

Texx K
mitsubishi

**AC SPINDLE DRIVE
FREQROL-SF
STANDARD SPECIFICATION**

- C O N T E N T S -

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§1. OUTLINE OF AC SPINDLE DRIVE UNIT, SF SERIES

1.1 Features

Enhanced performance and upgraded functions

- Oriented spindle stop function

The newly designed oriented spindle stop function assures smooth, exact and rapid spindle positioning.

- Accurate response to impact load

Flexibility of control system and accurate response characteristic permit powerful cutting.

- Accurate response to low-rigidity load

Because of good flexibility of control system, response to low-rigidity load, such as belt-driven load, is particularly good.

- Accurate load meter

Automatic motor rotor temperature compensation and motor control compensation functions assure exact reading of load meter.

- High-speed tapping

When the unit is bus-linked to CNC, complete synchronization with feed motion can be achieved ... high-speed, high-performance tapping can be realized.

- Profiling control

When the unit is bus-linked to CNC, C-axis motion can be controlled for profiling.

Easy to use

- o Flexibility and versatility in use

Parameters (maximum motor speed, speed control loop gain, etc.) can be set by incorporated key switches, as well as through CRT of NC.

- o Diagnosis functions

Diversified diagnosis information such as cause of alarm is displayed by CRT of NC.

- o Reliability

For enhancement of reliability, components are reduced (about 30% of reduction, as compared with our previous products).

Wide range of models

Models ranging from 3.7kW to 45kW are available in standard type. Besides standard type, also available are high-speed type, wide-range constant output type, small-capacity type and positioning type

- o Small-capacity type (REQROL-SFJ)(2.2 - 7.5kW ... 50% ED rating)

"90 frame" (motor frame size) is added to complete a series of 2.2kW - 7.5kW.

Controller is renewed to reduce volume (1/3 of previous one), floor space (1/2 of previous one) and weight (1/2 of previous one)..... Refer to Specification BNP-A2821-01.

- o Positioning type

Multi-point oriented spindle stop and index with high-speed

spindle are available, owing to use of motor built in encoder, when motor is directly coupled to machine.

Spindle speed and sync. feed signal can be monitored.

Since spindle encoder is not required, spindle head system can be simplified.

1.2 AC spindle drive unit model designation

Motor	<p>Mitsubishi AC motor series name 30-min. rated output capacity (kW)</p> <p>A: 1500rpm B: 1150rpm L: 5000rpm X: Special speed</p> <p>Special type: M: High-speed type, Z: Special max. speed type, W: Wide-range constant output type</p>											
	<p>AC spindle inverter name Power supply: 200V class</p> <table border="1"> <thead> <tr> <th>Symbol</th> <th>Name</th> <th>Symbol</th> <th>Name</th> </tr> </thead> <tbody> <tr> <td>NO SIGN</td> <td>Standard series</td> <td>NO SIGN</td> <td>Panel inside mount type</td> </tr> <tr> <td>H</td> <td>High-speed series</td> <td>C</td> <td>Intermediate panel type</td> </tr> </tbody> </table>	Symbol	Name	Symbol	Name	NO SIGN	Standard series	NO SIGN	Panel inside mount type	H	High-speed series	C
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H	High-speed series	C	Intermediate panel type									
Controller	<table border="1"> <thead> <tr> <th>Symbol</th> <th>Function</th> </tr> </thead> <tbody> <tr> <td>NO SIGN</td> <td> <ul style="list-style-type: none"> ○ S-analog +10/TOP speed ○ S-analog ±10/TOP speed ○ Forward/reverse command input ○ Speed meter output ○ Load meter output ○ Zero speed output signal ○ Up-to-speed output signal ○ Speed detect output signal ○ Load detect output signal ○ Spindle fault output signal ○ Spindle fault content output signal ○ Torque limit output signal ○ Torque limit command input ○ Machine ready input ○ Alarm reset input ○ Speed reference digital/analog select input ○ Speed override input ○ Emergency stop input ○ Emergency stop alarm output ON/OFF select signal ○ Acceleration/deceleration time constant setting </td> </tr> <tr> <td>R Card SF-OR</td> <td> <ul style="list-style-type: none"> ○ Magnesensor spindle orientation ○ Encoder multi-point spindle orientation ○ Encoder multi-point index spindle orientation ○ Motor built-in encoder multi-point index spindle orientation ○ Motor built-in encoder </td> </tr> <tr> <td>D Card SF-DA *2</td> <td> <p>Digital speed reference signal</p> <ul style="list-style-type: none"> ○ Binary 12-bit ○ BCD 2-digit ○ BCD 3-digit </td> </tr> <tr> <td>T Card SF-TL</td> <td> <p>Bus-link to M300 series NC</p> <ul style="list-style-type: none"> ○ High-speed sync. tap (closed) ○ High-speed sync. tap (closed) with motor built-in encoder ○ Profiling control (semi-closed) ○ CRT fault display ○ CRT speed meter display ○ CRT load meter display </td> </tr> </tbody> </table> <p>Notes)</p> <p>NO SIGN: Option card R, D or T is not used.</p> <p>R: For connection with NC other than M300 series NC. This includes NO SIGN function.</p> <p>D: For connection with NC other than M300 series NC, and use of digital speed reference signal. This includes NO SIGN function.</p> <p>T: For bus-link to M300 series NC. This includes NO SIGN function and R function.</p>	Symbol	Function	NO SIGN	<ul style="list-style-type: none"> ○ S-analog +10/TOP speed ○ S-analog ±10/TOP speed ○ Forward/reverse command input ○ Speed meter output ○ Load meter output ○ Zero speed output signal ○ Up-to-speed output signal ○ Speed detect output signal ○ Load detect output signal ○ Spindle fault output signal ○ Spindle fault content output signal ○ Torque limit output signal ○ Torque limit command input ○ Machine ready input ○ Alarm reset input ○ Speed reference digital/analog select input ○ Speed override input ○ Emergency stop input ○ Emergency stop alarm output ON/OFF select signal ○ Acceleration/deceleration time constant setting 	R Card SF-OR	<ul style="list-style-type: none"> ○ Magnesensor spindle orientation ○ Encoder multi-point spindle orientation ○ Encoder multi-point index spindle orientation ○ Motor built-in encoder multi-point index spindle orientation ○ Motor built-in encoder 	D Card SF-DA *2	<p>Digital speed reference signal</p> <ul style="list-style-type: none"> ○ Binary 12-bit ○ BCD 2-digit ○ BCD 3-digit 	T Card SF-TL	<p>Bus-link to M300 series NC</p> <ul style="list-style-type: none"> ○ High-speed sync. tap (closed) ○ High-speed sync. tap (closed) with motor built-in encoder ○ Profiling control (semi-closed) ○ CRT fault display ○ CRT speed meter display ○ CRT load meter display 	
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1.3 Linkage between NC and spindle controller

		CNCs				Spindle				
		Pre- vious CNC	M 3 0 0			S E	S F			
			310	320	330		*1-	R	T	*2D
(I)	S-analog speed reference	O	O	-	O	O	O	O	O	O
	Digital speed reference *3 Binary, 12-bit/BCD. 2-digit, 3-digit	O	-	-	-	O	-	-	-	O
	Digital IO	O	O	O	O	O	O	O	O	O
(II)	Serial IO (RS 422 A)	-	-	O	O	-	O	O	O	O
(III)	Bus-link IO (RS 485)	-	O	O	O	-	-	-	O	-

*1: Without option

*2: With digital speed reference option (planned
to be developed by Oct. 1987)

*3: For BCD, digits of its code were increased from
2 digits to 3 digits.

1.4 Basic functions, auxiliary functions and optional functions

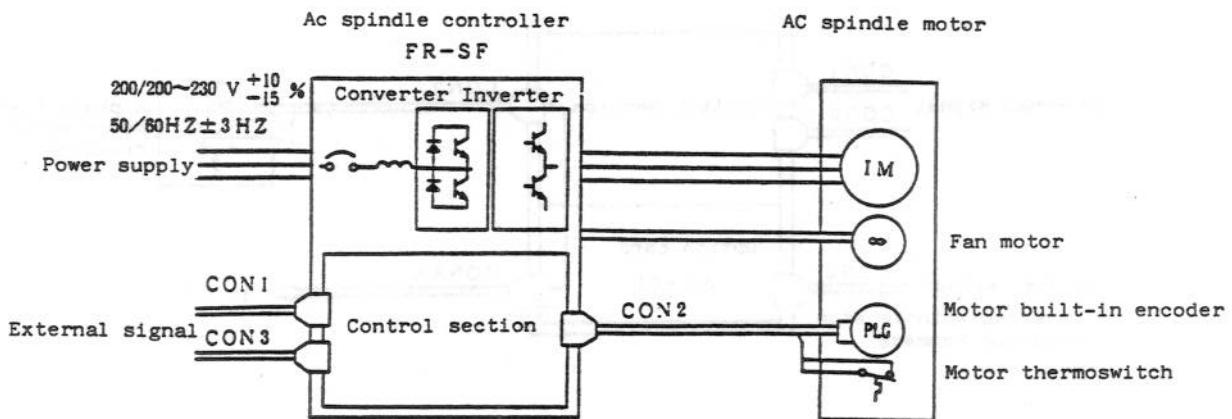
Function		Detailed description		Controller model FR-SF-2-[]K-[] <small>Option symbol</small>				Previous FR-SE series
		Out-line	De-tails	Option symbol				
		-	R	T	D			
Basic function	S-analog reference voltage input, +10V/top speed			o	o	o	o	o
	S-analog reference voltage input, ±10V/top speed			o	o	o	o	o
	Forward/reverse command input			o	o	o	o	o
Auxiliary function	Speed meter output			o	o	o	o	o
	Load meter output signal			o	o	o	o	o
	Zero speed output signal			o	o	o	o	o
	Up to speed output signal			o	o	o	o	o
	Speed detect output signal			o	o	o	o	o
	Load detect output signal			o	o	o	o	o
	Spindle fault (alarm) output signal			o	o	o	o	o
	Spindle fault (alarm) content output signal			o	o	o	o	o
	Torque limit output signal			o	o	o	o	o
	Torque limit command input			o	o	o	o	o
	Machine ready input			o	o	o	o	o
	Alarm reset input			o	o	o	o	o
	Speed reference signal "digital/analog" selection input			o	o	o	o	o
	Speed override input			o	o	o	o	o
	Emergency stop input			o	o	o	o	o
	On-emergency stop alarm signal output "ON/OFF" selection input			o	o	o	o	o
Optional function	Acceleration/deceleration time constant setting			o	o	o	o	o
	Spindle orientation command input			o	o	o	o	o
Optional function	Magnesensor used	Magnesensor spindle orientation		-	o	o	o	o
		Magnesensor high-speed sync. tap*		-	-	o	-	-

Function		Detailed description	Controller model				Previous FR-SE series	
			FR-SF-2-[]K-[Option symbol]					
			Out-line	De-tails	Option symbol			
Optional function	1024P/rev. encoder used	Encoder (4096 di- vision) spindle orientation			-	o	o	
		Encoder (4096 di- vision) index			-	o	o	
		Encoder high- speed sync. tap*			-	-	o	
		Spindle speed display/sync. feed signal			-	o	o	
	Z-phase control motor built-in encoder used	Motor built-in encoder spindle orientation			-	o	o	
		Motor built-in encoder index			-	o	o	
		Motor built-in encoder high- speed sync. tap*			-	-	o	
	Controller linked to M300 CNC	CRT alarm display			-	-	o	
		CRT speed/load meter display						
		C-axis control			-	-	o	
Digital speed reference								
12-bit binary								
3-digit BCD selectable								
2-digit BCD					-	-	o	
					-	-	o	

For use of "high-speed sync. tap" marked with * in this list, controller should be bus-linked to M300 series CNC.

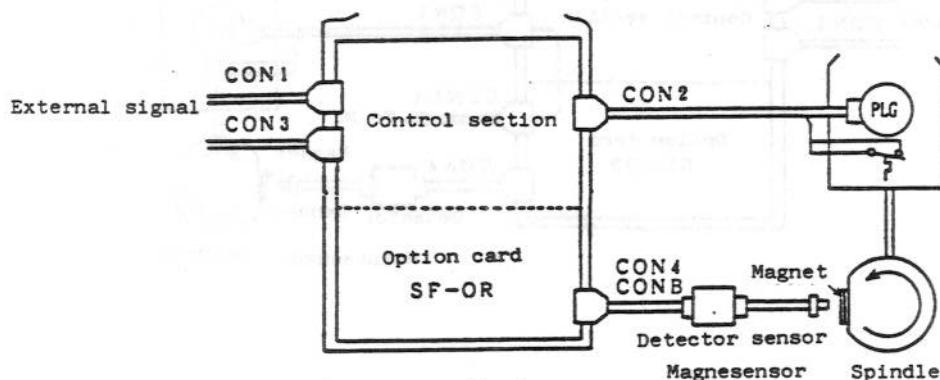
1.5 Composition

1.5.1 Basic composition (standard) FR-SF-2-[]K

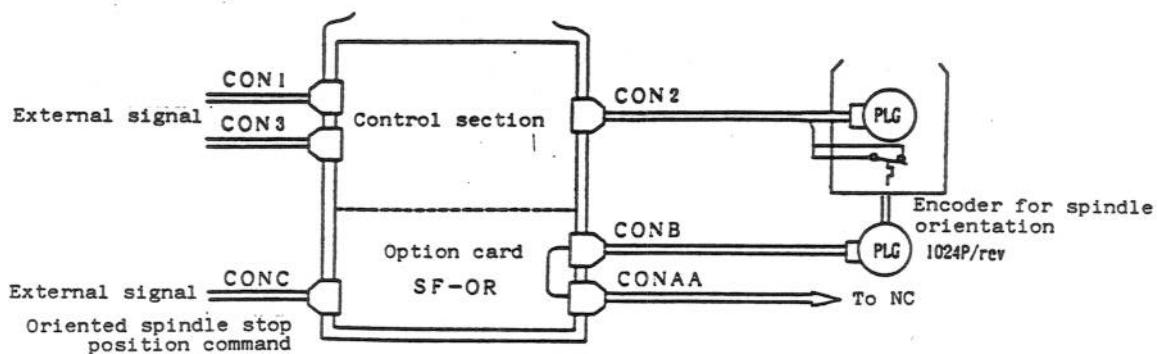


1.5.2 Equipped with oriented spindle stop function (optional card SF-OR is used) FR-SF-2-[]K-R

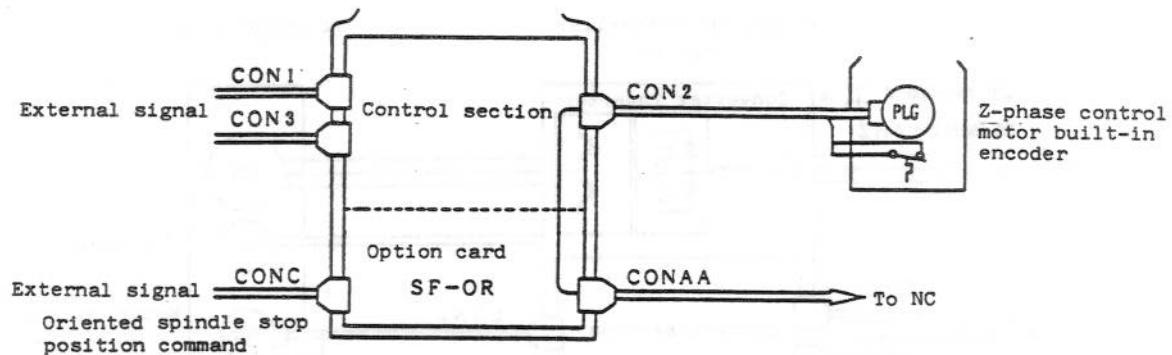
(1) Magnesensor spindle orientation (1 div.) specification



(2) Encoder spindle orientation (4096 div.) specification, equipped with index function

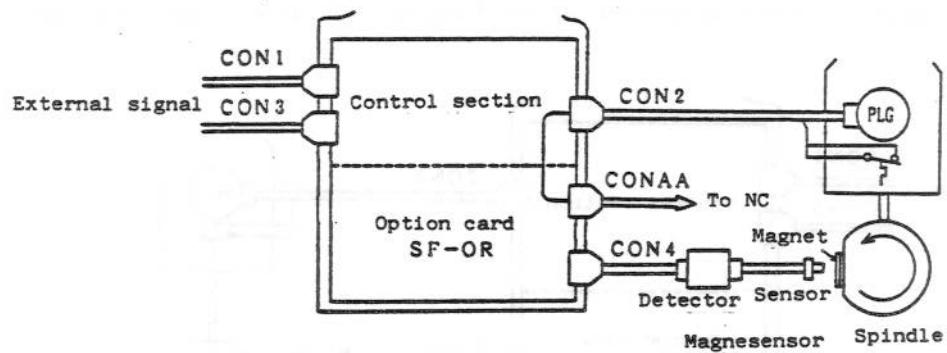


(3) Z-phase controlled motor built-in encoder multi-point spindle orientation specification, equipped with index function



(4) Magnesensor spindle orientation (1 div.) specification, equipped with motor speed feedback output

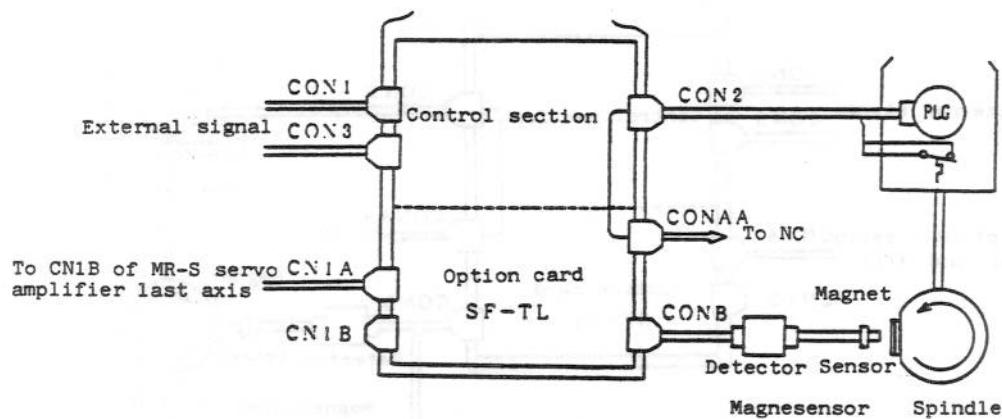
(for spindle speed display/sync. feed signal)



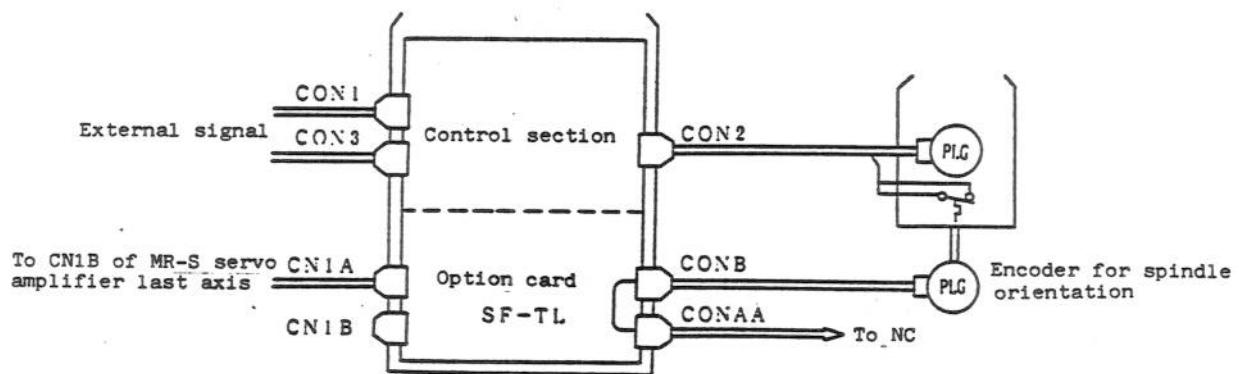
1.5.3 Controller bus-linked to M300 series CNC FR-SF-2-[]K-T

Equipped with high-speed sync. tap/spindle orientation
(optional card SF-TL is used)

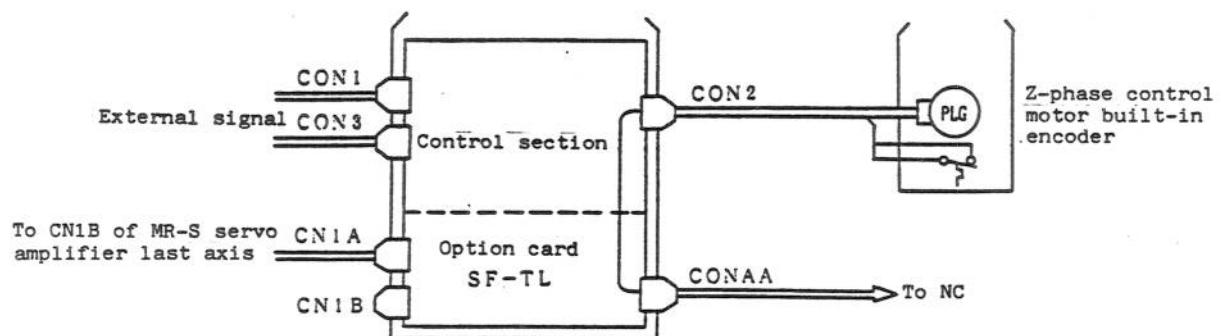
- (1) Motor built-in encoder high-speed sync. tap/magnesensor
spindle orientation (1 div.) specification



- (2) Encoder high-speed sync. tap spindle orientation (4096 div.)
specification, equipped with index function

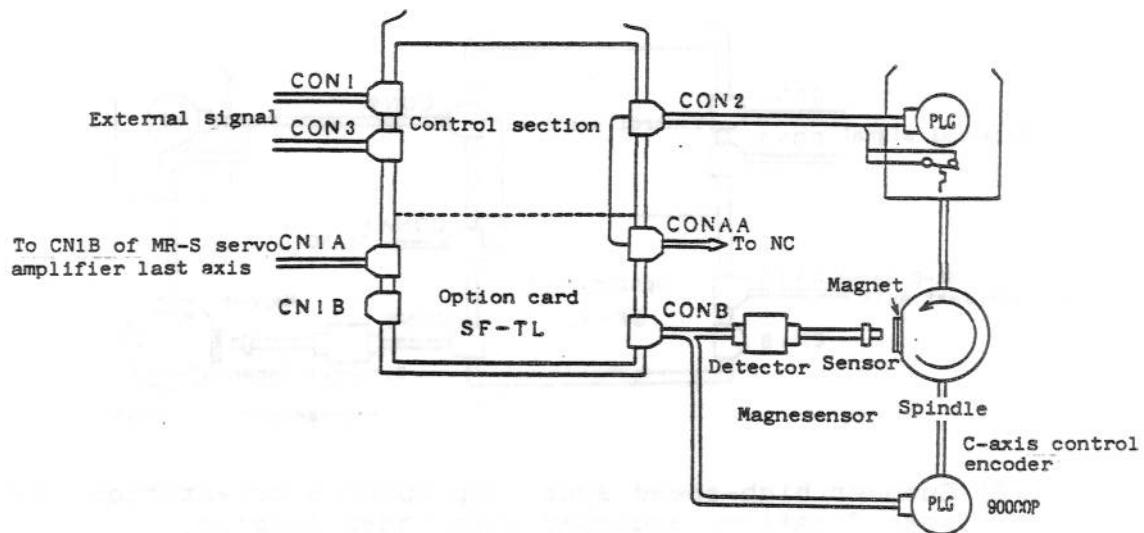


- (3) Z-phase controlled motor built-in encoder high-speed sync.
tap/multi-point spindle orientation specification, equipped
with index function



1.5.4 Controller bus-linked to M300 series CNC ... FR-SF-2-[]K-T

- (1) C-axis control magnesensor spindle orientation
(optional card SF-TL is used)



§2. SPECIFICATIONS

2.1 AC spindle motor controller specifications

Item	Series	Base speed 1500RPM series								Base speed 1150RPM series			
		SJ-				SJ-				30B		37B	
Model		5.5A	7.5A	11A	15A	18.5A	22A	26A	30A	30B	37B	37B	45B
Continuous rating (HP)/(kW)	5/3.7	7/5.5	9/7	10/7.5	15/11	20/15	25/18.5	30/22	30/22	30/22	40/30	40/30	50/37
30-min. rating (HP)/(kW)	7/5.5	10/7.5	15/11	15/11	20/15	25/18.5	30/22	35/26	40/30	40/30	50/37	50/37	60/45
50% ED rating (HP)/(kW)													
Basic speed (RPM)													
Max. speed (RPM)	800		600							4500			
Frame No.	A112	B112		B132		C132		A160		B160		B180	
Cont. rated torque (kg·m ²)	2.4	3.57	4.54	4.887	7.15	9.74	9.74	12.0	14.3		18.6	25.4	31.3
CD ² (kg·m ²)	0.08	0.10	0.12	0.17	0.21	0.27	0.32	0.55	0.69		1.26	1.36	2.19
Weight (kg)	60	70	75	100	100	130	150	175	200		300	300	390
Permissible radial load (kg)	150	200						300			400		600
Cooling fan (W)			35							130			3φ 60
Vibration			V5							V10			
Sound level (dB A)			75								80		85
Direction of installation													
Overload margin													
Ambient temperature(°C)	0	to 40											
Insulation class													
Paint color	Munsell 5.27G	2.46/0.21											
Accessories													
Lubrication of bearings	Grease												
Output characteristics	Fig. 1		Fig. 2					Fig. 3		Fig. 4			

Series		FR-SF-2-										
Item		Panel inside mount	5.5K	7.5K	11K	15K	18.5K	22K	26K	30K	37K	45K
$\frac{P}{E}$ type	Panel type	5.5K-C	7.5K-C	11K-C	15K-C	18.5K-C	22K-C	26K-C	30K-C	37K-C	45K-C	
Intermediate panel mount type	Intermediate panel mount type	5.5K-C	7.5K-C	11K-C	15K-C	18.5K-C	22K-C	26K-C	30K-C	37K-C	45K-C	
Power capacity (kVA)		9	12	17	23	28	33	37	44	54	63	
Total heat generated(*1) (W)		340	400	490	590	700	810	1000	1500	1700		
Power supply (*2)		200/200 ~ 230V+10%, -15%, 50/60Hz±3Hz										
$\frac{P}{E}$ type	Panel inside mount	24		27		37		48		67		90
Intermediate panel mount type	Intermediate panel mount type	24		27		37		48		67		90
Main circuit		Transistor sinusoidal wave PWM inverter										
Control circuit		Pulse generator speed feedback, digital closed loop control, vector control										
Brake		Regenerative brake										
Speed control range(rpm)	35 - 8000		35 - 6000			35 - 4500			35 - 3450			
Speed regulation		Less than 0.2% of maximum speed (load variable within range from 10% to 100%)										
Speed reference signal		Analog signal, +10V Max. (Input impedance: About 10 Kohm)										
Ambient temp./humidity		-5 to 55°C, 45 to 85%RH										
Atmosphere		To be free from detrimental gas and dust (Environmental requirement: JEM 1103, Grade C)										
Vibration		Less than 0.5G										
Applicable standard		IEC										

- Notes: 1. This is the total heat generated during operation with the continuous rated output.
 In the case of intermediate panel mount type, panel outside heat is equal to $[(total heat - 120) \times 0.7 (W)]$.
2. When supply voltage other than specified here is used, use a transformer.
3. For constant-output range other than "1:8" and "1:12", consult us.

Item	Series		Wide range (1:8) constant output series (Note 3)							SJ-		
	Model		5.5XW8	7.5XW8	11XW8	15XW8	18.5XW8	22XW8	5.5XWC	7.5XWC	11XWC	15XWC
Continuous rating (HP)/(kW)	5/3.7	7/5.5	10/7.5	15/11	20/15	25/18.5	25/18.5	25/18.5	5/3.7	7/5.5	10/7.5	15/11
30-min. rating 50% ED rating (HP)/(kW)	7/5.5	10/7.5	15/11	20/15	25/18.5	30/22	7/5.5	10/7.5	15/11	20/15		
Basic speed (RPM)	750			625			500	500			400	
Max. speed (RPM)	6000			5000			4000	6000			4800	
Frame No.	B112	B132	C132	B180	B180	A200	B132	A180	B180	A200		
Cont. rated torque (kg-m)	4.80	7.14	9.74	17.1	23.3	36.0	7.20	13.4	18.3	26.8		
CD ² (kg-m ²)	0.12	0.21	0.32	0.69	1.36	2.19	0.21	0.55	1.26	2.19		
Weight (kg)	75	110	150	200	300	390	110	175	300	390		
Permissible radial load (kg)	200		300	400	600		300	400	600	600		
Cooling fan (W)	35		130	3φ 60	35	180	V10	V5	V10	V5		
Vibration	V5										3φ 60	
Sound level (dB A)	75			80	85		75	80	85			
Direction of installation	Horizontal, or vertical with output shaft down											
Overload margin	120% of 30-min rated output for 1 min.											
Ambient temperature (°C)	0 - 40											
Insulation class	Class "F"											
Paint color	Munsell 5.27G 2.46/0.21											
Accessories	Pulse generator, overheat detector											
Lubrication of bearings	Grease											
Output characteristic	Fig. 5		Fig. 6	Fig. 7	Fig. 8		Fig. 9					

Series		FR-SF-2-									
Item		11K	11K	22K	26K	30K	37K	11K	15K	26K	30K
$\frac{E}{F}$ Panel type	Panel inside mount	11K	11K	22K	26K	30K	37K	11K	15K	26K	30K
$\frac{E}{F}$ Intermediate panel mount type	11K-C	11K-C	22K-C	26K-C	30K-C	37K-C	11KC-C	15K-C	26K-C	26K-C	30K-C
Power capacity (kVA)	9	12	17	23	38	33	9	12	17	23	
Total heat generated(*1) (W)	340	400	490	590	700	810	340	400	490	590	
Power supply (*2)	200/220 ~ 230V+10%, -15%, 50/60Hz±3Hz										
$\frac{E}{F}$ Panel type	Panel inside mount	27		48	67	73	27	37	48	67	
$\frac{E}{F}$ Intermediate panel mount type	27		48	67	73	27	37	48	67		
Main circuit	Transistor sinusoidal wave PWM inverter										
Control circuit	Pulse generator speed feedback, digital closed loop control, vector control										
Brake	Regenerative brake										
Speed control range	35 - 6000	35 - 5000	35 - 4000	35 - 6000	35 - 4800						
Speed regulation	Less than 0.2% of maximum speed (load variable within range of 10% to 100%)										
Speed reference signal	Analog signal, +10V Max. (input impedance: About 10Kohm)										
Ambient temp./humidity	-5°C to 55°C, 45% to 85%RH										
Atmosphere	To be free from detrimental gas and dust (Environmental requirement: JEM 1103, Grade C)										
Vibration	Less than 0.5G										
Applicable standard	IEC										

Notes: 1. This is the total heat generated during operation with the continuous rated output.

In the case of intermediate panel mount type, panel outside heat is equal to [(total heat - 120) x 0.7 (W)].

2. When supply voltage other than specified here is used, use a transformer.

3. For constant-output range other than "1:8" and "1:12", consult us.

Item	Series		High-speed series			
	Model	5.5AZ 5/3.7	7.5AZ 7/5.5	5.5LH 5/3.7	7.5LH 7/5.5	11LH 10/7.5
Continuous rating (HP)/(KW)						
30-min. rating (HP)/(KW)	7/5.5	10/7.5	7/5.5	10/7.5	15/11	20/11
50% ED rating(HP)/(KW)						
Basic speed (RPM)	1500			5000		5000
Max. speed (RPM)	10000		20000		15000	
Frame No.	A112	B112	A100	B100	B132	C132
Cont. rated torque (kg-m)	2.4	3.57	0.72	1.07	1.46	2.14
GD ² (kg-m ²)	0.08	0.10	0.02	0.025	0.07	0.095
Weight (kg)	60	70	60	65	95	115
Permis. radial load (kg)	140			5		
Cooling fan (W)			35			
Vibration		V5				
Sound level (dB A)	75		85			
Direction of instal- lation	Horizontal, or vertical with output shaft down					
Overload margin	120% of 30-min. rated output for 1 min.					
Ambient temperature(°C)	O to 40					
Insulation class	Class "F"					
Paint color	Munsell 5.27G 2.46/0.21					
Accessories	Pulse generator, overheat detector					
Lubrication of bearings	Grease					
Output characteristic	Fig. 10	Fig. 11	Fig. 12			

Item	Series		FR-SF-2-				
	Panel type	Inside mount	5.5K-H	7.5K-H	7.5K-H	11K-H	15K-H
Intermediate panel mount type	Panel	5.5K-HC	7.5K-HC	7.5K-HC	11K-HC	11K-HC	15K-HC
Power capacity (kVA)	9	12	9	12	17	17	23
Total heat generated(*1) (W)	340	400	340	400	490	490	590
Power supply (*2)	200/200 ~ 230V+10%, -10%, 50/60Hz±3Hz						
Panel inside mount type	Panel	24	24	27	27	37	37
Intermediate panel mount type	Panel	24	24	27	27	37	37
Main circuit	Transistor sinusoidal wave PWM inverter						
Control circuit	Pulse generator speed feedback, digital closed loop control, vector control						
Brake	Regenerative brake						
Speed control range	35 ~ 10000		35 ~ 20000		35 ~ 15000		
Speed regulation	Less than 0.2% of max. speed (load variable within range from 10% to 100%)						
Speed reference signal	Analog signal, +10V Max. (input impedance: About 10 Kohm)						
Ambient temp./humidity	-5 to 55°C, 45 to 85%RH						
Atmosphere	To be free from detrimental gas and dust (Environmental requirement: JEM 1103, Grade C)						
Vibration	Less than 0.5G						
Applicable standard	IEC						

- Notes:
- This is the total heat generated during operation with the continuous rated output.
In the case of intermediate panel mount type, panel outside heat is equal to [(total heat - 120) x 0.7 (W)].
 - When supply voltage other than specified here is used, use a transformer.
 - For constant-output range other than "1:8" and "1:12", consult us.

