BNP-A2956-02A-E

USA-E99631-001-*

MITSUBISHI

AC SPINDLE DRIVE

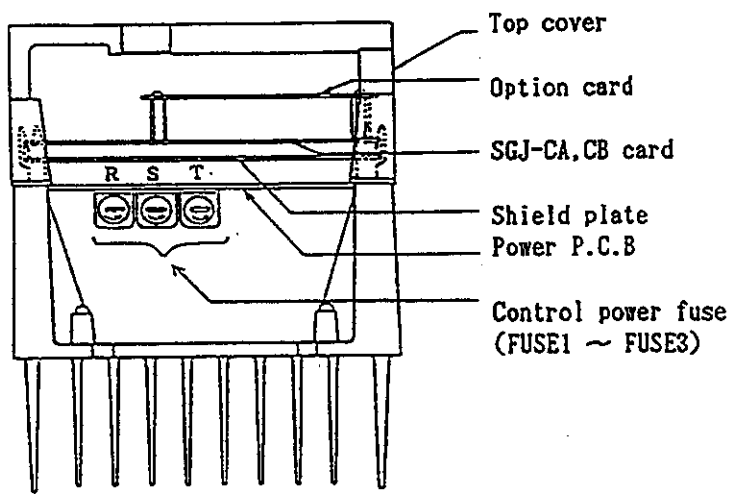
FREQROL-SGJ

MAINTENANCE MANUAL

ADVANCED AND EVER ADVANCING
MITSUBISHI ELECTRIC

MITSUBISHI AC SPINDLE DRIVE FREQROL-SGJ

MAINTENANCE MANUAL CORRIGENDA (BNP-A2956-02-A-E)

PAGE	FAULT	CORRECTION (ADDITIONAL)
3-10	———	(NOTES 2) When parameter data is set minus(-), the display would be as below. (ex) In case parameter NO.#0B(YOP) data is set "-3".  ※ Minus(-) appears " 三 ".
5-1	———	5.6 EXCHANGEING OF FUSE Looking from the bottom, you can see 3 black fuse holders. (refer to 2.2 Parts Arrangement.) Turn the lid of the fuse holder to the left with minus screw driver and pull it out with your hands. White fuse (FUSE1, FUSE2, FUSE3) are attached to the lid. Please exchange them with your hands.  (UNIT — looking from the bottom)

CHAPTER 3 OPERATION ADJUSTMENT

CHAPTER 1 GENERAL

1. General

1.1 Introduction

AC spindle drive unit, FR-SGJ series, is the inverter used to control a machine tool spindle drive. It is capable of controlling widely ranged motor speeds accurately and quietly. Discharge resistors are connected to the drive unit to disperse regenerative energy for regenerative braking of motor. This manual mainly describes periodic maintenance and troubleshooting which are very important to assure successful use of your AC spindle drive.

1.2 Safety During Maintenance and Troubleshooting

Maintenance and troubleshooting should be done with the following safety consideration:

- The control unit should be maintained and remedied by qualified electrician.
- When a person maintaining or remedying the control unit must touch a part of the control unit with power on, he should take off rings, wristwatch, necktie pin, and other metallic items before starting.
- Electric shocks may cause fatal accidents.
  When a circuit at high voltage must be checked, care should be taken to select appropriate test/inspection equipment, tools, etc. and to use them safely (no matter whether or not the circuit is grounded).
  When test equipment is applied to a part, component, or circuit of the unit, operator should pay attention not to touch a grounded part.
  In general, test equipment should not be grounded.
  During test or measurement, it is likely that high voltage is present across the test equipment and the ground.
  When motor is run during adjustment or remedy, care should be taken in this respect.
- Person who carries out maintenance or remedy of rotative machinery should not wear loose clothing (otherwise loose clothing might set caught in the running machine).
- Do not remove the printed circuit board while supplying power or when the unit is running as it may be damaged.
- Do not touch the controller immediately after the operation is terminated (maintenance or remedy should be started about 5 min. after the operation is terminated).

1.3 Cautions for Use

(1) The rated motor output is guaranteed to the controller rated input voltage (AC200/220/230V). When the input voltage decreases to below this, the rated output may not be output at times.

(2) As a highly harmonic chopper voltage that is PWM controlled is applied to the motor, a highly harmonic leakage voltage will flow during operation of the motor.
When the universal leakage breaker is used, malfunctions may occur because of this high voltage, so please use the leakage breaker for inverter use.

(3) The highly harmonic leakage voltage above flows through the earth wire between the motor and controller. If the earth wire and the NC CRT screen come in contact, the CRT screen may malfunction from the leakage voltage magnetic forces. Please keep the earth wire and NC CRT screen apart if possible.

(4) Noise may become a problem in AM radio frequencies due to the magnetic wave noise emitted from the motor and controller. Please keep radios away from the motor and controller when possible. A filter to prevent radio noise has been prepared as an option, so please use it when necessary.

(5) You may get burned if the resistivity unit is touched when hot.
Please use a protective cover or use consideration when installation so that people will not touch the unit.

(6) Do not turn off the power immediately after the motor operation has stopped. The power must be left on for a minimum of ten minutes to cool the resistivity unit. When the power is cut off immediately after load operation, the cooling fan will stop and the resistivity unit temperature may rise, emit smoke or be damaged from the remaining heat.

1.4 Storage

When your AC spindle drive is not used, store it in clean and dry environment.
Note that humidity and dust entering into the control unit may adversely affect insulation resistance of the drive unit.
When your AC spindle drive is left out of operation for any length of time, the same cautions should be taken. It is recommended, if the storage is humid, to use a heater to keep the environment dry.

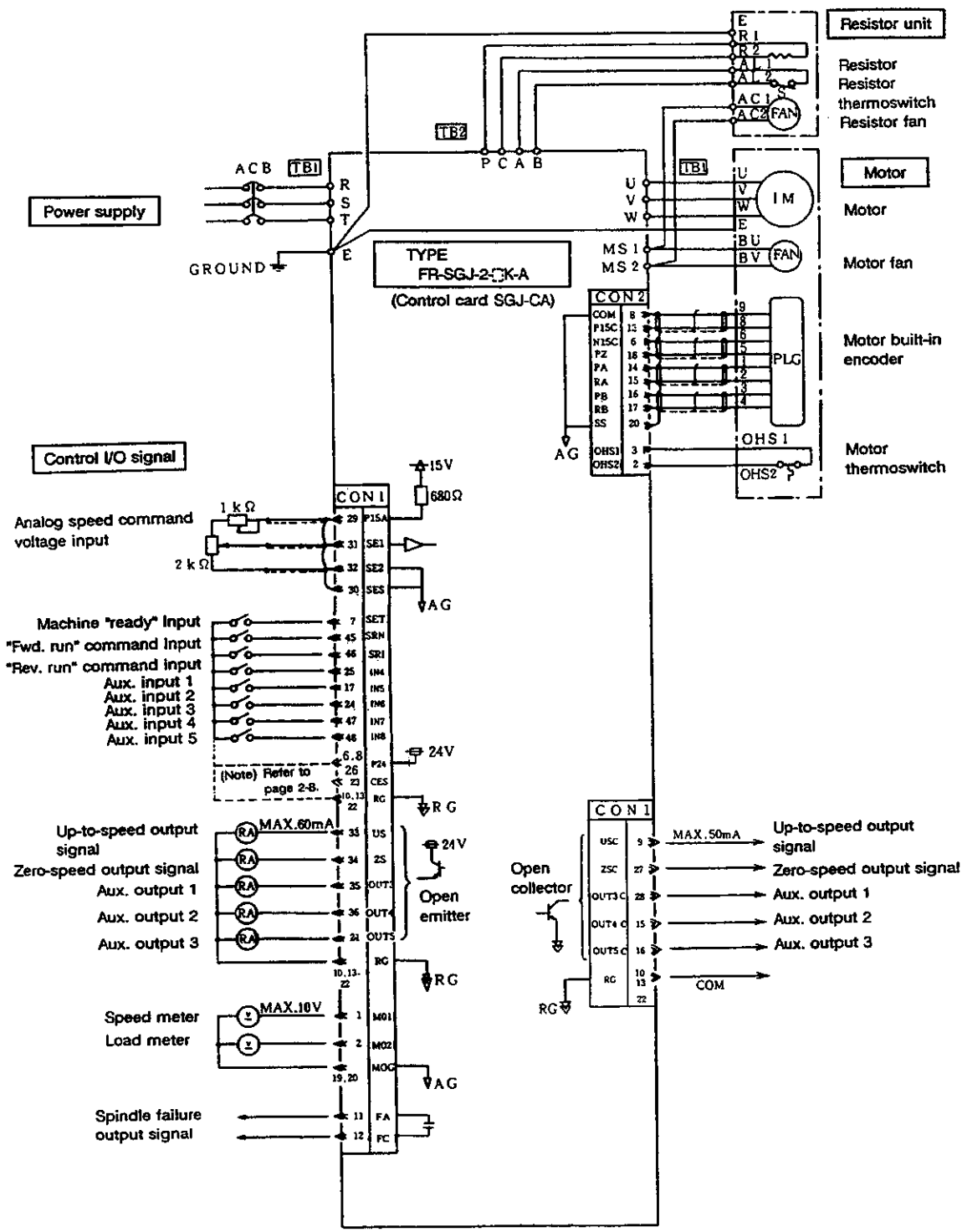
CHAPTER 2 CONNECTION

2. Connection

2.1 External Connection

2.1.1 Analog speed command and digital I/O type

2.1.1.1 Basic composition for analog speed command and digital I/O

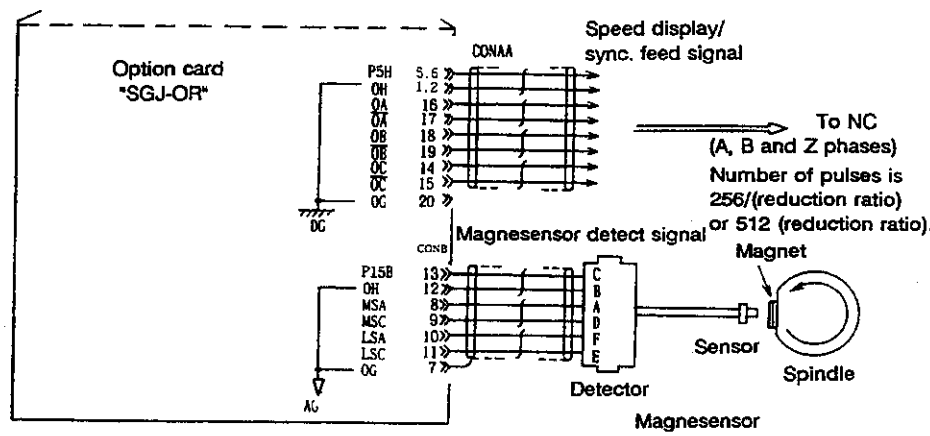


2.1.1.2 Analog speed command and digital I/O

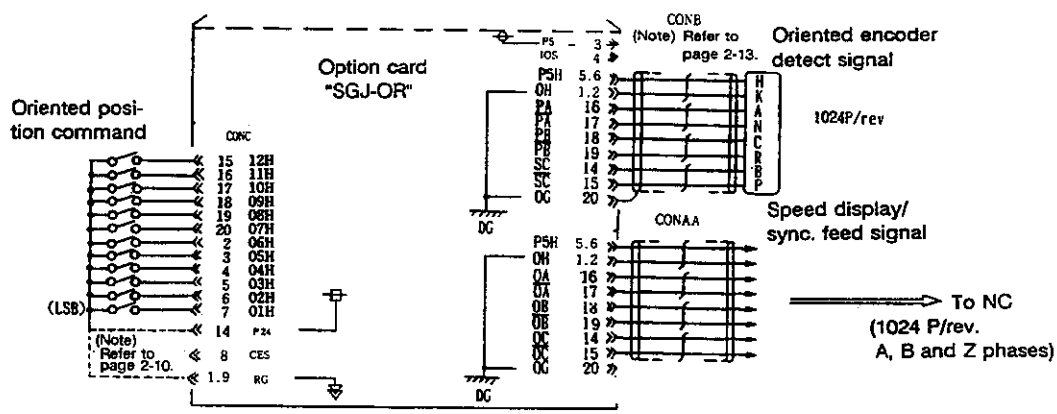
With oriented function (Option SGJ-OR card used) FR-SGJ-2- □K-AR

The wiring shown below is added to the basic wiring.

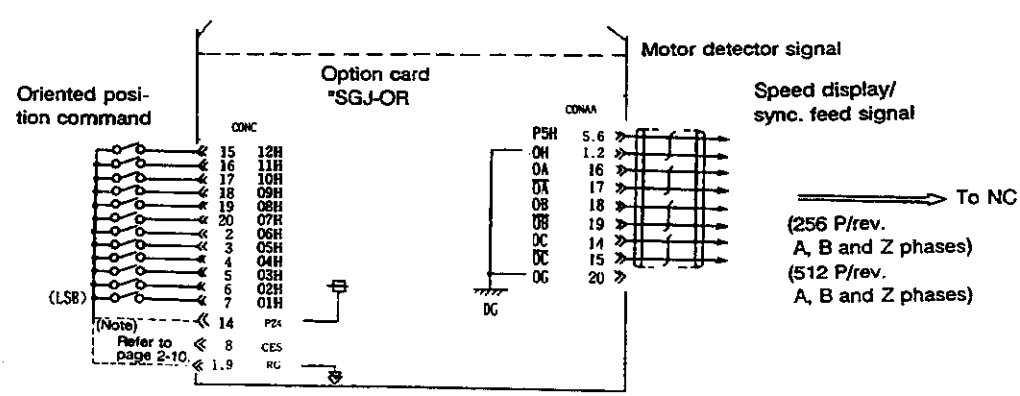
(1) Magnesensor oriented (1 point) specification
(with motor speed feedback output ... for spindle speed display and sync. feed signal)



(2) Encoder oriented specification (4096 points)/index function



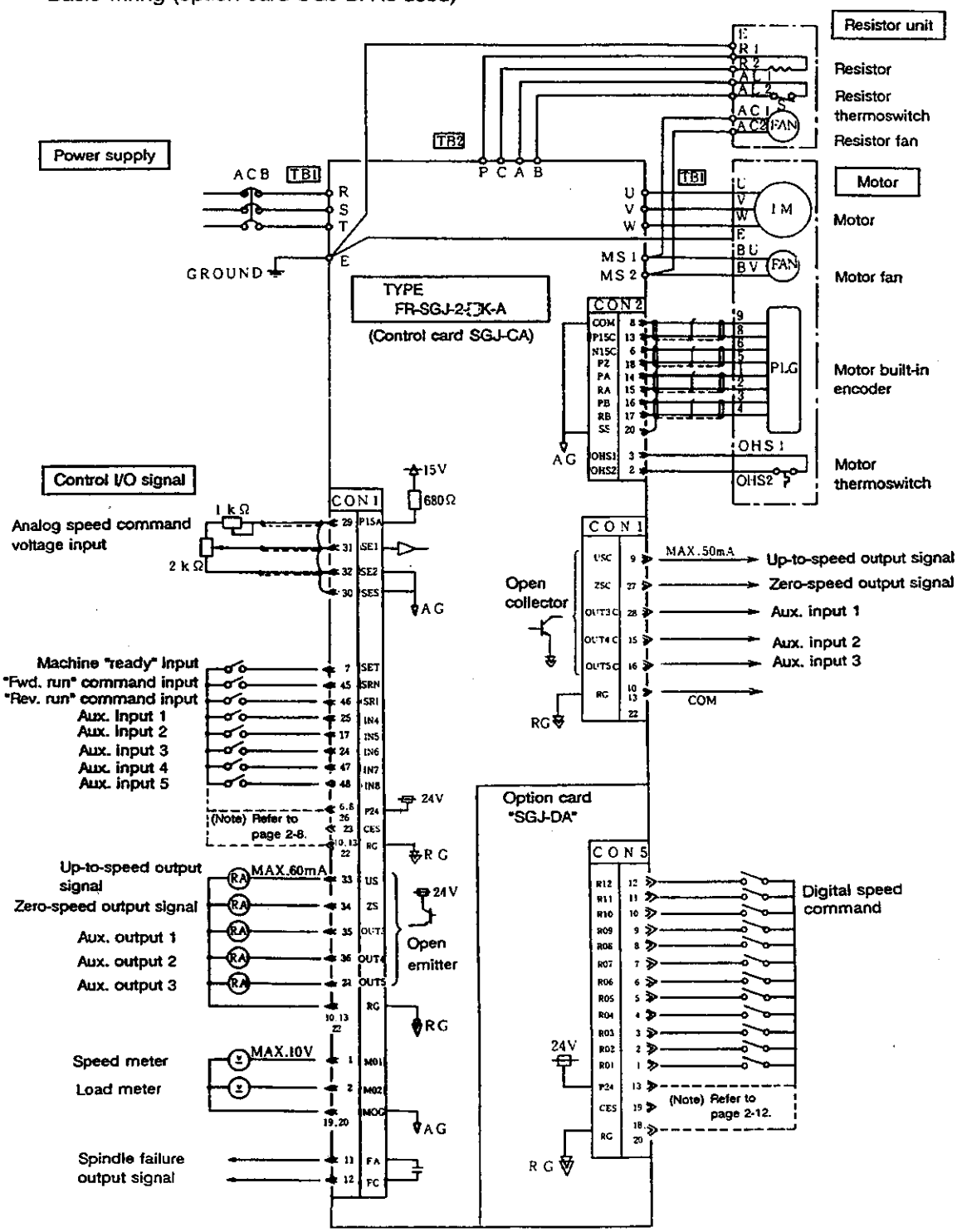
(3) Z-phase motor built-in encoder oriented specification (4096 points)/index function



2.1.1.3 Digital speed command and digital I/O

FR-SGJ-2-□K-AD

Basic wiring (option card SGJ-DA is used)

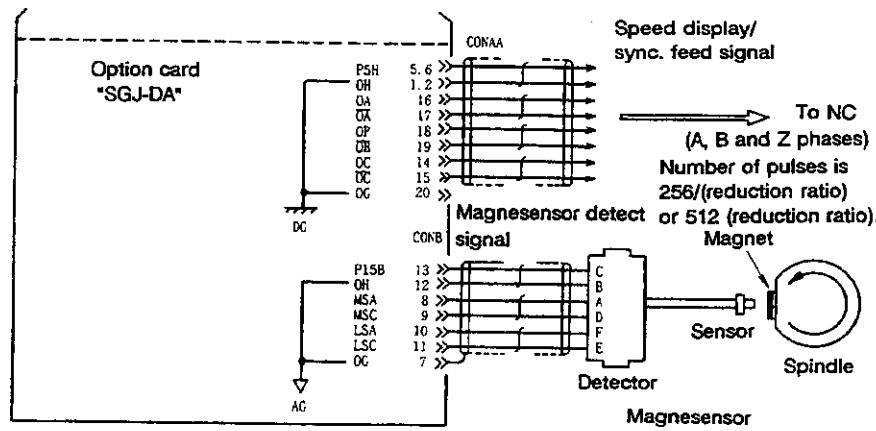


2.1.1.4 Digital speed command and digital I/O

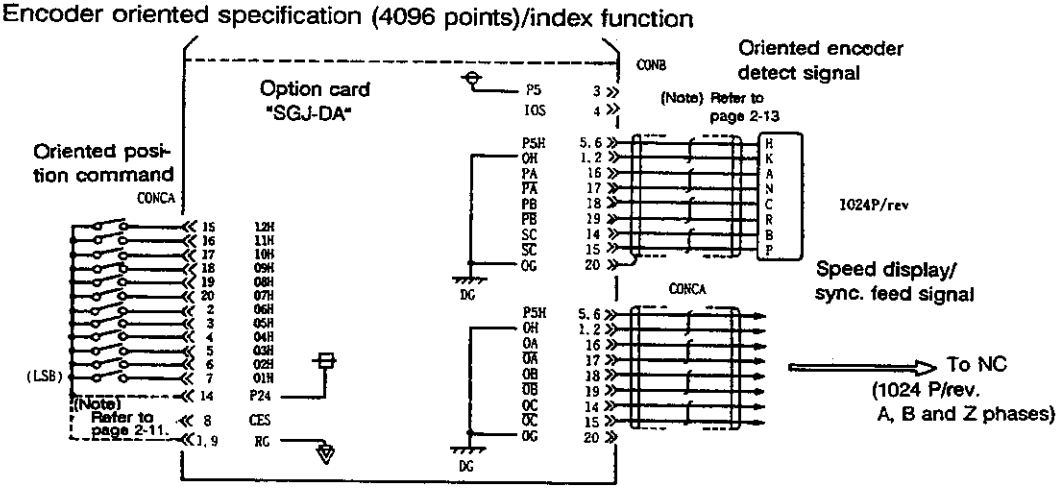
With oriented function (Option SGJ-DA card used)

The wiring shown below is added to the basic wiring. FR-SGJ-2-□K-AD

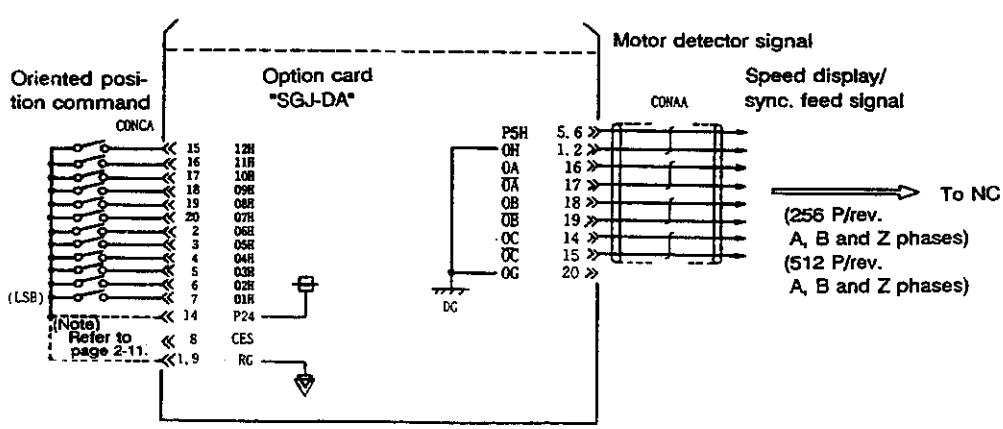
(1) Magnesensor oriented specification (1 point)
(with motor speed feedback output ... for spindle speed display and sync. feed signal)



(2) Encoder oriented specification (4096 points)/index function

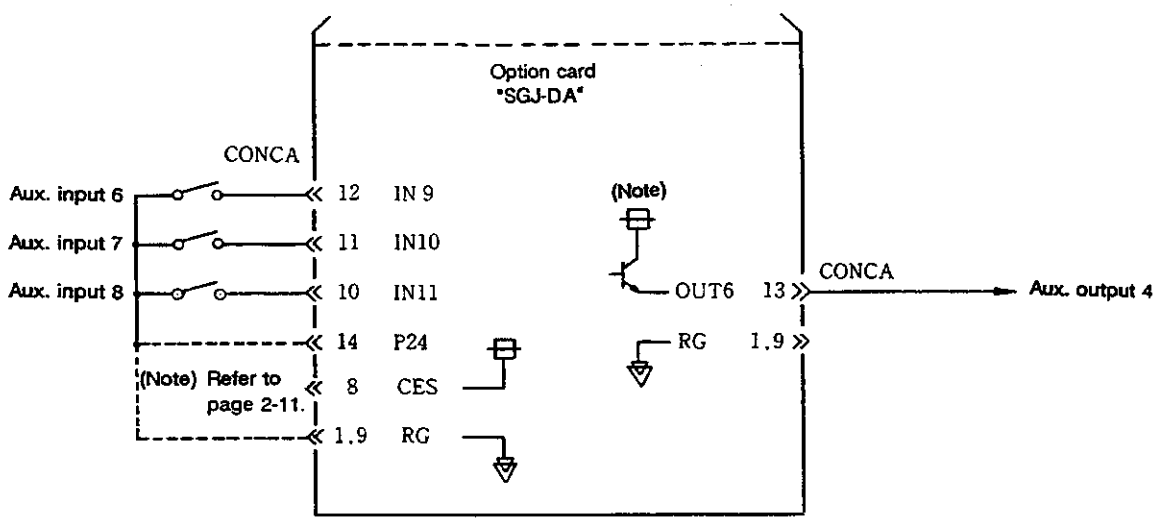


(3) Z-phase motor built-in encoder oriented specification (4096 points)/index function



2.1.1.5 Digital speed command and digital I/O

With the additional auxiliary input output (Option SGJ-DA card used) FR-SGJ-2-□K-AD
The wiring shown below is added to the basic wiring.

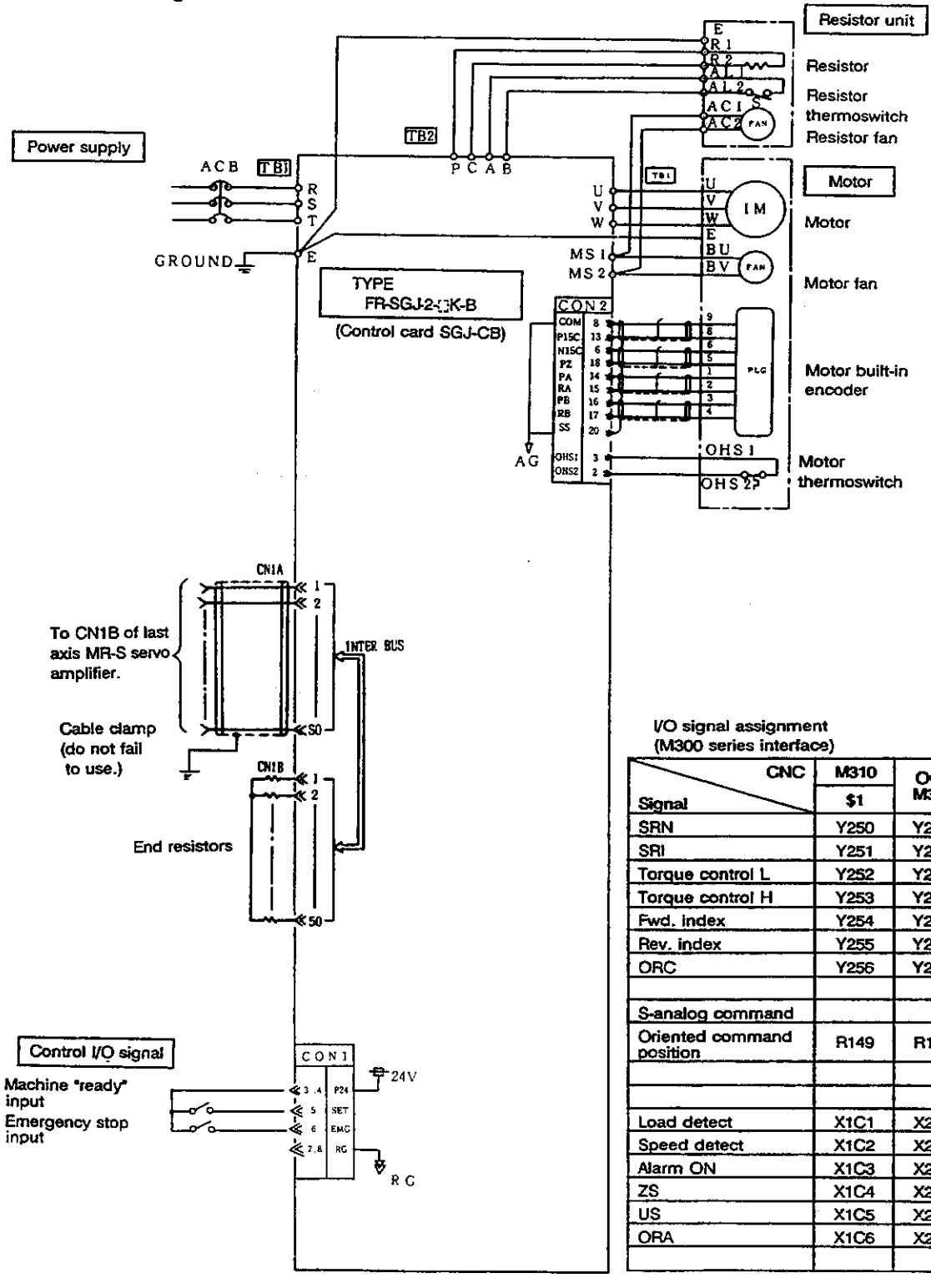


(Note) The auxiliary output 4 with the SGJ-DA card is open emitter output, and open collector output will not be possible.
For output interface, refer to 3.4.3 Output interface of STANDARD SPECIFICATION.

2.1.2 Bus-line connection type

2.1.2.1 Bus-line connection to M300, M3/L3

Basic wiring



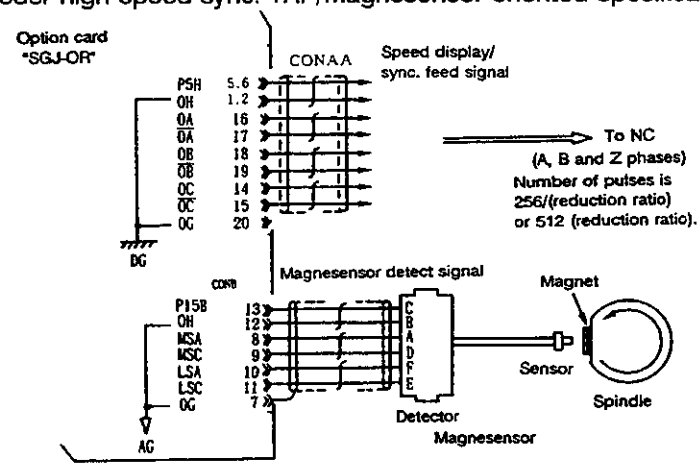
I/O signal assignment
(M300 series interface)

Signal \ CNC	M310 $1	Over M320
SRN	Y250	Y2D0
SRI	Y251	Y2D1
Torque control L	Y252	Y2D2
Torque control H	Y253	Y2D3
Fwd. index	Y254	Y2D4
Rev. index	Y255	Y2D5
ORC	Y256	Y2D6
S-analog command		
Oriented command position	R149	R149
Load detect	X1C1	X241
Speed detect	X1C2	X242
Alarm ON	X1C3	X243
ZS	X1C4	X244
US	X1C5	X245
ORA	X1C6	X246

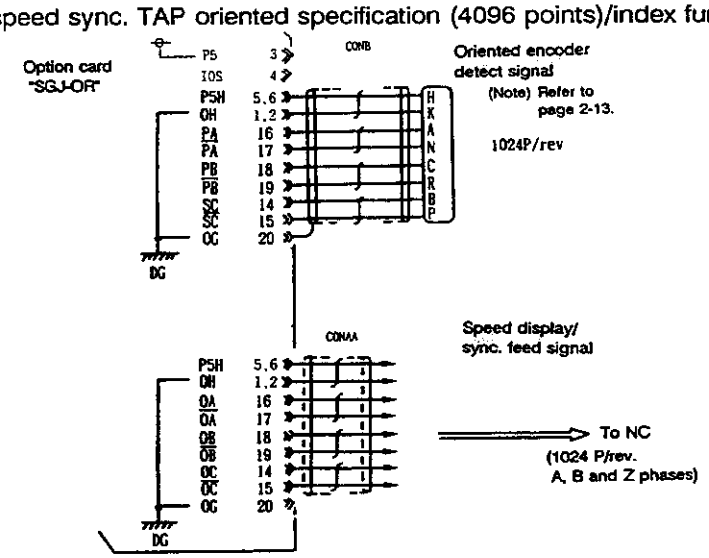
2.1.2.2 Bus-line connection to M300, M3/L3

With high speed synchronous tap and orient functions (Option SGJ-OR card used)
The following wiring is added to the basic wiring. FR-SGJ-2-□K-BR

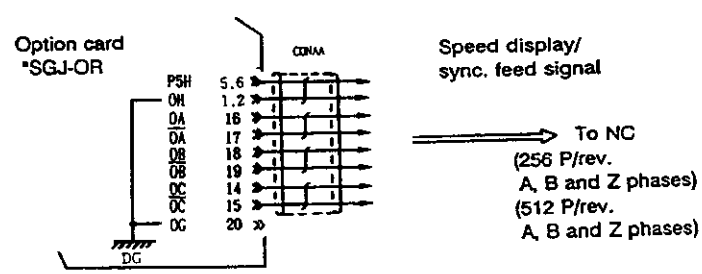
(1) Motor built-in encoder high speed sync. TAP/magnesensor oriented specification (1 point)



(2) Encoder high speed sync. TAP oriented specification (4096 points)/index function



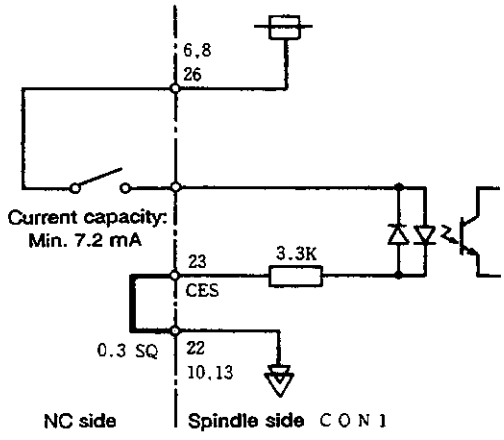
(3) Z-phase motor built-in encoder high speed sync. TAP multipoint oriented specification/index function



2.1.3 Digital input interface

(1) CON1 input circuit (SGJ-CA card)
For input circuit interface, select the best one from those shown below.

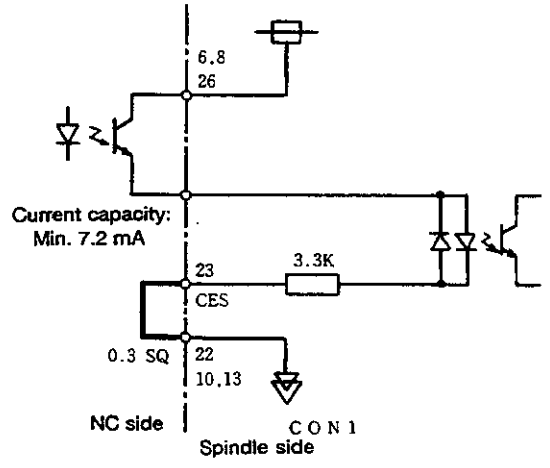
a) Connection at contact



Short circuit pins 23, 22

Delay caused by input filter is 5 to 15 ms.

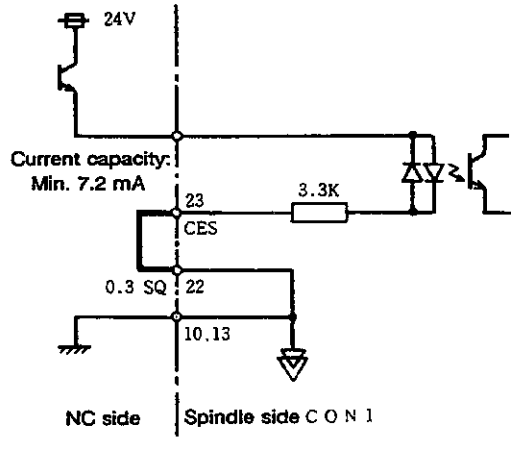
b) Connection with photo-coupler



Short circuit pins 23, 22

Delay caused by input filter is 5 to 15 ms.

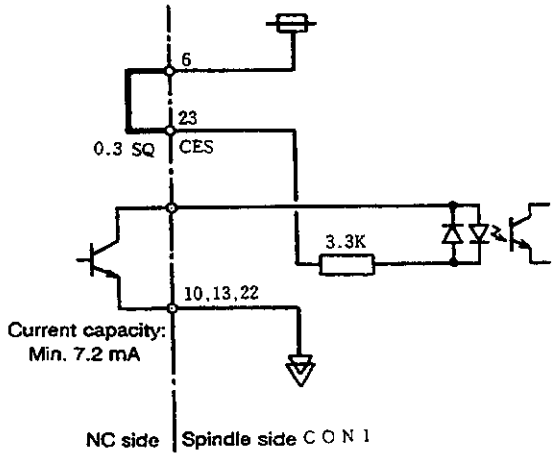
c) Connection with open emitter



Short circuit pins 23, 22

Delay caused by input filter is 5 to 15 ms.

d) Connection with open collector

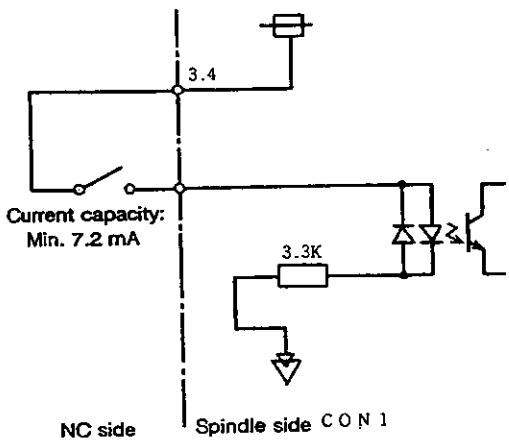


Short circuit pins 23, 6

Delay cause by input filter is 5 to 15 ms.

