Linear axes for collaborative robots
Industry 4.0 has driven a modernization of operations across different industries. Process automation is a key enabler to reach operational excellence with interconnected machineries.

Collaborative robots (cobots) can greatly improve productivity in industrial environments with repetitive tasks. The radius of action is usually limited by their reach. Additional linear axes can significantly enhance the radius of action up to 5 times, by re-positioning the base of the robot during its working cycle.

SKF Motion Technologies offers a range of linear motion axes - vertical and horizontal - to easily expand the capabilities of a cobot.
Applications

Benefits for palletizing

Fully automated pick and place solutions are becoming a new standard with packaging stations. The main challenge for packaging system manufacturers is to design multi-axis systems in a simple and cost-effective way. A typical application that benefits from an added linear axis is palletizing of boxes. Stacking on pallets can start at floor level, but the stack can be up to 2 m high. A standard collaborative robot does not have such a large vertical working range.

SKF Motion Technologies provides effective solutions to complete vertical adjustment in a smart way, providing a ready-to-mount additional linear axis to the robot. While stacking a pallet, the base of the robot can be lifted or lowered to work at a more optimal position.

Benefits for handling

Concerning handling applications, it’s often required to cover long distances between machines, like machined parts loading and unloading on CNC centers.

This repetitive operation, usually done manually, is time-consuming and with low added value for the operators.

By using a cobot on the SKF Motion Technologies linear module, it is possible to easily automate this handling process, increasing its productivity and reliability.

Linear modules from SKF Motion Technologies provide fast and precise movements to effectively position the robot along a horizontal axis.
Solutions for vertical axes

SKF Motion Technologies offers different telescopic pillar configurations to meet the demands of a range of cobot applications. These telescopic pillars are very robust and stable, with built in drive system for easy integration.

**TLT**
- Telescopic design using two motors to achieve a high stroke with low retracted height
- Fast speed up to 80 mm/s at 1500 N push load
- Very quiet operation
- Mechanical brake included
- Different screw and motor options

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**CPMT**
- Telescopic design using a double screw drive train to achieve a high stroke with low retracted height
- Higher duty cycle and lifetime compared to TLT
- Single motor design
- Push and pull load

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*With customization*
CPSM

- Servo pillar with full motor flexibility
- Can be provided with external brushless DC or servo motor, or interface for any third party motor
- Very high speeds over 200 mm/s
- Highest duty cycle and lifetime
- Push and pull load

Key benefits for collaborative robots

TLT
Main application
Palletizing
Stroke/Speed
High stroke
Duty cycle
Low
Push/pull force
Push
Positioning precision
0.3 mm
Brake
Internal

CPMT
Main application
Ceiling mounting
Stroke/Speed
High stroke
Duty cycle
Medium
Push/pull force
Push and pull
Positioning precision
0.2 mm
Brake
Internal

CPSM
Main application
Pick and place
Stroke/Speed
High speed
Duty cycle
High
Push/pull force
Push and pull
Positioning precision
0.1 mm
Brake
External

* with customization
Solutions for horizontal axes

SKF Motion Technologies offers different linear module configurations to meet the demands of a range of horizontal cobot positioning applications.

**CLSM-150-B**

**Features**

- Ball screw drive train (belt drive train on request)
- Four cover option for different protection levels
- High level of positioning precision and repeatability
- Inline and parallel gear boxes
- Customized motor adapter plate to fit any motor
- Stroke up to 1.8 m (longer strokes available on request)
- Speed up to 1.2 m/s (higher speed on request)

**Benefits**

- High movable loads in operation
- Long life in operation
- Easy maintenance by one-point lubrication option from both carriage sides
- Precise alignment and secure fastening of the attachments

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Dynamic load

\[ C_{\text{max}} = 21 \text{ kN} \]

Dynamic moment

\[ M_{\text{max}} = 2400 \text{ Nm} \]

Stroke

50 to 1800 mm

Repeatability

0.01 mm

Speed

1200 mm/s
Customized solutions

SKF Motion Technologies offers a wide range of possible customizations to satisfy different application needs. From basic modifications like custom attachments or painting to complete customized solution, SKF Motion Technologies can offer tailor made systems to empower cobots users in getting most benefits for their applications.

In this customization example, we have realized a multi-axes system to move independently 2 robots on both horizontal and vertical axes, dramatically enlarging the operating range while keeping a very compact footprint.

Features

- Rack and pinion drivetrain
- Independent movement
- Stroke up to 6m
- Multiple carriages
- Custom cobot mounting plates
Integrated solutions for Universal Robots

Complete plug & play solutions, UR+ certified, are available for cobots from Universal Robots. The LIFTKIT and SLIDEKIT provide a ready to install solution to easily add a vertical or horizontal axis to Universal Robots.

