GE Fanuc Automation

Computer Numerical Control Products

α Series Control Motor

Maintenance Manual

GFZ-65165E/01 *April 1994*

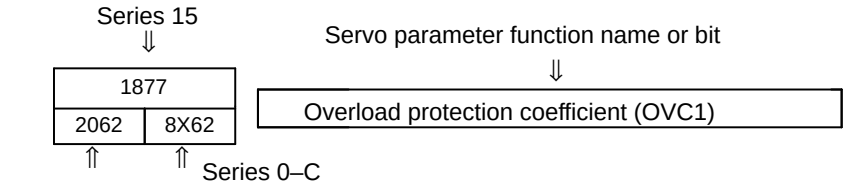
PREFACE

This manual describes information necessary to maintain FANUC control motor amplifier α series products, such as a power supply module, servo amplifier module, and spindle amplifier module.
Part I explains the start–up procedure, and part II focuses on troubleshooting.
The abbreviations listed below are used in this manual.

Product name	Abbrevi-ations	Product name	Abbrevi-ations
FANUC Series 0–TC	FS0–TC	Power Supply Module	PSM
FANUC Series 0–MC	FS0–MC	Servo Amplifier Module	SVM
FANUC Series 15	FS15	Spindle Amplifier Module	SPM
FANUC Series 16	FS16		
FANUC Series 18	FS18		
FANUC Series 20	FS20		
FANUC Series 21	FS21		
FANUC Power Mate MODEL D	PM–D		
FANUC Power Mate MODEL F	PM–F		

In this manual, the servo parameter number is explained as shown below.

(Example)



Related manuals

The following six kinds of manuals are available for FANUC CONTROL MOTOR α series. In the table, this manual is marked with an asterisk (*).

Document name	Document number	Major contents	Major usage	
FANUC AC SERVO MOTOR α series DESCRIPTIONS	B–65142E	● Specification ● Characteristics ● External dimensions ● Connections	● Selection of motor ● Connection of motor	
FANUC AC SPINDLE MOTOR α series DESCRIPTIONS	B–65152E	● Specification ● Characteristics ● External dimensions ● Connections		
FANUC CONTROL MOTOR AMPLIFIER α series DESCRIPTIONS	B–65162E	● Specifications and functions ● Installation ● External dimensions and maintenance area ● Connections	● Selection of amplifier ● Connection of amplifier	
FANUC CONTROL MOTOR α series MAINTENANCE MANUAL	B–65165E	● Start up procedure ● Troubleshooting ● Maintenance of motor	● Start up the system (Hardware) ● Troubleshooting ● Maintenance of motor	*
FANUC AC SERVO MOTOR α series PARAMETER MANUAL	B–65150E	● Initial setting ● Setting parameters ● Description of parameters	● Start up the system (Software) ● Turning the system (Parameters)	
FANUC AC SPINDLE MOTOR α series PARAMETER MANUAL	B–65160E	● Initial setting ● Setting parameters ● Description of parameters		

Table of contents

I START–UP PROCEDURE

1 OVERVIEW

This part describes the units and components of the FANUC control motor amplifier α series. It also explains the following information necessary to start up the control motor amplifier:

- Connecting the power
- Setting the printed–circuit board
- Initializing the parameter
- Confirmation of the operation

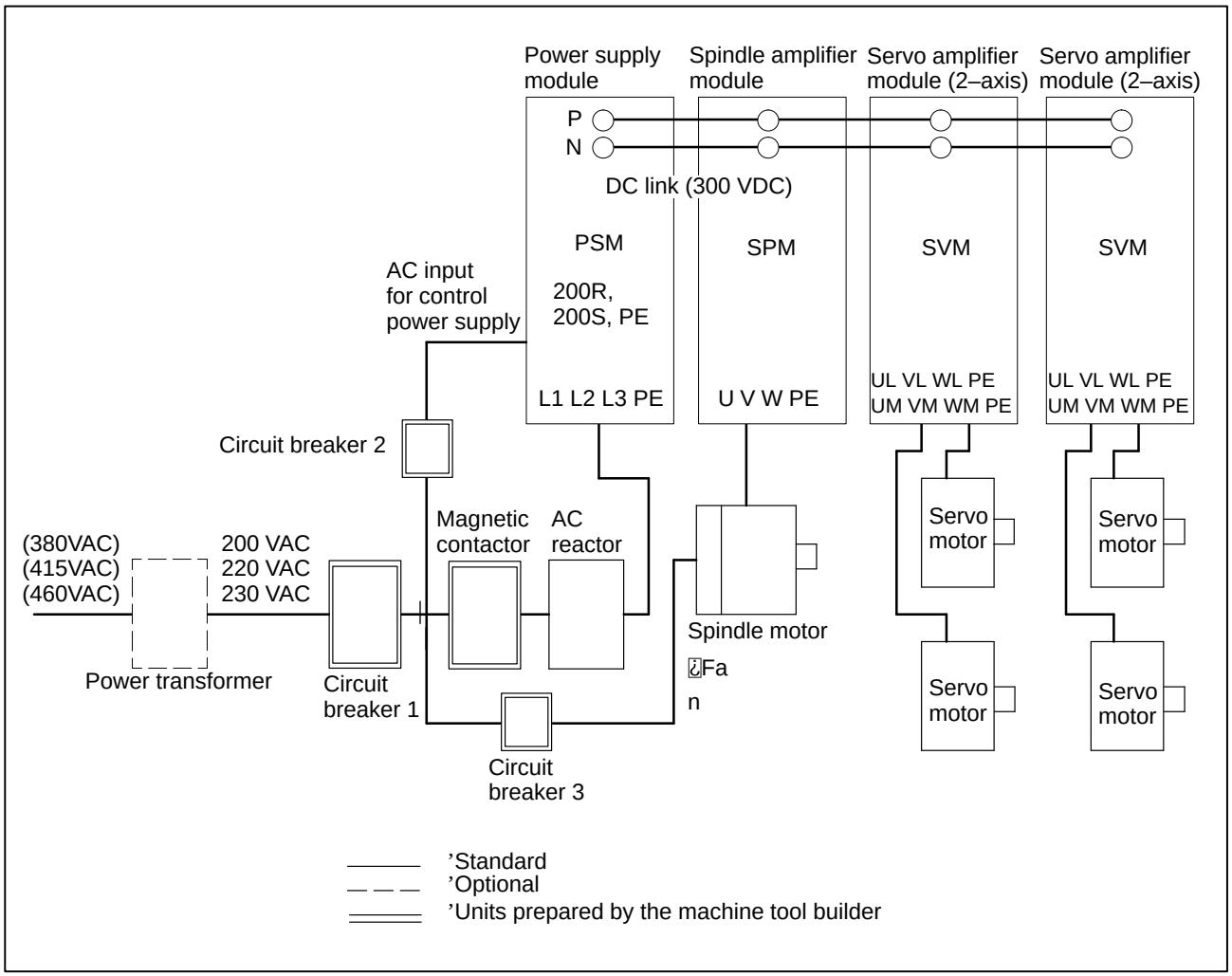
2 CONFIGURATIONS

2.1 CONFIGURATIONS

The FANUC control motor amplifier α series consists of the units and components listed below:

(1) Power supply module (PSM) (basic)
(2) Servo amplifier module (SVM) (basic)
(3) Spindle amplifier module (SPM) (basic)
(4) AC reactor (basic)
(5) Connectors (for connecting cables) (basic)
(6) Fuses (basic)
(7) Power transformer (option)
(8) Fan adaptor (option)

The diagram below shows an example of a basic configuration of the FANUC control motor amplifier α series system. The basic configuration consists of two two–axis servo amplifier modules and one spindle amplifier module.



NOTE1
Refer to the Control Motor Amplifier α series Specifications for combinations of the power supply module, servo amplifier module, and spindle amplifier module.
NOTE2
Always use the circuit breakers, magnetic contactor, and AC reactor.
NOTE3
Install a surge suppressor between the power lines and between each power line and a ground at the input of the power magnetics cabinet to protect the system from lightning surge.

2.2 MAJOR COMPONENTS

2.2.1 Power Supply Module

Model	Order specification	Wiring board specification	P.C.B.specification	Remarks
PSM–5.5	A06B–6077–H106	A16B–2202–0460	A16B–2202–0420	
PSM–11	A06B–6077–H111	A16B–2202–0461		
PSM–15	A06B–6077–H115	A20B–1005–0590	A16B–2202–0080	
PSM–26	A06B–6077–H126			
PSM–30	A06B–6077–H130			

2.2.2 Servo Amplifier Module

(1) Servo amplifier module (1axis)

Model	Order specification	Wiring board specification	P.C.B.specification	Remarks
SVM1–12	A06B–6079–H101	A16B–2202–0480	A20B–2001–0820	
SVM1–20	A06B–6079–H102	A16B–2202–0481		
SVM1–40S	A06B–6079–H103	A16B–2202–0600		
SVM1–40L	A06B–6079–H104	A16B–2202–0601		
SVM1–80	A06B–6079–H105	A16B–2202–0602		
SVM1–130	A06B–6079–H106	A16B–2202–0510	A20B–2001–0822	

(2) Servo amplifier module (2axis)

Model	Order specification	Wiring board specification	P.C.B.specification	Remarks
SVM2–12/12	A06B–6079–H201	A16B–2202–0490	A20B–2001–0821	
SVM2–12/20	A06B–6079–H202	A16B–2202–0491		
SVM2–20/20	A06B–6079–H203	A16B–2202–0492		
SVM2–12/40	A06B–6079–H204	A16B–2202–0610		
SVM2–20/40	A06B–6079–H205	A16B–2202–0611		
SVM2–40/40	A06B–6079–H206	A16B–2202–0612		
SVM2–40/80	A06B–6079–H207	A16B–2202–0613	A20B–2001–0823	
SVM2–80/80	A06B–6079–H208	A16B–2202–0614		

(3) Servo amplifier module (3axis)

Your order specification will vary with the interface you use for the NC.

(a) When you use an NC other than the FS20 or FS21–GA

Model	Order specification	Wiring board specification	P.C.B.specification	Remarks
SVM3–12/12/12	A06B–6079–H301	A16B–2202–0500	A20B–2001–0750	
SVM3–12/12/20	A06B–6079–H302	A16B–2202–0501		
SVM3–12/20/20	A06B–6079–H303	A16B–2202–0502		
SVM3–20/20/20	A06B–6079–H304	A16B–2202–0503		
SVM3–12/12/40	A06B–6079–H305	A16B–2202–0504		
SVM3–12/20/40	A06B–6079–H306	A16B–2202–0505		
SVM3–20/20/40	A06B–6079–H307	A16B–2202–0506		

Corresponding NC: FS15–A/B, FS0–C, FS16–A/B, FS18–A,
FS21–TA
Power Mate MODEL D, Power Mate MODEL F

(b) When you use the FS20 or FS21–GA

Model	Order specification	Wiring board specification	P.C.B.specification	Remarks
SVM3–12/12/12	A06B–6080–H301	A16B–2202–0500	A20B–2001–0760	
SVM3–12/12/20	A06B–6080–H302	A16B–2202–0501		
SVM3–12/20/20	A06B–6080–H303	A16B–2202–0502		
SVM3–20/20/20	A06B–6080–H304	A16B–2202–0503		
SVM3–12/12/40	A06B–6080–H305	A16B–2202–0504		
SVM3–12/20/40	A06B–6080–H306	A16B–2202–0505		
SVM3–20/20/40	A06B–6080–H307	A16B–2202–0506		

Corresponding NC: FS20, FS21–GA

2.2.3 Spindle Amplifier Module

Your order specification will vary with the detector (function) you use for the spindle amplifier module.

(1) Type I (standard specification)

Model	Order specification	Unit specification	Wiring board specification	P.C.B.specification	ROM (type)
SPM–2.2	A06B–6078–H202#H500	A06B–6078–H202	A16B–2202–0470	A16B–2202–0430	A06B–6072–H500 (9D00)
SPM–5.5	A06B–6078–H206#H500	A06B–6078–H206	A16B–2202–0471	A16B–2202–0431	
SPM–11	A06B–6078–H211#H500	A06B–6078–H211			
SPM–15	A06B–6078–H215#H500	A06B–6078–H215	A16B–1005–0572	A16B–2202–0070	
SPM–22	A06B–6078–H222#H500	A06B–6078–H222	A16B–1005–0571		
SPM–26	A06B–6078–H226#H500	A06B–6078–H226	A16B–1005–0570		
SPM–30	A06B–6078–H230#H500	A06B–6078–H230	A16B–1005–0573		

Applicable detectors: 1 Pulse generator, position coder, and magnetic sensor
2 Sensor built in the motor

(2) Type II (Cs contour control/separate built–in sensor specification)

Model	Order specification	Unit specification	Wiring board specification	P.C.B.specification	ROM (type)
SPM–2.2	A06B–6078–H302#H500	A06B–6078–H302	A16B–2202–0470	A16B–2202–0433	A06B–6072–H500 (9D00)
SPM–5.5	A06B–6078–H306#H500	A06B–6078–H306	A16B–2202–0471	A16B–2202–0434	
SPM–11	A06B–6078–H311#H500	A06B–6078–H311			
SPM–15	A06B–6078–H315#H500	A06B–6078–H315	A16B–1005–0572	A16B–2202–0160	
SPM–22	A06B–6078–H322#H500	A06B–6078–H322	A16B–1005–0571		
SPM–26	A06B–6078–H326#H500	A06B–6078–H326	A16B–1005–0570		
SPM–30	A06B–6078–H330#H500	A06B–6078–H330	A16B–1005–0573		

Applicable detectors: 1 Pulse generator + built–in sensor (using position coder signals only)
2 High–resolution magnetic pulse coder (motor only)
3 High–resolution magnetic pulse coder (motor and spindle)
4 High–resolution position coder + high–resolution magnetic pulse coder (motor only)

(3) Type III (spindle switch/differential speed control specification)

Model	Order specification	Unit specification	Wiring board specification	P.C.B.specification	ROM (type)
SPM–11	A06B–6078–H411#H500	A06B–6078–H411	A20B–1005–0574	A16B–2202–0160	A06B–6072–H500 (9D00)
SPM–15	A06B–6078–H415#H500	A06B–6078–H415	A20B–1005–0572		
SPM–22	A06B–6078–H422#H500	A06B–6078–H422	A20B–1005–0571		
SPM–26	A06B–6078–H426#H500	A06B–6078–H426	A20B–1005–0570		
SPM–30	A06B–6078–H430#H500	A06B–6078–H430	A20B–1005–0573		

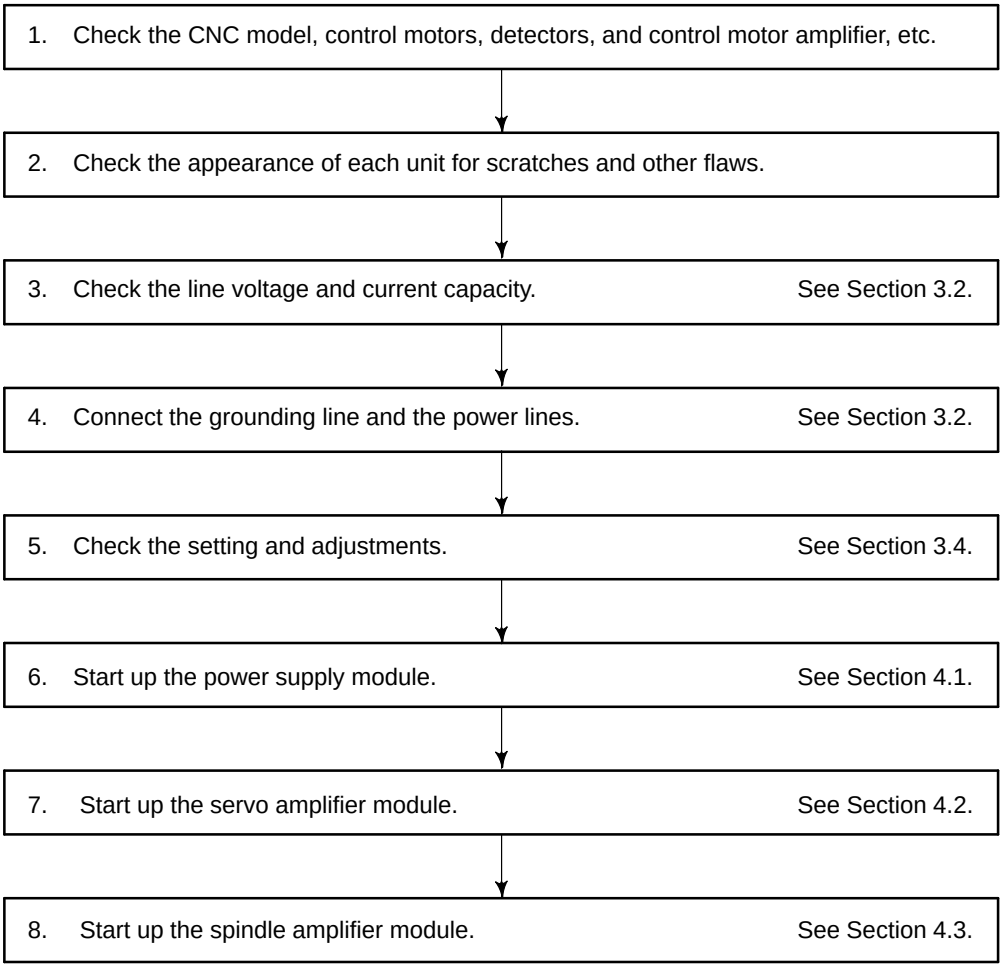
Applicable function: 1 Spindle switch control (switching only the speed or both the speed and position)
2 Spindle switch control (switching the built–in sensor)
3 Differential speed control (position coder signal input circuit)

3 START–UP PROCEDURE

3.1 SUMMARY OF THE START–UP PROCEDURE

First make sure that the specifications of the CNC, control motors, control motor amplifiers, and other units you received are exactly what you ordered. Then, connect the units and make sure that the connections are correct. Now start up the power supply module, servo amplifier module, and spindle amplifier module in the stated order.

Start–up procedure



3.2 CONNECTING THE POWER

3.2.1 Checking The Voltage And Capacity Of The Power

Measure the voltage of the AC power. Depending on the measurement, take action as follows:

Table 3.2.1 (1) Action for the AC power

AC power voltage	Nominal voltage	Action
170VA220V 210VA253V	200V 230V	These power lines can be connected directly to the system. Note) If the voltage is below the rated value, the rated output may not be obtained.
254V or more	380VA550V	This power line must be connected through an insulation transformer to step down the voltage to 200 V.

Table 3.2.1 (2) lists the input power specification for the power supply module. Use a power source with sufficient capacity so that the system will not malfunction due to a voltage drop even at a time of peak load.

Table 3.2.1 (2) Action for the AC Power

Model	PSM –5.5	PSM –11	PSM –15	PSM –26	PSM –30
Allowable input–voltage fluctuation	AC200/220/230V–15%, +10%				
Power source frequency	50/60Hz^1Hz				
Power source capacity (kVA)	9	17	22	37	44

3.2.2 Connecting A Protective Ground

Before connecting the power source, attach the protective ground line to the connection terminal PE of the power supply module.

3.2.3 Selecting The Ground Fault Interrupter That Matches The Leakage Current

Because the drive circuit of the servo amplifier module and spindle amplifier module uses an IGBT pulse width modulation control method, high–frequency current leaks to the ground through the stray capacitance in the motor windings, power line, and amplifiers. The leakage current may cause the ground fault interrupter or leakage–protection relay on the power source side to malfunction. Therefore, use a ground fault interrupter designed for operation with an inverter, which is protected against such malfunctions.

(1) Leakage current from the control motor

The limits of leakage current in motors and amplifiers have not yet been determined. The following tables show the leakage current limits for the S series motors and amplifiers'. Use them for reference.

(a) Servo motors

Motor model	Leakage current of commercially available power frequency component
α0.5 to α6	1.8mA
α12 to α22	2.0mA
α30 to α40	2.5mA

(b) Spindle motors

Motor model	Leakage current of commorcially available power frequency component
α1 tαo 22	2.0mA

(2) Example of selecting a ground fault interrupter

– Servo motor α12/3000 x 3, each with a 5–meter power cord
– Spindle motor α15, with a 10–meter power cord

With the conditions above:

▲▲▲ ×3 + ○○○ ×1 = □□□[mA]

Servo motor α12/2000 Spindle motor α15

From a manufacturer's brochure, select the ground fault interrupter designed for operation with an inverter that has a rated nooperation current greater than ¢¢¢mA.

3.3 SETTING THE PRINTED–CIRCUIT BOARD

Before supplying power, set the printed–circuit board as listed below.

3.3.1 Power Supply Module

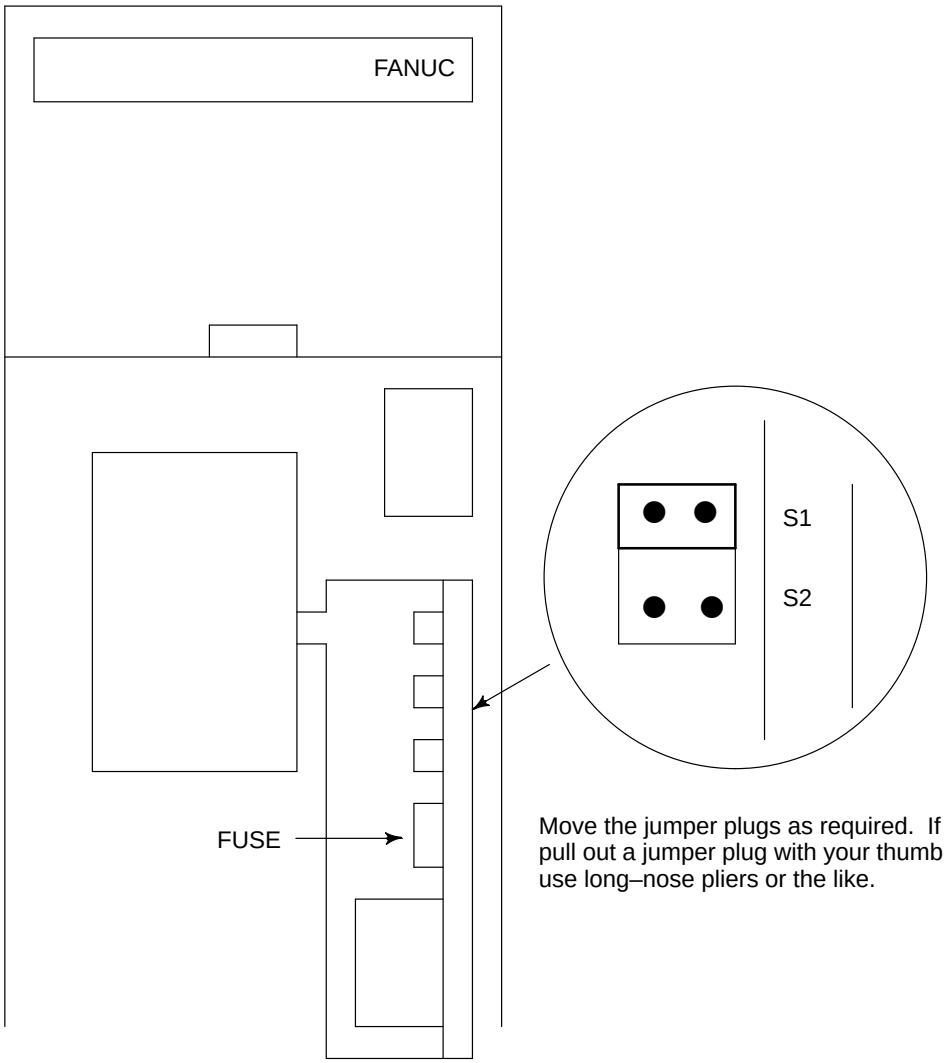
(1) Checking the DIP switch setting

Model	DIP switch	Position	Description
PSM–5.5 to –11	S1	SHORT	Do not change the setting of the DIP switches because they were already set at the factory.
	S2	OPEN	
PSM–15 to –30	RSW	3	

3.3.2 Servo Amplifier Module

(1) Checking the jumper plug setting (for 1–axis and 2–axis servo amplifier modules)

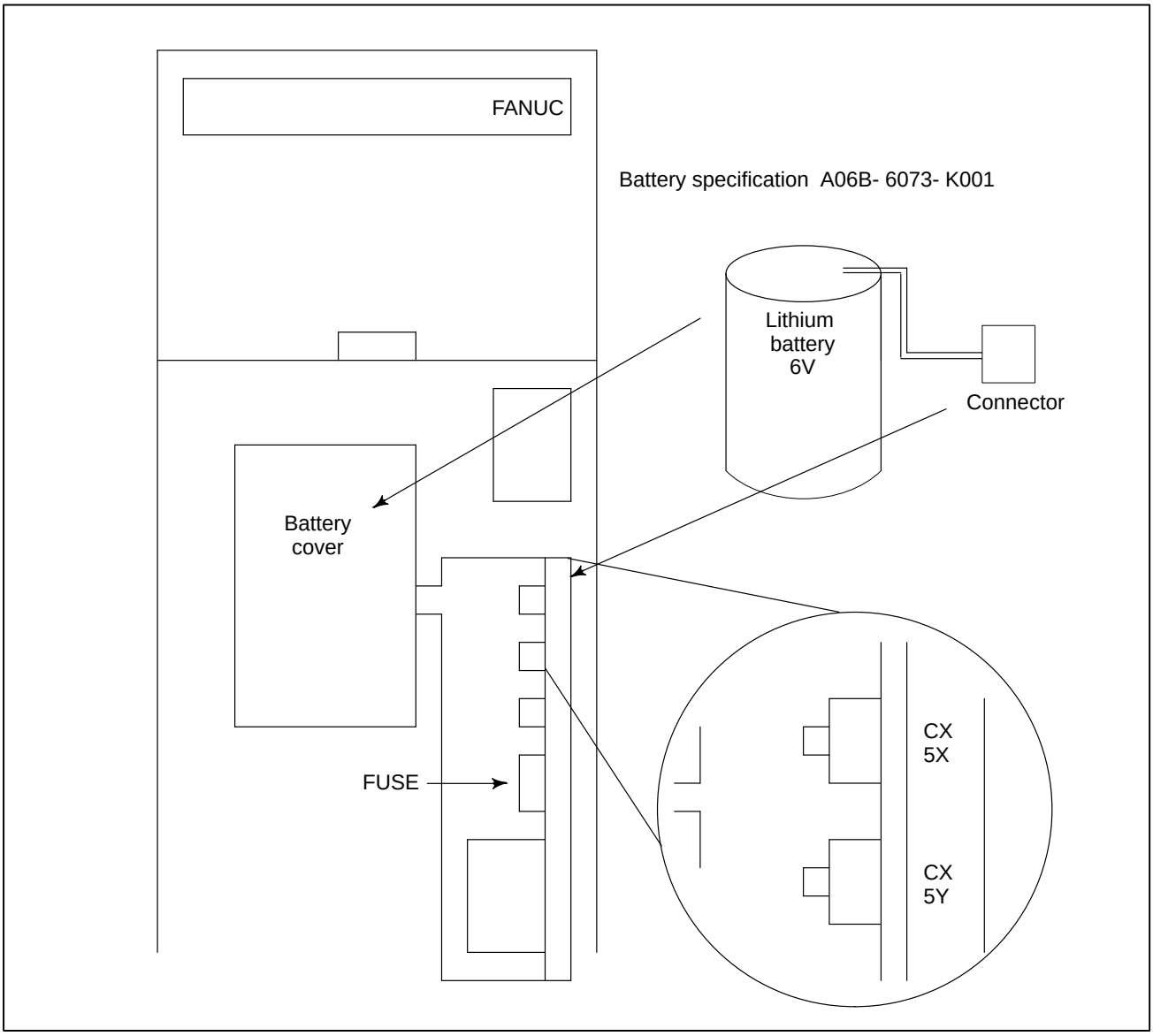
Set the servo amplifier module to either interface type A or B with the jumper plugs.



Jumper plug		Description
S1	S2	
SHORT	OPEN	With this setting, the servo amplifier module can operate with the NC (such as FS0, FS15, FS16, FS18, or PM–D) designed for operation with interface type A. In this case the JV*B connector is sued.
OPEN	SHORT	With this setting, the servo amplifier module can operate with the NC (such as FS20 or FS21–G) designed for operation with interface type B. In this case the JS*B and JF* connectors are used.

NOTE
There is no jumper plug or DIP switch on the three–axis servo amplifier module. The specification of the servo amplifier module determines the type (A or B) of the interface with which it can operate.

(2) Mounting the batteries for the ABS pulse coder
If your servo amplifier is the one that operates with interface type B, it can contain batteries (backup batteries) for the ABS pulse coder.



Remove the battery cover and put a battery in the holder, then put on the battery cover. Attach the battery connector to CX5X or CX5Y.

NOTE1
Connectors CX5X and XX5Y are connected internally. When the battery is connected for the first time, either connector may be used.

NOTE2
Be very careful when handling a lithium battery. If a lithium battery is short–circuited, it may overheat, blow out, or catch fire.

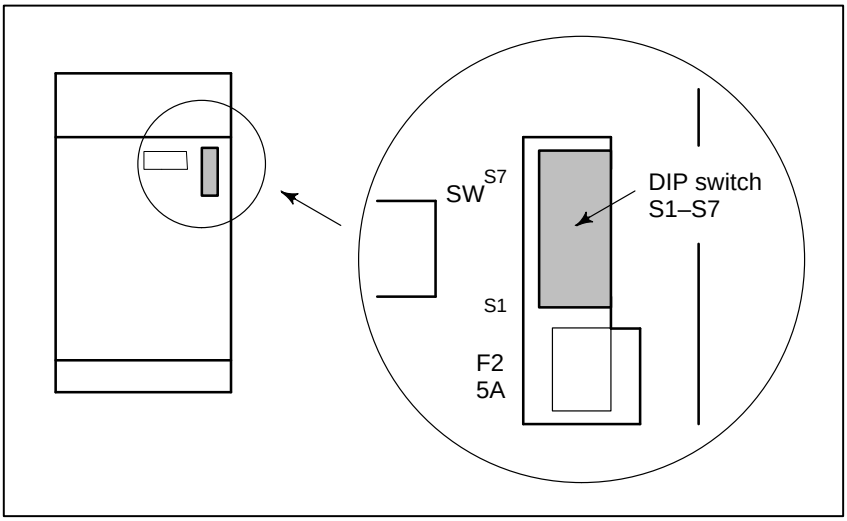
3.3.3 Spindle Amplifier Module

(1) (1) SPM–2.2 to –11 types I and II

These modules do not have a jumper plug or DIP switch.

(2) SPM–15 to –30 types I and II, and SPM–11 to –30 type III

Location of the DIP switch



DIP switch	Switch setting (factory–set to the underlined position)	Description	
S1	ON	If two SPMs are connected to one serial interface cable, S1 is set to ON in one SPM, and to OFF in the other.	
	OFF		
S2	ON	If an analog filter is used at the load meter output, S2 is set to ON. If not, it is set to OFF.	
	OFF		
S3	ON	If an analog filter is used at the speedometer output, S3 is set to ON. If not, it is set to OFF.	
	OFF		
S4 S5	S4: ON, S5: OFF	Reference switch of NPN type (pull up)	Reference switch (external reference signal receive function) setting for the main spindle
	S4: OFF, S5: ON	Reference switch of PNP type (pull down)	
	S4: OFF, S5: OFF	The external reference signal receive function.	
S6 S7	S6: ON, S7: OFF	Reference switch of NPN type (pull up)	Reference switch (external reference signal receive function) setting for the sub–spindle
	S6: OFF, S7: ON	Reference switch of PNP type (pull down)	
	S6: OFF, S7: OFF	The external reference signal receive function is not used.	