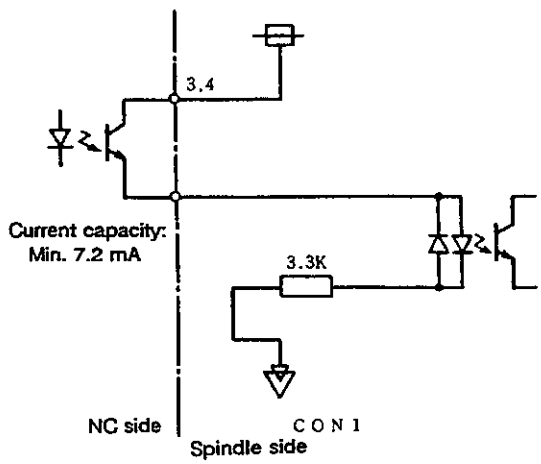
(2) CON1 input circuit (SGJ-CB card)
Select the input circuit interface from below.

a) Connection at contact



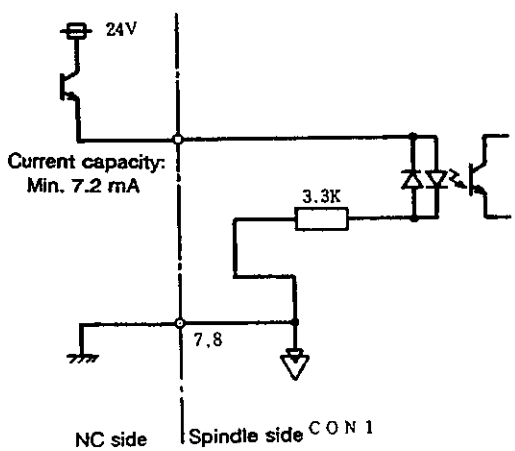
Delay caused by input filter is 5 to 15 ms.

b) Connection with photo-coupler



Delay caused by input filter is 5 to 15 ms.

c) Connection with open emitter



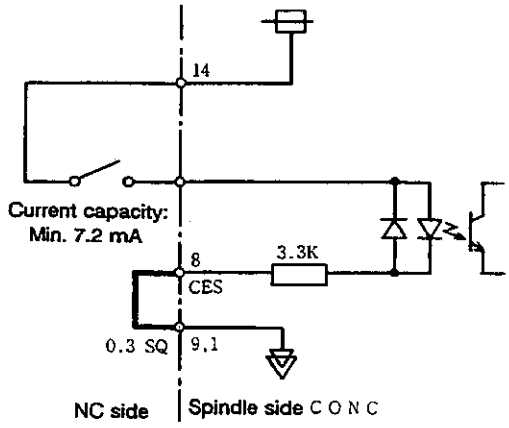
Delay caused by input filter is 5 to 15 ms.

d) Connection with open collector

Not connectable

(3) CONC orient position command input circuit (SGJ-OR card)
Select the input circuit interface from below.

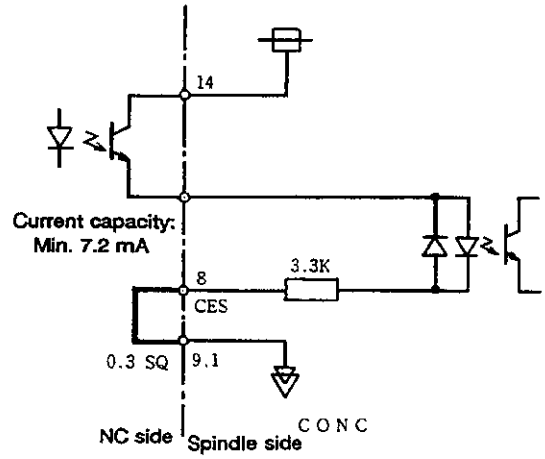
a) Connection at contact



Short circuit pins 8, 9

Delay caused by input filter is 5 to 15 ms.

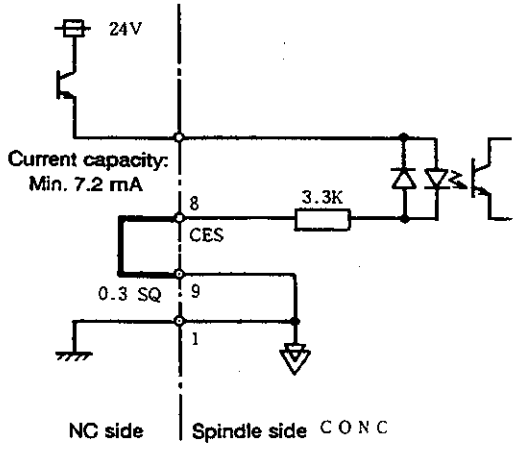
b) Connection with photo-coupler



Short circuit pins 8, 9

Delay caused by input filter is 5 to 15 ms.

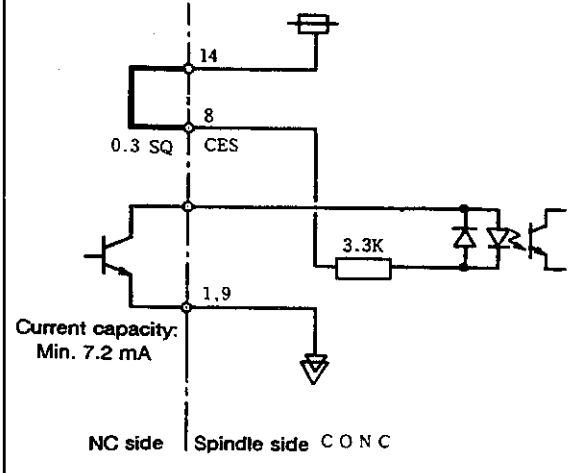
c) Connection with open emitter



Short circuit pins 8, 9

Delay caused by input filter is 5 to 15 ms.

d) Connection with open collector

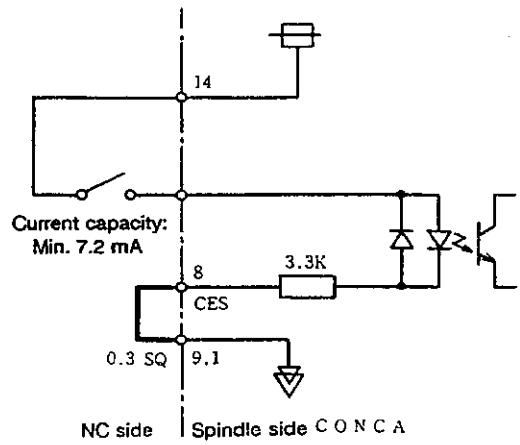


Short circuit pins 8, 14

Delay cause by input filter is 5 to 15 ms.

(4) CONCA orient position command input circuit and auxiliary input circuit (SGJ-DA card)
Select the input circuit interface from below.

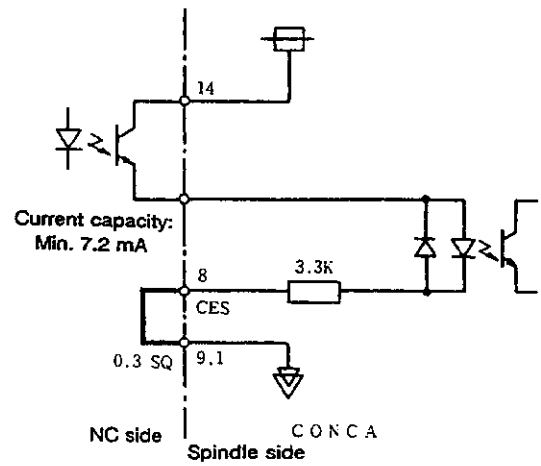
a) Connection at contact



Short circuit pins 8, 9

Delay caused by input filter is 5 to 15 ms.

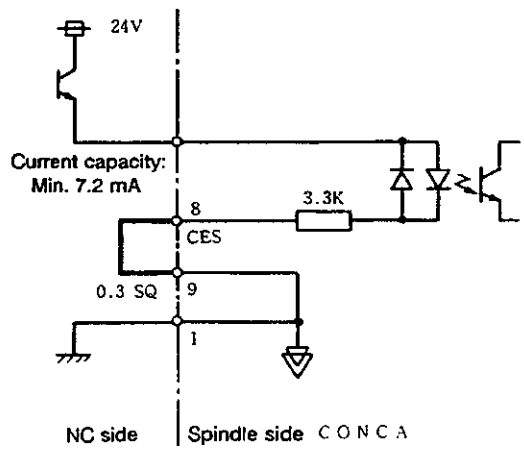
b) Connection with photo-coupler



Short circuit pins 8, 9

Delay caused by input filter is 5 to 15 ms.

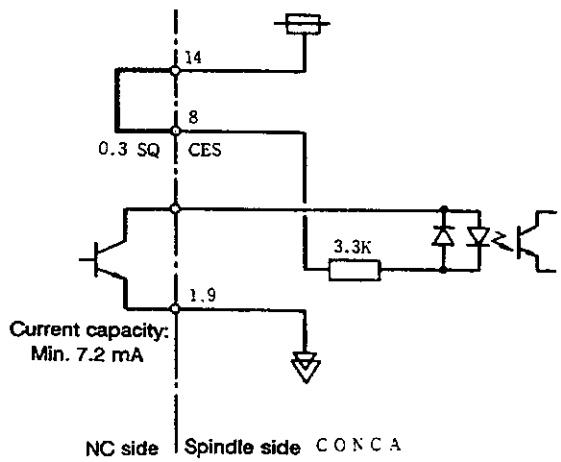
c) Connection with open emitter



Short circuit pins 8, 9

Delay caused by input filter is 5 to 15 ms.

d) Connection with open collector

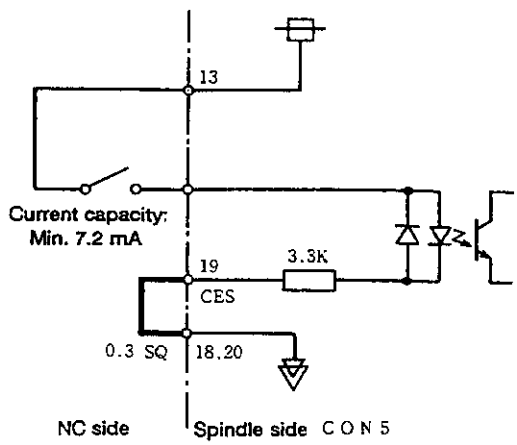


Short circuit pins 8, 14

Delay cause by input filter is 5 to 15 ms.

(5) CON5 digital speed command input circuit (SGJ-DA card)
Select the input circuit interface from below.

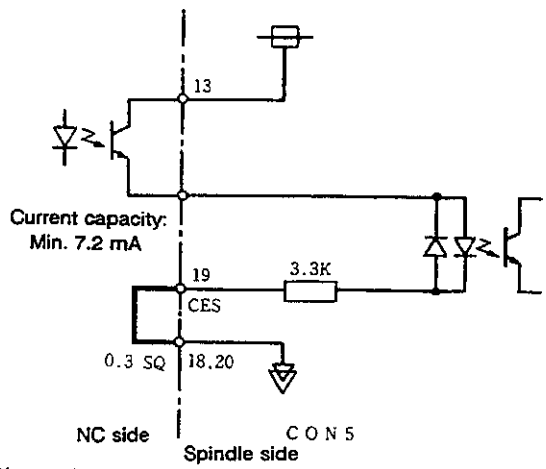
a) Connection at contact



Short circuit pins 19, 20

Delay caused by input filter is 5 to 15 ms.

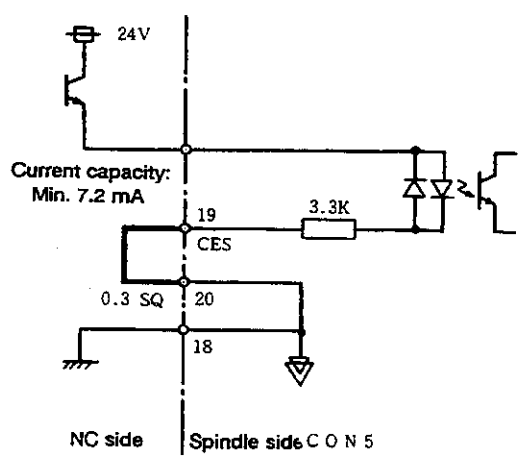
b) Connection with photo-coupler



Short circuit pins 19, 20

Delay caused by input filter is 5 to 15 ms.

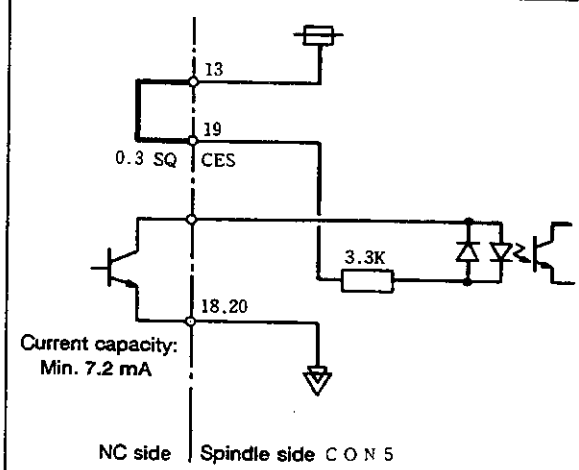
c) Connection with open emitter



Short circuit pins 19, 20

Delay caused by input filter is 5 to 15 ms.

d) Connection with open collector

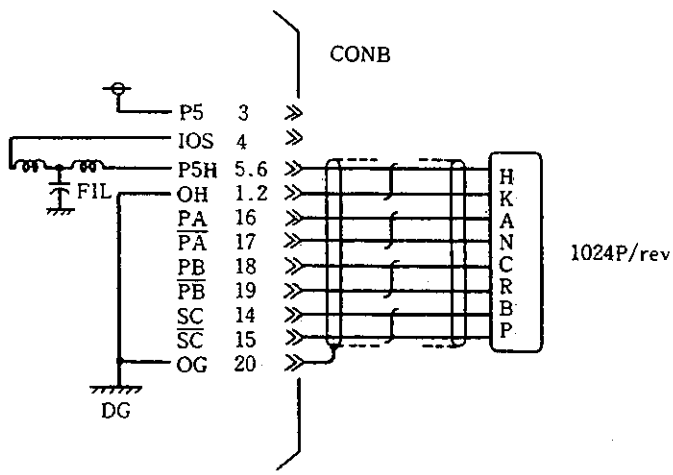


Short circuit pins 13, 19

Delay cause by input filter is 5 to 15 ms.

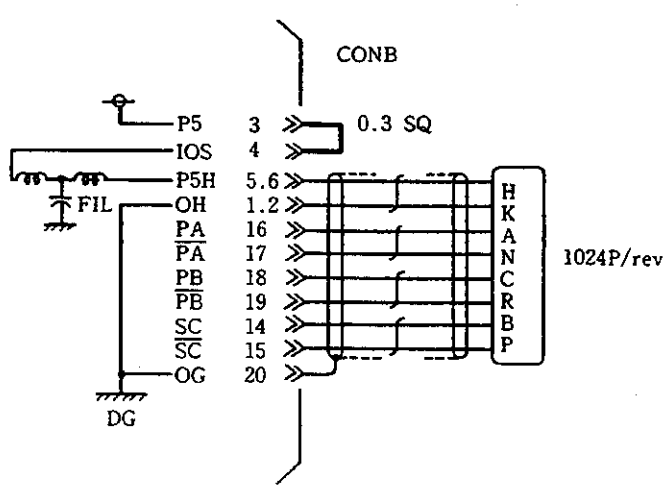
(6) Connection for using the encoder (1024 P/rev.) (SGJ-OR card, SGJ-DA card)
Select the external connection according to the encoder power supply method.

a) 5V power supply from external (NC)



* Pins 3 and 4 are open.

b) No 5V power supply from external (5V power inside amp is used.)

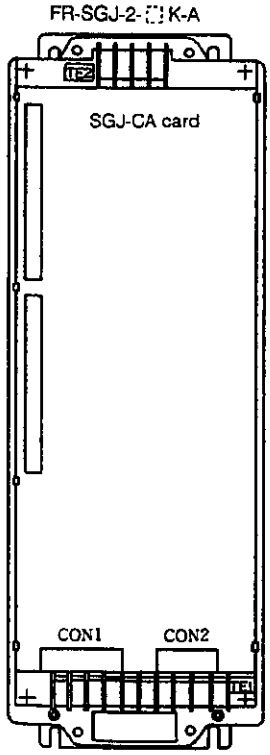


* Short circuit pins 3, 4.

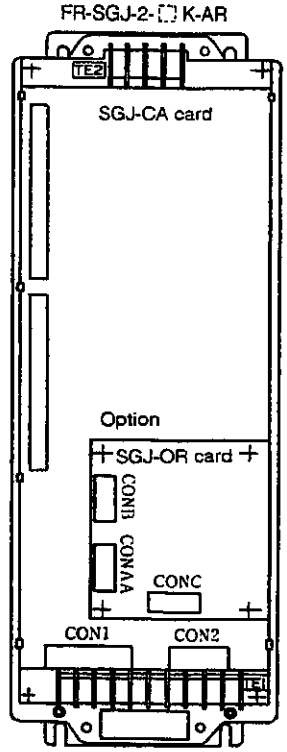
2.2 Parts Arrangement

(1) SGJ-CA/CB card and option card

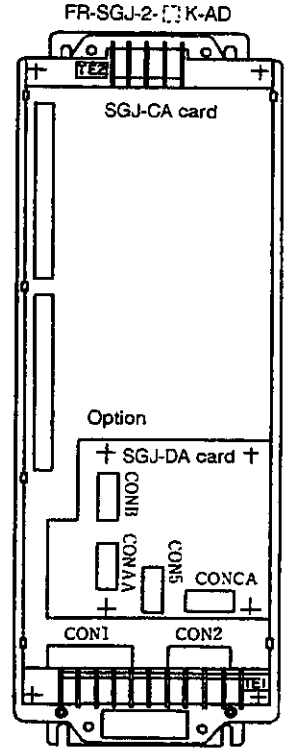
FR-SGJ-2-□K-A



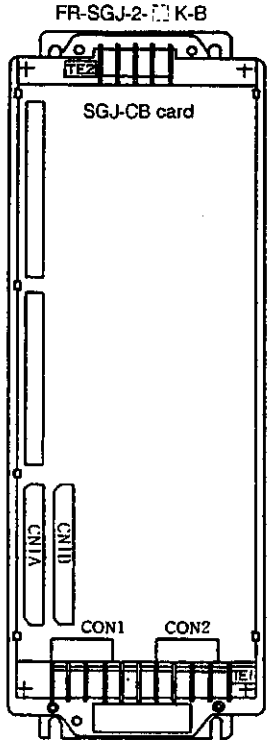
FR-SGJ-2-□K-AR



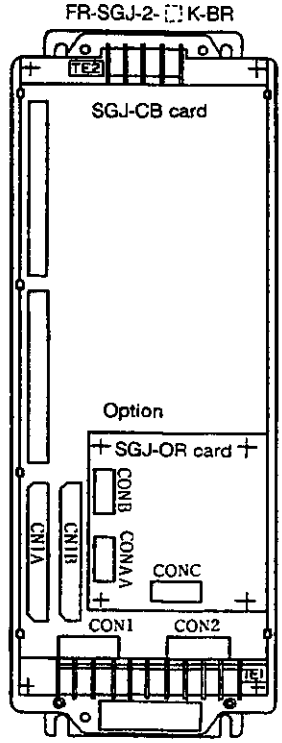
FR-SGJ-2-□K-AD



FR-SGJ-2-□K-B

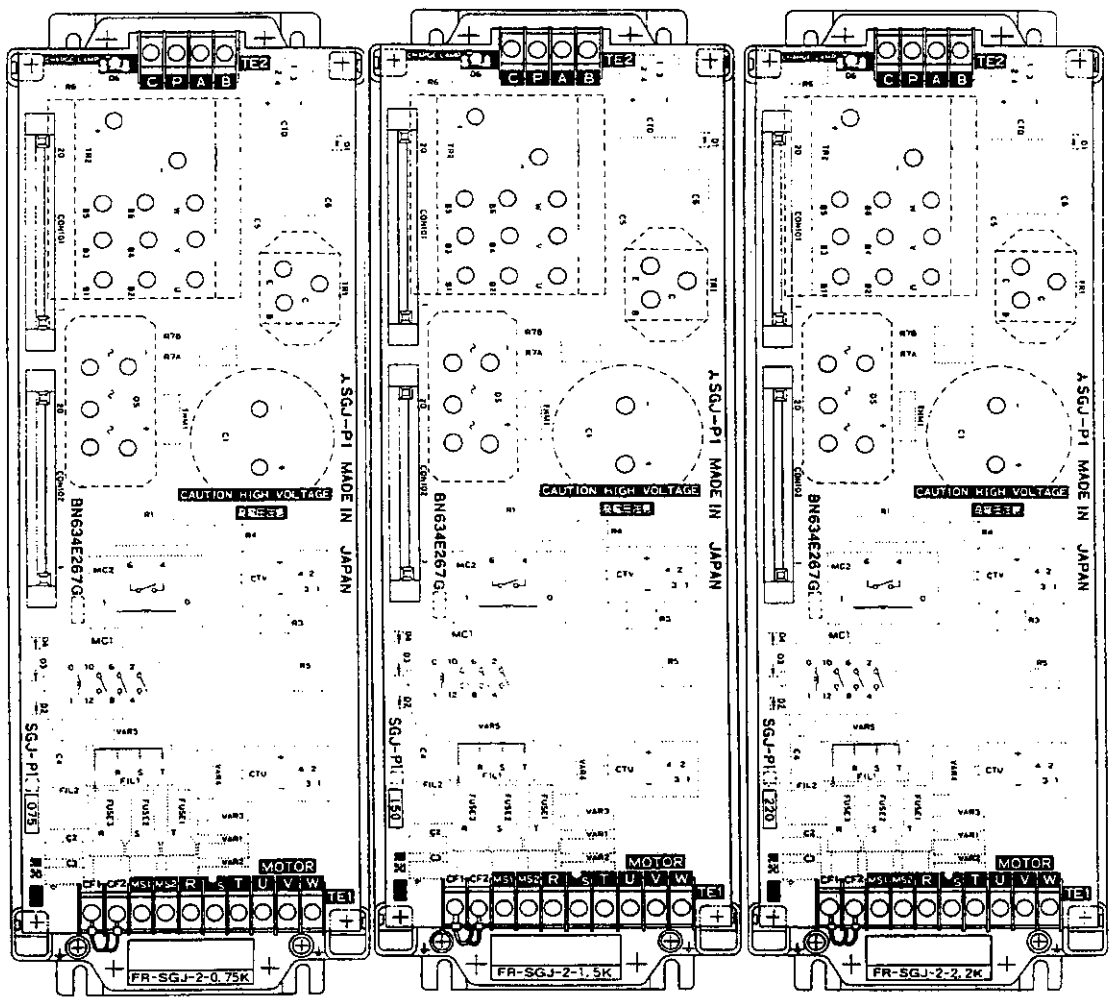


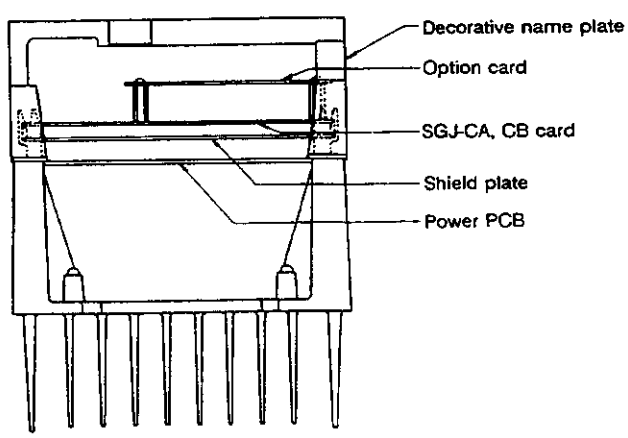
FR-SGJ-2-□K-BR



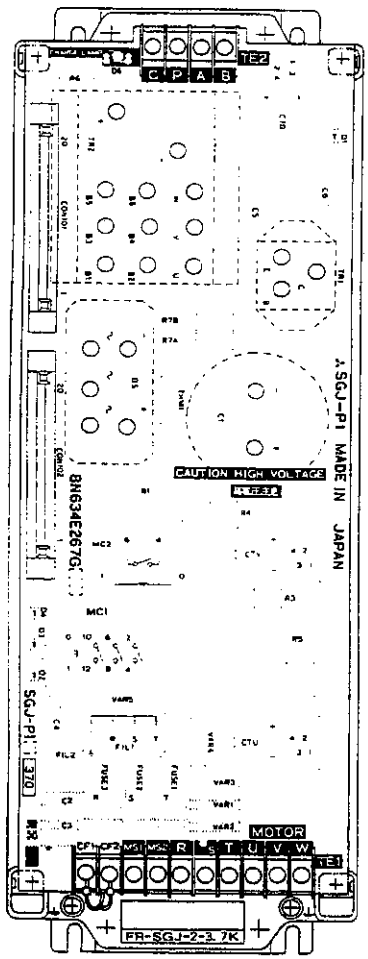
(2) Main body

FR-SGJ-2-0.75K FR-SGJ-2-1.5K FR-SGJ-2-2.2K

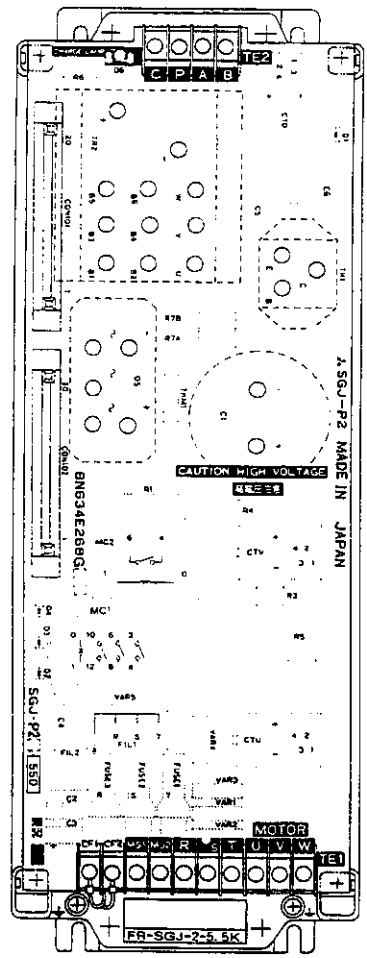




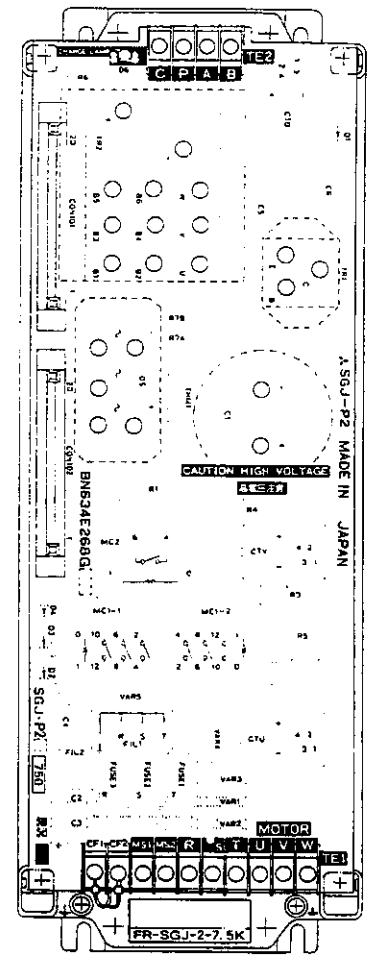
FR-SGJ-2-3.7K



FR-SGJ-2-5.5K



FR-SGJ-2-7.5K



CHAPTER 3 OPERATION ADJUSTMENT

3. Operation Adjustment

3.1 Preliminary Check

Before turning on FR-SGJ, perform the following checks.

(1) Is the external wiring in conformity with the relevant wiring diagram?
(2) Are the motor and control panel grounded properly?
(3) Are all shielding wires terminated properly?
- Is each shield armour connected to the corresponding terminal?
- Is each shield armour not looped?

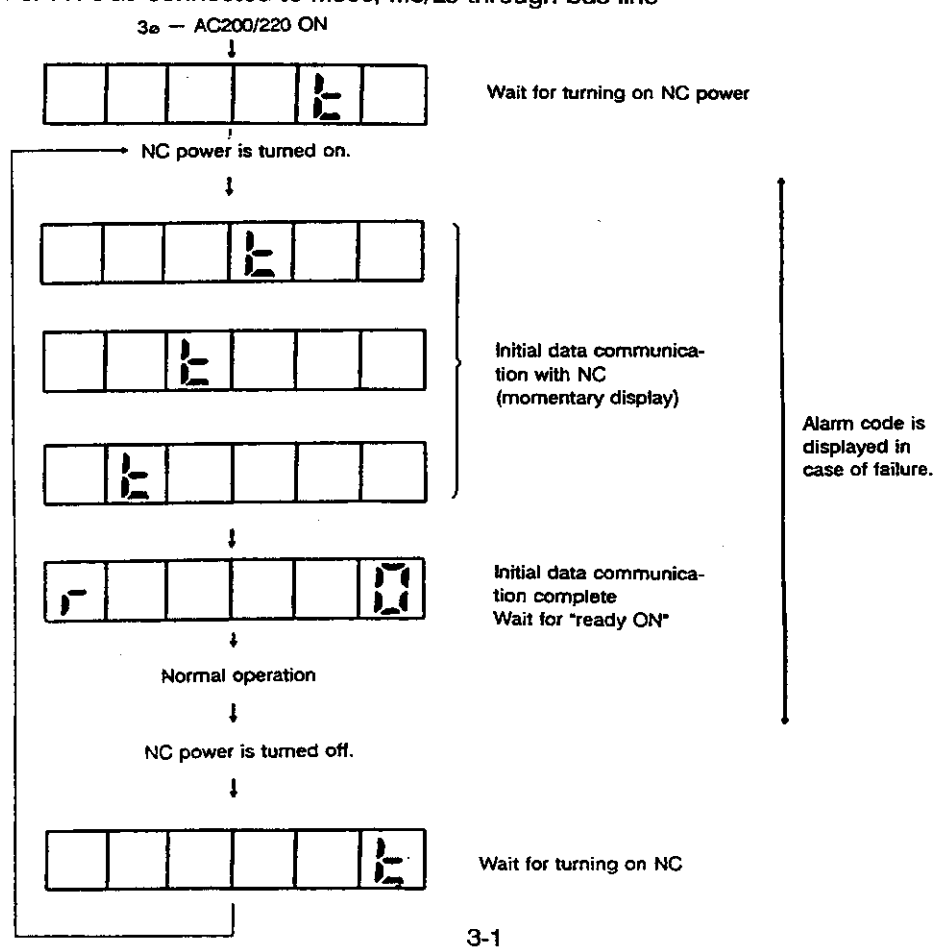
(4) Is any component or part damaged or loose?
(5) Is any foreign matter involved in the drive unit?
(6) Is there any damage or defects on each PCB?
(7) Do ROM No. and jumper pin settings meet the order sheet?

3.2 Power Feeding

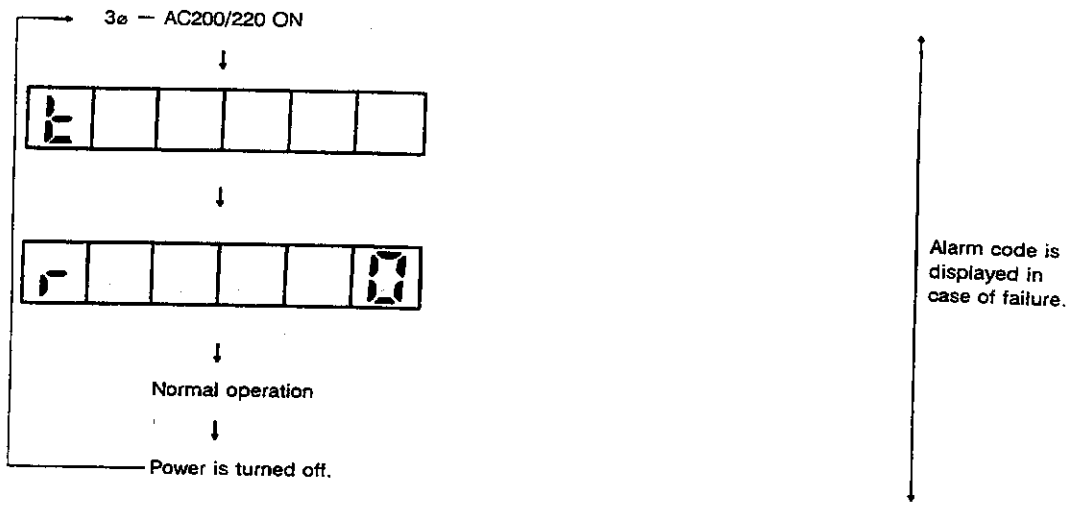
3.2.1 Turning on the power

Immediately after the FR-SGJ is turned on, see the 7-segment LED at the center of front panel to check conditions:

(1) For FR-SGJ connected to M300, M3/L3 through bus line



(2) For FR-SGJ not connected to M300, M3/L3 through bus line

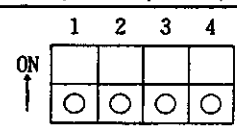
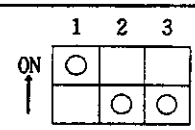
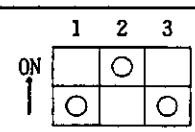
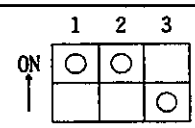
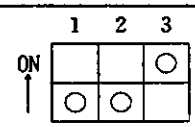
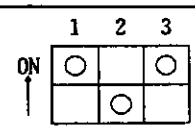
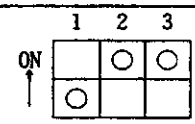
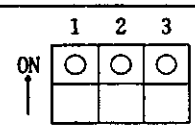
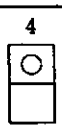


3.3 FR-SGJ Status Display and Parameter Settings

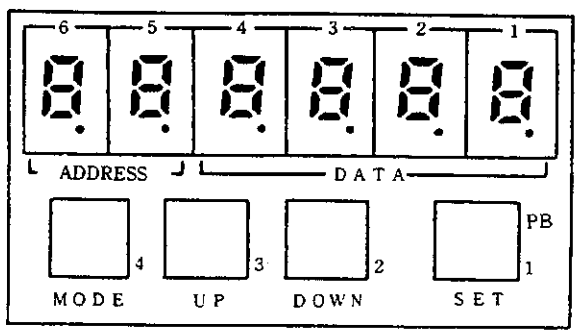
Operation status is displayed by the 7-segment LED on card SGJ-CA, CB and parameters can be set by DIP switches.
When FR-SGJ is connected to M300, M3/L3 CNC with bus line, status can be displayed and parameters can be set on the NC CRT. (For details, refer to Item 3.5.)

3.3.1 DIP switch settings and functions

Since DIP switch settings must be changed only when test operation is required, they should not be changed during normal operation.

Mode	DIP switch (SW1) setting (○ : Set position)	Function
1		Normal operation
2		Spindle parameters displayed by NC CRT are ignored. When FR-SGJ is connected to M300, M3/L3 with bus line, the spindle parameters set and displayed on the NC side are ignored and the parameters set on the FR-SGJ side are used.
3		Setting prohibited (Mitsubishi test operation)
4		
5		Setting prohibited (Mitsubishi parameter setting)
6		
7		
8		Initialization of parameters The standard values (Mitsubishi) are set for all parameters. User should not use this setting.
9		• Meter test mode Speed meter/load meter output (Full scale output) • Release display of outside parameter setting.

3.3.2 Display and setting switches (on SGJ-CA, CB card)



"Status display", "diagnosis", "alarm", "parameter setting (1) to (8)" and "debug" can be displayed.

[MODE] : Display mode can be changed.

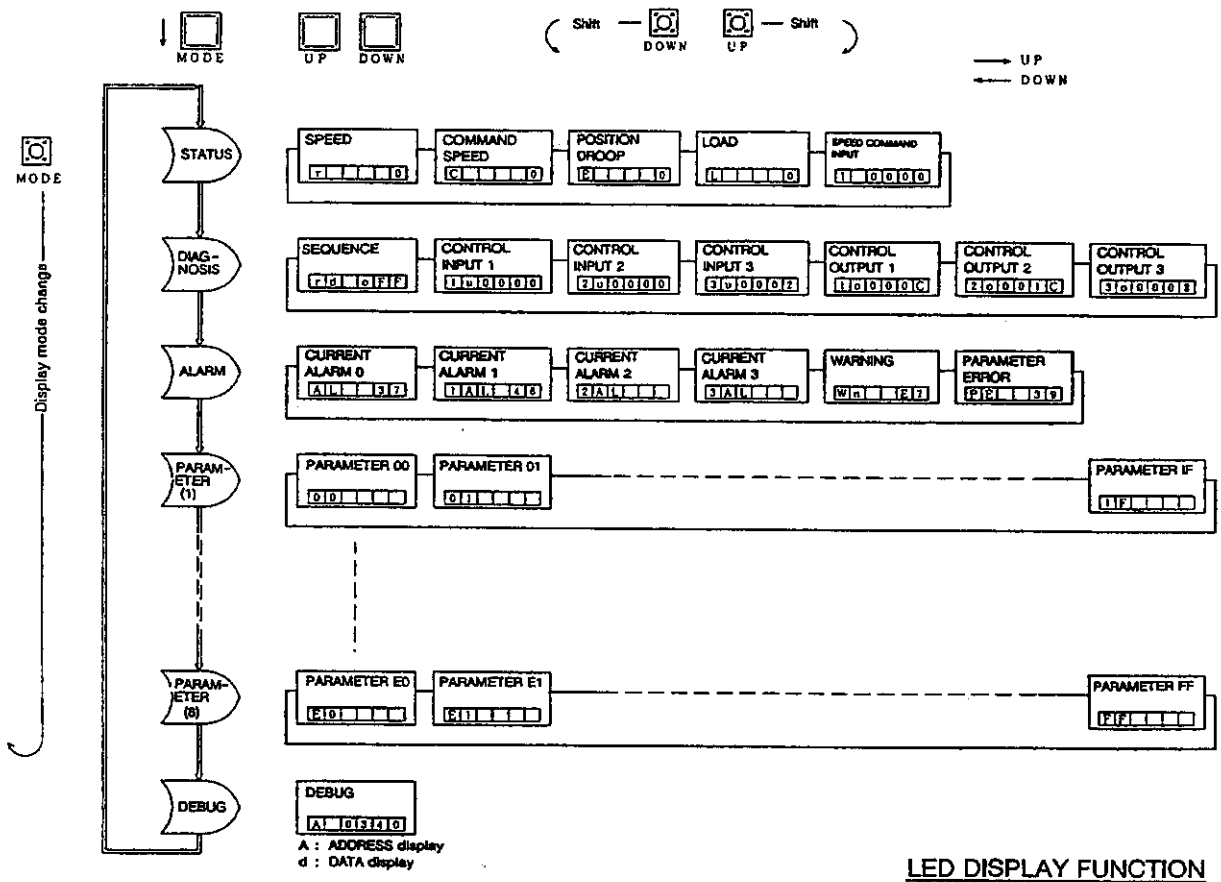
[UP] : Value displayed in ADRESS and DATA can be incremented.

