GE Fanuc Automation

Computer Numerical Control Products

Series 0-TD / 0-GCD
Series 0-MD / 0-GSD

Maintenance Manual

GFZ-62545EN/02 *April 1997*

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 damage 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 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.

WARNING

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 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 or more. 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 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 AND NOTES 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. If 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 2.8 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. If 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 2.8 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.

This manual can be used with the following models. The abbreviated names may be used.

Applicable models

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

Product name	Abbreviations		Series
FANUC Series 0–TD	0–TD	Series 0–D	T series
FANUC Series 0–GCD	0–GCD		
FANUC Series 0–MD	0–MD		M series
FANUC Series 0–GSD	0–GSD		

Manuals related to Series 0–D

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

Table 1 Manuals related to the FANUC Series 0–D

Manuals name	Specification number	
FANUC Series 0–TD/MD/GCD/GSD CONNECTION MANUAL (HARDWARE)	B–62543EN	
FANUC Series 0–TD/MD/GCD/GSD CONNECTION MANUAL (FUNCTION)	B–62543EN–1	
FANUC Series 0–TD/GCD OPERATOR'S MANUAL	B–62544EN	
FANUC Series 0–MD/GSD OPERATOR'S MANUAL	B–62574EN	
FANUC Series 0–TD/MD/GCD/GSD MAINTENANCE MANUAL	B–62545EN	*
FANUC Series 0–TD/GCD PARAMETER MANUAL	B–62550EN	
FANUC Series 0–MD/GSD PARAMETER MANUAL	B–62580EN	

Table of Contents

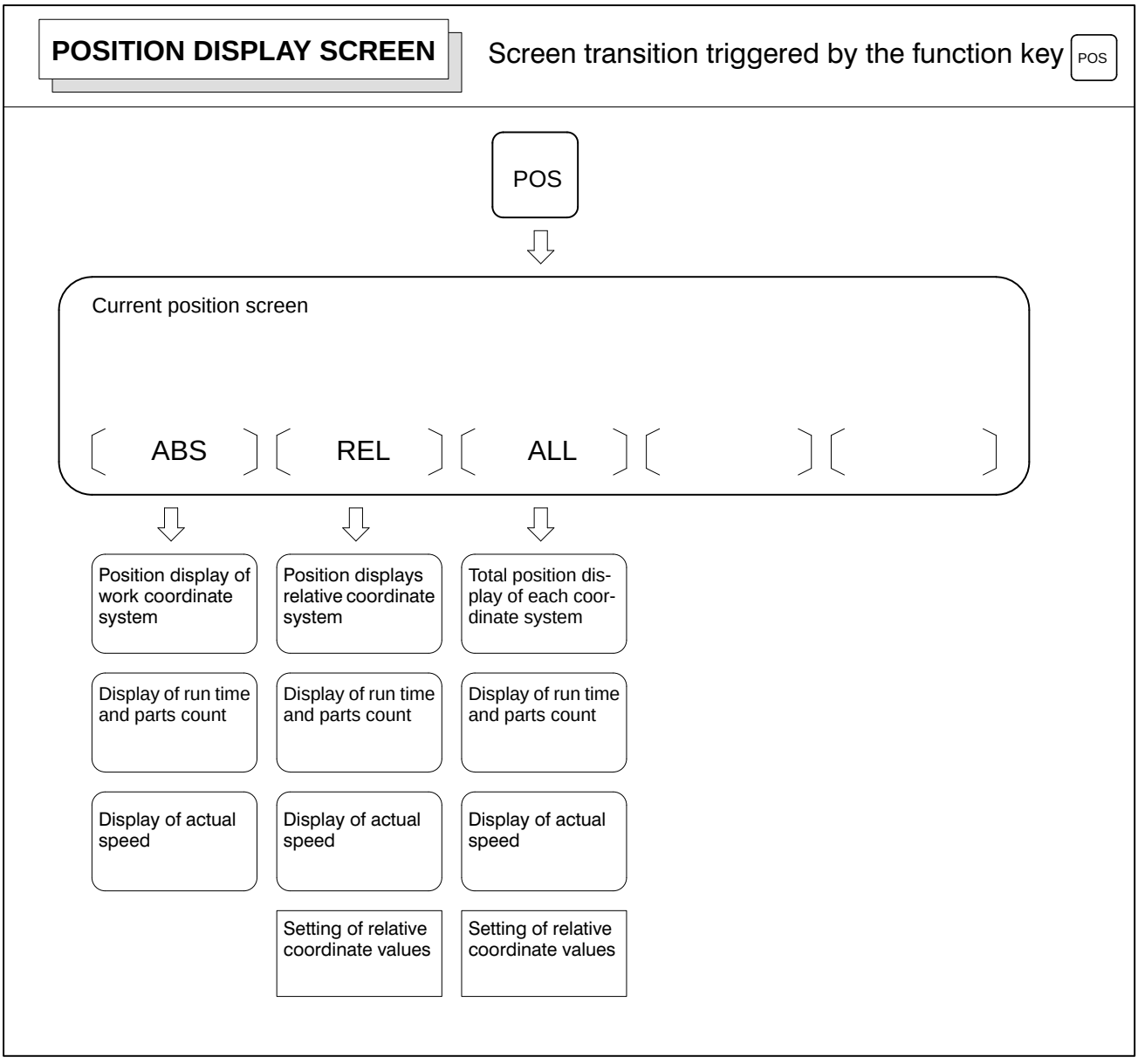
1 DISPLAY AND OPERATION OF CRT/MDI

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

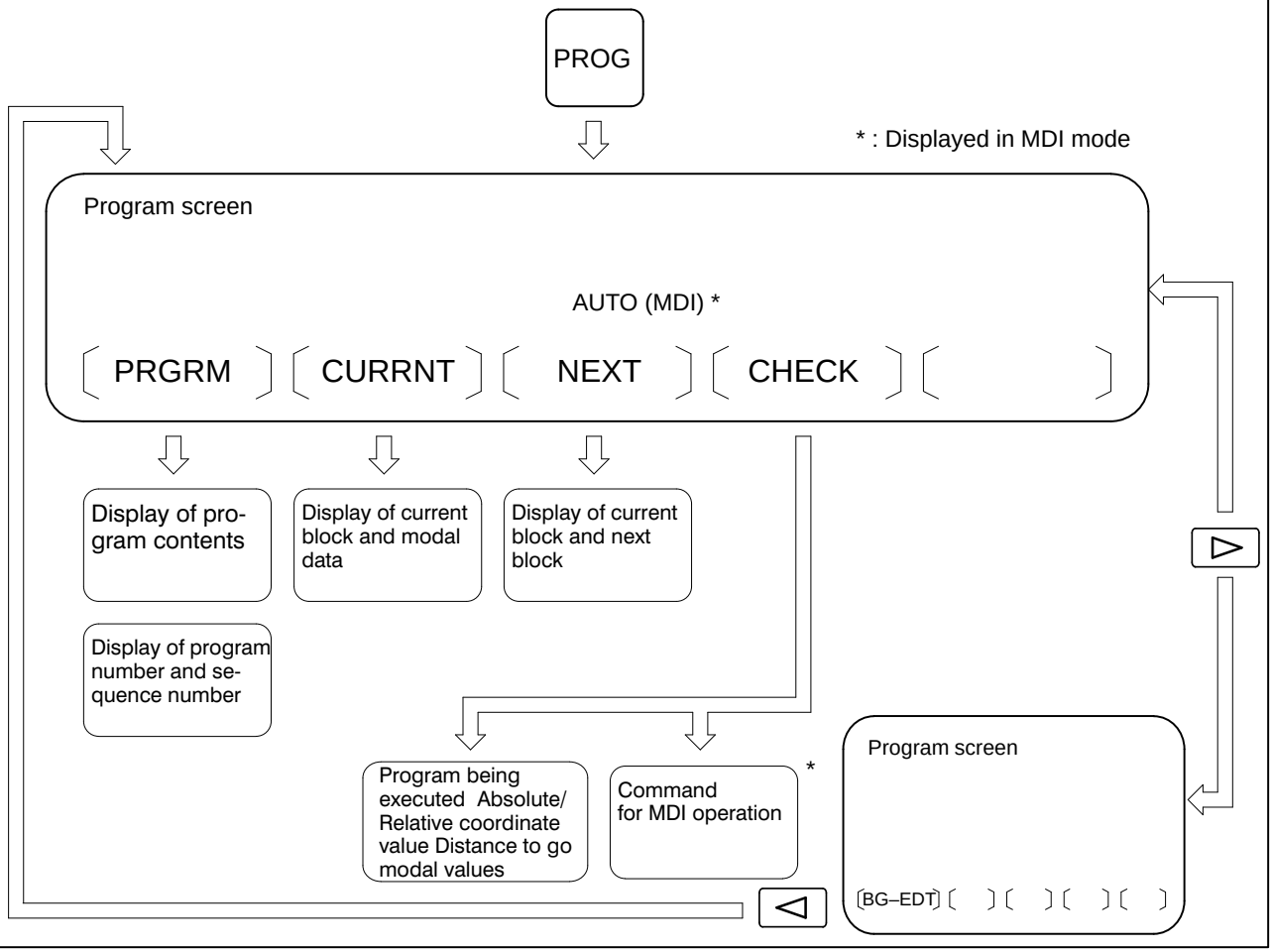
Operations and soft key display status for each function key are described below:

1.1.1 Screen Transition Triggered by The Function Key



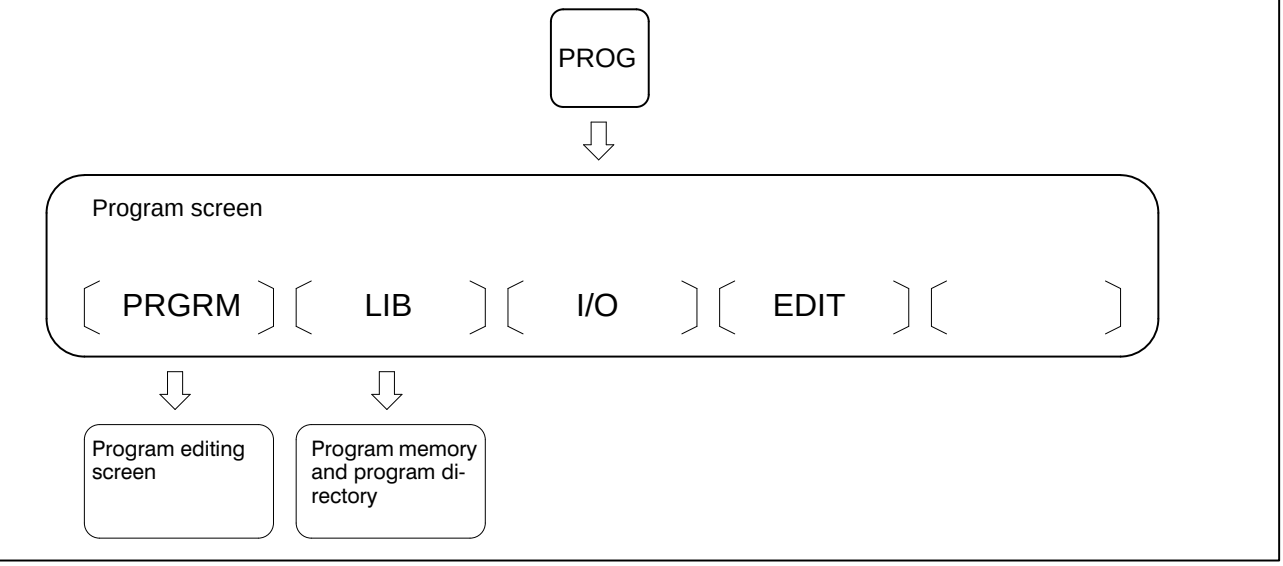
PROGRAM SCREEN

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



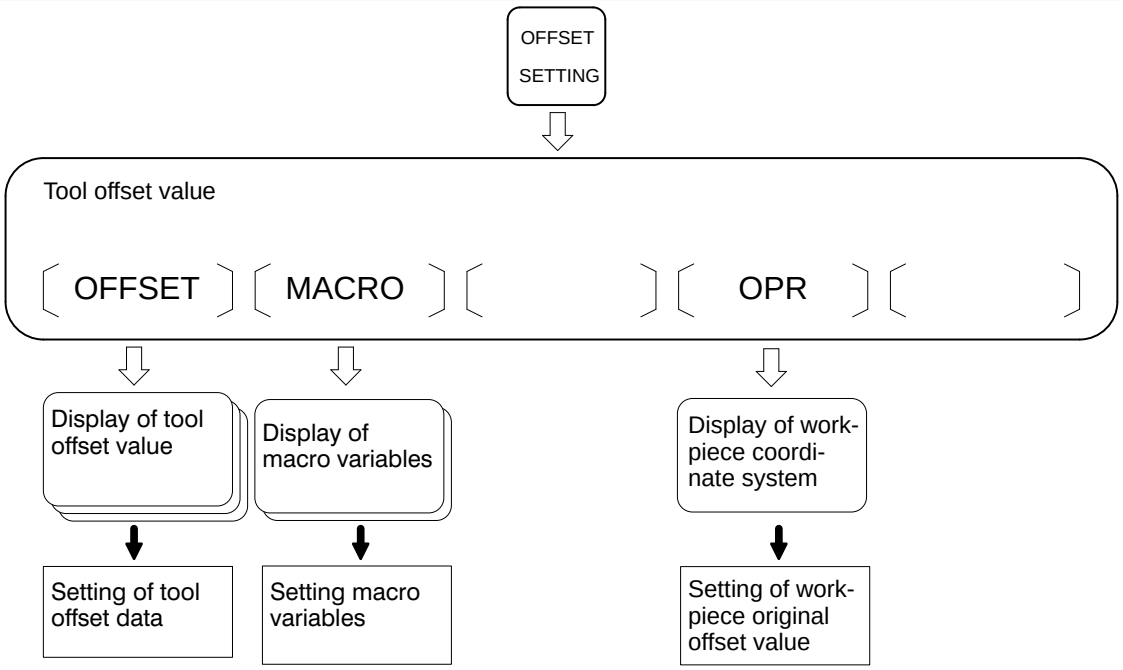
PROGRAM SCREEN

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



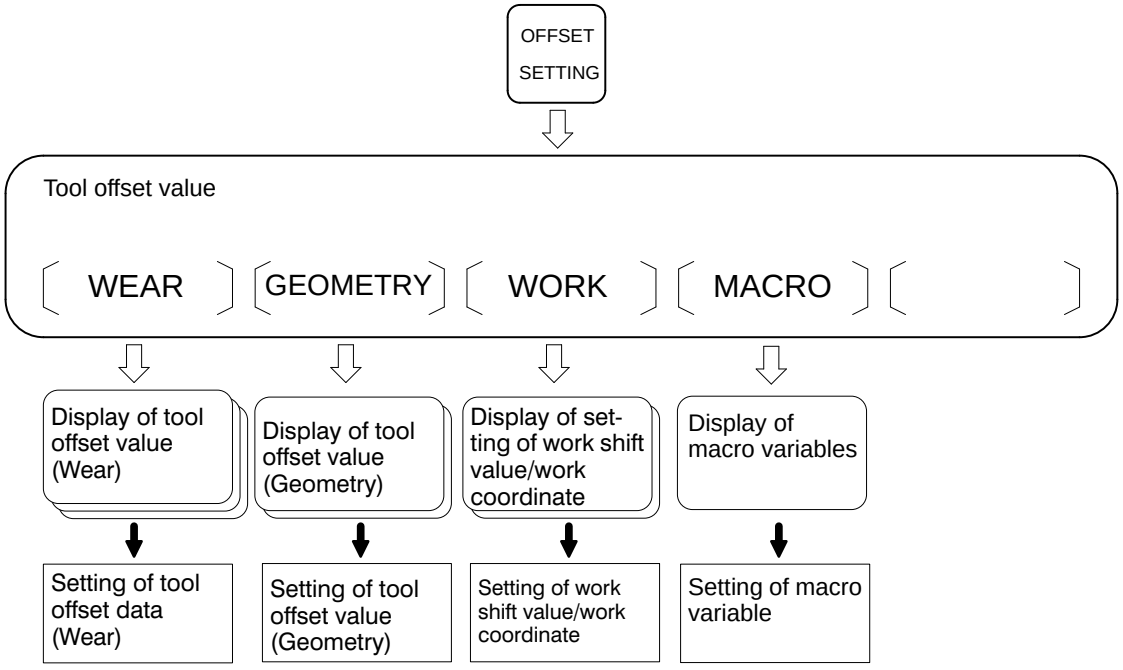
OFFSET/SETTING SCREEN

Screen transition triggered by the function key (Machining Center) 



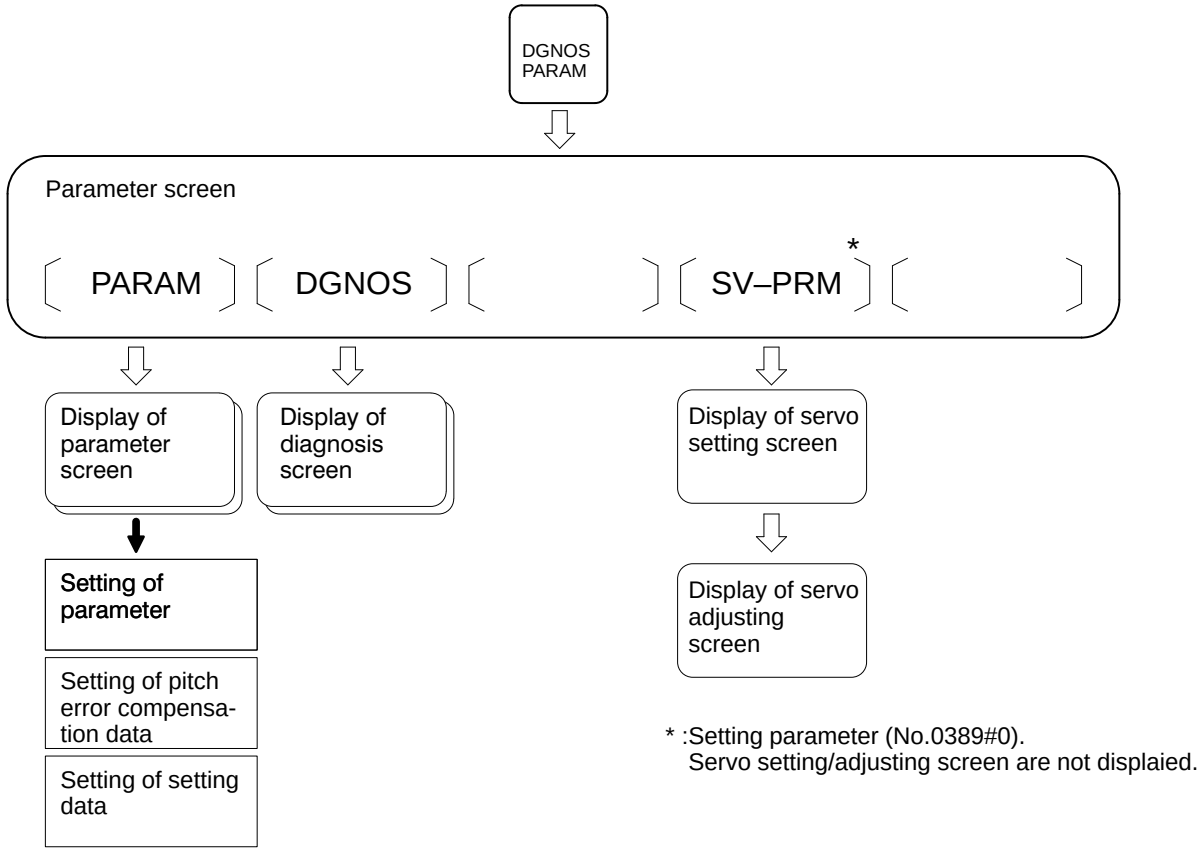
OFFSET/SETTING SCREEN

Screen transition triggered by the function key (Lathe) 



PARAMETER/DIAGNOSIS SCREEN

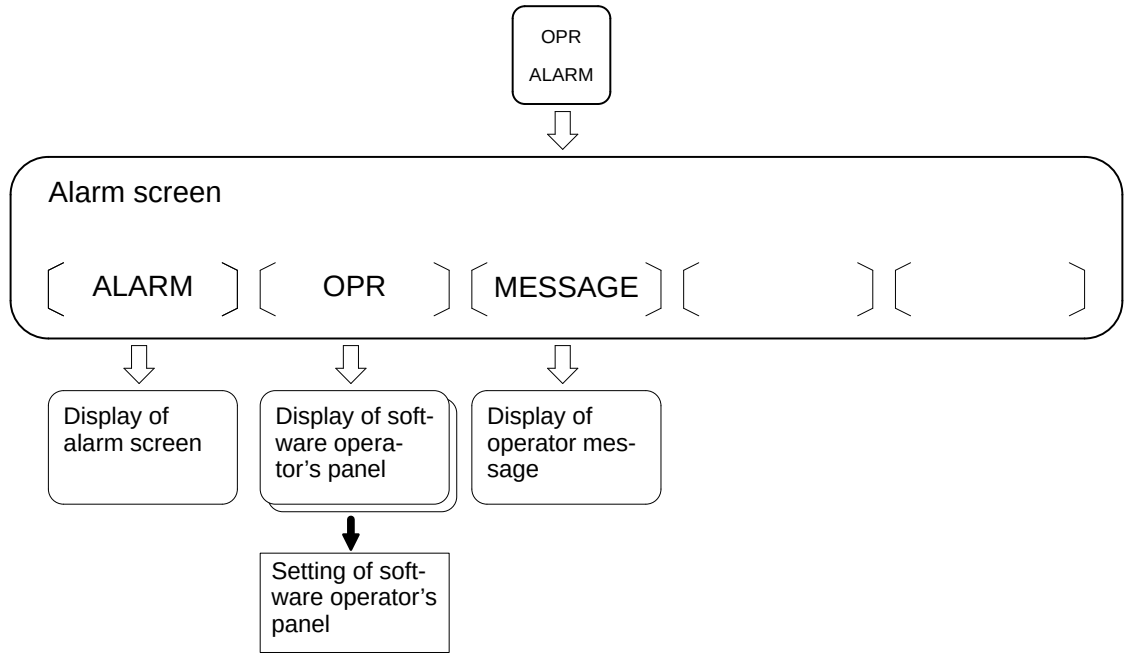
Screen transition triggered by the function key DGNOS PARAM (Lathe)



* :Setting parameter (No.0389#0).
Servo setting/adjusting screen are not displaied.

ALARM SCREEN

Screen transition triggered by the function key OPR ALARM

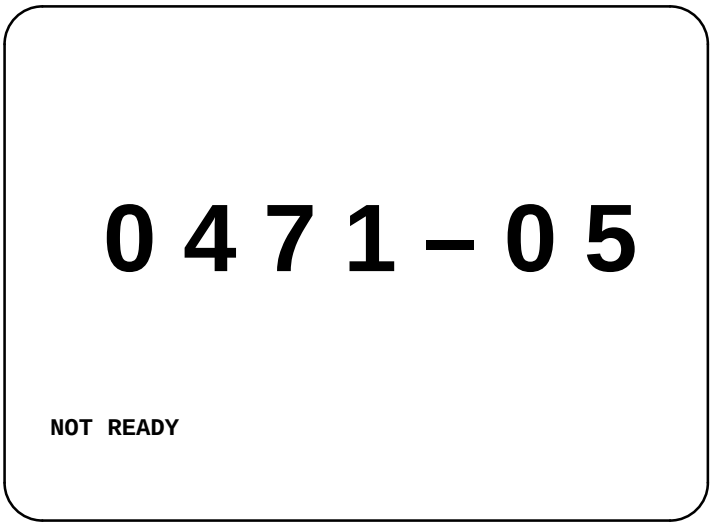


1.2 POWER–ON SCREEN DISPLAY

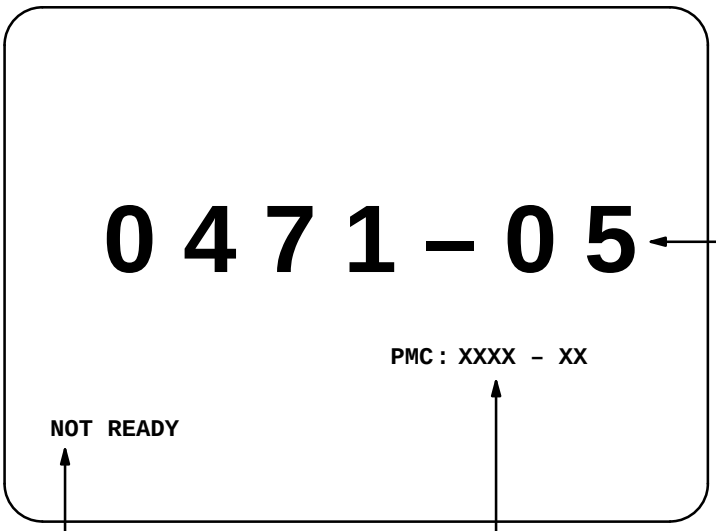
– The CRT screen displays differ slightly between the M and T systems.

– 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.

- **Slot state screen**



⇩ Automatically switched



CNC software edition and version displays, which also appear also on the program list screen

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

Type of other software in use
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 emergency 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 [Diagnosis] 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.

[0–MD and 0–GSD]

PRM 49#0	PRM 08#7	PRM 15#2	PRM 12#1	Signal name	DGN number
1	—	—	—	*±MITX, Y, Z	142.0 to 7
—	1	—	—	*ITX, Y, Z, 4	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)	

[0–TD and 0–GCD]

		#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

ITα 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

#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							

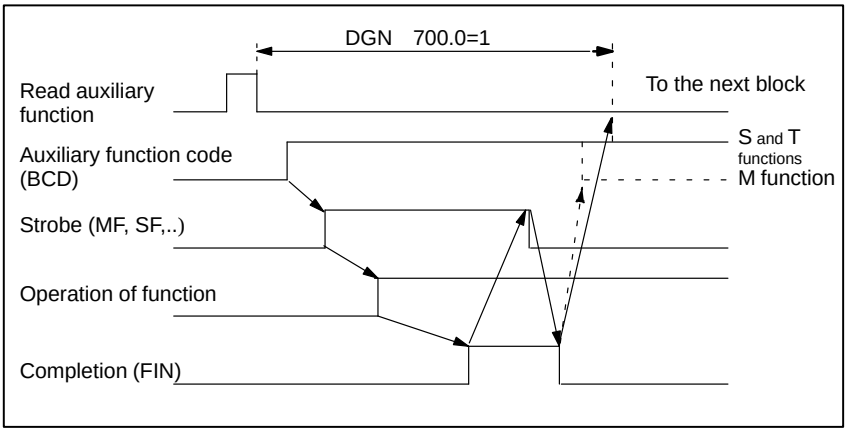
HSIF The M, S, T, and B code processing uses either of the following interfaces.

1 : High–speed interface

0 : Ordinary interface

[Ordinary interface]

- **Operation sequence of auxiliary functions**



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

Strobe signals

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

MF2, MF3 Strobe signal for multiple M functions per block

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

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

[M function]

		#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]

		#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]

		#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]

		#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

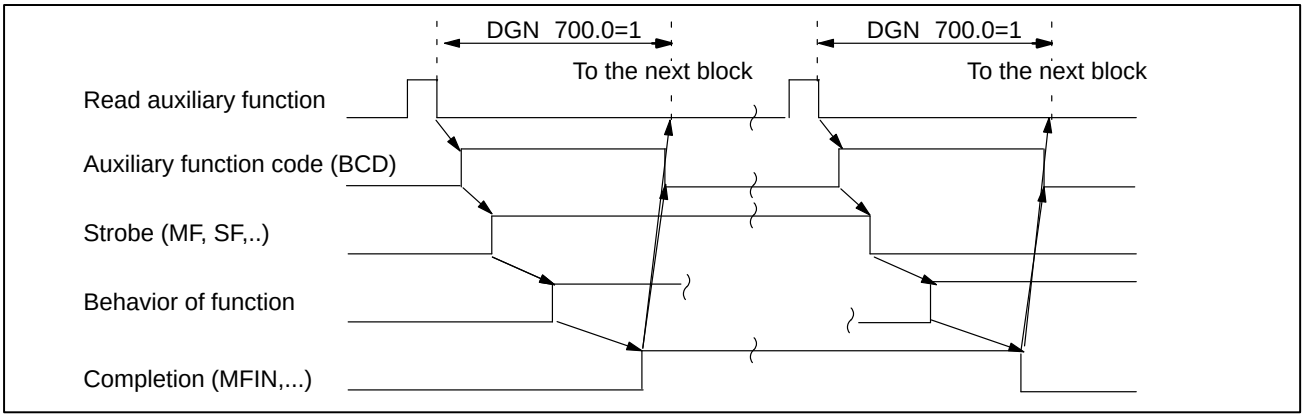
BF2 Strobe signal for the 3 high–order digits of the B code

		#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.

[High–speed interface]

- **Auxiliary–function operation sequences**



		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0150	BF1	BF2			TF	SF		MF
DGN	0115	BFIN1	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.

	#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	

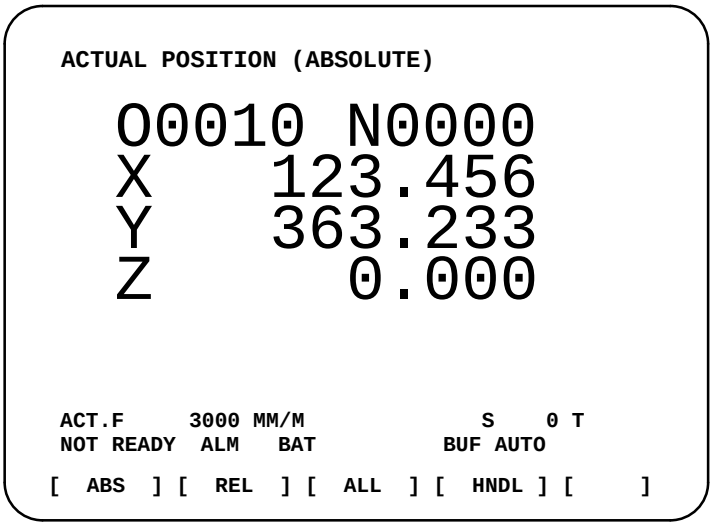
SBK 1 : The single block signal is on.

		#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 above table depending on the processing adopted by the machine tool builder.

1.4 NC STATUS DISPLAYS



(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) Other status displays

Input : Indicates that data is being input.
Output : Indicates that data is being output.
Search : Indicates that a search is being carried out.
Editing : Indicates that some other miscellaneous editing operation (such as insertion or modification) is under way.
Collation : Indicates that a program is being collated.
LSK : Indicates the state of label skipping during data input.
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		○	MDI	SYSTEM (PARAM)	Parameter no.→[NO.SRH]→Data→ INPUT → PWE =0 → RESET
Inputting offset values			–	OFFSET	Offset number→[NO.SRH]→Offset value→ INPUT
Inputting setting data			MDI	OFFSET SETTING	Setting no.→[NO.SRH]Data→ INPUT
Input of PMC parameters	○	○	MDI	SYSTEM (DGNOS)	Setting no.→ DGNOS PARAM →INPUT →Data→ INPUT

Registration from tape

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

Punch out

Function	Data protection key	Parameter write=1	Mode	Function button	Operation
Punch of parameter			EDIT	SYSTEM (PARAM)	OUTPUT
Punch of PMC parameter			EDIT	SYSTEM (DGNOS)	OUTPUT
Punch of offset			EDIT	OFFSET SETTING	OUTPUT
Punch of all programs			EDIT	PROG	O → –999 → OUTPUT
Punch of one program			EDIT	PROG	O →Program no.→ OUTPUT

Search

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

Edit

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

Input/Output with FANUC Cassette

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

Clear

Function	Data protection key	Parameter write=1	Mode	Function key	Operation
Memory all clear			At power ON		RESET AND DELETE
Parameter clear		○	At Power ON		RESET
Clearing a program		○	At Power ON		DELETE

2 HARDWARE

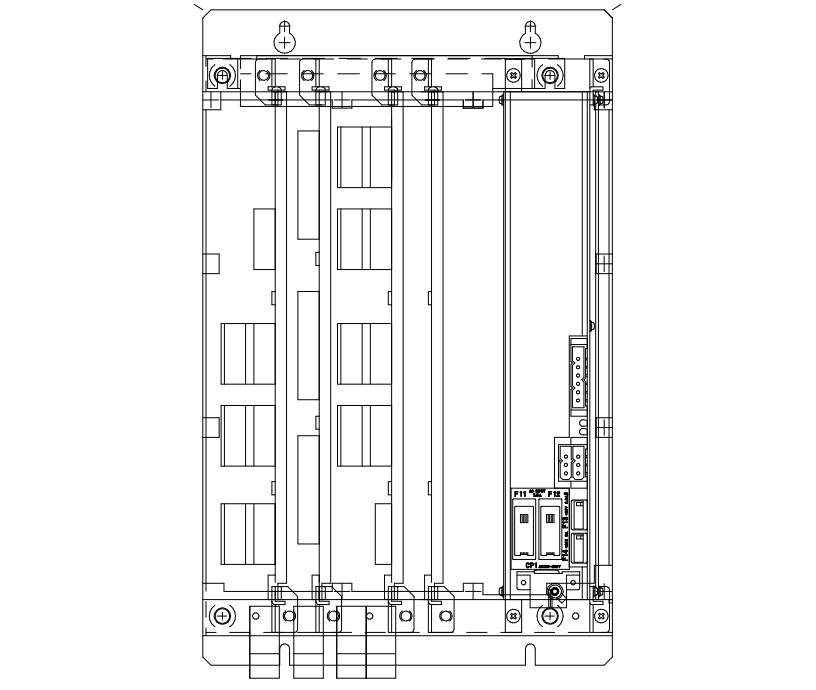
This chapter describes structure of CNC control section, connection of units and the functions of PCBs and modules mounted on PCBs.

2.1 CONTROL UNIT

2.1.1 Configuration of the Control Unit

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

MEM slot	I/O slot	AXE slot	PMC slot	Power supply unit
Memory card	Internal I/O card C6 (TD, GCD) C7 (all) E2 (TD) E3 (TD, MD)	1st to 4th card Type–A (TD, MD) Type–B (All)	PMC–M Package 3 of TD and MD can use	Power supply unit AI (All) CE marking AI (TD, MD)



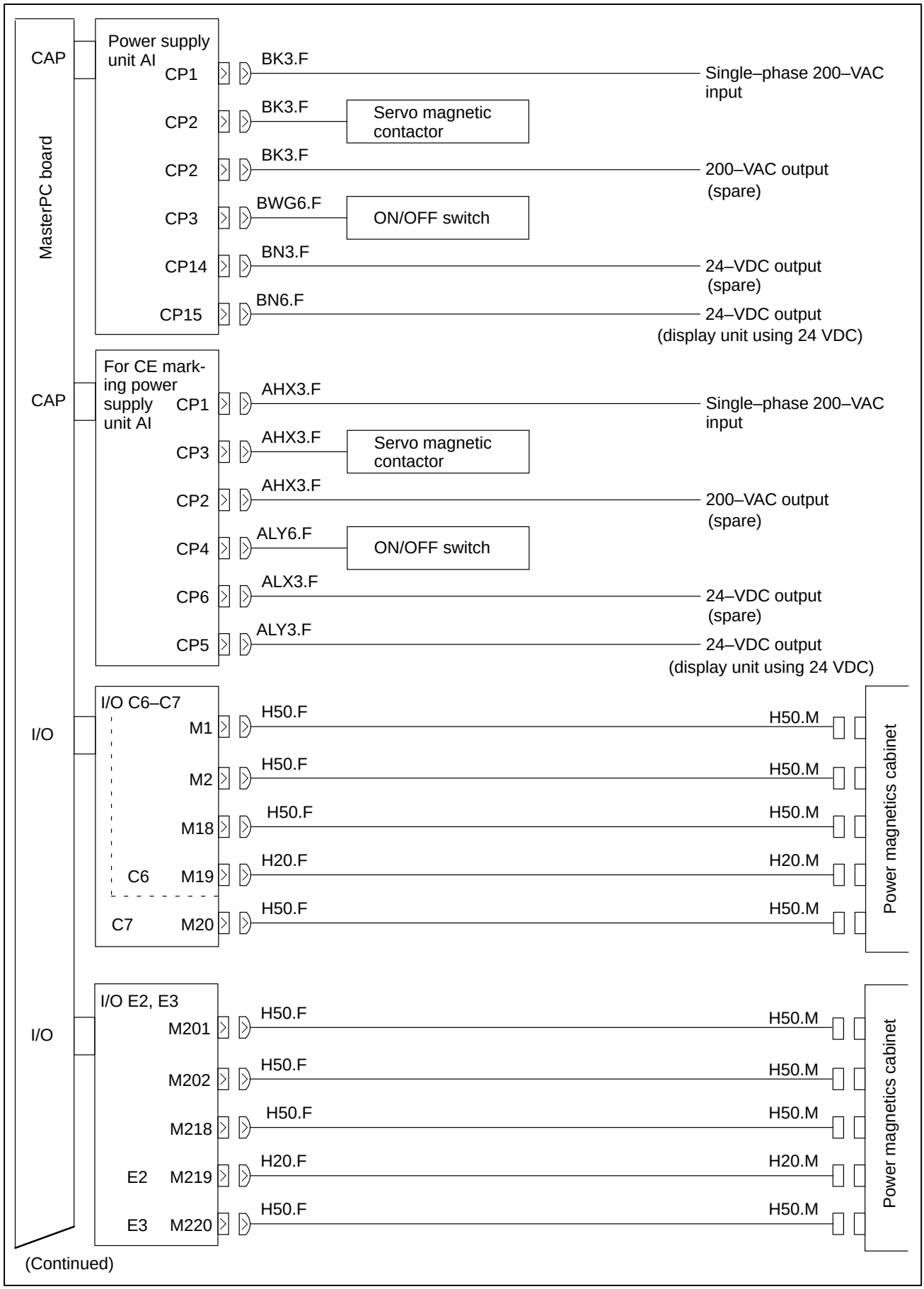
NOTE
Connection position of this figure are depended on each printed board.

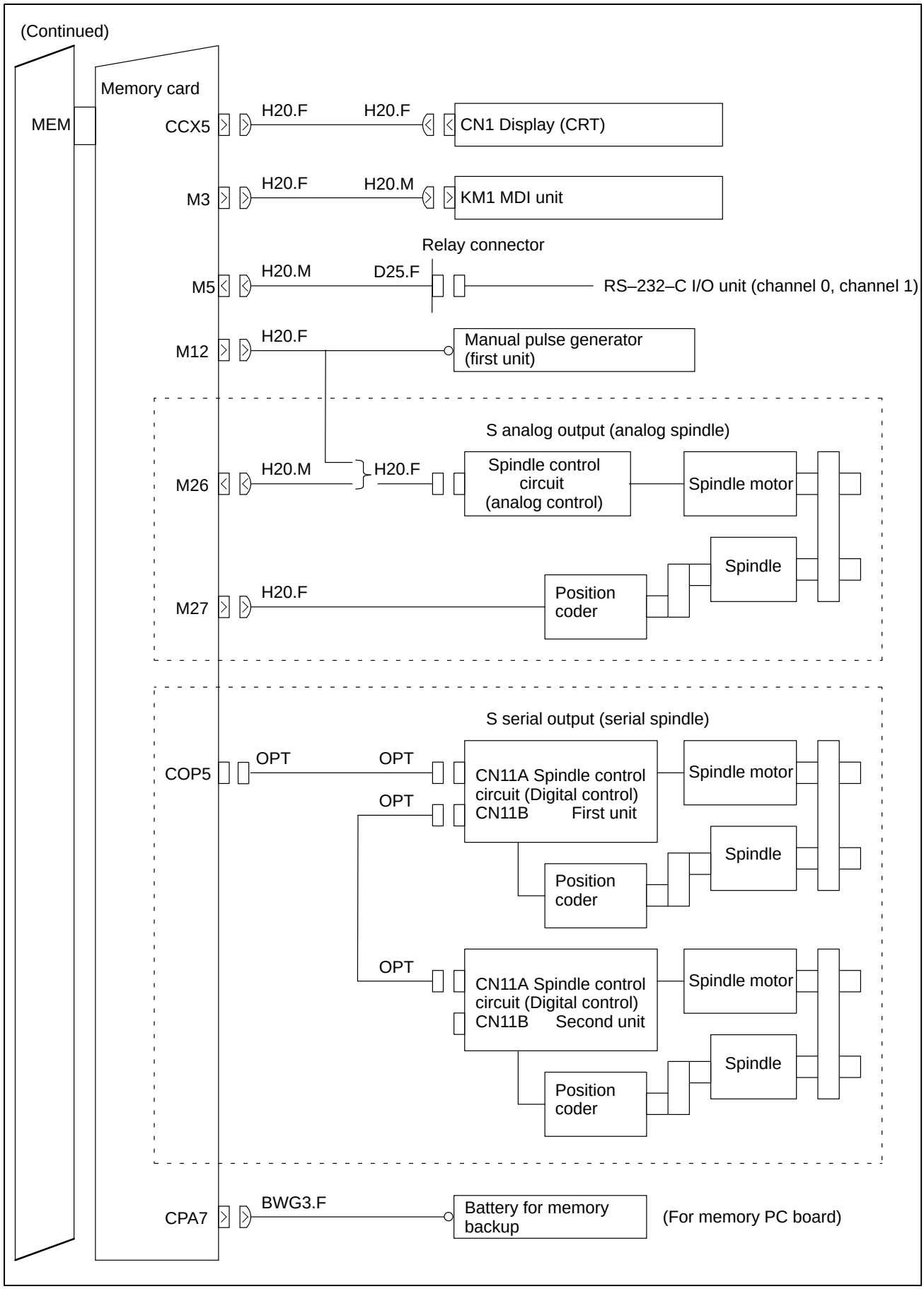
2.2 COMPLETE CONNECTION DIAGRAM

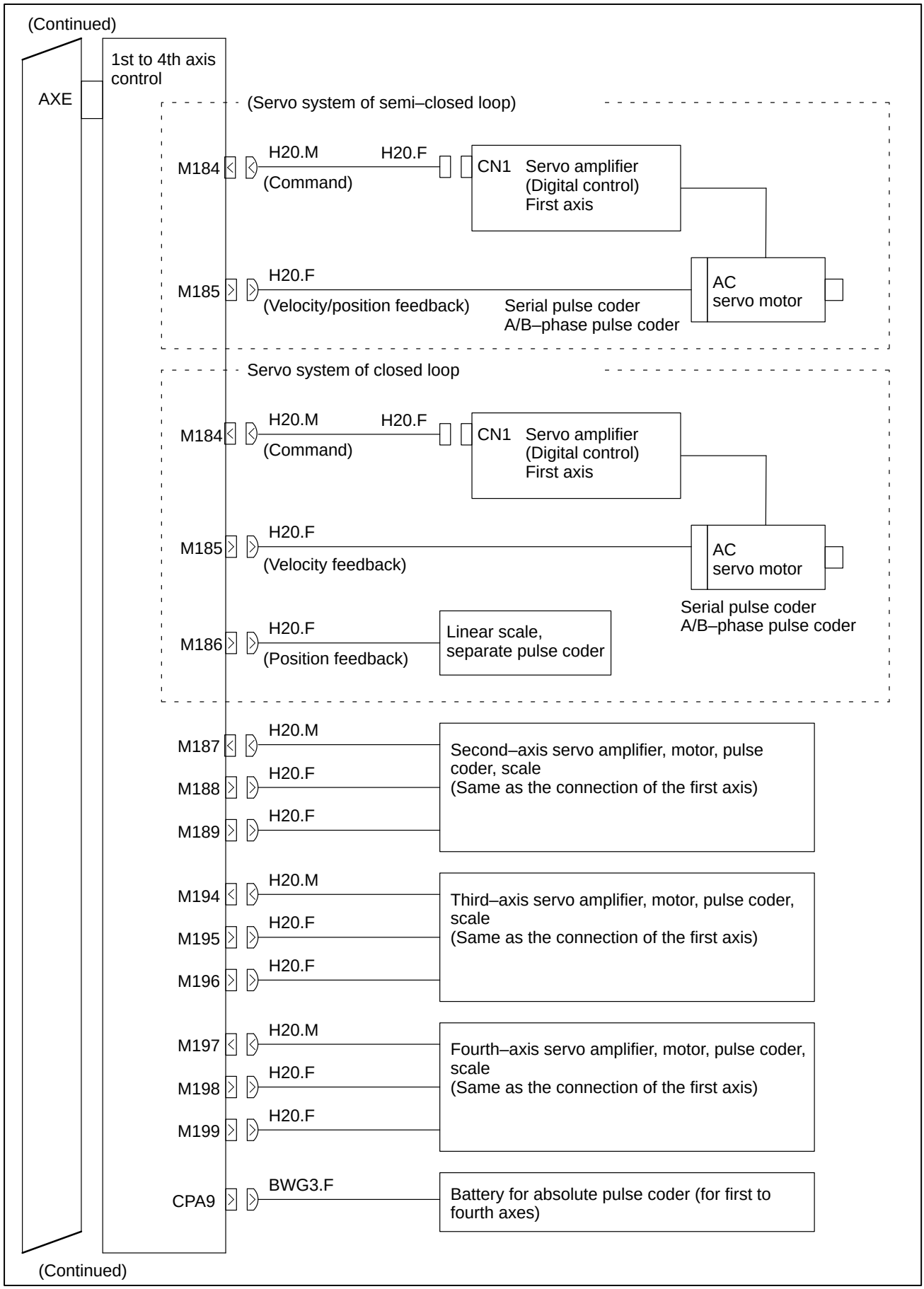
2.2.1 Precautions

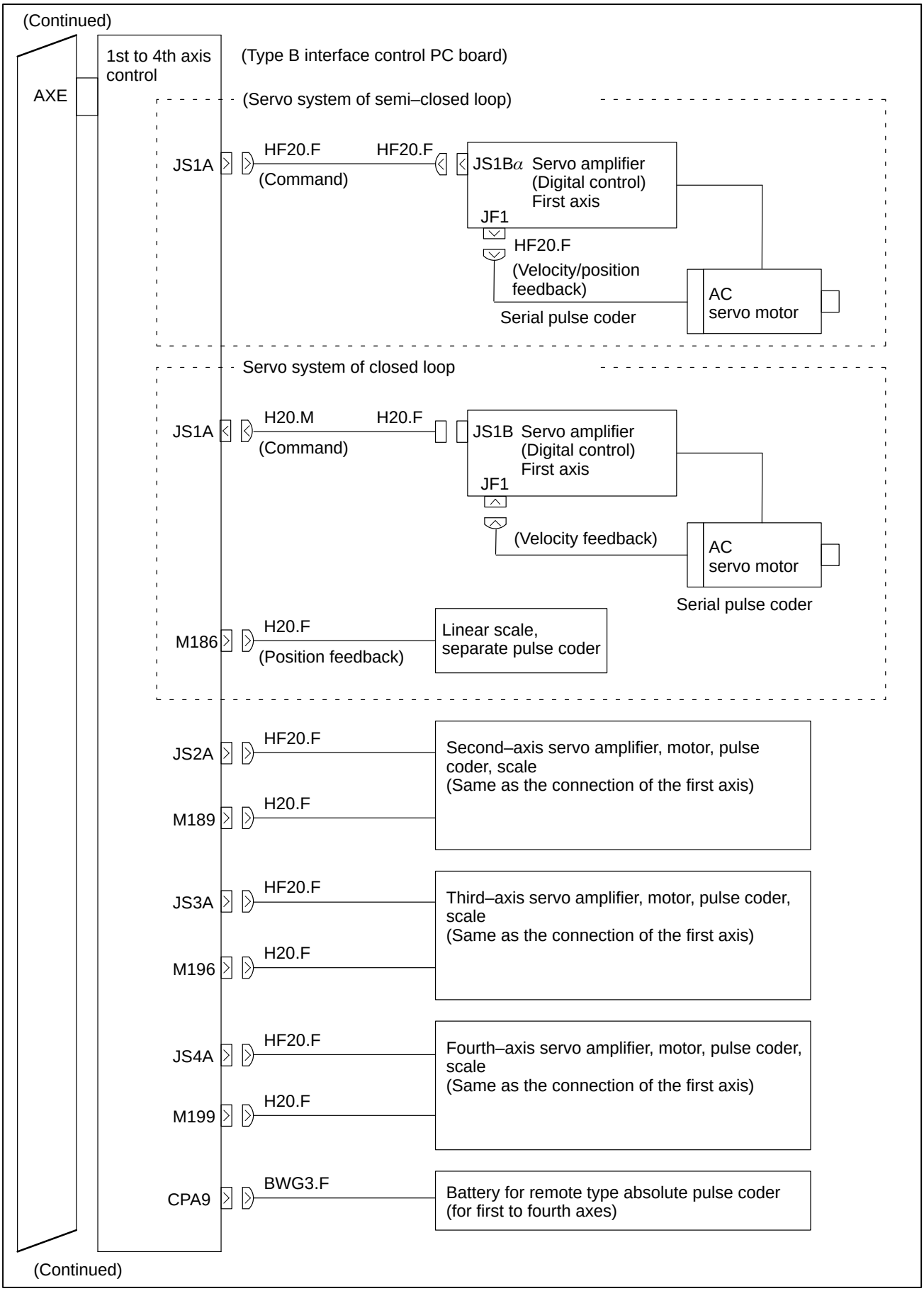
The complete connection diagram shows examples of connecting all PC boards that can fit into the slots of the master PC board. Some slots can accept two or more PC boards which are connected to different devices. This drawing shows two or more identical slot names, but actual individual slots on the master PC board have different names. See the connection of each slot according to the PC board to be fitted into the slot.

