A breakthrough linear conveyor concept

A new small-footprint conveyor concept that offers both speed and flexibility

1. How the unprecedented LCM100 linear conveyor compares to conventional types
2. Examples of solutions offered by the LCM100 conveyor
3. Message from the LCM100 developers
## LCM100 vs Conventional Conveyor System

### Conventional type conveyors
- Mechanical stoppers or sensors are required at each stop position.
- Complicated control due to the large number of conveyor components.
- Stopper adjustments are required each time the stop position is changed.
- Difficult to increase productivity.
- Requires various process for productivity.

### LCM100 Linear Conveyor Module
- Features direct-drive carriages.
- Programmable stop positions.
- No mechanical stoppers or external sensors required.
- Maximum speed of 3 m/sec for better transfer time.
- Adjustable transfer speed for total line flow coordination.
- Actual task times can be easily monitored.

### Comparison Table

<table>
<thead>
<tr>
<th></th>
<th>Conventional Type Conveyors</th>
<th>LCM100 Linear Conveyor Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same speed required on one conveyor</td>
<td>△ Speed control</td>
<td>Automatically set according to the travel distance (individual settings not possible)</td>
</tr>
<tr>
<td>Single (fixed) direction</td>
<td>× Operation control</td>
<td>Bi-directional and distance can be set individually for each carriage</td>
</tr>
<tr>
<td>Physical impact at mechanical stop</td>
<td>× Travel / Stops</td>
<td>Smooth servo-controlled acceleration and deceleration and incremental move</td>
</tr>
<tr>
<td>Stopper or sensor required at each stop position</td>
<td>× Number of system components</td>
<td>Consists of modules, slider, controller, and RFID antenna</td>
</tr>
<tr>
<td>Additional support is required to increase accuracy</td>
<td>△ Accuracy</td>
<td>Stop accuracy: 100 µm width</td>
</tr>
<tr>
<td>Additional support is required to ensure rigidity</td>
<td>△ Rigidity</td>
<td>Assembly work can be performed on carriage supported by high-rigidity guides</td>
</tr>
<tr>
<td>Allows a circulating design</td>
<td>○ Line flow layout</td>
<td>Allows circulating, forked, and merging designs (superior flexibility)</td>
</tr>
<tr>
<td>Requires stopper adjustments at each line flow change</td>
<td>× Line flow changes</td>
<td>Simple line length changes by adding or removing modules. Stop position changes by program.</td>
</tr>
<tr>
<td>Certain space is required</td>
<td>△ Footprint</td>
<td>Space saving design</td>
</tr>
</tbody>
</table>
Free-flow conveyors, roller conveyors, and belt conveyors are frequently used for conveyance between processes. However, these conventional conveyor types have slow conveyance speeds which increase the tact times. They also require many components, including stoppers or sensors at each stop position. Moreover, the impact shocks which occur when striking a stopper can cause workpiece deviations. These demerits, together with frequent stops due to line problems, reduce the system operation rate and result in higher maintenance costs.

The LCM100 features a moving magnet type linear motor which allows conveyance speeds as fast as 3 m/sec. The sliders are individually controlled by servos, thereby eliminating the need for stopping mechanisms such as stoppers, etc., while ensuring smooth deceleration and stops. With workpiece deviation problems also eliminated, the LCM100 enables a system which offers both high-speed and high-accuracy conveyance.
2. Examples of solutions offered by the latest linear conveyor

Flexible line design: set the speed, direction, and stop positions as desired.

Build sophisticated forking and merging lines.

Conventional conveyor issues

- The manufacturing line footprint is too large.
- Too many in-progress workpieces between processes.

Conventional conveyors move only in the forward direction (one way only). Therefore, in cases where the same process exists at multiple line locations, the equipment for repeating that process is required at each of those locations. Moreover, the slow conveyance speed increases the number of in-progress workpieces between processes, thereby making it difficult to increase the production rate.

LCM100 solutions

- Same-processes are consolidated
- High-speed conveyance is possible
- Equipment downsizing
- Reduces the number of in-progress workpieces

The conveyance direction, distance, and stop positions can be specified for each of the LCM100 sliders. This allows a flexible line design with the following features:

• The slider can be stopped at the required positions.
• The slider speed can be changed.
• The slider can move in the reverse direction.

In addition to the above features, the use of circulating, forked, and merging lines allows unprecedented freedom in line design. Even in lines where the same process must be performed multiple times, the "direction change" feature allows that process activity to be consolidated at a single location, resulting in a smaller equipment footprint.

Conventional type

The same process exists at 2 locations on the line

<Process sequence>

A → B → A → C

Same process

To change direction:

A → C

Same process

High-speed conveyance is possible.

Equipment downsizing

Reduces the number of in-progress workpieces

LCM100

Same-process activity is consolidated at one location

<Process sequence>

A → B → C

Same-processes are consolidated

Downsizing
Perform manufacturing tasks on the conveyor line itself
Eliminates the need to pull workpieces off the line, thereby reducing the equipment footprint.