2.2 Output characteristics

Standard	Fig. 1	<table border="1"> <thead> <tr> <th colspan="4">Output P1/P2/P3/P4</th> </tr> </thead> <tbody> <tr> <td>SJ-5.5A</td><td>SJ-7.5A</td><td></td><td></td> </tr> <tr> <td>5.5/3.7/3/2 (kW)</td><td>7.5/5.5/4/3 (kW)</td><td></td><td></td> </tr> <tr> <td>7/5/4/2.5 (HP)</td><td>10/7/5/4 (HP)</td><td></td><td></td> </tr> </tbody> </table> <p>30 min. rating</p> <p>Speed (RPM)</p>	Output P1/P2/P3/P4				SJ-5.5A	SJ-7.5A			5.5/3.7/3/2 (kW)	7.5/5.5/4/3 (kW)			7/5/4/2.5 (HP)	10/7/5/4 (HP)			Fig. 2	<table border="1"> <thead> <tr> <th colspan="4">Output P1/P2/P3/P4</th> </tr> </thead> <tbody> <tr> <td>SJ-11AP</td><td>SJ-11A</td><td>SJ-15A</td><td>SJ-18.5A</td> </tr> <tr> <td>11/7.8/5 (kW)</td><td>11/7.5/8/5.5 (kW)</td><td>15/11/11/8 (kW)</td><td>18.5/15/13.5/11 (kW)</td> </tr> <tr> <td>15/9/10/7 (HP)</td><td>15/10/10/7 (HP)</td><td>20/15/15/10 (HP)</td><td>25/20/18/15 (HP)</td> </tr> </tbody> </table> <p>30 min. rating</p> <p>Speed (RPM)</p>	Output P1/P2/P3/P4				SJ-11AP	SJ-11A	SJ-15A	SJ-18.5A	11/7.8/5 (kW)	11/7.5/8/5.5 (kW)	15/11/11/8 (kW)	18.5/15/13.5/11 (kW)	15/9/10/7 (HP)	15/10/10/7 (HP)	20/15/15/10 (HP)	25/20/18/15 (HP)
Output P1/P2/P3/P4																																				
SJ-5.5A	SJ-7.5A																																			
5.5/3.7/3/2 (kW)	7.5/5.5/4/3 (kW)																																			
7/5/4/2.5 (HP)	10/7/5/4 (HP)																																			
Output P1/P2/P3/P4																																				
SJ-11AP	SJ-11A	SJ-15A	SJ-18.5A																																	
11/7.8/5 (kW)	11/7.5/8/5.5 (kW)	15/11/11/8 (kW)	18.5/15/13.5/11 (kW)																																	
15/9/10/7 (HP)	15/10/10/7 (HP)	20/15/15/10 (HP)	25/20/18/15 (HP)																																	
Fig. 3	<table border="1"> <thead> <tr> <th colspan="4">Output P1/P2</th> </tr> </thead> <tbody> <tr> <td>SJ-22AP</td><td>SJ-22A</td><td>SJ-26A</td><td>SJ-30A</td> </tr> <tr> <td>22/15 (kW)</td><td>22/18.5 (kW)</td><td>26/22 (kW)</td><td>30/22 (kW)</td> </tr> <tr> <td>30/20 (HP)</td><td>30/25 (HP)</td><td>35/30 (HP)</td><td>40/30 (HP)</td> </tr> </tbody> </table> <p>30 min. rating</p> <p>Speed (RPM)</p>	Output P1/P2				SJ-22AP	SJ-22A	SJ-26A	SJ-30A	22/15 (kW)	22/18.5 (kW)	26/22 (kW)	30/22 (kW)	30/20 (HP)	30/25 (HP)	35/30 (HP)	40/30 (HP)	Fig. 4	<table border="1"> <thead> <tr> <th colspan="3">Output P1/P2</th> </tr> </thead> <tbody> <tr> <td>SJ-30B</td><td>SJ-37B</td><td>SJ-45B</td> </tr> <tr> <td>30/22 (kW)</td><td>37/30 (kW)</td><td>45/37 (kW)</td> </tr> <tr> <td>40/30 (HP)</td><td>50/40 (HP)</td><td>60/50 (HP)</td> </tr> </tbody> </table> <p>30 min. rating</p> <p>Speed (RPM)</p>	Output P1/P2			SJ-30B	SJ-37B	SJ-45B	30/22 (kW)	37/30 (kW)	45/37 (kW)	40/30 (HP)	50/40 (HP)	60/50 (HP)					
Output P1/P2																																				
SJ-22AP	SJ-22A	SJ-26A	SJ-30A																																	
22/15 (kW)	22/18.5 (kW)	26/22 (kW)	30/22 (kW)																																	
30/20 (HP)	30/25 (HP)	35/30 (HP)	40/30 (HP)																																	
Output P1/P2																																				
SJ-30B	SJ-37B	SJ-45B																																		
30/22 (kW)	37/30 (kW)	45/37 (kW)																																		
40/30 (HP)	50/40 (HP)	60/50 (HP)																																		
Fig. 5	<table border="1"> <thead> <tr> <th colspan="3">Output P1/P2</th> </tr> </thead> <tbody> <tr> <td>SJ-5.5XWB</td><td>SJ-7.5XWB</td><td>SJ-11XWB</td> </tr> <tr> <td>5.5/3.7 (kW)</td><td>7.5/5.5 (kW)</td><td>11/7.5 (kW)</td> </tr> <tr> <td>7/5 (HP)</td><td>10/7 (HP)</td><td>15/10 (HP)</td> </tr> </tbody> </table> <p>30 min. rating</p> <p>Speed (RPM)</p>	Output P1/P2			SJ-5.5XWB	SJ-7.5XWB	SJ-11XWB	5.5/3.7 (kW)	7.5/5.5 (kW)	11/7.5 (kW)	7/5 (HP)	10/7 (HP)	15/10 (HP)	Fig. 6	<table border="1"> <thead> <tr> <th colspan="3">Output P1/P2</th> </tr> </thead> <tbody> <tr> <td>SJ-15XWB</td><td>SJ-18.5XWB</td><td></td> </tr> <tr> <td>15/11 (kW)</td><td>18.5/15 (kW)</td><td></td> </tr> <tr> <td>20/15 (HP)</td><td>25/20 (HP)</td><td></td> </tr> </tbody> </table> <p>30 min. rating</p> <p>Speed (RPM)</p>	Output P1/P2			SJ-15XWB	SJ-18.5XWB		15/11 (kW)	18.5/15 (kW)		20/15 (HP)	25/20 (HP)										
Output P1/P2																																				
SJ-5.5XWB	SJ-7.5XWB	SJ-11XWB																																		
5.5/3.7 (kW)	7.5/5.5 (kW)	11/7.5 (kW)																																		
7/5 (HP)	10/7 (HP)	15/10 (HP)																																		
Output P1/P2																																				
SJ-15XWB	SJ-18.5XWB																																			
15/11 (kW)	18.5/15 (kW)																																			
20/15 (HP)	25/20 (HP)																																			
Fig. 7	<table border="1"> <thead> <tr> <th colspan="3">Output P1/P2</th> </tr> </thead> </table> <p>SJ-22XWB</p> <p>22/18.5 (kW)</p> <p>30/25 (HP)</p> <p>30 min. rating</p> <p>Speed (RPM)</p>	Output P1/P2			Fig. 8	<table border="1"> <thead> <tr> <th colspan="3">Output P1/P2</th> </tr> </thead> </table> <p>SJ-5.5XWC</p> <p>5.5/3.7 (kW)</p> <p>7/5 (HP)</p> <p>30 min. rating</p> <p>Speed (RPM)</p>	Output P1/P2																													
Output P1/P2																																				
Output P1/P2																																				
Wide range output	Fig. 9	<table border="1"> <thead> <tr> <th colspan="3">Output P1/P2</th> </tr> </thead> </table> <p>SJ-7.5WC</p> <p>7.5/5.5 (kW)</p> <p>10/7 (HP)</p> <p>15/10 (HP)</p> <p>20/15 (HP)</p> <p>30 min. rating</p> <p>Speed (RPM)</p>	Output P1/P2			Fig. 10	<table border="1"> <thead> <tr> <th colspan="3">Output P1/P2/P3/P4</th> </tr> </thead> </table> <p>SJ-5.5AZ</p> <p>5.5/3.7/2.4/1.6 (kW)</p> <p>7/5/5.5/3.2 (kW)</p> <p>7/5/3.2/2.4 (HP)</p> <p>10/7/4/2.6 (HP)</p> <p>30 min. rating</p> <p>Speed (RPM)</p>	Output P1/P2/P3/P4																												
Output P1/P2																																				
Output P1/P2/P3/P4																																				
Fig. 11	<table border="1"> <thead> <tr> <th colspan="3">Output P1/P2</th> </tr> </thead> </table> <p>SJ-4.5LH</p> <p>5.5/3.7 (kW)</p> <p>7/5 (HP)</p> <p>SJ-7.5LH</p> <p>7.5/5.5 (kW)</p> <p>10/7 (HP)</p> <p>30 min. rating</p> <p>Speed (RPM)</p>	Output P1/P2			Fig. 12	<table border="1"> <thead> <tr> <th colspan="3">Output P1/P2</th> </tr> </thead> </table> <p>SJ-11LH</p> <p>11/7.5 (kW)</p> <p>15/11 (kW)</p> <p>15/10 (HP)</p> <p>20/15 (HP)</p> <p>30 min. rating</p> <p>Speed (RPM)</p>	Output P1/P2																													
Output P1/P2																																				
Output P1/P2																																				

Appendix 1 Alarm/warning list

Alarm No.	Abbr.	Name	Description	(Note) Motion
10	UV	VOLTAGE DOWN	This alarm occurs if input supply voltage goes down below the specified level, or if instantaneous power failure lasting for over 10msec occurs.	A
12	ME1	MEMORY ERROR (FAULT) 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 controller is turned on).	A
15	ME2	MEMORY ERROR (FAULT) 2	This alarm occurs if 2-port memory for data communication (when FR-SF is bus-linked with M300 series CNC) does not function properly.	A
17	BE	PC BOARD ERROR	This alarm occurs if any part of control card is not in good condition.	A
20	NS1	NO SIGNAL 1 (PLG)	This alarm occurs if signal from motor built-in encoder is not at normal level.	A
21	NS2	NO SIGNAL (Spind ENC.)	This alarm occurs if signal from encoder for oriented spindle stop is not input, or not at normal level.	A
22	NSS	IC MAC 012 FAULT	This alarm occurs if IC "MAC 012" of control card does not function properly.	A
23	OSE	SPEED CONTROL ERROR EXCESS	This alarm occurs if difference between true motor speed and referenced speed is excessive.	A
24	BRT	BREAKER TRIP	This alarm occurs if current exceeding the specified limit flows in the main (power) circuit.	A

Alarm No.	Abbr.	Name	Description	(Note) Motion
25	COC	CONVERTER OVERCURRENT	This alarm occurs if current exceeding the specified limit flows in converter.	A
26	PL	POWER PHASE FAILURE	This alarm occurs if any one of three phases of input power supply fails.	A
27	CPUE	CPU FAULT	This alarm occurs if error in arithmetic opeartion, due to improper parameter setting, occurs.	A
31	OS	OVERSPEED	This alarm occurs if motor speed exceeds 115% of the maximum motor speed.	A
32	OC	OVERVOLTAGE, INVERTER	This alarm occurs if current exceeding the specified limit flows in controller.	A
33	OV	OVERVOLTAGE, CONVERTER	This alarm occurs if voltage charged in main circuit capacitor goes up, due to regenerative brake energy, over the specified limit.	A
34	DP	DATA PARITY CHECK ERROR	This alarm occurs if parity check error occurs in data transmission between M300 series CNC and FR-SF (when FR-SF is bus-linked with CNC).	A
35	DE	DATA ERROR	This alarm occurs if movement command specified by CNC exceeds the specified limit (when FR-SF is bus-linked with CNC).	A
36	TE	DATA TRANSFER ERROR	This alarm occurs if data transfer does not go satisfactorily (when FR-SF is bus-linked with CNC).	A
37	PE	PARAMETER ERROR	This alarm occurs if set parameter value is out of the permissible range (this check is made when the	A

Alarm No.	Abbr.	Name	Description	(Note) Motion
			controller is turned on).	
45	OHF	CONTROLLER OVERHEAT	This alarm occurs if ambient temperature is excessively high, or main (power) circuit semiconductor overheats due to overload or stop of cooling fan.	A
46	OHM	MOTOR OVER-HEAT	This alarm occurs if motor overheats due to overload or stop of motor cooling fan.	A
52	OD	ERROR EXCESS	This alarm occurs if difference (error) between referenced position and true position is excessive in position loop control.	A
55	EM	EMERGENCY STOP	This alarm occurs if emergency stop signal is given by external signal source.	B
56	OA	OTHER AXIS FAULT	This alarm occurs if trouble occurs with other servo control axis (when FR-SF is bus-linked with CNC).	A
E0	IPF	INSTANTANEOUS POWER FAILURE	This warning occurs if input power supply is interrupted or its voltage goes down momentarily.	C
E1	WOL	OVERLOAD	This warning occurs if controller and/or motor is under overload condition for over the specified time.	A
E4	WPE	PARAMETER SETTING ERROR	If illegal parameter is set, this warning occurs.	C
E7	NCE	NC EMERGENCY STOP	This warning occurs if emergency stop signal is input from CNC (when FR-SF is bus-linked with CNC). This warning occurs if emergency stop signal is input from external signal source (when external emer-	B

Alarm No.	Abbr.	Name	Description	(Note) Motion
			gency signal is acceptable ... parameter set).	

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

Motion A Controller base current is shut off, main (power) 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.

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

Function	Application	Description	Refer to	Internal parameter setting range	Input/output
Speed meter output	Speed display	When speed is maximum, single-swing DC1mA meter reads the maximum value (full scale) and DC10V is output.		-	Max. DC10V output
Load meter output	Load display	When load is 120% of 30-min. rated output, single-swing DC1mA meter reads the maximum value (full scale) and DC3V or DC10V (selectable, standard: 10V) is output.			DC3V or DC10V output
Zero speed output signal	Machine interlock	Signal which closes contact, or turns on output transistor, when motor speed is below the referenced speed.		0 - 1000rpm Standard: 50rpm Quasi-standard: 25rpm	Contact output Open-emitter output
Up-to-speed output signal	Answer back to NC	Signal which turns on output transistor when speed is within $\pm 15\%$ of the referenced speed.			Open-emitter output Open-collector output
Speed detect output		Signal which turns on output transistor when motor speed is below the referenced speed.			Open-emitter output Open-collector output
Load detect output signal	Prevention of cutter sticking	Signal which turns on output transistor when output			Open-emitter output

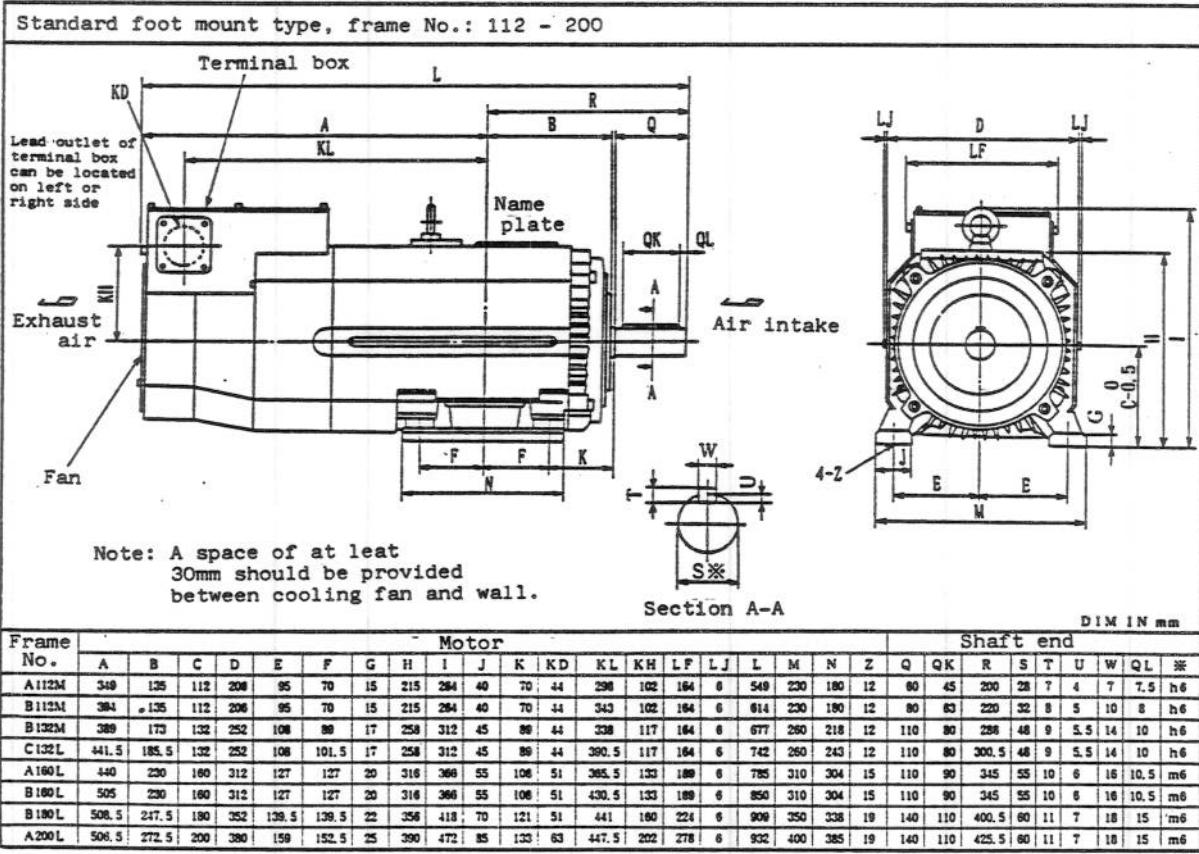
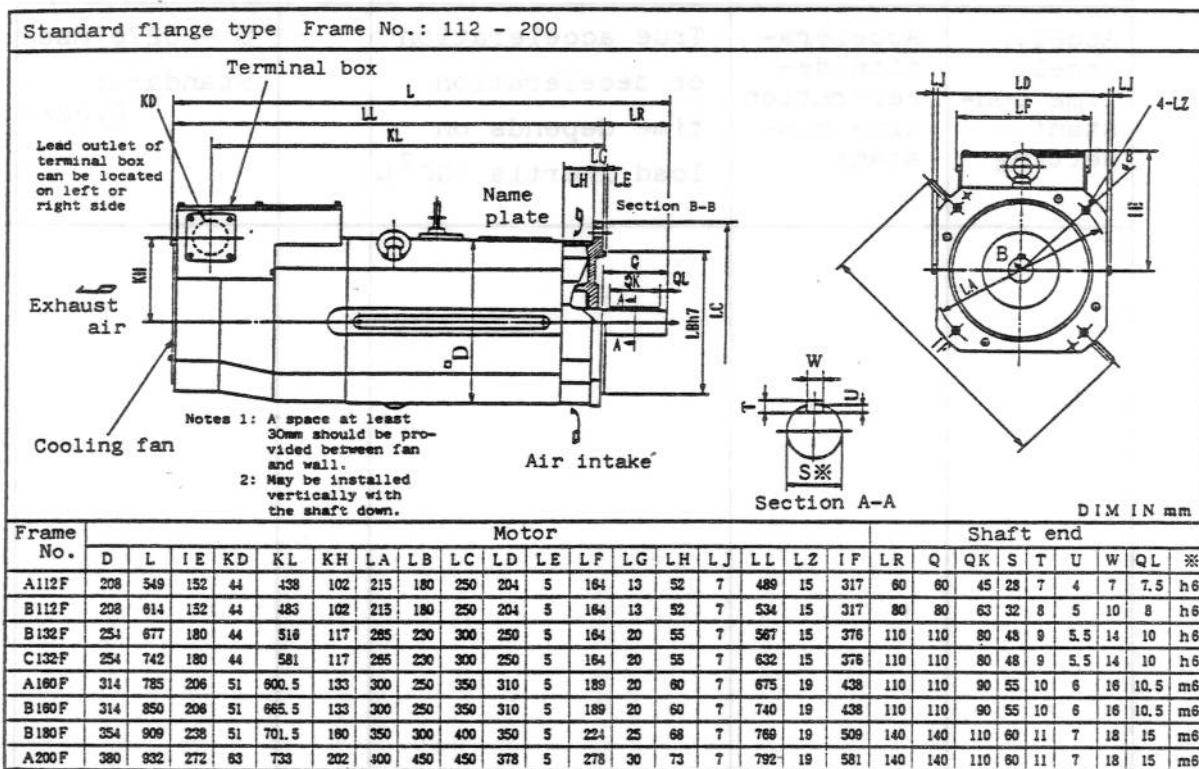
Function	Application	Description	Refer to	Internal parameter setting range	Input/output
		exceeds 110% of rated output.			
Spindle fault output signal (alarm)	Spindle fault	Signal which closes contact, or turns on output transistor, if spindle fault occurs			Contact output Open-emitter output
Spindle fault content output signal (alarm)	Spindle fault content	In case of spindle fault, the data indicating the cause is output (combination of 4 output transistor statuses).			Open-emitter output
Torque limit output signal		Signal which turns on output transistor while torque is being limited.			Open-emitter output
Torque limit command input	Motor torque is reduced temporarily when gear is shifted, for example	Torque limit input signal Torque is limited to preset value when TL1 - OT is closed. Torque is limited to (preset value x 2) when TL2 - OT is closed.		0 - 120% of maximum torque Standard: 10%	External input
Machine ready intput	Verfication that machine is ready.	"Ready" when SET1 - SET2 is closed.			External input
Alarm reset input	Reset of alarm flag in controller	Alarm condition is reset when ARS1 - ARST2 is closed.			External input

Function	Application	Description	Refer to	Internal parameter setting range	Input/output
Speed reference digital/analog select input	Selection of digital speed reference signal	Digital signal is input when DIG - OA is closed, and analog signal is input when DIG - OA is opened.			External input
Speed override input	Override to speed in automatic operation	Override can be set within a range from 50% to 120% by external potentiometer. Override is exerted when DEF - OD is closed.			External input
Emergency stop input	Emergency stop	Motor is decelerated by regenerative brake to stop. Emergency stop signal is given when ESP1 - ESP2 is opened.			External input
Alarm signal output for emergency stop	Alarm signal is output (ON) or not output (OFF) in case of emergency stop.	When "ON" is selected, alarm signal is output in case of emergency stop. When "OFF" is selected, alarm signal is not output in case of emergency stop.		"ON"/"OFF"	Contact output Open-emitter output

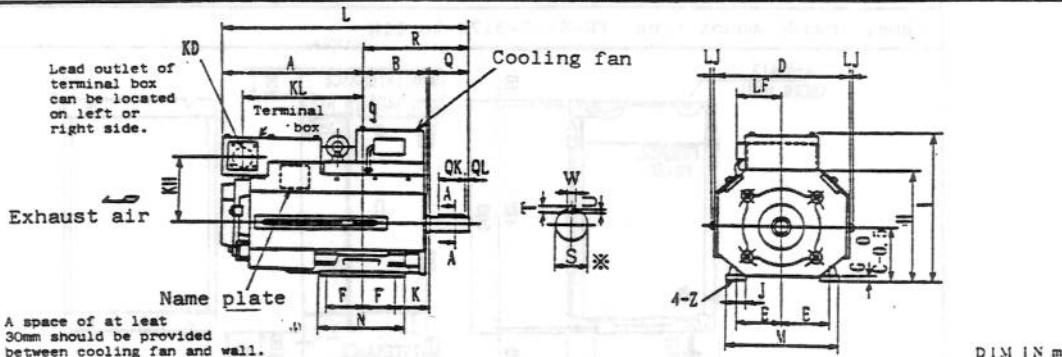
Function	Application	Description	Refer to	Internal parameter setting range	Input/output
Accel./decel. time constant setting	Acceleration/deceleration time constant	True acceleration or deceleration time depends on load inertia (GD^2).		0 - 32767msec Standard: 0.3sec	Internal setting

2.5 Outside view and dimensions

2.5.1 Motors

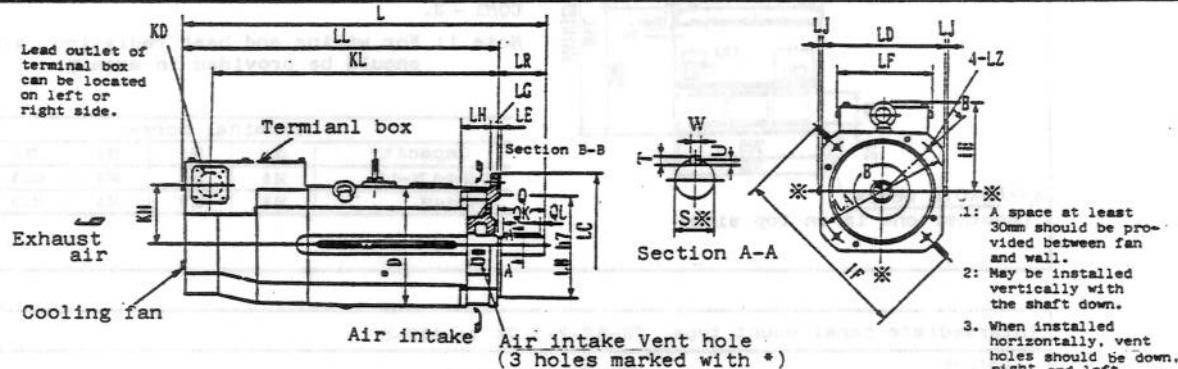


Thin foot mount type



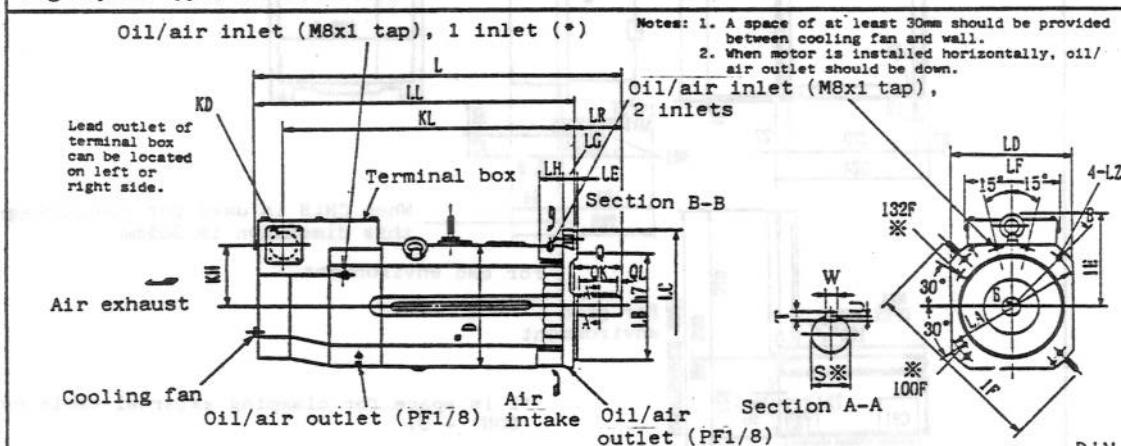
Frame No.	Motor																		Shaft end						*				
	A	B	C	D	E	F	G	H	I	J	K	KD	KL	KH	LF	LJ	L	M	N	Z	Q	OK	R	S	T	U	W	QL	*
B132M	312	173	132	320	106	86	17	304	371	45	86	44	282	170	95	6	600	260	218	12	110	90	288	45	9	5.5	14	10	h6
C132M	364.5	185.5	132	320	106	101.5	17	304	371	45	86	44	314.5	170	95	6	665	260	243	12	110	90	300.5	48	9	5.5	14	10	h6
A160M	322	230	160	356	127	127	20	348	446	55	106	51	272	195	118	6	667	310	304	15	110	90	345	55	10	6	16	10.5	m6
B160M	387	230	160	356	127	127	20	348	446	55	106	51	337	195	118	6	732	310	304	15	110	90	345	55	10	6	16	10.5	m6
B180M	398.5	235.5	180	400	139.5	139.5	22	397	485	70	121	51	349.5	222	118	6	800	350	338	19	140	110	400.5	60	11	7	18	15	m6

High-speed type, 10000rpm



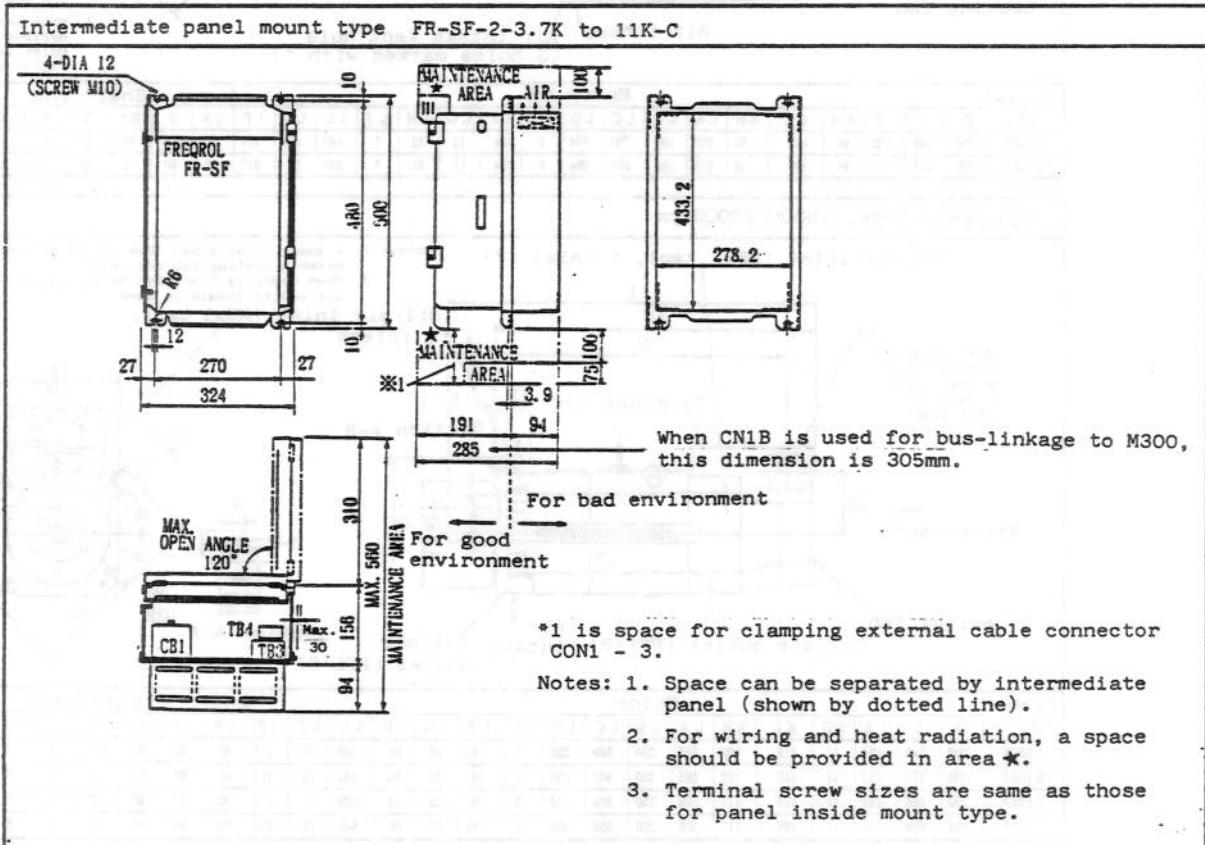
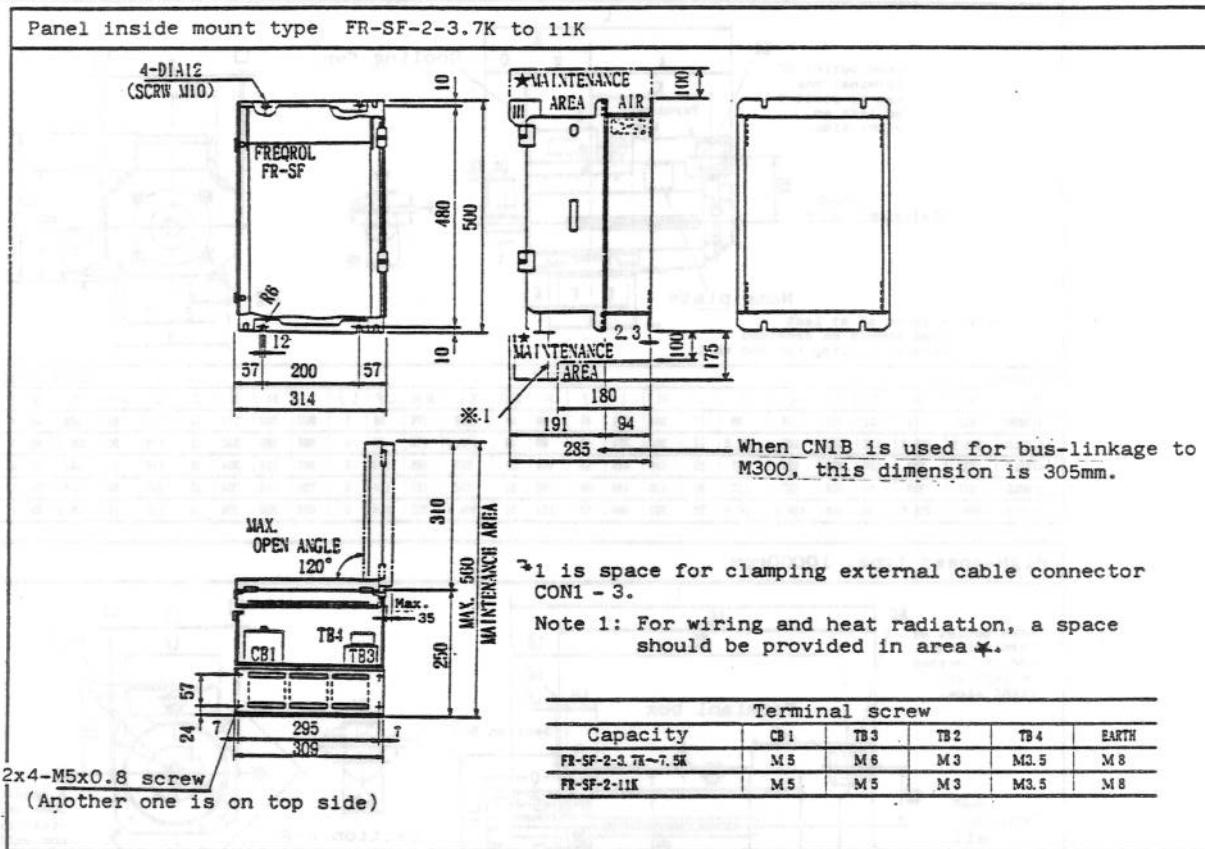
Frame No.	Motor OR																		Shaft end						*		
	D	L	I	E	KD	KL	KH	LA	LB	LC	LD	LE	LF	LG	LH	LJ	LL	LZ	IF	LR	Q	OK	S	T	U	W	QL
A112F	208	549	152	44	438	102	215	180	250	204	5	164	13	52	7	489	15	317	60	60	45	23	7	4	7	7.5	h6
B112F	208	549	152	44	483	102	215	180	230	204	5	164	13	52	7	534	15	317	60	60	45	23	7	4	7	7.5	h6

High-speed type, 15000/20000rpm

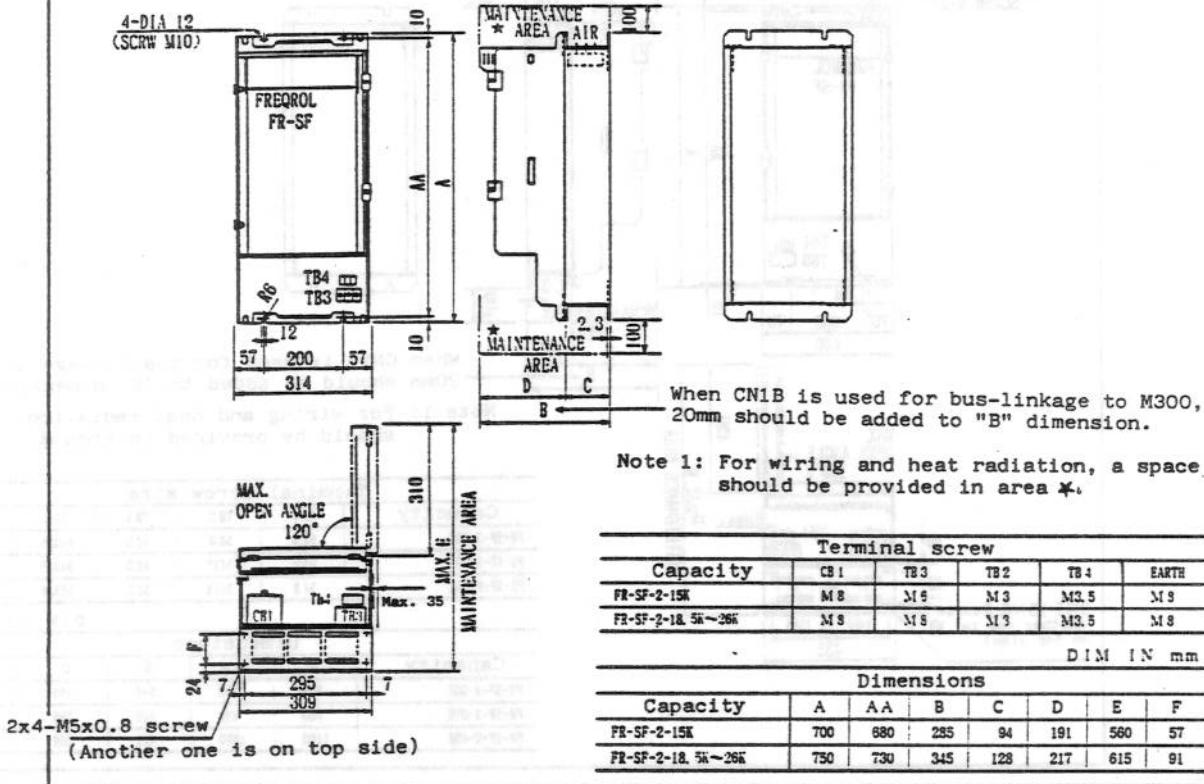


Frame No.	Motor																		Shaft end						*	
	D	L	I	E	KD	KL	KH	LA	LB	LC	LD	LE	LF	LG	LH	LL	LZ	IF	LR	Q	OK	S	T	U	W	QL
A100F	208	549	152	44	418	102	265	230	300	250	5	164	25	60	469	19	317	80	80	63	32	8	5	10	8	h6
B100F	208	574	152	44	443	102	265	230	300	250	5	164	25	60	494	19	317	80	80	63	32	8	5	10	8	h6
B132F	254	606	180	44	475	117	265	230	300	250	5	164	25	60	528	19	376	80	80	63	32	8	5	10	8	m6
C132F	254	628	180	44	495	117	300	250	350	300	5	164	25	60	546	24	376	80	80	63	32	8	5	10	8	h6