3.4 INITIALIZING SERVO PARAMETERS

3.4.1 Servo Amplifier Module

Before servo parameter initialization

Before starting servo parameter initialization, confirm the following:

1 NC model (Example: Series 15–B)
2 Servo motor model (Example: α6/2000)
3 Pulse coder built in a motor (Example: α pulse coder)
4 Whether a separate position detector is used or not (Example: Not used)
5 Distance the machine tool moves per revolution of the motor (Example: 10 mm per one revolution)
6 Machine detection unit (Example: 0.001 mm)
7 NC command unit (Example: 0.001 mm)

Servo parameter initialization procedure

1 Switch on the NC in an emergency stop state.
Enable parameter writing (PWE = 1).
2 Initialize servo parameters on the servo setting screen.
To display the servo setting screen, follow the procedure below, using the key on the NC.
– Series 15
Press the SERVICE key several times, and the servo setting screen will appear.
– Series 16, 18, 20, and 21
SYSTEM ⇒ [SYSTEM] ⇒ [▷] ⇒ [SV–PRM]
If no servo screen appears, set the following parameter as shown, and switch the NC off and on again.

	b7	b6	b5	b4	b3	b2	b1	b0
3111								SVS

SVS (b0)=1 (to display the servo screen)

– Series 0–C
Press the PARAM key several times, and the servo setting screen will appear.
If no servo screen appears, set the following parameter as shown, and switch the NC off and on again.

	b7	b6	b5	b4	b3	b2	b1	b0
389								SVS

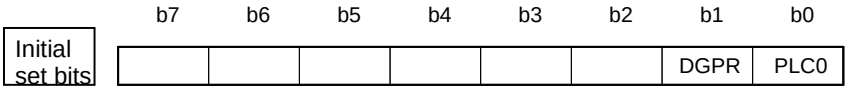
SVS (b0)=0 (to display the servo screen)

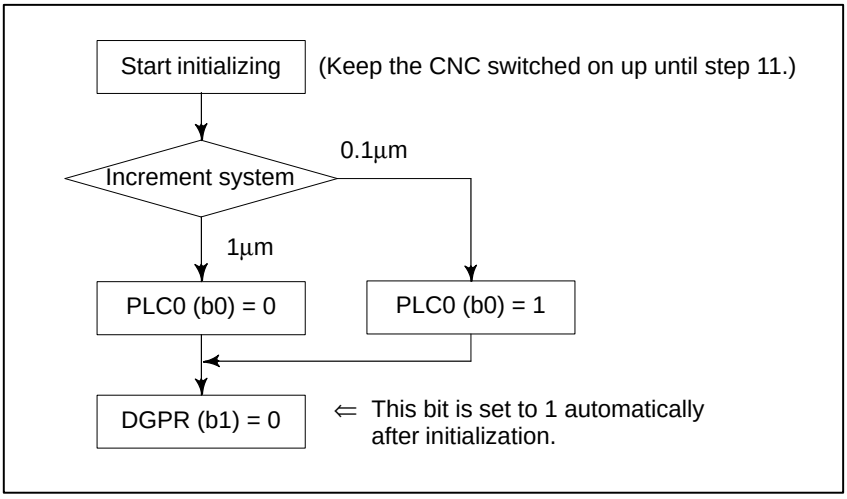
When the following menu appears on the screen, move the cursor to the item you want to set and enter data directly.

```
Servo set                                01000 N0000

                                 X axis     Z axis
INITIAL SET BITS                 00001010   00001011
Motor ID No.                           16         16
AMR                              00000000   00000000
CMR                                     2          2
Feed gear                  N            1          1
      (N/M)                M          100          1
Direction Set                        111       -111
Velocity Pulse No.                  8192        819
Position Palse No.                 12500       1250
Ref. counter                       10000      10000

Value SETTING =
```

Servo setting menu

3 Start initializing





4 Specify the motor ID No.

Select the motor ID No. according to the model and specification (four digits in the middle segment of A06B–XXXX–BXXX) of your motor.

Motor model	αC12HV	αC22HV	αC30HV	αC3/2000	αC6/2000	αC12/2000	αC22/1500
Motor specification	0176	0177	0178	0142	0123	0127	0128
Motor type No.	3	4	5	7	8	9	10

α0.5	α3/3000	α6/2000	α6/3000	α12/2000	α12/3000	α22/2000	α22/3000
0142	0123	0127	0128	0142	0143	0147	0148
13	15	16	17	18	19	20	21

α30/2000	α30/3000	αM3/3000	αM6/3000	αM9/3000
0152	0153	0161	0162	0163
22	23	24	25	26

α22/1500	α30/1200	α40/2000 with FAN	α40/2000 without FAN	E6/2000	E1/3000	E2/3000
0146	0151	0158	0157	0106	0101	0102
27	28	29	30	34	35	36

α2/2000	αL3/2000	αL6/3000	αL9/3000	αL25/3000	αL50/2000	α1/3000	α2/3000
0372	0561	0562	0564	0571	0572	0371	0373
46	56	57	58	59	60	61	62

5 Set AMR as described below. The setting does not depend on the model of the motor.

α pulse coder	00000000

6 Set CMR with the scale of a distance the NC instructs the machine to move.
CMR = Command unit/Detection unit

CMR 1/2 to 48	Setting value = CMR _ 2

Usually, CMR=1, so specity 2.

7 Specify the flexible feed gear (F.FG). This function makes it easy to specify a detection unit for the leads and gear reduction ratios of various ball screws by changing the number of position feedback pulses from the pulse coder and separate detector.

Setting for the α pulse coder and serial pulse coder A in the semi–closed mode

$$\frac{\text{F.FG numerator } (\leqq 32767)}{\text{F.FG denominator } (\leqq 32767)} \overset{\text{(Note1)}}{=} \frac{\text{Number of position pulses necessary for each revolution of the motor}}{1000000} \quad \text{(as irreducible fraction)}$$

NOTE1
For both F.FG numerator and denominator, the maximum setting value (after reduced) is 32767.

(Example of setting) For detection in 1 μm units, specify as follows:

Ball screw lead	Number of necessary position pulses	F&FG
10 (mm/rev)	10000 (pulses/rev)	1/100
20	20000	2/100 or 1/50
30	30000	3/100

(Example of setting)

If the machine is set to detection in 1,000 degree units with a gear reduction ratio of 100:1 for the rotation axis, the table rotates by 360/100 degrees each time the motor makes one turn. 1000 position pulses are necessary for the table to rotate through one degree. The number of position pulses necessary for the motor to make one turn is:
360/100 _ 1000 = 3600

$$\frac{\text{F.FG numerator}}{\text{F.FG denominator}} = \frac{3600}{1000000} = \frac{36}{10000}$$

Setting for use of a separate detector (full–closed)

$$\frac{\text{F.FG numerator } (\leqq 32767)}{\text{F.FG denominator } (\leqq 32767)} = \frac{\text{Number of position pulses necessary for the motor to make one turn}}{\text{Number of position pulses from the separate detector when the motor makes one turn}}$$ (as irreducible fraction)

NOTE2
DMR can also be used with the separate position detector, provided that F.FG = 0.

Example of setting) When the separate detector detects 1 μm for 10000 (pulses/rev)

Ball screw lead	Number of necessary position pulses	F&FG	DMR
1 (mm/rev)	1000 (pulses/rev)	1/10	–
5	5000	1/2	2
10	10000	1/1	4

8 Specify the direction in which the motor rotates.

111	Clockwise as viewed from the pulse coder
-111	Counterclockwise as viewed from the pulse coder

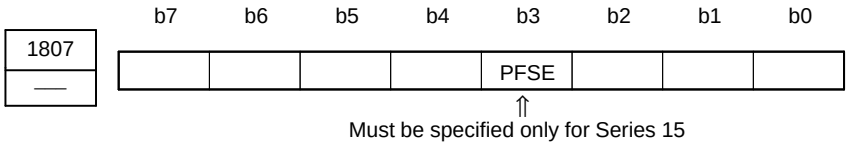
9 Specify the number of velocity pulses and the number of position pulses.

	Semi–closed		Full–closed	
Command unit (μm)	1	0.1	1	0.1
Initialization bit	b0=0	b0=1	b0=0	b0=1
Number of velocity pulses	8192	819	8192	819
Number of position pulses	12500	1250	Np	Np/10

Np: Number of position pulses from the separate detector when the motor makes one turn

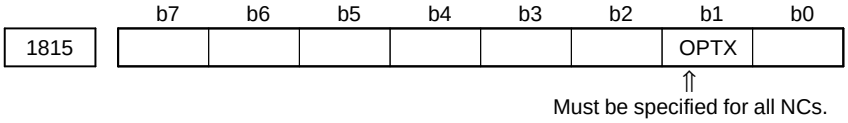
When using a separate detector (full–closed mode), also specify the following parameters:

– Series 15, 16, 18, 20, 21



PFSE(b3) The separate position detector is:
0: Not used
1: Used

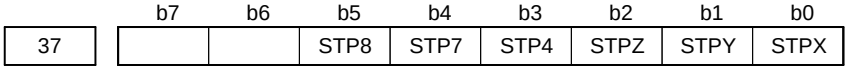
NOTE
This parameter is used only for Series 15.



OPTX(b1) The separate position detector is:
0: Not used
1: Used

NOTE
For Series 16, 18, 20, and 21, setting this parameter causes bit 3 of parameter No. 2002 to be set to 1 automatically.

– Series 0–C



STPX to 8 The separate position detector is:
0: Not used for the X–axis, Y–axis, Z–axis, fourth axis, seventh axis, or eighth axis
1: Used for the X–axis, Y–axis, Z–axis, fourth axis, seventh axis, and eighth axis

10 Specify the reference counter. The reference counter is used in making a return to the reference position by a grid method. The value to be specified is the number of pulses necessary for the motor to make one turn, or a value obtained by dividing the number by an integer.
(Example of setting)
αpulse coder, semi–closed (detection in 1 μm units)

Ball screw lead	Number of necessary position pulses	Reference counter	Grid width
10mm/rev	10000pulses/rev	10000	10mm
20	20000	20000	20
30	30000	30000	30

11 Switch the NC off and on again.
This completes servo parameter initialization.
If a servo alarm related to pulse coders occurs for an axis for which a servo motor or amplifier is not connected, specify the following parameter.

	b7	b6	b5	b4	b3	b2	b1	b0
1953								
2009 8X09								SERD

SERD(b0) The serial feedback dummy function is:
0:Not used
1:Used

12 When you are going to use an α pulse coder as an absolute pulse coder, use the following procedure.
The procedure for setting absolute position communication using the α pulse coder is somewhat different from the procedure using serial pulse coder A.
1. Set the following parameter, and switch the CNC off.
– Series 15, 16, 18, 20, 21

	b7	b6	b5	b4	b3	b2	b1	b0
1815			APCX					

Bit 5 (APCX)
0:Does not perform as absolute position pulsecoder.
1:Performs absolute position as communication pulsecoder.

– Series 0–C

	b7	b6	b5	b4	b3	b2	b1	b0
21			APC8	APC7	APC4	APCZ	APCY	APCX

STPX to 8
0:Does not perform absolute position communication for the X–, Y–, Z–, 4–, 7–, or 8–axis.

1:Performs absolute position communication for the X–, Y–, Z–, 4–, 7–, or 8–axis.

2. After making sure that the battery for the pulse coder is connected, switch the NC on.

3. Absolute position communication is performed, and a request to return to the reference position is displayed.
4. More motor more than one revolution by JOG Feed.
5. Turm off and on the CNC.

⇐ These step were adde

6. Absolute position communication is performed, and a request to return to the reference position is displayed.
7. Return to the reference position.

3.4.2 Spindle Amplifier Module

(1) Automatic spindle parameter initialization

Start automatic spindle parameter initialization using the following procedure.

The automatic initialization sets the initial values for both the parameters common to all models and those for an individual model.

1 Specify the model code number for motor parameters to be set automatically.

For model codes, refer to the respective parameter manual.

For motors with no model code, use the method (a) or (b) below.

(a) Specify the model code for the parameter values similar to those for your motor model. After automatic initialization, adjust the parameters by entering appropriate values manually so that they fit your motor.

(b) If there is no parameter value similar to those for your motor model, specify the model code for your motor as 0 (for a motor with output control switching, as 64). After automatic initialization, adjust the parameters by entering appropriate values manually so that they fit your motor.

Parameter No.					Value
FS0C		FS15		FS16/18/20/21 PM–D/F	
No. 1	No. 2	No. 1	No. 2		
6633	6773	3133	3273	4133	Model code

2 Specify so that automatic spindle parameter initialization is performed.

Parameter No.					Value
FS0C		FS15		FS16/18/20/21 PM–D/F	
No. 1	No. 2	No. 1	No. 2		
6519#7	6659#7	–	–	4019#7	1
–	–	5607#0	5607#1	–	0

NOTE
These bits are reset to the original setting after automatic parameter initialization.

3 When you switch the CNC off and on again, the spindle parameter values assigned to the specified model code are set for your motor model automatically.
4 If no model code is available, enter the parameter values for your motor model according to the list of parameters for individual models.

(2) Spindle speed command parameters
Set the spindle speed command parameters listed below. For details, refer to the relevant CNC manual.

Parameter No.				Description
FS0–TC	FS0–MC	FS15	FS16/18/20/21 PM–D/F	
0013 #7, 6		–	3706 #7, 6	Polarity of the spindle speed command (valid when SSIN = 0 for DI signal)
–	0543 (Note1)	5618	3735	Lowest clamp speed for the spindle motor
–	0542 (Note1)	5619	3736	Highest clamp speed for the spindle motor
6520		3020	4020	Highest spindle motor speed
0539	0577	5613	–	Spindle speed command off-set (always to be set as 0)
0516		5614	–	Spindle speed command gain (always to be set as 1000)
0540 A 0543	0541 0539 0555 (Note2)	5621 A 5628	3741 A 3744	Highest spindle speed corresponding to each gear

NOTE1
Valid only for M series. However, invalid if the constant surface speed control option is used.)
NOTE2
or M series using the constant surface speed control option, the same parameter Nos. (parameter Nos. 0540 to 0543) as for T series are used.

(3) Parameters for the detectors

The list below contains the parameters for the detectors. The parameters to be set vary with the detectors you use. Refer to the parameter manual for details.

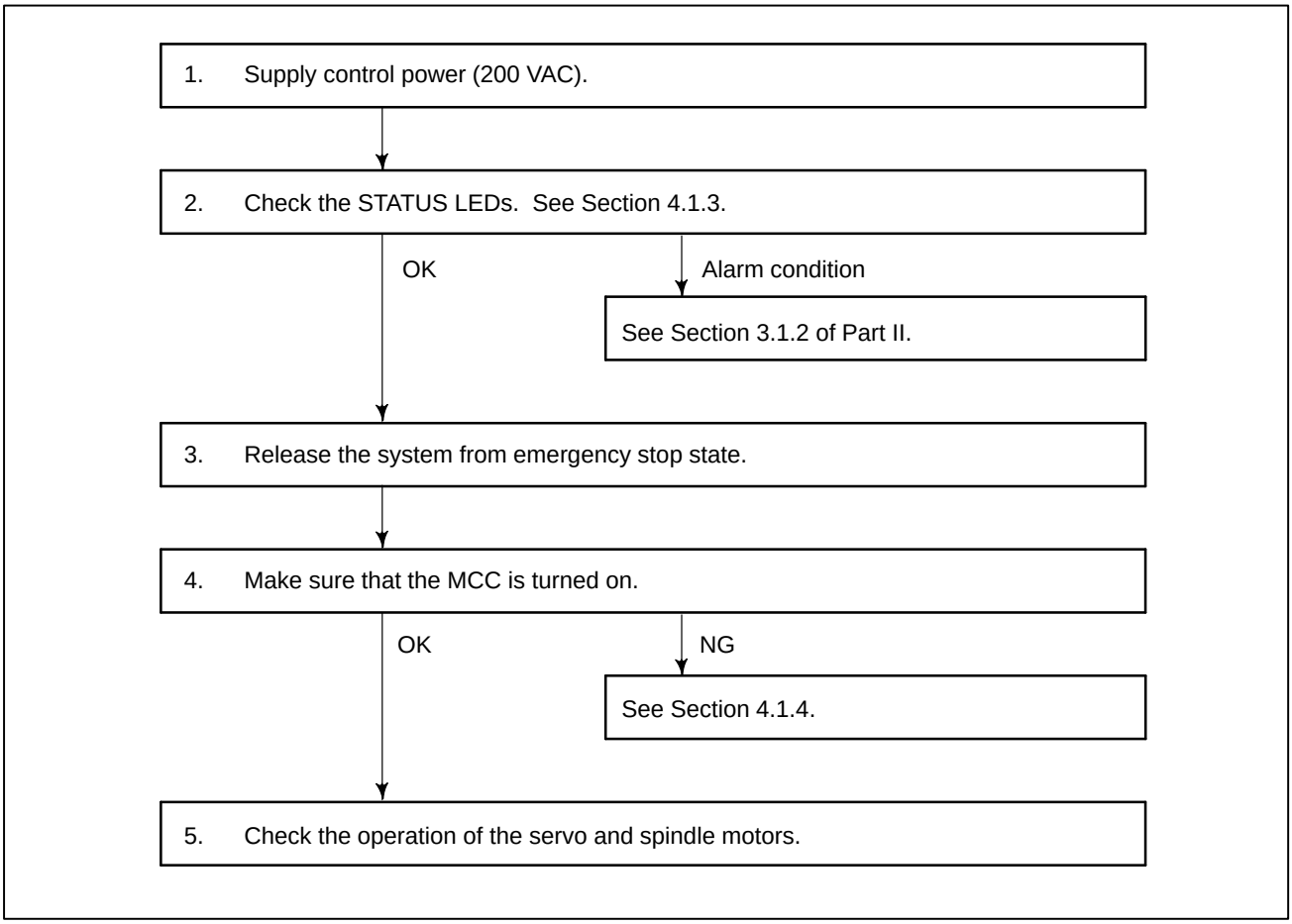
Parameter No.				Description
FS0 –TC	FS0 –MC	FS15	FS16/18/ 20/21 PM–D/F	
6500 #0		3000 #0	4000 #0	Directions in which the spindle and motor rotate 0: Same directions 1: Different directions
6511 #2, 1, 0		3011 #2, 1, 0	4011 #2, 1, 0	Motor speed detector 0, 0, 0: 64λ/rev 0, 0, 1: 128λ/rev 0, 1, 0: 256λ/rev 0, 1, 1: 512λ/rev 1, 0, 0: 192λ/rev 1, 0, 1: 384λ/rev
6503 #1		3003 #1	4003 #1	Sensor built in the motor 0: Not to be used 1: To be used
6504 #4		3004 #4	4004 #4	Type of sensor built in the motor 0: Standard 1: For α0.5
6504 #1		3004 #1	4004 #1	Built–in sensor on the spindle 0: Not to be used 1: To be used
6501 #2		3001 #2	4001 #2	Position coder signal 0: No to be used 1: To be used
6500 #2		3000 #2	4000 #2	Direction in which the position coder rotates 0: Same as the direction in which the spindle rotates 1: Reverse to the direction in which the spindle rotates
6503 #7, 6, 4		3003 #7, 6, 4	4003 #7, 6, 4	Position coder signal 0, 0, 0: Position coder Built–in sensor 256λ/r Cs sensor ϕ/65 High–resolution position coder 0, 0, 1: Built–in sensor 128λ/r 0, 1, 0: Built–in sensor 512λ/r Cs sensor o/130 0, 1, 1: Built–in sensor 64λ/r 1, 0, 0: Cs sensor o/195 1, 1, 0: Built–in sensor 384λ/r Cs sensor ϕ/97.5
6501 #5		3001 #5	4001 #5	Detector for Cs contour control 0: Not to be used 1: To be used
6501 #6		3001 #6	4001 #6	Detector with Cs contour control for built–in motor 0: Motor not built in the spindle 1: Built–in motor

6504 #0	3004 #0	4004 #0	High–resolution position coder 0: No to be used 1: To be used
6501 #7	3001 #7	4001 #7	Direction in which the detector for Cs contour control rotates 0: Same as the direction in which the spindle rotates 1: Reverse to the direction in which the spindle rotates
6556 to 6559	3056 to 3059	4056 to 4059	Spindle–motor gear ratio (This data is selected with the spindle control DI signals CTH1A and CTH2A.)

4 CONFIRMATION OF THE OPERATION

4.1 POWER SUPPLY MODULE

Check each item according to the procedure described below.



4.1.1 Check Terminal On The Printed–circuit Board

Location of the check terminal

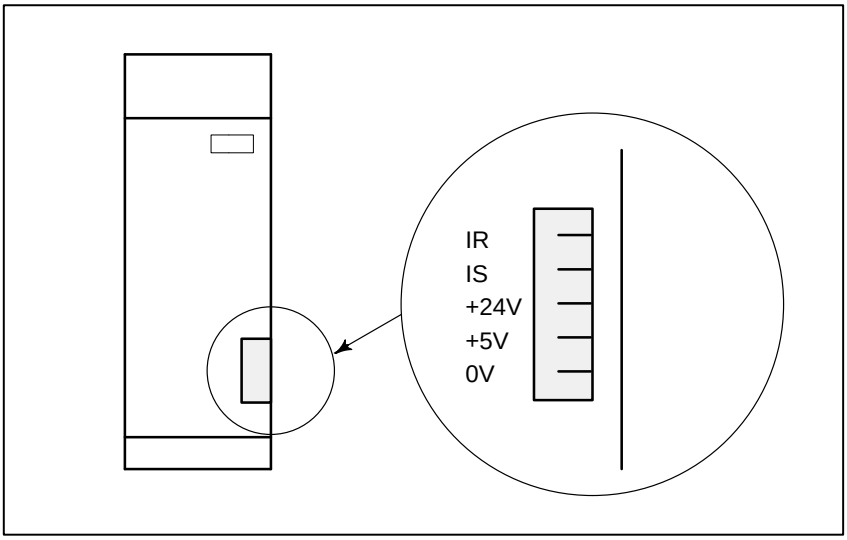


Table 4.1.1 Check Terminal

Check terminal	Description	
IR	Phase L1 (phase R) current	The current is positive when it is input to the amplifier. Model / Amount of current / Overcurrent alarm PSM–5.5 / 25A/1V / Depending on IPM alarm output PSM–11 / 37.5A/1V / Depending on IPM alarm output PSM–15 / 50A/1V / 300A (6V) PSM–26 / 75A/1V / 450A (6V) PSM–30 / 100A/1V / 600A (6V) If phase L1 and L2 currents exceed the overcurrent alarm level, PSM enters an alarm state. ● MCC trips, and IGBT switching stops. ● Alarm output (latch, alarm code 01)
IS	Phase L2 (phase S) current	
+24V +5V 0V	Control power	

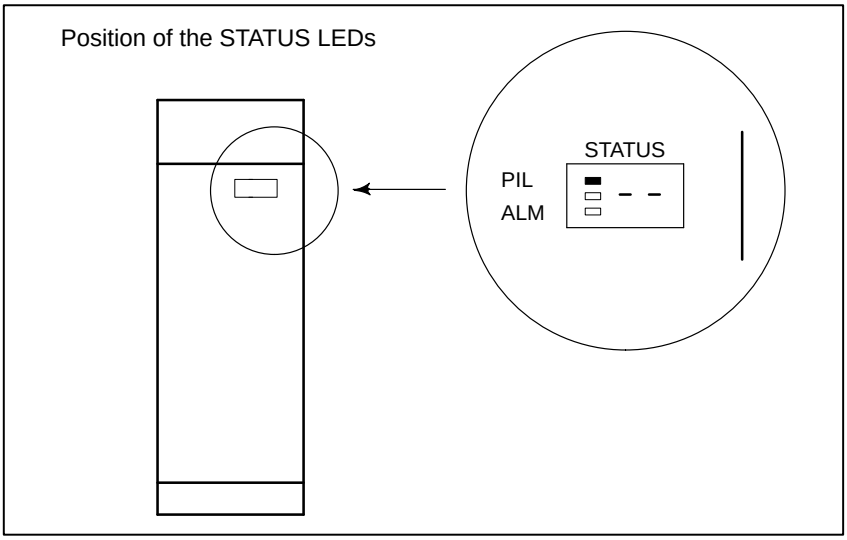
4.1.2 Checking The Power Supply Voltages

Table 4.1.2 Checking the Power Supply Voltages

Measurement item	Check method
AC power line voltage	Check on L1, L2, and L3 at terminal board TB2. See Section 3.2.1.
Control power voltage	Check on the check terminals.

Check terminal	Rating
+24V - 0V	24V ± 5%
+5V - 0V	5V ± 5%

4.1.3 Checking The Status Leds



No.	STATUS LEDs On a Off a The LED that is on is indicated in black.	Description
1.	PIL ALM	The PIL LED (power ON indicator) is off. Control power has not been supplied. The control power circuit is defective. See Section 4.1.2.
2.	PIL ALM	PSM not ready The main circuit is not supplied with power (MCC OFF). Emergency stop state
3.	PIL ALM	PSM ready The main circuit is supplied with power (MCC ON). The PSM is operable.
4.	PIL ALM Alarm code 01 or above is indicated.	Alarm state The PSM is not operable. See Section 3.1 of Part II.

4.1.4 The PIL LED (power ON indicator) Is Off.

Table 4.1.4 Check Method and Action

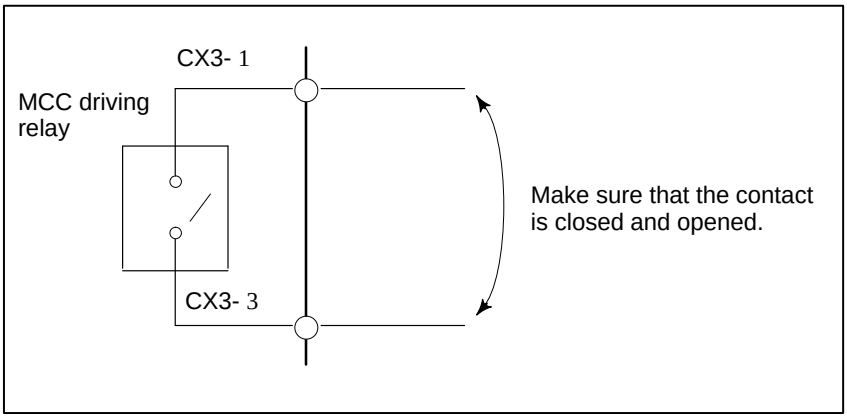
No.	Cause of trouble	Check method	Action
1.	No AC power is applied.	Check R and S of connector CX1.	Ensure a secure connection.
2.	The power supply circuit is defective.	The PIL LED (power ON indicator) operates on the +5V power supply. Check the control power supply voltage according to Section 4.1.2.	Check the printed–circuit board.

4.1.5 Checking For What Keeps The Mcc From Being Switched On

(1) The emergency stop state has not been released.
⇒ Ensure a secure connection.

(2) A terminating connector has not been attached.
⇒ Check whether connector K9 for the SVM or SPM has been attached at the end of the connection chain.

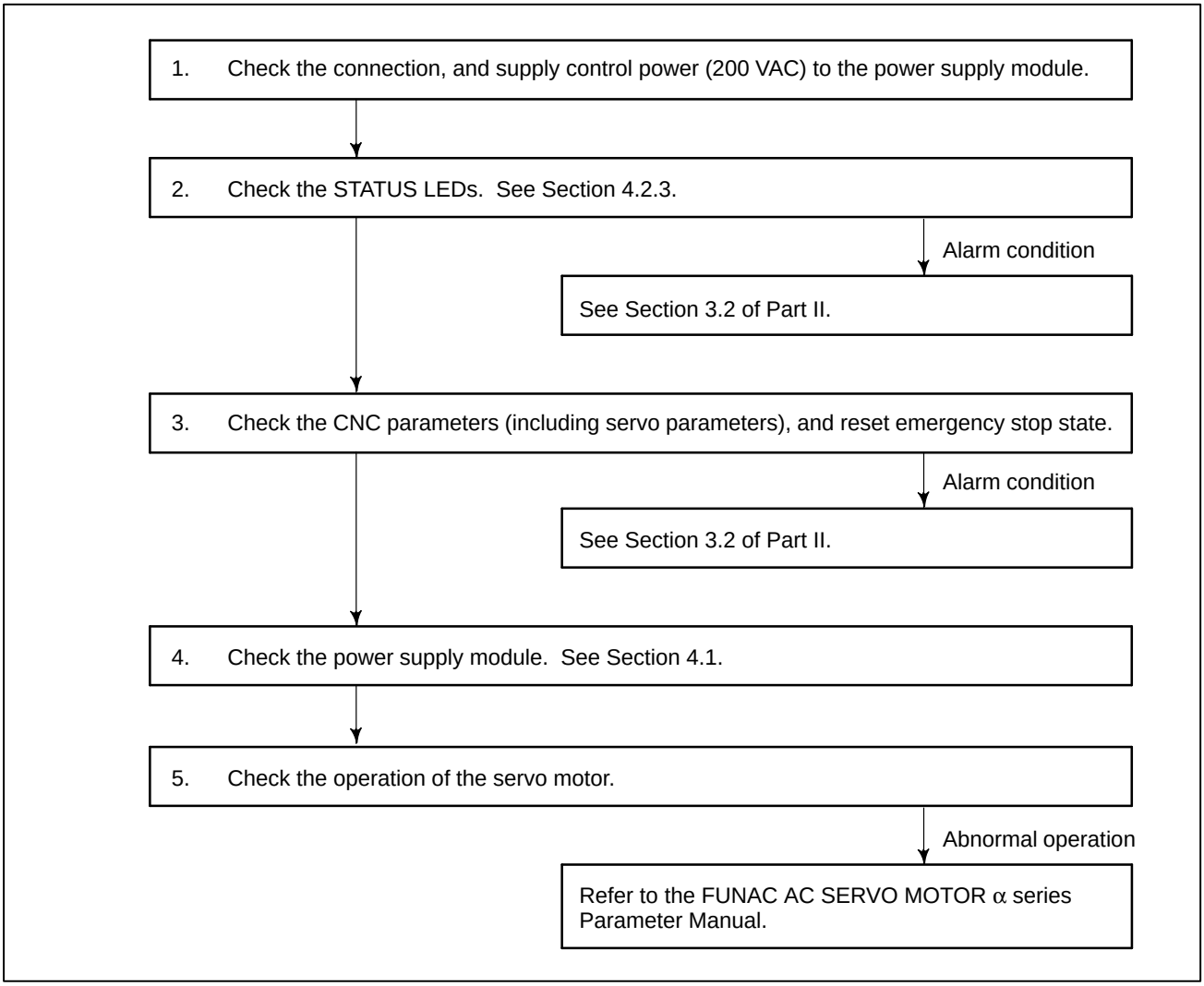
(3) The MCC driving relay is defective.
⇒ Check that a circuit between pins 1 and 3 of connector CX4 are closed and opened.



(4) The MCC driving power has not been supplied or connected.
⇒ Ensure a secure connection.

4.2 SERVO AMPLIFIER MODULE

Check each item according to the procedure described below.



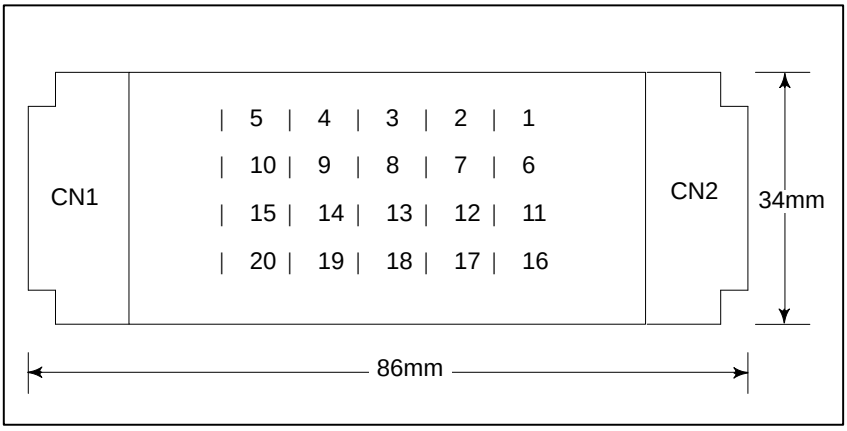
4.2.1 Check Pin Board

Overview

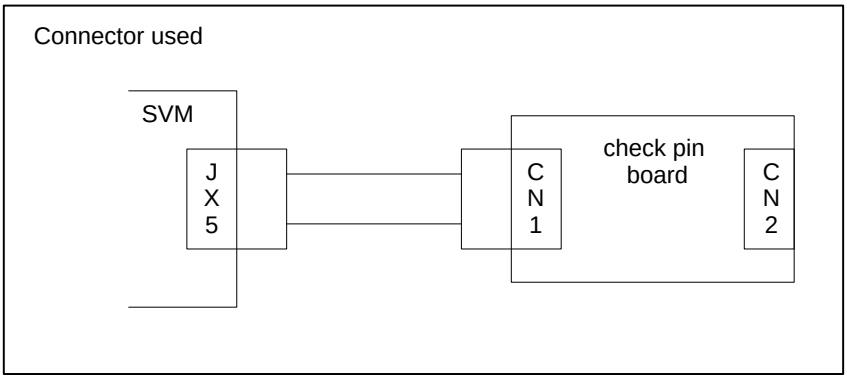
Unlike conventional servo amplifiers, the servo amplifier module does not have check pins. When you are going to observe the signals inside the amplifier with an oscilloscope, attach the pin board listed below to the connector.

