Omron Collaborative Robot Safety Guide

Information, products, and services for the complete collaborative robot safety solutions

Collaborative robots provide an ease of integration and high return on investment however safety implementation is a key to successful projects

This safety guide walks you through definitions, industry standards, project stages, and solutions to completing a collaborative robot safety project

Omron TM Collaborative Robot

Accomplishing a collaborative robot automation project with safety

One of the main benefits of collaborative robots is the integrated safety to allow the robot to work with or close by humans providing higher productivity for manufacturing. In effort to get this benefit we all want to make sure that the complete automation solution including the robot includes safe products and safe operations. Many application in use today unfortunately maybe using a collaborative robot but the gripper, end affecter, machine around it maybe unsafe. This is guide is meant take you through the project process to defining cobots, collaborative workspace, and collaborative operations.

Step 1

Collaborative Robots

Understanding collaborative robot safety systems

Step 2

Collaborative Workspace

Collaborative robots working together with machine safety solutions

Step 3

Collaborative Operation

Achieving a success safety assessment with a collaborative robots in operation

Step 4

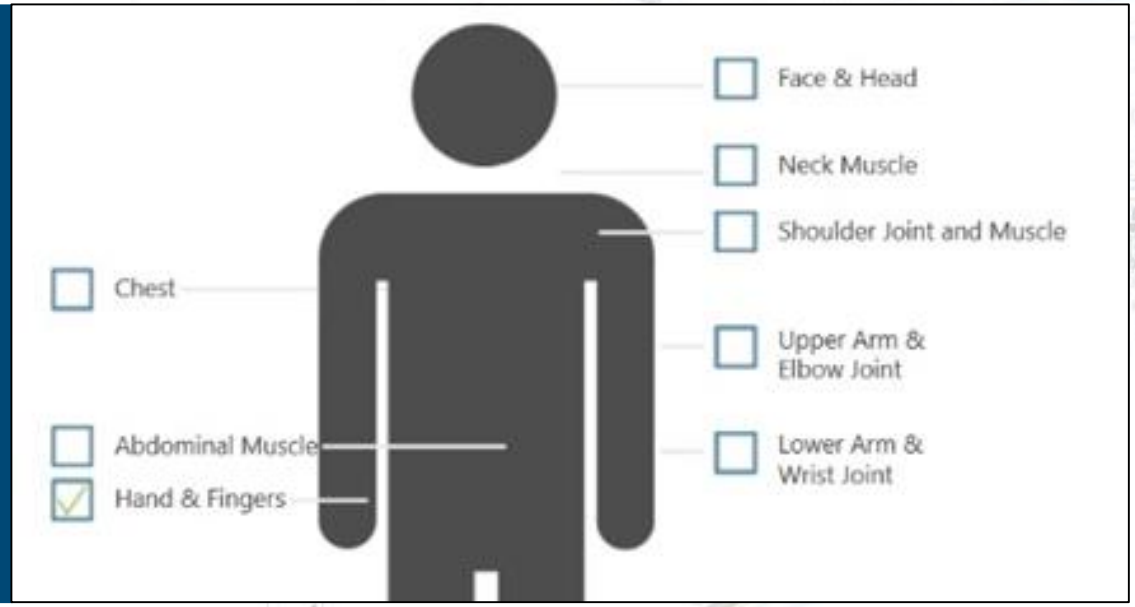
Collaborative Applications

Typical applications and safety system setup solutions

Defining Collaborative Robots

RIA TS 15066 defines the safety functions and performance of the collaborative robot

Force and speed monitoring are the defining abilities of collaborative robots



Using TS 15066 the force and speed monitoring of the collaborative robot is set based application data, human contact area, and workspace hazards,. Human contact is defined in two types. Transient, which is non-clamping. Quasi-static, which can cause a body part to be clamped. In either of these hazards consider the time, speed, and exerted force. All of these factor are then calculated safety settings based on TS 15066. This can be a challenging task if not familiar with safety standards however this is one the main value propositions of using a safety assessment provider. Being prepared and informed about the process will save you money.

