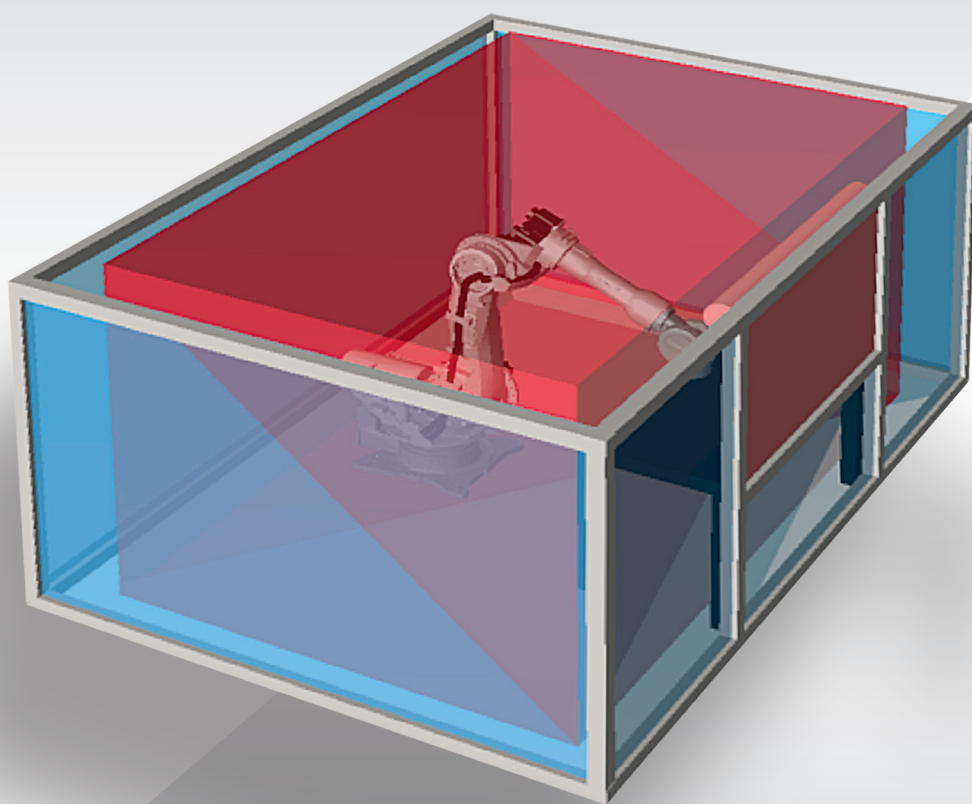


YASKAWA

Functional Safety Unit (FSU)

Improved Safety Functions
with integrated Safety Controller



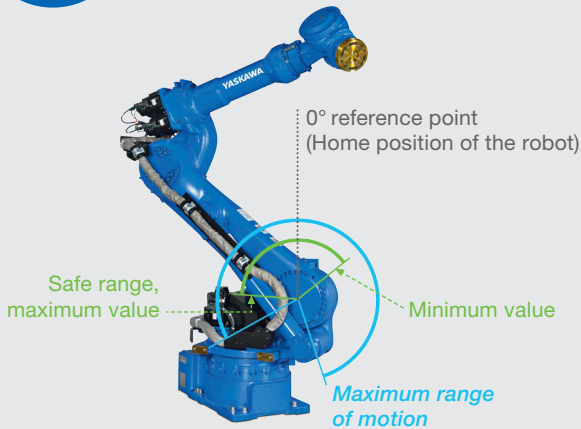
DX200

YRC1000

Functions (Examples)