[DOWN] : Value displayed in ADRESS and DATA can be decremented.

[SET] : Data set for parameter is stored when this switch is pressed.

a) There are 12 display modes, namely, "status display", "diagnosis", "alarm", "parameter setting (1) to (8)" and "debug".
b) After turning on the power, "Speed" is displayed in status mode unless alarm occurs.
c) In case of alarm, the alarm code is displayed in error alarm mode.
d) Display mode can be changed by pressing [MODE] switch.
e) For display mode sequence and display content, refer to "LED display mode" on the next page.

3.3.3 LED display mode



LED DISPLAY FUNCTION

- Display mode change, "status display", "status display", "diagnosis", "alarm", "parameter setting (1)" can be selected by pressing [MODE] switch.
- Display content can be changed in the same display mode by pressing [UP] or [DOWN] switch.

3.3.4 Display of status mode

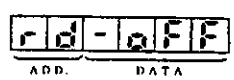
The following descriptions are explained in the display of state mode.

Name	Symbol	Unit	Description
Speed	r	rpm	Displays the motor speed.
Command speed	C	rpm	Displays command speed in motor.
Position droop	E	pulse	Displays absolute value of pulses collected in deflection counter.
Load	L	%	The load state is displayed with the 30 minute rated output at 100%.
Speed command input	I	HEX	The speed command value (HEX) data received from the NC is displayed.

3.3.5 Diagnosis display mode

In the diagnosis display mode, the description of the sequence, external signal, warning No., parameter error No. and alarm No. is displayed.

(1) Sequence

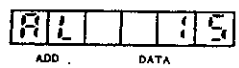
Name	Display	Description
Sequence		Means the preparation is completed.
		Means the preparation is not completed.

(2) External signal
These have the following meanings in response to the displayed bit, and the input/output signal can be confirmed.

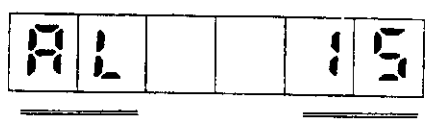
Name		CTM1	CTM2	CTM3	STS1	STS2	STS3
		10	20	30	10	20	30
		ADD (Input signal)	ADD (Input signal)	ADD (Input signal)	ADD (Output signal)	ADD (Output signal)	ADD (Output signal)
Display • Description	F						
	E	CTM Gear selection					
	D	CTL Gear selection					
	C						
	B						
	A						
	9	SYNC Spindle synchro-nized				Reverse run	
	8	TAP Tapping	PCHG Parameter change		Parameter being changed	Forward run	
	7		DFIN Data set completed		Torque limit		
	6	ORC Orientation command			Inposition	OFIN Orientation completed	
	5	Reverse run index			Z-phase passed	UTS Up-to-speed	
	4	Forward run index	NLRST NC reset			ZS Zero speed	
	3	TL2 Torque limit H			Alarm	ALM Alarm	
	2	TL1 Torque limit L			Emergency stop	SD Speed detect	Gate ON
	1	SRI Reverse run	SVON Servo ON	RDY External ready	Servo ON	CD Current detect	Contact 2 ON
	0	SRN Forward run	RDY Ready ON	EMG External emergency stop	Ready ON	Spindle synch-ronous speed match	Contact 1 ON

3.3.6 Alarm display mode

(1) Alarm No.

Name	Display	Description
Alarm No.		Alarm No. display

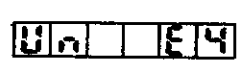
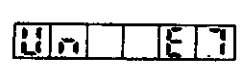
Alarm display



The alarm number is displayed.
For details on the alarm numbers, refer to page 6-26 "Alarm, Warning List".

Alarms that occur simultaneously will be displayed as: AL → 1AL → 2AL → 3AL.

(2) Warning No.

Name	Display	Description
Warning No.		Parameter error warning
		Emergency stop, warning

(3) Parameter error No.

Name	Display	Description
Parameter error No.		Parameter error No. display

3.3.7 Parameter settings

To specify parameter, set "SET" (machine ready for operation) to "OFF".

Turn on the power

- Unless alarm occurs, speed is displayed in status display mode by the readout (Fig. 1).

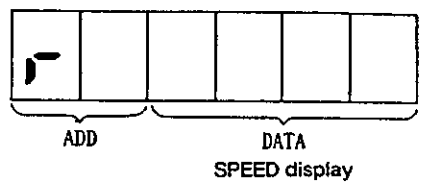


Fig. 1

Select mode

- Mode changes step by step when [MODE] switch is pressed.

  (Ex.) When [MODE] switch is pressed 3 times successively, display mode changes from status display mode (Fig. 1) to parameter (1) mode (Fig. 2).

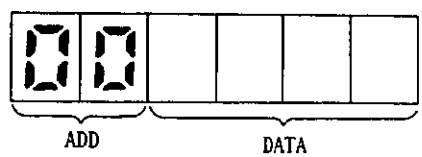


Fig. 2

Select address

- Address can be selected by pressing [UP] and/or [DOWN] switches.
  When address is selected, the data at that address is displayed.

  (Ex.) • When [UP] switch is pressed while display is as shown in Fig. 2, 0 1 appears.
  Another one touch of switch causes display of 0 2 (Fig. 3).
  • When [DOWN] switch is pressed while display is as shown in Fig. 3, 0 1 appears.
  Another one touch of switch causes display of 0 0 (Fig. 2).

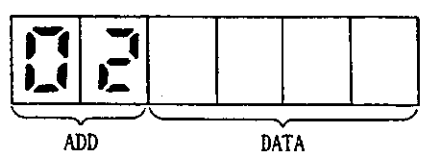


Fig. 3

Data rewrite

- To rewrite previously set data, press [SET] switch.
  When the switch is pressed, LEDs ADD flickers indicating that data can be rewritten.
- Set desired data by pressing [UP] and/or [DOWN] switches.
  Value can be incremented by pressing [UP] switch, and decremented by pressing [DOWN] switch.
  Value changes continuously while switch is held down.
- When [SET] switch is pressed again, newly set data is stored.
  After the switch is pressed, LEDs ADD light continuously.

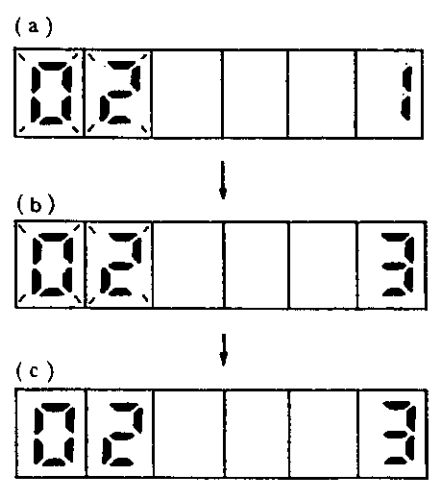


Fig. 4

Data set completed

- Press RESET switch and reset the FR-SGJ (or turn off and then on the power).

  Now data setting has been completed.

(Note) When the parameter data is not within the setting range, the LED display will be as shown in Fig. 5 (a). Reset after checking the parameter data value to be set.

* To confirm the presently set parameter, turn on dip switch (SW1) 4, and it will display. (Fig. 5(a) → (b).)

(Example)

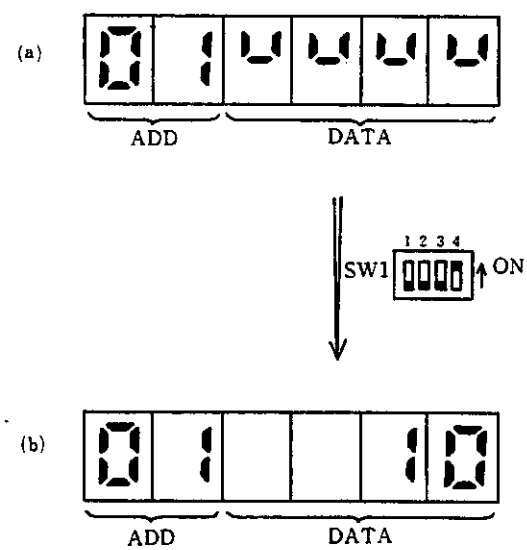


Fig. 5

3.3.8 Parameter list

#	Parameter		Description	Setting range (unit)
01	NOX	Motor type	bit0 = 0 Standard = 1 Set range constant output valid bit1 = 0 Standard = 1 Special motor constant (E_2ROM) bit2 = 0 Standard = 1 Base slide valid (When the motor constant is standard, select with MSL.)	Hexadecimal notation
02	MSL	Motor selection	<256PLG> 1 = SJ-N0.75A (10000 rpm) 2 = SJ-N1.5A (10000 rpm) 3 = SJ-N2.2X (10000 rpm) 4 = SJ-N2.2A (10000 rpm) 5 = SJ-N3.7A (10000 rpm) 6 = SJ-N5.5AP (10000 rpm) 7 = SJ-N5.5A (8000 rpm) 8 = SJ-N7.5A (8000 rpm) <128PLG> 17 = (Spare) 18 = (Spare) 19 = SJ-J2.2X (10000 rpm) 20 = SJ-J2.2A (10000 rpm) 21 = SJ-J3.7A (10000 rpm) 22 = (Spare) 23 = SJ-J5.5A (8000 rpm) 24 = SJ-J7.5A (8000 rpm) * The SJ-J motor can be selected also.	Decimal notation
03	PLG	Position loop encoder type	Setting is made for number of encoder pulses. 0: 1024 pulses (encoder orientation, sync. TAP)	Decimal notation
04	MOD	External interface mode selection	Setting depends on interface with NC. 0: Digital I/O (CON1 signal is used for operation) 2: Bus-line connection to M300	Decimal notation
05	DSR	Digital speed command type	Type of digital speed command input is selected. This parameter is valid when MOD (#04) is set "0". 0: 12-bit binary 1: Signed 12-bit binary 2: BCD (2-digit) 3: BCD (3-digit)	Decimal notation
06	MON	Output monitor selection	The details of the load meter output (CON1 M02 output) are set. 0: Load meter 2: Load meter (with primary delay filter)	Decimal notation
07			Not used. Set "0".	
08			Not used. Set "0".	
09			Not used. Set "0".	
0A			Not used. Set "0".	

Continued on the next page.

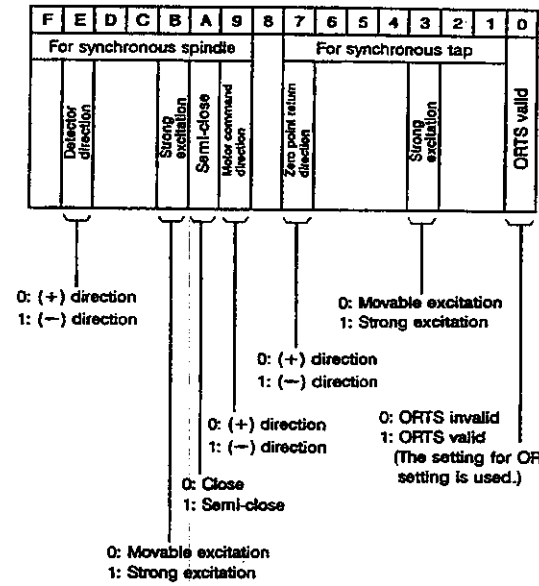
#	Parameter		Description	Setting range (unit)
0B	VOP	Speed command offset adjustment	When analog speed command is used, offset value is set. Standard setting: 0	Signed decimal notation −999 ~ +999
0C	VON	Speed command clamp value	Set "0".	−999≤ ≤+999
0D	VGP	Speed command gain adjustment	Gain for speed command is set. Actual speed command is product obtained by multiplyig speed command from external signal source by this setting (1 multiplier = 1000). Standard setting: 1000	Decimal notation 0 ~ 1150
0E			Not used. Set "0".	
0F	CSN2	2nd cushion (slow-start) time constant	Set "0".	Decimal notation
10	DTYP	Data type	Whether data of parameters #11 ~ #20 are valid or invalid depends on this setting. 0: Invalid 1: Valid When "1" is selected, data set for parameters #11 ~ #20 become valid for input signal to connector CONC of SGJ-OR card.	Decimal notation
11 12 13 14 15 16 17 18 19 1A 1B 1C	DT01 DT02 DT03 DT04 DT05 DT06 DT07 DT08 DT09 DT10 DT11 DT12	Data 1 Data 2 Data 3 Data 4 Data 5 Data 6 Data 7 Data 8 Data 9 Data 10 Data 11 Data 12	These data are valid when "1" is set for #10 DTYP. Speed command selected by speed select signal is set for each data. Data is set in terms of motor speed within the range up to the motor maximum speed set by #31 TSP.	Decimal notation
1D	DT13		Not used. Set "0".	
1E	DT14		Not used. Set "0".	
1F	DT15		Not used. Set "0".	
20			Not used. Set "0".	

Continued on the next page.

	#	Parameter		Description	Setting range (unit)
*	21	PG1	Magnesensor, Motor built-in encoder, Oriented position loop gain	The larger the setting, shorter time taken for orientation, and the higher is the servo stiffness. Larger setting, however, may cause more intense vibration overshoot. Standard setting: See Appendix table 1.	0 ~ 360 (1/10 rad/s)
*	22	PG2	Encoder oriented position loop gain	Same as above Standard setting: See Appendix table 1.	0 ~ 360 (1/10 rad/s)
*	23	PGC	Sync. TAP position loop gain	Spindle position loop gain in sync. TAP is set. Standard setting: 40 (NC display standard setting: 10.00)	1 ~ 512 (1/4 rad/s) For NC display parameter, 0.25 ~ 128.00 (rad/s)
*	24	ZRZ	Oriented in-position range	Positioning range within which "orientation complete" signal is output is set. Standard setting: 16 (NC display standard setting: 1.00)	Encoder: 1 ~ 5760 (1/16 deg.); Magnesensor: 1 ~ 512 (1/16 deg.) For parameter on NC display Encoder: 0~359 deg.; Magnesensor: 0 ~ 39 deg.
*	25	OSP		Not used. Set "0".	
*	26	CSP	Creep speed	Time taken for orientation is reduced by increasing this setting. Standard setting: See Appendix table 1.	1 ~ 1000
*	27	PST	Position shift	Oriented stop position is set. Encoder: Stop position is set within 360 deg. with increment of 360/4096. Magnesensor: Stop position is set within range from −5 deg. to +5 deg. with increment 10/1024 (2048 for 0 deg.). Standard setting: 2048	Encoder: 0 ~ 4095 (pulses); Magnesensor: 1536~2560 (about 1/100 deg.)
*	28	BRC		Not used. Set "0".	
*	29	PGT	Position loop gain during synchronous tap	When combining the synchronous spindle function and synchronous tap function set the position loop gain for during synchronous tapping. Here the PGC will become invalid. Standard setting: 40 (NC display standard setting: 10.00)	1 ~ 512 (1/4 rad/s) The NC display parameters will be 0.25 ~ 128.00 (rad/s)
*	2A	PGS	Position loop gain during synchronous spindle	Set the position loop gain for the spindle during synchronous spindle. When the setting value is "0", the parameter #23 PGC setting value will be used. Standard setting: 40 (NC display standard setting: 10.00)	1 ~ 512 (1/4 rad/s) The NC display parameters will be 0.25 ~ 128.00 (rad/s)

Continued on the next page.

Parameters marked with * are set on the NC side when the controller is connected to M300, M3/L3 series with bus line.

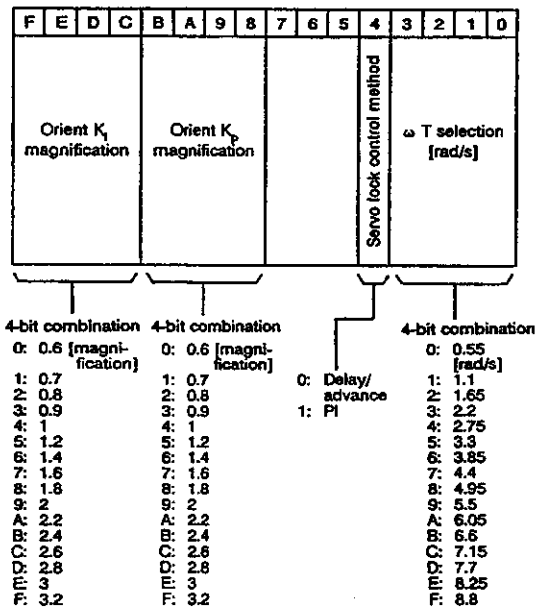
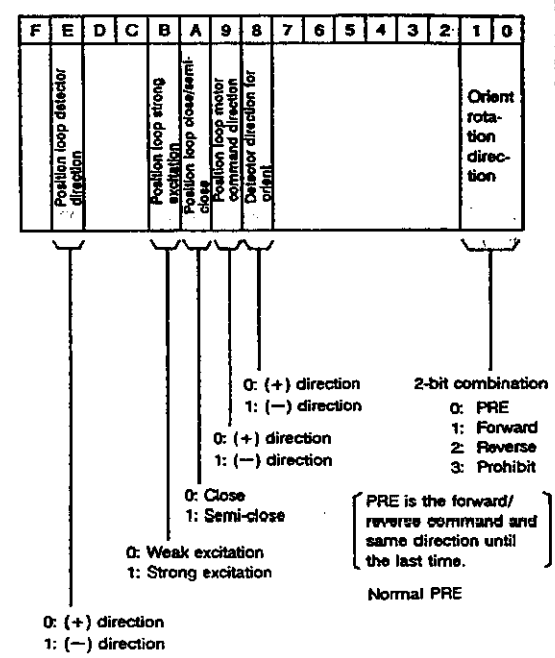
#	Parameter		Description	Setting range (unit)
* 2B	ORTS	Synchronous tap, synchronous spindle control selection	During synchronous spindle or when the synchronous spindle function and synchronous tap function are used together, set the control method for the synchronous tap. Here the ORS2 position loop related parameters will become invalid.  * Bits 0, 9, A, E are used for both the synchronous tap and synchronous spindle.	Hexadecimal notation
* 2C			Not used. Set "0".	
* 2D			Not used. Set "0".	
* 2E			Not used. Set "0".	

Continued on the next page.

Parameters marked with * are set on the NC side when the controller is connected to M300, M3/L3 series with bus line.

Appendix table 1 Parameter standard setting value for orientation

Parameter \ Application	For small load GD^2 (Machining center, etc.)	For large load GD^2 (Lathe, etc.)
PG1	100	50
PG2	100	50
CSP	20	8
ORS1	4400	4400

#	Parameter		Description	Setting range (unit)
* 2F	ORS1	Orient stop control 1	 Standard setting: Refer to Appendix table 1.	Hexadecimal notation
* 30	ORS2	Orient stop control 2		Hexadecimal notation

Continued on the next page.

Parameters marked with * are set on the NC side when the controller is connected to M300, M3/L3 series with bus line.

#	Parameter		Description	Setting range (unit)
* 31	TSP	Motor maximum speed	The maximum speed of motor depends on this setting.	1 ~ 3276 (10 rpm) 10 ~ 32760 (rpm) for parameter setting on NC display
* 32	ZSP	Zero speed	Speed at which "zero speed" is output is set. Standard setting: 50	1 ~ 1000 (rpm)
* 33	CSN	Acceleration time constant	Time for acceleration to maximum speed from zero speed is set (invalid for position loop control). Standard setting: 30 (300 for parameter setting on NC display)	2 ~ 3276 (10 msec) 20 ~ 32760 (msec) for parameter setting on NC display
* 34	SDT	Speed detection ratio	Speed at which "speed detect" signal is output is set in terms of percentage to motor maximum speed. Standard setting: 10	1 ~ 100 (%)
* 35	TLM	Torque limit	Torque limit is set in terms of percentage for torque limit. Standard setting: 10	1 ~ 120 (%)
* 36	VKP	Speed loop proportional gain	Proportional gain is set for speed loop. The larger the setting (100 ~ 150), the faster is the response, but the larger is the noise and vibration. Standard setting: 63	1 ~ 100 (rad/s)
* 37	VKI	Speed loop integral gain	Integral gain is set for speed loop. It should be set so that its ratio to proportional gain VKP is almost constant. Standard setting: 60	0 ~ 1000 (1/10 rad/s)
* 38	TYP	Position loop "IN" type	Setting is made for transition from "speed loop" to "position loop". 0: Position loop "IN" after orientation 1: Position loop "IN" after the stop with creep speed. Set "0" when initialization (zero return) is required, otherwise set "1". Standard setting: 0	Decimal notation

Continued on the next page.

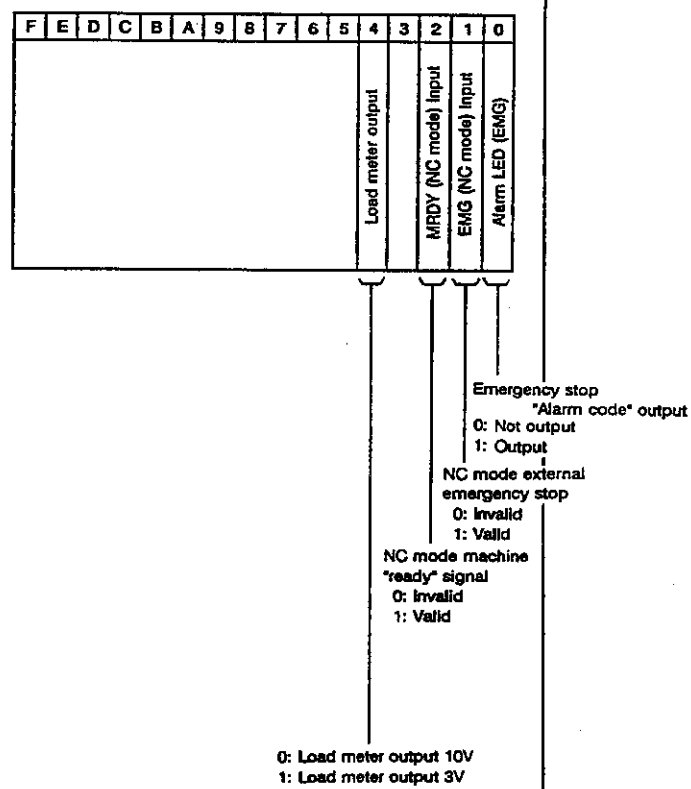
Parameters marked with * are set on the NC side when the controller is connected to M300, M3/L3 series with bus line.

#	Parameter		Description	Setting range (unit)
* 39	GRA1	Number of gear teeth on spindle side (Driven side)	Number of gear teeth for gear 00 is converted into hexadecimal value, and set.	Parameters necessary for oriented stop 64 ~ 7FFF (HEX) The NC display is a 100 ~ 32767 (decimal), and does not need to be changed to a hexadecimal. When the following equation is used, set (GRA1 ~ GRA4) and (GRB1 ~ GRB4) to the smallest integer within the setting range. Spindle speed × number of gear teeth on spindle side (GRA1~4) / number of gear teeth on motor side (GRB1~4) = motor speed. (Note 1)
* 3A	GRA2		Number of gear teeth for gear 01 is converted into hexadecimal value, and set.	
* 3B	GRA3		Number of gear teeth for gear 10 is converted into hexadecimal value, and set.	
* 3C	GRA4		Number of gear teeth for gear 11 is converted into hexadecimal value, and set.	
* 3D	GRB1	Number of gear teeth on motor side (Drive side)	Number of gear teeth for gear 00 is converted into hexadecimal value, and set.	
* 3E	GRB2		Number of gear teeth for gear 01 is converted into hexadecimal value, and set.	
* 3F	GRB3		Number of gear teeth for gear 10 is converted into hexadecimal value, and set.	
* 40	GRB4		Number of gear teeth for gear 11 is converted into hexadecimal value, and set.	

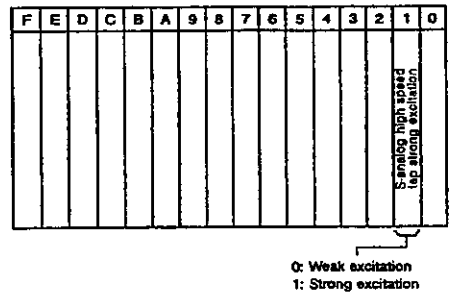
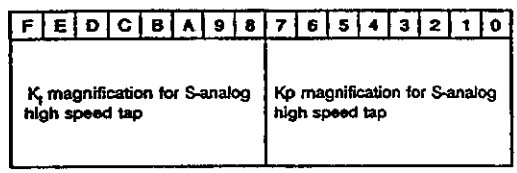
Continued on the next page.

Parameters marked with * are set on the NC side when the controller is connected to M300, M3/L3 series with bus line.

Note 1) When the GRA and GRB value is smaller than 64_H (100_D with a decimal), multiply GRA and GRB with the same constant and change it so that it will be a value larger than 100_D.
(Ex. When GRA1 = 31, GRB1 = 29, multiply both by 4, and set GRA1-$124_D = 7C_H$ and GRB1 = $116_D = 74_H$.)

#	Parameter		Description	Setting range (unit)
41	OSL	Orientation type	Type of orientation is set. 0: Motor built-in encoder 1: Encoder 2: Magnesensor	Hexadecimal notation
42	BSL	Bit assignment		Hexadecimal notation
43	SPC	For general-purpose motor, meter output is valid/invalid	This parameter is set when using 1 amp 2 motor function. For details refer to option specifications BNP-A2956-23.	Hexadecimal notation
44			Not used. Set "0".	
45			Not used. Set "0".	

Continued on the next page.

#	Parameter		Description	Setting range (unit)
46	HSP	S-analog high speed tap selection		Hexadecimal notation
47	HSPI	K_p, K_I magnification for S-analog high speed tap	The K_p, K_I magnification is set in addition to orient for the S-analog high speed tap.  The K_I and K_p magnifications can be set between 1/16 ~ 15 times with 10_H (16_D) as 1 time. When the magnification is raised, the response to the impact load is increased, and the noise of the gears will increase. Set at 1 ~ 2 times (1010_H ~ 2020_H). Normally the K_I and K_p magnifications are set to the same value.	Hexadecimal notation Setting example When setting both K_I and K_p to 1.5 times: $CPI = \frac{18}{K_I} = \frac{18_H}{K_p}$
48	DAM	PLG magnification	When optional SGJ-OR or SGJ-DA cards are added-on, the pulse number magnification of the PLG (motor built-in encoder) output from CONAA is set. 0H: ×1 (256PPR) 100H: ×2 (512PPR)	Hexadecimal notation
49			Not used. Set "0".	
4A			Not used. Set "0".	
4B			Not used. Set "0".	
4C			Not used. Set "0".	
4D			Not used. Set "0".	
4E			Not used. Set "0".	
4F			Not used. Set "0".	
50			Not used. Set "0".	
51			Not used. Set "0".	

Continued on the next page.

#	Parameter		Description	Setting range (unit)
52	SETM		This is a fixed parameter set by Mitsubishi. Please take care not to change it.	Decimal notation
53	ZSTM			Decimal notation
54			Not used. Set "0".	
55	STOD		This is a fixed parameter set by Mitsubishi. Please take care not to change it.	Decimal notation
56			Not used. Set "0".	
57			Not used. Set "0".	
58	CVHS		This is a fixed parameter set by Mitsubishi. Please take care not to change it.	Decimal notation
59			Not used. Set "0".	
5A			Not used. Set "0".	
5B			Not used. Set "0".	
5C			Not used. Set "0".	
5D			Not used. Set "0".	
5E			Not used. Set "0".	
5F	PXY	Variable excitation	The variable excitation ratio is set. When the gear noise is loud, select a small value. A large value is effective in responding to the impact load. (When setting value = 0, the excitation ratio is 50%.) Standard setting: 0	0 ~ 100 (%)

Continued on the next page.

<table>
<tr><th>#</th><th colspan="2">Parameter</th><th>Description</th><th>Setting range (unit)</th></tr>
<tr><td>60</td><td>HI1</td><td>Auxiliary input 1 selection</td><td rowspan="5">Meaning of each input
For details refer to the auxiliary input signal section of Standard Specification.

0 = Invalid
1 = Orient start
2 = Gear selection L
3 = Gear selection M
4 = Emergency stop
5 = Torque limit H
6 = Torque limit L
7 = Forward index
8 = Reverse index
9 = External reset
10 = Motor selection 1
11 = Motor selection 2
12 = Speed selection 1
13 = Speed selection 2
14 = Speed selection 3
15 = Digital speed selection
16 = S-analog high speed tap</td><td rowspan="5">Decimal notation
0 ~ 16</td></tr>
<tr><td>61</td><td>HI2</td><td>Auxiliary input 2 selection</td></tr>
<tr><td>62</td><td>HI3</td><td>Auxiliary input 3 selection</td></tr>
<tr><td>63</td><td>HI4</td><td>Auxiliary input 4 selection</td></tr>
<tr><td>64</td><td>HI5</td><td>Auxiliary input 5 selection</td></tr>
<tr><td>65</td><td>HO1</td><td>Auxiliary output 1 selection</td><td rowspan="3">Meaning of each output
For details refer to the auxiliary output signal section of Standard Specification.

0 = Invalid
1 = Orient completed
2 = Speed detect
3 = Current detect
4 = Emergency stop
5 = Torque limit
6 = Ready-ON
7 = Motor forward run
8 = Motor reverse run
9 = Alarm
10 = Motor selection output 1
11 = Motor selection output 2</td><td rowspan="3">Decimal notation
0 ~ 11</td></tr>
<tr><td>66</td><td>HO2</td><td>Auxiliary output 2 selection</td></tr>
<tr><td>67</td><td>HO3</td><td>Auxiliary output 3 selection</td></tr>
<tr><td>68</td><td>SS0</td><td>Speed setting 0</td><td rowspan="10">Speed selection with a combination of auxiliary input signal section 1, 2, 3

Speed selection
3 | 2 | 1 | Selection
0 | 0 | 0 | SS0
0 | 0 | 1 | SS1
0 | 1 | 0 | SS2
0 | 1 | 1 | SS3
1 | 0 | 0 | SS4
1 | 0 | 1 | SS5
1 | 1 | 0 | SS6
1 | 1 | 1 | SS7

0: Contact open
1: Contact closed</td><td rowspan="10">Decimal notation
0 ~ 9999 (rpm)</td></tr>
<tr><td>69</td><td>SS1</td><td>Speed setting 1</td></tr>
<tr><td>6A</td><td>SS2</td><td>Speed setting 2</td></tr>
<tr><td>6B</td><td>SS3</td><td>Speed setting 3</td></tr>
<tr><td>6C</td><td>SS4</td><td>Speed setting 4</td></tr>
<tr><td>6D</td><td>SS5</td><td>Speed setting 5</td></tr>
<tr><td>6E</td><td>SS6</td><td>Speed setting 6</td></tr>
<tr><td>6F</td><td>SS7</td><td>Speed setting 7</td></tr>
</table>

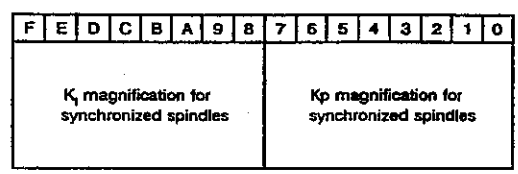
Continued on the next page.

#	Parameter		Description	Setting range (unit)
70	HI6	Auxiliary input 6 selection	Selection is possible by adding on the optional SGJ-DA card. The meaning of each input is the same as HI1 ~ HI5.	Decimal notation 0 ~ 16
71	HI7	Auxiliary input 7 selection		
72	HI8	Auxiliary input 8 selection		
73	HO4	Auxiliary output 4 selection	Selection is possible by adding on the optional SGJ-DA card. The meaning of the output is the same as HO1 ~ HO3.	Decimal notation 0 ~ 11
74			Not used. Set "0".	
75			Not used. Set "0".	
76			Not used. Set "0".	
77			Not used. Set "0".	
78			Not used. Set "0".	
79			Not used. Set "0".	
7A			Not used. Set "0".	
7B			Not used. Set "0".	
7C			Not used. Set "0".	
7D	HSPT	Maximum speed during S-analog high speed tap	When carrying out S-analog high speed tap, the maximum motor speed is set for when S-analog ± 10V is input. When the set value is 0, it will be the same value as TSP.	Decimal notation 0 ~ 3276 (10 rpm)
7E	DIQN		This is a fixed parameter set by Mitsubishi. Please take care not to change it.	Decimal notation
7F	SMO	Maximum speed for speed meter	The speed to output 10V to the speed meter is set. When the set value is 0, it will be the same value as TSP.	Decimal notation
80 ~ AF	TOUT ~ BSD		This is a fixed parameter set by Mitsubishi. Please take care not to change it.	Hexadecimal notation
B0			Not used. Set "0".	
B1			Not used. Set "0".	
B2			Not used. Set "0".	

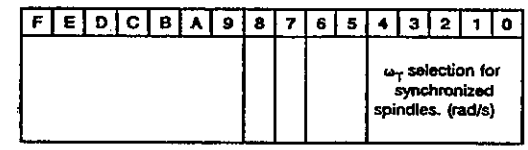
Continued on the next page.

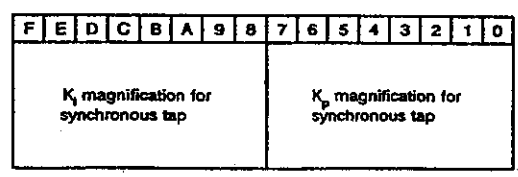
#	Parameter		Description	Setting range (unit)
B3			Not used. Set "0".	
B4			Not used. Set "0".	
B5			Not used. Set "0".	
B6			Not used. Set "0".	
B7			Not used. Set "0".	
B8			Not used. Set "0".	
B9			Not used. Set "0".	
BA			Not used. Set "0".	
BB			Not used. Set "0".	
BC			Not used. Set "0".	
BD			Not used. Set "0".	
BE			Not used. Set "0".	
BF			Not used. Set "0".	
C0 ~ C9	MT20 ~ MT29	General-purpose sub-motor 1 constant	This parameter is set when the 1 amp 2 motor function is used. For details refer to option specifications (BNP-A2956-23).	Decimal notation
CA			Not used. Set "0".	
CB			Not used. Set "0".	
CC			Not used. Set "0".	
CD			Not used. Set "0".	
CE			Not used. Set "0".	
CF			Not used. Set "0".	

Continued on the next page.

#	Parameter		Description	Setting range (unit)
D0 ~ D9	MT30 ~ MT39	General-purpose sub-motor 2 constant	This parameter is set when the 1 amp 3 motor function is used. For details refer to option specifications (BNP-A2956-23).	Decimal notation
DA			Not used. Set "0".	
DB			Not used. Set "0".	
DC			Not used. Set "0".	
DD			Not used. Set "0".	
DE			Not used. Set "0".	
DF			Not used. Set "0".	
E0			Not used. Set "0".	
E1	SYNV	Matched synchronized speeds	This parameter is set when the synchronized spindle function is used. This sets the judged speed difference that occurs when speed control is switched to position control.	Decimal notation
E2	SPI	K_p, K_i magnification for synchronized spindles	This is valid when #E3 SWT bit 8 is set to 1. The K_p, K_i magnifications are set in addition to orient for synchronized spindles.  The K_i and Kp magnifications can be set between 1/16 ~ 15 times with 10_H (16_D) as 1 time. When the magnification is raised, the response to the impact load is increased, and the noise of the gears will increase. Set at 1 ~ 2 times (1010_H ~ 2020_H). Normally the K_i and K_p magnifications are set to the same value.	Hexadecimal notation Setting example When setting both K_i and K_p to 1.5 times: $CPI = \frac{18}{K_i} \frac{18_H}{K_p}$

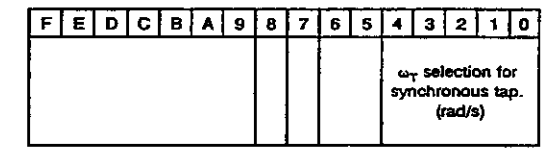
Continued on the next page.

<table>
<tr><th>#</th><th colspan="2">Parameter</th><th>Description</th><th>Setting range (unit)</th></tr>
<tr><td>E3</td><td>SWT</td><td>Setting of K_p, K_I, ω_T control methods for synchronized spindles. Valid/invalid selection.</td><td>


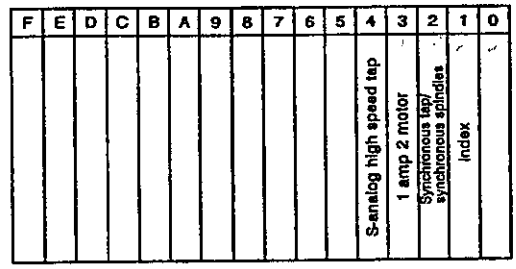
5-bit combination
0: 0.55 10: 9.4
1: 1.1 11: 10.0
2: 1.65 12: 10.55
3: 2.2 13: 11.10
4: 2.75 14: 11.65
5: 3.3 15: 12.2
6: 3.85 16: 12.8
7: 4.4 17: 13.35
8: 4.95 18: 13.9
9: 5.5 19: 14.45
A: 6.05 1A: 15.05
B: 6.6 1B: 15.6
C: 7.15 1C: 16.15
D: 7.7 1D: 16.75
E: 8.25 1E: 17.3
F: 8.85 1F: 17.85
Control method during synchronized spindle
0: Delay/advance
1: PI
Valid/invalid selection of #E2 and #E3 parameters.
0: Invalid
The K_p, K_I and ω_T control method will be the value set in #2F ORS1.
1: Valid
The K_p, K_I and ω_T control method during position loop will be the value set in #E2 and E3.</td><td>Hexadecimal notation</td></tr>
<tr><td>E4</td><td>TPI</td><td>K_p, K_I magnification during synchronous tap</td><td>This is valid when #E5TWT bit 8 is set to 1.
The K_p, K_I magnification is set in addition to the orient for synchronous tap.


