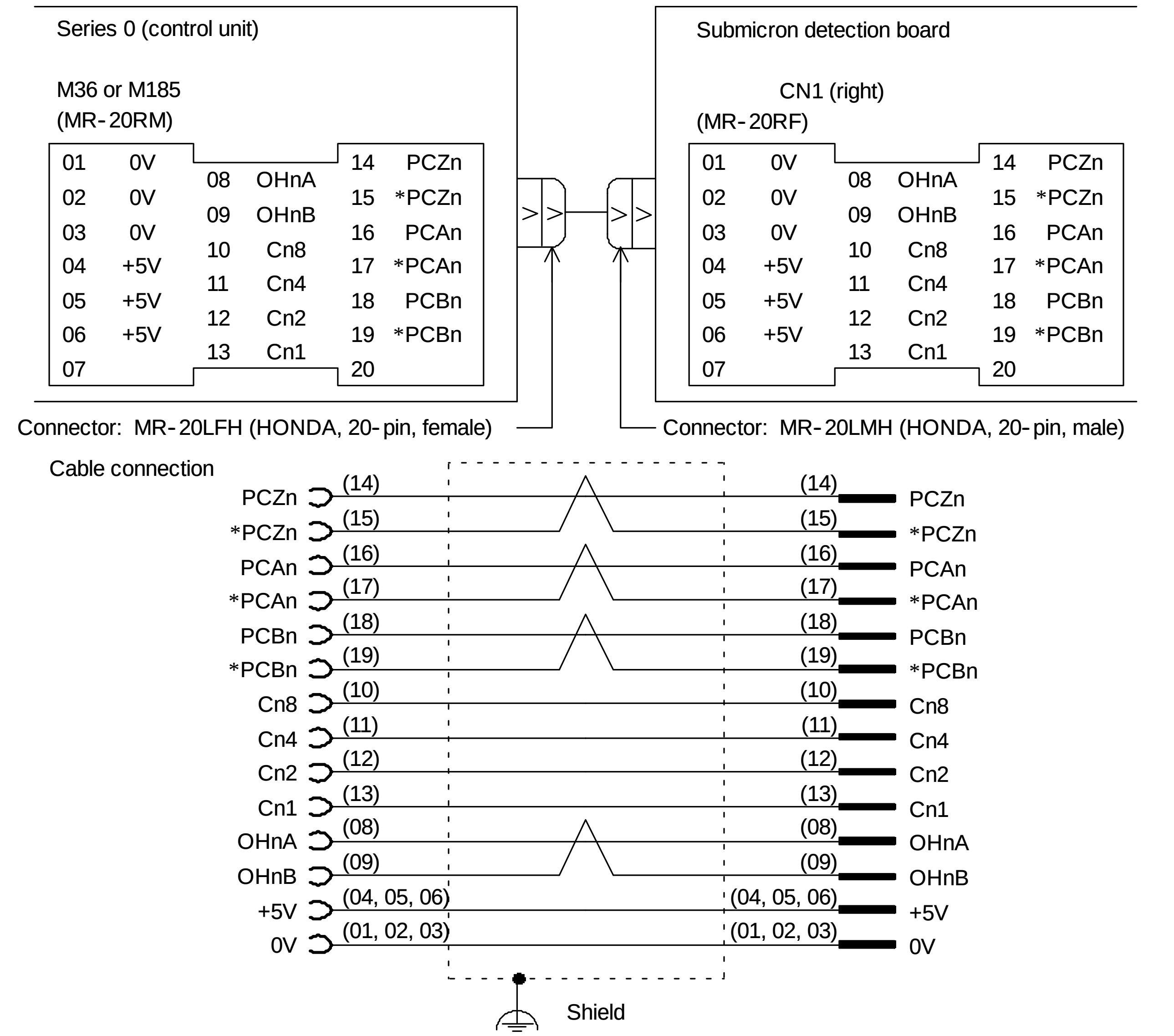
NOTE

The total voltage resistance for +5 V and 0 V must not exceed 0.5Ω, total for both ways.

D High-speed, high-resolution A/B phase separate pulse coder (2000P to 3000P, 24 m/min) (separate incremental pulse coder)

Connect a high-speed, high-resolution A/B-phase separate pulse coder via a submicron detection board.

(1) Connection between Series 0 and submicron detection board (velocity feedback connection)

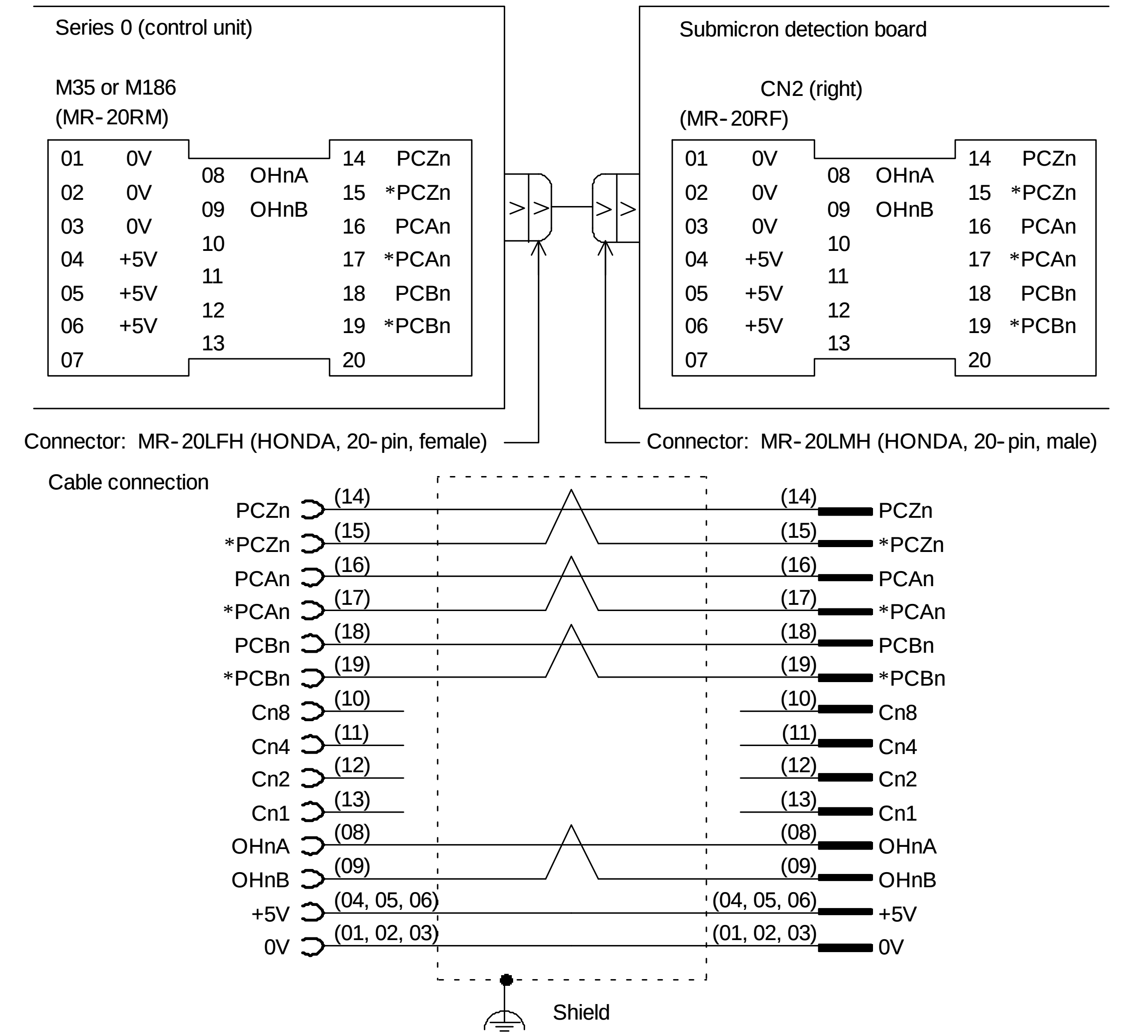


Cable material :	+5V, 0V	For each, six or more vinyl-coated wires each having a cross-sectional area of 0.2 mm^2
:	Cn1 to Cn8	Vinyl-coated wires each having a cross-sectional area of at least 0.2 mm^2
:	Others	Unified shield twisted pair wires each having a cross-sectional area of at least 0.2 mm^2

Recommended cable material A66L-0001-0199

The cable length must not exceed 2 m.

(2) Connection between Series 0 and submicron detection board (position feedback connection)



Cable material : +5V, 0V —— For each, six or more vinyl-coated wires each having a cross-sectional area of 0.2 mm^2
: Others —— Unified shield twisted pair wires each having a cross-sectional area of at least 0.2 mm^2

Recommended cable material A66L-0001-0199

The cable length must not exceed 2 m.

(3) Connection between submicron detection board and the motor's built-in pulse coder (for velocity feedback), and high-speed, high-resolution A/B-phase separate pulse coder (for position feedback)

Submicron detection board
CN1 (left) (velocity feedback)
CN2 (left) (position feedback)
(MR-20RM)

01	0V	08	OHnA	14	PCZn
02	0V	09	OHnB	15	*PCZn
03	0V	10	Cn8	16	An
04	+5V	11	Cn4	17	*An
05	+5V	12	Cn2	18	Bn
06	+5V	13	Cn1	19	*Bn
07				20	

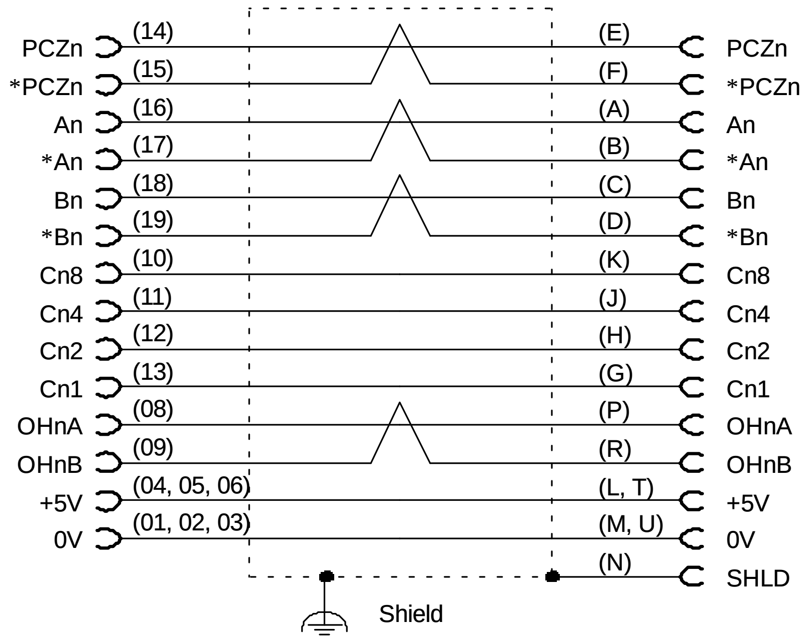
Motor's built-in pulse coder (velocity feedback)
High-speed, high-resolution A/B-phase separate pulse coder (position feedback)
(MS3102A-22-14P)

A	An	B	*An	C	Bn
D	*Bn	E	PCZn	F	*PCZn
G	Cn1	H	Cn2	J	Cn4
K	Cn8	L	+5V	M	0V
N	G	P	OHnA	R	OHnB
S		T	+5V	U	0V

Connector: MR-20LFH (HONDA, 20-pin, female)

Connector MS3106B-22-14S or MS3108B-22-14S

Cable connection



When the cable length is 14 m or less

Cable material : +5V, 0V—For each, six or more vinyl-coated wires each having a cross-sectional area of 0.2 mm^2
: Cn1 to Cn8—Vinyl-coated wires each having a cross-sectional area of at least 0.2 mm^2
: Others—Unified shield twisted pair wires each having a cross-sectional area of at least 0.2 mm^2

Recommended cable material A66L-0001-0199

D A/B Phase Separate Pulse Coder (Separate Absolute Pulse Coder)

(1) Velocity feedback connection

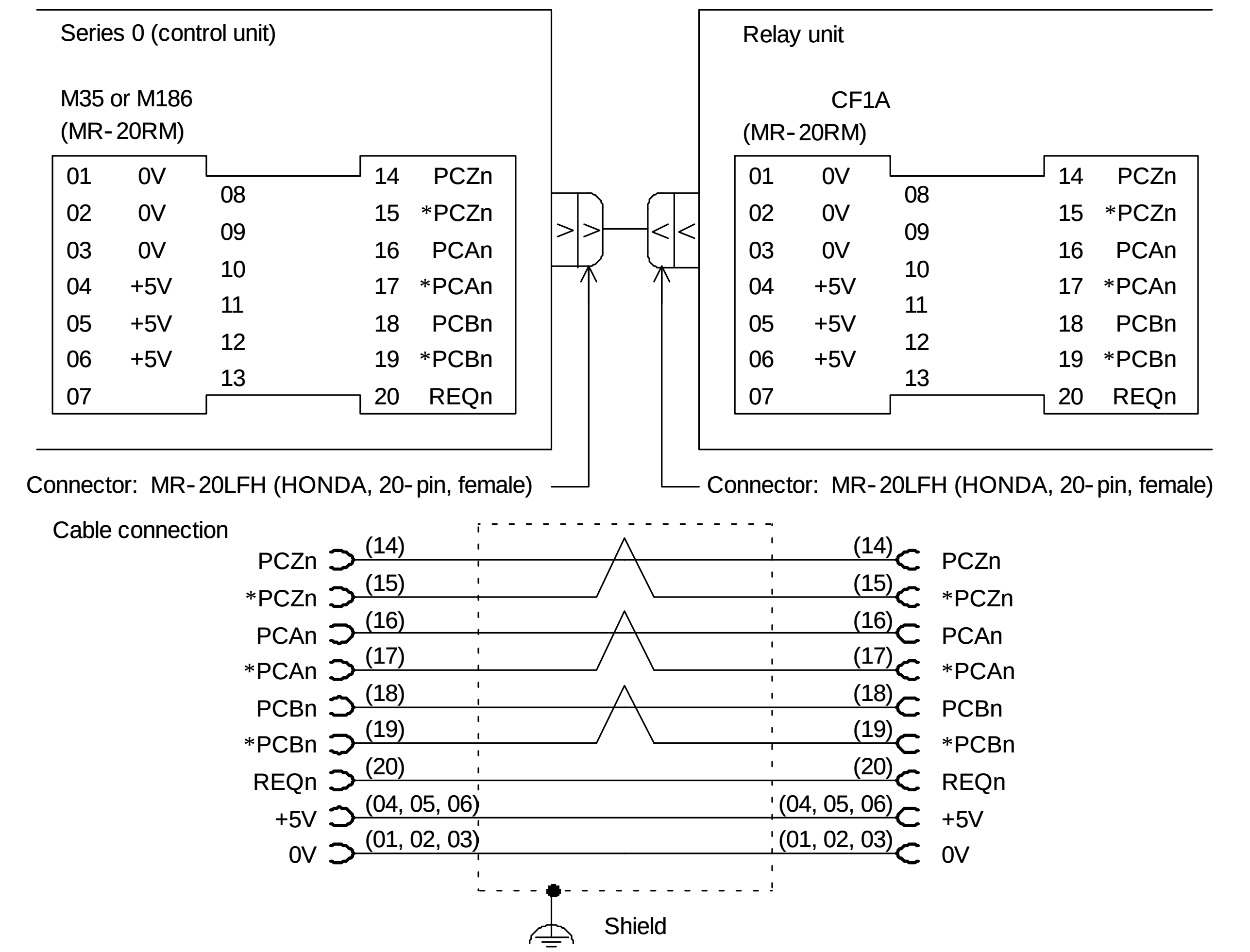
The velocity feedback connection between the motor's built-in pulse coder and the Series 0 is the same as that described in Subsec.9.3.5.

(2) Position feedback connection

An A/B-phase absolute pulse coder can be connected to the Series 0 in either of two ways: via the relay unit of the absolute pulse coder battery unit, or directly.

(a) When using the relay unit

(i) Connection between Series 0 and relay unit



Cable material : +5V, 0V——Six or more vinyl-coated wires each having a cross-sectional area of 0.5 mm^2
: Cn1 to Cn8——Vinyl-coated wires each having a cross-sectional area of at least 0.18 mm^2
: Others——Unified shield twisted pair wires each having a cross-sectional area of at least 0.18 mm^2

The cable length must not exceed 2 m.

Recommended cable specification A02B-0074-K804 (2m)

(ii)Connection between relay unit and A/B–phase pulse coder

Relay unit

CF1B
(MR-20RM)

01	0V		14	PCZn
02	0V	08	15	*PCZn
03	0V	09	16	PCAn
04	+5V	10	17	*PCAn
05	+5V	11	18	PCBn
06	+6VA	12	19	*PCBn
07		13	20	REQn

A/B-phase separate pulse coder
(separate absolute pulse coder)

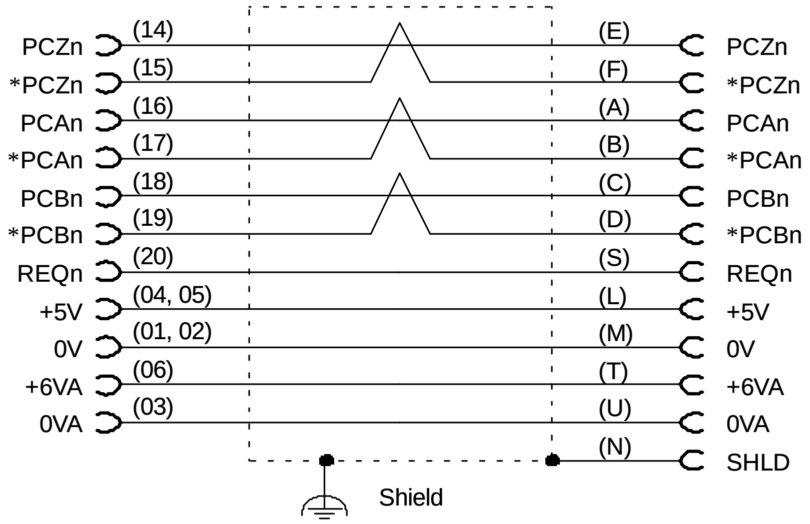
(MS3102A-22-14P)

A	PCAn	B	*PCAn	C	PCBn
D	*PCBn	E	PCZn	F	*PCZn
G		H		J	
K		L	+5V	M	0V
N	SHLD	P		R	
S	REQn	T	+6VA	U	0VA

Connector: MR-20LFH (HONDA, 20-pin, female)

Connector: MS3106B-22-14S (straight)
MS3108B-22-14S (elbow)

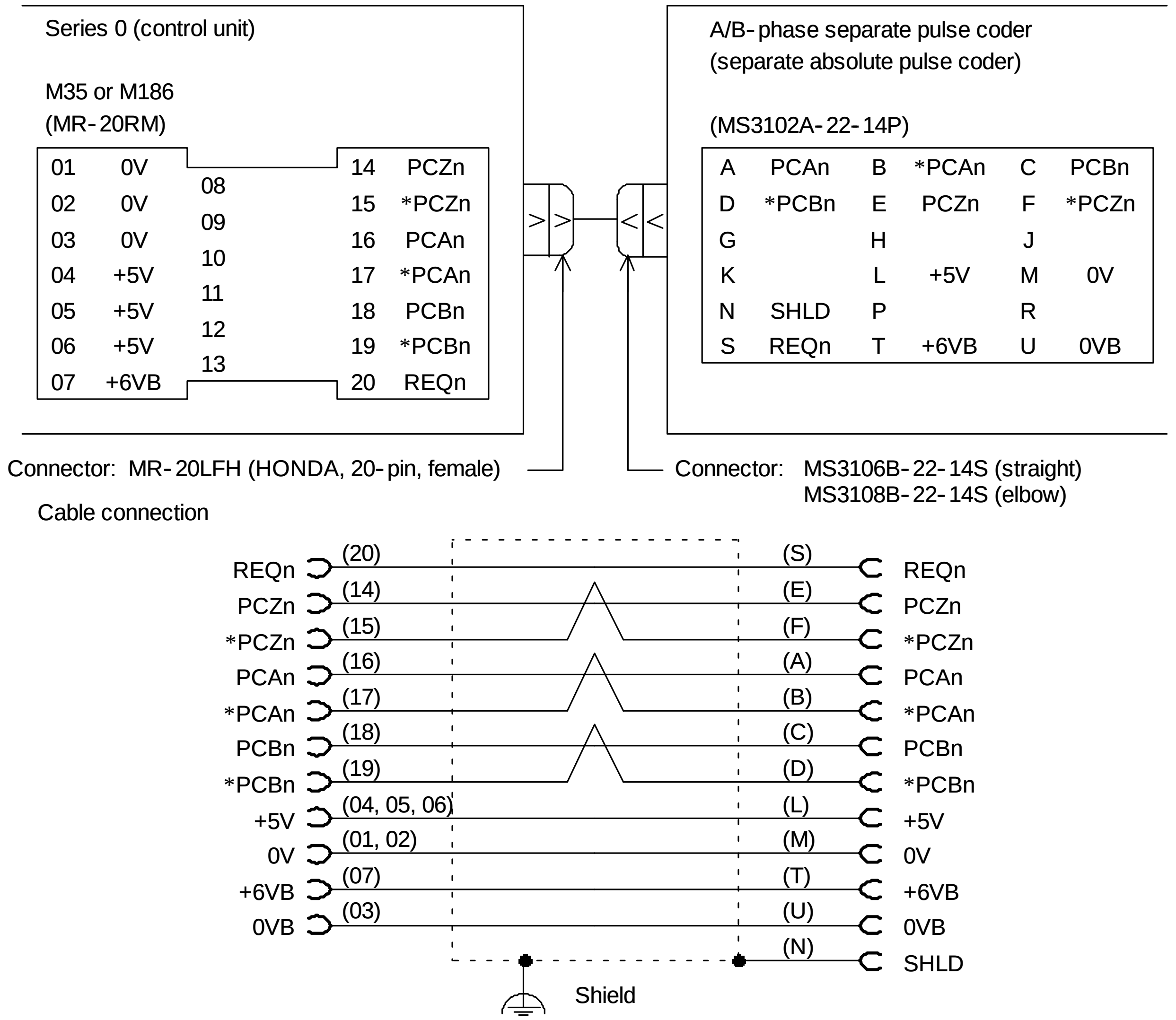
Cable connection



Cable material : +5V, 0V —— Two 0.5-mm^2 wires
: +6VA, 0VA —— One 0.5-mm^2 wire
: Others —— Unified shield twisted pair wires each having a cross-sectional area of 0.18 mm^2

NOTE
The total voltage resistance for +5 V and 0 V must not exceed 0.5Ω, total for both ways, including the cable between the axis control card and the relay unit.

(b) Direct connection



Cable material : +6VB, 0VB — One or more wires each haveing a cross-sectional area of at least 0.5 mm^2
: +5V, 0V — Two or more wires each haveing a cross-sectional area of at least 0.5 mm^2
: Others — Unified shield twisted pair wires each having a cross-sectional area of at least 0.18 mm^2
: REQn — One or more wires each haveing a cross-sectional area of at least 0.18 mm^2

Recommended cable specification A02B-0096-K801 (14m) (straight)
A02B-0096-K802 (14m) (elbow)

NOTE
The voltage resistance for +5 V must not exceed 0.5Ω, total for both ways.

Serial pulse coder interface

D Serial pulse coder A or B

Series 0-C (control unit)
Axis control card for serial pulse coder
M185
(MR-20RM)

14	REQ		01	0V
		08		
15	*REQ		02	0V
		09		
16	SD		03	0VB
		10		
17	*SD		04	+5V
		11		
18			05	+5V
		12		
19			06	+5V
		13		
20			07	+6VB

J23n

Pulse coder

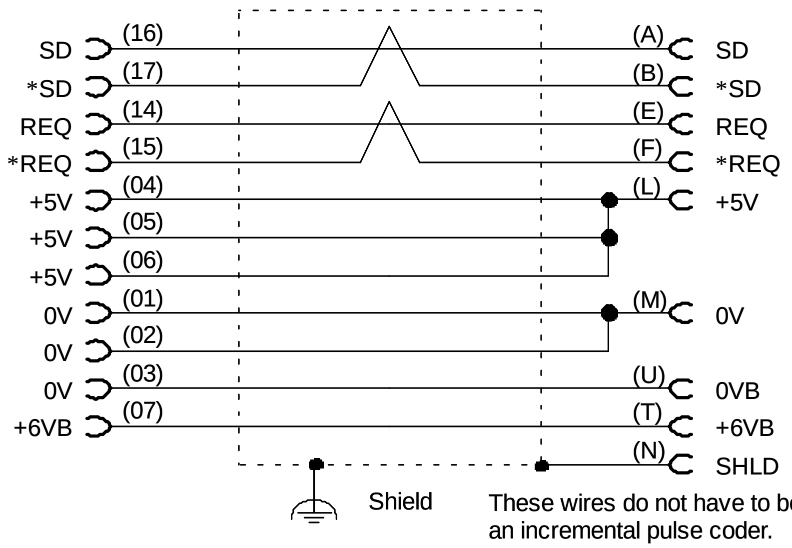
(MS3102A-22-14P)

A	SD	B	*SD	C	
D		E	REQ	F	*REQn
G		H		J	
K		L	+5V	M	0V
N	SHLD	P		R	
S		T	+6VB	U	0VB

Connector: MR-20LFH (HONDA, 20-pin, female)

Connector: MS3106B-22-14S or MS3108B-22-14S

Cable connection

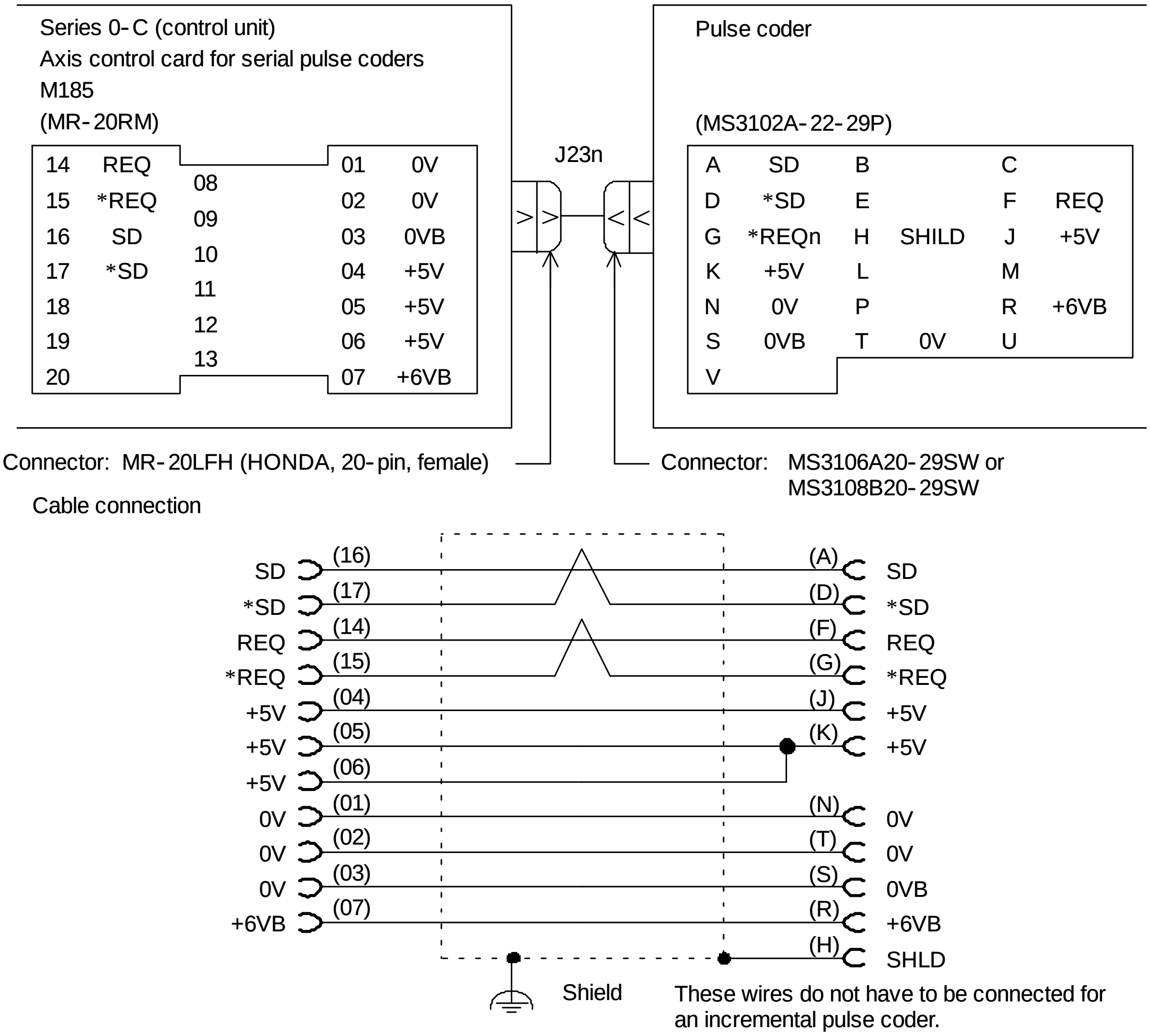


These wires do not have to be connected for an incremental pulse coder.

Cable material : +5V, 0V ——— Two or more wires each having a cross-sectional area of at least 0.5 mm^2 (when the cable length is 14 m or less)
: +6VB, 0VB ——— One or more wires each having a cross-sectional area of at least 0.5 mm^2
: SD, *SD, REQ, *REQ — Twisted pair wires each having a cross-sectional area of at least 0.18 mm^2

NOTE
The total voltage resistance for +5 V and 0 V must not exceed 0.5Ω, total for both ways.

D Serial pulse coder C (model 0S or above) α series motor (α3/3000 to α150/2000)

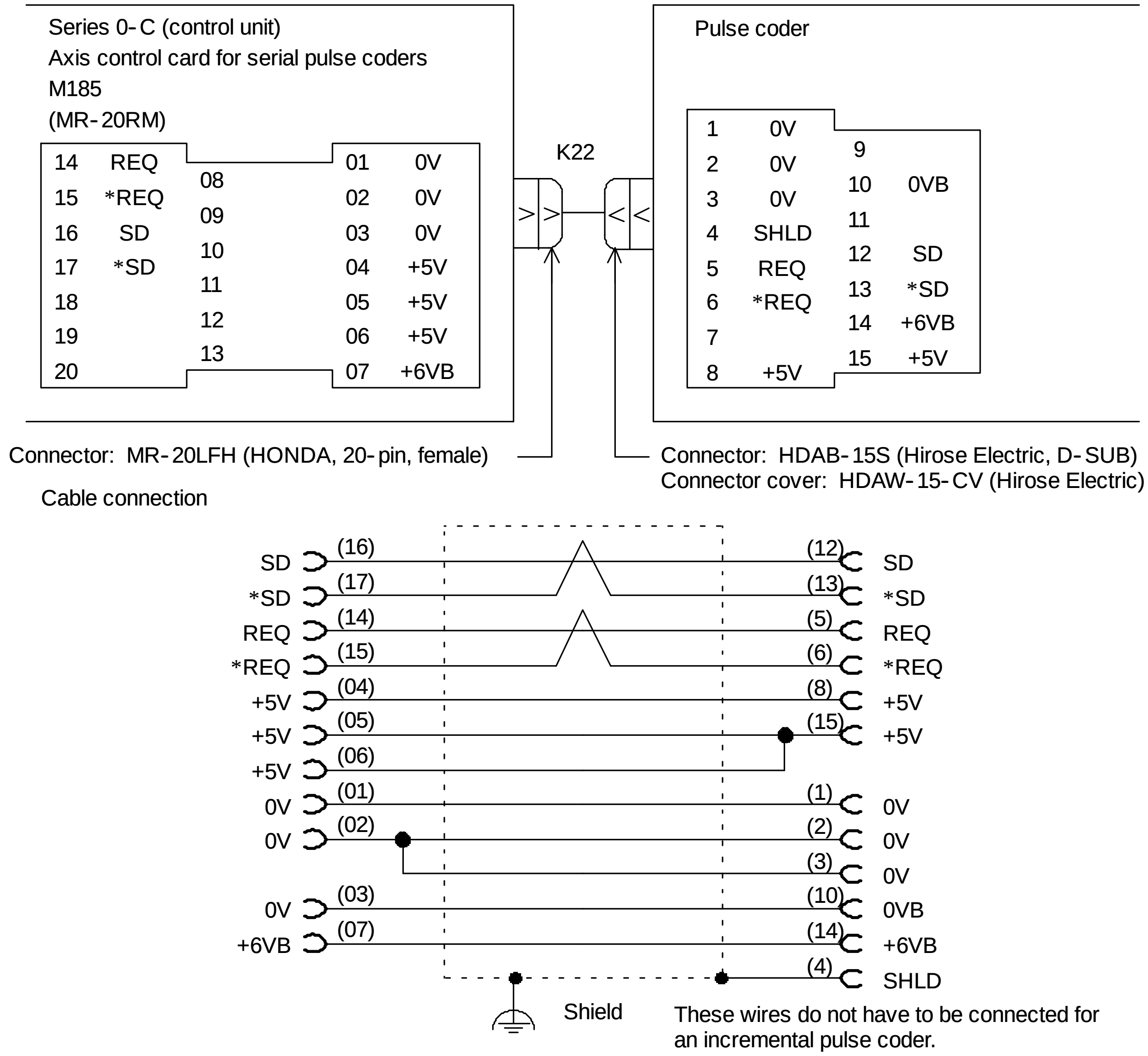


Cable material : +5V, 0V — Two or more wires each having a cross-sectional area of at least 0.5 mm^2 (when the cable length is 14 m or less)
: +6VB, 0VB — One or more wires each having a cross-sectional area of at least 0.5 mm^2
: SD, *SD, REQ, *REQ — Twisted pair wires each having a cross-sectional area of at least 0.18 mm^2

NOTE

The voltage resistance for +5 V must not exceed 0.5Ω, total for both ways.

D Serial pulse coder C (model 1-0S to 0-0SP) α series motor (α1/3000, α2/2000, or α2/3000)



Cable material : +5V, 0V ——— Two or more wires each having a cross-sectional area of at least 0.5 mm^2 (when the cable length is 14 m or less)

: +6VB, 0VB ——— One or more wires each having a cross-sectional area of at least 0.5 mm^2

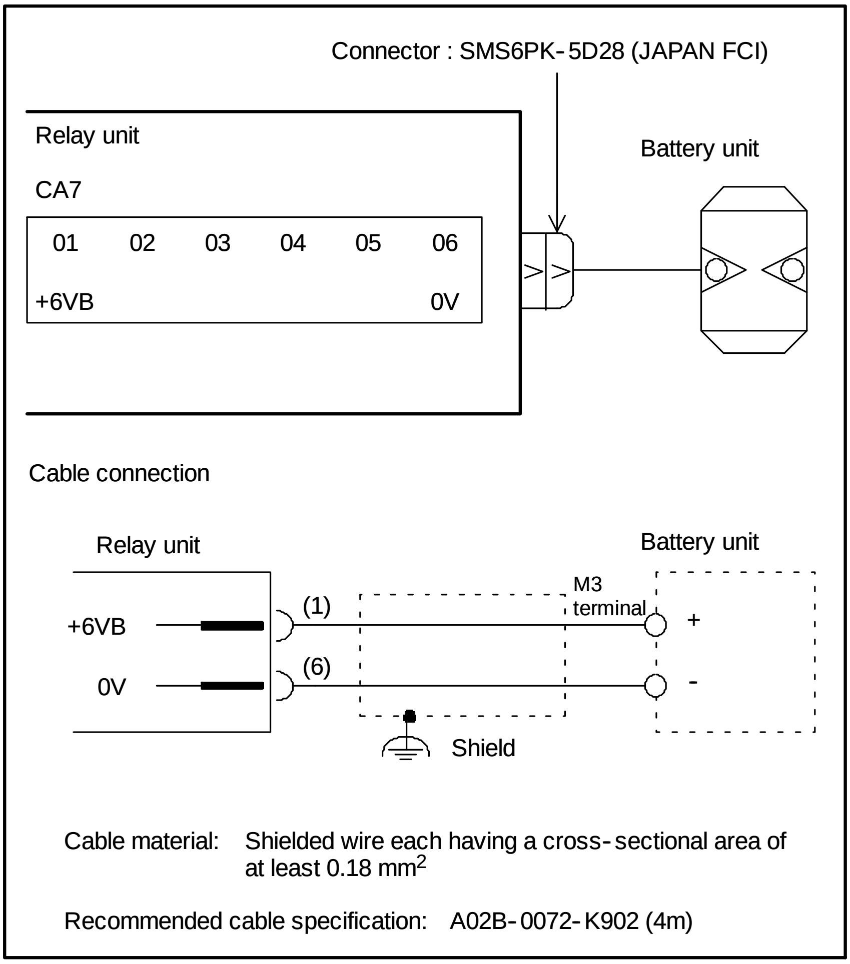
: SD, *SD, REQ, *REQ — Twisted pair wires each having a cross-sectional area of at least 0.18 mm^2

> **NOTE**
> The voltage resistance for +5 V must not exceed 0.5Ω, total for both ways.

Connection of the battery unit for an absolute pulse coder

The battery unit for an absolute pulse coder can be connected to the Series 0 in either of two ways: via a relay unit or directly.

D Connection using the relay unit



NOTE

1. A single relay unit can distribute power from the battery to up to four pulse coders.
2. A single battery unit can supply power to up to six pulse coders.
3. Replace the battery with a new one once a year.

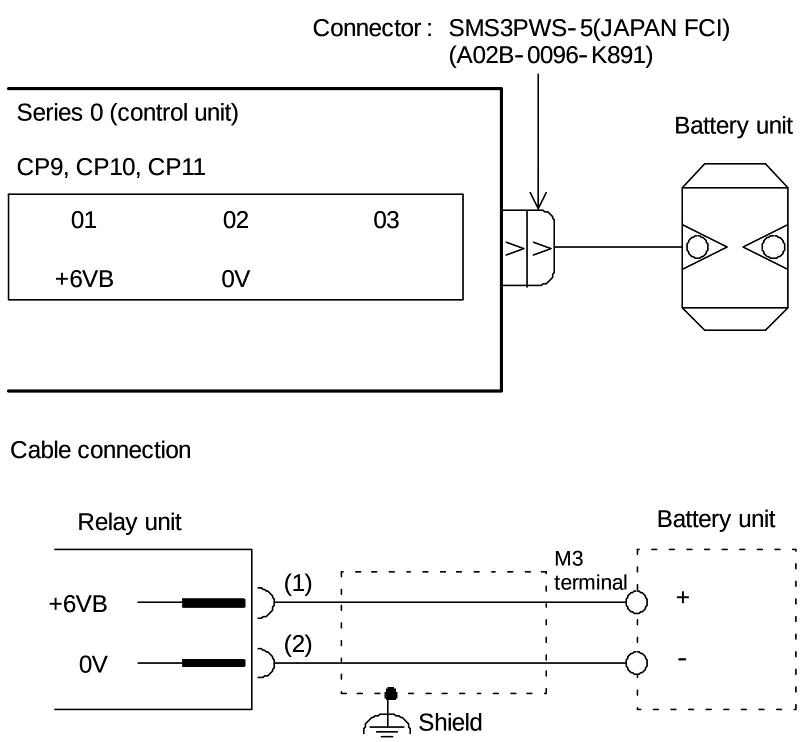
D Connection without a Relay Unit

The battery unit can be connected directly to each axis control card, from which the battery power is distributed to each pulse coder.

Battery connector name

	1st-4th axis control card				5th/6th axis control card		7th/8th axis control card	
	1st axis	2nd axis	3rd axis	4th axis	5th axis	6th axis	7th axis	8th axis
Connector name	CPA9				CPA10		CPA11	

For the Series 0–TTC, the first and second axes for tool post 2 correspond to the fifth and sixth axes in the above table.



Cable material: Shielded wire each having a cross-sectional area of at least 0.18 mm^2

NOTE
1 A single battery unit can supply power to up to six pulse coders.
2 Replace the battery with a new one once a year.

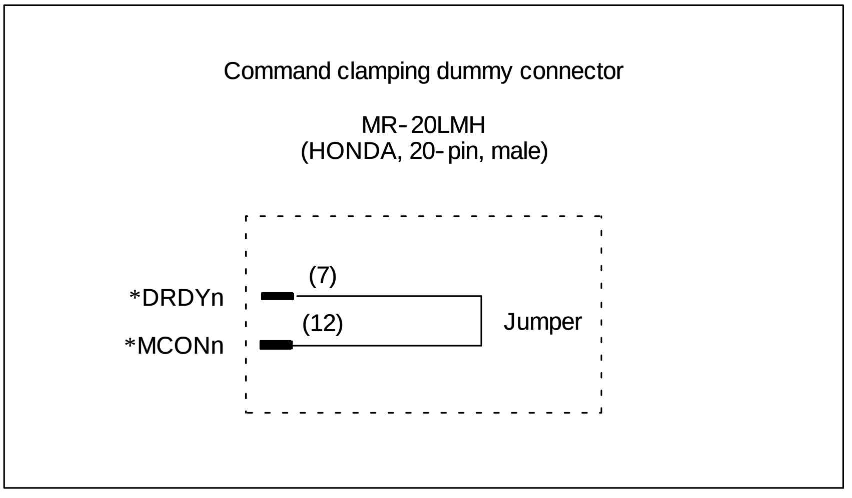
Handling of unused axes (clamping)

The user can select any of the supported axes as the axes to be controlled. A cable for a servo amplifier or motor need not be connected to those axes that are not to be used. Leaving the connector for an unused axis open, however, causes the CNC to enter a servo alarm state. This section describes how to handle (clamp) unused axes.

> **NOTE**
> Servo parameters must also be set for clamped axes. Set the same servo parameters as those for any axis to be used.

D handling of the command connectors of unused axes

Connect a command clamping dummy connector to the command connector of each unused axis (for example, M34 or M184 for the first axis).



D Handling of the feedback connectors of unused axes

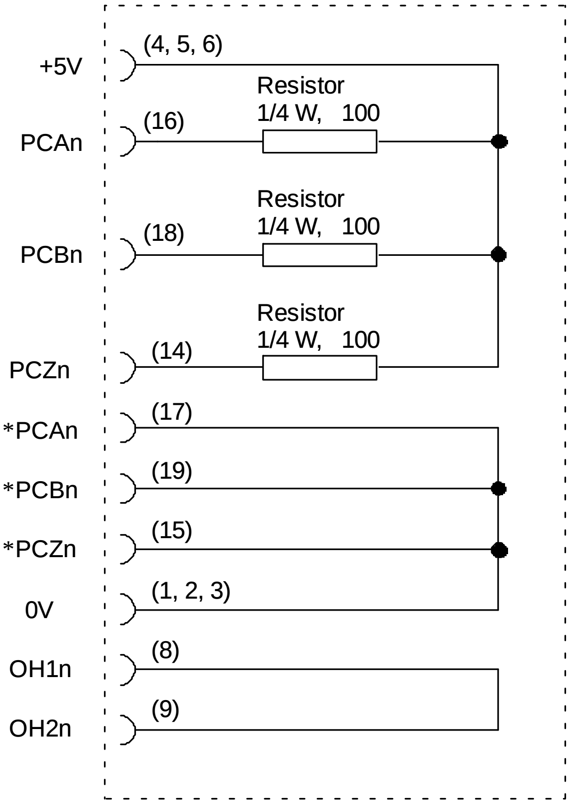
Handling varies depending on whether an α series servo motor is used.

(1) When an α series servo motor is not used

Connect a feedback clamping connector to the feedback connector of each unused axis (for example, M35 or M185 for the first axis).

Feedback clamping dummy connector

MR-20LFH
(HONDA, 20-pin, female)



The above example sets PCAn, PCBn, and PCZn to high and *PCAn, *PCBn, and *PCZn to low. The reverse connection is also allowed: PCAn, PCBn, and PCZn to low and *PCAn, *PCBn, and *PCZn to high.

(2) When an α series servo motor is used

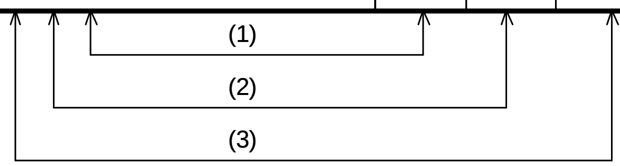
A dummy connector is not necessary. Set the relevant servo parameters as follows and leave the feedback connectors open.

Set the axis ignore parameter (bit 0 of No. 8n09: n is the axis number) for each unused axis to 1. Set flexible feed gear parameters 8n84 and 8n85 to 1.

Combination of axis cards for serial pulse coders and digital servo functions

This section describes the supported combinations of axis cards for serial pulse coders and digital servo functions.

Name	Order specification (PC board drawing number)	Digital servo function		
1st/2nd axis printed circuit board	A02B-0098-H045 (A16B-2200-0391)	9046	9040	9030
3rd/4th axis printed circuit board	A02B-0098-H046 (A16B-2200-0390)			
5th/6th axis printed circuit board	A02B-0098-J030 (A16B-2200-0800)			
5th/6th axis printed circuit board (for 0-TTC)	A02B-0098-J033 (A16B-2200-0800)			
7th axis printed circuit board	A02B-0098-J199 (A16B-2200-0791)			
7th/8th axis printed circuit board	A02B-0098-J198 (A16B-2200-0790)			



<Combination of axis cards for serial pulse coders and digital servo function series 9046 (1)>

Use this combination when using an AC servo motor α series as the servo motor. A motor of the AC servo motor α series cannot be used together with a motor of another series.

<Combination of axis cards for serial pulse coders and digital servo function series 9040 (2)>

Use this combination when using other than an AC servo motor α series as the servo motor. This combination does not, however, apply to those motors listed in (3) below. Serial pulse coders and A/B–phase pulse coders can be used together, provided the motors are used in a valid configuration.

<Combination of axis cards for serial pulse coders and digital servo function series 9030 (3)>

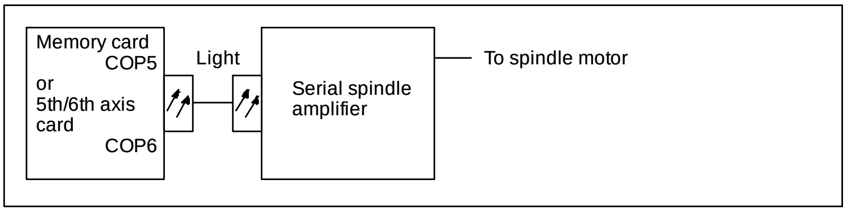
Use this combination when using any of the following motors as the servo motor. These motors cannot be used together with those for serial pulse coders, or with α series motors.

Motor model	2-0	1-0	0	5	10	30	6L(A06B-0563-BXXX)
Motor No.	6	7	8	9	10	13	17

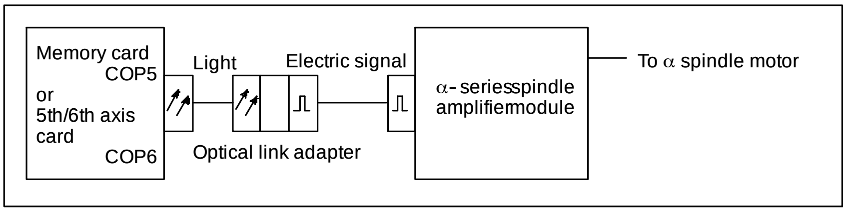
2.3.6 Serial Spindle Interface

Connection to the spindle amplifier through optical fiber cable.
When spindle amplifier is α series, electric cable is connected to amplifier through I/O Link adapter

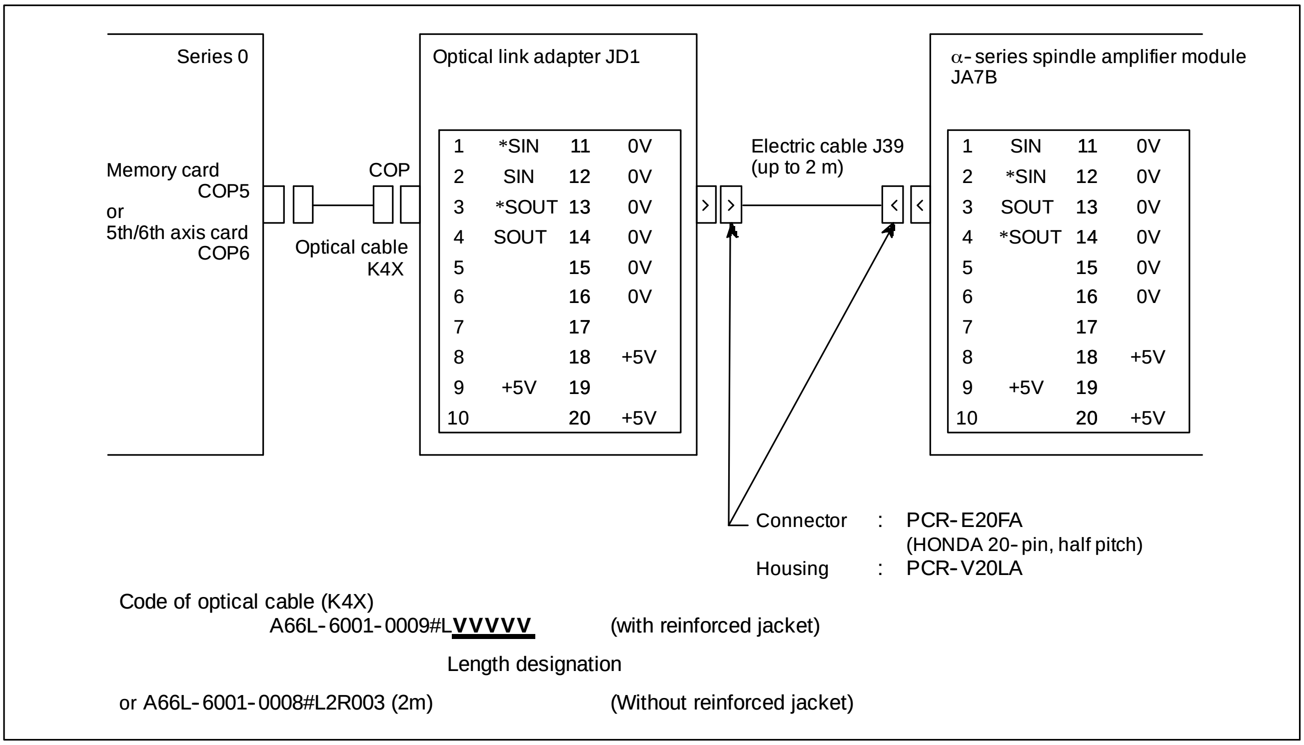
(a) When the serial spindle amplifier is used



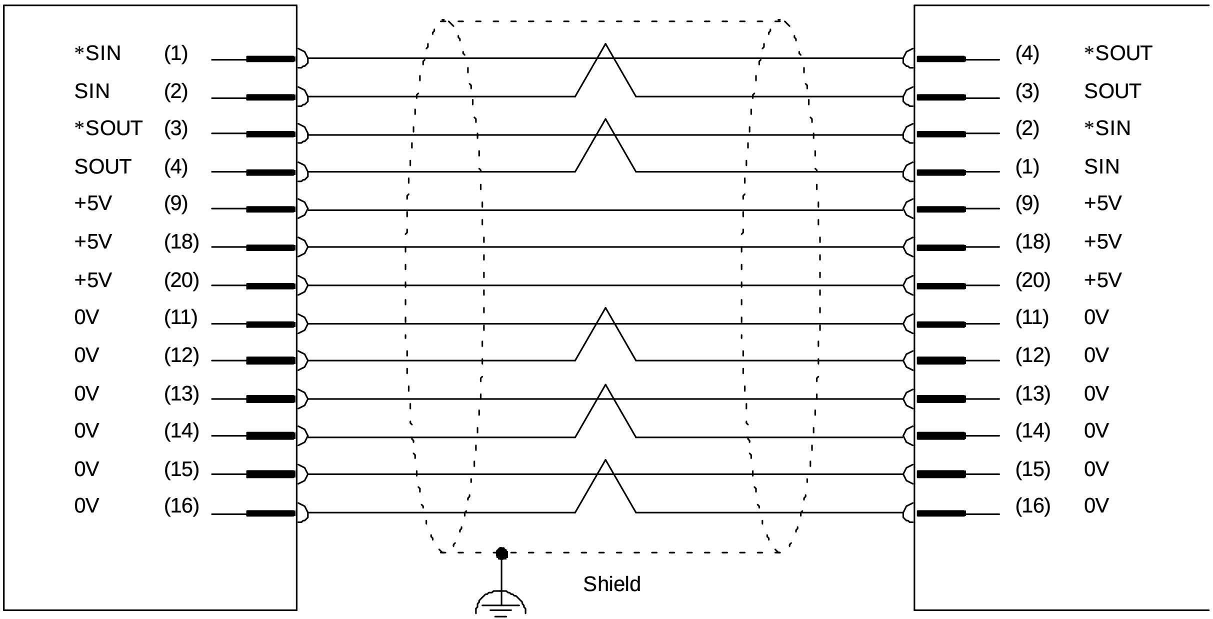
(b) When the α–series spindle amplifier module is used



Connection when the α–series spindle amplifier module is used



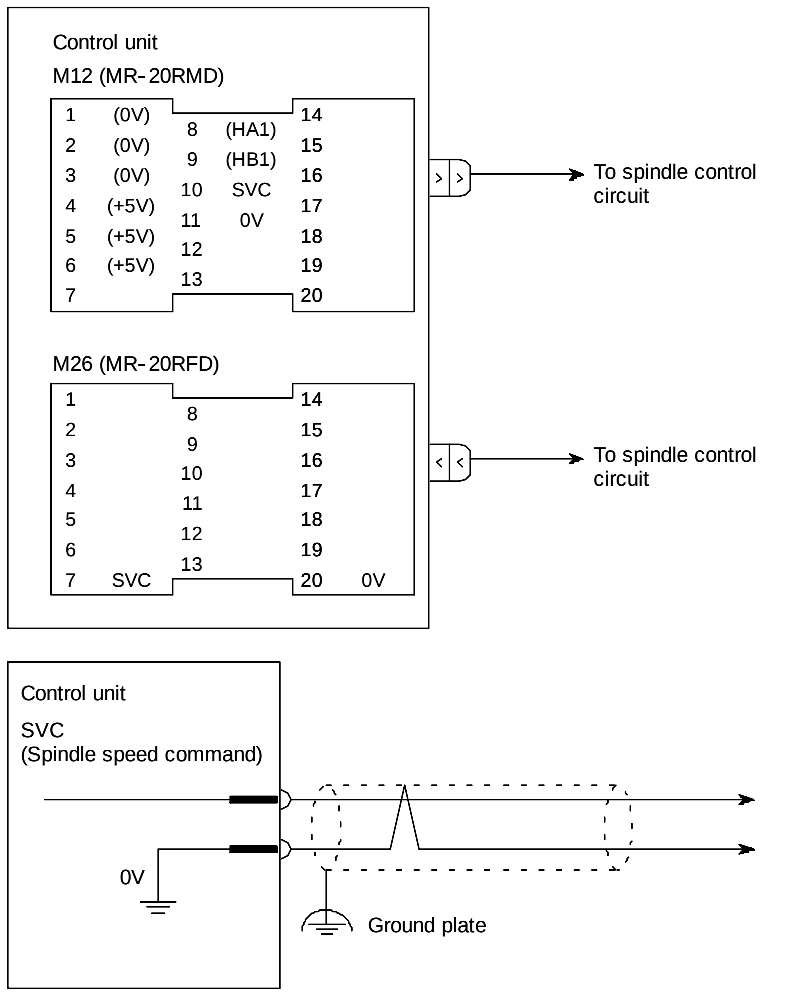
Electric cable connection J39



Recommended cable material	A66L-0001-0284#10P (#28AWG × 10)
Recommended cable specification	A02B-0120-K844 (1m)

2.3.7 Analog Spindle Interface

The speed of the analog spindle is specified by analog voltage output. The analog output for the first spindle can be output from pin 10 of M12 or pin 7 of M26.



Cable material	12/0.18 (0.3mm^2) Unified shield twisted-pair cable
Recommended cable	A66L-0001-0041

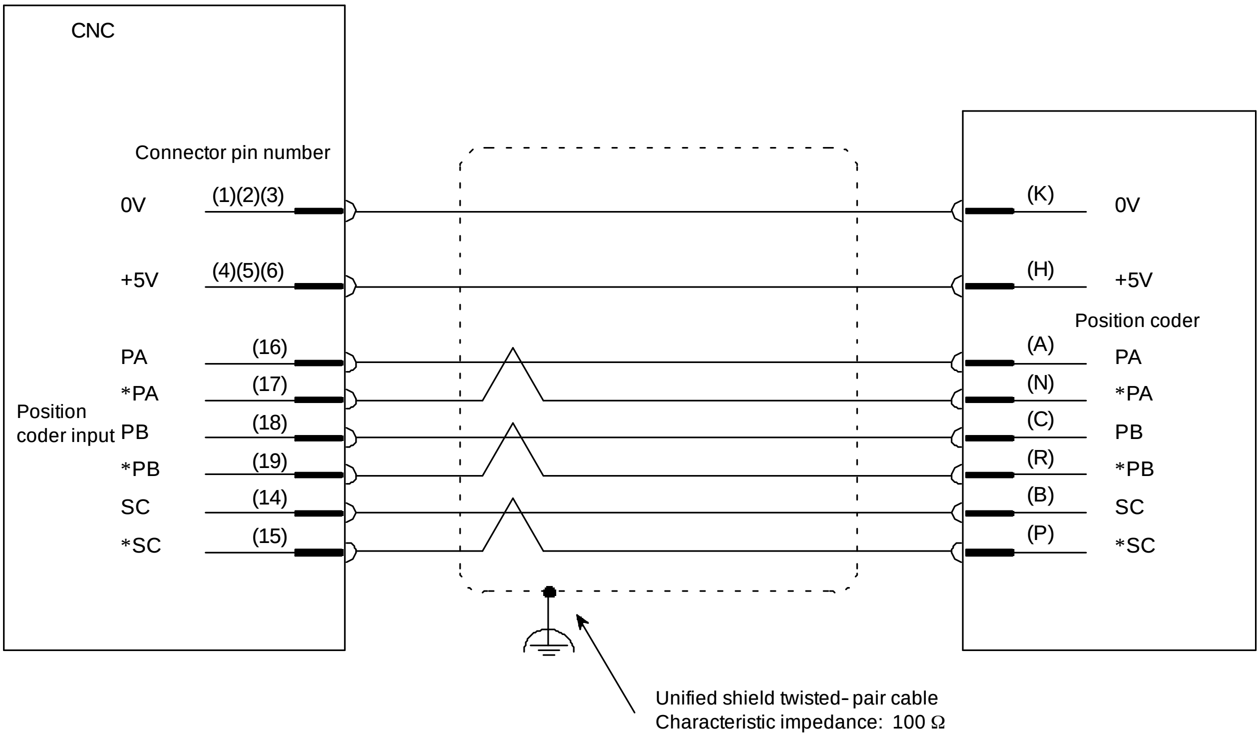
> **NOTE**
> M12 is also used as the connector for the first manual pulse generator.

2.3.8 Position Coder Interface

M27 MRE20-RMD

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

Signal name	Description
SC, *SC	Position coder phase-C signal
PA, *PA	Position coder phase-A signal
PB, *PB	Position coder phase-B signal



NOTE

1 The current drain of the position coder is 0.35 A. Determine the number of 0V and +5V lines to be connected so that the total voltage drop between the NC and position coder does not exceed 0.2 V, total for both ways.

2 With the 0–TTC, a second position coder can be used. Use the M29 connector of the 5th/6th axis card. The M29 connector has the same pin assignment as the M27 connector.
When the second position coder is not used, connect the first position coder to M27 and M29 in parallel.

2.3.9 Remote Buffer Interface (Including FANUC DNC2 Interface)

Outline

The remote buffer is an optional function used to supply a large amount of data to the CNC continuously and at high speed. The remote buffer is connected to the host computer or an input/output device via a serial interface.

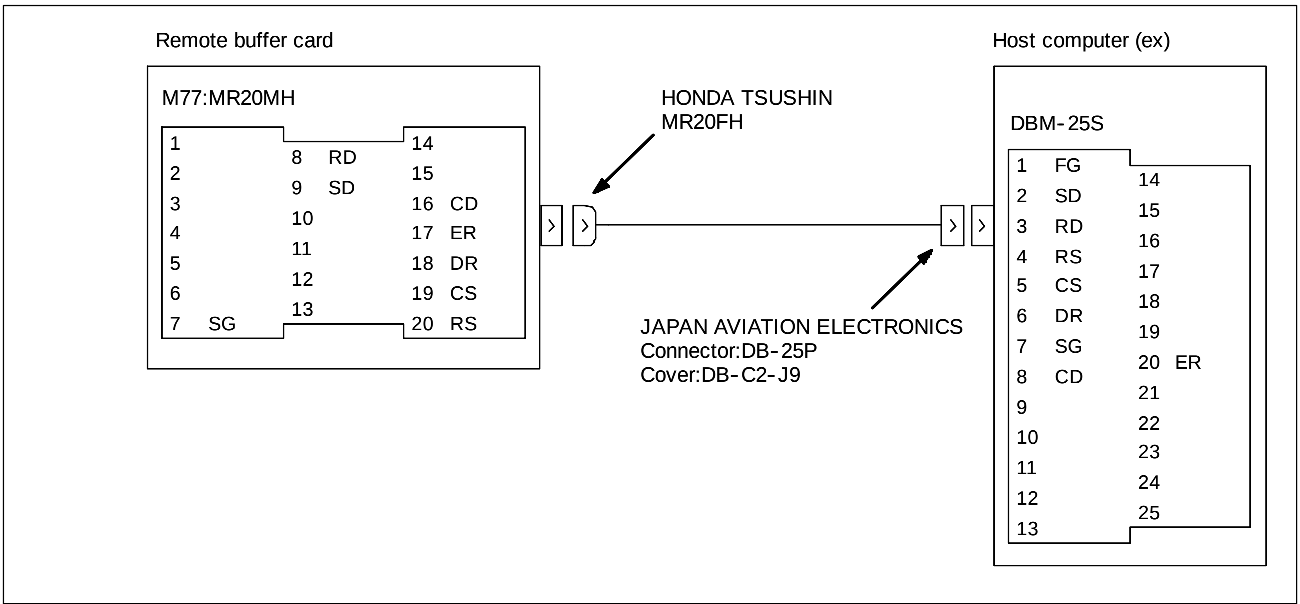
Table 2.3.9 lists the types of remote buffer printed circuit boards. Three types are available, according to their location in the control unit.

