

# **mitsubishi**

**General Purpose AC Servo**

## **MELSERVO**

**Pulse Factor Controller  
MR-RT**

**Instruction Manual**

## Setting of Short Pins in PCB

### 1. OPC 1 , OPC 2 / LID 1 , LID 2

Select the setting according to the input pulse method.

#### ① To use line driver type encoder

Set the short pins to  LID 1 and  LID 2 ..... This is the factory setting state.

#### ② To use open collector type encoder

Set the short pins to  OPC 1 and  OPC 2 .

\* Remove the pins inserted in  LID 1 and  LID 2 and reinsert to  OPC 1 and  OPC 2 .

#### ③ To use forward run pulse/reverse run pulse (When inputting from general positioning unit such as MR-VF or AD71)

Set the short pins to  OPC 1 and  OPC 2 .

\* Remove the pins inserted in  LID 1 and  LID 2 and reinsert to  OPC 1 and  OPC 2 .

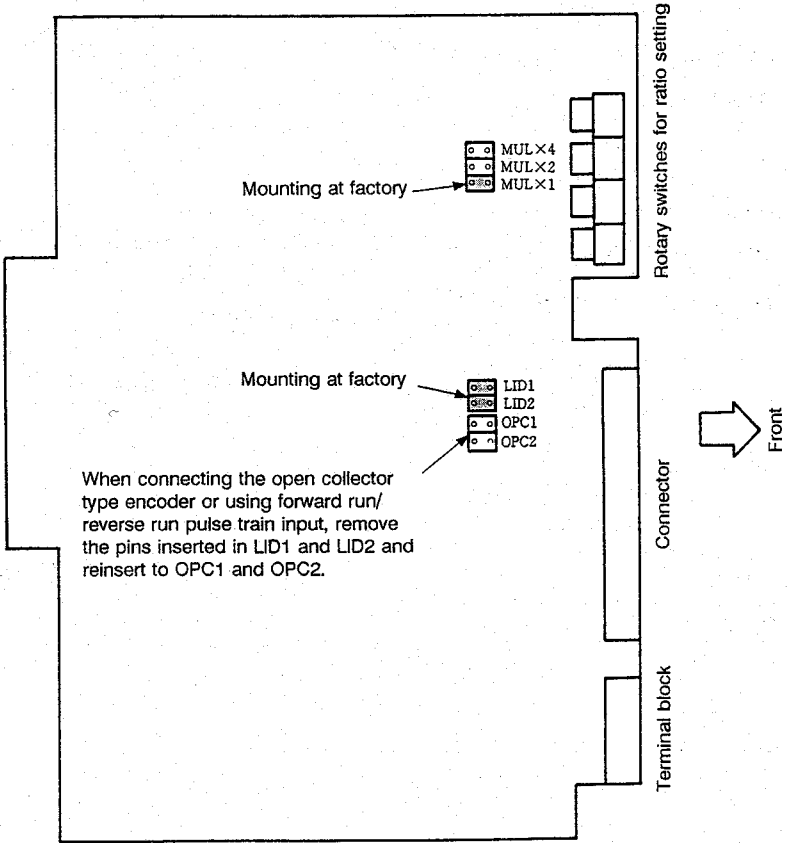
### 2. MULx1 / MULx2 / MULx4

When inputting from an encoder, the No. of encoder pulses are multiplied by one, two or four and output.

**Note:** This is invalid for the forward run pulse/reverse run pulse input. The pulses will be multiplied by one and output regardless of the setting.

Short pin name	Function	Factory setting
MULx1	1-fold	○
MULx2	2-fold	×
MULx4	4-fold	×

Top



When connecting the open collector type encoder or using forward run/reverse run pulse train input, remove the pins inserted in LID1 and LID2 and reinsert to OPC1 and OPC2.

Bottom

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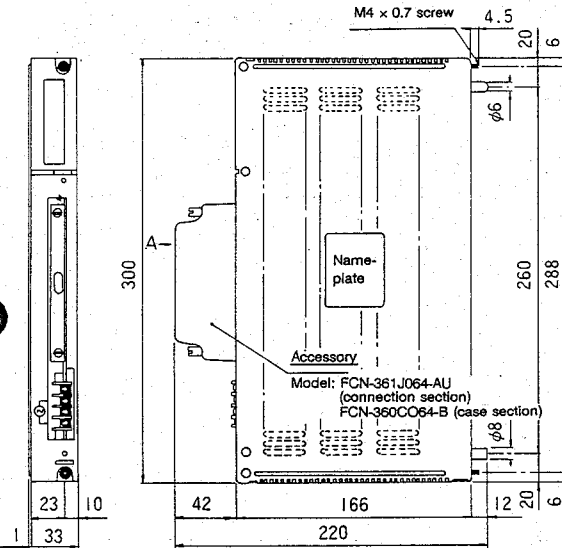
## 1. Introduction

This option is connected to the step before the general purpose AC servo amplifier MELSERVO, and functions to control the tracking axis according to the pulses from the encoder installed on the reference axis, and to perform high-accuracy synchronization operation according to the reference pulses from the V/F converter (MR-VF).

