Product Design and Development

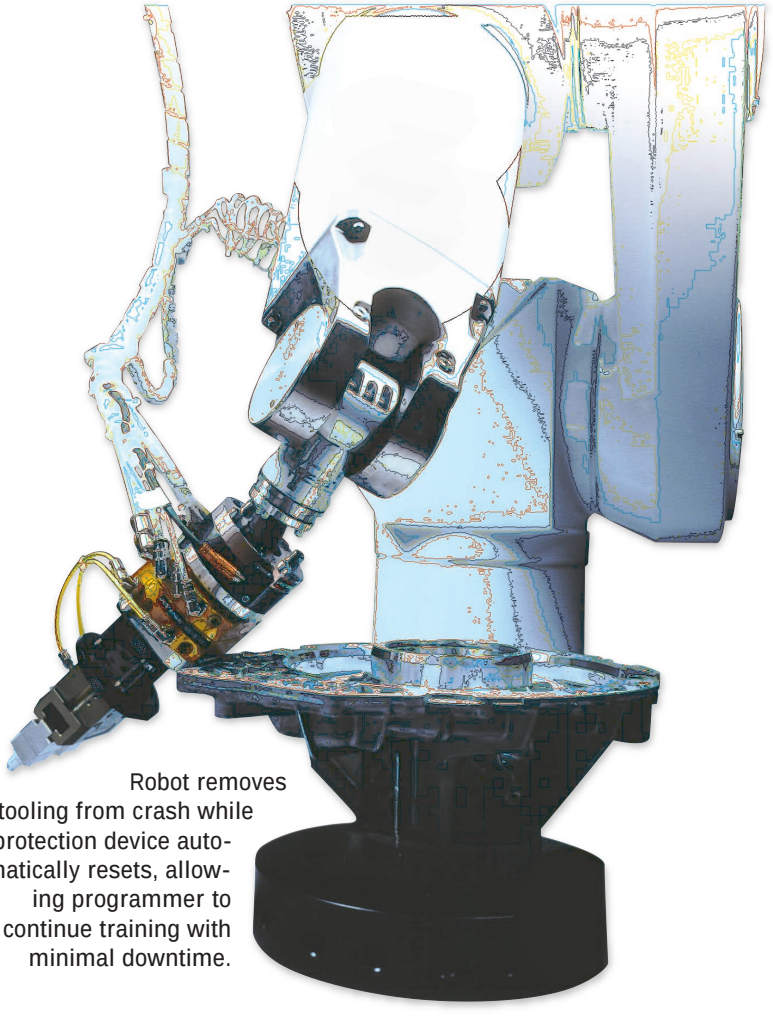
New & Notable
Motion Control

How To Keep Robots Up And Running

The problem with robots is you can't force them back to work. When these automated workers stop, you have to shut down production and go to work yourself - fixing them. To avoid this scenario, several companies now rely on a resettable crash protection device to virtually eliminate the time and money lost due to robot crashes.

A resettable crash protection device is designed to prevent costly damage to robotic end-effectors. It's adjusted to support typical loads experienced by a robot arm in all directions - angular, compression, and torsional. When the preset limits are exceeded, the device absorbs the impact energy through a pneumatic chamber and redirects the energy to reset itself.

Robert Little, the manager of mechanical products at ATI Industrial Automation, a manufacturer of resettable crash protection devices, says robot crashes are frequently caused by the misalignment of components or subassemblies. "Often



Robot removes tooling from crash while protection device automatically resets, allowing programmer to continue training with minimal downtime.

the workpieces entering the cell are either manually or semi-manually loaded, which may result in misaligned work. If parts are misaligned, a crash may occur resulting in tooling damage and significant lost production time."

Automated production isn't the only setting where crashes occur. They can happen in the training phase of robotic applications when the robot arm is being "walked" through its operations to map out a desired path and function. "In either case, tooling costing more than $10,000 may be damaged beyond repair," says Little. However, "a new crash protection device ranging in cost from $800 to $3,000 can absorb the crash and reset itself with minimal downtime."

Automotive Case In Point

Bert Britton, the technical engineering supervisor for Guide Corp. in Monroe, LA, has seen a big difference since crash protection devices were added to his company's high-speed production environment. Guide, which manufactures high-quality forward lighting systems for automobiles, uses industrial robots to perform adhesive trace operations on its assembly lines.

"We have more than 20 robots using the crash protection device and we have virtually eliminated downtime and re-training on these systems," says Britton.

Subassemblies are loaded manually into trays that are fed into a robot cell. The robot dispenses adhesives into a channel at the rate of one part every 24 seconds. In the past, if a part were loaded into the tray incorrectly, the robot arm would crash, shutting down the assembly process and possibly damaging the adhesive-dispensing nozzle. Each incident resulted in a shutdown of at least 30 minutes.

"Now, predetermined angular/axial displacement and torsional rotation limits are set within the crash protector to allow the robot controller time for corrective action," explains Britton. "We have set up the controller to return to home and re-index after a crash. The operator is notified of the location of the misloaded part so that he can correct the situation and continue production in a matter of minutes."

Crash Protection Details

Little lists quick-response crash detection, automatic reset, adjustable breakaway point settings, dynamically variable trip points, and energy absorption capabilities, as well as rugged construction, as key features of a crash protection device.

With quick-response crash detection, nuisance tripping of the signal is avoided. With automatic reset, the operator does not have to enter the robot cell to reset the robot arm. With adjustable breakaway point settings, breakaway points are set at a given pressure independent of whether the crash resulted from a moment or torque load. With dynamically variable trip points, the trip point can be set using variable air pressure supplemented by auxiliary springs for low breakaway if desired.
With energy absorption capabilities, impact energy during a crash is absorbed and redirected so that the device is automatically reset to its original position.

More information on resettable crash protection devices is available by contacting ATI Industrial Automation, 1031 Goodworth Dr., Apex, NC 27502, calling (919) 772-0115, or by visiting them online at www.ati-ia.com

Crash Protection Device Selection

In order to successfully match a crash protection device to a specific application, it's critical to consider the loads produced by the static weight of the tooling, the inertial loads imposed by robot motion, and the loads produced by the end-effector when performing its intended task.

Therefore, the selection process should begin with the calculation of the applied loads: static, dynamic, and working. The static load is the load applied by tooling weight while the robot arm is idle. The dynamic load is the inertial force imposed at the center of gravity due to acceleration of the robot arm. The working load is a variety of forces generated at the tool tip while the robot is under normal working conditions.

Manufacturers of crash protection devices usually provide tables and formulas to convert the forces applied to the end-effector tooling into moment, torque, and axial forces.

Once the loads are calculated, it's time to select a crash protection device that has a nominal moment rating above the calculated loads under both dynamic and working conditions.

The operator then can set the required air supply pressure accordingly. The required pressure must fall within an adjustable pressure range, i.e. a pressure setting of 50 psi should have a range of 25-75 psi.