NSK

Robot Module System

- P Series Module Main Unit
- R Series Module Main Unit
- EXEA Controller

User's Manual 3

= Installation and Maintenance of Module Main Unit =

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NSK Ltd.

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EC-T

Limited Warranty

NSK Ltd. warrants its products to be free from defects in material and/or workmanship which NSK Ltd. is notified of in writing within, which comes first, one (1) year of shipment or 2400 total operation hours. NSK Ltd., at its option, and with transportation charges prepaid by the claimant, will repair or replace any product which has been proved to the satisfaction of NSK Ltd. to have a defect in material and/or workmanship.

This warranty is the sole and exclusive remedy available, and under no circumstances shall NSK Ltd. be liable for any consequential damages, loss of profits and/or personal injury as a result of claim arising under this limited warranty. NSK Ltd. makes no other warranty express or implied, and disclaims any warranties for fitness for a particular purpose or merchantability.

Robot Module System
EC Directives Conformity

NSK Ltd. declares that "Robot Module System" conforms to EC Directive (CE Marking).

However, please note that the following conditions are added for conformity to the EC directive.

⊙ EC Declaration of Incorporation

- NSK Ltd. declares that the Robot Module System is a machine component which is to be incorporated into the machine. (EC Declaration of Incorporation)
- The Robot Module System must not be operated until it is incorporated to the machine.
- The Robot Module System, as the machine component, conforms with following EC Directives.
  - ◊ EC Machinery Directive 89/392 as amended 94/368 and 93/44.
  - ◊ EC Low Voltage Directive 73/23 as amended 93/68.
- The customer has to take appropriate measures to its machine to conform to Electro Magnetic Compatibility Directive. The Robot Module must not put into service until the machinery into which it to be incorporated has been declared in conformity with the provisions of EC Directives.
- Our declaration becomes invalid if technical or operational modifications are introduced without the consent of Mechatronics Technology Department of NSK Ltd.

⊙ Remaining Hazards (Following notes should be observed for your safety.)

- EXEA controller shall be put into the enclosure conforming to relevant European standard in terms of fire protection and electrical shock protection. The protection grade of the enclosure must be IP 54 or better. EXEA controller shall not be exposed to water or oil.
- Just after the power is turned on and off, there will be the hazardous voltage on the parts of EXEA controller, such as the power input terminal, motor connector and connector for an external regenerative dump resistor. Put covers on those parts to protect from touching when operating the machine or doing maintenance work.
  Furthermore, provide appropriate protection from disconnecting the motor connector accidentally.
- An isolation transformer must be used to prevent electrical shock. The isolation transformer must have enough capacity for the Robot Module System power consumption.
- Install noise filter in the primary AC power line as a measure for Electro Magnetic Compatibility Directive.
- A circuit breaker must be installed to the primary AC power line of Robot Module System.
- Ground earthing must be provided to EXEA controller.
- Wiring inside of EXEA controller is simply internal wirings and the grounding wire is not distinguished by color as the protective grounding conductive.
- Secure the controller cables and motor cables firmly so that those cables do not break or have loose contact.
- Surround the machine, to which the Robot Module System is incorporated, with safety fence to prevent any personnel from entering its moving range.

⊙ Unit Limitation

- Units of Robot Module System which conform to EC Directives are limited to the following reference number only.

  1. EXEA controller

     Reference No. : M-EXEA □ – □ □ □ □ T □ □

     ↑

     T : Indicates conformity with the Directive

  2. Teaching box

     Reference No. : M-EXTB 04

- However, all robot module main units are compatible with the EC Directives. If you require to build the Robot Module System that complies to the EC Directives, the EXEA controller and the Teaching box must be compatible with the EC Directives.

19. Reference Number • Specifications

19.1. Module Main Unit

19.1.1. Reference Number

Reference number example: **XY-HRS 030 - R H 2 00**

(1) NSK robot module

(2) Stroke [cm] (Example) 030: 300 mm

(3) Specification code
– : [standard specification]
C : [clean room specification] Available to R series only

(4) Series
P : [P series]
R : [R series]

(5) Module type ··· Capacity classification in each series (cross section area of main unit)
H : Main unit carrying heavy load.
M : Main unit carrying medium load.
S : Main unit carrying light load.

(6) Ball screw lead [cm]
1 : 10 mm 2: 20 mm 4 : 40 mm

(7) Description code

Table 19-1: Description code

(7)	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Speed reduction ratio 1/2		✓		✓		✓		✓		✓		✓		✓		✓
Equipped with motor brake			✓	✓			✓	✓			✓	✓			✓	✓
Motor right mount					✓	✓	✓	✓								
Motor left mount									✓	✓	✓	✓				
Motor back mount													✓	✓	✓	✓
High performance module																

(7)	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
Speed reduction ratio 1/2		✓		✓		✓		✓		✓		✓		✓		✓
Equipped with motor brake			✓	✓			✓	✓			✓	✓			✓	✓
Motor right mount					✓	✓	✓	✓								
Motor left mount									✓	✓	✓	✓				
Motor back mount													✓	✓	✓	✓
High performance module *	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

[Examples]

◊ Description code [05] : Maximum speed is reduced to 1/2. Motor brake is not incorporated.
Motor is mounted to right side. (indirect mount)
As the maximum speed is reduced to one half of standard specification, equivalent ball screw lead in "Motor conversion table" shall be 20 mm if the ball screw lead number is [4] (40 mm) in (6).

◊ Description code [00] : The maximum speed is standard. Direct motor mount main unit and no motor brake is equipped.

* High performance module is equipped with a higher power motor and has higher transportable moment as shown in Table 19-2 below.

Table 19-2

		RM module		RS module	
		00 ~ 15 normal specifications	32 ~ 47 high performance specification	00 ~ 15 normal specifications	32 ~ 47 high performance specification
Motor power [W]		200	400	100	200
Transportable moment [Nm]	Rolling	70		24	32
	Pitching	120		10	24
	Yawing	120		10	24

19.1.2. Specifications

◆ Standard specifications

Table 19-3 : P series

Item	PM module				PH module			
	200	212	100	102	200	212	100	102
Stroke [mm]	100, 200, 300, 400, 500, 600, 700, 800							
Maximum speed [mm/s]	1200		600		1200		600	
Horizontal transportable mass [kg]	20		40		40		80	
Vertical transportable mass [kg]	–			8	–			25
Transportable moment [N·m]*1	Rolling: 19, Pitching: 25, Yawing: 22				Rolling: 113, Pitching: 97, Yawing: 66			
Repeatability [mm]	±0.02				±0.02			
Motor power [W]	100				200			
Ball screw lead [mm]	20		10		20		10	
Ambient temperature	0～40°C (no condensation)							

Table 19-4 : R series

Item	RS module			
	204/208	104/108	106/110	138/142
Stroke [mm]	330, 430, 530, 630	130, 230, 330, 430, 530, 630		100, 200, 300, 400, 500, 600
Maximum speed [mm/s]	1200	600		600
Horizontal transportable mass [kg]	20			20
Vertical transportable mass [kg]	–		8	20
Transportable moment [N·m]*1	Rolling: 24, Pitching: 10, Yawing: 10			Rolling: 32, Pitching: 24, Yawing: 24
Repeatability [mm]	±0.01			±0.01
Motor power [W]	100			200
Ball screw lead [mm]	20	10		10
Ambient temperature	0～40°C (no condensation)			

Item	RM module					RH module				
	200/204 /208	234/238 /242	134/239 /243	405/409	439/443	200/204 /208	202/206 /210	102/207 /211	405/409	407/411
Stroke [mm]	250, 350, 450, 550, 750, 950			1150, 1350, 1550		300, 400, 500, 600, 800, 1000			1200, 1400, 1600, 1800, 2000	
Maximum speed [mm/s]	1200		600	1200, 1080, 840		1200		600	1200, 1080, 840, 680, 560	
Horizontal transportable mass [kg]	40					80		200	80	
Vertical transportable mass [kg]	–	20	40	–	20	–	20	40	–	20
Transportable moment [N·m]*1	Rolling: 70, Pitching: 120, Yawing: 120					Rolling: 600, Pitching: 450, Yawing: 400				
Repeatability [mm]	±0.01			±0.02		±0.01			±0.02	
Motor power [W]	200	400		200	400	400				
Ball screw lead [mm]	20		10 or equivalent	40 (20 equivalent)		20		10 or equivalent	40 (20 equivalent)	
Ambient temperature	0～40°C (no condensation)									

*1 Transportable moment : Maximum moment load for which a module main unit can last out an estimated life of 10 000 km when it is applied continuously in either one of rolling, pitching and yawing direction.

◆ Clean room specifications

Table 19-5 : R series

Item	RS module			RM module			
	204/208	104/108	106/110	200	134	405/409	439/443
Stroke [mm]	330, 430, 530, 630	130, 230, 330, 430, 530, 630		250, 350, 450, 550, 750, 950		1150, 1350, 1550	
Maximum speed [mm/s]	1200	600		1200	600	1200, 1080, 840	
Horizontal transportable mass [kg]	20			40			
Vertical transportable mass [kg]	–		8	–	40	–	20
Transportable moment [N·m]*1	Rolling: 20, Pitching: 10, Pitching: 10			Rolling: 60, Pitching: 120, Pitching: 120			
Repeatability [mm]	±0.01			±0.01		±0.02	
Motor power [W]	100			200	400	200	400
Ball screw lead [mm]	20	10		20	10	40 (20 equivalent)	
Ambient temperature	0～40°C (no condensation)						

Item	RH module			
	200	102	405/409	407/411
Stroke [mm]	300, 400, 500, 600, 800, 1000		1200, 1400, 1600, 1800, 2000	
Maximum speed [mm/s]	1200	600	1200, 1080, 840, 680, 560	
Horizontal transportable mass [kg]	80	200	80	
Vertical transportable mass [kg]	–	40	–	20
Transportable moment [N·m]*1	Rolling: 550, Pitching: 450, Pitching: 400			
Repeatability [mm]	±0.01		±0.02	
Motor power [W]	200	400	200	400
Ball screw lead [mm]	20	10	40 (20 equivalent)	
Ambient temperature	0～40°C (no condensation)			

*1 Transportable moment : Maximum moment load for which a module main unit can last out an estimated life of 10 000 km when it is applied continuously in either one of rolling, pitching and yawing direction.

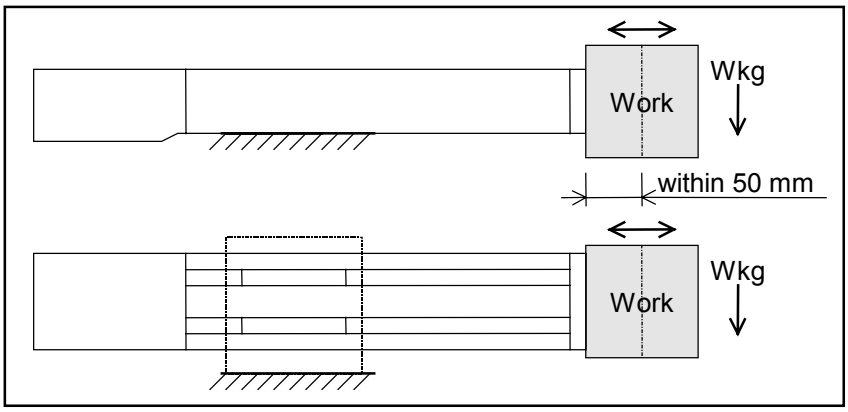
◆ Transportable mass of single axis moving main unit

- Transportable mass shown in Table 19-6 are applicable for all modules in standard and clean room specifications when it is used as a moving main unit.
  (The specification is valid when the center of gravity of the work is within 50 mm from the mounting surface of a main unit as indicated in Figure 19-1.)

Table 19-6 : Transportable mass for single axis in moving main unit

H module		M module		S module	
stroke [mm]	transportable mass W [kg]	stroke [mm]	transportable mass W [kg]	stroke [mm]	transportable mass W [kg]
300	40	250	25	130	3
400	40	350	20	230	1.4
500	40	450	16		
600	36	550	12		
800	25	750	7		
1000	17	950	3		

Figure 19-1: Position of center of gravity of load



◆ Transportable mass of multi-axis combination

- Stroke and transportable mass of respective multi-axis combinations is indicated in Table 19-4.

Figure 19-2 : Combination code

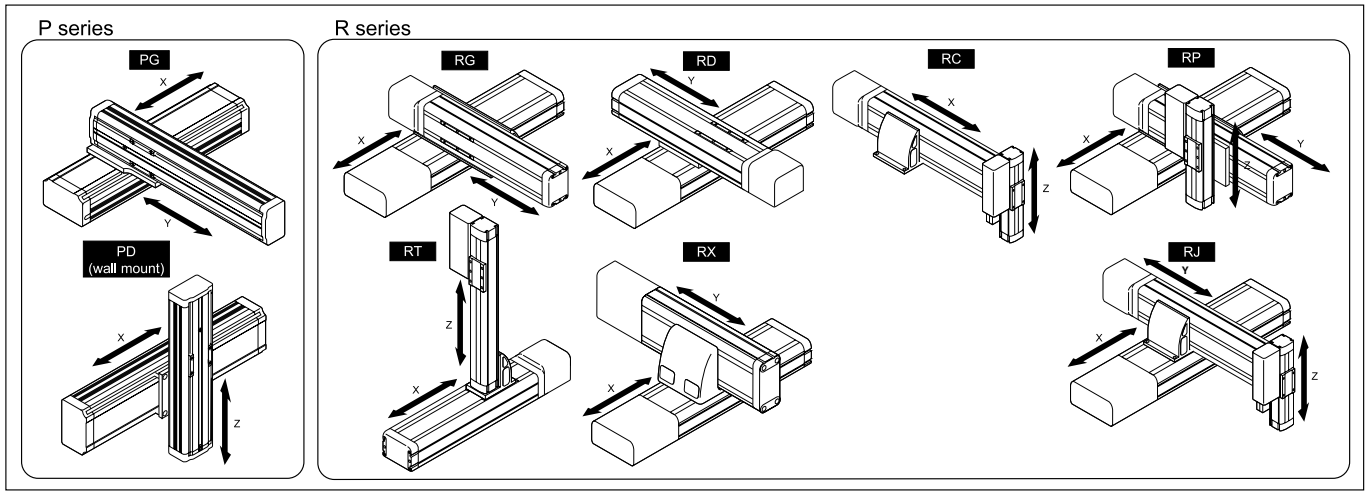


Table 19-7 : Transportable mass of multi-module combination

Series	Combination code	Combination style	Module main unit			Acceleration [m/s²]	Transportable mass [kg]										
			X axis	Y axis	Z axis		Y (Z) axis stroke [mm]										
							100	130	200	230	250	300	330	350	400	430	450
P series	PG	PG-HM	PH	PM	–	4.9	20		19			13.5			10		
						9.8	10		10			9			6		
	PD (wall mount)	PD-MMz	PM	–	PM	4.9	7.5		5.5			4			3		
						9.8	3.6		2.5			1.8			1.2		
		PD-HMz	PH	–	PM	4.9	8		8			5			4		
						9.8	8		5.5			3.6			3		
R series	RG	RG-MS	RM	RS	–	4.9		20		15			11			8	
						9.8		18		12			9			6.5	
		RG-HM	RH	RM	–	4.9					40			40			40
						9.8					40			40			33
	RD	RD-MS	RM	RS	–	4.9		20		20			20			20	
						9.8		20		20			20			20	
		RD-HM	RH	RM	–	4.9					40			40			40
						9.8					40			40			40
	RT	RT-MSz	RM	–	RS	4.9	20		20								
						9.8	20		20								
	RX	RX-HM	RH	RM	–	3.3					24			19			15
						4.9					21			16			12
		RS-HH	RH	RH	–	3.3						40			40		
						4.9						40			40		

Series	Combination code	Combination style	Module main unit			Acceleration [m/s²]	Transportable mass [kg]									
			X axis	Y axis	Z axis		Y (Z) axis stroke [mm]									
							500	530	550	600	630	700	750	800	950	1000
P series	PG	PG-HM	PH	PM	–	4.9	7.3			5.3		3.6		2.2		
						9.8	4			2.6		1.3				
	PD (wall mount)	PD-MMz	PM	–	PM	4.9	2			1						
						9.8	0.8									
		PD-HMz	PH	–	PM	4.9	3.2			2.9						
						9.8	2.5			2.2						
R series	RG	RG-MS	RM	RS	–	4.9		6			4					
						9.8		5			3.5					
		RG-HM	RH	RM	–	4.9			40				33		24	
						9.8			28				19		13	
	RD	RD-MS	RM	RS	–	4.9		20			20					
						9.8		20			20					
		RD-HM	RH	RM	–	4.9			40				40		40	
						9.8			40				40		40	
	RT	RT-MSz	RM	–	RS	4.9										
						9.8										
	RX	RX-HM	RH	RM	–	3.3			12				7		3	
						4.9			9				5		2	
		RS-HH	RH	RH	–	3.3	40					29				20
						4.9	39					28				19

Table 19-7 : Transportable mass of multi-module combination

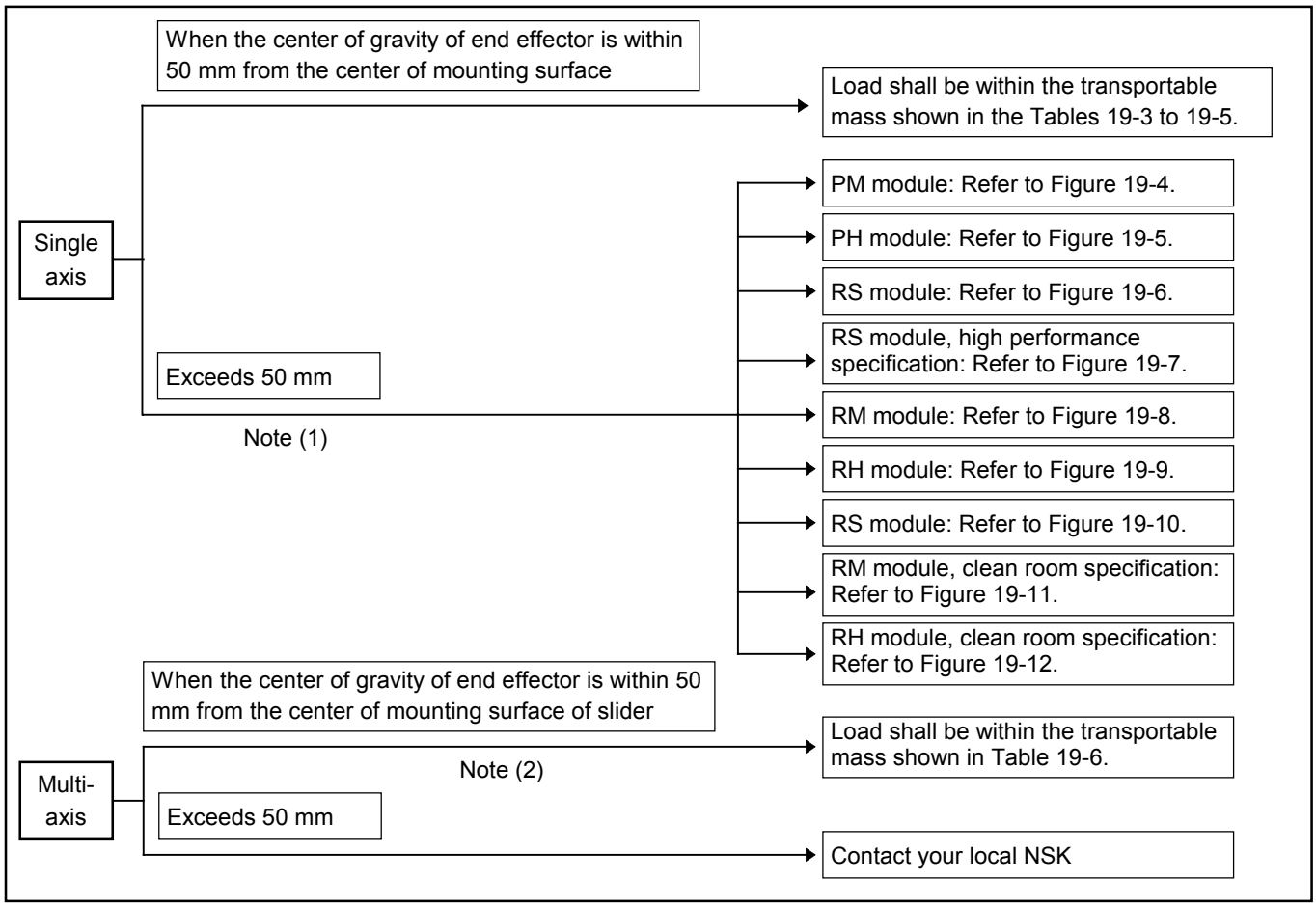
Series	Combination code	Combination style	Module main unit			Acceleration [m/s^2]	Transportable mass [kg]				
			X axis	Y axis	Z axis		Z axis stroke [mm]	Y axis stroke [mm]			
							100	250	350	450	550
R series	RC	RC-MSz	RM	–	RSz	3.3	130	8	8	8	5.4
						4.9		8	8	5.4	2.4
						3.3	230	8	8	7	4.7
						4.9		8	8	4.7	1.7

Series	Combination code	Combination style	Module main unit			Acceleration [m/s^2]	Transportable mass [kg]											
			X axis	Y axis	Z axis		Z axis stroke [mm]	Y axis stroke [mm]										
								130	230	250	330	350	430	450	530	550	630	750	950
R series	RP	RP-MSSz	RM	RS	RSz	4.9	130	8	8		4.8		1.8						
						9.8		8	5.8		2.8								
						4.9	230	8	8		4.1		1.1						
						9.8		8	5.1		2.1								
		RP-HMSz	RH	RM	RSz	4.9	100, 200			20		20		20		20		20	16
						9.8				20		20		20		20		12.6	6.6
	RJ	RJ-HMSz	RH	RM	RSz	3.3	130			8		8		8		5.4			
						4.9				8		8		5.4		2.4			
						3.3	230			8		8		7.7		4.7			
						4.9				8		8		4.7		1.7			

19.1.3. Precautions against Use of Module Main Unit

● Follow the checking procedure in Figure 19-3 to use the module main units properly.

Figure 19-3: Checking procedure [Mass of end effector, position of center of gravity of end effector, acceleration of module main unit]



Note (1)

◊ Figures 19-4 to 19-12 show the criteria of moment load for which a main unit can last out an estimated life of 10 000 km.

◊ The factors to define the criteria are:
- Mass of end effector (include mass of the work).
- Distance of the center of gravity of end effector from the mounting surface of slider (moment arm length L that is in normal direction of the mounting surface).
- Acceleration.
- Mounting position of robot

◊ Graphs in the figures show the relation between the mass of end effector and the moment arm length L for respective combinations of specific acceleration and position of center of gravity of the end effector.

◊ Refer to Figure 19-15 for acceleration set to the controller and positioning time.

Note (2)

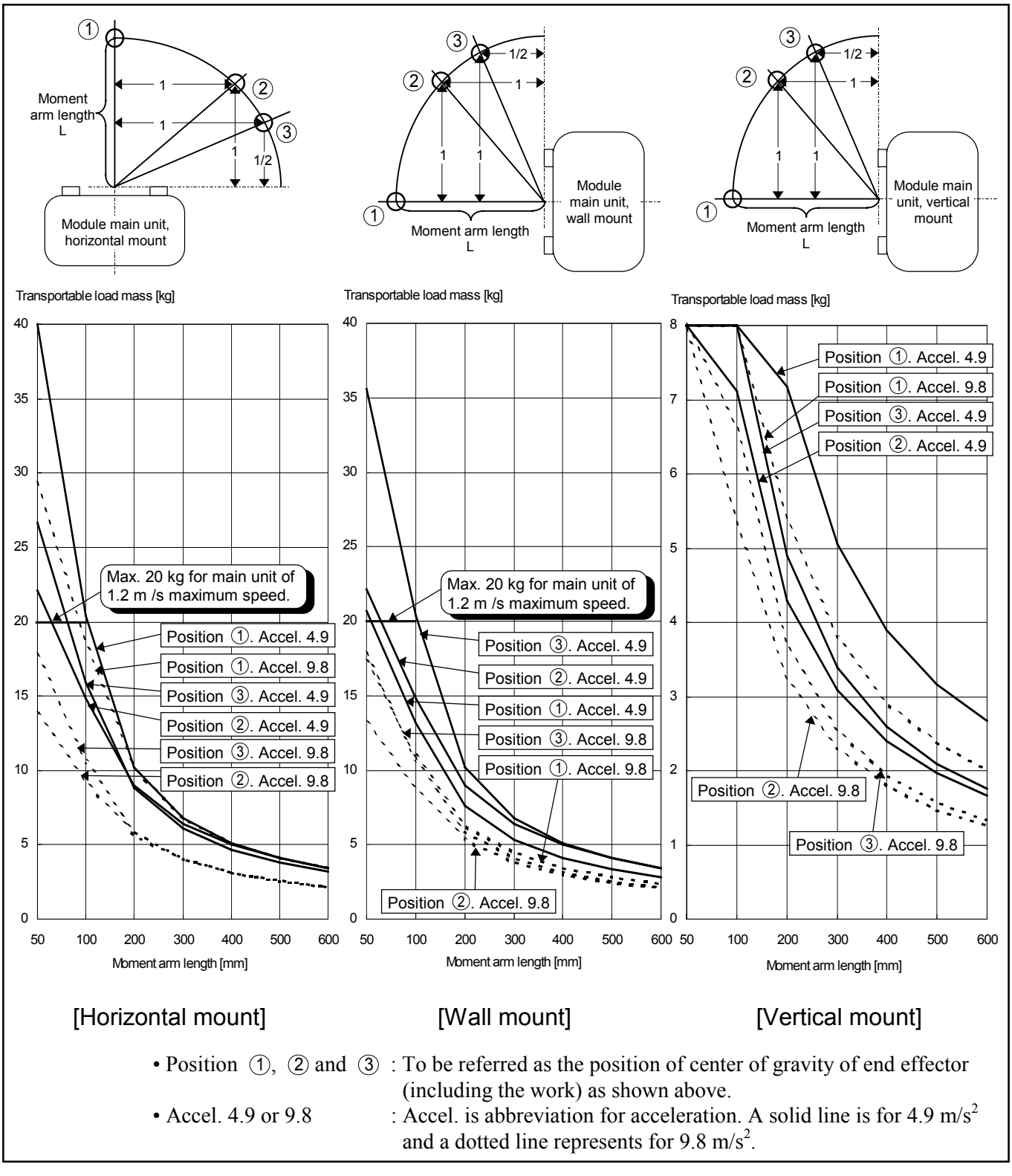
◊ For multi-axis combination, following two factors shall be examined for a module main unit.
- End effector mass W (load mass) shall be in the specification range stated on Table 19-6.
- Relation of the position of end effector and the main unit, to which the end effector is attached, shall be at lower left of a graph.

◆ Relation between end effector mass and moment arm length L [PM Module]

1) Select the closest position of center of gravity of the end effector from ① ~ ③ in the figure below.

2) The criteria shall be at lower left of each graph. Refer to Figure 19-13 for the concept of a moment load.

Figure 19-4



[Horizontal mount] [Wall mount] [Vertical mount]

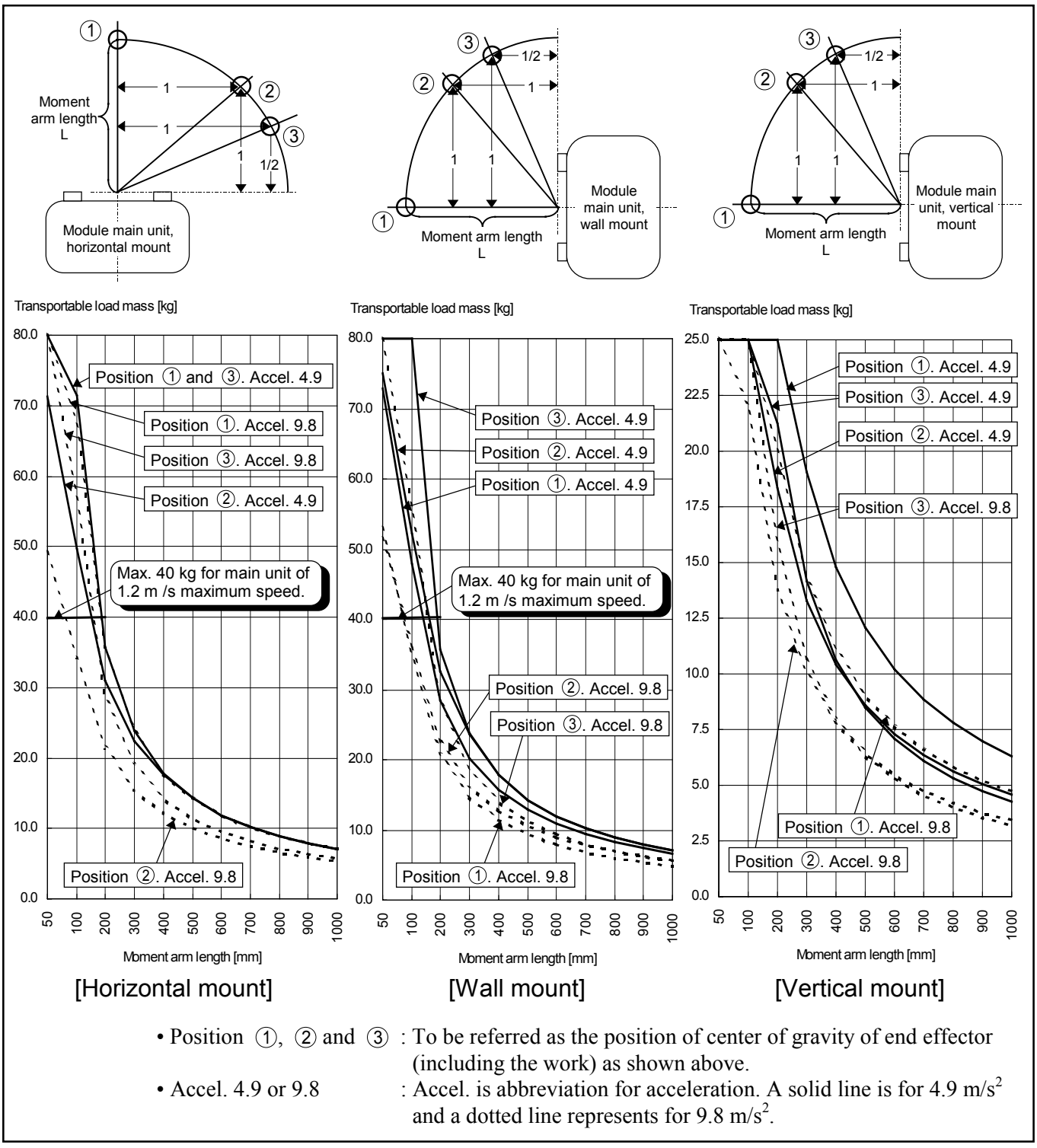
- Position ①, ② and ③ : To be referred as the position of center of gravity of end effector (including the work) as shown above.
- Accel. 4.9 or 9.8 : Accel. is abbreviation for acceleration. A solid line is for 4.9 m/s^2 and a dotted line represents for 9.8 m/s^2.

◆ Relation between end effector mass W and moment arm length L [PH Module]

1) Select the closest position of center of gravity of the end effector from ① ~ ③ in the figure below.

2) The criteria shall be at lower left of each graph. Refer to Figure 19-13 for the concept of a moment load.

Figure 19-5



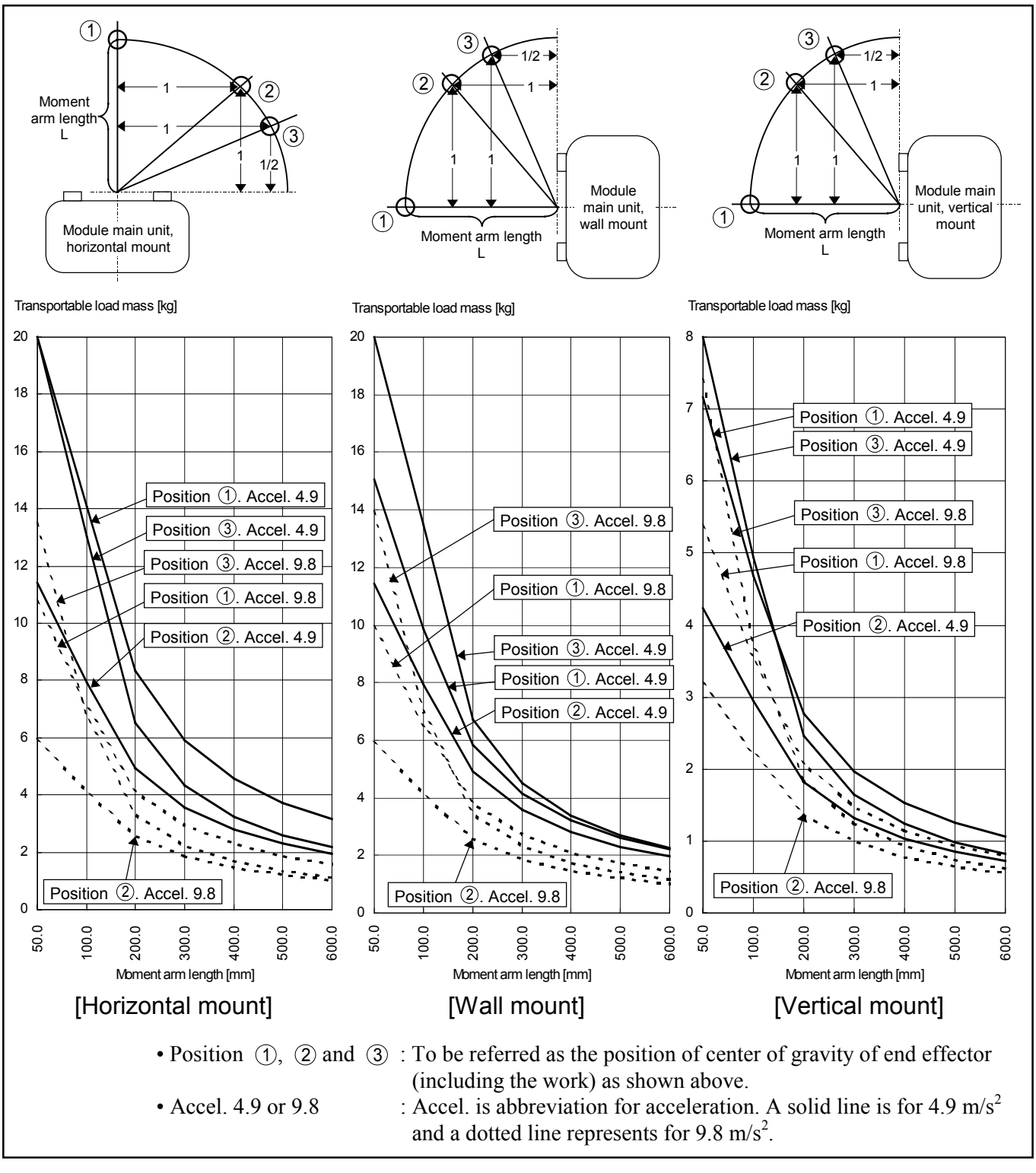
- Position ①, ② and ③ : To be referred as the position of center of gravity of end effector (including the work) as shown above.
- Accel. 4.9 or 9.8 : Accel. is abbreviation for acceleration. A solid line is for 4.9 m/s^2 and a dotted line represents for 9.8 m/s^2.

◆ Relation between end effector mass W and moment arm length L [RS Module]

1) Select the closest position of center of gravity of the end effector from ① ~ ③ in the figure below.

2) The criteria shall be at lower left of each graph. Refer to Figure 19-13 for the concept of a moment load.

Figure 19-6



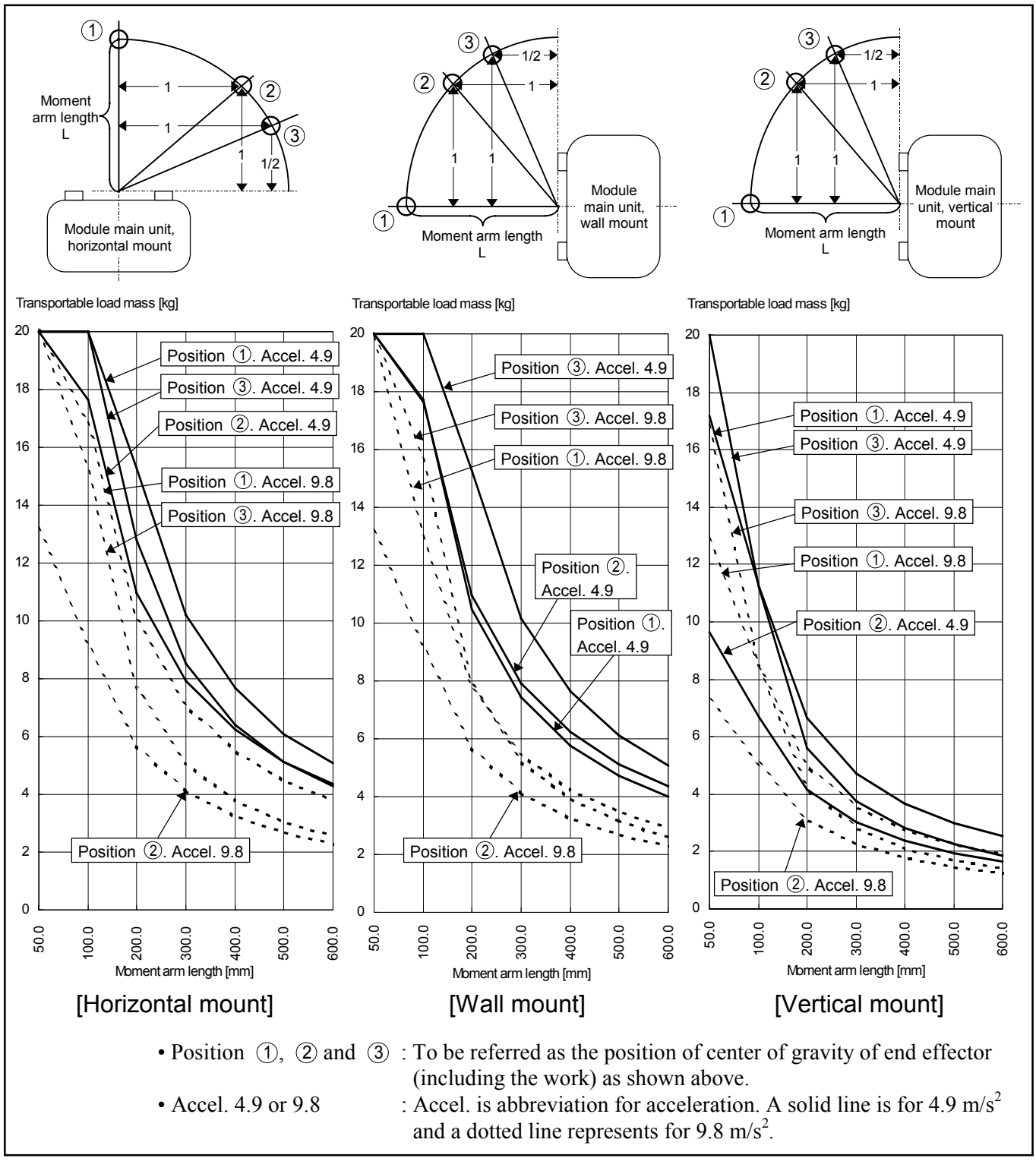
- Position ①, ② and ③ : To be referred as the position of center of gravity of end effector (including the work) as shown above.
- Accel. 4.9 or 9.8 : Accel. is abbreviation for acceleration. A solid line is for 4.9 m/s^2 and a dotted line represents for 9.8 m/s^2.

◆ Relation between end effector W and moment arm length L [RS Module, high performance specification]

1) Select the closest position of center of gravity of the end effector from ① ~ ③ in the figure below.

2) The criteria shall be at lower left of each graph. Refer to Figure 19-13 for the concept of a moment load.

Figure 19-7



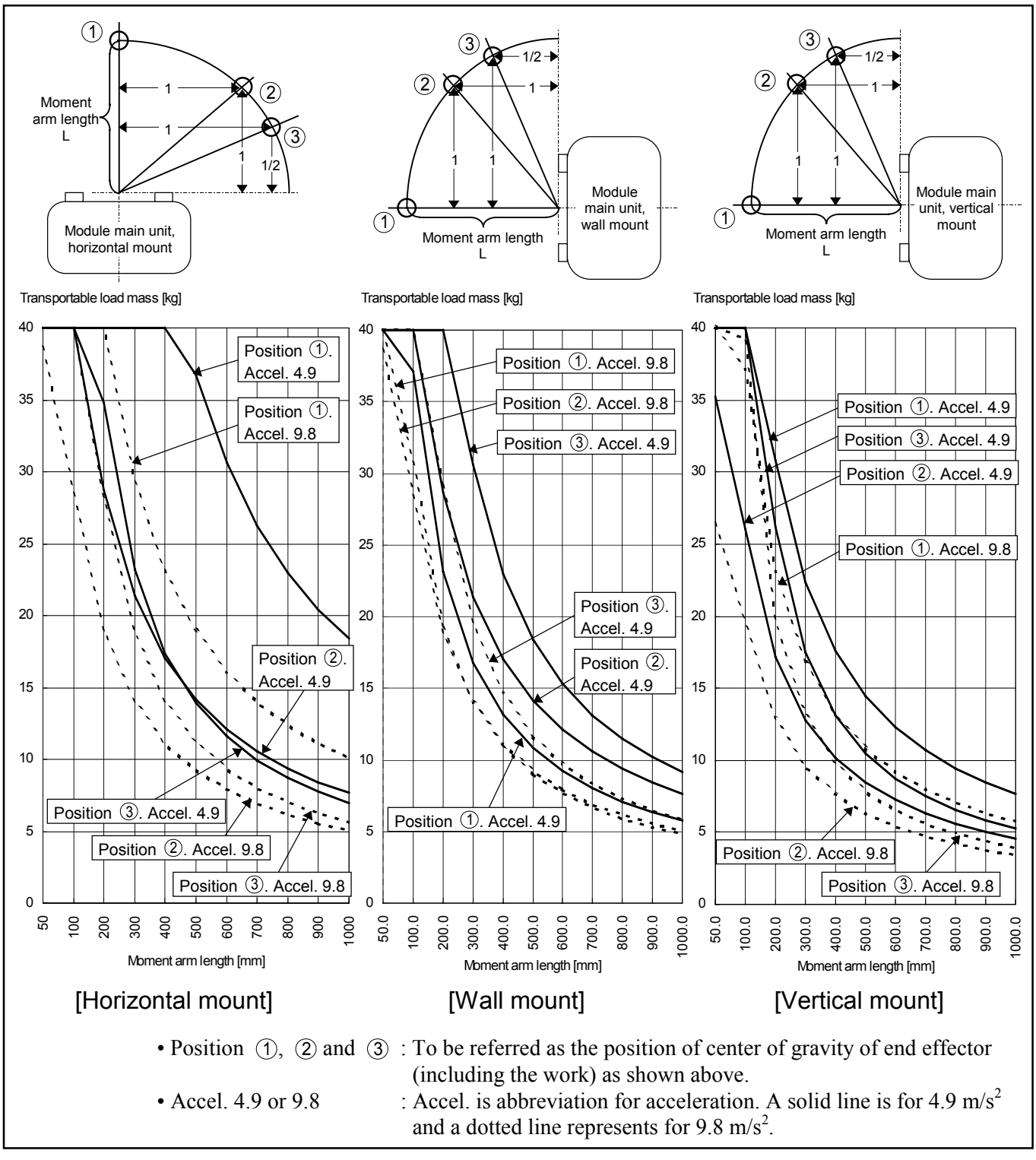
- Position ①, ② and ③ : To be referred as the position of center of gravity of end effector (including the work) as shown above.
- Accel. 4.9 or 9.8 : Accel. is abbreviation for acceleration. A solid line is for 4.9 m/s^2 and a dotted line represents for 9.8 m/s^2.

◆ Relation between end effector mass W and moment arm length L [RM Module]

1) Select the closest position of center of gravity of the end effector from ① ~ ③ in the figure below.

2) The criteria shall be at lower left of each graph. Refer to Figure 19-13 for the concept of a moment load.

Figure 19-8



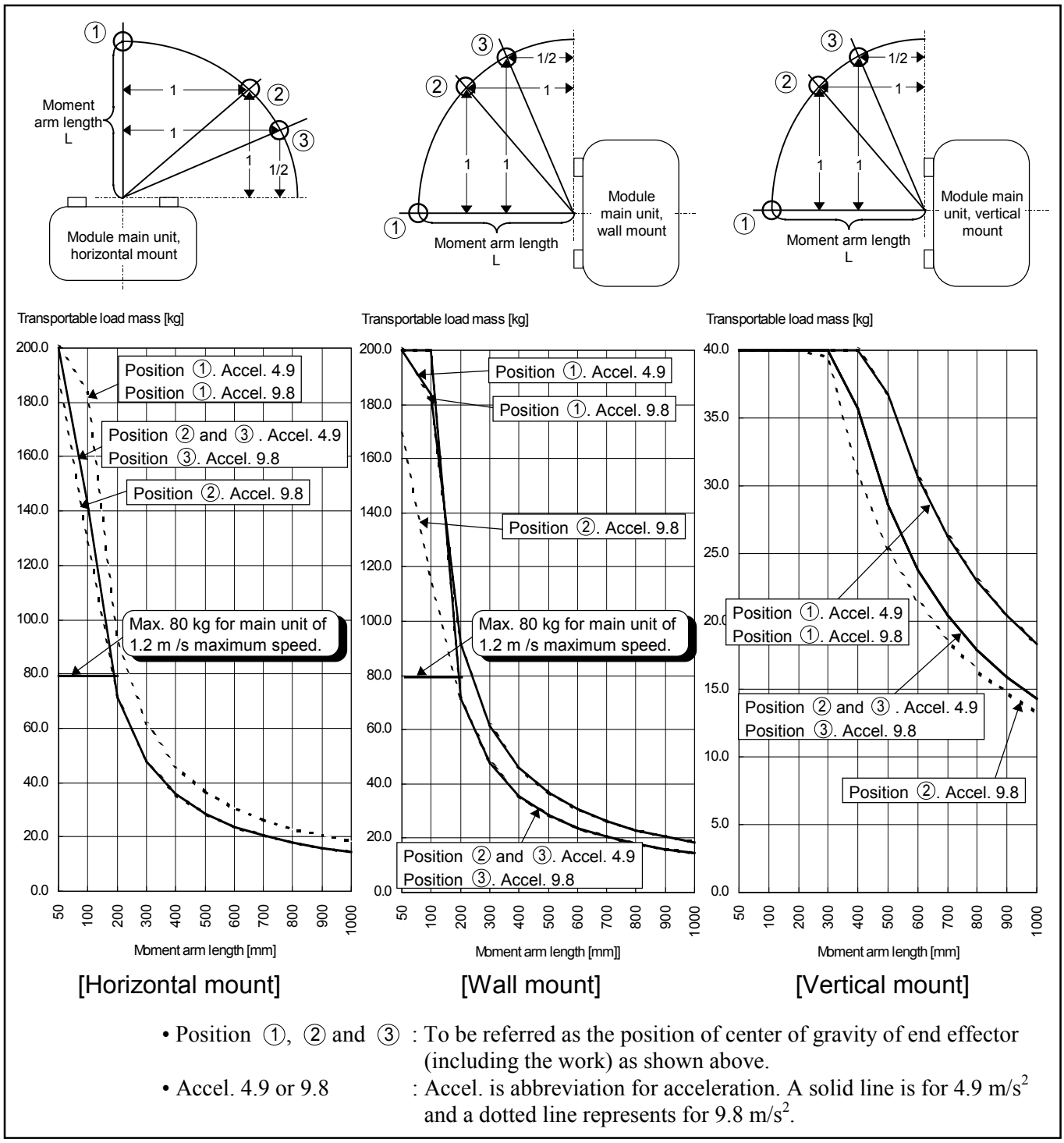
- Position ①, ② and ③ : To be referred as the position of center of gravity of end effector (including the work) as shown above.
- Accel. 4.9 or 9.8 : Accel. is abbreviation for acceleration. A solid line is for 4.9 m/s^2 and a dotted line represents for 9.8 m/s^2.

◆ Relation between end effector mass W and moment arm length L [RH Module]

1) Select the closest position of center of gravity of the end effector from ① ~ ③ in the figure below.

2) The criteria shall be at lower left of each graph. Refer to Figure 19-13 for the concept of a moment load.

Figure 19-9



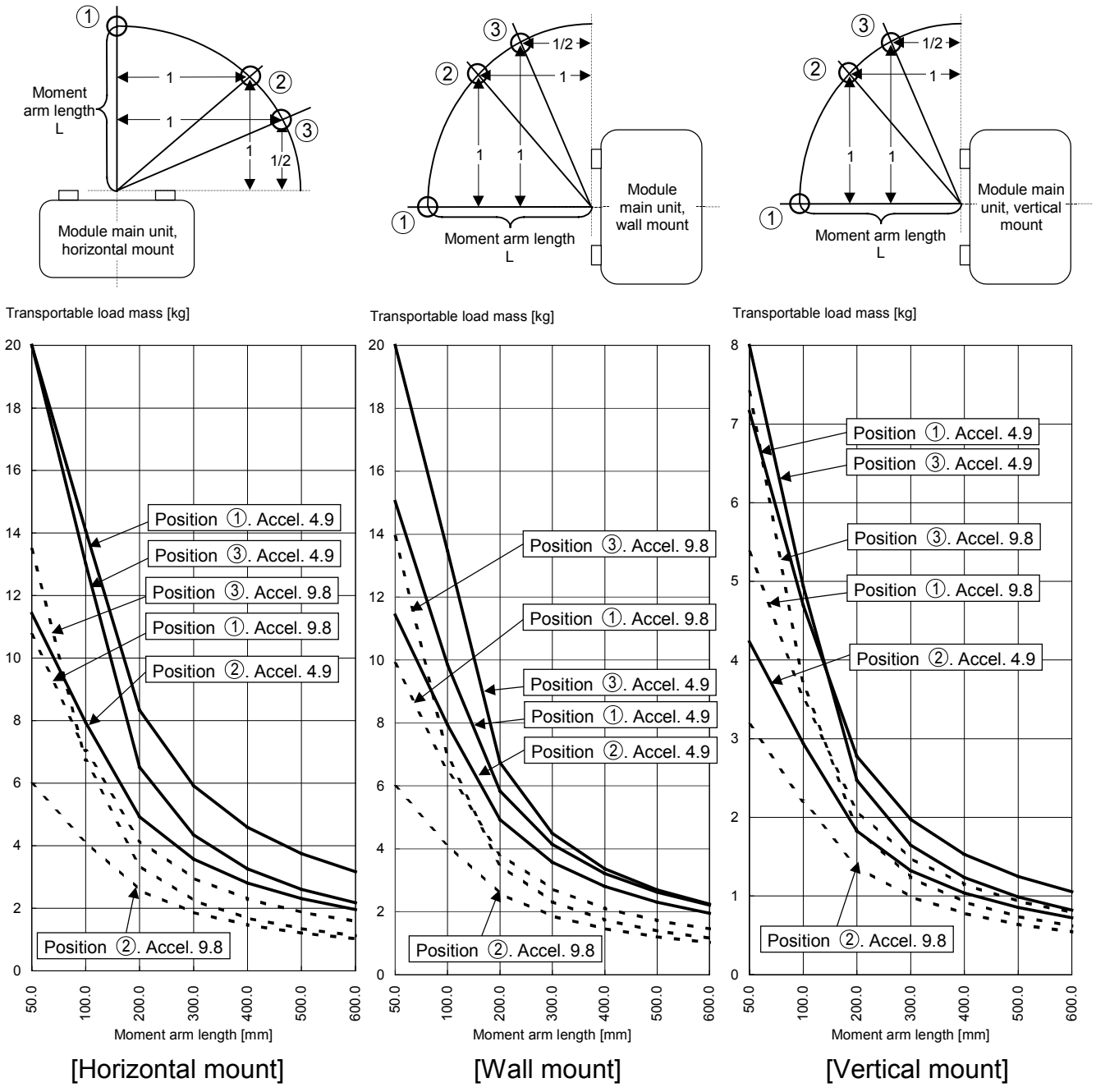
- Position ①, ② and ③ : To be referred as the position of center of gravity of end effector (including the work) as shown above.
- Accel. 4.9 or 9.8 : Accel. is abbreviation for acceleration. A solid line is for 4.9 m/s^2 and a dotted line represents for 9.8 m/s^2.

◆ Relation between end effector mass W and moment arm length L [RS Module, clean room specification]

1) Select the closest position of center of gravity of the end effector from ① ~ ③ in the figure below.

2) The criteria shall be at lower left of each graph. Refer to Figure 19-13 for the concept of a moment load.

Figure 19-10



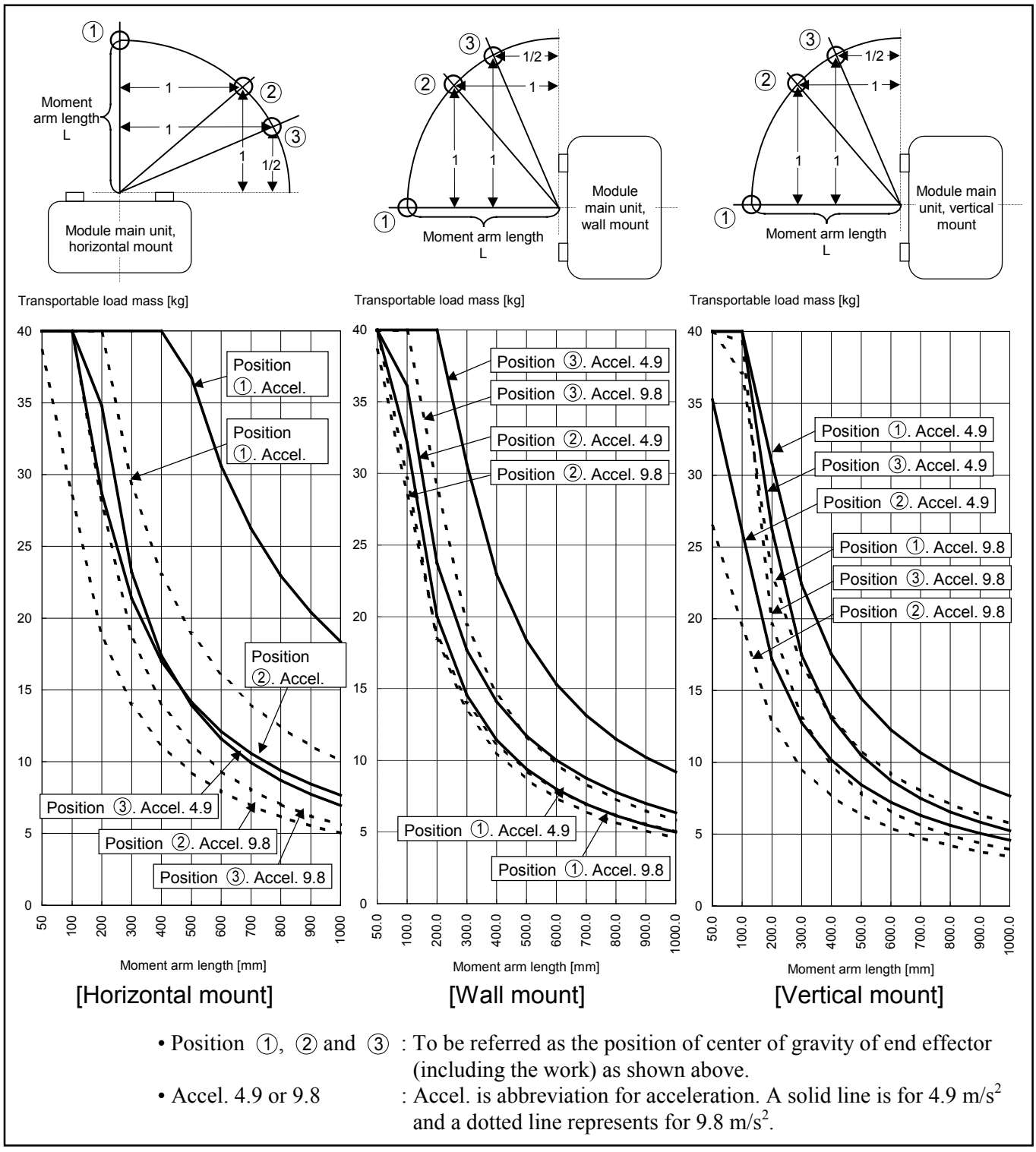
- Position ①, ② and ③ : To be referred as the position of center of gravity of end effector (including the work) as shown above.
- Accel. 4.9 or 9.8 : Accel. is abbreviation for acceleration. A solid line is for 4.9 m/s^2 and a dotted line represents for 9.8 m/s^2.

◆ Relation between end effector mass W and moment arm length L [RM Module, clean room specification]

1) Select the closest position of center of gravity of the end effector from ① ~ ③ in the figure below.

2) The criteria hall be at lower left of each graph. Refer to Figure 19-13 for the concept of a moment load.

Figure 19-11



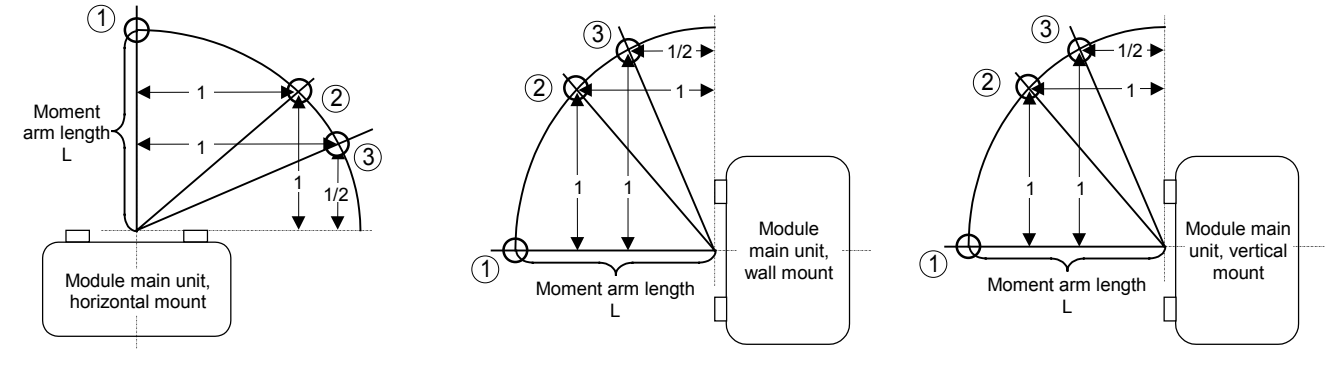
- Position ①, ② and ③ : To be referred as the position of center of gravity of end effector (including the work) as shown above.
- Accel. 4.9 or 9.8 : Accel. is abbreviation for acceleration. A solid line is for 4.9 m/s^2 and a dotted line represents for 9.8 m/s^2.

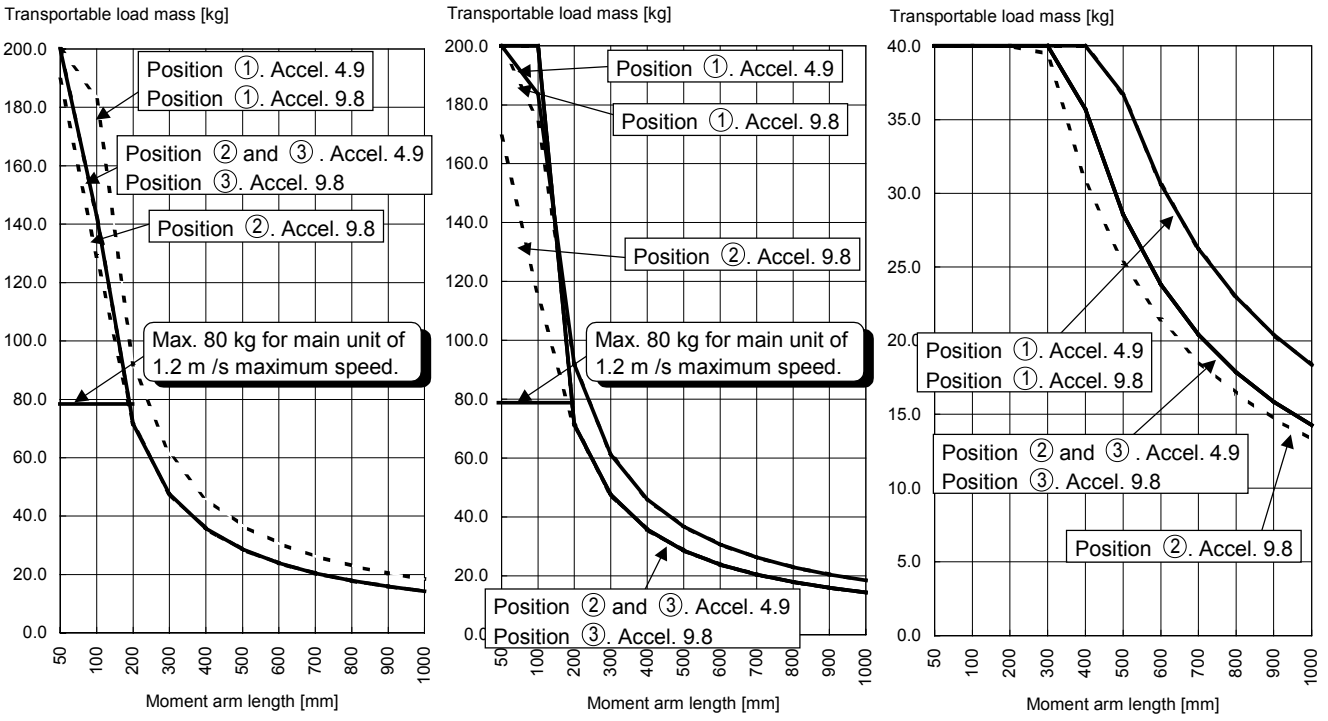
◆ Relation between end effector mass W and moment arm length L [RH Module, clean room specification]

1) Select the closest position of center of gravity of the end effector from ① ~ ③ in the figure below.

2) The criteria shall be at lower left of each graph. Refer to Figure 19-13 for the concept of a moment load.

Figure 19-12



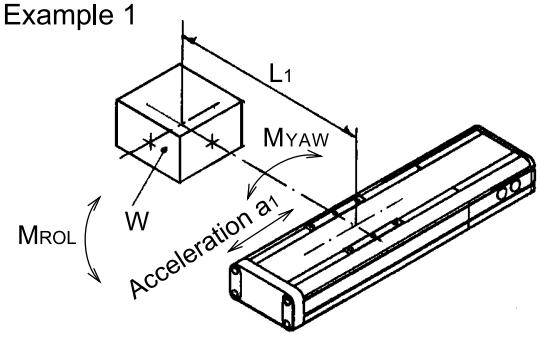


[Horizontal mount] [Wall mount] [Vertical mount]

- Position ①, ② and ③ : To be referred as the position of center of gravity of end effector (including the work) as shown above.
- Accel. 4.9 or 9.8 : Accel. is abbreviation for acceleration. A solid line is for 4.9 m/s^2 and a dotted line represents for 9.8 m/s^2.

Figure 19-13: Concept and direction of moment

Example 1



Rolling moment M_{ROL}

Weight component :

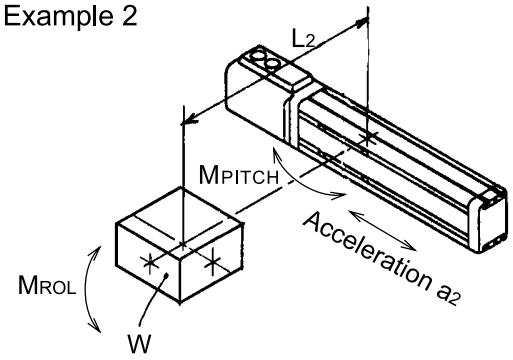
$$M_{ROL}[N \cdot m] = W[kg] \times L_1[m] \times 9.8[m/s^2]$$

Yawing moment M_{YAW}

Acceleration component :

$$M_{YAW}[N \cdot m] = W[kg] \times L_1[m] \times a_1[m/s^2]$$

Example 2



Rolling moment M_{ROL}

Weight component :

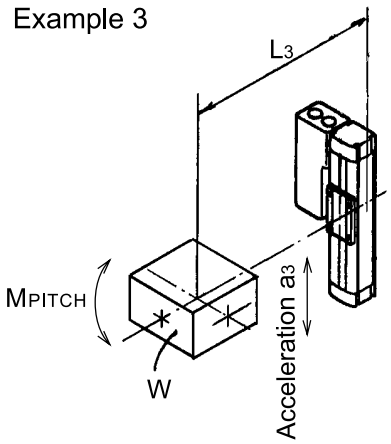
$$M_{ROL}[N \cdot m] = W[kg] \times L_2[m] \times 9.8[m/s^2]$$

Pitching moment M_{PITCH}

Acceleration component :

$$M_{PITCH}[N \cdot m] = W[kg] \times L_2[m] \times a_2[m/s^2]$$

Example 3



Pitching moment M_{PITCH}

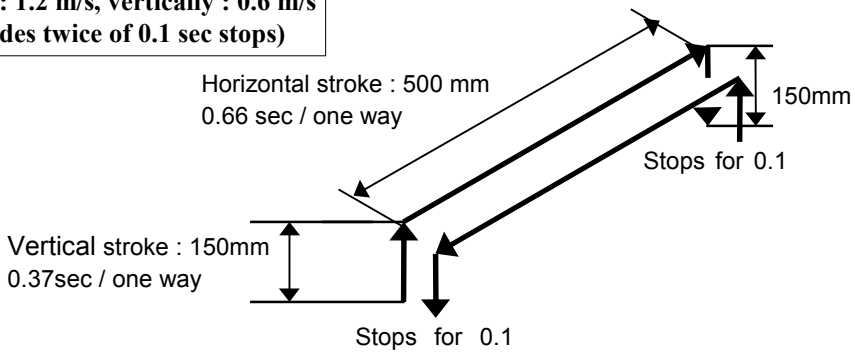
Weight component + acceleration component:

$$M_{PITCH}[N \cdot m] = W[kg] \times L_3[m] \times (9.8 + a_3)[m/s^2]$$

Figure 19-14: Standard operation pattern

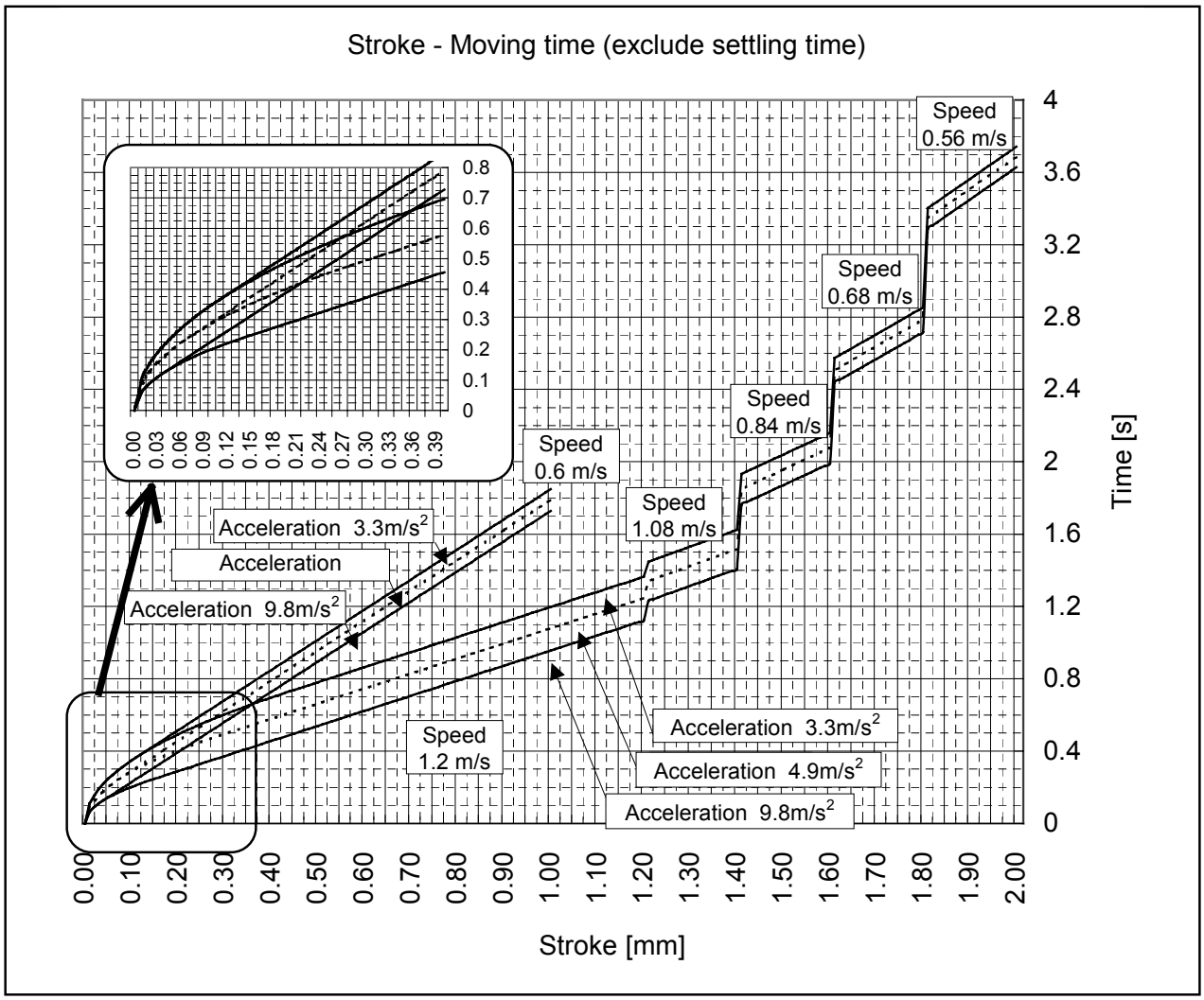
- Standard operation pattern defined as shown below may be carried out continuously when the load mass is in the transportable mass specified in Table 19-6. If an operation that exceeds conditions of the standard operation pattern is carried out, software thermal of the EXEA controller may function. In such a case, lower the acceleration set in the controller. (Other measures such as "lower the maximum speed" or "extend stopping time" may be effective. However, lowering acceleration is the most effective way for the shortest cycle time.)

Acceleration both horizontal and vertical axis: 4.9 m/s^2
Speed horizontally : 1.2 m/s, vertically : 0.6 m/s
Cycle time 3 sec (includes twice of 0.1 sec stops)



One axis continuous operation is possible if stopping time meets the following conditions.
- Single horizontal main unit : 1.65 sec or more stopping time for a cyclic motion of 500 mm stroke.
- Single vertical main unit : 0.7 sec or more stopping time for a cyclic motion of 150 mm stroke.

Figure 19-15



19.2. Controller Cable (Common to P and R Series)

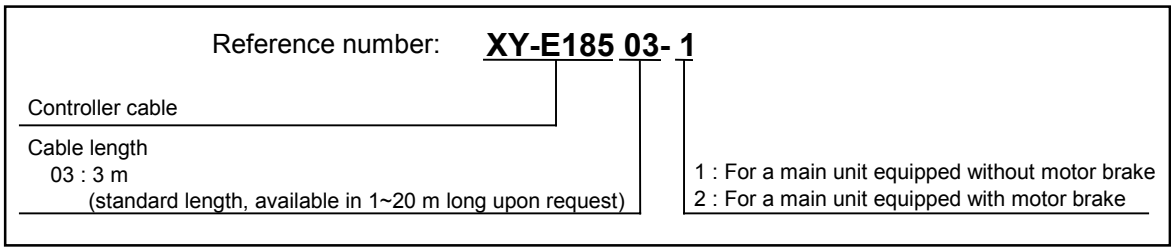
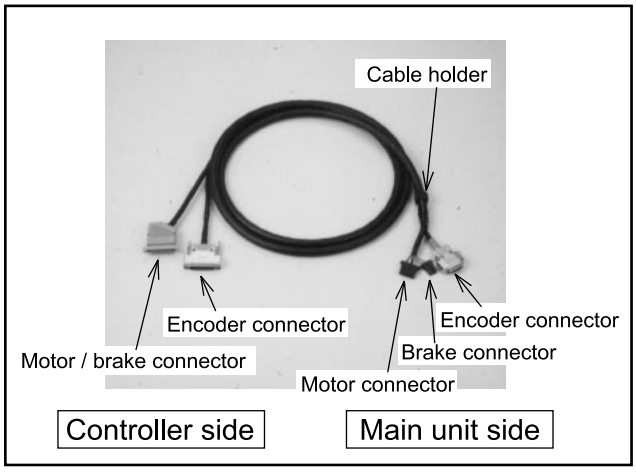


Table 19-8

Item	Specification
Length	1~20 m, available in 1 m step
Diameter	approximately 14 mm
Bending radius	45 mm or over in inside bending radius (at the fixed position)
Built-in cable	For motor and encoder, (-2: has power cable for motor brake as optional.)
Safety regulation	UL Subject 758 (AWM) Passed VW-1 : Fireproofing test

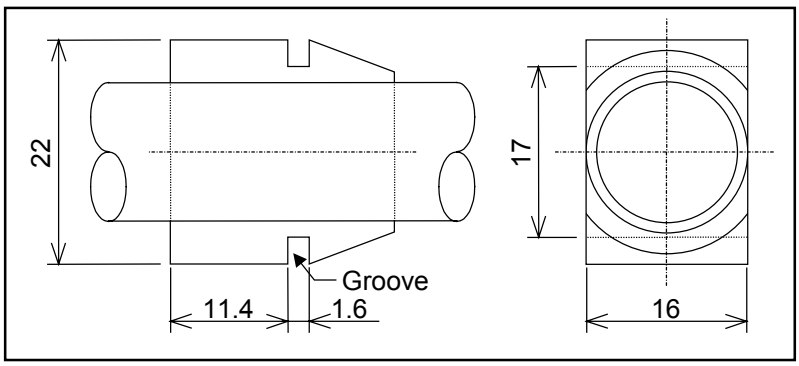
Figure 19-16



- Use XY-E185☐☐-1 for a main unit without motor brake. They do no have a motor brake connector. For a main unit with motor brake, use XY-E185☐☐-2.

- We recommend to use a connector box to prevent from pulling the connectors of main unit. If you do not use the connector box, use a groove of a cable holder to fix the cables.

Figure 19-17: Cable holder dimensions



Caution : The cable holder is fixed to the controller cable. Do not force to move it.

19.3. Cable Support

■ Cable support is one of the expendable part of the robot module system. We recommend to replace it after 5 millions cycles to avoid unexpected system shutdown due to a broken cable.

19.3.1. Flexible Tube Type for P Series

● This is a set of a flexible tube and built-in cables. You may add another cables (user cables) and air-tubes in diameter of ø6 mm or less..

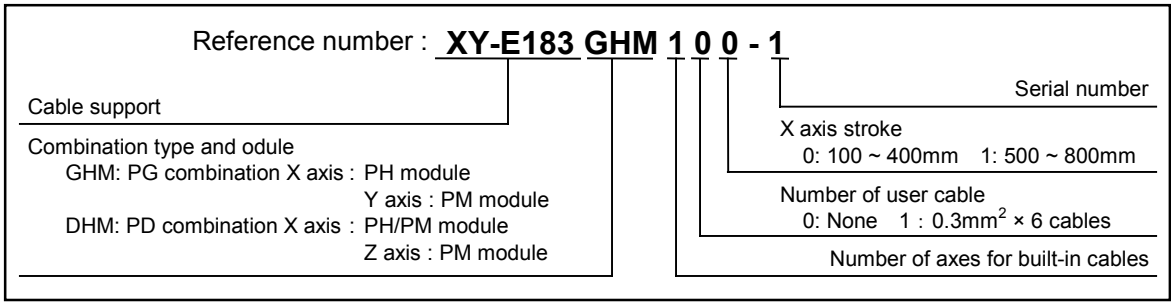


Table 19-9

Reference number XY-	Combination	X axis stroke	Internal cable	Number of user signal cables	Cross section area available for additional cables [mm²]
E183GHM100-1	PG-HM	100 ~ 400	Motor + Encoder	0	198
E183GHM101-1	PG-HM	500 ~ 800			
E183DHM110-1	PD-HM, PD-MM	100 ~ 400	Motor + Encoder + power cable for motor brake	0.3mm² × 6 cables	160
E183DHM111-1	PD-HM, PD-MM	500 ~ 800			

* Refer to Caution on the next page.

Recommendation of additional cable and air tubes

Cable	Robot cable in diameter of 7 ~ 8 mm and it has flexural strength and it is anti-vibration characteristics.
Air tube	Urethane tube, 4 ~ 6 mm in diameter (do not use nylon tube)

Flexibility, that is easily bent to approximately R30, is required for the additional cables and air tubes.

19.3.1.1. Flexible Tube Fixture

● This is to prevent the flexible tube from leaning. Clamp the flexible tube to the fixed side main unit using the fixture. (common for all combination)

Reference number: **XY-P180CC-1**

19.3.2. Caterpillar Type for R Series

- Select respectively a "cable support," which consists of a caterpillar and connector box (boxes), and "built-in cables."

Cable support reference number : **XY- E173 P H M S 31 27 - 1**

- E173: For R series
- Combination style
- X axis main unit
- Y axis main unit
- Z axis main unit
- Number of links for secondary axis
- Number of links for base axis
- 1: Base axis, motor direct mount
  2: Base axis, motor indirect mount

Built-in cable reference number: **XY- E173 010 - 1**

- E173: For R series
- Cable length 010 : 1 m, (numbers in 0.1 m unit)
- 1 : main unit with no motor brake
  2 : main unit with motor brake

Figure 19-18

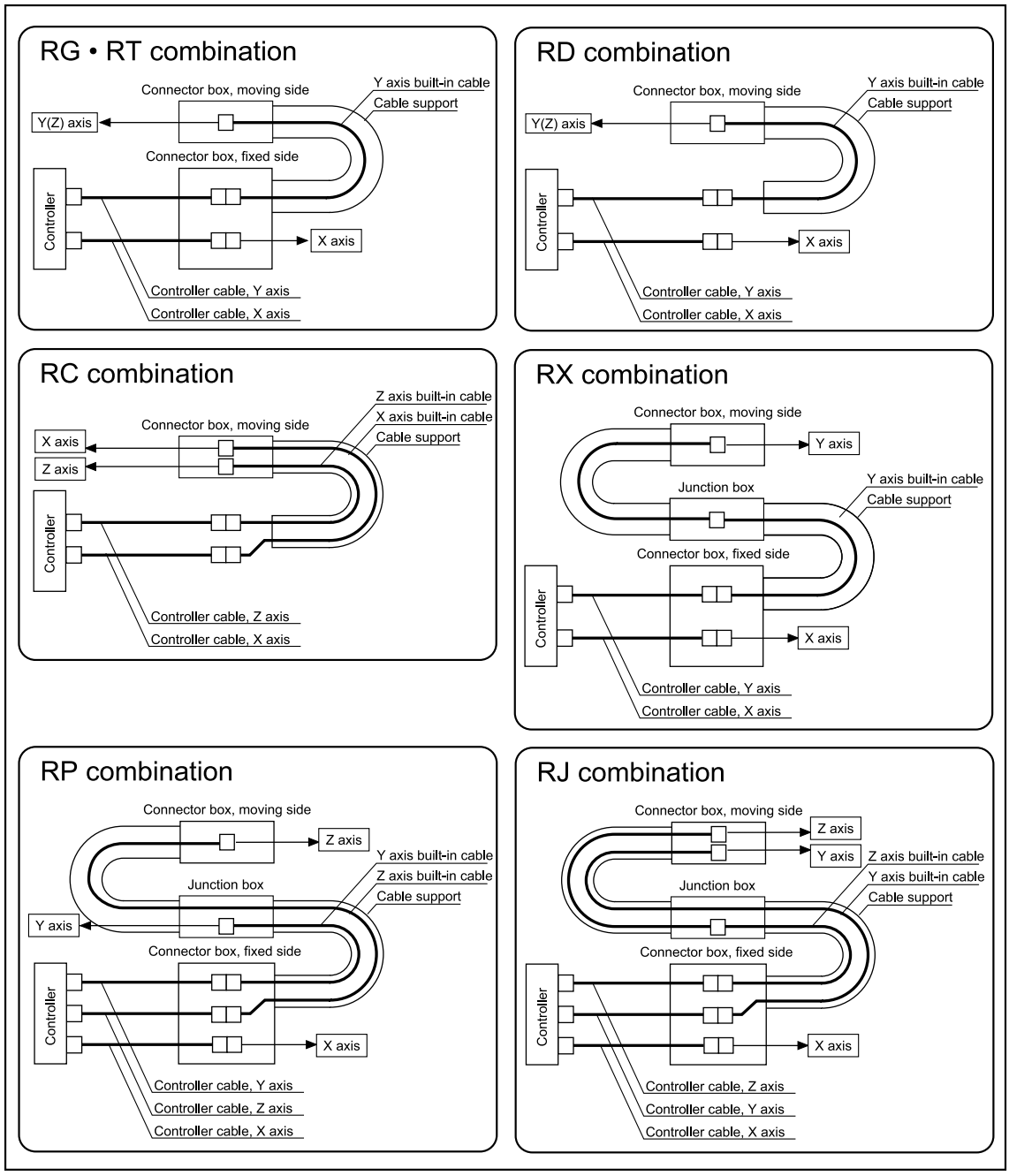


Table 9-10

Combination	Stroke [cm]			Cable support	Built-in cable	
	X axis	Y axis	Z axis		Y (X) axis	Z axis
RG-MS	25 ~ 95	Free	–	XY-E173GMS02700-1	XY-E173020-1	–
	* 115 ~ 155 ind.	Free	–	XY-E173GMS03900-2	XY-E173028-1	–
RG-HM	30 ~ 100	Free	–	XY-E173GHM02700-1	XY-E173020-1	–
	* 120 ~ 200 ind.	Free	–	XY-E173GHM04700-2	XY-E173028-1	–
RT-MSz	25 ~ 95	–	10 ~ 30	XY-E173TM0S3100-1	–	XY-E173028-2
	* 115 ~ 155 ind.	–	10 ~ 30	XY-E173TM0S4300-2	–	XY-E173028-2
RD-MS	25 ~ 95	Free	–	XY-E173DMS01900-1	XY-E173020-1	–
	* 115 ~ 155 ind.	Free	–	XY-E173DMS02600-2	XY-E173020-1	–
RD-HM	30 ~ 100	Free	–	XY-E173DHM02000-1	XY-E173020-1	–
	* 120 ~ 200 ind.	Free	–	XY-E173DHM03100-2	XY-E173028-1	–
RC-MSz	25 ~ 55	–	13 ~ 23	XY-E173CM0S1500-1	XY-E173020-1	XY-E173028-2
RX-HM or RX-HH	30 ~ 100	25 ~ 100	–	XY-E173XHM03222-1	XY-E173036-1	–
	* 120 ~ 200 ind.	25 ~ 100	–	XY-E173XHM05222-2	XY-E173044-1	–
RP-MSSz	25 ~ 95	13 ~ 43	13 ~ 23	XY-E173PMSS2716-1	XY-E173020-1	XY-E173036-2
	* 115 ~ 155 ind.	13 ~ 43	13 ~ 23	XY-E173PMSS3916-2	XY-E173036-1	XY-E173044-2
RP-HMSz	30 ~ 100	25 ~ 55	10 ~ 40	XY-E173PHMS2720-1	XY-E173020-1	XY-E173036-2
	30 ~ 100	75 ~ 95	10 ~ 40	XY-E173PHMS2728-1	XY-E173020-1	XY-E173036-2
	* 120 ~ 200 ind.	25 ~ 55	10 ~ 40	XY-E173PHMS4720-2	XY-E173028-1	XY-E173044-2
	* 120 ~ 200 ind.	75 ~ 95	10 ~ 40	XY-E173PHMS4728-2	XY-E173028-1	XY-E173044-2
RJ-HMSz	30 ~ 100	25 ~ 55	13 ~ 23	XY-E173JHMS3217-1	XY-E173044-1	XY-E173044-2
	* 120 ~ 200 ind.	25 ~ 55	13 ~ 23	XY-E173JHMS5217-2	XY-E173052-1	XY-E173052-2

Note *: ind. Stands for indirect motor mount.