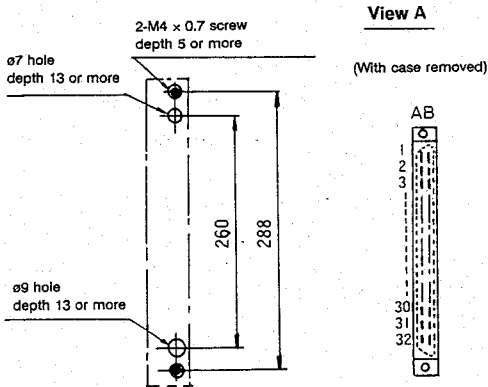
## 2. Specifications

Item		Specifications
Power supply	Voltage	AC100 to 110V, 85 to 110%, single-phase 50/60Hz
	Power supply for encoder	DC5V 200mA max. (built-in)
Input signal (cable length)		① Encoder (30m or less) Connection of differential line driver, open collector possible ② Forward run, reverse run pulse train (2m or less) Use either ① or ②. ③ Logic (2m or less) H: +15V to +12V, L: 0 to +3V (built-in power supply) Active low
Max. input frequency		100kpps (PLG input is the value after multiplication)
Ratio setting range		$\frac{1}{10000}$ to $\frac{9999}{10000}$ • Selection of 1/1 possible with external commands • Setting with internal switch or external switch possible
Output signal (cable length)		Forward run, reverse run pulse train Output pulse width approx. 4.5 $\mu$ sec (constant) Open collector output (2m or less)
Output pulse capacity		Max. four servo amplifier units can be driven
Max. output frequency		100kpps
Working temperature/humidity		0 to 55°C/90% or less
Protection function		Excessive input frequency protection
Paint color		Munsell 5Y 8/1
Weight		920g (excluding connector accessory)

### 3. Outline Dimension Drawing



Installation hole drawing

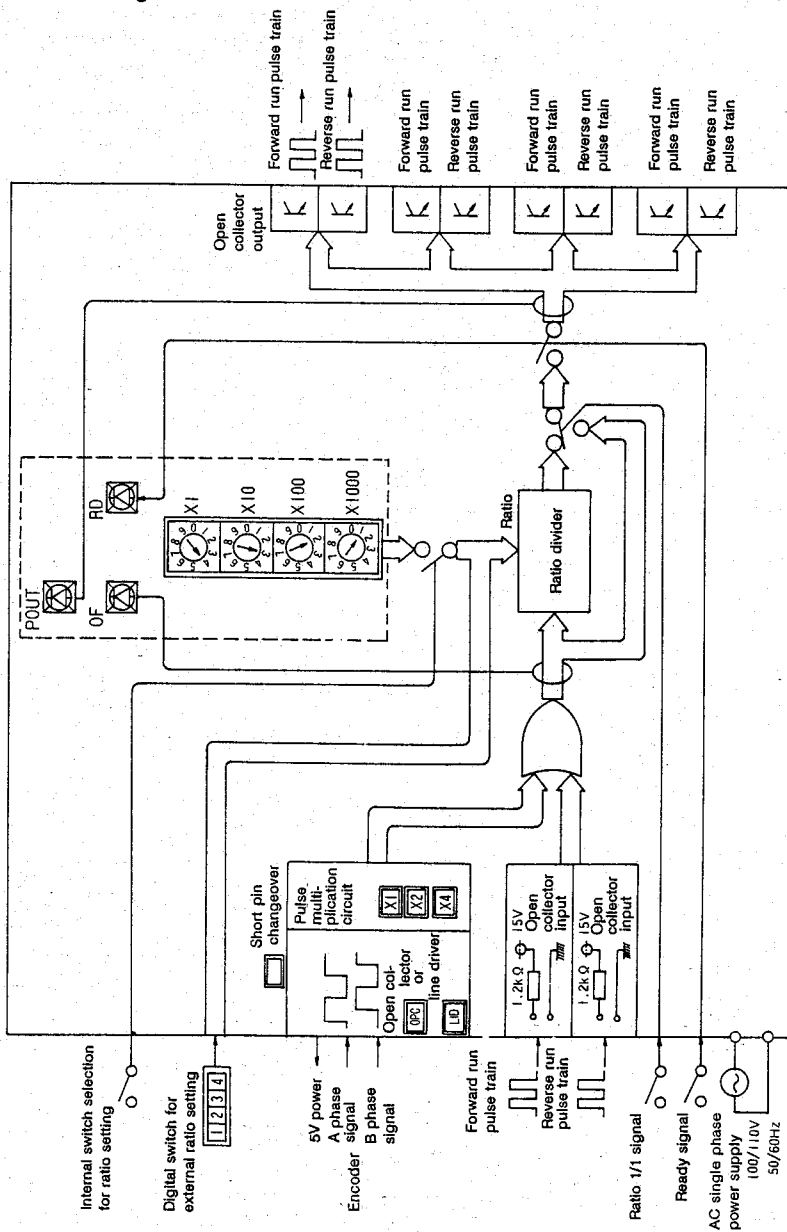


**Accessory connector pin layout**  
The pin layout looking from View A (cable connection side) is shown below.

Pin No.	A row	B row
1	INT	DG
2	MA 8	MA 4
3	MA 2	MA 1
4	MB 8	DAG
5	MB 4	MB 2
6	MB 1	DBG
7	MC 8	MC 4
8	MC 2	MC 1
9	MD 8	DCG
10	MD 4	MD 2
11	MD 1	DDG
12		
13	SD	DG
14	RP	DG
15	FP	DG
16	RB	PB
17	RA	DG
18	PA	DG
19	P5	
20		
21	RD	DG
22	RAT	DG
23		
24		
25	NP 4	NG 4
26	PP 4	PG 4
27	NP 3	NG 3
28	PP 3	PG 3
29	NP 2	NG 2
30	PP 2	PG 2
31	NP 1	NG 1
32	PP 1	PG 1