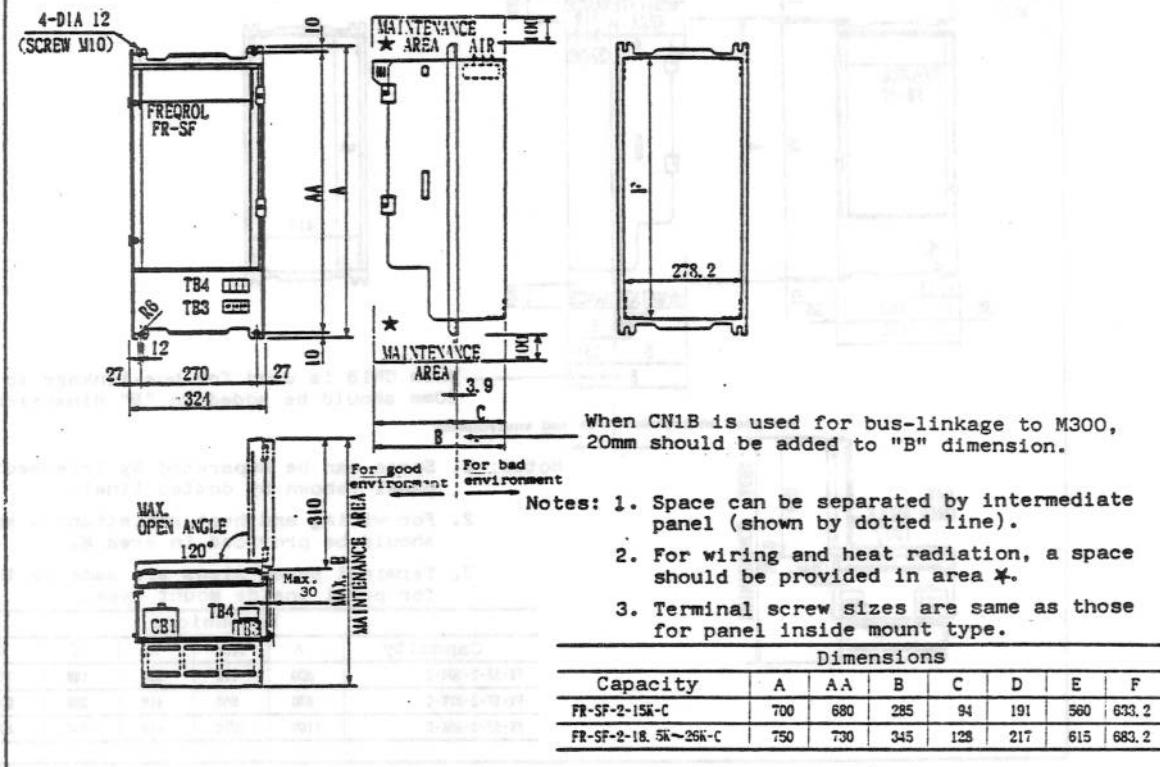
2.5.2 Controllers



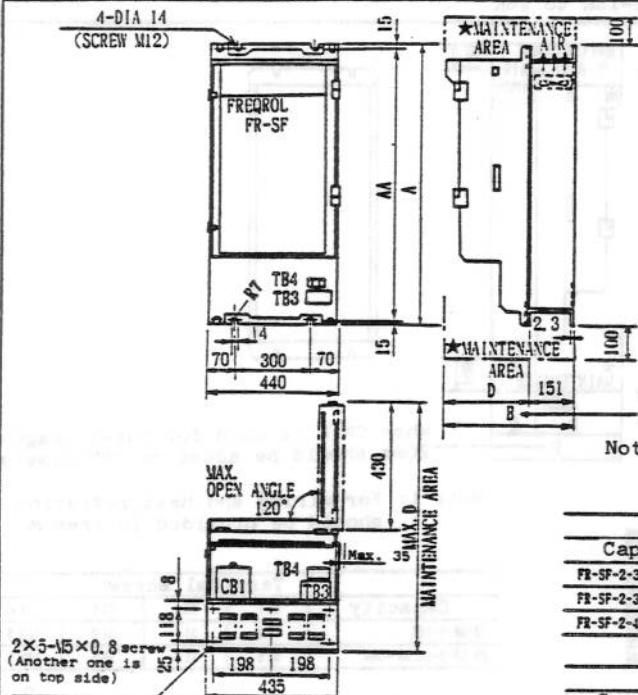
Panel inside mount type FR-SF-2-15K to 26K



Panel inside mount type FR-SF-2-15K to 26K-C



Panel inside mount type FR-SF-2-30K to 45K

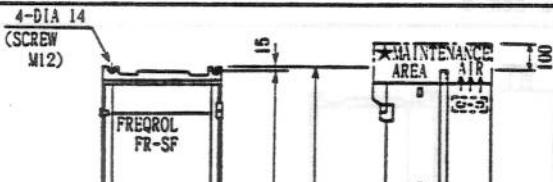


Note 1: For wiring and heat radiation, a space should be provided in area *

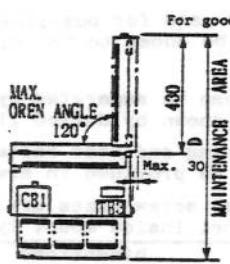
Capacity	Terminal screw size				
	CB1	TB3	TB2	TB4	EARTH
FR-SF-2-30K	M8	M8	M3	M3.5	M8
FR-SF-2-37K	M8	M12	M3	M3.5	M8
FR-SF-2-45K	M8	M12	M3	M3.5	M8

Capacity	Dimensions				
	A	AA	B	C	D
FR-SF-2-30K	800	770	340	189	730
FR-SF-2-37K	880	850	410	259	800
FR-SF-2-45K	1100	1070	410	259	800

Intermediate panel mount type FR-SF-2-30K to 45K-C



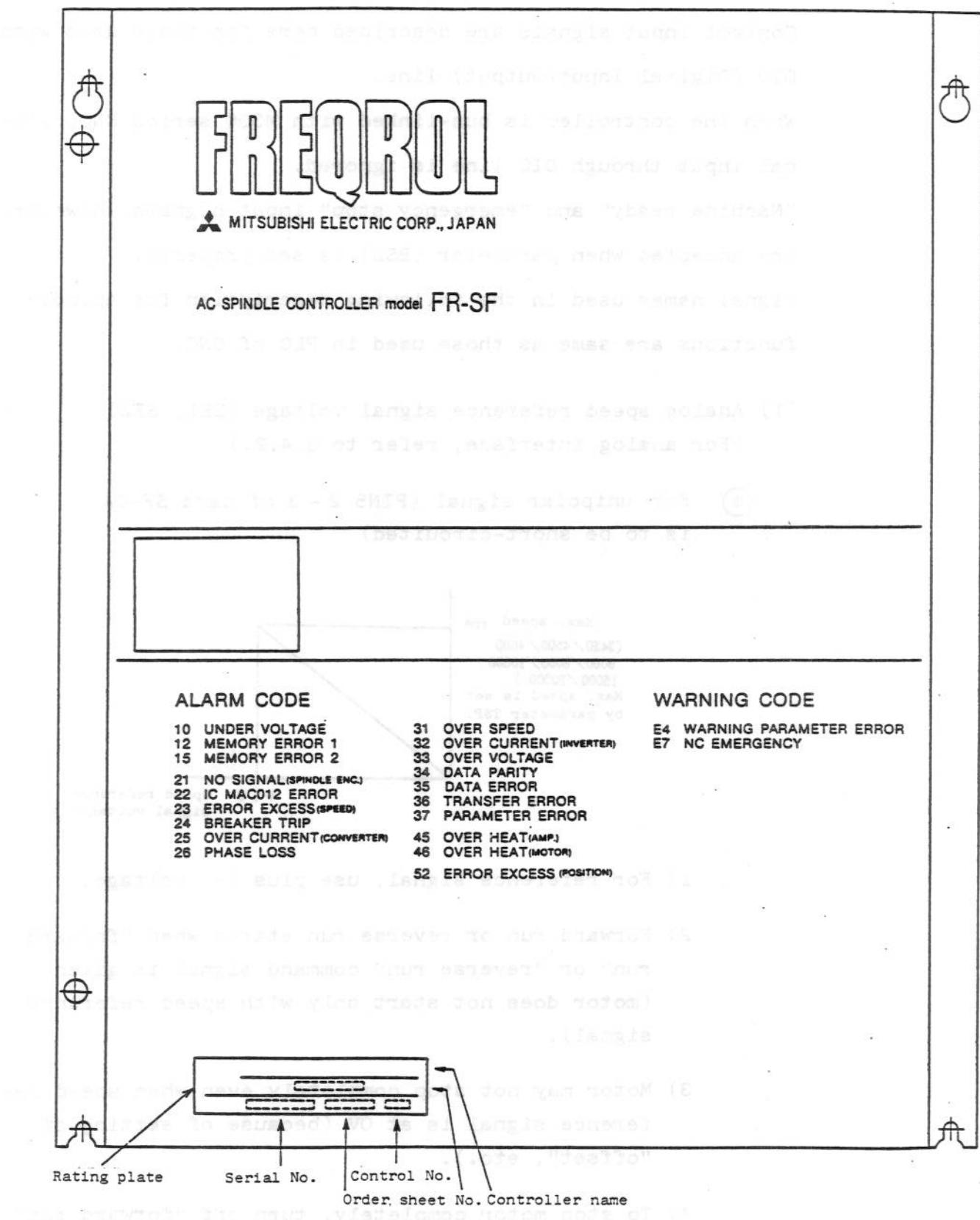
When CN1B is used for bus-linkage to M300, 20mm should be added to "B" dimension.



- Notes:
- Space can be separated by intermediate panel (shown by dotted line).
 - For wiring and heat radiation, a space should be provided in area *.
 - Terminal screw sizes are same as those for panel inside mount type.

Capacity	Dimensions					
	A	AA	B	C	D	E
FR-SF-2-30K-C	800	770	340	189	730	713.2
FR-SF-2-37K-C	880	850	410	259	800	793.2
FR-SF-2-45K-C	1100	1070	410	259	800	1013.2

(1) Controller front panel



§3. FUNCTIONS

3.1 Control input signals

Control input signals are described here for those used with DIO (Digital Input/Output) line.

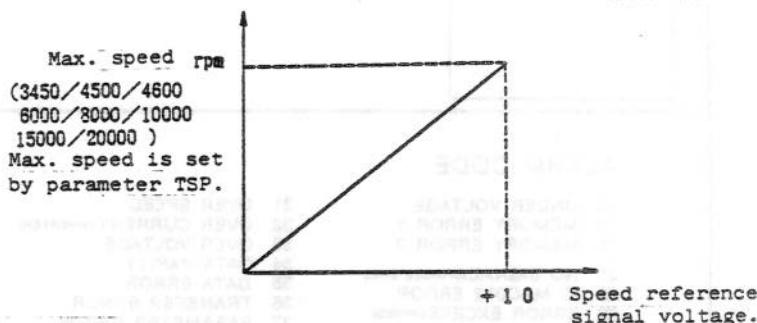
When the controller is bus-linked with M300 series CNC, signal input through DIO line is ignored.

"Machine ready" and "emergency stop" input signals, however, are accepted when parameter (BSL) is set properly.

Signal names used in the following description for spindle functions are same as those used in PLC of CNC.

(1) Analog speed reference signal voltage (SE1, SE2)
(For analog interface, refer to 3.4.2.)

(a) For unipolar signal (PIN5 2 - 3 of card SF-CA is to be short-circuited)



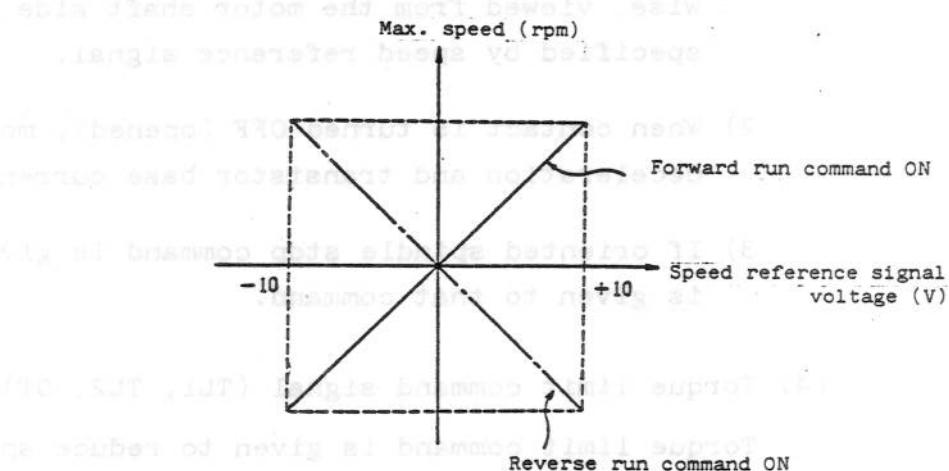
- 1) For reference signal, use plus (+) voltage.
- 2) Forward run or reverse run starts when "forward run" or "reverse run" command signal is given (motor does not start only with speed reference signal).
- 3) Motor may not stop completely even when speed reference signal is at OV (because of setting of "offset", etc.).
- 4) To stop motor completely, turn off "forward run"

or "reverse run" command signal.

- (5) Maximum speed and basic speed can be set by respective parameters.
- (6) To change analog speed reference signal to digital speed reference signal, external input signal is used.

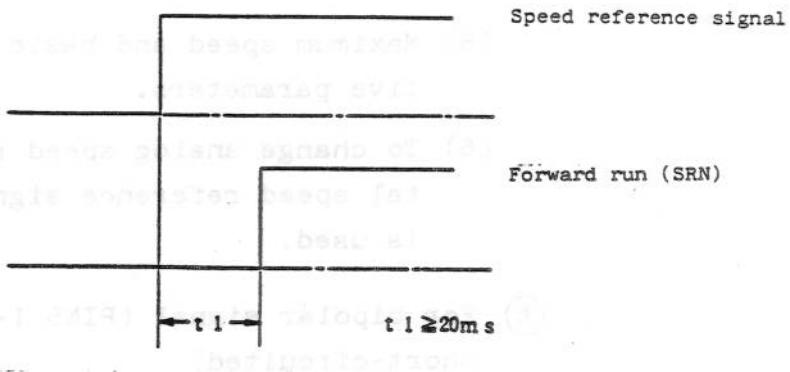
- (b) For bipolar signal (PIN5 1-2 of card SF-CA is to be short-circuited)

The relationship between reference signal voltage and speed is shown below (other characteristics are same as those of unipolar signal).



(2) Forward run command signal (SRN, OS)

- 1) While contact is ON (closed), motor rotates counter-clockwise, viewed from the motor shaft side, at the speed specified by speed reference signal.
- 2) When contact is turned OFF (opened), motor stops after deceleration and transistor base current is shut off.
- 3) If oriented spindle stop command is given, priority is given to that command.

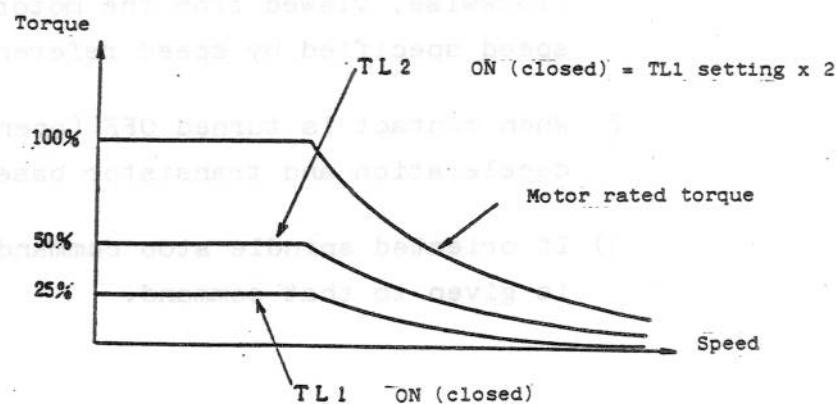


(3) Reverse run command signal (SR1, OS)

- 1) While contact is ON (closed), motor rotates clockwise, viewed from the motor shaft side, at the speed specified by speed reference signal.
- 2) When contact is turned OFF (opened), motor stops after deceleration and transistor base current is shut off.
- 3) If oriented spindle stop command is given, priority is given to that command.

(4) Torque limit command signal (TL1, TL2, OT)

Torque limit command is given to reduce spindle motor torque temporarily for mechanical oriented spindle stop or gear shift.



(5) Machine ready signal (SET1, SET2)

- 1) When contact is ON (closed), transistor base current is shut off, main circuit contactor closes and fan motor is turned on.
- 2) When contact is turned OFF while motor is running, the motor stops after coasting and transistor base current is shut off.
- 3) When machine operator touches spindle for setting up or removal of workpiece or tool, this signal should be turned off for safety.

The signal should not be turned on and off frequently over several hundred cycles per day .

(6) Alarm reset signal (ARST1, 2)

Alarm flags of CPU of card FR-SF are reset (initialized). The same occurs when "RESET" pushbutton of P.C. board is pressed.

(7) Speed reference digital/analog select signal (DIG, OA)

Digital signal becomes valid when this contact is ON (closed), and analog signal becomes valid when the contact is OFF.

Digital speed reference signal

[binary 12-bit, signed binary 12-bit,
BCD 2-digit, BCD 3-digit]

can be selected by parameter (DSR).

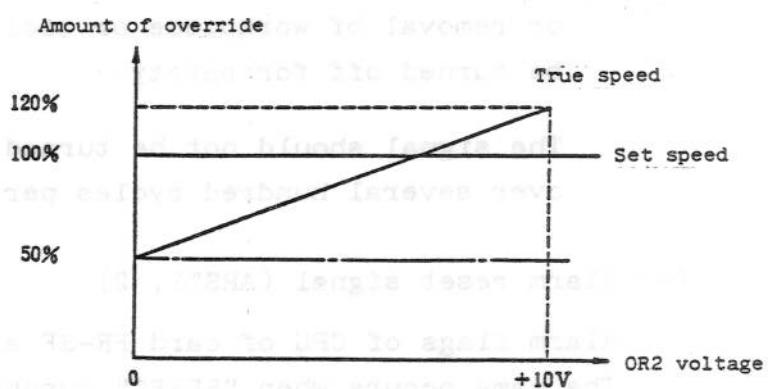
Note: For digital speed reference signal, card SF-DA (option) must be used.

(8) For speed override (DEF, OD) (OR1, OR2, OR3) analog signal input, refer to 3.4.2.

- 1) Speed override input becomes valid when DEF contact

is ON (closed).

- 2) Override can be adjusted within range from 50% to 120% by externally installed potentiometer.
- 3) Speed override can be applied to analog speed reference and analog speed reference as well.
When analog signal is given by means of potentiometer, speed override should be invalid.



(9) Emergency stop signal (ESP1, ESP2) ... Normally ON (closed)

- 1) When contact is turned OFF (opened), motor is decelerated to stop by regenerative brake and, after motor stops, output transistor base current is interrupted. Whether alarm signal is output or not at emergency stop depends on setting of parameter (BSL).
- 2) When contact is turned ON (closed) again, motor becomes ready for start (motor starts when start command signal is set to ON). "Forward run"/"reverse run" signal should be reset by external sequential control circuit.

(10) Oriented spindle stop command signal (ORC1, ORC2)

- 1) When this signal is turned ON (closed), oriented spindle stop function starts working, independent of operation start command (SRN, SRI).

2) Sindle speed

Spindle speed range selection	Spindle low speed (OTL)	Spindle medium speed (CTM)
High speed (H)	OFF (opened)	OFF (opened)
Medium speed (M)	OFF (opened)	ON (closed)
Low speed (L)	ON (closed)	OFF (opened)

In the case of 2-speed type,
(H) or (L) gear is selected.

- 3) When either forward run command (SRN) or reverse run command (SRI) is on at the time this command signal is given, motor runs at the referenced speed.

(11) Digital speed reference signal Optional card SF-DA is used FR-SF-2-[] K-D

For digital speed reference signal, one of the following signals can be selected by parameter (DSR).

2-digit (S2-digit) BCD code 8 bits
 3-digit (S3-digit) BCD code 12 bits
 Binary code 12 bits
 Signed binary code 12 bits

Ex.: 2-digit BCD code ... 8 bits

BCD code	Motor speed(6000rpm)	Motor speed(4500rpm)
00	0 rpm	0
01	60 rpm	45 rpm
02	120 rpm	90 rpm
.	.	.
.	.	.
.	.	.
.	.	.
98	5940 rpm	4455 rpm
99	6000 rpm	4500 rpm

When BCD code is "99", for example, bit pattern is as follows (input contact is closed for "1", and opened for "0"):

9				9				
1	0	0	1	1	0	0	1	R08 R07 R06 R05 R04 R03 R02 R01 Input terminal

Ex. 3-digit BCD code ... 12 bits

BCD code	Motor speed (6000rpm)	Motor speed (4500rpm)
000	0 rpm	0
001	6 rpm	4.5 rpm
002	12 rpm	9.0 rpm
.	.	.
.	.	.
.	.	.
998	5994 rpm	4495.5 rpm
999	6000 rpm	4500 rpm

When BCD code is "999", for example, bit pattern is as follows (input contact is closed for "1", and opened for "0")):

9				9				9				
1	0	0	1	1	0	0	1	1	0	0	1	R12 R11 R10 R9 R08 R07 R06 R05 R04 R03 R02 R01 Input terminal

Ex. Binary code 12 bits

Binary code	Motor speed (6000rpm)	Motor speed (4500rpm)
(000)H	0	0
.	.	.
.	.	.
.	.	.
.	.	.
.	.	.
(800)H	3000 rpm	2250 rpm
.	.	.
.	.	.
.	.	.
(FFF)H	6000 rpm	4500 rpm

(2183) D = (887) H											
1	0	0	1	1	0	0	1	1	0	0	1

Notes: 1. ()H and ()D indicate hexadecimal notation and decimal notation respectively.
 (Input contact is closed for "1", and opened

3.2 Control output signals

Control output signals are explained here for DIO connection (Digital Input/Output connection).

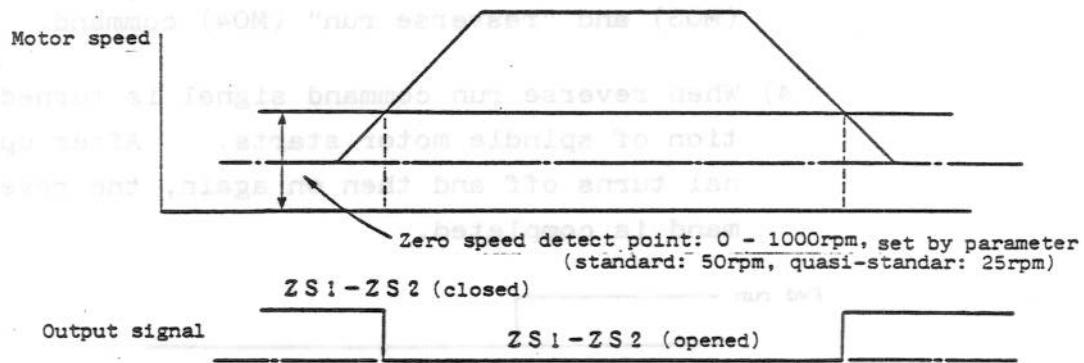
The same signals, however, are output when the controller is bus-linked with M300 series CNC.

Names of signals for spindle control used in CNC PLC do not differ from names of signals described here.

- (1) Zero speed output signal (ZS1, ZS2), (ZSO)(contact)
(open emitter output signal)

1) Contact (ZS1 - ZS2) turns ON (closed) when spindle motor speed goes down below the point at which "zero speed" is detected.

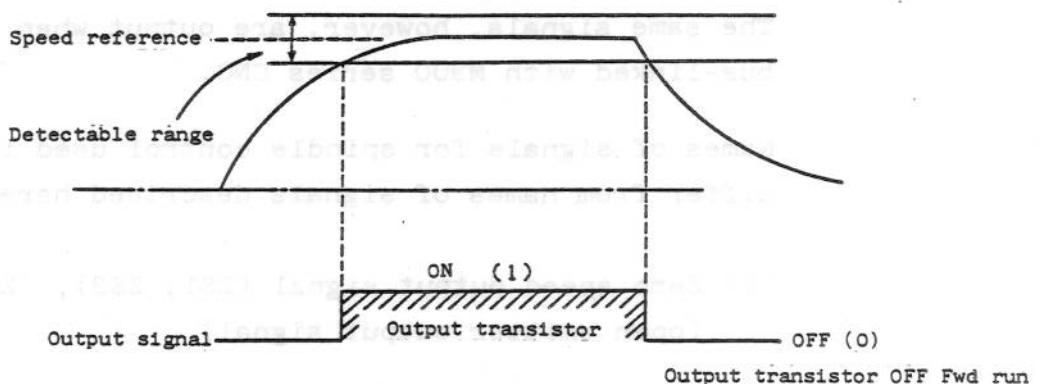
2) When contact turns on, the output transistors turn on.



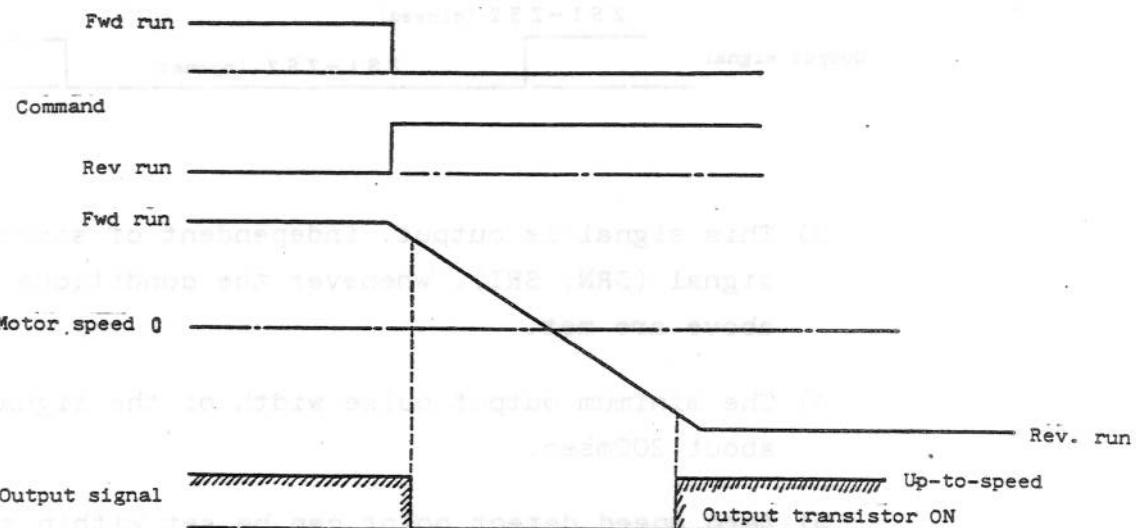
- 3) This signal is output, independent of start command signal (SRN, SRI), whenever the conditions described above are met.
- 4) The minimum output pulse width of the signal is about 200msec.
- 5) Zero speed detect point can be set within range from 0 to 1000rpm by parameter ZSP.

(2) Up-to-speed output signal (USO)(US10) (open-emitter output)(open-collector output)

- 1) The output transistors turn on when spindle motor speed reaches $\pm 15\%$ of referenced speed.

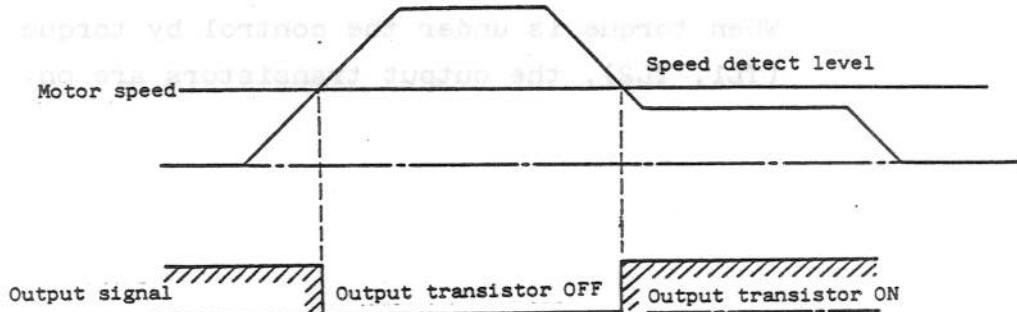


- 2) This signal is output only when either SRN or SRI turns on. It is not output when oriented spindle stop has been completed.
- 3) The signal can be used for check against "forward run" (M03) and "reverse run" (M04) command.
- 4) When reverse run command signal is turned on, deceleration of spindle motor starts. After up-to-speed signal turns off and then on again, the reverse run command is completed.



(3) Speed detect output signal (VRO)(VR10) (open-emitter output)(open-collector output)

- 1) When motor speed goes down below speed set by parameter SDT, the output transistors turn on.



- 2) The range within which this signal is output can be set by parameter SDT.
- 3) For speed detection, absolute motor speed is measured (that is, speed detection is irrespective of commanded direction of rotation, SRN or SRI).

(4) Load detect output signal (CDO) (open-emitter output)

The output transistors turn on when output current is close to current limit (120% output) 110% output.

(5) Spindle failure output signal (FA, FC) (FLO) (contact) (open-emitter output)

- 1) Relay operation and output status are as follows:

Mode	Relay	Contact	Open emitter transistor
Normal	Pull	Close	ON
Failure	Release	Open	OFF

- 2) In case of spindle failure, "alarm code No." is displayed by 7-segment LED readout (see page) or binary code (AL8 - AL1) is output (see page)

for open emitter output.

- 3) Alarm signal is output for about 1 sec. immediately after the power is turned on (until the control power supply is stabilized).

(6) Torque limit output signal (TLO) (open-emitter output)

When torque is under the control by torque limit signal (TL1, TL2), the output transistors are on.



When torque is under the control of torque limit signal (TL1, TL2), the output transistors are on.

The output of torque motor driver is controlled by torque limit signal. If torque limit signal is high, torque motor driver is controlled by torque limit signal (TL1 or TL2) and torque limit signal (TLO) is high.

Output of torque driver (ODD) is torque driver output signal. It is output signal from torque driver when torque limit signal (TL1 or TL2) is high.

Output of torque driver (ODD) is torque driver output signal. It is output signal from torque driver when torque limit signal (TL1 or TL2) is high.

Output of torque driver (ODD) is torque driver output signal when torque limit signal (TL1 or TL2) is high.

Condition	Condition	Condition	Output
TL1 = 0	TL2 = 0	TLO = 0	Output = 0
TL1 = 1	TL2 = 0	TLO = 1	Output = 1

Output of torque driver (ODD) is torque driver output signal when torque limit signal (TL1 or TL2) is high.

(7) Alarm signal list

"0": Output = H (Transistor OFF)
 "1": Output = L (Transistor ON)

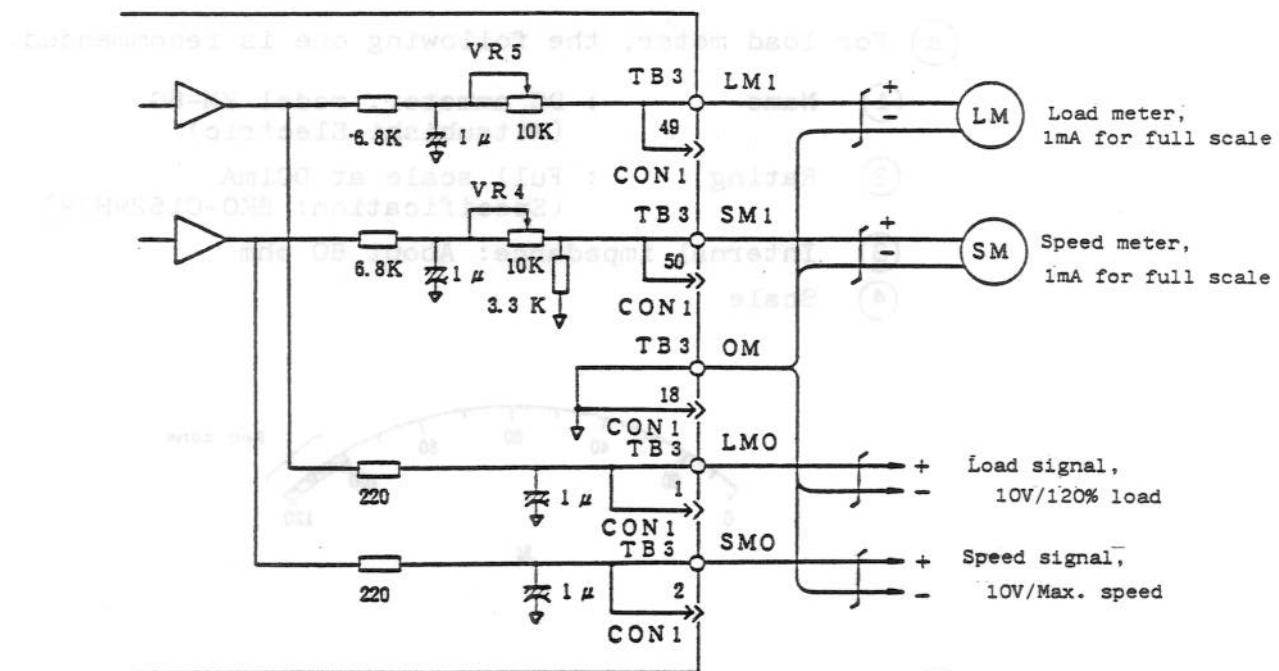
No.	Output				Cause of alarm	Description	Reset
	AL8 (CON3 (pin No.) (11))	AL4 (10)	AL2 (9)	AL1 (8)			
1	0	0	0	1	Motor overheat	Temperature inside motor is higher than the specified limit.	Reset (alarm reset or pressing RESET button) after motor is cooled.
2	0	0	1	0	Excess error in speed control	Motor speed deviates excessively from referenced speed.	Reset after motor is stopped and cause of alarm is removed.
3	0	0	1	1	(Reserve)		
4	0	1	0	0	Power breaker trip	Power breaker is activated by abnormally high supply current input.	
5	0	1	0	1	Phase failure	Phase failure is detected at reset or when power is turned on.	
6	0	1	1	0	Emergency stop	EMERGENCY STOP button of external operation box is ON.	Set the button to OFF.
7	0	1	1	1	Overspeed	Motor speed exceeds 115% of rated speed.	
8	1	0	0	0	Converter overcurrent	Overcurrent occurs on the converter side.	
9	1	0	0	1	Controller overheat	Ambient temperature and/or heatsink (semiconductor) temperature is high excessively.	
10	1	0	1	0	Voltage down	Supply voltage is less than	

Fault diagnosis manual

Output alarm: H = fault "0": Output = H (Transistor OFF)
Input alarm: L = fault "1": Output = L (Transistor ON)

No.	Output				Cause of alarm	Description	Reset
	AL8 (11)	AL4 (10)	AL2 (9)	AL1 (8)			
						170V for longer than 15msec.	
11	1	0	1	1	Overvolt- age	Converter DC voltage is ex- cessively high.	
12	1	1	0	0	Inverter overcur- rent	Inverter output current is excessively high.	
13	1	1	0	1	CNC fault	Failure occurs on the CNC side.	
14	1	1	1	0	PC board error (fault)	Control card (P.C. board) is not in good condition.	
15	1	1	1	1	CPU fault	CPU is not in good condi- tion.	