Table 2.3.9 Types of remote buffer printed circuit boards

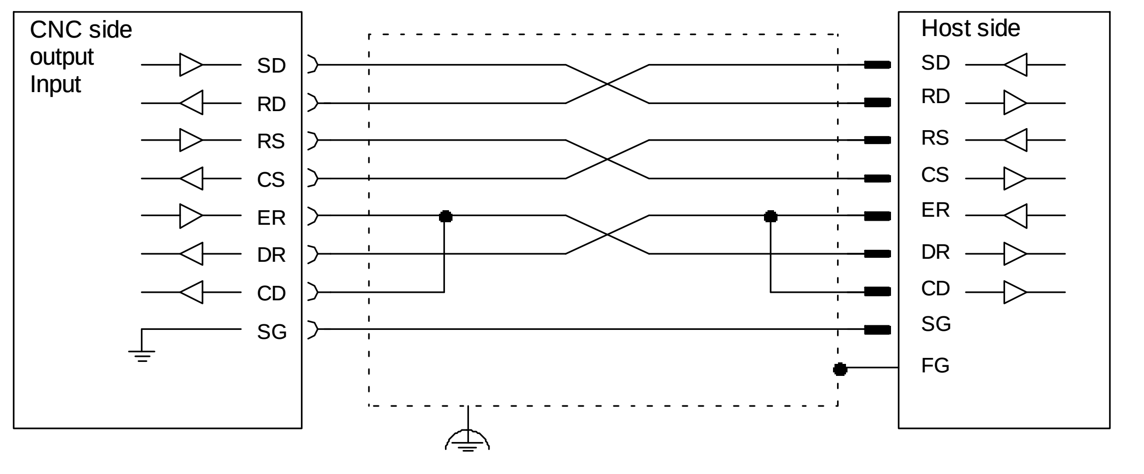
Type	Name	Remarks	Connection slot
A	SUB CPU card	Included in the multiaxis card. The fifth and sixth axes can be controlled as PMC axes.	SUB
	Remote buffer card for control unit B	The fifth and sixth axes cannot be connected.	
B	Remote buffer card for control unit A	Can also be used for the DNC2 interface.	Expansion connector JA1 or JA2
C	Remote buffer card for control unit B	Can also be used for the DNC2 interface.	SP

Some remote buffer cards can also be used for the FANUC DNC2 interface. FANUC DNC2 is a communication protocol which enables the exchange of a wide range of data between the CNC and a personal computer which is connected to the CNC via the RS–232C interface. Its hardware connection is the same as that for the remote buffer. For its specifications and other information, refer to the FANUC DNC2 Descriptions (B–61992E).

(1) Remote buffer interface (RS-232-C)



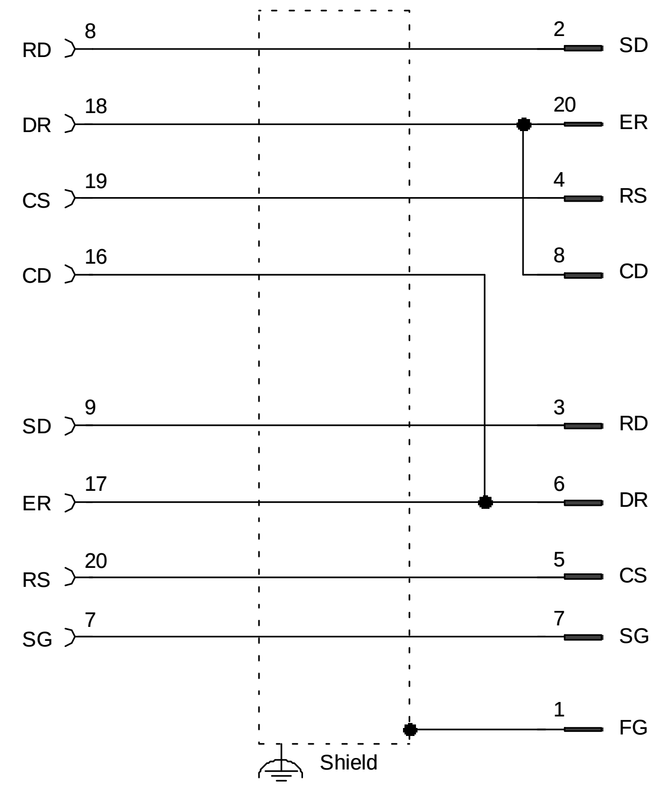
Conceptional diagram of signal connection



NOTE

When using the FANUC DNC2 interface with an IBM PC-AT as the host computer, the host computer negates its RS (to low) upon transition to the reception phase. In this case, therefore, CS on the CNC side must be connected to ER on the CNC side.

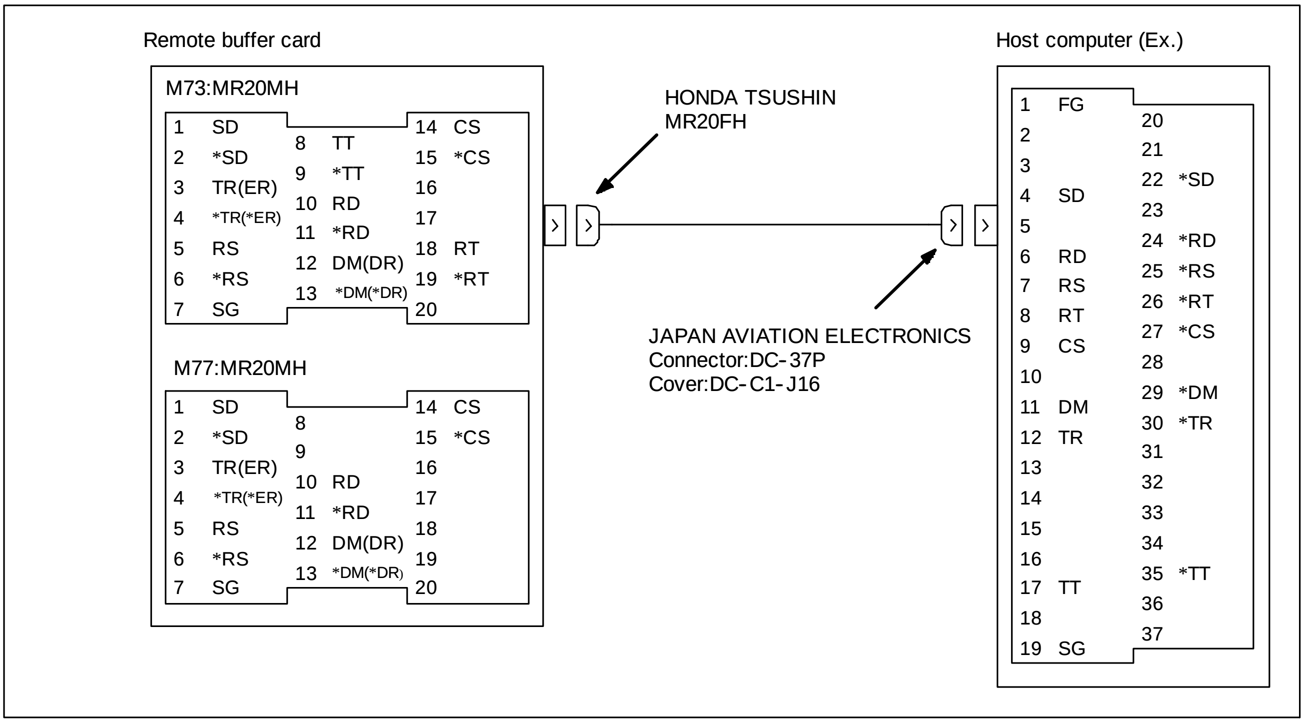
Cable wiring



Connect CS to RS if CS is not used. However, when protocol A or expanded protocol A is used, connect as shown above because CS is used for busy control. Connect DR to ER when DR is not used. Be sure to connect CD to ER.

The M77 connector is also used for the RS–422 interface. Those pins for which nothing is indicated in the connector table must be left open.

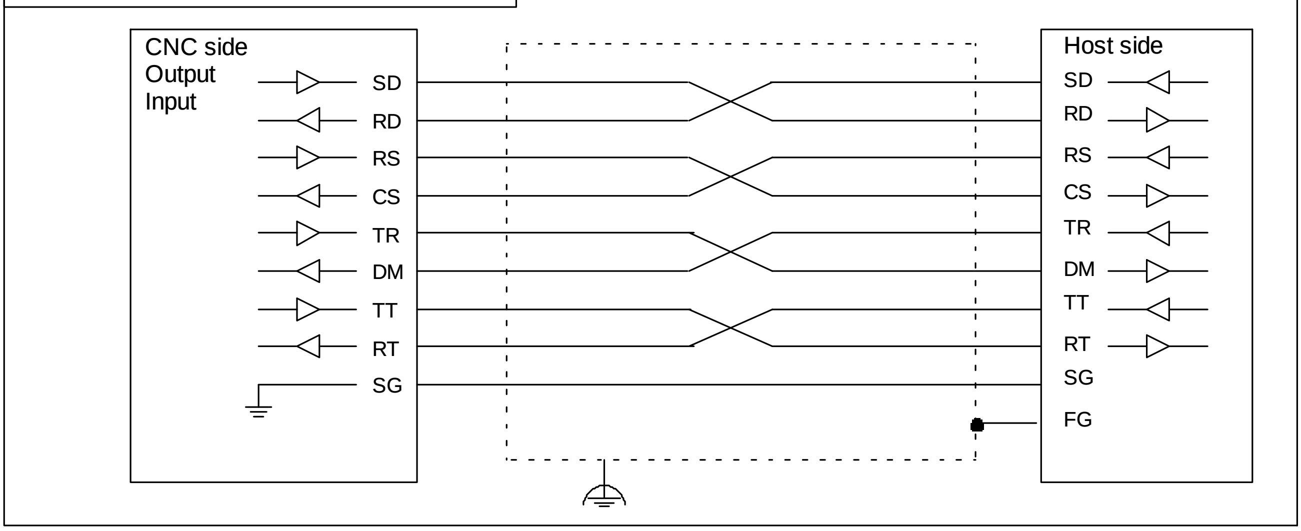
(2) Remote buffer interface (RS-422)



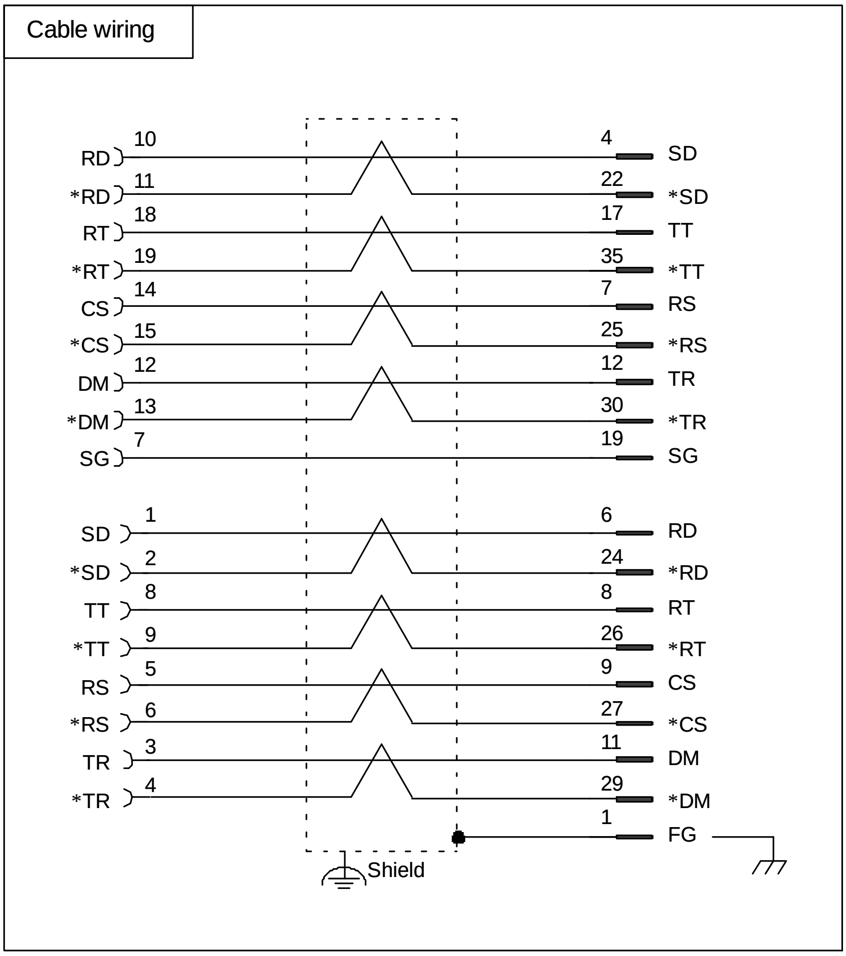
D Conceptional diagram of signal connection

The figure below shows a signal connection between CNC and host computer. Since signals other than FG and SG perform differential signal transmission standard RS-422, two wires of signal lines are used for those signals.

Conceptional diagram of signal connection



D Actual example of RS–422 signal wiring

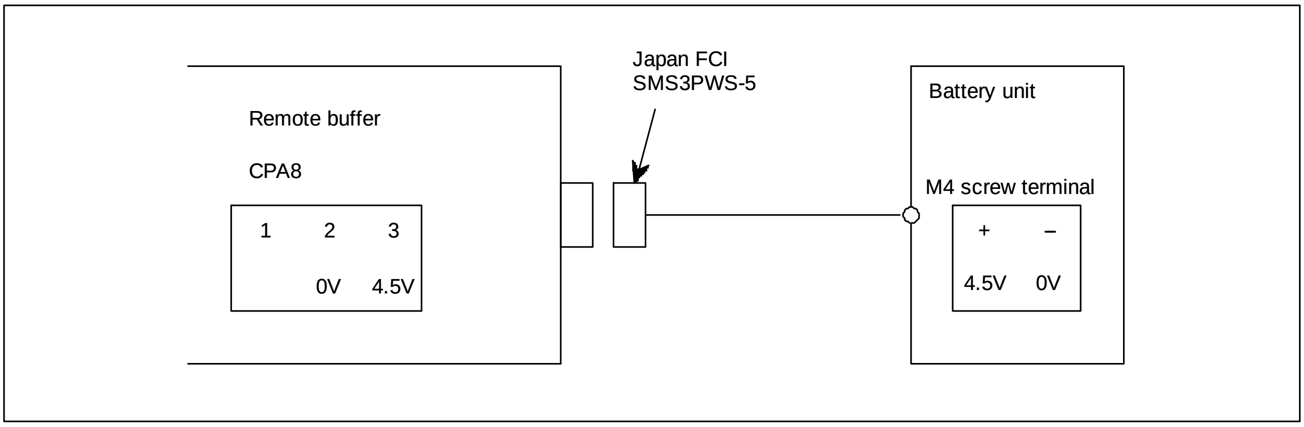


NOTE

1 Be sure to use twisted pair cable.
2 Note that unlike other signals, the *DM signal on the CNC–side connector is not regularly positioned. This is intended to maintain a low probability of breakdown due to inadvertent connection with a wrong connector.
3 The connection of TT, *TT, RT, and *RT is required only when an external clock is used.
4 When using an external clock, connect the cable to the M73 connector. Either the M73 or M77 connector can be used if an external clock is not used.
5 The M77 connector is also used for the RS–232C interface. Those pins for which nothing is indicated in the connector table must be left open.

(3) CONNECTION TO BATTERY UNIT

The remote buffer of type A is required to connect to a buttery unit.



Connect the remote buffer to the battery unit on the memory printed circuit board, using the supplied cable.

2.3.10 External Environmetal Requirements of Cabinet

The peripheral units, such as the control unit and CRT/MDI, have been designed on the assumption that they are housed in closed cabinets. In this manual "cabinet" refers to the following:

- Cabinet manufactured by the machine tool builder for housing the control unit or peripheral units;
- Cabinet for housing the flexible turnkey system provided by FANUC;
- Operation pendant, manufactured by the machine tool builder, for housing the CRT/MDI unit or operator's panel.
- Equivalent to the above.

The environmental conditions when installing these cabinets shall conform to the following table.

Room temperature	In operation	0_C to 45_C
	In storage or transportation	-20_C to 60_C
Change in temperature	1.1°C/minute max.	
Relative humidity	Normal	75% or less
	Temporary (within 1 month)	95% or less
Vibration	In operation: 0.5G or less	
Environment	Normal machine shop environment (The environment must be considered if the cabinets are in a location where the density of dust, coolant, and/or organic solvent is relatively high.)	

2.3.11 Installation Condition of CNC and Servo Unit

Room temperature	In operation	0°C to +55°C
	In storage or transportation	-20°C to +60°C
Relative humidity	95% RH or less (no condensation)	
Vibration	0.5 G or less	
Environment	The unit shall not be exposed direct to cutting oil, lubricant or cutting chips.	

2.3.12 Power Capacity

The power capacity of the CNC control unit, which in this section means the specification required for the power supply, is obtained by adding the power capacity of the control section and the power capacity of the servo section.
The power capacity of the control section includes the power capacity of the control unit, CRT/MDI, I/O unit, and operator's panel interface.

Power capacity of the control section	0.4 kVA
Power capacity of the servo section	Depends on servo motor type. Refer to each DESCRIPTIONS.

2.3.13 Action Against Noise

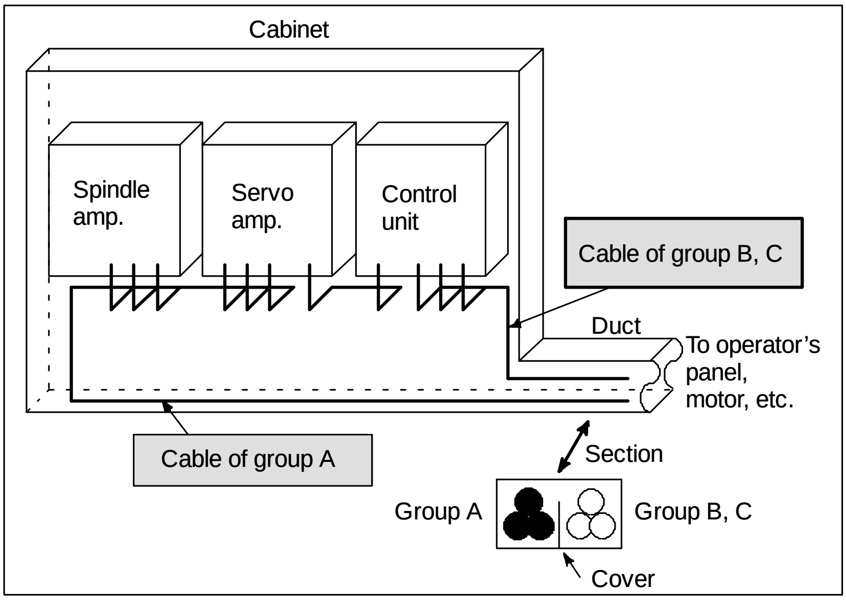
The CNC has been steadily reduced in size using surface–mount and custom LSI technologies for electronic components. The CNC also is designed to be protected from external noise. However, it is difficult to measure the level and frequency of noise quantitatively, and noise has many uncertain factors. Generally, noise is induced in the CNC due to electrostatic coupling, electromagnetic induction, and ground loop.
The CNC is equipped with provisions to minimize the influence of extraneous noise. However, it is difficult to quantitatively measure the strength of the noise and how often it occurs. Besides, noise has many unknown elements. To maintain the stability of the CNC machine tool system, it is important to minimize the occurrence of noise and prevent it from being induced into the CNC.
When designing the power magnetics cabinet, guard against noise in the machine as described in the following section.

(1) Separating signal lines

The cables used for the CNC machine tool are classified as listed in the following table:
Process the cables in each group as described in the action column.

Group	Signal line	Action
A	Primary AC power line	Bind the cables in group A separately (Note 1) from groups B and C, or cover group A with an electromagnetic shield (Note 2). See Item 2.3.13-(3) and connect spark killers or diodes with the solenoid and relay.
	Secondary AC power line	
	AC/DC power lines (containing the power lines for the servo and spindle motors)	
	AC/DC solenoid	
	AC/DC relay	
B	DC solenoid (24VDC)	Connect diodes with DC solenoid and relay. Bind the cables in group B separately from group A, or cover group B with an electromagnetic shield. Separate group B as far from Group C as possible. It is more desirable to cover group B with the shield.
	DC relay (24VDC)	
	DI/DO cable between the CNC and power magnetics cabinet	
	DI/DO cable between the CNC and machine	
C	Cable between the CNC and servo amplifier	Bind the cables in group C separately from group A, or cover group C with an electromagnetic shield. Separate group C as far from Group B as possible. Be sure to perform shield processing in Item 2.3.13-(4).
	Cable for position and velocity feedback	
	Cable between the CNC and spindle amplifier	
	Cable for the position coder	
	Cable for the manual pulse generator	
	Cable between the CNC and the CRT/MDI	
	RS-232-C, RS-422 interface cable	
	Cable for the battery	
	Other cables to be covered with the shield	

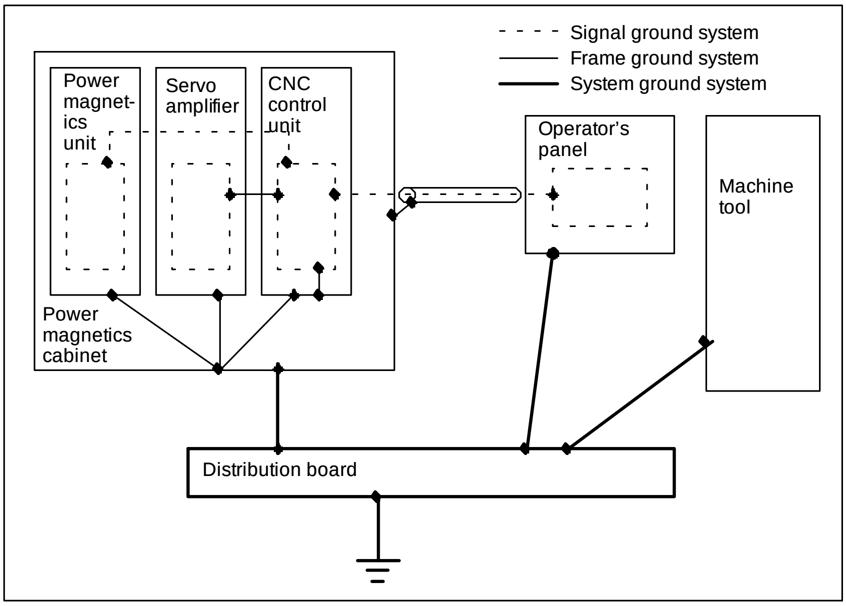
NOTE
1 The groups must be 10 cm or more apart from one another when binding the cables in each group.
2 The electromagnetic shield refers to shielding between groups with grounded steel plates.



(2) Ground

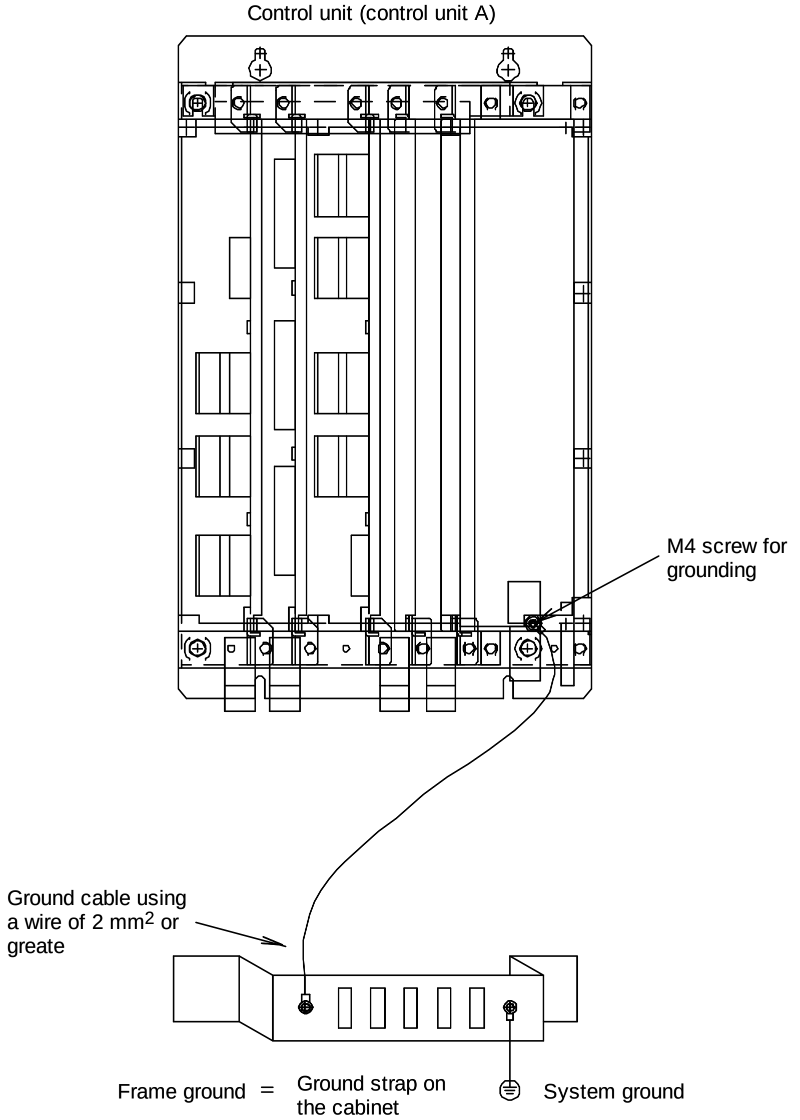
The following ground systems are provided for the CNC machine tool:

- **Signal ground system (SG)**
  The signal ground (SG) supplies the reference voltage (0V) of the electrical signal system.
- **Frame ground system (FG)**
  The frame ground system (FG) is used for safety, and suppressing external and internal noises. In the frame ground system, the frames, cases of the units, panels, and shields for the interface cables between the units are connected.
- **System ground system**
  The system ground system is used to connect the frame ground systems connected between devices or units with the ground.



D Notes on connecting the ground systems

- **D** Connect the signal ground (0V) with the frame ground (FG) at only one place in the CNC control unit.
- **D** The grounding resistance of the system ground shall be 100 ohms or less (class 3 grounding).
- **D** The system ground cable must have enough cross–sectional area to safely carry the accidental current flow into the system ground when an accident such as a short circuit occurs.
  (Generally, it must have the cross–sectional area of the AC power cable or more.)
- **D** Use the cable containing the AC power wire and the system ground wire so that power is supplied with the ground wire connected.



NOTE
Above figure shows the grounding of control unit A. The position of the protective grounding of control unit B is different. Connect the control unit B to the ground strap, too.

(3) Noise suppressor

The AC/DC solenoid and relay are used in the power magnetics cabinet. A high pulse voltage is caused by coil inductance when these devices are turned on or off.
This pulse voltage induced through the cable causes the electronic circuits to be disturbed.

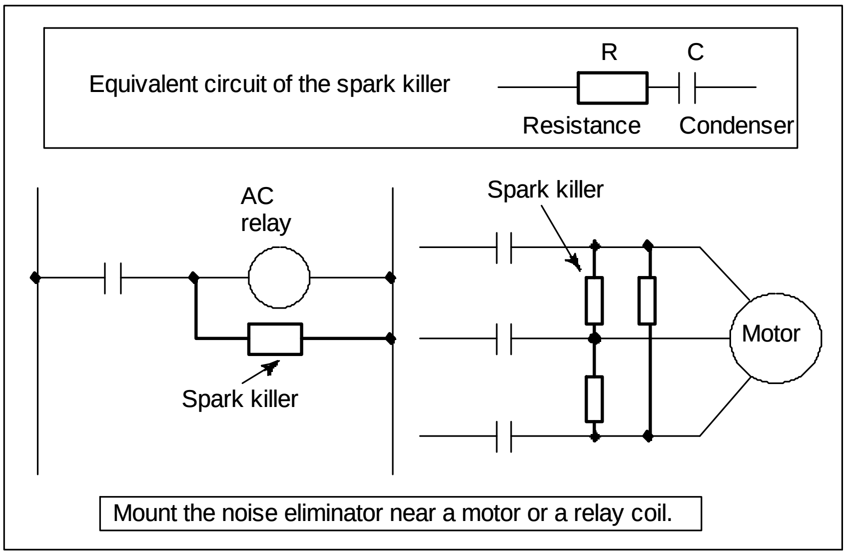
- Notes on selecting the spark killer

- Use a spark killer consisting of a resistor and capacitor in series. This type of spark killer is called a CR spark killer.(Use it under AC)
(A varistor is useful in clamping the peak voltage of the pulse voltage, but cannot suppress the sudden rise of the pulse voltage. FANUC therefore recommends a CR spark killer.)
- The reference capacitance and resistance of the spark killer shall conform to the following based on the current (I (A)) and DC resistance of the stationary coil:

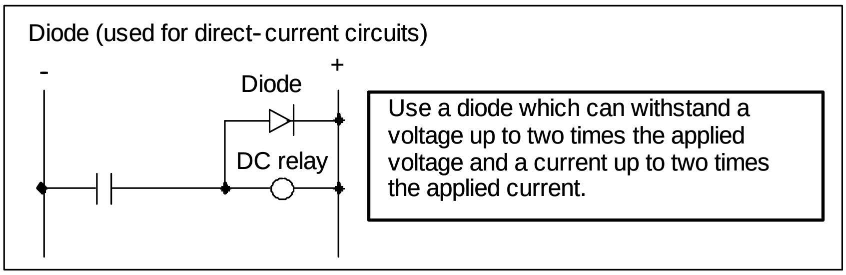
1) Resistance (R) : Equivalent DC resistance of the coil

2) Capacitance (C) : $\frac{I^2}{10}$ to $\frac{I^2}{20}$ (F)

I : Current at stationary state of the coil



NOTE
Use a CR-type noise eliminator. Varistor-type noise eliminators clamp the peak pulse voltage but cannot suppress a sharp rising edge.



(4) Cable clamp and shield processing

The CNC cables that require shielding should be clamped by the method shown below. This cable clamp treatment is for both cable support and proper grounding of the shield. To insure stable CNC system operation, follow this cable clamp method.

Partially peel out the sheath and expose the shield. Push and clamp by the plate metal fittings for clamp at the part. The ground plate must be made by the machine tool builder, and set as follows :

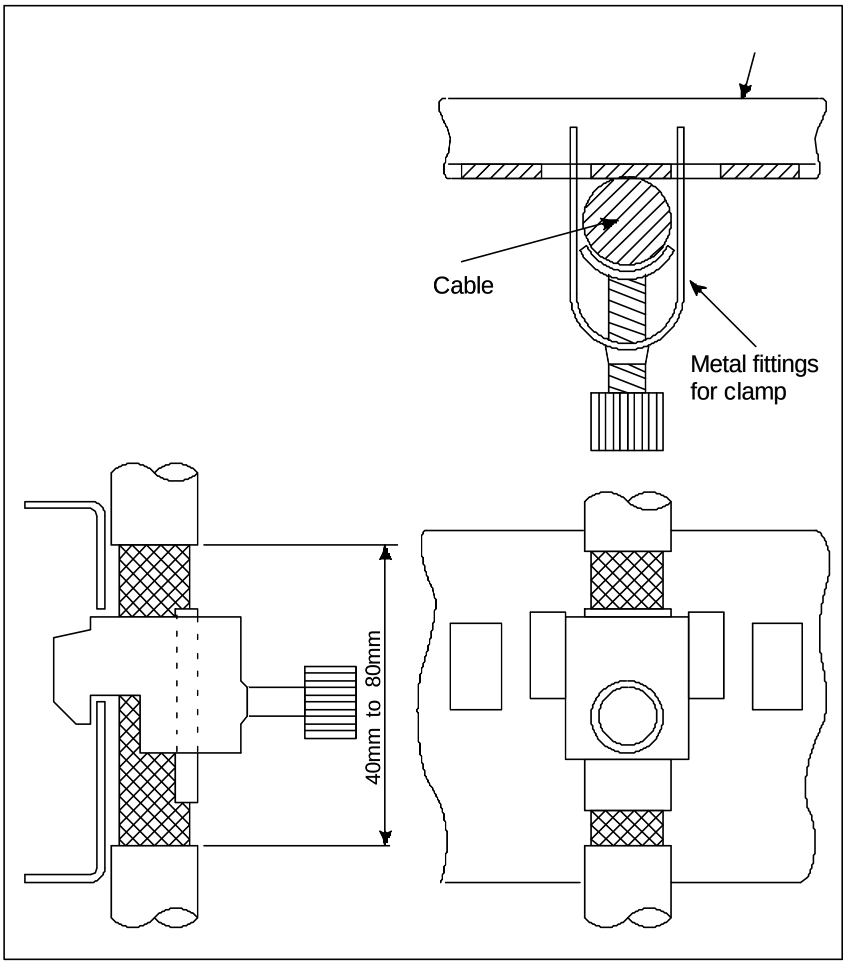


Fig.2.3.13(a) Cable clamp (1)

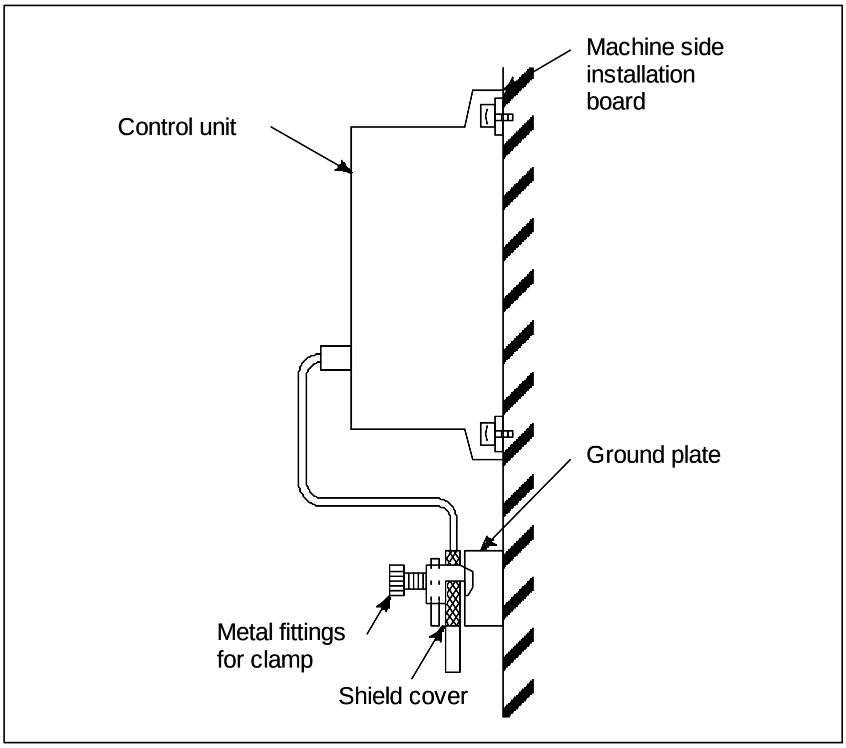


Fig.2.3.13(b) Cable clamp (2)

Prepare ground plate like the following figure.

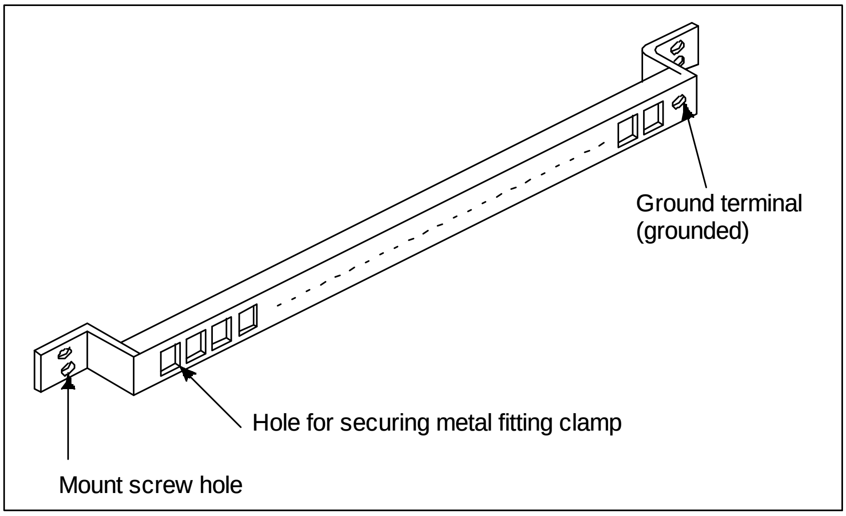
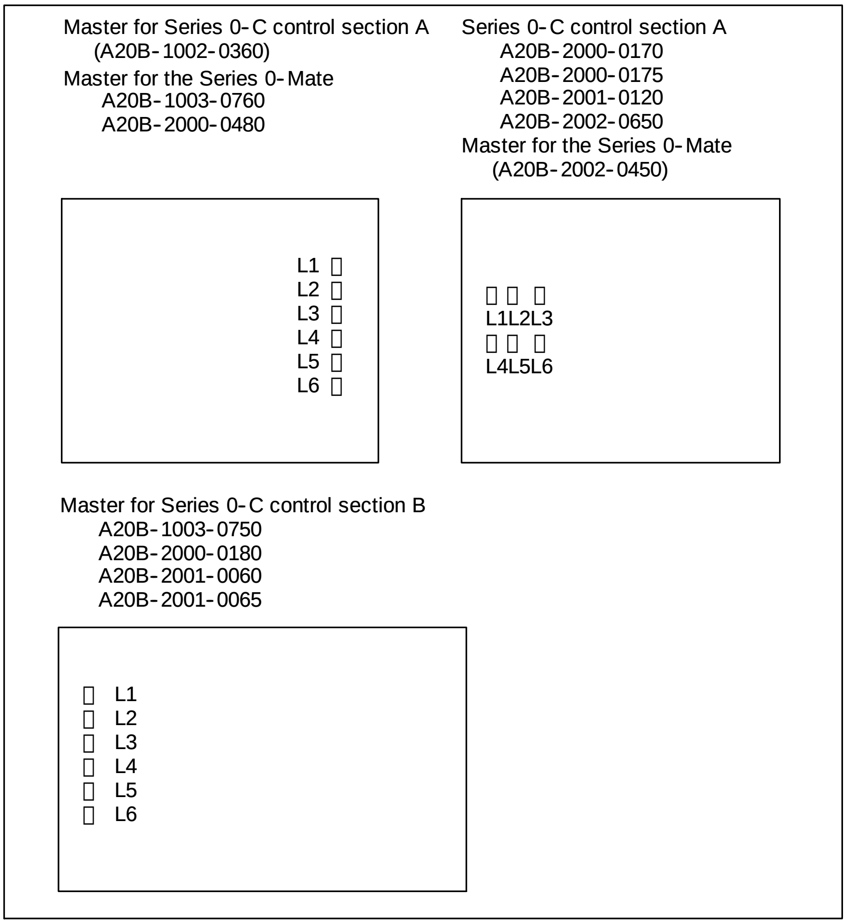


Fig.2.3.13(c) Ground plate

For the ground plate, use a metal plate of 2 mm or thicker, which surface is plated with nickel.

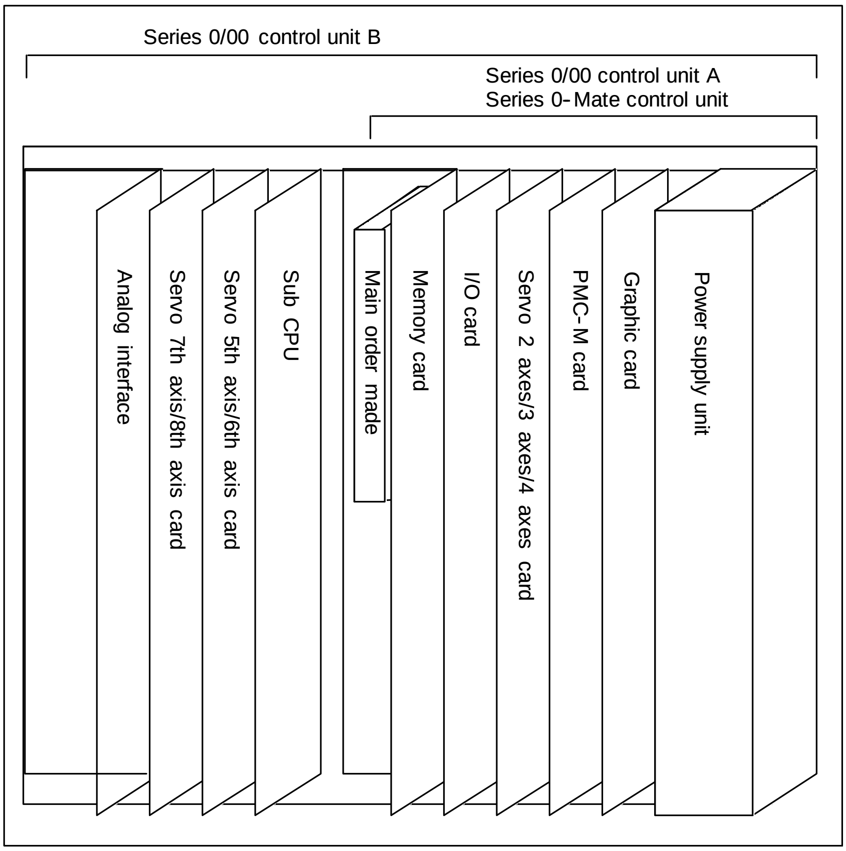
2.4 LEDS ON PRINTED-CIRCUIT BOARDS

LED		Description and Correction
Number	**Color**	
L1	Green	Blinks during automatic operation. Does not indicate an alarm.
L2	Red	Lights when an alarm occurs. Appropriate corrective action should be applied according to the alarm number displayed on the CRT screen.
L3	Red	No memory card has been installed.
L4	Red	(1) A watchdog timer alarm has occurred. The master printed-circuit board or memory card may be defective. . See alarm 920. (2) A servo alarm has occurred. (3) No axis card has been installed or, if one has been installed, it may be defective.
L5	Red	(1) A watchdog timer alarm has occurred in the sub-CPU. Replace the sub-CPU printed-circuit board. (2) A 5th/6th servo alarm has occurred.
L6	Red	A system alarm has occurred (1) The analog interface card is defective. (2) The DNC1 card is defective. (3) The 7th/8th card is defective.



2.5 PRINTED–CIRCUIT BOARD UNIT LIST

2.5.1 Structure



NOTE

The Series 00 is equipped with the following printed–circuit boards in place of the PMC–M and graphics cards.

If there is no PMC: A02B–0086–C051

PMC–M ROM board with electrical interface: A02B–0086–C052

PMC–M RAM board with electrical interface: A02B–0086–C053

PMC–M ROM board with optical interface: A02B–0086–C055

PMC–M RAM board with optical interface: A02B–0086–C056

2.5.2 Construction

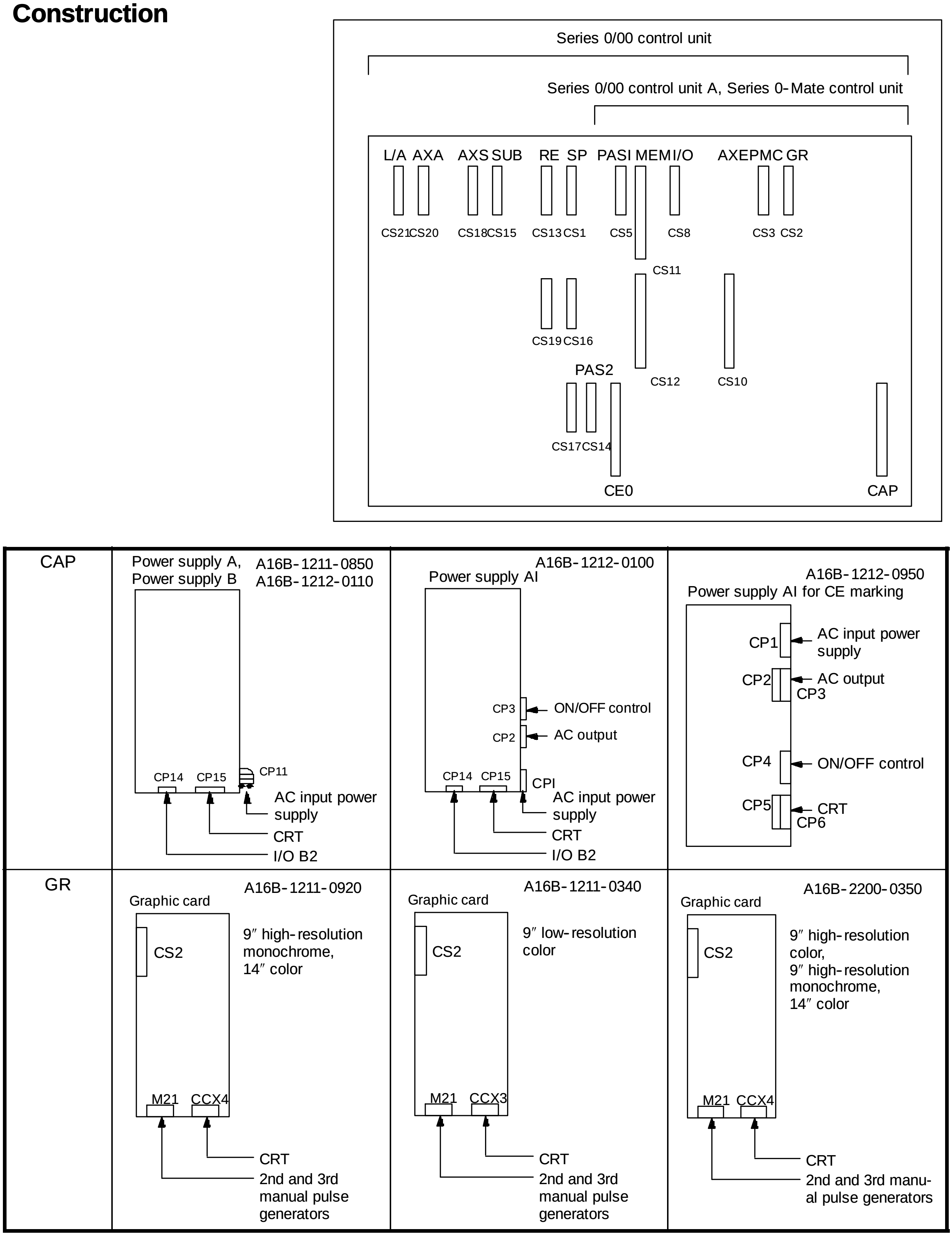


Fig.2.5.2 (a) Construction of Series 0/00

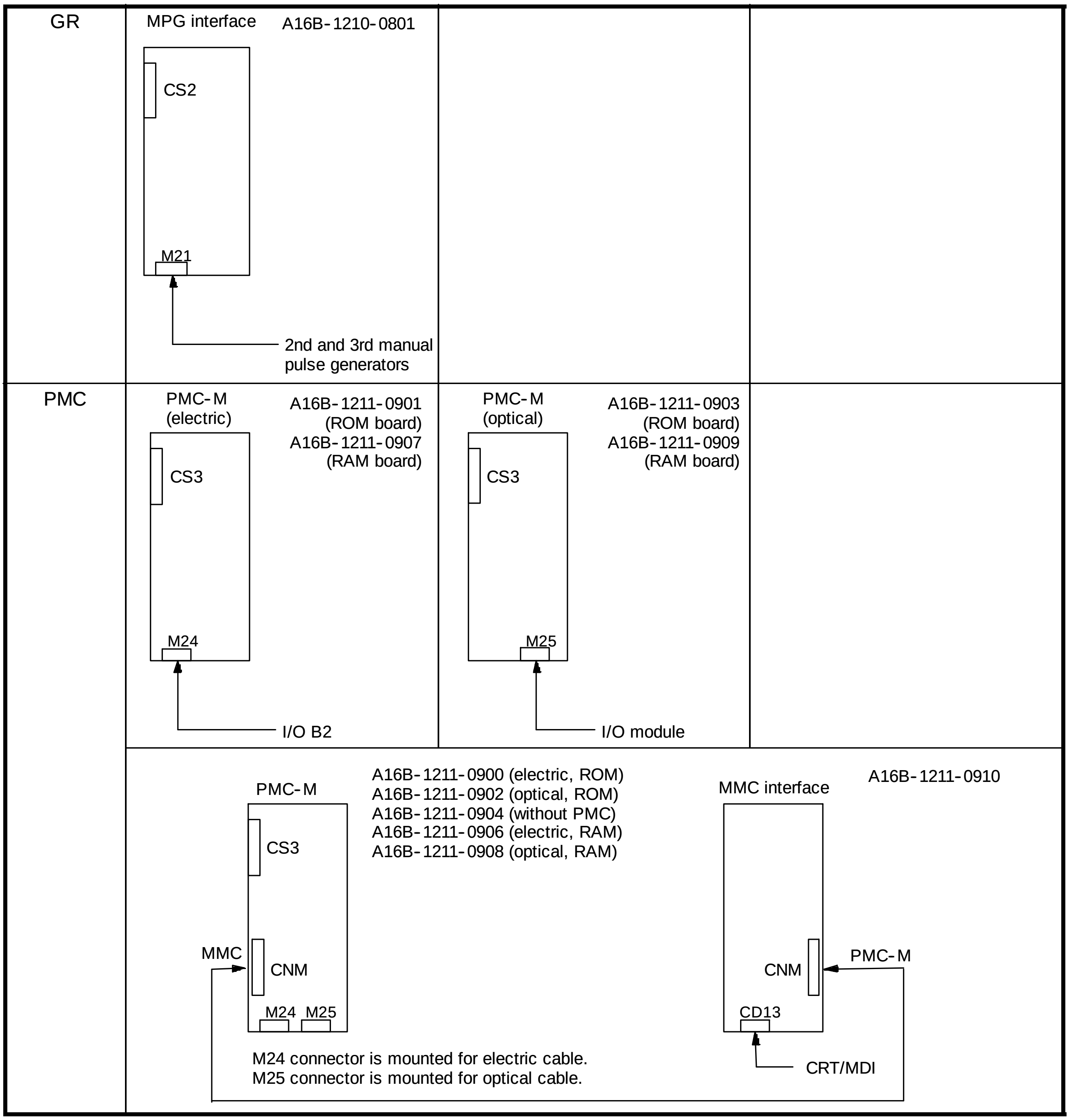


Fig.2.5.2 (b) Construction of Series 0/00

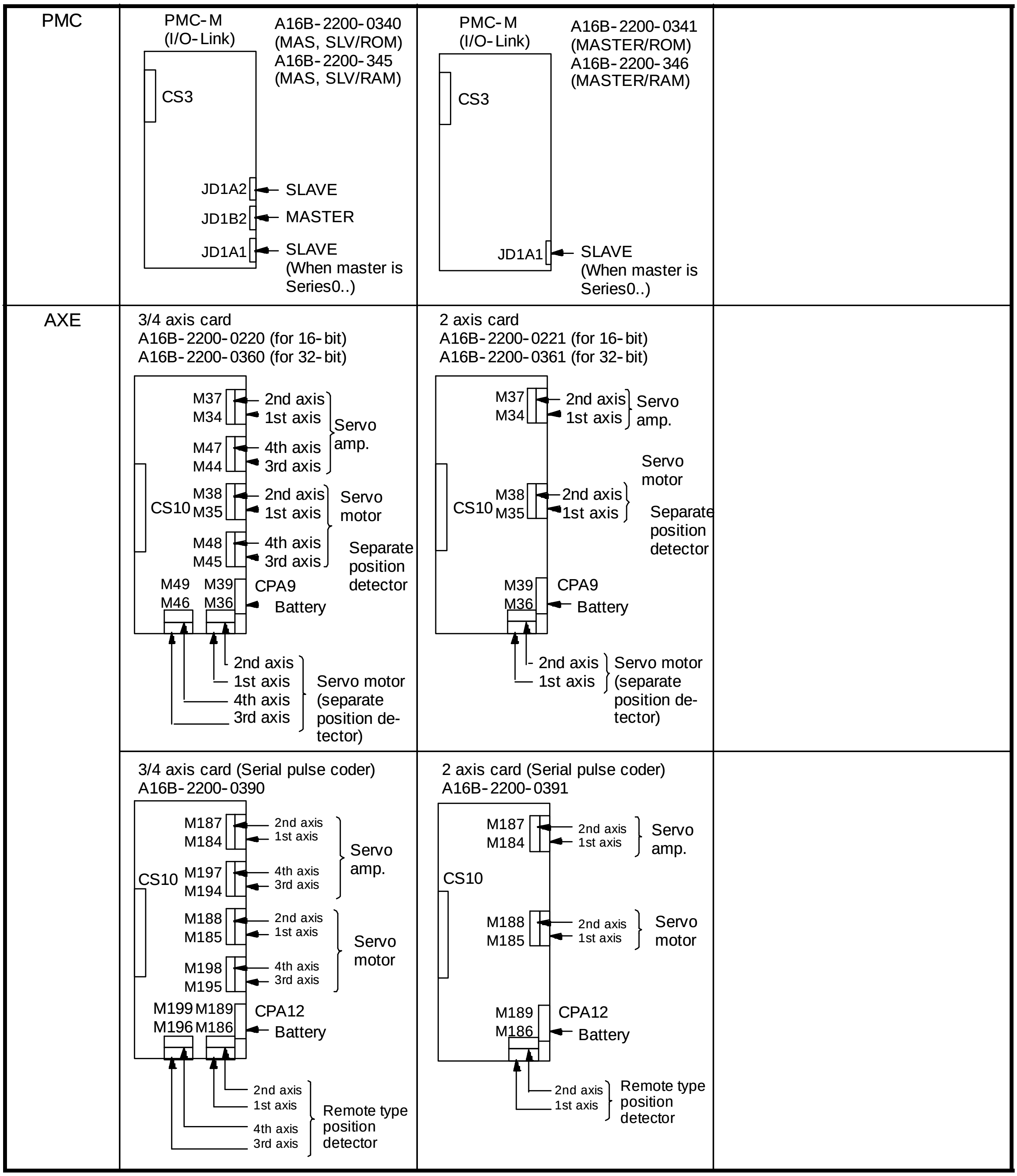


Fig.2.5.2 (c) Construction of Series 0/00

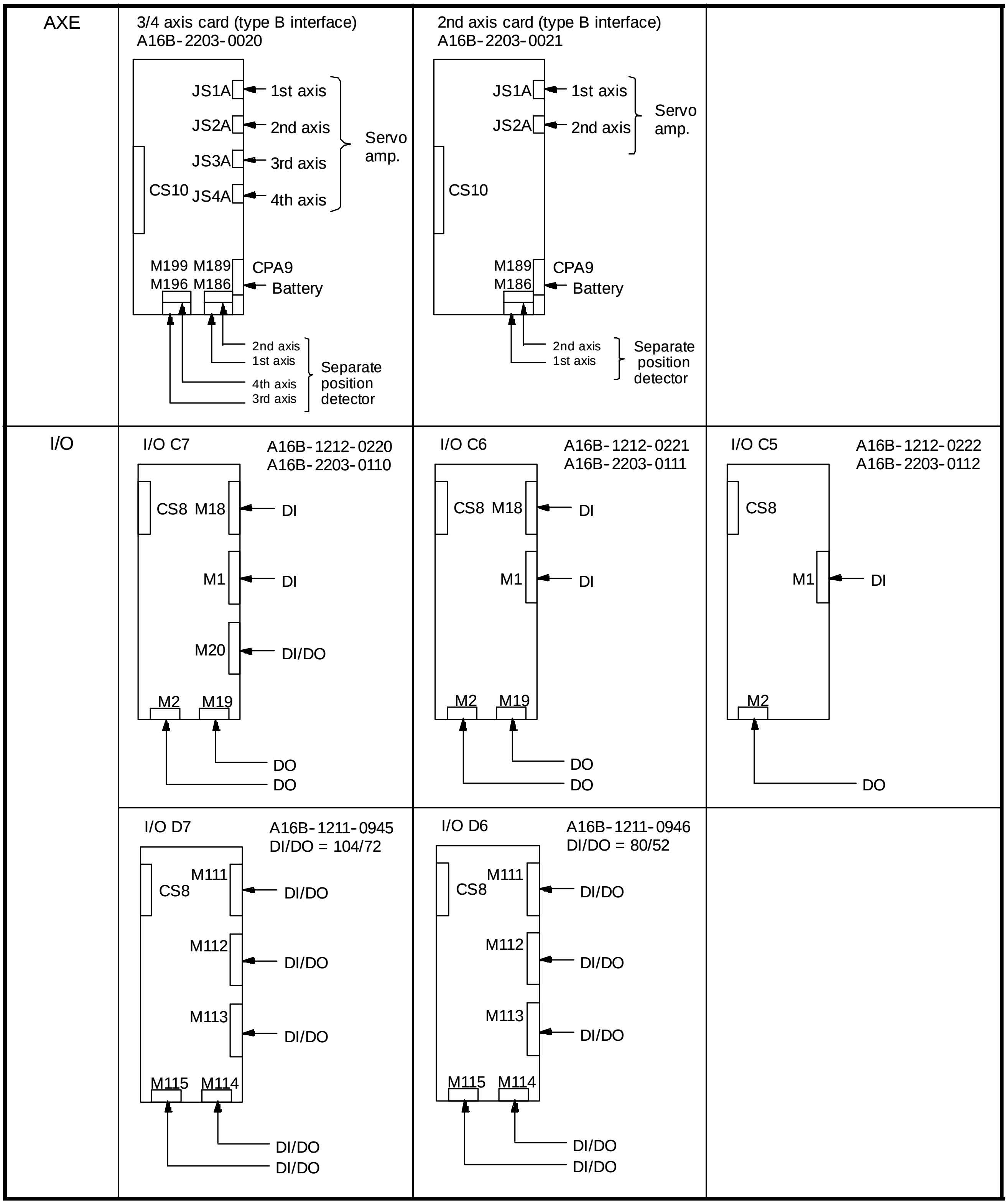
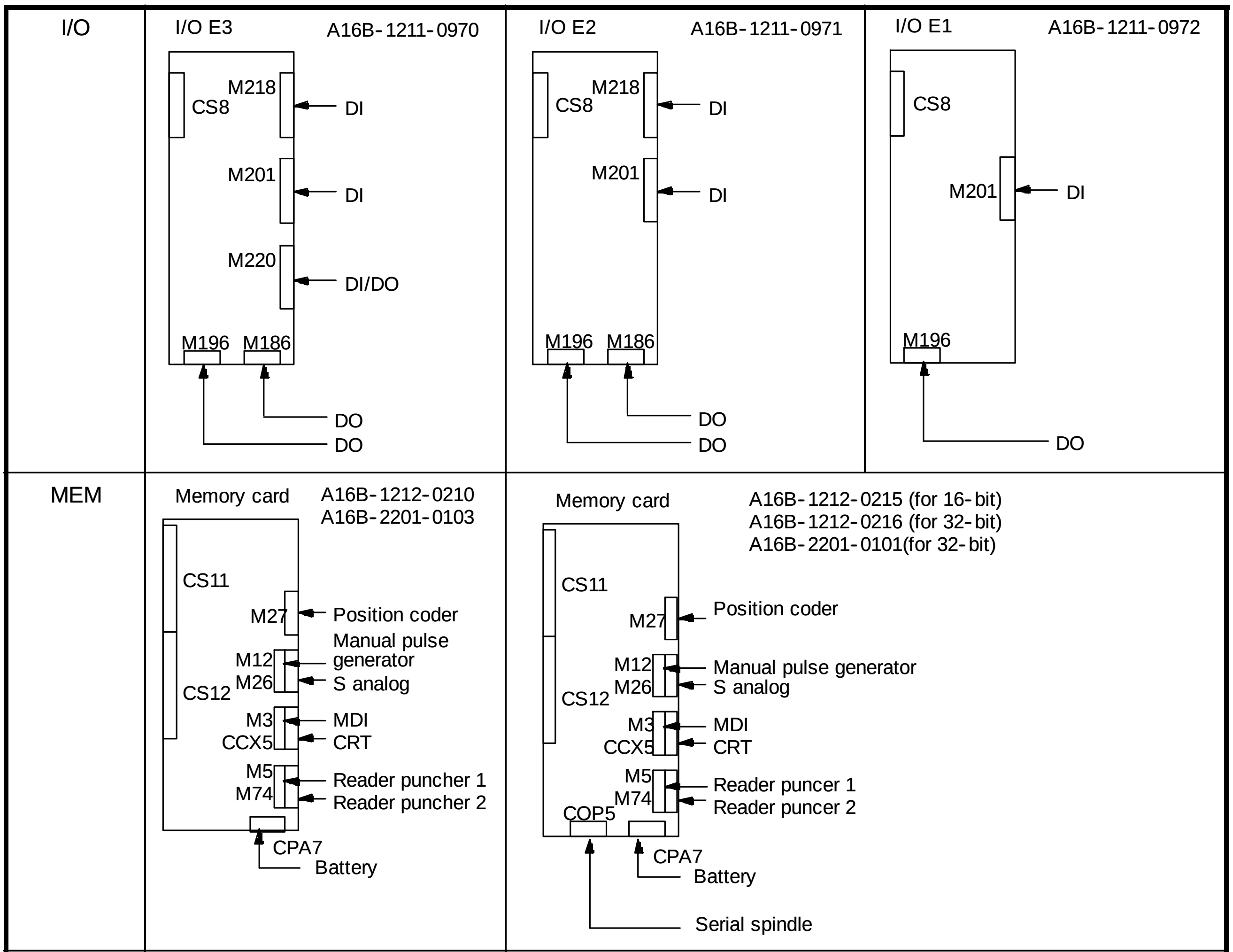


Fig. 2.5.2 (d) Construction of Series 0/00

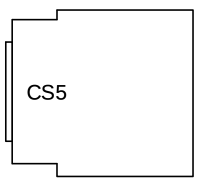


PAS1

PAS2

Macro cassette

64KB
128KB
256KB
512KB
1MB



OMM : Order-made macro (yellow label)
ME : Macro executor (white label)

64 KB	OMM	A02B-0091-C110
	ME	A02B-0091-C111
128 KB	OMM	A02B-0091-C112
	ME	A02B-0091-C113
256 KB	OMM	A02B-0091-C114
	ME	A02B-0091-C115
512 KB	OMM	A02B-0098-C116
	ME	A02B-0098-C117
1 MB	OMM	A02B-0098-C118
	ME	A02B-0098-C119

Fig. 2.5.2 (e) Construction of Series 0/00

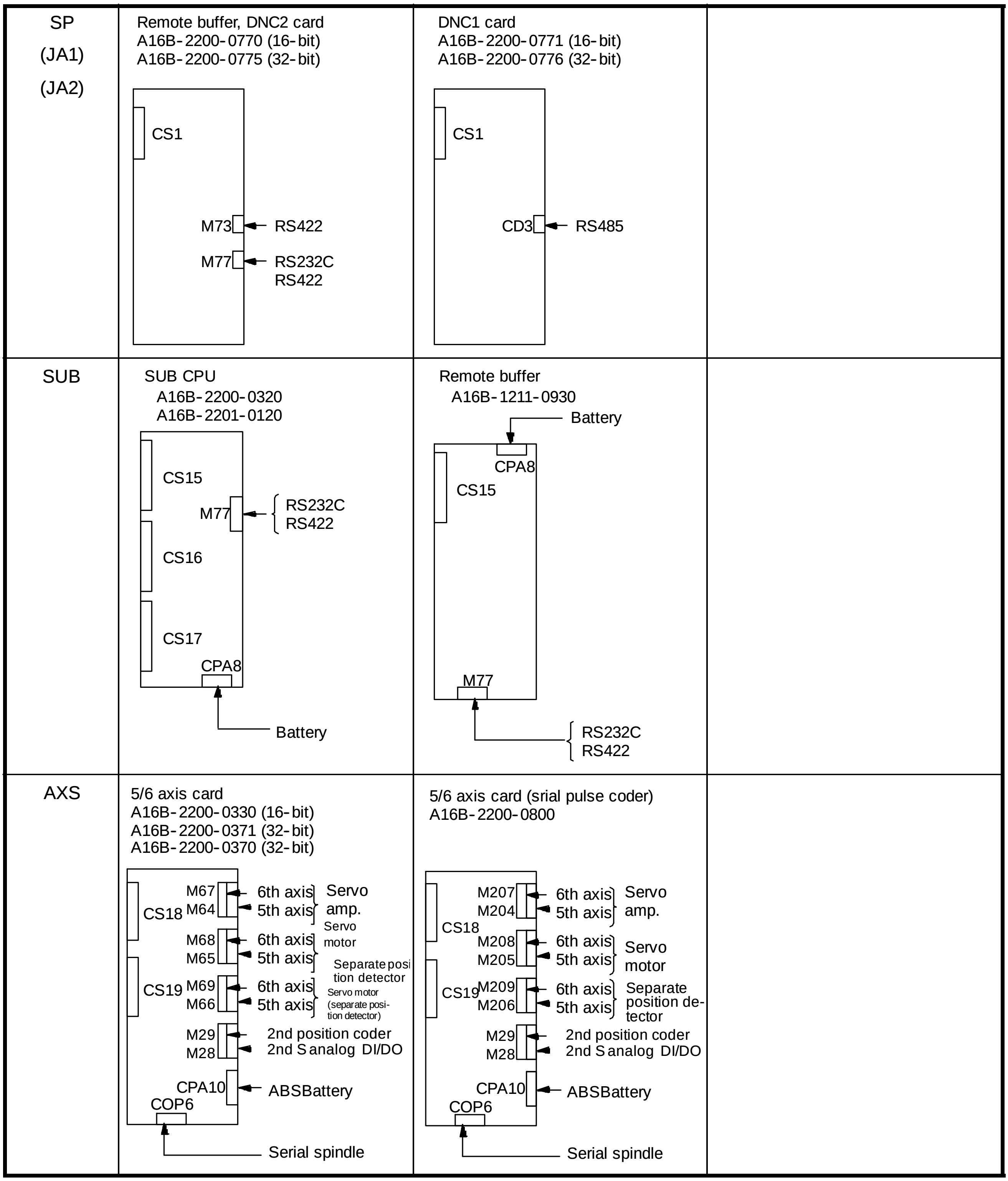


Fig. 2.5.2 (f) Construction of Series 0/00

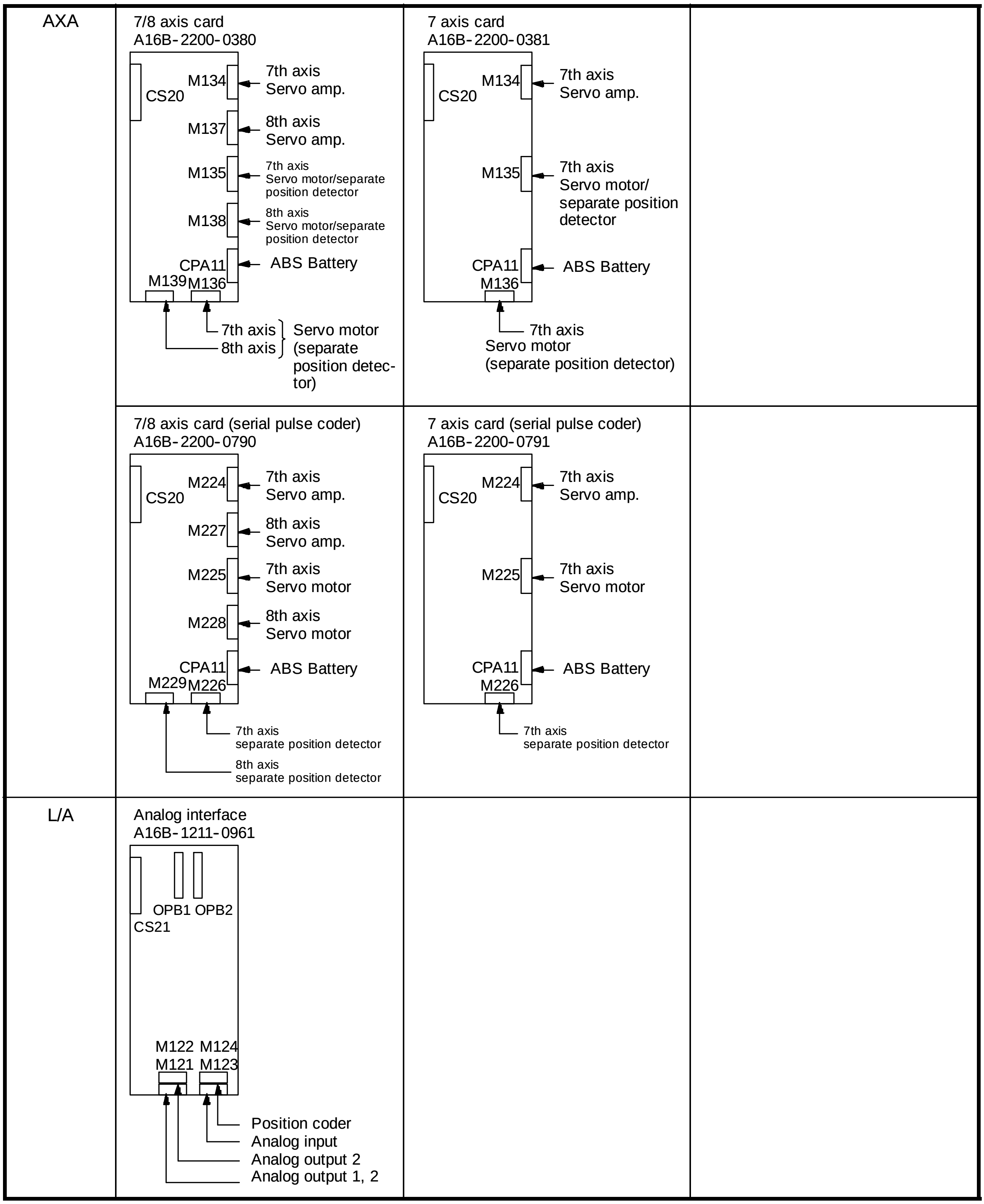


Fig. 2.5.2 (g) Construction of Series 0/00

2.6 BATTERY REPLACEMENT METHOD

2.6.1 CNC Memory Backup Battery Replacement

Part programs, offset data, and system parameters are stored in the CMOS memory of the control unit. Three ”D”(R20) size alkaline batteries are used to back up the memory of the control unit when the AC power source is off. These batteries are held in the battery unit. The user is requested to replace these batteries once a year. When replacing the batteries, it is necessary to keep the power supply switched on. Note that if the batteries are removed when the power supply is off, the contents (parameters and programs) of memory will be lost.

