

HT20S II

BL SUPER  
AC SERVO SYSTEM

2軸組込型  
BL860/861/862 (2-axle integrated type)

Maintenance Manual

SANYO DENKI CO., LTD.

This Maintenance Manual is intended for the user of 21950/851/862 Series, and describes a test run, adjustments, preventive maintenance as well as countermeasures against trouble which might happen during use.

Specification Manual M-04569 and Operation Manual M-04568 may also be helpful for maintenance and service.

## CONTENTS

|   |    |
|---|----|
| 1. TEST RUN .....   | 1  |
| 1.1 Check Item Before Test Run .....                                      | 1  |
| 1.1.1 Servo motor .....   | 1  |
| 1.1.2 Servo amplifier .....   | 2  |
| 1.2 Test Run Procedure .....  | 3  |
| 1.2.1 Preparation for test run .....                                      | 3  |
| 1.2.2 Operation .....   | 4  |
| 1.2.3 Check during test run .....   | 5  |
| 2. ADJUSTMENTS .....  | 5  |
| 2.1 Setting Before Shipment .....   | 5  |
| 2.1.1 Setting of dip switch (SW2) .....                                   | 5  |
| 2.1.2 Setting of jumper pin .....   | 5  |
| 2.1.3 Setting of volume .....   | 6  |
| 2.2 Characteristics Set Before Shipment .....                             | 7  |
| 2.2.1 Speed command/revolutions<br>characteristics .....                  | 7  |
| 2.2.2 Speed regulation .....  | 8  |
| 2.2.3 Acceleration/deceleration response<br>characteristics .....         | 9  |
| 2.3 Re-adjustment .....   | 10 |
| 2.3.1 Adjustment of volume and jumper pin .....                           | 10 |
| 2.3.2 Division of encoder signal .....                                    | 10 |
| 2.4 Adjustment Procedure .....  | 10 |
| 3. MAINTENANCE AND CHECK .....  | 22 |
| 3.1 Servo Motor .....   | 22 |
| 3.2 Servo Amplifier .....   | 23 |
| 4. DIAGNOSIS AND TROUBLESHOOTING .....                                    | 24 |
| 4.1 Servo Motor .....   | 24 |
| 4.2 Servo Amplifier .....   | 26 |
| 4.2.1 Diagnosis with 8-segment LED .....                                  | 26 |
| 4.2.2 Trouble caused by improper adjustment, and<br>countermeasures ..... | 35 |

must be made certain of the following items before  
in the test run.

#### 1.1 Check Item Before Test Run

Perform the following checks before a test run.

##### 1.1.1 Servo motor

Check to see if:

- (1) The servo motor is delivered in the specified type No.
- (2) The driven machine is kept in good condition and is well coupled with the motor and amplifier, and if the wiring, fuse, and grounding have no problem.
- (3) Each thread is in position and securely tightened.
- (4) The oil seal is free from breakage and has the sliding surface splashed by lubricating oil.

If any trouble occurs with repeat to the above items, immediately take proper countermeasures.

If a test run is started after an extended shutdown or storage, follow directions given in 3, "Maintenance and Check."

### 1.1.2 Servo amplifier

Check to see if:

- (1) The servo amplifier is delivered in the specified type No.
- (2) The connection and wiring lead wire are securely fastened with the terminal, or securely inserted into the connector.
- (3) The signal "alarm output" causes main circuit power supply to turn OFF and if a sequence is established so that the control circuit is turned ON in advance of the main circuit.
- (4) Power voltage is supplied to the servo amplifier at 200 to 230 V +10% and -15%.
- (5) The speed command is set to 0V (an input current is short-circuited).
- (6) Grounding meets requirements of Grounding, Class 3 (grounding resistance: 100  $\Omega$  or less).

If any faulty point is detected in the above check, immediately remedy it.

## 1.2 Test Run Procedure

### 1.2.1 Preparation for test run

To carry out a test run, operate the servo motor at no-load to avoid any accident. (Do not couple the driven machine with the servo motor during a test run.) If the servo motor has to be subjected to a test run, with the driven machine coupled with, for any reason, keep the servo motor ready for an emergency stop. Check to make certain that the servo motor causes no hazard to surrounding persons and equipment before starting a test run.

#### (1) Turning power ON

Press the "Power ON" push-button switch to the external sequence circuit, and power supply is turned ON. The control circuit is first turned ON, and the main circuit is then turned ON.

- (2) After turning power supply ON, turn the "Operation Ready" signal ON (turn the contact ON.). If the servo motor and servo amplifier are kept normal, the "Operation Ready Completed" signal is output. The dynamic brake circuit in the servo amplifier is turned OFF. Thus, the motor is set free, or left in "Servo OFF."

Note: If the model that processes the operation ready signal in the servo amplifier is used, turning on the contact is not required.

- (3) After turning the "Operation Ready Completed" signal ON, turn the "Servo ON" signal ON (contact ON). The power circuit in the servo amplifier functions. Thus, the motor is kept ready for starting (Servo ON state).

Note: The above steps (1) to (3) keep the servo motor in "servo lock" state, that is, an armature current flows at the current limit value.

### 1.2.2 Operation

This servo system may be operated only when signals "Operation Ready" and "Servo ON" are left turned ON.

In addition, the "external current limit" may prohibit the servo system from operation. Therefore, check for each current limit to which the input current flows.

- (1) Slowly raise the speed command from 0V. The motor rotates at a speed proportional to a command voltage.
- (2) The motor rotates in the normal rotary direction at the "plus" command voltage. "Normal rotation" means that the motor rotates counterclockwise when viewed from the load (driven machine) side.

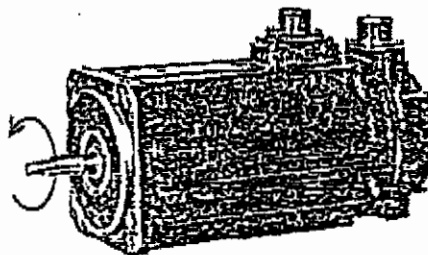


Figure 1.1 Direction in which motor runs at normal rotation

### 1.2.3 Check during test run

During a test run, carefully check to see if:

- (1) The motor generates abnormal vibration.
- (2) The motor is free from abnormal sound.
- (3) Motor temperature rises abnormally.

If any trouble occurs, follow directions given in 4. "Diagnosis and Troubleshooting."

## 2. ADJUSTMENTS

### 2.1 Setting Before Shipment

The standard dip switch, jumper pin, and volume are set before shipment, as shown below.

#### 2.1.1 Setting of dip switch (SW2)

This switch sets the division ratio of the encoder signal. The standard encoder has a division ratio of 1.1. (SW2, 2 to 8, are set to ON.)

#### 2.1.2 Setting of jumper pin

The jumper pin enables the operator to select various functions by inserting the socket according to his purpose. The jumper pins SN 1, 4, and 8 are of 3-pin type.