The kits include all required hardware, controllers and interfaces to the Universal Robots system. Also included is a URCaps software to directly control the additional axis from within the UR programming environment. No engineering resources needed! Ready to run in 30 minutes.

LIFTKIT

Connection diagram

SLIDEKIT

Connection diagram
Linear axis for collaborative robots
LIFTKIT

Operating range extension
• Vertical lifting of the cobot by up to 900 mm with compact retracted height
• Robust pillar design for industrial use, vibration free motion and virtually maintenance free

Plug-and-play solution
• Hardware interface compatible with UR3, UR5 and UR10 robots
• Universal Robots+ certified product
• Software control integrated with UR controller (URCaps) for easy motion programming

Cost savings and higher productivity
UR cobots combined with SKF Motion Technologies LIFTKIT provide a cost-effective solution to upgrade an existing assembly shop, moving from a manual handled to a fully automatized line.

Technical data

<table>
<thead>
<tr>
<th>Unit</th>
<th>LIFTKIT-UR-601</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mechanical</strong></td>
<td></td>
</tr>
<tr>
<td>Push load</td>
<td>N</td>
</tr>
<tr>
<td>Pull load</td>
<td>N</td>
</tr>
<tr>
<td>Speed</td>
<td>mm/s 80</td>
</tr>
<tr>
<td>Stroke</td>
<td>mm 500 – 900 mm</td>
</tr>
<tr>
<td>Retracted length (hardware)</td>
<td>mm Stroke/2 + 265 mm</td>
</tr>
<tr>
<td>Retracted length (software controlled)</td>
<td>mm Stroke/2 + 275 mm</td>
</tr>
<tr>
<td>Height of attachment plates</td>
<td>mm 2x15 mm</td>
</tr>
<tr>
<td>Cross section</td>
<td>mm 163 mm x 163 mm</td>
</tr>
<tr>
<td>Type of protection</td>
<td>IP 40</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>°C +10 to +40 °C</td>
</tr>
<tr>
<td>Compatibility to UR</td>
<td>UR3, UR5, UR10, e-Series</td>
</tr>
<tr>
<td>Cable management</td>
<td>Threads on pillar and interface plate to attach cable management</td>
</tr>
<tr>
<td><strong>Electrical</strong></td>
<td></td>
</tr>
<tr>
<td>Voltage/Current</td>
<td>V/A 120 AC / 6.5</td>
</tr>
<tr>
<td></td>
<td>230 AC / 3.3</td>
</tr>
<tr>
<td></td>
<td>24 DC / 10</td>
</tr>
<tr>
<td>Emergency stop</td>
<td>Connection to UR safety IO</td>
</tr>
<tr>
<td><strong>Software functionality</strong></td>
<td>mm ± 1 mm</td>
</tr>
<tr>
<td>Positioning, repeatability</td>
<td></td>
</tr>
<tr>
<td>Accessible positions</td>
<td>any</td>
</tr>
<tr>
<td>Feedback</td>
<td>Position feedback via URCaps</td>
</tr>
<tr>
<td>Soft start and stop</td>
<td>Implemented for smooth operation</td>
</tr>
<tr>
<td>Universal Robots controller compatibility</td>
<td>CB 3.1 / Polyscope 3.6 or higher</td>
</tr>
</tbody>
</table>
LIFTKIT contains

- UR attachment plate
- Bottom fixation plate
- Cables and screws
- Controller
- Telescopic pillar
- Handswitch

*Teach pendant not included

Ordering key

Robot
- UR Universal Robots

Stroke
- 500 mm
- 600 mm
- 700 mm
- 800 mm
- 900 mm

Electrical options
- 00 24 V DC
- 11 120 V AC / US cable
- 22 230 V AC / EU cable
- 23 230 V AC / CN cable
- 24 230 V AC / UK cable
- 25 230 V AC / CH cable

Pillar type
- 601 TLT
Linear axis for collaborative robots
SLIDEKIT

Operating range extension

By adding a linear module as a dynamic base for the robot, it is possible to extend the handling operating area of the robot, increasing the productivity of a series of machines working in the same production flow.

Plug-and-play solution

The SLIDEKIT provides quick and fast installation, by having a standardized mechanical, electrical and software interface with Universal Robots. In few steps, the system is ready to be used and simply programmed in operation.

Cost savings and higher productivity

UR cobots combined with the SLIDEKIT linear module provide a cost-effective solution to upgrade an existing assembly shop, moving from a manual handled to a fully automatized line.

