



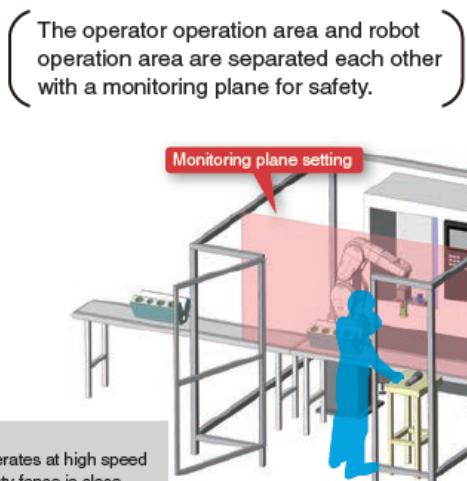
MEAU ROBOTS - SAFETY COOPERATIVE

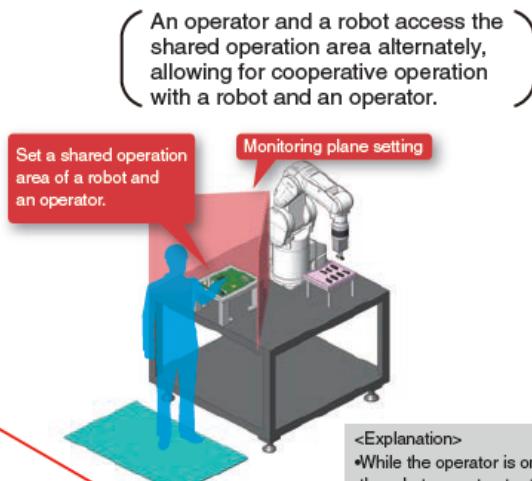
Pete Archer – Product Specialist

01-2020

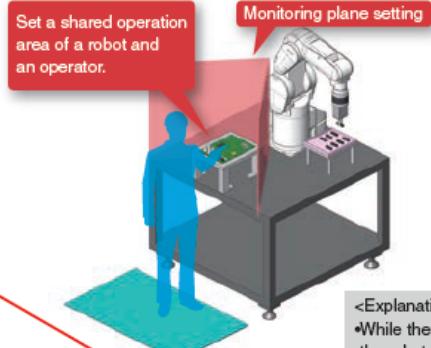
By adding Mitsubishi Electric Factory Automation's robot safety option to a Mitsubishi Robotic solution, your robots can perform in a cooperative mode with your operators. The "robot safety option", used together with external devices such as a safety switch or light curtain, enhances the robot safety function. Cooperative Robotic applications are applications where the operator and machinery are mostly operating in their own space but need to interact occasionally for short periods of time.

Examples of safety options


The operator operation area and robot operation area are separated each other with a monitoring plane for safety.

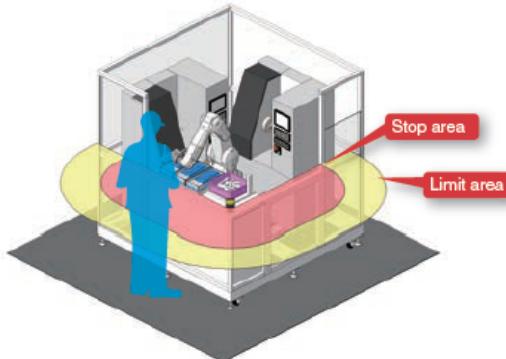

An operator and a robot access the shared operation area alternately, allowing for cooperative operation with a robot and an operator.

<Explanation>
•The robot operates at high speed while the safety fence is close.
•While the safety fence is open, the robot continues its operation at low speed inside the monitoring plane. The operator can perform inspection inside the safety fence and outside the monitoring plane.



<Explanation>
•While the operator is on the mat, the robot cannot enter the shared operation area.
•While the operator is not on the mat, the robot operates inside the shared operation area.

Area sensors secure the safety without safety fence.



<Explanation>
•When the operator enters the limit area, the robot operation speed is limited.
•Further, the operator approaches to the stop area, the robot stops its operation.



The robot safety option adds the following functionality:

- Safe Torque Off (STO): The function shuts off driving energy to the motors of the robot.
- Safe Operating Stop (SOS): Without shutting off the driving energy to the motors, this function monitors the robot so that it stays at rest.
- Safe Stop Function 1 (SS1): This is a function to stop the robot safely. After stopping the robot, power off the motors.
- Safe Stop Function 2 (SS2): This is a function to stop the robot safely. While the motor control keeps working after the robot stops, this function monitors the robot so that it does not work.
- Safety Limited Speed function (SLS): This is a function to monitor the robot arm and the tools so that their speeds do not exceed specified limits.
- Safely Limited Position function (SLP): This is a function to monitor whether positions of the robot arm and the hand are in a safe area.

For more information, please visit [http://dl.mitsubishielectric.com/dl/fa/document/catalog/robot/l\(na\)-09091eng/09091c.pdf#page=28](http://dl.mitsubishielectric.com/dl/fa/document/catalog/robot/l(na)-09091eng/09091c.pdf#page=28)



Safety option / Features

Operators can enter an operation area without stopping robots.

- High safety compliant with international standards

- Robot's automatic operation continues even with a safety fence opened.

The safety input function enables safety doors to open without causing an emergency stop of the robot.

- Operators and robots share an operation area. = They can cooperate.

While an operator is in a cooperative operation area, a robot does not approach the area. (Operation range limit function)

- Robots in cooperative operation keeps the safety speed.

A robot in cooperative operation continues its operation at the safety speed to secure operator's safety.

- Robots can automatically shift to single operation from cooperative operation.

Closing the safety door switches cooperative operation to single operation, and enables the robot to approach to the shared area.

*Risk assessment and safety level proof need to be performed for the system. Please contact us if you require any further information.

Safety monitoring function

Safety features compliant with the requirements of international standards are provided that make risk assessment easier.

Safety feature	Details	Comment	
STO function	Electrically shuts off power to the motors in the robot body	IEC 61800-5-2, category 4, PLe, SIL3	Supported as standard
SLS function	Monitors the TCP speed so that it does not exceed the monitoring speed.	EN61800-5-2-compliant	Supported in combination with each safety option
SLP function	Monitors a specified monitoring position so that it does not go beyond the position monitoring surface.	EN61800-5-2-compliant	
SOS function	Monitors the robot to ensure that it does not move from its stopped position	EN61800-5-2-compliant	
SS1 function	Function stopped by STO	IEC 60204-1 stop category 1	
SS2 function	Function stopped by the SOS	IEC 60204-1 stop category 2	