ROLLON®
BY TIMKEN

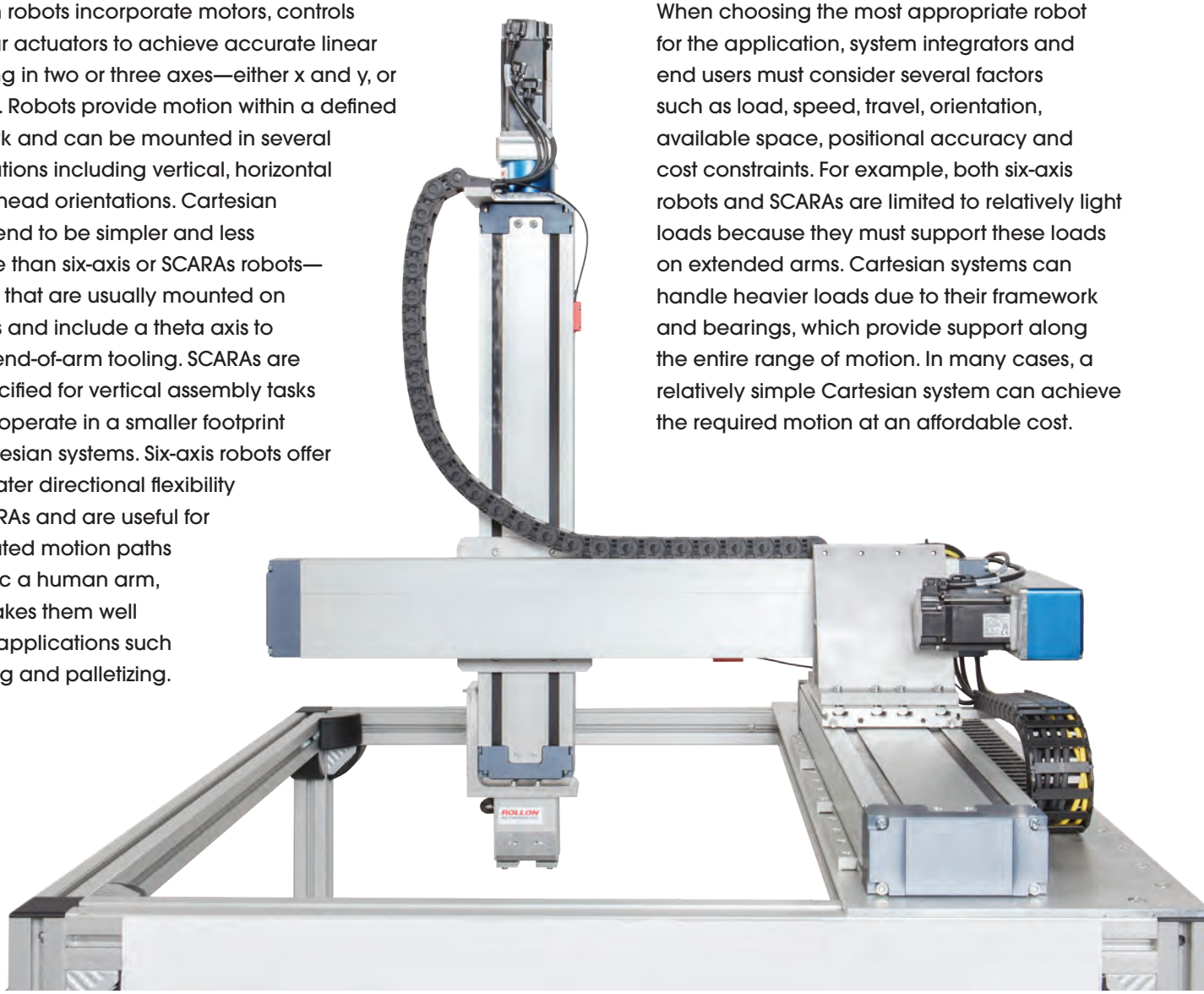
WHITE PAPER

STREAMLINED CARTESIAN ROBOT SIMPLIFIES AUTOMATION TASKS

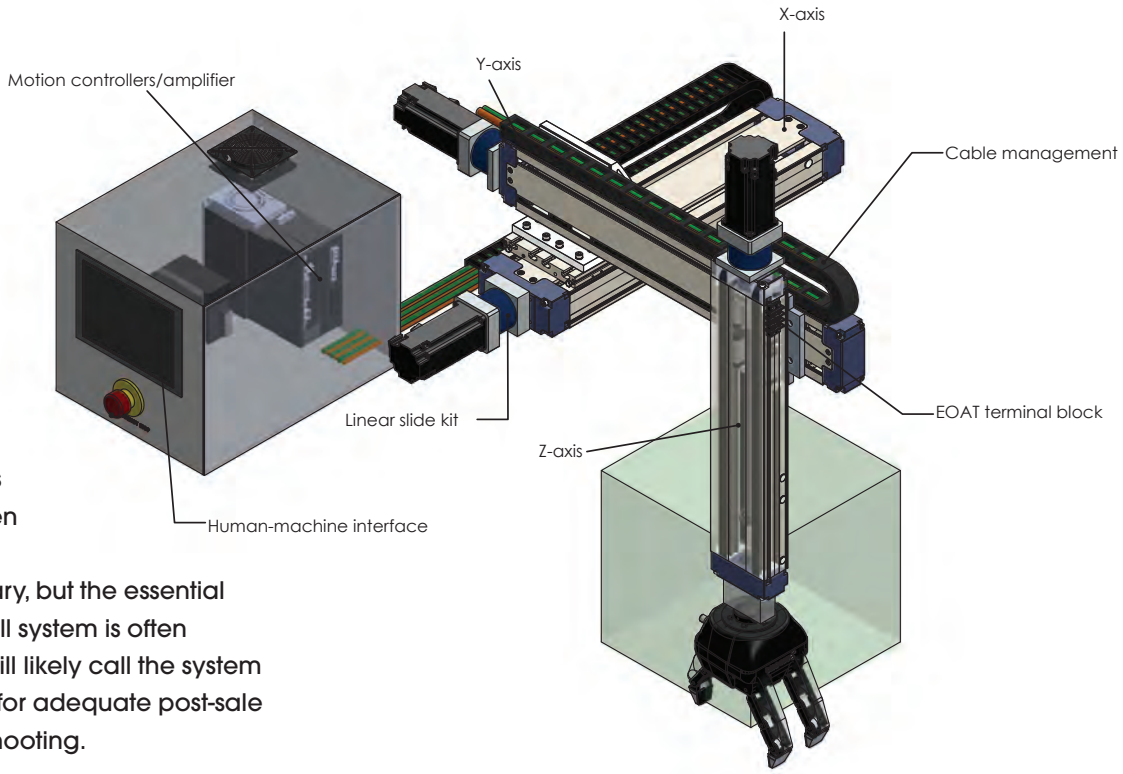
Pre-engineered system enables out-of-the-box functionality.

Cartesian robots incorporate motors, controls and linear actuators to achieve accurate linear positioning in two or three axes—either x and y, or x, y and z. Robots provide motion within a defined framework and can be mounted in several configurations including vertical, horizontal and overhead orientations. Cartesian systems tend to be simpler and less expensive than six-axis or SCARAs robots—two styles that are usually mounted on pedestals and include a theta axis to operate end-of-arm tooling. SCARAs are often specified for vertical assembly tasks and can operate in a smaller footprint than Cartesian systems. Six-axis robots offer even greater directional flexibility than SCARAs and are useful for complicated motion paths that mimic a human arm, which makes them well suited to applications such as welding and palletizing.

When choosing the most appropriate robot for the application, system integrators and end users must consider several factors such as load, speed, travel, orientation, available space, positional accuracy and cost constraints. For example, both six-axis robots and SCARAs are limited to relatively light loads because they must support these loads on extended arms. Cartesian systems can handle heavier loads due to their framework and bearings, which provide support along the entire range of motion. In many cases, a relatively simple Cartesian system can achieve the required motion at an affordable cost.

