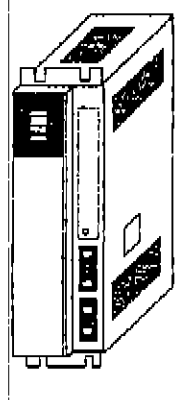
OMRON

TYPE R88D-E SERIES

TYPE R88D-EP06/EP12
TYPE R88D-ER13/ER15/ER16

DC SERVO DRIVER
(PULSE TRAIN INPUT TYPE)

INSTRUCTION MANUAL



1. GENERAL

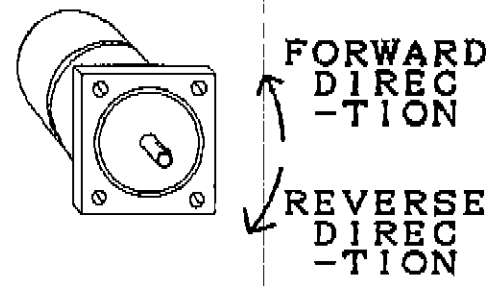
1.1 How to use this manual

This manual is compiled for users of the Servo Driver R88D-E Series to control a DC servo motor.
This manual consists of five chapters. Each chapter is independent so that you may refer to chapters in order of your preference.

Operators of machine using this equipment should read Chapter 2 ,"Adjustment and Operation", and Chapter 1.
Workers who install this equipment to control boxes or machines should read Chapter 3 ,"Initial settingt", and and Chapter 1.
Designers who make plan or make drawings should read Chapter 4, "Design", and Chapter 1.

1.2 Definition

(1) Motor rotation direction.
In this manual, rotation direction of a motor axis is defined as follows:
Forward rotation means anti-clock-wise direction when the motor is viewed from the flange side.



Reverse rotation means clock-wise direction when the motor is viewed from the flange side.

(2) Nomination of types.
In this manual, □ is sometimes indicated at nomoination of types. For example, R88M-E□□□□□□-5C, or so. This indication means that the description is applicable for any type with any number.

1.3 Features of the R88D-E Series

A servo driver is a driving controller that rotates a DC servo motor with command signals based on the data from a programmable controller. It generates and supplies DC power source to servo motors from commercial AC source, and performs highly accurate and wide ranging positioning.

In this DC servo driver E Series, two pulse train input types are available. One is the R88D-EP Series, incorporating a power unit, for 50W to 200W motors. The other is the R88D-ER Series, with a power unit separated, for 300W to 500W motors.

For the combination of these series and motors, see the following table:

Combination Table

Item \ Types of Driver		R88D -EP06	R88D -EP12	R88D -ER13	R88D -ER15	R88D -ER16
Applicable Motor	Output Power (W)	50~80	120~200	300	400	500
	Rated Voltage (V)	75			85	90
Power Unit		A power unit built-in type		R88S-S series		

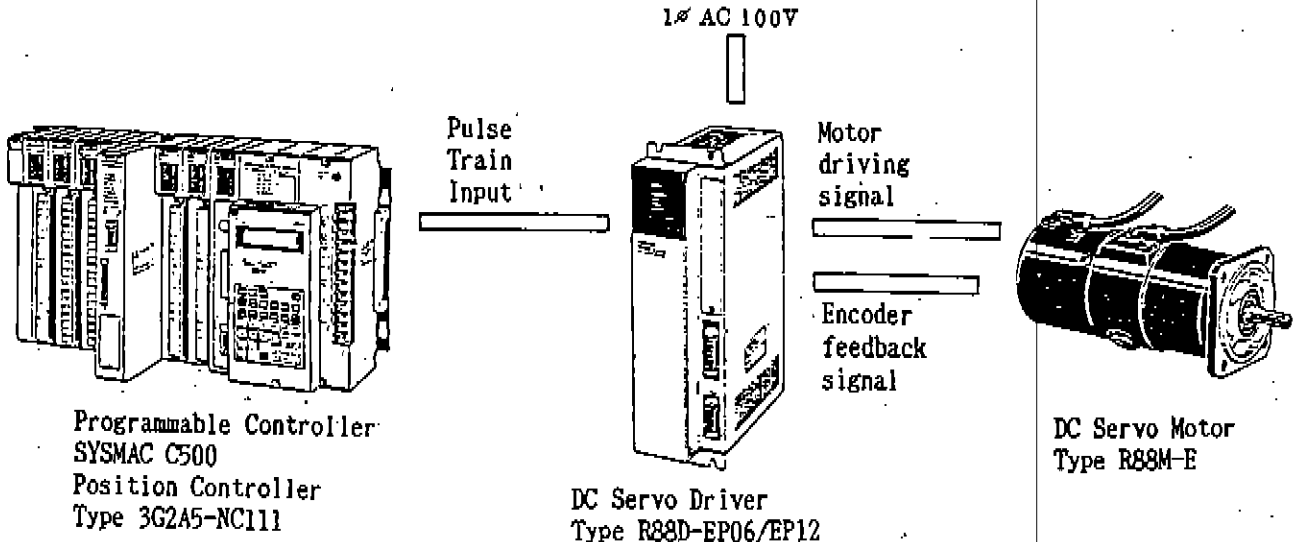
Servo motors (R88M-E Series) controlled with this driver has the following features:

- Compact and light weight.
- Speed control range is 1000:1 (Control motor rotation from 100% to 0.1% of rated speed with required power.)
- Magnetic encoder is used as a detector for positioning and speed control.
- Excellent durability against shock and ambient conditions.

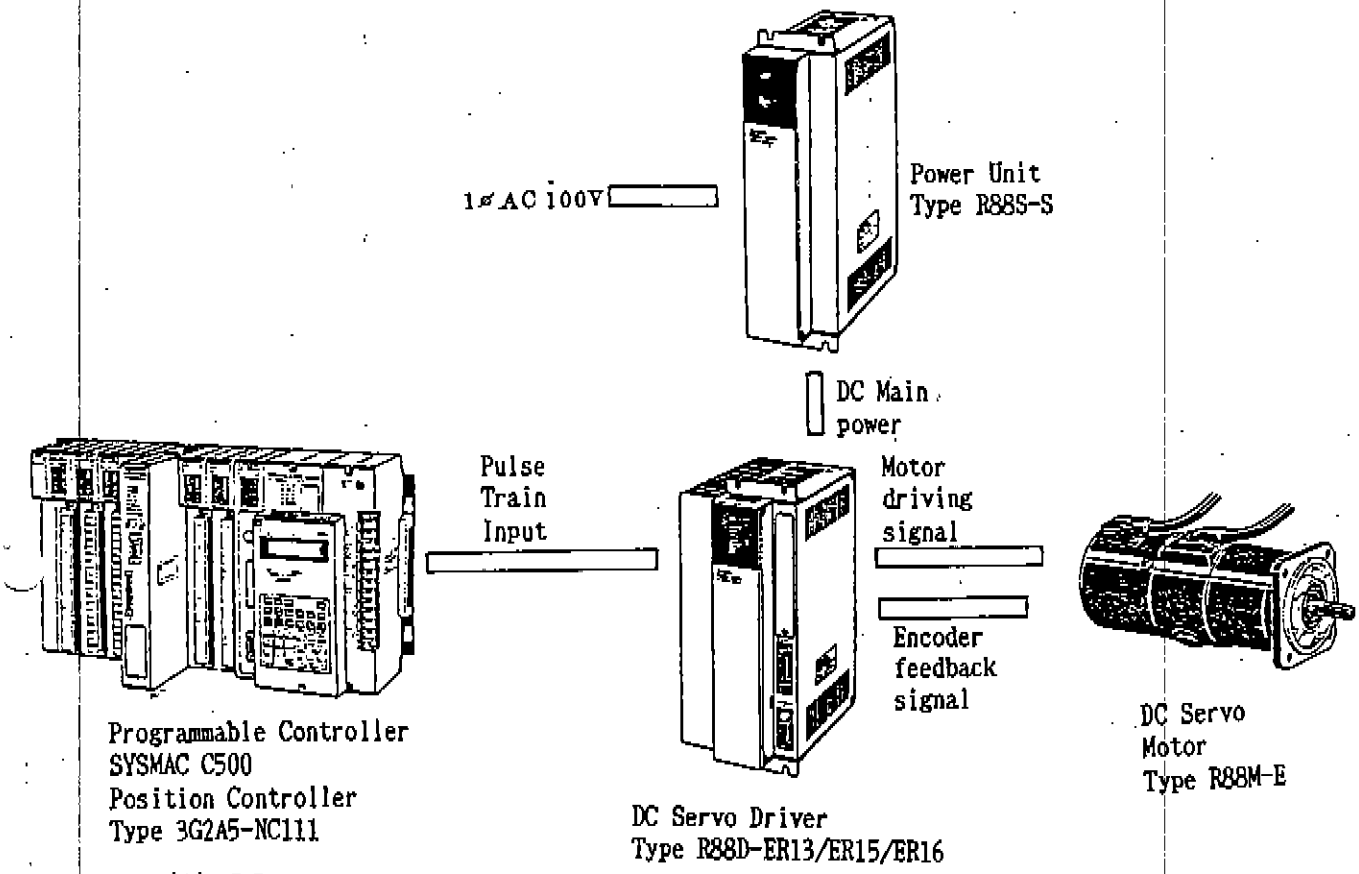
1.4 Servo motor control system.

A system using this equipment consists of:

☐ Type R88D-EP06/EP12 (built-in power unit type)



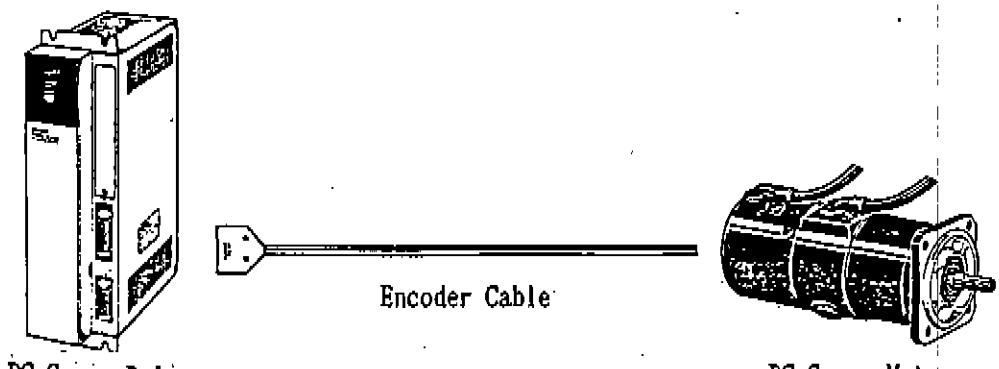
□ R88D-ER13/ER15/ER16 (power unit separated type)



(1) DC servo driver, type R88D-E
This is a circuit unit that controls the speed of a DC servo motor. Types of servo drivers should be selected according to the voltage and current of each DC servo motor.