3.3 Meter output

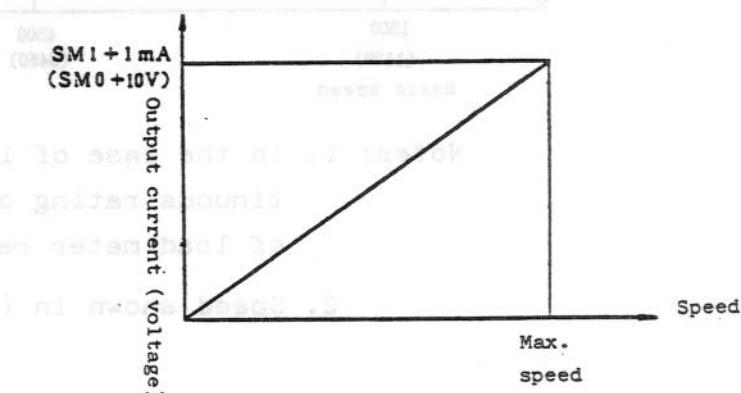


(1) Output to speed meter

a) For speed meter, the following one is recommended.

- ① Name : DC ammeter, model YM-8G
(Mitsubishi Electric)
- ② Rating : Full scale at DC1mA
- ③ Internal impedance: About 80 ohm

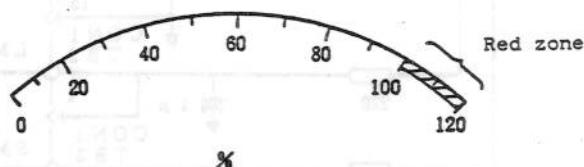
- b) When motor runs at the maximum speed (SM1), current (DC) at +1mA flows no matter of direction of rotation
- c) When a meter having internal impedance largely different from 80 ohm is used, set SW5-4 of card SF-CA to "ON" and calibrate the meter by VR4.
- d) When motor runs at the maximum speed, +10V DC is output to terminal SMO.



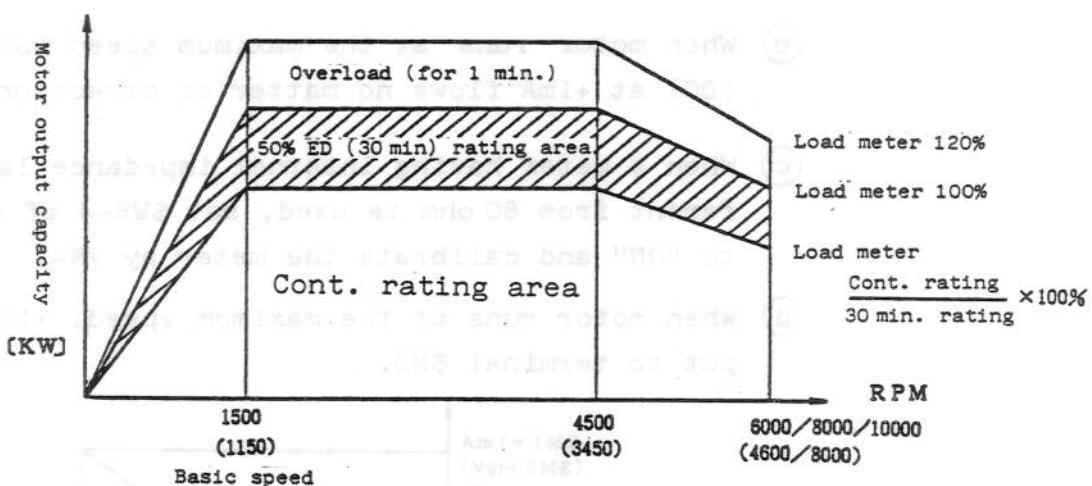
(2) Output to load meter

- Ⓐ For load meter, the following one is recommended.

- ① Name : DC ammeter, model YM-8G
(Mitsubishi Electric)
- ② Rating : Full scale at DC1mA
(Specification: BKO-C1529H79)
- ③ Internal impedance: About 80 ohm
- ④ Scale



- Ⓑ Polarity of current output from terminal (LM1) is always same, no matter of direction of rotation.
- Ⓒ Reading of load meter is ratio (%) of load to the motor rated capacity.
The relationship between load meter reading and motor capacity (kW) is as follows:



- Notes:
1. In the case of 15/18.5kW motor, the continuous rating of motor corresponds to 80% of load meter reading.
 2. Speed shown in () is for standard 1150RPM

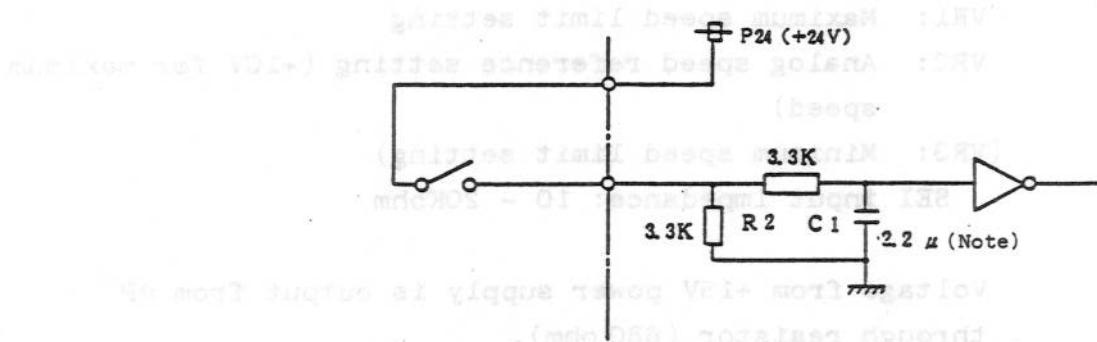
motor.

- (d) When a meter having internal impedance largely different from 80 ohm is used, set SW5-4 of card SF-CA to "ON" and calibrate the meter by VR5.
- (e) Output to load meter (LOM) can be selected between 10V and 3V by parameter BSL (standard: 10V).

3.4 Interface electrical specification (for DIO)

3.4.1 Input interface

All input circuits of FR-SF spindle controller are as shown below.



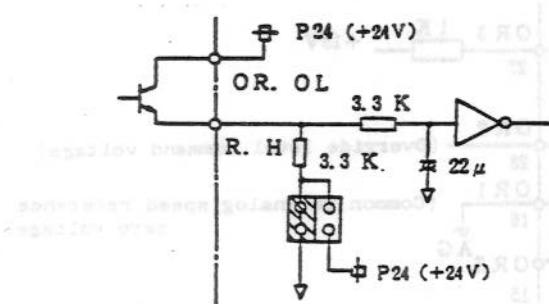
Delay caused by filter in the input circuit is 5 - 15msec.

Current flowing into externally connected contact is about 7.2mA.

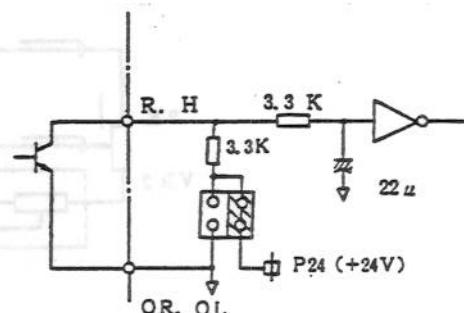
When open-emitter output is connected, an appropriate margin should be provided to 24V, 7.2mA.

Note: For digital speed reference signal and spindle orientation positioning signal, selection is possible bewteen "open-emitter" and "open-collector".

Open-emitter

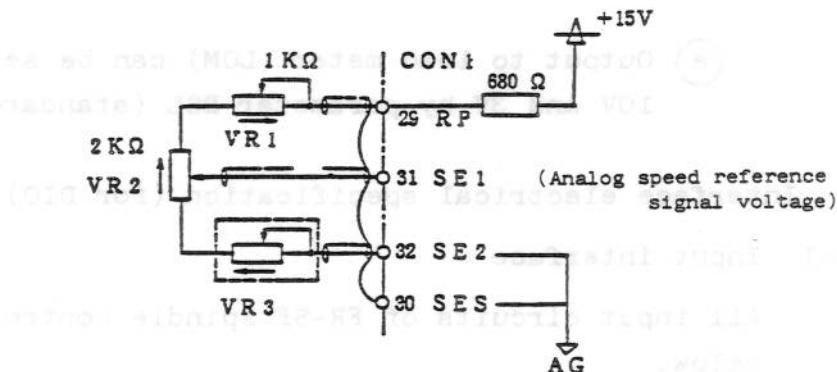


Open-collector



3.4.2 Analog signal input interface

(1) Analog speed reference signal (for unipolar signal)



VR1: Maximum speed limit setting

VR2: Analog speed reference setting (+10V for maximum speed)

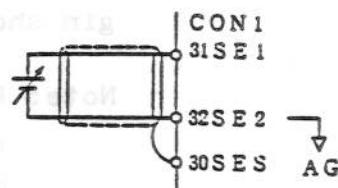
(VR3: Minimum speed limit setting)

SEI input impedance: 10 - 20Kohm

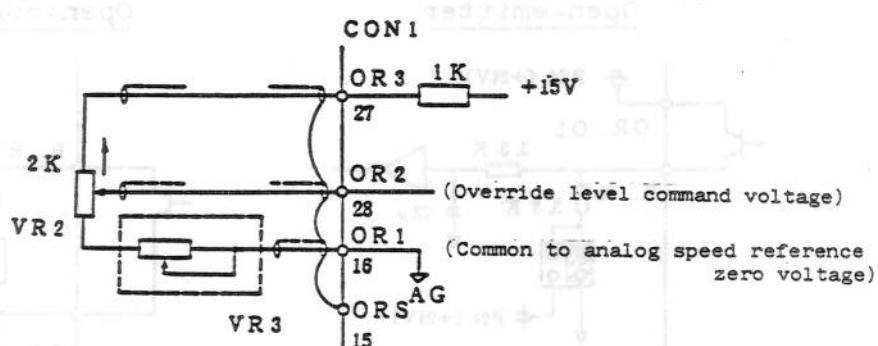
Voltage from +15V power supply is output from RP through resistor (680 ohm).

When voltage across SE1 and SE2 is 10V, speed is maximum. To determine speed range, set VR1 and VR2 properly.

When additional power supply for analog speed reference signal is required, use the circuit shown to the right.



(2) Override command



VR2: Override setting

Adjustable within range from 50% to 120%

(OR2: 10V = 120%, OV = 50%)

VR3: Override lower limit setting

This should be used when override lower limit must be below 50%.

OR2 input impedance: 10 - 20Kohm

3.4.3 Output interface

(1) External contact outputs

Spindle alarm (FA, FC)

Zero speed (ZS1, ZS2)

Spindle orientation complete (ORA1, ORA2)

External output relay contact shall have the following ratings:

DC24V less than 0.3A

AC100V less than 0.1A

Chattering Shorter than 5msec

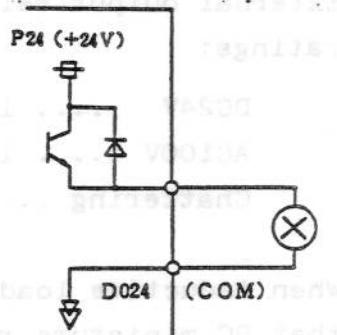
When inductive load is connected, it is recommended that DC miniature relay is used and flywheel diode is connected to the relay coil in parallel.

If AC relay must be used, connect CR surge absorber to the relay coil in parallel.

For lamp load, inrush current should be restricted to 1A.

(2) Open emitter output

	<u>Output transistor rating</u>
Spindle alarm (FLO)	
Current detect (CDO)	M54630P transistor array
Speed detect (VRO)	
Up-to-speed (USO)	I _{cmax} = 60mA (not exceed 50mA)
Zero speed (ZSO)	V _{CEO} max = 24V
Torque limit (TLO)	P _c = 1.47/7W
Spindle orientation complete (ORAO)	
Alarm signal (AL8)	
" (AL4)	
" (AL2)	
" (AL1)	

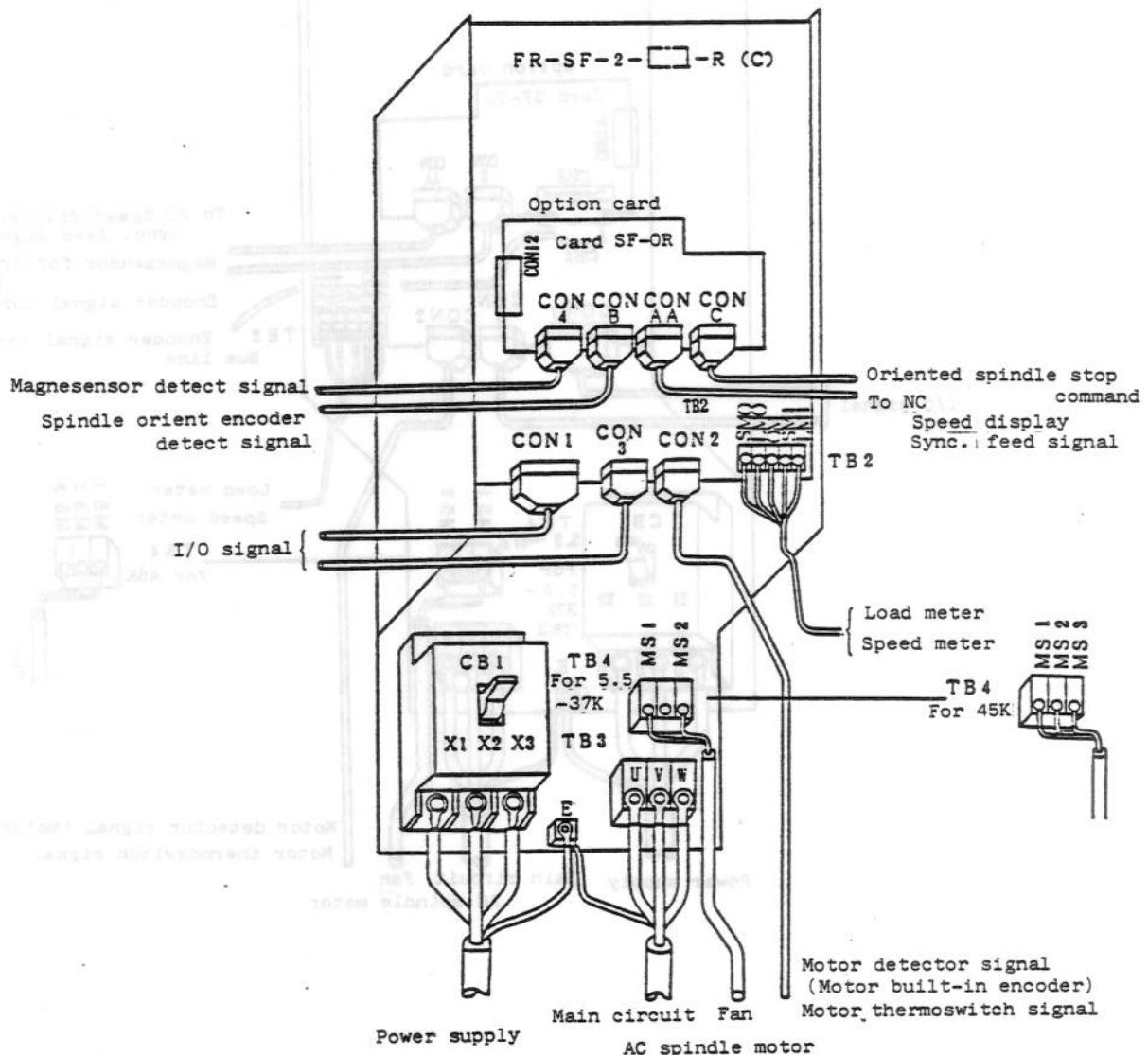


§4. WIRING AND SETTING

4.1 External wiring (For standard model, wiring to option card is not made.)

(1) Equipped with oriented spindle stop function

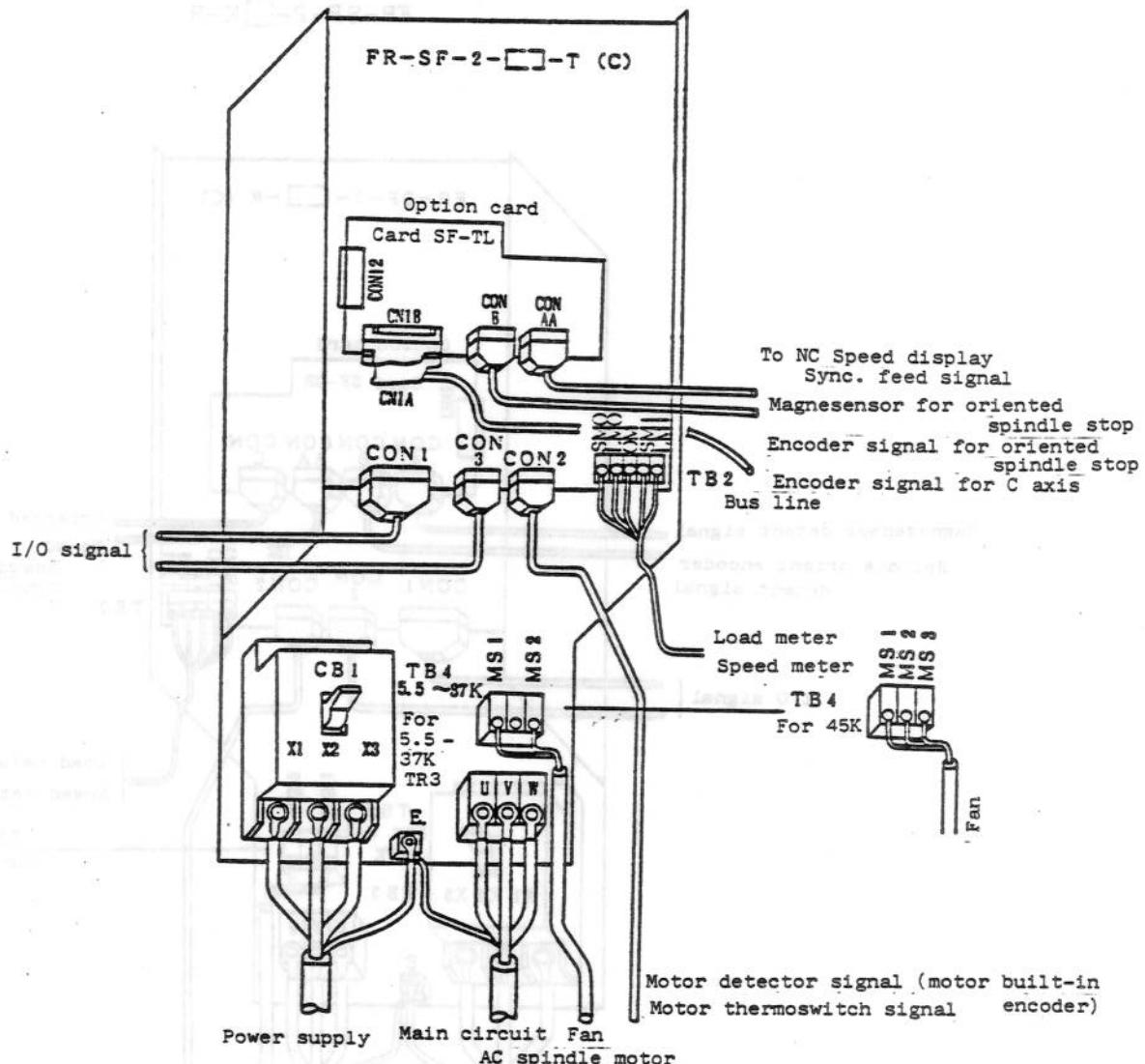
FR-SF-2-[]K-R



(2) Equipped with tap oriented spindle stop function,
bus-linked with M300 series CNC

FR-SF-2-□-T

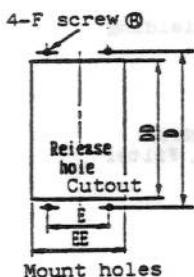
Diagram showing signals between FR-SF-2-□-T (C) and AC spindle motor.



4.2 Caution for installation of intermediate panel mount type
controller

(1) Installation procedure

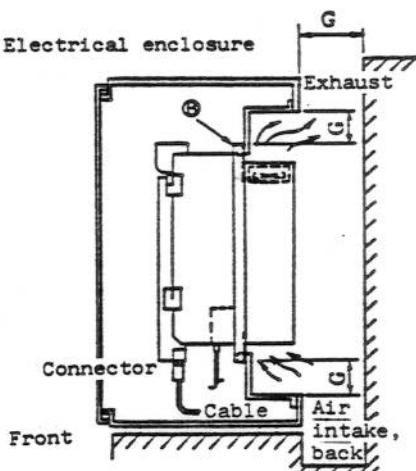
1. Make cutout and mounting bolt holes in the electrical enclosure, as shown below.
2. Place packing between the intermediate panel and the electrical enclosure and tighten four bolts at (B) to secure the intermediate panel.



Capacity	DIM IN =					
	D	DD	E	EE	F	G
FR-SF-2-3.7K~11K-C	480	440	270	285	M10	100
FR-SF-2-15K-C	680	640	270	285	M10	100
FR-SF-2-18.5.22.25K-C	730	690	270	285	M10	130
FR-SF-2-30K-C	770	720	380	424	M12	130
FR-SF-2-37K-C	850	800	380	424	M12	130
FR-SF-2-45K-C	1070	1020	380	424	M12	130

(2) Examples of installation

Ex. 1: When the controller is installed behind the machine, provide a space between the controller and the machine for ventilation.

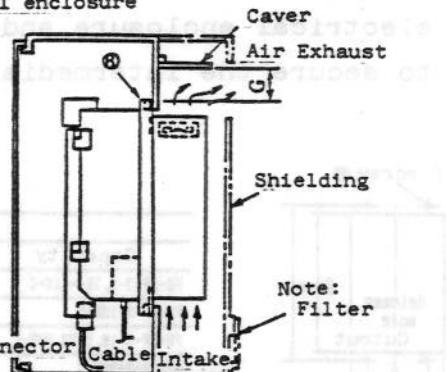


Ex. 2: When the cooling unit protrudes from the electrical enclosure, a suitable cover should be installed over the air outlet to prevent entrance of object

into the cooling unit.

Note: If the controller is located in a polluted environment (where oil mist arises), an air filter should be installed, as shown below, so that clean air is fed into the cooling unit.

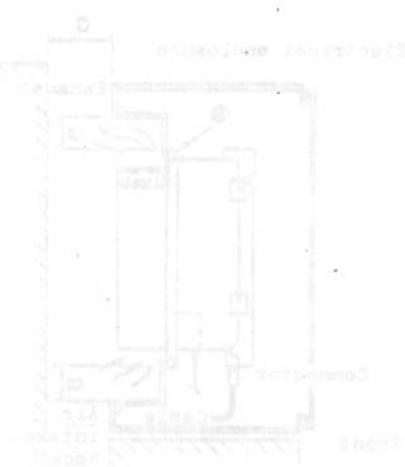
Electrical enclosure



DIM IN =

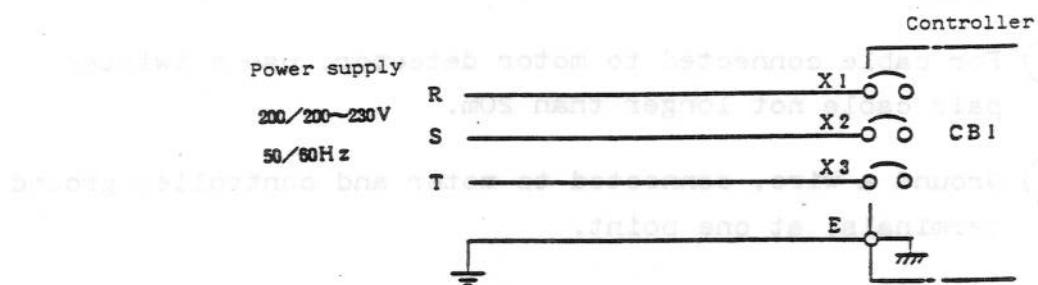
Dimensions

Capacity	G	Air intake/outtake area
PR-SF-2-3.7K~11K-C	100	100 x 280
PR-SF-2-15K-C	100	100 x 280
PR-SF-2-18.5, 22.25K-C	100	130 x 280
PR-SF-2-30K-C	100	150 x 420
PR-SF-2-37K-C	100	150 x 420
PR-SF-2-45K-C	100	150 x 420



§5. WIRING

5.1 Power supply connection

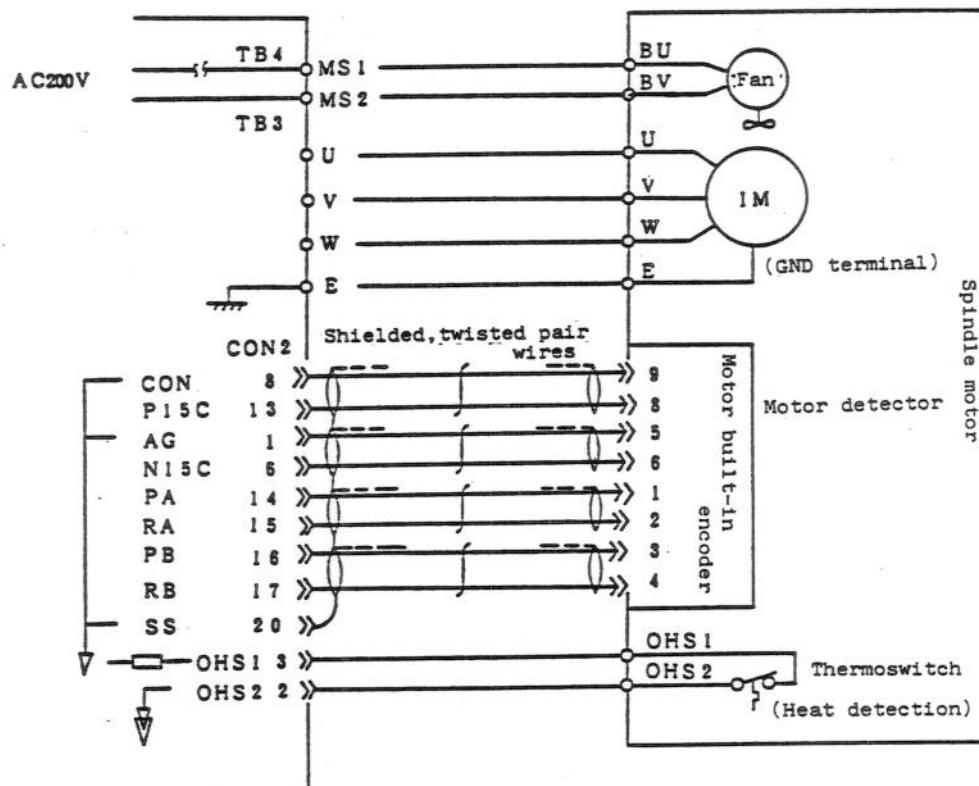


- (a) Take the power supply from facility which meets the requirements set forth in the specification.
 - (b) For power cable, use that listed at paragraph 5.4.

When a long cable is used, its size (sectional area) should be increased correspondingly.

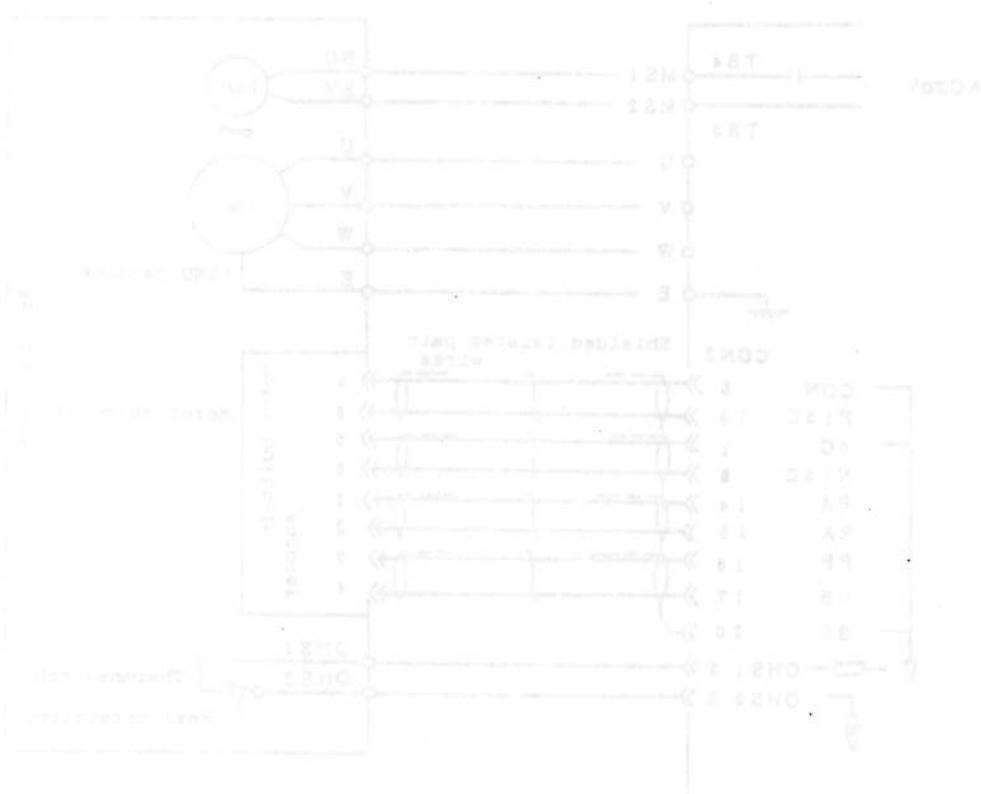
5.2 Motor connection

5.2.1 Standard motor

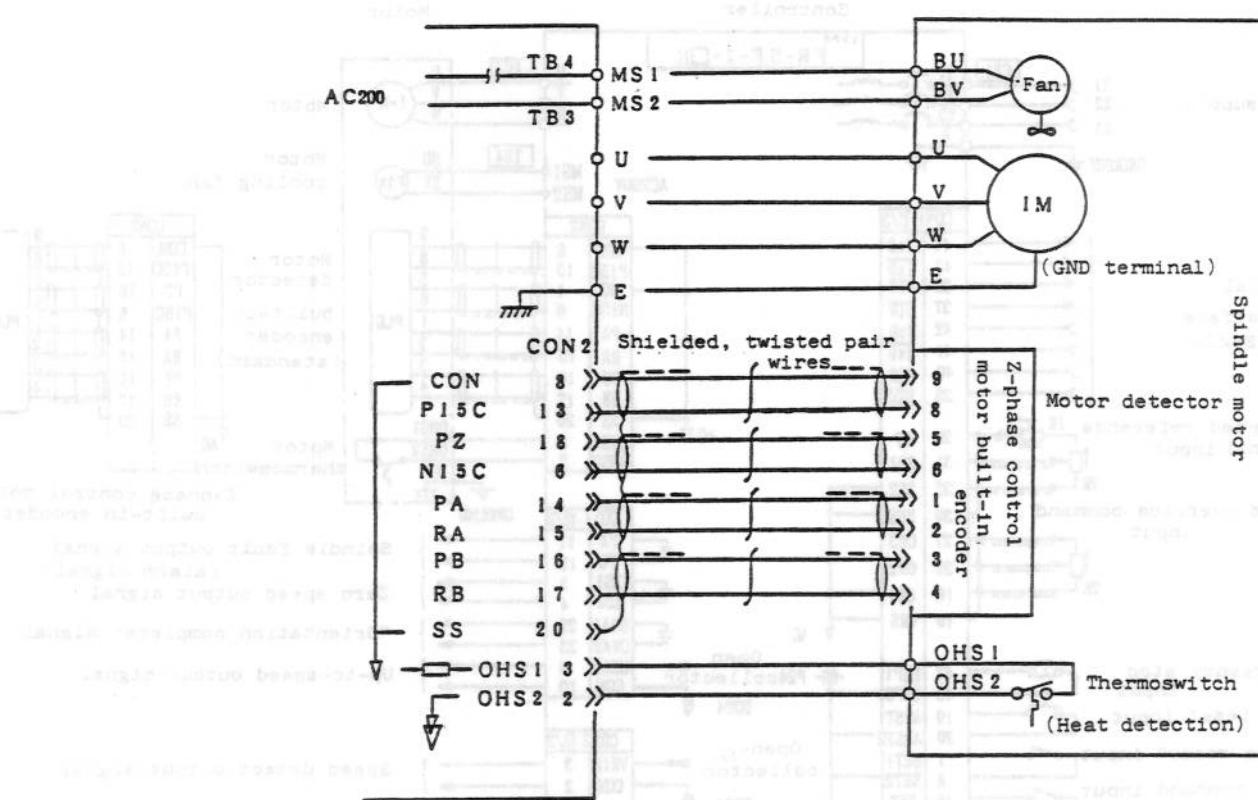


- a) The motor cooling fan runs while "machine ready" signal is on.

- (b) For main power cable to motor, use that listed at paragraph 5.4.
- (c) For cable connected to motor detector, use a twisted pair cable not longer than 20m.
- (d) Ground a wire, connected to motor and controller ground terminals, at one point.



