

## CONTENTS

|   |                     |
|---|---------------------|
| <b>1. FUNCTIONS AND CONFIGURATION</b>                           | <b>1- 1 to 1- 9</b> |
| 1.1 Introduction  | 1- 1                |
| 1.1.1 Function block diagram                                    | 1- 1                |
| 1.1.2 Positioning system  | 1- 3                |
| 1.1.3 Roll feeding system                                       | 1- 4                |
| 1.2 Model Name Make-Up  | 1- 5                |
| 1.3 Combination with Servo Motor                                | 1- 6                |
| 1.4 Parts Identification  | 1- 7                |
| 1.5 Controller and Its Auxiliary Equipment                      | 1- 8                |
| <b>2. INSTALLATION</b>  | <b>2- 1 to 2- 3</b> |
| 2.1 Environmental conditions                                    | 2- 1                |
| 2.2 Installation Direction and Clearances                       | 2- 2                |
| 2.3 Keep out foreign materials                                  | 2- 2                |
| 2.4 Cable Stress  | 2- 3                |
| <b>3. POSITIONING SYSTEM</b>                                    | <b>3- 1 to 3-68</b> |
| 3.1 Positioning System Specifications                           | 3- 1                |
| 3.2 Standard Connection Examples                                | 3- 2                |
| 3.2.1 Standard configuration (without the MR-H-D01 option card) | 3- 3                |
| 3.2.2 Extension configuration 1 (with the MR-H-D01 option card) | 3- 4                |
| 3.2.3 Extension configuration 2 (with the MR-H-D01 option card) | 3- 6                |
| 3.2.4 Extension configuration 3 (with the MR-H-D01 option card) | 3- 8                |
| 3.3 I/O Connectors  | 3-11                |
| 3.3.1 Connector signal layouts                                  | 3-11                |
| 3.3.2 Signal explanations                                       | 3-12                |
| 3.3.3 Control input/output signals                              | 3-17                |
| 3.4 Operation   | 3-25                |
| 3.4.1 When Switching Power On for the First Time                | 3-25                |
| 3.4.2 Startup   | 3-26                |
| 3.4.3 Manual operation mode                                     | 3-30                |
| 3.4.4 Automatic operation mode                                  | 3-33                |
| 3.4.5 Manual zeroing mode                                       | 3-45                |
| 3.4.6 Automatic zeroing   | 3-53                |
| 3.5 Absolute position detection system                          | 3-54                |
| 3.6 Point Table Data Setting Procedures                         | 3-58                |
| <b>4. ROLL FEEDING SYSTEM</b>                                   | <b>4- 1 to 4-44</b> |
| 4.1 Roll Feeding System Specifications                          | 4- 1                |
| 4.2 Standard Connection Example                                 | 4- 2                |
| 4.2.1 Standard configuration (without the MR-H-D01 option card) | 4- 3                |
| 4.2.2 Extension configuration 1 (with the MR-H-D01 option card) | 4- 4                |
| 4.2.3 Extension configuration 2 (with the MR-H-D01 option card) | 4- 6                |

|  |      |
|--|------|
| 4.3 I/O Connectors                               | 4-9  |
| 4.3.1 Connector signal layouts                   | 4-9  |
| 4.3.2 Signal explanations                        | 4-10 |
| 4.3.3 Control input/output signals               | 4-14 |
| 4.4 Operation                                    | 4-22 |
| 4.4.1 When Switching Power On for the First Time | 4-22 |
| 4.4.2 Startup                                    | 4-23 |
| 4.4.3 Manual operation remote mode               | 4-26 |
| 4.4.4 Manual Operation Mode                      | 4-29 |
| 4.4.5 Automatic Operation Mode                   | 4-30 |
| 4.5 Point Table Date Setting Procedures          | 4-38 |

|                               |                     |
|-------------------------------|---------------------|
| <b>5. SIGNALS AND WIRINGS</b> | <b>5- 1 to 5-21</b> |
|-------------------------------|---------------------|

|  |      |
|--|------|
| 5.1 Internal Connection Diagram of Servo Amplifier | 5-2  |
| 5.2 Interfaces                                     | 5-3  |
| 5.2.1 Common line                                  | 5-3  |
| 5.2.2 Detailed description of the interfaces       | 5-4  |
| 5.3 Power Line Circuit                             | 5-8  |
| 5.3.1 Connection example                           | 5-8  |
| 5.3.2 Terminal                                     | 5-9  |
| 5.3.3 Power-on sequence                            | 5-10 |
| 5.4 Connection of Controller and Servo Motor       | 5-11 |
| 5.4.1 Connection instructions                      | 5-11 |
| 5.4.2 Connection diagram                           | 5-11 |
| 5.4.3 Details of the servo motor side              | 5-13 |
| 5.4.4 Servo motor fan (HA-LH11K2 to HA-LH22K2)     | 5-17 |
| 5.5 Servo Motor with Electromagnetic Brake         | 5-17 |
| 5.5.1 Wiring instructions                          | 5-17 |
| 5.5.2 Operation of electromagnetic brake           | 5-18 |
| 5.6 Grounding                                      | 5-20 |
| 5.7 Alarm Occurrence Timing Chart                  | 5-21 |

|                      |                     |
|----------------------|---------------------|
| <b>6. PARAMETERS</b> | <b>6- 1 to 6-25</b> |
|----------------------|---------------------|

|   |      |
|---|------|
| 6.1 Parameter List  | 6-1  |
| 6.1.1 Parameter write inhibit   | 6-1  |
| 6.1.2 Lists   | 6-2  |
| 6.2 Detailed Explanation  | 6-21 |
| 6.2.1 Electronic gear   | 6-21 |
| 6.2.2 Changing the status display screen                              | 6-22 |
| 6.2.3 Analog output   | 6-23 |
| 6.2.4 Changing the stopping pattern at the forward/reverse stroke end | 6-24 |
| 6.2.5 Rough match output  | 6-24 |
| 6.2.6 Low acoustic noise mode   | 6-25 |

|  |                     |
|--|---------------------|
| <b>7. PARAMETER UNIT AND DISPLAY SECTION</b> | <b>7- 1 to 7-18</b> |
|--|---------------------|

|                         |     |
|-------------------------|-----|
| 7.1 Parameter Unit Keys | 7-1 |
|-------------------------|-----|

|                                     |      |
|-------------------------------------|------|
| 7.2 Operation of the Parameter Unit | 7- 2 |
| 7.3 Status Display                  | 7-10 |
| 7.4 Alarm/Diagnosis                 | 7-12 |
| 7.5 Servo Amplifier Display         | 7-14 |
| 7.5.1 Display examples              | 7-14 |
| 7.5.2 Selection of display data     | 7-15 |
| 7.6 Test Operation Mode             | 7-16 |
| 7.6.1 Jog operation                 | 7-16 |
| 7.6.2 Positioning operation         | 7-17 |
| 7.6.3 1-step feed operation         | 7-18 |
| 7.6.4 Motorless operation           | 7-18 |
| 7.6.5 DO forced output              | 7-18 |

## 8. RS-232C COMMUNICATION FUNCTIONS

8-1 to 8-34

|   |      |
|---|------|
| 8.1 Configuration                                       | 8- 1 |
| 8.2 Communication Specifications                        | 8- 2 |
| 8.3 Protocol  | 8- 2 |
| 8.4 Character Codes                                     | 8- 4 |
| 8.5 Error Codes   | 8- 4 |
| 8.6 Checksum  | 8- 5 |
| 8.7 Time-Out Operation                                  | 8- 5 |
| 8.8 Retry Operation                                     | 8- 5 |
| 8.9 Initialization                                      | 8- 6 |
| 8.10 Communication Procedure Example                    | 8- 6 |
| 8.11 Command and Data No. List                          | 8- 7 |
| 8.11.1 Read commands                                    | 8- 7 |
| 8.11.2 Write commands                                   | 8-12 |
| 8.12 Detailed Explanations of Commands                  | 8-15 |
| 8.12.1 Data processing                                  | 8-15 |
| 8.12.2 Status display                                   | 8-17 |
| 8.12.3 Parameters                                       | 8-18 |
| 8.12.4 External I/O signal status (DIO diagnosis)       | 8-20 |
| 8.12.5 External output signal ON/OFF (DO forced output) | 8-21 |
| 8.12.6 External input signal ON/OFF                     | 8-22 |
| 8.12.7 Disable/enable of external I/O signals (DIO)     | 8-23 |
| 8.12.8 Test operation mode                              | 8-24 |
| 8.12.9 Alarm history                                    | 8-27 |
| 8.12.10 Current alarm                                   | 8-28 |
| 8.12.11 Position block                                  | 8-30 |
| 8.12.12 Speed block                                     | 8-32 |
| 8.12.13 Selection between Japanese and English          | 8-34 |

## 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

9- 1 to 9-24

|                                    |      |
|------------------------------------|------|
| 9.1 Compliance With EC Directives  | 9- 1 |
| 9.1.1 What are EC directives?      | 9- 1 |
| 9.1.2 For compliance               | 9- 1 |
| 9.1.3 Standard connection examples | 9- 5 |

|   |      |
|---|------|
| 9.2 Conformance With UL/C-UL Standard .....       | 9-19 |
| 9.2.1 Controller and servo motor used .....       | 9-19 |
| 9.2.2 Installation .....                          | 9-19 |
| 9.2.3 Power supply .....                          | 9-19 |
| 9.2.4 Wires .....                                 | 9-19 |
| 9.2.5 Crimping terminals and crimping tools ..... | 9-20 |
| 9.2.6 Fuses .....                                 | 9-20 |
| 9.2.7 Terminal block tightening torque .....      | 9-21 |
| 9.2.8 Standard connection example .....           | 9-21 |
| 9.3 Signals .....                                 | 9-22 |
| 9.3.1 Main circuit terminal block .....           | 9-22 |
| 9.3.2 Interfaces .....                            | 9-23 |

|                       |                       |
|-----------------------|-----------------------|
| <b>10. ADJUSTMENT</b> | <b>10- 1 to 10-10</b> |
|-----------------------|-----------------------|

|   |       |
|---|-------|
| 10.1 What Is Gain Adjustment? .....                                       | 10- 1 |
| 10.1.1 Difference between servo amplifier and other drives .....          | 10- 1 |
| 10.1.2 Basics of the servo system .....                                   | 10- 2 |
| 10.2 Gain adjustment .....  | 10- 3 |
| 10.2.1 Parameters required for gain adjustment .....                      | 10- 3 |
| 10.2.2 Block diagram .....  | 10- 3 |
| 10.2.3 What is auto tuning? .....   | 10- 4 |
| 10.3 Gain Adjustment by Auto Tuning .....                                 | 10- 5 |
| 10.3.1 Adjustment method .....  | 10- 5 |
| 10.3.2 Valid conditions .....   | 10- 5 |
| 10.4 Manual Gain Adjustment .....   | 10- 6 |
| 10.4.1 When machine rigidity is low .....                                 | 10- 6 |
| 10.4.2 When the machine vibrates due to machine resonance frequency ..... | 10- 7 |
| 10.4.3 Load inertia moment is 20 or more times .....                      | 10- 8 |
| 10.4.4 When shortening the settling time .....                            | 10- 9 |
| 10.4.5 When the same gain is used for two or more axes .....              | 10-10 |

|                       |                      |
|-----------------------|----------------------|
| <b>11. INSPECTION</b> | <b>11- 1 to 11-2</b> |
|-----------------------|----------------------|

|                       |       |
|-----------------------|-------|
| 11.1 Inspection ..... | 11- 1 |
| 11.2 Life .....       | 11- 1 |

|                            |                      |
|----------------------------|----------------------|
| <b>12. TROUBLESHOOTING</b> | <b>12-1 to 12-11</b> |
|----------------------------|----------------------|

|   |       |
|---|-------|
| 12.1 Trouble at Start-Up .....                | 12- 1 |
| 12.2 When Alarm or Warning Has Occurred ..... | 12- 2 |
| 12.2.1 Alarms and Warning list .....          | 12- 2 |
| 12.2.2 Remedies for alarms .....              | 12- 3 |
| 12.2.3 Remedies for warnings .....            | 12- 9 |
| 12.2.4 RS-232C communication error .....      | 12-10 |
| 12.3 Clearing the Alarm History .....         | 12-11 |

|                           |                       |
|---------------------------|-----------------------|
| <b>13. SPECIFICATIONS</b> | <b>13- 1 to 13- 9</b> |
|---------------------------|-----------------------|

|   |       |
|---|-------|
| 13.1 Standard specifications .....      | 13- 1 |
| 13.2 Outline Dimensional Drawings ..... | 13- 2 |
| 13.2.1 Controllers .....                | 13- 2 |
| 13.2.2 Connectors .....                 | 13- 7 |

|                            |                       |
|----------------------------|-----------------------|
| <b>14. CHARACTERISTICS</b> | <b>14- 1 to 14- 8</b> |
|----------------------------|-----------------------|

|   |       |
|---|-------|
| 14.1 Overload Protection Characteristics .....                | 14- 1 |
| 14.2 Power Supply Equipment Capacity and Generated Loss ..... | 14- 3 |
| 14.3 Dynamic Brake Characteristics .....                      | 14- 5 |
| 14.4 Encoder Cable Flexing Life .....                         | 14- 8 |

|  |                        |
|--|------------------------|
| <b>15. OPTIONS AND AUXILIARY EQUIPMENT</b> | <b>15- 1 to 15- 56</b> |
|--|------------------------|

|   |        |
|---|--------|
| 15.1 Options .....  | 15- 1  |
| 15.1.1 Parameter unit .....                                 | 15- 1  |
| 15.1.2 Regenerative brake options .....                     | 15- 3  |
| 15.1.3 Brake unit .....                                     | 15- 11 |
| 15.1.4 Power return converter .....                         | 15- 14 |
| 15.1.5 External dynamic brake .....                         | 15- 16 |
| 15.1.6 Cables and connectors .....                          | 15- 19 |
| 15.1.7 Junction terminal block (MR-TB50) .....              | 15- 29 |
| 15.1.8 Servo Configuration Software .....                   | 15- 31 |
| 15.1.9 Heat sink outside mounting attachment (MR-ACN) ..... | 15- 32 |
| 15.1.10 Large setting/display unit (MR-PRU02) .....         | 15- 34 |
| 15.1.11 External Digital display (MR-DP60) .....            | 15- 36 |
| 15.1.12 Manual Pulse Generator (MR-HDP01) .....             | 15- 38 |
| 15.1.13 Battery (MR-BAT, A6BAT) .....                       | 15- 39 |
| 15.1.14 6-Digit Digital Switch (MR-DS60) .....              | 15- 40 |
| 15.1.15 MR-H-D01 option card .....                          | 15- 42 |
| 15.1.16 Battery (MR-BAT, A6BAT) .....                       | 15- 43 |
| 15.2 Auxiliary Equipment .....                              | 15- 44 |
| 15.2.1 Recommended wires .....                              | 15- 44 |
| 15.2.2 No-fuse breakers, magnetic contactors .....          | 15- 46 |
| 15.2.3 Power factor improving reactors .....                | 15- 47 |
| 15.2.4 Relays .....   | 15- 47 |
| 15.2.5 Surge absorbers .....                                | 15- 48 |
| 15.2.6 Noise reduction techniques .....                     | 15- 49 |
| 15.2.7 Leakage current breaker .....                        | 15- 54 |
| 15.2.8 Setting potentiometers for analog inputs .....       | 15- 56 |

|                 |                         |
|-----------------|-------------------------|
| <b>Appendix</b> | <b>App- 1 to App- 3</b> |
|-----------------|-------------------------|

|  |        |
|--|--------|
| POINT TABLE DATA RECORDING FORMS ..... | App- 1 |
|--|--------|

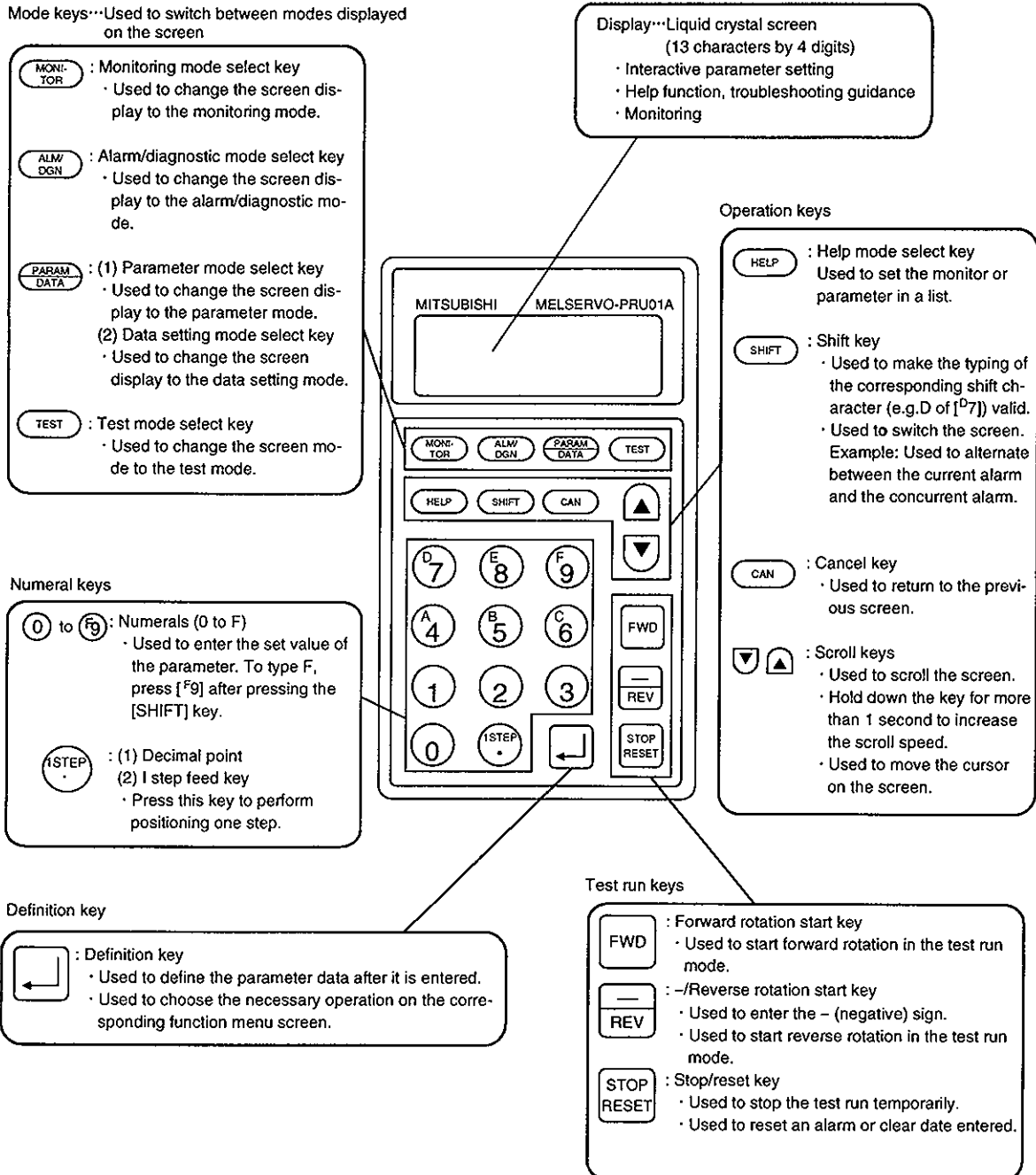
# 7. PARAMETER UNIT AND DISPLAY SECTION

## 7. PARAMETER UNIT AND DISPLAY SECTION

### 7.1 Parameter Unit Keys

The MR-PRU01A parameter unit is used to set data, perform test operation, set parameters, monitor the operating status, and display alarm definition.

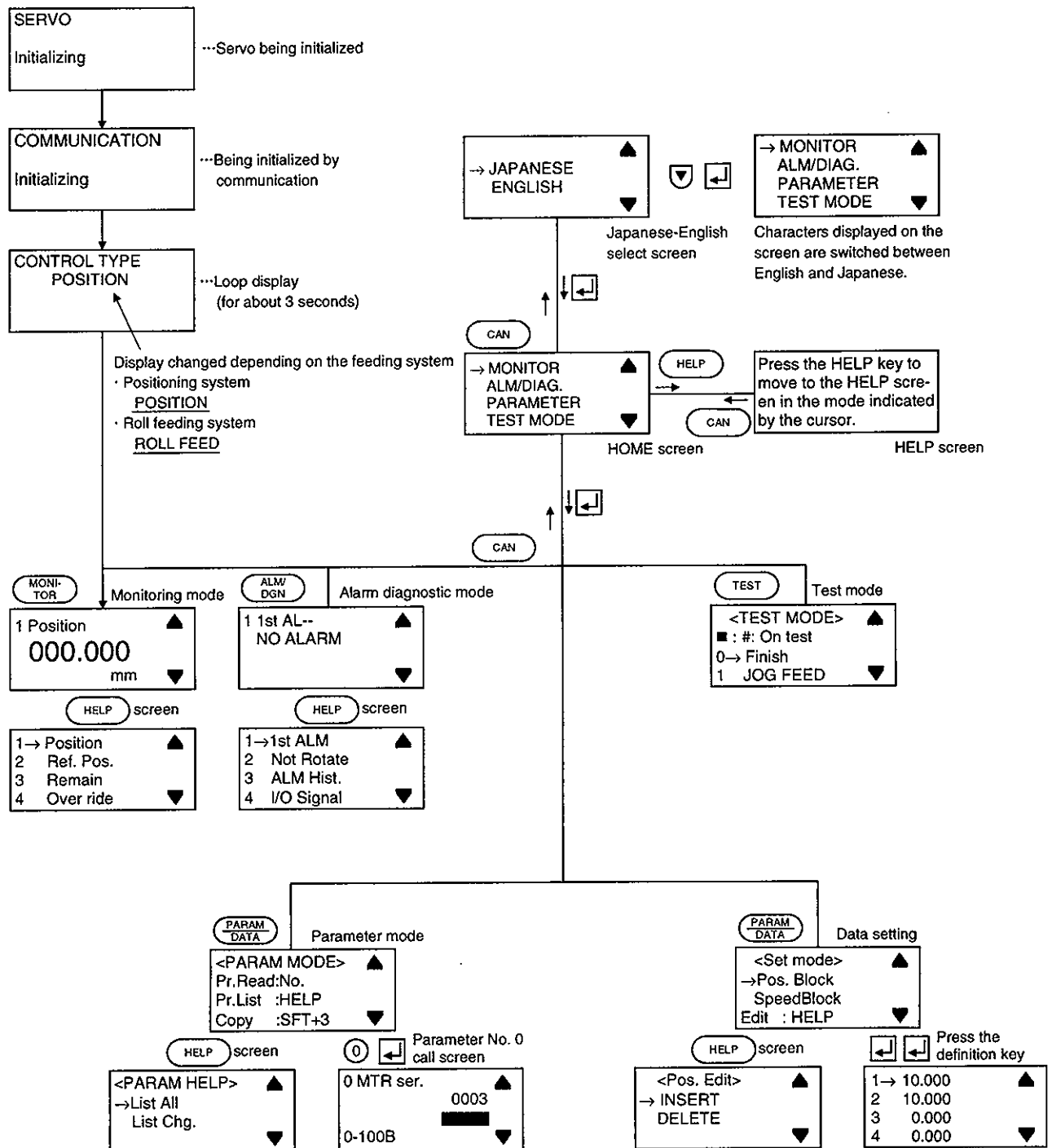
MR-PRU01A Structure



# 7. PARAMETER UNIT AND DISPLAY SECTION

## 7.2 Operation of the Parameter Unit

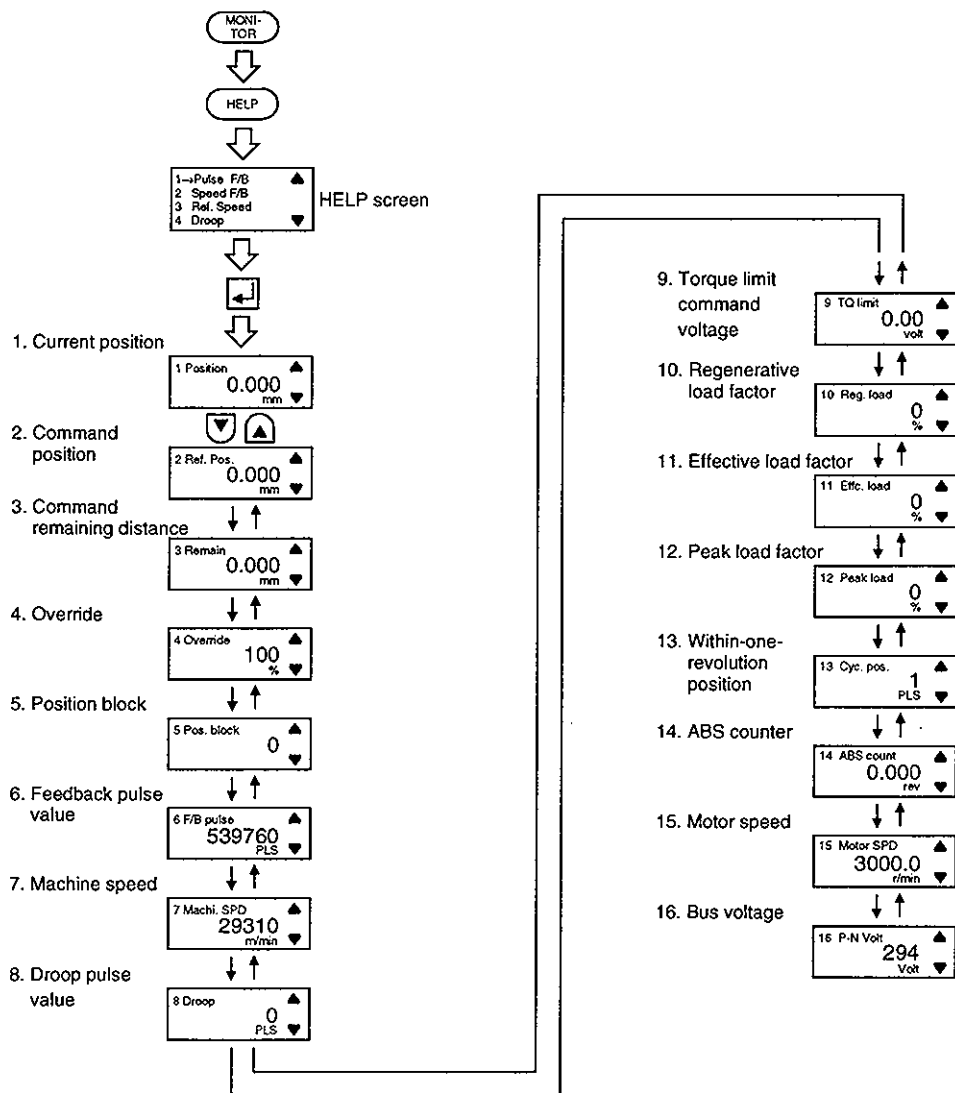
### (1) Outline of display sequence



The displays and operation procedure in each mode are given on the following pages. Refer to them.

# 7. PARAMETER UNIT AND DISPLAY SECTION

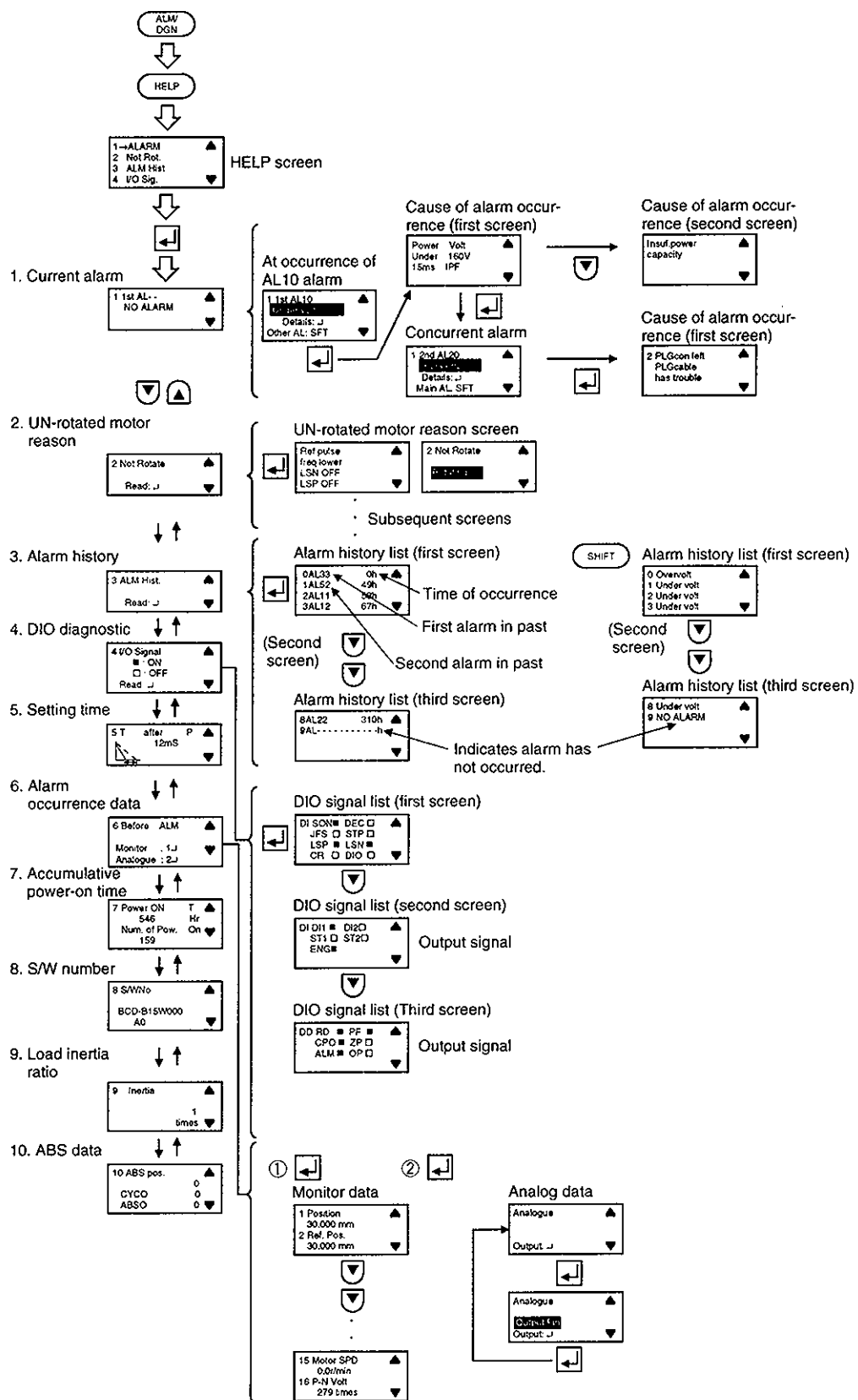
## (2) Monitoring mode





## 7. PARAMETER UNIT AND DISPLAY SECTION

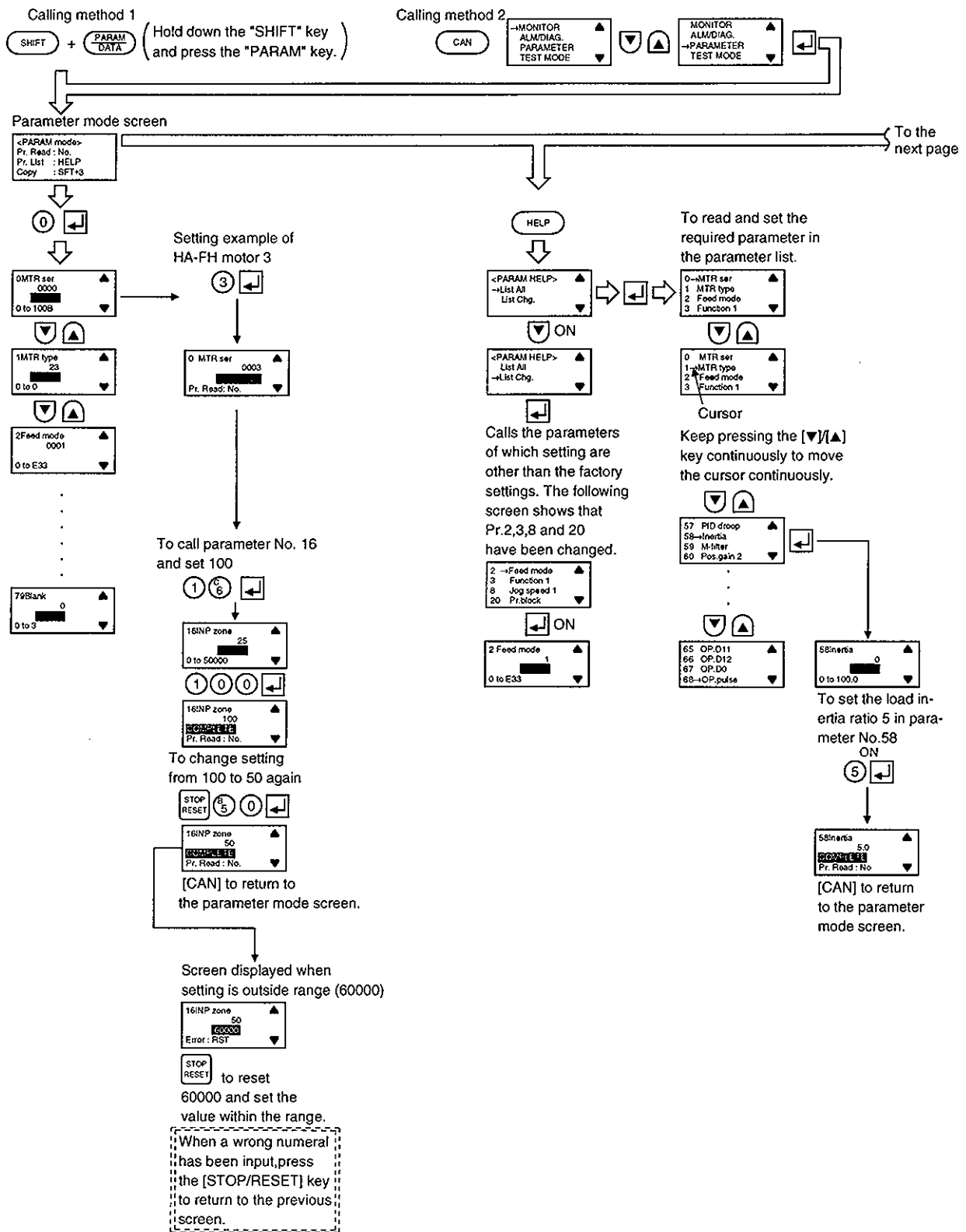
### (3) Alarm mode



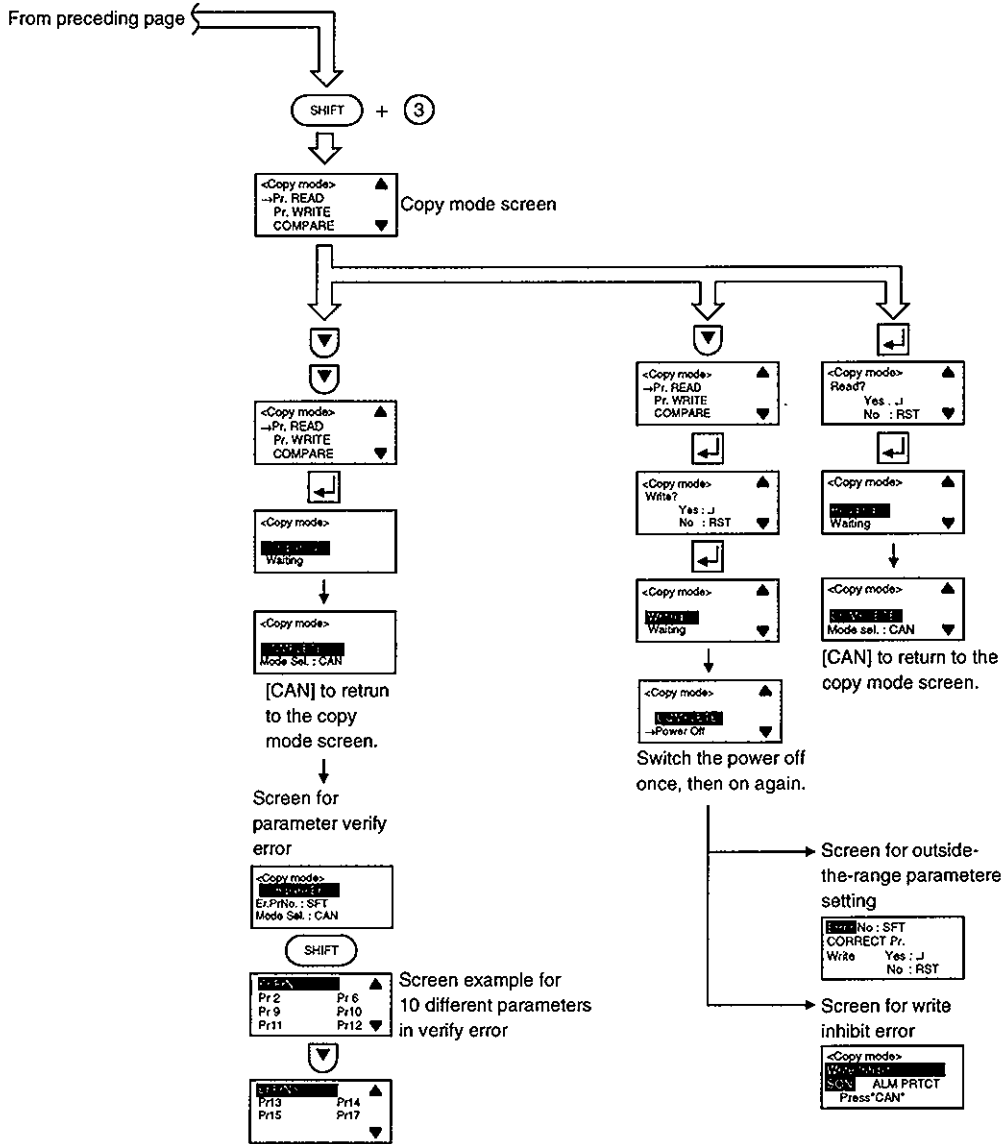
For details of the monitor screens, refer to Section 7.4.

# 7. PARAMETER UNIT AND DISPLAY SECTION

## (4) Parameter mode

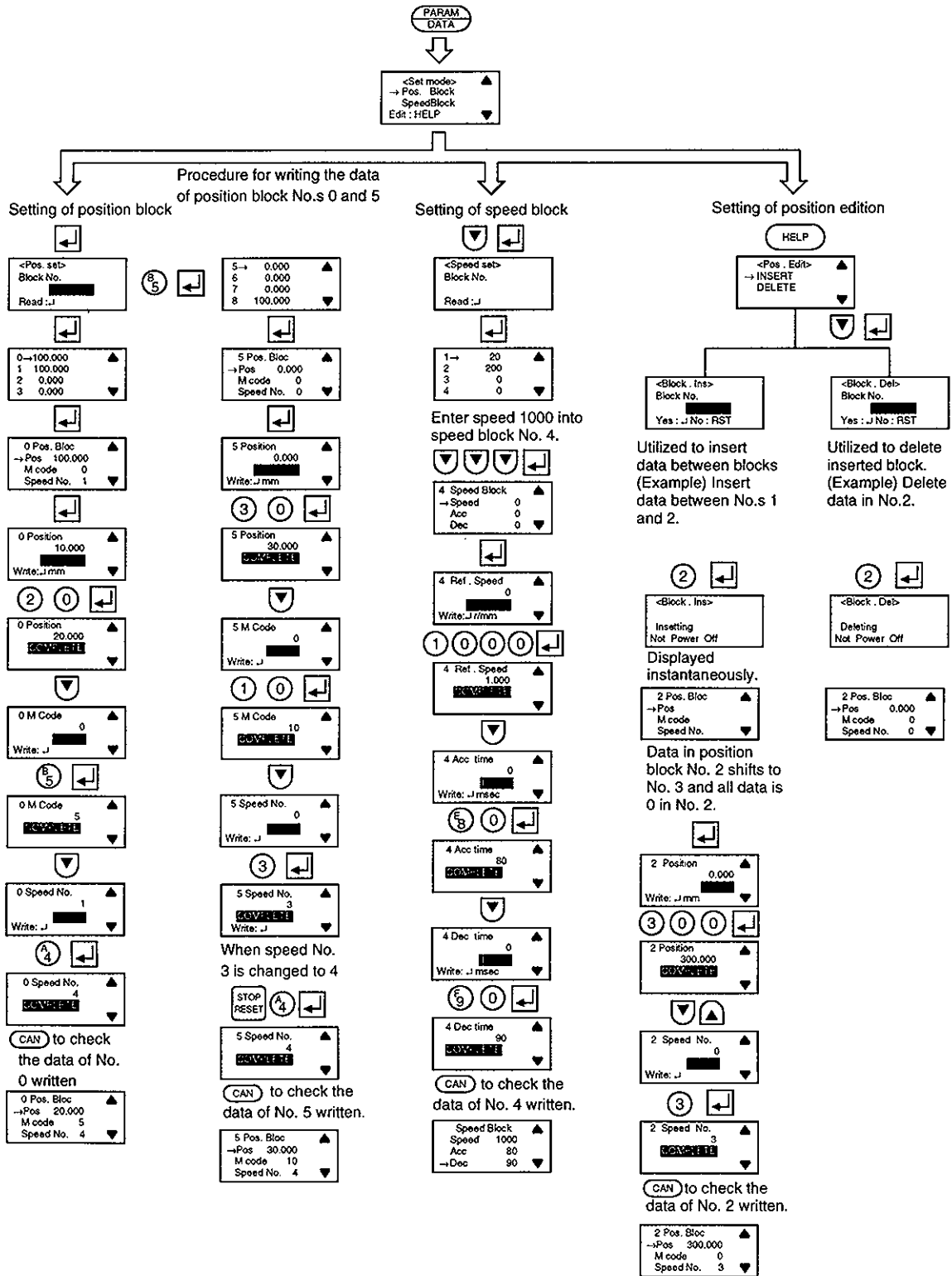


## 7. PARAMETER UNIT AND DISPLAY SECTION



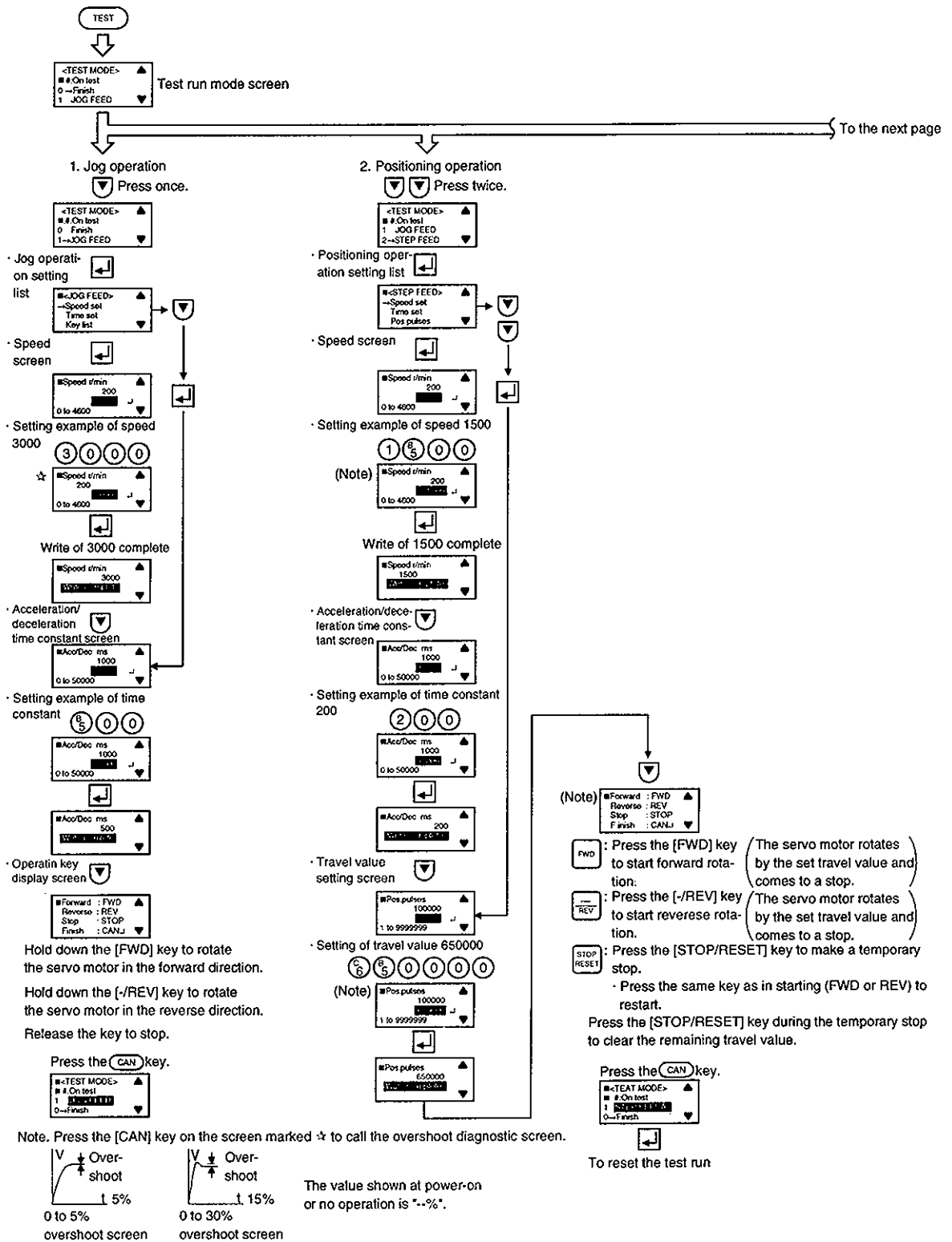
# 7. PARAMETER UNIT AND DISPLAY SECTION

## (5) Point table setting mode



# 7. PARAMETER UNIT AND DISPLAY SECTION

## (6) Test run mode

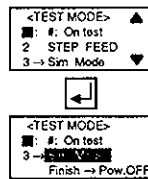


# 7. PARAMETER UNIT AND DISPLAY SECTION

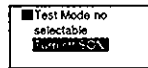
From preceding page

### 3. Motor-less operation

Press three times

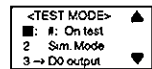


- Allows motor-less operation. To reset the motor-less operation, switch the power off once, then on.
- When the following screen appears, switch the SON signal off.

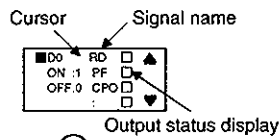


### 4. D0 forced output

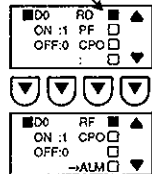
Press twice or press four times



Output ON  
Output OFF



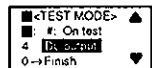
Press the 1 key to switch RD output on.



Press the 1 key to switch ALM output on.

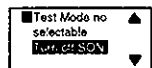
Press the 0 key to switch ALM output off.

Press the CAN key



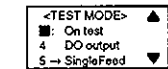
To reset the test run

- When the following screen appears, switch the SON signal off.

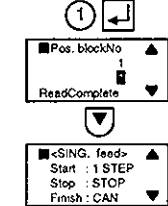


### 5. 1-step feed

Press one or Press five times



- This function reads the data of the block set in any of the operation modes in Chapters 3 and 4 and uses it for operation.
- 1-step feed example for position block No. 1



- [1STEP] : Press the [1STEP/] key to perform positioning one step.
- [STOP RESET] : Press the [STOP RESET] key to make a temporary stop. Press 1 STEP key to restart

Press the [STOP RESET] key during a temporary stop to clear the remaining travel value.

Press the CAN key.



To reset the test run

## 7. PARAMETER UNIT AND DISPLAY SECTION

### 7.3 Status Display

The running servo status can be shown on the parameter unit display and controller display. In addition, the status can be displayed in up to six digits by use of the optional external digital display (MR-DP60). For the usage and parameter setting method, refer to Section 7.5.

| Status Display               | Parameter Unit Indication | Unit   | Description   | Indication Range   |                     |
|------------------------------|---------------------------|--|---|--------------------|---------------------|
|                              |                           |  |   | Controller display | Parameter Unit      |
| Current position             | Position                  | $\times 10^{STM}mm$<br>$\times 10^{STM}inch$ | Positioning system:<br>The current position from the machine home position of 0 is displayed.<br>Roll feeding system:<br>0 appears at power-on, counting starts when the start signal turns on, and the current position appears. | -9999 to 9999      | -999999 to 999999   |
| Command position             | Ref.Pos.                  | $\times 10^{STM}mm$<br>$\times 10^{STM}inch$ | The position data or preset command position in the position block is displayed.  | -9999 to 9999      | -999999 to 999999   |
| Command remaining distance   | Remain                    | $\times 10^{STM}mm$<br>$\times 10^{STM}inch$ | During operation, the remaining distance between current position and command position is displayed. During a stop, the next feed distance is displayed.  | -9999 to 9999      | -999999 to 999999   |
| Override                     | Over ride                 | %  | The set value of override is displayed.<br>100% appears when override is invalid.   | 0 to 200           | 0 to 200            |
| Position block               | Pos. block                |  | The position block number being executed is displayed.  | 0 to 255           | 0 to 255            |
| Feedback pulse value         | F/B Pulse                 | pulse  | Feedback pulses from the servo motor encoder are counted and displayed.<br>When the value exceeds $\pm 9999999$ , it starts with 0. Press "RESET" to reset the value to "0".  | -9999 to 9999      | -9999999 to 9999999 |
| Machine speed                | Machi. SPD                | mm/min<br>m/s                                | Speed multiplied by the electronic gear is displayed.<br>The unit can be changed with parameter No. 4.  | 0 to 9.999         | 0 to 999.999        |
| Droop pulse value            | Droop                     | pulse  | The pulse value of the deviation counter is displayed.<br>Reverse rotation pulse value is indicated by "-".   | -9999 to 9999      | -9999999 to 9999999 |
| Torque limit command voltage | TQ limit                  | V  | The voltage of the torque limit command (TLAP) is displayed.  | 0.00 to 10.00      | 0.00 to 10.00       |
| Regenerative load factor     | Reg. load                 | %  | The percentage of regenerative power to the permissible regenerative value is displayed.  | 0 to 100           | 0 to 100            |
| Effective load factor        | Effc. load                | %  | Continuous effective load torque is displayed.<br>The effective value is displayed relative to the rated torque of 100%.  | 0 to 320           | 0 to 320            |
| Peak load factor             | Peak load                 | %  | Maximum generated torque is displayed.<br>The peak value for the past 15 seconds is displayed relative to the rated torque of 100%.   | 0 to 320           | 0 to 320            |

## 7. PARAMETER UNIT AND DISPLAY SECTION

| Status Display                 | Parameter Unit Indication | Unit  | Description  | Indication Range   |  |
|--------------------------------|---------------------------|-------|--|--|--|
|                                |                           |       |  | Controller Display   | Parameter Unit   |
| Within one-revolution position | Cyc. pos                  | pulse | The position within one revolution is displayed in terms of encoder pulses.<br>The value returns to 0 when it exceeds the maximum number of pulses.<br>As the controller display shows data in four digits, it shows the four lower digits of the actual position within one revolution. | Servo motor with resolution of 8192 pulses: 0 to 8191<br>Servo motor with resolution of 16384 pulses: 0 to 16383 | Servo motor with resolution of 8192 pulses: 0 to 8191<br>Servo motor with resolution of 16384 pulses: 0 to 16383 |
| ABS counter                    | ABS Count                 | rev   | Moving distance from the home position in the absolute position detection system is displayed in the counter value of the absolute position encoder.<br>As the controller display shows data in four digits, it shows the four lower digits of the actual counter value.                 | -32768 to 32767  | -32768 to 32767  |
| Servo motor speed              | Motor SPD                 | r/min | The speed of the servo motor is displayed.<br>Reverse rotation is indicated by "-".  | -4600 to 4600  | -4600.0 to 4600.0  |
| Bus voltage                    | P/N Volt                  | V     | The voltage (across P-N) of the main circuit converter is displayed.   | 0 to 400   | 0 to 400   |



## 7. PARAMETER UNIT AND DISPLAY SECTION

### 7.4 Alarm/Diagnosis

The servo motor failing to rotate or any abnormality occurring during operation is indicated by the corresponding alarm code. The alarm may also be confirmed on the controller display, parameter unit or digital display.

#### (1) Controller display

When abnormality occurs, its definition is indicated by the corresponding number. For definitions, refer to Section 11.2.

#### (2) Parameter unit

When abnormality occurs, its definition can be confirmed as listed below.

##### a) Alarm/diagnosis list

| No. | Name   | Parameter Unit Display | Description   |
|-----|--|------------------------|---|
| 1   | Current alarm  | 1stAL                  | The currently occurring alarm number, concurrent alarm, cause of alarm occurrence, etc. are displayed. When alarm occurs, the current alarm overrides the others in any display mode.   |
| 2   | Unrotated motor reason                               | Not Rotate             | When the servo motor does not rotate, the reason why it does not operate can be displayed.  |
| 3   | Alarm history  | ALM Hist.              | The history of alarms from the most recent one to 9th preceding one is displayed with alarm numbers and energization time up to alarm occurrence. All past alarms can be cleared.<br>(For full information, refer to Chapter 12.3)                      |
| 4   | DIO signal   | I/O Sig.               | The ON-OFF states of the external input signals are displayed.  |
| 5   | Setting time   | T after P              | The time from when the position command becomes 0 to when the in-position signal is output is displayed.  |
| 6   | Alarm occurrence data                                | Before ALM             | The status at alarm occurrence (16 types) is displayed.   |
| 7   | Accumulative power-on time                           | Power ON T.            | Accumulative power-on time after shipment from our factory is displayed.  |
| 8   | S/W number   | S/W No.                | For management by the manufacturer.   |
| 9   | Ratio of load inertia moment to motor inertia moment | Inertia                | The ratio of load inertia converted into the equivalent value at the servo motor shaft to the rotor inertia of the servo motor itself is estimated and displayed.   |
| 10  | ABS data   | ABS data               | Absolute position data (ABC in-position)<br>..... Present position relative to the home position of 0<br>1-revolution data (CYSO)<br>..... Position within 1 revolution<br>Multi-revolution data (ABS0)<br>..... Home position in multi-revolution data |

## 7. PARAMETER UNIT AND DISPLAY SECTION

### b) Unrotated motor reason

O: Relevant, X: Irrelevant

| No. | Parameter Unit Display                         | Description  | Feeding System |              |
|-----|--|--|----------------|--------------|
|     |  |  | Positioning    | Roll feeding |
| 1   | SON off  | Servo on (SON) signal is off.  | ○              | ○            |
| 2   | Alarm  | Alarm has occurred.  | ○              | ○            |
| 3   | RES on   | Reset (RES) signal is on.  | ○              | ○            |
| 4   | EMG off  | Emergency stop (EMG) signal is off.  | ○              | ○            |
| 5   | LSP on   | Forward rotation stroke end (LSP) signal is off.   | ○              | ○            |
| 6   | LSN off  | Reverse rotation stroke end (LSN) signal is off.   | ○              | ○            |
| 7   | ST1,ST2 on                                     | · Both the forward rotation start (ST1) and reverse rotation start (ST2) are on.<br>· The start signal is on in the positioning or zeroing mode.                         | ○              | ○            |
| 8   | ST1,ST2 off                                    | Both the forward rotation start (ST1) and reverse rotation start (ST2) are off.  | ○              | ○            |
| 9   | ST1 off  | · The start (ST1) signal switches off when the absolute position command is given.<br>· The start (ST1) signal switches off in the dog type zeroing mode.                | ○              | ×            |
| 10  | Ext. torque limit low                          | The servo motor speed is 5r/min or less when the torque limit signal is switched on.   | ○              | ○            |
| 11  | Int. torque limit low                          | The servo motor speed is 5r/min or less when the torque limit signal is switched on.   | ○              | ○            |
| 12  | Over ride lower                                | The servo motor speed, which is preset to higher than 1r/min, is restricted to not higher than 1r/min by override.   | ○              | ○            |
| 13  | Speed □- lower<br>□ = 1 to 8 (speed block No.) | In positioning operation, the servo motor speed is preset to not higher than 1r/min, independently of whether override is valid or invalid.                              | ○              | ○            |
| 14  | Test mode                                      | The motor does not operate because the FWD (forward rotation), REV (reverse rotation) or 1STEP (1-step feed) key of the parameter unit is not pressed in test operation. | ○              | ○            |
| 15  | Feed ref. lower                                | In positioning operation, the command remaining distance is less than the rough match output range.  | ○              | ○            |
| 16  | JOG speed lower                                | In jog feed, the jog speed is preset to not higher than 1r/min, independently of whether override is valid or invalid.   | ○              | ○            |
| 17  | ORG Speed lower                                | The zeroing speed or creep speed in the zeroing mode is preset to not higher than 1r/min, independently of whether override is valid or invalid.                         | ○              | ○            |
| 18  | Drive Mode Missetting                          | The operation mode has not been selected in the roll feeding system.   | ○              | ○            |
| 19  | Speed No.0 Selected                            | Speed block No. 0 has been selected.<br>Set any of speed blocks No. 1 to 8.  | ○              | ○            |
| 20  | Once stop                                      | During temporary stop.   | ○              | ○            |

#### POINT

- When the roll feeding operation, automatic positioning operation or zeroing (dog type) mode has been set, a start is made when the start signal (ST1, ST2) turns from OFF to ON. After a start, therefore, return ST1 or ST2 to OFF. Operation cannot be performed if ST1 or ST2 remains ON.
- Check the unrotated motor reasons No. 13 to 20 after clearing the No. 1 to 12 reasons.




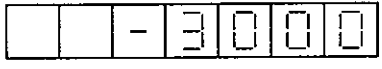

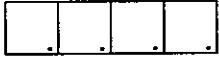

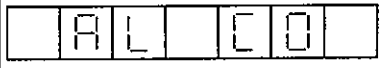

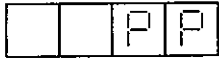
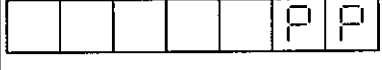
## 7. PARAMETER UNIT AND DISPLAY SECTION

### 7.5 Servo Amplifier Display

The status display and alarm can also be shown on the servo amplifier display.

#### 7.5.1 Display examples

The controller display shows the four lower digits of the data to be displayed.

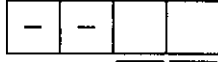
| Item  | 4-Digit Display of controller   | Display of Digital Display  |
|---|---|---|
| Indication of current position<br>(for -654.321)<br>Motor speed<br>(during reverse rotation at 3000r/min)                       | <br>  | <br>  |
| Indication of alarm or warning occurrence<br>{ Indication of overcurrent alarm occurrence }<br>{ Indication of watchdog alarm } | <br> | Not indicated in the controller display.<br>However, the error related to MR-DP60 is displayed.<br>· CPU error<br><br>· Communication error<br> |
| Indication during test operation  |    | The parameter No. 19 setting or controller's CS1 setting (table below) status is displayed.   |
| Indication given for 2 seconds after power-on or CS1 change-over<br>{ CS1: Current position abbreviation indication when set }  |    |    |

## 7. PARAMETER UNIT AND DISPLAY SECTION

### 7.5.2 Selection of display data

The status display data can be selected by setting parameter No. 19 and rotary switch CS1.

#### (1) Parameter setting



Status indication of controller display and digital display (MR-DP60)  
When the setting of the rotary switch CS1 is "0", the setting is the same as in the second digit. When the CS1 setting is other than "0", the CS1 setting has priority.

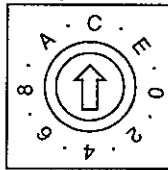
Status indication of parameter unit at power-on

|                               |                                   |
|-------------------------------|-----------------------------------|
| 0: Current position           | 8: Torque limit command voltage   |
| 1: Command position           | 9: Regenerative load factor       |
| 2: Command remaining distance | A: Effective load factor          |
| 3: Override                   | B: Peak load factor               |
| 4: Position block             | C: Within-one-revolution position |
| 5: Feedback pulse value       | D: ABC counter                    |
| 6: Machine speed              | E: Servo motor speed              |
| 7: Droop pulse value          | F: Bus voltage                    |

#### (2) Setting of rotary switch CS1

You can select the status display by setting the rotary switch CS1 of the controller. Setting of "0" shows the status set in the first digit of parameter No. 19.


Rotary switch CS1



| CS1 Setting | Status Display             | CS1 Setting | Status Display                 |
|-------------|----------------------------|-------------|--------------------------------|
| 0           | Parameter No. 18 setting   | 7           | Droop pulse value              |
| 1           | Command position           | 8           | Torque limit command voltage   |
| 2           | Command remaining distance | 9           | Regenerative load factor       |
| 3           | Override                   | A           | Effective load factor          |
| 4           | Position block             | B           | Peak load factor               |
| 5           | Feedback pulse value       | C           | Within-one-revolution position |
| 6           | Machine speed              | D           | Servo motor speed              |

## 7. PARAMETER UNIT AND DISPLAY SECTION

### 7.6 Test Operation Mode

|   |                |  |
|---|----------------|--|
|  | <b>CAUTION</b> | <ul style="list-style-type: none"><li>• The test operation mode is designed to confirm servo operation. It is not designed to confirm machine operation. Do not use this mode with the machine.</li><li>• If an operation fault occurs, use emergency stop (EMG) to make a stop.</li></ul> |
|---|----------------|--|

The parameter unit can be used to run the servo motor. For the way of operating the parameter unit, refer to Section 7.2 (6).

When a servo motor with electromagnetic brake is used with the machine to prevent the servo motor from starting in a brake operating status, always make up a sequence circuit which will operate the brake with the electromagnetic brake signal (ZSP) of the controller.

#### 7.6.1 Jog operation

Jog operation can be performed with no command given from the external command device.

##### (1) Operation

Connect EMG-SG to perform jog operation, and connect VDD-VIN to use the internal power supply. Hold down the "FWD" or "REV" key to rotate the servo motor. Release it to stop. The operating conditions can be changed with the parameter unit. The initial conditions and setting ranges of operation are listed below:

| Item  | Initial Value | Setting Range                        |
|---|---------------|--------------------------------------|
| Speed [r/min]                                       | 200           | 0 to instantaneous permissible speed |
| (Note) Acceleration/deceleration time constant [ms] | 1000          | 0 to 50000                           |

Note: The acceleration time constant indicates the time required for the servo motor to attain the rated speed from a stop (0r/min), and the deceleration time constant indicates the time required for the servo motor to stop from the rated speed.

How to use the keys is listed below:

| Key   | Description                                      |
|-------|--|
| "FWD" | Press to start CCW rotation.<br>Release to stop. |
| "REV" | Press to start CW rotation.<br>Release to stop.  |

If the parameter unit cable is disconnected during jog operation, the servo motor is decelerated to a stop.

##### (2) Status display

The status display can be monitored during jog operation. At this time, the "FWD", "REV" and "STOP" keys are valid.

## 7. PARAMETER UNIT AND DISPLAY SECTION

### 7.6.2 Positioning operation

Positioning operation can be performed once, with no command given from the external command device.

#### (1) Operation

Connect EMG-SG to perform positioning operation, and connect VDD-VIN to use the internal power supply.

By pressing the "FWD" or "REV" key, the servo motor rotates and the machine moves the preset distance and stops. The operating conditions can be changed with the parameter unit. The initial conditions and setting ranges of operation are listed below:

| Item  | Initial Value | Setting Range                        |
|---|---------------|--------------------------------------|
| Moving distance [pulse]                             | 100000        | 0 to 9999999                         |
| Speed [r/min]                                       | 200           | 0 to instantaneous permissible speed |
| (Note) Acceleration/deceleration time constant [ms] | 1000          | 0 to 50000                           |

Note: The acceleration time constant indicates the time required for the servo motor to attain the rated speed from a stop (0r/min), and the deceleration time constant indicates the time required for the servo motor to stop from the rated speed.

How to use the keys is listed below:

| Key    | Description  |
|--------|--|
| "FWD"  | Press to start positioning operation in the CCW direction.   |
| "REV"  | Press to start positioning operation in the CW direction.  |
| "STOP" | Press during operation to make a temporary stop. Press the "STOP" key again to erase the remaining distance.<br>To resume operation, press the key that was used to start operation. |

If the parameter unit cable is disconnected during positioning operation, the servo motor is decelerated to a stop.

#### (2) Status display

The status display can be monitored during positioning operation. At this time, the "FWD", "REV" and "STOP" keys are valid.

## 7. PARAMETER UNIT AND DISPLAY SECTION

### 7.6.3 1-step feed operation

When there is no command given from the external command unit, you can perform positioning operation once in accordance with the point table.

#### (1) Operation

Connect EMG-SG to perform 1-step feed operation, and connect VDD-VIN to use the internal power supply.

Choose the position block No. and press the "1STEP" key to rotate the servo motor and perform operation in accordance with the settings of the selected position block. The position block No. selected can be changed from the parameter unit. The initial condition and setting range of the operation are listed below:

| Item               | Initial Setting | Setting Range                                       |
|--------------------|-----------------|---|
| Position block No. | 0               | Standard: 0 to 7<br>When MR-H-D01 is used: 0 to 255 |

The keys are explained in the following table:

| Key     | Description  |
|---------|--|
| "1STEP" | Pressing this key starts positioning operation in accordance with the settings of the selected position block.   |
| "STOP"  | Pressing this key during operation stops the operation temporarily. Pressing the "STOP" key again erases the remaining distance. To resume operation, press the "1STEP" key. |

If the parameter unit cable is disconnected during positioning operation, the servo motor decelerates to a stop.

#### (2) Status display

The status display can be monitored during positioning operation. At this time, the "FWD", "REV" and "STOP" keys are valid.

### 7.6.4 Motorless operation

Without the servo motor being connected, the output signals can be provided and the status display monitored in response to external input signals as if the servo motor is actually running. This function can be used for the sequence check of the host programmable controller or the like.

#### (1) Operation

After turning off SON-SG, choose motorless operation. Then, perform external operation as in ordinary operation.

#### (2) Status display

The status display can be monitored during motorless operation.

#### (3) Termination of motorless operation

Switch power off to end motorless operation.

### 7.6.5 DO forced output

Each output signal can be turned on/off independently of the input signals and servo status. This function can be used for servo wiring check, etc.

# 8. RS-232C COMMUNICATION FUNCTIONS

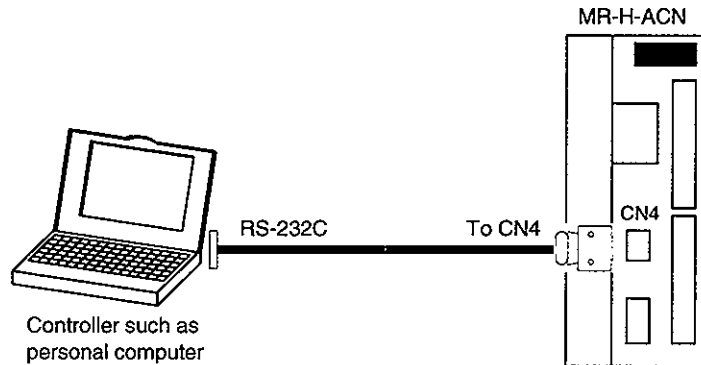
## 8. RS-232C COMMUNICATION FUNCTIONS

The MR-H-ACN has the RS-232C serial communication functions. These functions can be used to perform servo operation, parameter changing, monitor function, etc.

### 8.1 Configuration

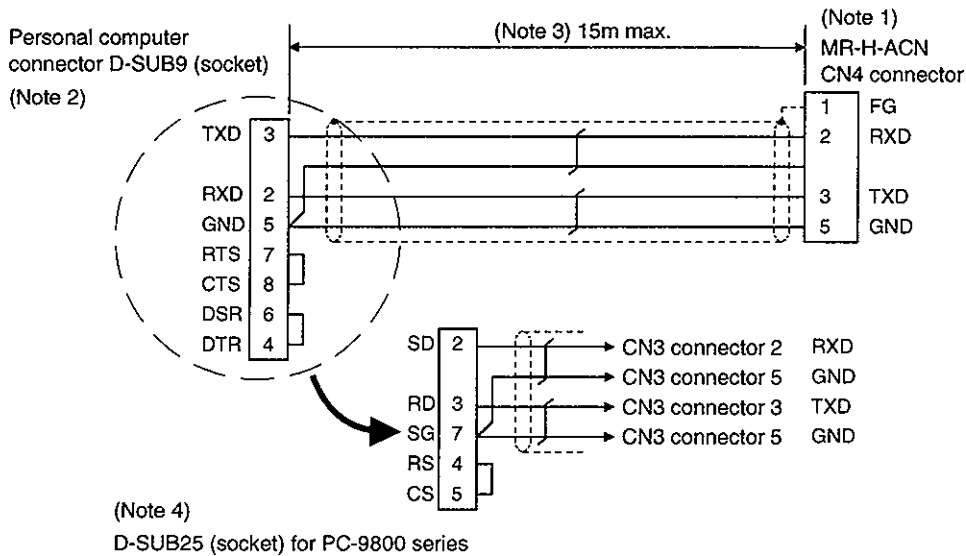
#### (1) Outline

A single axis of controller is operated.



#### (2) Cable connection diagram

Wire as shown below. The communication cable for connection with the personal computer (MR-HPCATCBL3M · MR-HPC98CBL3M) is available. (Refer to Section 15.1.6.)



- Note: 1. Honda Tsushin's CN3 connector  
 Connector: DE-9PF-N  
 Shell kit: DE-C1-J6-S6
2. For the PC-AT compatible controller series.
3. 15m max. in environment of little noise.
4. The PC-9800 series also has the half-pitch type.