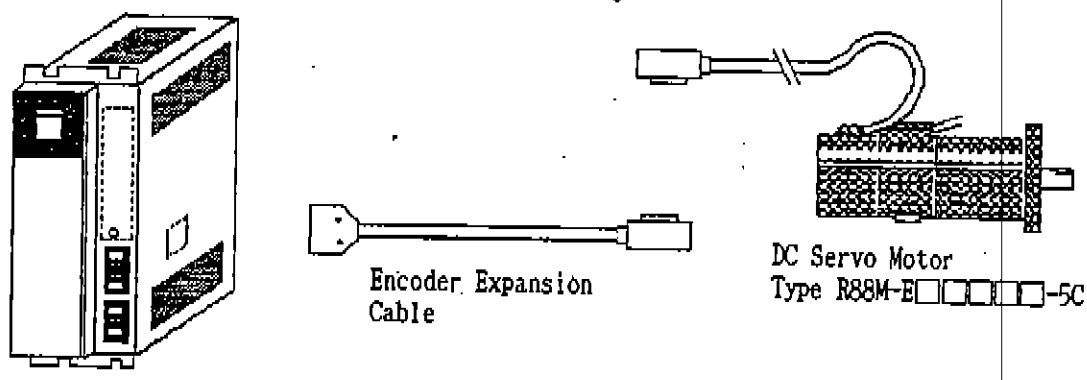
(2) DC Servo Motor, type R88M-E
This motor series includes seven types: 50W, 80W, 120W, 200W, 300W, 400W and 500W. Types of motor should be selected in accordance with load conditions.

(3) Exclusive cable between servo driver and servo motor.
· Encoder Cable (type R88A-CRE□□□S)



This cable should be used to connect a Connector CN2 of the E Series DC servo driver with an encoder of the DC servo motor.

· Encoder Expansion Cable (type R88A-CRE□□□C)



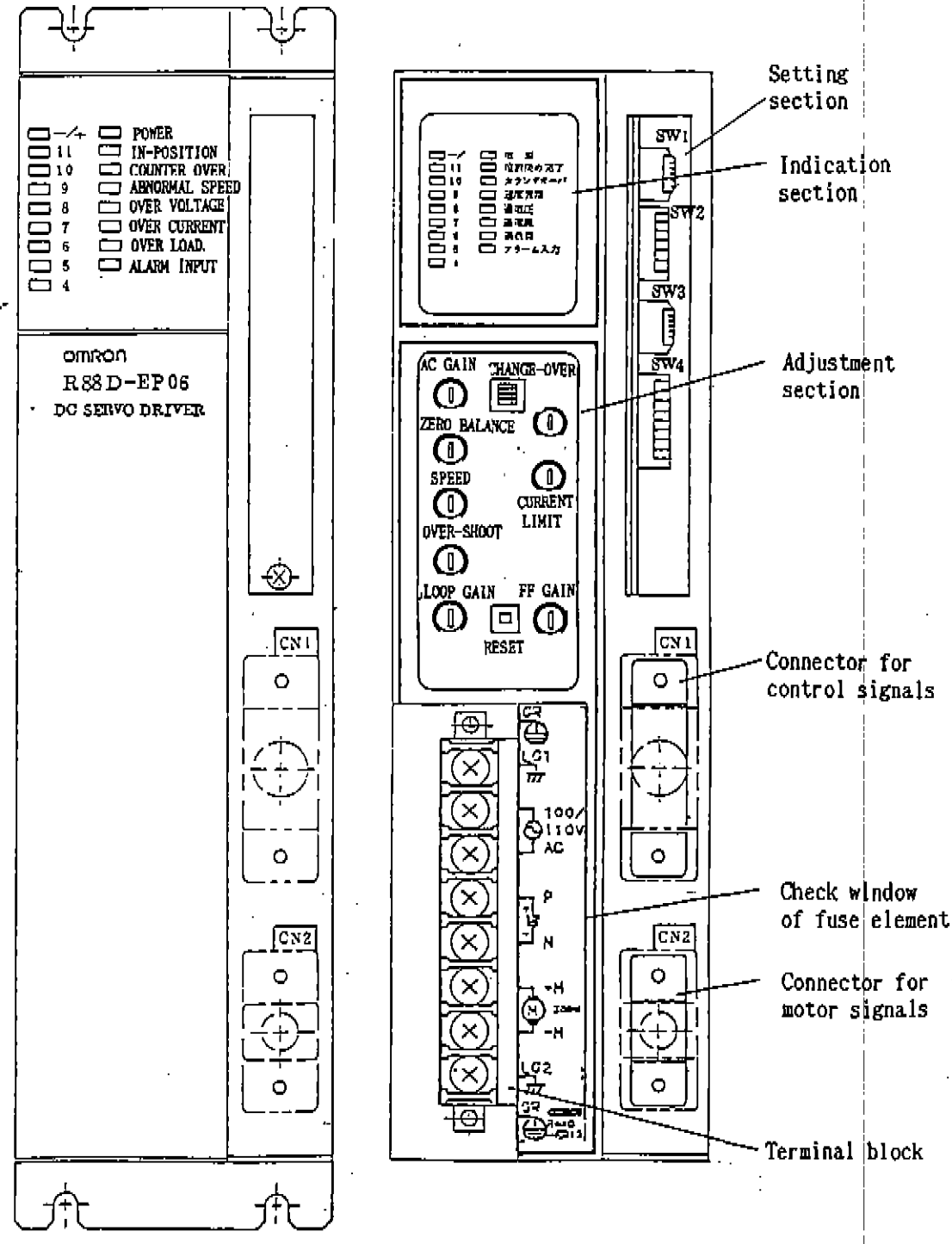
This cable is used to connect a Connector CN2 of E series DC Servo Driver with a connector of an encoder cable installed in the DC servo motor type R88M-E□□□□□-5C.

2. ADJUSTMENT AND OPERATION

2.1 Explanation of adjustment section

2.1.1 Front panel

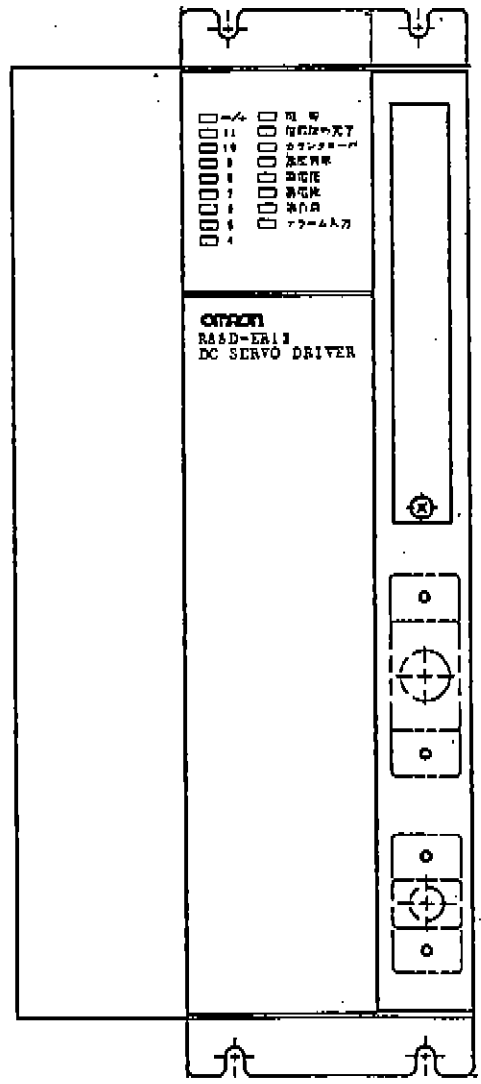
☐ Type R88D-EP06/EP12(built-in power unit type)



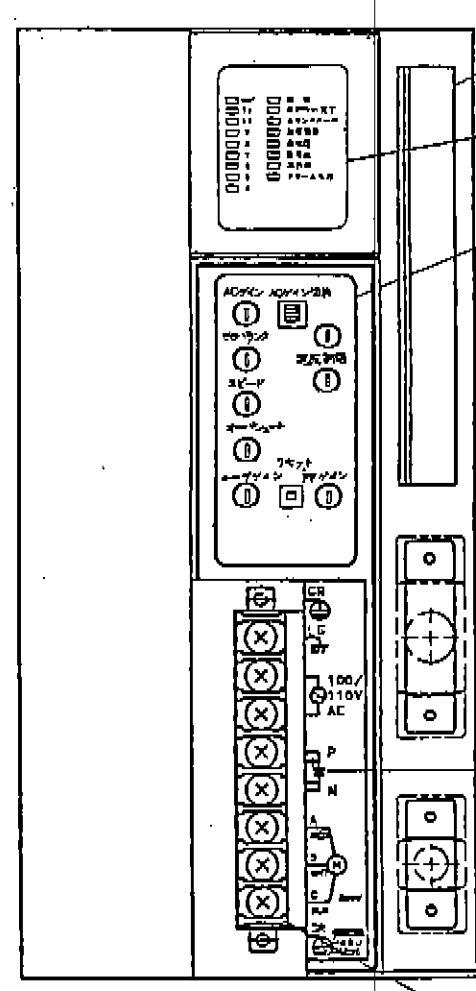
Front view with protection cover

Front view without protection cover

☐Type R88D-ER13/ER15/ER16(Power unit separated)



Front view with protection cover



Front view without protection cover

2.1.2 Display and adjustment sections

☐ Display section

Display	Function	Conditions for illumination
Power	Indicates input of control power source	Supplied control power source (AC100V)
Abnormal speed	Indicates over-speed	Rotation speed is more than limit. Motor axis is mechanically locked.
Over voltage	Indicates over voltage	DC voltage of main circuit is abnormally increased.
Over current	Indicates over current	Supply current to motor exceed over 200% of "Peak current".
Over load	Indicates over load	Load to motor is too large. Radiation fin is over-heated.
Alarm input	Indicates input from outer alarm	ALMI input signal opens.
-/+	Indicates sign of deflection counter	At increasing deflection + At decreasing deflection -
11～4	Indicates amount of deflection counter	2^{11} ～ 2^{4} (2048 pulse ～ 16 pulse)
Positioning finish	Indicates the condition of positioning finish	Deflection amount becomes less than fixed value of SW3 at positioning.
Counter over-flow	Indicates the condition of over flow of deflection counter	Deflection amount is more than fixed value of SW3(No4 & 5).