Table 2.1 Setting of standard jumper pins

| Jumper pin No.                           | JP1 | JP4 | JP8 |
|--|-----|-----|-----|
| Short-circuiting between pins<br>① and ④ | o   | o   | o   |
| Short-circuiting between pins<br>② and ③ | -   | -   | -   |

## 2.1.3 Setting of volume

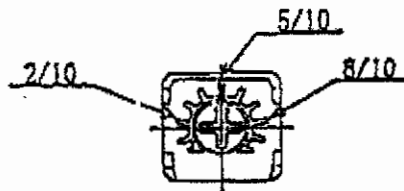
The volume of the servo amplifier has been adjusted to an optimum value to ensure that load inertia ( $J_L$ ) = motor inertia ( $J_M$ ).

Table 2.2 Adjusted position of volumes of standard amplifier

| Volume No.                            | VR1                      | VR2                              | VR4                    | VR8                     | VR7                   | VR9                                      | VR10                                      |
|---------------------------------------|--------------------------|----------------------------------|------------------------|-------------------------|-----------------------|--|---|
| Function                              | Axle 1<br>Speed<br>scale | Axle 1<br>PI<br>time<br>constant | Axle 1<br>Loop<br>gain | Axle 1<br>Zero<br>drift | Axle 1<br>F/V<br>gain | Axle 1<br>F/V<br>zero<br>adjust-<br>ment | Axle 1<br>Current<br>limit                |
| Position of<br>volume on the<br>scale | 2/10<br>to<br>8/10       | 2/10<br>to<br>8/10               | 5/10                   | 1/10<br>to<br>9/10      | 1/10<br>to<br>9/10    | 2/10<br>to<br>8/10                       | 10/10<br>for<br>user's<br>adjust-<br>ment |
| Volume No.                            | VR11                     | VR12                             | VR14                   | VR18                    | VR17                  | VR19                                     | VR20                                      |
| Function                              | Speed<br>scale           | PI<br>time<br>constant           | Loop<br>gain           | Zero<br>drift           | F/V<br>gain           | F/V<br>zero<br>adjust-<br>ment           | Current<br>limit                          |
| Position of<br>volume on the<br>scale | 2/10<br>to<br>8/10       | 2/10<br>to<br>8/10               | 5/10                   | 1/10<br>to<br>9/10      | 1/10<br>to<br>9/10    | 2/10<br>to<br>8/10                       | 10/10<br>for<br>user's<br>adjust-<br>ment |

Note 1: Volume scale

Note 2: Volumes with marks  $\Delta$  or X in Table 2.10. are sealed.



## 2.2 Characteristics Set Before Shipment

The standard servo motor is set to the following characteristics before shipment. Therefore, re-adjustment at site is not necessary where the servo motor is operated according to the standard specification.

### 2.2.1 Speed command/revolutions characteristics

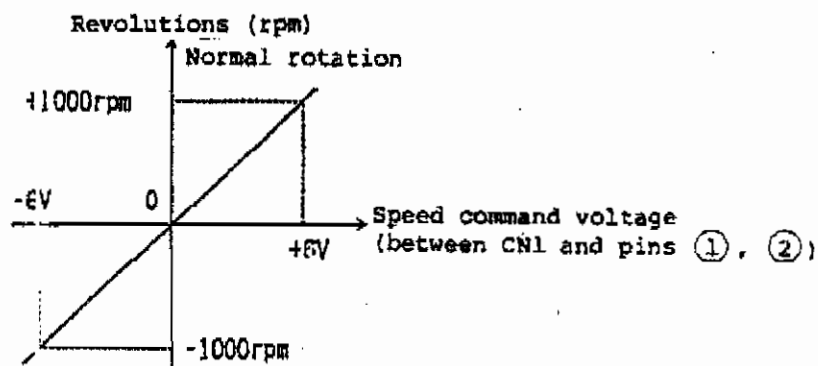


Figure 2.1 Speed command/revolutions characteristics

### 2.2.2 Speed regulation

The speed regulation in maximum revolutions ( $N_m$ ) is available in the following formula.

$$\frac{\Delta N}{N_m} \times 100\% \leq 0.015\%$$

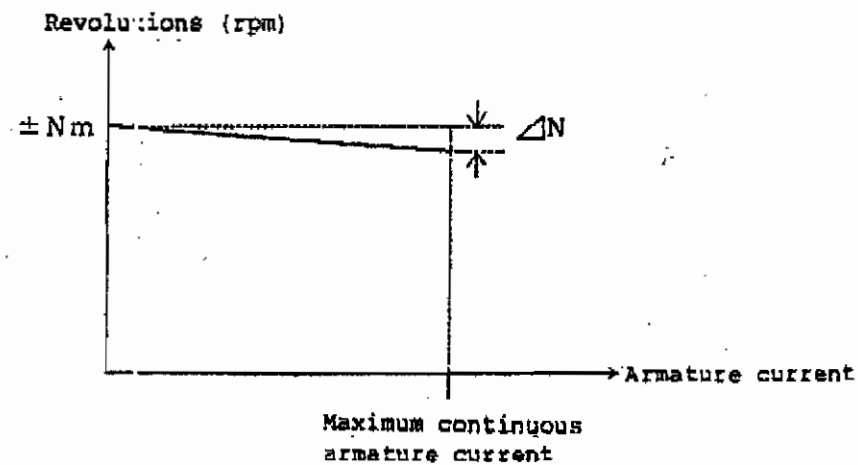


Figure 2.2 Speed regulation

### 2.2.3 Acceleration/deceleration response characteristics

Where load inertia ( $J_L$ ) [equal to motor inertia ( $J_M$ )] is accelerated and decelerated to the maximum revolution speed in response to the step speed command, the overshoot ( $\Delta N_{OV}$ ) and undershoot ( $\Delta N_{UD}$ ) are limited to 5% or less ( $\Delta N/N_m \times 100$ ).

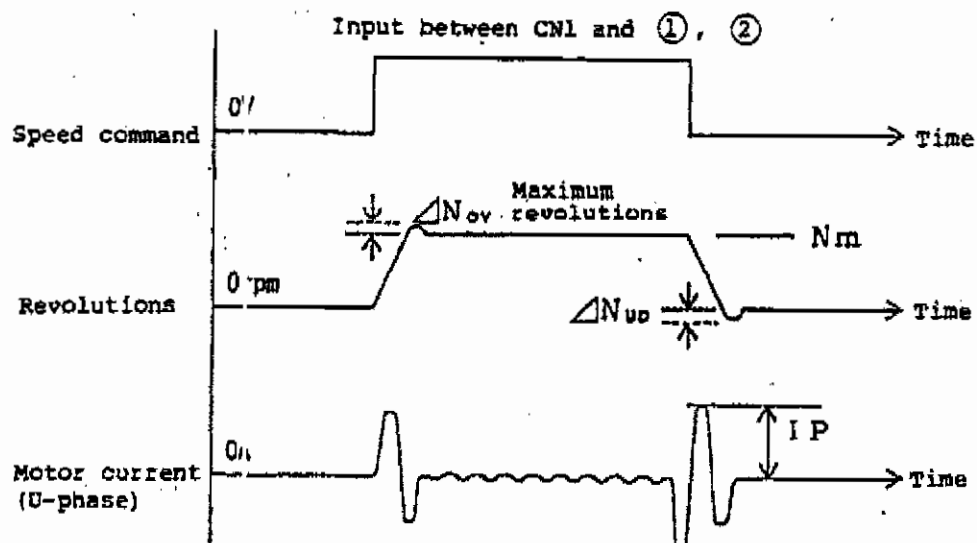


Figure 2.3 Acceleration/deceleration response characteristics

## 2.3 Re-adjustment

### 2.3.1 Adjustment of volume and jumper pin

- (1) Prior to shipment, the servo amplifier is so adjusted as to provide the mated servo motor with optimum characteristics. Therefore, re-adjustment is not necessary where the amplifier is operated according to the standard specification.
- (2) Re-adjustment and/or re-setting may be necessary depending on applications and usage. If necessary, follow directions given in Tables 2.10 and 2.11. Never touch each volume nor each jumper pin. (No re-adjustment is necessary.)