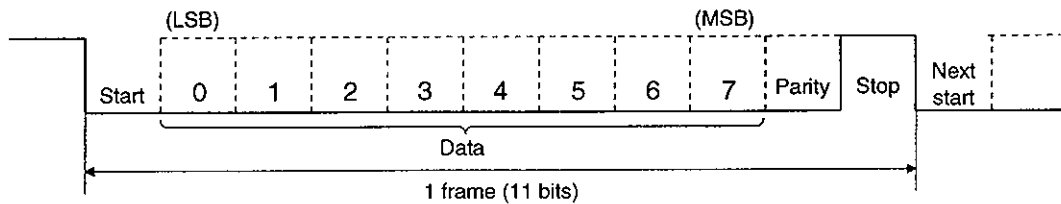


## 8. RS-232C COMMUNICATION FUNCTIONS

### 8.2 Communication Specifications

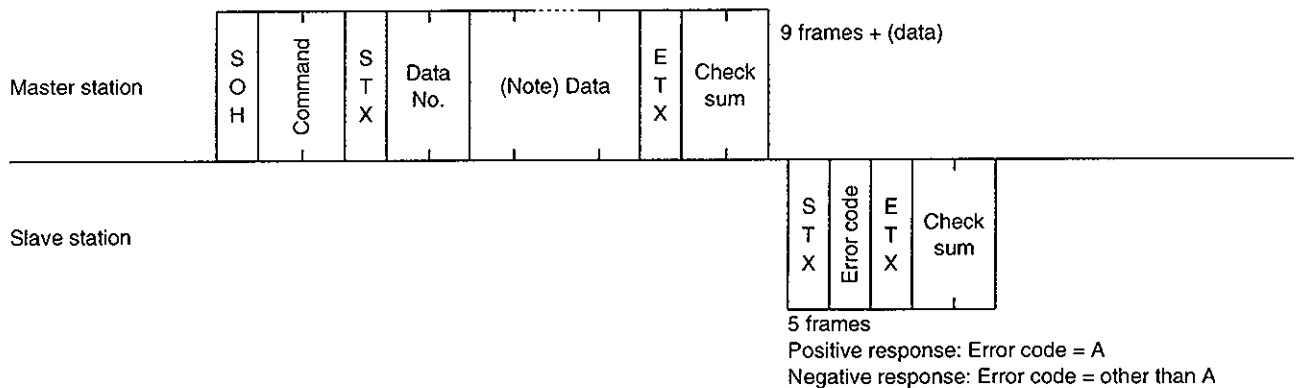
Servo Amplifier is designed to send a reply on receipt of an instruction. The device which gives this instruction (Servo Amplifier) is called a master station and the device which sends a reply in response to the instruction (Servo Amplifier) is called a slave station. When fetching data successively, the master station repeatedly commands the slave station to send data.

| Item              | Description   |
|-------------------|---|
| Baudrate          | 4800/9600/19200 asynchronous system   |
| Transfer code     | Start bit : 1 bit<br>Data bit : 8 bits<br>Parity bit : 1 bit (even)<br>Stop bit : 1 bit |
| Transfer protocol | Character system, half-duplex communication system                                      |



### 8.3 Protocol

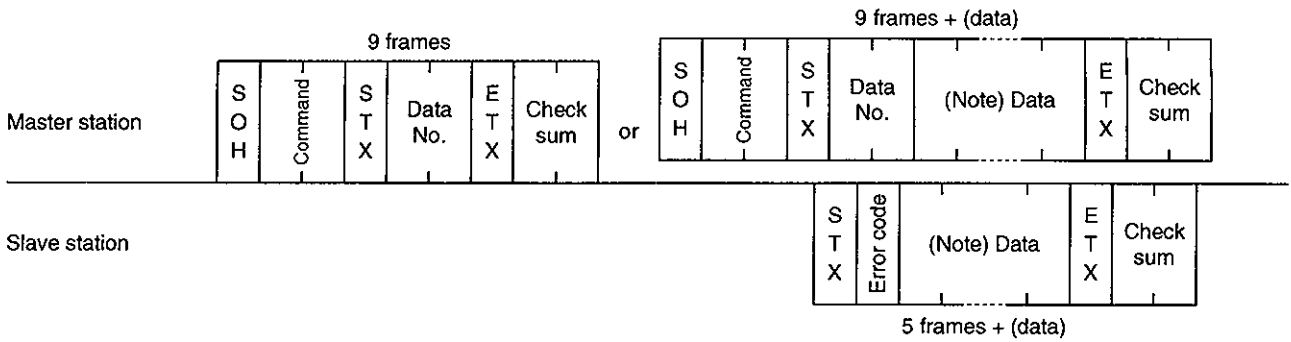
#### (1) Transmission of data from master station to slave station



Note: Refer to (4) in this section for the number of data frames.

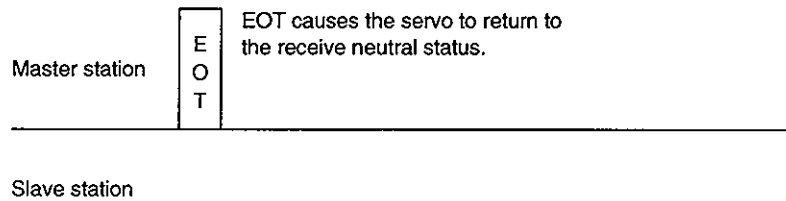
## 8. RS-232C COMMUNICATION FUNCTIONS

(2) Transmission of data request from master station to slave station



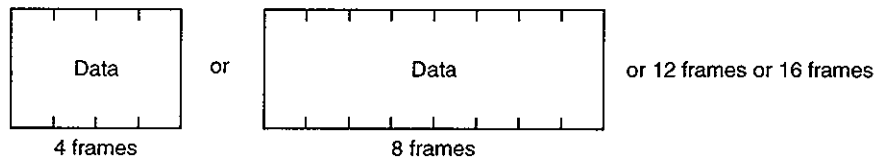
Note: Refer to (4) in this section for the number of data frames.

(3) Recovery of communication status by time-out



(4) Data frames

The data length depends on the command.



## 8. RS-232C COMMUNICATION FUNCTIONS

### 8.4 Character Codes

#### (1) Control codes

| Code Name | Hexadecimal (ASCII code) | Description         | Personal Computer Terminal Key Operation (General) |
|-----------|--------------------------|---------------------|--|
| SOH       | 01H                      | start of head       | ctrl + A   |
| STX       | 02H                      | start of text       | ctrl + B   |
| ETX       | 03H                      | end of text         | ctrl + C   |
| EOT       | 04H                      | end of transmission | ctrl + D   |

#### (2) Codes for data

JIS8 unit codes are used.

|   |                |   |   |   |   |   |   |   |   |
|---|----------------|---|---|---|---|---|---|---|---|
| → | b <sub>8</sub> | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| → | b <sub>7</sub> | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| → | b <sub>6</sub> | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| → | b <sub>5</sub> | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 |

| b <sub>8</sub> -b <sub>5</sub> | b <sub>4</sub> | b <sub>3</sub> | b <sub>2</sub> | b <sub>1</sub> |
|--------------------------------|----------------|----------------|----------------|----------------|
|                                | 0              | 0              | 0              | 0              |
|                                | 0              | 0              | 0              | 1              |
|                                | 0              | 0              | 1              | 0              |
|                                | 0              | 0              | 1              | 1              |
|                                | 0              | 1              | 0              | 0              |
|                                | 0              | 1              | 0              | 1              |
|                                | 0              | 1              | 1              | 0              |
|                                | 0              | 1              | 1              | 1              |
|                                | 1              | 0              | 0              | 0              |
|                                | 1              | 0              | 0              | 1              |
|                                | 1              | 0              | 1              | 0              |
|                                | 1              | 0              | 1              | 1              |
|                                | 1              | 1              | 0              | 0              |
|                                | 1              | 1              | 0              | 1              |
|                                | 1              | 1              | 1              | 0              |
|                                | 1              | 1              | 1              | 1              |

| R \ C | 0   | 1               | 2     | 3 | 4 | 5 | 6 | 7   |
|-------|-----|-----------------|-------|---|---|---|---|-----|
| 0     | NUL | DLE             | Space | 0 | @ | P | ` | p   |
| 1     | SOH | DC <sub>1</sub> | !     | 1 | A | Q | a | q   |
| 2     | STX | DC <sub>2</sub> | "     | 2 | B | R | b | r   |
| 3     | ETX | DC <sub>3</sub> | #     | 3 | C | S | c | s   |
| 4     |     |                 | \$    | 4 | D | T | d | t   |
| 5     |     |                 | %     | 5 | E | U | e | u   |
| 6     |     |                 | &     | 6 | F | V | f | v   |
| 7     |     |                 | '     | 7 | G | W | g | w   |
| 8     |     |                 | (     | 8 | H | X | h | x   |
| 9     |     |                 | )     | 9 | I | Y | i | y   |
| 10    |     |                 | *     | : | J | Z | j | z   |
| 11    |     |                 | +     | ; | K | [ | k | {   |
| 12    |     |                 | ,     | < | L | ¥ | l |     |
| 13    |     |                 | -     | = | M | J | m | }   |
| 14    |     |                 | .     | > | N | ^ | n | ~   |
| 15    |     |                 | /     | ? | O | _ | o | DEL |

### 8.5 Error Codes

Error codes are used in the following cases and an error code of single-code length is transmitted.

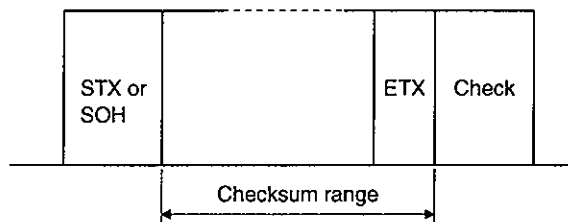
On receipt of data from the master station, the slave station sends the error code corresponding to that data to the master station.

| Error Code   |             | Error Name        | Description   | Remarks           |
|--------------|-------------|-------------------|---|-------------------|
| Servo normal | Servo alarm |                   |   |                   |
| [A]          | [a]         | Normal operation  | Data transmitted was processed properly.                      | Positive response |
| [B]          | [b]         | Parity error      | Parity error occurred in the transmitted data.                | Negative response |
| [C]          | [c]         | Checksum error    | Checksum error occurred in the transmitted data.              |                   |
| [D]          | [d]         | Character error   | Character not existing in the specifications was transmitted. |                   |
| [E]          | [e]         | Command error     | Command not existing in the specifications was transmitted.   |                   |
| [F]          | [f]         | Data No. error    | Data No. not existing in the specifications was transmitted.  |                   |
| [J]          | [j]         | External reset ON | Reset (RES) turned on.  | Special response  |

## 8. RS-232C COMMUNICATION FUNCTIONS

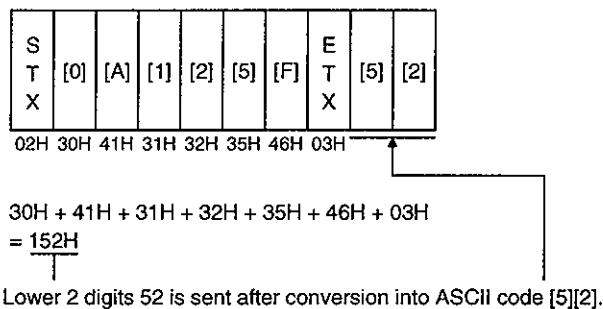
### 8.6 Checksum

#### Checksum range



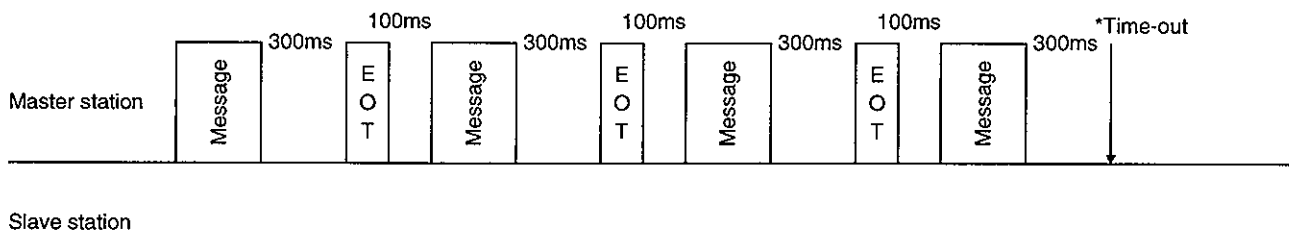
The checksum is sent as a JIS8-coded hexadecimal code representing the lower two digits of the sum of JIS8-coded hexadecimal values up to ETX, with the exception of the first control code (STX or SOH).

(Example)



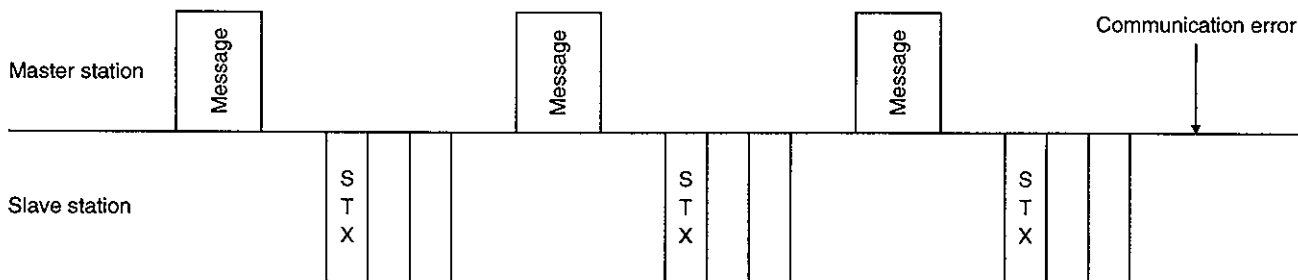
### 8.7 Time-Out Operation

The master station transmits EOT when the slave station does not start reply operation (STX is not received) 300[ms] after the master station has ended communication operation. 100[ms] after that, the master station retransmits the message. Time-out occurs if the slave station does not answer after the master station has performed the above operation three times. (Communication error)



### 8.8 Retry Operation

When a fault occurs in communication between the master and slave stations, the error code in the response data from the slave station is a negative response code ([B] to [I], [b] to [i]). In this case, the master station retransmits the message which was sent at the occurrence of the fault (Retry operation). A communication error occurs if the above operation is repeated and results in the error three or more consecutive times.



Similarly, when the master station detects a fault (e.g. checksum, parity) in the response data from the slave station, the master station retransmits the message which was sent at the occurrence of the fault. A communication error occurs if the retry operation is performed three times.

## 8. RS-232C COMMUNICATION FUNCTIONS

### 8.9 Initialization

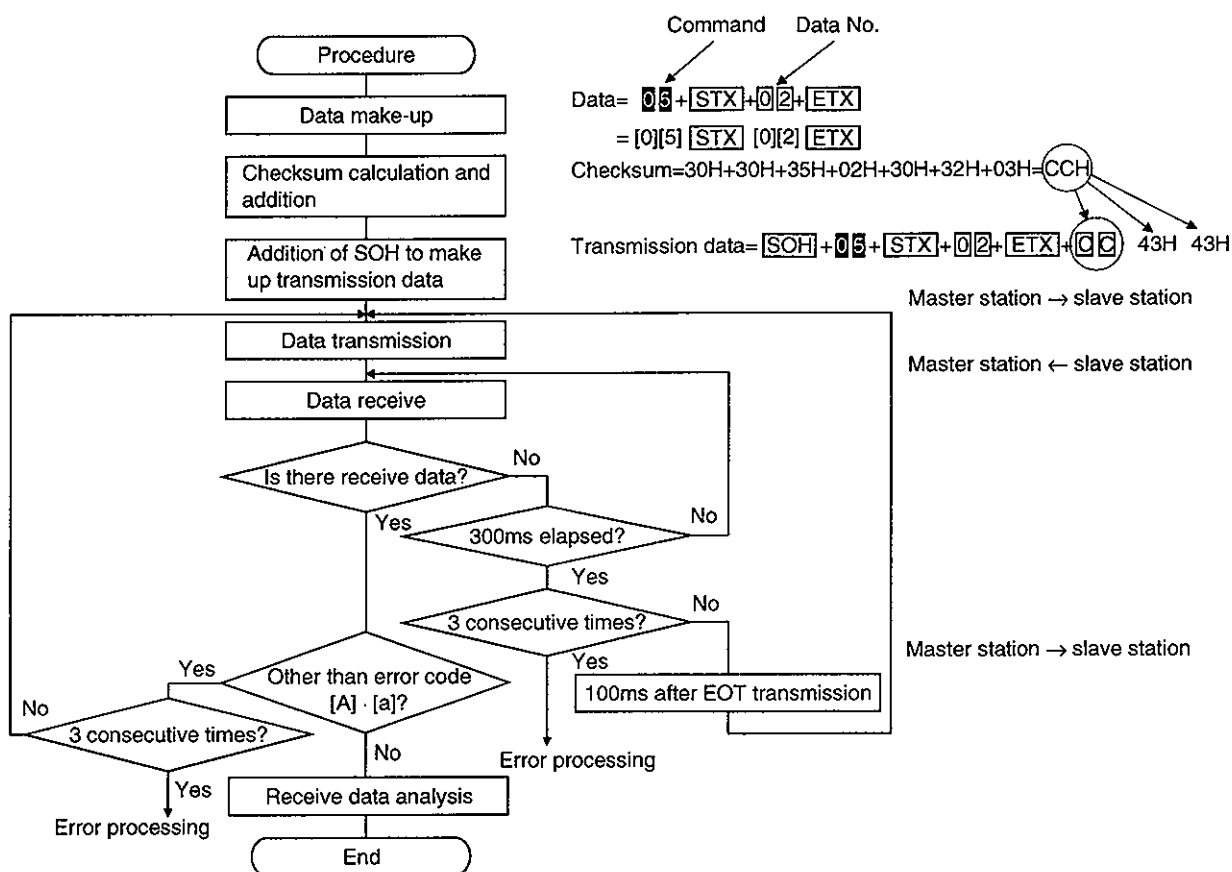
After the slave station is switched on, it cannot reply to communication until the internal initialization processing terminates. Hence, at power-on, ordinary communication should be started after:

- 1) 1s or more time has elapsed after the slave station is switched on; and
- 2) Making sure that normal communication can be made by reading the parameter or other data which does not pose any safety problems.

### 8.10 Communication Procedure Example

The following example reads the setting of parameter No. 2:

| Data Item | Value | Description    |
|-----------|-------|----------------|
| Command   | 05    | Read command   |
| Data No.  | 02    | Parameter No.2 |



## 8. RS-232C COMMUNICATION FUNCTIONS

### 8.11 Command and Data No. List

#### 8.11.1 Read commands

##### (1) Status display (Command [0][1])

| Command | Data No. | Description                    | Display Item   | Frame Length     |
|---------|----------|--------------------------------|--|------------------|
| [0][1]  | [0][0]   | Status display name and unit   | Current position                                     | 16               |
| [0][1]  | [0][1]   |                                | Command position                                     | 16               |
| [0][1]  | [0][2]   |                                | Command remaining distance                           | 16               |
| [0][1]  | [0][3]   |                                | Override   | 16               |
| [0][1]  | [0][4]   |                                | Position block                                       | 16               |
| [0][1]  | [0][5]   |                                | Command pulse value                                  | 16               |
| [0][1]  | [0][6]   |                                | Machine speed  | 16               |
| [0][1]  | [0][7]   |                                | Droop pulse  | 16               |
| [0][1]  | [8][8]   |                                | Torque limit command voltage                         | 16               |
| [0][1]  | [0][9]   |                                | Regenerative load ratio                              | 16               |
| [0][1]  | [0][A]   |                                | Effective load factor                                | 16               |
| [0][1]  | [0][B]   |                                | Peak load ratio                                      | 16               |
| [0][1]  | [0][C]   |                                | Within one-revolution position                       | 16               |
| [0][1]  | [0][D]   |                                | ABS counter  | 16               |
| [0][1]  | [0][E]   |                                | Servo motor speed                                    | 16               |
| [0][1]  | [0][F]   |                                | Bus voltage  | 16               |
| [0][1]  | [8][0]   |                                | Status display data value and processing information | Current position |
| [0][1]  | [8][1]   | Command position               |  | 12               |
| [0][1]  | [8][2]   | Command remaining distance     |  | 12               |
| [0][1]  | [8][3]   | Override                       |  | 12               |
| [0][1]  | [8][4]   | Position block                 |  | 12               |
| [0][1]  | [8][5]   | Command pulse value            |  | 12               |
| [0][1]  | [8][6]   | Machine speed                  |  | 12               |
| [0][1]  | [8][7]   | Droop pulse                    |  | 12               |
| [0][1]  | [8][8]   | Torque limit command voltage   |  | 12               |
| [0][1]  | [8][9]   | Regenerative load ratio        |  | 12               |
| [0][1]  | [8][A]   | Effective load factor          |  | 12               |
| [0][1]  | [8][B]   | Peak load ratio                |  | 12               |
| [0][1]  | [8][C]   | Within one-revolution position |  | 12               |
| [0][1]  | [8][D]   | ABS counter                    |  | 12               |
| [0][1]  | [8][E]   | Servo motor speed              |  | 12               |
| [0][1]  | [8][F]   | Bus voltage                    | 12   |                  |

## 8. RS-232C COMMUNICATION FUNCTIONS

### (2) Parameter (Command [0][5] to [0][8])

| Command | Data No.          | Description   | Frame Length |
|---------|-------------------|---|--------------|
| [0][5]  | [0][0]~<br>[4][F] | Present value of the corresponding parameter<br>(The decimal equivalent of the data No. value(hexadecimal) corresponds to the parameter number)                   | 8            |
| [0][6]  | [0][0]~<br>[4][F] | Upper limit value of the corresponding parameter setting range<br>(The decimal equivalent of the data No. value(hexadecimal) corresponds to the parameter number) | 8            |
| [0][7]  | [0][0]~<br>[4][F] | Lower limit value of the corresponding parameter setting range<br>(The decimal equivalent of the data No. value(hexadecimal) corresponds to the parameter number) | 8            |
| [0][8]  | [0][0]~<br>[4][F] | Name of the corresponding parameter<br>(The decimal equivalent of the data No. value(hexadecimal) corresponds to the parameter number)                            | 12           |

### (3) Alarm history (Command [3][3])

| Command | Data No. | Description                            | Alarm Occurrence Sequence | Frame Length |
|---------|----------|--|---------------------------|--------------|
| [3][3]  | [1][0]   | Alarm number in alarm history          | most recent alarm         | 4            |
| [3][3]  | [1][1]   |  | first alarm in past       | 4            |
| [3][3]  | [1][2]   |  | second alarm in past      | 4            |
| [3][3]  | [1][3]   |  | third alarm in past       | 4            |
| [3][3]  | [1][4]   |  | fourth alarm in past      | 4            |
| [3][3]  | [1][5]   |  | fifth alarm in past       | 4            |
| [3][3]  | [1][6]   |  | sixth alarm in past       | 4            |
| [3][3]  | [1][7]   |  | seventh alarm in past     | 4            |
| [3][3]  | [1][8]   |  | eighth alarm in past      | 4            |
| [3][3]  | [1][9]   |  | ninth alarm in past       | 4            |
| [3][3]  | [2][0]   | Alarm occurrence time in alarm history | most recent alarm         | 8            |
| [3][3]  | [2][1]   |  | first alarm in past       | 8            |
| [3][3]  | [2][2]   |  | second alarm in past      | 8            |
| [3][3]  | [2][3]   |  | third alarm in past       | 8            |
| [3][3]  | [2][4]   |  | fourth alarm in past      | 8            |
| [3][3]  | [2][5]   |  | fifth alarm in past       | 8            |
| [3][3]  | [2][6]   |  | sixth alarm in past       | 8            |
| [3][3]  | [2][7]   |  | seventh alarm in past     | 8            |
| [3][3]  | [2][8]   |  | eighth alarm in past      | 8            |
| [3][3]  | [2][9]   |  | ninth alarm in past       | 8            |
| [3][3]  | [3][0]   | Alarm occurrence name                  | most recent alarm         | 12           |
| [3][3]  | [3][1]   |  | first alarm in past       | 12           |
| [3][3]  | [3][2]   |  | second alarm in past      | 12           |
| [3][3]  | [3][3]   |  | third alarm in past       | 12           |
| [3][3]  | [3][4]   |  | fourth alarm in past      | 12           |
| [3][3]  | [3][5]   |  | fifth alarm in past       | 12           |
| [3][3]  | [3][6]   |  | sixth alarm in past       | 12           |
| [3][3]  | [3][7]   |  | seventh alarm in past     | 12           |
| [3][3]  | [3][8]   |  | eighth alarm in past      | 12           |
| [3][3]  | [3][9]   |  | ninth alarm in past       | 12           |

## 8. RS-232C COMMUNICATION FUNCTIONS

### (4) Current alarm (Command [0][2] · [3][5])

| Command | Data No. | Description             | Frame Length |
|---------|----------|-------------------------|--------------|
| [0][2]  | [0][0]   | Current alarm number    | 4            |
| [0][2]  | [0][1]   | Current alarm name      | 12           |
| [0][2]  | [0][8]   | Concurrent alarm number | 4            |
| [0][2]  | [0][9]   | Concurrent alarm name   | 12           |

| Command | Data No. | Description                                      | Status Display Item  | Frame Length     |
|---------|----------|--|--|------------------|
| [3][5]  | [0][0]   | Status display name and unit at alarm occurrence | Current position   | 16               |
| [3][5]  | [0][1]   |  | Command position   | 16               |
| [3][5]  | [0][2]   |  | Command remaining distance   | 16               |
| [3][5]  | [0][3]   |  | Override   | 16               |
| [3][5]  | [0][4]   |  | Position block   | 16               |
| [3][5]  | [0][5]   |  | Command pulse value  | 16               |
| [3][5]  | [0][6]   |  | Machine speed  | 16               |
| [3][5]  | [0][7]   |  | Droop pulse  | 16               |
| [3][5]  | [0][8]   |  | Torque limit command voltage   | 16               |
| [3][5]  | [0][9]   |  | Regenerative load ratio  | 16               |
| [3][5]  | [0][A]   |  | Effective load factor  | 16               |
| [3][5]  | [0][B]   |  | Peak load ratio  | 16               |
| [3][5]  | [0][C]   |  | Within one-revolution position   | 16               |
| [3][5]  | [0][D]   |  | ABS counter  | 16               |
| [3][5]  | [0][E]   |  | Servo motor speed  | 16               |
| [3][5]  | [0][F]   |  | Bus voltage  | 16               |
| [3][5]  | [8][0]   |  | Status display data value and processing information at alarm occurrence | Current position |
| [3][5]  | [8][1]   | Command position                                 |  | 12               |
| [3][5]  | [8][2]   | Command remaining distance                       |  | 12               |
| [3][5]  | [8][3]   | Override   |  | 12               |
| [3][5]  | [8][4]   | Position block                                   |  | 12               |
| [3][5]  | [8][5]   | Command pulse value                              |  | 12               |
| [3][5]  | [8][6]   | Machine speed                                    |  | 12               |
| [3][5]  | [8][7]   | Droop pulse                                      |  | 12               |
| [3][5]  | [8][8]   | Torque limit command voltage                     |  | 12               |
| [3][5]  | [8][9]   | Regenerative load ratio                          |  | 12               |
| [3][5]  | [8][A]   | Effective load factor                            |  | 12               |
| [3][5]  | [8][B]   | Peak load ratio                                  |  | 12               |
| [3][5]  | [8][C]   | Within one-revolution position                   |  | 12               |
| [3][5]  | [8][D]   | ABS counter                                      |  | 12               |
| [3][5]  | [8][E]   | Servo motor speed                                |  | 12               |
| [3][5]  | [8][F]   | Bus voltage                                      |  | 12               |



## 8. RS-232C COMMUNICATION FUNCTIONS

### (5) External I/O signals (command [3][4])

| Command | Data No. | Description                          | Signal | Frame Length |
|---------|----------|--------------------------------------|--------|--------------|
| [3][4]  | [1][1]   | External input signal ON/OFF status  | SON    | 4            |
| [3][4]  | [1][2]   |                                      | DEC    | 4            |
| [3][4]  | [1][3]   |                                      | JFS    | 4            |
| [3][4]  | [1][4]   |                                      | STP    | 4            |
| [3][4]  | [1][5]   |                                      | LSP    | 4            |
| [3][4]  | [1][6]   |                                      | LSN    | 4            |
| [3][4]  | [1][7]   |                                      | CR     | 4            |
| [3][4]  | [1][8]   |                                      | DI0    | 4            |
| [3][4]  | [1][9]   |                                      | DI1    | 4            |
| [3][4]  | [1][A]   |                                      | DI2    | 4            |
| [3][4]  | [1][B]   |                                      | ST1    | 4            |
| [3][4]  | [1][C]   |                                      | ST2    | 4            |
| [3][4]  | [9][1]   | External output signal ON/OFF status | RD     | 4            |
| [3][4]  | [9][2]   |                                      | PF     | 4            |
| [3][4]  | [9][3]   |                                      | COP    | 4            |
| [3][4]  | [9][4]   |                                      | ZP     | 4            |
| [3][4]  | [9][5]   |                                      | ALM    | 4            |
| [3][4]  | [9][6]   |                                      | OP     | 4            |

### (6) Position block

#### (a) Position data (command [4][0] to [4][3])

| Command | Data No.         | Description  | Frame Length |
|---------|------------------|--|--------------|
| [4][0]  | [0][0] to [F][F] | Data form and data of position data<br>(The decimal equivalent of the data No. corresponds to the position block No.)                | 8            |
| [4][1]  | [0][0] to [F][F] | Setting range of position data (upper limit value)<br>(The decimal equivalent of the data No. corresponds to the position block No.) | 8            |
| [4][2]  | [0][0] to [F][F] | Setting range of position data (lower limit value)<br>(The decimal equivalent of the data No. corresponds to the position block No.) | 8            |
| [4][3]  | [2][0]           | Display unit of position data  | 8            |

#### (b) M code (command [4][5] to [4][8])

| Command | Data No.         | Description   | Frame Length |
|---------|------------------|---|--------------|
| [4][5]  | [0][0] to [F][F] | Data form and data of M code<br>(The decimal equivalent of the data No. corresponds to the position block No.)                | 8            |
| [4][6]  | [0][0] to [F][F] | Setting range of M code (upper limit value)<br>(The decimal equivalent of the data No. corresponds to the position block No.) | 8            |
| [4][7]  | [0][0] to [F][F] | Setting range of M code (lower limit value)<br>(The decimal equivalent of the data No. corresponds to the position block No.) | 8            |
| [4][8]  | [2][0]           | Display unit of M code  | 8            |

#### (c) Speed block No. (command [4][A] to [4][D])

| Command | Data No.         | Description  | Frame Length |
|---------|------------------|--|--------------|
| [4][A]  | [0][0] to [F][F] | Data form and data of speed block No.<br>(The decimal equivalent of the data No. corresponds to the position block No.)                | 8            |
| [4][B]  | [0][0] to [F][F] | Setting range of speed block No. (upper limit value)<br>(The decimal equivalent of the data No. corresponds to the position block No.) | 8            |
| [4][C]  | [0][0] to [F][F] | Setting range of speed block No. (lower limit value)<br>(The decimal equivalent of the data No. corresponds to the position block No.) | 8            |
| [4][D]  | [2][0]           | Display unit of speed block No.  | 8            |

## 8. RS-232C COMMUNICATION FUNCTIONS

### (7) Speed block

#### (a) Speed (commands [5][0] to [5][3])

| Command | Data No.         | Description   | Frame Length |
|---------|------------------|---|--------------|
| [5][0]  | [0][1] to [0][8] | Data form and data of speed<br>(The decimal equivalent of the data No. corresponds to the speed block No.)                | 8            |
| [5][1]  | [0][1] to [0][8] | Setting range of speed (upper limit value)<br>(The decimal equivalent of the data No. corresponds to the speed block No.) | 8            |
| [5][2]  | [0][0] to [0][8] | Setting range of speed (lower limit value)<br>(The decimal equivalent of the data No. corresponds to the speed block No.) | 8            |
| [5][3]  | [2][0]           | Display unit of speed   | 8            |

#### (b) Acceleration time constant (commands [5][4] to [5][7])

| Command | Data No.         | Description  | Frame Length |
|---------|------------------|--|--------------|
| [5][4]  | [0][1] to [0][8] | Data form and data of acceleration time constant<br>(The decimal equivalent of the data No. corresponds to the speed block No.)                | 8            |
| [5][5]  | [0][1] to [0][8] | Setting range of acceleration time constant (upper limit value)<br>(The decimal equivalent of the data No. corresponds to the speed block No.) | 8            |
| [5][6]  | [0][0] to [0][8] | Setting range of acceleration time constant (lower limit value)<br>(The decimal equivalent of the data No. corresponds to the speed block No.) | 8            |
| [5][7]  | [2][0]           | Display unit of acceleration time constant   | 8            |

#### (c) Deceleration time constant (commands [5][8] to [5][B])

| Command | Data No.         | Description  | Frame Length |
|---------|------------------|--|--------------|
| [5][8]  | [0][1] to [0][8] | Data form and data of deceleration time constant<br>(The decimal equivalent of the data No. corresponds to the speed block No.)                | 8            |
| [5][9]  | [0][1] to [0][8] | Setting range of deceleration time constant (upper limit value)<br>(The decimal equivalent of the data No. corresponds to the speed block No.) | 8            |
| [5][A]  | [0][0] to [0][8] | Setting range of deceleration time constant (lower limit value)<br>(The decimal equivalent of the data No. corresponds to the speed block No.) | 8            |
| [5][B]  | [2][0]           | Display unit of deceleration time constant   | 8            |

#### (d) S-pattern time constant (commands [5][C] to [5][F])

| Command | Data No.         | Description   | Frame Length |
|---------|------------------|---|--------------|
| [5][C]  | [0][1] to [0][8] | Data form and data of S-pattern time constant<br>(The decimal equivalent of the data No. corresponds to the speed block No.)                | 8            |
| [5][D]  | [0][1] to [0][8] | Setting range of S-pattern time constant (upper limit value)<br>(The decimal equivalent of the data No. corresponds to the speed block No.) | 8            |
| [5][E]  | [0][0] to [0][8] | Setting range of S-pattern time constant (lower limit value)<br>(The decimal equivalent of the data No. corresponds to the speed block No.) | 8            |
| [5][F]  | [2][0]           | Display unit of S-pattern time constant   | 8            |

## 8. RS-232C COMMUNICATION FUNCTIONS

### 8.11.2 Write commands

#### (1) Japanese-English switch-over (command [8][0])

| Command | Data No. | Description   | Setting Range | Frame Length |
|---------|----------|---|---------------|--------------|
| [8][0]  | [0][0]   | Japanese-English switch-over<br>0000: Japanese<br>0001: English | 0000 · 0001   | 4            |

#### (2) Status display (command [8][1])

| Command | Data No. | Description               | Setting Range | Frame Length |
|---------|----------|---------------------------|---------------|--------------|
| [8][1]  | [0][0]   | Status display data clear | 1EA5          | 4            |

#### (3) Manual operation of roll feeding system (command [8][1])

| Command | Data No. | Description   | Setting Range | Frame Length |
|---------|----------|---|---------------|--------------|
| [8][1]  | [2][0]   | FWD key of parameter unit in manual operation mode of roll feeding system<br>1EA5: Forward rotation JOG start<br>5AE1: Forward rotation JOG end | 1EA5 · 5AE1   | 4            |
| [8][1]  | [2][1]   | REV key of parameter unit in manual operation mode of roll feeding system<br>1EA5: Reverse rotation JOG start<br>5AE1: Reverse rotation JOG end | 1EA5 · 5AE1   | 4            |
| [8][1]  | [2][2]   | 1STEP key of parameter unit in manual operation mode of roll feeding system<br>1-step operation start   | 1EA5          | 4            |

#### (4) Alarm (command [8][2])

| Command | Data No. | Description                                   | Setting Range | Frame Length |
|---------|----------|---|---------------|--------------|
| [8][2]  | [0][0]   | Alarm clear                                   | 1EA5          | 4            |
| [8][2]  | [2][0]   | Alarm history clear                           | 1EA5          | 4            |
| [8][2]  | [5][0]   | Analog output of data before alarm occurrence | 1EA5          | 4            |

#### (5) Parameter (command [8][4])

| Command | Data No.         | Description   | Setting Range             | Frame Length |
|---------|------------------|---|---------------------------|--------------|
| [8][4]  | [0][0] to [4][F] | Each parameter write<br>(The decimal equivalent of the data No. value (hexadecimal) corresponds to the parameter number.) | Depends on the parameter. | 8            |

#### (6) Operation mode selection (command [8][B])

| Command | Data No. | Description   | Setting Range | Frame Length |
|---------|----------|---|---------------|--------------|
| [8][B]  | [0][0]   | Operation mode changing<br>0000: Exit from test operation mode<br>0001: Jog operation<br>0002: Positioning operation<br>0003: Motor-less operation<br>0004: DO forced output (output signal forced output)<br>0005: 1 step feed operation | 0000 to 0004  | 4            |

## 8. RS-232C COMMUNICATION FUNCTIONS

### (7) DO forced output (command [8][B])

| Command | Data No. | Description                             | Signal | Setting Range | Frame Length |
|---------|----------|---|--------|---------------|--------------|
| [8][B]  | [8][1]   | DO forced output    0000:OFF    0001:ON | RD     | 0000 · 0001   | 4            |
| [8][B]  | [8][2]   |   | PF     | 0000 · 0001   | 4            |
| [8][B]  | [8][3]   |   | COP    | 0000 · 0001   | 4            |
| [8][B]  | [8][4]   |   | ZP     | 0000 · 0001   | 4            |
| [8][B]  | [8][5]   |   | ALM    | 0000 · 0001   | 4            |
| [8][B]  | [8][6]   |   | OP     | 0000 · 0001   | 4            |

### (8) External input signal disable (command [9][0])

| Command | Data No. | Description  | Setting Range | Frame Length |
|---------|----------|--|---------------|--------------|
| [9][0]  | [0][0]   | Turns off the external input signals (DI), external analog input signals and pulse train inputs with the exception of EMG, LSP and LSN, independently of the external ON/OFF statuses. | 1EA5          | 4            |
| [9][0]  | [0][1]   | Disables only the external input signals (DI) with the exception of EMG, LSP and LSN.  | 1EA5          | 4            |
| [9][0]  | [0][2]   | Disables only the external analog input signals.   | 1EA5          | 4            |
| [9][0]  | [0][3]   | Changes the external output signals (DO) into the value of command [8][B] or command [A][0] + data No. [0][1].   | 1EA5          | 4            |
| [9][0]  | [1][0]   | Enables the disabled external input signals (DI), external analog input signals and pulse train inputs with the exception of EMG, LSP and LSN.   | 1EA5          | 4            |
| [9][0]  | [1][1]   | Enables the disabled external input signals (DI) with the exception of EMG, LSP and LSN.   | 1EA5          | 4            |
| [9][0]  | [1][2]   | Enables the disabled external analog input signals.  | 1EA5          | 4            |
| [9][0]  | [1][3]   | Enables the disabled external output signals (DO).   | 1EA5          | 4            |

### (9) Forced ON/OFF of external I/O signals (DIO) [A][0]

| Command | Data No. | Description   | Setting Range           | Frame Length |
|---------|----------|---|-------------------------|--------------|
| [A][0]  | [0][0]   | Forces the external output signals (DO) to turn on/off.                                       | 00000000 to<br>FFFFFFFF | 8            |
| [A][0]  | [0][1]   | Forces the external input signals (DI) to turn on/off with the exception of EMG, LSP and LSN. | 00000000 to<br>FFFFFFFF | 8            |

### (10) Data for test operation mode (command [A][0])

| Command | Data No. | Description   | Setting Range           | Frame Length |
|---------|----------|---|-------------------------|--------------|
| [A][0]  | [1][0]   | Writes the speed of the test operation mode (jog operation, positioning operation).                                   | 0000 to 7FFF            | 4            |
| [A][0]  | [1][1]   | Writes the acceleration/deceleration time constant of the test operation mode (jog operation, positioning operation). | 00000000 to<br>7FFFFFFF | 8            |
| [A][0]  | [1][2]   | Clears the acceleration/deceleration time constant of the test operation mode (jog operation, positioning operation). | 1EA5                    | 4            |
| [A][0]  | [1][3]   | Writes the moving distance (in pulses) of the test operation mode (jog operation, positioning operation).             | 80000000 to<br>7FFFFFFF | 8            |
| [A][0]  | [1][5]   | Temporary stop command of the test operation mode (jog operation, positioning operation)                              | 1EA5                    | 4            |
| [A][0]  | [1][A]   | Writes the position block No. of the test operation mode (1 step feed operation).                                     | 80000000 to<br>7FFFFFFF | 8            |
| [A][0]  | [1][B]   | "1 STEP" key of test operation mode (1-step feed operation)   | 1EA5                    | 4            |

## 8. RS-232C COMMUNICATION FUNCTIONS

### (11) Position block data (commands [C][0], [C][2], [C][4])

| Command | Data No.         | Description   | Setting Range                           | Frame Length |
|---------|------------------|---|---|--------------|
| [C][0]  | [0][0] to [F][F] | Position data<br>(The decimal equivalent of the data No. corresponds to the position block No.)   | According to commands [4][1] and [4][2] | 8            |
| [C][2]  | [0][0] to [F][F] | M code<br>(The decimal equivalent of the data No. corresponds to the position block No.)          | According to commands [4][6] and [4][7] | 8            |
| [C][4]  | [0][0] to [F][F] | Speed block No.<br>(The decimal equivalent of the data No. corresponds to the position block No.) | According to commands [4][B] and [4][C] | 8            |

### (12) Speed block data (commands [C][6] to [C][9])

| Command | Data No.         | Description   | Setting Range                           | Frame Length |
|---------|------------------|---|---|--------------|
| [C][6]  | [0][1] to [0][7] | Speed<br>(The decimal equivalent of the data No. corresponds to the speed block No.)                      | According to commands [5][1] and [5][2] | 8            |
| [C][7]  | [0][1] to [0][7] | Acceleration time constant<br>(The decimal equivalent of the data No. corresponds to the speed block No.) | According to commands [5][5] and [5][6] | 8            |
| [C][8]  | [0][1] to [0][7] | Deceleration time constant<br>(The decimal equivalent of the data No. corresponds to the speed block No.) | According to commands [5][9] and [5][A] | 8            |
| [C][9]  | [0][1] to [0][7] | S-pattern time constant<br>(The decimal equivalent of the data No. corresponds to the speed block No.)    | According to commands [5][D] and [5][E] | 8            |

## 8. RS-232C COMMUNICATION FUNCTIONS

### 8.12 Detailed Explanations of Commands

#### 8.12.1 Data processing

When the master station transmits a command + data No. or a command + data No. + data to a slave station, the servo amplifier returns a reply or data according to the purpose.

When numerical values are represented in these send data and receive data, they are represented in decimal, hexadecimal, etc.

Therefore, data must be processed according to the application.

Since whether data must be processed or not and how to process data depend on the monitoring, parameters, etc., follow the detailed explanation of the corresponding command.

The following methods are how to process send and receive data when reading and writing data.

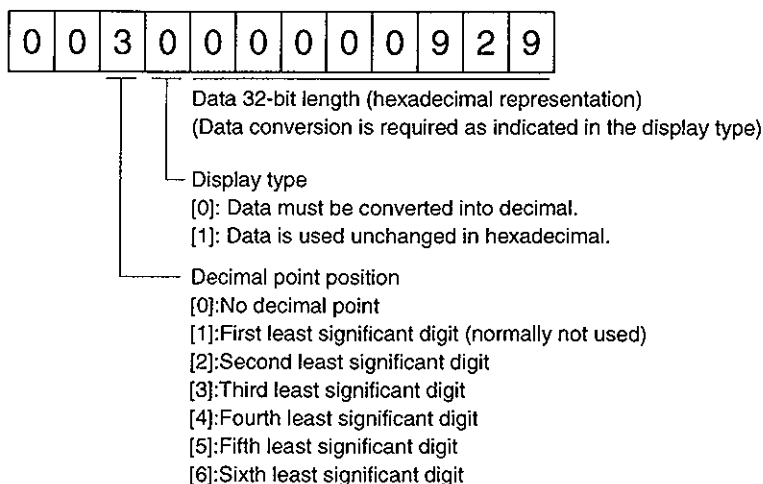
#### (1) Processing the read data

When the display type is 0, the eight-character data is converted from hexadecimal to decimal and a decimal point is placed according to the decimal point position information.

When the display type is 1, the eight-character data is used unchanged.

The following example indicates how to process the receive data "00300000929" given to show.

The receive data is as follows.



Since the display type is "0" in this case, the hexadecimal data is converted into decimal.

00000929H → 2345

As the decimal point position is "3", a decimal point is placed in the third least significant digit.

Hence, "23.45" is displayed.

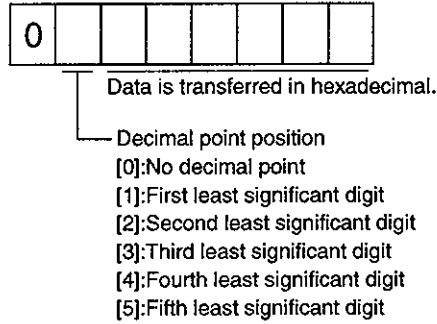
## 8. RS-232C COMMUNICATION FUNCTIONS

---

### (2) Writing the processed data

When the data to be written is handled as decimal, the decimal point position must be specified. If it is not specified, the data cannot be written. When the data is handled as hexadecimal, specify "0" as the decimal point position.

The data to be sent is the following value.



By way of example, here is described how to process the set data when a value of "15.5" is sent.

Since the decimal point position is the second digit, the decimal point position data is "2".

As the data to be sent is hexadecimal, the decimal data is converted into hexadecimal.

155→9B

Hence, "0200009B" is transmitted.

## 8. RS-232C COMMUNICATION FUNCTIONS

### 8.12.2 Status display

#### (1) Reading the status display name and unit

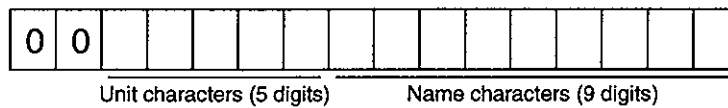
Read the status display name and unit.

##### (a) Transmission

Transmit command [0][1] and the data No. corresponding to the status display item to be read, [0][0] to [0][F]. (Refer to Section 8.11.1.)

##### (b) Reply

The slave station sends back the status display name and unit requested.



#### (2) Status display data read

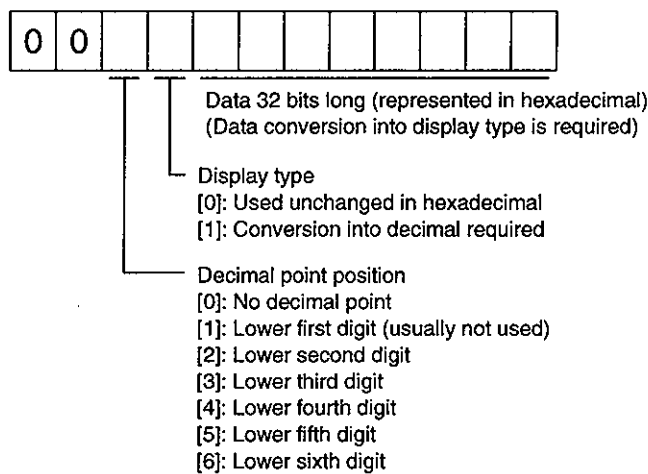
Read the status display data and processing information.

##### (a) Transmission

Transmit command [0][1] and the data No. corresponding to the status display item to be read. Refer to Section 8.11.1.

##### (b) Reply

The slave station sends back the status display data requested.



#### (3) Status display data clear

The cumulative feedback pulse data of the status display is cleared. Send this command immediately after reading the status display item. The data of the status display item transmitted is cleared to zero.

| Command | Data No. | Data         |
|---------|----------|--------------|
| [8][1]  | [0][0]   | [1][E][A][5] |

For example, after sending command [0][1] and data No. [8][0] and receiving the status display data, send command [8][1], data No. [0][0] and data [1EA5] to clear the cumulative feedback pulse value to zero.



## 8. RS-232C COMMUNICATION FUNCTIONS

### 8.12.3 Parameters

#### (1) Reading the name

Read the parameter name.

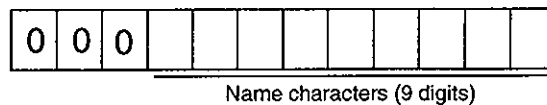
##### (a) Transmission

Transmit command [0][8] and the data No. corresponding to the parameter No., [0][0] to [4][F].  
(Refer to Section 8.11.1.)

The data No. is expressed in hexadecimal. The decimal equivalent of the data No. value corresponds to the parameter number.

##### (b) Reply

The slave station sends back the name of the parameter No. requested.



#### (2) Reading the setting

Read the parameter setting.

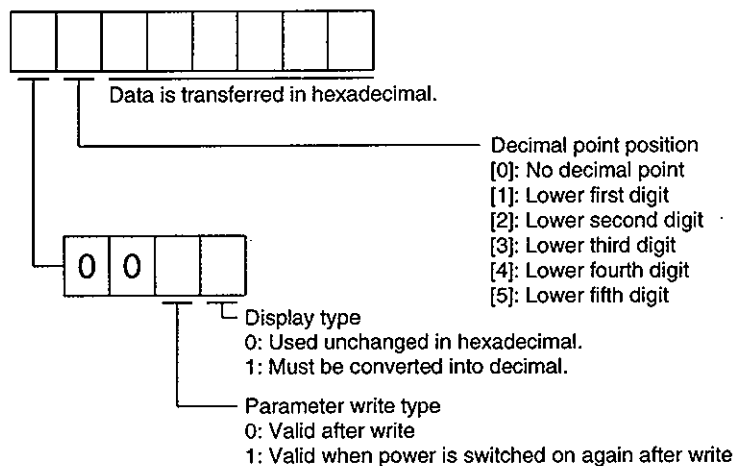
##### (a) Transmission

Transmit command [0][5] and the data No. corresponding to the parameter No., [0][0] to [4][F].  
(Refer to Section 8.11.1.)

The data No. is expressed in hexadecimal. The decimal equivalent of the data No. value corresponds to the parameter number.

##### (b) Reply

The slave station sends back the data and processing information of the parameter No. requested.



For example, data "1200270F" means 999.9 (decimal display format) and data "0003ABC" means 3ABC (hexadecimal display format).

When the display type is "0" (hexadecimal) and the decimal point position is other than 0, the display type is a special hexadecimal display format and "F" of the data value is handled as a blank. Data "01FFF053" means 053 (special hexadecimal display format).

"000000" is transferred when the parameter that was read is the one inaccessible for write/reference in the parameter write disable setting of parameter No. 20.

## 8. RS-232C COMMUNICATION FUNCTIONS

### (3) Reading the setting range

Read the parameter setting range.

#### (a) Transmission

When reading the upper limit value, transmit command [0][6] and the data No. corresponding to the parameter No., [0][0] to [6][3]. When reading the lower limit value, transmit command [0][7] and the data No. corresponding to the parameter No., [0][0] to [6][3]. (Refer to Section 8.11.1.)

The data No. is expressed in hexadecimal. The decimal equivalent of the data No. value corresponds to the parameter number.

#### (b) Reply

The slave station sends back the data and processing information of the parameter No. requested.



Data is transferred in hexadecimal.

For example, data "10FFFFEC" means -20.

### (4) Parameter write

Write the parameter setting into EEPROM of the controller.

Parameter settings may be written up to 100,000 times. Write the value within the setting enabled range. For the setting enabled range, refer to Section 6.1 or read the setting range by performing operation in (3) of this section.

Transmit command [8][4], the data No., and the set data.

The data No. is expressed in hexadecimal. The decimal equivalent of the data No. value corresponds to the parameter number.

When the data to be written is handled as decimal, the decimal point position must be specified. If it is not specified, data cannot be written. When the data is handled as hexadecimal, specify 0 as the decimal point position.

Write the data after making sure that it is within the upper/lower limit value range.

Read the parameter data to be written, confirm the decimal point position, and create transmission data to prevent error occurrence. On completion of write, read the same parameter data to verify that data has been written correctly.

| Command | Data No.         | Set Data   |
|---------|------------------|------------|
| [8][4]  | [0][0] to [3][5] | See below. |



Data is transferred in hexadecimal.

Decimal point position

- [0]: No decimal point
- [1]: Lower first digit
- [2]: Lower second digit
- [3]: Lower third digit
- [4]: Lower fourth digit
- [5]: Lower fifth digit

## 8. RS-232C COMMUNICATION FUNCTIONS

### 8.12.4 External I/O signal status (DIO diagnosis)

#### (1) Reading the external input signal ON/OFF status

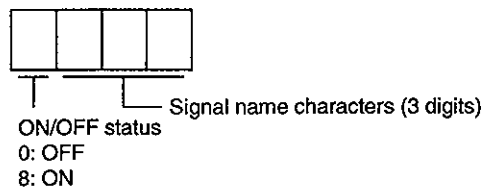
Read the ON/OFF status of the external input signal. When the master station transmits the data No. to the slave station, the slave station sends back the corresponding ON/OFF status to the master station.

##### (a) Transmission

Transmit command [3][4] and the data No. corresponding to the input signal to be read. (Refer to Section 8.11.1.)

##### (b) Reply

The slave station sends back the ON/OFF status of the input signal requested.



#### (2) Reading the external output signal ON/OFF status

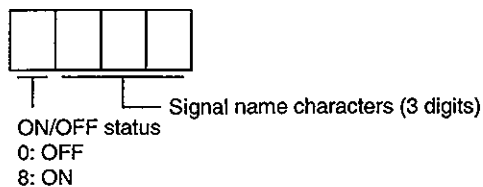
Read the ON/OFF status of the external output signal. When the master station transmits the data No. to the slave station, the slave station sends back the corresponding ON/OFF status to the master station.

##### (a) Transmission

Transmit command [3][4] and the data No. corresponding to the output signal to be read. (Refer to Section 8.11.1.)

##### (b) Reply

The slave station sends back the ON/OFF status of the output signal requested.



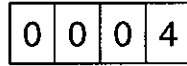
## 8. RS-232C COMMUNICATION FUNCTIONS

### 8.12.5 External output signal ON/OFF (DO forced output)

In the test operation mode, any output signal can be turned on/off independently of its status. Using command [9][0], disable the output signals in advance.

#### (1) Choosing DO forced output in test operation mode

Transmit command [8][B] + data No. [0][0] + data "0004" to choose DO forced output.

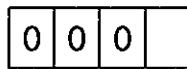


Selection of test operation mode  
4: DO forced output (output signal forced output)

#### (2) External output signal ON/OFF

##### (a) Turning the output signal ON/OFF signal-by-signal

Transmit command [8][B] + data No. corresponding to the output signal, [8][1] to [6][8], and the data which means ON/OFF.



ON/OFF command  
0: OFF  
1: ON

##### (b) Turning all output signals ON/OFF at once

Transmit the following communication commands:

| Command | Data No. | Setting Data |
|---------|----------|--------------|
| [A][0]  | [0][1]   | See below.   |



Command of each bit is sent to the slave station in hexadecimal.

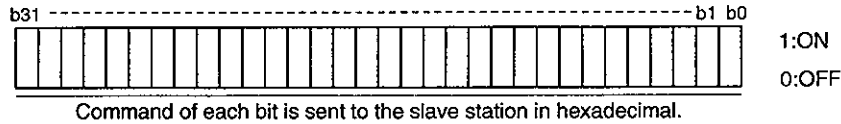
| bit | Signal Name | bit | Signal Name | bit | Signal Name |
|-----|-------------|-----|-------------|-----|-------------|
| 0   | RD          | 11  |             | 22  |             |
| 1   | PF          | 12  |             | 23  |             |
| 2   | CPO         | 13  |             | 24  |             |
| 3   | ZP          | 14  |             | 25  |             |
| 4   | ALM         | 15  |             | 26  |             |
| 5   | OP          | 16  |             | 27  |             |
| 6   |             | 17  |             | 28  |             |
| 7   |             | 18  |             | 29  |             |
| 8   |             | 19  |             | 30  |             |
| 9   |             | 20  |             | 31  |             |
| 10  |             | 21  |             |     |             |

## 8. RS-232C COMMUNICATION FUNCTIONS

### 8.12.6 External input signal ON/OFF

With the exception of EMG, LSP and LSN, the input signals can be turned on/off independently of their statuses. Using command [9][0], disable the external input signals in advance. When you want to keep the signals on, turn them on every time data is transmitted.

| Command | Data No. | Setting Data |
|---------|----------|--------------|
| [A][0]  | [0][0]   | See below.   |



| bit | Signal Name | bit | Signal Name | bit | Signal Name |
|-----|-------------|-----|-------------|-----|-------------|
| 0   | SON         | 11  | ST2         | 22  |             |
| 1   | DEC         | 12  |             | 23  |             |
| 2   | JFS         | 13  |             | 24  |             |
| 3   | STP         | 14  |             | 25  |             |
| 4   |             | 15  |             | 26  |             |
| 5   |             | 16  |             | 27  |             |
| 6   | CR          | 17  |             | 28  |             |
| 7   | DI0         | 18  |             | 29  |             |
| 8   | DI1         | 19  |             | 30  |             |
| 9   | DI2         | 20  |             | 31  |             |
| 10  | ST1         | 21  |             |     |             |

## 8. RS-232C COMMUNICATION FUNCTIONS

### 8.12.7 Disable/enable of external I/O signals (DIO)

Inputs can be disabled independently of the external I/O signal ON/OFF. When inputs are disabled, the input signals are recognized as follows. Among the external input signals, EMG, LSP and LSN cannot be disabled.

| Signal                        | Status |
|-------------------------------|--------|
| External input signals (DI)   | OFF    |
| External analog input signals | 0V     |
| Pulse train inputs            | None   |

- (1) Disabling/enabling the external input signals (DI), external analog input signals and pulse train inputs with the exception of EMG, LSP and LSN.

Transmit the following communication commands:

- (a) Disable

| Command | Data No. | Data |
|---------|----------|------|
| [9][0]  | [0][0]   | 1EA5 |

- (b) Enable

| Command | Data No. | Data |
|---------|----------|------|
| [9][0]  | [1][0]   | 1EA5 |

- (2) Disabling/enabling only the external input signals (DI) with the exception of EMG, LSP and LSN.

Transmit the following communication commands:

- (a) Disable

| Command | Data No. | Data |
|---------|----------|------|
| [9][0]  | [0][1]   | 1EA5 |

- (b) Enable

| Command | Data No. | Data |
|---------|----------|------|
| [9][0]  | [1][1]   | 1EA5 |

- (3) Disabling/enabling only the external analog input signals.

Transmit the following communication commands:

- (a) Disable

| Command | Data No. | Data |
|---------|----------|------|
| [9][0]  | [0][2]   | 1EA5 |

- (b) Enable

| Command | Data No. | Data |
|---------|----------|------|
| [9][0]  | [1][2]   | 1EA5 |

- (4) Disabling/enabling the external output signals (DO)

Transmit the following communication commands:

- (a) Disable

| Command | Data No. | Data |
|---------|----------|------|
| [9][0]  | [0][3]   | 1EA5 |

- (b) Enable

| Command | Data No. | Data |
|---------|----------|------|
| [9][0]  | [1][3]   | 1EA5 |

## 8. RS-232C COMMUNICATION FUNCTIONS

### 8.12.8 Test operation mode

#### (1) Instructions for test operation mode

The test operation mode must be executed in the following procedure. If communication is interrupted for longer than 0.5s during test operation, the MR-H-ACN causes the motor to be decelerated to a stop and servo-locked. To prevent this, continue communication without a break, e.g. monitor the status display.

1) Turn off all external input signals.

2) Disable the external input signals.

| Command | Data No. | Data |
|---------|----------|------|
| [9][0]  | [0][0]   | 1EA5 |

3) Choose the test operation mode.

| Command | Data No. | Transmission Data | Selection of Test Operation Mode |
|---------|----------|-------------------|----------------------------------|
| [8][B]  | [0][0]   | 0000              | Test operation mode cancel       |
| [8][B]  | [0][0]   | 0001              | Jog operation                    |
| [8][B]  | [0][0]   | 0002              | Positioning operation            |
| [8][B]  | [0][0]   | 0003              | Motor-less operation             |
| [8][B]  | [0][0]   | 0004              | DO forced output                 |
| [8][B]  | [0][0]   | 0005              | 1 step feed operation            |

4) Set the data needed for test operation.

5) Start.

6) Continue communication using the status display or other command.

To terminate the test operation mode, complete the corresponding operation and:

1) Clear the test operation acceleration/deceleration time constant.

| Command | Data No. | Data |
|---------|----------|------|
| [A][0]  | [1][2]   | 1EA5 |

2) Cancel the test operation mode.

| Command | Data No. | Data |
|---------|----------|------|
| [8][B]  | [0][0]   | 0000 |

3) Enable the disabled external input signals.

| Command | Data No. | Data |
|---------|----------|------|
| [9][0]  | [1][0]   | 1EA5 |

## 8. RS-232C COMMUNICATION FUNCTIONS

### (2) Jog operation

Transmit the following communication commands:

#### (a) Setting of jog operation data

| Item                                    | Command | Data No. | Data   |
|---|---------|----------|--|
| Speed                                   | [A][0]  | [1][0]   | Write the speed [r/min] in hexadecimal.                                |
| Acceleration/deceleration time constant | [A][0]  | [1][1]   | Write the acceleration/deceleration time constant [ms] in hexadecimal. |

#### (b) Start

Turn on the external I/O signals SON and DI3/DI4 by using command [A][0] + data No. [0][0] or command [A][0] + data No. [0][1].

| Item                   | Command | Data No. | Data                            |
|------------------------|---------|----------|---------------------------------|
| Forward rotation start | [A][0]  | [0][0]   | 00000401: Turns on SON and ST1. |
| Reverse rotation start | [A][0]  | [0][0]   | 00000801: Turns on SON and ST2. |

### (3) Positioning operation

Transmit the following communication commands:

#### (a) Setting of positioning operation data

| Item                                    | Command | Data No. | Data   |
|---|---------|----------|--|
| Speed                                   | [A][0]  | [1][0]   | Write the speed [r/min] in hexadecimal.                                |
| Acceleration/deceleration time constant | [A][0]  | [1][1]   | Write the acceleration/deceleration time constant [ms] in hexadecimal. |
| Moving distance                         | [A][0]  | [1][3]   | Write the moving distance [pulse] in hexadecimal.                      |

#### (b) Start

Turn on the external I/O signals SON and DI3/DI4 by using command [A][0] + data No. [0][0].

| Item                   | Command | Data No. | Data                            |
|------------------------|---------|----------|---------------------------------|
| Forward rotation start | [A][0]  | [0][0]   | 00000401: Turns on SON and ST1. |
| Reverse rotation start | [A][0]  | [0][0]   | 00000801: Turns on SON and ST2. |

#### (c) Temporary stop

A temporary stop can be made during positioning operation.

| Command | Data No. | Data |
|---------|----------|------|
| [A][0]  | [1][5]   | 1EA5 |

Retransmit the same communication commands as at the start time to resume operation.

To stop positioning operation after a temporary stop, retransmit the temporary stop communication command. The remaining moving distance is then cleared.



## 8. RS-232C COMMUNICATION FUNCTIONS

### (4) 1-step feed operation

Transmit the following communication commands:

#### (a) Setting of the position data No. to be executed

| Item               | Command | Data No. | Data                              |
|--------------------|---------|----------|-----------------------------------|
| Position block No. | [A][0]  | [1][0]   | According to the following figure |

|   |   |   |   |   |   |  |  |
|---|---|---|---|---|---|--|--|
| 0 | 0 | 0 | 0 | 0 | 0 |  |  |
|---|---|---|---|---|---|--|--|

Data 8-bit length  
Displayed in hexadecimal

#### (b) Start

| Item        | Command | Data No. | Data |
|-------------|---------|----------|------|
| 1-step feed | [A][0]  | [1][B]   | 1E5A |

Using command [A][0] + data No. [0][0], switch on SON of the external I/O signals.

| Item     | Command | Data No. | Data              |
|----------|---------|----------|-------------------|
| Servo on | [A][0]  | [0][0]   | 00000001 : on SON |

| Item        | Command | Data No. | Data |
|-------------|---------|----------|------|
| 1-step feed | [A][0]  | [1][B]   | 1E5A |

#### (c) Temporary stop

You can make a temporary stop during 1-step feed operation.

| Command | Data No. | Data |
|---------|----------|------|
| [A][0]  | [1][5]   | 1E5A |

Transmitting the 1-step feed communication command again resumes operation. At this time, SON need not be switched on again.

To stop the 1-step feed operation after a temporary stop, transmit the temporary stop communication command again. This clears the remaining moving distance.

## 8. RS-232C COMMUNICATION FUNCTIONS

### 8.12.9 Alarm history

The alarm numbers, occurrence times and name of No.0 (last alarm) to No.9 (ten alarm in the past) are read.

#### (1) Alarm No. read

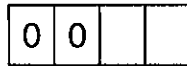
Read the alarm No. which occurred in the past.

##### (a) Transmission

Send command [3][3] and data No. [1][0] to [1][9]. Refer to Section 8.11.1.

##### (b) Reply

The alarm No. corresponding to the data No. is provided.



Alarm No. is transferred in decimal.

For example, "0032" means AL32 and "000F" means AL\_(no alarm).

#### (2) Alarm occurrence time read

Read the occurrence time of alarm which occurred in the past.

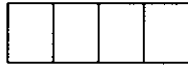
The alarm occurrence time corresponding to the data No. is provided in terms of the total time beginning with operation start, with the minute unit omitted.

##### (a) Transmission

Send command [3][3] and data No. [2][0] to [2][9].

Refer to Section 8.11.1.

##### (b) Reply



Alarm occurrence time is transferred in hexadecimal.  
Hexadecimal must be converted into decimal.

For example, data "01F5" means that the alarm occurred 501 hours after start of operation.

#### (3) Reading the alarm name

Read the name of the past alarm.

##### (a) Transmission

Transmit command [3][3] + data No. [3][0] to [3][9]. (Refer to Section 8.11.1.)

##### (b) Reply

The slave station sends back the alarm name corresponding to the data No.



Name characters (11 digits)

#### (4) Alarm history clear

Erase the alarm history. Transmit the following communication command:

| Command | Data No. | Data |
|---------|----------|------|
| [8][2]  | [2][0]   | 1EA5 |

## 8. RS-232C COMMUNICATION FUNCTIONS

### 8.12.10 Current alarm

#### (1) Current alarm No. read

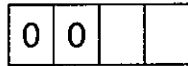
Read the alarm No. which is occurring currently.

##### (a) Transmission

Send command [0][2] and data No. [0][0].

##### (b) Reply

The slave station sends back the alarm currently occurring.



Alarm No. is transferred in decimal.

For example, "0032" means AL32 and "000F" means AL\_(no alarm).

#### (2) Reading the concurrent alarm No.

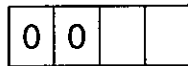
Read the concurrent alarm No.

##### (a) Transmission

Transmit command [0][2] + data No. [0][8].

##### (b) Reply

The slave station sends back the concurrent alarm.



Alarm No. is transferred in decimal.

#### (3) Reading the current alarm name

Read the name of the current alarm.

##### (a) Transmission

Transmit command [0][2] + data No. [0][0].

##### (b) Reply

The slave station sends back the current alarm.



Name characters (10 digits)

## 8. RS-232C COMMUNICATION FUNCTIONS

### (4) Reading the concurrent alarm name

Read the concurrent alarm name.

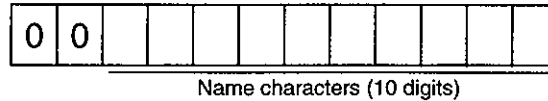
#### (a) Transmission

Transmit command [0][2] + data No. [0][9].

| Command | Data No. |
|---------|----------|
| [0][2]  | [0][9]   |

#### (b) Reply

The slave station sends back the concurrent alarm.



### (5) Read of the status display at alarm occurrence

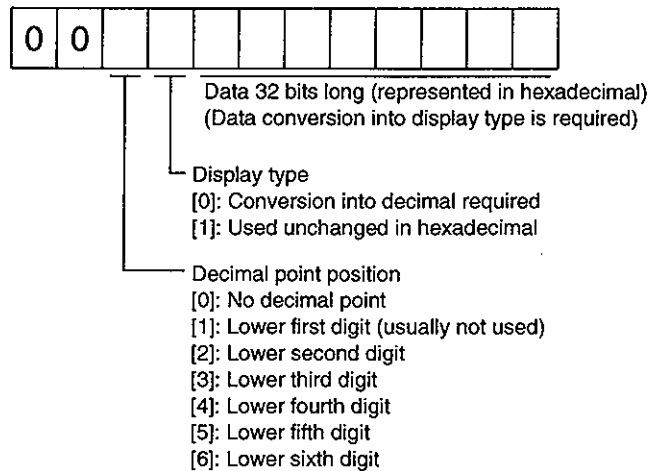
Read the status display data at alarm occurrence. When the data No. corresponding to the status display item is transmitted, the data value and data processing information are sent back.

#### (a) Transmission

Send command [3][5] and any of data No. [8][0] to [8][F] corresponding to the status display item to be read. Refer to Section 8.11.1.

#### (b) Reply

The slave station sends back the requested status display data at alarm occurrence.



### (6) Current alarm clear

As by the entry of the RES signal, reset the controller alarm to make the MR-H-ACN ready to operate. After removing the cause of the alarm, reset the alarm with no command entered.

#### Transmission

| Command | Data No. | Data |
|---------|----------|------|
| [8][2]  | [0][0]   | 1EA5 |

### (7) Analog output of data before alarm occurrence

The status display at the time of alarm occurrence is output to pins 4, 3 of CN3 as an analog signal. Use parameter No. 46 to set the output item.

Transmit the following communication command:

| Command | Data No. | Data |
|---------|----------|------|
| [8][2]  | [2][0]   | 1EA5 |

## 8. RS-232C COMMUNICATION FUNCTIONS

### 8.12.11 Position block

#### (1) Reading of the settings

Read the position data, M code and speed block No.

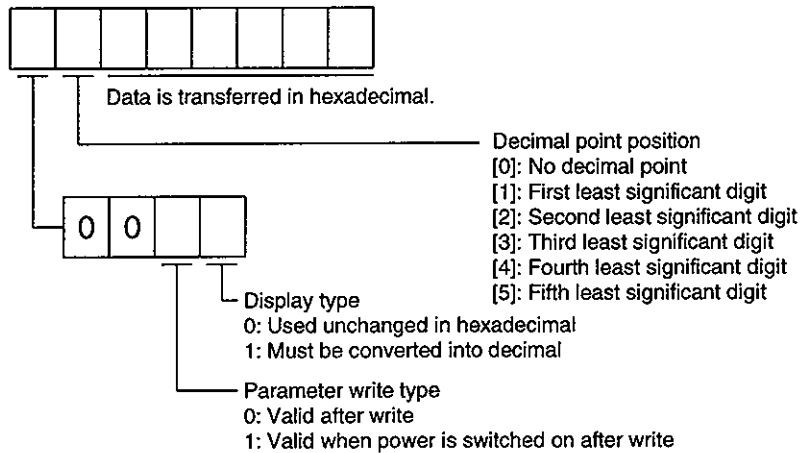
##### (a) Transmission

Transmit the following communication commands (refer to Section 8.11.1):

| Item            | Command | Data No.         |
|-----------------|---------|------------------|
| Position data   | [4][0]  | [0][0] to [F][F] |
| M code          | [4][5]  | [0][0] to [F][F] |
| Speed block No. | [4][A]  | [0][0] to [F][F] |

##### (b) Reply

The slave station returns the settings of the requested position block No.