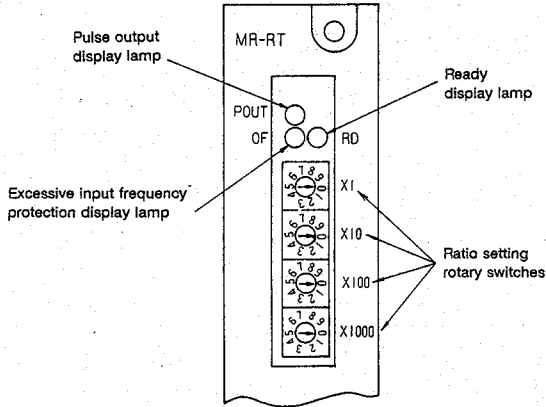
## 4. Configuration

### 4-1 Block diagram



## 4-2 Layout and explanation of setting panel

### (1) Setting panel layout drawing



### (2) Rotary switch

Name	Function	Details	Default setting
x1	Ratio 1st digit	If (ratio setting value) = n, then Output pulse = encoder pulse × multiplication value $\times \frac{n}{10000}$	0
x10	Ratio 2nd digit		0
x100	Ratio 3rd digit		0
x1000	Ratio 4th digit		1

#### Ratio setting example

① To set ratio to  $\frac{1234}{10000}$

x1	" 4 "
x10	" 3 "
x100	" 2 "
x1000	" 1 "

② To set ratio to  $\frac{1}{2}$

x1	" 0 "
x10	" 0 "
x100	" 0 "
x1000	" 5 "

Set the rotary switches as set in the tables ① and ② above.

### (3) Display lamp

Name	Function
RD	Lights when operation is ready.
POUT	Lights when pulses are being output. (The lamp flickers during low frequency output)
OF	Lights when the pulse train or forward run/reverse run pulse train input after encoder signal multiplication exceeds 100kpps. The pulse is immediately changed to a non-output pulse, and that state is held. To restart operation, reset the power or turn the ready signal OFF and ON.

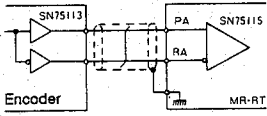
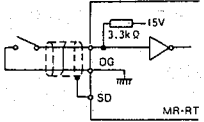
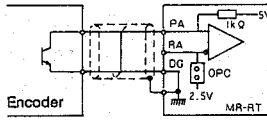
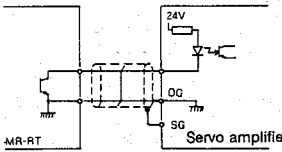



## 5. Connections

### 5-1 Explanation of input/output terminals

Application		Signal name	Connector pin No.	Function explanation	I/O class	
AC current			—	Connect to a commercial power supply of 100V to 110V, 50 to 60Hz.	I	
Encoder	A phase signal	PA	18A	If the A phase signal phase is earlier than the B phase signal, the forward run pulse (PP) is output. If delayed, the reverse run pulse (NP) is output.	I	
	A phase signal (reverse symbol)	RA	17A		I	
	B phase signal	PB	16B		I	
	B phase signal (reverse symbol)	RB	16A		I	
	DC 5V power supply	P5	19A		Max. 200mA can be supplied.	O
Common	DG	DG	18B	Common wiring	I	
	DG	DG	17B			
Reference axis pulse train input	Forward run pulse train input	FP	15A	If FP to DG is energized for 2 $\mu$ s or more, it is viewed that the forward run pulse has been input.	I	
	Forward run pulse train common	DG	15B			
	Reverse run pulse train input	RP	14A	If RP to DG is energized for 2 $\mu$ s or more, it is viewed that the reverse run pulse has been input.	I	
	Reverse run pulse train common	DG	14B			
Input signal shield		SD	13A	Connect to the shield section of the shield cable.	I	
External Pulse Factor Controller	× 1	2 <sup>0</sup>	MA1	Pulse Factor Controller Connect to the 1st digit step of the (BCD code, digital switch).	I	
		2 <sup>1</sup>	MA2			3A
		2 <sup>2</sup>	MA4			2B
		2 <sup>3</sup>	MA8			2A
		Common	DAG			4B
	× 10	2 <sup>0</sup>	MB1	6A	Pulse Factor Controller Connect to the 2nd digit step of the (BCD code, digital switch).	I
		2 <sup>1</sup>	MB2	5B		
		2 <sup>2</sup>	MB4	5A		
		2 <sup>3</sup>	MB8	4A		
		Common	DBG	6B		
	× 100	2 <sup>0</sup>	MC1	8B	Pulse Factor Controller Connect to the 3rd digit step of the (BCD code, digital switch).	I
		2 <sup>1</sup>	MC2	8A		
		2 <sup>2</sup>	MC4	7B		
		2 <sup>3</sup>	MC8	7A		
		Common	DCG	9B		
	× 1000	2 <sup>0</sup>	MD1	11A	Pulse Factor Controller Connect to the 4th digit step of the (BCD code, digital switch).	I
		2 <sup>1</sup>	MD2	10B		
		2 <sup>2</sup>	MD4	10A		
		2 <sup>3</sup>	MD8	9A		
		Common	DDG	11B		
Ratio setting 1/1		RAT	22A	The ratio is forcibly set to 1/1 when connected between PAT and DC.	I	
Ratio setting common		DG	22B			
Ratio internal setting		INT	1A	The ratio setting can be set with the switch in the unit when connected between INT and DC.	I	
Ratio internal common		DG	1B			
Ready		RD	21A	The output pulse is output when connected between RD and DG. When released, the output pulse is stopped immediately.	I	
Ready common		DG	21B			
Output pulse train	Forward run pulse train output		PP1	32A	The pulse train for driving the MR-A servo amplifier is output.	O
	Forward run pulse train common		PG1	32B		
	Reverse run pulse train output		NP1	31A	Same as above	O
	Reverse run pulse train common		NG1	31B		
	Forward run pulse train output, common		PP2, PG2	30A, 30B	Same as above	O
	Same as above		PP3, PG3	28A, 28B		
	Same as above		PP4, PG4	26A, 26B		
	Reverse run pulse train output, common		NP2, NG2	29A, 29B		
	Same as above		NP3, NG3	27A, 27B	Same as above	O
Same as above		NP4, NG4	25A, 25B			