Order No.	Description of the order
A03B–6071–K290	Printed–circuit board A20B–1005–0340 Cable (20 m) A660–2042–T031#L200R0

Pin arrangement on the pin board



Connection to the servo amplifier module



Pin No.	Signal name	Description
1		
2	0V	Reference voltage
3	IRL (NOTE3)	L–axis phase R motor current signal
4	ISL (NOTE3)	L–axis phase S motor current signal
5	IRM (NOTE1) (NOTE3)	M–axis phase R motor current signal
6	ISM (NOTE1) (NOTE3)	M–axis phase S motor current signal
7	IRN (NOTE1) (NOTE3)	N–axis phase R motor current signal
8	ISN (NOTE1) (NOTE3)	N–axis phase S motor current signal
9	0V	Reference voltage
10	0V	Reference voltage
11	+24V	+24 V power (with tolerance of +5%)
12	+15V	+15 V power (with tolerance of +5%)
13	–15V	+15 V power (with tolerance of +5%)
14	+5V	+5 V power (with tolerance of +5%)
15	ITL	L–axis phase T motor current signal(NOTE2)
16	0V	Reference voltage
17	ITM	M–axis phase T motor current signa l(NOTE2)
18	0V	Reference voltage
19	ITN	N–axis phase T motor current signal(NOTE2)
20	0V	Reference voltage

NOTE1
If there is no axis corresponding to the SVM, no relevant signal is output.

NOTE2
This signal is not output by A06B–6079–H3**.

NOTE3
The output voltage reflects directly the actual current in the motor. To observe the output voltage, use an oscilloscope. The voltmeter position of a volt–ohm–milliammeter or other voltmeters cannot be used.

Current–to–voltage conversion table

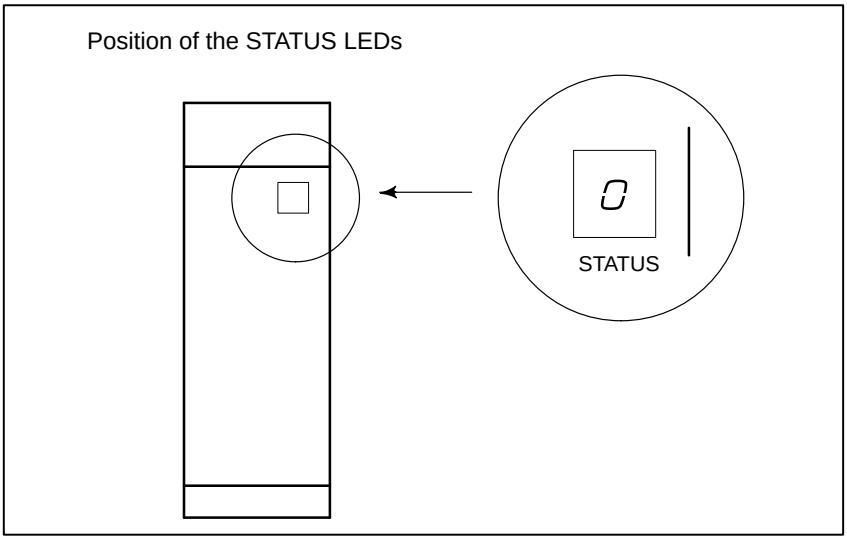
Servo amplifier module	Typical applicable motor	Conversion result
SVM1–12 SVM2–12/12 L, M axis SVM2–12/20 L axis SVM2–12/40 L axis SVM3–12/12/12 L, M, N axis SVM3–12/12/20 L, M axis SVM3–12/12/40 L, M axis SVM3–12/20/20 L axis SVM3–12/20/40 L axis	α0.5/3000 α1/3000 α2/2000 α2/3000	3 A/V
SVM1–20 SVM2–12/20 M axis SVM2–20/20 L, M xis SVM2–20/40 L axis SVM3–12/12/20 N axis SVM3–12/20/20 M, N axis SVM3–20/20/20 L, M, N axis SVM3–12/20/40 M axis SVM3–20/20/40 L, M axis	αC3/2000 αC6/2000 αC12/2000	5 A/V
SVM1–40S SVM2–40L SVM2–12/40 M axis SVM2–20/40 M axis SVM3–40/40 L, M axis SVM3–40/80 L axis SVM3–12/12/40 N axis SVM3–12/20/40 N axis SVM3–20/20/40 N axis	α3/3000 α6/2000 α12/2000 α22/1500 αC22/1500 αM3/3000 αL3/3000	10 A/V
SVM1–80 SVM2–40/80 SVM280/80	α6/3000 α12/3000 α22/2000 α30/1200 αM6/3000 αM9/3000 αL6/3000 αL9/3000	20 A/V
SVM1–130	α22/3000 α30/2000 α30/3000 α40/3000 αL25/3000 αL150/2000	32.5 A/V

4.2.2 Checking The Control Power Supply Voltage

Table 4.2.2 Checking the Control Power Supply Voltage

Measurement item	Check method		
Control power supply voltage	Check on the check pins on the check board.	Check pin	Rating
		24V – 0V	24V±5%
		15V – 0V	15%±5%
		5V – 0V	5V±5%
		–15V – 0V	–15V±5%

4.2.3 Checking The STATUS Display



No.	STATUS display	Description
1.		The STATUS display is not on. The control power supply has not been switched on. The power supply circuit is defective. Check the voltages with the data listed in Section 4.2.2.
2.	-	The control power supply is waiting for a ready signal (*MCON).
3.	0	The servo circuit is ready to operate. The motor is supplied with power.
4.	1 Alarm code from 01 to E is indicated.	Alarm state See Section 3.2 of Part II.

4.2.4 The STATUS Display Does Not Light.

When the PSM is supplied with control power, if the SVM STATUS display does not light, check the items listed below.

Table 4.2.4 Check Method and Action

No.	Cause of trouble	Check method	Action
1.	No control power is applied.	Check 24 V and 0 V on connector CX2.	Ensure a secure connection.
2.	The power supply circuit is defective.	The STATUS display operates on the +5V power supply. Check the control power supply voltage according to Section 4.2.2.	Check the printed–circuit board.

4.2.5 Servo Check Board

(1) General

The servo check board receives the digital value used for control inside the digital servo as numerical data and converts it to an analog form.

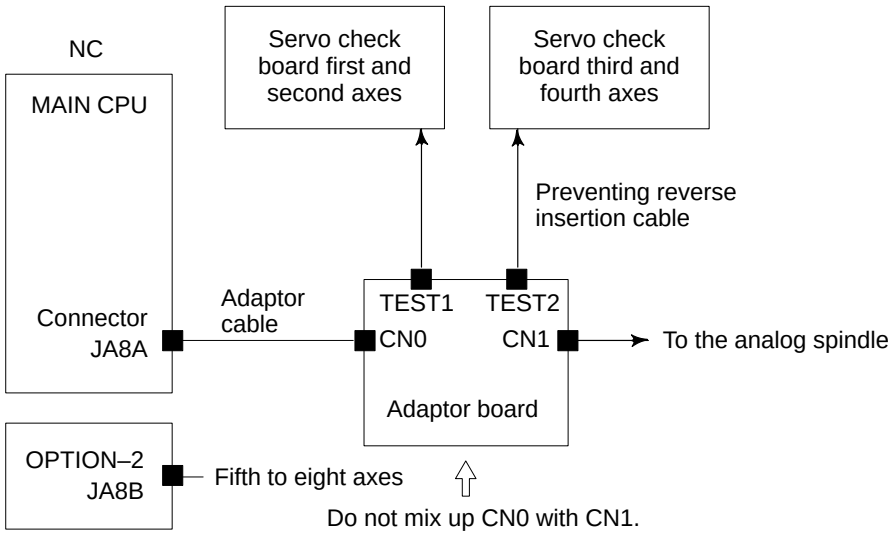
(2) Servo check board specifications

Specification	Name
A06B–6057–H602	Servo check board (with a cable having a provision to prevent incorrect insertion)
A02B–0120–C211	Servo adaptor board (not required for Series 0–C or 15–A)

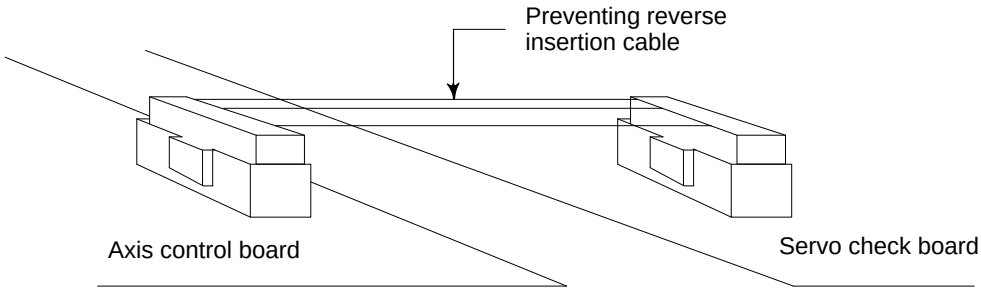
(3) Connecting the servo check board

When connecting the check board, always keep the NC switched off. If you do not obtain a correct waveform, install strapping on the 5 MHz side of clock pin S1 on the check board.

&Series 15–B, 16, 18, 20, 21, Power Mate MODEL D, Power Mate MODEL F



&Series 0–C, 15–A



(4) Location of signal output

Check pin	TSAL	TSAM	CH1	CH2	CH3	CH4	CH5	CH6
Signal	⇊	⇊	L axis VCMD	L axis TCMD	M axis VCMD	M axis TCMD	L axis TSA	M axis TSA

(Check terminal TSAL or TSAM is not used.)

(5) VCMD signal

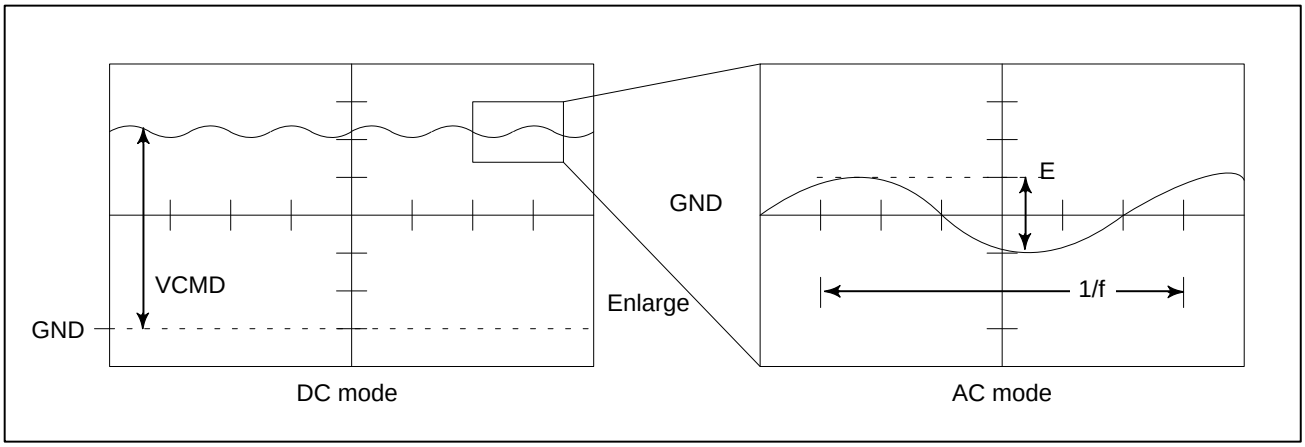
The VCMD signal is used to output a speed command. It can also be used to measure a very small vibration or uneven movement of the motor. The VCMD signal conversion mode can be switched by a parameter. Because the VCMD signal is clamped at +5 V, the waveform may become difficult to observe. In such a case, switch for easier observation.

1956	
2012	8X12

b7	b6	b5	b4	b3	b2	b1	b0
		VCM2	VCM1				

VCM2	VCM1	Specified speed / 5V
0	0	0.9155 rpm
0	1	14 rpm
1	0	234 rpm
1	1	3750 rpm

To check small vibrations, monitor the entire vibration on the DC mode of the ascilloscope then enlarge monitor the desired range on the AC mode.



When the signal conversion result for the VCMD waveform is W (rpm/5 V), the voltage per positional shift pulse is:

$$\text{Voltage (V) per positional deviation pulse} = \frac{300 \times \text{Position gain } (S^{-1})}{\text{Number of positional feedback pulses/motor revolution} \times W}$$

(Example)

Assume the conditions: Position gain = 30 (S^{-1}), the number of positional feedback pulses/motor revolution = 1000 pulses, and signal conversion result for the VCMD waveform = 14 rpm/5 V with 1 μm/pulse)

Under these conditions, if you observe E = 300 mV and 1/f = 20 ms:
Voltage per positional deviation pulse = 64 mv/pulse
Therefore, table vibration = 300 _ 1/64 = 4.6 μm, with a vibration period of 50 Hz

(6) TCMD signal

The TCMD signal outputs a motor torque command. It may be different from the actual current (IR, IS) of the motor rotating at high speed, because the motor produces a back electromotive force.

Maximum current	Signal output for maximum current	Ap/V	Applicable servo moter
12Ap	4.44V	2.7	α0.5, α1/3000 α2/2000, α2/3000
20Ap	4.44V	4.5	αC3/2000, αC6/2000, αC12/2000
40Ap	4.44V	9	α12HV, α22HV, α30HV αC22/1500, αC30/1200 αM3/3000 α3/3000, α6/2000 α12/2000, α22/1500 αL3/3000
80Ap	4.44V	18	αM6/3000, αM9/3000 α6/3000, α12/3000 α22/2000, α30/1200 αL6/3000, αL9/3000
130Ap	4.44V	29	α22/3000, α30/2000, α30/3000 α40/2000 αL25/3000, αL50/2000

Root mean square value (RMS) = TCMD signal output (Ap) _ 0.71

(7) TSA signal

The TSA signal outputs a motor speed.

Signal Conversion	3750 rpm/5V

If the TSA signal is clamped at 5 V, check whether the following parameter is specified.

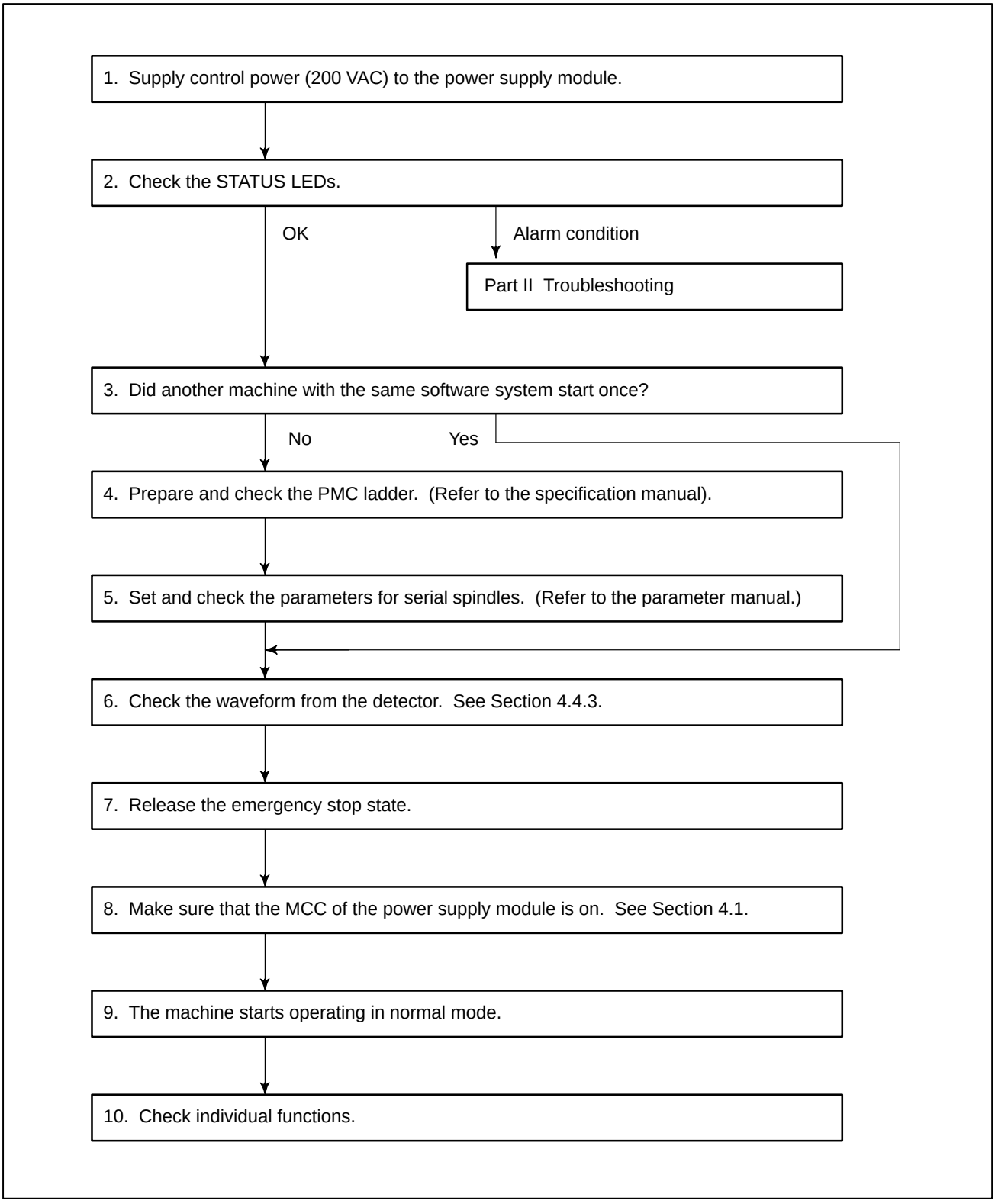
1726	
2115	——

Not used

Be sure to specify 0.

4.3 SPINDLE AMPLIFIER MODULE

Check each item according to the procedure described below.



4.3.1 Spindle Check Board

By connecting the check board, you can observe:

1 Various signal waveforms.
2 Internal data

(1) Check board specification

There are two types of check boards. They are not interchangeable. Select one that matches your application.

For the items that vary between the two check boards, they are identified by the drawing number of the printed–circuit board.

Table 4.3.1 (1) Check Board Specification

Name	Applicable unit	Specification	Printed–circuit board drawing number
Spindle check board	SPM–2.2 to 11 TYPE I SPM–2.2 to 11 TYPE II	A06B–6078–H001	A20B–2001–0830
	SPM–15 to 30 TYPE I SPM–15 to 30 TYPE II SPM–11 to 30 TYPE III	A06B–6072–H051	A20B–1005–0740

(2) Check terminal output signal. (See Section 4.3.3 for details of signals.)

Table 4.3.1 (2)–1 Check Terminal Output Signals (A20B–2001–0830)

Check terminal	Signal name	Check terminal	Signal name
LM	Load meter signal	PA1	Phase A sine wave signal 1
SM	Speedometer signal	PB1	Phase B sine wave signal 1
CH1	Channel 1, for internal data observation	PS1	Phase Z signal 1
CH2	Channel 2, for internal data observation	PA2	Phase A sine wave signal 2
CH1D	Bit 0 on channel 1, for internal data observation	PB2	Phase B sine wave signal 2
CH2D	Bit 0 on channel 2, for internal data observation	PS2	Phase Z signal 2
VRM	Reference voltage (2.5 VDC)	PA3	Phase A sine wave signal 3
LSA1	Magnetic sensor output LSA signal 1	PB3	Phase B sine wave signal 3
EXTSC1	External reference signal 1	PA4	Phase A sine wave signal 4
LSA2	Magnetic sensor output LSA signal 2	PB4	Phase B sine wave signal 4
EXTSC2	External reference signal 2	OVR2	Analog override input signal
PAD	Equivalent position coder output signal phase A	24V	DC+24V
PBD	Equivalent position coder output signal phase B	15V	DC+15V
PSD	Equivalent position coder output signal phase Z	5V	DC+5V
		GND	0V

Table 4.3.1 (2)–2 Check Terminal Output Signals (A20B–1005–0740)

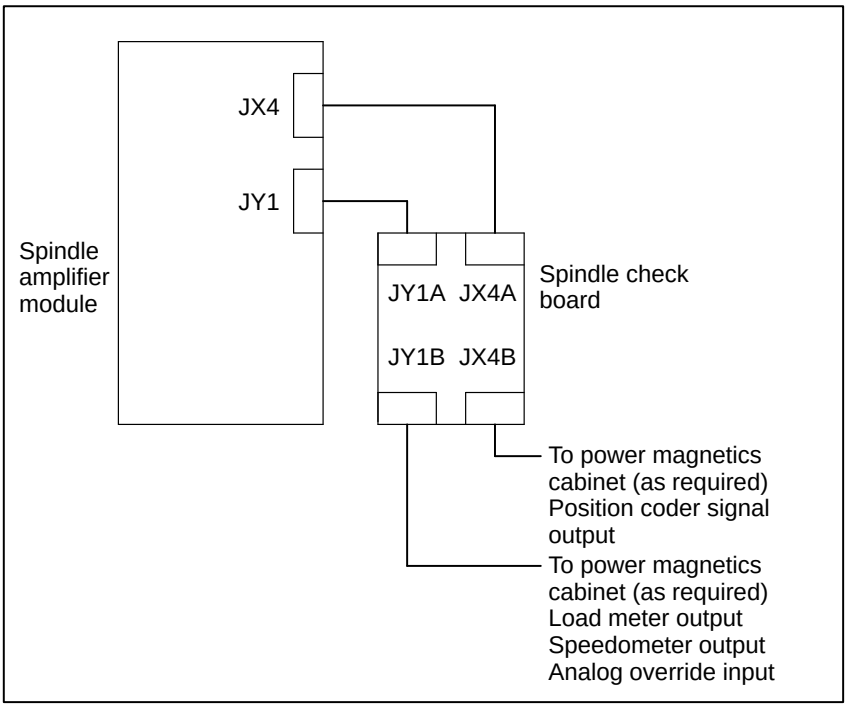
Check terminal	Signal name	Check terminal	Signal name
LM	Load meter signal	PAD	Equivalent position coder signal phase A
SM	Speedometer signal	PBD	Equivalent position coder signal phase B
IU	Phase U current	PSD	Equivalent position coder signal phase Z
IV	Phase V current	PA1	Phase A sine wave signal 1
		PB1	Phase B sine wave signal 1
		PS1	Phase Z signal 1
		PA2	Phase A sine wave signal 2
		PB2	Phase B sine wave signal 2
		PS2	Phase Z signal 2
		PA3	Magnetic sensor output LSA signal 1
VDC	DC link voltage signal	PB3	Phase B sine wave signal 3
VRM	Reference voltage (2.5 VDC)	PA4	Phase A sine wave signal 4
MSA1	Magnetic sensor output MSA signal 1	PB4	Phase B sine wave signal 4
LSA1	Magnetic sensor output LSA signal 1	OVR2	Analog override input signal
EXTSC1	External reference signal 1	24V	DC+24V
MSA2	Magnetic sensor output MSA signal 2	15V	DC+15V
LSA2	Magnetic sensor output LSA signal 2	5V	DC+5V
EXTSC2	External reference signal 2	GND	DC 0V

The current is positive when it is input to the amplifier.

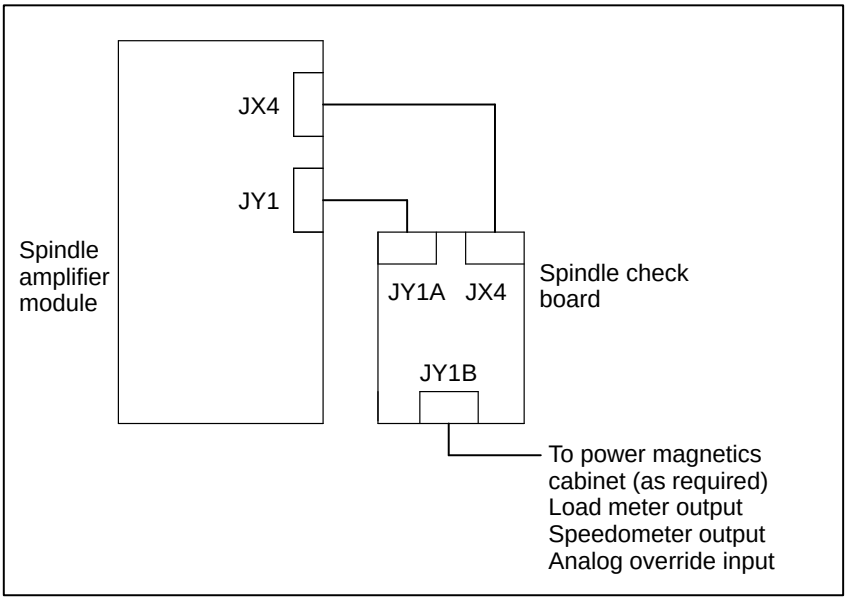
Model	Conversion result
SPM- 11	33. 3A/ 1V
SPM- 15	50. 0A/ 1V
SPM- 22	66. 7A/ 1V
SPM- 26	100A/ 1V
SPM- 30	133A/ 1V

(3) Connecting the check board

1 Connecting the check board (A20B–2001–0830)

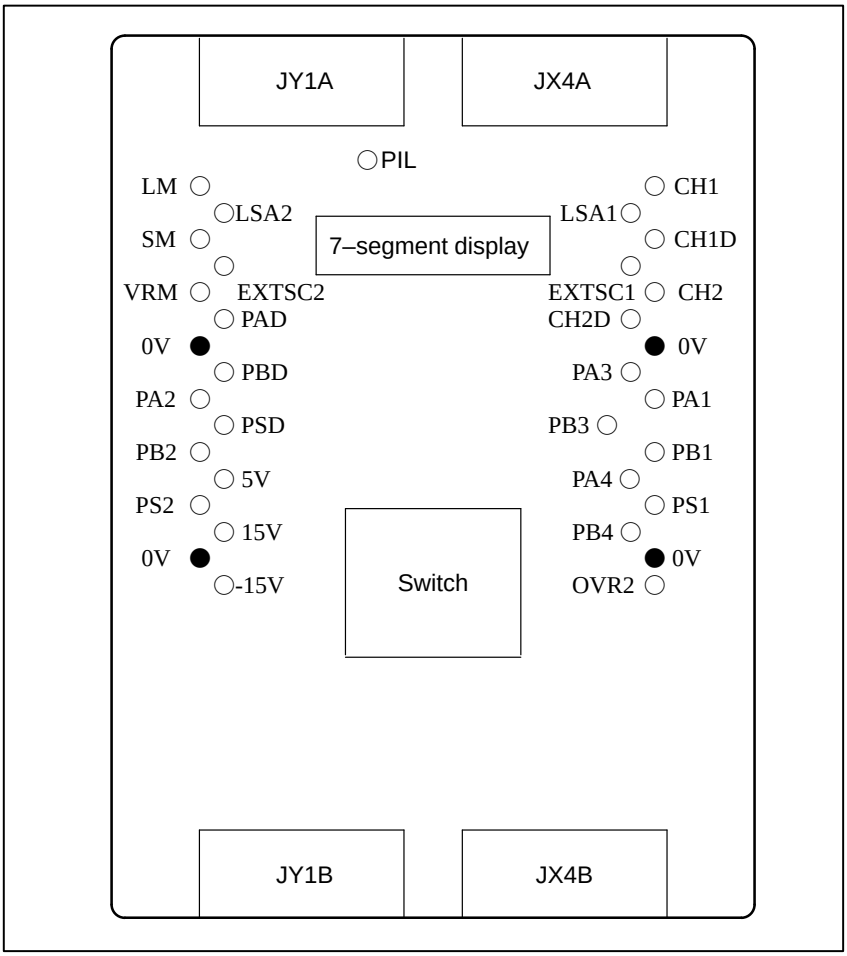


2 Connecting the check board (A20B–1005–0740)

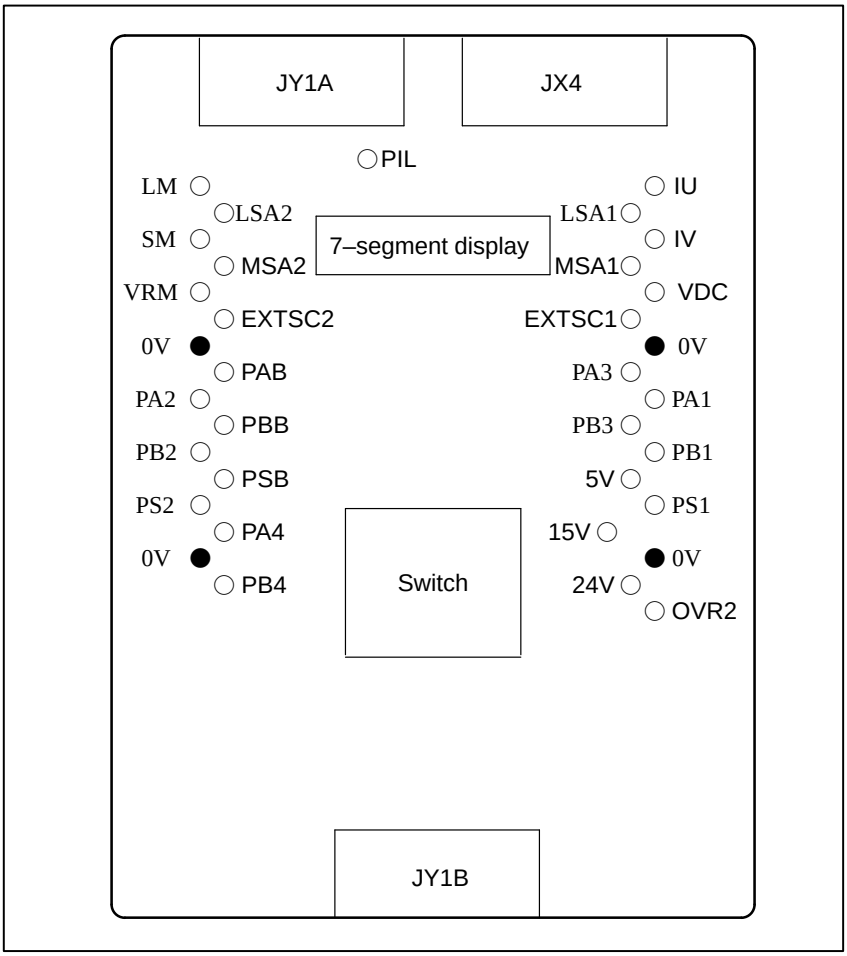


(4) Check terminal arrangement

1 Check terminal arrangement (A20B–2001–0830)



2 Check terminal arrangement (A20B–1005–0740)



4.3.2 Checking The Control Power Supply Voltage

(1) SPM–2.2 to –11 types I and II

Table 4.3.2 (1) Checking the Control Power Supply Voltage

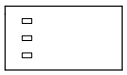
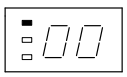
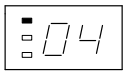
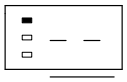
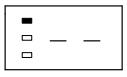
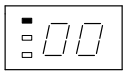
Check item	Check method		
Control power supply voltage	Check on the check terminals on the check board.	Check terminal	Rating
		+5 – 0V	5V^5%
		+15V – 0V	15V^5%
		–15V – 0V	–15V^5%

(2) SPM–15 to –30 types I and II, SPM–11 to –30 types III

Table 4.3.2 (2) Checking the Control Power Supply Voltage

Check item	Check method		
Control power supply voltage	Check on the check terminals on the check board.	Check terminal	Rating
		+5 – 0V	5V^5%
		+15V – 0V	15%^5%
		+24V – 0V	24V^5%

4.3.3 STATUS Display

No.	STATUS display On ▪ Off ▫ The LED that is on is indicated in black.	Description
1.	PIL ALM ERR 	The PIL LED (power ON indicator) is off. The control power supply has not been switched on. The power supply circuit is defective. See Section 4.3.2.
2. ↓ 3.	PIL ALM ERR 	For about 1.0 s after the control power supply is switched on, the lower two digits of the ROM series No. are indicated. **Example)** 00: ROM series No. 9D00
	PIL ALM ERR 	The ROM edition number is displayed for about 1.0 s. 01, 02, 03, and so on correspond to A, B, C, and so on, respectively. **Example)** 04: ROM edition D
4.	PIL ALM ERR  Blinking	The CNC has not been switched on. The machine is waiting for serial communication and parameter loading to end.
5.	PIL ALM ERR 	Parameter loading has ended. The motor is not supplied with power.
6.	PIL ALM ERR 	The motor is supplied with power.
7.	PIL ALM ERR  Alarm codes 01 or above is displayed.	Alarm state The SPM is not operable. See Section 3.3 of Part II.
8.	PIL ALM ERR  Error code 01 or above is displayed.	Error state Incorrect parameter setting or improper sequence. Refer to the parameter manual.

