

**AC SPINDLE DRIVE UNITS  
FREQROL-SE  
INSTRUCTIONS FOR OPERATION  
AND ADJUSTMENTS**

**NO. 2**

**MITSUBISHI ELECTRIC CORPORATION  
NAGYA WORKS**

## [ 1] PREPARING TO OPERATE

check the following points when switching on the power to the controller for the first time:

- (1) Has all the equipment been properly wired and connected as shown in the drawings?
- (2) Have the motor and control panel been grounded properly?
- (3) Have the shield wire terminations been connected properly?
  - o Make the proper connections to the shield terminals.
  - o Make the connections so that the shield areas do not form a loop.
- (4) Check that the equipment is secured properly to avoid looseness and damage.
- (5) Check that metal chips, pieces of wire and other foreign matter have not entered inside the equipment.
- (6) Check that there is nothing abnormal with the exteriors of the printed circuit boards.
- (7) Check that the ROM numbers and DIP switch settings are as per the order list.

## [2] RECEIVING POWER

If all items under section [1] are satisfactory, power up the equipment as follows:

- (1) Switch on the incoming power.
- (2) Check that light-emitting diodes LED13, 14, 15 and 16, which are designed to indicate trouble and which are located on the front of the controller, have not lighted.
- (3) Check that light-emitting diodes LED2 (READY) and LED10 (ZERO SPEED), which are designed to indicate the status and

which are located on the front of the controller, have lighted.

These procedures enable operation.

No problems are posed with the controller and re-connection is not necessary even if the phase sequence of the incoming power is reversed. It is possible to check whether the phase sequence is positive or reversed by observing LED1 (PHASE SEQUENCE). A positive phase sequence is indicated when LED1 lights.

### [3] ADJUSTMENT LOCATIONS

- (1) Speed meter adjustment (effective only with connections to ammeter terminals SM1 and LM1)

Item	Method		Adjustment VR
Speed meter	SW6-6 on SE-CPU1(2)	Set to maximum speed meter indication.	VR14, SE-101 card
Load meter	card to OFF.	Set to 120% load meter in- dication.	VR15, SE-101 card

- (2) Setting DIP switches, setting pins

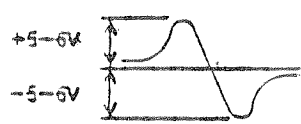
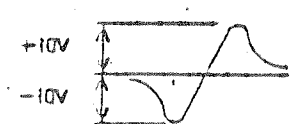
Check again that the settings in the order list corresponding to the machine have been made. Change the settings if they have not been made. To change the settings, set the set switch (ST1) to ON.

Refer to pages 10 to 14 for details on the settings.

- (3) Orient operation adjustment (only when optional functions are provided)

Magnetic sensor orient (SE-CPU1 card)

(A) Magnetic sensor sensitivity adjustment

Check Location	Between CON4(14)-(15)	Check Location	Between CH53-54
			
<p>Gap adjustment is required if the status is not as that in the figure above. Refer to the INSTRUCTIONS FOR OPERATION AND ADJUSTMENT.</p>		<p>VR2 for adjustment</p>	

(B) Use VR1 to adjust the orient stop position.

(C) Use switches SW4-8 to identify the mounting direction of the magnetic sensors.

\* Set SW4-8 in reverse of their present settings to identify the mounting direction of the sensors with a high degree hunting at orient stop.

Encoder orient (SE-CPU2 card)

(A) Orient stop position adjustment.

Change angle		Change switch
Per notch	0.088 deg. (1 pulse)	SW15
	1.4 deg. (16 pulses)	SW14
	22.5 deg. (256 pulses)	SW13

$$\text{Position shift} = 360 \text{ deg.} \times \frac{\text{set value}}{4096}$$

(B) Use SW4-8 to identify the encoder mounting direction.