## 5-2 Input/output interface format

<p><b>Differential line driver encoder</b></p>		<p><b>Logic input</b></p>	<p>Approximately 5mA flows so apply the signal with the miniature relay for fine currents or the open collector transistor.</p> 
<p><b>Open collector encoder</b></p>		<p><b>Pulse train output</b></p>	

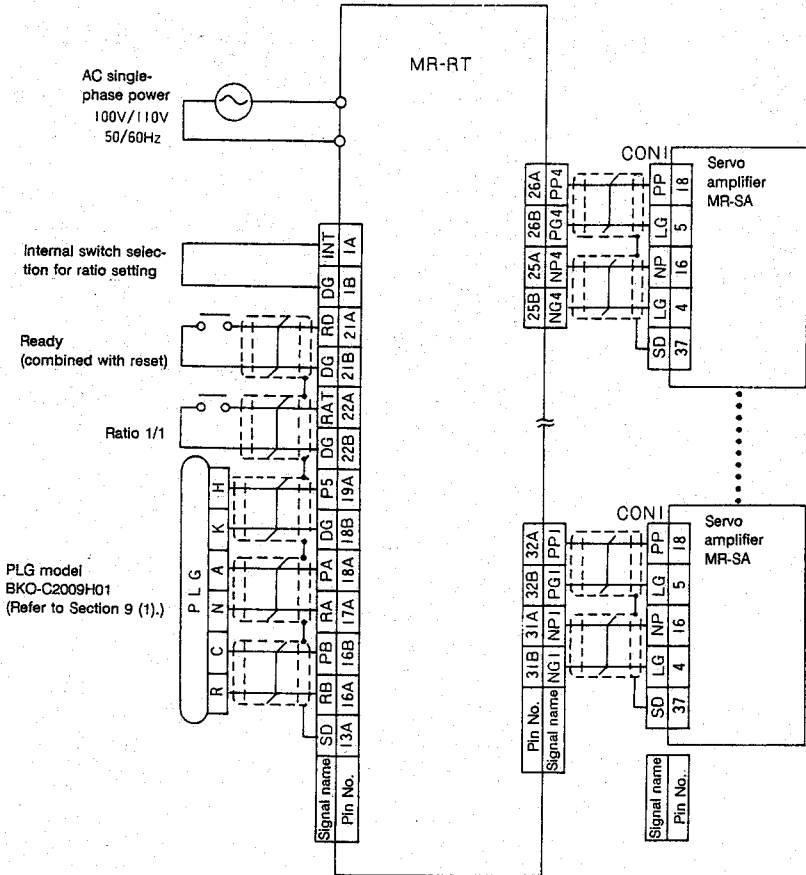
Note)  indicates a twisted pair shield cable.