### 2.3.2 Division encoder signal

To divide an encoder signal, use the dip switch (SW1, 2). For further information, refer to Specification Manual, paragraph "Encoder Signal." Note that the encoder signal is divided at a division ratio of 1:1.

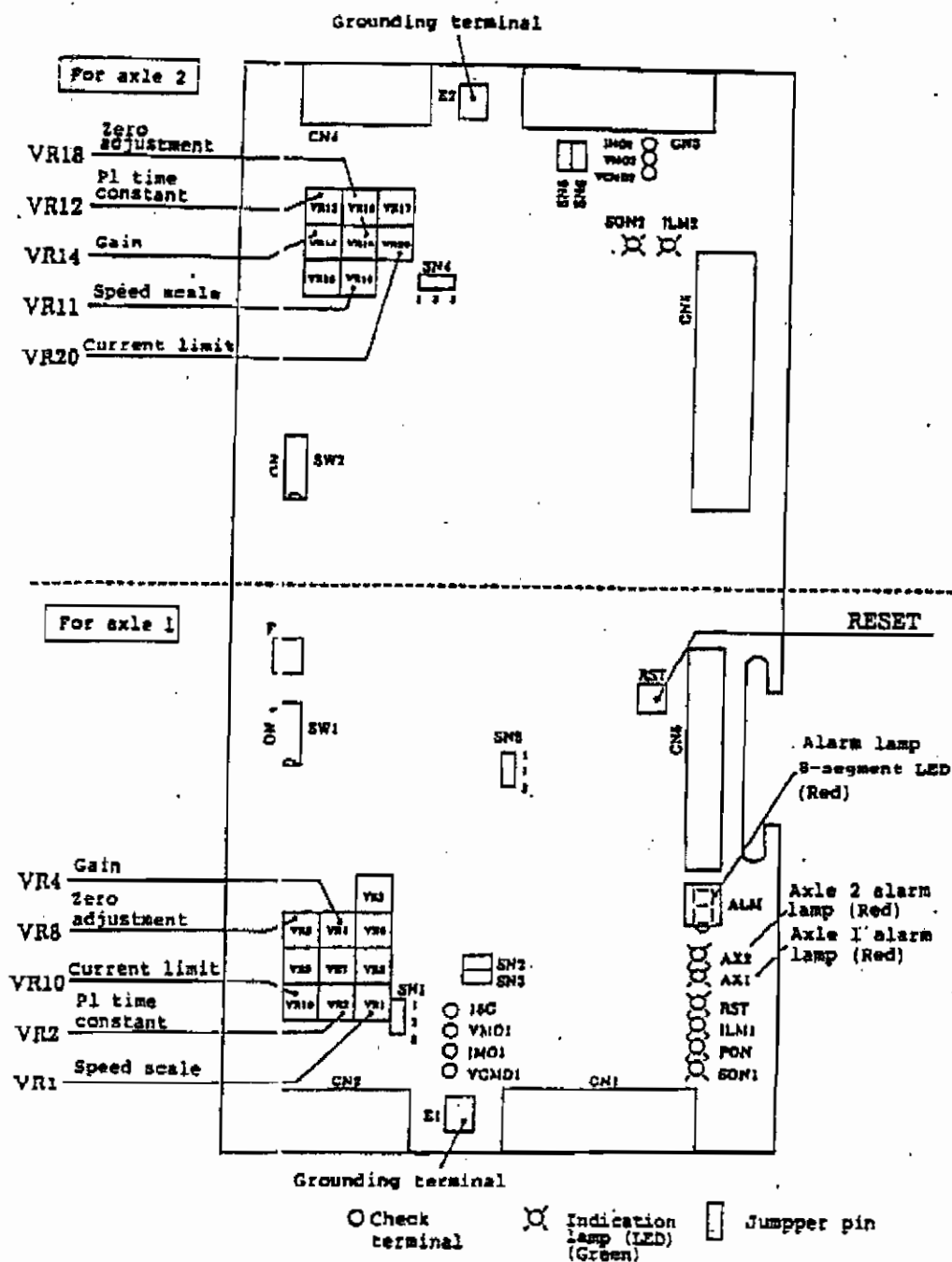
## 2.4 Adjustment Procedure

Figures 2.4 and 2.5 show the position of the adjusting volume, jumper pin, and waveform observing check terminal. Table 2.10 shows the volume adjustment procedure. Table 2.11 shows the jumper setting procedure. Table 2.12 describes each check terminal.

Be sure to adjust the volume while observing the waveform output by the specified check terminal.

Figure 2.6 shows the waveform of each check terminal where the motor is in step response.

The user should never touch the Sanyo's adjusting volume (marked X in Table 2.10).



- \*1 Connect the shield grounding terminal (E) with the frame of the servo amplifier using the accessory wire.
- \*2 The fuse (F) is included in the 5V power line for the optical encoder. If this fuse is blown, be sure to check the external wiring before replacing the blown fuse with a spare fuse.