The diagram shows the connection of all PC boards that can be fitted into the slots. In the actual unit, the PC boards to be mounted are determined by the model and optional functions. Note that all the PC boards shown in the diagram are not always mounted.

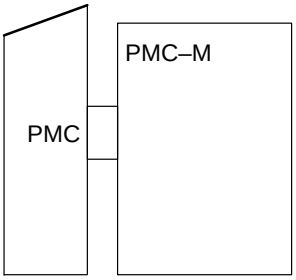

MasterPC board
CAP
Power supply unit AI
CP1
BK3.F
Single–phase 200–VAC input
CP2
BK3.F
Servo magnetic contactor
CP2
BK3.F
200–VAC output (spare)
CP3
BWG6.F
ON/OFF switch
CP14
BN3.F
24–VDC output (spare)
CP15
BN6.F
24–VDC output (display unit using 24 VDC)
CAP
For CE marking power supply unit AI
CP1
AHX3.F
Single–phase 200–VAC input
CP3
AHX3.F
Servo magnetic contactor
CP2
AHX3.F
200–VAC output (spare)
CP4
ALY6.F
ON/OFF switch
CP6
ALX3.F
24–VDC output (spare)
CP5
ALY3.F
24–VDC output (display unit using 24 VDC)
I/O
I/O C6–C7
M1
H50.F
H50.M
M2
H50.F
H50.M
M18
H50.F
H50.M
C6
M19
H20.F
H20.M
C7
M20
H50.F
H50.M
Power magnetics cabinet
I/O
I/O E2, E3
M201
H50.F
H50.M
M202
H50.F
H50.M
M218
H50.F
H50.M
E2
M219
H20.F
H20.M
E3
M220
H50.F
H50.M
Power magnetics cabinet
(Continued)


(Continued)
Memory card
MEM
CCX5
H20.F
H20.F
CN1 Display (CRT)
M3
H20.F
H20.M
KM1 MDI unit
Relay connector
M5
H20.M
D25.F
RS–232–C I/O unit (channel 0, channel 1)
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
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
(Servo system of semi–closed loop)
M184
H20.M
H20.F
(Command)
CN1 Servo amplifier (Digital control) First axis
M185
H20.F
(Velocity/position feedback)
Serial pulse coder A/B–phase pulse coder
AC servo motor
Servo system of closed loop
M184
H20.M
H20.F
(Command)
CN1 Servo amplifier (Digital control) First axis
M185
H20.F
(Velocity feedback)
AC servo motor
Serial pulse coder A/B–phase pulse coder
M186
H20.F
(Position feedback)
Linear scale, separate pulse coder
M187
M188
M189
H20.M
H20.F
H20.F
Second–axis servo amplifier, motor, pulse coder, scale (Same as the connection of the first axis)
M194
M195
M196
H20.M
H20.F
H20.F
Third–axis servo amplifier, motor, pulse coder, scale (Same as the connection of the first axis)
M197
M198
M199
H20.M
H20.F
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)
1st to 4th axis control
(Type B interface control PC board)
AXE
(Servo system of semi–closed loop)
JS1A
HF20.F
HF20.F
(Command)
JS1Bα Servo amplifier
(Digital control)
First axis
JF1
HF20.F
(Velocity/position feedback)
Serial pulse coder
AC servo motor
Servo system of closed loop
JS1A
H20.M
H20.F
(Command)
JS1B Servo amplifier
(Digital control)
First axis
JF1
(Velocity feedback)
AC servo motor
Serial pulse coder
M186
H20.F
(Position feedback)
Linear scale, separate pulse coder
JS2A
HF20.F
M189
H20.F
Second–axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis)
JS3A
HF20.F
M196
H20.F
Third–axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis)
JS4A
HF20.F
M199
H20.F
Fourth–axis servo amplifier, motor, pulse coder, scale
(Same as the connection of the first axis)
CPA9
BWG3.F
Battery for remote type absolute pulse coder
(for first to fourth axes)
(Continued)

(Continued)

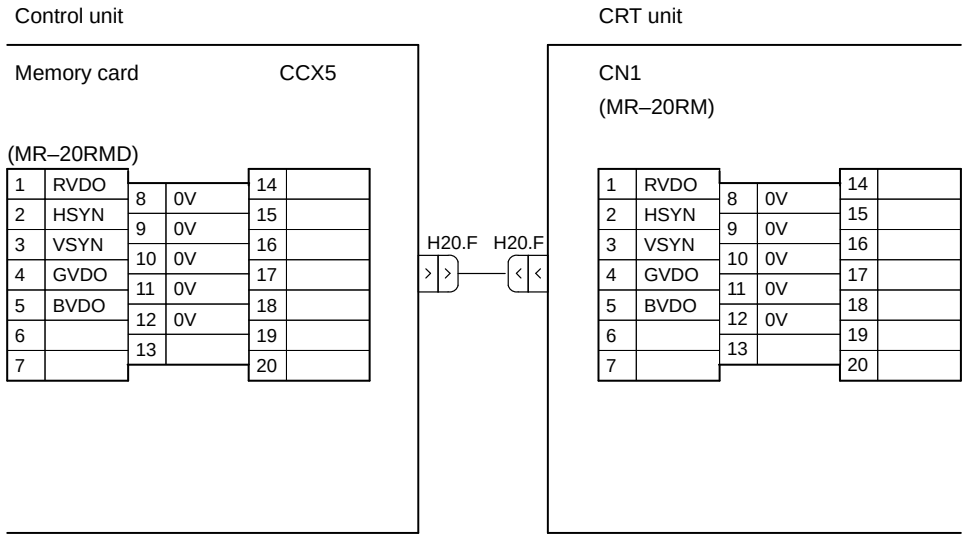


*Both Package 3 of 0–TD and 0–MD can use only.

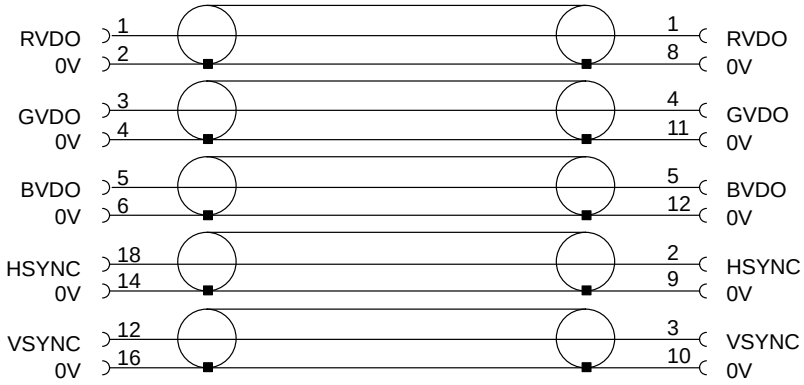
2.3 INTER–MACHINE CONNECTION

2.3.1 CRT/MDI Unit

- **Video signal interface**



Cable wiring



Maximum cable length: 50 m

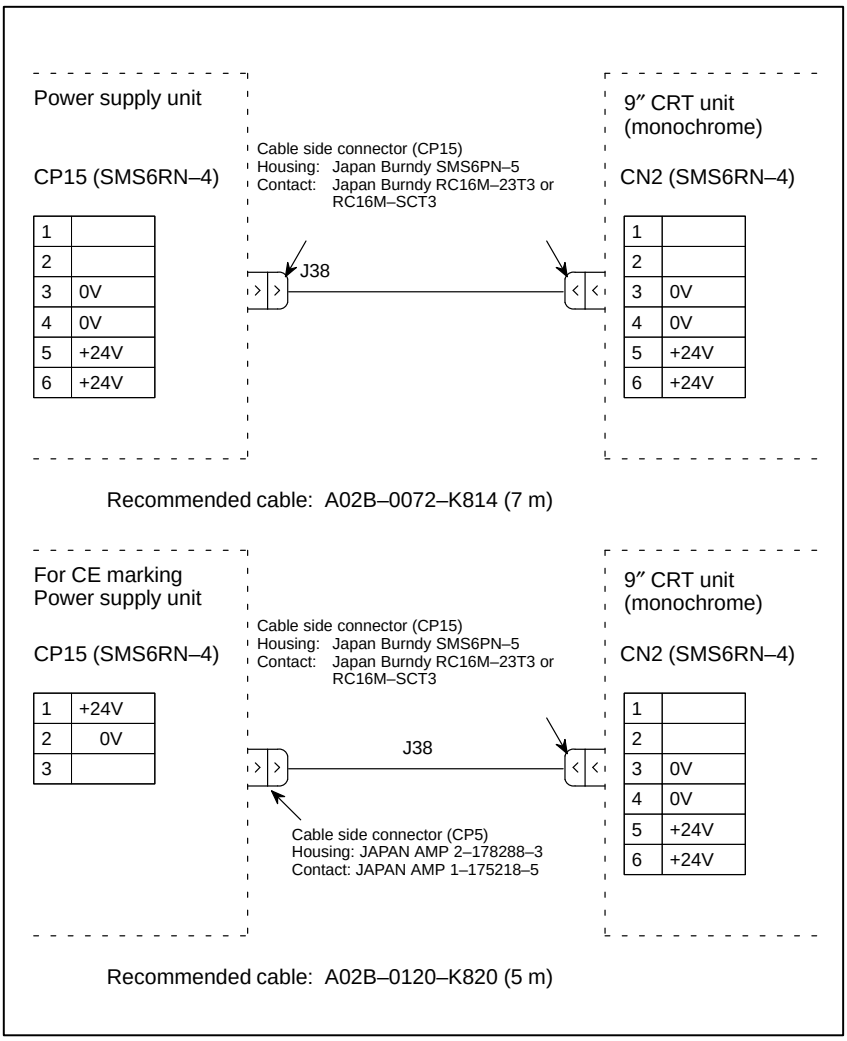
Recommended cable material : A66L–0001–0219 coaxial cable

Recommended cable order number: A02B–0098–K825 (7 m)

- **Connecting the display unit power supply**

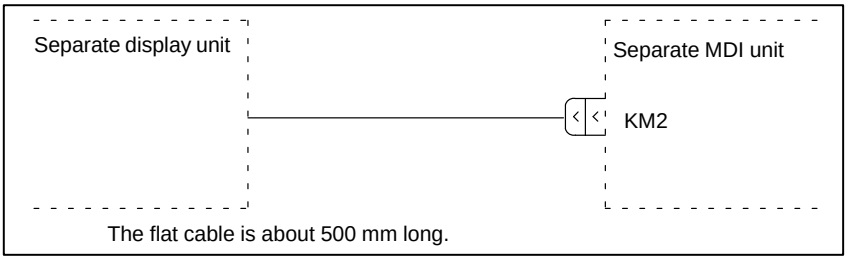
Use a power cable containing conductors of 30/0.18 (0.8 mm^2) or greater.

(1) 9″ monochrome CRT



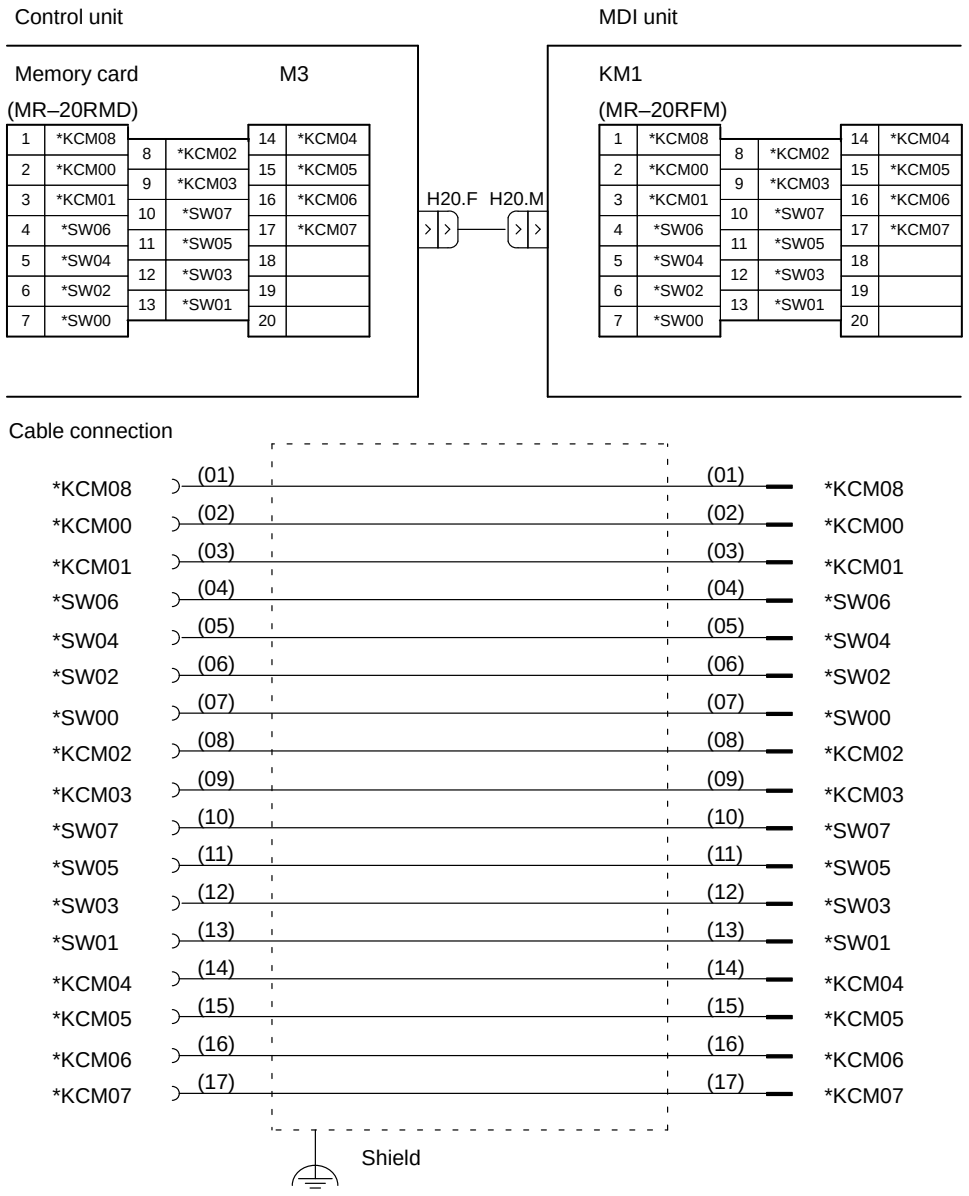
- **Connecting the soft key cable of a separate display unit**

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.



● Connection to MDI unit

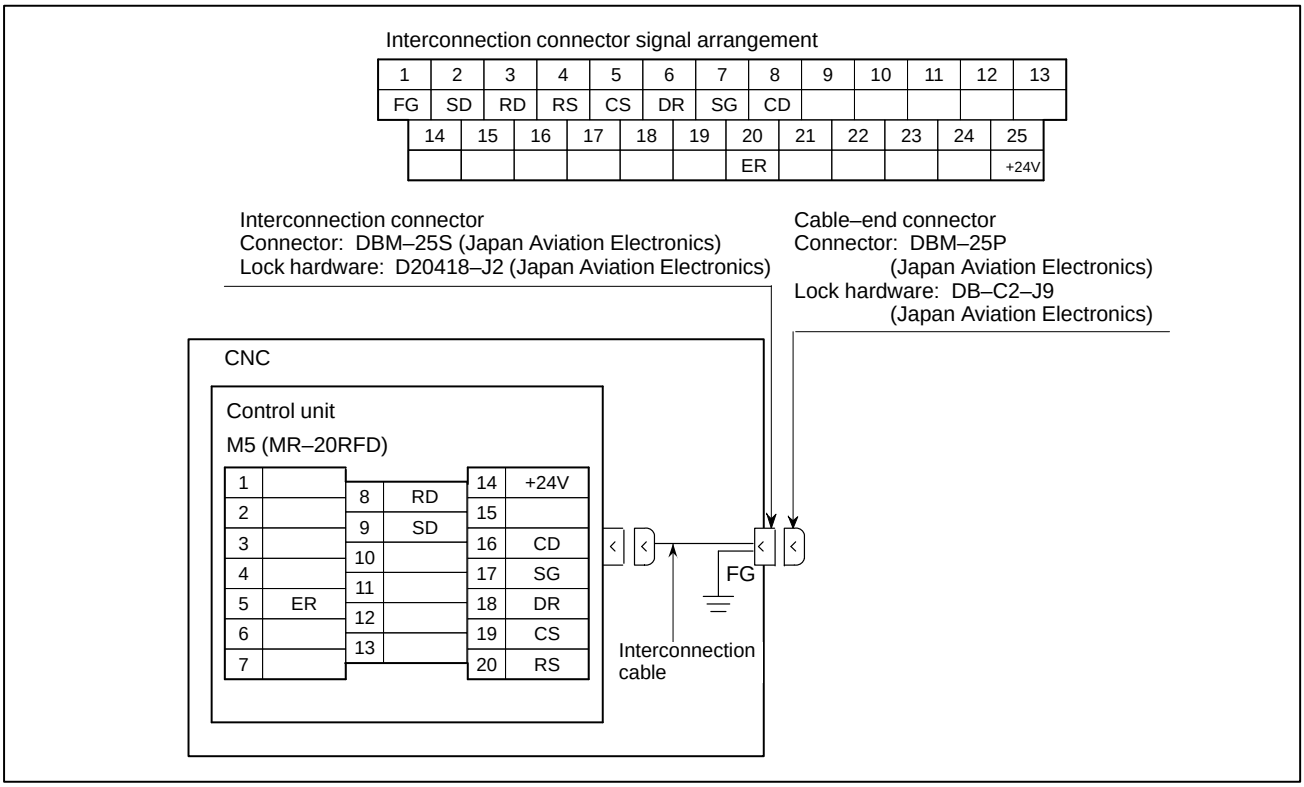
MDI unit interface



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

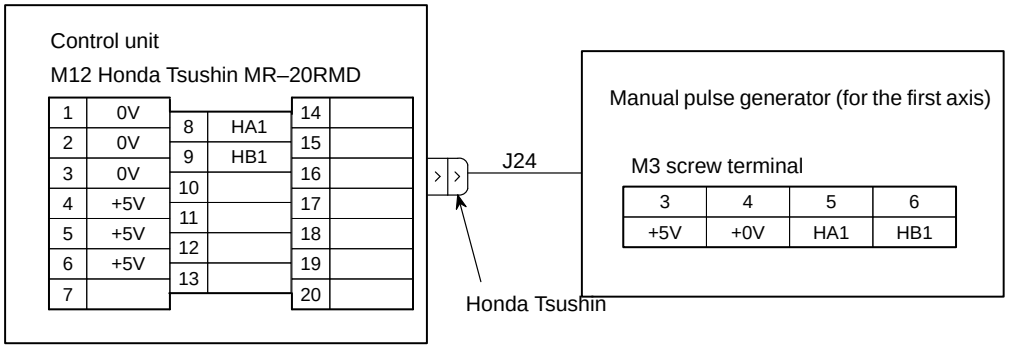
Recommended cable : A02B–0050–K803 (7m) or A02B–0098–K803 (7m)
Recommended cable material : A66L–0001–0041 (7/0. 18, 20 core)

2.3.2 Reader/Puncher Interface



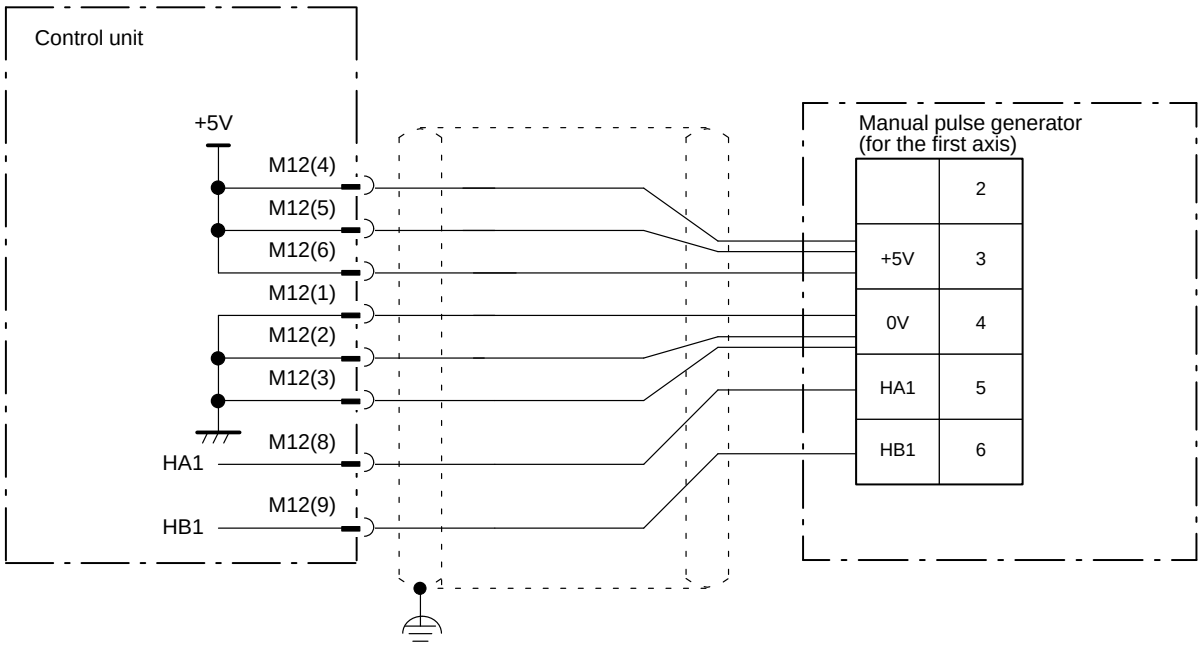
CAUTION
1 The machine tool builder is requested to provide the interconnection connectors and cables.
2 Use a common shielded cable for the signal cable.
Recommended cable specification: A66L–0001–0041

2.3.3 Manual pulse Generator



Cable: Cable with common shielded conductors, 7/0.18 (0.2 mm^2) or thicker
Recommended cable conductor specification: A66L–001–0041

A02B–0050–K802 (7 m) is usable for J24.



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:

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

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,

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

2.3.4 Servo Interface

This section describes the servo interface between the Series 0–D and the α and β series servo amplifier and servo motor.

● Outline

The Series 0–D supports two types of axis control cards according to the type of servo interface.

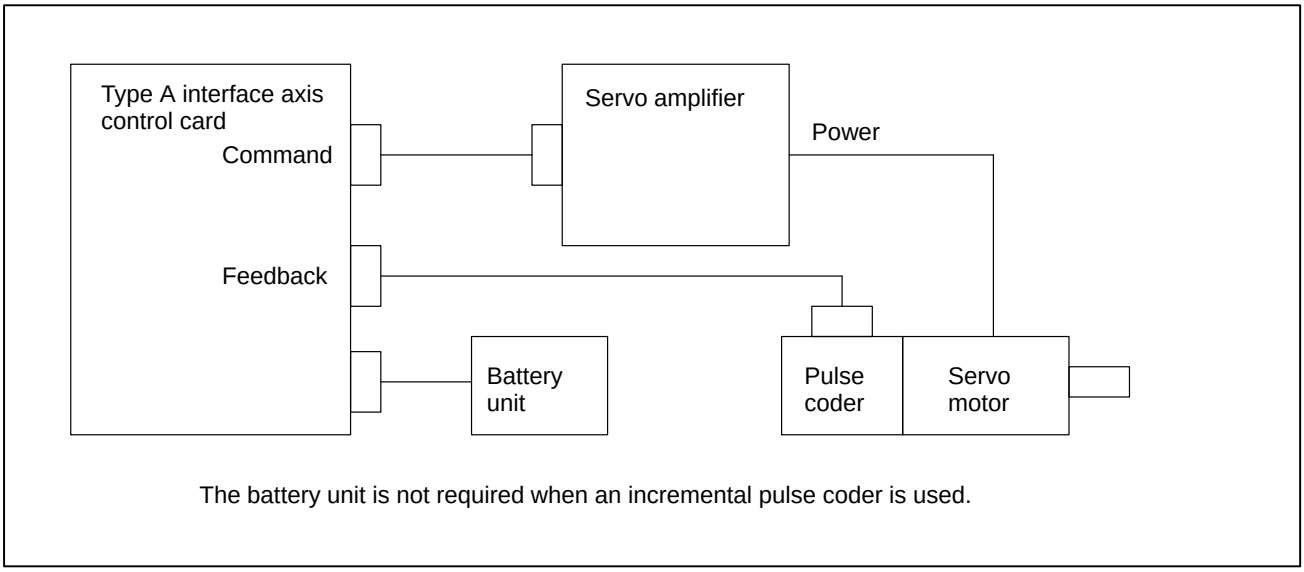
- Axis control card of type A interface
  (It can be used by 0–TD and 0–MD)
- Axis control card of type B interface

● Connector names

	Axis control card of type A interface				Axis control card of type B interface			
Axis name	Command	Semi–closed loop	Closed loop		Command	Semi–closed loop	Closed loop	
		Feedback	Position feedback	Velocity feedback		Feedback	Position feedback	Velocity feedback
1st axis	M184	M185	M186	M185	JS1A	JFn	M186	JFn
2nd axis	M187	M188	M189	M188	JS2A	JFn	M189	JFn
3rd axis	M194	M195	M196	M195	JS3A	JFn	M196	JFn
4th axis	M197	M198	M199	M198	JS4A	JFn	M199	JFn

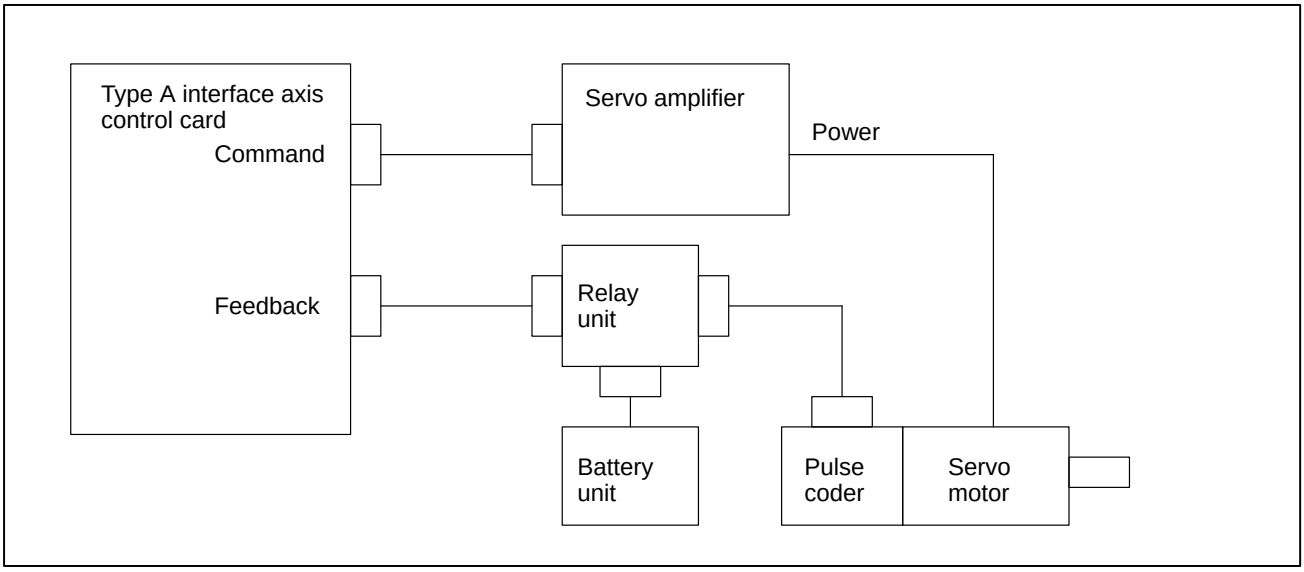
For a type B interface axis control card, the feedback or velocity feedback cable is connected to the JFn connector on the servo amplifier, where n varies with the servo amplifier being used.

- **Semi–closed loop system**

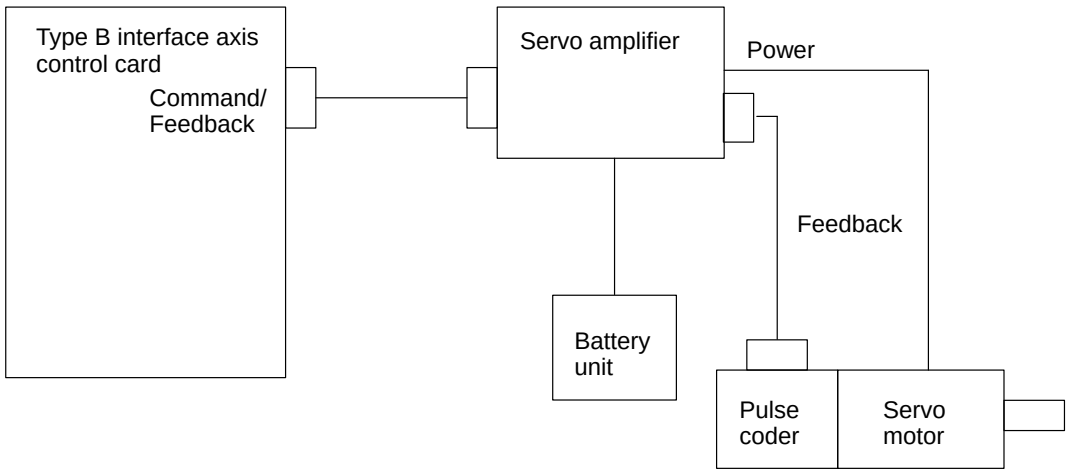


The battery unit is not required when an incremental pulse coder is used.

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

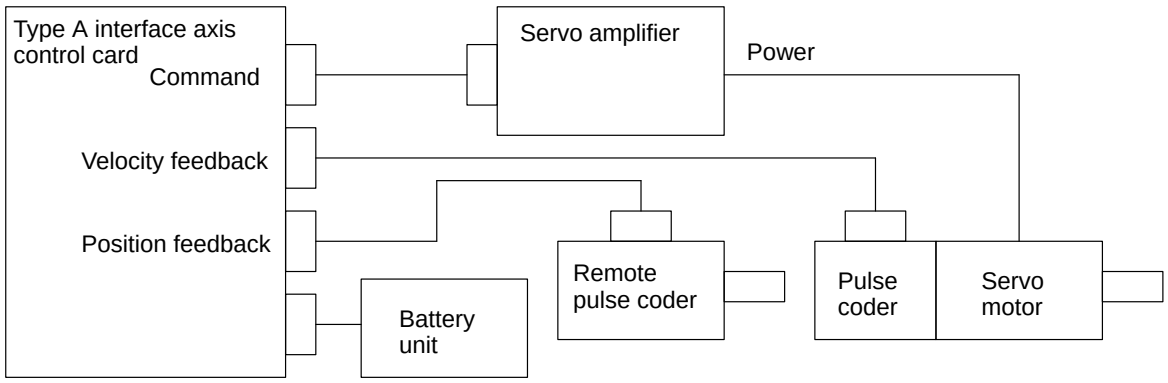


- **Semi–closed loop system**



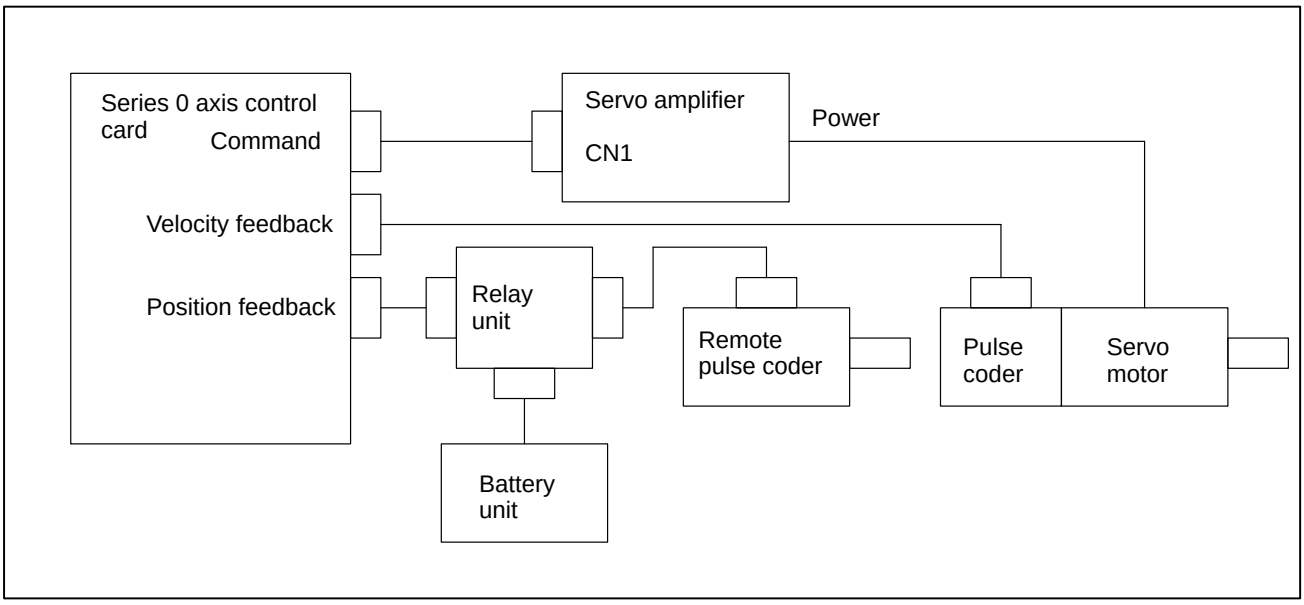
The battery unit is not required when an incremental pulse coder is used.
Use the servo amp. for type B interface or set common amp. to the B type.

- **Closed loop system**

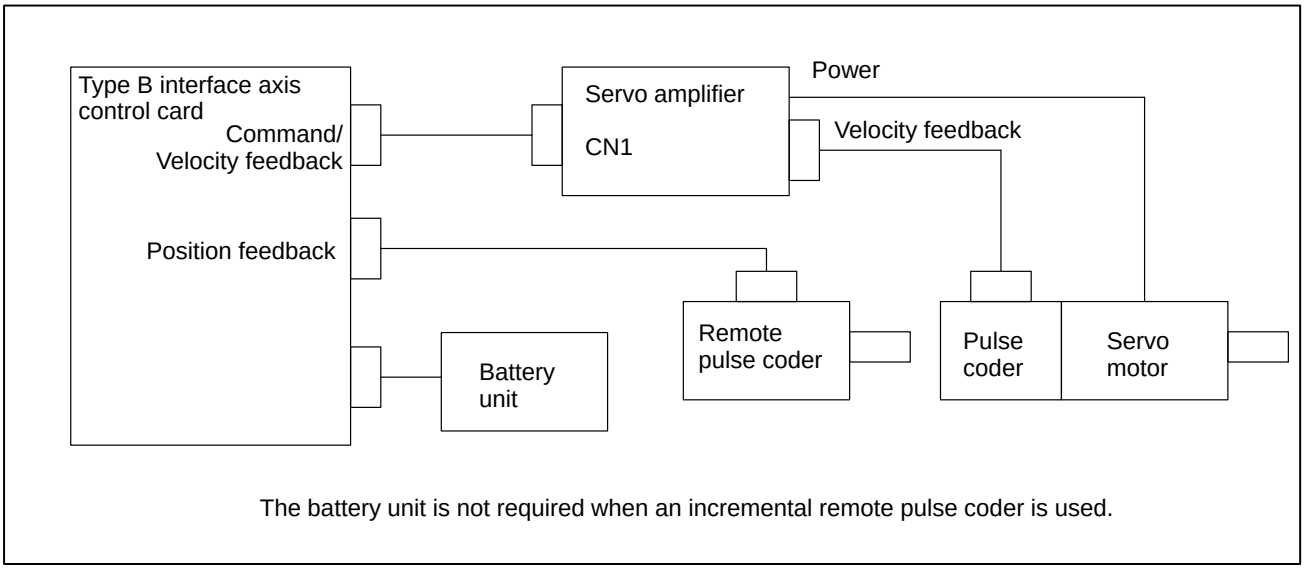


The battery unit is not required when an incremental pulse coder is used.

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



- **Closed loop system**

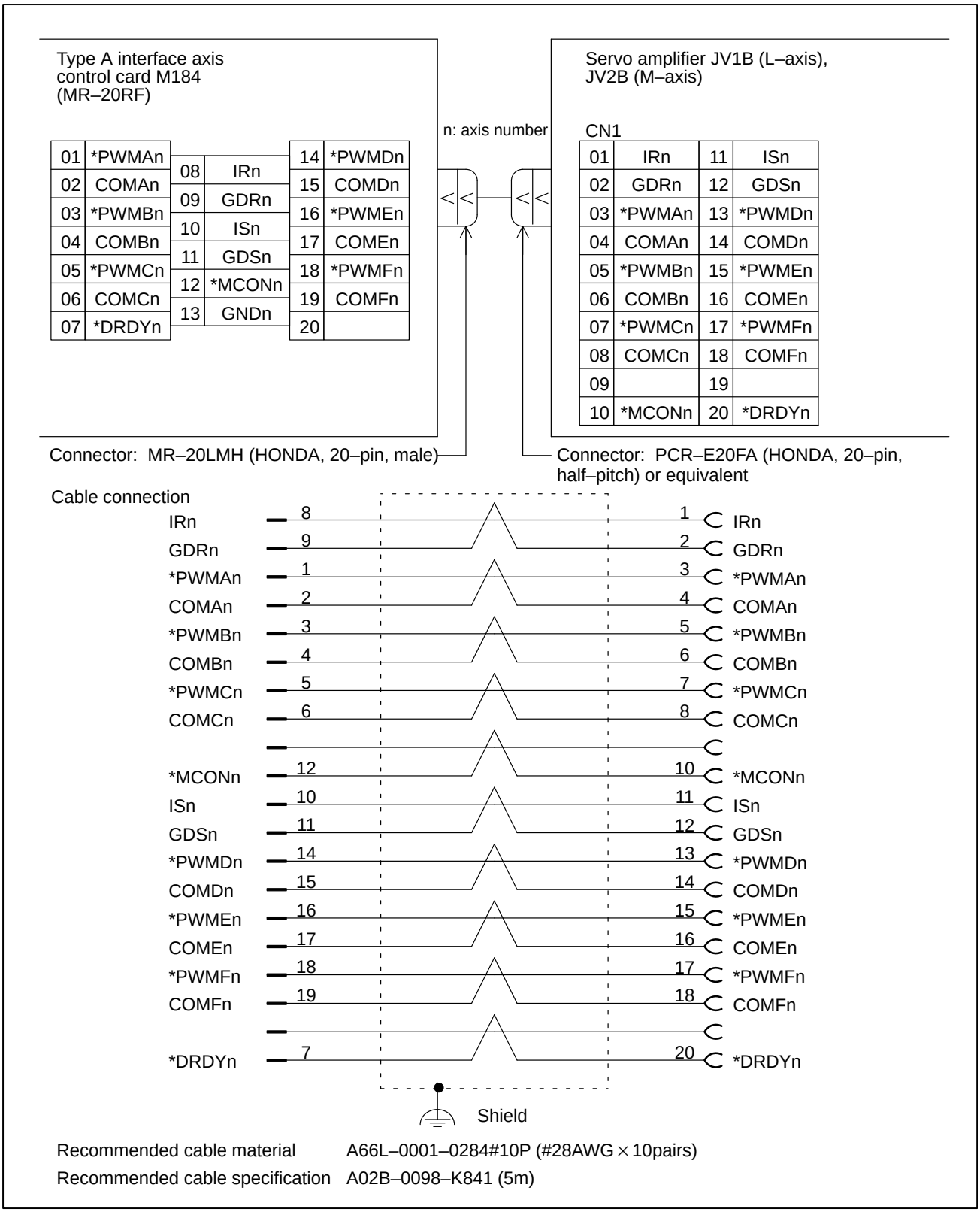


The battery unit is not required when an incremental remote pulse coder is used.