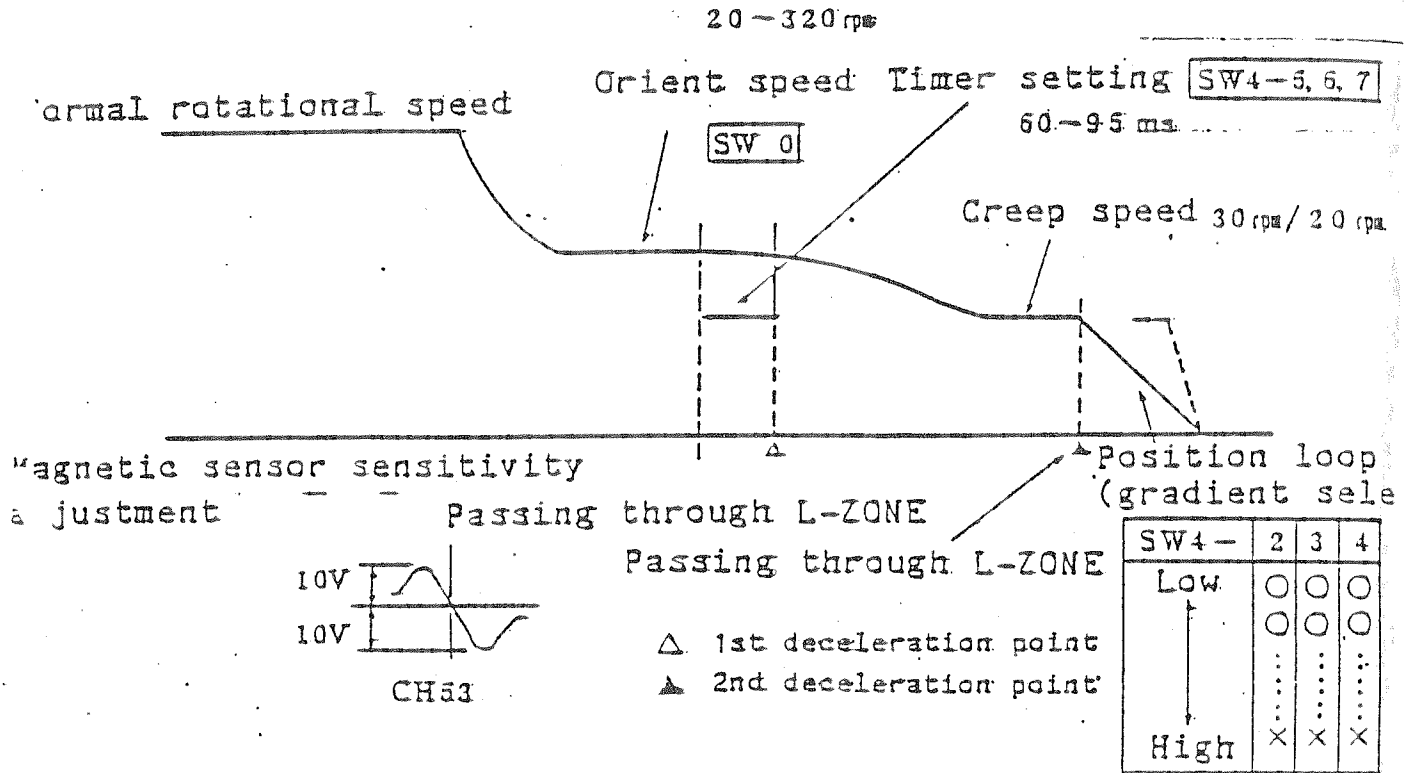
\* Set SW-8 in reverse of their present positions to identify the mounting direction of the encoder with a high degree hunting at orient stop.

These procedures complete the adjustments made when combining the machines.

Refer to pages 7 to 9 for the adjustments applying to the first machine.

[4] ORIENT ADJUSTMENTS

(1) Magnetic sensor system



Operate at the orient speed with SW6-10FF and ST2, adjust VR2 to the limit at which the magnetic sensor sensitivity LED11 lights and set CH53 to the peak voltage +/-10V.

The speed pattern for orient is now as shown in the figure above. Therefore,

proceed as follows when over shoot with stop:

- o Reduce the timer setting (SW4-5,6,7) time.
- o Reduce the position loop gain (SW4-2,3,4) gradient.
- o Reduce the orient speed. (SW10 F → E → .... → 0)
- o Reduce the creep speed. (SW4 OFF → ON)

Reduce the orient time.