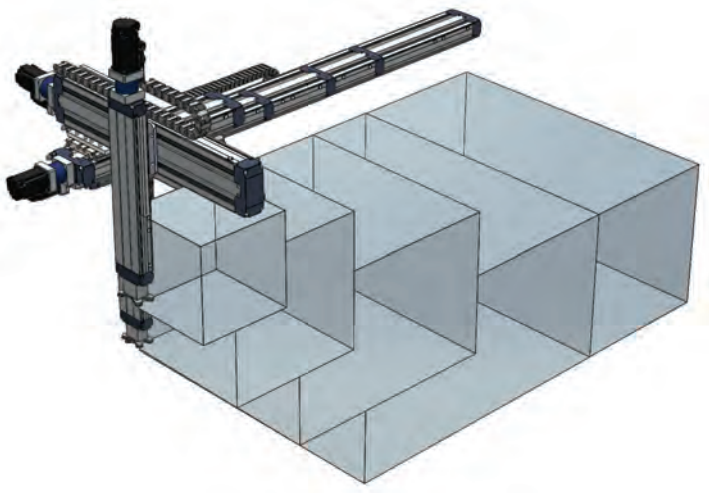


SPECIFYING CARTESIAN SYSTEMS



However, even with a fairly basic setup, gantry type systems often require more than 100 hours of engineering activity, including specifying dozens of parts across multiple vendors. With numerous failure points and a multitude of suppliers, it is difficult to know who to call when something goes wrong. System ownership is absolutely necessary, but the essential question of who owns the overall system is often left unanswered. The end user will likely call the system integrator or distributor, hoping for adequate post-sale technical support and troubleshooting.

Another option is to specify a pre-engineered Cartesian robot with the mechanical system and controls already in place and ready to go. One new offering in this arena is the Rollon Motion Box, which covers everything from the human-machine interface (HMI) on one side to the output of reliable motion on the other end. Even the cable management is included, which helps reduce the difficulty of setting up the system.



Motion Box has been fully tested with a 50 kg load at the edge of the motion envelope. The resulting deflection is no more than 1 mm.

The initial system setup is already complete so that the end user can quickly and easily get parts moving in a reliable and repeatable manner. The time from pulling it out of the box to entering programming mode is roughly two hours. Regarding flexibility, six Motion-Box sizes are available to suit more than 80% of all Cartesian motion applications:

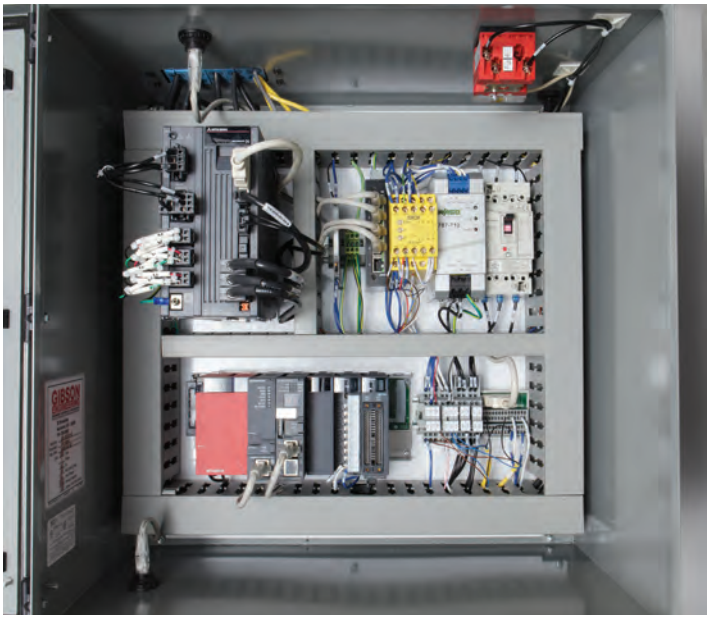
- 12x12x12 in.
- 16x16x16 in.
- 20x20x20 in.
- 30x30x20 in.
- 40x40x20 in.
- 60x40x20 in.

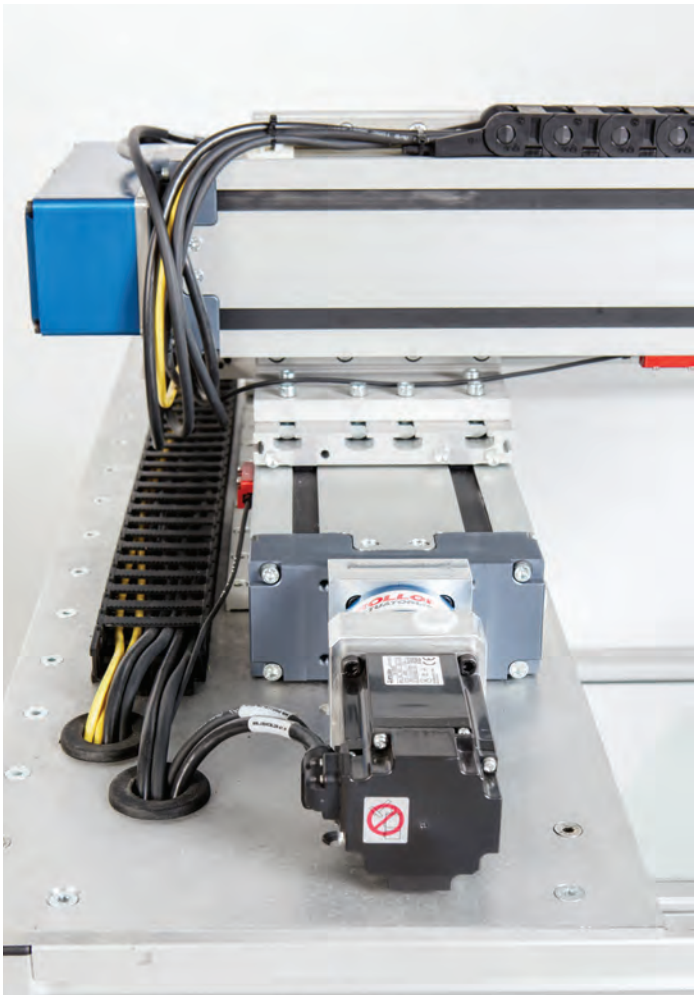
Once the available space and required motion footprint are defined, the next step is to check the load and speed requirements. Whether the load is 5 kg or 50 kg, maximum speeds are based on this variable. User-friendly load and speed charts make it simple to determine travel times for x, y and z axes so that the correct system is specified to match the application. For example, with the smallest work envelope of 12x12x12 in., it takes approximately half a second to move from corner to corner, whereas a larger motion envelope might take 2 or 3 seconds to make the same move, depending on the load.