For example, the received data of the respective items have the following meanings:

- Data "13F0BDC1" of position data indicates -9999.99
- Data "100000063" of M code indicates 99
- Data "10000005" of speed block No. indicates 5

#### (2) Reading of the position data unit

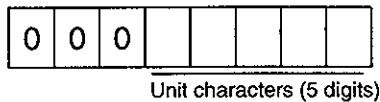
Read the unit of the position data.

##### (a) Transmission

Transmit command [4][3] + data No. [0][0].

##### (b) Reply

The slave station returns the unit of the position data.



## 8. RS-232C COMMUNICATION FUNCTIONS

### (3) Reading of the setting ranges (upper and lower limit values)

Read the setting ranges of the position data, M code and speed block No.

#### (a) Transmission

Transmit the following communication commands (refer to Section 8.11.1):

| Item  | Command | Data No.         |
|---|---------|------------------|
| Position data setting range (upper limit value)   | [4][1]  | [0][0] to [F][F] |
| Position data setting range (lower limit value)   | [4][2]  | [0][0] to [F][F] |
| M code setting range (upper limit value)          | [4][6]  | [0][0] to [F][F] |
| M code setting range (lower limit value)          | [4][7]  | [0][0] to [F][F] |
| Speed block No. setting range (upper limit value) | [4][B]  | [0][0] to [F][F] |
| Speed block No. setting range (lower limit value) | [4][C]  | [0][0] to [F][F] |

#### (b) Reply

The slave station returns the setting ranges in the requested position block No.



Data is transferred in hexadecimal.

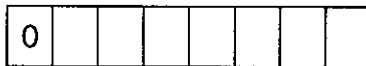
### (4) Writing of the settings

Write the position data, M code and speed block No. to the EEP-ROM of the MR-H-ACN.

The set value can be written up to 100,000 times.

Transmit the following communication commands (refer to Section 8.11.2):

| Item            | Command | Data No.         | Data                              |
|-----------------|---------|------------------|-----------------------------------|
| Position data   | [C][0]  | [0][0] to [F][F] | According to the following figure |
| M code          | [C][2]  | [0][0] to [F][F] |                                   |
| Speed block No. | [C][4]  | [0][0] to [F][F] |                                   |



Hexadecimal data

Decimal point position

- 0: No decimal point
- 1: First least significant digit
- 2: Second least significant digit
- 3: Third least significant digit
- 4: Fourth least significant digit
- 5: Fifth least significant digit

Make the decimal point position equal to the feed length multiplying factor (STM) set in parameter No. 4. The slavestation will not accept the decimal point position if the position specified is different from the STM setting.

## 8. RS-232C COMMUNICATION FUNCTIONS

### 8.12.12 Speed block

#### (1) Reading of the settings

Read the speed, acceleration time constant, deceleration time constant and S-pattern time constant.

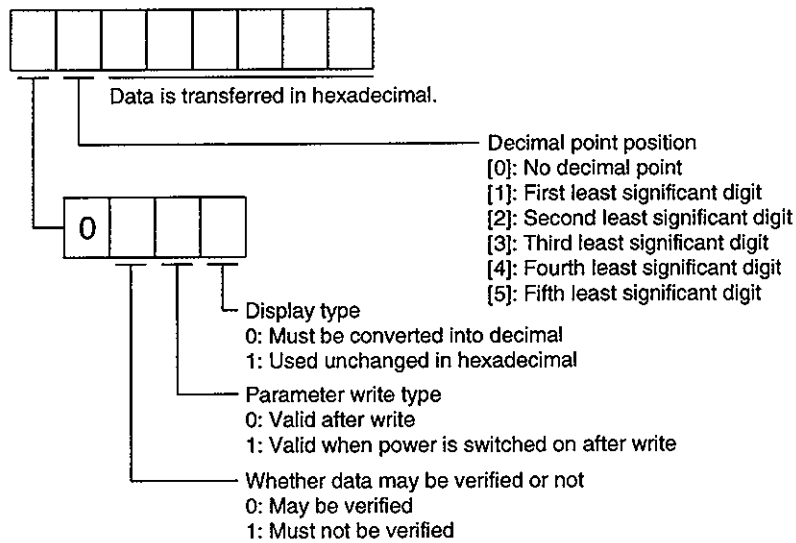
##### (a) Transmission

Transmit the following communication commands (refer to Section 8.11.1):

| Item                       | Command | Data No.         |
|----------------------------|---------|------------------|
| Speed                      | [5][0]  | [0][1] to [0][8] |
| Acceleration time constant | [5][4]  | [0][1] to [0][8] |
| Deceleration time constant | [5][8]  | [0][1] to [0][8] |
| S-pattern time constant    | [5][C]  | [0][1] to [0][8] |

##### (b) Reply

The slave station returns the settings of the requested speed block No.



#### (2) Reading of the speed unit

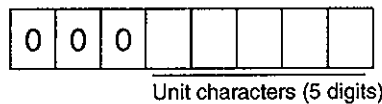
Read the unit of the speed.

##### (a) Transmission

Transmit command [5][3] + data No. [2][0].

##### (b) Reply

The slave station returns the unit of the speed.



## 8. RS-232C COMMUNICATION FUNCTIONS

### (3) Reading of the setting ranges (upper and lower limit values)

Read the setting ranges of the speed, acceleration time constant, deceleration time constant and S-pattern time constant.

#### (a) Transmission

Transmit the following communication commands (refer to Section 8.11.1):

| Item   | Command | Data No.         |
|--|---------|------------------|
| Speed (upper limit value)                      | [5][1]  | [0][1] to [0][8] |
| Speed (lower limit value)                      | [5][2]  | [0][1] to [0][8] |
| Acceleration time constant (upper limit value) | [5][5]  | [0][1] to [0][8] |
| Acceleration time constant (lower limit value) | [5][6]  | [0][1] to [0][8] |
| Deceleration time constant (upper limit value) | [5][8]  | [0][1] to [0][8] |
| Deceleration time constant (lower limit value) | [5][9]  | [0][1] to [0][8] |
| S-pattern time constant (upper limit value)    | [5][D]  | [0][1] to [0][8] |
| S-pattern time constant (lower limit value)    | [5][E]  | [0][1] to [0][8] |

#### (b) Reply

The slave station returns the setting ranges in the requested speed block No.



Data is transferred in hexadecimal.

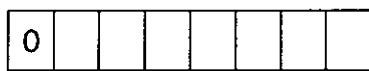
### (4) Writing of the settings

Write the speed, acceleration time constant, deceleration time constant and S-pattern time constant to the EEP-ROM of the MR-H-ACN.

The set value can be written up to 100,000 times.

Transmit the following communication commands (refer to Section 8.11.2):

| Item                       | Command | Data No.         | Data                              |
|----------------------------|---------|------------------|-----------------------------------|
| Speed                      | [C][6]  | [0][1] to [0][8] | According to the following figure |
| Acceleration time constant | [C][7]  | [0][1] to [0][8] |                                   |
| Deceleration time constant | [C][8]  | [0][1] to [0][8] |                                   |
| S-pattern time constant    | [C][9]  | [0][1] to [0][8] |                                   |



Hexadecimal data

- Decimal point position
- 0: No decimal point
  - 1: First least significant digit
  - 2: Second least significant digit
  - 3: Third least significant digit
  - 4: Fourth least significant digit
  - 5: Fifth least significant digit

Make the decimal point position equal to the feed length multiplying factor (STM) set in parameter No. 4. The slave station will not accept the decimal point position if the position specified is different from the STM setting.



## 8. RS-232C COMMUNICATION FUNCTIONS

---

### 8.12.13 Selection between Japanese and English

The characters representing the names of the status displays, parameters, etc. may be displayed in either Japanese or English.

Transmit the following communication command:

| Command | Data No. | Data                            |
|---------|----------|---------------------------------|
| [8][0]  | [0][0]   | 0000: Japanese<br>0001: English |

## 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

### 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

#### 9.1 Compliance With EC Directives

##### 9.1.1 What are EC directives?

The EC Directives were issued to standardize the regulations of the EU countries and ensure smooth distribution of safety-guaranteed products. In the EU countries, the Machinery Directive (effective in January, 1995), EMC Directive (effective in January, 1996) and Low Voltage Directive (effective in January, 1997) of the EC Directives require that products to be sold should meet their fundamental safety requirements and carry the CE marks (CE marking). CE marking applies to machines and equipment into which controllers have been installed.

The controllers do not function independently but are designed for use with machines and equipment. Therefore, the CE marking does not apply to the controllers but applies to the machines and equipment into which the controllers are installed.

This controller conforms to the standards related to the Low Voltage Directive to facilitate CE marking on machines and equipment into which the controllers will be installed. To ensure ease of compliance with the EMC Directive, Mitsubishi Electric prepared the "EMC INSTALLATION GUIDELINES" (IB(NA)67310) which provides controller installation, control box making and other procedures. Please contact your sales representative.

##### 9.1.2 For compliance

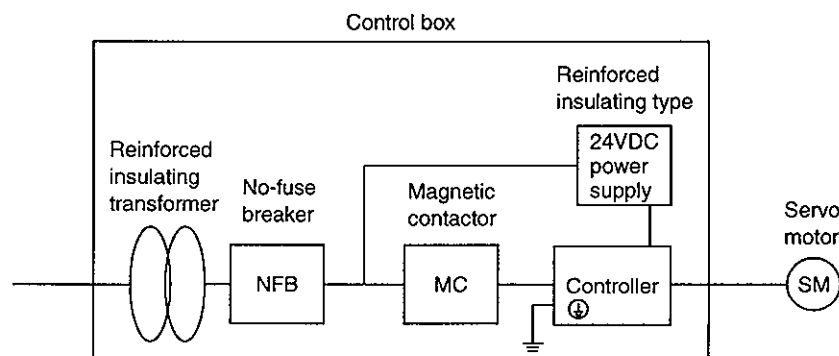
###### (1) Controllers and servo motors used

Use the controllers and servo motors which comply with the EN Standard.

Controller series : MR-H10ACN-UE to MR-H22KACN-UE  
Servo motor series : HA-LH□-EC  
HC-MF□-UE  
HA-FF□C-UE  
HC-SF□  
HC-RF□  
HC-UF□

The handling, performance, specifications and other information of the EN Standard-compliant models are the same as those of the standard models unless otherwise specified.

###### (2) Structure



## 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

### (3) Environment

Operate the controller at or above the contamination level 2 set forth in IEC664. For this purpose, install the controller in a control box which is protected against water, oil, carbon, dust, dirt, etc. (IP54).

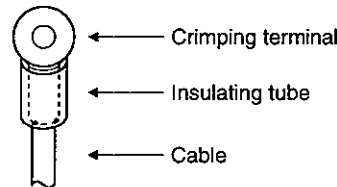
### (4) Power supply

(a) Operate the controller to meet the requirements of the overvoltage category II set forth in IEC664. For this purpose, a reinforced insulating transformer conforming to the IEC or EN Standard should be used in the power input section.

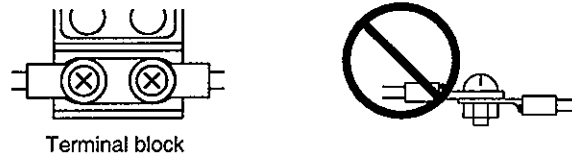
(b) When supplying interface power from external, use a 24VDC power supply which has been insulation-reinforced in I/O.

### (5) Wiring

(a) The cables to be connected to the terminal block of the controller must have crimping terminals provided with insulating tubes to prevent contact with adjacent terminals.



(b) Use a fixed terminal block to connect the power supply lead of the servo motor to the controller. Do not connect cables directly.




(c) Use the servo motor side power connector which complies with the EN Standard. The EN Standard-compliant power connector sets are available from us as options.

### (6) Noise reduction techniques

Use the EMC filter for noise reduction. The radio noise filter (FR-BIF) is not required.

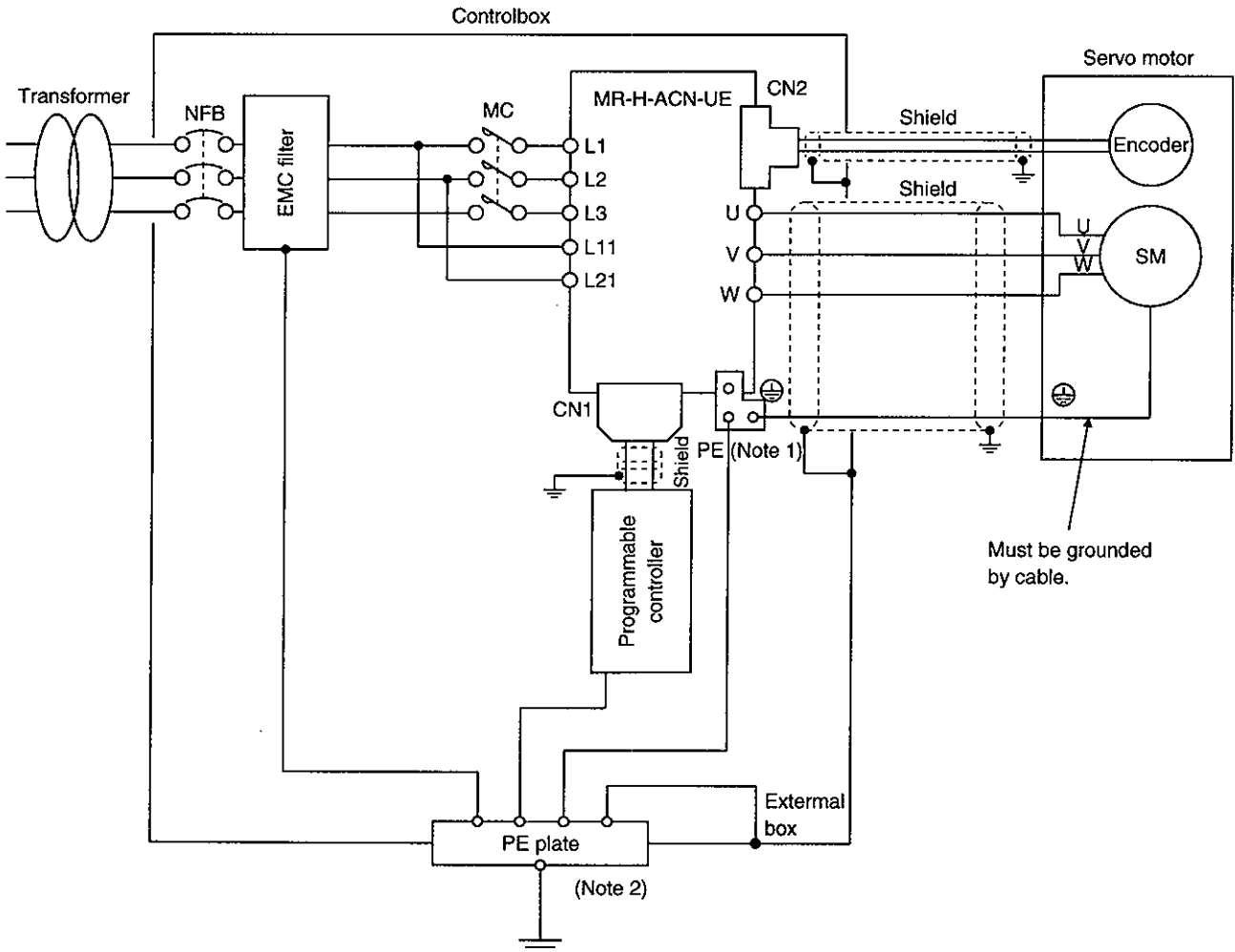
## 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

### (7) Grounding

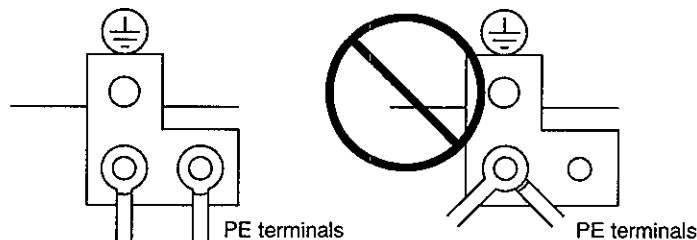
|  |   |
|--|---|
|  <b>WARNING</b> | <ul style="list-style-type: none"> <li>Securely ground the controller and servo motor.</li> <li>To prevent an electric shock, the protective earth (PE) terminal (marked <math>\oplus</math>) of the controller must be connected to the protective earth (PE) of the control box.</li> </ul> |
|--|---|

The controller switches the power transistor to supply power to the servo motor. Depending on the routing of the wiring and ground cables, the controller may be affected by the switching noises (due to  $di/dt$  and  $dv/dt$ ) of the transistor.

To prevent such a fault, refer to the following diagram and use the thickest possible ground cables (3.5mm<sup>2</sup> or larger preferable), such as flat mesh copper cables, to securely ground the controller and servo motor. Even when a leakage current breaker is used, always earth the protective earth (PE) terminal of the controller to prevent an electric shock.



Note: 1. Do not connect two ground cables to the same protective earth (PE) terminal as shown at right below. Always connect cables to the terminals one-to-one as shown at left:



2. For the grounding of the control box, refer to EN60204.

## 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

### (8) Cables, No-Fuse Breakers, Magnetic Contactors, Power Factor Improving Reactors

Always use the EN/IEC Standard compliant products specified in this section or their equivalent products compliant with the EN/IEC Standard.

| Controller    | (Note 4)<br>No-Fuse Breaker | (Note 4)<br>Magnetic<br>Contactor | (Note 1) Cables [mm <sup>2</sup> ] |                            |           |                   | Electro-<br>magnetic<br>Brake | Power Factor<br>Improving<br>Reactor FR-BAL |
|---------------|-----------------------------|-----------------------------------|------------------------------------|----------------------------|-----------|-------------------|-------------------------------|---|
|               |                             |                                   | L1 · L2 ·<br>L3<br>⊕               | (Note 2)<br>U · V · W<br>⊕ | L11 · L21 | (Note 3)<br>P · C |                               |   |
| MR-H10ACN-UE  | Type NF30 5A                | S-N10                             | 2                                  | 1.25                       | 2         | 2                 | 1.25                          | FR-BAL-0.4K                                 |
| MR-H20ACN-UE  | Type NF30 10A               | S-N10                             | 2                                  | 1.25                       | 2         | 2                 |                               | FR-BAL-0.4K                                 |
| MR-H40ACN-UE  | Type NF30 10A               | S-N10                             | 2                                  | 1.25                       | 2         | 2                 |                               | FR-BAL-0.75K                                |
| MR-H60ACN-UE  | Type NF30 10A               | S-N10                             | 2                                  | 1.25                       | 2         | 2                 |                               | FR-BAL-1.5K                                 |
| MR-H100ACN-UE | Type NF30 15A               | S-N10                             | 2                                  | 2                          | 2         | 2                 |                               | FR-BAL-2.2K                                 |
| MR-H200ACN-UE | Type NF30 20A               | S-N18                             | 3.5                                | 3.5                        | 2         | 2                 |                               | FR-BAL-3.7K                                 |
| MR-H350ACN-UE | Type NF50 30A               | S-N25                             | 5.5                                | (Note 5)5.5                | 2         | 2                 |                               | FR-BAL-7.5K                                 |
| MR-H500ACN-UE | Type NF50 50A               | S-N35                             | 5.5                                | 5.5                        | 2         | 2                 |                               | FR-BAL-11K                                  |
| MR-H700ACN-UE | Type NF100 75A              | S-K50                             | 8                                  | 8                          | 2         | 3.5               |                               | FR-BAL-15K                                  |
| MR-H11KACN-UE | Type NF100 100A             | S-K65                             | 14                                 | 22                         | 2         | 5.5               |                               | FR-BAL-15K                                  |
| MR-H15KACN-UE | Type NF225 125A             | S-K95                             | 22                                 | 30                         | 2         | 5.5               | FR-BAL-22K                    |   |
| MR-H22KACN-UE | Type NF225 175A             | S-K125                            | 50                                 | 60                         | 2         | 5.5               | FR-BAL-30K                    |   |

Note: 1. Cables are based on the 600V vinyl cables.

The cable sizes listed above conform to EN60204 under the following conditions:

- Ambient temperature 40°C
- PVC (polyvinyl chloride) sheath
- Run on wall surface or in open cable tray

When the cables in compliance with EN60204 are to be used under the conditions other than the above, refer to Table 5 and Appendix C in EN60204.

2. The values assume that the distance between the servo motor and controller is 30m max.
3. The cables for connection of the regenerative brake option (P · C) should be twisted for wiring.
4. Use the no-fuse breaker, magnetic contactor or equivalent which conforms to the EN/IEC Standards.
5. 3.5mm<sup>2</sup> for use of the HC-RF203 servo motor.

### (9) Performing EMC tests

When EMC tests are run on a machine/device into which the servo amplifier has been installed, it must conform to the electromagnetic compatibility (immunity/emission) standards after it has satisfied the operating environment/electrical equipment specifications.

For the way of dealing with the EMC Directive on servo amplifiers, refer to the "EMC INSTALLATION GUIDELINES".

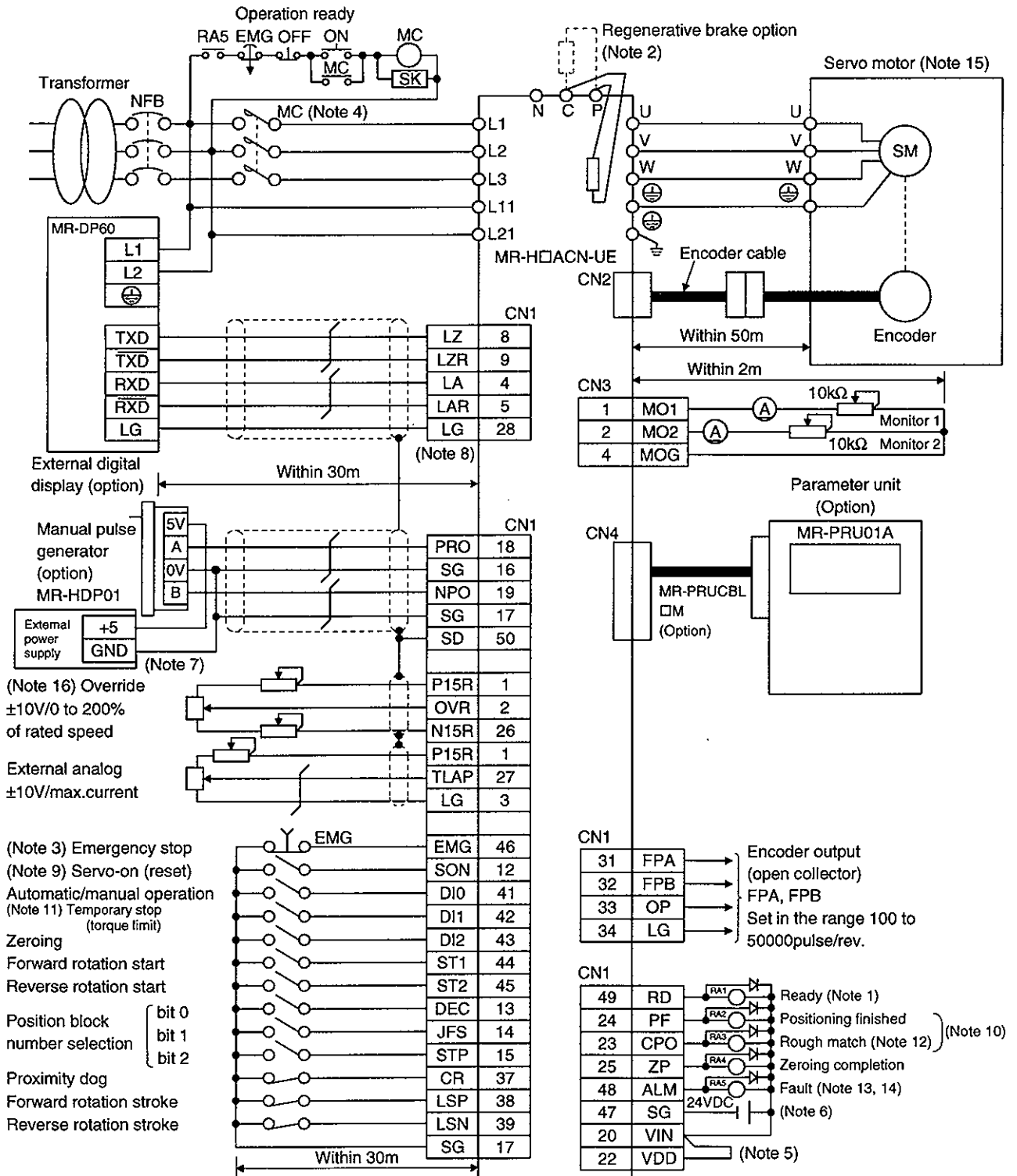
# 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

## 9.1.3 Standard connection examples

### (1) Positioning system

(a) Standard configuration (without the MR-H-D01 option card)

Positioning operation according to 8-position point table.



For the notes, refer to page 9-12

# 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

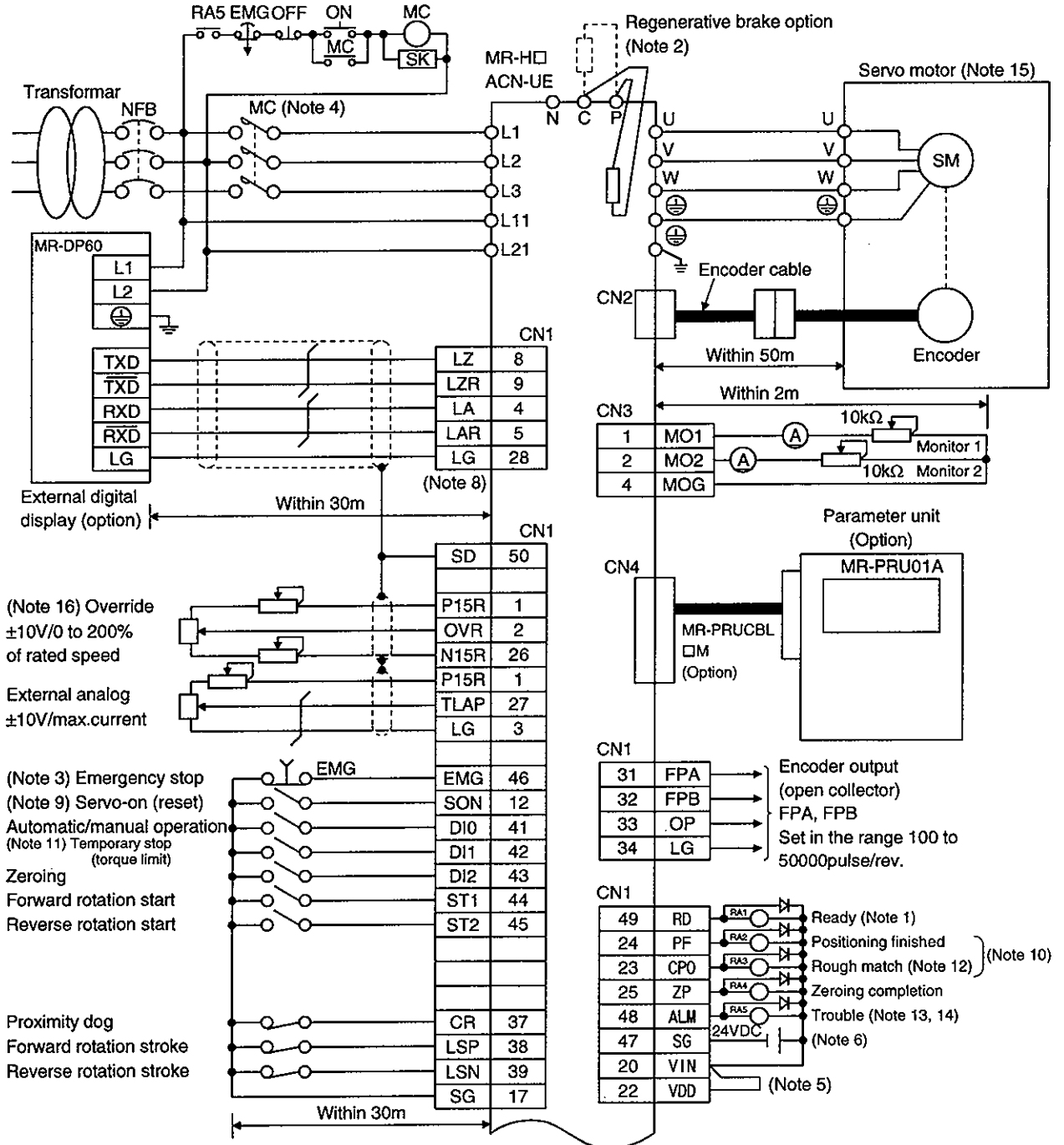
(b) Extension configuration 1 (with the MR-H-D01 option card )

Positioning operation according to 256-position point table. Set 1□□3 in parameter No.65.

Parameter No. 65

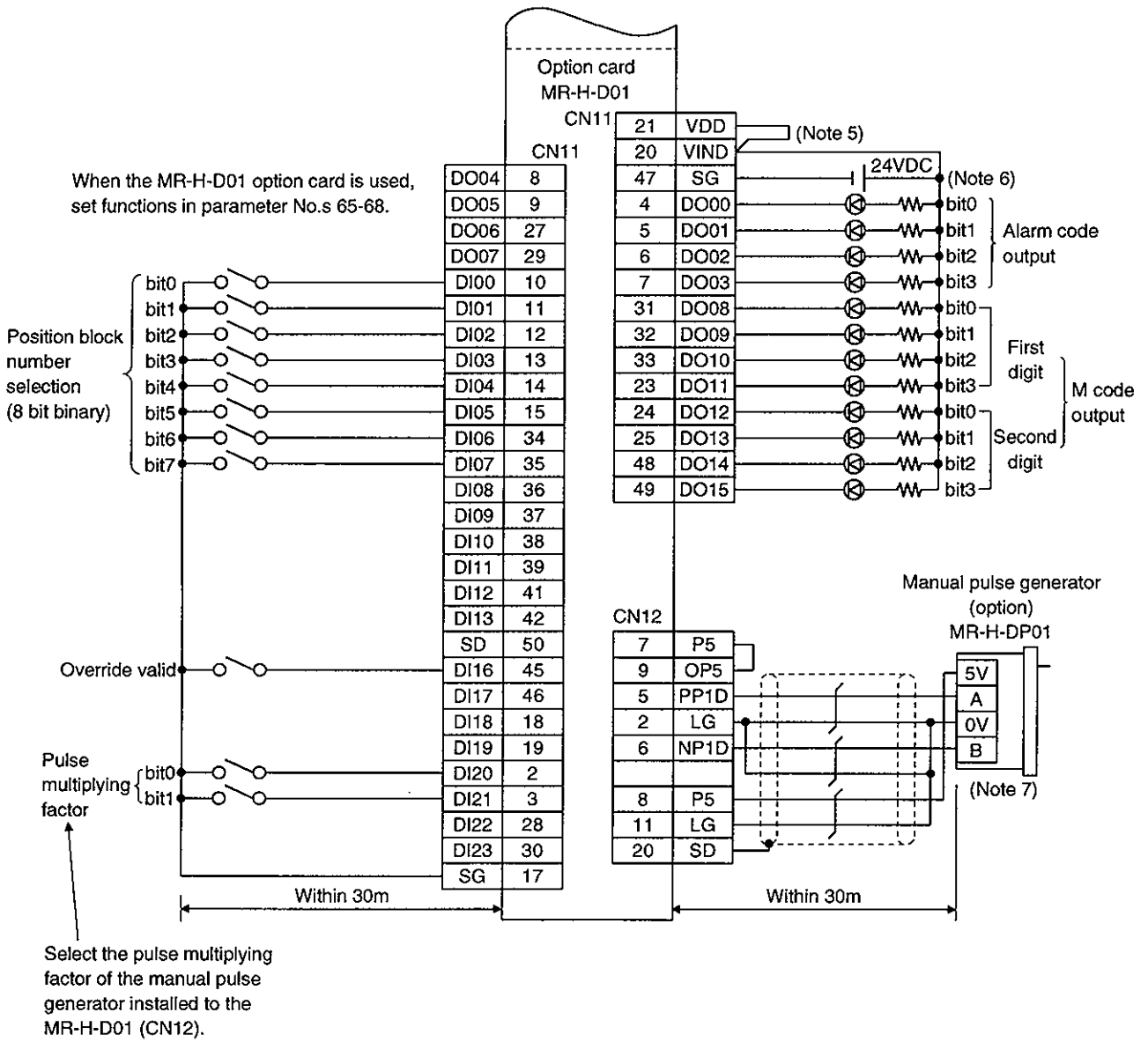


256 position blocks



For the notes, refer to page 9-12

# 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD



For the notes, refer to page 9-12



# 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

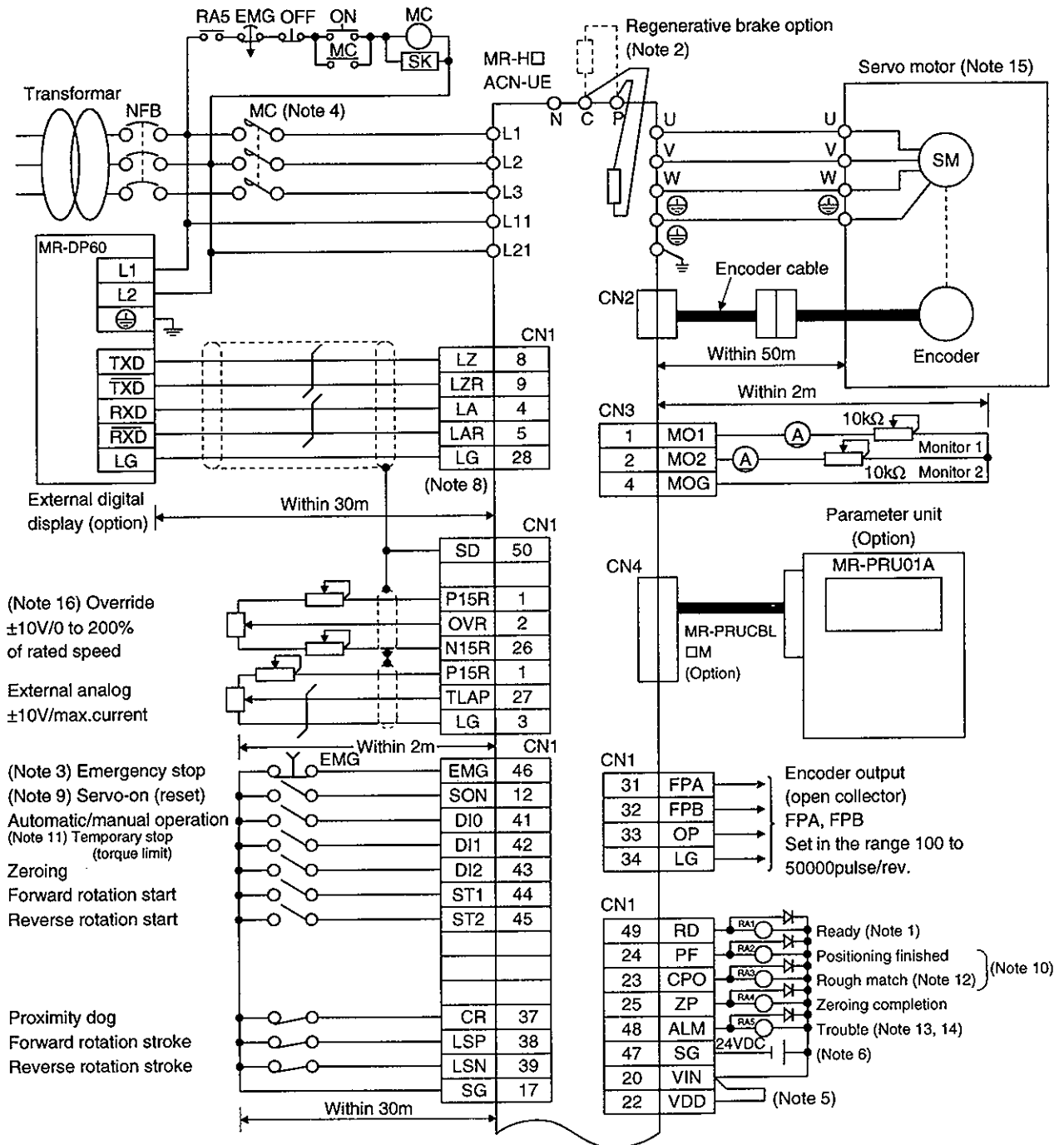
## (c) Extension configuration 2 (with the MR-H-D01 option card)

Positioning operation under digital switch (MR-DS60) position data command. The digital switch used must be the optional MR-DS60. Set 1□□1 in parameter No.65.

Parameter No.65



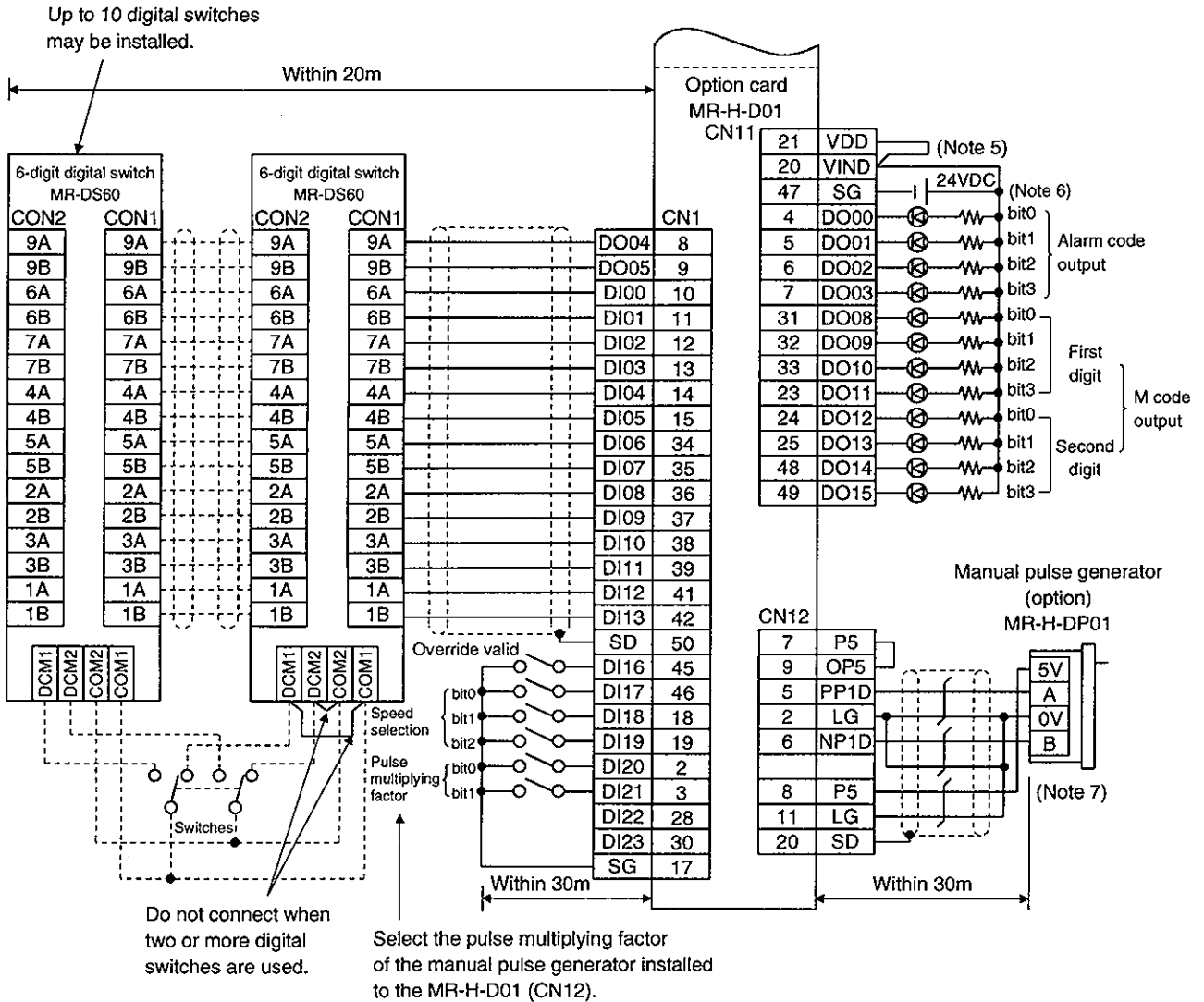
BDC 3 digits x 2 input  
Digital switch is used.



For the notes, refer to page 9-12

# 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

When the MR-H-D01 option card is used, set functions in parameter No.s 65-68.

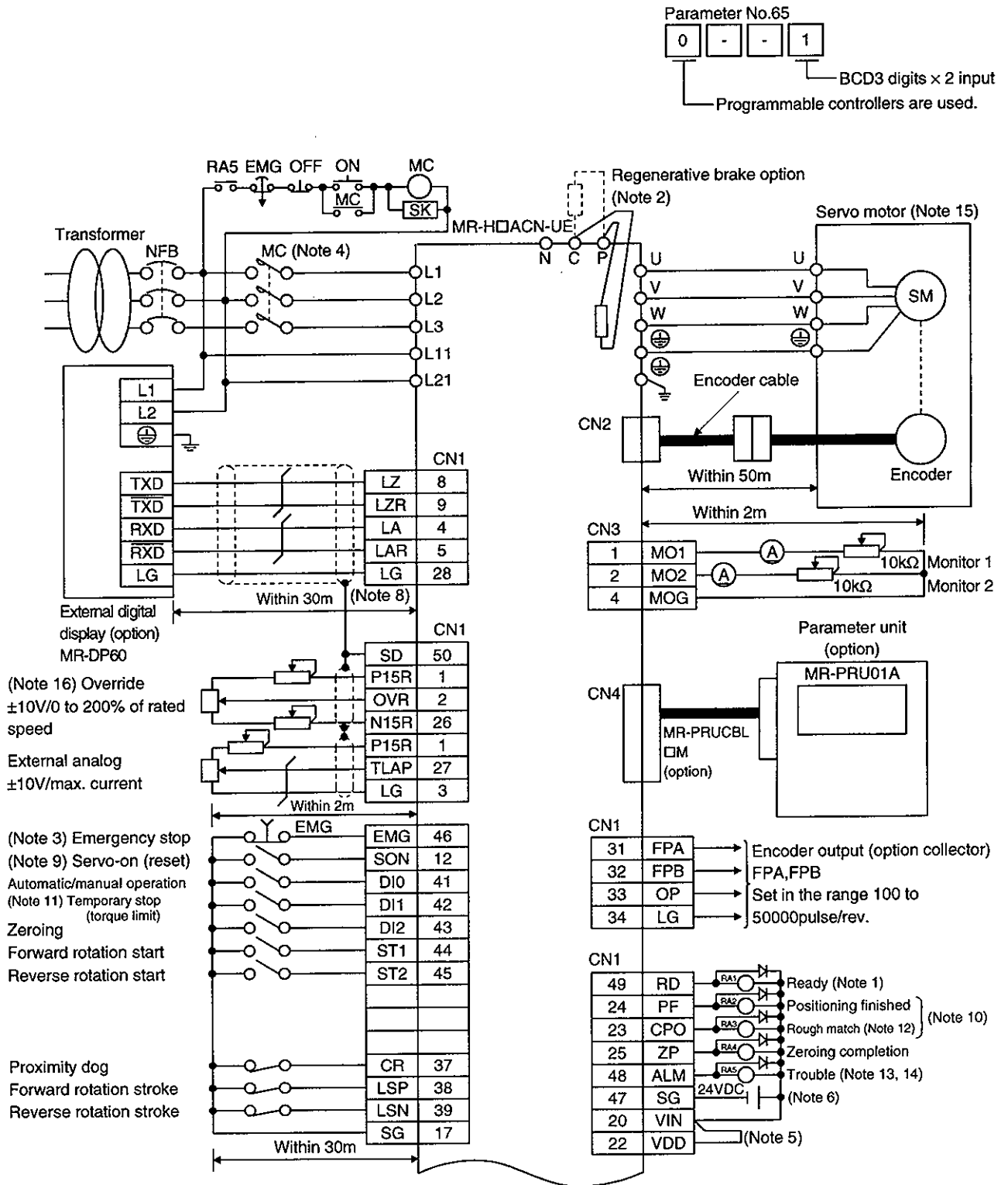


For the notes, refer to page 9-12

# 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

## (d) Extension configuration 3 (with the MR-H-D01 option card )

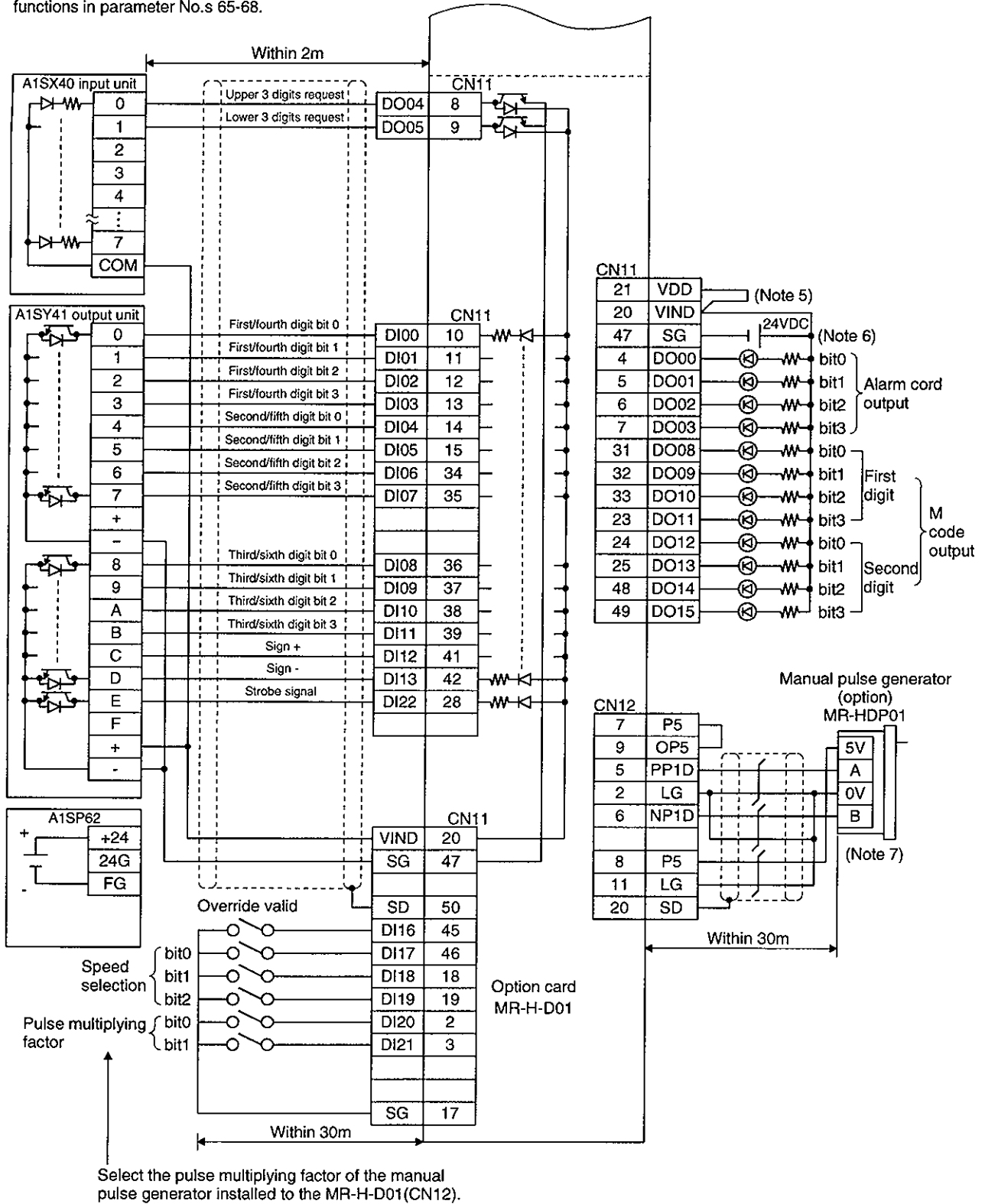
Positioning operation under programmable controller position data command. The wiring example shown in this section assumes that Mitsubishi's A1S series programmable controllers are used. Set 1□□1 in parameter No.65.



For the notes, refer to page 9-12

# 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

When the MR-H-D01 option card is used, set functions in parameter No.s 65-68.



For the notes, refer to page 9-12

## 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

---

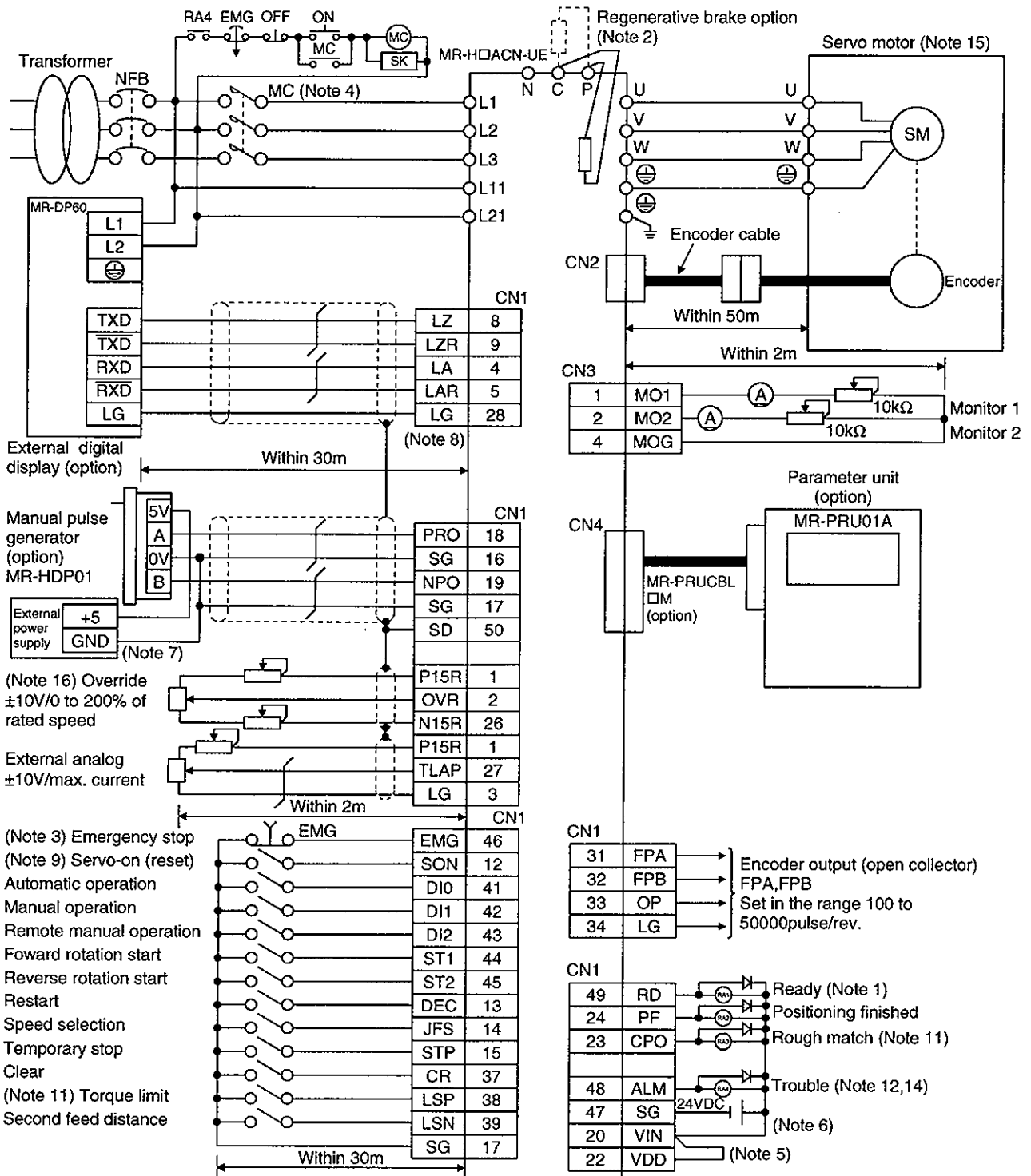
- Note:
1. Connect the diode in the correct orientation. If the diode is reversed, a fault will occur and signals not output, and the emergency stop and other protective circuits may be disabled.
  2. Connect the regenerative brake option across terminals P-C after disconnecting the leads of the built-in regenerative brake resistor from P-C
  3. The emergency stop switch must be installed.
  4. Make up a power circuit which will switch off the magnetic contactor after detection of alarm occurrence.
  5. The MR-H□ACN-UE does not contain an internal power supply for interface power supply. Always connect an external power supply across VIN-SG. At this time, also connect VDD-VIN.
  6. Use a 24VDC power supply which has been insulation-reinforced in I/O.
  7. When the MR-H-D01 option card is used, power can be supplied from the MR-H-D01.
  8. Change the setting of parameter No.52 to □□□0 to use LA, LAR, LB, LBR, LZ and LZR as encoder pulse outputs.
  9. Change the setting of parameter No.41 to □□□1 to use SON as a reset signal.
  10. Change the setting of parameter No.44 to □□□1 to use PF and CPO as an M code.
  11. Change the setting of parameter No.41 to □0□□ to use DI1 as a torque limit signal.
  12. Change the setting of parameter No.3 to □□1□ to use CPO as an electromagnetic brake interlock or the setting of parameter No.44 to □1□□ to use CPO as a torque limit-in-progress.
  13. Change the setting of parameter No.44 to □□1□ to use ALM as an pre-alarm output.
  14. The trouble (ALM) signal is on under normal conditions.
  15. The HC-MF-UE series servo motor is connected. For connection details of the other servo motors, refer to Chapter 5.
  16. The upper limit of the overriding speed is the permissible speed.

# 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

## (2) Roll feeding system

### (a) Standard configuration (without the MR-H-D01 option card)

Roll feeding operation according to 2-position point table.



For the notes, refer to page 9-18

# 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

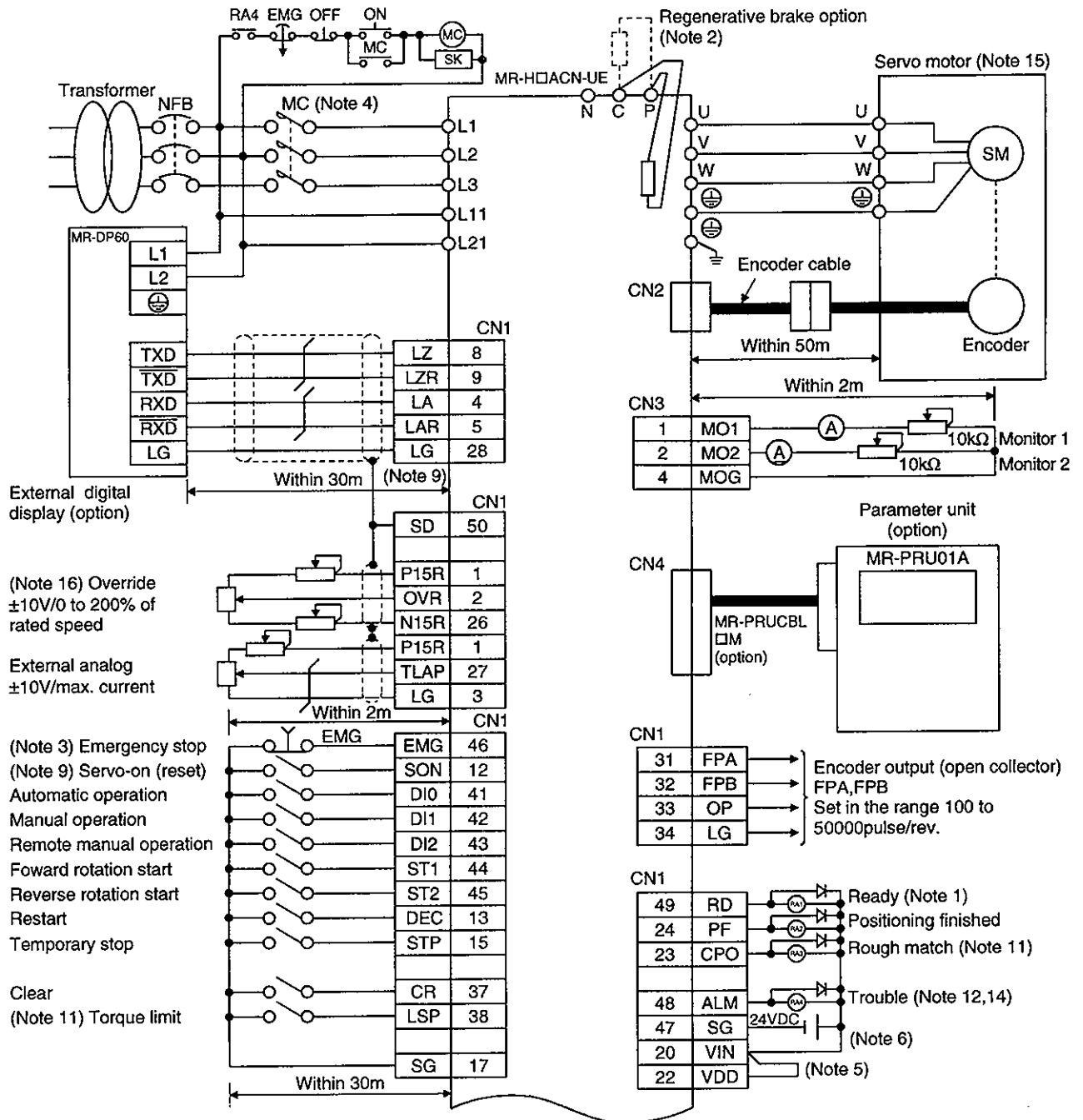
## (b) Extension configuration 1 (with the MR-H-D01 option card )

Roll feeding operation under digital switch (MR-DS60) position data command. The digital switch used must be the optional MR-DS60. Set 1□□1 in parameter No.65.

Parameter No. 65



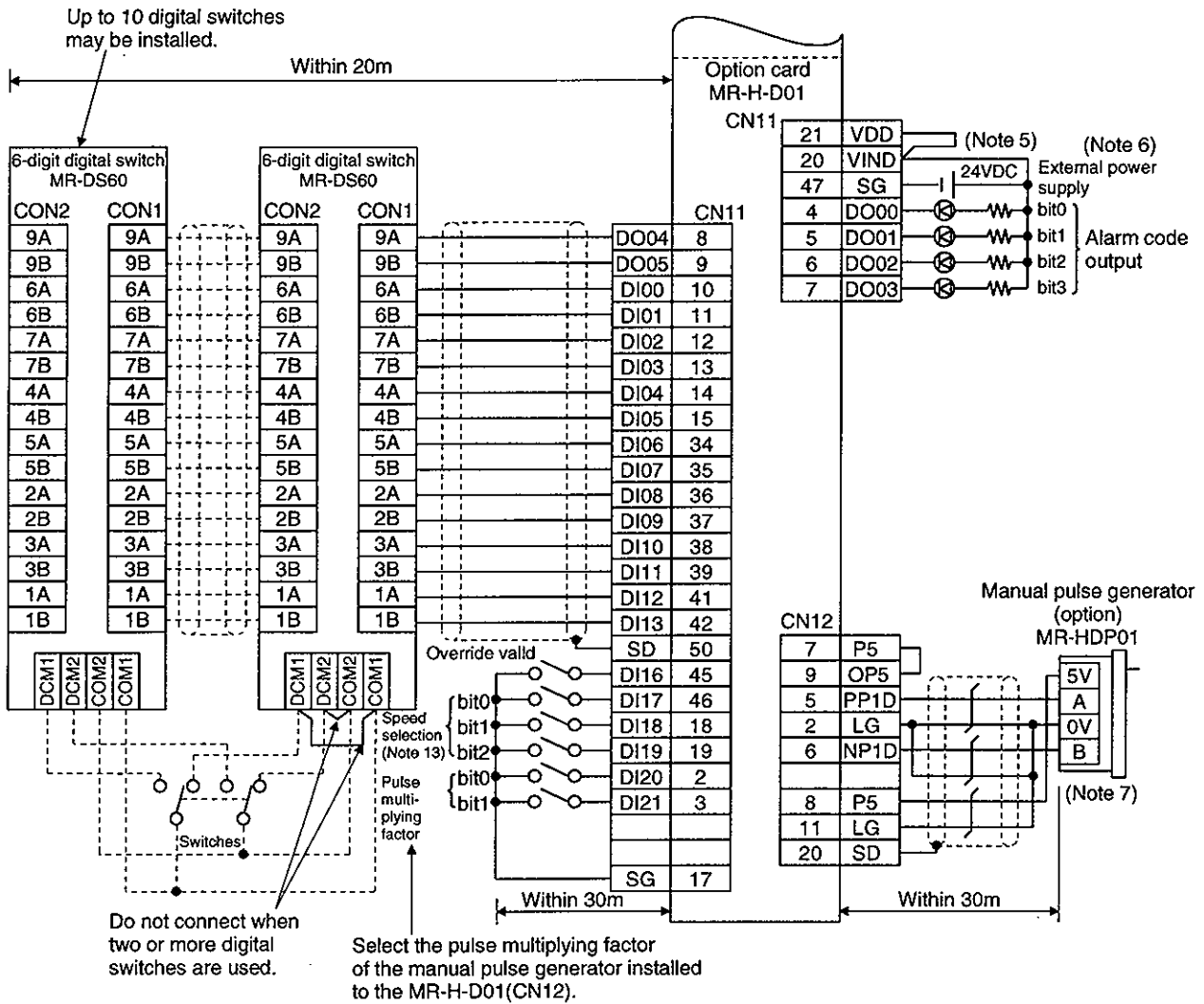
BCD 3 digits x 2 input  
Digital switch is used.



For the notes, refer to page 9-18

# 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

When the MR-H-D01 option card is used, set functions in parameter No.s 65-68.



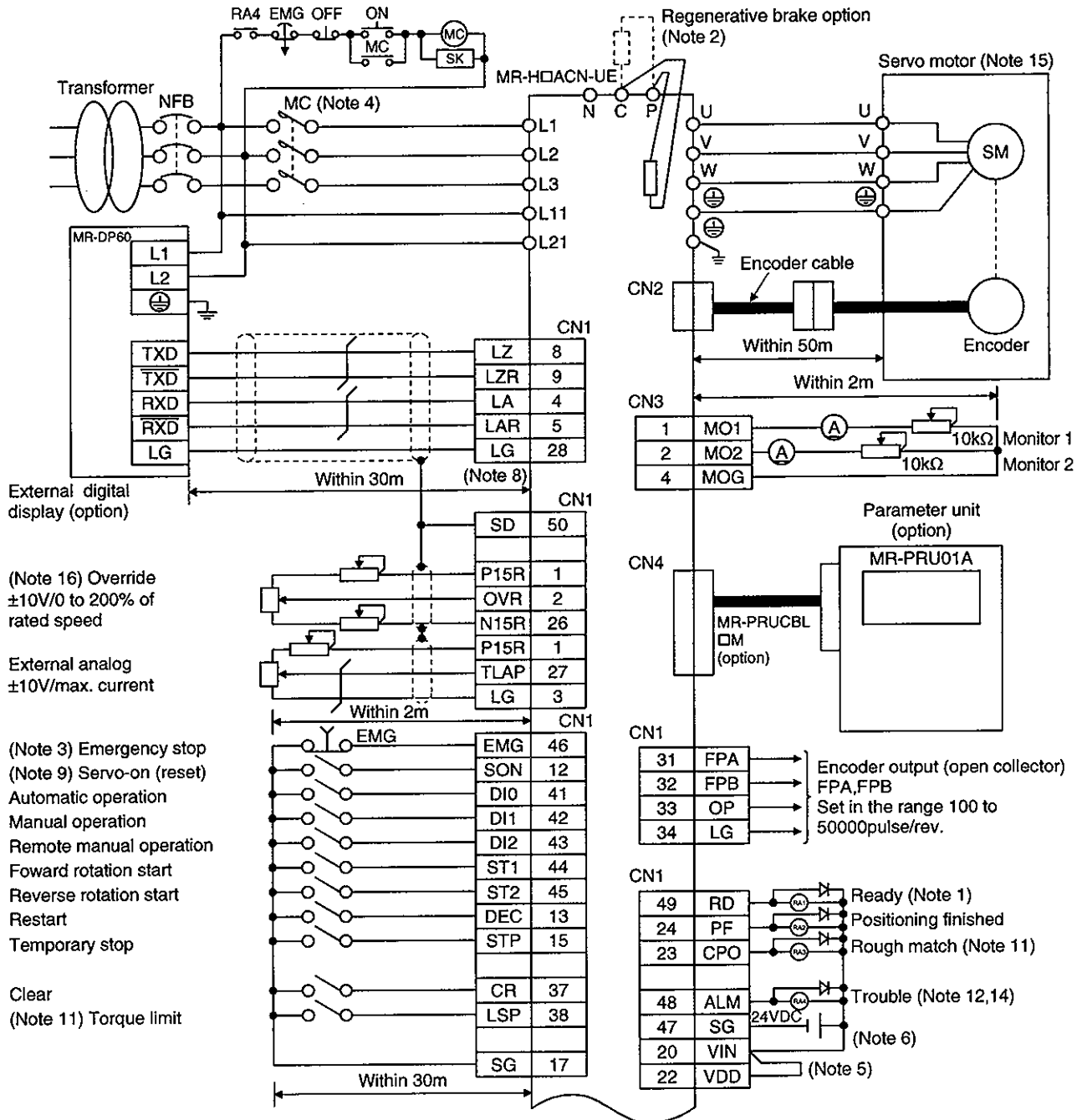
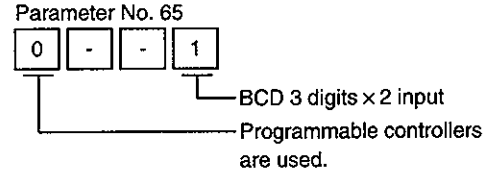
For the notes, refer to page 9-18



# 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

## (c) Extension configuration 2 (with the MR-H-D01 option card)

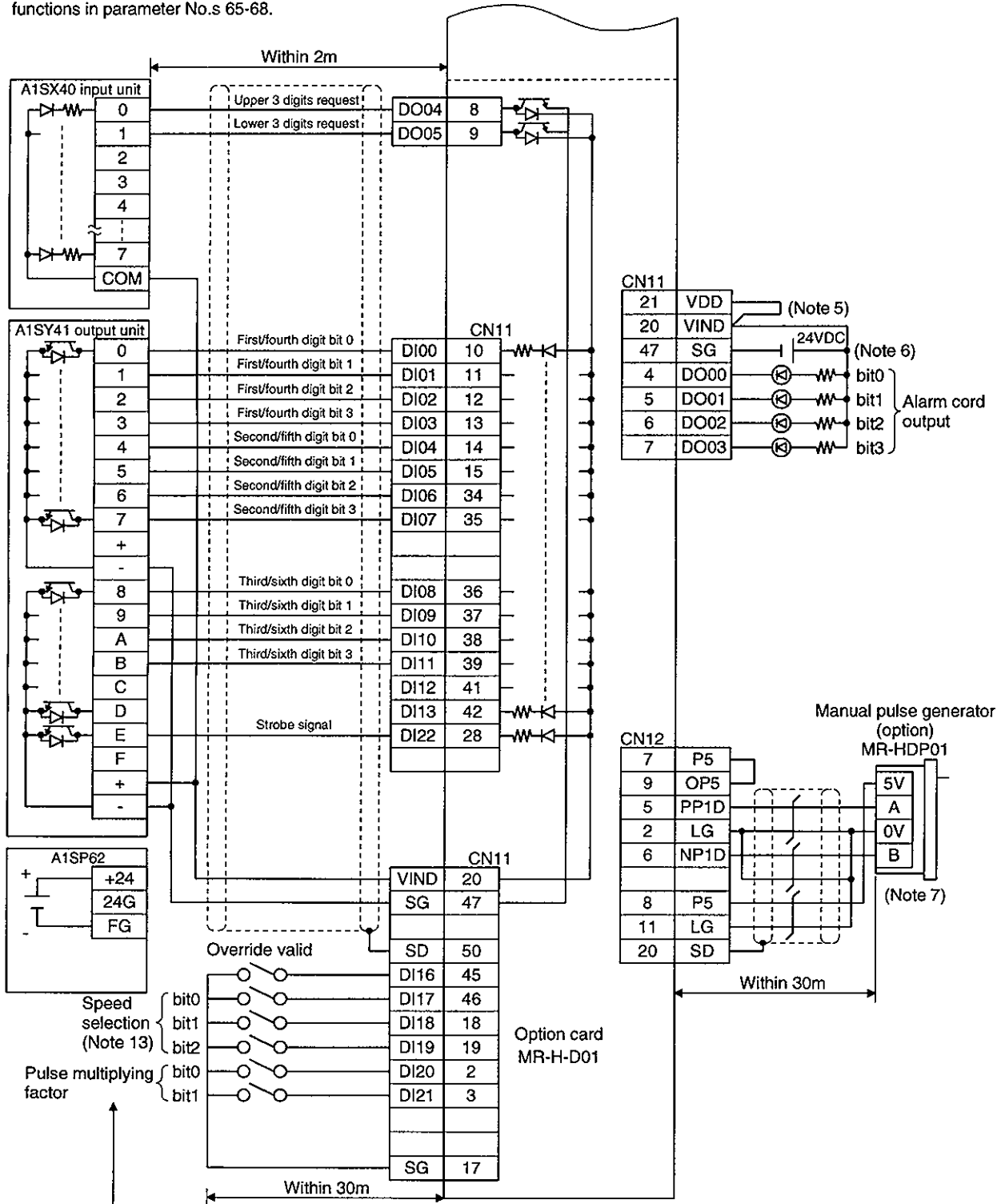
Roll feeding operation under programmable controller position data command. The wiring example shown in this section assumes that Mitsubishi's A1S series programmable controllers are used. Set 0□□1 in parameter No.65.



For the notes, refer to page 9-18

# 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

When the MR-H-D01 option card is used, set functions in parameter No.s 65-68.



Select the pulse multiplying factor of the manual pulse generator installed to the MR-H-D01(CN12).

