# KUKA KRC4

## Operators

# Safety

- Triggers for stop reactions

| Trigger | T1, T2 | AUT, AUT EXT |
|---|---|---|
| Start key released | STOP 2 | - |
| STOP key pressed | STOP 2 | |
| Drives OFF | STOP 1 | |
| $MOVE_ENABLE input drops out | STOP 2 | |
| Power switched off via main switch or power failure | STOP 0 | |
| Internal error in non-safety-oriented part of the robot controller | STOP 0 or STOP 1 (dependent on the cause of the error) | |
| Operating mode changed during operation | Safety stop 2 | |
| Safety gate opened (operator safety) | - | Safety stop 1 |
| Enabling switch released | Safety stop 2 | - |
| Enabling switch pressed fully down or error | Safety stop 1 | - |
| E-STOP pressed | Safety stop 1 | |
| Error in safety controller or periphery of the safety controller | Safety stop 0 | |

# Safety

- Overview of the safety functions

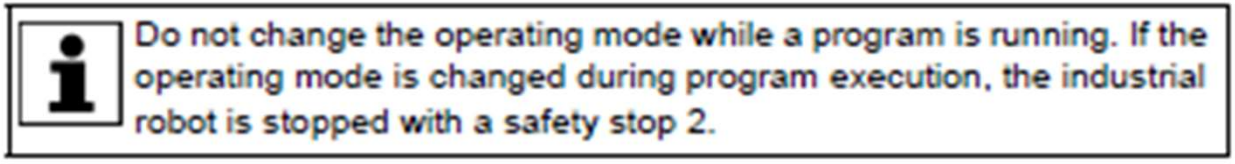
- ❑ Selecting the operating mode
- ❑ Operator safety (= connection for the monitoring of physical safeguards)
- ❑ EMERGENCY STOP device (must pressed at least once every 12 months)
- ❑ Enabling device
- ❑ External safe operational stop
- ❑ External safety stop 1
- ❑ External safety stop 2
- ❑ Velocity monitoring in T1

# Safety

- Selecting the operating mode

The industrial robot can be operated in the following modes:

- ❑ Manual Reduced Velocity (T1)
- ❑ Manual High Velocity (T2)
- ❑ Automatic (AUT)
- ❑ Automatic External (AUT EXT)



# Safety

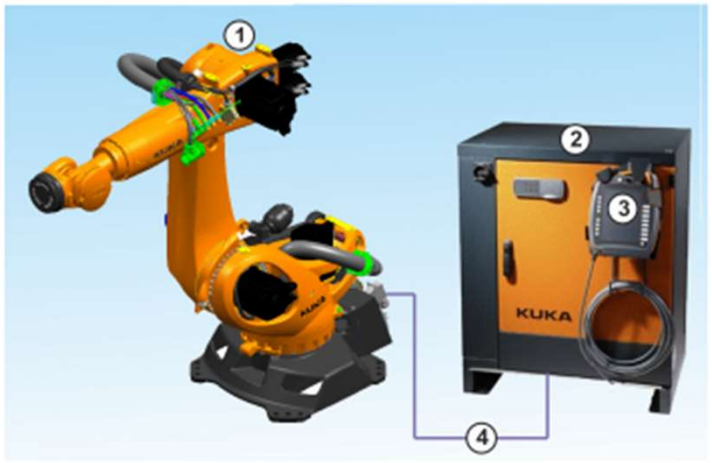
- Overview of operating modes and safety functions

The following table indicates the operating modes in which the safety functions are active.

| Safety functions | T1 | T2 | AUT | AUT EXT |
|---|---|---|---|---|
| Operator safety | - | - | Active | Active |
| EMERGENCY STOP device | Active | Active | Active | Active |
| Enabling device | Active | Active | - | - |
| Reduced velocity during program verification | Active | - | - | - |
| Jog mode | Active | Active | - | - |
| Software limit switches | Active | Active | Active | Active |