## 5-3 Standard connection diagram

5-3-1

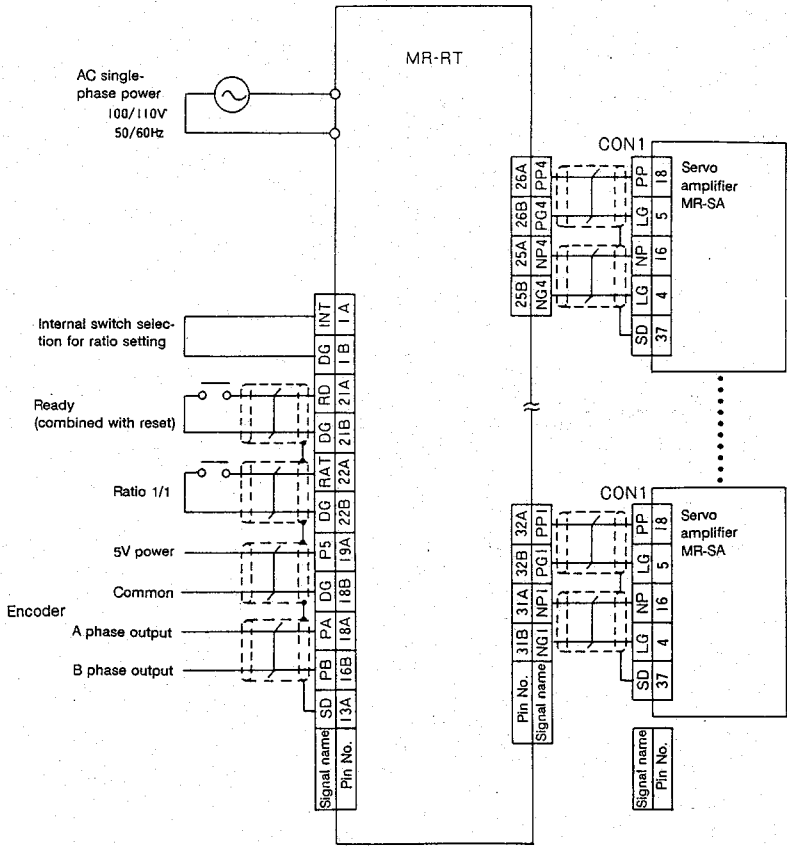
### (1) When using MR-RT internal digital switch for ratio setting.

- (a) When using the differential line driver type encoder output as the reference pulse, the short pins in the unit are kept at **LID1** and **LID2**.



- Note**
- ① Refer to the PCB layout diagram in Section 7 for the short pin positions.
  - ② Connections other than with the MR-RT have been omitted on the MR-SA side.
  - ③ This diagram shows an example with two AC servo amplifier units connected, but up to four units can be connected.

(b) When using open collector type encoder output as the reference pulse, change the short pins **LID1** and **LID2** in the unit to **OPC1** and **OPC2**.

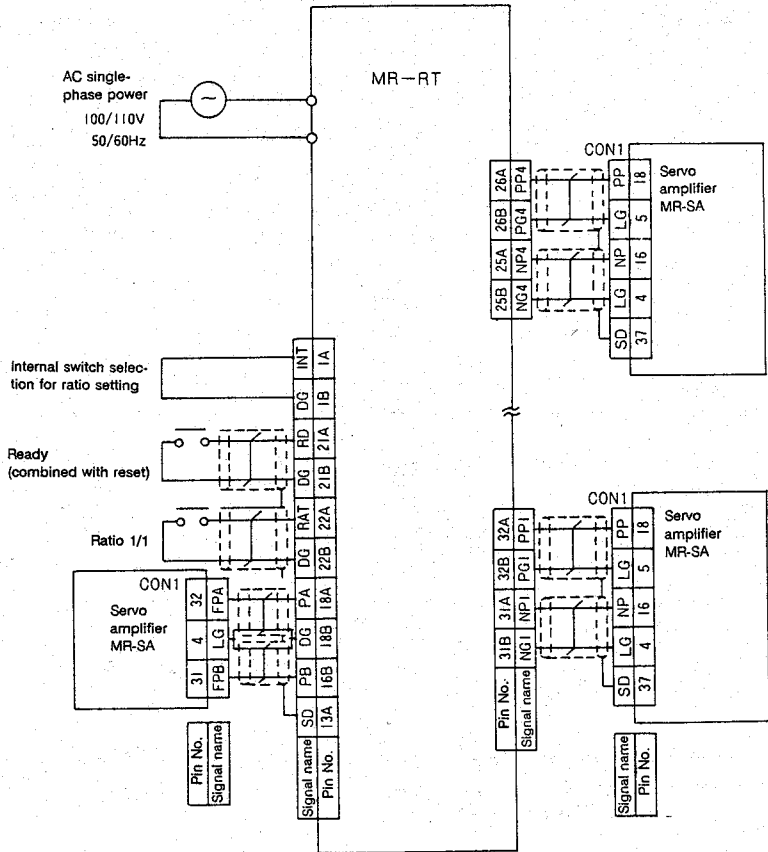


- Note) ① Refer to the PCB layout diagram in Section 7 for the short pin positions.  
 ② Connections other than with the MR-RT have been omitted on the MR-SA side.  
 ③ This diagram shows an example with two AC servo amplifier units connected, but up to four units can be connected.



(d) When using the MR-A encoder output as the reference pulse, change the short pins

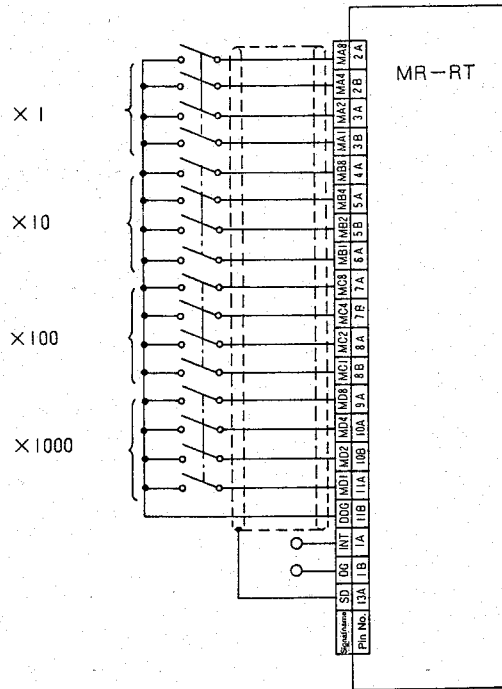
**LID1** and **LID2** in the unit to **OPC1** and **OPC2**.