- o Increase the timer setting (SW4-5,6,7) time.
- o Increase the position loop gain (SW4-2,3,4) gradient.
- o Increase the orient speed. (SW10 0 → 1 → .... F)

Hunting when drive unit stops

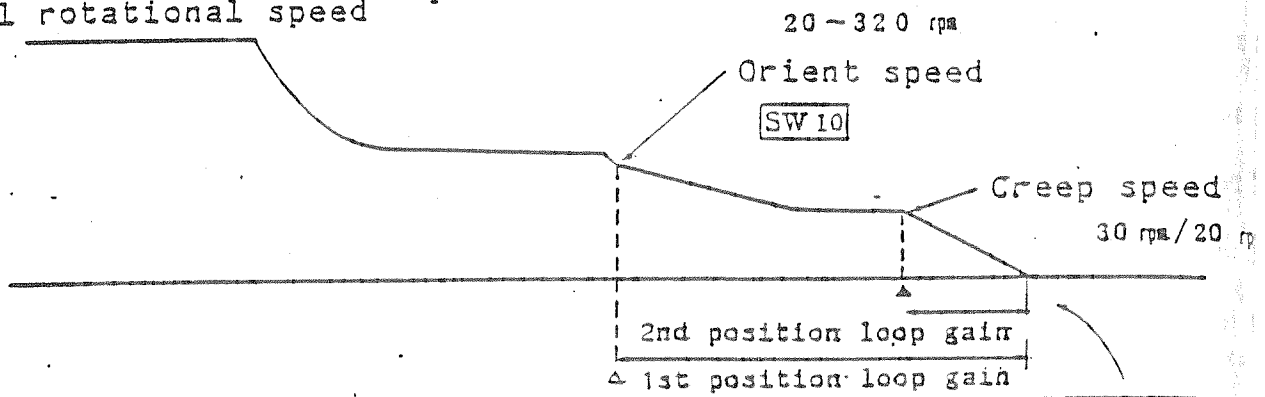
- o Reduce the position loop gain (SW4-2,3,4) gradient.
- o Reduce the magnetic sensor sensitivity. (VR2)
- o Reduce the creep speed. (SW4 OFF → ON)

Furthermore, adjust the stop position with position shift VR1.



(2) Encoder system

Normal rotational speed



△ 1st deceleration point  
 ▲ 2nd deceleration point

SW4-	5	6	7
Low	○	○	○
↑	○	○	×
↓	⋮	⋮	⋮
High	×	×	×

SW4-	2	3
Low	○	○
↑	⋮	⋮
↓	⋮	⋮
High	×	×

The speed pattern for orient is the same as that shown above.

Therefore,

Proceed as follows when over shoot with stop:

- o Reduce the 1st position loop gain.
- o Reduce the orient speed. (SW10 F → E → .... → 0)
- o Reduce the 2nd position loop gain.
- o Reduce the creep speed. (SW4 OFF → ON)

Reduce the orient time.

- o Increase the 1st position loop gain.
- o Increase the orient speed. (SW10 0 → 1 → .... → F)
- o Increase the 2nd position loop gain.

Hunting when drive unit stops

- o Reduce the 2nd position loop gain.
- o Reduce the creep speed. (SW4 OFF → ON)

Furthermore, adjust the stop position with position shift switches 13, 14 and 15.

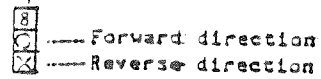


# (7) Orientation setting

Direction of magnetic sensor (encoder) mounting

SW4

	1	2	3	4	5	6	7	8
ON								
OFF								



Creep speed Position loop gain (1st position loop gain) Magnetic sensor orient (position loop gain)

1	20 rps
X	30 rps

Magnetic sensor (Encoder)			
2	3	4	
O	O	O	
O	O	X	25°
O	O	O	24
O	X	O	23
O	X	X	21
X	O	O	20
X	O	X	19
X	X	O	18
X	X	X	16