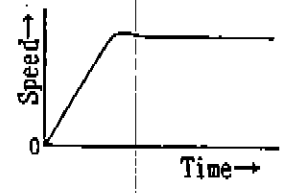
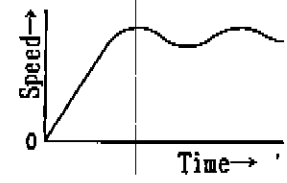
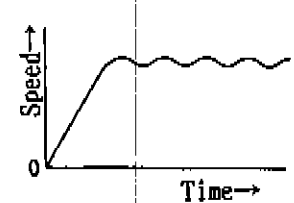
☐ Adjustment section

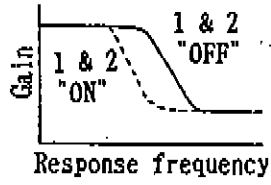
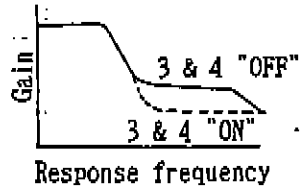
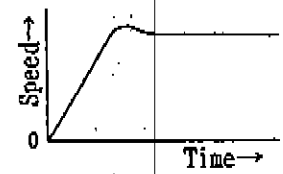
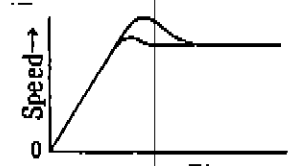
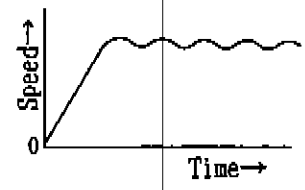
Volume	Function	Preset value at factory
Speed	For adjusting motor speed.	3000 rpm
Over-shoot	For adjusting overshoot and under-shoot at start/stop of motor rotation.	Adjusted to optimum.
Torque limit	For adjusting current limitation value with current limit input signal. Adjustable between 0 and 240%.	150% or rated torque
AG gain	For adjusting response of speed loop gain	Gain low (scale 1)
Change-over AC gain	For the support to delay response, switch No.1 & 2., are useful. For large load conditions, switch No.3 & 4 are useful.	Fixed to optimum with 3 time of load inertier
Loop gain	For the adjustment of position loop gain for mechanical conditions.	
FF gain	For optimum acceleration condition of servo motor.	
Current limit	For adjusting max current rate to motor. Adjustable between 0 and 300%	3 time of motor rated current
Zero balance	When position command pulse is zero, stop drift of the motor axis.	0 rpm
Reset	For return to normal operation from protection function. Same function as RESET input signal.	

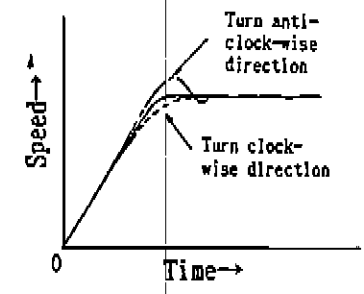
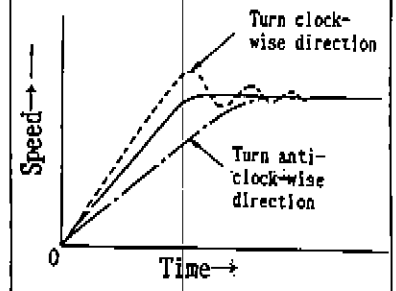
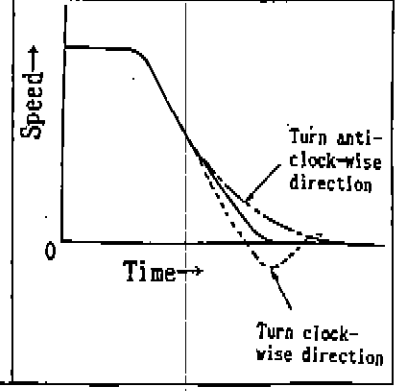
2.2 Adjustment of each volume

Each driver is factory-adjusted together with E series motors. However, if it is required to re-adjust drivers because of the load conditions and the change of motor types, see the following table:

<Caution> If unable to obtain an optimum operationg condition through the adjustment measures below, recheck the initial settings of switches and/or wiring and combination of equipment types.

Name of volume	Functions	The result with the adjustment
AC Gain Change-over of AC gain	Adjustment of AC gain At our factory, first, AC gain is adjusted to obtain an optimum condition through three time of load inertier. But, after them, it is minimized. Therefore, each user may adjust AC gain with each load condition. Mis-adjustment will cause the following conditions: (1) With excessive gain, vibration or abnormal noise may occure. (2) With too little gain, the servo lock power may lessen and the positioning accuracy is reduced. 1. AC gain volume Inspect wave shapes with oscillo-scope through a speed monitor terminal of NM (pin No. 18 of CN1) and a ground AG(pin No. 5 of CN1). Turn the volume, and conditions will appear at the right side.	 Optimun  Turn to Notch 0 (Fluctuation)  Turn to Notch 10 (Vibration)

Name of volume	Functions	The changes with the adjustment
	2. AC gain change-over With put on/off No. 1 & 2, fluctuation is adjusted. With change-over of No. 3 & 4, the vibration is adjusted. Ex: Changing No. 1 & 2 from "on" to "off", fluctuation will occure. This is because of the expansion of the gain to the higher zone.  Next, changing No. 3 & 4 switchs from "on" to "off" position, the vibration will occure. This is because of the increase of the higher zone gain.  In the above instructions, two switches are changed at once. With change-over of only one switch, the result may be smaller.	 Optimun  Change-over of No. 1 & 2 switches  Change-over of No. 3 & 4 switches
Zero balance	Zero balance Adjust this volume not to rotate the motor when a rotation command is not given. Adjust it to indicate "+" and "-" alternately.	If the balance is not correctly fixed the "+/-" indication stays in "on" or "off" conditions, and LEDs at lower bits of the deflection counter indicates.

Name of volume	Functions	Changes with adjustments
Speed	Speed setting This volume is already fixed with the number of encoder pulse. So, not touch. This function is same as the loop gain and later response.	Turn the volume toward clock-wise direction, and the loop gain will increase and the deflection counter will decrease.
Over-shoot	The adjustment of over-shoot This volume is for the adjustment of over-shoot and undershoot at acceleration and at deceleration of a motor rotation. Carry out this adjustment after the optimum setting of AC gain.	
Loop gain	The adjustment of positioning loop gain. With this gain, the response of accel./decel. are adjusted. The response of accel./decel. is also related to the up/down frequency of pulses. After obtaining an optimum condition with AC gain, make shape smoth with this loop gain. In case over-shoot still occures, make the up/down frequency of pulses a little.	
FF gain	Feedforward gain adjustment This gain is useful when put on bit 8 of SW4. With this volume, the amount of feedforward is adjusted. Maximum additional value is 50 %. In general, 25% may be suitable. Maximizing this value will increase undershoot.	

Name of volume	Functions	Changes with adjustments
Current limit.	Current limit value adjustment. With this volume, the max. current value is adjusted.	Fixed to full value of 300%. Turning the volume toward anti-clock-wise direction, the current limit value decreases.
Torque control	The max. current value for the motor is altered between "current control" and "torque control" with CLIM signal. With CLIM signal input, torque control is useful as current limitation.	This value is fixed to 150%. Turning the volume to anti-clock-wise direction, the current limit value decreases.

2.3 Protection and self-check function

The Light Emitting Diodes (LED) on the driver front panel indicate operational and abnormal conditions of the inside of the servo driver.

Indications	Conditions and functions
Positioning finish	Indicates when the deflection value of the counter becomes less than the finishing range.
Counter over	When the deflection value is accumulated more than the rated bit value, the system clears the deflection value and makes motor free (releases servo lock condition).
Abnormal speed	Indicates when: (1) Tacho-generator or F/V speed feed -back is out of order. (2) A speed condition exceeds more than ±10V speed command. (3) The encoder is out of order.
Over current	Indicates when current more than "peak current value" is supplied, or shorts output terminals.
Over load	Indicates when: (1) Current value exceeds the rated output current, and this condition continues more than 5 sec. (Limited time characte-ristic) (2) The radiationg fin temperature is more than 85℃.
Over voltage	Indicates when the main power DC voltage increases abnormally with the re-generationg functions.
Power source	Indicates when the power source of the gate drive functions at main power circuit. Motors do not rotate when this does not indicates.
Alarm input	Indicates when outer abnormal signal or alarm stop signal is "ON".

In order to protect the servo driver and the servo motor, the following protection circuits are equipped inside of the driver. When these circuits function, the operation stops at inside of the servo driver and output servo abnormal signals.
<Caution> In this case, the motor axis comes in a free condition. When a mechanical lock is required for this conditions, direct mechanical brake should be assembled outside of the motor.

Protection function	LED indication	Motion	Causes
Main circuit fuse element	none	When over current is supplied to the DC main circuit, the fuse blow and this circuit shuts off.	·broken FET ·short between driver-motor ·broken condensor
Detect over current	Over current LED	When over current is supplied to the DC main circuit, the FET gate shuts off with a detector.	·short between driver-motor ·broken FET ·broken condensor
Protection against over voltage	Over voltage LED	When main circuit power voltage is over the rated value with re-generation function, the FET gate shuts off.	·load inertier too large ·supplied AC power is more than 100V
Protection against over load	Over load LED	When over load condition at motor continues more than the rated interval, the FET gate shuts off.	·load torque too large ·motor axis is locked mechanically
Radiation fin temp. rise	Over load LED	When the temp. of the radiation fin for the FET rises more than the rated temp., the FET gate shuts off.	·load torque too large ·motor axis is locked mechanically
Detect signal dis-connectin	Speed abnormal LED	With disconnection of the encoder or the tacho generator signal wire, the FET gate shuts off.	·encoder or TG signal disconnected

Protection function	LED indication	Motion	Causes
Abnormal power source	Put off power source indication LED	When the power voltage is less than the rated value, the FET gate shuts off.	·voltage drop of supply power source ·short of source capacity
Over speed	abnormal speed LED	When the motor speed is more than the rated value, the FET gate shuts off.	·Motor is rotated with over speed
Instan-taneous power failure	put off power source indication LED	When the power source does not feed more than 40msec., the FET gate shuts off and reset after 800 msec.	·AC supply power source failure at once.
Control fuse	put off power source indication LED	Fuse blows with high voltage to the control circuit side.	·shorted or broken control circuit.
Deflection counter over flow	counter over LED	When the amount of the counter exceeds the set-ting amount of bit, pulses of the deflection counter clears and the motor will be free.	·to high command pulse frequency ·mis-setting multiply value of position feed-back pulse.

2.4 Cautions at alarm output signal.

1. Make sure that an alarm output signal applies as relay actuator when it comes from the circuit (when LED indicates).- This signal opens at abnormal conditions and closes at normal conditions.
   Also, make sure that the circuit outputs an alarm signal when the control source is not applied.
   About 800msec. later of the control source applied, above relay contactor will close.

2. When an abnormal alarm functions, a driving signal to the motor opens and an electrical brake of the motor (re-generating brake) is released at once, due control circuit itself will stop operation.
   Therefore, when braking is required for the motor axis at this alarm condition, a mechanical brake unit should be equipped so that it makes sequence to work this mechanical brake at alarm condition.