Caution : *6 cables out of 8 shielded cables for a main unit equipped with motor brake (XY-E183D□-1 or XYE173□□□-2) may be shared with the user signal cables. However, the user signal cables will be in a same rope-lay conductors with the motor brake excitation cable. Even though a surge suppresser is installed to the motor brake circuit, noise may cause problems when the motor brake is on and off. Take the following measures in such a case.*

- ◊ *Install noise filters to the signal cables.*
- ◊ *Provide a 24 VDC power supply for signal circuit besides the internal power supply of the EXEA controller.*

Fixed side of the cable shield is a round terminal. Connect it to the ground wiring of user's equipment through an M3 screw of the connector box.

19.4. Combining Bracket

- The bracket is used to combine the main units into a multi-axis combination.
- The bracket for R series uses the locating pins to link itself together the main units. This makes remounting main units highly accurate.

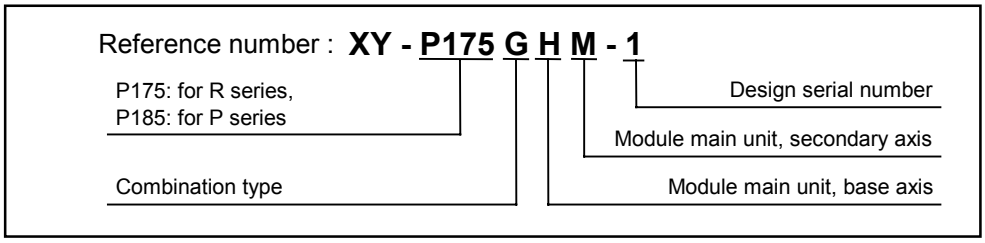


Table 19-11

Series	Applicable combination	Reference number	Mass [kg]
P	PG-HM	XY-P185GHM-1*	3.3
	PD-HM	XY-P185DHM-1	0.7
	PD-MM	XY-P185DMM-1	0.5
R	RG-MS RP-MSSz, X-Y axis	XY-P175GMS-1*	1.6
	RG-HM RP-HMSz, XY axis	XY-P175GHM-1*	3.6
	RP-MSSz, YZ axis	XY-P175DSS-1	0.4
	RD-MS RP-HMSz, YZ axis	XY-P175DMS-1	0.6
	RD-HM	XY-P175DHM-1	1.6
	RX-HM RC-MSz, X axis RJ-HMSz, XY axis	XY-P175XHM-1	1.4
	RX-HH	XY-P175XHH-1	4.0
	RT-MS	XY-P175TMS-1	1.1
	RC-MS RJ-HMSz, YZ axis	XY-P175CMS-1	0.9

* The bracket for mirror image type combination is available. (XY-P1□□5-2)

19.5. Mounting Bracket

- This is to fix the main unit from front side.

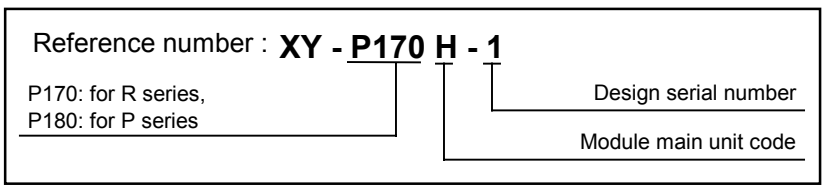


Table 19-12

Reference number	Applicable main unit	Mass [kg]	Quantity/axis
XY-P180M-1	PM module	0.4	2
XY-P180H-1	PH module	0.9	2
XY-P170S-1	RS module	0.9	2
XY-P170M-1	RM module	0.4	2 (3 for 750 mm stroke or over)
XY-P170H-1	RH module	0.9	2 (3 for 800 mm stroke or over)
XY-P170S-2	Support slide	0.5	3 (5 for 1200 mm stroke or over)

19.6. Connector Box

- This connector box is to stow connectors and to secure the controller cable in operations where only one main unit is used. You may operate the main unit without the connector box, however, be sure to clamp the controller cable so that the connectors are not pulled.
- It is not necessary to order the connector box for multi-axis combination. The connector box is provided as a part of cable support.
- It is not necessary for a main unit of a motor right or left mount main unit. The connectors are stored in the motor cover.
- This connector box cannot be used for a RS and P series main unit of which motor is mounted on its back.

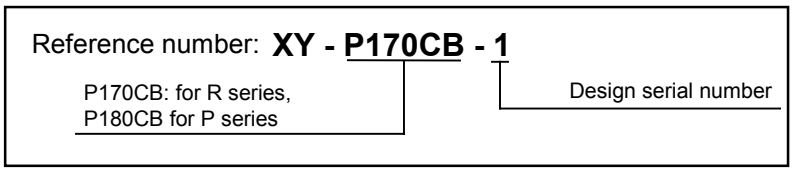


Table 19-13

Reference number	Applicable main unit
XY-P180CB-1	Common for PH and PM module
XY-P170CB-1	Common for RH and RM module

19.7. Support Slide

- A support unit shall be installed within the specifications shown in Figure 19-19 below, even though the misalignment of the support slide is absorbed by an incorporated linear ball bushing.

Slide unit

Reference number: **XY- P177S 030 - 2**

Stroke (cm) (Example) 030: 300mm

Support unit

Reference number: **XY-P177BGHM-1**

Figure 19-19

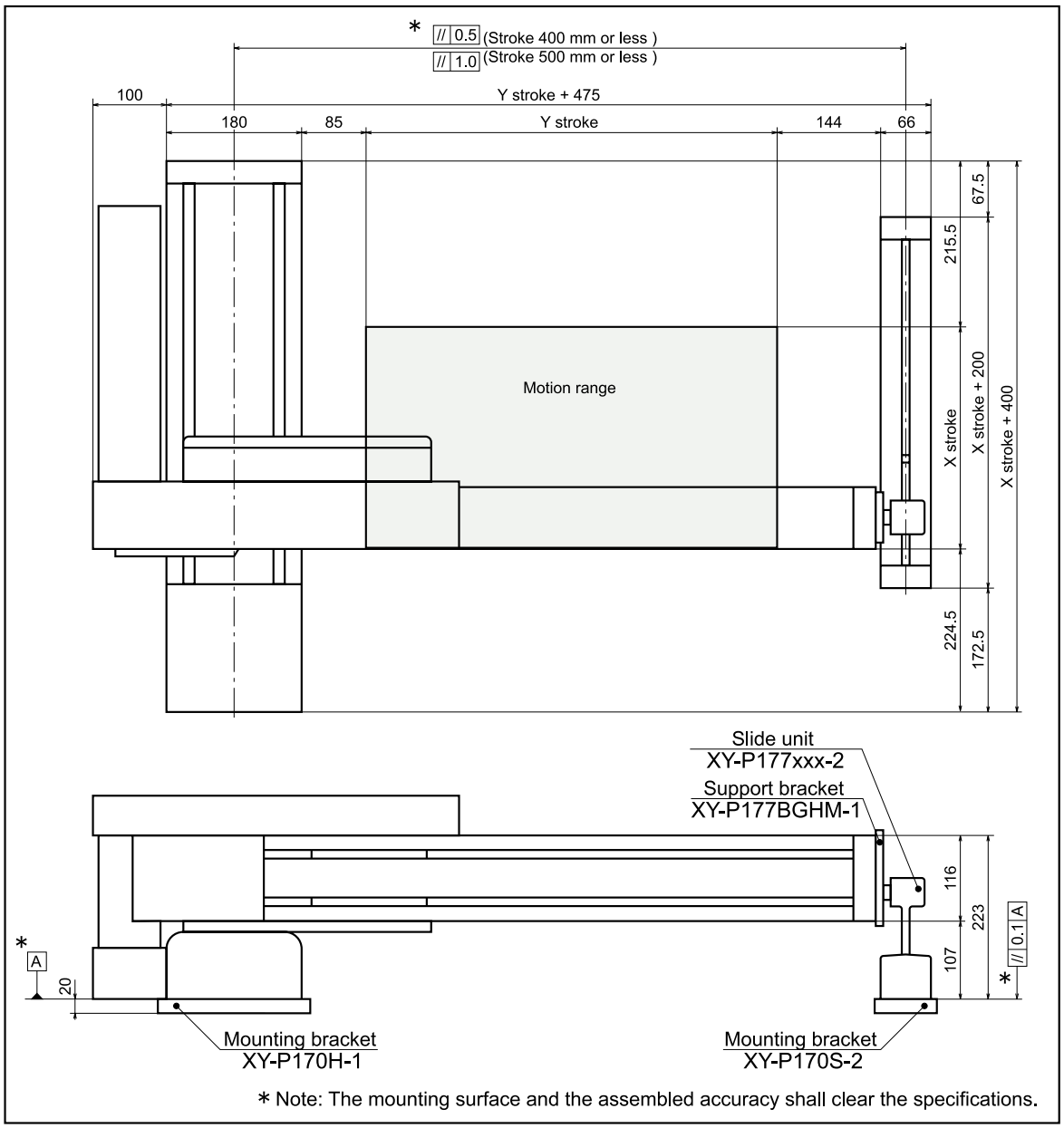


Table 19-14

Item	X axis						Y axis
Stroke [mm]	300 ~ 1000	1200	1400	1600	1800	2000	250 ~ 950
Maximum speed [mm/s]	1200	1200	1080	840	680	560	1200
Repeatability [mm]	±0.01	±0.02					±0.01
Transportable mass (max.) [kg]	40 (35 for Y axis of 950 mm Y stroke)						

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20. Unpacking

20.1. Transportation and Storage

- Do not give shocks to the module main unit during transportation.
- Store the module main unit indoors in a clean environment, and not to expose to wind, rain or direct sunlight.

Caution : *The robot modules are not provided any special measures against environmental problems for transportation and storage.*
Problems may arise or the service life may be reduced unless it is handled great care as a precision instrument

20.2. Unpacking

Danger : *When pulling out a module main unit from the container, keep it in its horizontal position. If you put a main unit without motor brake in vertical position, the slider may fall by its own weight (back drive), which arises hazards to you, such as your finger may be caught for injury.*

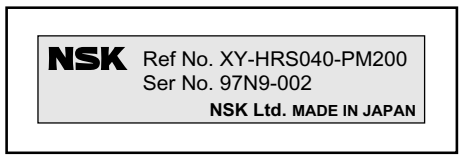
1 Damage and missing parts

- Unpack all containers and check damages on the products and missing parts.

2 Check reference number

- Check if the reference number indicated on the affixed seal to a main unit for correspondence to your order.

Figure 20-1



3 Accessory check

- Seals shown in Figure 20-1 are provided with the shipment. The seal is to indicate the positions of the home and mechanical stopper. When a slider collided with an obstacle, the indication of original position of home and mechanical stopper will be referred to decide if the main unit can be operated subsequently to the collision, or requires repair work.
  Affix the seals after the first Home return operation is completed.
  When affixing the seal, turn off the power and affix the seals on both stroke ends at where it can be seen clearly. Refer to "17.3.1. Home Return Operation."

Figure 20-2 : Seals

Photo 20-1 : Example of affixed seal

Home position

Mechanical stopper position

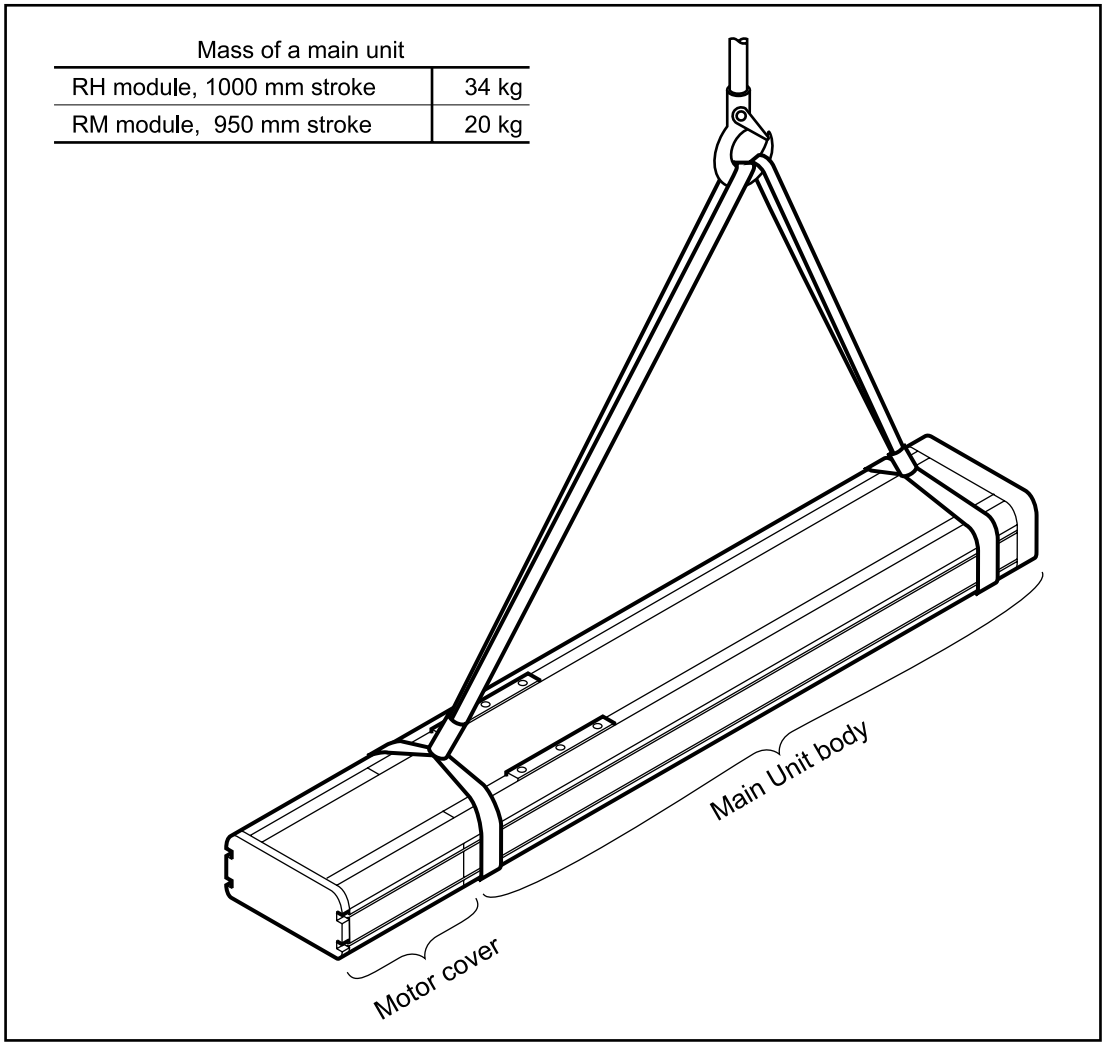
20.3. Handling

1) Single module main unit : Use main unit body for slinging or fixing to handle or transport.

2) Multi-axis combination : Fix the robot with ropes or fixture so that it won't move in transit.

Figure 20-3

Mass of a main unit	
RH module, 1000 mm stroke	34 kg
RM module, 950 mm stroke	20 kg



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21. Installation

Danger *: Improper mounting of the module main unit may result in mechanical breakage of the equipment and / or personal injuries.*

1) The base axis main unit of a multi-axis combination must be firmly fixed to the mounting surface by the bolts and the bolt holes as specified.

2) In case of a multi-axis combination, connect the main units firmly each other using the specified combining bracket and the bolts.

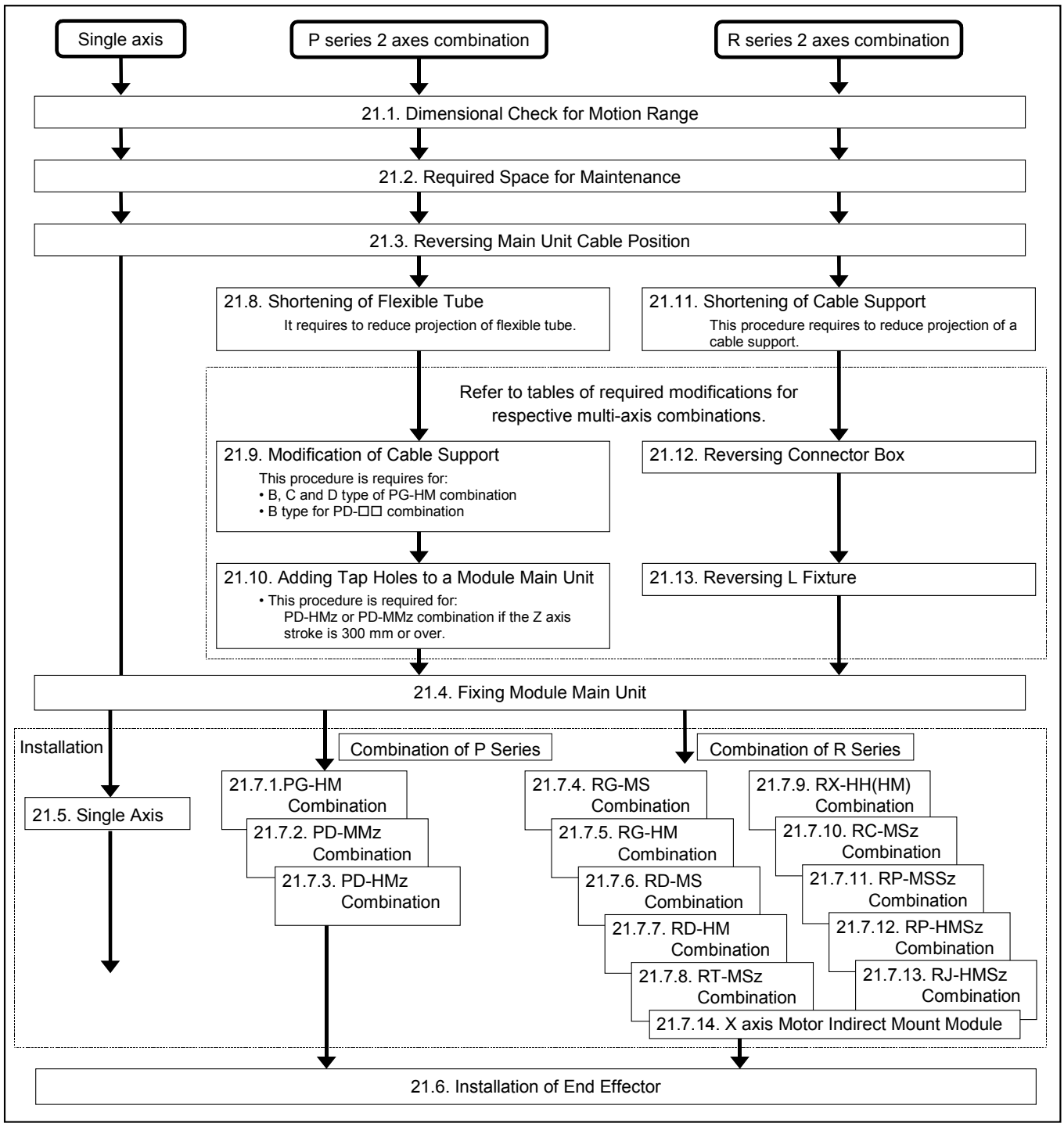
3) Be fully careful not to break the robot module system by the mechanical interference, and be most careful not to harm yourself.

Danger *: When carrying a 2 axes combination robot or a combined robot with the end effector, the sliders of these robots may back-drive and pinch your hands in. Fix the slider using a rope or etc. not to move while carrying the robot.*

Caution *: Do not grab motor cover, connector box or cables when carrying a main unit.*

- Refer to relevant sections in Figure 21-1 for the assembly procedures of your combination.

Figure 21-1 : Installation procedure



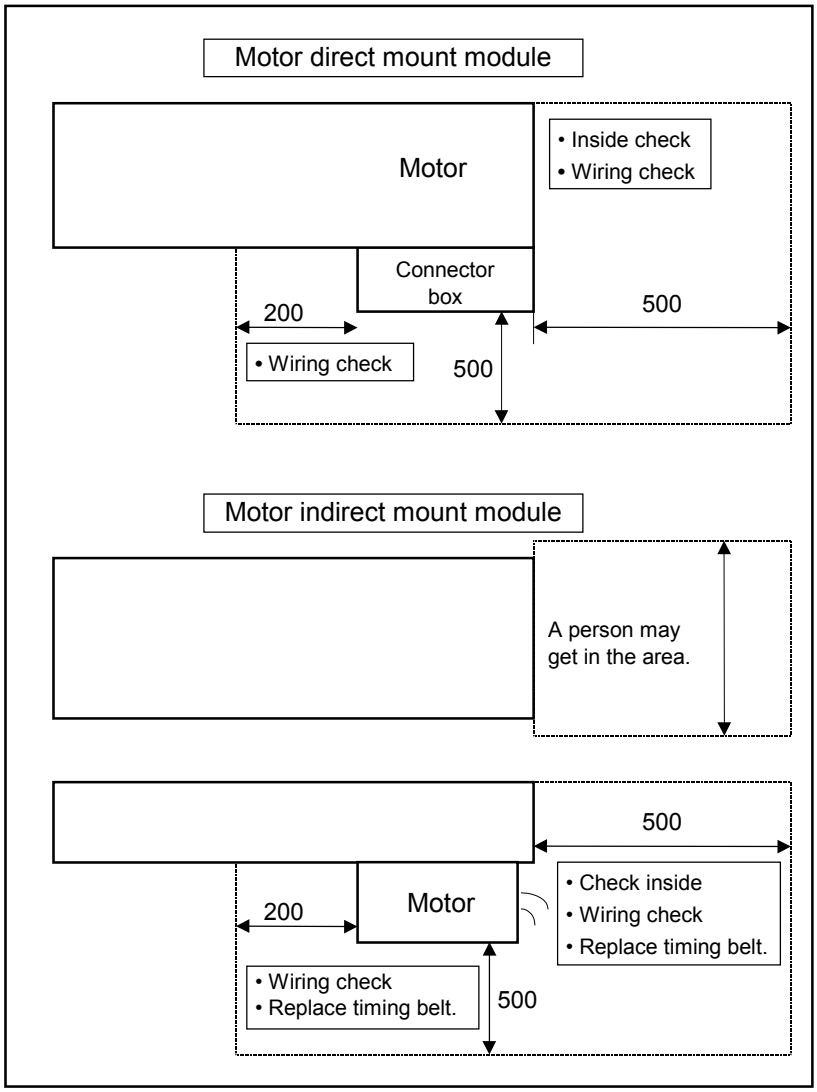
21.1. Dimensional Check for Motion Range

- Specified stroke of a main unit is between home position and just before the end of stroke. There is approximately 15 mm (10 mm for RS module) allowance to the dead end at both sides. Add 20 mm (15 mm for RS module) or more allowance to the end of specified stroke or the motion range of robot system for the floor plan so that the robot does not interfere with the ancillaries.

21.2. Required Space for Maintenance

- We recommend to allow an open space for maintenance work. If the space is not wide enough you may need to dismount a main unit for maintenance work.
  - ◊ Single axis : Clear upper side of the main unit and the area shown in Figure 21.2.
  - ◊ Multi-axis combination : The area shown in Figure 21-2 is required for motion range and each axis end.

Figure 21-2: Required space for maintenance [Unit: mm]



21.3. Reversing Main Unit Cable Position

- Cable position can be changed for motor direct mount, motor back mount and RS module main units.

- It requires to reverse the cable position of the main units for the following combinations prior to their installation.

  1) G-HM combination
     - B type : PH and PM module
     - C type : PH module
     - D type : PM module

  2) D-HM and D-MM combination
     - A type : Z axis module
     - B type : X axis module

21.3.1. Motor Direct Mount Module

- This section describes the procedure to reverse position of the cables. All procedures hereunder are common to PH, PM, RH and RM modules, though PH module is shown as an example in the following photographs.

1) Unfasten the bolts on end surface of main unit. Remove the motor end cover.

Photo 21.3-1

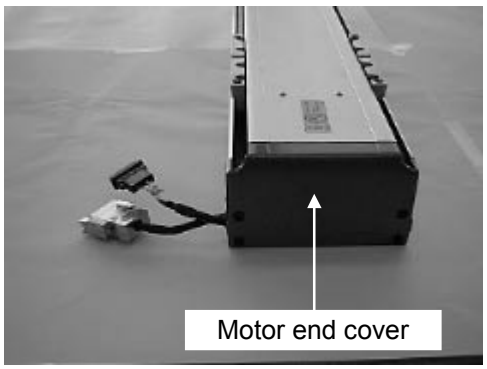
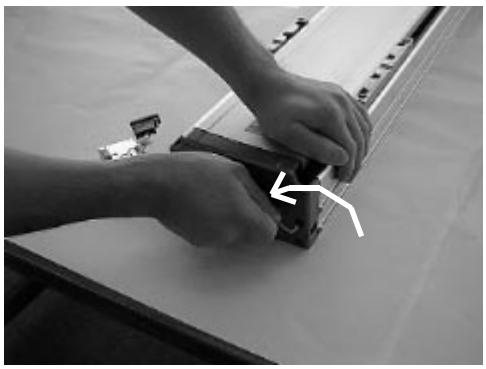


Photo 21.3-2



2) Remove the cables and a blind plug from the motor end cover. (See Photo 21.3-4.)

Photo 21.3-3

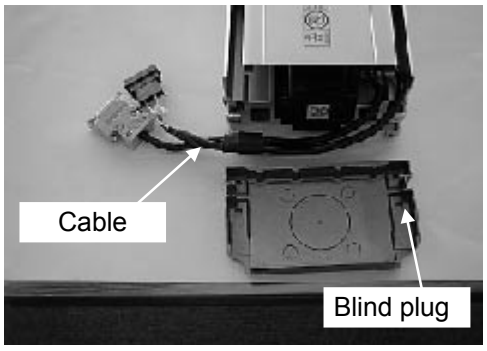
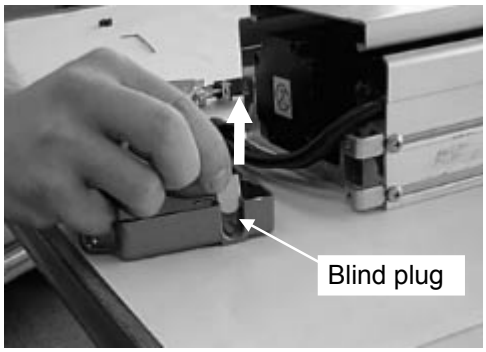


Photo 21.3-4



3) Put bound part of cable with rubber to the groove where the blind plug was inserted before. Bend the cable into a large radius as possible to minimize force to be applied to the cable outlet of the motor cover. Put the blind plug to the groove on the other side.

Photo 21.3-5

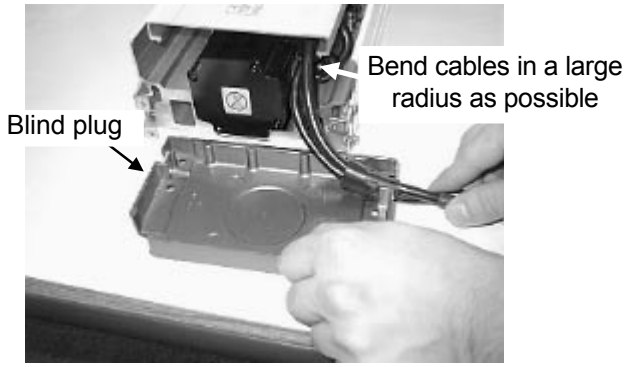
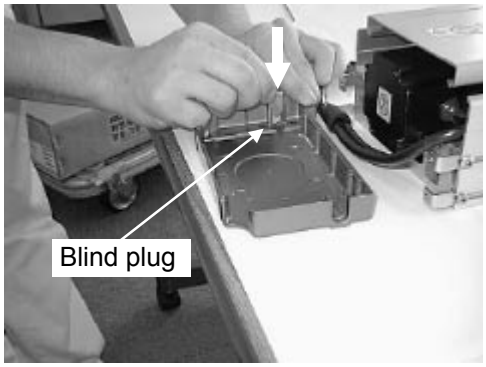


Photo 21.3-6



4) Fix the motor end cover. Be careful not to pinch the cables in the cover.

Photo 21.3-7

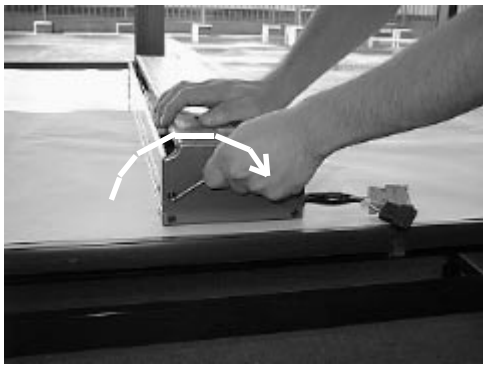
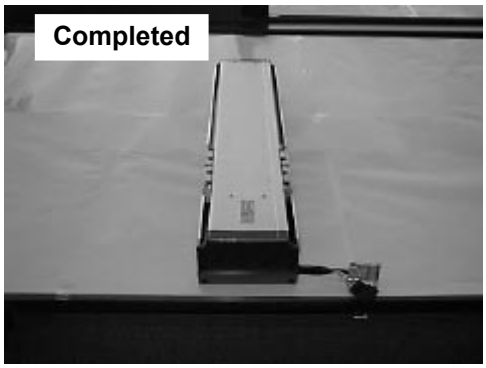


Photo 21.3-8



21.3.2. Motor Back Mount Module

- Though PM module is used for the following photos, the procedures are the same for PH modules.

1) Remove the motor cover. [M4 × 6. Hexagon socket button head screw. (2 screws)]

Photo 21.3-9

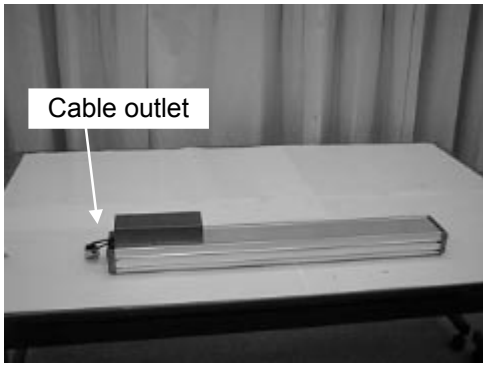
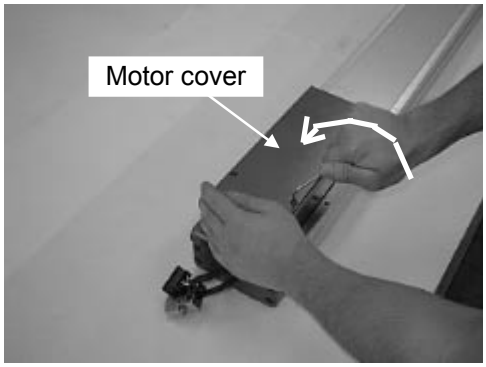


Photo 21.3-10



2) Reverse the cable position. (Photo 21.3-11, -12) Put bound part of cable with rubber to the opening of the motor cover. (Refer to Photo 21.3-13.) Be careful not to apply excessive bending force to the cable outlet. Fix the motor cover. (2 screws, M4 × 6)

Photo 21.3-11

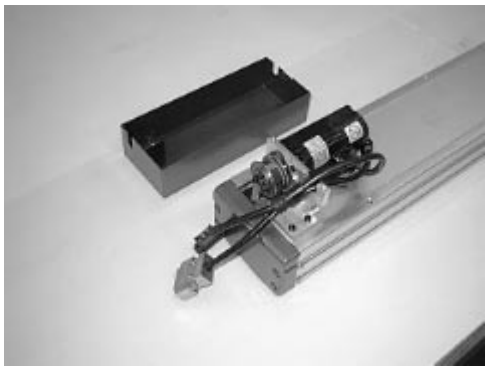


Photo 21.3-12

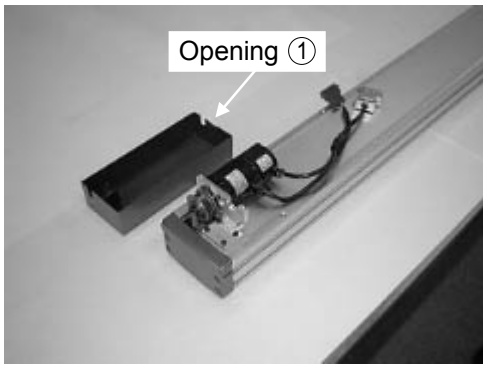
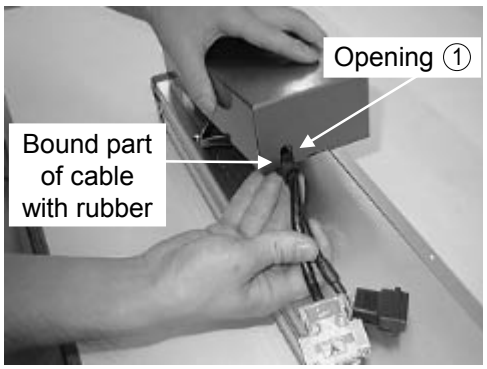
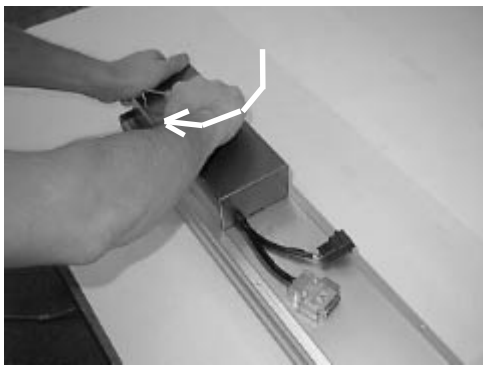


Photo 21.3-13

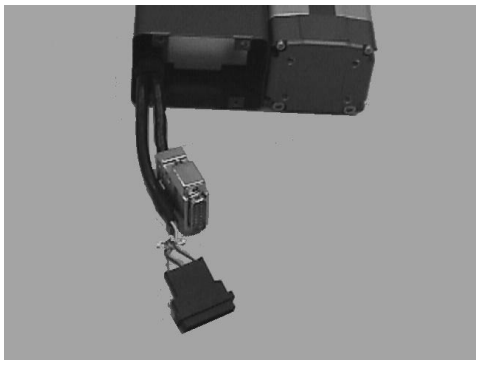




21.3.3. RS Module

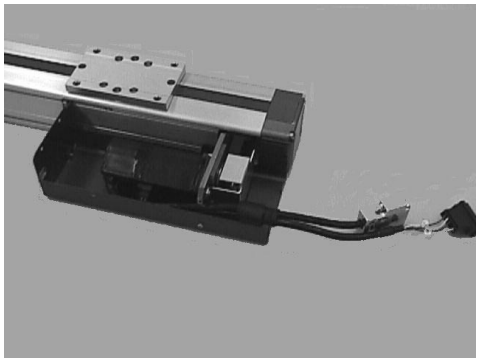
1) Remove the motor end cover. (Unfasten 4 screws, M3 × 6, slotted flat head screw)

Photo 21.3-15



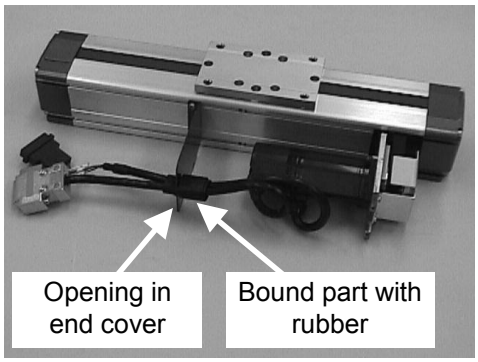
2) Unfasten the screws (4 screws total, M3 × 6, slotted pan head screw) on the side and end of the motor cover. (See Photo 21.3-16.)

Photo 21.3-16



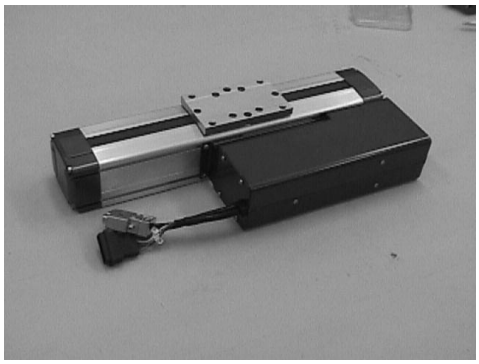
3) Remove the bottom motor cover in the same manner of procedure (2).
Put the bound part with rubber in the opening at the other end. (See Photo 21.3-17.) Be careful not to apply excessive bending force to the cable outlet. Fasten the motor cover.
(2 screws, M4 × 6)

Photo 21.3-17



5) Fasten all covers. (See Photo 21.3-18.)

Photo 21.3-18



21.4. Fixing Module Main Unit

- The following two ways of mounting method are available. For the both ways, flatness of mounting base shall be 0.1 mm or less and the surface shall be free of interfering protrusions. Adjust the flatness of mounting base using shims when there exists clearance between module surface and mounting base around mounting holes.

1 Fix a module main unit directly to mounting surface with tap holes on its bottom.

- Drill holes through the mounting base and fix a module main unit from its rear side. (See Figure 21-3.)

- For the R series modules, ø8 H7 holes on its bottom may be used for locating pins to secure position of a main unit. Refer to Figure 21-4 for specifications of the locating pins.

Figure 21-3

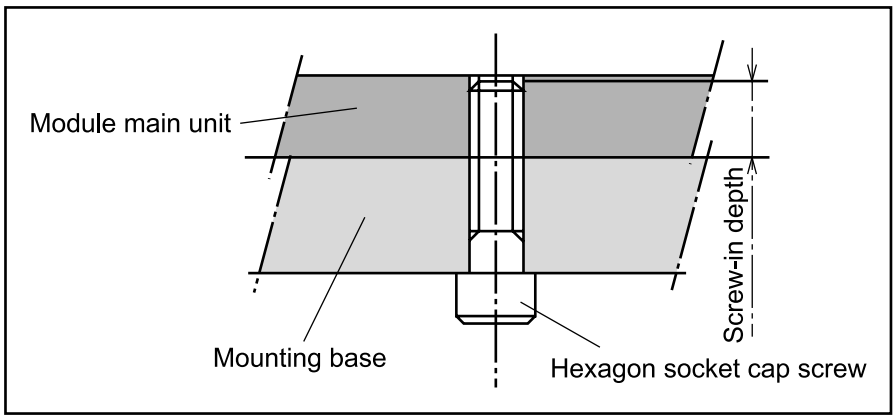


Table 21-1

	PH module	PM module	RH module	RM module	RS module
Bolt size	M8	M6	M8	M6	M5
Screw-in depth	12 ~ 14mm	7 ~ 10mm	12 ~ 16mm	9 ~ 12mm	7 ~ 9mm
Tightening torque (max.)	33.3N·m	11.7N·m	33.3N·m	14.7N·m	5.9N·m

2 Use of mounting brackets.

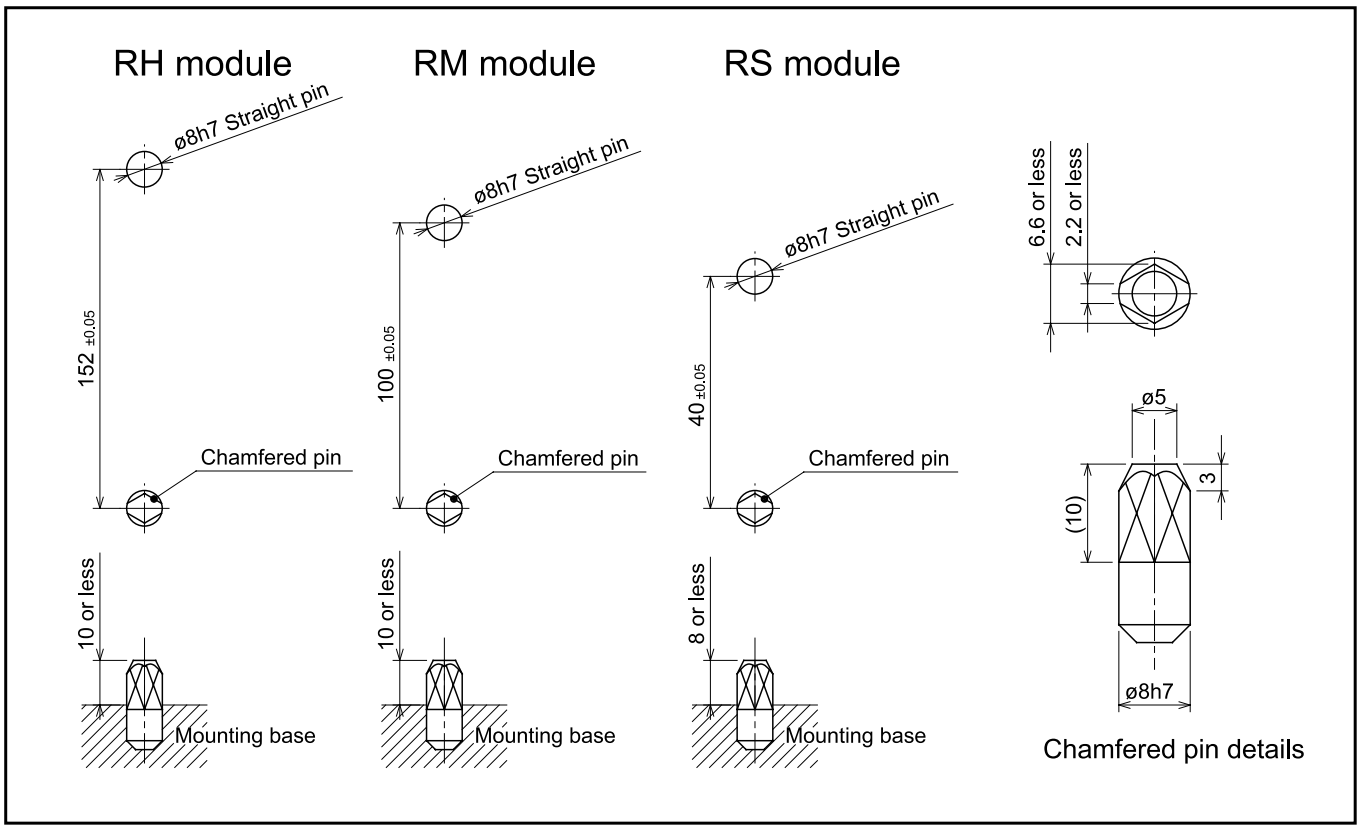
1) Fix optional mounting brackets to base surface of main unit using bolts provided with the mounting bracket. (XY-P180□-1 or XY-P170□-1)
Refer to Table 21-2 for fastening torque.

2) Tap on the mounting base and fasten the brackets.

Table 21-2

	PH module	PM module	RH module	RM module	RS module
Bolt dia. × length	M8 × 20	M6 × 14	M8 × 20	M6 × 20	M5 × 16
Tightening torque	33.3N·m	11.7N·m	33.3N·m	14.7N·m	5.9N·m

Figure 21-4


RH module
RM module
RS module
ø8h7 Straight pin
ø8h7 Straight pin
ø8h7 Straight pin
152 ±0.05
100 ±0.05
40 ±0.05
Chamfered pin
Chamfered pin
Chamfered pin
10 or less
10 or less
8 or less
Mounting base
Mounting base
Mounting base
6.6 or less
2.2 or less
ø5
3
(10)
ø8h7
Chamfered pin details

21.5. Installation of Single Axis

- Make sure that all parts and units are ready.

Table 21-3: <P series>

Name	Quantity	Reference No. AC200V spec.	Reference No. AC 100V spec.	Reference No. Comply to CE Marking (AC 200V)
Module main unit *2	1	XY-HRS□□□-PH□□□ or XY-HRS□□□-PM□□□		
Controller cable *2	1	XY-E185□□-1 or -2		
Controller *1	1	M-EXEA□-□□00A00	M-EXEA□-□□00C00	M-EXEA□-□□00T00
Teaching box	1	M-EXTB03		M-EXTB04
Mounting bracket	2	XY-P180H-1 or XY-P180M-1 *3		
Connector box	1	XY-P180CB-1 (Not applicable to motor back mount module.)		

Table 21-4 <R series>

Name	Quantity	Reference No. AC200V spec.	Reference No. AC 100V spec.	Reference No. Comply to CE Marking (AC 200V)
Module main unit *2	1	XY-HRS□□□-RH□□□ or XY-HRS□□□-RM□□□ or XY-HRS□□□-RS□□□		
Controller cable *2	1	XY-E185□□-1 or -2		
Controller *1	1	M-EXEA□-□□□0A00	M-EXEA□-□□□0C00	M-EXEA□-□□□0T00
Teaching box	1	M-EXTB03		M-EXTB04
Mounting bracket	2	XY-P170H-1 or XY-P170M-1 or XY-P170S-1 *3		
Connector box	1	XY-P170CB-1 (Not necessary for motor back mount assembly.)		

Note: Numbers substituted by □ in a reference number varies with stroke, specifications and module main unit.)

*1. Refer to "5. Reference Number • Specifications" for EXEA controller.

*2. Refer to "19. Reference Number • Specifications" for main unit and controller cable.

*3. This bracket is not required when the main unit is fixed from its bottom directly.

21.5.1. When Using Connector Box

21.5.1.1. P Series

< PH and PM modules, motor direct mount>

1) Fix the main unit to the mounting base as described in "21.4. Fixing Module Main Unit."

2) Insert a plate nut into a T-slot of main unit at cable outlet side. Use upper T-slot for PH module and lower for PM module. Face a sponge side of the plate nut to the main unit, turning stuck out sponge side up, insert it to T-slot pushing upward angle. (See Figure 21-5.)

Figure 21-5: Inserting plate nut to T-slot

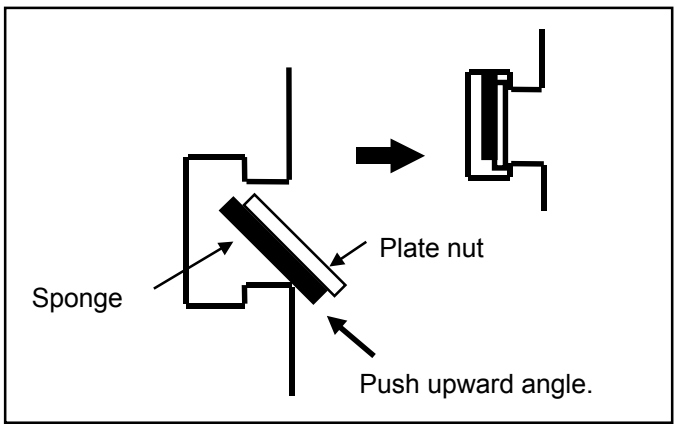
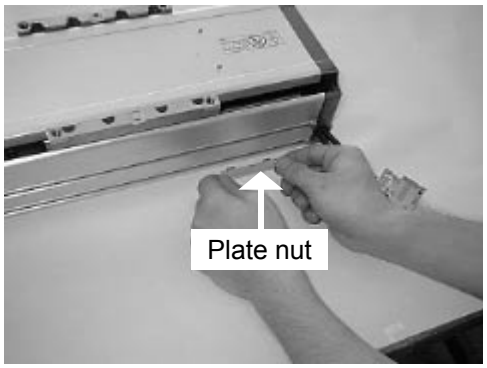
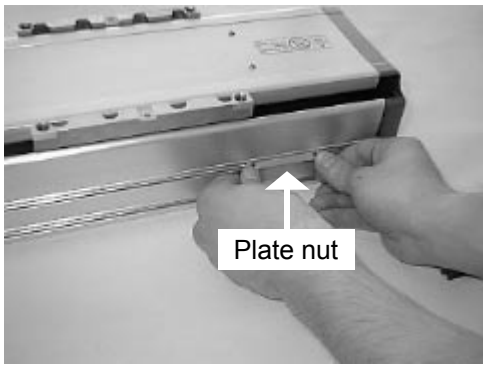


Photo 21.5-1



Insert the plate nut to the upper T-slot of PH module main unit.

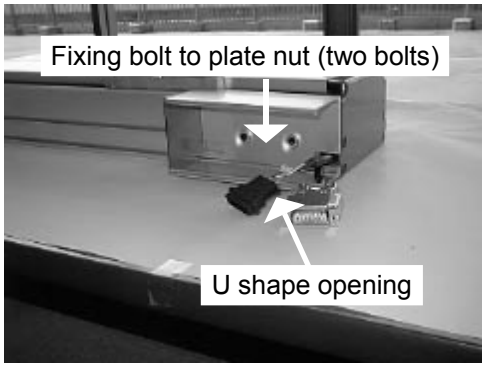
Photo 21.5-2



Pushing the plate nut into the upper T-slot.

3) Fix the connector box frame to the T-slot. (M4, two bolts, tightening torque : 1.5~ 1.8 N·m). Pass the cables through the U shape opening in the box frame.

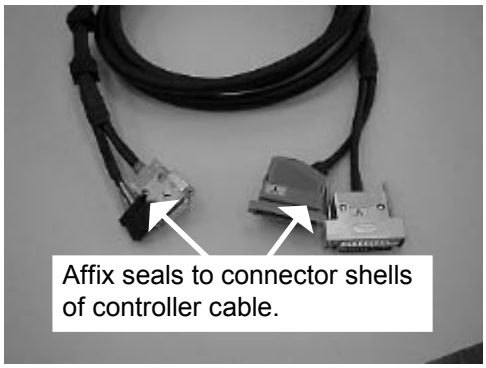
Photo 21.5-3



4) Affix seals of X, Y, Z and R axes, which are provided with the controller cable, to respective cable connectors.
(We recommend to affix the seals to the connectors to avoid miss-connection because the connector is common to all main units regardless their motor power specifications.)

Photo 21.5-4

Photo 21.5-5

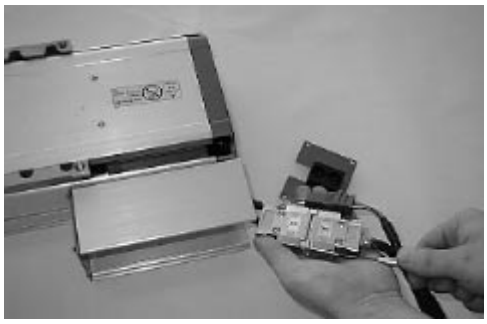


5) Connect the controller cable to the main unit. (Photo 21.5-6)

- ◊ Motor and brake connectors : Push into the end for "click" sound.
- ◊ Encoder connectors : Secure them with two screws.

When putting connectors in the connector box, bend cables in large radius as possible.

Photo 21.5-6



6) Insert the groove of controller cable holder to an opening in the end cover. Loosely attach the end cover to the box frame, then loosen the screws of the end cover on the other end.

Photo 21.5-7

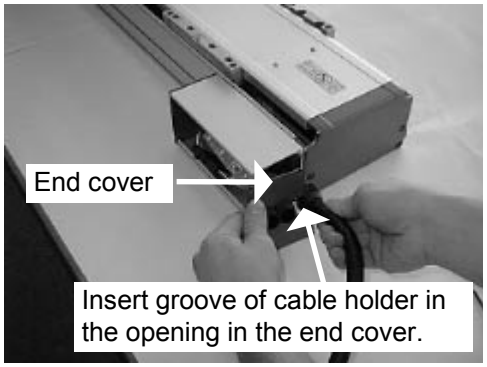
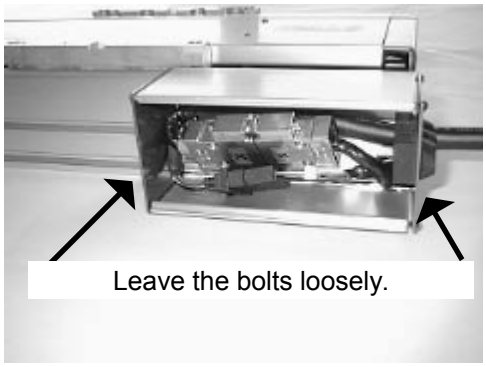


Photo 21.5-8



7) Fix the front cover to the box frame.

◊ Hock lower edge of front cover to a lower groove of the box frame. (Photo 21.5-9)

◊ Push into upper edge of front cover to box frame. Fasten both end covers.

Photo 21.5-9

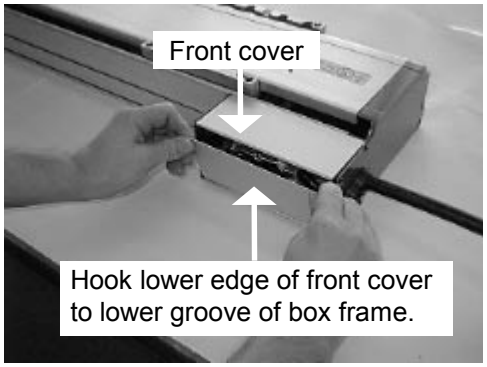
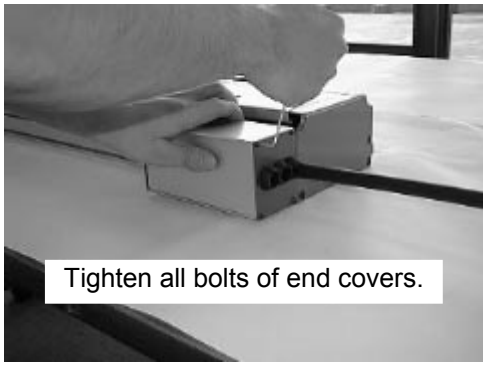


Photo 21.5-10

Photo 21.5-11



8) Connect the controller cable to the EXEA controller. Confirm the affixed seals described in the procedure 4) for correct connection.

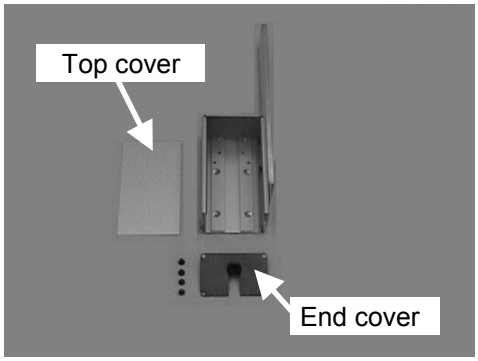
21.5.1.2. R Series

<RH and RM modules, motor direct mount>

1) Fix a main unit to the mounting base. Refer to "21.4. Fixing Module Main Unit."

2) Remove an end cover and top cover. (Photo 21.5-12)

Photo 21.5-12



3) Insert two plate nuts to the T-slots on a main unit cable side from opposite end of the motor. Fix the connector box to the main unit by four screws (M3 × 10). Put the cable to U-shape opening in the box frame. (Photo 21.5-14)

Photo 21.5-13

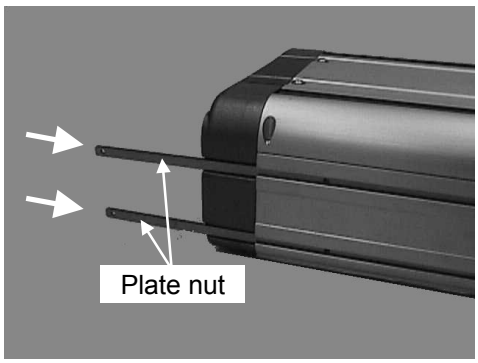
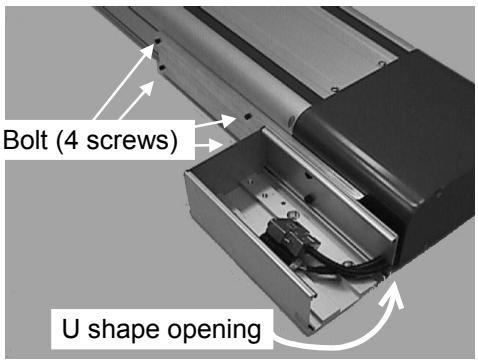
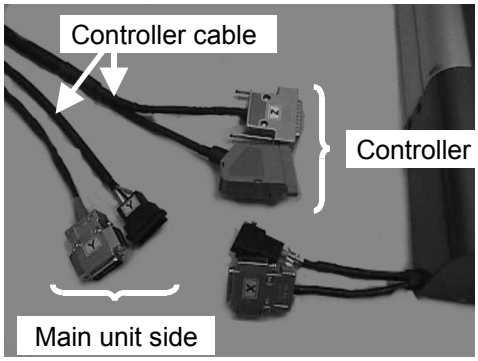


Photo 21.5-14



4) Affix the seals for "X, Y, Z and R" to the connectors.
(The connectors are common to all modules regardless the motor power specification. Be sure to affix them to avoid miss-connection.)

Photo 21.5-15

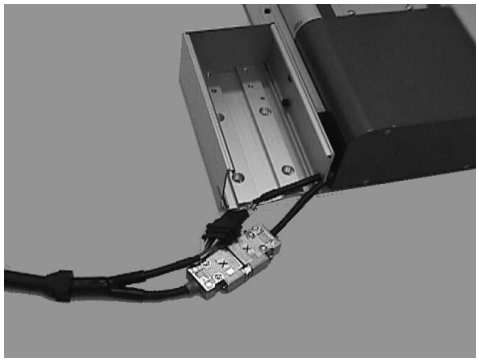


5) Insert the groove of cable holder to the opening in the end cover. Connect the controller cable to the main unit. (Photo 21.5-16)

◊ Motor connector and brake power connector : Snap to the end.

◊ Encoder connector : Secure it by two setscrews.

Photo 21.5-16



6) Put connectors in the connector box. Bend the cables in a large radius as possible. Attach the end cover loosely to the frame body and loosen the screws of the end cover on the other side. (Photo 21.5-17)

Photo 21.5-17

7) Then, fix the top cover. Insert the top cover edge to a groove of frame box, then push in the other side. (Photo 21.5-18) Fasten all screws of the both end covers.

Photo 21.5-18

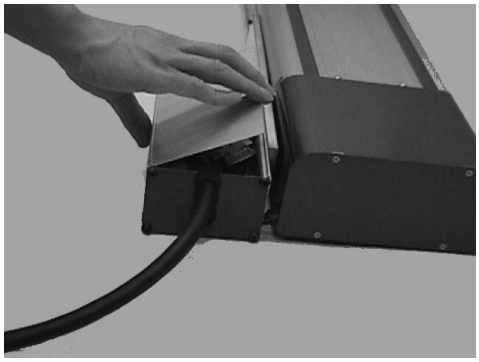
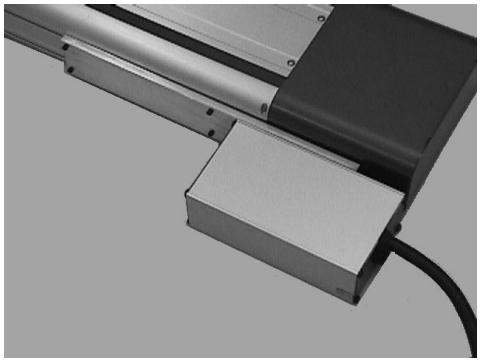


Photo 21.5-19



21.5.2. When not Using Connector Box

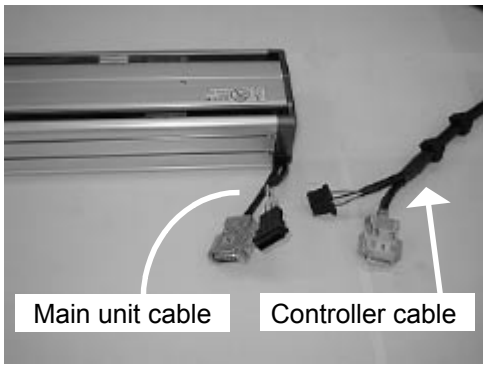
21.5.2.1. All Modules (Excludes RH and RM Motor Indirect Mount Modules)

<Following photos show PM module as an example. However, the procedures are the same for other modules except RH and RM motor indirect mount modules.>

1) Fix the main unit to the mounting base referring to "21.4. Fixing Module Main Unit."

2) Affix the seals provided with the respective controller cable connectors to indicate X, Y, Z or R axis. (The connectors are common to all main units regardless the motor power specifications.)

Photo 21.5-20



3) Connect the controller cable to the main unit. (Photos 21-21 and 22)

◊ Motor connector and brake power connector : Snap to the end.

◊ Encoder connector : Secure it by two setscrews.

Photo 21.5-21

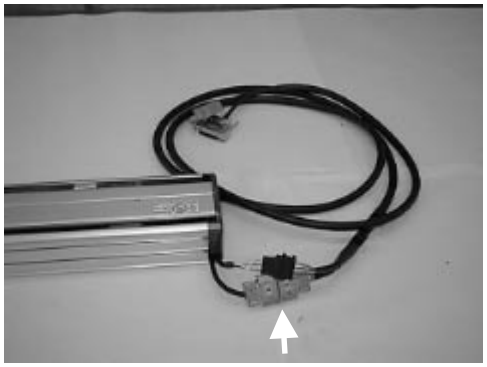
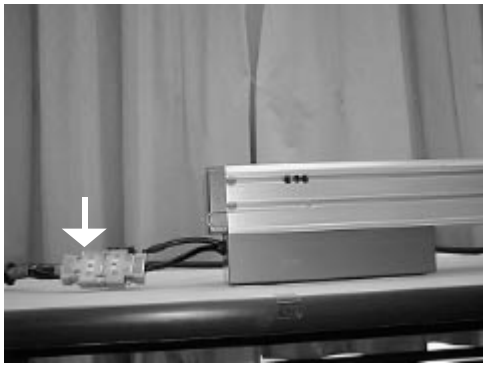


Photo 21.5-22



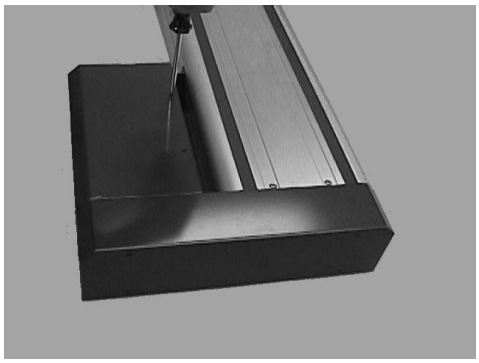
Motor indirect mount module

21.5.2.2. RH and RM Motor Indirect Mount Module

<Following photos show RM module as an example. However, the procedures are the same for RM module.>

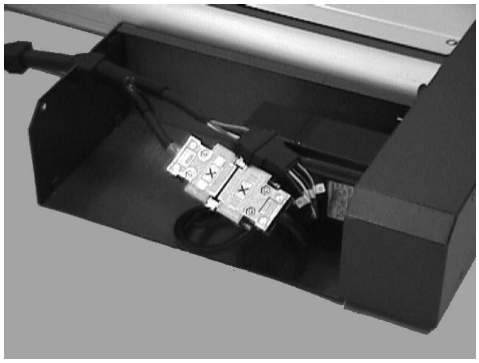
1) Remove the top cover of the motor cover. (Photo 21.5-23)

Photo 21.5-23



2) Connect the controller cable. Insert the cable holder to the opening in the end cover. (Photo 21.5-24)

Photo 21.5-24



3) Fix the top cover.

21.6. Installation of End Effector

21.6.1. Mounting to Slider

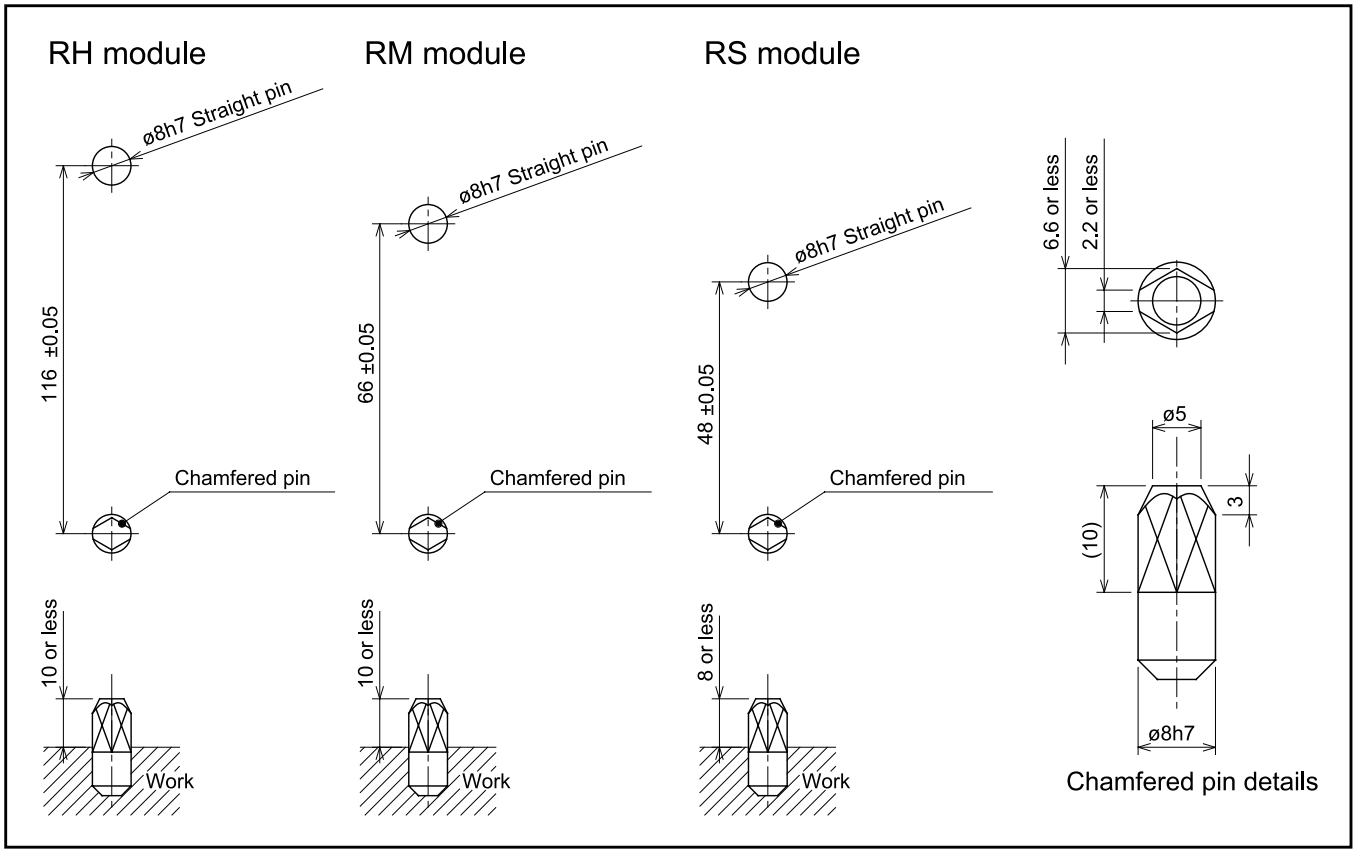
- Use specified fixing bolts in Table 21-5.
- When using ø8H7 pin holes of R series, refer to Figure 21-6 for dimensions of locating pins.

Caution : *After mounting an end effector to the slider, make sure that, by moving the slider manually, no interference in ancillaries exists. Clearance between the ancillaries and the robot on both stroke end shall be more than 20 mm. (12mm for RS module)*

Table 21-5.

	PH module	PM module	RH module	RM module	RS module
Bolt diameter	M8	M6	M8	M6	M6
Screw-in depth	12 ~ 16mm	7 ~ 12mm	12 ~ 16mm	9 ~ 12mm	6 ~ 8mm
Tightening toque	33.3N·m {340kgf·cm}	11.7N·m {120kgf·cm}	33.3N·m {340kgf·cm}	14.7N·m {150kgf·cm}	11.7N·m {120kgf·cm}

Figure 21-6



21.6.2. Mounting Effector to End Face of Main Unit

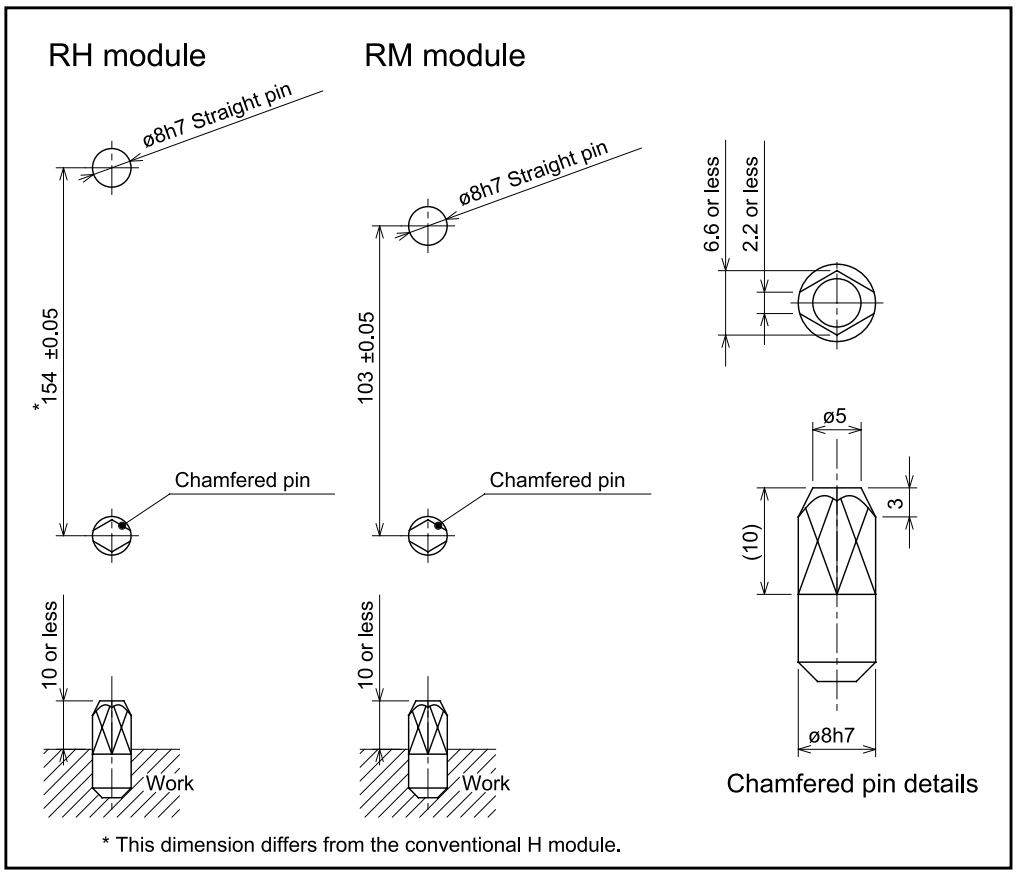
- This way of mounting effector is only applicable to R series.
- Use tap holes on the end face opposite to motor side for mounting. (For both ends for S module.)
- Use the bolts listed in Table 21-6.
- When using ø8H7 pin holes for locating pins, refer to Figure 21-7 for dimensions and positions of the pin.
- Refer to following sections for maximum transportable mass.
  - ◊ Single axis operation : "Table 19-6: Transportable mass for single axis in moving main unit"
  - ◊ Multi-axis combination : "Table 19-7: Transportable mass of multi-axis combination"

Danger *: You cannot not use the bolts listed in Table 21-6 to fix a main unit. Refer to "21.4. Fixing Module Main Unit" to fix the main unit.*

Table 21-6

	RH module	RM module	RS module
Bolt diameter	M8	M6	M5
Screw-in depth	12 ~ 16mm	9 ~ 12mm	8 ~ 10mm
Tightening torque	33.3N·m {340kgf·cm}	14.7N·m {150kgf·cm}	5.9N·m {60kgf·cm}

Figure 21-7



21.7. Installation of Multi-axis Combination

21.7.1. PG-HM Combination

- Required parts and units for PG-HM combination are listed in Table 21-7. Confirm that all parts are ready.

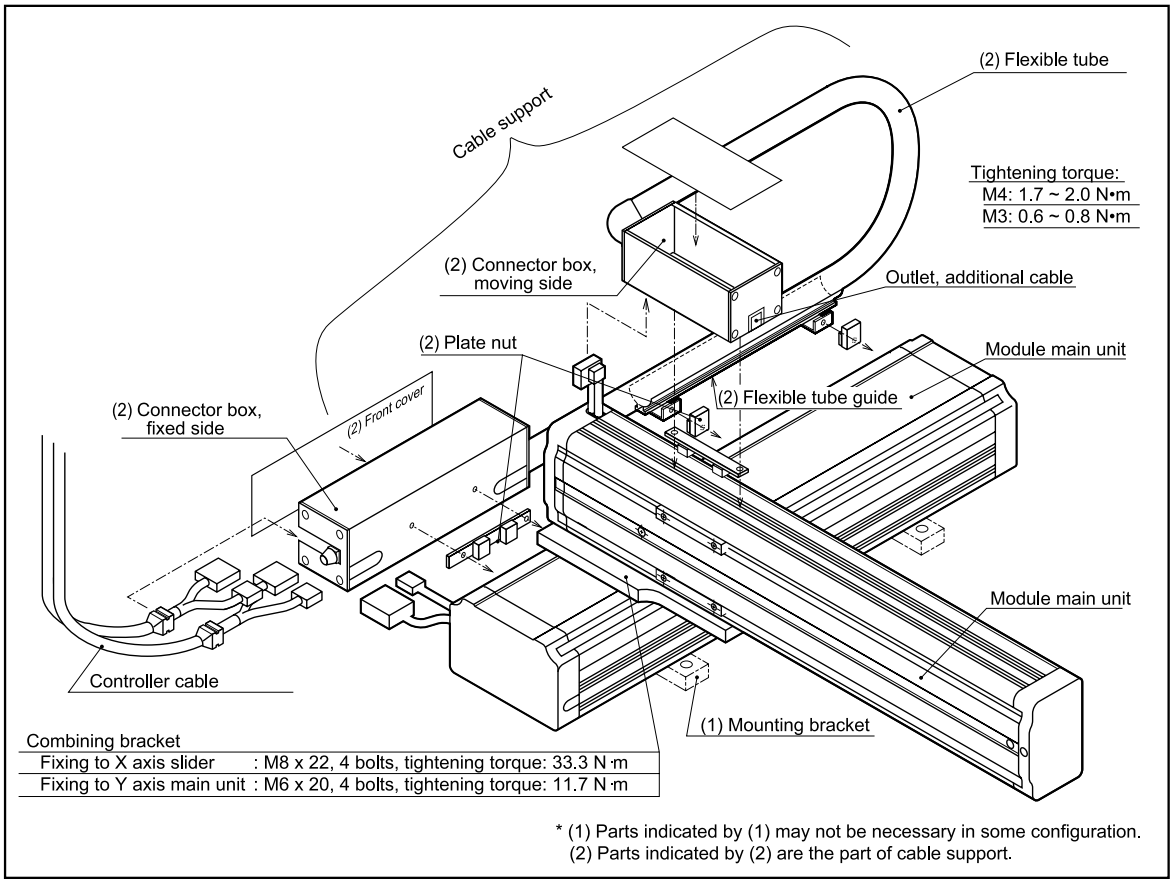
Table 21-7

Name	Quantity	Reference number	Sections to be referred.
X axis main unit	1	XY-HRS□□□-PH□□□	3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications"
Y axis main unit	1	XY-HRS□□□-PM□0□ (2)	
Controller	1	M-EXEA□-□□00□00	1 Installation and Maintenance of the EXEA Controller "5. Reference Number and Specifications"
Teaching box	1	M-EXTB0□	
Combining bracket			3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications"
A and C type	1	XY-P185GHM-1	
B and D type		XY-P185GHM-2	
Controller cable	2	XY-E185□□-1	
Cable support (2)	1	XY-P183GHM10□-1	
Mounting bracket	2	XY-P180H-1 (1) (2)	

(1) Mounting bracket is not necessary when fixing main unit from its bottom.

(2) These parts cannot be used in a motor back mount module.

Figure 21-8



◆ PG-HM combination

- Following descriptions are the assembly procedure for A type combination. However, the procedures for B, C and D combinations are fundamentally the same, though the combining directions of main units and cable support are different.

- Required modifications of parts are listed in Table 21-8 below for respective combination types. Modify them before assembly. No modification is required for A type.

Table 21-8 Modification requirement

	A	B	C	D
PH main unit	Not necessary	Reverse the cable outlet. *1		Not necessary
PM main unit	Not necessary	Reverse the cable outlet. *1	Not necessary	Reverse the cable outlet. *1
Cable support	Not necessary	Modification of cable support *2		

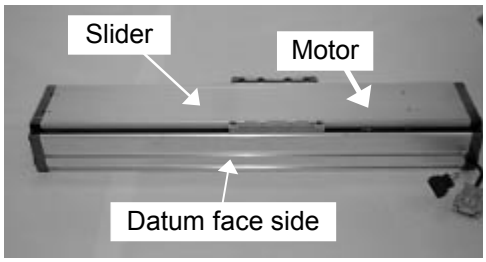
*1 Refer to "21.3. Reversing Main Unit Cable Position."

*2 Refer to "21.9. Modification of Cable Support."

◆ Assemble procedure (A type)

1) Fix X axis to the mounting surface referring to "21.4. Fixing Module Main Unit."

Photo 21-1PG



2) Fix the combining bracket to the slider of X axis main unit.
(Bolt size: M8, 4 bolts. Tightening torque: 27.4 ~ 33.3 N·m)
Prepare a steel plate which has sufficient flatness. Press it to the datum face of the slider (two places), and fix the combining bracket to the slider while pressing the side face of the bracket to the plate. This will give better perpendicular between X and Y axes main units, and will reproduce exactly same accuracy in a case of re-assembly of the two main units in the future.

Photo 21-2PG

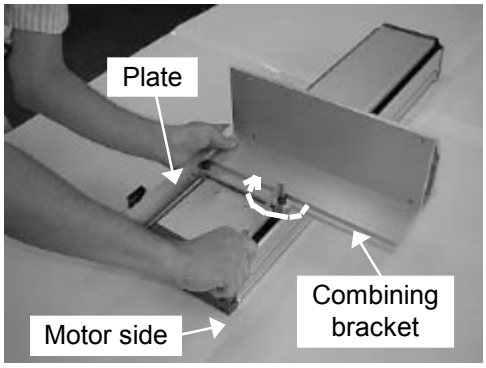
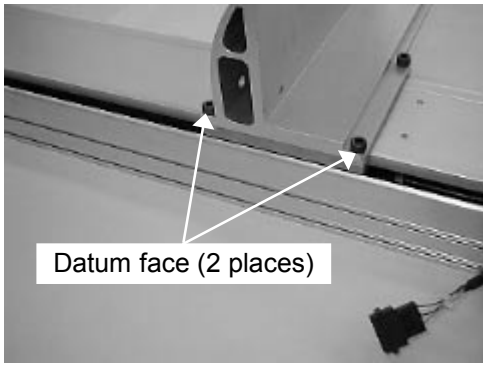
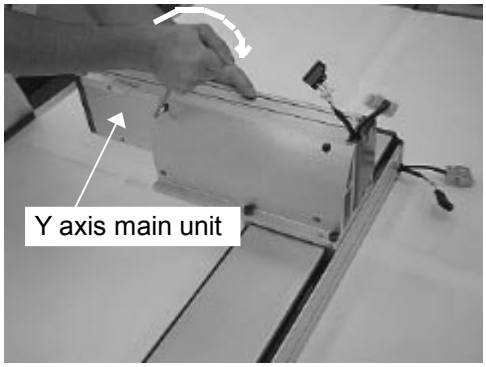


Photo 21-3PG



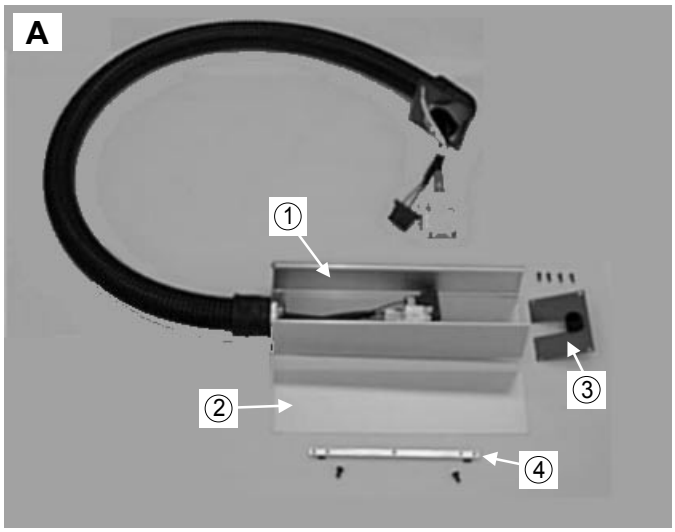
3) Combine the combining bracket and Y axis main unit.
(M6 bolts: 4 places, tightening torque: 9.8 ~ 11.75 N·m)

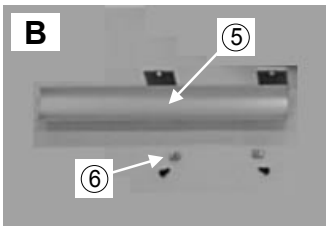
Photo 21-4PG



4) Attach the cable support to the main units and connect the cables. Confirm that all parts of the cable support are ready.

