LINEAR CONVEYOR MODULES

LCM-X

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Specifications and appearance are subject to change without prior notice.
Yamaha’s own unique universal robot control concept offers Total Optimization of your production line.

Yamaha Motor’s Advanced Robotics Automation Platform is a new integrated-type robot system that unites robots, conveyance systems, peripheral devices, and operations into a single platform. Robotizing both the conveyance process LCM-X series and the robots that perform operations reduces any time that is wasted for conveying work and paves the way for full digital production. Moreover, structuring the production line itself as a robot system centering on Universal Controller YHX series helps exploit the optimal value in terms of time, human resources, and cost and will maximize the return on investment for customers.
Introducing LCM-X

Faster, more accurate, and easier to use

Improve space efficiency, transport accuracy, and acceleration / deceleration performance.

Taking the place of the predecessor model “LCM100” while employing module structures and high speed direct drive by linear motors, the “LCM-X” enables to build up high value-added yet general-purpose transport systems between processes. Significantly improved space efficiency, higher transport accuracy and increased acceleration and deceleration performance, the linear conveyor modules realize higher level transport automation ever before.

<table>
<thead>
<tr>
<th>Stop position repeatability</th>
<th>Span between sliders</th>
<th>Low profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>±5 μm</td>
<td>210 mm</td>
<td>H: 85 mm</td>
</tr>
</tbody>
</table>
From ordinary “passive flow” to “active position transport”. By converting conveyor flow into active production process improves profitability.

Dramatically increase production line efficiency with the high-speed pitch operation, assembly work on the slider, and the reverse feed of the slider, etc. Eliminate wasted time and space in the transport process and increase profitability.

**Highly accurate transport improves product quality.**

<table>
<thead>
<tr>
<th>Single device stop position repeatability</th>
<th>Error width (machine difference) between sliders</th>
</tr>
</thead>
<tbody>
<tr>
<td>+/- 5 μm</td>
<td>+/- 10 μm</td>
</tr>
</tbody>
</table>

**High efficiency in production**

<table>
<thead>
<tr>
<th>Maximum speed*</th>
<th>Span between sliders</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 m/sec</td>
<td>210 mm</td>
</tr>
</tbody>
</table>

* 2 m/sec when the payload is 10 kg or more

**Reduce transport time.**

Comparison between LCM-X and a conventional conveyor:

- **LCM-X**
  - Transfer: Linear motor drive for high-speed pitch
  - Direct positioning: Optimum acceleration-deceleration ensures smooth deceleration and stop
  - Work: Slider is supported directly by a highly rigid guide
  - Transfer: Bi-directional move

- **Conventional conveyor**
  - Transfer: Slow transport due to frictional resistance
  - Deceleration: Requires some distance for deceleration
  - Stop: All stop positions require a sensor and stopper
  - Work: Workspace retraction is required because the system does not maintain rigidity
  - Retraction: Operation directly on slider

Transfer time is reduced by 4 seconds from 6 to 2 seconds

Increased yield

**A production line using LCM-X linear conveyor modules**

- Reduce transport time
- Improve productivity
- Cut back on costs
- Save space
- Step-by-step investment

Note: SCARA robots and Articulated robots are currently not supported.

**Improved productivity**

- Increase yield by approx. 100%

**Cut back on costs**

- Improved by approx. 60% in tact time

**Save space**

- Increased by approx. 100%

**Step-by-step investment**

- Reduced transport time
Further advanced usability for centralized control with one Universal Controller.

The module profile and pitch between sliders are approximately half the conventional sizes by incorporating the newly developed linear motor, sensor module, and integrated motor driver built into the body. At the same time, the acceleration/deceleration rate and stopping accuracy are both increased.

Centralized control with the Universal Controller

A single Universal Controller can control all the sliders in a centralized manner including slider circulation.

The bridge pier structure enables speedy setup.

Installation work, including coupling of each module, can be completed in a very easily in a short time using the connection unit that enables quick mechanical high-precision positioning and electrical connection of each model.

Top cover incorporated

A cover to protect the guide rail, motor, and sensors is attached to the top face to prevent faults caused by falling objects in each work process.

All the sliders can be operated / programmed independently.

Use of the motor driver integrated into and put together with the main body saves electrical wiring.