Figure 2.4 Layout of PCB P1

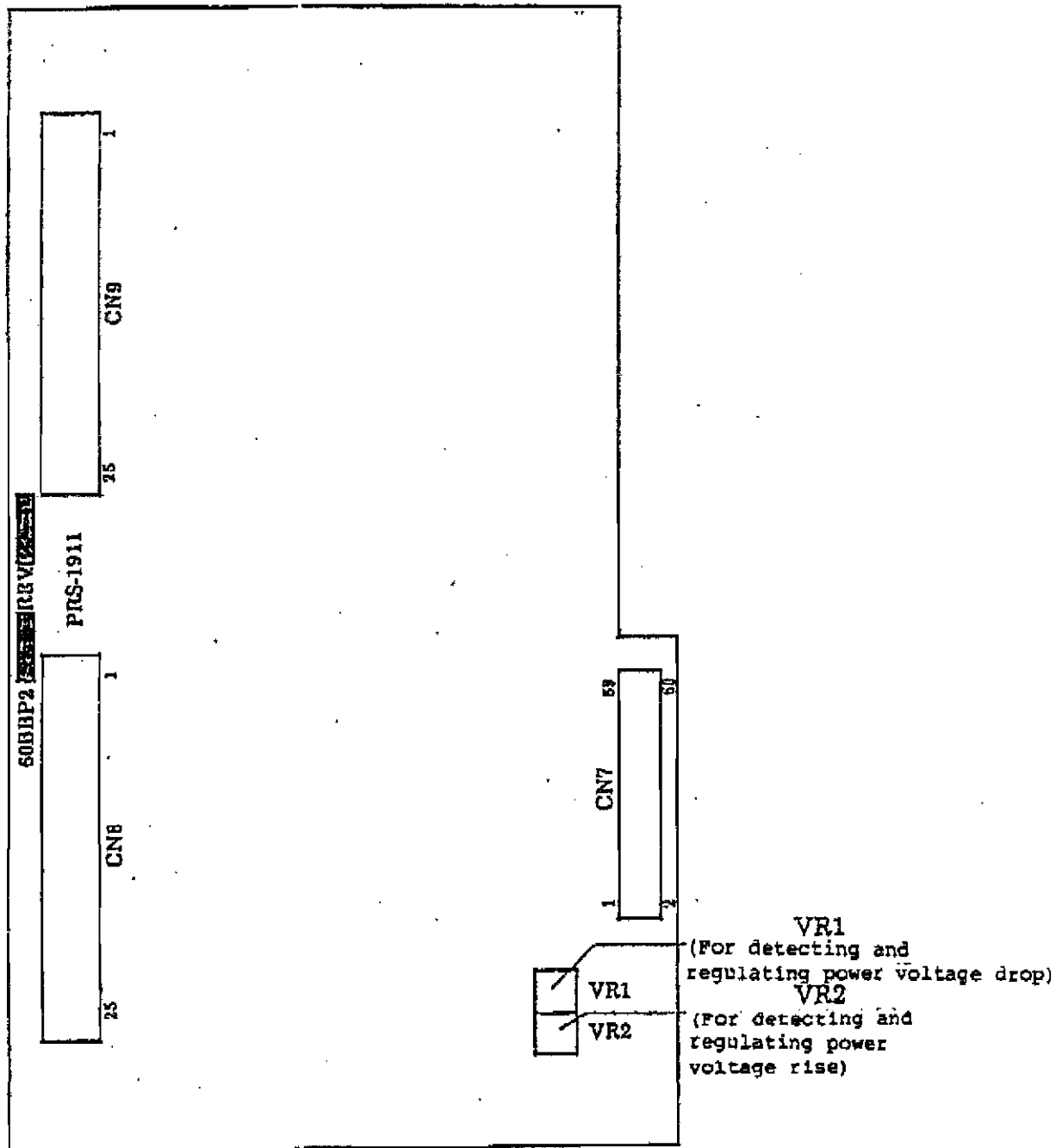


Figure 2.5 Layout of PCB P2

Table 2.10 Volume adjustment procedure (P1)

| Volume No.<br>(function)   | Adjust-<br>ment<br>standard | Adjusting method   | Change in<br>characteristics   |
|--|-----------------------------|--|--|
| VR1<br>(Axle 1)<br>VR11<br>(Axle 2)<br>[speed<br>scale]          | $\Delta$                    | Use these volumes to change a relationship between speed command voltage and revolutions (rpm). This relationship is adjusted to +6V/1000 rpm $\pm 1\%$ for the standard motor before shipment. Use VR1, 11 for fine turning. Turn VR1, 11 clock-wise, and revolutions increase. |  |
| VR2<br>(Axle 1)<br>VR12<br>(Axle 2)<br>[PI time<br>constant]     | $\Delta$                    | Use these volumes to adjust the PI time constant. The standard motor set is adjusted to the extent that inertia ( $J_L$ ) is equalized with motor inertia ( $J_M$ ), with an overshoot of 5% or less.  | Turn these volumes clockwise, and resistance increases while response is speeded up. Do not speed up response excessively. Otherwise, vibration may occur.                 |
| VR4<br>(Axle 1)<br>VR14<br>(Axle 2)<br>[Gain]                    | $\circ$                     | Use these volumes to adjust the gain of the speed loop. Turn the volumes until necessary response speed is available. Turn the volumes clockwise, and a gain increases.  | Turn these volumes counter-clockwise if vibration occur. The vibration is stabilized. Do not turn the VR3 clockwise excessively. Otherwise, the motor may start vibrating. |
| VR8<br>(Axle 1)<br>VR18<br>(Axle 2)<br>[Zero<br>adjust-<br>ment] | $\circ$                     | Use the VR8 until the motor may not turn when speed command voltage is 0V. For fine turning, turn the VR8 clock-wise, and the motor turns in the reverse direction. Turn it counter-clock-wise, and the motor in the normal direction.   |  |



| Volume No.<br>(function)  | Adjust-<br>ment<br>standard | Adjusting method   | Change in<br>characteristics   |
|---|-----------------------------|--|--|
| VR7<br>(Axle 1)<br>VR17<br>(Axle 2)<br>[F/V gain]                 | x                           | Use these volumes to control the gain of the F/V circuit. Never touch the volumes which has been properly adjusted before shipment.  | Turn the volumes clockwise, and the feedback voltage increases while the motor slows down. |
| VR9<br>(Axle 1)<br>VR19<br>(Axle 2)<br>[F/V zero adjust-<br>ment] | x                           | Use these volumes for fine turning of the F/V circuit. Never touch the volumes which has been adjusted before shipment.  |  |
| VR10<br>(Axle 1)<br>VR20<br>(Axle 2)<br>[current<br>limit]        | o                           | Use these volumes to adjust a motor current limit value when the "current limit" input signal is turned ON. Note that the standard VR8 is turned all the way in the clockwise direction (10/10). | Turn the volumes counter-clockwise, and the motor current limit value gets smaller.        |
| VR21<br>[Regenera-<br>tive<br>operation<br>voltage]               | x                           | The regenerative circuit (power transistor) functions at 395V, DC. Never touch the VR9, which has been properly adjusted before shipment.  | Turn the VR21 clockwise, and operation voltage rises.                                      |

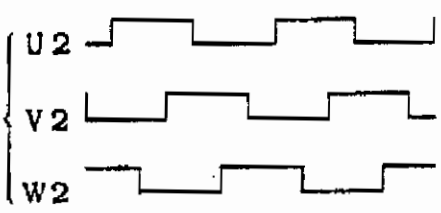
- Caution: 1. Volumes marked o: Adjust depending on use condition.  
 2. Volumes marked Δ: Adjust only when the motor is conditioned to a special load specification, or has special performance.  
 3. Volumes marked X: Never touch these volumes, which are adjusted exclusively by Sanyo.