# Robot System

- Overview of the industrial robot



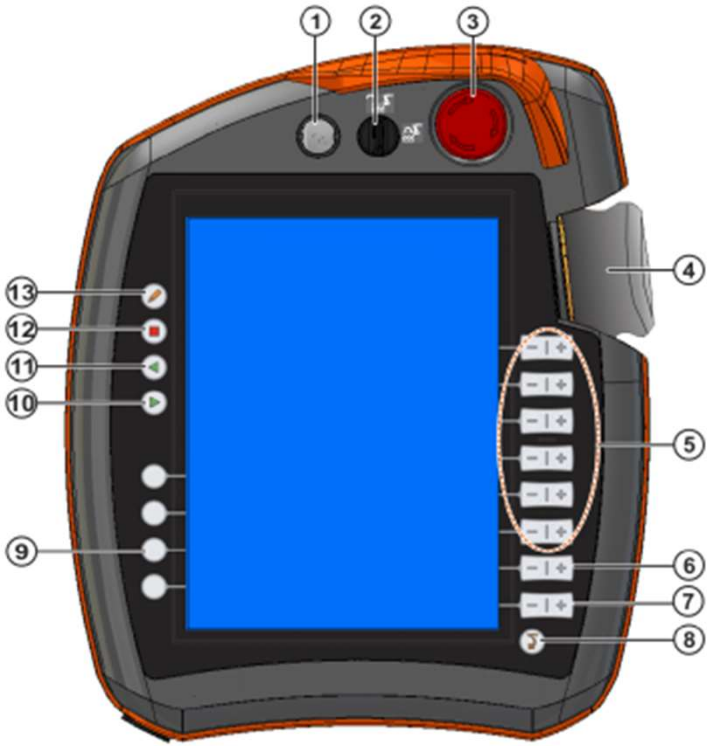

1 Manipulator
2 Robot controller
3 KUKA smartPAD
4 Connecting cables

The industrial robot consists of the following components:

- Manipulator
- Robot controller
- Teach pendant
- Connecting cables
- Software
- Options, accessories

# Operating

- SmartPAD




| Item | Description |
|---|---|
| 1 | Button for disconnecting the smartPAD<br>(>>> 4.1.3 "Disconnecting and connecting the smartPAD" Page 44) |
| 2 | Mode selector switch. The switch may be one of the following variants:<br>■ With key<br>■ Without key<br>The mode selector switch is used to call the connection manager. The operating mode can be changed by using the connection manager.<br>(>>> 4.12 "Changing operating mode" Page 59) |
| 3 | EMERGENCY STOP device Stops the robot in hazardous situations. The EMERGENCY STOP button locks itself in place when it is pressed. |
| 4 | Space Mouse: For moving the robot manually |
| 5 | Jog keys: For moving the robot manually |
| 6 | Key for setting the program override |
| 7 | Key for setting the jog override |
| 8 | Main menu key: Shows the menu items on the smartHMI. It can also be used for creating screenshots. |
| 9 | Status keys. The status keys are used primarily for setting parameters in technology packages. Their exact function depends on the technology packages installed. |
| 10 | Start key: The Start key is used to start a program. |
| 11 | Start backwards key: The Start backwards key is used to start a program backwards. The program is executed step by step. |
| 12 | STOP key: The STOP key is used to stop a program that is running. |
| 13 | Keyboard key<br>Displays the keyboard. It is generally not necessary to press this key to display the keyboard, as the smartHMI detects when keyboard input is required and displays the keyboard automatically.<br>(>>> 4.2.1 "Keypad" Page 46) |