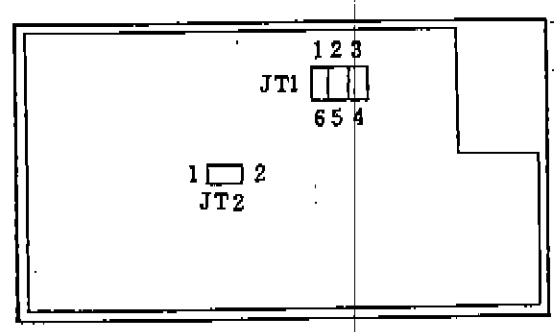
3. Abnormal alarm condition is released with reset signal input at reset button or resupply of the power source. If RUN signal is input at reset condition, the motor may run at this time. Therefore, check t hissignal before reset.

4. With abnormal alarm output, put off main circuit power source (AC100V) and operation signal.
   Control source may stay in this condition, and detect causes of an abnormal alarm. After removing these causes, restart the operation.

3. INITIAL SETTING

3.1 Setting of short pins

In order to adjust output current of the driver in accordance with the type of motors, set short pins as below.
The location of short pins is illustrated here.



Position of short pins
at the driver circuit board

☐ R88D-EP06/EP12
(Built-in power unit type)

· The setting of JT1

Output current of the driver alters with the setting of short pins as the Chart 1. In case of the setting with our DC servo motor type R88M-E Series, set pins with the Chart 2.

<Caution> In case of type R88D-EP12, the setting of short pins differs with each serial numbers. Therefore, be careful for the setting for this type.

CHART 1

Pin Nbr of JT1	DC servo driver		
	R88D-EP06	R88D-EP12	
	———	Serial No -210103	Serial No. 210404-
1-6	6A	12A	12A
2-5	5A	10A	8A
3-4	4A	4A	5.3A

CHART 2

Pin Nbr of JT1	DC servo driver		
	R88D-EP06	R88D-EP12	
	———	Serial No -210103	Serial No. 210104-
1-6	———	R88M-E20030	———
2-5	R88M-E08030	———	R88M-E20030
3-4	R88M-E05030	R88M-E12030	R88M-E12030

·The setting of JT2

If a tacho-generator is installed as speed detector, shorts JT2.

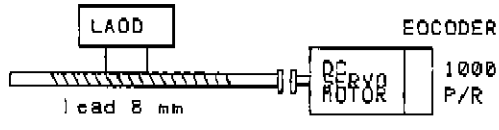
☐ R88D-ER13/ER15/ER16(Power unit separated type)

·The setting of JT1(factory-adjusted)
JT1 is already factory-adjusted, and output current of the driver is as the Chart 3.

CHART 3

Pin nbr of JT1	DC servo driver		
	R88D-ER13	R88D-ER15	R88D-ER16
1-6	———	———	16(A)
2-5	———	15(A)	———
3-4	12.5A		———

3.2 Settings of switches

<table>
<tr><th>Switch number</th><th>Function</th><th>Preset value at factory</th></tr>
<tr><td>SW1</td><td>·Multiple rate of position command pulse setting switch
Position command pulse is mulitiplied with a value fixed in this switch:
<table>
<tr><th>set value</th><th>multiple rate</th><th>set value</th><th>multiple rate</th></tr>
<tr><td>0</td><td>1</td><td>8</td><td>9</td></tr>
<tr><td>1</td><td>2</td><td>9</td><td>10</td></tr>
<tr><td>2</td><td>3</td><td>A</td><td>11</td></tr>
<tr><td>3</td><td>4</td><td>B</td><td>12</td></tr>
<tr><td>4</td><td>5</td><td>C</td><td>13</td></tr>
<tr><td>5</td><td>6</td><td>D</td><td>14</td></tr>
<tr><td>6</td><td>7</td><td>E</td><td>15</td></tr>
<tr><td>7</td><td>8</td><td>F</td><td>16</td></tr>
</table>
This function determines the value of feedback pulse from encoder per command pulse.
 

If feed-back pulse is multiplied four time based on the above mechamical system, the amount of feed-back pulse per one motor rotation is:
1000 p x 4 = 4000 p
(Nbr of encoder pulse) (feed back rate) (per motor axis rotation)

Thus, feed length per one feedback pulse is:
8 mm / 4000 p = 0.002 mm
With multiple rate of 5(set switch as "4"), feed length per command pulse is:
0.002 mm x 5 = 0.01 mm.</td><td>"0"
(Multiple rate = 1 times)</td></tr>
</table>

<table>
<tr><th>Switch number</th><th>Function</th><th>Preset value at factory</th></tr>
<tr><td>SW2 No. 1</td><td>Select command pulse input among:

1. Forward rotation command pulse/ reverse rotation command pulse input------"off"

2. Forward/reverse change-over signal/ feed command pulse input----"on"

With signal "H"---forward rotation
with signal "L"---reverse rotation</td><td>"off"</td></tr>
<tr><td>No. 2
No. 3</td><td>·Multiple rate of encoder feed-back pulse
For setting multiple rate of position feed-back pulse of encoder.
<table><tr><th>No. 2</th><th>No. 3</th><th>Multiple rate</th></tr><tr><td>ON</td><td>OFF</td><td>1 time</td></tr><tr><td>OFF</td><td>ON</td><td>2 time</td></tr><tr><td>ON</td><td>ON</td><td>4 time</td></tr></table><Caution> Never set these two switches as OFF/OFF due this means input prohibition of feed-back pulses.</td><td>No. 2 = "on"
No. 3 = "on"
(Multiple rate as 4 time)</td></tr>
</table>

<table>
<tr><th>Switch number</th><th>Function</th><th>Preset value at factory</th></tr>
<tr><td>SW2 No. 4
No. 5</td><td>·Change-over of a bit number of the deflection counter
<table><tr><th>No. 4</th><th>No. 5</th><th>Number of counter</th><th>(Amount of counter)</th></tr><tr><td>OFF</td><td>OFF</td><td>12 bit</td><td>(4096)</td></tr><tr><td>ON</td><td>OFF</td><td>11 bit</td><td>(2048)</td></tr><tr><td>OFF</td><td>ON</td><td>10 bit</td><td>(1024)</td></tr><tr><td>ON</td><td>ON</td><td>9 bit</td><td>(512)</td></tr></table>Change above value in accordance with the frequency of the command pulse. Normally, the following formula may applies:
Position loop gain $Kp = \frac{\text{Frequency of command pulse}}{\text{Amount of deflection counter}}$
In case of usual load condition:
$Kp < 30$
In case of small load and high response condition:
$Kp < 50$
Ex: Frequency of command pulse = 100KPPS
Bit number of deflection counter = 12 bit
$Kp = \frac{100,000}{4096}$ = about 24
Then, above equality is is available and set bit number at 12 bit.</td><td>No. 4="OFF"
No. 5="OFF"
(Number of bit = 12 bit)</td></tr>
<tr><td>No. 6</td><td>No use</td><td></td></tr>
</table>

<table>
<tr><th>Switch number</th><th>Function</th><th>Preset value at factory</th></tr>
<tr><td>SW3</td><td>·Positioning finish range setting switch.
When the bit number of the deflection counter exceeds this setting value, a position finishing signal is feeded.
<table>
<tr><th>Setting value</th><th>Finish range</th><th>Setting value</th><th>Finish range</th></tr>
<tr><td>0</td><td>± 1</td><td>8</td><td>± 17</td></tr>
<tr><td>1</td><td>± 3</td><td>9</td><td>± 19</td></tr>
<tr><td>2</td><td>± 5</td><td>A</td><td>± 21</td></tr>
<tr><td>3</td><td>± 7</td><td>B</td><td>± 23</td></tr>
<tr><td>4</td><td>± 9</td><td>C</td><td>± 25</td></tr>
<tr><td>5</td><td>± 11</td><td>D</td><td>± 27</td></tr>
<tr><td>6</td><td>± 13</td><td>E</td><td>± 29</td></tr>
<tr><td>7</td><td>± 15</td><td>F</td><td>± 31</td></tr>
</table>
If the finish range is small, the positioning finish signal outputs late. Thus, sets the finish range in accordance with the mechanical system speed, the load condition and mechanical precision.
Too small value may causes lack of finish signal.</td><td>"1"
(finish range = ±3</td></tr>
<tr><td>SW4 No. 1
∫
No. 4</td><td>·Change-over of feedforward pulse range.
This is a change-over switch to select pulse width of the F/V converter.
Selects positions in accordance with the command pulse frequency.
<table>
<tr><th>Frequency</th><th>No. 1</th><th>No. 2</th><th>No. 3</th><th>No. 4</th></tr>
<tr><td>100K~300K</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr>
<tr><td>50K~150K</td><td>ON</td><td>ON</td><td>ON</td><td>OFF</td></tr>
<tr><td>25K~ 75K</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td></tr>
<tr><td>15K~ 38K</td><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>5K~ 20K</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
</table></td><td>No. 1~No. 4
="ON"</td></tr>
</table>

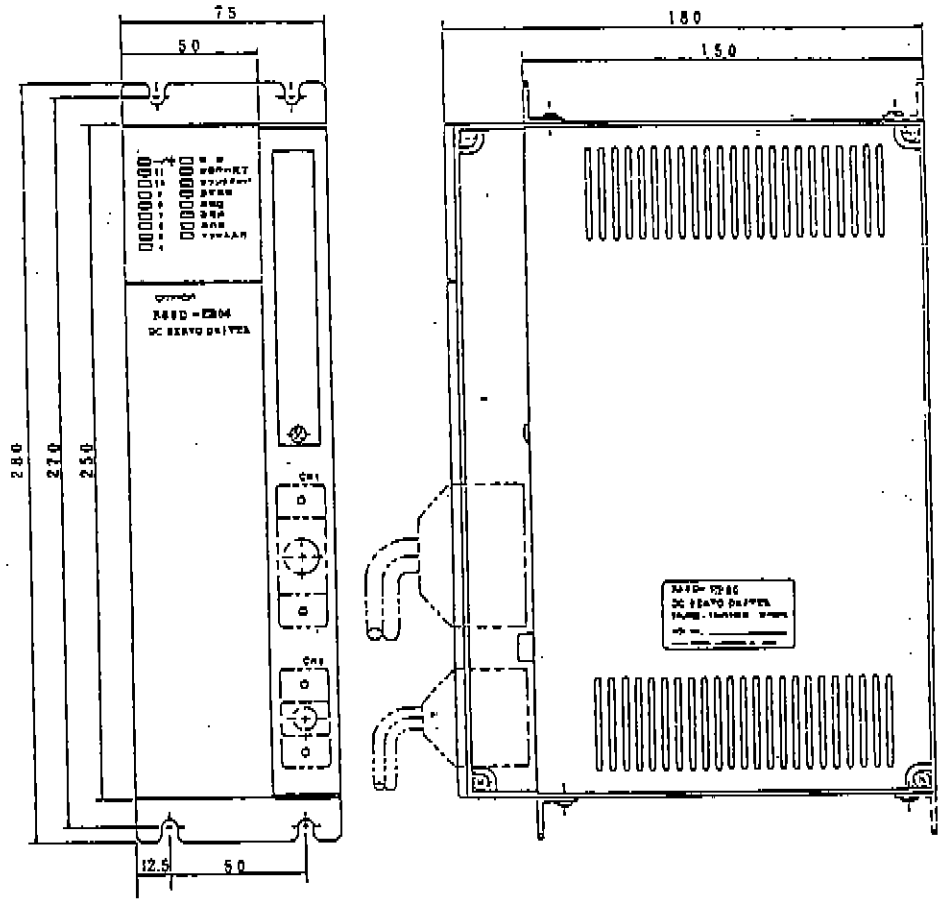
<table>
<tr><th colspan="2">Switch number</th><th>Function</th><th>Preset value at factory</th></tr>
<tr><td>SW4</td><td>No. 5
ƒ
No. 6</td><td>·Change-over of encoder pulse number
Set this switch in accordance with the number of built-in encoder pulse to servo motor. Set the F/V voltage with this switch.
<table>
<tr><th>No. 5</th><th>No. 6</th><th>Number of encoder pulse</th></tr>
<tr><td>OFF</td><td>OFF</td><td>2000 P/R</td></tr>
<tr><td>ON</td><td>OFF</td><td>1000 P/R</td></tr>
<tr><td>OFF</td><td>ON</td><td>500 P/R</td></tr>
</table>
In case of other number of encoder pulse, set to closer value, and adjust with speed adjust volume.</td><td>No. 5 "ON"
No. 6 "OFF"
(Number of encoder pulse = 1000 P/R)</td></tr>
<tr><td></td><td>No. 7</td><td>·Change-over of the speed feedback signal
In case of a tacho-generator use, set this switch to "OFF".
·In case of an encoder use, set this switch to "ON".</td><td>"ON"</td></tr>
<tr><td></td><td>No. 8</td><td>·Change-over of feedforward
In order to perform high speed positioning, set this switch to "ON". And use the feedforward control.</td><td>"OFF"</td></tr>
</table>