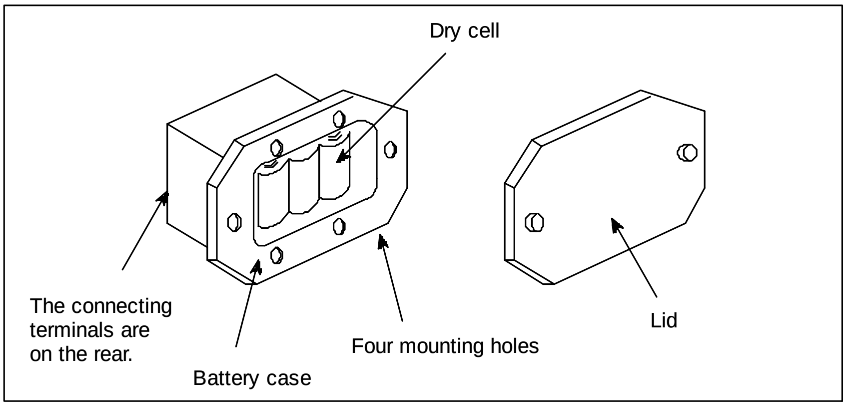
If the battery voltage drops, the warning message ”BAT” appears on the CRT screen, and a battery alarm signal is sent to the PMC. If a battery alarm occurs, replace the batteries as soon as possible (no later than within one or two weeks). Actually, however, the battery life depends on the configuration of your system.

If the battery voltage drops even further, it will become impossible to provide memory backup. If the power is switched on under this condition, a system alarm (SRAM party alarm) occurs, because the contents of memory will have been damaged. Therefore, after replacing the batteries, it is necessary to clear the entire contents of memory and re–enter the necessary programs and data. Keep the power switched on when replacing the batteries. Do not forget that disconnecting the memory backup batteries with the power switched off will result in the total loss of the memory contents.

Battery replacement

Battery replacement method

1 Obtain three new ”D” (R20) size alkaline dry cells.
2 Switch on the power to the control unit.
3 Remove the battery case lid.
4 Replace the batteries, observing the correct orientation.
5 Replace the battery case lid.
6 Switch off the power to the control unit.



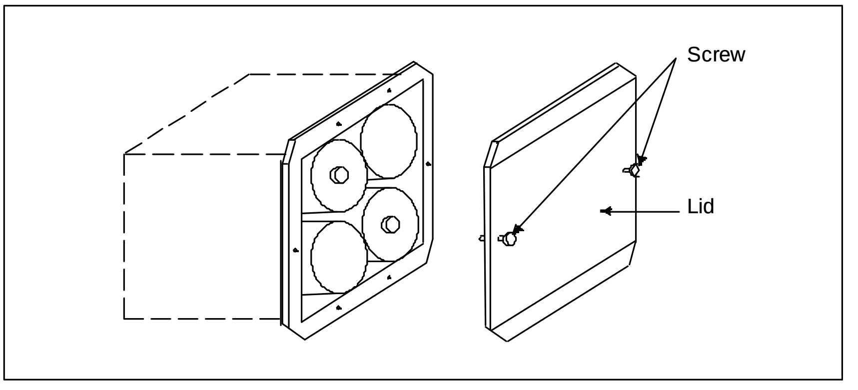
2.6.2 Absolute Pulse Coder Batteries

(1) Obtain four new ”D”(R20) size alkaline dry cells.

(2) Switch on the power to the CNC.
Note that replacing the batteries with the CNC power switched off will result in the machine absolute position being lost, making it necessary to make a return to the reference position.

(3) Loosen the battery case screws, then remove the lid.
To determine the location of the battery case, refer to the manual published by the machine tool builder.

(4) Install the new batteries.
The batteries must be installed as shown below. Note the orientation.



(5) After installing the new batteries, replace the lid.

(6) Switch the power off and then back on.

(7) A battery alarm will occur. Ignore this alarm; switch the power off and back on again.

(8) This completes battery replacement.

2.7 DETAILS OF POWER SUPPLY

2.7.1 Details of Power Supply Unit A (A16B-1211-0850) (A16B-1210-0510)

It is easy to mount and dismount the CNC power supply unit, because it is designed to be mounted on, and connected directly to, the master printed-circuit board. All its AC inputs and DC outputs are linked via connectors.

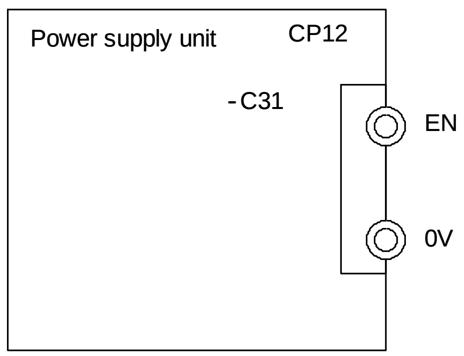
Fig.2.7.1(a) is an outline of this power supply unit, and Fig.2.7.1(b) is the block diagram.

(1) Input/output connectors

Connector name	Description
CP11	200/220/230/240VAC
	PA-PB signal output
CP12	Supply of +5V, +15V, -15V, +24V, and +24E to the master printed-circuit board
	EN signal output
CP14	+24E supply for the additional I/O B2 printed circuit board (for Series 0) +24E supply for the I/O card connection unit (for Series 0) +24E supply for the connection unit (for Series 0)
CP15	+24V supply for the 9" monochrome CRT/MDI unit (for Series 0) +24V supply for the 9" small CRT/MDI unit (for Series 10) +24V supply for the 9" small or standard CRT/MDI unit (for Series 15)

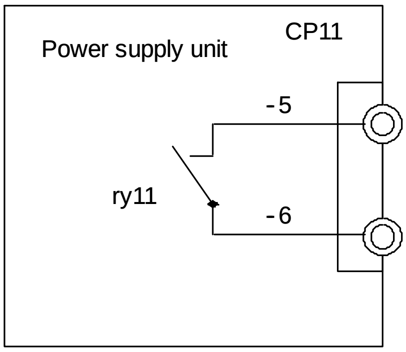
(2) Descriptions of the input/output signals

1. ENABLE signal EN (output)
   This TTL level signal indicates that all DC outputs are normal. It becomes low if an output failure is detected in any circuit.



EN: High when all outputs are normal
0V: Low if an output failure occurs.

2. PA–PB signal (output) for keeping the power applied
In a system with no input unit in use, the PA–PB signal is a contact signal used to keep the power applied. It is output from the power supply unit. In a system with an input unit in use, the PA–PB signal is used as an interface signal between the system and input unit. If the contact becomes open due to detection of an abnormal output, the signal functions as an alarm signal.



PA: The PA-PB contact is kept closed while the ENABLE signal is high.
PB: The PA-PB contact is kept open while the ENABLE signal is low.

(3) Adjustments and settings

This power supply unit requires no adjustment or setting. Do not attempt to adjust the reference voltage (=10.00V) at A10 unless absolutely necessary, because the reference voltage has been adjusted during unit test; merely confirm the voltage across A10 and A0 of check connector CP16.
If the reference voltage at A10 falls outside the rated range, set it to 10.00V, using VR11, while measuring the voltage with a digital voltmeter. Rotating VR11 clockwise increases the voltage at A10.
After the power supply unit is replaced, always to check the reference voltage at A10.

(4) Causes of blown fuses and required corrective actions

This power supply unit is provided with fuses F11 and F12 at its input, fuse F13 at the +24V output, and fuse F14 at the +24E output. Possible causes of these fuses blowing are listed below together with the corrective actions required to restore normal operation.

1. Fuses F11 and F12
   (a) Short circuit in surge absorber VS11
   VS11 is intended to suppress surge voltages on the input line. If an excessively large surge voltage or steady voltage is applied to VS11, it breaks down, short–circuiting and, causing F11 and F12 to blow. If VS11 has short–circuited, but you do not have a replacement part on hand, the machine can be used with VS11 removed. In such a case, however, you should obtain a replacement and install it as soon as possible, especially when the machine is being used in an installation prone to surge voltages. The specification number of VS11 is A50L–8001–0067#431U.
   (b) Short circuit in diode stack DS11
   (c) Short circuit between the collector and emitter of switching transistors Q14 and Q15

(d) Short circuit in diodes D33 and D34

(e) Short circuit between the collector and emitter of transistor Q1 in the auxiliary power supply circuit

If you suspect that any of short circuits (b) to (e) has occurred in the respective parts, replace the power supply unit with a spare. When replacing a fuse, use a replacement having the same rating. The specification number for fuses F11 and 12 is A60L–0001–0194#5.0.

2. Fuse F13

   (a) A short circuit may have occurred in the CRT/MDI unit or a +24 V power supply cord leading to it. Remove the cord from CP15, and check the unit and cord carefully.

   (b) A short circuit may have occurred in the +24 V circuit on the master printed–circuit board. Remove the cable from CP14 and CP15. Also, remove the power supply unit from the master printed–circuit board, then check the printed–circuit board carefully. When replacing a fuse, use a replacement having the same rating. The specification number for fuse F13 is A60L–0001–0075#3.2.

3. Fuse F14

   (a) Short circuit in +24E power supply cables for various printed–circuit board units

   (b) Ground fault of the +24E power supply line in the machine or false contact of the +24E power supply line with another power supply line

   If either of (a) or (b) may have occurred, remove the cable from CP14, and check it carefully. When replacing a fuse, use a replacement part having the same rating. The specification number for fuse F14 is A60L–0001–0046#5.0.

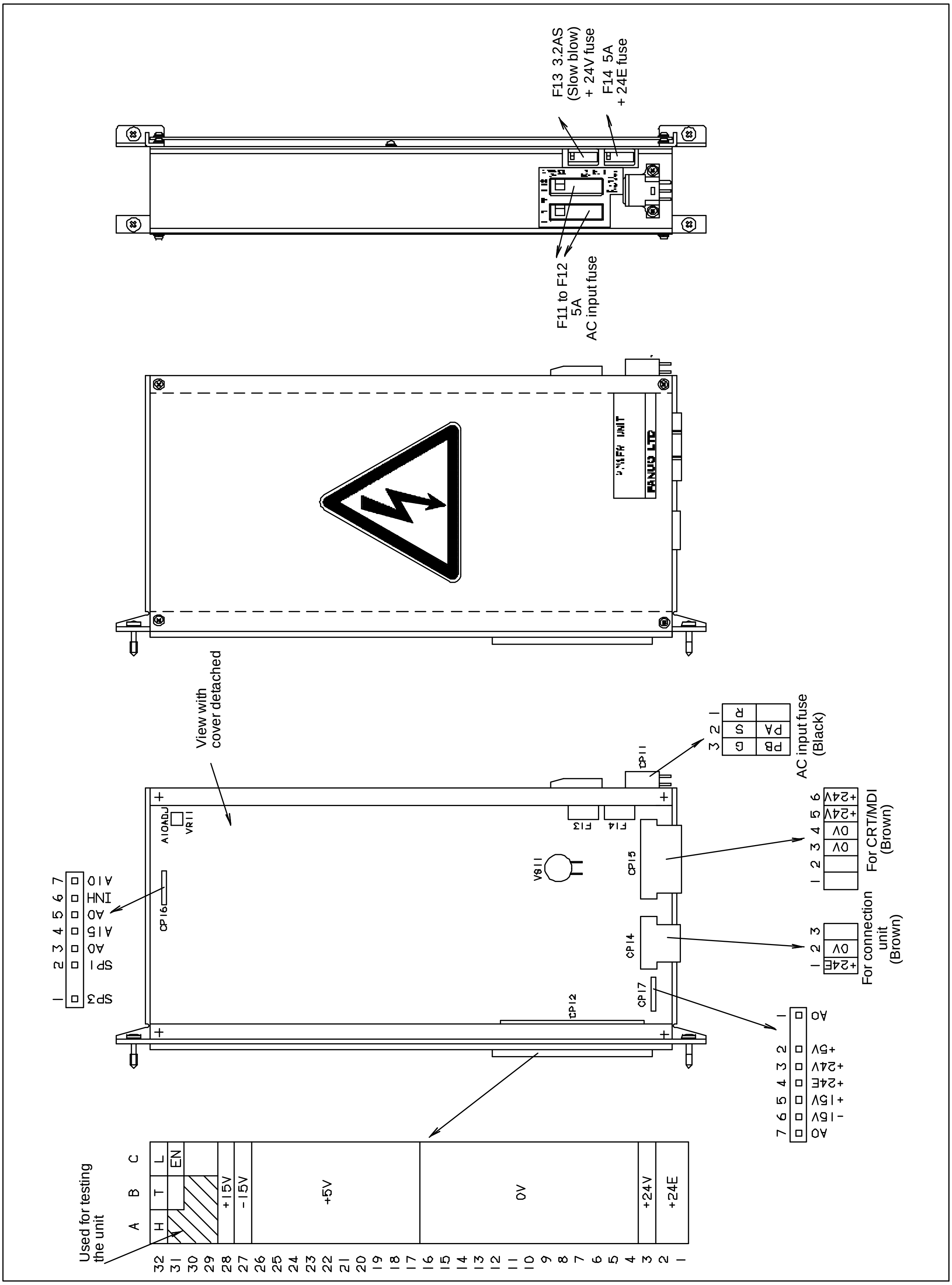


Fig.2.7.1(a) Power supply unit A external diagram

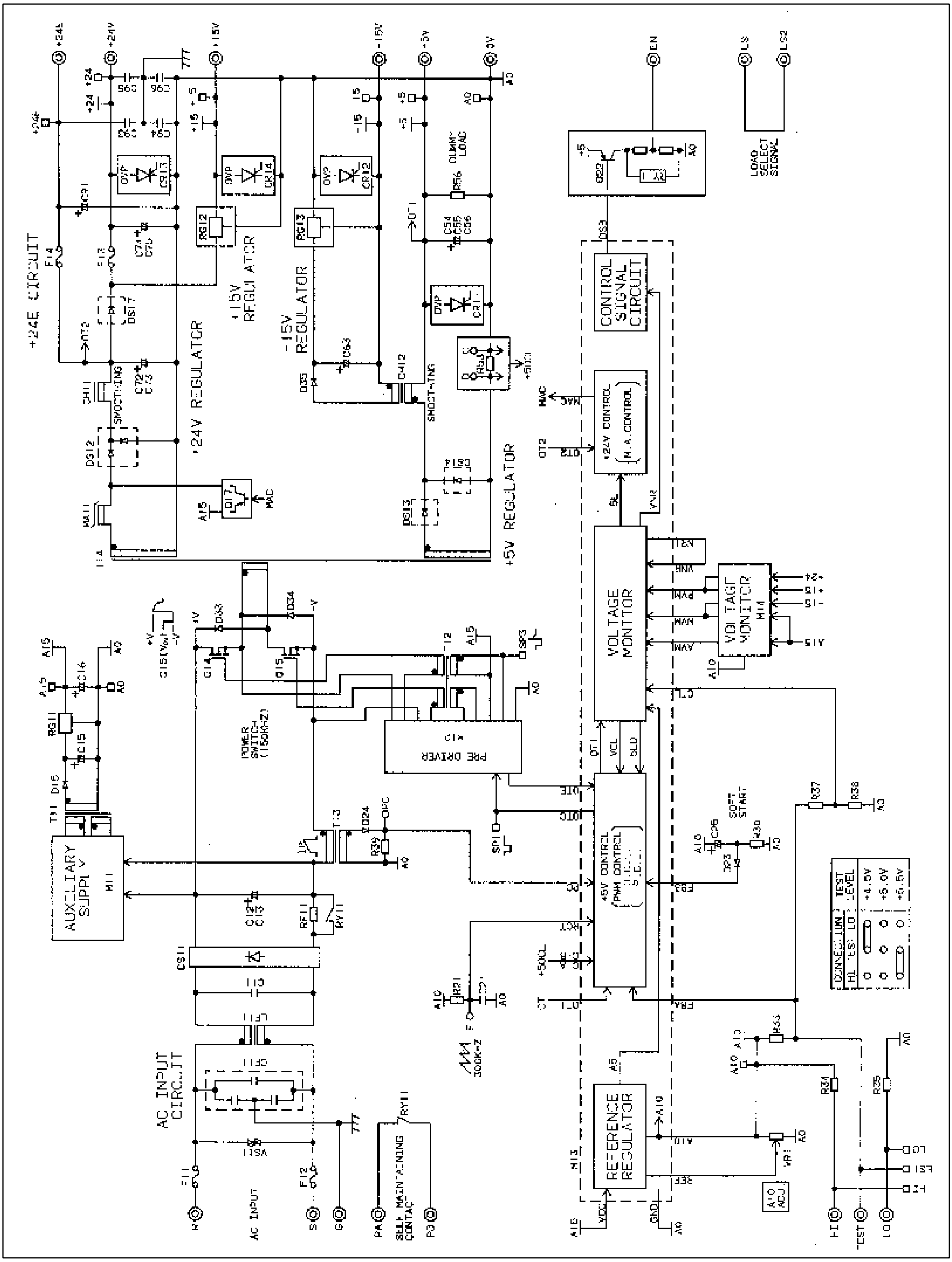


Fig.2.7.1(b) Power supply unit A block diagram

2.7.2 Details of Power Supply Unit B2 (A16B-1212-0110)

It is easy to mount and dismount the CNC power supply unit, because it is designed to be mounted on, and connected directly to, the master printed-circuit board. All its AC inputs and DC outputs are linked via connectors.

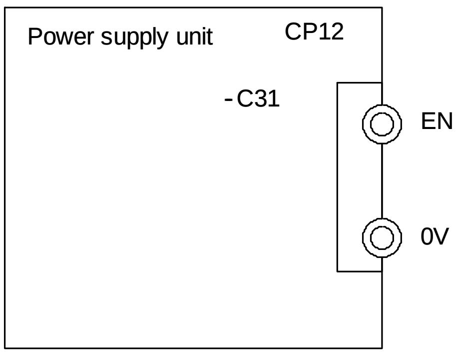
Fig.2.7.2(a) is an outline of this power supply unit, and Fig.2.7.2(b) is the block diagram.

(1) Input/output connectors

Connector name	Description
CP11	200/220/230/240VAC
	PA-PB signal output
CP12	Supply of +5V, +15V, -15V, +24V, and +24E to the master printed-circuit board
	EN signal output
CP14	+24E supply for the additional I/O B2 printed circuit board (for Series 0) +24E supply for the I/O card connection unit (for Series 0) +24E supply for the connection unit (for Series 0)
CP15	+24V supply for the 9" monochrome CRT/MDI unit (for Series 0) +24V supply for the 9" small or standard CRT/MDI unit (for Series 15)

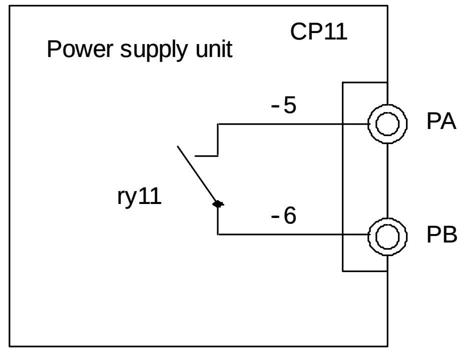
(2) Descriptions of the input/output signals

1. ENABLE signal EN (output)
   This TTL level signal indicates that all DC outputs are normal. It becomes low if an output failure is detected in any circuit.



EN: High when all outputs are normal
0V: Low if an output failure occurs.

2. PA–PB signal (output) for keeping the power applied
   In a system with no input unit in use, the PA–PB signal is a contact signal used to keep the power applied. It is output from the power supply unit. In a system with an input unit in use, the PA–PB signal is used as an interface signal between the system and input unit. If the contact becomes open due to detection of an abnormal output, the signal functions as an alarm signal.



PA: The PA-PB contact is kept closed while the ENABLE signal is high.
PB: The PA-PB contact is kept open while the ENABLE signal is low.

(3) Adjustments and settings

This power supply unit requires no adjustment or setting. Do not attempt to adjust the reference voltage (=10.00V) at A10 unless absolutely necessary, because the reference voltage has been adjusted during unit test; merely confirm the voltage across A10 and A0 of check connector CP16.
If the reference voltage at A10 falls outside the rated range, set it to 10.00V, using VR11, while measuring the voltage with a digital voltmeter. Rotating VR11 clockwise increases the voltage at A10.
After the power supply unit is replaced, always to check the reference voltage at A10.

(4) Causes of blown fuses and required corrective actions

This power supply unit is provided with fuses F11 and F12 at its input, fuse F13 at the +24 V output, and fuse F14 at the +24E output. Possible causes of these fuses blowing are listed below together with the corrective actions required to restore normal operation.

1. Fuses F11 and F12
   (a) Short circuit in surge absorber VS11
   VS11 is intended to suppress surge voltages on the input line. If an excessively large surge voltage or steady voltage is applied to VS11, it breaks down, short–circuiting and, causing F11 and F12 to blow. If VS11 has short–circuited, but you do not have a replacement part on hand, the machine can be used with VS11 removed. In such a case, however, you should obtain a replacement and install it as soon as possible, especially when the machine is being used in an installation prone to surge voltages. The specification number of VS11 is A50L–8001–0067#431U.
   (b) Short circuit in diode stack DS11
   (c) Short circuit between the collector and emitter of switching transistors Q14 and Q15

(d) Short circuit in diodes D33 and D34

(e) Short circuit between the collector and emitter of transistor Q11 in the auxiliary power supply circuit

If you suspect that any of short circuits (b) to (e) has occurred in the respective parts, replace the power supply unit with a spare. When replacing a fuse, use a replacement having the same rating. The specification number for fuses F11 and 12 is A60L-0001-0194#5.0.

2. Fuse F13

(a) A short circuit may have occurred in the CRT/MDI unit or a +24 V power supply cord leading to it. Remove the cord from CP15, and check the unit and cord carefully.

(b) A short circuit may have occurred in the +24 V circuit on the master printed-circuit board. Remove the cable from CP14 and CP15. Also, remove the power supply unit from the master printed-circuit board, then check the printed-circuit board carefully. When replacing a fuse, use a replacement having the same rating. The specification number for fuse F13 is A60L-0001-0075#3.2.

3. Fuse F14

(a) Short circuit in +24E power supply cables for various printed-circuit board units

(b) Ground fault of the +24E power supply line in the machine or false contact of the +24E power supply line with another power supply line

If either of (a) or (b) may have occurred, remove the cable from CP14, and check it carefully. When replacing a fuse, use a replacement part having the same rating. The specification number for fuse F14 is A60L-0001-0046#7.5.

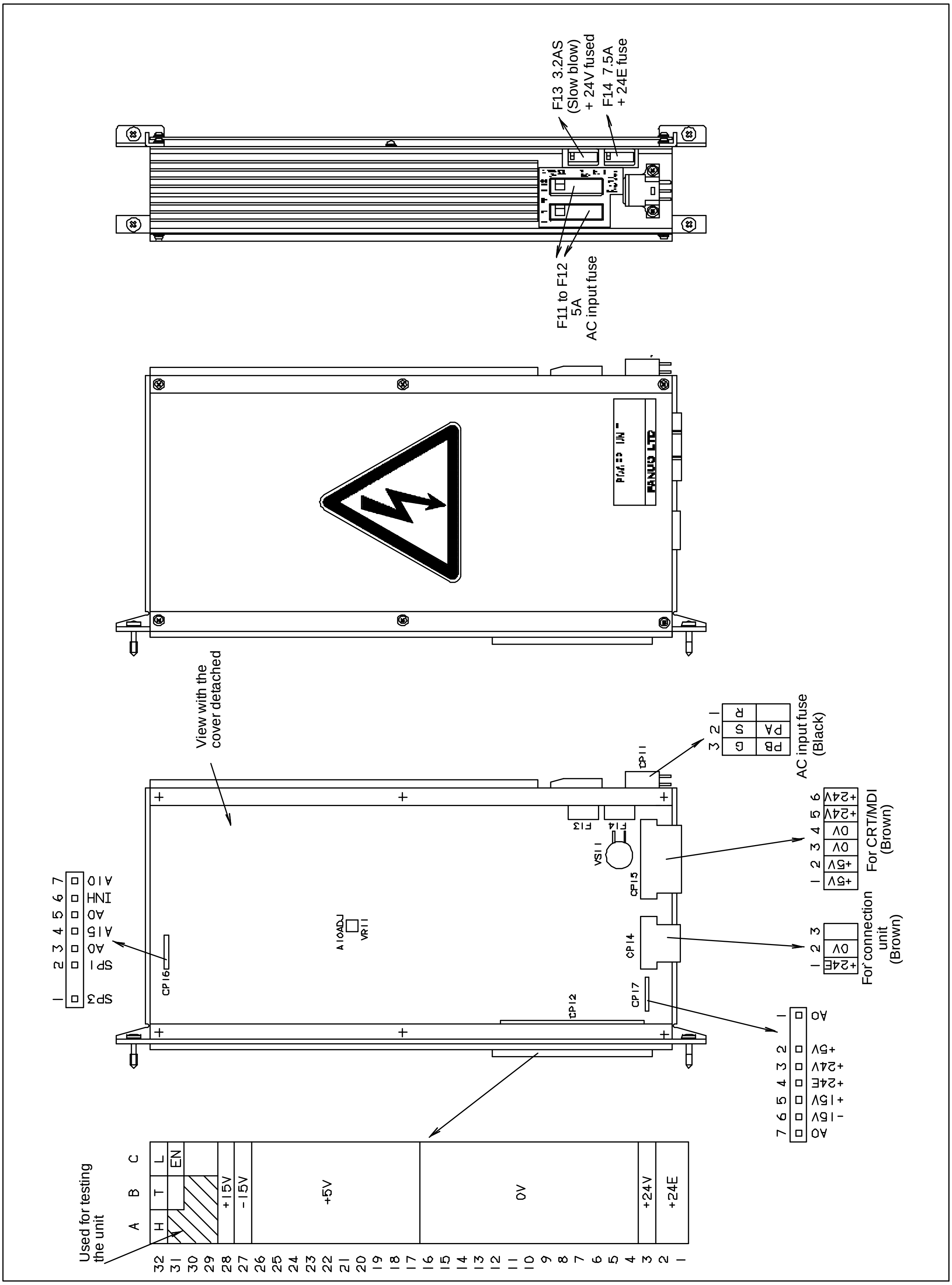


Fig.2.7.2(a) Power supply unit B2 external diagram

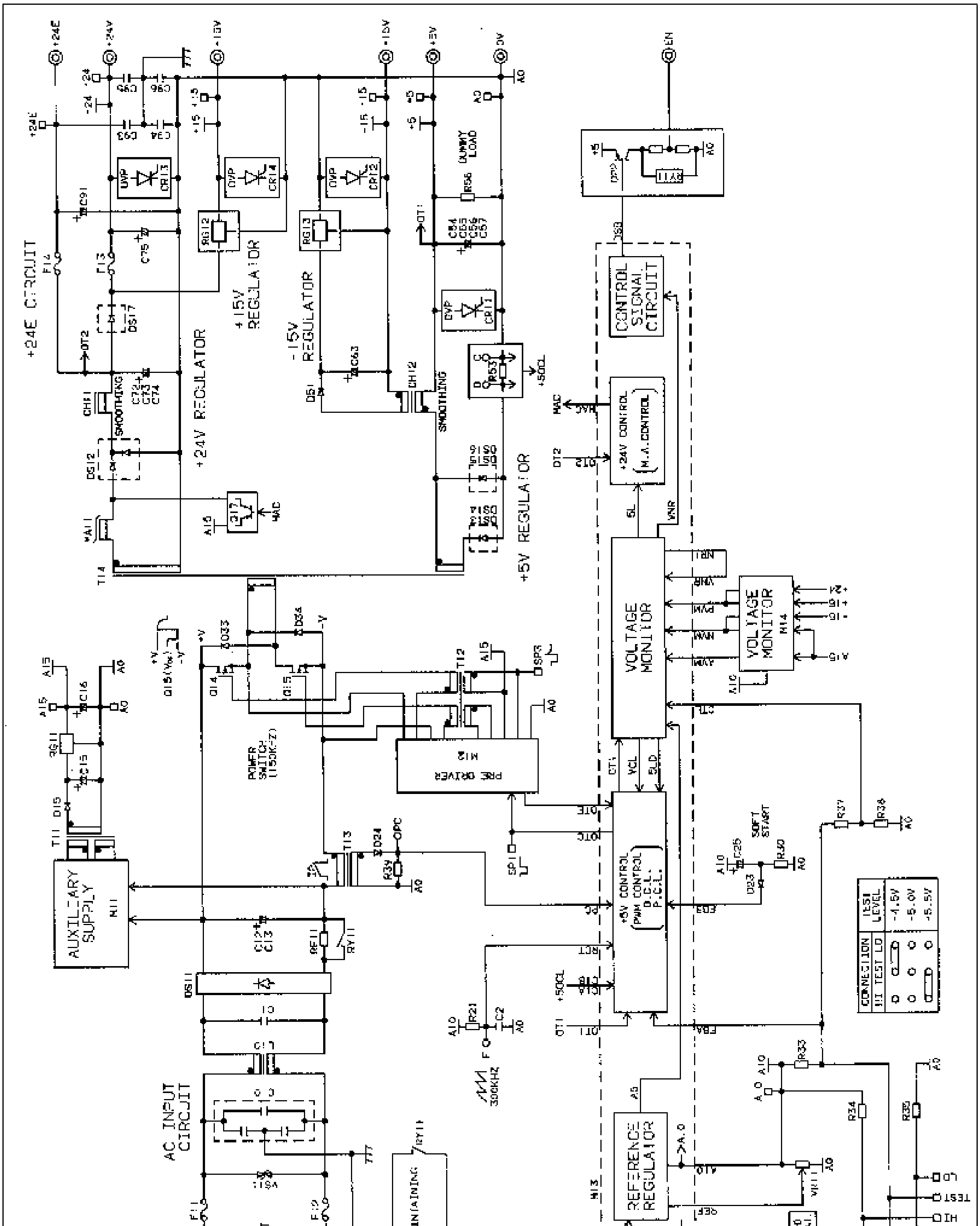


Fig.2.7.2(b) Power supply unit B2 block diagram

2.7.3 Details of Power Supply Unit AI (A16B-1212-0100)

It is easy to mount and dismount the CNC power supply unit, because it is designed to be mounted on, and connected directly to, the master printed-circuit board. All its AC inputs and DC outputs are linked via connectors.

Because this power supply unit has a built-in input unit function, it is not necessary to prepare a separate relay or input unit for switching the AC input on and off. The AC input can be connected directly to the power supply unit. The unit has an AC service outlet, which is switched on and off simultaneously with the power supply unit. This AC service outlet can be used to supply power to a unit such as a fan motor.

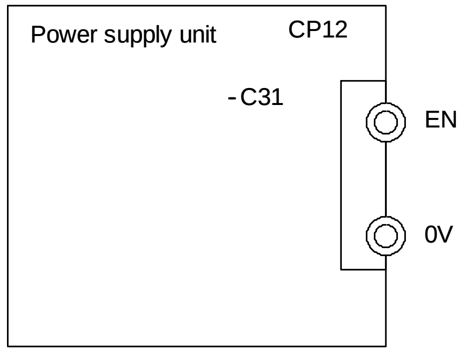
Fig.2.7.3(a) is an outline of this power supply unit, and Fig.2.7.3(b) is the block diagram.

(1) Input/output connectors

Connector name	Description
CP1	200/220/230/240 VAC input
CP2	200/220/230/240 VAC output (switched on and off simultaneously with the power supply unit)
CP3	Power on/off switch contact signal input
	External alarm signal input
	Alarm signal input
CP12	Supply of +5 V, +15 V, -15 V, +24 V, and +24E to the master printed-circuit board
	EN signal output
CP14	+24E supply for the additional I/O B2 printed circuit board (for Series 0) +24E supply for the connection unit (for Series 15)
CP15	+24V supply for the 9" monochrome CRT/MDI unit (for Series 0)

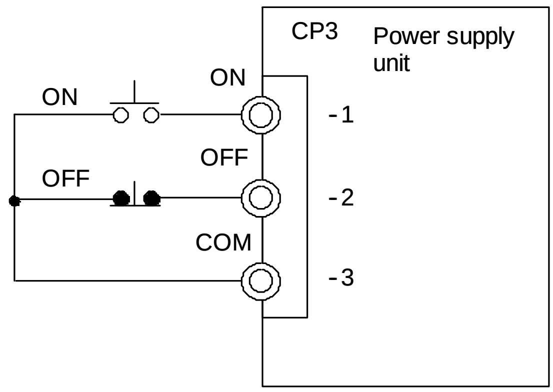
(2) Descriptions of the input/output signals and display LEDs

1. AC power supply display LED (green)
   When an AC power source is connected to the power supply unit, the LED lights regardless of whether the unit is on or off.
2. Alarm display LED (red)
   If the power supply unit is switched off because of an alarm condition due to a failure such as an output error, the alarm display LED lights and remains on until the alarm condition is cleared by pressing the OFF switch or shutting down the AC power supply.
3. ENABLE signal EN (output)
   This TTL level signal indicates that all DC outputs are normal. It becomes low if an output failure is detected in any circuit.



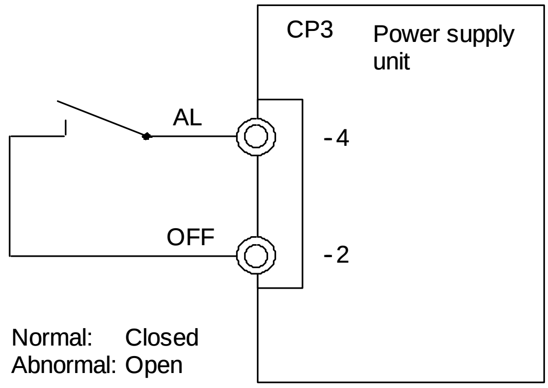
EN: High when all outputs are normal
0V: Low if an output failure occurs.

4. Power supply on/off control signal ON–OFF–COM (input)
   If two switches are connected to this circuit as shown below, pressing the ON switch turns on the power supply unit, while pressing the OFF switch turns the unit off.
   If an alarm occurs in the power supply unit, and the alarm display LED lights in red, however, pressing the ON switch will not turn on the power supply unit. In this case, it is necessary to remove the cause of the alarm and press the OFF switch.
   Pressing the OFF switch clears the alarm condition. Subsequently pressing the ON switch turns on the power supply unit.

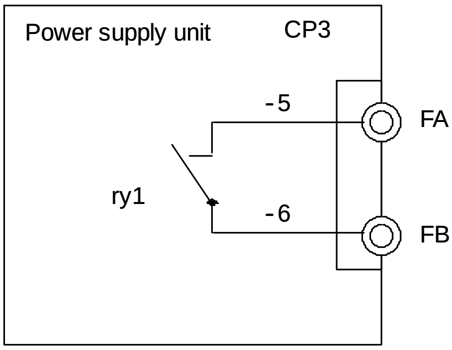


ON switch: Is closed when pressed.
OFF switch: Opens when pressed.

5. External alarm signal AL (input)
   When a contact signal from another unit or external power supply becomes ”closed,” the ENABLE signal of this power supply unit becomes low, thus immediately turning off the power supply unit.



6. Alarm signal FA–FB (output)
This contact signal indicates the state of all DC outputs. The contact is open when all the DC outputs are normal. It is closed if an output failure is detected in any DC output circuit.
If an external alarm signal (item 5) is connected, the FA–FB contact opens, when all DC outputs are normal and the external alarm signal is "open." The contact closes when the external alarm signal becomes "closed."



FA : The FA-FB contact opens, when all DC outputs are normal and the external alarm contact signal is "open."
FB : The FA-FB contact is closed if any DC output is normal, or if the external alarm contact signal is "closed."

(3) Adjustments and settings

This power supply unit requires no adjustment or setting. Do not attempt to adjust the reference voltage (=10.00V) at A10 unless absolutely necessary, because the reference voltage has been adjusted during unit test; merely confirm the voltage across A10 and A0 of check connector CP16.
If the reference voltage at A10 falls outside the rated range, set it to 10.00V, using VR11, while measuring the voltage with a digital voltmeter. Rotating VR11 clockwise increases the voltage at A10.
After the power supply unit is replaced, always to check the reference voltage at A10.

(4) Causes of blown fuses and required corrective actions

This power supply unit is provided with fuses F11 and F12 at its input, fuse F13 at the +24V output, and fuse F14 at the +24E output. Possible causes of these fuses blowing are listed below together with the corrective actions required to restore normal operation.

1. Fuses F11 and F12

   (a) Short circuit in surge absorber VS11
   VS11 is intended to suppress surge voltages on the input line. If an excessively large surge voltage or steady voltage is applied to VS11, it breaks down, short–circuiting and, causing F11 and F12 to blow. If VS11 has short–circuited, but you do not have a replacement part on hand, the machine can be used with VS11 removed. In such a case, however, you should obtain a replacement and install it as soon as possible, especially when the machine is being used in an installation prone to surge voltages. The specification number of VS11 is A50L–8001–0067#431U.

   (b) Short circuit in diode stack DS11

   (c) Short circuit between the collector and emitter of switching transistors Q14 and Q15

   (d) Short circuit in diodes D33 and D34

   (e) Short circuit between the collector and emitter of transistor Q1 in the auxiliary power supply circuit

   If you suspect that any of short circuits (b) to (e) has occurred in the respective parts, replace the power supply unit with a spare. When replacing a fuse, use a replacement having the same rating. The specification number for fuses F11 and 12 is A60L–0001–0245#GP75.

2. Fuse F13

   (a) A short circuit may have occurred in the CRT/MDI unit or a +24 V power supply cord leading to it. Remove the cord from CP15, and check the unit and cord carefully.

   (b) A short circuit may have occurred in the +24 V circuit on the master printed–circuit board. Remove the cable from CP14 and CP15. Also, remove the power supply unit from the master printed–circuit board, then check the printed–circuit board carefully. When replacing a fuse, use a replacement having the same rating. The specification number for fuse F13 is A60L–0001–0075#3.2.

3. Fuse F14

   (a) Short circuit in +24E power supply cables for various printed–circuit board units

   (b) Ground fault of the +24E power supply line in the machine or false contact of the +24E power supply line with another power supply line

   If either of (a) or (b) may have occurred, remove the cable from CP14, and check it carefully. When replacing a fuse, use a replacement part having the same rating. The specification number for fuse F14 is A60L–0001–0046#5.0.

4. Fuse F1

   Fuse F1 and surge absorber VS1 are wired so that, if a high current flows through VS1, it may cause F1 to blow. This is intended to protect the circuits in the power supply unit from an abnormal voltage that may occur due to a failure in the auxiliary power supply circuit of the power supply unit and an abnormal voltage that may originate in the power supply ON/OFF switch contact signal line or external alarm signal line. If F1 blows, probable causes are:

   (1) Failure in the auxiliary power supply circuit (M1, Q1, T1, D1, Q2, or ZD1)

   (2) False contact between the power supply ON/OFF switch contact signal line or external alarm signal line and the AC power line

If cause (1) is more likely, replace the power supply unit. If cause (2) is more likely, replace the power supply unit, because the power supply unit may have failed. After the power supply ON/OFF switch contact signal line and external alarm signal line have been checked, and all abnormal conditions (if any) have been cleared, if replacing F1 restores normal operation, there is no need to replace the power supply unit. The specification number of fuse F1 is A60L–0001–0172#DM03. When replacing the fuse, use a replacement having the same rating.

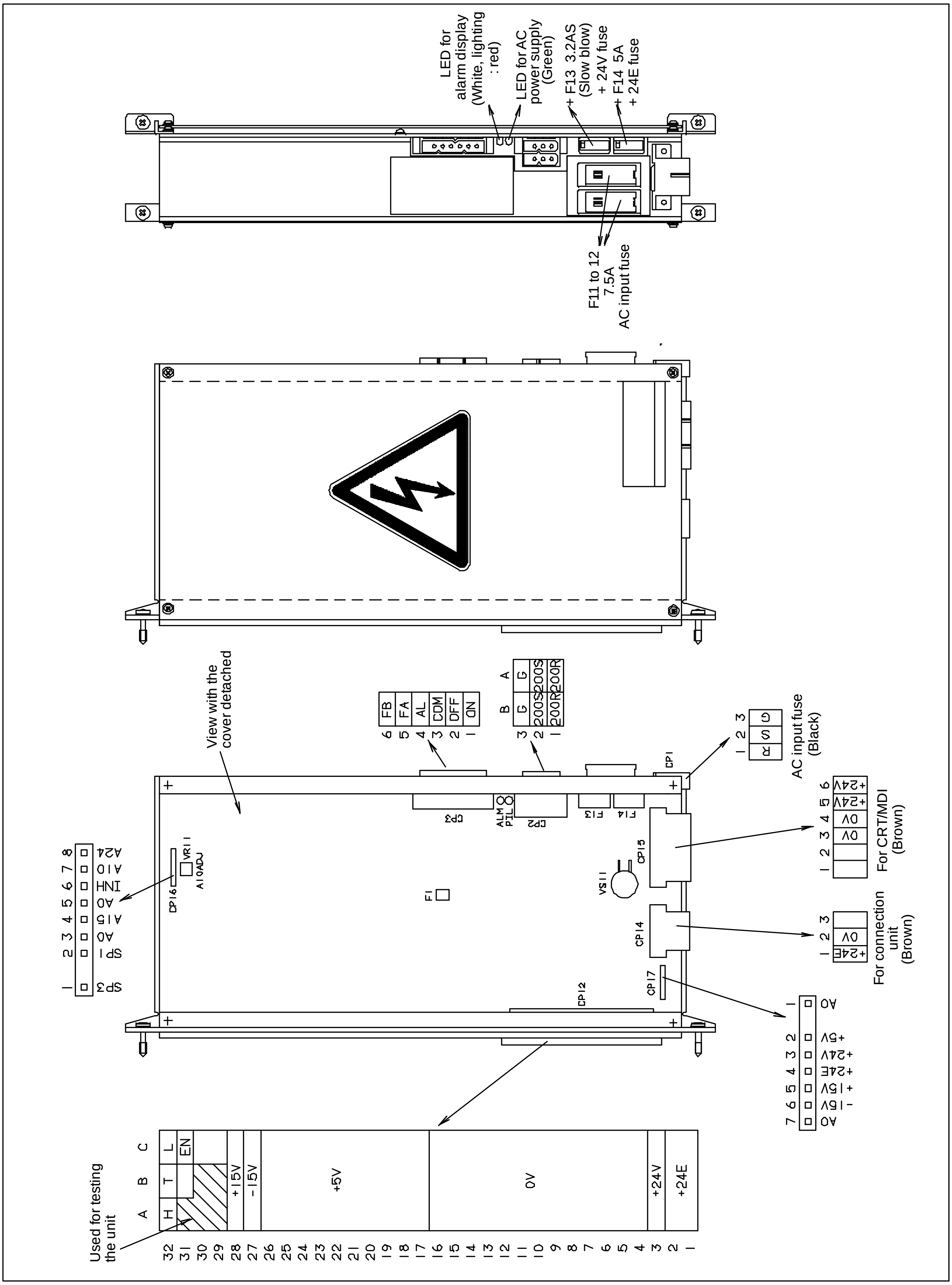


Fig.2.7.3(a) Power supply unit AI external diagram

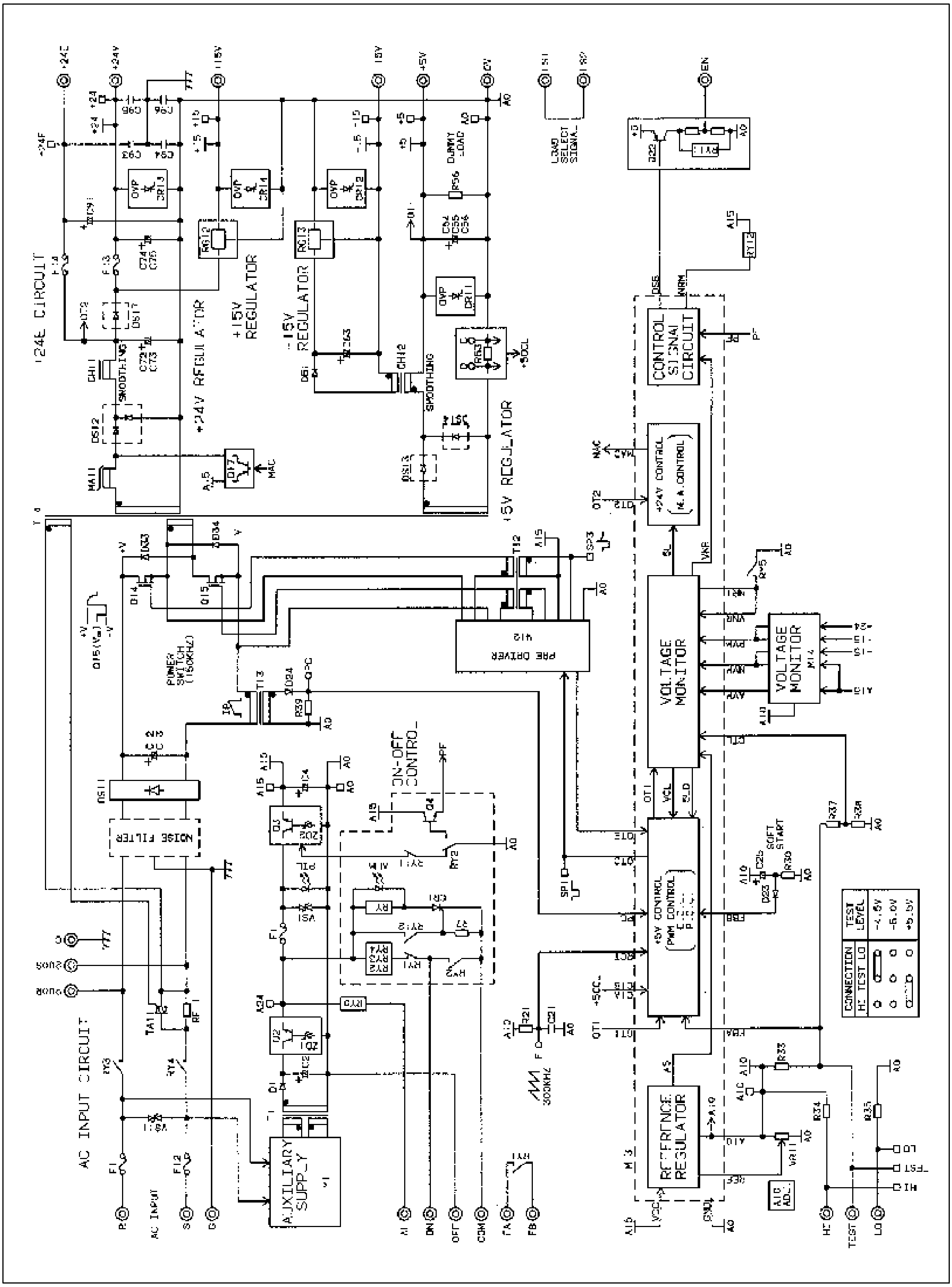


Fig.2.7.3(b) Power supply unit AI block diagram

2.7.4 CE Marking Correspond Details of Power Supply Unit AI (A16B-1212-0950)

It is easy to mount and dismount the CNC power supply unit, because it is designed to be mounted on, and connected directly to, the master printed-circuit board. All its AC inputs and DC outputs are linked via connectors.

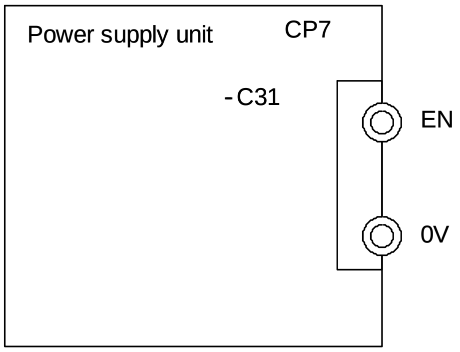
Because this power supply unit has a built-in input unit function, it is not necessary to prepare a separate relay or input unit for switching the AC input on and off. The AC input can be connected directly to the power supply unit. The unit has an AC service outlet, which is switched on and off simultaneously with the power supply unit. This AC service outlet can be used to supply power to a unit such as a fan motor.

(1) Input/output connectors

Connector name	Description
CP1	200/220/230/240 VAC input
CP2 or CP3	200/220/230/240 VAC output (switched on and off simultaneously with the power supply unit)
CP4	Power on/off switch contact signal input
	External alarm signal input
	Alarm signal (FA-FB) output
CP7	Supply of +5 V, +15 V, -15 V, +24 V, and +24E to the master printed-circuit board
	EN signal output
CP6	Reserved for future use
CP5	+24V supply for the 9” monochrome CRT/MDI unit (for Series 0)

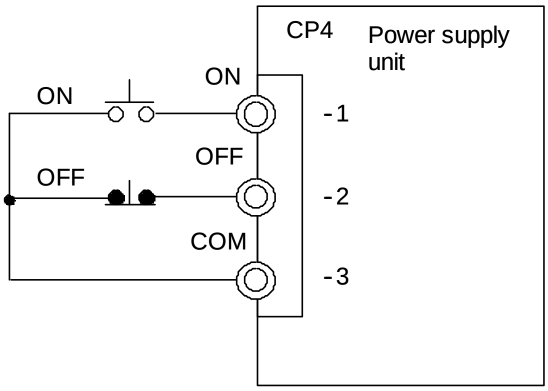
(2) Descriptions of the input/output signals and display LEDs

1. AC power supply display LED (green)
   When an AC power source is connected to the power supply unit, the LED lights regardless of whether the unit is on or off.
2. Alarm display LED (red)
   If the power supply unit is switched off because of an alarm condition due to a failure such as an output error, the alarm display LED lights and remains on until the alarm condition is cleared by pressing the OFF switch or shutting down the AC power supply.
3. ENABLE signal EN (output)
   This TTL level signal indicates that all DC outputs are normal. It becomes low if an output failure is detected in any circuit.



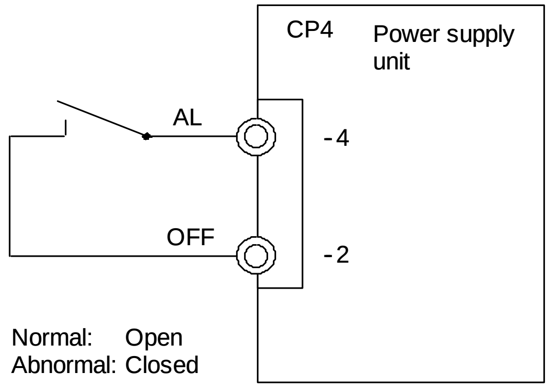
EN: High when all outputs are normal
0V: Low if an output failure occurs.

4. Power supply on/off control signal ON–OFF–COM (input)
   If two switches are connected to this circuit as shown below, pressing the ON switch turns on the power supply unit, while pressing the OFF switch turns the unit off.
   If an alarm occurs in the power supply unit, and the alarm display LED lights in red, however, pressing the ON switch will not turn on the power supply unit. In this case, it is necessary to remove the cause of the alarm and press the OFF switch.
   Pressing the OFF switch clears the alarm condition. Subsequently pressing the ON switch turns on the power supply unit.

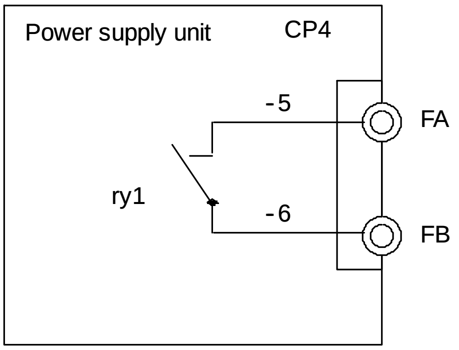


ON switch: Is closed when pressed.
OFF switch: Opens when pressed.

5. External alarm signal AL (input)
   When a contact signal from another unit or external power supply becomes "closed," the ENABLE signal of this power supply unit becomes low, thus immediately turning off the power supply unit.



6. Alarm signal FA–FB (output)
   This contact signal indicates the state of all DC outputs. The contact is open when all the DC outputs are normal. It is closed if an output failure is detected in any DC output circuit.
   If an external alarm signal (item 5) is connected, the FA–FB contact opens, when all DC outputs are normal and the external alarm signal is "open." The contact closes when the external alarm signal becomes "closed."



FA : The FA-FB contact opens, when all DC outputs are normal and the external alarm contact signal is "open."

FB : The FA-FB contact is closed if any DC output is normal, or if the external alarm contact signal is "closed."

(3) Adjustments and settings

This power supply unit requires no adjustment or setting.

(4) Causes of blown fuses and required corrective actions

This power supply unit is provided with fuses F1 at its input, fuse F3 at the +24V output, and fuse F4 at the +24E output. Possible causes of these fuses blowing are listed below together with the corrective actions required to restore normal operation.

1. Fuses F1

   (a) Short circuit in surge absorber VS11
   VS11 is intended to suppress surge voltages on the input line. If an excessively large surge voltage or steady voltage is applied to VS11, it breaks down, short–circuiting and, causing F1 to blow. If VS11 has short–circuited, but you do not have a replacement part on hand, the machine can be used with VS11 removed. In such a case, however, you should obtain a replacement and install it as soon as possible, especially when the machine is being used in an installation prone to surge voltages. The specification number of VS11 is A50L–2001–0122#G431K.

   (b) Short circuit in diode stack DB11

   (c) Short circuit between the collector and emitter of switching transistors Q21 and Q22, Q11

   (d) Short circuit in diodes D12, D31, D32

   (e) Failure auxiliary power supply circuit IC (H1)

   (f) Failure in power–factor improvement IC (H3)

   (g) Failure in a unit connected to AC OUT (CP2 and CP3) or short circuit in the wiring

   If you suspect that any of short circuits (b) to (e) has occurred in the respective parts, replace the power supply unit with a spare. When replacing a fuse, use a replacement having the same rating. The specification number for fuses F1 is A60L–0001–0245#GP75.

2. Fuse F3

   (a) A short circuit may have occurred in the CRT/MDI unit or a +24 V power supply cord leading to it. Remove the cord from CP5, and check the unit and cord carefully.

   (b) A short circuit may have occurred in the +24 V circuit on the master printed–circuit board. Remove the cable from CP5 and CP6. Also, remove the power supply unit from the master printed–circuit board, then check the printed–circuit board carefully. When replacing a fuse, use a replacement having the same rating. The specification number for fuse F3 is A60L–0001–0075#5.0.

3. Fuse F4

   (a) Short circuit in +24E power supply cables for various printed–circuit board units

   (b) Ground fault of the +24E power supply line in the machine or false contact of the +24E power supply line with another power supply line

   If either of (a) or (b) may have occurred, remove the cable from CP6, and check it carefully. When replacing a fuse, use a replacement part having the same rating. The specification number for fuse F4 is A60L–0001–0046#5.0.

EXCHANGE OF FANMOTOR(A16B-1212-0950)

(1)REMOVING AND SETTING A FAN MOTOR

FAN SPEC.	A90L-0001-0423#150

1) REMOVE THE PLATE WITH 4 SCREWING DOWN. → A

2) TAKE OFF THE FAN CONNECTOR(CP8). → B

3) REMOVE THE FAN WITH 2 SCREWING DOWN. → C

4) CASE OF PUTTING ON,DO THE REVERSE PROCESS C TO A.

