

# “Long stroke transfer needs to be performed with single-axis robot.”

Before

User:

Long stroke transfer needs to be performed with single-axis robot, but the cycle time and loading/unloading workpiece are in trouble.

With conventional system...

[Ball screw single-axis robot is used.]  
Effect of the critical speed is considered or a risk occurs during workpiece delivery.

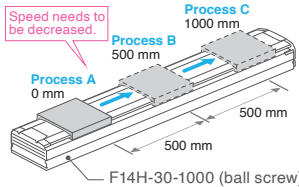
- Long ball screw single-axis robot is used by decreasing the speed.
- Full stroke is split and workpiece is delivered by multiple single-axis robots.
- As the transfer is performed by the belt single-axis, the repeated positioning accuracy lowers.

Issues

- **One** Ball Screw single axis robot.  
⇒ Speed cannot be increased due to the vibration and service life.
- **Multiple** Ball Screw single axis robots.  
⇒ As a workpiece is delivered between single-axis robots, a transfer mistake occurs. Installation space becomes larger.

Transfer among processes

500 mm × 2 operations

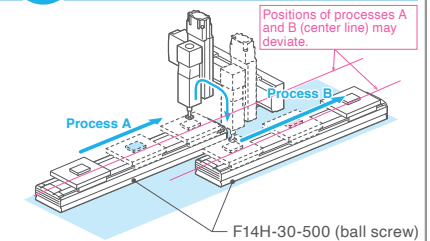


Maximum speed 900 mm/s (critical speed: 50%)  
Movement distance 500 mm × 2 operations  
Movement time Each 740 msec → 1,480 msec

Operation time becomes longer.

Transfer among processes

Loading/Unloading on the way



Movement distance 500 mm × 2 operations × 2 units  
Movement time Each 510 msec × 4 + delivery time  
→ Total time 2,040 msec + delivery time

Installation space becomes larger.

After

Yamaha's answer to the user's needs.

[Linear motor single-axis robot PHASER-series is used.]

Cycle time for the long stroke is shortened and risks during loading/unloading workpiece are eliminated.

- Maximum stroke: Up to 4,000 mm is supported.
- Payload: Up to 7 kg to 160 kg is supported.
- Repeated positioning accuracy: Repeatability
- No critical speed like ball screw
- In-house manufactured linear scale is used to achieve significant low cost and short delivery time.

Results:

Features unique to the linear motor single axis robot, the operation time is reduced significantly.

1 Critical speed is considered.

Comparison of operation time between ball screw single-axis F14H-30-1000 and linear single-axis MF30-1000



Approx. 40% Reduction

2 Loading and unloading workpiece.

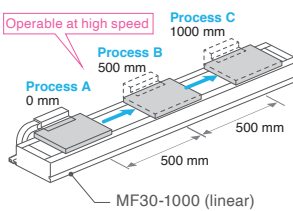
Comparison of operation time between ball screw single-axis F14H-20-500 × 2 and linear single-axis MF30D-1000



Approx. 14% Reduction

Transfer among processes

500 mm × 2 operations

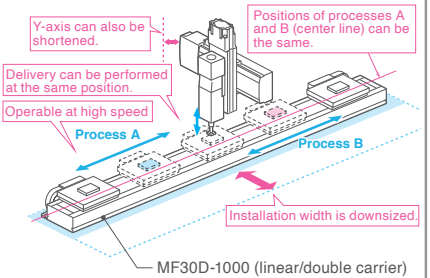


Maximum speed 2500 mm/s  
Movement distance 500 mm × 2 operations  
Movement time Each 440 msec → 880 msec

Operable at high speed

Transfer among processes

Delivery on the way



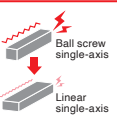
Movement distance 500 mm × 2 operations × 2 carriers  
Movement time Each 440 msec × 4 + delivery time  
→ Total time 1,760 msec + delivery time

Downsizing, Cycle time reduction

Added value

Noise and vibration are reduced. Space saving is also possible.

Use of linear single-axis makes it possible to reduce the noise and vibration during high speed movement when compared to the ball screw single-axis.



Equipment can be downsized by eliminating the multiple single-axis deliveries.

### User testimonial



Dedicated machine manufacturer

People in charge of production engineering

### Not only cycle time reduction, but also cost reduction, space saving, and noise reduction are achieved.

Our company is a dedicated machine manufacturer that designs and manufactures equipment with short cycle time per product. We work with relatively high-precision equipment.

We considered Yamaha's linear motor single axis robot "PHASER series" because of our customer's request to shorten the cycle time even more than before in long-stroke processes.

Rigid and high-precision ball screw single-axis robots were used for conventional equipment based on the idea that "rigidity = cycle time can be shortened", but for this equipment, we noticed linear motor single axis robot that do not need to reduce the critical speed even with long stroke. Additionally, since there was a workpiece loading and unloading process, we felt that it would be attractive to use one linear motor single axis robot that can support the longest stroke.

In this situation, a distributor suggested Yamaha's linear motor single axis robot "PHASER series". Originally, we were also considering other manufacturers, but we heard that Yamaha in-house manufactures linear scales necessary for positioning to enable low cost and stable supply.

When we asked Yamaha to select specifications, they selected a model that took the operating duty into account in addition to the cycle time, calculated the service life of the guide at the website, and provided other necessary information quickly. So, we decided to adopt Yamaha's robot.

Thanks to Yamaha, we are now able to not only shorten cycle time and eliminate risks during workpiece delivery, but also make the equipment more compact and quieter, and even reduce costs, which is a very pleasant adoption result.

In the future, we intend to pursue further performance improvement of equipment, including consideration of further cycle time reduction with multi-carriers.

## Functional description and merit of PHASER

### PHASER

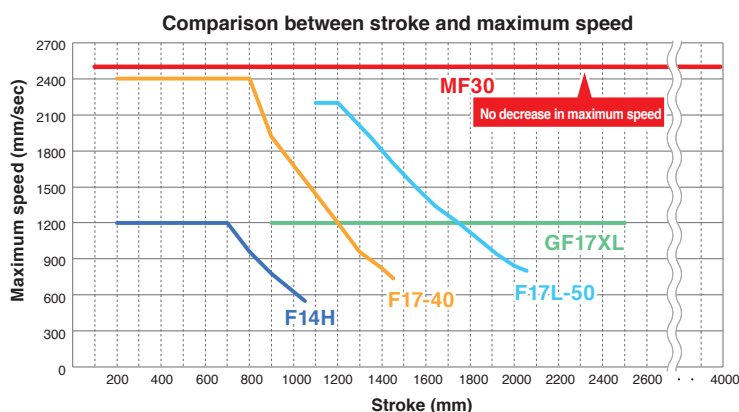
### No critical speed like ball screw!

The main attraction of linear motor single-axis robot is that it has no critical speed like ball screw.

The maximum speed does not decrease even during long distance transfer.

In addition, the maximum stroke is 4 m. The cycle time is reduced significantly in the long distance transfer process. Also, unlike the ball-screw single-axis robot, there are few sliding parts and rotating parts, ensuring excellent quietness.

Furthermore, the coil and magnet are non-contact and are not worn out, ensuring long-term use.



Linear motor single-axis robot  
PHASER



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