- Note**
- ① Refer to the PCB layout diagram in Section 7 for the short pin positions.
  - ② Connections other than with the MR-RT have been omitted on the MR-SA side.
  - ③ This diagram shows an example with two AC servo amplifier units connected, but up to four units can be connected.

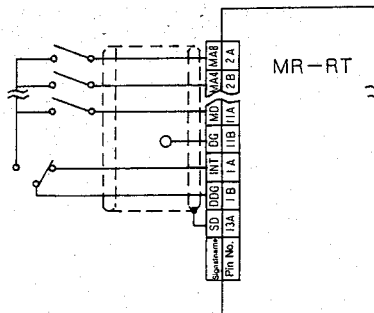
**(2) When using external digital switches**

The usage is the same as using the internal digital switches in section (1) except for the following diagram.



**(3) When using a changeover type internal digital switch and external digital switch.**

The usage is the same as sections (1) and (2) except for the following diagram. The diagram on the right shows the case when the internal digital switch is selected.

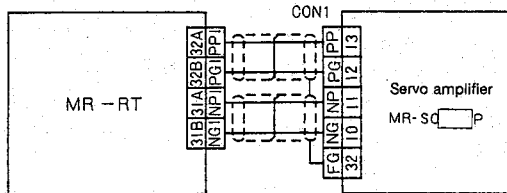


### 5-3-2 Connection with various servo amplifiers

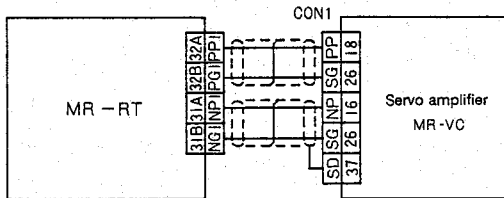
The connection with the MR-SA type servo amplifier is described in section 5-3-1. Use the following methods when connecting with other servo amplifiers.

Connections other than with the servo amplifier (PLG, MR-VF, etc.) have been omitted, however, these units are connected in the same manner as described in section 5-3-1.