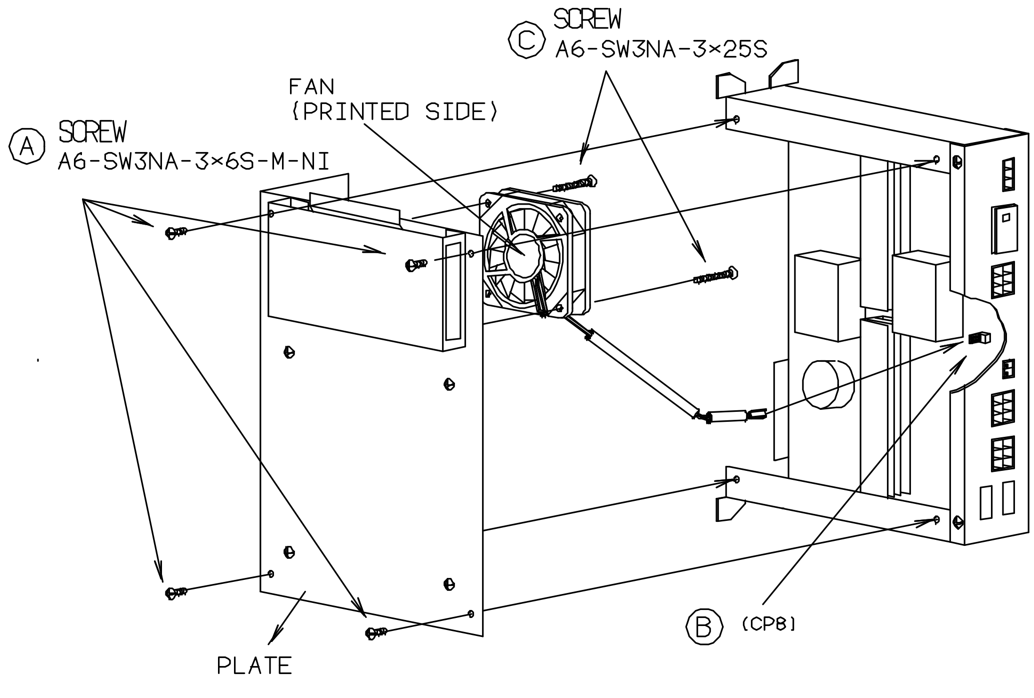


Fig.2.7.4(a) Exchange of fanmotor (A16B-1212-0950)

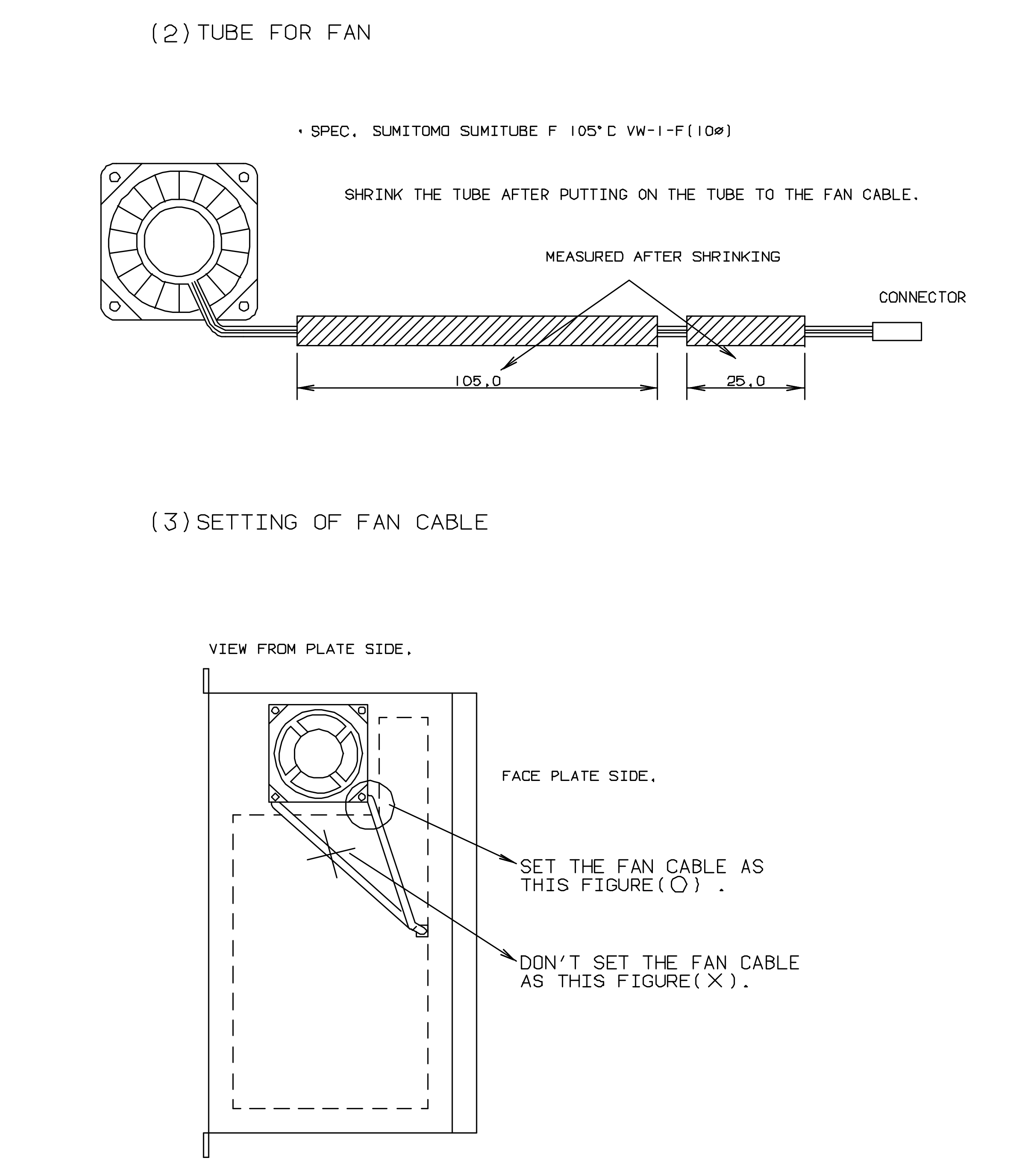
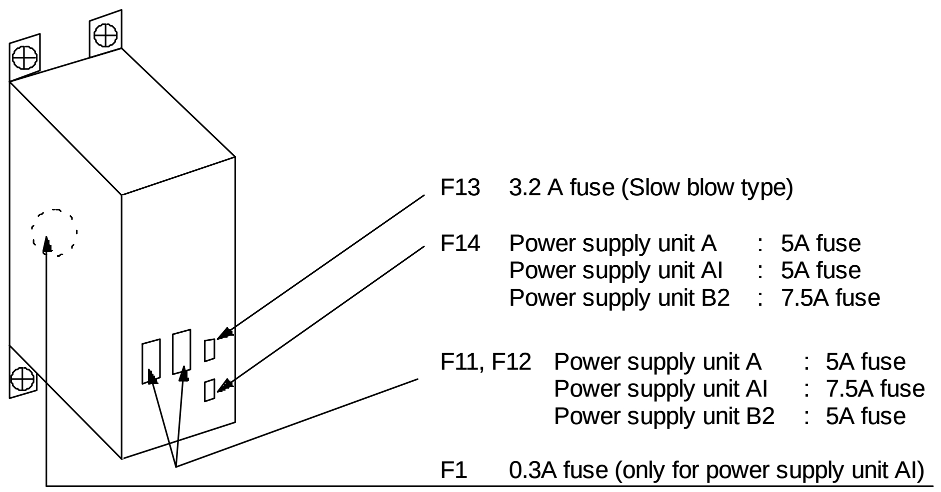


Fig.2.7.4(b) Exchange of fanmotor (A16B-1212-0950)

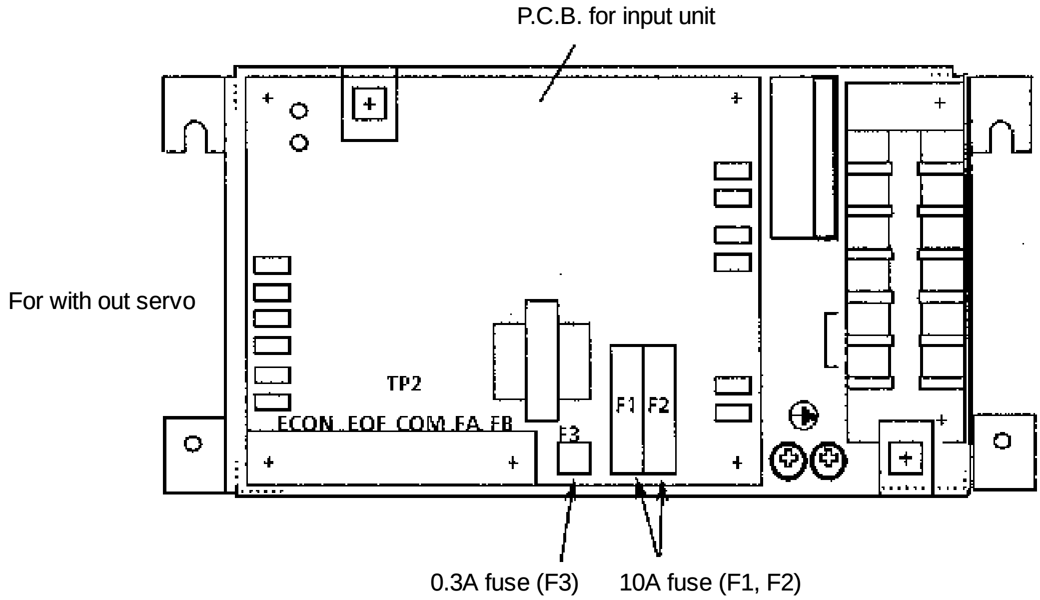
2.7.5 Fuses

Unit name		Part number	Rating	Specification	Use
Power supply unit	A	F11, F12	5A	A60L-0001-0194#5.0	For 200VAC input
		F13	3.2A	A60L-0001-0075#3.2	+24V for CRT/MDI master or option printed cisuit board
		F14	5A	A60L-0001-0046#5.0	Protection of +24E line in the machine from external failures
	AI	F11, F12	7.5A	A60L-0001-0245#GP75	For 200VAC input
		F13	3.2A	A60L-0001-0075#3.2	+24V for CRT/MDI master or option printed cisuit board
		F14	5A	A60L-0001-0046#5.0	Protection of +24E line in the machine from external failures
		F1	5A	A60L-0001-0172#DM03	For sections inside the power suppy unit
	B2	F11, F12	5A	A60L-0001-0194#5.0	For 200VAC input
		F13	3.2A	A60L-0001-0075#3.2	+24V for CRT/MDI master or option printed cisuit board
		F14	7.5A	A60L-0001-0046#7.5	Protection of +24E line in the machine from external failures
	AI (CE Marking)	F1	7.5A	A60L-0001-0245#GP75	For 200VAC input
		F3	5A	A60L-0001-0075#5.0	+24V for CRT/MDI master or option printed cisuit board
		F4	5A	A60L-0001-0046#5.0	Protection of +24E line in the machine from external failures
P.C.B. for input unit		F1, F2	10A	A60L-0001-0901#P4100H	For 200VAC input
		F3	0.3A	A60L-0001-0172#DM03	For power ON/OFF control circuit

(1) Mounted position of the fuse for power supply unit



(2) Mounted position of the fuses for input unit



2.8 MAINTENANCE OF HEAT PIPE TYPE HEAT EXCHANGER

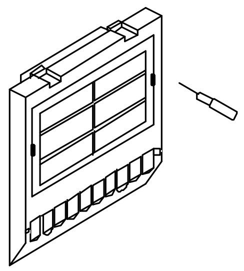
It is necessary to regulary clean the heat transformer, because the heat transformation ability will be reduced by the accumulation of dust. The frequency of the cleaning needed differs according to the installation environment and therefore should be determined by your own judgment according to the degree of dirt.

Air filter cleaning and replacement

Air filter cleaning and replacement method

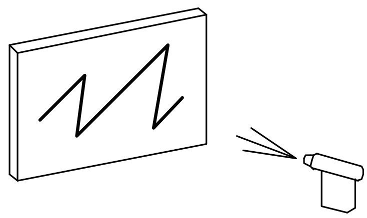
1 When cleaning and replacing the filter, be sure to cut off the fan's electric power source.

2 Detach the filter cover and take out the filter inside.



Detach the cover by pressing, the flanges which are in the grooves of both sides towards the inside by minus screwdriver, etc.

3 Protect the filter from silting due to dust by blowing air on both sides.



4 When dirt is conspicuous, press wash with a neutral detergent, rinse with fresh water, and the washing, allow to dry naturally. When replacing with the same product.

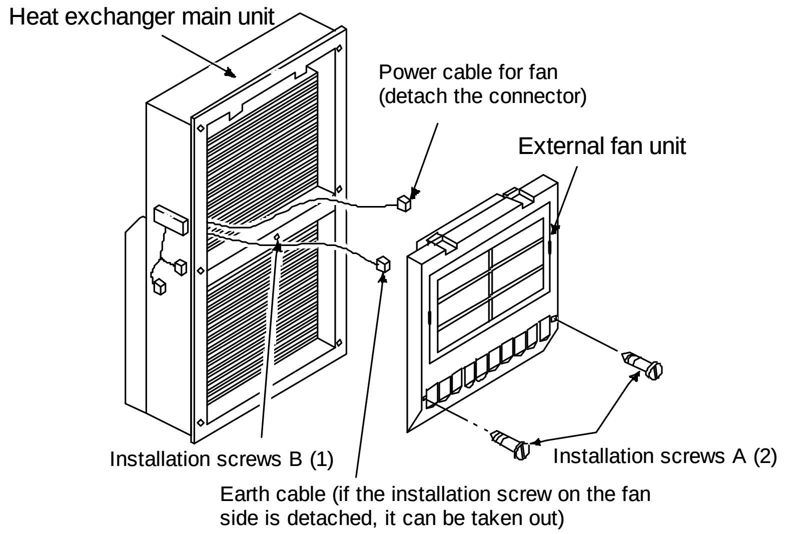
5 Insert the filter in the cover, align the flange in the groove, and install by pressing. Confirm that the cover will not come loose even if it is pulled.

D Cleaning heat exchanger

Cleaning heat exchanger

1 When cleaning, be sure to cut off the fan power source.

2 Take out the external fan unit from the heat exchanger main unit.

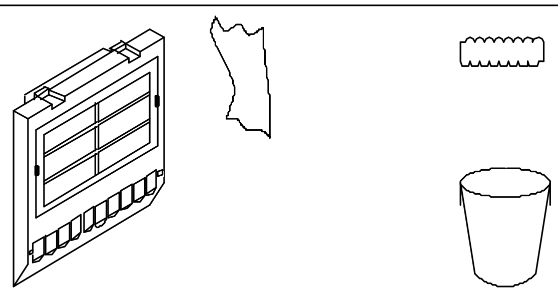


Detach the two installation screws (A) of the external fan unit, and detach the unit from the main unit by sliding it down. Detach the power source cable to the fan and the earth cable. Also detach installation screws (B).

D Cleaning fan unit

Method of cleaning fan unit

1 Wipe the dirt, condensation, etc., which has accumulated on the fan motor and fan installation case with a dry cloth, etc. When the condensation, etc. has accumulated and the dirt is difficult to remove, soak a cloth in neutral detergent, lightry sqeeze it and wipe away the dirt. However, take care not to allow the detergent to enter the electrical sections such as the internal rotor of the fan motor.



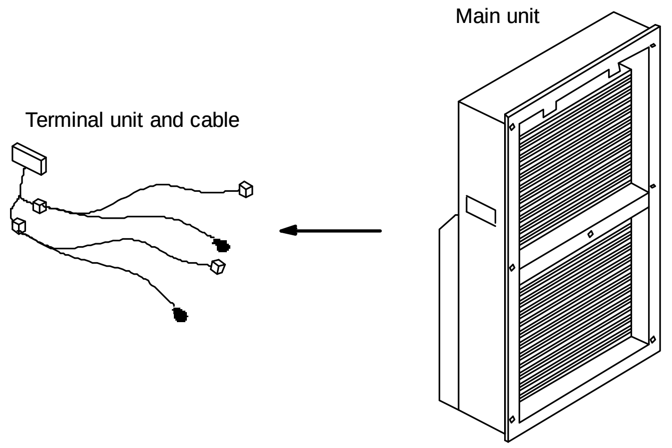
D Cleaning heat exchanger fan

Method of cleaning heat exchanger fan

1 Detach the heat exchanger format the unit and either blow off with air, wipe off with a dry cloth, or brush the accumulated dirt, condensation, etc.

When the dirt is especially severe

1 Detach the internal fan unit, the terminal unit, and the cable from the main unit.



2 Using a neutral detergent, remove the dirt from the main unit fan section by brushing. At this time, take care not to bend the fin of the element.

3 After cleaning, dry well.

D Installation

Method of installation after cleaning

After completing cleaning of the fan unit and heat transformer.

1 Install the terminal unit and cable in the original position.

2 Install the fan unit in the original position. At this time, do not forget to connect the fan power cable and the earth cable.

2.9 REPLACING THE LCD BACKLIGHT (FOR 7.2” MONOCHROME LCD)

The LCD backlight needs periodical replacement. It is replaced as a unit. The operation life of the LCD backlight (defined as the time until the brightness of the backlight becomes 50% or less of the initial value) is about 10,000 hours (5,000 hours guaranteed). The whole LCD backlight unit must be replaced. This job can be done either by the user or the service personnel.

(Remark) The display and backlight can be turned off using keys. Doing so can extend the operation life of the backlight.

<Erasing the display>

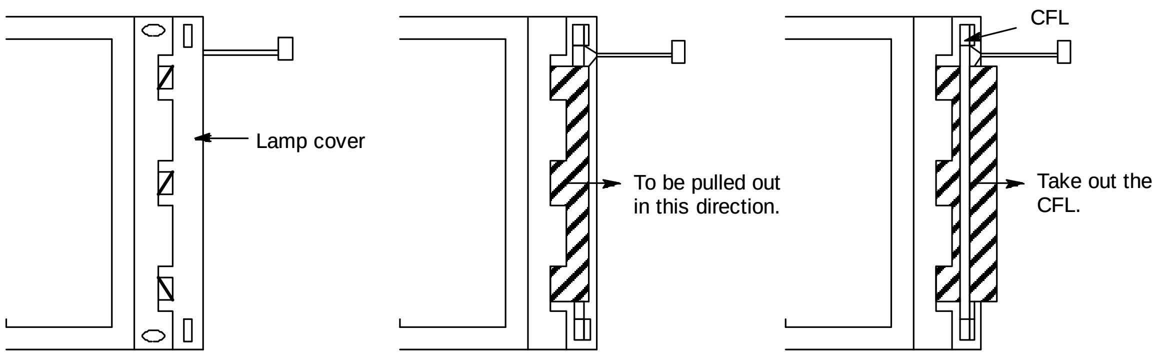
Hold down the CAN key, and press any function key (such as the POS key).

<Resuming the display>

Press any function key (such as the POS key).

D CFL replacement method

(1) How to remove the CFL

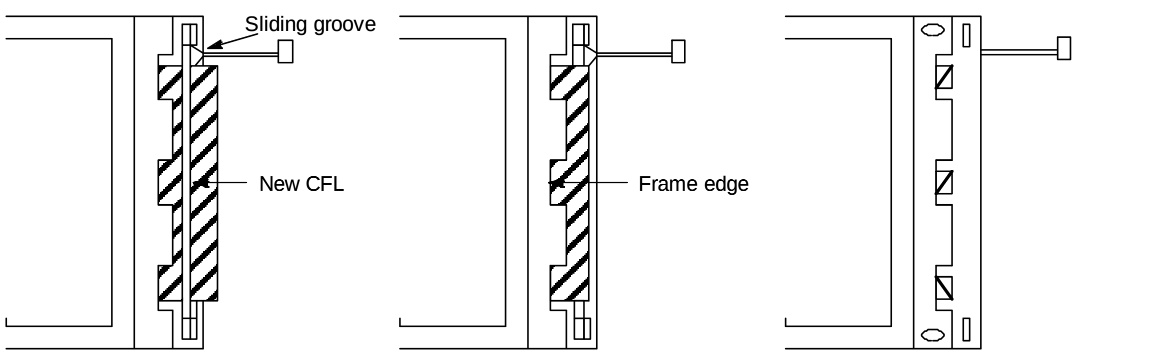


1) Release the three pawls.
2) Remove the CFL cover.

1) Pull out the reflective film.

1) Take out the CFL.
2) If the CFL is broken, remove all broken pieces of glass.

(2) How to install the CFL



1) When installing the CFL, wrap it with reflective sheet.
2) Set the CFL cable in the sliding groove.

1) Set the reflective sheet under the frame while lifting it by holding it at its edge.

1) Put the lamp cover back in place.
2) Bend the three pawls.

3 DATA INPUT/OUTPUT

Once the memory printed-circuit board has been replaced, the data must be re-input. This chapter explains how to input parameters, part programs, and tool offset values to, and output them from, I/O units such as floppy disk drives.

3.1 DATA INPUT/OUTPUT

3.1.1 Locating the File

(1) Select EDIT mode.

(2) Press the PRGRM key several times to display the program list screen.

```
PROGRAM                                O1224 N0000

        SYSTEM EDITION    0400 - 01
      PROGRAM NO.  USED :  14  FREE :  49
      MEMORY AREA  USED :  275 FREE :  3820
  PROGRAM LIBRARY LIST
    O0010 O2000 O0020 O0030 O0200 O0300
    O0555 O1200 O0777 O1234 O0040 O0050
    O1969 O1224




>
          EDIT
[ PRGRM ][ CONDNS ][      ][      ][ C.A.P. ]
```

(3) Key in address N.

(4) Key in the file number.

N0 ! Locates the first file on the floppy disk.
This is used regardless of whether a file exists on the floppy disk.

N1 ! Locates the first file on the floppy disk.
This is used when a file exists on the floppy disk.

N2 to N9999 ： Locates an arbitrary file.

3.1.2 Outputting CNC Parameters

(1) Select EDIT mode.

(2) Press the PRGRM key several times to display the parameter screen.

```
PARAMETER                              O1224 N0000

  (SETTING 1)
_ REVX = 0
  REVY = 0
  TVON = 0
  ISO  = 0   (0:EIA    1:ISO)
  INCH = 0   (0:MM     1:INCH)
  I/O  = 0
  ABS  = 0   (0:INC    1:ABS)
  SEQ  = 0



NO. REVX =                        S   0   T
                               MDI
[ PARAM ][ DGNOS ][      ][ SV-PRM ][      ]
```

(3) Press the OUTPT START key to start parameter output.

> **NOTE**
> Any parameter No. between 900 and 999 is not output.

3.1.3 PMC Parameter Output

(1) Select EDIT mode.

(2) Press the DGNOS PARAM key several times to display the DGNOS (diagnosis) screen.

(3) Press the OUTPT START key to begin PMC parameter output.

3.1.4 Program Output

(1) Select EDIT mode.

(2) Press the PRGRM key several times to display the program list screen.

```
PROGRAM                              O1224 N0000

     SYSTEM EDITION    0400 - 01
   PROGRAM NO.  USED :  14  FREE :   49
   MEMORY AREA  USED :  275 FREE :   3820
 PROGRAM LIBRARY LIST
   O0010 O2000 O0020 O0030 O0200 O0300
   O0555 O1200 O0777 O1234 O0040 O0050
   O1969 O1224






>
       EDIT
[ PRGRM ][ CONDNS ][      ][      ][ C.A.P. ]
```

(3) Key in address O.

(4) Key in the program number.

(5) Pressing the OUTPT START key begins program output.

* To output all programs, enter: O–9999 OUTPT START

3.1.5 Offset Value Output

(1) Select EDIT mode.

(2) Press the MENU OFSET key several times to display the offset screen.

```
OFFSET                                 O1224 N0000
   NO.       DATA           NO.          DATA
   001                      009          0.000
   002        0.000         010         12.269
   003        5.000         011         10.230
   004        0.000         012        -11.265
   005       12.580         013         -8.562
   006        0.000         014          0.000
   007        0.000         015          0.000
   008        0.000         016          0.000
ACTUAL POSITION (RELATIVE)
      X     0.000            Y           0.000
      Z     0.000


NO. 013 =
                             MDI
[ OFFSET ][ MACRO ][      ][      ][      ]
```

(3) Press the OUTPT START key to begin offset value output.

3.1.6 Conversational Data Output [M Series]

(1) Select the EDIT mode.

(2) Press the OFSET key several times to select the conversational data screen.

(3) Press the OUTPT START key to start output.

3.1.7 CNC Parameter Input

(1) Set the PWE setting data to 1.
(Parameter screen page 2)

(This setting is made in MDI mode or the emergency stop state.)

```
PARAMETER                            O1224 N0000

   (SETTING 2)
   _PWE   =  1  (0:DISABLE 1:ENABLE)
    REV4  =  0
    TAPEF =  0




 NO. PWE =

[ PARAM ][ DGNOS ][      ][      ][      ]
```

NOTE
Alarm P/S100 will occur at this point. After this alarm occurs, press the DGNOS PARAM key again to display the parameter screen.

(2) Select EDIT mode.
* Release the machine from the emergency stop state.

(3) Press the INPUT key to begin CNC parameter input.

* Usually, alarm P/S000 will occur at this point. After this alarm occurs, switch the CNC power off then back on.
* To input a CNC parameter when the machine is in the emergency stop state, hold down the EOB key and press the INPUT key. In this case, it is not necessary to select EDIT mode.

3.1.8 PMC Parameter Input

(1) Select EDIT mode.

(2) Locate the beginning of the file.

(3) Disable program protection (KEY = 1).

(4) Press the DGNOS PARAM key several times to display the DGNOS (diagnosis) screen.

(5) Press the INPUT key to begin PMC parameter input.

3.1.9 Program Input

(1) Select EDIT mode.

(2) Locate the beginning of the file.

(3) Disable program protection (KEY = 1).

(4) Press the PRGRM key several times to display the program list screen.

```
PROGRAM                                O1224 N0000

     SYSTEM EDITION     0400 - 01
   PROGRAM NO.  USED :  14  FREE :  49
   MEMORY AREA  USED :  275 FREE :  3820
 PROGRAM LIBRARY LIST
   O0010 O2000 O0020 O0030 O0200 O0300
   O0555 O1200 O0777 O1234 O0040 O0050
   O1969 O1224




>
      EDIT
[ PRGRM ][ CONDNS ][      ][      ][ C.A.P. ]
```

(5) Press the INPUT key to begin program input.

* This applies when only one program is to be input.

(6) To change the program number during program input, key in address O and the desired program number, then press the INPUT key.

3.1.10 Offset Value Input

(1) Select EDIT mode.

(2) Locate the beginning of the file.

(3) Press the OFSET key several times to display the offset screen.

```
OFFSET                                    O1224 N0000
   NO.       DATA            NO.          DATA
   001                       009           0.000
   002        0.000          010          12.269
   003        5.000          011          10.230
   004        0.000          012         -11.265
   005       12.580          013          -8.562
   006        0.000          014           0.000
   007        0.000          015           0.000
   008        0.000          016           0.000
ACTUAL POSITION (RELATIVE)
         X     0.000           Y           0.000
         Z     0.000


NO. 013 =
                                MDI
[ OFFSET ][ MACRO ][       ][       ][       ]
```

(4) Press the INPUT key to begin offset value input.

3.1.11 Conversational Data Input
[M Series]

(1) Select the EDIT mode.

(2) Locate the beginning of the file.

(3) Disable program protection (KEY = 1).

(4) Press the PRGRM key several times to select the program list screen.

(5) Key in the O–address.

(6) Key in a program number (arbitrary).

(7) Press the INPUT key to start input.

(8) Select the AUTO mode.

(9) Execute the previously input program.

Note) Pay attention to the following parameter.

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	015	CPRD	*	*	*	*	*	*	*

CPRD Specifies the measurement unit to be used when a decimal point is omitted from an address where it can be used, as follows.

1 : mm, inch, or second (usually)
0 : Least input increment (at data input time)

3.1.12 Parameters Related to Data Input/Output

To use the FANUC floppy cassette, set the parameters shown below:

Setting : I/O = 0 (*1)
Parameter : ISO = 1

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	002	1	*	*	*	*	0	*	1
PRM	552	10			(4800BPS)				
PRM	012	*	*	*	*	PRG9	*	*	*

PRG9 1 : Protects program numbers 9000 to 9999.
0 : Allows program numbers 9000 to 9999 to be edited.

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	038	0	1	*	*	FLKY	*	*	*

FLKY 1 : Specifies the use of a full keyboard.
0 : Specifies the use of a standard keyboard.

(*1) A data I/O unit is selected depending on whether I/O=reader/punch interface.

Function	Related parameter number			
	I/O=0	**I/O=1**	**I/O=2**	**I/O=3**
Feed NFED	2.7	12.7	50.7	51.7
20 mA current loop ASR33	2.2	12.2	Unusable	
Stop bit STP2	2.0	12.0	50.0	51.0
I/O unit type setting	38.7 38.6	38.7 38.6	38.5 38.4	38.2 38.1
Connector number	M5 channel 1	M5 channel 1	M74 channel 2	M77 channel 3

3.1.13 Displaying the Directory of Floppy Disk Files

1 Press the EDIT switch on the machine operator's panel.

2 Press function PRGRM key

3 Press soft key **[FLOPPY]**.

4 Press page key ⬆ PAGE or PAGE ⬇.

5 The screen below appears.

```
DIRECTORY (FLOPPY)                 O0555 N0000
   NO. FILE NAME                    (METER) VOL
 0001   PARAMETER                       65.6
 0002   ALL. PROGRAM                     1.9
 0003   O0001                            1.3
 0004   O0002                            1.3
 0005   O0003                            1.3
 0006   O0004                            1.3
 0007   O005                             1.3
 0008   O0100                            1.9
 0009   O0555                            1.3



  19:36:51  EDIT
[ SRHFIL ][ READ ][ PUNCH ][ DELETE ][      ]
```

6 Press a page key again to display another page of the directory.

3.1.14 Reading the Files

1 Press soft key **[READ]** after displaying the directory of files.

```
DIRECTORY (FLOPPY)              O0555 N0000
   NO. FILE NAME                (METER) VOL










READ
_FILE NO. =          PROGRAM NO. =
NUM.
19:38:35                  EDIT
[  EXEC  ][  CAN  ][      ][      ][  STOP  ]
```

2 Enter a file number.

3 Press function INPUT key .

4 To read a program by changing its program number, press the cursor key ⬇ to place the cursor on "program number =," then key in a new program number, and press the INPUT key.

5 Press soft key **[EXEC]**.

6 Press soft key **[CAN]** to return to the soft key display shown in the screen of file directory.

3.1.15 Outputting the Files

1 Press soft key **[PUNCH]** after displaying the directory of files.

```
DIRECTORY (FLOPPY)              O0555 N0000
   NO. FILE NAME                (METER) VOL






PUNCH
_FILE NO. =      _ PROGRAM NO. =
NUM.
19:39:17                     EDIT
[ EXEC ][  CAN  ][ PRG-NO ][     ][ STOP ]
```

2 Enter a program number. To write all programs into a single file, enter –9999 in the program number field.

3 Press function INPUT key .

4 Press soft key **[EXEC]**.

5 Press soft key **[CAN]** to return to the soft key display shown in the screen of file directory.

3.1.16 Deleting the Files

1 Press soft key **[DELETE]** after displaying the directory of files.

```
DIRECTORY (FLOPPY)             O0555 N0000
   NO. FILE NAME               (METER) VOL






DELETE
_FILE NO. =
NUM.                              S    0  T
19:39:56                       EDIT
[  EXEC  ][  CAN  ][      ][      ][  STOP  ]
```

2 When specifying the file with a file number, type the number and press function INPUT key.

3 Press soft key **[EXEC]**.

4 Press soft key **[CAN]** to return to the soft key display shown in the screen of file directory.

3.1.17 Changing the File Name

1 Press soft key **[RENAME]** after displaying the directory of files**.**

2 Position the cursor to FILE NO. then enter the number of the file whose name is to be changed. Press the INPUT key.

3 Position the cursor to NAME and key in a new file name. Then, press the INPUT key.

4 Press soft key **[EXEC]**.

5 To return to the previous screen, press the **[CAN]** soft key.

```
FILE DIRECTORY                       O0001 N0000
  NO.  FILE NAME                     (METER) VOL
 0001  PARAMETER                        87.1
 0002  ALL.PROGRAM                      87.1
 0003  O0001                             1.9
 0004  O0021                             7.1
 0005  O0041                             7.1
 0006  O0615                             5.8
 0007  O0651                             9.1
 0008  O0601                             7.1
 0009  O0645                             5.8
 RENAME
   FILE NO. =        NAME=
  NUM.
  21:59:53                  EDIT
[ EXEC ][ CAN ][      ][      ][ STOP ]
```

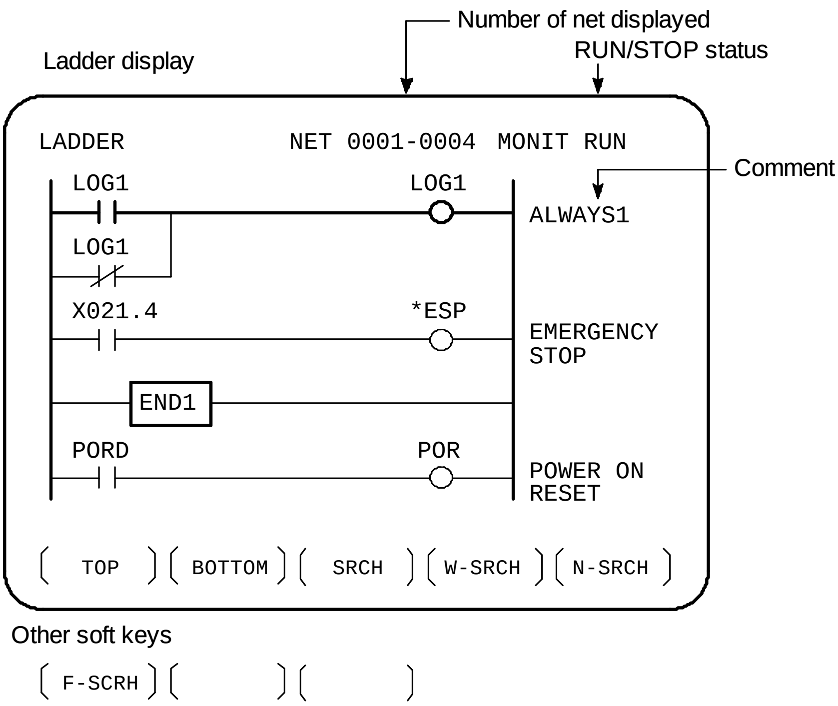
4 INTERFACE BETWEEN NC AND PMC

This chapter describes the signals between the machine operator's panel, magnetics cabinet and the PMC, connection of the signals between PMC and CNC, and confirmation method of on/off state of these signals.
It also describes system configuration of PMC, parameters of PMC, ladder and how to display time chart of the signals on the CRT.
It also describes a method of inputting/outputting PMC parameters to an external device.

4.1 PMC SCREEN

4.1.1 PMC LAD Screen

Press soft key [DGNOS PARAM], and a sequence program is displayed dynamically and operation monitoring can be confirmed :



D Contents displayed

1. Green (Low brightness display) Contacts : open Relay : off
2. White (High brightness display) Contacts : closed Relay : on

D Search method

1. Use the page keys or cursor keys to change display positions.
2. **[TOP]** : Searches top of ladder.
3. **[BOTTOM]** : Search bottom of ladder.
4. Address.bit, **[SRCH]** or Signal name, **[SRCH]**
5. Address.bit, **[W–SRCH]** or Signal name , **[W–SRCH]**
6. Net no. **[N–SRCH]** : Ladder is displayed from the specified net.
7. Functional instruction no. **[F–SRCH]** or Functional instruction name **[F–SRCH]**

[Remarks]

- The search function searches a signal in the forward direction and displays the ladder with the searched signal at its head. Because there may exist plural contacts, repeat the search operation to find plural locations, repeat the search operation to find plural locations with the specified signal.
- If a specified signal is not found up to the end of the program (ladder), execution returns to the head of a program and search continues.

4.2 LIST OF SIGNALS

	Symbol	Signal name	T	M	Address
	*+EDCX, *+EDCZ, *-EDCX , *-EDCZ	External deceleration signal	f		G138.0, G138.1, G138.3, G138.4
	*+EDCX, *+EDCY, *+EDCZ, *-EDCX, *-EDCY, *-EDCZ			f	G138.0, G138.1, G138.2, G138.3, G138.4, G138.5
	*+LX, *+LY, *+LZ, *-LX, *-LY, *-LZ	Overtravel signal		f	X020.0, X020.1, X020.2, X020.3, X020.4, X020.5
	*+LZ		f		X018.5
	*+MITX, *+MITY, *+MITZ, *+MIT4, *-MITX, *-MITY, *-MITZ, *-MIT4	Interlock signal for each axis and direction		f	G142.0, G142.1, G142.2, G142.3, G142.4, G142.5, G142.6, G142.7
	*ABSM	Manual absolute signal	f	f	G127.2
	*AOV16, *AOV32, *AOV64, *AOV128	Feedrate override signal		f	G116.4, G116.5, G116.6, G117.6
	*AOVR16, *AOVR32, *AOVR64, *AOVR128		f		G140.4, G140.5, G140.6, G140.7
	*BECLP	B axis clamp completion signal		f	G143.7
	*BEUCP	B axis unclamp completion signal		f	G143.6
	*DECX, *DECY, *DECZ, *DEC4,	Reference position return deceleration signals		f	X016.5, X017.5, X018.5, X019.5
	*DECX, *DECZ, *DEC3, *DEC4,		f		
*	*EAXSL	Control axis selection status signal (PMC axis control)	f	f	F188.7
	*ESP, *ESP	Emergency stop signal	f	f	X021.4, G121.4
	*ESPA, *ESPB	Emergency stop signal for spindle	f	f	G230.1, G234.1
	*FLWU	Follow-up signal	f	f	G104.5
	*ILK	Interlock signal		f	G117.0
	*ITX, *ITY, *ITZ, *IT4	Interlock signal for each axis		f	G128.0, G128.1, G128.2, G128.3
	*LDSP	Display and setting	f	f	G119.0
	*OV1, *OV2, *OV4, *OV8	Feedrate override signal	f	f	G121.0, G121.1, G121.2, G121.3
	*OV1E, *OV2E, *OV4E, *OV8E	Feedrate override signal (PMC axis control)	f	f	G147.0, G147.1, G147.2, G147.3
	*RILK	High-speed interlock signal		f	X008.5
	*SCPF	Spindle clamp completion signal	f		G123.5
	*SP	Feed hold signal	f	f	G121.5
	*SSTP	Spindle stop signal	f	f	G120.6
	*SSTP1, *SSTP2, *SSTP3	Individual spindle stop signal	f		G145.3, G145.4, G145.5
	*SUCPF	Spindle unclamp completion signal	f		G123.4
+	+LMX, +LMY, +LMZ, -LMX, -LMY, -LMZ	Stroke check external setting signals		f	G129.0, G129.1, G129.2, G129.3, G129.4, G129.5

	Symbol	Signal name	T	M	Address
	+MIT1, -MIT1, +MIT2, -MIT2	Interlock signal for each axis and direction	f		X008.2, X008.3 X008.4, X008.5
	+X, -X, +Y, -Y, +Z, -Z, +4, -4	Feed axis and direction select signal		f	G116.2, G116.3, G117.2, G117.3, G118.2, G118.3, G119.2, G119.3
+	+X, -X, +Z, -Z, +3, -3, +4, -4		f		
	+XO, -XO, +YO, -YO, +ZO, -ZO, +4O, -4O	Jog feed axis select signal (software operator's panel signal)		f	F177.0, F177.1, F177.2, F177.3, F177.4, F177.5, F177.6, F177.7
	+XO, -XO, +ZO, -ZO, +YO, -YO, +4O, -4O		f		
4	4NG	Ignore-the-fourth-axis-signal		f	X004.7
	AFL	Auxiliary function lock signal	f	f	G103.7
	AL	Alarm signal	f	f	F149.0
A	ALMA, ALMB	Spindle alarm signal		f	F281.0, F285.0
	AR0 to AR15	Actual spindle speed signal	f		F158.0 to F159.7
	ARSTA, ARSTB	Alarm reset signal	f	f	G230.0, G234.0
	B0 to B31	Second auxiliary function code signals	f		F276.0 to F279.7
	B11 to B38			f	F155.0 to F154.3
	BAL	Battery alarm signal	f	f	F149.2
	BAL1 to BAL4,BAL7,BAL8	Absolute pulse coder battery alarm signal		f	F159.0 to F159.5
			f		F156.0 to F156.5
	BCLP	B axis clamp signal		f	F188.3
	BDT1, BDT2 to BDT9	Optional block skip signals	f	f	G116.0, G141.0 to G141.7
B	BDTO	Optional block skip signal (software operator's panel signal)	f	f	F176.4
	BF	Second auxiliary function strobe signals	f		F150.7
	BF1, BF2			f	F150.7, F150.6
	BFIN	2nd auxiliary function completion signal	f		G115.7
	BFIN1, BFIN2			f	G115.7, G115.6
	BGEACT	Background editing signal	f	f	F180.4
	BOFF	Tool post interference check signal	F		F180.6
	BUCLP	B axis unclamp signal		f	F188.2
	CDZ	Chamfering signal	f		G126.7
	CFINA, CFINB	Spindle switch completion signal	f	f	F282.1, F286.1
	CHPA, CHPB	Power line switch signal	f	f	F282.0, F286.0
	CKGRP	Drwing signal	f	f	F164.5
C	COFF	C-axis-off signal	f		G123.0
	COFF	Spindle contour control change signal	f		G123.0
	CON			f	G123.7
	COSP	Spindle command signal;	F		F180.5
	CUT	Cutting feed signal	f	f	F188.6

	Symbol	Signal name	T	M	Address
C	CTH1A CTH2A	Gear selection signal	f	f	G229.3, G229.2
	CTH1A CTH2A	Clutch/gear signal (serial spindle)	f	f	G229.3, G229.2
D	DEN	Distribution end signals	f	f	F149.3
	DEN2	Passing point signal	f		F149.6
	DLK	Renewal disable signal of relative coordinate	f	f	G127.6
	DMMC	Direct operation select signal	f	f	G128.7
	DNCI	Mode selection signal DNC operation select signal	f	f	G127.5
	DRNO	Dry run signal (software operator's panel signal)	f	f	F176.7
	DRNE	Dry run signal (PMC axis control)	f	f	G147.7
	DRN	Dry run signal	f	f	G118.7
	DST	Manual data input start signal	f	f	F150.5
E	EA0 to EA6	Address signal (for external data input)	f	f	G102.0 to G102.6
	EAX1 to EAX8	Control axis selection signal (PMC axis control)	f	f	G144.0 to G144.5
	EBSYA, EBSYB	Axis control command read completion signal (PMC axis control)	f	f	F270.7, F273.7
	EBUFA, EBUFB	Axis control command read signal (PMC axis control)	f	f	G210.7, G218.7
	EC0A to EC6A, EC0B to EC6B	Axis control command signal (PMC axis control)	f	f	G211.0 to G211.6, G219.0 to G219.6
	ECKZA, ECZKB	Following zero checking signal (PMC axis control)	f	f	F270.1, F273.1
	ECLRA, ECLRB	Reset signal (PMC axis control)	f	f	G210.6, G218.6
	ED0 to ED15	Data signal (for external data input)	f	f	G100.0 to G101.7
	EDENA, EDENB	Auxiliary function executing signal (PMC axis control)	f	f	F270.3, F273.3
	EF	External operation signal		f	F150.1
	EF	External operation signal for high-speed interface		f	F150.1
	EFIN	External operation function completion signal		f	G115.1
	EFINA, EFINB	Auxiliary function completion signal (PMC axis control)	f	f	G210.0, G218.0
	EGENA, EGENB	Axis moving signal (PMC axis control)	f	f	F270.4, F273.4
	EIALA, EIALB	Alarm signal (PMC axis control)	f	f	F270.2, F273.2
	EID0A to EID31A, EID0B to EID31B	Axis control data signal (PMC axis control)	f	f	G214.0 to G217.7, G222.0 to G225.7
	EIF0A to EIF15A, EIF0B to EIF15B	Axis control feedrate signal (PMC axis control)	f	f	G212.0 to G213.7, G220.0 to G221.7

	Symbol	Signal name	T	M	Address
	EINPA, EINPB	In-position signal (PMC axis control)	f	f	F270.0, F273.0
	EM11A to EM28A, EM11B to EM28B	Auxiliary function code signal (PMC axis control)	f	f	F272.0 to F272.7, F275.0 to F275.7
	EMFA, EMFB	Auxiliary function strobe signal	f	f	F271.0, F274.0
	EMSBKA, EMSBKB	Block stop disable signal (PMC axis control)	f	f	F211.0, G219.0
	ENB	Spindle enable signal	f	f	F149.4
	ENB	Spindle enable signal	f	f	F149.4
	ENB2, ENB3		f		F149.4, F164.2, F164.3
	ENBKY	External key input mode selection signal	f	f	G134.0
	EOTNA, EOTNB	Negative-direction overtravel signal (PMC axis control)	f	f	F270.6, F273.6
	EOTPA, EOTPB	Positive-direction overtravel signal (PMC axis control)	f	f	F270.5, F273.5
	EOV0	Override 0% signal (PMC axis control)	f	f	F188.5
E	EREND	Read completion signal (for external data input)	f	f	F160.0
	ERS	External reset signal	f	f	G121.7
	ESBKA, ESBKB	Block stop signal (PMC axis control)	f	f	G210.3, G218.3
	ESEND	Search completion signal (for external data input)	f	f	F160.1
	ESKIP	Skip signal (PMC axis control)	f	f	X008.6
	ESOFA, ESOFB	Servo off signal (PMC axis control)	f	f	G210.4, G218.4
	ESRSYC	Spindle simple synchronous control signal	f	f	G104.4
	ESTB	Read signal (for external data input)	f	f	G102.7
	ESTPA, ESTPB	Axis control temporary stop signal (PMC axis control)	f	f	G210.5, G218.5
	EXLM2	Stored stroke check select signal	f	f	G129.6
	EXRD	External read start signal	f	f	G134.1
	EXSTP	External read/punch stop signal	f	f	G134.2
	EXWT	External punch start signal	f	f	G134.3
	F1D	F1-digit feed select signal		f	G140.7
	FIN	End signal	f	f	G120.3
	FSCSL	Spindle contour control change completion signal		f	F178.1
F	FSPPH	Spindle phase synchronous control completion signal	f	f	F178.3
	FSPSY	Spindle synchronous speed control completion signal	f	f	F178.2
	FXST	Canned cycle start signal		f	F161.4

	Symbol	Signal name	T	M	Address
G	GOQSM	Tool offset write mode select signal	f		G132.7
	GR1, GR2	Gear selection signal	f		G118.2, G118.3
				f	G123.2, G123.3
	GR1O, GR2O, GR3O	Gear selection signal		f	G152.0, G152.1, G152.2
	GR21	Gear selection signal for 2nd spindle	f		G145.6
	GR31	Gear selection signal for 3rd spindle	f		G145.7
	GWLF	Grinding wheel diameter automatic compensation signal		l	F165.3
H	HIX, HIY, HIZ, HI4	Manual handle interrupt axis selection signal		f	G126.0, G126.1, G126.2, G126.3
	HIX, HIZ, HI3, HI4		f		
	HX, HZ, H3, H4	Manual handle feed axis selection signal	f		G116.7, G117.7, G118.7, G119.7
	HX, HY, HZ, H4			f	
	HXO, HYO, HZO, HZ4	Manual pulse generator feed axis select signal (software operator's panel signal)		f	F174.4, F174.5, F174.6, F174.7
	HXO, HZO, H3O, H4O		f		
I	IGNVRY	All-axis CRDY OFF alarm ignore signal		f	G123.0
	IGNVRY		f		G127.0
	INDXA, INDXB	Spindle orientation stop position change signal	f	f	G231.0, G235.0
	INFD	In-feed control cut-in start signal		l	G237.6
	INHKY	Key input disable signal	f	f	F180.0
	INP1 to INP4	In-position signals	f	f	F184.0 to F184.3
	ITX, ITZ, IT3, IT4	Interlock signal for each axis	f		G128.0, G128.1, G128.2, G128.3
J	JOV1 to JOV8	Jog feedrate override signal		f	G104.0 to G104.3
	JV1O, JV2O, JV4O, JV8O	Jog feedrate override signal (software operator's panel signal)	f	f	F175.0, F175.1, F175.2, F175.3
K	K0, S, K1, H, K2, F, K3, R, K4, X, K5, Y, K6, Z, K7, 0, K8, N, K9, G, KALARM, KALTER, KB, K4, D, KCAN, KCUS↑, KCUS↓, KDELET, KDGNOS, KEOB, / , .	Key signal		f	G106.0, G106.1, G106.2, G106.3, G106.4, G106.5, G106.6, G106.7, G107.0, G107.1, G109.5, G108.0, G107.5, G110.7, G110.1, G110.0, G108.2, G109.4, G107.7
	K0, S, K1, U, K2, W, K3, R, K4, X, K5, Z, K6, F, K7, 0, K8, N, K9, G, KA, C, KALARM, KALTER, KCAN, KCUS↑, KCUS↓, KDELET, KDGNOS, KEOB		f		G106.0, G106.1, G106.2, G106.3, G106.4, G106.5, G106.6, G106.7, G107.0, G107.1, G107.5, G109.5, G108.0, G110.7, G110.1, G110.0, G108.2, G109.4, G107.7
	KEY	Program protect signal	f	f	G122.3
	KEYO	Program protect signal (software operator's panel signal)	f	f	F178.5

	Symbol	Signal name	T	M	Address
K	KF4TH, KFF, KFF%, KFGE, KFI,, KFJA, KFL+, KFM., KFNK, KFOJ, KFRC, KFS=, KFT*, KFXU, KFXW, KFYV, KH, J, K, KINPUT, KINSRT, KM, -, KOFSET, KP, Q, L, KPAGE↑, KPAGE÷, KPARAM, KPOS, KPROGRM, KRESET, KS1, KS2, KS3, KS4, KS5, KSL, KSR, KSTART, KT,., KXY, KYZ, KZX	Key signal		f	G113.7, G114.3, G114.2, G113.2, G114.0, G114.1, G114.7, G114.4, G113.1, G113.0, G113.3, G114.5, G114.6, G113.4, G113.6, G113.5, G107.6, G108.3, G108.1, G107.2, G109.2, G107.4, G110.3, G110.2, G109.3, G109.0, G109.1, G111.7, G112.6, G112.5, G112.4, G112.3, G112.2, G112.7, G112.1, G108.4, G107.3, G110.4, G110.6, G110.5
	KFF, KFFE, KFGB, KFI,, KFK%, KFL+, KFM., KFNK, KFOJ, KFRC, KFS=, KFT*, KFUV, KFWH, KFXY, KFZJ, KH, I, K		f		G114.3, G114.2, G113.2, G114.0, G114.1, G114.7, G114.4, G113.1, G113.0, G113.3, G114.5, G114.6, G113.6, G113.7, G113.4, G113.5, G107.6
	KILPLUS	Position coder feedback direction selection signal	f	f	G105.6
	KINPUT, KINSRT, KM, -, KP, Q, KPAGE ↑, KPAGE ÷, KPARAM, KPOS, KPROGRM, KRESET, KS1, KS2, KS3, KS4, KS5, KSL, KSR, KSTART, KT,., KXZ, KXZ	Key signal	f		G108.3, G108.1, G107.2, G107.4, G110.3, G110.2, G109.3, G109.0, G109.1, G111.7, G112.6, G112.5, G112.4, G112.3, G112.2, G112.7, G112.1, G108.4, G107.3, G142.7, G110.4
L	LDT1A, LDT1B, LDT2A, LDT2B	Load detection signal	f	f	F281.4, F285.4, F281.5, F285.5
M	M00, M01, M02, M30	Decode M signals		f	F154.7, F154.6, F154.5, F154.4
	M11, M12, M14, M18, M21, M22, M24, M28, M31, M32, M34, M38	Miscellaneous function code signal	f	f	F151.0, F151.1, F151.2, F151.3, F151.4, F151.5, F151.6, F151.7, F157.0, F157.1, F157.2, F157.3
	M211, M212, M214, M218, M221, M222, M224, M228, M231, M232, M234, M238	2nd M function code signal	f	f	F193.0, F193.1, F193.2, F193.3, F193.4, F193.5, F193.6, F193.7, F194.0, F194.1, F194.2, F194.3
	M311, M312, M314, M318, M321, M322, M324, M328, M331, M332, M334, M338	3rd M function code signal	f	f	F194.4, F194.5, F194.6, F194.7, F195.0, F195.1, F195.2, F195.3, F195.4, F195.5, F195.6, F195.7
	MCFNA, MCFNB	Power line switch completion signal	f	f	G230.3, G234.3
	MD1O, MD2O, MD4O	Mode select signal (software operator's panel signal)	f	f	F174.0, F174.1, F174.2
	MINP	External program input start signal	f		G117.0
				f	G120.0
	MIRX, MIRY, MIR4	Mirror image signal		f	G127.0, G127.1, G127.7
	MIX, MIZ		f		G120.0, G127.1
	MIX1, MIX2, MIX3, MIX4	Composite control start signals	F		G1437.4, G1437.5, G1437.7, G1437.6,
	MF2, MF3	2nd, 3rd M function strobe signal	f	f	F157.4, F157.5
	MFIN	Miscellaneous function completion signal	f	f	G115.0

	Symbol	Signal name	T	M	Address
	MFIN2, MFIN3	2nd, 3rd M function completion signal	f	f	G134.4, G134.5
	MMI1, MMI2	Mirror image check signal	f		F158.0, F158.1
	MMI1, MMI2, MMI4			f	F158.0, F158.1, F158.3,
	MP1, MP2	Manual handle heed amount selection signal	f		G117.0, G118.0
M				f	G120.0, G120.1
	MP1O, MP2O	Select of magnification of manual pulse generator (software operator's panel signal)	f	f	F175.6, F175.7
	MRDYA, MRDYB	Machine ready signal	f	f	G229.7, G233.7
	MVX, MVY, MVZ, MV4	Axis moving signal		f	F184.4 to F184.7
	MVX, MVZ, MV3, MV4		f		
	NOWT	No-wait signal	F		G133.1
	NOZAGC	Angular axis control-related Z-axis compensation movement signal	l		G133.6
N				l	G237.5
	NRROA, NRROB	Short-distant movement command while changing the orientation stop position signal	f	f	G231.2, G235.2
	OFN0, OFN1, OFN2, OFN3, OFN4	Tool offset number select signal	f		G132.0, G132.1, G132.2, G132.3, G132.4
	OP	Automatic operation signal	f	f	F148.7
	ORARA, ORARB	Spindle orientation completion signal	f	f	F281.7, F285.7
	ORCMA, ORCMB	Orientation command signal	f	f	G229.6, G233.6
O	OV1O, OV2O, OV4O, OV8O	Feedrate override signal (software operator's panel signal)	f	f	F176.0, F176.1, F176.2, F176.3
	OVC	Override cancel signal	f	f	G126.4
	OVCE	PMC axis override cancel signal	f	f	G147.5
	OUT0 to OUT7	Software operator's panel general-purpose switch signal (software operator's panel signal)	f	f	F171.0 to F171.7
	PC2SLC	2nd position coder selection signal	f		G146.7
	PCFNA, PCFNB	Output switching completion signal	f	f	F282.3, F286.3
	PCHPA, PCHPB	Output switching signal	f	f	F282.2, F286.2
	PECK2	Small-diameter peck drilling cycle execution in progress signal		f	F180.7
P	PK1M, PK2M, PK3M, PK4M, PK7M	Synchronization control start signals (tool post 1)	F		G238.0, G238.1, G238.2, G238.3, G238.4
	PK1S, PK2S, PK3S, PK4S	Synchronization control start signals (tool post 2)	F		G1438.0, G1438.1, G1438.2, G1438.3
	PKESS1	Parking signal for 1st spindle	f	f	G138.6
	PKESS2	Parking signal for 2nd spindle	f	f	G138.7
	PLCRVON	Position coder return control signal	f	f	G105.7

	Symbol	Signal name	T	M	Address
P	PN1, PN2, PN4, PN8	Workpiece number search signal	f	f	G122.4, G122.5, G122.6, G122.7
	PRC	Position record signal	f		G103.6
	PRGDPL	Program screen display signal	f	f	F180.1
	PRTSF	Required parts count reached signal	f	f	F164.7
	PSW01 to PSW10	Position switch signal	f	f	F190, F191.0, F191.1
	PSYN	Polygon synchronization under way signal	f		F160.7
	PX0 to PX7, PZ0 to PZ7	Position signal output signal	f		F165.0 to F165.7, F167.0 to F167.7
R	R01I to R12I, R01I2 to R12I2, R01I3 to R12I3	Motor speed command spindle input signal	f	f	G124.0 to G125.3, G106.0 to G107.3, G108.0 to G109.3
	R01O to R12O	S12-bit code signal	f	f	F172.0 to F173.3
	RCHA, RCHB	Power line status check signal	f	f	G230.7, G234.7
	RGSPM, RGSPP	Spindle rotation direction signal		f	F165.1, F165.0
	RGTPN	Rigid tapping signal	f	f	G123.1
	RLSOT	Stroke check release signal		f	G129.7
	RMTDI0 to RMTDI7	Input signals for remote buffer	f	f	G239.0 to G239.7
	RMTDO0 to RMTDO7	Output signals for remote buffer	f		F289.0 to F289.7
				f	F290.0 to F290.7
	ROTAA, ROTAB	Spindle rotation direction command signal while changing the orientation stop position	f	f	G231.1, G235.1
	ROV1, ROV2	Rapid traverse override signal	f	f	G116.7, G117.7
	ROV1D, ROV2D, ROV3D	Rapid traverse override B signal	f		G116.4, G116.5, G116.6
	ROV1E, ROV2E	PMC axis rapid traverse override signal	f	f	G146.0, G146.1
	ROV1O, ROV2O	Rapid traverse override signal (software operator's panel signal)	f	f	F175.4, F175.5
	RPALM	Read/punch alarm signal	f	f	F180.3
	RPBSY	Read/punch busy signal	f	f	F180.2
	RRW	Reset and rewind signal	f	f	G104.6
	RSLA, RSLB	Output switch request signal	f	f	G230.6, G234.6
	RSMAX	Serial spindle synchronization polygon signal	F		F189.7
	RST	Resetting signal	f	f	F149.1
	RT	Manual rapid traverse select signal	f	f	G121.6
	RTE	Manual rapid traverse selection signal (PMC axis control)	f	f	G147.6
	RTO	Jog rapid traverse select signal (software operator's panel signal)	f	f	F178.6
	RTNT	Tapping return start signal		f	G123.6

	Symbol	Signal name	T	M	Address
R	RTPT	Tapping return completion signal		f	F192.6
	RWD	Rewinding signal	f	f	F164.6

	Symbol	Signal name	T	M	Address
	S11, S12, S14, S18, S21, S22, S24, S28	Spindle-speed code signals	f	f	F152.0, F152.1, F152.2, F152.3, F152.4, F152.5, F152.6, F152.7
	S11 to S58	Spindle-speed function code signal (BCD output)	f	f	F185.0 to F187.3
	SA	Servo ready signal	f	f	F148.6
	SAR	Spindle speed arrival signal	f	f	G120.4
	SARA, SARB	Speed reached signal	f	f	F281.3, F285.3
	SBK	Single block signal	f	f	G116.1
	SBKO	Single block signal (software operator's panel signal)	f	f	F176.5
	SBRT	Spindle synchronous polygon code signal	F		G146.6
	SCLP	Spindle clamp signal	f		F164.0
	SDTA, SDTB	Speed detection signal	f	f	F281.2, F285.2
	SF	Spindle-speed strobe signals	f	f	F150.2
	SFIN	Spindle function completion signal	f	f	G115.2
	SFRA, SFRB	Spindle CW command signal	f	f	G229.5, G233.5
	SGN, SGN2, SGN3	Spindle motor command polarity select signal	f	f	G125.5, G107.5, G109.5
S	SHA00 to SHA11	1st spindle orientation external stop position command signal	f	f	G110.0 to G110.7, G111.0 to G111.3
	SHB00 to SHB11	2nd spindle orientation external stop position command signal	f	f	G112.0 to G112.7, G113.0 to G113.3
	SIND, SIND2, SIND3	Spindle motor speed command signal	f	f	G125.7, G107.7, G109.7
	SKIP	Skip signal	f	f	X008.7
	SKIP2, SKIP3, SKIP4	Skip signal	I		X008.2, X008.3, X008.4
	SLHZ0, SLHZ1	Manual handle feed axis selection signal for Z axis		f	G133.0, G133.1
	SLPCA, SLPCB	Spindle feedback select signal;	F		G1333.2, G1333.3
	SLSPA, SLSPB	Spindle command select signal	F		G133.2, G133.3
	SMZ	Error detect signal	f		G126.6
	SOR	Spindle orientation signal	f	f	G120.5
	SPA, SPB, SPC, SPD	Spindle speed override signal	f		G103.3, G103.4, G103.5, G103.2
	SPA, SPB, SPC			f	G103.3, G103.4, G103.5
	SPAL	Spindle fluctuation detection alarm signal	f		F154.0
	SPDS1, SPDS2, SPDS3, SPDS4	Signals output according to the speed or travel along an axis		f	F189.0, F189.1, F189.2, F189.3
	SPL	Feed hold lamp signal	f	f	F148.4

	Symbol	Signal name	T	M	Address
	SPO	Feed hold signal (software operator's panel signal)	f	f	F178.7
	SPPHS	Spindle phase synchronous control signal	f	f	G146.3
	SPSLA, SPSLB	Spindle select signal	f	f	G230.2, G234.2
	SPSTP	Spindle stop complete signal	f		G123.6
	SPSYC	Spindle synchronous control signal	f	f	G146.2
	SOCNA, SOCNB	Soft start /stop cancel signal	f	f	G230.4, G234.4
	SRN	Program restart signal	f	f	G103.0
	SRNMV	Program restart under way signal	f	f	F188.4
	SRVA, SRVB	Spindle CCW command signal	f	f	G229.4, G233.4
	SSIN, SSIN2, SSIN3	Spindle motor command polarity select signal	f	f	G125.6, G107.6, G109.6
	SSTA, SSTB	Speed zero detection signal	f	f	F281.1, F285.1
	ST	Cycle start signal	f	f	G120.2
	STL	Cycle start lamp signal	f	f	F148.5
	STLK	Start lock signal	f		G120.1
	STRD	Input and run simultaneous mode select signal		f	G140.5
S	STWD	Output and run simultaneous mode select signal		f	G140.6
	SUCLP	Spindle unclamp signal	f		F164.1
	SVFX, SVFZ, SVF3, SVF4	Servo off signal	f		G105.0, G105.1, G105.2, G105.3
	SVFX, SVFY, SVFZ, SVF4			f	
	SWS1, SWS2, SWS3	Spindle selection signal	f		G145.0, G145.1, G145.2
	SYCAL	Spindle synchronous control alarm signal	f	f	F178.4
	SYN1M, SYN2M, SYN3M, SYN4M, SYN7M	Synchronization control start signals (tool post 1)	F		G237.0, G237.1, G237.2, G237.3, G237.4
	SYN1OM, SYN2OM, SYN3OM, SYN4OM, SYN7OM	Axis recomposition signals (tool post 1)	F		F189.0, F189.1, F189.2, F189.3, F189.4
	SYN1OS, SYN2OS, SYN3OS, SYN4OS	Axis recomposition signals (tool post 2)	F		F1389.0, F1389.1, F1389.2, F1389.3
	SYN1S, SYN2S, SYN3S, SYN4S	Synchronization control start signals (tool post 2)	F		G1437.0, G1437.1, G1437.2, G1437.3
	SYNAL	Servo axis synchronization alarm signal		f	F192.7
	SYNCX, SYNCZ, SYNC3, SYNC4	Signals to select the slave axis for simple synchronous control	f		G237.0 to G237.3
	SYNC4			f	G237.3
	SYNCJ	Signal for selecting the manual feed axis for simple synchronous control		f	G133.6

	Symbol	Signal name	T	M	Address
T	T11 to T28	Tool function code signals	f		F153.0 to F153.7
	T11 to T48			f	F153.0 to F156.7
	TAL	Tool post interference alarm signal	F		F180.7
	TF	Tool function strobe signals	f	f	F150.3
	TFIN	Tool function completion signal	f	f	G115.3
	THRD	Thread cutting signal	f		F188.3
	TL01, TL02, TL04, TL08, TL16, TL32, TL64	Tool group number select signal	f	f	G139.0, G139.1, G139.2, G139.3, G139.4, G139.5, G139.6
	TLCH	Tool change signal	f	f	F188.0
	TLCHB	Remaining tool life expired signal		f	F192.2
	TLCHE	All tools' life expired signal		f	F192.1
	TLCHI	Individual tool change signal		f	F192.0
	TLMA, TLMB	Torque limit signal	f	f	F281.6, F285.6
	TLMHA, TLMHB	High-speed torque limit signal	f	f	G229.1, G233.1
	TLMLA, TLMLB	Low speed torque limit signal	f	f	G229.0, G233.0
	TLNW	New tool select signal	f	f	F188.1
	TLRST	Tool change reset signal	f	f	G139.7
	TLRSTI	Individual tool change reset signal		f	G140.4
	TLSKP	Tool skip signal	f	f	G140.0
	TNFS	Tool compensation number automatic selection disable signal	f		G132.5
	TORQ1, TORQ2, TORQ3, TORQ4, TORQ7, TORQ8	Torque limit reached signal	f		F170.0, F170.1, F170.2, F170.3, F170.4, F170.5
	TRT2, TRT2PC	Tool post selection signal	F		X018.3, G133.0
U	UI000 to UI015	Custom macro input signal	f	f	G130.0 to G131.7
	UINT	Interrupt signal for custom macro	f	f	G140.3
	UO000 to UO015, UO100 to UO131	Custom macro output signal	f	f	F162.0 to F163.7, F196.0 to F199.7
W	WNANS	Window completion signal	f	f	F250.0
	WNERR	Window error signal	f	f	F250.1
	WNRQ	Window request signal	f	f	G200.0
	WNWRT	Window rewrite signal	f	f	G200.1
	WOQSM	Workpiece coordinate system shift value write mode select signal	f		G132.6
	WOSET	Workpiece coordinate system shift value write signal	f		G133.7
X	XAE, YAE, ZAE	Measuring position reached signals		f	X008.0, X008.1, X008.2
	XAE, ZAE		f		X008.0, X008.1

	Symbol	Signal name	T	M	Address
	ZNG	Cancel-the-Z-axis command signal		f	G103.6
	ZP2X, ZP2Z, ZP23, ZP24	Second reference position return completion signals	f		F161.0, F161.1, F161.2, F161.3
	ZP2X, ZP2Y, ZP2Z, ZP24			f	
	ZP3	Cs contour control axis reference position return completion signal	f		F148.2
		Spindle orientation completion signal	f		
	ZP3X, ZP3Y, ZP3Z, ZP34	Third reference position return completion signals		f	F169.0, F169.1, F169.2, F169.3
	ZP3X, ZP3Z, ZP33, ZP34		f		
	ZP4	Cs contour control axis reference position return completion signal		f	F148.3
Z	ZP4X, ZP4Y, ZP4Z, ZP44	Fourth reference position return completion signals		f	F169.4, F169.5, F169.6, F169.7
	ZP4X, ZP4Z, ZP43, ZP44		f		
	ZPX, ZPY, ZPZ, ZP4	Reference position return completion signal		f	F148.0, F148.1, F148.2, F148.3
	ZPX, ZPZ, ZP3, ZP4		f		
	ZRFX, ZRFY, ZRFZ, ZRF4	Reference position establishment signal		f	F168.0, F168.1, F168.2, F168.3
	ZRFX, ZRFZ, ZRF3, ZRF4		f		
	ZRN	Mode selection signal Manual reference position return selection signal	f	f	G120.7
	ZRNO	Mode select signal (software operator's panel signal)	f	f	F174.3

5 DIGITAL SERVO

This chapter describes servo tuning screen required for maintenance of digital servo and adjustment of reference position.

