

# PHASER Series

Product Lineup

## LINEAR MOTOR SINGLE-AXIS ROBOTS

No limit on critical speed even when using a long stroke of 4 m.  
"PHASER" series delivers superb performance  
during long distance transfer.



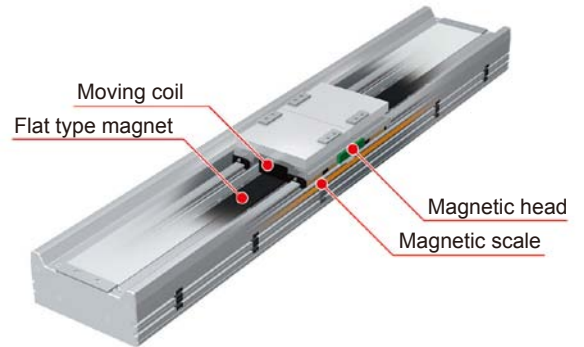
# Critical speed is not restricted and high-speed long-stroke transfer is possible.

## MF type

High-power and long-stroke using flat motor with core

P.186

- Maximum stroke: 4050 mm
- Maximum speed: 2500 mm/s
- Repeated positioning accuracy: +/-5 μm
- Maximum payload: 7 to 160 kg

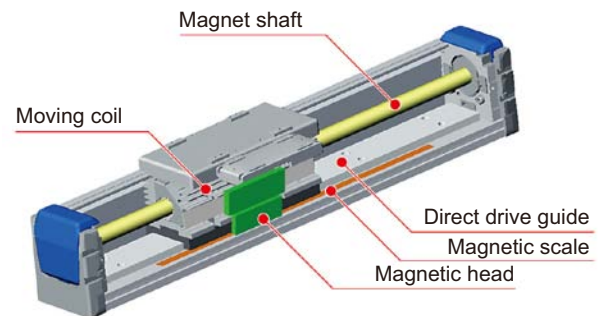


## MR type

Lightweight, compact, and low cogging by shaft motor drive

P.204

- Maximum stroke: 1050 mm
- Maximum speed: 2500 mm/s
- Repeated positioning accuracy: +/-5 μm
- Maximum payload: 5 kg



Type	Size (mm) <sup>Note 1</sup>	Model	Carrier	Maximum payload (kg)	Maximum speed (mm/sec.)	Stroke (mm)	Page
MF type Flat type with core Linear motor specifications	W85 × H80	MF7	Single	10 (7) <sup>Note 2</sup>	2500	100 to 4000	P.186
		MF7D	Double			100 to 3800	
	W100 × H80	MF15	Single	30 (15) <sup>Note 2</sup>		100 to 4000	P.192
		MF15D	Double			100 to 3800	
	W150 × H80	MF20	Single	40 (20) <sup>Note 2</sup>		150 to 4050	P.196
		MF20D	Double			150 to 3850	
		MF30	Single			60 (30) <sup>Note 2</sup>	
	MF30D	Double	150 to 3750				
W210 × H100	MF75	Single	160 (75) <sup>Note 2</sup>	1000 to 4000	P.202		
	MF75D	Double		680 to 3680			
MR type Shaft type Linear motor specifications	W60 × H90	MR12	Single	5	50 to 1050	P.204	
		MR12D	Double		50 to 1050		

Note 1. The size shows approximate maximum cross sectional size.

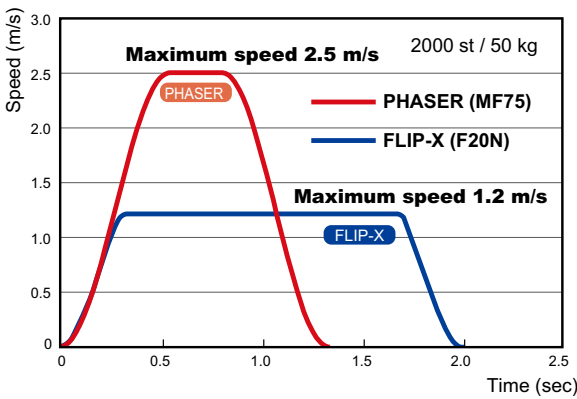
Note 2. When using at the maximum speed, the maximum payload becomes the value in ( ).

POINT 1

**Maximum speed 2.5 m/sec. and no critical speed limit**

The ultimate appeal of the linear motor single-axis robot is that there are restrictions on critical speed like ball screw. The maximum speed does not decrease even with long-distance transfer. Additionally, the maximum stroke of the MR type is set to up to 1050 mm and that of the MF type is set to up to 4000 mm with standard settings. In particular, the cycle time of the long-distance transfer is greatly improved.

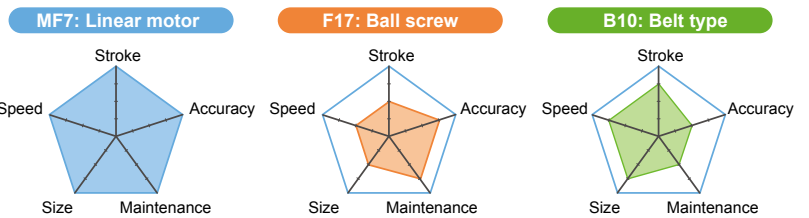
**Movement time comparison between linear single-axis robot PHASER and single-axis robot FLIP-X**



POINT 4

**In-house manufacturing of major parts achieves low costs.**

Magnetic scales are developed and manufactured at YAMAHA. In-house manufacturing of other major parts achieves large cost reduction. Nowadays, the linear motor is not a special mechanism. The customer can select the linear motor or ball screw in the similar way according to the customer's needs. In particular, when performing a high-speed and long-distance transfer of a light workpiece, selecting linear motor robots may reduce the cost.