Technical data

<table>
<thead>
<tr>
<th>Performance data</th>
<th>Unit</th>
<th>SLIDEKIT-UR</th>
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<tbody>
<tr>
<td>Max. dynamic load</td>
<td>N</td>
<td>21 000</td>
</tr>
<tr>
<td>Max. dynamic moments</td>
<td>Nm</td>
<td>2 400</td>
</tr>
<tr>
<td>Stroke</td>
<td>mm</td>
<td>100...1 800</td>
</tr>
<tr>
<td>Max. speed</td>
<td>mm/s</td>
<td>1 200</td>
</tr>
<tr>
<td>Duty cycle</td>
<td>%</td>
<td>100</td>
</tr>
<tr>
<td>Screw lead</td>
<td>mm</td>
<td>05 or 10 or 20</td>
</tr>
<tr>
<td>Repeatability</td>
<td>mm</td>
<td>0,01</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>°C</td>
<td>0 to +50</td>
</tr>
<tr>
<td>Max. humidity</td>
<td>%</td>
<td>95</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Electrical data</th>
<th>V AC / A</th>
<th>120 to 240 / 6,5 to 3,3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power input</td>
<td></td>
<td></td>
</tr>
</tbody>
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<table>
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<tr>
<th>Software functionality</th>
<th></th>
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<tbody>
<tr>
<td>Programmable positions</td>
<td>–</td>
</tr>
<tr>
<td>Access to position via UR Caps</td>
<td>–</td>
</tr>
<tr>
<td>Speed adjustable</td>
<td>–</td>
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<td>Universal Robots controller compatibility</td>
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### Dimension drawing

**Control unit**

![Control unit diagram](image)

NOTE. Side brackets for rack mounting are provided with the control box but are not pre-mounted.

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### SLIDEKIT contains

- Servomotor control unit
- CLSM Linear module
- Cables
- UR attachment plate
- Cableveyor

### Ordering key

**Robot**

- UR  Universal Robots

**Module options**

- B  Ball screw
- 05  Lead
- 10  Lead
- 20  Lead
- A  Cover Aluminum
- P  Cover PU-Strip
- S  Cover Steel

**Stroke**

- 100 ... 1 800 mm

**Electrical options**

- 11  120 VAC / US cable
- 22  230 VAC / EU cable
- 23  230 VAC / CN cable
- 24  230 VAC / UK cable
- 25  230 VAC / CH cable

**Accessories options**

- 0  No limit switches
- S  Limit switches
- 0  No cableveyor
- C  Cableveyor

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*Teach pendant not included

UR software plugin

CLSM Linear module

Control unit

Servomotor

Cables
Software functionality

The URCaps software for the LIFTKIT and SLIDEKIT allows easy positioning access directly within the UR Polyscope environment.

Setup

In the installation tab, the user can move the linear axis in both directions manually and define multiple user specific positions, that are accessible in programming mode.

Motion programming

Within the UR motion program, the LIFTKIT and SLIDEKIT axes are easily integrated through a URCaps command module. Simply insert this element from the structure tab at the desired position of the program.

Safety elements

The LIFTKIT and SLIDEKIT have a range of safety elements built in to allow their integration into a collaborative robot application.

LIFTKIT

- The LIFTKIT pillar has an integrated mechanical brake that prevents back-driving in case of power loss or motor failure
- A backup nut is installed to prevent a collapse of the pillar in case of failure or wear of the nut
- Pinching risk between the tube sections of the pillar and the UR attachment plate is minimized
- The LIFTKIT controller has to be connected to the UR safety IO to operate. Activation of the UR emergency stop will trigger a stop of the controller. If the UR system is turned off, the LIFTKIT cannot be operated
- The LIFTKIT controller and the URCaps software have mechanisms to monitor the integrity of the connection, and stop motion in case of failure

SLIDEKIT

- Pinching risk between the carriage and each end block of the SLIDEKIT is minimized
- The SLIDEKIT controller has to be connected to the UR safety IO to operate. Activation of the UR emergency stop will trigger a stop of the controller. If the UR system is turned off, the SLIDEKIT cannot be operated
- The SLIDEKIT controller and the URCaps software have mechanisms to monitor the integrity of the connection, and stop motion in case of failure

Note: LIFTKIT and SLIDEKIT are not functional safety systems compliant with EN ISO 13489-1 or IEC 62061. To integrate the LIFTKIT and SLIDEKIT into a functional safety chain, external safety devices have to be integrated into the overall system.

For more informations please visit www.skfmotiontechnologies.com to download technical datasheets and operating manuals.