(1) Servo amplifier interface

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

(1)–1 In case of type A interface



CAUTION
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.

For connection on control motor amplifier α series or β series, refer to the Descriptions manual.

(1)–2 Interface to the servo amplifier

Servo Amplifier Module

Type B interface axis control card
JS1A (PCR–EV20MDT)

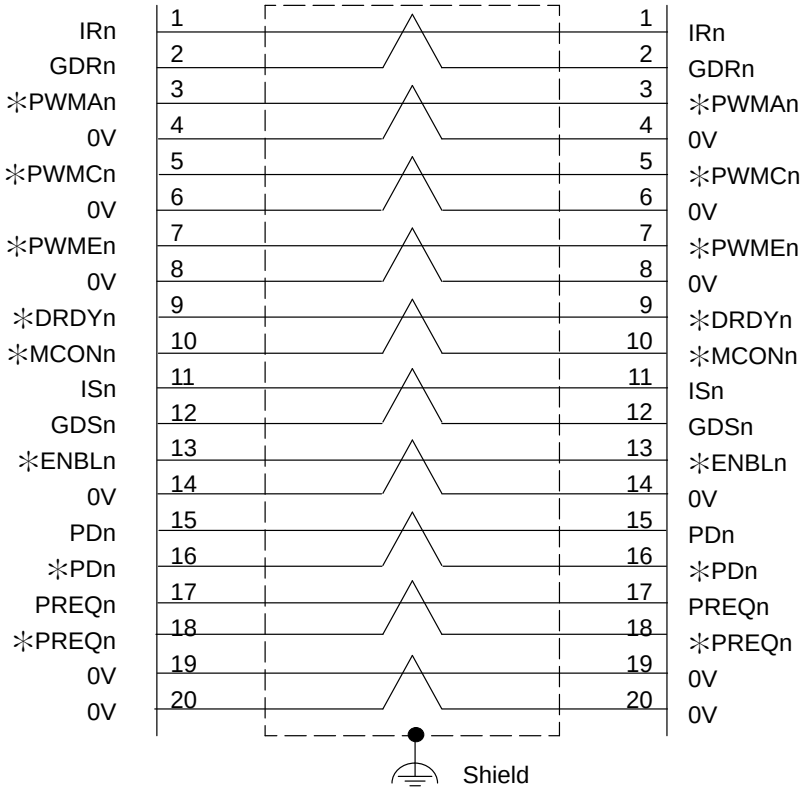
01	IRn	11	ISn
02	GDRn	12	GDSn
03	∗PWMAn	13	∗ENBLn
04	0V	14	0V
05	∗PWMCn	15	PDn
06	0V	16	∗PDn
07	∗PWMEn	17	PREQn
08	0V	18	∗PREQn
09	∗DRDYn	19	0V
10	∗MCONn	20	0V

JS1B (L axis) JS2B (M axis)
JS3B (N axis) (PCR–EV20MDT)

01	IRn	11	ISn
02	GDRn	12	GDSn
03	∗PWMAn	13	∗ENBLn
04	0V	14	0V
05	∗PWMCn	15	PDn
06	0V	16	∗PDn
07	∗PWMEn	17	PREQn
08	0V	18	∗PREQn
09	∗DRDYn	19	0V
10	∗MCONn	20	0V

Connector: PCR–E20FA etc.
(HONDA 20 pin half pitch)

CABLE WIRING



RECOMMENDED CABLE MATERIAL A66L–0001–0284#10P(#28WAG × 10 pair)
RECOMMENDED CABLE SPECIFICATION A02B–0120–K800(5m)

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.

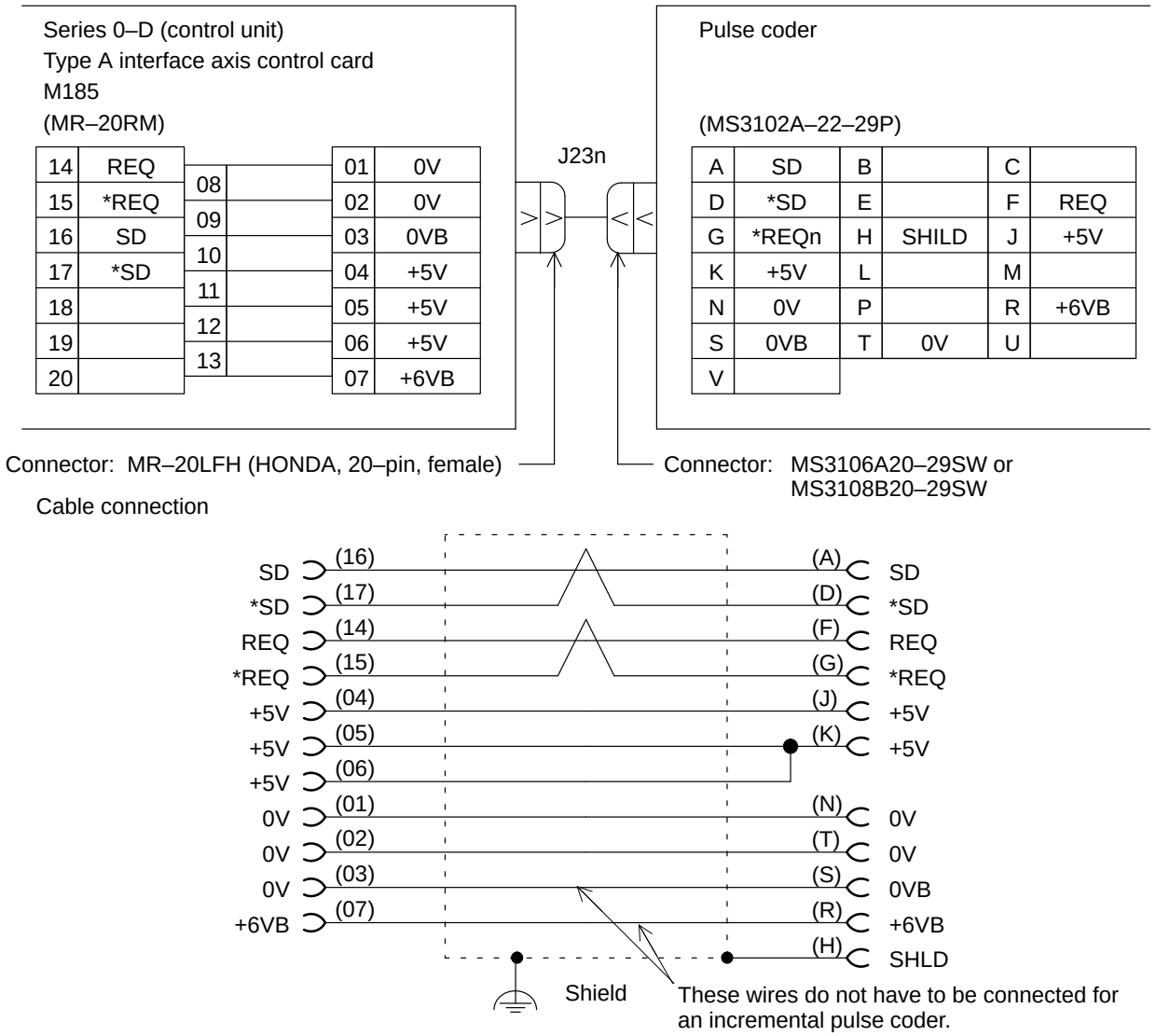
(2) Internal type pulse coder (Serial pulse coder interface)

The connector to which the feedback cable from the built–in pulse coder is connected varies with the servo interface type.

For the type A interface, connect the feedback cable to the feedback connector on the axis control card (for example, M185 for the first axis).

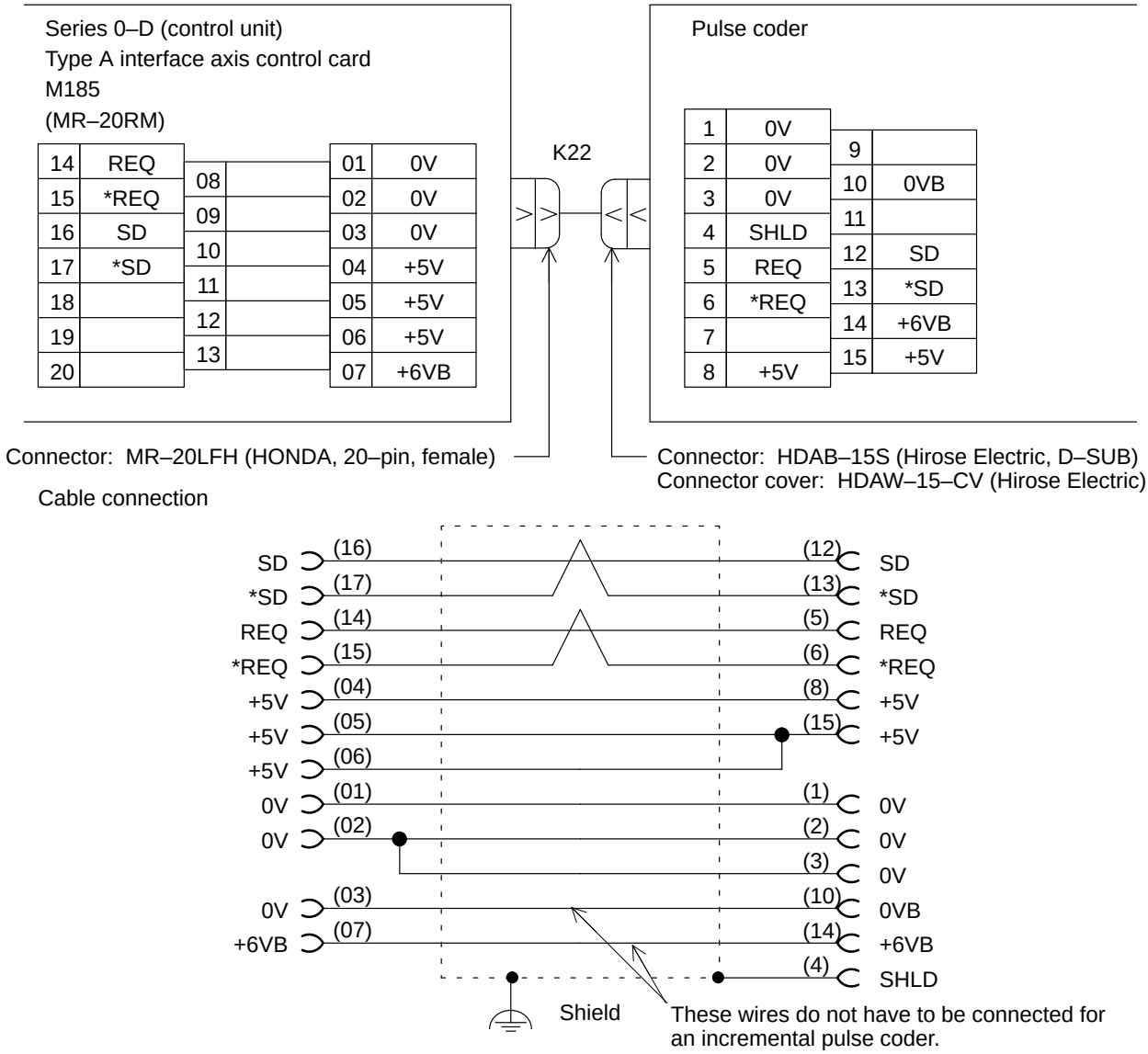
For the type B interface, connect the feedback cable to the feedback connector on the servo amplifier (for example, JF1 for the first axis).

(2)±1 α series motor (α3/3000 to α150/2000)



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

(2)±2 α series motor (α1/3000, α2/2000, or α2/3000)



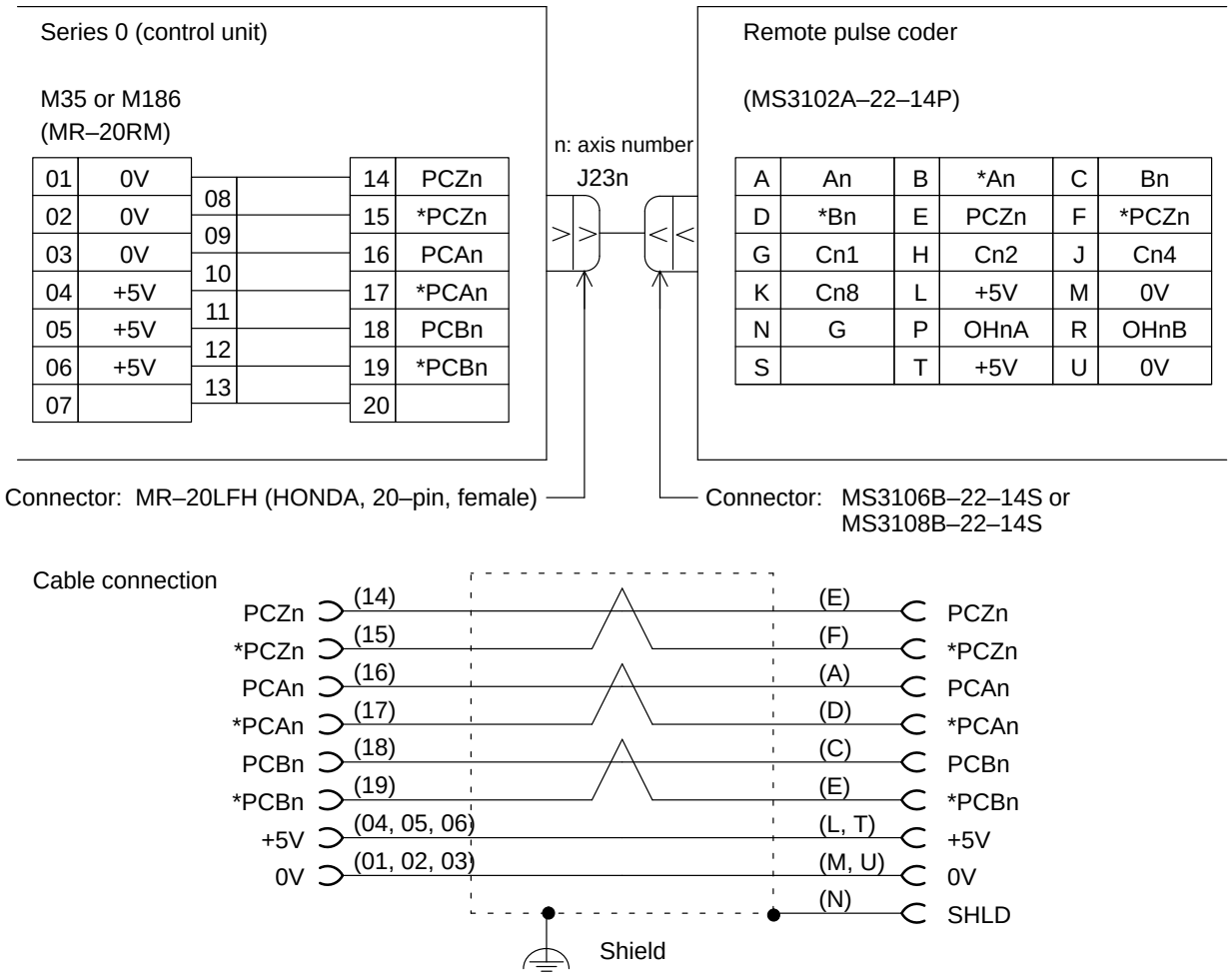
Cable material : +5V, 0V——Two or more wires each having a cross–sectional area of at least 0.5 mm^2 (when the cable length is 14 m or less)
: +6VB, 0VB——One or more wires each having a cross–sectional area of at least 0.5 mm^2
: SD, *SD, REQ, *REQ——Twisted pair wires each having a cross–sectional area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

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

(3) Remote type pulse coder

(3)–1 Low–resolution A/B phase separate pulse coder (2000P to 3000P) (Separate incremental pulse coder)

The position feedback cable from the separate pulse coder must be connected to the position feedback connector on the axis control card (for example, M186 for the first axis), regardless of the servo interface type.



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.

(3)–2 Remote pulse coder (Separate absolute pulse coder)

- **Velocity feedback connection**

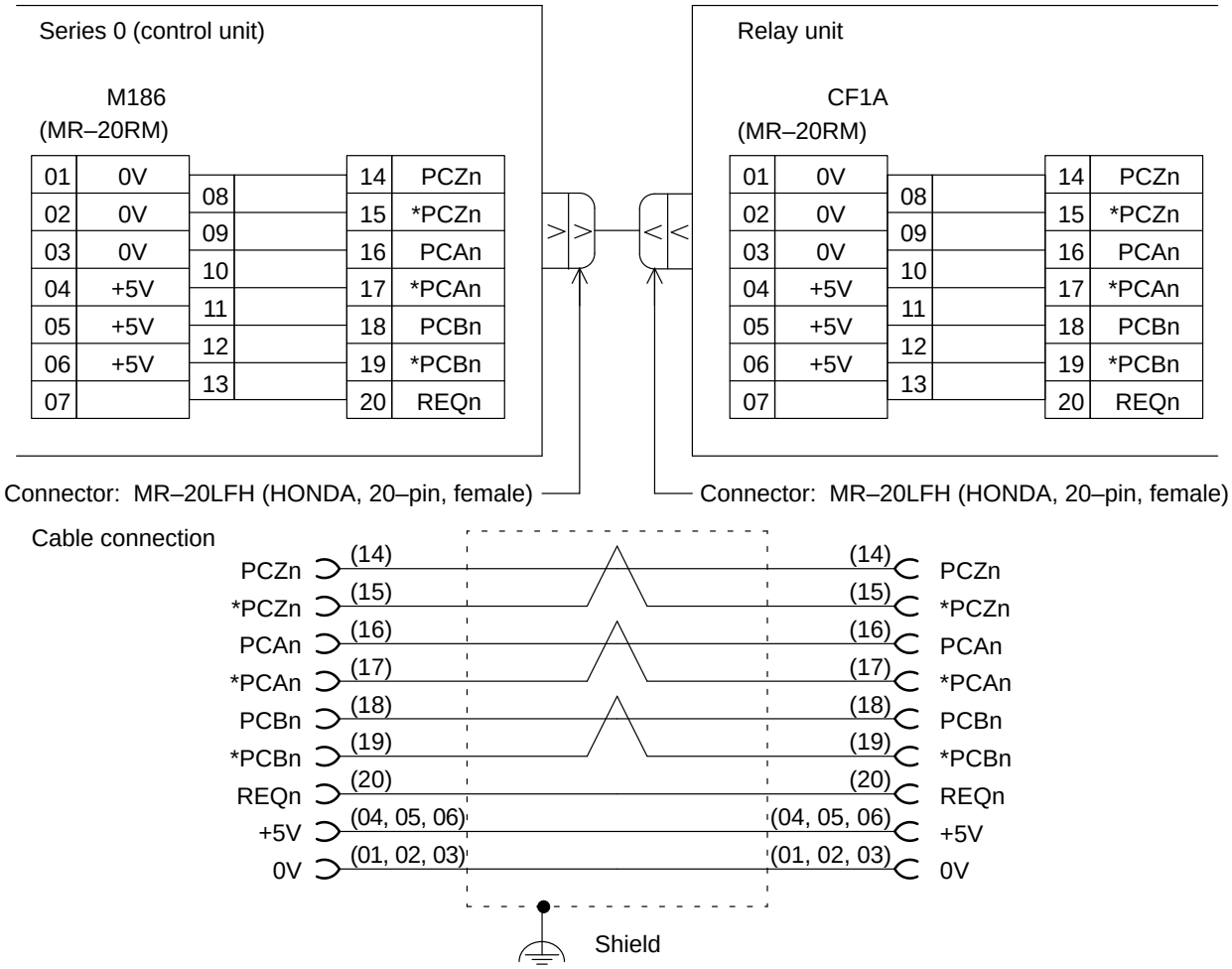
The velocity feedback connection between the motor's built–in pulse coder and the Series 0 is the same as that described in Section 9.3.5.

- **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.

- When using the relay unit

(a) 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)

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

Relay unit

CF1B
(MR–20RM)

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

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

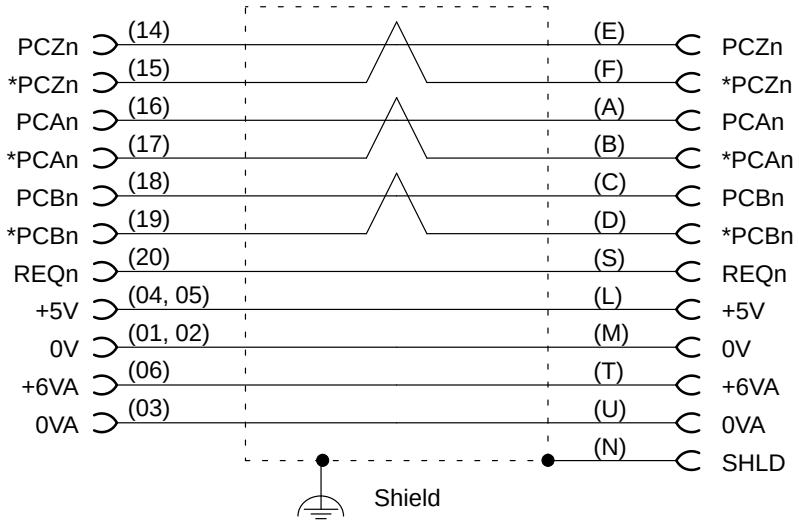
(MS3102A–22–14P)

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.

- Direct connection

Series 0 (control unit)

M186
(MR–20RM)

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

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

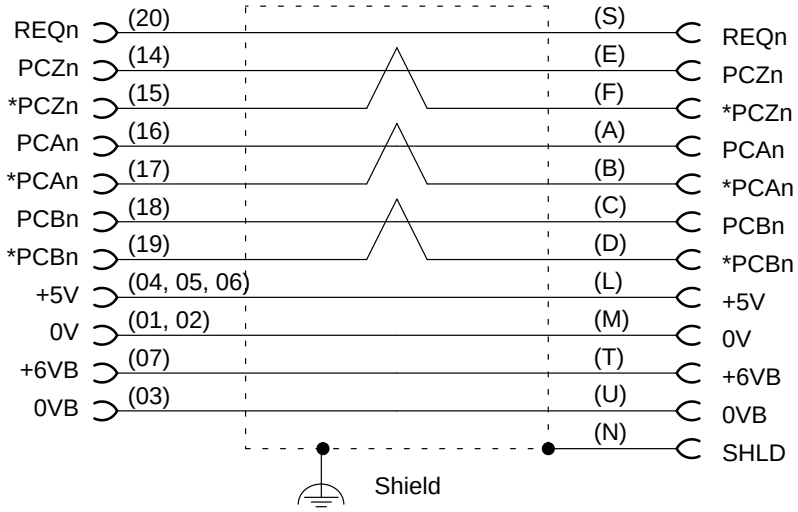
(MS3102A–22–14P)

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	+6VB	U	0VB

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

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

Cable connection



Cable material : +6VB, 0VB—0.5 mm^2 or more
: +5V, 0V——0.5 mm^2 or more
: Others———Unified shield twisted pair wires each having a cross–sectional area of at least 0.1 mm^2
: REQn———0.18 mm^2 or more

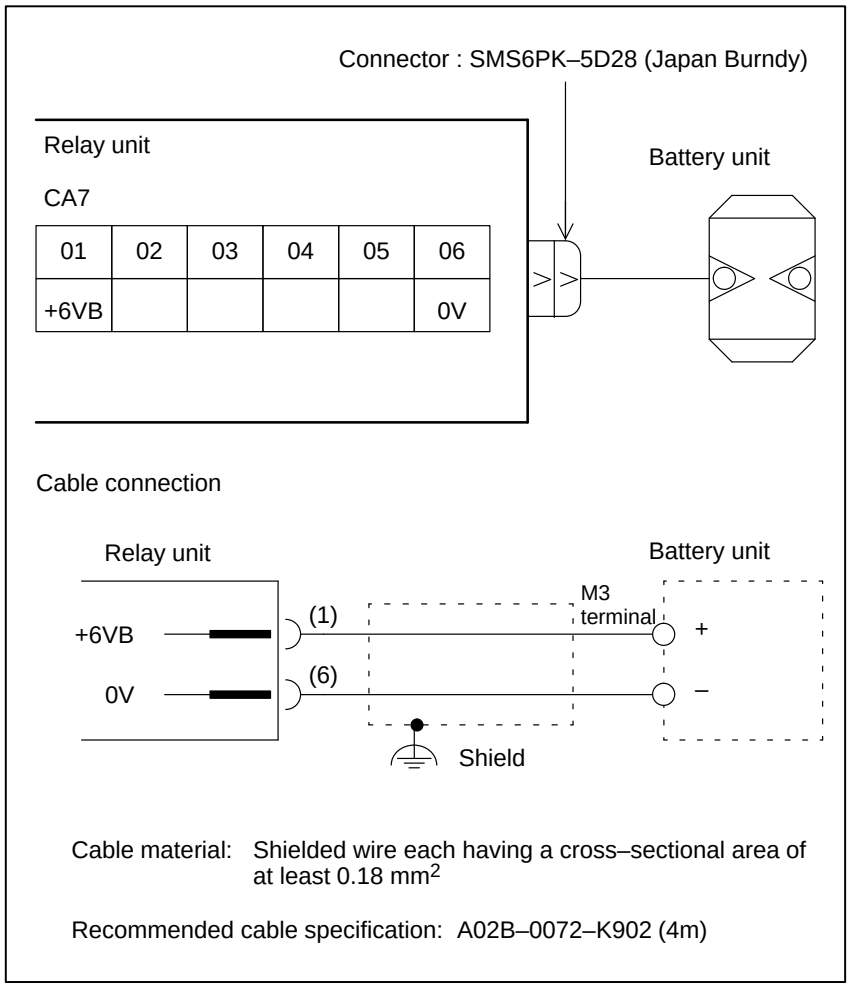
Recommended cable specification A02B–0096–K801 (14m) (straight)
A02B–0096–K802 (14m) (elbow)

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

(4) 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.

(4)–1 Connection Using the Relay Unit



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

Recommended cable specification: A02B–0072–K902 (4m)

NOTE

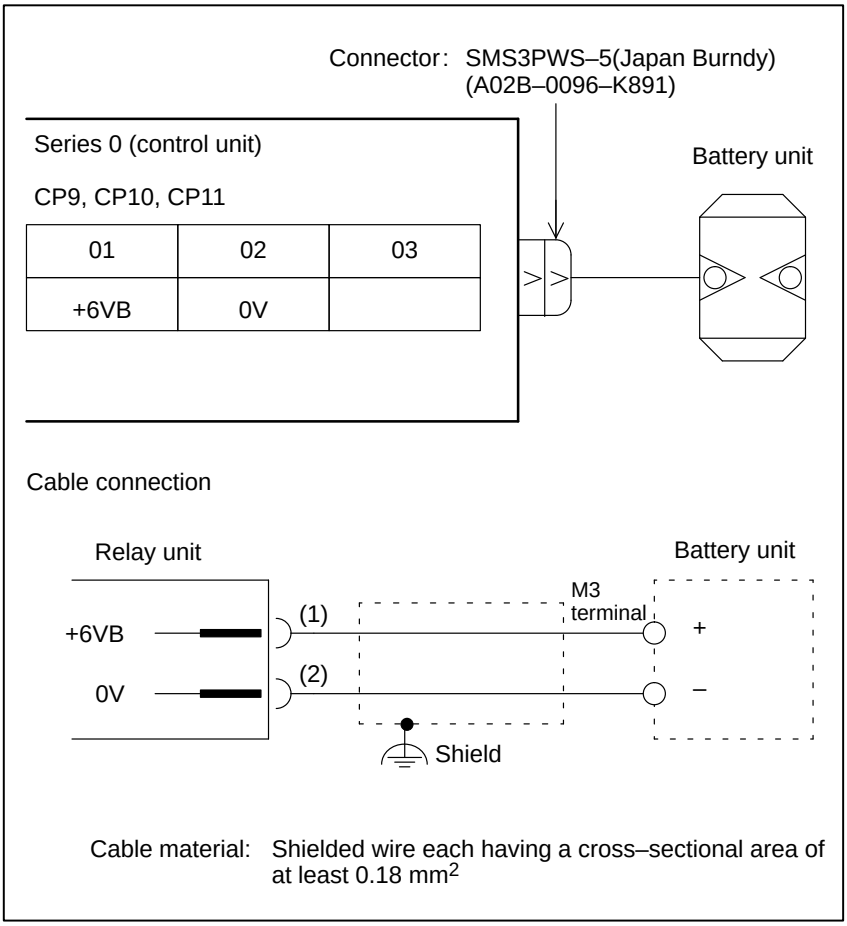
1 A single relay unit can distribute power from the battery to up to four pulse coders.
2 A single battery unit can supply power to up to six pulse coders.
3 Replace the battery with a new one once a year.

(4)–2 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			
	1st axis	**2nd axis**	**3rd axis**	**4th axis**
Connector name	CPA9			



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.

(5) Handling of unused axes (Clamping)

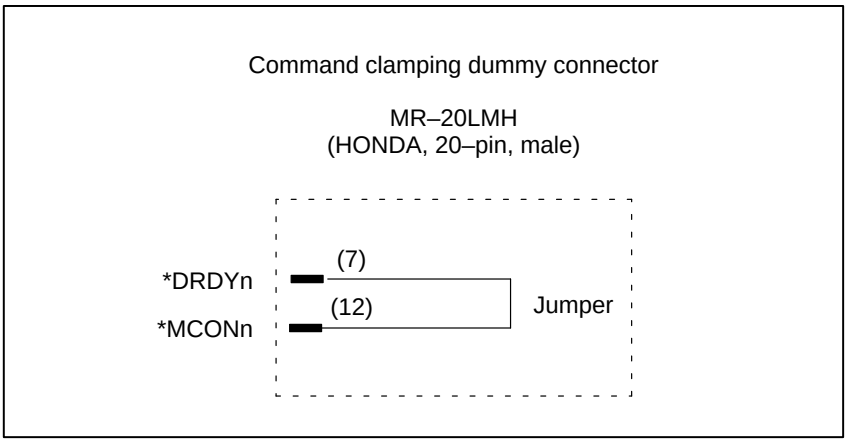
The user can select any of the supported axes as the axes to be controlled. A cable for a servo amplifier or motor need not be connected to those axes that are not to be used. Leaving the connector for an unused axis open, however, causes the CNC to enter a servo alarm state. This section describes how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

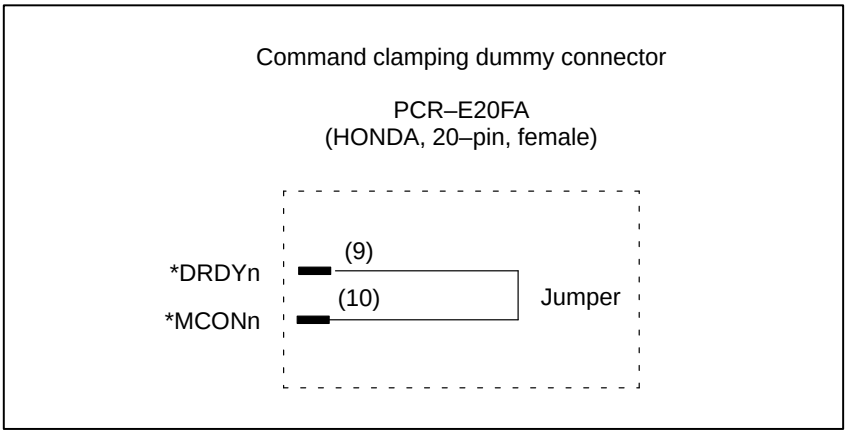
(5)–1 Handling of the Command Connectors of Unused Axes

Connect a command clamping dummy connector to the command connector of each unused axis.

- **Type A interface**



- **Type B interface**

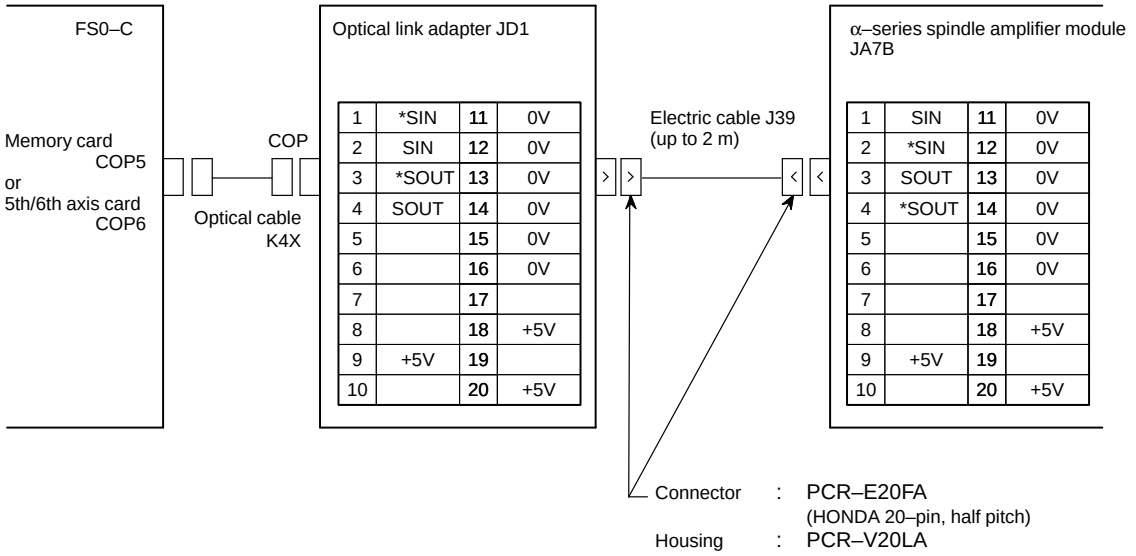


(5)–2 Handling of the Feedback Connectors of Unused Axes

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.

2.3.5
Serial Spindle Interface

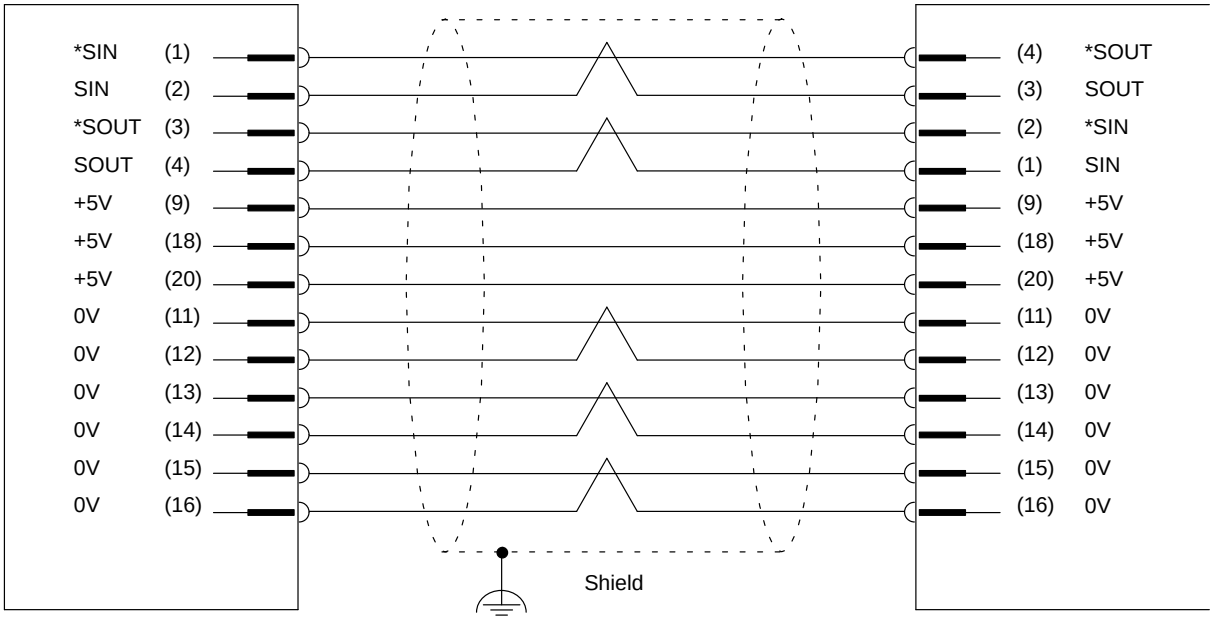


1	*SIN	11	0V
2	SIN	12	0V
3	*SOUT	13	0V
4	SOUT	14	0V
5		15	0V
6		16	0V
7		17	
8		18	+5V
9	+5V	19	
10		20	+5V

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

Code of optical cable (K4X)
A66L–6001–0009#L□□□□□ (with reinforced jacket)
Length designation
or A66L–6001–0008#L2R003 (2m) (Without reinforced jacket)

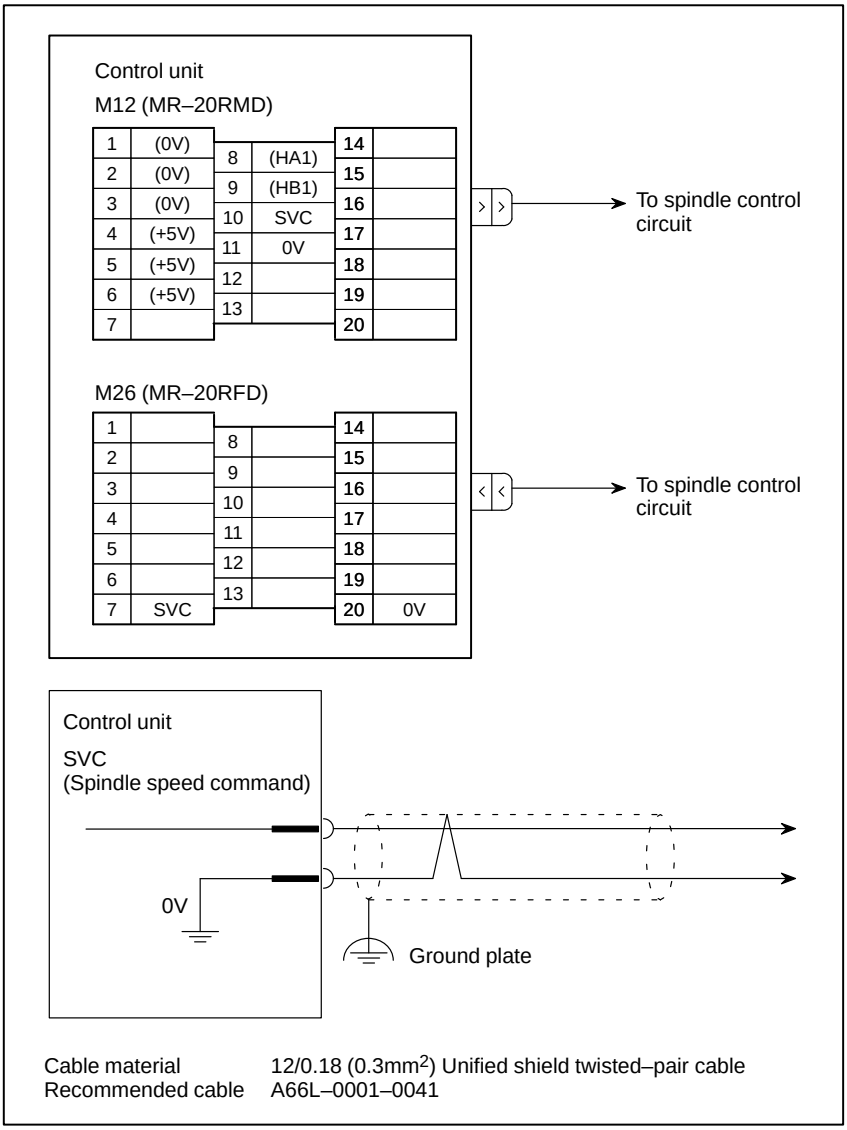
Electric cable connection J39



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

2.3.6 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.

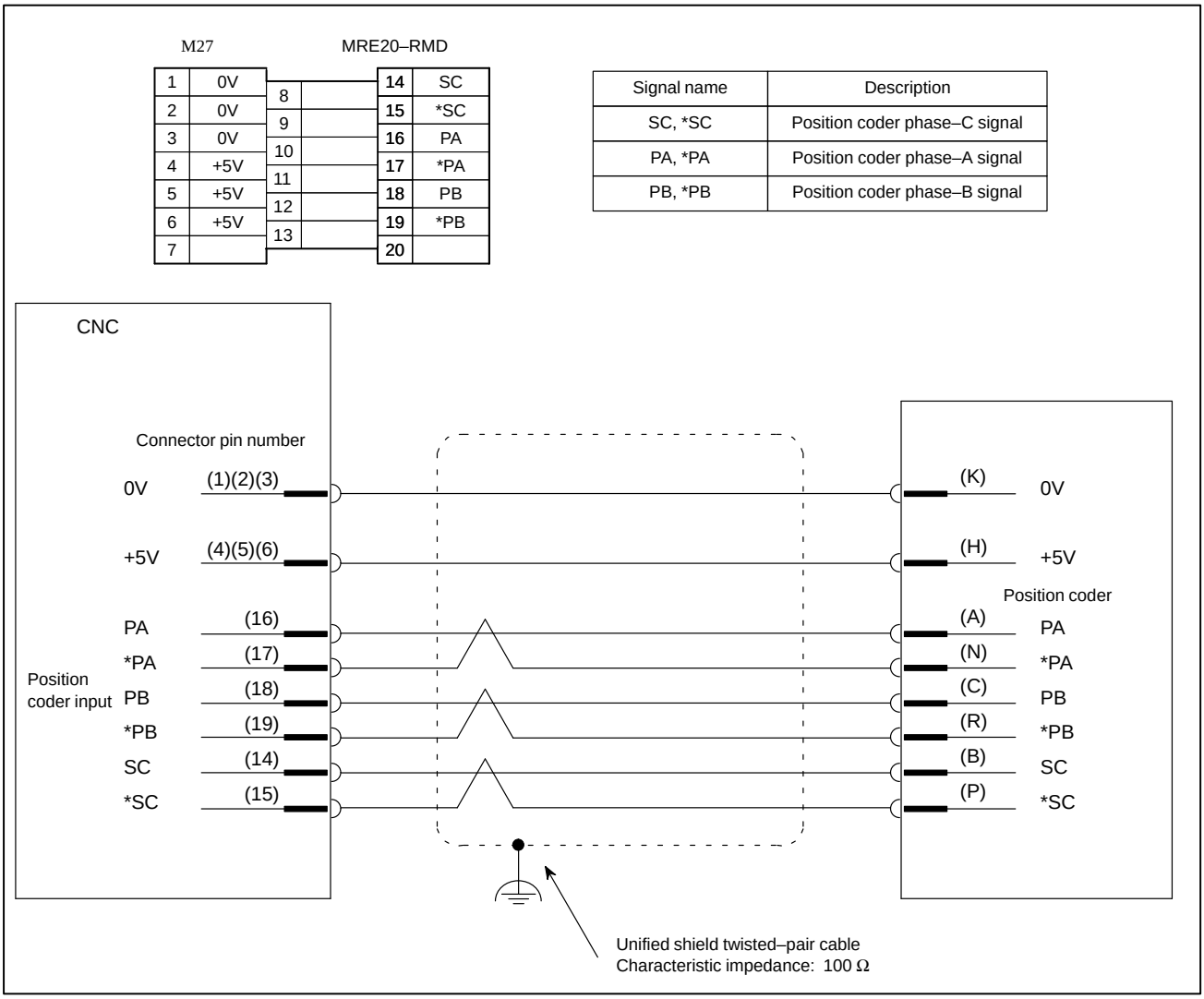


Cable material	12/0.18 (0.3mm^2) Unified shield twisted–pair cable
Recommended cable	A66L–0001–0041

NOTE

1 M12 is also used as the connector for the first manual pulse generator.
2 In addition to the spindle speed analog voltage signal (SVC), use the spindle enable signal (ENB). Use the same cable as that indicted above.

2.3.7 Position Coder Interface



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
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.

2.3.8 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° to 45°
	In storage or transportation	–20° to 60°
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.)	

2.3.9 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.	

2.3.10 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.