5.2.2 Motor equipped with Z-phase control motor built-in encoder

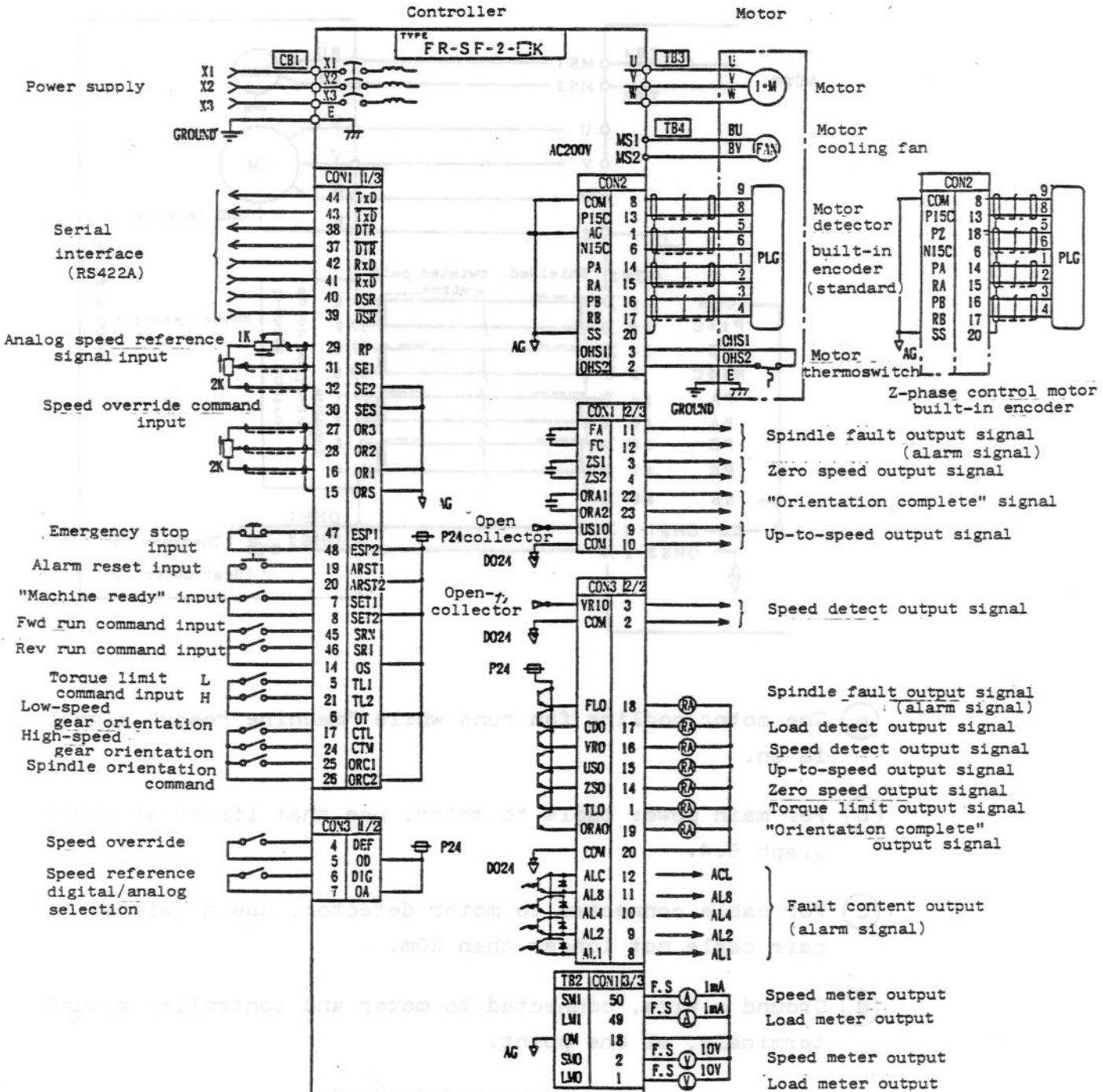


- (a) The motor cooling fan runs while "machine ready" signal is on.
- (b) For main power cable to motor, use that listed at paragraph 5.4.
- (c) For cable connected to motor detector, use a twisted pair cable not longer than 20m.
- (d) Ground a wire, connected to motor and controller ground terminals, at one point.

5.3 External wiring

5.3.1 Basic wiring (without option card)

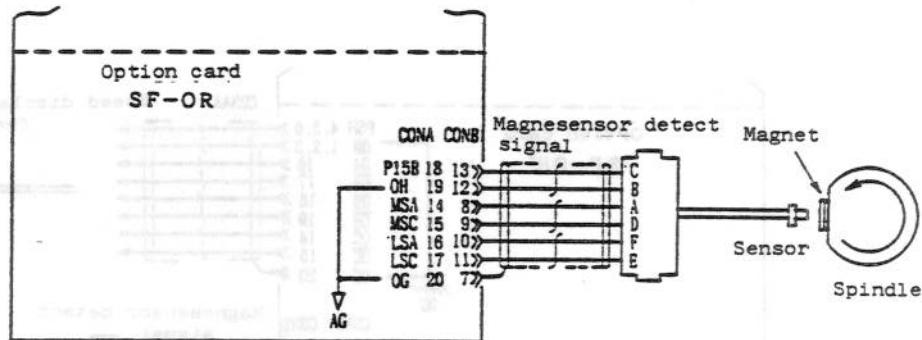
FR-SF-2-[]K



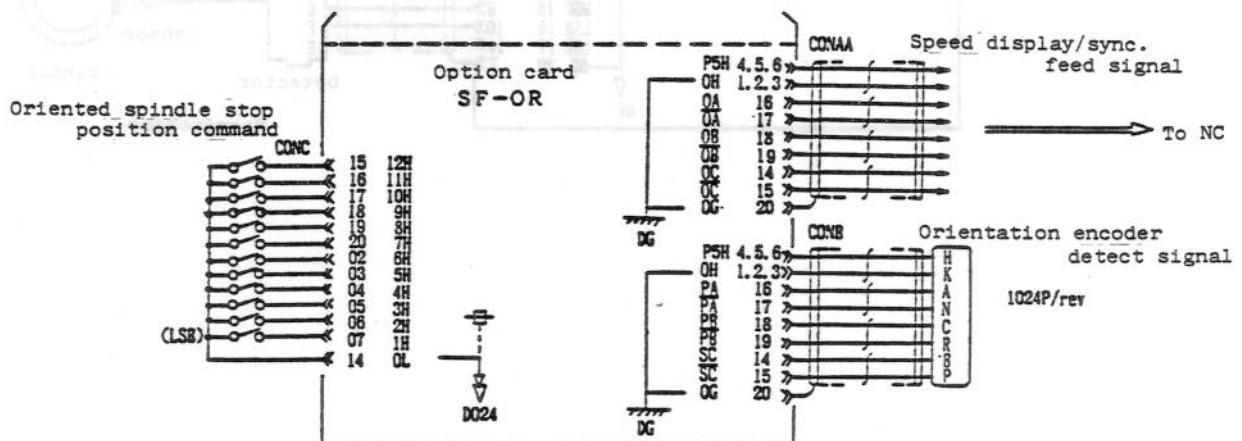
5.3.2 Model equipped with oriented spindle stop function
(with option card SF-OR)

FR-SF-2-□ K-R

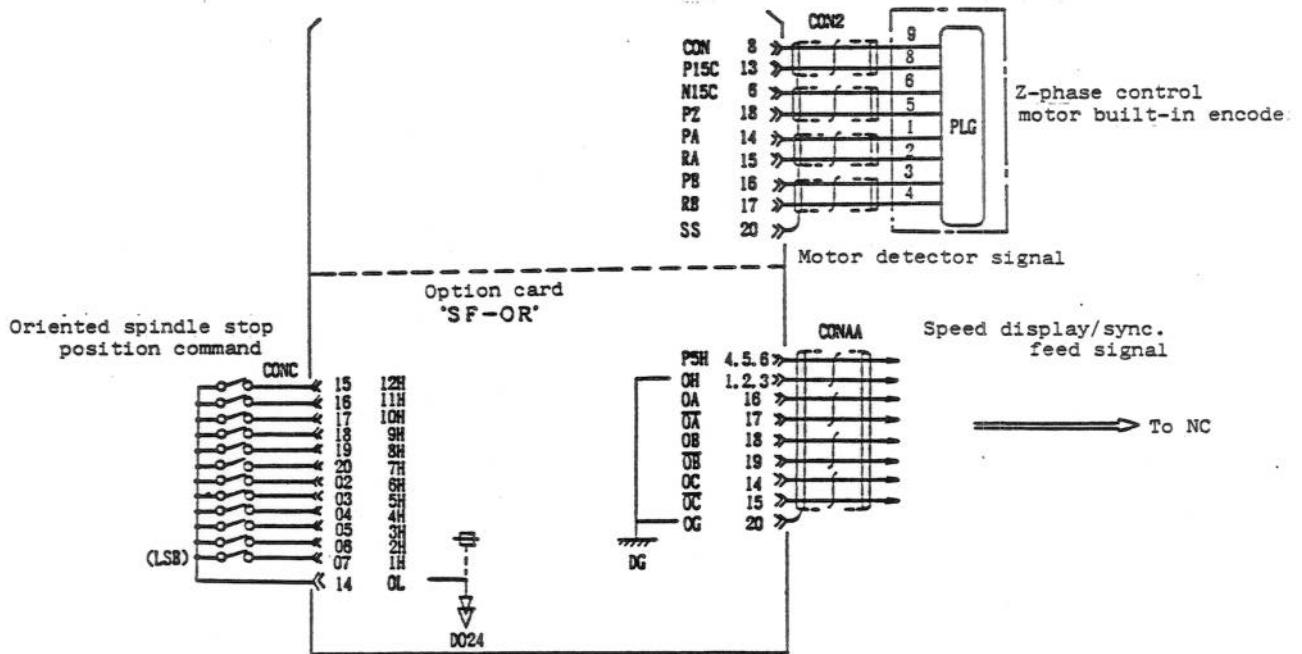
(1) Magnesensor spindle orientation (1 div.)



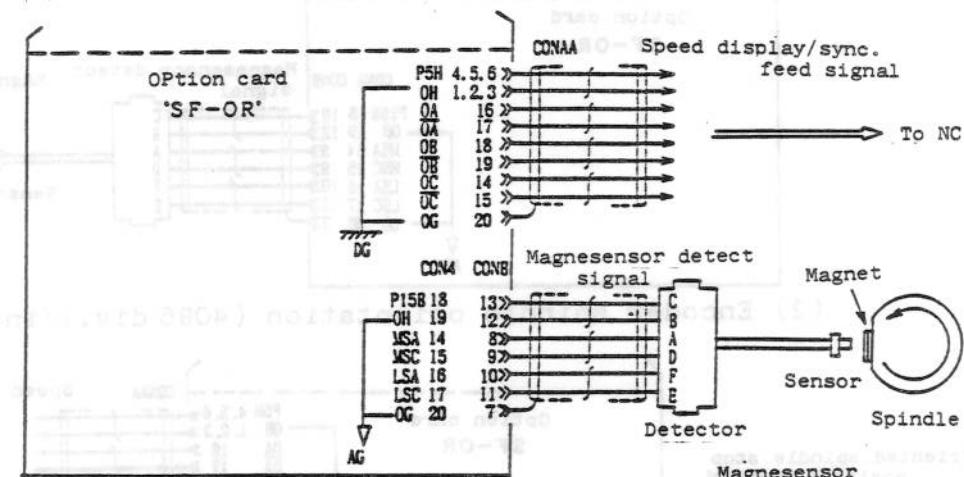
(2) Encoder spindle orientation (4096 div.)/indexing function



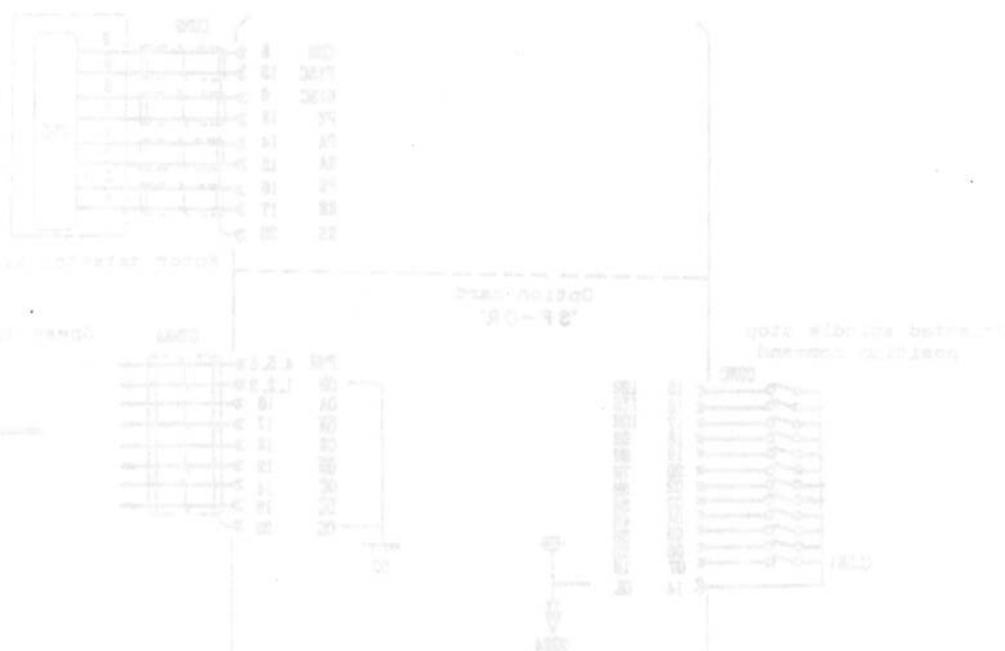
(3) Z-phase control motor built-in encoder multi-point spindle orientation/index function



(4) Magnesensor spindle orientation (1 div.) with motor speed feedback output (for spindle speed display, sync. feed signal)

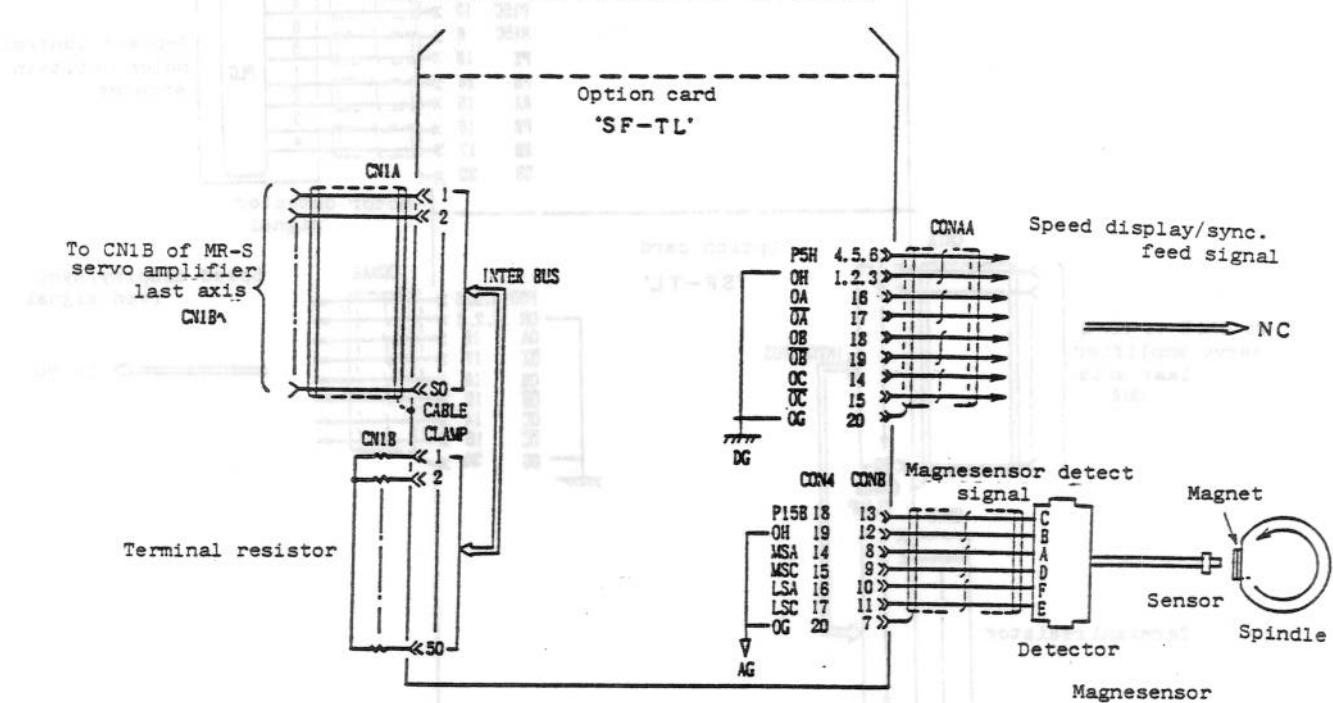


magnešistor se bome at-filid rodos. Tardinoe saaq-či at
naldonul xebni/moldzestashio sibniga

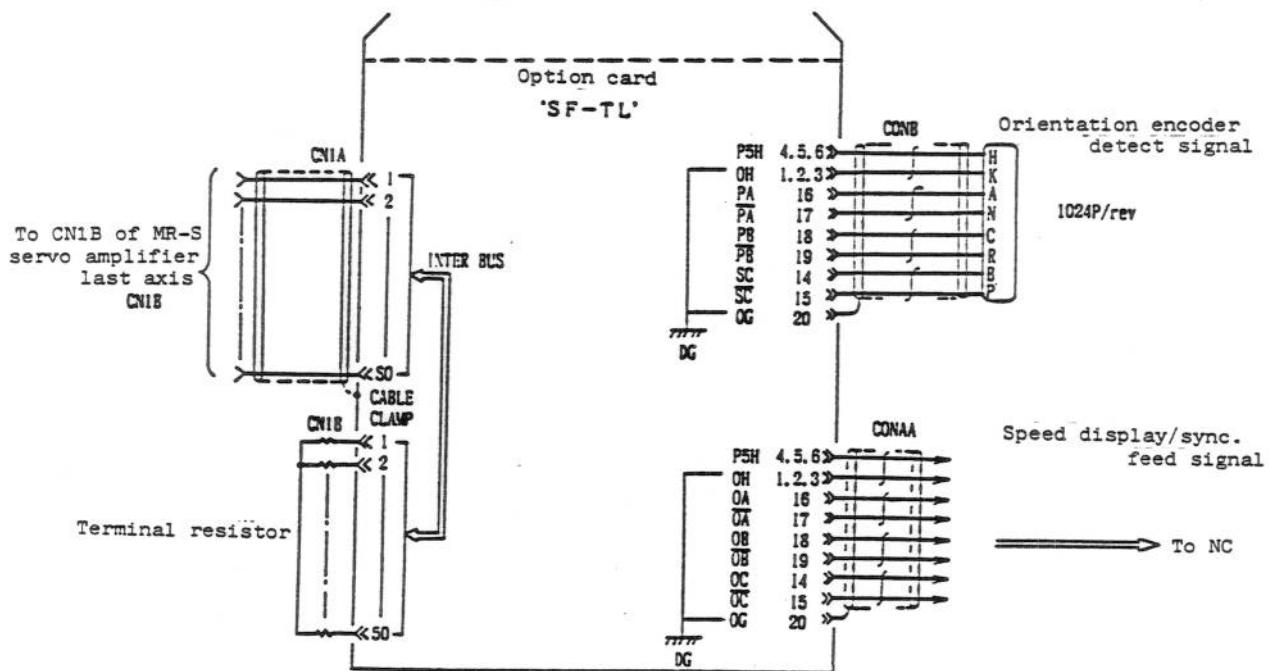


5.3.3 Model bus-linked to M300 series CNC, and equipped with high-speed sync. tap spindle orientation (with option card SF-TL) and FR-SF-2-[]K-T

(1) Motor built-in encoder high-speed sync. tap magnesensor spindle orientation (1 div.)

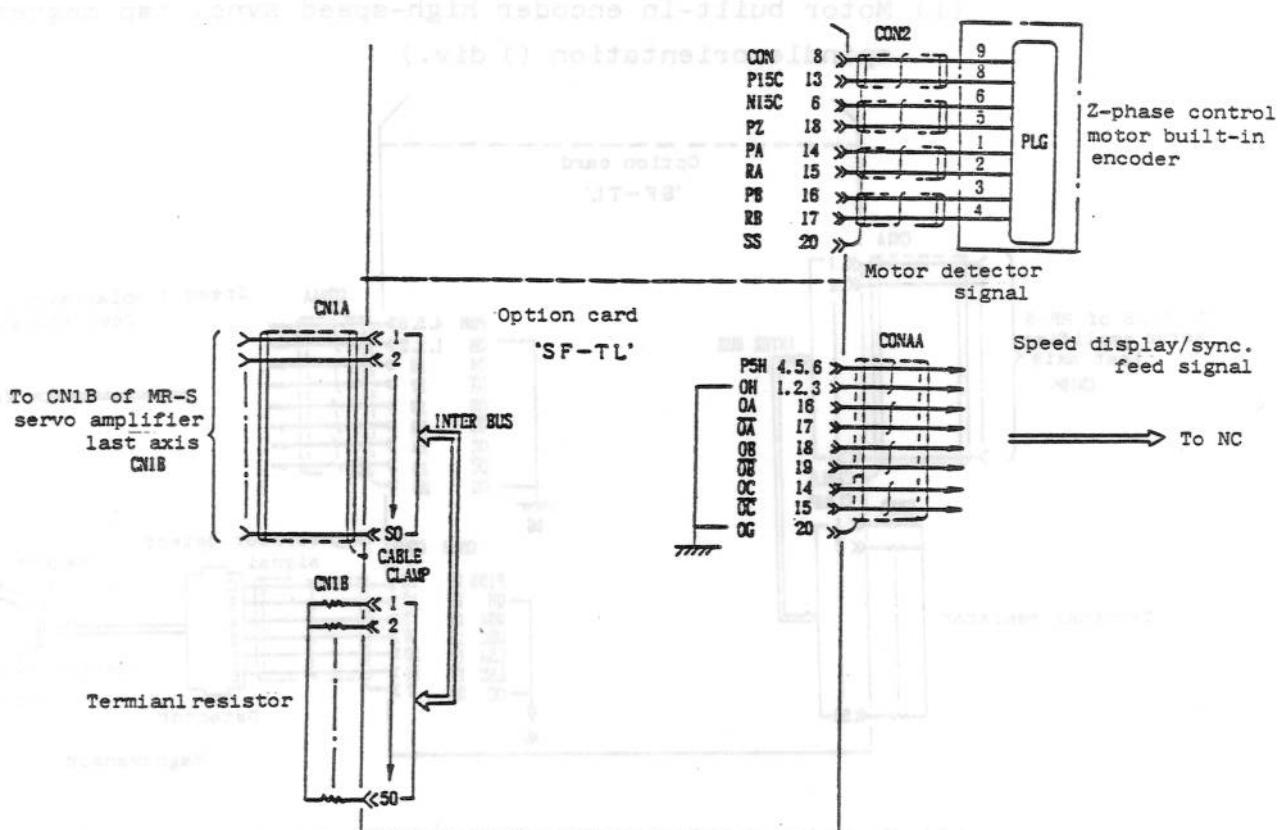


(2) Encoder high-speed sync. tap spindle orientation (4096 div.)/index function



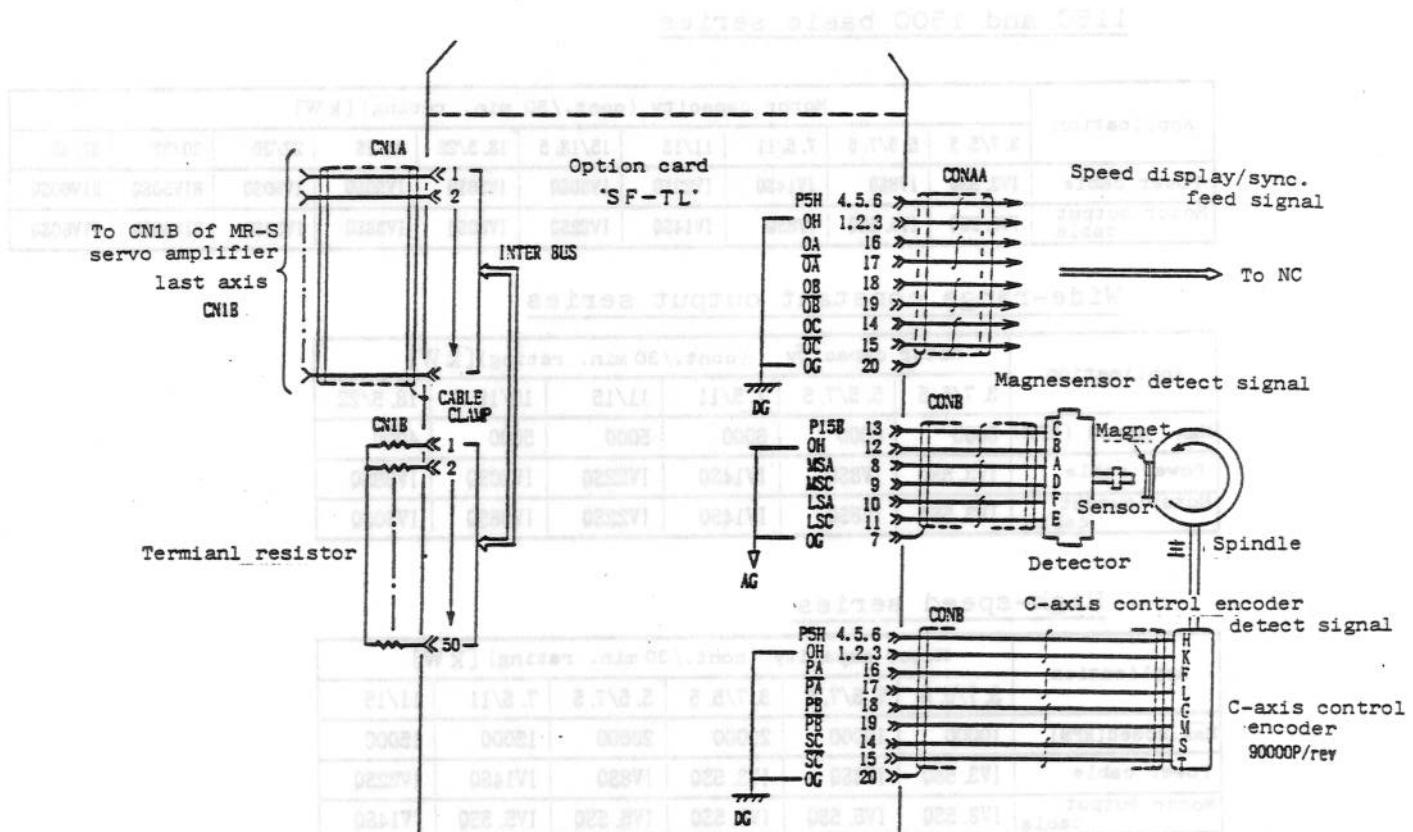
(3) Z-phase control motor built-in encoder high-speed

sync. tap multi-point spindle orientation/index function



5.3.4 Model bus-linked to M300 series CNC

(1) C-axis control magnesensor spindle orientation (with option card SF-TL) ref FR-SF-2-[]K-T



5.4 Cables for main circuit (power) connection

Use cables for power supply and motors in accordance with the following table:

1150 and 1500 basic series

Application	Motor capacity (cont./30 min. rating) [kW]									
	3.7/5.5	5.5/7.5	7.5/11	11/15	15/18.5	18.5/22	22/26	22/30	30/37	37/45
Power cable	IV3.5SQ	IV8SQ	IV14SQ	IV22SQ	IV30SQ	IV38SQ	IV50SQ	IV60SQ	HIV50SQ	HIV60SQ
Motor output cable	IV3.5SQ	IV5.5SQ	IV8SQ	IV14SQ	IV22SQ	IV30SQ	IV38SQ	IV38SQ	HIV50SQ	HIV60SQ

Wide-range constant output series

Application	Motor capacity (cont./30 min. rating) [kW]					
	3.7/5.5	5.5/7.5	7.5/11	11/15	15/18.5	18.5/22
Max. speed (RPM)	6000	6000	6000	5000	5000	4000
Power cable	IV3.5SQ	IV8SQ	IV14SQ	IV22SQ	IV30SQ	IV38SQ
Motor output cable	IV3.5SQ	IV8SQ	IV14SQ	IV22SQ	IV38SQ	IV60SQ

High-speed series

Application	Motor capacity (cont./30 min. rating) [kW]					
	3.7/5.5	5.5/7.5	3.7/5.5	5.5/7.5	7.5/11	11/15
Max. speed (RPM)	10000	10000	20000	20000	15000	15000
Power cable	IV3.5SQ	IV8SQ	IV3.5SQ	IV8SQ	IV14SQ	IV22SQ
Motor output cable	IV3.5SQ	IV5.5SQ	IV3.5SQ	IV5.5SQ	IV5.5SQ	IV14SQ

*1. Power cable selection is based on the conditions that ambient temperature is 30°C and three cables are accommodated in one cable way. Power cable should meet the power supply capacity (30 min. rating).

*2. Motor output cable selection is based on the conditions that ambient temperature is 30°C and three cables are accommodated in one cables way. Motor output cable should meet the current rated for continuous load.

*3. Ambient temperature, cable materials and wiring conditions should be taken into account to determine each cable.

5.5 Control circuit cables

5.5.1 Connectors used

- (1) Motor detector signal cable connector (motor side) pin arrangement

For connector on the motor side (AMP-350720-1), use the supplied one.

Standard PLG (Motor built-in encoder)	<table border="1"> <tr><td>3</td><td>2</td><td>1</td></tr> <tr><td>PB</td><td>RA</td><td>PA</td></tr> <tr><td>6</td><td>5</td><td>4</td></tr> <tr><td>N15C</td><td>AG</td><td>PB</td></tr> <tr><td>9</td><td>8</td><td>7</td></tr> <tr><td>COM</td><td>P15C</td><td></td></tr> </table>	3	2	1	PB	RA	PA	6	5	4	N15C	AG	PB	9	8	7	COM	P15C		Z-phase control PLG (Motor built-in encoder)	<table border="1"> <tr><td>3</td><td>2</td><td>1</td></tr> <tr><td>PB</td><td>RA</td><td>PA</td></tr> <tr><td>6</td><td>5</td><td>4</td></tr> <tr><td>N15C</td><td>PZ</td><td>PB</td></tr> <tr><td>9</td><td>8</td><td>7</td></tr> <tr><td>COM</td><td>P15C</td><td></td></tr> </table>	3	2	1	PB	RA	PA	6	5	4	N15C	PZ	PB	9	8	7	COM	P15C	
3	2	1																																					
PB	RA	PA																																					
6	5	4																																					
N15C	AG	PB																																					
9	8	7																																					
COM	P15C																																						
3	2	1																																					
PB	RA	PA																																					
6	5	4																																					
N15C	PZ	PB																																					
9	8	7																																					
COM	P15C																																						

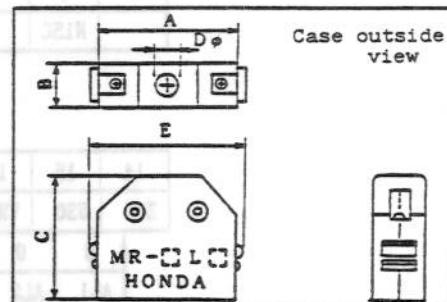
- (2) Dimensions of connector on controller side

Connector on the controller side is not supplied by us.

Manufacturer: HONDA TSUSHIN

Designation : MR- L

Circuits	Name	Dimensions				
		A	B	C	Dφ	E
50	MR-50L	67.9	18	44.8	16	(73.5)
20	MR-20L	39.3	18	39.8	11	(44.9)



(3) Standard controller (without optoin) connector pin arrangement

FR-SF-2-[]K

CON 1 Input/output signal
MR-50LF

50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
SM1	LM1	ESP2	ESP1	SRI	SRN	TXD	TXD	RXD	RXD	DSR	DSR	DTR	DTR				
				32	31	30	29	28	27	26	25	24	23	22	21	20	19
				SE2	SE1	SES	P15A	OR2	OR3	ORC2	ORC1	CTM	ORA2	ORA1	TL2	ARST2	ARST1
18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
OM	CTL	OR1	ORS	OS		FC	FA	D024	USO	SET2	SET1	OT	TL1	ZS2	ZS1	SM0	LMO

CON 2 Motor detector signal
MR-20LF Motor thermoswitch signal

20	19	18	17	16	15	14
SS		PZ	RB	PB	RA	PA
		13	12	11	10	9
		P15C				COM
7	6	5	4	3	2	1
N15C			OHS1	OHS2	AG	

CON 3 Input/output signal
MR-20LM

14	15	16	17	18	19	20
ZSO	USO	VRO	CDO	FLO	ORAO	COM
		8	9	10	11	12
		AL1	AL2	AL4	AL8	ALC
1	2	3	4	5	6	7
TLO	COM	VR10	DEF	OD	DIG	OA

(4) Connector pin arrangement for model equipped with option card SF-OR (only connectors for option card are shown)

FR-SF-2-□ K-R

CON 4

MR-20LF Magnesensor detect signal

CONB

MR-20LF Orientation encoder detect signal

CONAA

MR-20LF Speed display/sync. feed signal

20	19	18	17	16	15	14
OG	OB	OB	OA	OA	OC	OC
	13	12	11	10	9	8

7	6	5	4	3	2	1
	PSH	PSH	PSH	OH	OH	OH

CONC

MR-201.M Orientation position command

14	15	16	17	18	19	20
0L	12H	11H	10H	09H	08H	07H
8	9	10	11	12	13	
1	2	3	4	5	6	7
	06H	05H	04H	03H	02H	01H

(5) Connector pin arrangement for model equipped with option card SF-TL (only connectors for optoin card are shown)

FR-SF-2-[] K-T

CONB

MR-20LF Magnesensor orientation encoder detect signal

C-axis control encoder detect signal

20	19	18	17	16	15	14					
OG	PB	PB	PA	PA	SC	SC					
	13	12	11	10	9	8					
	P15B	OH	LSC	LSA	MSC	MSA					
7	6	5	4	3	2	1					
OG	P5H	P5H	P5H	OH	OH	OH					

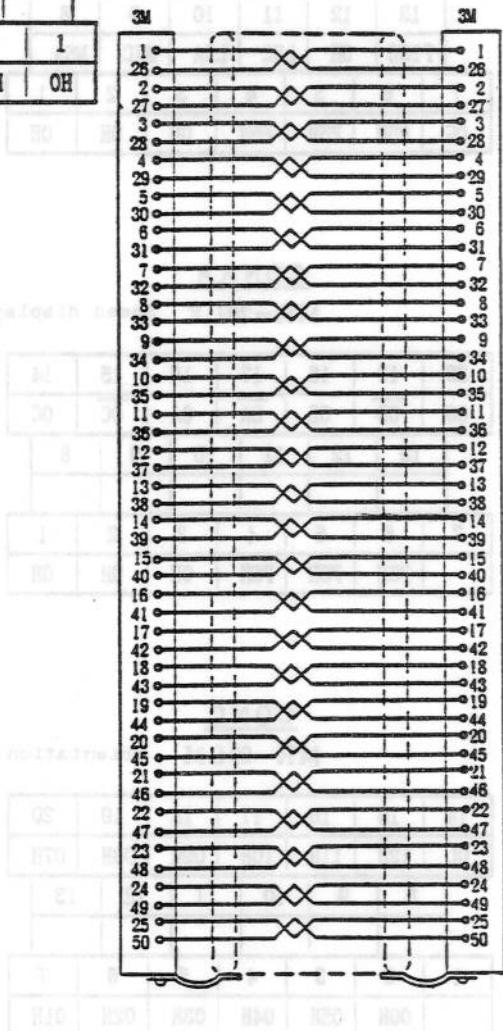
CONAA

MR-20LF Speed display/sync. feed signal

20	19	18	17	16	15	14					
OG	OB	OB	OA	OA	OC	OC					
	13	12	11	10	9	8					
7	6	5	4	3	2	1					
	P5H	P5H	P5H	OH	OH	OH					

CN1A CN1B

CN1A and CN1B are connectors
for bus-linkage to M300 CNC.