Table 2.11 Jumper pin setting procedure (P1)

| Jumper<br>pin No.<br>(Function)   | Setting<br>standard | Operation, Characteristics, and Precautions  |  |
|---|---------------------|--|--|
|   |                     | Short-circuiting be-<br>tween pins ① and ②   | Short-circuiting be-<br>tween pins ② and ③   |
| SN1<br>(Axle 1)<br>SN4<br>(Axle 2)<br>[selection<br>of motor<br>rotary<br>directions] | o                   | The motor turns in<br>the normal direction<br>in response to speed<br>command voltage<br>(+VCMD).<br>Note that the stan-<br>dard motor is set in<br>this way.<br>The normal direction<br>means that the motor<br>turns counter-clock-<br>wise when viewed from | The motor turns in<br>the reverse direction<br>in response to speed<br>command voltage<br>(+VCMD). |

Table 2.12 A list of check terminals (Pl)

| Terminal No.                 | Name/<br>function                      | Description  |     |  |     |  |  |     |     |     |     |                              |      |     |      |     |
|------------------------------|--|--|-----|--|-----|--|--|-----|-----|-----|-----|------------------------------|------|-----|------|-----|
| 15G                          | 15G                                    | Control circuit to 0V  |     |  |     |  |  |     |     |     |     |                              |      |     |      |     |
| CMDU1                        | -                                      | (Axle 1) U-phase current command   |     |  |     |  |  |     |     |     |     |                              |      |     |      |     |
| CMDV1                        | -                                      | (Axle 1) V-phase current command   |     |  |     |  |  |     |     |     |     |                              |      |     |      |     |
| CMDW1                        | -                                      | (Axle 1) W-phase current command   |     |  |     |  |  |     |     |     |     |                              |      |     |      |     |
| IU1                          | Axle 1<br>U-phase<br>current           | <p>. Each phase current is monitored.</p> <table><tr><td rowspan="2"></td><th colspan="4">Servo amplifier model No.<br/>(60B (B))</th></tr><tr><th>030</th><th>050</th><th>075</th><th>100</th></tr><tr><th>Feedback<br/>voltage<br/>(V/A)</th><td>0.33</td><td>0.2</td><td>0.13</td><td>0.1</td></tr></table> |     | Servo amplifier model No.<br>(60B (B)) |     |  |  | 030 | 050 | 075 | 100 | Feedback<br>voltage<br>(V/A) | 0.33 | 0.2 | 0.13 | 0.1 |
|                              | Servo amplifier model No.<br>(60B (B)) |  |     |  |     |  |  |     |     |     |     |                              |      |     |      |     |
|                              | 030                                    |  | 050 | 075                                    | 100 |  |  |     |     |     |     |                              |      |     |      |     |
| Feedback<br>voltage<br>(V/A) | 0.33                                   |  | 0.2 | 0.13                                   | 0.1 |  |  |     |     |     |     |                              |      |     |      |     |
| IV1                          | Axle 1<br>V-phase<br>current           |  |     |  |     |  |  |     |     |     |     |                              |      |     |      |     |
| IW1                          | Axle 1<br>W-phase<br>current           |  |     |  |     |  |  |     |     |     |     |                              |      |     |      |     |
| TG1                          | Axle 1<br>Revolutions                  | Speed feedback voltage monitor<br>(+3V +1%/1000 rpm)   |     |  |     |  |  |     |     |     |     |                              |      |     |      |     |
| ΔET1                         | Axle 1<br>Current<br>command           | Current command voltage (equal to speed<br>deviation voltage)  |     |  |     |  |  |     |     |     |     |                              |      |     |      |     |
| VM01                         | Axle 1<br>Speed<br>monitor             | Revolution monitor (+3V +5%/1000 rpm)  |     |  |     |  |  |     |     |     |     |                              |      |     |      |     |
| IM01                         | Axle 1<br>Current<br>monitor           | Current command voltage monitor<br>(+10V +20%/maximum continuous armature current)   |     |  |     |  |  |     |     |     |     |                              |      |     |      |     |
| VCMD1                        | Axle 1<br>Speed<br>command<br>voltage  | Speed command voltage monitor<br>(+6V/1000 rpm)  |     |  |     |  |  |     |     |     |     |                              |      |     |      |     |
| +5                           | +5V                                    | +5V power supply monitor   |     |  |     |  |  |     |     |     |     |                              |      |     |      |     |
| +15V                         | +15V                                   | +15V power supply monitor  |     |  |     |  |  |     |     |     |     |                              |      |     |      |     |
| -15V                         | -15V                                   | -15V power supply monitor  |     |  |     |  |  |     |     |     |     |                              |      |     |      |     |
| +V BUS                       | -                                      | Main circuit DC power supply monitor <u>WARNING</u><br>(High Voltage: Use particular care.)  |     |  |     |  |  |     |     |     |     |                              |      |     |      |     |

| Terminal No. | Name/function                              | Description  |  |
|--------------|--|--|--|
| A02          | Axle 2 PG frequency dividing output signal | A-phase pulse output after frequency division (5V system signal) |  |
| B02          |  | B-phase pulse output after frequency division (5V system signal) |  |
| C02          |  | C-phase pulse output after frequency division (5V system signal) |  |
| U2           | Axle 2 Magnetic pole sensor input signal   | U-phase pulse input (5V system signal)                           |  |
| V2           |  | V-phase pulse input (5V system signal)                           |  |
| W2           |  | W-phase pulse input (5V system signal)                           |  |

- Notes: 1. Observe the check terminal with a measuring device with an input impedance of 1 MΩ or more, for example, an oscilloscope.
2. Use a common standard of "15G" for measurement, excluding terminals "+V BUS" and "-V BUS."
3. When observing the check terminal, never allow each terminal to come into contact with other parts and adjacent terminals. Otherwise, the internal device may be broken down.

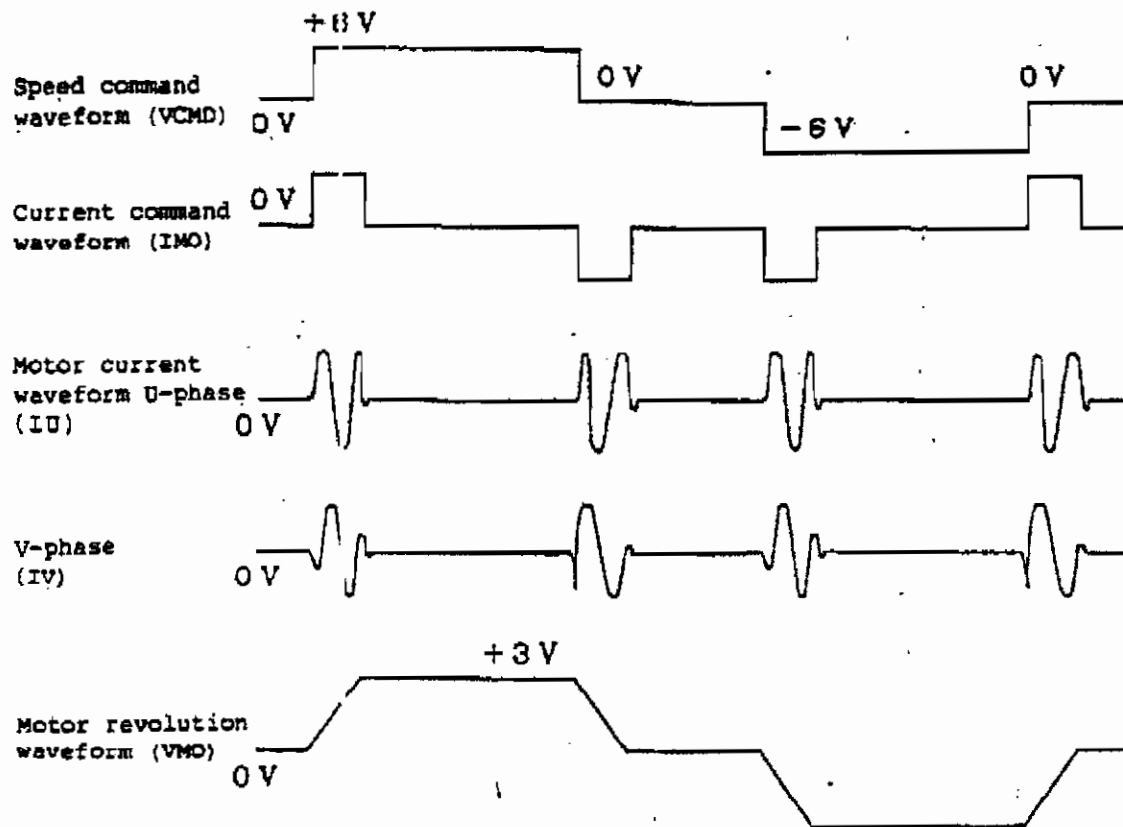


Figure 2.5 Waveform of check terminal during step response  
(at no-load)

### 3. MAINTENANCE AND CHECK

#### 3.1 Servo Motor

The servo motor requires only least maintenance and simplest routine checks, because no wear parts are provided. Follow directions given in Table 3.1.