5.1 INITIAL SETTING THE SERVO PARAMETERS

This section describes how to set initial servo parameters, which is used for field adjustment of machine tool.

(1) INITIAL SET BIT (Parameter 8n00, n is axis number)

	#7	#6	#5	#4	#3	#2	#1	#0
2000					PRMCAL		DGPRM	PLC01

#1 (DGPRM) 0 : Initial setting of digital servo parameter is done.

1 : Initial setting of digital servo parameter is not done.

#0 (PLC01) 0 : Values of parameter 8n23 and 8n24 are used as they are:

1 : Values of parameter 8n23 and 8n24 are multiplied by 10. (High–resolution detector)

(2) MOTOR NUMBER

PRM	8n20	Motor type no. per axis

(3) ARBITARY AMR(for 5–0S to 3–0S)

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	8n01	AMR7	AMR6	AMR5	AMR4	AMR3	AMR2	AMR1	AMR0

#7	#6	#5	#4	#3	#2	#1	#0	Motor model
1	0	0	0	0	0	1	0	5–0S
0	0	0	0	0	0	1	1	4–0S, 3–0S
0	0	0	0	0	0	0	0	other than above

Set “00000000” for serial pulse coder C.

(4) CMR

PRM	0100	Command multiply ratio
	:	:
PRM	0103	Command multiply ratio
PRM	0275	Command multiply ratio
PRM	0276	Command multiply ratio
PRM	7100	Command multiply ratio
PRM	7101	Command multiply ratio

1) When CMR is 1/2 to 1/27 Set value= $\frac{1}{CMR}$ +100

2) When CMR is 0.5 to 48 Set value=2×CMR

(5) Feed gear N/M

PRM	8n84	n of flexible feed gear
PRM	8n85	m of flexible feed gear

1) For serial pulse coder A or B, and serial α pulse coder.

$$\frac{n}{m} = \frac{\text{No. of feedback pulses per revolution of motor}}{1000000}$$

For serial pulse coder B, set 250,000 pulses or less.

Examples of calculation

		1/1000 mm	1/10000 mm
1 rotation of motor	8mm	n=1/m=125	n=2/m=25
	10mm	n=1/m=100	n=1/m=10
	12mm	n=3/m=250	n=3/m=25

2) For serial pulsecoder C

$$\frac{n}{m} = \frac{\text{No. of feedback pulses per revolution of motor}}{40000}$$

Examples of calculation

		1/1000 mm
1 rotation of motor	8mm	n=1/m=5
	10mm	n=1/m=4
	12mm	n=3/m=10

(6) Direction of Travel

PRM	8n22	Direction of motor rotation

111 : Positive (CCW) –111 : Reverse (CW)

(7) No. of velocity pulses and position pulses

1) For serial pulse coder A or B and serial α pulse coder
(Parameter no of 1st axis)

	Para-meter no.	Resolution 1/1000mm		Resolution 1/10000mm	
		Full close	Semi close	Full close	Semi close
High resolution setting	8100	xxxx xxx 0		xxxx xxx 1	
Separate detector	0037	xxxx xxx1	xxxx xxx0	xxxx xxx1	xxxx xxx0
Absolute position detector	0021	xxxx xxx1			
Velocity feedback pulses	8123	8192		819	
Position feedback pulses	8124	NS	12500	NS/10	1250

2) For serial pulse coder C
(Parameter no of 1st axis)

	Para-meter no.	Resolution 1/1000mm	
		Full close	Semi close
High resolution setting	8100	xxxx xxx1	
Separate detector	0037	0000 0010	0000 0000
Absolute position detector	0021	xxxx xxx0	
Velocity feedback pulses	8123	4000	
Position feedback pulses	8124	NS/10	4000

*) NS is the no. of position feedback pulses times 4.
*) For 5–0S to 3–0S motor, since the no. of poles is different, set parameter 8n01.

(8) Reference counter

PRM	0570	Reference counter capacity(0 to 32767)
	:	:
PRM	0575	Reference counter capacity(0 to 32767)

PRM	7570	Reference counter capacity(0 to 32767)
PRM	7571	Reference counter capacity(0 to 32767)

5.2 SERVO TUNING SCREEN

5.2.1 Parameter Setting

Set a parameter to display the servo tuning screen.

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0389								SVS

#0 (SVS) 0 : Servo tuning screen is displayed.
1 : Servo tuning screen is not displayed.

5.2.2 Displaying Servo Tuning Screen (Exa.: Incase of X axis)

1. Press DGNOS PARAM key, ▷ key, and soft key **[SV. PARA]** in this order.
2. Press soft key **[SV.TUN]** to select the servo tuning screen.

```
     SERVO TUNING                              01234 N12345
     (PAMAMETER)                               (MONITOR)
(1)  FUN.BIT          00000000      ALARM 1      00000000   (9)
(2)  LOOP GAIN            3000      ALARM 2      00000000   (10)
(3)  TURNING SET.            0      ALARM 3      10000000   (11)
(4)  SET PERIOD             50      ALARM 4      00000000   (12)
(5)  INT.GAIN              113      LOOP GAIN        2999   (13)
(6)  PROP.GAIN           -1015      POS ERROR         556   (14)
(7)  FILER                   0      CURRENT%           10   (15)
(8)  VELOC.GAIN            125      SPEED RPM         100   (16)

     ( SV SET )( SV TUN )(        )(        )(  OPR  )
```

(1) Function bit : PRM 8103
(2) Loop gain : PRM 0517 or 0512
(3) Tuning start : (Used by automatic servo tuning function)
(4) Set period : (Used by automatic servo tuning function)
(5) Integral gain : PRM 8143
(6) Proportional gain : PRM 8144
(7) Filter : PRM 8167
(8) Velocity gain : Set value= $\dfrac{\text{(PRM 8121)}+256}{256} \times 100$
(9) Alarm 1 : DGN 720 (Details of alarm 400 and 414)
(10) Alarm 2 : DGN 730 (Details of disconnection alarm, overload)
(11) Alarm 3 : DGN 760 (Details of alarm 319)
(12) Alarm 4 : DGN 770 (Details of alarm 319)
(13) Loop gain : Actual loop gain
(14) Position error : Actual position error(DGN 300)
(15) Current(%) : Indicate current with % to the rated value.
(16) Speed RPM : Number of motor actual rotation

	#7	#6	#5	#4	#3	#2	#1	#0
Alarm1	OVL	LV	OVC	HCA	HVA	DCA	FBA	OFA

DGN (720) :

#7 (OVL) : Overload alarm

#6 (LV) : Insufficient voltage alarm

#5 (OVC) : Overcurrent alarm

#4 (HCA) : Abnormal current alarm

#3 (HVA) : Excessive voltage alarm

#2 (DCA) : Discharge alarm

#1 (FBA) : Disconnection alarm

#0 (OFA) : Overflow alarm

	#7	#6	#5	#4	#3	#2	#1	#0
Alarm2	ALD			EXP				

DGN (730)

	⇓			⇓	
Overload alarm	0	—	—	—	Amplifier overheat
	1	—	—	—	Motor overheat
Discon-nection alarm	1	—	—	0	Built-in pulse coder disconnection (Hardware)
	1	—	—	1	Separate type pulse coder disconnection (Hardware)
	0	—	—	0	Pulse coder disconnection (software)

	#7	#6	#5	#4	#3	#2	#1	#0
Alarm3	SRFLG	CSA	BLA	PHA	RCA	BZA	CKA	SPH

DGN (760) :

#7 (SRFLG) : Not an alarm when serial pulse coder is connected, it will be 1.

#6 (CSA) : Hardware of serial pulse coder is abnormal.

#5 (BLA) : Battery voltage is in low (warning).

#4 (PHA) : Serial pulse coder or feedback cable is abnormal.
Counting the feedback signal is in error.

#3 (RCA) : Serial pulse coder is faulty.
Counting is in error.
If the RCA bit is set to 1 when both the FBA bit (bit 1 of alarm 1) and ALD bit of alarm 2 are set to 1 and the EXP bit of alarm 2 (internal hardware disconnection) is set to 0, a count miss alarm (CMAL) occurs in the α pulse coder.

#2 (BZA) : Battery voltage becomes 0.
Replace batteries and set the reference position.

#1 (CKA) : Serial pulse coder is faulty.
Internal block has stopped.

#0 (SPH) : Serial pulse coder or feedback cable is faulty.
Counting the feedback signal is in error.

	#7	#6	#5	#4	#3	#2	#1	#0
Alarm4	DTE	CRC	STB					

DGN (770) :

#7 (DTE) : Communication error of serial pulse coder.
There is no response.

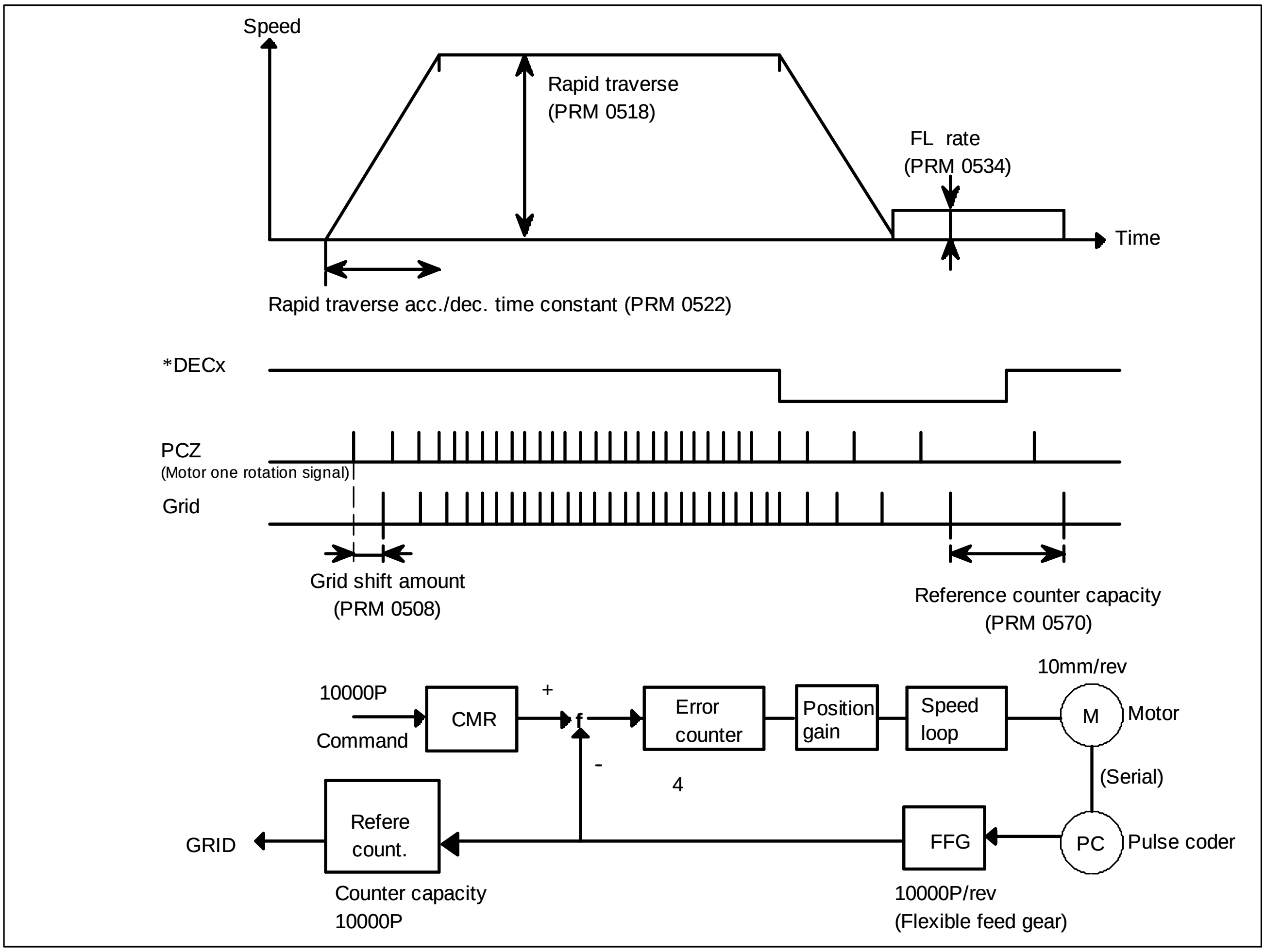
#6 (CRC) : Communication error of serial pulse coder.
Transmitted data is in error.

#5 (STB) : Communication error of serial pulse coder.
Transmitted data is in error.

5.3 ADJUSTING THE REFERENCE POSITION (DOG METHOD)

5.3.1 General

(Following No. of PRM are setting for X axis)



Related parameters

PRM	0570	Axial reference counter capacity [P]
	:	:
PRM	0575	Axial reference counter capacity [P]
PRM	7570	Axial reference counter capacity [P]
PRM	7571	Axial reference counter capacity [P]

This parameter specifies the number of feedback pulses per motor rotation, or its integral submultiple.

PRM	0508	Axial grid shift amount [P]
	:	:
PRM	0511	Axial grid shift amount [P]
PRM	0641	Axial grid shift amount [P]
PRM	0642	Axial grid shift amount [P]
PRM	7508	Axial grid shift amount [P]
PRM	7509	Axial grid shift amount [P]

* If a high resolution is to be specified, it must be specified in tenfold detection units.

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0021			APC8	APC7	APC4	APC3	APCZ	APCX
PRM	7021							APC6	APC5

0 : The position detection unit used for the corresponding axis is not an absolute pulse coder.
1 : The position detection unit used for the corresponding axis is an absolute pulse coder.

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0037			SPTP8	SPTP7	STPT4	STPT3	STPTZ	STPTX
PRM	7037							SPTP6	SPTP5

0 : The position detection unit used for the corresponding axis is the motor's built-in pulse coder.
1 : The position detection unit used for the corresponding axis is a separate pulse coder or linear scale.

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0022			ABS8	ABS7	ABS4	ABS3	ABSZ	ABSX
PRM	7022							ABS6	ABS5

Zero position of absolute pulse coder is:

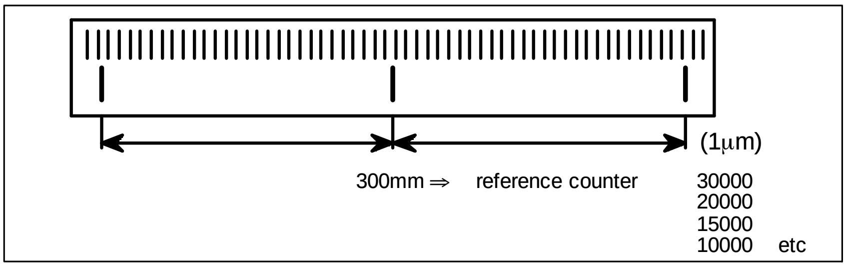
0 : Not established
1 : Established
(Turns to 1 after establishment)

D Separate Type Pulse Coder or Linear Scale is Used

PRM	0570	Reference counter capacity per axis [P]
	:	:
PRM	0575	Reference counter capacity per axis [P]
PRM	7570	Reference counter capacity per axis [P]
PRM	7571	Reference counter capacity per axis [P]

Normally, the number of feedback pulses per motor revolution is set to the reference counter capacity.
When plural reference marks are on a linear scale, a quotient of the distance between the reference marks divided by an interfer may be used as a reference counter capacity:

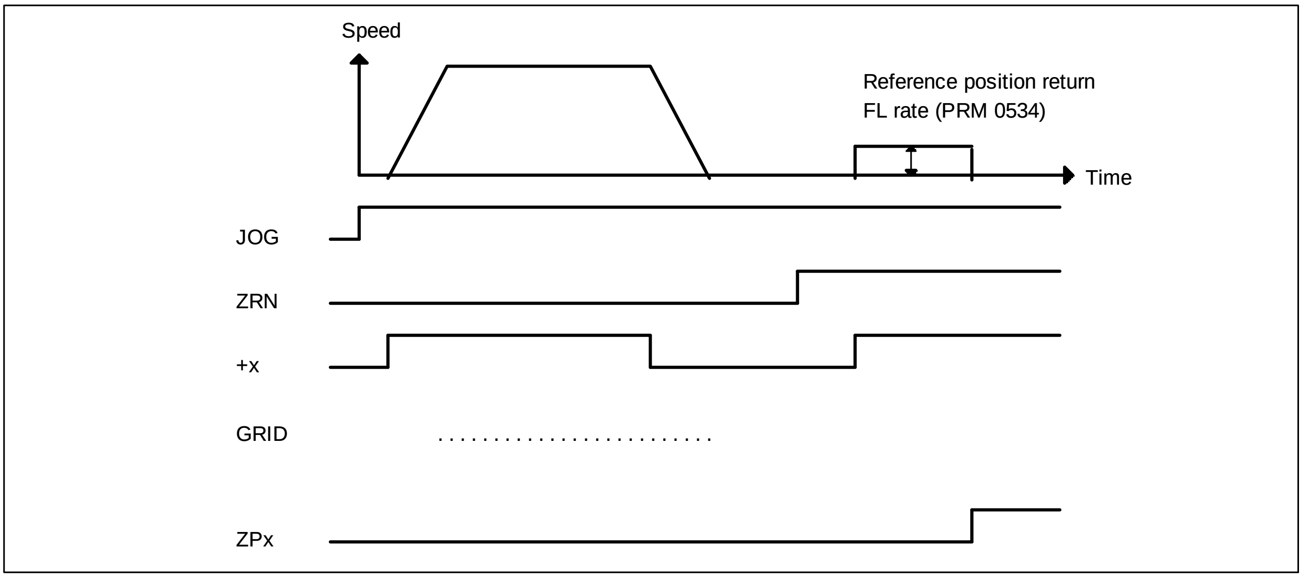
Example)



5.4 DOGLESS REFERENCE POSITION SETTING

When there are no dog nor limit switch for reference position return, this function enables the tool to return the reference position that is set by MTB.
When the absolute position detector is used, the reference position once set remains also during power off. When the absolute detector is replaced or absolute position is lost, perform this setting.

5.4.1 General



5.4.2 Operation

1 Move the tool near the reference position using a manual operation.

2 Select the reference position return mode or switch.

3 Press a button for an axis–and–direction–select–signal + or –, and the machine moves to the next grid, then stops.
(This position is set as the reference position).
After the reference position has been set, select the reference position return mode(ZRN signal is 1) and turn on an axis–and–direction–select signal, then the tool returns to the reference position.

5.4.3 Associated Parameters

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0076							JZRN	

#1(JZRN) 0 : Dog is used for reference position return
1 : Dogless reference position setting

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0391			JZRN8	JZRN7	JZRN4	JZRN3	JZRNZ	JZRNX

0 : The function for setting the dogless reference position is enabled for the corresponding axis.
1 : The function for setting the dogless reference position is disabled for the corresponding axis.

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	7076							JZRNS	

#1(JZRNS) 0 : An ordinary reference position return method (dog) is used for the 5th/6th axis.
1 : A dogless reference position return is used for the 5th/6th axis.

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0003					ZM4	ZM3	ZMZ	ZMX
PRM	7003							ZM6	ZM5
PRM	0066			ZM8	ZM7				

0 : Reference position return and backlash initial direction is +.
1 : Reference position return and backlash initial direction is –.

After ZRN signal becomes 1, manual feed direction is always the direction set by this parameter irrespective of an axis selection signal.

6 TROUBLESHOOTING

This chapter describes troubleshooting procedure.

6.1 CORRECTIVE ACTION FOR FAILURES

When a failure occurs, it is important to correctly grasp what kind of failure occured and take appropriate action, to promptly recover the machine.
Check for the failure according to the following procedure :

When? With what operation? What failure?

↓
Appropriate action
↓
Recovery

6.1.1 Investigating the Conditions Under which Failure Occurred

(1) When and how many times (frequency of occurrences)
(2) With what operation
(3) What failure occurred

1 When did the failure occur?

- Date and time?
- Occurred during operation? (how long was the operation?)
- Occurred when the power was turned on?
- Was there any lightening surge, power failure, or other disturbances to the power supply?

How many times has it occurred

- Only once?
- Occurred many times ? (How many times per hour, per day, or per month?)

2 With what operation did it occur ?

- What was the NC mode when the failure occurred?
  (Jog mode/memory operation mode /MDI mode /reference positionreturn mode)
- If during program operation,
  1) Where in the program ?
  2) Which program No. and sequence No. ?
  3) What program ?
  4) Occurred during axial movement ?
  5) Occurred during the execution of an M/S/T code ?
  6) Failure specific to the program ?
- Does the same operation cause the same failure ?
  (Check the repeatability of the failure.)
- Occurred during data input/output ?

<Feed axes and spindles>

- For a failure related to feed axis servo
  1) Occurred at both low feedrate and high feedrate ?
  2) Occurred only for a certain axis ? (In disconnection cable case)
- For a failure related to spindles
  When did the failure occur ? (during power-on, acceleration, deceleration, or constant rotation)

3 What failure occurred ?

- Which alarm was displayed on the alarm display screen on the CRT?
- Is the CRT screen correct ?
- If machining dimensions are incorrect
  1) How large is the error ?
  2) Is the position display on the CRT correct ?
  3) Are the offsets correct ?

4 Other information

- Is there noise origin around machine?
  If the failure has not occurred frequently, the cause may be external noise to the power supply or inductive noise on machinery cables. Operate other machines connected to the same power line and see if noise come from the relays or compressors.
- Is it taken any countermeasure for noise in machine side? (See 2.3.13)
- Check the following for the input power supply voltage :
  1) Is there variation in the voltage ?
  2) Are the voltages different depending on the phase ?
  3) Is the standard voltage supplied ?
- How high is the ambient temperature of the control unit?
  (0_C to 45_C during operation)
- Has excessive vibration been applied to the control unit?
  (0.5 G or less during operation)

5 When you contact our service center, specify the following items:

1) Name of the NC unit
2) Name of the machine tool builder and type of machine
3) Software series/version of the NC
4) Specifications of the servo amplifier and motor
   (for a failure related to the servo)
5) Specifications of the spindle amplifier and spindle motor
   (for a failure related to a spindle)

- See the drawing issued by the machine tool builder for the locations of the NC unit and servo/spindle amplifiers.
- We use the following specification codes :
  Servo /spindle amplifier : A06B–VVVV–HVVV
  Servo/spindle motor : A06B–VVVV–BVVV
  (V represents a number)

6.2 POWER CANNOT BE SWITCHED ON

Point

Check the LED on the input unit or power supply unit AI.

Cause and corrective action

(1) If no power supply alarm is detected (the red ”ALM” LED does not light):

1. If the PIL LED is off:

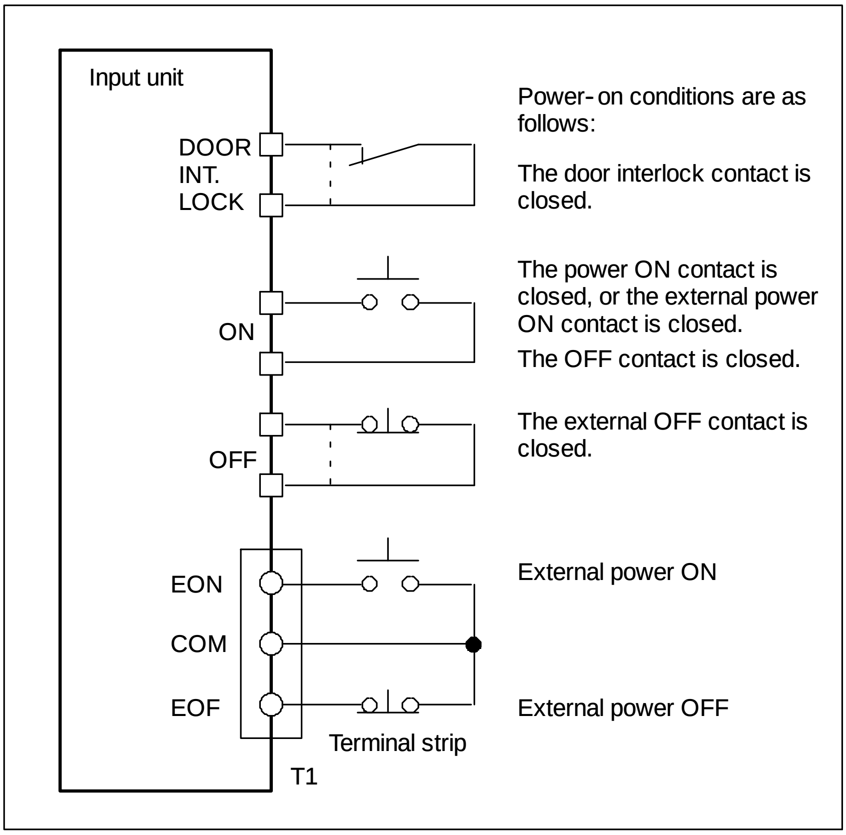
   (a) Check the input fuse of the input unit or power supply unit AI. Measure the voltage across the R and S terminals on the screw-on terminal strip of the input unit or at the connector CP1 of the power supply unit AI using a volt-ohm-milliammeter, and check whether 200 VAC is available. If the 200 VAC cannot be detected at connector CP1, check the corresponding circuit in the machine.

   (b) If both the fuse and power supply voltage are normal, the printed-circuit board of the input unit or the power supply unit AI may be defective.

2. If the PIL LED lights, and the input voltage is normal:
   Check whether the conditions for switching the power on are satisfied.

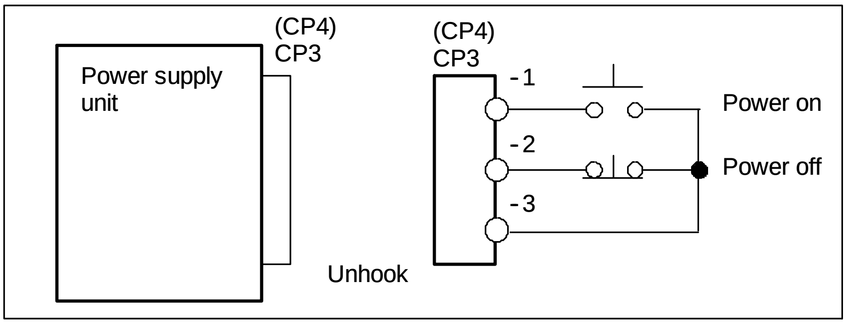
Other than power supply unit AI

When power is turned on with the connector CP11 at the bottom of the power supply unit detached, if a voltage of 200 VAC appears across pins 1 and 2 for about one second, it means that an ON condition is satisfied. (This method is not applicable to the power supply unit AI.)



Power supply unit AI

Unhook connectors CP3 (or CP4 for a power supply unit designed to satisfy CE marking requirements) from the front of the power supply unit, then check the circuit corresponding to the power being turned on and that corresponding to the power being turned off, as well as the operation of the switch, using a volt–ohm–milliammeter.

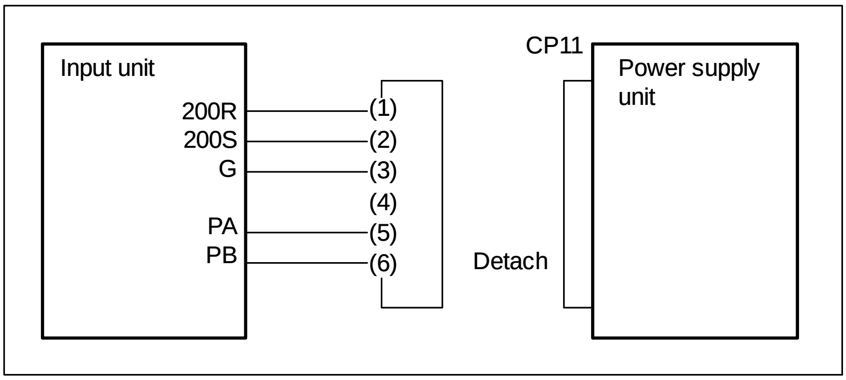


(2) If a power supply alarm is detected (the red "ALM" LED lights):

The most likely causes are a failure (short circuit or ground fault) or a defective power supply unit. Use the check procedure described below.

> **NOTE**
> Do NOT detach the memory backup battery cable.

1. Switch the power off, then check for a short circuit or ground fault between the DC voltage check terminals (+5V, +15V, –15V, +24V, and +24E) and the 0V point.
   (Overcurrent)
   If a short circuit or ground fault is detected, locate its cause by unhooking the related connectors, one by one, and measuring the resistance of each cable.
2. If a short circuit is still detected after all related connectors have been unhooked, remove the printed–circuit boards from the control section, one by one, to determine whether any printed–circuit board is short–circuited.
3. If neither a short circuit nor a ground fault is detected, check whether the input unit operates normally. (This method is not applicable to the power supply unit AI.)
   (a) Remove the connector CP11 from the bottom of the power supply unit, and measure the voltage across pins 1 and 2. If 200 VAC is output for about one second after the power on button is pressed, at least half the input unit is normal.
   (b) With the connector CP11 detached, connect pins 5 and 6 with a jumper wire, then turn on the power. If 200 VAC is output continuously, the input unit is normal.



(c) If neither item (a) nor item (b) does not occur, the power supply unit itself may be defective (overvoltage alarm or abnormal internal regulator circuit). Replace the power supply unit.

6.3 NO MANUAL OPERATION NOR AUTOMATIC OPERATION CAN BE EXECUTED

Points

(1) Execute the following procedure when no manual nor automatic operation is done

(2) Check whether position display shows correct position

(3) Check CNC status display

(4) Check CNC internal status using diagnostic function

Causes and Countermeasures

1. Position display (relative, absolute, machine coordinate) does not change

(a) Emergency stop status (Emergency stop signal is turned on)

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0021				*ESP				
DGN	0121				*ESP				

ESP=0 indicates that emergency stop signal is input.

(b) It is a reset status (Reset signal is turned on)

1) An input signal from the PMC functions

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0121	ERS							

When ERS is 1, external reset signal is input.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0104		RRW						

When RRW is 1, reset & rewing signal is input.

2) RESET key on the MDI keyboard functions

When the signals in 1) are 0, RESET key may be functioning. Check the contact of RESET key using a tester.
When it is abnormal, change the keyboard.

(c) Confirm the status of modes
Operation mode status is displayed on the lower part of CRT as follows :
If nothing is displayed, mode select signal is not input. Check mode select signal using PMC's diagnostic function (PMCDGN).
For details, refer to section 1.4 NC STATUS DISPLAY.

(Example of display)

JOG	:	Manual operation (JOG) mode
HNDL	:	Manual handle (MPG) mode
MDI	:	Manual data input (MDI) mode
AUTO	:	Automatic operation mode
EDIT	:	Memory edit (EDIT) mode

<Mode select signal>

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0122						MD4	MD2	MD1

	MD4	MD2	MD1
Manual operation (JOG) mode	1	0	1
Manual handle (MPG) mode	1	0	0
Manual data input (MDI) mode	0	0	0
Automatic operation (AUTO) mode	0	0	1
Memory edit (EDIT) mode	0	1	1

(d) In-position check is being done

It shows that positioning is not yet completed. Check the contents of the following diagnostic number.

DGN 800 Position Error >PARAM 500 In-position width

1) Check the parameters according to the parameter list.

DGN	0517	Servo loop gain per axis (Normal : 3000)
DGN	0512	Servo loop gain per axis (Normal : 3000)
	:	:
DGN	0515	Servo loop gain per axis (Normal : 3000)

2) Servo system may be abnormal. Refer to servo alarm 400, 4n0, and 4n1.

(e) Interlock or start lock signal is input

There are a plural interlock signals. Check at first which interlock signal is used by the machine tool builder at the parameters shown below.

[M series]

PRM 49#0	PRM 08#7	PRM 15#2	PRM 12#1	Signal name	DGNOS number
1	—	—	—	*+MIT1 to *-MIT4	142#0 to 142#7
—	1	—	—	*ITX, *ITY, *ITZ	128#0 to 128#3
—	0	0	0	*ILK (all axes)	117#0
—	0	0	1	*ILK (Z axis only)	
—	0	1	0	*RILK (all axes)	008#5
—	0	1	1	*RILK (Z axis only)	

[T series]

DGN		#7	#6	#5	#4	#3	#2	#1	#0
	0128					IT4	IT3	ITZ	ITX

ITα 1 : Axis interlock signal is input.
(This signal is effective when PRM 008#7 is 1.)

DGN		#7	#6	#5	#4	#3	#2	#1	#0
	0008			-MIT2	+MIT2	-MIT1	+MIT1		

±MITn 1 : Axis direction interlock signal is input.
(This signal is effective when PRM 024#7 is 1.)

(f) Jog feedrate override is 0%
Check the signals using PMC's diagnostic function (PMCDGN)

DGN		#7	#6	#5	#4	#3	#2	#1	#0
	0121					*OV8	*OV4	*OV2	*OV1

In case of PRM 003#4 OVRI=0
When all bits of the above address becomes 1111, the override is 0%.
In case of PRM 003#4 OVRI=1
When all bits of the above address becomes 0000, the override is 0%.

[M series]

DGN		#7	#6	#5	#4	#3	#2	#1	#0
	0104					JOV8	JOV4	JOV2	JOV1

When JOV8 to JOV1 = 0000, the override is 0%.

(g) NC is in a reset state

2. When machine coordinate value does not update on position display

(1) Machine lock signal (MLK) is input.

DGN		#7	#6	#5	#4	#3	#2	#1	#0
	0117							MLK	

MLK : All axes machine lock

When the signal is 1, the corresponding machine lock signal is input.

6.4 JOG OPERATION CANNOT BE DONE

Points

(1) Check whether position display is operating.

(2) Check CNC status display.

(3) Check internal status using Diagnostic funciton.

Causes and Remedies

1. Position display (relative, absolute, machine cooordinate) does not change

(1) Check mode selection status (JOG mode is not selected).

When status display shows JOG, it is normal.
When status display does not show JOG, mode select signal is not selected correctly. Confirm the mode select signal using PMC's diagnostic function (PMCDGN).

<Mode select signal>

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0122						MD4	MD2	MD1
							↓	↓	↓
		Manual operation (JOG) mode					1	0	1

(2) Feed axis and direction select signal is not input Check the signal using PMC's diagnostic function (PMCDGN).

[M series]

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0116					–X	+X		
DGN	0117					–Y	+Y		
DGN	0118					–Z	+Z		
DGN	0119					–4	+4		

[T series]

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0116					–X	+X		
DGN	0117					–Z	+Z		
DGN	0118					–3	+3		
DGN	0119					–4	+4		

Example)
When +X button is pressed on the operator's panel, signal+X turns to 1. This signal is effected at its rise. If axis selection signal is input before JOG mode is selected, axis movement does not occur. Turn the signal to off, then on.

(3)–(a) In–position check is being done

It shows that positioning is not yet completed. Check the contents of the following diagnostic number.

DGN 800 Position Error >PARAM 500 to In–position width

1) Check the parameters according to the parameter list.

PRM	0517	Servo loop gain per axis (Normal : 3000)
PRM	0512	Servo loop gain per axis (Normal : 3000)
	:	:
PRM	0515	Servo loop gain per axis (Normal : 3000)

2) Servo system may be abnormal. Refer to servo alarm 400, 410, and 411.

(3)–(b) Interlock or start lock signal is input

There are a plural interlock signals. Check at first which interlock signal is used by the machine tool builder at the parameters shown below.

[M series]

PRM 49#0	PRM 08#7	PRM 15#2	PRM 12#1	Signal name	DGNOS number
1	—	—	—	*+MIT1 to *-MIT4	142.0 to 7
—	1	—	—	*ITX, *ITY, *ITZ	128.0 to 3
—	0	0	0	*ILK (all axes)	117.0
—	0	0	1	*ILK (Z axis only)	
—	0	1	0	*RILK (all axes)	008.5
—	0	1	1	*RILK (Z axis only)	

[T series]

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0128					IT4	IT3	ITZ	ITX

ITα 1 : Axis interlock signal is input.
(This signal is effective when PRM 008#7 is 1.)

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0008			-MIT2	+MIT2	-MIT1	+MIT1		

+MITn 1 : Axis direction interlock signal is input.
(This signal is effective when PRM 024#7 is 1.)

(3)–(c) Jog feedrate override is 0%

Check the signals using PMC's diagnostic function (PMCDGN)

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0121					*OV8	*OV4	*OV2	*OV1

In case of PRM 0003#4 OVRI=0 when all bits of the above address becomes 1111, the override is 0%.
In case of PRM 0003#4 OVRI=1 when all bits of the above address becomes 0000, the override is 0%.

[M series]

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0104					JOV8	JOV4	JOV2	JOV1

When JOV8 to JOV1 = 0000, the override is 0%.

(3)–(d) NC is in a reset state

(4) Jog feed rate setting (Parameter) is not correct.

PRM	0559	Jog feedrate per axis [mm/min]
	:	:
PRM	0562	Jog feedrate per axis [mm/min]

(5) Manual feed per revolution is selected (T series only)

This funciton feeds an axis synchronized with spindle rotation and whether this function is used or not is selected by the following parameter:

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0008				MFPR				

#4 (MFPR) 0 : Jog feed is of feed per minute

1 : Jog feed is of feed per revolution

(a) When parameter MFPR is set to 1, feed rate of the axis is calculated by synchronizing with rotation of the spindle. Therefore, rotate the spindle.

(b) If the axis does not move even when the spindle is rotated, check the detector of the spindle (position coder) and the cable between the position coder and the CNC if it is short–circuited or ungrounded.Refer to 2.3 for connection diagram.

6.5 HANDLE OPERATION CANNOT BE DONE

Points

(1) Check another manual operation (JOG) is accepted.

(2) Check CNC status display.

Causes and Countermeasure

1 JOG operation is not acceptable, either

Consult with item 6.3 and 6.4.

2 When only handle operation (MPG) cannot be done

(1) Check CNC status display at lower left corner of the CRT.
(Refer to **1.4 NC STATUS DISPLAY** for details)
When the status display shows HND, mode selection is correct.
If it is not HND, mode select signal is not input correctly. Check the mode select signal using the PMC's diagnostic function(PMCDGN).

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0122						MD4	MD2	MD1
							↓	↓	↓
		Manual handle mode					1	0	0

(2) Manual handle feed axis select signal is not input.

Check the signals using diagnostic function (PMCDGN).

[M–series]

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0116	HX							
DGN	0117	HY							
DGN	0118	HZ							
DGN	0119	H4							

Manual pulse generator axis selection signal and selected axis are :

(i) If one manual pulse generator is used

HX	HY	HZ	H4	Selected axis
0	0	0	0	No selection
1	0	0	0	X axis
0	1	0	0	Y axis
0	0	1	0	Z axis
0	0	0	1	4th axis

(ii) If two or three manual pulse generators are used

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0003	HSLE							

HSLE Specifies whether to enable the manual pulse generator axis selection signal if three manual pulse generators are used:

0 : Disable (the first, second, and third manual pulse generators are fixed at the X–, Y–, and Z–axes, respectively.)

1 : Enable (as listed below)

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0019								MHPGB

MHPGB Selects the specification of the multihandle function.

0 : Specification A
1 : Specification B

(If the multihandle function is of specification A)

HX	HY	HZ	H4	Selected axis: First manual pulse generator	Second manual pulse generator	Third manual pulse generator
1	1	0	0	X axis	Y axis	No selection
1	0	1	0	X axis	Z axis	No selection
0	1	1	0	Y axis	Z axis	No selection
1	1	1	0	X axis	Y axis	Z axis
1	0	0	1	X axis	4th axis	No selection
0	1	0	1	Y axis	4th axis	No selection
1	1	0	1	X axis	Y axis	4th axis
0	0	1	1	Z axis	4th axis	No selection
1	0	1	1	X axis	Z axis	4th axis
0	1	1	1	Y axis	Z axis	4th axis

(If the multihandle function is of specification B)

X–axis	First manual pulse generator
Y–axis	Second manual pulse generator
Z–axis	Selected according to SLHZ0 and SLHZ1

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0113							SLHZ1	SLHZ0

SLHZ1	SLHZ0	Z–axis
0	0	Selected according to parameter 117
0	1	First manual pulse generator
1	0	Second manual pulse generator
1	1	Third manual pulse generator

PRM	0117	Manual pulse generator for the 4th axis and Z–axis

This parameter specifies which manual pulse generator is to be used for the 4th axis and Z–axis.

Example) Assuming the second manual pulse generator is used for the Z–axis, and the third, for the 4th axis:

PRM 117 = $\underset{\text{4th axis}}{\underline{3}}\ \underset{\text{Z axis}}{\underline{2}}$

[T series]

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0116	HX							
DGN	0117	HZ							
DGN	0118	H3							

(Valid only when bit 5 of parameter 0031 = 1)

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0119	H4							

Manual pulse generator axis selection signal and selected axis are :

(i) If one manual pulse generator is used

HX	HY	H3	H4	Selected axis
0	0	0	0	No selection
1	0	0	0	X axis
0	1	0	0	Z axis
0	0	1	0	3rd axis
0	0	0	1	4th axis

(ii) If two manual pulse generators are used

HX	HZ	H3	H4	Selected axis	
				First manual pulse generator	Second manual pulse generator
1	1	0	0	X-axis	Z-axis
1	0	1	0	X-axis	3rd axis
0	1	1	0	Z-axis	3rd axis
1	1	1	0	X-axis	Z-axis
1	0	0	1	X-axis	4th axis
0	1	0	1	Z-axis	4th axis
1	1	0	1	X-axis	Z-axis
0	0	1	1	3rd axis	4th axis
1	0	1	1	X-axis	3rd axis
0	1	1	1	Z-axis	3rd axis

(3) Manual handle feed multiplication is not correct

Check the following signals using PMC’s PCDGN. Also confirm the following parameters based on the parameter list.

[M series]

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0120			MP2	MP1				

[T series]

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0117								MP1
DGN	0118								MP2

MP2	MP1	Multiplication
0	0	1
0	1	10
1	0	m
1	1	n

PRM	0121	Magnification of handle feed m(1 to 127)
PRM	0699	Magnification of handle feed n(1 to 1000)

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0386	HDPIG4	HDPIG3	HDPIG2	HDPIG1	HPNEG4	HPNEG3	HPNEG2	HPNEG1

M series only

HDPIGx Magnification of handle feed (X1000)

1 : Not effective

0 : Effective

HPNEGx Direction of MPG

1 : Reverse direction

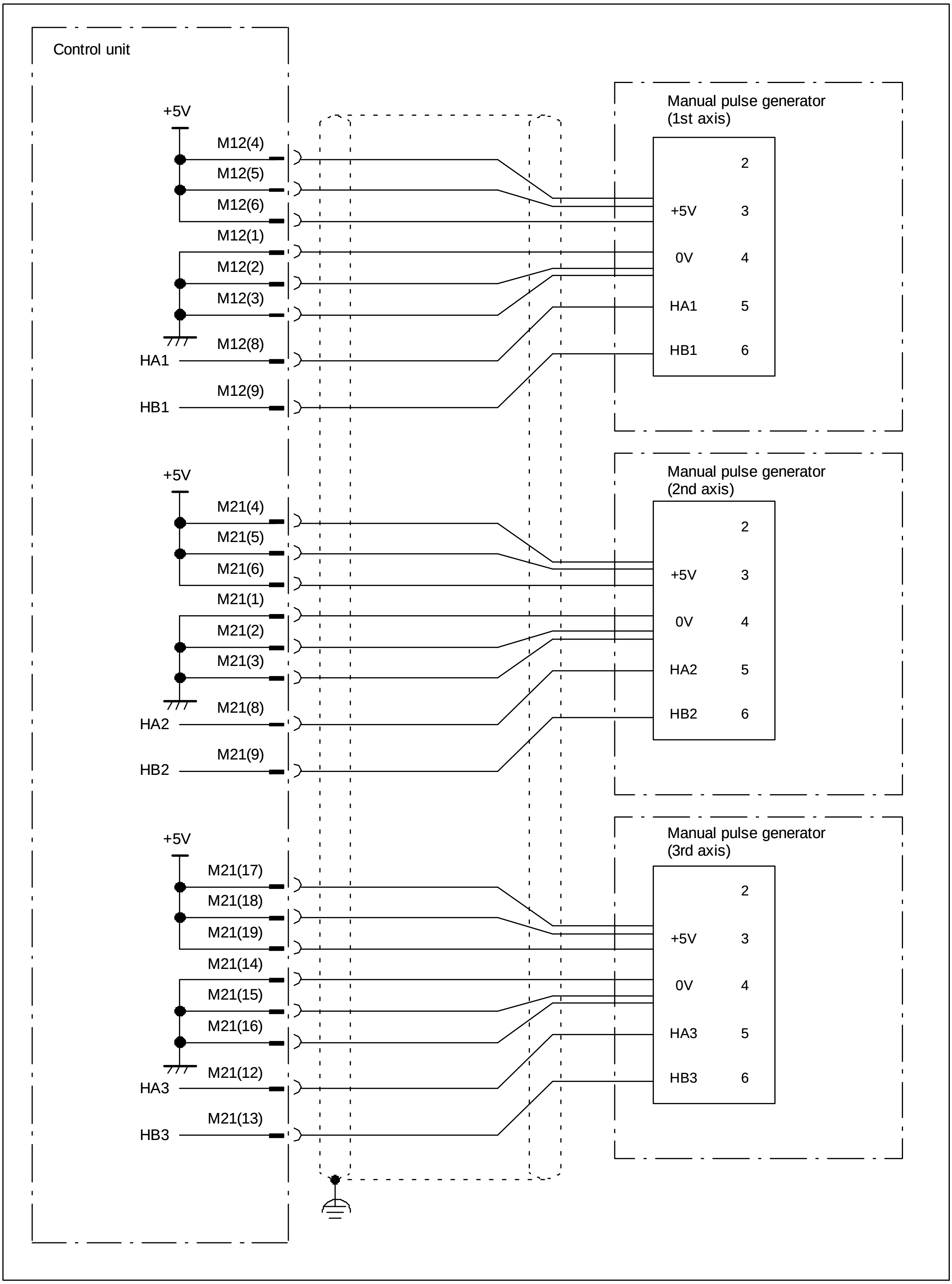
0 : Same direction

[M series]

PRM	0118	Number of manual pulse generators in use

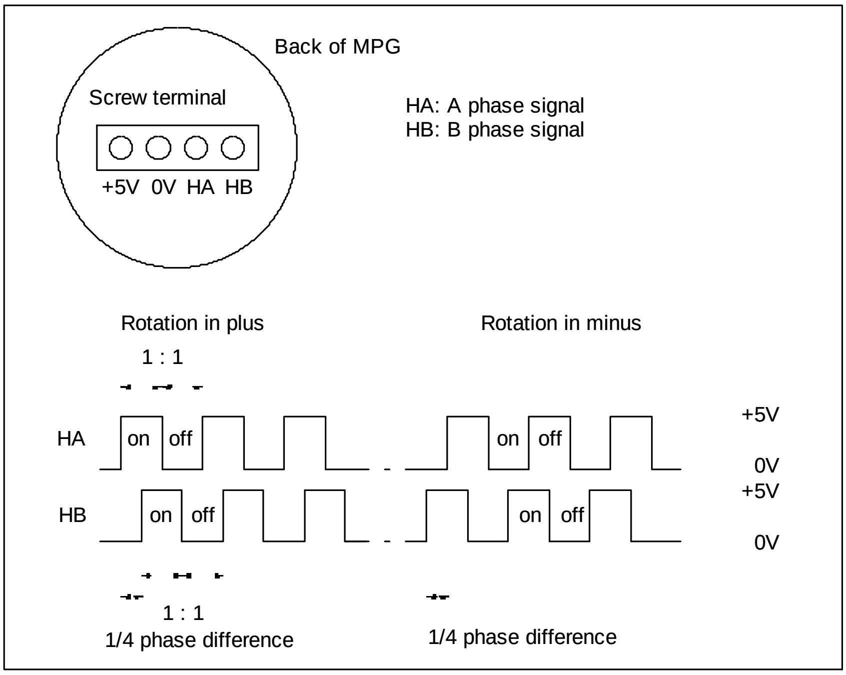
(4) Checking manual pulse generator

(a) Incorrect cable
Check disconnection of cable or short circuit.


Control unit
+5V
M12(4)
M12(5)
M12(6)
M12(1)
M12(2)
M12(3)
M12(8)
HA1
M12(9)
HB1
+5V
M21(4)
M21(5)
M21(6)
M21(1)
M21(2)
M21(3)
M21(8)
HA2
M21(9)
HB2
+5V
M21(17)
M21(18)
M21(19)
M21(14)
M21(15)
M21(16)
M21(12)
HA3
M21(13)
HB3
Manual pulse generator (1st axis)
2
+5V 3
0V 4
HA1 5
HB1 6
Manual pulse generator (2nd axis)
2
+5V 3
0V 4
HA2 5
HB2 6
Manual pulse generator (3rd axis)
2
+5V 3
0V 4
HA3 5
HB3 6

(b) Manual pulse generator is faulty

When you rotate the MPG, the following signal is output. Measure the signal with synchroscope at screw terminal on back of MPG. If no signal is output, measure +5V voltage.



Check on and off ratio and phase difference of HA and HB.

6.6 AUTOMATIC OPERATION CANNOT BE DONE

Points

(1) Check manual operation is possible.

(2) Check the status of cycle start LED on machine operator's manual.

(3) Check status of CNC.

Causes and Remedies

When manual operation is either impossible, perform countermeasure, based on the previous item "Jog operation cannot be done".
Confirm that a correct mode is selected according to the mode select status of CNC status display. Also, by confirming the automatic operation status it is possible to identify cycle operation, feed hold and cycle stop state.

1. When cycle operation is not started (Cycle start LED does not light)

"****" is displayed at status display on CRT.

(1) Mode select signal is not correct.

When the mode select signal is input correctly, following status display is done.
MDI : Manual data input mode (MDI)
AUTO : Automatic operation mode

If status display does not show a correct status, check the mode signal with following diagnosis function of PMC side (PMCDGN).

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0122						MD4	MD2	MD1

MD4	MD2	MD1	Mode select
0	0	0	Manual data input (MDI) mode
0	0	1	Automatic operation (AUTO) mode

(2) Cycle start signal is not input

This signal turns 1 when cycle start button is pressed and turns 0 when it is released. The cycle start actuates when it changes from 1 to 0. Check the state of the signal using PMC's diagnostic function (PMCDGN).

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0120						ST		

ST : Cycle start signal
Feed hold signal is input

(3) Under normal state, the feed hold signal is 1 when the feed hold button is not pressed.
Check the state of this signal using the PMC's diagnostic function (PMCDGN) .

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0121			*SP					

***SP** : Feed hold signal

2. When automatic operation is being performed (the start lamp is lit):

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0700		CSCT	CITL	COVZ	CINP	CDWL	CMTN	CFIN

The following descriptions apply when the respective bits are 1.

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

b. **CMTN** : A move command is being executed in automatic operation.

c. **CDWL** : A dwell command is being executed.

d. **CINP** : A position check is being performed.

e. **COVZ** : The override value is 0%.

f. **CITL** : The interlock signal is on.

g. **CSCT** : The machine is waiting for the spindle speed reached signal to become on.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0701		CRST						

h. **CRST** : The emergency stop, external reset, reset & rewind, or MDI panel reset button is on.

* Items a to h are related to automatic operation. Details follow.

a. An auxiliary function is being executed (waiting for FIN signal)

An auxiliary function (M/S/T/B) specified in a program is not ended.
Check according to the following procedure.
At first, confirm the kind of interface of an auxiliary function.

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0045	HSIF							

#7(HSIF) 0 : M/S/T/B is of normal interface.

1 : M/S/T/B is of high-speed interface.

1) Normal interface

When the auxiliary function finish signal turns from 1 to 0, the auxiliary function is supposed to be ended and the next block is read for operation. Confirm the status of this signal using PMC's diagnostic function(PMCDGN).

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0120					FIN			

#3 (FIN) : Auxiliary function finish signal

2) High-speed interface

The auxiliary function is supposed to be ended when the signals are in the following state. Confirm it using PMC's diagnostic function (PMCDGN).

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0115	BFIN	BFIN2			TFIN	SFIN		MFIN

#0(MFIN) : M function finish signal
#2(SFIN) : S function finish signal
#3(TFIN) : T function finish signal
#6(BFIN2) : B function finish signal (M series only)
#7(BFIN) : B function finish signal

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0150	BF	BF2			TF	SF		MF

#0(MF) : M function strobe signal
#2(SF) : S function strobe signal
#3(TF) : T function strobe signal
#6(BF2) : B function strobe signal (M series only)
#7(BF) : B function strobe signal

Signal	End state	
Finish signal	0	1
strobe signal	0	1

b. Travel command is being executed

CNC is reading an axis command (X,Y,Z,...) in a program and giving the command to the axis.

c. A dwell command is being executed

CNC is reading a dwell command (G04) in a program and is executing the dwell command.

d. In–position check (confirming positioning) is being done

Positioning (G00) to a specified position of a specified axis is not completed.
Whether positioning is completed or not is checked as the servo position error amount. Check it CNC's diagnostic function as follows:

DGN no.800 $\boxed{\text{Position Error}}$ > PARAM 500 $\boxed{\text{In–position width}}$

Position error amount almost becomes 0, when positioning of an axis completes and when the amount becomes within the in–posiiton width, it is assumed that positioning completes and the next block is exected.
If position error amount does not become within the in–position width, refer to servo alarm 400, 4n0 and 4n1.

e. Feedrate override is at 0%

Actual feedrate is overridden by the override signals to a programmed feedrate. Check the override signals using the PMC's diagnostic function (PMCDGN).

<Normal override signal>

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0121					*OV8	*OV4	*OV2	*OV1

In case of PRM 0003#4 OVRI=0 when all bits of the above address becomes 1111, the override is 0%.
In case of PRM 0003#4 OVRI=1 when all bits of the above address becomes 0000, the override is 0%.

[M series]

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0104					JOV8	JOV4	JOV2	JOV1

When JOV8 to JOV1 = 0000, the override is 0%.

f. Interlock signal or start lock signal is input

[T series]

(1) All axis interlock signal (STLK) is input

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0120							STLK	

STLK With this signal being 1, start lock signal is input.

(2) Axis interlock signal (ITX to IT4) is input

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0008	EILK							

EILK 0 : Interlock signal is invalid

1 : Interlock signal is valid.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0128						IT3	ITZ	ITX

ITx When this bit is 1, interlock signal is input.

(3) Interlock signal per axis and direction(□ MIT1, □ MIT2) is input

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0024	EDILK							

EDILK 0 : Axis direction interlock signal is invalid.

1 : Axis direction interlock signal is valid.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0008			–MIT2	+MIT2	–MIT1	+MIT1		

When this bit is 1, interlock signal is input.

[M series]

(1) The ordinary interlock signal (*ILK) and the high–speed interlock signal (*RILK) are on.

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0015						RILK		

RILK 0 : The ordinary interlock signal (*ILK) is enabled.

1 : The high–speed interlock signal (*RILK) is enabled.

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0012							ZILK	

ZILK 0 : Interlock is applied to all axes.

1 : Interlock is applied only to the Z–axis.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0008			+RILK					
DGN	0117								*ILK

When these bits are 0, they indicate that the corresponding interlock signals are on.

(2) The axial interlock signals (*ITX to *IT4) are on.

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0008	EILK							

EILK 0 : Axial interlock is disabled.
1 : Axial interlock is enabled.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0128					IT4	IT3	ITZ	ITX

When these bits are 0, they indicate that the corresponding axial interlock signals are on.

(3) The axis direction interlock signals (±*MITX to ±*MIT4) are on.

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0049	DILK							

DILK 0 : Axis direction interlock is disabled.
1 : Axis direction interlock is enabled.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0142	-*MIT4	-*MITZ	-*MITY	-*MITX	+*MIT4	+*MITZ	+*MITY	+*MITX

When these bits are 0, they indicate that the corresponding axis direction interlock signals are on.

g. CNC is waiting for spindle speed arrival signal to be input

Actual spindle speed does not arrive at a speed specified in a program. Confirm the signal state using the PMC's diagnostic function (PMCDGN).

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0120				SAR				

SAR : When this signal is 0, spindle speed does not arrive at the specified speed.

This function is valid when PARAM 024#2=1.

h. NC is in a reset state

In this case, the CNC's status display shows RESET. Refer to item 1.

(1) Only rapid traverse in positioning (G00) does not function confirm the following parameter and signals from the PMC.

(a) Setting value of rapid traverse rate

PRM	0518	Rapid traverse rate per axis [mm/min]
	:	:
PRM	0521	Rapid traverse rate per axis [mm/min]
PRM	0643	Rapid traverse rate per axis [mm/min]
PRM	0644	Rapid traverse rate per axis [mm/min]
PRM	7518	Rapid traverse rate per axis [mm/min]
PRM	7519	Rapid traverse rate per axis [mm/min]

(b) Rapid traverse override signals

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0116	ROV1							
DGN	0117	ROV2							
PRM	0003				OVRI				

ROV1	ROV2	OVRI=0	OVRI=1
0	0	100%	Fo
1	1	50%	25%
0	1	25%	50%
1	1	Fo	100%

PRM	0533	Rapid traverse override F0 rate [mm/min]

(2) Only feed (other than G00) does not function

(a) Maximum feedrate set by parameter is incorrect.

PRM	0527	Maximum feedrate [mm/min]

Feedrate is clamped at this upper feedrate.

(b) Feedrate is specified by feed per revolution (mm/rev)

1) Position coder does not rotate

Check the connection between spindle and position coder
The following failure is considered:

- Timing belt is broken
- Key is removed
- Coupling is loose
- Connecting point is loose
- Connector of signal cable is loosened

2) Position coder is faulty

(c) Thread cutting does not operate

1) Position coder does not rotate

Check the connection between spindle and position coder
The following failure is considered:

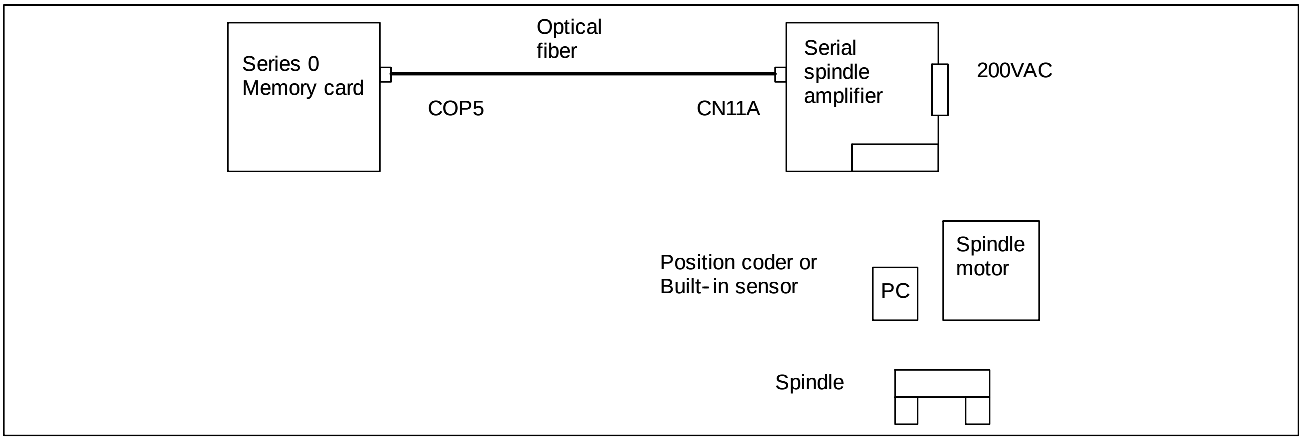
- Timing belt is broken
- Key is removed
- Coupling is loose
- Connector of signal cable is loosened

2) Position coder is faulty

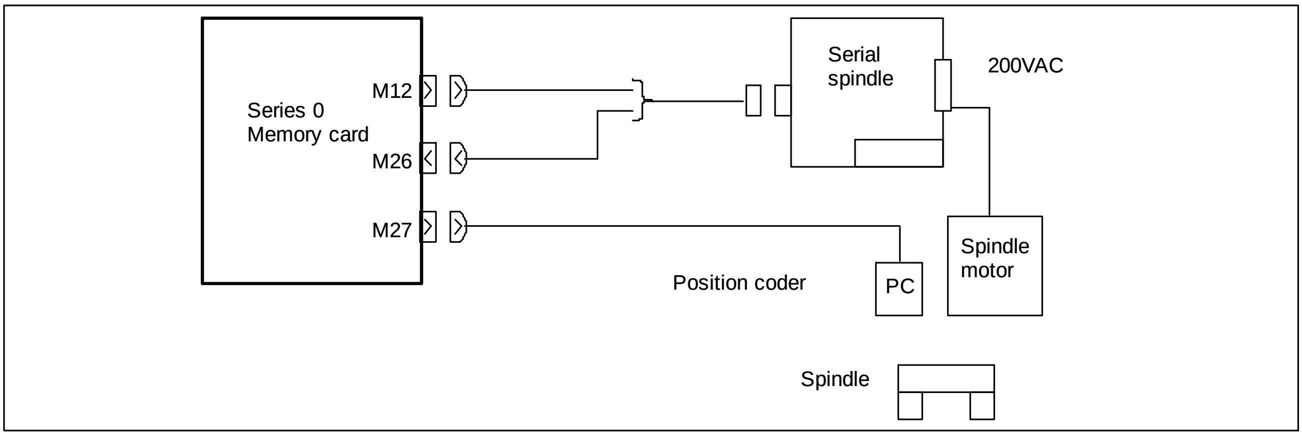
Position coder is connected to the spindle amplifier when serial interface spindle is used or connected to the CNC when analog interface spindle is used.
For details of connection, refer to the following.

