

The background of the entire page is a light gray technical drawing. It features various mechanical components, pipes, valves, and tanks, all rendered in thin white lines. The drawings are scattered across the page, with some larger, more complex assemblies in the upper half and smaller, individual components in the lower half. The overall style is that of a professional engineering or industrial design blueprint.

SAFETY

# SAFETY

[shellomatic.com](http://shellomatic.com)

**SHELL-O-MATIC**

+1.514.323.0868

# ENHANCING ROBOT AND MACHINE SAFETY

## ENSURING SAFE INTERACTION BETWEEN INDUSTRIAL ROBOTS AND THEIR OPERATORS IS AN ESSENTIAL PART OF A HIGH-FUNCTIONING INTEGRATED SYSTEM.

At Shell-O-Matic, we work with the ANSI/RIA R15.06 (Industrial Robot and Robot Systems Safety Requirements), ISO 10218 (Safety requirements for industrial robots) and ISO 12100/ ISO 13849 (Safety of Machinery) guidelines to provide the comprehensive safety solutions specific to our customers' needs.

Table 2 – Risk level decision matrix			
Severity of injury	Exposure to the hazard	Probability of the hazard	Risk level
S1 - Minor	E1 - Low	A1 - Low	NEGLIGIBLE
	E2 - High	A2B3 - Medium/Not possible	LOW
	E3 - Medium	A3 - High	MEDIUM
	E4 - High	A4 - High	HIGH
S2 - Moderate	E1 - Low	A1 - Low	NEGLIGIBLE
	E2 - High	A2B3 - Medium/Not possible	LOW
	E3 - Medium	A3 - High	MEDIUM
	E4 - High	A4 - High	HIGH
S3 - Serious	E1 - Low	A1 - Low	NEGLIGIBLE
	E2 - High	A2B3 - Medium/Not possible	LOW
	E3 - Medium	A3 - High	MEDIUM
	E4 - High	A4 - High	HIGH

Table 3 – Hierarchy of risk reduction measures			
Measure	Measure	Measure	Measure
Elimination	Substitution	Limit interaction	Safeguards and Safety-Related Parts of the Control System (SRPS)
Complementary Protective Measures	Warnings and Awareness Means	Administrative Controls	Personal Protective Equipment (PPE)

Table 5 – Minimum functional safety performance			
Risk Level	PL <sub>r</sub>	Structure Category	
NEGLIGIBLE (see 6.5.3.1)	b	-	
LOW	c	2	
MEDIUM	d	2	
HIGH	d	3	
VERY HIGH (see 6.5.3.2)	e	4	

Three-step process:

- » Generating a risk assessment matrix of your machinery, as required by the relevant standards
- » Analyzing all interactions between humans and machines
- » Providing risk-reduction strategies

## DYNAMIC CONTROL OF ROBOT WORKING ENVELOP

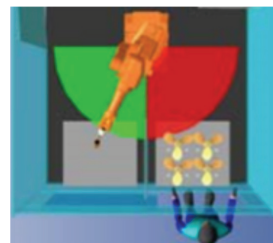
Controlling the robot's working envelop (its reach) is the first step to creating a dynamic and safe collaboration between the robot and an operator.

Robot manufacturers offer software options to dynamically control the robot working envelop as a function of system status.

No restriction on robot working envelop



Dynamic restriction of envelop



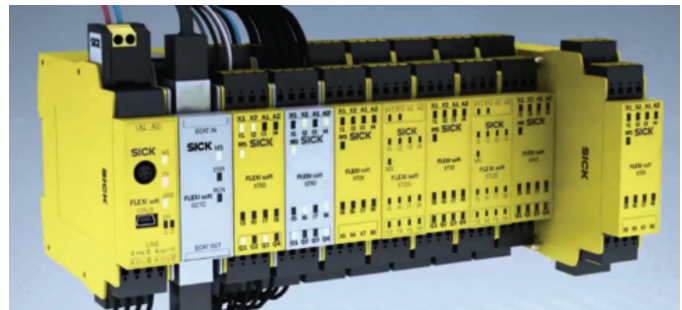
Dynamic Robot Working Envelop Control

# PROGRAMMABLE SAFETY CONTROLLER

An optional part of the Shell-O-Matic Supervisory system, the programmable safety controller allows for more complex safety logic.

Advantages of the programmable safety controller:

- » Manage the various safety devices and functions required with a robotic cell
- » Scalable
- » Reprogrammable, so it can evolve the logic or system with changing customer needs
- » Communicates at the machine network level
  - Share safety system status
  - Adjust PLC control logic
  - Display appropriate messages on the HMI screen



## SAFETY DEVICES

Shell-O-Matic can create a custom safety system tailored to customer needs. The system can be connected to various safety devices, including:

- » Light curtains
- » E-stop buttons
- » Two-hand controls
- » Area scanner
- » Safety mats

This system allows Shell-O-Matic to deliver not only a new state-of-the-art safety system, but also to retrofit or upgrade existing robotic cell safety systems.

