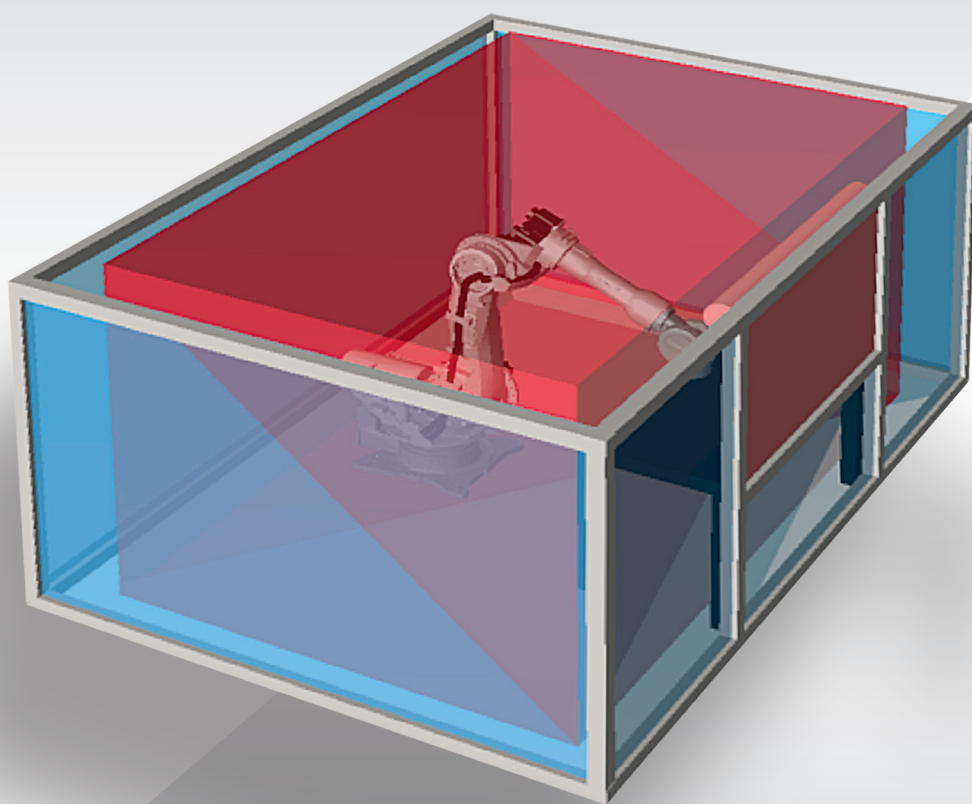


YASKAWA

Functional Safety Unit (FSU)

Improved Safety Functions
with integrated Safety Controller



DX200

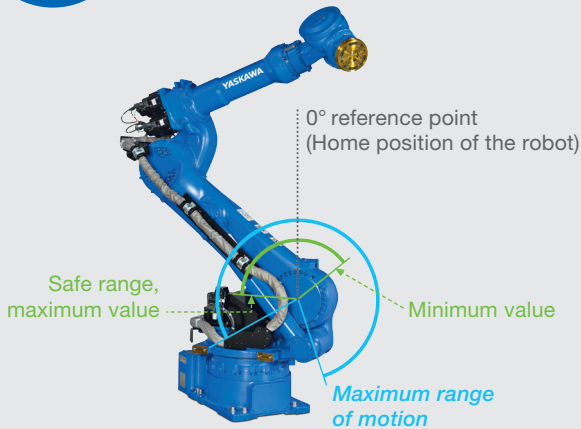
YRC1000

Functional Safety Unit (FSU)

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

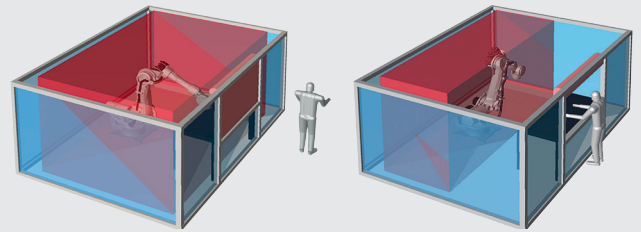


- Defines **max. permissible individual single axis speed** of the robot axis, base axis and station axes
- Definition of up to **32 conditional files**
- With **standstill monitoring** (in case 0°/s is set as max. speed limit)

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.