The K_I and K_p magnifications can be set between 1/16 ~ 15 times with 10_H (16_D) as 1 time. When the magnification is raised, the response to the impact load is increased, and the noise of the gears will increase.
Set at 1 ~ 2 times (1010_H ~ 2020_H).
Normally the K_I and K_p magnifications are set to the same value.</td><td>Hexadecimal notation
Setting example
When setting both K_I and K_p to 1.5 times:
$CPI = \frac{18}{K_I} \frac{18_H}{K_p}$</td></tr>
</table>

Continued on the next page.

#	Parameter		Description	Setting range (unit)
E5	TWT	Setting of K_p, K_I, ω_T control methods for synchronous tap. Valid, invalid selection.	 5-bit combination 0: 0.55 10: 9.4 1: 1.1 11: 10.0 2: 1.65 12: 10.55 3: 2.2 13: 11.10 4: 2.75 14: 11.65 5: 3.3 15: 12.2 6: 3.85 16: 12.8 7: 4.4 17: 13.35 8: 4.95 18: 13.9 9: 5.5 19: 14.45 A: 6.05 1A: 15.05 B: 6.6 1B: 15.6 C: 7.15 1C: 16.15 D: 7.7 1D: 16.75 E: 8.25 1E: 17.3 F: 8.85 1F: 17.85 Control method during synchronous tap 0: Delay/advance 1: PI Valid/invalid selection of #E4 and #E5 parameters. 0: Invalid The K_p, K_I and ω_T control method will be the value set in #2F ORS1. 1: Valid The K_p, K_I and ω_T control method during position loop will be the value set in #E4 and E5.	Hexadecimal notation
E6			Not used. Set "0".	
E7			Not used. Set "0".	
E8			Not used. Set "0".	
E9			Not used. Set "0".	
EA			Not used. Set "0".	
EB			Not used. Set "0".	
EC			Not used. Set "0".	
ED			Not used. Set "0".	
EE			Not used. Set "0".	
EF			Not used. Set "0".	

Continued on the next page.

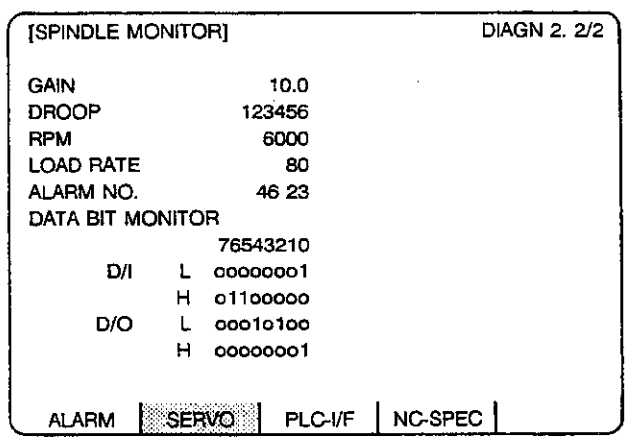
#	Parameter		Description	Setting range (unit)
F0	FNK	Option function selection	 { 0: Function valid 1: Function invalid • When the corresponding option function bit is not set to 1, the function will not run and the option error will show "AL 57" when command is input. This parameter can be set only when shipped from the factory, and cannot be changed by the user.	Hexadecimal notation
F1			Not used. Set "0".	
F2			Not used. Set "0".	
F3			Not used. Set "0".	
F4			Not used. Set "0".	
F5			Not used. Set "0".	
F6			Not used. Set "0".	
F7			Not used. Set "0".	
F8 ~ FF	OLL ~ ENCP		This is a fixed parameter set by Mitsubishi. Please take care not to change the settings.	Decimal notation

3.4 NC Screen Spindle Monitor during M300, M3/L3 Connection

Since display (format, content, etc.) and setting method differ from NC to NC, refer to the instruction manual for your NC system.
Typical examples of NC display are described here.

3.4.1 Status display

For status display, "SPINDLE MONITOR" is selected from the menu. For use of this display function, FR-SGJ should be connected to NC with bus line.



Display	Description
GAIN	Position loop gain is displayed. When position loop is not used, "0" is displayed. The standard position loop gain is, $\frac{\text{Motor speed (rad/s)}}{\text{Response delay (rad/s)}} = 10$
DROOP	Error in true spindle angle from commanded spindle angle is called "droop". Droop is expressed in number of pulses. When position loop is not used, "0" is displayed.
RPM	Means autual speed of motor expressed in rpm.
LOAD RATE	Load is displayed in ratio (%) to motor rated output (capacity). The output rated for 30 min. is 100%. Range of display is from 0 to 120%.
ALARM NO.	When an error occurs in the spindle amp, the descriptions of the last alarm that occurred (left display) and the other alarms (right display) will be displayed with alarm codes. For alarm contents, refer to Appendix table 2.

Continued on the next page.

<table>
<tr><th>Display</th><th>Description</th></tr>
<tr><td>D/I</td><td>Signal input to spindle amplifier is displayed by bit.
<table>
<tr><th colspan="8">Control input H</th><th colspan="8">Control input L</th></tr>
<tr><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td colspan="5">Gear select
00: GEAR 00
01: GEAR 01
10: GEAR 10
11: GEAR 11</td><td>Synchronized spindles</td><td>Tapping</td><td>Oriented command</td><td colspan="3"></td><td>H Torque limit H</td><td>L Torque limit L</td><td>SRI Reverse run</td><td>SRN Forward run</td></tr>
</table></td></tr>
<tr><td>D/O</td><td>Signal output from spindle amplifier is displayed by bit.
<table>
<tr><th colspan="8">Control output H</th><th colspan="8">Control output L</th></tr>
<tr><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr>
<tr><td colspan="6"></td><td>CW Reverse run</td><td>CCW Forward run</td><td>Oriented completed</td><td>Up-to-speed</td><td>Zero speed</td><td>Alarm</td><td>Speed detect</td><td>Current detect</td><td>Synchronized spindle speed match</td></tr>
</table></td></tr>
</table>

Appendix Table 2 Spindle alarm list

FR-SGJ

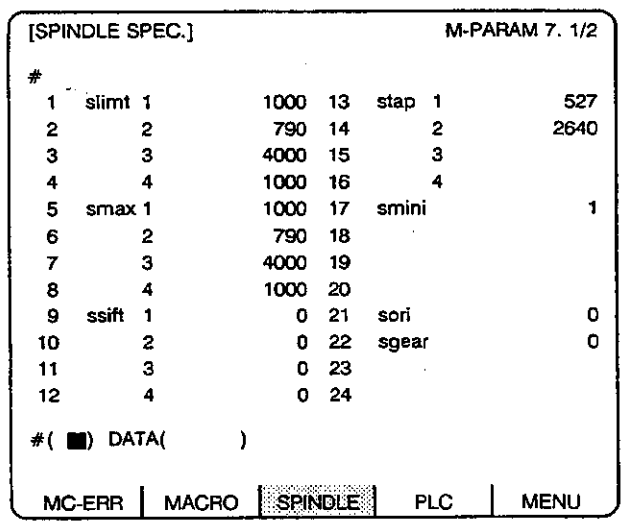
Alarm, Warning List

No.	Description			No.	Description		
10	UV	Under voltage	PR	40			
11				41			
12	ME1	Memory error 1	AR	42			
13	CE	External clock error	PR	43			
14	WD	Watch dog alarm	AR	44			
15	ME2	Memory error 2	PR	45	OHF	Overheat (Controller)	NR
16				46	OHM	Overheat (Motor or resistor)	NR
17				47			
20				50			
21	NS	No signal (Spindle ENC.)	PR	51	OL	Overload alarm	NR
22				52	OD	Error excessive	NR
23	OSE	Speed deflection excessive	PR	53			
24	CB	Main circuit fault	PR	54			
25	BK	Braking circuit fault	PR	55	EMA	External emergency stop alarm	PR
26				56	OA	Other axis error	NR
27	CPUE	CPU error (Calculation error)	PR	57	OPE	Option error	NR
30	GF	Grounding detection	PR	E0			
31	OS	Overspeed	PR	E1	WOL	Overload warning	*
32	OC	Over current	PR	E2			
33	OV	Over voltage	PR	E3			
34	DP	Data parity	PR	E4	WPE	Parameter error warning	*
35	DE	Data error	PR	E5			
36	TE	Transfer error	PR	E6			
37	PE	Parameter error	PR	E7	NCE	NC emergency stop warning	*

PR : Reset by turning off NC power supply
AR : Reset by turning off spindle amplifier power supply
NR : NC reset
* : Warning (Reset by removing conditions)

3.5 Spindle Parameter Setting with NC Screen during M300, M3/L3 Connection

When "SPINDLE PARAMETER" is selected from the display menu, the list of spindle parameters is displayed.
There are two types of spindle parameters; one is those used on the NC side, and the other is those sent to FR-SGJ when FR-SGJ is connected to NC through bus line.



3.5.1 Parameters used on NC side

Spindle parameter list (1/2)

#	Parameter		Description	Setting range (unit)
1 2 3 4	slimt 1 2 3 4	Speed limit	For GEAR 00 GEAR 01 GEAR 10 GEAR 11 } spindle speed with motor at maximum speed is set.	0 ~ 99999 (rpm)
5 6 7 8	smax 1 2 3 4	Max. speed	For GEAR 00 GEAR 01 GEAR 10 GEAR 11 } maximum spindle speed is set. S limit ≥ 1 S max.	
9 10 11 12	ssift 1 2 3 4	Shift speed	For GEAR 00 GEAR 01 GEAR 10 GEAR 11 } spindle speed for gear shift is set.	0 ~ 32767 (rpm)
13 14 15 16	stap 1 2 3 4	Tap speed	For GEAR 00 GEAR 01 GEAR 10 GEAR 11 } maximum spindle speed during tap cycle is set.	0 ~ 99999 (rpm)
17	smini	Min. speed	Minimum spindle speed is set. Spindle runs at this speed even when speed specified by S command is lower than this speed.	0 ~ 32767 (rpm)
21	sori		Not used. Set "0".	
22	sgear	Encoder gear ratio	Gear ratio between spindle gear and encoder gear is set.	0: 1/1 1: 1/2 2: 1/4 3: 1/8

3.5.2 Parameters sent to FR-SGJ from NC

These parameters are sent from FR-SGJ to NC when FR-SGJ is connected to NC through bus line.
Although FR-SGJ itself has the same parameters, the parameters appear-ing on the NC display are valid when FR-SGJ is connected to NC.

Note) Parameters on the NC display can be made invalid by setting DSW-1 switch of card SGJ-CB to "ON".
In this case, the parameters stored in FR-SGJ are all valid.

For a 9 inch CRT

[SPINDLE SPEC.] M_PARAM 7.2/ 2

#								
1	PG1	100	13			25	GRA 1	100
2	PG2	100	14			26	2	100
3	PGC	10.00	15	ORS 1	4400	27	3	100
4	ZRZ	1.00	16	ORS 2	0	28	4	100
5	OSP	0	17	TSP	4500	29	GRB 1	100
6	CSP	20	18	ZSP	50	30	2	100
7	PST	2048	19	CSN	300	31	3	100
8	BRC	0	20	SDT	10	32	4	100
9			21	TLM	10	33		
10			22	VKP	63	34		
11			23	VKI	60	35		
12			24	TYP	0	36		

#(■) DATA( )

MC-ERR | MACRO | SPINDLE | PLC | MENU

Refer to the spindle parameter list found in the back for parameter details.

For a 14 inch CRT

[SPINDLE SPEC.] M_PARAM 9

#											
1	slimt	1	17	smini	1	33	PG1	100	49	TSP	4500
2		2	18			34	PG2	100	50	ZSP	50
3		3	19			35	PGC	10.00	51	CSN	300
4		4	20			36	ZRZ	1.00	52	SDT	10
5	smax	1	21	sori	0	37	OSP	0	53	TLM	10
6		2	22	sgear	0	38	CSP	20	54	VKP	63
7		3	23			39	PST	2048	55	VKI	60
8		4	24			40	BRC	0	56	TYP	0
9	ssift	1	25			41			57	GRA 1	100
10		2	26			42			58	2	100
11		3	27			43			59	3	100
12		4	28			44			60	4	100
13	stap	1	29			45			61	GRB 1	100
14		2	30			46			62	2	100
15		3	31			47	ORS1	4400	63	3	100
16		4	32			48	ORS2	0	64	4	100

SPINDLE

Spindle parameter list (2/2)

#	Parameter		Description	Setting range (unit)	
1	PG1	Magnesensor oriented position loop gain	The larger the setting, the shorter is the time taken for orientation, and the higher is the servo stiffness. Larger setting, however, may cause more intense vibration overshoot. Standard setting: See Appendix table 1 (page 6-10).	0 ~ 360 (1/10 rad/s)	
2	PG2	Encoder oriented position loop gain	Same as above Standard setting: See Appendix table 1 (page 6-10).	0 ~ 360 (1/10 rad/s)	
3	PGC	Sync. TAP position loop gain	Spindle position loop gain in sync. TAP is set. Standard setting: 10.00	0.01 ~ 999.99 (rad/s)	
4	ZRZ	Oriented in-position range	Positioning error range within which "orientation complete" signal is output is set. Standard setting: 1.00	Encoder 0 ~ 359 deg.	Magnesensor 0 ~ 39 deg.
5	OSP		Not used. Set "0".		
6	CSP	Creep speed	Time taken for orientation is reduced by increasing this setting. Standard setting: See Appendix table 1 (page 6-10)	0 ~ 100	
7	PST	Position shift	Oriented stop position is set. Encoder : Stop position is set within 360 deg. with increment of 360/4096. Magnesensor: Stop position is set within range from −5 deg. to +5 deg. with increment 10/1024 (2048 for 0 deg.). Standard setting: 2048	Encoder 0 ~ 4095 (pulses)	Magnesensor 1536 ~ 2560 (about 1/100 deg.)
8	BRC		Not used. Set "0".		
15	ORS1	Oriented stop control 1	See page 6-30.	Hexadecimal notation 0 ~ FFFF	
16	ORS2	Oriented stop control 2	See page 6-30.		
17	TSP	Motor maximum speed	The maximum speed of motor depends on this setting.	10 ~ 32760 (10 rpm)	
18	ZSP	Motor zero speed	Speed at which "zero speed" is output is set. Standard setting: 50	1 ~ 1000 (rpm)	
19	CSN	Acceleration time constant	Time for acceleration to maximum speed from zero speed is set (invalid for position loop). Standard setting: 300	20 ~ 32760 (msec)	
20	SDT	Speed detection ratio	Speed at which "speed detect" signal is output is set in terms of percentage to motor maximum speed. Standard setting: 10	1 ~ 100 (%)	
21	TLM	Torque limit	Torque limit is set in terms of percentage for torque limit signal H. (The torque limit signal L will be a limit ratio that is one-half of this.) Standard setting: 10	1 ~ 120 (%)	

Continued on the next page.

#	Parameter		Description	Setting range (unit)
22	VKP	Speed loop proportional gain	Proportional gain is set for speed control loop. The larger the setting (100 ~ 150), the faster is the response, but the larger is the noise and vibration. Standard setting: 63	1 ~ 1000 (rad/s)
23	VKI	Speed loop integral gain	Integral gain is set for speed control loop. It should be set so that its ratio to proportional gain VKP is almost constant. Standard setting: 60	0 ~ 1000 (1/10 rad/s)
24	TYP	Position loop "IN" type	Setting is made for transition from "speed loop" to "position loop". 0: Position control loop "IN" after spindle orientation 1: Position control loop "IN" after the stop with creep speed. Set "0" when initialization (zero return) is required, otherwise set "1". Standard setting: 0	Decimal notation
25	GRA1	Number of gear teeth on spindle side (Driven side)	Number of gear teeth for gear 00 is converted into hexadecimal value, and set.	Note) 100 ~ 32767
26	GRA2		Number of gear teeth for gear 01 is converted into hexadecimal value, and set.	
27	GRA3		Number of gear teeth for gear 10 is converted into hexadecimal value, and set.	
28	GRA4		Number of gear teeth for gear 11 is converted into hexadecimal value, and set.	
29	GRB1	Number of gear teeth on motor side (Drive side)	Number of gear teeth for gear 00 is converted into hexadecimal value, and set.	Note) 100 ~ 32767
30	GRB2		Number of gear teeth for gear 01 is converted into hexadecimal value, and set.	
31	GRB3		Number of gear teeth for gear 10 is converted into hexadecimal value, and set.	
32	GRB4		Number of gear teeth for gear 11 is converted into hexadecimal value, and set.	

(Note) If setting of GRA1 ~ GRB4 is smaller than 100, multiply the same factor to GRA and GRB to make the value larger than 100.

Ex.: When GRA1 = 31 and GRB1 = 29, they are multiplied by 4.
Settings: GRA1 = 124 GRB1 = 116

3.6 Test Operation

Connect the motor shaft directly to the machine shaft. Run the machine and perform the following checks:

(1) Does the true motor speed meet the given command speed?
If no, make adjustment in accordance with the instruction in Item 3.7.
(2) Is motor rotation smooth?
(3) Does any unusual sound occur?
(4) Does any foreign odor arise?
(5) Is temperature of each bearing normal?

When it is verified that the motor and machine are in good condition, operate the motor and machine under load condition to check.

3.7 Adjustment of Motor Speed (For SGJ-CA card)

All FR-SGJ controllers are adjusted, before shipment, in accordance with the order specifications. When analog voltage speed command signal is used, however, voltage drop caused by signal line may cause deviation, and requires fine adjustment.
When FR-SGJ uses option SGJ-CB card and is connected to M300, M3/L3 CNC with bus line, or uses option SGJ-DA card for digital speed command signal, no deviation occurs and therefore readjustment is not required.
In this case, the parameter No. OD [VGP] is to be set to 1000.

Adjustment procedure:

(1) Input speed command signal to the forward run minimum speed and record the motor speed displayed by the 7-segment LED of controller (record the speed as N_{1f} (rpm)). When the desired motor speed is N_{1r} (rpm), set k_1, determined from the following formula, for parameter No. OB [VOP].

$$k_1 = \frac{N_{1f} - N_{1r}}{\text{Max. motor speed with command signal voltage at 10V (rpm)}} \times 2048$$

(2) Input speed command signal to the forward run maximum speed and record the motor speed displayed by the 7-segment LED of controller (record the speed as N_{2f} (rpm)). If this N_{2f} is not equal to the desired speed N_{2r}, set k_2, determined from the following formula, for parameter No. OD [VGP].

$$k_2 = (\text{Current [VGP] data}) \times \frac{N_{2r}}{N_{2f}}$$

(3) When the adjustment has been completed for forward run, speed in reverse run should have been adjusted automatically. It is, however, recommended to verify that specified command speeds are always equal to true motor speeds.

[Ex.]: If the rated motor speed be 8000 rpm with 10V speed command signal, and the reduction ratio be 2:1 (motor speed: spindle speed) .....

$N_{1f} = 200$: Motor speed should be 200 rpm with spindle speed command of S100

$N_{1f} = 188$: Reading of 7-segment LED with spindle speed command of S100.

$$\therefore k_1 = \frac{188 - 200}{8000} \times 2048 \fallingdotseq -3$$

⇓

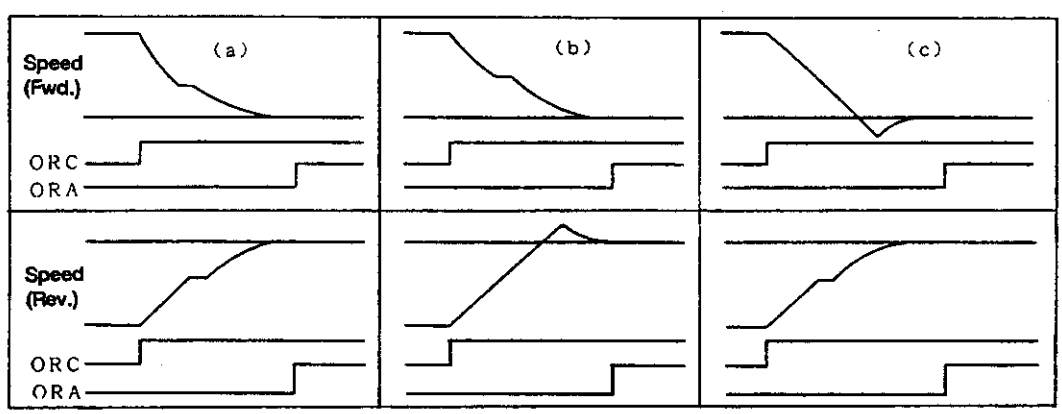
Set −3 for parameter VOP.

3.8 Adjustment of Oriented Function

3.8.1 Oriented motions

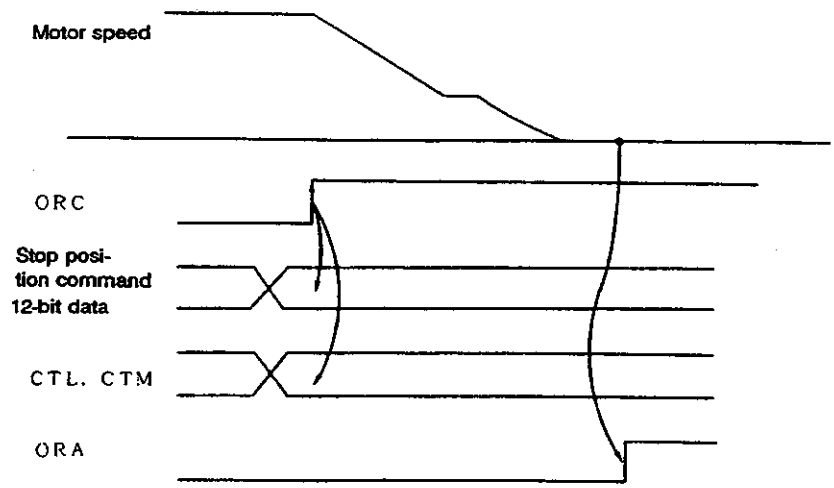
There are three types of orient and can be selected by setting parameter ORS2.

1. PRE (a) Spindle approaches the stop position in the direction of rotation which is same as that of on-going rotation.
2. Forward orientation (b) Spindle always approaches the stop position in the direction of forward rotation.
3. Reverse orientation (c) Spindle always approaches the stop position in the direction of reverse rotation.



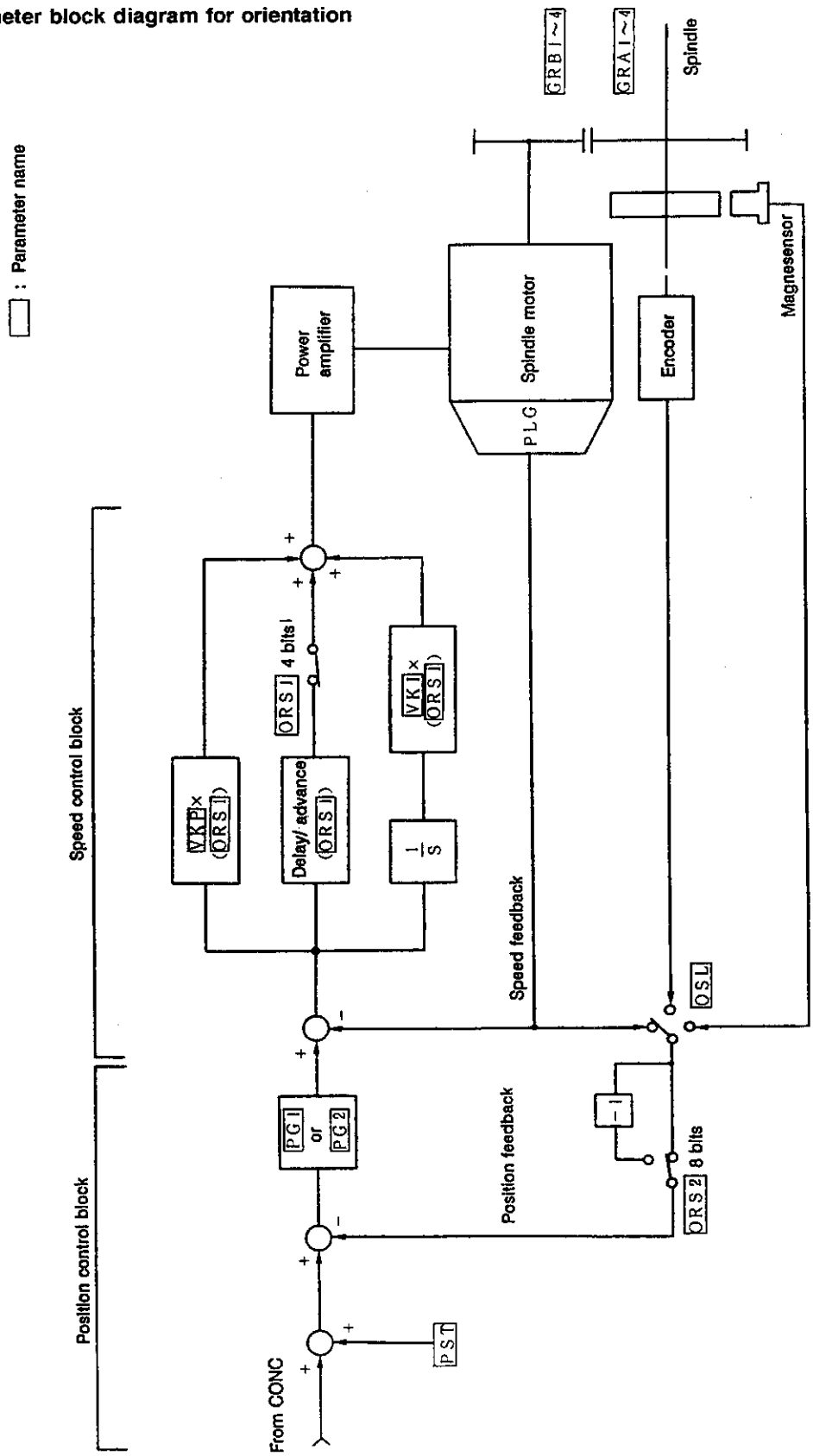
3.8.2 Operation sequence

(1) When orient command signal ORC turns on, motor speed changes from steady run speed to position loop control speed and at the same time "stop position command" (multipoint spindle orientation) is read.
(2) When motor speed reaches the position loop control speed, control mode changes from "speed control" mode to "position control" mode (position control loop gain parameter (Note 1)).
(Position loop control speed is automatically set in accordance with position control loop gain setting.)
(3) When control mode changes to position control mode, distance to the stop position is calculated and spindle speed is decelerated in accordance with the deceleration pattern set by parameter CSP to stop.
(4) When the spindle enters the "in-position" range set by parameter ZRZ, oriented complete signal ORA turns on.
(5) Spindle stop position can be shifted by setting parameter PST.
(6) When orient command signal (ORC) is turned off, motor speed returns to the previously set reference speed.



Note: PG1 is used for magnesensor/motor built-in encoder type orientation, and PG2 for encoder type orientation.

3.8.3 Parameter block diagram for orientation



3.8.4 Preparation for adjustment of motor built-in encoder orientation

[Parameters]

	For FR-SGJ connected to M300 with bus line (NC display "spindle parameter", page 2)		For FR-SGJ not connected to M300 with bus line (7-segment LED display)	
Parameter name	**No.**	**Initial value**	**No.**	**Initial value**
PG1	1	Refer to appendix table 1.	21	Refer to appendix table 1.
ZRZ	4	1.00	24	16
CSP	6	Refer to appendix table 1.	26	Refer to appendix table 1.
PST	7	2048	27	2048
ORS1	15	Refer to appendix table 1.	2F	Refer to appendix table 1.
ORS2	16		30	
GRA1	25	100	39	64
GRA2	26	100	3A	64
GRA3	27	100	3B	64
GRA4	28	100	3C	64
GRB1	29	100	3D	64
GRB2	30	100	3E	64
GRB3	31	100	3F	64
GRB4	32	100	40	64
OSL	⟶		41	0

[Preparation]

a) Check parameters [PG1], [CSP] and [PST] are set as listed above.
No setting is required for [PG2] and [OSP].

b) After parameter setting is changed, be sure to turn off and on the power, or press RESET button to reset.

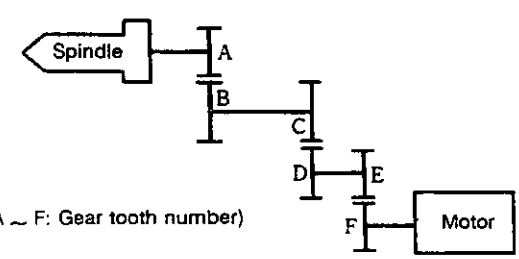
3.8.5 Preparation for adjustment of encoder orientation

[Parameters]

	For FR-SGJ connected to M300 with bus line (NC display "spindle parameter", page 2)		For FR-SGJ not connected to M300 with bus line (7-segment LED display)	
Parameter name	**No.**	**Initial value**	**No.**	**Initial value**
PG2	2	Refer to appendix table 1.	22	Refer to appendix table 1.
ZRZ	4		24	
CSP	6	Refer to appendix table 1.	26	Refer to appendix table 1.
PST	7	2048	27	2048
ORS1	15	Refer to appendix table 1.	2F	Refer to appendix table 1.
ORS2	16		30	
GRA1	25	100 ~ 32767	39	64 ~ 7FFF
GRA2	26	100 ~ 32767	3A	64 ~ 7FFF
GRA3	27	100 ~ 32767	3B	64 ~ 7FFF
GRA4	28	100 ~ 32767	3C	64 ~ 7FFF
GRB1	29	100 ~ 32767	3D	64 ~ 7FFF
GRB2	30	100 ~ 32767	3E	64 ~ 7FFF
GRB3	31	100 ~ 32767	3F	64 ~ 7FFF
GRB4	32	100 ~ 32767	40	64 ~ 7FFF
OSL	⟶		41	1

[Preparation]

a) An accurate gear ratio (or pulley ratio) from the motor axis to the spindle axis is required.
Confirm that the correct gear tooth number is set in parameters [GRA1] to [GRB4].



[GRA] = A × C × E
[GRB] = B × D × F

Note) User may be requested to set gear tooth parameters [GRA1] to [GRB4] for machine used.

b) Check parameters [PG2], [CSP] and [PST] are set as listed above.
No setting is required for [PG1] and [OSP].

c) After parameter setting is changed, be sure to turn off and on the power, or press RESET button to reset.

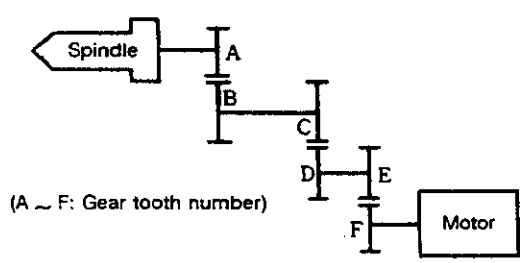
3.8.6 Preparation for adjustment of magnesensor orientation

[Parameters]

	For FR-SGJ connected to M300 with bus line (NC display "spindle parameter", page 2)		For FR-SGJ not connected to M300 with bus line (7-segment LED display)	
Parameter name	**No.**	**Initial value**	**No.**	**Initial value**
PG1	1	Refer to appendix table 1.	21	Refer to appendix table 1.
ZRZ	4	1.00	24	16
CSP	6	Refer to appendix table 1.	26	Refer to appendix table 1.
PST	7	2048	27	2048
ORS1	15	Refer to appendix table 1.	2F	Refer to appendix table 1.
ORS2	16		30	
GRA1	25	100 ~ 32767	39	64 ~ 7FFF
GRA2	26	100 ~ 32767	3A	64 ~ 7FFF
GRA3	27	100 ~ 32767	3B	64 ~ 7FFF
GRA4	28	100 ~ 32767	3C	64 ~ 7FFF
GRB1	29	100 ~ 32767	3D	64 ~ 7FFF
GRB2	30	100 ~ 32767	3E	64 ~ 7FFF
GRB3	31	100 ~ 32767	3F	64 ~ 7FFF
GRB4	32	100 ~ 32767	40	64 ~ 7FFF
OSL	⟶		41	2

[Preparation]

a) An accurate gear ratio (or pulley ratio) from the motor axis to the magnesensor rotation axis is required.
Confirm that the correct gear tooth number is set in parameters [GRA1] to [GRB4].



[GRA] = A × C × E
[GRB] = B × D × F

Note) User may be requested to set gear tooth parameters [GRA1] to [GRB4] for machine used.

b) Check parameters [PG1], [CSP] and [PST] are set as listed above.
No setting is required for [PG2] and [OSP].

c) After parameter setting is changed, be sure to turn off and on the power, or press RESET button to reset.

3.8.7 Adjustment of orientation

<Adjustment> ([ ] for encoder orientation)

(1) Orient position adjustment (Test orient mode)
There is no volume or rotary switch for the position shift, so use the following steps to adjust it.

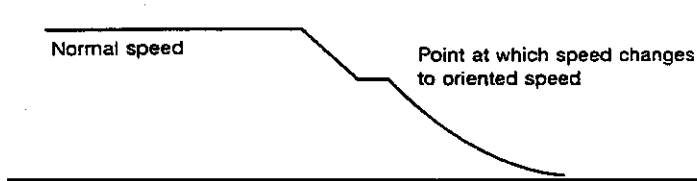
a) With READY signal turned on, set "3" for parameter "00" and press [SET] button.

b) After the spindle rotates two revolutions and stops, "27" will be displayed on the 7-segment LED display.
Press [UP] or [DOWN] button to adjust stop position.
The spindle remains rotating while button is held down. The spindle rotates about 1 deg. for each 100 of data value (one revolution for 4096 of data value).

c) After the stop position has been determined, remove the dial gauge or other measuring device and press [SET] button.
After the completion of orient position adjustment, turn off and on the power or press RESET button to reset.

d) When FR-SGJ is connected to M300, M3/L3 through bus line, the values set for parameters "27" and "30" should be also set for parameters [PST] and [ORS2] appearing on the NC screen ("Spindle parameter", page 2).

(2) Adjustment of oriented time and vibration



Set the corresponding parameters properly, referring to the following table:

Phenomena	Adjustment	
	PG1 (PG2)	CSP
Overrun at stop	↘	↘
Long orientation time	↗	↗
Hunting at stop	↘	→

Note: 1
↗ : Increase parameter setting.
→ : Do not change parameter setting.
↘ : Decrease parameter setting.

Adjust PG1 [PG2] first and then adjust CSP.

If a large hunting occurs during orient stop, adjustment of the orient detector installation direction etc. is needed. Adjust by using the orient position adjustment steps on this page.

3.8.8 Adjustment of servo rigidity

"Servo rigidity" at oriented stop can be increased as follows:

1) Increase PG1 setting (magnesensor type) or PG2 setting (encoder type) to an extent where overrun does not occur.
2) By setting the parameter ORS1 bit, increase K_p and K_i two magnifications proportionally (if K_p is set to "1.2", for example, K_i should be set to "1.2").
   If intense vibration occurs at oriented spindle stop, the magnifications should not be increased further.
3) ω_T of parameter ORS1 is "gain" for "advance/delay" compensation. Momentary servo rigidity can be increased by increasing this value. With increase of ω_T, however, torque for positioning motion decreases. This adjustment is valid when bit 4 of parameter ORS1 is "0".

3.8.9 "Advance/delay control" and "PI control" application

Usually, "advance/delay control" is employed.
In the case described below, use "PI control" function.

- Frictional torque of spindle is large and particularly accurate stop is required.

When "PI control" is used, servo rigidity is somewhat inferior than that in "advance/delay" control.

3.8.10 Troubleshooting during orient error

(1) Does not orient

(a) Keeps rotating

Cause	Check items	Remedy	Remarks
Parameter inappropriate	The parameters with the orient detector do not match. Parameter #41 [OSL] Motor built-in encoder orient .... 0 Encoder orient ..... 1 Magnesensor orient 2	Set parameter #41 [OSL] correctly.	
Specifications are not correct.	Orient is being carried out with standard motor other than the motor built-in encoder with Z-phase.	Change to the motor with the motor built-in encoder with Z-phase.	For motor built-in encoder orient.
Wiring error	Power is not supplied to the encoder. Pins 5, 6 in the CONAA are not used.	With the NC change to the connection for encoder power not supplied. (Ref.) Digital input interface item 2.1.3.	
Wiring error	The connection using the wire for CON4 is connected to CONB (or vice versa).	Change the wiring.	For magnesensor orient.

(b) Runs out of control. An abnormal operation occurs.

Cause	Check items	Remedy	Remarks
Parameter inappropriate		Set parameters #FA, FB and FC to standard value and run the test orient mode (Ref. 3.8.7).	For magnesensor orient.

(2) Stops after exceeding stopping point.