# Operating

- SmartPAD Rear view


1 Enabling switch

2 Start key (green)

3 Enabling switch

4 USB connection

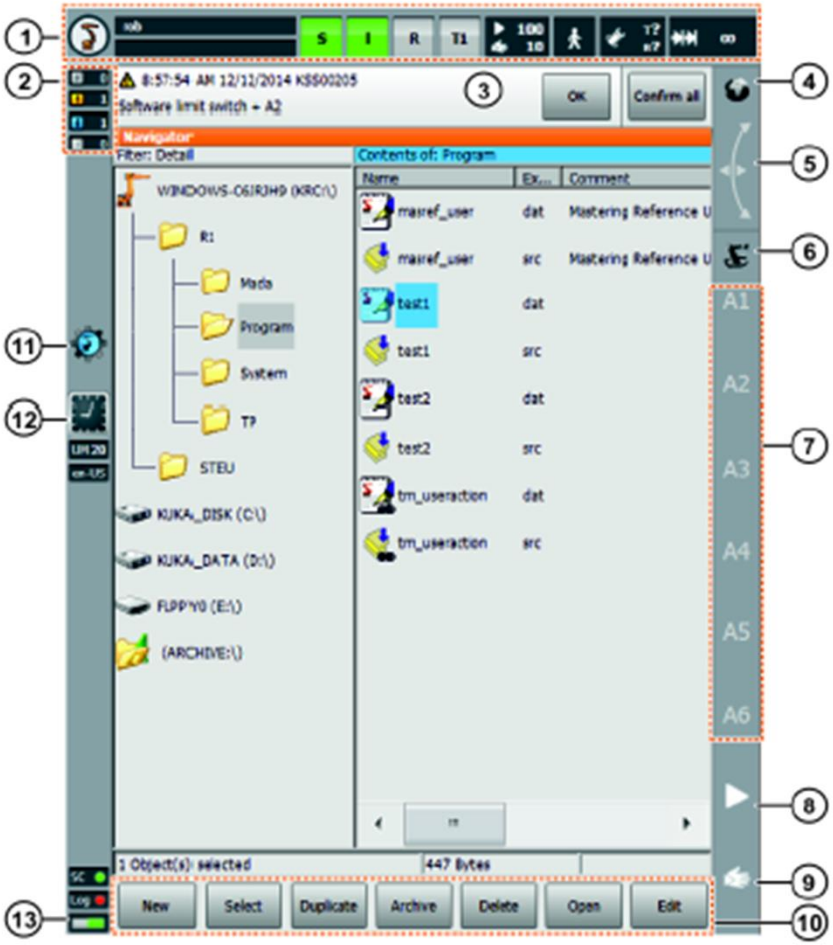
5 Enabling switch

6 Identification plate

| Element | Description |
|---|---|
| **Rating plate** | Rating plate |
| **Start key** | The Start key is used to start a program. |
| **Enabling switch** | The enabling switch has 3 positions:<br>■ Not pressed<br>■ Center position<br>■ Fully pressed (panic position)<br>The enabling switch must be held in the center position in operating modes T1 and T2 in order to be able to jog the manipulator.<br>In the operating modes Automatic and Automatic External, the enabling switch has no function. |
| **USB connection** | The USB connection is used, for example, for archiving and restoring data.<br>Only for FAT32-formatted USB sticks. |