4.3.4 The PIL LED (power ON indicator) Is Off.

When the power supply module is supplied with control power, if the PIL LED on the spindle amplifier module is off, check according to the table below.

Table 4.3.4 Check Method and Action

No.	Cause of trouble	Check method	Action
1.	Control power is not supplied.	Check for 24 V and 0 V on connector CX2.	Ensure a secure connection.
2.	The power supply circuit is defective.	The PIL LED operates on +5 V. Check the control power supply voltages with the values described in section 4.3.2.	Check the printed–circuit board.

4.3.5 The STATUS Display Is Blinking With ”– –”

After the CNC has started up, if the STATUS display is still blinking with ”– –”, check according to the table below.

Table 4.3.5 Check Method and Action

No.	Cause of trouble	Check method	Action
1.	When only one SPM is available, the setting is such that two SPMs are connected. (SPM–15 to –30).	Check the switch setting.	Set DIP switch S1 to OFF.
2.	The CNC has not been set in such a way that α series (serial spindle) can be used.	Check the parameters. Refer to the parameter manual.	Set the parameters correctly.
3.	The CNC has not been connected.	Be careful that the specification of the electric–to–electric interface cable is different from that of the I/O link adaptor cable.	Check the connection and specification.

4.3.6 Checking The Feedback Signal Waveform

The measurement positions and connector connections vary from one detector configuration to another. Check the waveform with Table 4.3.4. The check terminals are on the check board.

Do not observe the feedback signal before the parameters for the detectors are set. Phase A, B, and Z signals are not output until the parameters are loaded from the CNC.

Table 4.3.6 Check Terminals by Detector Configuration

No.	Detector		Motor speed feedback signal	Position feedback signal	One–rotation signal	Cs contour control		Connector connection
						Motor speed	Spindle position	
1.	Pulse generator		PA1,PB1					JY2
	Position coder			PAD,PBD	PSD			JY4
	Magnetic sensor			MSA1	LSA1			JY3
2.	Built–in sensor		PA1,PB1	PA1,PB1	PS1			JY2
	External reference signal				EXTSC1			JY3
3.	Pulse generator		PA2,PB2					JY5 (NOTE1)
	Separate built–in sensor (spindle)			PA1,PB1	PS1			JY2 (NOTE1)
4.	High–resolution magnetic pulse coder (built–in motor)		PA2,PB2	PA2,PB2	Z (NOTE2) PSD	PA3,PB3	PA3,PB3	JY5
5.	High–resolution magnetic pulse coder (motor)		PA1,PB1			PA4,PB4		JY2
	High–resolution magnetic pulse coder (spindle)			PA2,PB2	Z(NOTE2) PSD		PA3,PB3	JY5
6.	High–resolution magnetic pulse coder (motor)		PA1,PB1			PA4,PB4		JY2
	High–resolution magnetic pulse coder (spindle)			PAD,PBD	PSD		PA3,PB3	JY4
7.	MAIN side (NOTE 3)	Pulse generator	PA1,PB1					JY2
		Position coder		PAD,PBD	PSD			JY4
		Magnetic sensor		MSA1	LSA1			JY3
	SUB side (NOTE 3)	Pulse generator	PA2,PB2					JY6
		Position coder		PAD,PBD	PSD			JY8
		Magnetic sensor		MSA2	LSA2			JY7
8.	MAIN side (NOTE 3)	Built–in sensor	PA1,PB1	PA1,PB1	PS1			JY2
		External reference signal			EXTSC1			JY3
	SUB side (NOTE 3)	Built–in sensor	PA2,PB2	PA2,PB2	PS2			JY6
		External reference signal			EXTSC2			JY7

NOTE1
Position where the connector for SPM–2.2 to –11 is connected.
For SPM–15 to –30, see the table below.

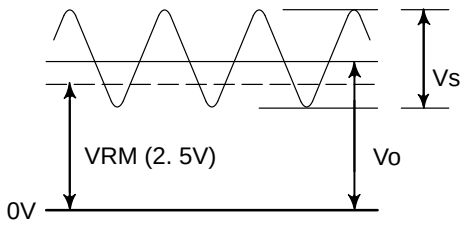
Table 4.3.6 Check Terminals by Detector Configuration (continued)

No.	Detector	Motor speed feedback signal	Position feedback signal	One–rotation signal	Cs contour control		Connector connection
					Motor speed	Spindle position	
9.	Pulse generator	PA1,PB1					JY2
	Separate built–in sensor (spindle)		PA2,PB2	PS2			JY6

NOTE2
Check terminal Z is on the preamplifier printed–circuit board.
The PSD signal is a square wave produced from the Z signal (analog waveform). It is on the check board.

NOTE3
All output signals are for the currently selected spindle (MAIN or SUB).

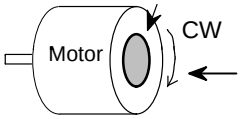
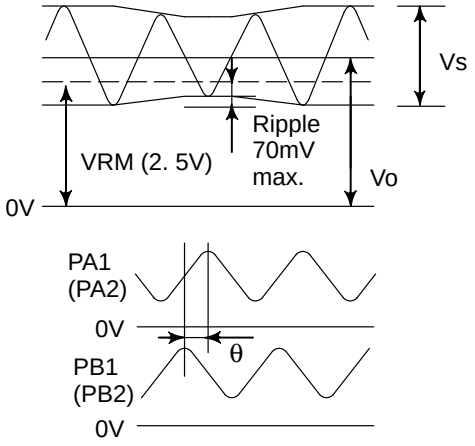
(1) Motor speed feedback signal (pulse generator)
Measurement conditions
Direction of rotation: Normal (CCW), reverse (CW)
Motor speed : 1500 rpm

No.	Measurement location	Sample waveform
1.	PA1,PB1 (PA2, PB2 for the sub–spindle)	

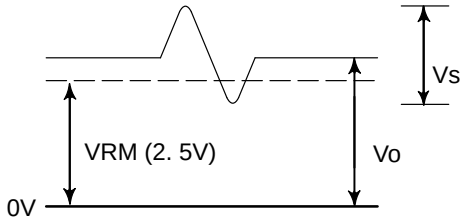
Measurement item	Standard	Make sure that the measurement meets the standard.
Vs amplitude	0.64 to 0.90V	
Vo offset	2.5V ±90mV	Measure with a digital voltmeter in the DC range.

(2) Motor speed feedback signal (for other than built–in sensor α 0.5)
Measurement conditions
Direction of rotation: Normal (CCW), reverse (CW)
Motor speed : 1500 rpm

<table>
<tr><th>No.</th><th>Measurement location</th><th>Sample waveform</th></tr>
<tr><td>1.</td><td>PA1,PB1
(PA2, PB2 for the sub–spindle)

Detection gear
 
</td><td> 

Adjust the mounting position of the detector so that the ripple in the output signal does not exceed 70 mV.

<table>
<tr><th>Measurement item</th><th>Standard</th><th>Make sure that the measurement meets the standard.</th></tr>
<tr><td>Vs amplitude</td><td>0.66 to 0.93V</td><td></td></tr>
<tr><td>Vo offset</td><td>2.5V ±272mV</td><td>Measure with a digital voltmeter in the DC range.</td></tr>
<tr><td>θ phase difference</td><td>90±3°</td><td>When the motor is rotating clockwise (CW) as viewed from the detection gear side</td></tr>
</table></td></tr>
<tr><td>2.</td><td>PS1
(PS2 for the sub–spindle)</td><td> 

<table>
<tr><th>Measurement item</th><th>Standard</th><th>Make sure that the measurement meets the standard.</th></tr>
<tr><td>Vs amplitude</td><td>1.08 to 2.40V</td><td></td></tr>
<tr><td>Vo offset</td><td>2.5V ±500mV</td><td>Measure with a digital voltmeter in the DC range.</td></tr>
</table></td></tr>
</table>

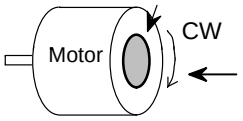
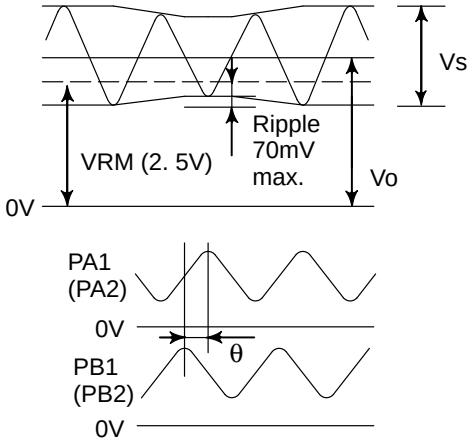
(3) Motor speed feedback signal

Measurement conditions

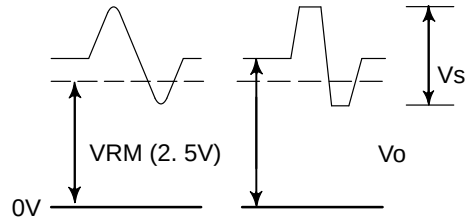
Direction of rotation: Normal (CCW), reverse (CW)

Motor speed: 1500 rpm

<table>
<tr><th>No.</th><th>Measurement location</th><th>Sample waveform</th></tr>
<tr><td>1.</td><td>PA1,PB1
(PA2, PB2 for the sub–spindle)

Detection gear
 
</td><td> 

Adjust the mounting position of the detector so that the ripple in the output signal does not exceed 70 mV.

<table><tr><th>Measurement item</th><th>Standard</th><th>Make sure that the measurement meets the standard.</th></tr><tr><td>Vs amplitude</td><td>0.50 to 1.45V</td><td></td></tr><tr><td>Vo offset</td><td>2.5V ±295mV</td><td>Measure with a digital voltmeter in the DC range.</td></tr><tr><td>θ phase difference</td><td>90±3°</td><td>When the motor is rotating clockwise (CW) as viewed from the detection gear side</td></tr></table></td></tr>
<tr><td>2.</td><td>PS1
(PS2 for the sub–spindle)</td><td>Example 1 Example 2
 

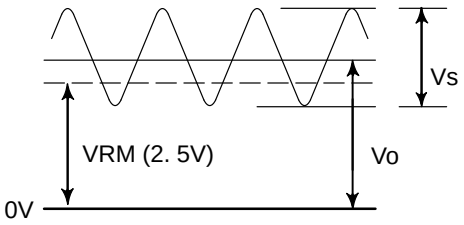
<table><tr><th>Measurement item</th><th>Standard</th><th>Make sure that the measurement meets the standard.</th></tr><tr><td>Vs amplitude</td><td>2V min.</td><td>If the Vs amplitude is not less the 2 V, the waveform may be clamped.</td></tr><tr><td>Vo offset</td><td>2.5V ±500mV</td><td>Measure with a digital voltmeter in the DC range.</td></tr></table></td></tr>
</table>

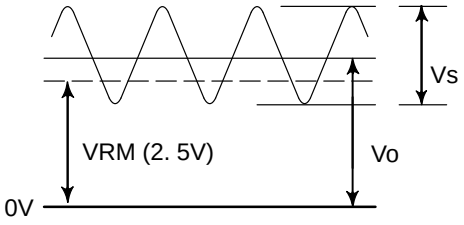
(4) Cs contour control feedback signal (motor speed feedback signal, spindle position feedback signal)

The preamplifier was factory–set, but you should check its waveform after it is mounted on the machine. If it does not meet the standard, you must readjust it.

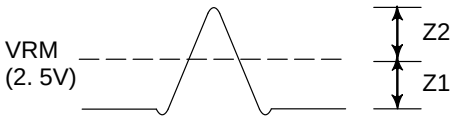
After mounting the sensor, check the waveform before you mount the pulley, draw bar, brake, etc.

Direction of rotation: Normal (CCW), reverse (CW)
Motor speed: 1500 rpm

<table>
<tr><th>No.</th><th>Measurement location</th><th>Sample waveform</th></tr>
<tr><td>1.</td><td>Motor speed feedback signal (128λ/rev.)
PA1,PB1
(PA2, PB2 for the built–in type)
Spindle position feedback signal (1λ28/rev.)
PA2,PB2</td><td>


<table>
<tr><td rowspan="2">Measurement item</td><td rowspan="2">Standard</td><td>Measurement point (The name of the potentiometer is underlined.)</td></tr>
<tr><td>If the measurement does not meet the standard, adjust by turning the potentiometer on the preamplifier.</td></tr>
<tr><td>Vs amplitude</td><td>0.86 to 1.20V</td><td>PA1(PA2) : A3G
PB1(PB2) : B3G</td></tr>
<tr><td>Vo offset</td><td>2.5V ±24mV</td><td>Measure with a digital voltmeter in the DC range.
PA1(PA2) : A30
PB1(PB2) : B30</td></tr>
</table>
</td></tr>
<tr><td>2.</td><td>Spindle position feedback signal (90,000λ/rev.)
PA3,PB3
Motor speed feedback signal (90,000λ/rev.)
PA4,PB4</td><td>


<table>
<tr><td rowspan="2">Measurement item</td><td rowspan="2">Standard</td><td>Measurement point (The name of the potentiometer is underlined.)</td></tr>
<tr><td>If the measurement does not meet the standard, adjust by turning the potentiometer on the preamplifier.</td></tr>
<tr><td>Vs amplitude</td><td>1.20 to 1.51V</td><td>PA3(PA4) : A1G
PB3(PB4) : B1G</td></tr>
<tr><td>Vo offset</td><td>2.5V ±15mV</td><td>Measure with a digital voltmeter in the DC range.
PA3(PA4) : A1O
PB3(PB4) : B1O</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>No.</th><th>Measurement location</th><th>Sample waveform</th></tr>
<tr><td>3.</td><td>1. One–rotation signal Z
Observe the waveform between the check terminal Z on the preamplifier and VRM.</td><td>


<table>
<tr><th>Measurement item</th><th>Standard</th><th>Measurement point (The name of the potentiometer is underlined.)</th></tr>
<tr><td>Z1,Z2</td><td>Z1≒Z2
Z1,Z2
≧60mV</td><td>If the measurement does not meet the standard, adjust by turning potentiometer ZO on the preamplifier.</td></tr>
</table>
</td></tr>
</table>

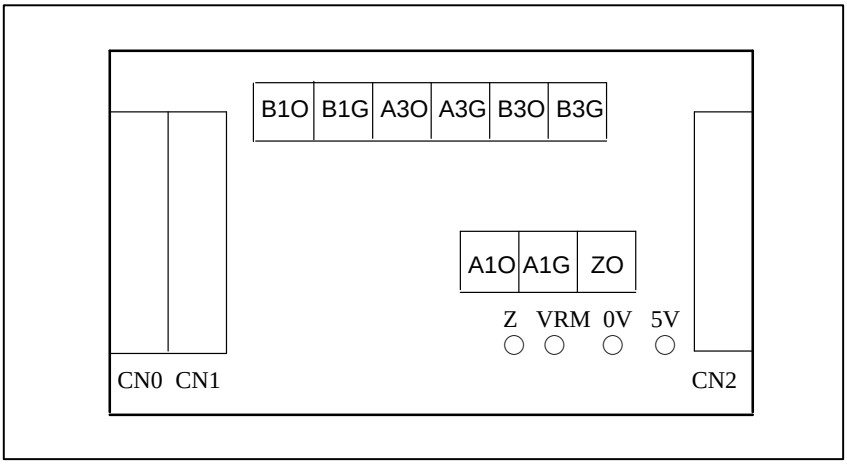


Table 4.3.4 (d) Preamplifier Printed–Circuit Board

4.3.7 Observing The Internal Data

(1) Overview

By using the check board, you can convert digital signals used for control in the spindle amplifier module to analog voltage, and observe the conversion result with an oscilloscope. The internal data can be indicated also with the five–digit display.

- A20B–2001–0830
  This model has two analog output channels (CH1 and CH2) at which the internal data (with output of –5 V to +5 V) can be observed. It also has CH1D and CH2D at which specific bits such as data bits can be observed.
- A20B–1005–0740
  This model outputs internal data (output of 0 to 11 V) at terminals LM and SM using the analog output circuit for the load meter (LM) and speedometer (SM).

(2) Major characteristics

Item	Applicable module		
	Printed–circuit board		
	SPM–2.2 to –11 TYPE I SPM–2.2 to –11 TYPE II		SPM–15 to –30 TYPE I SPM–15 to –30 TYPE II SPM–11 to –30 TYPE III
	A20B–20001–0830		A20B–1005–0740
Measurement point	CH1,CH2	CH1D,CH2D	LM,SM
Output voltage range	–5V to 5V	H :2Vmin L :0.8Vmax	0V to 11V
Resolution	About 38mV (10V/256)	–	About 43mV (11V/256)
Input impedance of the external measuring instrument	10kΩmin	10kΩmin	10kΩmin

(3) Observation method

By setting data using four DIP switches on the check board, you can output internal data to the five–digit display, analog voltage output circuit, channels 1 and 2 (LM and SM or CH1 and CH2).

Data on channels 1 and 2 is the one from an 8–bit D/A convertor.

The correspondence between channel 1/2 and the check terminal is listed below.

Measurement point	Check terminal	
	Printed–circuit board	
	A20B–2001–0830	A20B–1005–0740
Channel 1	CH1 CH1D, data bit 0	LM
Channel 2	CH2 CH2D, data bit 0	SM

NOTE

When using printed–circuit board A20B–1005–0740, set DIP switches S2 and S3 on the spindle amplifier module front panel to OFF. After observation, set them to ON.

This operation is not necessary when you use printed–circuit board A20B–2001–0830.

DIP switch	ON position	OFF position
S2, S3	Output voltage is filtered out.	Output voltage is not filtered out.

(4) Specifying data to be monitored

1 Press the four setting switches at the same time for at least a second.HFFFFFIwill be displayed on the indicator.

2 Turn off the switches and press theHMODEIswitch.Hd-00Iwill be displayed on the indicator and the system will enter the mode for monitoring internal data.
In this mode, the motor can be operated normally.

3 Press theHUPIorHDOWNIswitch while holding down theHMODEIswitch. The indicator display will change in the range ofHd-00ItoHd-12I.

4 The following shows the correspondence between the destinations of the internal data of the serial spindle and addresses d-01 to d-12.
d-01 to d-04 : Specifies the amount of data to be output to the indicator, data shift, and output format (decimal or hexadecimal).
d-05 to d-08 : Specifies the amount of data to be output to the LM terminal, data shift, and whether an offset is provided.
d-09 to d-12 : Specifies the amount of data to be output to the SM terminal, data shift, and whether an offset is provided.

5 Select address d-xx in the procedure for setting data described in (3).

6 Turn off theHMODEIswitch. Hd-xxIwill disappear 0.5 second later, and the data will be displayed for a second.
Change the set data using theHUPIorHDOWNIswitch within the second the data is displayed.

7 When more than a second elapses without pressing theHUPIorHDOWNIswitch, data cannot be changed.
If theHMODEIswitch is turned on or off, however, setting can be started from the beginning of the step in item (6).

(5) Description of Addresses

[Output to the indicator]

Address	Description	Initial value
d–01	Specifies a data number.	0
d–02	Shift at data output (0 to 31 bits)	0
d–03	Data shift direction 0 : Data is shifted right. 1 : Data is shifted left.	0
d–04	Display format 0 : Decimal notation 1 : Hexadecimal notation(0 to F)	0

[Output to the channel 1]

Address	Description	Initial value	
		Printed–circuit board (output terminal name)	
		A20B–2001–0830 (CH1)	A20B–1005–0740 (LM)
d–05	Specifies a data number	218	132
d–06	Shift at data output (0 to 31 bits)	8	0
d–07	Data shift direction 0 : Data is shifted right 1 : Data is shifted left	0	0
d–08	Offset 0 : Not provided 1 : Provided	1	0

[Output to the channel 2]

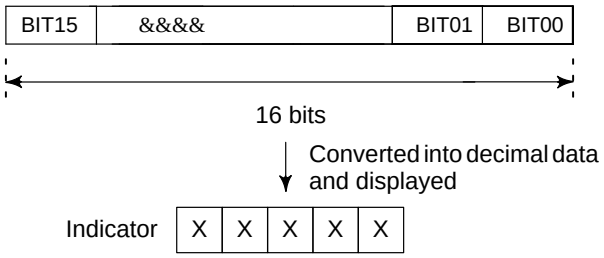
Address	Description	Initial value	
		Printed–circuit board (output terminal name)	
		A20B–2001–0830 (CH2)	A20B–1005–0740 (SM)
d–09	Specifies a data number	19	131
d–10	Shift at data output (0 to 31 bits)	18	0
d–11	Data shift direction 0 : Data is shifted right 1 : Data is shifted left	0	0
d–12	Offset 0 : Not provided 1 : Provided	1	0

(6) Principles in Outputting the Internal Data of the Serial Spindle
The length of data is 32 bits (BIT31 TO BIT00) unless it is described as 16 bits.

BIT31	&&&&	BIT03	BIT02	BIT01	BIT00

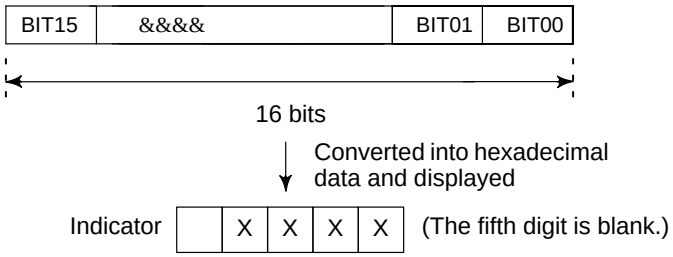
1 Example of output to the indicator

Example1 Displaying data in decimal
When the number of digits to shift data (d-02)=0 and display format (d-04)=0 (decimal notation): The last 16 bits of data (BIT15 to BIT00) are converted into decimal (0 to 65535 max.) and displayed.



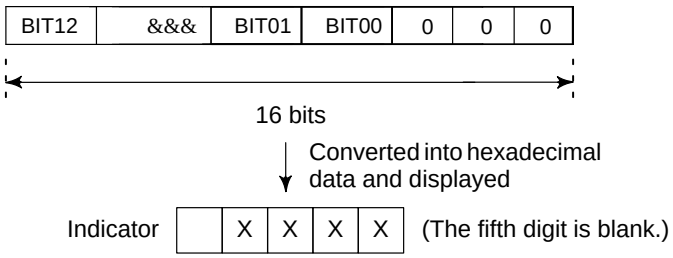
Example2 Displaying data in hexadecimal

When the number of digits to shift data (d-02)=0 and display format (d-04)=1 (hexadecimal notation): The last 16 bits of data (BIT15 to BIT00) are converted into hexadecimal (0 to FFFFF max.) and displayed.



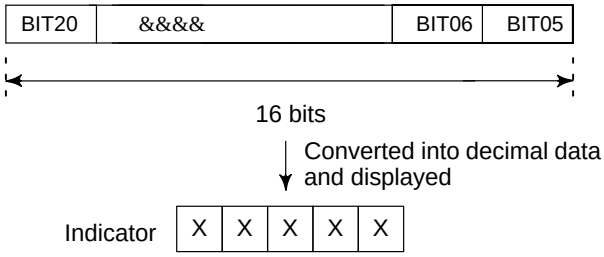
Example3 Shifting data left

When the number of digits to shift data (d-02)=3, the shift direction is left (d-03=1), and display format (d-04)=1 (hexadecimal notation): Data in BIT12 to BIT00 and the last three bits of data (=0) are converted into hexadecimal (0 to FFFFF max.) and displayed.



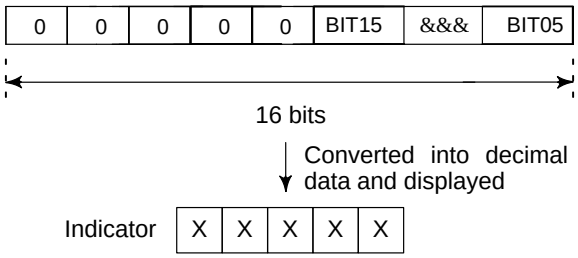
Example4 Shifting data right

When the number of digits to shift data (d-02)=5, shift direction is right (d-03=0), and display format (d-04)=0 (decimal notation): Data in BIT20 to BIT05 is converted into decimal (0 to 65535 max.) and displayed.



Example5 Shifting data right when the data length is 16 bits

When the data length is 16 bits, data shift (d-02)=5, shift direction is right (d-03=0), and display format is decimal notation (d-04=0): The first five bits of data and data in BIT15 to BIT05 are converted into decimal and displayed.



2 Example of output to the channel 1

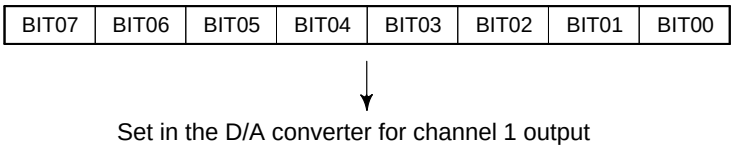
Internal data is output to channel 1 by setting it in an 8–bit D/A convertor.

The output range of the D/A convertor varies from one printed–circuit board to another. The output ranges from –5 V to +5 V (printed–circuit board A20B–2001–0830) or from 0 V to +11 V (printed–circuit board A20B–1005–0740) according to the internal data that is set. See the table below.

Internal data in binary (decimal)	Setting d–08 (whether there is offset)	Output on channel 1	
		Printed–circuit board	
		A20B–2001–0830	A20B–1005–0740
00000000(0)	0	–5V	0V
11111111(255)	0	+4.96V	+11V
10000000(-128)	1	–5V	0V
00000000(0)	1	0V	+5.5V
01111111(127)	1	+4.96V	+11V

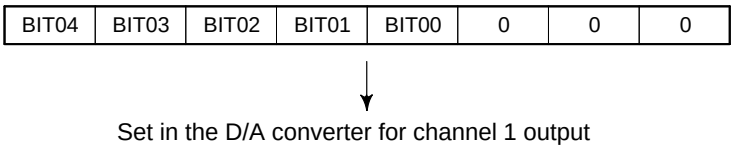
Example1 Data set

When the number of digits to shift data (d-06)=0 and when no offset is provided (d-08=0): The last eight bits of data (BIT07 to BIT00) is set in the D/A converter of the LM terminal.



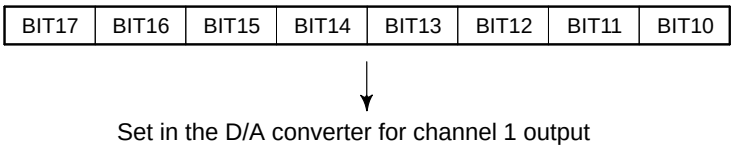
Example2 Shifting data left

When the number of digits to shift data (d-06)=3, shift direction is right (d-07=1), and no offset is provided (d-08=0): Data in BIT14 to BIT00 and the last three bits of data (=0) are set in the D/A converter.



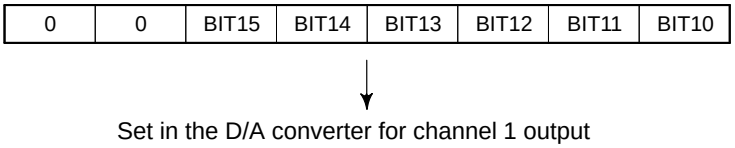
Example3 Shifting data right

When the number of digits to shift data (d-06)=10, shift direction is right (d-07=1), and no offset is provided (d-08=0): Data in BIT17 to BIT10 is set in the D/A converter.



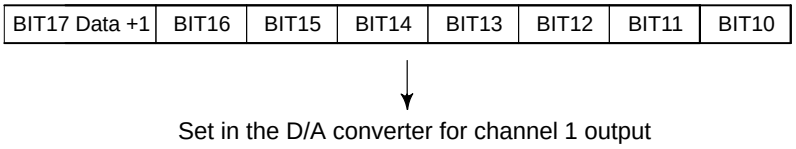
Example4 Shifting data right when the data length is 16 bits

When the data length is 16 bits, data shift (d-06)=10, shift direction is right (d-07=0), and no offset is provided (d-08=0): The first two bits of data (=0) and data in BIT15 to BIT10 are set in the D/A converter.



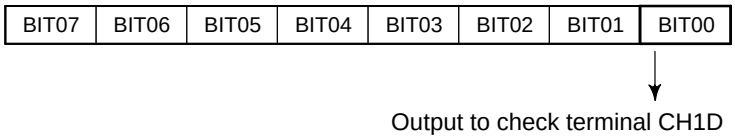
Example5 If an offset is provided

When the number of digits to shift data (d-06)=10, shift direction is right (d-07=0), and an offset is provided (d-08=1): Data in most significant bit BIT17 (to which 1 is added) and data in BIT16 to BIT10 are set in the D/A converter.



Example6 Data bit observation
(for printed–circuit board A20B–2001–0830 only)

For data shift (d–06) = 0 with no offset (d–08 = 0), the lowest data bit (BIT00) can be observed as a high/low level at check terminal CH1D.



3 Example of output to the channel 2

Output to the channel 2 is the same as that to the channel 1. However, the addresses for setting data (d-09 to d-12) are different from those for output to the channel 1.

Setting velocity information in the channel 1 and the number of errors in the channel 2 enables simultaneous monitoring of the change in each data item using the two channels.