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

2.3.11 Action Against Noise

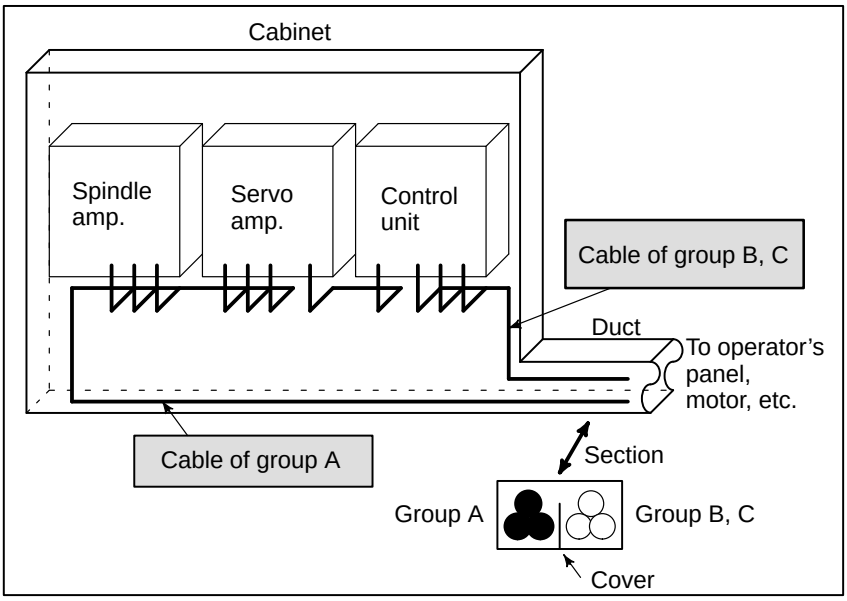
The CNC has been steadily reduced in size using surface–mount and custom LSI technologies for electronic components. The CNC also is designed to be protected from external noise. However, it is difficult to measure the level and frequency of noise quantitatively, and noise has many uncertain factors. 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) Separationg 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 Section (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 Section (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 interface cable	
	Cable for the battery	
	Other cables to be covered with the shield	

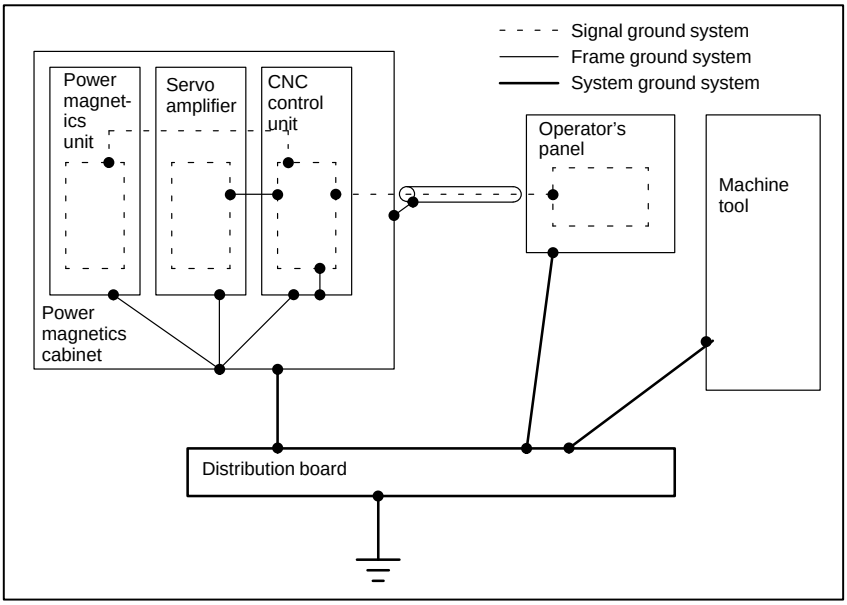
NOTE
1 The groups must be 10 cm or more apart from one another when binding the cables in each group.
2 The electromagnetic shield refers to shielding between groups with grounded steel plates.



(2) Ground

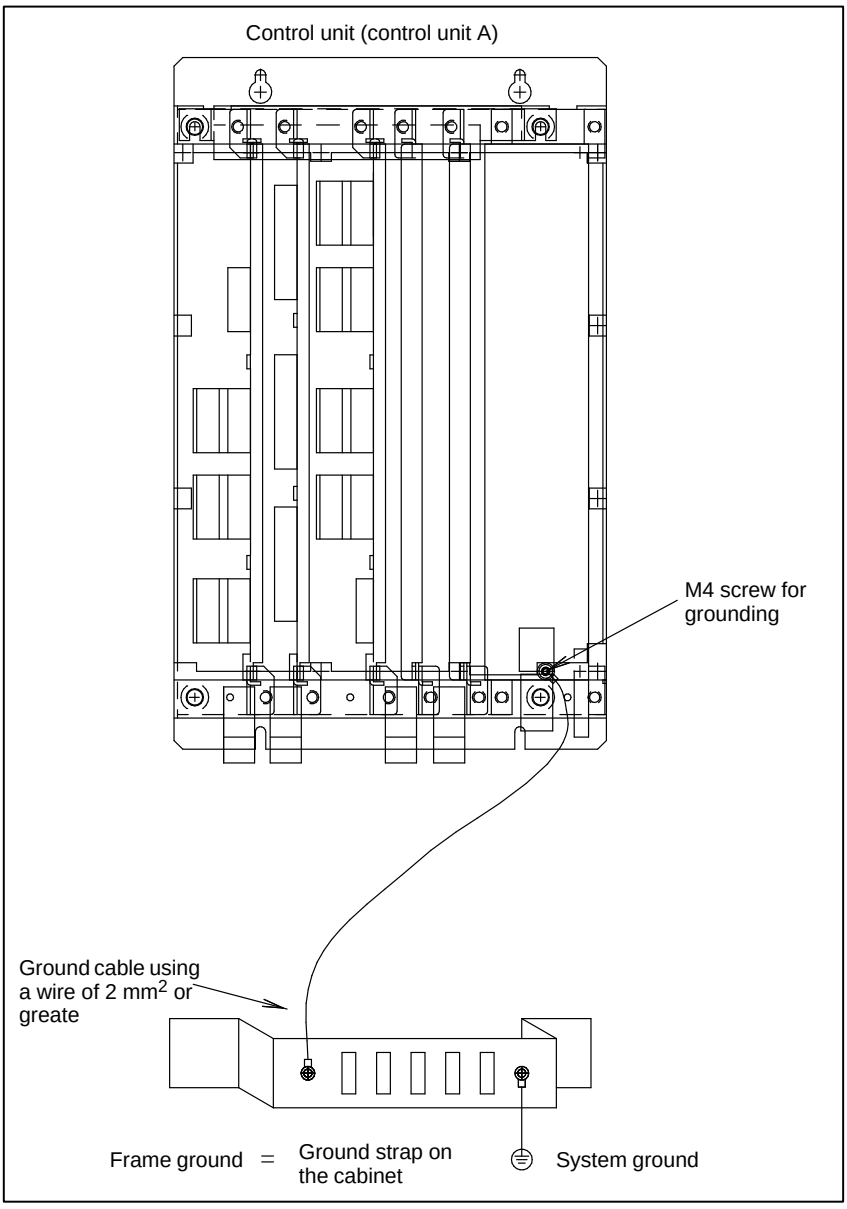
The following ground systems are provided for the CNC machine tool:

- **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.



Notes on connecting the ground systems

- Connect the signal ground with the frame ground (FG) at only one place in the CNC control unit.
- The grounding resistance of the system ground shall be 100 ohms or less (class 3 grounding).
- 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.)
- Use the cable containing the AC power wire and the system ground wire so that power is supplied with the ground wire connected.



(3) Noise suppressor

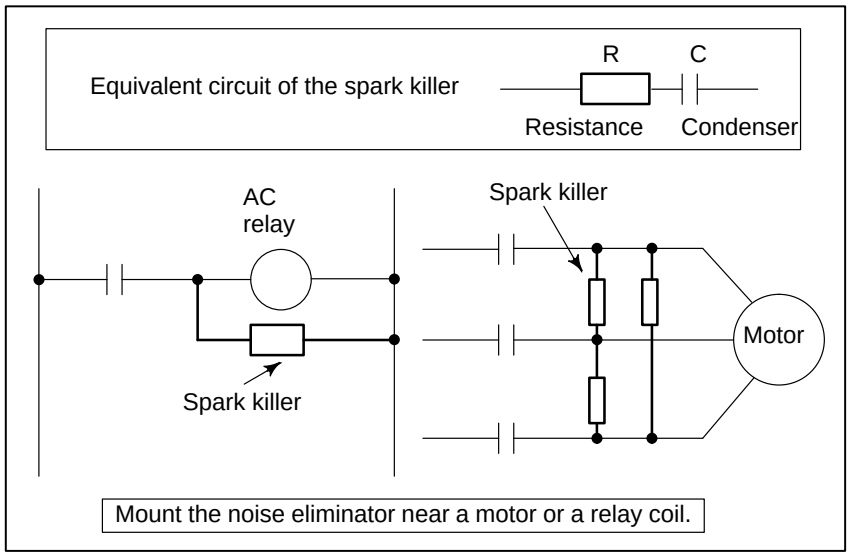
The AC/DC solenoid and relay are used in the power magnetics cabinet.
A high pulse voltage is caused by coil inductance when these devices are turned on or off.
This pulse voltage induced through the cable causes the electronic circuits to be disturbed.

Notes on selecting the spark killer

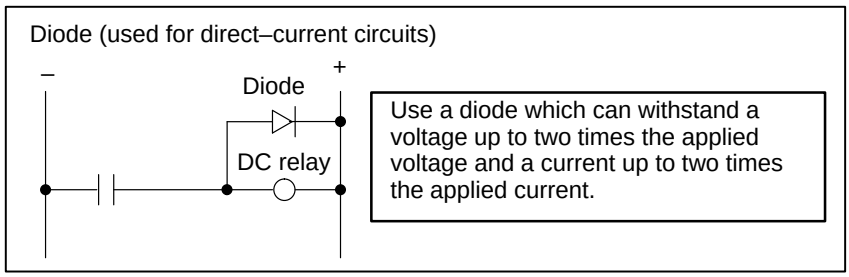
- Use a spark killer consisting of a resistor and capacitor in series. This type of spark killer is called a CR spark killer.(Use it under AC)
  (A varistor is useful in clamping the peak voltage of the pulse voltage, but cannot suppress the sudden rise of the pulse voltage. FANUC therefore recommends 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 $\frac{I^2}{20}$ (μF)

  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 :

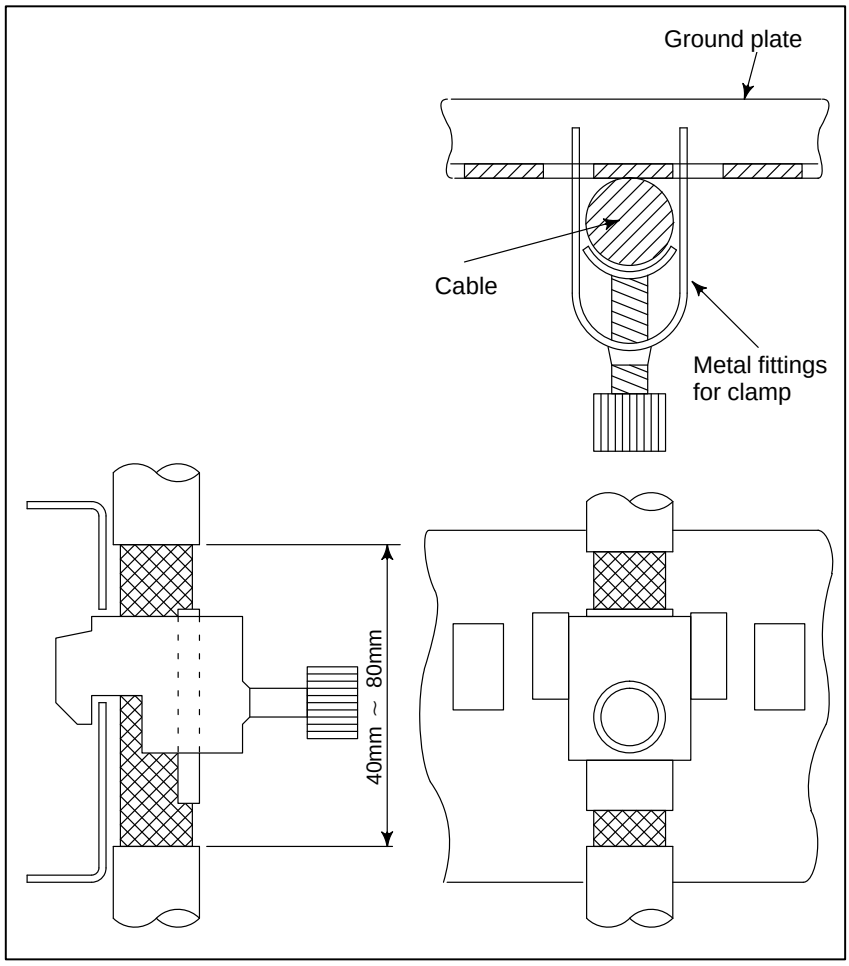


Fig.2.3.11(a) Cable clamp (1)

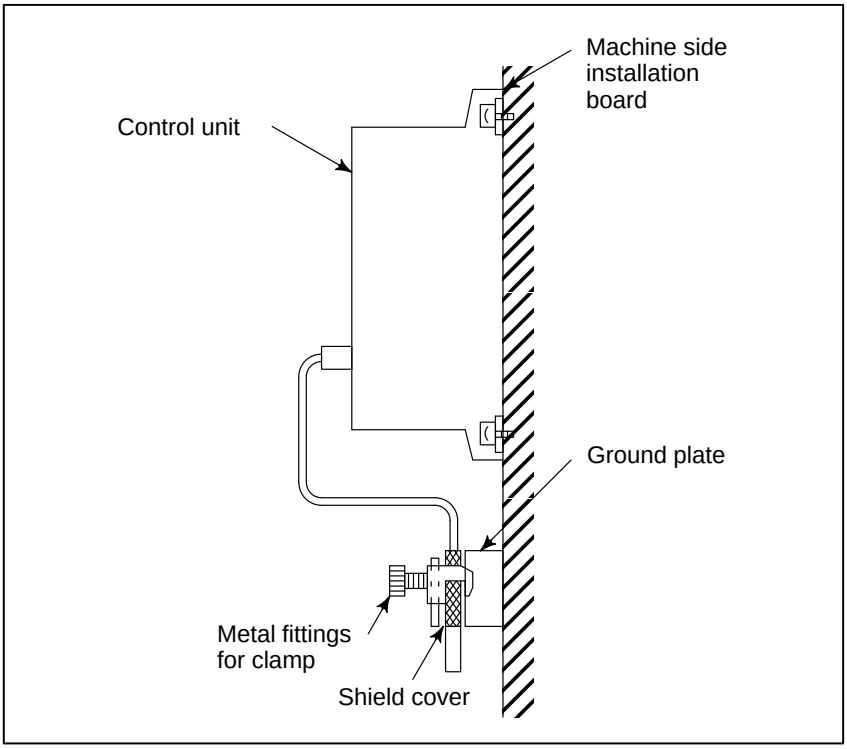


Fig.2.3.11(b) Cable clamp (2)

Prepare ground plate like the following figure.

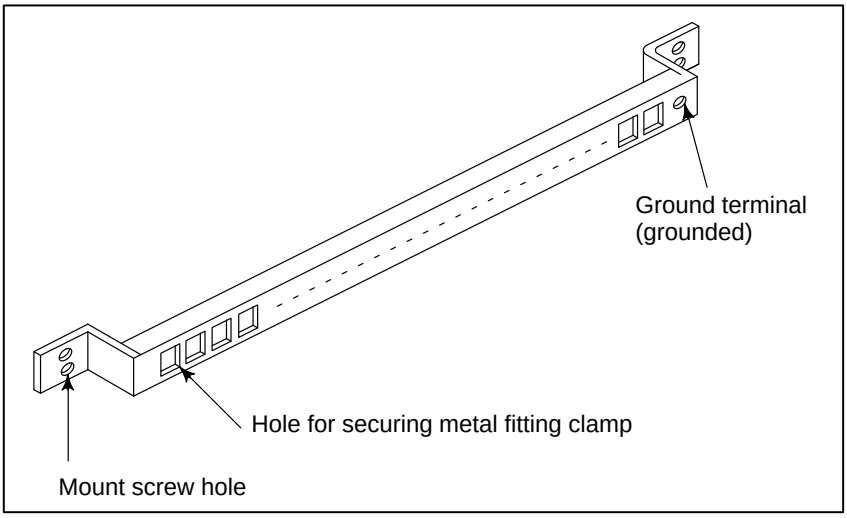
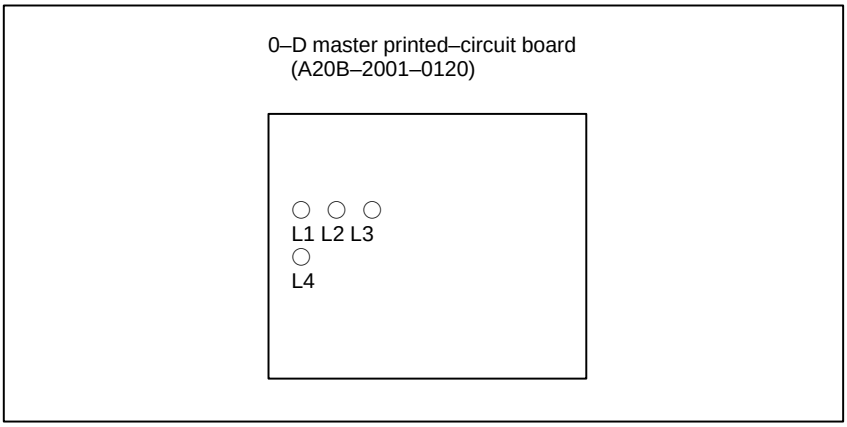


Fig.2.3.11(c) Ground plate

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

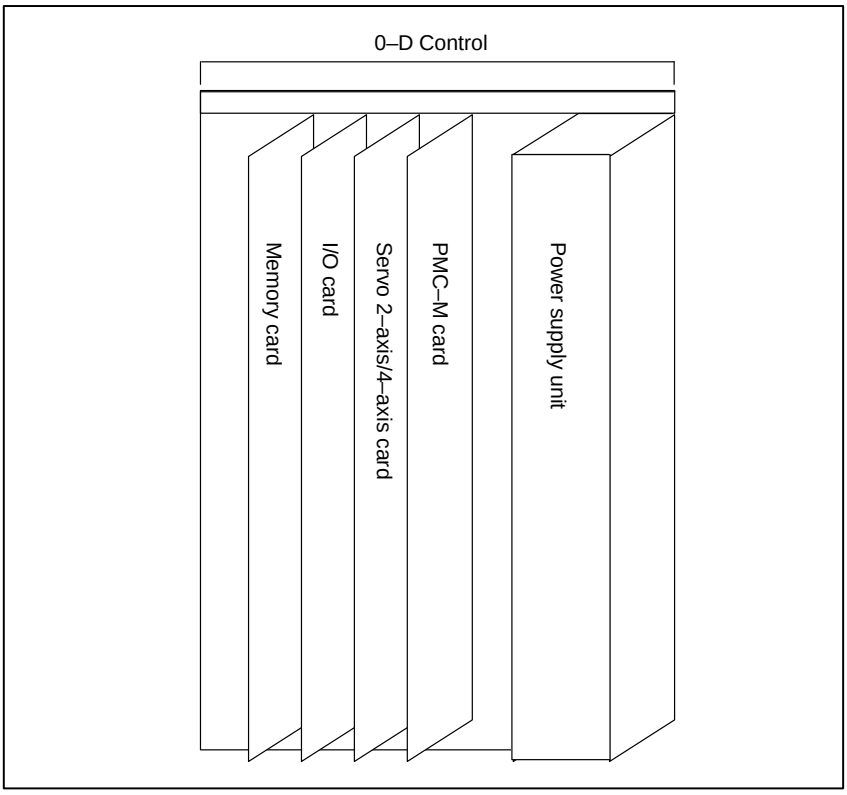
2.4 LEDS ON PRINTED–CIRCUIT BOARDS

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 902. (2) A servo alarm has occurred. (3) No axis card has been installed or, if one has been installed, it may be defective.

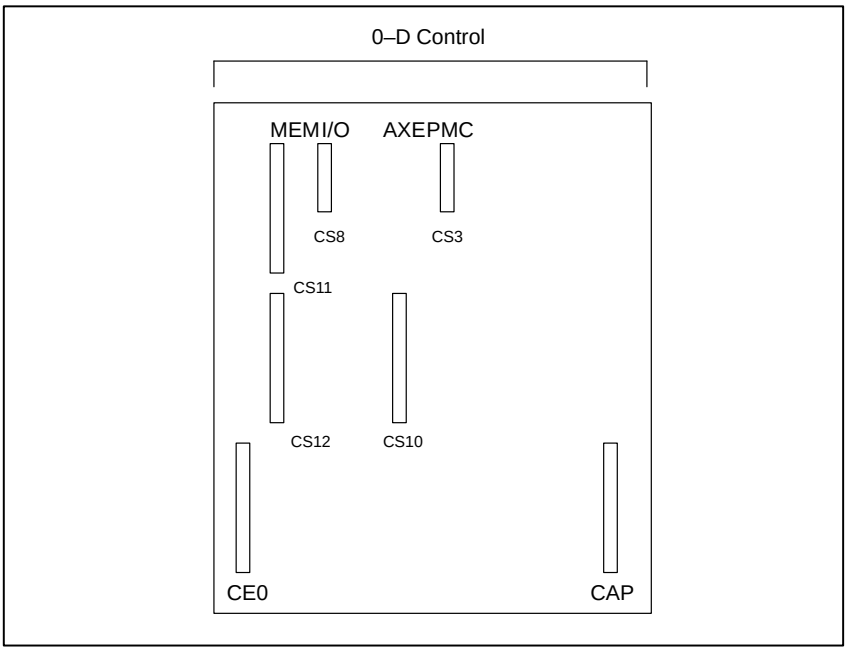


2.5 PRINTED–CIRCUIT BOARD UNIT LIST

2.5.1 Structure



2.5.2 Construction



CAP	A16B–1212–0950 Power supply AI for CE marking CP1 ← AC input power supply CP2 ← AC output CP3 CP4 ← ON/OFF control CP5 ← CRT CP6	A16B–1212–0100 Power supply AI CP3 ← ON/OFF control CP2 ← AC output CP14 CP15 CPI AC input power supply CRT Reserve
PMC		PMC–M (I/O–Link) CS3 A16B–2200–0341 (MASTER/ROM) A16B–2200–346 (MASTER/RAM)

Fig.2.5.2 (a) Construction of 0–D

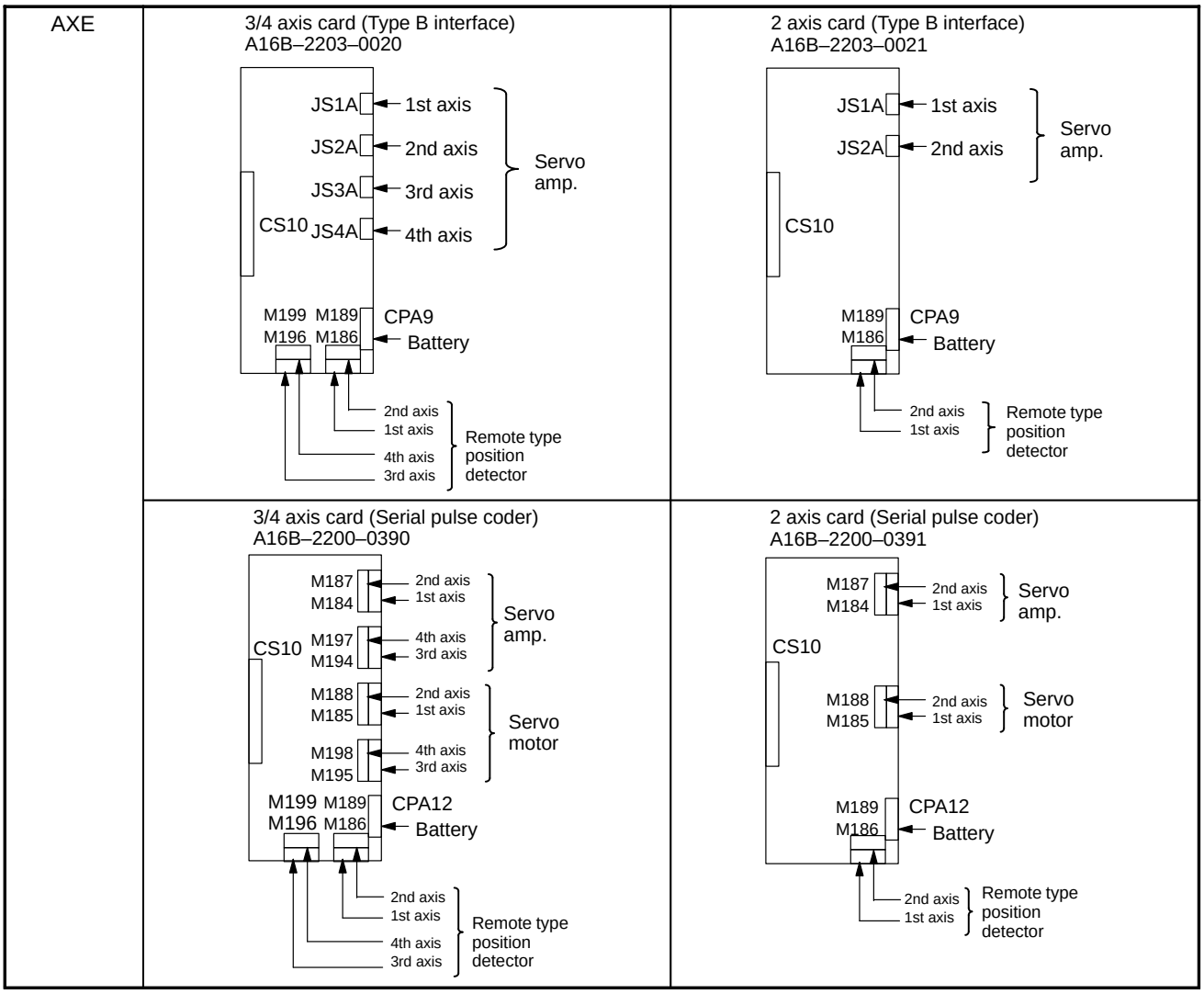


Fig.2.5.2 (b) Construction of 0–D

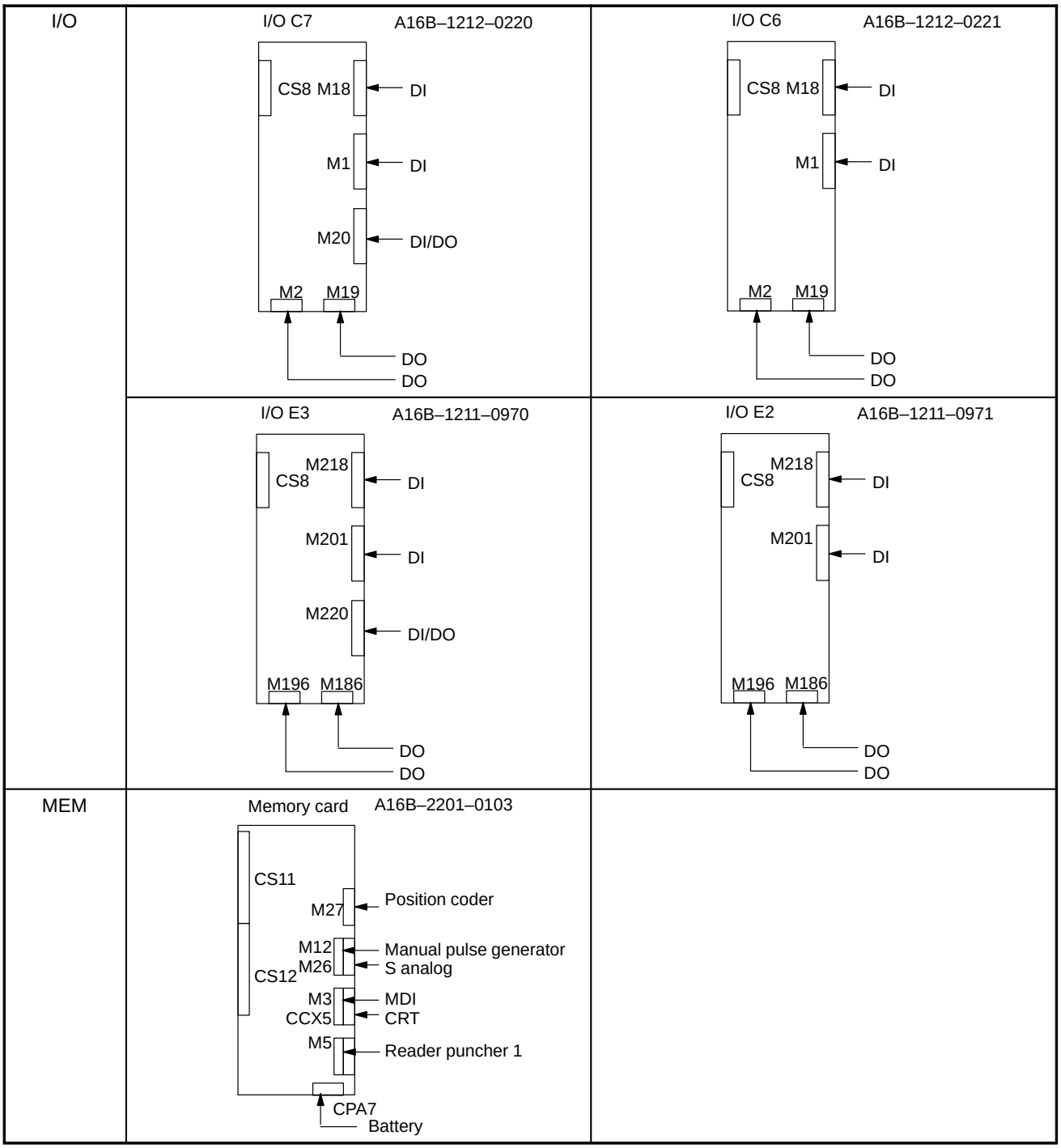


Fig.2.5.2 (c) Construction of 0–D

2.5.3 Printed board unit list

Name		Drawing number	Remark
9″ CRT / MDI	Small type key board	A86L–0001–0125	
	Soft key board	A20B–1001–0720	
	Small type key sheet 0–MD, 0–GSD	A98L–0001–0518#MR	English for CE mark
	Small type key sheet 0–TD, 0–GCD	A98L–0001–0518#TR	English for CE mark
	CRT soft key sheet	A98L–0001–0629	
	9″ monochrome CRT	A13B–0057–C001	
Power supply unit	AI	A16B–1212–0100	
	CE mark	A16B–1212–0950	
Master printed board	0–D 32bit control A	A20B–2001–0120	
Memory printed board		A16B–2201–0101	
I/O printed board	C6	A16B–2203–0111	DI/DO=80/56
	C7	A16B–2203–0110	DI/DO=104/72
	E2	A16B–1211–0971	DO common output I/O–C6
	E3	A16B–1211–0970	DO common output I/O–C7
Axis printed board		A16B–2200–0391	1/2 axis
		A16B–2200–0390	3/4 axis
		A16B–2203–0021	1/2 axis type B
		A16B–2203–0020	3/4 axis type B
PMC–M Printed board	ROM board	A16B–2200–0341	
	RAM board for debug	A16B–2200–0346	

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.

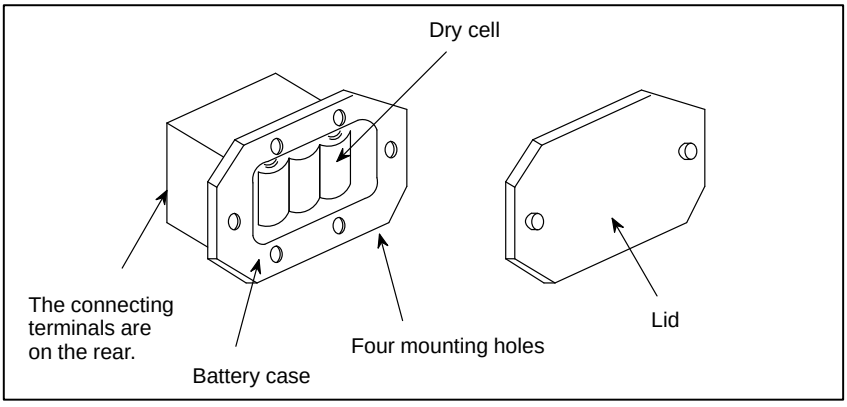
2 Switch on the power to the control unit.

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.



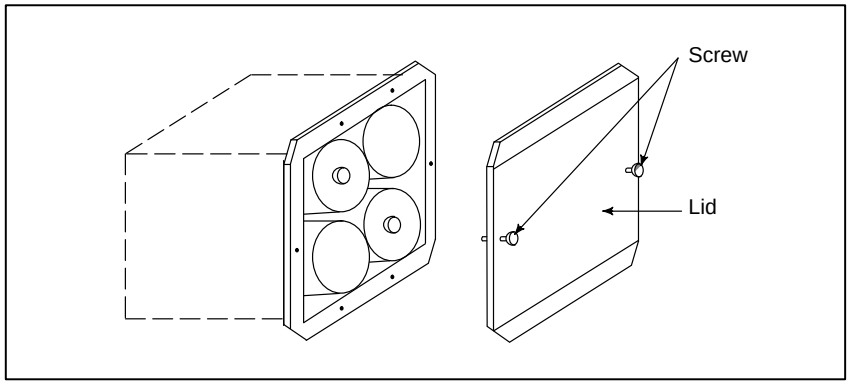
2.6.2 Absolute Pulse Coder Batteries

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

(1) Input/output connectors

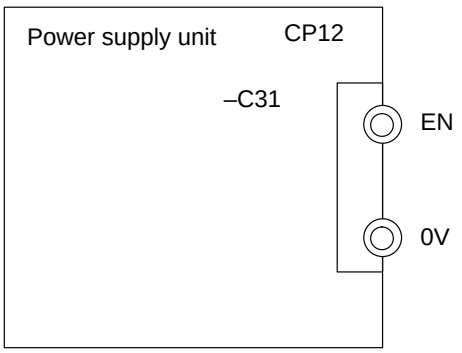
Connector name	Description
CP1	200/220/230/240 VAC input
CP2	200/220/230/240 VAC output (switched on and off simultaneously with the power supply unit)
CP3	Power on/off switch contact signal input
	External alarm signal input
	Alarm signal input
CP12	Supply of +5 V, +15 V, –15 V, +24 V, and +24E to the master printed–circuit board
	EN signal output
CP14	Reserved for future use
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.

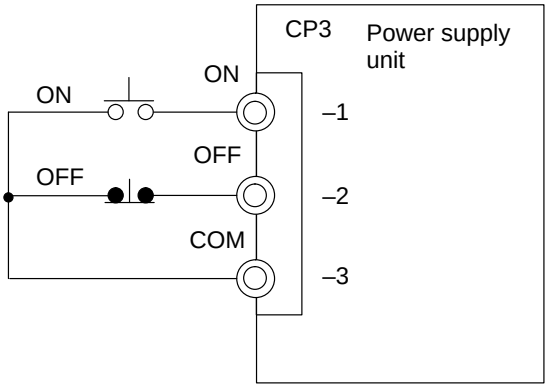
2. Alarm display LED (red)
   If the power supply unit is switched off because of an alarm condition due to a failure such as an output error, the alarm display LED lights and remains on until the alarm condition is cleared by pressing the OFF switch or shutting down the AC power supply.

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.



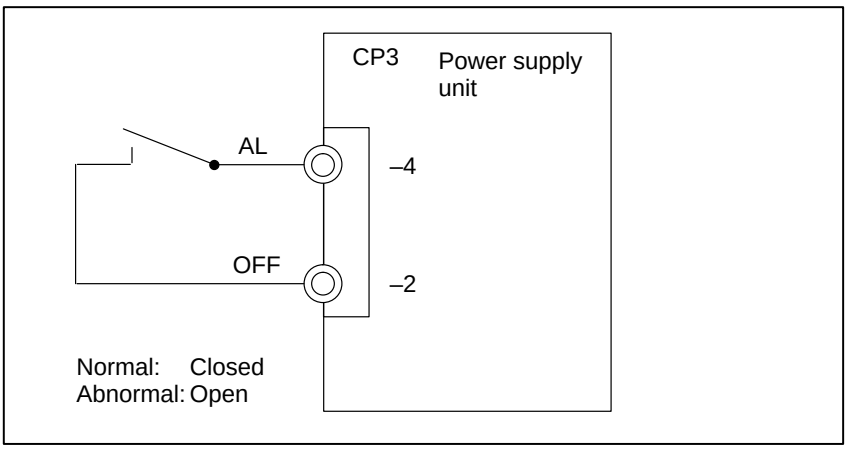
EN: High when all outputs are normal
0V: Low if an output failure occurs.

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.

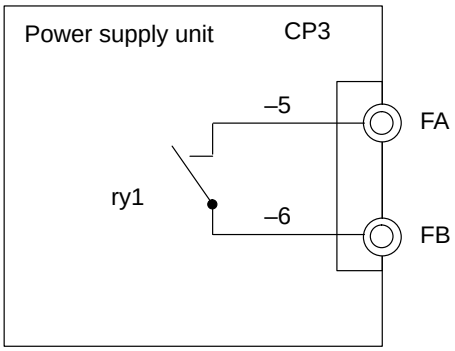


ON switch: Is closed when pressed.
OFF switch: Opens when pressed.

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 +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 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.

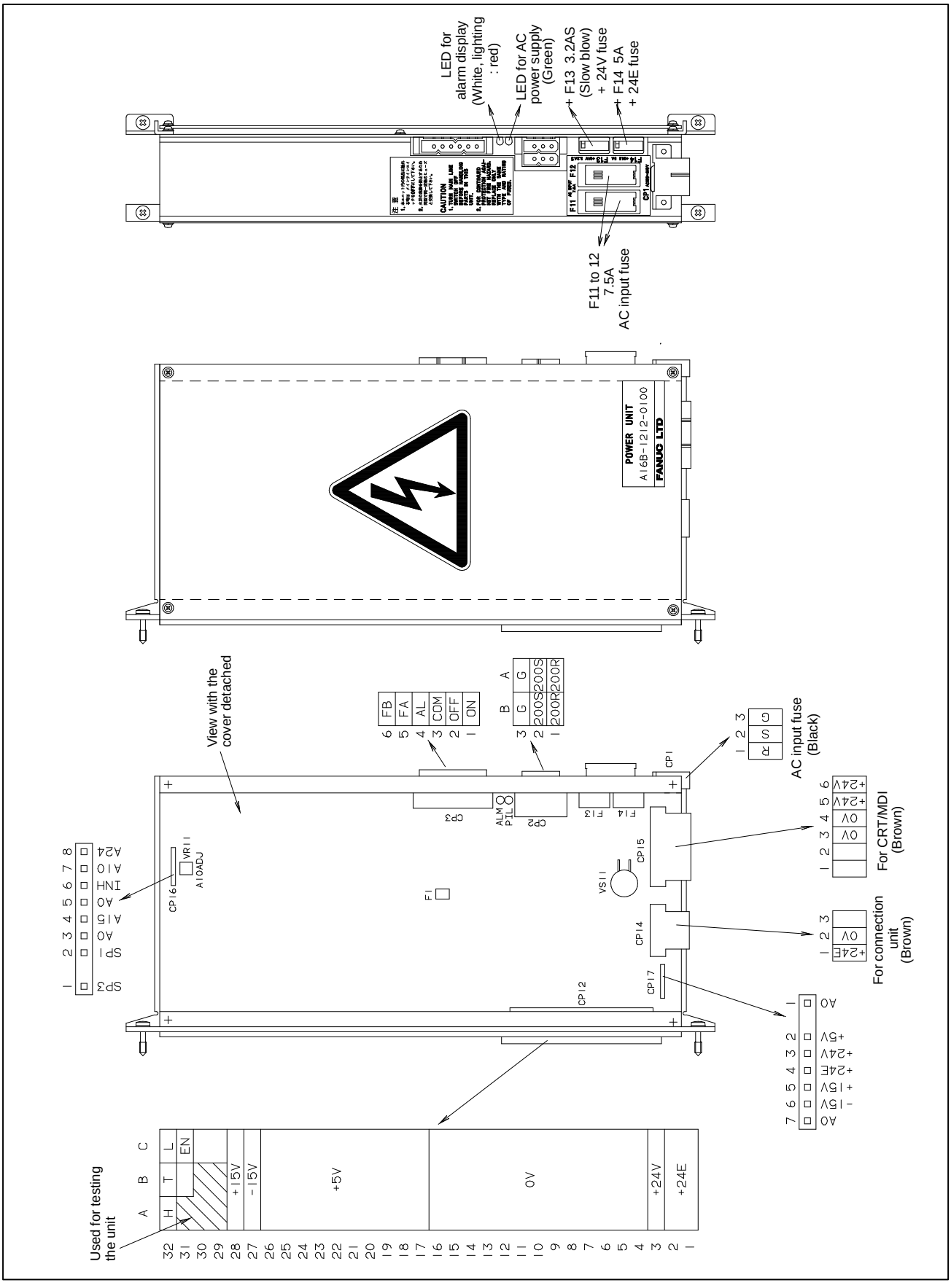


Fig.2.7.1(a) Power supply unit AI external diagram

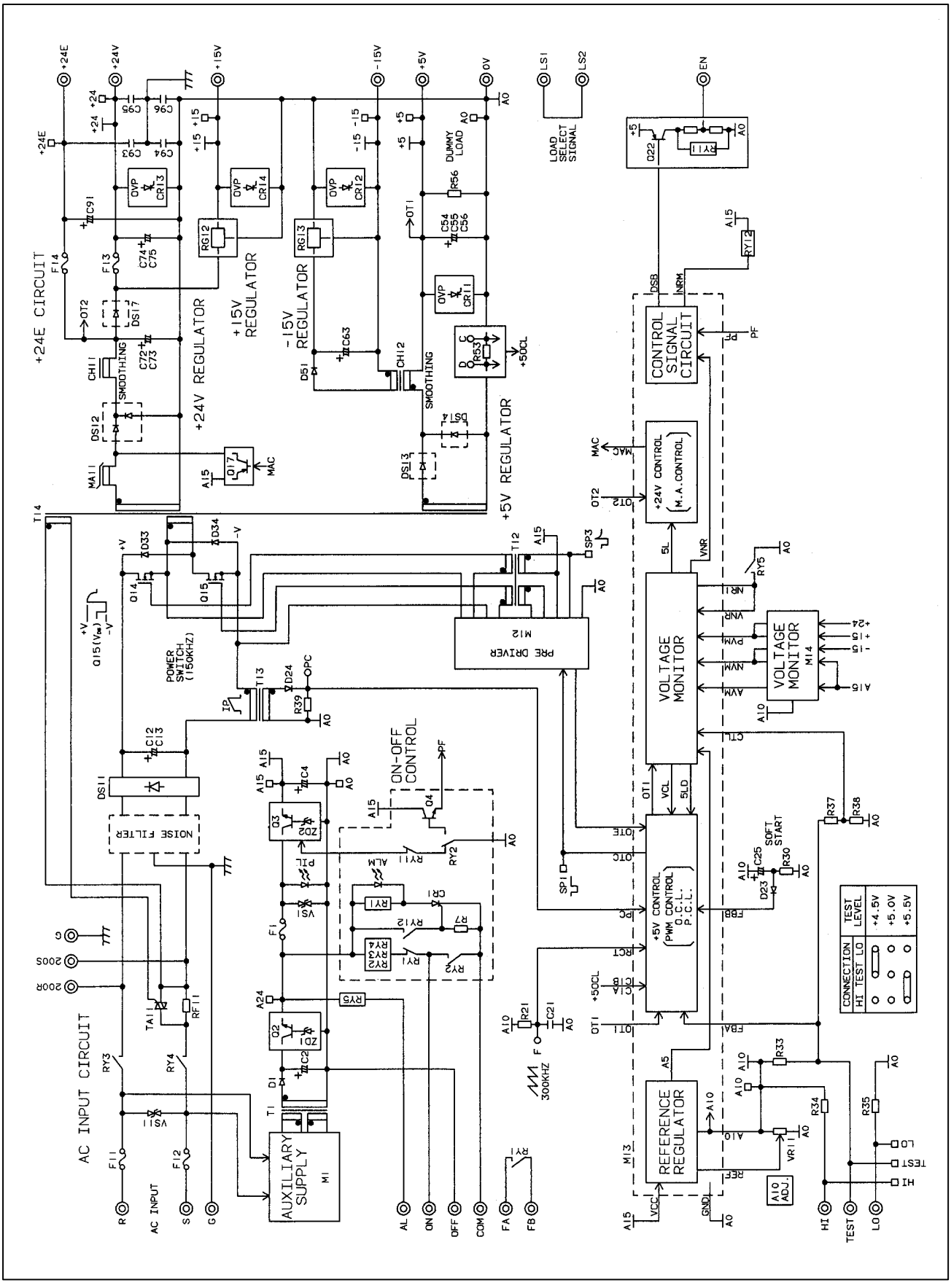


Fig.2.7.1(b) Power supply unit AI block diagram

2.7.2 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.