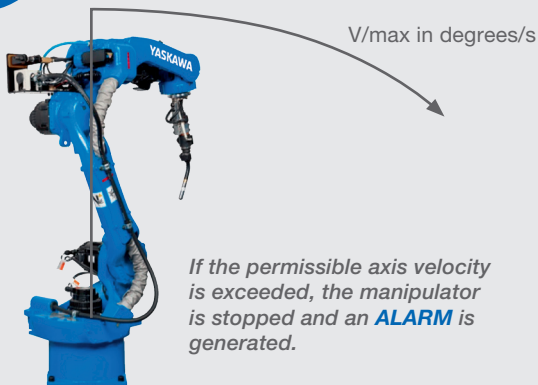
Individual Axis Range Limitation



- Defines **permissible range of motion** for each robot axis, base axis and station axis
- Definition of up to **32 conditional files**



Individual Axis Speed Monitoring

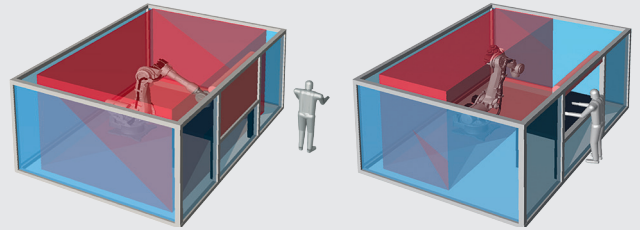


- Defines **max. permissible individual single axis speed** of the robot axis, base axis and station axes
- Definition of up to **32 conditional files**
- With **standstill monitoring** (in case 0°/s is set as max. speed limit)

Manipulator does not regulate its axis speed to defined speed of selected file. For each robot axis a separate max. single axis speed limit can be defined.



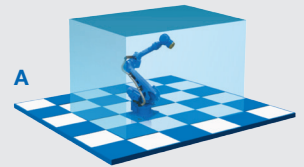
Safety Range Limitation



- Defines **workspaces** within which the robot can move freely
- Takes into consideration the **overall contour of the robot and tool**
- **Real-time playback** of the robot position on the programming pendant
- Definition of up to **32 conditional files**
- Depending on the contour, **multiple areas can be activated simultaneously**

Safe areas can be defined ...

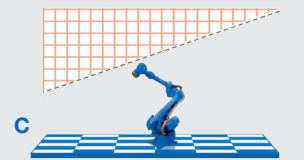
A ... that the manipulator **must not leave**.



B ... that the manipulator **must not enter**.

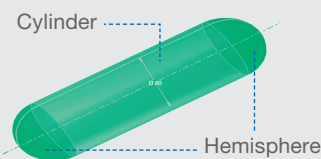


C ... as **limits**, e.g. infinitely long walls/inclined surfaces.



If the manipulator attempts to leave a defined space, it is immediately stopped by the FSU! (Regardless of its speed)

- Definition of up to **5 envelope curves** to define the shape of the tool

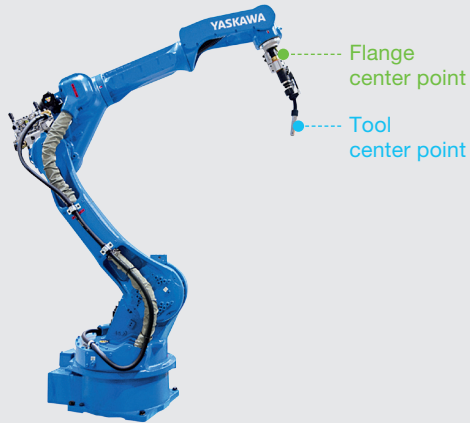


Envelope curve is formed from a cylindrical central part and a hemisphere at each end of the cylinder.

The complete tool must be enclosed by the envelope curves.