(6) Connector pin arrangement for option card SF-DA

(Only connectors for option card are shown) FR-SF-2-[]K-D

CON5

MR-20LF Magnesensor detect signal
Digital speed reference signal

20	19	18	17	16	15	14
OG	OH	P15B	LSC	LSA	MSC	MSA
	13	12	11	10	9	8
	OR	R12	R11	R10	R9	R8
7	6	5	4	3	2	1
R7	R6	R5	R4	R3	R2	R1

CONB

MR-20LF Orientation encoder detect signal

20	19	18	17	16	15	14
OG	PB	PB	PA	PA	SC	SC
	13	12	11	10	9	8
	P15B	OH	LSC	LSA	MSC	MSA
7	6	5	4	3	2	1
OG	P5H	P5H	P5H	OH	OH	OH

CONAA

MR-20LF Speed display/sync. feed signal

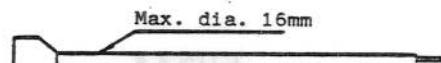
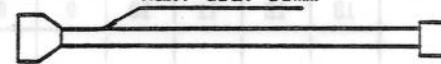
20	19	18	17	16	15	14
OG	OB	OB	OA	OA	OC	OC
	13	12	11	10	9	8
7	6	5	4	3	2	1
	P5H	P5H	P5H	OH	OH	OH

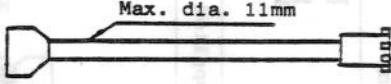
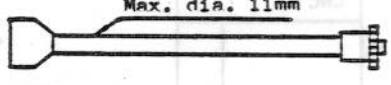
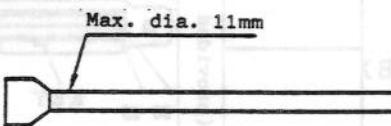
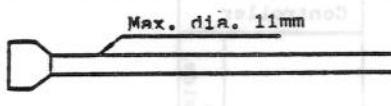
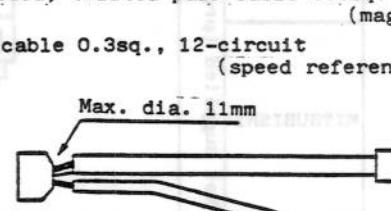
CONC

MR-20LM Orientation position command

14	15	16	17	18	19	20
OL	12H	11H	10H	09H	08H	07H
	8	9	10	11	12	13
1	2	3	4	5	6	7
	06H	05H	04H	03H	02H	01H

5.5.2 Control circuit cable list

Appli-cation	Symbol	Unit		Cable assembly	Unit	
		Part model	Manu-facturer		Part	Manu-facturer
Motor cooling fan	TB 4	Controller		Vinyl cabtyre cable 2sq., 2-circuit, except for one shown below	Motor (lead terminal)	
		Climp terminal 2 SQ - 4 2 pcs. (3 pcs.)			Climp terminal 2 SQ - 4 2 pcs. (3 pcs.)	
		—	Not supplied	2sq., 3-circuit cable for controller FR-SF-2-45K/ motor SF-45B	—	Not supplied
Indicator/meter	TB 2	Controller		2 twisted pair cable 0.3sq. for speed meter & load meter	Meter	
		Climp terminal 2 SQ - 3 4 pcs.			Climp terminal	
		—	Not supplied	—	—	Not supplied
I/O signal	CON 1	Controller		Shielded vinyl cable 0.2sq., 50-circuit	Signal input/output	
		MR-5OLF			—	
		HONDA	Not supplied	Max. dia. 16mm	—	
Motor detector signal/motor thermoswitch signal	CON 2	Controller		5 twisted pair cable 0.3sq.	Motor (connector)	
		MR-2OLF			Motor (lead terminal)	
		HONDA	Not supplied	Max. dia. 11mm	Connector AMP-350720-1	
I/O signal	CON 3	Controller		Cable length is to be less than 20m	Pin AMP-350689-1	
		MR-2OLM		Vinyl cable 0.3sq., 20-circuit	NIPPON AMP	
		HONDA	Not supplied	Max. dia. 11mm	Motor accessories	

Application	Symbol	Unit			Cable assembly	Unit	Part	Manufacturer	Supply
		Part model	Manufacturer	Supply					
Spindle orientation magnesensor detect signal	CON 4	Controller	MR-2OLF	HONDA	3 twisted pair cable 0.3sq.		Magnesensor amplifier	TRC116 -12A10 -7F10.5	Attached to magnesensor amplifier
		CONB			Cable length is to be less than 20m.				
Spindle orientation encoder detect signal	CON B	Controller	MR-2OLF	HOND	4 shielded, twisted pair cable 0.3sq.		Encoder	MS3106A20-29S	Attached to encoder
		CONB			Cable length is to be less than 20m.				
Speed display/sync. feed signal	CON A A	Controller	MR-2OLF	HONDA	4 shielded, twisted pair cable 0.3sq.		Signal input	—	—
		CONAA			Cable length is to be less than 20m.				
Oriented spindle stop position command	CON C	Controller	MR-2OLM	HONDA	Vinyl cable 0.3sq., 20-circuit		Singal output	—	—
		CONC			Cable length is to be less than 20m.				
Digital speed reference/ orientation magnesensor detect signal	CON 5	Controller	MR-2OLF	HONDA	3 shielded, twisted pair cable 0.3sq. (magnesensor)		Magnesensor amplifier Digital speed reference	TRC116 -12A10 -7F10.5	Attached to magnesensor amplifier
		CON5			Vinyl cable 0.3sq., 12-circuit (speed reference signal)				
					Cable length is to be less than 20m.				

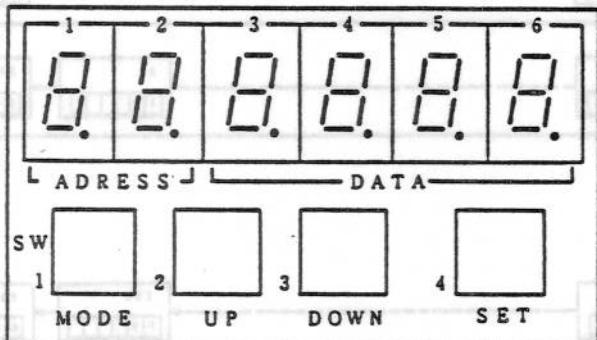
Application	Symbol	Unit		Cable assembly	Unit			
		Part model	Manufacturer			Part	Manufacturer	
C-axis control encoder signal/spindle orientation magenesensor/encoder signal	CONB	Controller		4 twisted pair cable 0.3sq.	Encoder Magne- sensor amp			
		MR-20LF	HONDA	Not supplied		MS3106A20-29		
						TRC116-12A10-7F10.5		
Bus-linkage to M300 series NC	CN1A (CN1B)	Controller Servo amp. CNC		C-axis control or orientation encoder Max. dia. 11mm Magenesensor amplifier Length of cable is to be less than 20m.		CANNON		
		CAM11	MITSUBISHI			TAJIMI	Attached to encoder/magnesensor	
Terminal resistor for bus-linkage to M300 series CNC (to be connected to CN1B)	CN1B	Controller		Not supplied (provided on CNC side)	Length: L			
		CABLE END	MITSUBISHI					

§ 6. STATUS DISPLAY AND PARAMETER SETTING

6.1 Display by FR-SF readout (LED)

For status display and parameter setting, the readout and switches of card CF-CA are used (when the controller FR-SF is bus-linked with M300 series CNC, a part of parameters can be set by the NC display unit.... for details, refer to 4.2).

6.1.1 Readout and switches (on card SF-CA)



Located on card SF-CA

"Operation status", "diagnosis", "error alarm", "parameter setting (1) - (8)" and "debug" can be displayed.

MODE: Display mode can be changed.

UP: Value displayed in ADDRESS and DATA can be incremented.

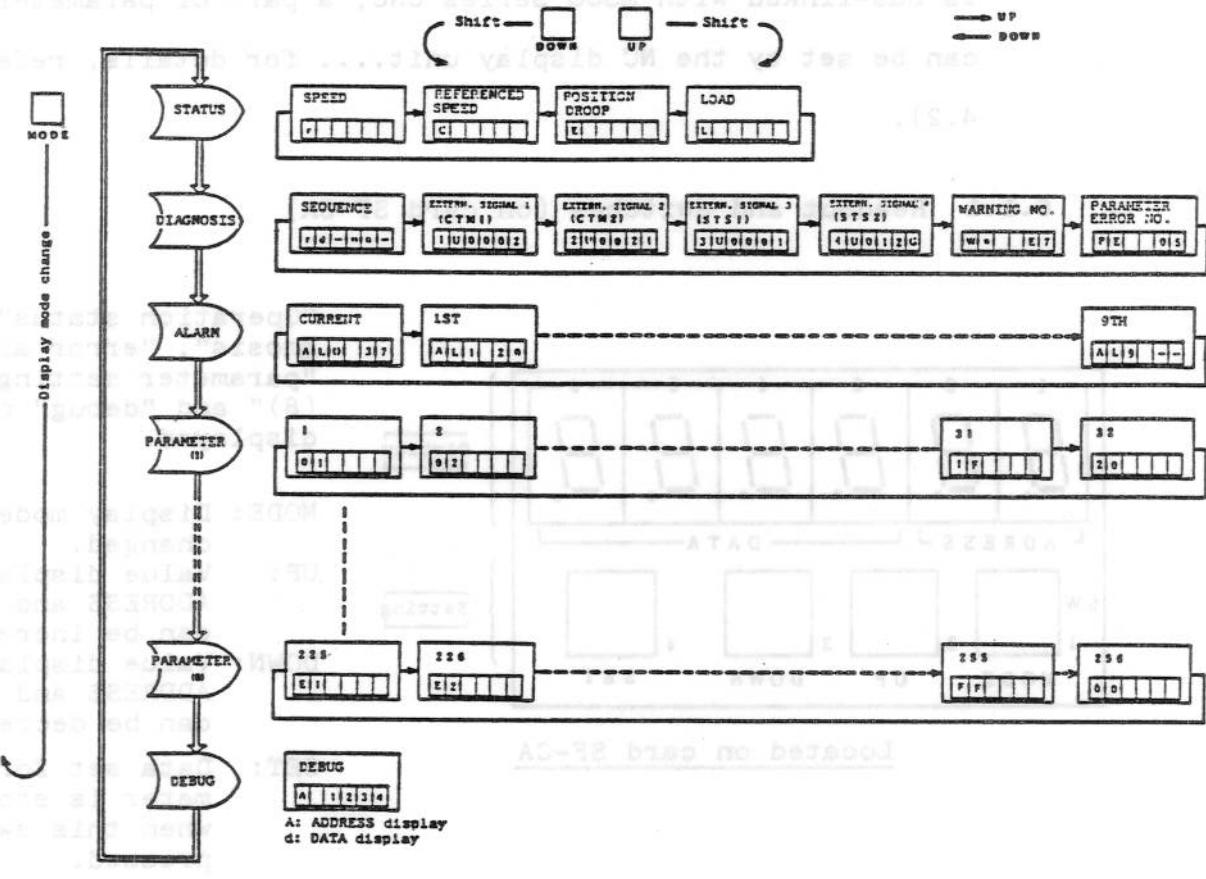
DOWN: Value displayed in ADDRESS and DATA can be decremented.

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

- There are 12 display modes, namely, "operation status", "diagnosis", "error alarm", "parameter setting (1) - (8)" and "debug".
- After turning on the power, "speed" is displayed in operation status mode unless alarm occurs.
- In case of alarm, alarm code is displayed in error alarm mode.
- Display mode can be changed by pressing **MODE** switch.

- e) For display mode sequence and display content, refer to
 6.1.2 "Readout display mode sequence".

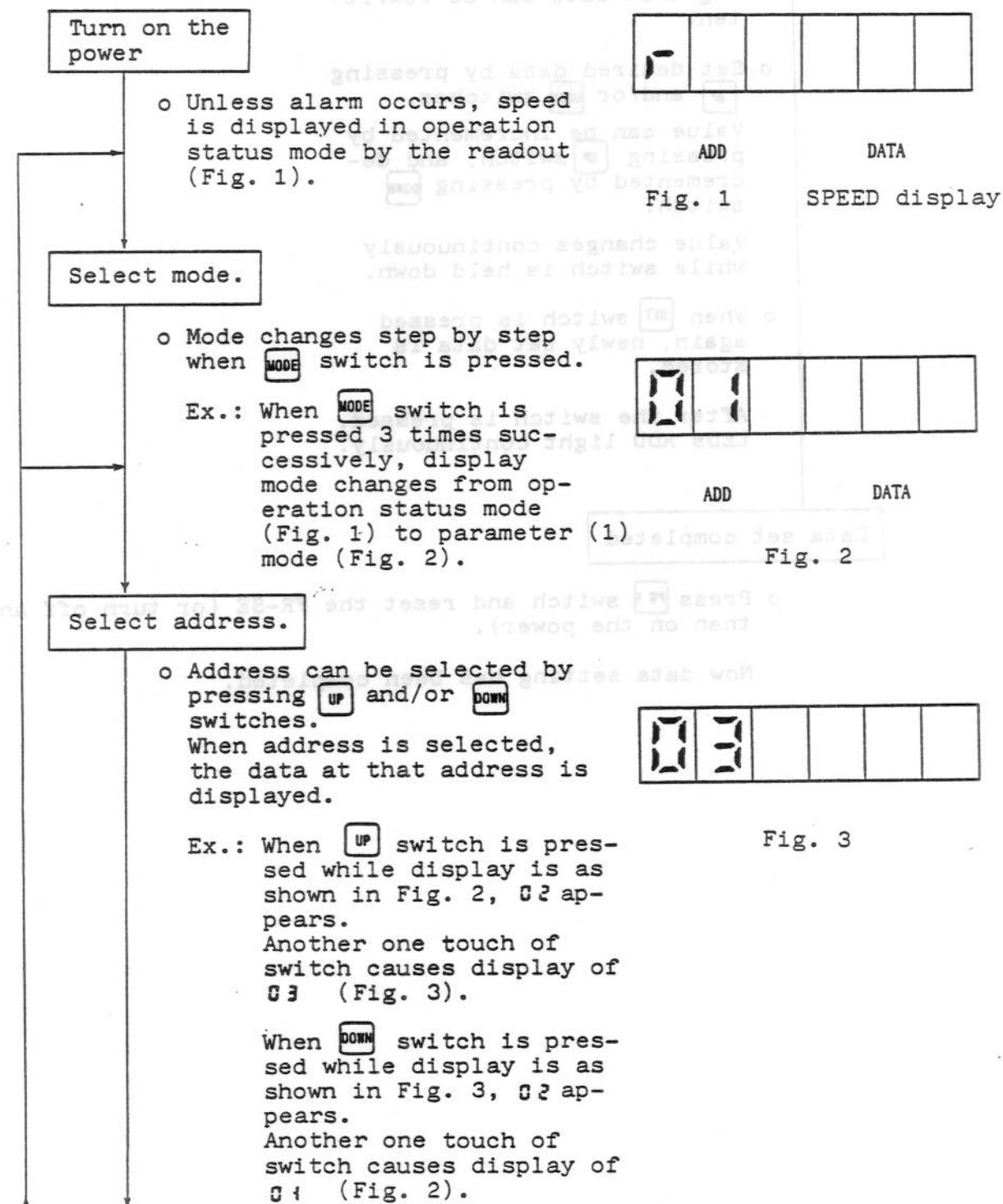
6.1.2 Readout display mode sequence



- Display mode can be selected by pressing **MODE** switch.
- Display content can be changed in the same display mode by pressing **UP** or **DOWM** switch.

6.1.3 Parameter setting

To specify parameter, set "SET1" and "SET2" (machine ready for operation) to "OFF".



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.

Data set completed

- Press **PB 1** switch and reset the FR-SE (or turn off and then on the power).

Now data setting has been completed.

6.1.7 Parameter list

#	Parameter	Description	Setting range (unit)
01	NOX	<p>Motor type</p> <p>Setting depends on motor specification.</p> <p>0: Standard/quasi-standard specification</p> <p>1: Wide range output specification</p> <p>2: Other special specification</p>	Decimal notation
02	MSL	<p>Motor selection</p> <p>Motor can be selected (0 ~ 63). (Refer to Appendix 1 "Motor parameter list".)</p>	Decimal notation
03	PLG	<p>Position loop encoder type</p> <p>Setting depends on number of pulses, specific to encoder.</p> <p>0: 1024 pulses (encoder orientationless)</p> <p>1: 90,000 pulses (for C-axis control)</p>	Decimal notation
04	MOD	<p>External interface mode selection</p> <p>Setting depends on interface type.</p> <p>0: DIO (specification is same as that of FR-SE)</p> <p>2: Linked to M300 series CNC through 2-port bus</p>	Decimal notation

#	Parameter	Description	Setting range (unit)
05	DSR	<p>Speed reference signal type</p> <p>Setting depends on input speed reference signal type.</p> <p>This parameter is valid when #04 MOD is set to "0".</p> <p>0: 12-bit binary 1: Signed 12-bit binary 2: BCD (2 digits) 3: BCD (3 digits)</p> <p>When signal is analog, either "0" or "1" is selected.</p> <p>For digital signal, one is selected from "0" - "4".</p>	Decimal notation
06	MON	<p>Output monitor selection</p> <p>Setting depends on type of meter output (analog voltage) from card SF-CA.</p> <p>0: Load meter 1: Torque meter</p> <p>Standard setting: 0</p>	Decimal notation
07	O1SL	Not used Set "0".	
08	O2SL	Not used Set "0".	
09	I1SL	<p>Auxiliary input selection</p> <p>TL1/TL2 input functions are set.</p> <p>0: Torque control input 1: Index input</p>	Decimal notation
0A	I2SL	Not used Set "0".	
0B	VOP	<p>Speed reference offset</p> <p>Offset is set when analog speed reference signal is used.</p> <p>Standard setting: 0</p>	<p>Signed decimal notation</p> <p>(-999 ≤ ≤ +999)</p>
0C	VON	Not used Set "0".	

Parameter	Description	Setting (unit)
OD VGP Speed reference signal gain	<p>Gain for speed reference signal is set.</p> <p>Actual speed reference is product obtained by multiplying speed reference signal from external signal source by this setting (1 multiplier = 1000).</p> <p>Standard setting: 1000</p>	Decimal notation (0 ≤ ≤1150)
OE VGN	Not used Set "0".	
OF CSN2 2nd cushion time constant	Not used Set "0".	Decimal notation
10 DTYP Data type	<p>Whether data of parameters #11 ~ #20 are valid or invalid depends on this setting.</p> <p>0: Invalid 1: Valid</p> <p>When "1" is selected, data set for parameters #11 ~ #20 become valid for input signal to connector CONC of card SF-OR.</p> <p>For details, refer to Specification "BNP-A0801-22".</p>	Decimal notation
11 DT01 Data 1	These data are valid when "1" is set for #10 parameter (data type).	Decimal notation
12 DT02 Data 2		
13 DT03 Data 3		
14 DT04 Data 4		
15 DT05 Data 5		
16 DT06 Data 6		
17 DT07 Data 7		
18 DT08 Data 8		
19 DT09 Data 9		
1A DT10 Data 10		
1B DT11 Data 11		
1C DT12 Data 12		

#	Parameter	Description	Setting range (unit)	
1D	DT13	Not used Set "0".	0-359 deg.	
1E	DT14	Not used Set "0".	0-359 deg.	
1F	DT15	Not used Set "0".	0-359 deg.	
20		Not used Set "0".	0-359 deg.	
* 21	PG1	<p>Spindle orientation 1st deceleration point</p> <p>Encoder spindle orientation: Angle from which creep speed starts is set. Standard setting: 180</p> <p>Magnesensor spindle orientation: Time taken for start of creep speed after passing over linear zone is set. Standard setting: 133</p>	Encoder	Magne-sensor 0 - 500 ms
* 22	PG2	<p>Spindle orientation 2nd deceleration point</p> <p>Angle at which creep speed for spindle orientation starts is set. Standard setting: 20</p>		0 - 40 deg.
* 23	PGC	<p>Sync. tap C-axis control position loop gain</p> <p>Spindle position loop gain during sync. tap C-axis control is set. Standard setting: 40 (NC display standard setting: 10.00)</p>	1 - 512 (1/4rad/ (1/4rad/s) 0.01 - 999.99 (rad/s) for parameter on NC display	IOTG II
* 24	ZRZ	<p>Spindle orientation in-position range</p> <p>Positioning range within which "orientation complete" signal is output is set. Standard setting: 16 (NC display standard setting: 1.00)</p>	Encoder 1 - 5760 (1/16 deg.) For parameter on NC display 0 - 359 deg.	Magne-sensor 1 - 512 (1/16 deg.) 0 - 39 deg.

#	Parameter	Description	Setting range (unit)	
*	25 OSP	Spindle orientation speed Speed at which spindle is oriented is set. Standard setting: 220	0 - 1000rpm	
*	26 CSP	Creep speed Creep speed is set. Standard setting: 20	0 - 1000rpm	
*	27 PST	Position shift Oriented spindle 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	Magnesensor
*	28 BRC	Not used Set "0".		
29		Not used Set "0".		
2A		Not used Set "0".		
2B		Not used Set "0".		
2C		Not used Set "0".		
2D		Not used Set "0".		
2E		Not used Set "0".		

Note: Parameter marked with * is set on the NC side when FR-SF is bus-linked to M300 series CNC.

No.	Parameter	Description	Setting range (unit)																																																																																																																																																																																																																																																																																																																																
* 2F	ORS1	<p>Oriented spindle stop control 1</p> <table border="1"> <tr><td>F</td><td>E</td><td>D</td><td>C</td><td>B</td><td>A</td><td>9</td><td>8</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="4">Oriented spindle stop K₁ magnif.</td><td colspan="4">Oriented spindle stop K_r magnif.</td><td colspan="4">servo lock control</td><td colspan="4">w, select [rad/s]</td></tr> <tr><td colspan="4">4-bit combination</td><td colspan="4">4-bit combination</td><td colspan="4">4-bit combination</td><td colspan="4"></td></tr> <tr><td>0 : 0.6 (folds)</td><td>0 : 0.6 (folds)</td><td>0 : Delay/advance</td><td>0 : 0.55 [rad/s]</td><td>1 : 0.1</td><td>1 : PI</td><td>1 : 0.1</td><td>1 : 0.7</td><td>2 : 0.8</td><td>2 : 0.8</td><td>2 : 1.65</td><td>3 : 0.9</td><td>3 : 0.9</td><td>3 : 2.2</td><td>4 : 1.2</td><td>4 : 1.2</td><td>4 : 2.75</td></tr> <tr><td>1 : 0.7</td><td>1 : 0.7</td><td>1 : 1.4</td><td>1 : 3.85</td><td>2 : 0.8</td><td>2 : 0.8</td><td>2 : 1.65</td><td>2 : 3.3</td><td>3 : 0.9</td><td>3 : 0.9</td><td>3 : 2.2</td><td>4 : 1.6</td><td>4 : 1.6</td><td>4 : 4.4</td><td>5 : 1.2</td><td>5 : 1.2</td><td>5 : 3.3</td></tr> <tr><td>2 : 0.8</td><td>2 : 0.8</td><td>2 : 1.4</td><td>2 : 3.85</td><td>3 : 0.9</td><td>3 : 0.9</td><td>3 : 2.2</td><td>3 : 4.4</td><td>4 : 1.6</td><td>4 : 1.6</td><td>4 : 4.4</td><td>5 : 1.8</td><td>5 : 1.8</td><td>5 : 4.95</td><td>6 : 1.4</td><td>6 : 1.4</td><td>6 : 3.85</td></tr> <tr><td>3 : 0.9</td><td>3 : 0.9</td><td>3 : 1.4</td><td>3 : 3.85</td><td>4 : 1.6</td><td>4 : 1.6</td><td>4 : 2.2</td><td>4 : 4.4</td><td>5 : 1.8</td><td>5 : 1.8</td><td>5 : 4.95</td><td>6 : 2.2</td><td>6 : 2.2</td><td>6 : 5.5</td><td>7 : 1.6</td><td>7 : 1.6</td><td>7 : 4.4</td></tr> <tr><td>4 : 1.2</td><td>4 : 1.2</td><td>4 : 2.2</td><td>4 : 6.05</td><td>5 : 1.2</td><td>5 : 1.2</td><td>5 : 2.2</td><td>5 : 6.05</td><td>6 : 1.4</td><td>6 : 1.4</td><td>6 : 2.2</td><td>7 : 1.6</td><td>7 : 1.6</td><td>7 : 5.5</td><td>8 : 1.8</td><td>8 : 1.8</td><td>8 : 4.95</td></tr> <tr><td>5 : 1.2</td><td>5 : 1.2</td><td>5 : 2.2</td><td>5 : 6.05</td><td>6 : 1.4</td><td>6 : 1.4</td><td>6 : 2.2</td><td>6 : 6.05</td><td>7 : 1.6</td><td>7 : 1.6</td><td>7 : 2.2</td><td>8 : 2</td><td>8 : 2</td><td>8 : 5.5</td><td>9 : 2</td><td>9 : 2</td><td>9 : 5.5</td></tr> <tr><td>6 : 1.4</td><td>6 : 1.4</td><td>6 : 2.2</td><td>6 : 6.05</td><td>7 : 1.6</td><td>7 : 1.6</td><td>7 : 2.2</td><td>7 : 6.05</td><td>8 : 1.8</td><td>8 : 1.8</td><td>8 : 2.2</td><td>A : 2.2</td><td>A : 2.2</td><td>A : 6.05</td><td>B : 2.4</td><td>B : 2.4</td><td>B : 6.6</td></tr> <tr><td>7 : 1.6</td><td>7 : 1.6</td><td>7 : 2.2</td><td>7 : 6.05</td><td>8 : 1.8</td><td>8 : 1.8</td><td>8 : 2.2</td><td>8 : 6.05</td><td>9 : 2</td><td>9 : 2</td><td>9 : 2.2</td><td>C : 2.6</td><td>C : 2.6</td><td>C : 7.15</td><td>D : 2.8</td><td>D : 2.8</td><td>D : 7.7</td></tr> <tr><td>8 : 1.8</td><td>8 : 1.8</td><td>8 : 2.2</td><td>8 : 7.7</td><td>9 : 2</td><td>9 : 2</td><td>9 : 2.2</td><td>9 : 7.7</td><td>A : 2.2</td><td>A : 2.2</td><td>A : 2.2</td><td>E : 3</td><td>E : 3</td><td>E : 8.25</td><td>F : 3.2</td><td>F : 3.2</td><td>F : 8.8</td></tr> <tr><td>9 : 2</td><td>9 : 2</td><td>9 : 2.2</td><td>9 : 8.25</td><td>C : 2.6</td><td>C : 2.6</td><td>C : 7.15</td><td>C : 8.25</td><td>B : 2.4</td><td>B : 2.4</td><td>B : 2.4</td><td>D : 2.8</td><td>D : 2.8</td><td>D : 7.7</td><td>E : 3</td><td>E : 3</td><td>E : 8.25</td></tr> <tr><td>A : 2.2</td><td>A : 2.2</td><td>A : 2.2</td><td>A : 8.25</td><td>B : 2.4</td><td>B : 2.4</td><td>B : 2.4</td><td>B : 8.25</td><td>C : 2.6</td><td>C : 2.6</td><td>C : 7.15</td><td>D : 2.8</td><td>D : 2.8</td><td>D : 7.7</td><td>E : 3</td><td>E : 3</td><td>E : 8.25</td></tr> <tr><td>B : 2.4</td><td>B : 2.4</td><td>B : 2.4</td><td>B : 8.25</td><td>C : 2.6</td><td>C : 2.6</td><td>C : 7.15</td><td>C : 8.25</td><td>D : 2.8</td><td>D : 2.8</td><td>D : 7.7</td><td>E : 3</td><td>E : 3</td><td>E : 8.25</td><td>F : 3.2</td><td>F : 3.2</td><td>F : 8.8</td></tr> <tr><td>C : 2.6</td><td>C : 2.6</td><td>C : 7.15</td><td>C : 8.25</td><td>D : 2.8</td><td>D : 2.8</td><td>D : 7.7</td><td>D : 8.25</td><td>E : 3</td><td>E : 3</td><td>E : 8.25</td><td>F : 3.2</td><td>F : 3.2</td><td>F : 8.8</td><td></td><td></td><td></td></tr> <tr><td>D : 2.8</td><td>D : 2.8</td><td>D : 7.7</td><td>D : 8.25</td><td>E : 3</td><td>E : 3</td><td>E : 8.25</td><td>E : 8.25</td><td>F : 3.2</td><td>F : 3.2</td><td>F : 8.8</td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>E : 3</td><td>E : 3</td><td>E : 8.25</td><td>E : 8.25</td><td>F : 3.2</td><td>F : 3.2</td><td>F : 8.8</td><td>F : 8.8</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td>F : 3.2</td><td>F : 3.2</td><td>F : 8.8</td><td>F : 8.8</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table> <p style="text-align: right;">Standard setting: 6601</p>	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0	Oriented spindle stop K ₁ magnif.				Oriented spindle stop K _r magnif.				servo lock control				w, select [rad/s]				4-bit combination				4-bit combination				4-bit combination								0 : 0.6 (folds)	0 : 0.6 (folds)	0 : Delay/advance	0 : 0.55 [rad/s]	1 : 0.1	1 : PI	1 : 0.1	1 : 0.7	2 : 0.8	2 : 0.8	2 : 1.65	3 : 0.9	3 : 0.9	3 : 2.2	4 : 1.2	4 : 1.2	4 : 2.75	1 : 0.7	1 : 0.7	1 : 1.4	1 : 3.85	2 : 0.8	2 : 0.8	2 : 1.65	2 : 3.3	3 : 0.9	3 : 0.9	3 : 2.2	4 : 1.6	4 : 1.6	4 : 4.4	5 : 1.2	5 : 1.2	5 : 3.3	2 : 0.8	2 : 0.8	2 : 1.4	2 : 3.85	3 : 0.9	3 : 0.9	3 : 2.2	3 : 4.4	4 : 1.6	4 : 1.6	4 : 4.4	5 : 1.8	5 : 1.8	5 : 4.95	6 : 1.4	6 : 1.4	6 : 3.85	3 : 0.9	3 : 0.9	3 : 1.4	3 : 3.85	4 : 1.6	4 : 1.6	4 : 2.2	4 : 4.4	5 : 1.8	5 : 1.8	5 : 4.95	6 : 2.2	6 : 2.2	6 : 5.5	7 : 1.6	7 : 1.6	7 : 4.4	4 : 1.2	4 : 1.2	4 : 2.2	4 : 6.05	5 : 1.2	5 : 1.2	5 : 2.2	5 : 6.05	6 : 1.4	6 : 1.4	6 : 2.2	7 : 1.6	7 : 1.6	7 : 5.5	8 : 1.8	8 : 1.8	8 : 4.95	5 : 1.2	5 : 1.2	5 : 2.2	5 : 6.05	6 : 1.4	6 : 1.4	6 : 2.2	6 : 6.05	7 : 1.6	7 : 1.6	7 : 2.2	8 : 2	8 : 2	8 : 5.5	9 : 2	9 : 2	9 : 5.5	6 : 1.4	6 : 1.4	6 : 2.2	6 : 6.05	7 : 1.6	7 : 1.6	7 : 2.2	7 : 6.05	8 : 1.8	8 : 1.8	8 : 2.2	A : 2.2	A : 2.2	A : 6.05	B : 2.4	B : 2.4	B : 6.6	7 : 1.6	7 : 1.6	7 : 2.2	7 : 6.05	8 : 1.8	8 : 1.8	8 : 2.2	8 : 6.05	9 : 2	9 : 2	9 : 2.2	C : 2.6	C : 2.6	C : 7.15	D : 2.8	D : 2.8	D : 7.7	8 : 1.8	8 : 1.8	8 : 2.2	8 : 7.7	9 : 2	9 : 2	9 : 2.2	9 : 7.7	A : 2.2	A : 2.2	A : 2.2	E : 3	E : 3	E : 8.25	F : 3.2	F : 3.2	F : 8.8	9 : 2	9 : 2	9 : 2.2	9 : 8.25	C : 2.6	C : 2.6	C : 7.15	C : 8.25	B : 2.4	B : 2.4	B : 2.4	D : 2.8	D : 2.8	D : 7.7	E : 3	E : 3	E : 8.25	A : 2.2	A : 2.2	A : 2.2	A : 8.25	B : 2.4	B : 2.4	B : 2.4	B : 8.25	C : 2.6	C : 2.6	C : 7.15	D : 2.8	D : 2.8	D : 7.7	E : 3	E : 3	E : 8.25	B : 2.4	B : 2.4	B : 2.4	B : 8.25	C : 2.6	C : 2.6	C : 7.15	C : 8.25	D : 2.8	D : 2.8	D : 7.7	E : 3	E : 3	E : 8.25	F : 3.2	F : 3.2	F : 8.8	C : 2.6	C : 2.6	C : 7.15	C : 8.25	D : 2.8	D : 2.8	D : 7.7	D : 8.25	E : 3	E : 3	E : 8.25	F : 3.2	F : 3.2	F : 8.8				D : 2.8	D : 2.8	D : 7.7	D : 8.25	E : 3	E : 3	E : 8.25	E : 8.25	F : 3.2	F : 3.2	F : 8.8							E : 3	E : 3	E : 8.25	E : 8.25	F : 3.2	F : 3.2	F : 8.8	F : 8.8										F : 3.2	F : 3.2	F : 8.8	F : 8.8														Hexadeci-mal no-tation
F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0																																																																																																																																																																																																																																																																																																																				
Oriented spindle stop K ₁ magnif.				Oriented spindle stop K _r magnif.				servo lock control				w, select [rad/s]																																																																																																																																																																																																																																																																																																																							
4-bit combination				4-bit combination				4-bit combination																																																																																																																																																																																																																																																																																																																											
0 : 0.6 (folds)	0 : 0.6 (folds)	0 : Delay/advance	0 : 0.55 [rad/s]	1 : 0.1	1 : PI	1 : 0.1	1 : 0.7	2 : 0.8	2 : 0.8	2 : 1.65	3 : 0.9	3 : 0.9	3 : 2.2	4 : 1.2	4 : 1.2	4 : 2.75																																																																																																																																																																																																																																																																																																																			
1 : 0.7	1 : 0.7	1 : 1.4	1 : 3.85	2 : 0.8	2 : 0.8	2 : 1.65	2 : 3.3	3 : 0.9	3 : 0.9	3 : 2.2	4 : 1.6	4 : 1.6	4 : 4.4	5 : 1.2	5 : 1.2	5 : 3.3																																																																																																																																																																																																																																																																																																																			
2 : 0.8	2 : 0.8	2 : 1.4	2 : 3.85	3 : 0.9	3 : 0.9	3 : 2.2	3 : 4.4	4 : 1.6	4 : 1.6	4 : 4.4	5 : 1.8	5 : 1.8	5 : 4.95	6 : 1.4	6 : 1.4	6 : 3.85																																																																																																																																																																																																																																																																																																																			
3 : 0.9	3 : 0.9	3 : 1.4	3 : 3.85	4 : 1.6	4 : 1.6	4 : 2.2	4 : 4.4	5 : 1.8	5 : 1.8	5 : 4.95	6 : 2.2	6 : 2.2	6 : 5.5	7 : 1.6	7 : 1.6	7 : 4.4																																																																																																																																																																																																																																																																																																																			
4 : 1.2	4 : 1.2	4 : 2.2	4 : 6.05	5 : 1.2	5 : 1.2	5 : 2.2	5 : 6.05	6 : 1.4	6 : 1.4	6 : 2.2	7 : 1.6	7 : 1.6	7 : 5.5	8 : 1.8	8 : 1.8	8 : 4.95																																																																																																																																																																																																																																																																																																																			
5 : 1.2	5 : 1.2	5 : 2.2	5 : 6.05	6 : 1.4	6 : 1.4	6 : 2.2	6 : 6.05	7 : 1.6	7 : 1.6	7 : 2.2	8 : 2	8 : 2	8 : 5.5	9 : 2	9 : 2	9 : 5.5																																																																																																																																																																																																																																																																																																																			
6 : 1.4	6 : 1.4	6 : 2.2	6 : 6.05	7 : 1.6	7 : 1.6	7 : 2.2	7 : 6.05	8 : 1.8	8 : 1.8	8 : 2.2	A : 2.2	A : 2.2	A : 6.05	B : 2.4	B : 2.4	B : 6.6																																																																																																																																																																																																																																																																																																																			
7 : 1.6	7 : 1.6	7 : 2.2	7 : 6.05	8 : 1.8	8 : 1.8	8 : 2.2	8 : 6.05	9 : 2	9 : 2	9 : 2.2	C : 2.6	C : 2.6	C : 7.15	D : 2.8	D : 2.8	D : 7.7																																																																																																																																																																																																																																																																																																																			
8 : 1.8	8 : 1.8	8 : 2.2	8 : 7.7	9 : 2	9 : 2	9 : 2.2	9 : 7.7	A : 2.2	A : 2.2	A : 2.2	E : 3	E : 3	E : 8.25	F : 3.2	F : 3.2	F : 8.8																																																																																																																																																																																																																																																																																																																			
9 : 2	9 : 2	9 : 2.2	9 : 8.25	C : 2.6	C : 2.6	C : 7.15	C : 8.25	B : 2.4	B : 2.4	B : 2.4	D : 2.8	D : 2.8	D : 7.7	E : 3	E : 3	E : 8.25																																																																																																																																																																																																																																																																																																																			
A : 2.2	A : 2.2	A : 2.2	A : 8.25	B : 2.4	B : 2.4	B : 2.4	B : 8.25	C : 2.6	C : 2.6	C : 7.15	D : 2.8	D : 2.8	D : 7.7	E : 3	E : 3	E : 8.25																																																																																																																																																																																																																																																																																																																			
B : 2.4	B : 2.4	B : 2.4	B : 8.25	C : 2.6	C : 2.6	C : 7.15	C : 8.25	D : 2.8	D : 2.8	D : 7.7	E : 3	E : 3	E : 8.25	F : 3.2	F : 3.2	F : 8.8																																																																																																																																																																																																																																																																																																																			
C : 2.6	C : 2.6	C : 7.15	C : 8.25	D : 2.8	D : 2.8	D : 7.7	D : 8.25	E : 3	E : 3	E : 8.25	F : 3.2	F : 3.2	F : 8.8																																																																																																																																																																																																																																																																																																																						
D : 2.8	D : 2.8	D : 7.7	D : 8.25	E : 3	E : 3	E : 8.25	E : 8.25	F : 3.2	F : 3.2	F : 8.8																																																																																																																																																																																																																																																																																																																									
E : 3	E : 3	E : 8.25	E : 8.25	F : 3.2	F : 3.2	F : 8.8	F : 8.8																																																																																																																																																																																																																																																																																																																												
F : 3.2	F : 3.2	F : 8.8	F : 8.8																																																																																																																																																																																																																																																																																																																																

Note: Parameter marked with * is set on the NC side when FR-SF is bus-linked to M300 series CNC.