Photo 21-5PG





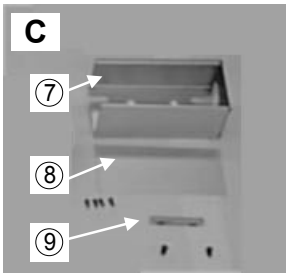


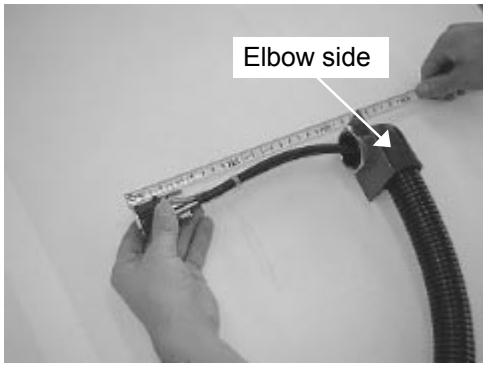
Table 21-9

Section	Name of section	Part number	Name of part	Quantity	Hexagon socket head cap screw
A	Cable support	①	Fixed side connector box frame	1	
		②	Front cover	1	
		③	End cover	1	M3 × 8 (4 bolts)*
		④	Plate nut	1	M4 × 6 (2 bolts)
B	Flexible tube guide	⑤	Flexible tube guide	1	
		⑥	Square plate nut	2	M4 × 6 (2 bolts)
C	Fixed side connector	⑦	Stable side connector box frame	1	M3 × 8 (4 bolts)*
		⑧	Front cover	1	
		⑨	Plate nut	1	M4 × 6 (2 bolts)

* These are hexagon socket button head screw.

5) Adjust the exposed length of cables at the elbow side to 200 to 220 mm. If additional cables or air-tubes are required, put them into the flexible tube before this adjustment.

Photo 21-6PG



6) Fix the fixed side connector box frame to X axis main unit.
Insert the plate nut (part number ④ in Photo 21-5PG) into the upper T-slot at the motor side. Facing its sponge side to the main unit, turning the stuck out sponge side up, insert it to T slot pushing upward angle. (See Figure 21-9.)

Figure 21-9: Inserting plate nut to T-slot

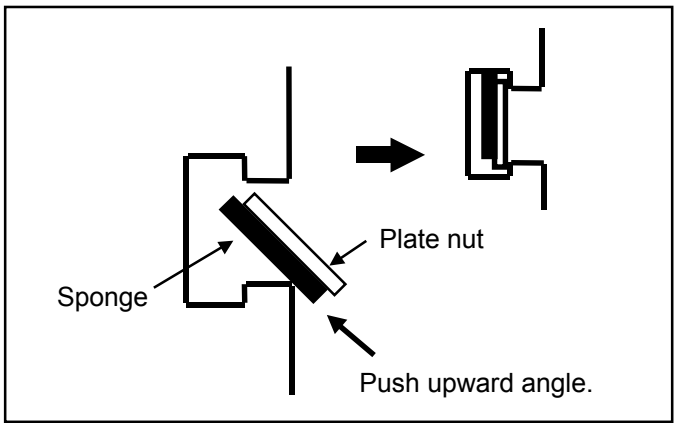


Photo 21-7PG

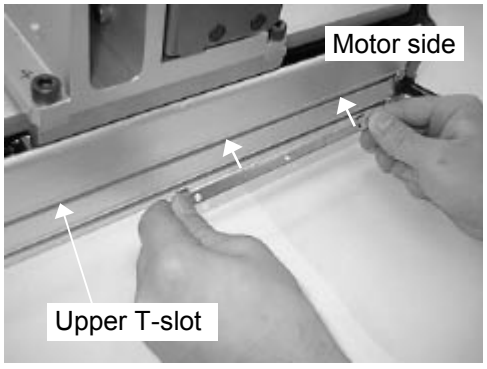
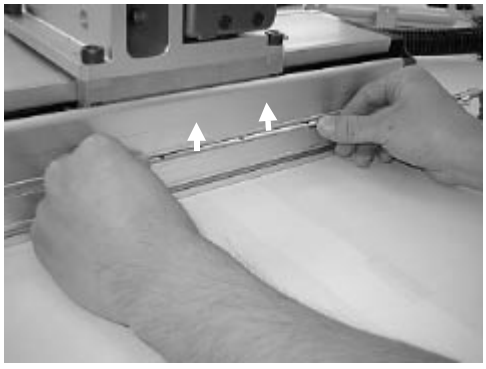


Photo 21-8PG



7) Fix the flexible tube guide to X axis main unit. Insert the square plate nut (part number ⑥ in Photo 21-5PG) to the upper T-slot on opposite side of the motor. Facing sponge side to the main unit, turning the stuck-out sponge side up, push the square plate nut upward angle into T-slot. (See Figure 21-9.)

Photo 21-9PG

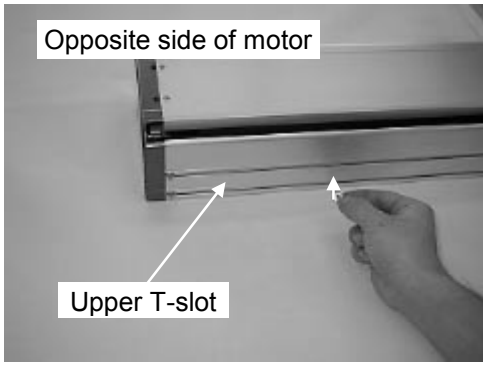
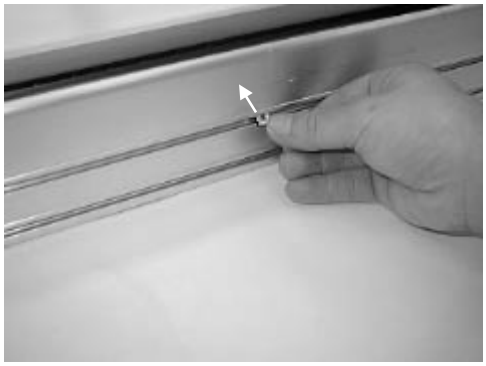


Photo 21-10PG



8) Fix the flexible tube guide temporarily by the bolts. (M4 × 6, 2 places) Adjust the guide position using an adding tape to L dimension from the end of motor side of main unit, then tighten the bolts firmly. (Tightening torque: 1.7 ~ 2.0 N·m) L dimensions are shown in Table 21-10 below.

Photo 21-11PG

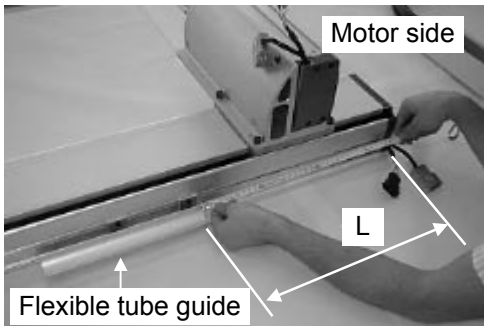


Photo 21-12PG

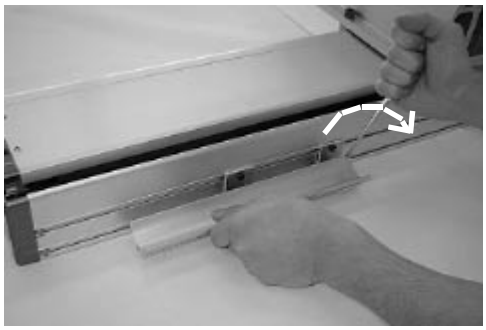
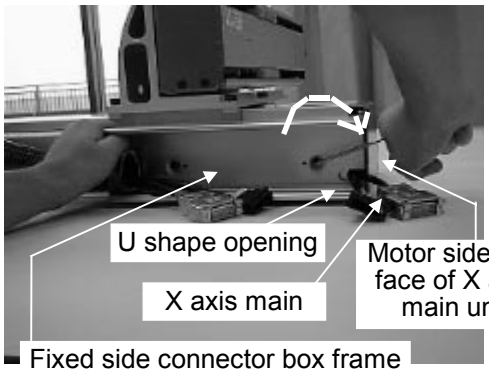


Table 21-10

X axis stroke [mm]	Cable support reference number	L [mm]
100 ~ 400	XY-E183GHM100-1	440
500 ~ 800	XY-E183GHM101-1	550

9) Set the fixed side connector box frame to the motor side of main unit so that its side, opposite to the cable outlet, is flush with the end face of main unit. Pass the main unit cables through U shape opening on the bottom of the box frame. Tighten the bolts to fix the connector box frame. (M4 × 6, 2 places, tightening torque: 1.7 ~ 2.0 N·m)

Photo 21-13PG



10) Same as X axis main unit, insert the plate nut to fix the fixed side connector box frame (part number ⑨ in Photo 21-5PG) to the T-slot ⑩ on the side of Y axis main unit as shown in Photo 21-14PG.
Facing its sponge side to the main unit, turning the stuck-out sponge side down, insert it into T-slot pushing downward angle as shown in Figure 21-10.

Figure 21-10

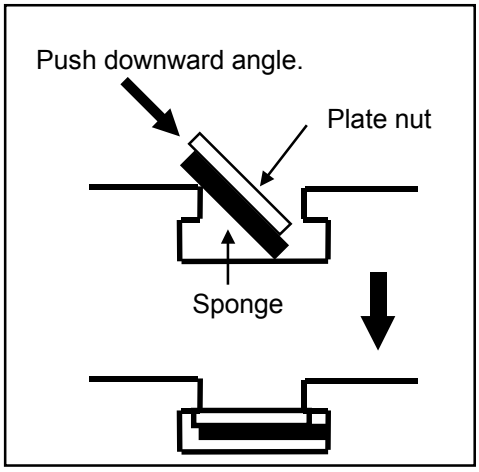


Photo 21-14PG

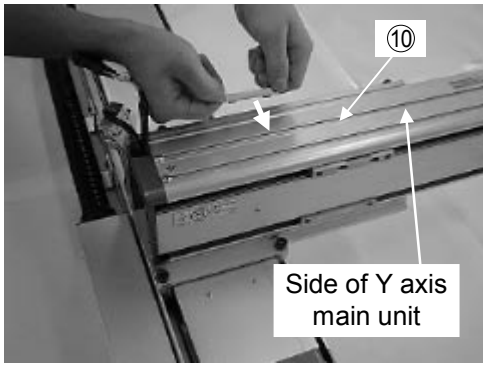
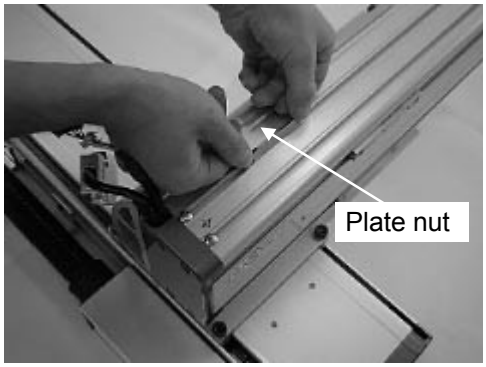


Photo 21-15PG



12) Set the moving side connector box frame (part number ⑦ in Photo 21-5PG) to the side of Y axis main unit so that its elbow side end is flush with the motor side end face of the main unit. Pass the main unit cables through U shape opening on the bottom of the box. Screw the bolts to the plate nut and tighten them to fix the connector box. (M4 × 6, 2 places, tightening torque: 1.7 ~ 2.0 N·m)

Photo 21-16PG

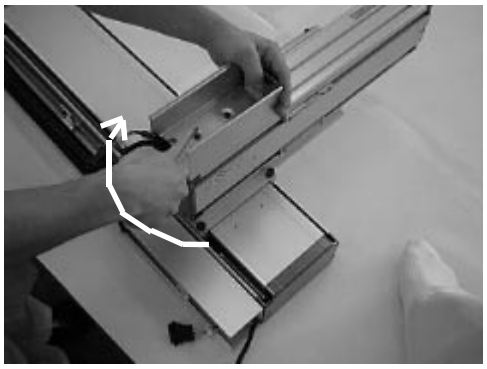
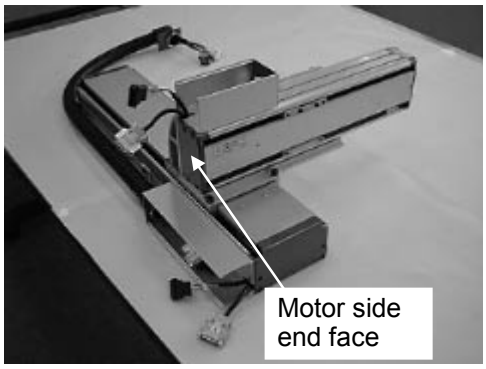


Photo 21-17PG



12) The seals of X, Y, Z and R to identify cables are contained in the controller cable container. Affix them respectively to the connectors of X and Y axis in the fixed side connector box. (See Photo 21-18PG.) Affix the seals to connectors of X and Y axis controller cables as well. (See Photo 21-19PG and Photo 21-20PG.)

Photo 21-18PG

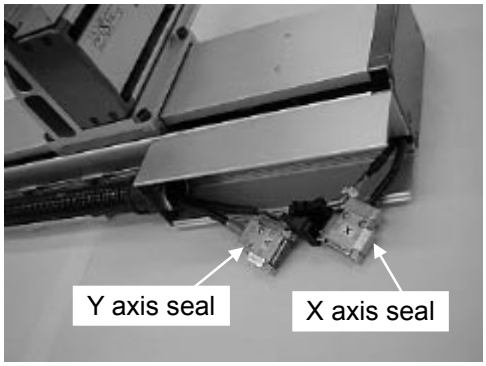


Photo 21-19PG

Photo 21-20PG

13) Connect the motor connector ⑪ and sensor connector ⑫ of the fixed side connector box on Y axis main unit. Secure the sensor connector firmly with 2 screws. Put the cables in the connector box. Bend them in a large radius as possible. (Photo 21-21PG)
Loosely attach both covers. (Photo 21-22PG)
End cover of elbow side ⑬ : M3 × 8 (4 bolts)
End cover ⑭ : M3 × 8 (4 bolts)

Photo 21-21PG

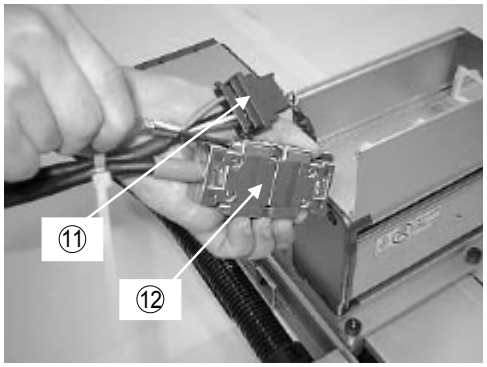
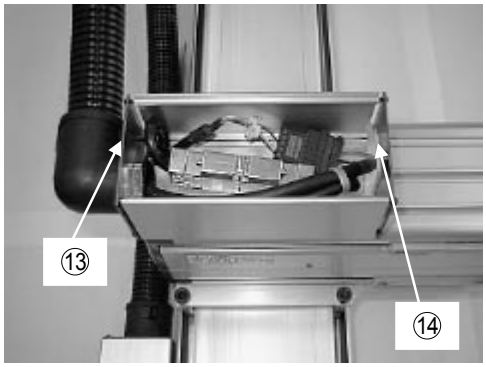


Photo 21-22PG



14) Then attach the front cover of moving side connector box. (part number ⑧ in Photo 21-5PG) Hook the edge of front cover to the slot of the connector box frame (in the position ⑮ in Photo 21-23PG) and push the cover in by both thumbs. (See Photo 21-24PG.)

Photo 21-23PG

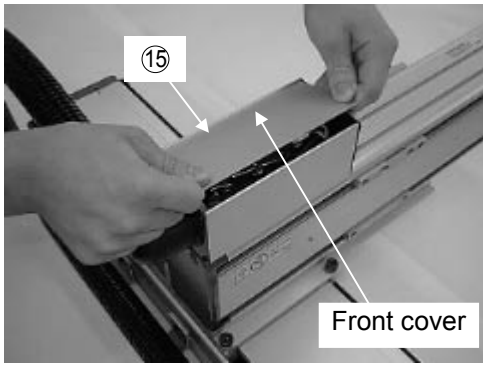


Photo 21-24PG

15) Secure the covers on both ends. (Tightening torque: 0.6 ~ 0.8 N·m)
End cover of elbow side : M3 × 8 (4 bolts)
End cover ⑯ : M3 × 8 (4 bolts)

Photo 21-25PG

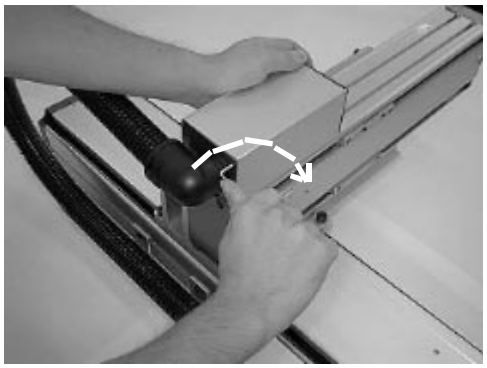
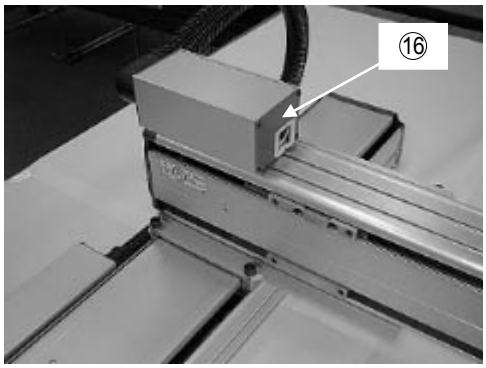


Photo 21-26PG



16) Connect X and Y axis cables in the fixed side connector box attached to X axis main unit. Connect Y axis connectors. Secure the sensor connector ⑰ with 2 screws. Then connect X axis connectors as enlarged in Photo 21-28PG. Connection procedures are the same as Y axis.

Photo 21-27PG

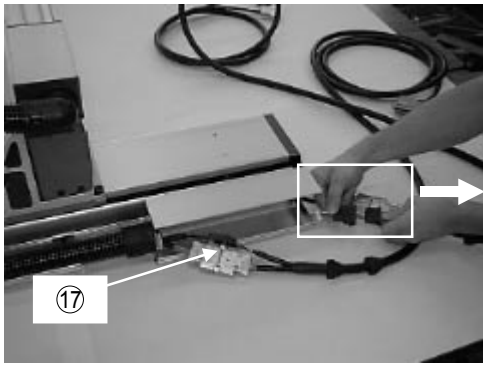
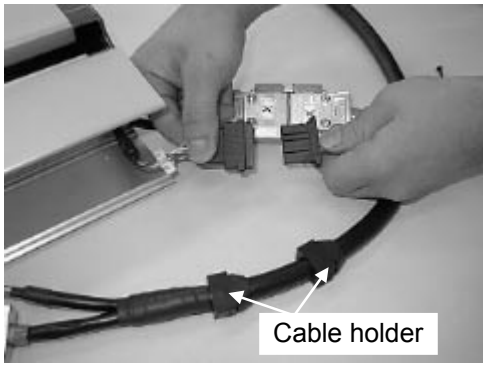


Photo 21-28PG



17) Insert the cable holders of X and Y axis controller cables to the opening in the end cover with blind plug. (See Photo 21-29PG.) Insert the Y axis cable holder ⑱ to the opening first, then X axis cable holder ⑲ next. (See Photo 21-30PG for the cable holder.) Then screw down the end cover. (M3 × 8 bolts, 4 places). Leave the bolts loose. Do same for the end cover on cable support side ⑳.

Photo 21-29PG

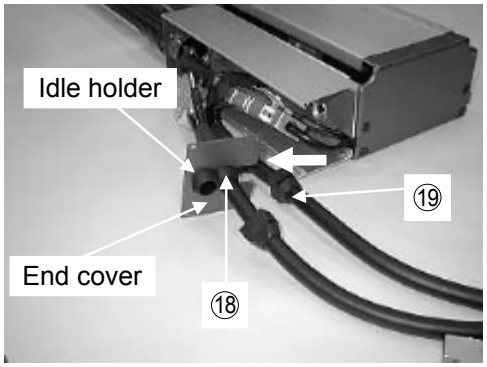
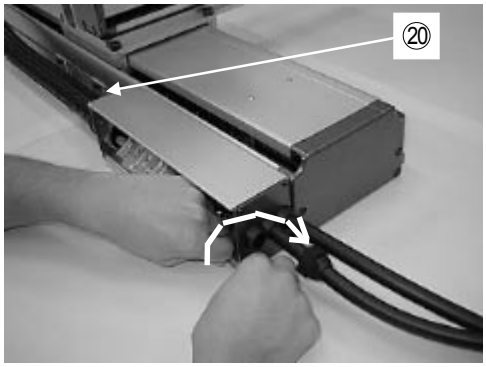


Photo 21-30PG



18) Attach the front cover (part number ② in Photo 21-5PG) to the connector box frame. Hook edge of front cover to the slot of box frame (in position ㉑), and push the upper side of the cover by both thumbs.

Photo 21-31PG

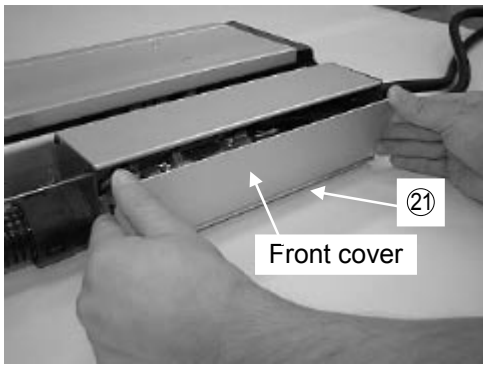
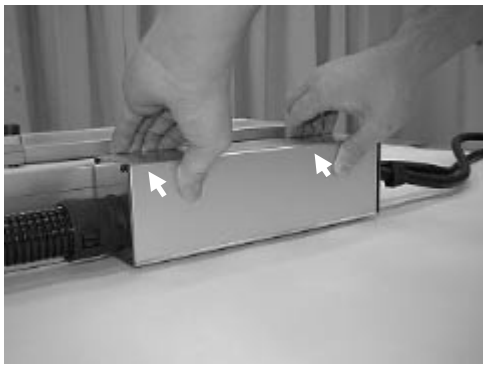


Photo 21-32PG



19) Tighten the bolts of the covers on both ends.
(8 bolts in total, tightening torque: 0.6 ~ 0.8 N·m)

Photo 21-33PG

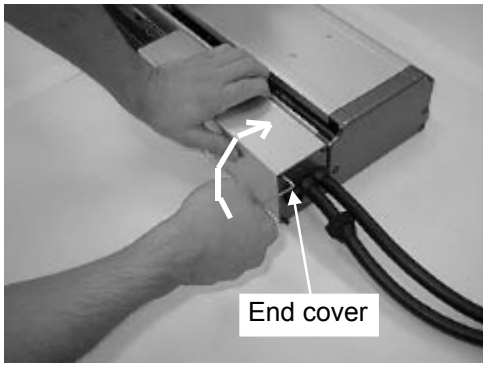
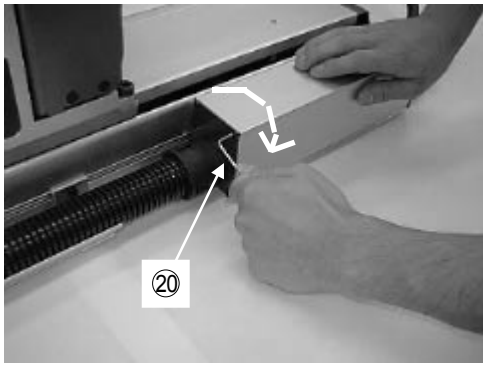


Photo 21-34PG



Completion of PG-HM Combination

Photo 21-35PG

20) Move X axis manually to both stroke ends. Check for twist of the flexible tube and interference with ancillaries. If the flexible tube is twisted during the motion, take measures listed in Table 21-11 for the adjustment.

Table 21-11

No	Cause	Measures
1	Flexible tube is inclined.	Adjust position of the moving side connector box.
2	Due to core set of flexible tube.	Make adjustment by twisting the flexible tube on both ends. (Flexible tube can be rotated at tube connectors on both ends.)
3	The cables are twisted in flexible tube.	Disassemble fixed side connector box. Straighten the flexible tube to remove twist of the cables.
4	Affected by additional cables.	Shortening the flexible cable is effective when X axis stroke is 500 to 800 mm stroke. (Refer to "21.8. Shortening Flexible Tube.") Addition of a metal fixture (XY-P180CC-1) for fixing flexible tube is effective as well.

21) After installation of the controller (refer to "6.3. Installation of EXEA Controller"), connect the controller cables to the controller. Check for affixed seal of each part described in the procedure 12).

22) Affix seals provided with a main unit to indicate the Home and mechanical stopper position. Firstly, after completion of Home return motion (refer to "17.3.1. Home Return Operation."), turn off the power and affix the seal onto a side of a main unit to indicate Home position. Then move the slider manually to the other end of stroke, keeping turn power off, until slider contacts the mechanical stopper, then affix another seal to indicate position of the mechanical stopper. <See Photo 20-1.>
Indication of the position of mechanical stopper will be referred in the future whether a main unit can be used subsequently if it collided to obstacles including the mechanical stopper. (Refer to "14. Troubleshooting.")

21.7.2. Installation of PD-MMz Combination (Exclusive to Wall Mount Type)

- Confirm that all parts and units listed in Table 21-12 are ready.

Table 21-12

Name	Quantity	Reference number	Sections to be referred.
X axis main unit	1	XY-HRS□□□-PM□□□	3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications"
Z axis main unit	1	XY-HRS□□□-PM102 (3)	
Controller	1	M-EXEA□-□□00□00	1 Installation and Maintenance of the EXEA Controller "5. Reference Number and Specifications"
Teaching box	1	M-EXTB0□	
Combining bracket	1	XY-P185DMM-1	3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications"
X axis controller cable	1	XY-E185□□-1	
Z axis controller cable	1	XY-E185□□-2	
Cable support	1	XY-P183DHM11□-1 (1)	
Mounting bracket	2	XY-P180M-1 (2) (3)	

(1) 6 signal cables are available for user cables. Hoever, there might be some noise problems. Refer to "19.3. Cable Support."

(2) This is not necessary when fixing X axis from its bottom.

(3) Motor back mount module cannot be used as a Z axis main unit.

(4) This bracket cannot be used for a motor back mount module.

Figure 21-11

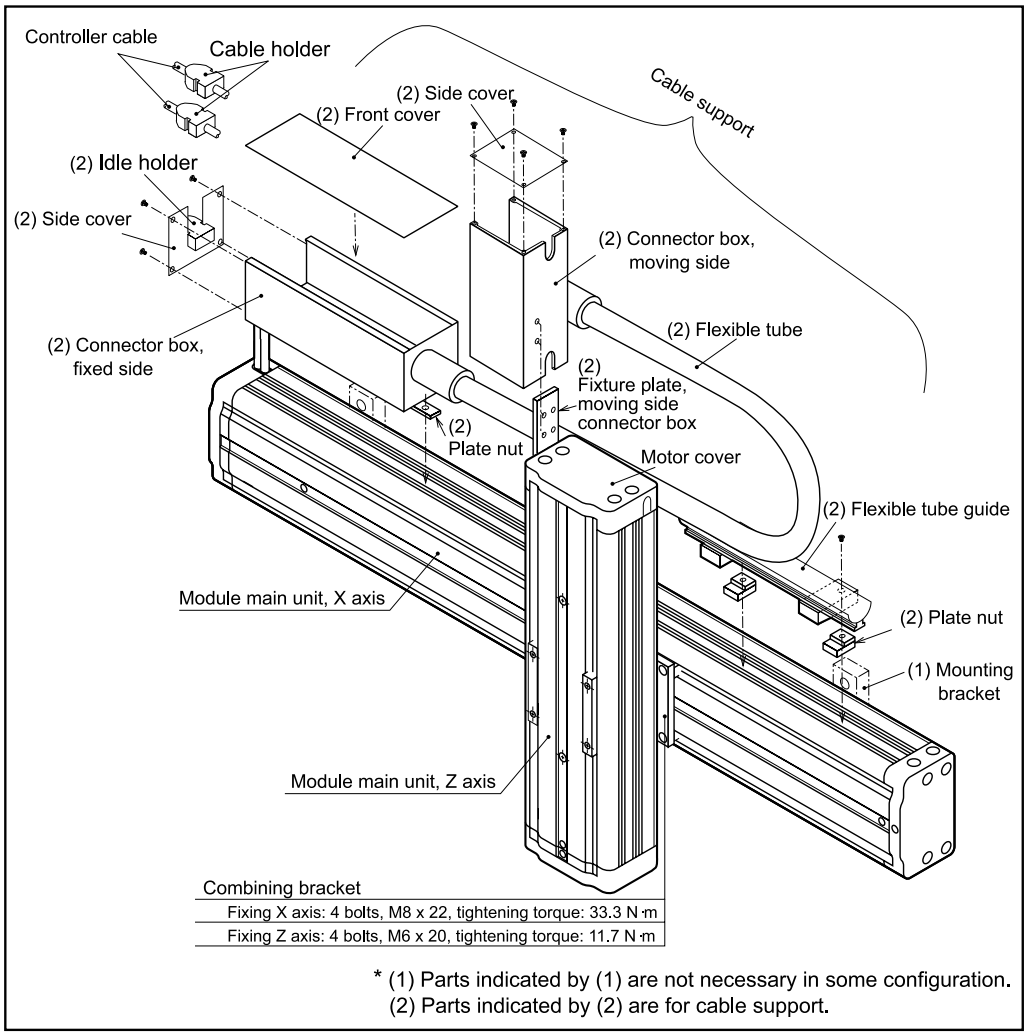


Figure 21-12: A type combination: Assemble of connector box (moving side) and fixture plate

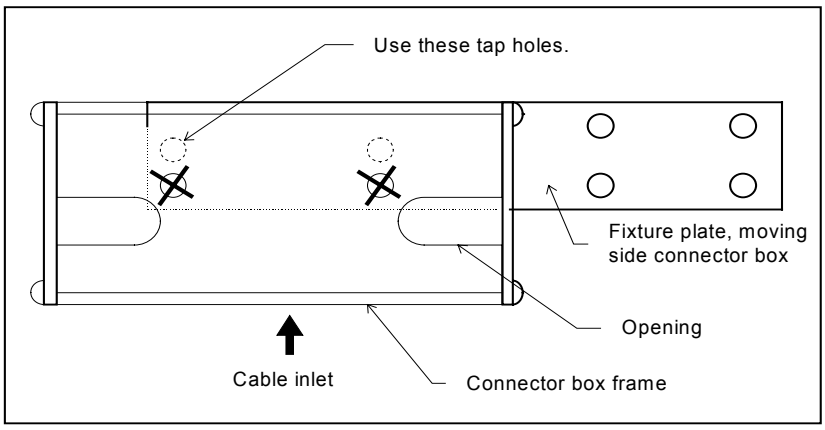
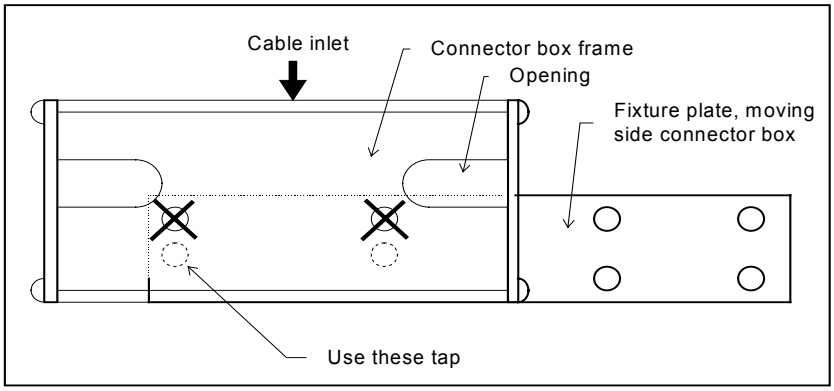


Figure 21-13: B type combination: Assembly of connector box (moving side) and fixture plate



◆ PD-MMz combination

- This section describes the assembly procedure of A type combination. For B type combination, though combining directions of main units and cable support are different from A type, fundamental procedures are the same.

- Modifications required for parts of respective combinations are listed in Table 21-13. Modify them before assembly.

Table 21-13

	A	B
X axis main unit	Not necessary	Reverse cable position *1
Z axis main unit	Reverse cable position *1	Not necessary
Cable support	Not necessary	Modification of cable support *2

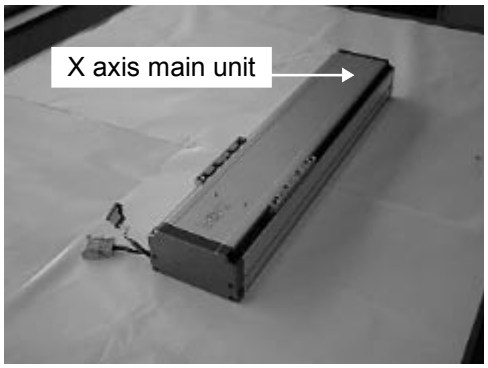
*1. Refer to "21.3. Reversing Main Unit Cable Position"

*2. Refer to "Modification of Cable Support."

◆ Assembly procedure (A type)

1) Fix X axis main unit (PM module) to the mounting base.

Photo 21-1PD



2) Turn over Z axis main unit. Fix the combining bracket to ite mounting surface.
(M6 bolts: 4 places, tightening torque: 9.8 ~ 11.75 N·m)
Fix the combining bracket to the slider of X axis main unit.
(M6 bolts: 4 places, tightening torque: 9.8 ~ 11.75 N·m)

Photo 21-2PD

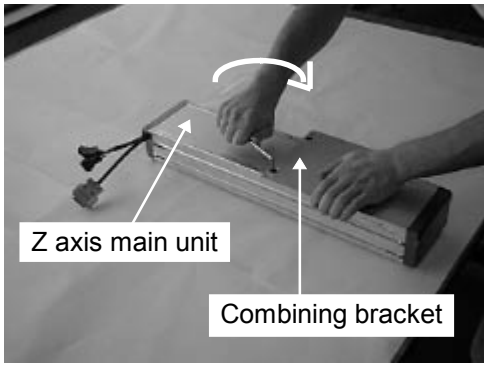
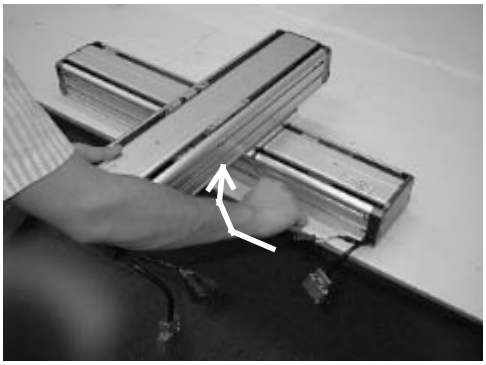


Photo 21-3PD



3) Attach the cable support to the main unit and wire the cables. Check if all parts listed in Table 21-14 are ready. (Photo 21-4PD)

Photo 21-4PD

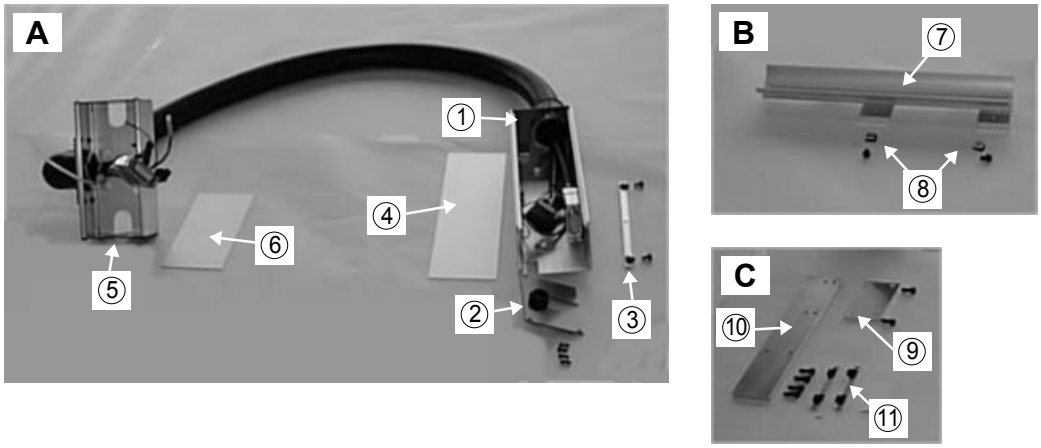


Table 21-14

Section	Name of section	Part number	Name of part	Quantity	Hexagon socket head cap screw
A	Cable support	①	Connector box frame, fixed side	1	
		②	End cover	1	M3 × 8 (4 bolts) *
		③	Plate nut	1	M4 × 6 (2 bolts) *
		④	Front cover	1	
		⑤	Connector box frame, moving side	1	
		⑥	Front cover	1	
B	Flexible tube guide	⑦	Flexible tube guide	1	
		⑧	Plate nut	2	M4 × 12 (2 bolts)
C	Fixture plate, moving side connector box	⑨	Spacer	1	
		⑩	Fixture plate, moving side connector box	1	M4 × 6 (2 bolts)
		⑪	Plate nut	2	M4 × 12 (4 bolts)

* These are hexagon socket button head screws.

4) Unfasten bolts (4 bolts, M3x8) on the end cover of moving side connector box frame and remove it. (The cover has an opening for additional cables.)

Photo 21-5PD

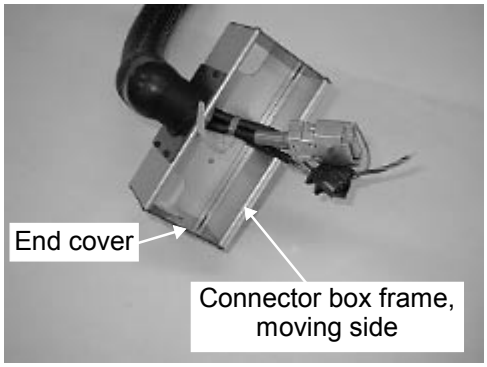
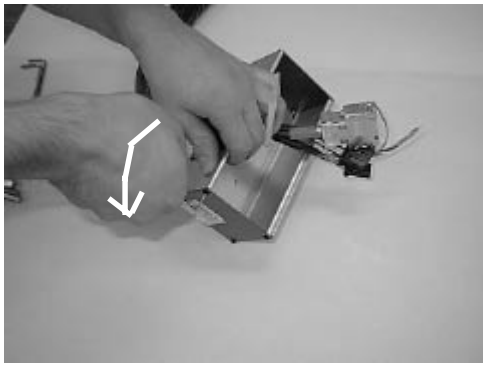


Photo 21-6PD



5) Assemble the fixture plate (part number ⑩ in Photo 21-4PD) and moving side connector box frame.

◊ M4 × 6, 2 places, tightening torque: 1.7 ~ 2.0 N·m

◊ Use holes shown in Photo 21-7PD and 21-8PD.

Photo 21-7PD

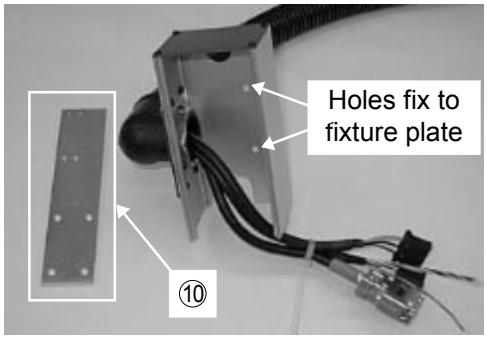
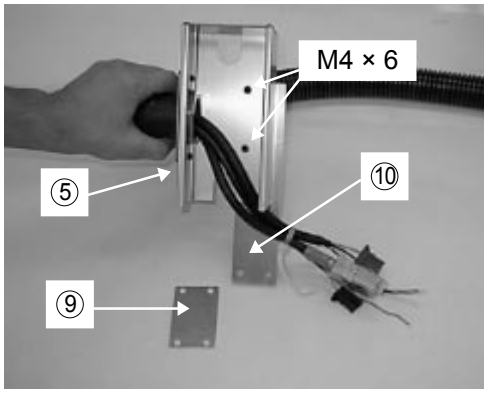


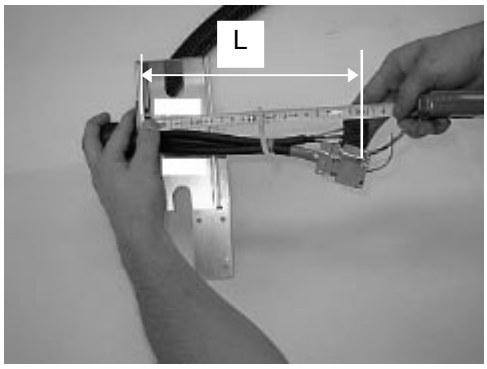
Photo 21-8PD

Photo 21-9PD



6) Adjust exposed length (L in Photo 21-10PD) of cables from the moving side connector box to 200 to 220 mm using an adding tape as shown in Photo 21-10PD.

Photo 21-10PD



7) Insert two plate nuts (part number ⑪ in Photo 21-4PD) to upper and lower T-slots of Z axis main unit at its cable side. Insert them as shown in Figure 21-14, turning stuck out sponge side up, pushing the nut upward angle. (Photo 21-11PD and 21-12PD)

Figure 21-14: How to insert plate nut to T-slot

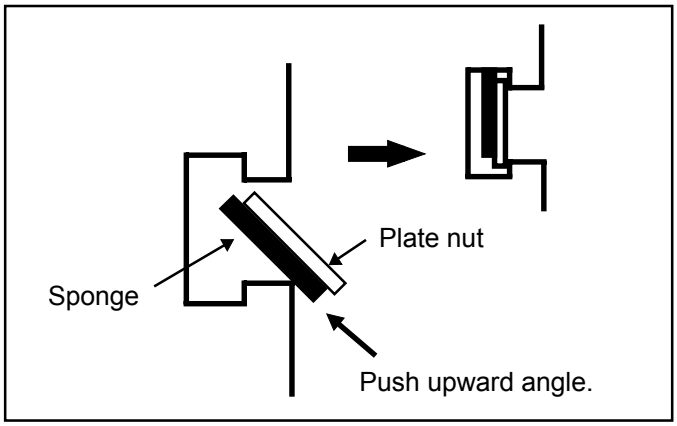


Photo 21-11PD

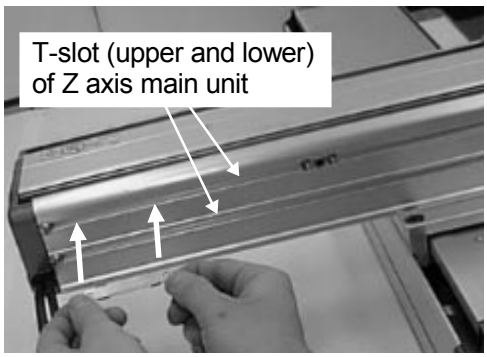
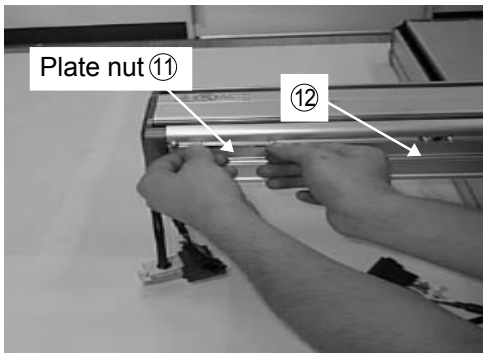
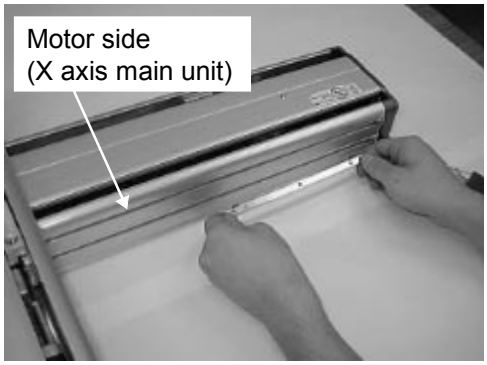


Photo 21-12PD



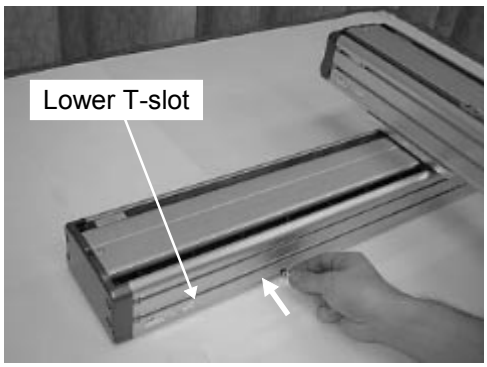
8) Insert a plate nut (part number ③ in Photo 21-4PD) to the upper T-slot of X axis main unit at motor side. As shown in Figure 21-14, push upward angle the nut, turning stuck out sponge side up.

Photo 21-13PD



9) Insert two plate nuts (part number ⑧ in Photo 21-4PD) to upper T-slot of X axis main unit at opposite to motor side. This procedure is the same as 7) and 8).

Photo 21-14PD



10) Attach the flexible tube guide (part number ⑦ in Photo 21-4PD) to X axis main unit. Loosely attach the flex tube guide temporarily by bolts (M4 × 12, 4 places), then set it to the position L as shown in Photo 21-15PD from the end face of motor side using an adding tape. Tighten the bolts firmly. (Tightening torque: 1.7 ~ 2.0 N·m)

Photo 21-15PD

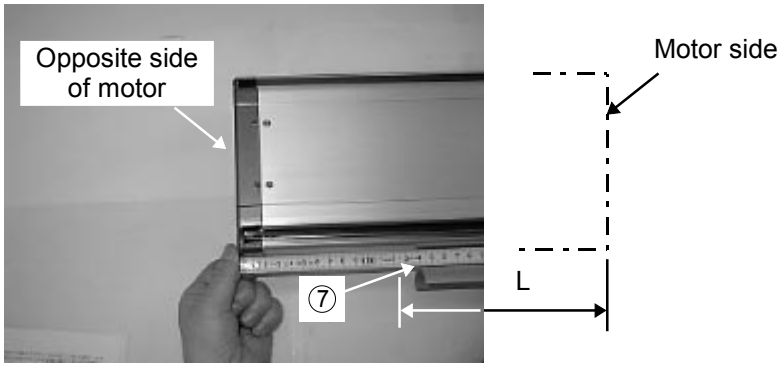


Table 21-15

X axis stroke [mm]	Reference number of cable support	L [mm]	
		Z axis stroke 100 ~ 300mm	Z axis stroke 400 ~ 600mm
100 ~ 400	XY-E183DHM110-1	650	600
500 ~ 800	XY-E183DHM111-1	1050	1050

11) Loosely screw in the moving side connector box frame to two plate nuts (part number ⑪ in Photo 21-4PD) inserted to upper and lower T-slots on the side of Z axis main unit through spacer (part number ⑨ in Photo 21-4PD). (M4 × 12, 4 places)

Photo 21-16PD

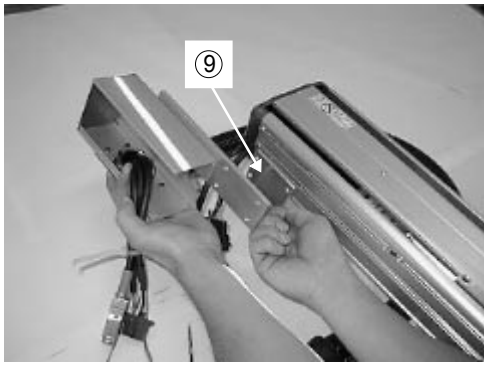
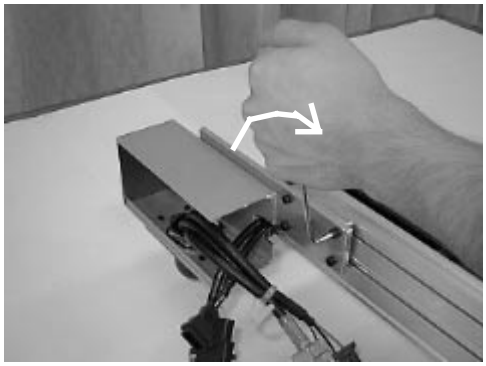


Photo 21-17PD



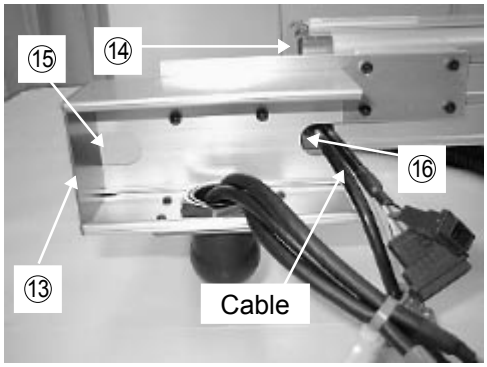
12) Position of moving side connector box (distance between its end cover ⑬ and end face of Z axis main unit ⑭ in Photo 21-18PD) must be set as below.

◊ Z axis stroke 300 mm or under : 124 mm

◊ Z axis stroke 400 ~ 600 mm : 0 (zero) (Flush with each other.)

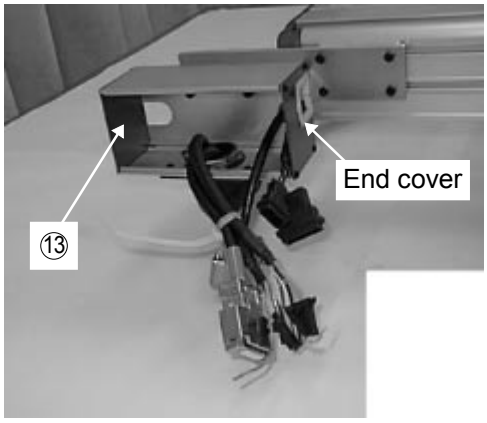
Pass Z axis cables through U shape opening ⑯ , then tighten bolts.
(M14 × 12, tightening torque 1.7 ~ 2.0 N·m)

Photo 21-18PD



13) Loosely attach the end cover to moving side connector box frame. Loosen bolts of the other end cover ⑬. (M3 × 8, 4 places)

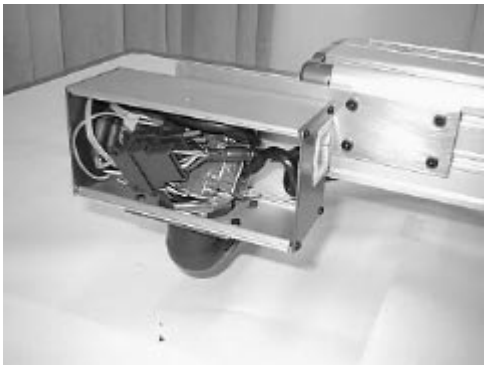
Photo 21-19PD



14) Connect the cables of main unit and cable support. There are three connectors, motor power, sensor and brake power connectors. Secure the sensor connector by tightening two screws.

Photo 21-20PD

Photo 21-21PD



15) Apply the edge of front cover to the slot of moving side connector box and push the front cover in.

Photo 21-22PD

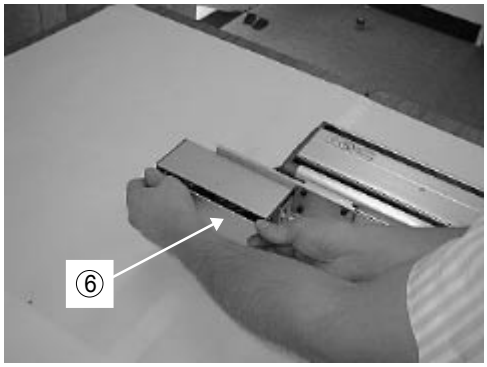
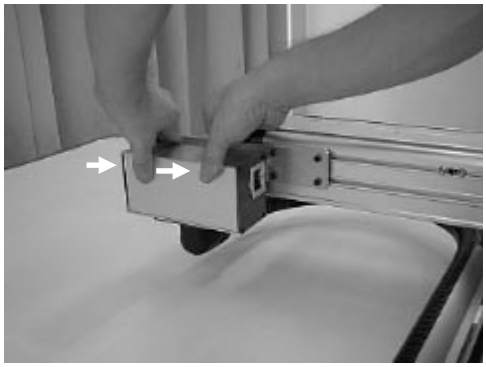
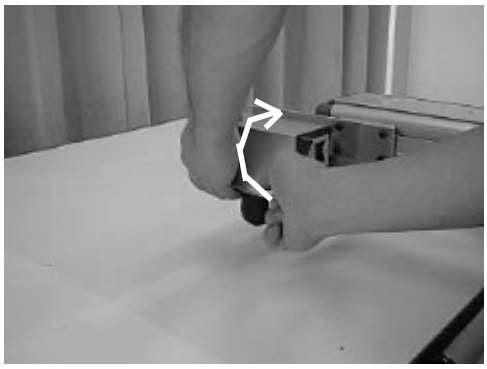


Photo 21-23PD



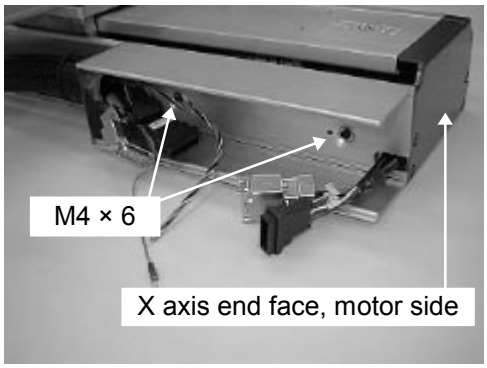
16) Fix the both end covers to the connector box. (M3 × 8, tightening torque: 0.6 ~ 0.8 N·m)

Photo 21-24PD



17) Flush the right end surface of the connector box (Part number ① in Photo 21-4PD) with the end face of X axis main unit (motor side). Tighten the bolts to fix the connector box to the plate nut (part number ③), which are inserted to T slot in process 8).
(2 places, M4 × 6, tightening torque: 1.7 ~ 2.0 N·m)
Pass the cables of X axis through U shape opening beforehand.

Photo 21-25PD



18) Affix the seals provided with the controller cable to identify the connectors for reference in multi-axis combination.
Seals for X, Y, Z and R axes are provided. Affix them to corresponding cables. For the controller cable, affix seals both for X and Z axes.

Photo 21-26PD

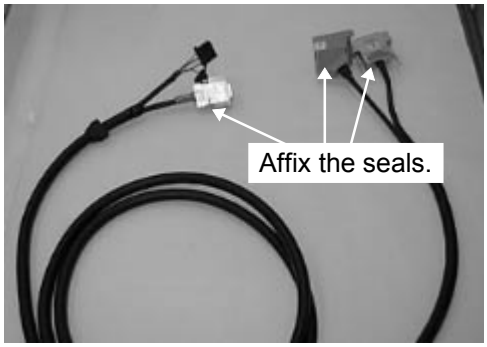
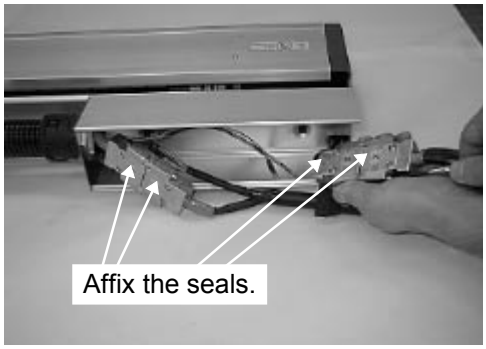
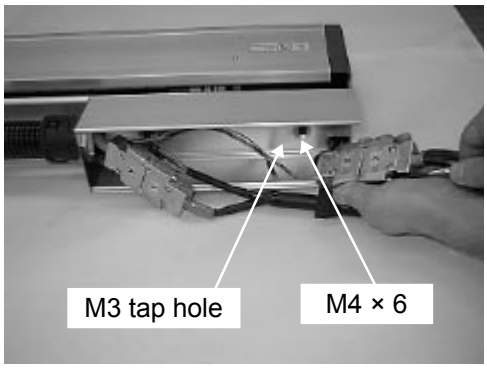


Photo 21-27PD



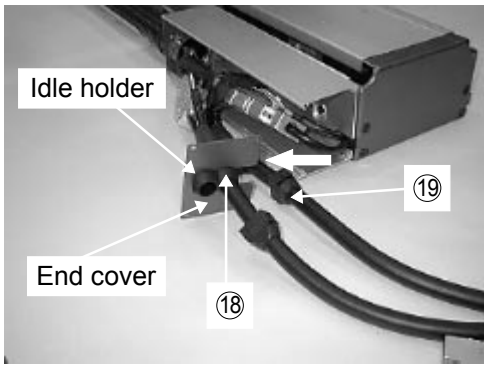
19) Connect X and Z axes connectors of the cable support and controller cable at the fixed side connector box. The round terminal of earth wiring (green) of cable support must be connected to M3 tap hole adjacent to M4 bolts. (Tightening torque: 1.6 ~ 1.8 N·m) This fixed round ground terminal must be connected to the ground wiring of user's equipment when the user cable (6 cores) are to be added to the cable support.

Photo 21-28PD



20) Insert cable holders (part number ⑱ , ⑲ in Photo 21-4PD) of controller cable to the slot of end cover (part number ② in Photo 21-4PD) , to where an idle holder is previously inserted. Insert Z axis cable holder ⑱ first, then X axis cable holder ⑲.

Photo 21-29PD



21) Loosely attach both end covers. (Photo 21-30PD) Fit the front cover (part number ④ in Photo 21-31PD) into the connector box frame. Hook its edge on lower grooves of the box frame and push it in by both thumbs as shown in Photo 21-32PD. Fix both end covers firmly. (Tightening torque: 0.6 ~ 0.8 N·m)

Photo 21-30PD

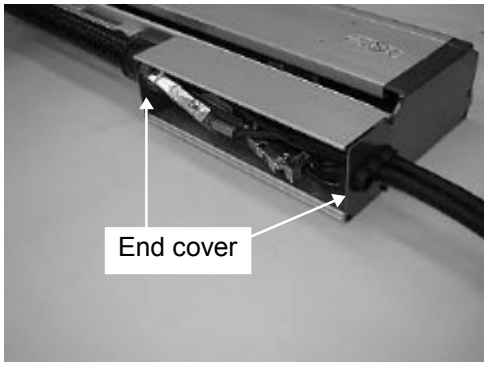
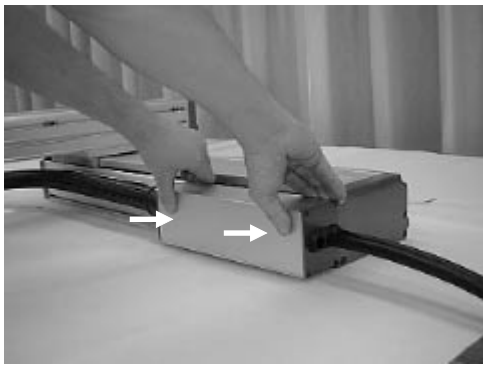


Photo 21-31PD

Photo 21-32PD



Installation of D-HM combination is completed.

Photo 21-33PD

22) Move X axis manually in full stroke and check twist of the flexible tube and interference with the ancillaries. Take measures in Table 21-16 below if the flexible tube is twisted.

Table 21-16

No	Cause	Measures
1	Due to core set of flexible tube.	Make adjustment by twisting flexible tube. (Flexible tube can be rotated at tube connector.) Adjust at both ends.
2	Cables are twisted in the flexible tube.	Disassemble the fixed side connector box. Straighten the flexible tube to remove twist of the cables.
3	Affected by additional cables or air tube.	Shortening the flexible cable is effective when X axis stroke is 500 to 700 mm. (Refer to "21.8. Shortening Flexible Tube.") Addition of metal fixture (XY-P180CC-1) for fixing flexible tube is effective also.

23) After installation of a controller, connect the controller cable to it. (Refer to "6.3. Installation of EXEA Controller.") Confirm the affixed seals to the connectors in procedure 18) hereinabove.

24) Affix the seals to X and Z axis main units to indicate positions of Home and the mechanical stopper. (See Photo 21-1.)

- ◊ After completion of Home return motion, turn the power off and affix one of the seals provided with module main unit to indicate Home position. (Refer to "17.3.1. Home Return Operation.")
- ◊ Then move the slider manually to opposite stroke end, at where the slider makes contact with mechanical stopper, and affix the other seal to indicate location of the mechanical stopper.

Indication of mechanical stopper position will be referred for possibility of subsequent use of main unit when it collided to obstacles, including the mechanical stopper. (Refer to "14. Troubleshooting.")

21.7.3. PD-HM Combination (Exclusive for Wall Mount)

- Table 21-17 shows required parts and units for the combination. Check if all parts are ready.

Table 21-17

Name	Quantity	Reference number	Sections to be referred.
X axis main unit	1	XY-HRS□□□-PH□□□	3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications"
Z axis main unit	1	XY-HRS□□□-PM102 (3)	
Controller	1	M-EXEA□-□□00□00	1 Installation and Maintenance of the EXEA Controller "5. Reference Number and Specifications"
Teaching box	1	M-EXTB0□	
Combining bracket	1	XY-P185DHM-1	3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications"
X axis controller cable	1	XY-E185□□-1	
Z axis controller cable	1	XY-E185□□-2	
Cable support	1	XY-P183DHM11□-1 (1)	
Mounting bracket	2	XY-P180H-1 (2) (3)	

(1) 6 signal cables are available for user cables. However, there might be some noise problems. Refer to "19.3. Cable Support."

(2) This is not necessary when fixing X axis from its bottom.

(3) Motor back mount module cannot be used as a Z axis main unit.

(4) This bracket cannot be used for a motor back mount module.

Figure 21-15

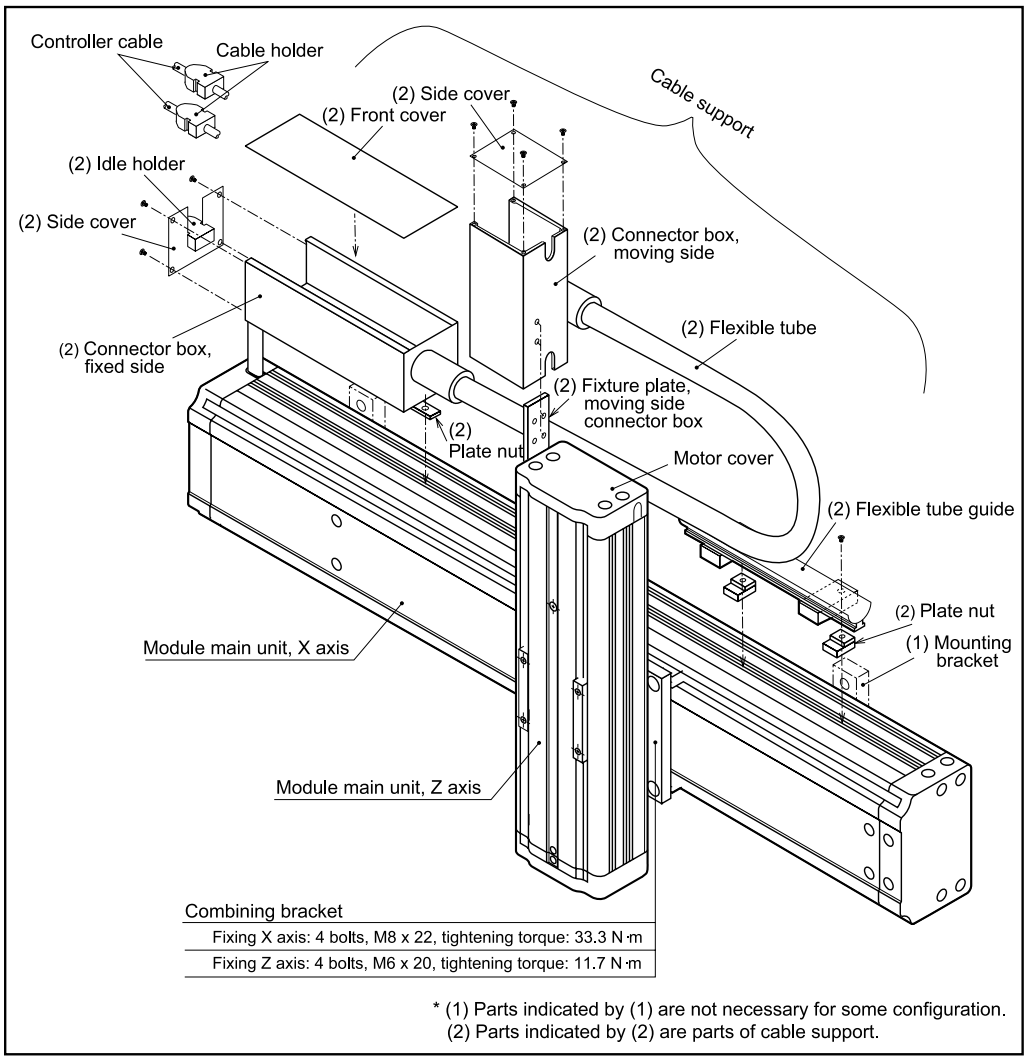


Figure 21-16: A type combination: Assemble of connector box (moving side) and fixture plate

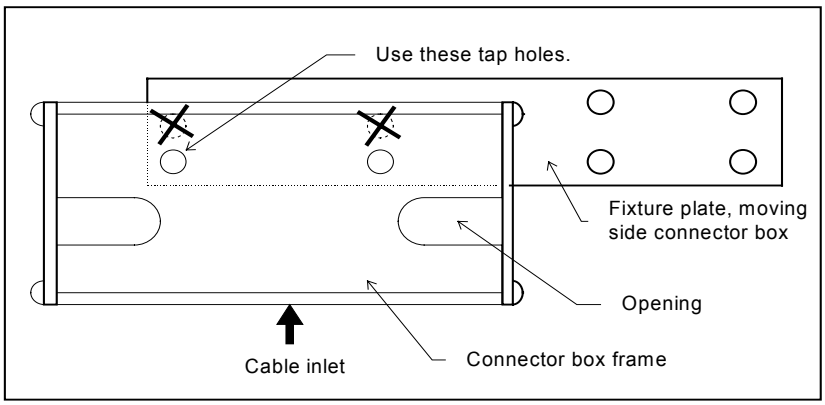
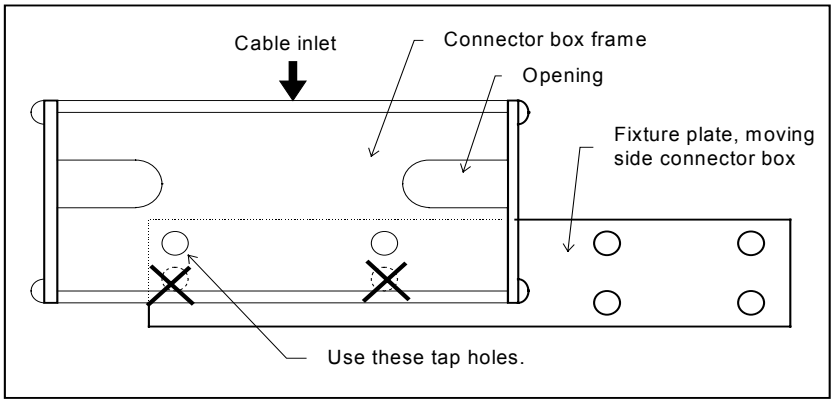


Figure 21-17: B type combination: Assembly of connector box (moving side) and fixture plate



◆ PD-HMz combination

- Description hereafter are assemble procedure of A type combination. For B type, though the orientation of main units and cable support are diferent from A type, fundamental procedures are the same.

- Table 21-18 below shows modification requirements of main unit prior to assembly for respective combination types

Table 21-18

	A	B
X axis main unit	Not necessary	Reverse cable position. *1
Z axis main unit	Reverse cable position. *1	Not necessary
Cable support	Not necessary	Modification of cable support *2

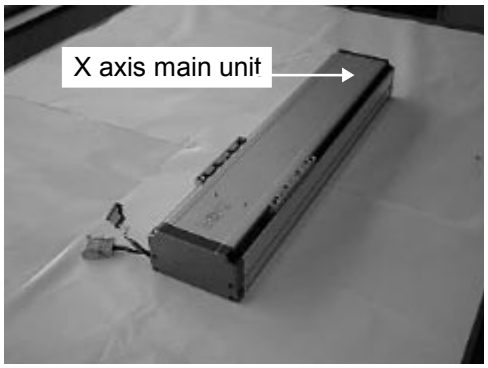
*1. Refer to "21.3. Reversing Main Unit Cable Position"

*2. Refer to "Modification of Cable Support."

◆ Assembly Process (A type)

1) Fix X axis main unit (PH module) to the mounting base.

Photo 21-34PD



2) Turn over Z axis main unit (PM module) and fix the combining bracket to its mounting surface. (M6 bolts: 4 places, tightening torque: 100 ~ 120 kgf·cm)
then secure the combing bracket firmly to the mounting face of slider of X axis main unit. (M8 bolts: 4 places, tightening torque: 280 ~ 340 kgf·cm)

Photo 21-35PD

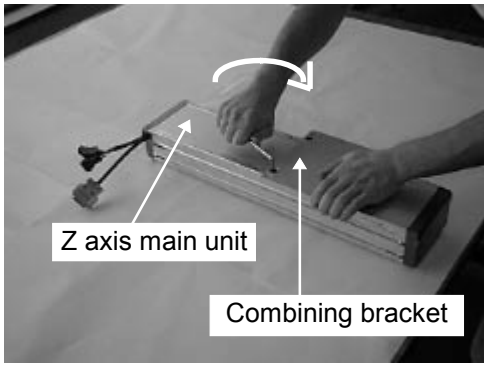
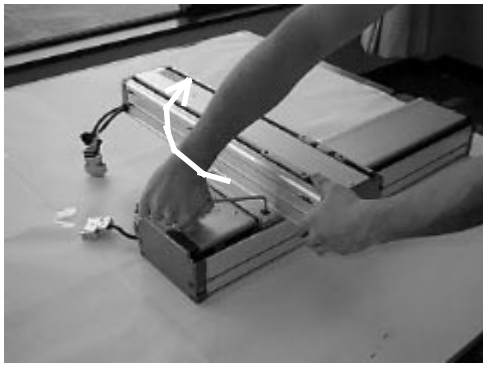


Photo 21-36PD



3) Attach the cable support to the main units. Be sure that all parts of the cable supports are ready.

Photo 21-37PD

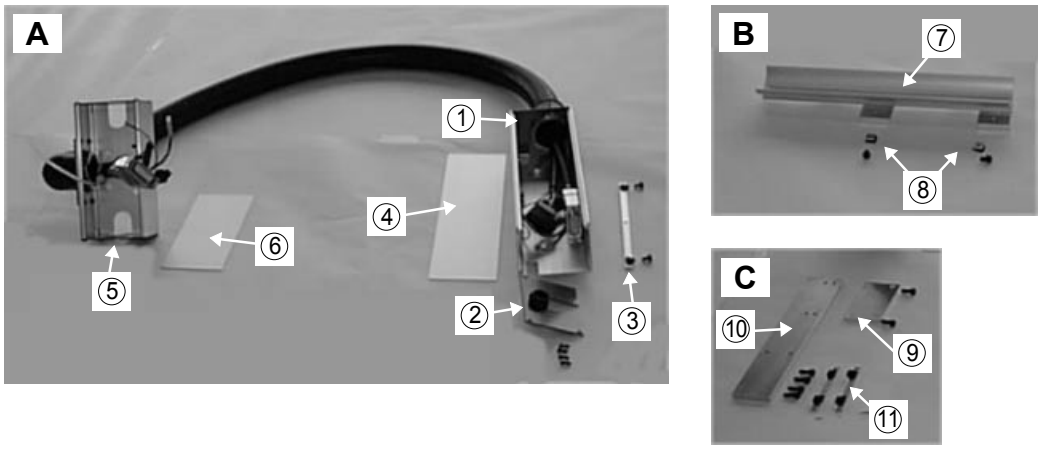


Table 21-19

Section	Name of section	Part number	Name of part	Quantity	Hexagon socket head cap screw
A	Cable support	①	Connector box frame, fixed side	1	
		②	End cover	1	M3 × 8 (4 bolts) *
		③	Plate nut	1	M4 × 6 (2 bolts) *
		④	Front cover	1	
		⑤	Connector box frame, moving side	1	
		⑥	Front cover	1	
B	Flexible tube guide	⑦	Flexible tube guide	1	
		⑧	Plate nut	2	M4 × 12 (2 bolts)
C	Fixture plate, moving side connector box	⑨	Spacer	1	
		⑩	Fixture plate, moving side connector box	1	M4 × 6 (2 bolts)
		⑪	Plate nut	2	M4 × 12 (4 bolts)

4) Unfasten bolts (4 places, M3 × 8) of the end cover of the moving side connctor box frame and disassemble it. (this cover has opening for additional cables.)

Photo 21-38PD

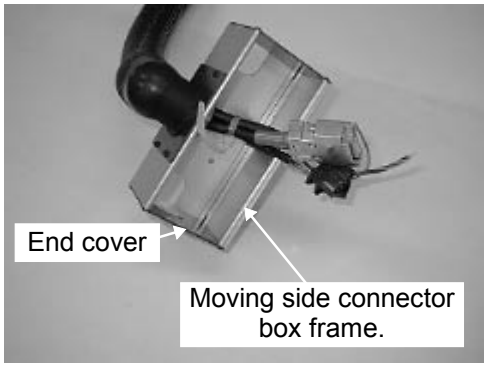
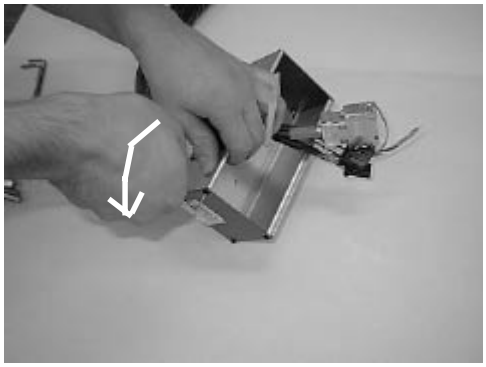


Photo 21-39PD



5) Assemble a fixture plate (part number ⑩) and moving side connector box.

◊ M4 × 6, 2 places, fastening torque: 1.7 ~ 2.0 N·m

◊ Use holes shown in Photo 21-40PD and 21-41PD.

Photo 21-40PD

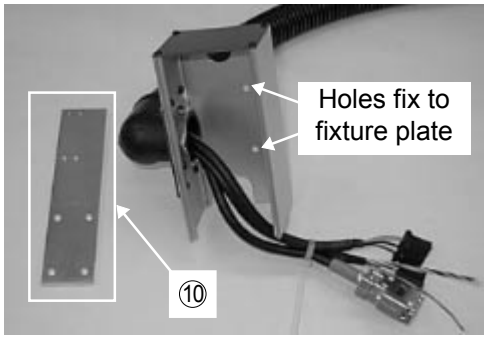
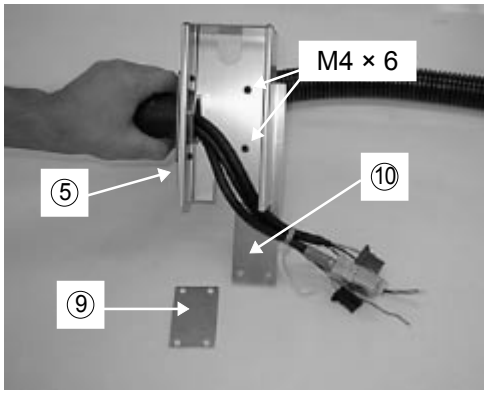


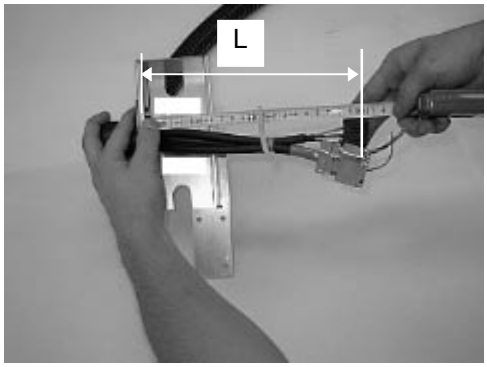
Photo 21-41PD

Photo 21-42PD



6) Adjust exposed length (L in Photo 21-43PD) of cables from the moving side connector box to 200 to 220 mm using an adding tape as shown in Photo 21-43PD.

Photo 21-43PD



7) Insert two plate nuts (part number ⑪ in Photo 21-37PD) to upper and lower T-slots of Z axis main unit at its cable side. Insert them as shown in Figure 21-18, turning stuck out sponge side up, pushing the nut upward angle. (Photo 21-44PD and 7-61)

Figure 21-18: How to insert plate nut to T-slot

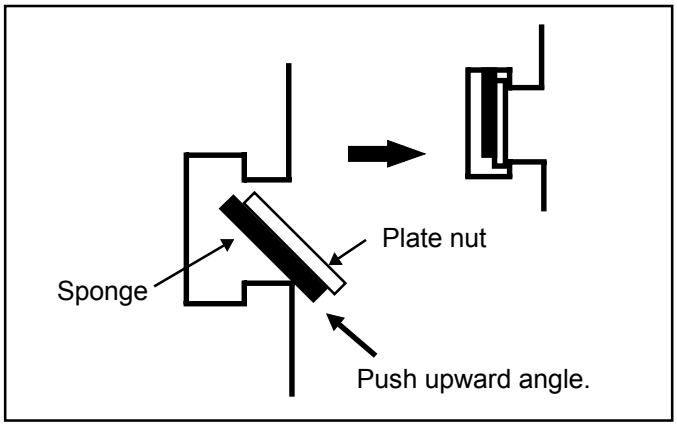


Photo 21-44PD

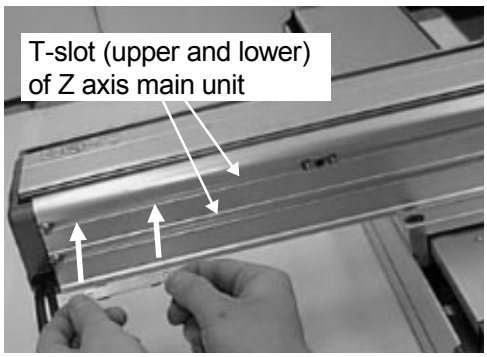
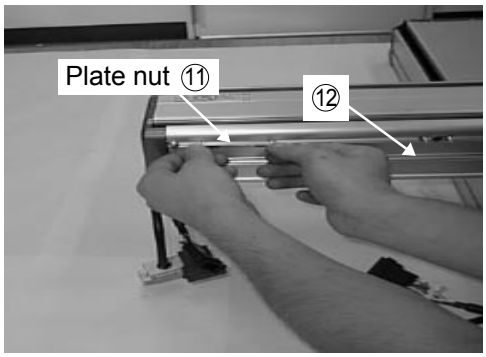
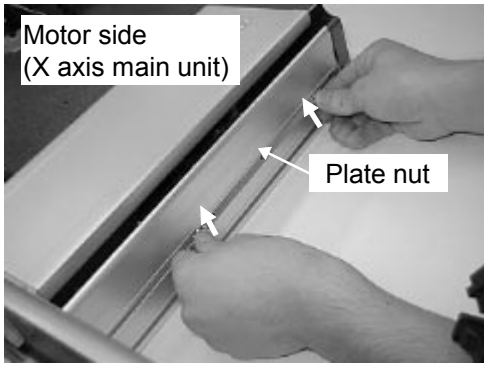


Photo 21-45PD



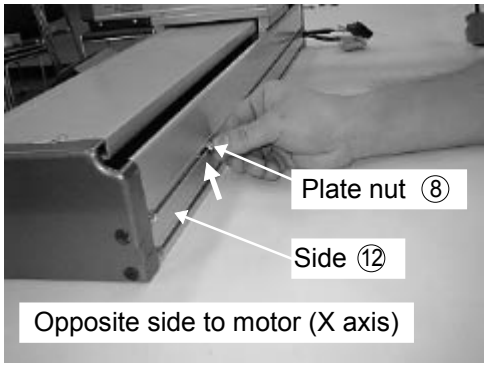
8) Insert a plate nut (part number ③ in Photo 21-37PD) to the upper T-slot of X axis main unit on motor side. As shown in Figure 21-18, push upward angle the nut, turning stuck out sponge side up.

Photo 21-46PD



9) Insert two plate nuts (part number ⑧ in Photo 21-37PD) to upper T-slot of X axis main unit at opposite to motor side. This procedure is the same as 7) and 8).

Photo 21-47PD



10) Attach the flexible tube guide (part number ⑦ in Photo 21-37PD) to X axis main unit. Loosely attach the flexible tube guide temporarily by bolts (M4 × 12, 4 places), then set it to the position L as shown in Photo 21-48PD from the end face of motor side using an adding tape. Tighten the bolts firmly. (Tightening torque: 1.7 ~ 2.0 N·m)

Photo 21-48PD

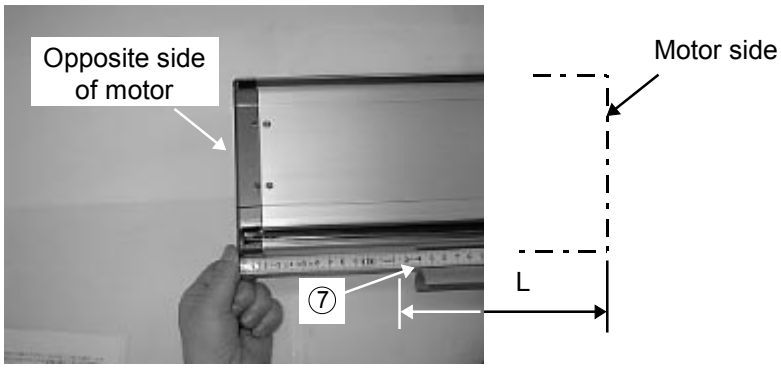


Table 7-14

X axis stroke [mm]	Reference number of cable support	L [mm]	
		Z axis stroke 100 ~ 300mm	Z axis stroke 400 ~ 600mm
100 ~ 400	XY-E183DHM110-1	650	600
500 ~ 800	XY-E183DHM111-1	1100	1100

11) Loosely screw in the moving side connector box frame to two plate nuts (part number ⑪ in Photo 21-37PD) inserted to upper and lower T-slots on the side of Z axis main unit through spacer (part number ⑨ in Photo 21-37PD). (M4 × 12, 4 places)

Photo 21-49PD

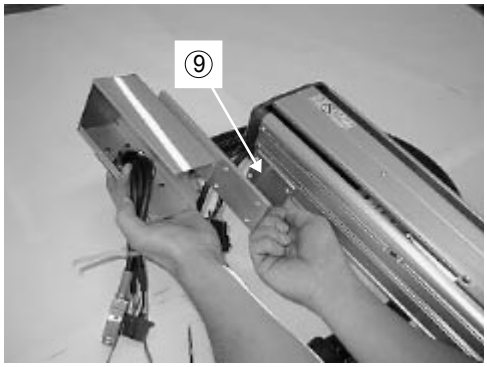
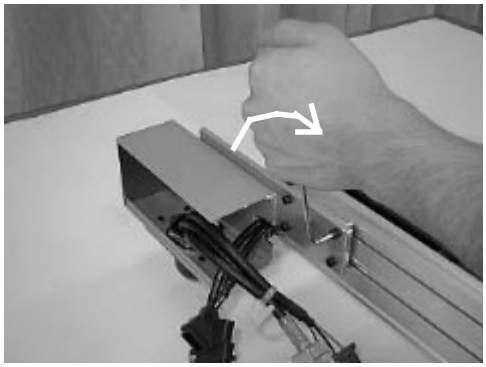


Photo 21-50PD



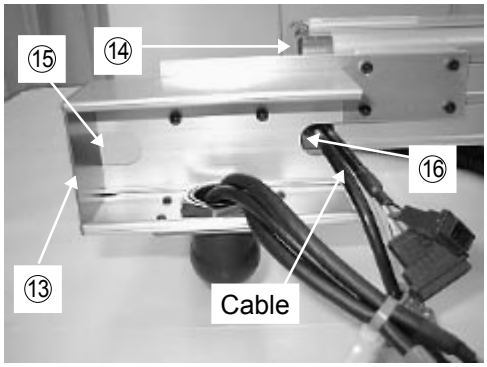
12) Position of moving side connector box (distance between its end cover ⑬ and end face of Z axis main unit ⑭ in Photo 21-51PD) must be set as shown below.