For the notes, refer to page 9-18

## 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

---

- Note:
1. Connect the diode in the correct orientation. If the diode is reversed, a fault will occur and signals not output, and the emergency stop and other protective circuits may be disabled.
  2. Connect the regenerative brake option across terminals P-C after disconnecting the leads of the built-in regenerative brake resistor from P-C.
  3. The emergency stop switch must be installed.
  4. Make up a power circuit which will switch off the magnetic contactor after detection of alarm occurrence.
  5. The MR-H□ACN-UE does not contain an internal power supply for interface power supply. Always connect an external power supply across VIN-SG. At this time, also connect VDD-VIN.
  6. Use a 24VDC power supply which has been insulation-reinforced in I/O.
  7. When the MR-H-D01 option card is used, power can be supplied from the MR-H-D01.
  8. Change the setting of parameter No.52 to □□□0 to use LA, LAR, LB, LBR, LZ and LZR as encoder pulse outputs.
  9. Change the setting of parameter No.41 to □□□1 to use SON as a reset signal.
  10. Change the setting of parameter No.41 to 11□□ to use LSP as a forward rotation stroke end signal and LSN as a reverse rotation stroke end signal.
  11. Change the setting of parameter No.3 to □□1□ to use CPO as an electromagnetic brake interlock or the setting of parameter No.44 to □1□□ to use CPO as a torque limit-in-progress.
  12. Change the setting of parameter No.44 to □□1□ to use ALM as an pre-alarm output.
  13. Speed selection is made valid by setting □□1□ in parameter No.65.  
When the initial value (□□0□) is used, speed block No.1 is selected.
  14. The trouble (ALM) signal is on under normal conditions.
  15. The HC-MF-UE series servo motor is connected. For connection details of the other servo motors, refer to Chapter 5.
  16. The upper limit of the overriding speed is the permissible speed.

## 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

### 9.2 Conformance With UL/C-UL Standard

#### 9.2.1 Controller and servo motor used

Use the UL/C-UL Standard-compliant model of controller and servo motor. The 11kW and higher controllers will be certified by the UL/C-UL Standard soon, and the UL/C-UL Standard-compliant models of the HA-LH702 to HA-LH22K2 will be released soon.

|                    |   |
|--------------------|---|
| Controller series  | : MR-H10ACN-UE to MR-H700ACN-UE                         |
| Servo motor series | : HC-MF□-UE<br>HA-FF□C-UE<br>HC-SF□<br>HC-RF□<br>HC-UF□ |

Unless otherwise specified, the handling, performance, specifications, etc. of the UL/C-UL Standard-compliant models are the same as those of the standard models.

When using the options and auxiliary equipment, use those which conform to the UL/C-UL Standard.

To comply with the UL/C-UL Standard, strictly observe the following:

#### 9.2.2 Installation

Install a fan of 100CFM air flow 10.16[cm] (4[in]) above the controller or provide cooling of at least equivalent capability to ensure that the ambient temperature conforms to the environment conditions.

#### 9.2.3 Power supply

##### (1) Short circuit rating

Having been subjected to UL tests in the alternating-current circuit whose peak current is limited to 5000A or less, this servo amplifier conforms to this circuit.

##### (2) Capacitor discharge time

The capacitor discharge time exceeds 1 minute. To ensure safety, do not touch the charging section for 10 minutes after power-off.

#### 9.2.4 Wires

Always use the wires specified in this section.

| Controller    | (Note 1) Wire[mm <sup>2</sup> ] |                        |           |                | Electromagnetic Brake |
|---------------|---------------------------------|------------------------|-----------|----------------|-----------------------|
|               | L1 · L2 · L3                    | (Note 2) U · V · W · ⊕ | L11 · L21 | (Note 3) P · C |                       |
| MR-H10ACN-UE  | 2(AWG 14)                       | 1.25(AWG 16)           | 2(AWG 14) | 2(AWG 14)      | 1.25(AWG 16)          |
| MR-H20ACN-UE  | 2(AWG 14)                       | 1.25(AWG 16)           | 2(AWG 14) | 2(AWG 14)      |                       |
| MR-H40ACN-UE  | 2(AWG 14)                       | 1.25(AWG 16)           | 2(AWG 14) | 2(AWG 14)      |                       |
| MR-H60ACN-UE  | 2(AWG 14)                       | 1.25(AWG 16)           | 2(AWG 14) | 2(AWG 14)      |                       |
| MR-H100ACN-UE | 2(AWG 14)                       | 2(AWG 14)              | 2(AWG 14) | 2(AWG 14)      |                       |
| MR-H200ACN-UE | 3.5(AWG 12)                     | 3.5(AWG 12)            | 2(AWG 14) | 2(AWG 14)      |                       |
| MR-H350ACN-UE | 5.5(AWG 10)                     | (Note 4)5.5(AWG 10)    | 2(AWG 14) | 2(AWG 14)      |                       |
| MR-H500ACN-UE | 5.5(AWG 10)                     | 5.5(AWG 10)            | 2(AWG 14) | 2(AWG 14)      |                       |
| MR-H700ACN-UE | 8(AWG 8)                        | 8(AWG 8)               | 2(AWG 14) | 3.5(AWG 12)    |                       |

Note: 1. The wires are based on 600V vinyl cables.

2. The values assume that the distance between the servo motor and controller is 30m max.
3. Twist the regenerative brake option (P · C) cables.
4. 3.5mm<sup>2</sup> (AWG12) for use of the HC-RF203 servo motor.

## 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

### 9.2.5 Crimping terminals and crimping tools

When connecting the wires to the terminal block, always use AMP's crimping terminals specified in this section or UL Standard-compliant products.

For symbols a to e in the list, refer to the table at right.

| Controller    | Crimping Terminals, Crimping Tools |                      |           |       |
|---------------|------------------------------------|----------------------|-----------|-------|
|               | L1 · L2 · L3                       | U · V · W · $\oplus$ | L11 · L21 | P · C |
| MR-H10ACN-UE  | a                                  | a                    | a         | a     |
| MR-H20ACN-UE  | a                                  | a                    | a         | a     |
| MR-H40ACN-UE  | a                                  | a                    | a         | a     |
| MR-H60ACN-UE  | a                                  | a                    | a         | a     |
| MR-H100ACN-UE | a                                  | a                    | a         | a     |
| MR-H200ACN-UE | b                                  | b                    | a         | a     |
| MR-H350ACN-UE | b                                  | b                    | a         | a     |
| MR-H500ACN-UE | b                                  | b                    | c         | a     |
| MR-H700ACN-UE | e                                  | e                    | d         | d     |

| Symbol | (Note) Type        |  |
|--------|--------------------|--|
|        | Crimping Terminals | Crimping Tools                               |
| a      | 32959              | 47387  |
| b      | 32968              | 59239  |
| c      | 32957              | 47387  |
| d      | 171517-1           | 59239  |
| e      | 322128             | 59974-1 (body)<br>48752-0 (dies)             |
| f      | 52042              | 69040 (body)<br>69066 (head)<br>48859 (dies) |
| g      | 322153             | 59974-1 (body)<br>48753-0 (dies)             |

Note: AMP make

### 9.2.6 Fuses

When using a fuse, it must be the one specified in this section or its equivalent compliant with the UL/C-UL Standard.

| Controller    | Fuse                          |         |             |         |
|---------------|-------------------------------|---------|-------------|---------|
|               | Type (Maker)                  | Class   | Current [A] | Voltage |
| MR-H10ACN-UE  | NON-10(Buss) or OT10(Gould)   | K5      | 10          | 250VAC  |
| MR-H20ACN-UE  | NON-10(Buss) or OT10(Gould)   | K5      | 10          |         |
| MR-H40ACN-UE  | NON-15(Buss) or OT15(Gould)   | K5      | 15          |         |
| MR-H60ACN-UE  | NON-20(Buss) or OT20(Gould)   | K5      | 20          |         |
| MR-H100ACN-UE | NON-25(Buss) or OT25(Gould)   | K5      | 25          |         |
| MR-H200ACN-UE | NON-40(Buss) or OT40(Gould)   | K5      | 40          |         |
| MR-H350ACN-UE | NON-70(Buss) or OT70(Gould)   | K5 or H | 70          |         |
| MR-H500ACN-UE | NON-125(Buss) or OT125(Gould) | K5 or H | 125         |         |
| MR-H700ACN-UE | NON-150(Buss) or OT150(Gould) | K5 or H | 150         |         |

## 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

---

### 9.2.7 Terminal block tightening torque

The following torques are recommended to tighten screws to the terminal blocks. For the screw size of each terminal block, refer to Section 13.2.

| Screw size                          |         | M3.5 | M4  | M5  | M6  |
|-------------------------------------|---------|------|-----|-----|-----|
| Recommended tightening torque value | [N·cm]  | 0.8  | 1.2 | 2.0 | 2.5 |
|                                     | [lb·in] | 8    | 11  | 20  | 24  |

### 9.2.8 Standard connection example

Same as in Section 9.1.3.

## 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD


### 9.3 Signals

#### 9.3.1 Main circuit terminal block

Note that the power supply symbols of the MR-H□ACN-UE given on the terminal block are different from those of the standard models. What the symbols R, S, T, R1 and S1 used in other than this chapter indicate are the same as what L1, L2, L3, L11 and L21 indicate.

| Signal Name                  | Power Supply Symbols |              |
|------------------------------|----------------------|--------------|
|                              | MR-H□ACN             | MR-H□ACN-UE  |
| Main circuit power supply    | R · S · T            | L1 · L2 · L3 |
| Control circuit power supply | R1 · S1              | L11 · L21    |

The position and signal arrangement of the terminal block depend on the controller capacity. Refer to Section 13.2.1.

| Symbol  | Signal                       | Description  |
|---|------------------------------|--|
| L1, L2, L3  | Main circuit power supply    | Main circuit power input terminals<br>Connect a three-phase 200 to 230VAC, 50/60Hz power supply to L1, L2, L3.<br>For MR-H700□ACN-UE or more, the voltage of 50Hz power is 200 to 220V.  |
| U, V, W   | Servo motor output           | Servo motor power output terminals<br>Connect to the servo motor power supply terminals (U, V, W).   |
| L11, L21  | Control circuit power supply | Control circuit power input terminals<br>L11 and L21 should be in phase with L1 and L2, respectively.<br>Connect a single-phase 200 to 230VAC, 50/60Hz power supply.<br>For MR-H700□ACN-UE or more, the voltage of 50Hz power is 200 to 220V.  |
| P, C, D   | Regenerative brake           | Regenerative brake option connection terminals<br>In the MR-H-400ACN-UE to MR-H700ACN-UE, the built-in regenerative brake resistor is factory-connected across P-C.<br>When using the regenerative brake option, brake unit or power return converter, always connect it after removing the wiring of the built-in regenerative brake resistor connected across P-C.<br>For MR-H11KACN-UE or more, always connect the supplied regenerative brake resistor across P-C. |
| MS1 · MS2   | Servo motor fan              | Servo motor fan power supply terminals<br>Connect to the cooling fan which is built in the HA-LH11K2-EC to HA-LH22K2-EC servo motors. Provided for the controllers of MR-H11KACN-UE or more.   |
|  | Grounding                    | Ground terminal<br>Connect this terminal to the protective earth (PE) terminals of the servo motor and control box for grounding.  |

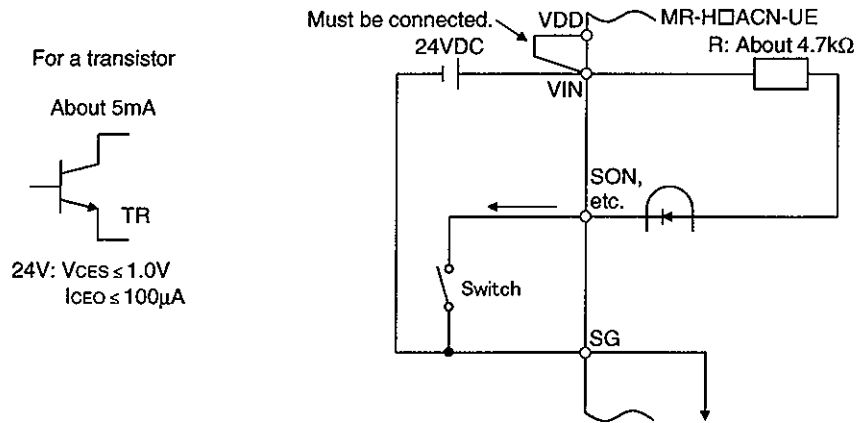
## 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

### 9.3.2 Interfaces

#### (1) Digital input interface DI-1

Always use an external power supply.

Provide a signal using a relay or open collector transistor.

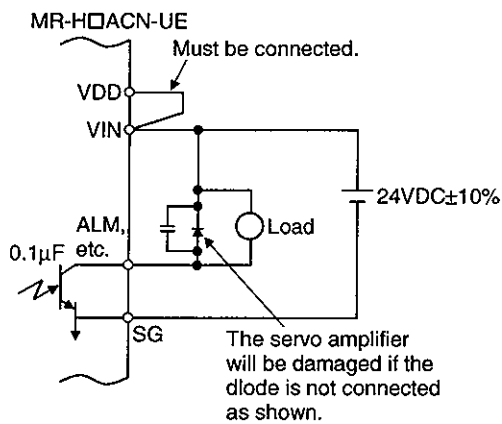


#### (2) Digital output interface DO-1

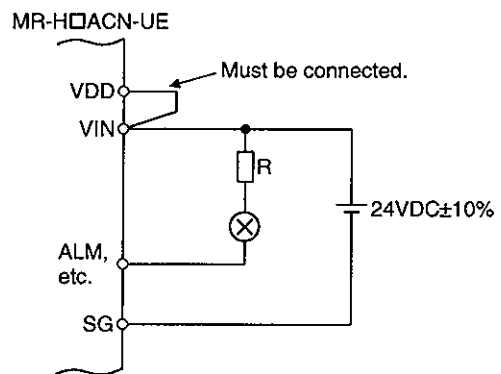
Always use an external power supply.

Can drive a lamp, relay or photocoupler. Provide absorbers (D, C) for an inductive load or an inrush current suppressing resistor (R) for a lamp load. (Permissible current: 50mA or less, inrush current: 100mA or less)

##### • Inductive load



##### • Lamp load



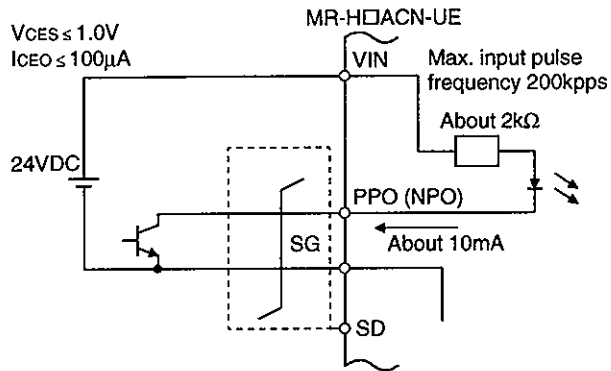


## 9. COMPLIANCE WITH THE EUROPEAN EC DIRECTIVES AND UL/C-UL STANDARD

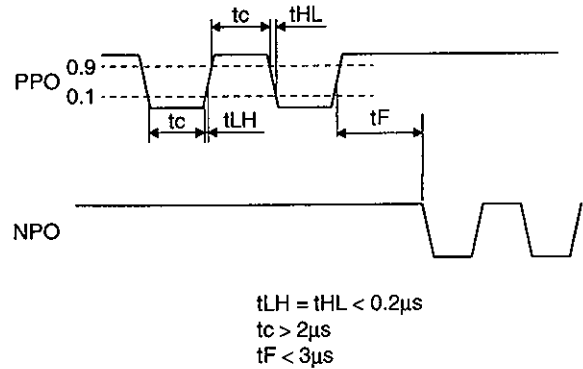
### (3) Pulse train input interface DI-2

#### (a) Open collector system

##### • Interface example

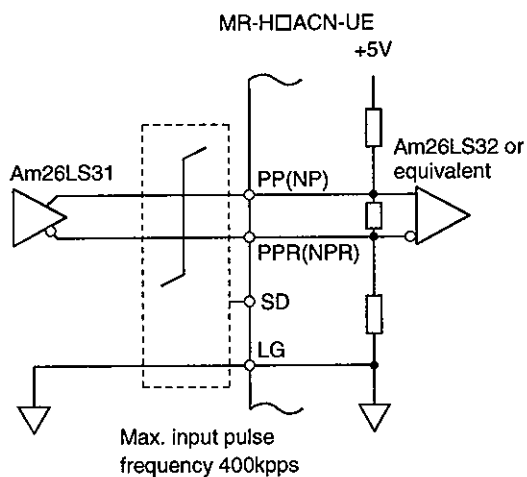


##### • Input pulse conditions

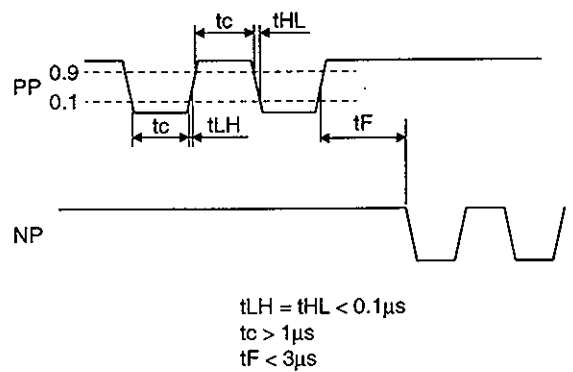


#### (b) Differential line driver system

##### • Interface example



##### • Input pulse conditions



## 10. ADJUSTMENT

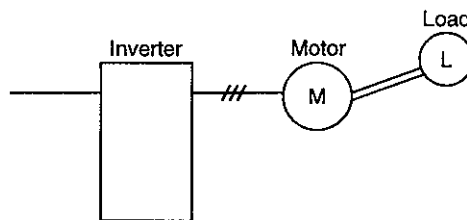
---

### 10. ADJUSTMENT

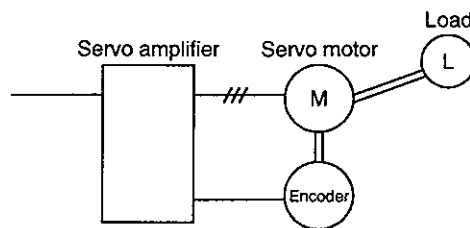
#### 10.1 What Is Gain Adjustment?

##### 10.1.1 Difference between servo amplifier and other drives

Besides the servo amplifier (MR-H-ACN controller is contained. ), there are other motor drives such as an inverter and stepping driver. Among these drives, the servo amplifier requires gain adjustment. The inverter and stepping driver are in an open loop (actual motor speed and position are not detected on the driver side).



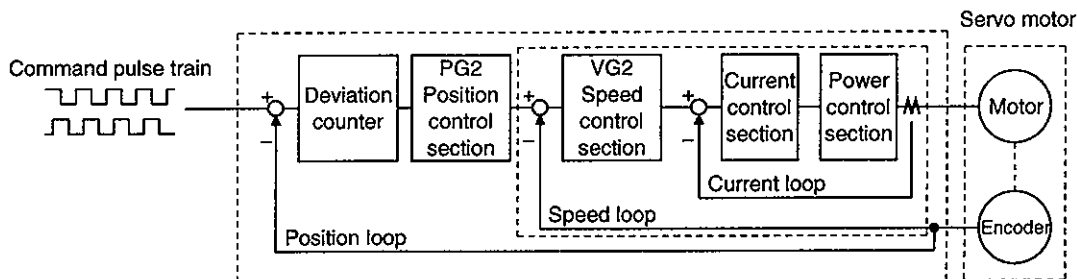
On the other hand, the servo amplifier always detects the positions and speeds of the motor and machine using the servo motor encoder, and exercises control to match the position and speed commands with the actual motor (machine) position and speed. In the servo system, adjustment is needed because:



- (1) Response changes according to the inertia moment of the machine;
- (2) Vibration occurs due to the resonance point, etc. peculiar to the machine; and
- (3) Operation delay and accuracy specification differ between machines and response should satisfy this specification.

## 10. ADJUSTMENT

### 10.1.2 Basics of the servo system



A general servo system configuration is shown above. The servo control system consists of three loops: current loop, speed loop and position loop. Among these three loops, the response of the inside loop must be increased 4 to 6 times higher. If this condition is not satisfied, vibration will be generated. If the condition further worsens, hunting will occur.

#### (1) Current loop

For the MR-H-ACN, the response level of the current loop is factory-set to a high value and need not be adjusted. If the motor is installed to the machine, the response of the current loop will hardly vary.

#### (2) Speed loop

Response will vary according to the inertia moment of the machine. When the load inertia moment increases, the response of the speed loop will reduce. Use the speed loop gain (VG2) to compensate for the reduction of the response level.

$$\text{Speed loop response } f_v[\text{rad/s}] = \frac{\text{Amplifier gain setting VG2}[\text{rad/s}]}{1+m}$$

$$m: \text{Load inertia moment ratio } \left[ = \frac{J_L}{J_M} \right]$$

$J_L$  = load inertia moment

$J_M$  = servo motor shaft inertia moment

#### (3) Position loop

The response level will not vary according to machine conditions.

$$\text{Position loop response } f_p[\text{rad/s}] = \text{amplifier gain setting PG2}[\text{rad/s}]$$

When the motor is installed to the machine, the gain must be adjusted to satisfy  $f_v = 4$  to  $6f_p$  according to the load inertia moment ratio  $m$ .

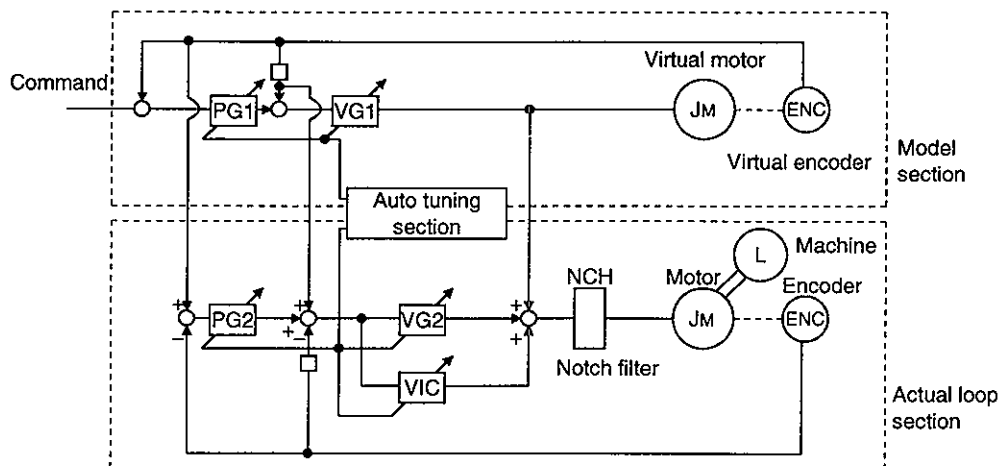
## 10. ADJUSTMENT

### 10.2 Gain adjustment

#### 10.2.1 Parameters required for gain adjustment

| Parameter No. | Symbol | Name   |
|---------------|--------|--|
| No.21         | AUT    | Function selection (Auto tuning)                     |
| No.7          | PG1    | Position loop gain 1                                 |
| No.59         | NCH    | Machine resonance suppression filter.                |
| No.58         | GD2    | Ratio of load inertia moment to motor inertia moment |
| No.60         | PG2    | Position loop gain 2                                 |
| No.61         | VG1    | Speed loop gain 1                                    |
| No.62         | VG2    | Speed loop gain 2                                    |
| No.63         | VIC    | Speed integral compensation                          |

#### 10.2.2 Block diagram



The block diagram of the MR-H-ACN servo control section is shown above. (The current loop is omitted.)

(1) Actual loop section

A control loop designed to control the actual motor and acts to control the servo system stably in response to the load torque of the machine.

(2) Model section

Acts to provide the ideal operation values to the current loop in response to the command.

(3) Auto tuning section

Judges the load inertia moment of the machine fitted with the actual motor from the operation error of the motor to change each control gain in real time.

The gains changed by auto tuning are PG1, VG1, PG2, VG2 and VIC.

## 10. ADJUSTMENT

---

### 10.2.3 What is auto tuning?

The load inertia moment is estimated from the angular speed ( $\omega$ ) and torque ( $T$ ) are estimated in accordance with the equation of motion (10.1) used for motor acceleration/deceleration. In actuality, the acceleration/deceleration characteristics of the model and those of the actual motor are compared to estimate the inertia moment of the load in real time.

$$J \frac{d\omega}{dt} = T \dots\dots\dots (10.1)$$

J : Inertia moment

$\omega$  : Angular speed

T : Torque

Real-time auto tuning is performed in the following procedure:

- (1) When the motor makes acceleration/deceleration, load inertia moment JL is estimated in the above method to calculate the load inertia moment ratio (GD2).
- (2) Each gain (PG1, VG1, PG2, VG2, VIC) to the calculated load inertia moment ratio (GD2) is changed according to the response level set in parameter No.21. Note that these gains have been patterned beforehand to satisfy the aforementioned stabilization condition.

## 10. ADJUSTMENT

### 10.3 Gain Adjustment by Auto Tuning

#### 10.3.1 Adjustment method

The MR-H-ACN is factory-set to make auto tuning valid (parameter No.21: 01).

In the factory setting of the controller, auto tuning is valid and the response setting is "2".

The initial settings provide sufficient tuning for general machines. Higher-level tuning can be provided by adjusting the response setting (third digit of parameter No.21) according to machine rigidity.

The following table lists guidelines for response setting to drive systems. Choose slow response when using a reduction gear having backlash:

| Main Drive System (Note) |                     | Fast Response | Middle Response | Slow Response |
|--------------------------|---------------------|---------------|-----------------|---------------|
| Ballscrew                | Direct coupling     | ←————→        | ————→           |               |
|                          | With reduction gear |               | ←————→          | ————→         |
| Rack & pinion            | Direct coupling     |               | ←————→          | ————→         |
|                          | With reduction gear |               | ←————→          | ————→         |
| Timing belt              | Direct coupling     |               | ←————→          | ————→         |
|                          | With reduction gear |               | ←————→          | ————→         |
| Chain                    | Direct coupling     |               | ←————→          | ————→         |
|                          | With reduction gear |               | ←————→          | ————→         |

The following is how to adjust the response setting to machine phenomena:

| (Note) Actual Machine Operation   | Ideal Machine Operation | Parameter No.3 Setting   |
|-----------------------------------|-------------------------|--|
| Settling time is long             | Reduce settling time.   | Increase response setting.   |
| Large overshoot at stop           | Reduce overshoot.       | Decrease response setting.<br>Set machine selection setting to "large friction". |
| Gear sound generated from machine | Reduce gear sound.      | Decrease response setting.   |

Note: Settling time indicates time from zero command pulse to servo motor stop.

#### 10.3.2 Valid conditions

| POINT  |
|--|
| <ul style="list-style-type: none"> <li>If the acceleration/deceleration time is long or the motor speed used is only low speed, the valid conditions of auto tuning are not satisfied. Therefore, it may result in false tuning.<br/>In this case, after performing operation which satisfies the auto tuning conditions, set parameter No. 21 to "auto tuning not executed".</li> </ul> |

This section provides constraints on the operation pattern to enable excellent auto tuning. If the conditions in this section cannot be satisfied, normal auto tuning may not be performed. In this case, after executing auto tuning in operation which satisfies the conditions given in this section, make auto tuning invalid to disallow the gain setting from being changed.

- (1) Set the acceleration time (time until the preset speed is reached) to 5s or less and the acceleration/deceleration current to 50% or more.
- (2) Perform operation several times until the cumulative acceleration/deceleration time is 1s or more.
- (3) Set the servo motor speed to 500r/min or more.

## 10. ADJUSTMENT

---

### 10.4 Manual Gain Adjustment

On some machines, gain adjustment may not be made by auto tuning or excellent gain setting may not be made if gain adjustment is performed by auto tuning. In this case, adjust the gains manually. Use any of the methods given in this section to adjust the gains.

#### 10.4.1 When machine rigidity is low

##### (1) Machine condition

Because of low machine rigidity, the response setting of auto tuning is set to slow response and it takes too much time to reach the target position.

When the machine or motor shaft is moved lightly at a stop, it moves easily.

##### (2) Adjustment procedure

###### Adjustment 1

- a) Execute auto tuning with the response setting of the level at which machine will not vibrate.  
Set 0101 in parameter No.21.
- b) Set "Not executed" auto tuning in parameter No.21.
- c) Gradually decrease the speed integral compensation VIC (parameter No.63) setting.

###### Adjustment 2

- a) Perform auto tuning with the response setting of slow response.  
Set 0101 in parameter No.21.
- b) Set the machine resonance suppression filter (parameter No.59) in order from higher to lower frequencies.
- c) Alternate a start and a stop several times, execute auto tuning, and check whether the machine does not vibrate.
- d) If the machine condition does not become excellent after the above adjustment, reduce the setting of speed integral compensation as in Adjustment 1.

## 10. ADJUSTMENT

### 10.4.2 When the machine vibrates due to machine resonance frequency

#### (1) Machine condition

The servo motor shaft is oscillating at high frequency (100Hz or more).

The servo motor shaft motion cannot be confirmed visually. However, if the machine generates large noise and vibrates, make Adjustment 1.

If higher "response setting" of auto tuning increases vibration, make Adjustment 2.

#### (2) Adjustment procedure

##### (a) Adjustment 1

- 1) Perform auto tuning with the response setting of slow response.

Set 0101 in parameter No.21.

- 2) Set 563Hz or 375Hz to the machine resonance suppression filter (Parameter No.59).
- 3) Alternate a start and a stop several times, execute auto tuning, and check whether the machine does not vibrate.
- 4) Increase the machine resonance suppression filter value gradually and repeat step 3).  
The optimum value is provided at the point just before vibration increases.
- 5) To further shorten the settling time, gradually increase the response setting in parameter No.21 and repeat steps 1) to 4).

##### (b) Adjustment 2

- 1) Choose the response setting of slow response.

Set 0101 in parameter No.21.

- 2) Set the load inertia moment ratio (machine inertia moment ratio in parameter No.58).

If an exact machine inertia moment ratio is unknown, enter an approximate value.

When the value is set in this parameter, the following parameters are set automatically. When there is no machine resonance, the value of each parameter is set to the ideal gain for the parameter No.58 value.

| Parameter No. | Symbol | Name                        |
|---------------|--------|-----------------------------|
| No.7          | PG1    | Position loop gain 1        |
| No.60         | PG2    | Position loop gain 2        |
| No.61         | VG1    | Speed loop gain 1           |
| No.62         | VG2    | Speed loop gain 2           |
| No.63         | VIC    | Speed integral compensation |

- 3) Set parameter No. 21 to □□□2 (auto tuning not executed).
- 4) Decrease the speed control gain (parameter No. 62) to a value about 100 to 200 smaller than the automatically set value.
- 5) Set 563Hz or 375Hz to the machine resonance suppression filter (Parameter No.59).
- 6) Alternate a start and a stop several times, execute auto tuning, and check whether the machine does not vibrate.
- 7) Decrease the machine resonance suppression filter gradually and repeat step 6).  
The optimum value is provided at the point where vibration is minimum.
- 8) When there is no machine resonance, check the operating status and gradually increase the speed loop gain 2 (parameter No.62) and repeat steps 5) to 7) in Adjustment 1.  
Set the value about 50 to 100 smaller than the value at which gear sound begins to be generated.  
Make this gain a little smaller if there is variation in the machine because a timing belt or the like is used.
- 9) To further shorten the settling time, gradually increase the response setting of parameter No.21 and repeat steps 1) to 8).



## 10. ADJUSTMENT

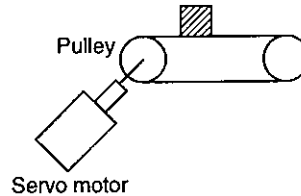
### 10.4.3 Load inertia moment is 20 or more times

#### (1) Machine condition

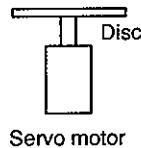
The machine inertia moment is 20 times or more and the servo motor oscillates at low frequency (5Hz or more). At this time, servo motor shaft vibration can be confirmed visually.

This adjustment method is valid for the following machines:

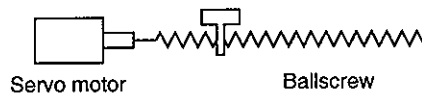
#### 1) Machine in which a timing belt is driven without reduction gear



#### 2) Machine in which a disc is rotated without reduction gear



#### 3) Machine of which ballscrew lead is long



#### (2) Adjustment procedure

##### 1) Choose the response setting of slow response.

Set 0101 in parameter No.21.

##### 2) Set the load inertia moment ratio (machine inertia moment ratio in parameter No.58).

If an exact machine inertia moment ratio is unknown, enter an approximate value.

When the value is set in this parameter, the following parameters are set automatically. When there is no machine resonance, the value of each parameter is set to the ideal gain for the parameter No.58 value.

| Parameter No. | Symbol | Name                        |
|---------------|--------|-----------------------------|
| No.7          | PG1    | Position loop gain 1        |
| No.60         | PG2    | Position loop gain 2        |
| No.61         | VG1    | Speed loop gain 1           |
| No.62         | VG2    | Speed loop gain 2           |
| No.63         | VIC    | Speed integral compensation |

##### 3) Set parameter No. 21 to □□□2 (auto tuning not executed).

4) Alternate a start and a stop several times, and check whether the machine does not vibrate.

5) If vibration still persists, repeat steps 1) and 4).

6) If vibration still persists, make (a) Adjustment 1 and (b) Adjustment 2 in paragraph (2) of Section 10.4.2.

7) If you want to further increase the response, set parameter No. 21 to "auto tuning executed" (third digit) with operation at a stop, and increase the response setting (first digit). After that, set the parameter to "auto tuning not executed" (third digit).

For example, after setting parameter No. 21 to "□2□1", set it to "□2□2".

8) Reducing the speed loop's integral time constant (parameter No. 63) may improve the performance. However, making it too small may generate vibration.

## 10. ADJUSTMENT

### 10.4.4 When shortening the settling time

#### (1) Machine condition

The settling time will be increased by the gains provided by auto tuning.

#### (2) Adjustment procedure

- a) Choose the response setting of slow response.

Set 0101 in parameter No.21.

- b) Alternate a start and a stop several times, execute auto tuning, and check whether the machine does not vibrate.

- c) Set the load inertia moment ratio (machine inertia moment ratio in parameter No.58).

If an exact machine inertia moment ratio is unknown, enter an approximate value.

When the value is set in this parameter, the following parameters are set automatically. When there is no machine resonance, the value of each parameter is set to the ideal gain for the parameter No.58 value.

| Parameter No. | Symbol | Name                        |
|---------------|--------|-----------------------------|
| No.7          | PG1    | Position loop gain 1        |
| No.60         | PG2    | Position loop gain 2        |
| No.61         | VG1    | Speed loop gain 1           |
| No.62         | VG2    | Speed loop gain 2           |
| No.63         | VIC    | Speed integral compensation |

- d) Set 2 in parameter No.21 to make auto tuning invalid.

Make the parameter No.7, 60 to 63 settings manually adjustable.

- e) Check the operating status and adjust the following parameter values:

| Parameter No. | Symbol | Name                        | Description  |
|---------------|--------|-----------------------------|--|
| No.7          | PG1    | Position loop gain 1        | Higher setting shortens the settling time but is liable to cause overshooting.   |
| No.60         | PG2    | Position loop gain 2        |  |
| No.61         | VG1    | Speed loop gain 1           | Higher setting improves the servo response level but is liable to cause vibration.   |
| No.62         | VG2    | Speed loop gain 2           |  |
| No.63         | VIC    | Speed integral compensation | Lower setting keeps the speed constant to load disturbance and increases holding force at a stop (servo rigidity) but is liable to cause overshooting. |

Make adjustment by gradually increasing the parameter No.7, 60 to 62 settings at the same ratio and reducing the speed integral compensation (parameter No.63). The optimum value is provided at the point just before vibration increases. Use of the machine resonance filter (parameter No.59) may increase the limit point.

## 10. ADJUSTMENT

---

### 10.4.5 When the same gain is used for two or more axes

#### (1) Machine condition

To perform interpolation operation with two or more axes of controllers, the position loop gains of the axes are set to the same value.

#### (2) Adjustment procedure

a) To adjust the gains of each axis, adjust the gains of all axes in the adjustment procedures in Sections 10.4.1 to 10.4.5.

b) Set  or  in parameter No.21.

0: Interpolation control ······ The following parameter values change at the next start/stop.


| Parameter No. | Symbol | Name                        |
|---------------|--------|-----------------------------|
| No.7          | PG1    | Position loop gain 1        |
| No.60         | PG2    | Position loop gain 2        |
| No.63         | VIC    | Speed integral compensation |

: No auto tuning ······ Make auto tuning invalid and set each gain manually.

c) Match position loop gain 1 to the minimum value of each axis to make the gains of all axes equal.

# 11. INSPECTION

## 11. INSPECTION

|  |   |
|--|---|
|  <b>WARNING</b> | <ul style="list-style-type: none"> <li>• Before starting maintenance and/or inspection, make sure that the charge lamp is off more than 10 minutes after power-off. Then, confirm that the voltage is safe in the tester or the like. Otherwise, you may get an electric shock.</li> <li>• Any person who is involved in inspection should be fully competent to do the work. Otherwise, you may get an electric shock. For repair and parts replacement, contact your sales representative.</li> </ul> |
|--|---|

|              |  |
|--------------|--|
| <b>POINT</b> | <ul style="list-style-type: none"> <li>• Do not test the controller with a megger (measure insulation resistance), or it may become faulty.</li> <li>• Do not disassemble and/or repair the equipment on customer side.</li> </ul> |
|--------------|--|

### 11.1 Inspection

It is recommended to make the following checks periodically:

- 1) Check for loose terminal block screws. Retighten any loose screws.
- 2) Check the servo motor bearings, brake section, etc. for unusual noise.
- 3) Check the cables and the like for scratches and cracks. Perform periodic inspection according to operating conditions.
- 4) Check the servo motor shaft and coupling for misalignment.

### 11.2 Life

The following parts must be changed periodically as listed below. If any part is found faulty, it must be changed immediately even when it has not yet reached the end of its life, which depends on the operating method and environmental conditions.

Also when using the servo motor in the atmosphere having much oil mist, dust, etc., clean and inspect every three months. For parts replacement, please contact your sales representative.

|             | Part Name                 | Life Guideline                        |
|-------------|---------------------------|---------------------------------------|
| Controller  | Smoothing capacitor       | 10 years                              |
|             | Relay                     | 10,000times                           |
|             | Cooling fan               | 10,000 to 30,000 hours (2 to 3 years) |
|             | Absolute position battery | 10,000 hours                          |
| Servo motor | Bearings                  | 20,000 to 30,000 hours                |
|             | Encoder                   | 20,000 to 30,000 hours                |
|             | Oil seal, V ring          | 5,000 hours                           |
|             | Cooling fan               | 20,000 hours                          |

## 11. INSPECTION

---

(1) Smoothing capacitor

Affected by ripple currents, etc. and deteriorates in characteristic. The life of the capacitor greatly depends on ambient temperature and operating conditions. The capacitor will reach the end of its life in 10 years of continuous operation in normal air-conditioned environment.

(2) Relays

Their contacts will wear due to switching currents and contact faults occur. Relays reach the end of their life at cumulative 100,000 switching times (switching life), which depends on the power supply capacity.

(3) Controller cooling fan

The cooling fan bearings reach the end of their life in 10,000 to 35,000 hours. Normally, therefore, the fan must be changed in a few years of continuous operation as a guideline.

It must also be changed if unusual noise or vibration is found during inspection.

(4) Servo motor bearings

When the servo motor is run at rated speed under rated load, change the bearings in 20,000 to 30,000 hours as a guideline. This differs on the operating conditions. The bearings must also be changed if unusual noise or vibration is found during inspection.

(5) Servo motor oil seal, V ring

Must be changed in 5,000 hours of operation at rated speed as a guideline. This differs on the operating conditions. These parts must also be changed if oil leakage, etc. is found during inspection.

(6) Servo motor cooling fan (HA-LH11K2 or more)

The design life of the cooling fan is 20,000 hours. Change the cooling fan periodically.

## 12. TROUBLESHOOTING

### 12. TROUBLESHOOTING

#### 12.1 Trouble at Start-Up



#### CAUTION

- Excessive adjustment or change of parameter setting must not be made as it will make operation instable.

#### POINT

- If the servo motor is inoperative, refer to the "unrotated motor reason" screen (Section 7.4 (2)) and take corrective action.

The following faults may occur at start-up. If any of such faults occurs, take the corresponding action.

| No. | Start-Up Sequence          | Fault  | Investigation   | Possible Cause  | Refer To     |
|-----|----------------------------|--|---|---|--------------|
| 1   | Power on                   | <ul style="list-style-type: none"> <li>• LED is not lit.</li> <li>• LED flickers.</li> </ul> | Not improved if connectors CN1, CN2, CN3, CN4, CN11 and CN12 are disconnected.  | 1) Power supply voltage fault<br>2) Servo amplifier is faulty.                              | /            |
|     |                            |  | Improved when connectors CN1 and CN11 are disconnected.   | Power supply of CN1 cabling is shorted.   |              |
|     |                            |  | Improved when connector CN2 is disconnected.  | 1) Power supply of encoder cabling is shorted.<br>2) Encoder is faulty.                     |              |
|     |                            |  | Improved when connector CN3 is disconnected.  | Power supply is shorted.  |              |
|     |                            | Alarm occurs.  | Refer to Section 12.2 and remove cause.   |   | Section 12.2 |
| 2   | Switch on servo-on signal. | Alarm occurs.  | Refer to Section 12.2 and remove cause.   |   | Section 12.2 |
|     |                            | Servo motor shaft is not servo-locked (is free).   | Check the display to see if the controller is ready to operate.   | 1) Servo on signal is not input. (Wiring mistake)<br>2) 24VDC power is not supplied to COM. | Section 7.3  |
| 3   | Gain adjustment            | Rotation ripples (speed fluctuations) are large at low speed.                                | Make gain adjustment in the following procedure:<br>1) Increase the auto tuning response level.<br>2) Repeat acceleration and deceleration several times to complete auto tuning. | Gain adjustment fault   | Chapter 10   |
|     |                            | Large load inertia moment causes the servo motor shaft to oscillate side to side.            | Make gain adjustment in the following procedure:<br>If the servo motor may be run with safety, repeat acceleration and deceleration several times to complete auto tuning.        | Gain adjustment fault   | Chapter 10   |
| 4   | Cyclic operation           | Position shift occurs  | Confirm the cumulative command pulses, cumulative feedback pulses and actual servo motor position.  | Pulse counting error, etc. due to noise.  | /            |

## 12. TROUBLESHOOTING

### 12.2 When Alarm or Warning Has Occurred

#### 12.2.1 Alarms and Warning list

When a fault occurs during operation, the corresponding alarm or warning is displayed. If any alarm or warning has occurred, refer to Section 12.2.2 or 12.2.3 and take the appropriate action.

You can use the MR-H-D01 option card to output the alarm code. Set 1 in parameter No. 67.

|               | Indication | (Note1)<br>MR-H-D01 Alarm Code |      |      |                                 | Function Name                       | Parameter Unit<br>Screen Display | Alarm Deactivation  |                                 |                                   |
|---------------|------------|--------------------------------|------|------|---------------------------------|-------------------------------------|----------------------------------|---|---------------------------------|-----------------------------------|
|               |            | DO03                           | DO02 | DO01 | DO00                            |                                     |                                  | Power<br>OFF→<br>ON   | Para-<br>meter<br>unit<br>*RES* | Alarm<br>reset<br>(RES)<br>signal |
| Alarm codes   | AL10       | 0                              | 0    | 1    | 0                               | Under voltage                       | Under volt                       | ○   | ○                               | ○                                 |
|               | AL12       | 0                              | 0    | 0    | 0                               | Memory alarm 1                      | Memory er 1                      | ○   | ○                               | ○                                 |
|               | AL13       | 0                              | 0    | 0    | 0                               | Clock alarm                         | OSC err                          | ○   | ○                               | ○                                 |
|               | AL14       | 0                              | 0    | 0    | 0                               | Watchdog                            | Watch dog                        | ○   | ○                               | ○                                 |
|               | AL15       | 0                              | 0    | 0    | 0                               | Memory alarm 2                      | Memory er 2                      | ○   | ○                               | ○                                 |
|               | AL16       | 0                              | 1    | 1    | 0                               | Encoder alarm 1                     | PLG err 1                        | ○   | ○                               | ○                                 |
|               | AL17       | 0                              | 0    | 0    | 0                               | Board alarm                         | Board err                        | ○   | ○                               | ○                                 |
|               | AL19       | 0                              | 0    | 0    | 0                               | Memory alarm 3                      | Memory er 3                      | ○   | ○                               | ○                                 |
|               | AL1A       | 0                              | 1    | 1    | 0                               | Motor combination error             | Motor err.                       | ○   | ○                               | ○                                 |
|               | AL20       | 0                              | 1    | 1    | 0                               | Encoder alarm 2                     | PLG err 2                        | ○   | ○                               | ○                                 |
|               | AL24       | 1                              | 1    | 0    | 0                               | Ground fault                        | Grounded                         | ○   | ○                               | ○                                 |
|               | AL25       | 1                              | 1    | 1    | 0                               | Absolute position erase             | ABS lost                         | ○   | ○                               | ○                                 |
|               | AL30       | 0                              | 0    | 0    | 1                               | Regenerative alarm                  | Reg. err                         | ○   | ○                               | ○                                 |
|               | AL31       | 0                              | 1    | 0    | 1                               | Over speed                          | Over speed                       | ○   | ○                               | ○                                 |
|               | AL32       | 0                              | 1    | 0    | 0                               | Over current                        | Over curr                        | ○   | ○                               | ○                                 |
|               | AL33       | 1                              | 0    | 0    | 1                               | Over voltage                        | Over volt                        | ○   | ○                               | ○                                 |
|               | AL35       | 1                              | 1    | 0    | 1                               | Command pulse frequency alarm       | Ref. f err                       | ○   | ○                               | ○                                 |
|               | AL37       | 1                              | 0    | 0    | 0                               | Parameter alarm                     | Pr. err                          | ○   | ○                               | ○                                 |
|               | AL42       | 0                              | 1    | 1    | 0                               | Feedback alarm                      | Pos. err                         | ○   | ○                               | ○                                 |
|               | AL45       | 0                              | 0    | 1    | 1                               | Main circuit device overheat        | Fin heat                         | ○   | ○                               | ○                                 |
| AL46          | 0          | 0                              | 1    | 1    | Servo motor overheat            | Motor heat                          | ○                                | ○   | ○                               |                                   |
| AL50          | 0          | 0                              | 1    | 1    | Over load 1                     | Over load 1                         | ○<br>(Note2)                     | ○<br>(Note2)  | ○<br>(Note2)                    |                                   |
| AL51          | 0          | 0                              | 1    | 1    | Over load 2                     | Over load 2                         | ○<br>(Note2)                     | ○<br>(Note2)  | ○<br>(Note2)                    |                                   |
| AL52          | 0          | 1                              | 0    | 1    | Error excessive                 | Over droop                          | ○                                | ○   | ○                               |                                   |
| AL73          | 1          | 1                              | 0    | 1    | Auxiliary pulse frequency alarm | OpRef. f er                         | ○                                | ○   | ○                               |                                   |
| AL74          | 1          | 1                              | 1    | 1    | Option memory alarm 1           | OpMemo. er 1                        | ○                                | ○   | ○                               |                                   |
| AL75          | 1          | 1                              | 1    | 1    | Option memory alarm 2           | OpMemo. er 2                        | ○                                | ○   | ○                               |                                   |
| AL8E          | 0          | 0                              | 0    | 0    | RS-232C alarm                   | RS232 err                           | ○                                | ○   | ○                               |                                   |
| AL8F          | 1          | 0                              | 0    | 0    | RS-422 alarm                    | RS422 err                           | ○                                | ○   | ○                               |                                   |
| Warning codes | AL90       | /                              |      |      |                                 | Zeroing incomplete                  | ORG error                        | Removing the cause of occurrence deactivates the alarm automatically. |                                 |                                   |
|               | AL92       |                                |      |      |                                 | Open battery cable warning          | BTT cable                        |   |                                 |                                   |
|               | AL96       |                                |      |      |                                 | Zero setting error                  | ZERO set er                      |   |                                 |                                   |
|               | AL9A       |                                |      |      |                                 | Digital switch warning              | Dig.SW err                       |   |                                 |                                   |
|               | AL9F       |                                |      |      |                                 | Battery warning                     | BTT volt                         |   |                                 |                                   |
|               | ALE0       |                                |      |      |                                 | Excessive regenerative load warning | OR warning                       |   |                                 |                                   |
|               | ALE1       |                                |      |      |                                 | Over load warning                   | OL warning                       |   |                                 |                                   |
|               | ALE3       |                                |      |      |                                 | Absolute position counter warning   | ABS warning                      |   |                                 |                                   |
|               | ALE6       |                                |      |      |                                 | Servo emergency stop                | EMG stop                         |   |                                 |                                   |
|               | ALE9       |                                |      |      |                                 | Main circuit off warning            | Main P-off                       |   |                                 |                                   |

Note 1. 0: Any terminal-SG OFF (open)

1: Any terminal-SG ON (short)

2. Deactivate the alarm about 30 minutes of cooling time after removing the cause of occurrence.

## 12. TROUBLESHOOTING

### 12.2.2 Remedies for alarms



**CAUTION**

- When any alarm has occurred, eliminate its cause, ensure safety, then reset the alarm, and restart operation. Otherwise, injury may occur.

#### POINT

- When any of the following alarms has occurred, always remove its cause and allow about 30 minutes for cooling before resuming operation. If operation is resumed by switching control circuit power off, then on to reset the alarm, the controller, servo motor and regenerative brake option may become faulty.
  - Regenerative alarm (AL30)
  - Overload 1 (AL50)
  - Overload 2 (AL51)
- The alarms can be deactivated by switching power off, then on, by pressing the "RES" key of the parameter unit or by turning on the reset signal (RES). Refer to Section 12.2.1 for details.
- When 1 is set in parameter No. 41 to make reset (SON) valid, reset (SON) can be used to deactivate the alarm.

When an alarm occurs, the trouble signal (ALM) switches off and the dynamic brake operates to stop the servo motor. At this time, the display shows the corresponding alarm number.

Remove the cause of the alarm in accordance with this section. The optional Parameter Unit may be used to refer to the cause.

| Indication | Name              | Definition  | Parameter Unit Screen Display          |                            | Cause   | Action                         |  |
|------------|-------------------|---|--|----------------------------|---|--------------------------------|--|
|            |                   |   | Current Alarm<br>(name and definition) | Alarm Occurrence<br>Factor |   |                                |  |
| AL10       | Undervoltage      | Power supply voltage dropped.<br>160V or less                         | Under volt                             | Power Volt<br>under 160V   | 1. Power supply voltage is low.   | Review the power supply.       |  |
|            |                   |   |  | 15ms IPF                   |   |                                | 2. Power failed instantaneously.<br>In case of MR-H700ACN or less<br>: 15ms or less<br>In case of MR-HI1KACN or more<br>: 10ms or less |
|            |                   |   |  | Insuf. Power<br>capacity   |   |                                |  |
|            |                   |   |  |                            | 4. Power switched on within 5s after it<br>had switched off.  |                                |  |
|            |                   |   |  |                            | 5. Faulty parts in the controller<br><br>— Checking method —<br>Alarm (AL 10) occurs if power is<br>switched on after all connectors<br>are disconnected.           |                                | Change the Servo<br>amplifier.   |
| AL12       | Memory<br>alarm 1 | RAM, ROM<br>memory fault  | Memory er 1                            | Board error                | Faulty parts in the controller<br><br>— Checking method —<br>Alarm (any of AL 12 to 15) occurs<br>if power is switched on after all<br>connectors are disconnected. | Change the Servo<br>amplifier. |  |
| AL13       | Clock alarm       | Printed board<br>fault  | OSC err                                |                            |   |                                |  |
| AL14       | Watch dog         | CPU fault   | Watch dog                              |                            |   |                                |  |
| AL15       | Memory<br>alarm 2 | EEPROM fault  | Memory er 2                            |                            |   |                                |  |
| AL16       | Encoder<br>alarm  | Communication<br>error occurred<br>between encoder<br>and controller. | PLG err 1                              | PLG con. left              | 1. Encode connector disconnected.   | Connect correctly.             |  |
|            |                   |   |  | PLG trouble                | 2. Encoder faulty.  | Change the servo<br>motor.     |  |
|            |                   |   |  | PLG cable<br>has trouble   | 3. Encoder cable faulty<br>(wire breakage or short)   | Repair or change the<br>cable. |  |



## 12. TROUBLESHOOTING

| Indication               | Name  | Definition   | Parameter Unit Screen Display          |   | Cause   | Action   |  |
|--------------------------|---|--|--|---|---|--|--|
|                          |   |  | Current Alarm<br>(name and definition) | Alarm Occurrence<br>Factor  |   |  |  |
| AL17                     | Board alarm                                 | CPU/parts fault  | Board err                              | Board error   | Faulty parts in the controller<br><br>— Checking method —<br>Alarm (AL 17 or AL 19) occurs if power is switched on after all connectors have been disconnected. | Change the controller.   |  |
| AL19                     | Memory alarm 3                              | Flash ROM fault  | Memory alarm 3                         | Board error   |   |  |  |
| AL1A                     | Motor combination erase                     | Motor combination error  | Motor err.                             | Motor err.  | When using HC-MF, HA-FF, HC-SF, HC-RF or HC-UF series servo motor, improper motor was connected with controller.  | Use correct combination.   |  |
| AL20                     | Encoder alarm 2                             | Communication error occurred between encoder and controller.   | PLG err 2                              | PLG con. left   | 1. Encoder connector disconnected.  | Connect correctly.   |  |
|                          |   |  |  | PLG cable has trouble   | 2. Encoder cable faulty (wire breakage or short)  | Repair or change the cable.  |  |
| AL24                     | Ground fault                                | Ground fault occurred at the servo motor outputs (U,V and W phases) of the servo amplifier.                          | Grounded                               | UVW ground fault  | 1. Power input cable and servo motor output cable are making contact at the main circuit terminal block (TE1).  | Connect correctly.   |  |
|                          |   |  |  |   | 2. Servo motor power cable insulation deteriorated.   | Change the cable.  |  |
| AL25                     | Absolute position erase                     | Absolute position data in error  | ABS lost                               | Power trset after 2-3 min. pow. on  | 1. Reduced voltage of super capacitor in encoder  | After alarm has occurred, hold power on for a few minutes, and switch it off once, then on again. Make home position return again. |  |
|                          |   |  |  | BTT life time over  | 2. Battery voltage low  |  | Change battery. Make home position return again. |
|                          |   |  |  | BTT cable has trouble   | 3. Battery cable or battery is faulty.  |  |  |
| AL30                     | Regenerative alarm                          | Permissible regenerative power of the built-in regenerative brake resistor or regenerative brake option is exceeded. | Reg. err                               | Pr. 2 missetting  | 1. Wrong setting of parameter No. 2   | Set correctly.   |  |
|                          |   |  |  | Reg. Resist. Missing  | 2. Built-in regenerative brake resistor or regenerative brake option is not connected.  | connect correctly.   |  |
|                          |   |  |  | Reg. Load exceeded  | 3. High-duty operation or continuous regenerative operation caused the permissible regenerative power of the regenerative brake option to be exceeded.          | 1. Reduce the frequency of positioning.<br>2. Use the regenerative brake option of larger capacity.<br>3. Reduce the load.         |  |
|                          |   |  |  | — Checking method —<br>Call the status display and check the regenerative load ratio. |   |  |  |
|                          |   | Power supply voltage is abnormal. 260V or more   |  | Review power supply   |   |  |  |
|                          |   | Reg. Tr. damaged   |  | 5. Regenerative transistor faulty.  | Change the controller.  |  |  |
|                          |   | Reg. Resist. has trouble   |  | 6. Built-in regenerative brake resistor or regenerative brake option faulty.          | Change controller or regenerative brake option.   |  |  |
| Reg. Resist. has trouble | 7. Unusual overheat due to cooling fan stop | 1. Change the controller or cooling fan.<br>2. Reduce ambient temperature.   |  |   |   |  |  |

## 12. TROUBLESHOOTING

| Indication | Name                          | Definition  | Parameter Unit Screen Display          |                            | Cause   | Action   |
|------------|-------------------------------|---|--|----------------------------|---|--|
|            |                               |   | Current Alarm<br>(name and definition) | Alarm Occurrence<br>Factor |   |  |
| AL31       | Over speed                    | Speed has exceeded the instantaneous permissible speed.                     | Over speed                             | Acc. time-C shortage       | 1. Small acceleration/deceleration time constant caused overshoot to be large.  | Increase acceleration/deceleration time constant.  |
|            |                               |   |  | Overshoot by unstable      | 2. Servo system is instable to cause overshoot.   | 1. Re-set servo gain to proper value.<br>2. If servo gain cannot be set to proper value:<br>1) Reduce load inertia moment ratio; or<br>2) Reexamine acceleration/deceleration time constant. |
|            |                               |   |  | Pr. 1 missetting           | 3. Parameter No. 1 setting error.   | Set correctly.   |
|            |                               |   |  | PLG trouble                | 4. Encoder faulty.  | Change the servo motor.  |
| AL32       | Over current                  | Current that flew is higher than the permissible current of the controller. | Over curr.                             | UVW short circuit          | 1. Short occurred in controller output phases U, V and W.   | Correct the wiring.  |
|            |                               |   |  | IPM damaged                | 2. Transistor (IPM) of the controller faulty.<br><br><div style="border: 1px solid black; padding: 5px; width: fit-content;">                     Checking method<br/>                     Alarm (AL 32) occurs if power is switched on after U, V and W are disconnected.                 </div> | Change the controller  |
|            |                               |   |  | UVW fault                  | 3. Ground fault occurred in controller output phases U, V and W.  | Correct the wiring.  |
|            |                               |   |  | Ext. noise                 | 4. External noise caused the overcurrent detection circuit to misoperate.   | Take noise suppression measures.   |
| AL33       | Over voltage                  | Converter bus voltage exceeded 400V.  | Over volt.                             | Reg. resist. Missing       | 1. Lead of built-in regenerative brake resistor or regenerative brake option is open or disconnected.   | 1. Change lead.<br>2. Connect correctly.   |
|            |                               |   |  | Reg. Tr. damaged           | 2. Regenerative transistor faulty.  |  |
|            |                               |   |  | Reg. Resist. has trouble   | 3. Wire breakage of built-in regenerative brake resistor or regenerative brake option   | 1. For wire breakage of built-in regenerative brake resistor, change controller.<br>2. For wire breakage of regenerative brake option, change regenerative brake option.                     |
|            |                               |   |  | Power volt exceeded        | 4. Capacity of built-in regenerative brake resistor or regenerative brake option is insufficient.   | Add regenerative brake option or increase capacity.  |
|            |                               |   |  |                            | 5. Power supply voltage high.   | Review the power supply.   |
| AL35       | Command pulse frequency alarm | Input pulse frequency of the manual pulse generator is too high.            | Ref. f err                             | Ref. pulse f exceeded      | 1. Command pulse frequency too high.  | Change the command pulse frequency to a proper value.  |
|            |                               |   |  | Ref. pulse has noise       | 2. Noise entered the command pulse.   | Take action against noise.   |
|            |                               |   |  |                            | 3. Manual pulse generator faulty.   | Change the manual pulse generator.   |

## 12. TROUBLESHOOTING

| Indication | Name                         | Definition  | Parameter Unit Screen Display          |  | Cause  | Action  |
|------------|------------------------------|---|--|--|--|---|
|            |                              |   | Current Alarm<br>(name and definition) | Alarm Occurrence<br>Factor   |  |   |
| AL37       | Parameter alarm              | Parameter setting is wrong.   | Pr. err                                | Pr. data destroyed   | 1. Servo amplifier fault caused the parameter setting to be rewritten.   | Change the controller.  |
|            |                              |   |  | Pr. □ □ err.   | 2. Parameter data mis-setting  | Set parameter correctly.  |
|            |                              |   |  | Ps. □ □ err.   | 3. Position block data mis-setting   |   |
|            |                              |   |  | Spd. □ □ err.  | 4. Speed block data mis-setting  |   |
| AL42       | Feedback alarm               | Encoder signal is faulty.   | Pos. err                               | PLG trouble  | Encoder faulty.  | Change the servo motor.   |
| AL45       | Main circuit device overheat | Main circuit device overheat  | Fin heat                               | Overload   | 1. Servo amplifier faulty.   | Change the controller.  |
|            |                              |   |  | Amb. temp. over 55°C   | 2. The power supply was turned on and off continuously by overloaded status.   | The drive method is reviewed.   |
|            |                              |   |  | Amp. Cooling trouble   | 3. Air cooling fan of controller stops.  | The cooling method is reviewed.   |
| AL46       | Servo motor overheat         | Servo motor temperature rise actuated the thermal protector.  | Motor overheat                         | Motor amb. over 40°C   | 1. Ambient temperature of servo motor is over 40°C.  | Review environment so that ambient temperature is 0 to 40°C.  |
|            |                              |   |  | Overload   | 2. Servo motor is overloaded.  | 1. Reduce load.<br>2. Review operation pattern.<br>3. Use servo motor that provides larger output.  |
|            |                              |   |  | PLG-TH trouble   | 3. Thermal protector in encoder is faulty.   | Change servo motor.   |
|            |                              |   |  | Motor cool trouble   | 4. Air cooling fan of the servo motor stops.   | Change servo motor.   |
| AL50       | Over load 1                  | Load exceeded overload protection characteristic of controller.<br>Load ratio 300%:<br>2.5s or more<br>Load ratio 200%:<br>100s or more | Over load 1                            | E-thermal tripped  | 1. Servo amplifier is used in excess of its continuous output current.   | 1. Reduce load.<br>2. Review operation pattern.<br>3. Use servo motor that provides larger output.  |
|            |                              |   |  | Mot. Vibrat. by untabl   | 2. Servo system is instable and hunting.   | 1. Repeat acceleration/ deceleration to execute auto tuning.<br>2. Change auto tuning response setting.<br>3. Set auto tuning to OFF and make gain adjustment manually. |
|            |                              |   |  | Machine locked   | 3. Machine struck something.   | 1. Review operation pattern.<br>2. Install limit switches.  |
|            |                              |   |  | UVW miswire  | 4. Wrong connection of servo motor. Servo amplifier's output terminals U, V, W do not match servo motor's input terminals U, V, W. | Connect correctly.  |
|            |                              |   |  | PLG trouble  | 5. Encoder faulty.   | Change the servo motor.   |
|            |                              |   |  | <p style="text-align: center;">— Checking method —</p> <p>When the servo motor shaft is rotated slowly with the servo off, the cumulative feedback pulses should vary in proportion to the rotary angle. If the indication skips or returns midway, the encoder is faulty.</p> |  |   |

## 12. TROUBLESHOOTING

| Indication   | Name               | Definition   | Parameter Unit Screen Display          |                            | Cause   | Action  |
|--|--------------------|--|--|----------------------------|---|---|
|  |                    |  | Current Alarm<br>(name and definition) | Alarm Occurrence<br>Factor |   |   |
| AL51   | Over load 2        | Machine collision or the like caused max. output current to flow successively for several seconds. Servo motor locked:<br>1s or more | Over load 2                            | Machine locked             | 1. Machine struck something.  | 1. Review operation pattern.<br>2. Install limit switches.  |
|  |                    |  |  | UVW miswire                | 2. Wrong connection of servo motor. Servo amplifier's output terminals U, V, W do not match servo motor's input terminals U, V, W.  | Connect correctly.  |
|  |                    |  |  | Mot. Vibrat. by unstabl    | 3. Servo system is instable and hunting.  | 1. Repeat acceleration/ deceleration to execute auto tuning.<br>2. Change auto tuning response setting.<br>3. Set auto tuning to OFF and make gain adjustment manually. |
|  |                    |  |  | Dc-bus low                 | 4. The bus voltage of the unit has decreased.   | Change the controller.  |
|  |                    |  |  | PLG trouble                | 5. Encoder faulty.<br><br><div style="border: 1px solid black; padding: 5px; width: fit-content;">                     Checking method<br/>                     When the servo motor shaft is rotated slowly with the servo off, the cumulative feedback pulses should vary in proportion to the rotary angle. If the indication skips or returns midway, the encoder is faulty.                 </div> | Change the servo motor.   |
| AL52   | Error excessive    | Droop pulse value of the deviation counter exceeded 80k pulses.  | Error excessive                        | Acc. time-c shortage       | 1. Acceleration/deceleration time constant is too small.  | Increase the acceleration/deceleration time constant.   |
|  |                    |  |  | Start torque missing       | 2. Torque limit value (parameter No.40) is too small.   | Increase the torque limit value.  |
|  |                    |  |  |                            | 3. Motor cannot be started due to torque shortage caused by power supply voltage drop.  | 1. Review the power supply capacity.<br>2. Use servo motor which provides larger output.  |
|  |                    |  |  | Pr. 7 shortage             | 4. Position control gain I (parameter No.7) value is small.   | Increase set value and adjust to ensure proper operation.   |
|  |                    |  |  | Machine locked             | 5. The bus voltage of the unit due to the breakdown.  | Change controller.  |
|  |                    |  |  | Rotated by ext. force      | 6. Servo motor shaft was rotated by external force.   | 1. When torque is limited, increase the limit value.<br>2. Reduce load.<br>3. Use servo motor that provides larger output.  |
|  |                    |  |  | DC-bus low                 | 7. Machine struck something.  | 1. Review operation pattern.<br>2. install limit switches.  |
|  |                    |  |  | PLG trouble                | 8. Encoder faulty.  | Change the servo motor  |
| 9. Wrong connection of servo motor. Servo amplifier's output terminals U, V, W do not match servo motor's input terminals U, V, W. | Connect correctly. |  |  |                            |   |   |

## 12. TROUBLESHOOTING

| Indication | Name                            | Definition   | Parameter Unit Screen Display          |                              | Cause   | Action                                  |
|------------|---------------------------------|--|--|------------------------------|---|---|
|            |                                 |  | Current Alarm<br>(name and definition) | Alarm Occurrence<br>Factor   |   |   |
| AL73       | Auxiliary pulse frequency alarm | Input pulse frequency of manual pulse generator connected to option card is too high.  | OpRef.fer                              | Op. board AUX pulse exceeded | Pulse input command frequency exceeded 600kpps.                   | Use at 600keeps or less.                |
| AL74       | Option memory alarm 1           | Option card RAM fault  | OpMemo. er 1                           | Op. board error              | MR-H-D01 option card faulty.                                      | Change the option card.                 |
| AL75       | Option memory alarm 2           | Option card EEPROM fault   | OpMemo. er 1                           | Op. board error              |   |   |
| AL8E       | RS-232C alarm                   | Serial communication error occurred between controller and communication device (parameter unit, personal computer or similar device). | RS232 err                              | RS232 comm. error            | 1. Encoder cable faulty. (write breakage or short)                | Repair or change the cable.             |
|            |                                 |  |  |                              | 2. Telecommunications equipment faulty.                           | Change the telecommunication equipment. |
| AL8F       | RS-422 alarm                    | Serial communication error occurred between controller and communication device (parameter unit, personal computer or similar device). | RS422 err                              | RS422 comm. error            | 1. The connection is defective with the external digital display. | Wiring is repaired.                     |
|            |                                 |  |  |                              | 2. External digital display faulty.                               | Change the external digital display.    |

## 12. TROUBLESHOOTING

### 12.2.3 Remedies for warnings

If the warning that occurred is other than AL E6, and AL E9, operation can be continued but proper operation may not be performed. Occurrence of any other warning will result in a servo off status.

