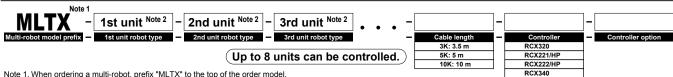# Multi-robot

MULTI-FLIP/MULTI-PHASER

This robot has multi specifications that control multiple robots using one controller.

Advantages of control with multi-axis controller

● Sequence control is easy. System upgrades are easy at less expensive price.

● Compact and space saving when compared to the operation with multiple single-axis controllers.

● More advanced control is possible.

● RCX221, RCX320 and RCX340 provide mixed control of the FLIP-X series and PHASER series (linear single-axis).

Multi-robot ordering method

MLTX Note 1	–	1st unit Note 2	–	2nd unit Note 2	–	3rd unit Note 2	. . .	–		–		–	
Multi-robot model prefix	–	1st unit robot type	–	2nd unit robot type	–	3rd unit robot type		–	Cable length	–	Controller	–	Controller option

Up to 8 units can be controlled.

	Cable length
3K:	3.5 m
5K:	5 m
10K:	10 m

Controller
RCX320
RCX221/HP
RCX222/HP
RCX340

Note 1. When ordering a multi-robot, prefix "MLTX" to the top of the order model.
Note 2. Select either MULTI-FLIP or MULTI-PHASER shown below.
Note 3. For details about the controller and controller option models, please refer to relevant page of each controller.

MULTI-FLIP

Type	Model	Lead (mm)	Stroke (mm)
T type Frame-less structure model	T4L/T4LH	12 / 6 / 2	50 to 400
	T5L/T5LH	20 / 12 / 6	50 to 800
	T6L	20 / 12 / 6	50 to 800
	T9 (Standard)	30 / 20 / 10 / 5	150 to 1050
	T9H (High thrust)	30 / 20 / 10 / 5	150 to 1050
F type Model with high rigidity frame	F8	20 / 12 / 6	150 to 800
	F8L	30 / 20 / 10 / 5	150 to 1050
	F8LH	20 / 10 / 5	150 to 1050
	F10 (Standard)	30 / 20 / 10 / 5	150 to 1050
	F10H (High thrust)	30 / 20 / 10 / 5	150 to 1000
	F14 (Standard)	30 / 20 / 10 / 5	150 to 1050
	F14H (High thrust)	30 / 20 / 10 / 5	150 to 1050
	F17L	50	1100 to 2050
	F17	40 / 20 / 10	200 to 1450 / 200 to 1250
	F20	40 / 20 / 10	200 to 1450 / 200 to 1250
	F20N	20	1150 to 2050
GF type	GF14XL	20	750 to 2000
	GF17XL	20	850 to 2500
N type Nut rotation type model	N15 (Single-carrier)	20	500 to 2000
	N15D (Double-carrier)		250 to 1750
	N18 (Single-carrier)		500 to 2500
	N18D (Double-carrier)		250 to 2250
B type Timing belt drive model	B10	Belt drive	150 to 2550
	B14 (Standard)	Belt drive	150 to 3050
	B14H (High thrust)	Belt drive	
R type Rotation axis model	R5	-	360 °
	R10		
	R20		

Type	Model	Lead (mm)	Stroke (mm)
C type Clean room model	C4L C4LH	12 / 6 / 2	50 to 400
	C5L C5LH	20 / 12 / 6	50 to 800
	C6L	20 / 12 / 6	50 to 800
	C8	20 / 12 / 6	150 to 800
	C8L	20 / 10 / 5	150 to 1050
	C8LH	20 / 10 / 5	150 to 1050
	C10	20 / 10 / 5	150 to 1050
	C14	20 / 10 / 5	150 to 1050
	C14H	20 / 10 / 5	150 to 1050
	C17	20 / 10	250 to 1250
	C17L	50	1150 to 2050
	C20	20 / 10	250 to 1250

MULTI-PHASER

Type	Model	Carrier	Stroke (mm)
MF type Flat type with core Linear motor specifications	MF7	Single	100 to 4000
	MF7D	Double	100 to 3800
	MF15	Single	300 to 4000
	MF15D	Double	100 to 3800
	MF20	Single	150 to 4050
	MF20D	Double	150 to 3850
	MF30	Single	100 to 4000
	MF30D	Double	150 to 3750
	MF75	Single	1000 to 4000
	MF75D	Double	680 to 3680

Robot settings

2-robot settings

Use of 2-robot settings and multi-task program makes it possible to perform asynchronous independent operation. As the auxiliary axis setting is used together, more free axis assignment can be made.