◊ Z axis stroke 300 mm or under: 124 mm

◊ Z axis stroke 400 ~ 600 mm : 0 (zero) (Flush with each other.)

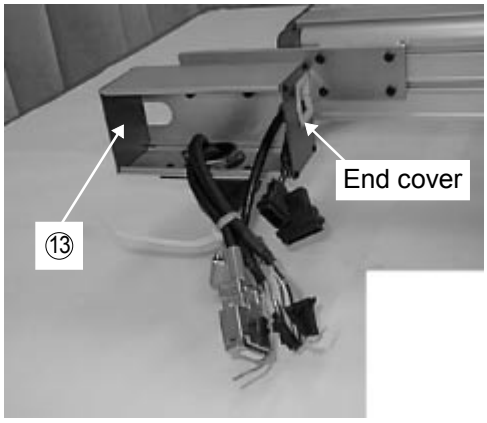
Pass Z axis cables through U shape opening ⑯, then tighten bolts.
(M14 × 12, tightening torque 1.7 ~ 2.0 N·m)

Photo 21-51PD



13) Loosely attach the end cover to moving side connector box frame. Loosen bolts of the other end cover ⑬. (M3 × 8, 4 places)

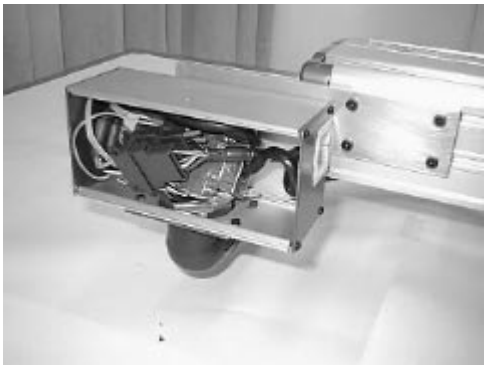
Photo 21-52PD



14) Connect the cables of main unit and cable support. There are three connectors, motor power, sensor and brake power connectors. Secure the sensor connector by tightening two screws.

Photo 21-53PD

Photo 21-54PD



15) Hook the edge of the front cover ⑥ to lower groove of moving side connector box frame and push it in by both thumbs.

Photo 21-55PD

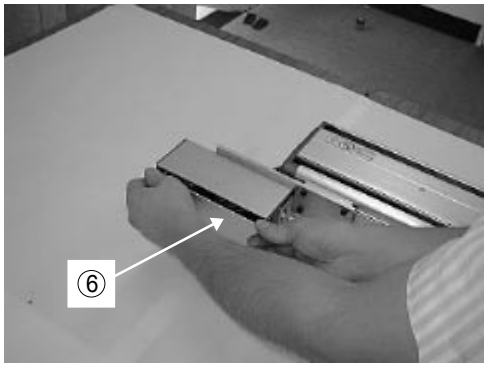
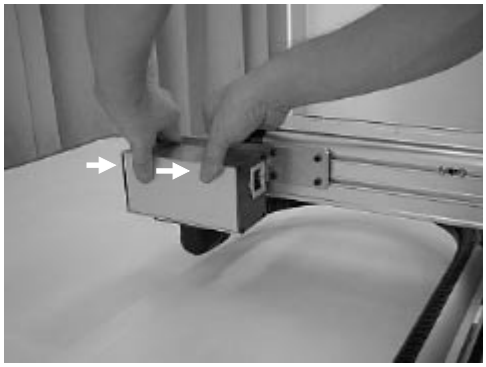
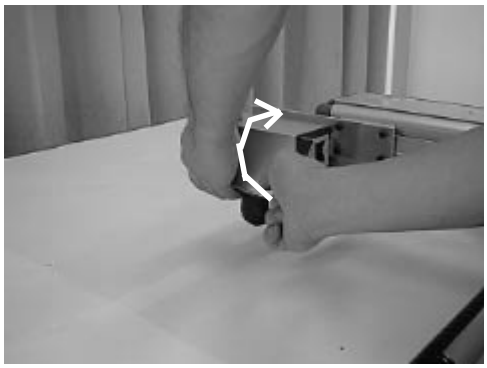


Photo 21-56PD



16) Secure the end covers of moving side connector box by bolts.
(Bolt size: M3 × 8, tightening torque: 0.6 ~ 0.8 N·m)

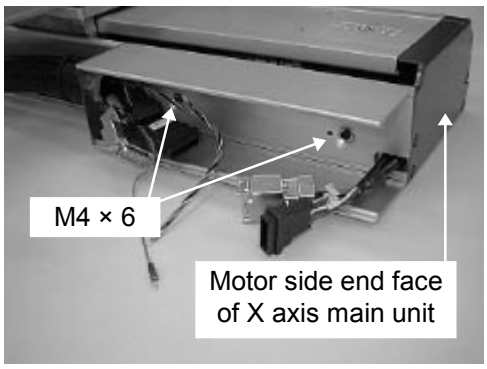
Photo 21-57PD



17) Fix the fixed side connector box frame (part number ① in Photo 21-37PD) to X axis main unit using the plate nut ((part number ③ in Photo 21-37PD) inserted to T-slot in the procedure 8) hereinabove.
(Bolt size: M4 × 6, 2 places, tightening torque: 1.7 ~ 2.0 N·m)

- ◊ Pass the cables of X axis through U shape opening of the connector box.
- ◊ Flush the right side face of connector box with the end face of the main unit motor side.

Photo 21-58PD



18) Affix the seals provided with the controller cable to identify the connectors for reference in multi-axis combination.
Seals for X, Y, Z and R axes are provided. Affix them to corresponding cables. For the controller cable, affix seals both for X and Z axes.

Photo 21-59PD

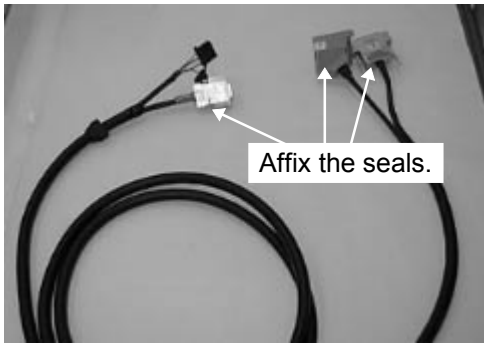
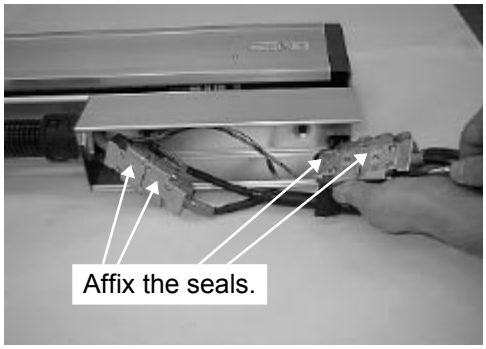
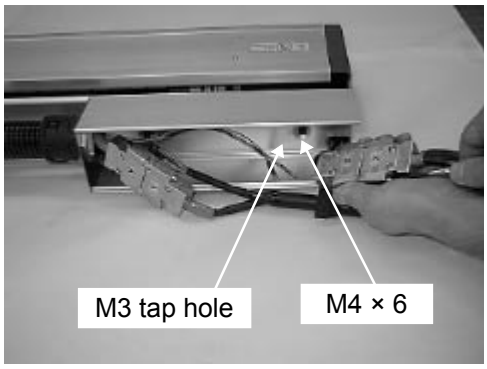


Photo 21-60PD



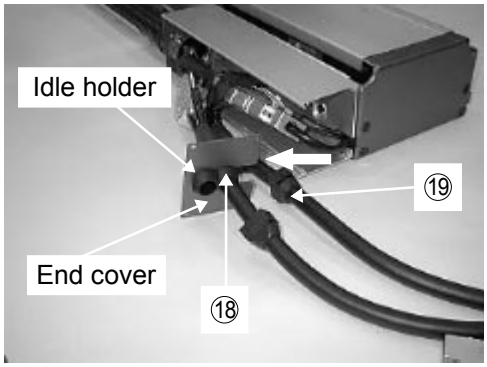
19) Connect X and Z axes connectors of the cable support and controller cable at the fixed side connector box. The round terminal of earth wiring (green) of cable support must be connected to M3 tap hole adjacent to M4 bolts. (Tightening torque: 0.6 ~ 0.8 N·m) This round ground terminal must be connected to the ground wiring of user's equipment when the user cable (6 rope-lay conductors) are added to the cable support.

Photo 21-61PD



20) Insert cable holders (⑱, ⑲ in Photo 21-37PD) of controller cable to the slot of end cover (part number ② in Photo 21-37PD), to where an idle holder is previously inserted. Insert Z axis cable holder ⑱ first, then X axis cable holder ⑲ next.

Photo 21-62PD



21) Loosely attach both end covers. (Photo 21-63PD) Fit the front cover (part number ④ in Photo 21-37PD) into the connector box frame. Hook its edge on lower grooves of the box frame and push it in by both thumbs as shown in Photo 21-65PD. Fix both end covers firmly. (Tightening torque: 0.6 ~ 0.8 N·m)

Photo 21-63PD

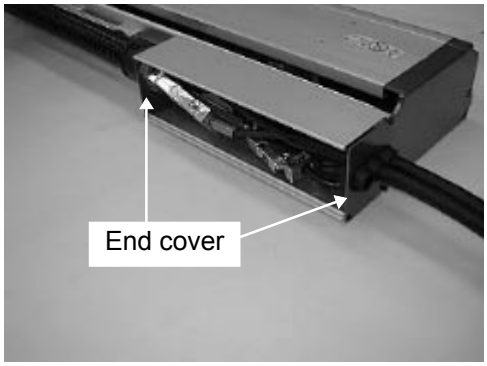
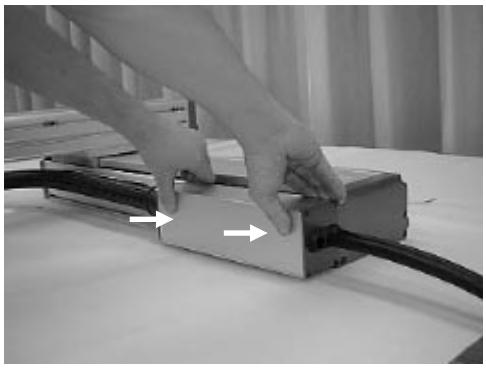


Photo 21-64PD

Photo 21-65PD



Installation of PD-HMz combination is completed.

Photo 21-66PD

22) Move X axis main unit frame manually in full stroke and check twist of the flexible tube and interference with the ancillaries. Take measures in Table 21-21 below if the flexible cable is twisted.

Table 21-21

No	Cause	Measures
1	Due to core set of flexible tube.	Make adjustment by twisting flexible tube. (Flexible tube can be rotated at tube connector.) Adjust at both ends.
2	Cables are twisted in the flexible tube.	Disassemble the fixed side connector box. Straighten the flexible tube to remove twist of the cables.
3	Affected by additional cables or air tube.	Shortening the flexible cable is effective when X axis stroke is 500 to 700 mm. (Refer to "21.8. Shortening Flexible Tube.") Addition of metal fixture (XY-P180CC-1) for fixing flexible tube is effective also.

23) After installation of a controller, connect the controller cable to it. (Refer to "6.3. Installation of EXEA Controller.") Confirm the affixed seals to the connectors in procedure 18) hereinabove.

24) Affix the seals to X and Z axis module main unit to indicate positions of Home and the mechanical stopper. (See Photo 21-1.)

- ◊ After completion of Home return motion, turn the power off and affix one of the seals provided with module main unit to indicate Home position. (Refer to "17.3.1. Home Return Operation.")
- ◊ Then move the slider manually to opposite stroke end, at where the slider makes contact with mechanical stopper, and affix the other seal to indicate location of the mechanical stopper.

Indication of mechanical stopper position will be referred for possibility of subsequent use of main unit when it collided to obstacles including the mechanical stopper.
(Refer to "14. Troubleshooting.")

21.7.4. RG-MS Combination

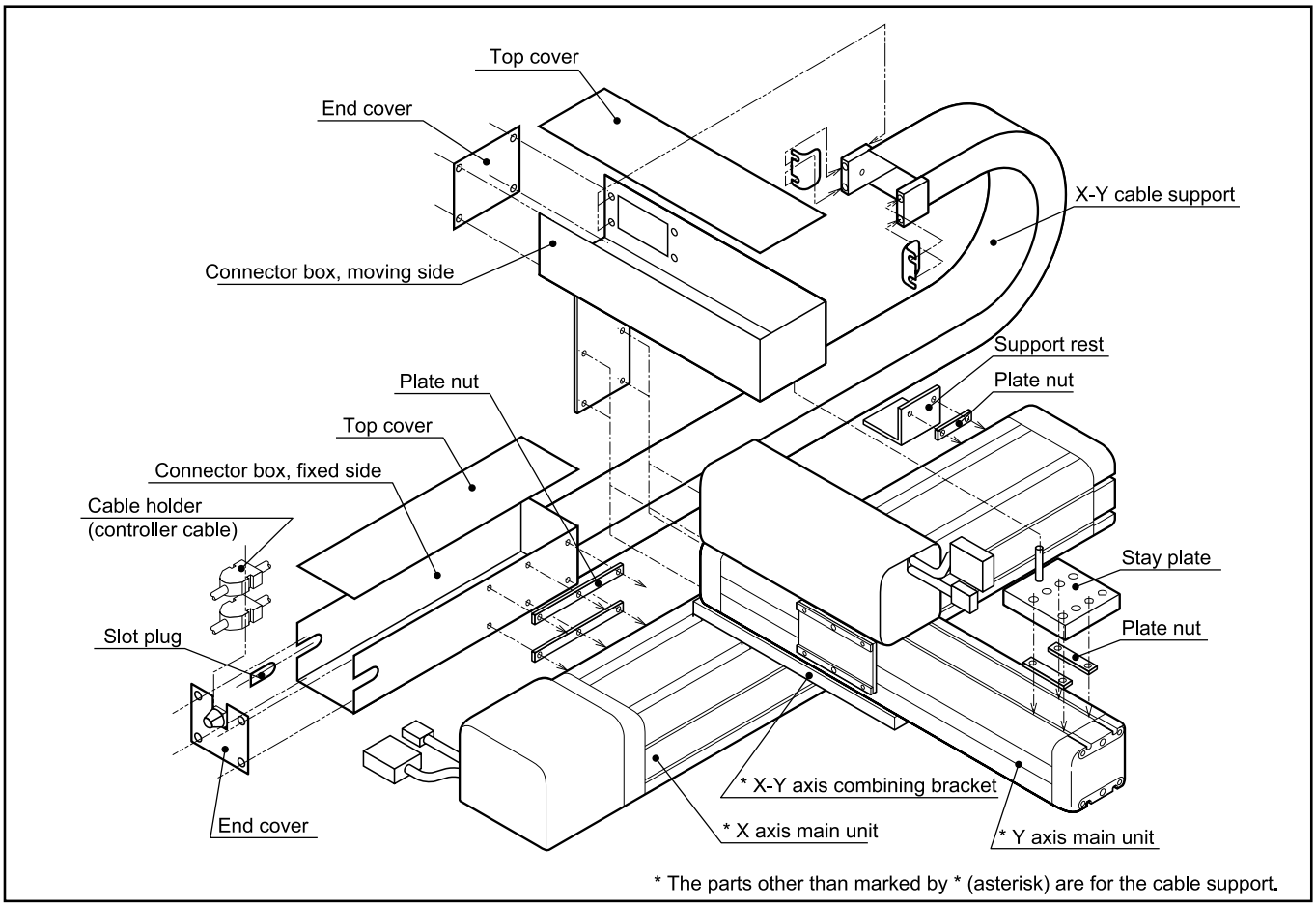
● Required parts are listed in Table 21-22 below. Confirm that all parts are ready.

Table 21-22

Name	Quantity	Reference number	Sections to be referred.
X axis main unit	1	XY-HRS0□5-RM200	3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications"
Y axis main unit	1	XY-HRS0□3-RS□04	
Controller	1	M-EXEA2-1100□00	1 Installation and Maintenance of the EXEA Controller "5. Reference Number and Specifications"
Teaching box	1	M-EXTB0□	
X-Y combining bracket			3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications"
A and C type	1	XY-P175GMS-1	
B and D type		XY-P175GMS-2	
Controller cable	2	XY-E185□□-1	
Cable support	1	XY-E173GMS02700-1	
Y axis built-in cable	1	XY-E173□□□-1	
Mounting bracket	2	XY-P170M-1 *	

* Mounting bracket is not necessary when a main unit is fixed to the mounting base from its bottom surface.

Figure 21-19



◆ RG-MS combination assemble procedures

- Following descriptions are the assembly procedures of A type. However, the procedures for B, C and D are fundamentally the same, though combining directions of main units and cable support are different.

1) Modifications of parts required for respective combination types are listed in Table 21-23 below. Position change of cable outlet of main unit and cable support are required for some multi-axis combination. Modify them before assembly. No modification is required for A type combination.

Table 21-23

	A	B	C	D
X axis main unit	Not necessary	Reverse of cable outlet position *1		Not necessary
Y axis main unit	Not necessary	Reverse of cable outlet position *1	Not necessary	Reverse of cable outlet position *1
Connector box, moving side	Not necessary			
Connector box, fixed side	Not necessary	Reverse of connector box *2 Reverse of L-fixture *3		Not necessary

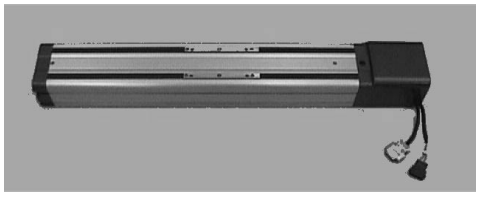
*1. Refer to "21.3. Reversing Main Unit Cable Position."

*2. Refer to "21.12. Reversing Connector Box."

*3. Refer to "21.12.3. Reversing L-fixture."

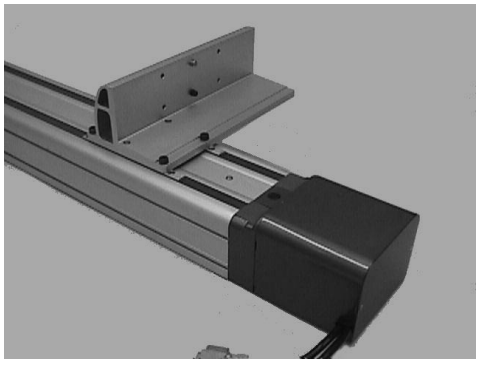
2) Fix X axis main unit to mounting base. (Photo 21-1RG)

Photo 21-1RG



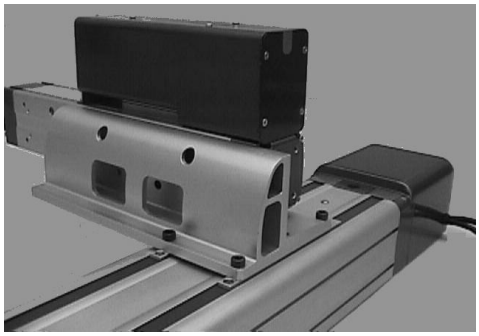
3) Fix X-Y combining bracket to the slider of X axis main unit.
(M6 bolts: 4 places, tightening torque: 9.8 ~ 11.8 N·m)

Photo 21-2RG



4) Fix Y axis main unit to the combining bracket.
(M5 bolts, 4 places, tightening torque: 4.9 ~ 5.9 N·m)

Photo 21-3RG



5) Attach the cable support to the main units and wire the cables. Be sure that all parts are ready. (Photo 21-4RG shows the parts.)

Photo 21-4RG

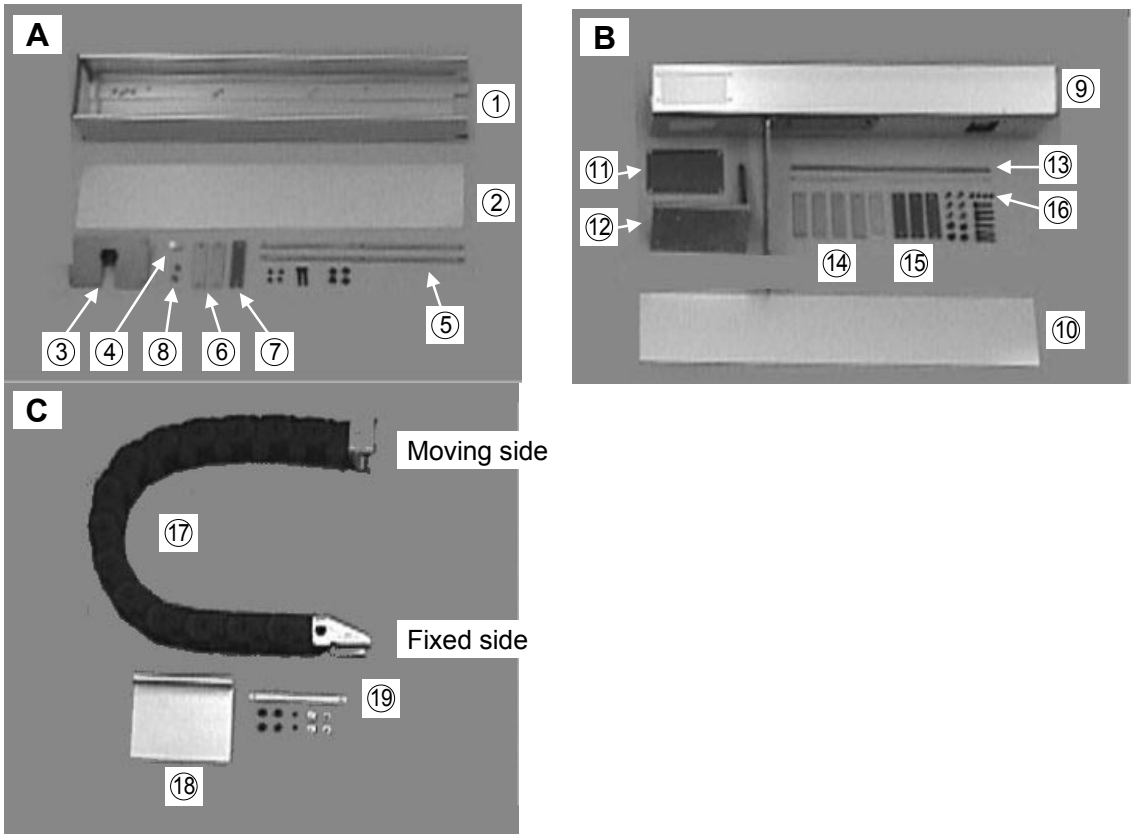
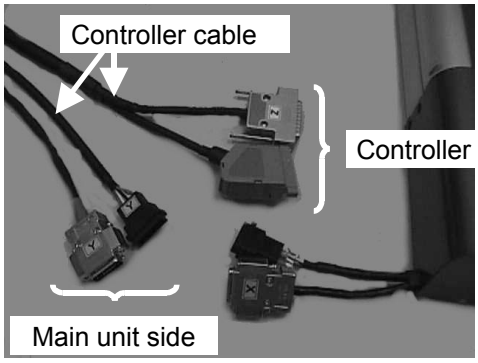


Table 21-24

Section	Name of section	Part No.	Name	Quantity	Hexagon socket head cap screw
A	Connector box, fixed side (attach to X axis)	①	Connector box	1	M5 × 10 (4 bolts)
		②	Top cover	1	
		③	End cover	1	
		④	Slot plug	1	
		⑤	Plate nut	2	M3 × 6 (6 bolts)
		⑥	Clamp base	2	
		⑦	Cable clamp	1	M4 × 20 (2 bolts)
		⑧	Spacer	2	
B	Connector box, moving side (attach to Y axis)	⑨	Connector box	1	M5 × 10 (9 bolts)
		⑩	Top cover	1	
		⑪	End cover	1	
		⑫	Stay fixture	1	
		⑬	Plate nut	2	M3 × 6 (4 bolts)
		⑭	Clamp base	4	
		⑮	Cable clamp	2	M4 × 20 (6 bolts)
		⑯	Spacer	4	
C	Cable support	⑰	X-Y cable support	1	M5, 6 × 10 (4 bolts each)
		⑱	Support rest	1	
		⑲	Plate nut	1	M3 × 6 (2 bolts)

6) Affix seals of X and Y axes, which are provided with the controller cable, to respective cable connectors.
(We recommend to affix the seals to the connectors to avoid miss-connection in multi-axis combination because the connector is common to all main units regardless their motor power specifications.)

Photo 21-5RG



7) Insert the plate nuts ⑤ to T slots on a side of X axis main unit from opposite side of the motor. (Photo 21-6RG)
Attach the fixed side connector ① to the main unit. (M3 × 6, 6 bolts)
(Photo 21-7RG)

Photo 21-6RG

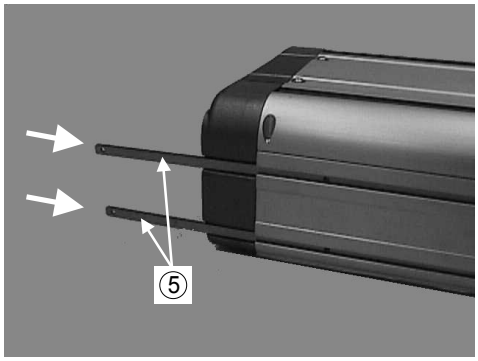
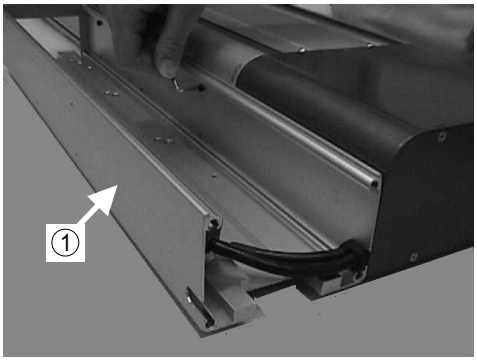


Photo 21-7RG



8) Insert the plate nuts, the same as the procedure 7), to T slots on a side of Y axis main unit from opposite side of the motor.
Fix the stay fixture ⑫ to the plate nuts temporally (M3 × 6, 4 bolts). (Photo 21-8RG)
Then fix L-fixture of moving side connector box to the end surface of Y axis main unit (M5 × 10, 4 bolts). (Photo 21-9RG)
Fix the connector box ⑨ to the stay (Photo 21-10RG) and secure the stay fixture to the plate nuts. (M3 bolts)

Photo 21-8RG

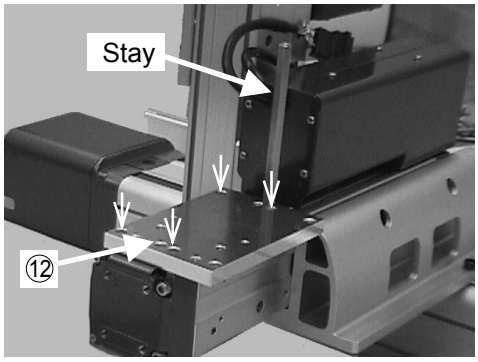


Photo 21-9RG

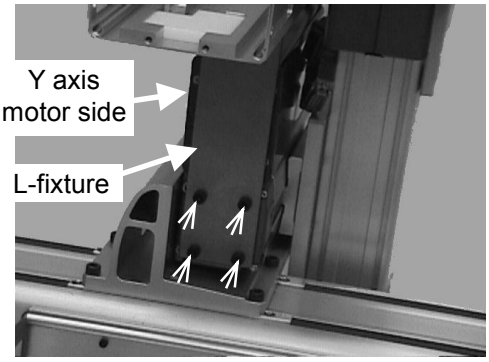
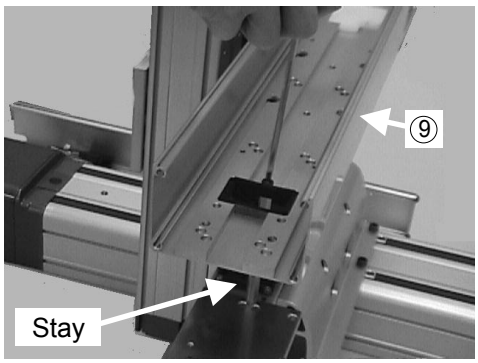
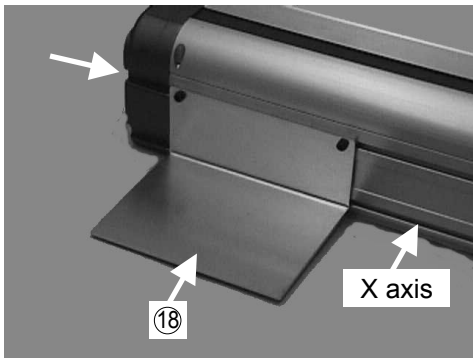


Photo 21-10RG



9) Attach the support rest ⑱ of cable support to the X axis main unit.
Insert the plate nuts to T slots, the same as the procedure 7), and fix the support rest ⑱. (M3 × 6, 2 bolts)

Photo 21-11RG



10) Pass the Y axis built-in cable through the cable support ⑰. (Be careful the direction of the cable. Photo 21-12RG)
Fix the cable to the connector box ①. (M6 × 10, 4 bolts) (Photo 21-13RG)

Photo 21-12RG

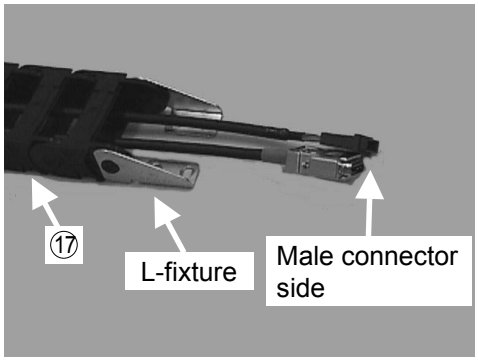
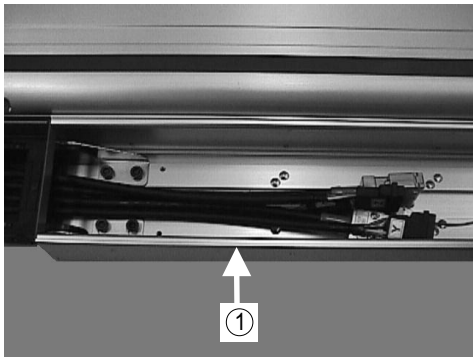


Photo 21-13RG



11) Fix the moving side of cable support to the moving side connector box ⑨.

(1) Unfasten the side bolts of each side of cable support and remove covers (a) and blocks (b) from the cable support temporally. (both sides of the cable support)
(Photo 21-14RG)

(2) Pass the cable support and the cables through an opening of the connector box, then fix the covers (a) and the blocks (b) to the cable support and fix the block to the connector box by the bolts. (M5, 2 bolts each side, Photo 21-15RG)

Photo 21-14RG

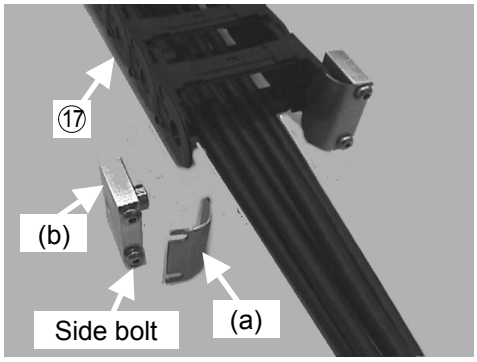
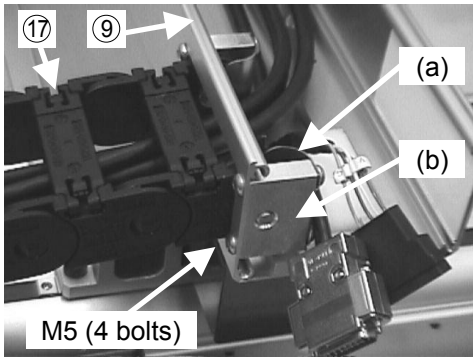


Photo 21-15RG



12) Pass the cables of Y axis main unit through the opening in the bottom of connector box ⑨ and connect to the built-in cables. (2 connectors)

◊ Motor connectors : Snap to the end.

◊ Encoder connectors: Secure them by 2 setscrews. (Photo 21-16RG)

Then fix the end cover ⑪. (M5 × 10, 4 bolts) (Photo 21-17RG)

Photo 21-16RG

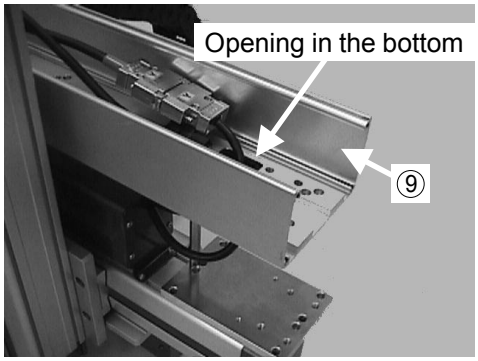
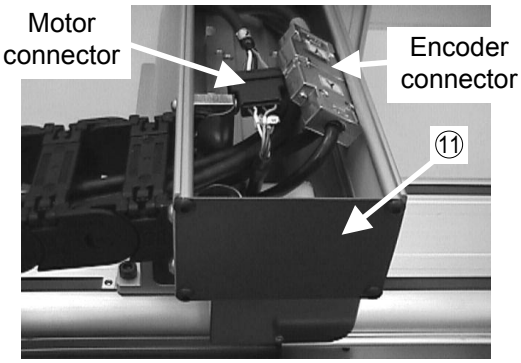


Photo 21-17RG



13) Connect the controller cables of both axes. (Photo 21-18RG)
Insert the slot plug ④ to the slot. Fix the end cover ③ to the connector box ①.
(M5 × 10, 4 bolts) Insert the cable holder to the groove in the order of Y and X axis controller cables. (Photo 21-18RG)

Photo 21-18RG

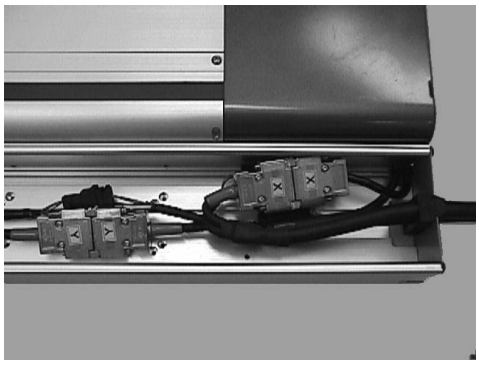
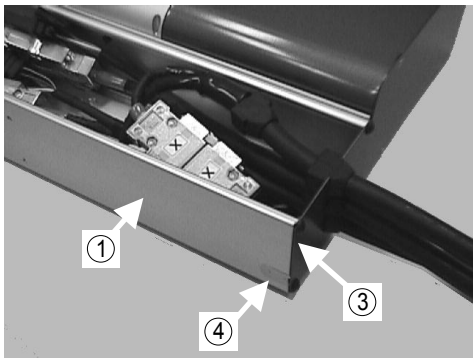
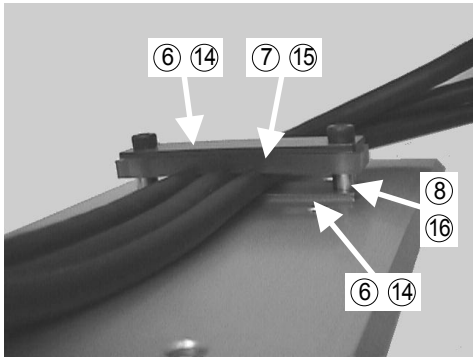


Photo 21-19RG



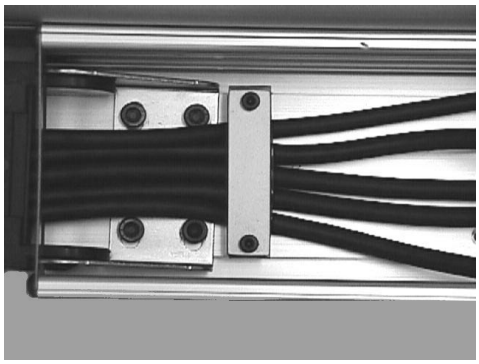
14) Set the cables loosely in the cable support so that they don't get a jerk. Set a large bending radius to the cables as much as possible in the connector boxes. Then clamp the cables to the connector boxes with the clamping parts ⑥ ~ ⑧ and ⑭ ~ ⑯.
(2 places: put the clamp base ⑥ on the connector box first, put the cables on it, then clamp them with the cable clamp ⑦.)

Photo 21-20RG



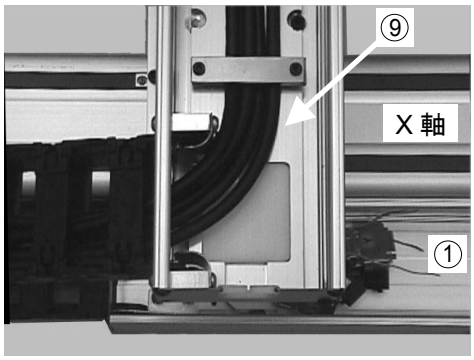
Details of clamping cables

Photo 21-21RG



Connector box, fixed side

Photo 21-22RG



Connector box, moving side

15) Fix the top covers to respective connector boxes. Loosen the bolts of both end covers, hook the edge of top cover to a groove on the side of connector box as shown in Photo 21-23RG and push the other side edge to other groove. Fasten both end covers. (Photo 21-24RG)

Photo 21-23RG

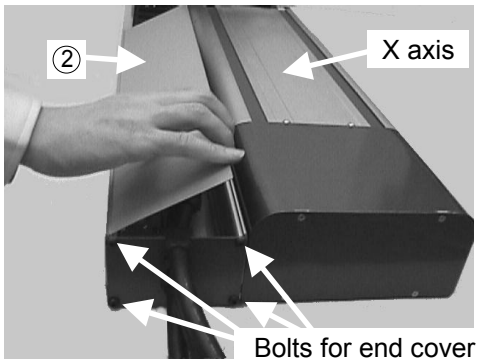
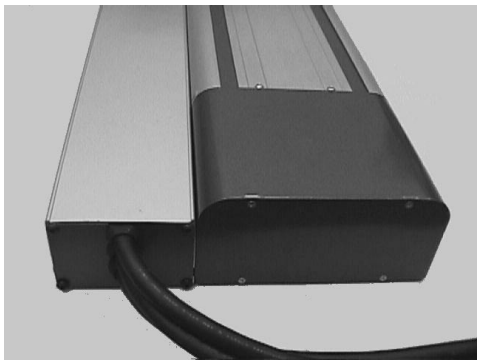
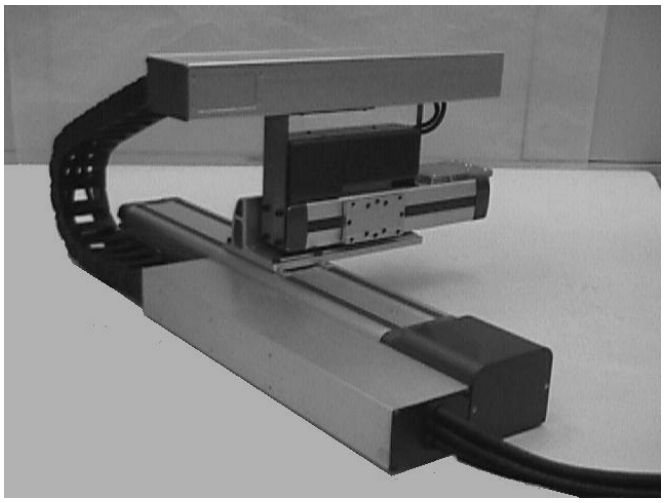


Photo 21-24RG



Completion of RG-MS combination

Photo 21-25RG



21.7.5. RG-HM Combination

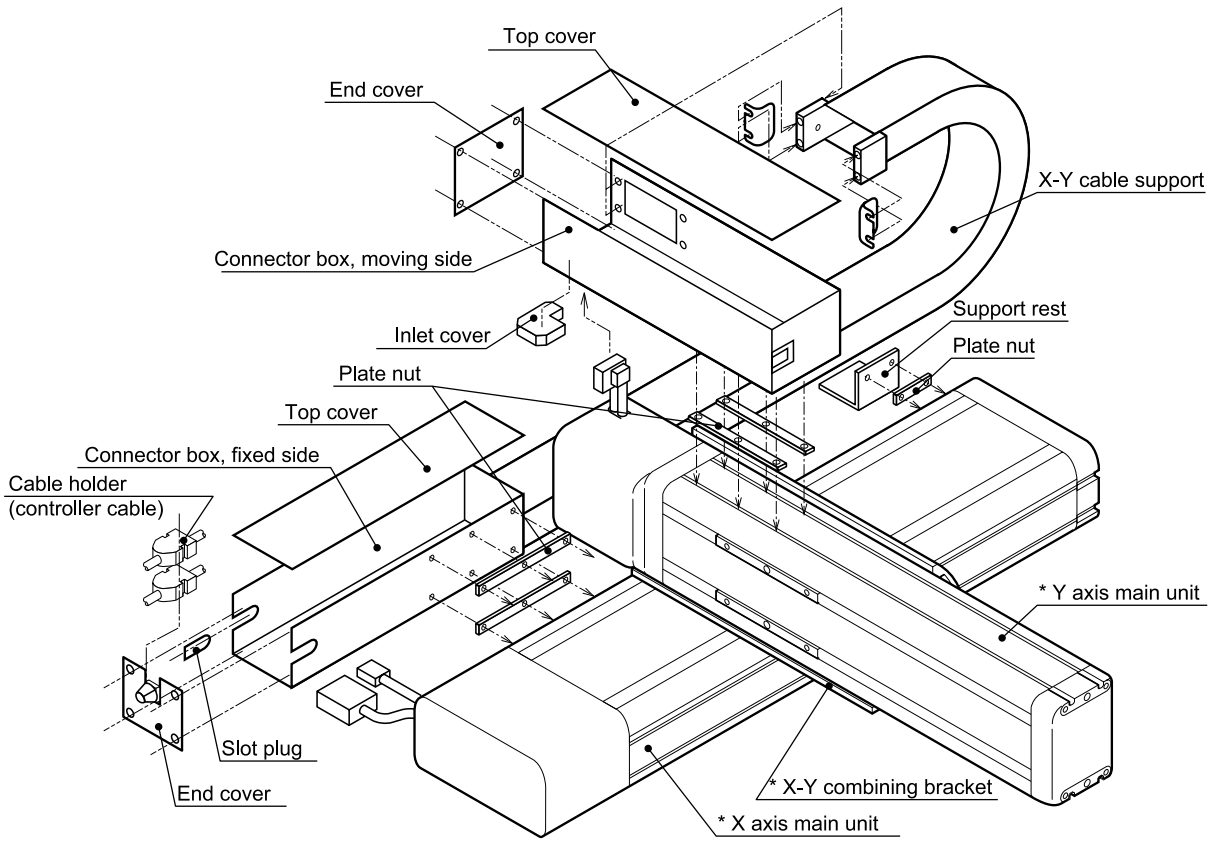
● Required parts are listed in Table 21-25 below. Confirm that the all parts are ready.

Table 21-25

Name	Quantity	Reference number	Sections to be referred.
X axis main unit	1	XY-HRS□□0-RH200	3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications"
Y axis main unit	1	XY-HRS0□5-RM200	
Controller	1	M-EXEA03-0210□00	1 Installation and Maintenance of the EXEA Controller "5. Reference Number and Specifications"
Teaching box	1	M-EXTB0□	
X-Y combining bracket			3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications"
A and C type	1	XY-P175GHM-1	
B and D type		XY-P175GHM-2	
Controller cable	2	XY-E185□□-1	
Cable support	1	XY-E173GHM02700-1	
Y axis built-in cable	1	XY-E173□□□-1	
Mounting bracket	2	XY-P170H-1 *	

* Mounting bracket is not necessary when a main unit is fixed to the mounting base from its bottom surface.

Figure 21-20



The parts other than marked by * (asterisk) are for the cable support.

◆ RG-HM combination assemble procedures

- Following descriptions are the assembly procedures for A type combination. However, the procedures for B, C and D type combinations are fundamentally the same, though combining directions of the main units and the cable support are different.

Table 21-26

	A	B	C	D
X axis main unit	Not necessary	Reverse of cable outlet position *1		Not necessary
Y axis main unit	Not necessary	Reverse of cable outlet position *1	Not necessary	Reverse of cable outlet position *1
Connector box, fixed side	Not necessary			
Connector box, moving side	Not necessary	Reverse of connector box *2		Not necessary

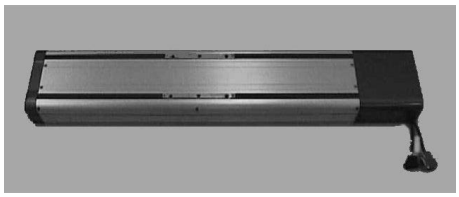
*1. Refer to "21.3. Reversing Main Unit Cable Position."

*2. Refer to " 21.12. Reversing Connector Box."

1) Required modifications of parts for respective combination types are listed in Table 21-26 below. Position change of cable outlet of main unit and cable support are required in some multi-axis combinations. Modify them before assembly.

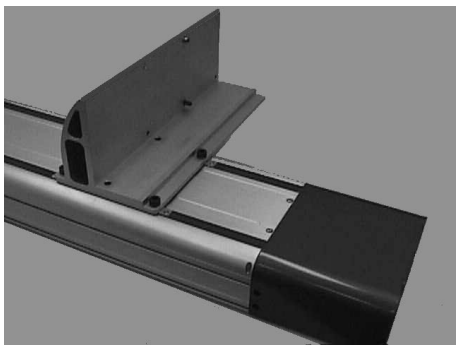
2) Fix X axis main unit to mounting base. (Photo 21-26RG)

Photo 21-26RG



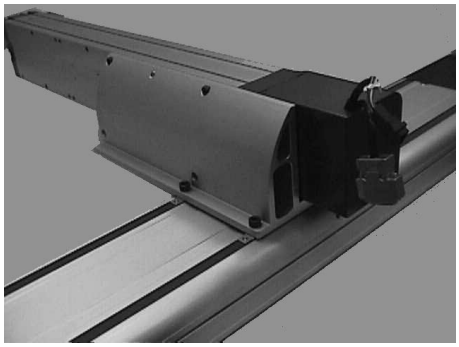
3) Fix the X-Y combining bracket to the slider of X axis main unit.
(M8 bolts: 4 places, tightening torque: 27.5 ~ 33.3 N·m)

Photo 21-27RG



4) Fix Y axis main unit to the combining bracket.
(M6 bolts, 4 places, tightening torque: 9.8 ~ 11.8 N·m)

Photo 21-28RG



5) Attach the cable support to the main units and wire the cables. Be sure that all parts are ready. (Photo 21-29RG shows the parts for the cable support.)

Photo 21-29RG

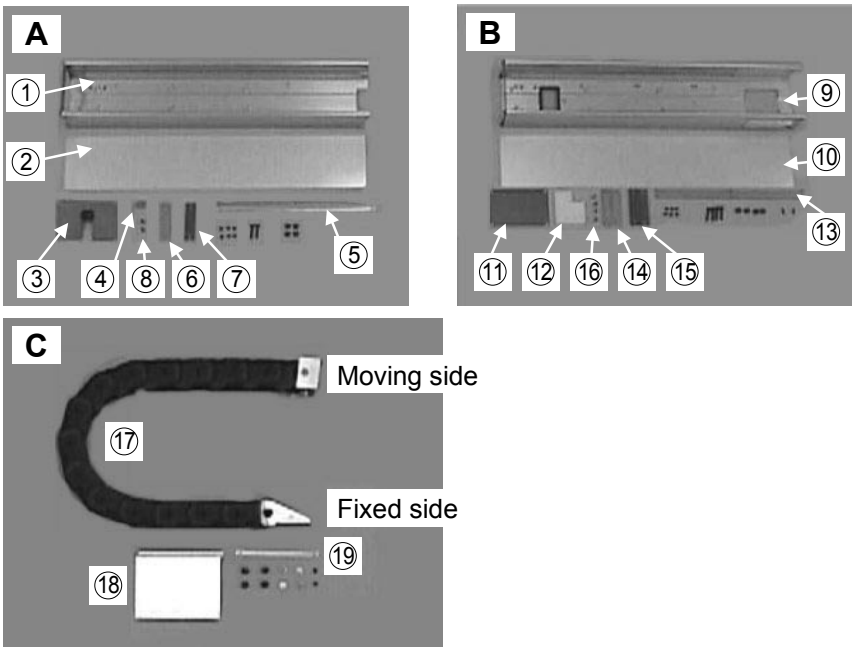
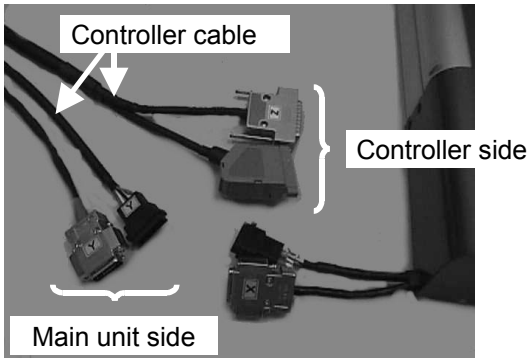


Table 21-24

Section	Name of section	Part No.	Name	Quantity	Hexagon socket head cap screw
A	Connector box, fixed side (attach to X axis)	①	Connector box	1	M5 × 10 (4 bolts)
		②	Top cover	1	
		③	End cover	1	
		④	Slot plug	1	
		⑤	Plate nut	2	M3 × 6 (6 bolts)
		⑥	Clamp base	2	
		⑦	Cable clamp	1	M4 × 20 (2 bolts)
		⑧	Spacer	2	
B	Connector box, moving side (attach to Y axis)	⑨	Connector box	1	M5 × 10 (4 bolts)
		⑩	Top cover	1	
		⑪	End cover	1	
		⑫	Inlet cover	1	M4 × 10 set screws (2 screws)
		⑬	Plate nut	2	M3 × 6 (6 bolts)
		⑭	Clamp base	4	
		⑮	Cable clamp	2	M4 × 20 (4 bolts)
		⑯	Spacer	4	
C	Cable support	⑰	X-Y cable support	1	M5, 6 × 10 (4 bolts each)
		⑱	Support rest	1	
		⑲	Plate nut	1	M3 × 6 (2 bolts)

10) Affix seals of X and Y axes, which are provided with the controller cable, to respective cable connectors.
(We recommend to affix the seals to the connectors to avoid miss-connection in a multi-axis combination because the connector is common to all main units regardless their motor power specifications.)

Photo 21-5RG



7) Insert the plate nuts ⑤ to T slots on a side of X axis main unit from opposite side of the motor. (Photo 21-30RG)
Attach the fixed side connector ① to the main unit. (M3 × 6, 6 bolts, Photo 21-31RG)

Photo 21-30RG

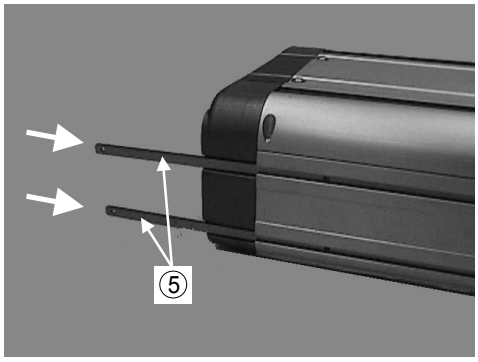
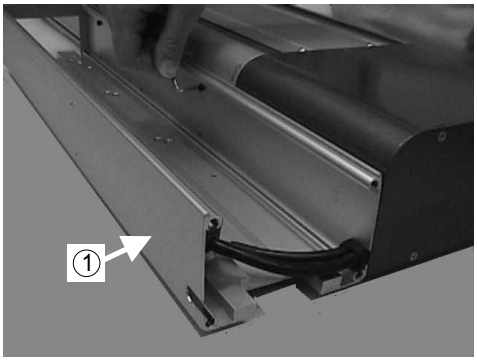


Photo 21-31RG



8) Insert the plate nuts, the same as the procedure 7), to T slots on a side of Y axis main unit from opposite side of the motor. Then fix the moving side connector box ⑨ to the main unit. Use bolt holes in the bottom as shown in Figure 21-21 to fix it. Locations of the bolt holes are different by combination type. Pass the cables through the opening of the connector box in its bottom. Attach the inlet cover to the connector box as show in Photo 21-33RGand fix it from end side of the main unit. (M4 × 10, 2 screws, hexagon socket set crews)

Figure 21-21

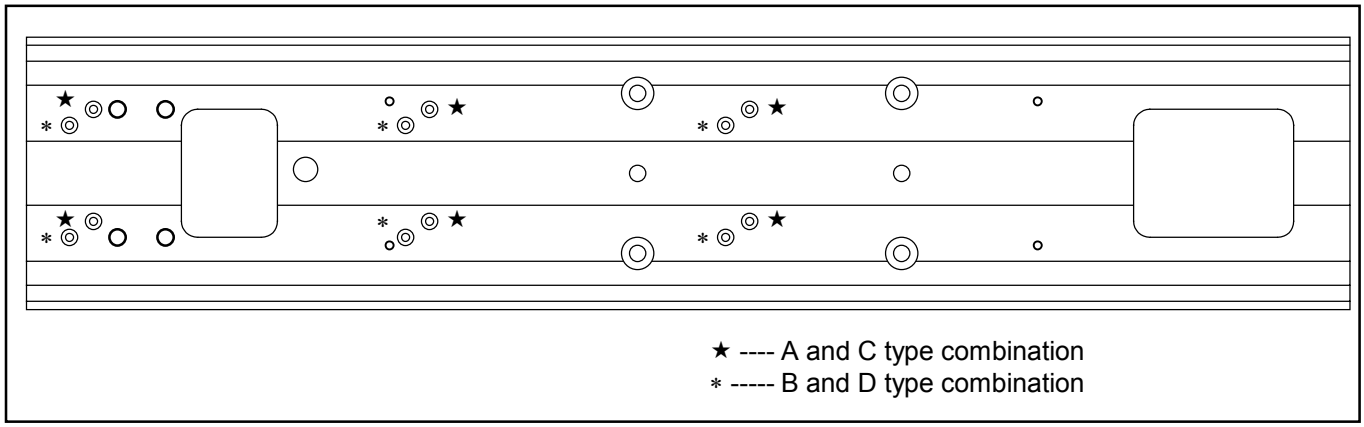


Photo 21-32RG

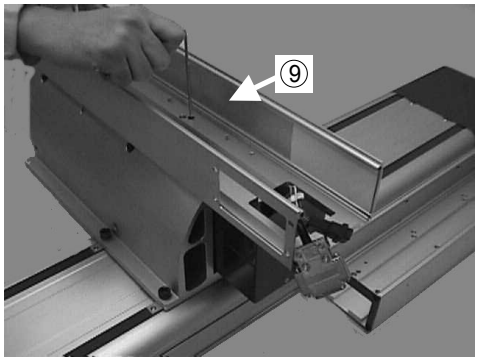
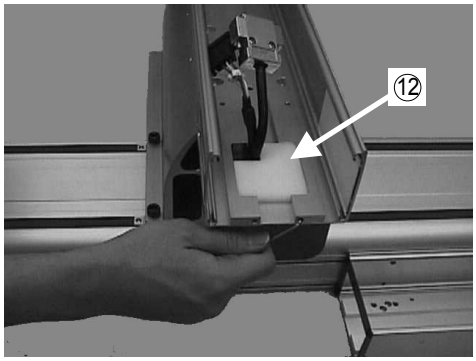
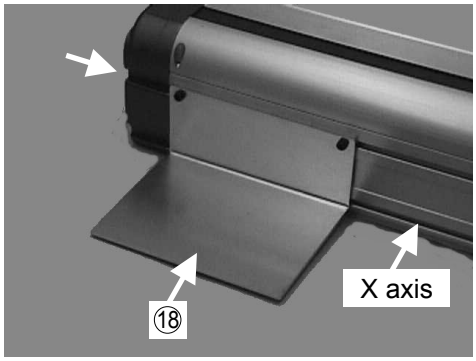


Photo 21-33RG



9) Fix the support rest ⑱ to the X axis main unit. Insert the plate nuts as the same way as the procedure 7) and secure it by M3 × 6 bolts. (two bolts)

Photo 21-34RG



10) Pass the Y axis built-in cable through the cable support ⑰. (Be careful the direction of the cable. Photo 21-35RG)
Fix the cable to the connector box ①. (M6 × 10, 4 bolts) (Photo 21-36RG)

Photo 21-35RG

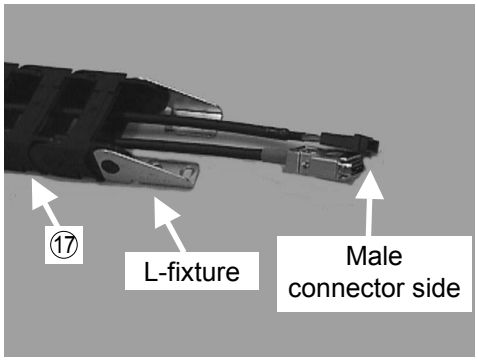
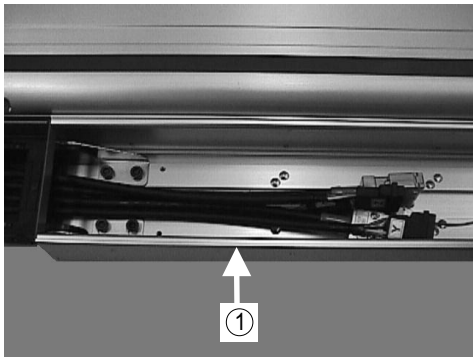


Photo 21-36RG



11) Fix the moving side of cable support to the connector box of moving side ⑨.

(1) Unfasten side bolts of each side of cable support and remove covers (a) and blocks (b) from the cable support temporally. (both sides of the cable support)
(Photo 21-37RG)

(2) Put the cable support and the cables through an opening of the connector box, then fix the covers (a) and the blocks (b) to the cable support and fix the block to the connector box by the bolts. (M5, 2 bolts each side)
(Photo 21-38RG)

Photo 21-37RG

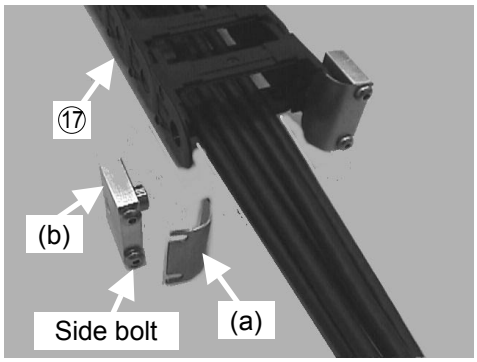
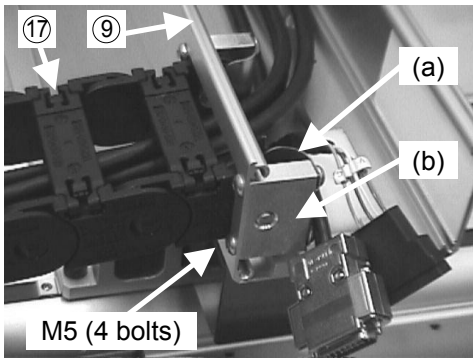


Photo 21-38RG



12) Pass the cables of Y axis main unit through the opening in the bottom of connector box ⑨ and connect to the built-in cables. (2 connectors) (Photo 21-39RG)

◊ Motor connectors : Snap to the end.

◊ Encoder connectors: Secure them by 2 setscrews.

Then fix the end cover ⑪. (M5 × 10, 4 bolts) (Photo 21-40RG)

Photo 21-39RG

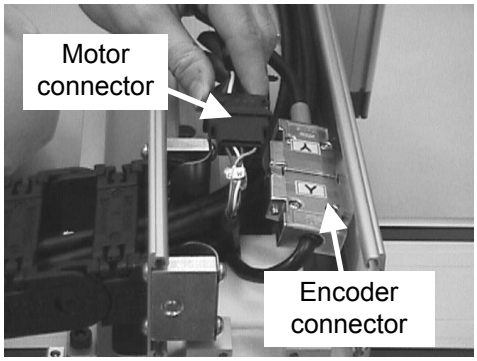
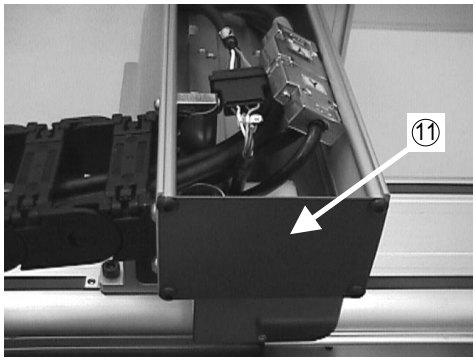


Photo 21-40RG



13) Connect the controller cables of both axes. (Photo 21-41RG)
Insert the slot plug ④ to the slot. Fix the end cover ③ to the connector box ①.
(M5 × 10, 4 bolts) Insert the cable holders to the groove in the order of Y and X axis controller cables. (Photo 21-42RG)

Photo 21-41RG

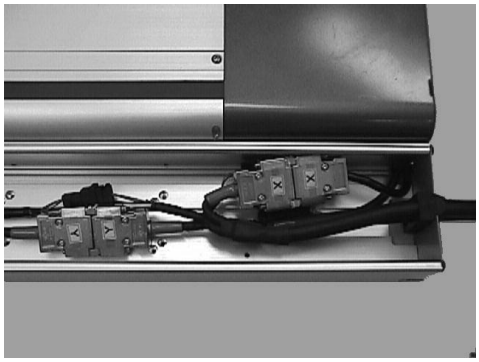
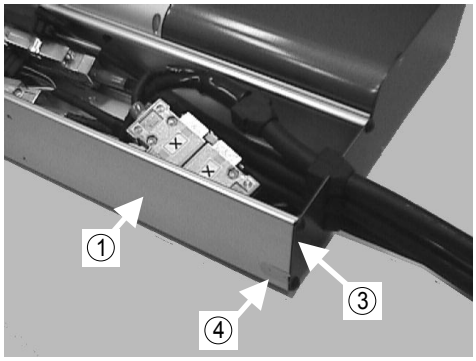
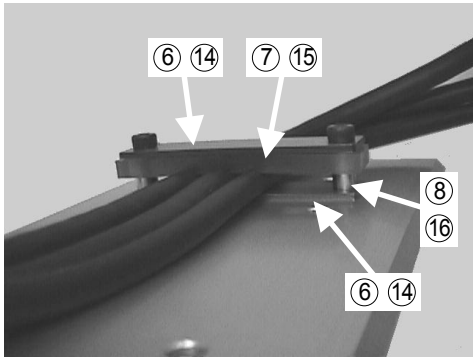


Photo 21-42RG



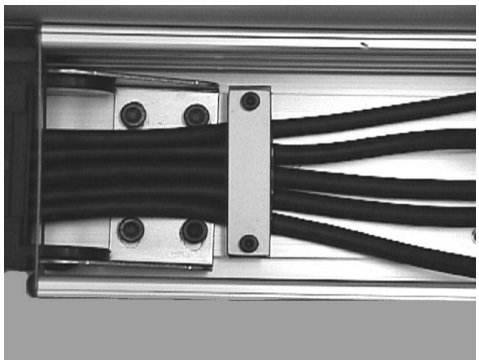
14) Place the cables loosely in the cable support so that a full stroke operation does not jerk the cables. Set a large bending radius to the cables as much as possible when fix them to the connector boxes. Then fasten them with the clamping parts ⑥ ~ ⑧ and ⑭ ~ ⑯.
(2 places: put the clamp base ⑥ under the cables , set the cables on it and clamp them with the cable clamp ⑦.)

Photo 21-43RG



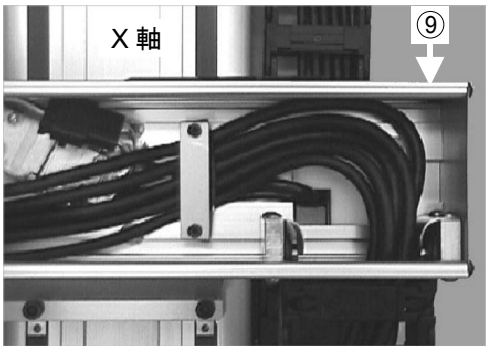
Details of clamping cables

Photo 21-44RG



Connector box, fixed side

Photo 21-45RG



Connector box, moving side

15) Fix the top covers to respective connector boxes.
Loosen the bolts of both end covers, hook the edge of top cover to a groove on the side of connector box as shown in Photo 21-46RG and push the other side edge to other groove. Fasten both end covers. (Photo 21-47RG)

Photo 21-46RG

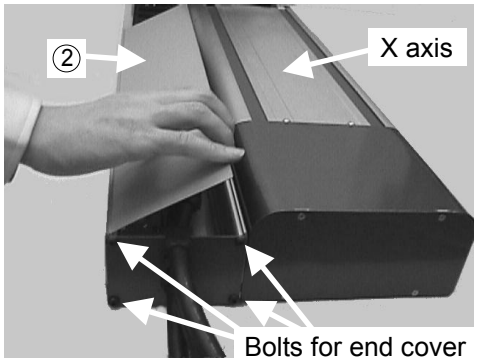
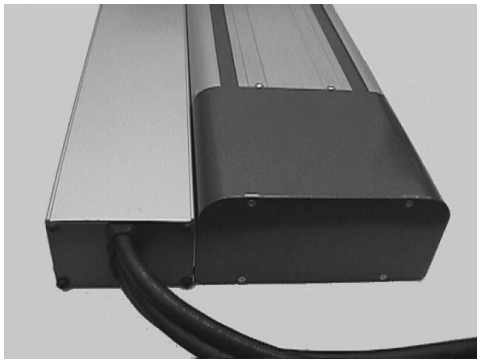
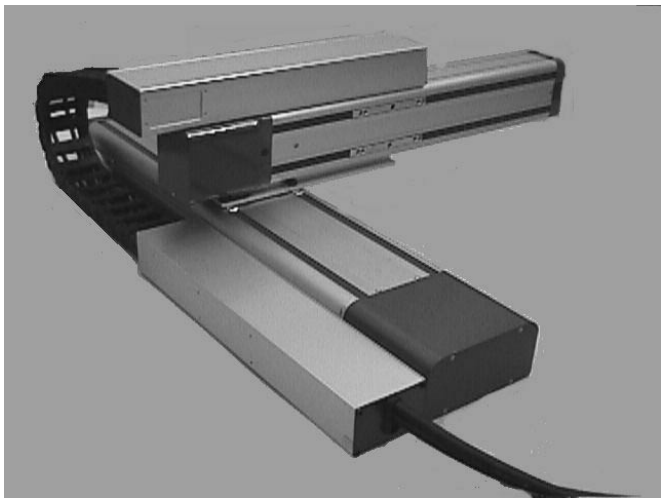


Photo 21-47RG



Completion of RG-HM combination

Photo 21-48RG



21.7.6. RD-MS Combination

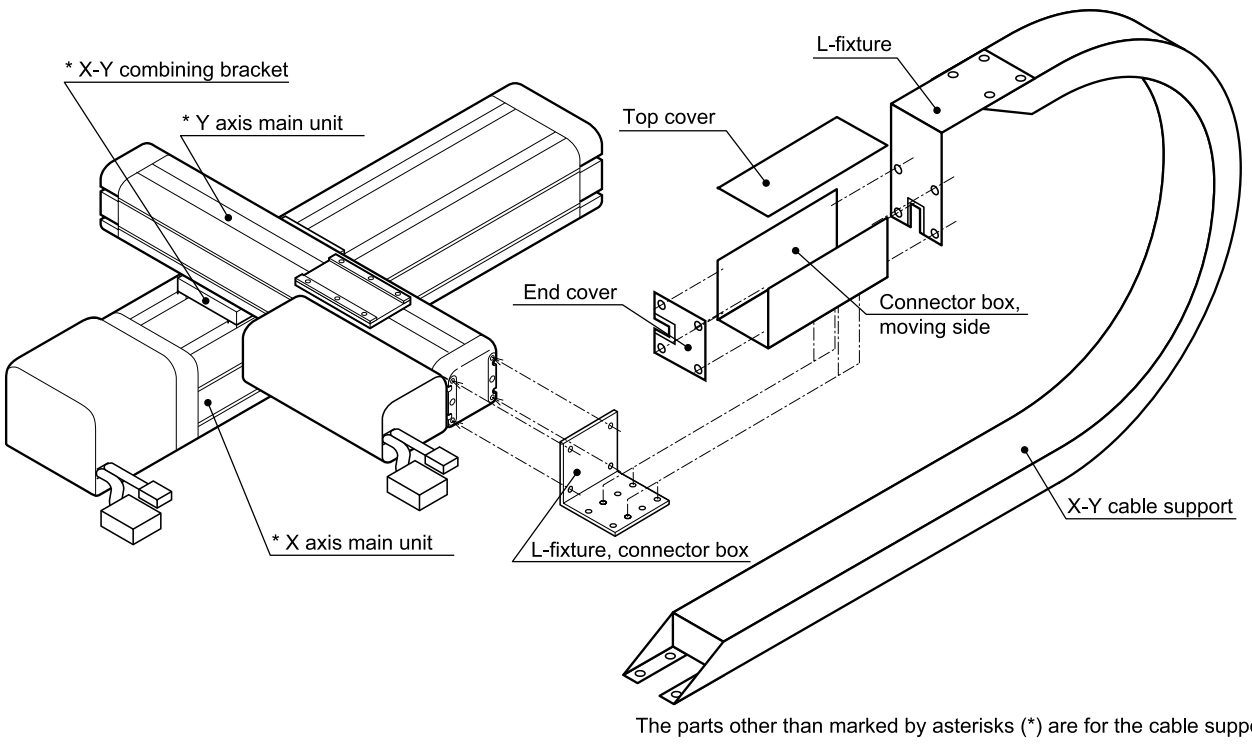
- The parts required for RD-MS combination are listed in Table 21-28 below. Confirm that all parts are ready.

Table 21-28

Name	Quantity	Reference number	Sections to be referred.
X axis main unit	1	XY-HRS0□5-RM200	3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications
Y axis main unit	1	XY-HRS0□3-RS□□□	
Controller	1	M-EXEA2-0110□00	1 Installation and Maintenance of the EXEA Controller "5. Reference Number and Specifications"
Teaching box	1	M-EXTB0□	
X-Y combining bracket	1	XY-P175DMS-1	3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications
Controller cable	2	XY-E185□□-1	
Cable support	1	XY-E173DMS01900-1	
Y axis built-in cable	1	XY-E173020-1	
Mounting bracket	2	XY-P170M-1 *	

* This bracket is not necessary when fixing a main unit from its bottom.

Figure 21-22



◆ Assembly procedure of RD-MS combination

- Following description is the assembly procedures for A type combination. However, the procedures for B, C and D type are fundamentally the same, though the combining directions of the main units and the cable support are different.

1) Modifications of the cable support required for A type combination types. Modify it beforehand.

Table 21-29

	A	B
X axis main unit	Reversing main unit cable position *1	Not necessary
Y axis main unit	Not necessary	
Connector box, moving side	Not necessary	

*1. Refer to "21.3. Reversing Position of Main Unit Cable.

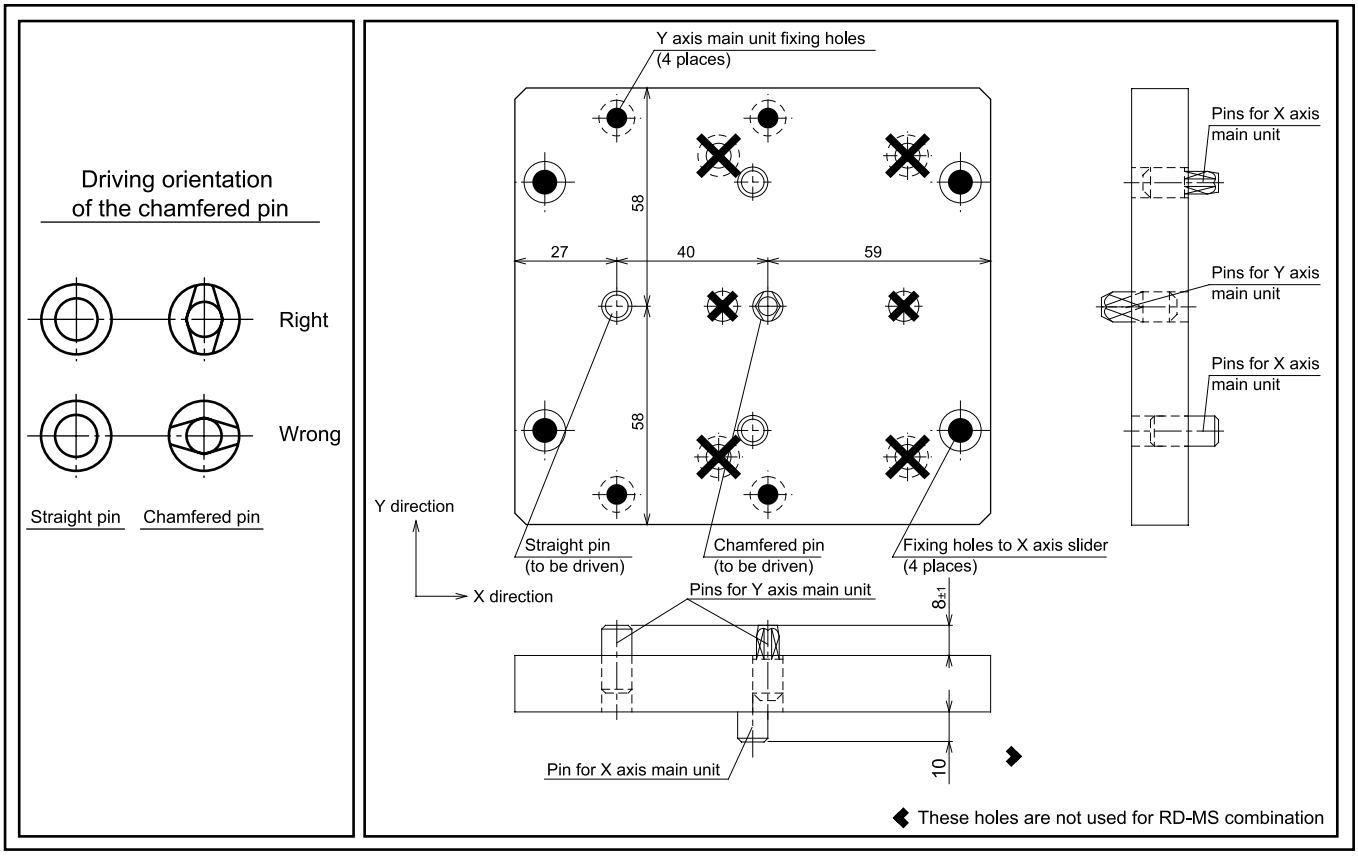
2) Drive pins to Y-Z axis combining bracket.

- Drive a chamfered pin and a straight pin with a plastic hammer into the bracket on the position as shown in lower left of Figure 21-23. The pins are provided with the bracket.

Caution : *• When driving the chamfered pin, be careful with its orientation. (See the figure at lower left.)*

• Be careful not to push in the pin for Y axis on the back of the bracket when driving the chamfered pin and the straight pin.

Figure 21-23

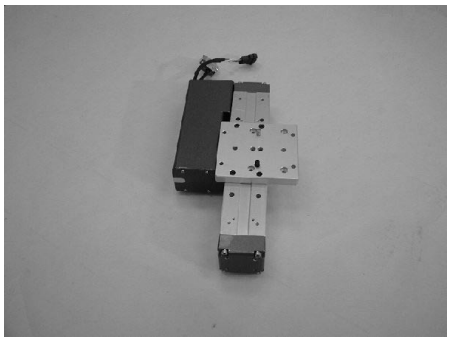


3) Fix the X axis main unit to the mounting base referring to "21.4. Fixing Module Main Unit."

Photo 21-1RD

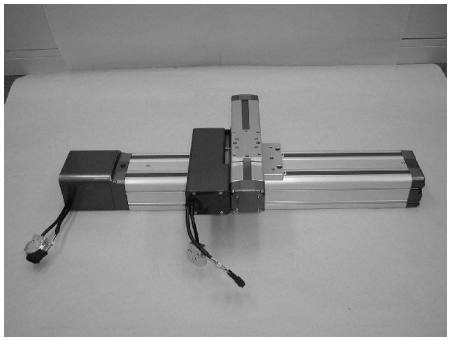
4) Turn the main unit over and attach the X-Y combining bracket.
(M5, 4 bolts, tightening torque: 4.9 ~ 5.9 N·m) (Photo 21-2RD)

Photo 21-2RD



5) Fix the Y axis main unit with the combining bracket to the slider of the X axis main unit.
(M6, 4 bolts: tightening torque: 9.8 ~ 11.8 N·m)

Photo 21-3RD



6) Fix the cable support to the main units. The required parts are listed in Table 21-30. Confirm that all parts are ready.

Photo 21-4RD

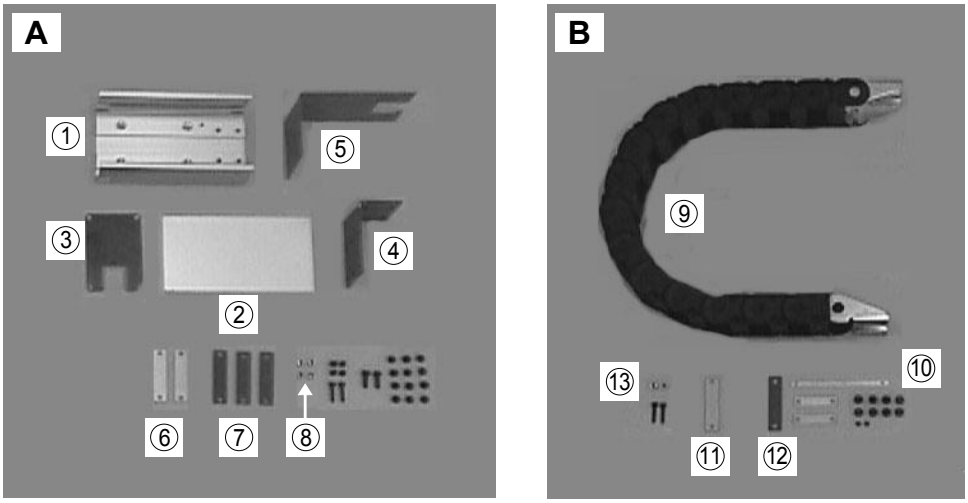
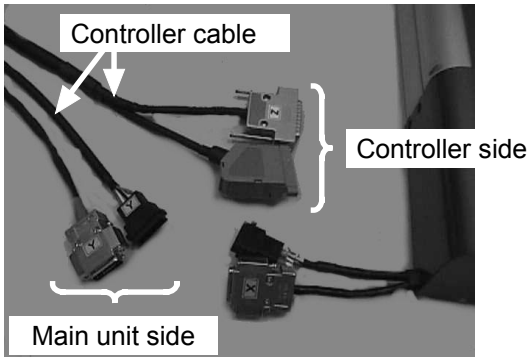


Table 21-30

Section	Name of section	Part No.	Name	Quantity	Hexagon socket cap screw
A	Connector box, moving side (Fix to Y axis main unit)	①	Connector box	1	M4 × 10 (4 bolts)
		②	Top cover	1	
		③	End cover	1	M5 × 10 (4 bolts) M4 × 10 (4 bolts)
		④	L-fixture (to fix the connector box)	1	M5 × 10 (4 bolts)
		⑤	L-fixture	1	M5 × 10 (4 bolts)
		⑥	Clamp base	3	M5 × 16 (2 bolts)
		⑦	Cable clamp	2	M4 × 20 (2 bolts)
		⑧	Spacer	4	
B	Cable support	⑨	X-Y axis cable support	1	M6 × 10 (4 bolts)
		⑩	Plate nut	2	M6 × 10 (4 bolts)
		⑪	Clamp base	1	
		⑫	Cable clamp	1	M4 × 20 (2 bolts)
		⑬	Spacer	2	

7) Affix seals of X and Y axes, which are provided with the controller cable, to respective cable connectors.
(We recommend to affix the seals to the connectors to avoid miss-connection because the connector is common to all main units regardless their motor power specifications.)