(7) Data Numbers

1 Main data

Data No.	Description	Data length	Remarks
16	Motor speed command	32	The 12th bit (BIT12) indicates a units in rpm.
19	Motor speed	32	The 12th bit (BIT12) indicates a units in rpm.
25	Motor speed deviation (speed command - motor speed)	32	The 12th bit (BIT12) indicates a units in rpm.
4	Move command	32	Number of command pulses for ITP (usually 8 ms)
9	Positioning error	32	Number of erroneous pulses (Spindle synchronous control Cs contour control Rigid mode)
90	Torque command	16	0 to ±16384
131	Speedometer data	16	SM terminal
132	Load meter data	16	LM terminal
136	Position error	32	Number of erroneous pulses (Position coder orientation)

2 Data to be transmitted between the serial spindle and the CNC

Data No.	Description	Data length	Remarks
2	Control bit signal 1	16	Command bit sent from the CNC to the spindle
3	Control bit signal 2	16	Command bit sent from the CNC to the spindle
5	Speed command data	16	¿16384 for the maximum speed command
6	Spindle control signal	16	Command bit sent from the PMC to the spindle
10	Load meter data	16	0 to 32767 (maximum)
11	Motor speed data	16	±16384 for maximum speed
12	Spindle status signal	16	Status bit sent from the spindle to the PMC

3 Others

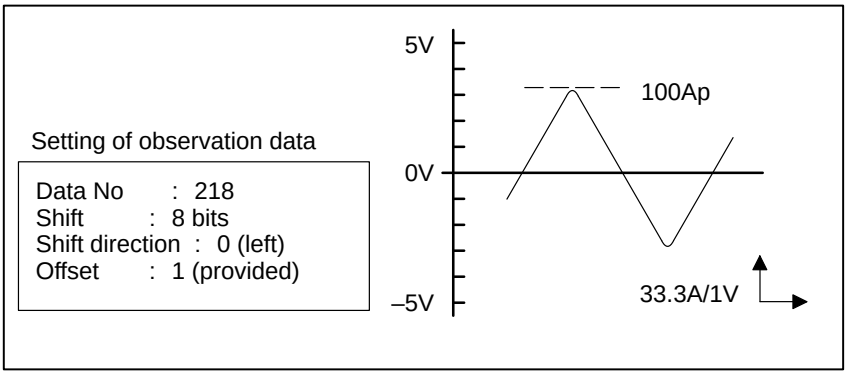
Data No.	Description	Data length	Remarks
112	Position coder data	16	Number of the pulses that return to the position coder for ITP (usually 8ms)
51	U–phase current command	16	
52	V–phase current command	16	
53	W–phase current command	16	
218	U–phase current (A/D changer data)	16	10V/FS with 8 bits shifted left(Note)
219	V–phase current (A/D changer data)	16	
121	Magnetic sensor signal (MS signal on the main spindle side)	16	15.4V/FS with 8 bits shif ted left(Note)
125	Magnetic sensor signal (MS signal on the sub–spindle side)	16	
162	DC link voltage	316	1000V/FS with 8 bits shifted left(Note)

Table 4.3.7 (1) Internal Data Conversion (A20B–2001–0830)

<table>
<tr><th>Data No.</th><th>Signal name</th><th colspan="2">Description
(conversion with 8 bits shifted left and with an offset)</th></tr>
<tr><td>218</td><td>IU</td><td>Phase U current</td><td rowspan="3">The current is positive when it is input to the amplifier.<table><tr><th>Model</th><th>Conversion result</th></tr><tr><td>SPM–2.2
SPM–5.5</td><td>16.7A/1V</td></tr><tr><td>SPM- 11</td><td>33. 3A/ 1V</td></tr><tr><td>SPM- 15</td><td>50. 0A/ 1V</td></tr><tr><td>SPM- 22</td><td>66. 7A/ 1V</td></tr><tr><td>SPM- 26</td><td>100A/ 1V</td></tr><tr><td>SPM- 30</td><td>133A/ 1V</td></tr></table></td></tr>
<tr><td>219</td><td>IV</td><td>Phase V current</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>162</td><td>VDC</td><td colspan="2">DC link voltage signal 100V/1V</td></tr>
<tr><td>121</td><td>MSA1</td><td colspan="2">Magnetic sensor output MSA signal 1 1.54V/1V</td></tr>
<tr><td>125</td><td>MSA2</td><td colspan="2">Magnetic sensor output MSA signal 2 1.54V/1V</td></tr>
</table>

Example

Observation of phase U current in the SPM–11



Example of Monitoring Data

1 Example of monitoring a positioning error using the LM terminal

Address	Description	Set Data			
d–05	Data number	9	9	9	9
d–06	Data shift	0	1	1	2
d–07	Data shift direction	0	0	1	1
d–08	Offset	1	1	1	1
Data unit (NOTE)		256p/FS	512p/FS	128p/FS	64p/FS

NOTE
Printed–circuit board A20B–2001–0830 :
FS=10V (–5V to 5V)
Printed–circuit board A20B–1005–0740 :
FS=11V (0V to 11V)

2 Example of monitoring a motor speed using the SM terminal

Address	Description	Set Data		
d–09	Data number	19	19	19
d–10	Data shift	12	13	11
d–11	Data shift direction	0	0	0
d–12	Offset	1	0	0
Data unit (NOTE)		256p/FS	512p/FS	128p/FS

NOTE
Printed–circuit board A20B–2001–0830 :
FS=10V (–5V to 5V)
Printed–circuit board A20B–1005–0740 :
FS=11V (0V to 11V)

II TROUBLESHOOTING

1 OVERVIEW

This part describes the troubleshooting procedure for each module. Read the section related to your current trouble to locate it and take an appropriate action.
First, check the alarm number and STATUS display indicated on your module with each list (alarm numbers in the list are those for the CNC) in Chapter 2 to find the corresponding detailed information in Chapter 3. Then take an appropriate action according to the detailed information.

- Power supply module
- Servo amplifier module
- Spindle amplifier module

2 ALARM NUMBERS AND BRIEF DESCRIPTIONS

2.1 ALARM NUMBERS IN SERIES 15 (SERVO ALARMS)

Alarm No.	SVM	SPM	PSM	Description	Remarks
SV001				Overload alarm	3.4.2
SV003	8 9 A b C d E		 1	Abnormal current alarm (L axis) (M axis) (N axis) (L, M axis) (M, N axis) (L, N axis) (L, M, N axis) (PSM overcurrent + IPM alarm)	3.2.1 3.1.1
	8. 9. A. b. C. d. E.			IPM alarm (L axis) (M axis) (N axis) (L, M axis) (M, N axis) (L, N axis) (L, M, N axis)	3.2.2
SV004			7	DC link overvoltage	3.1.7
SV005			5	Precharge alarm (Series 15–A) (simultaneously with SV006)	3.1.5
SV006	2 5		 4 6	Control power supply undervoltage alarm DC link undervoltage alarm (SVM) DC link undervoltage alarm (PSM) Power supply state alarm	3.2.3 3.2.4 3.1.4 3.1.6
			5	Precharge alarm (Series 15–A) (simultaneously with SV005)	3.1.5
SV015				Feedback disconnected alarm	3.4.3
SV023	1		 2 3	Fan stop alarm (SVM) Fan stop alarm (PSM) Overheat alarm (PSM) Overheat alarm (motor)	3.2.5 3.1.2 3.1.3 3.4.4
SV027				Invalid servo parameter setting alarm	3.4.5
SV110				α pulse coder error alarm	3.4.6
SV114				Rotation speed data error alarm	3.4.7
SV115				Pulse coder communication error alarm	3.4.8
SV116			5	Precharge alarm (Series 15–B)	3.1.5
SV117				Current conversion error alarm	3.2.6

For Series 15 (spindle alarm)

Alarm No.	SVM	SPM	PSM	Description	Remarks
OT300		A0		Program ROM error	3.3.1
OT300		A1		Program RAM error	3.3.1
OT301		01		Motor overheat	3.3.2
OT302		02		Excessive velocity error	3.3.3
OT339		03		DC link fuse blown	3.3.4
OT339		04	06	Input power supply open phase and power supply failure	3.1.6
OT307		07		Overspeed	3.3.5
OT309		09		Main circuit overload	3.3.6
OT311		11	07	DC link overvoltage	3.1.7
OT312		12		DC link overcurrent/IPM alarm	3.3.7
OT300		13		CPU internal data memory failure	3.3.8
OT399		15		Speed range switching and spindle switching alarm	3.3.9
OT300		16		RAM error	3.3.10
OT300		19		Phase U current detector circuit excessive offset	3.3.11
OT300		20		Phase V current detector circuit excessive offset	3.3.12
OT300		24		Serial transfer data error	3.3.13
OT300		25		Serial data transfer stopped	3.3.14
OT326		26		Cs contouring control velocity detection signal disconnected	3.3.15
OT327		27		Position coder signal disconnected	3.3.16
OT328		28		Cs contouring control position detection signal disconnected	3.3.17
OT329		29		Short–period overload	3.3.18
OT330		30	01	PSM main circuit overcurrent	3.1.1
OT331		31		Speed detection signal disconnected and motor lock alarm	3.3.19
OT300		32		Serial communication LSI internal RAM error	3.3.20
OT333		33	05	DC link precharge failure	3.1.5
OT334		34		Parameter data out of specification	3.3.21
OT335		35		Too large gear ratio specified	3.3.22
OT336		36		Error counter overflow	3.3.23
OT399		37		Speed detector parameter error	3.3.24
OT399		39		Cs contouring control one–rotation signal detection error	3.3.25
OT399		40		Cs contour controling one–rotation signal not detected	3.3.26
OT399		41		Position coder one–rotation signal detection error	3.3.27
OT399		42		Position coder one–rotation signal not detected	3.3.28
OT399		43		Differential speed mode position coder signal disconnected	3.3.29
OT399		44		A/D conversion error	3.3.30

Alarm No.	SVM	SPM	PSM	Description	Remarks
OT399		46		Position coder one–rotation signal detection error during thread cutting	3.3.31
OT399		47		Position coder signal error	3.3.32
OT399		49		Excessive differential speed conversion result	3.3.33
OT399		50		Excessive speed command computed value during the synchronization control of the spindle	3.3.34
OT399		51	04	DC link undervoltage	3.1.4
OT399		52		ITP signal error I	3.3.35
OT399		53		ITP signal error II	3.3.35
OT399		54		Overload current alarm	3.3.36
OT399		55		Power line state error at spindle or speed range switching	3.3.37
OT399		56		Control circuit cooling fan stopped	3.3.38
OT399		58	03	PSM main circuit overload	3.1.3
OT399		59	02	PSM cooling fan stopped	3.1.2

2.2 FOR SERIES 0–C (SERVO ALARM)

Alarm No.		SVM	SPM	PSM	Description	Remarks
309	Alarm3				α pulse coder error alarm	3.4.6
	Alarm4				Pulse coder communication error alarm	3.4.8
400	Alarm1 bit7	1			Fan stopped alarm (SVM)	3.2.5
				2	Fan stopped alarm (PSM)	3.1.2
				3	Overheat alarm (PSM)	3.1.3
					Overheat alarm (motor)	3.4.4
414	Alarm1 bit3			7	DC link overvoltage alarm	3.1.7
	Alarm1 bit2 Alarm1 bit6			5	Precharge alarm (Bits 2 and 6 of alarm 1 are set to 1 simultaneously.)	3.1.5
	Alarm1 bit4	8			Abnormal current alarm (L axis)	3.2.1
		9			(M axis)	
		A			(N axis)	
		b			(L, M axis)	
		C			(M, N axis)	
		d			(L, N axis)	
		E			(L, M, N axis)	
				1	(PSM overcurrent + IPM alarm)	3.1.1
		8.			IPM alarm (L axis)	3.2.2
		9.			(M axis)	
		A.			(N axis)	
		b.			(L, M axis)	
		C.			(M, N axis)	
		d.			(L, N axis)	
		E.			(L, M, N axis)	
	Alarm1 bit5				Overload alarm	3.4.2
	Alarm1 bit6	2			Control power supply undervoltage alarm	3.2.3
		5			DC link undervoltage alarm (SVM)	3.2.4
				4	DC link undervoltage alarm (PSM)	3.1.4
				6	Power supply state alarm	3.1.6
416	Alarm1 bit1				Feedback disconnected alarm	3.4.3
417					Invalid servo parameter setting alarm	3.4.5

⇑ For how to interpret alarms 1 to 3, see Section 3.4.1 or diagnose No. listed at the right.

Alarm1 Diagnose No.720–723
Alarm2 Diagnose No.730–733
Alarm3 Diagnose No.760–763
Alarm4 Diagnose No.770–773

For Series 0–C (spindle alarm)

Alarm No.	SVM	SPM	PSM	Description	Remarks
945		A0		Program ROM error	3.3.1
945		A1		Program RAM error	3.3.1
409		01		Motor overheat	3.3.2
409		02		Excessive velocity error	3.3.3
409		03		DC link fuse blown	3.3.4
409		04	06	Input power supply open phase and power supply failure	3.1.6
409		07		Overspeed	3.3.5
409		09		Main circuit overload	3.3.6
409		11	07	DC link overvoltage	3.1.7
409		12		DC link overcurrent/IPM alarm	3.3.7
408		13		CPU internal data memory failure	3.3.8
409		15		Speed range switching and spindle switching alarm	3.3.9
408		16		RAM error	3.3.10
408		19		Phase U current detector circuit excessive offset	3.3.11
408		20		Phase V current detector circuit excessive offset	3.3.12
945		24		Serial transfer data error	3.3.13
945		25		Serial data transfer stopped	3.3.14
409		26		Cs contouring control velocity detection signal disconnected	3.3.15
409		27		Position coder signal disconnected	3.3.16
409		28		Cs contouring control position detection signal disconnected	3.3.17
409		29		Short–period overload	3.3.18
409		30	01	PSM main circuit overcurrent	3.1.1
409		31		Speed detection signal disconnected and motor lock alarm	3.3.19
408		32		Serial communication LSI internal RAM error	3.3.20
409		33	05	DC link precharge failure	3.1.5
409		34		Parameter data out of specification	3.3.21
409		35		Too large gear ratio specified	3.3.22
409		36		Error counter overflow	3.3.23
409		37		Speed detector parameter error	3.3.24
409		39		Cs contouring control one–rotation signal detection error	3.3.25
409		40		Cs contouring control one–rotation signal not detected	3.3.26
409		41		Position coder one–rotation signal detection error	3.3.27
409		42		Position coder one–rotation signal not detected	3.3.28
409		43		Differential speed mode position coder signal disconnected	3.3.29
409		44		A/D conversion error	3.3.30

Alarm No.	SVM	SPM	PSM	Description	Remarks
409		46		Position coder one–rotation signal detection error during thread cutting	3.3.31
409		47		Position coder signal error	3.3.32
409		49		Excessive differential speed conversion result	3.3.33
409		50		Excessive speed command computed value during the synchronization control of the spindle	3.3.34
409		51	04	DC link undervoltage	3.1.4
409		52		ITP signal error I	3.3.35
409		53		ITP signal error II	3.3.35
409		54		Overload current alarm	3.3.36
409		55		Power line state error at spindle or speed range switching	3.3.37
409		56		Control circuit cooling fan stopped	3.3.38
409		58	03	PSM main circuit overload	3.1.3
409		59	02	PSM cooling fan stopped	3.1.2

2.3 FOR SERIES 16,18,20 (SERVO ALARM)

Alarm No.		SVM	SPM	PSM	Description	Remarks
350	Alarm3				α pulse coder error alarm	3.4.6
	Alarm4 bit6				Rotation speed data error alarm	3.4.7
351	Alarm4				Pulse coder communication error alarm	3.4.8
400	Alarm1 bit7	1			Fan stopped alarm (SVM)	3.2.5
				2	Fan stopped alarm (PSM)	3.1.2
				3	Overheat alarm (PSM)	3.1.3
					Overheat alarm (motor)	3.4.4
414	Alarm1 bit3			7	DC link overvoltage alarm	3.1.7
	Alarm1 bit4	8			Abnormal current alarm (L axis)	3.2.1
		9			(M axis)	
		A			(N axis)	
		b			(L, M axis)	
		C			(M, N axis)	
		d			(L, N axis)	
		E			(L, M, N axis)	
				1	(PSM overcurrent + IPM alarm)	3.1.1
		8.			IPM alarm (L axis)	3.2.2
		9.			(M axis)	
		A.			(N axis)	
		b.			(L, M axis)	
		C.			(M, N axis)	
		d.			(L, N axis)	
		E.			(L, M, N axis)	
	Alarm1 bit5				Over load alarm	3.4.2
	Alarm1 bit6	2			Control power supply undervoltage alarm	3.2.3
		5			DC link undervoltage alarm (SVM)	3.2.4
				4	DC link undervoltage alarm (PSM)	3.1.4
				6	Power supply state alarm	3.1.6
	Alarm5 bit2	1			Fan stopped alarm (Series 20 only)	3.2.5
				2	Fan stopped alarm (Series 20 only)	3.1.2
	Alarm5 bit5			5	Precharge alarm	3.1.5
	Alarm5 bit6				Current conversion error alarm	3.2.6
416	Alarm1 bit1				Feedback disconnected alarm	3.4.1
	417				Invalid servo parameter setting alarm	3.4.5

⇑ For how to interpret alarms 1 to 3, see Section 3.4.1 or diagnose No. listed at the right.

Alarm1 Diagnose No.200
Alarm3 Diagnose No.202
Alarm4 Diagnose No.203
Alarm5 Diagnose No.204

For Series 16,18,20 (spindle alarm)

NOTE
Alarm number is 751 for the 1st spindle and 761 for the 2nd spindle.

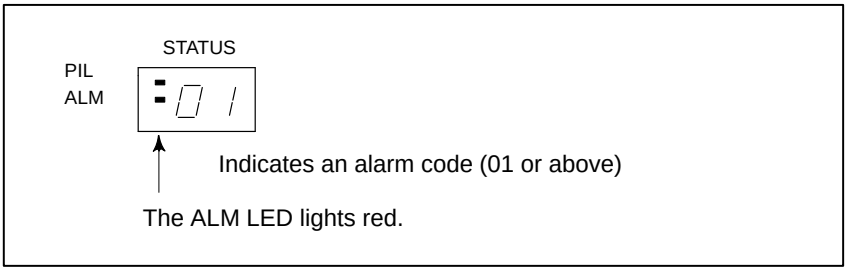
Alarm No.	SVM	SPM	PSM	Description	Remarks
749		A0		Program ROM error	3.3.1
749		A1		Program RAM error	3.3.1
751 (AL–01)		01		Motor overheat	3.3.2
751 (AL–02)		02		Excessive velocity error	3.3.3
751 (AL–03)		03		DC link fuse blown	3.3.4
751 (AL–04)		04	06	Input power supply open phase and power supply failure	3.1.6
751 (AL–07)		07		Overspeed	3.3.5
751 (AL–08)		09		Main circuit overload	3.3.6
751 (AL–11)		11	07	DC link overvoltage	3.1.7
751 (AL–12)		12		DC link overcurrent/IPM alarm	3.3.7
750		13		CPU internal data memory failure	3.3.8
751 (AL–15)		15		Speed range switching and spindle switching alarm	3.3.9
750		16		RAM error	3.3.10
750		19		Phase U current detector circuit excessive offset	3.3.11
750		20		Phase V current detector circuit excessive offset	3.3.12
749		24		Serial transfer data error	3.3.13
749		25		Serial data transfer stopped	3.3.14
751 (AL–26)		26		Cs contouring control velocity detection signal disconnected	3.3.15
751 (AL–27)		27		Position coder signal disconnected	3.3.16
751 (AL–28)		28		Cs contouring control position detection signal disconnected	3.3.17
751 (AL–29)		29		Short–period overload	3.3.18
751 (AL–30)		30	01	PSM main circuit overcurrent	3.1.1
751 (AL–31)		31		Speed detection signal disconnected and motor lock alarm	3.3.19
750		32		Serial communication LSI internal RAM error	3.3.20
751 (AL–33)		33	05	DC link precharge failure	3.1.5
751 (AL–34)		34		Parameter data out of specification	3.3.21
751 (AL–35)		35		Too large gear ratio specified	3.3.22
751 (AL–36)		36		Error counter overflow	3.3.23
751 (AL–37)		37		Speed detector parameter error	3.3.24
751 (AL–39)		39		Cs contouring control one–rotation signal detection error	3.3.25
751 (AL–40)		40		Cs contouring control one–rotation signal not detected	3.3.26
751 (AL–41)		41		Position coder one–rotation signal detection error	3.3.27

Alarm No.	SVM	SPM	PSM	Description	Remarks
751 (AL–42)		42		Position coder one–rotation signal not detected	3.3.28
751 (AL–43)		43		Differential speed mode position coder signal disconnected	3.3.29
751 (AL–44)		44		A/D conversion error	3.3.30
751 (AL–46)		46		Position coder one–rotation signal detection error during thread cutting	3.3.31
751 (AL–47)		47		Position coder signal error	3.3.32
751 (AL–49)		49		Excessive differential speed conversion result	3.3.33
751 (AL–50)		50		Excessive speed command computed value during the synchronization control of the spindle	3.3.34
751 (AL–51)		51	04	DC link undervoltage	3.1.4
751 (AL–52)		52		ITP signal error I	3.3.35
751 (AL–53)		53		ITP signal error II	3.3.35
751 (AL–54)		54		Overload current alarm	3.3.36
751 (AL–55)		55		Power line state error at spindle or speed range switching	3.3.37
751 (AL–56)		56		Control circuit cooling fan stopped	3.3.38
751 (AL–58)		58	03	PSM main circuit overload	3.1.3
751 (AL–59)		59	02	PSM cooling fan stopped	3.1.2

3 TROUBLESHOOTING AND ACTION

3.1 POWER SUPPLY MODULE

If an alarm occurs, in the STATUS display, the ALM LED lights red, and the two–digit 7–segment display indicates an alarm code.



3.1.1 Alarm Code 01

Meaning

The main circuit power module (IPM) has detected an error. (PSM–5.5, –11)
Overcurrent flows into the input of the main circuit. (PSM–15 to –30)

- Cause and troubleshooting
  (a) IGBT (or IPM) defective
  ⇒ Replace IGBT (or IPM).
  (b) The specification of the AC reactor does not match the PSM in use.
  ⇒ Check the PSM and the specification of the AC reactor.

3.1.2 Alarm Code 02

Meaning

A cooling fan for the control circuit has stopped.

- Cause and troubleshooting
  (a) Cooling fan broken
  Check whether the cooling fan rotates normally.
  ⇒ Replace it.

3.1.3 Alarm Code 03

| Meaning
The temperature of the main circuit heat sink has risen abnormally.

- Cause and troubleshooting
  (a) Cooling fan broken
  Check whether the cooling fan rotates normally.
  ⇒ Replace it.
  (b) Dust accumulation
  ⇒ Clean the cooling system with a vacuum cleaner or the factory air blower.
  (c) Overload
  ⇒ Examine the operating conditions.

3.1.4 Alarm Code 04

| Meaning
In the main circuit, the DC voltage (DC link) has dropped.

- Cause and troubleshooting
  (a) A small power dip has occurred.
  Check the power supply.
  (b) Low input power supply voltage
  Check the power supply specification.
  (c) The main circuit power supply may have been switched off with an emergency stop state released.
  ⇒ Check the sequence.

3.1.5 Alarm Code 05

| Meaning
The main circuit capacitor was not recharged within the specified time.

- Cause and troubleshooting
  (a) Too many SVM and/or SPM units are connected.
  ⇒ Check the specification of the PSM.
  (b) The DC link is short–circuited.
  ⇒ Check the connection.
  (c) The recharge current limiting resistor is defective.
  ⇒ Replace the wiring board.

3.1.6 Alarm Code 06

| Meaning
The input power supply is abnormal (open phase).

- Cause and troubleshooting
  (a) The input power supply has an open phase.
  ⇒ Check the connection.

3.1.7 Alarm Code 07

| Meaning
In the main circuit, the DC voltage at the DC link is abnormally high.

- Cause and troubleshooting

(a) Excessive regenerated power
Regeneration is impossible. The PSM does not have a sufficient capacity.
⇒ Check the specification of the PSM.
(b) The output impedance of the AC power source is too high.
⇒ Check the power source output impedance.
(c) Regeneration circuit failure
Check whether there is an overvoltage at check terminal IR or IS.
⇒ Replace the wiring board or control printed circuit board.
(d) IGBT (or IPM) defective
⇒ Replace the IGBT (or IPM).

3.2 SERVO AMPLIFIER MODULE TROUBLESHOOTING

3.2.1 Abnormal Current Alarms (8, 9, A, b, C, d, and E in the LED display)

(1) Make sure that the following parameters are set to the standard values. If they are not, abnormal current control is performed.

No. 1809	
No. 2004	No. 8X04

No. 1884	
No. 2006	No. 8X06

NO. 1954 (15- A) , 1955 (15- B)	
No. 2011	No. 8X10

No. 1852	
No. 2040	No. 8X40

No. 1853	
No. 2041	No. 8X41

No. 1967	
No. 2074	No. 8X74

No. 1991	
No. 2098	No. 8X98

(1) Remove the power line wires from the amplifier terminals, and release an emergency stop state.
If an abnormal current alarm occurs, go to (4).
If not, go to (3).
(2) Check for insulation between PE and each of the removed power wires U, V, and W. If insulation is perfect, go to (4). If not, disconnect the power wires from the motor connector. Then check for insulation between PE and each of the U, V, and W terminals on the motor.
⇒ If there is a short-circuit between PE and U, V, or W of the motor, replace the motor.
⇒ If insulation is perfect, replace the power wires.
(3) Connect the power wires. Attach the check board (A06B–6071–K290) to connector JX5 to measure the waveform of the actual current (IR and IS) in the servo amplifier module. Accelerate or decelerate the motor, and measure the actual current (IR and IS) of the amplifier.

If an abnormal current alarm occurs right after an emergency stop state is released, go to (5).
Release an emergency stop state, and start the motor.
Check whether the waveform of the actual current (IR and IS) is a normal sine wave.
⇒ If normal, go to (5).
⇒ If not, replace the amplifier.

(5) Check whether there is noise on the actual current (IR and IS) waveform.
⇒ If there is no noise, replace the amplifier.
⇒ If there is noise, use a shielding wire, and ground the shielding, or take other countermeasures as required.

(6) If still there is noise, a probable cause is a defective command cable or a hardware failure in the CNC.

3.2.2 IPM Alarms (8., 9., A., b., C., d., and E in the LED display; note these codes are displayed simultaneously with a period.)

(1) Wait for about 10 minutes. Then release the emergency stop state. If an IPM alarm still occurs, go to (2).
If the cause is IPM overheat, the IPM alarm will not recur. IPM overheat can occur if the ambient temperature is high or the motor is overloaded. Check the operating condition.

(2) Remove the power wires from the amplifier terminals, and release an emergency stop state.
If the IPM alarm does not recur, go to (3).
If the IPM alarm recurs, the probable cause is the operation of the IPM protective function (for overcurrent or power failure). Replace the amplifier and see.
⇒ If the IPM does not recur, go to (3).

(3) Check for insulation between PE and each of the removed power wires U, V, and W. If insulation is perfect, go to (4). If not, disconnect the power wires from the motor connector. Then check for insulation between PE and each of the U, V, and W terminals on the motor.
⇒ If there is a short–circuit between PE and U, V, or W of the motor, replace the motor.
⇒ If insulation is perfect, replace the power wires.

(4) Connect the power wires. Attach the check board (A06B–6071–K290) to connector JX5 to measure the waveform of the actual current (IR and IS) in the servo amplifier module. Accelerate or decelerate the motor, and measure the actual current (IR and IS) of the amplifier.
If an overcurrent alarm occurs right after an emergency stop state is released, go to (5).
Release an emergency stop state, and start the motor.
Check whether the waveform of the actual current (IR and IS) is a normal sine wave.
⇒ If normal, go to (5).
⇒ If not, replace the amplifier.

(5) Check whether there is noise on the actual current (IR and IS) waveform.

⇒ If there is no noise, replace the amplifier.
⇒ If there is noise, use a shielding wire, and ground the shielding, or take other countermeasures as required.

(6) If still there is noise, a probable cause is a defective command cable or a hardware failure in the CNC.

3.2.3 Control Power Supply Undervoltage Alarm (2 in the LED display)

(1) Check the three–phase input voltage to the amplifier.
⇒ If the voltage is below 0.85 times the rating, adjust it to the rated value.
(2) Replace the servo amplifier.

3.2.4 DC link Undervoltage Alarm (5 in the LED display)

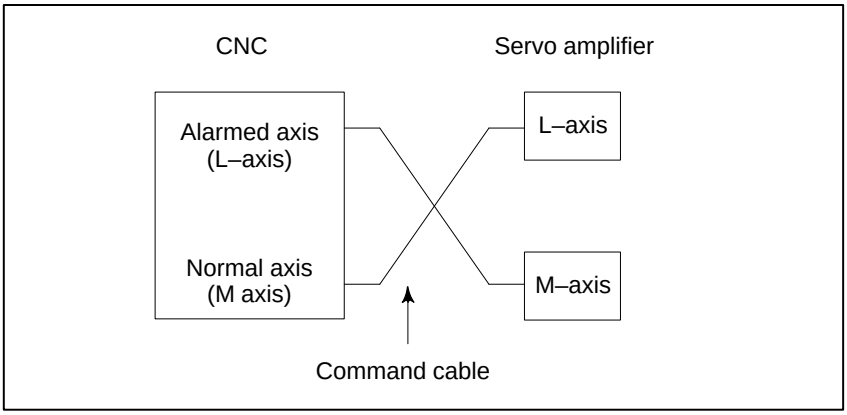
(1) Check the three–phase input voltage to the amplifier.
⇒ If the voltage is below 0.85 times the rating, adjust it to the rated value.
(2) Replace the servo amplifier.

3.2.5 Fan Stopped Alarm (1 in the LED display)

(1) Make sure that the fan is not clogged up.
(2) Check the power line connector of the fan for secure connection.
(3) Replace the fan or servo amplifier as required.

3.2.6 Current Conversion Error Alarm

(1) Exchange the command cable with the cable for the axis on which no alarm has occurred. If the alarm occurs on the same axis, go to (3).
If the alarm occurs on the new axis, go to (2).
(2) The command cable is defective. Replace it.
(3) Exchange the command cables according to the diagram here. When switching the CNC on, do so in an emergency stop state.
If the alarm recurs on the same axis, go to (5).
If the alarm occurs on the other axis, go to (4).



(4) The servo amplifier is defective.
(5) The module for current conversion in the CNC is defective.

3.3 SERVO SOFTWARE

3.3.1 Servo Adjustment Screen

Cause the servo adjustment screen to appear, and check the position error, actual current, and actual speed on it.

Using the keys on the CNC, enter the required value according to the following procedure.

- Series 15–B
  Press the SERVICE key several times to cause the servo setting screen to appear. Then press the [⇩] key, and the servo adjustment screen will appear.
- Series 0–C, 16, 18, 20, or 21
  SYSTEM ⇒ [SYSTEM] ⇒ [▷] ⇒ [SV–TUM]
  If the servo setting screen does not appear, specify the following parameter, then switch the NC off and on again.

Series 16, 18, 20, 21

	b7	b6	b5	b4	b3	b2	b1	b0
3111								SVS

SVS (b0)=1 (to display the servo setting screen)

Series 0–C

	b7	b6	b5	b4	b3	b2	b1	b0
389								SVS

SVS (b0)=0 (to display the servo setting screen)

```
Servo adjustment                  01000 N0000
   X axis

Func bit    00000000      Alarm1     00000000
Loop goin       3000      Alarm2     00000000
Tuning st          0      Alarm3     10000000
Set period         0      Alarm4     00000000
Int. gain        113      Alarm5     00000000
Prop. gain     -1015      Loop gain      3000
Filter             0      Pos error      5555
Veloc gain       100      Current(%)        5
                          Speed(rpm)     1000
```

Servo adjustment screen

The cause and detailed information of servo alarms are indicated with alarms 1 to 5.

3.3.2 Overload Alarm

(1) Make sure that the motor is not vibrating.
⇒ If a motor vibrates, the current flowing in it becomes more than necessary, resulting in an alarm.

(2) Make sure that the power line to the motor is connected correctly.
⇒ If the connection is incorrect, an abnormal current flows in the motor, resulting in an alarm.

(3) Make sure that the following parameters are set correctly.
⇒ An overload alarm is issued based on the result of calculation of these parameters. Be sure to set them to the standard values.

1877	
2062	8X62

Overload protection coefficient (OVC1)

1878	
2063	8X63

Overload protection coefficient (OVC2)

1893	
2065	8X65

Overload protection coefficient (OVCLMT)

(4) Attach the check board (A06B–6071–K290) to connector JX5 to measure the waveform of the actual current (IR and IS) of the servo amplifier module. Start the motor and measure the actual current (IR and IS).
⇒ If the actual current exceeds 1.4 times the rated current, the constant for the acceleration/deceleration duration is too small,or the load on the machine is too heavy for the capacity of the motor.
⇒ If the actual current exceeds 1.4 times the rated current during normal operation, the load on the machine is too heavy for the capacity of the motor.