Eliminate the cause of the warning according to this section. Use the operation parameter unit to refer to the cause of warning.

| Indication | Name                   | Definition   | Parameter Unit Screen Display          |  | Cause   | Action  |
|------------|------------------------|--|--|--|---|---|
|            |                        |  | Current Alarm<br>(name and definition) | Alarm Occurrence<br>Factor                 |   |   |
| AL90       | Zero setting error     | In incremental system:<br>1. Positioning operation was performed without zeroing.<br>2. Zeroing ended abnormally.  | ZERO set er                            | ORG return missetting                      | 1. Positioning operation was performed without zeroing.<br>2. Zeroing speed could not be reduced to creep speed.<br>3. Limit switch was actuated due to zeroing made from other than the position beyond the dog. | 1. Perform zeroing.<br>2. Reconsider zeroing speed/creep speed. |
|            |                        | In absolute position detection system<br>1. Positioning operation was performed without home position setting.<br>2. Home position setting ended abnormally. |  |  |   |   |
| AL96       | Zero setting error     | 1. In incremental system: Zeroing could not be made.<br>2. In absolute position detection system: Zero setting could not be made.                            | ZERO set er                            | Ref. P input after CR on Out of inposition | Droop pulses remaining are greater than the in-position range setting.  | Remove the cause of droop pulse occurrence                      |
| AL9A       | Digital switch warning | Setting is defective of the clock. digital switch MR-DS60.   | Dig.SW err                             | Dig. SW minus feed                         | 1.Minus setting was entered for an incremental command.<br>2.+ and - sign commands were entered at the same time.   | Set parameter correctly.  |
| AL9F       | Battery warning        | Voltage of battery for absolute position detection system reduced.   | BTT volt                               | BTT voltage low                            | Battery voltage fell to 3.2V or less.   | Change the battery.   |

## 12. TROUBLESHOOTING

| Indication | Name                                | Definition   | Parameter Unit Screen Display          |                              | Cause  | Action  |
|------------|-------------------------------------|--|--|------------------------------|--|---|
|            |                                     |  | Current Alarm<br>(name and definition) | Alarm Occurrence<br>Factor   |  |   |
| ALE0       | Excessive regenerative load warning | There is a possibility that regenerative power may exceed permissible regenerative power of built-in regenerative brake resistor or regenerative brake option. | OR warning                             | Reg. Load over 85% of alarm  | Regenerative power increased to 85% or more of permissible regenerative power of built-in regenerative brake resistor or regenerative brake option.<br><br><div style="border: 1px solid black; padding: 5px; width: fit-content;">                     Checking method<br/>                     Call the status display and check regenerative load ratio.                 </div> | 1. Reduce frequency of positioning.<br>2. Change regenerative brake option for the one with larger capacity.<br>3. Reduce load. |
| ALE1       | Over load warning                   | There is a possibility that overload alarm 1 or 2 may occur.   | OL warning                             | Load over 85% of alarm       | Load increased to 85% or more of overload alarm 1 or 2 occurrence level.<br><br><div style="border: 1px solid black; padding: 5px; width: fit-content;">                     Cause, checking method<br/>                     Refer to AL 50, 51.                 </div>  | Refer to AL 50, AL 51.  |
| ALE3       | Absolute position counter warning   | Absolute position encoder pulses faulty.   | ABS warning                            | PLG trouble by noise         | 1. Noise entered the encoder.  | Take noise suppression measures.  |
|            |                                     |  |  |                              | 2. Encoder faulty.   | Change servo motor.   |
| ALE6       | Servo emergency stop                | EMG-SG are open.   | EMG stop                               | EMG off                      | External emergency stop was made valid. (EMG-SG opened.)   | Ensure safety and deactivate emergency stop.  |
| ALE9       | Main circuit off warning            | Servo was switched on with main circuit power off.   | Main P-off                             | Main power down while SON-on | /  | Switch on main circuit power.   |

### 12.2.4 RS-232C communication error

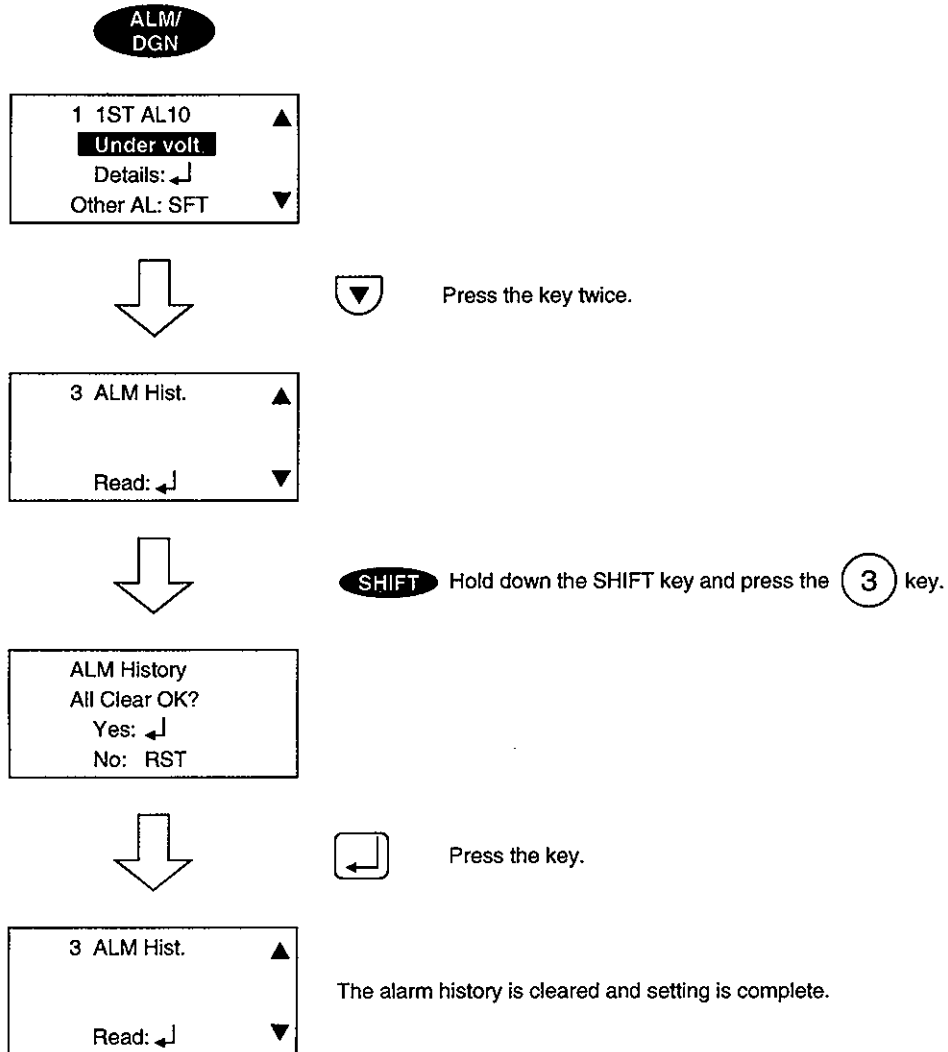
When a communication fault occurs between the controller and parameter unit, any of the following errors is displayed on the screen of the parameter unit. In this case, switch the power off, take the corresponding action, and switch the power on.

| Screen display      | Error Definition  | Cause  | Corrective Action  |
|---------------------|---|--|--|
| COMMUNICATION ERROR | A fault occurred in communication between the controller and parameter unit during servo operation. | 1. Parameter unit cable or communication cable connection fault<br>2. Parameter unit cable or communication cable open | 1. Connect properly.<br>2. Change the cable.               |
| SERVO CPU ERROR     | Communication cannot be made at power-on between the controller and parameter unit.                 | 3. Servo amplifier faulty.<br>4. Parameter unit faulty.  | 3. Change the controller.<br>4. Change the parameter unit. |
| PRU MEMORY ERROR    | Parameters cannot be copied from the controller to the parameter unit.                              | Memory (EEPROM) in the parameter unit faulty.  | Change the parameter unit.                                 |

## 12. TROUBLESHOOTING

### 12.3 Clearing the Alarm History

The parameter unit can be used to confirm an alarm history. The controller stores one current alarm and nine past alarms which occurred since it had been switched on first. Before starting operation, clear the alarm history so that you can control alarms which may occur during the operation.





# 13. SPECIFICATIONS

## 13. SPECIFICATIONS

### 13.1 Standard specifications

#### (1) Controller

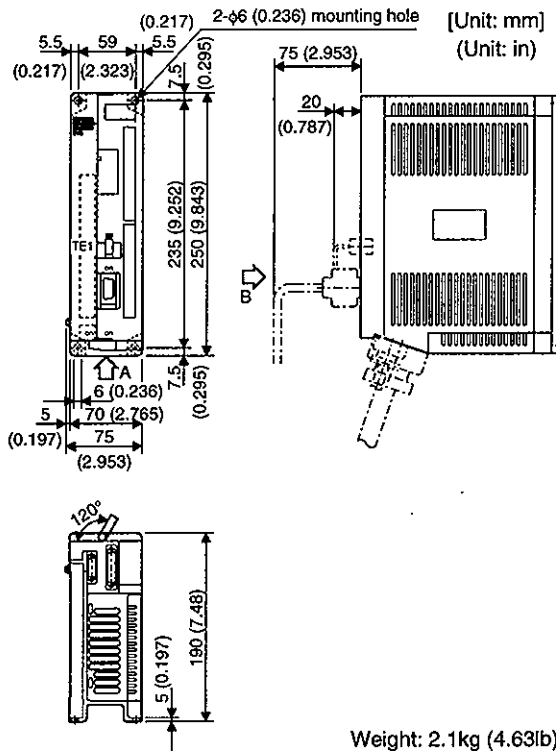
| Controller<br>MR-H□ACN                     |  | Item  |      |      |      |       |     |     |        |        |                             |        |        |                             |
|--|--|---|------|------|------|-------|-----|-----|--------|--------|-----------------------------|--------|--------|-----------------------------|
|  |  | 10  | 20   | 40   | 60   | 100   | 200 | 350 | 500    | 700    | 11K                         | 15K    | 22K    |                             |
| Power supply                               | Voltage/frequency                      | 3-phase 200 to 230VAC, 50/60Hz  |      |      |      |       |     |     |        |        | 3-phase 200 to 220VAC, 50Hz |        |        | 3-phase 200 to 230VAC, 60Hz |
|  | Permissible voltage fluctuation        | 3-phase 170 to 253VAC, 50/60Hz  |      |      |      |       |     |     |        |        | 3-phase 170 to 242VAC, 50Hz |        |        | 3-phase 170 to 253VAC, 60Hz |
|  | Permissible frequency fluctuation      | Within ±5%  |      |      |      |       |     |     |        |        |                             |        |        |                             |
|  | Power supply capacity                  | Given in Section 14.2   |      |      |      |       |     |     |        |        |                             |        |        |                             |
| System                                     |  | Sine-wave PWM control, current control system   |      |      |      |       |     |     |        |        |                             |        |        |                             |
| Dynamic brake                              |  | Built-in  |      |      |      |       |     |     |        |        | Option                      |        |        |                             |
| Protective functions                       |  | Overcurrent shut-off, regenerative overvoltage shut-off, overload shut-off (electronic thermal relay), servo motor overheat protection, encoder fault protection, regenerative fault protection, undervoltage, instantaneous power failure protection, overspeed protection, excessive error protection |      |      |      |       |     |     |        |        |                             |        |        |                             |
| Speed frequency response                   |  | 250Hz or more   |      |      |      |       |     |     |        |        |                             |        |        |                             |
| Torque limit input                         |  | 0 to ±10VDC/max. current (individual commands for forward rotation and reverse rotation, input impedance 10 to 12kΩ)  |      |      |      |       |     |     |        |        |                             |        |        |                             |
| Electronic gear                            |  | A/B times A · B:1 to 50000 1/50 < A/B < 50  |      |      |      |       |     |     |        |        |                             |        |        |                             |
| Error excessive                            |  | ±80k pulse  |      |      |      |       |     |     |        |        |                             |        |        |                             |
| Positioning system specifications          |  | Given in Section 3.1  |      |      |      |       |     |     |        |        |                             |        |        |                             |
| Roll Feeding system specifications         |  | Given in Section 4.1  |      |      |      |       |     |     |        |        |                             |        |        |                             |
| Absolute position detection specifications |  | Given in Section 3.5  |      |      |      |       |     |     |        |        |                             |        |        |                             |
| Structure                                  |  | Open (IP00)   |      |      |      |       |     |     |        |        |                             |        |        |                             |
| Environment                                | Ambient temperature                    | 0 to +55 [°C] (non-freezing)  |      |      |      |       |     |     |        |        |                             |        |        |                             |
|  |  | 32 to +131 [°F] (non-freezing)  |      |      |      |       |     |     |        |        |                             |        |        |                             |
|  | Ambient humidity                       | 90%RH or less (non-condensing)  |      |      |      |       |     |     |        |        |                             |        |        |                             |
|  | storage temperature                    | -20 to +65 [°C] (non-freezing)  |      |      |      |       |     |     |        |        |                             |        |        |                             |
|  |  | -4 to +149 [°F] (non-freezing)  |      |      |      |       |     |     |        |        |                             |        |        |                             |
|  | storage humidity                       | 90%RH or less (non-condensing)  |      |      |      |       |     |     |        |        |                             |        |        |                             |
|  | Ambient                                | Indoors (no direct sunlight)<br>Free from corrosive gas, flammable gas, oil mist, dust and dirt   |      |      |      |       |     |     |        |        |                             |        |        |                             |
|  | Altitud                                | Max. 1000m (3280ft) above sea level   |      |      |      |       |     |     |        |        |                             |        |        |                             |
| Vibration                                  | 5.9 [m/s <sup>2</sup> ] {0.6G} or less |   |      |      |      |       |     |     |        |        |                             |        |        |                             |
|  | 19.4 [ft/s <sup>2</sup> ] or less      |   |      |      |      |       |     |     |        |        |                             |        |        |                             |
| Weight                                     | [kg]                                   | 2.1   | 2.1  | 2.1  | 2.1  | 2.4   | 4.4 | 4.4 | 7.0    | 12.0   | 21                          | 27     | 30     |                             |
|  | [lb]                                   | 4.63  | 4.63 | 4.63 | 4.63 | 5.291 | 9.7 | 9.7 | 15.432 | 26.455 | 46.297                      | 59.525 | 66.139 |                             |

# 13. SPECIFICATIONS

## 13.2 Outline Dimensional Drawings

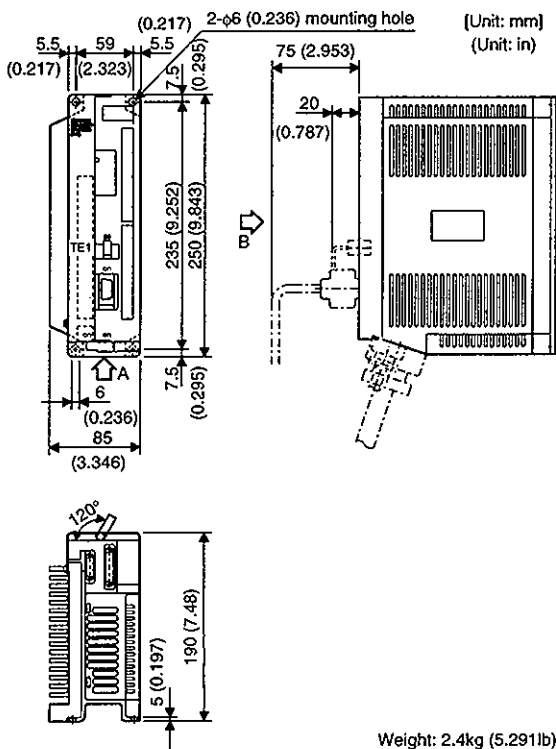
### 13.2.1 Controllers

#### MR-H10ACN(-UE) to MR-H60ACN(-UE)



| Terminal block TE1  |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
|---|--------------------|---|---|---|---|---|----|----|---|---|---|---|---|---|---|---|----|----|----|-----|-----|---|---|---|--------|
| MR-H□ACN  | MR-H□ACN-UE        |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| Terminal screw: M4  | Terminal screw: M4 |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| <table border="1"> <tr><td>P</td></tr> <tr><td>C</td></tr> <tr><td>N</td></tr> <tr><td>R</td></tr> <tr><td>S</td></tr> <tr><td>T</td></tr> <tr><td>R1</td></tr> <tr><td>S1</td></tr> <tr><td>U</td></tr> <tr><td>V</td></tr> <tr><td>W</td></tr> <tr><td>⊥</td></tr> </table> | P                  | C | N | R | S | T | R1 | S1 | U | V | W | ⊥ | <table border="1"> <tr><td>P</td></tr> <tr><td>C</td></tr> <tr><td>N</td></tr> <tr><td>L1</td></tr> <tr><td>L2</td></tr> <tr><td>L3</td></tr> <tr><td>L11</td></tr> <tr><td>L21</td></tr> <tr><td>U</td></tr> <tr><td>V</td></tr> <tr><td>W</td></tr> <tr><td>(Note)</td></tr> </table> <p>Chassis</p> <p>Note: Keep it open.</p> | P | C | N | L1 | L2 | L3 | L11 | L21 | U | V | W | (Note) |
| P   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| C   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| N   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| R   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| S   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| T   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| R1  |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| S1  |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| U   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| V   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| W   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| ⊥   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| P   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| C   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| N   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| L1  |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| L2  |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| L3  |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| L11   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| L21   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| U   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| V   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| W   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| (Note)  |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |

#### MR-H100ACN(-UE)

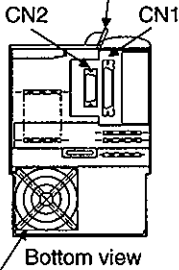
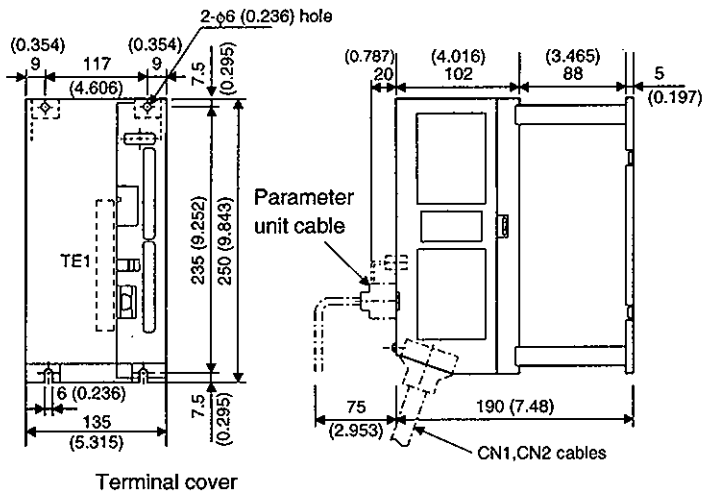


| Terminal block TE1  |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
|---|--------------------|---|---|---|---|---|----|----|---|---|---|---|---|---|---|---|----|----|----|-----|-----|---|---|---|--------|
| MR-H□ACN  | MR-H□ACN-UE        |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| Terminal screw: M4  | Terminal screw: M4 |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| <table border="1"> <tr><td>P</td></tr> <tr><td>C</td></tr> <tr><td>N</td></tr> <tr><td>R</td></tr> <tr><td>S</td></tr> <tr><td>T</td></tr> <tr><td>R1</td></tr> <tr><td>S1</td></tr> <tr><td>U</td></tr> <tr><td>V</td></tr> <tr><td>W</td></tr> <tr><td>⊥</td></tr> </table> | P                  | C | N | R | S | T | R1 | S1 | U | V | W | ⊥ | <table border="1"> <tr><td>P</td></tr> <tr><td>C</td></tr> <tr><td>N</td></tr> <tr><td>L1</td></tr> <tr><td>L2</td></tr> <tr><td>L3</td></tr> <tr><td>L11</td></tr> <tr><td>L21</td></tr> <tr><td>U</td></tr> <tr><td>V</td></tr> <tr><td>W</td></tr> <tr><td>(Note)</td></tr> </table> <p>Chassis</p> <p>Note: Keep it open.</p> | P | C | N | L1 | L2 | L3 | L11 | L21 | U | V | W | (Note) |
| P   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| C   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| N   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| R   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| S   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| T   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| R1  |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| S1  |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| U   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| V   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| W   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| ⊥   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| P   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| C   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| N   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| L1  |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| L2  |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| L3  |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| L11   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| L21   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| U   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| V   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| W   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| (Note)  |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |

# 13. SPECIFICATIONS

MR-H200ACN(-UE) · MR-H350ACN(-UE)

[Unit: mm]  
[Unit: in]

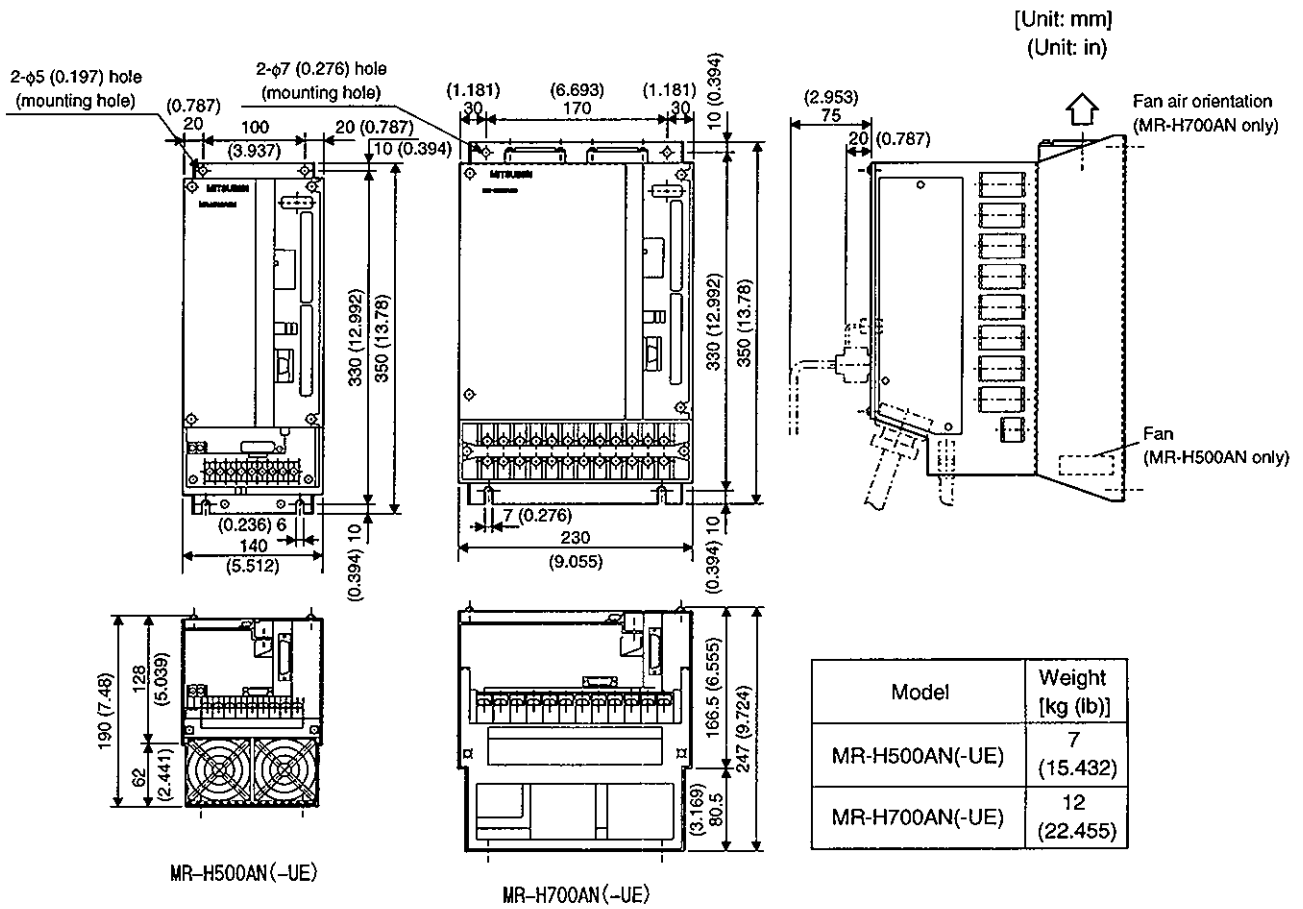


Weight: 4.4kg (9.7lb)

| Terminal block TE1  |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
|---|--------------------|---|---|---|---|---|----|----|---|---|---|---|---|---|---|---|----|----|----|-----|-----|---|---|---|--------|
| MR-H□ACN  | MR-H□ACN-UE        |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| Terminal screw: M4  | Terminal screw: M4 |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| <table border="1"> <tr><td>P</td></tr> <tr><td>C</td></tr> <tr><td>N</td></tr> <tr><td>R</td></tr> <tr><td>S</td></tr> <tr><td>T</td></tr> <tr><td>R1</td></tr> <tr><td>S1</td></tr> <tr><td>U</td></tr> <tr><td>V</td></tr> <tr><td>W</td></tr> <tr><td>⊥</td></tr> </table> | P                  | C | N | R | S | T | R1 | S1 | U | V | W | ⊥ | <table border="1"> <tr><td>P</td></tr> <tr><td>C</td></tr> <tr><td>N</td></tr> <tr><td>L1</td></tr> <tr><td>L2</td></tr> <tr><td>L3</td></tr> <tr><td>L11</td></tr> <tr><td>L21</td></tr> <tr><td>U</td></tr> <tr><td>V</td></tr> <tr><td>W</td></tr> <tr><td>(Note)</td></tr> </table> <p>Chassis</p> <p>Note: Keep it open.</p> | P | C | N | L1 | L2 | L3 | L11 | L21 | U | V | W | (Note) |
| P   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| C   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| N   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| R   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| S   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| T   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| R1  |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| S1  |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| U   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| V   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| W   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| ⊥   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| P   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| C   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| N   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| L1  |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| L2  |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| L3  |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| L11   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| L21   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| U   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| V   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| W   |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |
| (Note)  |                    |   |   |   |   |   |    |    |   |   |   |   |   |   |   |   |    |    |    |     |     |   |   |   |        |

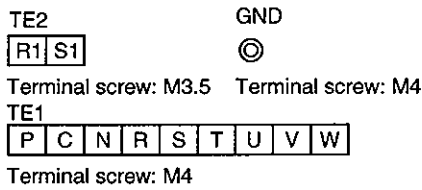
# 13. SPECIFICATIONS

## MR-H500ACN(-UE) · MR-H700ACN(-UE)

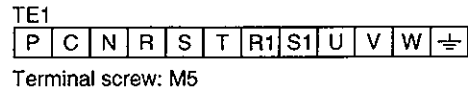


### Terminal block signal arrangement

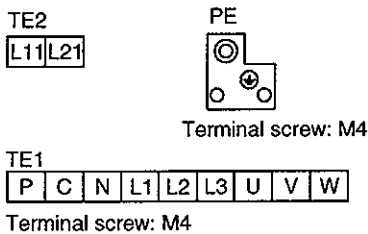
#### • MR-H500ACN



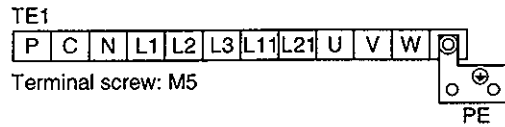
#### • MR-H700ACN



#### • MR-H500ACN-UE

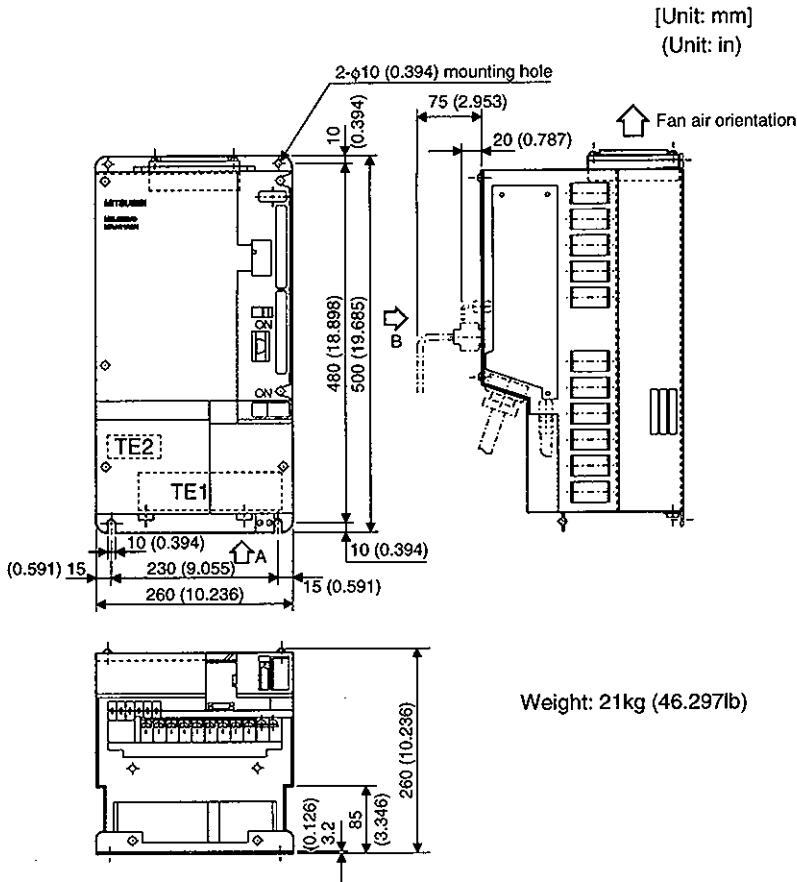


#### • MR-H700ACN-UE



# 13. SPECIFICATIONS

## MR-H11KACN(-UE)



### Terminal block signal arrangement

#### • MR-H11KACN

TE2

|    |    |     |     |
|----|----|-----|-----|
| R1 | S1 | MS1 | MS2 |
|----|----|-----|-----|

Terminal screw: M4

TE1

|   |   |   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|
| R | S | T | U | V | W | P | C | N | ⊕ |
|---|---|---|---|---|---|---|---|---|---|

Terminal screw: M5

#### • MR-H11KACN-UE

TE2

|    |    |     |     |
|----|----|-----|-----|
| L1 | L2 | MS1 | MS2 |
|----|----|-----|-----|

Terminal screw: M4

TE1

|    |    |    |   |   |   |   |   |   |   |
|----|----|----|---|---|---|---|---|---|---|
| L1 | L2 | L3 | U | V | W | P | C | N | ⊕ |
|----|----|----|---|---|---|---|---|---|---|

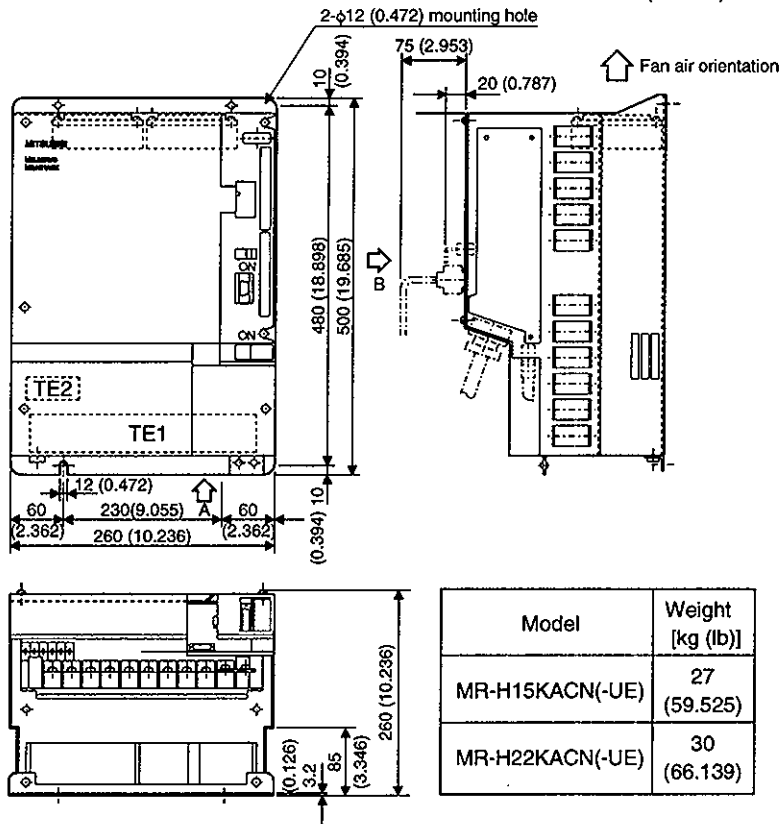
Terminal screw: M5



# 13. SPECIFICATIONS

MR-H15KACN(-UE) · MR-H22KACN(-UE)

[Unit: mm]  
[Unit: in]

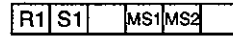


| Model           | Weight [kg (lb)] |
|-----------------|------------------|
| MR-H15KACN(-UE) | 27 (59.525)      |
| MR-H22KACN(-UE) | 30 (66.139)      |

Terminal block signal arrangement

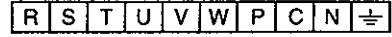
• MR-H15KACN · MR-H22KACN

TE2



Terminal screw: M4

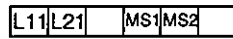
TE1



Terminal screw: M6(MR-H15KAN)  
M8(MR-H22KAN)

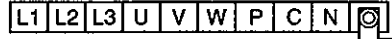
• MR-H15KACN-UE · MR-H22KACN-UE

TE2



Terminal screw: M4

TE1



Terminal screw: M6(MR-H15KAN)  
M8(MR-H22KAN)

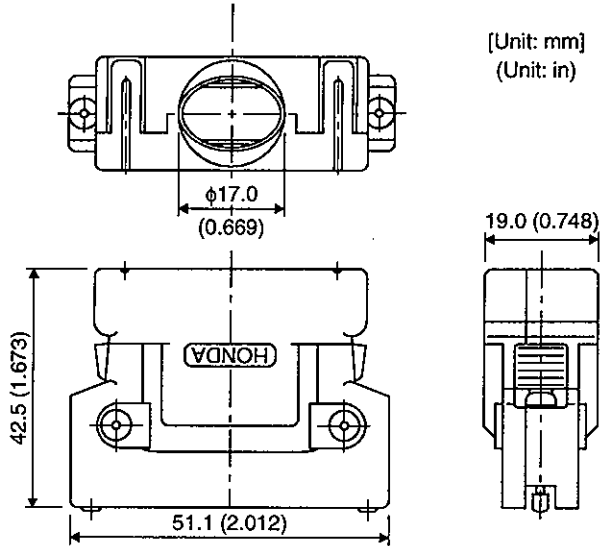


## 13. SPECIFICATIONS

### 13.2.2 Connectors

#### (1) Controller side connector

<Honda Tsushin Kogyo make>

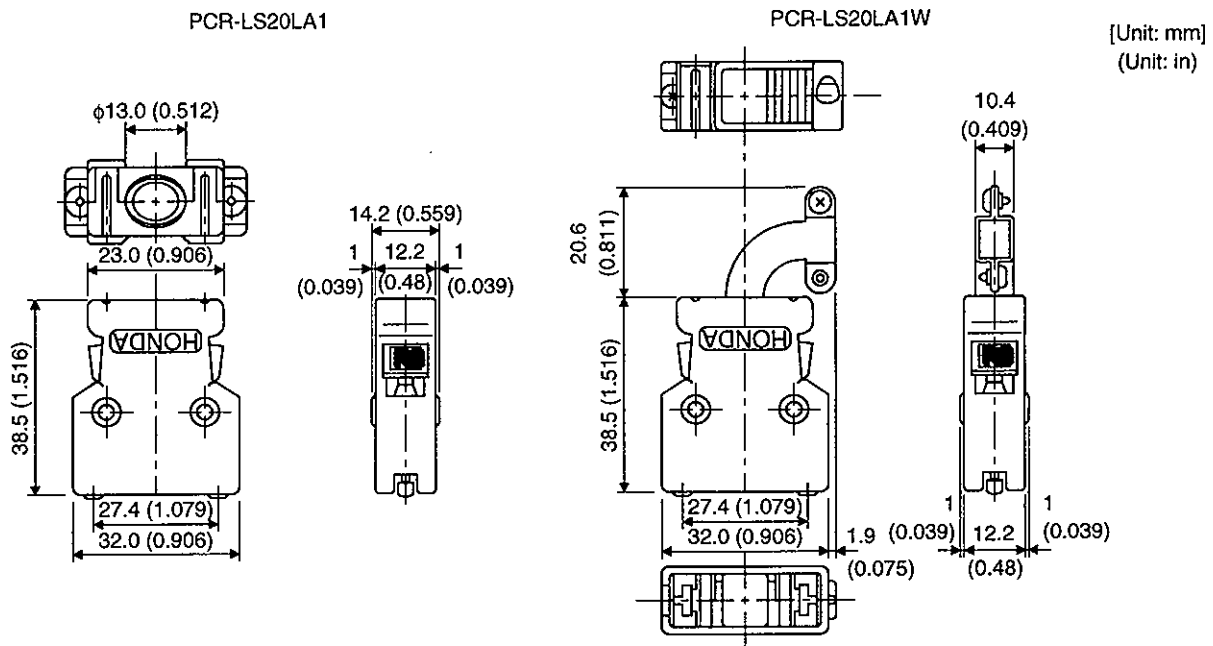


| Number of Pins | Model                                   |             |
|----------------|---|-------------|
|                | Connector                               | Case        |
| 50             | PCR-S50FS (soldering type)              | PCR-LS50LA1 |
|                | PCR-S50F (insulation displacement type) |             |

Crimping terminal: FHAT-002A

Note: PCR-S50F is not an option and is to be supplied by the customer.

# 13. SPECIFICATIONS



[Unit: mm]  
[Unit: in]

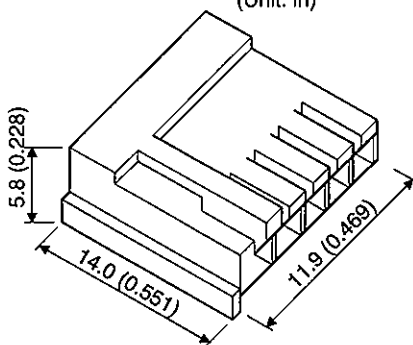
| Number of Pins | Model                                   |              |
|----------------|---|--------------|
|                | Connector                               | Case         |
| 50             | PCR-S20FS (soldering type)              | PCR-LS20LA1  |
|                | PCR-S20F (insulation displacement type) | PCR-LS20LA1W |

Crimping terminal: FHAT-002A

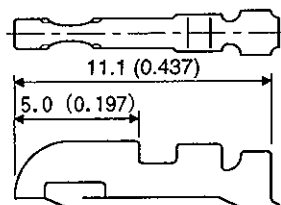
Note: PCR-S20F and PCR-LS20LA1W are not options and are to be supplied by the customer.

<Nippon AMP make>

- Housing Model: 171822-4  
[Unit: mm]  
(Unit: in)



- Contactor Model: 170262-2 (chain type)  
170204-2 (loose type)  
[Unit: mm]  
(Unit: in)



Applicable wire range  
AWG: 30-26  
(0.05 to 0.15mm<sup>2</sup>)  
Contactor caulking hand tool  
Model: 722561-1

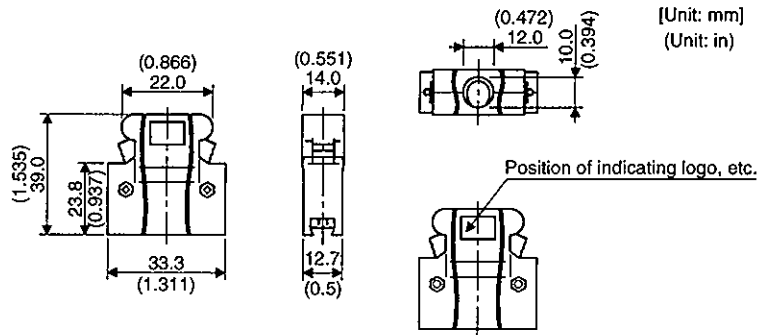


### 13. SPECIFICATIONS

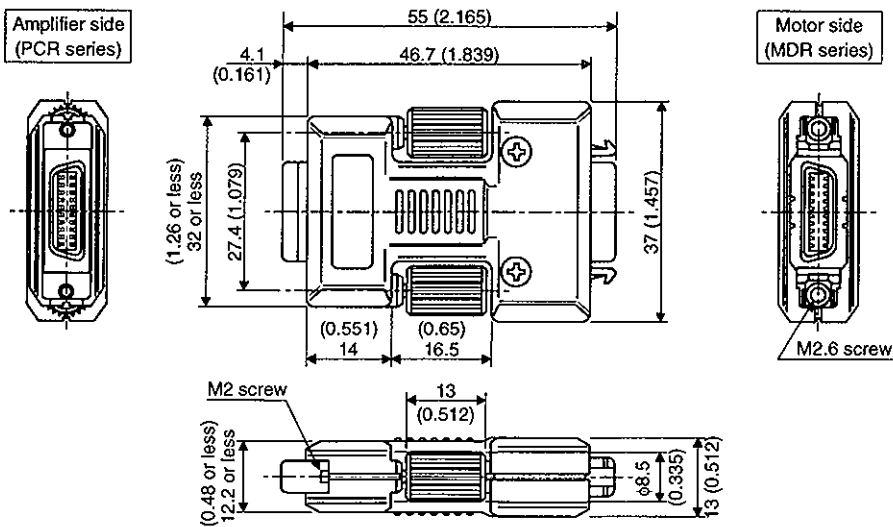
#### (2) Connector for conversion connector

Signal connector

<Sumitomo Three M make>



#### (3) MR-HCN2 conversion connector



# 14. CHARACTERISTICS

## 14. CHARACTERISTICS

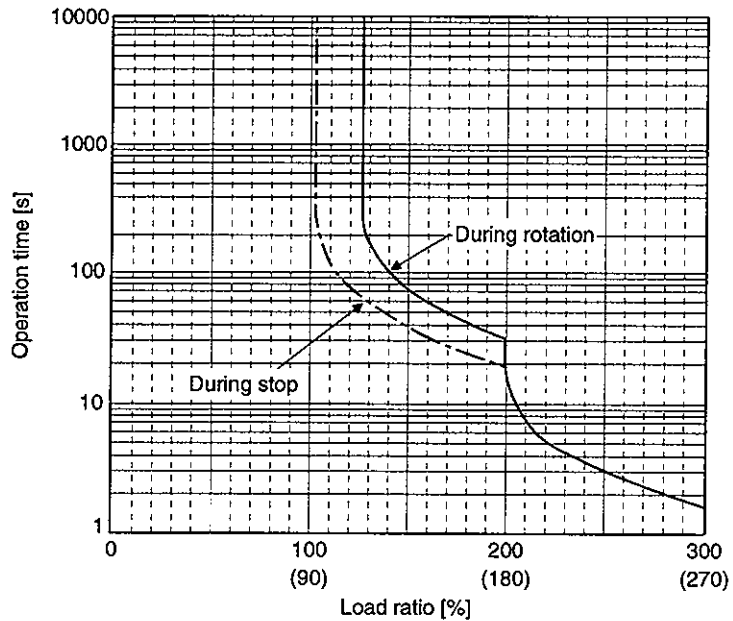
### 14.1 Overload Protection Characteristics

An electronic thermal relay is built in the controller to protect the servo motor and controller from overloads. The operation characteristics of the electronic thermal relay are shown below. Overload 1 alarm (AL50) occurs if overload operation performed is above the electronic thermal relay protection curve shown below. Overload 2 alarm (AL51) occurs if the maximum current flew continuously for several seconds due to machine collision, etc. Use the equipment on the left-hand side area of the continuous or broken line in the graph.

If load is applied at a stop (during servo lock), 70% of the rated torque must not be exceeded.

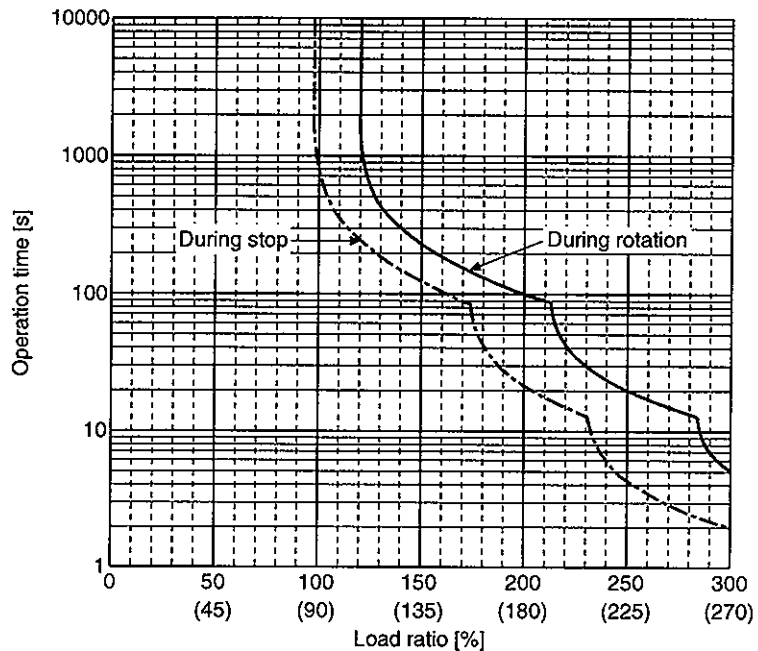
HA-LH serie  
(11kW or more)

Note: Values within parentheses  
in the graph are those in  
the low acoustic noise mode.



HC-MF serie  
HC-SF serie  
HC-RF serie  
HC-UF serie

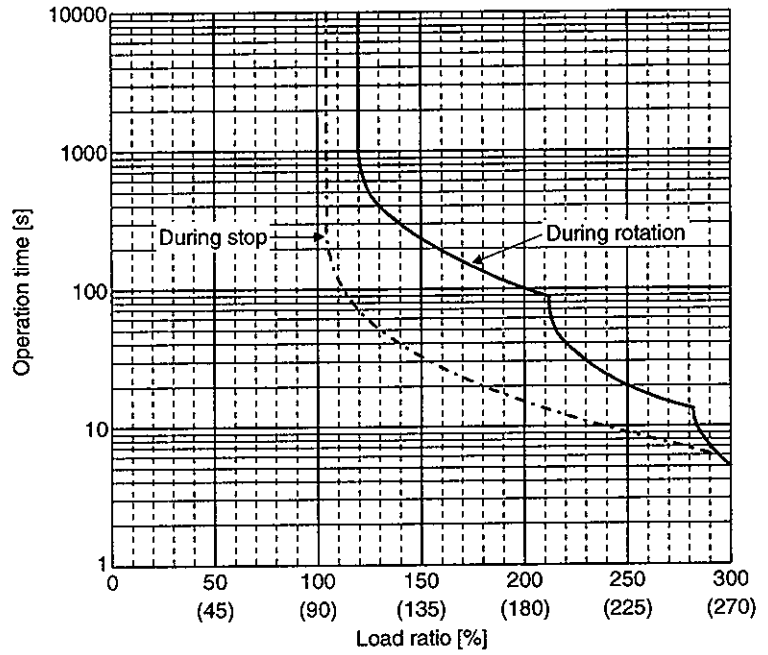
Note: Values within parentheses  
in the graph are those in  
the low acoustic noise mode.



# 14. CHARACTERISTICS

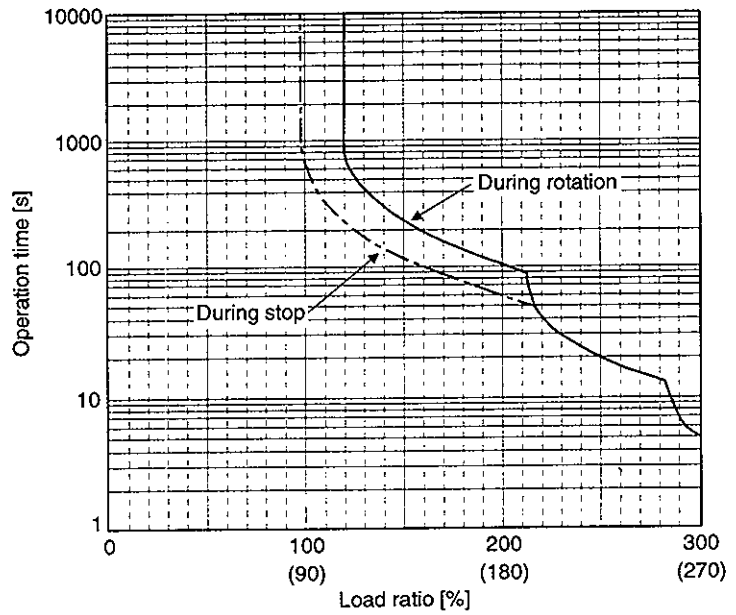
HC-FF serie  
(200W or less)

Note: Values within parentheses in the graph are those in the low acoustic noise mode.



HC-FF serie  
(300W or more)

Note: Values within parentheses in the graph are those in the low acoustic noise mode.



## 14. CHARACTERISTICS

### 14.2 Power Supply Equipment Capacity and Generated Loss

#### (1) Amount of heat generated by the controller

Table 14.1 indicates controllers' power supply capacities and losses generated under rated load. For thermal design of an enclosure, use the values in Table 14.1 in consideration for the worst operating conditions. The actual amount of generated heat will be intermediate between values at rated torque and zero torque according to the duty used during operation. When the servo motor is run at less than the maximum speed, the power supply capacity will be smaller than the value in the table, but the controller's generated heat will not change.

Table 14.1 Power Supply Capacity and Generated Heat Per Controller at Rated Output

| Controller | Servo Motor          | Power Supply Capacity [kVA] | Controller-Generated Heat [W] |                | Area Required for Heat Dissipation |                    |
|------------|----------------------|-----------------------------|-------------------------------|----------------|------------------------------------|--------------------|
|            |                      |                             | At rated torque               | With servo off | [m <sup>2</sup> ]                  | [ft <sup>2</sup> ] |
| MR-H10ACN  | HA-FF053 · 13        | 0.3                         | 40                            | 30             | 0.8                                | 8.6                |
|            | HC-UF13              | 0.3                         | 40                            | 30             | 0.8                                | 8.6                |
| MR-H20ACN  | HA-MF053 · 13        | 0.3                         | 40                            | 30             | 0.8                                | 8.6                |
|            | HA-FF23              | 0.5                         | 40                            | 30             | 0.8                                | 8.6                |
| MR-H40ACN  | HC-MF23              | 0.5                         | 40                            | 30             | 0.8                                | 8.6                |
|            | HA-FF33              | 0.7                         | 50                            | 30             | 0.9                                | 9.7                |
|            | HA-FF43              | 0.9                         | 50                            | 30             | 0.9                                | 9.7                |
|            | HC-UF23              | 0.5                         | 40                            | 30             | 0.8                                | 8.6                |
| MR-H60ACN  | HC-MF43              | 0.9                         | 55                            | 30             | 1.0                                | 10.8               |
|            | HA-FF63              | 1.1                         | 55                            | 30             | 1.0                                | 10.8               |
|            | HA-SF52 · 53         | 1.0                         | 55                            | 30             | 1.0                                | 10.8               |
|            | HC-UF43              | 0.9                         | 55                            | 30             | 1.0                                | 10.8               |
| MR-H100ACN | HC-MF73              | 1.3                         | 65                            | 30             | 1.2                                | 12.9               |
|            | HC-SF81              | 1.5                         | 65                            | 30             | 1.2                                | 12.9               |
|            | HC-SF102 · 103       | 1.7                         | 65                            | 30             | 1.2                                | 12.9               |
|            | HC-UF72 · 73         | 1.3                         | 65                            | 30             | 1.2                                | 12.9               |
| MR-H200ACN | HC-SF121             | 2.1                         | 105                           | 35             | 2.0                                | 21.5               |
|            | HC-SF152 · 153       | 2.5                         | 105                           | 35             | 2.0                                | 21.5               |
|            | HC-SF201 · 202 · 203 | 3.5                         | 105                           | 35             | 2.0                                | 21.5               |
|            | HC-RF103             | 1.7                         | 105                           | 35             | 2.0                                | 21.5               |
|            | HC-RF153             | 2.5                         | 105                           | 35             | 2.0                                | 21.5               |
|            | HC-UF152             | 2.5                         | 105                           | 35             | 2.0                                | 21.5               |
| MR-H350ACN | HC-SF301             | 4.8                         | 145                           | 35             | 2.7                                | 29.1               |
|            | HC-SF352 · 353       | 5.5                         | 145                           | 35             | 2.7                                | 29.1               |
|            | HC-RF203             | 3.5                         | 135                           | 35             | 2.5                                | 26.9               |
|            | HC-UF202             | 3.5                         | 145                           | 35             | 2.7                                | 29.1               |
| MR-H500ACN | HC-SF502             | 7.5                         | 210                           | 40             | 4.0                                | 43.1               |
|            | HC-RF353             | 5.5                         | 145                           | 35             | 2.7                                | 29.1               |
|            | HC-RF503             | 7.5                         | 210                           | 40             | 4.0                                | 43.1               |
|            | HC-UF352             | 5.5                         | 210                           | 40             | 4.0                                | 43.1               |
|            | HC-UF502             | 7.5                         | 210                           | 40             | 4.0                                | 43.1               |
| MR-H700ACN | HC-SF702             | 10.0                        | 320                           | 45             | 6.0                                | 64.6               |
| MR-H11KACN | HA-LH11K2            | 16                          | 540                           | 57             | 10.0                               | 107.6              |
| MR-H15KACN | HA-LH15K2            | 22                          | 660                           | 68             | 13.0                               | 139.9              |
| MR-H22KACN | HA-LH22K2            | 33                          | 870                           | 82             | 16.0                               | 172.2              |

Note: 1. Sufficient heat-related capacity (kVA) values are indicated in Table for the power supply. However, since instantaneous power 2 to 2.5 times higher than the rated will be required for servo motor acceleration, use a power supply with small voltage fluctuation which will provide the voltage within the permissible voltage fluctuation at the terminals of the controller.

Note that the power supply capacity will vary according to the power supply impedance.

2. Refer to Table for the current capacity of the power supply.
3. When using multi-axes, add the power capacity per axis.
4. Heat generated during regeneration is not included in the controller-generated heat. To calculate heat generated by the regenerative brake option, use Equation 15.1 in Section 15.1.2.

## 14. CHARACTERISTICS

### (2) Heat dissipation area for enclosed controller

An enclosure or control box for the controller should be designed to operate at the ambient temperature of 40°C (104°F) within a temperature rise of 10°C (50°F). (With a 5°C (41°F) safety margin, the system should operate within a maximum 55°C (131°F) limit.) The necessary enclosure heat dissipation area can be calculated by Equation 14.1:

$$A = \frac{P}{K \cdot \Delta T} \dots\dots\dots (14.1)$$

where, A : Heat dissipation area [m<sup>2</sup>]

P : Loss generated in the control box [W]

ΔT : Difference between internal and ambient temperatures [°C]

K : Heat dissipation coefficient [5 to 6]

When calculating the heat dissipation area with Equation 14.1, assume that P is the sum of all losses generated in the enclosure. Refer to Table 14.1 for heat generated by the controller. "A" indicates the effective area for heat dissipation, but if the enclosure is directly installed on an insulated wall, that extra amount must be added to the enclosure's surface area.

The required heat dissipation area will vary with the conditions in the enclosure. If convection in the enclosure is poor and heat builds up, effective heat dissipation will not be possible. Therefore, arrangement of the equipment in the enclosure and the use of a fan should be considered.

Table 14.1 lists the enclosure dissipation area for each controller when the controller is operated at the ambient temperature of 40°C (104°F) under rated load.

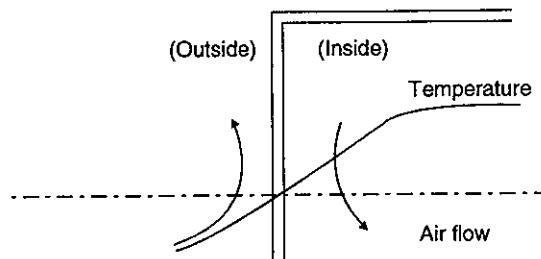


Fig. 14.1 Temperature Distribution in Enclosure

When air flows along the outer wall of the enclosure, effective heat exchange will be possible, because the temperature slope inside and outside the enclosure will be steeper.

### (3) Fitting of the controller (MR-H200ACN or more)

When mounted with the heat sink outside mounting attachment (option), the controller can dissipate generated loss directly to the outside of a control box. This method can reduce the heat dissipation area of the control box since 45 to 55% of the generated loss given in Table 14.1 is dissipated to the outside of the enclosure. For details of the heat sink outside mounting attachment, refer to Section 15.1.9.

# 14. CHARACTERISTICS

## 14.3 Dynamic Brake Characteristics

When an alarm, emergency stop or power failure occurs, the dynamic brake is operated to bring the servo motor to a sudden stop. Fig. 14.2 shows the pattern in which the servo motor comes to a stop when the dynamic brake is operated. Use Equation 14.2 to calculate an approximate coasting distance to a stop. The dynamic brake time constant  $t$  varies with the servo motor and machine operation speeds. (Refer to Fig. 14.3 and Table 14.5.)

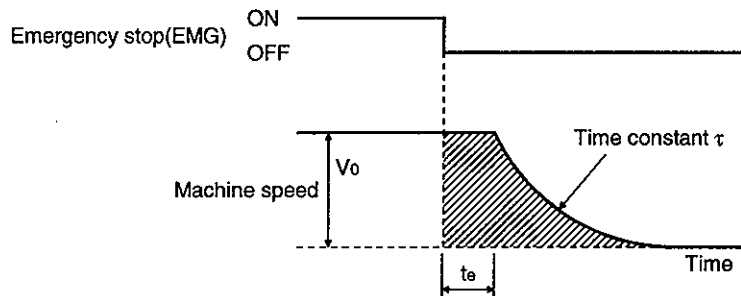
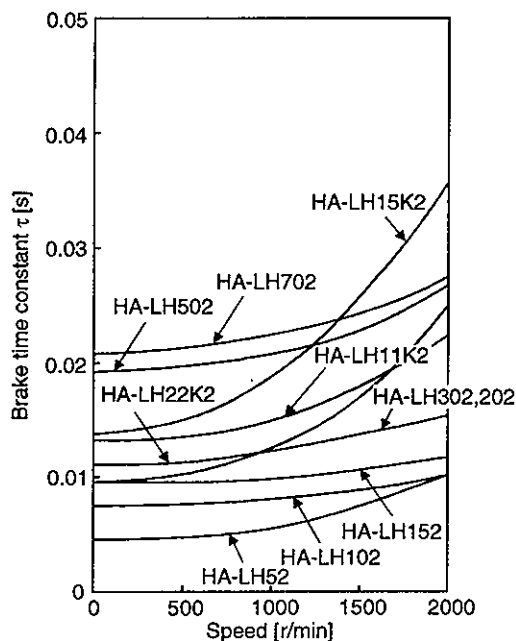


Fig. 14.2 Dynamic Brake Operation Diagram

$$L_{max} = \frac{V_0}{60} \cdot \left\{ t_e + \tau \left[ 1 + \frac{J_L}{J_M} \right] \right\} \dots \dots \dots (14.2)$$

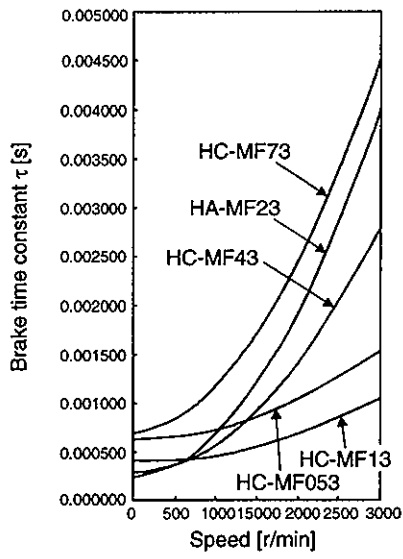
- $L_{max}$  : Maximum coasting distance ..... [mm][in]
  - $V_0$  : Machine rapid feedrate ..... [mm/min][in/min]
  - $J_M$  : Servo motor inertial moment ..... [kg · cm<sup>2</sup>][oz · in<sup>2</sup>]
  - $J_L$  : Load inertia moment converted into equivalent value on servo motor shaft ..... [kg · cm<sup>2</sup>][oz · in<sup>2</sup>]
  - $\tau$  : Brake time constant (Fig. 14.3 · Table 14.4) ..... [s]
  - $t_e$  : Delay time of control section (Fig. 14.2) ..... [s]
- (There is internal relay delay time of about 30ms.)



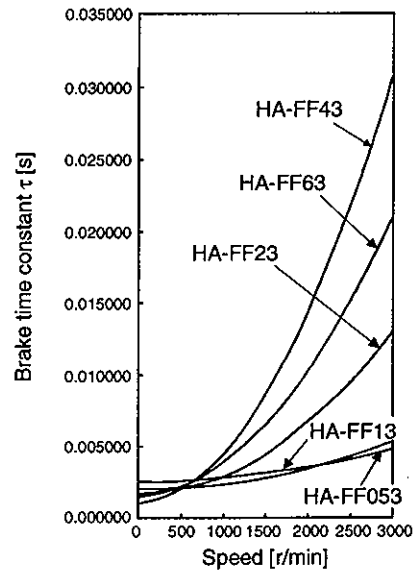
a. HA-LH Series

Fig. 14.3 Dynamic Brake Time Constant 1

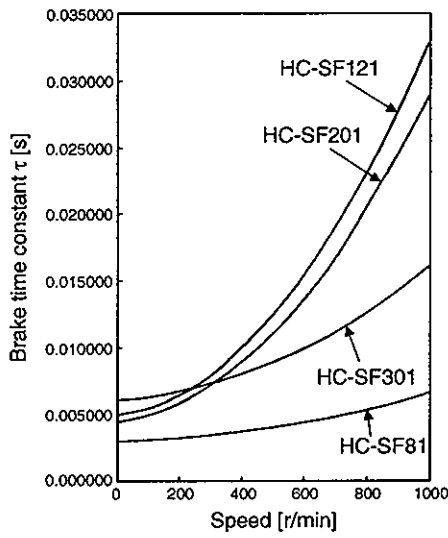
# 14. CHARACTERISTICS



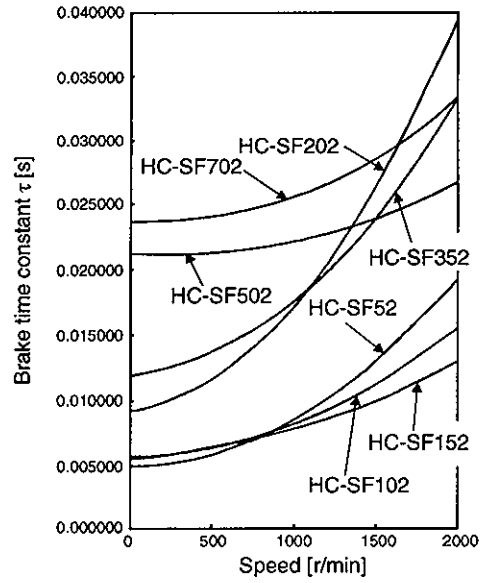
b. HC-MF Series



c. HA-FF Series



d. HC-SF1000r/min Series



e. HC-SF2000r/min Series

Fig. 14.4 Dynamic Brake Time Constant 2

## 14. CHARACTERISTICS

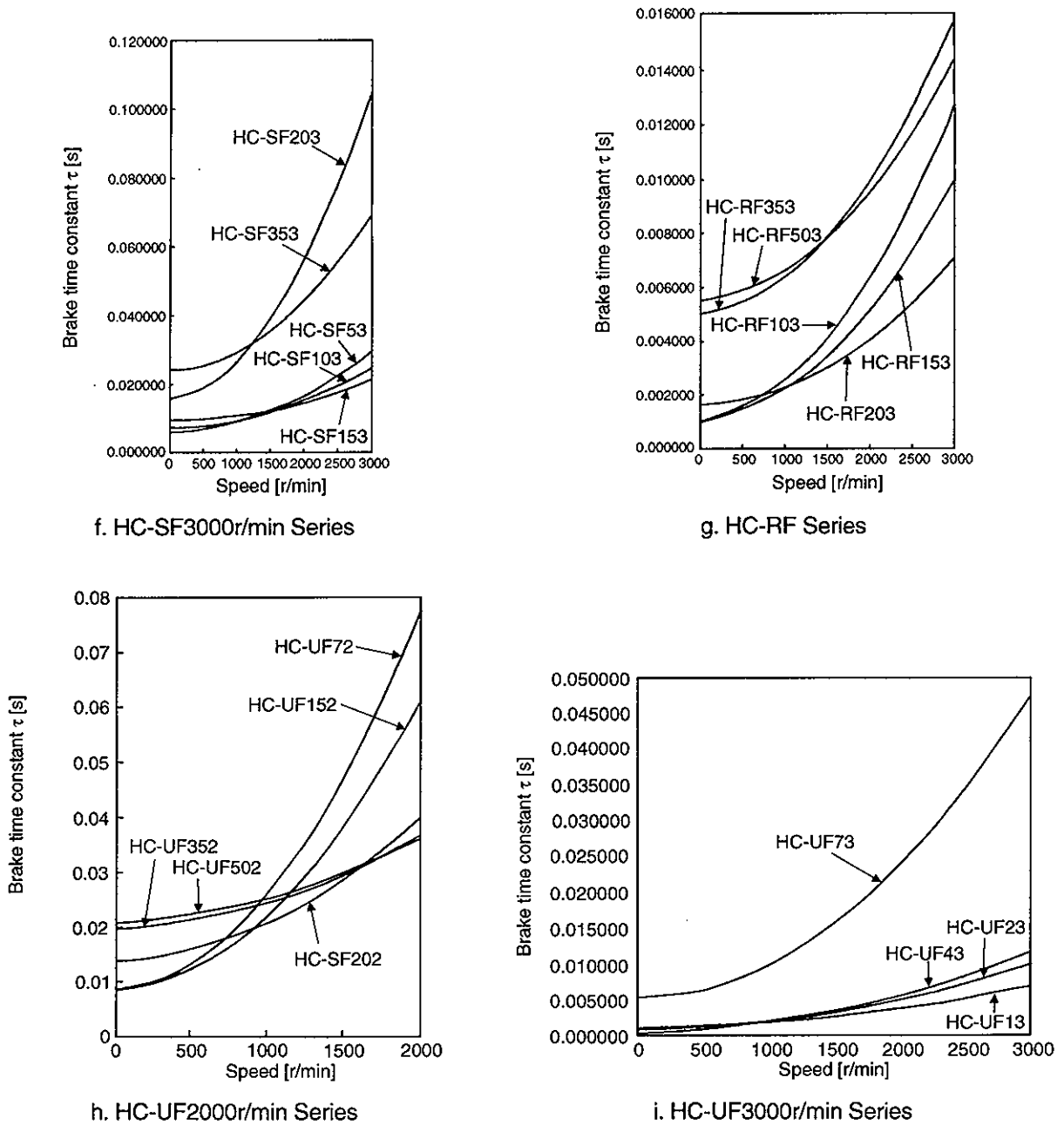


Fig. 14.5 Dynamic Brake Time Constant 3

[Dynamic brake's permissible load inertia moment]

If the dynamic brake is operated at the load inertia moment above the corresponding value indicated in the following list, the brake resistor in the controller (external brake resistor for 11kW or more) may burn out. If the value is exceeded, contact us.

| Controller               | JL/JM           |
|--------------------------|-----------------|
| MR-H10ACN to MR-H100ACN  | 30 times        |
| MR-H200ACN               | 20 times        |
| MR-H350ACN to MR-H700ACN | 10 times (Note) |
| MR-H11KACN to MR-H22KACN | 30 times        |

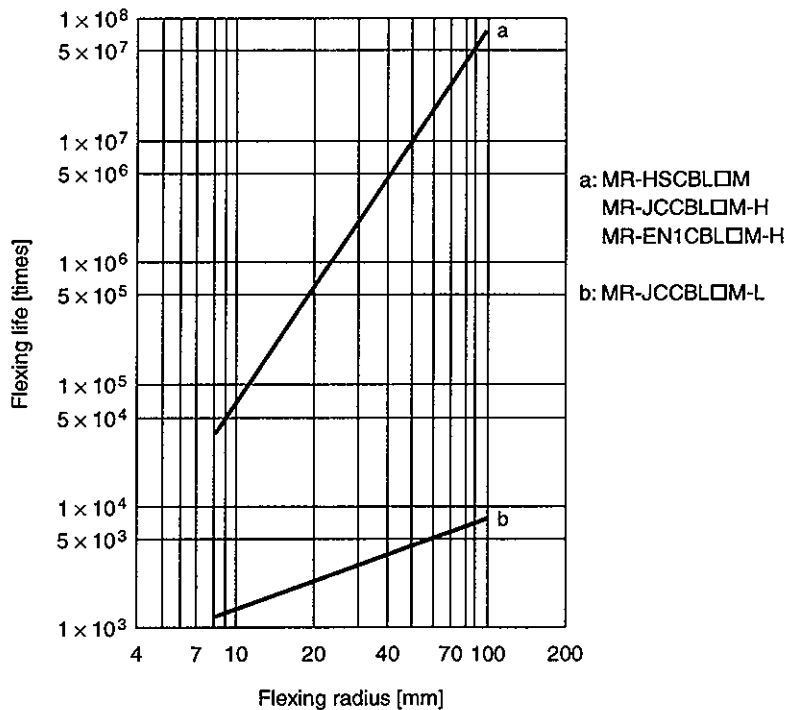
Note: 15 times for the HC-SF series.



## 14. CHARACTERISTICS


### 14.4 Encoder Cable Flexing Life


The flexing life of the cables is shown below. The flexing life of the cables is shown below. This graph gives calculated values. Since they are not guaranteed values, provide a little allowance for values.



# 15. OPTIONS AND AUXILIARY EQUIPMENT

## 15. OPTIONS AND AUXILIARY EQUIPMENT

|  |  |
|--|--|
|  <b>WARNING</b> | <ul style="list-style-type: none"> <li>• Before connecting any option or auxiliary equipment, make sure that the charge lamp is off more than 10 minutes after power-off, then confirm the voltage with a tester or the like. Otherwise, you may get an electric shock.</li> </ul> |
|--|--|

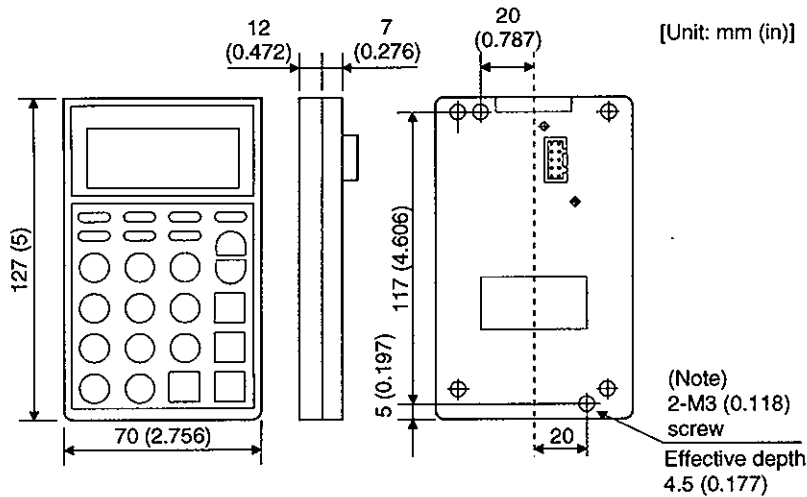
|  |  |
|--|--|
|  <b>CAUTION</b> | <ul style="list-style-type: none"> <li>• Use the specified auxiliary equipment and options. Unspecified ones may lead to a fault or fire.</li> </ul> |
|--|--|

### 15.1 Options

#### 15.1.1 Parameter unit

One parameter unit (MR-PRU01A) is required to use the MR-H-ACN. It displays parameter settings, test operation and alarms. Use it with the parameter unit cable (MR-PRUCBL□M).

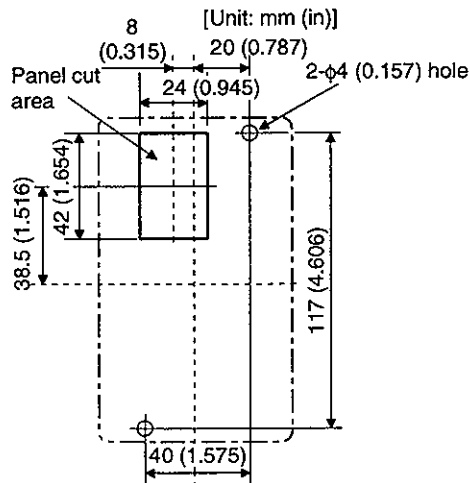
#### (1) Outline drawing



Note: The length of the mounting screw selected should not exceed the effective depth of the parameter unit mounting screw.

#### (2) Panel cutting dimensions

The following dimensions assume that the parameter unit is installed on a panel or the like.



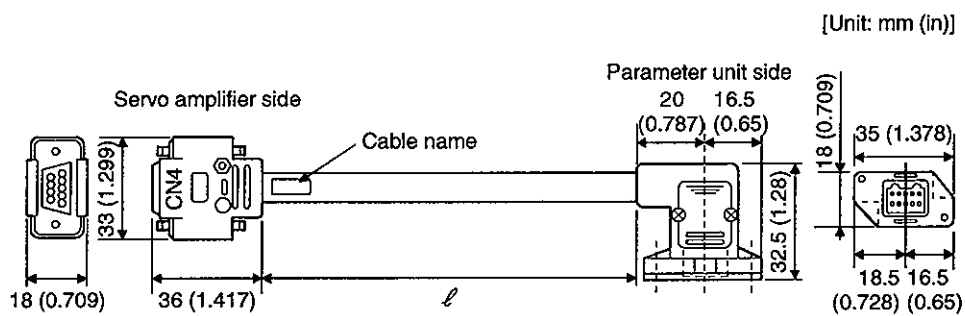
## 15. OPTIONS AND AUXILIARY EQUIPMENT

### (3) Parameter unit cable

Used for connection of the parameter unit and MR-H-ACN.