Note that Table 3.1 shows only a general guideline. Establish a check interval depending on working environment, work conditions, etc. Never disassemble the motor at any time. Note that the optical encoder is precisely adjusted and coupled directly with the motor. If the motor requires disassembling, call Sanyo Denki.

Table 3.1 Maintenance and check procedure

| Maintenance/<br>check work   | Check<br>interval             | Maintenance and<br>check procedure   | Remarks   |
|--|-------------------------------|--|---|
| Visual check,<br>cleaning  | Every<br>month                | Clean with rags<br>or compressed air.  |   |
| Check for<br>vibration and<br>sound                                    | Every<br>day                  | Carefully touch<br>and listen to the<br>critical part.   | Make sure the motor<br>runs as usual,<br>with no vibration<br>or sound increased.               |
| Measurement of<br>insulation<br>resistance<br>(motor windings<br>only) | Every<br>year                 | Disconnect the<br>motor from the<br>control panel.<br>Measure the ter-<br>minal for insula-<br>tion resistance<br>with a 500V megger.<br>Windings exceeding<br>10 M $\Omega$ are accepta-<br>ble. Never connect<br>the megger with the<br>encoder. | If the measured<br>insulation resis-<br>tance is 10 M $\Omega$ or<br>less, call<br>Sanyo Denki. |
| Overall<br>inspection  | 20,000<br>hours or<br>5 years | Replace consumable<br>parts and repair<br>the motor, as<br>required.   | Call Sanyo Denki.   |

| Maintenance/<br>check work | Check<br>interval         | Maintenance and<br>check procedure                  | Remarks |
|----------------------------|---------------------------|---|---------|
| Replacement of<br>oil seal | * Every<br>5,000<br>hours | Disconnect the<br>motor from the<br>driven machine. |         |

\* This time interval is specified where the motor is specified to have water-proof and oil-proof functions.

### 3.2 Servo Amplifier

The servo amplifier requires no special maintenance owing to circuit parts with high reliability. Wipe the servo amplifier clean periodically, and re-tighten threads and screws, as necessary. That is all.

When the fuse is blown, replace it with the spare fuse which accompanies the servo amplifier. Keep the spare parts at user's responsibility.

#### 4. DIAGNOSIS AND TROUBLESHOOTING

Should any trouble occur during operation, or if the alarm indicating lamp (8-segment LED) lights and the motor stops, refer to Tables 4.1, 4.2, and 4.3 and follow directions for diagnosis and troubleshooting. When interrupting only the main circuit power supply in response to the "alarm signal," etc., be sure to turn the speed command to "0V," and turn ON the main circuit power supply, "operation ready" and "servo ON" signals before restarting the motor. This prevents hazard at a restart.

If trouble is not solved for all your efforts, immediately call Sanyo Denki.

##### 4.1 Servo Motor

Follow directions given in Table 4.1 for trouble with the servo motor.

Table 4.1 Cause of trouble and troubleshooting procedure

| Trouble                   | Cause                         | Troubleshooting procedure            | Action   |
|---------------------------|-------------------------------|--------------------------------------|--|
| The motor will not start. | . * Loosened connection       | . Check the tightening part.         | . Tighten the loosened part.   |
|                           | . The motor is over-loaded.   | . Try to start the motor at no-load. | . If the motor starts, reduce the load or replace the motor with another motor with a larger capacity. |
|                           | . Faulty motor                | . Try to start the motor at no-load. | . If the motor will not start, replace it.   |
|                           | . * Erroneous external wiring | . Check the wiring.                  | . Correct the wiring.  |



| Trouble                           | Cause                                 | Troubleshooting procedure   | Action  |
|-----------------------------------|---------------------------------------|---|---|
| The motor runs unstably.          | . * Faulty connection                 | . Check the motor and encoder for connections.  | . Correct the faulty part.  |
| The motor is over-heated.         | . Higher ambient temperature          | . Check to see if ambient temperature is 40°C or less.  | . Reduce ambient temperature to 40°C or less.                                       |
|                                   | . The motor is over-loaded.           | . Try to start the motor at no-load.  | . Reduce the load or replace the motor with another motor with a larger capacity.   |
|                                   | . The motor is soiled on the surface. | . Check whether the motor is free from soil on the surface.                                     | . Wipe the motor surface clean.   |
| Abnormal sound occurs.            | . Improper installation               | . Check set screws for looseness.<br>. Check the coupling for misalignment and unbalance        | . Re-tighten set screws.<br>. Align the coupling, and make it balanced as required. |
|                                   | . Faulty bearing                      | . Check for sound and vibration generated from the bearing and adjacent portion.                | . Replace the motor. (Call Sanyo Denki.)  |
|                                   | . Vibration from the driven machine   | . Check the moving part of the driven machine for deposited foreign matter, breakage, etc.      | . Have contact with the machine manufacturer.                                       |
| The brake (option) will not open. | . Disconnect-ed brake coil            | . Check the brake coil for continuity using a tester.   | . Replace the motor. (Have contact with Sanyo Denki.)                               |
| The brake works unsatisfactorily. | . * Worn friction plate               | . Turn the motor shaft, with power to the brake turned OFF, to measure a shaft friction torque. | . Replace the motor. (Have contact with Sanyo Denki.)                               |

CAUTION: Be sure to turn power supply OFF before starting maintenance and checks.

## 4.2 Servo Amplifier

### 4.2.1 Diagnosis with 8-segment LED

When the alarm indicating lamp (8-segment LED) lights, follow directions given in Table 4.2. To reset an alarm, press the RESET (RST) push-button on the PCB of the servo amplifier or short-circuit pin 7 of CN1 with pin 8. When the "CPU Trouble" lamp lights, once turn control power supply OFF, and turn it ON once again to reset the alarm.

If the fuse of the PCB is blown, be sure to check the wiring before replacing the fuse with a spare fuse. Erroneous wiring or short-circuited external wiring would be responsible.

