FAQs

How to Safeguard Your Robots and Robot Cells

What are the first things I have to consider when thinking about robot safeguarding?

Understand the relevant standards that are required at your location and for your operations. Then you'll want to understand the robot's functionality and limitations. What is your robot doing and what are the hazards associated with it? Know what guarding principles you want to use that will create the greatest safety for people from the hazards associated with the robot manipulator and end-effector as well as any additional equipment in the area, not just the robot. Some core risk assessment and safeguarding standard associations include ANSI/RIA15.06, ISO10218-1 and ISO10218-2, and CSA-Z434. These standards are easily available. Along with the standards, there are various technical reports to offer guidance to conformity.

What do you mean by functionality and limitations?

Conventional industrial robots are defined in spaces. Make sure you consider this in a three-dimensional manner. Then think of the space in three levels. There is a maximum space, which includes the end of arm tooling. There is the restricted space, which is where safety limits are set up based on where the robot is set to operate—its hardware or software limitations. And there is the operating space, which consists of what you program the robot to do and the space it has to work in.

For fixed industrial robots, consider that fencing of any kind should be located completely outside the maximum space of the robot. This protects people from full extension of the robot system in the event of a faulted condition. For collaborative robots, understand the different types of collaborative systems as some provide the proper safety with the controller while other need further guarding considerations.

Could you run through the major safety features available?

Hard fences for perimeter guarding, access doors with safety interlock switches, safety light curtains and grids, safety mats, three position enabling devices, laser scanners, safety camera systems, and double reset functions (for coming in and going out of the area) are some of the most used. New technologies such as three-dimensional radar systems are emerging, and being tried and proven on robot systems. With some collaborative robots, safety features are built into the controller that limits the speed and force through safety parameter settings.

Can I rely on just a light curtain to be sufficient for most robot applications?

Not always. Light curtains are great for some operations but may not stop a runaway robot. Even a hard perimeter fence—which may be outside the operating space, but inside the maximum space—may fail depending on the strength of the robot itself and the impact resistant of the guarding. This is why it's important to perform a risk assessment, so that you can cover all of the possible entry points. Adequate safeguarding often includes several of those mentioned above.

Aren't robot controls equipped with safety functions, too?

Older robots may not have the same functions that newer controls have, which would mean you would have to fulfill the safety standard requirements using a variety of other methods. Newer controls have some safety elements available, but not all controllers offer the same functionality.

For example, robotic safety controls should have inputs that are safety rated for the performance level of the robot, as well as provide dual channel safety inputs that will put the robot into a stop position when one of the other sensors is triggered. When this is the case, the robot control itself might fulfill one or more of the requirements for your safeguarding standard assessment. But also remember that it is important to reassess risk regularly so that you are compliant with the latest standards requirements.

Are collaborative robots safer compared to industrial robots?

The general thought is that they are safer because of all the built-in safety elements and controls, but you also have to consider the tools that are attached to the collaborative robot. For example, a standard, low-grip-pressure tool may be safe, but a knife blade used to open packages may not. Consider getting poked or scraped by an end tool with sharp edges or pointy protrusions.

Also consider what the tool is handling. For example, if the tool is handling a hot item, you wouldn't want that touching your skin. ISO/TS15066 states that collaborative operations may include one or more of the following safety capabilities: a safety-rated monitored stop, speed, and separation monitoring ability; power and force limiting operation; and/or hand guiding capabilities. In an effort to compare a collaborative robot versus an industrial robot, it really is more looking at a collaborative robot system compared to an industrial robot system. In either system, an effective risk assessment needs to be performed.

Can you explain these safety features more thoroughly?

A safety-rated monitored stop is when robot motion is stopped prior to a person entering into the collaborative workspace, and if the robot moves while a person is inside the space, a protective stop (like motor shutdown or braking) must be initiated. Speed and separation monitoring is performed when the robot is operating at high speed until someone enters the collaborative area, in which case it slows down for safety reasons.

Power and force limiting is when the robot system comes into direct contact either intentionally or accidentally with a person and the robot stops automatically. You must be sure to verify that the force measurements are set properly to reduce the risk of harm. Finally, for hand guided operations, a person will enter the collaborative space and the robot must fall automatically into a safety-rated monitored stop where the motor may not be in operation, but the feedback sensor is.

Could you summarize my concerns?

Use the standards that are available as guidance, then understand the forces associated with the robot—whether it is a fixed industrial robot or a collaborative robot. Remember that it is not just the robot arm that is a possible risk, but any type of tooling and end-effector that is being used along with additional devices/machines as part of the robot system. Evaluate the acceptable speeds and forces needed in different situations, understand the needs and tasks for the human interaction, assure that controls are wired properly and safely, and implement all proper safeguarding as determined by your risk assessment.