Hand Guiding Collaborative Robots

ISO 10218 and ISO/TS 15066 provide standards and guidance teaching cobots

Handing guide mode limits motion by monitoring force and speed allowing safety rated collaborative hand teaching of robot

Step 1: Enabling hand guiding

- To enter in the area of the robot for teaching it must be stopped even if force and speed limiting is active. If not a protective stop must be executed as detected by a safety device like an area scanner
- As opposed to high speed robots the operate activate the teach mode with a simple trigger, button, or mode selection as long as safety force and speed monitoring are active. Otherwise a 3 position safety enable is required.
- Safety standards require teaching mode transition to be deliberate, not lead to unexpected motion, and not create additional hazards

Step 2: Safe teaching

- Beware that the operator is responsible for the robots motion. This includes being aware of surrounding equipment and safety concerns
- It is possible to enable limits in motion to help keep the operator safe like space and soft axis limits

Step 2: Enabling operation

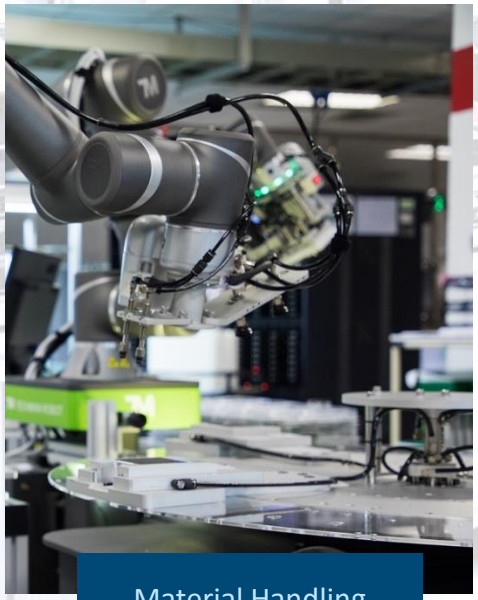
- First the operator must leave the safeguard space which can be detected by safety sensors or additional operator verification.
- To re-enable the robot for operation intentional mode selection must be provided.

Collaborative Workspace

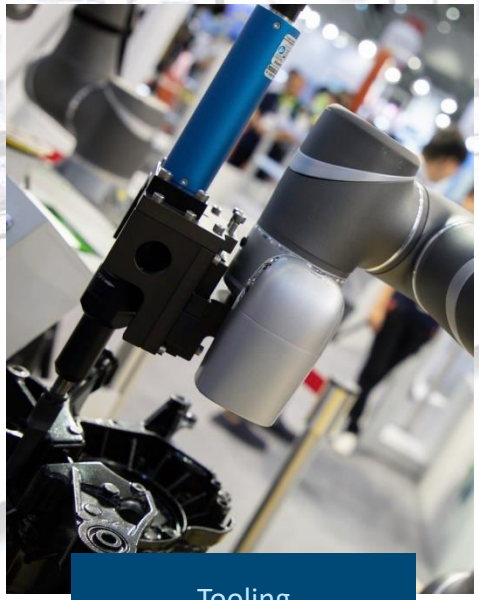
Collaborative robots perform automation within the area of other equipment and use tool that require safety

As defined by the ISO 10218 / ANSI RIA 15.06 the collaborative workspace is the space with the safe guarded area where the robot and human can perform task simultaneously during production operations. TS 15066 defines concurrently or collaboratively. This is technical specification verses a standard therefore provides cobot guidance as opposed to the required standards of ISO 10218 for all robots. It is important to list and map out all additional equipment in the complete cobot automation project. Evaluate each device for potential hazards and safety sensors to use prevent human and equipment damage. Final the collaborative workspace must be clearly marked.