4. DESIGN

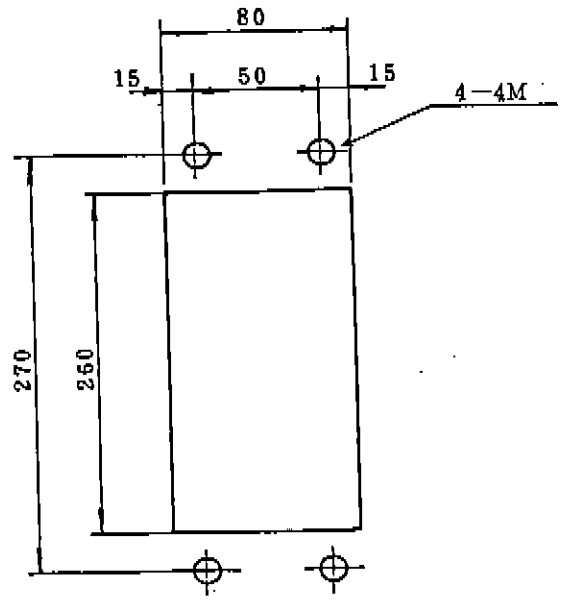
4.1 Design for installation

☐ Type R88D-EP06/EP12 (Built-in power unit type)

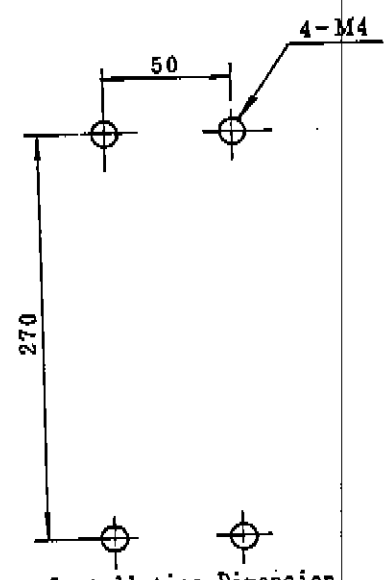
·Outside dimensions



·Installation dimensions

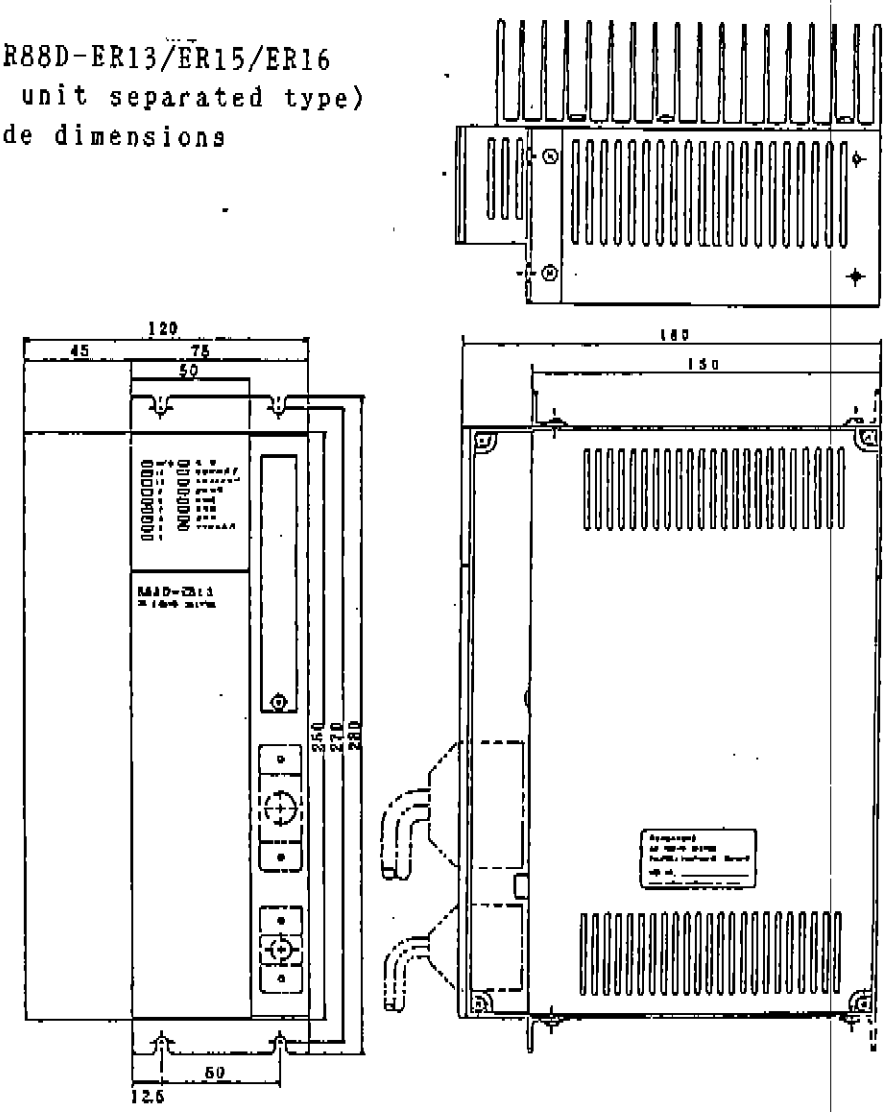


Installation Dimension
for rack mount fixing

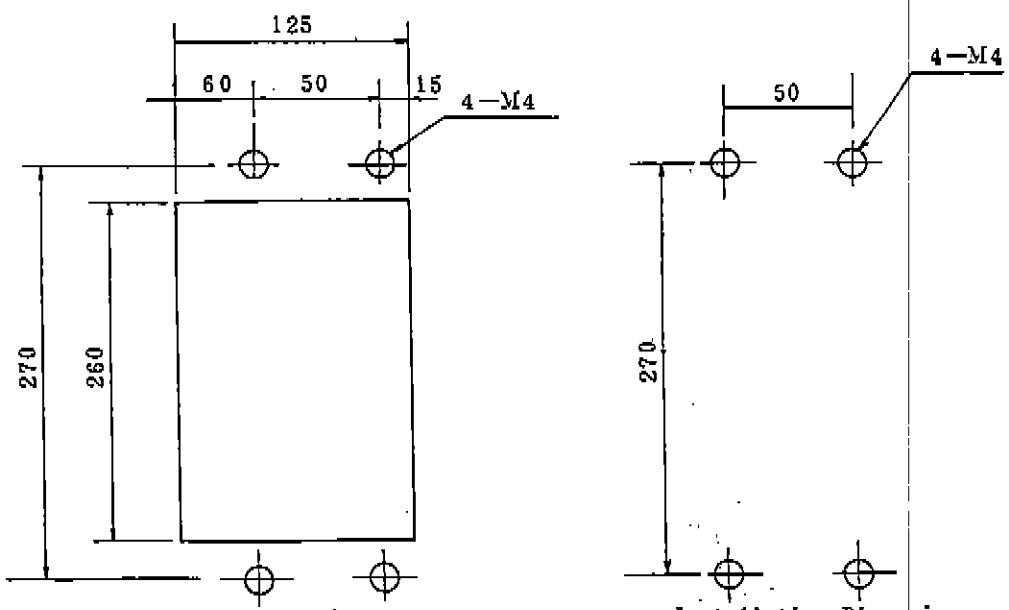


Installation Dimension
for back side fixing

☐ Type R88D-ER13/ER15/ER16
(Power unit separated type)
·Outside dimensions



·Installation dimensions



Installation Dimension
for rack mount fixing

Installation Dimension
for back side fixing

4.2 Connector and terminal block

4.2.1 The power source and the terminal block

· R88D-EP06/EP12(Built-in power unit type)

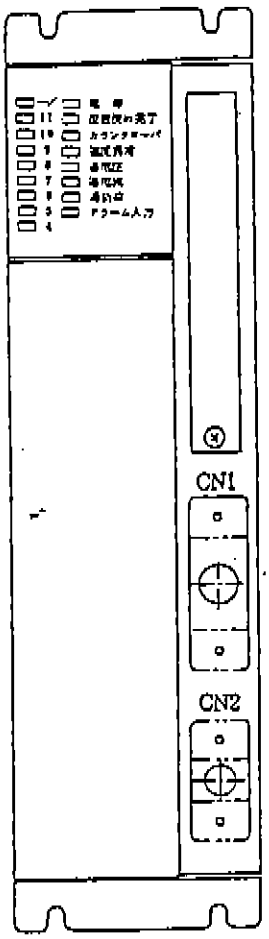
Sign	Name	Contents	
AC AC	Control Power input	Input terminal for control circuit. Supply commercial source between AC85 and 132V	
+M -M	Output for motor	Single phase output terminal for the DC servo motor	+M white -M black
┐ ⏦ ┘	Power source for main circuit	Supply commercial source between AC85 and 132V.	
GR FG)	Frame ground	This terminal is connected to the body. Connect low impedance earth to this terminal.	
LG	Logic ground	This terminal is connected to AC100V, +M, -M at 4700pF. Short FG and this terminal with a bar.	