Model: MR-PRUCBL□M

| Symbol | Cable Length [m (ft)] |
|--------|-----------------------|
| 1      | 1 (3.281)             |
| 3      | 3 (9.843)             |
| 5      | 5 (16.404)            |



## 15. OPTIONS AND AUXILIARY EQUIPMENT

### 15.1.2 Regenerative brake options



#### CAUTION

- The specified combinations of regenerative brake options and controllers may only be used. Otherwise, a fire may occur.

#### (1) Combination and regenerative power

The regenerative power values listed below are not the permissible power values of the resistors.

| Controller | Regenerative Power [W]               |                   |                   |                  |                  |                         |
|------------|--------------------------------------|-------------------|-------------------|------------------|------------------|-------------------------|
|            | Built-in Regenerative Brake Resistor | MR-RB013<br>[52Ω] | MR-RB033<br>[52Ω] | MR-RB32<br>[40Ω] | MR-RB34<br>[26Ω] | (Note) MR-RB54<br>[26Ω] |
| MR-H10ACN  | None                                 | 10                | 30                |                  |                  |                         |
| MR-H20ACN  | None                                 | 10                | 30                |                  |                  |                         |
| MR-H40ACN  | 50                                   |                   |                   | 300              |                  |                         |
| MR-H60ACN  | 50                                   |                   |                   | 300              |                  |                         |
| MR-H100ACN | 80                                   |                   |                   | 300              |                  |                         |
| MR-H200ACN | 80                                   |                   |                   |                  | 300              | 500                     |

Note: Always install a cooling fan.

| Controller | Regenerative Power [W]               |                  |                   |                  |                          |
|------------|--------------------------------------|------------------|-------------------|------------------|--------------------------|
|            | Built-in Regenerative Brake Resistor | MR-RB30<br>[13Ω] | MR-RB31<br>[6.7Ω] | MR-RB50<br>[13Ω] | (Note) MR-RB51<br>[6.7Ω] |
| MR-H350ACN | 130                                  | 300              |                   | 500              |                          |
| MR-H500ACN | 130                                  | 300              |                   | 500              |                          |
| MR-H700ACN | 170                                  |                  | 300               |                  | 500                      |

Note: Always install a cooling fan.

| Controller | Regenerative Power [W]                                  |                 |                 |                 |
|------------|---|-----------------|-----------------|-----------------|
|            | (Note) External Regenerative Brake Resistor (Accessory) | MR-RB65<br>[8Ω] | MR-RB66<br>[5Ω] | MR-RB67<br>[4Ω] |
| MR-H11KACN | 500 (800)   | 500 (800)       |                 |                 |
| MR-H15KACN | 850 (1300)  |                 | 850 (1300)      |                 |
| MR-H22KACN | 850 (1300)  |                 |                 | 850 (1300)      |

Note: Values in parentheses assume the installation of a cooling fan.

#### (2) Selection of the regenerative brake option

##### (a) Simple selection method

In horizontal motion applications, select the regenerative brake option as described below:

When the servo motor is run without load in the regenerative mode from the running speed to a stop, the permissible duty is as indicated in Section 5.1 of the separately available Servo Motor Instruction Manual. For the servo motor with a load, the permissible duty changes according to the inertia moment of the load and can be calculated by the following formula:

$$\text{Permissible duty} = \frac{\text{permissible duty for servo motor with no load (value indicated in Section 5.1 of the Servo Motor Instruction Manual)}}{(m+1)} \times \left( \frac{\text{rated speed}}{\text{running speed}} \right)^2 \text{ [times/min]}$$

where m = load inertia moment/servo motor inertia moment

From the permissible duty, find whether the regenerative brake option is required or not.

Permissible duty < number of positioning times [times/min]

Select the regenerative brake option out of the combinations in (1) in this section.

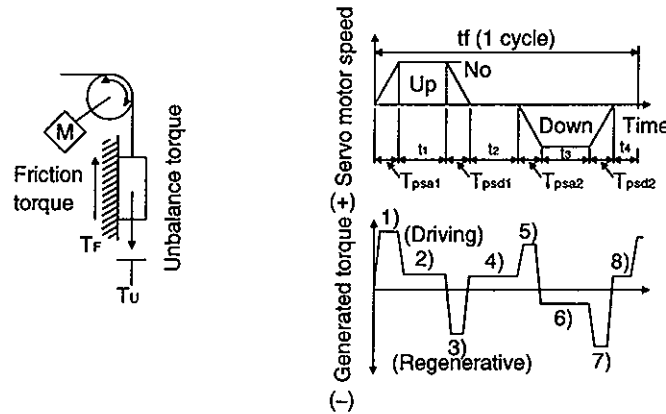
## 15. OPTIONS AND AUXILIARY EQUIPMENT

(b) To make selection according to regenerative energy

Use the following method when regeneration occurs continuously in vertical motion applications or when it is desired to make an in-depth selection of the regenerative brake option:

1) Regenerative energy calculation

Use the following table to calculate the regenerative energy.



Formulas for Calculating Torque and Energy in Operation

| Regenerative Power                 | Torque Applied To Servo Motor [N □ m]   | Energy [J]  |
|------------------------------------|---|---|
| 1)                                 | $T_1 = \frac{(J_L + J_M) \cdot N_o}{9.55 \times 10^4} \cdot \frac{1}{T_{Psa1}} + T_U + T_F$ | $E_1 = \frac{0.1047}{2} \cdot N_o \cdot T_1 \cdot T_{Psa1}$ |
| 2)                                 | $T_2 = T_U + T_F$   | $E_2 = 0.1047 \cdot N_o \cdot T_2 \cdot t_1$                |
| 3)                                 | $T_3 = \frac{(J_L + J_M) \cdot N_o}{9.55 \times 10^4} \cdot \frac{1}{T_{Psd1}} + T_U + T_F$ | $E_3 = \frac{0.1047}{2} \cdot N_o \cdot T_3 \cdot T_{Psd1}$ |
| 4), 8)                             | $T_4 = T_U$   | $E_4 \geq 0$ (No regeneration)                              |
| 5)                                 | $T_5 = \frac{(J_L + J_M) \cdot N_o}{9.55 \times 10^4} \cdot \frac{1}{T_{Psa2}} - T_U + T_F$ | $E_5 = \frac{0.1047}{2} \cdot N_o \cdot T_5 \cdot T_{Psa2}$ |
| 6)                                 | $T_6 = T_U + T_F$   | $E_6 = 0.1047 \cdot N_o \cdot T_6 \cdot t_3$                |
| 7)                                 | $T_7 = \frac{(J_L + J_M) \cdot N_o}{9.55 \times 10^4} \cdot \frac{1}{T_{Psd2}} - T_U + T_F$ | $E_7 = \frac{0.1047}{2} \cdot N_o \cdot T_7 \cdot T_{Psd2}$ |
| Sum total of regenerative energies |   | Sum total of negative energies in 1) to 8)                  |

2) Losses of servo motor and controller in regenerative mode

The following table lists the efficiencies and other data of the servo motor and controller in the regenerative mode.

| Controller | Inverse Efficiency [%] | Capacitor Charging [J] |
|------------|------------------------|------------------------|
| MR-H10ACN  | 55                     | 9                      |
| MR-H20ACN  | 70                     | 9                      |
| MR-H40ACN  | 85                     | 9                      |
| MR-H60ACN  | 85                     | 9                      |
| MR-H100ACN | 80                     | 15                     |
| MR-H200ACN | 85                     | 25                     |

| Controller | Inverse Efficiency [%] | Capacitor Charging [J] |
|------------|------------------------|------------------------|
| MR-H350ACN | 90                     | 30                     |
| MR-H500ACN | 90                     | 45                     |
| MR-H700ACN | 90                     | 70                     |
| MR-H11KACN | 90                     | 120                    |
| MR-H15KACN | 90                     | 180                    |
| MR-H22KACN | 90                     | 250                    |

Inverse efficiency ( $\eta$ ) :Efficiency including some efficiencies of the servo motor and controller when rated (regenerative) torque is generated at rated speed. Since the efficiency varies with the speed and generated torque, allow for about 10%.

Capacitor charging ( $E_c$ ):Energy charged into the electrolytic capacitor in the controller.

## 15. OPTIONS AND AUXILIARY EQUIPMENT

Subtract the capacitor charging from the result of multiplying the sum total of regenerative energies by the inverse efficiency to calculate the energy consumed by the regenerative brake option.

$$ER [J] = \eta \cdot E_s - E_c$$

Calculate the power consumption of the regenerative brake option on the basis of single-cycle operation period  $t_f$  [s] to select the necessary regenerative brake option.

$$PR [W] = ER/t_f \dots\dots\dots (13.1)$$

### (3) Parameter setting

When using the regenerative brake option, set parameter No.2 according to the regenerative brake option used.

Parameter No. 2



Regenerative brake option selection

0: Set 0 when the servo amplifier of less than 11kW capacity has no external option or when the servo amplifier of 11kW or more uses the supplied regenerative brake resistor or regenerative brake option

1:FR-RC,FR-BU model brake unit

2:MR-RB013

3:MR-RB033

5:MR-RB32

6:MR-RB34

7:MR-RB54

8:MR-RB30

9:MR-RB50

B:MR-RB31

C:MR-RB51

E: When the servo amplifier is 11kW or more and the supplied regenerative brake resistor or regenerative brake option is cooled by a fan to increase its capability

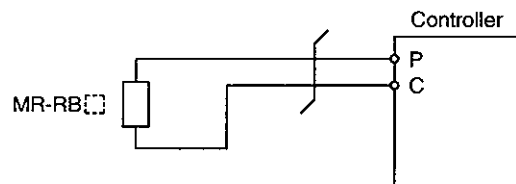
### (4) Connection of the regenerative brake option

The regenerative brake option will generate heat of about 100°C. Fully examine heat dissipation, installation position, used cables, etc. before installing the option. For wiring, use fire-retarding cables and keep them clear of the regenerative brake option body.

Always use twisted cables of max. 5m (16.404ft) length for connection with the controller.

#### (a) MR-H10ACN · MR-H20ACN

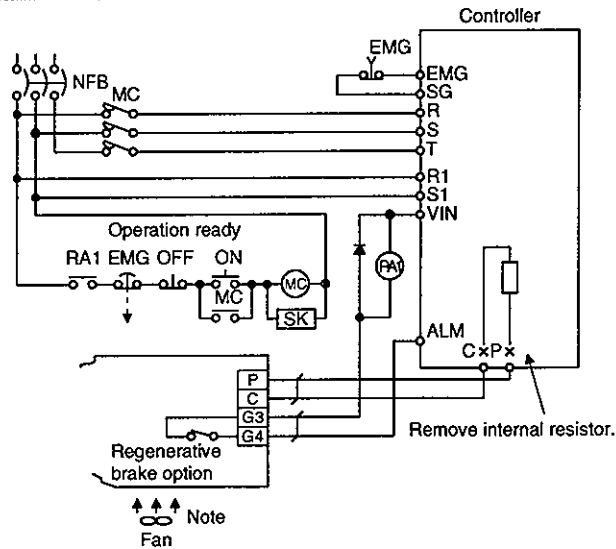
This controller does not have the built-in regenerative brake resistor.



## 15. OPTIONS AND AUXILIARY EQUIPMENT

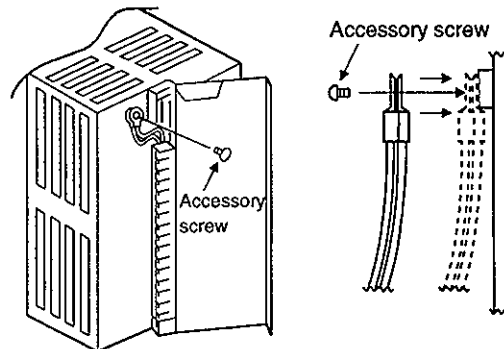
### (b) MR-H40ACN to MR-H700ACN

When any of the MR-RB50 to MR-RB54 is used, the regenerative brake option must be forcibly cooled by the cooling fan.

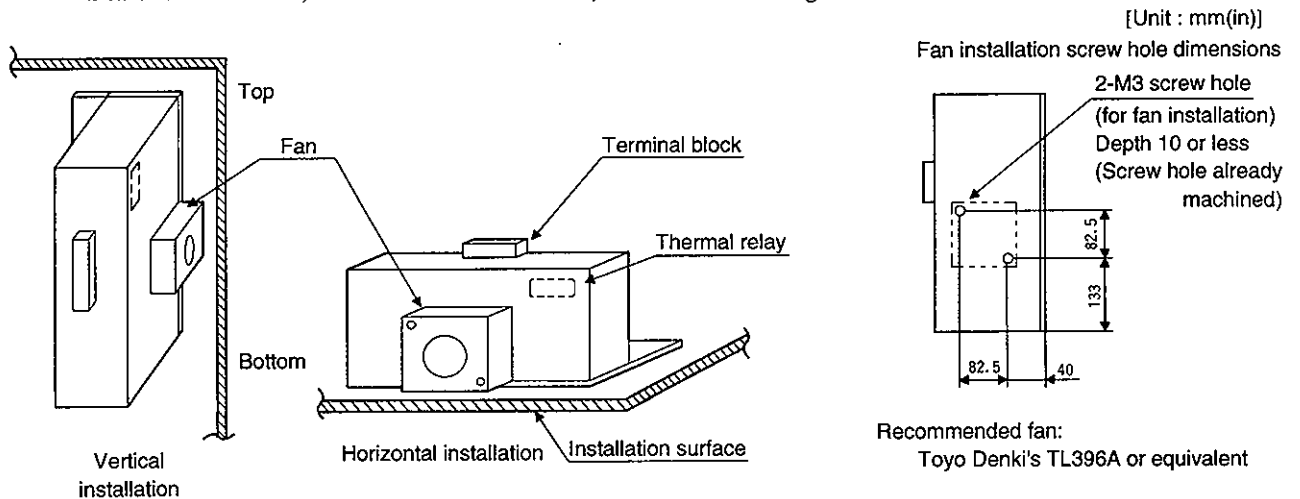


Note: When the MR-RB50 is used, cool it forcibly by the cooling fan (1.0m<sup>2</sup>/min, about □92).

When the regenerative brake option is used, disconnect the cables from the regenerative brake resistor terminals (across C-P) in the controller and fix them to the area provided at the opposite side on the front cover as shown in the figure below.



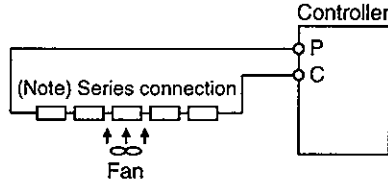
For the MR-RB50, MR-RB51 or MR-RB54, install the cooling fan as shown.



## 15. OPTIONS AND AUXILIARY EQUIPMENT

### (C) MR-H11KACN to MR-H22KACN (when using the supplied regenerative brake resistor)

When using the regenerative brake resistors supplied to the controller, the specified number of resistors (4 or 5 resistors) must be connected in series. If they are connected in parallel or in less than the specified number, the controller may become faulty and/or the regenerative brake resistors burn. Install the resistors at intervals of about 70mm. Cool the resistors with fans to increase the regenerative capability.

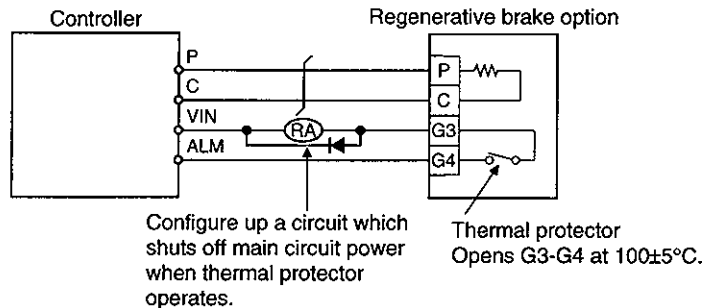


Note: The number of resistors connected in series depends on the resistor type.

| Controller | Regenerative Brake Resistor | Regenerative Power (W) |      | Resistance ( $\Omega$ ) | Number Of Resistors |
|------------|-----------------------------|------------------------|------|-------------------------|---------------------|
| MR-H11KACN | GRZG400-2 $\Omega$          | 600                    | 800  | 8                       | 4                   |
| MR-H15KACN | GRZG400-1 $\Omega$          | 600                    | 1300 | 5                       | 5                   |
| MR-H22KACN | GRZG400-0.8 $\Omega$        | 600                    | 1300 | 4                       | 5                   |

### (D) MR-H11KACN-P90 to MR-H22KACN-P90 (when using the regenerative brake option)

Cooling the regenerative brake option with fans improves regenerative capability.

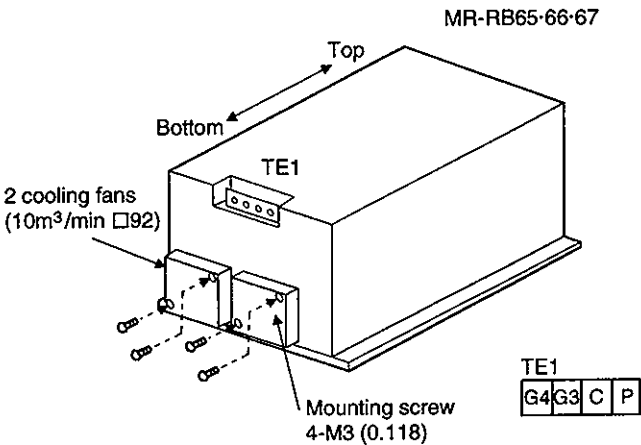


| Controller | Regenerative Brake Option Model | Resistor ( $\Omega$ ) | (Note) Regenerative Power |           |
|------------|---------------------------------|-----------------------|---------------------------|-----------|
|            |                                 |                       | Without Fans              | With Fans |
| MR-H11KACN | MR-RB65                         | 8                     | 500                       | 800       |
| MR-H15KACN | MR-RB66                         | 5                     | 850                       | 1300      |
| MR-H22KACN | MR-RB67                         | 4                     | 850                       | 1300      |

When using fans, install them using the mounting holes provided in the bottom of the regenerative brake option.



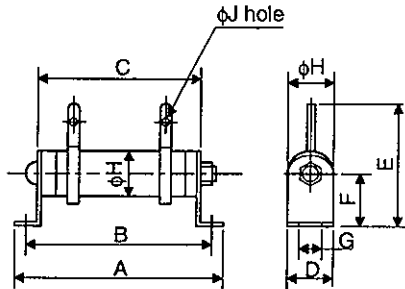
15. OPTIONS AND AUXILIARY EQUIPMENT



# 15. OPTIONS AND AUXILIARY EQUIPMENT

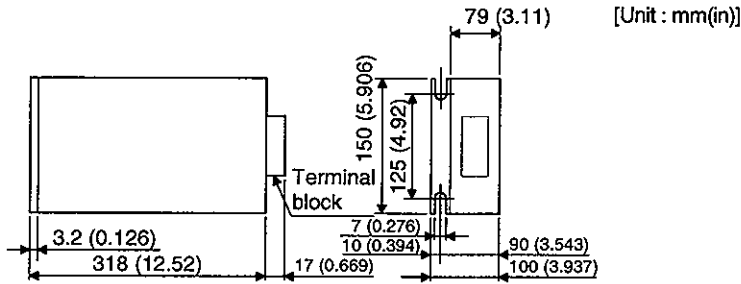
## (5) Outline dimension drawings

MR-RB013 · MR-RB033



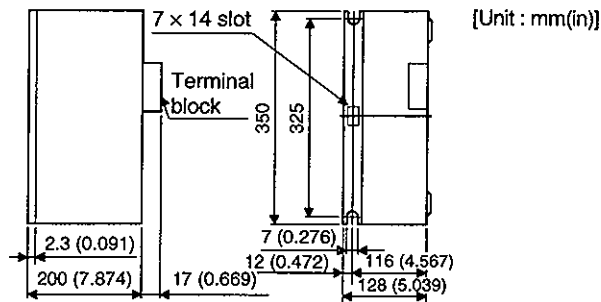
| Regenerative Brake Option | Variable Dimensions [mm(in)] |                |                |               |               |               |                |               |                | Weight [kg(lb)] |
|---------------------------|------------------------------|----------------|----------------|---------------|---------------|---------------|----------------|---------------|----------------|-----------------|
|                           | A                            | B              | C              | D             | E             | F             | G              | H             | J              |                 |
| MR-RB013                  | 110<br>(4.331)               | 101<br>(3.979) | 85<br>(3.346)  | 18<br>(0.709) | 35<br>(1.378) | 16<br>(0.63)  | 4.5<br>(0.177) | 18<br>(0.709) | 3.2<br>(0.126) | 0.1<br>(0.22)   |
| MR-RB033                  | 192<br>(7.559)               | 173<br>(6.811) | 152<br>(5.984) | 26<br>(1.024) | 54<br>(2.126) | 22<br>(0.866) | 6<br>(0.236)   | 26<br>(1.024) | 3.2<br>(0.126) | 0.2<br>(0.441)  |

MR-RB30 · MR-RB31 · MR-RB32 · MR-RB34



| Regenerative Brake Option | Weight [kg(lb)] |
|---------------------------|-----------------|
| MR-RB30                   | 2.9<br>(6.393)  |
| MR-RB31                   |                 |
| MR-RB32                   |                 |
| MR-RB34                   |                 |

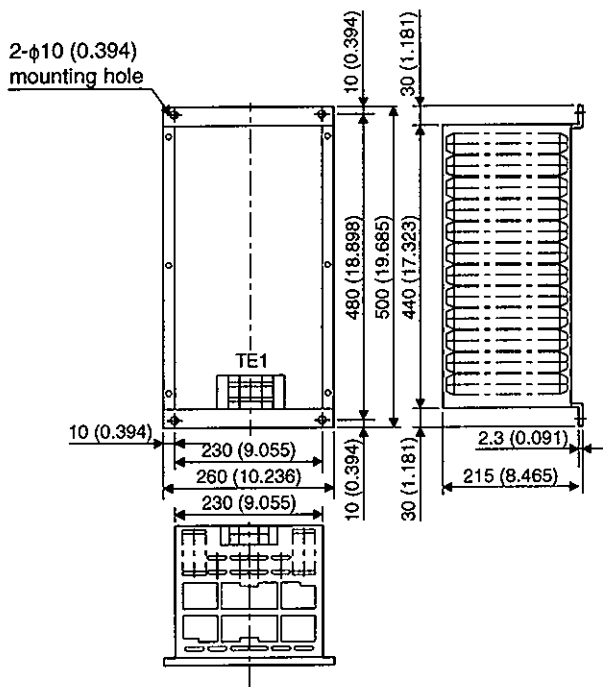
MR-RB50 · MR-RB51 · MR-RB54



| Regenerative Brake Option | Weight [kg(lb)] |
|---------------------------|-----------------|
| MR-RB50                   | 5.6<br>(12.346) |
| MR-RB51                   |                 |
| MR-RB54                   |                 |

# 15. OPTIONS AND AUXILIARY EQUIPMENT

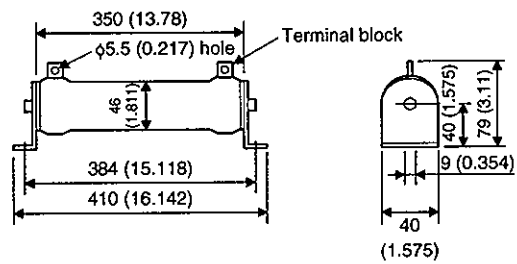
MR-RB65 · MR-RB66 · MR-RB67



[Unit : mm(in)]

| Regenerative Brake Option | Weight [kg(lb)] |
|---------------------------|-----------------|
| MR-RB65                   | 10(22.046)      |
| MR-RB66                   | 11(24.251)      |
| MR-RB67                   | 11(24.251)      |

GRZG400-2 $\Omega$  · GRZG400-1 $\Omega$  · GRZG400-0.8 $\Omega$  (standard accessories)



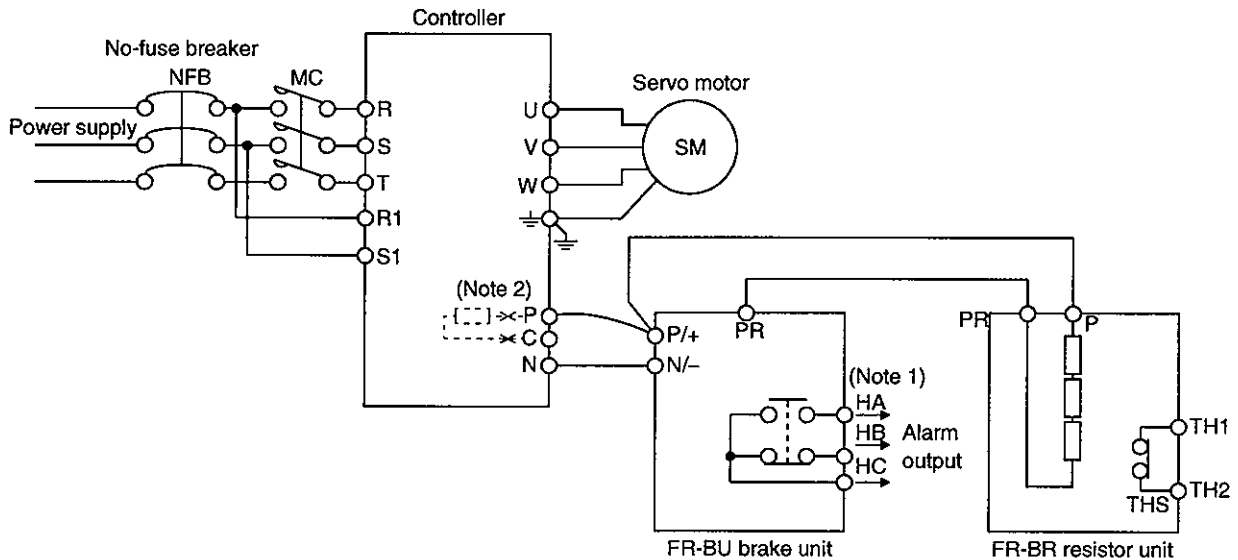
[Unit : mm(in)]

## 15. OPTIONS AND AUXILIARY EQUIPMENT

### 15.1.3 Brake unit

The brake unit is the integration of the regenerative control and resistor and is connected to the bus (across P-N) of the controller. As compared to the MR-RB regenerative brake option, the brake unit can return larger power. Hence, use the this brake unit when the MR-RB cannot provide sufficient regenerative brake capability.

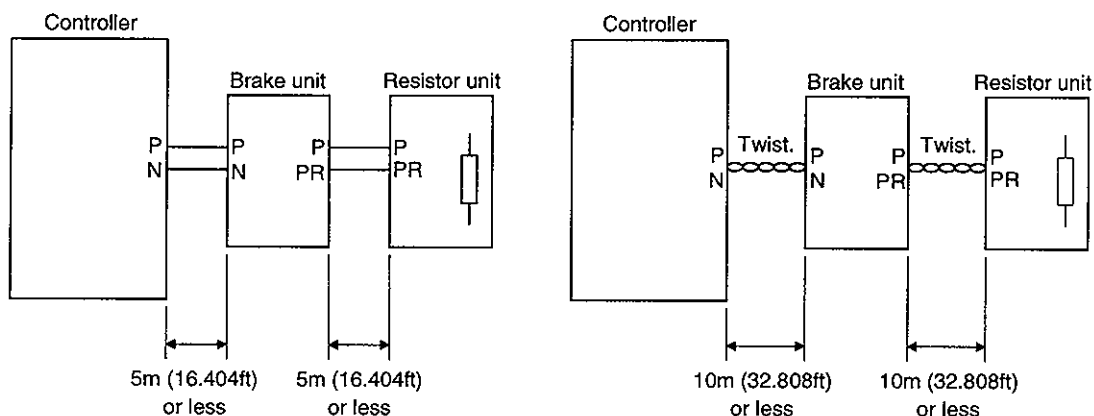
#### (1) Connection example for use of brake unit



- Note: 1. Make up the external sequence to switch the power off when an alarm occurs or when the thermal relay is actuated.  
2. The cables of the resistor in the controller across P-C must be disconnected.

The cables between the controller and brake unit and between the resistor unit and brake unit should be as short as possible. The cables longer than 5m should be twisted. (If twisted, the cables must not be longer than 10m.)

The cable size should be equal to or larger than the recommended size. See the brake unit instruction manual. You cannot connect one set of brake unit to two controllers or two sets of brake units to one controller.

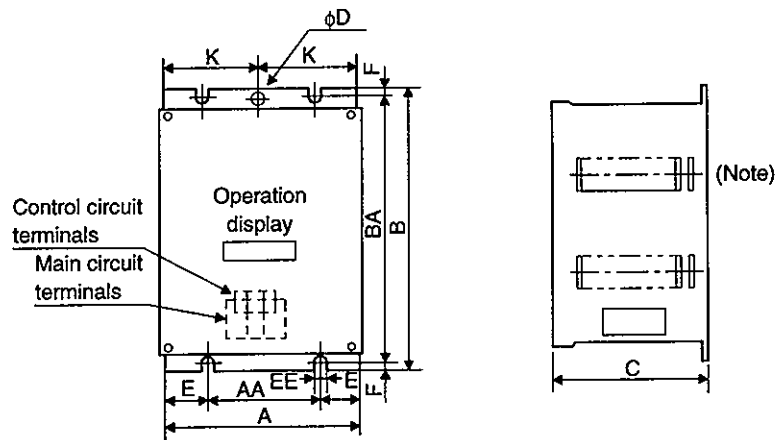


## 15. OPTIONS AND AUXILIARY EQUIPMENT

### (2) Outside dimensions

#### · Brake unit (FR-BU)

[Unit : mm(in)]

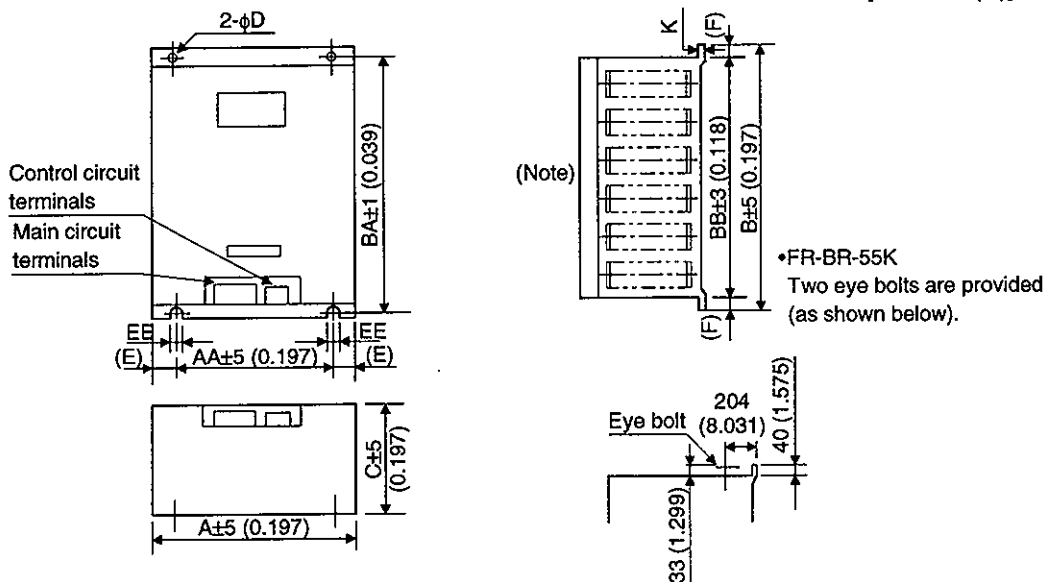


Note: Ventilation ports are provided in both side faces and top face. The bottom face is open.

| Brake Unit Model | A               | AA             | B              | BA              | C              | D            | E               | EE           | K               | F              | Approx. Weight [kg(lb)] |
|------------------|-----------------|----------------|----------------|-----------------|----------------|--------------|-----------------|--------------|-----------------|----------------|-------------------------|
| FR-BU-15K        | 100<br>(3.937)  | 60<br>(2.362)  | 240<br>(9.446) | 225<br>(10.039) | 128<br>(5.039) | 6<br>(0.236) | 18.5<br>(0.728) | 6<br>(0.236) | 48.5<br>(1.909) | 7.5<br>(0.295) | 2.4<br>(5.291)          |
| FR-BU-30K        | 160<br>(6.299)  | 90<br>(3.543)  | 240<br>(9.446) | 225<br>(10.039) | 128<br>(5.039) | 6<br>(0.236) | 33.5<br>(1.319) | 6<br>(0.236) | 78.5<br>(3.091) | 7.5<br>(0.295) | 3.2<br>(7.055)          |
| FR-BU-55K        | 265<br>(10.433) | 145<br>(5.709) | 240<br>(9.446) | 225<br>(10.039) | 128<br>(5.039) |              | 58.5<br>(2.303) | 6<br>(0.236) |                 | 7.5<br>(0.295) | 5.8<br>(12.787)         |

#### · Resistor unit (FR-BR)

[Unit : mm(in)]



Note: Ventilation ports are provided in both side faces and top face. The bottom face is open.

| Resistor Unit Model | A               | AA              | B               | BA              | BB              | C               | D             | E             | EE            | K              | F             | Approx. Weight [kg(lb)] |
|---------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|---------------|---------------|---------------|----------------|---------------|-------------------------|
| FR-BR-15K           | 170<br>(6.693)  | 100<br>(3.937)  | 450<br>(17.717) | 432<br>(17.008) | 410<br>(16.142) | 220<br>(8.661)  | 6<br>(0.236)  | 35<br>(1.378) | 6<br>(0.236)  | 1.6<br>(0.063) | 20<br>(0.787) | 15<br>(66.139)          |
| FR-BR-30K           | 340<br>(11.389) | 270<br>(10.63)  | 600<br>(23.622) | 582<br>(22.913) | 560<br>(22.047) | 220<br>(8.661)  | 10<br>(0.394) | 35<br>(1.378) | 10<br>(0.394) | 2<br>(0.079)   | 20<br>(0.787) | 30<br>(33.069)          |
| FR-BR-55K           | 480<br>(18.898) | 410<br>(16.142) | 700<br>(27.559) | 670<br>(26.378) | 620<br>(24.409) | 450<br>(17.717) | 12<br>(0.472) | 35<br>(1.378) | 12<br>(0.472) | 3.2<br>(0.126) | 40<br>(1.575) | 70<br>(154.323)         |

## 15. OPTIONS AND AUXILIARY EQUIPMENT

---

| POINT  |
|--|
| <ul style="list-style-type: none"><li>• The brake unit and resistor unit of other than 200V class are not applicable to the controller.</li><li>• The brake unit and resistor unit of the same capacity must be combined. The units of different capacities may result in damage.</li><li>• The brake unit and resistor unit must be installed on a vertical surface in the vertical direction. If they are installed in the horizontal direction or on a horizontal surface, a heat dissipation effect reduces.</li><li>• The temperature of the resistor unit casing rises to higher than 100°C. Do not cause cables and combustibles to make contact with the casing.</li></ul> |

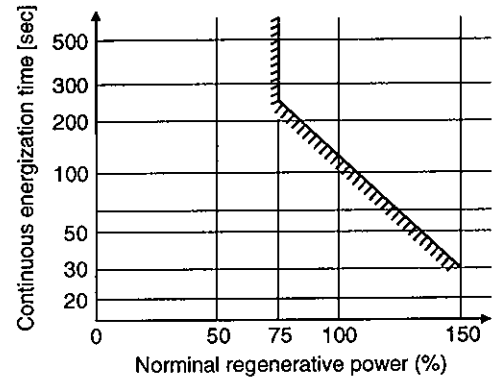
## 15. OPTIONS AND AUXILIARY EQUIPMENT

### 15.1.4 Power return converter

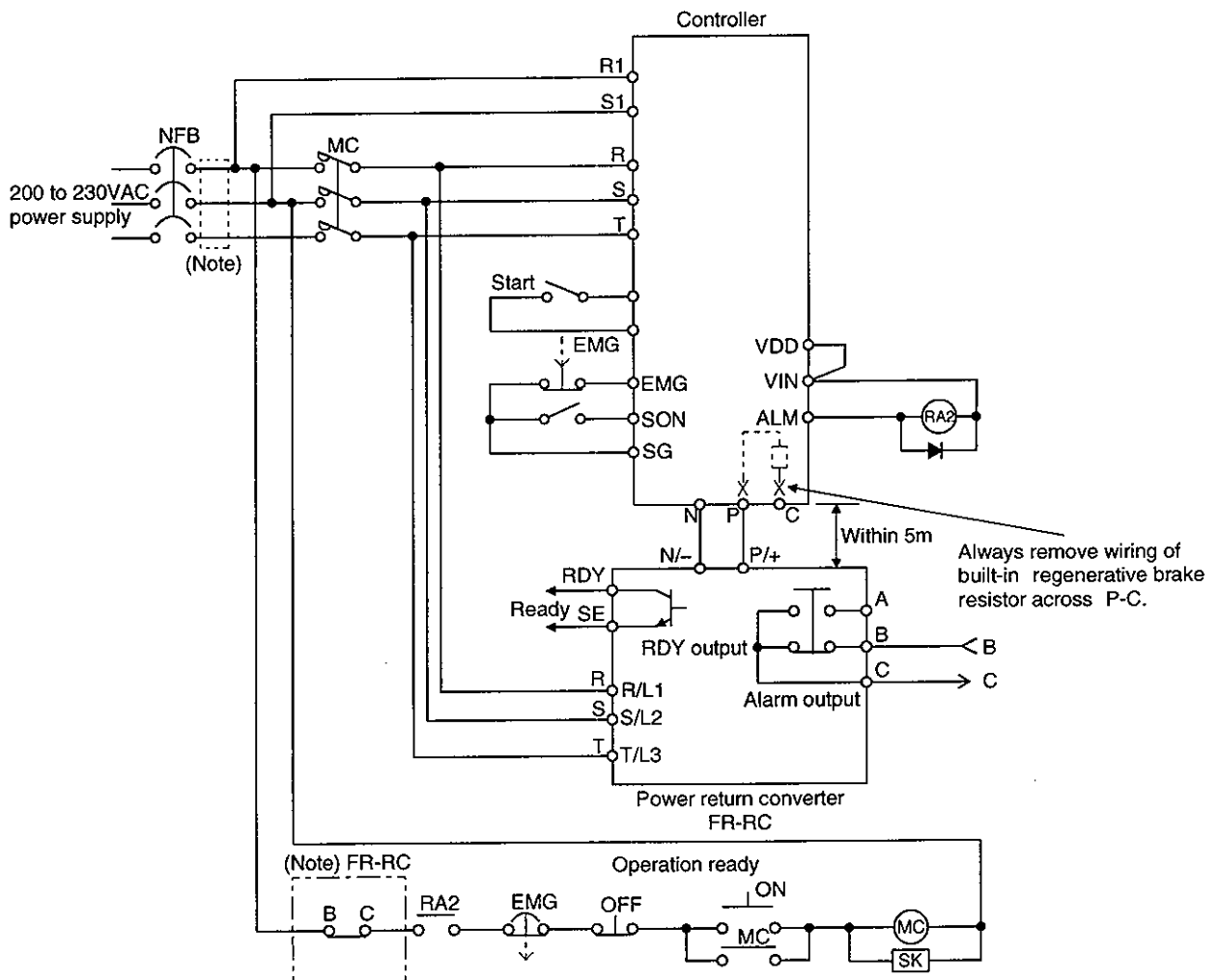
#### (1) Selection

The characteristics in the figure are common to all units of the FR-RC. The converters can continuously return 75% of the nominal regenerative power. They are applied to the controllers of the MR-H350ACN or more.

| Model   | Nominal Regenerative Power (kW) | Controller                     |
|---------|---------------------------------|--------------------------------|
| FR-RC15 | 15                              | MR-H350ACN<br>to<br>MR-H700ACN |
| FR-RC30 | 30                              | MR-H11KACN<br>MR-H15KACN       |
| FR-RC55 | 55                              | MR-H22KACN                     |



#### (2) Connection example

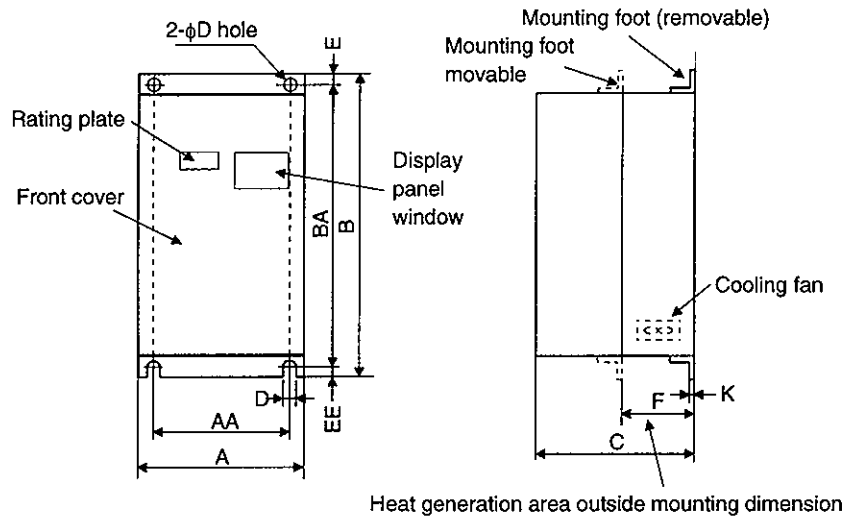


Note: To improve the input power factor or when connecting two or more FR-RC's to the same power transformer, install the power factor improving reactor (FR-BAL) in the dotted area.

## 15. OPTIONS AND AUXILIARY EQUIPMENT

### (3) Outside dimensions of the power return converters

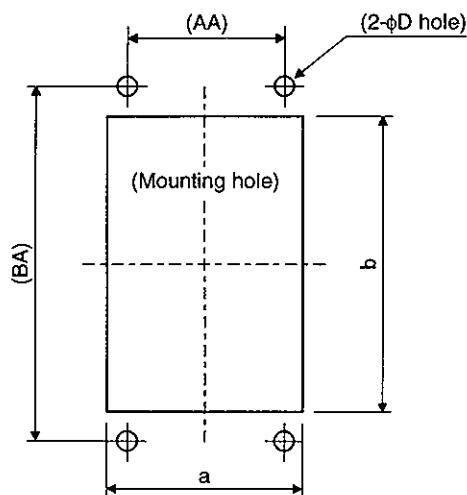
[Unit : mm(in)]



| Model     | A               | AA              | B               | BA              | C              | D             | E             | EE            | K              | F              | Approx. Weight [kg(lb)] |
|-----------|-----------------|-----------------|-----------------|-----------------|----------------|---------------|---------------|---------------|----------------|----------------|-------------------------|
| FR-RC-15K | 270<br>(10.630) | 200<br>(7.874)  | 450<br>(17.717) | 432<br>(17.008) | 195<br>(7.677) | 10<br>(0.394) | 10<br>(0.394) | 8<br>(0.315)  | 3.2<br>(0.126) | 87<br>(3.425)  | 19<br>(41.888)          |
| FR-RC-30K | 340<br>(13.386) | 270<br>(10.630) | 600<br>(23.622) | 582<br>(22.913) | 195<br>(7.677) | 10<br>(0.394) | 10<br>(0.394) | 8<br>(0.315)  | 3.2<br>(0.126) | 90<br>(3.543)  | 31<br>(68.343)          |
| FR-RC-55K | 480<br>(18.898) | 410<br>(16.142) | 700<br>(27.559) | 670<br>(26.378) | 250<br>(9.843) | 12<br>(0.472) | 15<br>(0.591) | 15<br>(0.591) | 3.2<br>(0.126) | 135<br>(5.315) | 55<br>(121.254)         |

### (4) Mounting hole machining dimensions

When the power return converter is fitted to a totally enclosed type box, mount the heat generating area of the converter outside the box to provide heat generation measures. At this time, the mounting hole having the following dimensions is machined in the box.



[Unit : mm(in)]

| Model     | A               | B               | D             |
|-----------|-----------------|-----------------|---------------|
| FR-RC-15K | 260<br>(10.236) | 412<br>(16.220) | 10<br>(0.394) |
| FR-RC-30K | 330<br>(12.992) | 562<br>(22.126) | 10<br>(0.394) |
| FR-RC-55K | 470<br>(18.504) | 662<br>(26.063) | 12<br>(0.472) |



## 15. OPTIONS AND AUXILIARY EQUIPMENT

### 15.1.5 External dynamic brake

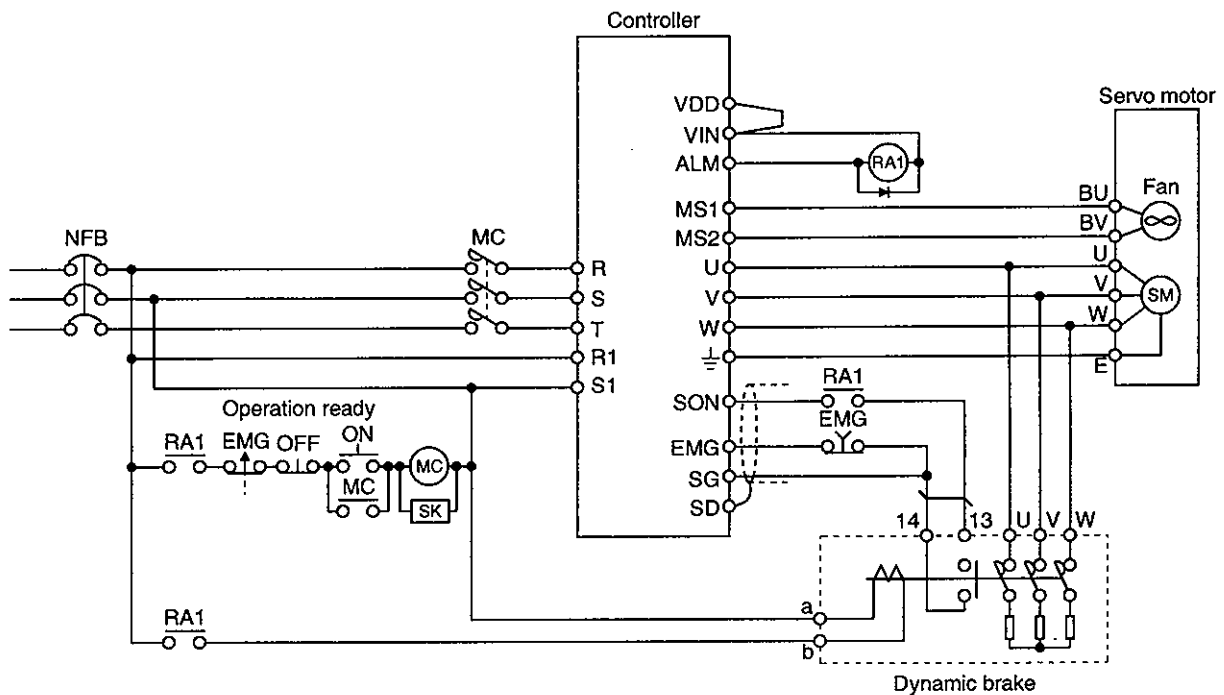
#### (1) Selection of dynamic brake

The dynamic brake is designed to bring the motor to a sudden stop when a power failure occurs or the protective circuit is activated. This brake is contained in the controller of 7kW or less but is not included in the controller of 11kW or more. When this brake is required, refer to the following table and place a purchase order Set □1□□ in parameter No.3.

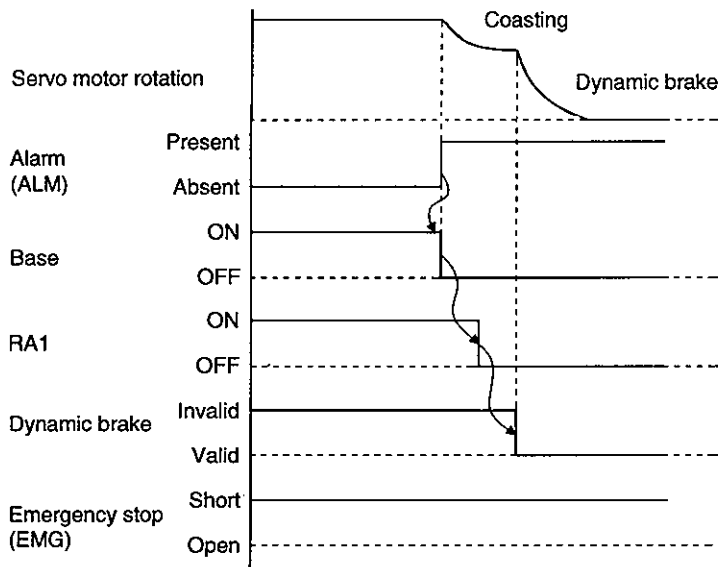
Note that when the inertia moment of the load is large, the built-in brake in the controller of 7kW or less may be used. (Refer to Section 14.3)

| Controller | Dynamic Brake |
|------------|---------------|
| MR-H11KACN | DBU-11K       |
| MR-H15KACN | DBU-15K       |
| MR-H22KACN | DBU-22K       |

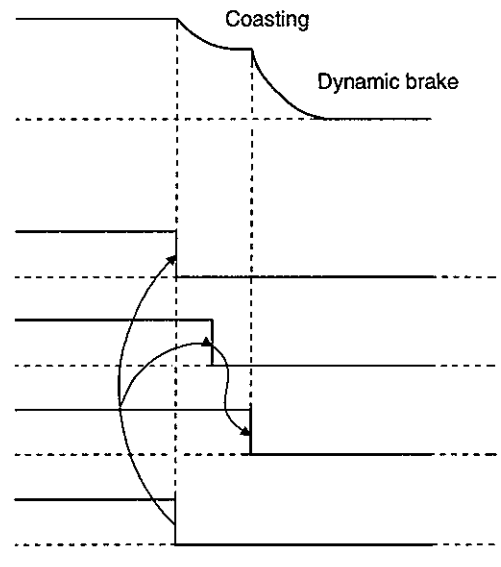
#### (2) Connection example



# 15. OPTIONS AND AUXILIARY EQUIPMENT



a. Timing chart at alarm (ALM) occurrence

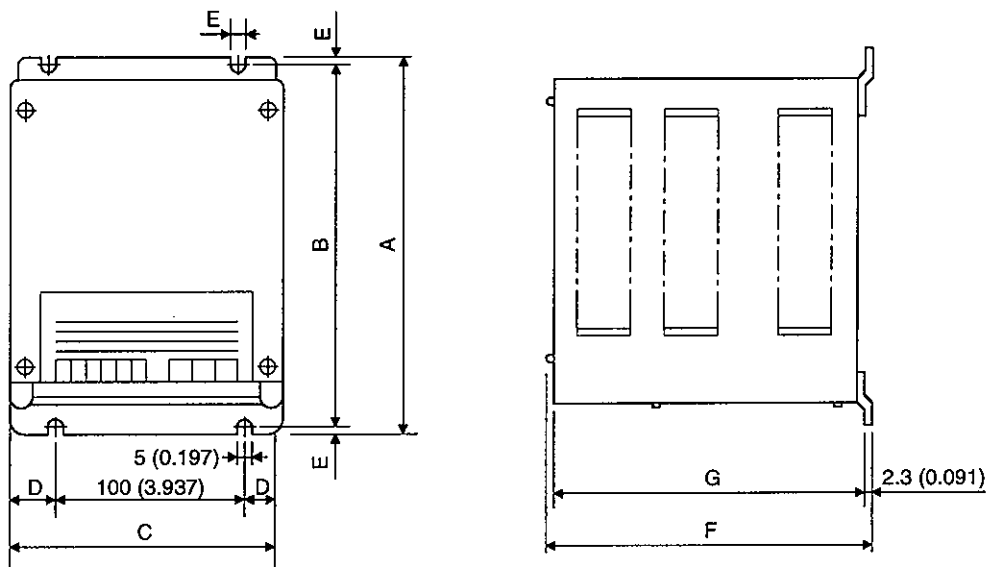


b. Timing chart at emergency stop (EMG) validity

## 15. OPTIONS AND AUXILIARY EQUIPMENT

### (3) Outline dimension drawing

[Unit: mm (in)]



Terminal block

|            |  |   |   |    |    |
|------------|--|---|---|----|----|
| E<br>(GND) |  | a | b | 13 | 14 |
|------------|--|---|---|----|----|

Screw: M3.5

|   |   |   |
|---|---|---|
| U | V | W |
|---|---|---|

Screw: M4

| Model   | A              | B               | C              | D             | E            | F              | G                | Approx. Weight<br>[kg(lb)] | Connection<br>Wire[mm <sup>2</sup> ] |
|---------|----------------|-----------------|----------------|---------------|--------------|----------------|------------------|----------------------------|--------------------------------------|
| DBU-11K | 200<br>(7.874) | 290<br>(11.417) | 140<br>(5.512) | 20<br>(0.787) | 5<br>(0.197) | 170<br>(6.693) | 163.5<br>(6.437) | 2<br>(4.409)               | 5.5<br>(AWG10)                       |
| DBU-15K | 250<br>(9.843) | 238<br>(9.370)  | 150<br>(5.906) | 25<br>(0.984) | 6<br>(0.236) | 235<br>(9.252) | 228<br>(8.976)   | 6<br>(13.228)              | 5.5<br>(AWG10)                       |

#### POINT

- Configure up a sequence which switches off the contact of the brake unit after (or as soon as) it has turned off the servo on signal at a power failure or failure.
- For the braking time taken when the dynamic brake is operated, refer to Section 14.3.
- The brake unit is rated for a short duration. Do not use it for high duty.

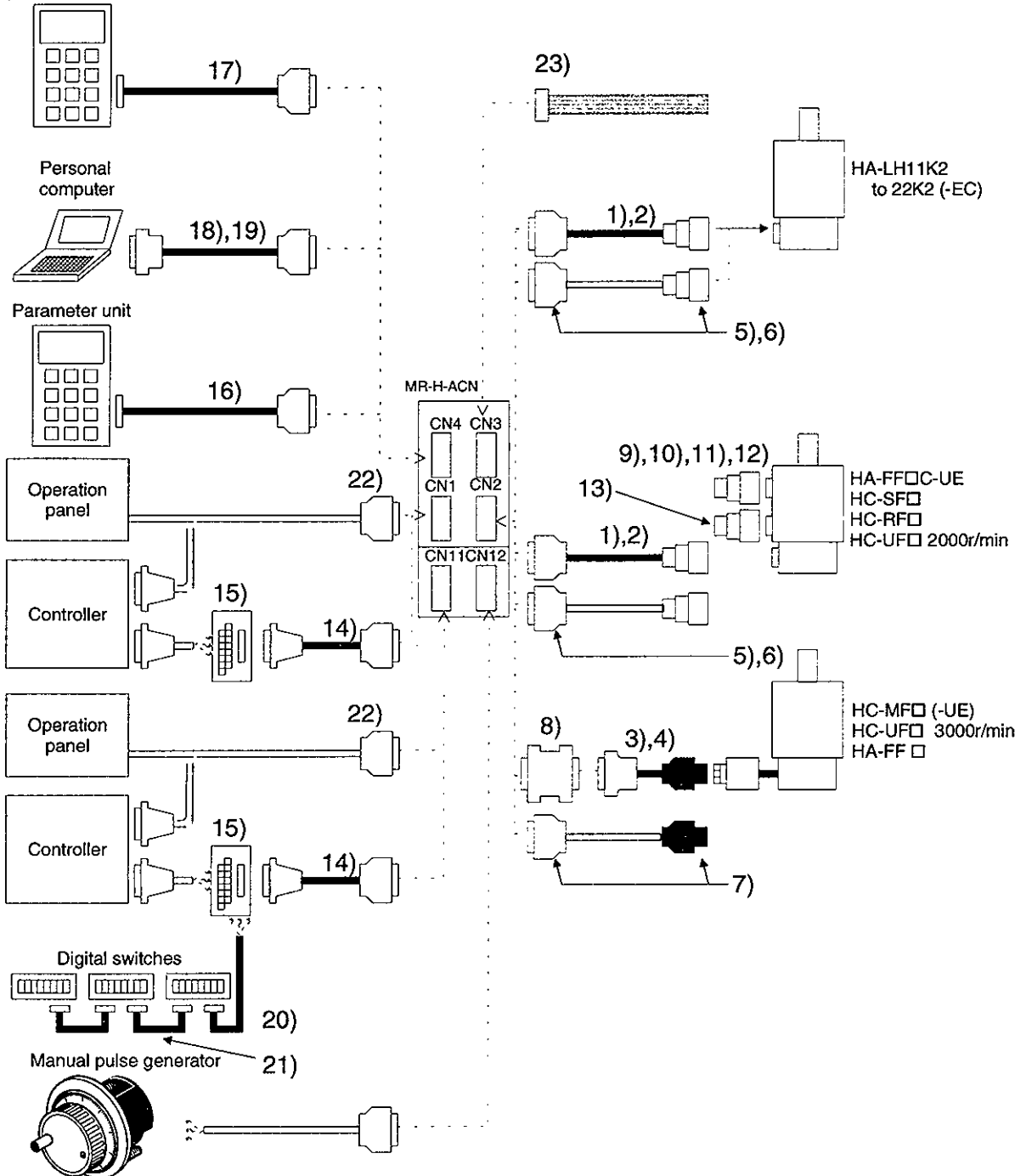
# 15. OPTIONS AND AUXILIARY EQUIPMENT

## 15.1.6 Cables and connectors



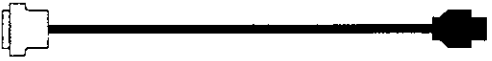
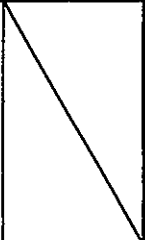



### (1) Cable make-up

The following cables are used for connection with the servo motor and other models.








Large setting/display unit








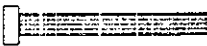
## 15. OPTIONS AND AUXILIARY EQUIPMENT

| No. | Product Name                    | Model  | Description  |  | Application   |
|-----|---------------------------------|--|--|--|---|
| 1)  | Encoder cable                   | MR-HSCBL□M<br>Refer to (2) in this section.    | Controller side connector<br>(Honda Tsushin Kogyo make)<br>Connector: PCR-S20FS<br>Cable: PCR-LS20LA1        | Encoder side connector<br>(Japan Aviation Electronics Industry make)<br>Plug: MS3106B20-29S<br>Cable clamp: MS-3057-12A                      | Long flexing life   |
|     |                                 |  |                            |  |   |
| 2)  | Encoder cable                   | MR-EN1CBL□M-H<br>Refer to (2) in this section. | Controller side connector<br>(Honda Tsushin Kogyo make)<br>Connector: PCR-S20FS<br>Cable: PCR-LS20LA1        | Encoder side connector<br>(DDK make)<br>Plug: MS3106A20-29S(D190)<br>Cable clamp: CE3057-12A-3(D265)<br>Back shell: CE02-20BS-S              | Long flexing life<br>IP65 compliant   |
|     |                                 |  |                            |  |   |
| 3)  | Standard encoder cable          | MR-JCCBL□M-L<br>Refer to (2) in this section.  | Controller side connector<br>(3M make or equivalent)<br>Connector: 10120-3000VE<br>Shell kit: 10320-52F0-008 | Encoder side connector<br>(3M make or equivalent)<br>Housing: 1-172161-9<br>Connector pin: 170359-1  | Standard flexing life   |
| 4)  | Long flexing life encoder cable | MR-JCCBL□M-H<br>Refer to (2) in this section.  |                           |  | Long flexing life   |
| 5)  | Encoder connector set           | MR-JSCNS                                       | Controller side connector<br>(Honda Tsushin Kogyo make)<br>Connector: PCR-S20FS<br>Cable: PCR-LS20LA1        | Encoder side connector<br>(Japan Aviation Electronics Industry make)<br>Plug: MS3106B20-29S<br>Cable clamp: MS3057-12A                       |  |
|     |                                 |  |                          |  |   |
| 6)  | Encoder connector set           | MR-EN1CNS                                      | Controller side connector<br>(Honda Tsushin Kogyo make)<br>Connector: PCR-S20FS<br>Cable: PCR-LS20LA1        | Encoder side connector<br>Plug: MS3106A20-29S(D190)<br>Cable clamp: CE3057-12A-3(D265)<br>Back shell: CE02-20BS-S                            |   |
|     |                                 |  |                          |  |   |
| 7)  | Encoder connector set           | MR-HCNM  | Controller side connector<br>(Honda Tsushin Kogyo make)<br>Connector: PCR-S20FS<br>Cable: PCR-LS20LA1        | Encoder side connector<br>(3M make or equivalent)<br>Housing: 1-172161-9<br>Pin: 170359-1<br>Cable clamp: MTI-0002<br>(Toa Denki Kogyo make) |   |
|     |                                 |  |                          |  |   |

## 15. OPTIONS AND AUXILIARY EQUIPMENT

| No. | Product Name                      | Model                                    | Description   |   | Application   |
|-----|-----------------------------------|--|---|---|---|
| 8)  | Conversion connector              | MR-HCN2                                  | Controller side   | Encoder cable side  |   |
| 9)  | Power connector set               | MR-PWCNF                                 |                                    | Plug: CE05-6A14S-2SD-B<br>(Daiichi Denshi Kogyo make)<br>Cable connector: YS014-9 to 11<br>(Daiwa Dengyo make)    | IP65 compliant<br>Must be used for compliance with the EN Standard. |
| 10) | Power connector set               | MR-PWCNS1                                |                                    | Daiichi Denshi Kogyo make<br>Plug: CE05-6A22-23SD-B-BSS<br>Cable clamp: CE3057-12A-2(D265)                        |   |
| 11) | Power connector set               | MR-PWCNS2                                |                                    | Daiichi Denshi Kogyo make<br>Plug: CE05-6A22-10SD-B-BSS<br>Cable clamp: CE3057-16A-2(D265)                        |   |
| 12) | Power connector set               | MR-PWCNS3                                |                                    | Daiichi Denshi Kogyo make<br>Plug: CE05-6A32-17SD-B-BSS<br>Cable clamp: CE3057-20A-1(D265)                        |   |
| 13) | Brake connector set               | MR-BKCN                                  |                                    | Plug: MS3106A10SL-4S(D190)<br>(Daiichi Denshi Kogyo make)<br>Cable connector: YS010-5 to 8<br>(Daiwa Dengyo make) |   |
| 14) | Junction terminal block cable     | MR-HTBL□M<br>Refer to Section 15.1.7.    | Junction terminal block side connector<br>(Izumi Denki make)<br>Connector: JE1S-501                                 | Controller side connector<br>(Honda Tsushin Kogyo make)<br>Connector: PCR-S50FS<br>Cable: PCR-LS50LA              |   |
| 15) | Junction terminal block           | MR-TB50                                  | Refer to Section 15.1.7.  |   |   |
| 16) | Parameter unit cable              | MR-PRUCBL□M<br>Refer to Section 15.1.1.  |                                 |   |   |
| 17) | Large setting /display unit cable | MR-PRUCBL□M<br>Refer to Section 15.1.10. | Controller side connector<br>(Japan Aviation Electronics Industry make)<br>Connector: DE-9PF-N<br>Case: DE-C1-J6-S6 | MR-PRU02 side connector<br>(Japan Aviation Electronics Industry make)<br>Connector: DE-9PF-N<br>Case: DE-C1-J6-S6 |   |
|     |                                   |  |                                 |   |   |

## 15. OPTIONS AND AUXILIARY EQUIPMENT

| No. | Product Name         | Model  | Description   |  | Application  |
|-----|----------------------|--|---|--|--|
| 18) | Communication cable  | MR-HPC98CBL3M<br>Refer to (3) in this section. | Controller side connector<br>(Japan Aviation Electronics Industry make)<br>Connector: DE-9PF-N<br>Case: DE-C1-J6-S6 | Personal computer side connector<br>(Japan Aviation Electronics Industry make)<br>Connector: DE-25PF-N<br>Case: DB-C2-J9   | For connection with PC-98 personal computer            |
|     |                      |  |                                   |  |  |
| 19) | Communication cable  | MR-HPCATCBL3M<br>Refer to (3) in this section. | Controller side connector<br>(Japan Aviation Electronics Industry make)<br>Connector: DE-9PF-N<br>Case: DE-C1-J6-S6 | Personal computer side connector<br>(Japan Aviation Electronics Industry make)<br>Connector: DE-9SF-N<br>Case: DE-C1-J6-S6 | For connection with PC-AT-compatible personal computer |
|     |                      |  |                                   |  |  |
| 20) | Digital switch cable | MR-DSCBL□M-G                                   |                                   |  | /  |
| 21) | Digital switch cable | MR-DSCBL□M                                     |                                 |  | /  |
| 22) | Connector set        | MR-HCN1  |                                  | Controller side connector<br>(Honda Tsushin Kogyo make)<br>Connector: PCR-S50FS<br>Cable: PCR-LS50LA                       | /  |
| 23) | CN3 cable            | MR-H3CBL1M                                     |                                  | Controller side connector<br>(AMP make)<br>Housing: 171822-4   | /  |

## 15. OPTIONS AND AUXILIARY EQUIPMENT

### (2) Encoder cable



**CAUTION**

- If you have fabricated the encoder cable, connect it correctly.
- Otherwise, misoperation or explosion may occur.

#### POINT

- The encoder cable is not oil-proof.
- Refer to Section 14.4 for the flexing life of the encoder cables.

Generally use the encoder cable available as our options. If the required length is not found in the options, fabricate the cable on the customer side.

#### (a) Selection

The following table lists the encoder cables for use with the servo motors. Choose the appropriate encoder cable according to your operating conditions. The connector sets are also available for your fabrication.

| Servo Motor Model  | Standard Encoder Cable |                        |                   |                 | Connector Set |                 |
|--|------------------------|------------------------|-------------------|-----------------|---------------|-----------------|
|  | (Note 1) Model         | Use For EN/UL Standard | Long Flexing Life | IP65 Compliance | Model         | IP65 Compliance |
| HA-LH<br>HA-LH-EC<br>HA-FF□C-UE (Note 2)<br>HC-SF<br>HC-RF<br>HC-UF2000r/min | MR-HSCBL□M             | ○                      | ○                 |                 | MR-JSCNS      |                 |
|  | MR-EN1CBL□M-H          | ○                      | ○                 | ○               | MR-EN1CNS     | ○               |
| HC-MF<br>HC-MF-UE<br>HA-FF<br>HC-UF3000r/min                                 | MR-JCCBL□M-L           | ○                      |                   |                 | MR-J2CNM      |                 |
|  | MR-JCCBL□M-H           | ○                      | ○                 |                 | MR-HCNM       |                 |

Note:1 □ indicates the cable length: 2, 5, 10, 20, 30, 40, 50 (m).

2 If the IP65-compliant option is used with the HA-FF□C-UE, the protection system (IP54) of the servo motor is not improved.

3 Not oil-proof.



# 15. OPTIONS AND AUXILIARY EQUIPMENT

## (b) MR-HSCBL□M (long flexing life product)

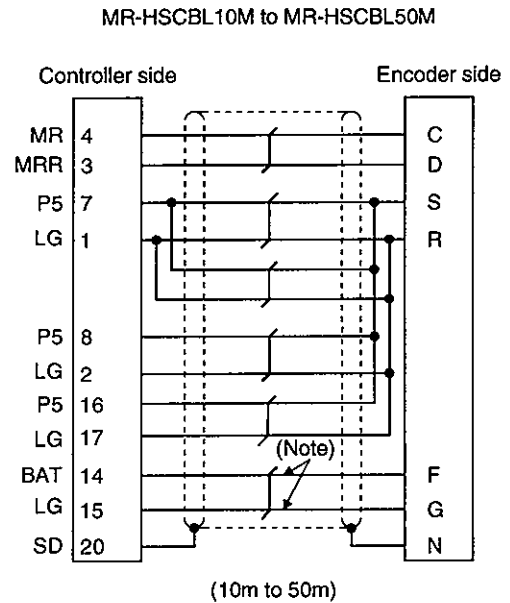
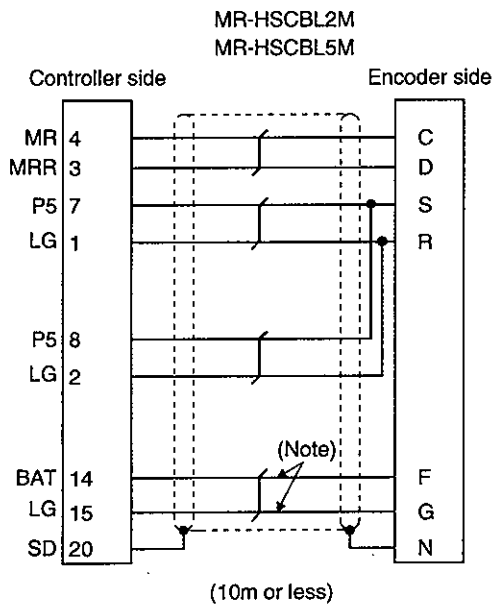
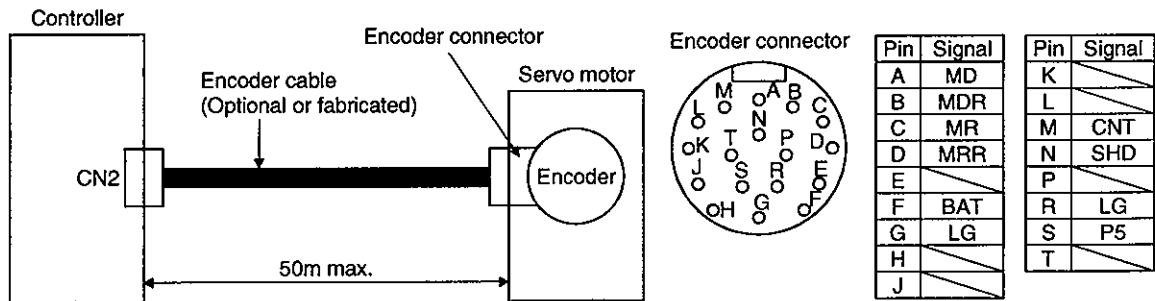
### 1) Explanation of model name

Model: MR-HSCBL□M

| Symbol | Cable Length [m] |
|--------|------------------|
| 2      | 2                |
| 5      | 5                |
| 10     | 10               |
| 20     | 20               |
| 30     | 30               |
| 40     | 40               |
| 50     | 50               |

### 2) Connection diagram

Refer to Section 3.3.1 or Section 4.3.1 for the controller side pin assignment.



Note: This wiring is required for use in the absolute position detection system.  
This wiring is not needed for use in the incremental system.

When fabricating an encoder cable, use the recommended wires given in Section 15.2.1 and the MR-JSCNS connector set for encoder cable fabrication, and fabricate an encoder cable as shown in the following wiring diagram. Referring to this wiring diagram, you can fabricate an encoder cable of up to 50m length including the length of the encoder cable supplied to the servo motor.