Table 4.2 Diagnosis with LED

| Indication                       | Time of "ON"  | Cause                             | Countermeasures                |
|----------------------------------|---|-----------------------------------|--------------------------------|
| <div>1</div> (OC)<br>Overcurrent | . Turned ON if only control power supply is turned ON.  | . Faulty PCB                      | . Replace the servo amplifier. |
|                                  | . Turned ON when main power supply is turned ON and then the "Operation Ready" lamp is turned ON. | . Faulty main circuit transistor  | . Replace the servo amplifier. |
|                                  | . Turned ON when the "Servo ON" lamp is turned ON.  | . Faulty main circuit transistor  | . Replace the servo amplifier. |
|                                  | . The MCB (circuit protector) does not trip   | . Faulty current feedback circuit |                                |

| Indication   | Time of "ON"  | Cause  | Countermeasures                |
|--|---|--|--------------------------------|
|  | . Turned ON when the "Servo ON" lamp is turned ON.  | . Defective motor grounding  | . Replace the motor            |
|  | . MCB also trips.   | . Faulty main circuit transistor   | . Replace the servo amplifier. |
|  | . Turned ON when the motor starts and stops.  | . Faulty current limit circuit   | . Replace the servo amplifier. |
| <div style="border: 1px solid black; display: inline-block; padding: 2px;">2</div><br>(OL)<br>Overload | . Turned ON if only control power supply is turned ON.  | . Faulty PCB   | . Replace the servo amplifier. |
|  | . Turned ON while the motor is running.   | . The motor turns at a load of about 120% or more of the continuous torque (overloaded). | . Review the load.             |
|  |   | . The hold brake is in operation.  | . Excite the brake before use. |
|  | . The motor turns but does not generate the expected torque. The "OL" lamp turns ON after the motor runs for some time. | . Erroneous wiring in the motor circuit.   | . Correct the wiring.          |
|  |   | . Disconnection of one out of 3 phases (U, V, and W) of motor main circuit wiring.       |                                |
|  | . Turned ON even if the motor runs at less than the continuous torque.  | . Faulty control circuit   | . Replace the servo amplifier. |

| Indication                                       | Time of "ON"   | Cause   | Countermeasures   |
|--|--|---|---|
| <div>3</div> (OH)<br>Heat sink<br>overheat       | <ul style="list-style-type: none"> <li>Turned ON if only control power supply is turned ON.</li> </ul>   | <ul style="list-style-type: none"> <li>Faulty temperature sensor or PCB</li> </ul>  | <ul style="list-style-type: none"> <li>Replace the servo amplifier.</li> </ul>        |
|  | <ul style="list-style-type: none"> <li>Turned ON while the motor is running.</li> </ul>  | <ul style="list-style-type: none"> <li>Defective cooling fan</li> </ul>   | <ul style="list-style-type: none"> <li>Replace the servo amplifier.</li> </ul>        |
|  | <ul style="list-style-type: none"> <li>Turned ON even if the motor runs at less than the continuous torque.</li> </ul>                                 | <ul style="list-style-type: none"> <li>Temperature rises to 55°C or more around the servo amplifier.</li> </ul>           | <ul style="list-style-type: none"> <li>Reduce temperature to 55°C or less.</li> </ul> |
|  |  | <ul style="list-style-type: none"> <li>Only the servo amplifier becomes abnormally hot.</li> </ul>                        | <ul style="list-style-type: none"> <li>Replace the servo amplifier.</li> </ul>        |
|  | <ul style="list-style-type: none"> <li>The motor runs at the continuous torque or more.</li> </ul>   | <ul style="list-style-type: none"> <li>The motor runs at a torque about 110% or more of the continuous torque.</li> </ul> | <ul style="list-style-type: none"> <li>Review the Load.</li> </ul>                    |
| <div>4</div> (CB)<br>Circuit<br>protector<br>OFF | <ul style="list-style-type: none"> <li>Turned ON if only control power supply is turned ON.</li> <li>MCB (circuit protector) does not trip.</li> </ul> | <ul style="list-style-type: none"> <li>Faulty PCB</li> <li>Faulty MCB</li> </ul>  | <ul style="list-style-type: none"> <li>Replace the servo amplifier.</li> </ul>        |
|  | <ul style="list-style-type: none"> <li>MCB trips when main power supply is turned ON.</li> </ul>   | <ul style="list-style-type: none"> <li>Faulty thyristor diode in main circuit</li> </ul>                                  | <ul style="list-style-type: none"> <li>Replace the servo amplifier.</li> </ul>        |
|  | <ul style="list-style-type: none"> <li>MCB trips when the "Operation Ready" lamp turns ON after main supply is turned ON.</li> </ul>                   | <ul style="list-style-type: none"> <li>Faulty transistor module in main circuit</li> </ul>                                | <ul style="list-style-type: none"> <li>Replace the servo amplifier.</li> </ul>        |

| Indication  | Time of "ON"  | Cause  | Countermeasures   |
|---|---|--|---|
|   | . MCB trips when the "Servo ON" lamp is turned ON.              | . Faulty motor insulation<br>. Faulty transistor in main circuit<br>. Defective connection between the motor and amplifier | . Replace the motor.<br>. Replace the servo amplifier.<br>. Correct the wiring. |
|   | . MCB trips after the motor runs for some time.                 | . Faulty motor insulation<br>. Faulty MCB  | . Replace the motor.<br>. Replace the servo amplifier.                          |
| <div style="border: 1px solid black; display: inline-block; padding: 2px;">5</div><br>(OV)<br>Faulty regenerative circuit | . Turned ON if only control power supply is turned ON.          | . Faulty PCB   | . Replace the servo amplifier.  |
|   | . Turned ON for some time after main power supply is turned ON. | . Input power voltage is too high.<br>. Input power voltage waveform is distorted.   | . Reduce power voltage to the specified voltage or less.                        |
|   |   | . Faulty regenerative transistor<br>. Faulty PCB   | . Replace the servo amplifier.  |


| Indication                      | Time of "ON"   | Cause  | Countermeasures                                       |
|---------------------------------|--|--|---|
|                                 | . Turned on while the motor is running.                | . Load inertia is too large.                               | . Reduce load inertia to the specified value or less. |
|                                 |  | . Faulty regenerative transistor                           | . Replace the servo amplifier.                        |
|                                 |  | . Defective regenerative resistor                          |   |
|                                 |  | . Faulty PCB   | . Replace the regenerative resistor.                  |
|                                 |  | . Defective regenerative resistor installed separately     |   |
| <div>6</div> (OS)<br>Over-speed | . Turned ON if only control power supply is turned ON. | . Faulty PCB   | . Replace the servo amplifier.                        |
|                                 | . Turned ON while the motor is running.                | . Improperly adjusted speed scale volume (VR1, ⑪)          | . Re-adjust VR1, ⑪.                                   |
|                                 |  | . Command speed is too high. (120% of maximum revolutions) | . Modify the command to the specified speed or less.  |
|                                 |  | . Faulty PCB   | . Replace the servo amplifier.                        |
|                                 |  | . Faulty encoder of motor                                  | . Replace the motor.                                  |
|                                 |  | . Faulty encoder signal wiring to motor                    | . Correct the wiring.                                 |