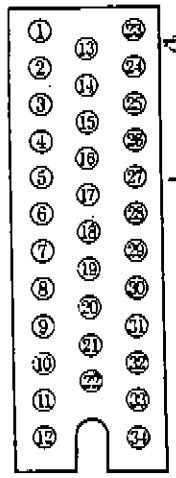
· R88D-ER13/ER15/ER16(Power unit separated type)

Sign	Name	Contents	
AC AC	Control Power input	Input terminal for the control circuit. Supply commercial source between AC85～132V	
+M -M	Output for motor	Single phase output terminal for the DC servo motor.	+M white -M black
P N	DC power input terminal for main circuit	Connect these terminals to P and N terminals of the power unit respectively. P as positive (+), N as negative (-) polarity.	
GR FG)	Frame ground	This terminal is connected to the body. Connect low impedance earth to this terminal.	
LG	Logic ground	This terminal is connected to AC100V, +M, -M at 4700pF. Short FG and this terminal with a bar.	

4.2.2 Connector terminal for the control and the motor signal.

☐ Connector terminal for control CN1
This connector CN1 consists of the speed command, ON/OFF, the monitor, and the encoder signal.



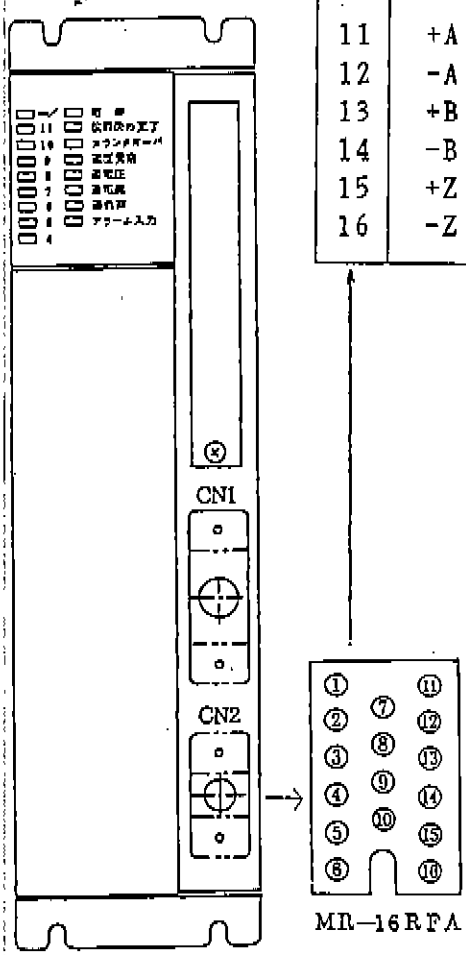


MR-34RFA
Honda Tsushin

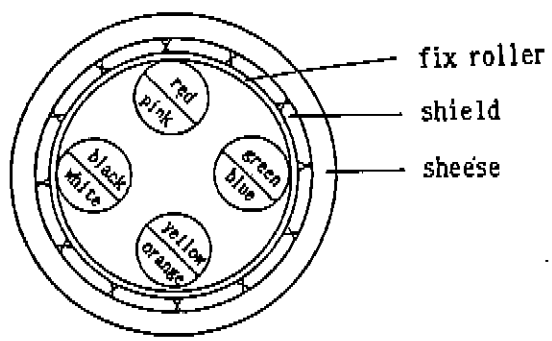
No	Sign	Function
1	+CW	Reverse command pulse input
2	-CW	or feed command pulse input
3	+CCW/+P/M	Forward command pulse input
4	-CCW/-P/M	or forward/reverse change-over signal input
5	AG	Analogue ground
6	AG	Analogue ground
7	INP	In-position output
8	GND	Ground of above signal
9	FG	Frame ground
10	FG	Frame ground
11	ALM1	Abnormal output(contactor output
12	ALM2	-ditto-
13	+5V	DC+5V power input
14	+5V	
15	CLIM	Current limit input
16	MING	Minimize gain input
17		
18	NM	Speed voltage monitor output
19	AM	Ampere monitor output
20	+A	Encoder A phase + output
21	+B	Encoder B phase + output
22	+Z	Encoder Z phase + output
23	RUN	Run command input
24	EM	Emergency stop input
25	ALMRS	Abnormal reset input
26	IPG	Command pulse prohibition input
27	H·RET	Zero position return command input
28	RESET	Deflection counter reset input
29		
30		
31	-A	Encoder A phase - output
32	-B	Encoder B phase - output
33	-Z	Encoder Z phase - output
34	GND	Encoder signal GND

☐ Connector terminal for the motor signal
This is a terminal to input the encoder signal from the built-in encoder of the motor.

	No	Sign	Function	Color	Wire size
	1	-TG	Tacho-generator -input		
	2	+TG	Tacho-generator +input		
	3	SG	Shield ground		
	4	+5V	Encoder supply power +5V	white	AWG24
	5	+5V	Encoder supply power +5V		
	6	SG	Shield ground	shield	
Remark 1→	7	ALMI1	Outer abnormal input		
Remark 1→	8	ALMI2	Outer abnormal input		
	9	0V	Encoder GND supply terminal	black	AWG24
	10	0V	Encoder GND supply terminal		
	11	+A	Encoder +A phase input	red	AWG24
	12	-A	Encoder -A phase input	pink	AWG24
	13	+B	Encoder +B phase input	green	AWG24
	14	-B	Encoder -B phase input	blue	AWG24
	15	+Z	Encoder +Z phase input	yellow	AWG24
	16	-Z	Encoder -Z phase input	orange	AWG24



Structure diagram



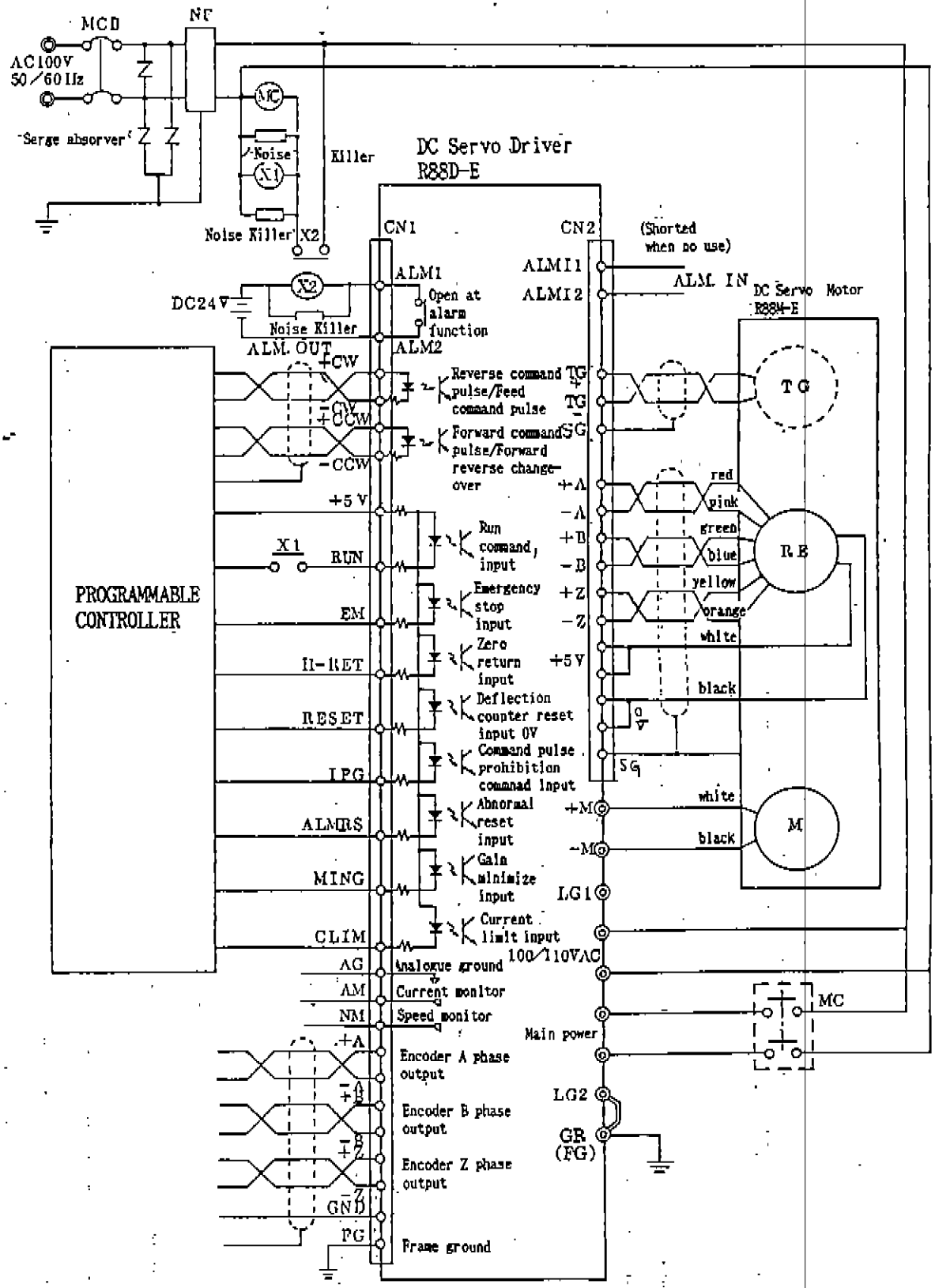
Cross section for
motor signal lead wire

Remark 1: In case outer abnormal input is not used, short ALMI1 and ALMI2 terminals. When an optional cable (type R88A-CRE series) is used, these terminals connected inside of this plug.