The following are examples of non collaborative safety rated equipment that can be part of the workspace requiring safety devices

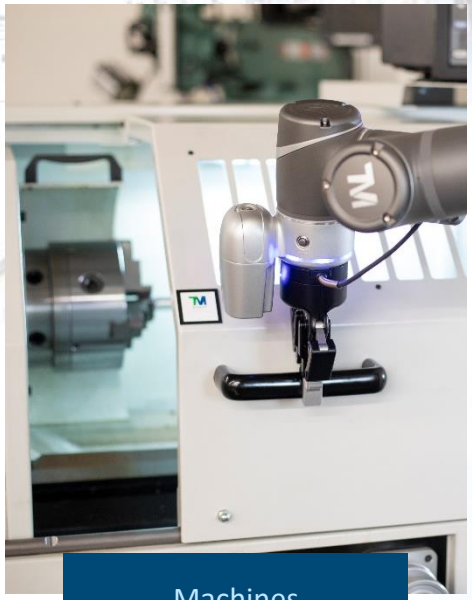


Material Handling



Tooling

Grippers / Actuators



Machines

Collaborative Workspace

Safety devices are easy to integrated with your collaborative robot

Open area safety guarding solutions

Safety area scanners and mats are the most popular safe guarding for cobots and is also one the simplest to integrate in applications with low hazards and few additional equipment

Gated / limited area safety guarding solutions

Safety light curtains and safety switches are used for applications with hazards or high speed operation enablement for increased productivity.

Active hazards safety guarding solutions

When operators need to collaborate when a hazard is present or operation could cause a hazard then safety enable of “Deadman” switch can provide safe guarding

Collaborative Operations

Safety validating your collaborative robot application through all operations

Enabling

Safe Robot Enable

Whether starting up the robot or recovering from a emergency stop there must an intentional act to enable the robot that ensures operators are safe and no hazards are present.

For example an e-stop in activated by an operator the robot should not perform an automatic re-enable but must require a secondary operator input.

Teaching

Safe Handing Guiding

Ensure in your design and safety set up that hand guiding can only occur after the robot has stopped, intentional mode selection has occurred, and speed and force monitoring are active.

For example if the hand guiding activation occurs without a stop command or safety input this should initiate a safety stop and fault.

Operations

Safe Operation

Enabling the automatic or run operation of the cobot must be an international mode selection by the operator that requires all safety devices and conditions are validated for operation.

For example validate operators are outside a high speed work zone or operators are clear from hazards on the end of tooling.

Validation

Safety Validation

It is important to work a safety assessment service group to review all these areas and equipment to provide a safety remediation service if need.

For example a safety service group will visit your facility, inspect of equipment, confirment certifications, engineer safety parameter settings, test performance, document safe validation.

Collaborative Machine Tending Applications

Safety solutions and considerations for a successful machine tending automation project

Machine tending is the most applied solution for collaborative robots due to ease of installation, high rate of return, and flexible manufacturing capability

Machine tending application can be misleading in their appearance of safety and minimal hazards but it is one of the industries top safety concerns for industry experts who have completed many inspections and safety assessments. Here are top areas to consider in your design.

1. Use a safety rated gripper or safe guard against operator injury
2. Investigate whether the product itself presents any damagers like being hot or sharp.
3. Does the machine need to be safety control linked to prevent either from operating when the other is in a safety stop condition.
4. Is there material handling equipment being used and what are the safety considerations needed.
5. Since machine tending cobots can be moved from machine to machine how is the safety setting and program validated?
6. Are there warning zones for operator to indicate hazards or operation interference?
7. Review the complete area for any circumstances where an operator can be trapped or clamped.

Collaborative Material Handling Applications

Safety solutions and considerations for a successful material handling automation project

Material handling applications for cobots can be numerous ranging from picking, packing, palletizing, to sorting. Installation into existing areas with operators is a great time savings.