The utilized electro-mechanical structure with a motor driver built in the module controls entire LCM-X. Connecting with the Universal Controller via one YQ Link cable is all you have to do. It surely contributes to saving space in the control panel.

Recognize slider’s individual IDs

The multi-track magnetic sensor enables to identify a slider ID at any point in the transport process. Even if you have unintentionally changed sliders, the system correctly identifies the ID of each slider.

No origin process needed

Newly developed high-precision full-range absolute server eliminates the need for return-to-origin. The operation can be started and stopped easily, so there is no time loss even when starting or restarting.

Low profile structure

Use of the newly developed linear motor makes the module height approximately half compared with the previous model. You can also use a space under the frame.

<table>
<thead>
<tr>
<th>Mechanical tolerance between sliders +/-10 µm</th>
</tr>
</thead>
</table>
| When stopping two or more sliders at a point one after another, the actual stop positions are inevitably different because each slider has its own error width (machine-difference). The LCM-X minimizes the width error among the sliders within as little as +/-10 µm to best suit high accuracy processes. Costs can be reduced as there is no need for RFID, etc.

Top cover incorporated

A cover to protect the guide rail, motor, and sensors is attached to the top face to prevent faults caused by falling objects in each work process.

Centralized control

Centrally control all sliders on the transport process, including the circulation operation, and the peripheral robots.

Universal Controller YHX series

Centrally control all sliders on the transport process, including the circulation operation, and the peripheral robots.

<table>
<thead>
<tr>
<th>Control line length</th>
<th>Max. 25.5 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of simultaneous controllable sliders</td>
<td>Max. 64 units</td>
</tr>
</tbody>
</table>

Individual ID recognition

Complete absolute position system

No origin process needed

Maximum speed 3 m/sec*

*2 m/sec when the payload is 10 kg or more.

Individual ID recognition

High acceleration rate

High speed motion between an extremely short distance is possible even in a high density process or pitch fed.

<table>
<thead>
<tr>
<th>Mechanical tolerance between sliders +/-10 µm</th>
</tr>
</thead>
<tbody>
<tr>
<td>+/10 µm</td>
</tr>
</tbody>
</table>

Low profile structure

Use of the newly developed linear motor makes the module height approximately half compared with the previous model. You can also use a space under the frame.

<table>
<thead>
<tr>
<th>Maximum load</th>
<th>15 kg</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Span between sliders</th>
<th>210 mm</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Slider width</th>
<th>150 mm</th>
</tr>
</thead>
</table>

Note: SCARA robots and Articulated robots are currently not supported.
Realizing universal and high value-added transport between processes.

Reduce transport cycle time, and save equipment space. Increase production ability, and contribute a stronger cost competitiveness.

**Process sharing**
- Because the slider motion is bi-directional, the same processes can be shared, costs can be reduced, and the transport line can be downsized.
- Flexible operations including high-speed reciprocation and retracting just part of the slider are possible.

**Can be moved efficiently between processes with different tacts**
- Direct drive with the servo control eliminates the need to install mechanical stoppers and sensors for stopping.
- Set the stop position in a short time just by changing the program.
- Flexibly handle frequent setup required when changing part types.
- Narrow pitch movement makes it possible to perform pitch feed within the same process for short time processes.
- In long time processes, three workpieces can be moved together at a high speed so the movement time can be reduced.

**Easily serviceability = Easy troubleshooting**
- Prevention of penetration of falling objects (foreign objects) with the top-face cover.
- The environment-resistant magnetic sensor is resilient to contamination.
- One-touch positioning eliminates the need for bothersome precision setting.
- Motors and scales do not make contact and are free from abrasion.
- As only the rails are sliding parts, dust generation is low.

- Standardized components reduce spare parts SKU.
- Parts can be replaced easily.
- Operation can be restored just by replacing the slider or linear module, and the manufacturing line down time can be kept to a minimum.

**Workpieces do not need to be retracted**
- The highly rigid guide enables assembly and processing on the transport line.
- There’s no need to pull the part from the transport line to the work table, the system can be downsized, and costs can be reduced.

**Sleek and simple configuration. Easy to design transport system with high degree of freedom.**

All slider operations in the transport process and control of the peripheral robots can be completed with a single Universal Controller.

Efficiently and easily build an automated production line.