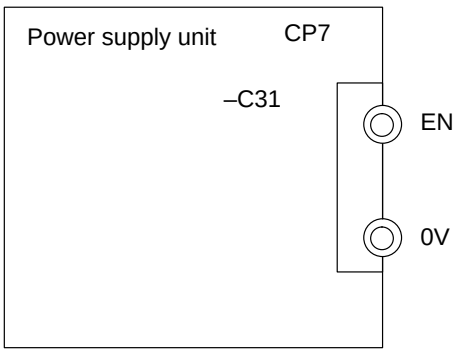
Fig.2.7.2(a) is an outline of this power supply unit, and Fig.2.7.2(b) is the block diagram.

(1) Input/output connectors

Connector name	Description
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)

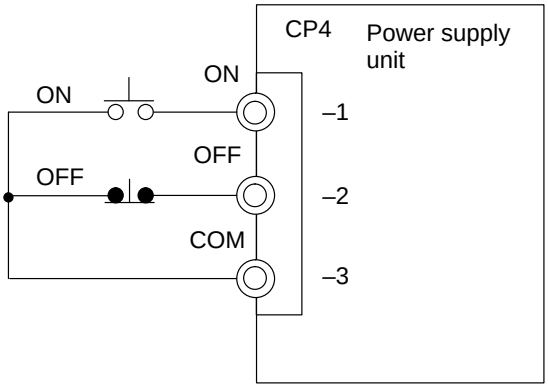
(2) Descriptions of the input/output signals and display LEDs

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.



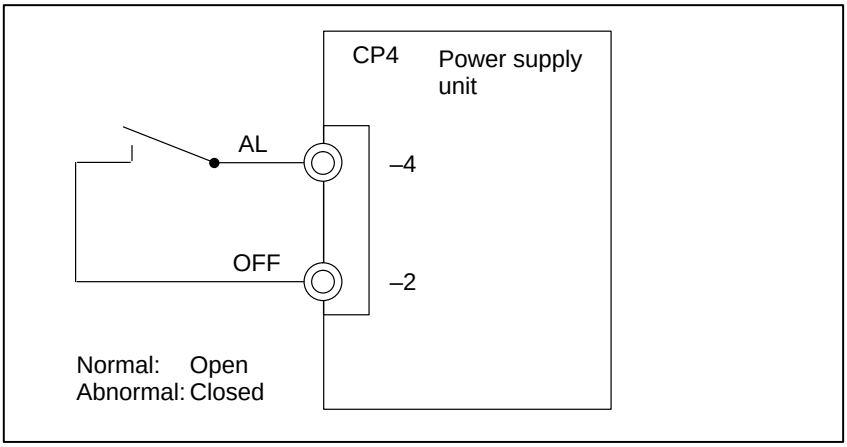
EN: High when all outputs are normal
0V: Low if an output failure occurs.

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.

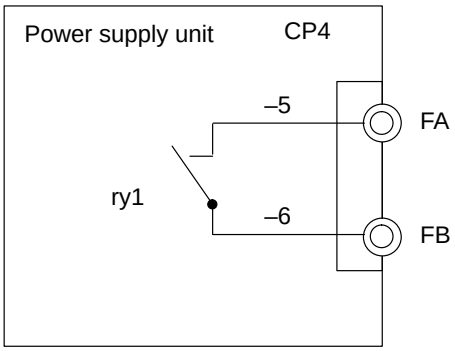


ON switch: Is closed when pressed.
OFF switch: Opens when pressed.

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.

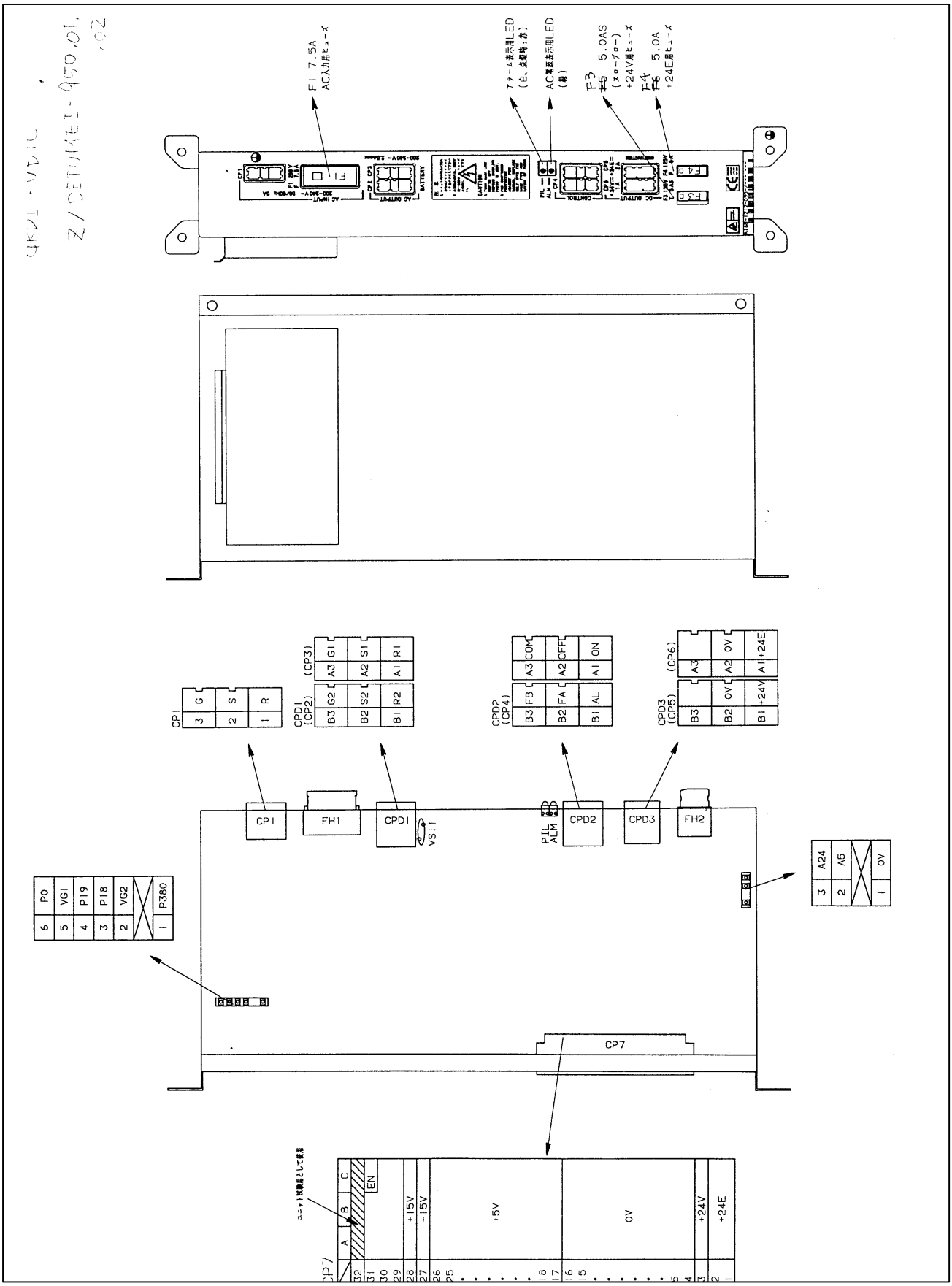


Fig.2.7.2(a) Power supply AI for CE marking

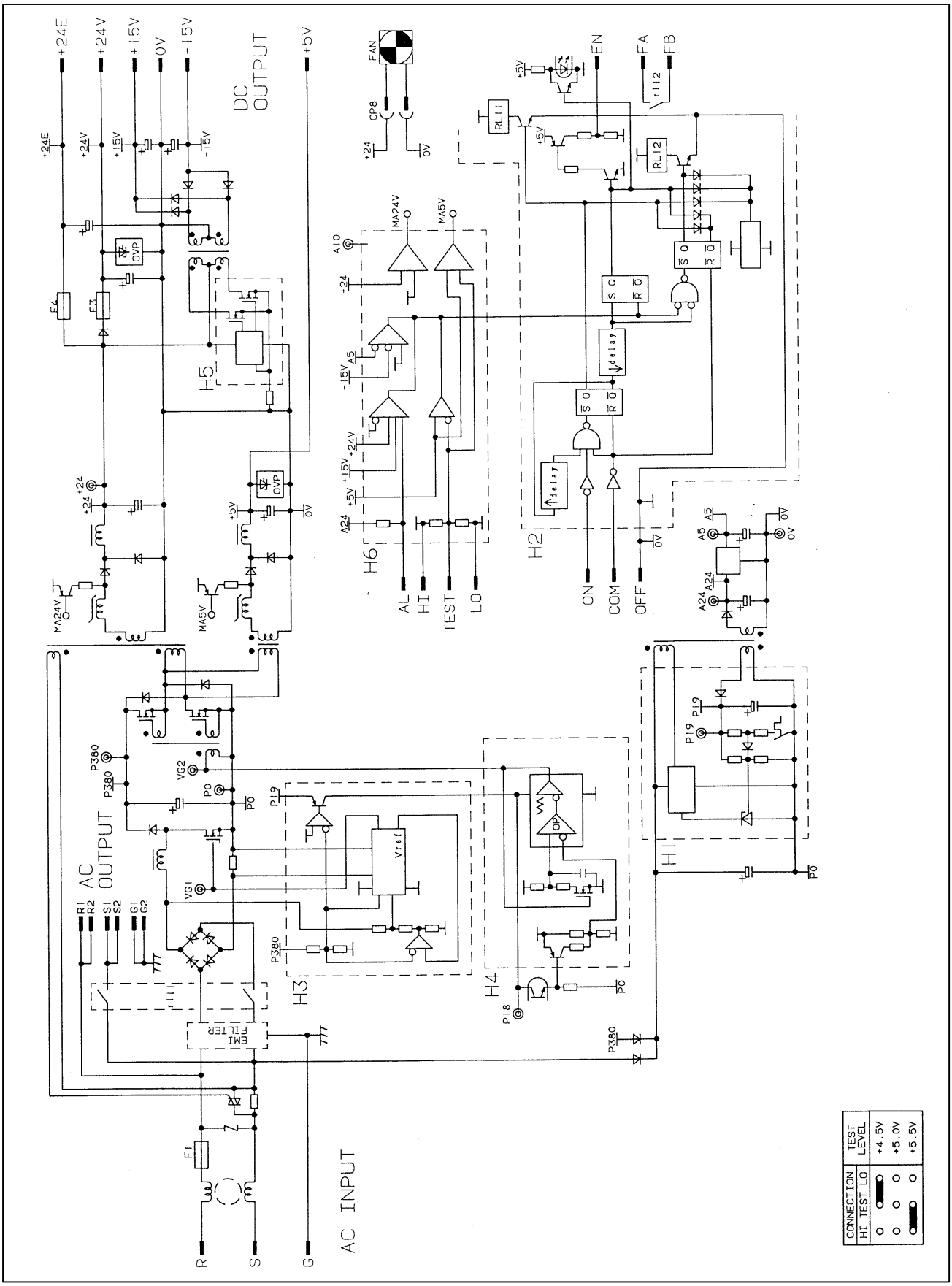


Fig.2.7.2(b) Block diagram of power supply AI for CE marking

2.7.3 Fuses

Unit name		Part number	Rating	Specification	Use
Power supply unit	AI	F11, F12	7.5A	A60L–0001–0245#GP75	For 200 VAC input
		F13	3.2A	A60L–0001–0075#3.2	+24 V for small–sized CRT/MDI master printed–circuit 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 supply unit
Power supply unit AI complying with CE marking requirements	AI	F1	7.5A	A60L–0001–0245#GP75	For 200 VAC input
		F3	5A	A60L–0001–0075#5.0	+24 V for small–sized CRT/MDI master printed–circuit board
		F4	5A	A60L–0001–0046#5.0	Protection of +24E line in the machine from external failures

2.8 MAINTENANCE OF HEAT PIPE TYPE HEAT EXCHANGER

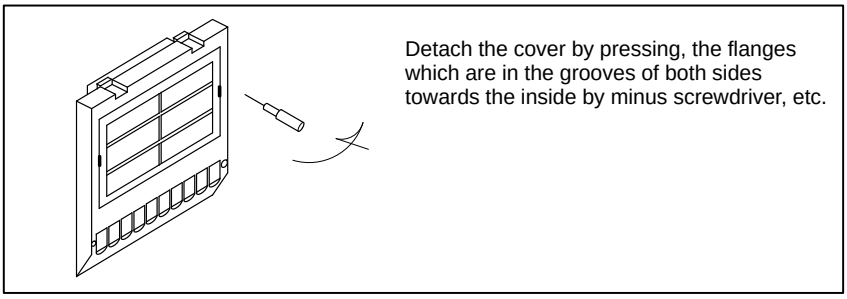
It is necessary to regulary clean the heat transformer, because the heat transformation ability will be reduced by the accumulation of dust. The frequency of the cleaning needed differs according to the installation environment and therefore should be determined by your own judgment according to the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

Air filter cleaning and replacement

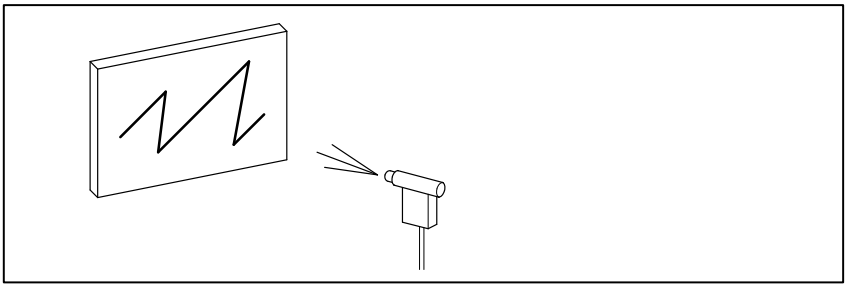
Air filter cleaning and replacement method

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.



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.

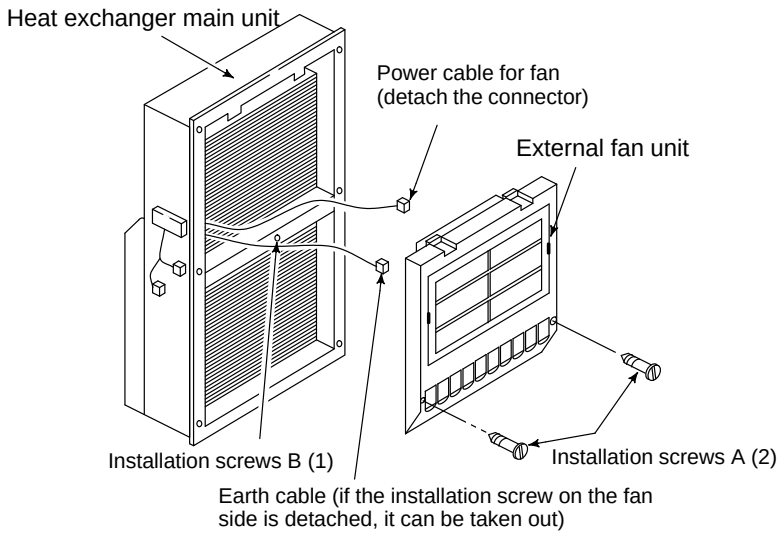
5 Insert the filter in the cover, align the flange in the groove, and install by pressing. Confirm that the cover will not come loose even if it is pulled.

- **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.

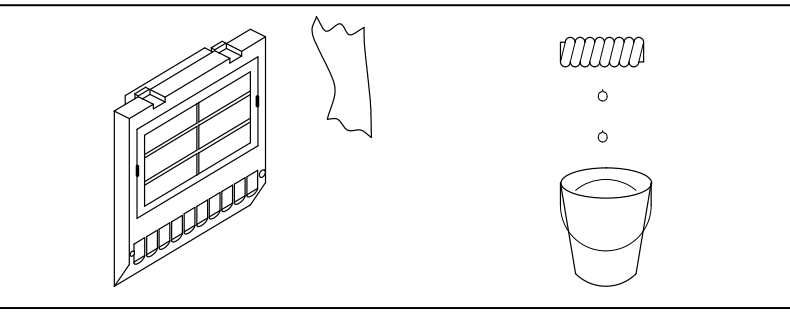


Detach the two installation screws (A) of the external fan unit, and detach the unit from the main unit by sliding it down. Detach the power source cable to the fan and the earth cable. Also detach installation screws (B).

- **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.



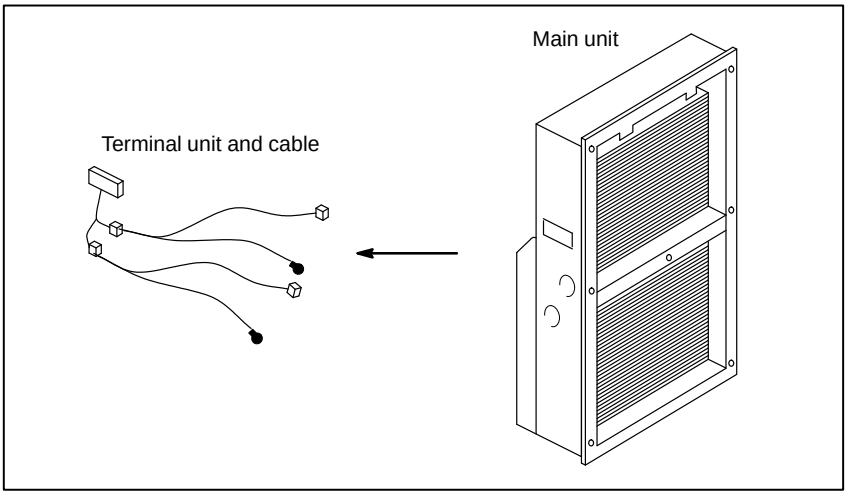
- **Cleaning heat exchanger fan**

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.

- **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.

3 DATA INPUT/OUTPUT

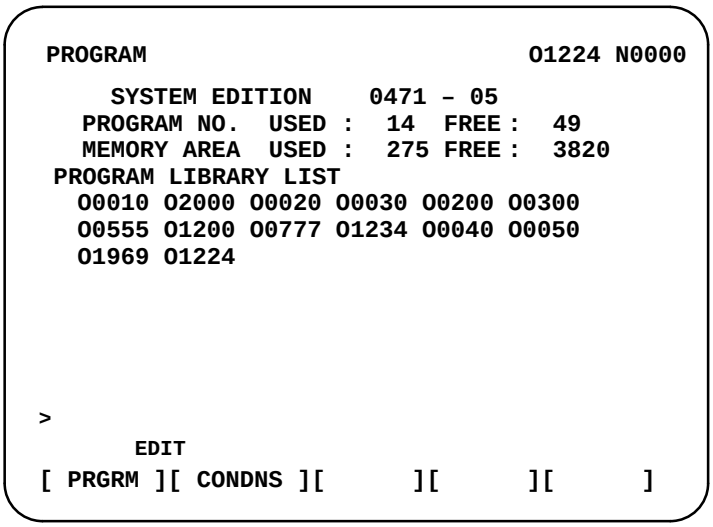
Once the memory printed–circuit board has been replaced, the data must be re–input. This chapter explains how to input parameters, part programs, and tool offset values to, and output them from, I/O units such as floppy disk drives.

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.



(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.

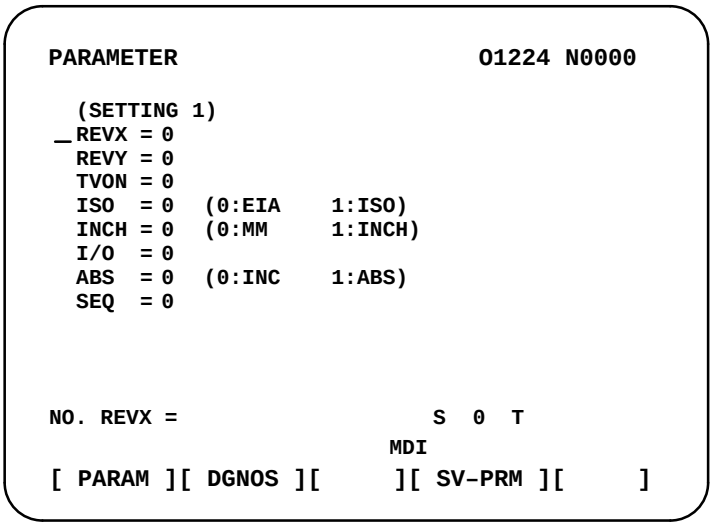
N1→ Locates the first file on the floppy disk.
This is used when a file exists on the floppy disk.

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.



(3) Press the **[OUTPT]** 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 key several times to display the DGNOS (diagnosis) screen.

(3) Press the OUTPT 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    0471 – 05
   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 ][      ][      ][      ]
```

(3) Key in address O.

(4) Key in the program number.

(5) Pressing the **[OUTPT]** key begins program output.
* To output all programs, enter: O–9999**[OUTPUT]**

3.1.5 Offset Value Output

(1) Select EDIT mode.

(2) Press the **[OFSET]** key several times to display the offset screen.

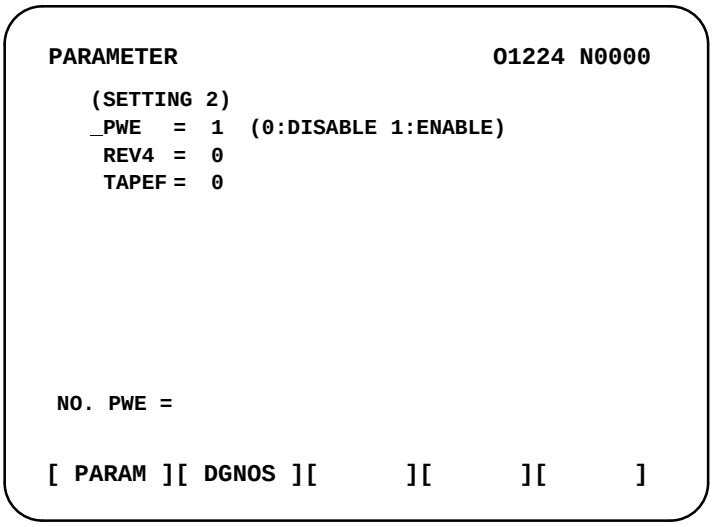
```
OFFSET                                O1224 N0000
   NO.       DATA          NO.          DATA
   001                     009          0.000
   002        0.000        010         12.269
   003        5.000        011         10.230
   004        0.000        012        –11.265
   005       12.580        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 ][      ][      ][      ]
```

(3) Press the **[OUTPT]** key to begin offset value output.

3.1.6 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.)



CAUTION
Alarm P/S100 will occur at this point. After this alarm occurs, press the 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.

3.1.7 PMC Parameter Input

(1) Select EDIT mode.

(2) Locate the beginning of the file.

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

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

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

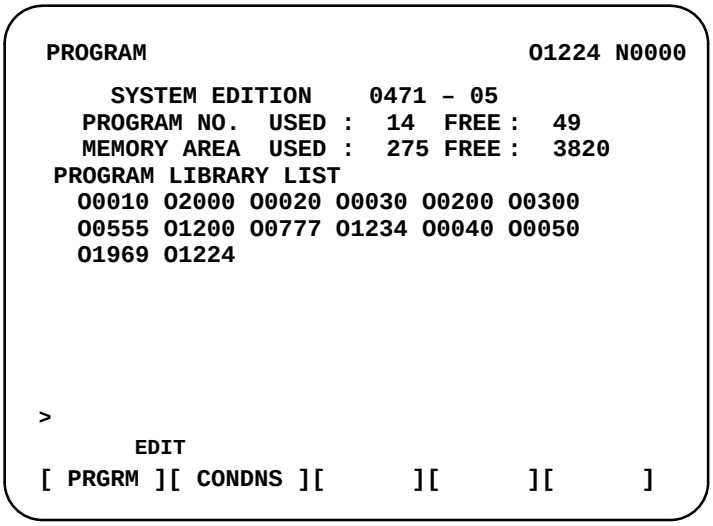
3.1.8 Program Input

(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.



(5) Press the **[INPUT]** key to begin program input.
* This applies when only one program is to be input.

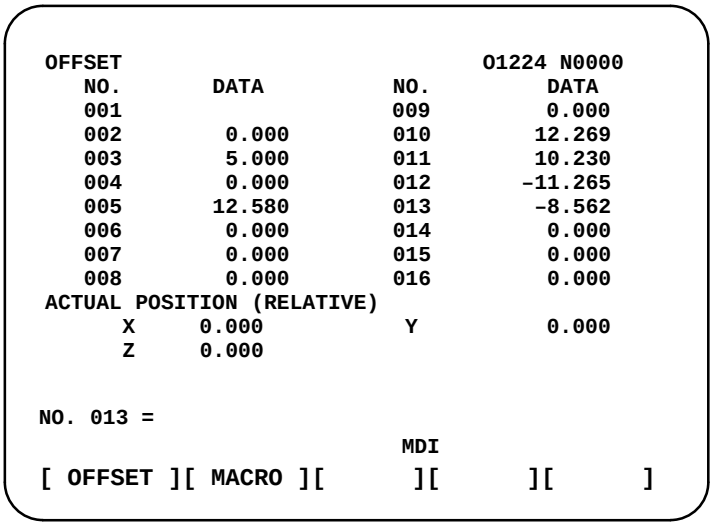
(6) To change the program number during program input, key in address O and the desired program number, then press the **[INPUT]** key.

3.1.9 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.



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

3.1.10 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
Feed NFED	2.7	12.7
20 mA current loop ASR33	2.2	12.2
Stop bit STP2	2.0	12.0
I/O unit type setting	38.7 38.6	38.7 38.6
Connector number	M5 channel 1	M5 channel 1

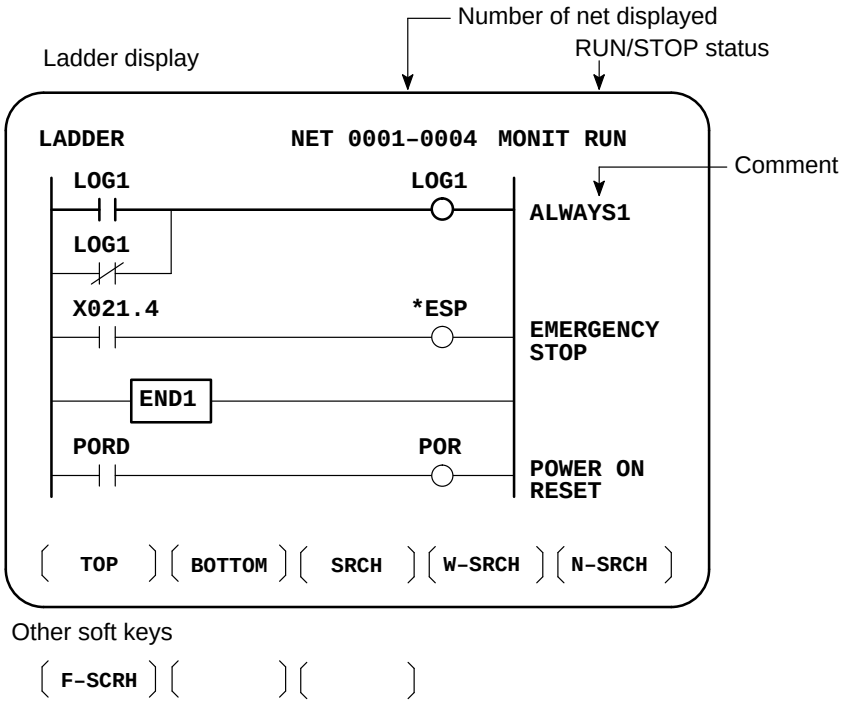
4 INTERFACE BETWEEN NC AND PMC

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 PMCLAD SCREEN

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



- **Contents displayed**

1. Low brightness display Contacts : open Relay :off
2. High brightness display Contacts : closed Relay : on

- **Search method**

1. Use the 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 SIGNAL AND SYMBOL TABLE

M series

	SYM-BOL	PMC address	Signal names
A	+4 –4	G119.2 G119.3	Feed Axis Direction Selection Signal
	4NG	X004.7	4th axes ignored signal
	*ABSM	G127.2	Manual Absolute Signal
	AFL	G103.7	Auxiliary Function Lock Signal
	AL	F149.0	Alarm Signal
	ALMA, B	F281.0 F285.0	Spindle Alarm Signal
	AOV16 AOV32 AOV64 AOV128	G116.4 G116.5 G116.6 G117.6	1% Step override signal
	ARSTA, B	G230.0 G234.0	Spindle Alarm Reset Signal
B	B11 to B38	F155.0 to F154.3	2nd auxiliary function signal
	BAL	F149.2	Battery Alarm Signal
	BAL1 to BAL4	F159.0 to F159.3	Absolute pulse coder Battery Alarm
	BDT	G116.0	Optional Block Skip Signal
		F176.4	
	BF1 BF2	F150.7 F150.6	B Function Strobe Signal
	BFIN1 BFIN2	G115.7 G115.6	B Function Completion Signal
	BGEACT	F180.4	Background Editing Signal
C	CFINA, B	F282.1 F286.1	Switch Completion Signal
	CHPA CHPB	F282.0 F286.0	Power cable switching signal
	CTH1A CTH1B CTH2A CTH2B	G229.3 G233.3 G229.2 G233.2	Gear Selection Signal (Serial Spindle)
	CUT	F188.6	Cutting Signal
D	*DECX *DECY *DECZ *DEC4	X016.5 X017.5 X018.5 X019.5	Reference Position Return Deceleration Signal
	DEN	F149.3	Distribution End Signal
	DEN2	F149.6	Pass point output signal
	DLK	G127.6	Invalidate change of Relative coordinate system
	DNCI	G127.5	Operation by I/O device Mode
	DRN	F176.7	Dryrun signal
	DRNE	G147.7	PMC axis Dry Run Signal
	DST	G150.5	Manual Data Input start Signal
E	EA0 to EA6	G102.0 to G102.6	External Data Input Address Signal
	EAX1 to EAX4	G144.0 to G144.3	PMC control axis selection signal
	*EAXSL	F188.7	PMC axis control axis selection signal
	EBSYA EBSYB	F270.7 F273.7	Axis command read signal of PMC axis control
	EBUFA EBUFB	G210.7 G218.7	Axis control command completed signal of PMC axis control

	SYM-BOL	PMC address	Signal names
E	EC0A to EC7A EC0B to EC7B	G211.0 to G211.7 G219.0 to G219.7	Axis control command signal of PMC axis control
	ECKZA ECKZB	F270.1 F273.1	Standing zero checking signal of PMC axis control
	ECLRA ECLRB	G210.6 G218.6	Reset signal of PMC axis control
	ED0 to ED15	G100.0 to G101.7	External Data Input Data signal
	EDENA EDENB	F270.3 F273.3	Auxiliary function executing signal of PMC axis control
	EFD	F150.1	External operation signal (High–speed interface)
	EFIN	G115.1	External operation Function completion signal (High–speed interface)
	EFINA EFINB	G210.0 G218.0	Auxiliary function completion signal of PMC axis control
	EGENA EGENB	F270.4 F273.4	Axis moving signal of PMC axis control
	EIALA EIALB	F270.2 F273.2	Alarm signal of PMC axis control
	EID0A to EID31A EID0B to EID31B	G214.0 to G217.7 G222.0 to G225.7	Moving rate of PMC axis control
	EIF0A to EIF15A EIF0B to EIF15B	G212.0 to G213.7 G220.0 to G221.7	Feed rate of PMC axis control
	EINPA EINPB	G270.0 G273.0	In–position signal of PMC axis control
	EM11A to EM28A EM11B to EM28B	F272.0 to F272.7 F275.0 to F275.7	Auxiliary function BCD code of PMC axis control
	EMFA EMFB	F271.0 F274.0	Auxiliary function read signal of PMC axis control
	ENB	F149.4	Spindle enable signal
	EOTNA EOTNB	F270.6 F273.6	Overtravel – direction signal of PMC axis control
	EOTPA EOTPB	F270.5 F273.5	Overtravel + direction signal of PMC axis control
	EOV0	F188.5	Override 0% signal of PMC axis
	EREND	F160.0	Read end signal
	ERS	G121.7	External reset signal
	ESBKA ESBKB	G210.3 G218.3	Block stop signal of PMC axis control
	ESEND	F160.1	Search end signal
	ESKIP	X008.6	Skip signal of PMC axis
	ESOFA ESOFB	G210.4 G218.4	Servo off signal of PMC axis control
	*ESP *ESP	X021.4 G121.4	Emergency stop signal

	SYM-BOL	PMC address	Signal names
E	*ESPA *ESPB	G230.1 G234.1	Emergency stop signal (Spindle)
	ESTB	G102.7	External data input
	ESTPA ESTPB	G210.5 G218.5	Axis control hold signal of PMC axis control
	EXLM2	G129.6	Stored stroke limit 2
	EXRD	G134.1	External Read Start Signal
	EXSTP	G134.2	External Read/Punch Stop Signal
	EXWT	G134.3	External Punch Start Signal
F	FIN	G120.3	M, S, T, B function completion signal
	*FLWU	G104.5	Follow–up signal
	FXST	F161.4	Canned cycle signal
G	GR1 GR2	G123.2 G123.3	Gear selection signal
H	H4	G119.7	Handle feed axis select signal
	HX HY HZ	G116.7 G117.7 G118.7	Handle feed axis select signal
	HYO	F174.5	Manual Pulse Generator Feed Axis Selection Signal
	HZO	F174.6	
	H4O	F174.7	
I	IGNVRY	G123.0	V–READY check signal
	*ILK	G117.0	Interlock signal
	INDXA INDXB	G231.0 G235.0	Spindle orientation stop position change command
	INFD	G237.6	In–feed control cutting start signal
	*ITX *ITY *ITZ *IT4	G128.0 G128.1 G128.2 G128.3	Each axis interlock signal
J	*JV1 to *JV16	G143.0 to G143.4	Manual feed rate override
K	KEY	G122.3	Program protection signal
		F178.5	Protect Key Signal
L	*LDSP	G119.0	Ladder display signal
	LDT1A LDT1B	F281.4 F285.4	Load detection signal 1
	LDT2A LDT2B	F281.5 F285.5	Load detection signal 2
	*+LX *+LY *+LZ	X020.0 X020.1 X020.2	+ overtravel limit
	*–LX *–LY *–LZ	X020.3 X020.4 X020.5	– overtravel limit
M	M00 M01 M02 M30	F154.7 F154.6 F154.5 F154.4	M function code signal
	M11 M12 M14 M18 M21 M22 M24 M28 M31 M32 M34 M38	F151.0 F151.1 F151.2 F151.3 F151.4 F151.5 F151.6 F151.7 F157.0 F157.1 F157.2 F157.3	M function code signal

	SYM-BOL	PMC address	Signal names
M	M211 M212 M214 M218 M221 M222 M224 M228 M231 M232 M234 M238	F193.0 F193.1 F193.2 F193.3 F193.4 F193.5 F193.6 F193.7 F194.0 F194.1 F194.2 F194.3	2nd M function signal
	M311 M312 M314 M318 M321 M322 M324 M328 M331 M332 M334 M338	F194.4 F194.5 F194.6 F194.7 F195.0 F195.1 F195.2 F195.3 F195.4 F195.5 F195.6 F195.7	3rd M function signal
	MA	F149.7	NC Ready Signal
	MCFNA MCFNB	G230.3 G234.3	Power Cable Condition Verification Signal
	MD1 MD2 MD4	G122.0 G122.1 G122.2	Mode Selection Signal
	MF MF2 MF3	F150.0 F157.4 F157.5	M function strobe signal
	MFIN	G115.0	High–speed M/S/T Interface signal
	MFIN2 MFIN3	G134.4 G134.5	2nd M function completion signal 3rd M function completion signal
	MIRX MIRY MIR4	G127.0 G127.1 G127.7	Mirror Image Signal
	*+MITX *+MITY *+MITZ *+MIT4 *–MITX *–MITY *–MITZ *–MIT4	G142.0 G142.1 G142.2 G142.3 G142.4 G142.5 G142.6 G142.7	Interlock Signal for Each axis and Direction Signal
	MLK	G117.1 F176.6	Machine Lock Signal
	MP1 MP2	G120.0 G120.1	Incremental Feed Signal
	MRDYA MRDYB	G229.7 G233.7	Machine Ready Signal (Serial spindle)
N	NRR0A NRROB	G231.2 G235.2	Short direction command at changing the spindle orientation stop position
O	OP	F148.7	Automatic Operation Signal
	ORARA ORARB	F281.7 F285.7	Spindle Orientation Completion Signal
	ORCMA ORCMB	G229.6 G233.6	Orientation Command Signal
	OUT	F171.5 to F171.7	General Purpose Signal
	*OV1 *OV2 *OV4 *OV8	G121.0 G121.1 G121.2 G121.3	Override Signal

	SYM-BOL	PMC address	Signal names
O	*OV1E *OV2E *OV4E *OV8E *OV16E	G147.0 G147.1 G147.2 G147.3 G147.4	PMC axis indepenent override signal
	OVC	G126.4	Override cancel signal
	OVCE	G147.5	PMC axis override cancel signal
P	PCFNA PCFNB	F282.3 F286.3	Output switching completion signal
	PCHPA PCHPB	F282.2 F286.2	Output switching signal
	PKESS2	G138.7	2nd spindle parking signal
	PN1 PN2 PN4 PN8	G122.4 G122.5 G122.6 G122.7	Workpiece Number Search Signal
	PRGDPL	F180.1	Program Screen Display Signal
	PRTSF	F164.7	Target Part Count Reached Signal
R	R01O to R12O	F172.0 to F173.3	Spindle Speed Binary Code Output Signal
	RO1I to R12I	G124.0 to G125.3	Spindle Speed Binary Code Input Signal
	RCHA RCHB	G230.7 G234.7	Power Cable Condition Verification Signal
	RGSPM RGSPP	F165.1 F165.0	Spindle Rotate Signal in Rigid Tapping Mode
	RGTAP RGTPN	G135.0 G123.1	Rigid Tapping Signal
	ROTAA ROTAB	G231.1 G235.1	Rotation direction command at changing the spindle orientation stop position
	ROV1 ROV2	F175.4 F175.5	Rapid Feed Override Signal
	ROV1E ROV2E	G146.1 G146.0	PMC axis rapid traverse override signal
	ROV3 ROV4	G133.4 G133.5	Rapid traverse override signal
	RPALM	F180.3	Read/Punch Alarm Signal
	RPBSY	F180.2	Read/Punch Busy Signal
	RRW	G104.6	Rewind Signal
	RSLA RSLB	G230.6 G234.6	Spindle Output Switching Request Signal
	RST	F149.1	Reset Signal
	RT	G121.6	Manual Rapid Traverse Signal
		F178.6	Rapid feed signal
	RWD	F164.6	Rewinding Signal
S	S11 S12 S14 S18 S21 S22 S24 S28	F152.0 F152.1 F152.2 F152.3 F152.4 F152.5 F152.6 F152.7	Spindle function code signal
	SA	F148.6	Servo Unit Ready Signal
	SAR	G120.4	Spindle Speed Arrival Signal
	SARA SARB	F281.3 F285.3	Speed arrival signal
	SBK	G116.1	Single Block Signal
		F176.5	

	SYM-BOL	PMC address	Signal names
S	SDTA SDTB	F281.2 F285.2	Speed detection signal
	SF	F150.2	S Function Strobe Signal
	SFIN	G115.2	High–Speed M/S/T Interface Signal
	SFRA SFRB	G229.5 G233.5	Spindle Forward Direction Signal
	SGN	G125.5	Spindle Polarity Selection Signal
	SIGN	G125.7	Spindle analog voltage control signal
	SKIP	X008.7	Skip Signal (FSO–GSD only)
	SOCNA SOCNB	G230.4 G234.4	Spindle Soft–start/Stop Cancel Signal
	SOR	G120.5	Spindle Orientation Command
	*SP	G121.5	Automatic feed hold signal
		F178.7	Feed Hold Signal
	SPA SPB SPC	G103.3 G103.4 G103.5	Spindle override
	SPDS1 SPDS2 SPDS3 SPDS4	F189.0 F189.1 F189.2 F189.3	Signal by axis moving speed
	SPL	F148.4	Automatic feed hold signal
	SPSLA SPSLB	G230.2 G234.2	Spindle selection signal
	SRVA SRVB	G229.4 G233.4	Spindle reverse rotation command signal
	SSIN	G125.6	Spindle Polarity Selection Signal
	SSTA SSTB	F281.1 F285.1	Speed zero detection signal
	*SSTP	G120.6	Spindle stop signal
	ST	G120.2	Automatic operation start signal
	STL	F148.5	Automatic operation starting signal
	SVFX SVFY SVFZ SVF4	G105.0 G105.1 G105.2 G105.3	Servo off signal
T	T11 to T48	F153.0 to F156.7	Tool function code signal
	TAP	F149.5	Tapping Mode Signal
	TF	F150.3	T Function Strobe Signal
	TFIN	G115.3	High–speed M/S/T interface signal
	TLMA TLMB	F281.6 F285.6	Torque limit signal
	TLMHA TLMHB	G229.1 G233.1	High–speed Torque Limit Signal
	TLMLA TLMLB	G229.0 G233.0	Low–speed Torque Limit Signal
	TORQL	F168.7	Torque limit arrival signal
U	U00 to U15	F162.0 to F163.7	Output Signal by Custom Macro Function Signal
	UI0 to UI15	G130.0 to G131.7	Input Signal by Custom Macro Function Signal
	UO100 to UO131	F196.0 to F199.7	Output Signal by Custom Macro Function Signal

	SYM-BOL	PMC address	Signal names
X	+X –X –Y +Y –Z +Z	G116.2 G116.3 G117.3 G117.2 G118.3 G118.2	Feed axis direction selection signal
	+X to +4 –X to –4	F177.5 to F177.7	Jog Feed Axis Selection Signal
Z	ZNG	G103.6	Z axis command cancel signal
	ZP2X ZP2Y ZP2Z ZP24	F161.0 F161.1 F161.2 F161.3	2nd reference point return completion signal
	ZPX ZPY ZPZ ZP4	F148.0 F148.1 F148.2 F148.3	Reference point return completion signal
	ZRFX ZRFY ZRFZ ZRF4	F168.0 F168.1 F168.2 F168.3	Start point decision signal
	ZRN	G120.7	Automatic reference point return selection signal

T series

	SYM-BOL	PMC address	Signal names
A	*ABSM	G127.2	Manual Absolute Signal
	AFL	G103.7	Auxiliary Function Lock Signal
	AL	F149.0	Alarm Signal
	ALMA, B	F281.0 F285.0	Spindle Alarm Signal
	AOV16 AOV32 AOV64 AOV128	G140.4 G140.5 G140.6 G140.7	1% Step override signal
	ARSTA, B	G230.0 G234.0	Spindle Alarm Reset Signal
B	BAL	F149.2	Battery Alarm Signal
	BAL1 to BAL3	F156.0 to F156.2	Absolute pulse coder Battery Alarm
	BDT	G116.0	Optional Block Skip Signal
		F176.4	
	BGEACT	F180.4	Background Editing Signal
C	CDZ	G126.7	Chamfering Signal
	CFINA, B	F282.1 F286.1	Switch Completion Signal
	CHPA CHPB	F282.0 F286.0	Power cable switching signal
	COSP	F180.5	Spindle command signal
	CTH1A CTH1B CTH2A CTH2B	G229.3 G233.3 G229.2 G233.2	Gear Selection Signal (Serial Spindle)
	CUT	F188.6	Cutting signal
D	*DECX *DECZ *DEC3 *DEC3	X016.5 X017.5 X016.7 X019.7	Reference Position Return Deceleration Signal
	DEN	F149.3	Distribution End Signal
	DEN2	F149.6	Pass point output signal
	DLK	G127.6	Invalidate change of Relative coordinate system
	DNCI	G127.5	Operation by I/O device Mode
	DRN	G118.7	Dry Run Signal
		F176.7	
	DRNE	G147.7	PMC axis Dry Run Signal
	DST	F150.5	Manual Data Input start Signal
E	EA0 to EA6	G102.0 to G102.6	External Data Input Address Signal
	EAX1 to EAX3	G144.0 to G144.2	PMC control axis selection signal
	*EAXSL	F188.7	Control axis selection signal
	EBSYA EBSYB	F270.7 F273.7	Axis command read signal of PMC axis control
	EBUFA EBUFB	G210.7 G218.7	Axis control command completed signal of PMC axis control
	EC0A to EC7A EC0B to EC7B	G211.0 to G211.7 G219.0 to G219.7	Axis control command signal of PMC axis control

	SYM-BOL	PMC address	Signal names
E	ECKZA ECKZB	F270.1 F273.1	Standing zero checking signal of PMC axis control
	ECLRA ECLRB	G210.6 G218.6	Reset signal of PMC axis control
	ED0 to ED15	G100.0 to G101.7	External Data Input Data signal
	EDENA EDENB	F270.3 F273.3	Auxiliary function executing signal of PMC axis control
	EFINA EFINB	G210.0 G218.0	Auxiliary function completion signal of PMC axis control
	EGENA EGENB	F270.4 F273.4	Axis moving signal of PMC axis control
	EIALA EIALB	F270.2 F273.2	Alarm signal of PMC axis control
	EID0A to EID31A EID0B to EID31B	G214.0 to G217.7 G222.0 to G225.7	Moving rate of PMC axis control
	EIF0A to EIF15A EIF0B to EIF15B	G212.0 to G213.7 G220.0 to G221.7	Feed rate of PMC axis control
	EINPA EINPB	G270.0 G273.0	In–position signal of PMC axis control
	EM11A to EM28A EM11B to EM28B	F272.0 to F272.7 F275.0 to F275.7	Auxiliary function BCD code of PMC axis control
	EMFA EMFB	F271.0 F274.0	Auxiliary function read signal of PMC axis control
	ENB ENB2	F149.4 F164.2	Spindle enable signal
	EOTNA EOTNB	F270.6 F273.6	Overtravel – direction signal of PMC axis control
	EOTPA EOTPB	F270.5 F273.5	Overtravel + direction signal of PMC axis control
	EOV0	F188.5	Override 0% signal of PMC axis
	EREND	F160.0	Read end signal
	ERS	G121.7	External reset signal
	ESBKA ESBKB	G210.3 G218.3	Block stop signal of PMC axis control
	ESEND	F160.1	Search end signal
	ESOFA ESOFB	G210.4 G218.4	Servo off signal of PMC axis control
	*ESP *ESP	X021.4 G121.4	Emergency stop signal
	*ESPA *ESPB	G230.1 G234.1	Emergency stop signal (Spindle)
	ESTB	G102.7	External data input
	ESTPA ESTPB	G210.5 G218.5	Axis control hold signal of PMC axis control
	EXLM2	G129.6	Stored stroke limit 2
	EXRD	G134.1	External Read Start Signal
	EXSTP	G134.2	External Read/Punch Stop Signal
	EXWT	G134.3	External Punch Start Signal

	SYM-BOL	PMC address	Signal names
F	FIN	G120.3	M, S, T function completion signal
	*FLWU	G104.5	Follow–up signal
G	GR1 GR2	G118.2 G118.3	Gear selection signal
	GR21	G145.6	2nd spindle gear selection signal
H	HX HZ, H3	G116.7 G117.7 G118.7	Handle feed axis select signal
	HYO	F174.5	Manual Pulse Generator Feed Axis Selection Signal
	HZO	F174.6	
	H4O	F174.7	
I	IGNVRY	G127.0	V–READY check signal
	*ITX *ITZ *IT3	G128.0 G128.1 G128.2	Each axis interlock signal
K	KEY	G122.3	Program protection signal
		F178.5	Protect Key Signal
	KILPLUS	G105.6	Position coder return derection selection signal
L	*LDSP	G119.0	Ladder display signal
	LDT1A LDT1B LDT2A LDT2B	F281.4 F285.4 F281.5 F285.5	Load detection signal
	*+LZ	X018.5	Oovertravel limit signal
M	M11 M12 M14 M18 M21 M22 M24 M28 M31 M32 M34 M38	F151.0 F151.1 F151.2 F151.3 F151.4 F151.5 F151.6 F151.7 F157.0 F157.1 F157.2 F157.3	M function code signal
	M211 M212 M214 M218 M221 M222 M224 M228 M231 M232 M234 M238	F193.0 F193.1 F193.2 F193.3 F193.4 F193.5 F193.6 F193.7 F194.0 F194.1 F194.2 F194.3	2nd M function signal
	M311 M312 M314 M318 M321 M322 M324 M328 M331 M332 M334 M338	F194.4 F194.5 F194.6 F194.7 F195.0 F195.1 F195.2 F195.3 F195.4 F195.5 F195.6 F195.7	3rd M function signal
	MA	F149.7	NC Ready Signal
	MCFNA MCFNB	G230.3 G234.3	Power Cable Condition Verification Signal
	MD1 MD2 MD4	G122.0 G122.1 G122.2	Mode Selection Signal
	MF	F150.0	M function strobe signal

	SYM-BOL	PMC address	Signal names
M	MF2 MF3	F157.4 F157.5	M function code signal
	MFIN	G115.0	High–speed M/S/T Interface signal
	MFIN2 MFIN3	G134.4 G134.5	2nd M function completion signal 3rd M function completion signal
	+MIT1 –MIT1 +MIT2 –MIT2	X008.2 X008.3 X008.4 X008.5	Interlock Signal for Each axis and Direction Signal
	MIX MIZ	G120.0 G127.1	Mirror Image Signal
	MLK	G117.1 F176.6	Machine Lock Signal
	MP1 MP2	G117.0 G118.0	Incremental Feed Signal
	MRDYA MRDYB	G229.7 G233.7	Machine Ready Signal (Serial spindle)
N	NOZAGC	G133.6	Angular axis control Z–axis compensation move signal
O	OP	F148.7	Automatic Operation Signal
	ORARA ORARB	F281.7 F285.7	Spindle Orientation Completion Signal
	ORCMA ORCMB	G229.6 G233.6	Orientation Command Signal
	OUT	F171.5 to F171.7	General Purpose Signal
	*OV1 *OV2 *OV4 *OV8 *0V16	G121.0 G121.1 G121.2 G121.3 G126.5	Override Signal
	*OV1E *OV2E *OV4E *OV8E *OV16E	G147.0 G147.1 G147.2 G147.3 G147.4	PMC axis independent override signal
	OVC	G126.4	Override cancel signal
	OVCE	G147.5	PMC axis override cancel signal
P	PC2SLC		Position coder feed back pulse switch signal
	PCFNA PCFNB	F282.3 F286.3	Output switching completion signal
	PCHPA PCHPB	F282.2	Output switching signal
	PKESS1 PKESS2	G138.6 G138.7	1st spindle parking signal
	PN1 PN2 PN4 PN8	G122.4 G122.5 G122.6 G122.7	Workpiece Number Search Signal
	PRTSF	F164.7	Target Part Count Reached Signal
R	R01O to R12O	F172.0 to F173.3	Spindle Speed Binary Code Output Signal
	RO1I to R12I	G124.0 to G125.3	Spindle Speed Binary Code Input Signal
	RCHA RCHB	G230.7 G234.7	Power Cable Condition Verification Signal
	ROV1 ROV2	F175.4 F175.5	Rapid Feed Override Signal
	ROV1D ROV2D ROV3D	G116.4 G116.5 G116.6	Rapid traverse override B

	SYM-BOL	PMC address	Signal names
R	ROV1E ROV2E	G146.1 G146.0	PMC axis rapid traverse override signal
	RPALM	F180.3	Read/Punch Alarm Signal
	RPBSY	F180.2	Read/Punch Busy Signal
	RRW	G104.6	Rewind Signal
	RSLA RSLB	G230.6 G234.6	Spindle Output Switching Request Signal
	RST	F149.1	Reset Signal
	RT	G121.6	Manual Rapid Traverce Signal
		F178.6	Rapid feed signal
	RTE	G147.6	PMC axis manual rapid traverse selection signal
	RWD	F164.6	Rewinding Signal
S	S11 S12 S14 S18 S21 S22 S24 S28	F152.0 F152.1 F152.2 F152.3 F152.4 F152.5 F152.6 F152.7	Spindle function code signal
	SA	F148.6	Servo Unit Ready Signal
	SAR	G120.4	Spindle Speed Arrival Signal
	SARA SARB	F281.3 F283.3	Speed arrival signal
	SBK	G116.1	Single Block Signal
		F176.5	
	SDTA SDTB	F281.2 F283.2	Speed detection signal
	SF	F150.2	S Function Strobe Signal
	SFIN	G115.2	High–Speed M/S/T Interface Signal
	SFRA SFRB	G229.5 G233.5	Spindle Forward Direction Signal
	SGN	G125.5	Spindle Polarity Selection Signal
	SIND	G125.7	Spindle analog voltage control signal
	SKIP	X008.7	Skip Signal (FSO–GSD only)
	SLSPA SLSPB	G133.2 G133.3	Spindle analog voltage output selection signal
	SMZ	G126.6	Error detect Signal
	SOCNA SOCNB	G230.4 G234.4	Spindle Soft–start/Stop Cancel Signal
	SOR	G120.5	Spindle Orientation Command
	*SP	G121.5	Automatic feed hold signal
		F178.7	Feed Hold Signal
	SPA SPB SPC SPD	G103.3 G103.4 G103.5 G103.2	Spindle override
	SPL	F148.4	Automatic feed hold signal
	SPSLA SPSLB	G230.2 G234.2	Spindle selection signal
	SRVA SRVB	G229.4 G233.4	Spindle reverse rotation command signal
	SSIN	G125.6	Spindle Polarity Selection Signal
	SSTA SSTB	F281.1 F283.1	Speed zero detection signal
	*SSTP	G120.6	Spindle stop signal
	ST	G120.2	Automatic operation start signal
	STL	F148.5	Automatic operation starting signal

	SYM-BOL	PMC address	Signal names
S	STLK	G120.1	Start Lock signal
	SVFX SVFZ SVF3	G105.0 G105.1 G105.2	Servo off signal
T	T11 to T28	F153.0 to F153.7	Tool function code signal
	TF	F150.3	T Function Strobe Signal
	TFIN	G115.3	High–speed M/S/T interface signal
	TLMA TLMB	F281.6 F283.6	Torque limit signal
	TLMHA TLMHB	G229.1 G233.1	High–speed Torque Limit Signal
	TLMLA TLMLB	G229.0 G233.0	Low–speed Torque Limit Signal
	TORQ1 TORQ2 TORQ3	F170.0 F170.1 F170.2	Torque limit arrival signal
	U00 to U15	F162.0 to F163.7	Output Signal by Custom Macro Function Signal
	UI0 to UI15	G130.0 to G131.7	Input Signal by Custom Macro Function Signal
	UO100 to UO131	F196.0 to F199.7	Output Signal by Custom Macro Function Signal
X	+X –X	G116.2 G116.3	Feed axis direction selection signal
	+X to +4 –X to –4	F177.5 to F177.7	Jog Feed Axis Selection Signal
Z	–Z +Z	G117.3 G117.2	Feed axis direction selection signal
	ZP2X ZP2Z ZP23	F161.0 F161.1 F161.2	2nd reference point return completion signal
	ZPX ZPZ ZP3	F148.0 F148.1 F148.2	Reference point return completion signal
	ZRFX ZRFZ ZRF3	F168.0 F168.1 F168.2	Start point decision signal
	ZRN	G120.7	Automatic reference point return selection signal

5 DIGITAL SERVO

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

5.1 INITIAL SETTING 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

For α series servo motor (A06B–xxxx–B□□□)

Format number	15
Drawing number (Item of xxxx)	0123
Model name	α3/3000

Format number	16	17	18	19
Drawing number (Item of xxxx)	0127	0128	0142	0143
Model name	α6/2000	α6/3000	α12/2000	α12/3000

Format number	20	21	22	23
Drawing number (Item of xxxx)	0147	0148	0152	0153
Model name	α22/2000	α22/3000	α30/2000	α30/3000

Format number	24	25	26
Drawing number (Item of xxxx)	0161	0162	0163
Model name	αM3	αM6	αM9

(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= $\frac{1}{\text{CMR}}$ +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)

	Parameter 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)

	Parameter 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 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      ALARM 5       00000000  (13)
(6) PROP.GAIN           -1015      LOOP GAIN         2999  (14)
(7) FILER                   0      POS ERROR          556  (15)
(8) VELOC.GAIN            125      CURRENT%            10  (16)
                                   SPEED RPM          100  (17)

[SV SET] [SV TUN] [      ] [      ] [      ]
```