3.3.3 Feedback Disconnected Alarm

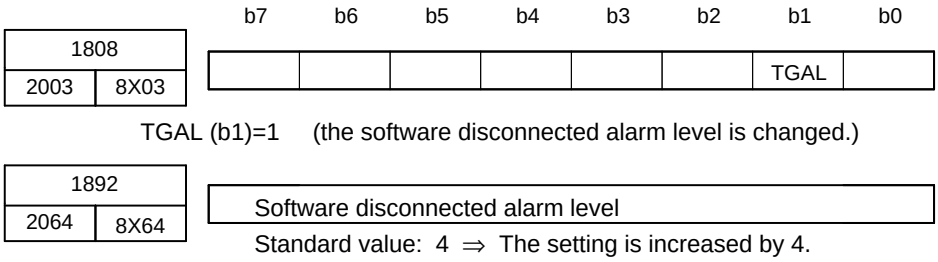
This alarm is detailed with alarms 1 and 2 on the servo adjustment screen (⇒ 3.3.1).

Alarm1		Alarm details	Alarm2	
b7	b2		b7	b4
0	1	CM alarm (α pulse coder)	1	1
0	1	Pulse coder disconnected (soft ware)	0	0
0	1	Separate pulse coder disconnected (hard ware)	1	1

For the CM alarm, go to 3.3.7.
For software disconnected, go to (1).
For hardware disconnected, go to (3).

(1) For a full–closed Series 0–C system, make sure that the phase C signal is not connected to full–closed feedback pins 10 to 13. When the connection is correct, or when the system is not a Series 0–C, go to (2).

(2) If there is a large backlash; or if the number of position feedback pulses divided by the motor one–rotation signal is equal to or less than 640, and a software disconnected alarm is detected when it should not, change the alarm level.



If the alarm is a separate detector hardware disconnected alarm, check the specification and wiring of the separate detector.

3.3.4 Motor Overheat Alarm

Check whether the motor has overheated; **it is dangerous to touch the motor by the hand or any other part of you body.** If the motor is overheated, use it less frequently.

When the motor is cooled enough, check whether an overheat alarm occurs.

⇒ If it occurs, the thermostat is defective.

⇒ If not, use the motor less frequently.

3.3.5 Invalid Servo Parameter Setting Parameters

The following table contains actions to be taken for invalid servo parameter setting alarms.

Find the relevant guideline under ”Decision criterion,” and proceed to the corresponding ”Adjustment item.”

Alarm	Decision criterion	Adjustment item
POA1 overflow	Try resetting POA1 to 0. Parameter: No. 8X47–1859–2047–1047 = 0	Adjustment1
1 pulse suppression level overflow	Disable the pulse suppression function. Function bit: No. 8X03–1808–2003–1003,B4 = 0	Adjustment2
Feed–forward coefficient overflow	Reset the feed–forward coefficient to 0. Parameter: No. 8X68–1961–2068 = 0 No. 8X92–1985–2092 (advance) = 0	Adjustment3
Position gain overflow	Reset the position gain to 0. Parameter: No. 517–1825–1825 = 0	Adjustment4
Number of position pulses overflow	The number of position pulses is greater than 13100 (No. 8X00–1804–2000, bit 0 = 1). Parameter: No. 8X00–1804–2000, B0	Adjustment5
Motor ID No.	Check whether the motor ID No. is correct. Parameter: No. 8X20–1874–2020	Adjustment6
Invalid axis selection parameter setting	Check whether the setting is correct. Series 0–C: No. 269 to 274 Series 15, 16: No. 1023	
Others	Number of position pulses ≦ 0 Number of velocity pulses ≦ 0 Direction of travel = 0 Feed gear numerator ≦ 0, denominator ≦ 0 Numerator>denominator(Serial A, α and semi-closed mode)	

NOTE
The parameter numbers in the table are in the following order:
No. (Series 0–C)–(Series 15)–(Series 16, 18, 20, 21)

Survey

If the adjustments described below cannot eliminate overflow, let us work out the setting procedure individually.

Adjustment 1: POA1 overflow (No. 8X47–1859–2047)

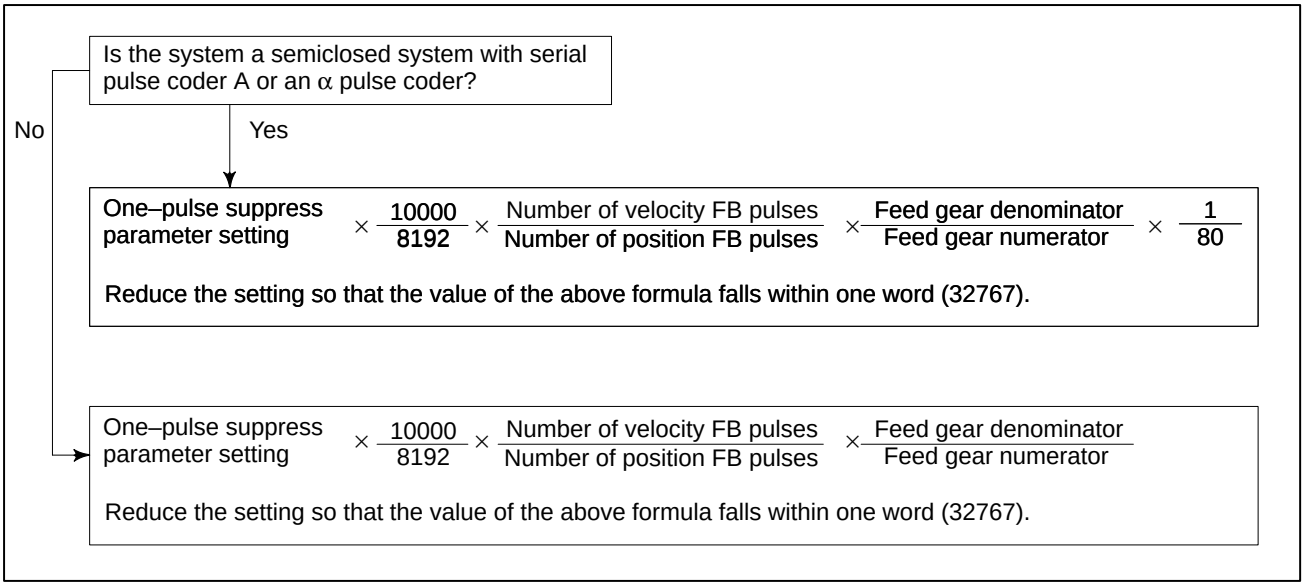
Use the tenfold POA1 setting function.

Note) This function is available for 9060/L. 9070/C, 9046/A, and later versions.

- How to use the tenfold POA1 setting function
  If POA1 is specified as a negative value, the absolute value is internally multiplied by 10. If the value you want to set is a positive value, specify as follows:
  $(-1) \times$ the desired setting/10

Adjustment 2: One–pulse suppress (No. 1992–2099)

Reduce the setting according to the flowchart shown below. If an overflow occurs in the FS0C, stop using it, because the level parameter is fixed at a standard value of 400.



NOTE
Number of velocity FB pulses (No. 8X23–1876–2023)
Number of position FB pulses (No. 8X24–1891–2024)
Feed gear numerator (No. 8X84–1977–2084)
Feed gear denominator (No. 8X85–1978–2085)

Adjustment 3: Feed forward coefficient (No. 8X68–1961–2068, No. 8X92–1985–2092 (advance))
[9060, 9070, Series]

Specify the position gain setting range expansion function.
Function bit: No. 1804–2000–1000, B4=1
(Series 15–B, 16, 18, 20, 21)

- The function also expands the feed–forward coefficient range.
  [9046 Series]
  If a negative number is specified for the feed–forward coefficient, the internal processing assumes a value ten times the absolute number of the specified number.
  If the calculation result obtained during parameter setting exceeds 32767, specify as follows:
  (–1) x calculation result/10

Adjustment 4: Position gain

Use the position gain setting range expansion function.
Setting: No. 8X11–1955, B5 = 1 (Series 0–C, 15–A)
Multiply 8X24–1891 by 8 and re–enter it.
No. 2000–1804, B4 = 1 (Series 15–B, 16, 18, 20, 21)

↓ If an overflow still occurs :

1 Multiply the feed gear (or DMR) value by an integer.
2 Increase the following values by the same integer.

Parameter	Series 0–C	Series 15	Series 16, 18, 20, 21
CMR	No. 100–103	No. 1820	No. 1820
Effective area	500–503	1826,27	1826,27
Limit to a position error during travel	504–507	1828	1828
Limit to a position error at a halt	593–596	1829	1829
Backlash	535–538	1851,52	1851,52
Reference counter	570–573	1896	1821

(Example) The position gain overflows internally under the following conditions:

α pulse coder, Reduction gear ratio: 1/20, Ball screw: 1 mm/rev, Position gain: 30 (with 1μ scale)

In this case, specify the position gain setting range expansion function. For 9046 series, multiply the number of position pulses by 8.

Number of position pulses (No. 8X24–1891) 50 $\xrightarrow{\times 8}$ 400

Adjustment 5: Number of position pulses

Make the changes listed below. Value E must satisfy the following:
Number of current position pulses/E < 13100

Current setting value/E			Current setting value/E		
Series 0–C	Series 15	Series 16	Series 0–C	Series 15	Series 16
No. 8X23 8X24 8X43 8X44 8X54 8X56 8X57	No. 1876 1891 1855 1856 1866 1868 1869	No. 2023 2024 2043 2044 2054 2056 2057	No. 8X53 8X74 8X76	No. 1865 1967 1969	No. 2053 2074 2076

Adjustment 6: Motor ID No.

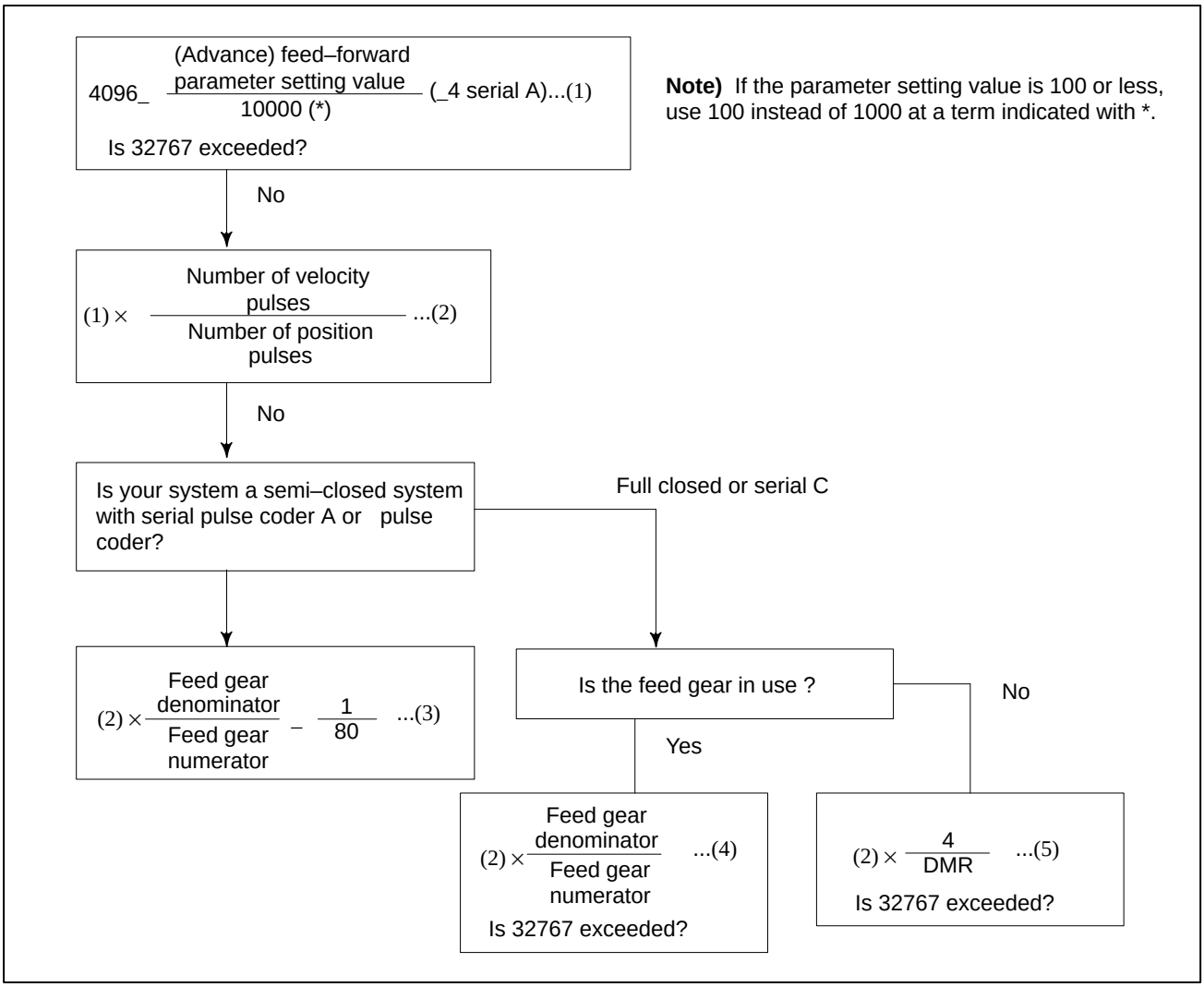
The motor ID numbers valid for each series of models are listed below.

9046 series	15–89 (edition A)
9060 series	15–89 (edition K) 3–89 (edition L)
9070 series	3–89 (edition C)

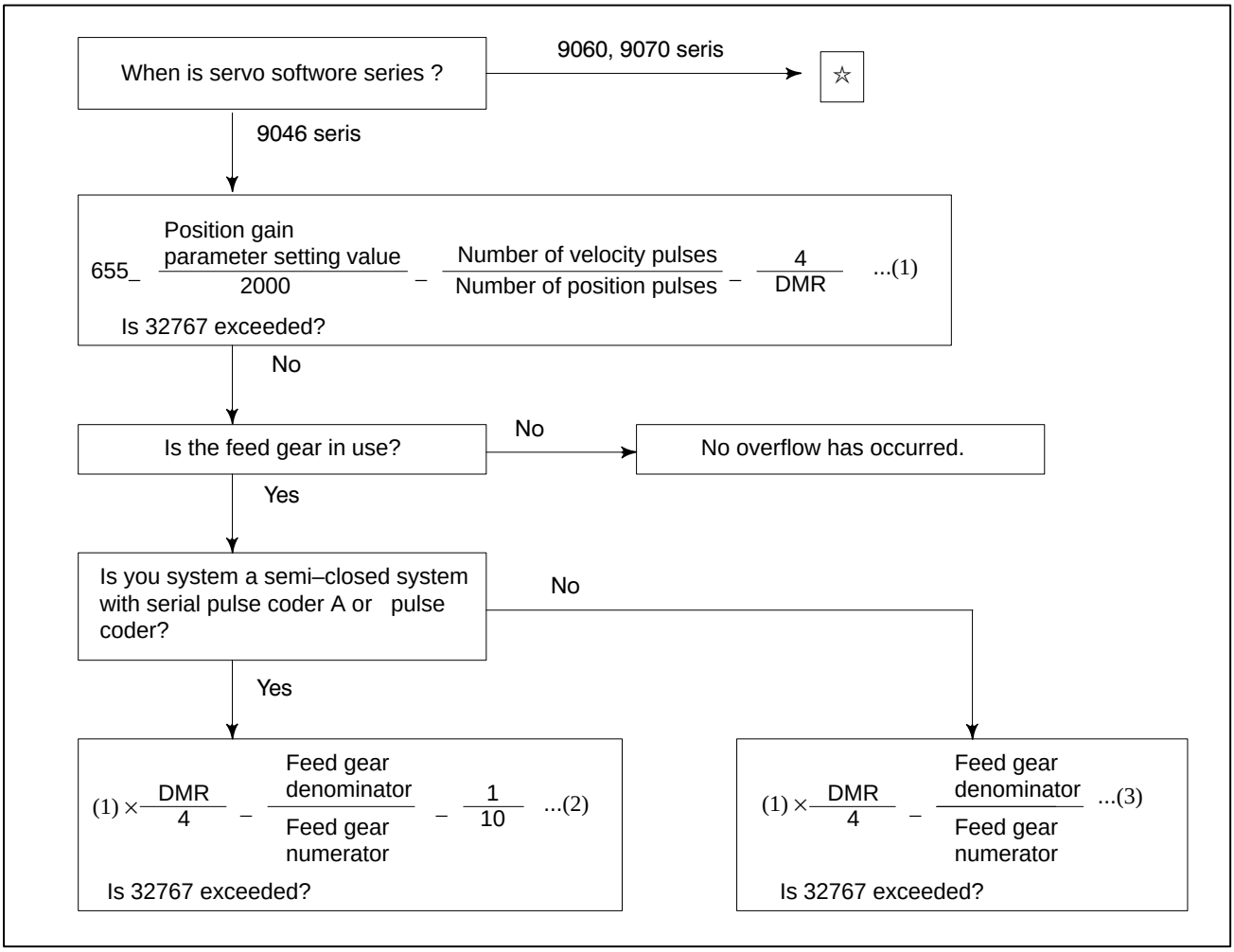
Reference

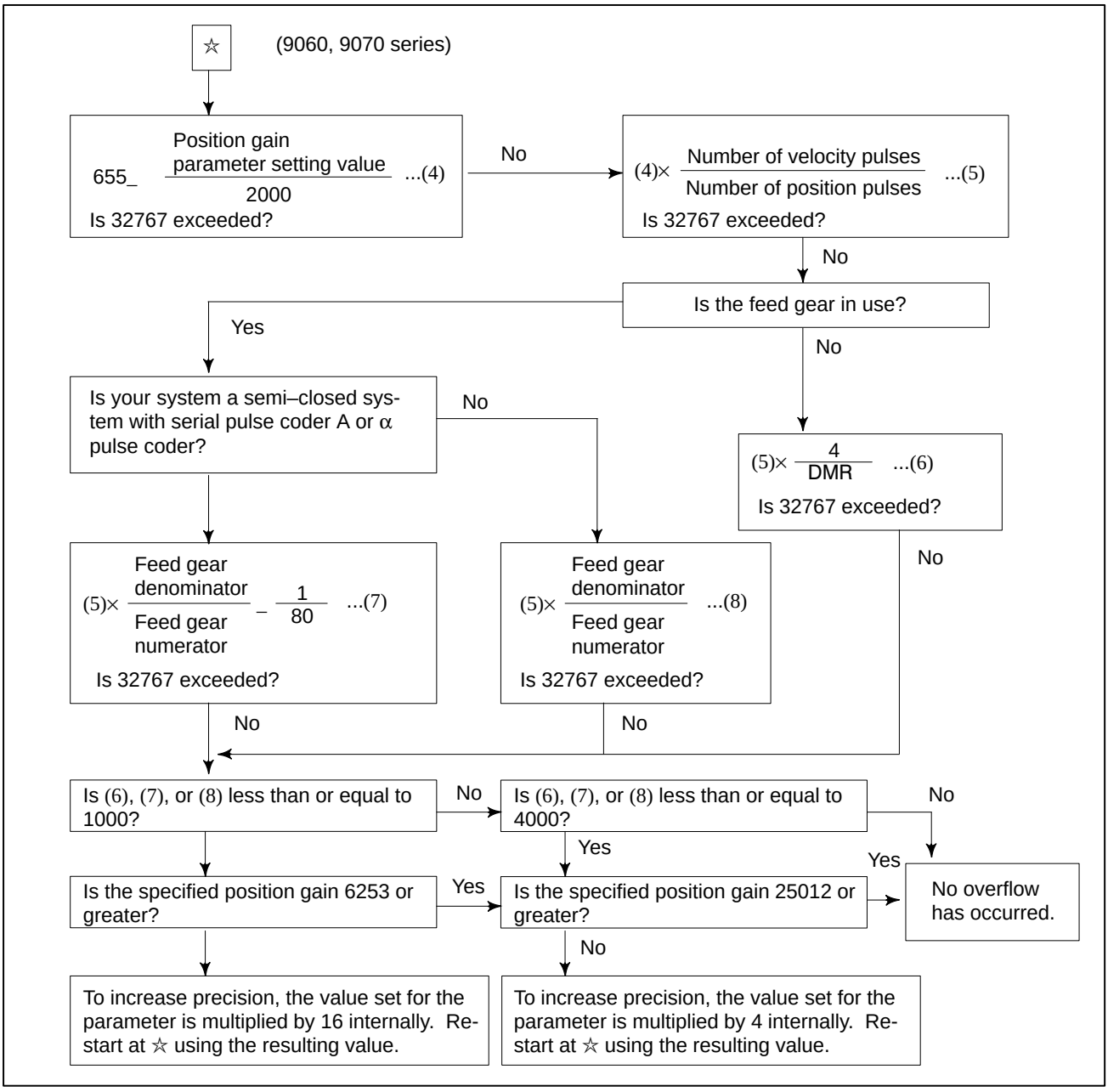
Feed–forward cosfficient overflow check (9060, 9070 series)

If the result of any of the following calculations exceed 32767, an overflow occurs.



Position gain overflow check




☆
(9060, 9070 series)
655_ Position gain parameter setting value / 2000 ...(4)
Is 32767 exceeded?
No
(4)× Number of velocity pulses / Number of position pulses ...(5)
Is 32767 exceeded?
No
Is the feed gear in use?
Yes
No
Is your system a semi–closed system with serial pulse coder A or α pulse coder?
No
(5)× 4 / DMR ...(6)
Is 32767 exceeded?
No
(5)× Feed gear denominator / Feed gear numerator – 1/80 ...(7)
Is 32767 exceeded?
(5)× Feed gear denominator / Feed gear numerator ...(8)
Is 32767 exceeded?
No
No
Is (6), (7), or (8) less than or equal to 1000?
No
Is (6), (7), or (8) less than or equal to 4000?
No
Yes
Yes
Is the specified position gain 6253 or greater?
Yes
Is the specified position gain 25012 or greater?
No overflow has occurred.
No
To increase precision, the value set for the parameter is multiplied by 16 internally. Restart at ☆ using the resulting value.
To increase precision, the value set for the parameter is multiplied by 4 internally. Restart at ☆ using the resulting value.

3.3.6 Pulse Coder Error Alarm

	b7	b6	b5	b4	b3	b2	b1	b0
Alarm 3		CSAL	BLAL	PHAL		BZAL	CKAL	SPH

(⇒ See Section 3.3.1.)

			Whether the alarm occurs in each pulse coder	
			α pulse coder	Serial A
SPH	(b0)	Probably, pulse coder or feedback cable is abnormal, or noise	○	○
CKAL	(b1)	For serial pulse coder A, a clock alarm has occurred. For α pulse coder, the pulse coder or feedback cable is abnormal.	×	○
BZAL	(b2)	The voltage of the pulse coder battery is 0 V. Replace the battery and cause a return to the reference position.	○	○
PHAL	(b4)	Pulse coder or feedback cable is abnormal	×	○
BLAL	(b5)	The voltage of the pulse coder battery is dropping (warning).	○	○
CSAL	(b6)	For serial pulse coder A, a check sum alarm has occurred. For α pulse coder, an LED error has occurred.	×	○
	(b7)	This is not an alarm.		

	b7	b6	b5	b4	b3	b2	b1	b0
Alarm 5				LDAL	PMAL			

(⇒ See Section 3.3.1.)

PMAL	(b3)	The pulse coder or feedback cable is abnormal.	○	×
LDAL	(b4)	The pulse coder LED is abnormal.	○	×

3.3.7 Rotation Speed Data Error Alarm

- Serial pulse coder A

	b7	b6	b5	b4	b3	b2	b1	b0
Alarm 3					RCAL			

(⇒ See Section 3.3.1.)

RCAL	(b3)	A rotation speed data error alarm occurred.

- α pulse coder

	b7	b6	b5	b4	b3	b2	b1	b0
Alarm 1							FBAL	
Alarm 2	ALDF							
Alarm 3					CMAL			

(⇒ See Section 3.3.1.)

CMAL (b3) A pulse count error occurred. If the CNC software does not correspond to α Series, this bit is not used for a mode other than the APC MODE. If a built–in pulse coder hardware discontinued alarm (bit 1 of alarm 1 = 1 and bit 7 of alarm 2 = 1) occurs in a system with an α pulse coder, a pulse count error has occurred.

3.3.8 Pulse Coder Communication Error Alarm

	b7	b6	b5	b4	b3	b2	b1	b0
Alarm 4	DTER	CRC	STB					

(⇒ See Section 3.3.1.)

STB (b5) A communication error occurred from the pulse coder

The pulse coder or feedback cable is abnormal, or the servo module is defective.

CRC (b6) A communication error occurred from the pulse coder

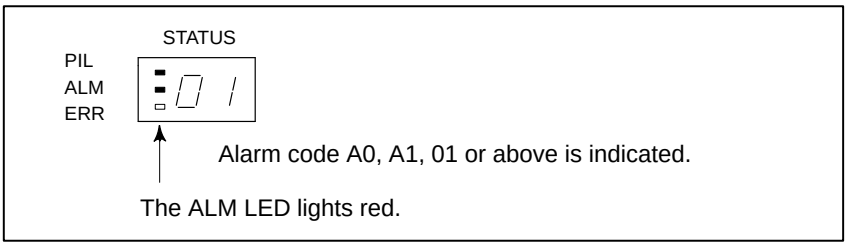
The pulse coder or feedback cable is abnormal, or the servo module is defective.

DTER (b7) The pulse coder does not communicate.

The pulse coder or feedback cable is abnormal.

3.4 SPINDLE AMPLIFIER MODULE

If an alarm occurs in the spindle amplifier module, the ALM LED lights red in the STATUS display, and the two–digit 7–segment LEDs indicate the alarm code.



3.4.1 Alarm A0, A1

(1) Meaning

The control program is not running.

(2) Cause and corrective action

(a) ROM installed improperly or yet to be installed
Make sure that the ROM is attached properly to the socket and there is no imperfect contact due to a broken or bent pin.
⇒ Install the ROM properly.

(b) Incorrect ROM installed
The series number of the software is printed on the ROM package and is displayed at power–on. See Section 4.3.3 of Part I.
⇒ Replace it with the correct ROM.

(c) Printed–circuit board defective
⇒ Replace it with a normal printed circuit board.

3.4.2 Alarm AL–01

(1) Meaning

The temperature inside the motor is higher than the rating.

(2) Cause and corrective action

(a) Over loaded operation
Check the cutting conditions, the state of the cutting tool, and the load meter reading during cutting.
⇒ Examine the cutting conditions and the tool.

(b) The cooling fan inside the motor is defective.
Check whether the cooling fan rotates smoothly.
⇒ Replace the cooling fan.

(c) The motor cooling system is dirty.
⇒ Clean the cooling system with a vacuum cleaner or the factory air blower.

(d) Motor overheat signal wire discontinued or loosely connected
Check the motor overheat signal wire for secure connection.
⇒ Connect the signal wire properly.

(e) Invalid detector parameter setting
Check the detector and its parameters.
⇒ Set the parameters that match the detector correctly.

(f) Motor or thermostat defective
⇒ Replace the motor.

3.4.3 Alarm AL–02

(1) Meaning

The actual motor speed is largely deviated from the commanded speed.

(2) Cause and corrective action

(a) Over loaded operation or too heavy load
Check the load meter to see if the load is too heavy.
⇒ Examine the cutting conditions and the tool again.

(b) Abnormal power line connect
Check the power line for disconnection or poor contact.
⇒ Connect the power line properly.

(c) Incorrect acceleration/deceleration duration parameter setting
Check the parameter setting and the actual acceleration / deceleration duration.

FS0	FS15	FS16/18, PM–D/F	Description
6582	3082	4082	Acceleration/deceleration duration setting

⇒ Set the parameter with a value somewhat greater (margin) than the required acceleration/deceleration duration.

(d) Incorrect speed detector parameter setting
Check the parameter setting and the speed detector.

FS0	FS15	FS16/18, PM–D/F	Description
6511 #2, 1, 0	3011 #2, 1, 0	4011 #2, 1, 0	Speed detector setting

⇒ Set the parameter correctly according to the speed detector.

(e) IGBT module/IPM defective
Replace the IGBT module/IPM.

(f) Speed feedback signal faulty
Check the speed feedback signal level.
⇒ Check the speed detector. Also check the signal cable for continuity.

3.4.4 Alarm AL–03

(1) Meaning

The fuse at the DC link has blown.

(2) Cause and corrective action

(a) Overcurrent flowed in the main circuit.
Check the IGBT module/IPM. If the IGBT module/IPM is defective, it allows overcurrent to flow in the main circuit.
⇒ Replace the fuse and/or IGBT module/IPM.

3.4.5 Alarm AL–07

(1) Meaning

The actual motor speed exceeded 115% of the maximum allowable motor speed (standard parameter setting).

Cause and corrective action

(a) Incorrect speed detector parameter setting

Check the parameter setting and the speed detector.

FS0	FS15	FS16/18, PM–D/F	Description
6511 #2, 1, 0	3011 #2, 1, 0	4011 #2, 1, 0	Speed detector setting

⇒ Set the parameter correctly according to the speed detector.

3.4.6 Alarm AL–09

(1) Meaning

The temperature of the main circuit heat sink has risen abnormally.

(2) Cause and corrective action

(a) Cooling fan defective
Check whether the cooling fan rotates smoothly.
⇒ Replace the cooling fan.

(b) Overloaded operation
Check the load meter to see if the load is too heavy.
⇒ Examine the cutting conditions again.

(c) Cooling fan clogged
⇒ Clean the cooling fan with a vacuum cleaner or the factory air blower.

3.4.7 Alarm AL–12

(1) Meaning

Excessive current flowed in the DC section (DC link) of the main circuit.
The main circuit power module (IPM) detected an error.

(2) Cause and corrective action

(a) Short–circuit between the amplifier output terminals or inside the motor
Check the power line connection for a short–circuit.
⇒ Make a correct connection. Replace the motor if it is defective.

(b) IGBT (or IPM) defective
Replace the IGBT (or IPM).

(c) Printed–circuit board defective
⇒ Replace the printed circuit board.

(d) Incorrect model–specific parameters.
Check the model–specific parameter settings with the model – specific parameter list.
⇒ Set the parameters with the values that match the motor used.

3.4.8 Alarm AL–13

(1) Meaning

The memory inside the CPU is abnormal. It is checked when power is switched on.

(2) Cause and corrective action

(a) Printed–circuit board defective
⇒ Replace the printed circuit board.

3.4.9 Alarm AL–15

(1) Meaning

A sequence of switching operations was incorrect during speed range switching control or spindle switching control.

Cause and corrective action

(a) Switching unit (magnetic contactor for power line switching) defective

Check the operation of the switching unit.

⇒ Replace the switching unit.

(b) Loose contact of the magnetic contactor state signal (auxiliary contact signal)

Make sure that the magnetic contactor state signal is switched properly.

⇒ Connect the magnetic contactor correctly.

(c) Improper sequence

⇒ Adjust the switching unit for the correct sequence.

3.4.10 Alarm AL–16

(1) Meaning

The memory (RAM) is abnormal. It is checked when power is switched on.

(2) Cause and corrective action

(a) Printed–circuit board defective

⇒ Replace the printed–circuit board.

3.4.11 Alarm AL–19

(1) Meaning

The offset voltage for the phase U current detection circuit is too high. This check is made when power is switched on.

(2) Cause and corrective action

(a) Loose contact of the printed–circuit board

Check that the printed–circuit board is connected to the power circuit securely.

⇒ Connect the printed–circuit board securely.

(b) Phase U current detection circuit defective.

⇒ Replace the printed–circuit board.

(c) A/D converter defective

⇒ Replace the printed–circuit board.

3.4.12 Alarm AL–20

(1) Meaning

The offset voltage for the phase V current detection circuit is too high. This check is made when power is switched on.

(2) Cause and corrective action

(a) Loose contact of the printed–circuit board

Check that the printed–circuit board is connected to the power circuit securely.

⇒ Connect the printed–circuit board securely.

(b) Phase V current detection circuit defective.

⇒ Replace the printed–circuit board.

3.4.13 Alarm AL–24

(1) Meaning

The serial communication data between the CNC and spindle amplifier is abnormal. (This alarm occurs also when the CNC power is switched off.)

(2) Cause and corrective action

(a) The CNC power is off.
⇒ Switch on the CNC power.

(b) Serial communication cable defective
Check the connection of the cable. Also check for a broken wire.
⇒ Connect the cable correctly. If any wire in the cable is broken, replace it.

(c) Serial communication LSI chip defective
⇒ Replace the LSI chip or the printed–circuit board with the LSI on it.