The main benefits of using an out-of-the-box Cartesian system such as Motion Box include working with one vendor for advice and troubleshooting needs, one part number/one item to specify and one engineering hour to get the system up and running. Buying a part and buying a robot become virtually the same task, making both initial specification and setup fast and easy. In addition, Motion Box offers flexible integration options via an Ethernet connection. The Cartesian robot system can connect to wider automation setups using EtherNet/IP, DeviceNet, TCP/IP, CC-Link, Profibus and ProfiNet, as well as company-specific networks and control architectures. A streamlined control system also simplifies ease of use. Motion Box incorporates the Q-Motion Controller from Mitsubishi Electric, which features four-axis motion control, energy-efficient drivers, integrated I/O and network access and a clean, efficient HMI setup.

ROBUST ACTUATORS ENABLE RELIABLE, REPEATABLE MOTION

When specifying a Cartesian robot system, one of the most important factors to consider is the quality of the actuators included in the overall design. Because the actuators serve as the workhorses of the application, they must be extremely reliable and comprised of high-quality parts such as rigid linear guides and heavy-duty ball screws. Motion Box incorporates Rollon's TH series (TH 110 and TH 145) linear actuators. These compact, pre-loaded, ball-screw-driven units have zero backlash and offer positioning accuracy and repeatability within 5 µm.





Thrust force and positioning is provided by highly efficient, precision ball screws. Linear motion is based on preloaded recirculating ball bearing blocks with ball retainer technology, mounted on two precision aligned parallel rails. Further, the incredibly compact structure of the TH actuators helps the Motion Box Cartesian system provide long stroke lengths in a compact package. High load capacity and stiffness translate to reliable and repeatable x/y/z movements, often at maximum speeds of 1.5 m/s depending on the load being moved.

Several other factors must also be considered when evaluating the actuators used in any Cartesian robot system. Among the most important are the actuator's subcomponents, such as the base unit, carriage, guides, rails and drive system. All of these parts work together to provide a guaranteed level of reliability and precision, with high-quality parts ensuring more accurate motion and less downtime.

For example, the Motion Box system uses anodized aluminum (alloy 6060) for the profiles and carriages of its TH series actuators, enabling the system to withstand a wide range of environmental conditions. Precision ball bearing guides with ground rails and preloaded blocks enable high accuracy running parallelism, high positioning accuracy, high rigidity and reduced wear. In addition, TH series actuators use precision ball screws to achieve high speeds, high load capacity and accurate thrust force, excellent mechanical performance and long life. When specifying a robotic system, especially one that will handle high-speed tasks, be sure to understand the parts that make up the whole.

Specifying a robot system can seem like a daunting task, but it doesn't have to be. Once the best robot style is selected, whether Cartesian, SCARA or six-axis, more detailed choices can be made based on desired speed and load profiles. If a Cartesian system turns out to be the best choice for the application at hand, be sure to consider a pre-engineered system such as Motion Box. It can save you the time and cost of engaging multiple vendors, sizing and specifying dozens of parts, and spending more than 100 engineering hours to construct a rather simple gantry setup. System integrators, high-tech distributors and robot manufacturers are all good sources of information to help explore the available options.

For more information visit www.rollonmotionbox.com