(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 $\text{Set value} = \frac{(\text{PRM } 8121)+256}{256} \times 100$
(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
Disconnection 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.

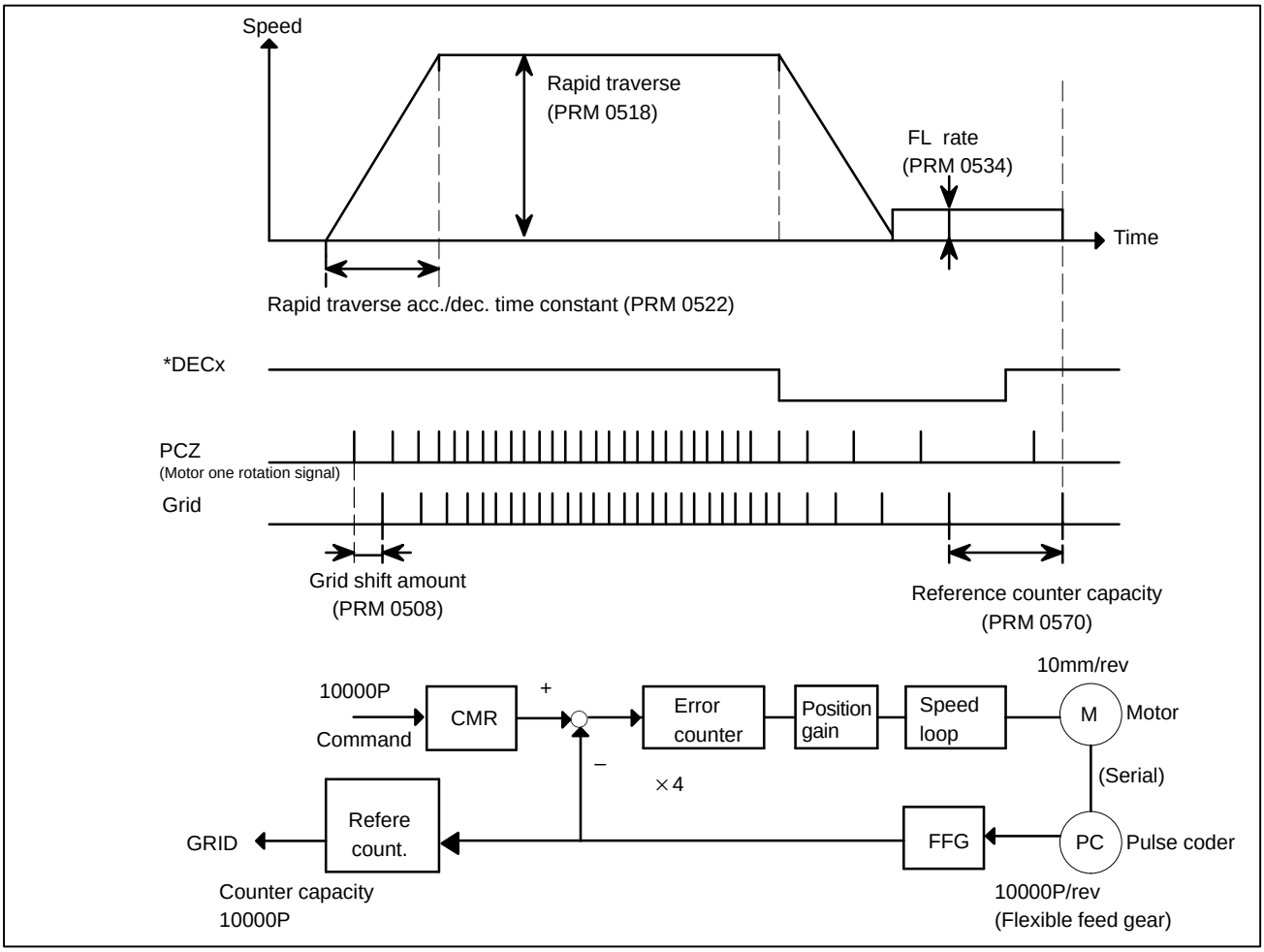
#6 (CRC) : Communication error of serial pulse coder.
Transmitted data is in error.

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

5.3 ADJUSTING 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	0573	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]

* 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					APC4	APC3	APCZ	APCX

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					STPT4	STPT3	STPTZ	STPTX

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					ABS4	ABS3	ABSZ	ABSX

Zero position of absolute pulse coder is :

0 : Not established

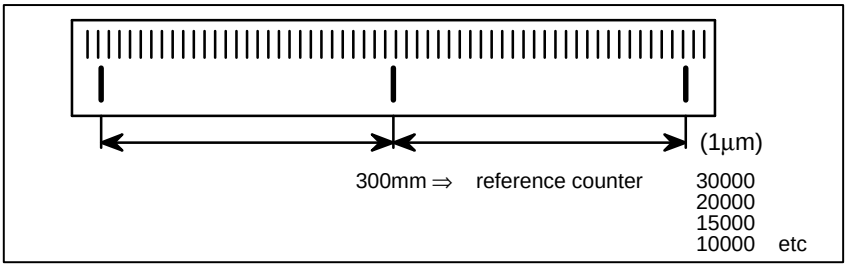
1 : Established
(Turns to 1 after establishment)

- **Separate Type Pulse Coder or Linear Scale is Used**

PRM	0570	Reference counter capacity per axis [P]
:		:
PRM	0573	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:

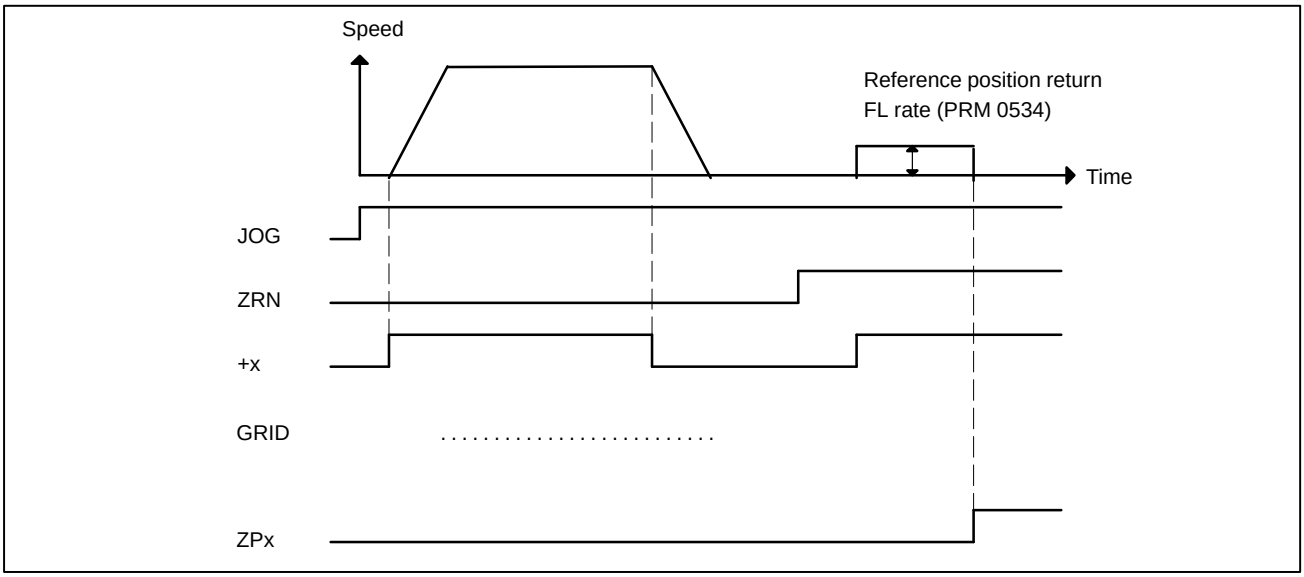
Example)



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					JZRN4	JZRN3	JZRNZ	JZRNX

0 : The function for setting the reference position without dogs is enabled for the corresponding axis.

1 : The function for setting the reference position without dogs is disabled for the corresponding axis.

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0003					ZM4	ZM3	ZMZ	ZMX

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

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

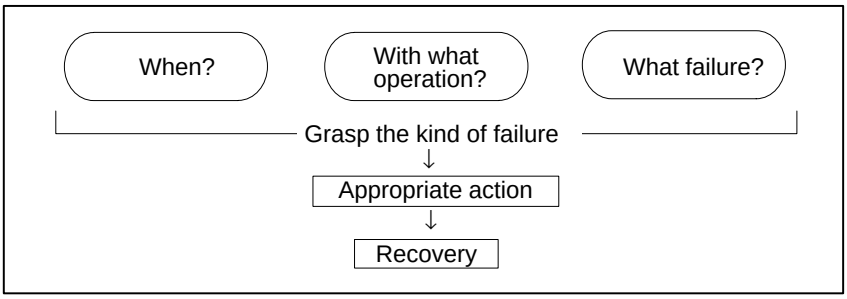
After ZRN signal becomes 1, manual feed direction is always the direction set by this parameter irrespective of an axis selection signal.

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 :



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 position return 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 2.3.11)
- 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–□□□□–H□□□
   Servo/spindle motor : A06B–□□□□–B□□□
   (□ represents a number)

6.2 POWER CANNOT BE SWITCHED ON

Point

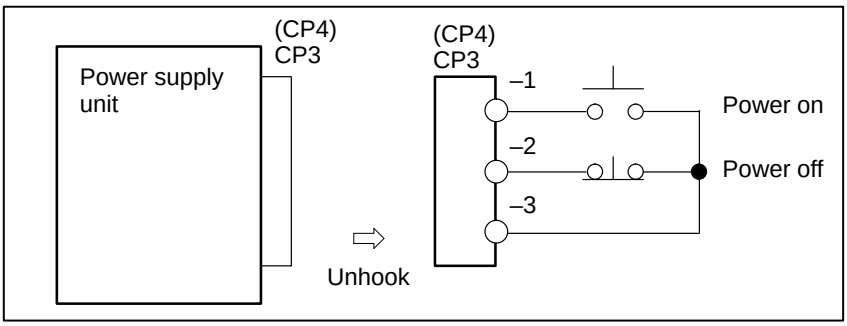
Check the LED on the power supply unit.

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 power supply unit. Also, check that 200 VAC is applied to connector CP1 of the power supply unit, using a volt–ohm–milliammeter. 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 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.

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.

CAUTION
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.

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 STATUS DISPLAY.

(Example of display)

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

<Mode select signal>

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0122						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 (Memory) mode	0	0	1
EDIT (Memory 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.

In case of 0–MD and 0–GSD

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)	

In case of 0–TD and 0–GCD

		#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.)

(f) 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 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%.

(g) NC is in a reset state
In this case, RESET is also displayed on the status display. Check it using the procedure of 1 above.

2. When machine coordinate value does not update on position display

(1) Machine lock signal (MLK) is input.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	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).

[0–MD, 0–GSD]

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0116					–X	+X		
DGN	0117					–Y	+Y		
DGN	0118					–Z	+Z		
DGN						–4	+4		

[0–TD, 0–GCD]

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0116					–X	+X		
DGN	0117					–Z	+Z		
DGN	0118					–3	+3		

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.

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.

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.

In case of 0–MD and 0–GSD

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)	

In case of 0–TD and 0–GCD

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0128						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.)

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 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%.

d. NC is in a reset state

(3) Jog feed rate setting (Parameter) is not correct.

PRM	0559	Jog feedrate per axis	[mm/min]
	:	:	
PRM	0562	Jog feedrate per axis	[mm/min]

(4) Manual feed per revolution is selected (0–TD, 0–GCD 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 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
							↓	↓	↓
		Manuale handle mode					1	0	0

(2) Manual handle feed axis select signal is not input.
Check the signals using diagnostic function (PMCDGN).

[0–MD, 0–GSD]

		#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 :

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

In case of 0–TD and 0–GCD

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0116	HX							
DGN	0117	HZ							
	0118	H3							

Manual pulse generator axis selection signal and selected axis are :

HX	HZ	H3	Selected axis
0	0	0	No selection
1	0	0	X axis
0	1	0	Z axis
0	0	1	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.

In case of 0–MD and 0–GSD

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0120							MP2	MP1

In case of 0–TD and 0–GCD

		#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

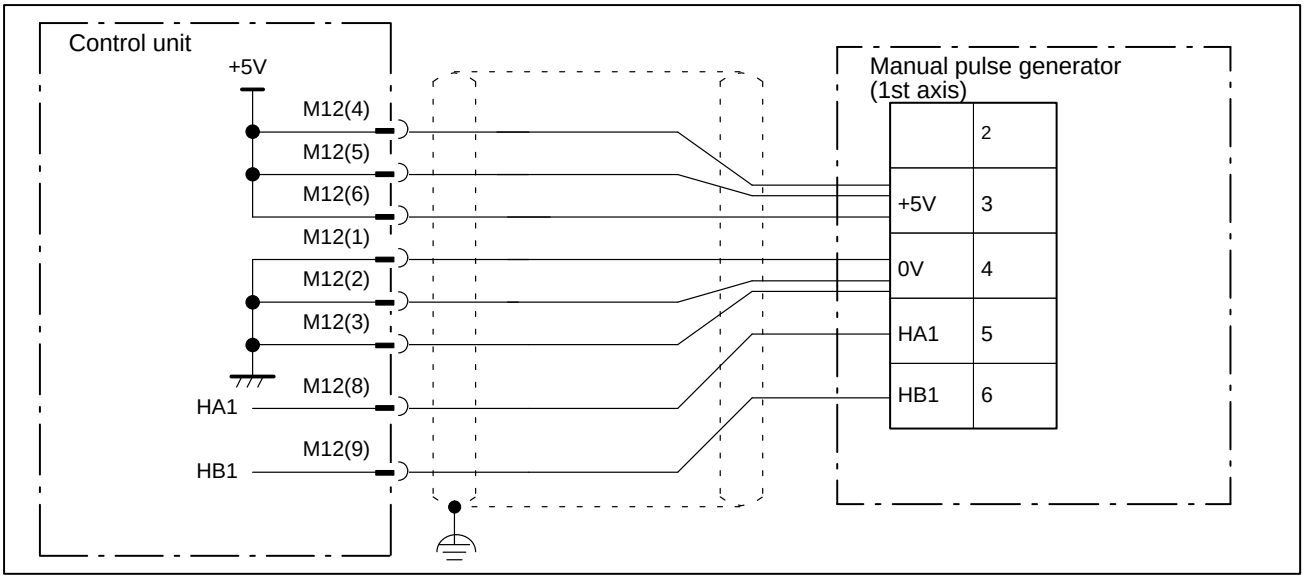
HPNEGx Direction of MPG

1 : Reverse direction

0 : Same direction

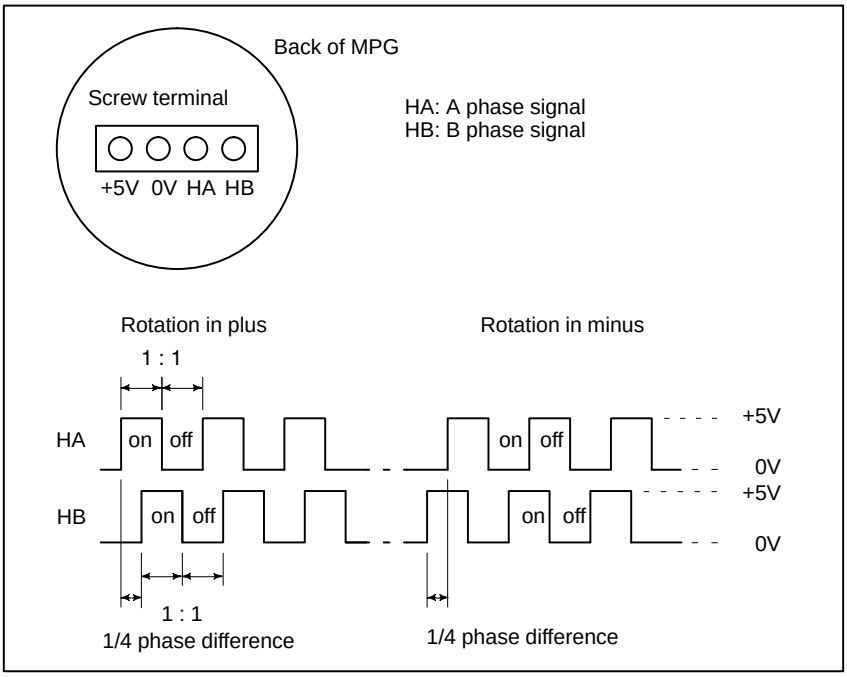
(4) Checking manual pulse generator

(a) Incorrect of cable
Check disconnection of cable or short circuit.



(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 (MEM) 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).

<M series>

		#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 [Position Error] > PARAM 500 [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 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%.

f. Interlock signal or start lock signal is input

In case of 0–TD and 0–GCD

(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.

In case 0–MD and 0–GSD

(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]

(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:

- T iming 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:

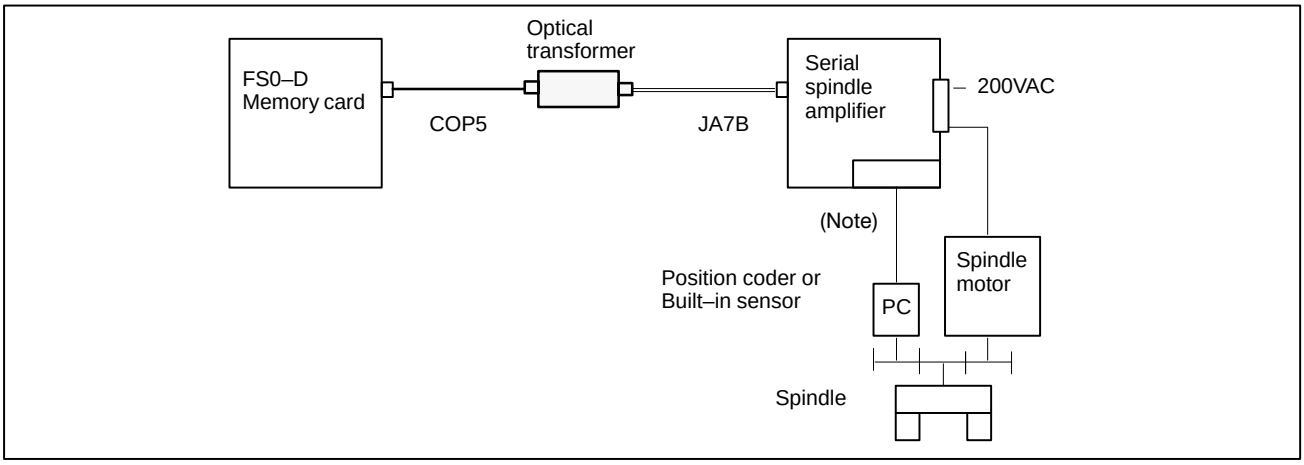
- Timing belt is broken
- Key is removed
- Coupling is loose
- Connector of signal cable is loosened

2) Position coder is faulty

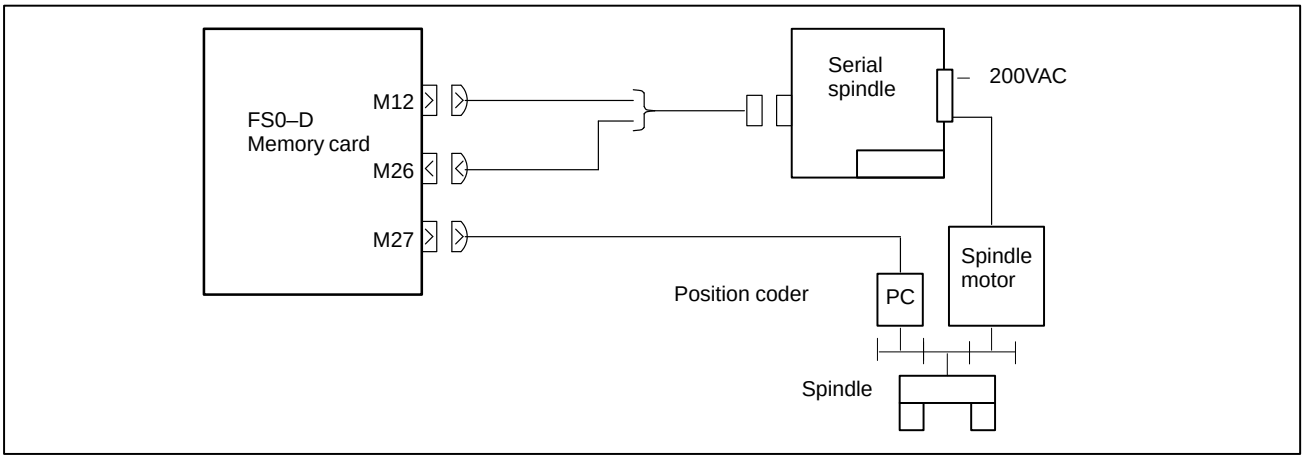
Position coder is connected to the spindle amplifier when serial interface spindle is used or connected to the CNC when analog interface spindle is used.
For details of connection, refer to the following.

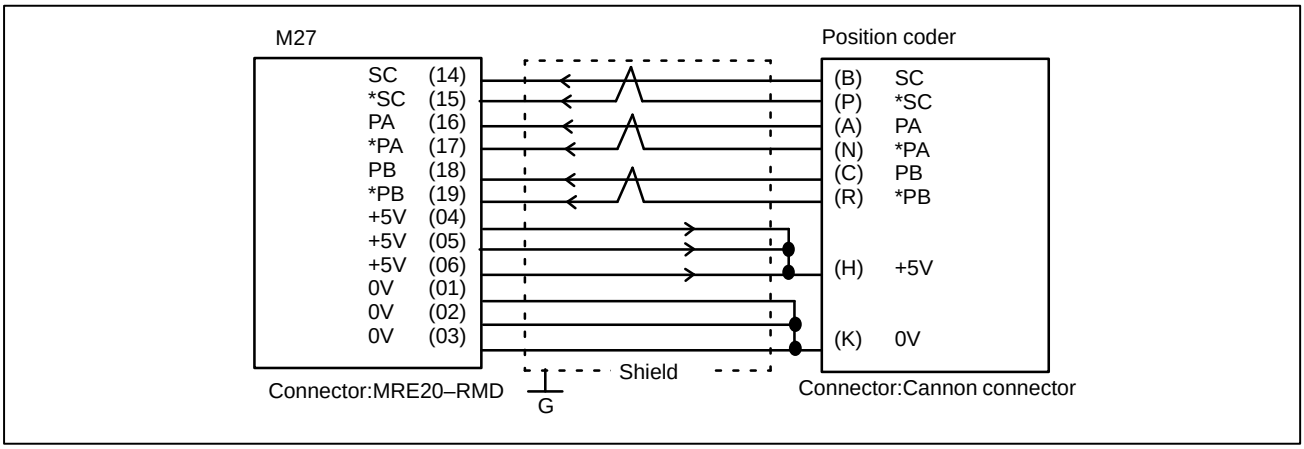
<0–TD and 0–GCD>
Whether A/B phase signals from the position coder are read correctly, can be judged also by the spindle speed display on the CRT screen (position screen). (However, it is not displayed when PARAM 014#2=0).

<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					

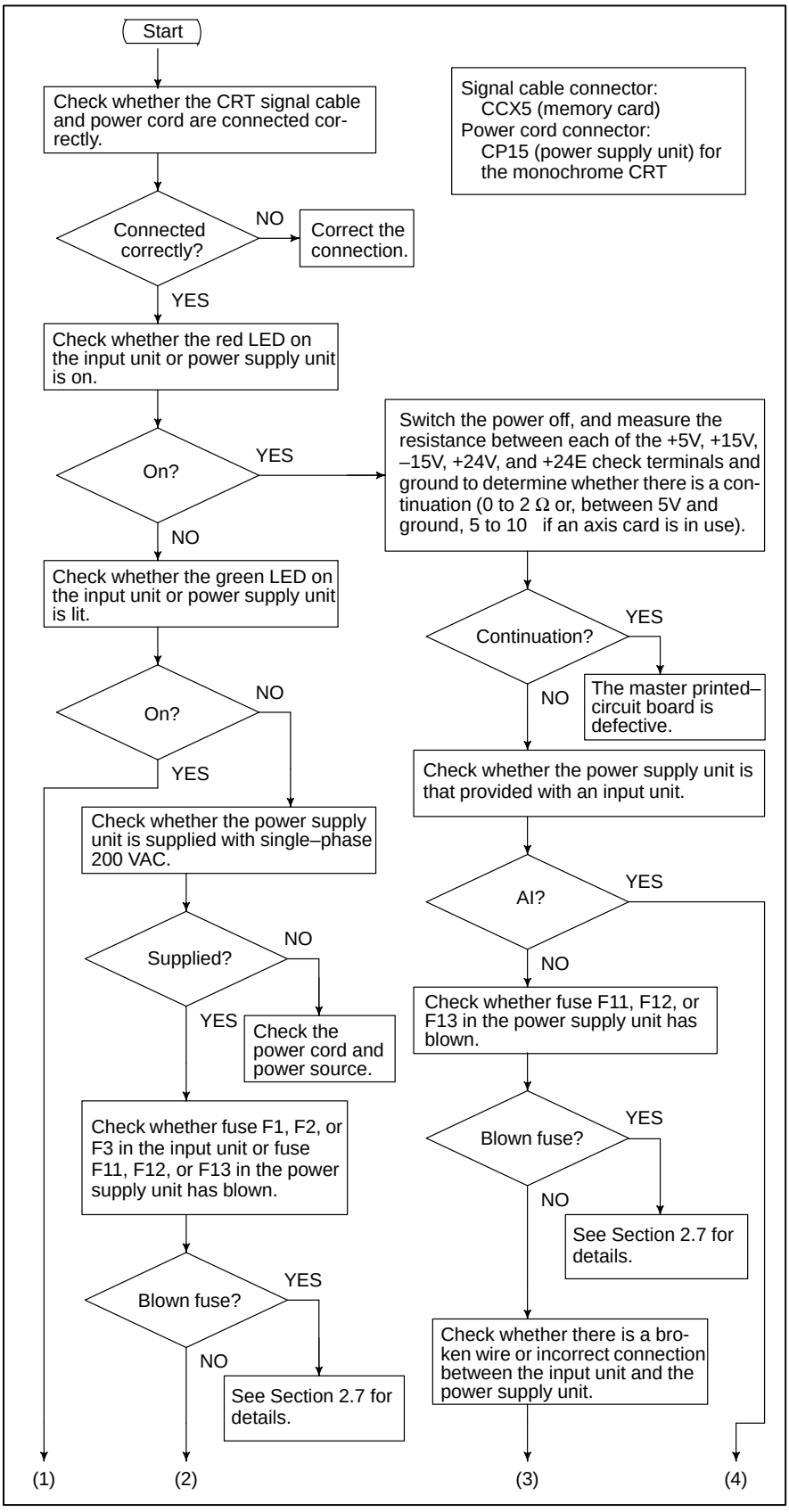
***SP :** When this signal is 0, the feed hold signal is input.

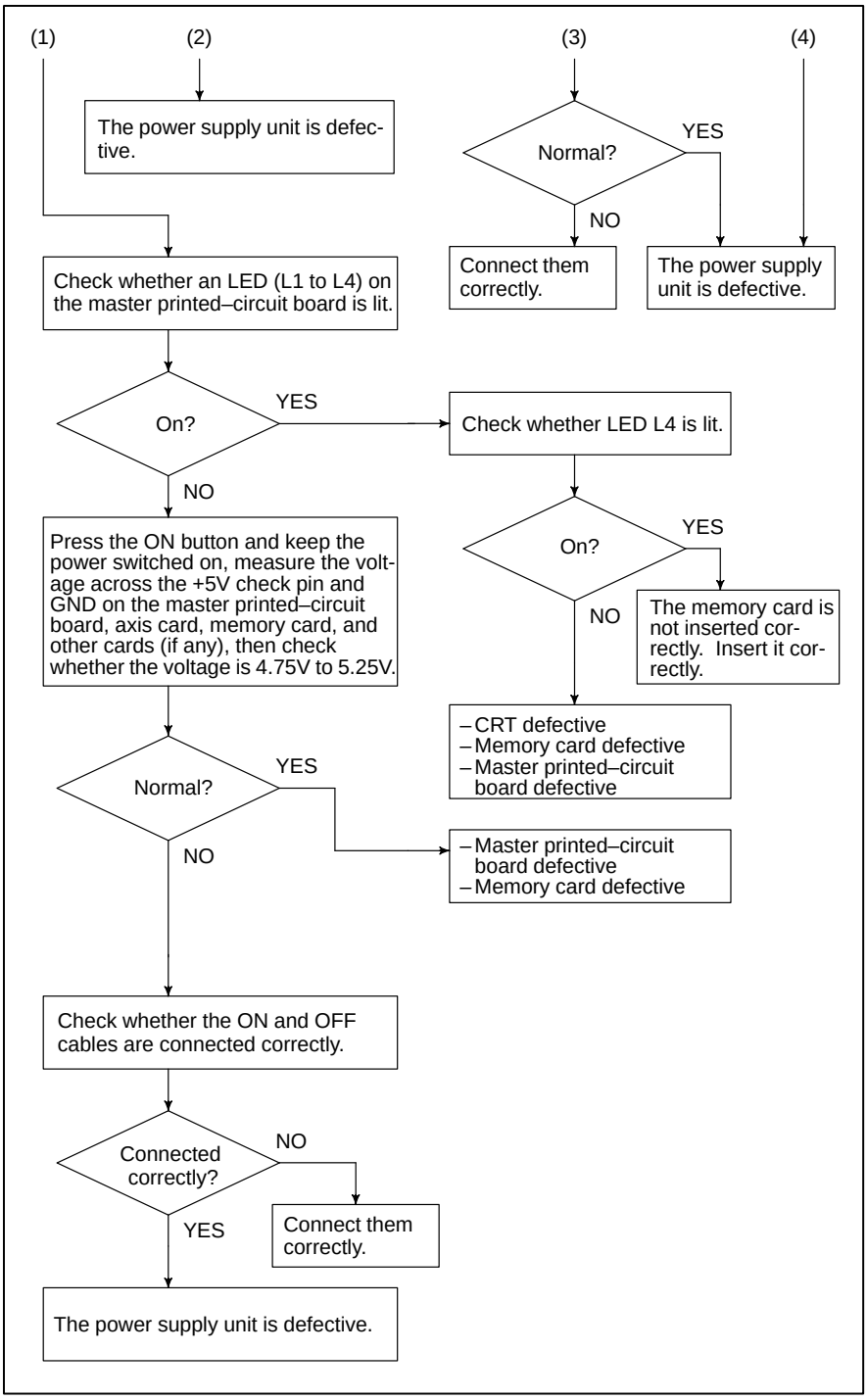
g. It become single block stop during automatic operation

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

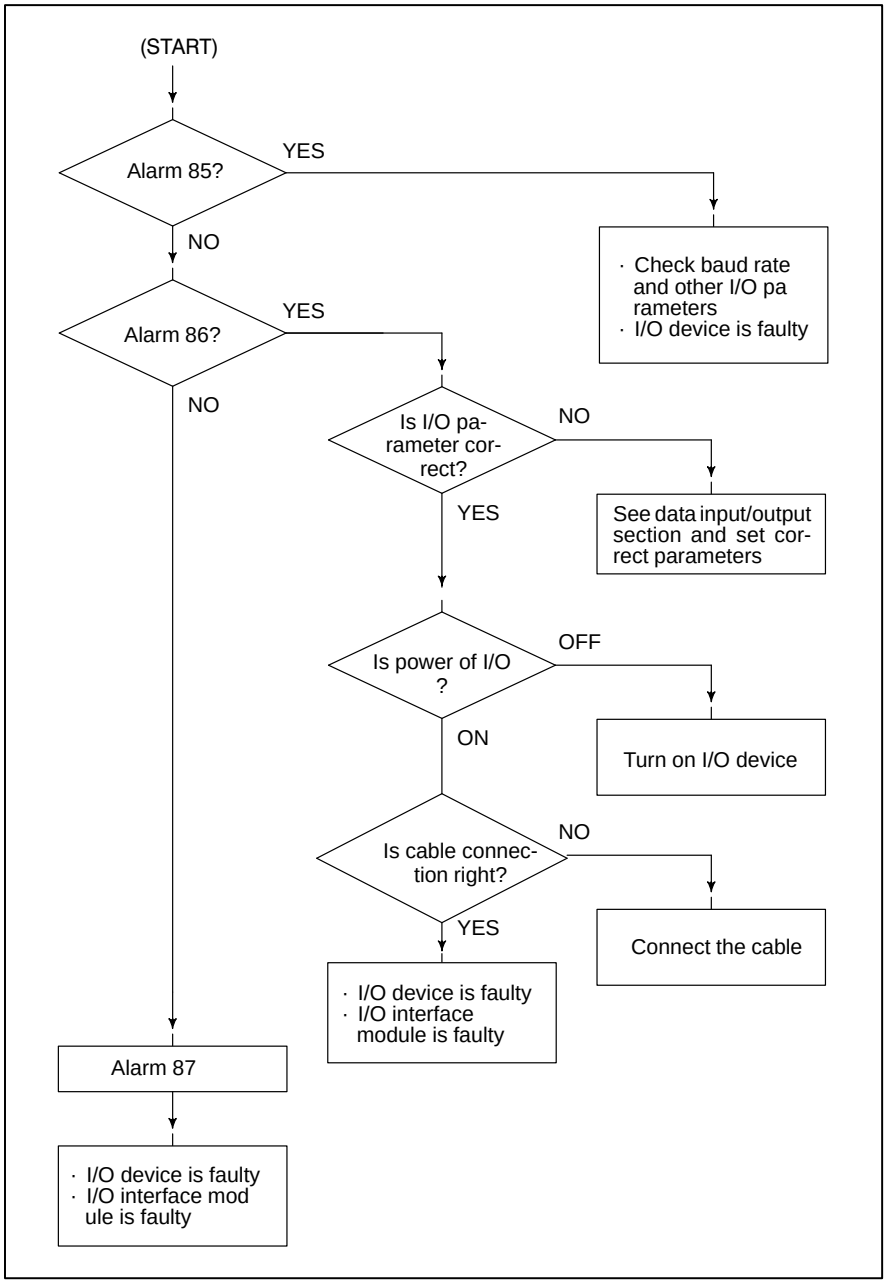
SBK : When this signal is 1, the single block signal is input.