(d) I/O link adapter defective (if used)
⇒ Replace the I/O link adapter.

3.4.14 Alarm AL–25

(1) Meaning

Serial communication between the CNC and the spindle amplifier has stopped.

(2) Cause and corrective action

(a) Serial communication cable defective
Check the connection of the cable. Also check for a broken wire.
⇒ Connect the cable correctly. If any wire in the cable is broken, replace it.

(b) Serial communication LSI chip defective
⇒ Replace the printed–circuit board.

3.4.15 Alarm AL–26

(1) Meaning

The Cs contouring control speed detection signal (detector on the motor side) is abnormal.

(2) Cause and corrective action

(a) Feedback signal cable defective
Check the connection of the cable. Also check for a broken wire.
⇒ Connect the cable correctly. If any wire in the cable is broken, replace it.

(b) Feedback signal level insufficient
Check the feedback signal level with an oscilloscope.
⇒ Adjust so that the feedback signal level becomes the rated value.

(c) Feedback signal cable not shielded properly (circuit malfunction due to noise)
Check whether the cable is shielded properly.
⇒ Shield it correctly.

(d) Detection circuit defective
⇒ Replace the printed–circuit board.
(e) Incorrect parameter setting
Check the parameter setting for use of the Cs contouring control detector.

FS0	FS15	FS16/18, PM–D/F	Description
6511#5	3011#5	4011#5	Parameter set to specify use of the Cs contouring control detector

⇒ Set the parameter correctly according to the detector used.

3.4.16 Alarm AL–27

(1) Meaning

Position coder signal error

Cause and corrective action

(a) Feedback signal cable defective
Check the connection of the cable. Also check for a broken wire.
⇒ Connect the cable correctly. If any wire in the cable is broken, replace it.
(b) Position coder defective
Check the position coder signal.
⇒ Replace the position coder.
(c) Feedback signal level insufficient (for built–in sensor or the high–resolution magnetic pulse coder)
Check the feedback signal level with an oscilloscope.
⇒ Adjust so that the feedback signal level becomes the rated value.
(d) Feedback signal cable not shielded properly (circuit malfunction due to noise)
Check whether the cable is shielded properly.
⇒ Shield it correctly.
(e) Detection circuit defective
⇒ Replace the printed–circuit board.
(f) Incorrect parameter setting
Check the parameter set to specify use of the Cs contouring control detector.

FS0	FS15	FS16/18, PM–D/F	Description
6501#2	3001#2	4001#2	Parameter set to specify use of the Cs contouring control detector

⇒ Set the parameter correctly according to the detector used.

3.4.17 Alarm AL–28

(1) Meaning

The Cs contouring control speed detection signal (detector on the spindle side) is abnormal.

(2) Cause and corrective action

(a) Feedback signal cable defective

Check the connection of the cable. Also check for a broken wire.

⇒ Connect the cable correctly. If any wire in the cable is broken, replace it

(b) Feedback signal level insufficient

Check the feedback signal level with an oscilloscope.

⇒ Adjust so that the feedback signal level becomes the rated value.

(c) Feedback signal cable not shielded properly (circuit malfunction due to noise)

Check whether the cable is shielded properly.

⇒ Shield it correctly.

(d) Detection circuit defective

⇒ Replace the printed–circuit board.

(e) Incorrect parameter setting

Check the parameter set to specify use of the Cs contouring control detector.

FS0	FS15	FS16/18, PM–D/F	Description
6501#2	3001#2	4001#2	Parameter set to specify use of the Cs contouring control detector

⇒ Set the parameter correctly.

3.4.18 Alarm AL–29

(1) Meaning

Excessive load (at least 90% of the maximum output as set initially by a parameter) was applied continuously for a certain period (30 seconds as set initially by a parameter).

(2) Cause and corrective action

(a) Overloaded operation, or too heavy load

Check the load meter to see if the load is too heavy.

⇒ Examine the cutting conditions and the tool again.

3.4.19 Alarm AL–31

(1) Meaning

The motor cannot rotate at a specified speed. It rotates at very low speed, or even stops.

(2) Cause and corrective action

(a) Motor locked

Check whether the motor cannot accelerate because it is physically locked.

⇒ Remove the cause.

(b) Motor speed feedback cable defective

Check the connection of the cable. Also check for a broken wire.

⇒ Connect the cable correctly. If any wire in the cable is broken, replace it

(c) Motor speed feedback signal abnormal
Check the speed feedback signal with an oscilloscope.
⇒ Adjust so that the feedback signal level becomes the rated value.

(d) Incorrect power line wire connection
Check the connection of the power line wires (for phase order, etc.)
⇒ Connect the power line correctly.

3.4.20 Alarm AL–32

(1) Meaning

The memory in the serial communication LSI chip is abnormal. It is checked when power is turned on.

(2) Cause and corrective action

(a) LSI chip defective
⇒ Replace the printed–circuit board.

3.4.21 Alarm AL–34

(1) Meaning

The parameter setting is invalid.

(2) Cause and corrective action

(a) Incorrect parameter setting
Check the parameter setting
⇒ Set the parameter with a valid value.

3.4.22 Alarm AL–35

(1) Meaning

The value set in the gear ratio data parameter is greater than the limit allowed in the internal processing.

(2) Cause and corrective action

(a) Incorrect gear ratio parameter setting
Check whether the specified gear ratio is too high.

FS0	FS15	FS16/18, PM–D/F	Description
6556 to 6559	3056 to 3059	4056 to 4059	Spindle–to–motor gear ratio

⇒ Use the appropriate value.

3.4.23 Alarm AL–36

(1) Meaning

The error counter overflowed.

(2) Cause and corrective action

(a) Incorrect parameter setting
Check whether the values set in the gear ratio and position gain parameters are too large.

FS0	FS15	FS16/18, PM–D/F	Description
6556 to 6559	3056 to 3059	4056 to 4059	Spindle–to–motor gear ratio data
6560 to 6563	3060 to 3063	4060 to 4063	Position gain during orientation
6565 to 6568	3065 to 3068	4065 to 4068	Position gain during servo mode/synchronization control of the spindle
6569 to 6572	3069 to 3072	4069 to 4072	Position gain during Cs contouring control

⇒ Use the appropriate values.

3.4.24 Alarm AL–37

(1) Meaning

When an emergency stop signal was entered, the motor did not decelerate, rather accelerate, or the motor was kept excited even after acceleration/deceleration duration (10 seconds as set initially by a parameter).

(2) Cause and corrective action

(a) Incorrect speed detector parameter setting

Check the parameter setting and the speed detector.

FS0	FS15	FS16/18, PM–D/F	Description
6511 #2, 1, 0	3011 #2, 1, 0	4011 #2, 1, 0	Speed detector setting

⇒ Set the parameter to the value that matches the speed detector used.

(b) Incorrect acceleration/deceleration duration parameter setting

Check the parameter setting with the required deceleration time.

FS0	FS15	FS16/18, PM–D/F	Description
6582	3082	4082	Acceleration/deceleration duration setting

⇒ Set the parameter with a value somewhat greater (margin) than the required deceleration duration.

3.4.25 Alarm AL–39

(1) Meaning

The Cs contouring control one–rotation signal has not been detected correctly.

(2) Cause and corrective action

(a) Feedback signal cable not shielded properly

Check whether there is noise on the feedback signal.
Also check whether the cable is shielded properly.

⇒ Shield it correctly.

(b) Feedback signal level insufficient

Check the feedback signal level with an oscilloscope.

⇒ Adjust so that the feedback signal level becomes the rated value.

(c) Incorrect parameter setting
Check the parameter setting for use of the Cs contouring control detector.

FS0	FS15	FS16/18, PM–D/F	Description
6503 #7, 6, 4	3003 #7, 6, 4	4003 #7, 6, 4	Parameter set to specify use of the Cs contouring control detector

⇒ Set the parameter correctly according to the detector used.

(d) Detection circuit defective
⇒ Replace the printed–circuit board.

3.4.26 Alarm AL–40

(1) Meaning

The Cs contouring control one–rotation signal is not generated.

(2) Cause and corrective action

(a) Feedback signal cable defective
Check the connection of the cable.
⇒ Connect the cable correctly.

(b) Feedback signal level insufficient
Check the offset of the Cs contouring control one–rotation signal with an oscilloscope.
⇒ Adjust the offset of the Cs contouring control one–rotation signal.

(c) Detection circuit defective
⇒ Replace the printed–circuit board.

3.4.27 Alarm AL–41

(1) Meaning

The position coder one–rotation signal was not detected correctly.

(2) Cause and corrective action

(a) Feedback signal cable not shielded properly
Check whether there is noise on the feedback signal. Also check whether the cable is shielded properly.
⇒ Shield it correctly.

(b) Position coder defective
Check the position coder signal.
⇒ Replace the position coder.

(c) Feedback signal level insufficient (for built–in sensor)
Check the feedback signal level with an oscilloscope.
⇒ Adjust so that the feedback signal level becomes the rated value.

(d) Incorrect parameter setting
Check the parameter setting and the Cs contouring control detector.

FS0	FS15	FS16/18, PM–D/F	Description
6503 #7, 6, 4	3003 #7, 6, 4	4003 #7, 6, 4	Position coder signal setting

⇒ Set the parameter correctly according to the detector used.

(e) Detection circuit defective

⇒ Replace the printed–circuit board.

3.4.28 Alarm AL–42

(1) Meaning

The position coder one–rotation signal was not generated.

(2)Cause and corrective action

(a) Feedback signal cable defective
Check the connection of the cable.
⇒ Connect the cable correctly.

(b) Position coder defective
Check the position coder signal.
⇒ Replace the position coder.

(c) Feedback signal level insufficient (for built–in sensor)
Check the feedback signal level with an oscilloscope.
⇒ Adjust the feedback signal level.

(d) Detection circuit defective
⇒ Replace the printed–circuit board.

3.4.29 Alarm AL–43

(1) Meaning

The position coder signal used for the main spindle during the differential speed mode was disconnected.

(2) Cause and corrective action

(a) Feedback signal cable defective
Check the connection of the cable. Also check for a broken wire.
⇒ Connect the cable correctly. If any wire in the cable is broken, replace the cable.

(b) Feedback signal cable not shielded properly
Check whether the cable is shielded properly.
⇒ Shield it correctly.

(c) Position coder defective
Check the position coder signal.
⇒ Replace the position coder.

(d) Incorrect parameter setting
Check the parameter setting for the differential speed mode functions.

FS0	FS15	FS16/18, PM–D/F	Description
6500#5	3000#5	4000#5	Setting to specify use of the differential speed mode functions

⇒ Set the parameter correctly according to the function used.

(e) Detection circuit defective
⇒ Replace the printed–circuit board.

3.4.30 Alarm AL–44

(1) Meaning

An A/D converter error occurred.

(2) Cause and corrective action

(a) A/D converter defective.

⇒ Replace the printed–circuit board.

3.4.31 Alarm AL–46

(1) Meaning

The position coder one–rotation signal was not detected correctly during thread cutting.

(2) Cause and corrective action

(a) Feedback signal cable not shielded properly

Check whether there is noise on the feedback signal. Also check whether the cable is shielded properly.

⇒ Shield it correctly.

(b) Position coder defective

Check the position coder signal.

⇒ Replace the position coder.

(c) Feedback signal level insufficient (for built–in sensor)

Check the feedback signal level with an oscilloscope.

⇒ Adjust so that the feedback signal level becomes the rated value.

(d) Incorrect parameter setting

Check the parameter setting and the Cs contouring control detector.

FS0	FS15	FS16/18, PM–D/F	Description
6503 #7, 6, 4	3003 #7, 6, 4	4003 #7, 6, 4	Position coder signal setting

⇒ Set the parameter correctly according to the detector used.

(e) Detection circuit defective

⇒ Replace the printed–circuit board.

3.4.32 Alarm AL–47

(1) Meaning

A pulse count for the position coder signal is abnormal.

(2) Cause and corrective action

(a) Feedback signal cable not shielded properly

Check whether there is noise on the feedback signal. Also check whether the cable is shielded properly.

⇒ Shield it correctly.

(b) Position coder defective

Check the position coder signal.

⇒ Replace the position coder.

(c) Feedback signal level insufficient (for built–in sensor)

Check the feedback signal level with an oscilloscope.

⇒ Adjust so that the feedback signal level becomes the rated value.

(d) Incorrect parameter setting
Check the parameter setting and the detector.

FS0	FS15	FS16/18, PM–D/F	Description
6503 #7, 6, 4	3003 #7, 6, 4	4003 #7, 6, 4	Position coder signal setting

⇒ Set the parameter correctly according to the detector used.

(e) Detection circuit defective
⇒ Replace the printed–circuit board.

3.4.33 Alarm AL–49

(1) Meaning
During differential speed mode, the sub–spindle motor speed converted from the main spindle motor speed exceeded the limit.

(2) Cause and corrective action
(a) The differential speed is calculated by multiplying the main spindle motor speed by the gear ratio.
Make sure that the calculation result does not exceed the maximum motor speed.
⇒ Do not exceed the maximum motor speed.

3.4.34 Alarm AL–50

(1) Meaning
During the synchronization control of the spindle, the calculation result for the speed command exceeded the limit.

(2) Cause and corrective action
(a) The motor speed command is calculated by multiplying the spindle speed command by the gear ratio.
Make sure that the calculation result does not exceed the maximum motor speed.
⇒ Do not exceed the maximum motor speed.

3.4.35 Alarm AL–53, AL–53

(1) Meaning
The ITP signal (sync signal for sync with the CNC) stopped.

(2) Cause and corrective action
(a) CNC error
⇒ Check the operation of the CNC.
(b) Serial communication LSI chip defective
⇒ Replace the printed–circuit board.

3.4.36 Alarm AL–54

(1) Meaning
It was detected that a high current flowed in the motor for a long period.

(2) Cause and corrective action
(a) Overloaded operation, or frequent acceleration/deceleration
Check the load meter to see if the load is too heavy. Also check that acceleration/deceleration was repeated frequently.

⇒ Examine the cutting conditions again.

3.4.37 Alarm AL–55

(1) Meaning

During spindle switching control or speed range switching control, there was a conflict between the switch request signal (SPSL or RSL) and the power line state confirmation signal (MCFN, MFNHG, or RCH, RCHHG).

(2) Cause and corrective action

(a) Switching unit (magnetic contactor for power line switching) defective

Check the operation of the switching unit.

⇒ Replace the switching unit (magnetic contactor for power line switching).

(b) Loose contact of the magnetic contactor state signal (auxiliary contact signal)

Make sure that the magnetic contactor state signal is switched properly.

=> Connect the magnetic contactor correctly.

(c) Incorrect parameter setting

Make sure that the parameters for the power line state signals related to spindle switch control and output switch control are set correctly.

FS0	FS15	FS16/18, PM–D/F	Description
6514#2	3014#2	4014#2	Parameter to specify the power line state signal for spindle switching control
6514#3	3014#3	4014#3	Parameter to specify the power line state signal for speed range switching control

Set the parameter correctly according to the system used.

3.4.38 Alarm AL–56

(1) Meaning

The cooling fan for the control circuit stopped.

(2) Cause and corrective action

(a) Cooling fan defective

Check whether the cooling fan rotates smoothly.

⇒ Replace the cooling fan.

4 HOW TO REPLACE THE FUSES AND PRINTED CIRCUIT BOARDS

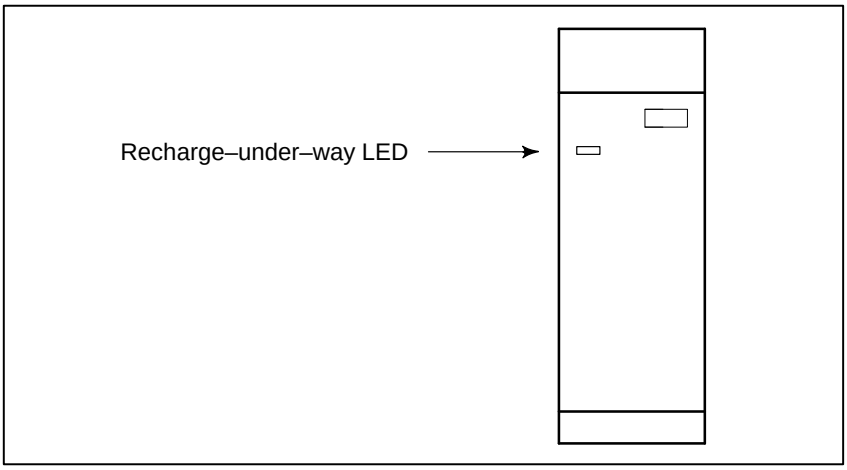
Before replacing fuses or printed–circuit boards, make sure that the recharge–under–way LED (red) is off.
To replace the fuses or printed–circuit board in each module, remove its case according to the procedure described below.

4.1 HOW TO REMOVE THE CASES

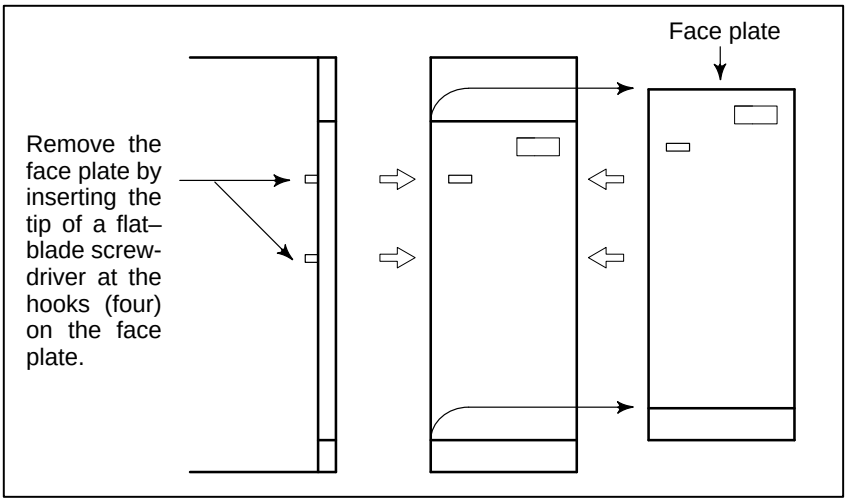
4.1.1 60/90 mm Width Modules

Target modules: PSM–5.5 to –11
SVM
SPM–2.2 to –11

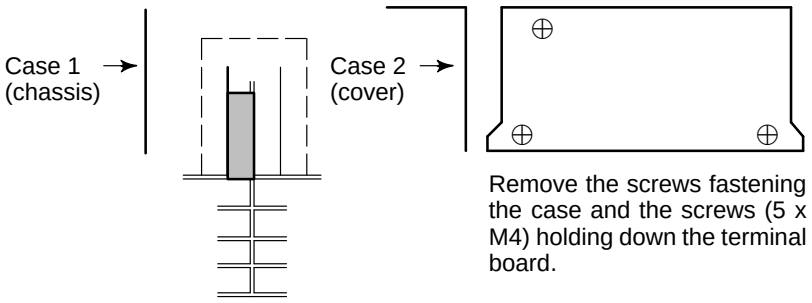
(1) Make sure that the recharge–under–way LED (red) is off.



(2) Remove the face plate.

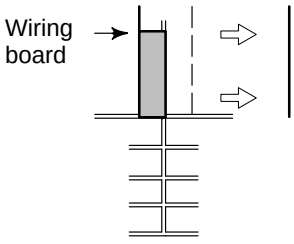


(3) Remove the cases

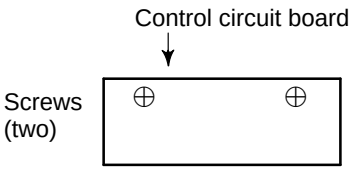


Remove the screws fastening the case and the screws (5 x M4) holding down the terminal board.

(4) Remove the printed–circuit board.

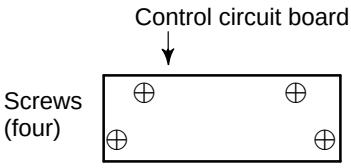


- Cases for the SVM



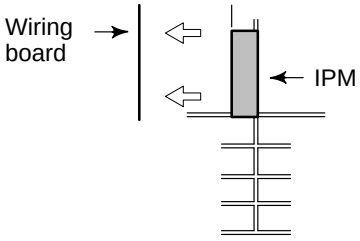
Remove the screws (2 x M3) fastening the printed–circuit board.

- Cases for the PSM and SPM



Remove the screws (4 x M3) fastening the printed–circuit board.

(5) Remove the IPM.



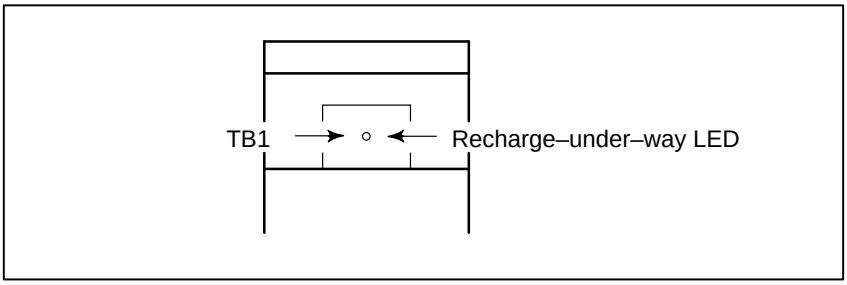
1 Remove the screws (5 x M5) fastening the IPM. Then remove the wiring board.
2 Remove the IPM.

Note) There is a snubber capacitor between the IPM and wiring board. When re–assembling, do not forget to mount it.

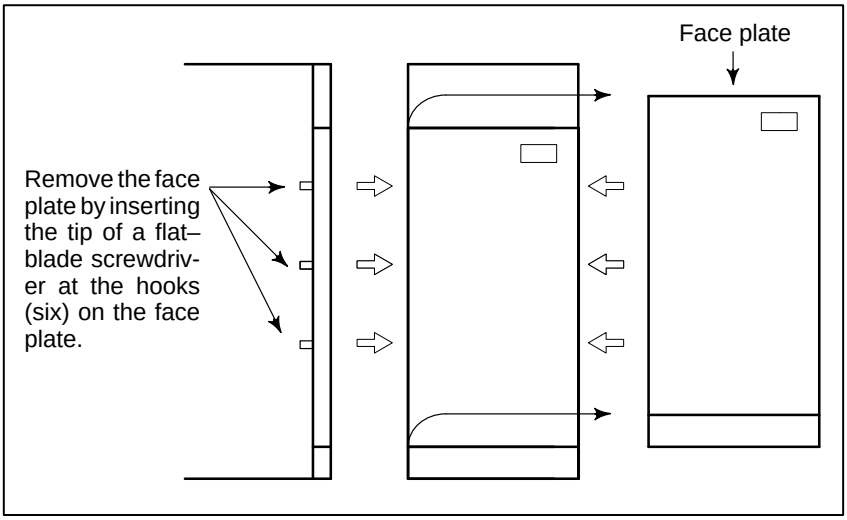
4.1.2 150 mm Width Module

Target modules: PSM–15 to –30
SPM–15 to –30

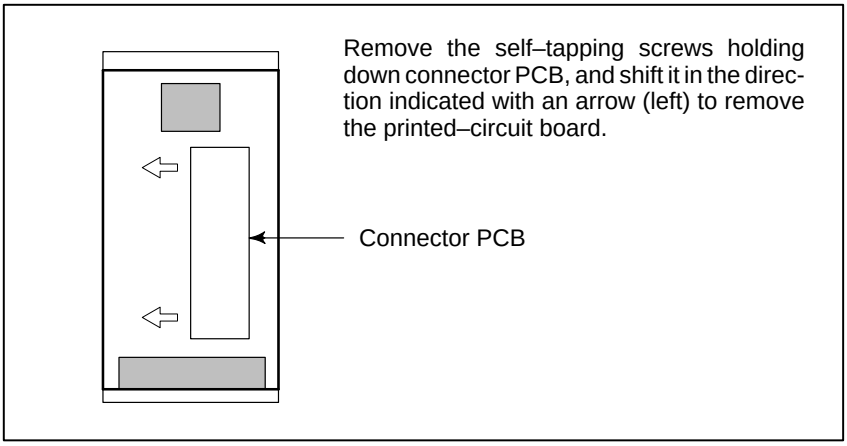
(1) Make sure that the recharge–under–way LED (red) is off.
The recharge–under–way LED (red) is at the center of terminal board TB1. Open the cover at the top of the module, and check the LED.



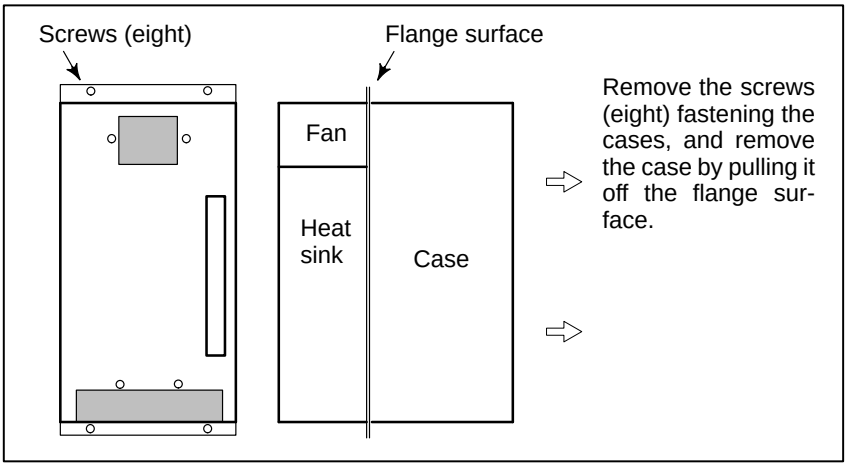
(2) Remove the face plate.



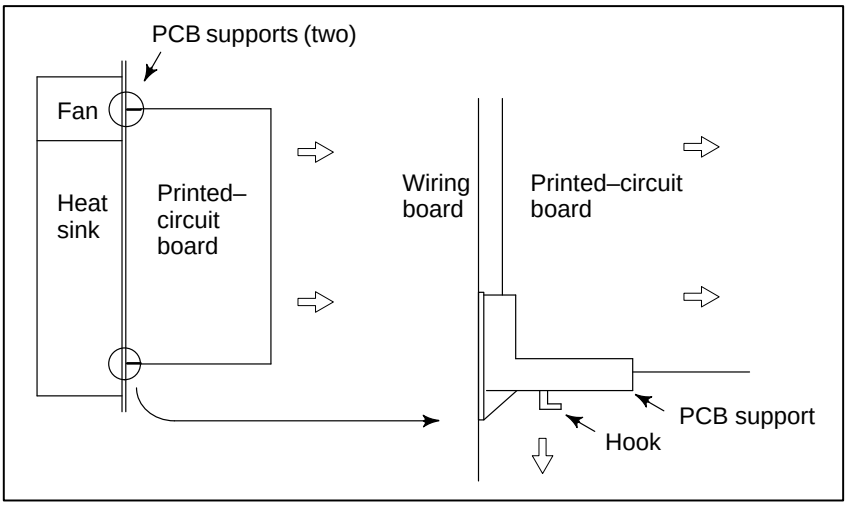
(3) Remove connector PCB.



(4) Remove the case

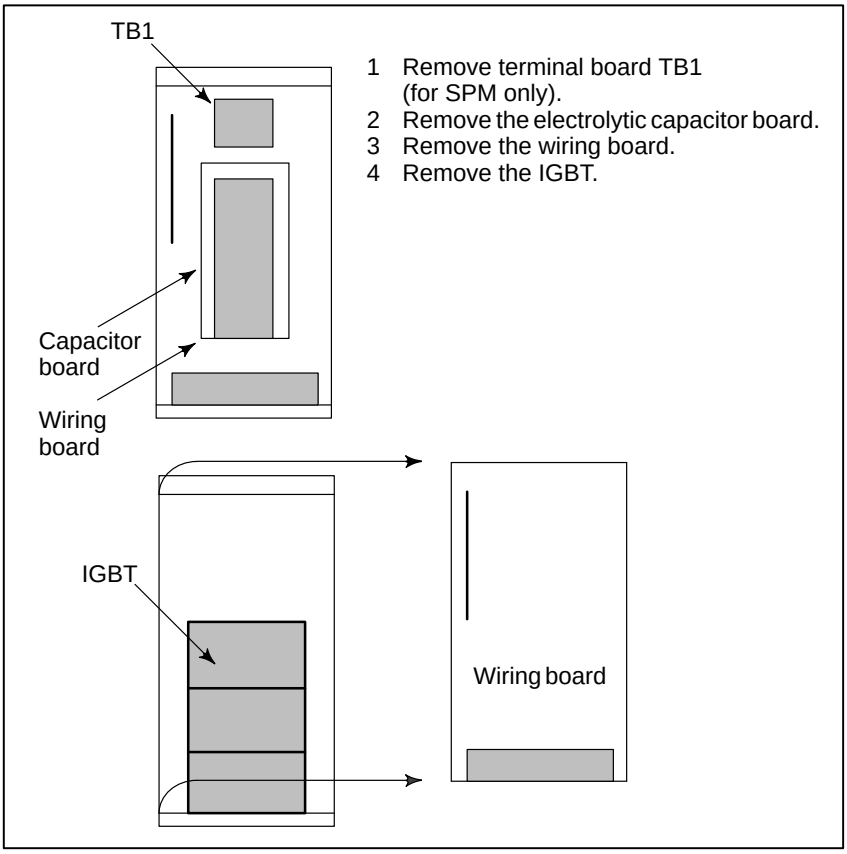


(5) Remove the printed–circuit board.



While spreading the PCB support hooks, pull the printed–circuit board off the flange surface to remove it.

(6) Remove the IGBT.



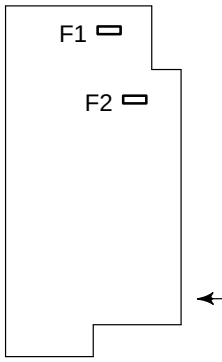
4.2 POWER SUPPLY MODULE

4.2.1 Replacing Fuses

(1) PSM–5.5 and –11

Remove the cases and printed–circuit board according to Section 4.1.1.

Replace the fuses according to the figure below.



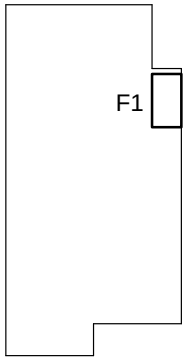
Fuse designation	Specification	Remark
F1	A60L–0001–0359	250V F5.0A DAITO HM50
F2	A60L–0001–0175#2.0A	250V F2.0A DAITO HM20

Fig. 4.2.1 (1) Locations of the Fuses

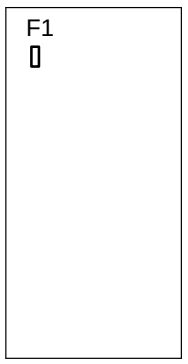
(2) PSM–15 to –30

Remove the cases and printed–circuit board according to Section 4.1.2.

Replace the fuses as shown below.



Fuse designation	Specification	Remark
F1	A60L–0001–0245#GP75	250V F7.5A DAITO GP75



Fuse designation	Specification	Remark
F1	A60L–0001–0175#0.5A	250V F0.5A DAITO HM05

Fig. 4.2.1 (2) Locations of the Fuses

4.2.2 Replacing The Printed–circuit Board

Remove the printed–circuit board according to Section 4.1.

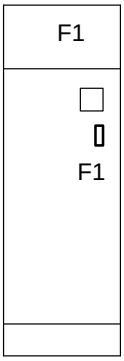
1 Printed–circuit board version No.
2 Setting of DIP switch RSW (or jumper pins S1 and S2)

After checking the following, replace the printed–circuit board:

4.3 SERVO AMPLIFIER MODULE

4.3.1 Replacing The Fuses

Replace the fuses according to the figure below.



Fuse designation	Specification	Remark
F1	A60L–0001–0290#LM50C	50V F5.0A DAITO LM50C

4.3.2 Replacing The Printed–circuit Board

Remove the printed–circuit board according to Section 4.1.