Main auxiliary axis setting

This auxiliary axis setting is used when it is inconvenient that two axes move simultaneously by the MOVE command. The axis set for the main auxiliary axis does not operate by the MOVE command and it operates only by the DRIVE command (movement command in axis units). This setting is recommended for the axis that needs to be operated asynchronously from the main robot.

Double-carrier

In robot types that the motor runs separately, such as linear motor single-axis PHASER series or N type (nut rotation type) of FLIP-X series, two motors can be added to one axis.

Dual setting

This setting is used when performing the dual drive (2-axis synchronous control). This setting is used when the gantry type Cartesian robot with a long Y-axis stroke stabilizes the high acceleration/deceleration or when a high load or high thrust is needed.

Applicable controllers

Name	1 to 2 axes controller		1 to 2 axes controller	1 to 4 axes controller
	RCX221	RCX222	RCX320	RCX340
Appearance	P.670	P.670	P.660	P.678
Position detection	Incremental	Absolute	Incremental/Absolute	
Control model	FLIP-X and PHASER can be mixed.	FLIP-X	FLIP-X and PHASER can be mixed.	
Maximum number of programs	100 programs			
Maximum number of points	10,000 points		30,000 points	
Number of input/output points — Standard	Dedicated input 10 points/ dedicated output 12 points General-purpose input 16 points/ general-purpose output 8 points		Dedicated input 8 points/ dedicated output 9 points General-purpose input 16 points/ general-purpose output 8 points	
Number of input/output points — Expansion	General-purpose input 24 points/ general-purpose output 16 points			
Network option	CC-Link, DeviceNet™, PROFIBUS		CC-Link, DeviceNet™, EtherNet/IP™, Ethernet, PROFIBUS, PROFINET, EtherCAT	

Examples of multi-robot ordering methods

Separate single axes

<Example> F14H and F10 are installed separately.

MLTX - **F14H** - **20** - **U** - **500**   **1st unit**

- **F10** - **20** - **300**   **2nd unit**

- **5K** - **RCX222** - **N** - **N1**   **Controller**

1st unit (X)

2nd unit (Y)

3 axes combination

<Example> C17L, C14H, and C14H are used for the X-axis, Y-axis, and Z-axis, respectively to form a 3-axis XYZ combination.

MLTX - **C17L** - **50** - **Z** - **1500**   **1st unit**

- **C14H** - **20** - **450**   **2nd unit**

- **C14H** - **10** - **BK** - **150**   **3rd unit**

- **3K** - **RCX240** - **R** - **N** - **BB**   **Controller**

3rd unit (Z)

1st unit (X)

2nd unit (Y)

2 axes + 1 axis

<Example> T6 is installed on the base for the 1st axis, C6 is secured to the upper portion for the 2nd axis, and CH4 is secured to the upper portion for the 3rd axis to assemble the C6 and C4H to the XZ. (Either 2 axes + 1 axis or 3 axes simultaneous control can be made by the setting.)

MLTX - **T6** - **6** - **300**   **1st unit**

- **C6** - **6** - **300**   **2nd unit**

- **C4H** - **6** - **BK** - **100**   **3rd unit**

- **3K** - **RCX240S** - **N** - **BB**   **Controller**
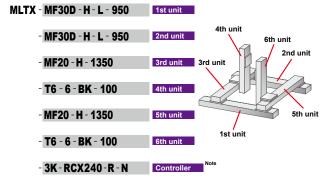
3rd unit (Z)

2nd unit (Y)

1st unit (X)

Note. When the customer combines each axis, it is recommended to use the cable terminal (relay cable) for the wiring among axes. For details about cable terminal, please contact YAMAHA.

Double-carrier/dual drive (2-axis simultaneous control)

Example of 8-axis control

<Example> Two double-carriers of the MF30 are arranged in parallel and two MF20 installed on the top are moved by the dual-drive.
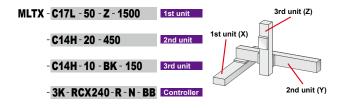T6 is attached to each tip of the MF20 and the robots are controlled using two controllers.

MLTX - **MF30D** - **H** - **L** - **950**   **1st unit**

- **MF30D** - **H** - **L** - **950**   **2nd unit**

- **MF20** - **H** - **1350**   **3rd unit**

- **T6** - **6** - **BK** - **100**   **4th unit**

- **MF20** - **H** - **1350**   **5th unit**

- **T6** - **6** - **BK** - **100**   **6th unit**

- **3K** - **RCX240** - **R** - **N**   **Controller** Note

4th unit

6th unit

2nd unit

3rd unit

5th unit

1st unit

Note. For this specification, when writing one controller model, two controller will be arranged automatically.
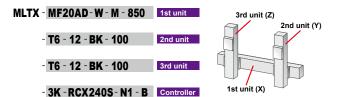
Double-carrier

Example of 4-axis control

<Example> Two T6 are assembled to the double-carrier of the MF20A, and they are used as XZ type and controlled using one controller.