| Indication                                | Time of "ON"  | Cause  | Countermeasures   |
|---|---|--|---|
| <div>7</div> (PE)<br>Power supply trouble | <ul style="list-style-type: none"> <li>Turned ON when control power supply is turned ON.</li> </ul> | <ul style="list-style-type: none"> <li>Input power supply is 160V or less.</li> <li>Input power supply is 265V or more.</li> </ul> | <ul style="list-style-type: none"> <li>Reduce power supply voltage to the specified voltage or less.</li> </ul> |
|   |   | <ul style="list-style-type: none"> <li>Faulty PCB</li> </ul>   | <ul style="list-style-type: none"> <li>Replace the servo amplifier.</li> </ul>                                  |
|   | <ul style="list-style-type: none"> <li>Turned ON while the motor is running.</li> </ul>             | <ul style="list-style-type: none"> <li>Input voltage regulation is too large (160V or less, 265V or more).</li> </ul>              | <ul style="list-style-type: none"> <li>Reduce power supply voltage to the specified voltage or less.</li> </ul> |
| <div>8</div> (DE)<br>Sensor error         | <ul style="list-style-type: none"> <li>Turned ON when control power supply is turned ON.</li> </ul> | <ul style="list-style-type: none"> <li>Erroneous wiring between PG and servo amplifier</li> </ul>                                  | <ul style="list-style-type: none"> <li>Check the wiring before replacing the fuse with a spare fuse.</li> </ul> |
|   | <ul style="list-style-type: none"> <li>The fuse (F) of PCB P1 is blown.</li> </ul>                  | <ul style="list-style-type: none"> <li>Life of fuse</li> </ul>   |   |
|   |   | <ul style="list-style-type: none"> <li>Faulty encoder of motor</li> </ul>  | <ul style="list-style-type: none"> <li>Replace the motor.</li> </ul>  |
|   | <ul style="list-style-type: none"> <li>Turned ON when control power supply is turned ON.</li> </ul> | <ul style="list-style-type: none"> <li>Faulty encoder of motor</li> </ul>  | <ul style="list-style-type: none"> <li>Replace the motor.</li> </ul>  |
|   | <ul style="list-style-type: none"> <li>The fuse (F) of PCB P1 is normal.</li> </ul>                 | <ul style="list-style-type: none"> <li>Erroneous wiring between PG and servo amplifier, and disconnected wire</li> </ul>           | <ul style="list-style-type: none"> <li>Correct the wiring.</li> </ul>   |
|   |   | <ul style="list-style-type: none"> <li>Faulty PCB</li> </ul>   | <ul style="list-style-type: none"> <li>Replace the servo amplifier.</li> </ul>                                  |

| Indication   | Time of "ON"  | Cause  | Countermeasures   |
|--|---|--|---|
|  | <ul style="list-style-type: none"> <li>Turned ON after the motor runs a little.</li> </ul>  | <ul style="list-style-type: none"> <li>Faulty encoder of motor</li> <li><del>Excessive</del> wiring between PG and servo amplifier, and disconnected wire</li> <li>Faulty PCB</li> </ul> | <ul style="list-style-type: none"> <li>Replace the motor.</li> <li><del>Check the</del> wiring.</li> <li>Replace the servo amplifier.</li> </ul>      |
| <b>[9]</b><br>(MPE)<br>Main circuit power voltage drop | <ul style="list-style-type: none"> <li>Turned ON when control power supply is turned ON.</li> </ul>   | <ul style="list-style-type: none"> <li>Faulty PCB</li> </ul>   | <ul style="list-style-type: none"> <li>Replace the servo amplifier.</li> </ul>  |
|  | <ul style="list-style-type: none"> <li>Turned ON after main power supply is turned ON and then the "Operation Ready" lamp turns ON.</li> </ul>              | <ul style="list-style-type: none"> <li>Power voltage is too low. (200V DC or less)</li> <li>Faulty thyristor diode in main circuit</li> </ul>  | <ul style="list-style-type: none"> <li>Reduce power supply voltage to the specified voltage or less.</li> <li>Replace the servo amplifier.</li> </ul> |
|  | <ul style="list-style-type: none"> <li>Turned on while the motor is running.</li> </ul>   | <ul style="list-style-type: none"> <li>Improperly tightened input terminal</li> <li>Faulty PCB</li> </ul>  | <ul style="list-style-type: none"> <li>Correct the wiring.</li> <li>Replace the servo amplifier.</li> </ul>   |
|  | <ul style="list-style-type: none"> <li>Turned ON when control power supply is turned ON.</li> </ul>   | <ul style="list-style-type: none"> <li>Faulty PCB</li> </ul>   | <ul style="list-style-type: none"> <li>Replace the servo amplifier.</li> </ul>  |
|  | <ul style="list-style-type: none"> <li>Turned ON when main power supply is turned ON.</li> </ul>  | <ul style="list-style-type: none"> <li>The 3-phase power supply lacks a phase.</li> <li>Improperly tightened input terminal</li> </ul>   | <ul style="list-style-type: none"> <li>Turn power supply normal.</li> <li>Correct the wiring.</li> </ul>  |
| <b>[A]</b><br>(FP)<br>Main power source faulty phase   | <ul style="list-style-type: none"> <li>Turned ON when control power supply is turned ON.</li> <li>Turned ON when main power supply is turned ON.</li> </ul> | <ul style="list-style-type: none"> <li>Faulty PCB</li> <li>The 3-phase power supply lacks a phase.</li> <li>Improperly tightened input terminal</li> </ul>                               | <ul style="list-style-type: none"> <li>Replace the servo amplifier.</li> <li>Turn power supply normal.</li> <li>Correct the wiring.</li> </ul>        |



| Indication  | Time of "ON"   | Cause   | Countermeasures  |
|---|--|---|--|
| <div> <div>C</div> <div>(SE)<br/>Overrun</div> </div>       | . Turned ON when control power supply is turned ON.              | . Faulty PCB  | . Replace the servo amplifier.   |
|   | . Turned ON when the "Servo ON" lamp turns ON.                   | . The motor oscillates (vibrates).  | . Adjust according to 4.2.2.<br>↓<br>. If impossible, replace the servo amplifier.<br><br>. Replace the motor. |
|   | . Turned ON when speed command is given.                         | . Erroneous wiring to or disconnection from motor<br><br>. Erroneous encoder signal wiring to or disconnection from motor | . Correct the wiring.  |
| <div> <div>□ *</div> <div>(CPUE)<br/>CPU error</div> </div> | . The dot does not light when control power supply is turned ON. | . Control power supply (P, E) does not function.  | . Check input power supply.  |
|   |  | . 5V power voltage drops to 4.5V or less.   | . Check PCB P2 for fuse (F1).<br><br>. Replace the servo amplifier.  |

| Indication  | Time of "ON"                         | Cause                       | Countermeasures  |
|---|--------------------------------------|-----------------------------|--|
|   |                                      | . CPU error<br>. Faulty PCB | . Once turn control power OFF.<br>↓<br>. If an error occurs once again<br>. Replace the servo amplifier. |
|  | . The dot lights when CPU is normal. | —                           | —  |

\* If the 8-segment LED is kept turned OFF, with control power supply (⊗, ⊕) working, the following trouble is probable.

- (1) The fuse (F1) of PCB is blown.
- (2) "CPU error detection" circuit functions.
- (3) A display circuit device is faulty.