6.8 NO DISPLAY APPEARS ON THE SCREEN WHEN THE POWER IS SWITCHED ON




(1)
(2)
(3)
(4)
The power supply unit is defective.
Normal?
YES
NO
Connect them correctly.
The power supply unit is defective.
Check whether an LED (L1 to L4) on the master printed–circuit board is lit.
On?
YES
NO
Check whether LED L4 is lit.
On?
YES
NO
The memory card is not inserted correctly. Insert it correctly.
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.
– CRT defective
– Memory card defective
– Master printed–circuit board defective
Normal?
YES
NO
– Master printed–circuit board defective
– Memory card defective
Check whether the ON and OFF cables are connected correctly.
Connected correctly?
NO
YES
Connect them correctly.
The power supply unit 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

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

		#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.

		#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
Feed NFED	2.7	12.7
20 mA current loop ASR33	2.2	12.2
Stop bit STP2	2.0	12.0
I/O unit type setting	38.7 38.6	38.7 38.6
Connector number	M5 channel 1	M5 channel 1

I/O is 0

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0002	NFED				RSASCI	ASR33		STP2

I/O is 1

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0012	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.
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						

#6(DEVFL1) :

#7(RSCMD1) : Setting of I/O device for reader/puncher interface (I/O=0, 1)

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 0

PRM	0552	Baud rete

I/O is 1

PRM	0553	Baud rete

Value	Baud rate
7	600
8	1200
9	2400

10	4800
11	9600
12	19200

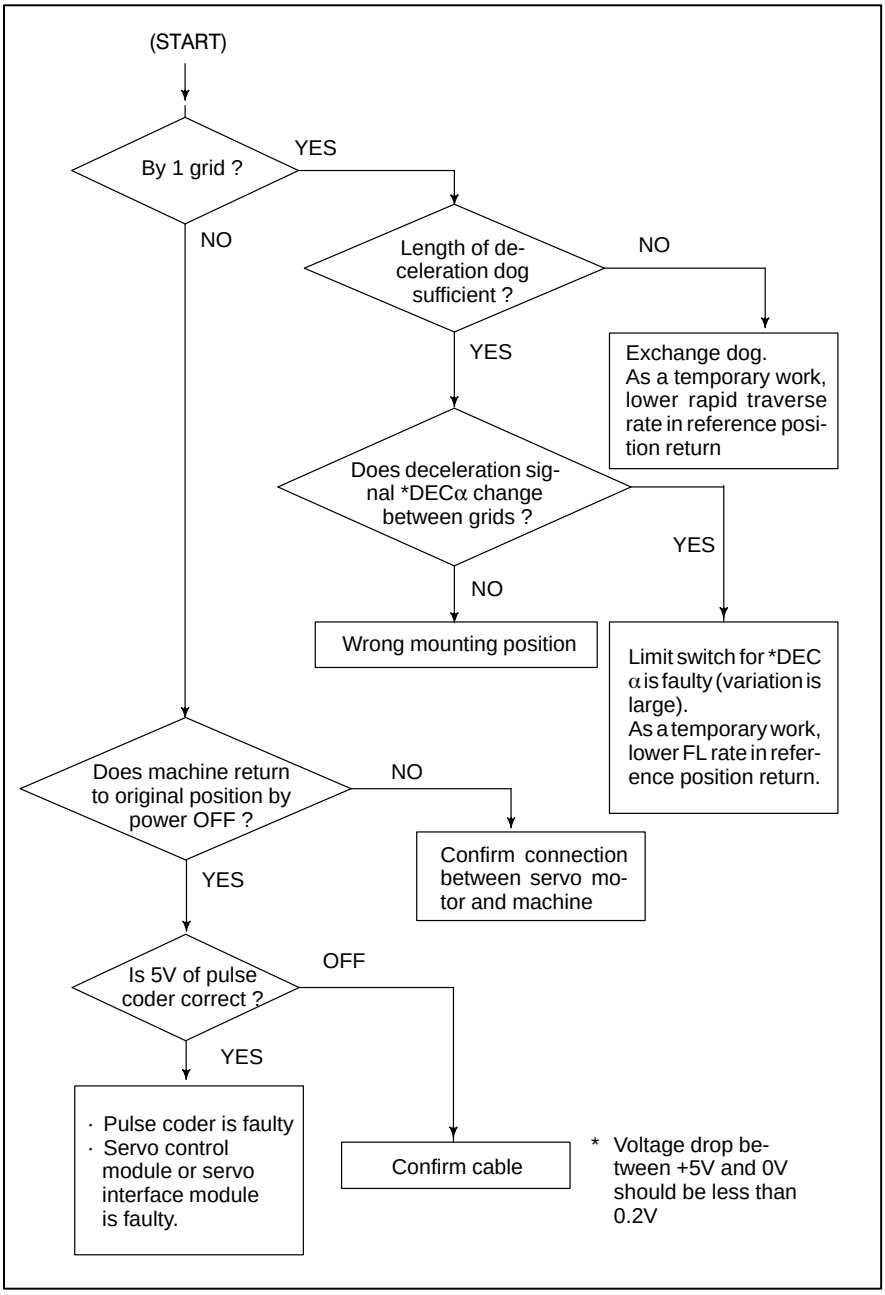
(a) External I/O device or Host computer is in trouble

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.

(b) 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)

$$\text{Position error} = \frac{F \times 5000/3}{G \times \text{detection unit}[\mu m/\text{PLUSE}]}$$

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.

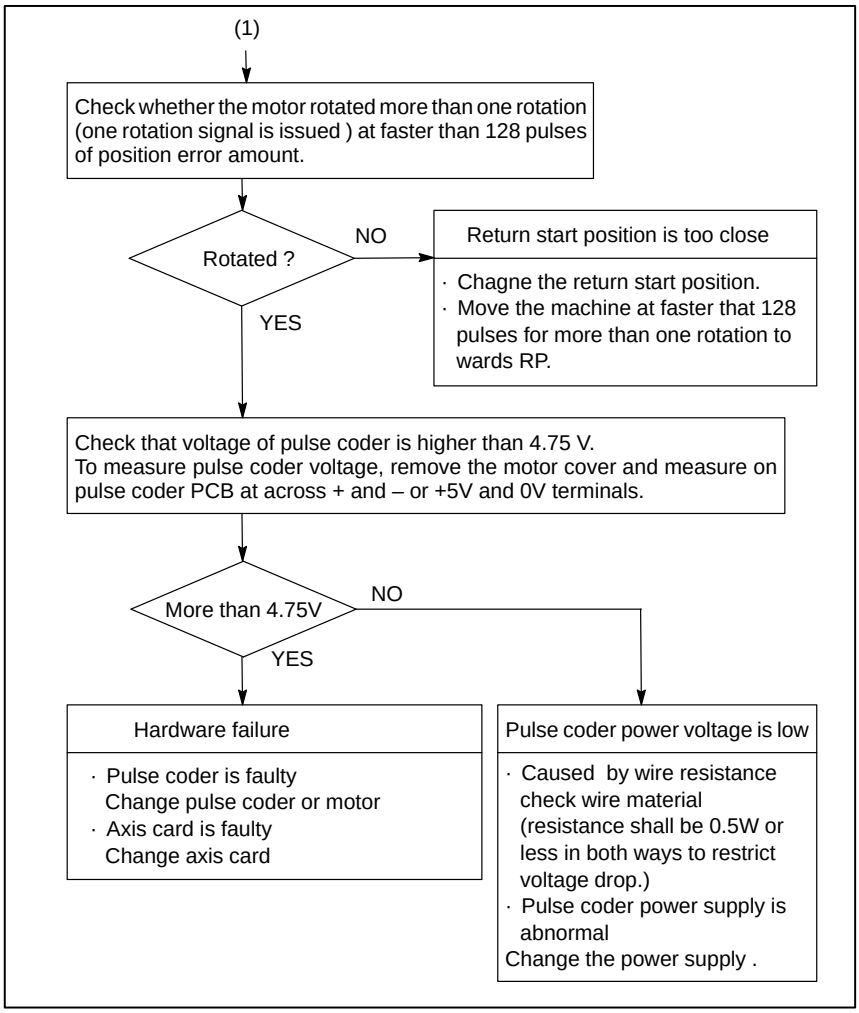
Check rapid traverse override signals :

ROV1	DGN	116.7
ROV2	DGN	117.7
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 PMR 38.0 is 0)
* DEC3 DGN 016.7 * DEC4 DGN 017.7
(* DEC3, * DEC4 when PRM 38.0 is 1)
When reference position return is started from deceleration signal 0, feed rate becomes FL rate.
PRM 534 FL rate
Deceleration signal PRM 001.5 is valiable when “1”/“0”.



CAUTION

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.

- **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.

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) to correct the position.

Related parameters

		#7	#6	#5	#4	#3	#2	#1	#0
PRM	0021					APC4	APCZ	APCY	APCX

#0(APCX)
#1(APCY)
#2(APCZ)
#3(APC4) 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					ABS4	ABSZ	ABSY	ABSX

#0(ABSX)
#1(ABSY)
#2(ABSZ)
#3(ABS4) Reference position of absolute pulse coder per axis is :

0 : Established
1 : Not established

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

If the absolute pulse coder being used is a separate type, replace the batteries in the battery case connected to the axis card connector. If the axis board being used is type B and if the absolute pulse coder is a built–in type, the batteries are installed in the servo amplifier. Replace the batteries as described in the appropriate manual.

CAUTION
1 When replacing the batteries for the α 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).

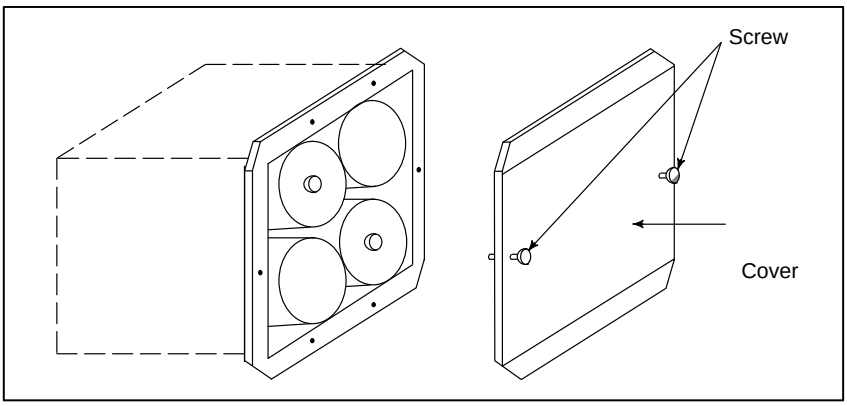
Procedure for replacing batteries for absolute pulse coder (separate type pulse coder)

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 763.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0760		CSA		PHA	RCA		CKA	SPH
	:					:			
DGN	0763		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 **CAUTION**
2 When diagnostic result does not the same, or other abnormality is detected, an external noise may be generated.

> **CAUTION**
> 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.

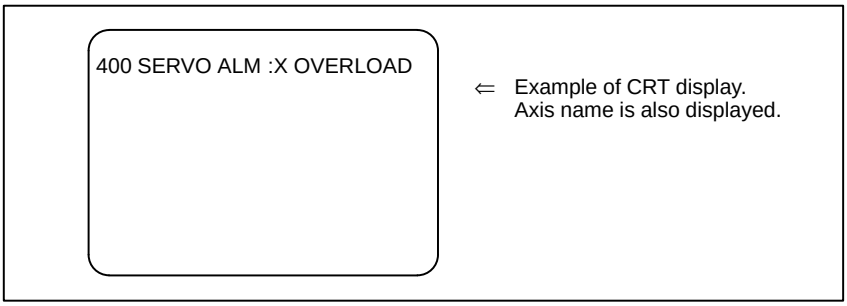
Causes

1) #7(DTE):Response from serial pulse coder is absent.
   1 Signal cable is disconnected
   2 Serial pulse coder is faulty. ⇒ See **CAUTION**
   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 **CAUTION**
   3 Axis card is faulty

> **CAUTION**
> 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 (OVERLOAD)

Amplifier or overheat of motor is detected.



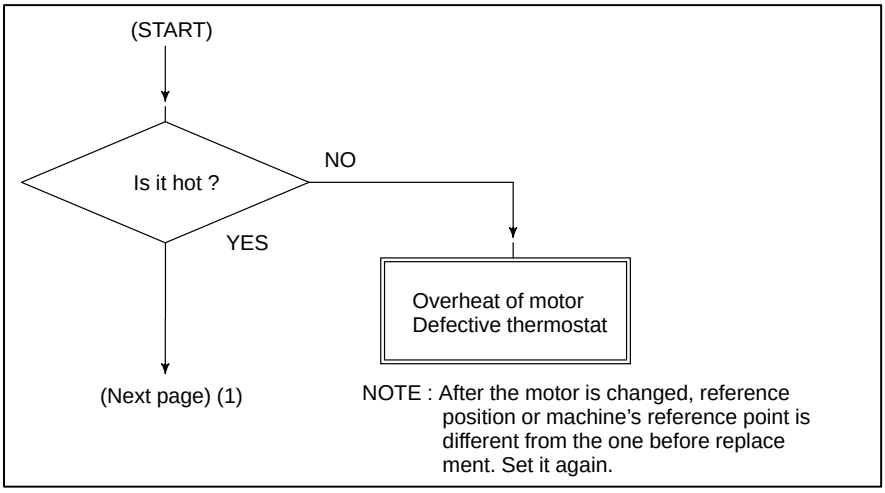
Points

Confirm the detail by the diagnostic function of CNC.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0720	OVL							
:						:			
DGN	0727	OVL							

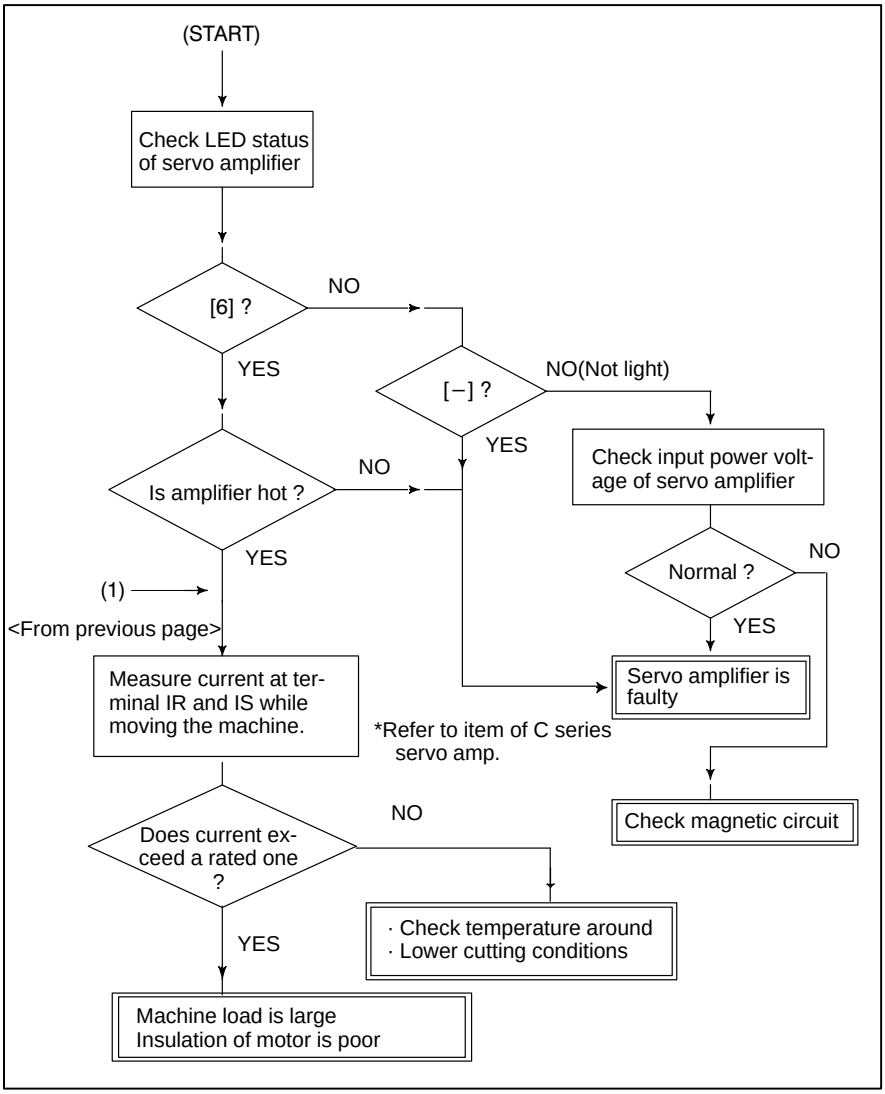
#7(OVL): 1 OVERLOAD ALARM is displayed.

Overheat of servo motor



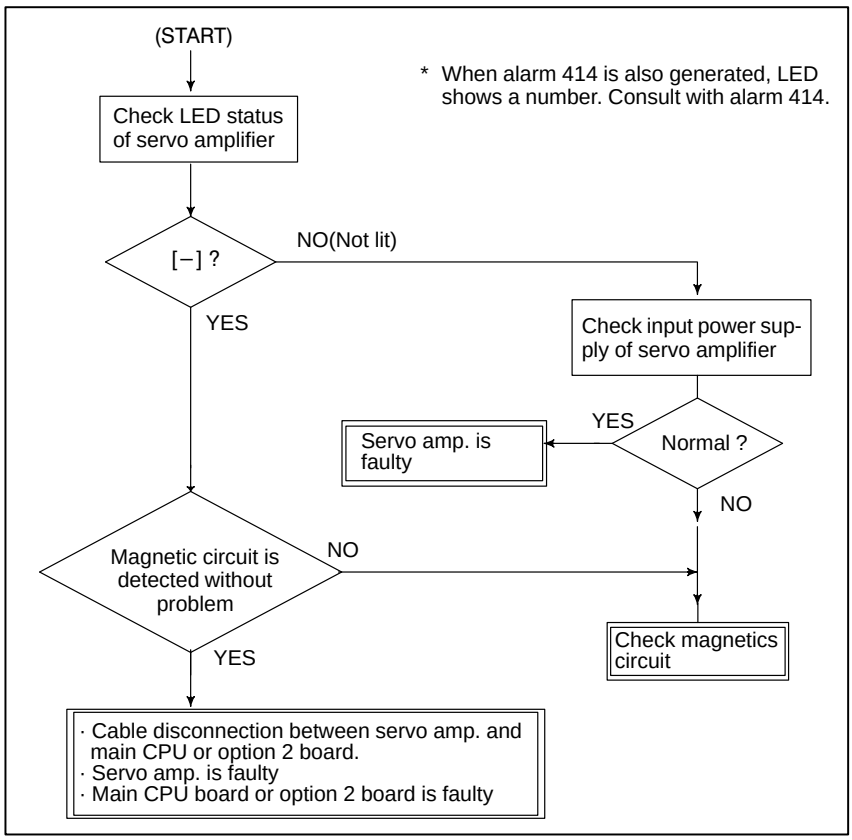
- **Overheat of servo amplifier**

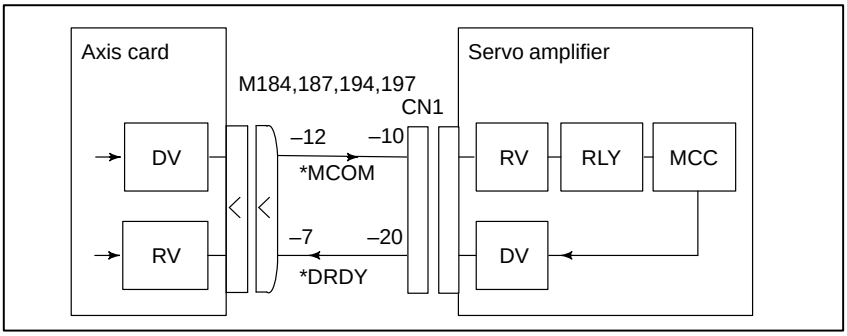
LED 6 of servo amplifier is lit



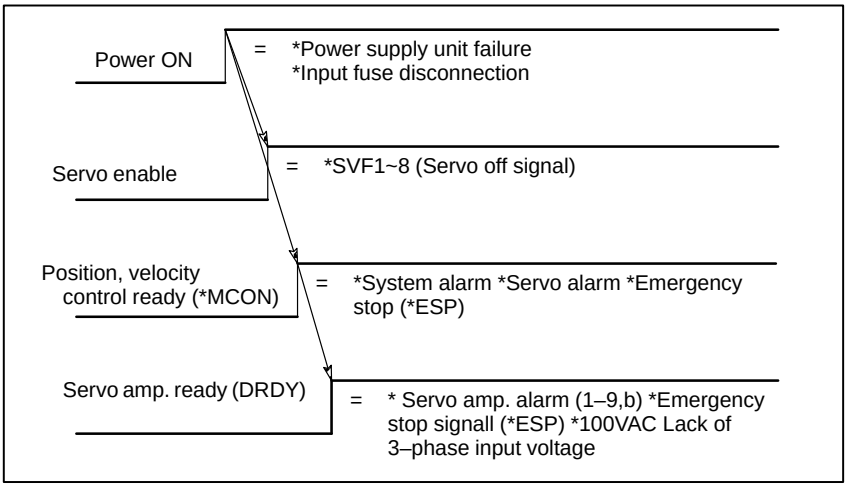
6.17 ALARM 401, 403 (*DRDY SIGNAL TURNED OFF)

Alarm 401, 403 of servo amplifier is not turned on or turned off during operation.





Power on sequence (NC⇔Servo amplifier)



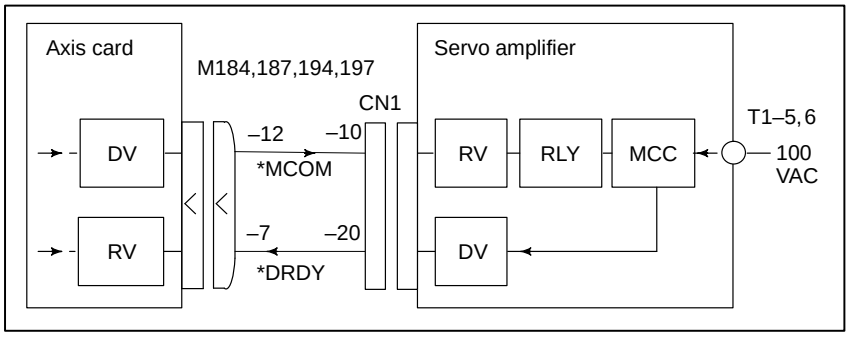
6.18 ALARM 404 AND 405 (*DRDY SIGNAL TURNED ON)

- **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.



From 1st axis to 4th axis are main CPU board. 5th axis or later are option 2 board.

- **Alarm 405 (Reference positin return is abnormal)**

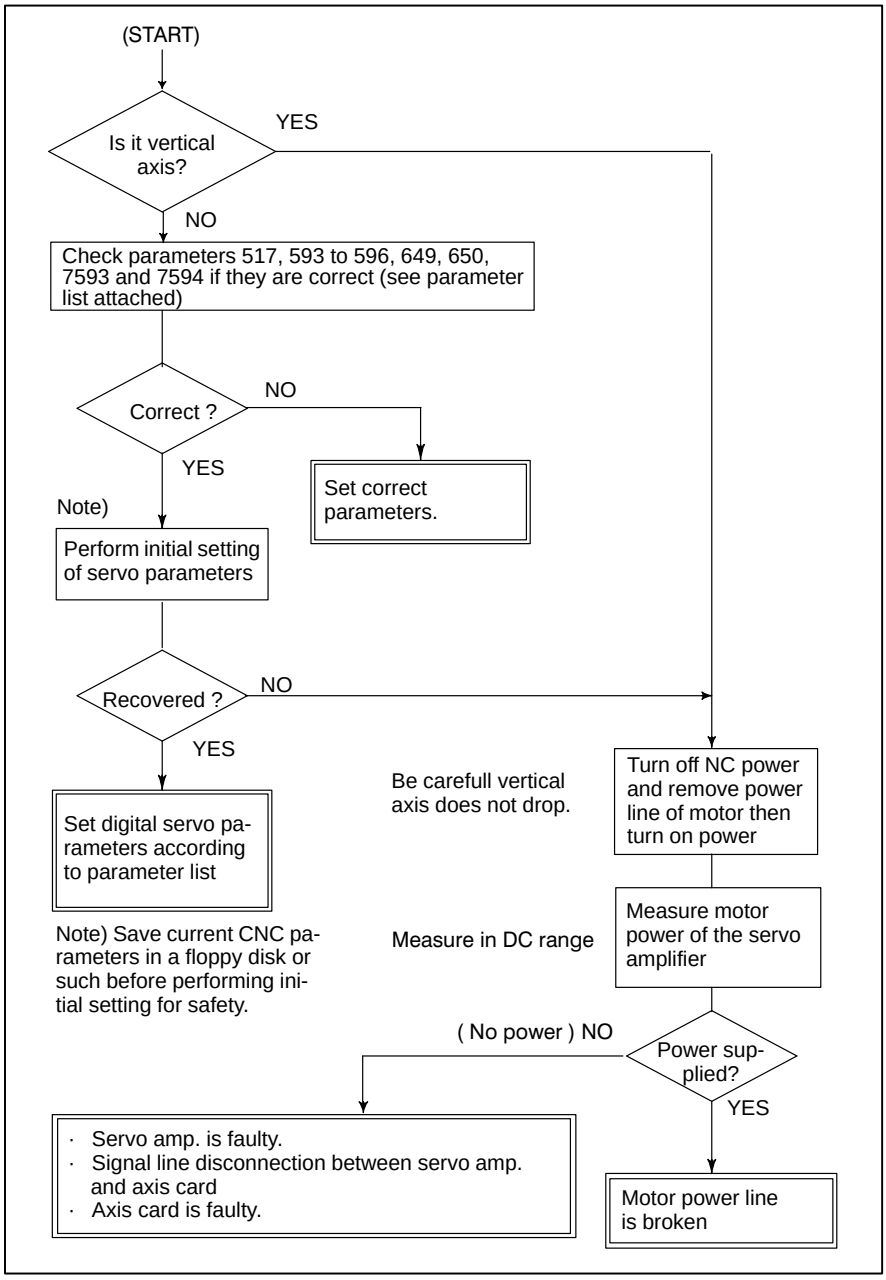
The grid signal is not turned on when the automatic reference position return by G28 is completed.

- **Causes**

Axis card is faulty.

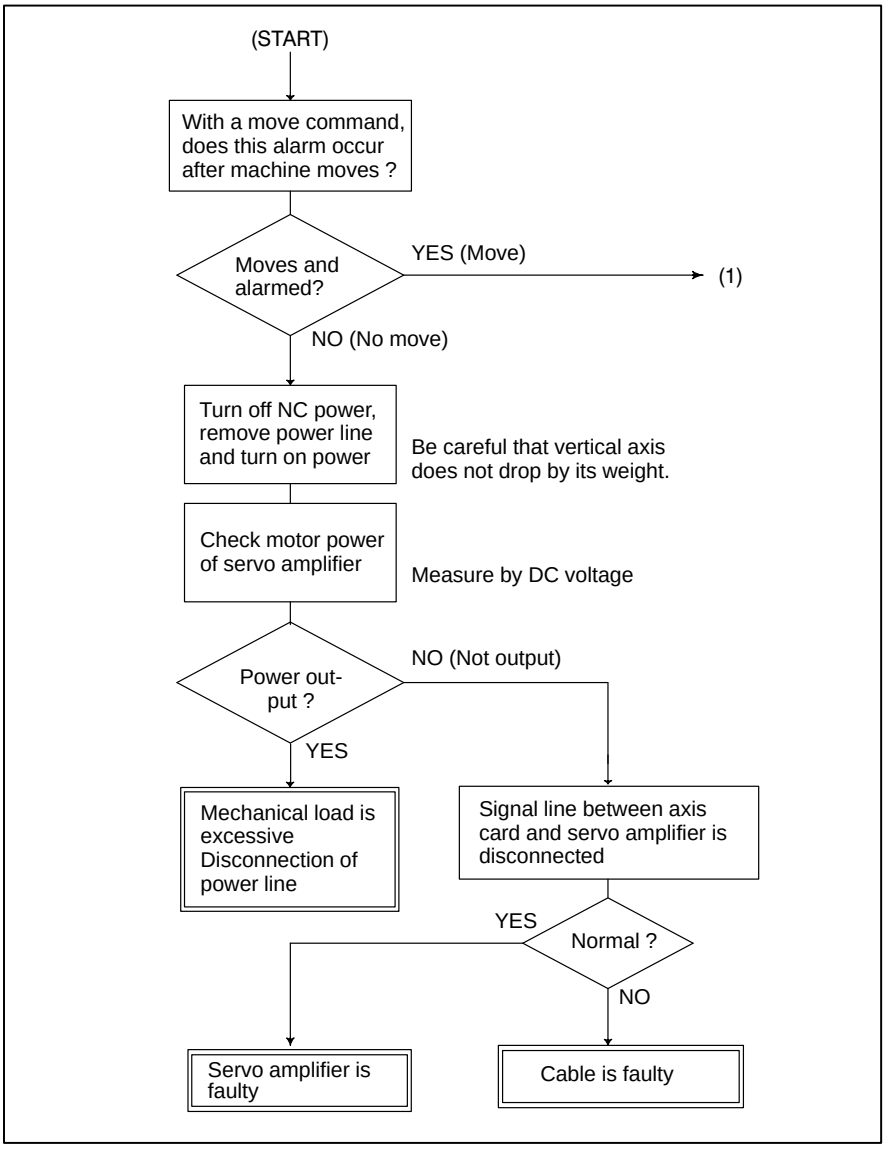
6.19 ALARM 4n0 (EXCESSIVE POSITION ERROR AMOUNT DURING STOP)

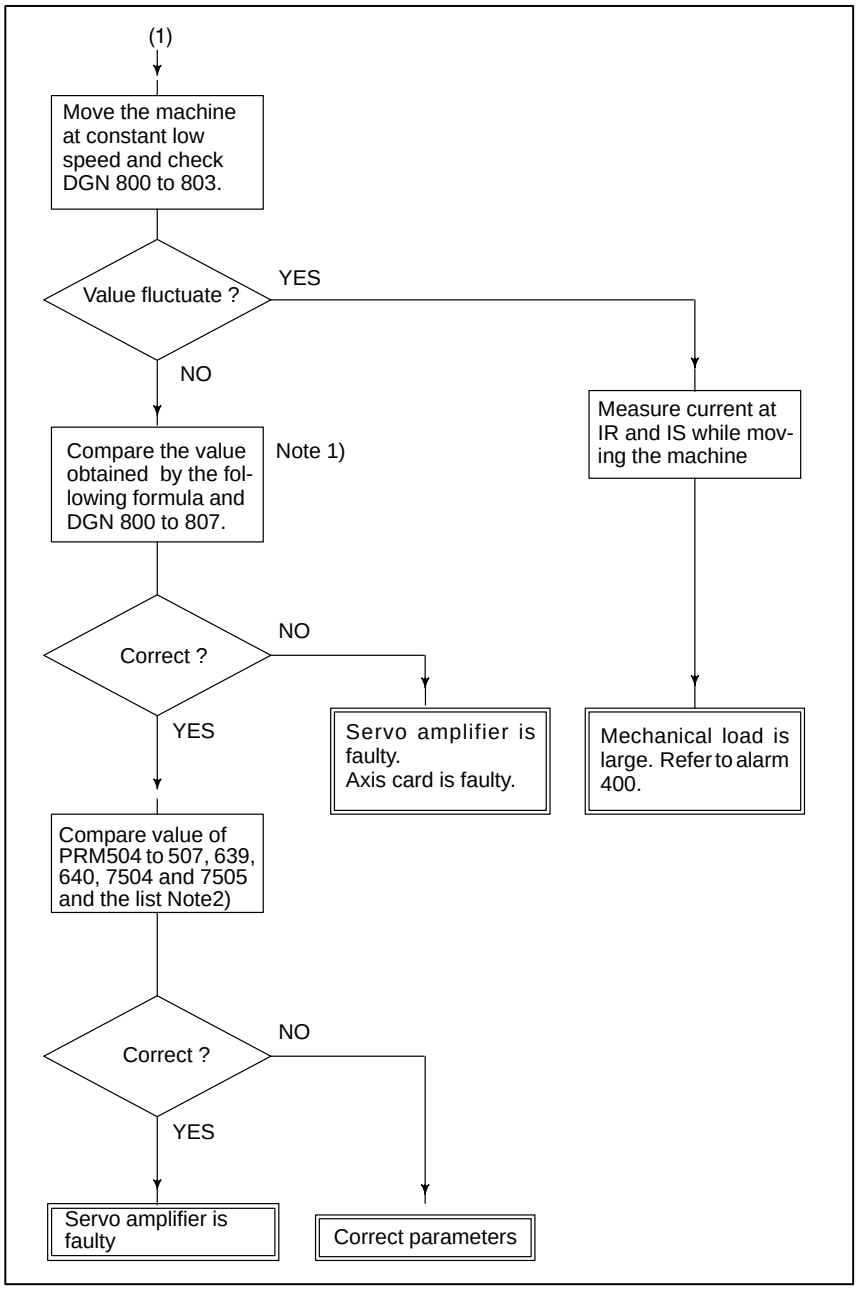
osition error amount at stop (DGN 800 to 803) exceeds a value set by parameter No.593 to 596.



6.20 ALARM 4n1 (EXCESSIVE POSITION ERROR DURING MOVE)

Position error amount during movement (DGN 800 to 803) exeeeds a value set by parameter 504 to 507.



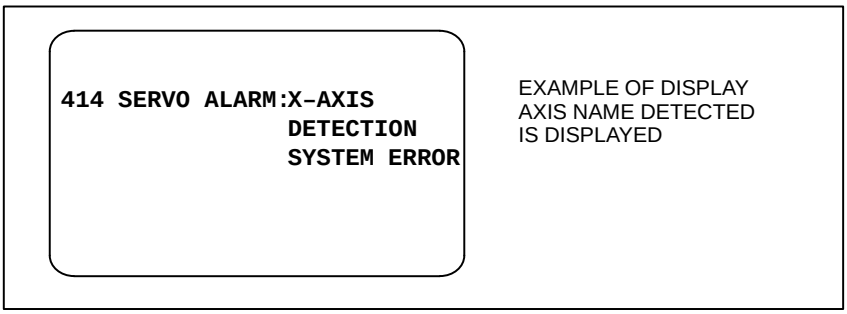


NOTE

1 Position error= $\frac{\text{Feed rate (mm/min)}}{60 \times \text{PRM517}} \times \frac{100}{\text{Detection unit}}$

2 Parameter 504 to 507 ≧ Position error at rapid traverse × 1.2

6.21 ALARM 4n4 (DIGITAL SERVO SYSTEM IS ABNORMAL)



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	0723		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

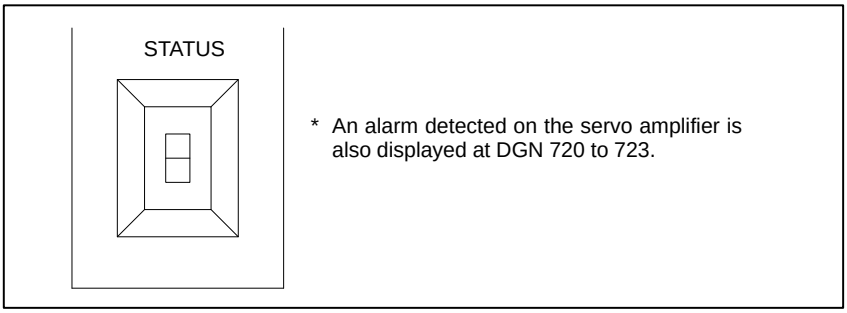
#3(HVA): Over current alarm → LED [1] lights

#2(DCA): Discharge alarm → LED [4] or [5] lights

#1(FBA): Disconnection alarm

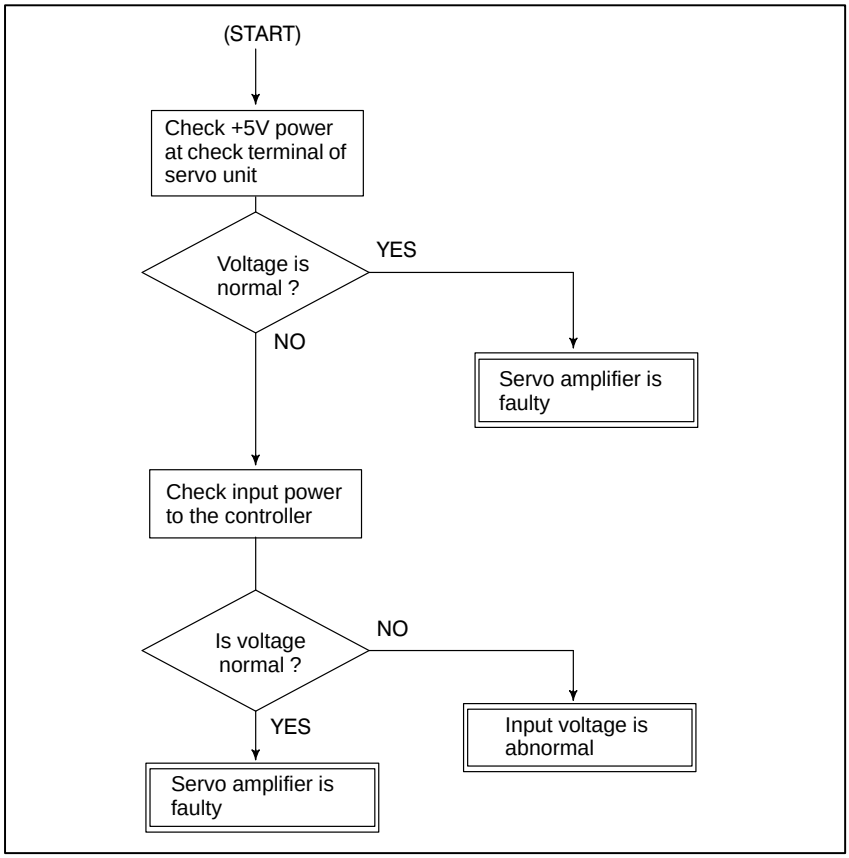
#0(OFA): Overflow alarm

(2) LED display on the servo amplifier

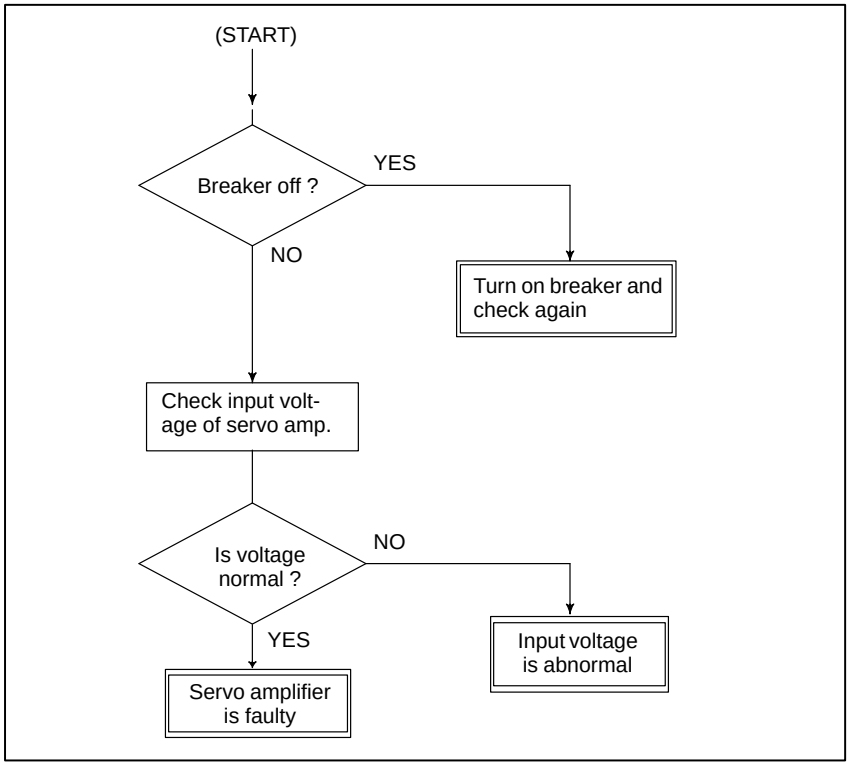


- **#6(LV):Insufficient voltage alarm**

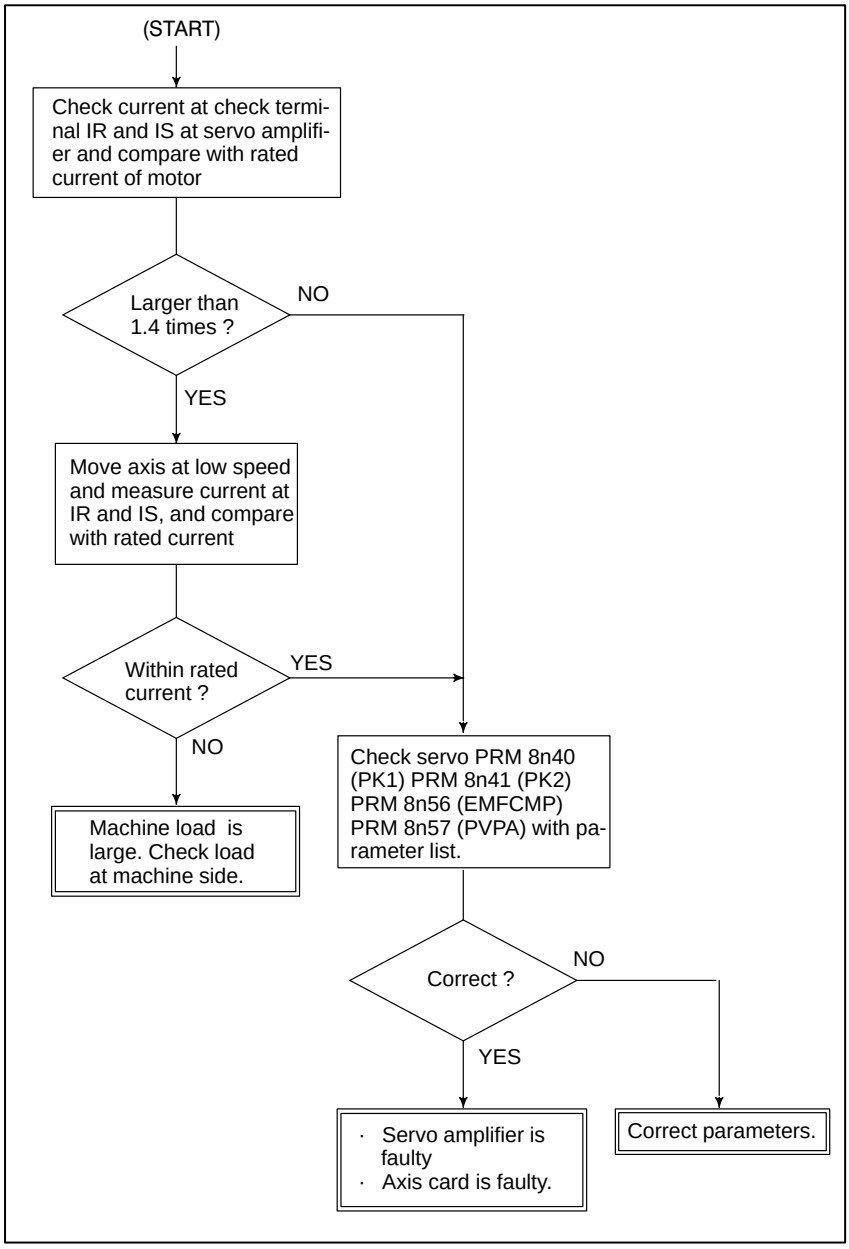
(1) Servo amp LED [2] turns on (control power shortage)