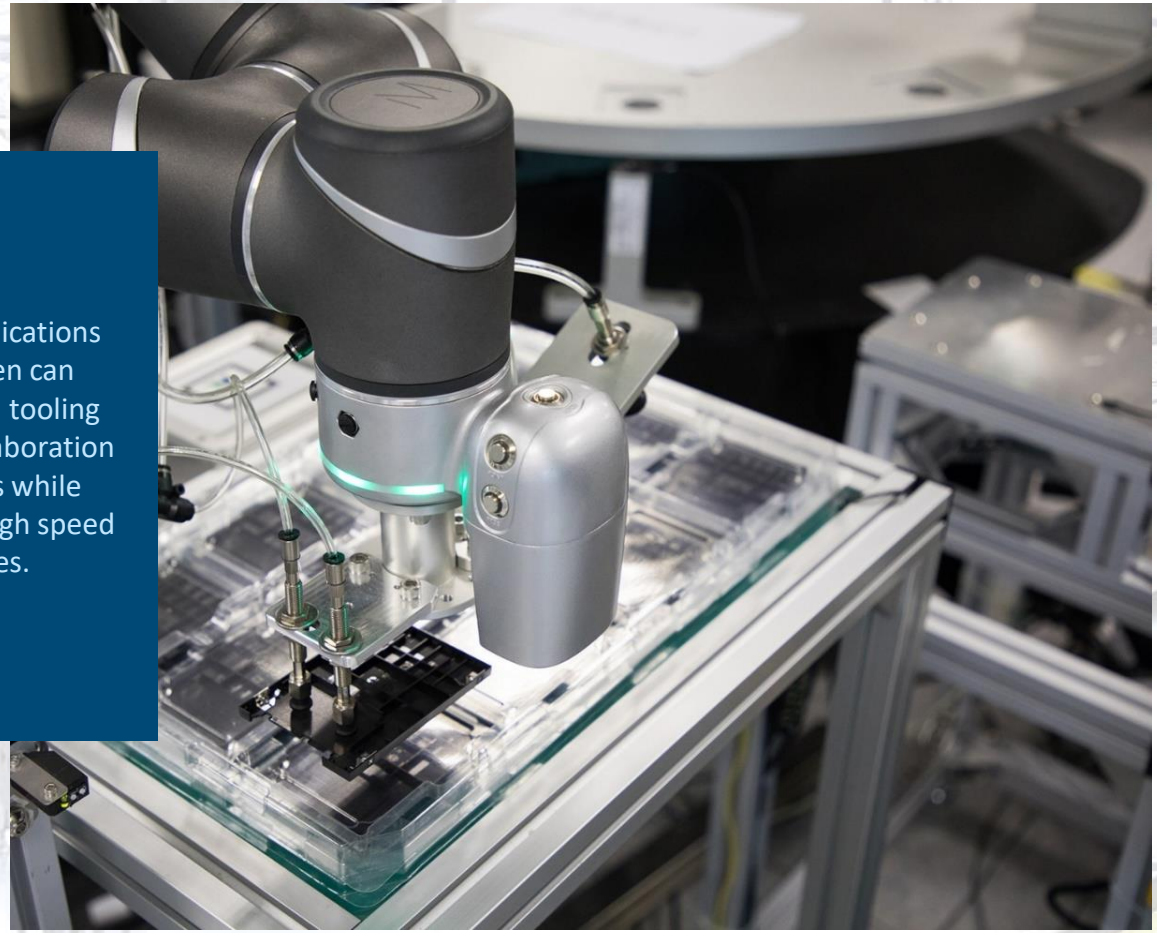
Material handling applications due to their wide uses makes them more site specific solution for safety implantation. Often operators and other people can moving or transporting other material around the cobot requiring more planning to avoid hazards.

1. Safety rated gripper are rare at this point in the market. Use of pneumatic gripper is most common which require safety consideration for impacts and loss of power or suction.
2. Investigate whether the product itself presents any damagers like being heavy, containing hazardous material, or being dropped.
3. Do other machines need to be safety control linked to prevent either from operating when the other is in a safety stop condition.
4. Since cobots can be moved from application to application how is the safety settings and program validated?
5. Are there warning zones for operator to indicate hazards or operation interference?
6. Review the complete area for any circumstances where an operator can be trapped or clamped.

Collaborative Assembly Applications

Safety solutions and considerations for a successful machine tending automation project

Assembly applications for cobots often can involve special tooling and close collaboration with operators while also require high speed operation zones.



Assembly applications due to their wide use of tools and custom end of arm tooling can be more complex than other applications. Applications involving multiple cobots and operator are possible which require coordinated safety solutions.

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