# Operating

- KUKA smartHMI user interface




1 Status bar

2 Message counter

3 Message window

4 Space Mouse status

5 Spave Mouse alignment

6 Jog keys status

7 Jog key labels

8 Program override

9 Jog override

10 Button bar

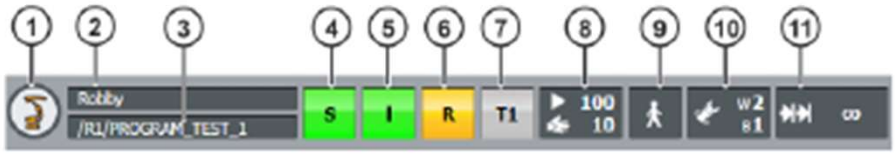
11 WorkVisual icon

12 Clock

13 Life sign display

# Operating

- Status Bar




1 Main menu key

2 Robot name

3 If a program has been selected, the name

4 Submit interpreter status indicator

5 Drives status indicator

6 Robot interpreter status indicator

7 Current operating mode

8 POV/HOV status indicator

9 Program run mode status indicator

10 Tool/base status indicator

11 Incremental jogging status indicator

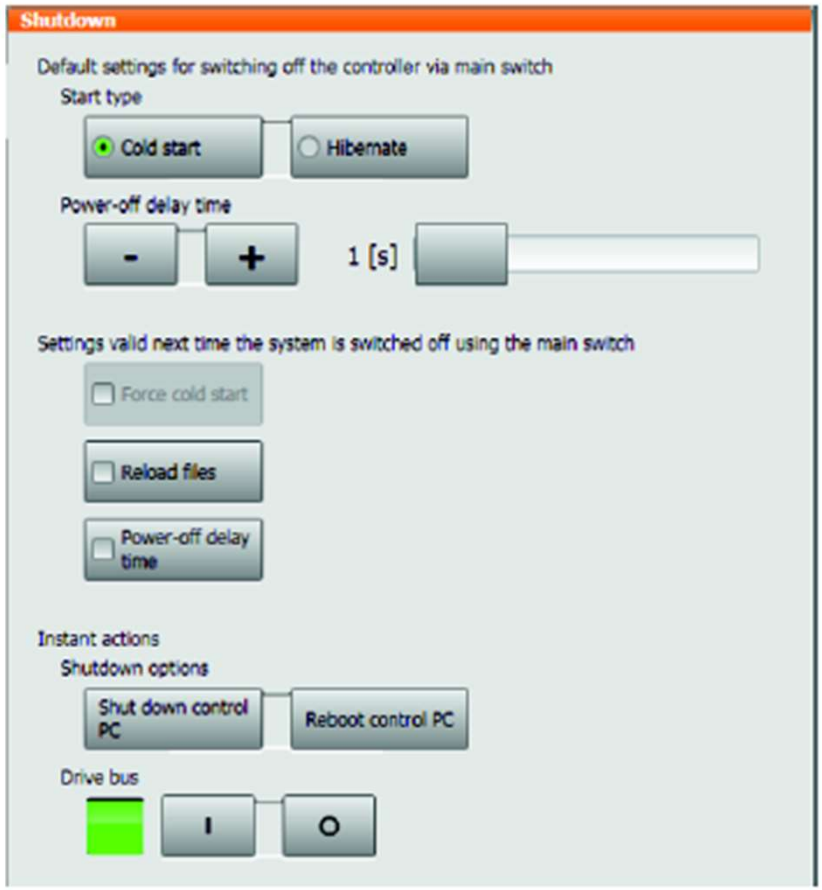
# Operating

- Submit interpreter status indicator

| Icon | Color | Description |
|---|---|---|
|  | Yellow | The submit interpreter is selected. The block pointer is situated on the first line of the selected SUB program. |
|  | Green | A SUB program is selected and running. |
|  | Red | The submit interpreter has been stopped. |
|  | Gray | The submit interpreter is deselected. |

# Operating

- Exiting or restarting KSS




The KSS starts in whatever operating mode was most recently selected. Exceptions:

- If the most recent operating mode was T2, the mode after starting is T1.
- After an initial cold start, the operating mode is T1.

**Procedure**

1. Select the menu item **Shutdown** in the main menu.

2. Select the desired options.

3. Press **Shut down control PC** or **Reboot control PC**.

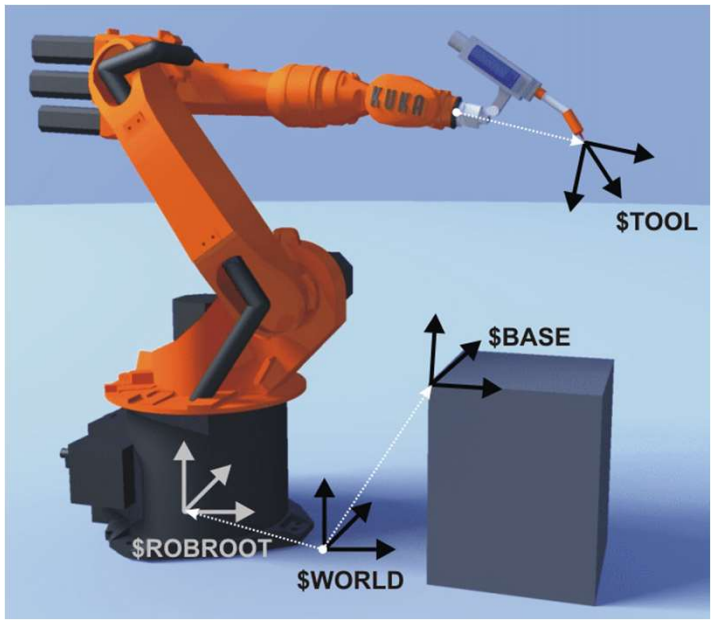
4. Confirm the request for confirmation with **Yes**. The System Software is terminated and restarted in accordance with the selected option.