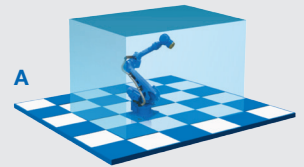
Safety Range Limitation



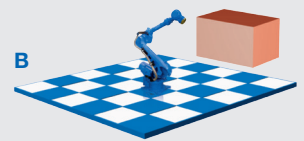
- Defines **workspaces** within which the robot can move freely
- Takes into consideration the **overall contour of the robot and tool**
- **Real-time playback** of the robot position on the programming pendant
- Definition of up to **32 conditional files**
- Depending on the contour, **multiple areas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

Safe areas can be defined ...

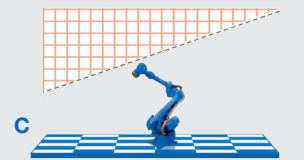
A ... that the manipulator **must not leave**.



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

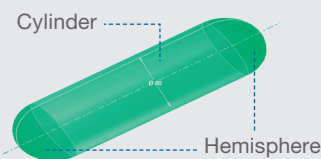


C ... as **limits**, e.g. infinitely long walls/inclined surfaces.



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

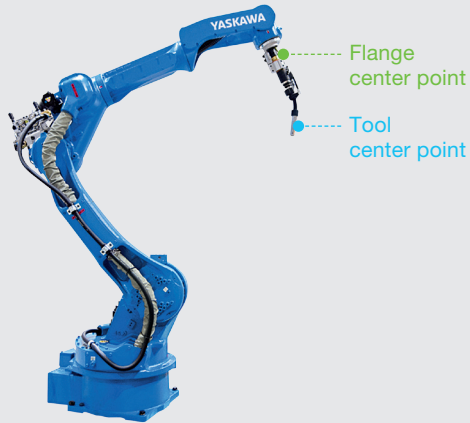


Envelope curve is formed from a cylindrical central part and a hemisphere at each end of the cylinder.

The complete tool must be enclosed by the envelope curves.



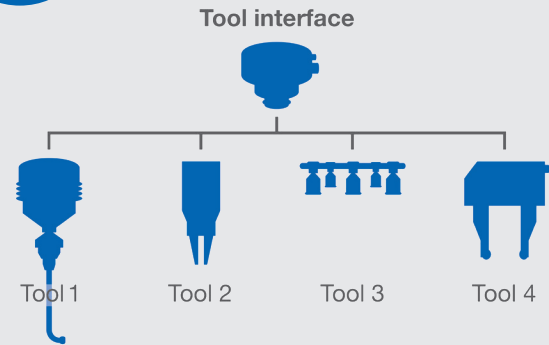
Safety Speed Limitation



- **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

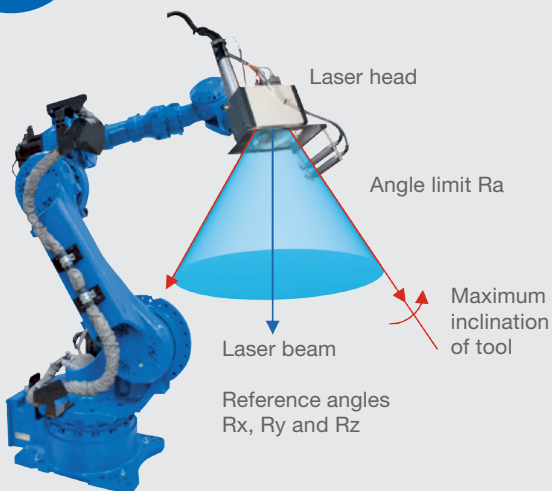


- **Monitoring** that the **correct tool** is used for each motion instruction in the robot job
- Up to **16 different tools per robot can be defined**

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

TOTAL CRC CONFIRM	
TOOL	3077564303
TOOL INTERFERE	0530771238
HOME POS CALIB	1047733930
AXIS RANGE LIMIT	2764763989
AXIS SPEED MONITOR	2155873973
ROBOT RANGE LIMIT	2786858021
SPEED LIMIT	3941984649
TOOL ANGLE MONITOR	1558066036



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