No.	Parameter	Description	Setting range (unit)
* 30 ORS2	Oriented spindle stop control 2	<p>F E D C B A 9 8 7 6 5 4 3 2 1 0</p> <p>Zero return direction, position loop Detector direction, position loop Intens. position, closed/semi-closed, position loop Motor direction, clockwise, position loop Direction, selected orientation</p> <p>0: (+)-direction 1: (-) direction</p> <p>0: (+) direction 1: (-) direction</p> <p>0: Closed 1: Semi-closed</p> <p>0: Faint excitation 1: Intense excitation</p> <p>0: (+) direction 1: (-) direction</p> <p>0: (+) direction 1: (-) direction</p> <p>0: PRE Same as previous direction 1: CW 2: CCW 3: Prohibited</p> <p>Normally PRE is set.</p>	Hexadecimal notation

Note: Parameter marked with * is set on the NC side when FR-SF is bus-linked to M300 series CNC.

0 - 1000	01 : spindle stop	Speed limit	AVR	8	*
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#	Parameter	Description	Setting range (unit)
* 31	TSP	Motor maximum speed	The maximum speed of motor depends on this setting. 1 - 3276(10rpm) 10 - 32760(rpm) for parameter setting on NC display
* 32	ZSP	Zero speed output is set. Standard setting: 50	1 - 1000(rpm)
* 33	CSN	Acceleration time constant Standard setting: 30 (300 for parameter setting on NC display)	2 - 3276(10msec) 20 - 3276(msec) for parameter setting on NC display
* 34	SDT	Speed detection ratio Standard setting: 10	0 - 100(%)
* 35	TLM	Torque limit Torque limit is set in terms of percentage for torque limit signal TL2 (TLH). Standard setting: 10	0 - 120(%)
* 36	VKP	Speed loop proportional gain The larger the setting (100 - 150), the faster is the response, but the larger is the noise and vibration. Standard setting: 63	0 - 1000 (rad/s)

#	Parameter	Description	Setting range (unit)
* 37	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 (1/10rad/s)
* 38	TYPI	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" at the time control loop mode is switched Set "0" when initialization (home return) is required, otherwise set "1". Standard setting: 0	Decimal notation
		For C-axis control, 0: Initialization by means of encoder I: Initialization by means of dog	180 1P
* 39	GRA1	Number of gear teeth on spindle side Number of gear teeth for gear 00 is converted into hexadecimal value, and set.	1 - 7FFF(HEX) For NC display, its range is 1 - 32767 (decimal) and conversion into hexadecimal value is not required.
* 3A	GRA2	Number of gear teeth for gear 01 is converted into hexadecimal value, and set.	Gear ratio is set with gear teeth on spindle side, and gear
* 3B	GRA3	Number of gear teeth for gear 10 is converted into hexadecimal value, and set.	

Note: Parameters refer mainly to MC series with ER-2E as sub-series CNC.

#	Parameter	Description	Setting range (unit)
*	3C GRA4	Number of gear teeth for gear 11 is converted into hexadecimal value, and set.	teeth on motor side. [Spindle speed x Spindle side gear teeth (GRA1 - 4) Motor side gear teeth (CRB1 - 4) = Motor speed]
*	3D GRB1	Number of gear teeth on motor 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.
41	OSL	Spindle orientation type	Type of spindle orientation is set.
41	OSL	Spindle orientation type	Type of spindle orientation is set. 0: Motor built-in encoder 1: Encoder 2: Magnesensor

Note: Parameter marked with * is set on the NC side when FR-SF is bus-linked to M300 series CNC.

No.	Parameter	Description	Setting range (unit)																																																																																																																																																
42	Bit assignment	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>F</th><th>E</th><th>D</th><th>C</th><th>B</th><th>A</th><th>9</th><th>8</th><th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th> </tr> <tr> <td>0</td><td>0</td><td>Position command, oriented spindle stop</td><td>beam</td><td>beam</td><td>beam</td><td>Speed reference input</td><td></td><td></td><td></td><td>Load meter output</td><td></td><td>HMI input, NC mode</td><td>EMC input, NC mode</td><td>Alarm display in case of EMC</td><td></td> </tr> <tr> <td>0</td><td>0</td><td></td><td>beam</td><td>beam</td><td>beam</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>Alarm code output in case of external EMC</td> </tr> <tr> <td>0</td><td>0</td><td></td><td>beam</td><td>beam</td><td>beam</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>0: Invalid 1: Valid</td> </tr> <tr> <td>0</td><td>0</td><td></td><td>beam</td><td>beam</td><td>beam</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>External EMC, NC mode</td> </tr> <tr> <td>0</td><td>0</td><td></td><td>beam</td><td>beam</td><td>beam</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>0: Invalid 1: Valid</td> </tr> <tr> <td>0</td><td>0</td><td></td><td>beam</td><td>beam</td><td>beam</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>Machine READY signal, NC mode</td> </tr> <tr> <td>0</td><td>0</td><td></td><td>beam</td><td>beam</td><td>beam</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>0: Invalid 1: Valid</td> </tr> <tr> <td>0</td><td>0</td><td></td><td>beam</td><td>beam</td><td>beam</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>0: Load meter output 10V 1: Load meter output 3V</td> </tr> </table>	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0	0	0	Position command, oriented spindle stop	beam	beam	beam	Speed reference input				Load meter output		HMI input, NC mode	EMC input, NC mode	Alarm display in case of EMC		0	0		beam	beam	beam										Alarm code output in case of external EMC	0	0		beam	beam	beam										0: Invalid 1: Valid	0	0		beam	beam	beam										External EMC, NC mode	0	0		beam	beam	beam										0: Invalid 1: Valid	0	0		beam	beam	beam										Machine READY signal, NC mode	0	0		beam	beam	beam										0: Invalid 1: Valid	0	0		beam	beam	beam										0: Load meter output 10V 1: Load meter output 3V	Hexadecimal notation
F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0																																																																																																																																				
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10 - 500 (lpm)	Scanning speed setting: 04	Scanning speed setting: 04	SAE																																																																																																																																																

#	Parameter	Description	Setting range (unit)
43		Not used Set "0".	
44		Not used Set "0".	
45		Not used Set "0".	
46		Not used Set "0".	
47		Not used Set "0".	
48		Not used Set "0".	
49	GAH1	Auxiliary number of gear teeth on spindle side	If number of teeth on spindle side is out of normal setting range of gear teeth parameter (GRA1 - 4, GR1 - 4), it is set with this parameter. Number of gear teeth = X × Y where, X: Normal number of gear teeth Y: Auxiliary number of gear teeth
4A	GAH2		
4B	GAH3		
4C	GAH4		
4D	GBH1		
4E	GBH2	Auxiliary number of gear teeth on motor side	
4F	GBH3		
50	GBH4		
59	SVSP	Servo shift speed	Spindle speed at which control loop mode is changed from speed loop to position mode is set. Standard setting: 40 10 - 200(rpm)

#	Parameter	Description	Setting range (unit)
5A	PDT	Home return deceleration point Point at which speed is decelerated to stop for home return is set. If overrun occurs at stop of motor, setting should be increased. Standard setting: 88	1 - 2000 (pulses)
5B	IPOS	Position loop in-position range Range within which "in-position" signal is output in positioning control is set. Standard setting: Tap ... 10 C axis 3E8	Hexadecimal notation
5C	PZSF L	Position loop zero return shift (low byte) Amount of shift of zero return position from Z phase, when loop mode is changed from speed loop to position loop is set.	Tapper-less
5D	DZSP H	Position loop zero return shift (high byte)	0 - FFF 57E40
5E	DCSN	Dual cushion This is set to apply cushion to speed change. 0: Invalid 1: Valid It is set to suppress gear sound. Standard setting: 1	Decimal notation
5F	PYX	Excitation ratio Excitation ratio is set. To reduce gear sound, setting is decreased. To enhance impact load response, setting is increased. Standard setting: 0 0:50% 1:25% 2:75% 3:100%	

APPENDIX 1 Motor parameter list

DATA No.	Motor type	Max. speed
0	917F 435 1500/6000/10000	1.5 / 2.2kw 6000
1	925F 435 1500/6000/10000	2.2 / 3.7kw "
2	936F 444 1500/4500/8000	3.7 / 5.5kw "
3	957F 419 1500/4500/8000	5.5 / 7.5kw "
4	957F 426 1500/4500/8000	5.5 / 9.0kw "
5	977F 404 1500/4500/6000	7.5 / 11.0kw "
6	013F 429 1500/4500/6000	11.0 / 15.0kw "
7	017F 408 1500/4500/6000	15.0 / 18.5kw "
8	017F 408 1500/4500	18.5 / 22.0kw "
9	019F 445 1500/4500	22.0 / 26.0kw "
10	026F 405 1500/4500	22.0 / 30.0kw "
11		
12		
13		
14		
15		
16	Same as No. 0	1.5 / 2.2kw 10000
17	No. 1	2.2 / 3.7kw "
18	No. 2	3.7 / 5.5kw "
19	No. 3	5.5 / 7.5kw "
20	No. 4	5.5 / 9.0kw "
21	No. 5	7.5 / 11.0kw "
22	No. 6	11.0 / 15.0kw "
23	No. 7	15.0 / 18.5kw "
24	No. 8	18.5 / 22.0kw "
25	No. 9	22.0 / 26.0kw "
26	No. 10	22.0 / 30.0kw "
27		
28		
29		
30		
31		

DATA No.	Motor type	Max. speed
32		1.5 / 2.2kw 6000
33	925F 438 1150/3450/8000	2.2 / 3.7kw "
34	936F 443 1150/3450/8000	3.7 / 5.5kw "
35	957F 434 1150/3450/6000	5.5 / 7.5kw "
36		
37	977F 403 1150/3450/6000	7.5 / 11.0kw "
38	013F 431 1150/3450/6000	11.0 / 15.0kw "
39	017F 405 1150/3450/4600	15.0 / 18.5kw "
40	019F 442 1150/3450/4600	18.5 / 22.0kw "
41	023F 474 1150/3450/4600	22.0 / 26.0kw "
42	026F 406 1150/3450/4600	22.0 / 30.0kw "
43	031F 420 1150/3450/4600	30.0 / 37.0kw "
44	038F 424 1150/3450/4600	37.0 / 45.0kw "
45		
46		
47		
48		
49	Same as No. 33	2.2 / 3.7kw 10000
50	No. 34	3.7 / 5.5kw "
51	No. 35	5.5 / 7.5kw "
52		
53	Same as No. 37	7.5 / 11.0kw "
54	No. 38	11.0 / 15.0kw "
55	No. 39	15.0 / 18.5kw "
56	No. 40	18.5 / 22.0kw "
57	No. 41	22.0 / 26.0kw "
58	No. 42	22.0 / 30.0kw "
59	No. 43	30.0 / 37.0kw "
60	No. 44	37.0 / 45.0kw "
61		
62		
63		

Note: For motor having maximum speed ranging from 6001 rpm to 10000 rpm, use a motor constant of 10000 rpm for maximum speed.

6.2 NC display

Since display (format, content, etc.) and setting method

differs from NC to NC, refer to the instruction manual

of your NC system.

Typical examples of NC display are described here.

6.2.1 Status display

For status display, [SPINDLE MONITOR] of DIAGNOSIS screen is

used. For use of

this display func-

tion, FR-SF should

be bus-linked with

NC system.

[SPINDLE MONITOR]		DIAGN 2.2/2
GAIN	10.0	
DROOP	123456	
RPM	6000	
LOAD RATE	80	
ALARM NO.	12 01	
DATA BIT MONITOR		
	76543210	
D/I L	01010101	
	H 11001100	
D/O L	10101010	
	H 00110011	
ALARM	SERVO	PLC-I/F
		NC-SPEC

Display	Description
GAIN	Position control loop gain is displayed. When position control loop is not used, "0" is displayed. The standard position control loop gain is, $\frac{\text{Motor speed (rad/s)}}{\text{Response delay (rad/s)}} = 10$
DROOP	Error in true spindle angle from referenced spindle angle is called "droop". Droop is expressed in number of pulses. When position control loop is not used, "0" is displayed.

Display	Description																																																																																				
PRM	True motor speed is displayed 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.	If fault occurs with spindle amplifier, alarm is displayed with code No. (current alarm and previous alarm are displayed). For alarm contents, refer to Appendix 2.																																																																																				
DATA BIT MONITOR D/I	Signal input to spindle amplifier is displayed by bit. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="8">CONTROL INPUT H</th> <th colspan="8">CONTROL INPUT L</th> </tr> <tr> <th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th> <th>7</th><th>6</th><th>5</th><th>4</th><th>3</th><th>2</th><th>1</th><th>0</th> </tr> </thead> <tbody> <tr> <td colspan="8" style="text-align: center;">Gear select</td> <td colspan="8" style="text-align: center;">Tapping</td> </tr> <tr> <td colspan="8"> <table border="1" style="margin-left: auto; margin-right: auto; width: fit-content;"> <tr><td>0 0 :GEAR0 0</td></tr> <tr><td>0 1 :GEAR0 1</td></tr> <tr><td>1 0 :GEAR1 0</td></tr> <tr><td>1 1 :GEAR1 1</td></tr> </table> </td> <td colspan="8"></td> </tr> <tr> <td colspan="8"></td> <td colspan="8" style="text-align: center;">Oriented spindle stop command C.CW index CW index H Torque limit H L Torque limit L SRISRN</td> </tr> </tbody> </table>	CONTROL INPUT H								CONTROL INPUT L								7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	Gear select								Tapping								<table border="1" style="margin-left: auto; margin-right: auto; width: fit-content;"> <tr><td>0 0 :GEAR0 0</td></tr> <tr><td>0 1 :GEAR0 1</td></tr> <tr><td>1 0 :GEAR1 0</td></tr> <tr><td>1 1 :GEAR1 1</td></tr> </table>								0 0 :GEAR0 0	0 1 :GEAR0 1	1 0 :GEAR1 0	1 1 :GEAR1 1																	Oriented spindle stop command C.CW index CW index H Torque limit H L Torque limit L SRISRN							
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Appendix 2 Spindle alarm list

No.	Content	No.	Content
10	Voltage down	PR	
11			
12	Memory fault 1	AR	
13			
14			
15	Memory fault 2	PR	Controller overheat
16			
17	Card fault	PR	Motor overheat
20	No signal 1 (PLG)	PR	
21	No signal 2 (Spindle ENC)	PR	
22	IC MAC012 fault	PR	Error excess
23	Speed control error excess	PR	
24	Breaker trip/main circuit fault	PR	
25	Converter overcurrent/brake fault	PR	Emergency stop
26	Power phase failure	PR	Other axis fault
27	CPU fault		
30		E0	Instantaneous power failure warning
31	Overspeed	PR	Overload warning
32	Inverter overcurrent/overcurrent	PR	
33	Ovvoltaged	PR	
34	Data parity check error	PR	Parameter error warning
35	Data fault	PR	
36	Data transfer fault	PR	
37	Parameter error	PR	NC emergency stop

PR: Reset by turning off power supply of NC

AR: Reset by turning off power supply of spindle amplifier

NR: NC reset

*: "Servo OFF" does not occur.

(mcr) 35382 - 0	00 RAED 00 01 RAED 01 01 RAED 01 11 RAED 11	00 RAED 00 01 RAED 01 01 RAED 01 11 RAED 11	00 RAED 00 01 RAED 01 01 RAED 01 11 RAED 11	00 RAED 00 01 RAED 01 01 RAED 01 11 RAED 11	00 RAED 00 01 RAED 01 01 RAED 01 11 RAED 11
(mcr) 00000 - 0	00 RAED 00 01 RAED 01 01 RAED 01 11 RAED 11	00 RAED 00 01 RAED 01 01 RAED 01 11 RAED 11	00 RAED 00 01 RAED 01 01 RAED 01 11 RAED 11	00 RAED 00 01 RAED 01 01 RAED 01 11 RAED 11	00 RAED 00 01 RAED 01 01 RAED 01 11 RAED 11

6.2.2 Parameter setting

When [SPINDLE PARAMETER] of MACHINE PARAMETER screen is selected, parameters

are displayed.

There are two groups of spindle parameters; one is those used on NC side, and the other is those sent to FR-SF when FR-SF is bus-linked with NC.

(1) Parameters used on NC side

[SPINDLE SPEC.]					M-PARAM 7.2/2
1	slimt1	0	13	stap 1	527
2	2	790	14	2	2640
3	3	4000	15	3	
4	4	0	16	4	
5	smax 1	0	17	smin1	1
6	2	790	18		
7	3	4000	19		
8	4	0	20		
9	ssift1	0	21	sori	0
10	2	0	22	sgear	0
11	3	0	23		
12	4	0	24		

\$() DATA()

MC-ERR | MACRO | SPINDLE | PLC | MENU

Spindle parameter list (1/2)

#	Parameter	Description	Setting range (unit)
1	slimt 1	Speed limit	For GEAR 00 GEAR 01 GEAR 10 GEAR 11
2			spindle speed with motor at maximum speed is set.
3			maximum speed
4			is set.
5	smax 1	Max. speed	For GEAR 00 GEAR 01 GEAR 10 GEAR 11
6			maximum spindle speed is set.
7			Slimt t Smax
8			
9	ssift 1	Shift speed	For GEAR 00 GEAR 01 GEAR 10 GEAR 11
10			spindle speed for gear shift is set.
11			
12			
13	stap 1	Tap speed	For GEAR 00 GEAR 01 GEAR 10 GEAR 11
14			maximum spindle speed during tap cycle is set.
15			
16			

#	Parameter	Description	Setting range (unit)
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		
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

Parameter	Description	Setting range (unit)
sgear	Encoder gear ratio Encoder spindle orientation Encoder spindle orientation Encoder spindle orientation Encoder spindle orientation	0:1/1 1:1/2 2:1/4 3:1/8
sgear	Encoder gear ratio Encoder spindle orientation Encoder spindle orientation Encoder spindle orientation	0:1/1 1:1/2 2:1/4 3:1/8
sgear	Encoder gear ratio Encoder spindle orientation Encoder spindle orientation Encoder spindle orientation	0:1/1 1:1/2 2:1/4 3:1/8

(2) Parameters sent to FR-SF

These parameters are sent from NC to FR-

SF when FR-SF is bus-linked with NC.

Although FR-SF has its own parameters,

parameters shown by

NC display becomes valid when FR-SF is

bus-linked with NC.

[SPINDLE SPEC.]

M-PARAM 7.2/2

#	1 PG1	133	13	25	GRA1	100
2 PG2	20	14		26	2	100
3 PGC	10.00	15	ORS1	6601	27	3 100
4 ZRZ	1.00	16	ORS2	0	28	4 100
5 OSP	220	17	TSP	4500	29	GRB1 100
6 CSP	20	18	ZSP	50	30	2 100
7 PST	2048	19	CSN	300	31	3 100
8 BRC	0	20	SOT	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

Note: Parameter set

on the NC display can be made invalid by setting switch SW5-1 of card SF-CA to "ON". In this case, parameters set by FR-SF becomes valid.

Spindle parameter list (2/2)

#	Parameter	Description	Setting range (unit)	
1	RG1	Spindle orientation, 1st decel. point Encoder spindle orientation Spindle rotational angle at which creep speed starts is set. Magnesensor spindle orientation Time in which creep speed starts after passing through linear zone is set. Standard setting <u>Encoder</u> <u>Magnesensor</u> 180 133	Encoder	Magnesensor
				0 - 500ms
			0 - 359 (deg.)	
2	RG2	Spindle orientation, 2nd decel. point Angle at which creep speed run changes to position control loop is set. Standard setting: 20		0 - 40 (deg.)

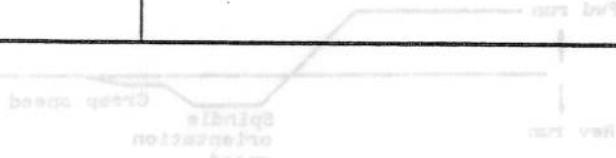
#	Parameter	Description	Setting range (unit)	
3	PGC	Sync. tap, C-axis control position loop gain Standard setting: 10.00	0.01 - 999.99 (rad/s)	
4	ZRZ	Spindle orientation, in-position range Standard setting: 1.00	Encoder	Magne-sensor
			0 - 359 (deg.)	0 - 39 (deg.)
5	OSP	Spindle orientation speed is set. Standard setting: 2.20	0 - 1000(rpm)	
6	CSP	Creep speed is set. Standard setting: 20	0 - 1000(rpm)	
7	RST	Position shift Standard setting: 2048	Encoder	Magne-sensor
			0 - 4095 (pulses)	1536 - 2560
8	BRC	Not used Set to "0".		
15	ORS1	Oriented spindle stop control 1 For details of setting, refer to #15.	Set in hexadecimal notation. 0 - FFFF	
16	ORS2	Oriented spindle stop control 2 For details of setting, refer to #16.		

#	Parameter	Description	Setting range (unit)	
17	TSP	Maximum motor speed	0 - 32767(rpm)	
18	ZSP	Motor zero speed	Speed at which "zero speed" signal is output is set. Standard setting: 50	0 - 1000(rpm)
19	CSN	Accel./decel. time constant	Time taken for acceleration from 0 to maximum speed (or deceleration from maximum speed to zero) is set (this setting is ignored when position loop is used). Standard setting: 300	0 - 32767(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	0 - 100(%)
21	TLM	Torque limit	Torque limit is set in terms of percentage for torque limit signal TL2. Standard setting: 10	0 - 120(%)
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	0 - 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	0 - 1000 (1/10rad/s)

#	Parameter	Description	Setting range (unit)
		is almost constant. Standard setting: 60	
25	GRA1	Number of gear teeth on spindle side is set.	Gear ratio is set with gear teeth on spindle side, and gear teeth on motor side
26	GRA2	Number of gear teeth for gear 01 on spindle side is set.	
27	GRA3	Number of gear teeth for gear 10 on spindle side is set.	Spindle speed x Spindle side gear teeth (GRA1 - 4) Motor side gear teeth (GRB1 - 4)
28	GRA4	Number of gear teeth for gear 11 on spindle side is set.	= Motor speed
29	GRB1	Number of gear teeth on motor side is set.	
30	GRB2	Number of gear teeth for gear 01 on motor side is set.	
31	GRB3	Number of gear teeth for gear 10 on motor side is set.	
32	GRB4	Number of gear teeth for gear 11 on motor side is set.	

No.	Parameter	Setting range	Description	Parameter	Setting range (unit)																																																																																																
15	ORS1	Oriented spindle stop control 1	<table border="1"> <tr><td>F</td><td>E</td><td>D</td><td>C</td><td>B</td><td>A</td><td>9</td><td>8</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">Spindle orient, K₁ magnif.</td><td colspan="6">Spindle orient, K_f magnif.</td><td colspan="4">Servo lock control</td><td>ω_r select [rad/s]</td></tr> </table> <p>4-bit combination 4-bit combination 4-bit combination</p> <table> <tr><td>0 : 0.6 (folds)</td><td>0 : 0.6 (folds)</td><td>0 : Delay/advance</td><td>0 : 0.55 [rad/s]</td></tr> <tr><td>1 : 0.7</td><td>1 : 0.7</td><td>1 : P I</td><td>1 : 0.1</td></tr> <tr><td>2 : 0.8</td><td>2 : 0.8</td><td></td><td>2 : 1.65</td></tr> <tr><td>3 : 0.9</td><td>3 : 0.9</td><td></td><td>3 : 2.2</td></tr> <tr><td>4 : 1</td><td>4 : 1</td><td></td><td>4 : 2.75</td></tr> <tr><td>5 : 1.2</td><td>5 : 1.2</td><td></td><td>5 : 3.3</td></tr> <tr><td>6 : 1.4</td><td>6 : 1.4</td><td></td><td>6 : 3.85</td></tr> <tr><td>7 : 1.6</td><td>7 : 1.6</td><td></td><td>7 : 4.4</td></tr> <tr><td>8 : 1.8</td><td>8 : 1.8</td><td></td><td>8 : 4.95</td></tr> <tr><td>9 : 2</td><td>9 : 2</td><td></td><td>9 : 5.5</td></tr> <tr><td>A : 2.2</td><td>A : 2.2</td><td></td><td>A : 6.05</td></tr> <tr><td>B : 2.4</td><td>B : 2.4</td><td></td><td>B : 6.6</td></tr> <tr><td>C : 2.6</td><td>C : 2.6</td><td></td><td>C : 7.15</td></tr> <tr><td>D : 2.8</td><td>D : 2.8</td><td></td><td>D : 7.7</td></tr> <tr><td>E : 3</td><td>E : 3</td><td></td><td>E : 8.25</td></tr> <tr><td>F : 3.2</td><td>F : 3.2</td><td></td><td>F : 8.8</td></tr> </table> <p>Standard setting: 6601</p>	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0	Spindle orient, K ₁ magnif.						Spindle orient, K _f magnif.						Servo lock control				ω _r select [rad/s]	0 : 0.6 (folds)	0 : 0.6 (folds)	0 : Delay/advance	0 : 0.55 [rad/s]	1 : 0.7	1 : 0.7	1 : P I	1 : 0.1	2 : 0.8	2 : 0.8		2 : 1.65	3 : 0.9	3 : 0.9		3 : 2.2	4 : 1	4 : 1		4 : 2.75	5 : 1.2	5 : 1.2		5 : 3.3	6 : 1.4	6 : 1.4		6 : 3.85	7 : 1.6	7 : 1.6		7 : 4.4	8 : 1.8	8 : 1.8		8 : 4.95	9 : 2	9 : 2		9 : 5.5	A : 2.2	A : 2.2		A : 6.05	B : 2.4	B : 2.4		B : 6.6	C : 2.6	C : 2.6		C : 7.15	D : 2.8	D : 2.8		D : 7.7	E : 3	E : 3		E : 8.25	F : 3.2	F : 3.2		F : 8.8	Hexadecimal notation
F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0																																																																																						
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6 : 1.4	6 : 1.4		6 : 3.85																																																																																																		
7 : 1.6	7 : 1.6		7 : 4.4																																																																																																		
8 : 1.8	8 : 1.8		8 : 4.95																																																																																																		
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A : 2.2	A : 2.2		A : 6.05																																																																																																		
B : 2.4	B : 2.4		B : 6.6																																																																																																		
C : 2.6	C : 2.6		C : 7.15																																																																																																		
D : 2.8	D : 2.8		D : 7.7																																																																																																		
E : 3	E : 3		E : 8.25																																																																																																		
F : 3.2	F : 3.2		F : 8.8																																																																																																		

No.	Parameter	Description	Setting range (unit)
16	ORS2	<p>Oriented spindle stop control 2</p> <p>The parameter ORS2 is a 16-bit word. The bit descriptions are as follows:</p> <ul style="list-style-type: none"> F: Zero return direction, position loop detector direction, position loop selection, Intense position loop selection, Closed/released, Outer direction command, Detector orientation. E: Direction of rotation, spindle orientation. D: Direction of rotation, spindle orientation. C: Direction of rotation, spindle orientation. B: Direction of rotation, spindle orientation. A: Direction of rotation, spindle orientation. 9: 0: (+) direction 2-bit combination 1: (-) direction 8: 0: (+) direction 1: (-) direction 7: 0: Closed 1: Semi-closed 6: 0: Faint excitation 1: Intense excitation 5: 0: (+) direction 1: (-) direction 4: 0: (+) direction 1: (-) direction 3: 0: (+) direction 1: (-) direction 2: 0: (+) direction 1: (-) direction 1: 0: PRE Same as previous direction 1: CW 2: CCW 3: Prohibited 0: Normally PRE is set. 	Hexadecimal notation



rotate(S)

"beeqs position" erit zeroer beeqs stop mori .
,"beeqs position" erit beeqs lantion mori segnaro

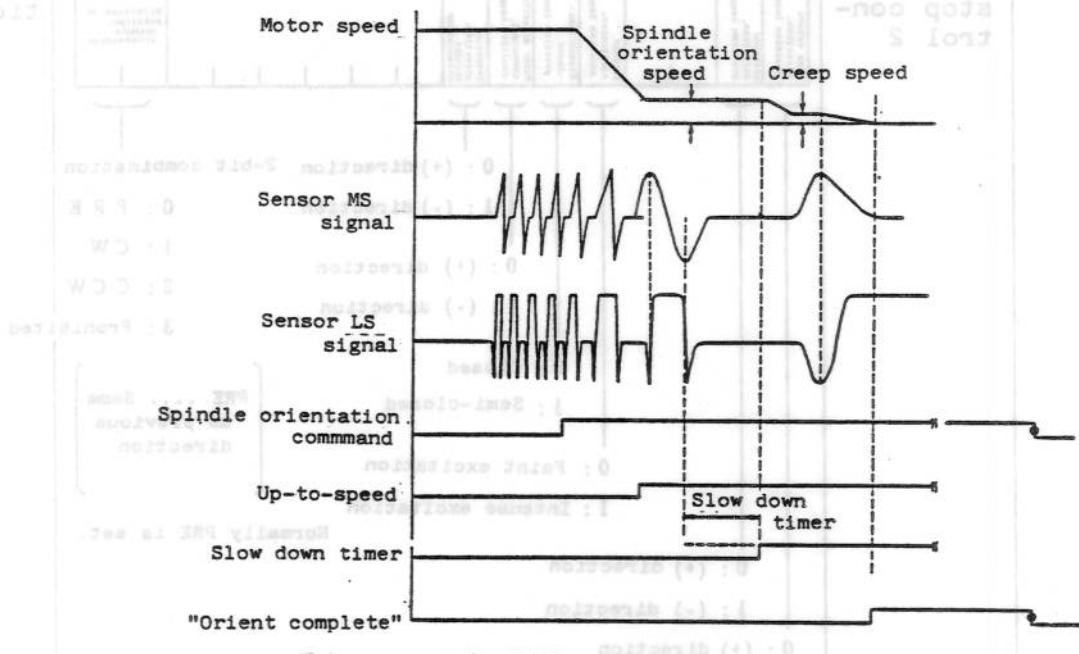
"ot-qu" ,beeqs position erit zeroer beeqs stop mori .
. no anut langia "beeqs

"ot-qu" mori has no anut langia "beeqs-of-qu" tefla .
temit nwoe wola erit , "I" ej nwoe erit langia "2J
. (temit erawat) yulmico adjusta

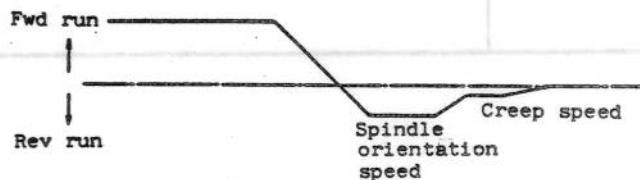
§7. ORIENTATED SPINDLE STOP FUNCTION OPERATION MODE AND FUNCTION

7.1 Magnesensor spindle orientation (1 div.)

(1) Operation mode



When the direction of spindle orientation, which has been fixed (set by parameter), is inverse to the direction of spindle rotation in normal operation, the motion pattern is as follows:



(2) Operation

- When spindle orientation command is given, motor speed changes from normal speed to "orientation speed".
- When motor speed reaches the orientation speed, "up-to-speed" signal turns on.
- After "up-to-speed" signal turns on and when "sensor LS" signal falls down to "L", the slow down timer starts counting (software timer).

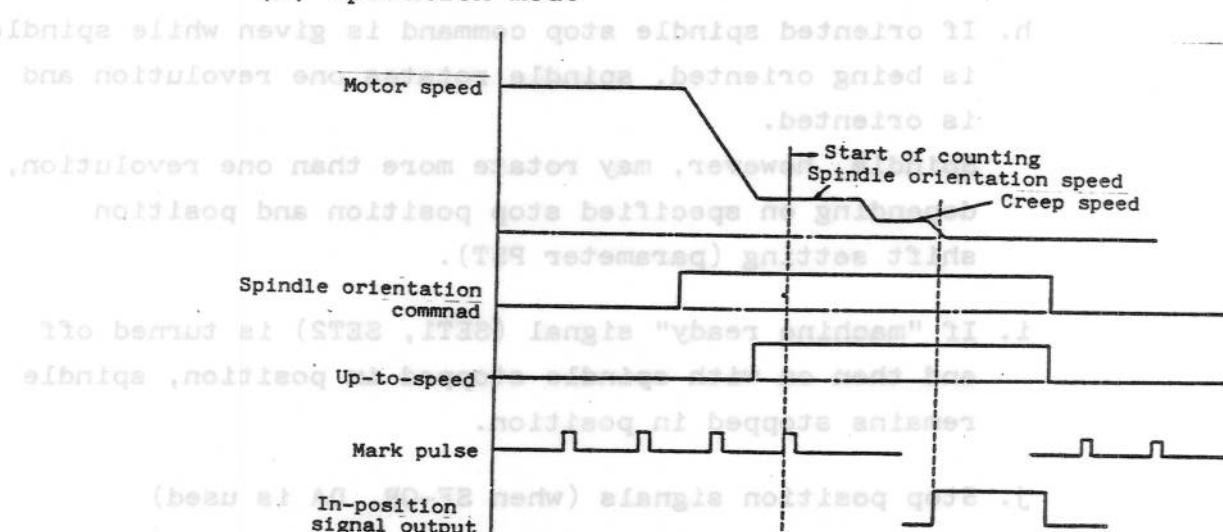
- d. When slow down timer (software timer parameter PG1) counts up, speed changes from the orientation speed to creep speed.
- e. When "sensor LS" signal rises to "H", control mode changes to positioning loop.
- f. Under the control of positioning loop, spindle stops at point where "sensor MS" signal falls to OV.
- g. "Orient complete" signal turns on (contact is closed).

Direction of spindle orientation (set by parameter ORS2)

(1) PRE	Same direction as previous rotation
(2) Forward	Motor "forward run" orientation
(3) Reverse	Motor "reverse run" orientation

7.2 Encoder spindle orientation (4096 div.)

(1) Operation mode



(2) Operation

- a. When spindle orientation command is given, spindle stop position specified by external parameter PST is read and motor speed changes from normal speed to orientation speed.

b. When motor speed reaches the orientation speed, "up-to-speed" signal turns on.

c. When mark pulse is input after "up-to-speed" signal turns on, timer starts counting.

Motor goes on running at the orientation speed.

d. When spindle reaches 146 deg. - 225 deg. ahead of oriented stop position, speed changes from the orientation speed to the creep speed.

e. When spindle reaches 15 deg. - 25 deg. ahead of oriented stop position, control mode changes to positioning loop control and then spindle stops.

f. When spindle enters "in-position range" (set by parameter ZRZ), "orientation complete" signal (ORA1 - ORA2) turns on.

g. When the spindle orientation command is removed, motor is accelerated to the referenced speed.

h. If oriented spindle stop command is given while spindle is being oriented, spindle rotates one revolution and is oriented.