■ Comparison of single-axis robot models

Model name	Main body price <sup>Note 1</sup>	Maximum speed (mm/sec.)	Maximum payload (kg)	Repeated positioning accuracy (μm)	Maximum stroke (mm)	Maximum cross-sectional dimension <sup>Note 2</sup> (mm)
MF7-1500		2500	10 (7) <sup>Note 3</sup>	+/- 5	4000	W85 × H80
F17-40-1450		720 <sup>Note 4</sup>	40	+/- 10	1450	W168 × H100
B10-1450		1850	10	+/- 40	2550	W100 × H81

Note 1: The prices are compared with the strokes shown above.  
 Note 2: Cable carriers are not included.  
 Note 3: The payload is 7 kg when the maximum speed is 2500 mm/s. (10 kg-payload: 2100 mm/s)  
 Note 4: This value is obtained by considering the critical speed with a stroke of 1450 mm.

POINT 5

**Double-carrier available as standard**

Double-carrier specifications that operate two carriers on one robot are available as standard. High effects, such as space saving, cost reduction, and tact improvement are obtained when compared to two single-axis robots. Furthermore, no axis alignment is needed and tools are commonly used to shorten the setup time. (When using the RCX series controller, an anti-collision function can be used.)

POINT 2

**Suitable for heavy object transfer. Maximum payload 160 kg**

The maximum payload of the MF type using a flat magnet is 160 kg. The robot can transfer a heavy object, such as large LCD panel at a high speed with high accuracy. (In the payload range of some MF types, the maximum speed may be restricted. For details, refer to the specification page of each model.)

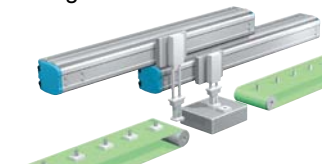
POINT 3

**Effective use of stroke**

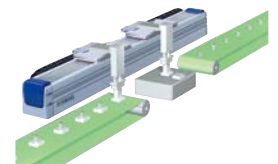
As the linear motor single-axis robot incorporates a coil that is the drive part inside the table, dead spaces are eliminated to maximize the stroke. Additionally, as the main body is symmetrical, the flexibility of the layout is improved.



■ Layout using two ball screw single-axis robots



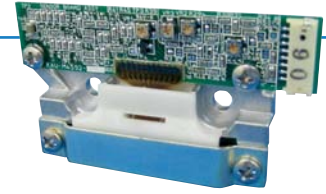
■ Space saving using double-carrier



## POINT 6

### Linear scale developed by YAMAHA

YAMAHA originally developed a new linear scale based on its excellent magnetic signal detection technology.



#### Magnetic scale provides high environment resistance.

YAMAHA's magnetic scale is resistant to dirt and can be used in an environment where grease or cutting fluid sometimes splashes.

#### Semi-absolute specifications

The current position is obtained by reading the signal recorded in the linear scale. So, it is not necessary to perform a large return-to-origin movement before starting the operation after turning on the power (the slider moves up to 76 mm when reading the signals).

#### Cost reduction

In-house linear scale development and manufacturing achieves large cost reduction.

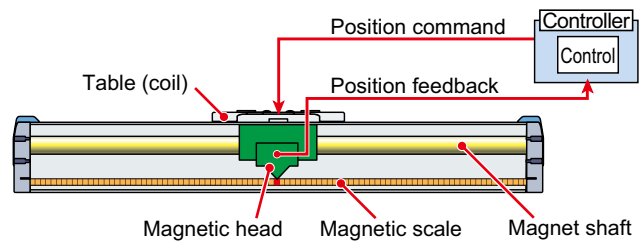
#### High resolution 1 $\mu\text{m}$

Magnetic signals recorded in the magnetic scale are detected and interpolated to achieve a highly accurate resolution of 1  $\mu\text{m}$ .

#### Repeated positioning accuracy: $\pm 5 \mu\text{m}$

A fully-closed control that always feeds back the table position provides high accuracy steadily.

Additionally, there are no mechanical backlashes, such as ball screws or timing belts.



## POINT 7

### Silence and long service life

Unlike ball screw type robots, there are few sliding and rotating parts. So, the operation is very quiet. Moreover, as the coil is not in contact with the magnet, they are not worn out and can be used for an extended period of time.

## POINT 8

### Dust-proof structure

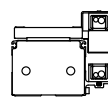
All YAMAHA's linear motor robots use a stainless steel shutter. This prevents entry of foreign objects. Additionally, these shutters are made of tough stainless steel with an extremely high fatigue strength to support high-speed and long-stroke operation.

## POINT 9

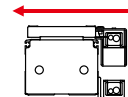
### Flat type without cable carrier protrusion

For the MF7, as the main body is made compact, a flat type that the cable carrier becomes flat on the top surface of the table is prepared as standard. Please select this type according to the tool or workpiece shape, or installation method.

#### Standard type



#### Flat type



As the cable carrier does not protrude from the table upper surface in the flat type, a large tool can be installed easily.



#### Applicable to multi-carrier operation

The PHASER series also supports "multi-carrier" operation that allows using three or more carriers on one robot. This "multi-carrier" operation drastically extends applications due to its high effect in improving tact time and saving space.



#### Applicable to dual-drive

As a dual-drive that simultaneously drives two axes, high-speed transfer and heavy object transfer are possible in a wide area. YAMAHA can propose an optimal control method according to the robot linkage rigidity.