Cause	Check items	Remedy	Remarks
Parameter inappropriate	Gear ratio parameters GRA1 to 4, GRB1 to 4 are incorrect.	Set the correct gear ratio parameters.	For magnesensor orient.
	Improves when parameter [CSP] is halved.	Readjust parameter [CSP] and select appropriate value.	
	Improves when parameters [PG1] and [PG2] are halved.	Readjust parameters [PG1] and [PG2] to select appropriate value.	
	The orient stop direction is in one direction (CCW or CW). (Parameter [ORS2] bit 0, 1 are not set to 0.)	Change the orient stop to Pre. (Change [ORS2] to Pre.)	
		Readjust test orient mode (Paragraph 3.8.7)	

(3) The stop position is off.

Cause	Check items	Remedy	Remarks
Machine factor	The stop position is not off on the encoder axis. * The deceleration ratio between the spindle and encoder is not 1:1 or 1:2.	There is backlash or slippage between the spindle and encoder.	
		Change the deceleration ratio to 1:1 or 1:2.	
	The position shift changes to 2048 when the deceleration ratio between the spindle and encoder is 1:2. (Encoder axis is off.)	The position does not change here, as one turn is carried out at 2048. (But the encoder axis changes.)	
Noise	The encoder cable is disconnected midway.	Use one encoder cable.	

(4) Vibrates when stopping.

Cause	Check items	Remedy	Remarks
Parameter setting malfunction	Gear ratio parameters GRA1 to 4 and GRB1 to 4 are incorrect.	Correctly set the gear ratio parameters.	
Orient adjustment	The vibration frequency is several Hz.	Lower the position loop gain [PG1] and [PG2].	
	Frequency is 10 to 20 Hz.	Lower the speed loop gain during orient, lower [ORS1].	
	Frequency is 20 to 100 Hz.	Change the parameter #58 data from "0" to "2". Lower the current loop gain.	

(5) The oriented complete signal is not output.

Cause	Check items	Remedy	Remarks
Refer to (1) Does not orient.			
The machine load is heavy.	The in position is too small (parameter [ZRZ].)	Review the in position range. (Parameter [ZRZ].)	
	The oriented complete is output when the orient control is set to PI control.	Review the orient speed loop gain. (Parameter [ORS1].)	This also can be considered when hunting occurs at the stop point.

3.9 Synchronous Tap Adjustment

3.9.1 Synchronous tap operation adjustment

Preparation

Before adjusting the synchronous tap, carry out operation with the speed command or orient adjustment, and then follow the steps below.

Parameter

(1) Setting the spindle controller

<table>
<tr><th>#</th><th colspan="2">Parameter</th><th>Description</th></tr>
<tr><td>03</td><td>PLG</td><td>Encoder type for position loop</td><td>Set to 0.</td></tr>
<tr><td>41</td><td>OSL</td><td>Orient type</td><td>Possibilities of orient type and synchronous tap type combinations and setting values.
<table>
<tr><th colspan="2" rowspan="2">Synchronous tap type / Orient type</th><th colspan="2">Closed type</th><th colspan="2">Semi-closed type</th><th rowspan="2">Setting value</th></tr>
<tr><th>TYP 0</th><th>TYP 1</th><th>TYP 0</th><th>TYP 1</th></tr>
<tr><td colspan="2">No orient</td><td>×</td><td>×</td><td>×</td><td>O</td><td>0</td></tr>
<tr><td rowspan="3">Orient type</td><td>Motor built-in encoder</td><td>×</td><td>×</td><td>O</td><td>O</td><td>0</td></tr>
<tr><td>Encoder orient</td><td>O</td><td>O</td><td>×</td><td>×</td><td>1</td></tr>
<tr><td>Magnesensor orient</td><td>×</td><td>×</td><td>O</td><td>O</td><td>2</td></tr>
</table>
O ..... Possible, × ..... Not possible</td></tr>
</table>

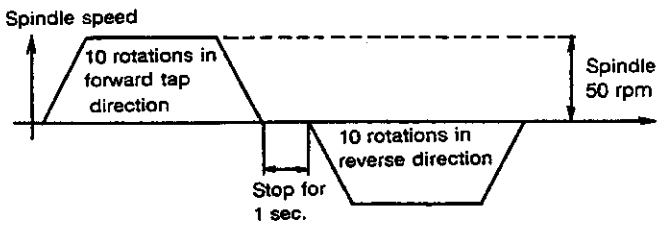
(2) NC screen settings

Selection screen	Parameter	Description	Setting value
<User parameter>			
Control parameter	Synchronous tap	Synchronous tap is validated. When not valid, the conventional tap cycle will run.	Valid
<Machine parameter>			
Basic specifications	tap t1	Sets the speed command time constant for during synchronous tap. The start-up time for when the rotations are carried out with S commands at the maximum tap speed considerable is set with t + α. (α = 200 msec.)	1 ~ 1500(msec) Standard: 1000
Spindle specification Z-axis	tap g	Sets the position loop gain during synchronous tap. The same setting as for the spindle parameter PGC must be set.	10 ~ 20 Standard: 10
Spindle parameter	sgear	Sets the gear ratio between the spindle and spindle encoder. When there is no spindle encoder, always set to 0 (1:1).	0 Standard: 0
Spindle parameter	PGC	Sets the position loop gain during synchronous tap. The same setting as for the Z-axis, axis specification tap g must be set.	10 ~ 20 Standard: 10
	ORS 2	bit E ..... Sets the synchronous tap detector rotation direction. Set at 0 for semi-close. bit B ..... Set at 1 for a strong excitation during synchronous tap. The response to impact loads will increase. Normally 0. bit A ..... 0: Closed (when there is an encoder on the spindle) 1: Semi-closed (when there is no encoder on the spindle) bit 9 ..... Decides the motor command direction (spindle rotation direction at G84) during synchronous tap.	—
	TYP	0000 ..... Carries out zero point return at the beginning of the synchronous tap mode. 0001 ..... Enters the position loop immediately after deceleration and stopping without carrying out zero point return.	0001
	GRA1 ⟆ GRA4, GRB1 ⟆ GRA4	The gear ratio of each gear step must be correctly set with tooth numbers. Motor speed × Motor axis side gear teeth (GRB1 ~ GRB4) / Spindle side gear teeth (GRA1 ~ GRA4) = Spindle speed	—

Points of caution

1) When the spindle is driven with the belt or the timing belt in the semi-closed method (with no spindle encoder) the belt may slip or stretch and make precise synchronized tapping difficult. When driving with the belt, use the spindle encoder, and carry out synchronized tapping in the closed method. In this case, use the encoder type orient for orientation.
2) When the spindle and encoder are connected with a ratio of 2:1 in the closed method (with the spindle encoder), set the spindle parameter [PGC] to twice that of the axis specification Z-axis [tapg].
   Set the spindle parameter [Sgear] to 1.

Confirmation and adjustment of the operation

	Normal operation	Items to check during abnormal operation
1	With the work not in place: G84 Z-10, F1.0, P1000, S50  	Reverse ORS2 bit 9 when the rotation direction goes in the reverse tap direction. When the rotation numbers differ, recheck whether the parameter and machine specifications match. Others: Refer to troubleshooting for synchronous tap error.
2	Carry out the cutting test with the floating tap chuck installed. 1) Is there any stretching or shrinking of the tapper? 2) Is precise tap machining carried out?	Refer to troubleshooting for synchronous tap error.
3	Carry out the cutting test without the floating tap chuck installed. 1) Is precise tap machining carried out?	Refer to troubleshooting for synchronous tap error.

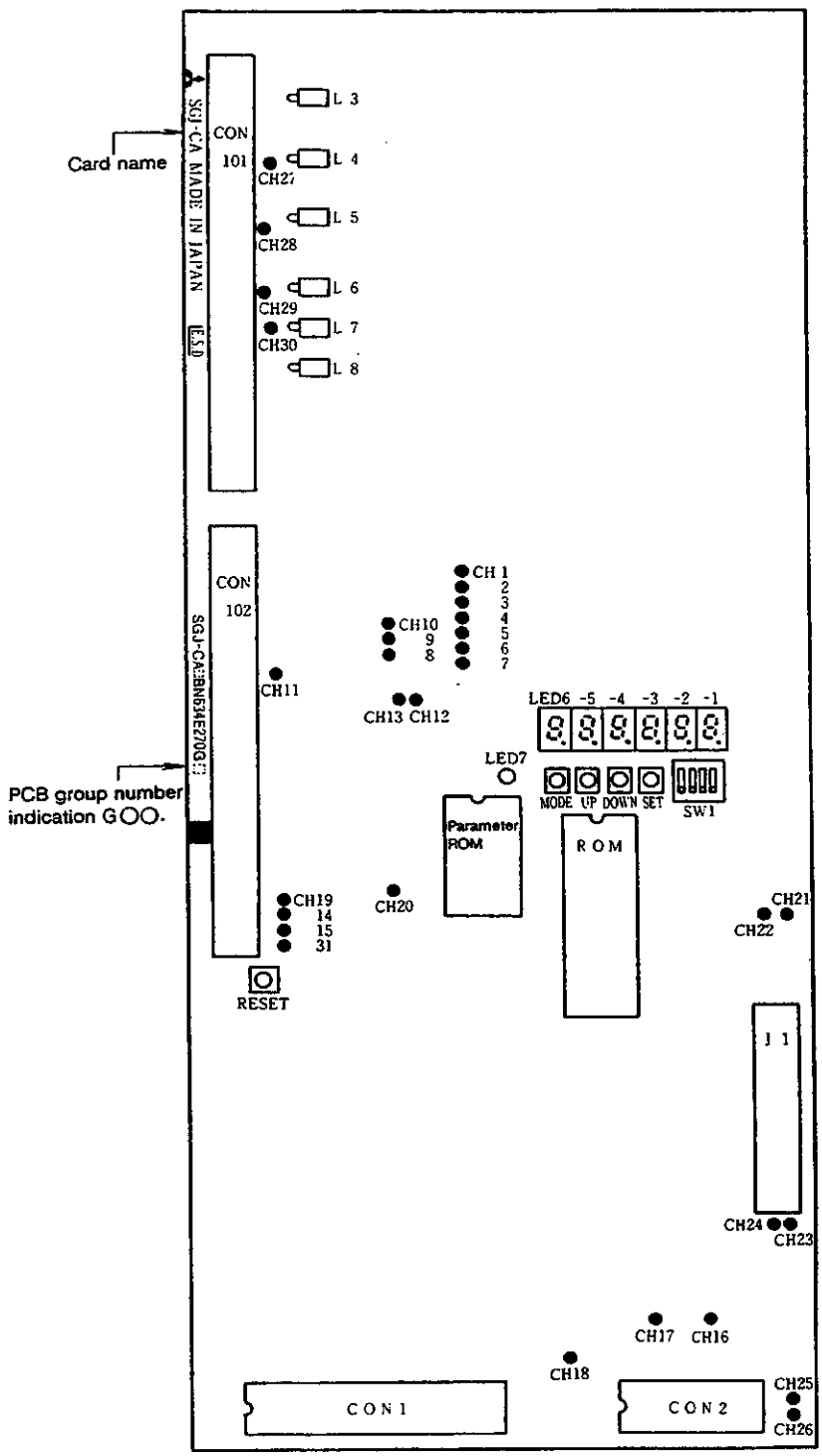
3.9.2 Troubleshooting for synchronous tap error

No.	Phenomena	Cause / remedy
1	Excessive difference alarm (ALO.52) occurs.	1) The spindle parameter [ORS2] bit E synchronous tap detector direction is set in reverse. 2) The spindle motor cannot follow the command as the basic specification [tapt1] is too short. Set to the start up time during S command + 0.2 sec.
2	An over current (ALO.32) or CPU error (ALO.27) occurs.	1) The spindle motor cannot follow the command as the basic specification [tapt1] is too short. Set to the start up time during S command + 0.2 sec.
3	The spindle rotation movement amount does not match the command value.	1) The spindle parameter [ORS2] bit A close/semi-close setting is wrong. 2) The spindle parameter gear ratio [GRA1] to [GRA4], [GRB1] to [GRB4] settings do not match the machine gear ratio.
4	1) The tap breaks. 2) The tap precision is poor.	1) The axis specification Z-axis [tapg] and spindle parameter [PGC] setting do not match. 2) The basic specification [tapt1] is too short. 3) The program screw pitch F and the actual tap pitch are different. 4) The tap slips at the chuck. Change to a larger chuck with a looser tightening torque. 5) The prepared hole is shallow and the cut powder is not removed well. 6) A tap with poor removal of the chip is used. (A spiral tap is desirous.) 7) The tap depth is too deep for the tap diameter. (Normally 2 to 3 times.) 8) A large noise interrupts with the position feedback signal, and the synchronized precision is poor. In the closed method, check the spindle encoder cable and in the semi-closed method check the shield treatment of the speed feedback cable from the motor. Check whether a normal shield wire is used or if it is disconnected. 9) Replace with a new tap.
5	1) The spindle stops or the precision is poor during tapping as the load is too heavy.	1) Set the spindle parameter [ORS2] bit B to 1, and select the strong excitation. 2) Speed loop during tapping. 3) Use tapping paste.
6	At low-speed rotations (under 1000 rpm) there are no problems, and at high speeds: 1) The tap breaks. 2) The tap precision is poor.	1) The position loop gain is slightly off. (Example) At close, the pulley ratio when V belt connection is carried out between the motor and spindle does not match the theoretical gear ratio (α).

CHAPTER 4 CARD SETTINGS AND CHECK TERMINALS

4. Card Settings and Check Terminals

4.1 SGJ-CA card



(1) DIP switch setting table

○ : Set to "ON" × : Set to "OFF"

Switch No.	Name	Description
SW1-1 ~ 3	Test mode	Test mode is selected. 1 2 3 × × × ..... Normal setting ○ × × ..... NC parameters ignored (internally set parameters are valid) × ○ × ..... • Test aging ○ ○ × ..... × × ○ ..... Test mode • Parameter transfer ○ × ○ ..... × ○ ○ ..... ○ ○ ○ ..... • E^2ROM initialization
SW1-4	Meter calibration	4 ○ ..... Meter full-scale output × ..... Meter normal mode Speed meter and load meter can be calibrated.

(2) Pushbutton table

Name	Description
MODE	Changes the LED display mode. Each time this is pressed, the LED display changes modes from status display → diagnosis → alarm → parameter (1) → ..... parameter (8) → debug.
UP	This pushbutton is used to change to the next page in the MODE. When the SET SW is pressed in the parameter mode and then UP is pressed, the parameter data will increment.
DOWN	This pushbutton is used to change to the last page in the MODE. When the SET SW is pressed in the parameter mode and then DOWN is pressed, the parameter data will decrement.
SET	This pushbutton is used to rewrite the parameter. When SET is pressed in the parameter mode, the parameter data will flash. Using the UP, DOWN switches and rewrite the data, and the E^2PROM parameter will be rewritten when SET is pressed.
RESET	This is the CPU master reset. Press this after rewriting the parameter. Do not reset while the motor is rotating.

(3)Emission diode table

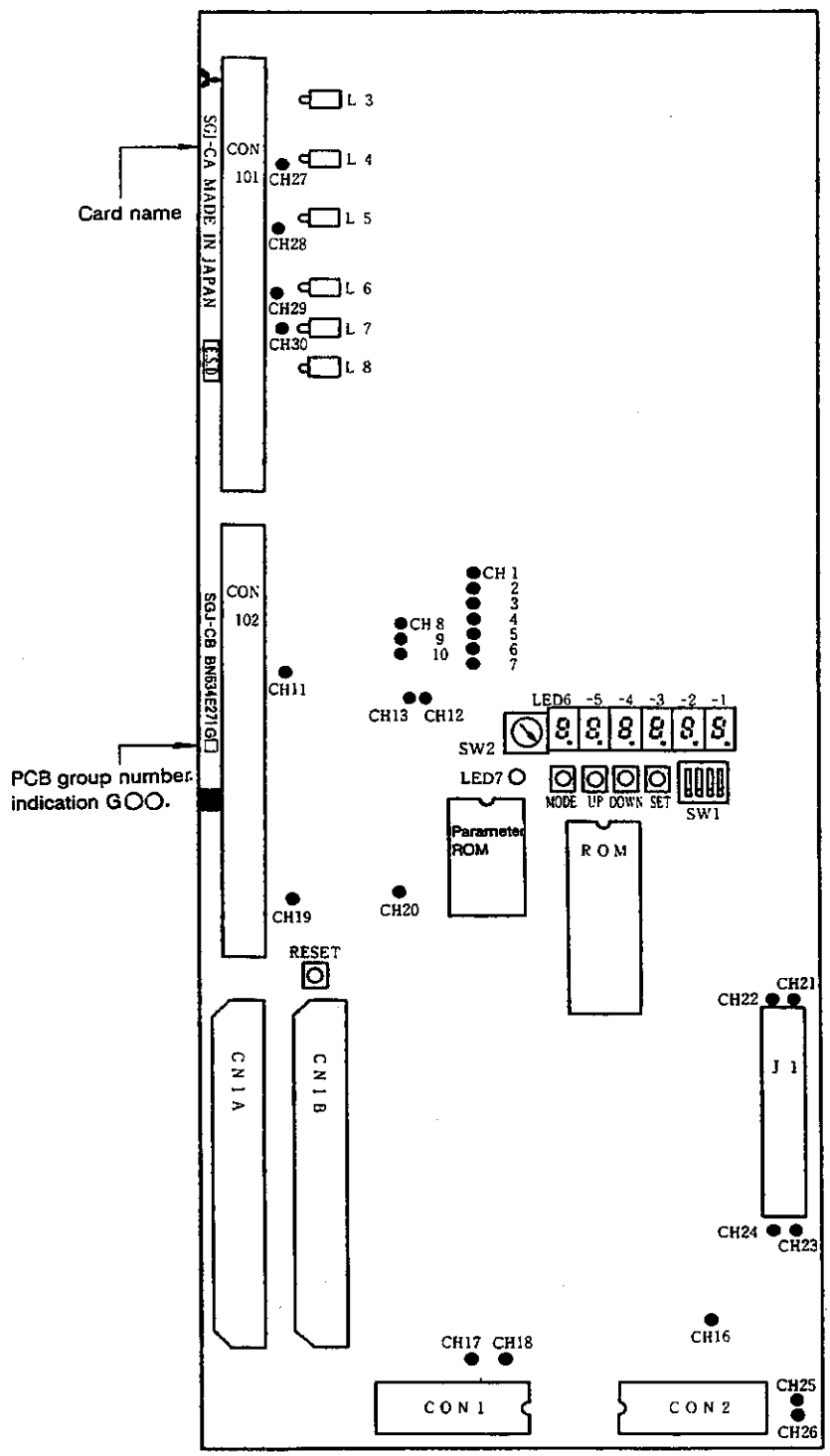
No.	Description
LED1 ~ LED6	Status display and alarm display
LED 7	Lights in case of watchdog alarm.

(4) Check terminal table

No.	Common	Description
CH1	AG, DG	W-phase PWM modulated wave form
CH2		V-phase PWM modulated wave form
CH3		U-phase PWM modulated wave form
CH4		W-phase PWM modulated wave form
CH5		V-phase PWM modulated wave form
CH6		U-phase PWM modulated wave form
CH7		Brake transistor PWM modulated wave form
CH8		W-phase PWM wave form
CH9		V-phase PWM wave form
CH10		U-phase PWM wave form
CH11		Converter current wave form
CH12		V-phase current wave form
CH13		U-phase current wave form
CH14		Load meter output
CH15		Speed meter output
CH16		Speed feedback B-phase
CH17		Speed feedback A-phase
CH18		Speed feedback Z-phase
CH19		A/D transformer input wave form
CH20		Converter voltage feedback
CH21		+5V power
CH22	–	0V, AG (analog ground) DG (digital ground)
CH23	AG, DG	+15V power
CH24		–15V power
CH25	–	RG (relay ground)
CH26	RG	+24V power
ϟ L3 left	CH27	W-phase base amp drive signal
ϟ L4 left	CH28	V-phase base amp drive signal
ϟ L5 left	CH29	U-phase base amp drive signal
ϟ L6 left	CH30	W-phase base amp drive signal
ϟ L7 left		V-phase base amp drive signal
ϟ L8 left		U-phase base amp drive signal
CH31	AG, DG	Analog speed command input

"ϟ" part are impressed with high voltages so please take care when handling to electric shocks.

4.2 SGJ-CB card

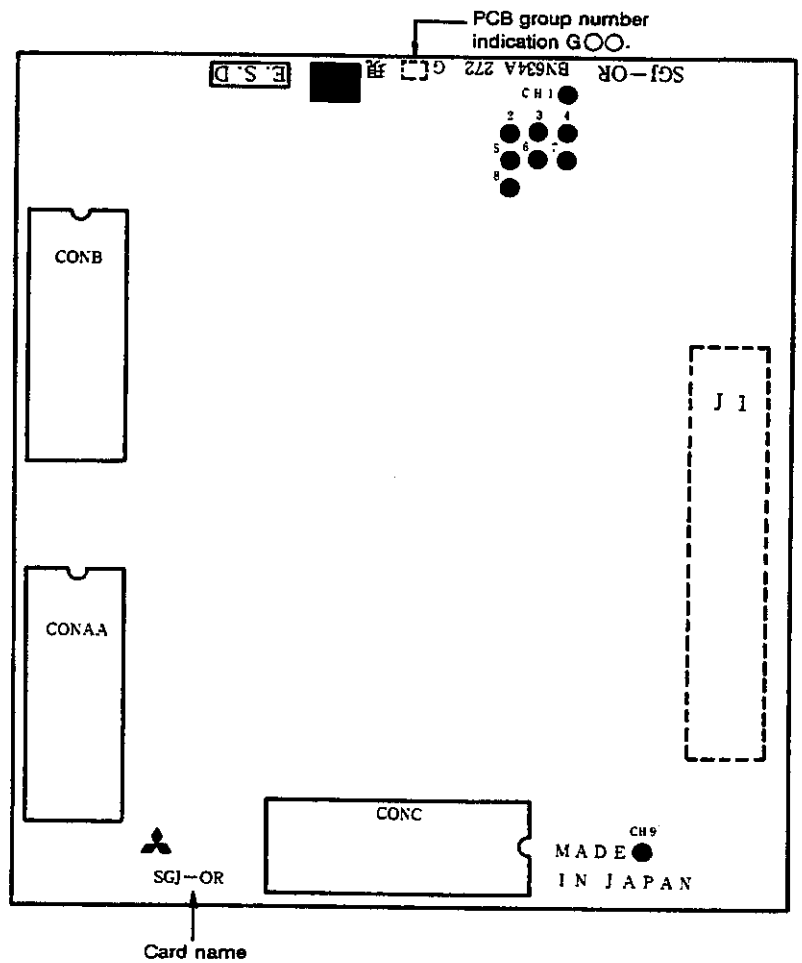


The (1) DIP switch setting table, (2) Pushbutton table, (3) Emission diode table, and (4) Check terminal table are the same as for the SGJ-CA card.
(However, the SGJ-CB card does not have CH14, 15 and 31.)

(5) Rotary switch table

Name	Description
SW2	The rotary switch for setting the axis number. Normally set to "6".

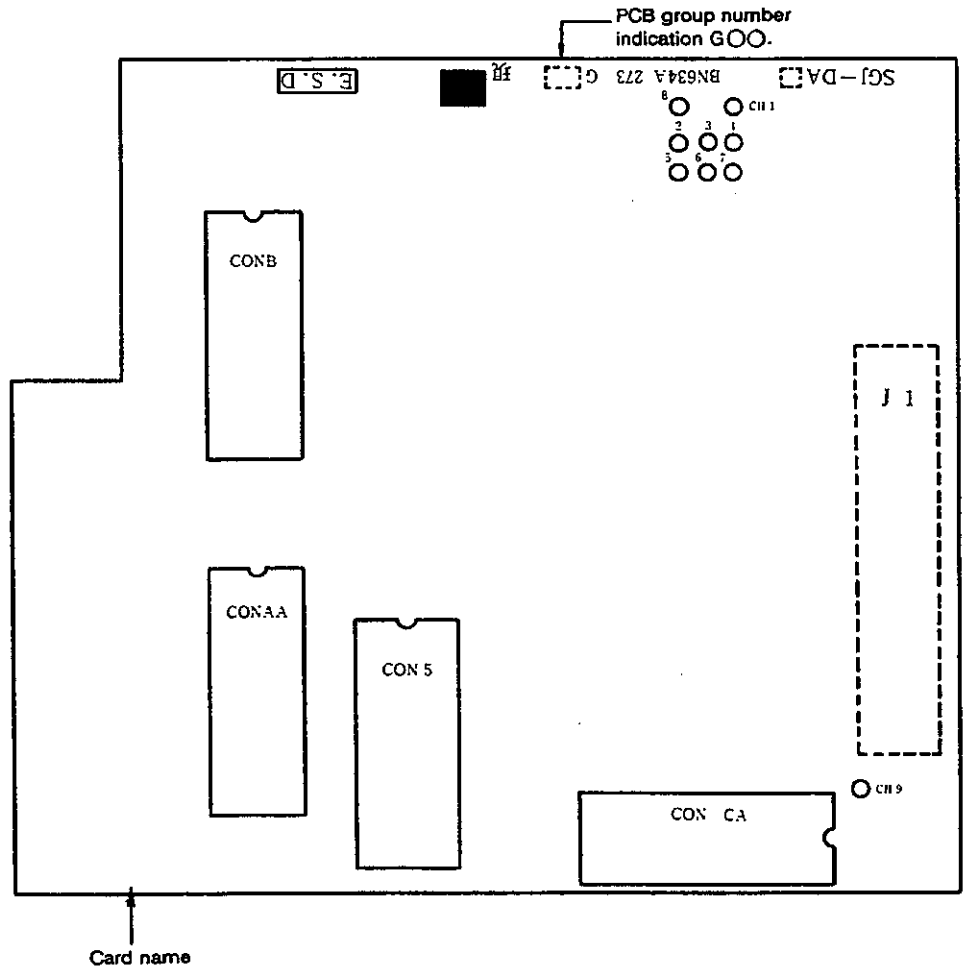
4.3 SGJ-OR card



Check terminal table

No.	Common	Description
CH1	AG, DG (CH8)	Magnesensor output
CH2		Magnesensor linear zone output
CH3		Speed feedback A-phase
CH4		Speed feedback B-phase
CH5		Position feedback A-phase
CH6		Position feedback B-phase
CH7		Position feedback Z-phase
CH8	–	AG, DG
CH9	–	RG

4.4 SGJ-DA card



Check terminal table

No.	Common	Description
CH1	AG, DG (CH8)	Magnesensor output
CH2		Magnesensor linear zone output
CH3		Speed feedback A-phase
CH4		Speed feedback B-phase
CH5		Position feedback A-phase
CH6		Position feedback B-phase
CH7		Position feedback Z-phase
CH8	–	AG, DG
CH9	–	RG

CHAPTER 5 ADDITION AND REPLACEMENT OF COMPONENT

5. Addition and Replacement of Component

Before a component is added or replaced, be sure to turn off the main power supply.

5.1 Addition of Option Card (SGJ-OR, SGJ-DA Card)

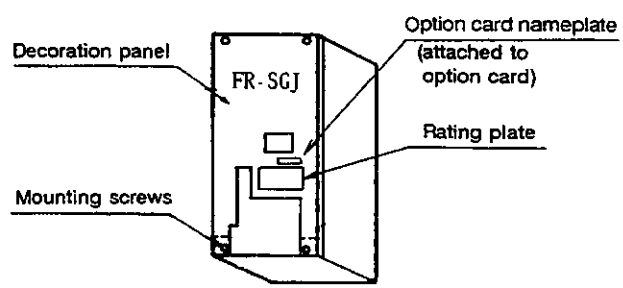
When an option card is newly added to the unit having no option card, follow the procedure and cautions described below.

Procedure

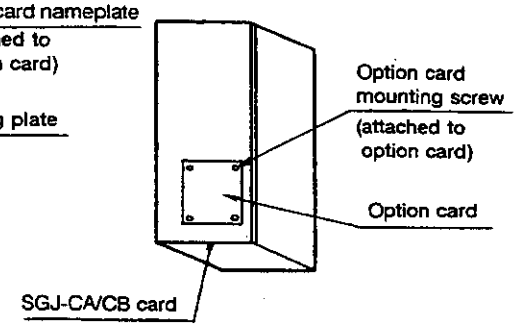
(1) Remove the decoration panel of the control unit.
(2) Place the option card on the card SGJ-CA/CB, where the spacer is provided for installation of option card, and secure the option card with four mounting screws.
(3) Perform the required settings.
(For parameter settings, refer to paragraph 3.3.7 setting method and 3.3.8 parameter table.

Due care should be taken when parameter(s) are set.
Option card is shipped with the standard settings.
Upon reception of option card, check it against the specifications.

(4) Write in or revise the card settings and parameter setting description into the appropriate page of the "Order List" included with the control unit (decoration panel).
(5) Install the decoration panel of the control unit.
(6) Affix the "option card nameplate" attached to the option card to the decoration panel, as shown below.



Sketch drawing

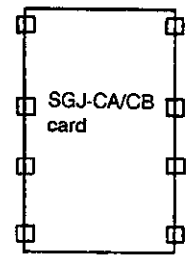


Location of option card
(View with decoration
panel removed)

5.2 Replacement of Card

To replace the card, the decoration panel must be removed.

(1) Card SGJ-CA/CB
Disengage 8 card locks (□)
to remove the card.



CAUTION

Before replacement, check ROM No., and switch settings.
When the previous parameter settings are to be used, remove the parameter ROM (E^2ROM) from the old card and mount it to the new card.

(2) Cards SGJ-OR, SGJ-DA
To remove these cards, remove the 4 mounting screws.

5.3 Replacement of ROM

ROM should be a ROM1 (SGJ-CA card: 6F or SGJ-CB card: 4E).

Procedure

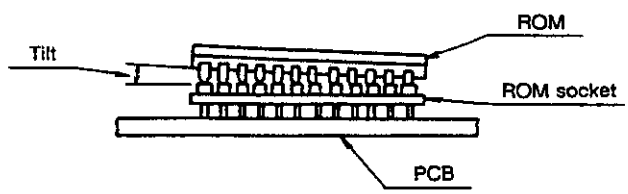
(1) Remove the decoration panel of the control unit.

(2) Remove the ROM
To remove the ROM, be sure to use a ROM remover and carefully disengage it from the socket.
Take care not to bend ROM pins.

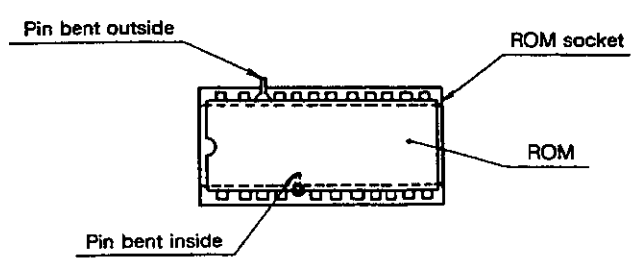
(3) Load new ROM
To load, identify the ROM (see ROM No.) and check orientation. Then engage the ROM pins with the socket and secure the ROM.
After it is loaded, visually check the condition.

Example of ROM loading failure

1) Example of loading failure (1)
The ROM is tilted and its pins are not fit into the socket securely.



2) Example of loading failure (2)
ROM pin(s) is not fit into the socket.



(4) After the replacement of ROM, the corresponding description in the "Order list" attached to the control unit (front panel) should be changed accordingly.

5.4 Replacement of Diode Module and Transistor Module

(1) Removal of defective module
Remove all the screws (M4 × 10: 25) on the power PCB (SGJ-P1 or SGJ-P2 card) and remove the module from the heat radiating fin.

(2) Applying silicone grease
Uniformly spread silicone grease over the rear surface of the new module.

(3) Tightening
Secure the new module in place with the specified torque (see Table 5.1).

CAUTION

Only diodes and transistors specified by Mitsubishi are applicable.
For replacement and spare parts, please place an order with Mitsubishi.

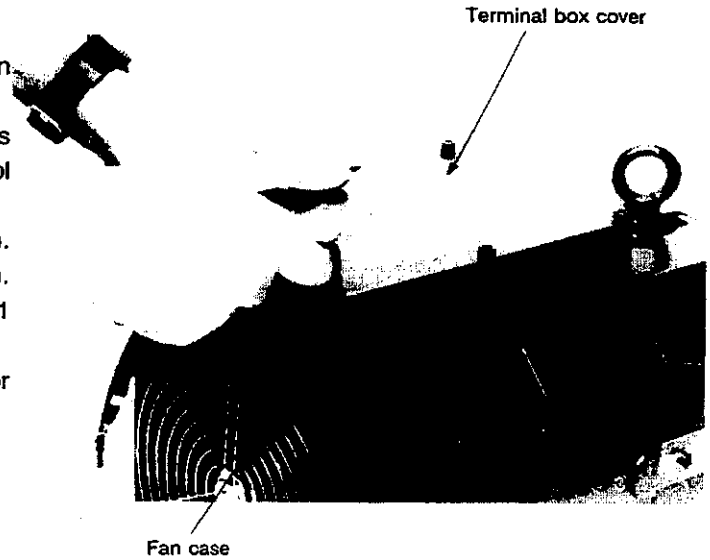
Table 5.1 Tightening Torque Table

	Model	Screw size	Max. tightening torque (kg-cm)	Recommended tightening torque (kg-cm)
Diode	PT30S8 6RI50E-050	M4 × 0.7	20	17 ± 2
Transistor	QM30TX-HB QM50TX-HB QM75TX-HB QM100TX1-HB	M4 × 0.7	20	17 ± 2
Transistor	ETG81-050	M4 × 0.7	20	17 ± 2

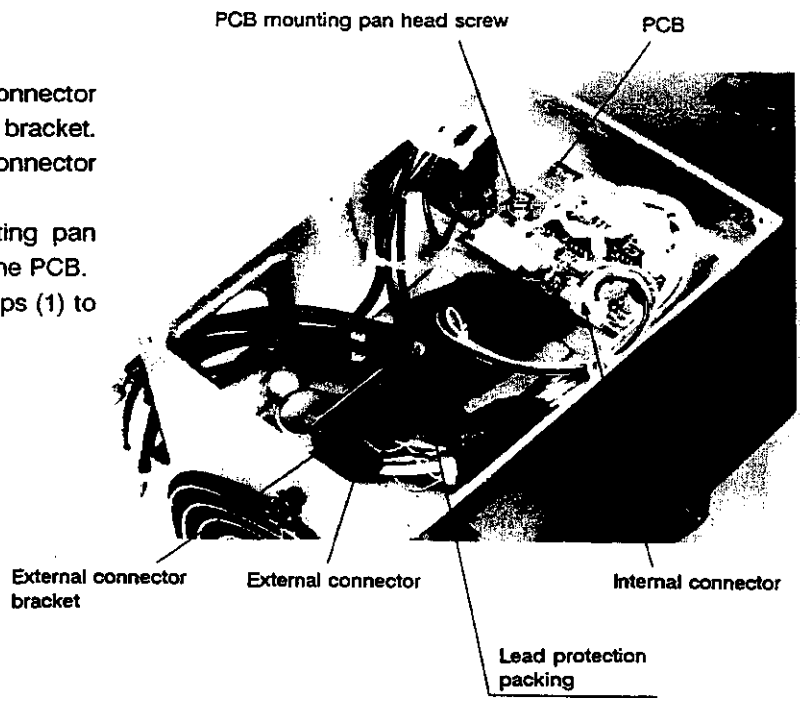
5.5 Disassembly and Assembly of SJ-N Type AC Spindle Motor

[1] Cables and PCB

(1) Remove the terminal box cover on the top of the fan case.
(2) Disconnect the cables and leads coming from the power control box.
   a) 3 motor main leads (U, V and W).
   b) 2 cooling fan leads (BU and BV).
   c) 2 thermal protector leads (OHS1 and OHS2).
   d) Mating plug to external connector of PCB.

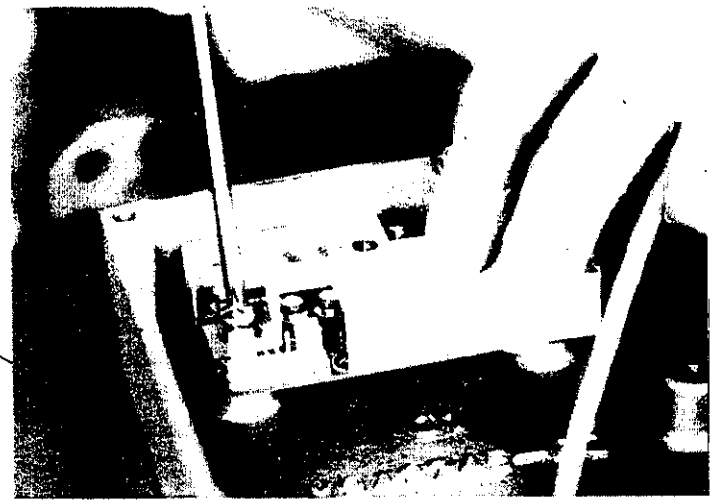


(3) Remove the external connector from the connector bracket. Disengage the internal connector from the socket.
(4) Remove the PCB mounting pan head screws to remove the PCB.
(5) To assemble, perform steps (1) to (4) in the reverse order.
For details, see (6).