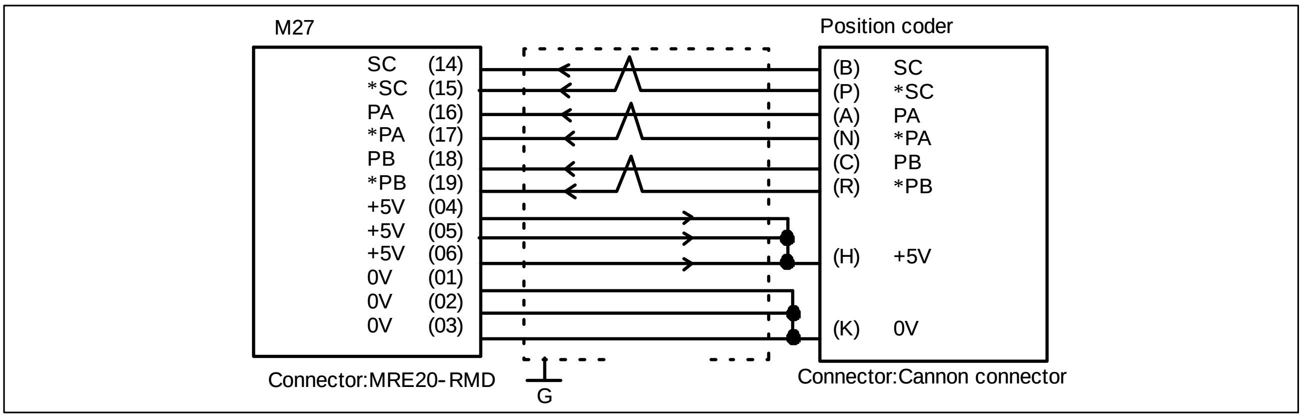
<T series>
Whether A/B phase signals from the position coder are read correctly, can be judged also by the spindle speed display on the CRT screen (position screen). (However, it is not displayed when PARAM 014#2=0).

<Serial spindle amplifier>



<Analog interface spindle amplifier>





6.7 CYCLE START LED SIGNAL HAS TURNED OFF

Points

(1) After cycle operation is started, then stopped, check as follows:

(2) Confirm cycle start LED on machine operator's panel.

(3) Confirm CNC's diagnostic function.

Causes and Remedies

The reason why cycle start LED signal (STL) has turned off are displayed on CNC's diagnostic numbers 712 and read as follows :

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0712	STP	REST	EMS	RRW	RSTB			CSU

#7	#6	#5	#4	#3	#2	#1	#0	Reasons
1	1	1	0	0	0	0	1	a. Emergency stop signal
1	1	0	0	0	0	0	0	b. External reset signal
1	1	0	1	0	0	0	0	c. Reset & rewind signal
1	1	0	0	1	0	0	0	d. Reset button on MDI
1	0	0	0	0	0	0	1	e. Servo alarm
1	0	0	0	0	0	0	0	f. Feed hold signal or switch other modes

Details of signals a. to f. are as follows:
Confirm the signals concerned using diagnostic function (PMCDGN).

a. Emergency stop is input

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0021				*ESP				
DGN	0121				*ESP				

***ESP=0 :** Emergency stop signal is input :

b. External reset signal is input

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	G121	ERS							

ERS : When the bit is 1, external reset signal is input.

This signal is usually used for a confirmation signal of M02 when an M02 is specified in a program as the end of a program.
Therefore, when M02 is executed, this signal is input.

c. Reset & rewind signal is input

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	G0104		RRW						

RRW : When this signal is 1, the reset & rewind signal is input.

This signal is usually used for a confirmation signal of M30 when an M30 is specified in a program as the end of a program.
Therefore, when M30 is executed, this signal is input.

d. Reset & rewind signal is input

An automatic operation is put into a reset status when RESET key on the MDI panel is pressed.

e. Servo alarm has generated

When any servo alarm has generated, cycle operation is put into the reset state and operation stop.

f. Cycle operation is in a feed hold state

The cycle operation becomes feed hold state in the following cases:

1) Modes are switched from an automatic operation mode to a manual operation mode.
2) Feed hold signal is input.

<Mode select signal>

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0122						MD4	MD2	MD1

Automatic operation	memory edit(EDIT)	0	1	1
	Automatic operation (AUTO)	0	0	1
	Manual data input (MDI)	0	0	0
Manual operation	Jog feed (JOG)	1	0	0
	Handle/step	1	0	1
	TEACH IN HANDLE	1	1	1
	TEACH IN JOG	1	1	0

<Feed hold signal>

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0121			*SP					

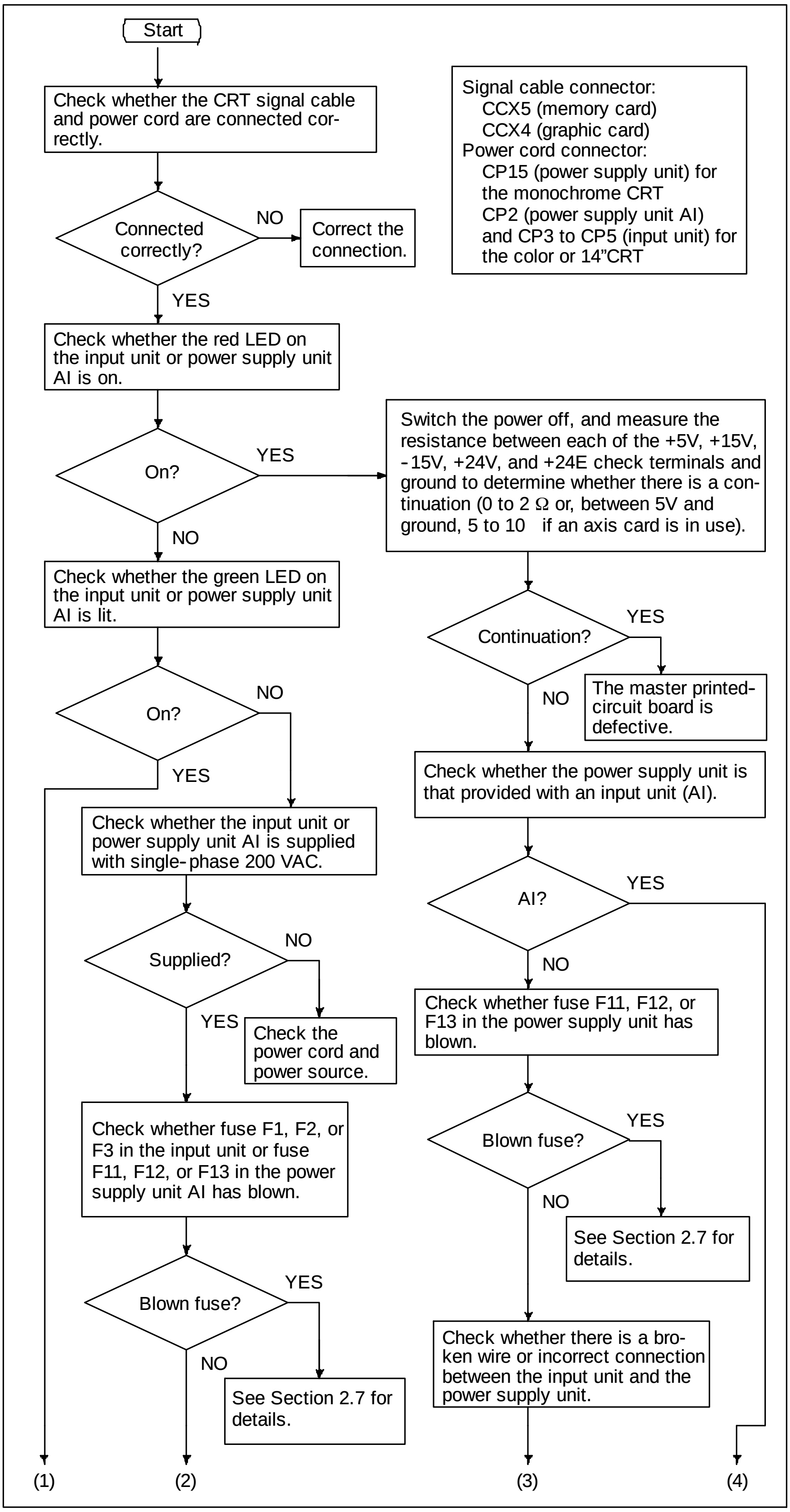
***SP :** When this signal is 0, the feed hold signal is input.

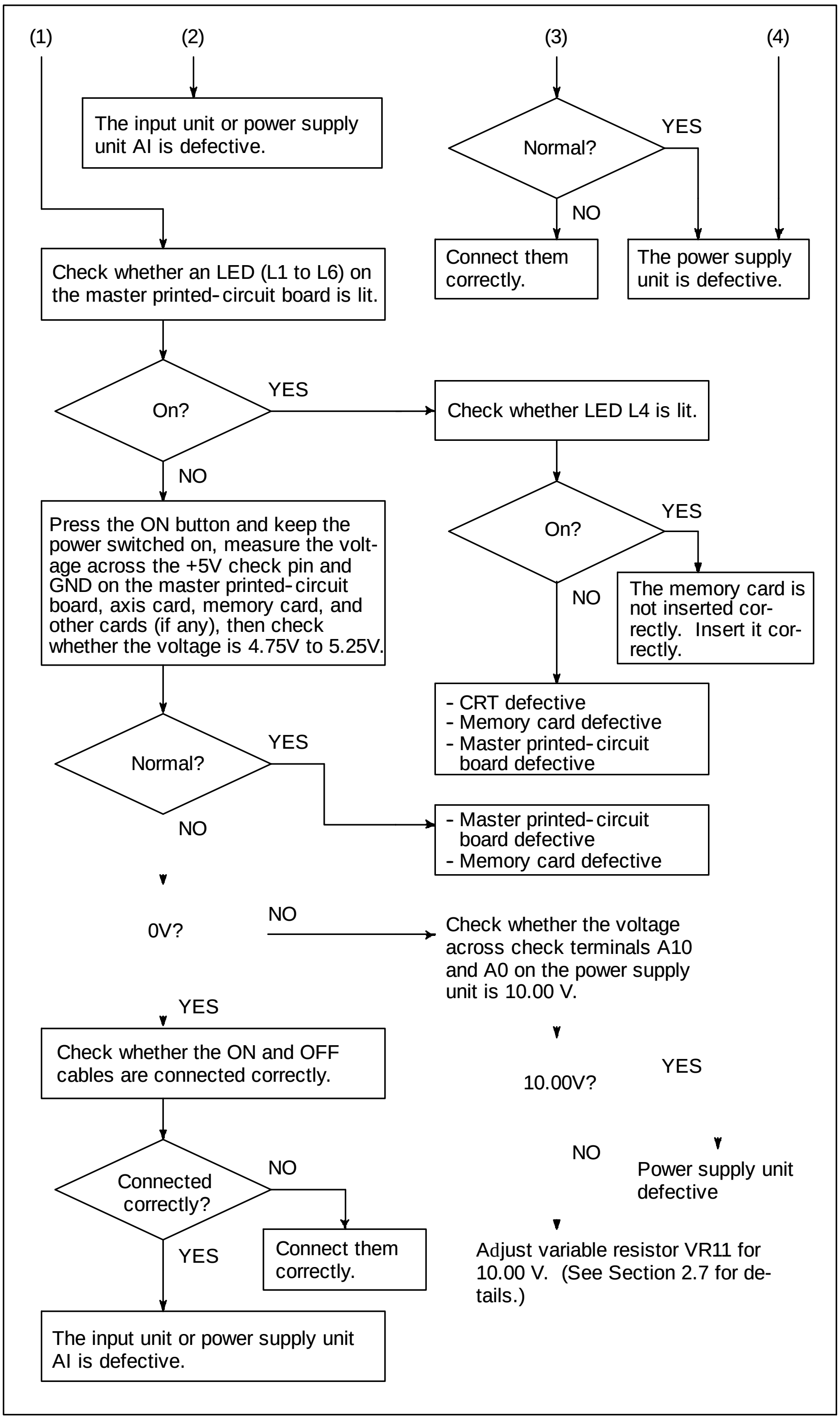
g. It become single block stop during automatic operation

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0116							SBK	

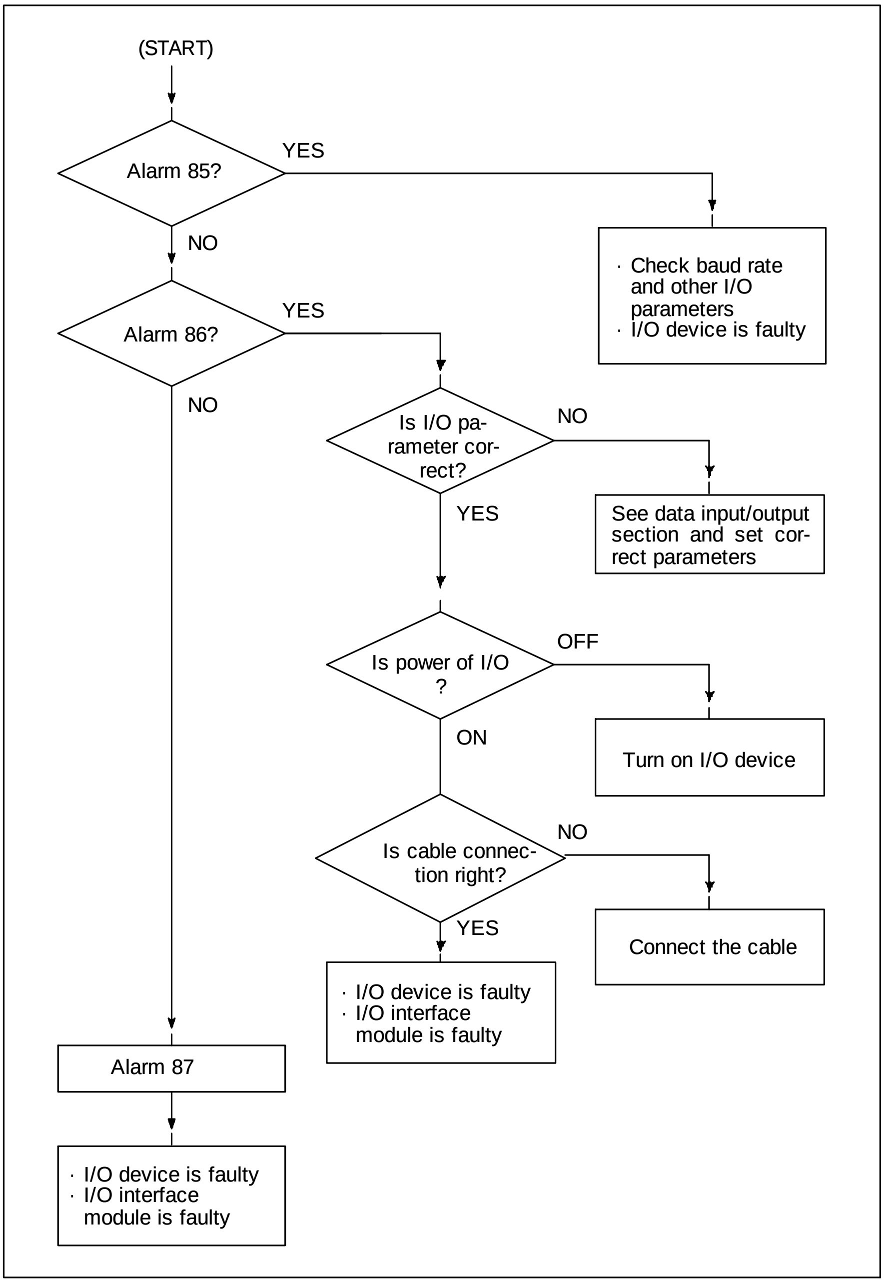
SBK : When this signal is 1, the single block signal is input.

6.8 NO DISPLAY APPEARS ON THE SCREEN WHEN THE POWER IS SWITCHED ON




(1)
(2)
(3)
(4)
The input unit or power supply unit AI is defective.
Normal?
YES
NO
Connect them correctly.
The power supply unit is defective.
Check whether an LED (L1 to L6) on the master printed-circuit board is lit.
On?
YES
NO
Check whether LED L4 is lit.
Press the ON button and keep the power switched on, measure the voltage across the +5V check pin and GND on the master printed-circuit board, axis card, memory card, and other cards (if any), then check whether the voltage is 4.75V to 5.25V.
On?
YES
NO
The memory card is not inserted correctly. Insert it correctly.
- CRT defective
- Memory card defective
- Master printed-circuit board defective
Normal?
YES
NO
- Master printed-circuit board defective
- Memory card defective
0V?
NO
Check whether the voltage across check terminals A10 and A0 on the power supply unit is 10.00 V.
YES
Check whether the ON and OFF cables are connected correctly.
10.00V?
YES
NO
Power supply unit defective
Connected correctly?
NO
YES
Connect them correctly.
Adjust variable resistor VR11 for 10.00 V. (See Section 2.7 for details.)
The input unit or power supply unit AI is defective.

6.9 ALARM 85 TO 87 (READER/PUNCHER INTERFACE ALARM)



Causes

(a) Parameters on reader/puncher interface are not correct. Check the following setting data and parameters.

(b) External I/O device or host computer is faulty.

(c) I/O board is faulty.

(d) Cable between NC and I/O device is faulty.

Countermeasures

(a) Parameters on reader/puncher interface are not correct. Check the following setting data and parameters:

Parameters related to data input/output

To use the FANUC floppy cassette, set the parameters as shown below:
Setting: I/O = 0 (*1)
Parameter: ISO = 1

PRM		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0002	1	*	*	*	*	0	*	1
PRM	0552	10 (4800BPS)							
PRM	0010	*	*	*	*	PRG9	*	*	*

PRG9 1 : Protects program numbers 9000 to 9999.
0 : Allows program numbers 9000 to 9999 to be edited.

PRM		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0038	*	*	*	*	FLKY	*	*	*

FLKY 1 : Specifies the use of a full keyboard.
0 : Specifies the use of a standard keyboard.

***1** A data I/O unit is selected depending on whether I/O = reader/punch interface.

Function	Related parameter number			
	I/O=0	I/O=1	I/O=2	I/O=3
Feed NFED	2.7	12.7	50.7	51.7
20 mA current loop ASR33	2.2	12.2	Unusable	
Stop bit STP2	2.0	12.0	50.0	51.0
I/O unit type setting	38.7 38.6	38.7 38.6	38.5 38.4	38.2 38.1
Connector number	M5 channel 1	M5 channel 1	M74 channel 2	M77 channel 3

When M77 is used, the RS–232–C or RS–422 can be selected according to bit 3 of parameter No. 55.

I/O is 0

PRM		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0002	NFED				RSASCI	ASR33		STP2

I/O is 1

PRM		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0012	NFED				RSASCI	ASR33		STP2

I/O is 2

PRM		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0050	NFED				RSASCI	ASR33		STP2

I/O is 3

PRM		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0051	NFED				RSASCI	ASR33		STP2

NFED 0 : Feed is output before and after data in data output (FANUC PPR)
1 : Feed is not output (standard).

RSASCI 0 : Data input code is EIA or ISO (automatic recognition)
1 : Data input code is ASCII.

ASR33 1 : Specifies the use of a 20 mA current interface.
(When I/O is 0 or 1) 0 : specifies the use of the FANUC PPR, FANUC cassette, or portable tape reader.

STP2 0 : No. of stop bits is 1.
1 : No. of stop bits is 2.

	#7	#6	#5	#4	#3	#2	#1	#0
PRM 0038	RSCMD1	DEVFL1	RSCMD2	DEVFL2		RSCMD3	DEVFL3	

#1(DEVFL3) :
#2(RSCMD3) : Setting I/O device for remote buffer (I/O = 3)
#4(DEVFL2) :
#5(RSCMD2) : Setting I/O device for reader/punch interface (I/O = 2)
#6(DEVFL1) :
#7(RSCMD1) : Setting I/O device for reader/puncher interface (I/O=0, 1)

(I/O=3)

RSCMD3	DEVFL3	Used I/O device
0	0	Bubble cassette
0	1	Floppy cassette
1	0	Unit such as paper tape reader
1	1	Unit such as paper tape reader

(I/O=0, 1, 2)

RSCMD*	DEVFL*	Used I/O device
0	0	Bubble cassette
0	1	Floppy cassette
1	0	RS-232-C, PPR
1	1	New interface

I/O is 2

PRM 0250	Baud rate

I/O is 3

PRM 0251	Baud rate

I/O is 0

PRM 0552	Baud rate

I/O is 1

PRM 0553	Baud rate

Value	Baud rate
7	600
8	1200
9	2400
10	4800
11	9600
12	19200

The following settings are also valid if bit 3 of parameter No. 55 is 1 (RS-422 interface is used).

Value	Baud rate
13	38400
14	76800
15	86400
16	153600
17	307200
18	335100
19	368400
20	409600
21	460800
22	526600
23	614400
24	737300
25	921600

If the value is set to 15 (86400 bps) or greater, use an external clock.

If the I/O setting parameter = 3, check the following parameter too.

PRM	0051	#7	#6	#5	#4	#3	#2	#1	#0
				CLK	NCD		SYN	PRY	

CLK 0 : The internal clock is used for the RS–422 interface baud rate.
1 : An external clock is used for the RS–422 interface baud rate.

NCD 0 : The CD (signal quality detection) of the RS–232C interface is checked.
1 : The CD (signal quality detection) of the RS–232C interface is not checked.

SYN 0 : For protocol B, an NC reset/alarm is not reported to the host.
1 : For protocol B, an NC reset/alarm is reported to the host using the SYN and NAK code.

PRY 0 : A parity bit is not used.
1 : A parity bit is used.

PRM	0055	#7	#6	#5	#4	#3	#2	#1	#0
		RMS				R42	PRA	ETX	ASC

RMS specifies, for protocol A, how to handle the "remote/tape operation state" of the SAT command during transmission.
0 : Keeps the state always at 0.
1 : Returns information about the "remote/tape operation changeover request" of the SET command from the host.

R42 0 : The RS–232C interface is used.
1 : The RS–422 interface is used.

PRA 0 : Communication protocol A is used.
1 : Communication protocol B is used.

ETX 0 : The end code for protocol A or extended protocol A is a CR character in the ASCII/ISO code system.
1 : The end code for protocol A or extended protocol A is an ETX character in the ASCII/ISO code system.

ASC 0 : All communication codes (except NC data) are of ISO code system.
1 : All communication codes (except NC data) are of ASCII code system.

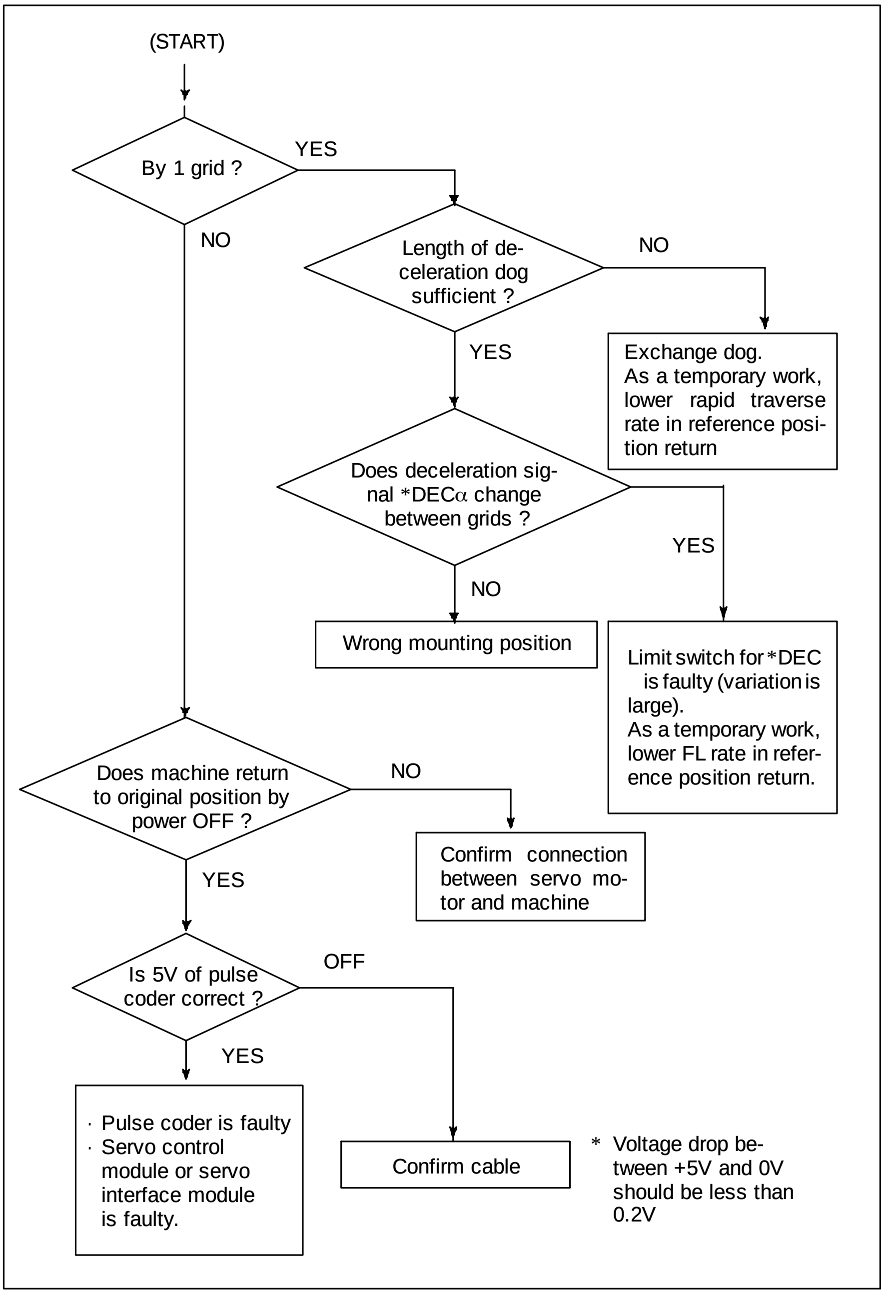
(b) External I/O device or Host computer is in trouble

1) Check whether the setting on communication of external I/O device or host computer is the same as that of the CNC. (baud rate, stop bits,etc.) If they are not the same, change the setting.

2) When spare I/O device presents, check whether it is possible to realize communication using the spare I/O device.

(c) Cable between NC and I/O device is faulty.
Check the cable for disconnection or wrong connection.

6.10 REFERENCE POSITION DEVIATES



6.11 ALARM 90 (REFERENCE POSITION RETURN IS ABNORMAL)

Contents

The CNC received one rotation signal at least one time when the axis is moving to the reference position at a speed higher than a speed equivalent to 128 pulses of position error amount(DGN800 to 807).

Countermeasures

(START)

Check whether position gain is greater than 128 pulses (DGN 800 to 807) before or during reference position return.

Position error amount : 800 to 803

128 or more — YES → (1) Next page

NO ↓

Raise the speed

Check feed rate command:

PRM	518 to 521	F :	Rapid traverse rate (mm/min)
PRM	559 to 562		Manual rapid traverse rate (mm/min)
PRM	517	G :	Servo loop gain (0.01sec-1)

$$\text{Position error} = \frac{F \quad 5000/3}{G \quad \text{detection unit}[\mu m/PLUSE]}$$

Detection unit : Move amount to a command pulse (usually 1μm)
In metric machine, if the no. of digits below decimal point is 4 on the position display screen, detection unit is 0.1 μm.

↓

Check rapid traverse override signals :

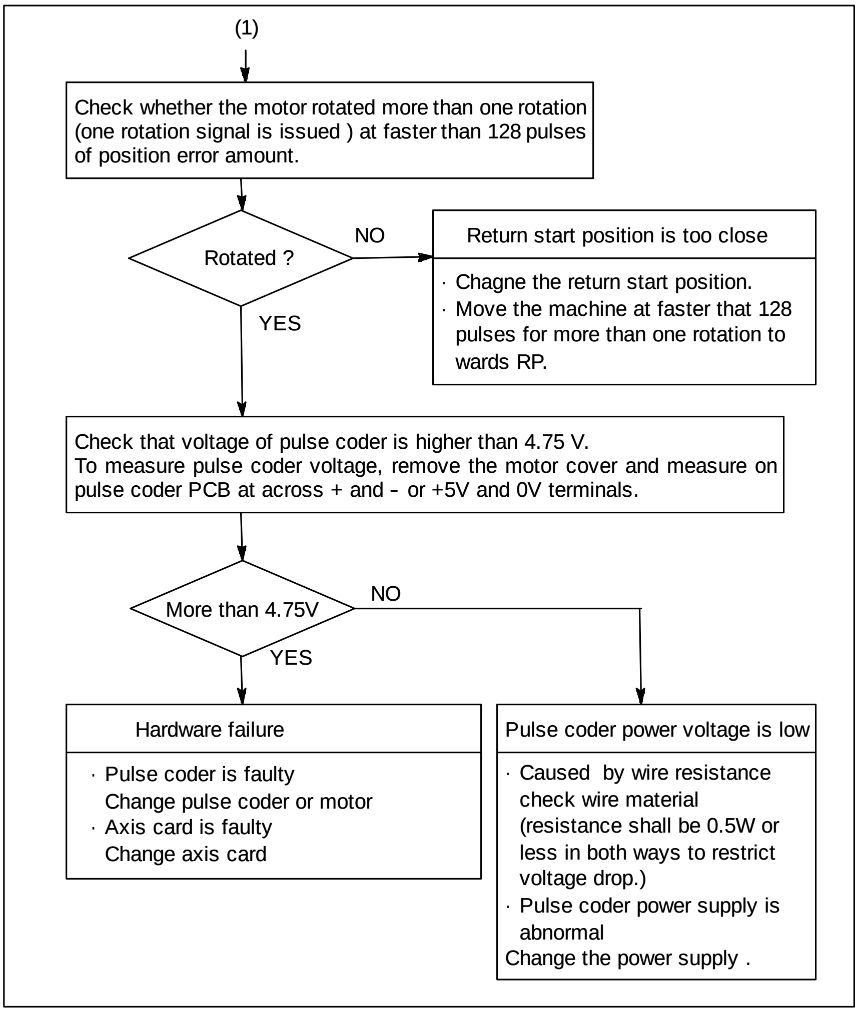
ROV1	DGN	116.7
DGN	1316.7 (for TT series)	
ROV2	DGN	117.7
DGN	1317.7 (for TT series)	
PRM	553	Fo rate

If PRM 003.4=0, the override values are as listed in the table on the right.
If PRM 003.4=1, the override values are the reverse of those listed in the table on the right.

ROV1	ROV2	Override
0	0	100%
0	1	50%
1	0	25%
1	1	Fo rate

↓

Check reference position return deceleration signal
(M series) * DECX DGN 016.5 * DECY DGN 017.5 * DECZ DGN 018.5
* DEC4 DGN 019.5
(T series) * DECX DGN 016.5 * DECZ DGN 017.5 * DEC3 DGN 019.7
* DEC4 DGN 019.5 (* DEC3, *DEC4 when PRM 0038#0 is 0)
* DEC3 DGN 016.7 * DEC4 DGN 017.7
(* DEC3, * DEC4 when PRM 0038#0 is 1)
When reference position return is started from deceleration signal 0, feed rate becomes FL rate.
PRM 534 FL rate
Deceleration signal PRM 0001#5 is valiable when “1”/“0”.



NOTE

After the pulse coder or motor is exchanged, reference position or machine's standard point may be different from former one. Please set it correctly.

D Reference

A speed more than 128 pulses is required because if speed is lower that this, one–rotation signal does not function stably, causing improper position detection.

α Pulse coder alarm on FANUC series 0–C

When α pulse coder is used as the detection of the absolute position, the reference point can be established after the motor turns more than one rotation with the battery connected.
Otherwise, the following alarms are displayed when the operation of reference point establishment is executed in FS0–C.

(1) In case of grid method reference point return operation

Operations

- Manual reference point return
- Dog less reference point return

Alarm

Type	No.	Contents
P/S alarm	090	The reference point return cannot be performed.

(2) In case of other reference point return operation

Operations

- Reference point return with mechanical stopper
- Parameter No. 022 ABS* is set to "1"

Alarm

Type	No.	Contents
SPC alarm	3*5	The reference point cannot be established.

* : Axis Number

NOTE
The alarm message of SPC alarm 3*5 is changed as follows.
Alarm Message

Before changing		After changing
"PULSE MISS"	→	"ZRN IMPOSSIBLE"

Available software	Software	Edition
FS0–MC	A02B–0099–H501#0469	14
FS0–TC	A02B–0098–H501#0669	09
FS0–TTC	A02B–0098–H501#0683	05 (For Main CPU)
	A02B–0098–H502#0684	05 (For Sub CPU of 16bit)
	A02B–0098–H503#0685	05 (For Sub CPU of 32bit)

6.12 ALARM 3n0 (REQUEST FOR REFERENCE POSITION RETURN)

Absolute position data in the serial pulse coder was lost.
(This alarm will be generated when serial pulse coder is exchanged or position feedback signal cable of the serial pulse coder is disconnected).

Remedies

Machine position must be memorized using the following method:

- **When reference position return function is present**

(1) Execute manual reference position return only for an axis for which this alarm was generated.When manual reference position return cannot be executed because of an another alarm, change parameter 0021 and release the alarm and perform manual operation.

(2) Press RESET key at the end of reference position return to release the alarm.

- **When reference position return function is not present**

Execute dogless reference position setting to memorize the reference position.

- **When serial pulse coder is changed**

Since the reference position is different from the former one, change the grid shift value (PRM No.508 to 511, 641, 642, 7508, 7509) to correct the position.

Related parameters

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0021			APC8	APC7	APC4	APCZ	APCY	APCX

#0(APCX)
#1(APCY)
#2(APCZ)
#3(APC4)
#4(APC7)
#5(APC8) Detector of absolute pulse coder per axis is :

0 : Used
1 : Not used

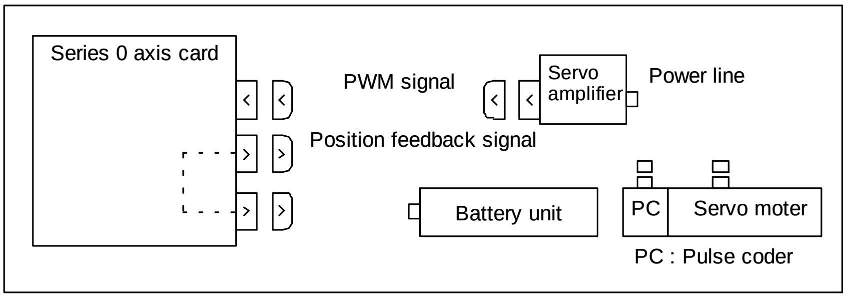
System configuration

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0022			ABS8	ABS7	ABS4	ABSZ	ABSY	ABSX

#0(ABSX)
#1(ABSY)
#2(ABSZ)
#3(ABS4)
#4(ABS7)
#5(ABS8) Reference position of absolute pulse coder per axis is :

0 : Established
1 : Not established

System configuration



6.13 ALARM 3n1 TO 3n6 (ABSOLUTE PULSE CODER IS FAULTY)

Absolute pulse coder, cable or servo module is faulty.

Countermeasures

1 Joggle the feedback cable leading from the servo motor to the axis card. Note whether an alarm occurs. If an alarm occurs, replace the cable.

2 Replace the axis cable.

6.14 ALARM 3n7 TO 3n8 (ABSOLUTE PULSE CODER BATTERY IS LOW)

This alarm is generated when absolute pulse coder battery becomes low.

Procedure

Replace the batteries in the battery box connected to the connector of axis cards (CPA9 for the 1st– to 4th–axis cards, CPA10 for the 5th–/6th–axis card, and CPA11 for the 7th/8th–axis card).

When a type–B axis board is being used with a built–in absolute pulse coder and an α or β series amplifier, the battery is installed in the servo amplifier. In such a case, replace the battery as described in the appropriate manual supplied with the servo amplifier.

NOTE
1 When replacing the batteries for the series servo amplifier module, keep the power to the servo amplifier switched on.
2 Note that we are not supposed to replace the batteries for the control unit (for memory backup).

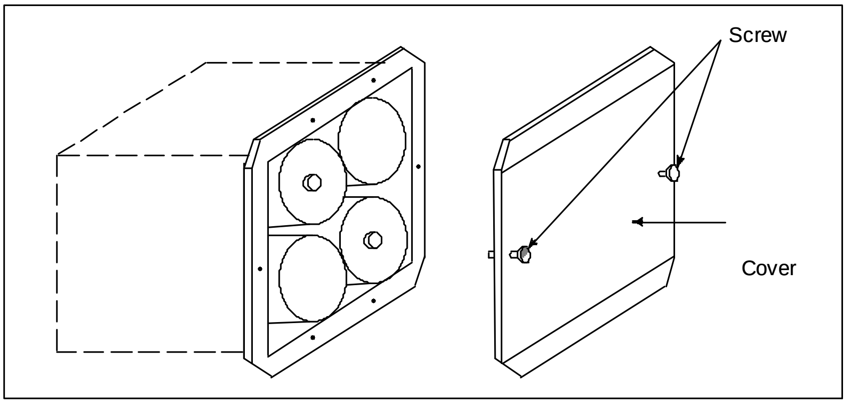
Procedure for replacing batteries for absolute pulse coder (separate type pulse coder)

1 Prepare 4 alkaline batteries (UM–1type) commercially available in advance.

2 Turn machine (CNC) power ON. (When replacing the batteries, keep the power to the NC switched on. If the batteries are replaced with the power switched off, all data relating to the absolute position will be lost.)

3 Loosen screws on the battery case to remove the cover. For placement of the battery case, refer to the machine tool builder's manual.

4 Replace the batteries in the case. Insert 2 batteries each in the opposite direction as illustrated below.



5 After replacement, install the cover.

6 Turn machine (CNC) power OFF

6.15 ALARM 3n9 (SERIAL PULSE CODER IS ABNORMAL)

An error is generated in the control section of the serial pulse coder.

Points

Check the details by the diagnostic function 760 to 767.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0760		CSA		PHA	RCA		CKA	SPH
	:				:				
DGN	0767		CSA		PHA	RCA		CKA	SPH

#6(CSA) Check sum alarm has generated.
#4(PHA) Phase data abnormal alarm has generated.
#3(RCA) Speed count abnormal alarm has generated.
#1(CKA) Clock alarm has generated.
#0(SPH) Soft phase data abnormal alarm has generated.

1 Check the contens using the above diagnostic function if the alarm generates repeatedly. If diagnostic data is the same, serial pulse coder may be faulty.⇒Refer to **NOTE**
2 When diagnostic result does not the same, or other abnormality is detected, an external noise may be generated.

> **NOTE**
> Reference position and machine's standard position are different from the ones before, adjust and set them correctly.

Check the details by the diagnostic function of the CNC.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0770	DTE	CRC	STB					
	:				:				
DGN	0777	DTE	CRC	STB					

#7(DTE) Data error has generated.
#6(CRC) Serial communication error has generated.
#5(STB) Stop bit error has generated.

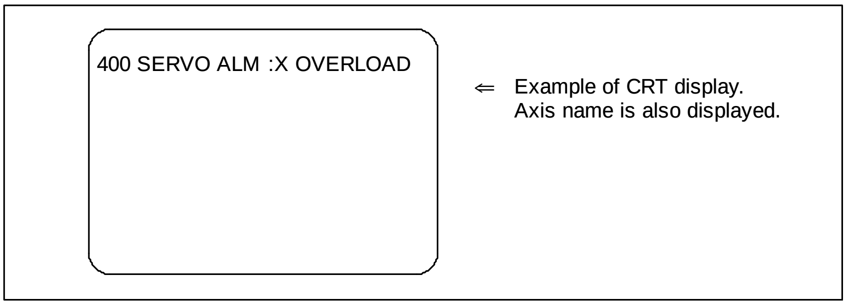
Causes

1) #7(DTE):Response from serial pulse coder is absent.
   1 Signal cable is disconnected
   2 Serial pulse coder is faulty. ⇒ See **NOTE**
   3 +5V to the serial pulse coder is lowered.
2) #6(CRC),#5(STB):Serial communication is in faulty
   1 Signal cable is disconnected.
   2 Serial pulse coder is faulty ⇒ See **NOTE**
   3 Axis card is faulty

> **NOTE**
> After the serial pulse coder is changed, reference position or machine's standard point is different from the one before replacement. Therefore reset and adjust it again.

6.16 ALARM 400, 402, 406, 490 (OVERLOAD)

Amplifier or overheat of motor is detected.



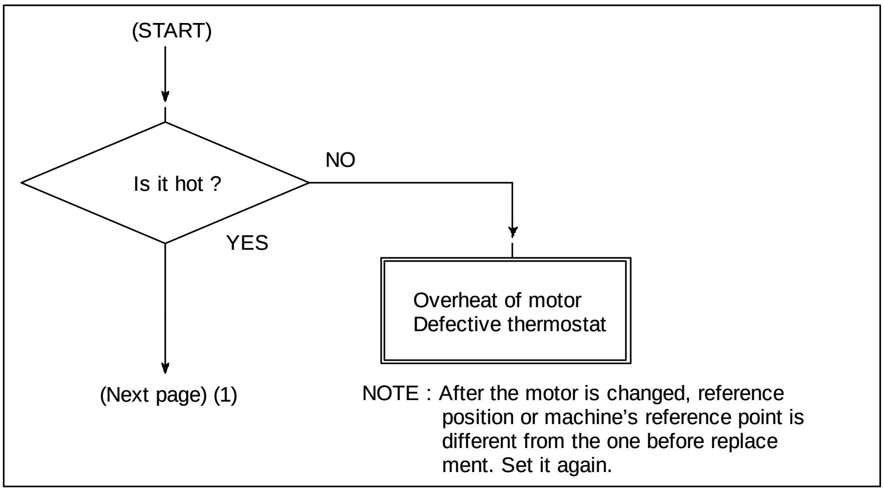
Points

Confirm the detail by the diagnostic function of CNC.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0720	OVL							
	:					:			
DGN	0727	OVL							

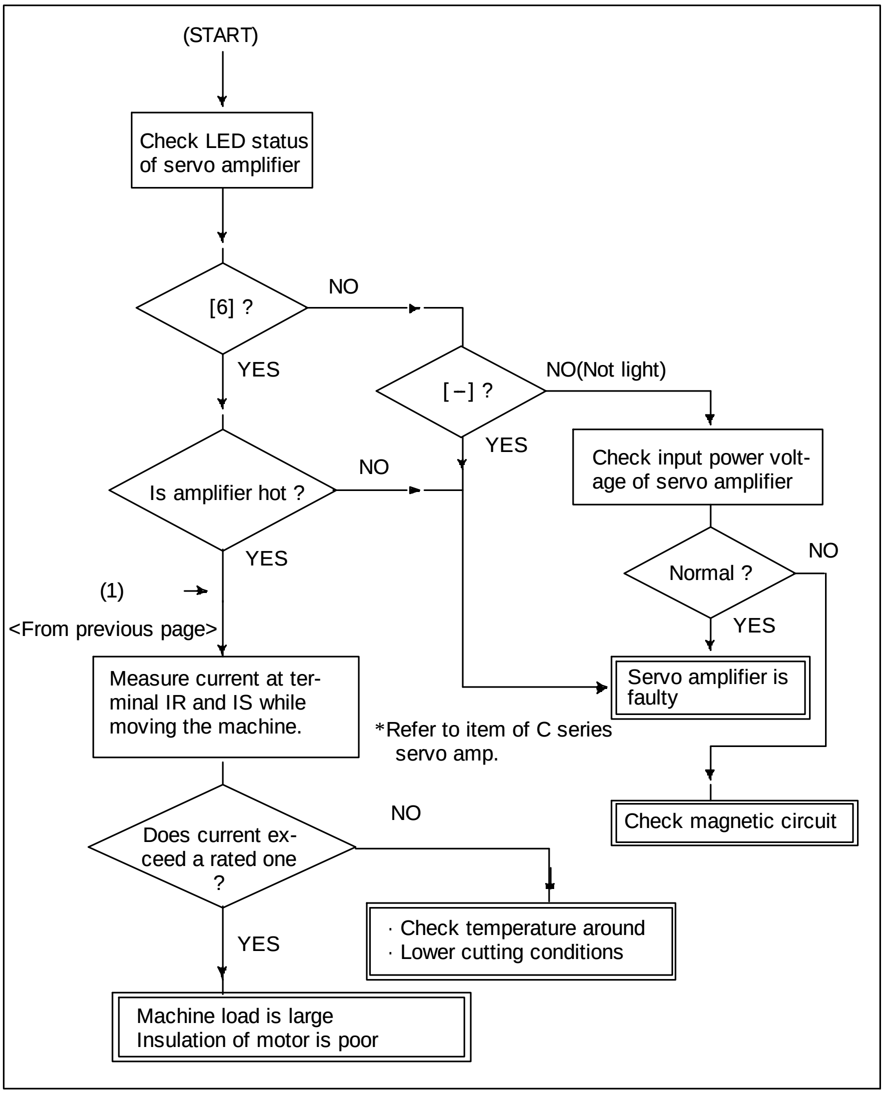
#7(OVL): 1 OVERLOAD ALARM is displayed.

Overheat of servo motor

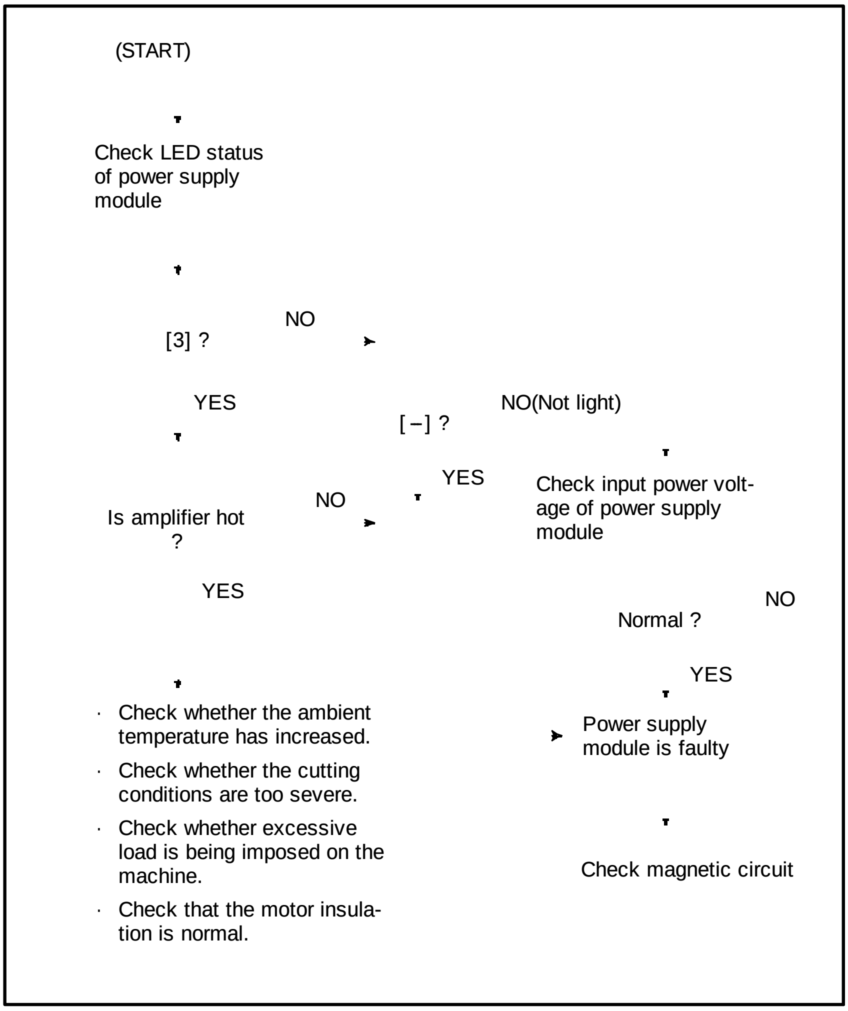


D Overheat of servo amplifier

LED 6 of servo amplifier is lit



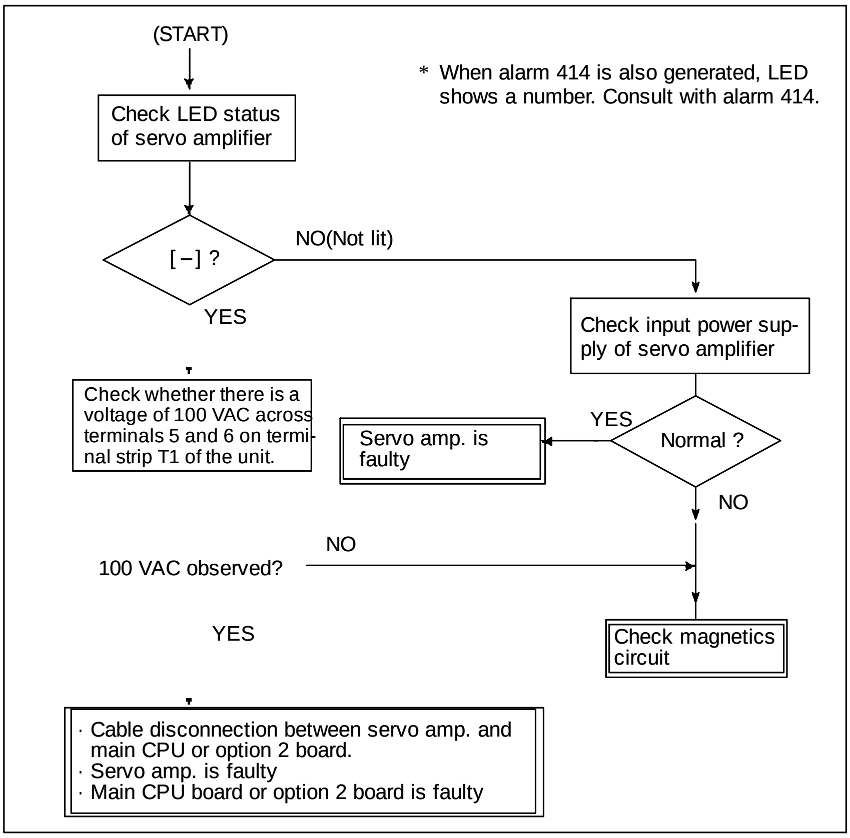
D Overheat of α series power supply module



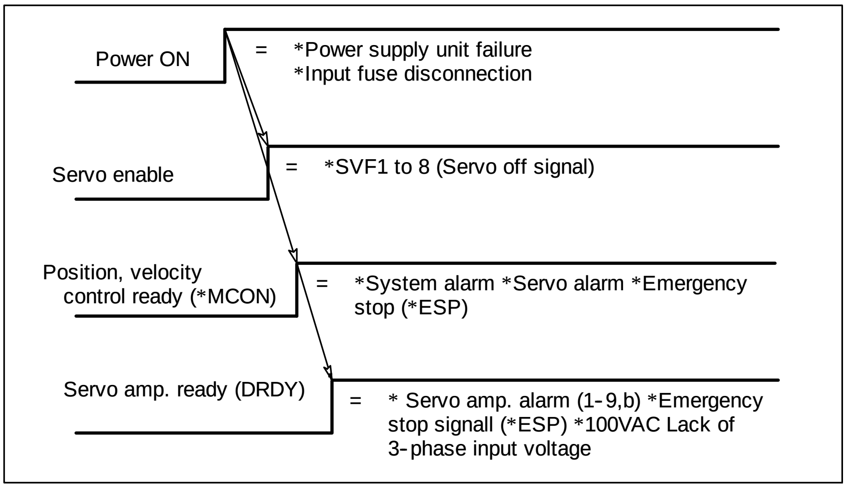
6.17 ALARM 401, 403 406, 491 (*DRDY SIGNAL TURNED OFF)

D C series servo amplifier

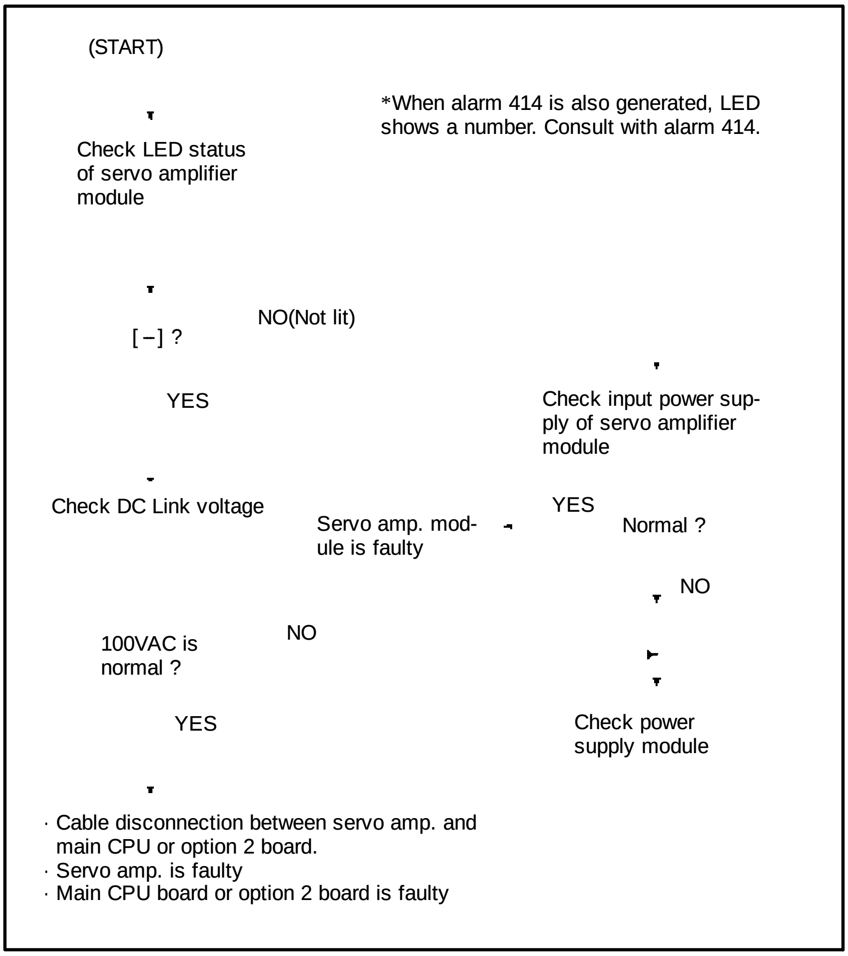
Alarm 401, 403, 406 or 491 of servo amplifier is not turned on or turned off during operation.



Power on sequence (NC→Servo amplifier)



D α series servo amplifier



6.18 ALARM 404 AND 405 (*DRDY SIGNAL TURNED ON)

D Alarm 404

DRDY signal is turned on before MCON signal is turned on. Or DRDY is not turned off after MCON signal is turned off.

[Causes]

1 Servo amplifier is faulty.

2 Between servo amplifier and axis card is faulty.

3 Axis card is faulty.

D Alarm 405 (Reference positin return is abnormal)

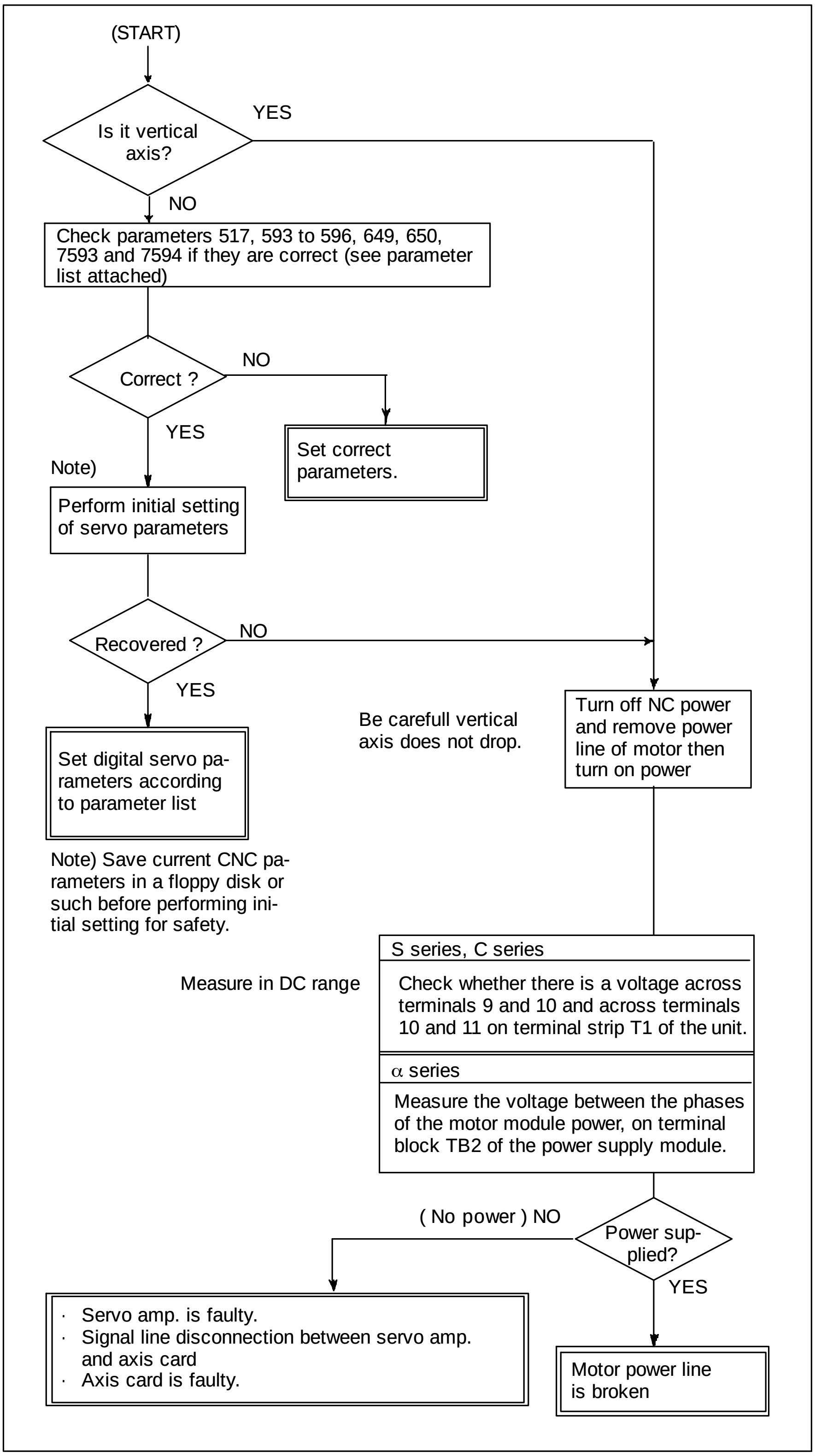
The grid signal is not turned on when the automatic reference position return by G28 is completed.

[Causes]

Axis card is faulty.