**Freedom and flexibility in line layout design**
- Layout examples by combining modules with circulation mechanisms
**System configuration diagram**

**Configuration example**

One way 1700 m, vertical circulation transport line

- 200 m linear module and single-axis robot are used for circulation section (travels)

**YAMAHA LCM-X**

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**Universal Controller YHX series**

**Name Icon Description**

- **Cable carrier**
  - Required quantity: "Number of connection modules" + 1
  - When connecting a 200 m, 500 m, and 1000 m linear module as shown above, a total of four units are required.
  - When only one linear module is used, such as shown at the circulation section, two units are required.

- **Robot slider**
  - Minimum pitch: 210 mm at distance between centers
  - If the 210 mm is mounted on the robot slider is longer, the pitch will be the g/p pallet length + 12 mm.

- **YQ Line terminating connector**
  - Connect to the terminal end of the linear conveyor module that is connected with the Universal Controller.

- **Module drive power supply connector**
  - 5-pin

- **Module drive power jumper connector**
  - 6-pin

- **48 VDC power supply**

- **YQ Link cable**
  - As shown above, the Universal Controller and each line of the linear conveyor module are connected from left to right with a single cable.

- **Module power cable**
  - The user must prepare a wire with diameter corresponding to the required power capacity.

- **Flexible power cable for movable module**
  - This LCM-X power cable is a flexible cable that is especially connected within the cable conduit for the circulation section, etc.

**Basic specifications of linear conveyor module**

**Drive method**

- Linear motor with moving magnet type core

**Position Search**

- Full range absolute position detection sensor and full range slider ID detection

**Maximum payload**

- 15 kg

**Maximum speed**

- 3,000 mm/sec

**Repeatability**

- ±0.25 μm

**Mechanical tolerance between robot sliders**

- ±0.1 mm

**Total stroke limit**

- Approx. 25 m

**Minimum number of robot sliders**

- 64 units

**Minimum spacing between robot sliders**

- 210 mm

**Main frame dimensions**

- Max. external size of frame cross-section
  - 1738 x 865 mm (including robot slider)

**Linear module length**

- 200 mm / 300 mm / 500 mm / 1000 mm

**Robot slider length**

- 198 mm

**Weight**

- Linear module: 10 kg (Per 1 m of linear module)
- Robot slider: 1.5 kg
- Connection unit: 0.6 kg

**Power supply**

- Control power supply: 48 VDC +5%, -10%, 75 W [Per 1 m of linear module]
- Motor power supply: 48 VDC +10%, 100 W at maximum (at min. acceleration)

**Maximum current capacity**

- Total 30 A [Control power supply: 15 Amax., Motor power supply: 30 Amax]

**Operating environment**

- Operating temperature: 0 °C ~ 40 °C
- Storage temperature: -10 °C ~ 65 °C
- Operating humidity: 20% ~ 85%RH (No condensation)

**Controller**

- YHX series

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**Allowable Overhang Amount**

- Allowable Overhang Amount
  - Payload: 5 kg
  - Payload: 10 kg
  - Payload: 15 kg

**Load: Horizontal Direction**

- Payload: 5 kg
- Loading Position X [mm]: 0 / 20 / 40 / 60 / 80 / 100
- Loading Position Z [mm]: Y [mm]: Z
- Allowable Overhang Amount

**Load: Vertical Direction**

- Payload: 5 kg
- Loading Position X [mm]: 0 / 20 / 40 / 60 / 80 / 100
- Loading Position Y [mm]: Z
- Allowable Overhang Amount

**Notes**

- Values when the center-of-gravity of transferred object is at the center of slider.
- Allowable load in the moving direction of slider is always 28 N regardless of the loading position.
- Maximum current capacity for one input section (one connection unit). Where the electrical power demand exceeds the input capacity, supply electrical power through multiple input sections.
- The YAMAHA LCM-X is the temperature environment (±5 °C) that installation and adjustment were performed.
Linear module

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 mm</td>
<td>LCM-X200</td>
</tr>
<tr>
<td>300 mm</td>
<td>LCM-X300</td>
</tr>
<tr>
<td>500 mm</td>
<td>LCM-X500</td>
</tr>
<tr>
<td>1000 mm</td>
<td>LCM-X1000</td>
</tr>
</tbody>
</table>

YQ Link movable cable

This cable connects the controller (YHX) and linear conveyor module. Refer to the system configuration drawing for a connection example.