Photo 21-5RD



8) Attach the L-fixture ④ to the side of Y axis main unit (M5 × 10, 4 bolts) (Photo 21-6RD) and fix the connector box ① to the L-fixture. (M4 × 10, 4 bolts) (Photo 21-7RD)

Photo 21-6RD

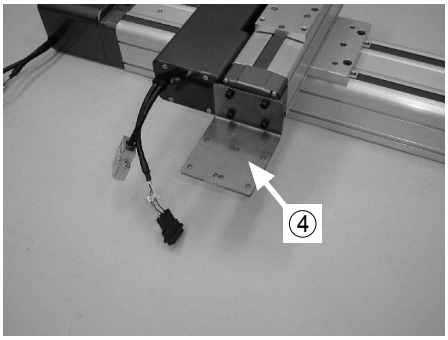
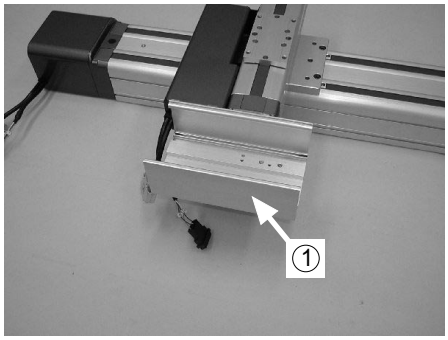


Photo 21-7RD



9) Pass the built-in cable of Y axis through the X-Y cable support. (Be sure to keep its direction. Photo 21-8RD) Fix the fixed side of cable support to the mounting surface. (M6 × 10, 4 bolts) (Photo 21-9RD)
Tap to 4- ø7 holes beforehand as shown on the figure of RD-MS combination of the catalogue.

Photo 21-8RD

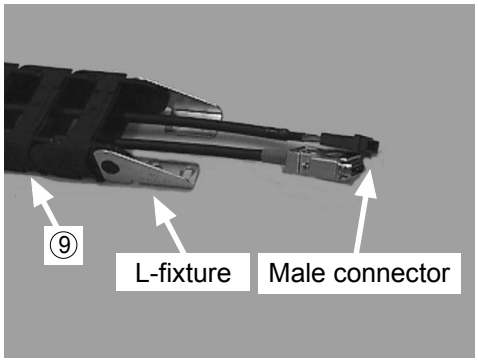
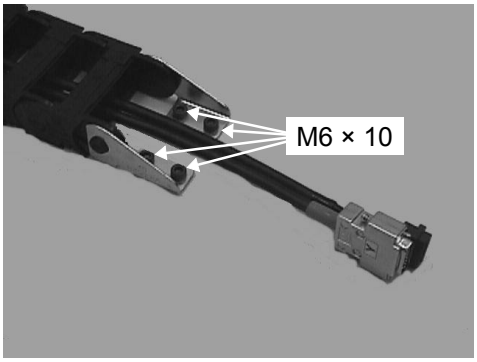


Photo 21-9RD



10) Pass the built-in cable through an Edge saddle of the L-fixture ⑤, then attach the L-fixture to the main unit ①. (M5 × 10, 4 bolts) (Photo 21-10RD)
Fix the moving side of cable support ⑨ to L-fixture (M6 × 10, 4 bolts) with the plate nuts ⑩. (Photo 21-11RD)

Photo 21-10 RD

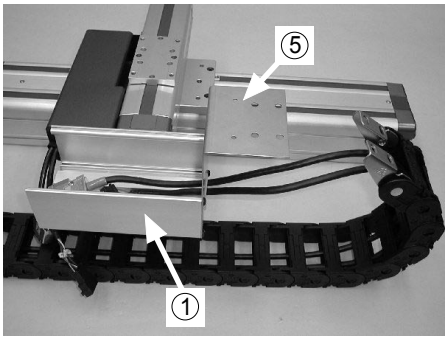
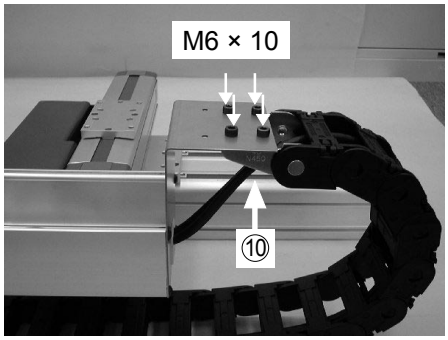


Photo 21-11 RD

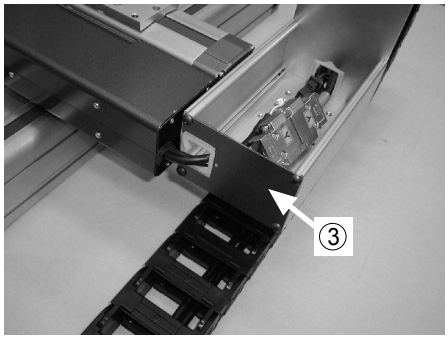


11) Pass the cable of Y axis main unit through an Edge saddle of the end cover ③ and attach the end cover to the connector box. (M5 × 10, 4 bolts)
Connect the cable and built-in cable. (Photo 21-12RD)

◊ Motor connector : Snap to the end.

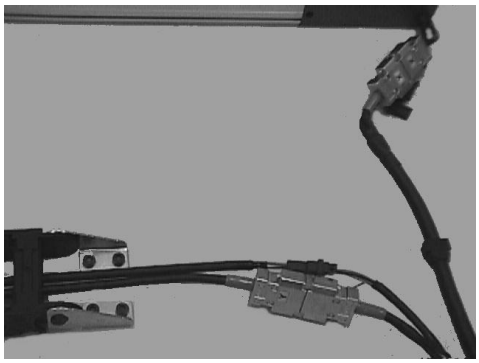
◊ Encoder connector : Secure them by two screws.

Photo 21-12RD



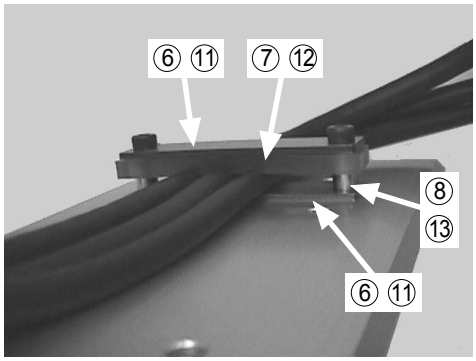
12) Connect the controller cables of both axes.

Photo 21-13 RD



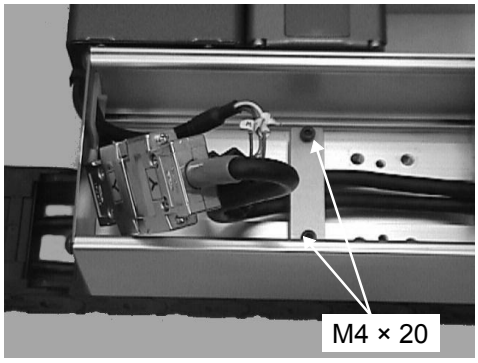
13) Store the cables loosely in the cable support so that they don't get a jerk. Set a large bending radius to the cables as much as possible, then fasten them with the clamping parts ⑥ ~ ⑧ and ⑪ ~ ⑬ to the connector box.
(M4 × 20 and M5 × 16 2 bolts each)
(Place the clamp base to the connector box first, put the cables on it, then fix them.)
(Photo 21-14RD ~ 16RD)

Photo 21-14RD



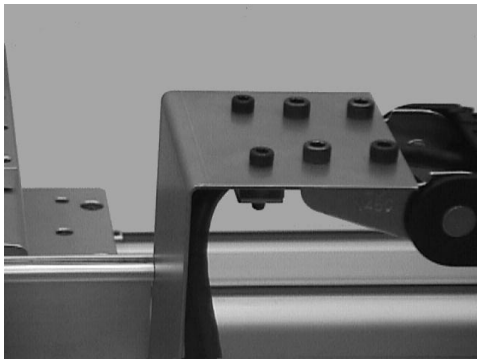
Details of cable clamp

Photo 21-15RD



Inside of the connector box

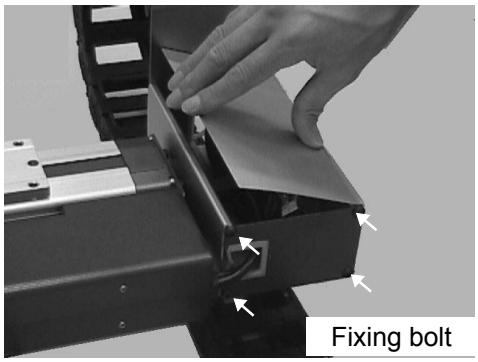
Photo 21-17RD



Under the L-fixture

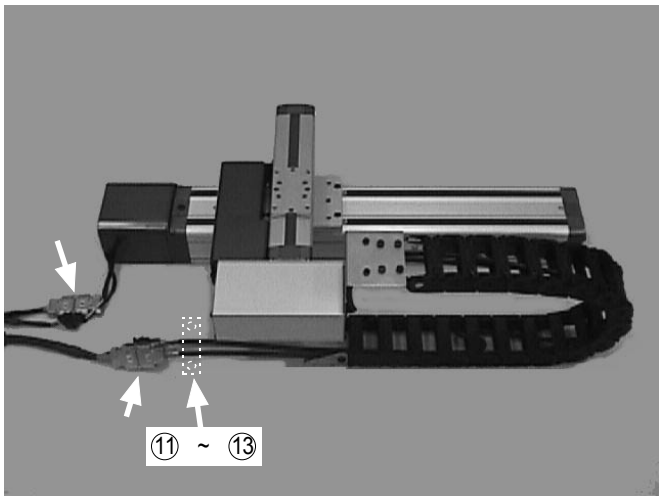
14) Attach the top cover ② to the connector box. Pass the built-in cables through an Edge-saddle of the top cover. Loosen the fixing bolts of the end cover and the L-fixture, push an edge of the top cover to the groove of the connector box, then push into other side of the top cover to the connector box as shown in Photo 21-35RD. Fasten the bolts to secure the end cover with the L-fixture.

Photo 21-17RD



Completion of RD-MS combination

Photo 21-18RD



Caution : *The two connectors on the mounting base shall be fixed referring to "21.5.2.1. All Modules (Excludes RH and RM Motor Indirect Mount)." We recommend to fix the built-in cables to the mounting base by the clamping parts ⑪ ~ ⑬ with M4 × 20 bolts. (2 bolts)*

21.7.7. RD-HM Combination

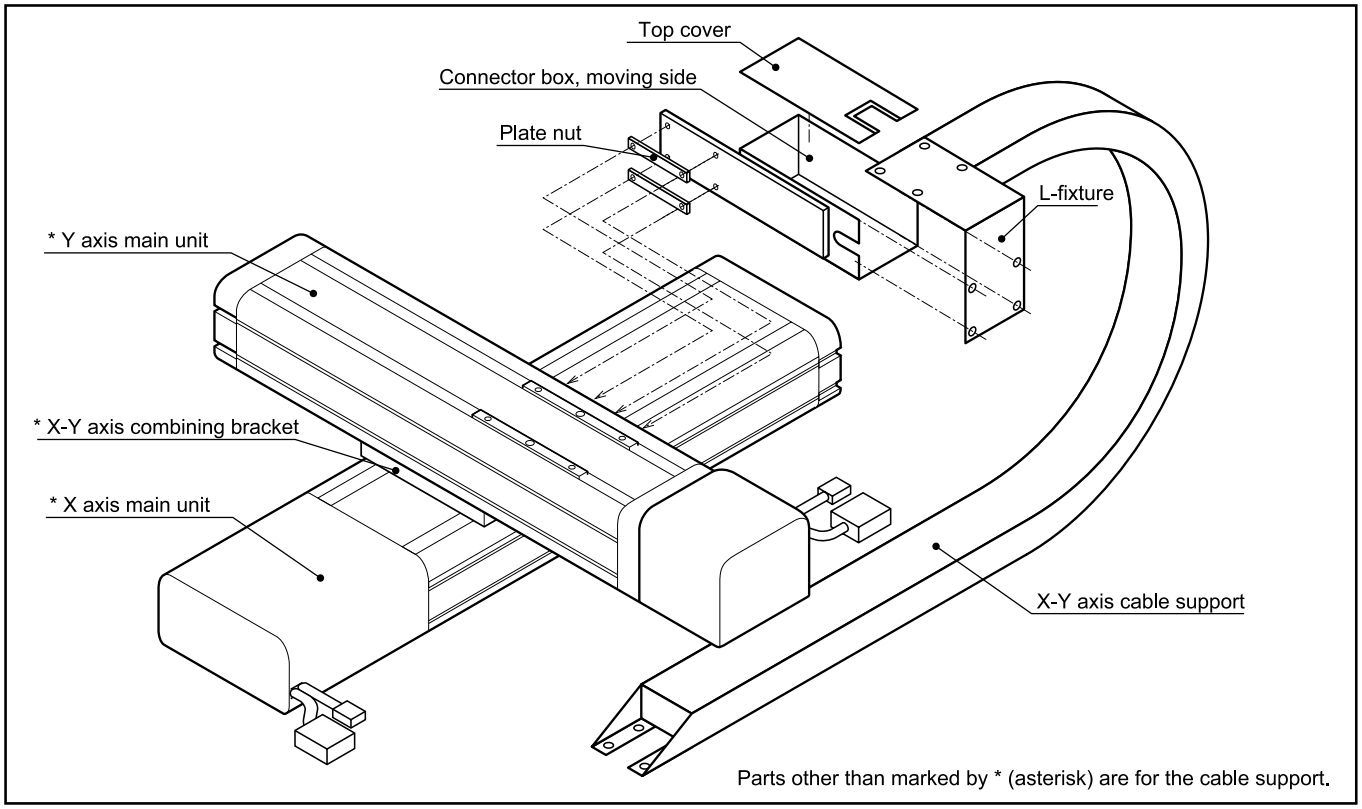
- The parts required for RD-HM combination are listed in Table 21-31 below. Confirm that all parts are ready.

Table 21-31

Name	Quantity	Reference number	Sections to be referred.
X axis main unit	1	XY-HRS0□5-RH200	3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications
Y axis main unit	1	XY-HRS0□0-RM200	
Controller	1	M-EXEA2-0110□00	1 Installation and Maintenance of the EXEA Controller "5. Reference Number and Specifications"
Teaching box	1	M-EXTB0□	
X-Y combining bracket	1	XY-P175DHM-1	3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications
Controller cable	2	XY-E185□□-1	
Cable support	1	XY-E173DHM02000-1	
Y axis built-in cable	1	XY-E173020-1	
Mounting bracket	2	XY-P170H-1 *	

* This bracket is not necessary when a main unit is fixed from its bottom surface.

Figure 21-24



◆ Assembly procedures of RD-HM combination

- Following description is assembly procedures of A type combination. The procedures for B type are fundamentally the same, though combining directions of main units and cable support are different.

1) Modifications of cable position of main units and orientation of connector box are required as listed in Table 21-32.

Table 21-32

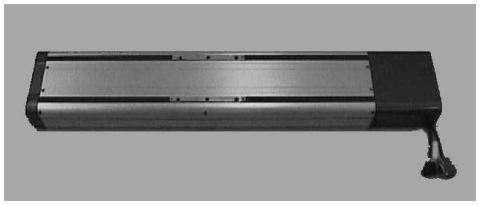
	A	B
X axis main unit	Reverse cable position of main unit *1	Not necessary
Y axis main unit	Reverse cable position of main unit *1	Not necessary
Connector box, moving side	Not necessary	Reversing connector box *2

*1 Refer to "21.3. Reversing Position of Main Unit Cable."

*2 Refer to "21.12. Reversing Connector Box."

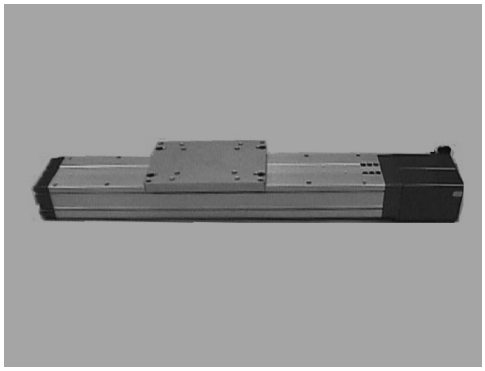
2) Fix X axis main unit to the mounting base. Refer to "21.4. Fixing Main Unit."

Photo 21-19RD



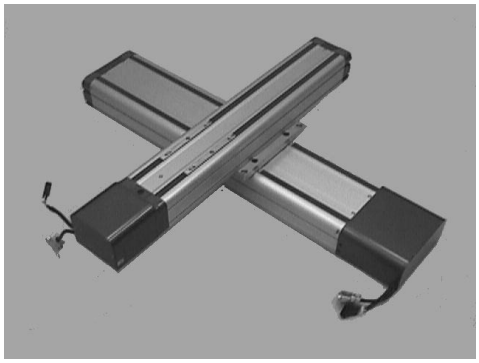
3) Turn Y axis main unit over and fix the X-Y axis combining bracket to its bottom surface. (M6, 4 bolts: tightening torque: 9.8 ~ 11.8 N·m)

Photo 21-20RD



4) Fix Y axis main unit with the combining bracket to the slider of X axis main unit. (M8, 4 bolts: tightening torque: 27.5 ~ 33.3 N·m)

Photo 21-21RD



5) Attach the cable support to the main units and wire the cables. The parts of the cable support are listed in Table 21-33. Confirm that all parts are ready.

Photo 21-22RD

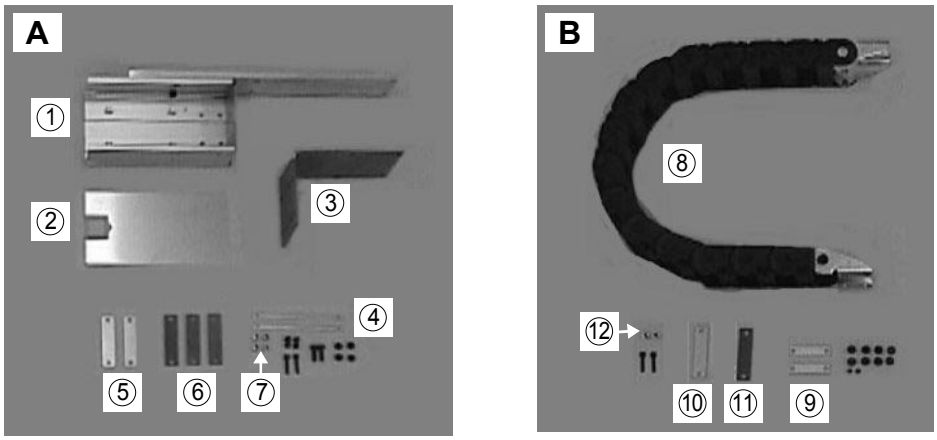
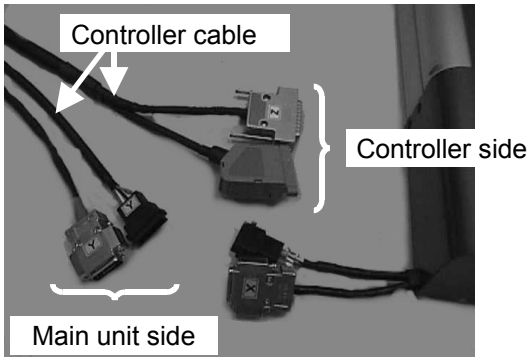


Table 21-33

Section	Name of section	Part No.	Name	Quantity	Hexagon socket cap screw
A	Connector box, moving side (Fix to Y axis main unit)	①	Connector box	1	M3 × 6 (4 bolts)
		②	Top cover	1	
		③	L-fixture	1	M4 × 10 (4 bolts)
		④	Plate nut	2	
		⑤	Clamp base	3	M3 × 6 (6 bolts)
		⑥	Cable clamp	2	M4 × 20 (2 bolts)
		⑦	Spacer	4	
B	Cable support	⑧	X-Y axis cable support	1	M6 × 10 (4 bolts)
		⑨	Plate nut	2	M6 × 10 (4 bolts)
		⑩	Clamp base	1	
		⑪	Cable clamp	1	M4 × 20 (2 bolts)
		⑫	Spacer	2	

6) Affix seals of X and Y axes, which are provided with the controller cable, to respective cable connectors.
(We recommend to affix the seals to the connectors to avoid miss-connection because the connector is common to all main units regardless their motor power specifications.)

Photo 21-23RD



7) Inset two palate nuts ④ to T-slots of Y axis main unit from the opposite side of the motor. (Photo 21-24RD)
Then attach the connector box of moving side ① to the main unit.
(M3 × 6, 4 bolts) (Photo 21-25RD)

Photo 21-24RD

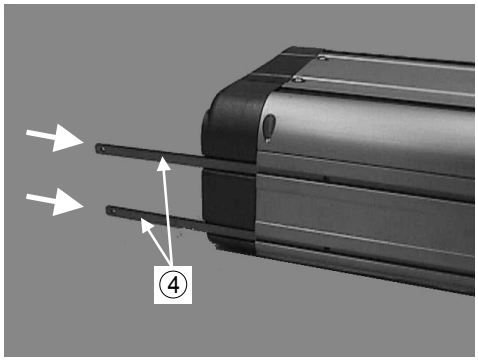
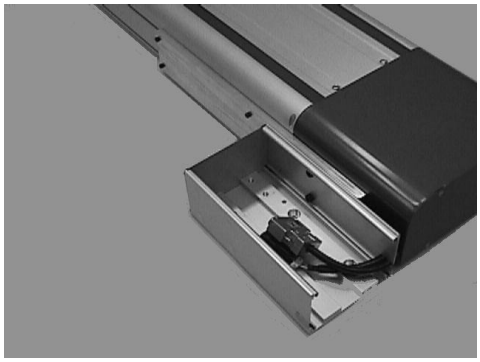


Photo 21-25RD



8) Pass the built-in Y axis cable through the support unit ⑧. Be careful for direction of the cable. (Photo 21-26RD)
Fix the fixed side of the cable support to the mounting base.
(M6 × 10, 4 bolts) (Photo 21-27RD)

Photo 21-26RD

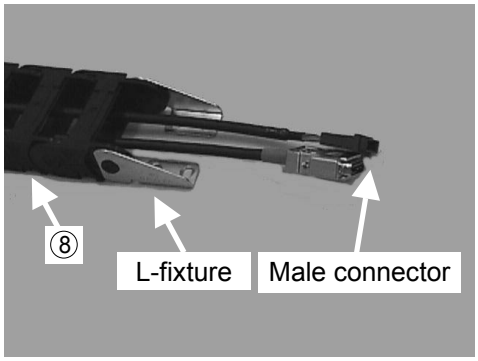
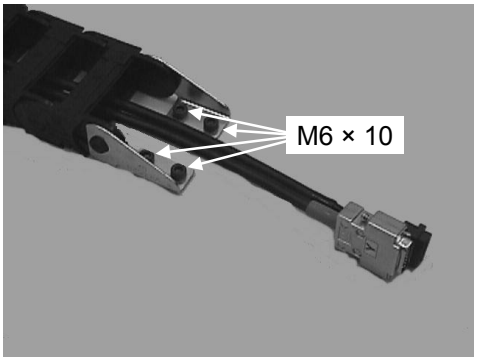


Photo 21-27RD



9) Attach L-fixture ③ to the connector box of moving side ①. (M5 × 10, 4 bolts) (Photo 21-28RD)
Fix the moving side of cable support to the L-fixture ③. (M6 × 10, 4 bolts and plate nuts ⑨) (Photo 21-29RD)

Photo 21-28RD

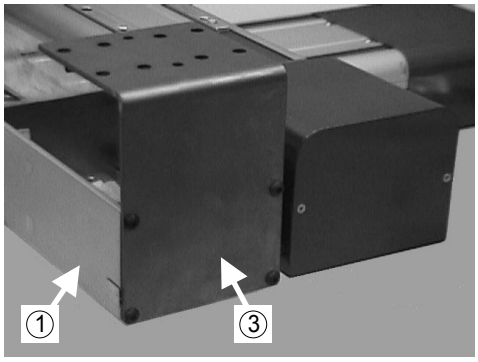
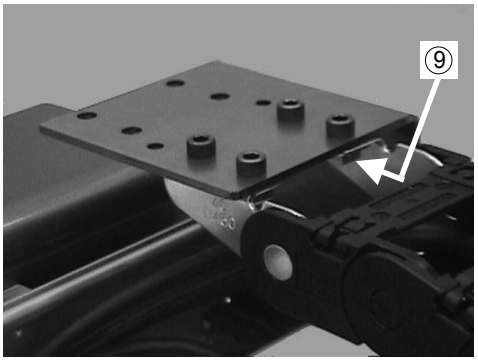


Photo 21-29RD

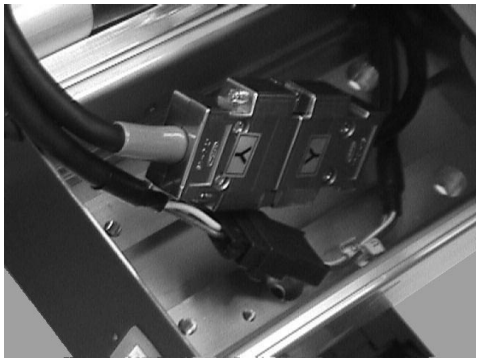


10) Connect the cables of Y axis main unit and the built-in cables. (Photo 21-30RD)

◊ Motor connector : Snap to the end.

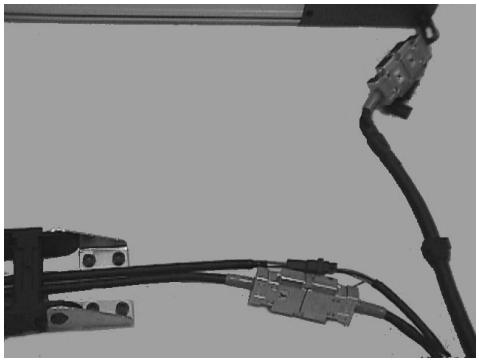
◊ Encoder connector : Secure by two screws.

Photo 21-30RD



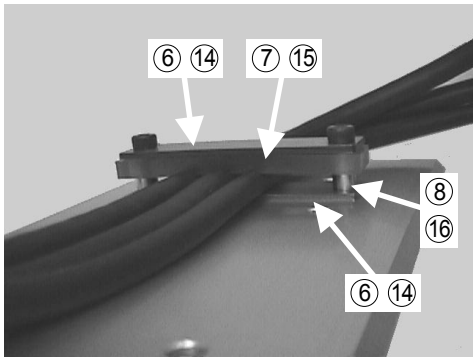
11) Connect the controller cables to both X and Y axes main units.

Photo 21-31RD



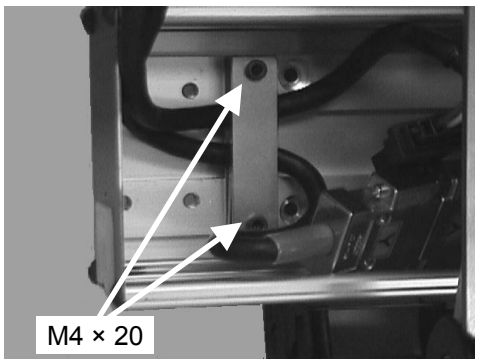
12) Place the cables loosely in the cable support so that they don't get a jerk. Set a large bending radius to the cables as much as possible in the connector boxes. Then fasten the cables with the clamping parts ⑥ ~ ⑦ and ⑩ ~ ⑫.
(M4 × 20 or M5 × 16, 2 bolts)
(There are two places. In the connector box, place the clamp base ⑤ first, put the cables on it, then fix them by cable clamp ⑥.) (Photo 21-32RD ~ 34RD)

Photo 21-14RD



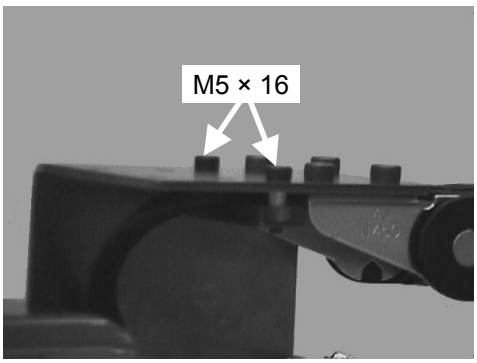
Details of clamping cables

Photo 21-33 RD



In the connector box

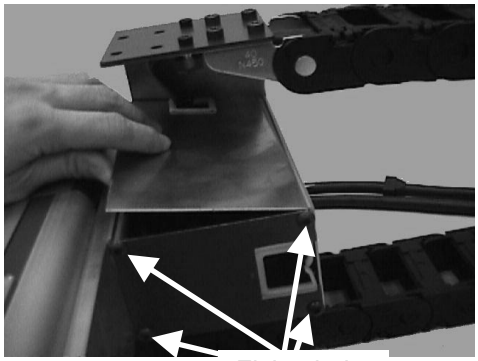
Photo 21-34RD



Under the L-fixture

13) Attach the top cover ② to the connector box. Pass the built-in cables through an Edge-saddle of the top cover. Loosen the fixing bolts of the end cover and the L-fixture, push an edge of the top cover to the groove of the connector box, then push into other side of the top cover to the connector box as shown in Photo 21-35RD. Fasten the bolts to secure the end cover with the L-fixture.

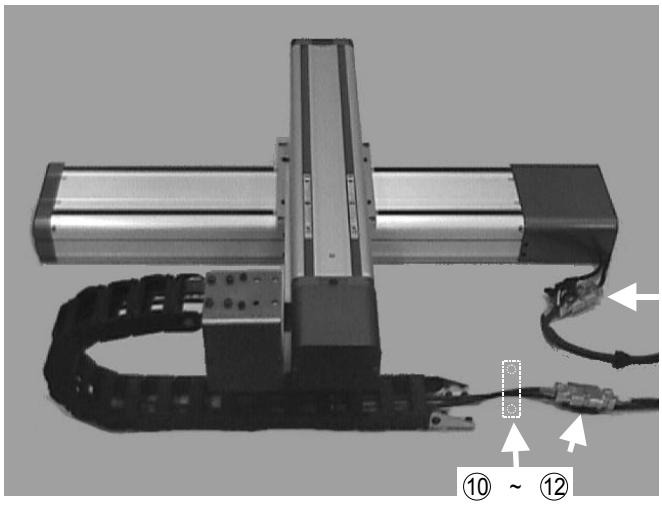
Photo 21-35RD



Fixing bolts

Completion of RD-HM combination

Photo 21-36RD



Caution : *Be sure to fix two connectors on the mounting base referring to "21.5.2.1. All Modules (Excludes RH and RM Motor Indirect Mount Modules)." We recommend to fix the built-in cables to the mounting base using clamping parts ⑩ ~ ⑫ as well.) (M4 × 20, 2 bolts)*

21.7.8. RT-MSz Combination

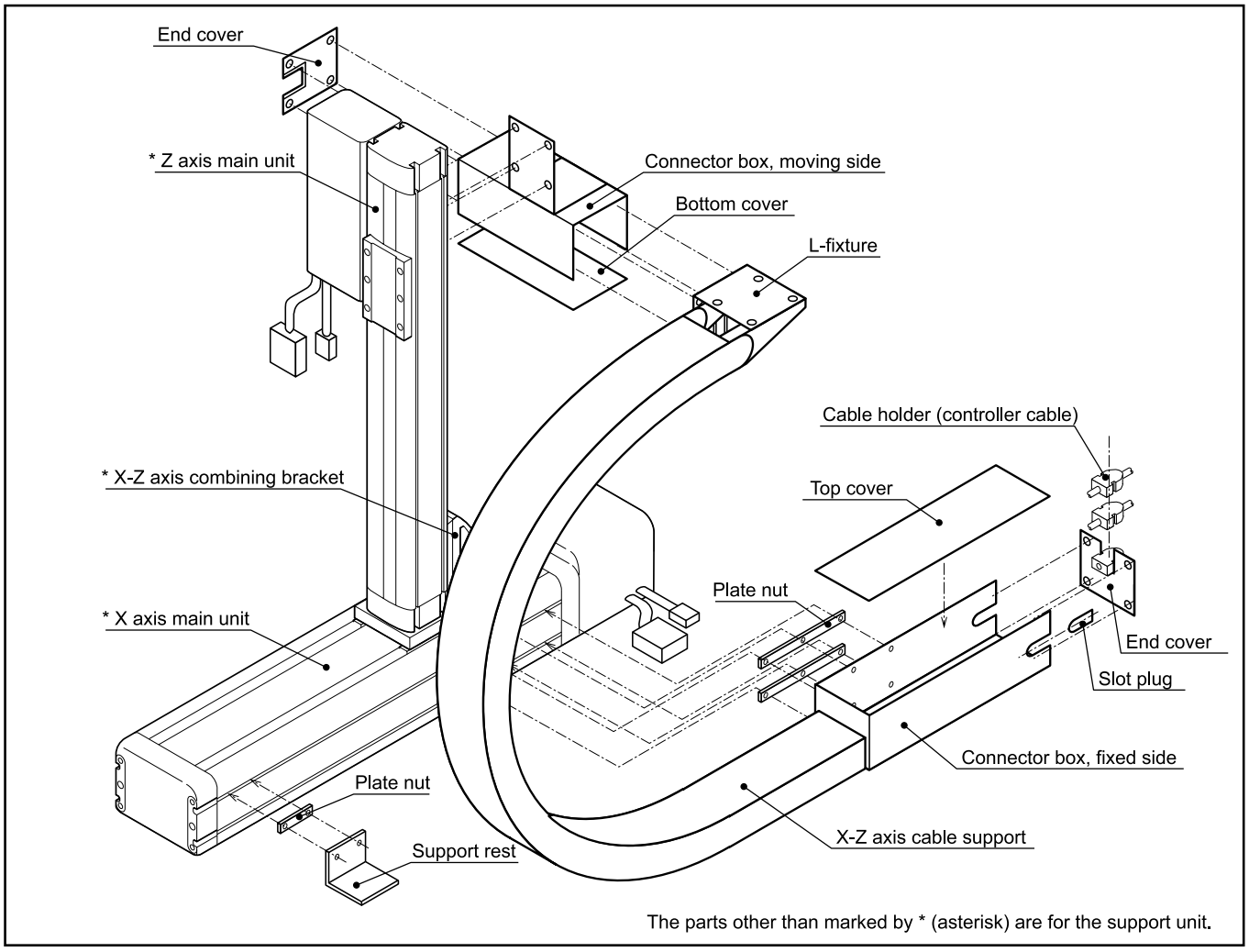
- The parts required for RT-MSz combination are listed in Table 21-34 below.

Table 21-34

Name	Quantity	Reference number	Sections to be referred.
X axis main unit	1	XY-HRS0□5-RM200	3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications"
Z axis main unit	1	XY-HRS0□0-RS1□□	
Controller	1	M-EXEA2-0200□00	1 Installation and Maintenance of the EXEA Controller "5. Reference Number and Specifications"
Teaching box	1	M-EXTB0□	
X-Z combining bracket	1	XY-P175TMS-1	3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications"
Controller cable	1	XY-E185□□-1	
Controller cable	1	XY-E185□□-2	
Cable support	1	XY-E173TM0S2700-1	
Z axis built-in cable	1	XY-E173028-2	
Mounting bracket	2	XY-P170M-1 *	

The parts other than marked * (asterisk) are for the support unit.

Figure 21-25



◆ Assembly procedures of PT-MSz combination

- Following description is the assembly procedures of A type combination. However, the procedures of B type are fundamentally the same, though the combining direction of main units and the cable support are different.

1) Modifications of position of the main unit cable and orientation of L-fixture of the cable support are required as listed in Table 21-35. Modify them before assembly.

Table 21-35

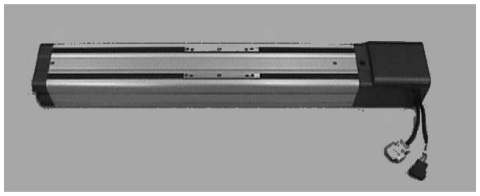
	A	B
X axis main unit	Not necessary	Reversing cable position of main unit *1
Y axis main unit	Reversing cable position of main unit *1	
Connector box, fixed side	Not necessary	
Connector box, moving side	Not necessary	Reversing L-fixture of cable support *2

*1. Refer to "21.3. Reversing Position of Main Unit Cable."

*2. Refer to "21-13. Reversing L-Fixture

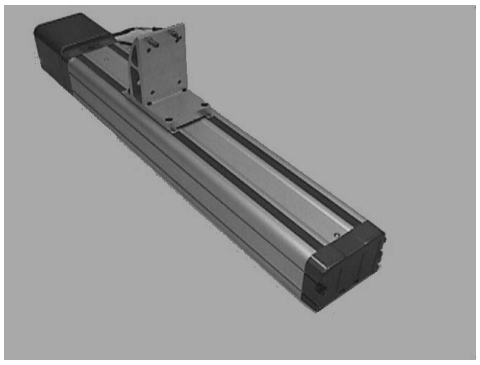
2) Fix the X axis main unit to the mounting base referring to "21.4. Fixing Module Main Unit."

Photo 21-1RT



3) Fix the X-Z combining bracket to the slider of X axis main unit.
(M6, 4 bolts: tightening torque: 9.8 ~ 5.9 N·m)

Photo 21-2RT



4) Sturn the Z axis main unit over and attach the bracket (plate) to its mounting surface.
(M5, 4 bolts: tightening torque: 4.9 ~ 5.9 N·m) (Photo 21-3RT)
Then fix the both brackets each other.
(M6, 4 bolts: tightening torque: 9.8 ~ 11.8 N·m) (Photo 21-86RT)

Photo 21-3RT

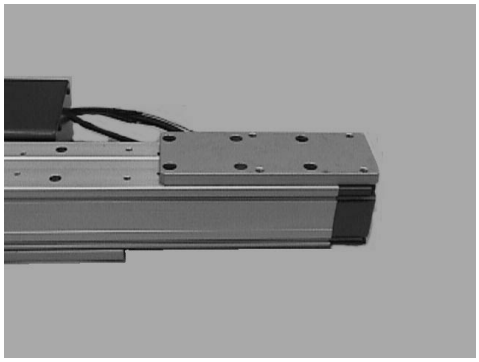


Photo 21-4RT

5) Attach the cable support to the main units and wire the cables. The parts of the cable support are listed in Table 21-36. Confirm that all parts are ready.

Photo 21-5RT

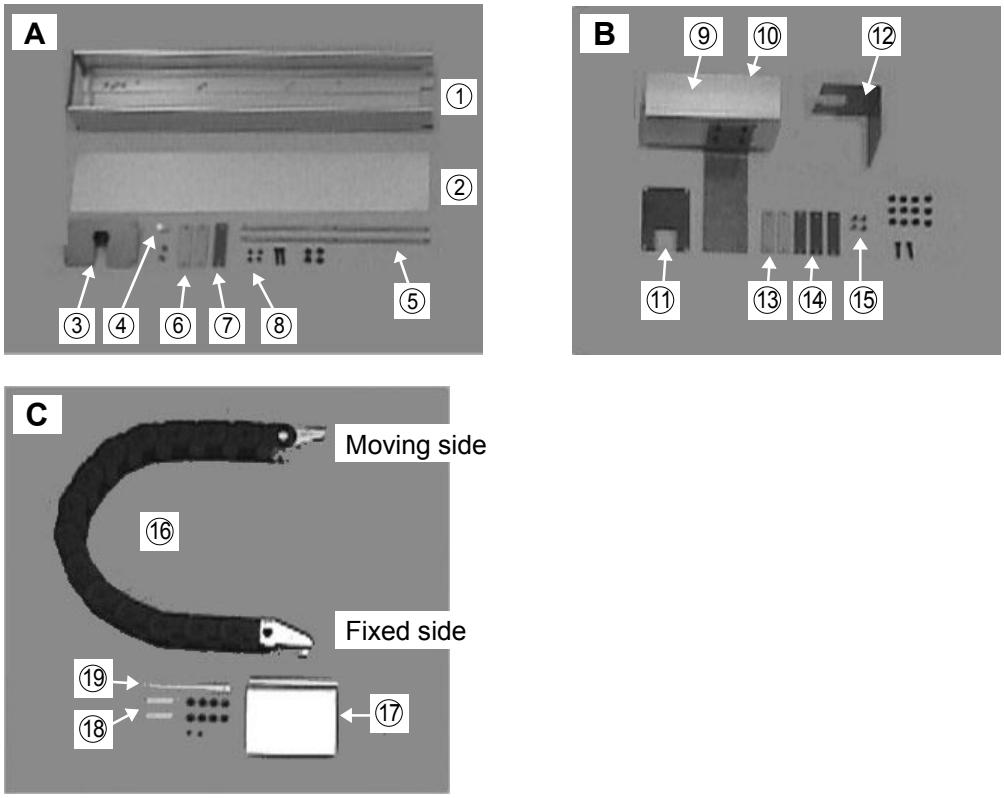
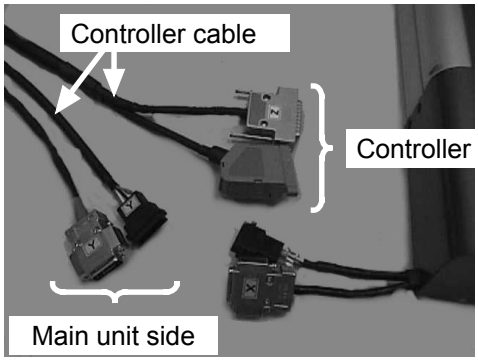


Table 21-36

Section	Name of section	Part No.	Name	Quantity	Hexagon socket cap screw
A	Fixed side Connector box (Attach to X axis main unit)	①	Connector box	1	M5 × 10 (4 bolts)
		②	top cover	1	
		③	End cover	1	
		④	Slot plug	1	
		⑤	Plate nut	2	M3 × 6 (6 bolts)
		⑥	Clamp base	2	
		⑦	Cable clamp	1	M4 × 20 (2 bolts)
		⑧	Spacer	2	
B	Moving side Connector box (Attach to Z axis main unit)	⑨	Connector box	1	M5 × 10 (4 bolts)
		⑩	Bottom cover	1	
		⑪	End cover	1	M5 × 10 (4 bolts)
		⑫	L-fixture	1	M5 × 10 (4 bolts)
		⑬	Clamp base	3	M5 × 16 (2 bolts)
		⑭	Cable clamp	2	M4 × 20 (2 bolts)
		⑮	Spacer	4	
C	Cable support	⑯	X-Z axis cable support	1	M6 × 10 (4 bolts)
		⑰	Support rest	1	
		⑱	Plate nut (long)	1	M3 × 6 (2 bolts)
		⑲	Plate nut (short)	2	M6 × 10 (4 bolts)

6) Affix seals of X and Z axes, which are provided with the controller cable, to respective cable connectors.
(We recommend to affix the seals to the connectors to avoid miss-connection because the connector is common to all main units regardless their motor power specifications.)

Photo 21-6RT



7) Insert two plate nuts ⑤ to each T-slot on the side of X axis main unit and attach the fixed side connector box ① at motor end. (M3 × 6, 6 bolts) (Photo 21-7RT and 8RT)

Photo 21-7RT

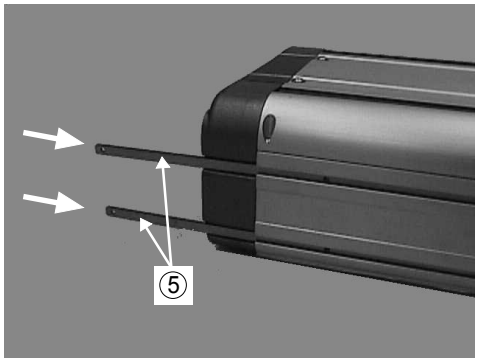
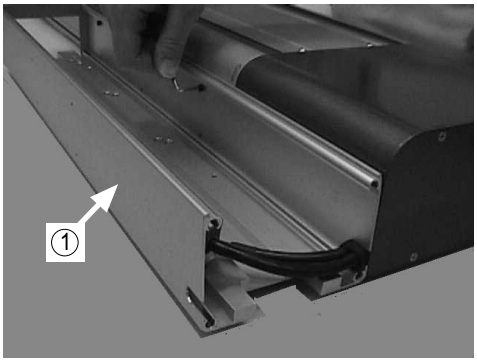
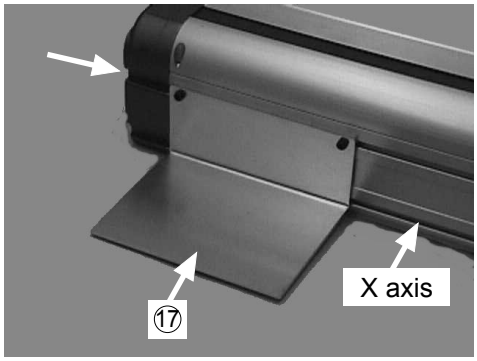


Photo 21-8RT



8) Attach the cable rest ⑰ to X axis main unit.
Same as the procedure 7), insert the plate nut ⑤ to the T-slot and fix the cable rest.
(M3 × 6, 2 bolts)

Photo 21-9RT



9) Pass the Z axis built-in cable through the cable support ⑯. (Photo 21-10: Be careful the direction of the cable.) Fix the cable support at its fixed side to the connector box. (M6 × 10, 4 bolts) (Photo 21-11RT)

Photo 21-10RT

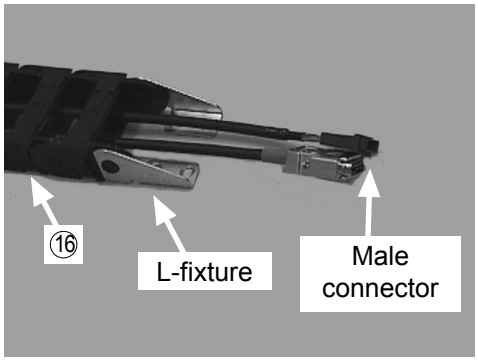
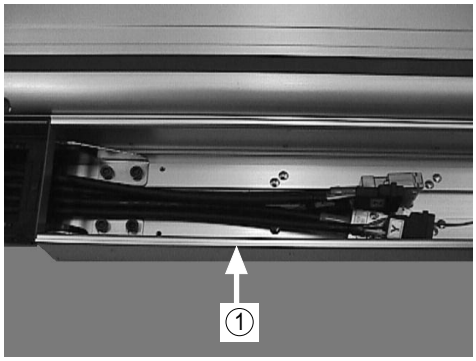


Photo 21-11RT



10) Fix Z axis built-in cables to the moving side connector box at its base part of the connector side (approximately 10 cm or more from the connector end) by the clamping parts ⑥ ~ ⑧ and ⑬ ~ ⑮. (M4 × 20, 2 bolts)
Place the clamp base ⑬ first, then put the cables on it, and then fix them as shown in Photo 21-12RT.

Photo 21-12RT

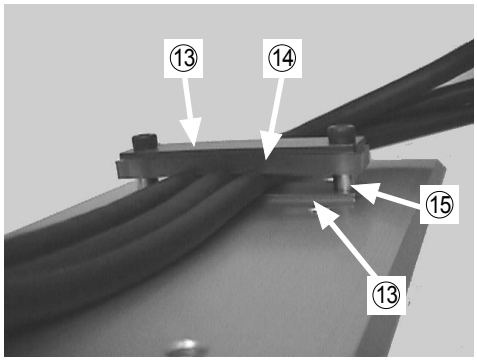
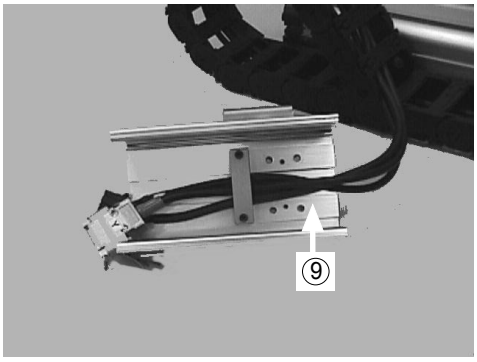
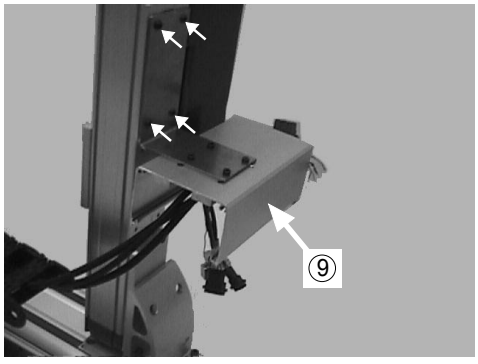


Photo 21-13RT



11) Attach the moving side connector box ⑨ to the back face of Z axis main unit. (M5 × 10, 4 screws: hexagon socket pan head screw)

Photo 21-14RT



12) Pass the built-in cable through Edge saddle of L-fixture ⑫ and fix the L-fixture to the moving side connector box ⑨. (Photo 15RT)
Then fix the cable support to the L-fixture ⑫ using the plate nuts ⑲.
(M6 × 10, 4 bolts) (Photo 21-16RT)

Photo 21-15RT

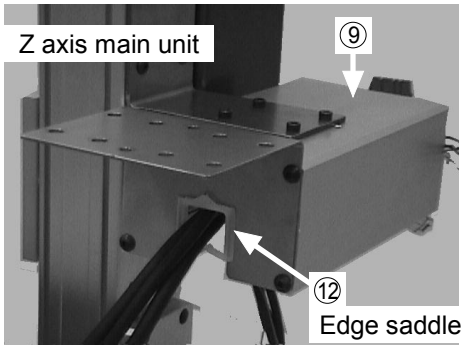
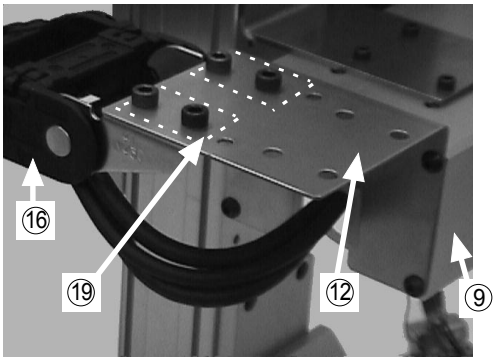


Photo 21-16RT



13) Pass the cable of Z axis main unit through Edge saddle of the end cover ⑪, then fix the end cover to the moving side connector box. (Photo 21-17RT)
Connect the cables of Z axis main unit and the built-in cables. (Photo 21-18RT)

◊ Motor connector : Snap to the end.

◊ Brake connector : Snap to the end.

◊ Encoder connector : Secure the connectors with two screws.

Photo 21-17RT

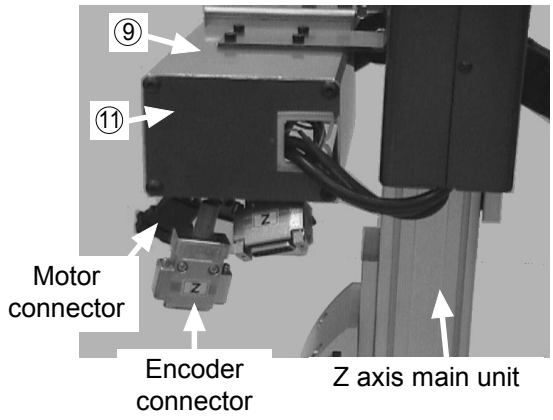
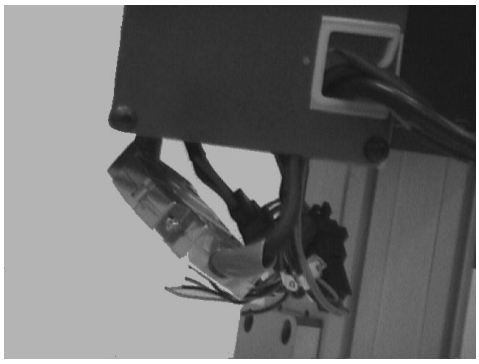
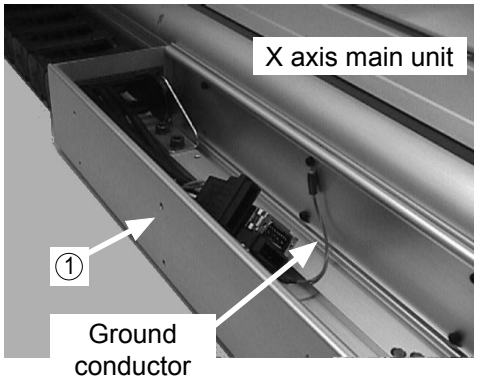


Photo 21-18RT



14) Secure a round terminal of ground conductor (green) of the built-in cable using a bolt (M3 × 6) of connector box. (Photo 21-19RT)
When you use the user cables (6 rope-lay conductors) provided with the cable support, wire the ground conductor to the ground terminal of external user's equipment from the fixed round terminal on the connector box.

Photo 21-19RT



15) Connect both controller cables (X and Z axis main unit). (Photo 21-20RT)
Attach the end cover ③ to the fixed side connector box. (M5 × 10, 4 hexagon socket pan head screws) Insert the cable holders to the groove, Z axis cable first then Y axis cable next. (Photo 21-21RT)

Photo 21-20RT

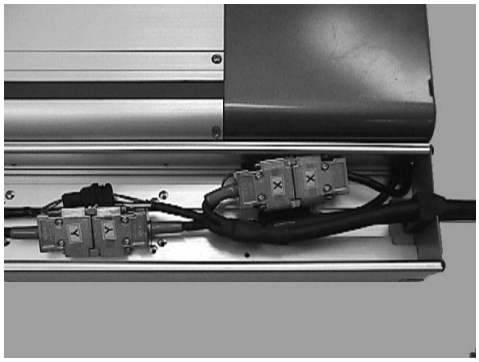
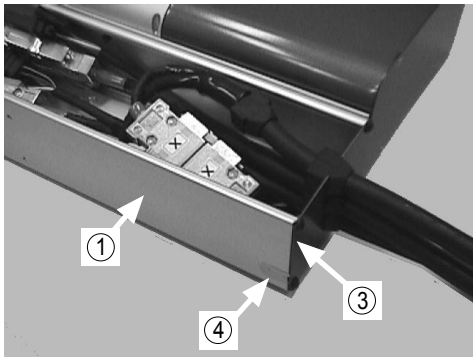
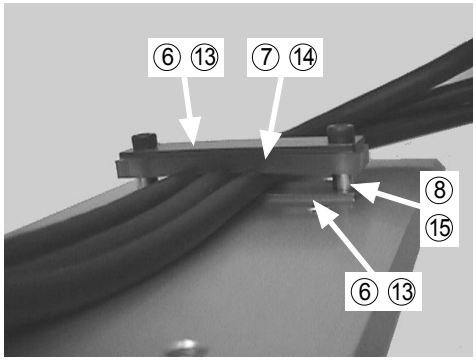


Photo 21-21RT



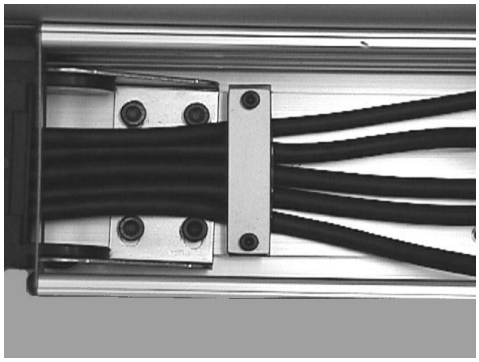
16) Loosely store the cables in the cable support so that they don't get a jerk. Set a large bending radius to the cables as much as possible in the connector boxes, then fasten them with the clamping parts ⑥ ~ ⑧ and ⑪ ~ ⑬. (M4 × 20 and M5 × 16 2 bolts each)
(Place the clamp base first, put the cables on it, and then fix them by the clamp.)
(Photo 21-22RT ~ 24RT)

Photo 21-22RT



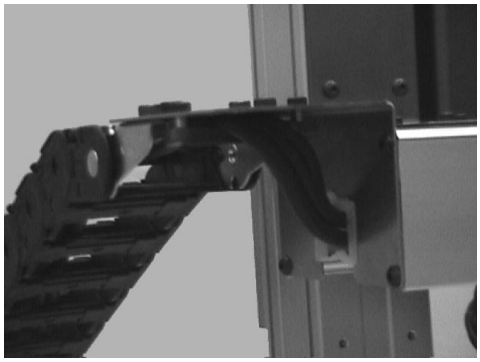
Details of the clamp in the box

Photo 21-23RT



Inside of fixed side of connector box

Photo 21-24RT



Under the L-fixture

17) Fix the top and bottom covers of both connector boxes. Loosen the bolts of both sides of end covers, hook the edge of the top (bottom) cover to a groove of connector box, then push in the other side of the top (bottom) cover. (Photo 21-25RT)
Then retighten the screws for the end covers.

Photo 21-25RT

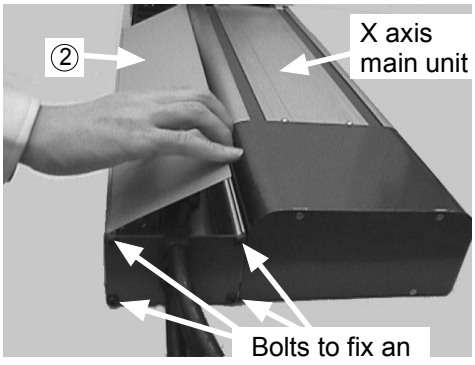
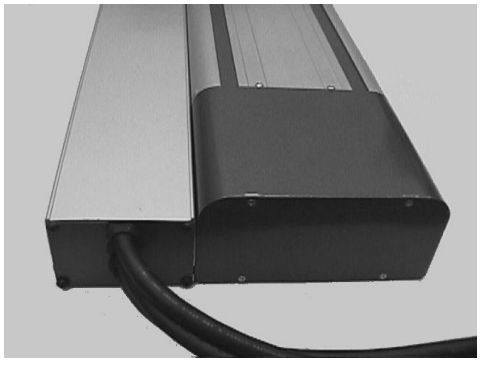
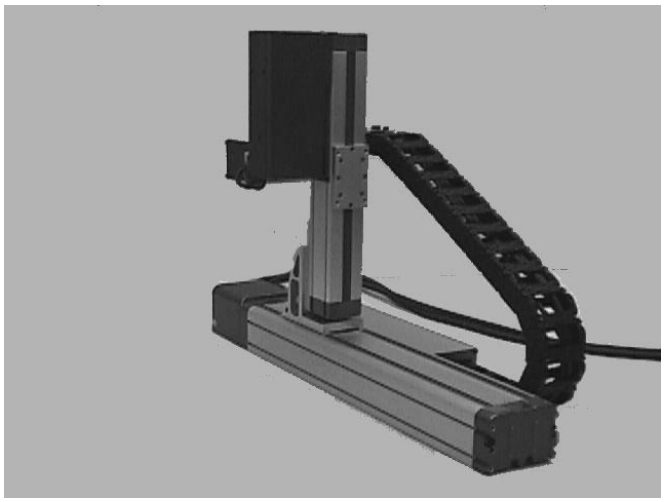


Photo 21-26RT



Completion of RT-HMz combination

Photo 21-27RT



21.7.9. RX-HH (HM) combination

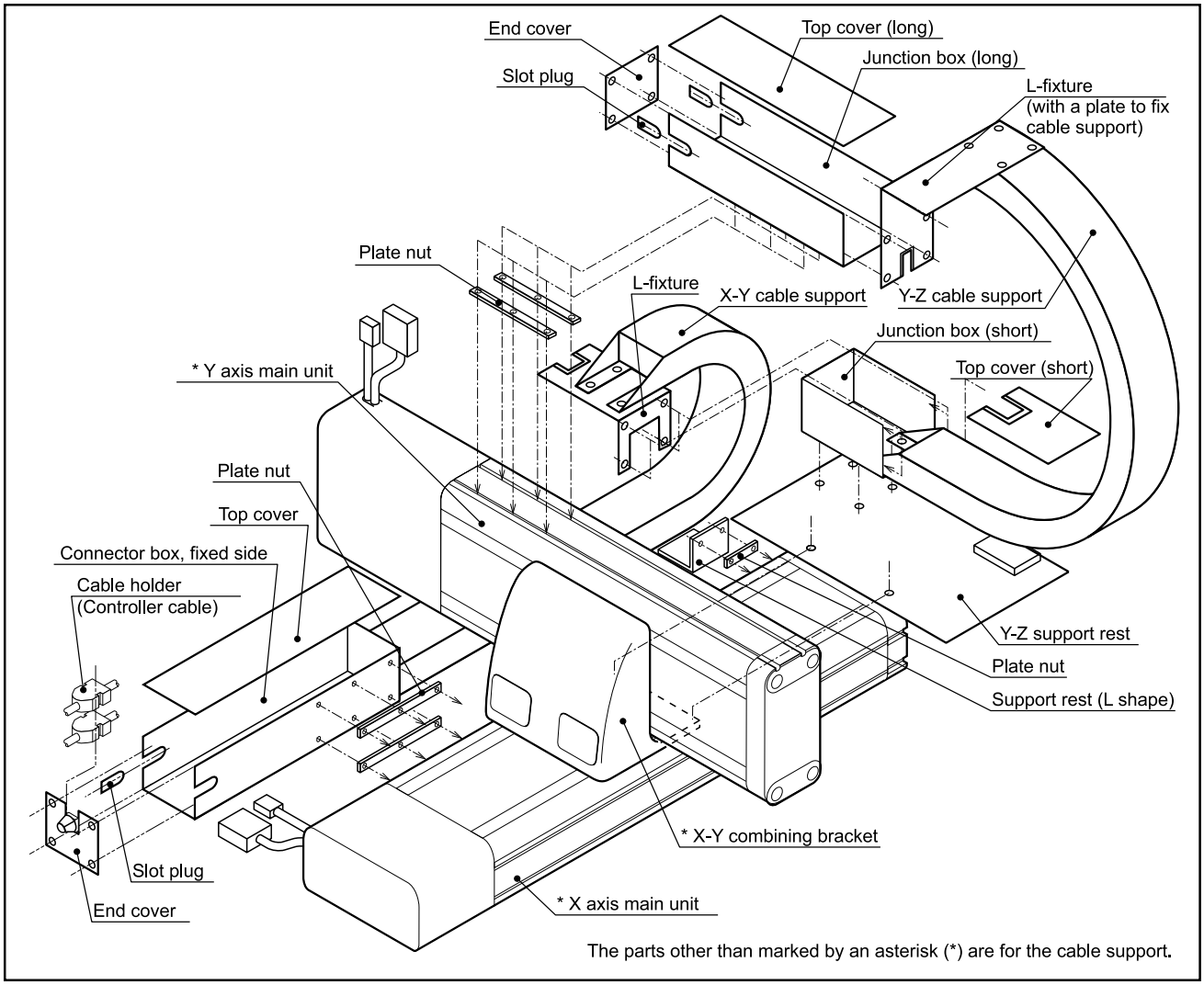
- The parts required for RX-HH (HM) combination are listed in Table 21-37 below. Check that all parts are ready.

Table 21-37

Name	Quantity	Reference number	Sections to be referred.
X axis main unit	1	XY-HRS□□0-RH200	3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications"
Y axis main unit	1	XY-HRS□□0-RH200 (XY-HRS0□5-RM200)	
Controller	1	M-EXEA2-0110□00	1 Installation and Maintenance of the EXEA Controller "5. Reference Number and Specifications"
Teaching box	1	M-EXTB0□	
X-Y combining bracket	1	XY-P175XHH-1 (XY-P175XHM-1)	3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications"
Controller cable	2	XY-E185□□-1	
Cable support	1	XY-E173XHM03222-1	
Y axis built-in cable	1	XY-E173□□□-1	
Mounting bracket	2	XY-P170H-1 *	

* This bracket is not required when the X axis main unit is fixed from its bottom surface directly.
[The reference numbers in brackets are for the parts of HM combination.]

Figure 21-26



◆ Assembly procedures of RX-HH (HM) combination

- Following description is the assembly procedures for A type. However, the procedures for B type are fundamentally the same, though combining directions of main units and the support unit are different.

1) Modifications of the main units and L fixture listed in Table 21-40 are required for B type combination. No modification is required for A type.

Table 21-38

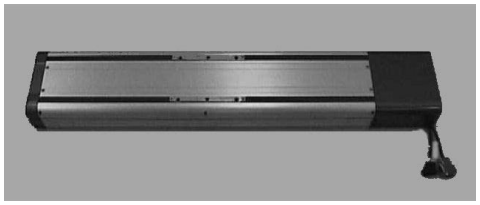
	A	B
X axis main unit	Not necessary	Reversing position of main unit cable *1
Y axis main unit	Not necessary	Reversing position of main unit cable *1
Connector box, fixed side	Not necessary	
Junction box	Not necessary	Reversing L-fixture *2

*1. Refer to "21.3. Reversing Position of main unit cable."

*2. Refer to "21.13. Reversing L-fixture."

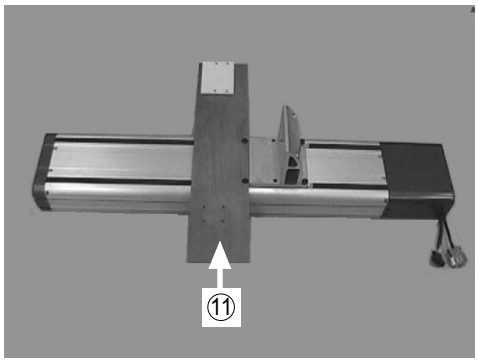
2) Fix the X axis main unit to the mounting base. Refer to "21.4. Fixing Module Main Unit." (Photo 21-1RX)

Photo 21-1RX



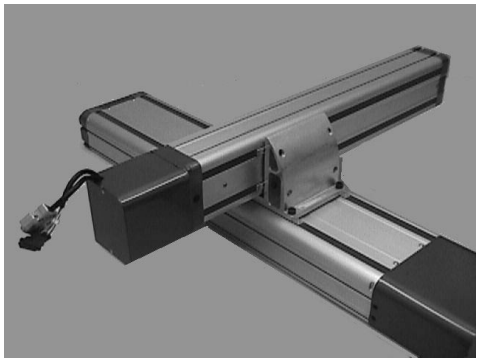
3) Fix the X-Y combining bracket to the slider of X axis main unit. At the same time fix Y-Z support rest ⑪ as shown in Photo 21-2RX.
[M8 button head screw, 4 places (an accessory of the cable support): tightening torque: 27.5 ~ 33.3 N·m]

Photo 21-2RX



4) Fix the X-Y combining bracket to the slider of Y axis main unit.
(RX-HH combination: M8, 4 bolts: tightening torque: 27.5 ~ 33.3 N·m)
(RX-HM combination: M6, 4 bolts: tightening torque: 9.8 ~ 11.8 N·m)

Photo 21-3RX



5) Attach the cable support to the module main units and wire the cables. The parts of the cable supports are listed in Table 21-39. Confirm that all parts are ready beforehand.

Photo 21-4RX

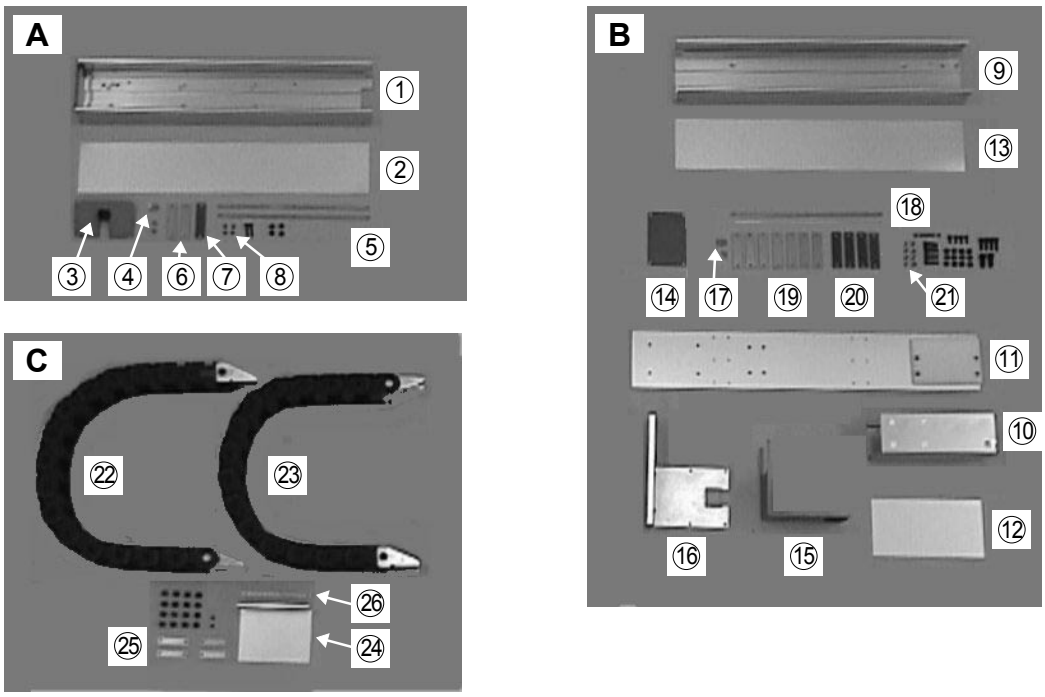
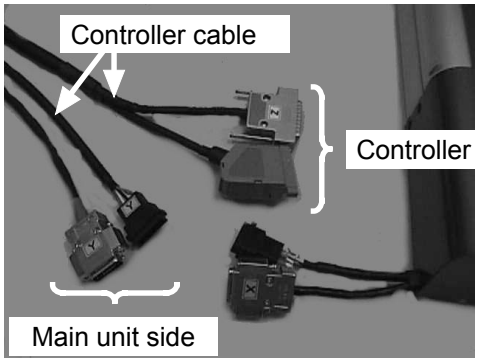


Table 21-39

Section	Name of section	Part No.	Name	Quantity	Hexagon socket cap screw
A	Fixed side Connector box (attach to X axis main unit)	①	Connector box	1	M5 × 10 (4 bolts)
		②	Top cover	1	
		③	End cover	1	
		④	Slot plug	1	
		⑤	Plate nut	2	M3 × 6 (6 bolts)
		⑥	Clamp base	2	
		⑦	Cable clamp	1	M4 × 20 (2 bolts)
		⑧	Spacer	2	
B	Junction box (attach to Y axis main unit)	⑨	Junction box (long)	1	M5 × 10 (4 bolts)
		⑩	Junction box (short)	1	
		⑪	Y-Z support rest	1	M8 × 25 (4 bolts)
		⑫	Top cover (long)	1	
		⑬	Top cover (short)	1	
		⑭	End cover	1	M5 × 10 (4 bolts)
		⑮	L-fixture	1	M5 × 10 (4 bolts)
		⑯	L-fixture (with a plate to fix cable support)	1	M5 × 10 (4 bolts)
		⑰	Slot plug	4	
		⑱	Plate nut	2	M3 × 6 (6 bolts)
		⑲	Clamp base	8	M5 × 16 (2 bolts), M5 × 25 (2 bolts)
		⑳	Cable clamp	5	M4 × 20 (6 bolts)
		㉑	Spacer	10	
C	Cable support	㉒	X-Y cable support	1	M6 × 10 (4 bolts)
		㉓	Y-Z cable support	1	
		㉔	Support rest	1	
		㉕	Plate nut (to fix cable support)	4	M6 × 10 (4 bolts), M6 × 16 (4 bolts)
		㉖	Plate nut	1	M3 × 6 (2 bolts)

6) Affix seals of X and Y axes, which are provided with the controller cable, to respective cable connectors.
(We recommend to affix the seals to the connectors to avoid miss-connection in the multi-axis combination because the connector is common to all main units regardless their motor power specifications.)

Photo 21-5RX



7) Insert two plate nuts ⑤ to each T-slot of X axis main unit. (Photo 21-6RX)
Affix the connector box ① to the X main unit using the plate nuts. (M3 × 6, 6 bolts) (Photo 21-7RX)

Photo 21-6RX

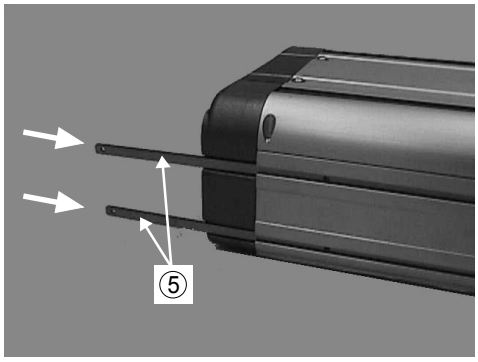
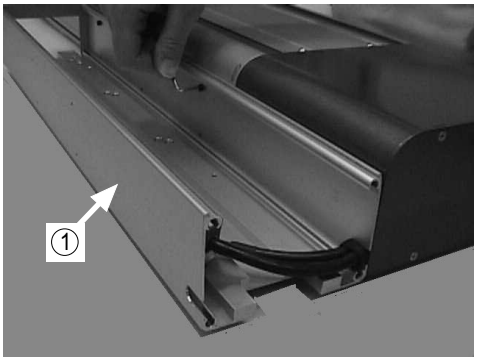


Photo 21-7RX



8) Same as the procedure 7), insert two plate nuts ⑱ to each T-slot on the side of Y axis main unit. Attach the long junction box ⑨ to Y axis main unit using the plate nuts. (M3 × 6, 6 bolts) Use the holes of the junction box as shown in Figure 21-27 to fix the box. Then insert two slot plugs ⑰ to the junction box at Y axis motor side, fix the end cover ⑭. (M5 × 10, 4 bolts) (Photo 21-27)

Figure 21-27

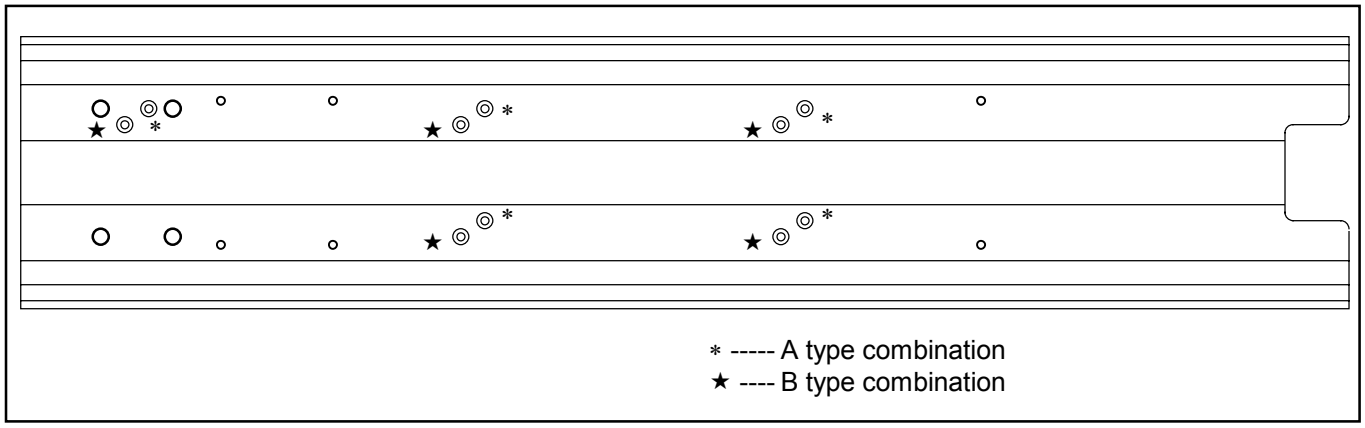
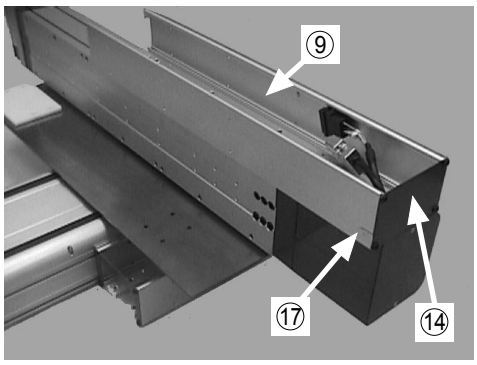
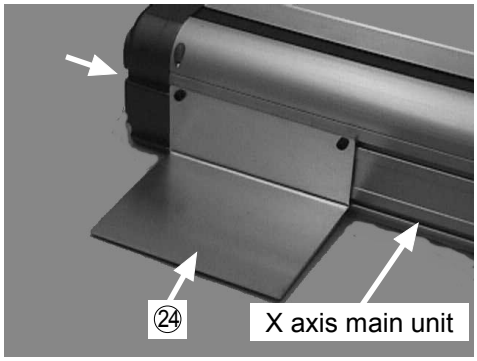


Photo 21-8RX



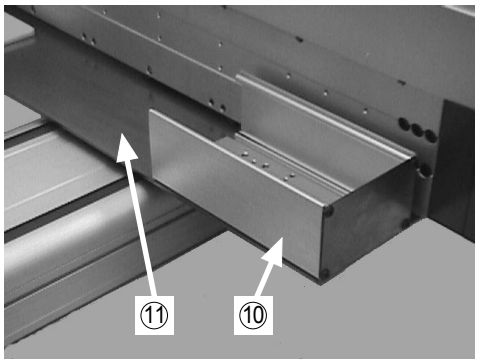
9) Attach the support rest ㉔ to X axis main unit. Same as the procedure 8), insert two plate nuts ㉕ to each T-slot and fix it. (M3 × 6, 2 places)

Photo 21-9RX



12) Attach the short junction box ⑩ to Y-Z support rest ⑪. (M5 × 10, 4 bolts)

Photo 21-10RX



13) Pass Y axis built-in cable through the cable support ㉒.
(Photo 21-11RX. Be careful of the direction of the built-in cable.) Fix it to the fixed side connector box ①.

Photo 21-11RX

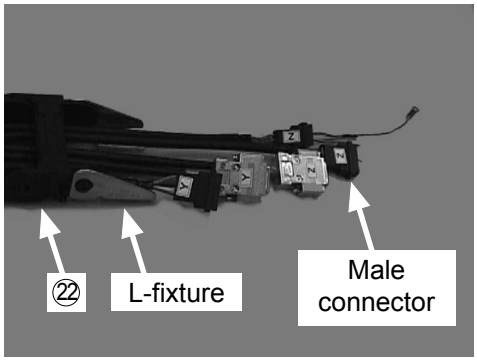
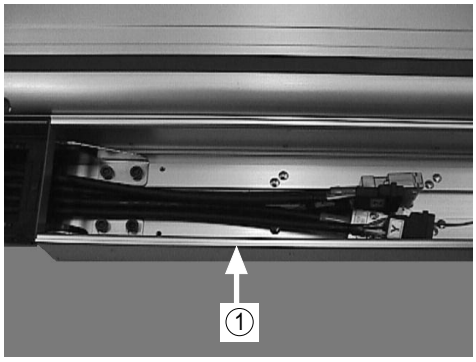


Photo 21-12RX



14) Attach the other side (moving side) of cable support with L-fixture ⑮ and two plate nuts ㉜. (M6 × 10, 4 bolts) Then put the Y-Z built-in cables in the Y-Z cable support via Edge saddle of L-fixture ⑮. (Photo 21-13RX)
Then attach the fixed side of Y-Z cable support to the shorter junction box ⑩. (M6 × 10, 4 bolts) (Photo 21-14RX)
Fix the L-fixture ⑮ to the short junction box. (Photo 21-15RX)

Photo 21-13RX

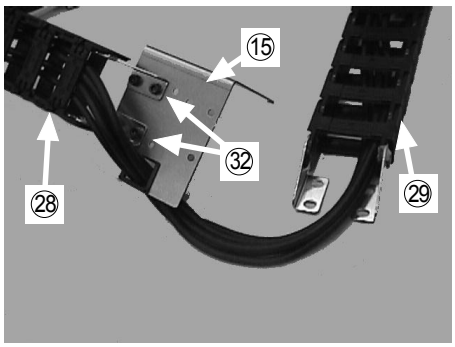


Photo 21-14RX

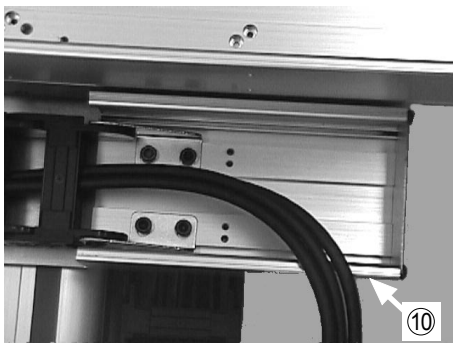
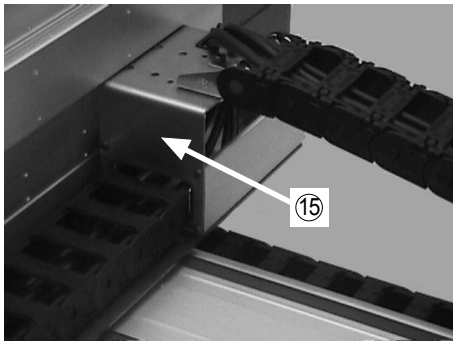


Photo 21-15RX



15) Pass the Y axis built-in cable through Edge saddle of L-fixture ⑯, then fix the L-fixture to the connector box ⑨. (Photo 21-16RX)
Then fix the moving side (other end) of cable support to L-fixture with two plate nuts ㉜. (M6 × 16, 4 bolts) (Photo 21-17RX)

Photo 21-16RX

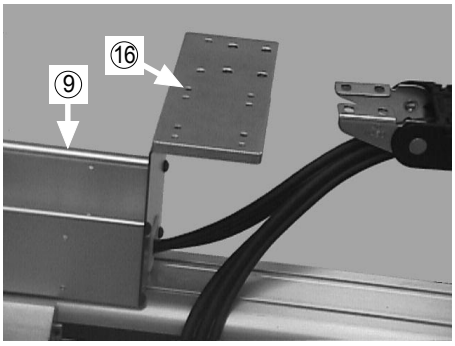
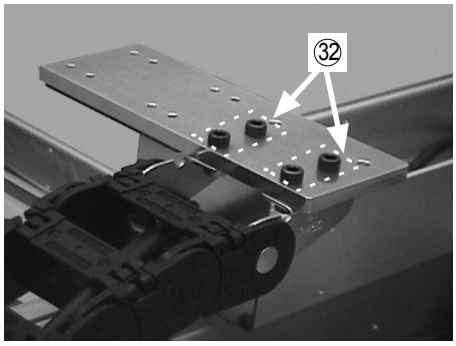
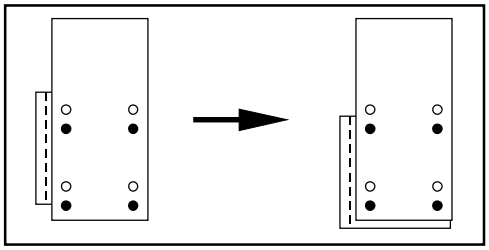


Photo 21-17RX



Note : The plate provided with the L-fixture ⑯ is set to RX-HM combination at the factory.
For RX-HH combination, change the setting as shown in Figure 21-28 below.

Figure 21-28

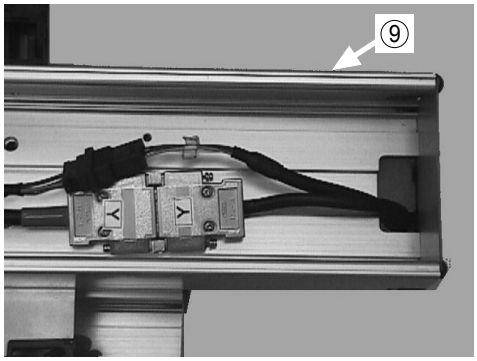


16) Connect the Y axis built-in cables to the cables of Y axis main unit. (2 connectors)

◊ Motor connector : Snap to the end.