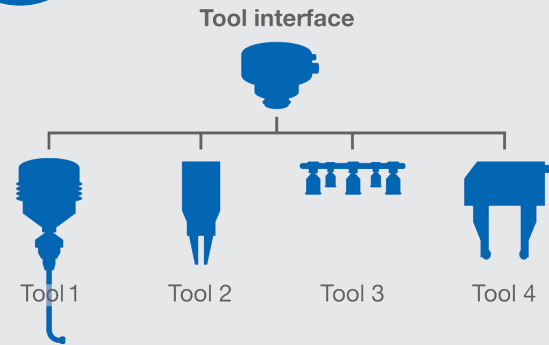
Safety Speed Limitation



- **Speed of the Tool Center Point (TCP)** is limited and monitored. If no TCP is defined, the Flange Center Point (FCP) is limited and monitored
- Definition of up to **32 conditional files**
- With **standstill monitoring**



Tool Change Monitoring

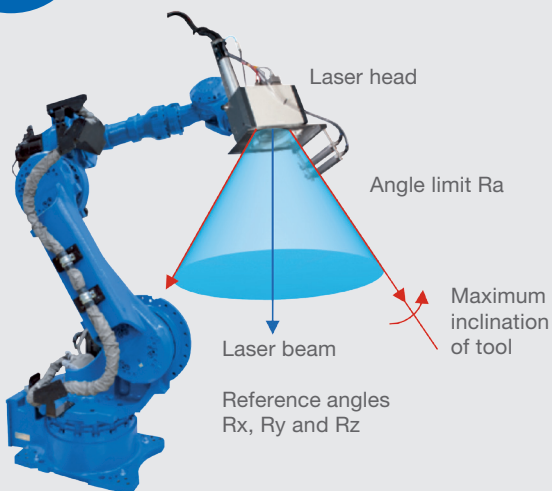


- **Monitoring** that the **correct tool** is used for each motion instruction in the robot job
- Up to **16 different tools per robot can be defined**

Teach mode monitors whether the selected tool matches the tool that is actually being used.



Tool Angle Monitoring



- **FSU monitors the tool angle** in space and ensures that the tool orientation remains within the cone defined by angle limit Ra
- Definition of up to **32 conditional files**

Note



Maximum:
3 external axes
for **6-axis** robots



Maximum:
2 external axes
for **7-axis** robots



Maximum:
16 tools
per robot

Safety Mode

- Settings for the FSU can only be made in Safety Mode
- Safety Mode is protected by an editable password



Control of FSU functions

- Activation/deactivation of safety functions by means of dual-channel binary control (8 inputs)
- Freely definable binary patterns for activation of functions
- Multiple individual functions can be activated simultaneously
- Multiple axis and range limitations can be activated simultaneously
- Up to 8 dual-channel safe outputs can be assigned (each safe output can only be assigned once)
- Optional control via ProfiSafe or Ethernet IP Safety (max. 64 inputs and outputs*)

* Currently only for DX200 controller

CRC Code (checksum)

- The robot controller creates a separate checksum (CRC Code) for all safety-relevant data and functions. This is recalculated every time values and settings are changed and is saved with the change date.
- The function of the checksum is to enable quick and easy verification and documentation of possible changes to settings.
- Checksum data is stored in the individual data back-ups of the FSU functions and system files.

Display of the checksum on the Teachbox

DATA	EDIT	DISPLAY	UTILITY
EX. MEMORY	PARAMETER	SETUP	SAFETY FUNC.
PM	DISPLAY SETUP	TOTAL_CRC_CONFIRM	
TOOL		LAST UPDATE	3077564303
TOOL INTERFERE		LAST UPDATE	2017/03/08 16:33
HOME POS CALIB		LAST UPDATE	0530771238
AXIS RANGE LIMIT		LAST UPDATE	2017/03/08 16:35
AXIS SPEED MONITOR		LAST UPDATE	1047733930
ROBOT RANGE LIMIT		LAST UPDATE	2017/03/08 16:33
SPEED LIMIT		LAST UPDATE	2764763989
TOOL ANGLE MONITOR		LAST UPDATE	2017/02/23 13:22
		LAST UPDATE	2155873973
		LAST UPDATE	2786858021
		LAST UPDATE	2017/01/27 12:28
		LAST UPDATE	3941984649
		LAST UPDATE	2017/02/23 13:24
		LAST UPDATE	1558066036



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