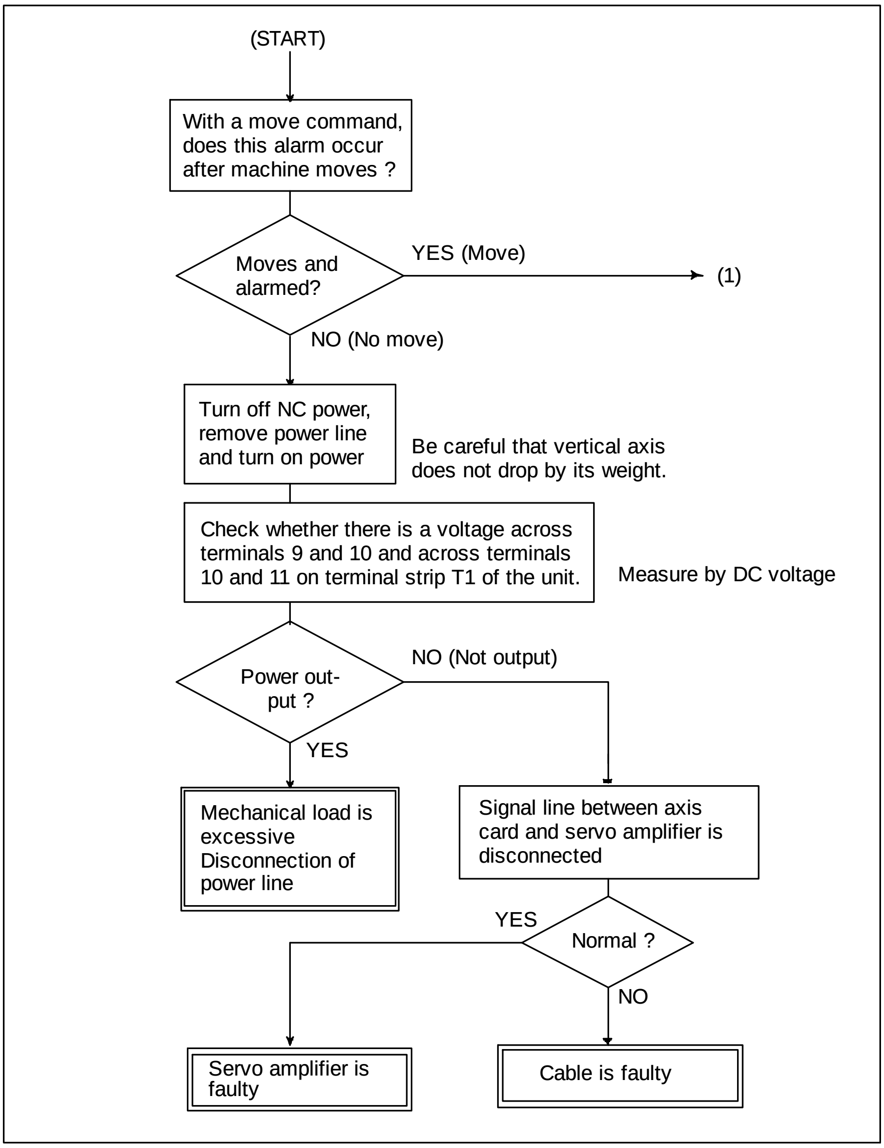
6.19 ALARM 4n0 (EXCESSIVE POSITION ERROR AMOUNT DURING STOP)

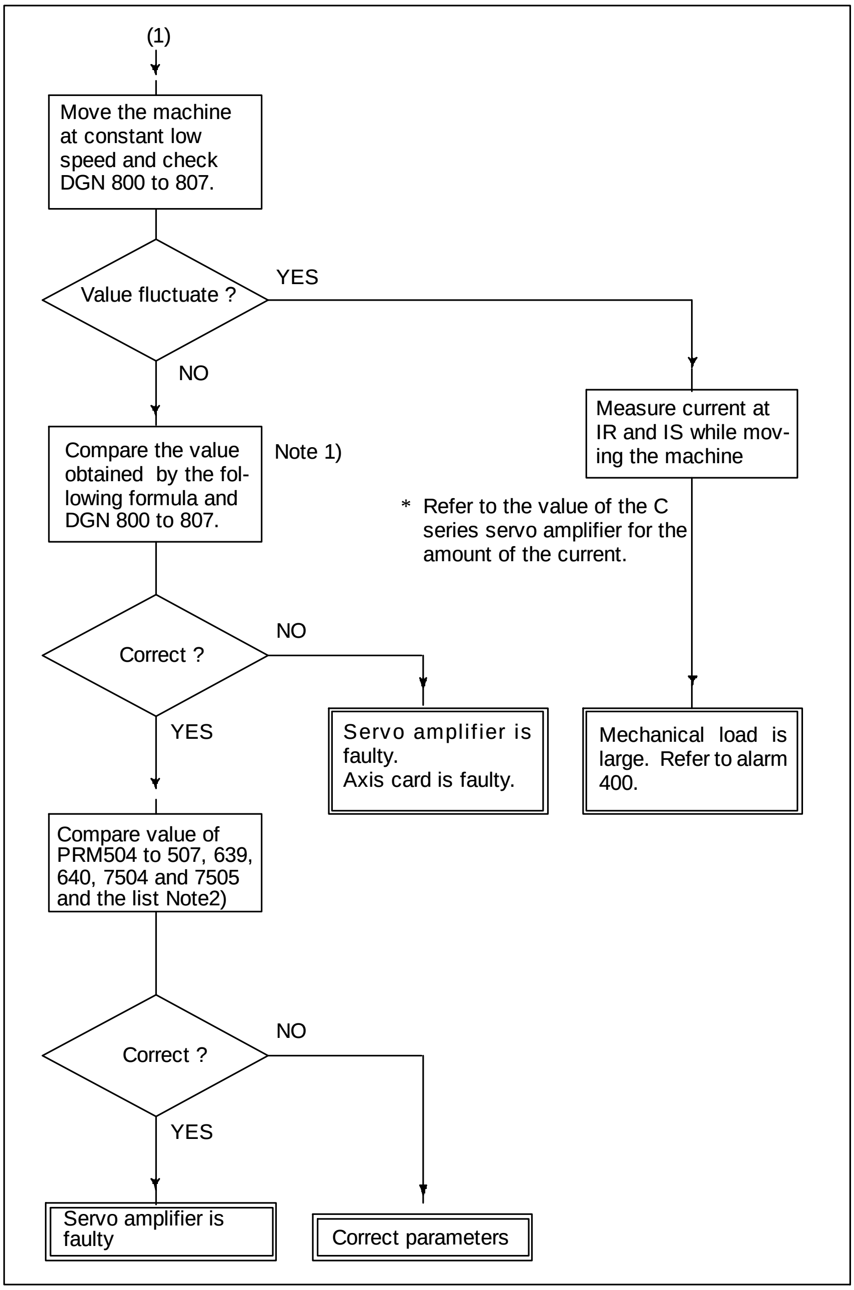
osition error amount at stop (DGN 800 to 807) exceeds a value set by parameter No.593 to 596, 649, 650, 7593, 7594.



6.20 ALARM 4n1 (EXCESSIVE POSITION ERROR DURING MOVE)

Position error amount during movement (DGN 800 to 807) execeeds a value set by parameter 504 to 507, 639, 640, 7504, 7505.





NOTE

1 Position error= $\dfrac{\text{Feed rate (mm□min)}}{60 \quad \text{PRM517}}$ $\dfrac{100}{\text{Detection unit}}$

2 Parameter 504 to 507, 639, 640, 7504, 7505 □ Position error at rapid traverse 1.2

6.21 ALARM 4n4 (DIGITAL SERVO SYSTEM IS ABNORMAL)

```
414 SERVO ALARM:X-AXIS
                DETECTION
                SYSTEM ERROR
```

EXAMPLE OF DISPLAY
AXIS NAME DETECTED
IS DISPLAYED

Points

Check details by CNC's diagnostic fucntion and LED display on the servo amplifier.

(1)

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0720		LV	OVC	HCA	HVA	DCA	FBA	OFA
	:				:				
DGN	0727		LV	OVC	HCA	HVA	DCA	FBA	OFA

(2) LED display on the servo amplifier

STATUS

* An alarm detected on the servo amplifier is also displayed at DGN 200.

When 1 is displayed at DGN 200.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0200		LV	OVC	HCA	HVA	DCA	FBA	OFA

#6(LV): Low voltage alarm → LED [2] or [3] lights

#5(OVC): Over current alarm

#4(HCA): Abnormal current alarm → LED [8] lights

#3(HVA): Over current alarm → LED [1] lights

#2(DCA): Discharge alarm → LED [4] or [5] lights

#1(FBA): Disconnection alarm

#0(OFA): Overflow alarm

6.22 ALARM 4n6 (DISCONNECTION ALARM)

4n6 : Position detection signal line is disconnected or short–circuited.

Point

Check the details using the CNC’s diagnostic fucntion.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0730	ALD			EXP				
	:				:				
DGN	0737	ALD			EXP				

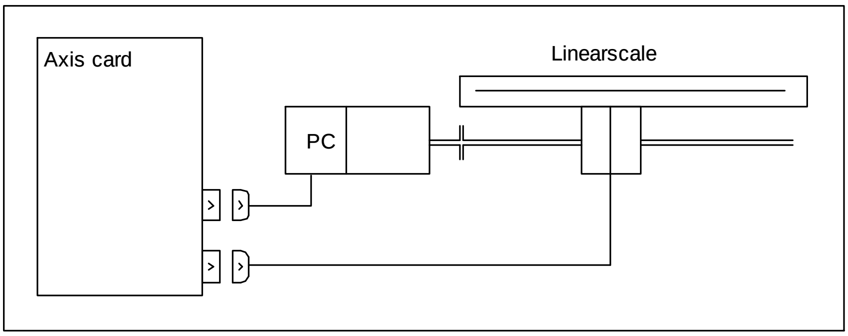
ALD			EXP	
1	-	-	0	Built-in serial pulse coder disconnection
1	-	-	1	Separate type position detector connection (Note)
0	-	-	0	Pulse coder disconnection (software)

NOTE
This alarm is related with full–closed system.

Causes

(1) Signal cable is disconnected or short–circuitted.
(2) Serial pulse coder or position detector is faulty.Refer to **NOTE.**
(3) Axis card is faulty.
(4) When no separate pulse coder is in use, separate pulse coder parameters have been specified by mistake.
Bits 0 to 5 of PRM0037
Bits 0 and 1 of PRM7037
(If these bits are 1, a separate pulse coder is to be used.)

NOTE
After the pulse coder is replaced, reference position or machine’s standard position is different from former one.
Adjust and set it correctly.



6.23 ALARM 4n7 (DIGITAL SERVO SYSTEM IS ABNORMAL)

Digital servo parameters are abnormal.
(Digital servo parameters are set incorrectly.)

D Causes

(1) Confirm the setting value of the following parameters:

PRM 8n20 : Motor format number
PRM 8n22 : Motor rotation direction
PRM 8n23 : Number of pulses of velocity feedbacks
PRM 8n24 : Number of pulses of position feedback
PRM 0269 to 0274 : Servo axis number
PRM 8n84 : Flexible feed gear ratio
PRM 8n85 : Flexible feed gear ratio
Confirm the details with diagnosis function of CNC side.

(2) Change the setting of this parameter to 0.

PRM 8047 : Observer parameter

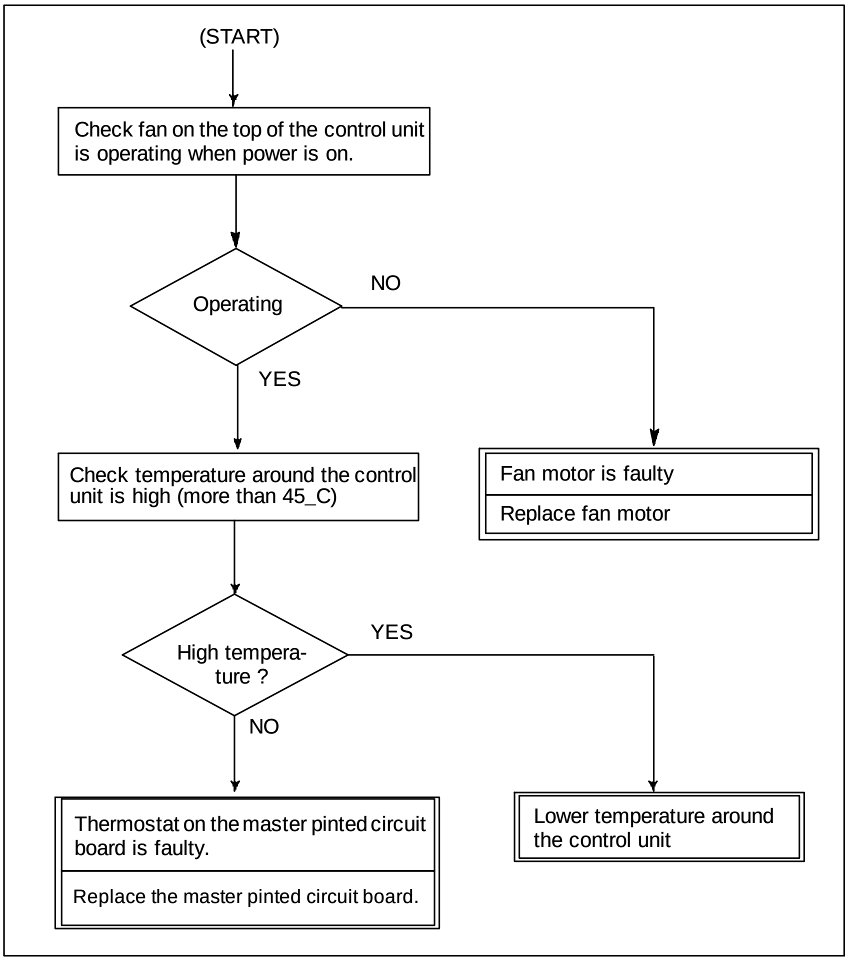
(3) Perform initial setting of digital servo parameters.

Refer to Sec. 5.1 “Initial Setting of Servo Parameters” .

6.24 ALARM 700 (OVERHEAT AT CONTROL SIDE)

Because an ambient temperature of the control unit becomes high, a thermostat mounted on the back panel of NC functions and informs an alarm.

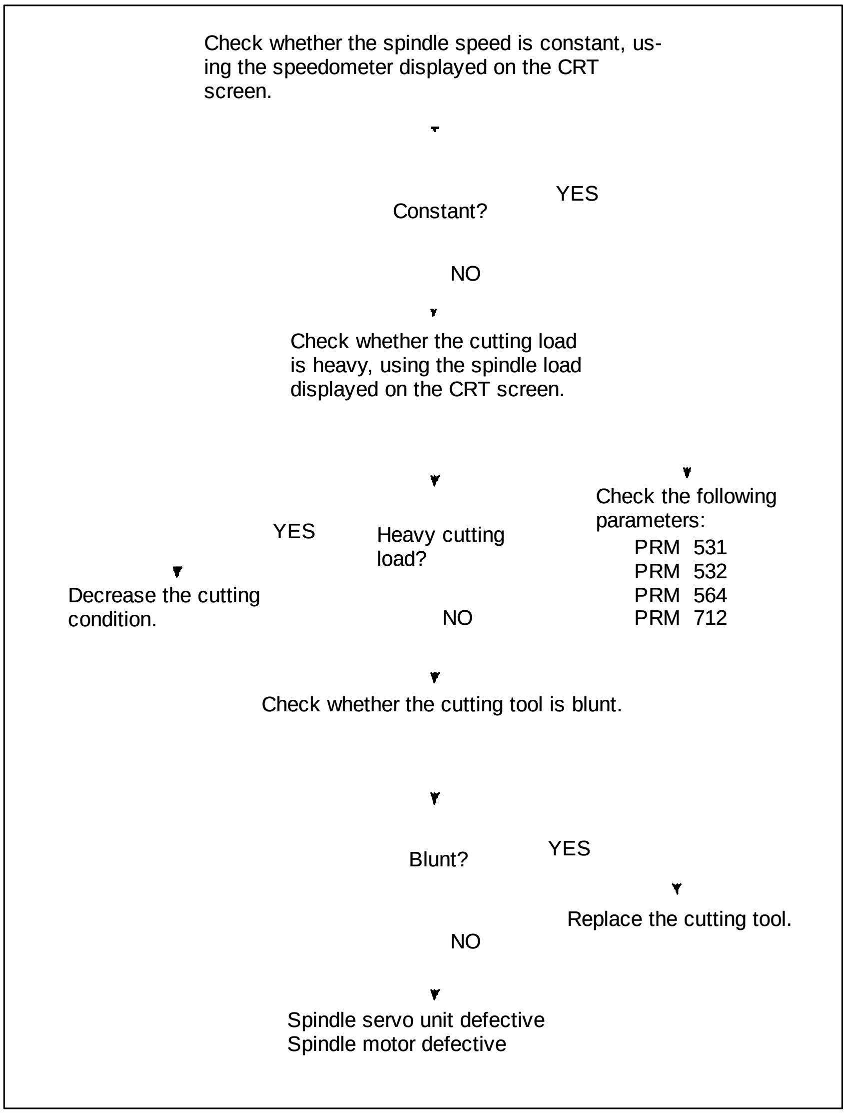
Remedies



6.25 ALARM 704 (SPINDLE SPEED FLUCTUATION DETECTION ALARM)

This alarm indicates that the spindle speed has changed abnormally due to the load.

Corrective action



Reference

PRM 531: Spindle speed ratio at which the spindle is assumed to have reached the specified spindle speed

PRM 532: Spindle fluctuation ratio at which no spindle speed fluctuation detection alarm is not detected

PRM 564: Spindle fluctuation speed at which no spindle speed fluctuation detection alarm is not detected

PRM 712: Time since the specified spindle speed changed until spindle speed fluctuation detection begins

6.26 ALARM 408 (THE SPINDLE SERIAL LINK DOES NOT START NORMALLY.)

408 : Indicates that, in a system using serial spindles, the spindle amplifier does not start normally when power is applied.

Point

This alarm will not occur once the system (including the spindle control unit) has started. It can occur before the system starts during power turn–on processing. Once the system has started, an error is indicated as system alarm 945.

Causes

(1) The fiber optics cable is poorly connected, or the power to the spindle amplifier is turned off.

(2) An attempt was made to switch the NC power on when the spindle amplifier display was SU–01 or any alarm condition other than AL–24.
This condition occurs mainly if the NC power is switched off when the serial spindles are running. In this case, switch the power to the spindle amplifier off then back on.

(3) The hardware combination is invalid.

(4) The second spindle is under any of conditions (1) to (3).
If the second spindle is in use, bit 4 of parameter No. 71 is 1.

6.27 ALARM 409 (SPINDLE ALARM)

This alarm indicates, to the CNC, that in a system with serial spindles, an alarm has occurred in the spindle unit.

The alarm is described using the AL–XX (where XX is a number) format indicated on the spindle amplifier display.

Setting bit 7 of parameter No. 0397 to 1 enables the display of the alarm number from the spindle on the alarm screen.

Point

This alarm is intended to indicate a failure in the spindle control unit. It is detailed below. The spindle should be repaired according to the procedure described for each alarm.

Cause and corrective action

See Maintenance Manual (B–65045E) of AC spindle servo unit (serial interface) for alarm list.

6.28 ALARM 998 (ROM PARITY ERROR)

A ROM parity error has occurred.

Cause and corrective action

The ROM, or the printed-circuit board on which the ROM is mounted, is defective.

```
SYSTEM ALARM                          0666-02
998 ROM PARITY :ROM No.

               0E2
```

The name of the ROM in which the parity error was detected is displayed.

Also, check the control software series and edition displayed at the right corner of the screen.

6.29 ALARMS 910 TO 916 (RAM PARITY ERRORS)

These alarms indicate RAM parity errors.

Point of detection

RAM is provided with a check bit (parity bit). When data is written to RAM, the check bit is also written to the RAM by either setting it to 1 or resetting it to 0 so that the total number of 1 bits in the data, including the check bit, is even or odd. When the data is read from RAM, the check bit is used to ensure that the read data is correct.

#7	#6	#5	#4	#3	#2	#1	#0	#P
1	0	1	1	0	1	1	1	0

(Parity bit)
(This example applies to even parity.)

Cause and corrective action

(1) If any of these alarms occurs immediately after the power is switched on, switch the power off then back on while holding down the RESET and DELET keys so that the RAM is cleared to all 0s.

If a parity alarm still occurs after the RAM has been cleared to all 0s, it is likely that the printed–circuit board on which the RAM in which the alarm has occurred is defective. So, replace the printed–circuit board.
* Re–set all data according to Chapter 3 "Data input/output."

Number	Message	Contents
910	RAM PARITY	RAM parity error (low byte) in the tape memory RAM module. Replace the memory printed board.
911	RAM PARITY	RAM parity error (high byte) in the tape memory RAM module. Replace memory printed board.
912	SHARED RAM PARITY	There is a parity error of the RAM that is shared with the digital servo (low byte). Replace the axis control printed board.
913	SHARED RAM PARITY	There is a parity error of the RAM that is shared with the digital servo (high byte). Replace the axis control printed board.
914	SERVO RAM PARITY	There is parity error of the digital servo local RAM. Replace the axis control printed board.
915	LADDER PROGRAM EDITING CASSETTE RAM PARITY	RAM parity error (low-order bytes) of the ladder program editing cassette. Replace the ladder program editing cassette.
916	LADDER PROGRAM EDITING CASSETTE RAM PARITY	RAM parity error (high-order bytes) of the ladder program editing cassette. Replace the ladder program editing cassette.

(2) Memory backup battery voltage drop

The rated voltage of the memory backup battery is 3.0 V. If it drops to or below 2.6 V, a battery alarm occurs.
If the memory backup battery voltage drops, the message "BAT" blinks on the screen.
If a battery alarm occurs, replace the batteries with new lithium batteries as soon as possible.

* See Section 2.6 for an explanation of how to replace the batteries.

(3) Defective power supply unit

If an alarm is eliminated by clearing the memory to all 0s, a probable cause is a defective power supply unit.

6.30 ALARM 920 TO 922 (WATCH DOG OR RAM PARITY)

920 : Watch dog alarm or servo system alarm of 1st to 4th axis.
921 : Sub–CPU watchdog alarm or 5th/6th servo system alarm
922 : 7th/8th servo system alarm

Points

• Watch dog timer alarm

The timer used to monitor the operation of CPU is called the watch dog timer. The CPU resets timer time every time a constant time has passed. When an error occurs in CPU or peripheral device, timer is not reset but the alarm is informed.

Causes and Remedies

• Axis P.C.B is faulty

The servo module includes servo RAM, watch dog timer circuit, etc. Defectiveness of hardware, abnormality or malfunctioning of detection circuit or the like is considered.

• Master P.C.B is faulty

CPU or peripheral circuits may be faulty. Replace the master P.C.B.

• Memory P.C.B is faulty

Software may not work properly due to failure of memory PCB. Change the memory PCB.

• Power supply unit is faulty

DC output voltage of power supply unit may be faulty. Replace the power supply unit.

6.31 ALARM 941 (INCORRECTLY INSTALLED MEMORY PRINTED–CIRCUIT BOARD)

This alarm indicates the poor connection of a memory printed–circuit board. Check that all connections are secure.

> **NOTE**
> This alarm will not occur during ordinary operation. It is most likely to occur when a printed–circuit board is pulled out and inserted again, or replaced, for maintenance purposes, for example.

Cause and corrective action

Ensure that all printed–circuit boards are installed securely.

If this alarm occurs even when the memory printed–circuit boards are installed securely, replace the master and memory printed–circuit boards.

6.32 ALARM 930 (CPU ERROR)

CPU error (abnormal interrupt) has generated.

Causes and Remedies

Main CPU board is faulty

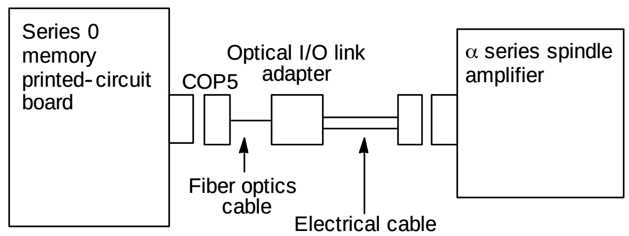
An interrupt which will not occur during usual operation has generated. Peripheral circuit of the CPU may be abnormal. Change the main CPU board. If operation is performed normally by power off and on, noise may be a cause. Refer to Subsec. 2.3.13 Action Against Noise.

6.33 ALARMS 945 AND 946 (SERIAL SPINDLE COMMUNICATION ERRORS)

945 : A communication error occurred in the first serial spindle.
946 : A communication error occurred in the second serial spindle.

Cause and corrective action

A poor connection between a memory printed–circuit board and the serial spindle amplifier may occur at the points shown below.



Note) The optical I/O link adapter and electrical cable are required only when the α series spindle amplifier is used.

- The memory printed–circuit board is defective.
- The cable between the memory printed–circuit board and optical I/O link adapter has a broken wire or is unhooked.
- The optical I/O link adapter is defective.
- The fiber optics cable has a broken wire or is unhooked.
- The serial spindle amplifier is defective.

6.34 ALARM 960 (SUB–CPU ERROR)

960 : A sub–CPU error (illegal interrupt) occurred.

Cause and corrective action

(1) Sub–CPU printed–circuit board defective

An interrupt that would not occur under a usual condition occurred. It is likely that a CPU peripheral circuit malfunctioned.
Replace the sub–CPU printed–circuit board. If a normal operation can be resumed by turning the power off and on again, the malfunction may have occurred due to noise. See Subsec. 2.3.13 for how to eliminate the effect of noise.

6.35 ALARM 950 (BLOWN FUSE)

950 : The +24E fuse has blown.

Cause and corrective action

An overcurrent has flowed through the +24E line, which is a 24V line used for the I/O printed–circuit board and machine power magnetics circuit.

There may be a short circuit between the 24V line and 0V in the machine or I/O cable. After removing the cause, replace fuse in the power supply unit.

A ALARM LIST

A.1 LIST OF ALARM CODES (CNC)

(1) Program errors (P/S alarm) for T series

[T series]

Number	Meaning	Contents
000	PLEASE TURN OFF POWER	A parameter which requires the power off was input, turn off power.
001	TH PARITY ALARM	TH alarm (A character with incorrect parity was input). Correct the tape.
002	TV PARITY ALARM	TV alarm (The number of characters in a block is odd). This alarm will be generated only when the TV check is effective.
003	TOO MANY DIGITS	Data exceeding the maximum allowable number of digits was input. (Refer to the item of max. programmable dimensions in Operator's Manual.)
004	ADDRESS NOT FOUND	A numeral or the sign " - " was input without an address at the beginning of a block. Modify the program .
005	NO DATA AFTER ADDRESS	The address was not followed by the appropriate data but was followed by another address or EOB code. Modify the program.
006	ILLEGAL USE OF NEGATIVE SIGN	Sign " - " input error (Sign " - " was input after an address with which it cannot be used. Or two or more " - " signs were input.) Modify the program.
007	ILLEGAL USE OF DECIMAL POINT	Decimal point " . " input error (A decimal point was input after an address with which it can not be used. Or two decimal points were input.) Modify the program.
008	PROGRAM HAS AN ERROR AT THE END	The program does not end with M02/M30/M99 and the execution of EOR (%) was attempted instead. Correct the program.
009	ILLEGAL ADDRESS INPUT	Unusable character was input in significant area. Modify the program.
010	IMPROPER G-CODE	An unusable G code or G code corresponding to the function not provided is specified. Modify the program.
011	NO FEEDRATE COMMANDED	Feedrate was not commanded to a cutting feed or the feedrate was inadequate. Modify the program.
014	ILLEGAL LEAD COMMAND	In variable lead threading, the lead incremental and decremental outputted by address K exceed the maximum command value or a command such that the lead becomes a negative value is given. Modify the program.
015	TOO MANY AXES COMMANDED	An attempt was made to move the machine along the axes, but the number of the axes exceeded the specified number of axes controlled simultaneously. Alternatively, in a block where where the skip function activated by the torque-limit reached signal (G31 P99/P98) was specified, either moving the machine along an axis was not specified, or moving the machine along multiple axes was specified. Specify movement only along one axis.
020	OVER TOLERANCE OF RADIUS	In circular interpolation (G02 or G03), difference of the distance between the start point and the center of an arc and that between the end point and the center of the arc exceeded the value specified in parameter No. 0876.
021	ILLEGAL PLANE AXIS COMMANDED	An axis not included in the selected plane (by using G17, G18, G19) was commanded in circular interpolation. Modify the program.

[T series]

Number	Meaning	Contents
023	ILLEGAL RADIUS COMMAND	In circular interpolation by radius designation, negative value was commanded for address R. Modify the program.
028	ILLEGAL PLANE SELECT	In the plane selection command, two or more axes in the same direction are commanded. Modify the program.
029	ILLEGAL OFFSET VALUE	The offset values specified by T code is too large. Modify the program.
030	ILLEGAL OFFSET NUMBER	The offset number in T function specified for tool offset is tool large. Modify the program.
031	ILLEGAL P COMMAND IN G10	In setting an offset amount by G10, the offset number following address P was excessive or it was not specified. Modify the program.
032	ILLEGAL OFFSET VALUE IN G10	In setting an offset amount by G10 or in writing an offset amount by system variables, the offset amount was excessive.
033	NO SOLUTION AT CRC	A point of intersection cannot be determined for tool nose radius compensation. Modify the program.
034	NO CIRC ALLOWED IN ST-UP / EXT BLK	The start up or cancel was going to be performed in the G02 or G03 mode in tool nose radius compensation. Modify the program.
035	CAN NOT COMMANDED G31	Skip cutting (G31) was specified in tool nose radius compensation mode. Modify the program.
037	CAN NOT CHANGE PLANE IN NRC	The offset plane is switched in tool nose radius compensation. Modify the program.
038	INTERFERENCE IN CIRCULAR BLOCK	Overcutting will occur in tool nose radius compensation because the arc start point or end point coincides with the arc center. Modify the program.
039	CHF/CNR NOT ALLOWED IN NRC	Chamfering or corner R was specified with a start-up, a cancel, or switching between G41 and G42 in tool nose radius compensation. The program may cause overcutting to occur in chamfering or corner R. Modify the program.
040	INTERFERENCE IN G90/G94 BLOCK	Overcutting will occur in tool nose radius compensation in canned cycle G90 or G94. Modify the program.
041	INTERFERENCE IN NRC	Overcutting will occur in tool nose radius compensation. Modify the program.
046	ILLEGAL REFERENCE RETURN COMMAND	Other than P2, P3 and P4 are commanded for 2nd, 3rd and 4th reference position return command.
050	CHF/CNR NOT ALLOWED IN THRD BLK	Chamfering or corner R is commanded in the thread cutting block. Modify the program.
051	MISSING MOVE AFTER CHF/CNR	Improper movement or the move distance was specified in the block next to the chamfering or corner R block. Modify the program.
052	CODE IS NOT G01 AFTER CHF/CNR	The block next to the chamfering or corner R block is not vertical line. Modify the program.
053	TOO MANY ADDRESS COMMANDS	In the chamfering and corner R commands, two or more of I, K and R are specified. Otherwise, the character after a comma(",") is not C or R in direct drawing dimensions programming. Modify the program.
054	NO TAPER ALLOWED AFTER CHF/CNR	A block in which chamfering in the specified angle or the corner R was specified includes a taper command. Modify the program.

[T series]

Number	Meaning	Contents
055	MISSING MOVE VALUE IN CHF/ CNR	In chamfering or corner R block, the move distance is less than chamfer or corner R amount.
056	NO END POINT & ANGLE IN CHF/ CNR	Neither the end point nor angle is specified in the command for the block next to that for which only the angle is specified (A). In the chamfering comman, I(K) is commanded for the X(Z) axis.
057	NO SOLUTION OF BLOCK END	Block end point is not calculated correctly in direct dimension drawing programming.
058	END POINT NOT FOUND	Block end point is not found in direct dimension drawing programming.
059	PROGRAM NUMBER NOT FOUND	In an external program number search, a specified program number was not found. Otherwise, a program specified for searching is being edited in background processing. Check the program number and external signal. Or discontinue the background eiting.
060	SEQUENCE NUMBER NOT FOUND	Commanded sequence number was not found in the sequence number search. Check the sequence number.
061	ADDRESS P/Q NOT FOUND IN G70-G73	Address P or Q is not specified in G70, G71, G72, or G73 command. Modify the program.
062	ILLEGAL COMMAND IN G71-G76	1 The depth of cut in G71 or G72 is zero or negative value. 2 The repetitive count in G73 is zero or negative value. 3 the negative value is specified to Δi or Δk is zero in G74 or G75. 4 A value other than zero is specified to address U or W, though Δi or Δk is zero in G74 or G75. 5 A negative value is specified to Δd, thoughthe relief direction in G74 or G75 is determined. 6. Zero or a negative value is specified to the height of thread or depth of cut of first time in G76. 7 The specified minimum depth of cut in G76 is greater than the height of thread. 8 An unusable angle of tool tip is specified in G76. Modify the program.
063	SEQUENCE NUMBER NOT FOUND	The sequence number specified by address P in G70, G71, G72, or G73 command cannot be searched. Modify the program.
064	SHAPE PROGRAM NOT MONOTONOUSLY	A target shape which cannot be made by monotonic machining was specified in a repetitive canned cycle (G71 or G72).
065	ILLEGAL COMMAND IN G71-G73	1 G00 or G01 is not commanded at the block with the sequence number which is specified by address P in G71, G72, or G73 command. 2. Address Z(W) or X(U) was commanded in the block with a sequence number which is specified by address P in G71 or G72, respectively. Modify the program.
066	IMPROPER G-CODE IN G71-G73	An unallowable G code was commanded beween two blocks specified by address P in G71, G72, or G73. Modify the program.
067	CAN NOT ERROR IN MDI MODE	G70, G71, G72, or G73 command with address P and Q. Modify the program.
068	TEN OR MORE POCKETS	The number of pockets is greater than or equal to ten for G71 or G72 of type II.
069	FORMAT ERROR IN G70-G73	the final move command in the blocks specified by P and Q of G70, G71, G72, and G73 ended with chamfering or corner R. Modify the program.

[T series]

Number	Meaning	Contents
070	NO PROGRAM SPACE IN MEMORY	The memory area is insufficient. Delete any unnecessary programs, then retry.
071	DATA NOT FOUND	The address to be searched was not found. Or the program with specified program number was not found in program number search. Check the data.
072	TOO MANY PROGRAMS	The number of programs to be stored exceeded 63 (basic), 125 (option), 200 (option). Delete unnecessary programs and execute program registeration again.
073	PROGRAM NUMBER ALREADY IN USE	The commanded program number has already been used. Change the program number or delete unnecessary programs and execute program registeration again.
074	ILLEGAL PROGRAM NUMBER	The program number is other than 1 to 9999. Modify the program number.
076	ADDRESS P NOT DEFINED	Address P (program number) was not commanded in the block which includes an M98, G65, or G66 command. Modify the program.
077	SUB PROGRAM NESTING ERROR	The number of subprograms called exceeded the limit.
078	NUMBER NOT FOUND	A program number or a sequence number which was specified by address P in the block which includes an M98, M99, M65 or G66 was not found. The sequence number specified by a GOTO statement was not found. Otherwise, a called program is being edited in background processing. Correct the program, or discontinue the background editing.
079	PROGRAM VERIFY ERROR	In memory or program collation,a program in memory does not agree with that read from an external I/O device. Check both the programs in memory and those from the external device.
080	G37 ARRIVAL SIGNAL NOT ASSERTED	In the automatic tool compensation function (G36, G37), the measurement position reach signal (XAE or ZAE) is not turned on within an area specified in parameter (value ε). This is due to a setting or operator error.
081	OFFSET NUMBER NOT FOUND IN G37	Automatic tool compensation (G36, G37) was specified without a T code. (Automatic tool compensation function) Modify the program.
082	T-CODE NOT ALLOWED IN G37	T code and automatic tool compensation (G36, G37) were specified in the same block. (Automatic tool compensation function) Modify the program.
083	ILLEGAL AXIS COMMAND IN G37	In automatic tool compensation (G36, G37), an invalid axis was specified or the command is incremental. Modify the program.
085	COMMUNICATION ERROR	When entering data in the memory by using Reader / Puncher interface, an overrun, parity or framing error was generated. The number of bits of input data or setting of baud rate or specification No. of I/O unit is incorrect.
086	DR SIGNAL OFF	When entering data in the memory by using Reader / Puncher interface, the ready signal (DR) of reader / puncher was turned off. Power supply of I/O unit is off or cable is not connected or a P.C.B. is defective.
087	BUFFER OVERFLOW	When entering data in the memory by using Reader / Puncher interface, though the read terminate command is specified, input is not interrupted after 10 characters read. I/O unit or P.C.B. is defective.

[T series]

Number	Meaning	Contents
090	REFERENCE RETURN INCOMPLETE	The reference position return cannot be performed normally because the reference position return start point is too close to the reference position or the speed is too slow. Separate the start point far enough from the reference position, or specify a sufficiently fast speed for reference position return. Check the program contents.
091	MANUAL RETURN TO THE REFERENCE POSITION IS IMPOSSIBLE BECAUSE OF A TEMPORARY STOP.	A manual return to the reference position cannot be made because the system is in the temporary stop state. After pressing the RESET key, execute manual return to the reference position.
092	AXES NOT ON THE REFERENCE POINT	Automatic reference position return (G28) or the commanded axis by G27 (Reference position return check) did not return to the reference position.
094	P TYPE NOT ALLOWED (COORD CHG)	P type cannot be specified when the program is restarted. (After the automatic operation was interrupted, the coordinate system setting operation was performed.) Perform the correct operation according to th operator's manual.
095	P TYPE NOT ALLOWED (EXT OFS CHG)	P type cannot be specified when the program is restarted. (After the automatic operation was interrupted, the external workpiece offset amount changed.) Perform the correct operation according to th operator's manual.
096	P TYPE NOT ALLOWED (WRK OFS CHG)	P type cannot be specified when the program is restarted. (After the automatic operation was interrupted, the workpiece offset amount changed.) Perform the correct operation according to th operator's manual.
097	P TYPE NOT ALLOWED (AUTO EXEC)	P type cannot be directed when the program is restarted. (After power ON, after emergency stop or P / S 94 to 97 reset, no automatic operation is performed.) Perform automatic operation.
098	G28 FOUND IN SEQUENCE RETURN	A command of the program restart was specified without the reference position return operation after power ON or emergency stop, and G28 was found during search. Perform the reference position return.
099	MDI EXEC NOT ALLOWED AFT. SEARCH	After completion of search in program restart, a move command is given with MDI.
100	PARAMETER WRITE ENABLE	On the PARAMETER(SETTING) screen, PWE(parameter writing enabled) is set to 1. Set it to 0, then reset the system.
101	PLEASE CLEAR MEMORY	The power was turned off while memory was being rewritten by program edit operation. When this alarm is issued, clear the program by setting the setting parameter (PWE) to 1, then turning on the power again while holding down the <DELETE> key.
110	DATA OVERFLOW	The absolute value of fixed decimal point display data exceeds the allowable range. Modify the program.
111	CALCULATED DATA OVERFLOW	The result of calculation turns out to be invalid, an alarm No.111 is issued. Modify the program.
112	DIVIDED BY ZERO	Division by zero was specified. (including tan 90°) Modify the program.
113	IMPROPER COMMAND	A function which cannot be used in custom macro is commanded. Modify the program.

[T series]

Number	Meaning	Contents
114	FORMAT ERROR IN MACRO	Custom macro A contains an undefined H code in a G65 block. Custom macro B contains an error in a format other than <expression>. Correct the program.
115	ILLEGAL VARIABLE NUMBER	A value not defined as a variable number is designated in the custom macro or in high-speed cycle machining. The header contents are improper. This alarm is given in the following cases: High speed cycle machining 1. The header corresponding to the specified machining cycle number called is not found. 2. The cycle connection data value is out of the allowable range (0 - 999). 3. The number of data in the header is out of the allowable range (0 - 32767). 4. The start data variable number of executable format data is out of the allowable range (#20000 - #85535). 5. The last storing data variable number of executable format data is out of the allowable range (#85535). 6. The storing start data variable number of executable format datais overlapped with the variable number used in the header. Modify the program.
116	WRITE PROTECTED VARIABLE	The left side of substitution statement is a variable whose substitution is inhibited. Modify the program.
118	PARENTHESIS NESTING ERROR	The nesting of bracket exceeds the upper limit (quintuple). Modify the program.
119	ILLEGAL ARGUMENT	The SQRT argument is negative. Or BCD argument is negative, and other values than 0 to 9 are present on each line of BIN argument. Modify the program.
122	DUPLICATE MACRO MODAL-CALL	The macro modal call is specified in double. Modify the program.
123	CAN NOT USE MACRO COMMAND IN DNC	Macro control command is used during DNC operation. Modify the program.
124	MISSING END STATEMENT	DO - END does not correspond to 1 : 1. Modify the program.
125	FORMAT ERROR IN MACRO	Custom macro A contains an address that cannot be specified in a G65 block. Custom macro B contains a format error in <expression>. Correct the program.
126	ILLEGAL LOOP NUMBER	In DOn, $1 \le n \le 3$ is not established. Modify the program.
127	NC, MACRO STATEMENT IN SAME BLOCK	NC and custom macro commands coexist. Modify the program.
128	ILLEGAL MACRO SEQUENCE NUMBER	The sequence number specified in the branch command was not 0 to 9999. Or, it cannot be searched. Modify the program.
129	ILLEGAL ARGUMENT ADDRESS	An address which is not allowed in <Argument Designation > is used. Modify the program.
130	ILLEGAL AXIS OPERATION	An axis control command was given by PMC to an axis controlled by CNC. Or an axis control command was given by CNC to an axis controlled by PMC. Modify the program.
131	TOO MANY EXTERNAL ALARM MESSAGES	Five or more alarms have generated in external alarm message. Consult the PMC ladder diagram to find the cause.

[T series]

Number	Meaning	Contents
132	ALARM NUMBER NOT FOUND	No alarm No. concerned exists in external alarm message clear. Check the PMC ladder diagram.
133	ILLEGAL DATA IN EXT. ALARM MSG	Small section data is erroneous in external alarm message or external operator message. Check the PMC ladder diagram.
135	SPINDLE ORIENTATION PLEASE	Without any spindle orientation , an attept was made for spindle indexing. Perform spindle orientation.
136	C/H-CODE & MOVE CMD IN SAME BLK.	A move command of other axes was specified to the same block as spindle indexing addresses C, H. Modify the program.
137	M-CODE & MOVE CMD IN SAME BLK.	A move command of other axes was specified to the same block as M-code related to spindle indexing. Modify the program.
139	CAN NOT CHANGE PMC CONTROL AXIS	An axis is selected in commanding by PMC axis control. Modify the program.
146	IMPROPER G CODE	G codes which cannot be specified in the polar coordinate interpolation mode was specified. See section II-4.4 and modify the program.
150	ILLEGAL TOOL GROUP NUMBER	Tool Group No. of tool life management exceeds the maximum allowable value. Modify the program. Alternatively, modify the tool life data.
151	TOOL GROUP NUMBER NOT FOUND	The tool group of tool life management commanded in the machining program is not set. Modify the value of program or parameter.
152	NO SPACE FOR TOOL ENTRY	The number of tools within one group of tool life management exceeds the maximum value registerable. Modify the number of tools.
153	T-CODE NOT FOUND	In tool life data registration, a T code was not specified where one should be. Correct the program.
155	ILLEGAL T-CODE IN M06	In the machining program, M06 and T code in the same block do not correspond to the group of tool life management in use. Correct the program.
156	P/L COMMAND NOT FOUND	P and L commands are missing at the head of program in which the tool group of tool life management is set. Correct the program.
157	TOO MANY TOOL GROUPS	The number of tool groups of tool life management to be set exceeds the maximum allowable value. Modify the program.
158	ILLEGAL TOOL LIFE DATA	The tool life to be set is too excessive. Modify the setting value.
159	TOOL DATA SETTING INCOMPLETE	During executing a life data setting program of tool life management, power was turned off. Set again.
160	MISMATCH WATING M-CODE (TT only)	Diffrent M code is commanded in heads 1 and 2 as waiting M code. Modify the program.
163	COMMAND G68/G69 INDEPENDENTLY (TT only)	G68 and G69 are not independently commanded in balance cut. Modify the program.
169	ILLEGAL TOOL GEOMETRY DATA (TT only)	Incorrect tool figure data in interference check.
175	ILLEGAL G107 COMMAND	Conditions when performing circular interpolation start or cancel not correct. Modify the program.

[T series]

Number	Meaning	Contents
176	IMPROPER G-CODE IN G107	Any of the following G codes which cannot be specified in the cylindrical interpolation mode was specified. 1) G codes for positioning: G28, G76, G81 - G89, including the codes specifying the rapid traverse cycle 2) G codes for setting a coordinate system: G50, G52 3) G code for selecting coordinate system: G53 G54-G59 Modify the program.
177	CHECK SUM ERROR (G05 MODE)	Check sum error Modify the program.
178	G05 COMMANDED IN G41/G42 MODE	G05 was commanded in the G41/G42 mode. Correct the program.
179	PARAM. SETTING ERROR	The number of controlled axes set by the parameter 597 exceeds the maximum number. Modify the parameter setting value.
180	COMMUNICATION ERROR (REMOTE BUF)	Remote buffer connection alarm has generated. Confirm the number of cables, parameters and I/O device.
194	SPINDLE COMMAND IN SYNCHRO-MODE	A contour control mode, spindle positioning (Cs-axis control) mode, or rigid tapping mode was specified during the serial spindle synchronous control mode. Correct the program so that the serial spindle synchronous control mode is released in advance.
195	MODE CHANGE ERROR	The control mode of the serial spindle cannot be changed. Check the Ladder diagram of the PMC.
197	C-AXIS COMMANDED IN SPINDLE MODE	The program specified a movement along the Cf-axis when the signal CON was off. Correct the program, or consult the PMC ladder diagram to find the reason the signal is not turned on.
199	MACRO WORD UNDEFINED	Undefined macro word was used. Modify the custom macro.
200	ILLEGAL S CODE COMMAND	In the rigid tap, an S value is out of the range or is not specified. The range for S values which can be specified in rigid tapping is set in parameter 5243. Change the setting in the parameter or modify the program.
201	FEEDRATE NOT FOUND IN RIGID TAP	In the rigid tap, no F value is specified. Correct the program.
202	POSITION LSI OVERFLOW	In the rigid tap, spindle distribution value is too large.
203	PROGRAM MISS AT RIGID TAPPING	In the rigid tap, position for a rigid M code (M29) or an S command is incorrect. Modify the program.
204	ILLEGAL AXIS OPERATION	In the rigid tap, an axis movement is specified between the rigid M code (M29) block and G84 (G74) block. Modify the program.
205	RIGID MODE DI SIGNAL OFF	Rigid mode DI signal is not ON when G84 (G74) is executed though the rigid M code (M29) is specified.Consult the PMC ladder diagram to find the reason the DI signal is not turned on.
210	CAN NOT COMAND M198/M199	M198 and M199 are executed in the schedule operation. M198 is executed in the DNC operation. Modify the program.
211	G31 (HIGH) NOT ALLOWED IN G99	G31 is commanded in the per revolution command when the high-speed skip option is provided. Modify the program.
212	ILLEGAL PLANE SELECT	The direct drawing dimensions programming is commanded for the plane other than the Z-X plane. Correct the program.
213	ILLEGAL COMMAND IN SYNCHRO-MODE	Movement is commanded for the axis to be synchronously controlled.

[T series]

Number	Meaning	Contents
214	ILLEGAL COMMAND IN SYN-CHRO-MODE	Coordinate system is set or tool compensation of the shift type is executed in the synchronous control. Correct the program.
217	DUPLICATE G251 (COMMANDS)	G251 is further commanded in the G251 mode. Modify the program.
218	NOT FOUND P/Q COMMAND IN G251	P or Q is not commanded in the G251 block, or the command value is out of the range. Modify the program.
219	COMMAND G250/G251 INDEPEN-DENTLY	G251 and G250 are not independent blocks.
220	ILLEGAL COMMAND IN SYNCHR-MODE	In the synchronous operation, movement is commanded by the NC program or PMC axis control interface for the synchronous axis.
221	ILLEGAL COMMAND IN SYNCHR-MODE	Polygon machining operation and axis control or balance cutting are executed at a time. Modify the program.
224	RETURN TO REFERENCE POINT	Not returned to reference point before cycle start.
225	SYNCHRONOUS/MIXED CONTROL ERROR (TT only)	This alarm is generated in the following circumstances. (Searched for during synchronous and mixed control command. 1 When there is a mistake in axis number parameter setting. 2 When there is a mistake in control commanded. Modify the program or the parameter.
226	ILLEGAL COMMAND IN SYN-CHRO-MODE (TT only)	A travel command has been sent to the axis being synchronized in synchronous mode. Modify the program or the parameter.
229	CAN NOT KEEP SYNCHRO-STATE (TT only)	This alarm is generated in the following circumstances. 1 When the synchro/mixed state could not be kept due to system over-load. 2 The above condition occurred in CMC devices (hardware) and syn-chro-state could not be kept. (This alarm is not generated in normal use conditions.)
233	P/S ALARM	In the skip function activated by the torque limit signal, the number of accumulated erroneous pulses exceed 32767 before the signal was input. Therefore, the pulses cannot be corrected with one distribution. Change the conditions, such as federates along axes and torque limit, and try again.

(2) Program errors (P/S alarm) for M series

[M series]

Number	Meaning	Contents and remedy
000	PLEASE TURN OFF POWER	A parameter which requires the power off was input, turn off power.
001	TH PARITY ALARM	TH alarm (A character with incorrect parity was input). Correct the tape.
002	TV PARITY ALARM	TV alarm (The number of characters in a block is odd). This alarm will be generated only when the TV check is effective.
003	TOO MANY DIGITS	Data exceeding the maximum allowable number of digits was input. (Refer to the item of max. programmable dimensions in Operator's Manual.)
004	ADDRESS NOT FOUND	A numeral or the sign " - " was input without an address at the beginning of a block. Modify the program .
005	NO DATA AFTER ADDRESS	The address was not followed by the appropriate data but was followed by another address or EOB code. Modify the program.
006	ILLEGAL USE OF NEGATIVE SIGN	Sign " ." input error (Sign " - " was input after an address with which it cannot be used. Or two or more " - " signs were input.) Modify the program.
007	ILLEGAL USE OF DECIMAL POINT	Decimal point " - " input error (A decimal point was input after an address with which it can not be used. Or two decimal points were input.) Modify the program.
008	ILLEGAL USE OF PROGRAM END	An attempt was made to execute EOR (%) because there was not M02, M30, or M99 at the end of the program. Correct the program.
009	ILLEGAL ADDRESS INPUT	Unusable character was input in significant area. Modify the program.
010	IMPROPER G-CODE	An unusable G code or G code corresponding to the function not provided is specified. Modify the program.
011	NO FEEDRATE COMMANDED	Feedrate was not commanded to a cutting feed or the feedrate was inadequate. Modify the program.
014	CAN NOT COMMAND G95	A synchronous feed is specified without the option for threading / synchronous feed.
015	TOO MANY AXES COMMANDED	The number of the commanded axes exceeded that of simultaneously controlled axes.
020	OVER TOLERANCE OF RADIUS	In circular interpolation (G02 or G03), difference of the distance between the start point and the center of an arc and that between the end point and the center of the arc exceeded the value specified in parameter No. 876.
021	ILLEGAL PLANE AXIS COMMANDED	An axis not included in the selected plane (by using G17, G18, G19) was commanded in circular interpolation. Modify the program.
025	CANNOT COMMAND F0 IN G02/G03	F0 (fast feed) was instructed by F1 -digit column feed in circular interpolation. Modify the program.
027	NO AXES COMMANDED IN G43/G44	No axis is specified in G43 and G44 blocks for the tool length offset type C. Offset is not canceled but another axis is offset for the tool length offset type C. Modify the program.
028	ILLEGAL PLANE SELECT	In the plane selection command, two or more axes in the same direction are commanded. Modify the program.
029	ILLEGAL OFFSET VALUE	The offset values specified by H code is too large. Modify the program.

[M series]

Number	Meaning	Contents and remedy
030	ILLEGAL OFFSET NUMBER	The offset number specified by D/H code for tool length offset or cutter compensation is too large. Modify the program.
031	ILLEGAL P COMMAND IN G10	In setting an offset amount by G10, the offset number following address P was excessive or it was not specified. Modify the program.
032	ILLEGAL OFFSET VALUE IN G10	In setting an offset amount by G10 or in writing an offset amount by system variables, the offset amount was excessive.
033	NO SOLUTION AT CRC	A point of intersection cannot be determined for cutter compensation C. Modify the program.
034	NO CIRC ALLOWED IN ST-UP/EXT BLK	The start up or cancel was going to be performed in the G02 or G03 mode in cutter compensation. Modify the program.
035	CAN NOT COMMANDED G39	G39 is commanded in cutter compensation B cancel mode or on the plane other than offset plane. Modify the program.
036	CAN NOT COMMANDED G31	Skip cutting (G31) was specified in cutter compensation mode. Modify the program.
037	CAN NOT CHANGE PLANE IN CRC	G40 is commanded on the plane other than offset plane in cutter compensation B. The plane selected by using G17, G18 or G19 is changed in cutter compensation C mode. Modify the program.
038	INTERFERENCE IN CIRCULAR BLOCK	Overcutting will occur in cutter compensation C because the arc start point or end point coincides with the arc center. Modify the program.
041	INTERFERENCE IN CRC	Overcutting will occur in cutter compensation C. Two or more blocks are consecutively specified in which functions such as the auxiliary function and dwell functions are performed without movement in the cutter compensation mode. Modify the program.
042	G45/G48 NOT ALLOWED IN CRC	Tool offset (G45 to G48) is commanded in cutter compensation. Modify the program.
043	ILLEGAL T-CODE COMMAND	In the DRILL-MATE, a T code was not specified together with the M06 code in a block. Alternatively, the Tcode was out of range.
044	G27-G30 NOT ALLOWED IN FIXED CYC	One of G27 to G30 is commanded in canned cycle mode. Modify the program.
046	ILLEGAL REFERENCE RETURN COMMAND	Other than P2, P3 and P4 are commanded for 2nd, 3rd and 4th reference position return command.
050	CHF/CNR NOT ALLOWED IN THRD BLK	Chamfering or corner R is commanded in the thread cutting block. Modify the program.
051	MISSING MOVE AFTER CHF/CNR	Improper movement or the move distance was specified in the block next to the chamfering or corner R block. Modify the program.
052	CODE IS NOT G01 AFTER CHF/CNR	The block next to the chamfering or corner R block is not G01. Modify the program.
053	TOO MANY ADDRESS COMMANDS	For systems without the arbitary angle chamfering or corner R cutting, a comma was specified. For systems with this feature, a comma was followed by something other than R or C Correct the program.
055	MISSING MOVE VALUE IN CHF/CNR	In the arbitrary angle chamfering or corner R block, the move distance is less than chamfer or corner R amount.
058	END POINT NOT FOUND	In a arbitrary angle chamfering or corner R cutting block, a specified axis is not in the selected plane. Correct the program.

[M series]

Number	Meaning	Contents and remedy
059	PROGRAM NUMBER NOT FOUND	In an external program number search, a specified program number was not found. Otherwise, a program specified for searching is being edited in background processing. Check the program number and external signal. Or discontinue the background eiting.
060	SEQUENCE NUMBER NOT FOUND	Commanded sequence number was not found in the sequence number search. Check the sequence number.
070	NO PROGRAM SPACE IN MEMORY	The memory area is insufficient. Delete any unnecessary programs, then retry.
071	DATA NOT FOUND	The address to be searched was not found. Or the program with specified program number was not found in program number search. Check the data.
072	TOO MANY PROGRAMS	The number of programs to be stored exceeded 63 (basic), 125 (option) or, 200 (option). Delete unnecessary programs and execute program registeration again.
073	PROGRAM NUMBER ALREADY IN USE	The commanded program number has already been used. Change the program number or delete unnecessary programs and execute program registeration again.
074	ILLEGAL PROGRAM NUMBER	The program number is other than 1 to 9999. Modify the program number.
076	ADDRESS P NOT DEFINED	Address P (program number) was not commanded in the block which includes an M98, G65, or G66 command. Modify the program.
077	SUB PROGRAM NESTING ERROR	A level larger than the maximum allowable nesting level of subprogram calls was specified. Modify the program.
078	NUMBER NOT FOUND	A program number or a sequence number which was specified by address P in the block which includes an M98, M99, M65 or G66 was not found. The sequence number specified by a GOTO statement was not found. An attempt was made to call a program being edited in the background processing mode. Correct the program.
079	PROGRAM VERIFY ERROR	In memory or program collation,a program in memory does not agree with that read from an external I/O device. Check both the programs in memory and those from the external device.
080	G37 ARRIVAL SIGNAL NOT ASSERTED	In the automatic tool length measurement function (G37), the measurement position reach signal (XAE, YAE, or ZAE) is not turned on within an area specified in parameter (value ε). This is due to a setting or operator error.
081	OFFSET NUMBER NOT FOUND IN G37	Tool length automatic measurement (G37) was specified without a H code. (Automatic tool length measurement function) Modify the program.
082	H-CODE NOT ALLOWED IN G37	H code and automatic tool compensation (G37) were specified in the same block. (Automatic tool length measurement function) Modify the program.
083	ILLEGAL AXIS COMMAND IN G37	In automatic tool length measurement, an invalid axis was specified or the command is incremental. Modify the program.
085	COMMUNICATION ERROR	When entering data in the memory by using Reader / Puncher interface, an overrun, parity or framing error was generated. The number of bits of input data or setting of baud rate or specification No. of I/O unit is incorrect.

[M series]

Number	Meaning	Contents and remedy
086	DR SIGNAL OFF	When entering data in the memory by using Reader / Puncher interface, the ready signal (DR) of reader / puncher was turned off. Power supply of I/O unit is off or cable is not connected or a P.C.B. is defective.
087	BUFFER OVERFLOW	When entering data in the memory by using Reader / Puncher interface, though the read terminate command is specified, input is not interrupted after 10 characters read. I/O unit or P.C.B. is defective.
090	REFERENCE RETURN INCOMPLETE	The reference position return cannot be performed normally because the reference position return start point is too close to the reference position or the speed is too slow. Separate the start point far enough from the reference position, or specify a sufficiently fast speed for reference position return.
091	MANUAL RETURN IMPOSSIBLE DURING PAUSE	A manual return to the reference position was impossible because of the program being at pause. Press the reset button to cause a manual return.
092	AXES NOT ON THE REFERENCE POINT	The commanded axis by G28 (automatic reference position return) or G27 (reference position return check) did not return to the reference position.
094	P TYPE NOT ALLOWED (COORD CHG)	P type cannot be specified when the program is restarted. (After the automatic operation was interrupted, the coordinate system setting operation was performed.) Perform the correct operation according to th operator's manual.
095	P TYPE NOT ALLOWED (EXT OFS CHG)	P type cannot be specified when the program is restarted. (After the automatic operation was interrupted, the external workpiece offset amount changed.)
096	P TYPE NOT ALLOWED (WRK OFS CHG)	P type cannot be specified when the program is restarted. (After the automatic operation was interrupted, the workpiece offset amount changed.)
097	P TYPE NOT ALLOWED (AUTO EXEC)	P type cannot be directed when the program is restarted. (After power ON, after emergency stop or P / S 94 to 97 reset, no automatic operation is performed.) Perform automatic operation.
098	G28 FOUND IN SEQUENCE RETURN	A command of the program restart was specified without the reference position return operation after power ON or emergency stop, and G28 was found during search.
099	MDI EXEC NOT ALLOWED AFT. SEARCH	After completion of search in program restart, a move command is given with MDI.
100	PARAMETER WRITE ENABLE	On the PARAMETER(SETTING) screen, PWE (parameter writing enabled) is set to 1. Set it to 0, then reset the system.
101	PLEASE CLEAR MEMORY	The power turned off while rewriting the memory by program edit operation. When this alarm occurs, set the PWE parameter to 1, then switch on the power while holding down the <DELET> key. All programs will be deleted.
110	DATA OVERFLOW	The absolute value of fixed decimal point display data exceeds the allowable range. Modify the program.
111	CALCULATED DATA OVERFLOW	The result of calculation turns out to be invalid, an alarm No.111 is issued.
112	DIVIDED BY ZERO	Division by zero was specified. (including tan 90°)
113	IMPROPER COMMAND	A function which cannot be used in custom macro is commanded. Modify the program.

[M series]

Number	Meaning	Contents and remedy
114	FORMAT ERROR IN MACRO	Custom macro A specified an undefined H code in a G65 block. There is an error in other formats than <Formula>. Modify the program.
115	ILLEGAL VARIABLE NUMBER	A value not defined as a variable number is designated in the custom macro or in high-speed cycle machining. The header contents are improper. This alarm is given in the following cases: High speed cycle machining 1. The header corresponding to the specified machining cycle number called is not found. 2. The cycle connection data value is out of the allowable range (0 - 999). 3. The number of data in the header is out of the allowable range (0 - 32767). 4. The start data variable number of executable format data is out of the allowable range (#20000 - #85535). 5. The last storing data variable number of executable format data is out of the allowable range (#85535). 6. The storing start data variable number of executable format datais overlapped with the variable number used in the header. Modify the program.
116	WRITE PROTECTED VARIABLE	The left side of substitution statement is a variable whose substitution is inhibited. Modify the program.
118	PARENTHESIS NESTING ERROR	The nesting of bracket exceeds the upper limit (quintuple). Modify the program.
119	ILLEGAL ARGUMENT	The SQRT argument is negative. Or BCD argument is negative, and other values than 0 to 9 are present on each line of BIN argument. Modify the program.
122	DUPLICATE MACRO MODAL-CALL	The macro modal call is specified in double. Modify the program.
123	CAN NOT USE MACRO COMMAND IN DNC	Macro control command is used during DNC operation. Modify the program.
124	MISSING END STATEMENT	DO - END does not correspond to 1 : 1. Modify the program.
125	FORMAT ERROR IN MACRO	Custom macro A specified an undefined H code in a G65 block. <Formula> format is erroneous. Modify the program.
126	ILLEGAL LOOP NUMBER	In DOn, $1 \leq n \leq 3$ is not established. Modify the program.
127	NC, MACRO STATEMENT IN SAME BLOCK	NC and custom macro commands coexist. Modify the program.
128	ILLEGAL MACRO SEQUENCE NUMBER	The sequence number specified in the branch command was not 0 to 9999. Or, it cannot be searched. Modify the program.
129	ILLEGAL ARGUMENT ADDRESS	An address which is not allowed in <Argument Designation > is used. Modify the program.
130	ILLEGAL AXIS OPERATION	An axis control command was given by PMC to an axis controlled by CNC. Or an axis control command was given by CNC to an axis controlled by PMC. Modify the program.
131	TOO MANY EXTERNAL ALARM MESSAGES	Five or more alarms have generated in external alarm message. Consult the PMC ladder diagram to find the cause.

[M series]

Number	Meaning	Contents and remedy
132	ALARM NUMBER NOT FOUND	No alarm No. concerned exists in external alarm message clear. Check the PMC ladder diagram.
133	ILLEGAL DATA IN EXT. ALARM MSG	Small section data is erroneous in external alarm message or external operator message. Check the PMC ladder diagram.
135	ILLEGAL ANGLE COMMAND	The index table indexing positioning angle was instructed in other than an integral multiple of the value of the minimum angle. Modify the program.
136	ILLEGAL AXIS COMMAND	In index table indexing.Another control axis was instructed together with the B axis. Modify the program.
139	CAN NOT CHANGE PMC CONTROL AXIS	An axis is selected in commanding by PMC axis control. Modify the program.
141	CAN NOT COMMAND G51 IN CRC	G51 (Scaling ON) is commanded in the tool offset mode. Modify the program.
142	ILLEGAL SCALE RATE	Scaling magnification is commanded in other than 1 - 999999. Correct the scaling magnification setting .
143	SCALED MOTION DATA OVERFLOW	The scaling results, move distance, coordinate value and circular radius exceed the maximum command value. Correct the program or scaling mangification.
144	ILLEGAL PLANE SELECTED	The coordinate rotation plane and arc or cutter compensation C plane must be the same. Modify the program.
148	ILLEGAL SETTING DATA	Automatic corner override deceleration rate is out of the settable range of judgement angle. Modify the parameters (No.1710 to No.1714)
150	ILLEGAL TOOL GROUP NUMBER	Tool Group No. exceeds the maximum allowable value in the tool life management. Modify the program.
151	TOOL GROUP NUMBER NOT FOUND	The tool group of the tool life management commanded in the machining program is not set. Modify the value of program or parameter.
152	NO SPACE FOR TOOL ENTRY	The number of tools within one group in the tool life management exceeds the maximum value registerable. Modify the number of tools.
153	T-CODE NOT FOUND	In tool life data registration, a T code was not specified where one should be. Correct the program.
154	NOT USING TOOL IN LIFE GROUP	When the group is not commanded in the tool life management, H99 or D99 was commanded. Correct the program.
155	ILLEGAL T-CODE IN M06	In the machining program, M06 and T code in the same block do not correspond to the group in use. Correct the program.
156	P/L COMMAND NOT FOUND	P and L commands are missing at the head of program in which the tool group of the tool life management is set. Correct the program.
157	TOO MANY TOOL GROUPS	The number of tool groups in the tool life management to be set exceeds the maximum allowable value. Modify the program.
158	ILLEGAL TOOL LIFE DATA	The tool life to be set is too excessive. Modify the setting value.
159	TOOL DATA SETTING INCOMPLETE	During executing a life data setting program, power was turned off. Set again.