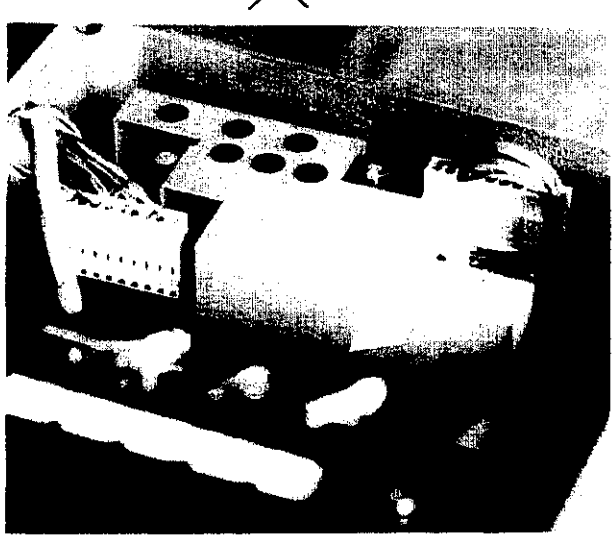


(6) Mounting of the PCB

Method:	Fix with two bolts together with the case. Connect the sensor connector.
Caution:	Connect the output cable to the amp. Do not allow the motor power cable to contact the bottom of the amp.

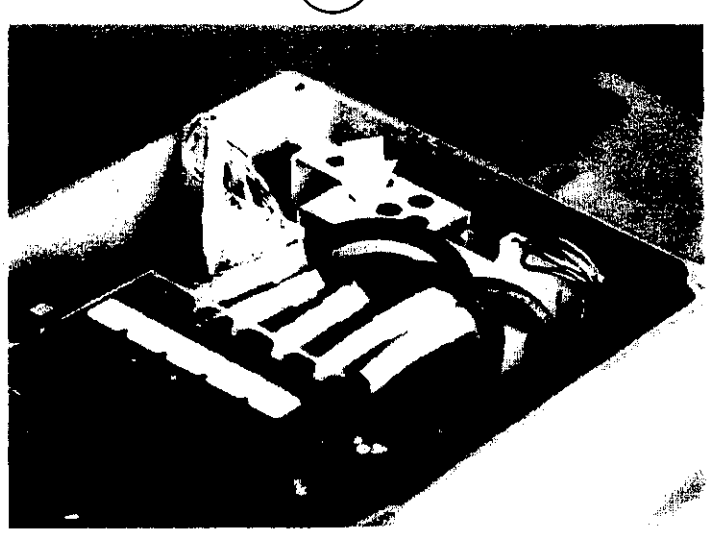


×



The motor cable is under the amp.

○



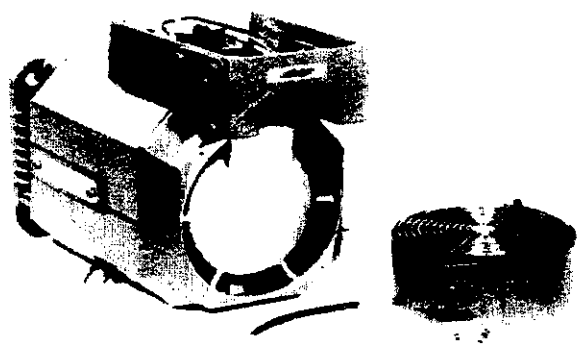
The motor cable protrudes from the amp.

[2] Cooling fan

For frame No. 90

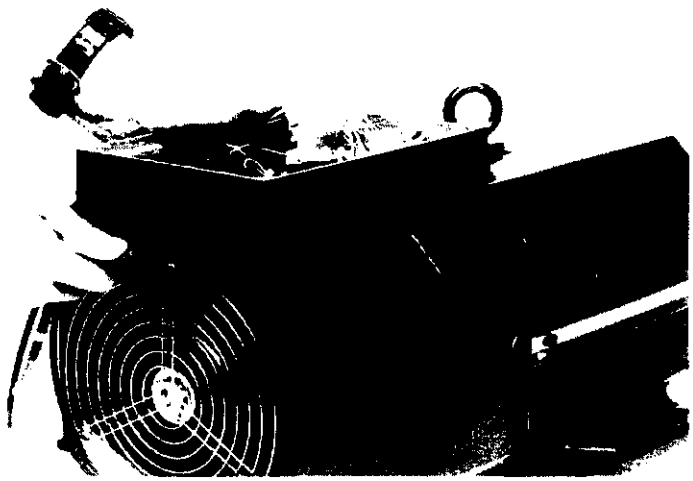
(1) Remove two hexagon socket head bolts used to secure the cooling fan.
The cooling fan can be removed from the fan case being assembled with finger guard.

(2) To reassemble perform step (1) in reverse order.

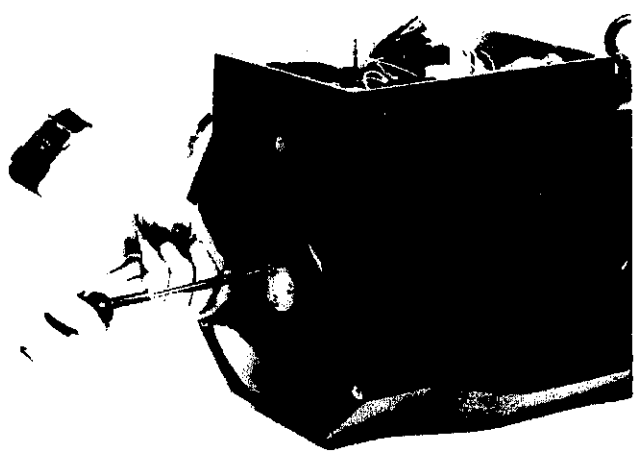


For frame No.112

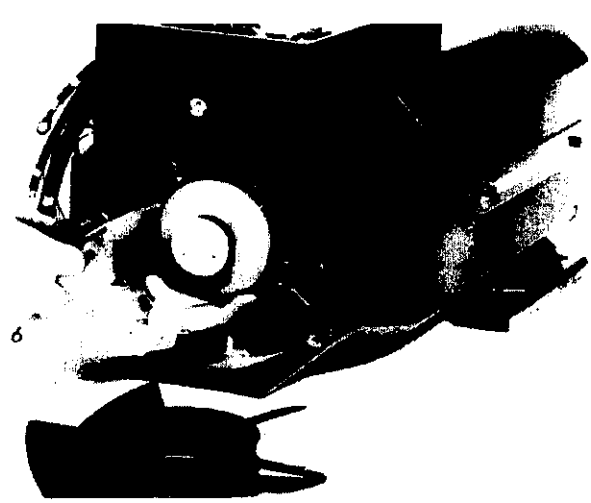
(1) Remove the hexagon socket head bolts used to secure the finger guard.



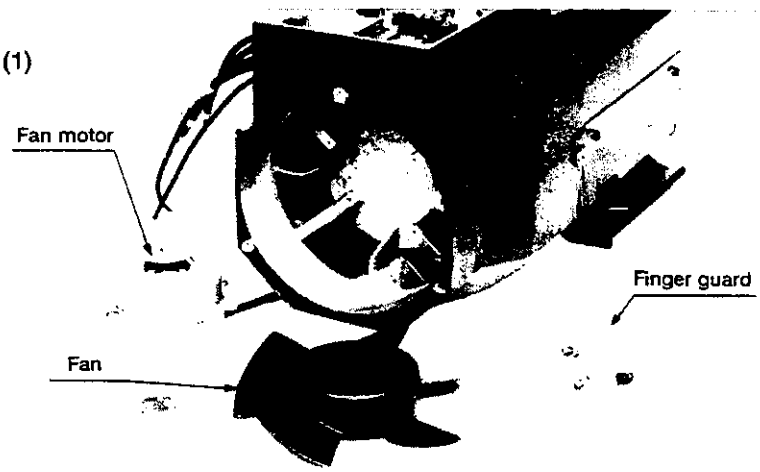
(2) Remove the pan-head screws at the center of the cooling fan to remove the fan.



(3) Cut the four fan leads of the cooling fan which are connected inside the terminal box.
Remove the pan-head screws used to mount the fan motor assembly and draw out the fan motor from the fan case.



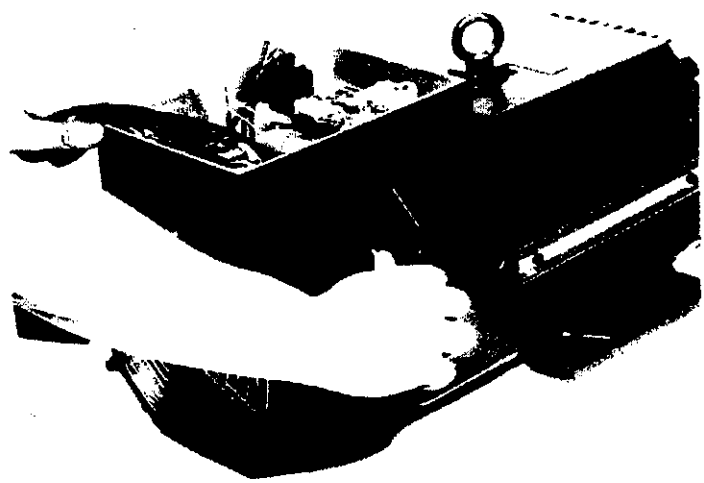
(4) To reassemble, perform steps (1) to (3) in the reverse order.



[3] Sensor and detection drum

(1) Disengage the sensor connector (internal) from the PCB in the terminal box.

(2) Remove the three fan case mounting hexagon socket head screws. Pull back the fan case to remove the fan case together with the cooling fan.



(3) Remove two pan-head screws used to fix the sensor bracket and the sensor bracket can be removed together with sensor (take care to prevent hitting of the sensor against the detection drum).

(4) Mounting the sensor

Conditions:
Position with the sensor V-type base side and the motor base positioning ring protrusion.
Preparation:
Clean (air blow) the sensor block mounting face (motor base) and the sensor V-type base side.
Method:
Lightly fix the sensor block with bolts (so that the block can be moved.)
Tighten the bolt so that the sensor block is pressed against the mounting face and so that the V-type base side contacts the motor base positioning ring as shown in the figure.
Caution:
Take care so that the sensor base does not slip from the tightening of the bolts.
Do not apply strength to the flexible plate.

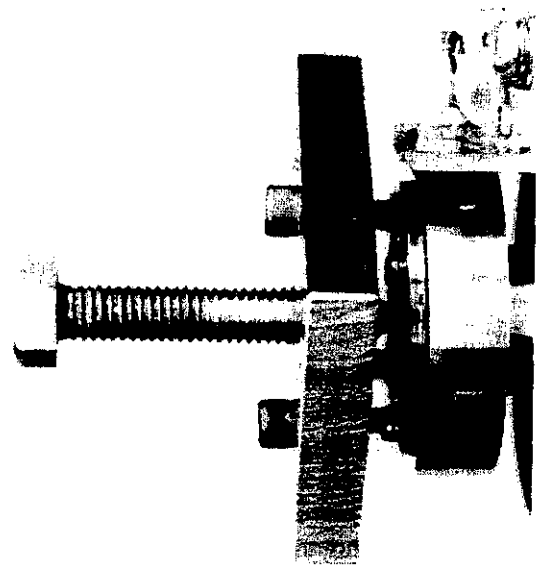
(5) Apply lock paint to the sensor mounting screw and the sensor bracket mounting screws.

(6) When the sensor is put into the fan case, arrange the sensor leads properly inside the terminal box to prevent sensor lead from being wedged.

(7) Removal of the drum

Method:	Forcibly pull out with the removal jig.
Caution:	The removed drum cannot be reused.

To remove the detection drum, an eye bolt is screwed into the screw hole, and the removing bolt is removed using a remover while turning with a spanner, etc.



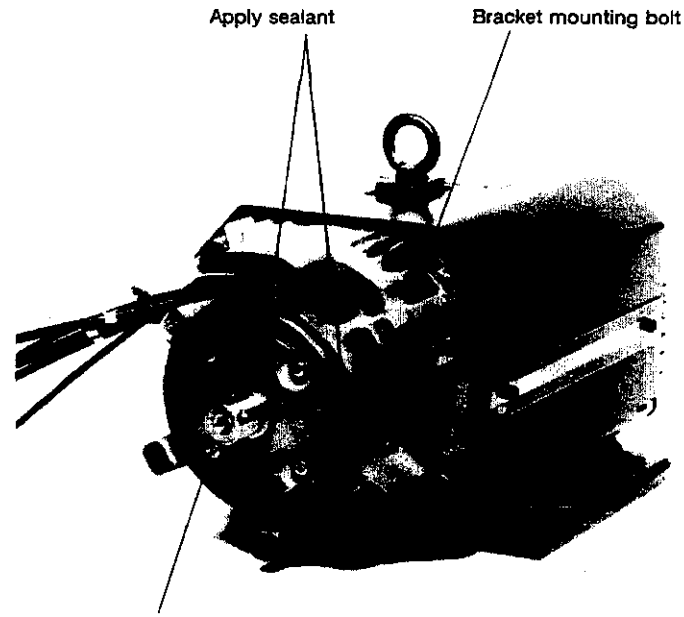
(8) Installation of the drum

Condition	:	Heat fitting (heated temperature: below 150°C)
Method	:	Confirm that the drum is at the specified temperature. Hold the drum with leather gloved hands and quickly insert it.
Caution	:	There must not be a magnetic field of over 50G inside the heating device. Cotton gloves will slip.
Confirmation:		Is the drum completely inserted?

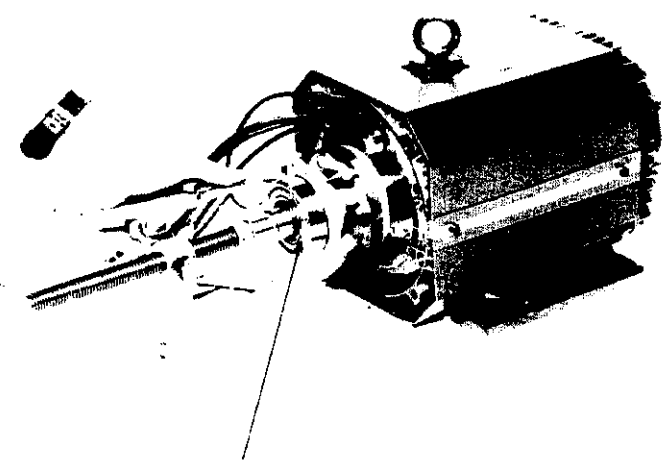
[4] Bearings

(1) Remove the shaft case cover mounting screws and the bracket mounting hexagon socket head bolts and remove the bracket on the opposite side.

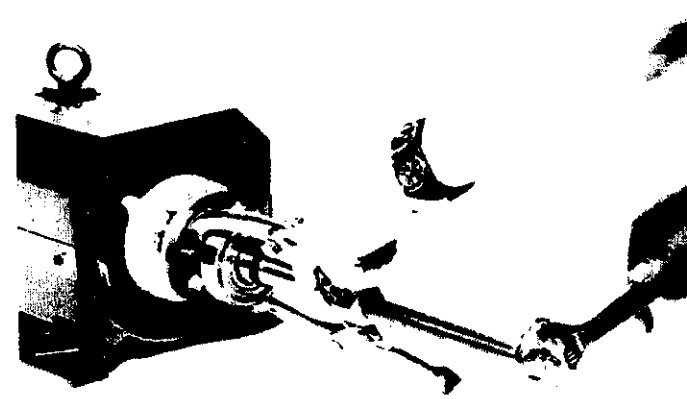
(2) When the bracket on the opposite side is installed again, apply a sealing compound to the fitting surfaces.



(3) To remove the bearing on the opposite side, remove the C type shaft stop ring and apply a bearing remover.
Turn the removing bolt with spanner and the bearing can be removed together with the shaft case cover.

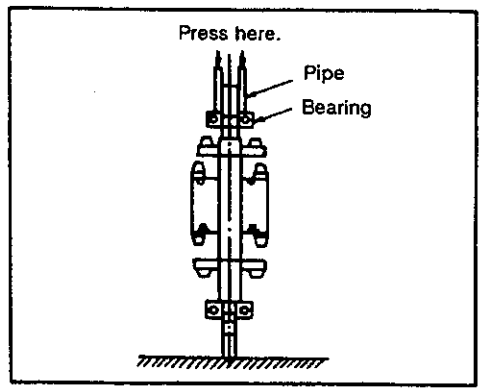


(4) To remove the bearing on the load side, apply a bearing remover to the inner ring of bearing and turn the handle of bearing remover.



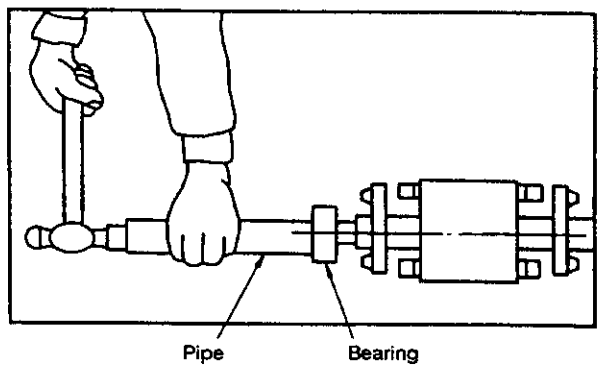
(5) To install the bearing to shaft, all fitting surfaces should be thoroughly cleaned and smoothed.

(6) Apply grease to bearing bore surface and shaft.
Put a pipe on the bearing inner ring and carefully depress the bearing with a press machine.



Press machine is used to install bearing.

(7) If press machine is not available, lightly hammer the pipe to drive the bearing in.
Use care not to hammer the outer ring of the bearing.



Hammer is used to install bearing.

CHAPTER 6 INSTALLATION OF ORIENTATION POSITION DETECTOR

6. Installation of Orientation Position Detector

6.1 Magnesensor 1-point Orientation

6.1.1 Magnet and sensor

The sensor generates two types of voltage signals as shown in Fig. 6.1.

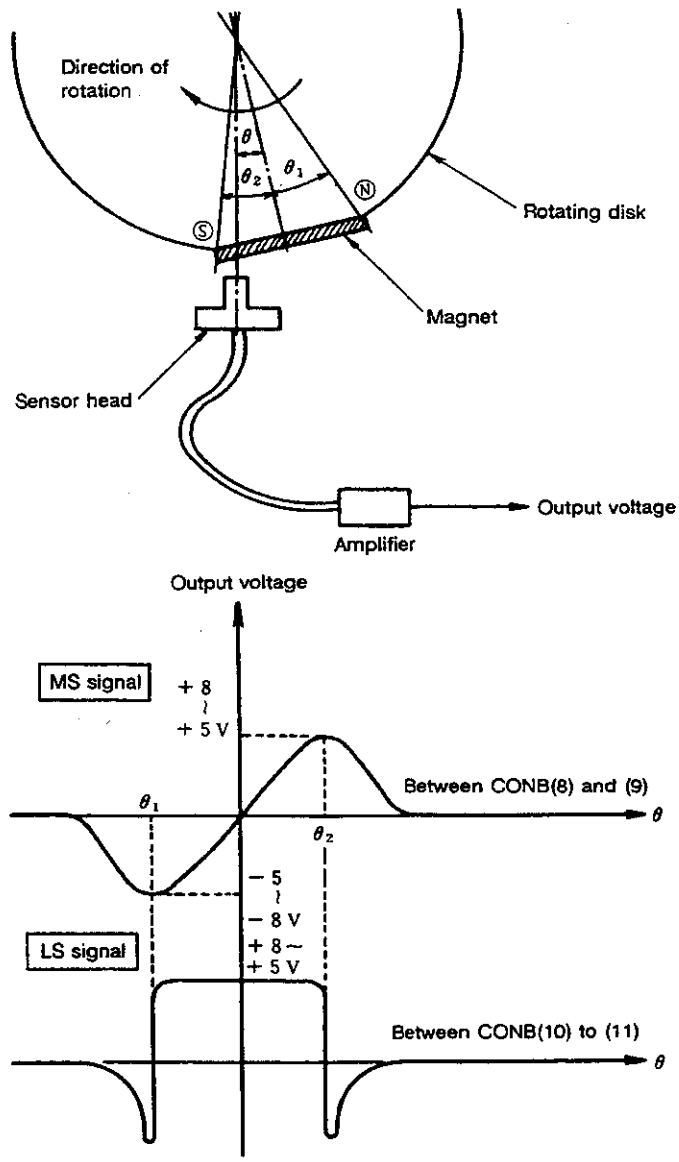


Fig. 6.1 Sensor Output Voltage

MS signal : Signal voltage output is 0V when the center of magnet comes to the sensor head, and maximum at both ends of the magnet.
Spindle is stopped with this signal at 0V.

LS signal : Signal voltage is constant within the zone (width) of magnet.
This signal is used to verify that spindle remains stopped within the zone of magnet.

6.1.2 Orientation of magnet and sensor head

The magnet and sensor head should be installed in the specified orientation.

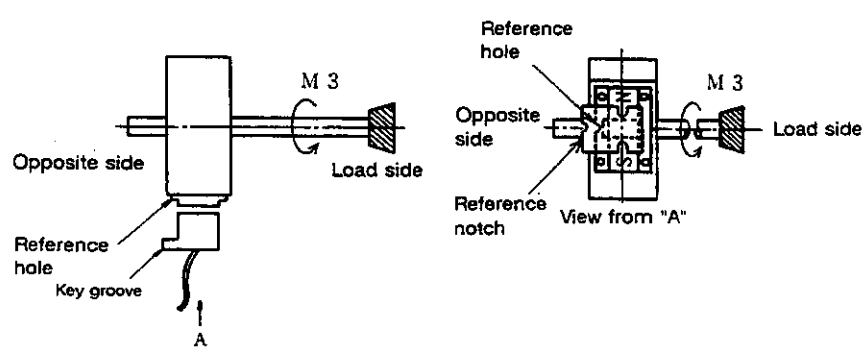
(I) Standard type
High speed standard type
..... The center reference hole of magnet and the reference notch of sensor head should come to the same side.
Refer to CASE 1, CASE 2, CASE 3 and UNACCEPTABLE EXAMPLE 1.

(II) High speed miniature type
..... The reference notch of sensor head should be located in reference with polarity (N, S) of magnet.
Refer to CASE 4, CASE 5 and UNACCEPTABLE EXAMPLE 2.

(III) High speed ring type
..... The reference notch of sensor head should be located in reference with polarity (N, S) of magnet.
Refer to CASE 6, CASE 7 and UNACCEPTABLE EXAMPLE 3.

(I) CASE 1 Magnet is installed on the circumferential surface of rotating disk. (Circumferential mounting)

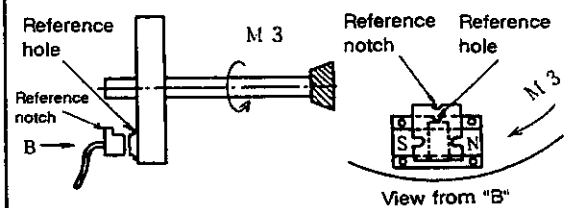
The center reference hole of magnet and the reference notch of sensor head should come on the opposite side, as shown below.



Magnet is installed on circumferential surface of rotating disk.

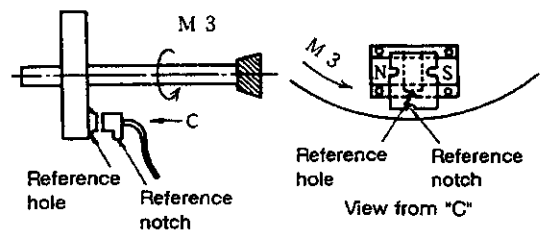
CASE 2 Magnet is installed on the front or back flat surface of rotating disk. (Flat mounting)

(1) When the magnet is installed on the opposite side of spindle, the reference hole of magnet and reference notch of sensor head should face inward, as shown below.



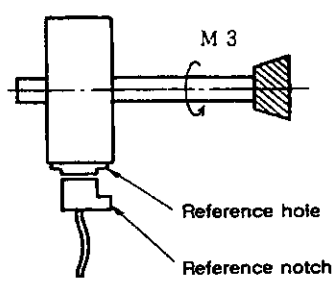
Magnet is installed on the opposite side.

(2) When the magnet is installed on the load side of spindle, the reference hole of magnet and reference notch of sensor head should face outward, as shown below.



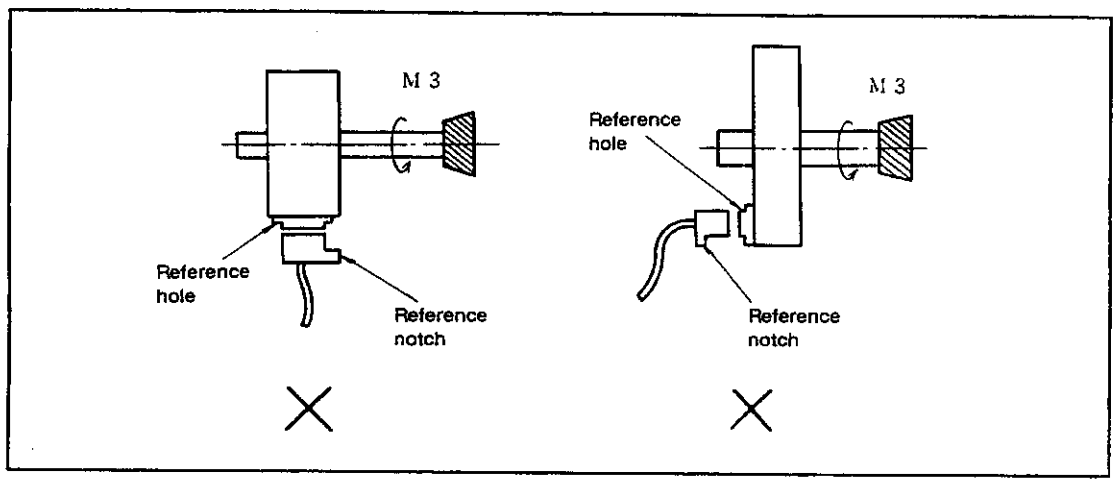
Magnet is installed on the load side.

CASE 3 In regard to CASE 1, the magnet and sensor head can be changed to the following position as long as the reference hole and reference notch are aligned. With this, normal orientation can be carried out.
(However the parameter #30 ORS2 orientation detector installation direction bit must be changed.)



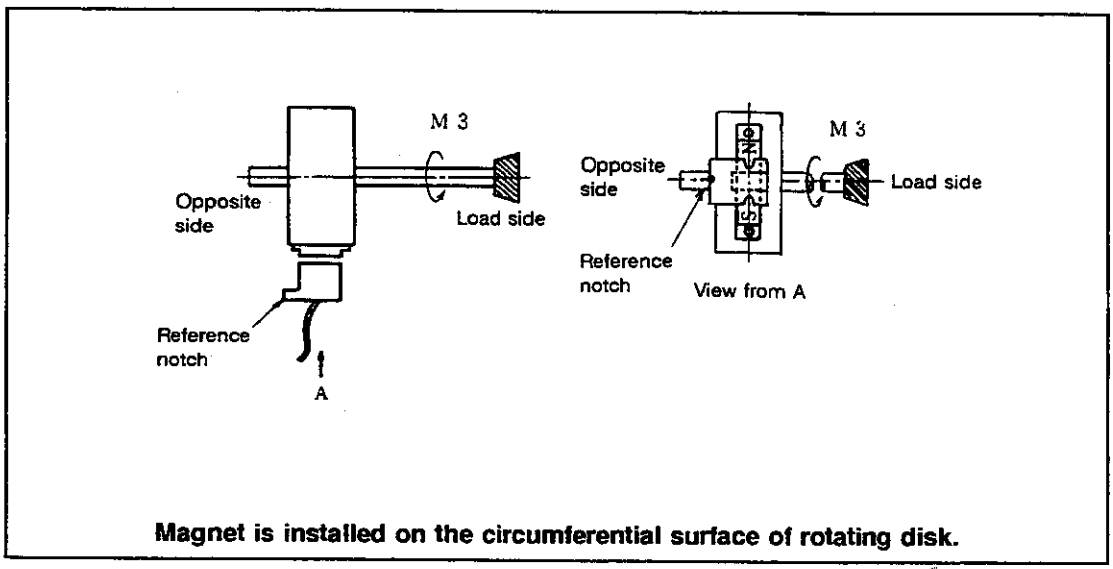
UNACCEPTABLE EXAMPLE 1

If the magnet reference hole and sensor head reference notch are not aligned, intense vibration will occur when the sensor head is at end of magnet (orientation is impossible.)



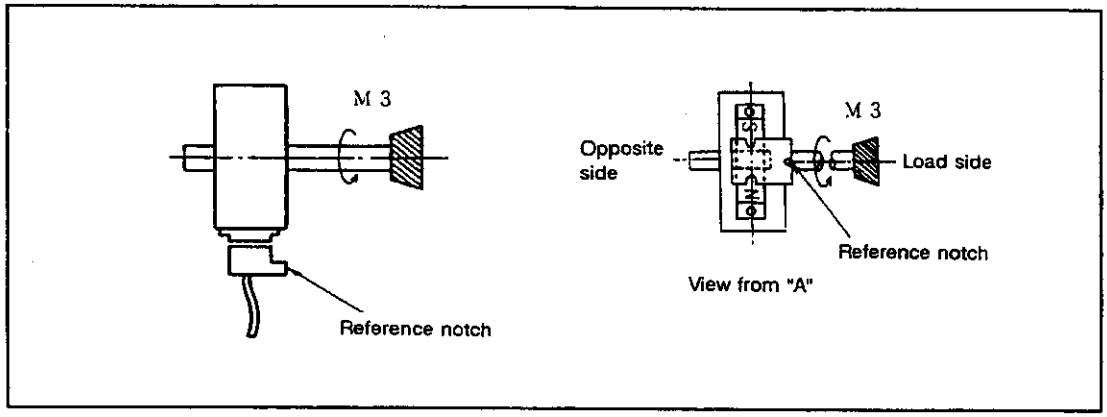
(II) CASE 4

Magnet is installed on the circumferential surface of rotating disk.
(Circumferential mounting)
The sensor head reference notch should be on the opposite side and the magnet should be installed in the polarity shown below.

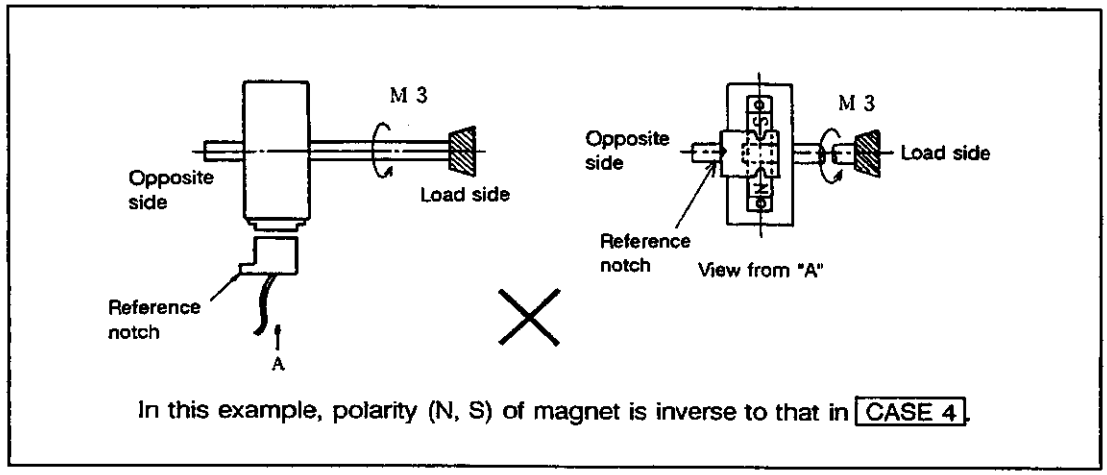


Magnet is installed on the circumferential surface of rotating disk.

CASE 5 As long as the relationship between location of the sensor head reference notch and the polarity of the magnet are aligned, the sensor head and the magnet can be installed as shown below in CASE 4, and normal orientation can be carried out. (Bit for parameter #30 ORS2 (Direction of orientation detector) must be changed correspondingly.)

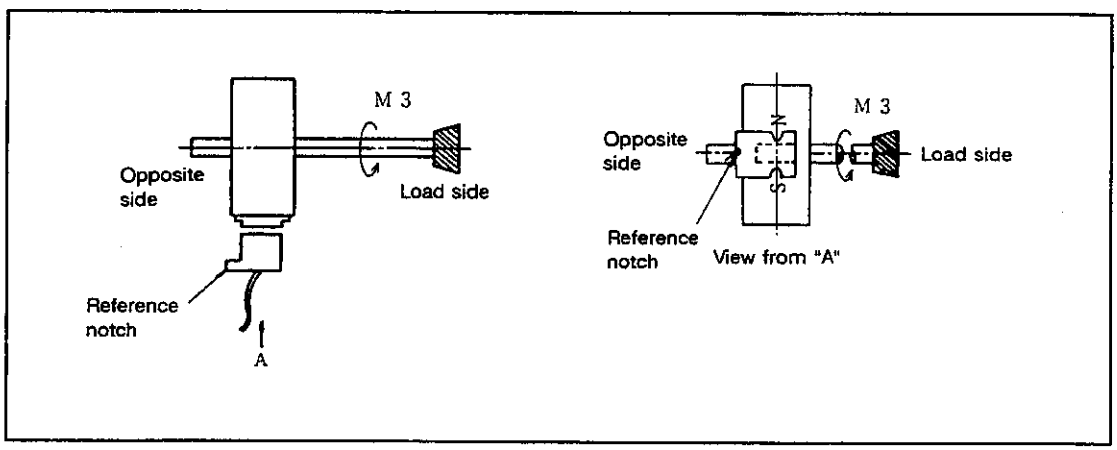


UNACCEPTABLE EXAMPLE 2 If the sensor head reference notch is not aligned properly in reference to polarity of the magnet, intense vibration occurs when the sensor head is at the end of the magnet, and orientation is impossible.

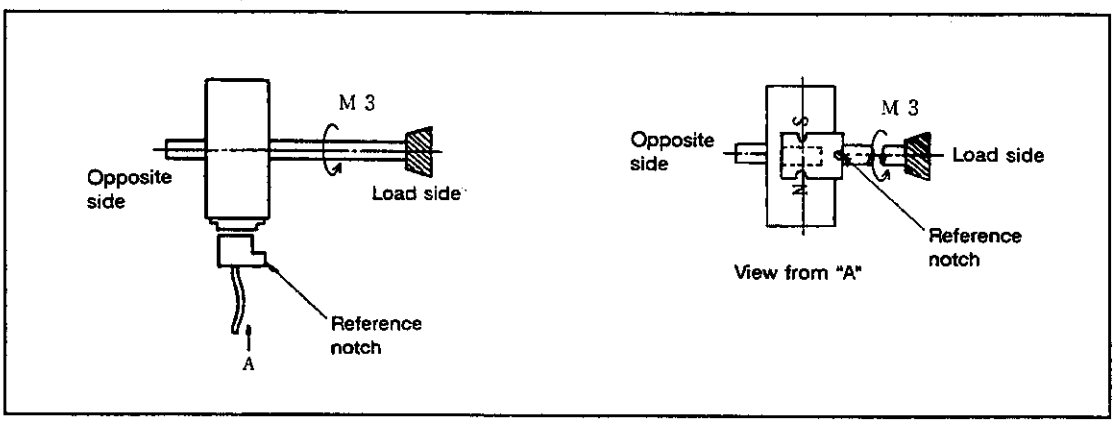


In this example, polarity (N, S) of magnet is inverse to that in CASE 4.

(III) CASE 6 The sensor head reference notch is on the opposite side of spindle and the polarity of the magnet is as shown below.

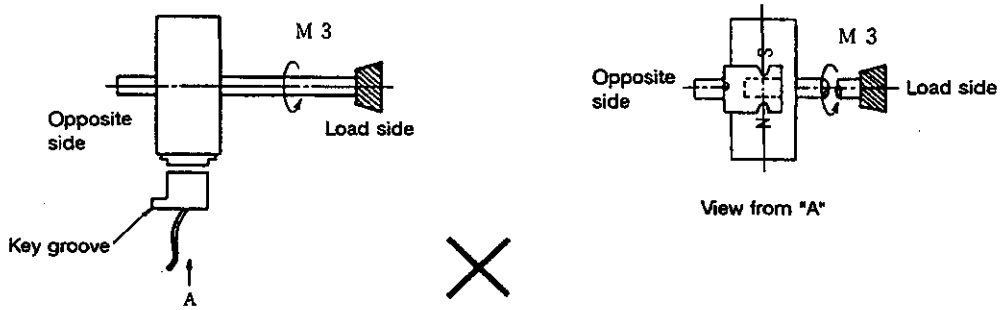


CASE 7 As long as the relationship between location of sensor head reference notch and the polarity of the magnet are aligned, the sensor head and the magnet can be installed as shown below in CASE 4, and normal orientation can be carried out. (Bit for parameter ORS2 (Direction of orientation detector) must be changed.)



UNACCEPTABLE EXAMPLE 3

If the sensor head reference notch is not aligned properly in reference to polarity of the magnet, intense vibration occurs when the sensor head is at the end of the magnet, and orientation is impossible.



In this example, polarity (N, S) of magnet is inverse to that in CASE 6.

6.1.3 Caution on installation of magnet

When the magnet is installed to the spindle, pay attention to the following:

(1) Do not place strong magnetic source near the magnet.
(2) Carefully handle the magnet, avoiding mechanical shock to the magnet.
(3) Secure the magnet to the spindle with appropriate screws.
For appropriate screws, refer to the drawing showing the outside view of magnet in the STANDARD SPECIFICATION.
(4) After the magnet is installed, balance the entire spindle.
(5) Align the center of the magnet (between N and S) with the center line of the rotating disk and make sure the orientation of the magnet and sensor head is as indication in 6.1.2 CASE 1 to CASE 7.
(6) Keep the magnet clean and keep the peripherals free of iron particles and cut chips (iron particles may cause malfunction).
(7) Apply lock paint etc. to prevent mounting screw from becoming loose.
(8) If the magnet is installed on a ground rotation disk, demagnetize the disk.
(9) Diameter of rotating disk on which the magnet (other than ring type) is installed should be within the range from 80 mm to 120 mm.
When spindle speed is low, use a rotating disk of larger diameter.
(10) If speed of the spindle exceeds 6000 rpm (12000 rpm or under), use a high speed type, high speed miniature type or high speed ring type magnet.
(11) For details of high speed ring type magnet, refer to the relevant description in the STANDARD SPECIFICATION.
(12) When the magnet is installed on the flat face of the rotating disk, the spindle speed should be within 6000 rpm.