MLTX - **MF20AD** - **W** - **M** - **850**   **1st unit**

- **T6** - **12** - **BK** - **100**   **2nd unit**

- **T6** - **12** - **BK** - **100**   **3rd unit**

- **3K** - **RCX240S** - **N1** - **B**   **Controller**

3rd unit (Z)

2nd unit (Y)

1st unit (X)

Note. For the double-carrier, since one robot occupies two axes of the controller, the number of robots may differ from the number of controllable axes.

CAUTION

Conditions needing regenerative unit on multi-robot

● The total motor capacity exceeds 450 W.

● The total motor capacity of the vertical axis exceeds 240 W.

● The B14H performs the operation at a maximum speed of more than 1250 mm/s.

● When the vertical axis is 240 W or less, the conditions shown below are satisfied.

  • There is a 200 W-vertical axis.

  • A 100 W-vertical axis has a stroke of 700 mm or more.

  • There are two 100 W-vertical axes with a 5 mm-lead.

FLIP-X terminology

High lead

This term indicates models supporting ball screw leads that exceed the standard lead (12 mm or 20 mm). (The standard lead of the F17L and C17L is 50.)

Origin on non-motor side

This term indicates models that are applicable to the origin non-motor specifications as standard. The origin on the non-motor side in the standard state is not supported with a lead not stated in the catalog. If special specifications are needed, please consult YAMAHA.

Maximum speed

This term indicates the maximum transfer speed. YAMAHA's single-axis robots can transfer a workpiece at this speed regardless of the transfer weight as long as it is within the maximum payload. However, as the workpiece is heavier, the acceleration/deceleration curve becomes gentle. If the movement distance is short, the speed does not reach the maximum speed stated in the catalog.

> **CAUTION**
>
> When the stroke of the ball screw drive type is long, noise or vibration is produced due to resonance of the ball screw if moved at the maximum speed. If this happens, lower the speed to that stated in the note column. (It is also possible to lower the transfer speed of the entire program using the SPEED setting or make the adjustment for each movement command.)
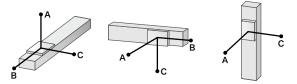
Maximum payload

This term indicates the maximum weight that can be loaded on the slider and transferred. Select an appropriate model so that the total weight of the customer's tools (air cylinder or chuck) and workpiece is less than this data. When the center of gravity of the tool or workpiece is offset from the center of the slider, the allowable overhang needs to be taken into consideration. Additionally, when entering the total weight of the tool and workpiece for the payload parameter of the controller, optimal acceleration/deceleration and servo parameter are automatically set.

Rated thrust

This term indicates the force to be applied in the slider advancing direction in the slider stationary (hold) state. When using vertically, the weight of the loaded workpiece is subtracted from this value (when the force is applied downward from the top). The slider can move only at a low speed (approximately 10 % of the maximum speed), but this value becomes lower than the specification value. Additionally, the type B of the timing belt drive cannot be used for applications, in which thrust is applied.
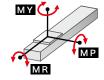
Allowable overhang

This term indicates an allowable overhang of an object to be transferred. In the specification data, this indicates the distance from the center of the top face of the slider to the center of gravity of an object to be transferred by the weight. This value is determined according to the service life of the linear guide. Under normal operation conditions[Note], the 90 %-service life of the linear guide is 10,000 km or more if gravity centers of the workpiece and tool are kept within the allowable overhang. When using with an overhang amount exceeding the specification data, it is necessary to install a separate support guide or restrict operating conditions (speed, acceleration) so that a load is not applied to the linear guide of the single-axis robot. For detail, please consult YAMAHA.

Note. Speed, acceleration 100 % (It is preconditioned that the weight parameters are set correctly.)
There shall be no impact load or excessive vibration during operation.
Additionally, the alignment is correct.

Static tolerance moment

This term indicates the load moment applied to the slider in the robot stationary state.

Critical speed

When the stroke of the ball screw drive type is long, noise or vibration is produced due to resonance of the ball screw if moved at the maximum speed. If this happens, lower the speed to that stated in the note column. (It is also possible to lower the transfer speed of the entire program using the SPEED setting or make the adjustment for each movement command.)