Magnetic sensor (Encoder)		
5	6	7
O	O	O
O	O	X
O	X	O
O	X	X
X	O	O
X	O	X
X	X	O
X	X	X

(8) SW5

	1	2	3	4	5	6	7	8
ON								
OFF								

(9) SW6

	1	2	3	4	5	6	7	8
ON	O	O			O			
OFF								

Acceleration/ deceleration Torque restriction time constant Speed detection range

1 2		3 4 5			6 7 8		
O	O	O	O	O	O	O	O
O	X	O	O	X	O	O	X
X	O	O	X	O	O	X	O
X	X	X	X	X	X	X	X

- 3 Speed command
  - O --- BINARY 12BIT
  - X --- BCD 2 digits
- 4 Speed command input
  - O --- Source drive (open emf)
  - X --- Sync drive (open coll)
- 5 Position command input
  - O --- Source drive (open emf)
  - X --- Sync drive (open coll)
- 7 Maximum speed 1500 base
  - O --- L
  - X --- H
- 8 Zero speed 8000 rpm
  - O --- 25 RPM specification
  - X --- 50RPM

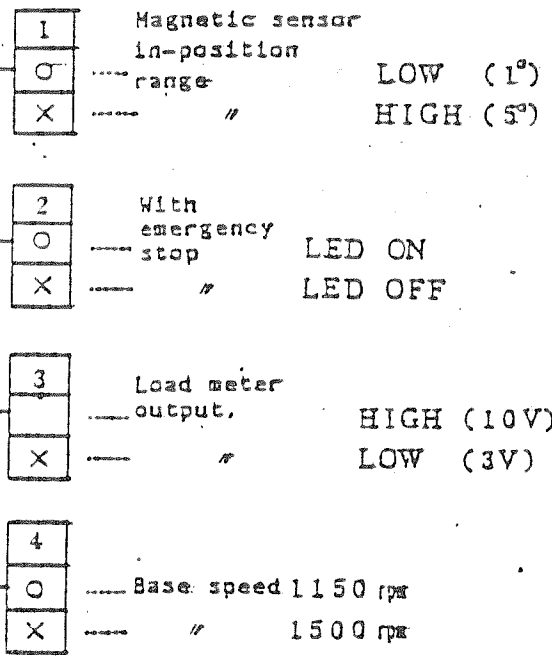
NOTE: In the charts for SW 5, 6, 7,

O indicates the ON side,

and X indicates the OFF side.

1) SW7

1	2	3	4	5	6	7	3



Base = 1150 rpm				Base = 1500 rpm							
5	6	7	8	Capacity	Top speed	5	6	7	8	Capacity	Top speed
○	○	○	○	----- Spare	Spare	○	○	○	○	----- Spare	Spare
○	○	○	×	----- 22/37kV	3450/4600rpm	○	○	○	×	----- 22/37kV	4500/6000 rpm
○	○	×	○	----- 37/55	"	○	○	×	○	----- 37/55	"
○	○	×	×	----- 55/75	"	○	○	×	×	----- 55/75	"
○	×	○	○	----- 75/11	"	○	×	○	○	----- 75/11	"
○	×	○	×	----- 11/15	"	○	×	○	×	----- 11/15	"
○	×	×	○	----- 15/18.5	"	○	×	×	○	----- 15/18.5	"
○	×	×	×	----- 18.5/22	"	○	×	×	×	----- 18.5/22	"
×	○	○	○	----- Spare	Spare	×	○	○	○	----- Spare	Spare
×	○	○	×	----- Spare	Spare	×	○	○	×	----- Spare	Spare
×	○	×	○	----- 22/37	8000	×	○	×	○	----- 37/5.5	8000
×	○	×	×	----- 37/55	"	×	○	×	×	----- 55/7.5	8000
×	×	○	○	----- 55/75	6000	×	×	○	○	----- 7.5/9	8000
×	×	○	×	----- 75/11	"	×	×	○	×	----- 22/37	6000/1000
×	×	×	○	----- 11/15	"	×	×	×	○	----- 22/3.7/5.5	"
×	×	×	×	----- Spare	Spare	×	×	×	×	----- 5.5/7.5	"