6.1.4 Caution on installation of sensor head

When the sensor is installed, pay attention to the following:

(1) Install the sensor head in accordance with 6.1.2 CASE 1 to CASE 7.

(2) Align the center line of the sensor head with the center of magnet. (Fig. 6-2)

(3) The gap between the magnet and the sensor head are listed in Table 1 to Table 3.
- When a standard type magnet is installed in accordance with CASE 1 or CASE 3, refer to Table 1.
- When a high speed standard magnet is installed in accordance with CASE 1 or CASE 3, refer to Table 1.
- When a standard magnet is installed in accordance with CASE 2, refer to Table 2.
- When a high speed standard magnet is installed in accordance with CASE 2, refer to Table 2.
- When a high speed miniature magnet is installed in accordance with CASE 4 or CASE 5, refer to Table 3.

For high speed ring type magnet, refer to the outside view in the STANDARD SPECIFICATION.

* When magnets are mass-produced, it is recommended to prepare jigs for production.

(4) For connector used in the amplifier, BKO-C1810 type is oil-proof, but BKO-C1730 is not. It is recommended to place the connector in an oil-free location.

(5) The cable between the amplifier and the controller should be laid down away from high voltage cables.

(6) Check the connector wiring, securely engage the connector and tighten connector lock screws.

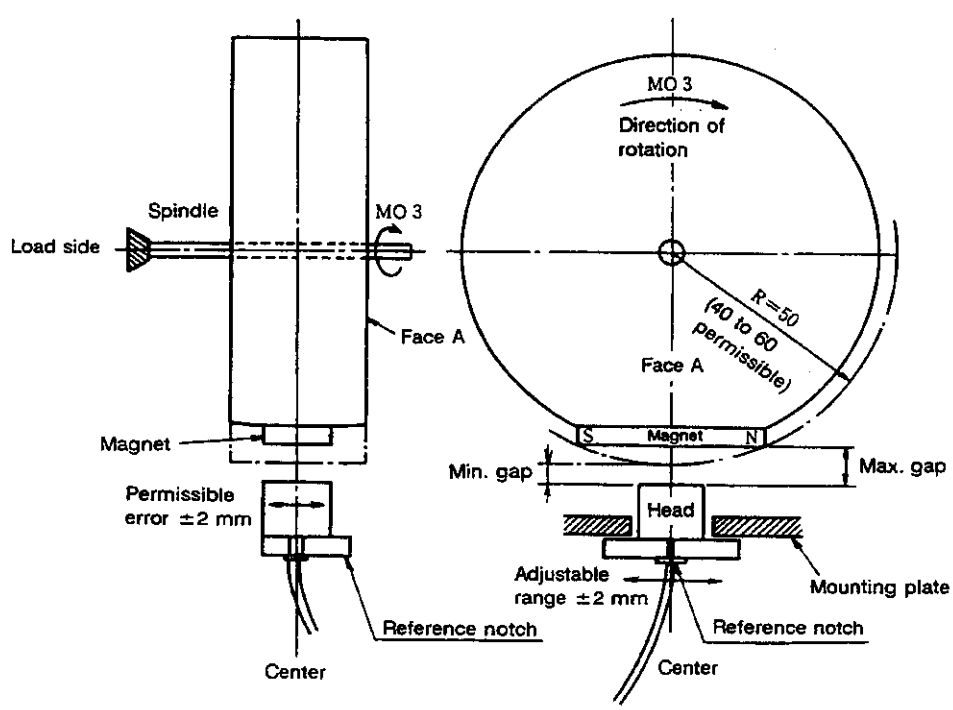


Fig. 6-2 Sensor Mounting Drawing

Table 1

	BKO-C1810H03 Standard		BKO-C1730H06 High speed standard	
Radius (R) mm	Max. gap mm	Min. gap mm	Max. gap mm	Min. gap mm
40	11.5 ± 0.5	2.7 ± 0.5	10 ± 0.5	1.22 ± 0.5
50	9.5 ± 0.5	2.8 ± 0.5	8 ± 0.5	1.31 ± 0.5
60	8.5 ± 0.5	3.0 ± 0.5	7 ± 0.5	1.5 ± 0.5
70	8.0 ± 0.5	3.4 ± 0.5	7 ± 0.5	2.38 ± 0.5

Table 2

	BKO-C1810H03 Standard	BKO-C1730H06 High speed standard
Radius (R) mm	Gap mm	Gap mm
40	6 ± 0.5	5 ± 0.5
50	6 ± 0.5	5 ± 0.5
60	6 ± 0.5	5 ± 0.5

Table 3

	BKO-C1730H09 High speed miniature	
Radius (R) mm	Max. gap mm	Min. gap mm
40	6.25 ± 0.5	3.3 ± 0.5
50	6.0 ± 0.5	3.7 ± 0.5
60	5.75 ± 0.5	3.85 ± 0.5
70	5.5 ± 0.5	3.87 ± 0.5

CHAPTER 7 RESISTOR UNIT

7. Resistor Unit

7.1 Combination of Resister Unit and Control Unit

FR-SGJ unit can be combined with resistor unit and control unit as listed below.

	R-UNIT-1 (30 Ω)	R-UNIT-2 (15 Ω)	R-UNIT-3 (15 Ω)
FR-SFJ-2-0.75K to FR-SFJ-2- 3.7K	O	× (Control unit may be damaged.)	× (Control unit may be damaged.)
FR-SFJ-2-5.5K	× (0V alarm may occur.)	O	O
FR-SFJ-2-7.5K			

O ..... Applicable, × ..... Not applicable

R-UNIT-1 and 2 are the standard resistor unit, and R-UNIT-3 is for heavy duty application.

Caution:

Hot air will flow out from the top of unit.

Resistor unit should be installed so that the hot air is led outside the enclosure.

CHAPTER 8 TROUBLESHOOTING

8. Troubleshooting

8.1 Introduction

If any trouble occurs with the control unit, perform the preliminary checks described below and then proceed to the troubleshooting described later.

The following preliminary checks are very important when you consult with service engineer.

Preliminary check:

1. Was any alarm displayed on the control unit?
   If yes, identify the cause of alarm.
   Also examine previous alarms through the LED in "alarm" mode (refer to 8.4 "Alarm and warning table").
2. If fuse was blown out, identify the phase (R, S, T) in which the blown out fuse was used (control circuit power supply fuse F1, F2, F3).
3. Is the trouble or failure recording?
4. Are ambient temperature and inner-panel temperature normal?
5. When did the trouble occur (during acceleration, or deceleration, or steady-speed operation)? What was the speed?
6. Is direction of rotation correct?
7. Did instantaneous power failure occur?
8. Does the same trouble occur in a specific operation, or when a specific command is given?
9. How frequently does the trouble occur?
10. Does the trouble occur when load is applied, or when load is removed?
11. Was any part replaced or any provisional remedy done?
12. How many years has the control system be used?
13. Is supply voltage normal?
    Does it change from time to time?

8.2 First Step of Troubleshooting

Perform the following check:

(1) Power supply voltage should be 200V$^{+10\%}_{-15\%}$, 50/60Hz, or 210V, 220V or 230V, 60Hz.
In any case, it should not go down below −15% of 200V.

(Ex.) • Check if the supply voltage drops at a specific time everyday.
• Check if the supply voltage drops at start of a specific machine in the factory.

(2) Are the peripheral control unit or functions in good condition?

(Ex.) • Are the NC, sequence circuit, etc. proper?
• Visually check cables and other components for condition.

(3) Is temperature inside and outside the control unit below 55°C?

(4) Visually check the control unit appearance.

(Ex.) • Cards, circuit patterns, etc.
• Looseness of wire, damage, foreign matter, etc.

(5) Do all control power supplies of SGJ-CA/CB card meet the specified voltages?

Outside voltage, nominal	P5	P15	N15	P24
Check pin	CH21	CH23	CH24	CH26
Common	CH22	CH22	CH22	CH25
Normal voltage (V)	5 ± 5%	15 ± 5%	−15 ± 5%	24 ± 10%

The most likely troubles or failures can be largely divided into the following two groups:

Trouble A
- Control unit does not work satisfactorily when it is turned on for the first time (I).
- Control unit comes into a standstill abruptly (II).
- Control unit fails from time to time, or error occurs in orientation stop position, or "alarm" lamp lights (III).

Trouble B
- Trouble with control unit
  - Failure in main circuit
  - Failure in control circuit
- Trouble with detector
  - Failure in speed detect encoder
  - Failure in multipoint orientation encoder
  - Failure in 1-point orientation magnesensor
- Failure in parameter, transfer data from NC
- Trouble with power supply
- Trouble with motor
- Other troubles (mismatching input signal conditions, cable disconnection, etc.)

8.3 Second Step of Troubleshooting

Trouble I	Checkup	Remedy
Control unit does not work satisfactorily when it is turned on for the first time	As long as the control unit is handled carefully, this type of trouble is quite unlikely to occur. The most possible cause is, (1) Mechanical shock or impact was given to the equipment during shipment, installation or handling.	(1) Visually check if any part of the equipment is damaged.
	(2) External wiring or sequence is incorrect, or disconnected. Check grounding wire. (It is not required to consider power phase sequence.)	(2) Check that the 7-segment LED is on. Check the wiring and sequence. (Note 1)
	(3) Check ROM No. and parameters against the order list.	(3) If discrepancy is found, replace ROM or change parameter setting.
	(4) Motor speed cannot be increased.	(4) Interchange motor connection between any two phases (U, V and W).
	(5) No-load operation is in good condition.	(5) Check load condition.
	(6) Only orientation stop function is not in good condition (overrun, etc.)	(6) Readjust.
	(7) "Alarm" lamp lights.	Refer to 8.5

Note 1: "Start signal SRN, SRI" should be turned on after "ready" signal and "speed reference" signal have been input.

Trouble II	Checkup	Remedy
Control unit comes into a standstill abruptly	(1) Check if fuse was blown.	(1) Replace blown fuse.
	(2) Check the input power supply. AC200V$^{+10\%}_{-15\%}$, 50Hz AC200 ~ 230V$^{+10\%}_{-15\%}$, 60Hz	(2) Input correct power supply. Provide power supply with sufficient margin in capacity.
	(3) "Alarm" is displayed.	Refer to 8.4.
	(4) Are signals from NC and sequencer proper? Check the input signals (machine "ready", "fwd run", "rev run", etc.), using "diagnosis" function (LED).	(4) Correct the external input.
	(5) In open-loop control mode, • Set control parameter to 00 (ADD) 0001 (DATA). • Input "speed command" signal and "start" command to try operation. (Control mode returns to closed-loop mode, when PB1 button is pressed, or the power is turned off after parameter setting.)	(5) If operation becomes possible, it is likely that speed feedback system is in failure ..... replace the encoder. If operation is impossible, it is likely that the main circuit is in failure ("alarm" lamp will light).

Trouble III	Checkup	Remedy
Control unit fails from time to time, or error occurs in orientation stop position. (Condition is restored when the power is turned off and then on to reset.)	In this case, the comprehensive analysis must be accomplished to determine the cause (load condition, operation mode, etc.). Refer to the causes below.	
	(1) Check if instantaneous power failure occurred or "UNDER VOLTAGE" was displayed.	(1) Check the power supply.
	(2) Check if malfunction occurred in control circuit, due to large noise. The controller is capable of withstanding noise (in power supply) of 1600V/1μs.	(2) Determine the noise source and install a surge killer, etc. Check and improve grounding method (particularly, grounding of detector).
	(3) Check if overload occurred due to momentary change of load. Check with particular care if error occurred in orientation.	(3) Check mechanisms carefully. Check backlash between spindle and spindle encoder.

8.4 Alarm and Warning Table

Alarm No.	Abbr.	Name	Description	Motion (Note)
10	UV	UNDER VOLTAGE	This alarm occurs if input supply voltage goes down below the specified level, or if instantaneous power failure lasting for over 15 ms occurs.	A
12	ME1	MEMORY ERROR 1	This alarm occurs if read from, or write to internal memory for controller system control does not go normally (memory is checked when the control unit is turned on).	A
13	CE	EXT. CLOCK ERROR	This alarm occurs if error occurs in access time (2-ports memory), due to failure in external clock, during NC mode operation with FR-SGJ connected to M300 series CNC through bus line.	A
15	ME2	MEMORY ERROR 2	This alarm occurs if 2-port memory for data communication (when FR-SGJ is connected to M300 series CNC) does not function properly.	A
21	NS2	NO SIGNAL SPINDLE ENC.	This alarm occurs if signal from encoder for orientation is not input, or not at normal level.	A
22				
23	OSE	ERROR EXCESS SPEED	This alarm occurs if deviation of true motor speed is excessively large from command speed.	A
24	MCF	MAIN CIRCUIT FAULT	This alarm occurs if main circuit does not work properly.	A
25	BCF	BRAKING CIRCUIT FAULT	This alarm occurs in case of trouble with braking circuit.	A
27	CPUE	CPU ERROR (DIVISION ERROR)	This alarm occurs if error occurs in arithmetic operation (division) by CPU, due to improperly set parameter.	A
30	GF	GROUND DETECT	This alarm occurs if either the amp output U, V, W phases is grounded.	A
31	OS	OVER SPEED	This alarm occurs if motor speed exceeds 115% of the maximum motor speed.	A
32	OC	OVER CURRENT	This alarm occurs if current larger than the specified maximum current flows into FR-SGJ.	A
33	OV	OVER VOLTAGE	If voltage on main circuit capacitor exceeds the specified maximum level, due to regenerative energy, during deceleration of motor.	A
34	DP	DATA PARITY	This alarm occurs if parity error occurs in data transmission between M300 series CNC and FR-SGJ (when FR-SGJ is connected to CNC through bus line).	A
35	DE	DATA ERROR	This alarm occurs when error movement command has been given from the CNC (when FR-SGJ is connected to CNC through bus line).	A
36	TE	TRANSFER ERROR	This alarm occurs if data transfer does not go satisfactorily (when FR-SGJ is connected to CNC through bus line.)	A
37	PE	PARAMETER ERROR	This alarm occurs if set parameter value is out of the permissible range (this check is made when the control unit is turned on).	A

Continued on the next page.

Alarm No.	Abbr.	Name	Description	Motion (Note)
45	OHF	OVER HEAT AMP. (CONTROL UNIT)	This alarm occurs if ambient temperature is excessively high, or main circuit semi-conductor overheats, due to overload or stop of cooling fan.	A
46	OHM	OVERHEAT MOTOR OR RESISTOR UNIT	This alarm occurs if motor overheats due to overload or stop of motor cooling fan.	A
51	OL	OVERLOAD ALARM	This alarm occurs when operated continuously longer than the set time with an excessive load.	A
52	OD	ERROR EXCESS POSITION	This alarm occurs if difference (error) between referenced stop position and true stop position is excessively large.	A
55	EMA	EXTERNAL EMERGENCY STOP ALARM	This alarm occurs when an emergency stop signal is input from external sources when the external emergency stop signal (alarm signal output) is valid.	B1
56	OA	OTHER AXIS ALARM	This alarm occurs if trouble occurs with other servo axis (when FR-SGJ is connected to CNC through bus line).	A
57	OPE	OPTION CARD ERROR	This alarm occurs if "sync. TAP", "C-axis control" or "index" signal is input though FR-SGJ is not equipped with the corresponding option card.	A
W1	WOL	WARNING OVERLOAD	This warning occurs when a level over 80% of the overload alarm is detected.	C
E4	WPE	WARNING PARA-METER ERROR	This warning arises if parameter setting is beyond the specified limit.	C
E7	NCE	NC EMERGENCY	• If emergency stop signal is input to FR-SGJ from CNC (when FR-SGJ is connected to CNC through bus line), this warning is given. • If emergency stop signal is input from external signal source (when parameter #42 (BSL) is set so that external emergency signal is acceptable), this warning is given.	B2

Note: If protective function listed above is activated, Alarm No. is displayed by 7-segment and the following occurs.

Motion A : Control unit base current is shut off, main circuit contactor opens and the motor stops after coasting. Fault signal contact FA-FC opens.

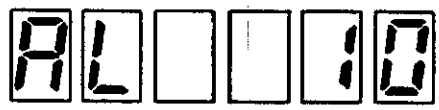
Motion B : Motor is decelerated by regenerative brake and stops. After motor stops, base current is interrupted. In this case, whether fault signal contact FA-FC opens or not depends on parameter setting.
- B1: Contact FA-FC opens
- B2: Contact FA-FC closed

Motion C : Only warning is displayed (operation can be continued).

8.5 Countermeasures against Each Phenomenon

8.5.1 "Alarm/warning" display by LED

(1) UNDER VOLTAGE



This alarm appears if voltage under 170V lasts for longer than 15 ms.

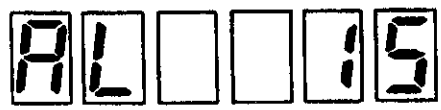
Cause	Checkup	Remedy
Power supply capacity insufficient	This alarm appears when speed is changed or load is excessive.	Increase capacity of power supply.
Interval between turning off and on AC power supply short	AC power supply should be turned on in minimum 1 sec. after turning off.	Prolong AC power supply off time.
Card SGJ-CA/CB not in good condition	It should be checked if this alarm is reproducible. Replace the card SGJ-CA/CB in use with a new card to check if the same alarm occurs again. Use the previous card SGJ-CA/CB again to check if the same alarm occurs again.	Replace the card SGJ-CA/CB.

(2) MEMORY ERROR 1

This display appears if reading from, or writing to the memory incorporated in the controller cannot be done successfully.

Cause	Checkup	Remedy
ROM loaded improperly	Visually check that all pins of ROM are put into the socket properly.	Load ROM properly.
Card SGJ-CA/CB trouble	Check card SGJ-CA/CB.	Replace the card SGJ-CA/CB.

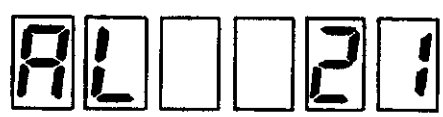
(3) MEMORY ERROR 2



This display appears if the buffer for bus-connection with M3/L3 CNC, M300 series, does not function properly.

Cause	Checkup	Remedy
Bus-connection cable defective	Replace the cable in use with a new cable to check.	Replace the cable.
Card SGJ-CB trouble	After making sure this alarm is reproducible, replace the card SGJ-CB in use with a new card to check.	Replace the card SGJ-CB.

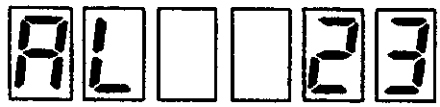
(4) NO SIGNAL SPINDLE ENC.



This alarm appears if signal from the orientation encoder is not input correctly.

Cause	Checkup	Remedy
Trouble with encoder or encoder cable	Check waveform of signal feed back from encoder, using a synchroscope. Card SGJ-OR Card SGJ-DA CH3 ~ CH7	Replace the defective encoder or cable.
Mis-connection of cable	Visual check	Correct the connection.
Error in parameter setting	Although the control system has no encoder type orientation function, parameter OSL (#41) is set to "1".	Set parameter OSL (#41) to "0".
Card trouble	After making sure this alarm is reproducible, replace the cards SGJ-OR and SGJ-DA to check.	Replace the cards SGJ-OR and SGJ-DA.

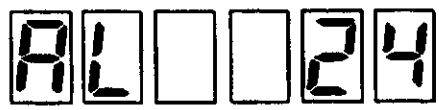
(5) ERROR EXCESS SPEED



This alarm occurs if deviation of true motor speed from the specified speed is larger than 50 rpm, lasting for 12 sec. or longer.

Cause	Checkup	Remedy
Motor wiring improper	Motor cable connection (U, V and W) is not correct.	Connect, the motor cable in correct phase sequence.
Error in parameter setting	"Motor constant" parameter [MSL] (#2) setting does not meet the motor used.	Change parameter setting.
GD^2 excessively large	It takes more than 6 sec. for acceleration to the maximum motor speed from zero speed.	Increase setting of parameter [SETM] (#52).
Overload	Load (read on load meter) is larger than 120%.	Decrease the load. Lighten the cutting amount.
Trouble with CON2 cable or motor built-in encoder	Rotate the motor shaft with "ready" signal turned off with hand and check speed indication by the LED. (Lower value, excess variation)	Replace the CON2 cable or motor built-in encoder.
Trouble with card SGJ-CA/CB	After making sure this alarm is reproducible, replace the card SGJ-CA/CB in use with a new card to check.	Replace the card SGJ-CA/CB.
Trouble with control unit	Speed can not be increased to desired speed in open loop control mode. Check speed indication by the LED.	Replace the control unit.

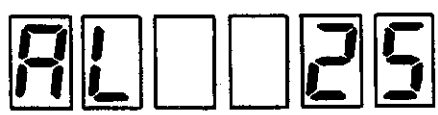
(6) MAIN CIRCUIT FAULT



This alarm occurs if the main circuit is not in good condition.

Cause	Checkup	Remedy
Trouble with card SGJ-CA/CB	Replace the card SGJ-CA/CB with a new card to check.	Replace the card with a new one.
Trouble with control unit	If the same alarm occurs again with a new card SGJ-CA/CB, the control unit is likely to be defective.	Replace the control unit.

(7) BREAKING CIRCUIT FAULT



This alarm occurs if the braking circuit does not function properly.

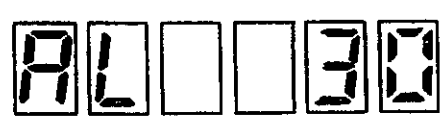
Cause	Checkup	Remedy
Trouble with card SGJ-CA/CB	Replace the card SGJ-CA/CB with a new one to check.	Replace the card SGJ-CA/CB.
Trouble with control unit	If the same alarm occurs again with a new card SGJ-CA/CB, the control unit is likely to be defective.	Replace the control unit.

(8) CPU ERROR

This alarm occurs if in the CPU calculation a calculation that could be divided by 0 was carried out or the division answer overflowed.

Cause	Checkup	Remedy
The gear ratio parameter setting is mistaken.	Check and compare the enclosed "Parameter setting list".	Properly set the parameter.
The parameter regarding the speed loop gain is mistaken VKP, VKI, ORS1.	Check and compare the enclosed "Parameter setting list". When bus line connected with M300 and M3/L3, check the NC display spindle parameter also.	Properly set the parameter.
The bus-connection connector (CN1A) joint with the NC is not securely connected.	Will be corrected when the cable is reinserted.	Secure the connector connection and the tightening of the fixing screws.
Error in the cable bus-connecting with the NC.	Will be corrected when the cable is replaced.	Replace the cable.
When using the special motor (when #02 is set to 2), the motor constant #81 to #AF is incorrect.	Check and compare the enclosed "Parameter setting list".	Properly set the parameter.

(9) PHASES GROUND DETECT



This alarm occurs if either the amp output U, V, W phases is grounded.

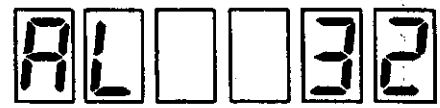
Cause	Checkup	Remedy
Error in the motor output wire.	Check the resistivity value between the terminal block TE1 UVW terminals and the motor earth with a tester.	Replace the defective wire.
Error in the card.	Will be corrected when the SGJ-CA/CB card is replaced.	Replace the SGJ-CA/CB card.

(10) OVER SPEED

This alarm appears if motor speed exceeds 115% of the rated speed.

Cause	Checkup	Remedy
Parameter setting improper	The motor maximum speed setting is under 1000 rpm.	If the setting is too low, speed detection range is narrow (15%) and therefore this alarm is likely to occur. Increase setting of maximum speed parameter [TSP] (#31).
Speed detection signal distorted by noise	Observe the signal from CH17 and 16 (common CH22) of SGJ-CA/CB, using an oscilloscope, to check for signal. Check if shielding of cable between motor and CON2 is disconnected.	Use a continuous cable to assure continuous shielding.
Trouble with motor built-in encoder	Observe the signal from CH17 and 16 (common CH22) of SGJ-CA/CB, using an oscilloscope. When motor runs at 1500 rpm, the signal should be sinusoidal-wave signal at the following frequency: $\frac{1500}{60} \times 256 = 6.4$ kHz	Replace the motor built-in encoder.
Trouble with position loop	This alarm occurs due to out of control in sync. TAP, sync. control, or other position loop operation.	Set parameter [ORS2] (position loop detector direction) properly.
	Gear ratio parameter GRA1 to GRA4, GRB1 to GRB4, is not set properly (parameter setting is smaller than 100).	Set gear ratio parameter 100 or more (refer to "Parameter setting list)".

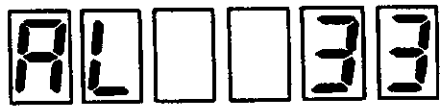
(11) OVER CURRENT



This alarm appears if overcurrent flows to the control unit.

Cause	Checkup	Remedy
Motor constant parameter set improperly	Parameter [MSL] (#2) setting does not meet motor in use.	Set parameter [MSL] (#2) properly.
Overload	Load (read on load meter) is larger than 120% of rated load.	Reduce the load.
Motor wiring improper	Motor wiring is incorrect. • Loose terminal screw • U, V or W lead grounded • Short-circuit of motor leads (U, V, or W)	Correct motor wiring.
Motor coil layer-short, or grounding	Measure insulation resistance. Insulation resistance should be less than 1 MΩ.	Replace the motor.
Power supply capacity insufficient	Check if AC input voltage (R, S, T) goes down below 170V during acceleration/deceleration or load state.	Use power supply of larger capacity (refer to the Standard Specification). Operation FR-SGJ with limited torque and reduced output.
Trouble with card SGJ-CA/CB	Make sure the same alarm is reproducible and then replace the card SGJ-CA/CB in use with a new one to check.	Replace the card SGJ-CA/CB.
Trouble with control unit	If the same alarm occurs again even when a new card SGJ-CA/CB is used, the control unit is likely to be defective.	Replace the control unit.

(12) OVER VOLTAGE



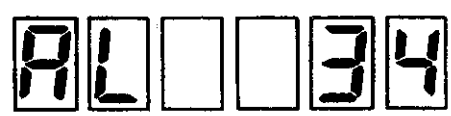
This alarm appears if voltage across rectifier capacitor is excessive (due to excessively large regenerative energy).

Cause	Checkup	Remedy
Wrong wiring	Resistor unit is not connected to FR-SGJ.	Connect resistor unit.
Motor constant parameter set improperly	Parameter [MSL] (#2) setting does not meet motor in use.	Set parameter [MSL] (#2) properly.
Trouble with resistor unit	Resistance measured across R1 and R2 of resistor unit is improper, or zero (open circuit). 30Ω for 2.2K and 3.7K control unit 15Ω for 5.5K and 7.5K control unit	Replace the resistor unit.
Trouble with card SGJ-CA/CB	Replace the card SGJ-CA/CB card with a new one to check.	Replace the card SGJ-CA/CB.
Trouble with control unit	The control unit will be defective if the same alarm occurs again even after the remedy described above.	Replace the control unit.

(13) DATA PARITY and TRANSFER ERROR

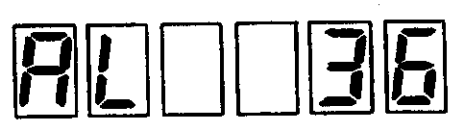
DATA PARITY

This alarm appears if parity error occurs in data communication between M300 series M3/L3 CNC and FR-SGJ.



TRANSFER ERROR

This alarm appears if data are not transferred correctly in data communication between M300 series M3/L3 CNC and FR-SGJ.



Cause	Checkup	Remedy
Connector engaged loosely	Cable connector is not engaged securely or connector mounting screw is loose.	Engage connector securely and tighten all screws.

Continued on the next page.

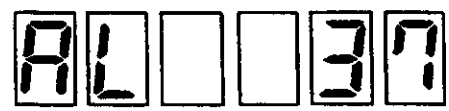
Cause	Checkup	Remedy
Trouble with terminal resistor	Check if this alarm occurs on the servo axis when spindle amplifier is disconnected and the resistor is connected to servo axis.	Replace the terminal resistor.
Trouble with bus-line cable	Exchange cable for servo axis control with cable for spindle amplifier to check.	Replace the bus-line cable.
Trouble with card SGJ-CB	Check if alarm disappears if the card SGJ-CB is replaced with a new one.	Replace the card SGJ-CB.

(14) DATA ERROR and PARAMETER ERROR

DATA ERROR

This alarm appears when movement command is larger than the specified limit in operation of FR-SGJ connected to M300, M3/L3 CNC.

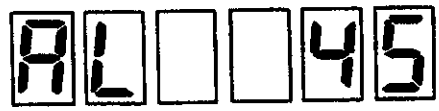
PARAMETER ERROR



This alarm appears when parameter setting is larger than the specified limit in operation of FR-SGJ connected to M300, M3/L3 CNC.

Cause	Checkup	Remedy
Parameter setting error Programming error	1. Check that spindle parameter settings meet the order list. 2. Check the program.	1. Correct parameter setting. 2. Correct program.
Parameter setting improper	The parameter GRA 1 to 4 and GRB 1 to 4 values are below 100 on the spindle parameter display.	Change the setting value so the GRA 1 to 4 and GRB 1 to 4 values are over 100.

(15) OVER HEAT AMP.



This alarm appears if thermal protector of control unit (installed on cooling fan).

Cause	Checkup	Remedy
Overload	1. Check motor for load condition. 2. Check motor start/stop frequency.	1. Lighten load. 2. Decrease start/stop frequency.
High ambient temperature	Measure the ambient temperature.	If the ambient temperature is higher than 55°C, appropriate provision should be made to cool.
Trouble with control unit cooling fan	Cooling fan does not work properly or remains stopped.	Replace the cooling fan.
Heat radiating fins dirty	Check if heat radiating fins on the back of FR-SGJ are heavily dirtied.	Clean the fins.
Fuse blown out	Check if fuse is blown out.	Replace the fuse.
	If new fuse is blows out again.	Refer to "Alarm 46".

(16) OVER HEAT MOTOR OR RESISTOR UNIT

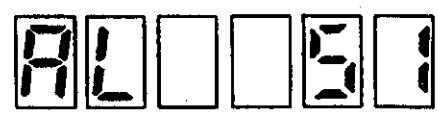
OHS1/OHS2 discontinuous

Cause	Checkup	Remedy
24V power supply short circuit	Check if the alarm disappears when the power is turned on with CON1, CON5, CONC and CONCA disengaged.	Correct the wiring. Open collector/emitter settings should meet input interface for speed command and position command 12-bit signals. (Refer to the STANDARD SPECIFICATION)
Wrong wiring	Voltage is not output across terminals A and B (at top of FR-SGJ).	Correct the wiring.

Continued on the next page.

Cause	Checkup	Remedy
Overload	1. Check motor for load condition. 2. Check frequency of start/stop.	1. Lighten load. 2. Reduce start/stop frequency.
Trouble with motor cooling fan	Fan does not run satisfactorily, or remains stopped.	Repair or replace the fan.
Motor air inlet clogged	Check cooling air flow.	Clean the air inlet.
Trouble with motor thermosensor (thermoswitch)	Check if the thermosensor does not reset when the motor fan is operated for 15 to 16 min. with the motor stopped.	1. Shortcircuit OHS1–OHS2 to continue operation (provisional remedy). 2. Replace the motor.
Fuse blown out	Check if the fan remains stopped due to blown out fuse.	Replace the fuse.
	If the new fuse is blown out again, 1. Check wiring of motor cooling fan and resistor unit cooling fan (short circuit, grounding fault, etc.).	Replace the wiring with new one.
Trouble with resistor unit cooling fan	Check if resistor unit cooling fan is in standstill or does not run satisfactorily.	Replace the cooling fan.
Trouble with resistor unit thermosensor (thermoswitch)	Check if thermosensor does not reset when the cooling fan is operated for 15 to 16 min. with the motor stopped.	Replace the resistor unit.

(17) OVERLOAD alarm



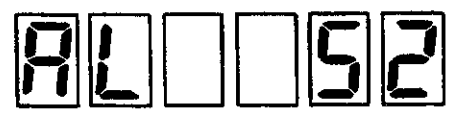
This alarm appears when operated continuously longer than the set time with an excessive load.

Cause	Checkup	Remedy
Was used exceeding the motor continuous rating.	The motor is hot when touched. Try to decrease the load. Decrease the heavy cutting time ratio.	Lighten the load.
The motor is locked.	The motor stops with heavy cutting. The load meter is larger than 120%.	Lighten the load.

Continued on the next page.

Cause	Checkup	Remedy
Parameters #F8 OLL, #F9 OLT are inappropriate.	Check the standard setting value. OLL: 110 OLT: 600	Correct to the parameter as shown at the left.
Error in the motor wiring.	The wiring around the motor is incorrect. The U, V, W wiring is incorrect. The U, V, W wiring is short-circuiting.	Correct the wiring.
Error in the CON2 cable or motor built-in encoder.	When the motor is turned manually with the "ready" signal off, the 7 segment LED rotation number display is incorrect. (The value is 0 or small. The changes in the value is great.)	Replace either the CON2 cable or motor built-in encoder.
Error in the card SGJ-CA/CB.	Will be corrected when the card SGJ-CA/CB is replaced.	Replace the card SGJ-CA/CB.

(18) ERROR EXCESS POSITION



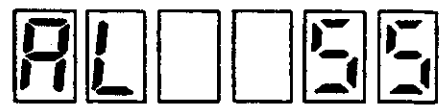
This alarm appears if deviation of true stop position from commanded stop position is excessive in orientation stop operation or position control loop operation.

Cause	Checkup	Remedy
Parameter (orientation of encoder) setting improper.	Check if alarm is removed when bit 8 of parameter [ORS2] is inversed in encoder orientation.	Set parameter [ORS2] properly.
	Check if alarm is removed when bit E of parameter [ORS] is inversed.	
Encoder orientation adjustment improper	Check if alarm is removed when value of parameter [CSP] is halved.	Set parameter [CSP] properly.
Sync. TAP adjusted improperly	Check if alarm is removed when sync. TAP command time constant is increased.	Set time constant TAP-Tℓ properly.
Trouble with encoder	Stop position is valiable in each oriented stop (encoder type). (Check the encoder shaft.)	Replace the encoder.

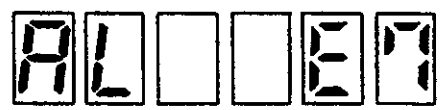
Continued on the next page.

Cause	Checkup	Remedy
Trouble with card SGJ-OR, SGJ-DA	Check if alarm is removed when card SGJ-OR, SGJ-DA is replaced with a new one.	Replace card SGJ-OR, SGJ-DA.
Parameter adjustment	The alarm does not occur when parameter [PG1] and [PG2] are increased two-fold.	Adjust [PG1] [PG2] [CSP] following the section 3.8 Adjustment of Oriented Function.
Belt slip	The belt slips from the oil.	Wipe off the oil on the belt and pulley, and make it not slip.

(19) EXTERNAL EMERGENCY STOP alarm



(20) EMERGENCY STOP, EXTERNAL EMERGENCY STOP



Cause	Checkup	Remedy	Remarks
Parameter mis-setting	The external emergency stop is treated as a warning instead of an alarm.	By setting the parameter #42 [BSL] bit 0 to 0, the emergency stop "E7" that does not handle alarms can be changed.	
Specifications change	The CON1 emergency stop signal is not used.	Parameter #42 bit 1: 1 → 0	Bus-line connection
		Parameter #60 ~ 64 (Auxiliary input) Data "4" → "0" (Refer to the STANDARD SPECIFICATION for details.)	S-analog type

8.5.2 Troubles that are not displayed by LED

(1) No alarm display appears, but motor does not start.

Cause	Checkup	Remedy
Miswiring or wire disconnection	Check the wiring.	Correct the wiring.
Input power supply (voltage improper	Check the input power supply (200V 50Hz or 200 to 230V 60Hz in all 3 phases).	Use the specified power supply.
Control power supply improper	Measure the control power supply voltage, using a multimeter and check terminals.	Replace card SGJ-CA/CB.
Required signal not input	Check if contactor closes (clicks when contactor is closed).	Input "ready" signal.
	Check that start signal (SRN, SRI or ORC) is input within 1 sec. after "ready" signal is input.	Signal input sequence should be changed so that start signal is input in 2 to 3 sec. after "ready" signal turns on. (For details, see specifications.)
Speed command signal remains zero. (Input signal is improper.)	Rotate motor shaft to make sure motor is under "servo lock" condition. 1. Signals SRN and SRI turn on at the same time. 2. "slimit" or "smax" (NC display parameter) is set at "0". 3. "Analog/digital select" signal is on. 4. The input interface (open collector, emitter) setting (connection) with the speed selection signal function specifications does not match the specifications.	1. Change the program so that SRN and SRI do not turn on at the same time. 2. Set "slimit" and "smax" properly. 3. Turn off "analog/digital select" signal. 4. Set (connect) according to the input interface.
Orientation signal ON	Orientation signal (ORA) is on.	Turn off orientation signal.
Parameter inappropriate	Rotates when the cushion time parameter [CSN] is set to the standard value 300 ms.	Set [CSN] and [TSP] to the appropriate value.
	Rotates when the motor maximum speed parameter [TSP] is set to over 2000 rpm.	