[M series]

Number	Meaning	Contents and remedy
175	ILLEGAL G107 COMMAND	Conditions when performing circular interpolation start or cancel not correct. To change the mode to the cylindrical interpolation mode, specify the command in a format of "G07.1 rotation-axis name radius of cylinder."
176	IMPROPER G-CODE IN G107	Any of the following G codes which cannot be specified in the cylindrical interpolation mode was specified. 1) G codes for positioning: G28,, G73, G74, G76, G81 - G89, including the codes specifying the rapid traverse cycle 2) G codes for setting a coordinate system: G52,G92, 3) G code for selecting coordinate system: G53 G54-G59 Modify the program.
177	CHECK SUM ERROR (G05 MODE)	Check sum error is occurred in the high-speed remote buffer.
178	G05 COMMANDED IN G41/G42 MODE	G05 was commanded in the G41/G42 mode. Correct the program.
179	PARAMETER SETTING ERROR	The number of controlled axes set by the parameter 7510 exceeds the maximum number. Modify the parameter setting value.
180	COMMUNICATION ERROR (REMOTE BUF)	Remote buffer connection alarm has generated. Confirm the number of cables, parameters and I/O device.
181	FORMAT ERROR IN G81 BLOCK (Hobbing machine)	G81 block format error 1) T (number of teeth) has not been instructed. 2) Data outside the command range was instructed by either T, L, Q or P. Modify the program.
182	G81 NOT COMMANDED (Hobbing machine)	G83 (C axis servo lag quantity offset) was instructed though synchronization by G81 has not been instructed. Correct the program.
183	DUPLICATE G83 (COMMANDS) (Hobbing machine)	G83 was instructed before canceled by G82 after compensating for the C axis servo lag quantity by G83.
184	ILLEGAL COMMAND IN G81 (Hobbing machine)	A command not to be instructed during synchronization by G81 was instructed. 1) A C axis command by G00, G27, G28, G29, G30, etc. was instructed. 2) Inch/Metric switching by G20, G21 was instructed.
185	RETURN TO REFERENCE POINT (Hobbing machine)	G81 was instructed without performing reference position return after power on or emergency stop. Perform reference position return.
186	PARAMETER SETTING ERROR (Hobbing machine)	Parameter error regarding G81 1) The C axis has not been set to be a rotary axis. 2) A hob axis and position coder gear ratio setting error
190	ILLEGAL AXIS SELECT	In the constant surface speed control, the specified axis command (P) contains an illegal value. Correct the program.
194	SPINDLE COMMAND IN SYNCHRO-MODE	Cs contour control or rigid tapping was specified during serial spindle synchronous control. Correct the program.
195	SPINDLE CONTROL MODE SWITCH	The serial spindle control mode was not switched. Check the PMC ladder program.

[M series]

Number	Meaning	Contents and remedy
197	C-AXIS COMMANDED IN SPINDLE MODE	A command for Cs-axis movement was issued when the current control mode is not serial spindle Cs contour control. Check the PMC ladder program or machining program.
199	MACRO WORD UNDEFINED	Undefined macro word was used. Modify the custom macro.
200	ILLEGAL S CODE COMMAND	In the rigid tap, an S value is out of the range or is not specified. Modify the program.
201	FEEDRATE NOT FOUND IN RIGID TAP	In the rigid tap, no F value is specified. Correct the program.
202	POSITION LSI OVERFLOW	In the rigid tap, spindle distribution value is too large.
203	PROGRAM MISS AT RIGID TAPPING	In the rigid tap, position for a rigid M code (M29) or an S command is incorrect. Modify the program.
204	ILLEGAL AXIS OPERATION	In the rigid tap, an axis movement is specified between the rigid M code (M29) block and G84 (G74) block. Modify the program.
205	RIGID MODE DI SIGNAL OFF	Rigid mode DI signal is not ON when G84 (G74) is executed though the rigid M code (M29) is specified.Consult the PMC ladder diagram to find the reason the DI signal (DGNG061.1) is not turned on. Modify the program.
206	CAN NOT CHANGE PLANE (RIGID TAP)	Plane changeover was instructed in the rigid mode. Correct the program.
210	CAN NOT COMAND M198/M199	M198 and M199 are executed in the schedule operation. M198 is executed in the DNC operation.
211	CAN NOT COMMAND HIGH-SPEED SKIP	A high-speed skip (G31) was specified during the feed-per-rotation or rigid tapping mode. Correct the program.
212	ILLEGAL PLANE SELECT	The arbitrary angle chamfering or a corner R is commanded or the plane including an additional axis. Correct the program.
213	ILLEGAL COMMAND IN SYNCHRO-MODE	Any of the following alarms occurred in the operation with the simple synchronization control. 1) The program issued the move command to the slave axis. 2) The program issued the manual continuous feed/manual handle feed/incremental feed command to the slave axis. 3) The program issued the automatic reference position return command without executing the manual reference position return after the power was turned on. 4) The difference between the position error amount of the master and slave axes exceeded the value specified in parameter .
214	ILLEGAL COMMAND IN SYNCHRO-MODE	Coordinate system is set or tool compensation of the shift type is executed in the synchronous control. Correct the program.
222	DNC OP. NOT ALLOWED IN BG.-EDIT	Input and output are executed at a time in the background edition. Execute a correct operation.
224	RETURN TO REFERENCE POINT	Reference position return has not been performed before the automatic operation starts. Perform reference position return.
230	R CODE NOT FOUND	The infeed quantity R has not been instructed for the G160 block of th ecanned grinding cycle. Or the R command value is negative. Correct the program.
250	SIMULTANEOUS M06 AND Z-AXIS MOVEMENT NOT ALLOWED	A tool change (M06) and a Z-axis movement were specified simultaneously in the DRILL MATE. Correct the program.

(3) Background edit alarm

Number	Meaning	Contents
???	BP/S alarm	BP/S alarm occurs in the same number as the P/S alarm that occurs in ordinary program edit. (P/S 070, 071, 072, 073, 074 085,086,087 etc.)
140	BP/S alarm	It was attempted to select or delete in the background a program being selected in the foreground. **(Note)** Use background editing correctly.

NOTE

Because it uses the background editing function, a background editing alarm may be issued during MDI operation B.

(4) Absolute pulse coder (APC) alarm

Number	Meaning	Contents
3n0	nth-axis origin return	Manual reference position return is required for the nth-axis (n=1 - 8).
3n1	APC alarm: nth-axis communication	nth-axis APC communication error. Failure in data transmission Possible causes include a faulty APC, cable, or servo interface module.
3n2	APC alarm: nth-axis over time	nth-axis APC overtime error. Failure in data transmission. Possible causes include a faulty APC, cable, or servo interface module.
3n3	APC alarm: nth-axis framing	nth-axis APC framing error. Failure in data transmission. Possible causes include a faulty APC, cable, or servo interface module.
3n4	APC alarm: nth-axis parity	nth-axis APC parity error. Failure in data transmission. Possible causes include a faulty APC, cable, or servo interface module.
3n5	APC alarm: nth-axis pulse error	nth-axis APC pulse error alarm. APC alarm.APC or cable may be faulty.
3n6	APC alarm: nth-axis battery voltage 0	nth-axis APC battery voltage has decreased to a low level so that the data cannot be held. APC alarm. Battery or cable may be faulty.
3n7	APC alarm: nth-axis battery low 1	nth-axis axis APC battery voltage reaches a level where the battery must be renewed. APC alarm. Replace the battery.
3n8	APC alarm: nth-axis battery low 2	nth-axis APC battery voltage has reached a level where the battery must be renewed (including when power is OFF). APC alarm.

(5) Serial pulse coder (SPC) alarms

When either of the following alarms is issued, a possible cause is a faulty serial pulse coder or cable.

Number	Meaning	Contents
3n9	SPC ALARM: n AXIS PULSE CODER	The n axis pulse coder has a fault.

D The details of serial pulse coder alarm No.3n9

The details of serial pulse coder alarm No. 3n9 are displayed in the diagnosis display (No.760 to 767, 770 to 777) as shown below.

	#7	#6	#5	#4	#3	#2	#1	#0
760 to 767		CSA	BLA	PHA	RCA	BZA	CKA	SPH

CSA : The serial pulse coder is defective. Replace it.
BLA : The battery voltage is low. Replace the batteries. This alarm has nothing to do with alarm (serial pulse coder alarm).
PHA : The serial pulse coder or feedback cable is defective. Replace the serial pulse coder or cable.
RCA : The serial pulse coder is defective. Replace it.
BZA : The pulse coder was supplied with power for the first time. Make sure that the batteries are connected.
Turn the power off, then turn it on again and perform a reference position return. This alarm has nothing to do with alarm (serial pulse coder alarm).
CKA : The serial pulse coder is defective. Replace it.
SPH : The serial pulse coder or feedback cable is defective. Replace the serial pulse coder or cable.

	#7	#6	#5	#4	#3	#2	#1	#0
770 to 777	DTE	CRC	STB					

DTE : The serial pulse coder encountered a communication error. The pulse coder, feedbak cable, or feedback receiver circuit is defective. Replace the pulse coder, feedback cable, or NC–axis board
CRC : The serial pulse coder encountered a communication error. The pulse coder, feedback cable, or feedback receiver circuit is defective. Replace the pulse coder, feedback cable, or NC–axis board.
STB : the serial pulse coder encountered a communication error. The pulse coder, feedback cable, or feedback receiver circuit is defective.

(6) Servo alarms

Number	Meaning	Contents and actions
400	SERVO ALARM: 1, 2TH AXIS OVERLOAD	1-axis, 2-axis overload signal is on. Refer to diagnosis display No. 720 or 721 for details.
401	SERVO ALARM: 1, 2TH AXIS VRDY OFF	1-axis, 2-axis servo amplifier READY signal (DRDY) went off.
402	SERVO ALARM: 3, 4TH AXIS OVERLOAD	3-axis, 4-axis overload signal is on. Refer to diagnosis display No. 722 or 723 for details.
403	SERVO ALARM: 3, 4TH AXIS VRDY OFF	3-axis, 4-axis servo amplifier READY signal (DRDY) went off.
404	SERVO ALARM: n-TH AXIS VRDY ON	Even though the n-th axis (axis 1-8) READY signal (MCON) went off, the servo amplifier READY signal (DRDY) is still on. Or, when the power was turned on, DRDY went on even though MCON was off. Check that the axis card and servo amplifierr are connected.
405	SERVO ALARM: ZERO POINT RETURN FAULT	Position control system fault. Due to an NC or servo system fault in the reference position return, there is the possibility that reference position return could not be executed correctly. Try again from the manual reference position return.
406	SERVO ALARM: 7, 8TH AXIS OVER LOAD 7, 8TH AXIS VRDY OFF	7-axis, 8-axis overload signal is on. Refer to diagnosis display No. 726 or 727 for details. 7-axis, 8-axis servo amplifier READY signal (DRDY) went off.
4n0	SERVO ALARM: n-TH AXIS - EXCESS ERROR	The position deviation value when the n-th axis stops is larger than the set value. Note) Limit value must be set to parameter for each axis.
4n1	SERVO ALARM: n-TH AXIS - EXCESS ERROR	The position deviation value when the n-th axis moves is larger than the set value. Note) Limit value must be set to parameter for each axis.
4n3	SERVO ALARM: n-th AXIS - LSI OVERFLOW	The contents of the error register for the n-th axis exceeded $^\wedge 2^{31}$ power. This error usually occurs as the result of an improperly set parameters.
4n4	SERVO ALARM: n-TH AXIS - DETECTION RELATED ERROR	N-th axis digital servo system fault. Refer to diagnosis display No. 720 and No.727 for details.
4n5	SERVO ALARM: n-TH AXIS - EXCESS SHIFT	A speed higher than 4000000 units/s was attempted to be set in the n-th axis. This error occurs as the result of improperly set CMR.
4n6	SERVO ALARM: n-TH AXIS - DISCONNECTION	Position detection system fault in the n-th axis pulse coder (disconnection alarm).
4n7	SERVO ALARM: n-TH AXIS - PARAMETER INCORRECT	This alarm occurs when the n-th axis is in one of the conditions listed below. (Digital servo system alarm) 1) The value set in Parameter No. 8n20 (motor form) is out of the specified limit. 2) A proper value (111 or -111) is not set in parameter No. 8n22 (motor revolution direction). 3) Illegal data (a value below 0, etc.) was set in parameter No. 8n23 (number of speed feedback pulses per motor revolution). 4) Illegal data (a value below 0, etc.) was set in parameter No. 8n24 (number of position feedback pulses per motor revolution). 5) Parameters No. 8n84 and No. 8n85 (flexible field gear rate) have not been set. 6) An axis selection parameter (from No. 269 to 274) is incorrect. 7) An overflow occurred during parameter computation.
490	SERVO ALARM: 5TH AXIS OVER LOAD	5-axis, 6-axis overload signal is on. Refer to diagnosis display No. 724 or 725 for details.

Number	Meaning	Contents and actions
491	SERVO ALARM: 5, 6TH VRDY OFF	5-axis, 6-axis servo amplifier READY signal (DRDY) went off.
494	SERVO ALARM: 5, 6TH AXIS VRDY ON	The axis card ready signal (MCON) for axes 5 and 6 is off, but the servo amplifier ready signal (DRDY) is not. Alternatively, when the power is applied, the DRDY is on, but the MCON is not. Ensure that the axis card and servo amplifier are connected.
495	SERVO ALARM: 5, 6TH AXIS ZERO POINT RETURN	This is a position control circuit error. It is likely that a return to the reference position failed because of an error in the NC or the servo system. Retry a return to the reference position.

NOTE
If an excessive spindle error alarm occurs during rigid tapping, the relevant alarm number for the tapping feed axis is displayed.

D Details of servo alarm No.4n4

The detailed descriptions of servo alarm number 4n4 are displayed with diagnosis numbers 720 to 727 in the sequence of axis numbers.

	#7	#6	#5	#4	#3	#2	#1	#0
720 to 727	OVL	LV	OVC	HCAL	HVA	DCAL	FBAL	OFAL

OVL : An overload alarm is being generated.
(This bit causes servo alarm No. 400, 402, 406, 490).

LV : A low voltage alarm is being generated in servo amp.
Check LED.

OVC : A overcurrent alarm is being generated inside of digital servo.

HCAL : An abnormal current alarm is being generated in servo amp.
Check LED.

HVAL : An overvoltage alarm is being generated in servo amp.
Check LED.

DCAL : A regenerative discharge circuit alarm is being generated in servo amp. Check LED.

FBAL : A disconnection alarm is being generated.
(This bit causes servo alarm No.4n6.)

OFAL : An overflow alarm is being generated inside of digital servo.

(7) Spindle alarms

Number	Meaning	Contents and remedy
408	SPINDLE SERIAL LINK START FAULT	This alarm is generated when the spindle control unit is not ready for starting correctly when the power is turned on in the system with the serial spindle. The four reasons can be considered as follows: 1) An improperly connected optic cable, or the spindle control unit's power is OFF. 2) When the NC power was turned on under alarm conditions other than SU-01 or AL-24 which are shown on the LED display of the spindle control unit. In this case, turn the spindle amplifier power off once and perform startup again. 3) Other reasons (improper combination of hardware) This alarm does not occur after the system including the spindle control unit is activated.
409	SPINDLE ALARM DETECTION	A spindle amplifier alarm occurred in a system with a serial spindle. The alarm is indicated as "AL-XX" (where XX is a number) on the display of the spindle amplifier. For details, see Maintenance Manual for AC SPINDLE (Serial Interface) (B-65145E). Setting bit 7 of parameter No. 0397 causes the spindle amplifier alarm number to appear on the screen.

(8) Over travel alarms

Number	Meaning	Contents and remedy
5n0	OVER TRAVEL : +n	Exceeded the n-th axis + side stored stroke check 1, 2.
5n1	OVER TRAVEL : -n	Exceeded the n-th axis - side stored stroke check 1, 2.
5n2	OVER TRAVEL : +n	Exceeded the n-th axis + side stored stroke check 3.
5n3	OVER TRAVEL : -n	Exceeded the n-th axis - side stored stroke check 3.
5n4	OVER TRAVEL : +n	A hardware overtravel occured in the positive direction of the n-axis. (M series)
5n5	OVER TRAVEL : -n	A hardware overtravel occured in the positive direction of the n-axis. (M series)
5n4	OVER TRAVEL : +n	Exceeded the n-th axis + side stored stroke check 4. (T series)
5n5	OVER TRAVEL : -n	Exceeded the n-th axis - side stored stroke check 4. (T series)
520	OVER TRAVEL : +Z	A hardware overtravel occurred in the positive direction of the Z-axis. (T series)
590	Tool post interference alarm:+X-axis	A tool post interference alarm occurred during traveling in the positive direction on the X-axis.
591	Tool post interference alarm:-X-axis	A tool post interference alarm occurred during traveling in the negative direction on the X-axis.
592	Tool post interference alarm:+Z-axis	A tool post interference alarm occurred during traveling in the positive direction on the Z-axis.
593	Tool post interference alarm:-Z-axis	A tool post interference alarm occurred during traveling in the negative direction on the Z-axis.

(9) Macro alarms

Number	Meaning	Contents and remedy
500 to 599	MACRO ALARM	This alarm is related to the custom macro, macro executor, or order-made macro (including conversational program inputs). Refer to the relevant manual for details. (The macro alarm number may coincide with an overtravel alarm number. However, they can be distinguished from each other because the overtravel alarm number is accompanied with the description of the alarm.

(10) PMC alarms

Number	Meaning	Contents and remedy
600	PMC ALARM : INVALID INSTRUCTION	An invalid-instruction interrupt occurred in the PMC.
601	PMC ALARM : RAM PARITY	A PMC RAM parity error occurred.
602	PMC ALARM : SERIAL TRANSFER	A PMC serial transfer error occurred.
603	PMC ALARM : WATCHDOG	A PMC watchdog timer alarm occurred.
604	PMC ALARM : ROM PARITY	A PMC ROM parity error occurred.
605	PMC ALARM : OVER STEP	The maximum allowable number of PMC ladder program steps was exceeded.
606	PMC ALARM : I/O MODULE ASSIGNMENT	The assignment of I/O module signals is incorrect.
607	PMC ALARM : I/O LINK	An I/O link error occurred. The details are listed below.

Number	Details of PMC alarm (No. 607)
010	* Communication error (SLC (master) internal register error)
020	* An SLC RAM bit error occurred (verification error).
030	* An SLC RAM bit error occurred (verification error).
040	No I/O unit has been connected.
050	32 or more I/O units are connected.
060	* Data transmission error (no response from the slave)
070	* Communication error (no response from the slave)
080	* Communication error (no response from the slave)
090	An NMI (for other than alarm codes 110 to 160) occurred.
130	* An SLC (master) RAM parity error occurred (detected by hardware).
140	* An SLC (slave) RAM parity error occurred (detected by hardware).
160	* SLC (slave) communication error * AL0 : Watchdog timer DO clear signal received * IR1 : CRC or framing error Watchdog timer alarm Parity error

Hardware errors are indicated with an asterisk (*).

(11) Overheat alarms

Number	Meaning	Contents and remedy
700	OVERHEAT: CONTROL UNIT	Control unit overheat Check that the fan motor operates normally, and clean the air filter.
704	Overheat: Spindle	The spindle overheated during spindle variation detection. Check the cutting conditions.

(12) M-NET alarm

Number	Meaning	Contents and remedy
899	M-NET INTERFACE ALARM	This alarm is related to a serial interface for an external PLC. The details are listed below.

Number	Details of M-NET alarm (No. 899)
0001	Abnormal character (character other than transmission codes) received
0002	”EXT” code error
0003	Connection time monitor error (parameter No. 0464)
0004	Polling time monitor error (parameter No. 0465)
0005	Vertical parity or framing error detected
0257	Transmission time-out error (parameter No. 0466)
0258	ROM parity error
0259	Overrun error detected
Others	CPU interrupt detected

(13) System alarms

(These alarms cannot be reset with reset key.)

Number	Meaning	Contents and remedy
910	MAIN RAM PARITY	This RAM parity error is related to low-order bytes. Replace the memory PC board.
911	MAIN RAM PARITY	This RAM parity error is related to high-order bytes. Replace the memory PC board.
912	SHARED RAM PARITY	This parity error is related to low-order bytes of RAM shared with the digital servo circuit. Replace the axis control PC board.
913	SHARED RAM PARITY	This parity error is related to high-order bytes of RAM shared with the digital servo circuit. Replace the axis control PC board.
914	SERVO RAM PARITY	This is a local RAM parity error in the digital servo circuit. Replace the axis control PC board.
915	LADDER EDITING CASSETTE RAM PARITY	This RAM parity error is related to low-order bytes of the ladder editing cassette. Replace the ladder editing cassette.
916	LADDER EDITING CASSETTE RAM PARITY	This RAM parity error is related to high-order bytes of the ladder editing cassette. Replace the ladder editing cassette.
920	WATCHDOG ALARM	This is a watchdog timer alarm or a servo system alarm for axis 1 to 4. Replace the master or axis control PC board.
921	SUB CPU WATCHDOG ALARM	This is a watchdog timer alarm related to the sub-CPU board or a servo system alarm for axis 5 or 6. Replace the sub-CPU board or the axis-5/6 control PC board.
922	7/8 AXIS SERVO SYSTEM ALARM	This is a servo system alarm related to axis 7 or 8. Replace the axis-7/8 control PC board.
930	CPU ERROR	This is a CPU error. Replace the master PC board.
940	PC BOARD INSTALLATION ERROR	PC board installation is incorrect. Check the specification of the PC board.
941	MEMORY PC BOARD CONNECTION ERROR	The memory PC board is not connected securely. Ensure that the PC board is connected securely.
945	SERIAL SPINDLE COMMUNICATION ERROR	The hardware configuration is incorrect for the serial spindle, or a communication alarm occurred. Check the hardware configuration of the spindle. Also ensure that the hardware for the serial spindle is connected securely.
946	SECOND SERIAL SPINDLE COMMUNICATION ERROR	Communication is impossible with the second serial spindle. Ensure that the second serial spindle is connected securely.
950	FUSE BLOWN ALARM	A fuse has blown. Replace the fuse (+24E; F14).
960	SUB CPU ERROR	This is a sub-CPU error. Replace the sub-CPU PC board.
998	ROM PARITY	This is a ROM parity error. Replace the ROM board in which the error occurred.

(14) External alarm

Number	Meaning	Contents and remedy
1000	EXTERNAL ALARM	This alarm was detected by the PMC ladder program. Refer to the relevant manual from the machine builder for details.

B LIST OF MAINTENANCE PARTS

B.1 MAINTENANCE PARTS

Maintenance parts

Consumables here refer to the parts which are not reused after replacement. Rank : AA>A>BB>B>CC>C

Name			Drawing number	Remarks	Rank
Battery unit			A02B-0096-H021		B
Battery for absolute pulse coder			A06B-6050-K060	Battery case	B
			A06B-6050-K061	Battery (4 pcs.)	A
Fuse	F11, F12	For A, B2	A60L-0001-0194#5.0	200VAC for input power supply (5A)	B
		For AI	A60L-0001-0245#GP75	200VAC for input power supply (5A)	B
	F13	Common	A60L-0001-0075#3.2	P.C.B. CRT/MDI (3.2A)	B
	F14	For A, AI	A60L-0001-0046#5.0	Machine side + 24E line (5A)	B
		For B2	A60L-0001-0046#7.5	Machine side + 24E line (7.5A)	B
	F51	For I/O B2	A60L-0001-0046#1.6	Machine side + 24E line (1.6A)	B
	F1, F2	For input unit	A60L-0001-0901#P4100H	200VAC for input power supply (10A)	B
	F3		A60L-0001-0172#DM03	Power ON/OFF circuit (0.3A)	B
	F1	Qualifying for CE marking AI power	A60L-0001-0245#GP75	7.5A	B
	F3		A60L-0001-0075#5.0	5A	B
	F4		A60L-0001-0046#5.0	5AS	B
9″ CRT/MDI 9″ EL/MDI	Small keyboard		A86L-0001-0125		B
	Full keyboard		A86L-0001-0137		B
	Soft keyboard		A20B-1001-0720		B
	Small keysheet (M series)		A98L-0001-0518#M	Standard	B
			A98L-0001-0518#MR	Qualifying for CE marking (English)	B
			A98L-0001-0518#MB	Qualifying for CE marking (Symbolic)	B
	Full keysheet (M series)		A98L-0001-0568#M	Standard	B
			A98L-0001-0568#MR	Qualifying for CE marking (English)	B
			A98L-0001-0568#MB	Qualifying for CE marking (Symbolic)	B
	Small keysheet (T series)		A98L-0001-0518#T	Standard	B
			A98L-0001-0518#TR	Qualifying for CE marking (English)	B
			A98L-0001-0518#TB	Qualifying for CE marking (Symbolic)	B

Name		Drawing number	Remarks	Rank
9″ CRT/MDI 9″ EL/MDI	Full keysheet (T series)	A98L-0001-0568#T	Standard	B
		A98L-0001-0568#TR	Qualifying for CE marking (English)	B
		A98L-0001-0568#TB	Qualifying for CE marking (Symbolic)	B
	CRT soft keysheet	A98L-0001-0629		B
	EL soft keysheet	A98L-0001-0660	PDP soft keysheet is same.	B
	9″ monochrome CRT	A13B-0057-C001		B
	9″ color CRT	A61L-0001-0090		B
	9″ EL	A61L-0001-0114		B
9″ PDP unit	Soft keyboard	A20B-1001-0722	Qualifying for CE marking	B
	9″ PDP unit	A13B-0169-C001	Qualifying for CE marking	B
7.2″ LCD unit	7.2″ LCD	A61L-0001-0142		B
	LCD control P.C.B.	A20B-2002-0130		B
	Soft keyboard	A20B-1001-0723		B
	Soft keysheet	A98L-0001-0660#A		B
8.4″ LCD unit	8.4″ color LCD panel	A61L-0001-0162	For A02B-0098-C088, -C089	B
	8.4″ color LCD panel	A61L-0001-0139	For A02B-0098-C098, -C099	B
	LCD control P.C.B.	A16B-2300-0200	For A02B-0098-C088, -C089	B
	LCD control P.C.B.	AA16B-2300-0140	For A02B-0098-C098, -C099	B
	Soft keyboard	A20B-1006-0720	Seven keys	B
	Soft keysheet	A20B-1006-0730	Twelve keys	B
14″ CRT/MDI	Keyboard	A86L-0001-0138		B
	Soft keyboard	A20B-1002-0320		B
	Keysheet (M series)	A98L-0001-0569#M	Standard	B
		A98L-0001-0569#MR	Qualifying for CE marking (English)	B
	Keysheet (T series)	A98L-0001-0569#T		B
		A98L-0001-0569#TR	Qualifying for CE marking (English)	B
	Soft keysheet	A98L-0001-0630		B
	14″ color CRT	A61L-0001-0094		B
MMC unit	Main CPU	A20B-1002-0700		B
	Sub CPU	A20B-1002-0710		B
	Back panel	A20B-1001-0920		B
	ROM file 512KB	A20B-1001-0860		B
	ROM file 1MB	A20B-1001-0870 A20B-1001-0871		B
	ROM file 2MB	A20B-1001-0340 A20B-1001-0341		B

Name			Drawing number	Remarks	Rank
MMC unit	RAM file 128KB		A20B-1001-0880		B
	RAM file 256KB		A20B-1001-0881		B
	RAM file 512KB		A20B-1001-0882		B
	Bubble memory 512KB		A20B-1001-0911		B
	Bubble memory1MB		A20B-1001-0910		B
	Keyboard		A86L-0001-0130		B
	Soft keyboard		A20B-1002-0350		B
	Keysheet		A98L-0001-0555#A		B
	Power supply unit		A20B-1001-0930		B
	14″ color CRT		A61L-0001-00074#A		B
Standard machine operator's panel	Control P.C.B.		A16B-1310-0380	I/O card I/O-C5, C6, C7	B
			A16B-2300-0110	I/O-E1, E2, E3 (Qualifying for CE marking)	B
	Small keyboard	M series	A86L-0001-0126		B
		T series	A86L-0001-0127		B
	Full keyboard		A98L-0001-0151	Common	B
	Small keysheet (M series)		A98L-0001-0524#A	Standard	B
			A98L-0001-0524#MB	Qualifying for CE marking (Symbolic)	B
	Full keysheet (M series)		A98L-0001-0633#M	Standard	B
			A98L-0001-0633#MB	Qualifying for CE marking (Symbolic)	B
	Small keysheet (T series)		A98L-0001-0524#B	Standard	B
			A98L-0001-0524#TB	Qualifying for CE marking (Symbolic)	B
	Full keysheet (T series)		A98L-0001-0633#T	Standard	B
			A98L-0001-0633#TB	Qualifying for CE marking (Symbolic)	B
Power supply unit	A		A16B-1211-0850		B
	AI		A16B-1212-0100		B
	B2		A16B-1212-0110		B
	C3		A16B-1211-0890		B
	Qualifying for CE marking		A16B-1212-0950		B
P.C.B. for input unit			A16B-1600-0090		B
Master P.C.B.	0-C 16bit	Control unit A	A16B-1002-0360		B
	0-C 16bit	Control unit B	A20B-1003-0750		B
	0-Mate C		A20B-1003-0760		B
	0-C 32bit	Control unit A	A20B-2000-0170		B

Name			Drawing number	Remarks	Rank
Master P.C.B.	0-C 32bit	Control unit A	A20B-2000-0175 A20B-2002-0650	High-speed CPU is mounted.	B
	0-C 32bit	Control unit B	A20B-2000-0180	For 0-C, 00-L, 00-LC	B
	0-Mate C		A20B-2000-0480 A20B-2000-0450		B
	0-C 32bit	Control unit B	A20B-2000-0490	For 00-PC	B
	0-C 32bit	Control unit B	A20B-2000-0500	For 0-LE-B4	B
	0-C 32bit	Control unit B	A20B-2001-0060		B
	0-C 32bit	Control unit B	A20B-2001-0065	High-speed CPU is mounted.	B
	0-C 32bit	Control unit B	A20B-2001-0110	For 0-LC	B
	0-D		A20B-2001-0120		B
Memory P.C.B.	For analog spindle		A16B-1212-0210 A16B-2201-0103		B
	For serial spindle		A16B-1212-0215 A16B-1212-0216 A16B-2201-0101	SIC1 SIC2	B
I/O P.C.B.	C5		A16B-1212-0222 A16B-2203-0112	DI/ DO=40/40	B
	C6		A16B-1212-0221 A16B-2203-0111	DI/ DO=80/56	B
	C7		A16B-1212-0220 A16B-2203-0110	DI/ DO=104/72	B
	D6		A16B-1211-0946	For turn key, DI/DO=80/ 52	B
	D7		A16B-1211-0945	For turn key, DI/DO=104/ 72	B
	E1		A16B-1211-0972	DO common output, corresponding I/O-C5	B
	E2		A16B-1211-0971	DO common output, corresponding I/O-C6	B
	E3		A16B-1211-0970	DO common output, corresponding I/O-C7	B
Additional I/O P.C.B.	B2		A20B-1001-0731	DI/DO=104/72	B
	B3 (I/O-Link)		A20B-1004-0500	DI/DO=104/72	B
	F1		A20B-1002-0310	DO common output, corresponding I/O-B2	B
	F3 (I/O-Link)		A20B-2001-0880	DO common output, corresponding I/O-B3	B
	F4 (I/O-Link)		A20B-2001-0881	DO common output, DI/DO=64/32	B
Operator's panel connection unit C1			A16B-2201-0050	I/O-Link DI/DO=96/64	B
Axis P.C.B.	16bit 0-C and 0-Mate C		A16B-2200-0221	1/2 axes	B
	For phase A/B pulse coder		A16B-2200-0220	3/4 axes	B
			A16B-2200-0330	5/6 axes	B

Name			Drawing number	Remarks	Rank
Axis P.C.B.	32bit 0-C		A16B-2200-0361	1/2 axes	B
	For phase A/B pulse coder		A16B-2200-0360	3/4 axes	B
			A16B-2200-0371	5 axes	B
			A16B-2200-0370	5/6 axes	B
			A16B-2200-0381	7 axes	B
			A16B-2200-0380	7/8 axes	B
	32bit 0-C		A16B-2200-0391	1/2 axes	B
	For serial pulse coder		A16B-2200-0390	3/4 axes	B
			A16B-2200-0800	5/6 axes	B
			A16B-2200-0791	7 axes	B
			A16B-2200-0790	7/8 axes	B
	32bit 0-C		A16B-2203-0021	1/2 axes	B
	For serial pulse coder type B		A16B-2203-0020	3/4 axes	B
Graphic card	For 9″ low-resolution CRT		A16B-1211-0340		B
	For 14″ CRT		A16B-1211-0920		B
	For 14″ /9″ high-resolution CRT		A16B-2200-0350		B
Manual pulse interface			A16B-1210-0801	For two or three manual pulse generators	B
PMC-M	Electric interface		A16B-1211-0901	ROM board	B
			A16B-1211-0907	RAM board for debugging	B
	Optical interface		A16B-1211-0903	ROM board	B
			A16B-1211-0909	RAM board for debugging	B
	I/O-Link	MASTER	A16B-2200-0341	ROM board	B
			A16B-2200-0346	RAM board for debugging	B
		MASTER & SLAVE	A16B-2200-0340	ROM board	B
			A16B-2200-0345	RAM board for debugging	B
Series 00-C CRT/MDI adapter	Without PMC-M		A02B-0086-C051 ├ A16B-1211-0904 └ A16B-1211-0910		B
	With PMC-M	Electric interface	A02B-0086-C052 ├ A16B-1211-0900 └ A16B-1211-0910	ROM board	B
			A02B-0086-C053 ├ A16B-1211-0906 └ A16B-1211-0910	RAM board for debugging	B
		Optical interface	A02B-0086-C055 ├ A16B-1211-0902 └ A16B-1211-0910	ROM board	B
			A02B-0086-C056 ├ A16B-1211-0908 └ A16B-1211-0910	ROM board	B

Name			Drawing number	Remarks	Rank
Macro cassette	64 KB		A02B-0091-C111 └── A20B-1001-0801	Drawing number of order made macro cassette is A02B-0091-C110.	B
	128 KB		A02B-0091-C113 └── A20B-1002-0301	Drawing number of order made macro cassette is A02B-0091-C112.	B
	256 KB		A02B-0091-C115 └── A20B-1002-0330	Drawing number of order made macro cassette is A02B-0091-C114.	B
	512 KB		A02B-0091-C117 └── A20B-1002-0331	Drawing number of order made macro cassette is A02B-0091-C116.	B
	1 MB		A02B-0091-C119 └── A20B-1004-0450	Drawing number of order made macro cassette is A02B-0091-C1108.	B
Sub CPU			A16B-2200-0320	Standard	B
			A16B-2201-0120	For 0-TTC	B
DNC1 card	16bit 0-C and 0-Mate C		A16B-2200-0771		B
	32bit 0-C		A16B-2200-0776		B
DNC2& remote buffer card		16 bit 0-C	A16B-2200-0770		B
		32 bit 0-C	A16B-2200-0775		B
Remote buffer card			A16B-1211-0930		B
Analog interface card			A16B-1211-0961		B
Laser interface card			A16B-1212-0270		B

C CONNECTION OF CRT/MDI UNIT FOR SERIES 00

C.1 INSTALLATION

The installation conditions and method for the CRT/MDI for the Series 00 are basically the same as in 9″ CRT/MDI unis. Therefore, refer to item 3 in the text. Follow this reference material, however, for the following items.

Cautions about heating value

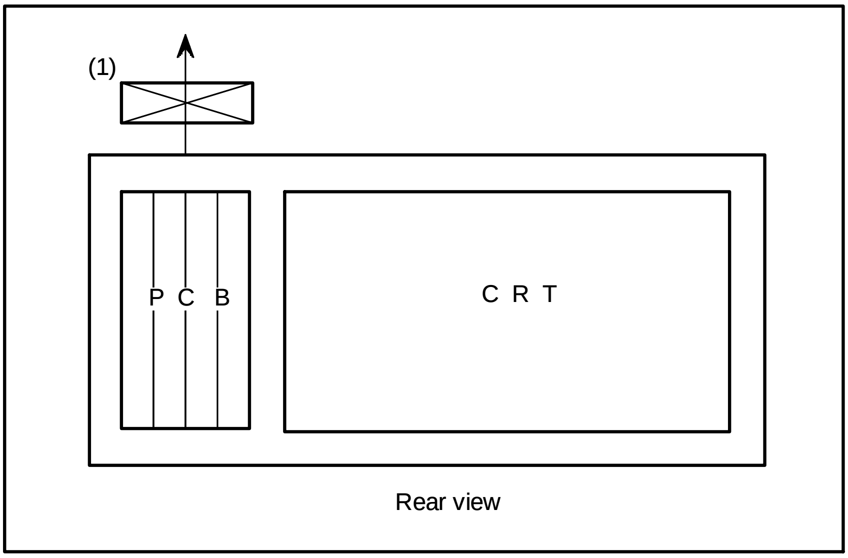
This unit's heating value is about 170 W. The pendant, etc. on which to mount this unit should be designed as follows so that the inside temperature does not rise more than 15_C above the outside temperature.

1) Heat absorber

The conventional 14″ CRT/MDI unit heat absorber has insufficient radiation. A special heat absorber is available for this unit. (It is a little different from the conventional 14″ CRT/MDI unit heat absorber in size.)

2) Air agitation fan in cabinet

An air agitation fan (1) should be installed at the position shown in the figure below so that air flows between the printed circuit boards at 0.5m/sec. (A special fan unit is available.)

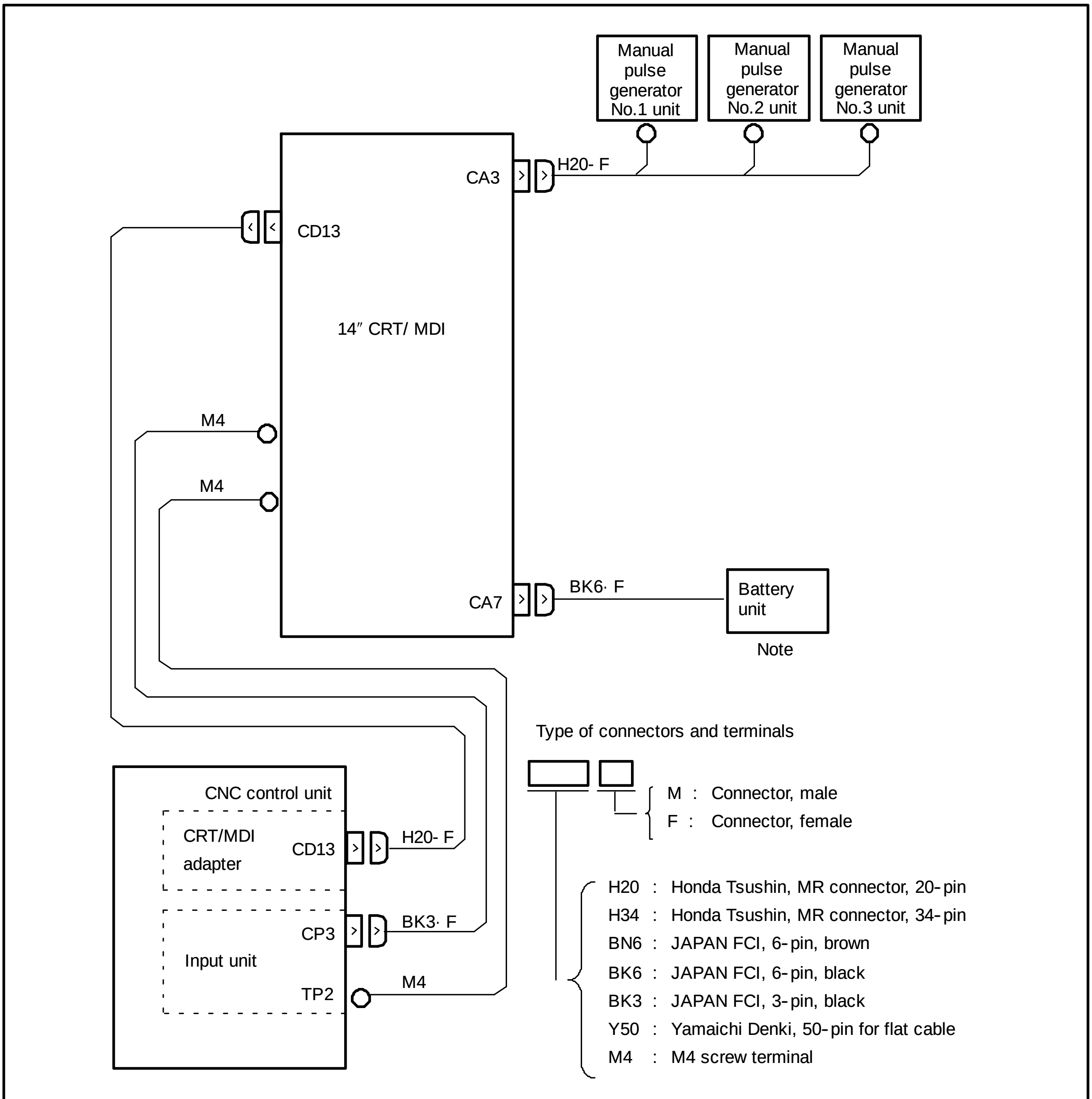


The unit's supporting attachments should be procured.

(See section C.3 for external dimension.)

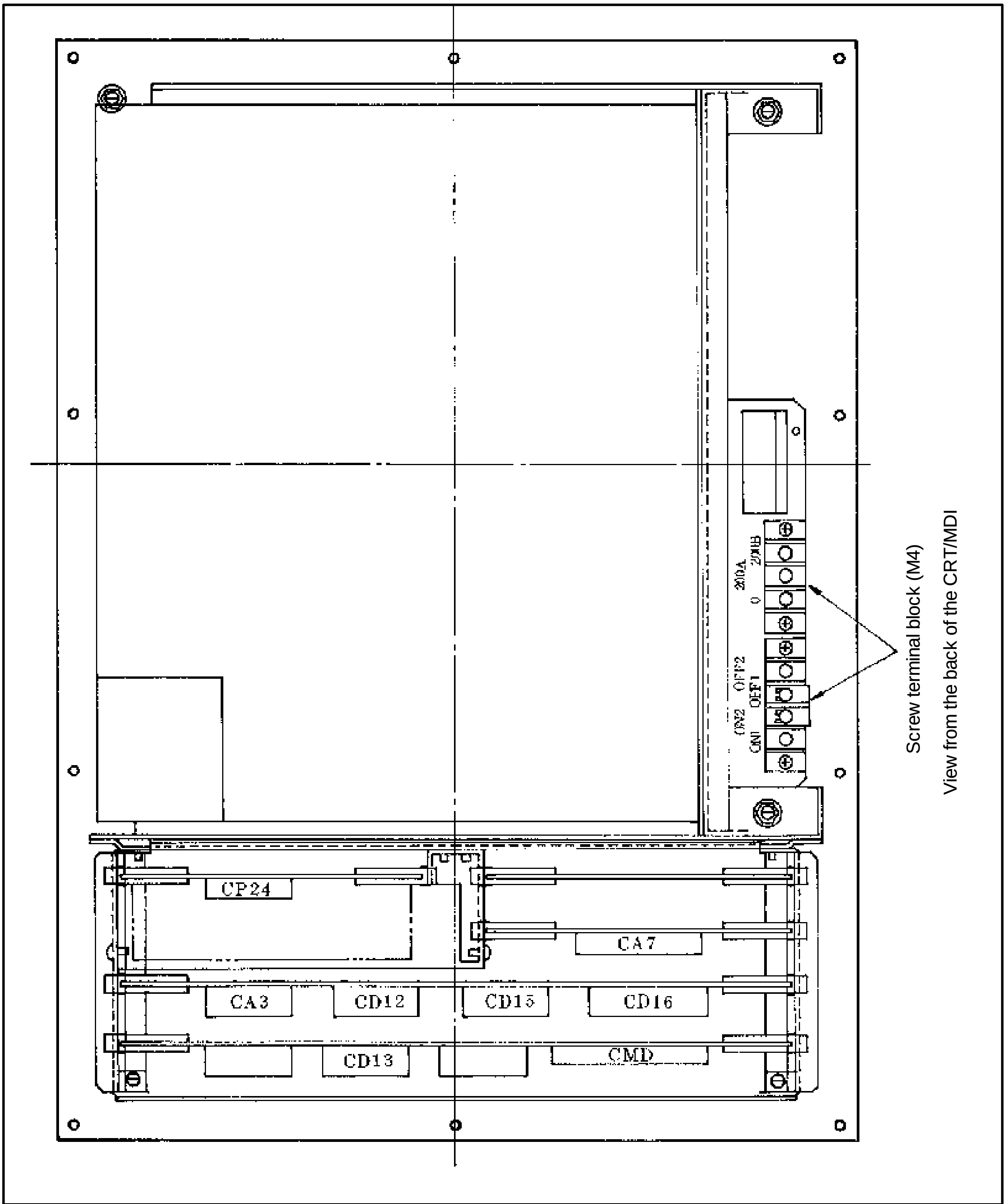
C.2 CONNECTION

C.2.1 General Connection Diagram

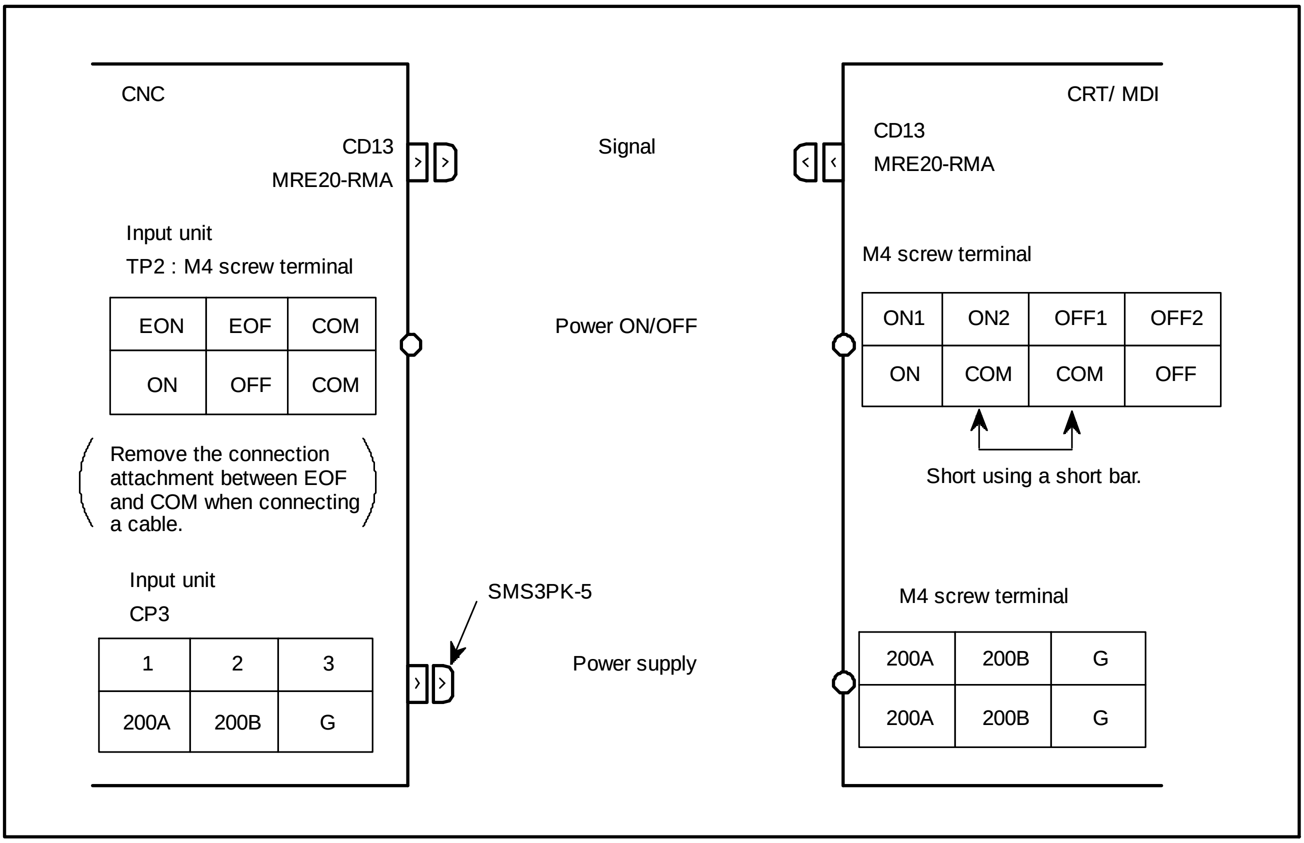


NOTE
Connection with the battery unit is necessary when using RAM file.
Connection with the battery unit on the CNC side is also possible.

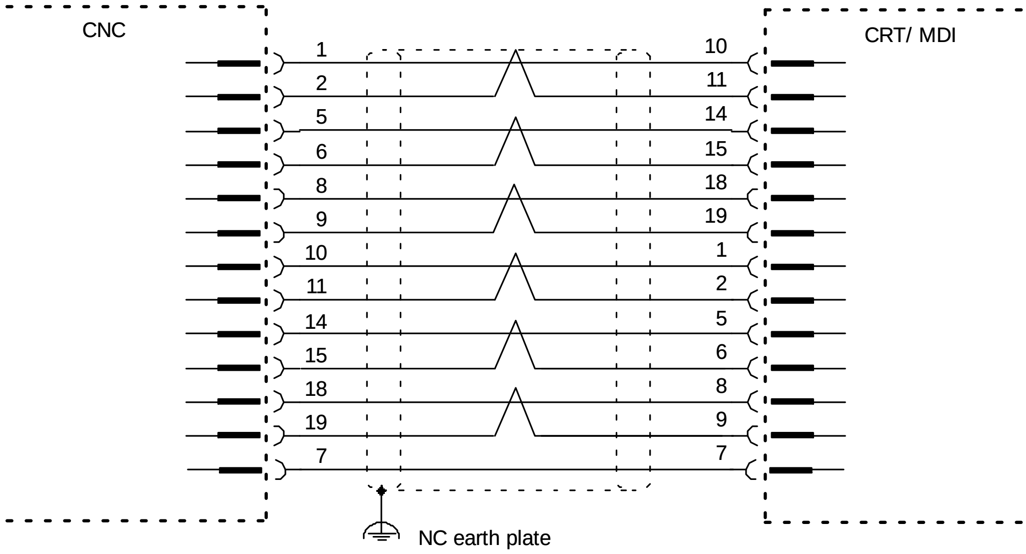
C.2.2 Connector Layout Drawing



C.2.3 Connection of the CNC and the CRT/MDI



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



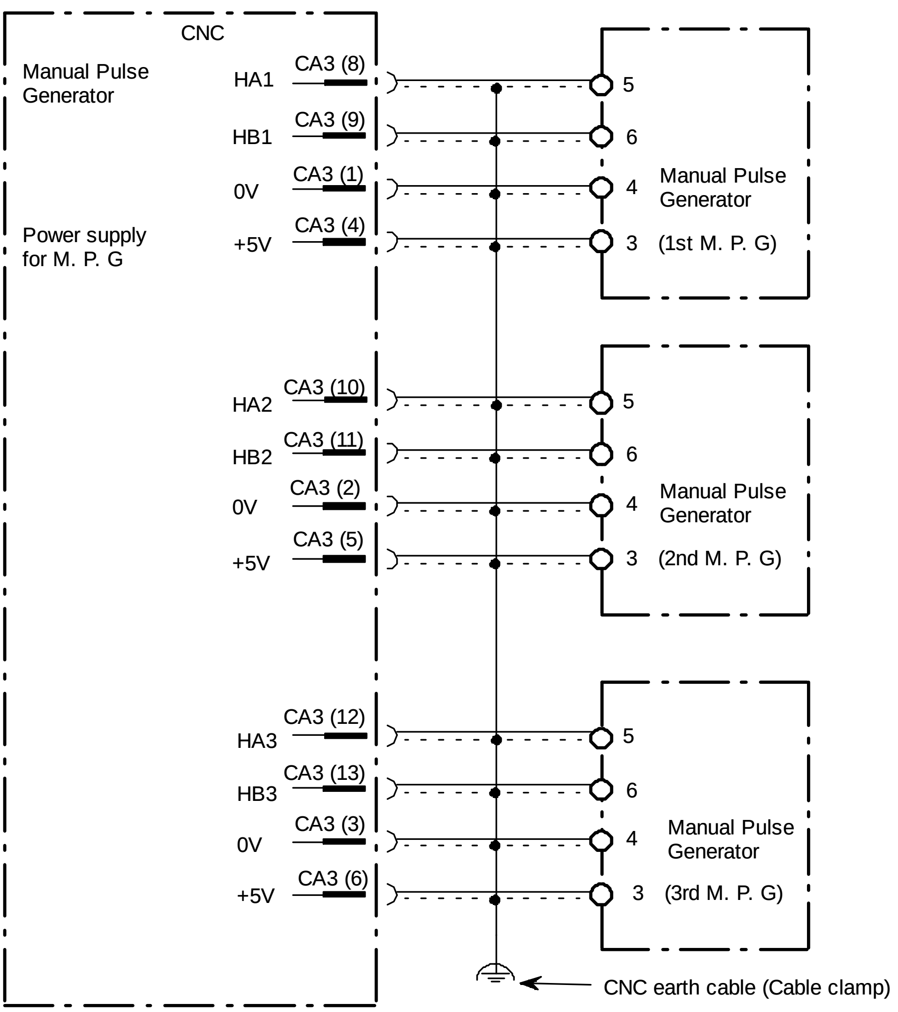
Wiring gauge : 7/0.18 ($0.18mm^2$), twist pairl, entire shielding
Specification : A66L-0001-0041

C.2.4 Connection of the CRT/MDI and Manual Pulse Generators

CA3 MRE20-RMD

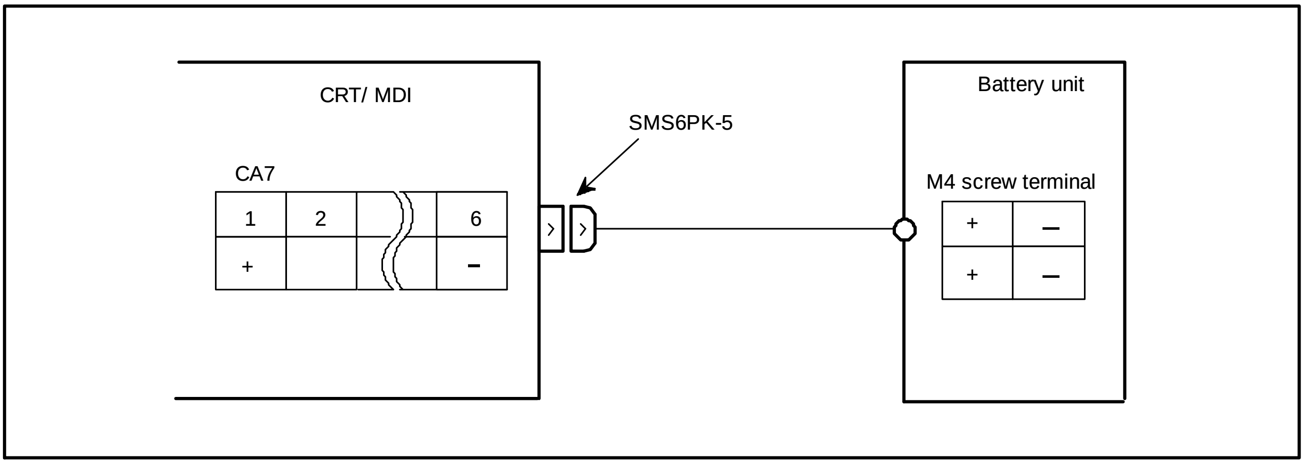
Pin	Signal	Pin	Signal	Pin	Signal
1	0V			14	
2	0V	8	HA1	15	
3	0V	9	HB1	16	
4	+5V	10	HA2	17	
5	+5V	11	HB2	18	
6	+5V	12	HA3	19	
7		13	HB3	20	

Name of signal	Description
HA1 to HA3	Manual pulse generator, Phase A signal
HB1 to HB3	Manual pulse generator, Phase B signal



NOTE
The manual pulse generator's current drain is 95mA per unit. The +5–V and 0–V wire gauges should be decided on so that the two–way voltage drop between the CRT/MDI and the manual pulse generator is not over 0.25V.

C.2.5 Connection of the CRT/MDI and the Battery Unit

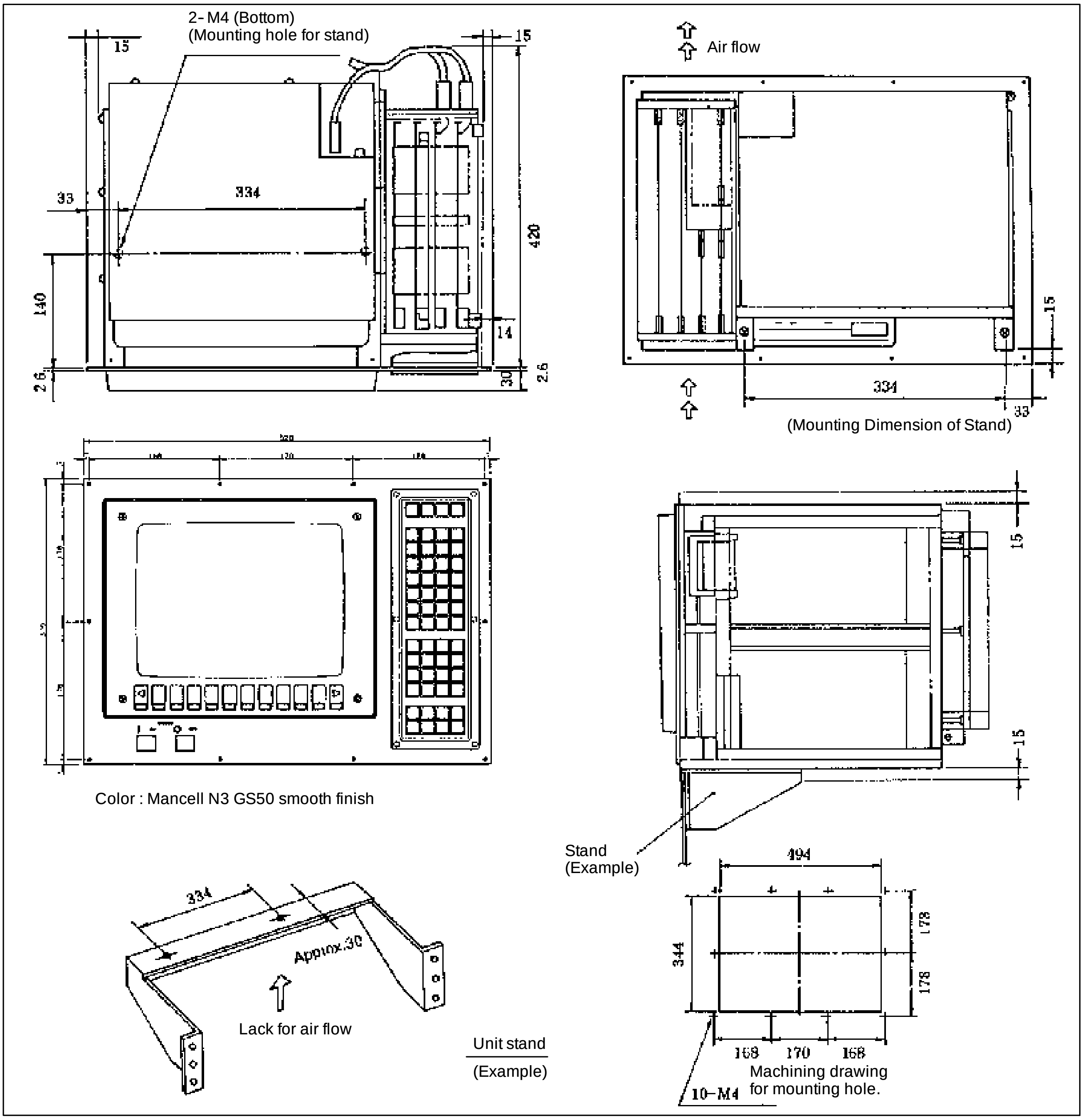


NOTE

1 Connection with the battery unit is necessary only when using RAM file.
2 A cable (3.4m) is attached to the battery unit for CRT/MDI.
3 Connection with the battery unit on the CNC side is also possible. In this case, the cable should be manufactured by the machine tool builder.
Wire gauge : 30/0.18 (0.75mm^2) and over twist pair, shielding
Connector contact : Gold–plated
4 The cable shielding should be shorted to the earth plate.

C.3 OUTER VIEW

C.3.1 Outer View of CRT/MDI Unit



D Notices of mount

> **NOTE**
> 1 The calorific value of this unit is 170 W. Give careful consideration to cooling at design. Specially, air is made flow at section with □ Mark in above drawings.
> 2 Consider the mounting of stand when mounting the unit.

D MASTER PRINTED–CIRCUIT BOARD INCORPORATING A HIGH–SPEED CPU

Overview

The Series 0–C master printed–circuit board incorporates a high–speed CPU for an improved performance.

Target models

FANUC Series 0–TC
FANUC Series 0–TF
FANUC Series 0–TTC
FANUC Series 0–MC
FANUC Series 0–MF
FANUC Series 0–GSC
FANUC Series 0–GCC

Specifications

	Model with high–speed CPU	Conventional model
Control section A	A20B–2000–0175 A20B–2002–0650	A20B–2000–0170
Control section B	A20B–2001–0065	A20B–2001–0060

Compatibility

Hardware / Software	Model with high–speed CPU	Conventional model
Version modified for high–speed CPU	◎	○
Version not modified for high–speed CPU	○	○

◎ : The throughput was improved by employing a high–speed CPU.
○ : Same performance as before

Parameters

In a system with a printed–circuit board incorporating a high–speed CPU and a software version modified for the high–speed CPU, it is possible to forcibly reduce the throughput to the conventional level (usually set to 0). If the A20B–2002–0650 is being used as the master printed circuit board, this parameter must be set to 0.

[T seires]

PRM		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0398					NORMAL			

[M series]

PRM		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0032	NORMAL							

1: The internal processing of the high–speed CPU is not performed at high speed.

0: The internal processing of the high–speed CPU is performed at high speed.

Maintenance parts

For control unit A, any previously shipped master printed circuit board must be replaced only with an identical master printed circuit board, provided as a maintenance part having the drawing number listed below.

Currently used PC board drawing number		Maintenance PC board drawing number
A20B–2000–0170	→	A20B–2000–0170
A20B–2000–0175	→	A20B–2000–0175
A20B–2002–0650	→	A20B–2002–0650

Non–applicable axis printed circuit boards

The following axis printed circuit boards cannot be used with a master printed circuit board having a high–speed CPU:

1/4–axis printed circuit board (dedicated to A/B–phase pulse coder) \
A16B–2200–0360

1/2–axis printed circuit board (dedicated to A/B–phase pulse coder) \
A16B–2200–0361

As substitutes for the above, axis printed circuit boards which can be used with either an A/B–phase pulse coder or serial pulse coder are available:

1/4–axis printed circuit board (also supporting serial pulse coder) \
A16B–2200–0390

1/2–axis printed circuit board (also supporting serial pulse coder) \
A16B–2200–0391

If these boards are used, the digital servo function (software) must be modified accordingly.

Non–applicable software functions

The A20B–2002–0650 master printed circuit board cannot be used with the following models:

FANUC Series 0–MF
FANUC Series 0–TTC
FANUC Series 0–MC with graphic conversation for machining centers

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[A]

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Revision Record

FANUC 0/00/0–Mate MAINTENANCE **MANUAL (B-61395E)**

Edition	Date	Contents	Edition	Date	Contents
05	Aug., '92	– Correction of alarms 4X6 (disconnection alarm) – Addition of signal details – Addition of parameters related to the reader/punch interface – Addition of error codes			
04	Oct., '91	– Correction of troubleshooting			
03	Sep., '89	– Addition of functions for 32 bit. – Correction of error			

02	Jun., '89	– Addition
		  – 0-GC, 00-GC
		– Correction
		  – PARAMETER LIST
		  – ERROR CODE LIST
			07	Nov., '98	– Correction of errors

01	Nov., '88		06	Oct., '97	– Total revision