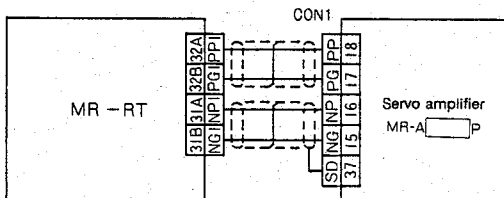
#### (1) Connection with MR-SO



#### (2) Connection with MR-VC



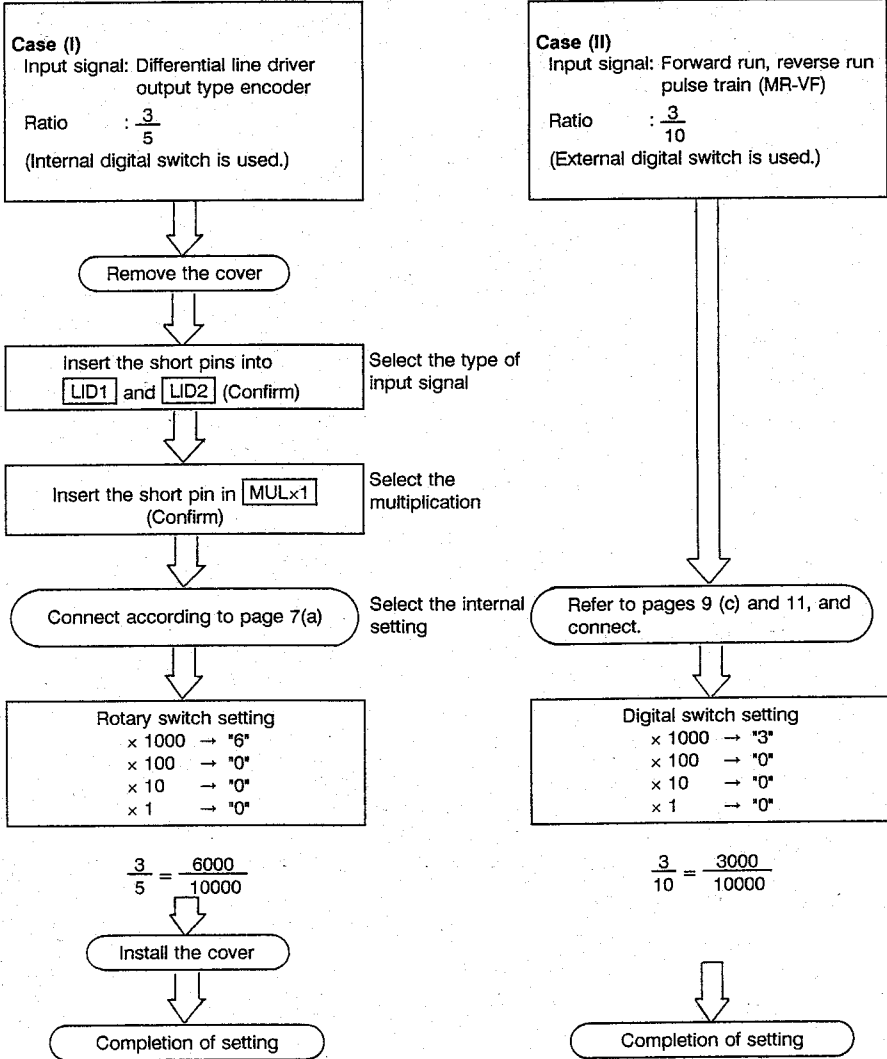
#### (3) Connection with MR-A



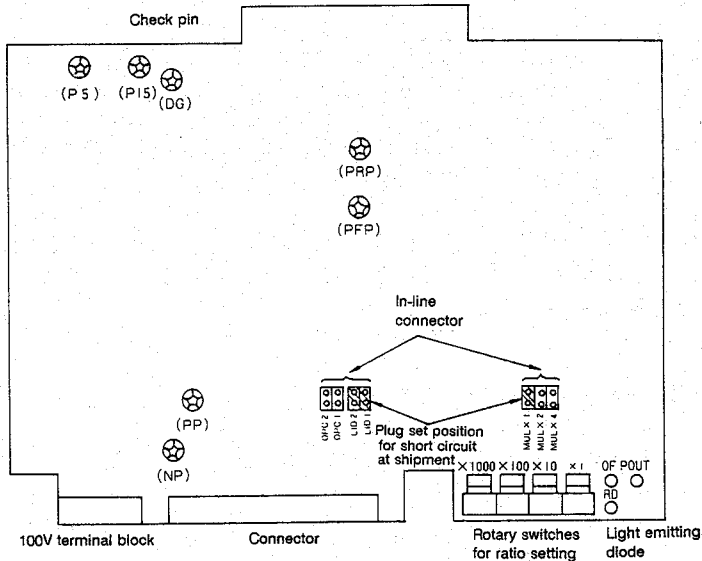


## 6. Initial Setting

The setting examples for case (I) and (II) are shown below.



## 7. PCB Layout Diagram



### (1) Check pin

Abbr.	Name	Function/measurement value
P5	+5V power supply	Power supply for encoder
P15	+15V power supply	DC control power supply
DG	Common line	Connect to the instrument's common.
PPF	Input pulse train	Forward run pulse
PRP		Reverse run pulse
PP	Forward run output pulse train	15V level pulse train
NP	Reverse run output pulse train	

### (2) Shorting pin

Name	Function	Details	Default setting
OPC1	Open collector output encoder I/F	Insert the short pin when using open collector output encoder for reference axis.	×
OPC2			×
LID1	Differential line driver output encoder I/F	Insert the short pin when using differential line driver output encoder for reference axis.	○
LID2			○
MULx1	1-fold	Select the reference axis encoder (2-phase pulse train) output multiplication rate, and select from the three available types.	○
MULx2	2-fold		×
MULx4	4-fold		×

## 8. Precautions for Handling

### (1) Excessive input frequency protection

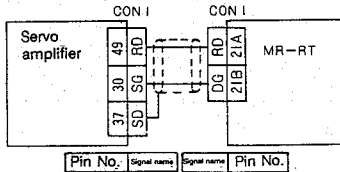
If the pulse train after encoder signal multiplication or the forward run or reverse run pulse train input exceeds 100kpps, the LED  lights, and the output pulse is immediately stopped. This causes the motor to rapidly decelerate and applies a shock to the machine. In this case, set so that the No. of input pulses so that the input will be 100kpps or less, and the reset the power or turn the ready signal OFF and ON before restarting operation.

### (2) Handling of ready signal

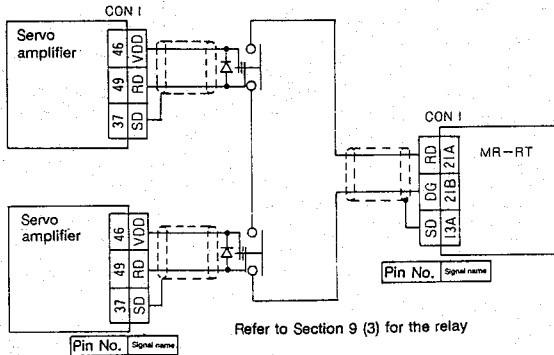
(a) If the servo amplifier accepts and outputs an input pulse before it is ready, the motor will rapidly accelerate simultaneously with servo ON creating a hazardous situation.

An interlock is applied as shown below.

- When one servo amplifier is connected to MR-RT



- When two or more servo amplifiers are connected to MR-RT  
Ready signal turns ON when all connected servo amplifiers are ready.



(b) The output pulse will immediately stop when the ready signal turns OFF during operation causing the motor to rapidly decelerate and a shock to be applied to the machine. Therefore, turn the ready signal OFF after the output pulses have stopped (after motor has stopped) or after turning SON (servo ON) of the servo amplifier OFF.

**(3) When two or more servo amplifiers are connected**

When two or more servo amplifiers are connected, correct operation will not be possible if one servo amplifier is set to the servo OFF state and the other to the servo ON state. In this case, set the system so that the signal wires on the servo OFF side are simultaneously separated.

**(4) When motor stops periodically**

When using the unit for applications other than ratio speed control in which the stopped state is entered during servo ON, set the MR-RT pulse multiplication ratio to 2 or 4. When the multiplication ratio is 1, the motor may start moving even when the pulse input is zero.