◊ Encoder connector : Secure the connectors with 2 set screws. (Photo21-18RX)

Photo 21-18RX



17) Connect both controller cables. (Photo 21-19RX) Attach the end cover ③ to the fixed side connector box. (M5 × 10, 4 bolts)
Put the respective cable holders to the groove in the end cover in order of Y and X axis. (Photo 21-20)

Photo 21-19RX

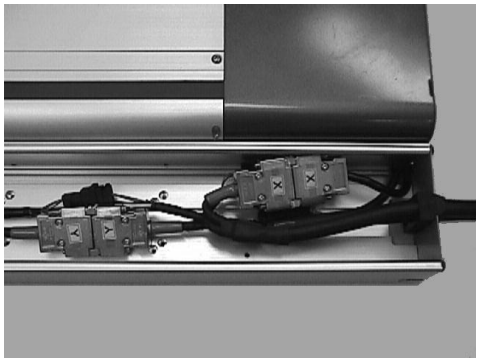
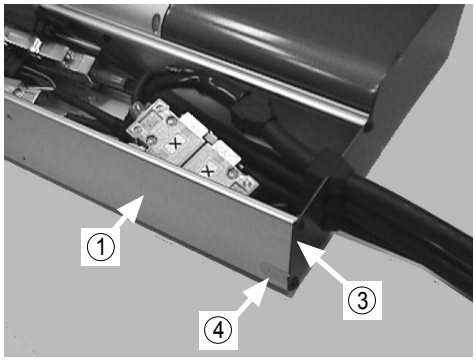
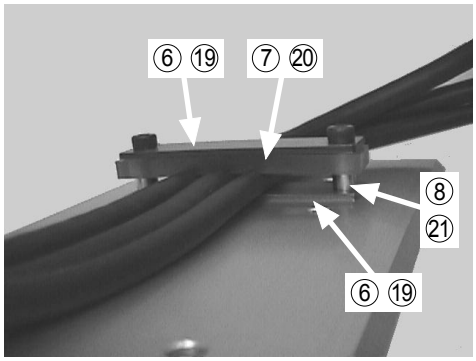


Photo 21-20RX



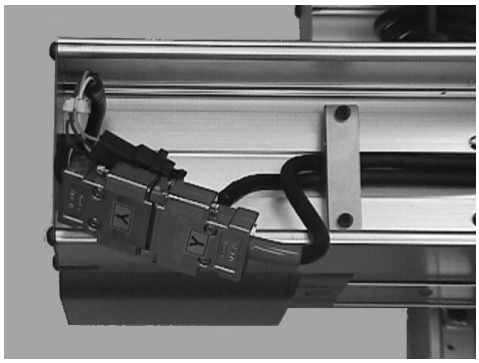
18) Loosely store the cables in the cable support so that they don't get a jerk. Set a large bending radius to the cables as much as possible in the connector boxes, then fasten them with the clamping parts ⑥ ~ ⑧ and ⑲ ~ ㉑.
(M4 × 20 or M5 × 16 2 bolts each)
(Place the clamp base first, put the cables on it, then fix them by the clamp.)
(Photo 21RX ~ 25RX)

Photo 21-21RX



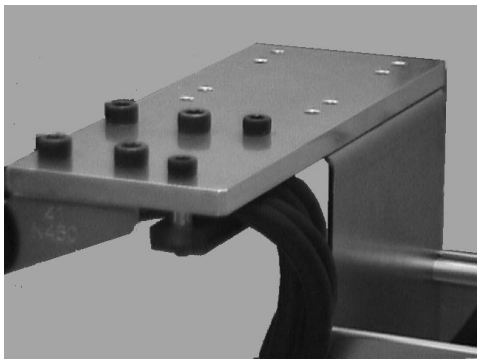
Details of the clamp in the box

Photo 21-22RX



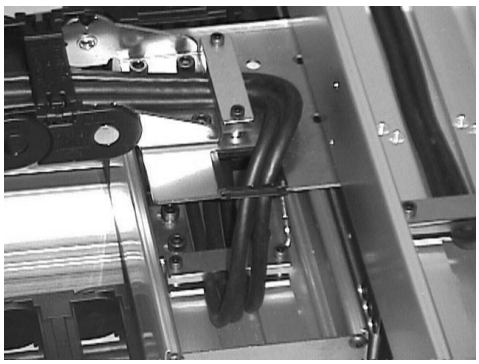
In the moving side connector box
Y axis motor side

Photo 21-23RX



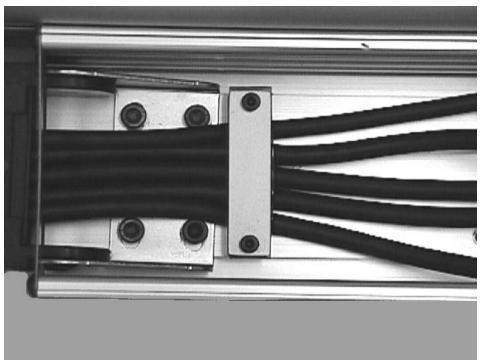
Moving side of connector box
under L-fixture

Photo 21-24RX



In the junction box

Photo 21-25RX



In the fixed side connector box

20) Fix the top and bottom covers of both connector boxes. Loosen the bolts of both sides end covers, hook the edge of the top (bottom) cover to a groove of a connector box, then push in the other side of the top (bottom) cover. (Photo 21-26RX)
Then retighten the screws for the end covers. (Photo 21-27RX)
(Pass the built-in cable through Edge saddle beforehand when attaching the short top cover ⑫.)

Photo 21-26RX

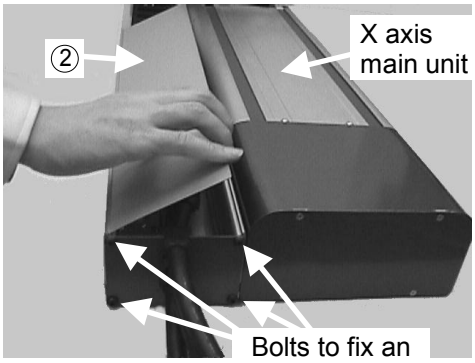
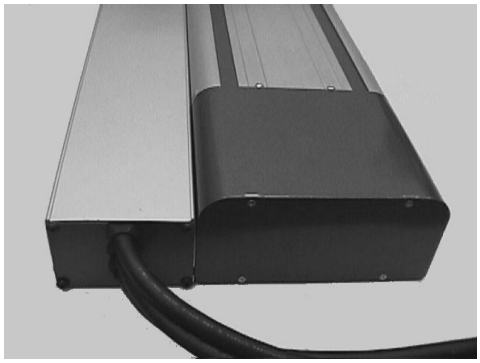
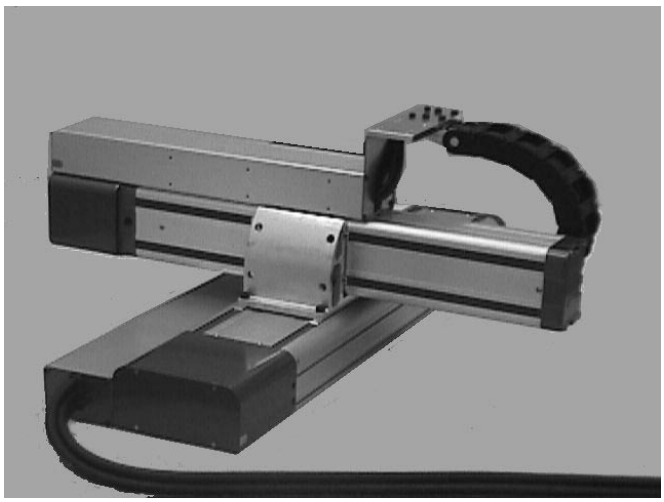


Photo 21-27RX



Completion of RX-HH (HM) combination

Photo 21-28RX



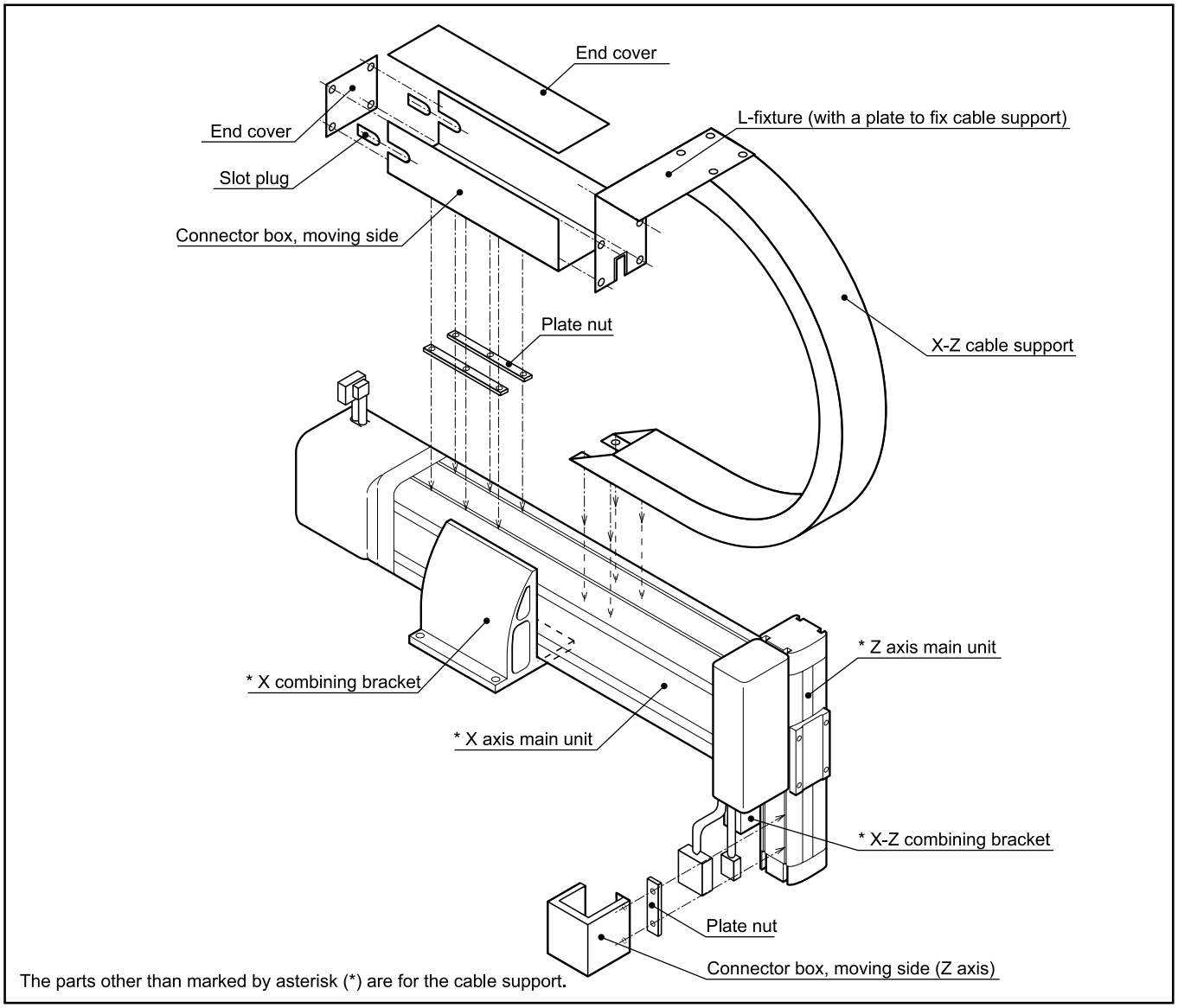
21.7.10. RC-MSz Combination

- The parts required for RC-MSz combination are listed in Table 21-40. Confirm the all parts are ready before assembly.

Table 21-42

Name	Quantity	Reference number	Sections to be referred.
X axis main unit	1	XY-HRS0□5-RM200	3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications"
Z axis main unit	1	XY-HRS0□0-RS1□□	
Controller	1	M-EXEA2-1100□00	1 Installation and Maintenance of the EXEA Controller "5. Reference Number and Specifications"
Teaching box	1	M-EXTB0□	
X combining bracket	1	XY-P175XHM-1	3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications"
X-Z combining bracket	1	XY-P175CMS-1	
Controller cable	1	XY-E185□□-1	
Controller cable	1	XY-E185□□-2	
Cable support	1	XY-E173CM0S1500-1	
X axis built-in cable	1	XY-E173□□□-1	
Z axis built-in cable	1	XY-E173□□□-2	

Figure 21-29



◆ Assembly procedures of RC-MSz combination

- Following description is the assembly procedures for A type combination. However, the procedures for B type is fundamentally the same, though assembly direction of main unit and the cable supports are different.

1) Modifications of the main unit and L fixture required for respective types are listed in Table 21-41. Modify then before assembly.

Table 21-41

	A	B
X axis main unit	Not necessary	Reverse outlet position of main unit cable.*1
Z axis main unit	Reverse outlet position of main unit cable.*1	
Connector box, moving side	Reverse L-fixture. *2	

*1. Refer to "21.3. Reversing Position of Main Unit Cable."

*2. Refer to "21.13. Reversing L-fixture."

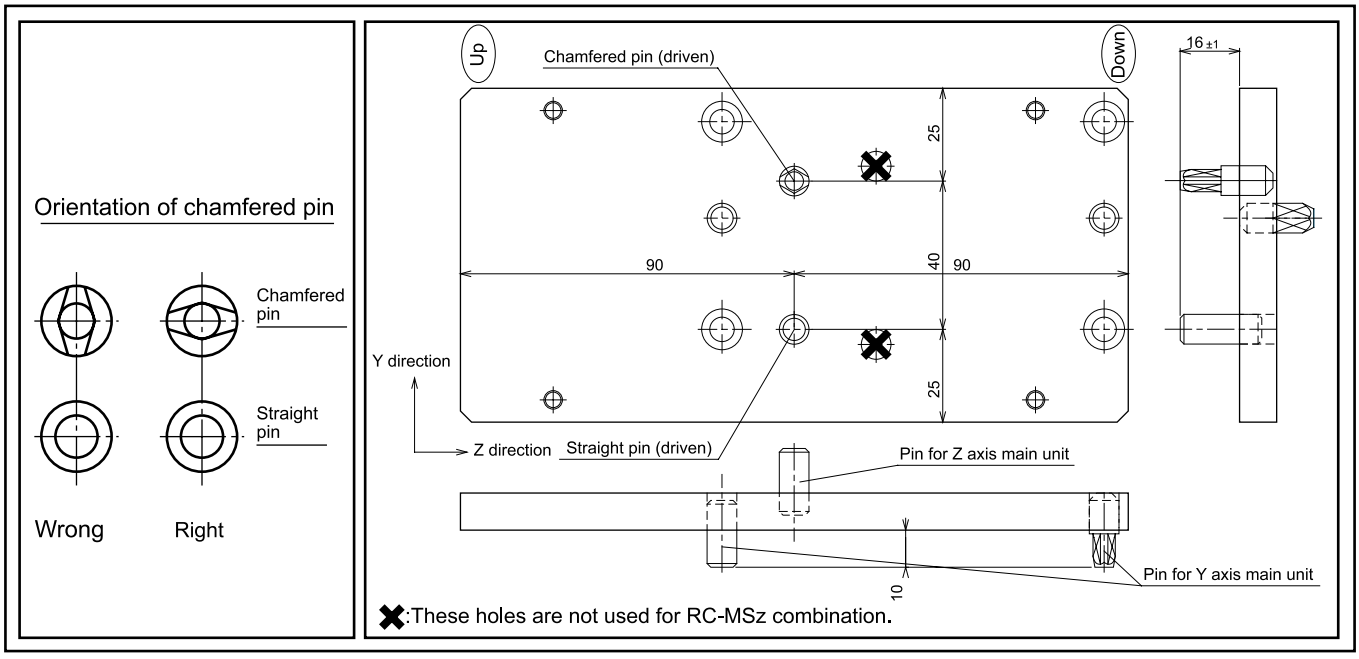
2) Drive the pins to the X axis bracket. (part of X-Z combining bracket)

- The X-Z combining bracket consists of X axis bracket and Z axis bracket.
- Drive a chamfered pin and a straight pin to X axis bracket to the locations shown in Figure 21-30 using a plastic hammer. (The pins are provided with X-Z combining bracket.)

Caution : *• Be careful with orientation of the chamfered pin. See a lower left figure for correct orientation.*

• Do not push in the locating pins for Y axis main unit on the back of the bracket when driving the pins.

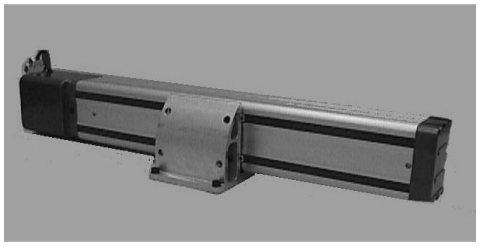
Figure 21-30: X axis bracket



3) Fix X combining bracket to the mounting base. Tap to 4-ø9 holes on the mounting base as shown in the figure of RC-MSz combination on the Robot Module catalog.
(M8, 4 bolts: tightening torque: 27.5 ~ 33.3 N·m)

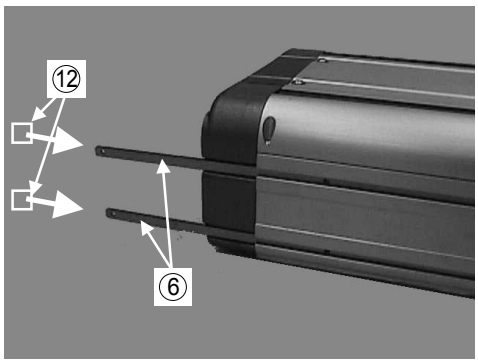
4) Fix the slider of X axis main unit to X combining bracket. (Photo 21-1RC)
(M6, 4 bolts: tightening torque: 9.8 ~ 11. 8 N·m)

Photo 21-1RC



5) Insert the plate nuts ⑥ and ⑫ to T-slots on X axis main unit from opposite side of the motor as shown in Photo 21-2RC. (Insert the plate nut ⑥ first, then 4 small plate nuts ⑫ to each T-slot. (Photo 21-2RC)

Photo 21-2RC



6) Turn Z axis main unit over and fix Z axis bracket of X-Z combining bracket to the mounting surface of Z axis main unit. (M5, 4 bolts: tightening torque: 4.9 ~ 5.9 N·m) (Photo 21-3RC)
Attach X axis bracket of X-Z combining bracket to an end face of X axis main unit.
(M6, 4 bolts: tightening torque: 9.8 ~ 11.8 N·m) (Photo 21-4RC)

Photo 21-3RC

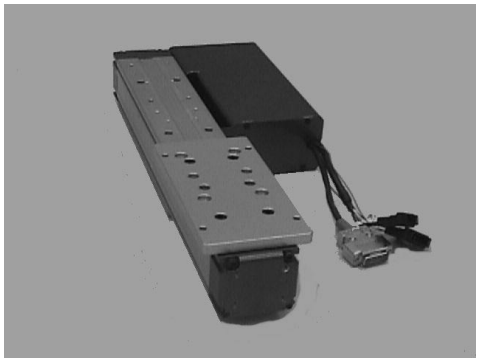
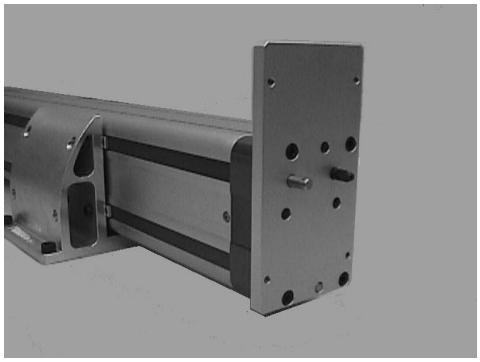
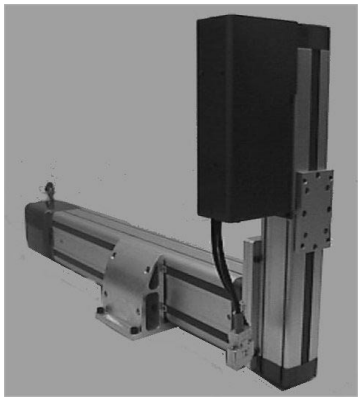


Photo 21-4 RC



7) Fix Z axis main unit to X axis bracket using Z axis bracket.
(M6, 4 bolts: tightening torque: 9.8 ~ 11.8 N·m) (Photo 31-5RC)

Photo 21-5RC



8) Attach the cable support to the main units and wire the cables. The parts of cable support are listed in Table 21-42. Confirm that all parts are ready.

Photo 21-6RC

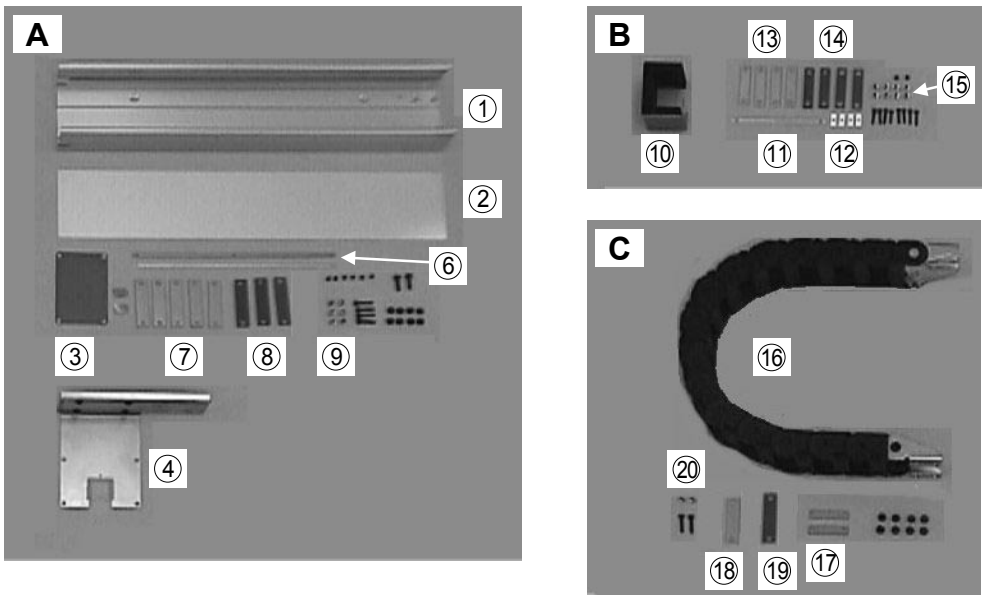
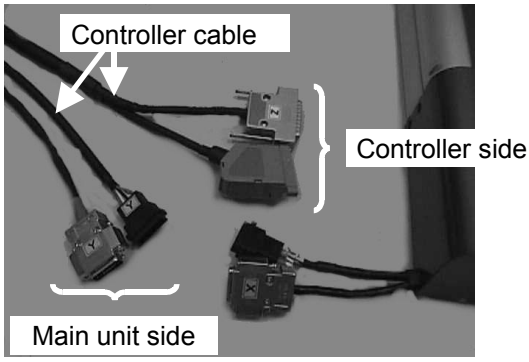


Table 21-42

Section	Name of section	Part No.	Name	Quantity	Hexagon socket cap screws
A	Moving side Connector box (attach to X axis)	①	Connector box	1	M5 × 10 (4 bolts)
		②	Top cover	1	
		③	End cover	1	
		④	L-fixture (with a plate to fix cable support)	1	M5 × 10 (4 bolts)
		⑤	Slot plug	1	
		⑥	Plate nut	2	M3 × 6 (6 bolts)
		⑦	Clamp base	5	M5 × 25 (2 bolts)
		⑧	Cable clamp	3	M4 × 20 (2 bolts)
		⑨	Spacer	2	
B	Moving side Connector box (Attach to Z axis)	⑩	Connector box	1	
		⑪	Plate nut	1	M3 × 6 (2 bolts)
		⑫	Plat nut, small	8	
		⑬	Clamp base	4	
		⑭	Cable clamp	4	M3 × 16 (8 bolts)
		⑮	Spacer	8	
C	Cable support	⑯	X-Z cable support	1	M6 × 10 (4 bolts), M6 × 16 (4 bolts)
		⑰	Plate nut (to fix cable support)	2	M6 × 10 (4 bolts)
		⑱	Clamp base	1	
		⑲	Cable clamp	1	M4 × 20 (2 bolts)
		⑳	Spacer	2	

8) Affix seals of X and Z axes, which are provided with the controller cable, to respective cable connectors.
(We recommend to affix the seals to the connectors to avoid miss-connection because the connector is common to all main units regardless their motor power specifications.)

Photo 21-7RC



10) Fix the connector box ① to X axis main unit with the plate nuts ⑥ inserted to T-slots at the procedure 8). Use the holes in the connector box as shown in Figure 21-31 below.
(M3 × 6, 6 bolts) Then insert two slot plugs ⑤ and attach the end cover ③ on the motor side.
(M5 × 10, 4 bolts) (Photo 21-8RC)

Figure 21-31

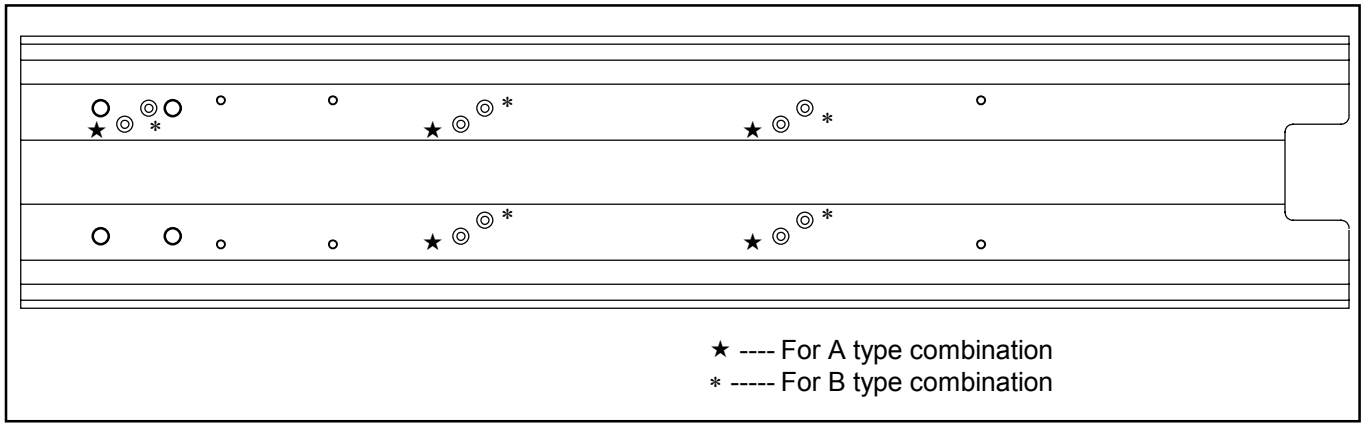
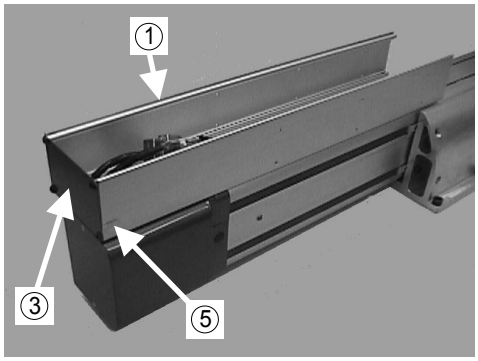


Photo 21-8RC



11) Pass the X-Z built-in cable through the cable support ⑯. (Be careful direction of the built in cable. See Photo 21-9RC.)
Fix the fixed side of cable support to the mounting base. (M6 × 10, 4 bolts) (Photo 21-10)
Tap M6 for the bolts beforehand on the mounting base to positions indicated by 4- ø7 in the figure of RC-MSz combination on the catalog.

Photo 21-9RC

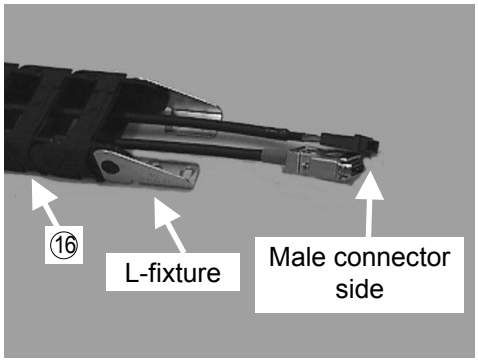
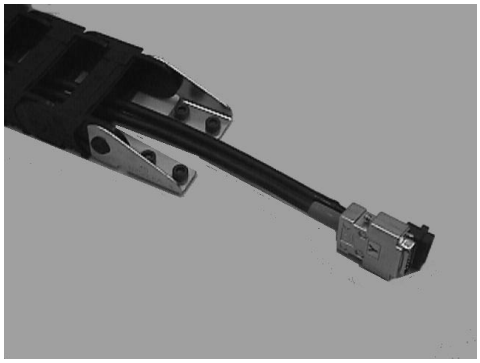


Photo 21-10RC



12) Pass X axis built-in cable through Edge cover of the L-fixture ④ and fix to the connector box ①. (Photo 21-11RC)
Then fix the other end (moving side) of cable support to the connector cable with the plate nut ⑰. (M6 × 10, 4 bolts) (Photo 21-12RC)

Photo 21-11RC

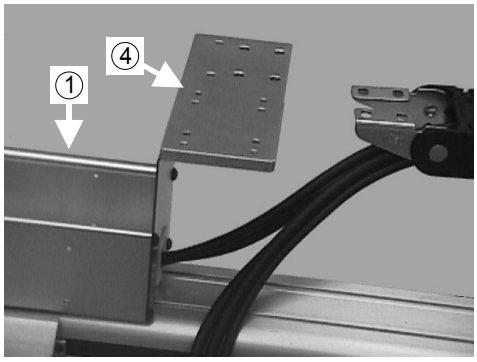
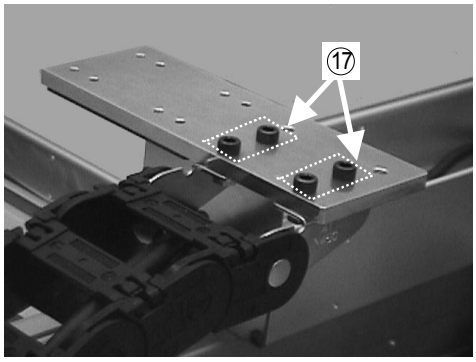


Photo 21-12RC

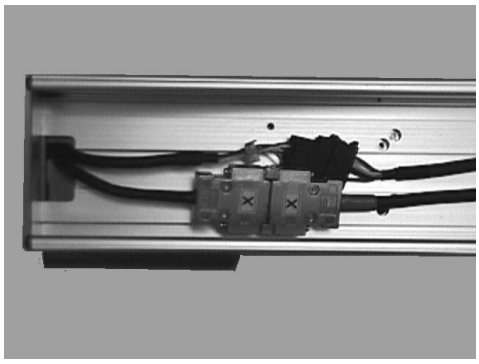


13) Connect X axis main unit cables and X axis built-in cables.

◊ Motor connector : Snap to the end.

◊ Encoder connector : Secure the connectors with 2 set screws. (Photo 21-13RC)

Photo 21-13RC



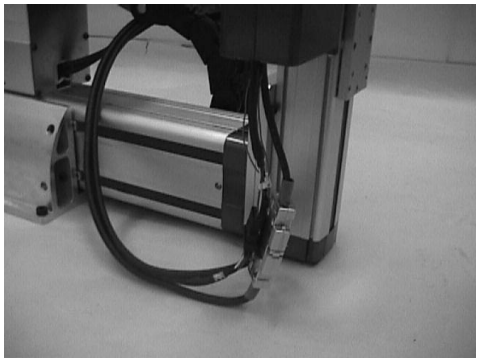
14) Connect Z axis main unit cables and Z axis built-in cables. (Photo 21-14RC)

◊ Motor connector : Snap to the end.

◊ Brake connector : Snap to the end.

◊ Encoder connector : Secure them with 2 set screws.

Photo 21-14RC



15) Insert the plate nut ⑪ to T-slots from the slider side of Z axis main unit and fix the connector box ⑩ to Z axis main unit. (M3 × 6, 2 bolts) (Photo 21-15RC) Put the connectors connected at the procedure 14) into the connector box on the side of Z axis main unit and fix it to the connector box. (Photo 21-16C)

Photo 21-15RC

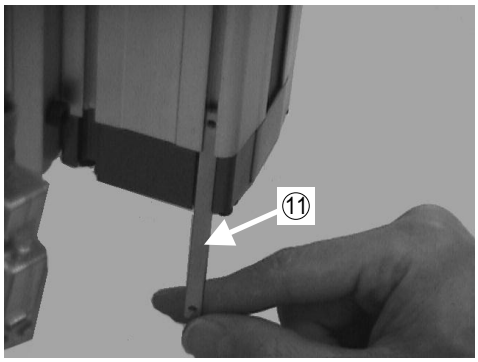
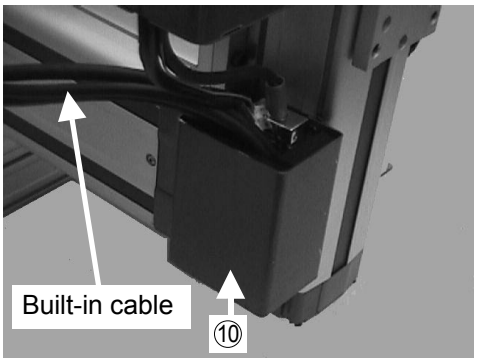
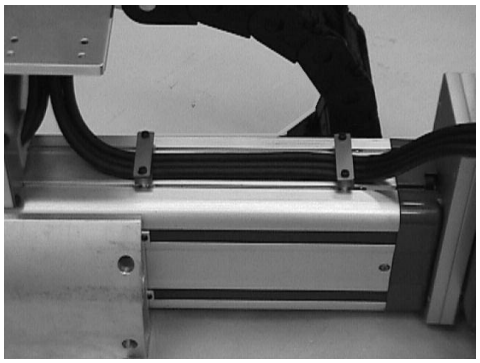


Photo 21-16RC



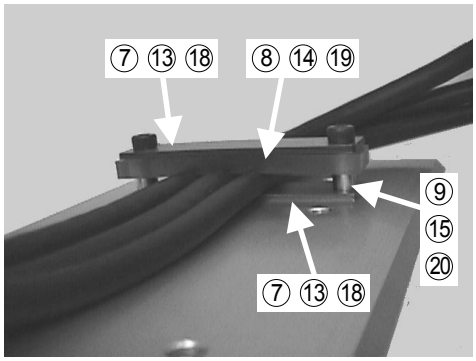
16) Fix Z axis built-in cable to the upper side of Z axis main unit with the clamping parts ⑬ ~ ⑮ and the small plate nuts ⑫, which have been inserted at the procedure 5). (M3 × 16, 4 bolts) (Photo 21-17RC)

Photo 21-17RC



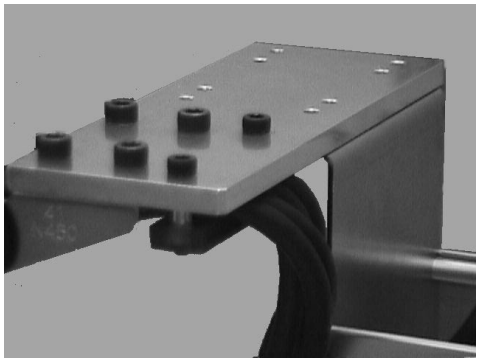
17) Loosely store the cables in the cable support so that they don't get a jerk. Set a large bending radius to the cables as much as possible in the connector box, then secure them with the clamping parts ⑦ ~ ⑨, ⑫ ~ ⑮ and ⑱ ~ ⑳.
[M4 × 20 (2 bolts), M5 × 16 (2 bolts) or M5 × 25 (2 bolts)]
(Place the clamp bases first on the connector box, put the cables on it, and then fasten them with the cable clamps.) (Photo 21-18RC to 20RC)

Photo 21-18RC



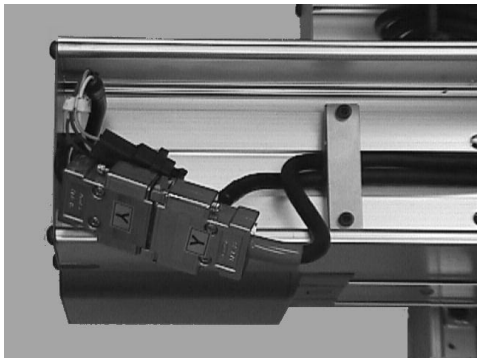
Inside the connector box

Photo 21-19RC



Connector box
under L-fixture

Photo 21-20RC



Connector box
Y axis motor side

18) Attach the top covers of the connector boxes.
Unfasten the screws of end covers loosely, hook an edge of the top cover to a groove on the connector box and push the other side in (Photo 21-21RC), then secure the end covers.

Photo 21-21RC

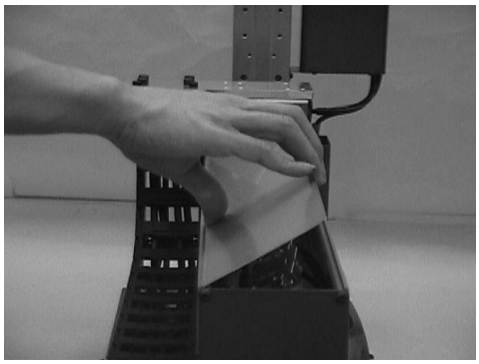
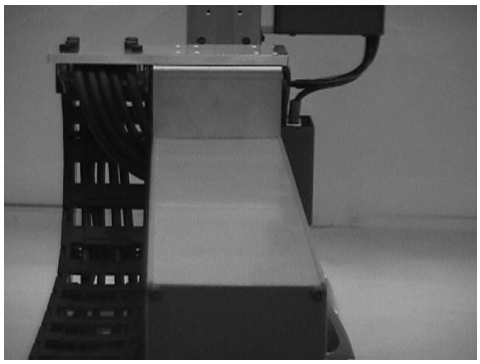
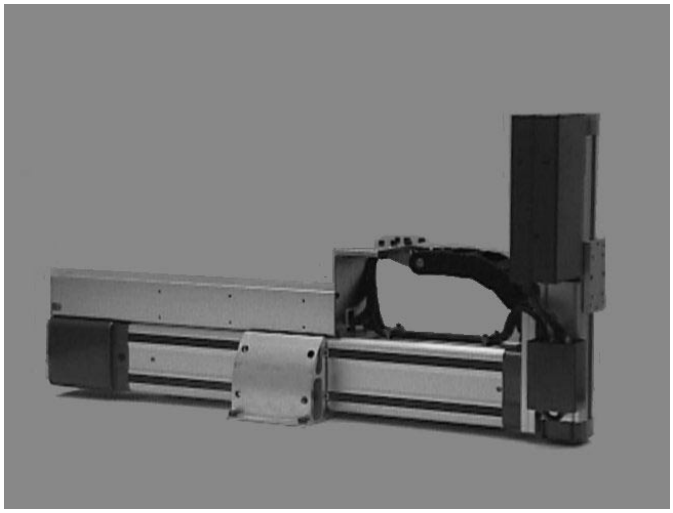


Photo 21-22RC



Completion of RC-MZz combination

Photo 21-23RC



Caution : *Be sure to fix two connectors on the mounting base referring to "21.5.2.1. All Modules (Excludes RH and RM Motor Indirect Mount Modules)." We recommend to fix the built-in cables to the mounting base using clamping parts ⑱ ~ ⑳ as well. (M4 × 20, 2 bolts)*

21.7.11. RP-MSSz Combination

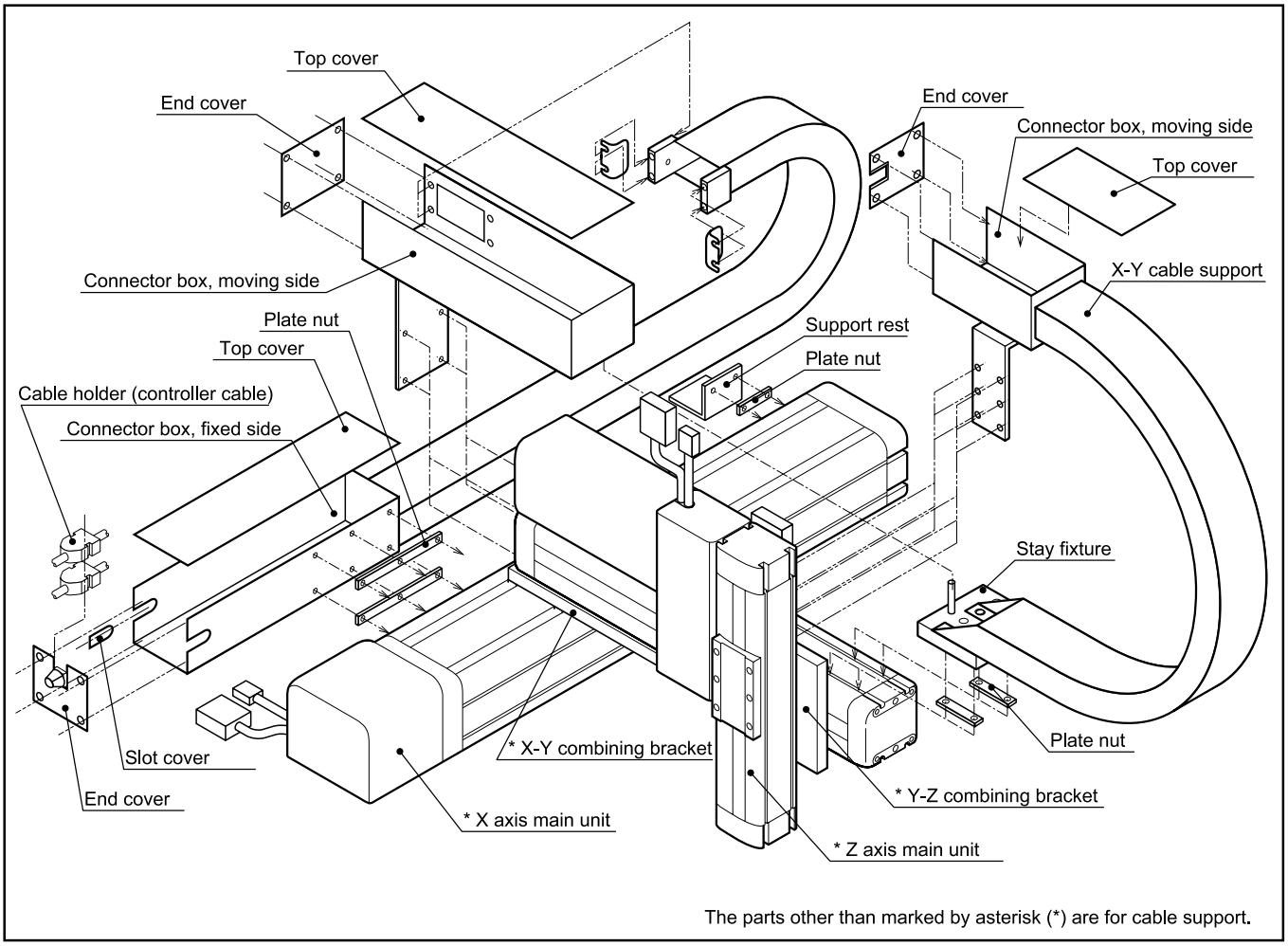
- The parts required for RP-MSSz combination are listed in Table 21-43. Confirm that all parts are ready before assembly.

Table 21-43

Name	Quantity	Reference number	Sections to be referred.
X axis main unit	1	XY-HRS□□5-RM200	3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications"
Y axis main unit	1	XY-HRS0□3-RS2□□	
Z axis main unit	1	XY-HRS0□0-RS1□□	
Controller	1	M-EXEA3-2100□00	1 Installation and Maintenance of the EXEA Controller "5. Reference Number and Specifications"
Teaching box	1	M-EXTB0□	
X-Y combining bracket			3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications"
A and C type	1	XY-P175GMS-1	
B and D type		XY-P175GMS-2	
Y-Z combining bracket	1	XY-P175DSS-1	
Controller cable	2	XY-E185□□-1	
Controller cable	1	XY-E185□□-2	
Cable support	1	XY-E173PMSS2716-1	
Y axis built-in cable	1	XY-E173□□□-1	
Z axis built-in cable	1	XY-E173□□□-2	
Mounting bracket	2	XY-P170H-1 *	

* This is not required when X axis main unit is fixed from its back surface directly.

Figure 21-32



◆ Assembly procedures of RP-MSSz combination

- Following description is the assembly procedures of A type. However, the procedures for B, C and D types are fundamentally the same, though combining directions of the main units and the cable support are different.

- Modifications of the main units, the connector box and L-fixture are required for some combination types. Modify them before assembly.

1) The required modifications are listed in Table 21-44 for respective combination types. No modification is required for A type.

Table 21-44

	A	B	C	D
X axis main unit	Not necessary	Reverse outlet position of main unit cable *1		Not necessary
Y axis main unit	Reverse outlet position of main unit cable *1			
Connector box, fixed side	Not necessary			
Junction box	Not necessary	Reverse connector box *2 Reverse L-fixture. *3		Not necessary
Connector box, moving side	Not necessary	Reverse L-fixture. *3	Not necessary	Reverse L-fixture. *3

*1. Refer to "21.3. Reversing Position of Main Unit Cable."
*2. Refer to "21.12. Reversing Connector Box."
*3. Refer to "21.13. Reversing L-fixture."

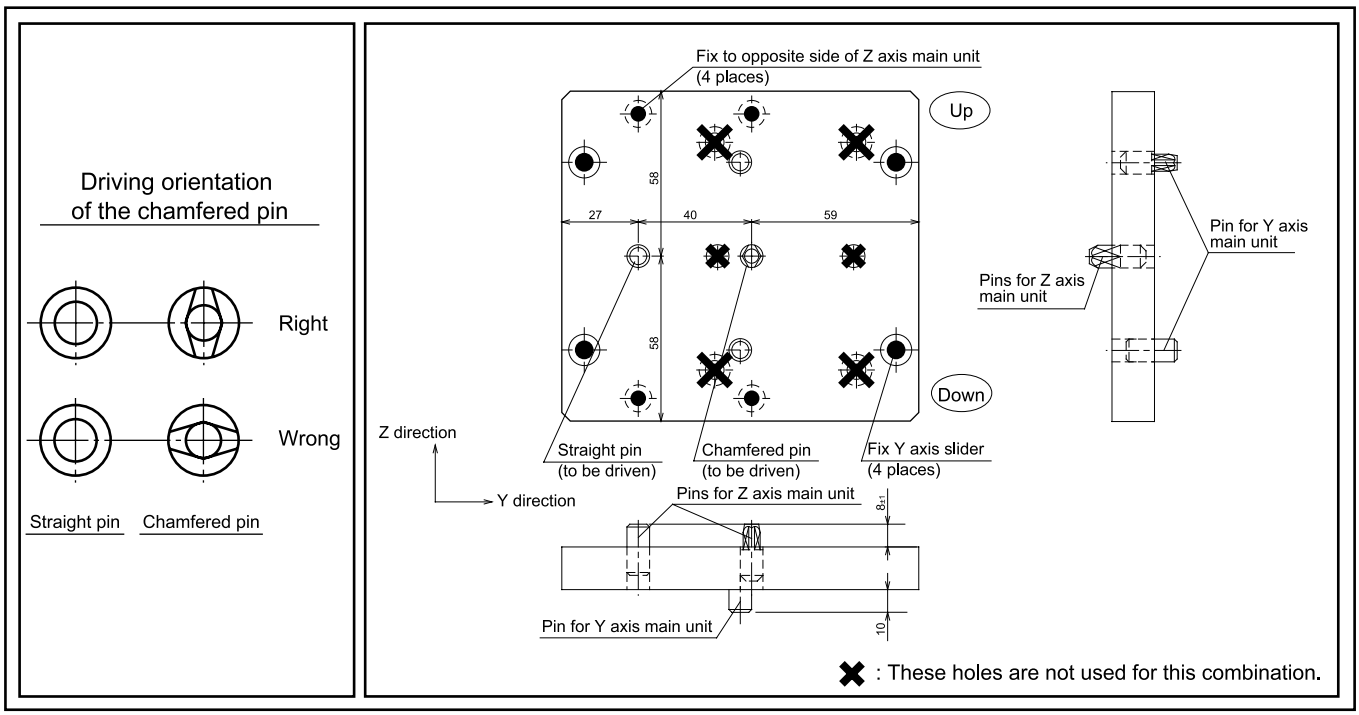
2) Drive the pins to Y-Z combining bracket.

- Drive a chamfered pin and a straight pin with a plastic hammer to the bracket on the locations shown in Figure 21-33 below. The pins are provided with Y-Z combining bracket.

Caution : *• Be careful with the orientation of the chamfered pin. See lower left figure for the orientation.*

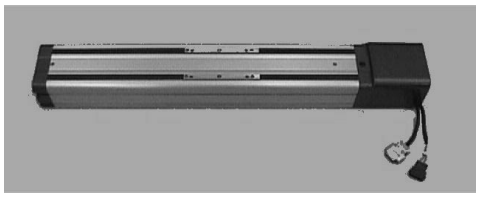
• Be careful not to push in pins for Y axis main unit on the back when driving the pins for Z axis main unit.

Figure 21-33



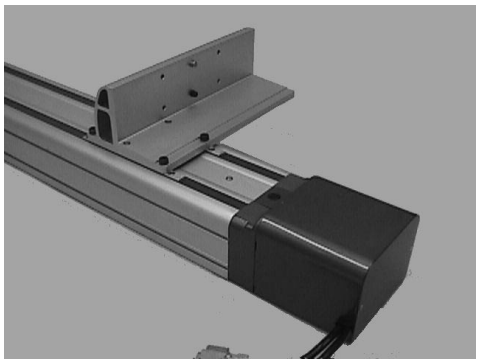
3) Fix X axis main unit to the mounting base. Refer to "21-4. Fixing Module Main Unit."

Photo 21-1RP



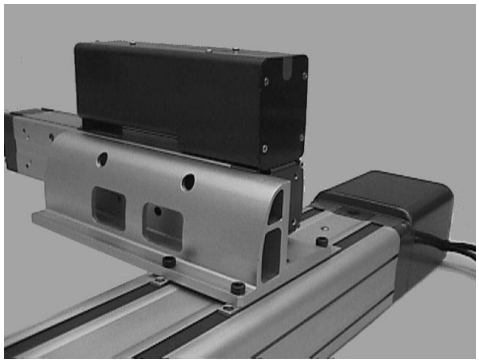
4) Fix X-Y combining bracket to the slider of X axis main unit.
(M6, 4 bolts: tightening torque: 9.8 ~ 44.8N·m)

Photo 21-2PR



5) Fix Y axis main unit to X-Y combining bracket.
(M5, 4 bolts: tightening torque: 4.9 ~ 5.9 N·m)

Photo 21-3RP



6) Turn Z axis main unit over and fix Y-Z combining bracket to its mounting surface.
(M5, 4 bolts: tightening torque4.9 ~ 5.9N·m) (Photo 21-4RP)
Then fix Y-Z combining bracket with Z axis main unit to the slider of Y axis.
(M6, 4 bolts: tightening torque: 9.8 ~ 11.8 N·m) (Photo 21-5RP)

Photo 21-4RP

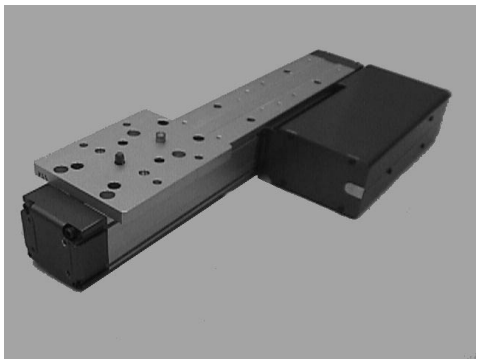
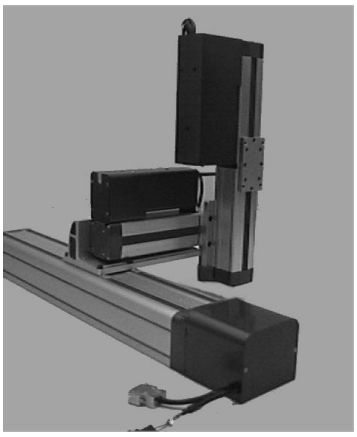


Photo 21-5RP



7) Attach the cable support to the main units and wire the cables. The parts of the cable support are listed in Table 21-45. Confirm that all parts are ready.

Photo 21-6RP

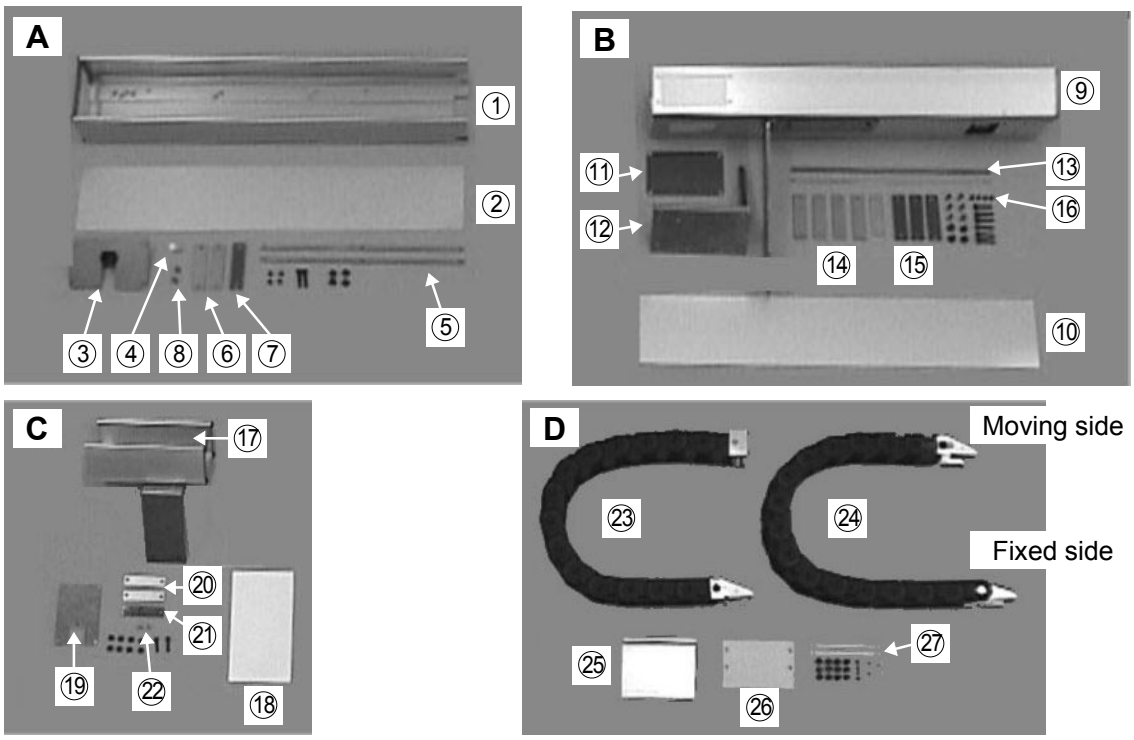
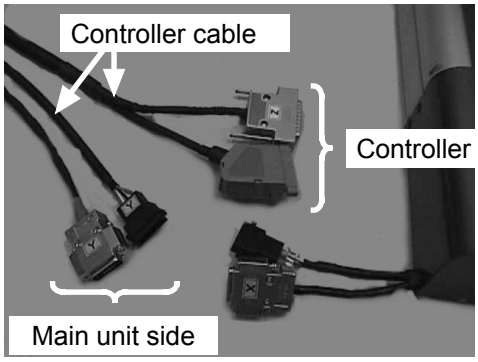


Table 21-45

Section	Name of section	Part No.	Name	Quantity	Hexagon socket cap screw
A	Fixed side Connector box (attach to X axis main unit)	①	Connector box	1	M5 × 10 (4 bolts)
		②	Top cover	1	
		③	End cover	1	
		④	Slot cover	1	
		⑤	Plate nut	2	M3 × 6 (6 bolts)
		⑥	Clamp base	2	
		⑦	Cable clamp	1	M4 × 20 (2 bolts)
		⑧	Spacer	2	
B	Junction Connector box (attach to Y axis main unit)	⑨	Junction box	1	M5 × 10 (9 bolts)
		⑩	Top cover	1	
		⑪	End cover	1	
		⑫	Stay fixture	1	
		⑬	Plate nut	2	M3 × 6 (6 bolts)
		⑭	Clamp base	4	
		⑮	Cable clamp	2	M4 × 20 (6 bolts)
		⑯	Spacer	4	
C	Moving side Connector box (attach to Z axis main unit)	⑰	Connector box	1	M5 × 10 (8 bolts)
		⑱	Top cover	1	
		⑲	End cover	1	
		⑳	Clamp base	2	
		㉑	Cable clamp	1	M4 × 20 (2 bolts)
		㉒	Spacer	2	
D	Cable support	㉓	X-Y cable support	1	M5 × 10 (4 bolts)
		㉔	Y-Z cable support	1	M6 × 10 (12 bolts)
		㉕	X axis support rest	1	
		㉖	Y axis support rest	1	
		㉗	Plate nut	2	M3 × 6 (4 bolts)

8) Affix seals of X, Y and Z axes, which are provided with the controller cable, to respective cable connectors.
(We recommend to affix the seals to the connectors to avoid miss-connection because the connector is common to all main units regardless their motor power specifications.)

Photo 21-7RP



9) Insert two plate nuts ⑤ to T-slots on the side of X axis main unit. (Photo 21-8RP)
Attach the fixed side connector box ① to the main unit. (M3 × 6, 6 bolts)

Photo 21-8RP

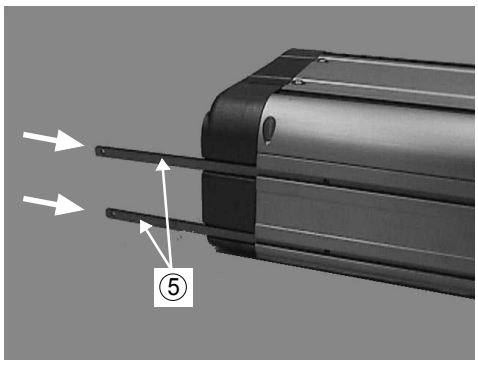
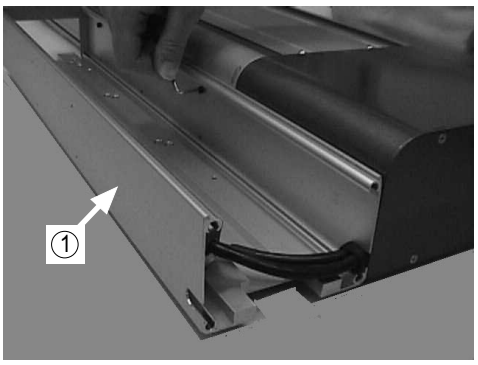


Photo 21-9RP



10) Insert two plate nuts ⑬ to T-slots on the side of Y axis main unit and loosely attach the stay fixture ⑫ to Y axis main unit. (M3 × 6, 4 bolts) (Photo 21-10RP)
Attach L-fixture of the junction box ⑨ to the end face of Y axis main unit.
(M5 × 10, 4 bolts) (Photo 21-11RP)
Fix the junction box ⑨ to the stay (Photo 21-12RP), then secure the stay fixture. (M3 bolts)

Photo 21-10RP

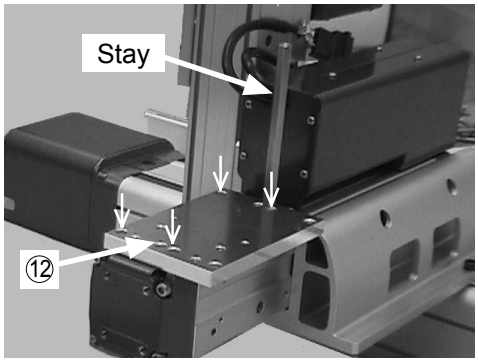


Photo 21-11RP

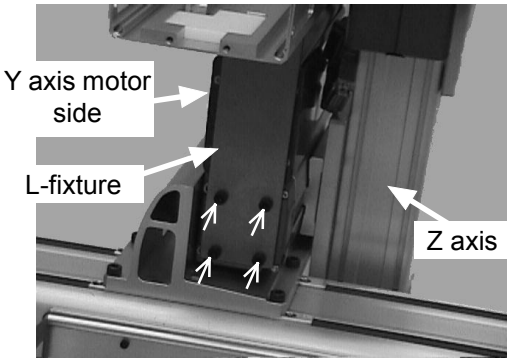
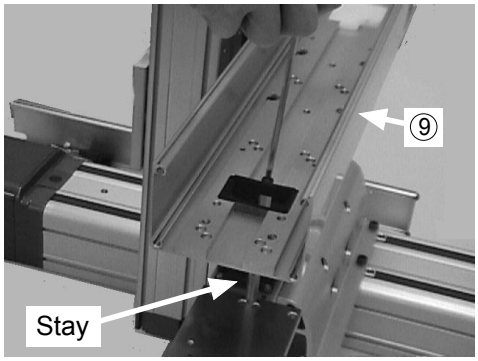


Photo 21-12RP



11) Attach the support rests for X and Y axis main unit.
X axis : ㉕ (L shape bracket)
Y axis : ㉖ (plastic)

Insert the plate nuts ㉗ to T-slots on the slider side of X and Y axis main unit, then attach the support rests respectively. (M3 × 6, 2 bolts)

Photo 21-13RP

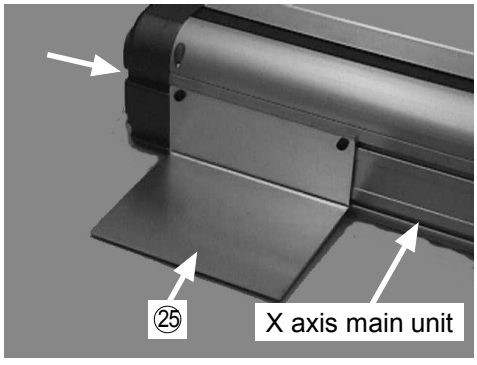
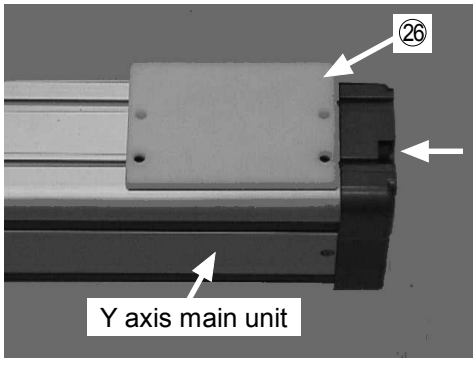
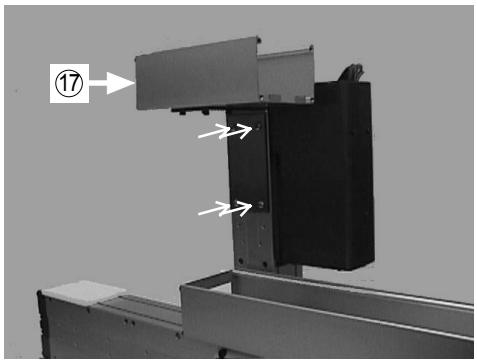


Photo 21-14RP



12) Attach the moving side connector box ⑰ to the back of Z axis main unit. (M5 × 10, 4 bolts)

Photo 21-15RP



13) Put the built-in cables for Y and Z axis through X-Y cable support. (Be careful the direction of the built-in cables. See Photo 21-16RP.) Fix the cable support to the fixed side connector box. (M6 × 10, 4 bolts. Photo 21-17RP)

Photo 21-16RP

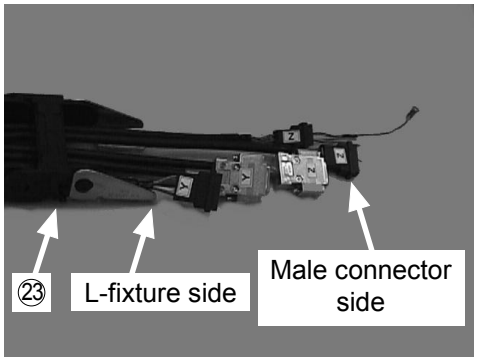
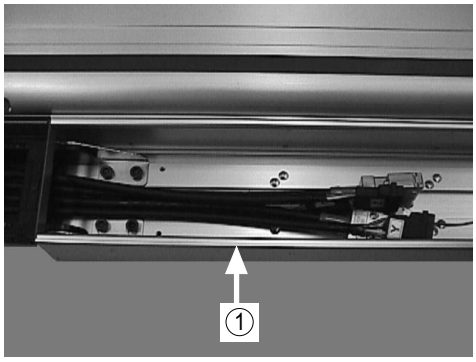


Photo 21-17RP



14) Fix the other end (moving side) of the cable support to the junction box ⑨. Detach covers a) and blocks b) temporally from the end of moving side of the cable support (Photo 21-18RP). Put the cables and the cable support through an opening in the junction box, then attach the covers (a) and the blocks (b) to the cable support again. Fix the blocks (b) to the junction box. (M5 × 10, 4 bolts, Photo 21-19RP)

Photo 21-18RP

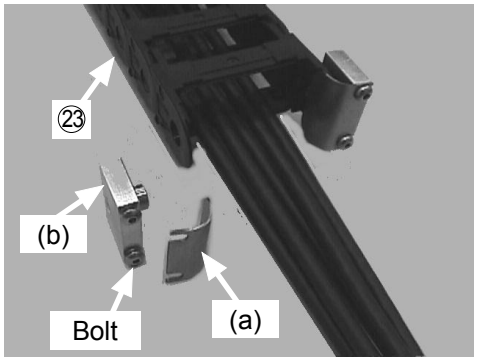
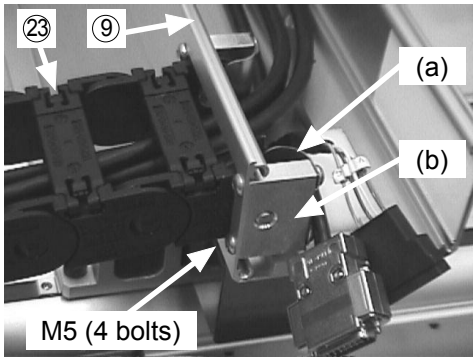


Photo 21-19RP



15) Put the cables of Y axis main unit through an opening in the bottom of junction box ⑨ and connect them to the built-in cables. (two connectors, Photo 21-20)

◊ Motor connector : Snap to the end..

◊ Encoder connector : Secure them with two screws.

Attach the end cover ⑪. (Photo 21-21RP)

Photo 21-20RP

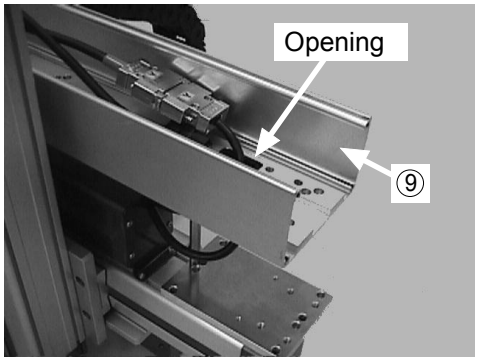
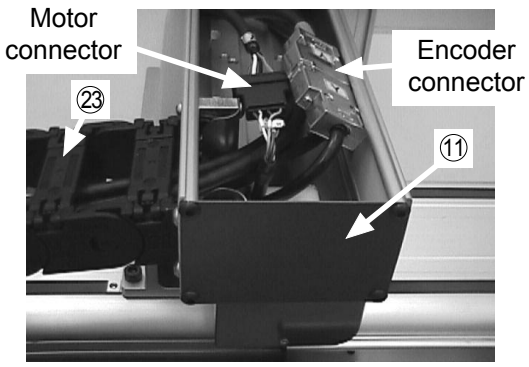
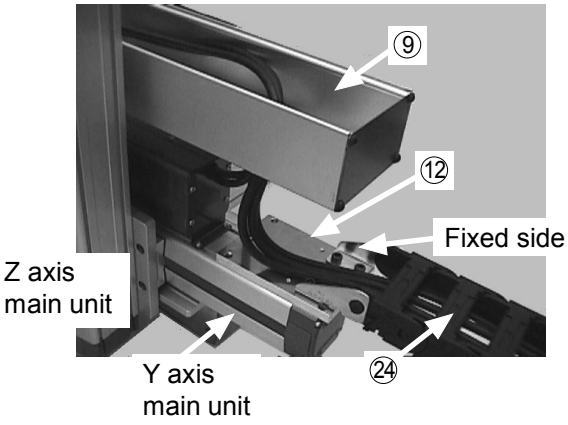


Photo 21-21RP



16) Put the Z axis built-in cables through Y-Z cable support ㉔ via the opening in the bottom of junction box ⑨. Fix the end of fixed side of Y-Z cable support (bracket with holes) to the stay plate ⑫. (M6 × 10, 4 bolts, Photo 21-22RP)

Photo 21-22RP



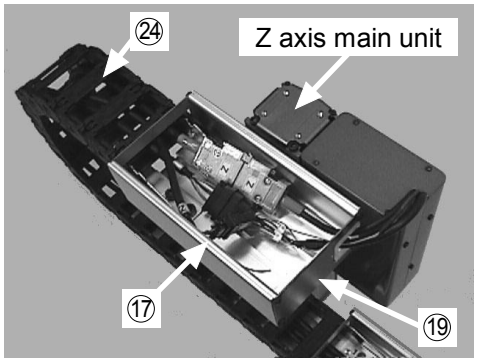
17) Fix the other end (moving side) of the cable support to the moving side connector box ⑰ as the same procedure 16). (M6 × 10, 4bolts) Put the cables of Z axis main unit through Edge saddle of the end cover ⑲ and fix the end cover to the connector box, then connect the cables of Z axis main unit and the built-in cables.

◊ Motor connector : Snap to the end.

◊ Brake connector : Snap to the end.

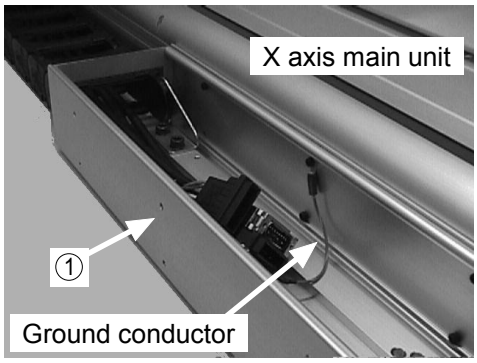
◊ Encoder connector : Secure them with 2 screws.

Photo 21-23RP



18) Secure the round terminal of the ground conductor (green) to a fixing bolt of the connector box ① (M3 × 6, Photo 21-24RP)
When you use the user cables (6 rope-lay conductors) provided with the cable support, wire the ground conductor to the ground terminal of external user's equipment from the fixed round terminal on the connector box.

Photo 21-24RP



19) Connect the controller cables for X, Y and Z axis. (Photo 21-25RP) Attach the end cover ③ to the connector box ①. (M5 × 10, 4 bolts) Insert the cable holders of controller cables to he groove in the order of Z, Y and X axis. (Photo 21-26RP)

Photo 21-25RP

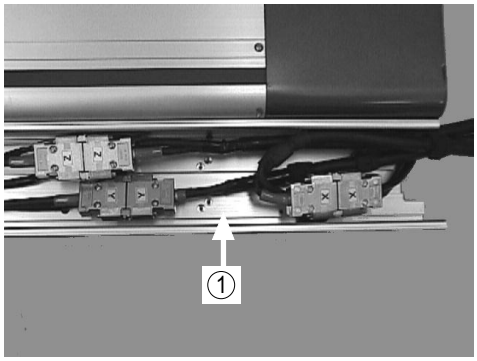
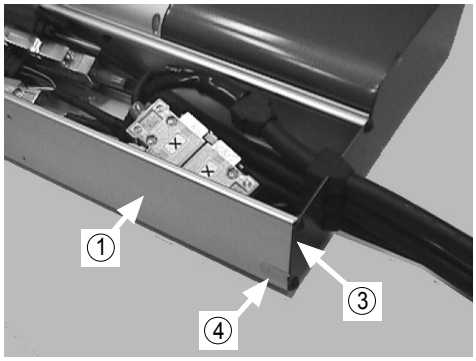
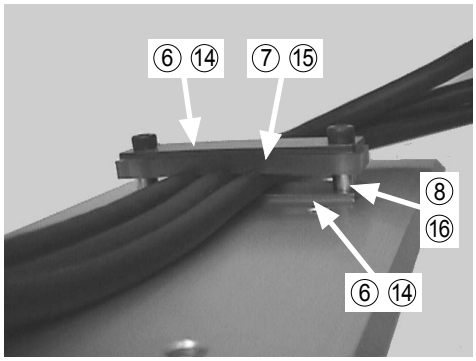


Photo 21-26RP



20) Pass the cables through loosely the cable supports so that they don't get a jerk. Set a large bending radius to the cables as much as possible in the connector boxes, then secure them with the clamping parts ⑥ ~ ⑧, ⑭ ~ ⑯ and ⑳ ~ ㉒.
[M4 × 20 (2 bolts), M5 × 16 (2 bolts) or M5 × 25 (2 bolts)]
(Place the clamp bases first on the connector box, put the cables on it, and then fasten them with the cable clamps.) (Photo 21-27RP to 31RP)

Photo 21-27RP

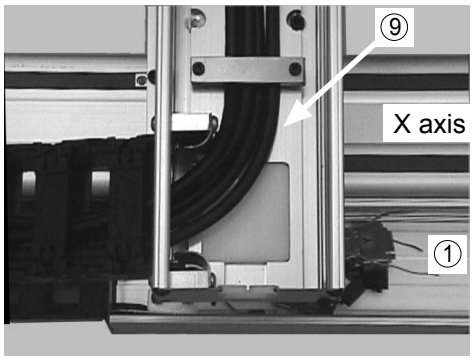


Details of clam parts

Photo 21-28RP

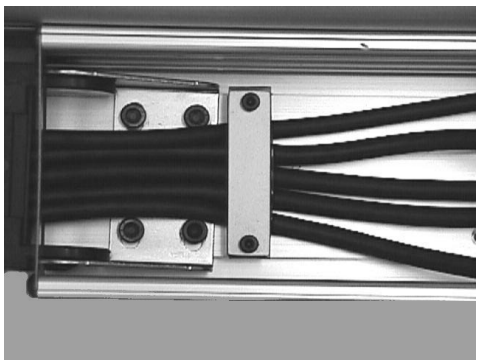
In the junction box
Y-Z cable support side

Photo 21-29RP



In the junction box
X-Y cable support side

Photo 21-30RP



In the fixed side connector box

Photo 21-31RP

In the moving side of connector box

21) Attach the top covers to each connector boxes. Loosely fasten both end covers and press an edge of top cover to a groove and push in the other side of the top cover. Fix both end covers. (Photo 21-33RP)

Photo 21-32RP

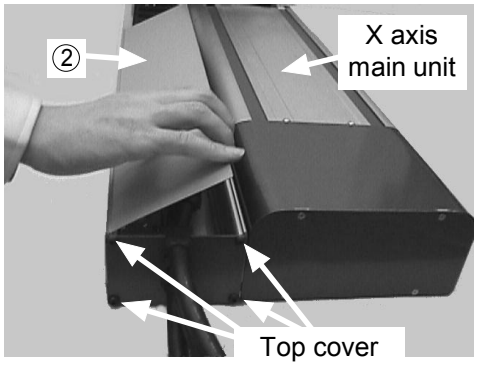
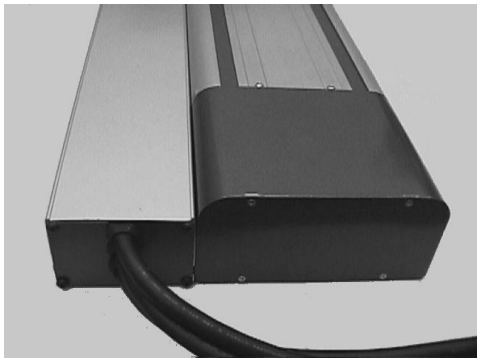
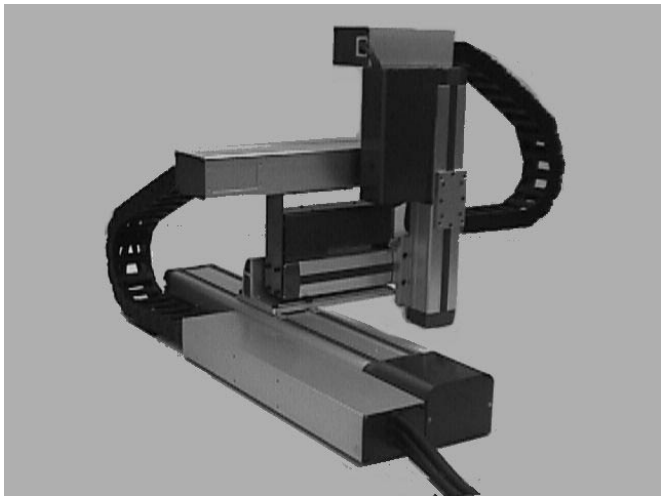


Photo 21-33RP



Completion of RP-MSSz combination

Photo 21-34RP



21.7.12. RP-HMSz Combination

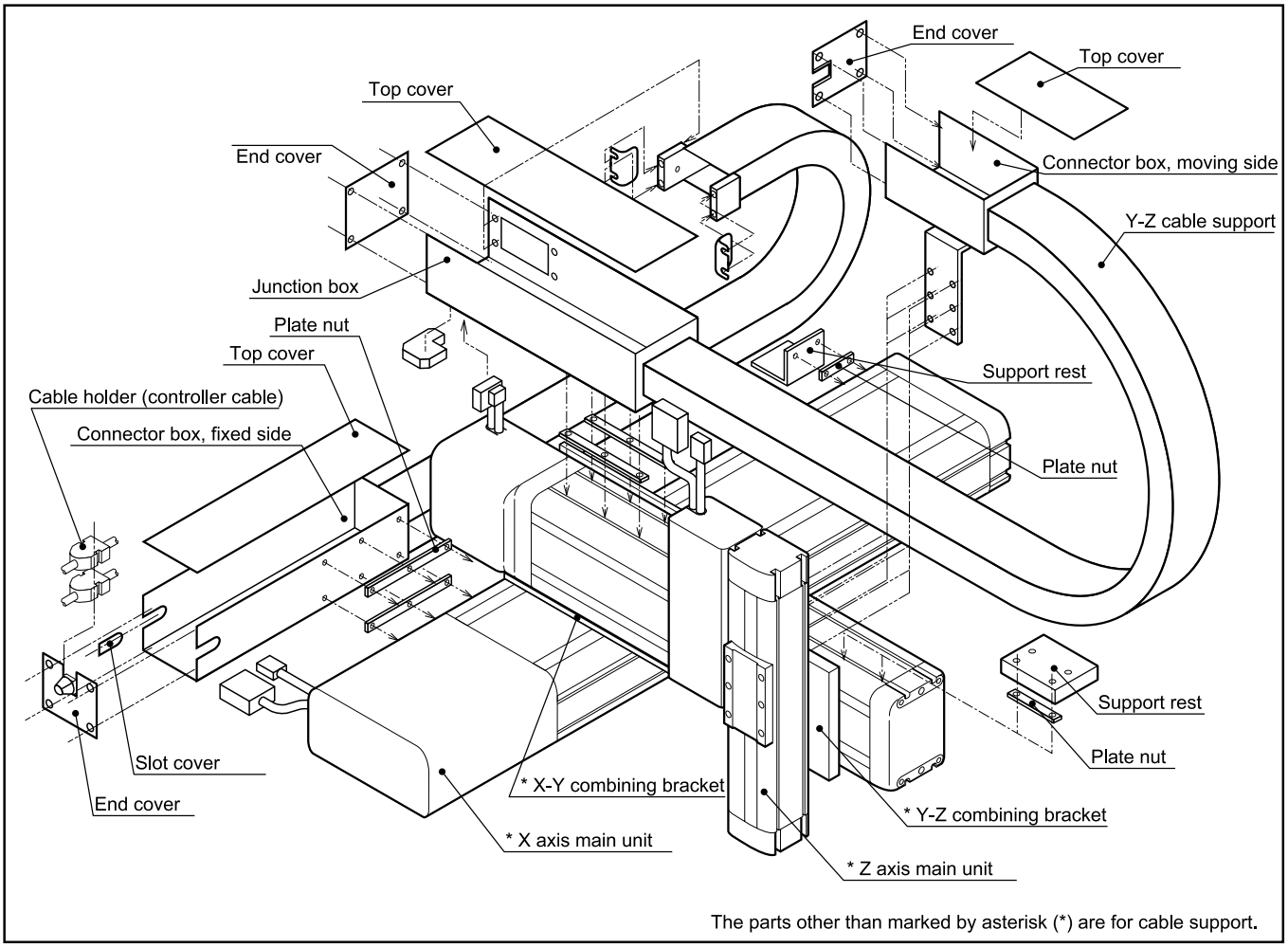
- The parts required for RP-HMSZ combination are listed in Table 21-46. Confirm that all parts are ready.

Table 21-46

Name	Quantity	Reference number	Sections to be referred.
X axis main unit	1	XY-HRS□□0-RH200	3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications"
Y axis main unit	1	XY-HRS0□5-RM200	
Z axis main unit	1	XY-HRS0□0-RS1□□	
Controller	1	M-EXEA3-0210□00	1 Installation and Maintenance of the EXEA Controller "5. Reference Number and Specifications"
Teaching box	1	M-EXTB0□	
X-Y combining bracket			3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications"
A and C type	1	XY-P175GHM-1	
B and D type		XY-P175GHM-2	
Y-Z combining bracket	1	XY-P175DMS-1	
Controller cable	2	XY-E185□□-1	
Controller cable	1	XY-E185□□-2	
Cable support	1	XY-E173PHMS272□-1	
Y axis built-in cable	1	XY-E173□□□-1	
Z axis built-in cable	1	XY-E173□□□-2	
Mounting bracket	2	XY-P170H-1 *	

* This is not required when X axis main unit is fixed from its back surface directly.

Figure 21-34



◆ Assembly procedures of RP-HMSz combination

- Following description is the assembly procedures of A type. However, the procedures for B, C and D types are fundamentally the same, though combining directions of main units and cable support are different.

- Modifications of main units, connector box and L-fixture are required for some combination types. Modify them before assembly.

1) The required modifications are listed in Table 21-47 for respective combination types. No modification is required for A type.