---

**Conventional conveyor issues**

- Production quantity is too low.
- Manufacturing line footprint is too large.

Production efficiency would be greatly enhanced by the ability to perform assembly tasks, etc., with the workpieces remaining on the line itself. Unfortunately, the low rigidity of conventional conveyors does not allow process tasks to be performed with the workpieces on the line. Instead, supplementary functions such as backups, etc., are required, or the workpiece is temporarily pulled off the line for the task in question. This results in considerable waste in time, space, and cost.

---

**LCM100 solutions**

- High rigidity guides allow process tasks to be performed with the workpiece on the slider
- Faster tact times
- Smaller equipment footprint

The LCM100 sliders are directly supported by high-rigidity guides with retainers, allowing process tasks to be performed with the workpieces on the conveyor line sliders. This not only shortens the tact time by eliminating the time required to pull the workpiece off the line, it also reduces the equipment footprint.

Moreover, multiple workpieces can be placed on a single slider, with small-pitch and long-distance movement being used together to improve efficiency at processes with differing tact times. Pitch feed can be used within short tact time same-processes, and high-speed conveyance can be used at long tact time processes to reduce conveyance times.
4 A perfect fit for small-lot production of multiple workpiece types

The LMC100 offers the flexibility to configure an optimal line for the product type and process tasks in question.

Conventional conveyor issues

- Troublesome setup changeovers.
- Troublesome stop position changes.
- Time-consuming startup.

Changing the conveyor line configuration requires time and effort.

Once a conventional conveyor line has been built, it requires considerable time and effort to reconfigure it. Doing so entails troublesome changes to both the hardware and software, such as adjusting the stopper positions and changing the sensor settings, etc.

LCM100 solutions

- Allows length changes simply by adding or removing line modules.
- Stop positions can be changed simply by changing the program.
- Quick startup time.

Easy to change the conveyor line configuration.

The LCM100 module format allows easy line configuration changes simply by adding or removing line modules, and stop position changes can be completed simply by rewriting the program.

Modules which were removed to shorten a line can be reused in other lines, or stored for maintenance purposes.
Quick recovery from failures is possible by replacing the slider. Minimizes line stop times.

**Conventional conveyor issues**

- Long recovery time after a system failure.
- Single-axis robots are expensive items, and replacement parts cannot be kept in stock.
- Line stops continue for extended periods.

**LCM100 solutions**

- Parts are standardized, making them easy to use for maintenance purposes.
- Part replacements are simple.
- Conveyor stop times can be minimized.

Practically maintenance free

**Conventional conveyor issues**

- Requires too much maintenance.
- Maintenance work prevents uninterrupted use for extended periods.

**LCM100 solutions**

- The motor and scale are non-contact types
  - No wear
- The slideway consists only of a rail
  - Easy maintenance
- Few consumable parts
  - Long life

- The LCM100 consists only of the modules, sliders, controller, and RFID antennas. The motor and scale are non-contact parts which present no wear related problems.
- Moreover, the LCM100 requires no cable carrier, and the slideway consists only of a rail which generates little dust. These features add up to extremely simple maintenance, and the presence of few consumable parts ensures long life.
Message to users from the development leaders of YAMAHA's innovative leap from a "flow" to a "move" conveyor concept

The next-generation LCM100 conveyor supersedes belt and roller conveyors

The LCM100 was developed as the successor to belt and roller conveyors. A single LCM100 module comprises a linear motor, slider, and controller, with workpieces being placed on the slider. The slider speed and stop positions, etc., are determined by the controller, resulting in an extremely flexible format that enables high-speed, high-accuracy conveyance.

Conventional conveyors move in a single direction at a constant speed, with workpieces being introduced into that "flow". With the LCM100, the speed and direction of the workpiece carrying slider can be changed at will to obtain the optimal conditions. The ability to control each slider individually allows the kind of high-speed conveyance which is not possible with conventional conveyors.

Increase profits by eliminating wasted conveyance time and motion

Compared to manufacturing and processing operations, conveyor systems are not generally seen as an avenue for adding value, but the LCM100 does exactly that. By vastly expanding the realm of conveyor system possibilities by allowing previously impossible line configurations, etc., the LCM100 completely changes both the conveyor landscape, and the way we think about conveyor systems.

Shorter tact times mean that products reach the marketplace more quickly. And bringing the conveyance process closer to real time production means fewer in-progress workpieces and less inventory. Investment in conveyor process methods and improvements translates directly into profits. And based on the numerous inquiries received from manufacturers in the electronic device and automotive related fields, the future of the LCM100 is proving to be a promising one indeed.

It is our hope that you, too, will utilize this next-generation conveyor to realize benefits that are impossible with conventional conveyors.