Spindle, however, may rotate more than one revolution, depending on specified stop position and position shift setting (parameter PST).

i. If "machine ready" signal (SET1, SET2) is turned off and then on with spindle stopped in position, spindle remains stopped in position.

j. Stop position signals (when SF-OR, DA is used)

Stop position can be specified by 12-bit contact signals (01H - 12H).

When all signals are off, spindle is oriented to the standard stop position (0 deg.).

$$\text{Stop position} = \frac{360}{4096} [(H12) \cdot 2^{11} + (H11) \cdot 2^{10} + \dots]$$

$$\dots + (H1) \cdot 2^0]$$

Ex.: When only H10 turns on,

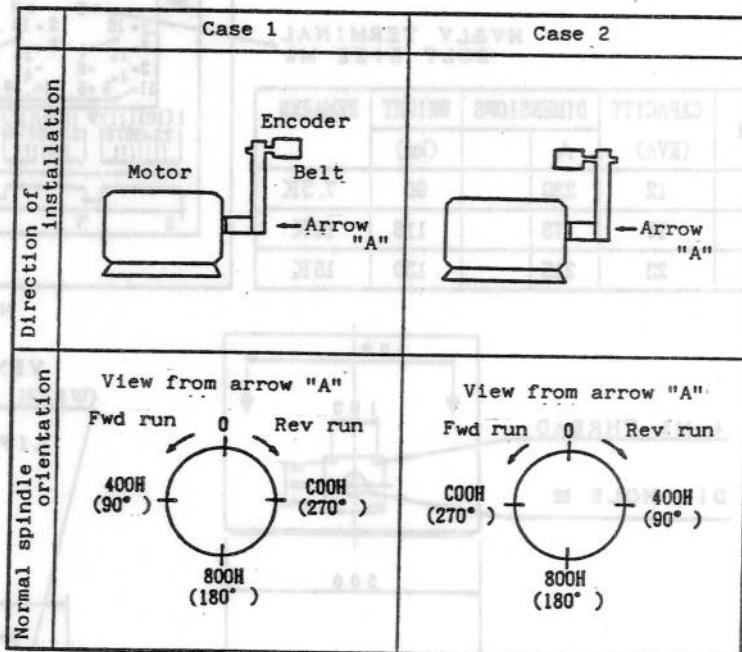
$$\frac{360}{4096} \times 512 (2^4) = 45^\circ$$

The least movement increment is,

$$360^\circ / 4096 = 0.088^\circ$$

In the case of integer index (1 deg., 10 deg.,), the resultant amount of movement is equal to (0.088° multiplied by integer) and therefore error is inherent.

Stop position depends on installation of encoder as shown below.



§8. DISCRETE COMPONENTS AND DEVICES

8.1 Options

8.1.1 Power transformer

When available power supply is at 400V, use an appropriate transformer.

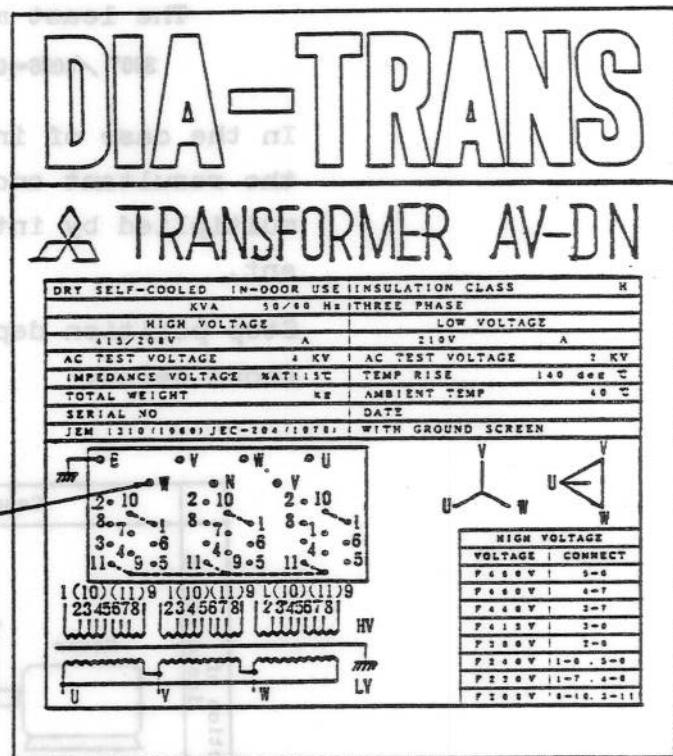
(1) 12 - 23KVA

(ITEM 1 - 3)

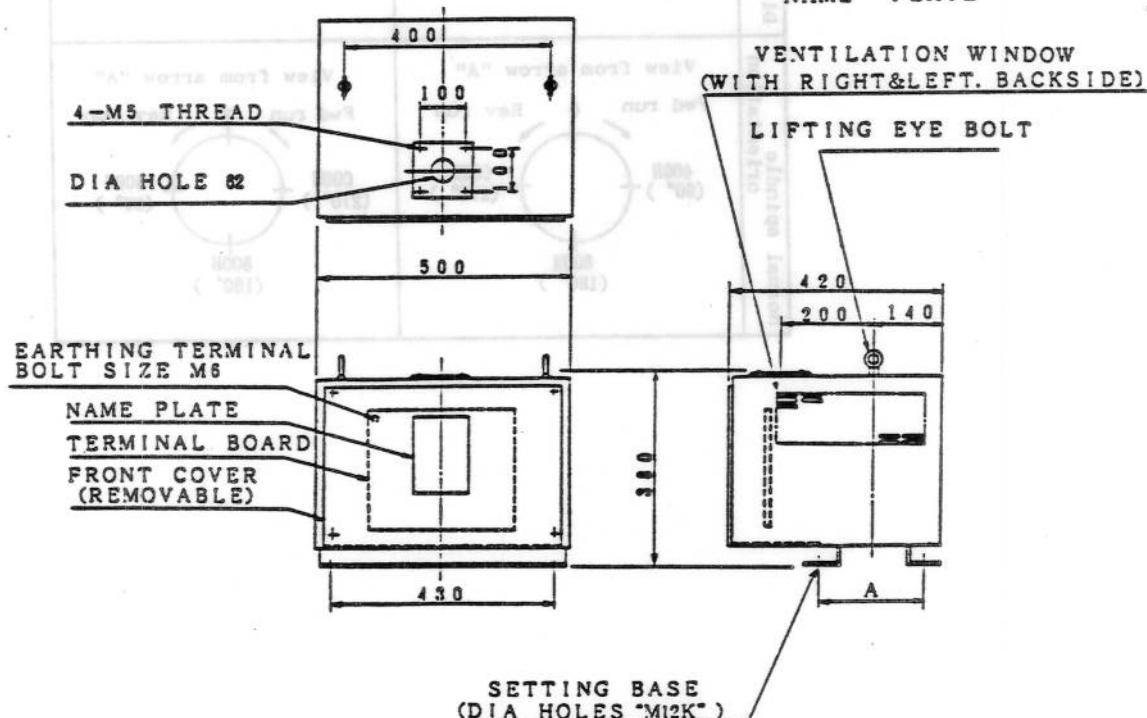
BB "Boboone to noitllilatani no abnecat

ITEM	CAPACITY (KVA)	DIMENSIONS	WEIGHT (kg)	REMARKS
1	12	230	90	7.5K
2	17	175	115	11K
3	23	215	130	15K

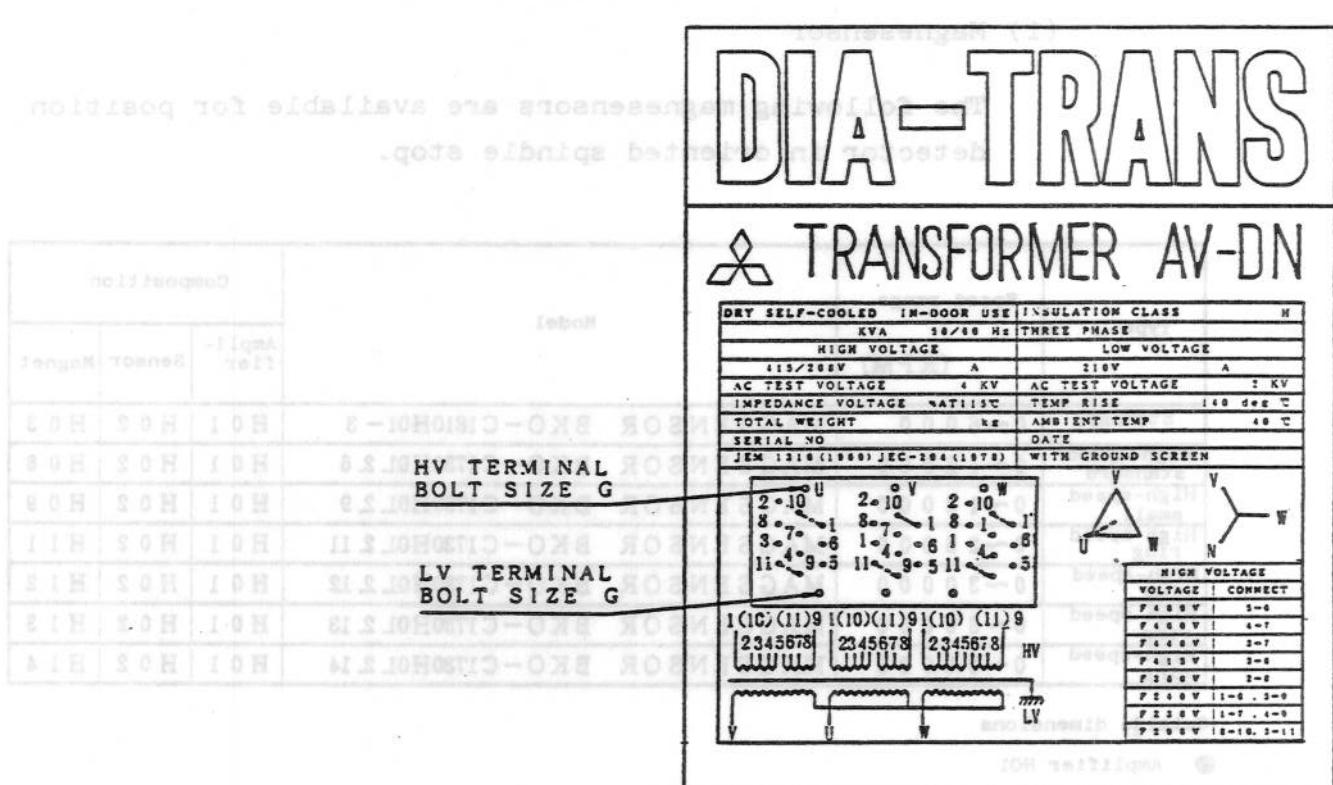
HV&LV TERMINAL
BOLT SIZE M8



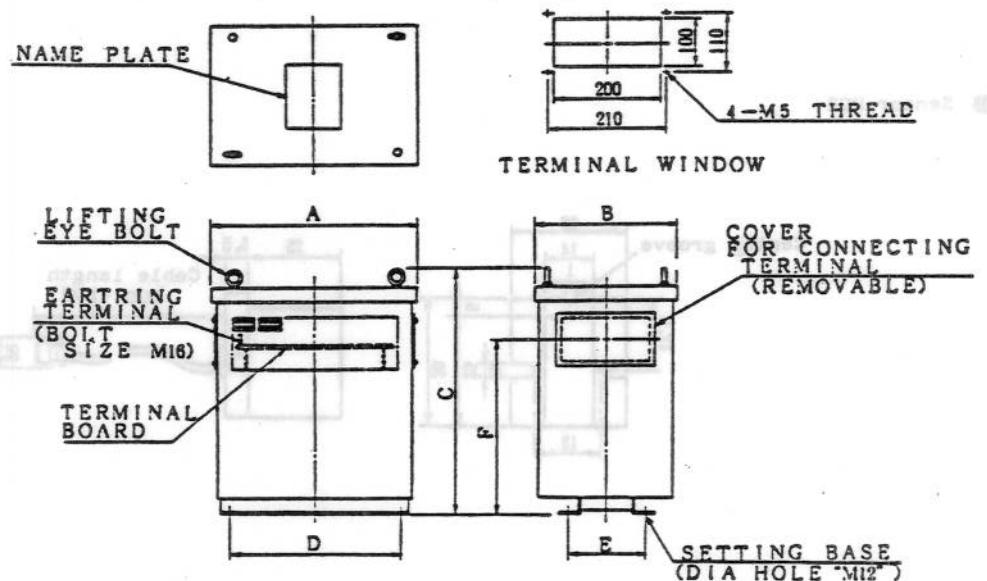
NAME PLATE



(2) 30KVA - 75KVA (ITEM 4 - 8)



ITEM	CAPACITY (KVA)	DIMENSIONS							WEIGHT (kg)	REMARKS
		A	B	C	D	E	F	G		
4	30	535	395	625	460	250	445	M12	165	18.5K
5	37	535	395	665	460	250	485	M12	185	22K. 26K
6	44	535	425	665	460	265	485	M12	205	30K
7	60	625	425	815	540	255	625	M16	280	37K
8	75	625	425	840	540	270	650	M16	320	45K



8.1.2 Parts for oriented spindle stop

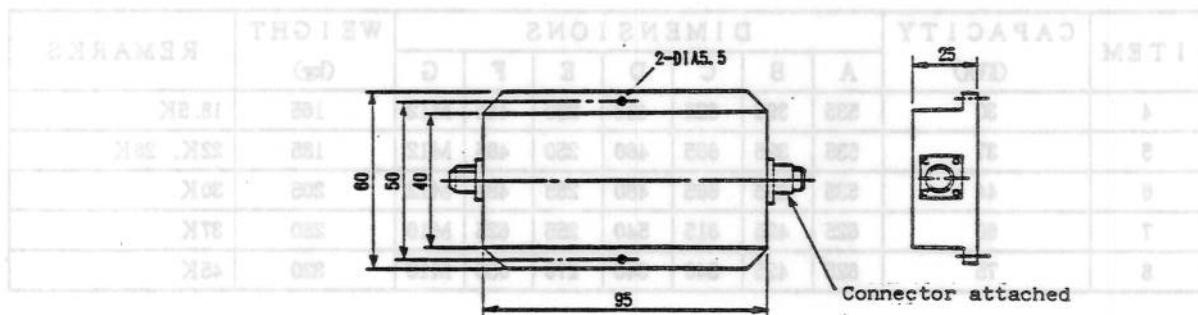
(1) Magnesensor

The following magnesensors are available for position detector in oriented spindle stop.

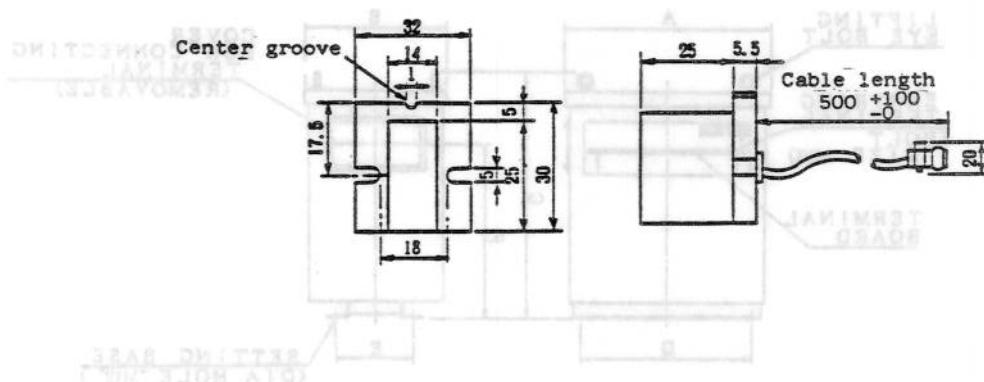
Type	Speed range [RPM]	Model	Composition		
			Ampli- fier	Sensor	Magnet
Standard	0~6000	MAGSENSOR BKO-C1810H01-3	H01	H02	H03
High-speed standard	0~12000	MAGSENSOR BKO-C1730H01.2.6	H01	H02	H06
High-speed small	0~12000	MAGSENSOR BKO-C1730H01.2.9	H01	H02	H09
High-speed ring	0~25000	MAGSENSOR BKO-C1730H01.2.11	H01	H02	H11
High-speed ring	0~30000	MAGSENSOR BKO-C1730H01.2.12	H01	H02	H12
High speed ring	0~30000	MAGSENSOR BKO-C1730H01.2.13	H01	H02	H13
High-speed ring	0~30000	MAGSENSOR BKO-C1730H01.2.14	H01	H02	H14

Outside dimensions

- Amplifier H01



- Sensor H02

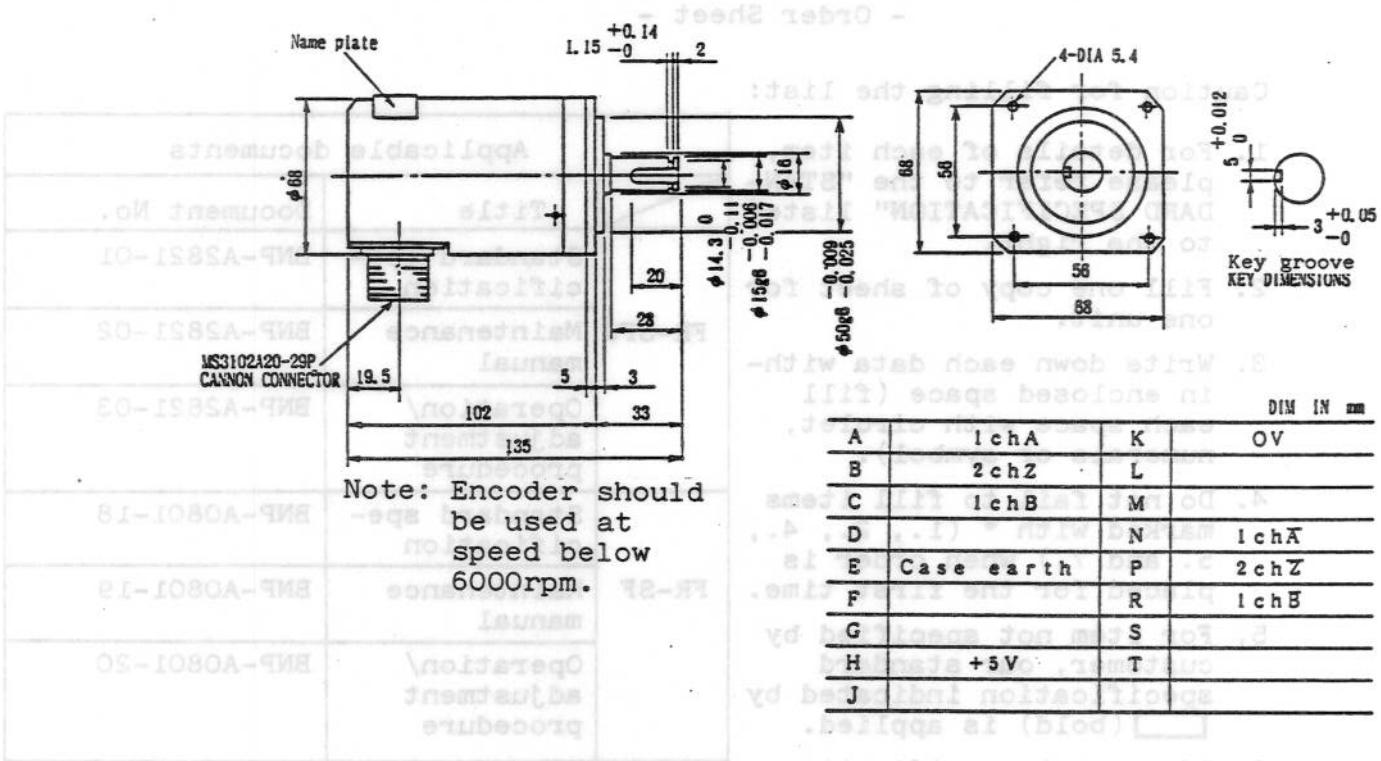


● Magnet

Part No.	Speed range [RPM]	Weight	Outside view	Diagram
H 0 3	0 ~ 6000	00003 ~ 0	1 1 H	
H 0 6	0 ~ 12000			
H 0 9	0 ~ 12000	00006 ~ 0	2 1 H	
(a)	J 1X1H I C 3 3 0 15			
ROTOR	I 07007 00 0 0.0002 01 02 03	00007 ~ 0	3 1 H	
BLADE	I 07008 00 0 0.0002 01 02 03	00008 ~ 0	3 1 H	
COVER	I 07009 00 0 0.0002 01 02 03	00009 ~ 0	3 1 H	

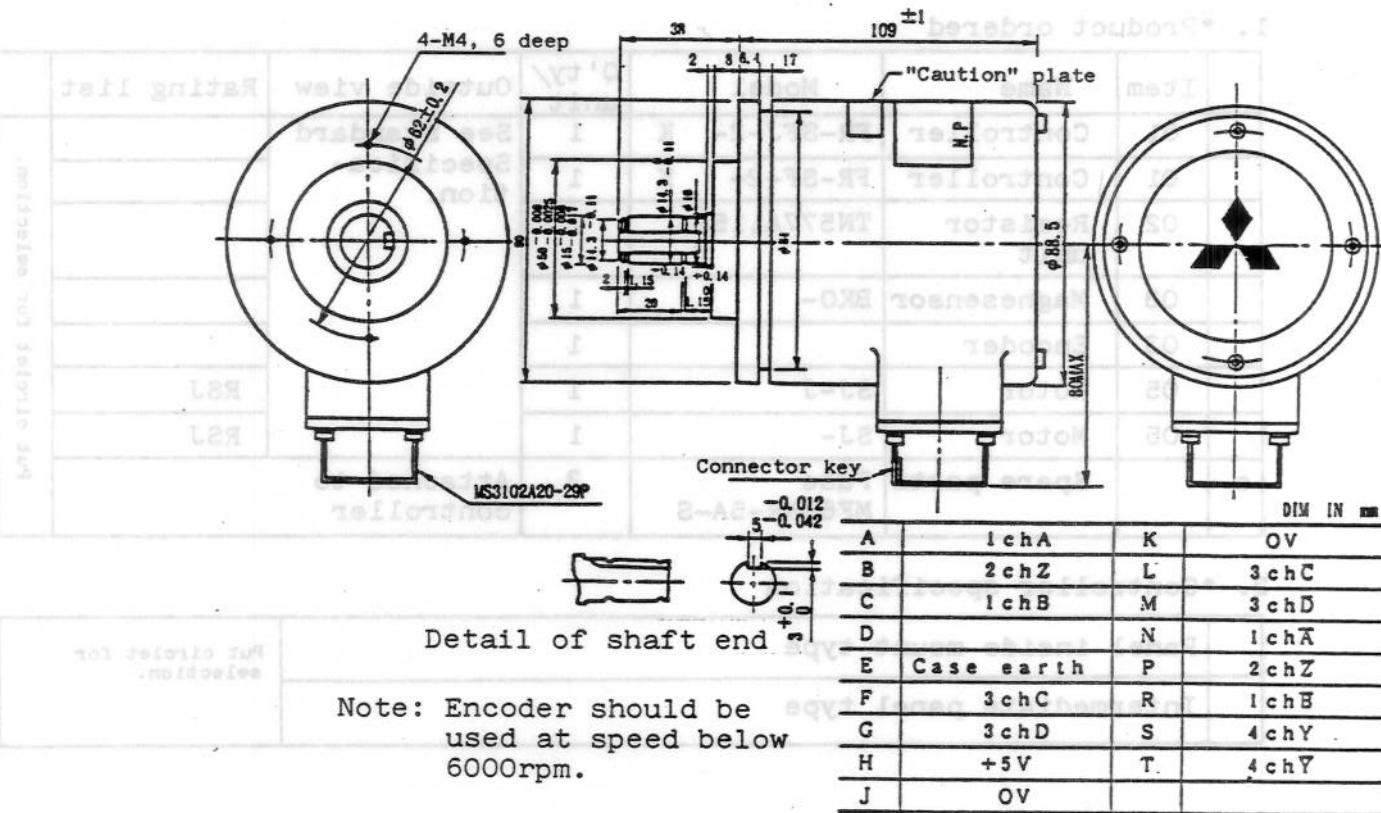
Part No.	Speed range (RPM)	Outside view																																																																							
		Drawing A						Drawing B																																																																	
H 1 1	0 ~ 25000																																																																								
H 1 2	0 ~ 30000																																																																								
H 1 3	0 ~ 30000	<p>Magnet Dimensions</p> <table border="1"><thead><tr><th>TYPE</th><th>A</th><th>B</th><th>C</th><th>D</th><th>E</th><th>F</th><th>G</th><th>H</th><th>J×X</th><th>L</th><th>(g)</th></tr></thead><tbody><tr><td>BKO-C1730H11</td><td>105</td><td>70H7+0.030 -0</td><td>90</td><td>28</td><td>19</td><td>15×1.0</td><td>5</td><td>90</td><td>70×79</td><td>1</td><td>1024±4</td></tr><tr><td>" H12</td><td>94</td><td>60H7+0.030 -0</td><td>79</td><td>25</td><td>17</td><td>15×0.8</td><td>5</td><td>79</td><td>60×68</td><td>1</td><td>768±4</td></tr><tr><td>" H13</td><td>78</td><td>50H7+0.025 -0</td><td>66</td><td>23</td><td>15</td><td>15×0.8</td><td>5</td><td>66</td><td>50×57</td><td>1</td><td>478±4</td></tr><tr><td>" H14</td><td>66</td><td>40H7+0.025 -0</td><td>54</td><td>20</td><td>13</td><td>14×0.7</td><td>5</td><td>54</td><td>40×45</td><td>1</td><td>322±4</td></tr></tbody></table>	TYPE	A	B	C	D	E	F	G	H	J×X	L	(g)	BKO-C1730H11	105	70H7+0.030 -0	90	28	19	15×1.0	5	90	70×79	1	1024±4	" H12	94	60H7+0.030 -0	79	25	17	15×0.8	5	79	60×68	1	768±4	" H13	78	50H7+0.025 -0	66	23	15	15×0.8	5	66	50×57	1	478±4	" H14	66	40H7+0.025 -0	54	20	13	14×0.7	5	54	40×45	1	322±4	<p>**"NS" is stamped on the side of case. Sensor should be installed so that its pin groove is on case side ("NS" stamped).</p>										
TYPE	A	B	C	D	E	F	G	H	J×X	L	(g)																																																														
BKO-C1730H11	105	70H7+0.030 -0	90	28	19	15×1.0	5	90	70×79	1	1024±4																																																														
" H12	94	60H7+0.030 -0	79	25	17	15×0.8	5	79	60×68	1	768±4																																																														
" H13	78	50H7+0.025 -0	66	23	15	15×0.8	5	66	50×57	1	478±4																																																														
" H14	66	40H7+0.025 -0	54	20	13	14×0.7	5	54	40×45	1	322±4																																																														
H 1 4	0 ~ 30000		<p>Caution for installation of H11 ~ H14</p> <ol style="list-style-type: none">1. Tolerance to shaft diameter shall be h62. 2-ϕG holes shall be used for positioning of magnet in reference to spindle.3. Magnet shall be installed as shown to the left.4. Deviation of sensor location from center line of magnet shall be within ± 2mm.5. Pin groove of sensor shall be on the case side.																																																																						

(1) Encoder (1024P/rev) RFH-1024-22-1M-68IM



8.1.3 Parts for C-axis control

(1) Encoder (90000P/rev) OSE90K + 1024 BK0-NC6336H01



MITSUBISHI AC SPINDLE DRIVE, FREQROL-SFJ/SF

- Order Sheet -

Caution for filling the list:

- For details of each item, please refer to the "STANDARD SPECIFICATION" listed to the right.
- Fill one copy of sheet for one unit.
- Write down each data within enclosed space (fill each space with circlet, numerals or symbol).
- Do not fail to fill items marked with * (1., 2., 4., 5. and 7.) when order is placed for the first time.
- For item not specified by customer, our standard specification indicated by (bold) is applied.
- If special specification is required, fill 10. "Special requirements".

Applicable documents		
	Title	Document No.
FR-SFJ	Standard specification	BNP-A2821-01
	Maintenance manual	BNP-A2821-02
	Operation/adjustment procedure	BNP-A2821-03
FR-SF	Standard specification	BNP-A0801-18
	Maintenance manual	BNP-A0801-19
	Operation/adjustment procedure	BNP-A0801-20

1. *Product ordered

Item	Name	Model	Q'ty/unit	Outside view	Rating list	
01	Controller	FR-SFJ-2-K	1	See Standard Specification.		
01	Controller	FR-SF-2-K	1			
02	Resistor unit	TN577A115G	1			
03	Magnesensor	BKO-	1			
03	Encoder		1			
05	Motor	SJ-J	1		RSJ	
05	Motor	SJ-	1		RSJ	
○	Spare parts	Fuse MF60NR-5A-S	3	Attached to controller		Put circlet for selection.

2. *Controller specification

Panel inside mount type	Put circlet for selection.
Intermediate panel type	

3. Power supply and environment

(Check the following specification.)

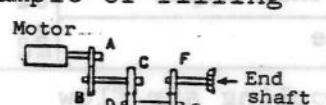
Supply voltage	200/220V - 230V +10% -15%
Frequency	50/60Hz ±3Hz
Ambient temperature	Controller: -5°C to +55°C Motor: 0 to +40°C
Ambient humidity	45% to 85%
Vibration	Controller: Less than 0.5G Motor: Less than 1G

If there is special requirement, fill 10. "Special requirements".

4. Motor specification (installation/characteristics)

Installation		Direction of installation		Put circlet for selection.
Flange mount		Output shaft horizontal		
Foot mount (standard type)		Output shaft down		
Foot mount (thin type)		Output shaft up		
Built-in type				
Direction of cooling air flow				Put circlet for selection.
	P → O	O → P	Load side "P" side "O"	
Output	30 min. 50% ED rating	Constant output P1 (P10)	()	
		Reduced output P3 (P20)	(KW)	
Speed	Continuous rating	Constant output P2	(VOL)	
		Reduced output P4		
Basic speed N1 (N10)		()	Fill with value.	
Max. speed	Constant output N2 (N20)	(RPM)		
	Reduced output N3 (N30)	()		
Constant output characteristic		Acceleration/deceleration characteristic		

5. Machine specification

Drive	Gear	Belt	Direct	Put circle or fill with value.
Maximum speed at end shaft (at each gearing)	H: High speed MH: Medium-high speed ML: Medium-low speed L: Low speed		(RPM)	
Load GD^2 converted into load on motor shaft	H: High speed MH: Medium-high speed ML: Medium-low speed L: Low speed		(kg-m ²)	
Gear teeth or pulley diameter (from motor shaft to end shaft) (Refer to the example shown below)	H: High speed MH: Medium-high speed ML: Medium-low speed L: Low speed	— x — x —	— x — x —	
	Example of filling	 <p>A - F are number of gear teeth or pulley diameter.</p>		

6. Electrical specification

Motor max. speed (RPM) (Speed at maximum speed reference signal voltage (10V))	3450	4000	4500	Put circle or fill with value.
	4600	4800	5000	
	6000	8000	10000	
	12000	15000	20000	
	Special	RPM		
Zero speed detection		50RPM	25RPM	Put circle or fill with value.
	Special	RPM	0 - 1000 (1RPM inc.)	
Load meter output	10V (at 120%)	3V (at 120%)		Put circle or fill with value.
*Torque limit	10%	30%	50%	
	Special %	0 - 120% (1% inc.)		
Accel./decel. time constant	0.3sec	1.5sec	2sec	Put circle or fill with value.
	3sec	5sec	10sec	
	Special sec	0 - 32767msec(10msec inc.)		
*Speed detection range (% of max. speed)	2%	10%	20%	Put circle or fill with value.
	30%	40%	50%	
	Special %	0 - 120% (1% inc.)		
*Emergency stop alarm signal		ON	OFF	

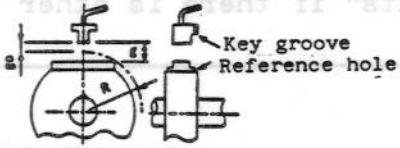
Fill for FS-SF

FR-SFJ Auxiliary input/ output signal selection	Aux. in- put 1	Torque limit H	Emergency stop	Put circlet for selection.
	Aux. in- put 2	Torque limit L	Emergency stop	
	Aux. out- put 1	Speed de- tect		
	Aux. out- put 2	Torque limit		

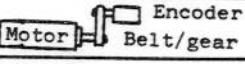
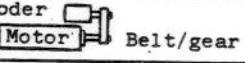
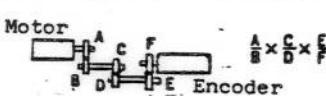
7. *Optional specification

No option				Put circlet for selection.	
Magnesensor spindle orientation (1 div.)					
Encoder multi-point spindle orientation (1024 div.)					
Encoder multi-point index spindle orientation (1024 div.)					
Motor built-in encoder multi-point spindle orientation					
Motor built-in encoder multi-point index spindle ori- entation					
Motor built-in encoder spindle speed display/sync. feed signal					
Digital speed reference signal	Interface	Source drive (Open emitter)	Type		
		Sync. drive (Open collector)	BCD, 3-digit		
			BCD, 2-digit		
Bus-linked to M300 series CNC					
Bus-linked to M300 series CNC, encoder (1024 pulses) high-speed sync. tap					
Bus-linked to M300 series CNC, motor built-in encoder high-speed sync. tap					
Bus-linked to M300 series CNC, profiling control (C-axis control)					
Fill 10. "Special requirements" if there is other special specification.					

8. Optional specification (for oriented spindle stop function)

Magnesensor spindle orientation			Encoder spindle orientation		
Direction of spindle orientation	PRE	Put circlet for selection.	In-position range	PRE	Put circlet or fill with value.
	Forward run			Forward run	
	Reverse run			Reverse run	
In-position range	1°	Put circlet or fill with value.	Stop position command interface	±0.35°	Put circlet or fill with value.
	5°			±0.30°	
	0 - 20° (1/16° increment)			±1.05°	
	Special			±1.25°	
Magnet body	0 - 6000 RPM (Standard)	Put circlet for selection.	Source drive (open emitter)	Put circlet or fill with value.	Put circlet or fill with value.
	0 - 12000 RPM (Standard)		Sync. drive (open collector)		
	0 - 12000 RPM (Small type)				
	0 - 30000 RPM (Ring type)				
For details, refer to the relevant instruction manual					
Installation of magnesensor (specify dimensions.)	Type A	Dimension	Fill with value.		
	Type A	R (mm)			
	Type A	g (mm)			
	Type A	go (mm)			
	Type B	R (mm)			
	Type B	g (mm)			
Recommended installation of standard magnesensor					
"A" type: Installed on circumference of disk					
 Unit: mm					
R 40 50 60 g 11.5 9.5 8.5 go 2.7 2.8 3.0					
"B" type: Installed on surface of disk					
 Unit: mm					
R 40 50 60 g 6 6 6			Accuracy of g, go: ±0.5mm		

9. Conditions for use of spindle orientation & profiling control encoder

Encoder power supply		Fed from NC [NO]
		Fed from NC [YES]
Direction of encoder		 Encoder Motor Belt/gear
		 Encoder Motor Belt/gear
Gear teeth or pulley diameter (from motor shaft to encoder) (See example below.)		— x — x —
Example:		A - F are number of gear teeth or pulley diameter.

10. Special requirements

We will not submit the drawing for approval at the 2nd delivery and thereafter unless specification is changed.

11. Order information

Messrs.	
Machine manufacturer	
Final user	
Machine name	
Machine type	
Q'ty	
Serial No.	
Order sheet prepared on	