Table 21-47

	A	B	C	D
X axis main unit	Not necessary	Reverse outlet position of main unit cable *1		不要
Y axis main unit	Not necessary	Reverse outlet position of main unit cable *1	Not necessary	Reverse outlet position of main unit cable *1
Connector box, fixed side	Not necessary			
Junction box	Not necessary	Reverse connector box *2		Not necessary
Connector box, moving side	Not necessary	Reverse L-fixture. *3	Not necessary	Reverse L-fixture. *3

*1. Refer to "21.3. Reversing Position of Main Unit Cable."

*2. Refer to "21.12. Reversing Connector Box."

*3. Refer to "21.13. Reversing L-fixture."

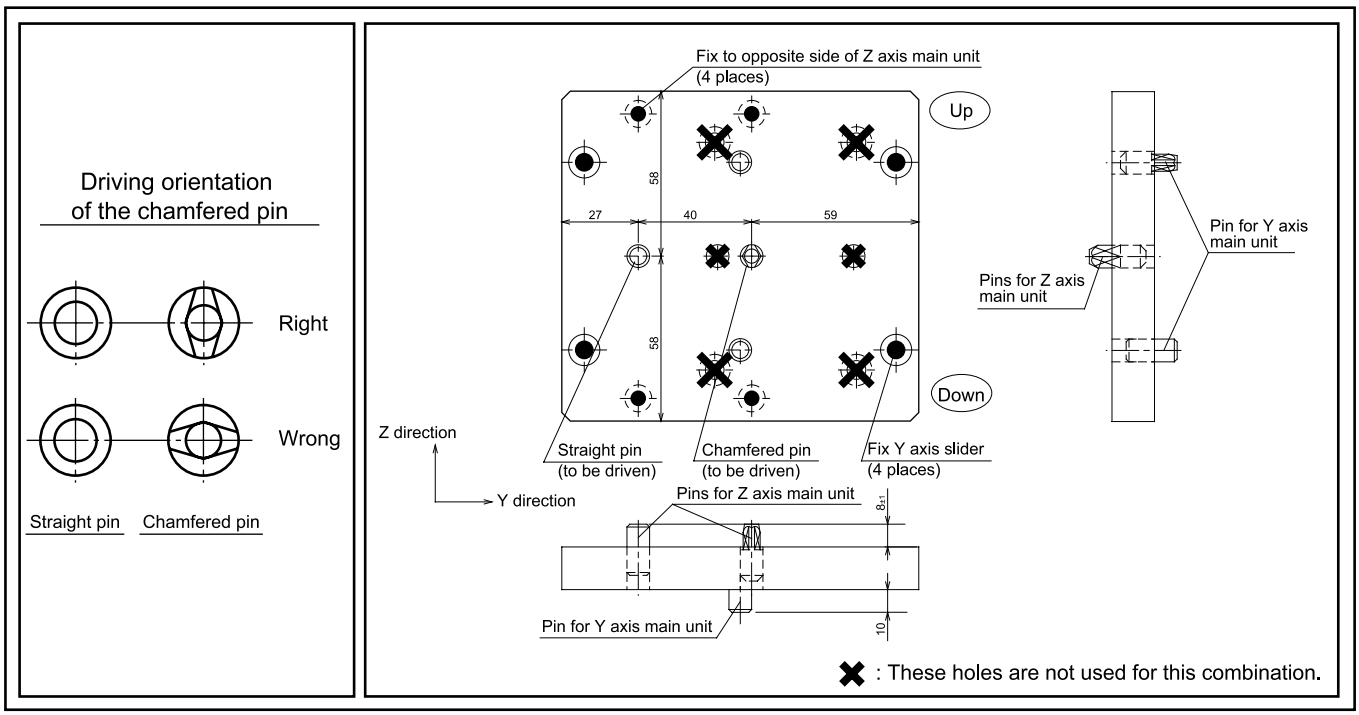
2) Drive the pins to Y-Z combining bracket.

- Drive a chamfered pin and a straight pin with a plastic hammer to the bracket on the locations shown in Figure 21-33 below. The pins are provided with Y-Z combining bracket.

Caution : *• Be careful with the orientation of the chamfered pin. See lower left figure for the orientation.*

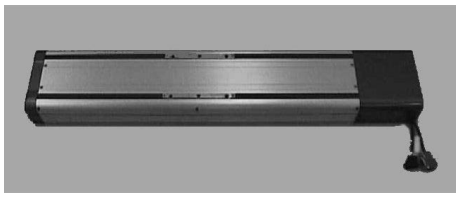
• Be careful not to push in pins for Y axis main unit on the back when driving the pins.

Figure 21-35



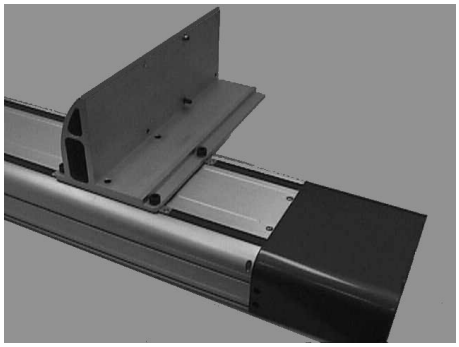
3) Fix X axis main unit to the mounting base. Refer to "21-4. Fixing Module Main Unit."

Photo 21-35RP



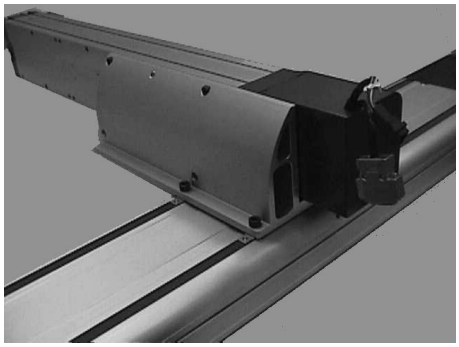
4) Fix X-Y combining bracket to the slider of X axis main unit.
(M6, 4 bolts: tightening torque: 9.8 ~ 44.8N·m)

Photo 21-36PR



5) Fix Y axis main unit to X-Y combining bracket.
(M5, 4 bolts: tightening torque: 4.9 ~ 5.9 N·m)

Photo 21-37RP



6) Turn Z axis main unit over and fix Y-Z combining bracket to its mounting surface.
(M5, 4 bolts: tightening torque4.9 ~ 5.9N·m) (Photo 21-38RP)
Then fix Y-Z combining bracket with Z axis unit to the slider of Y axis.
(M6, 4 bolts: tightening torque: 9.8 ~ 11.8 N·m) (Photo 21-39RP)

Photo 21-38RP

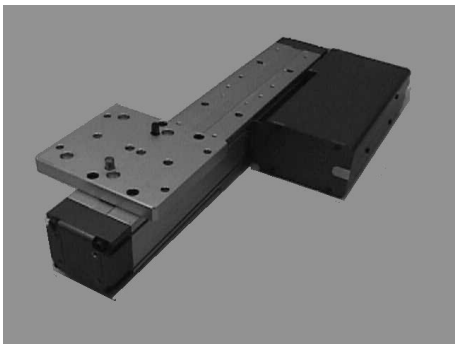
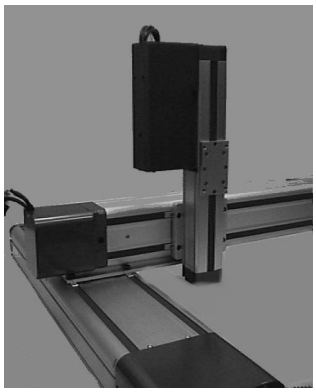


Photo 21-39RP



7) Attach the cable support to the main units and wire the cables. The parts of the cable support are listed in Table 21-47. Confirm that all parts are ready.

Photo 21-40RP

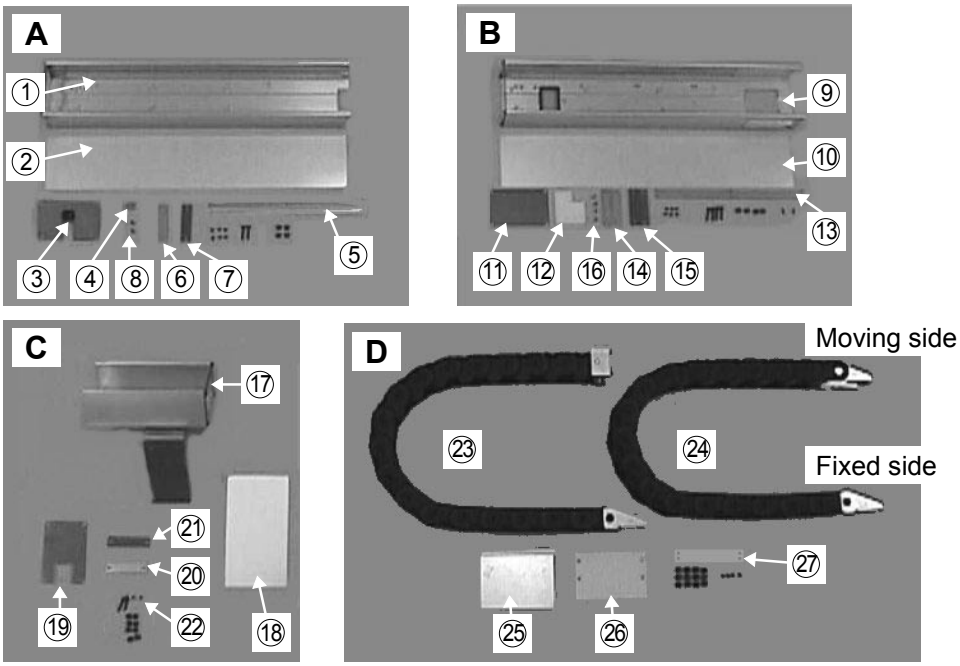
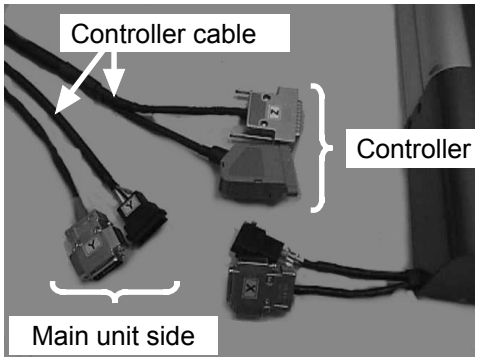


Table 21-48

Section	Name of section	Part No.	Name	Quantity	Hexagon socket cap screw
A	Fixed side Connector box (attach to X axis main unit)	①	Connector box	1	M5 × 10 (4 bolts)
		②	Top cover	1	
		③	End cover	1	
		④	Slot cover	1	
		⑤	Plate nut	2	M3 × 6 (6 bolts)
		⑥	Clamp base	2	
		⑦	Cable clamp	1	M4 × 20 (2 bolts)
		⑧	Spacer	2	
B	Junction Connector box (attach to Y axis main unit)	⑨	Junction box	1	M5 × 10 (4 bolts)
		⑩	Top cover	1	
		⑪	End cover	1	
		⑫	Opening cover (plastic)	1	M4 × 10 Set screw (2 screws)
		⑬	Plate nut	2	M3 × 6 (6 bolts)
		⑭	Clamp base	4	
		⑮	Cable clamp	2	M4 × 20 (4 bolts)
		⑯	Spacer	4	
C	Moving side Connector box (attach to Z axis main unit)	⑰	Connector box	1	M5 × 10 (8 bolts)
		⑱	Top cover	1	
		⑲	End cover	1	
		⑳	Clamp base	2	
		㉑	Cable clamp	1	M4 × 20 (2 bolts)
		㉒	Spacer	2	
D	Cable support	㉓	X-Y cable support	1	M5 × 10 (4 bolts)
		㉔	Y-Z cable support	1	M6 × 10 (12 bolts)
		㉕	X axis support rest	1	
		㉖	Y axis support rest	1	
		㉗	Plate nut	2	M3 × 6 (4 bolts)

8) Affix seals of X, Y and Z axis, which are provided with the controller cable, to respective cable connectors.
(We recommend to affix the seals to the connectors to avoid miss-connection because the connector is common to all main units regardless their motor power specifications.)

Photo 21-41RP



9) Insert two plate nuts ⑤ to T-slots on the side of X axis main unit. (Photo 21-42RP) Attach the fixed side connector box ① to the main unit. (M3 × 6, 6 bolts)

Photo 21-42RP

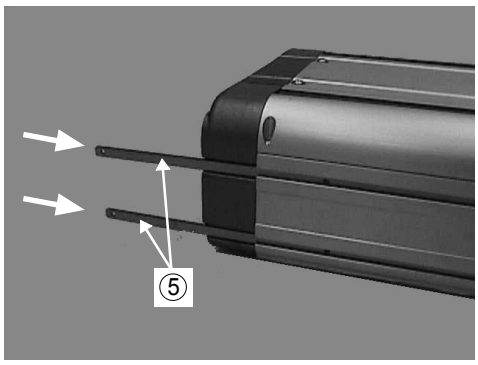
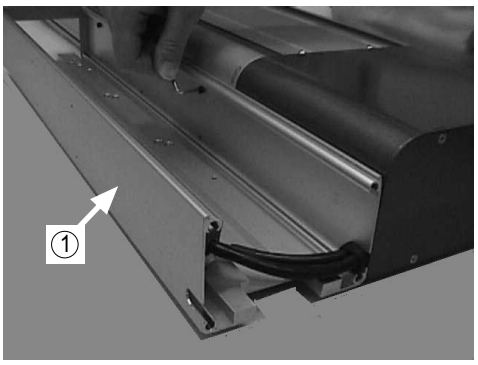


Photo 21-43RP



10) Insert two plate nuts ⑬ to T-slots on the side of Y axis main unit attach the junction box ⑨. Use holes shown in Figure 21-36 to fix the junction box. (Photo 21-44RP)
Put the cables of main unit through the opening in the bottom of the junction box, then put the opening plug (plastic) ⑫ on to plug the opening and secure it from the end. (M4 × 10, 2 bolts, Photo 21-45RP)

Figure 21-36

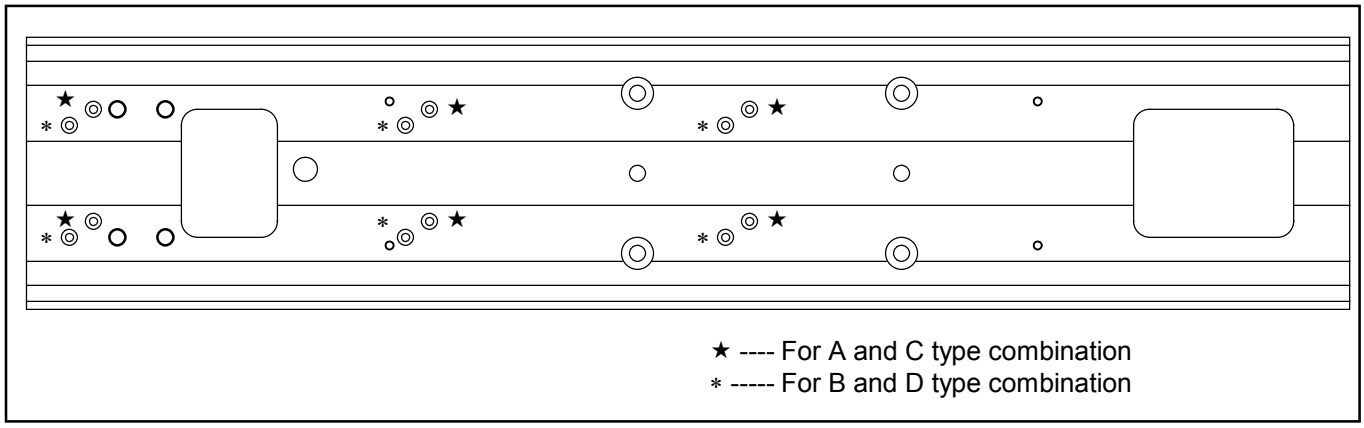


Photo 21-44RP

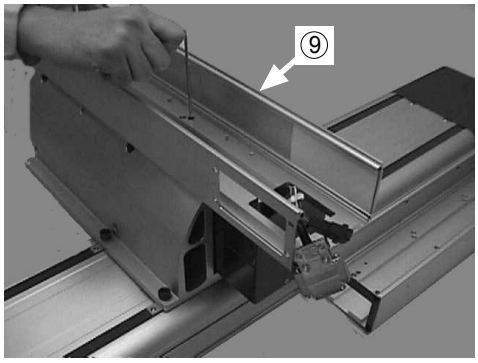
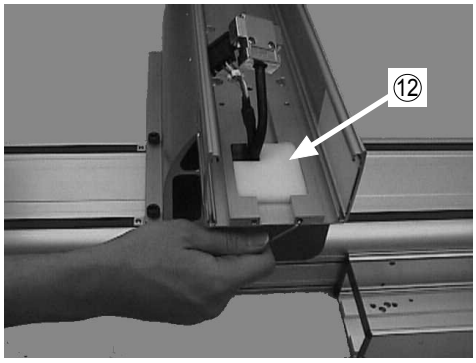


Photo 21-45RP



11) Attach the support rests of X and Y axis main unit.
X axis : ㉕ (L shape bracket)
Y axis : ㉖ (plastic)
Insert the plate nuts ㉗ to T-slots, then attach the support rests respectively. (M3 × 6, 2 bolts)

Photo 21-46RP

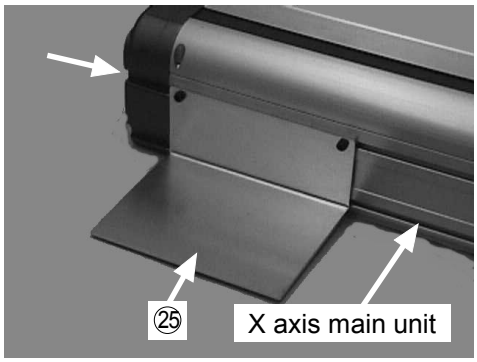
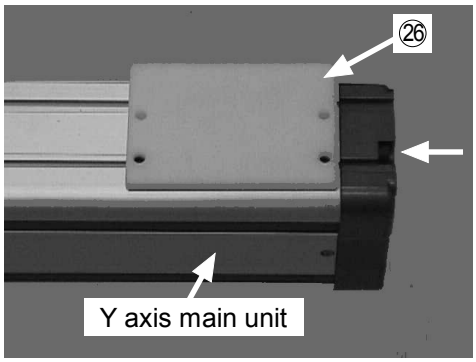
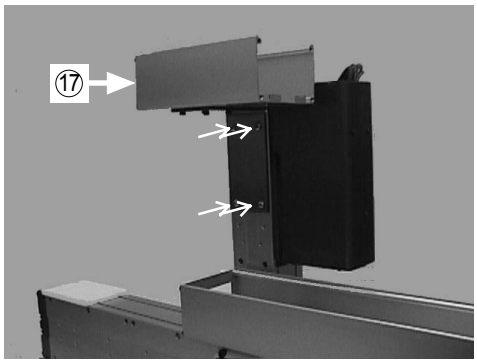


Photo 21-47RP



12) Attach the moving side connector box ⑰ to the back of Z axis main unit. (M5 × 10, 4 bolts)

Photo 21-48RP



13) Put the built-in cables for Y and Z axis through X-Y cable support ㉓. (Be careful the direction of the built-in cables. See Photo 21-49RP.) Fix the cable support to the fixed side connector box ①. (M6 × 10, 4 bolts. Photo 21-50RP)

Photo 21-49RP

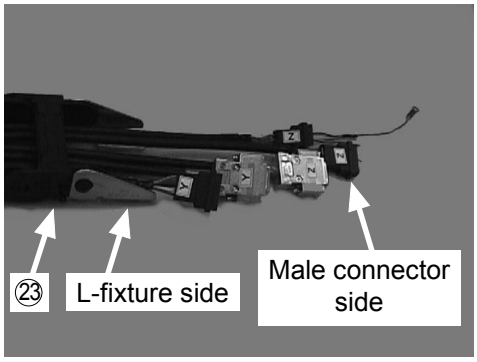
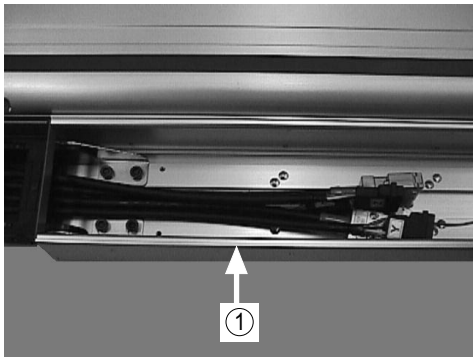


Photo 21-50RP



14) Fix the other end (moving side) of the cable support to the junction box ⑨. Detach covers (a) and blocks (b) from the end of moving side of the cable support (Photo 21-51RP). Put the cables and the cable support through an opening in the junction box, then attach the covers (a) and the blocks (b) to the cable support. Fix the blocks (b) to the junction box. (M5 × 10, 4 bolts, Photo 21-52RP)

Photo 21-51RP

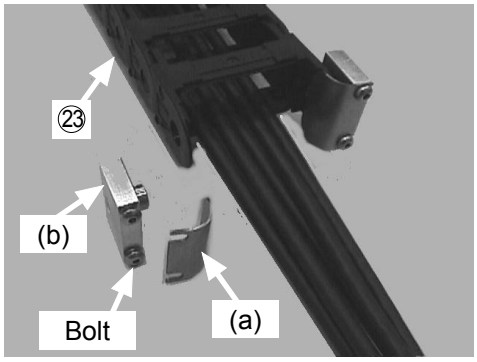
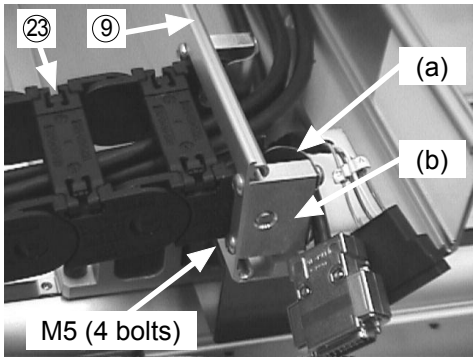


Photo 21-52RP



15) Connect the cables of Y axis main unit and built-in cables. (Two connectors, Photo 21-53RP)

◊ Motor connector : Snap to the end.

◊ Encoder connector : Secure with two bolts.

Attach the end cover ⑪. (M5 × 10, 4 bolts, Photo 21-54RP)

Photo 21-53RP

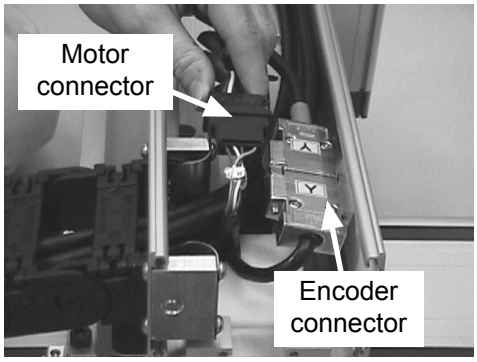
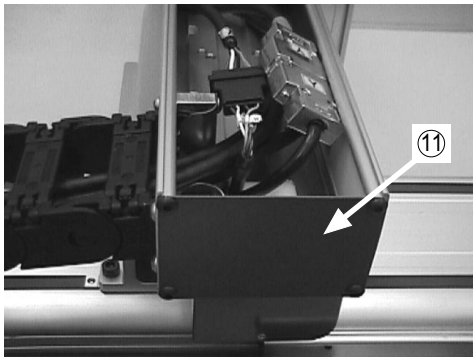


Photo 21-54RP



16) Put the Z axis built-in cables through Y-Z cable support ㉔. (Photo 21-55RP)
Fix the fixed side of Y-Z cable support ㉔ (bracket with holes) to the junction box ⑨. (M6 × 10, 4 bolts, Photo 21-36RP)

Photo 21-55RP

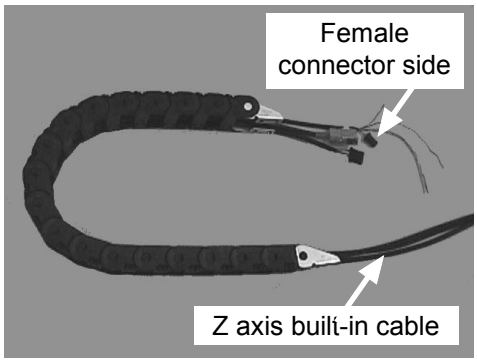
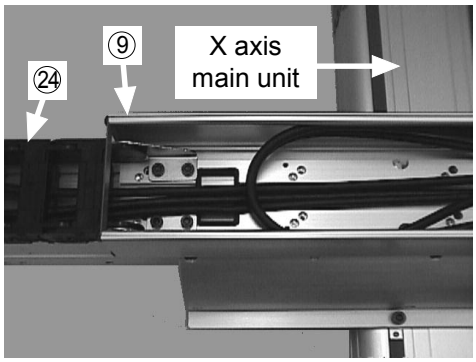


Photo 21-56RP



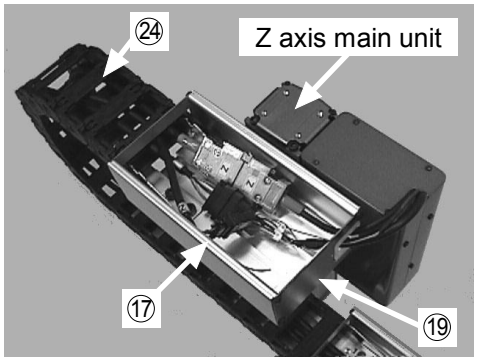
17) Fix the other end (moving side) of the cable support to the moving side connector box ⑰ as the same procedure 16). (M6 × 10, 4bolts) Put the cables of Z axis main unit through Edge saddle of the end cover ⑲ and fix the end cover to the connector box, then connect the cables of Z axis main unit and the built-in cables. (Photo 21-57RP)

◊ Motor connector : Snap to the end.

◊ Brake connector : Snap to the end.

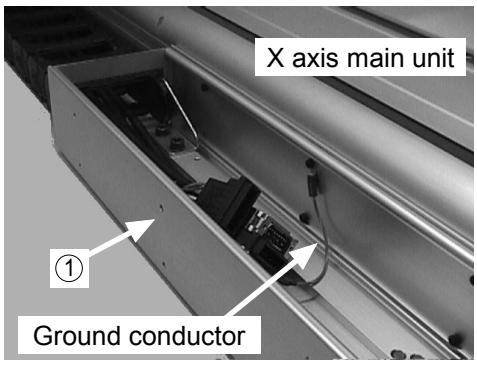
◊ Encoder connector : Secure them with 2 screws.

Photo 21-57RP



18) Secure the round terminal of the ground conductor (green) to a fixing bolt of the connector box ①. (M3 × 6, Photo 21-58RP)
When you use the user cables (6 rope-lay conductors) provided with the cable support, wire the ground conductor to the ground terminal of external user's equipment from the fixed round terminal on the connector box.

Photo 21-58RP



19) Connect the controller cables for X, Y and Z axis. (Photo 21-59RP) Insert the slot plugs ④ to the slots on the front side of fixed side connector box, attach the end cover ③ to the connector box ①. (M5 × 10, 4 bolts) Insert the cable holders of controller cables to he groove in the order of Z, Y and X axis. (Photo 21-60RP)

Photo 21-59RP

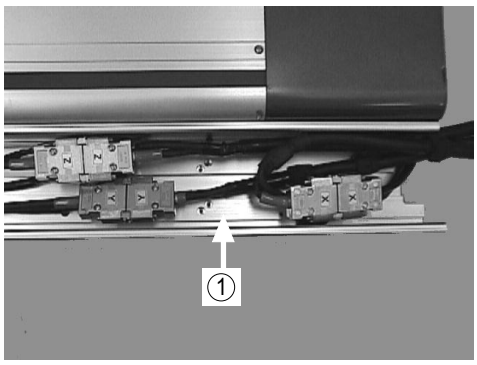
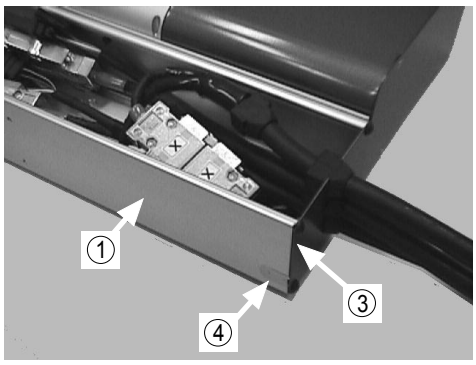
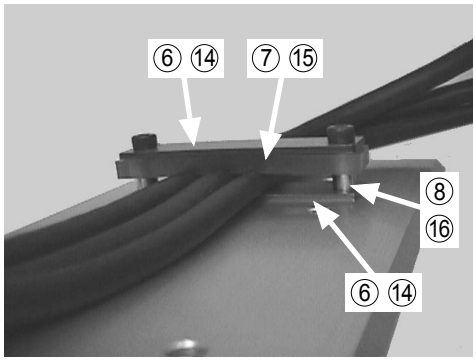


Photo 21-60RP



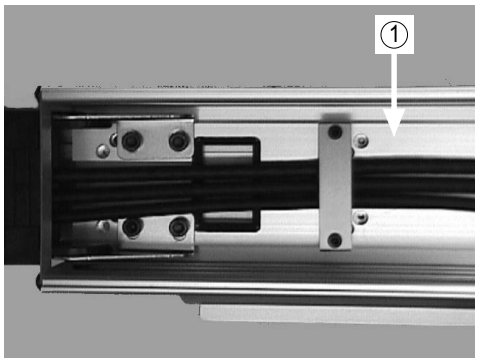
20) Put the cables through the cable supports loosely so that they don't get a jerk. Set a large bending radius to the cables as much as possible, then secure them with the clamping parts ⑥ ~ ⑧, ⑭ ~ ⑯ and ⑳ ~ ㉒ to the connector box.
[M4 × 20 (2 bolts), M5 × 16 (2 bolts) or M5 × 25 (2 bolts)]
(Place the clamp bases first on the connector box, put the cables on it, then fasten them with the cable clamps.) (Photo 21-61RP to 65RP)

Photo 21-61RP



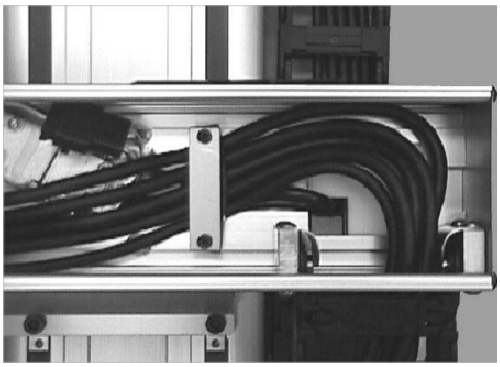
Details of clam parts

Photo 21-62RP



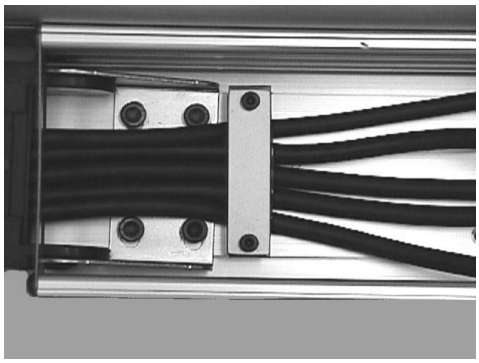
In the junction box
Y-Z cable support side

Photo 21-63RP



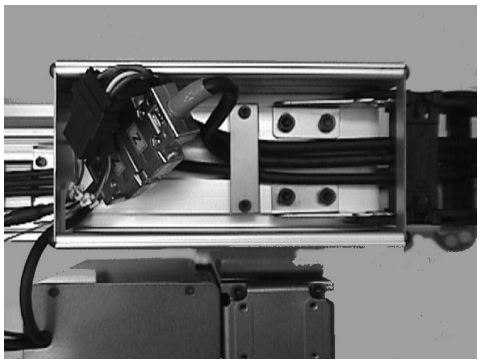
In the junction box
X-Y cable support side

Photo 21-64RP



In the fixed side connector box

Photo 21-65RP



In the moving side of connector box

21) Attach the top covers to each connector boxes. Loosely fasten both end covers and press an edge of top cover to a groove and push in the other side of the top cover. Fix both end covers. (Photo 21-67RP)

Photo 21-66RP

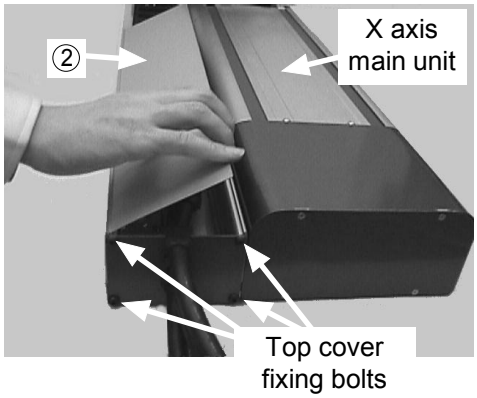
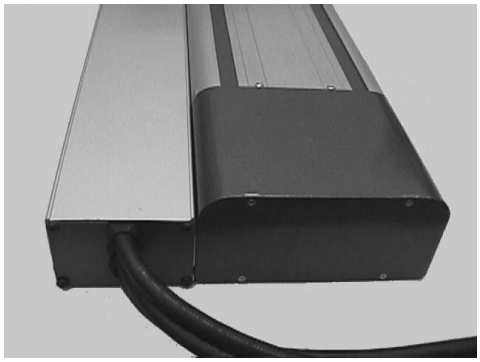
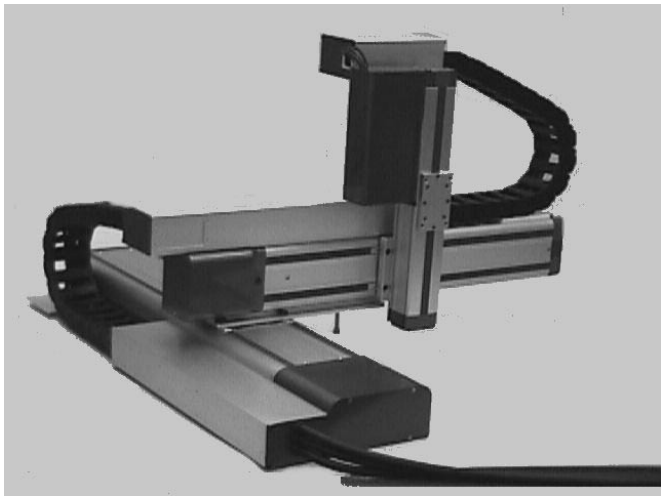


Photo 21-67RP



Completion of RP-HMSz combination

Photo 21-68RP



21.7.13. RJ-HMSz Combination

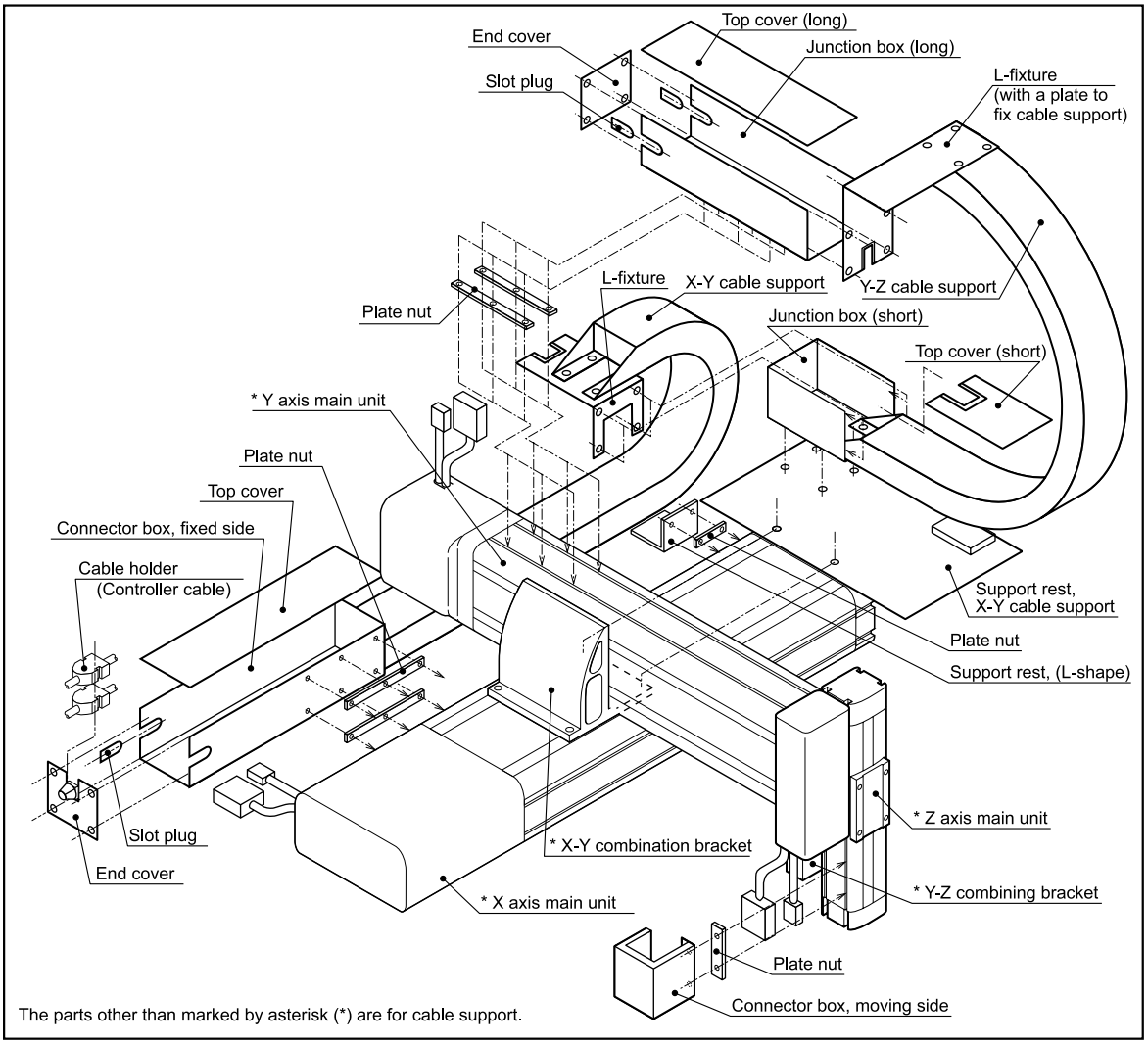
- The parts required for RJ-HMSz combination are listed in Table 21-49 below. Confirm that all parts are ready.

Table 21-49

Name	Quantity	Reference number	Sections to be referred.
X axis main unit	1	XY-HRS□□0-RH200	3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications"
Y axis main unit	1	XY-HRS0□5-RM200	
Z axis main unit	1	XY-HRS0□0-RS1□□	
Controller	1	M-EXEA3-1110□00	1 Installation and Maintenance of the EXEA Controller "5. Reference Number and Specifications"
Teaching box	1	M-EXTB0□	
X-Y combining bracket	1	XY-P175XHM-1	3 Installation and Maintenance of Module Main Unit "19. Reference Number and Specifications"
Y-Z combining bracket	1	XY-P175CMS-1	
Controller cable	2	XY-E185□□-1	
Controller cable	1	XY-E185□□-2	
Cable support	1	XY-E173JHMS3217-1	
Y axis built-in cable	1	XY-E173□□□-1	
Z axis built-in cable	1	XY-E173□□□-2	
Mounting bracket	2	XY-P170H-1 *	

* This bracket is not necessary when X axis main unit is fixed from its bottom directly.

Figure 21-37



◆ Assembly procedures for RJ-HMSz combination

- Following description is the assembly procedures for A type combination. However, the procedures for B type are fundamentally the same, though the combining direction of the main units and cable support are different.

- Modifications of main units and L-fixture are required.

1) The required modifications are listed in Table 21-50 for respective combination types.

Table 21-50

	A	B
X axis main unit	Not necessary	Reverse position of cable outlet *1
Y axis main unit	Not necessary	Reverse position of cable outlet *1
Z axis main unit	Reverse position of cable outlet *1	
Connector box, fixed side	Not necessary	
Junction box	Not necessary	Not necessary
Connector box, moving side	Not necessary	Reverse L-fixture. *2

*1. Refer to "21.3. Reversing Position of Main Unit Cable."

*2. Refer to "21.13. Reversing L-Fixture."

2) Drive pins to Y-Z combining bracket.

- Drive a chamfered pin and a straight pin to the combining bracket to the locations shown in Figure 21-38 using a plastic hammer etc.

2) Drive the pins to the Y axis bracket. (part of Y-Z combining bracket)

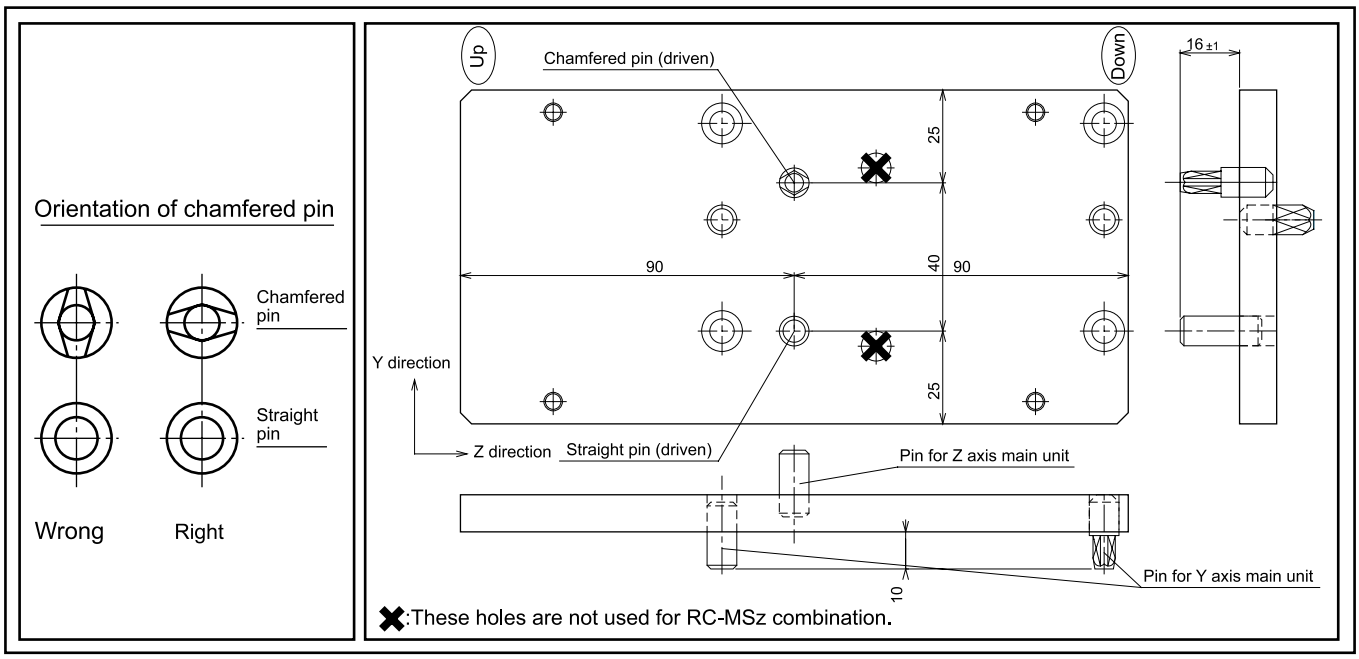
- The Y-Z combining bracket consists of Y axis bracket and Z axis bracket.

- Drive a chamfered pin and a straight pin to Y axis bracket to the locations shown in Figure 21-38 using a plastic hammer. (The pins are provided with Y-Z combining bracket.)

Caution : *• Be careful with driving orientation of the chamfered pin. See lower left of the figure for correct orientation.*

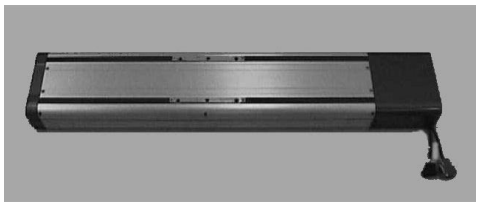
• Do not push in the locating pins for Y axis main unit on the back of the bracket when driving the pins.

Figure 21-38: Y axis bracket



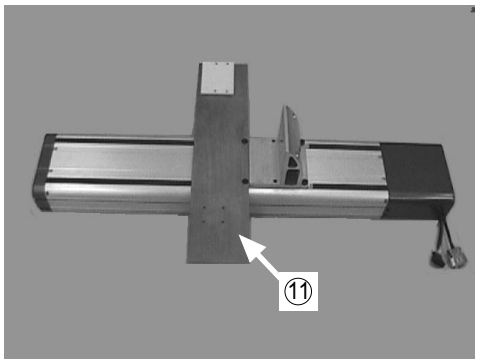
3) Fix X axis main unit to the mounting base. Refer to "21.4. Fixing Module Main Unit." (Photo 21-1RJ)

Photo 21-1RJ



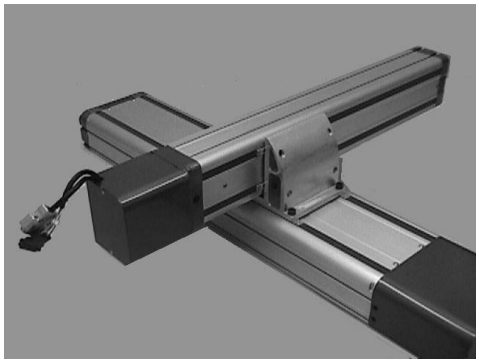
4) Fix X-Y combining bracket to the slider of X axis main unit with the support rest for Y-Z cable support (part number ⑪ in Table 21-51on the next page.) as shown in Photo 21-2 RJ. (M8 hexagon socket button head screws, 4 places, provided with the support unit)

Photo 21-2RJ



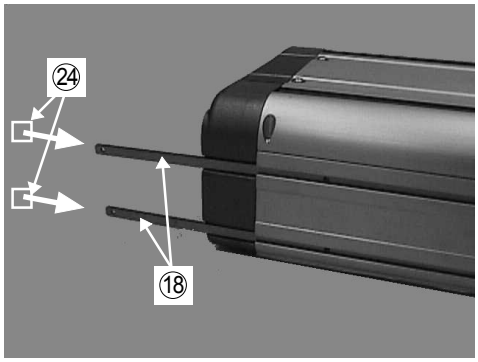
5) Fix Y axis main unit to the combining bracket.
(M6, 4 bolts: tightening torque: 9.8 ~ 11.8 N·m)

Photo 21-3RJ



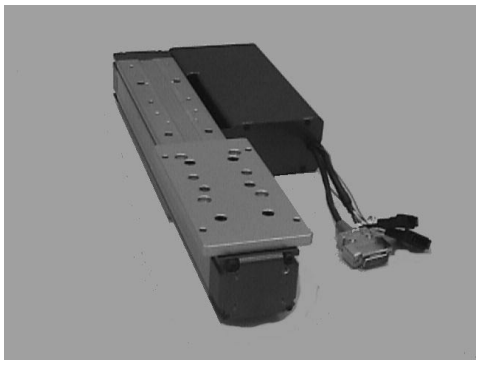
6) Insert the plate nut ⑱ and ㉔ to each T-slot on the side of Y axis main unit. Insert the plate Nut ⑱ first, then ㉔. (4 nuts for each T-slot)
(Refer to Table 21-51 for the part numbers.)

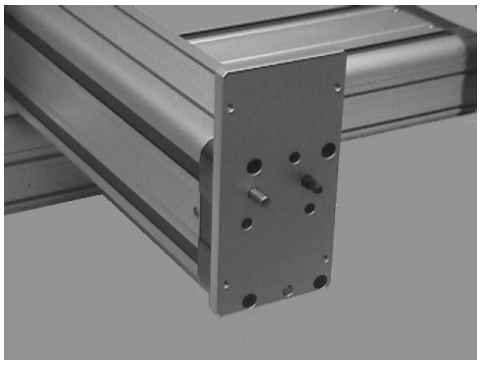
Photo 21-4RJ



7) Turn Z axis main unit over and attach Z axis bracket of Y-Z combining bracket to its mounting surface.
(M5, 4 bolts: Tightening torque: 4.9 ~ 11.8 N·m) (Photo 21-5RJ)
Fix Y axis bracket of Y-Z axis bracket to the end face of Y axis main unit.
(M6, 4 bolts: tightening torque: 9.8 ~ 11.8 N·m) (Photo 21-6RJ)

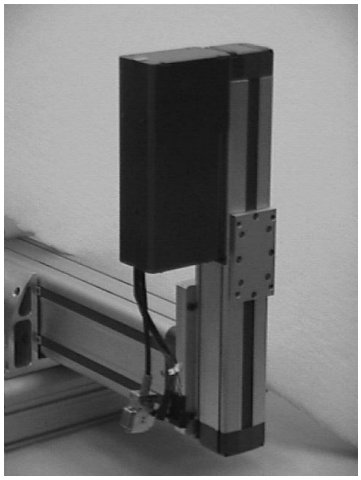
Photo 21-5RJ Photo 21-6RJ





8) Fix the Z axis bracket with Z axis main unit to the bracket on the end face of Y axis main unit. (M6, 4 bolts: tightening torque: 9.8 ~ 11.8 N·m) (Photo 21-7RJ)

Photo 21-7RJ



9) Attach the cable support to the main units and wire the cables. The parts required for the cable support and wiring are listed in Table 21-51. Confirm that all parts are ready before assembly.

Photo 21-8RJ

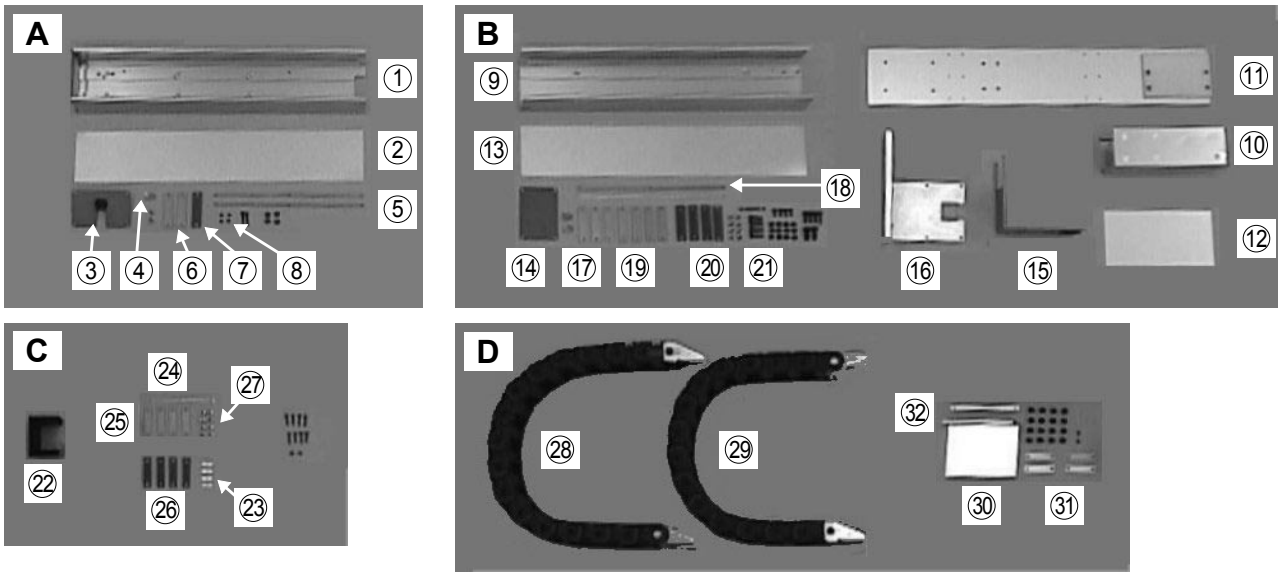
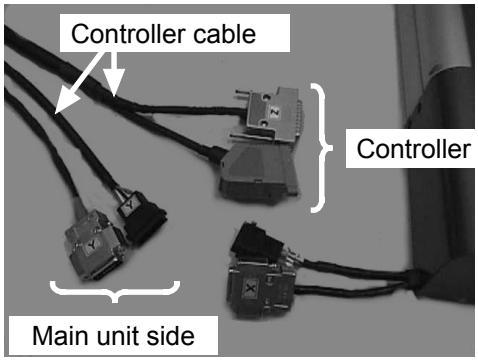


Table 21-51

Section	Name of section	Part No.	Name	Quantity	Hexagon socket cap bolt
A	Fixed side Connector box (attach to X axis main unit)	①	Connector box	1	M5 × 10 (4 bolts)
		②	Top cover	1	
		③	End cover	1	
		④	Slot plug	1	
		⑤	Plate nut	2	M3 × 6 (6 bolts)
		⑥	Clamp base	2	
		⑦	Cable clamp	1	M4 × 20 (2 bolts)
		⑧	Spacer	2	
B	Junction connector box (attach to Y axis main unit)	⑨	Junction box (long)	1	M5 × 10 (4 bolts)
		⑩	Junction box (short)	1	
		⑪	Y-Z cable support rest (plate)	1	M8 × 25 (4 bolts)
		⑫	Top cover (long)	1	
		⑬	top cover (short)	1	
		⑭	End cover	1	M5 × 10 (4 bolts)
		⑮	L-fixture	1	M5 × 10 (4 bolts)
		⑯	L-fixture (with a plate to fix cable support)	1	M5 × 10 (4 bolts)
		⑰	Slot plug	4	
		⑱	Plate nut	2	M3 × 6 (6 bolts)
		⑲	Clamp base	8	M5 × 16 (2 bolts), M5×25 (2 bolts)
		⑳	Cable clamp	5	M4 × 20 (6 bolts)
		㉑	Spacer	10	
C	Moving side Connector box (attach to Z axis main unit)	㉒	Connector box	1	
		㉓	Plate nut	1	M3 × 6 (2 bolts)
		㉔	Plat nut (small)	8	
		㉕	Clamp base	4	
		㉖	Cable clamp	4	M3 × 16 (8 bolts)
		㉗	Spacer	8	
D	Cable support	㉘	X-Y cable support	1	M6 × 10 (4 bolts)
		㉙	Y-Z cable support	1	M6 × 10 (4 bolts)
		㉚	X axis support rest (L-fixture)	1	
		㉛	Plate nut (to fix cable support)	4	M6 × 10 (4 bolts), M6 × 16 (4 bolts)
		㉜	Plate nut	1	M3 × 6 (2 bolts)

10) Affix seals of X, Y and Z axes, which are provided with the controller cable, to respective cable connectors.
(We recommend to affix the seals to the connectors to avoid miss-connection because the connector is common to all main units regardless their motor power specifications.)

Photo 21-9RJ



11) Insert the plate nuts ⑤ to two T-slots on the side of X axis main unit (Photo 21-9RJ). Attach the fixed side connector box. (M3 × 6, 6 bolts, Photo 21-11RJ)

Photo 21-10RJ

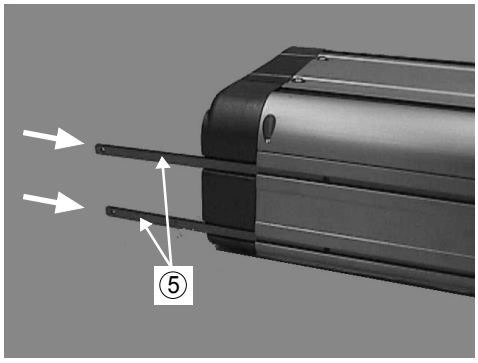
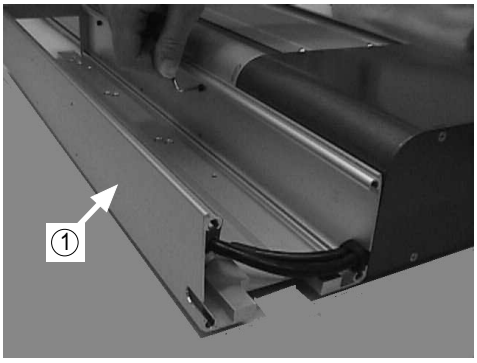


Photo 21-11RJ



12) Attach the long junction box ⑨ to Y axis main unit with the plate nuts ⑯ which are inserted to the T-slots. Use holes of the junction box to fix it as shown in Figure 21-39. (M3 × 6, 6 bolts)
Insert two slot plugs ⑰ to the Y axis motor side slots and attach the end cover ⑭.
(M5 × 10, 4 bolts, Photo 21-12RJ)

Figure 21-39

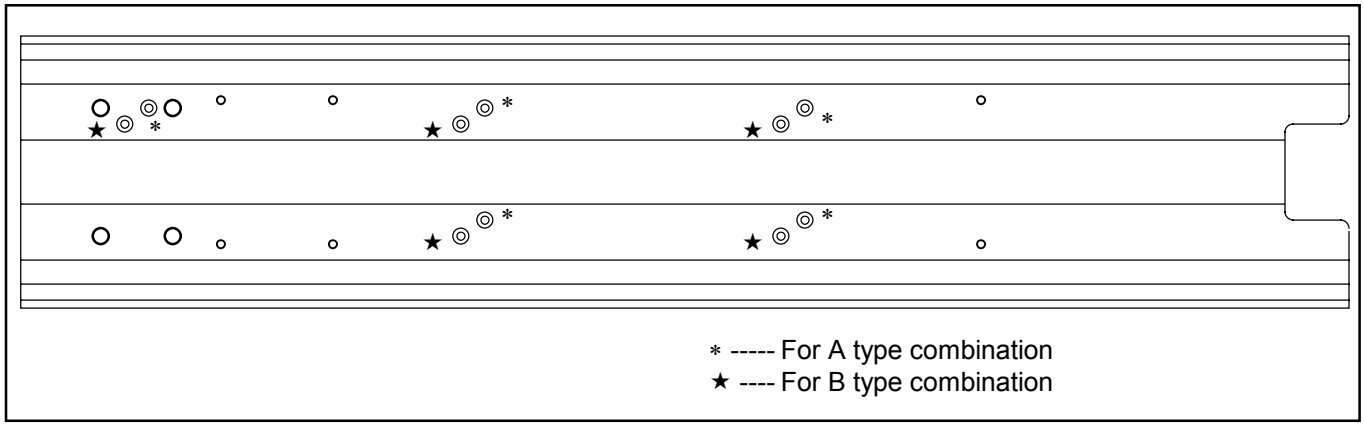
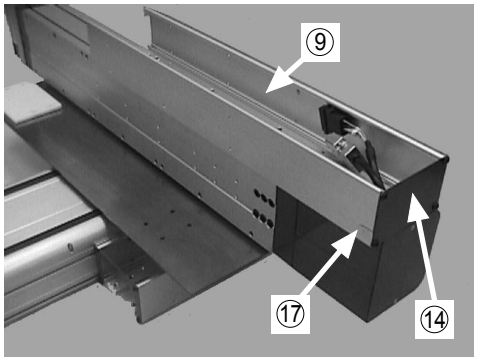
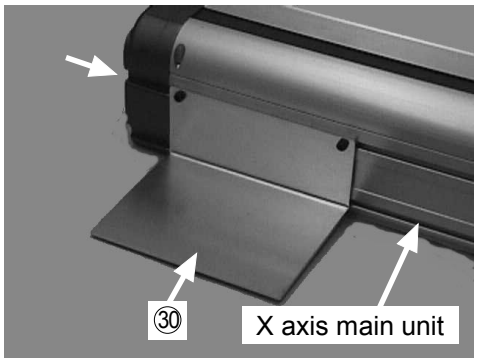


Photo 21-12RJ



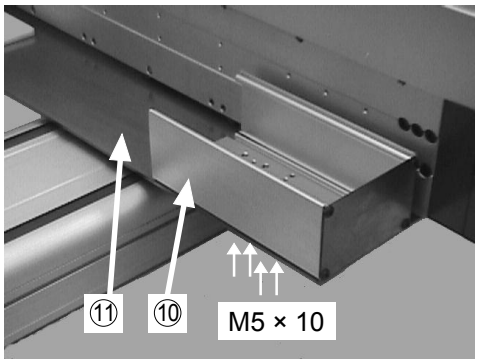
13) Attach X axis support rest ㉚ to X axis main unit. Insert the plate nuts ㉜ to T-slots the same as the procedure 11). (M3 × 6, 2 bolts)

Photo 21-13RJ



14) Fix the short junction box ⑩ to Y-Z cable support rest ⑪. (M5 × 10, 4 bolts)

Photo 21-14RJ



15) Put Y-Z built-in cable through X-Y cable support ㉘. Be careful the direction of the built-in cable. (Photo 21-15RJ) Fix the fixed end of cable support to the fixed side connector box. (M6 × 10, 4 bolts, Photo 21-16RJ)

Photo 21-15RJ

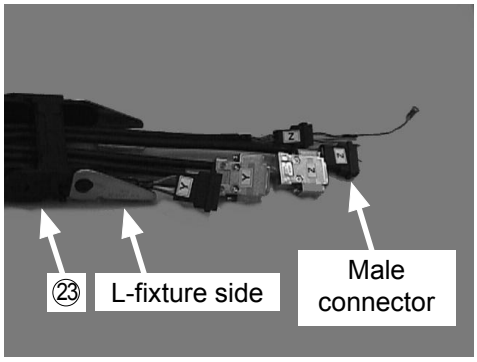
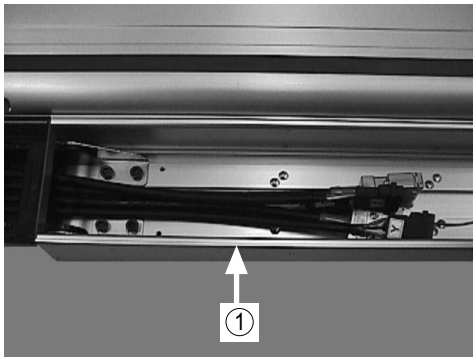


Photo 21-16RJ



16) Attach the L-fixture ⑮ to the moving side of X-Y cable support with the plate nut ㉜. (M6 × 10, 4 bolts).
Then put Y and Z axis built-in cables through Y-Z cable support via Edge saddle of the L-Fixture ⑮. (Photo 21-17RJ)
Fix the fixed side of Y-Z cable support to the short junction box ⑩ (M6 × 10, 4 bolts, Photo 21-18RJ), then fix L-fixture ⑮ to the short junction box. (Photo 21-19)

Photo 21-17RJ

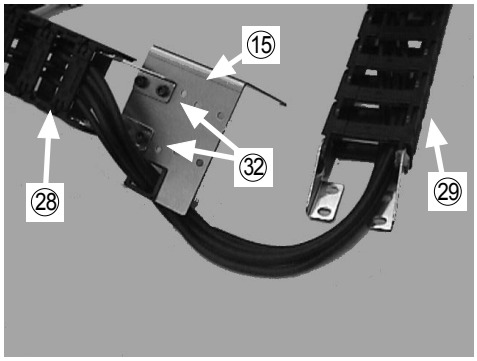


Photo 21-18RJ

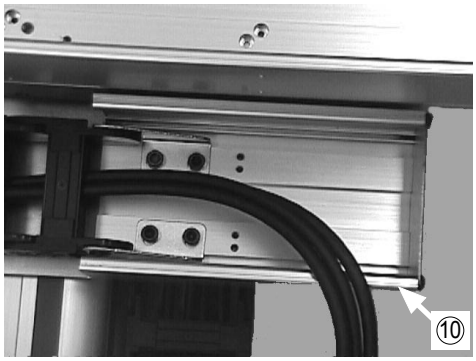
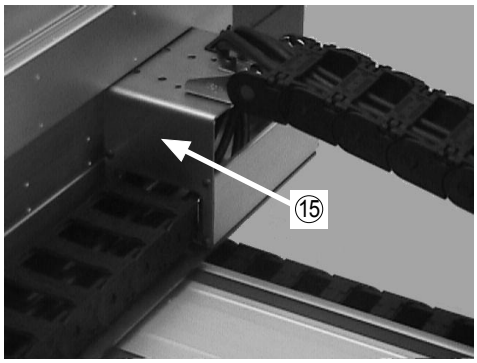


Photo 21-19RJ



17) Put Y axis built-in cable through Edge saddle of L-fixture ⑯, then fix the L-fixture to the long junction box ⑨. (Photo 21-20RJ)
Then fix the moving side of Y-Z cable support to the l-fixture with ㉜ plate nuts. (M6 × 16, 4 bolts, Photo 21-21RJ)

Photo 21-20RJ

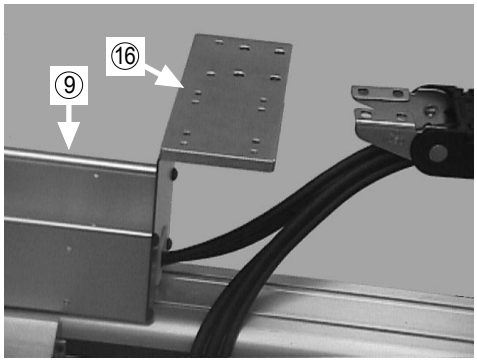
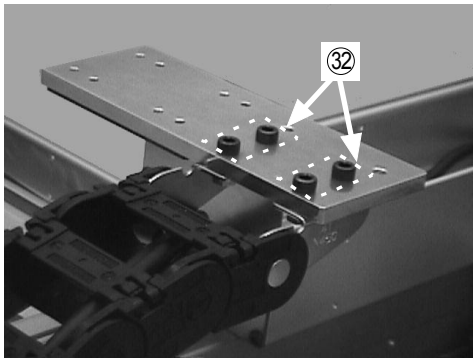


Photo 21-21RJ

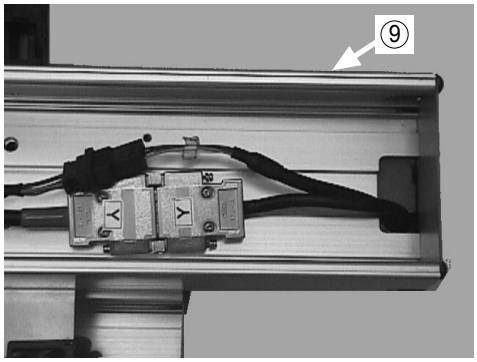


18) Connect Y axis built-in cable to the cables of main unit.

◊ Motor connector : Snap to the end.

◊ Encoder connector : Secure them with two screws. (Photo 21-22RJ)

Photo 21-22RJ



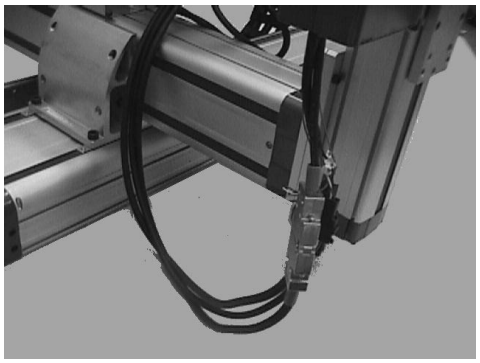
19) Connect Z axis built-in cable to the cables of main unit.

◊ Motor connector : Snap to the end.

◊ Brake connector : Snap to the end.

◊ Encoder connector : Secure with two screws. (Photo 21-23RJ)

Photo 21-23RJ



20) Insert the plate nut ㉓ to T-slot of Z axis main unit on the slider side of Y axis main unit (Photo 21-24RJ) and attach the junction box ㉒ to Z axis main unit. (M3 × 6, 2 bolts)
When attaching the junction box, push the connectors, which have connected at the procedure 19), into the junction box as shown in Photo 21-25RJ.

Photo 21-24RJ

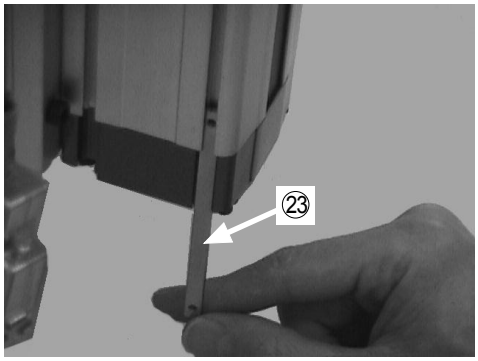
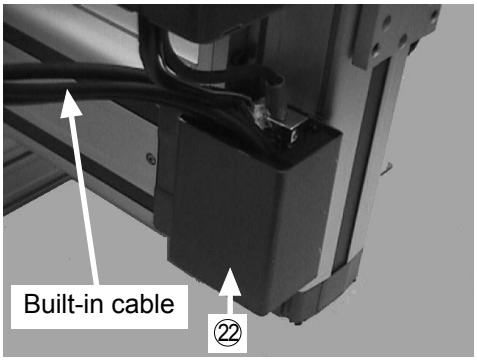
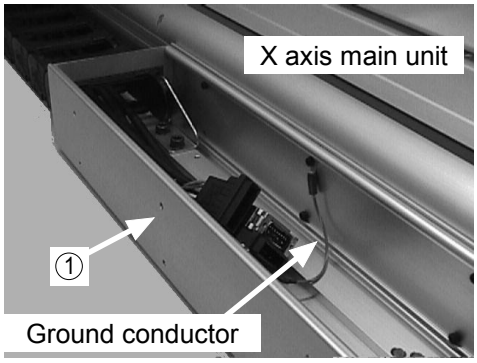


Photo 21-25RJ



21) Fix a round terminal of the ground conductor (green) of the built-in cable to the fixing screw (M3 × 6) of connector box ① on X axis main unit. (Photo 21-26RJ)
If you use the user cable (6 rope-lay conductors) provided with the cable support, wire the ground conductor to the ground terminal of external user equipment from the fixed round terminal.

Photo 21-26RJ



22) Connect all controller cables. (Photo 21-27RJ) Attach the end cover ③ to the fixed side connector box ① (M5 × 10, 4 bolts). Set the cable holders of controller cables to the end cover groove in order of Z, Y and X axis. (Photo 21-28RJ)

Photo 21-27RJ

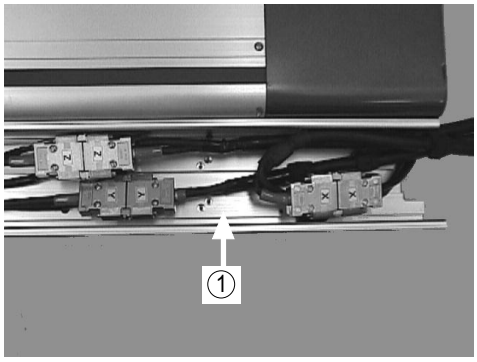
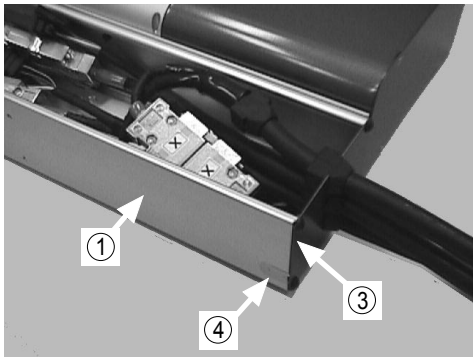


Photo 21-28RJ



23) Fix Z axis built-in cable to upper side of M module (side of M module) with the clamping parts ㉕ ~ ㉗ using the small plate nuts which have been inserted to T slots in the procedure 6). (M3 × 16, 2 bolts, Photo 21-29RJ)
Store the rest of Z axis built in cable to the fixed side connector box ①. (Photo 21-30RJ)

Photo 21-29RJ

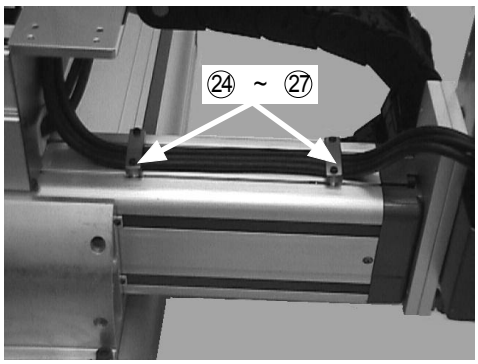
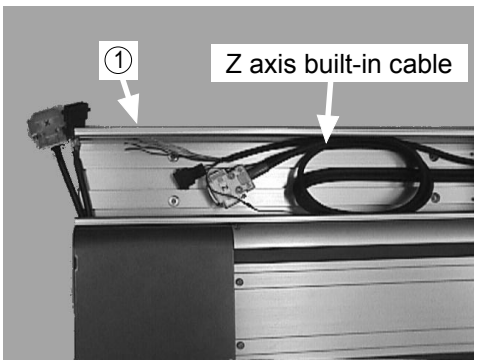
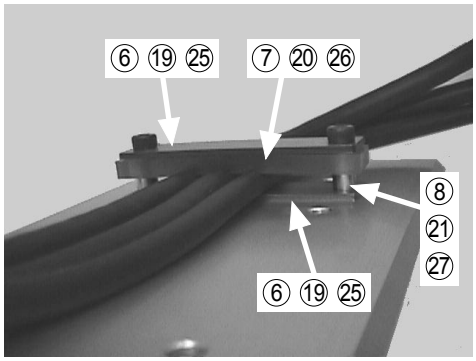


Photo 21-30 RJ



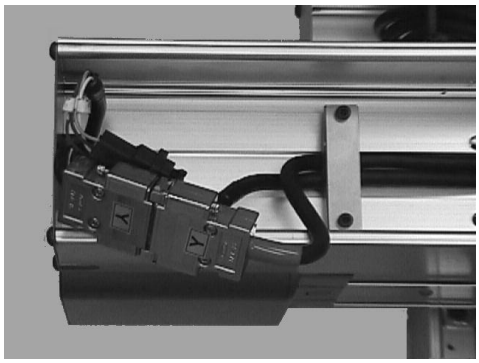
24) Pass the cables through the cable supports loosely so that they don't get a jerk. Set a large bending radius to the cables as much as possible in the connector boxes, then secure them with the clamping parts ⑥ ~ ⑧, ⑲ ~ ㉑ and ㉕ ~ ㉗.
[M4 × 20 (2 bolts), M5 × 16 (2 bolts) or M5 × 25 (2 bolts)]
(Place the clamp bases first on the connector box, put the cables on it, then fasten them with the cable clamps.) (Photo 21-31RJ ~ 35RJ)

Photo 21-31RJ



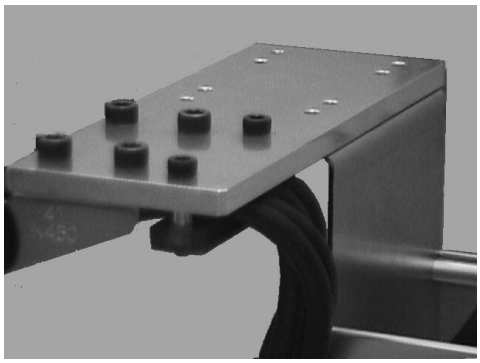
Details of cable clamp

Photo 21-32RJ



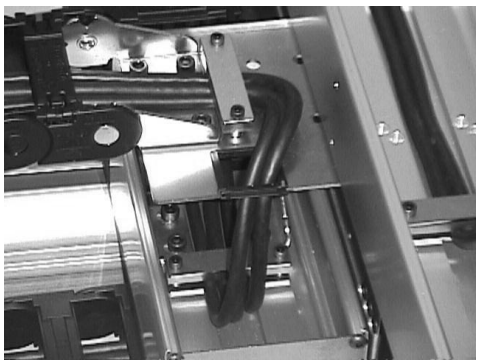
Inside of the junction box
Motor side of Y axis main unit

Photo 21-33RJ



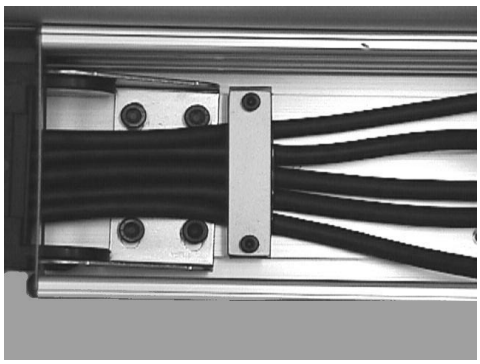
Moving side connector box
Under L-fixture

Photo 21-34RJ



Inside of the junction box

Photo 21-35RJ



Inside of the fixed side connector box

25) Attach the top covers to each connector boxes. Loosely fasten both end covers and press an edge of top cover to a groove and push in the other side of the top cover. (Photo 21-36RJ)
Fix both end covers. (Photo 21-37RJ)

Photo 21-36RJ

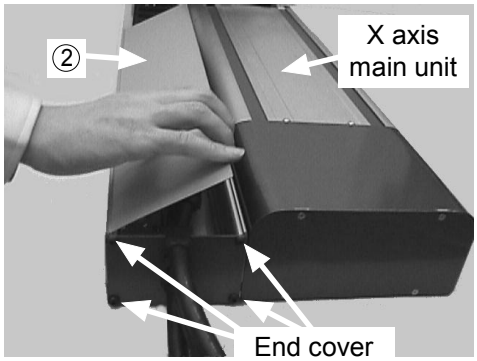
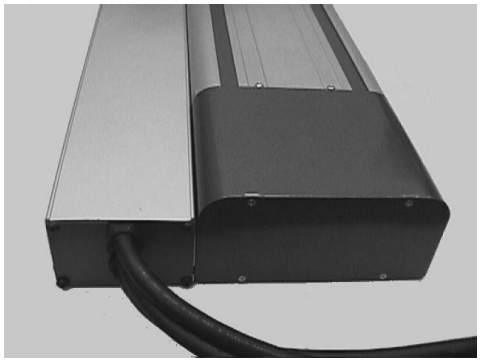
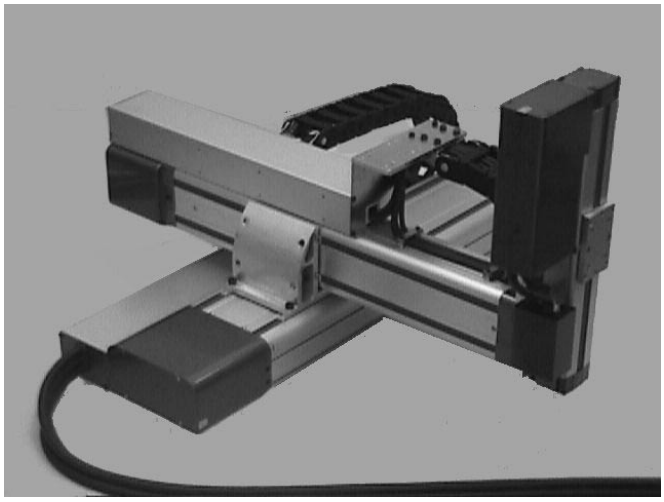


Photo 21-37RJ



Completion of RJ-HMSz combination

Photo 21-38RJ



21.7.14. Use of Motor Indirect Mount Module for X Axis Main Unit

- This section describes the way of how to use a motor indirect mount module for an X axis main unit for respective combination styles / types.

- The table below shows the difference in the parts to be used for motor indirect mount X axis main unit from the motor indirect mount main unit.

Table 21-52

Combination	Parts	Reference number		
		Motor straight mount		Motor indirect mount
RG-MS	Main unit	XY-HRS0□5-RM200	→	XY-HRS1□5-RM40□
	Cable support	XY-E173GMS02700-1	→	XY-E173GMS03900-2
RG-HM	Main unit	XY-HRS□□0-RH200	→	XY-HRS□□0-RH40□
	Cable support	XY-E173GHM02700-1	→	XY-E173GHM04700-2
RD-MS	Main unit	XY-HRS□□0-RH200	→	XY-HRS□□0-RH40□
	Cable support	XY-E173DMS01900-1	→	XY-E173DMS02600-2
RD-HM	Main unit	XY-HRS□□0-RH200	→	XY-HRS□□0-RH40□
	Cable support	XY-E173DHM02000-1	→	XY-E173DHM03100-2
RT-MSz	Main unit	XY-HRS0□5-RM200	→	XY-HRS1□5-RM40□
	Cable support	XY-E173TM0S3100-1	→	XY-E173TM0S4300-2
RX-HM(H)	Main unit	XY-HRS□□0-RH200	→	XY-HRS□□0-RH40□
	Cable support	XY-E173XHM03222-1	→	XY-E173XHM05222-2
RX-MSSz	Main unit	XY-HRS0□5-RM200	→	XY-HRS1□5-RM40□
	Cable support	XY-E173PMSS2716-1	→	XY-E173PMSS3916-2
RP-HMSz	Main unit	XY-HRS□□0-RH200	→	XY-HRS□□0-RH40□
	Cable support	XY-E173PHMS472□-1	→	XY-E173PHMS472□-2
RJ-HMSz	Main unit	XY-HRS□□0-RH200	→	XY-HRS□□0-RH40□
	Cable support	XY-E173JHMS3217-1	→	XY-E173JHMS5217-2

- For B and C type combinations, reverse the connector box referring to "21-12. Reversing Connector Box." For A type combination, this procedure is not necessary.

◆ Installation procedures for fixed side connector box for an X axis motor indirect mount module

1) The parts required for the fixed side connector box are listed in Table 21-53. Confirm that the parts are ready.