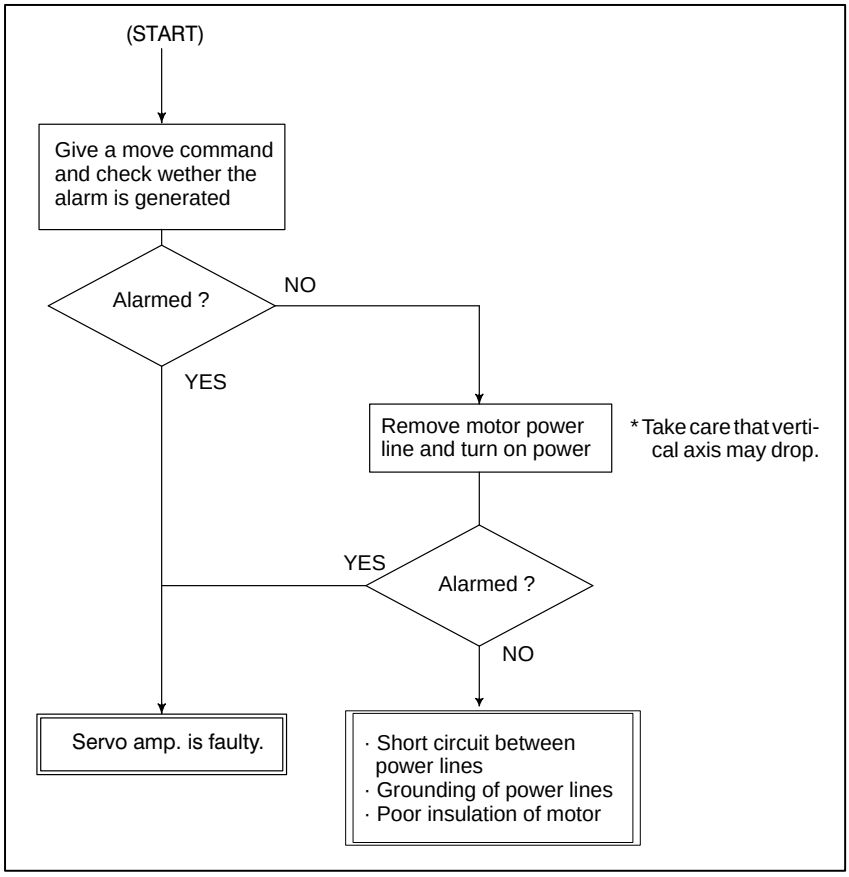
(2) Servo amp LED [3] turns on (DC power shortage)



- **#5(OVC):Over current detection by software**

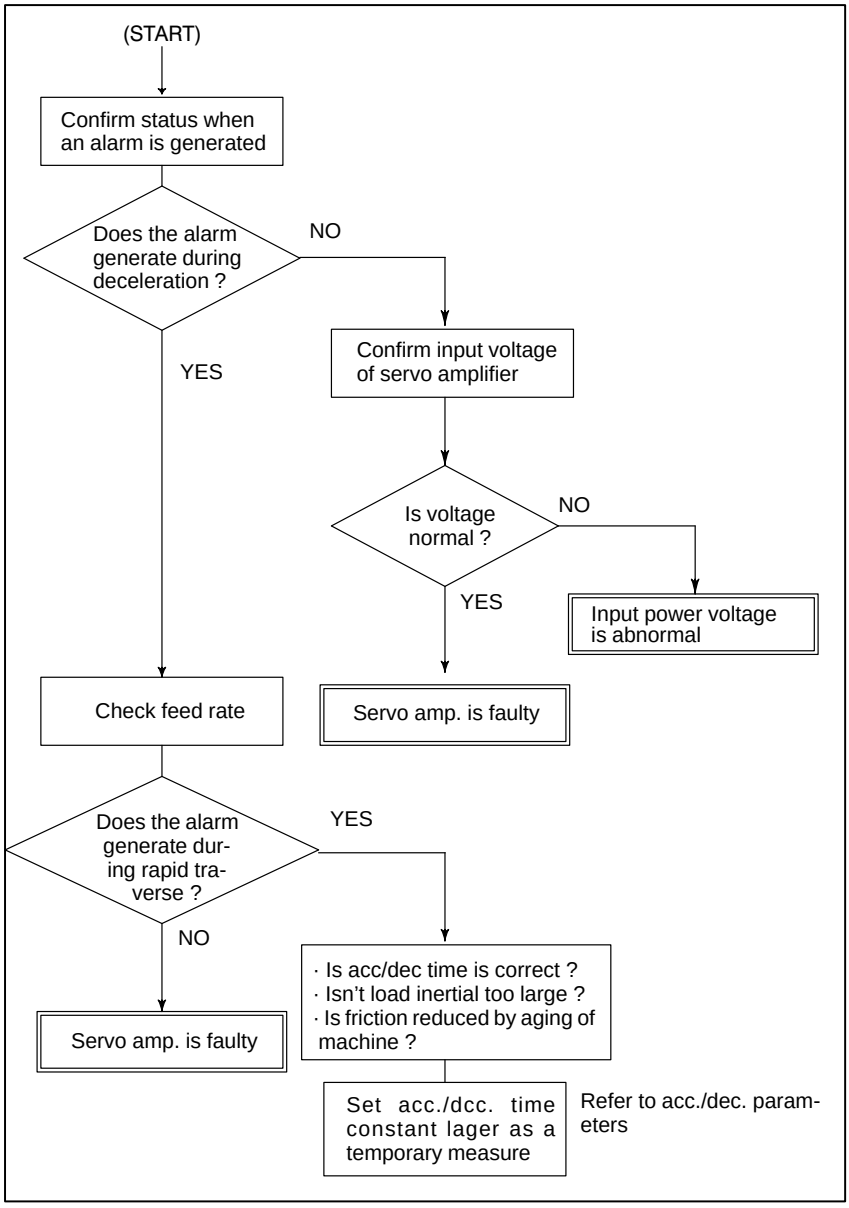


- **#4(HCA):Abnormal current alarm (Servo amp. LED:[8] lights)**



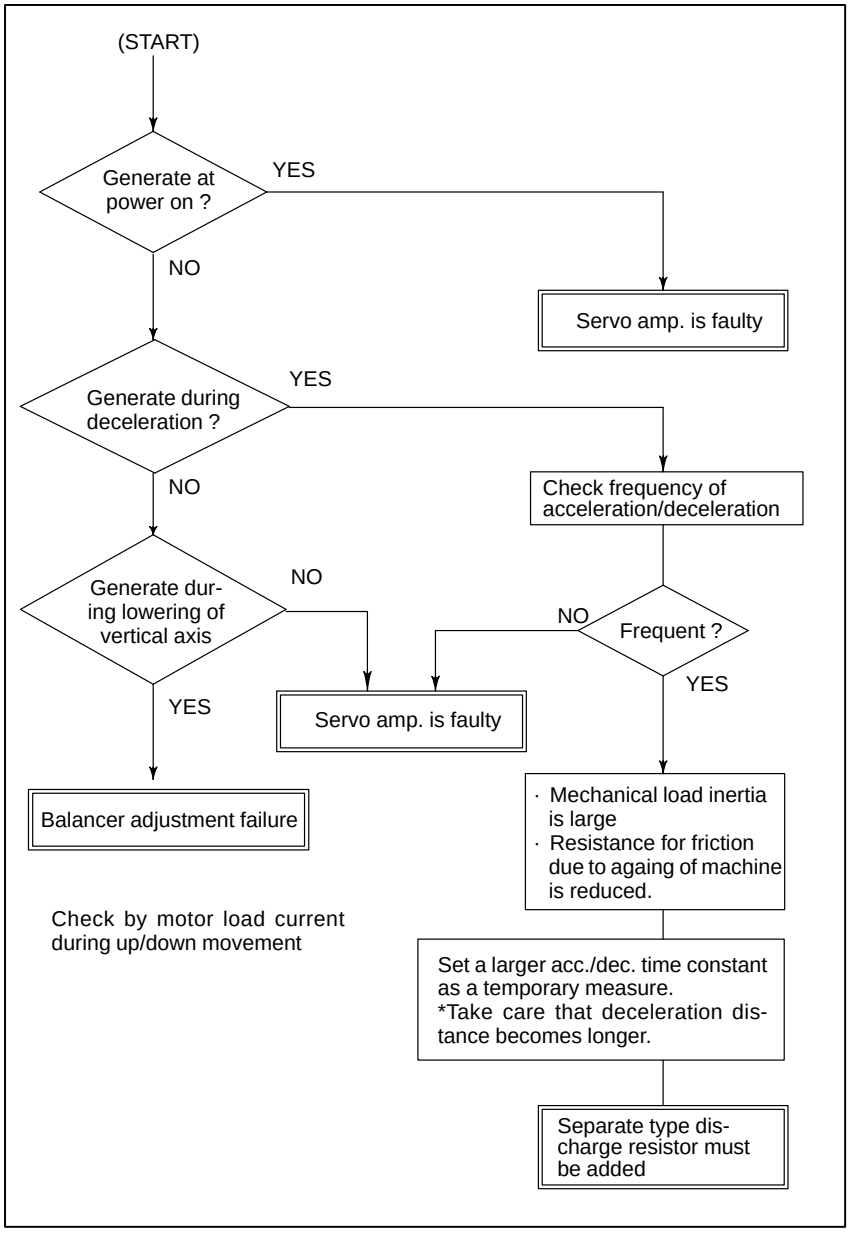
- **#3(HVA):Over voltage alarm (Servo amp.LED [1] lights)**

DC voltage in servo amp. is excessive.

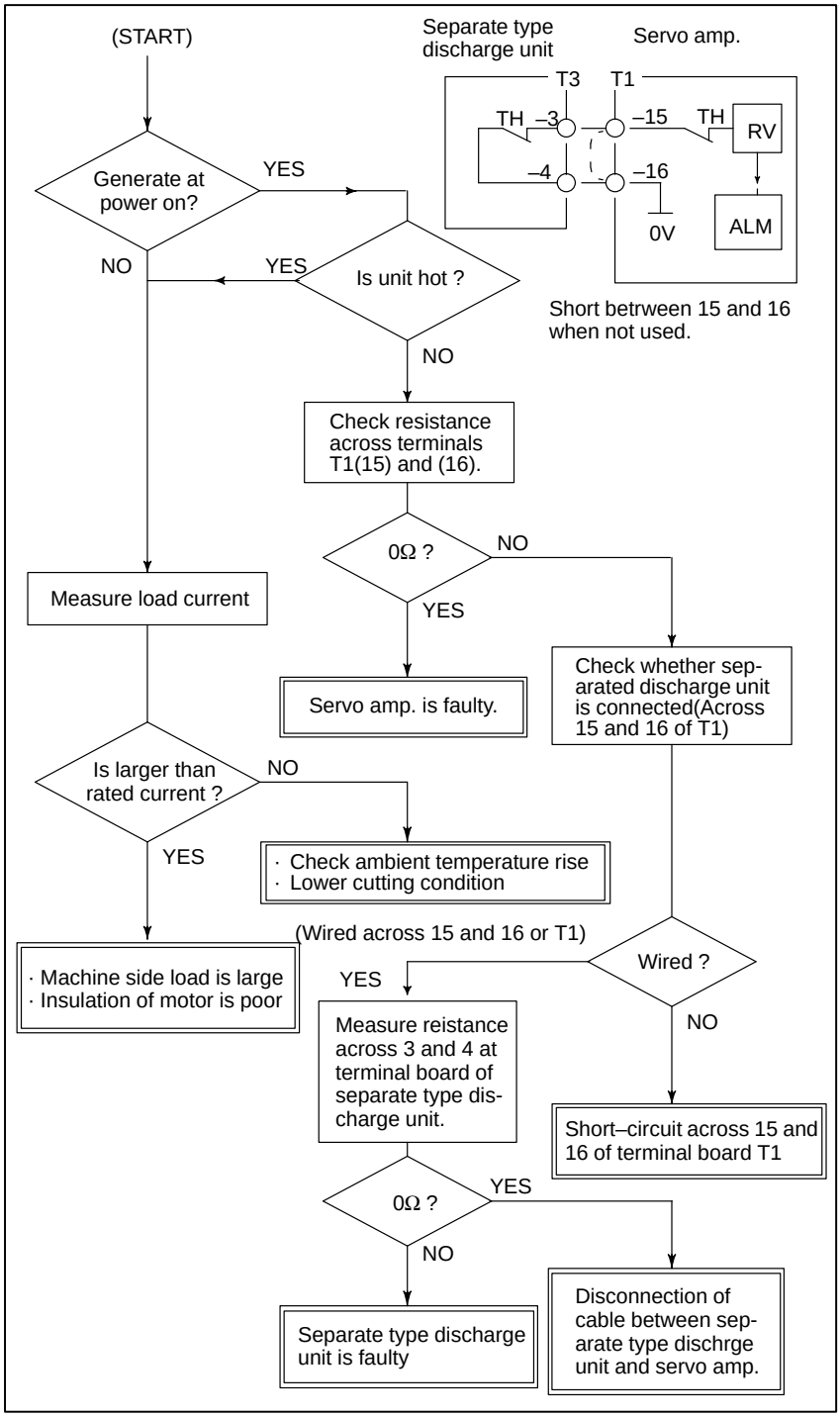


- **#2(DCA):Discharge alarm**

1 Servo amp LED 4 lights (discharge control circuit is abnormal)



2 Servo amp LED 5 lights (discharge circuit overheat)



- **#1(FBA):DISCONNECTION ALARM**

Position detection signal line is disconnected or short–circuited.

		#7	#6	#5	#4	#3	#2	#1	#0
DGN	0730	ALD			EXP				
:						:			
DGN	0733	ALD			EXP				

1	–	–	0	Built–in serial pulse coder disconnection
1	–	–	1	Separate type position detector connection
0	–	–	0	Pulse coder disconnection (software)

Note

NOTE
This alarm is related with full–closed system.

- **Causes**

1 Signal cable is disconnected or short–circuited.
2 Serial pulse coder or position detector is faulty Refer to **CAUTION**
3 Axis card is faulty.

CAUTION
After the pulse coder is replaced, reference position or machine's standard position is different from former one. Adjust and set it correctly.

- **#0(OFA):Overflow alarm**

causes

1 Wrong setting of servo parameters.
2 Axis card is fault.

- **LED display**

Display	Meaning	Explanation
	Power off	Power to the servo converter is not supplied.
	NOT READY	Internal MMC (electro–magnetic contactor) is not turned on.
	READY	Internal MMC is turned on and the motor becomes ready.
	HV Excessive voltage alarm	DC voltage for driving main circuit is considerabley high.
	LV5V Control power low alarm	+5V of control power is abnormally low.
	LVDC DC link voltage low alarm	DC voltage for main circuit is extremely low.
	DCSW Abnormal regenerative control circuit	Regenerative discharge energy in short time is large or regenerative discharge circuit is faulty.
	DCOH Excessive regenerative discharge	Average regenerative discharge energy is large or frequency of acc./dec. is large.
	OH Servo amplifier overheat	Lights when thermostat in the servo amplifier functions.
	MCC Electro magnetic contactor	Contacts of electro–magnetic contactor is blown.
	HCL L axis excess current	Lights when a large current flows through the main circuit of L axis.
	HCM M axis excess current	Lights when a large current flows through the main circuit of M axis.
	HCLM Excess current	Lights when a large current flows throught the main circuit of L axis and M axis.

NOTE
1st axis is L, 2nd axis is M.

- **LVDC alarm**

When the electro–magnetic contactor is turned on in the servo amp. or DC voltage for the main circuit becomes low, this LED is lit.
Causes are;

1) Input voltage is insufficient.
2) Contacts of electro–magnetic contactor in servo amp. is poor.
3) Power circuit in servo amp. is abnormal.

- **DCSW alarm**

This alarm is lit when the transistor for regenerative discharging turns on more than 1 second.
Its causes are;

1) Mulfunction of servo amplifier such as regenerative discharge circuit.
2) Regenerative discharge energy is excessive due to cutting conditions.

- **DCOH alarm**

This alarm is lit when regenerative discharge registance is overheated and the thermost at operates.
Its causes are ;

1) Average discharge energy is excessive due to frequent acc./dec. or no use of balancer in vertical axis
2) Functioning of a thermostat in the power transformer when thermostat signal TH1 and TH2 are connected.

- **MCC alarm**

When turning on MCC, if the contacts are already on.

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	0733	ALD			EXP				

1	–	–	0	Built–in serial pulse coder disconnection
1	–	–	1	Separate type position detector connection
0	–	–	0	Pulse coder disconnection (software)

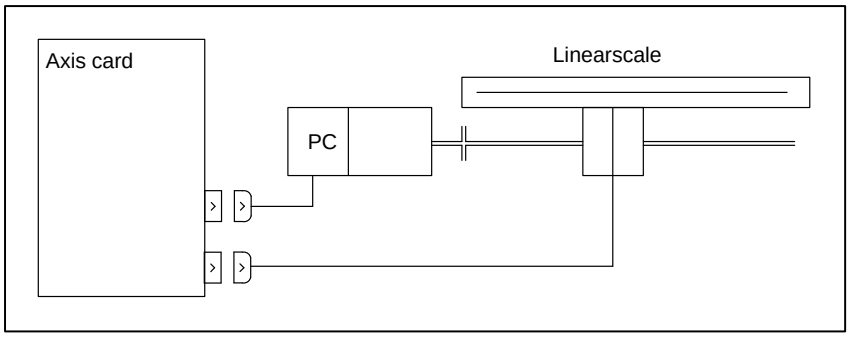
Note

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 **CAUTION**
(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
(If these bits are 1, a separate pulse coder is to be used.)

CAUTION
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.)

- **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 0272 : 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

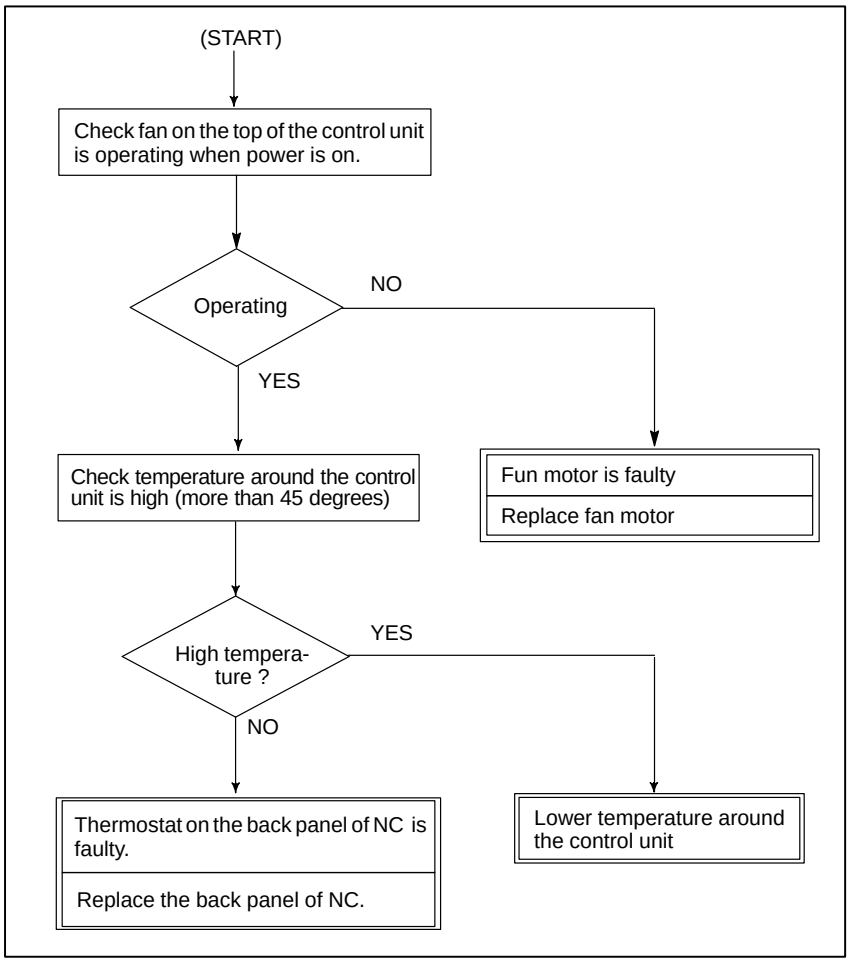
(3) Perform initial setting of digital servo parameters.

Refer to “Initial Setting of Servo Parameters” .

6.24 ALARM 700 (OVERHEAT AT CONTROL SIDE)

Remedies

Because an ambient temperature of the control unit becomes high, a thermostat mounted on the back panel of NC functions and informs an alarm.



6.25 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.

6.26 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

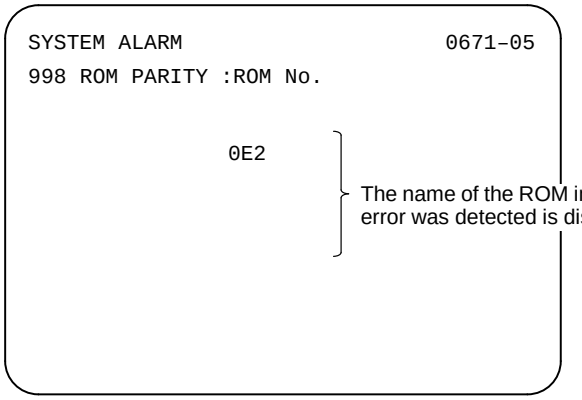
Appendix A list the alarms.

6.27 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.



Also, check the control software series and edition displayed at the right corner of the screen.

6.28 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 ”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.

6.29 ALARM 920 (WATCH DOG OR RAM PARITY)

920 : Watch dog alarm or servo system alarm of 1st to 4th axis.

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.

- **Main CPU board is faulty**

  CPU or peripheral circuits may be faulty. Replace the main CPU board.

- **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.

6.30 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.

CAUTION
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.

6.31 ALARM 930 (CPU ERROR)

CPU error (abnormal interrupt) has generated.

Causes and Remedies

Main CPU board is faulty

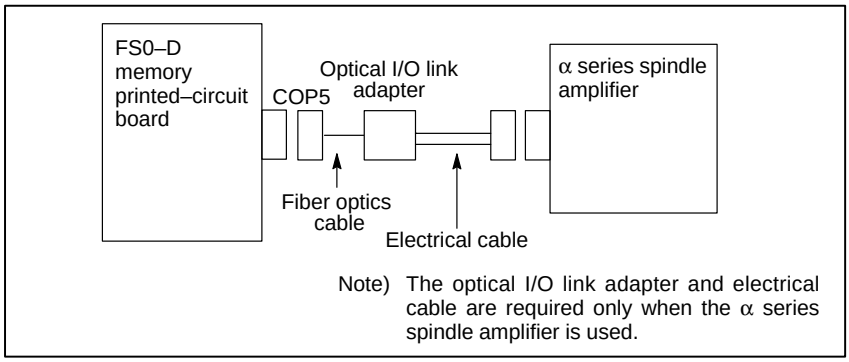
An interrupt which will not occur during usual operation has generated. Peripheral circuit of the CPU may be abnormal. Change the main CPU board. If operation is performed normally by power off and on, noise may be a cause. Refer to Subsec. 2.3.11 Action Against Noise.

6.32 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.



- 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.

6.33 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 F14 (A60L–0001–0046#5.0) in the power supply unit.

APPENDIX

A ALARM LIST

A.1 LIST OF ALARM CODES

(1) Alarms on program and operation of 0–MD, 0–GSD (P/S alarm)

Number	Message	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.)
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.
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. Modify the program.
015	TOO MANY AXES COMMANDED	An attempt has been made to move the tool along more than the maximum number of simultaneously controlled axes. Modify the program.
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.
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.
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. Modify the program.

Number	Message	Contents
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 C. 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. 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 a system using the DRILL–MATE with an ATC, 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. Modify the program.
050	CHF/CNR NOT ALLOWED IN THRD BLK	Optional 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 optional 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. Modify the program.
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.
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), 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 subprogram was called in five folds. Modify the program.

Number	Message	Contents
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 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 (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.
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	REFERENCE RETURN INCOMPLETE	Manual reference position return cannot be performed when automatic operation is halted.
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. Modify the program.
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 the 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. Move axis before a move command or don't interrupt MDI operation.

Number	Message	Contents
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. If this alarm has occurred, set parameter PWE to 1 while pressing <DELET>, and only the program being edited will be deleted. Register the deleted program.
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 overflow the capacity. (-2^{32} to -2^{32-1})
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.
114	FORMAT ERROR IN MACRO	Custom macro A commands indefinite H code in the block of G65. Custom macro B has 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 data is 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	FOUR FOLD MACRO MODAL–CALL	The macro modal call is specified four fold. 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 commands indefinite H code in the block of G65. Custom macro B has an error in the other formats then <Formula>. Modify the program.
126	ILLEGAL LOOP NUMBER	In DOn, $1 \leqq n \leqq 3$ 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.

Number	Message	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	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 OVER-FLOW	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.
150	ILLEGAL TOOL GROUP NUMBER	Tool Group No. exceeds the maximum allowable value. Modify the program.
151	TOOL GROUP NUMBER NOT FOUND	The tool group 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 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, 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 is set. Correct the program.
157	TOO MANY TOOL GROUPS	The number of tool groups 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.
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 Modify the program.
178	G05 COMMANDED IN G41/G42 MODE	G05 was commanded in the G41/G42 mode. Correct the program.
179	PARAM. (NO. 7510) SETTING ERROR	The number of controlled axes set by the parameter exceeds the maximum number. Modify the parameter setting value.

Number	Message	Contents
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	G81 block format error (hobbing machine) 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	G83 (C axis servo lag quantity offset) was instructed though synchronization by G81 has not been instructed. Correct the program. (hobbing machine) Modify the program.
183	DUPLICATE G83 (COMMANDS)	G83 was instructed before canceled by G82 after compensating for the C axis servo lag quantity by G83. (hobbing machine) Modify the program.
184	ILLEGAL COMMAND IN G81	A command not to be instructed during synchronization by G81 was instructed. (hobbing machine) 1) A C axis command by G00, G27, G28, G29, G30, etc. was instructed. 2) Inch/Metric switching by G20, G21 was instructed. Modify the program.
185	RETURN TO REFERENCE POINT	G81 was instructed without performing reference position return after power on or emergency stop. (hobbing machine) Perform reference position return.
186	PARAMETER SETTING ERROR	Parameter error regarding G81 (hobbing machine) 1) The C axis has not been set to be a rotary axis. 2) A hob axis and position coder gear ratio setting error Modify the parameter.
190	ILLEGAL AXIS SELECT	In the constant surface speed control, the axis specification is wrong. The specified axis command (P) contains an illegal value. Correct the program.
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	Switching command to spindle command mode is not correctly completed. Check the PMC ladder program.
197	C–AXIS COMMANDED IN SPINDLE MODE	The program specified a movement along the Cs–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. 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. (System error)
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 or G74 block. Modify the program.
205	RIGID MODE DI SIGNAL OFF	Rigid mode DI signal is not ON when G84 or 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.
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. 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 arbitrary angle chamfering or a corner R is commanded or the plane including an additional axis. Correct the program.

Number	Message	Contents
213	ILLEGAL COMMAND IN SYNCHRO–MODE	Movement is commanded for the axis to be synchronously controlled. 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 specifying 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 NO.8313.
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 (GS series)	The infeed quantity R has not been instructed for the G160 block. Or the R command value is negative. Correct the program.
250	Z AXIS WRONG COMMAND (ATC)	A value for the Z–axis has been specified in a block for the tool exchange command (M06T_) on a system with DRILL–MATE ARC installed.

(2) Program errors /Alarms on program and operation of 0–TD, 0–GCD (P/S alarm)

Number	Message	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.)
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.
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 has been made to move the tool along more than the maximum number of simultaneously controlled axes. Alternatively, no axis movement command or an axis movement command for two or more axes has been specified in the block containing the command for skip using the torque limit signal (G31 P99/98). The command must be accompanied with an axis movement command for a single axis, in the same block.

Number	Message	Contents
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.
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 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 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 G01. 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.
055	MISSING MOVE VALUE IN CHF/CNR	In chamfering or corner R block, the move distance is less than chamfer or corner R amount. Modify the program.
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 (Aa). In the chamfering comman, I(K) is commanded for the X(Z) axis Modify the program..
057	NO SOLUTION OF BLOCK END	Block end point is not calculated correctly in direct dimension drawing programming. Modify the program.

Number	Message	Contents
058	END POINT NOT FOUND	Block end point is not found in direct dimension drawing programming. Modify the program.
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	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, though the 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	NUMBER OF POCKETS (10 or more)	The number of pockets are 10 or more in G71 and G72 type III.
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.
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 subprogram was called in five folds. Modify the program.

Number	Message	Contents
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.
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	REFERENCE RETURN INCOMPLETE	Manual reference position return cannot be performed when automatic operation is halted. Reset and execute manual reference position 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. Check the program contents.
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 the 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. Move axis before a move command or don't interrupt MDI operation.

Number	Message	Contents
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. If this alarm has occurred, set the parameter PWE to 1 while pressing <DELETE>, and only the program being edited will be deleted. Register the deleted program.
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.
114	FORMAT ERROR IN MACRO	Custom macro A commands indefinite H code in the block of G65. Custom macro B has an error in other formats then <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 data is 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	FOUR FOLD MACRO MODAL–CALL	The macro modal call is specified four fold. 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 commands indefinite H code in the block of G65. Custom macro B has an error in other formats then <Formula>. Modify the program.
126	ILLEGAL LOOP NUMBER	In DOn, 1≦ n ≦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.

Number	Message	Contents
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.
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.
145	ILLEGAL CONDITIONS IN POLAR COORDINATE INTERPOLATION	The conditions are incorrect when the polar coordinate interpolation starts or it is canceled. 1) In modes other than G40, G12.1/G13.1 was specified. 2) An error is found in the plane selection. Modify the value of program or parameter.
146	IMPROPER G CODE	G codes which cannot be specified in the polar coordinate interpolation mode was specified. Modify the program.
150	ILLEGAL TOOL GROUP NUMBER	Tool Group No. exceeds the maximum allowable value. Modify the program.
151	TOOL GROUP NUMBER NOT FOUND	The tool group 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 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	Group No.ΔΔ which is specified with TΔΔ 88 of the machining program do not included in the tool 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 is set. Correct the program.
157	TOO MANY TOOL GROUPS	The number of tool groups 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.
160	MISMATCH WATING M–CODE TT series	Diffrent M code is commanded in heads 1 and 2 as waiting M code. Modify the program.
163	COMMAND G68/G69 INDEPENDENTLY TT series	G68 and G69 are not independently commanded in balance cut. Modify the program.
169	ILLEGAL TOOL GEOMETRY DATA TT series	Incorrect tool figure data in interference check. Set correct data, or select correct tool figure data.
175	ILLEGAL G107 COMMAND	Conditions when performing circular interpolation start or cancel not correct. Modify the program.
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, 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.

Number	Message	Contents
178	G05 COMMANDED IN G41/G42 MODE	G05 was commanded in the G41/G42 mode. Correct the program.
179	PARAM. (NO. 7510) 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	Switching command to contouring mode, Cs axis control or rigid tap mode or switching to spindle command mode is not correctly completed. Check the ladder diagram of 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. 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. (System error)
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 or G74 for M series (G84 or G88 for T series) block. Modify the program.
205	RIGID MODE DI SIGNAL OFF	Rigid mode DI signal is not ON when G84 or G74 for M series (G84 or G88 for T series) 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.
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	A move command has been specified for an axis subject to synchronous control.
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.
217	DUPLICATE G51.2 (COMMANDS)	G251 is further commanded in the G250 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 INDEPENDENTLY	G251 and G250 are not independent blocks. Modify the program.
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. Modify the program or check PMC ladder diagram.
221	ILLEGAL COMMAND IN SYNCHR–MODE	Polygon machining synchronous operation and axis control or balance cutting are executed at a time. Modify the program.
224	TURN TO REFERENCE POINT	Reference position return is necessary before cycle start.
225	SYNCHRONOUS/MIXED CONTROL ERROR T series (At two–path)	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.

Number	Message	Contents
226	ILLEGAL COMMAND IN SYNCHRO–MODE T series (At two–path)	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	This alarm is generated in the following circumstances. 1 When the synchro/mixed state could not be kept due to system overload. 2 The above condition occurred in hardware and synchro–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 feed rates along axes and torque limit, and try again.

(3) Background edit alarm (BP/S)

Number	Message	Contents
???	BP/S alarm	BP/S alarm is produced with the same number as P/S alarm taking place in normal program editing. (070, 071, 072, 073, 074, etc.)
140	BP/S alarm	An attempt was made to select or delete a program being selected in foreground. Execute correct background editing.

(4) Absolute pulse coder (APC) alarm

Number	Message	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 (n=1 – 8) 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 (n=1 – 8) 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 (n=1 – 8) 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 (n=1 – 8) 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 (n=1 – 8) APC pulse error alarm. APC alarm.APC or cable may be faulty.
3n6	APC alarm: nth–axis battery voltage 0	nth–axis (n=1 – 8) 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 (n=1 – 8) 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 (n=1 – 8) APC battery voltage has reached a level where the battery must be renewed (including when power is OFF). APC alarm .Replace battery.

(5) Serial pulse coder (SPC) alarms

Number	Message	Contents
3n9	SPC ALARM: n AXIS PULSE CODER	The n axis (axis 1–4) pulse coder has a fault.

- **The details of serial pulse coder alarm 3n9**

	#7	#6	#5	#4	#3	#2	#1	#0
760		CSAL	BLAL	PHAL	P.CAL	BZAL	CKAL	SPHL
:					:			
763		CSAL	BLAL	PHAL	P.CAL	BZAL	CKAL	SPHL

#6 (CSAL) : Serial pulse coder is incorrect.
Replace the pulse coder.

#5 (BLAL) : Replace the battery.
(This bit does not relate with serial pulse coder.)

#4 (PHAL) : Serial pulse coder or feedback cable is incorrect.
Replace the cable or pulse coder.

#3 (P.CAL) : Serial pulse coder is incorrect.
Replace the pulse coder.

#2 (BZAL) : The pulse coder was supplied with power for the first time. Check that the batteries are connected, then switch the power off then back on, then make a reference position return. (This bit is not related to a serial pulse coder alarm.)

#1 (CKAL) : Serial pulse coder is incorrect.
Replace the pulse coder.

#0 (SPHL) : Serial pulse coder or feedback cable is incorrect.
Replace the cable or pulse coder.

	#7	#6	#5	#4	#3	#2	#1	#0
770	DTE	CRC	STB					
:					:			
773	DTE	CRC	STB					

#7 (DTE) :
#6 (CRC) :
#5 (STB) : This is a communication error in the serial pulse coder. The error may have occurred in the pulse coder, feedback cable, or feedback reception circuit.
Replace the pulse coder, feedback cable, or NC axis board.

(6) Servo alarms

Number	Message	Contents
400	SERVO ALARM: 1st and 2nd AXIS OVERLOAD	The 1st and 2nd axis overload signal is on. Refer to diagnosis display No.720, 721 for details.
401	SERVO ALARM: 1st and 2nd AXIS VRDY OFF	The 1st and 2nd axis servo amplifier signal (DRDY) went off.
402	SERVO ALARM: 3rd and 4th AXIS OVERLOAD	The 3rd and 4th axis overload signal is on. Refer to diagnosis display No.722, 723 for detailes.
403	SERVO ALARM: 3rd and 4th AXIS VRDY OFF	The 3rd and 4th axis servo amplifier 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 servo interface module and servo amp 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.
4n0	SERVO ALARM: n–TH AXIS – EXCESS ERROR	The position deviation value when the n–th axis (axis 1–8) stops is larger than the set value. Limit value of each axis should be set to the parameter.
4n1	SERVO ALARM: n–TH AXIS – EXCESS ERROR	The position deviation value when the n–th axis (axis 1–8) moves is larger than the set value. Limit value of each axis should be set to the parameter.
4n3	SERVO ALARM: n–th AXIS – LSI OVERFLOW	The contents of the error register for the n–th axis exceeded $\pm 2^{31}$ 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 to 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) Parameter No.0269 to 0274 to axis selection are incorrect. 7) Overflow is occured in calculation.

CAUTION
If a spindle excess error alarm occurs during rigid tapping, the excess error alarm number for the related tap feed axis is displayed.

- **Details of servo alarm No.4n4**

The details of servo alarm No.4n4 are displayed in the diagnosis display (No.720 to 727) as shown below.

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

#7 (OVL) : An overload alarm is being generated.
(This bit is cause of servo alarm No.400, 402, 406 and 409.)

#6 (LV) : A low voltage alarm is being generated in servo amp.
Check the LED of servo amp.

#5 (OVC) : A overcurrent alarm is being generated inside of digital servo.

#4 (HCA) : An abnormal current alarm is being generated in servo amp.
Check the LED of servo amp.

#3 (HVA) : An overvoltage alarm is being generated in servo amp.
Check the LED of servo amp.

#2 (DCA) : A regenerative discharge circuit alarm is being generated in servo amp.
Check the LED of servo amp.

#1 (FBA) : A disconnection alarm is being generated.
(This bit is cause of servo alarm No.4n6.)

#0 (OFA) : An overflow alarm is being generated inside of digital servo.

(7) Serial spindle alarms

Number	Message	Contents
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	FIRST SPINDLE ALARM DETECTION (AL–XX)	This alarm indicates in the NC that an alarm is generated in the spindle unit of the system with the serial spindle. The alarm is displayed in form AL–XX (XX is a number). Refer to 9.1 Serial Spindle amp. alarm List. To set the parameter (No.0397#7), the alarm number of spindle alarm can be displayed on the alarm screen.

(8) Over travel alarms

Number	Message	Contents
5n0	OVER TRAVEL : +n	Exceeded the n–th axis + side stored stroke limit 1,2.
5n1	OVER TRAVEL : –n	Exceeded the n–th axis – side stored stroke limit 1,2.
5n4	OVER TRAVEL : +n	Exceeded the n–th axis + side hardware OT. (M series)
5n5	OVER TRAVEL : –n	Exceeded the n–th axis – side hardware OT. (M series)
520	OVER TRAVEL : –z	Exceeded the z–th axis + side hardware OT. (T series)

(9) Macro alarms

Number	Message	Contents
500 to 599	MACRO ALARM	These alarms are related to custom macros, the macro executor, and order–made macros (including conversational program input). See the respective manuals for details. (Some macro alarm numbers are the same as overtravel alarm numbers, but overtravel alarms can be distinguished because corresponding descriptions of the alarms are displayed.)

(10) Alarm in PMC

Number	Message	Contents
600	PMC ALARM : Illegal command	An illegal command interruption has occurred in the PMC.
601	PMC ALARM : RAM parity	A PMC RAM parity error has occurred.
602	PMC ALARM : Serial transmission	A PMC serial transmission error has occurred.
603	PMC ALARM : Wachdog	A PMC watchdog error has occurred.
604	PMC ALARM : ROM parity	A PMC ROM parity error has occurred.
605	PMC ALARM : Area exceed	The ladder storage area of the PMC has been exceeded.
606	PMC ALARM : Conventional I/O module	Allocation data for a conventional I/O module is erroneous.
607	PMC ALARM : I/O Link	SLC ERROR (xxx) Alarm for the FANUC I/O LINK Followings are alarm details.

Number	Description of PMC alarm
010	* Communication error (Internal register error of the SLC (master))
020	* SLC RAM bit error (Verification error)
030	* SLC RAM bit error (Verification error)
040	I/O units are not connected.
050	32 or more I/O units are connected.
060	* Data transmission error (No response from the slave unit)
070	* Communication error (No response from the slave unit)
080	* Communication error (No response from the slave unit)
090	NMI occurred. (NMI with an alarm code other than 110 to 160)
130	* SLC (master) RAM parity error (Detected by hardware)
140	* SLC (slave) RAM parity error (Detected by hardware)
160	* SLC (slave) communication error * AL0 : Watchdog alarm DO clear reception * IR1 : CRC or framing error Watchdog alarm Parity error

* indicates a hardware error.

(11) Overheat alarms

Number	Message	Contents
700	OVERHEAT: CONTROL UNIT	Control unit overheat Check that the fan motor operates normally, and clean the air filter.
704	OVERHEAT: SPINDLE	Spindle overheat in the spindle fluctuation detection Check whether the cutting tool is share. (T series)

(12) System alarms

(These alarms cannot be reset with reset key.)

Number	Message	Contents
910	RAM PARITY	RAM parity error (low byte). Replace the memory printed board. In the tape memory RAM module.
911	RAM PARITY	RAM parity error (high byte). Replace the memory printed board. In the tape memory RAM module.
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 SRAM PARITY	There is a 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.
920	WATCHDOG ALARM	There is a watchdog or servo system alarm of 1st to 4th axis. Replace the master printed board or axis control printed board.
930	CPU INTERRUPUT	CPU error. Replace the master printed board.
940	PRINTED–CIRCUIT BOARD INSTALLATION ERROR	Other than the correct printed–circuit board has been installed. Check its specification.
941	MEMORY PRINTED–CIRCUIT BOARD POOR CONNECTION	The connection of the memory printed–circuit board is unsatisfactory. Ensure that it is connected securely.
945	SERIAL SPINDLE CONNECTION FAILURE	The hardware configuration of the serial spindle is invalid, or a communication alarm has occurred. Check the serial spindle hardware configuration and the state of the connection.
946	SERIAL SPINDLE CONNECTION FAILURE (SECOND SPINDLE)	It is impossible to communicate with the second serial spindle. Check the state of connection with the second serial spindle
950	FUSE ALARM	A fuse has blown. Replace fuse F14 for +24E.
960	SUB–CPU ERROR	An error has occurred in the sub–CPU. Replace the sub–CPU board.
998	ROM PARITY ERROR	A ROM parity error has occurred. Replace the ROM in which the error occurred.

(13) External alarms

Number	Message	Contents
1000 to	EXTERNAL ALARMS	These alarms are related to the PMC ladder program. For details, refer to the applicable manual provided by the machine tool builder.

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			A20B–0096–H021		B
Battery for absolute pulse coder			A06B–6050–K060	Battery case	B
			A06B–6050–K661	Battery (4 pcs)	A
Fuse	F11, F12	For AI	A60L–0001–0245#GP75	200VAC for input power supply	B
	F13	Common	A60L–0001–0075#3.2	Printed board CRT/MDI (3.2A)	B
	F14	For A, AI	A60L–0001–0046#5.0	Machine side +24E line (5A)	B
	For CE marking		A60L–0001–0245#GP75	F1 (7.5A) DAITO TSUSHIN	B
			A60L–0001–0075#5.0	F3 (5A) DAITO TSUSHIN	B
			A60L–0001–0046#5.0	F4 (5AS) DAITO TSUSHIN	B
9” CRT/MDI	Small keyboard		A86L–0001–0125		B
	Soft keyboard		A20B–1001–0720		B
	Small keysheet 0–MD, 0–GSD		A98L–0001–0518#MR	Qualifying for CE marking (English)	B
	Small keysheet 0–TD, 0–GCD		A98L–0001–0518#T	Standard	B
			A98L–0001–0518#TR	Qualifying for CE marking (English)	B
			A98L–0001–0518#TB	Qualifying for CE marking (Symbol)	B
	CRT soft keysheet		A98L–0001–0629		B
	9” Monochrome CRT		A13B–0057–C001		B
	9” EL		A61L–0001–0114		B
Power supply unit	AI		A16B–1212–0100		B
	Qualifying for CE marking		A16B–1212–0950		B
Master printed board	0–D 32 bit control unit A		A16B–2001–0120		B
Memory	Printed board		A16B–2201–0103		B
I/O printed board	C6		A16B–1212–0221	DI/DO=80/56	B
	C7		A16B–1212–0220	DI/DO=104/72	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
Axis printed board	For serial pulse coder		A16B–2200–0391	1/2 axis	B
			A16B–2200–0390	3/4 axis	B
			A16B–2203–0020	3/4 axis (Type B interface)	B
			A16B–2203–0021	1/2 axis (Type B interface)	B
PMC–M	I/O–Link	MASTER	A16B–2200–0341	ROM board	B
			A16B–2200–0346	RAM board for debug	B

[A]

[B]

[C]

[D]

[E]

[F]

[H]

[I]

[J]

[L]

[M]

[N]

[O]

[P]

[R]

[S]

[T]

Revision Record

FANUC Series 0–TD/0–MD/0–GCD/0–GSD MAINTENANCE MANUAL (B–62545EN)

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