(2) No alarm display appears, but motor rotates slowly (acceleration is impossible), or large sound arises in motor

Cause	Checkup	Remedy
Miswiring of motor	Check wire connection to output terminals U, V and W of FR-SGJ (phase sequence).	Correct the wiring.
Input power supply (voltage) improper	Check the input power supply in all 3 phases.	Use the correct specified power supply.
Speed command signal input from external signal source is incorrect.	Check if motor speed does not increase in accordance with speed command signal.	Remedy the external speed command signal circuit.
Trouble with motor built-in encoder/CON2 cable or motor built-in encoder	When motor shaft is turned by hand with "ready" signal turned off, speed display by the 7-segment LED readout is not in accordance with motor shaft rotation.	Check the motor built-in encoder/CON2 cable. Replace the motor built-in encoder.

(3) True speed does not meet command speed.

Cause	Checkup	Remedy
Adjustment improper	Adjustment is not made for S-analog speed command.	Correct spindle parameter setting (NC display). (Refer to Item 3.5)
External speed command signal improper	Voltage of speed command signal from external signal source does not change linearly from 0V to 10V. (Analog input: CH31 to AG)	Remedy the external speed command signal circuit.
S command code improper	BCD code is output instead of binary code for S command (machine parameter "Sbin" is set at "0").	Binary code should be used for S command. (Set "Sbin" to "1")
A different speed command is valid.	Up-to-speed signal is ON. • The S-analog command is valid.	
	• The digital speed command is valid.	Check the digital speed command type (#05 DSR).
	• The speed selection signal function is selected. (Parameter #10DTYP = 1)	Review the CONC, CONCA signals.
	• The S-analog signal is input with the bus-line connection.	S-analog signals cannot be input with bus-line connection.
	• The polygonal cutting function is valid. (Parameter #10DTYP = 2)	Turn parameter #10DTYP = 0, and run.

(4) Required torque cannot be obtained.
Perform check in accordance with (1), (2) and (5).

(5) It takes longer time to start the motor.

Cause	Checkup	Remedy
Load increased	Check the load condition.	Lighten the load.

(6) "Up-to-speed" signal is not output (for DIO interface with NC)

Cause	Checkup	Remedy
Trouble with output circuit of card SGJ-CA	Check that "up-to-speed" flag (external output in DIAGNOSIS mode) turns on when motor speed reaches the preset speed. If the flag turns on, the output circuit is defective.	Replace the card SGJ-CA.

(7) Data sent from the NC is not accepted.
Interlock turns on because "up-to-speed" signal is not output properly.
Check the control sequence and perform check in accordance with (6).

(8) "Speed detection" signal is not output (for DIO interface with NC).

Cause	Checkup	Remedy
Trouble with card SGJ-CA	Check that "speed detection" flag (external output in DIAGNOSIS mode) turns on when motor speed is below the preset speed. If the flag turns on, the output circuit is defective.	Replace the card SGJ-CA.

(9) "Zero speed" signal is not output (for DIO interface with NC).

Cause	Checkup	Remedy
Trouble with card SGJ-CA	Check that "zero speed" flag (external output in DIAGNOSIS mode) turns on when motor speed is below 25 rpm or 50 rpm. If the flag turns on, the output circuit is defective.	Replace the card SGJ-CA.

(10) Speed range cannot be changed (for DIO interface with NC).
"Speed detection" and/or "zero speed" signal is not output properly.
Perform check in accordance with (8) an (9).

(11) The motor stops when loaded.

Cause	Checkup	Remedy
Overload	The load meter shows over 120%.	Decrease the load.
The torque is limited.	Will rotate correctly when parameter [TLM] is set to 100.	Turn off the torque limit signal. • Connector CON1 47, 48 pin • Check the bus-line connection signal (refer to the Standard Specifications unit-to-unit connection diagram.)

(12) The sound and vibration is great.

Cause	Checkup	Remedy
Adjust the alarm 23 section.		
Refer to "(14) The gear sound and belt flapping sound is great."		

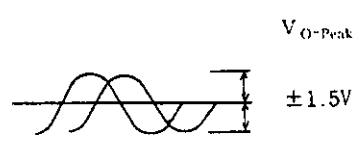
(13) The operation during deceleration is not correct.
Enters the free run state midway.

Cause	Checkup	Remedy
The SET signal is OFF.	The cushion time is increased by 10 seconds, and still enters the coasting state with (parameter = [CSN]) during deceleration (at the same time before changing the cushion time.)	Replace the SET signal relay.
The belt slips.	• The output signal ZS enters the coasting state after turning ON. • When the S command is set to zero in the M03 state, the spindle continues to rotate at the point where the motor stopped. • Correct when the motor unit singly decelerates.	• Readjust the belt tension. • Wipe off any dirt on the belt. • Replace the belt.

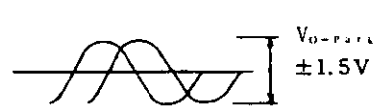
(14) The gear sound and belt flapping sound is great.

Cause	Checkup	Remedy
Dynamic unbalance.	The same sound occurs when the motor is put into the coasting state from running at the maximum speed. (Refer to Item 8.2)	Review the dynamic balance of the spindle, motor axis pulley, and middle axis.
There is an oscillation point in the machine.	In the same coasting state as above, the noise increases at a certain speed.	Increase the machine rigidness and increase the oscillation frequency.
Great backlash	A banging of the gear occurs only once during deceleration and acceleration.	Shorten the backlash.

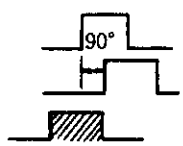
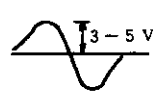
(15) The rotation is unstable.

Cause	Checkup	Remedy
The speed loop gain is inappropriate.	Large GD^2_L. (GD^2 is more than ten times the motor GD^2_M.) Will improve when parameter VKI is changed to 6.	Select the maximum value for parameter VKI. Raise VKI, and set the value that is 5% that of the value when the instability occurs.
Speed command (S-analog) noise.	The 7-segment display speed command is also unstable.	Enforce S-analog signal noise countermeasures.
Motor PLG signal noise	Measure CH31, 32 with an oscilloscope and the noise is superimposed.	Enforce motor PLG signal noise countermeasures.
Error in the motor built-in encoder	Signals on CH17 and 16 (CH22 for common) of card SGJ-CA/CB do not offset accurately. Normal waveform  Peak voltage of signal is not within ±1.5V.	Replace the motor.

(16) Speed cannot be increased over a certain speed.
Check the maximum speed setting.
Check if "override" signal is input.
Check if value of the load meter is excessively large (check the load conditions).

Cause	Checkup	Remedy
Dynamic unbalance	Large vibration and noise occur during coasting of motor.	Balance the control system and motor dynamically.
Insulation resistance decreased	Disconnect the power cable (R, S, T) and measure insulation resistance, using 500V megger (each grounding terminal screw should have been unfastened.) (a) Between entire main circuit and ground ..... At least 20 MΩ (Terminals R, S, T, U, V, W, MS1 and MS2, and E) (b) Between control circuit COM and ground ..... At least 20 MΩ (Terminal CH22 of card SGJ-CA/CB and E) (c) Between entire main circuit and control circuit COM ..... At least 20 MΩ	If insulation resistance is found decreased, identify the part where insulation is deteriorated and remedy.
Trouble with motor bearing	Turn the motor by hand to check.	Replace bearing.
Motor mounting screws loose	Check motor mounting screws for looseness.	Retighten screws.
Motor shaft runout	Check if any trace of physical damage is found on motor shaft.	Repair or replace the motor.
"Speed detection" signal noise	Signal on CH17 and 16 (CH22 for common) of card SGJ-CA/CB is distorted by noise.	Shield the cable between CON2 and motor built-in encoder (without discontinuity). Use a cable of larger size for motor.
S-analog speed command signal noise.	Signal on CH31 (CH22 for common) of card SGJ-CA is distorted by noise.	Shield the signal line properly.
Error in motor built-in encoder	Signals on CH17 and 16 (CH22 for common) of card SGJ-CA/CB do not offset accurately. Normal waveform  Peak voltage of signal is not within ±1.5V.	Replace the motor built-in encoder.

(17) Speed can be controlled normally, but spindle cannot be stopped in position (Orientation).

Cause	Checkup	Remedy
Speed can be decreased to "orientation stop" speed, but motor does not stop.	Check if position feedback encoder or magnesensor is in good condition. Run the motor under speed control to check position feedback signal. Check the signals on the following check pins of cards SGJ-OR, SGJ-DA while the motor is running forward. CH5 – CH8(DG) CH6 – CH8(DG) CH7 – CH8(DG) (Mark pulse)  Check on the following pins of card SGJ-OR, SGJ-DA while the motor is running forward. CH1 – CH8(DG)  CH2 – CH8(DG)  CONB(10) – CH8(DG) 	Replace the position detector or replace card SGJ-OR, SGJ-DA.
Orientation stop position in forward rotation deviates from orientation stop position in reverse rotation (during multipoint orientation stop).	Backlash in encoder is large.	Reduce the backlash.
Hunting occurs at stop.	Decrease parameter [PG1] and [PG2] settings to check.	Parameter #22 [PG2] Parameter #21 [PG1] Set these parameters properly.
Servo rigidness (stability) poor	Check gear ratio settings. Check parameter setting.	Increase speed control loop constant. ([VKP], [VKI] or [ORSI])
Overshoot in speed control		Decrease speed control loop constant. ([VKI])

CHAPTER 9 PERIODIC INSPECTION

9. Periodic Inspection

In order to ensure high-performance operation of equipment, and trouble-free long use of equipment, the periodic inspection is particularly important.

Caution

To prevent accident, make sure the power is interrupted completely before starting the inspection.

9.1 Inspection of Control Unit

Check item	Frequency	Check	Remedy
1. Cooling fan	Monthly	(1) Rotate the fan shaft by hand to check. (2) Turn on the fan to check that the fan runs powerfully. (3) Check if abnormal sound occurs in bearing.	Replace the fan.
2. Soiling, deformation, and terminal screw looseness	Appropriate interval	Periodically clean the parts and tighten the input/output terminals and connection points. Especially clean the middle panel type controller cooling fin part.	
3. Miniature relays	Every 3 months	(1) Check contact points for wear. (2) Check that main circuit contactor opens and closes in accordance with relay operation.	Replace defective relay(s).
4. Wiring	Appropriate interval	The wire is not caught in the hinge part and that the center wire is not touching the case.	

9.2 Inspection of Motor

Check item	Frequency	Check	Remedy
1. Sound (noise) and vibration	Monthly	• Check if abnormal sound or intense vibration occurs. If abnormal sound or intense vibration occurs, perform the following check: (1) Check foundation and installation. (2) Check shaft alignment. (3) Check if vibration is transmitted through shaft coupling. (4) Check if bearing is damaged or abnormal sound occurs. (5) Check if noise or vibration is caused by reduction gear or belt. (6) Check control unit for condition. (7) Check cooling fan for condition. (8) Check belt tension.	

Continued on the next page.

Check item	Frequency	Check	Remedy
2. Temperature rise	Monthly	• Check bearing temperature. (Normal amb. temp. + 10 to 40°C) • Check motor frame temperature. If temperature is high excessively, perform the following check: (1) Check cooling fan operation. (2) Check cooling air passage (between frame and cover). (3) Check load condition.	Clean
		(4) Check control unit.	See "Trouble-shooting".
3. Insulation resistance	Every 6 months	• Check if insulation resistance is excessively low. To check, measure insulation resistance between the entire circuit and ground (control panel disconnected). Insulation resistance should be larger than 1 MΩ, measured by 500V megger. If insulation resistance is less than 1 MΩ, clean and dry motor interior. To dry, disassemble and heat motor at temperature less than 90°C.	
4. Cooling fan	Weekly, monthly	• Check cooling fan for operation, noise and vibration.	

9.3 Inspection of Resistor Unit

Check item	Frequency	Check	Remedy
1. Cooling fan	Weekly, monthly	1. Check if fan shaft can be rotated smoothly by hand. 2. Check if fan motor runs powerfully. 3. Check if abnormal sound arises in bearing.	Replace the fan.

CHAPTER 10 PARTS LIST

10. Parts List

AC spindle control unit, resistor unit and motor

Remarks:

1. Spare A : Spare parts recommended to be replaced every 2 years.
2. Spare B : Spare parts recommended to be replaced every 5 years.
3. Spare C : Spare parts recommended to be stored by machine manufacturer.

No.	Name	Capacity kW	Model		Manufacturer	Symbol	Q'ty req'd	Spare				Remarks
								Standard accessory	Selection			
									A	B	C	
1	TRANSISTOR	0.75	QM30TX-HB	BKO-NC1164 H01	MITSUBISHI ELECTRIC	TR2	1	0	0	0	1	
		1.5	QM50TX-HB	BKO-NC1164 H02								
		2.2										
		3.7	QM75TX-HB	BKO-NC1164 H03								
		5.5	QM100TX1-HB	BKO-NC1164 H04								
		7.5										
2	TRANSISTOR	0.75 ~ 7.5	ETG81-050		FUJI ELECTRIC	TR1	1	0	0	0	1	
3	DIODE STACK	0.75 1.5	PT30S8		NIHON INTER	DS	1	0	0	0	1	
		2.2 ~ 7.5	6RI50E-050		FUJI ELECTRIC							
4	CAPACITOR	0.75	1000UF350V	BKO-NC1043 H135	NIPPON CHEMI-CON	C1	1	0	0	1	1	
		1.5	1500UF350V	BKO-NC1043 H136								
		2.2 ~ 7.5	2400UF350V	BKO-NC1043 H137								
5	FAN	3.7 ~ 7.5	N3951MVL BKO-C1792 H51		TOBISHI	FAN	1	0	1	0	1	

Continued on the next page.

No.	Name	Capacity kW	Model	Manufacturer	Symbol	Q'ty req'd	Spare				Remarks
							Standard accessory	Selection			
								A	B	C	
6	PRINTED CIRCUIT BOARD	0.75	SGJ-P1-075	MITSUBISHI ELECTRIC	SGJ-P1	1	0	0	0	1	
		1.5	SGJ-P1-150								
		2.2	SGJ-P1-220								
		3.7	SGJ-P1-370								
		5.5	SGJ-P2-550		SGJ-P2						
		7.5	SGJ-P2-750								
7	PRINTED CIRCUIT BOARD	0.75 ~ 7.5	SGJ-CA	MITSUBISHI ELECTRIC	SGJ-CA	1	0	0	0	1	
		0.75 ~ 7.5	SGJ-CB	MITSUBISHI ELECTRIC	SGJ-CB	1	0	0	0	1	
8	OPTION PRINTED CIRCUIT BOARD	—	SGJ-OR	MITSUBISHI ELECTRIC	SGJ-OR	1	0	0	0	0	1
		—	SGJ-DA		SGJ-DA						
9	OPTION MAGNESENSOR	MAGNET	BKO-C1810 H03	SONY MAGNESCALE	—	1	0	0	0	1	
			BKO-C1730 H06	MACOME	—	1	0	0	0	1	
			BKO-C1730 H09								
			BKO-C1730 H11								
			BKO-C1730 H12								
			BKO-C1730 H13								
			BKO-C1730 H14								
		SENSOR	BKO-C1810 H02	SONY MAGNESCALE	—	1	0	0	0	1	
			BKO-C1730 H02	MACOME							
		AMPLIFIRE	BKO-C1810 H01	SONY MAGNESCALE	—	1	0	0	0	1	
			BKO-C1730 H01	MACOME							
	OPTION ROTARY ENCODER	—	RFH1024-22-1M-68	TAMAGAWA SEIKI	—	1	0	0	0	1	
10	FAN	—	8550MVL BKO-C1942 H01	TOBISHI	FAN1	1	0	1	0	1	
11	TERMINAL	—	TE-K5.5-6S	MITSUBISHI ELECTRIC	TE1	1	0	0	0	1	

Continued on the next page.

No.	Name	Capacity kW	Model	Manufacturer	Symbol	Q'ty req'd	Spare				Remarks
							Standard accessory	Selection			
								A	B	C	
12	RESISTOR	0.75 ~ 3.7	900W 30 OHM BKO-NC1115 H01		R1	1	0	0	0	1	
		5.5	900W 15 OHM BKO-NC1115 H02								
		7.5									
		5.5	900W 45 OHM BKO-NC1115 H03		R1, 2, 3	3	0	0	0	3	
		7.5									
13	PULSE SIGNAL GENERATOR	B71	MBE256-15M	YAMAHA		1	0	0	0	1	FOR MOTOR
		C71									
		A90	MBE256-25M								
		B90									
		A112									
		B112									
14	FAN	B71	TLHS455C	TOYO		1	0	0	1	1	FOR MOTOR
		C71									
		A90	TR655D-7	TOYO							
		B90									
		A112	IA-15101	UNION SEIKO							
		B112									
15	BERING LOAD SIDE	B71	6205ZZC3	NTN BEARING		1	0	0	1	1	FOR MOTOR
		C71									
		A90	6206ZZC3								
		B90									
		A112	6307M2ZZCS19								
		B112									
16	BERING OPPOSITE SIDE	B71	6204ZZC3	NTN BEARING		1	0	0	1	1	FOR MOTOR
		C71									
		A90	6006ZZC3								
		B90									
		A112	6306M2ZZCS16								
		A112									

APPENDIX 1

Appendix 1

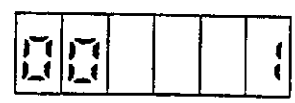
(1) How to rotate with open loop

<Purpose>

This is used to investigate the cause when the motor is rotated and the following phenomena occur.

1. The motor sound and vibration is great.
2. Alarm 23 (speed deviation excessive)
3. Rotates at 10 rpm but no at a higher rpm.
4. The rotation unevenness is great. Hunting occurs.
5. The motor does not rotate according to commands.

<Method>



1. When parameter #00 data is set from "0" to "1", the open loop state is entered.
2. The motor will rotate when the machine ready input signal (SET) is turned ON and then the forward command (SRN) is turned ON, and the S command is slowly increased from 0.
3. When the controller power is turned OFF, the normal operation mode will turn ON again.

<Cause of phenomenon and trouble>

Judge the malfunction cause from the phenomena that occurs when the motor is rotated with the above method.

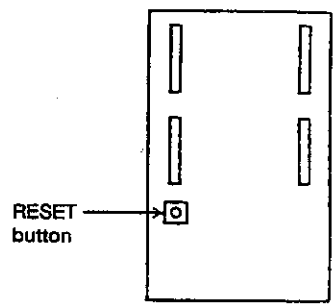
Motor rotation direction	Controller speed display	Rotation state	Cause of trouble
	Normal display	Rotates smoothly	The motor U, V, W phase order is not correct.
	At zero, or changes greatly.	Rotates smoothly	The CON2 cable wiring is not correct. Error in the motor built-in encoder.
Same as above	Normal display	The speed does not change even when the speed command is increased.	The speed command signal is not properly transmitted.
Same as above	Same as above	Hunting occurs with the motor stopped.	Error in the controller.

(2) How to turn the motor into the coasting state

<Purpose>

When there is great vibration or noise when the motor rotates, it can be judged whether it is caused by the machine (balance, oscillation) or whether it is caused electrically (motor rotation unevenness) by putting the motor in the coasting state.

At this time, if the noise and vibration is eliminated it is cause electrically. If the same vibration and sound as during the motor operation continues, it is caused by the machine.



<Method>

1. Rotate the motor at the maximum speed.
2. When the [RESET] button is pressed while the motor is running, the motor will enter the coasting state.

(3) How to format the parameters

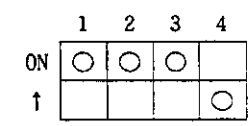
<Purpose>

This is used when a mistaken value is written into the parameter while setting, and watch dog alarm lights.

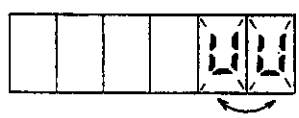
Normally the values et at ship out are used, so do not format the parameters.

<Method>

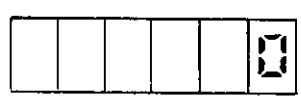
1. Set the dip switches as shown at the right, and turn the control unit power ON.



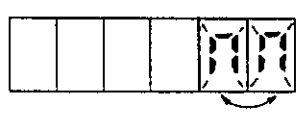
2. The last two-digit LEDs will interchangedly flash as shown at the right.



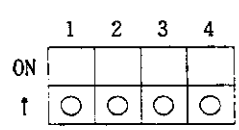
3. When the [SET] button is pressed, the right 1-digit LED will change from 0, 1, 2 ..... F and the data will be written into the E^2ROM.



4. When the data has been written in, the LEDs will interchangedly flash as shown at the right.



5. Turn the control unit power OFF, and turn all of the dip switches OFF.



6. Turn the control unit power ON again, and reset the parameters.

APPENDIX 2

Appendix 2 Order List, Parameter Setting List

(1) Order list

(2) Parameter setting list
   a) With SGJ-CA card (when not connected with the M300 series)
   b) With SGJ-CB card (when connected with the M300, M3/L3)

(3) CNC CRT screen setting (when connected with M300, M3/L3)

MITSUBISHI
AC SPINDLE DRIVE
FREQROL-SGJ
Order parts list

Precautions
1. The content of the specification depends on that of the order list.
2. If the content of the specification and settings are changed, inform us of them so as to change the specification.
   - For changing the settings of the bus-line interface, it is necessary to change the parameter MOD.
   - For changing the settings of the analog speed command, it is necessary to change the parameter DSR.

Customer

Machine name

Detailed documentation

Standard specifications	BNP-A2154-01-E
Maintenance operation manual	BNP-A2154-02-E
Instructions for operation and adjustments	BNP-A2154-03-E

When driving the machine while CNC is linked with the bus line, it is necessary to set the content of the each parameter which is shown on the CRT screen to the spindle parameters on the CRT setting and display unit.

For changing the machine model:
This unit is set for _____ .
To change the machine model, refer to the page listed on the right hand table and accomplish the following steps 1) to 2).
1) Change the settings of the parameters marked with ● using the indicator of the "SGJ-C card".

2) When linked with the bus line, set the spindle parameters on the specified CRT screen.

1. Order Contents

Item	Parts name	Type	Units/set	Remarks
01	Controller	FR-SGJ-2- K	1	
02	Resistor unit	R-UNIT-	1	
O	Spare parts (Fuse)	MF60NR-5A-S	3	100% for F1, F2 and F3

2. Pages and Items to be Changed for Applicable Machine Model

Machine name	Page		Portion to be Changed				
	Controller setting	CRT screen	Controller parameter	SGJ-C			
	/		—	—			

Change

Special notes

MITSUBISHI ELECTRIC CORPORATION

Date			
Drawn	Checked	Designed	Approved

Order parts list number: BN42U R00 1/

ROM NO. 552W000

Customer 1
MESA 1
MEO 1
FAE 1
Field QC 1
Quality control 1
Contractor 1
Duplicate 1
Distribution SDKO

Parameter Setting List

Machine name:

No.	Symb.	Data	Type
00	TSM		HEX
01	NOX		HEX
02	MSL		DEC
03	PLG		DEC
04	MOD		DEC
05	DSR		DEC
06	MON		DEC
07			
08			
09			
0A			
0B	VOP		DEC
0C	VON		DEC
0D	VGP		DEC
0E			
0F	CSN2		DEC
10	DTYP		DEC
11	DT01		DEC
12	DT02		DEC
13	DT03		DEC
14	DT04		DEC
15	DT05		DEC
16	DT06		DEC
17	DT07		DEC
18	DT08		DEC
19	DT09		DEC
1A	DT10		DEC
1B	DT11		DEC
1C	DT12		DEC
1D	DT13		DEC
1E	DT14		DEC
1F	DT15		DEC
20	DT16		DEC
21	PG1		DEC
22	PG2		DEC
23	PGC		DEC
24	ZRZ		DEC
25			
26	CSP		DEC
27	PST		DEC
28			
29	PGT		DEC
2A	PGS		DEC
2B	ORTS		HEX
2C			
2D			
2E			
2F	ORS1		HEX
30	ORS2		HEX
31	TSP		DEC
32	ZSP		DEC
33	CSN		DEC
34	SDT		DEC
35	TLM		DEC
36	VKP		DEC
37	VKI		DEC
38	TYP		HEX
39	GRA1		HEX
3A	GRA2		HEX
3B	GRA3		HEX
3C	GRA4		HEX
3D	GRB1		HEX
3E	GRB2		HEX
3F	GRB3		HEX

No.	Symb.	Data	Type
40	GRB4		HEX
41	OSL		DEC
42	BSL		HEX
43	SPC		HEX
44			
45			
46	HSP		HEX
47	HSP1		HEX
48	DAM		HEX
49			
4A			
4B			
4C			
4D			
4E			
4F			
50			
51			
52	SETM		DEC
53	ZSTM		DEC
54			
55	STOD		DEC
56			
57			
58	CVHS		HEX
59			
5A			
5B			
5C			
5D			
5E			
5F	PYX		DEC
60	HI1		DEC
61	HI2		DEC
62	HI3		DEC
63	HI4		DEC
64	HI5		DEC
65	HI01		DEC
66	HI02		DEC
67	HI03		DEC
68	SS0		DEC
69	SS1		DEC
6A	SS2		DEC
6B	SS3		DEC
6C	SS4		DEC
6D	SS5		DEC
6E	SS6		DEC
6F	SS7		DEC
70			
71			
72			
73			
74			
75			
76			
77			
78			
79			
7A			
7B	DZRZ		DEC
7C			
7D	HSPT		DEC
7E	DION		DEC
7F	SMO		DEC

No.	Symb.	Data	Type
80	TOUT		HEX
81	NR		HEX
82	NP		HEX
83	NB		HEX
84	NF		HEX
85	PM		HEX
86	PG		HEX
87	ICT		HEX
88	KI1		HEX
89	KI2		HEX
8A	IDSM		HEX
8B	IQSM		HEX
8C	KVDS		HEX
8D	KVQS		HEX
8E	TMLR		HEX
8F	TMLD		HEX
90	TMLS		HEX
91	IDKP		HEX
92	IDKI		HEX
93	IQKP		HEX
94	IQKI		HEX
95	KWS		HEX
96	KWSR		HEX
97	WRKP		HEX
98			
99			
9A	ID1		HEX
9B	ID2		HEX
9C	IQ1		HEX
9D	IQ2		HEX
9E	M0		HEX
9F	M1		HEX
A0	M2		HEX
A1	FLUX		HEX
A2	FKP		HEX
A3	FKI		HEX
A4	PYLT		HEX
A5			
A6			
A7			
A8			
A9	SPO		HEX
AA	SBS		HEX
AB	SIQ		HEX
AC	DPO		HEX
AD	DBS		HEX
AE	DIQ		HEX
AF	BSD		HEX
B0			
B1			
B2			
B3			
B4			
B5			
B6			
B7			
B8			
B9			
BA			
BB			
BC			
BD			
BE			
BF			

No.	Symb.	Data	Type
C0	MT20		DEC
C1	MT21		DEC
C2	MT22		DEC
C3	MT23		DEC
C4	MT24		DEC
C5	MT25		DEC
C6	MT26		DEC
C7	MT27		DEC
C8	MT28		DEC
C9	MT29		DEC
CA			
CB			
CC			
CD			
CE			
CF			
D0	MT30		DEC
D1	MT31		DEC
D2	MT32		DEC
D3	MT33		DEC
D4	MT34		DEC
D5	MT35		DEC
D6	MT36		DEC
D7	MT37		DEC
D8	MT38		DEC
D9	MT39		DEC
DA			
DB			
DC			
DD			
DE			
DF			
E0	SEMT		HEX
E1	SYNV		DEC
E2	SPI		HEX
E3	SWT		HEX
E4	TPI		HEX
E5	TWT		HEX
E6	TSVS		DEC
E7	TPDT		DEC
E8	TIPS		DEC
E9	TPSF		DEC
EA	PUTS		DEC
EB	ODR		HEX
EC			
ED			
EE			
EF	PGX		HEX
F0	FNK		HEX
F1			
F2			
F3			
F4			
F5			
F6			
F7			
F8	OLL		DEC
F9	OLT		DEC
FA	MGD0		DEC
FB	MGD1		DEC
FC	MGD2		DEC
FD	MAGO		DEC
FE	PLGO		DEC
FF	ENCP		DEC

Revision		SGJ-CA card	SW1	2/
			B N 4 U R O	

Parameter Setting List

Machine name: _____

No.	Symb.	Data	Type
00	TSM		HEX
01	NOX		HEX
02	MSL		DEC
03	PLG		DEC
04	MOD		DEC
05	DSR		DEC
06	MON		DEC
07			
08			
09			
0A			
0B	VOP		DEC
0C	VON		DEC
0D	VGP		DEC
0E			
0F	CSN2		DEC
10	DTYP		DEC
11	DT01		DEC
12	DT02		DEC
13	DT03		DEC
14	DT04		DEC
15	DT05		DEC
16	DT06		DEC
17	DT07		DEC
18	DT08		DEC
19	DT09		DEC
1A	DT10		DEC
1B	DT11		DEC
1C	DT12		DEC
1D	DT13		DEC
1E	DT14		DEC
1F	DT15		DEC
20	DT16		DEC
21	PG1		DEC
22	PG2		DEC
23	PGC		DEC
24	ZRZ		DEC
25			
26	CSP		DEC
27	PST		DEC
28			
29	PGT		DEC
2A	PGS		DEC
2B	ORTS		HEX
2C			
2D			
2E			
2F	ORS1		HEX
30	ORS2		HEX
31	TSP		DEC
32	ZSP		DEC
33	CSN		DEC
34	SDT		DEC
35	TLM		DEC
36	VKP		DEC
37	VKI		DEC
38	TYP		HEX
39	GRA1		HEX
3A	GRA2		HEX
3B	GRA3		HEX
3C	GRA4		HEX
3D	GRB1		HEX
3E	GRB2		HEX
3F	GRB3		HEX

No.	Symb.	Data	Type
40	GRB4		HEX
41	OSL		DEC
42	BSL		HEX
43	SPC		HEX
44			
45			
46	HSP		HEX
47	HSP1		HEX
48	DAM		HEX
49			
4A			
4B			
4C			
4D			
4E			
4F			
50			
51			
52	SETM		DEC
53	ZSTM		DEC
54			
55	STOD		DEC
56			
57			
58	CVHS		HEX
59			
5A			
5B			
5C			
5D			
5E			
5F	PYX		DEC
60	H11		DEC
61	H12		DEC
62	H13		DEC
63	H14		DEC
64	H15		DEC
65	H01		DEC
66	H02		DEC
67	H03		DEC
68	SS0		DEC
69	SS1		DEC
6A	SS2		DEC
6B	SS3		DEC
6C	SS4		DEC
6D	SS5		DEC
6E	SS6		DEC
6F	SS7		DEC
70			
71			
72			
73			
74			
75			
76			
77			
78			
79			
7A			
7B	DZR2		DEC
7C			
7D	HSPT		DEC
7E	DION		DEC
7F	SMO		DEC

No.	Symb.	Data	Type
80	TOUT		HEX
81	NR		HEX
82	NP		HEX
83	NB		HEX
84	NF		HEX
85	PM		HEX
86	PG		HEX
87	ICT		HEX
88	KI1		HEX
89	KR2		HEX
8A	IOSM		HEX
8B	IQSM		HEX
8C	KVDS		HEX
8D	KVQS		HEX
8E	TMLR		HEX
8F	TMLD		HEX
90	TMLS		HEX
91	IDKP		HEX
92	IDKI		HEX
93	IQKP		HEX
94	IQKI		HEX
95	KWS		HEX
96	KWSR		HEX
97	WRKP		HEX
98			
99			
9A	ID1		HEX
9B	ID2		HEX
9C	IQ1		HEX
9D	IQ2		HEX
9E	M0		HEX
9F	M1		HEX
A0	M2		HEX
A1	FLUX		HEX
A2	FKP		HEX
A3	FKI		HEX
A4	PYLT		HEX
A5			
A6			
A7			
A8			
A9	SPO		HEX
AA	SBS		HEX
AB	SIQ		HEX
AC	DPO		HEX
AD	DBS		HEX
AE	DIQ		HEX
AF	BSD		HEX
B0			
B1			
B2			
B3			
B4			
B5			
B6			
B7			
B8			
B9			
BA			
BB			
BC			
BD			
BE			
BF			

No.	Symb.	Data	Type
C0	MT20		DEC
C1	MT21		DEC
C2	MT22		DEC
C3	MT23		DEC
C4	MT24		DEC
C5	MT25		DEC
C6	MT26		DEC
C7	MT27		DEC
C8	MT28		DEC
C9	MT29		DEC
CA			
CB			
CC			
CD			
CE			
CF			
D0	MT30		DEC
D1	MT31		DEC
D2	MT32		DEC
D3	MT33		DEC
D4	MT34		DEC
D5	MT35		DEC
D6	MT36		DEC
D7	MT37		DEC
D8	MT38		DEC
D9	MT39		DEC
DA			
DB			
DC			
DD			
DE			
DF			
E0	SEMT		HEX
E1	SYNV		DEC
E2	SPI		HEX
E3	SWT		HEX
E4	TPI		HEX
E5	TWT		HEX
E6	TSVS		DEC
E7	TPDT		DEC
E8	TIPS		DEC
E9	TPSF		DEC
EA	PUTS		DEC
EB	ODR		HEX
EC			
ED			
EE			
EF	PGX		HEX
F0	FNK		HEX
F1			
F2			
F3			
F4			
F5			
F6			
F7			
F8	OLL		DEC
F9	OLT		DEC
FA	MGD0		DEC
FB	MGD1		DEC
FC	MGD2		DEC
FD	MAGO		DEC
FE	PLGO		DEC
FF	ENCP		DEC

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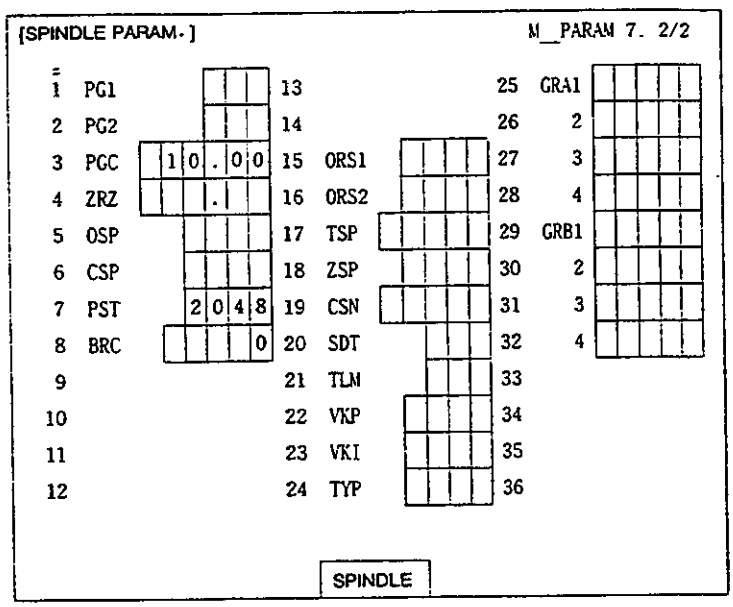
CNC CRT Screen Setting

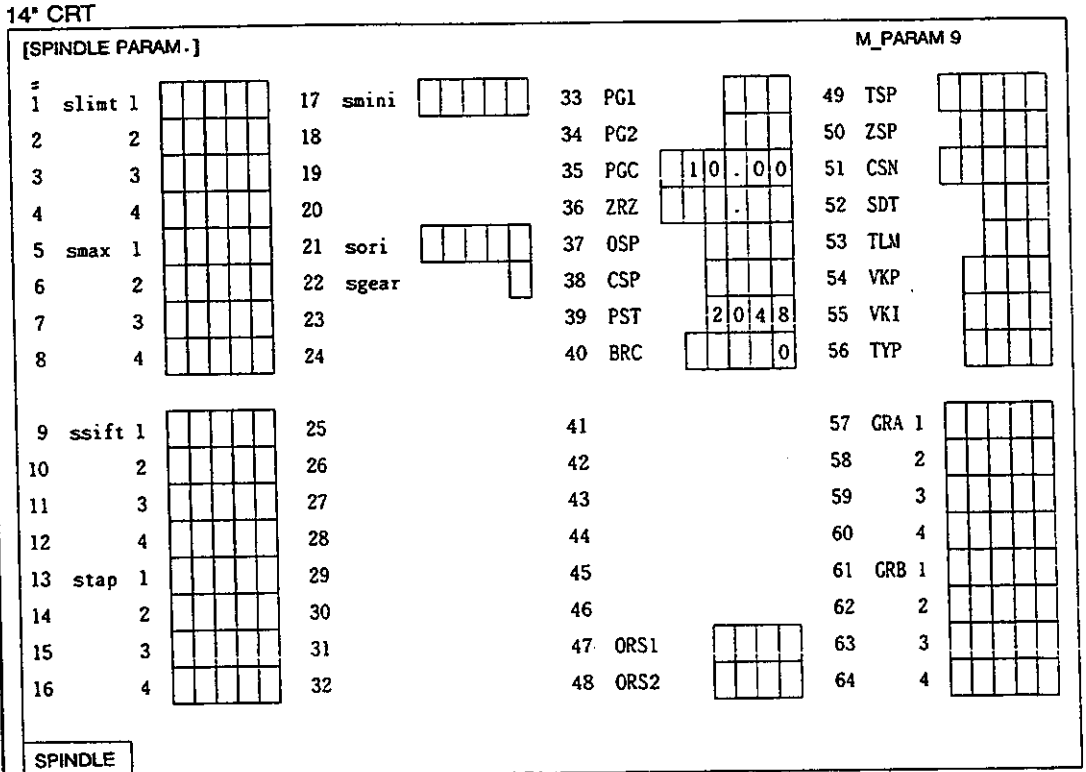
This is the spindle parameter screen for the machine name:

Reset the spindle parameter to the following details from the CNC CRT setting display unit.
Set GRA1 to GRB4 with the gears being used.

9" CRT



14" CRT



Revision			
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