Photo 21-1

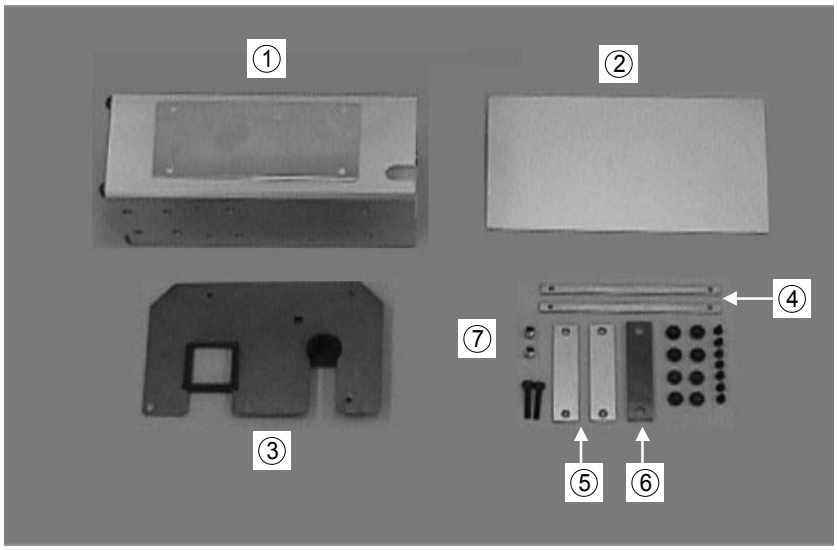
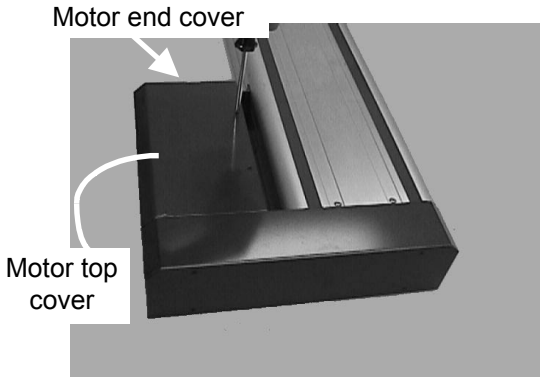


Table 21-53

Section	Part No.	Name	Quantity	Hexagon socket cap screw
Fixed side Connector box	①	Connector box	1	M5 × 10 (2 bolts)
	②	Top cover	1	
	③	End cover	1	M3 × 8 (3 bolts)
	④	Plate nut	2	M3 × 8 (4 bolts)
	⑤	Clamp base	2	M4 × 20 (2 bolts)
	⑥	Cable clamp	1	
	⑦	Spacer	2	

2) Detach the top and end motor cover of main unit. (Photo 21-2)

Photo 21-2



3) Insert the plate nuts ④ to T-slots on a side of X axis main unit (Photo 21-3). Attach the connector box ① temporally to the main unit near the motor cover. (Photo 21-4)

Photo 21-3

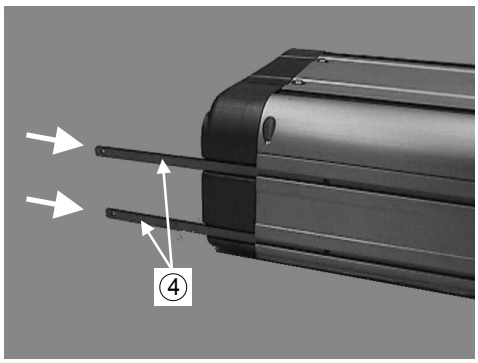
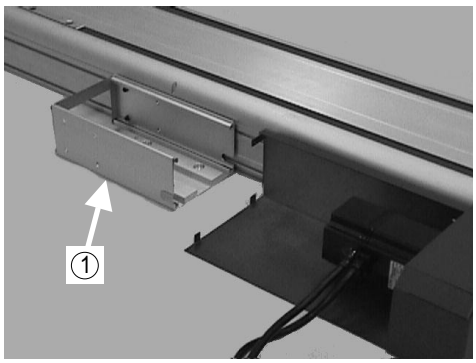


Photo 21-4



4) Put the built-in cable through X-Y cable support (or X-Z cable support).
(Photo 21-5. Be careful the direction of the built-in cable.) Fix the fixed side of the cable support to the connector box ①.
(Photo 21-6)

Photo 21-5

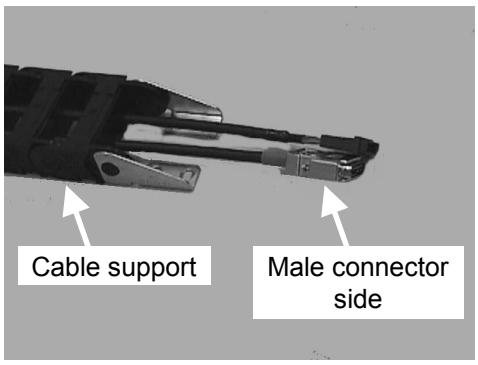
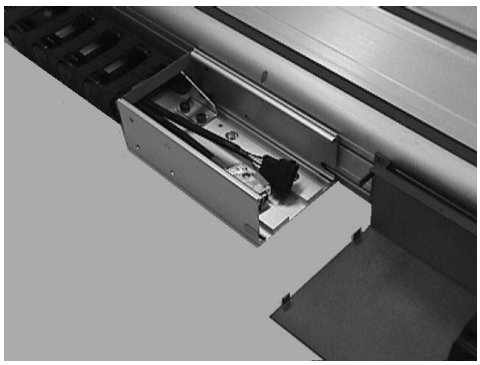


Photo 21-6

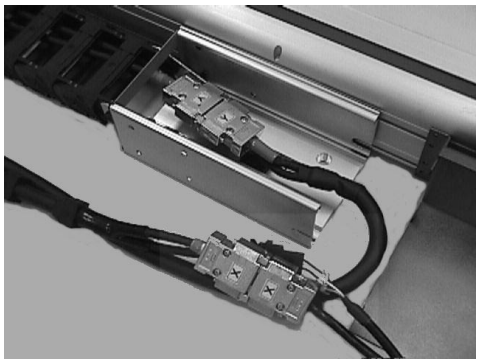


5) Connect the connectors of the controller cable and main unit cable.

◊ Motor connector : Snap to the end.

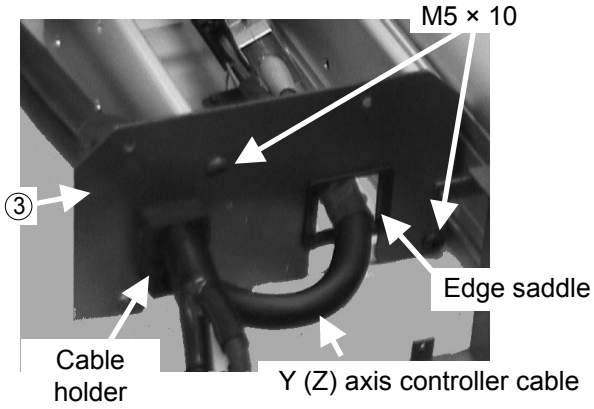
◊ Encoder connector : Secure with 2 screws.

Photo 21-7



6) Open Edge saddle of the end cover ③, put through the Y)Z) axis controller cable, then insert the cable holder to the end cover.
Fix the end cover ③ to the connector box. (M5 × 10, 2 bolts)

Photo 21-8



7) Move the connector box to the end of motor cover, and then secure the connector box and the end cover. (M3 × 8, 6 bolts)

Photo 21-9

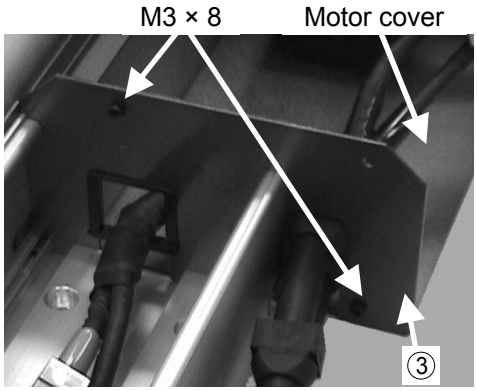
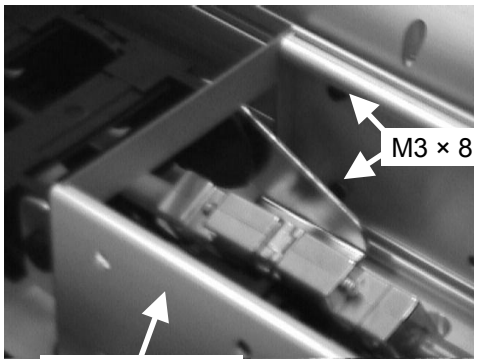


Photo 21-10



8) Fix the built-in cable to the connector box with the clamp parts ⑤ ~ ⑦. (M4 × 20, 2 bolts)
(Place the clamp base under the cable and clamp it.)

Photo 21-11

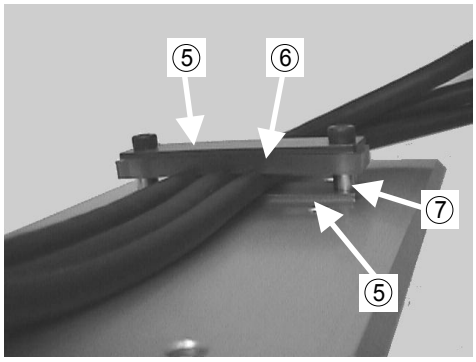
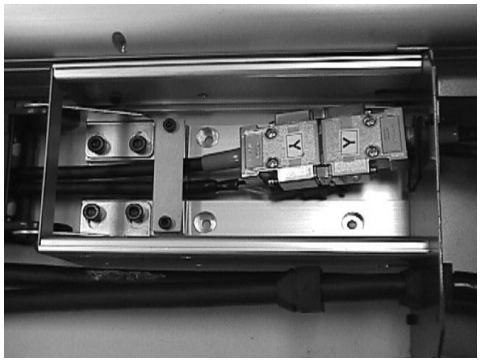
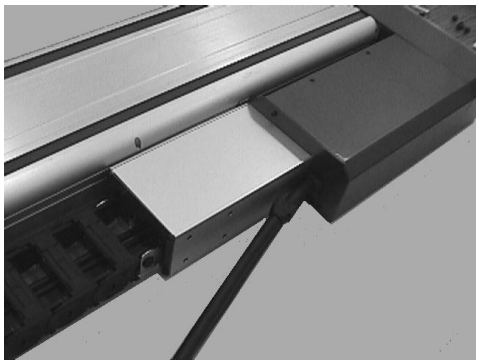


Photo 21-12



9) Attach the top and end motor cover of main unit. (Photo 21-13)

Photo 21-13



21.8. Shortening of Flexible Tube

- The flexible tube of cable support (abbreviated to 'tube' hereafter) is available in two standard length, which cover X axis stroke of 100 ~ 400 mm and 500 mm ~ 800 mm respectively. These two standard tubes are designed to cover all multi-axis combinations.

- A protruding dimension of the tube 'a' of respective combinations, which are shown in the figures of multi-axis combination in the catalog, is the factory set. However, it may be shortened by cutting the tube in some combinations. Refer to Table 21-54 and 21-55 for the relation between allowable cut length and the dimension 'a.'

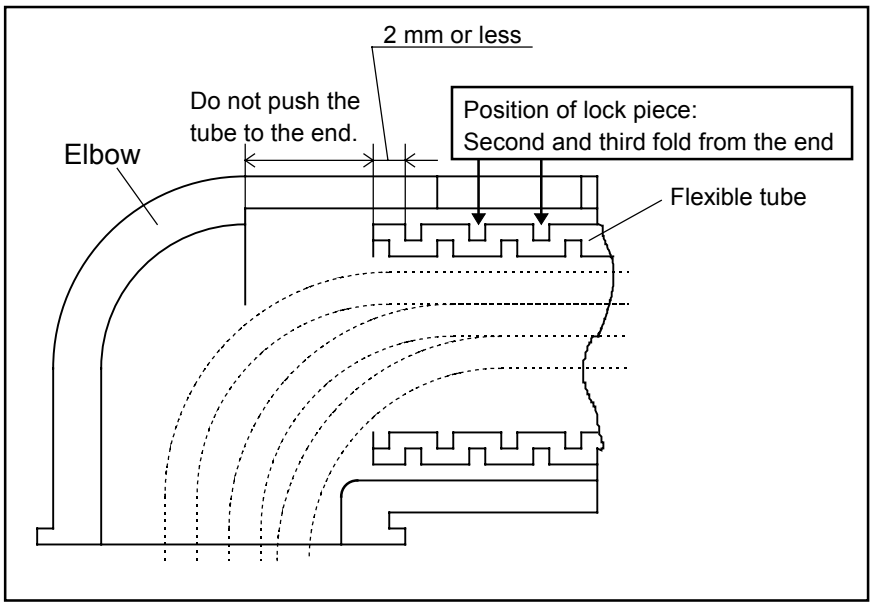
- In Table 21-54, allowable cutting length for respective multi-axis combinations are shown and the dimensions 'a' resulted from the shortened tube length are shown in Table 21-55.

  Danger : *Take appropriate safety measures when cutting the tube. (e.g. wearing groves and glasses)*

  Caution : *Take a great care not to damage the cables inside.*

  Caution : *Do not cut the tube at the end of moving side (elbow side). The moving side of the tube is assembled as shown in Figure 21-40 as the shipping set. The end of tube does not touch an inside face of the elbow so that the tube is not damaged due to repetitive motions of the robot. If you disassemble this side accidentally, assemble it referring to Figure 21-40.*

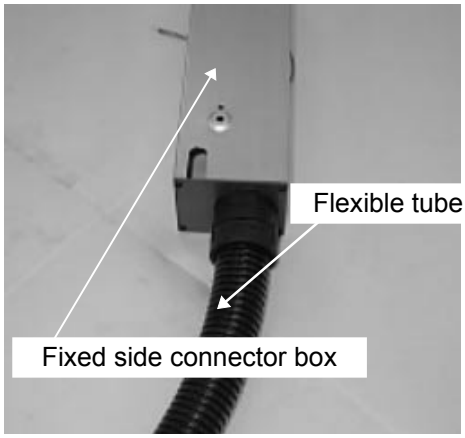
Figure 21-40: Flexible tube assembly, moving side (elbow side)



◆ Cutting procedure

1) Remove the tube from a straight fitting of the fixed side connector box and cut the tube to desired length. (Photo 21.8-1)

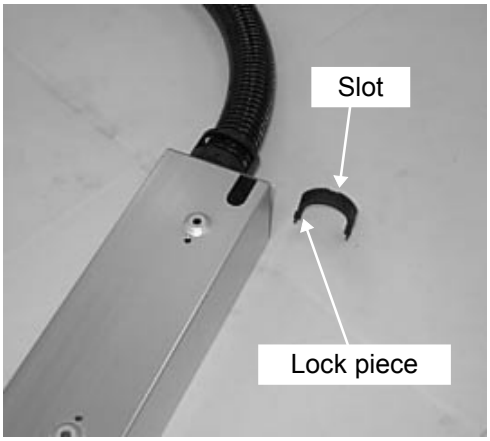
Photo 21.8-1



2) Put a screwdriver into a slot of lock piece and pry the lock piece to detach from the straight tube fitting. (Photo 21.8-2 and 3)

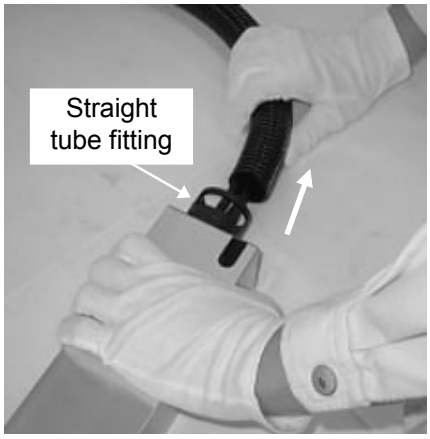
Photo 21.8-2

Photo 21.8-3



3) Pull out the tube from the straight tube fitting. (Photo 21.8-4)

Photo 21.8-4



4) Cut the tube at the bottom of a fold to the length specified in Table 21-54. Remove the cut-off tube. (Photo 21.8-5 and 6)

Photo 21.8-5

Photo 21.8-6

5) Insert the tube to the straight tube fitting. Push in the lock piece to the straight tube fitting. (Photo 21.8-7, 8 and 9)

Photo 21.8-7

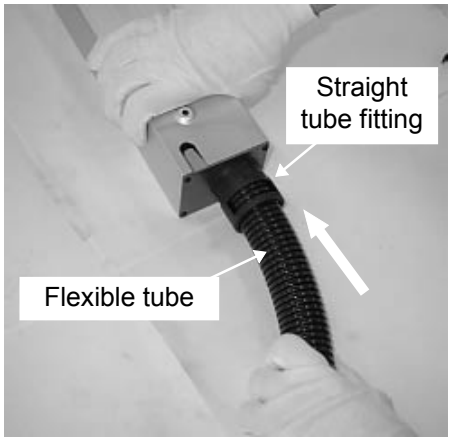


Photo 21.8-8

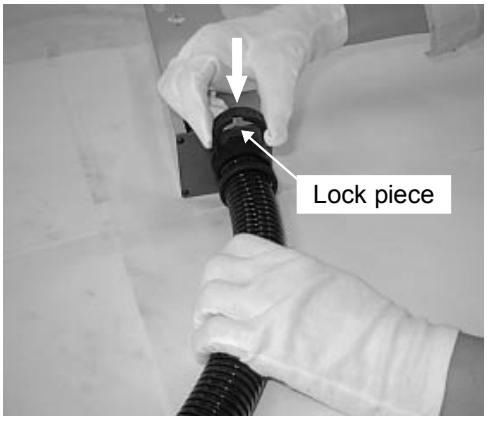


Photo 21.8-9

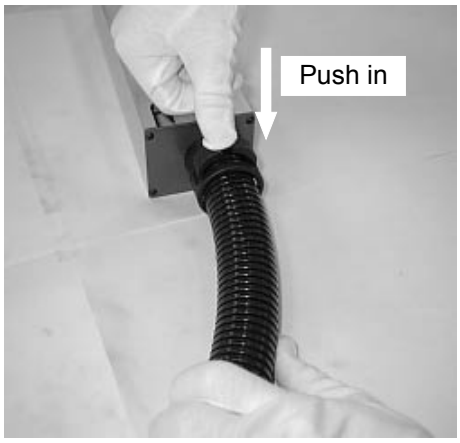


Table 21-54: Cut off length of flexible tube *[unit: mm]*

Combination	X axis spec.	X axis stroke		100	200	300	400	500	600	700	800
PG-HM	Motor straight mount	Combination type, A, B		300	200	100	*	300	200	100	*
		Combination type, C, D		355	255	155	55	355	255	155	55
	Motor indirect mount	Combination type, A, B		330	285	185	85	385	285	185	85
		Combination type, C, D		385	340	240	140	440	340	240	140
PD-HM	Motor straight mount	Z axis stroke	400	340	260	160	60	360	260	160	60
			200, 500	260	230	130	30	330	230	130	30
			300, 600	180	180	100	*	300	200	100	*
	Motor indirect mount		400	250	250	245	145	445	345	245	145
			200, 500	175	175	175	115	415	315	215	115
			300, 600	95	95	95	85	385	285	185	85
PD-MM	Motor straight mount		400	315	255	155	55	355	255	155	55
			200, 500	240	230	130	30	330	230	130	30
			300, 600	160	160	100	*	300	200	100	*
	Motor indirect mount		400	230	230	230	145	445	345	245	145
			200, 500	150	150	150	115	415	415	215	115
			300, 600	70	70	70	70	385	285	185	85

* Do not cut.

Table 21-55: Dimension 'a' (after tube cut off) *[unit: mm]*

Combination	X axis spec.	X axis stroke		100	200	300	400	500	600	700	800
PG-HM	Motor straight mount	Combination type, A, B		125	125	125	125	125	125	125	125
		Combination type, C, D		130	130	130	130	130	130	130	130
	Motor indirect mount	Combination type, A, B		155	130	130	130	130	130	130	130
		Combination type, C, D		160	130	130	130	130	130	130	130
PD-HM	Motor straight mount	Z axis stroke	400	75	65	65	65	65	65	65	65
			200, 500	100	65	65	65	65	65	65	65
			300, 600	125	75	65	65	65	65	65	65
	Motor indirect mount		400	165	115	70	70	70	70	70	70
			200, 500	190	140	90	65	65	65	65	65
			300, 600	210	160	110	70	70	70	70	70
PD-MM	Motor straight mount		400	100	80	80	80	80	80	80	80
			200, 500	130	85	85	85	85	85	85	85
			300, 600	155	105	85	85	85	85	85	85
	Motor indirect mount		400	190	140	90	85	85	85	85	85
			200, 500	220	170	120	85	85	85	85	85
			300, 600	245	195	145	95	85	85	85	85

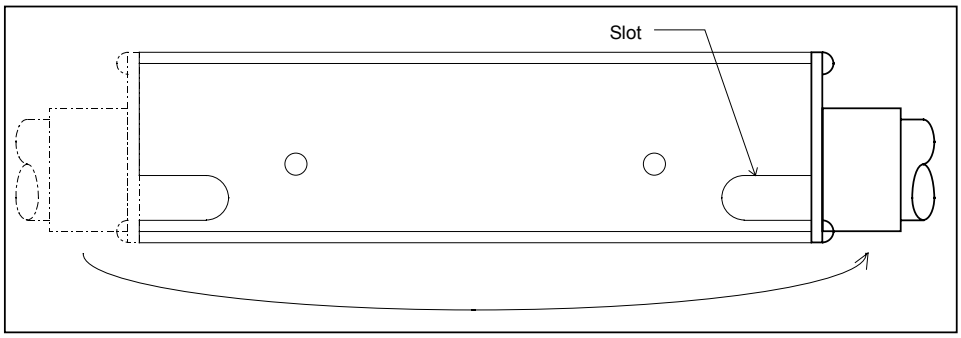
21.9. Modification of Cable Support

- Modification of the cable support is required for all combinations other than A type of PG-HM and PD-HM combinations. The modification is simply reversing position of the flexible tube.
- Follow the procedures described hereafter to change position of the flexible tube.

1 B type of PG-HM combination

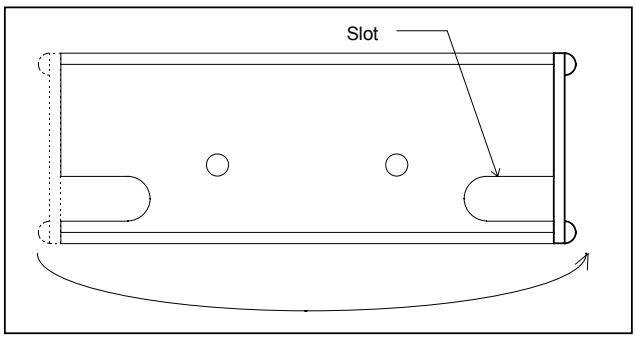
1) Unscrew M3 bolts at corners of end cover of the connector box, reverse the tube position to the other side of the connector box so that the flexible tube is at the slot side as shown in Figure 21-41.

Figure 21-41: Reverse the flexible tube position



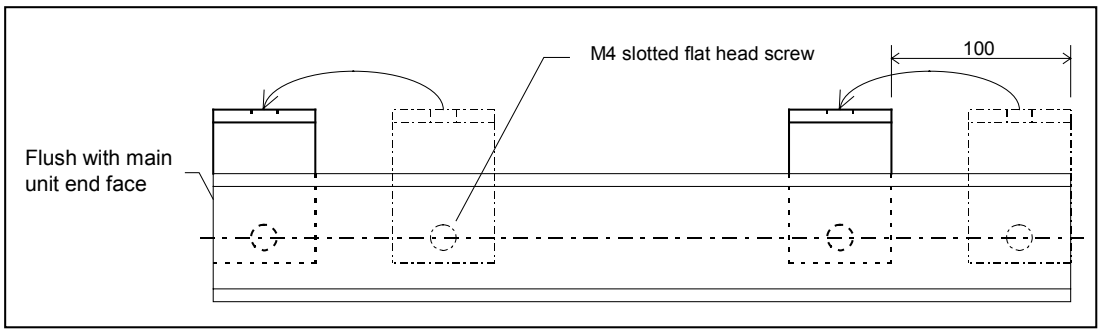
2) Unscrew M3 bolts on the four corners of end cover and detach the cover. Attach it to the other end of the connector frame (shorter one) as sown in Figure 21-42
(Tightening torque: 0.59 ~ 0.78 N·m)

Figure 21-42: Reverse the end cover position (connector frame)



3) This procedure is required only for XY-E183GHM100-1 (X axis stroke: 400 mm or less). Loosen screws on back side of the attaching plate of flexible tube guide and change the guide position as shown in Figure 21-43, then fix it.
(M4 slotted flat head screw, tightening torque:1.67 ~ 1.96 N·m)

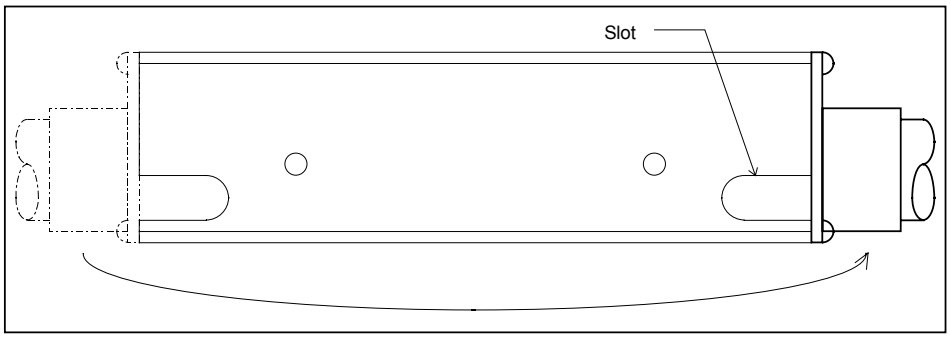
Figure 21-43: Changing position of the flexible tube guide



2 C type of PG-HM combination

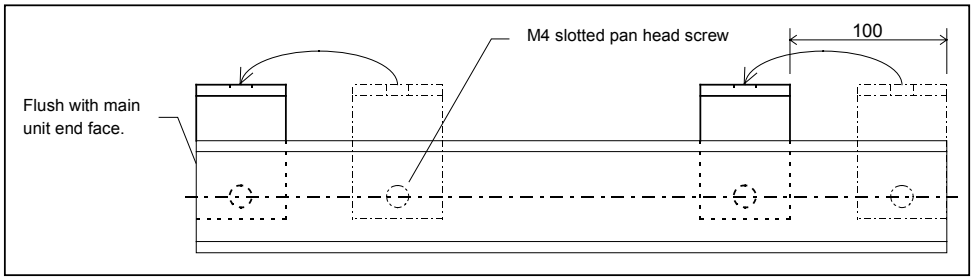
1) Remove M3 bolts on the corner of end cover of flexible tube, reverse the tube position to the other side of the connector box so that the flexible tube is at a slot side as shown in Figure 21-44.

Figure 21-44: Reverse the flexible tube position



2) This process is required only for XY-E183GHM100-1 (X axis stroke: 400 mm or less). Unscrew M4 screws on back side of the attaching plate of flexible tube guide and change the guide position as shown in Figure 21-45, then fix it.
(M4 slotted flat head screw, tightening torque:1.67 ~ 1.96 N·m)

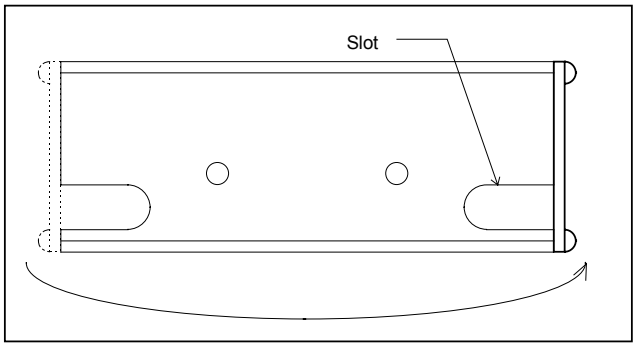
Figure 21-45: Changing position of the flexible tube guide



3 D type of PG-HM combination

2) Remove M3 bolts on the four corners of end cover and detach it. Attach it to the other end of the connector frame (shorter one) as shown in Figure 21-46. (Tightening torque: 0.59 ~ 0.78 N·m)

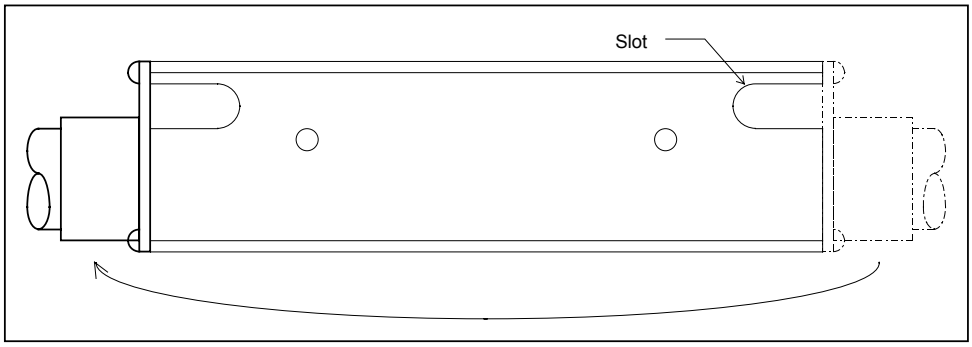
Figure 21-46: Reverse the end cover position (connector frame)



4 B type of PD-HM and PD-MM combinations

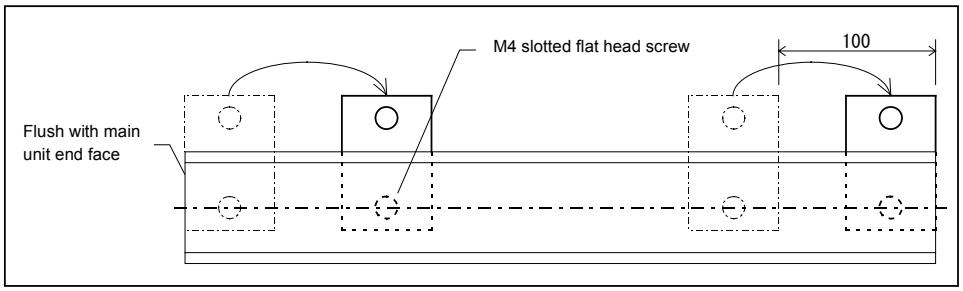
1) Remove M3 bolts on corners of end cover of flexible tube, reverse the tube position to the other side of the connector box so that the flexible tube is at a slot side as shown in Figure 21-47. M3 bolt. Tightening torque: 0.59 ~ 0.78 N·m)

Figure 21-47: Reverse the flexible tube position



2) This procedure is required only for XY-E183DHM110-1 (X axis stroke: 400 mm or less). Loosen screws on back side of the attaching plate of flexible tube guide and change the guide position as shown in Figure 21-48, then fix it.
(M4 slotted flat head screw, tightening torque:1.67 ~ 1.96 N·m)

Figure 21-48: Changing position of the flexible tube guide



21.10. Adding Tap Holes to a Module Main Unit

- Standard stroke of Z axis in PD-HM and PD-MM combinations are 100 and 200 mm. Therefore, it requires to add tap holes to the Z axis main unit of 300 mm or more stroke to attach the combining bracket. (The tap holes are provided with a main unit of 200 mm or less stroke beforehand.)

- Tap onto four countersink on the bottom surface of PM main unit. (100 × 130)
  (4-M6 × 1.0 pitch, 9 ~ 12 mm deep, pilot drill depth: 22 mm or less)

21.11. Shortening of Cable Support

- A standard cable support can be used for several multi-axis combinations in terms of stroke.
- You may shorten dimensions of cable support projection 'a' and 'b', which are shown in the figures of multi-axis combination in the catalogue.

Danger : *Take appropriate safety measures when shortening the cable support. (e.g. wearing groves and glasses)*

Danger : *Be careful not to pinch your fingers in a rung or a links of the cable support.*

Caution : *Take a great care not to damage the cables inside.*

◆ Procedures of shortening a cable support

1) Open (or take off) rung of links to be removed, and a rung in front and behind of removing portion. Put a flat screwdriver in a clearance at the side of a rung, then pry a rung off a cable support. (both sides)

Photo 21.11-1

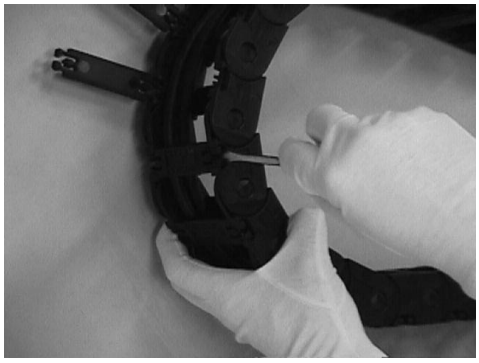
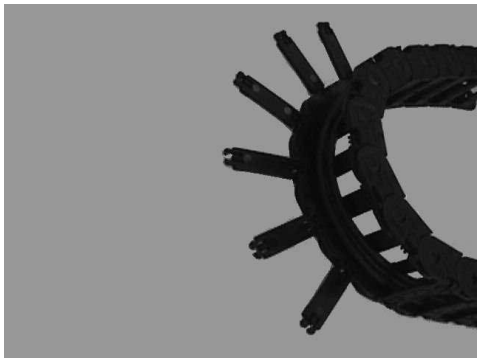


Photo 21.11-2



2) Take off a link at both ends of the cable support to be removed. Put a flat screwdriver in a clearance between two adjacent links and turn the screwdriver approximately 90 ° .

Photo 21.11-3

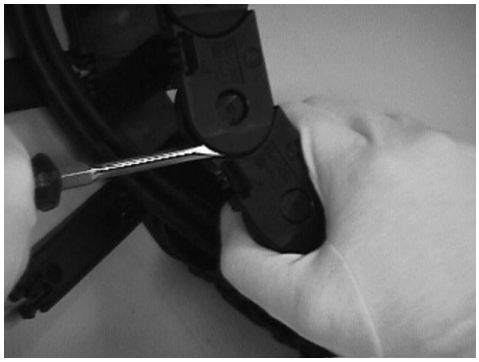
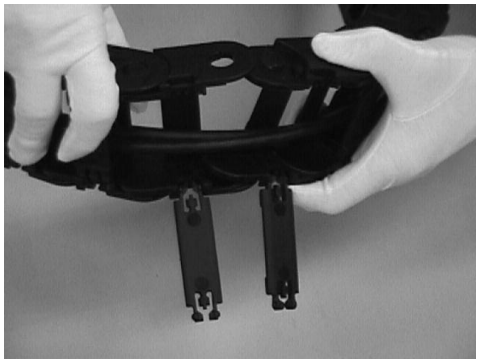


Photo 21.11-4

3) Connect the links.
Insert the pin of link to the pin hole of other one and push in the other side of the links.

Photo 21.11-5



4) Connect the links on both sides. Do not fold the cables in the cable support. Push the cables into the connector box, then snap the rungs to close.

Photo 21.11-5

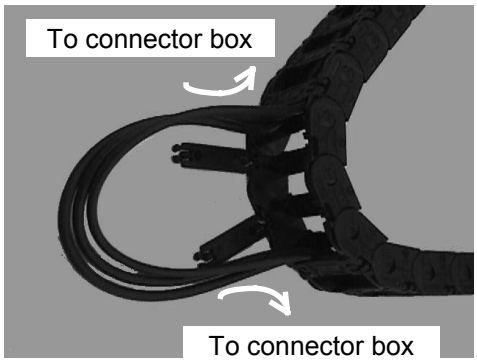
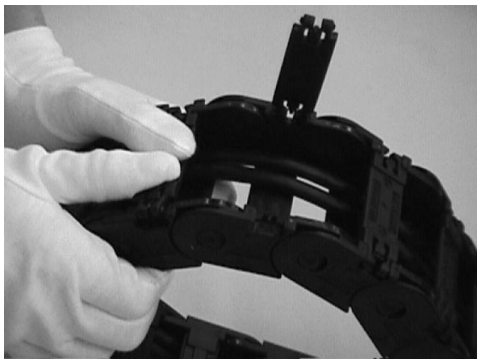


Photo 21.11-6



Caution : *Move the main units for full stroke to check any disturbance after the cable has been shortened. It leads to reduction of stroke or breakage of the cable support if the cable support is shortened too much.*

21.12. Reversing Connector Box

21.12.1. RP and RG Combination (junction Box)

1) Pull off the cover in the junction box, then put it into the other side. (Photo 21.12-1)

Photo 21.12-1

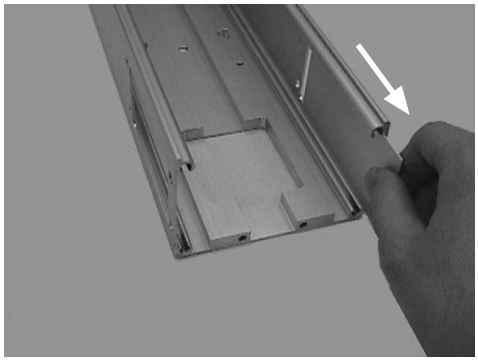
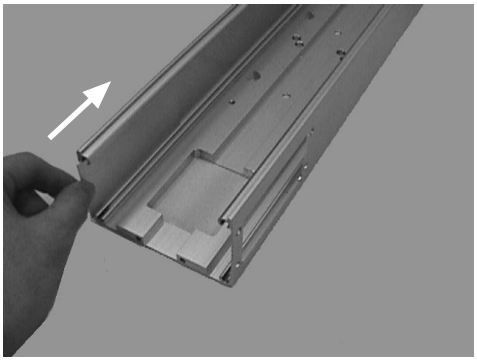


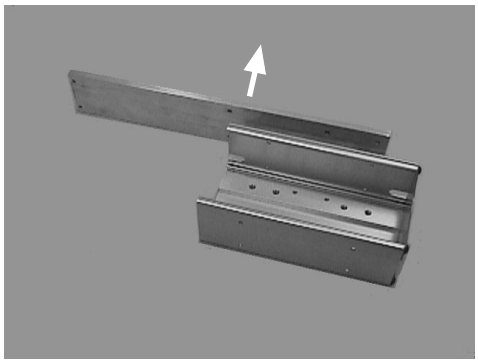
Photo 21.12-2



21.12.2. RD-HM Combination

1) Unfasten M3 bolts (4 place) and remove the connector plate.

Photo 21.12.-3



2) Unfasten M5 bolts (4 places) and remove the end cover (Photo 21.12-4), then attach it to the other side of the connector box. (Photo 21.12-5)

Photo 21.12-4

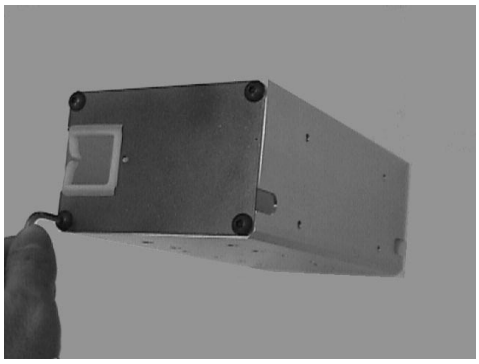
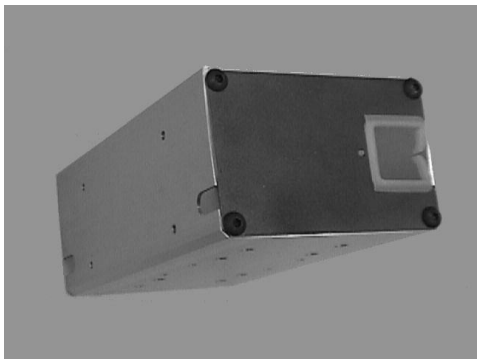
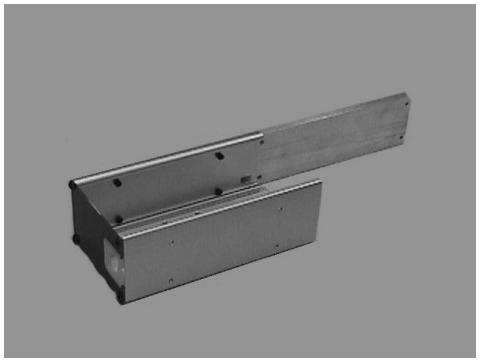


Photo 21.12-5



3) Reverse the connector plate and secure it to the connector box.

Photo 21.12-6



21.12.3. Indirect Motor Mount X axis Main Unit

- Unfasten M5 bolts (4 places) and remove the end cover (Photo 21.12.-7), then attach it to the other side of the connector box. (Photo 21.12-8)

Photo 21.12-7

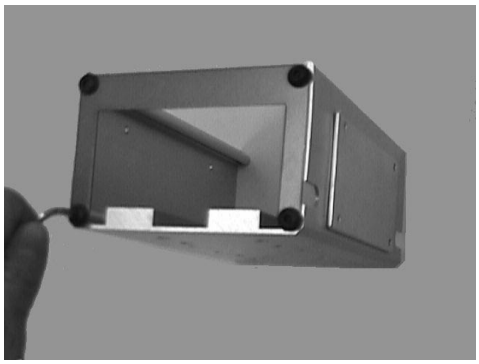
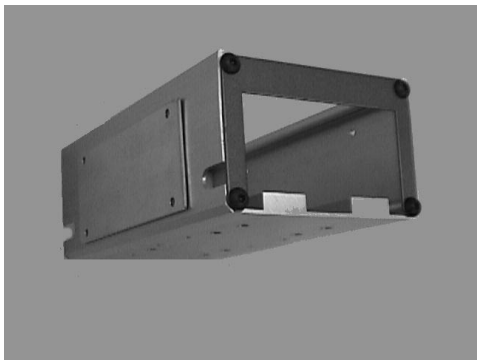


Photo 21.12-8



21.13. Reversing L-fixture

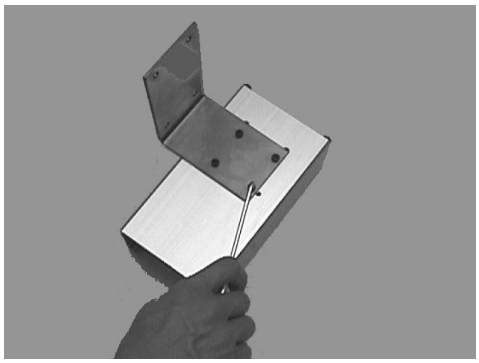
21.13.1. RP and RT Combination

1) Get the moving side connector box ready. (Photo 21.13-1)

Photo 21.13-1

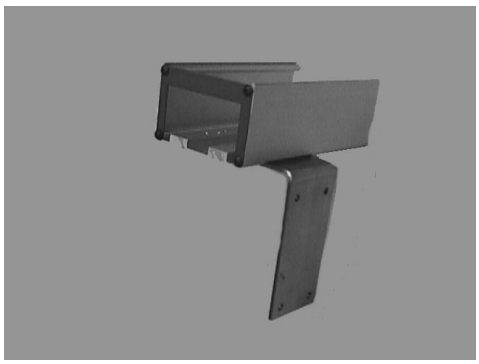
2) Unfasten M4 bolts (4 places) to detach the L-fixture. (Photo 21.13-2)

Photo 21.13-2



3) Reverse the L-fixture and attach it to the connector box.

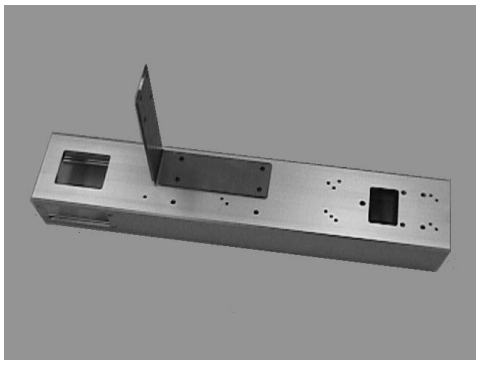
Photo 21.13-3



21.13.2. RP-MSSz and RG-MS Combination

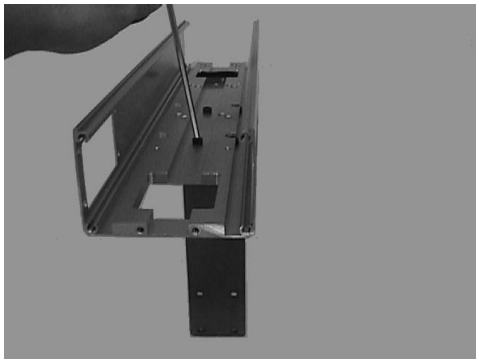
1) Get the junction box ready.

Photo 21.13.4



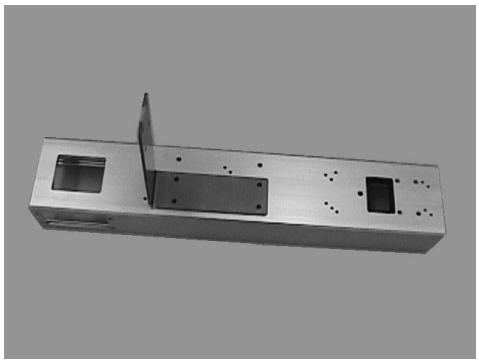
2) Unfasten M5 bolts (4 places) and detach the L-fixture. (Photo 21.13-5)

Photo 21.13-5



3) Change the position of the L-fixture as shown in Photo 21- 13-6.

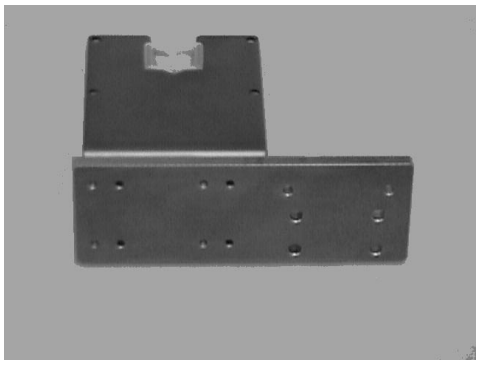
Photo 21.13-6



21.13.3. RX, RC and RX Combination

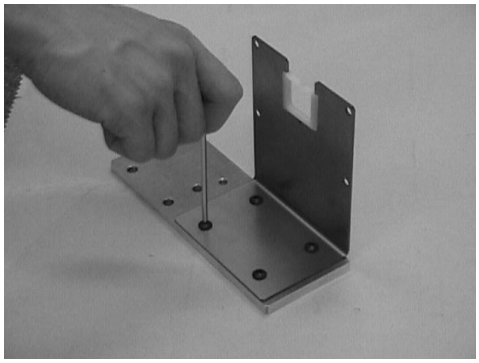
1) Get the L-fixture (with a plate to fix cable support) ready.

Photo 21.13-7



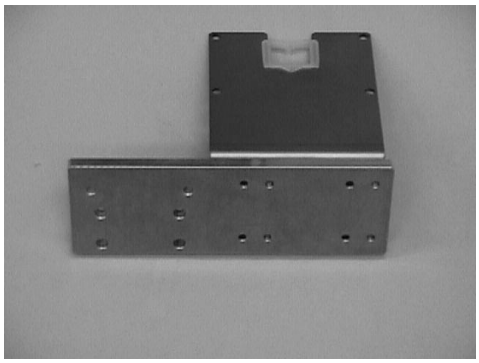
2) Unfasten M4 bolts (4 places) and detach the L-fixture.

Photo 21.13-8



3) Reverse the position of the L-fixture as shown in Photo 21.13-9 and fix it. (In Photo 21.13-9, the palate to fix the cable support is reversed.)

Photo 21.13-9



22. Maintenance • Checking

- We recommend to conduct the periodical checks and replace the parts as shown in Table 22-1 to avoid an unexpected system shutdown due to the breakdown of the parts.

- Ball screws and NSK linear guides used for the main units are equipped with a unique lubrication system, which consists of K1 lubrication unit* and high load grease. Because of this lubrication system, you do not need replenish the grease if the robot system is going to be operated in the conditions described hereunder.

  1) Clean environment and no contamination

  2) Ambient temperature is 0 ~ 40 °C and no condensation

  3) Load conditions, transportable mass and moment are in the criteria as specified in "19.1.2. Specifications."

  * K1 lubrication unit : A unique lubrication unit originated by NSK Ltd. It is made of a porous synthetic resin that contains a large amount of lubricating oil and supplies the lubrication oil for a long time.

Table 22-1

Checking	Recommended intervals *1	Checking items	Chapter to be referred
Routine checking	Once a week	Loose bolts, connectors and cables	22.1.1.
Periodical checking	Every half year	Inspect timing belt for damage and looseness. *2	22.2.1.
Periodical replacement of expendable parts	Every two years	Replace built-in cables (or cable support). Replace timing belt. *2	22.3.1. 22.3.2.
Overhaul	Approximately every 5 years	Thorough checking, replace parts if necessary. (to be returned to the manufacturer for repair)	22.4.

*1 Increase the frequency of inspection if your operating condition exceeds the standard operation pattern described below.

*2 This check is not necessary for a motor direct mount main unit. (Timing belt is not used.)

Standard operation pattern

[Repetitive 500 mm stroke reciprocation, 3 sec/cycle, 8 hours/day, 300 days / year]

- The life expectancy of a main unit is 10 000 km in travel distance or 3.4 years under the standard operation pattern when the maximum load mass and transportable moment load are constantly applied.
- The fatigue life expectancy is inversely proportionate to cube of load (force). When the operating conditions are 80 % *1 of above examples, the expected life will be 20 000 km in travel distance or 4.9 years under the standard operation pattern.

  *1 Example

  In case of a G-HM type combination with 400 mm Y axis stroke, the transportable mass is 10 kg when the acceleration is set to 4.9 m/s^2. However, when the Y axis slider is operating closely to X axis main unit, the moment load of X axis main unit is less than a half of the allowable moment load, and consequently, the average moment load will be approximately 80 % of the allowable transportable moment load. This will give a 20 000 km approximate travel distance.
  (This estimation varies according to the operating pattern.)

22.1. Routine Checking

22.1.1. Checking of Bolts and Cables

Warring : To prevent from an accident due to loose bolts, perform following checking listed in the table below. Be sure to turn the main and control power of the controller off before the checking.

Table 22-2

Check point	Description
Bolts for fixing main unit Bolts for securing the end effector	• Check for a loose bolts by tightening them. *
Cables	• Replace a built-in cable or flexible tube if it has serious crack or breakage. • Check for loose bolts by tightening them.

* Refer to "21.4. Fixing Module Main Unit" and "21.6. Installation of End Effector" for the tightening torque of the bolts

22.2. Periodical Check

22.2.1. Checking Timing Belt

- This checking is only necessary for a motor indirect mount main unit.

Warring : *The timing belt is treated as an expendable part. The manufacturer has no obligation to the timing belt beyond the warranty period. Be sure to perform the periodical checks to prevent from malfunctioning of the system, colliding against an obstacle and free-falling of a vertical axis slider.*

◆ Checking timing belt

1) Turn off the power of the EXEA controller or the servo switch.

2) Remove the covers of the main unit.
PH and PM module

◊ Motor bottom cover : Remove M4 bolts on the bottom. (2 places) (Photo 22-1)

◊ Motor end cover : Remove M4 bolts on the end. (4 places) (Photo 22-2)

◊ Top cover : Remove M3 bolts on the top surface. (Photo 22-3)
PM module : 2 places
PH module : 4 places

RH and RM module

◊ pulley cover : Remove M 3 bolts on the end. (4 places) (Photo 22-4)

RS module

◊ Motor end cover : Remove M3 bolts. (4 places) (Photo 22-5)

◊ Motor side cover : Remove M3 bolts on the side and the end. (2 places each) (Photo 22-6)

Photo 22-1

Photo 22-2

Photo 22-3

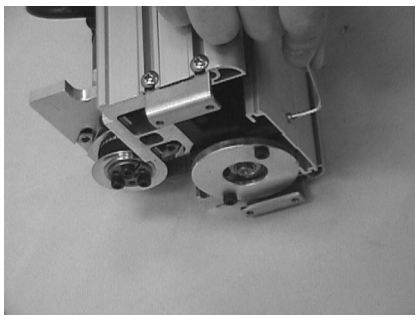


Photo 22-4

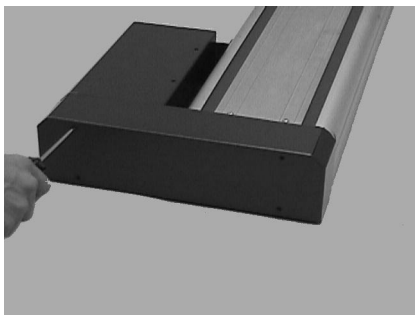


Photo 22-5

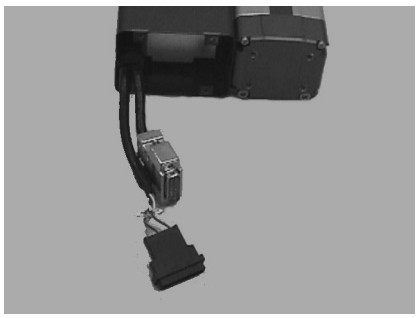
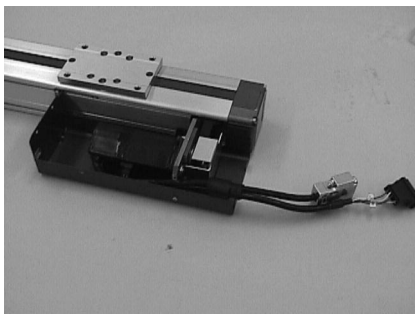


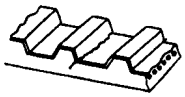
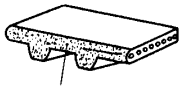
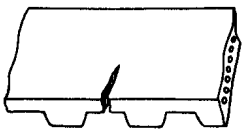
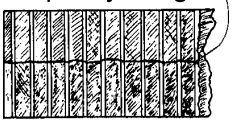
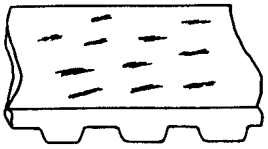
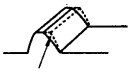
Photo 22-6



3) Move the slider manually and inspect the timing belt visually for damage. Replace the timing belt if it is damaged as described in Table 22-3 below. Refer to "22.3.2. Replacement of Timing Belt."

4) Attach the covers again if there is no damage on the timing belt.

Table 22-3: Criteria for replacing timing belt

	Appearance	Description
The teeth are worn off.		The duck of teeth are worn off. • The duck fiber is fuzzed up and texture is getting vague. • The surface rubber is removed and faded to whitish.
The teeth are sheared.		Cracks in the root of teeth
The side face is fuzzed and worn off.	Core thread got frayed.  Abnormal wear	The edges are worn out and the thread is getting frayed.
The belt is partially damaged.		The belt is partially cracked. In some case, it may be accompanied by scores in the other part of belt, which are caused by foreign matters.
Scored in lengthwise.	Scores caused by running on pulley flange. 	The belt has run on the pulley flange.
The rubber of the back surface have softened and got sticky.		Softened rubber stuck to the back surface. (Use of an idle pulley may be the cause.) The back surface is sticky. (Stuck oil may be the cause.)
Cracks in the back surface	 Crack	Cracks in the back surface are parallel to the teeth. (due to high or low temperature)
Wear on pulley teeth	 Pressure angle is changed due to wear. Wear on tooth edge 	May be caused by improper pulley material or existence of fine particles.

22.3. Periodical Replacement of Expendable Parts

22.3.1. Replacement of Cable Support

- The cable support is an expendable part. We recommend to replace it periodically to avoid system failure due to a sheared cable.

22.3.1.1. P Series

Table 22-4: Cable Support [Set of cables with connectors and flexible tube]

No	Reference number	Applicable multi-axis combination	Contents
1	XY-E183100-1	PG-HM combination: X-axis stroke is 400 mm or less.	Motor / Encoder cable, one each
2	XY-E183101-1	PG-HM combination: X axis stroke is 800 mm or less.	Motor / Encoder cable, one each
3	XY-E183110-1	PD-HM and PD-MM combination: X axis stroke is 400 mm or less.	Motor / Encoder cable, one each A user signal cable (doubles as a brake cable)
4	XY-E183111-1	PD-HM and PD-MM combination: X axis stroke is 800 mm or less.	Motor / Encoder cable one each A user signal cable (doubles as a brake cable)

◆ Procedure for replacement

1) Turn of f main and control power of the EXEA controller.

2) Remove the flexible tube.
   - ◊ Detach the connector box end cover of flexible tube side.
   - ◊ Remove the nut fixing the flexible tube.
   - ◊ Put the nut and the connectors through the end cover.

3) Affix the seals to respective connectors on both sides of cable, secure the cable to the connector box, connect all connectors. Assemble the flexible tube in reverse order of the procedures described above.
   (The seals for X, Y, Z or R axis to identify a cable are provided with the cable support.)

4) Move respective main units manually in full stroke and check for twisting flexible tube and interference between the ancillaries.

5) Turn on the main and control power of the EXEA controller.

22.3.1.2. R Series

Table 22-4: Built-in cable [Cables with connectors]

No	Reference number	Contents
1	XY-E173020-1	Motor / Encoder cable, one each
2	XY-E173028-1	Motor / Encoder cable, one each
3	XY-E173036-1	Motor / Encoder cable, one each
4	XY-E173044-1	Motor / Encoder cable, one each
5	XY-E173052-1	Motor / Encoder cable, one each
6	XY-E173020-2	Motor / Encoder cable, one each
		A user signal cable (doubles as a brake cable)
7	XY-E173028-2	Motor / Encoder cable, one each
		A user signal cable (doubles as a brake cable)
8	XY-E173036-2	Motor / Encoder cable, one each
		A user signal cable (doubles as a brake cable)
8	XY-E173044-2	Motor / Encoder cable, one each
		A user signal cable (doubles as a brake cable)
9	XY-E173052-2	Motor / Encoder cable, one each
		A user signal cable (doubles as a brake cable)

- Built-in cable differs according to the multi-axis combination and stroke of respective main units. Select a built-in cable referring to "Selection table of R series cable"in the catalog.

◆ Replacement procedures

1) Turn off the main and control power of the EXEA controller.

2) Remove an end cover of respective connector boxes and pull out the top cover.

3) Detach the cable clamps and cable holders, disconnect all connectors of the built-in cable and pull out it from the cable support.

4) Affix the seals of X, Y, Z and R to the connectors of new built-in cable respectively. Connect the cable to the controller cable.

5) Install the built-in cable to the cable support in reversed order of procedure 3) and connect it to the main units. Fix it to the connector box with the cable clamp and the cable holders.

6) Attach the top and end cover of respective connector boxes in reversed order of procedure 2).

7) Move the main units respectively and check for jerking of cable in the cable support.

8) Turn on the main and control power of the EXEA controller. Execute a home return operation if it rises a home return alarm.

22.3.2. Replacement of Timing Belt

- This section is only applicable for a motor indirect mount main unit.

Warring : *The timing belt is treated as a expendable part. NSK Ltd. is not liable to its damage when it is out of the warranty. We recommend to replace it periodically to avoid the system malfunction, collision to an obstacle and free-falling of slider of a vertical axis main unit.*

Table 22-5

No.	Reference number	Manufacturer	Applicable module main unit
1	XY-P189BH-1	Tsubakimoto Chain Co. Ltd. • 285P3M15	PH module, motor back mount
2	XY-P189BM-1	Tsubakimoto Chain Co. Ltd. • 225P3M10	PM module, motor back mount
3	XY-P179BM-1	Mitsuboshi Belt Co. Ltd. • B150S5M425	RM module, motor right /left mount RH module, motor right / left mount, speed reduction ratio 1:1
4	XY-P179BH-1	Mitsuboshi Belt Co. Ltd. • B150S5M475	RH module, motor right / left mount, speed reduction ratio 1:2
5	XY-P179BS-1	Mitsuboshi Belt Co. Ltd. • B100S3M246	RS module 100W
6	XY-P179BS-2	Mitsuboshi Belt Co. Ltd. • B100S3M255	RS module 200W

22.3.2.1. PH and PM Module

◆ Replacement procedure

1) Turn off the power of the EXEA controller and remove the covers.
   (1) Bottom motor cover : M4 button head bolts (2 bolts) (Photo 22-7)
   (2) End motor cover : M4 thin head cap bolts (4 bolts) (Photo 22-8)
   (3) Top cover : M3 button head bolts (4 bolts for PH and 2 bolts for PM module) (Photo 22-9)

Photo 22-7

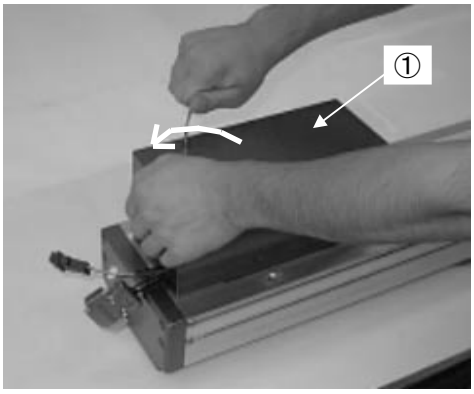


Photo 22-8

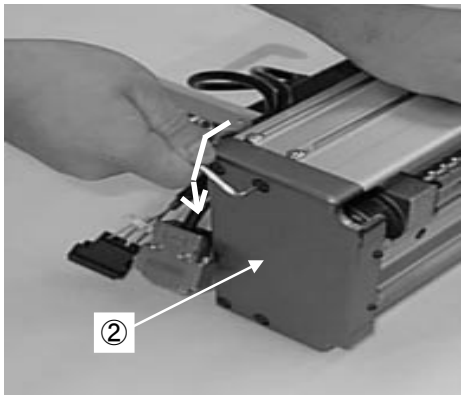
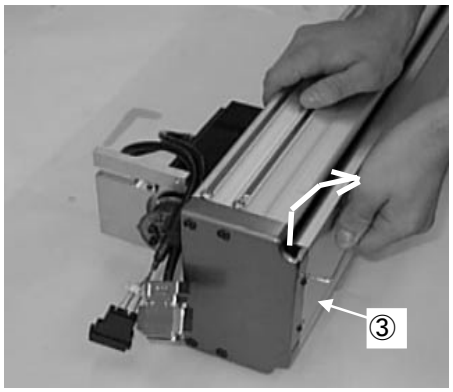


Photo 22-9



2) Turn on the controller power and execute a Home return. (Be sure that no one is in the operating area of robot before turning on the power.) Turn off the power. Be careful not to move the slider in procedures thereafter.

3) Remove a ball screw support unit. Unfasten the bolts (PH: M5, 4 places, PM: M4, 2places) and pull out the support unit. The support bearings will come off with it.
(Photo 22-10 and Photo 22-11)

Photo 22-10

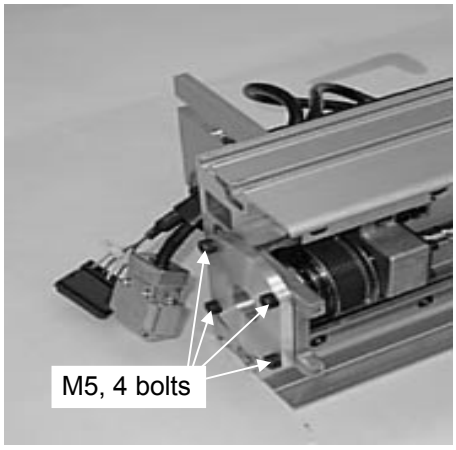
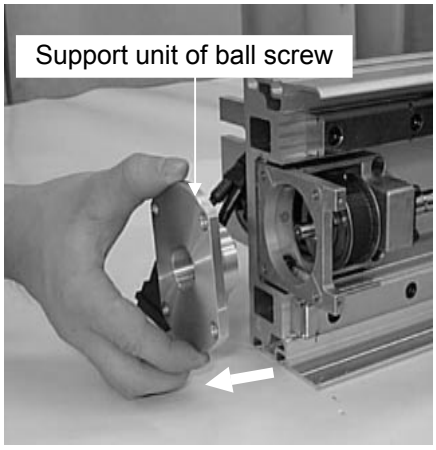
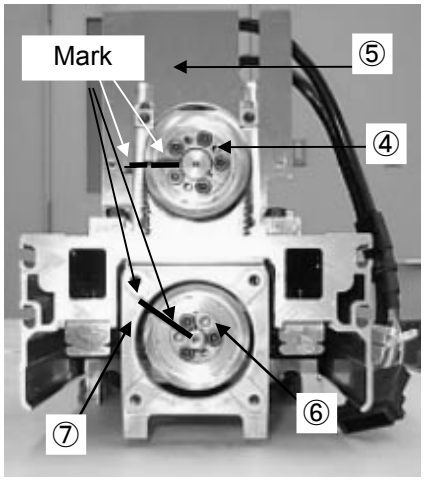


Photo 22-11



4) Put matching marks with a marker between the motor pulley④and end of motor housing⑤, and the motor pulley⑥and the support unit housing⑦as shown in Photo 22-12.

Photo 22-12



5) Unfasten and remove the motor fixing bolts (PH: M5 × 4 bolts, PM: M4 × 2 bolts). Be careful not to lose square nuts. Then pull out the motor with its pulley and take off the timing belt.
(Photo 22-12 and 22-13)

Photo 22-13

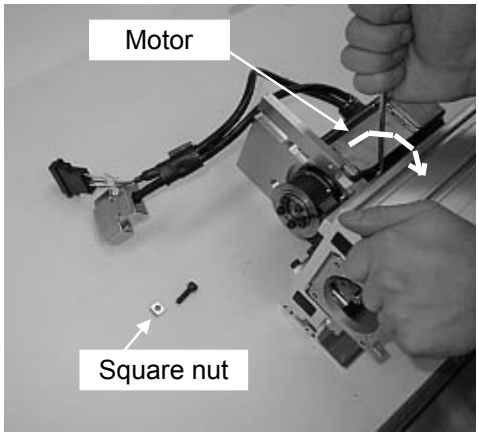
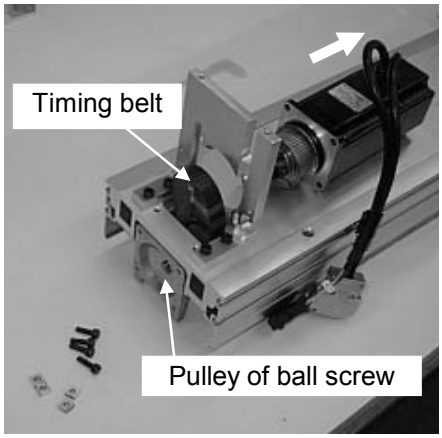
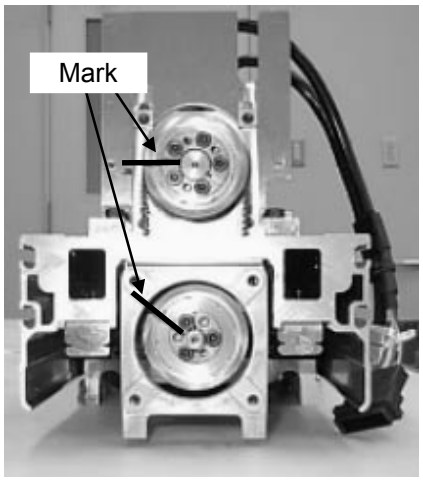


Photo 22-14



6) Put respective matching marks in a line, which are marked in the procedure 4), and put the new timing belt on both pulleys. (Photo 22-15)

Photo 22-15

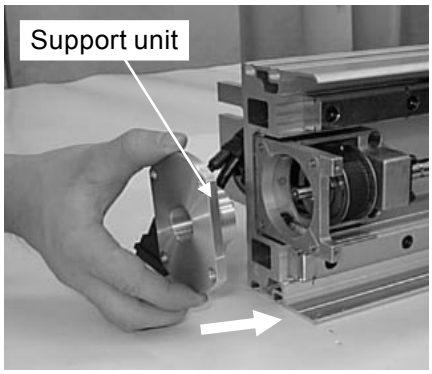


7) Insert the ball screw support unit, which is pulled out in the procedure 3). Be sure to align its center with the center line of the ball screw. Fasten the hexagon socket cap bolts at a uniform fastening torque.

◊ PH module : M5 × 4 bolts, fastening torque: 5 ~ 6 N·m

◊ PM module : M4 × 2 bolts, fastening torque: 3 ~ 4 N·m

Photo 22-16



8) Apply tension to the belt and fasten the motor fixing bolts at a uniform torque.

◊ PH module : M5 × 4 bolts, fastening torque: 4 ~ 5 N·m

◊ PM module : M4 × 2 bolts, fastening torque: 3 ~ 4 N·m

Loosely fasten the bolts and adjust the tension. We recommend to apply extra tension to the timing belt by hanging the weight T from the motor flange in the manner shown in Photo 22-17. Be aware that an excessive tension results in the motor breakage, while an insufficient tension will cause a position error due to slippage of the belt. Additional tension T is shown in Table 22-6. (Photo 22-17)

Photo 22-17

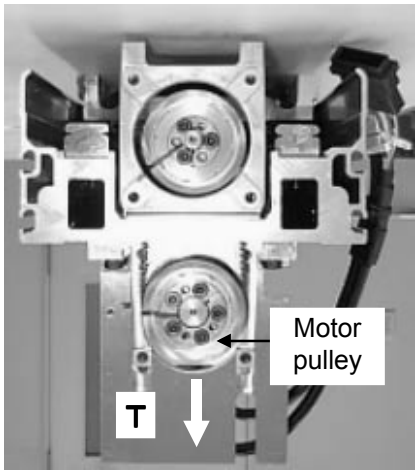


Table 22-6

Module	Tension [N]	Motor mass [kg]	Additional tension [kg (N)]
PH	100 ~ 120	1.1	9 ~ 11 (90 ~ 110)
PM	60 ~ 70	0.5	5.5 ~ 6.5 (55 ~ 65)

9) Check if any one is in the operating area of the robot, then perform a Home return by the command of the controller and define the Home position. When the Home position is shifted by difference in phase of the pulleys, use "Home position offset" function of the EXEA controller. Refer to "9.3.2. Parameters for Home Return Operation."

10) Attach the covers.

(1) Bottom motor cover : M4 button head bolts (2 bolts)

(2) End motor cover : M4 thin head cap bolts (4 bolts)

(3) Top cover : M3 button head bolts
(4 bolts for PH and 2 bolts for PM module)

22.3.2.2. RH and RM Module

◆ Replacing procedure

1) Turn off the power of the EXEA controller and remove covers shown below.
   (1) Pulley end cover : M3 counter-sunk screws, 4 screws (Photo 22-18)
   (2) Motor top cover : M3 counter-sunk screws, 3 screws
   (2 screws on top and one screw on end face) (Photo 22-19)

Photo 22-18

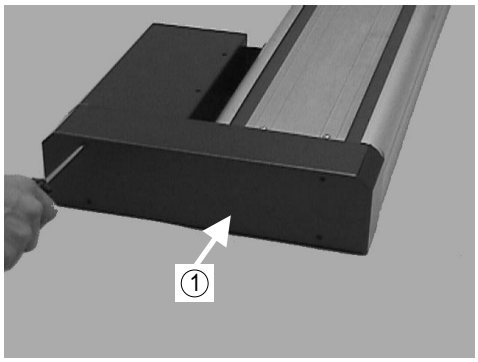
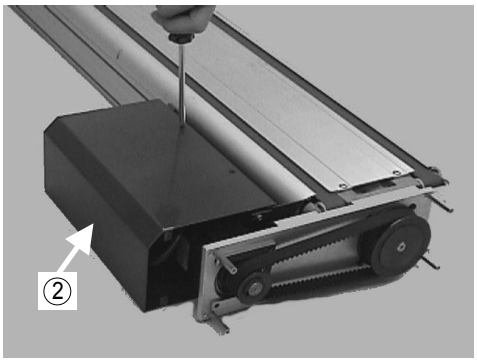


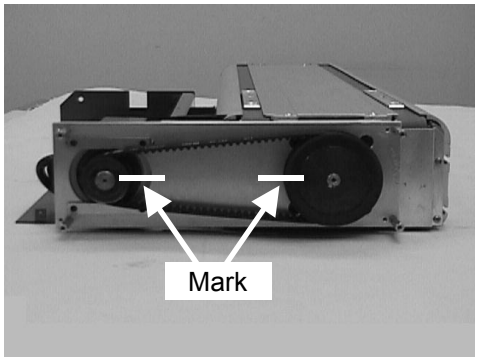
Photo 22-19



2) Be sure that anyone is in operating area of the robot, then turn on the power of the controller, perform a Home return, then turn off the controller power. Be careful not to move the slider until the procedure 6).

3) Put matching marks on the motor pulley and ball screw pulley with a marker as shown in Photo 22-20.

Photo 22-20



4) Unscrew the motor fixing bolts (M5 × 4 bolts). Be careful not to lose disassembled bolts and keys. Pull out the motor with the pulley and take off the timing belt. (Photo 22-21, 22-22)

Photo 22-21

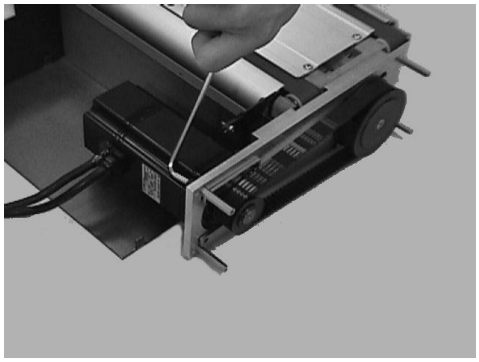
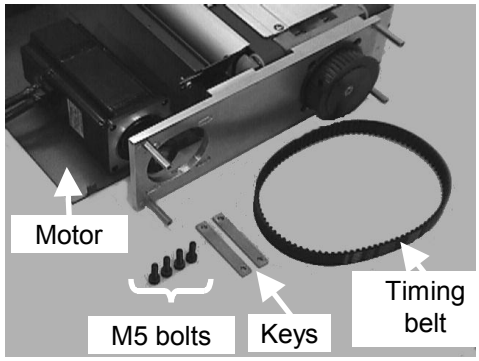
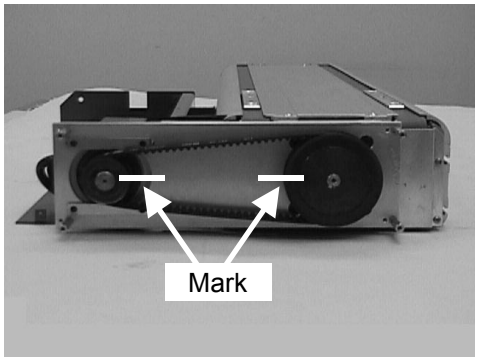


Photo 22-22



5) Put the new timing belt on both pulleys aligning the marks on pulleys which are put on in the procedure 3) as shown in Photo 22-23.

Photo 22-23



6) Tighten the motor fixing bolts (M5 × 4 bolts, tightening torque: 4 ~ 5 N·m), while applying tension to the belt. Slightly loosen the motor fixing bolts and adjust the tension. We recommend the way of applying the tension to the belt as described below.

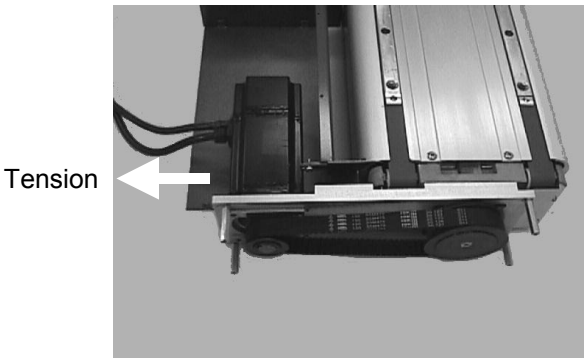
(1) Wind a wire around the motor flange.

(2) Pull the wire with a spring balance.

(3) Apply a constant tension of 210 ~ 240 N to the belt.

Be aware that an excessive tension results in the motor breakage, while an insufficient tension will cause a position error due to slippage of the belt.

Photo 22-24



7) Restore the covers to the original positions.

(1) Pulley end cover : M3 counter-sunk screws, 4 screws

(2) Motor top cover : M3 counter-sunk screws, 3 screws
(2 screws on top and one screw on end face)

22.3.2.3. RS Module

◆ Replacing procedure

1) Turn of the controller power and remove the covers shown below.

(1) Motor end cover : Remove M3 counter-sunk head screws (4 screws) (Photo 22-25)

(2) Top and bottom motor cover : Remove M3 pan head screws (3 screws on the side) and M3 counter sunk head screws (3 screws on the end). Lay down the cables in the opposite to the pulley. (Photo 22-26)

(3) Pulley cover : Unscrew M3 pan head screws. (2 screws) (Photo 22-27)

Photo 22-25

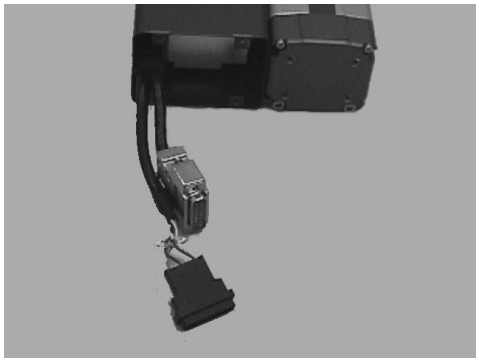


Photo 22-26

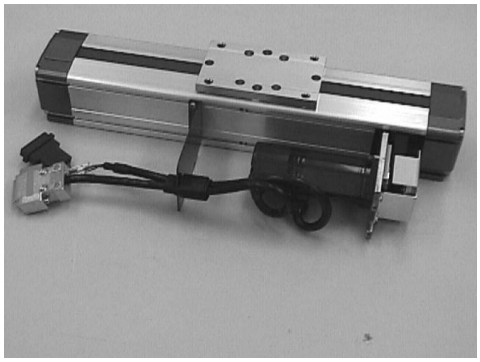
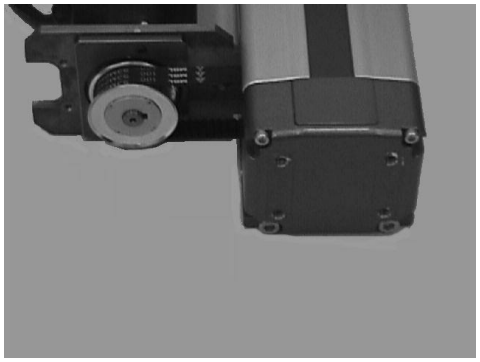


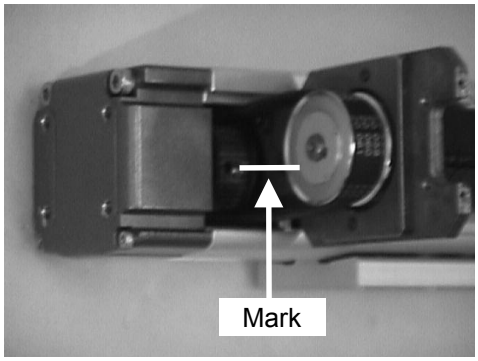
Photo 22-27



2) Check if anyone is in the operating area of the robot. Turn on the power of the controller and perform a Home return. Then turn off the power again. Be careful not to move the slider until the procedure 6).

3) Put matching mark on the side of ball screw and motor pulleys with a marker as shown in Photo 22-28.

Photo 22-28



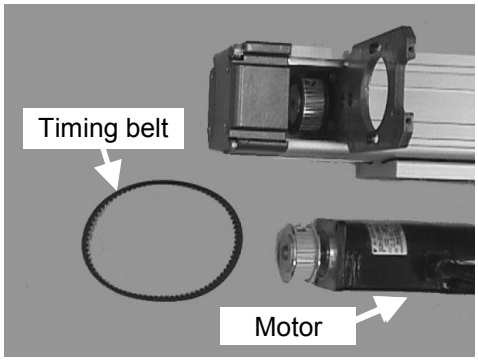
4) Unscrew the motor fixing bolt.

◊ 100W : M4 × 2 bolts

◊ 200W : M5 × 4 bolts

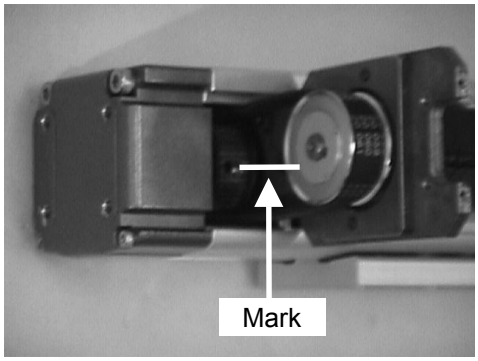
Be careful not to lose the removed bolts and keys. Pull out the motor with the pulley on and take off the timing belt. (Photo 22-29)

Photo 22-29



5) Put on the new timing belt to the pulleys, while aligning the matching marks on the ball screw and motor pulleys, which are marked in the procedure 3) as shown in Photo 22-30.

Photo 22-30



6) Tighten the motor fixing bolts while applying tension to the belt.

◊ 100W : M4 × 2 bolts, tightening torque: 2.4 ~ 3 N·m

◊ 200W : M5 × 4 bolts, tightening torque: 4 ~ 5 N·m

Slightly loosen the motor fixing bolts and adjust the tension. We recommend the way of applying the tension to the belt as described hereunder.

(1) Wind a wire around the motor flange.

(2) Pull the wire with a spring balance.

(3) Apply a constant tension at as shown in Table 22-7.

Be aware that an excessive tension results in the motor breakage, while an insufficient tension will cause a position error due to slippage of the belt.

Photo 22-31

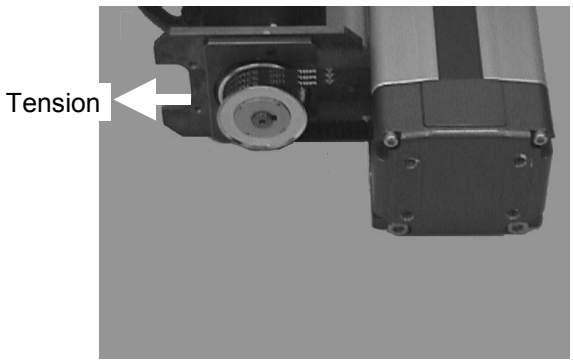


Table 22-7: Tension to the belt

Motor power	Tension [N]
100W	34 ~ 36
200W	70 ~ 90

7) Restore the covers to original positions.

(1) Pulley cover : Pan head screw (M3 × 2 screws)

(2) Top and bottom motor cover : Pan head screw (M3 × 3 screws on the side.
Counter sunk screw (M3 × 4 screws on the side)

(3) Motor end cover : Counter sunk screw (M3 × 4 screws)

22.4. Overhaul

- We recommend to overhaul periodically to prevent from the system failure due to the wear and/or deterioration.
  - ◊ Recommended overhaul period : 5 years
  - ◊ Way of overhaul : Return to the manufacturer.

22.5. Warranty Coverage

22.5.1. Warranty Period

- The warranty is effective for one year from the delivery of the product or 2400 working hours, whichever comes first.

22.5.2. Limit of Warranty

- The warranty shall be given to the products which NSK have manufactured and shipped to users.
- NSK Ltd. will repair or replace any products which have been proved to the satisfaction of NSK Ltd. to have a defect in material and/or workmanship.
- Repair cost will be charged to a user after the warranty period stated above has expired.

22.5.3. Immunity

- NSK Ltd. shall not be liable for any circumstances described below.
  - ◊ Failure of a unit or system due to installation or operation not in accordance with the instruction manual specified by the supplier.
  - ◊ Failure of a unit or system induced by improper handling, operation, modification and careless handling by a user.
  - ◊ Failure by modification and/or repair without manufacturer's consent.
  - ◊ Damages caused by natural disaster or uncontrollable circumstances by the supplier.
  - ◊ Designated parts as expendable.
    (Fuse of the EXEA controller, cable, cable support and timing belt)
- NSK Ltd. warrants for its products and, under no circumstances, is not liable for any consequential damages, loss of profits and/or injury of personal as a result of claim arising under this limited warranty.

22.5.4. Service Charge

- The price of the product does not include the engineering service charges incurred after the shipment.
- Service fee according to the supplier's standard will be charged for field service even in the warranty period.

World-wide Manufacturing and Marketing Organization

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Robot Module System

- **P Series Module Main Unit**
- **R Series Module Main Unit**
- **EXEA Controller**

User's Manual 3
= Installation and Maintenance of Module Main Unit =

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