## 15. OPTIONS AND AUXILIARY EQUIPMENT

### (c) MR-EN1CBL□M-H (long flexing life product)

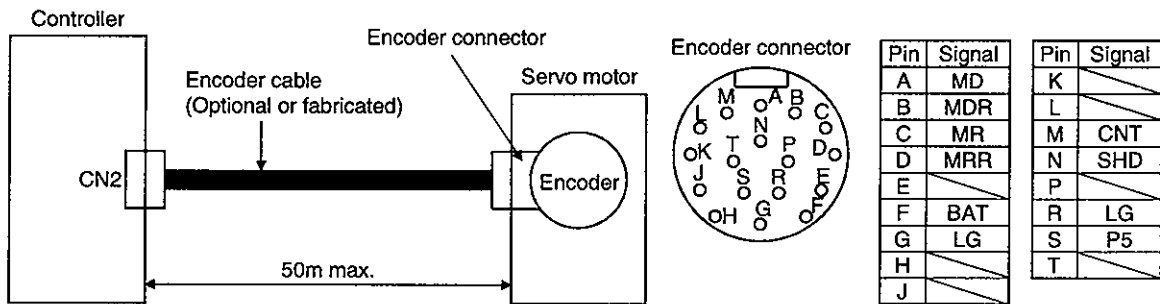
#### 1) Explanation of model name

Model: MR-EN1CBL□M-H

| Symbol | Cable Length [m] |
|--------|------------------|
| 2      | 2                |
| 5      | 5                |
| 10     | 10               |
| 20     | 20               |
| 30     | 30               |
| 40     | 40               |
| 50     | 50               |

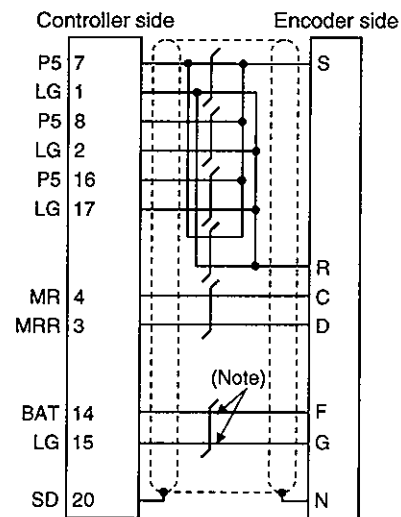
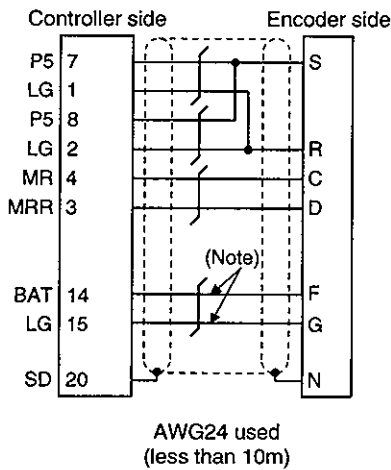
#### 2) Connection diagram

Refer to Section 3.3.1 or Section 4.3.1 for the controller side pin assignment.



MR-EN1CBL2M-H  
MR-EN1CBL5M-H

MR-EN1CBL10M-H to MR-EN1CBL50M-H



Note: This wiring is required for use in the absolute position detection system.  
This wiring is not needed for use in the incremental system.

When fabricating an encoder cable, use the recommended wires given in Section 15.2.1 and the MR-ENICNS connector set for encoder cable fabrication, and fabricate an encoder cable as shown in the following wiring diagram. Referring to this wiring diagram, you can fabricate an encoder cable of up to 50m length including the length of the encoder cable supplied to the servo motor.

# 15. OPTIONS AND AUXILIARY EQUIPMENT

## (d) MR-JCCBL□M-L · MR-JCCBL□M-H

### 1) Explanation of model name

Model: MR-JCCBL□M-□

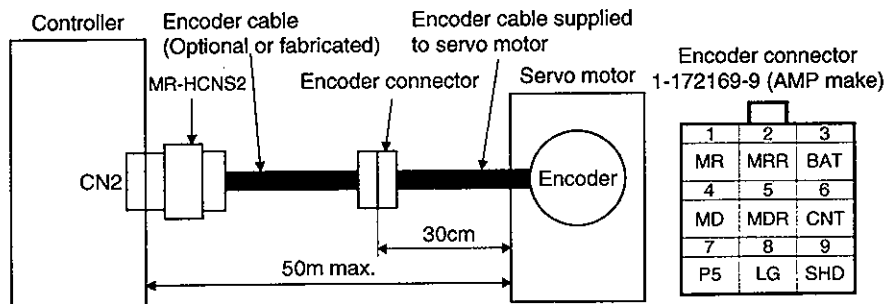
| Symbol | Specifications        |
|--------|-----------------------|
| L      | Standard flexing life |
| H      | Long flexing life     |

| Symbol | (Note) Cable Length [m] |
|--------|-------------------------|
| 2      | 2                       |
| 5      | 5                       |
| 10     | 10                      |
| 20     | 20                      |
| 30     | 30                      |
| 40     | 40                      |
| 50     | 50                      |

Note: MR-JCCBL□M-H has no 40 and 50m sizes.

### 2) Connection diagram

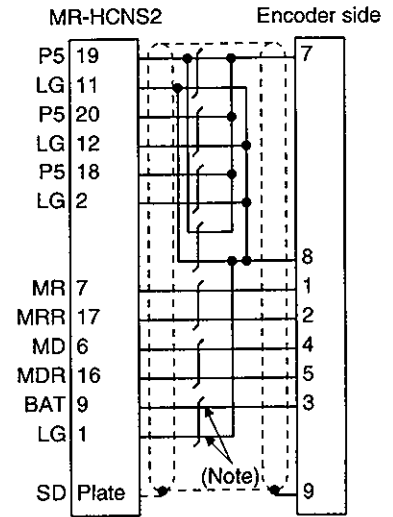
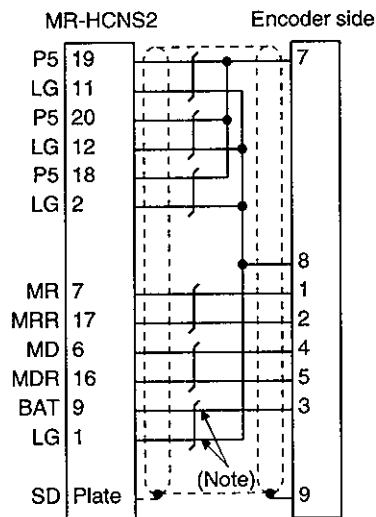
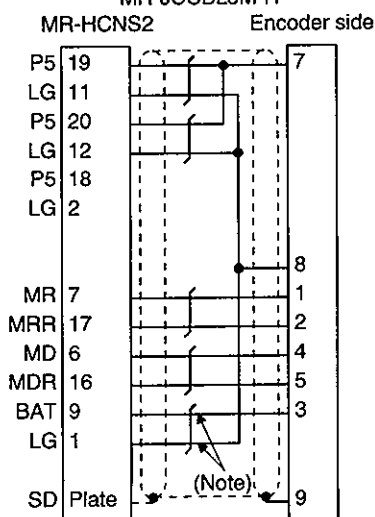
Refer to Section 3.3.1 or Section 4.3.1 for the controller side pin assignment.



MR-JCCBL2M-L  
MR-JCCBL5M-L  
MR-JCCBL2M-H  
MR-JCCBL5M-H

MR-JCCBL10M-L to MR-JCCBL30M-L

MR-JCCBL10M-H to MR-JCCBL50M-H

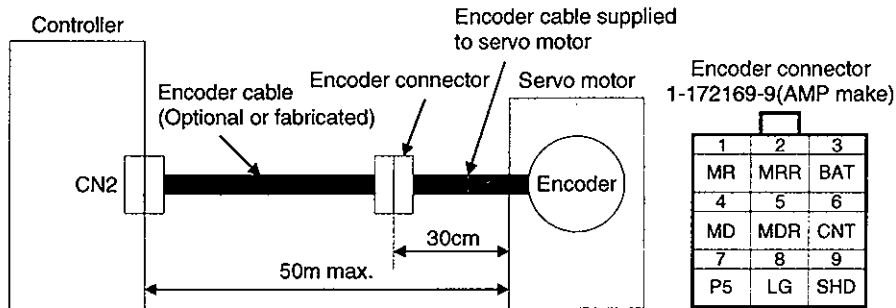


Note: This wiring is required for use in the absolute position detection system.  
This wiring is not needed for use in the incremental system.

## 15. OPTIONS AND AUXILIARY EQUIPMENT

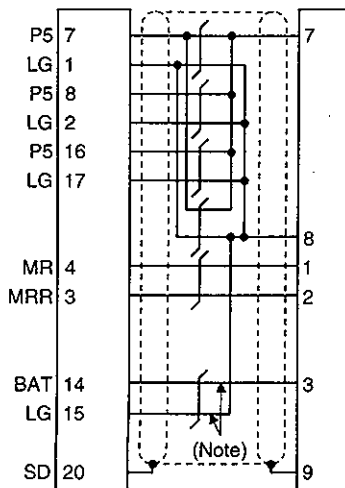
### (e) When using MR-HCNM

Refer to Section 3.3.1 or Section 4.3.1 for the controller side pin assignment. Use the recommended wires given in Section 15.2.1 and fabricate the encoder cable in accordance with the connection diagram shown below. In this connection, an up to 50m long encoder cable including the encoder cable supplied to the servo motor can be fabricated.



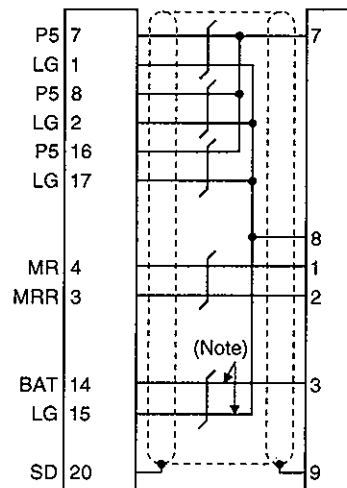
#### When using AWG24

Controller side  
(Honda Tsushin Kogyo make) Encoder side



#### When using AWG22

Controller side  
(Honda Tsushin Kogyo make) Encoder side



Note: This wiring is required for use in the absolute position detection system.  
This wiring is not needed for use in the incremental system.

## 15. OPTIONS AND AUXILIARY EQUIPMENT

### (3) Communication cable

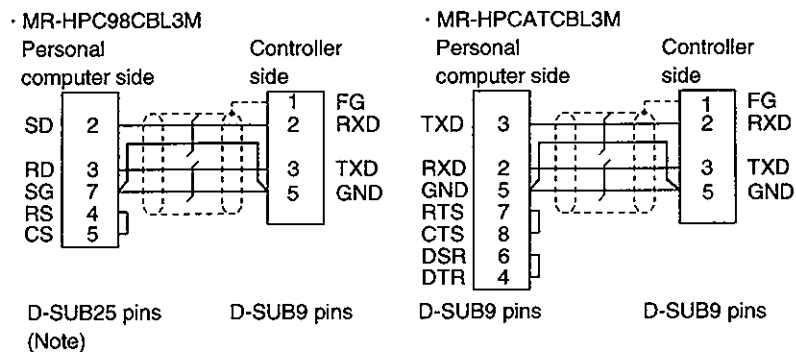
| POINT   |
|---|
| <ul style="list-style-type: none"> <li>• This cable may not be used with some personal computers. After fully examining the signals of the RS-232C connector, refer to this section and fabricate the cable.</li> </ul> |

Select the communication cable according to the shape of the RS-232C connector of the personal computer used. When fabricating the cable, refer to the connection diagram in this section.

The following must be observed in fabrication:

- Always use a shielded, multi-core cable and connect the shield with FG securely.
- The optional communication cable is 3m (10 ft) long. When the cable is fabricated, its maximum length is 15m (49 ft) in offices of good environment with minimal noise.

#### Connection diagram



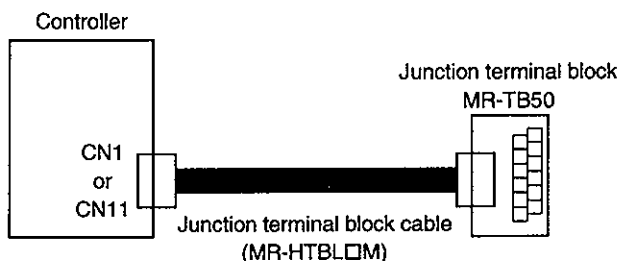
Note: The PC98 Notes having the connector of half-pitch 14 pins are also available.  
Confirm the shape of the RS-232C connector of the personal computer used.

## 15. OPTIONS AND AUXILIARY EQUIPMENT

### 15.1.7 Junction terminal block (MR-TB50)

#### (1) How to use the junction terminal block

Always use the junction terminal block (MR-TB50) with the junction terminal block cable (MR-HTBL□M) as a set. A connection example is shown below:



Ground the junction terminal block cable on the junction terminal block side with the standard accessory cable clamp fitting (AERSBAN-ESET). For the use of the cable clamp fitting, refer to (3), Section 15.2.6

#### (2) Terminal block labels

Use the following labels among the terminal block labels attached to the junction terminal block.

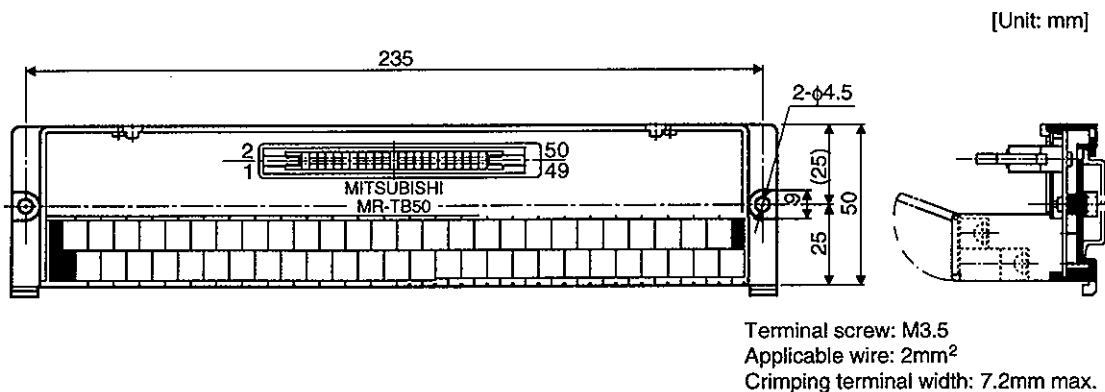
##### (a) For CN1

|     |    |     |     |     |     |     |     |     |    |     |     |     |     |      |     |     |     |     |     |      |      |  |  |  |  |    |  |
|-----|----|-----|-----|-----|-----|-----|-----|-----|----|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|------|------|--|--|--|--|----|--|
| VDD | CR | PP0 | NPO | SG  | SG  | JFS | LSP | DEC | PF | ALM | D10 | D12 | ST2 | P15R | LA  | LB  | LZ  | FPA | PPB | N15R | LG   |  |  |  |  |    |  |
| RD  | SG | SG  | VDD | VIN | SON | STP | LSN | CP0 | ZP | EMG | D11 | ST1 | LG  | OP   | LAR | LBR | LZR | LG  | LG  | OVR  | TLAF |  |  |  |  | SD |  |

##### (b) For CN11

|    |    |    |     |      |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |    |
|----|----|----|-----|------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|----|
|    | D1 | D1 | D1  | SG   | SG | D1 | D1 | D1 | DO | DO | D1 | D1 | D1 | DO | DO | DO | DO | DO |    | D1 | DO | D1 | D1 |    |    |  |    |
|    | 9  | 18 | 19  |      |    | 4  | 10 | 3  | 12 | 14 | 12 | 14 | 16 |    | 0  | 2  | 4  | 8  | 9  | 21 | 7  | 1  | 8  |    |    |  |    |
| DO | SG | SG | VDD | VINE | D1 | D1 | DO | DO | D1 | D1 | D1 | D1 | DO | DO | DO | DO | D1 | D1 | D1 | DO | D1 | D1 | DO | D1 | D1 |  | SD |
|    | 15 |    |     |      | 2  | 5  | 11 | 11 | 13 | 17 | 13 | 15 | 6  | 10 | 1  | 3  | 5  | 22 | 23 | 20 | 6  | 0  | 7  |    |    |  |    |

#### (3) Outline drawing



# 15. OPTIONS AND AUXILIARY EQUIPMENT

## (4) Junction terminal block cable (MR-HTBL□M)

### (a) Explanation of model name

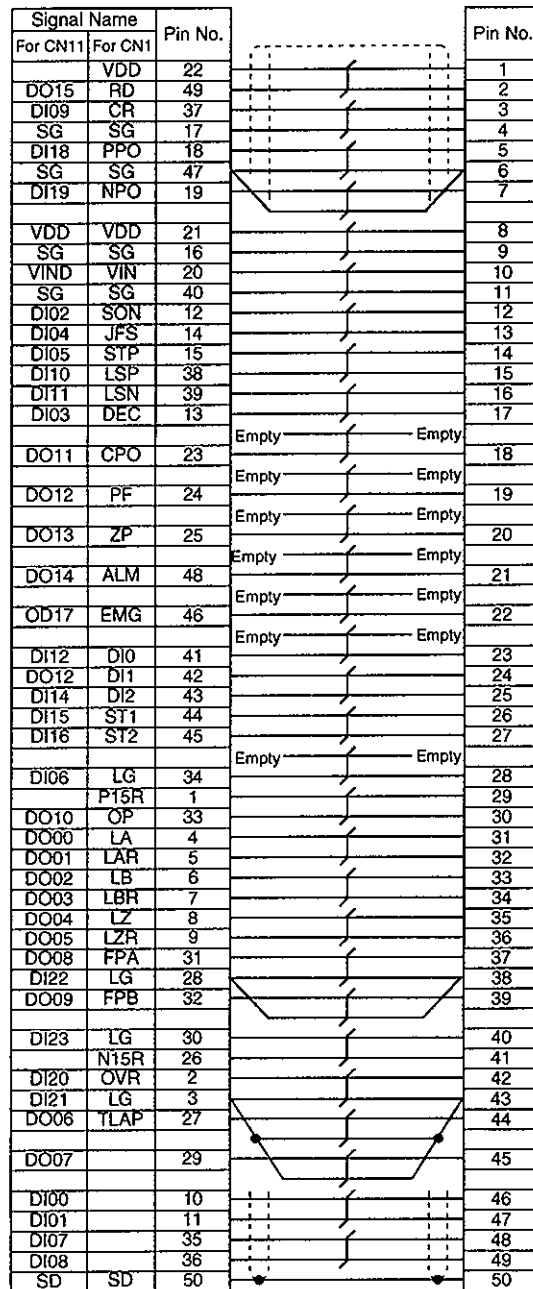
Model: MR-HTBL□M

| Symbol | Cable Length [m] |
|--------|------------------|
| 05     | 0.5              |
| 1      | 1                |

### (b) Connection diagram

PCR-S50FS (controller side)

JEIS-501 (junction terminal side)



## 15. OPTIONS AND AUXILIARY EQUIPMENT

### 15.1.8 Servo Configuration Software

The Servo Configuration software uses the communication function of the controller to perform parameter setting changes, graph display, test operation, etc. on a personal computer.

#### (1) Specifications

| Item                 | Description  |
|----------------------|--|
| Communication signal | Conforms to RS-232C.   |
| Baudrate             | 19200bps, 9600bps  |
| Monitor              | Batch display, high-speed display, graph display   |
| Alarm                | Alarm display, alarm history, data display at alarm occurrence   |
| Diagnostic           | External I/O signal display, function device display, cumulative power-on time display, software number display, tuning data display, ABS data display |
| Parameters           | Data setting, list display, change list display, detailed information display  |
| Test operation       | Jog operation, positioning operation, motor-less operation, output signal forced output<br>1 step feed operation                                       |
| Point data           | Position block, speed block  |
| File operation       | Data read, save, print   |
| Others               | help display   |

Note: On some personal computers, this software may not run properly.

#### (2) System configuration

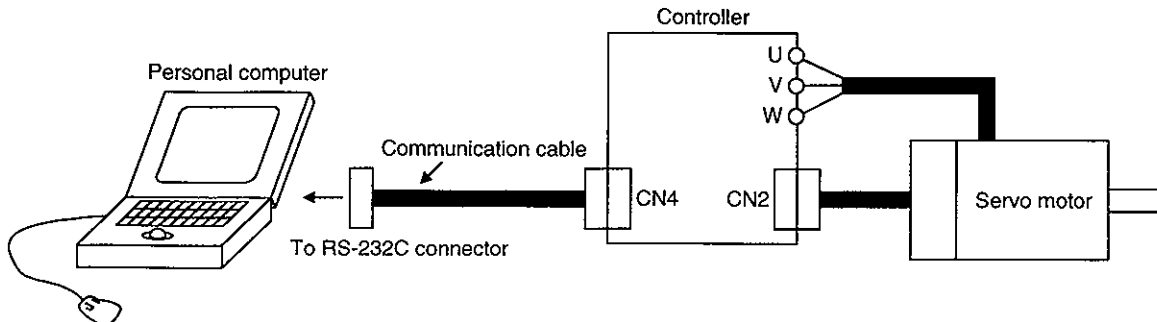
##### (a) Components

To use this software, the following components are required in addition to the controller and servo motor:

| Model               | Description   |
|---------------------|---|
| Personal computer   | Which contains a 80386 or higher CPU and on which Windows 3.1· 95 runs (80486 or higher recommended).Memory: 8MB or more, hard disk: 1MB or more, serial port used. |
| OS                  | Windows 3.1· 95   |
| Display             | 640×400 or more color or 16-scale monochrome display which can be used with Windows 3.1· 95.  |
| Keyboard            | Which can be connected to the personal computer.  |
| Mouse               | Which can be used with Windows 3.1· 95. Note that a serial mouse is not used.   |
| Printer             | Which can be used with Windows 3.1· 95.   |
| Communication cable | MR-HPC98CBL3M·MR-HPCATCBL3M<br>When these cannot be used, refer to Section 15.1.6(3) and fabricate.   |

Note: Windows is a registered trademark of Microsoft Corporation.

##### (b) Configuration diagram





## 15. OPTIONS AND AUXILIARY EQUIPMENT

### 15.1.9 Heat sink outside mounting attachment (MR-ACN)

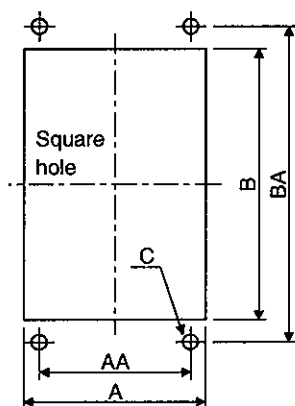
Use the heat sink outside mounting attachment to mount the heat generation area of the controller in the outside of the control box to dissipate controller-generated heat to the outside of the box and reduce the amount of heat generated in the box, thereby allowing a compact control box to be designed.

In the control box, machine a hole having the panel cut dimensions, fit the heat sink outside mounting attachment to the controller with the fitting screws (4 screws supplied), and install the controller to the control box.

The environment outside the control box when using the heat sink outside mounting attachment should be within the range of the controller operating environment conditions.

#### (1) Panel cut dimensions

##### (a) MR-ACN350 to MR-ACN700

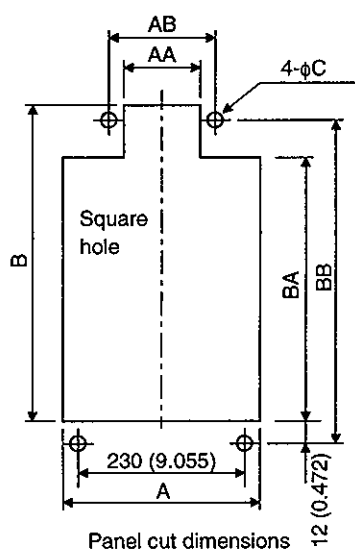


Panel cut dimensions

[Unit: mm (in)]

| Model     | AA             | BA              | A              | B               | C    | Controller               |
|-----------|----------------|-----------------|----------------|-----------------|------|--------------------------|
| MR-ACN350 | 117<br>(4.606) | 280<br>(11.024) | 131<br>(5.157) | 265<br>(10.433) | 4-5M | MR-H200ACN<br>MR-H350ACN |
| MR-ACN500 | 100<br>(3.937) | 370<br>(14.567) | 134<br>(5.276) | 355<br>(13.976) | 4-5M | MR-H500ACN               |
| MR-ACN700 | 170<br>(6.693) | 380<br>(14.961) | 222<br>(8.740) | 360<br>(14.173) | 4-5M | MR-H700ACN               |

##### (b) MR-ACN11K, MR-ACN22K



Panel cut dimensions

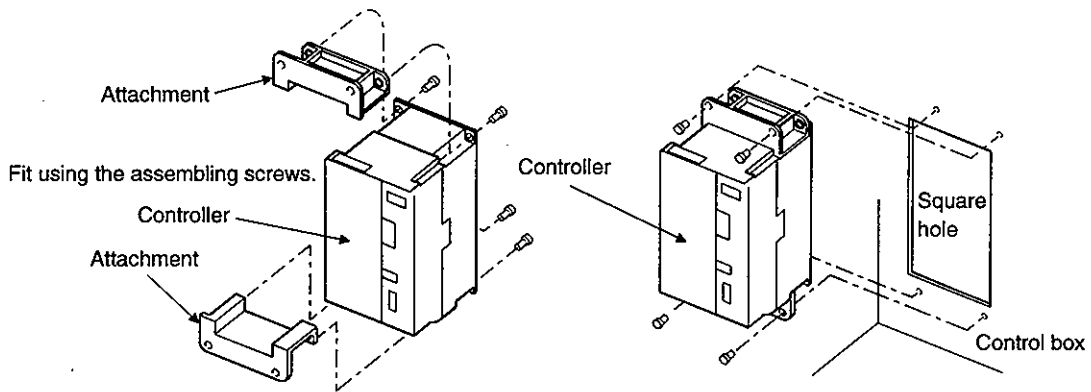
[Unit: mm (in)]

| Model     | A               | AA              | AB              | B               | BA              | BB              | C     | Controller               |
|-----------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-------|--------------------------|
| MR-ACN11K | 250<br>(9.843)  | 190<br>(7.480)  | 230<br>(9.055)  | 553<br>(21.772) | 483<br>(19.016) | 523<br>(20.591) | 4-M8  | MR-H11KACN               |
| MR-ACN22K | 340<br>(13.386) | 284<br>(11.181) | 308<br>(12.126) | 556<br>(21.890) | 483<br>(19.016) | 483<br>(20.709) | 4-M10 | MR-H15KACN<br>MR-H22KACN |

# 15. OPTIONS AND AUXILIARY EQUIPMENT

## (1) Fitting method

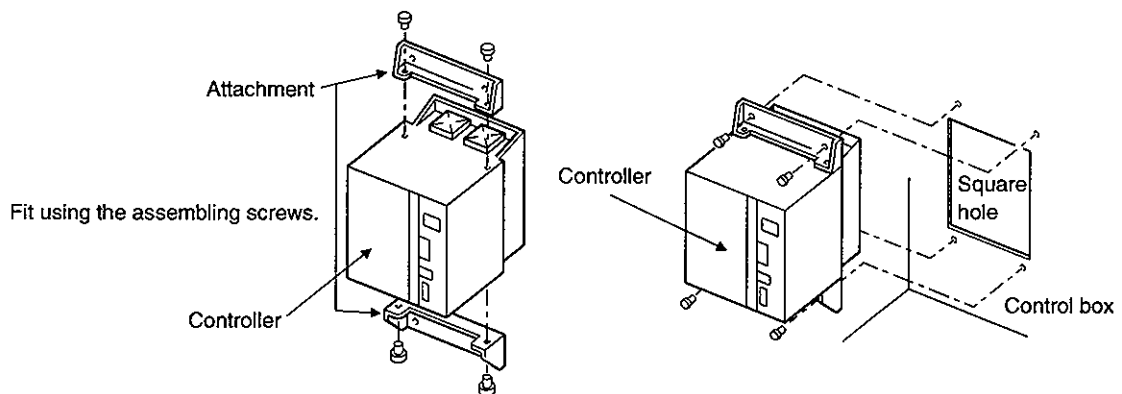
### (a) MR-ACN350 (for MR-H200ACN, MR-H350ACN)



a. Assembling the heat sink outside mounting attachment

b. Installation to the control box

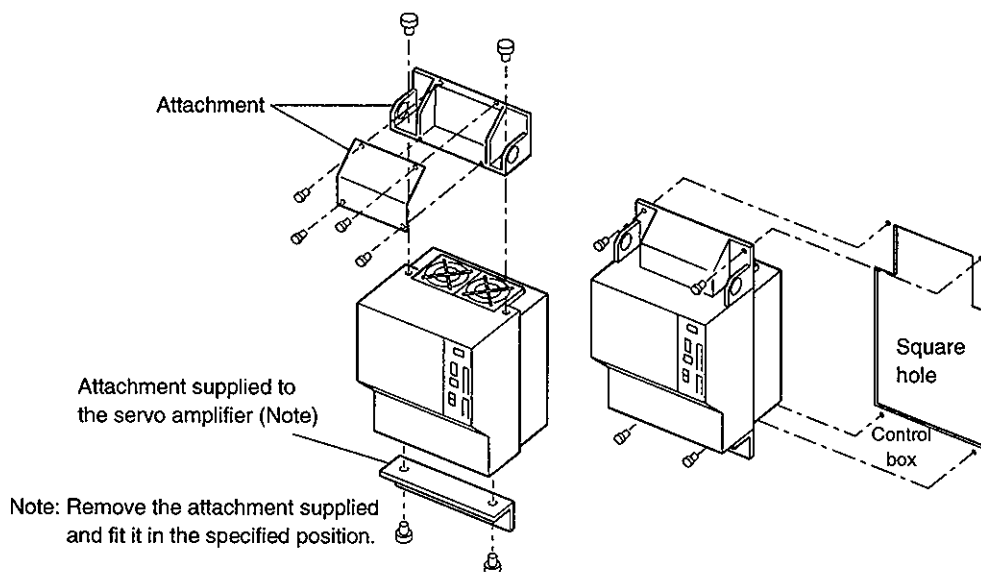
### (b) MR-ACN500 (for MR-H500ACN), MR-ACN700 (for MR-H700ACN)



a. Assembling the heat sink outside mounting attachment

b. Installation to the control box

### (c) MR-ACN11K (for MR-H11KACN), MR-ACN22K (for MR-H15KACN, MR-H22KACN)



a. Assembling the heat sink outside mounting attachment

b. Installation to the control box

## 15. OPTIONS AND AUXILIARY EQUIPMENT

### 15.1.10 Large setting/display unit (MR-PRU02)

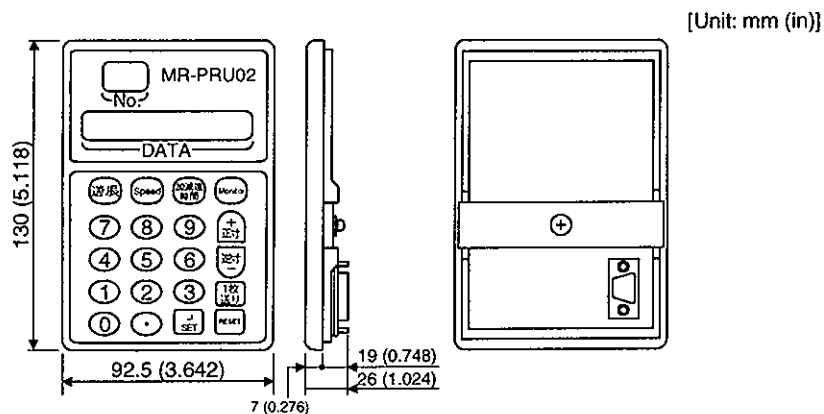
When using the MR-H-ACN in the roll feeding system, the MR-PRU02 allows status display, test operation, and reference to point table data. For details of its usage, refer to the installation guide of the MR-PRU02 large setting/display unit.

Use it with the large setting/display unit cable (MR-PRUBCBL□M).

#### (1) Specification

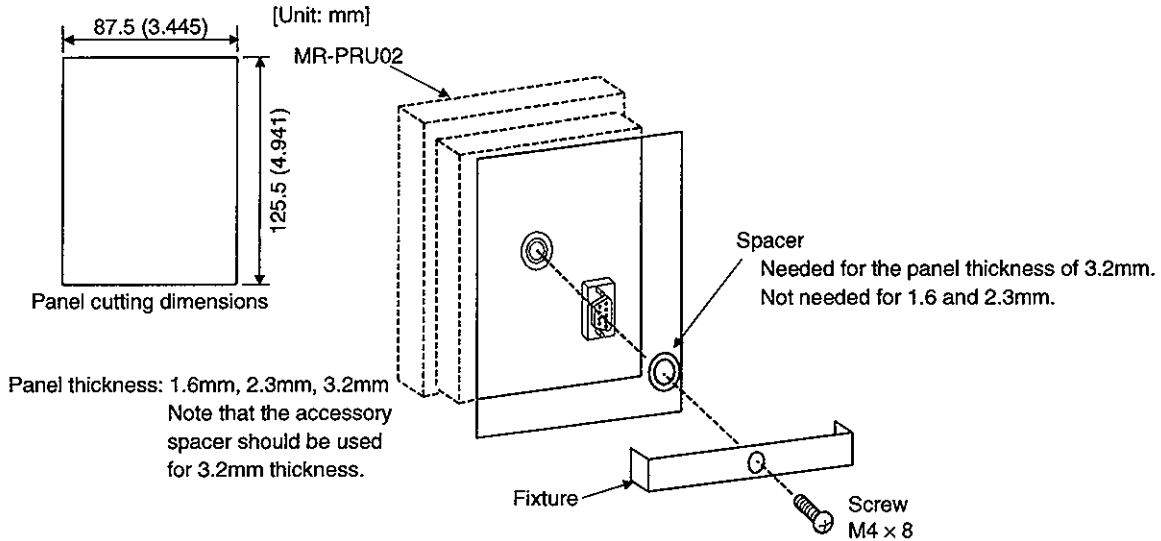
| Item                                  |                     | Specification   |
|---------------------------------------|---------------------|---|
| Model                                 |                     | MR-PRU02  |
| Function                              | Manual operation    | Jog operation, 1 step feed operation  |
|                                       | Status display      | Current position, Command position, Command remaining distance, Override, Position block, Command pulse value, Machine speed, Droop pulse, Torque limit command voltage, Regenerative load ratio, Effective load factor, Peak load ratio, Within one-revolution position, ABS counter, Servo motor speed, Bus voltage |
|                                       | Point table data    | Reference to position data<br>speed and acceleration / deceleration time constant   |
| Display                               |                     | 7 segment LED, 2 digits (code) and 7 digits (data)  |
| Environment                           | Ambient temperature | 0 to +55 [°C] (non-freezing)<br>32 to +131 [°F] (non-freezing)  |
|                                       | Ambient humidity    | 90%RH or less (non-condensing)  |
|                                       | storage temperature | -20 to +65 [°C] (non-freezing)<br>-4 to +149 [°F] (non-freezing)  |
|                                       | storage humidity    | 90%RH or less (non-condensing)  |
|                                       | Ambient             | Indoors (no direct sunlight)<br>Free from corrosive gas, flammable gas, oil mist, dust and dirt   |
|                                       | Altitude            | Max. 1000m (3280ft) above sea level   |
|                                       | Vibration           | 5.9 [m/s <sup>2</sup> ] {0.6G} or less<br>19.4 [ft/s <sup>2</sup> ] or less   |
| Cooling method                        |                     | Self-cooling  |
| Installation panel thickness [mm(in)] |                     | 1.6(0.063), 2.3(0.091), 3.2(0.126)  |
| Weight [g(oz)]                        |                     | 130(4.586)  |

#### (2) Outline drawing

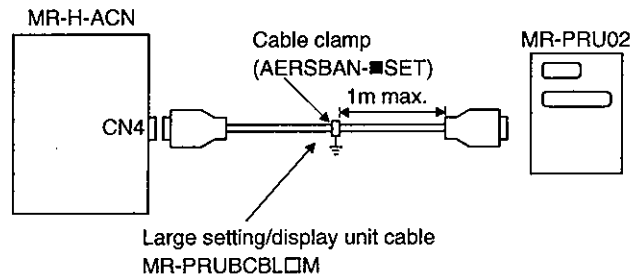


## 15. OPTIONS AND AUXILIARY EQUIPMENT

### (3) Panel cutting/fitting method



### (4) Makeup



#### POINT

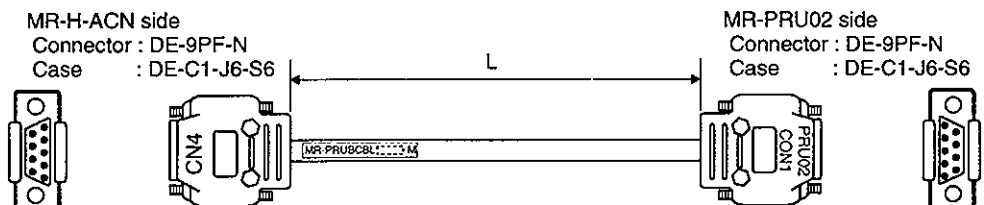
- If noise is generated to malfunction the equipment, use the cable clamp (AERSBAN-■SET) to suppress noise. Use the cable clamp fixture in accordance with Section 15.2.6, (3).

### (5) Large setting/display unit cable

Used to connect the large setting/display unit and MR-H-ACN.

Model: MR-PRUCBL□M

| Symbol | Cable Length L [m (in)] |
|--------|-------------------------|
| 3      | 3 (9.843)               |
| 5      | 5 (16.404)              |



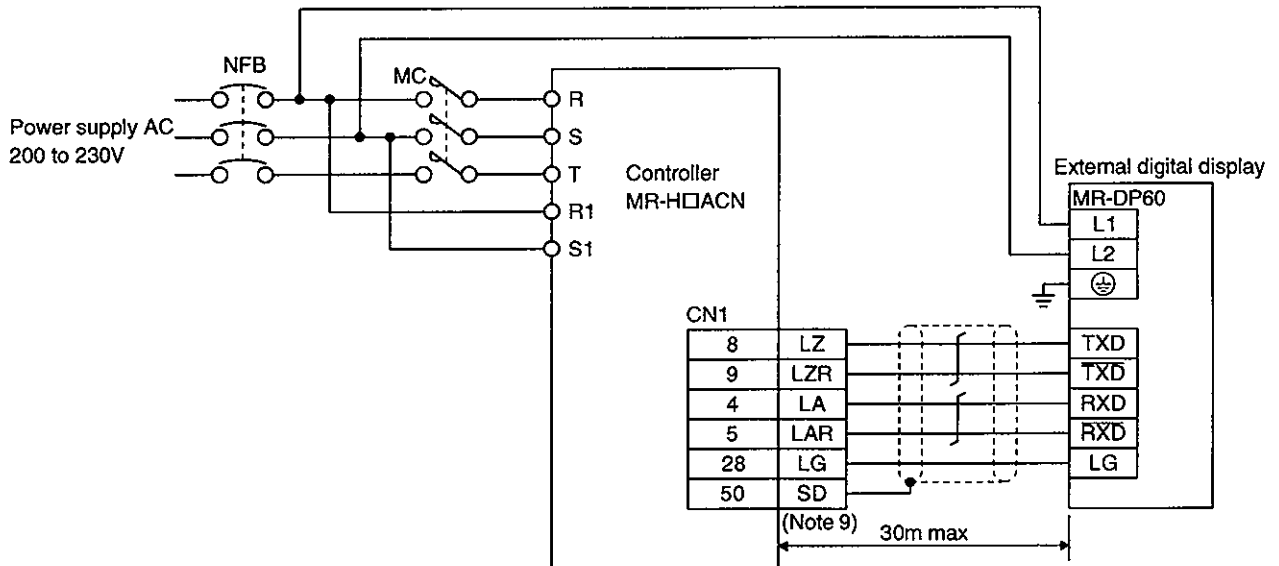
## 15. OPTIONS AND AUXILIARY EQUIPMENT

### 15.1.11 External Digital display (MR-DP60)

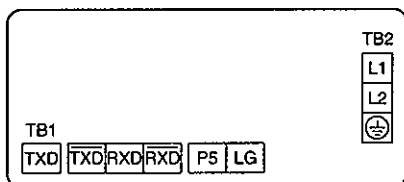
#### (1) Specifications

| Item                        |                                 | Specifications  |
|-----------------------------|---------------------------------|---|
| Display                     |                                 | Red 7-segment LED, signed 6 digits                        |
| Power supply                | Permissible voltage fluctuation | Single phase, 85 to 253VAC                                |
|                             | Current consumption             | Within 200mA  |
| Communication               | Interface                       | Conforming to RS-422A                                     |
|                             | Baudrate                        | 4800bps asynchronous                                      |
|                             | Bit length                      | Start bit = 1, data bit = 8, parity bit = 1, stop bit = 1 |
|                             | Protocol                        | MELSERVO-H protocol                                       |
|                             | Communication commands          | Commands dedicated to the MELSERVO-H                      |
| Operating temperature range |                                 | 0°C to +60°C, 90%RH or less, non-condensing               |
| Storage temperature range   |                                 | -5°C to +70°C   |

#### (2) Connection example



#### (3) Terminal layout



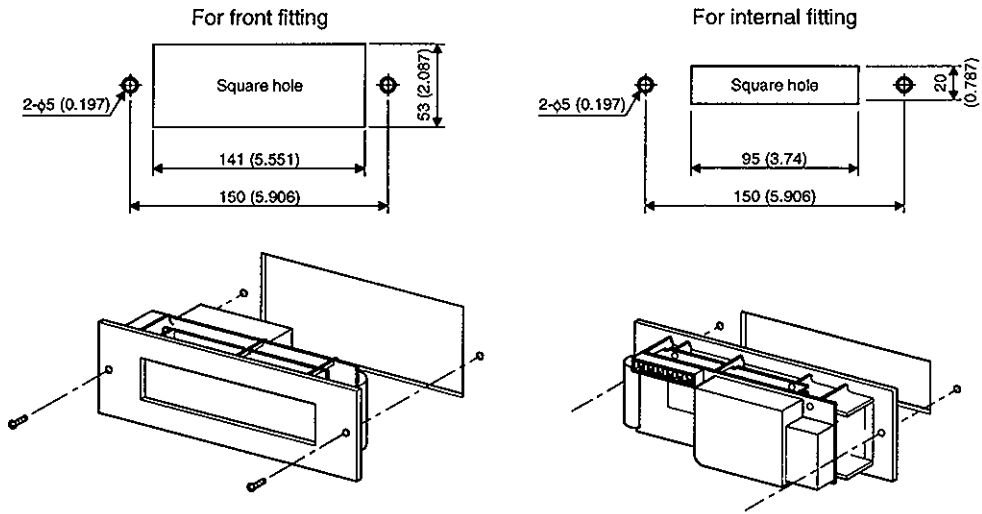
| Signal                  | Description                             |
|-------------------------|---|
| R                       | Single-phase, 100 to 230VAC power input |
| S                       | Single-phase, 100 to 230VAC power input |
| ⊕                       | Earth                                   |
| RXD                     | Receive signal input                    |
| $\overline{\text{RXD}}$ | Inverse receive signal input            |
| $\overline{\text{TXD}}$ | Inverse transmission signal output      |
| TXD                     | Transmission signal output              |
| P5                      | 5VDC output                             |
| LG                      | Control common                          |

Note: The 5VDC output is used for the internal control circuit to check voltage, etc. Do not use this terminal to supply voltage to the other equipment.

# 15. OPTIONS AND AUXILIARY EQUIPMENT

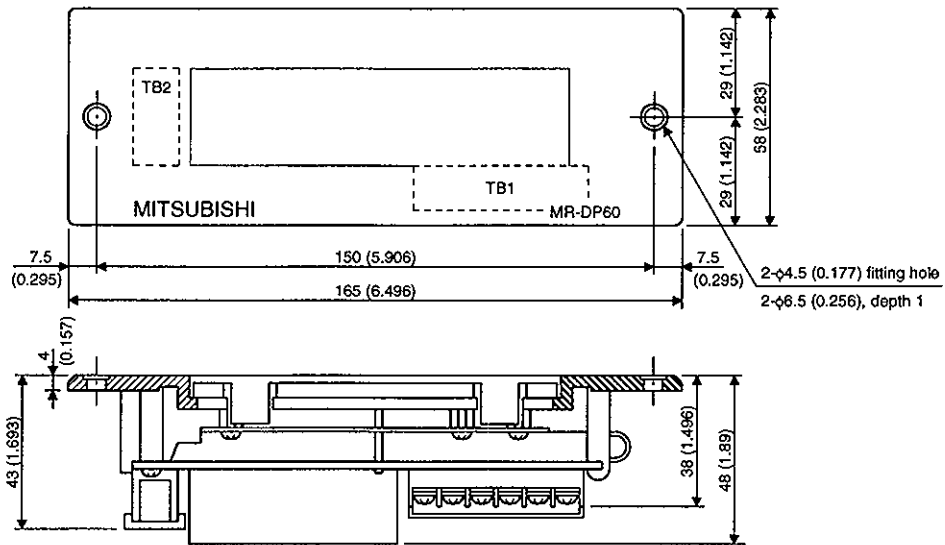
## (4) Fitting

[Unit: mm (in)]



## (5) Outline dimensional drawing

[Unit: mm (in)]



## 15. OPTIONS AND AUXILIARY EQUIPMENT

### 15.1.12 Manual Pulse Generator (MR-HDP01)

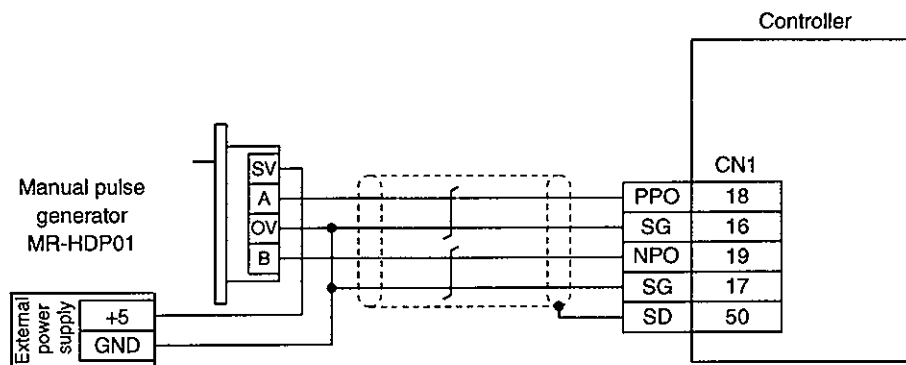
#### (1) Specifications

| Item                        |                     | Specifications   |
|-----------------------------|---------------------|--|
| Power supply                | Voltage             | 4.5 to 13.2VDC   |
|                             | Current consumption | 60mA or less   |
| interface                   |                     | Output current max. 20mA for open collector output         |
| Pulse signal form           |                     | A phase, B phase, 2 signals of 90° phase difference        |
| Pulse resolution            |                     | 25P/rev (100P/rev after multiplied by 4 in the controller) |
| Max. speed                  |                     | Max. 600r/min instantaneously, 200r/min normally           |
| Operating temperature range |                     | -10°C to +60°C   |
| Storage temperature range   |                     | -30°C to +80°C   |

#### (2) Connection example

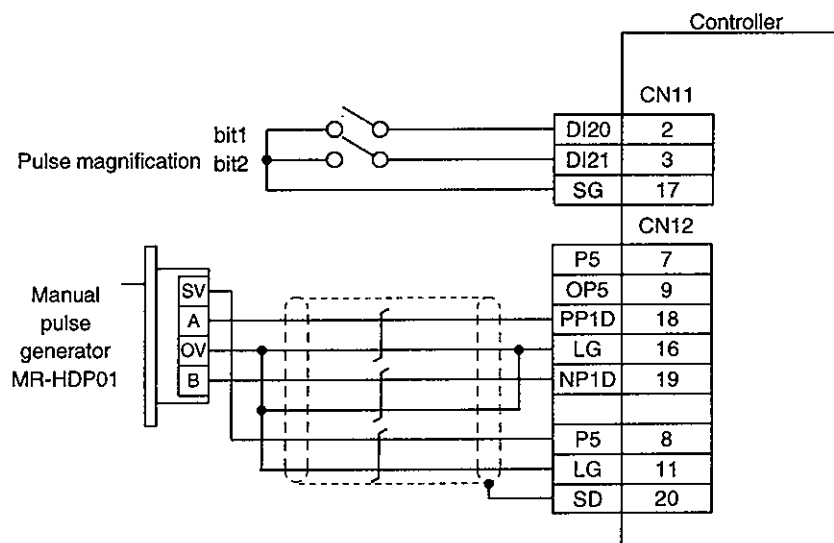
##### 1) Standard configuration

Supply external power to the manual pulse generator.



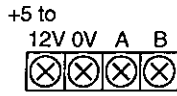
##### 2) When the option card (MR-H-D01) is used

Supply power to the manual pulse from the MR-H-D01.



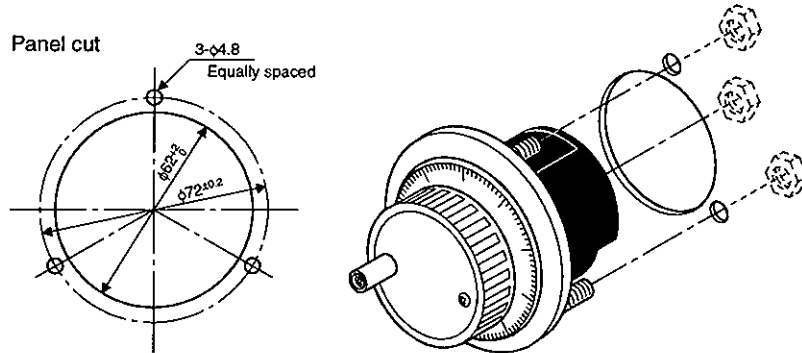
# 15. OPTIONS AND AUXILIARY EQUIPMENT

## (3) Terminal layout

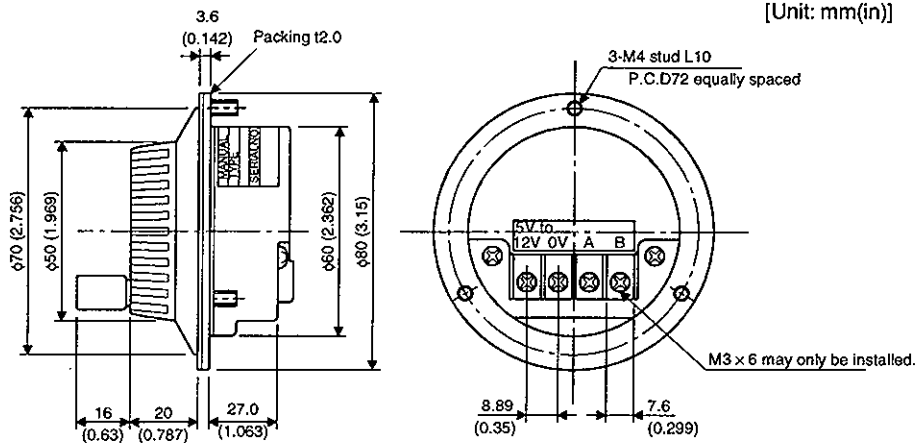


| Signal    | Description                 |
|-----------|-----------------------------|
| +5 to 12V | Power input                 |
| 0V        | Common for power and signal |
| A         | A-phase pulse output        |
| B         | B-phase pulse output        |

## (4) Installation

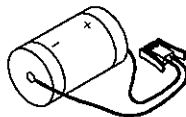


## (5) Outline drawing



### 15.1.13 Battery (MR-BAT, A6BAT)

Used to configure up the absolute position detection system.





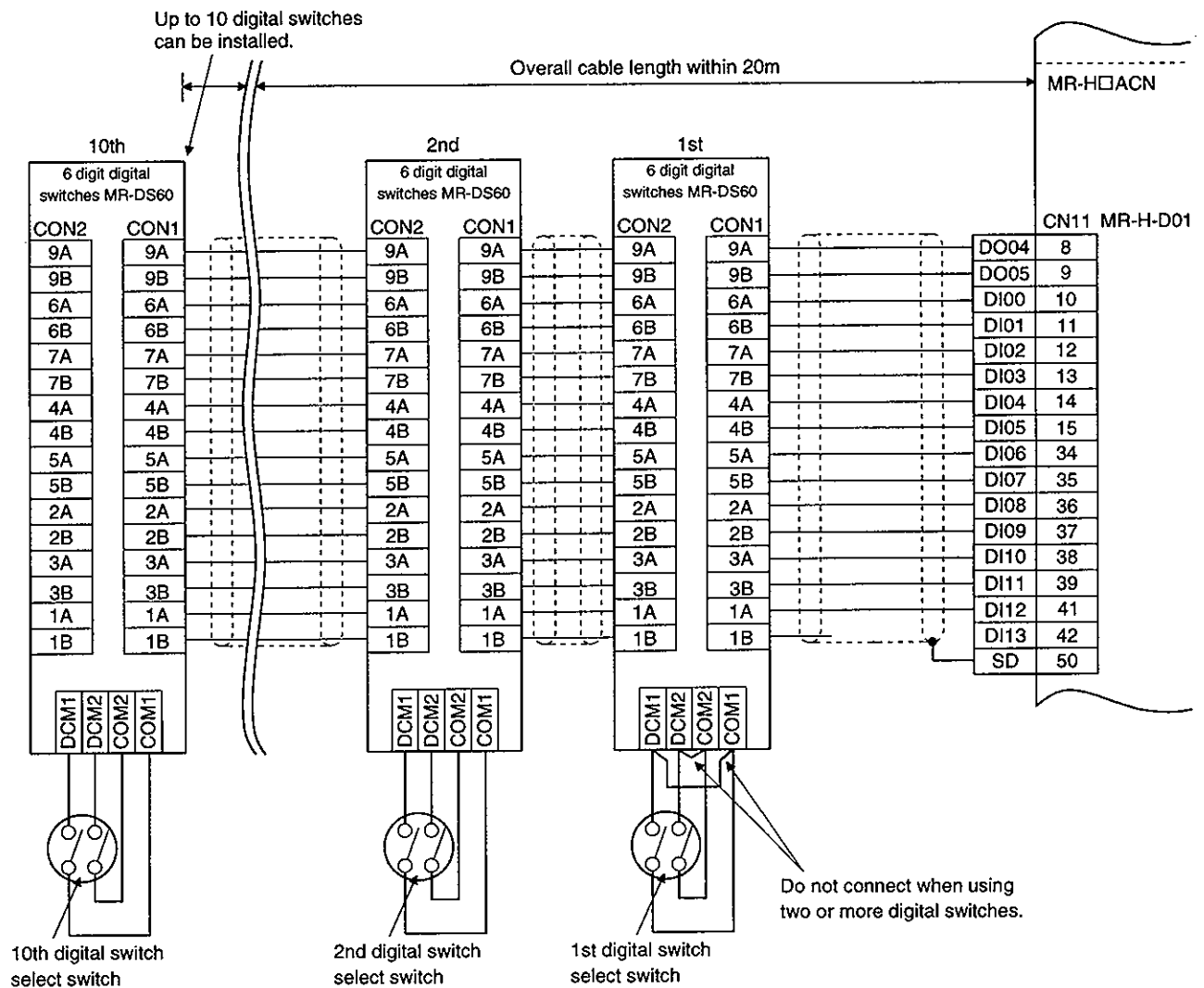
## 15. OPTIONS AND AUXILIARY EQUIPMENT

### 15.1.14 6-Digit Digital Switch (MR-DS60)

#### (1) Specifications

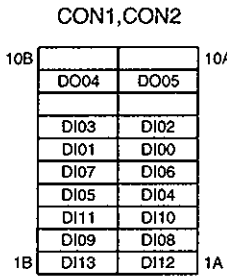
| Item                         | Specifications     |
|------------------------------|--------------------|
| Type                         | MR-DS60A           |
| Number of digits             | Signal 6-digit BCD |
| Electrical characteristic    | 28VDC (0.5A)       |
| Dielectric withstand voltage | 500Vr.m.s          |
| Contact resistance           | 100mΩ or less      |
| Life                         | 1,000,000 times    |
| Operating temperature range  | 0°C to 60°C        |
| Storage temperature range    | -5°C to 70°C       |

#### (2) Connection example

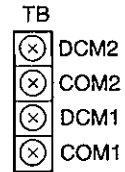


# 15. OPTIONS AND AUXILIARY EQUIPMENT

## (3) Terminal layout



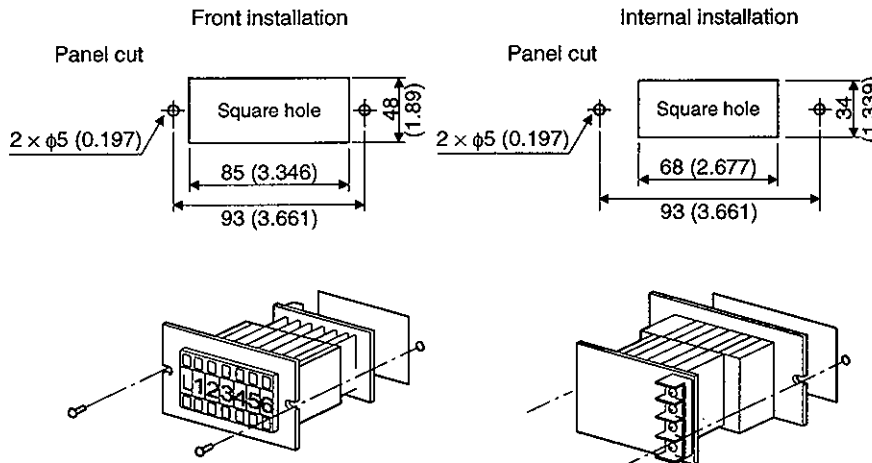
| Signal | Pin No. | Description  |
|--------|---------|--|
| DO04   | 9A      | Common output 1, sign, x1000, x10000, x100000 side common output |
| DO05   | 9B      | Common output 2, x1, x10, x100 side common output                |
| DI00   | 6A      | x1, x1000 bit 0  |
| DI01   | 6B      | x1, x1000 bit 1  |
| DI02   | 7A      | x1, x1000 bit 2  |
| DI03   | 7B      | x1, x1000 bit 3  |
| DI04   | 4A      | x10, x10000 bit 0  |
| DI05   | 4B      | x10, x10000 bit 1  |
| DI06   | 5A      | x10, x10000 bit 2  |
| DI07   | 5B      | x10, x10000 bit 3  |
| DI08   | 2A      | x100, x100000 bit 0  |
| DI09   | 2B      | x100, x100000 bit 1  |
| DI10   | 3A      | x100, x100000 bit 2  |
| DI11   | 3B      | x100, x100000 bit 3  |
| DI12   | 1A      | Sign bit 0   |
| DI13   | 1B      | Sign bit 1   |



| Signal | Description   |
|--------|---|
| DCM2   | Common input 2. Connect with COM2 when selecting a block.                                       |
| COM2   | Common output 2. Common 2 used for switch selection when two or more digital switches are used. |
| DCM1   | Common input 1. Connect with selecting a block.   |
| COM1   | Common output 1. Common 1 used for switch selection when two or more digital switches are used. |

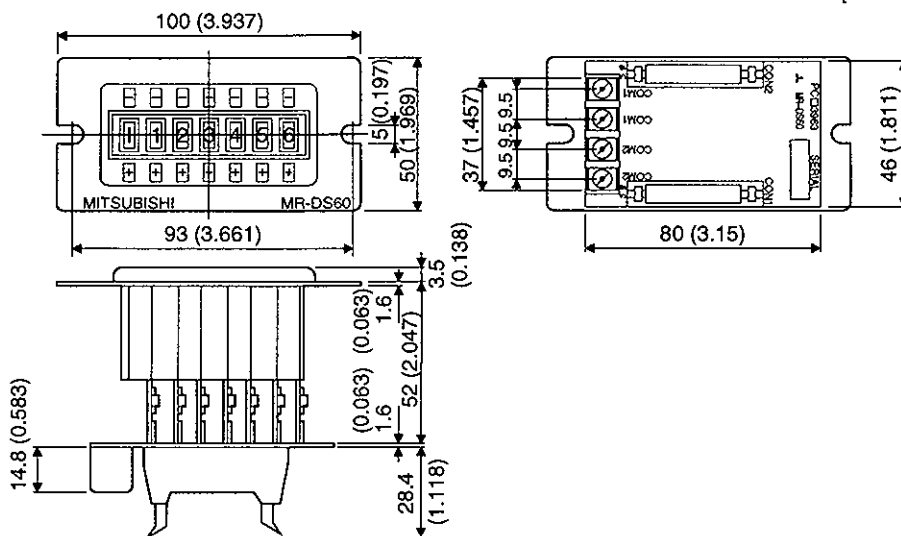
## (4) Installation

[Unit: mm (in)]



## (5) Outline drawing

[Unit: mm (in)]



## 15. OPTIONS AND AUXILIARY EQUIPMENT

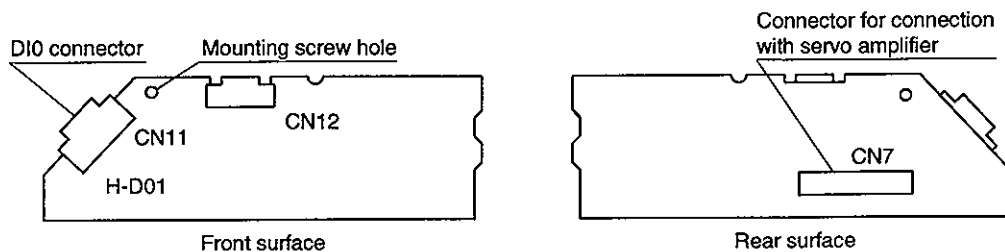
### 15.1.15 MR-H-D01 option card

Increase of point table and used for alarm code output, etc. See Chapter 3 or Chapter 4 for the connection and usage.

#### (1) Specifications

| Item              |           | Specifications  |
|-------------------|-----------|---|
| Function          |           | Extra digital I/O, point table expansion memory                               |
| Digital input     |           | 24 points, photocoupler isolated, 24VDC, 5mA                                  |
| Digital output    |           | 16 points, open collector, 24VDC, 50mA max.                                   |
| Pulse train input | System    | Forward/reverse rotation pulse train, 2-phase pulse train, signed pulse train |
|                   | Frequency | Differential 400kpps, open collector 200kpps                                  |

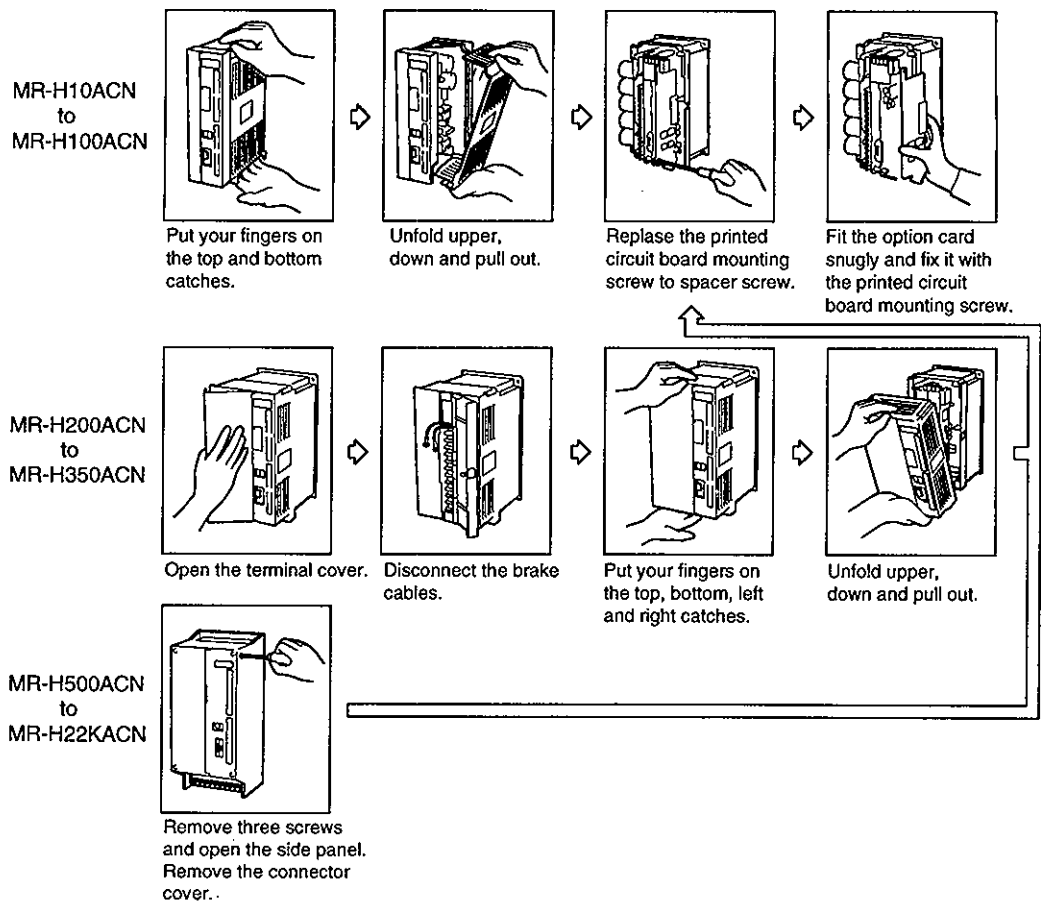
#### (2) Part names



#### (3) Installation to controller

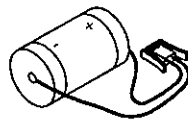
| POINT  |
|--|
| <p>The internal circuits of the controller may be damaged by static electricity. Always take the following precautions:</p> <ul style="list-style-type: none"> <li>• Ground human body and work bench.</li> <li>• Do not touch the conductive areas, such as connector pins and electrical parts, directly by hand.</li> </ul> |

## 15. OPTIONS AND AUXILIARY EQUIPMENT



### 15.1.16 Battery (MR-BAT, A6BAT)

Use the battery to build an absolute position detection system.



## 15. OPTIONS AND AUXILIARY EQUIPMENT

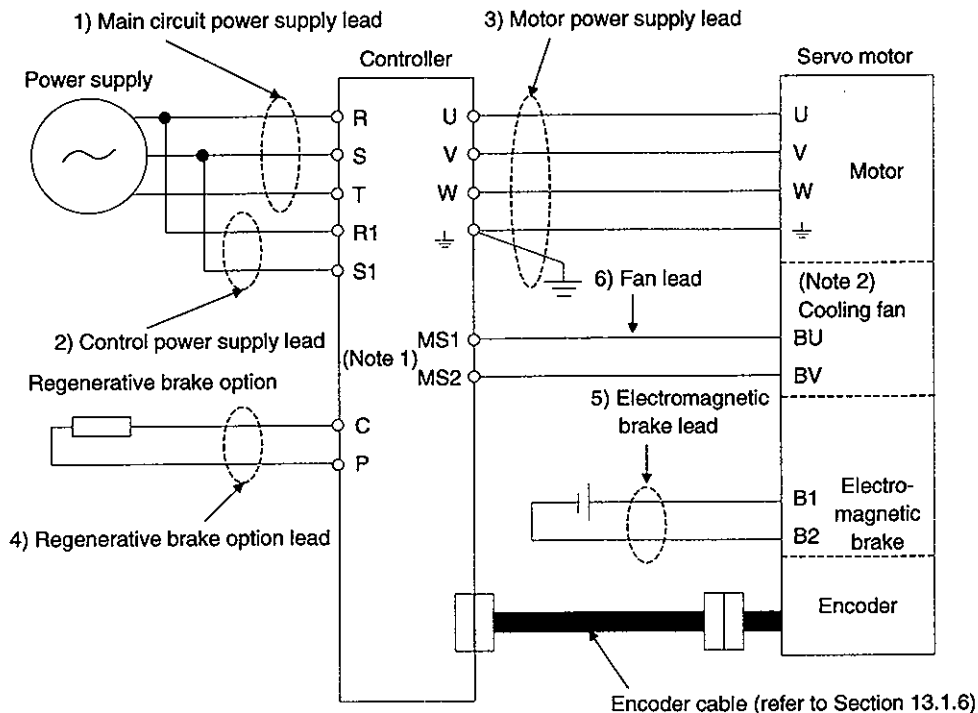
### 15.2 Auxiliary Equipment

Always use the devices indicated in this section or equivalent. To comply with the EN Standard or UL/C-UL Standard, use the products which conform to the corresponding standard.

#### 15.2.1 Recommended wires

##### (1) Wires for power supply wiring

The following diagram shows the wires used for wiring. Use the wires given in this paragraph or equivalent.



Note: 1. Provided for the 11kW and more controller.

2. Provided for the HA-LH11K2 to 22K2 servo motors.

The following table lists wire sizes. The wires used assume that they are 600V vinyl wires and the wiring distance is 30m max. If the wiring distance is over 30m, choose the wire size in consideration of voltage drop.

The servo motor side connection method depends on the type and capacity of the servo motor. Refer to Section 3.8.

The crimping terminals used with the U, V and W wires for MR-H11KACN should be those of Japan Crimping Terminal's 22-S5 or equivalent.

## 15. OPTIONS AND AUXILIARY EQUIPMENT

Tale 15.1 Recommended Wires

| Controller | Wires [mm <sup>2</sup> ] |            |                  |          |            |            |           |
|------------|--------------------------|------------|------------------|----------|------------|------------|-----------|
|            | 1) R · S · T             | 2) R1 · S1 | 3) U · V · W · ⊕ | 4) P · C | 5) B1 · B2 | 6) BU · BV |           |
| MR-H10ACN  | 2                        | 1.25       | 1.25             | 2        | 1.25       | /          |           |
| MR-H20ACN  |                          |            |                  |          |            |            |           |
| MR-H40ACN  |                          |            |                  |          |            |            |           |
| MR-H60ACN  |                          |            |                  |          |            |            |           |
| MR-H100ACN |                          |            |                  |          |            |            |           |
| MR-H200ACN | 3.5                      | 1.25       | 2                | 2        | 1.25       | /          |           |
| MR-H350ACN | 5.5                      |            |                  |          |            |            | 3.5       |
| MR-H500ACN |                          |            |                  |          |            |            | (Note)5.5 |
| MR-H700ACN | 8                        | 1.25       | 8                | 3.5      | /          | 2          |           |
| MR-H11KACN | 14                       |            | 22               | 5.5      |            |            |           |
| MR-H15KACN | 22                       |            | 30               |          |            |            |           |
| MR-H22KACN | 50                       |            | 60               |          |            |            |           |

Note: 3.5mm<sup>2</sup> for use of the HC-RF203 servo motor.