<table>
<thead>
<tr>
<th>Cable length</th>
<th>Model</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.3 m</td>
<td>YQ-QL-Y</td>
<td>KFA-M581-00</td>
</tr>
<tr>
<td>3 m</td>
<td>YQ-YL-Y</td>
<td>KFA-M581-30</td>
</tr>
<tr>
<td>10 m</td>
<td>YQ-YL-Y</td>
<td>KFA-M581-40</td>
</tr>
</tbody>
</table>

Robot slider

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCM-XBOT</td>
<td>KFA-M267-00</td>
</tr>
</tbody>
</table>

Connection unit

Use this unit to fix the modules to the frame, to connect modules together. The recommended quantity “Number of connection modules” = 1

<table>
<thead>
<tr>
<th>Type</th>
<th>Model</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front type</td>
<td>LCM-XCUF</td>
<td>KFA-M2040-H0</td>
</tr>
<tr>
<td>Bottom type</td>
<td>LCM-XCUB</td>
<td>KFA-M2040-V0</td>
</tr>
</tbody>
</table>

Module electric power supply jumper connector (6 pins)

This connector supplies power from module to module. This is a 6-pin jumper connector with view for power bypasses.

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCM-XCU-PJC</td>
<td>KFA-M4421-00</td>
</tr>
</tbody>
</table>

Module electric power supply connector (3 pins)

This is a 3-pin connector (for power input) that supplies power from the external power unit to the module. The applicable area dimensions are 120 x 40 mm.

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCM-XCU-PSC</td>
<td>KFA-M4421-10</td>
</tr>
</tbody>
</table>

Module electric power supply (48 VDC-1000 W)

This general-purpose 48 VDC power supply unit can be used for both module control and motor drive.

- Rated output 21 A, peak output rating 42 A (within 5 sec.)
- Use type general-purpose power, efficiency > 90%, power factor > 0.7%

<table>
<thead>
<tr>
<th>Module</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCM-XCU-P-1000W</td>
<td>KFA-M501-00</td>
</tr>
</tbody>
</table>

YQ Link terminating connector

Connect to the terminal end of the linear conveyor module that is connected with the Universal Controller. Refer to the system configuration drawing for a connection example.

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>YQX-YQL-TC</td>
<td>KFA-M581-00</td>
</tr>
</tbody>
</table>

Module electric power supply jumper connector (8 pins)

This connector supplies power from module to module. This is a 8-pin jumper connector with view for power bypasses.

<table>
<thead>
<tr>
<th>Model</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>LCM-XCU-PJC</td>
<td>KFA-M4421-00</td>
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<td>LCM-XCU-P-1000W</td>
<td>KFA-M501-00</td>
</tr>
</tbody>
</table>

Note 1. A robot slider is unable to stop in an area 99 mm from both ends of the line. Most robot slider stoppers are from the ends, which cause severe addition. The robot slider stopper juts out from the ends, which could cause collision.

Note 2. The maximum output current of the power supply unit is 21 A. The maximum output rating of the power supply unit is 42 A (within 5 sec.). Where the YQ Link cables are not connected from the line end to another line, install the YQ Link and YQ Link terminating connectors. Note 3. The maximum output current of the power supply unit is 21 A. When the number of robots is one (not connected with LCM-XMS or longer (Refer to Table).)

Note 4. The maximum output current of the power supply unit is 21 A. The maximum output rating of the power supply unit is 42 A (within 5 sec.). Where the YQ Link cables are not connected from the line end to another line, install the YQ Link and YQ Link terminating connectors. Note 5. The maximum output current of the power supply unit is 21 A. When the number of robots is one (not connected with LCM-XMS or longer (Refer to Table).)

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Note 9. The maximum output current of the power supply unit is 21 A. When the number of robots is one (not connected with LCM-XMS or longer (Refer to Table).

Note 10. The maximum output current of the power supply unit is 21 A. When the number of robots is one (not connected with LCM-XMS or longer (Refer to Table).

Note 11. The maximum output current of the power supply unit is 21 A. When the number of robots is one (not connected with LCM-XMS or longer (Refer to Table).

External view

Configuration parts

External view

YAMAHA LCM-X

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