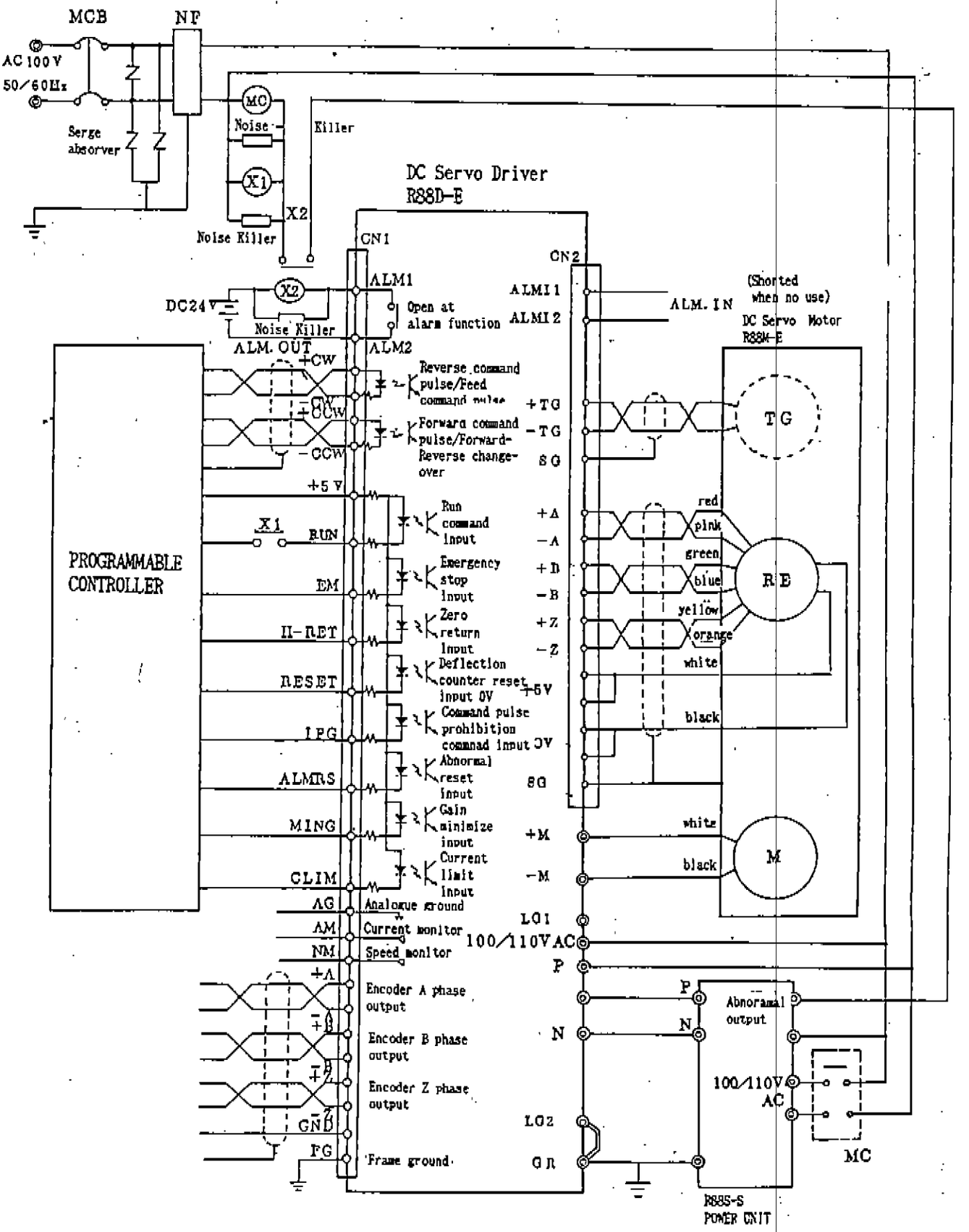
4.3 Connection diagram

4.3.1 Example of connection

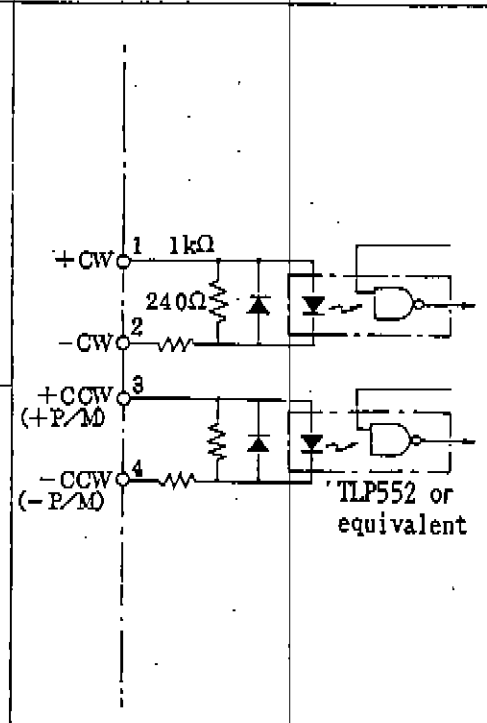
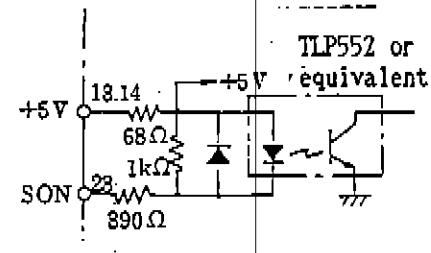
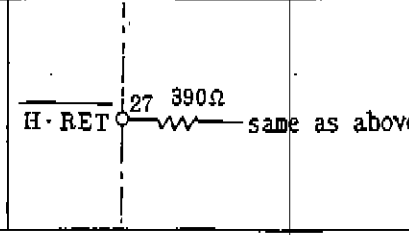
· Type R88D-EP06/EP12(Built-in power unit type)

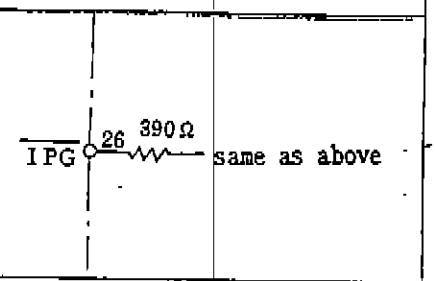
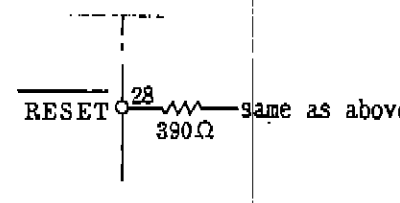
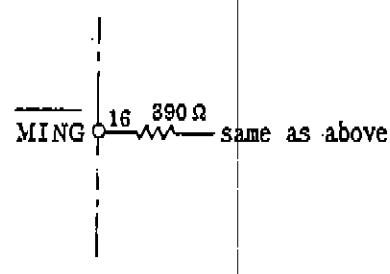
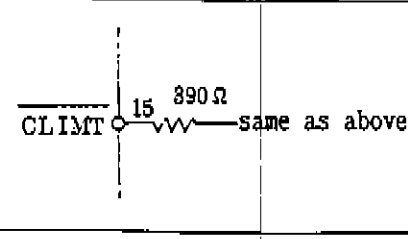
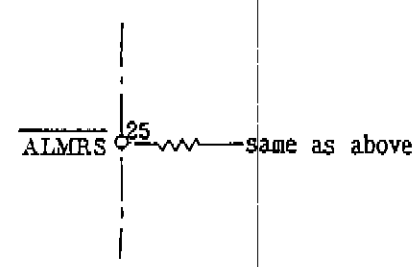
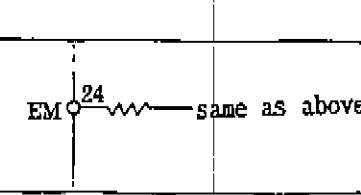


☐ Type R88D-ER13/ER15/ER16 (Power unit separated type)

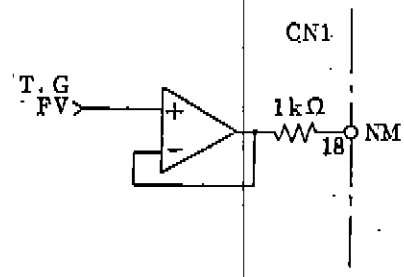
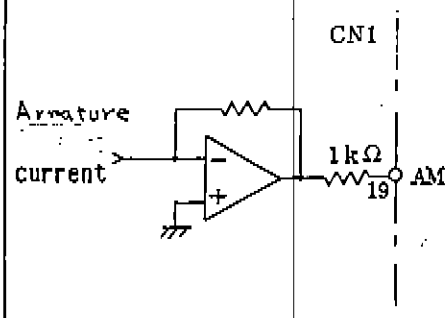
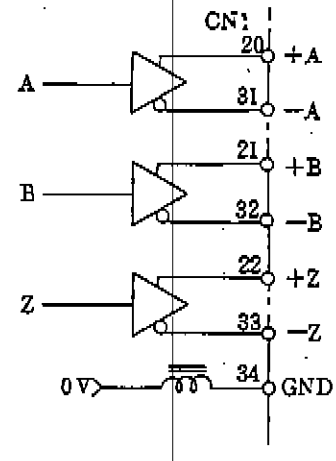


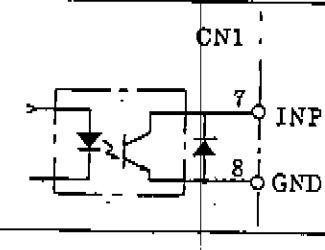
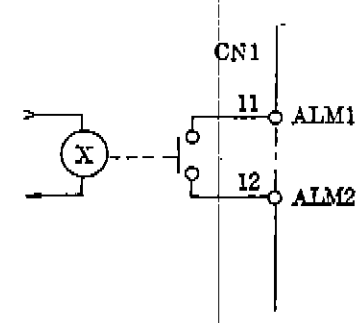
4.3.2 Control input interface

Signal	Function	Specification	Input interface
Reverse command pulse input or feed command pulse input	After change-over reverse command pulse, this signal turns to feed command pulse.	14mA with input voltage 5V. 4mA with input voltage 3V. Pulse width = more than 2μsec Up/down time = less than 0.5μsec.	
Forward command pulse or forward reverse change-over	After change-over forward command pulse, this signal turns to forward/ reverse change-over function.	14mA with input voltage 5V. 4mA with input voltage 3V. Pluse width = more than 2μsec Up/down time = less than 0.5μsec.	
Run command input (RUN)	If this signal is applied, armature current is is feeded to the motor. If this signal is not applied the deflection couunter will clear and the motor axis will be free.	11mA with input voltage 5V	
Zero return command input (H.RET)	Start zero return operation when this signal applies.	-ditto-	

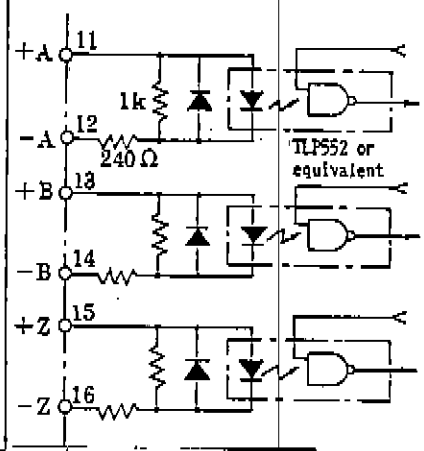
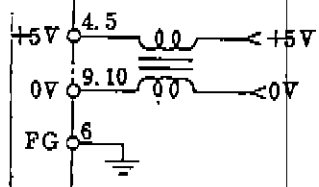
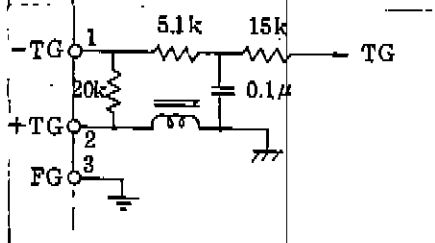
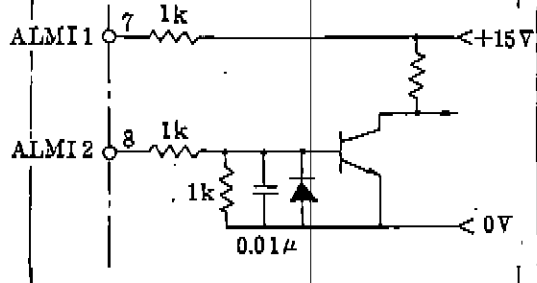
Signals	Function	Specification	Input interface
Command pulse prohibition input	Command pulse input is prohibited to apply when this signal applies.	-ditto-	
Deflection counter reset input (RESET)	Resets deflection counter and prohibits input command pulse.	-ditto-	
Gain minimizing input (MING)	This signal is used to stop the motor rotation completely. But, the servo lock power is decreased with minimizing the gain.	-ditto-	
Current limit input (CLIM)	Function current limit with the set value of the torque limit.	-ditto-	
Reset input from abnormal protection condition (ALMRS)	The protection function reset to normal operation. Same function available with inner reset switch.	-ditto-	
Emergency stop input(EM	Put off this line at emergency.	-ditto-	

4.3.3 Control output interface

Signals	Function	Specification	Input interface
Speed monitor output (NM)	This is a output to monitor the voltage of the tacho-generator. At forward rot rotation, positive output, at reverse rotation, negative output is applied	0～±10V	
Current monitor output (AM)	This is a transformed voltage of the supply current to the motor. At forward rotation, positive output. At reverse rotation, , negative output is applied	0～10V For voltage amount of each driver type, see item 6.2.	
Encoder feed-back output (A, B, Z)	The encoder signals are converted to line driver signal with a high speed photocoupler. If you need TTL level signal, use one phase of this line driver and GND with required polarity.	Line diriver out put for AM26LS3 or equivalent. Load impedance is more than 100Ω.	