Use the following wires to wire the brake unit (FR-BU) and power return converter (FR-RC):

| Model     | Wire [mm <sup>2</sup> ] |
|-----------|-------------------------|
| FR-BU-15K | 3.5                     |
| FR-BU-30K | 5.5                     |
| FR-BU-55K | 14                      |
| FR-RC-15K | 14                      |

### (2) Wires for cables

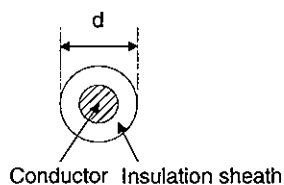
When fabricating a cable, use the wire models given in the following table or equivalent:

Table 15.2 Wires for Standard Encoder cables

| Wire Model                   | Core Size (mm <sup>2</sup> ) | Number of Cores | Finishing OD [mm] (Note 1) | Core insulation Outline d (mm) (Note 2) | Cable Type             | Cable Model                      |
|------------------------------|------------------------------|-----------------|----------------------------|---|------------------------|----------------------------------|
| UL20276AWG2<br>8 7pair(BLAC) | 0.08                         | 14 (7 pairs)    | 5.6                        | 0.9 to 1.27                             | Standard encoder cable | MR-JCCBL2M-L<br>to MR-JCCBL10M-L |
|                              |                              |                 |                            |   | Communication cable    | MR-HPC98CBL□M<br>MR-HPCATCBL□M   |
| UL20276AWG2<br>2 6pair(BLAC) | 0.3                          | 14 (7 pairs)    | 8.2 (8.7)                  | 0.9 to 1.27                             | Standard encoder cable | MR-JCCBL20M-L<br>MR-JCCBL30ML    |

Note 1: Value in parentheses is max. OD.

Note 2: d is as shown below:



## 15. OPTIONS AND AUXILIARY EQUIPMENT

Table 15.3 Wires for Long Flexing Life Encoder Cables

| (Note)<br>Junkosha's Wire<br>Model | Core Size<br>[mm <sup>2</sup> ] | Number of<br>Cores | Finishing OD<br>[mm] | Characteristics of 1 Core            |                                   | Cable Type                            | Cable Model  |
|------------------------------------|---------------------------------|--------------------|----------------------|--------------------------------------|-----------------------------------|---------------------------------------|--|
|                                    |                                 |                    |                      | Structure<br>[Number of<br>wires/mm] | Conductor<br>resistance<br>[Ω/km] |                                       |  |
| A14B2339                           | 0.2                             | 8 (4 pairs)        | 7.2                  | 40/0.08                              | 105 min.                          | Long flexing<br>life encoder<br>cable | MR-HSCBL5M<br>MR-JCCBL5M-H<br>MR-JHSCBL5M-H                            |
| A14B2343                           | 0.2                             | 12 (6 pairs)       | 7.9                  | 40/0.08                              | 105 min..                         |                                       | MR-HSCBL10M or more<br>MR-JCCBL10M-H or more<br>MR-JHSCBL10M-H or more |

Note: purchase from Toa Electric industry

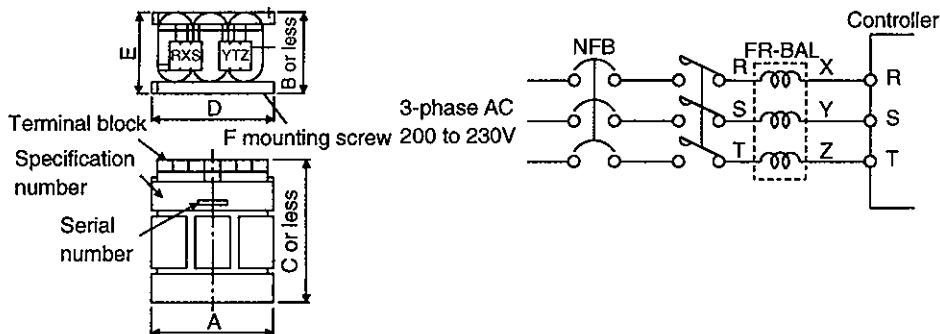
### 15.2.2 No-fuse breakers, magnetic contactors

Always use one no-fuse breaker and one magnetic contactor with one controller.

| Controller | No-Fuse Breaker  | Magnetic Contactor |
|------------|------------------|--------------------|
| MR-H10ACN  | Model NF30 5A    | S-N10              |
| MR-H20ACN  | Model NF30 10A   | S-N10              |
| MR-H40ACN  | Model NF30 10A   | S-N10              |
| MR-H60ACN  | Model NF30 10A   | S-N10              |
| MR-H100ACN | Model NF30 15A   | S-N10              |
| MR-H200ACN | Model NF30 20A   | S-N18              |
| MR-H350ACN | Model NF50 30A   | S-N25              |
| MR-H500ACN | Model NF50 05A   | S-N35              |
| MR-H700ACN | Model NF100 75A  | S-N50              |
| MR-H11KACN | Model NF100 100A | S-N65              |
| MR-H15KACN | Model NF225 125A | S-N95              |
| MR-H22KACN | Model NF225 175A | S-N125             |

## 15. OPTIONS AND AUXILIARY EQUIPMENT

### 15.2.3 Power factor improving reactors



| Controller | Model        | dimensions [mm (in)] |         |          |          |         |    | Approx. Weight<br>[kg (lb)] |
|------------|--------------|----------------------|---------|----------|----------|---------|----|-----------------------------|
|            |              | A                    | B       | C        | D        | E       | F  |                             |
| MR-H10ACN  | FR-BAL-0.4K  | 135                  | 64      | 120      | 120      | 45      | M4 | 2                           |
| MR-H20ACN  |              | (5.315)              | (2.520) | (4.724)  | (4.724)  | (1.772) |    | (4.409)                     |
| MR-H40ACN  | FR-BAL-0.75K | 135                  | 74      | 120      | 120      | 57      | M4 | 3                           |
|            |              | (5.315)              | (2.913) | (4.724)  | (4.724)  | (2.244) |    | (6.614)                     |
| MR-H60ACN  | FR-BAL-1.5K  | 160                  | 76      | 145      | 145      | 55      | M4 | 4                           |
|            |              | (6.299)              | (2.992) | (5.709)  | (5.709)  | (2.165) |    | (8.818)                     |
| MR-H100ACN | FR-BAL-2.2K  | 160                  | 96      | 145      | 145      | 75      | M4 | 6                           |
|            |              | (6.299)              | (3.780) | (5.709)  | (5.709)  | (2.953) |    | (13.228)                    |
| MR-H200ACN | FR-BAL-3.7K  | 220                  | 95      | 200      | 200      | 70      | M5 | 8.5                         |
|            |              | (8.661)              | (3.740) | (7.874)  | (7.874)  | (2.756) |    | (18.739)                    |
| MR-H350ACN | FR-BAL-7.5K  | 220                  | 125     | 205      | 200      | 100     | M5 | 14.5                        |
|            |              | (8.661)              | (4.921) | (8.071)  | (7.874)  | (3.937) |    | (31.967)                    |
| MR-H500ACN | FR-BAL-11K   | 280                  | 140     | 245      | 255      | 100     | M6 | 19                          |
|            |              | (11.024)             | (5.512) | (9.646)  | (10.039) | (3.937) |    | (41.888)                    |
| MR-H700ACN | FR-BAL-15K   | 295                  | 156     | 280      | 270      | 110     | M6 | 27                          |
| MR-H11KACN |              | (11.614)             | (6.142) | (11.024) | (10.630) | (4.331) |    | (59.525)                    |
| MR-H15KACN | FR-BAL-20K   | 290                  | 200     | 300      | 240      | 170     | M8 | 35                          |
|            |              | (11.417)             | (7.874) | (11.811) | (9.449)  | (6.693) |    | (77.162)                    |
| MR-H22KACN | FR-BAL-30K   | 290                  | 220     | 300      | 240      | 190     | M8 | 43                          |
|            |              | (11.417)             | (8.661) | (11.811) | (9.449)  | (7.480) |    | (94.799)                    |

### 15.2.4 Relays

The following relays should be used with the interfaces:

| Interface  | Selection Example  |
|--|--|
| Relay used especially for switching on-off analog input command and input command (interface DI-1) signals | To prevent defective contacts, use a relay for small signal (twin contacts).<br>(Ex.) OMRON : type G2A, MY |
| Relay used for digital output signals (interface DO-1)   | Small relay with 12VDC or 24VDC of 40mA or less<br>(Ex.) OMRON : type MY                                   |



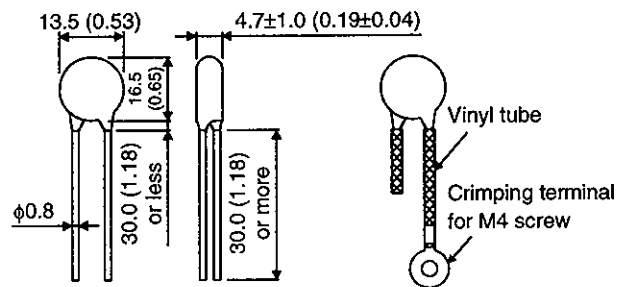
## 15. OPTIONS AND AUXILIARY EQUIPMENT

### 15.2.5 Surge absorbers

A surge absorber is required for the electromagnetic brake. Use the following surge absorber or equivalent. Insulate the wiring as shown in the diagram.

| Maximum Rating              |       |                    |                 |             | Maximum Limit Voltage |     | Static Capacity (Reference value) | Varistor Voltage Rating (Range) V1mA |
|-----------------------------|-------|--------------------|-----------------|-------------|-----------------------|-----|-----------------------------------|--------------------------------------|
| Permissible circuit voltage |       | Surge immunity     | Energy immunity | Rated power |                       |     |                                   |                                      |
| AC[Vma]                     | DC[V] | [A]                | [J]             | [W]         | [A]                   | [V] | [pF]                              | [V]                                  |
| 140                         | 180   | (Note)<br>500/time | 5               | 0.4         | 25                    | 360 | 300                               | 220<br>(198 to 242)                  |

Note: 1 time =  $8 \times 20\mu\text{s}$



## 15. OPTIONS AND AUXILIARY EQUIPMENT

### 15.2.6 Noise reduction techniques

Noises are classified into external noises which enter the controller to cause it to malfunction and those radiated by the controller to cause peripheral devices to malfunction. Since the controller is an electronic device which handles small signals, the following general noise reduction techniques are required.

Also, the controller can be a source of noise as its outputs are chopped by high carrier frequencies. If peripheral devices malfunction due to noises produced by the controller, noise suppression measures must be taken. The measures will vary slightly with the routes of noise transmission.

#### (1) General reduction techniques

- Avoid laying power lines (input and output cables) and signal cables side by side or do not bundle them together. Separate power lines from signal cables.
- Use shielded, twisted pair cables for connection with the encoder and for control signal transmission, and connect the shield to the SD terminal.
- Ground the controller, servo motor, etc. together at one point (refer to Section 3.6).

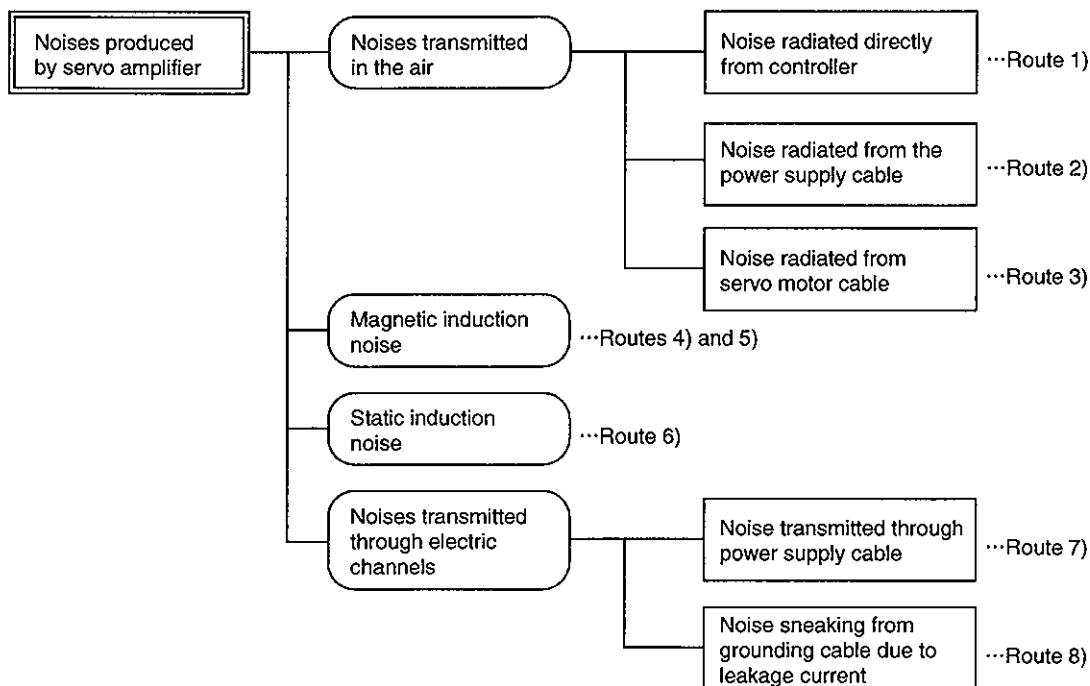
#### (2) Reduction techniques for external noises that cause the controller to malfunction

If there are noise sources (such as a magnetic contactor, an electromagnetic brake, and many relays which make a large amount of noise) near the controller and the controller may malfunction, the following countermeasures are required.

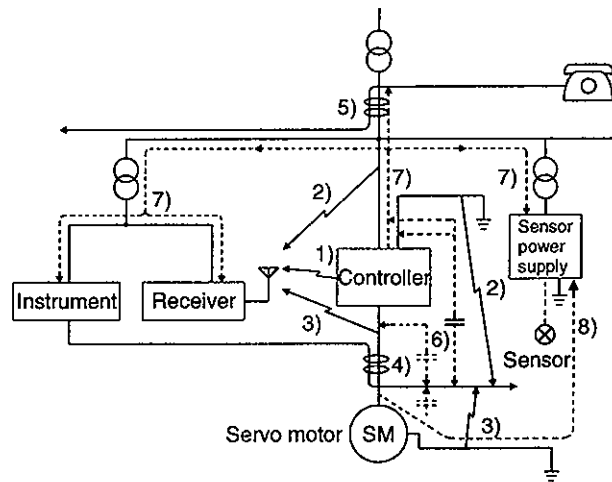
- Provide surge absorbers on the noise sources to suppress noises.
- Attach data line filters to the signal cables.
- Ground the shields of the encoder connecting cable and the control signal cables with cable clamp fittings.

#### (3) Techniques for noises radiated by the controller that cause peripheral devices to malfunction

Noises produced by the controller are classified into those radiated from the cables connected to the controller and its main circuits (input and output circuits), those induced electromagnetically or statically by the signal cables of the peripheral devices located near the main circuit cables, and those transmitted through the power supply cables.



# 15. OPTIONS AND AUXILIARY EQUIPMENT



| Noise Transmission Route | Suppression Techniques   |
|--------------------------|--|
| 1) 2) 3)                 | <p>When measuring instruments, receivers, sensors, etc. which handle weak signals and may malfunction due to noise and/or their signal cables are contained in a control box together with the controller or run near the controller, such devices may malfunction due to noises transmitted through the air. The following techniques are required.</p> <p>(1) Provide maximum clearance between easily affected devices and the controller.</p> <p>(2) Provide maximum clearance between easily affected signal cables and the I/O cables of the controller.</p> <p>(3) Avoid laying the power lines (I/O cables of the controller) and signal cables side by side or bundling them together.</p> <p>(4) Insert a line noise filter to the I/O cables or a radio noise filter on the input line.</p> <p>(5) Use shielded wires for signal and power cables or put cables in separate metal conduits.</p> |
| 4) 5) 6)                 | <p>When the power lines and the signal cables are laid side by side or bundled together, magnetic induction noise and static induction noise will be transmitted through the signal cables and malfunction may occur. The following techniques are required.</p> <p>(1) Provide maximum clearance between easily affected devices and the controller.</p> <p>(2) Provide maximum clearance between easily affected signal cables and the I/O cables of the controller.</p> <p>(3) Avoid laying the power lines (I/O cables of the controller) and signal cables side by side or bundling them together.</p> <p>(4) Use shielded wires for signal and power cables or put the cables in separate metal conduits.</p>  |
| 7)                       | <p>When the power supply of peripheral devices is connected to the power supply of the controller system, noises produced by the controller may be transmitted back through the power supply cable and the devices may malfunction. The following techniques are required.</p> <p>(1) Insert the radio noise filter (FR-BIF) on the power cables of the controller.</p> <p>(2) Insert the line noise filter (FR-BIF-FR-BLF01) on the power cables of the controller.</p>   |
| 8)                       | <p>When a closed loop circuit is formed by the ground cables of the peripheral device and controller, a leakage current may flow through to malfunction the device. If so, malfunction may be prevented by disconnecting the grounding cable of the peripheral device.</p>   |

## 15. OPTIONS AND AUXILIARY EQUIPMENT

### (1) Data line filter

Noise can be prevented by installing a data line filter onto the encoder cable, etc.

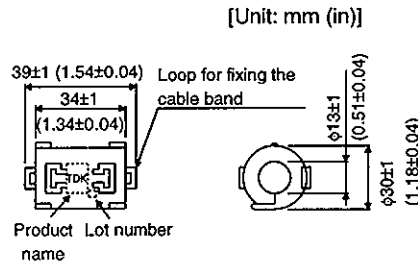
Example: Data line filter: ZCAT3035-1330 [TDK]

ESD-SR-25 [Tokin]

Impedance specifications (ZCAT3035-1330)

| Impedance[Ω] |               |
|--------------|---------------|
| 10 to 100MHz | 100 to 500MHz |
| 80           | 150           |

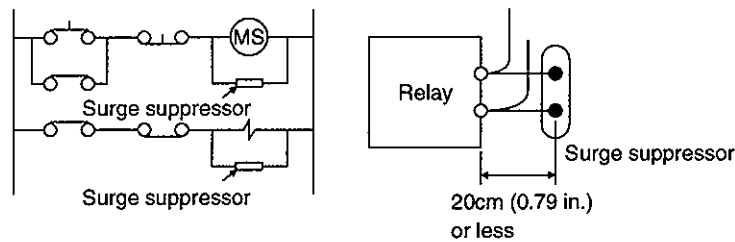
The above impedances are reference values and not guaranteed values.



Outline drawing (ZCAT3035-1330)

### (2) Surge suppressor

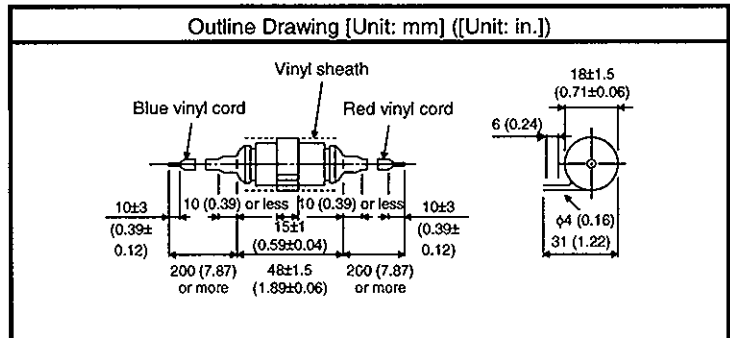
The recommended surge suppressor for installation to an AC relay, AC valve, AC electromagnetic brake or the like near the controller is shown below. Use this product or equivalent.



(Ex.) 972A.2003 50411

(Matsuo Electric Co.,Ltd.-200VAC rating)

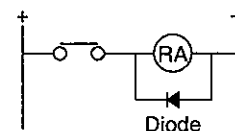
| Rated Voltage AC[V] | C [μF] | R [Ω]   | Test Voltage AC[V]    |
|---------------------|--------|---------|-----------------------|
| 200                 | 0.5    | 50 (1W) | Across T-C 1000(1-5s) |



Note that a diode should be installed to a DC relay, DC valve or the like.

Maximum voltage: Not less than 4 times the drive voltage of the relay or the like

Maximum current: Not less than twice the drive current of the relay or the like

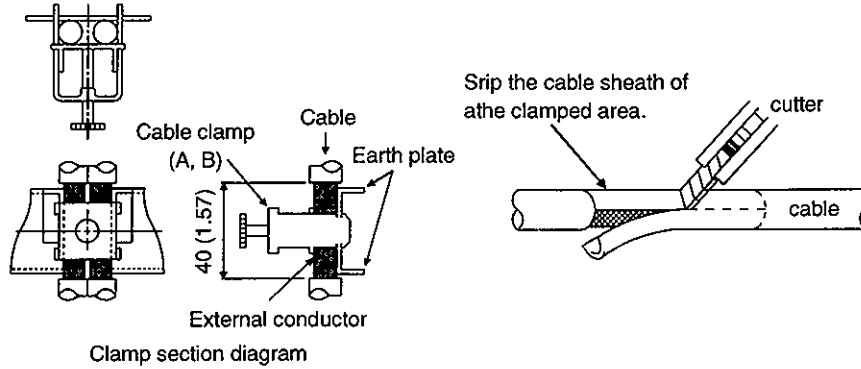


## 15. OPTIONS AND AUXILIARY EQUIPMENT

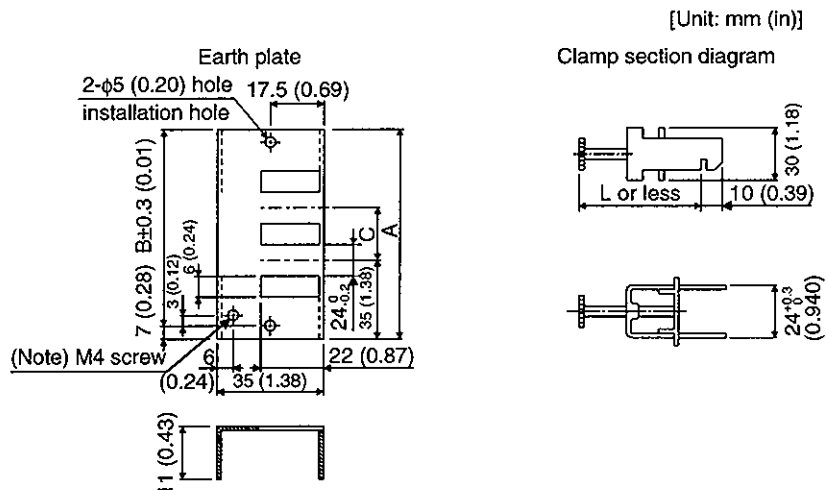
### (3) Cable clamp fitting (AERSBAN-DSET)

Generally, the earth of the shielded cable may only be connected to the connector's SD terminal. However, the effect can be increased by directly connecting the cable to an earth plate as shown below. Install the earth plate near the controller for the encoder cable. Peel part of the cable sheath to expose the external conductor, and press that part against the earth plate with the cable clamp. If the cable is thin, clamp several cables in a bunch.

The clamp comes as a set with the earth plate.



#### • Outline drawing



Note: Screw hole for grounding. Connect it to the earth plate of the control box.

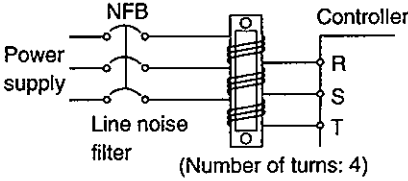
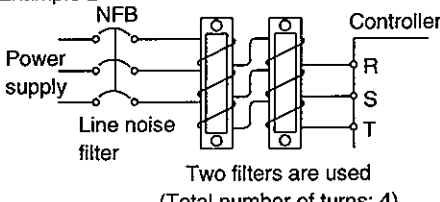
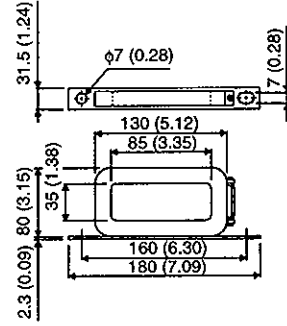
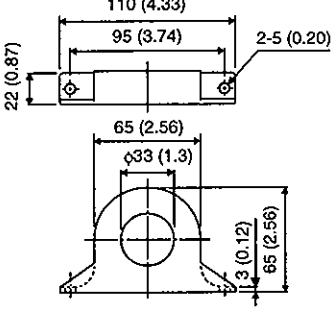
| Type         | A             | B            | C            | Accessory Fittings |
|--------------|---------------|--------------|--------------|--------------------|
| AERSBAN-DSET | 100<br>(3.94) | 86<br>(3.39) | 30<br>(1.18) | clamp A: 2pcs.     |
| AERSBAN-ESET | 70<br>(2.76)  | 56<br>(2.20) |              | clamp B: 1pc.      |

| Clamp Fitting | L            |
|---------------|--------------|
| A             | 70<br>(2.76) |
| B             | 45<br>(1.77) |

## 15. OPTIONS AND AUXILIARY EQUIPMENT

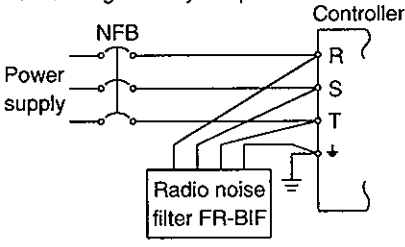
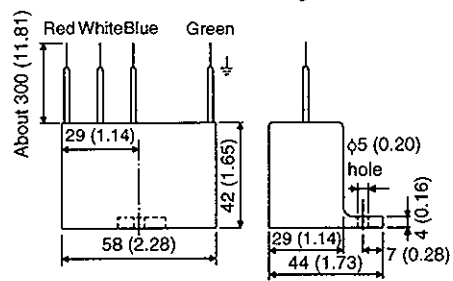
### (4) Line noise filter (FR-BLF, FR-BSF01)

This filter is effective in suppressing noises radiated from the power supply side and output side of the controller and also in suppressing high-frequency leakage current (zero-phase current) especially within 0.5MHz to 5MHz band.

| Connection Diagram  | Outline Drawing [Unit: mm] ([Unit: in.])   |
|---|--|
| <ul style="list-style-type: none"> <li>· Wind the three-phase wires by the equal number of times in the same direction, and connect the filter to the power supply side and output side of the controller.</li> <li>· The effect of the filter on the power supply side is higher as the number of winds is larger. The number of turns is generally four. On the output side, the number of turns must be four or less.</li> <li>· Do not wind the grounding wire together with the three-phase wires. The filter effect will decrease. Use special caution when a four-core cable is used. Use a separate wire for grounding.</li> <li>· If the wires are too thick to be wound, use two or more filters and the number of turns should be as mentioned above.</li> </ul> <p>Example 1</p>  <p>(Number of turns: 4)</p> <p>Example 2</p>  <p>Two filters are used<br/>(Total number of turns: 4)</p> | <p>FR-BLF (MR-H350ACN or more)</p>  <p>FR-BSF01 (for MR-H200ACN or less)</p>  |

### (5) Radio noise filter (FR-BIF)

This filter is effective in suppressing noises radiated from the power supply side of the controller especially in 10MHz and lower radio frequency bands. The FR-BIF is designed for the input only.

| Connection Diagram  | Outline Drawing (Unit: mm) ([Unit: in.])   |
|---|--|
| <p>Make the connection cables as short as possible.<br/>Grounding is always required.</p>  | <p>Leakage current: 4mA</p>  |

## 15. OPTIONS AND AUXILIARY EQUIPMENT

### 15.2.7 Leakage current breaker

#### (1) Selection method

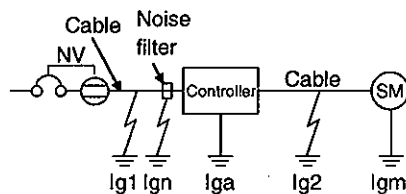
High-frequency chopper currents controlled by pulse width modulation flow in the AC servo circuits. Leakage currents containing harmonic contents are larger than those of the motor which is run with a commercial power supply.

Select a leakage current breaker according to the following formula, and ground the controller, servo motor, etc. securely.

Make the input and output cables as short as possible, and also make the grounding cable as long as possible (about 30cm (11.8 in)) to minimize leakage currents.

$$\text{Rated sensitivity current} \geq 10 \cdot \{I_{g1} + I_{gn} + I_{ga} + K \cdot (I_{g2} + I_{gm})\} \text{ [mA]} \dots\dots (15.2)$$

K: Constant considering the harmonic contents



| Leakage current breaker                                      |                         |   |
|--|-------------------------|---|
| Type   | Mitsubishi products     | K |
| Models provided with harmonic and surge reduction techniques | NV-SF<br>NV-CF          | 1 |
| General models   | NV-CA<br>NV-CS<br>NV-SS | 3 |

- Ig1: Leakage current on the electric channel from the leakage current breaker to the input terminals of the controller (Found from Fig. 15.1.)
- Ig2: Leakage current on the electric channel from the output terminals of the controller to the servo motor (Found from Fig. 15.1.)
- Ign: Leakage current when a filter is connected to the input side (4.4mA per one FR-BIF)
- Iga: Leakage current of the controller (Found from Table 15.4.)
- Igm: Leakage current of the servo motor (Found from Table 15.3.)

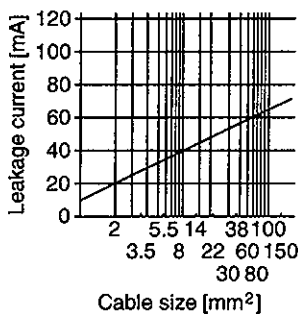


Fig.15.1 Leakage Current Example (Ig1,Ig2)for CV Cable Run in Metal Conduit

Table 15.4 Servo Motor's Leakage Current Example (Igm)

| Servo Motor Output [kW] | Leakage Current [mA] |
|-------------------------|----------------------|
| 0.05 to 0.5             | 0.1                  |
| 0.6 to 1.0              | 0.1                  |
| 1.2 to 2.2              | 0.2                  |
| 3 to 3.5                | 0.3                  |
| 4.5                     | 0.3                  |
| 5                       | 0.5                  |
| 7                       | 0.7                  |
| 11                      | 1.0                  |
| 15                      | 1.3                  |
| 22                      | 2.3                  |

Table 15.5 Controller's Leakage Current Example (Iga)

| Controller Capacity [kW] | Leakage Current [mA] |
|--------------------------|----------------------|
| All series               | 2                    |

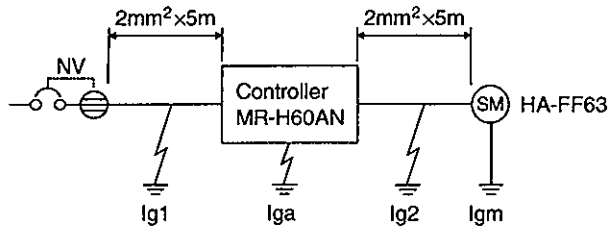
Table 15.6 Leakage Circuit Breaker Selection Example

| Controller               | Rated Sensitivity Current of Leakage Circuit Breaker |
|--------------------------|--|
| MR-H10ACN to MR-H350ACN  | 15mA   |
| MR-H500ACN               | 30mA   |
| MR-H700ACN               | 50mA   |
| MR-H11KACN to MR-H22KACN | 100mA  |

## 15. OPTIONS AND AUXILIARY EQUIPMENT

### (2) Selection example

Indicated below is an example of selecting a leakage current breaker under the following conditions:



Use a leakage current breaker generally available.

Find the terms of Equation (14.2) from the diagram:

$$I_{g1} = 20 \cdot \frac{5}{1000} = 0.1 \text{ [mA]}$$

$$I_{g2} = 20 \cdot \frac{5}{1000} = 0.1 \text{ [mA]}$$

$$I_{gn} = 0 \text{ (not used)}$$

$$I_{ga} = 0.1 \text{ [mA]}$$

$$I_{gm} = 0.1 \text{ [mA]}$$

Insert these values in Equation (15.2):

$$\begin{aligned} I_g &\geq 10 \cdot \{0.1+0+0.1+3 \cdot (0.1+0.1)\} \\ &\geq 8.0 \text{ [mA]} \end{aligned}$$

According to the result of calculation, use a leakage current breaker having the rated sensitivity current ( $I_g$ ) of 8.0[mA] or more. A leakage current breaker having  $I_g$  of 15[mA] is used with the NV-CA/CS/SS series.



## 15. OPTIONS AND AUXILIARY EQUIPMENT

### 15.2.8 Setting potentiometers for analog inputs

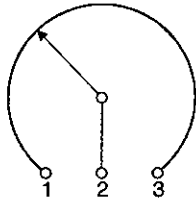
The following variable resistors are available for use with analog inputs such as override and analog torque commands:

#### (1) Single-revolution type

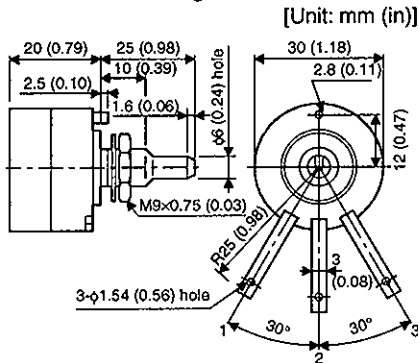
WA2WYA2SEBK2K $\Omega$  (Japan Resistor make)

| Rated Power | Resistance  | Resistance Tolerance | dielectric Strength (for 1 minute) | Insulation Resistance | Mechanical Rotary Angle      | Rotary Torque         |
|-------------|-------------|----------------------|------------------------------------|-----------------------|------------------------------|-----------------------|
| 2W          | 2k $\Omega$ | $\pm 10\%$           | 700V A.C                           | 100M $\Omega$ or more | 300 $^{\circ} \pm 5^{\circ}$ | 10 to 100g-cm or less |

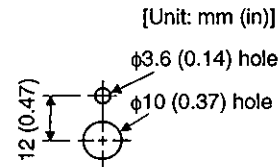
connection diagram



Outline dimension drawing



Panel hole machining diagram

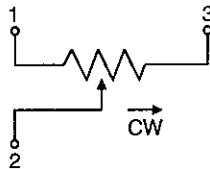


#### (2) Multi-revolution type

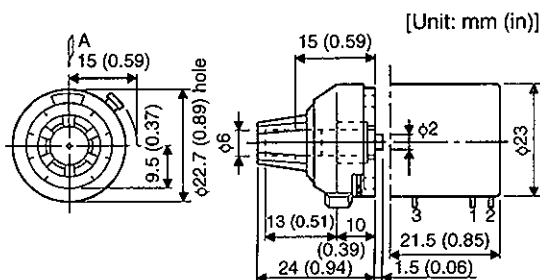
RRS10(M)2K $\Omega$  (Japan Resistor make)

| Rated Power | Resistance  | Resistance Tolerance | dielectric Strength (for 1 minute) | Insulation Resistance  | Mechanical Rotary Angle                | Rotary Torque   |
|-------------|-------------|----------------------|------------------------------------|------------------------|--|-----------------|
| 1W          | 2k $\Omega$ | $\pm 10\%$           | 700V A.C                           | 1000M $\Omega$ or more | 3600 $^{\circ} +10^{\circ} -0^{\circ}$ | 100g-cm or less |

connection diagram

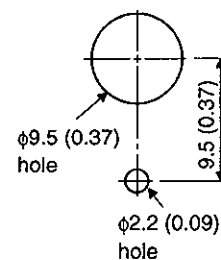


Outline dimension drawing



Panel hole machining diagram

[Unit: mm (in)]  
Panel thickness: 2 to 6 (0.08 to 0.24)



POINT TABLE DATA RECORDING FORMS

(1) Position blocks

1) 256-positions (positioning)

| (Position Block No.) | D107 | D106 | D105 | D104 | D103 | D102 | D101 | D100 | Position Data | M Code | Speed Block No. |
|----------------------|------|------|------|------|------|------|------|------|---------------|--------|-----------------|
|                      | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |               |        |                 |
| 0                    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |               |        |                 |
| 1                    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    |               |        |                 |
| 2                    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 0    |               |        |                 |
| 3                    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 1    |               |        |                 |
| 4                    | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 0    |               |        |                 |
| 5                    | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 1    |               |        |                 |
| 6                    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 0    |               |        |                 |
| 7                    | 0    | 0    | 0    | 0    | 0    | 1    | 1    | 1    |               |        |                 |
| 8                    | 0    | 0    | 0    | 0    | 1    | 0    | 0    | 0    |               |        |                 |
| 9                    | 0    | 0    | 0    | 0    | 1    | 0    | 0    | 1    |               |        |                 |
| 10                   | 0    | 0    | 0    | 0    | 1    | 0    | 1    | 0    |               |        |                 |
| 11                   | 0    | 0    | 0    | 0    | 1    | 0    | 1    | 1    |               |        |                 |
| 12                   | 0    | 0    | 0    | 0    | 1    | 1    | 0    | 0    |               |        |                 |
| 13                   | 0    | 0    | 0    | 0    | 1    | 1    | 0    | 1    |               |        |                 |
| 14                   | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 0    |               |        |                 |
| 15                   | 0    | 0    | 0    | 0    | 1    | 1    | 1    | 1    |               |        |                 |
| 16                   | 0    | 0    | 0    | 1    | 0    | 0    | 0    | 0    |               |        |                 |
| 17                   | 0    | 0    | 0    | 1    | 0    | 0    | 0    | 1    |               |        |                 |
| 18                   | 0    | 0    | 0    | 1    | 0    | 0    | 1    | 0    |               |        |                 |
| 19                   | 0    | 0    | 0    | 1    | 0    | 0    | 1    | 1    |               |        |                 |
| 20                   | 0    | 0    | 0    | 1    | 0    | 1    | 0    | 0    |               |        |                 |
| 21                   | 0    | 0    | 0    | 1    | 0    | 1    | 0    | 1    |               |        |                 |
| 22                   | 0    | 0    | 0    | 1    | 0    | 1    | 1    | 0    |               |        |                 |
| 23                   | 0    | 0    | 0    | 1    | 0    | 1    | 1    | 1    |               |        |                 |
| 24                   | 0    | 0    | 0    | 1    | 1    | 0    | 0    | 0    |               |        |                 |
| 25                   | 0    | 0    | 0    | 1    | 1    | 0    | 0    | 1    |               |        |                 |
| 26                   | 0    | 0    | 0    | 1    | 1    | 0    | 1    | 0    |               |        |                 |
| 27                   | 0    | 0    | 0    | 1    | 1    | 0    | 1    | 1    |               |        |                 |
| 28                   | 0    | 0    | 0    | 1    | 1    | 1    | 0    | 0    |               |        |                 |
| 29                   | 0    | 0    | 0    | 1    | 1    | 1    | 0    | 1    |               |        |                 |
| 30                   | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 0    |               |        |                 |
| 31                   | 0    | 0    | 0    | 1    | 1    | 1    | 1    | 1    |               |        |                 |
| 32                   | 0    | 0    | 1    | 0    | 0    | 0    | 0    | 0    |               |        |                 |
| 33                   | 0    | 0    | 1    | 0    | 0    | 0    | 0    | 1    |               |        |                 |
| 34                   | 0    | 0    | 1    | 0    | 0    | 0    | 1    | 0    |               |        |                 |
| 35                   | 0    | 0    | 1    | 0    | 0    | 0    | 1    | 1    |               |        |                 |
| 36                   | 0    | 0    | 1    | 0    | 0    | 1    | 0    | 0    |               |        |                 |
| 37                   | 0    | 0    | 1    | 0    | 0    | 1    | 0    | 1    |               |        |                 |
| 38                   | 0    | 0    | 1    | 0    | 0    | 1    | 1    | 0    |               |        |                 |
| 39                   | 0    | 0    | 1    | 0    | 0    | 1    | 1    | 1    |               |        |                 |
| 40                   | 0    | 0    | 1    | 0    | 1    | 0    | 0    | 0    |               |        |                 |
| 41                   | 0    | 0    | 1    | 0    | 1    | 0    | 0    | 1    |               |        |                 |
| 42                   | 0    | 0    | 1    | 0    | 1    | 0    | 1    | 0    |               |        |                 |
| 43                   | 0    | 0    | 1    | 0    | 1    | 0    | 1    | 1    |               |        |                 |
| 44                   | 0    | 0    | 1    | 0    | 1    | 1    | 0    | 0    |               |        |                 |
| 45                   | 0    | 0    | 1    | 0    | 1    | 1    | 0    | 1    |               |        |                 |
| 46                   | 0    | 0    | 1    | 0    | 1    | 1    | 1    | 0    |               |        |                 |
| 47                   | 0    | 0    | 1    | 0    | 1    | 1    | 1    | 1    |               |        |                 |
| 48                   | 0    | 0    | 1    | 1    | 0    | 0    | 0    | 0    |               |        |                 |
| 49                   | 0    | 0    | 1    | 1    | 0    | 0    | 0    | 1    |               |        |                 |

| (Position Block No.) | D107 | D106 | D105 | D104 | D103 | D102 | D101 | D100 | Position Data | M Code | Speed Block No. |
|----------------------|------|------|------|------|------|------|------|------|---------------|--------|-----------------|
|                      | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |               |        |                 |
| 50                   | 0    | 0    | 1    | 1    | 0    | 0    | 1    | 0    |               |        |                 |
| 51                   | 0    | 0    | 1    | 1    | 0    | 0    | 1    | 1    |               |        |                 |
| 52                   | 0    | 0    | 1    | 1    | 0    | 1    | 0    | 0    |               |        |                 |
| 53                   | 0    | 0    | 1    | 1    | 0    | 1    | 0    | 1    |               |        |                 |
| 54                   | 0    | 0    | 1    | 1    | 0    | 1    | 1    | 0    |               |        |                 |
| 55                   | 0    | 0    | 1    | 1    | 0    | 1    | 1    | 1    |               |        |                 |
| 56                   | 0    | 0    | 1    | 1    | 1    | 0    | 0    | 0    |               |        |                 |
| 57                   | 0    | 0    | 1    | 1    | 1    | 0    | 0    | 1    |               |        |                 |
| 58                   | 0    | 0    | 1    | 1    | 1    | 0    | 1    | 0    |               |        |                 |
| 59                   | 0    | 0    | 1    | 1    | 1    | 0    | 1    | 1    |               |        |                 |
| 60                   | 0    | 0    | 1    | 1    | 1    | 1    | 0    | 0    |               |        |                 |
| 61                   | 0    | 0    | 1    | 1    | 1    | 1    | 0    | 1    |               |        |                 |
| 62                   | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 0    |               |        |                 |
| 63                   | 0    | 0    | 1    | 1    | 1    | 1    | 1    | 1    |               |        |                 |
| 64                   | 0    | 1    | 0    | 0    | 0    | 0    | 0    | 0    |               |        |                 |
| 65                   | 0    | 1    | 0    | 0    | 0    | 0    | 0    | 1    |               |        |                 |
| 66                   | 0    | 1    | 0    | 0    | 0    | 0    | 1    | 0    |               |        |                 |
| 67                   | 0    | 1    | 0    | 0    | 0    | 0    | 1    | 1    |               |        |                 |
| 68                   | 0    | 1    | 0    | 0    | 0    | 1    | 0    | 0    |               |        |                 |
| 69                   | 0    | 1    | 0    | 0    | 0    | 1    | 0    | 1    |               |        |                 |
| 70                   | 0    | 1    | 0    | 0    | 0    | 1    | 1    | 0    |               |        |                 |
| 71                   | 0    | 1    | 0    | 0    | 0    | 1    | 1    | 1    |               |        |                 |
| 72                   | 0    | 1    | 0    | 0    | 1    | 0    | 0    | 0    |               |        |                 |
| 73                   | 0    | 1    | 0    | 0    | 1    | 0    | 0    | 1    |               |        |                 |
| 74                   | 0    | 1    | 0    | 0    | 1    | 0    | 1    | 0    |               |        |                 |
| 75                   | 0    | 1    | 0    | 0    | 1    | 0    | 1    | 1    |               |        |                 |
| 76                   | 0    | 1    | 0    | 0    | 1    | 1    | 0    | 0    |               |        |                 |
| 77                   | 0    | 1    | 0    | 0    | 1    | 1    | 0    | 1    |               |        |                 |
| 78                   | 0    | 1    | 0    | 0    | 1    | 1    | 1    | 0    |               |        |                 |
| 79                   | 0    | 1    | 0    | 0    | 1    | 1    | 1    | 1    |               |        |                 |
| 80                   | 0    | 1    | 0    | 1    | 0    | 0    | 0    | 0    |               |        |                 |
| 81                   | 0    | 1    | 0    | 1    | 0    | 0    | 0    | 1    |               |        |                 |
| 82                   | 0    | 1    | 0    | 1    | 0    | 0    | 1    | 0    |               |        |                 |
| 83                   | 0    | 1    | 0    | 1    | 0    | 0    | 1    | 1    |               |        |                 |
| 84                   | 0    | 1    | 0    | 1    | 0    | 1    | 0    | 0    |               |        |                 |
| 85                   | 0    | 1    | 0    | 1    | 0    | 1    | 0    | 1    |               |        |                 |
| 86                   | 0    | 1    | 0    | 1    | 0    | 1    | 1    | 0    |               |        |                 |
| 87                   | 0    | 1    | 0    | 1    | 0    | 1    | 1    | 1    |               |        |                 |
| 88                   | 0    | 1    | 0    | 1    | 1    | 0    | 0    | 0    |               |        |                 |
| 89                   | 0    | 1    | 0    | 1    | 1    | 0    | 0    | 1    |               |        |                 |
| 90                   | 0    | 1    | 0    | 1    | 1    | 1    | 0    | 1    |               |        |                 |
| 91                   | 0    | 1    | 0    | 1    | 1    | 0    | 1    | 1    |               |        |                 |
| 92                   | 0    | 1    | 0    | 1    | 1    | 1    | 0    | 0    |               |        |                 |
| 93                   | 0    | 1    | 0    | 1    | 1    | 1    | 0    | 1    |               |        |                 |
| 94                   | 0    | 1    | 0    | 1    | 1    | 1    | 1    | 0    |               |        |                 |
| 95                   | 0    | 1    | 0    | 1    | 1    | 1    | 1    | 1    |               |        |                 |
| 96                   | 0    | 1    | 1    | 0    | 0    | 0    | 0    | 0    |               |        |                 |
| 97                   | 0    | 1    | 1    | 0    | 0    | 0    | 0    | 1    |               |        |                 |
| 98                   | 0    | 1    | 1    | 0    | 0    | 0    | 1    | 0    |               |        |                 |
| 99                   | 0    | 1    | 1    | 0    | 0    | 0    | 1    | 1    |               |        |                 |

# Appendix

| Position Block No.) | D107 | D106 | D105 | D104 | D103 | D102 | D101 | D100 | Position Data | M Code | Speed Block No. |
|---------------------|------|------|------|------|------|------|------|------|---------------|--------|-----------------|
|                     | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |               |        |                 |
| 100                 | 0    | 1    | 1    | 0    | 0    | 1    | 0    | 0    |               |        |                 |
| 101                 | 0    | 1    | 1    | 0    | 0    | 1    | 0    | 1    |               |        |                 |
| 102                 | 0    | 1    | 1    | 0    | 0    | 1    | 1    | 0    |               |        |                 |
| 103                 | 0    | 1    | 1    | 0    | 0    | 1    | 1    | 1    |               |        |                 |
| 104                 | 0    | 1    | 1    | 0    | 1    | 0    | 0    | 0    |               |        |                 |
| 105                 | 0    | 1    | 1    | 0    | 1    | 0    | 0    | 1    |               |        |                 |
| 106                 | 0    | 1    | 1    | 0    | 1    | 0    | 1    | 0    |               |        |                 |
| 107                 | 0    | 1    | 1    | 0    | 1    | 0    | 1    | 1    |               |        |                 |
| 108                 | 0    | 1    | 1    | 0    | 1    | 1    | 0    | 0    |               |        |                 |
| 109                 | 0    | 1    | 1    | 0    | 1    | 1    | 0    | 1    |               |        |                 |
| 110                 | 0    | 1    | 1    | 0    | 1    | 1    | 1    | 0    |               |        |                 |
| 111                 | 0    | 1    | 1    | 0    | 1    | 1    | 1    | 1    |               |        |                 |
| 112                 | 0    | 1    | 1    | 1    | 0    | 0    | 0    | 0    |               |        |                 |
| 113                 | 0    | 1    | 1    | 1    | 0    | 0    | 0    | 1    |               |        |                 |
| 114                 | 0    | 1    | 1    | 1    | 0    | 0    | 1    | 0    |               |        |                 |
| 115                 | 0    | 1    | 1    | 1    | 0    | 0    | 1    | 1    |               |        |                 |
| 116                 | 0    | 1    | 1    | 1    | 0    | 1    | 0    | 0    |               |        |                 |
| 117                 | 0    | 1    | 1    | 1    | 0    | 1    | 0    | 1    |               |        |                 |
| 118                 | 0    | 1    | 1    | 1    | 0    | 1    | 1    | 0    |               |        |                 |
| 119                 | 0    | 1    | 1    | 1    | 0    | 1    | 1    | 1    |               |        |                 |
| 120                 | 0    | 1    | 1    | 1    | 1    | 0    | 0    | 0    |               |        |                 |
| 121                 | 0    | 1    | 1    | 1    | 1    | 0    | 0    | 1    |               |        |                 |
| 122                 | 0    | 1    | 1    | 1    | 1    | 0    | 1    | 0    |               |        |                 |
| 123                 | 0    | 1    | 1    | 1    | 1    | 0    | 1    | 1    |               |        |                 |
| 124                 | 0    | 1    | 1    | 1    | 1    | 1    | 0    | 0    |               |        |                 |
| 125                 | 0    | 1    | 1    | 1    | 1    | 1    | 0    | 1    |               |        |                 |
| 126                 | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 0    |               |        |                 |
| 127                 | 0    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |               |        |                 |
| 128                 | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |               |        |                 |
| 129                 | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 1    |               |        |                 |
| 130                 | 1    | 0    | 0    | 0    | 0    | 0    | 1    | 0    |               |        |                 |
| 131                 | 1    | 0    | 0    | 0    | 0    | 0    | 1    | 1    |               |        |                 |
| 132                 | 1    | 0    | 0    | 0    | 0    | 1    | 0    | 0    |               |        |                 |
| 133                 | 1    | 0    | 0    | 0    | 0    | 1    | 0    | 1    |               |        |                 |
| 134                 | 1    | 0    | 0    | 0    | 0    | 1    | 1    | 0    |               |        |                 |
| 135                 | 1    | 0    | 0    | 0    | 0    | 1    | 1    | 1    |               |        |                 |
| 136                 | 1    | 0    | 0    | 0    | 1    | 0    | 0    | 0    |               |        |                 |
| 137                 | 1    | 0    | 0    | 0    | 1    | 0    | 0    | 1    |               |        |                 |
| 138                 | 1    | 0    | 0    | 0    | 1    | 0    | 1    | 0    |               |        |                 |
| 139                 | 1    | 0    | 0    | 0    | 1    | 0    | 1    | 1    |               |        |                 |
| 140                 | 1    | 0    | 0    | 0    | 1    | 1    | 0    | 0    |               |        |                 |
| 141                 | 1    | 0    | 0    | 0    | 1    | 1    | 0    | 1    |               |        |                 |
| 142                 | 1    | 0    | 0    | 0    | 1    | 1    | 1    | 0    |               |        |                 |
| 143                 | 1    | 0    | 0    | 0    | 1    | 1    | 1    | 1    |               |        |                 |
| 144                 | 1    | 0    | 0    | 1    | 0    | 0    | 0    | 0    |               |        |                 |
| 145                 | 1    | 0    | 0    | 1    | 0    | 0    | 0    | 1    |               |        |                 |
| 146                 | 1    | 0    | 0    | 1    | 0    | 0    | 1    | 0    |               |        |                 |
| 147                 | 1    | 0    | 0    | 1    | 0    | 0    | 1    | 1    |               |        |                 |
| 148                 | 1    | 0    | 0    | 1    | 0    | 1    | 0    | 0    |               |        |                 |
| 149                 | 1    | 0    | 0    | 1    | 0    | 1    | 0    | 1    |               |        |                 |
| 150                 | 1    | 0    | 0    | 1    | 0    | 1    | 1    | 0    |               |        |                 |
| 151                 | 1    | 0    | 0    | 1    | 0    | 1    | 1    | 1    |               |        |                 |
| 152                 | 1    | 0    | 0    | 1    | 1    | 0    | 0    | 0    |               |        |                 |
| 153                 | 1    | 0    | 0    | 1    | 1    | 0    | 0    | 1    |               |        |                 |
| 154                 | 1    | 0    | 0    | 1    | 1    | 0    | 1    | 0    |               |        |                 |

| Position Block No.) | D107 | D106 | D105 | D104 | D103 | D102 | D101 | D100 | Position Data | M Code | Speed Block No. |
|---------------------|------|------|------|------|------|------|------|------|---------------|--------|-----------------|
|                     | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |               |        |                 |
| 155                 | 1    | 0    | 0    | 1    | 1    | 0    | 1    | 1    |               |        |                 |
| 156                 | 1    | 0    | 0    | 1    | 1    | 1    | 0    | 0    |               |        |                 |
| 157                 | 1    | 0    | 0    | 1    | 1    | 1    | 0    | 1    |               |        |                 |
| 158                 | 1    | 0    | 0    | 1    | 1    | 1    | 1    | 0    |               |        |                 |
| 159                 | 1    | 0    | 0    | 1    | 1    | 1    | 1    | 1    |               |        |                 |
| 160                 | 1    | 0    | 1    | 0    | 0    | 0    | 0    | 0    |               |        |                 |
| 161                 | 1    | 0    | 1    | 0    | 0    | 0    | 0    | 1    |               |        |                 |
| 162                 | 1    | 0    | 1    | 0    | 0    | 0    | 1    | 0    |               |        |                 |
| 163                 | 1    | 0    | 1    | 0    | 0    | 0    | 1    | 1    |               |        |                 |
| 164                 | 1    | 0    | 1    | 0    | 0    | 1    | 0    | 0    |               |        |                 |
| 165                 | 1    | 0    | 1    | 0    | 0    | 1    | 0    | 1    |               |        |                 |
| 166                 | 1    | 0    | 1    | 0    | 0    | 1    | 1    | 0    |               |        |                 |
| 167                 | 1    | 0    | 1    | 0    | 0    | 1    | 1    | 1    |               |        |                 |
| 168                 | 1    | 0    | 1    | 0    | 1    | 0    | 0    | 0    |               |        |                 |
| 169                 | 1    | 0    | 1    | 0    | 1    | 0    | 0    | 1    |               |        |                 |
| 170                 | 1    | 0    | 1    | 0    | 1    | 0    | 1    | 0    |               |        |                 |
| 171                 | 1    | 0    | 1    | 0    | 1    | 0    | 1    | 1    |               |        |                 |
| 172                 | 1    | 0    | 1    | 0    | 1    | 1    | 0    | 0    |               |        |                 |
| 173                 | 1    | 0    | 1    | 0    | 1    | 1    | 0    | 1    |               |        |                 |
| 174                 | 1    | 0    | 1    | 0    | 1    | 1    | 1    | 0    |               |        |                 |
| 175                 | 1    | 0    | 1    | 0    | 1    | 1    | 1    | 1    |               |        |                 |
| 176                 | 1    | 0    | 1    | 1    | 0    | 0    | 0    | 0    |               |        |                 |
| 177                 | 1    | 0    | 1    | 1    | 0    | 0    | 0    | 1    |               |        |                 |
| 178                 | 1    | 0    | 1    | 1    | 0    | 0    | 1    | 0    |               |        |                 |
| 179                 | 1    | 0    | 1    | 1    | 0    | 0    | 1    | 1    |               |        |                 |
| 180                 | 1    | 0    | 1    | 1    | 0    | 1    | 0    | 0    |               |        |                 |
| 181                 | 1    | 0    | 1    | 1    | 0    | 1    | 0    | 1    |               |        |                 |
| 182                 | 1    | 0    | 1    | 1    | 0    | 1    | 1    | 0    |               |        |                 |
| 183                 | 1    | 0    | 1    | 1    | 0    | 1    | 1    | 1    |               |        |                 |
| 184                 | 1    | 0    | 1    | 1    | 1    | 0    | 0    | 0    |               |        |                 |
| 185                 | 1    | 0    | 1    | 1    | 1    | 0    | 0    | 1    |               |        |                 |
| 186                 | 1    | 0    | 1    | 1    | 1    | 0    | 1    | 0    |               |        |                 |
| 187                 | 1    | 0    | 1    | 1    | 1    | 0    | 1    | 1    |               |        |                 |
| 188                 | 1    | 0    | 1    | 1    | 1    | 1    | 0    | 0    |               |        |                 |
| 189                 | 1    | 0    | 1    | 1    | 1    | 1    | 0    | 1    |               |        |                 |
| 190                 | 1    | 0    | 1    | 1    | 1    | 1    | 1    | 0    |               |        |                 |
| 191                 | 1    | 0    | 1    | 1    | 1    | 1    | 1    | 1    |               |        |                 |
| 192                 | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 0    |               |        |                 |
| 193                 | 1    | 1    | 0    | 0    | 0    | 0    | 0    | 1    |               |        |                 |
| 194                 | 1    | 1    | 0    | 0    | 0    | 0    | 1    | 0    |               |        |                 |
| 195                 | 1    | 1    | 0    | 0    | 0    | 0    | 1    | 1    |               |        |                 |
| 196                 | 1    | 1    | 0    | 0    | 0    | 1    | 0    | 0    |               |        |                 |
| 197                 | 1    | 1    | 0    | 0    | 0    | 1    | 0    | 1    |               |        |                 |
| 198                 | 1    | 1    | 0    | 0    | 0    | 1    | 1    | 0    |               |        |                 |
| 199                 | 1    | 1    | 0    | 0    | 0    | 1    | 1    | 1    |               |        |                 |
| 200                 | 1    | 1    | 0    | 0    | 1    | 0    | 0    | 0    |               |        |                 |
| 201                 | 1    | 1    | 0    | 0    | 1    | 0    | 0    | 1    |               |        |                 |
| 202                 | 1    | 1    | 0    | 0    | 1    | 0    | 1    | 0    |               |        |                 |
| 203                 | 1    | 1    | 0    | 0    | 1    | 0    | 1    | 1    |               |        |                 |
| 204                 | 1    | 1    | 0    | 0    | 1    | 1    | 0    | 0    |               |        |                 |
| 205                 | 1    | 1    | 0    | 0    | 1    | 1    | 0    | 1    |               |        |                 |
| 206                 | 1    | 1    | 0    | 0    | 1    | 1    | 1    | 0    |               |        |                 |
| 207                 | 1    | 1    | 0    | 0    | 1    | 1    | 1    | 1    |               |        |                 |
| 208                 | 1    | 1    | 0    | 1    | 0    | 0    | 0    | 0    |               |        |                 |
| 209                 | 1    | 1    | 0    | 1    | 0    | 0    | 0    | 1    |               |        |                 |

| Position Block No.) | D107 | D106 | D105 | D104 | D103 | D102 | D101 | D100 | Position Data | M Code | Speed Block No. |
|---------------------|------|------|------|------|------|------|------|------|---------------|--------|-----------------|
|                     | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |               |        |                 |
| 210                 | 1    | 1    | 0    | 1    | 0    | 0    | 1    | 0    |               |        |                 |
| 211                 | 1    | 1    | 0    | 1    | 0    | 0    | 1    | 1    |               |        |                 |
| 212                 | 1    | 1    | 0    | 1    | 0    | 1    | 0    | 0    |               |        |                 |
| 213                 | 1    | 1    | 0    | 1    | 0    | 1    | 0    | 1    |               |        |                 |
| 214                 | 1    | 1    | 0    | 1    | 0    | 1    | 1    | 0    |               |        |                 |
| 215                 | 1    | 1    | 0    | 1    | 0    | 1    | 1    | 1    |               |        |                 |
| 216                 | 1    | 1    | 0    | 1    | 1    | 0    | 0    | 0    |               |        |                 |
| 217                 | 1    | 1    | 0    | 1    | 1    | 0    | 0    | 1    |               |        |                 |
| 218                 | 1    | 1    | 0    | 1    | 1    | 0    | 1    | 0    |               |        |                 |
| 219                 | 1    | 1    | 0    | 1    | 1    | 0    | 1    | 1    |               |        |                 |
| 220                 | 1    | 1    | 0    | 1    | 1    | 1    | 0    | 0    |               |        |                 |
| 221                 | 1    | 1    | 0    | 1    | 1    | 1    | 0    | 1    |               |        |                 |
| 222                 | 1    | 1    | 0    | 1    | 1    | 1    | 1    | 0    |               |        |                 |
| 223                 | 1    | 1    | 0    | 1    | 1    | 1    | 1    | 1    |               |        |                 |
| 224                 | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 0    |               |        |                 |
| 225                 | 1    | 1    | 1    | 0    | 0    | 0    | 0    | 1    |               |        |                 |
| 226                 | 1    | 1    | 1    | 0    | 0    | 0    | 1    | 0    |               |        |                 |
| 227                 | 1    | 1    | 1    | 0    | 0    | 0    | 1    | 1    |               |        |                 |
| 228                 | 1    | 1    | 1    | 0    | 0    | 1    | 0    | 0    |               |        |                 |
| 229                 | 1    | 1    | 1    | 0    | 0    | 1    | 0    | 1    |               |        |                 |
| 230                 | 1    | 1    | 1    | 0    | 0    | 1    | 1    | 0    |               |        |                 |
| 231                 | 1    | 1    | 1    | 0    | 0    | 1    | 1    | 1    |               |        |                 |
| 232                 | 1    | 1    | 1    | 0    | 1    | 0    | 0    | 0    |               |        |                 |
| 233                 | 1    | 1    | 1    | 0    | 1    | 0    | 0    | 1    |               |        |                 |
| 234                 | 1    | 1    | 1    | 0    | 1    | 0    | 1    | 0    |               |        |                 |
| 235                 | 1    | 1    | 1    | 0    | 1    | 0    | 1    | 1    |               |        |                 |
| 236                 | 1    | 1    | 1    | 0    | 1    | 1    | 0    | 0    |               |        |                 |
| 237                 | 1    | 1    | 1    | 0    | 1    | 1    | 0    | 1    |               |        |                 |
| 238                 | 1    | 1    | 1    | 0    | 1    | 1    | 1    | 0    |               |        |                 |
| 239                 | 1    | 1    | 1    | 0    | 1    | 1    | 1    | 1    |               |        |                 |
| 240                 | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 0    |               |        |                 |
| 241                 | 1    | 1    | 1    | 1    | 0    | 0    | 0    | 1    |               |        |                 |
| 242                 | 1    | 1    | 1    | 1    | 0    | 0    | 1    | 0    |               |        |                 |
| 243                 | 1    | 1    | 1    | 1    | 0    | 0    | 1    | 1    |               |        |                 |
| 244                 | 1    | 1    | 1    | 1    | 0    | 1    | 0    | 0    |               |        |                 |
| 245                 | 1    | 1    | 1    | 1    | 0    | 1    | 0    | 1    |               |        |                 |
| 246                 | 1    | 1    | 1    | 1    | 0    | 1    | 1    | 0    |               |        |                 |
| 247                 | 1    | 1    | 1    | 1    | 0    | 1    | 1    | 1    |               |        |                 |
| 248                 | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 0    |               |        |                 |
| 249                 | 1    | 1    | 1    | 1    | 1    | 0    | 0    | 1    |               |        |                 |
| 250                 | 1    | 1    | 1    | 1    | 1    | 0    | 1    | 0    |               |        |                 |
| 251                 | 1    | 1    | 1    | 1    | 1    | 0    | 1    | 1    |               |        |                 |
| 252                 | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 0    |               |        |                 |
| 253                 | 1    | 1    | 1    | 1    | 1    | 1    | 0    | 1    |               |        |                 |
| 254                 | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 0    |               |        |                 |
| 255                 | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1    |               |        |                 |

2) 8-positions (positioning)

| Position Block No.) | DEC  | JFS  | STP  | Position Data | M Code | Speed Block No. |
|---------------------|------|------|------|---------------|--------|-----------------|
|                     | bit2 | bit1 | bit0 |               |        |                 |
| 0                   | 0    | 0    | 0    |               |        |                 |
| 1                   | 0    | 0    | 1    |               |        |                 |
| 2                   | 0    | 1    | 0    |               |        |                 |
| 3                   | 0    | 1    | 1    |               |        |                 |
| 4                   | 1    | 0    | 0    |               |        |                 |
| 5                   | 1    | 0    | 1    |               |        |                 |
| 6                   | 1    | 1    | 0    |               |        |                 |
| 7                   | 1    | 1    | 1    |               |        |                 |

3) 2-positions (roll feeding)

| (Position Block No.) | LSN | Position Data |
|----------------------|-----|---------------|
| 0                    | 0   |               |
| 1                    | 1   |               |

(2) Speed blocks

1) 8 speeds (positioning · roll feeding)

| Speed block No. | D119 | D118 | D117 | Speed (r/min) | Acceleration Time Constant (ms) or Acceleration/Deceleration Time Constant (ms) | Deceleration Time Constant (ms) or S-Shape Time Constant (ms) |
|-----------------|------|------|------|---------------|---|---|
|                 | bit2 | bit1 | bit0 |               |   |   |
| 1               | 0    | 0    | 0    |               |   |   |
| 2               | 0    | 0    | 1    |               |   |   |
| 3               | 0    | 1    | 0    |               |   |   |
| 4               | 0    | 1    | 1    |               |   |   |
| 5               | 1    | 0    | 0    |               |   |   |
| 6               | 1    | 0    | 1    |               |   |   |
| 7               | 1    | 1    | 0    |               |   |   |
| 8               | 1    | 1    | 1    |               |   |   |

2) 2 speeds (roll feeding)

| Speed block No. | JFS | Speed (r/min) | Acceleration Time Constant (ms) or Acceleration/Deceleration Time Constant (ms) | Deceleration Time Constant (ms) or S-Shape Time Constant (ms) |
|-----------------|-----|---------------|---|---|
| 1               | 0   |               |   |   |
| 2               | 1   |               |   |   |

## REVISIONS

\*The manual number is given on the bottom left of the back cover.

| Print Date | *Manual Number | Revision   |
|------------|----------------|--|
| Oct.,1998  | SH(NA)3198-A   | First edition  |
| Sep.,1999  | SH(NA)3198-B   | <p>Sentences of compliance with the European EC Directives changed.</p> <p>Section 1.1.2 (2) Part of the figure deleted.</p> <p>Section 1.2 (1) Rating plate changed.</p> <p>Section 2.4 (2) Sentence modified.</p> <p>Section 3.3.1 Sentence deleted, POINT added.</p> <p>Section 3.3.2 (1) Sentence added to Function/Application of Digital I/F power supply input.</p> <p>Description modified in Function/Application of Trouble. 6) to 9) deleted from Function/Application of Zeroing completion.</p> <p>Section 3.4.5 (4)(b) Automatic/manual mode selection (DI0) changed to Zeroing (DI2) in Timing chart. Automatic/manual mode selection (DI0) added.</p> <p>Section 4.3.1 Sentence deleted. POINT added.</p> <p>Section 4.3.2 (1) Sentence added to Function/Application of Digital I/F power supply input.</p> <p>In-position added.</p> <p>Section 4.3.3 (3) Sentence modified.</p> <p>Section 4.4.3 Manual operation remote mode added.</p> <p>Section 4.4.4 Manual operation mode added.</p> <p>Section 4.4.5 Automatic operation mode added.</p> <p>Section 5.1 Figure modified.</p> <p>Section 5.2.1 POINT added.</p> <p>Section 5.2.2 (4)(a) 1) Figure changed.</p> <p>Section 5.6 Partial sentence change.</p> <p>Section 6.1.1 Parameters No. 65 to No. 79 added to the table.</p> <p>Section 6.2.1 Partial sentence addition to POINT</p> <p>Section 6.2.1 (2) 32767 changed to 50000 in conveyor setting example.</p> <p>Section 7.3 Indication range of Effective load factor and Peak load factor changed to 320.</p> <p>Section 8.1 (2) CN3 changed to CN4 in cable connection diagram.</p> <p>Section 8.11.1 Partial table change.</p> <p>Section 8.11.2 (5) Data No. changed from [3][5] to [4][F].</p> <p>Section 8.11.2 (7) Partial table change.</p> <p>Section 8.12.3 (2) Partial sentence change.</p> <p>Section 8.12.3 (3) Partial sentence addition.</p> <p>Section 8.12.3 (4) Partial sentence addition.</p> <p>Section 8.12.6 Sentence added.</p> <p>Section 8.12.7 Sentence added.</p> <p>Section 8.12.9 (1)(2) Partial sentence change.</p> <p>Section 8.12.10 (1) Partial sentence change.</p> <p>Section 8.12.11 (1) Partial sentence change.</p> <p>Section 8.12.11 (4) Sentence added.</p> <p>Section 8.12.12 (4) Sentence added.</p> <p>Section 9.1.1 (8) Sentences added to Note 4 and 5.</p> <p>Section 9.1.3 (1) Operation-ready added.</p> <p>Sentence changed in Note 5.</p> <p>Section 9.1.3 (2) Sentence changed in Note 5.</p> <p>Section 9.2.3 (1) Sentence changed in Note 5.</p> <p>Section 9.2.3 Power supply capacity changed to Short-circuit rating.</p> <p>Sentence changed.</p> <p>Section 9.2.4 Sentence of Note 4 added.</p> <p>Section 9.2.7 Table change.</p> <p>Section 10.3.2 POINT addition.</p> <p>Section 10.4.1 (2) Partial sentence change.</p> |

|  |  |   |
|--|--|---|
|  |  | <p>Section 10.4.2 (2)(b) Addition of 5), 6), 7).</p> <p>Section 10.4.3 (2) Addition of 7), 8).</p> <p>CHAPTER 11 CAUTION changed to WARNING.</p> <p>Section 11.2 CAUTION deleted.</p> <p>Section 11.2 Sentence added. Remarks in the table deleted.</p> <p>Section 12.2.1 Partial addition to alarm and warning lists.</p> <p>Section 12.2.2 Partial sentence addition.</p> <p>Section 12.2.2 AL 35 name changed to Command pulse frequency alarm.</p> <p>Part of AL 50 definition deleted.</p> <p>Servo motor locked: 1s or more added to AL51 definition.</p> <p>Section 12.2.3 Partial sentence change.</p> <p>Section 15.1.2 (2)(a) Part of sentence changed to Section 5.1 of the separately available Servo Motor Instruction Manual.</p> <p>Section 15.1.6 (d) 2) Encoder connector No. changed to 1-172169-9.</p> <p>Section 15.1.7 (2) Terminal labels changed to Terminal block labels.</p> <p>Sentence changed.</p> <p>Section 15.2.2 No-fuse breaker Model NF30 30A changed to Model NF50 30A.</p> <p>Section 15.2.6 Changed to FR-BAL-22K.</p> |
|--|--|---|