1 Printed–circuit board version No.
2 Setting of jumper pins S1 and S2 (for SVM1 and SVM2 only; SVM3 has no jumper pin to set)

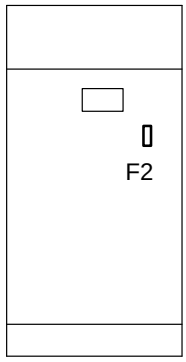
After checking the following, replace the printed–circuit board:

4.4 SPINDLE AMPLIFIER MODULE

4.4.1 Replacing The Fuse

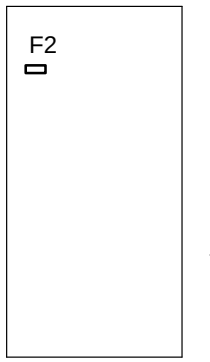
SPM–15 to –30

Replace the fuse according to the figure below.



Fuse designation	Specification	Remark
F2	A60L–0001–0290#LM50C	50V F5.0A DAITO LM50C5

To replace fuse F2 on the wiring board, first remove the cases and printed–circuit board according to the procedure in Section 4.1.



Fuse designation	Specification	Remark
F2	A60L–0001–0175#0.5A	250V F0. 5A DAITO HM50

← Wiring board (A20B–1005–057X)

Fig. 4.4.1 (1) Location of the Fuse

4.4.2 Replacing The Printed–circuit Board

Remove the printed–circuit board according to the procedure in Section 4.1.

1 Printed–circuit board version number
2 ROM series and edition
3 Whether there is a detection module
4 Setting of DIP switches S1 to S7

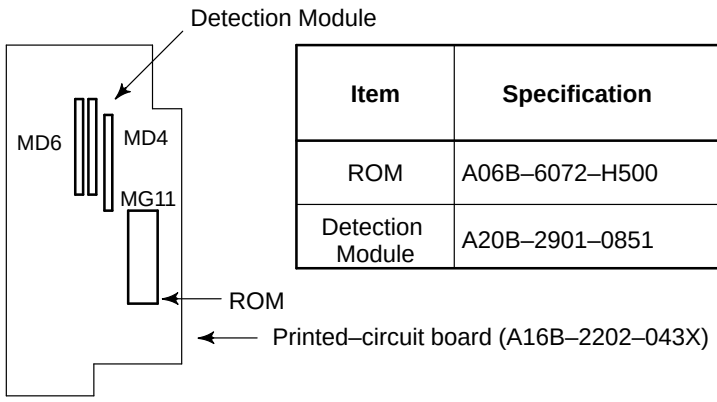
After checking the following, replace the printed–circuit board:

4.4.3 Replacing The ROM And Detection Modules

Remove the printed–circuit board according to the procedure in Section 4.1.

Check the locations of the ROM and detection module with the figure below.

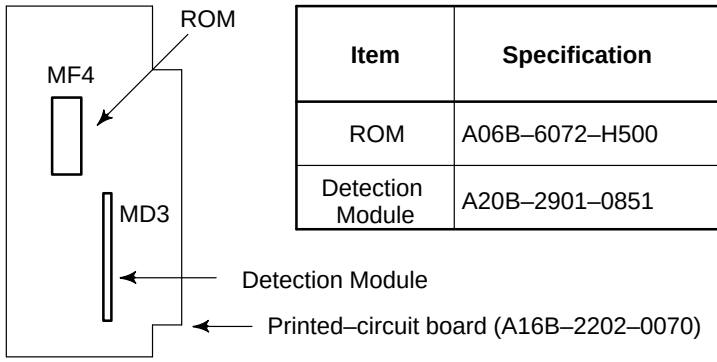
(1) SPM–2.2 to –11 type I and SPM–2.2 to –11 type II



Item	Specification	Remark
ROM	A06B–6072–H500	9D00 Series
Detection Module	A20B–2901–0851	

Fig. 4.4.3 (1) Locations of the ROM and Detection Module

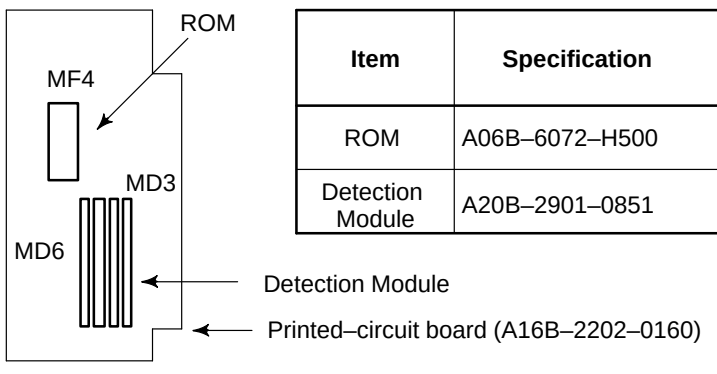
(2) SPM–15 to –30 type I



Item	Specification	Remark
ROM	A06B–6072–H500	9D00 Series
Detection Module	A20B–2901–0851	

Fig. 4.4.3 (2) Locations of the ROM and Detection Module

(3) SPM–15 to –30 type II and SPM–11 to –30 type III



Item	Specification	Remark
ROM	A06B–6072–H500	9D00 Series
Detection Module	A20B–2901–0851	

Fig. 4.4.3 (3) Locations of the ROM and Detection Module

III MOTOR MAINTENANCE

1 AC SERVO MOTOR MAINTENANCE

Generally, AC servo motors have no parts that wear off or that must be replaced periodically, unlike DC servo motors, which have brushes that must be replaced periodically.
However, you should perform periodic maintenance for servo motors so as to keep their initial performance as long as possible and to prevent breakdowns. AC servo motors have precision detectors. Their incorrect use or damage caused during transportation or assembling can result in breakdowns or accidents. We recommend that you inspect the servo motors periodically according to the descriptions given below.

1.1 RECEIVING AND KEEPING AC SERVO MOTORS

When you receive an AC servo motor, make sure that:

- The motor is exactly the one you ordered, in terms of model, shaft, and detector specifications.
- No damage has been caused on the motor.
- The shaft can be rotated by the hand normally.
- The brake works normally.
- There is no loose bolt or play.

Because FANUC inspects servo motors strictly before shipment, you do not, in principle, have to inspect them when you receive them. However, you should check the specifications (wiring, current, and voltage) of the motor and detector carefully, as required.
The servo motors should be kept indoors as a rule. The storage temperature range is –20 to +60 C. Do not place or install AC servo motors in the place where:

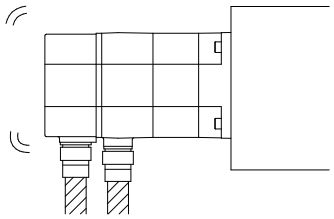
- It is extremely humid and dew is prone to form,
- There is a steep change in temperature,
- There is constant vibration, which may cause damage to the shaft bearings, or
- There is lots of dust and trash.

1.2 DAILY INSPECTION OF AC SERVO MOTORS

Before starting operation, or periodically (once a week or month), you should inspect the AC servo motors in terms of the following:

(1) Vibration and noise
Check the motor for abnormal vibration (by the hand) and noise (by the ear) when the motor is:
  – Not rotating
  – Rotating at low speed
  – Accelerating or decelerating

If you find anything unusual, contact your FANUC service staff.

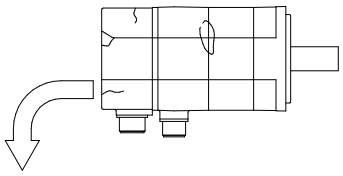


(2) Damage on the outside

Check the motor cover (red plastic) for crevices and the motor surface (black coating) for scratches and cracks.

If you find a crevice in the motor cover, you should replace it as quickly as possible. For how to replace, see the description about the pulse coder in Section 3.1.4. If you are not sure about replacement, contact you FANUC service staff.

If there is a scratch or crack on the motor surface, the user should repair it by himself as required. If coating has come off, dry the portion of interest (or the entire surface) and coat it with paint for machines such as urethane paint.



Replace a motor cover with a crevice
or crack as quickly as possible.

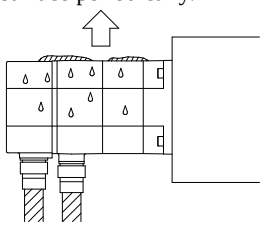
(3) Stains and smudges

Check the motor surface and bolt holes for oil or cutting fluid.

Wipe off oil and cutting fluid on the motor surface periodically. Oil or cutting fluid can damage the coating by chemical reaction, possibly leading to a failure

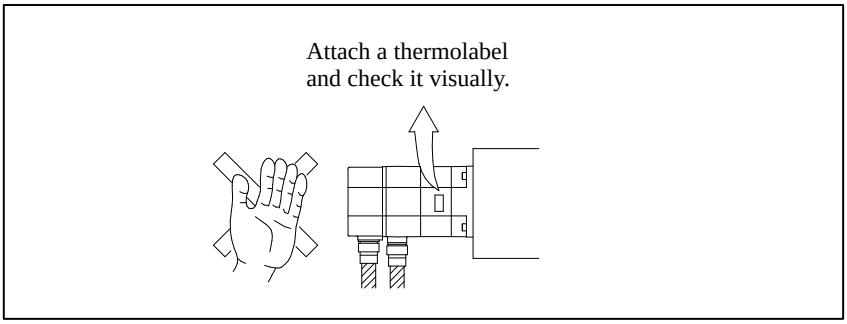
Also check how such a liquid leaks onto the motor, and repair if needed.

Wipe off oil and cutting fluid on the
motor surface periodically.



(4) Overheating
Check to see if the motor is too hot during normal operation.
Attach a thermolabel on the motor surface and check it visually to see if the motor becomes too hot during normal operation.

NOTE
Temperature on the motor surface can exceed 80 C under some conditions. Never touch it by the hand.

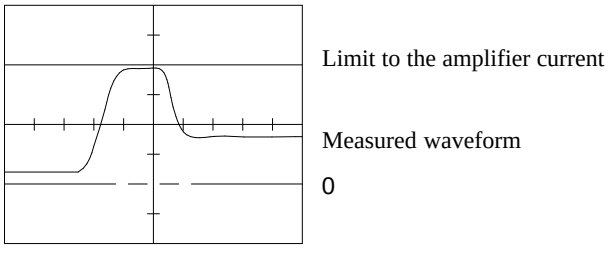


1.3 PERIODIC INSPECTION OF AC SERVO MOTORS

We recommend that you inspect the AC servo motors for the following items at least once a year.

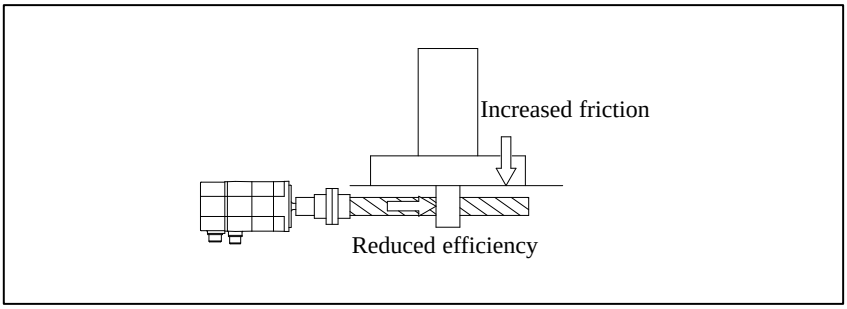
(1) Observation of torque command (TCMD) and speed command (VCMD) waveforms
Observe normal voltage waveforms with an oscilloscope, and keep notes of them. During periodic inspection, check the current waveforms with the records.
The waveforms vary according to the operating conditions such as load and cutting speed. Note that you should make comparisons under the same condition (for example, during fast traverse to the reference position or low–speed cutting).
See descriptions on the check boards in Section 6 for detailed inspection procedures.

(2) Diagnosis by waveforms
Check the measured waveforms to see whether:
1 The peak current is within the limit to the current in the amplifier.
The limit to the amplifier current is listed below.



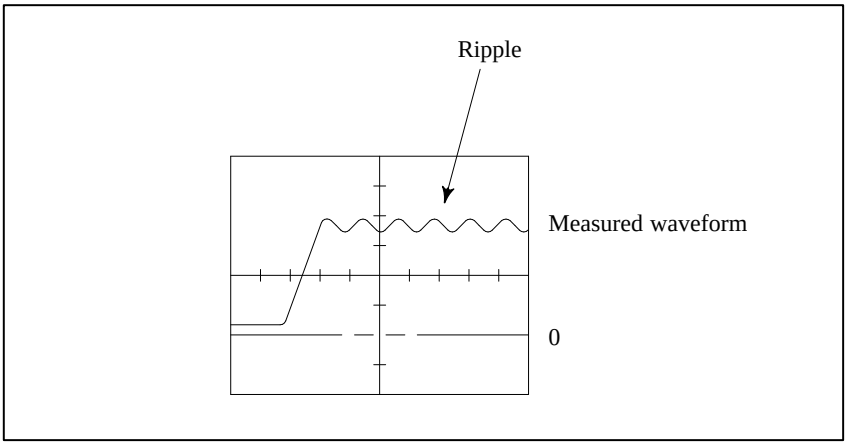
⇒ The motor used to accelerate/decelerate with the amplifier current within the limit (the acceleration/ deceleration torque used to be sufficient), but something is wrong now. If this is the case, the probable causes are:

– The load conditions in the machine have changed because of changed friction or reduced machine efficiency after long period of use.
– Motor failure

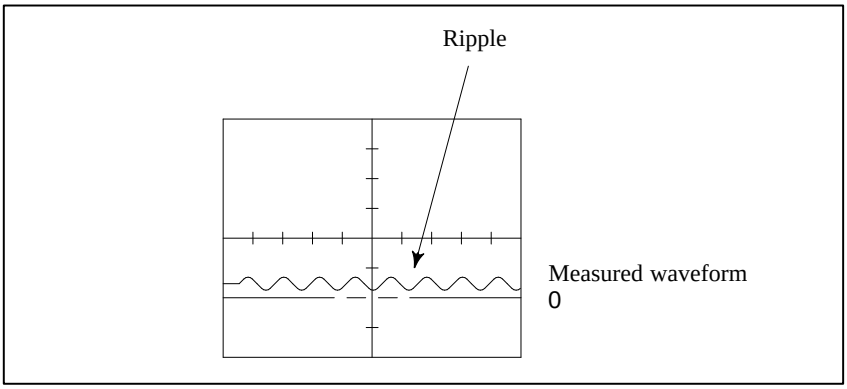


α0.5/3000, α1/3000, α2/2000, α2/3000	12Ap
αC3/2000, αC6/2000, αC12/2000	20Ap
α3/3000, α6/2000, α12/2000, α22/1500, αC22/1500, αM3/3000, αL3/3000	40Ap
α6/3000, α12/3000, α22/2000, α30/1200, αM6/3000,αM9/3000, αL6/3000, αL9/3000	80Ap
α22/3000, α30/2000, α30/3000, α40/2000, αL25/3000, αL50/2000	130Ap

2 The waveform has ripple during constant–speed feeding.



3 The current waveform has ripple or jumps when the motor is not rotating.



If you find anything unusual in relation to the above items, contact your FANUC service staff.

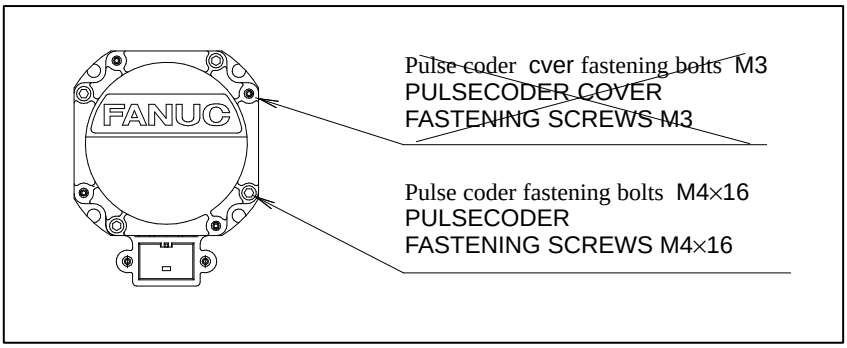
1.4 REPLACING THE PULSE CODER

This section explains how to replace the pulse coder and motor cover, assuming that the pulse coder has broken down and is in need of immediate replacement.

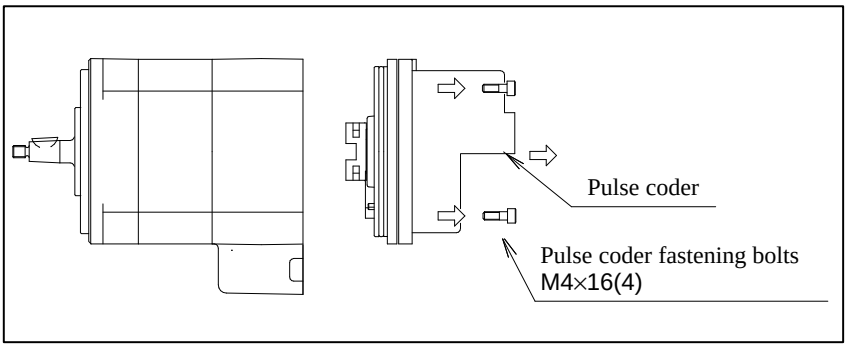
When replacing the pulse coder and motor cover, be careful not to give a shock to the pulse coder or motor, because they are precision devices prone to a breakdown. Also keep them from dust and cutting chips.

(1) Model α1/2

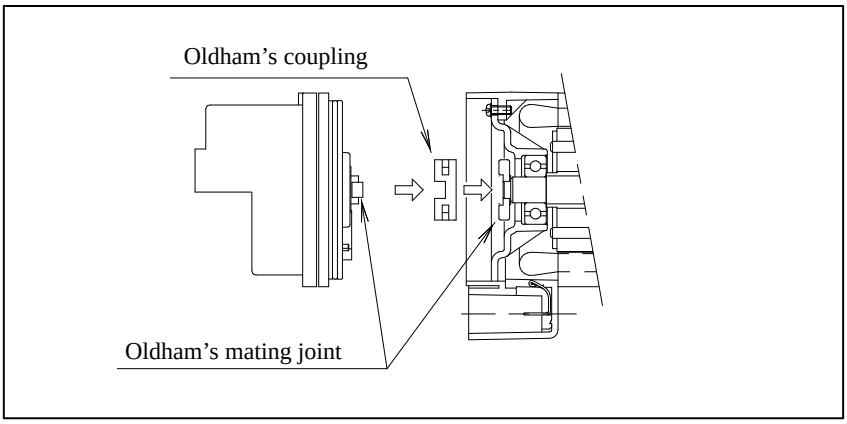
1 Remove the four M4 hexagonal socket head bolts that fasten the pulse coder. Do not loosen the M3 bolts near each M4 bolt. (Removing the M3 bolts will impair airtightness.)



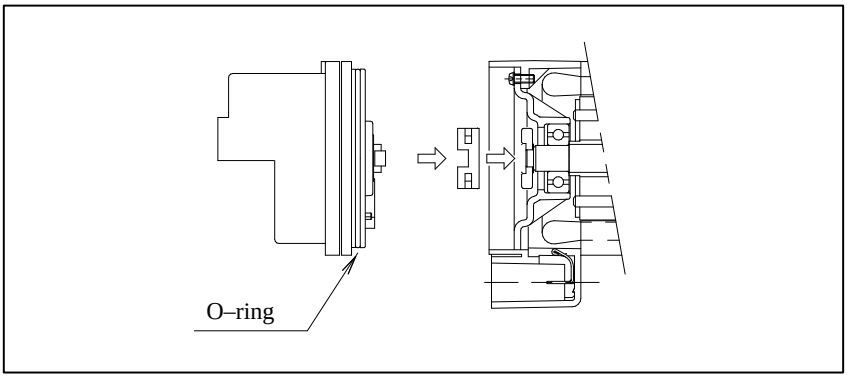
2 Remove the pulse coder and Oldham’s coupling



3 Mount a new pulse coder on the motor. Place the Oldham's coupling in phase with the mating sections and puts the gears in engagement.

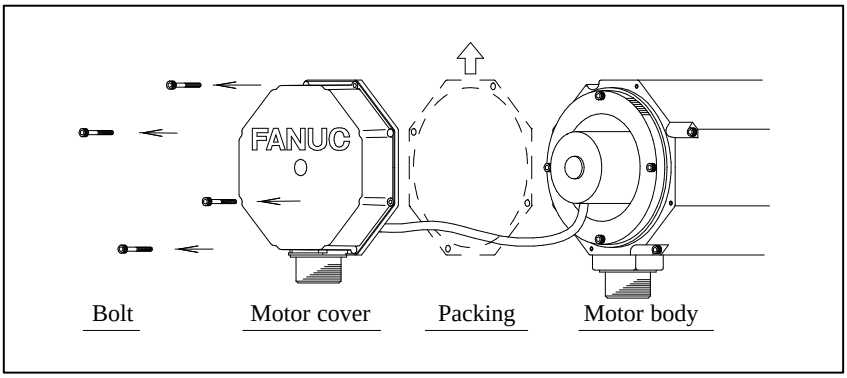


4 Attach the four M4 bolts. When tightening them, be careful not to catch the pulse coder O–ring under them.



(2) Models α3 to 40, αC, αM, and αL

1 Loosen the bolts fastening the red motor cover to remove the cover.



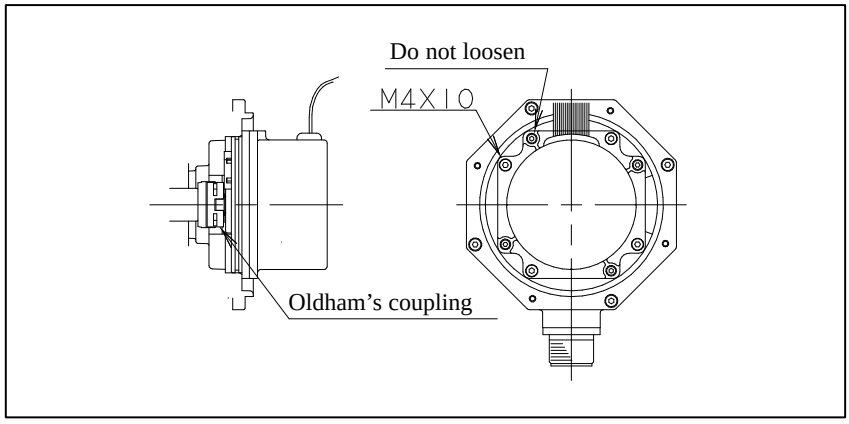
2 Disconnect the cannon connector for the pulse coder from the red motor cover.

a) Remove the M3 bolts fastening the connector.
b) Shift the rubber packing, remove the C–ring fastening the insulator on the back of the connector (on the wiring side), and separate the connector housing from the terminal section.
c) Remove the connector terminal section from the motor cover.

d) Put the connector housing back on the pulse coder you removed, and fasten it with the C–ring.

3 Cut off the thermal switch leads at places as close to the base of the crimp terminals as possible.

4 Remove the four M4 hexagonal socket head bolts fastening the pulse coder. Do not loosen the M3 bolts near each M4 bolt. (Removing the M3 bolts will impair airtightness.)



5 Remove the pulse coder and Oldham's coupling.

6 Mount a new pulse coder on the motor. The pulse coder may be mounted in any orientation. However, you should place it in the same orientation as the pulse coder that was removed, for easier cabling. Place the Oldham's coupling in phase with the mating sections, and put the gears in engagement.

7 Fasten the pulse coder with four M4 bolts.

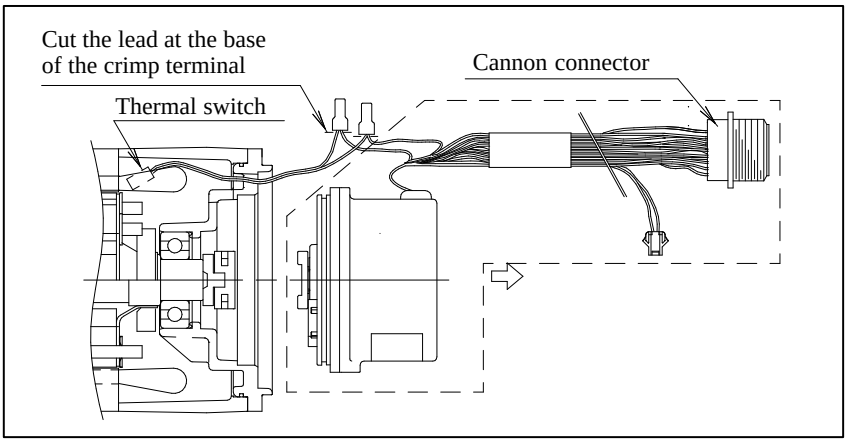
8 Replace the packing on the mounting surface of the motor cover with a new one. If the packing is reused, it does not assure sufficient sealing. Whenever you replace the motor cover, replace the packing too.

9 Mount the connector on the cover by reversing the steps of procedure 2.

The connector insulation (insulating material around the terminal) has a key to prevent incorrect insertion. When mounting the connector, align the key to the notch.

10 Connect the thermal switch leads. Strip the tips of the leads on the motor side to about 1 cm, and connect them to the terminals on the pulse coder. Crimp terminals should preferably be used. In emergency, however, the leads may be twined and insulated using vinyl tape.

11 Mount the motor cover. Be careful not caught the pulse coder leads under the motor cover. Fasten the motor cover with bolts.



1.5 REPLACEMENT PARTS SPECIFICATIONS

Listed below are the maintenance arrangement numbers.

(1) Oil seal

Motor model	Oil seal specification (manufacturer's specifications are enclosed in parentheses)
α0.5	A98L–0001–0135/C0514E0 (AC0514E0 type SC) *1
α1/2	A98L–0001–0135/C0616E0 (AC0616E0 type SC) *1
α3/6 αC3/6 αM3/6/9 αL3/6/9	A98L–0004–0249/A1188R *2
α12/22/30/40 αC12/22 αL25/50	A98L–0004–0249/A1189R *2
α65/100/150	A98L–0001–0135/B3220E0 (AB3220E0 type SB) *1

*1 Standard products from NOK K.K.

*2 Special oil seal for FANUC motors (product of NOK)

(2) Pulse coder arrangement specification

1 Arrangement specification for pulse coders with no motor cover

[Model α1–2]

A290–0371–T□□□

- 575 :αA64
- 577 :αI64
- 569 :Serial A

[Model α3–40, αC, αM, αL]

A860–0360–T201 :αA64
A860–0365–T101 :αI64

A860–0362–T201 :αA8
A860–0367–T101 :αI8

A860–0346–T241 :Serial A

2 Arrangement specification for pulse coders with a motor cover

[Model α3/6, αC3/6, αM, αL3/6/9]

A290–0121–T□□□

- 575 :αA64
- 577 :αI64
- 584 :Serial A
- 578 :αA8
- 580 :αI8

[Model α12–40, αC12/22, αL25/50]

A290–0141–T□□□

- 575 :αA64
- 577 :αI64
- 584 :Serial A
- 578 :αA8
- 580 :αI8

3 Motor cover arrangement specification

A290–05□□–X053

- 01 : Model α12, 22, 30, 40
α C12, 22
α L25, L50
- 11 : Model α 3, 6
α C3, C6
α M3, M6, M9
α L3, L6, L9

2 SPINDLE MOTOR MAINTENANCE

2.1 PREVENTIVE MAINTENANCE

To maintain the original performance and reliability of the spindle motor for a long time, it is necessary to inspect them as described below.

Inspection item	Symptom	Action	
Noise or abnormal vibration	There is unusual noise or vibration.	Check the following and take necessary actions: ● Base and installation ● Centering accuracy of directly coupled section ● Abnormal sound from motor shaft bearings (See ”Motor shaft bearing” below.) ● Vibration of or noise from the reducer or belts ● Amplifier failure ● Fan motor failure (See ”Fan motor” below.)	
Cooling air path	The cooling air path is clogged with dust.	Clean	
Motor surface	Cutting fluid on the motor surface.	Clean. If there is lot of fluid on the motor surface, protect the motor by installing a shelter over it.	
Fan motor	Not rotating.	If the fan motor can be rotated by the hand,	Replace the fan motor.
		If the fan motor cannot be rotated by the hand,	Remove foreign materials, if any. Adjust its mounting position by loosening the bolts and tightening them again. If the motor still cannot be rotated by the hand, replace it.
	Unusual sound	Remove foreign materials, if any. Adjust its mounting position by loosening the bolts and tightening them again. If the motor still cannot be rotated by the hand, replace it.	
Motor shaft bearing	Unusual sound from the motor shaft bearing	Replace the shaft bearing, and check the shaft for centering accuracy. Also check on the radial load. Before replacing the shaft bearing, contact your FANUC service staff.	

2.2 PARTS FOR MAINTENANCE

Terminal box parts

Model	Terminal box assembly		Terminal box lid
	B □ 0 □ or B □ 9 □ as the last segment of the motor specification number (NOTE1)	B □ 3 □ as the last segment of the motor specification number (NOTE1)	
α1, α1.5, αC1, αC1.5	A290–0850–T400		A290–0853–V410
α2, α3, αC2, αC3	A290–0853–T400	A290–0853–T401	A290–0853–V410
α6, α8, α12, α15 αP8, αP12, αP15, αP18, αP22 α15(HV) αC6, αC8	A290–0854–T400	A290–0854–T401	A290–0854–V410
α18, α22 α18(HV), α22(HV)	A290–0731–T420	A290–0731–T421	A290–0731–V410
αP30, αP40, αP50	A290–0731–T451	A290–0731–T460	A290–0731–V410

NOTE1
For example, B □ 0 □ for A06B–0856–B100 and B □ 3 □ for A06B–0856–B130
NOTE2
This table may not apply to the motors with B9 □□.
Contact you FANUC service staff.

Fan motor parts

Model	Fan cover	Fan motor	Air flow direction
α1, α1.5, αC1, αC1.5	A290–0750–T500 (NOTE2)	A90L–0001–0343/R	Away from the load shaft
	A290–0750–T501 (NOTE2)	A90L–0001–0343/F	Toward the load shaft
α2, α3, αC2, αC3	A290–0853–X501	A90L–0001–0442/R	Away from the load shaft
		A90L–0001–0442/F	Toward the load shaft
α6, α8, αP8 αC6, αC8	A290–0854–X501	A90L–0001–0443/R	Away from the load shaft
		A90L–0001–0443/F	Toward the load shaft
α12, α15, α18, α22 αP12, αP15, αP18, αP22	A290–0856–X501	A90L–0001–0444/R	Away from the load shaft
		A90L–0001–0444/F	Toward the load shaft
αP3, αP40	A290–0731–T510 (NOTE2)	A90L–0001–0318/R	Away from the load shaft
	A290–0731–T511 (NOTE2)	A90L–0001–0318/F	Toward the load shaft
αP50	A290–1040–T510 (NOTE2)	A90L–0001–0319/R	Away from the load shaft
	A290–1040–T511 (NOTE2)	A90L–0001–0319/F	Toward the load shaft
α15(HV), α18(HV), α22(HV)	A290–0856–X501	A90L–0001–0447/R	Away from the load shaft
		A90L–0001–0447/F	Toward the load shaft

NOTE
Specification number for a fan assembly with a fan motor

2.3 ALLOWABLE RADIAL LOAD

Do not apply the radial load exceeding the data listed below on the motor output shaft.

Model	Maximum allowable radial load on the tip of the output shaft
αi0.5	30Kg
αi1, αiC1	40Kg
αi1.5, αi2, αiC1.5, αiC2	90Kg
αi3, αiC3	150Kg
αi6, αiC6	200Kg
αi8, αi12, αi15 αiP8, αiP12, αiP15 αi15(HV), αiC8	300Kg
αi18, αi22, αiP18, αiP22 αi18(HV), αi22(HV)	450Kg
αiP30, αiP40	550Kg
αiP50	1100Kg

NOTE1
When a belt is used to link the load to the motor shaft, adjust the belt tension so that the limit described above will not be exceeded.

NOTE2
If the center of the belt tension is away from the tip of the output shaft, the maximum allowable load becomes smaller than the data above.

–A–

–C–

–D–

–F–

–H–

–I–

–M–

–O–

–P–

–R–

–S–

–T–

Revision Record

FANUC CONTROL MOTOR α series MAINTENANCE MANUAL (B–65165E)

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