( ) **SW8** Speed control loop proportional gain

Notch	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯
Magnification	8/32	11/32	14/32	17/32	20/32	23/32	26/32	29/32	1	1.2	1.4	1.6	1.8	2	2.2	2.4
$W_c$	25	34	44	55	63	72	81	91	100	120	140	160	180	200	220	240

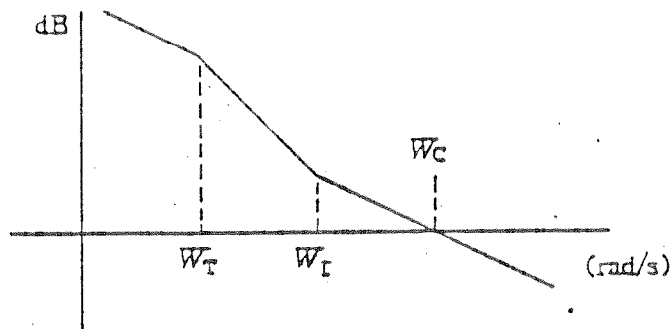
(rad/s)

**SW9** Speed control loop integral gain

Notch	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯
Magnification	8/32	11/32	14/32	17/32	20/32	23/32	26/32	29/32	1	1.2	1.4	1.6	1.8	2	2.2	2.4
$W_i$	1.5	2.1	2.6	3.2	3.8	4.3	4.9	5.4	6.0	7.2	8.4	9.6	10.8	12.0	13.2	14.4

(rad/s)

Determine the loop transfer function of the speed control in combination with the SW11-3.4 mode selection.



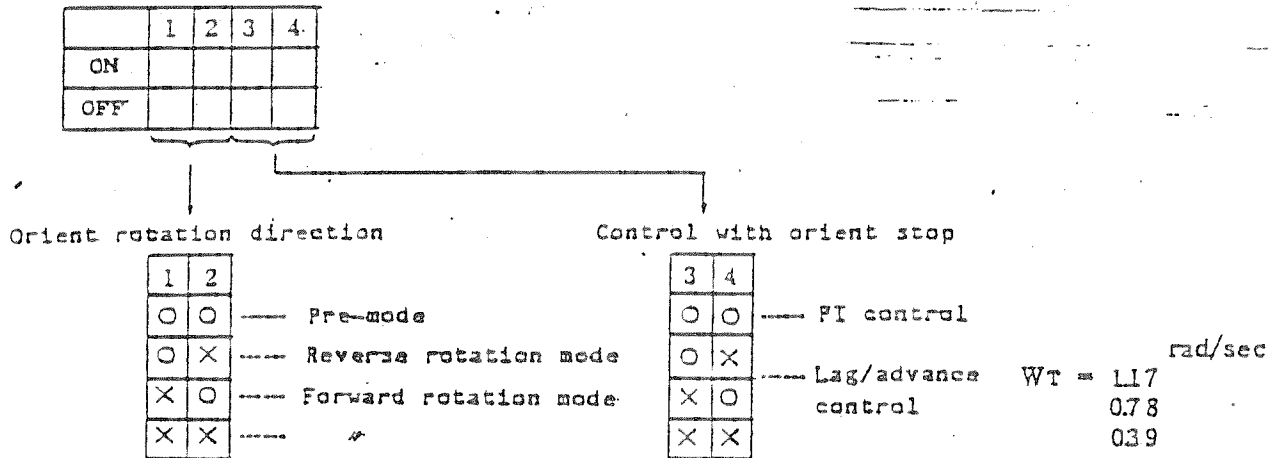
Note: The condition of  $W_T > W_I > W_C$  must be met.

The standard settings are notch 8 for both SW8 and for SW9

12) **SW10** Orient speed setting

Notch	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	
rpm	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320

(13) SW 11



(14) SW12 In-position range

In-position range	0	± 0	8	±0.704
	1	±0.088	9	±0.792
	2	±0.176	A	±0.88
	3	±0.264	B	±0.968
	4	±0.352	C	±1.056
	5	±0.44	D	±1.144
	6	±0.528	E	±1.232
	7	±0.616	F	±1.320