**(5) Installation and wiring of reference encoder**

If an excessive vibration is applied on the reference encoder, or if noise is applied on the signal wires, pulses that exceed the MR-RT tolerable value will be input causing an alarm.

Take sufficient vibration and noise measures.

## 9. Selection of peripheral parts

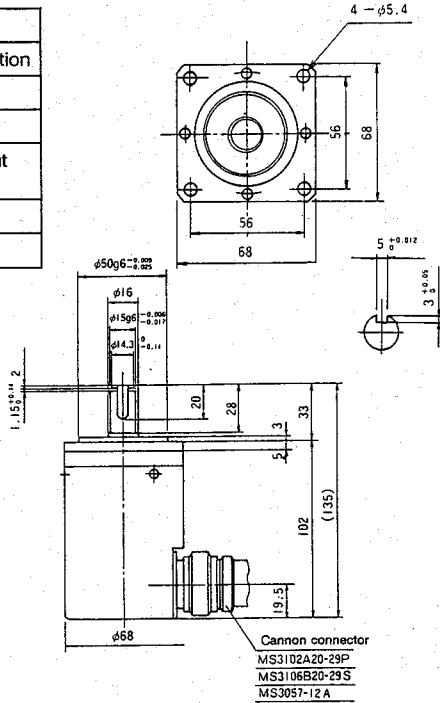
### (1) Encoder

Use the following encoder or equivalent product as the detector for the reference axis.

#### (a) Specifications

Type	BKO-C2009H01
Resolution	1000 pulses/rotation
Response frequency	100kpps
Max. speed	6000RPM
Output circuit	Line driver output using SN75113
Working temp.	0 to +50°C
Weight	1.5kg max.

#### (d) Outline drawing



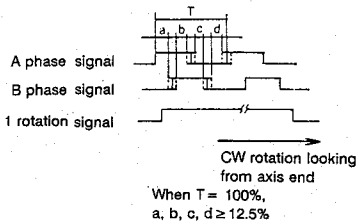
#### (b) Connector pin function

Pin symbol and function	
A	A phase signal
B	1 rotation signal
C	B phase signal
H	DC +5V
K	0V
N	A phase signal
P	1 rotation signal
R	B phase signal

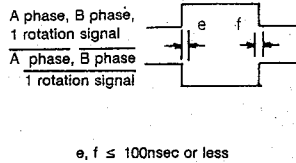
Reverse signals

#### (c) Output characteristics

- Relation of A phase, B phase and 1 rotation signal phase



- Phase relation with reverse signals



(2) Digital switch for external ratio setting

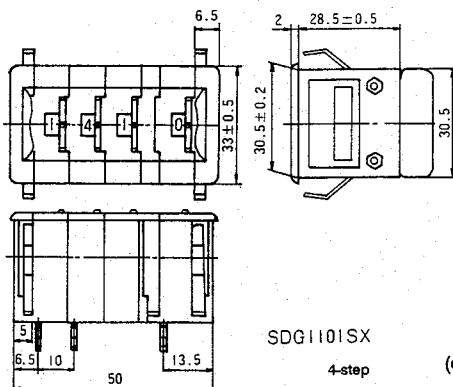
Use the following switch or equivalent part.

(a) Specifications

(Fujisoku)

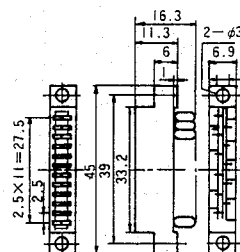
Type	Switching rating	Conductivity rating	Initial contact resistance	Withstand voltage	Insulation resistance	Electrical life
SDG 1100 type	100mA 50V AC 100mA 28V DC (Resistance load)	1μA to 1A AC-DC	200mΩ or less	500V AC-DC for one minute	1000mΩ or more	1,000,000 times

(b) Unit dimension table



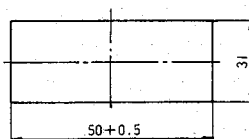
(d) Connector

The connector for 6 pins is a binary type, and the terminal Nos. are on the terminals with even Nos.



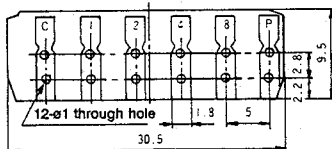
(e) Installation hole dimensions

Installation panel effective plate thickness: 1 to 3mm



(c) How to read switch characteristics table

Dial stop position	Dial character	Terminal that contacts with common (C)					
		1	2	4	8	P	
0	0					●	
1	1	●					
2	2		●				
3	3	●	●			●	
4	4			●			
5	5	●		●		●	
6	6		●	●		●	
7	7	●	●	●			
8	8				●		
9	9	●			●	●	



**(3) Miniature relay**

When inserting a contact in the ratio setting 1/1 (RAT), ratio internal setting (INT) or ready (RD), use a miniature relay (twin contact).

Recommended relay: Tateishi G2A type  
Fujitsu 473, 474 type

**(4) 2-core shield cable**

Use the following (or equivalent) twisted pair shield cable for the input signal cables.

Type B-22 (19) U x 2SJ-1 x 9 (Sumitomo Electric)

No. of wires and size (mm <sup>2</sup> )	Finished outer dimensions (mm)	Characteristics of one wire		Color
		Configuration (wires/mm)	Conductive resistance (Ω/km)	
2 x 0.3	4.18	19/0.16	54.8 x 2	Grey



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