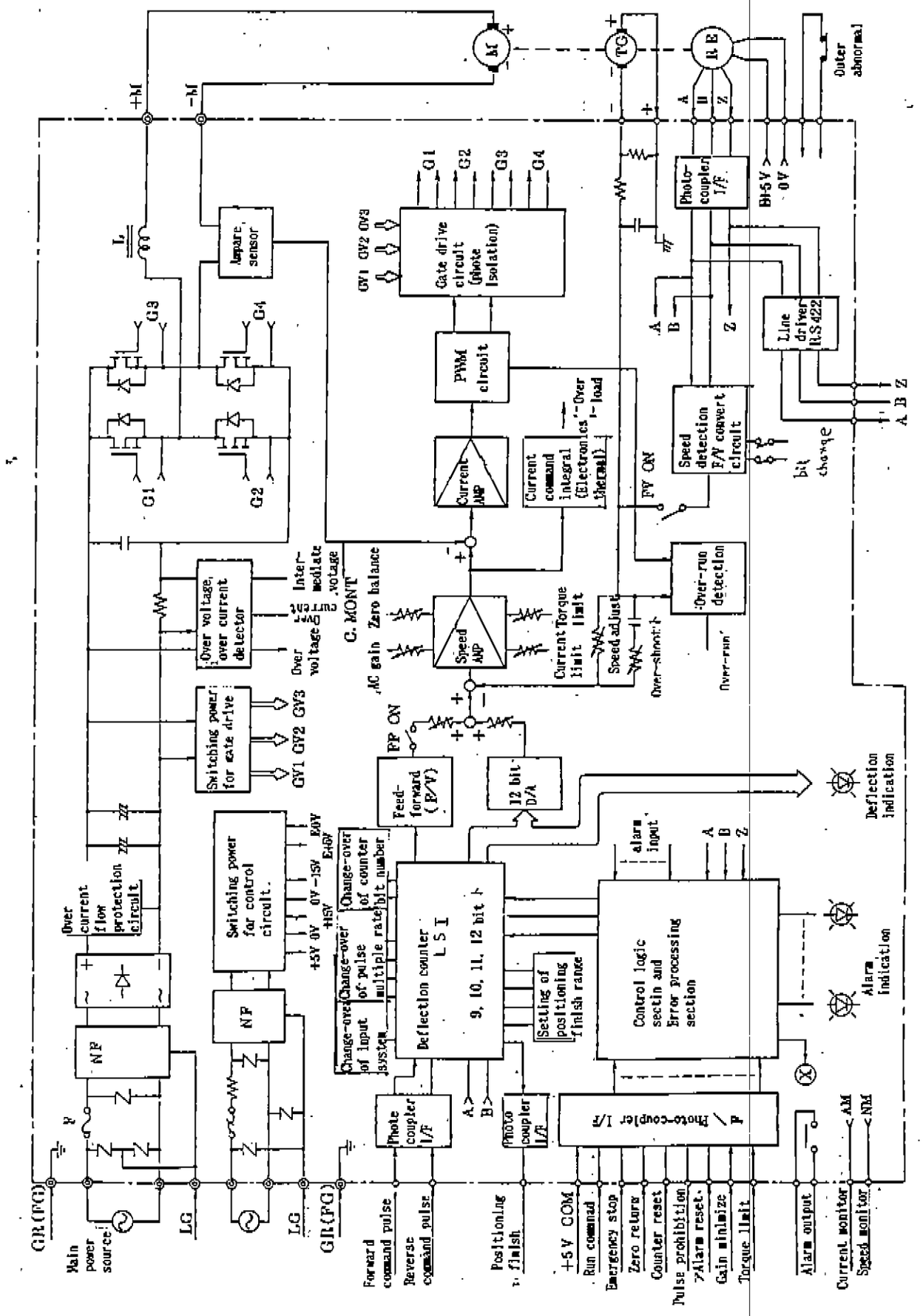
Signal	Function	Specification	Input interface
In-position output (INP)	Output when the deflection value is less than the in-position range	DC 24V 10mA	
Abnormal output (ALM. OUT)	Shut off the connection when outer or inner abnormal condition occures. For reset, input abnormal reset signal or push a reset button.	DC48V -0.5A	

4.3.4 Serovo motor interface

Signal	Function	Specification	Interface
Encoder input (A, B, Z)	Input terminal for built-in encoder signal of the motor.	+5V-13mA +3V-5.5mA ·Line driver ·Open collector ·TTL applicable	
Power output to encoder	+5V power source for the rotary encoder. This line is isolated from the inner logic circuit.	+5V±5% max 200mA	
Tacho -gene -rator input	Input terminal for speed feed back from the tacho-gene-rator. This line is not isolated from the inner logic circuit.	7V/1000rpm	
Outer abnormal input (ALMI1, ALMI2)	Input terminal of a thermal switch for the motor or a thermal relay. The system detects abonormal when this signal does not apply.	Sink +15V-7mA	

4.5. Inner block diagram of the servo driver

☐ R88D-EP06/EP12(Built-in power unit type)



5 SPECIFICATION

5.1 General specification

Type	Built-in power unit type		Power unit separated type		
Item	R88D -EP06	R88D -EP12	R88D -ER13	R88D -ER15	R88D -ER16
Main power source voltage allowance	1φ AC85～132V		DC120～187V		
Control power source voltage allowance	1φ AC85～132V 50Hz/60Hz				
Insulating resistance	Between outer terminal and outer box more than 20MΩ (at DC 500V Mega)				
Voltage proof capacity	Between outer teminal and outer box (excluded control input/output section) AC1500V 50/60Hz with 1 minite				
Noise proof capacity	Equivalent to NEMA ICS3-304 (1200V P-P with pulse width 1μs) (up time = 1 ns)				
Vibration proof capacity	JIS C 0911 ⅡB 3 item (16. 7Hz Vibration range 3mm, 30 time for each X, Y, Z direction)				
Shock proof capacity	Equivalent to JIS C 0912 (10G, 3 time for each X, Y, Z direction)				
Ambient temperature	0° C～+55° C				
Ambient humidity	35 ～ 90% RH (without duew condensation)				
Storage temperature	-10 ～+70° C				
Ambient condition	Without corrosive gases				
Structure	Rack mount or hanging up installation type				
Painting color	5Y7/1				
Weight	2.4 kg		3.7 kg		

5.2 Performance specification

5.2.1 Deflection counter section and control input/output specification.

Max. response pulse frequency		250 kpps
Max. deflection amount		Change-over among 9, 10, 11, 12 bits
Multiple rate of position command pulse		1～16 time
In-position range setting		±1～±31 pulse
Position detector input signal		90° phase difference signal, A, B, Z signal 75kpps max.
Multiple rate of detector input signal		1, 2, 4 time
Feedforward control		available with change-over of the inner switch
INPUT SIGNAL	Position feedback signal	Rotary encoder with isolated A, B and Z signals.
	Command pulse	TTL, line driver input, isolated.
		Width of pulse : 2μsec. or more
		Up/down time : 0.5 μsec. or less
	Preparation of operation	+5V -10mA , phote isolation
	Zero postioning command	+5V -10mA , phote isolation
	Pulse prohibition	+5V -10mA , phote isolation
	Emergency stop	+5V -10mA , phote isolation
	Reset of deflection counter	+5V -10mA , phote isolation
	Reset of abnormal condition	+5V -10mA , phote isolation
	Current limit	+5V -10mA , phote isolation
	Minimize gain	+5V -10mA , phote isolation
OUTPUT SIGNAL	Alarm output	relay output DC48V -0.5A
	Positioning finish	Open collector output max 24V -10mA
	Position feedback output	A, B, Z phase (line driver) for./rev
Power output for position detector		+5V -200mA(max.)

5.2.2 Specification of servo driver section

		Built-in power unit type		Power unit separated type		
Type of servo driver		R88D -EP06	88D -EP12	R88D -ER13	R88D -ER15	R88D -ER16
Capacity of applicable servo motor		50～80W	120～200W	300W	400W	500W
Control system		MOS-FET, PWM system				
Main circuit DC voltage		100～160V		---	---	---
Capacity of control power		19VA		20VA		
Peak output current		6A	12A	13A	15A	16A
Continuous output current		3A	5A	5.5A	6A	6.6A
Range of current limit		0～100% of maximum output current				
Range of speed control		3000:1 with tacho-generator detection In case of F/V feed-back, this value depends on numbers of a encoder pulse.				
Speed feedback		With tacho-generator or with F/V feedback				
Speed monitor output		0～±10V				
Current monitor output		0～±10V	0～±10V	0～±5V	0～±5.8V	0～±6.2V
PROTECTION FUNCTION	Over-run detection	Functions when speed feedback is over the rated value or not applied. (Tacho-generator or encoder out of order)				
	Intermediate voltage detection	Functions when the FET gate drive voltage is in the main power circuit.				
	Deflection counter over	Functions when the deflection counter is more than the setting number of bit.				
	Electoronics thermal	Functions when the exceeded ampare of the continuous value applies with the rated interval.				
	Over-heat radiation fins	Functions when the temperature of the radiation fins exceeds 85℃±5℃.				
	Over-voltage at main circuit	Functions when the main power source exceeds 220V.				
	Over current	Functions when the armature ampere exceeds 120% of the peak current value.				
Tacho-generator input		7V at 1000 rpm of the motor speed.				
Current limit system		Set with the inner current limit adjustable volume, change-over with outer signal.				