After the restart, the following message is displayed:

- *Cold start of controller*
- Or, if **Reload files** has been selected: *Initial cold start of controller*

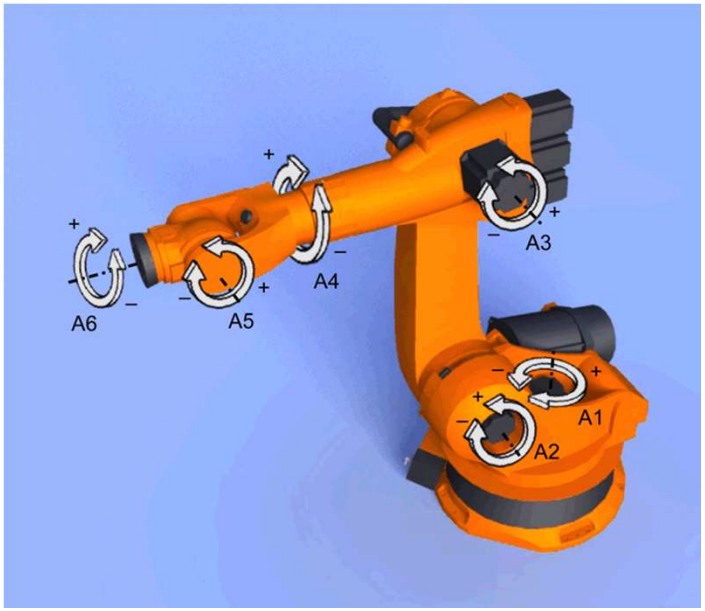
# Operating

- Joging




There are 2 ways of jogging the robot:

- Cartesian jogging; The TCP is jogged in the positive or negative direction along the axes of a coordinate system.
- Axis-specific jogging; Each axis can be moved individually in the positive or negative direction.



# Operating

- Starting Automatic External mode

**Robot interpreter status indicator**

| Icon | Color | Description |
|---|---|---|
|  | Gray | No program is selected. |
|  | Yellow | The block pointer is situated on the first line of the selected program. |
|  | Green | The program is selected and is being exe-cuted. |
|  | Red | The selected and started program has been stopped. |
|  | Black | The block pointer is situated at the end of the selected program. |

Procedure;

1. Select the program CELL.SRC in the Navigator. (This program is located in the folder “R1”.)

2. Set program override to 100%. (This is the recommended setting. A different value can be set if required.)

3. Carry out a BCO run:

Hold down the enabling switch. Then press the Start key and hold it down until the message “Programmed path reached (BCO)” is displayed in the message window.

4. Select “Automatic External” mode.

5. Start the program from a higher-level controller (PLC).

To stop a program that has been started in Automatic mode, press the STOP key.

# Operating (advanced)

- Block pointer

```
5  PTP P3 Vel=100 % PDAT1 Tool[1] Base[0]
6  PTP P4 Vel=100 % PDAT2 Tool[1] Base[0]
7  PTP P5 Vel=100 % PDAT3 Tool[1] Base[0]
```

The robot moving from P3 to P4

```
5  PTP P3 Vel=100 % PDAT1 Tool[1] Base[0]
6  PTP P4 Vel=100 % PDAT2 Tool[1] Base[0]
7  PTP P5 Vel=100 % PDAT3 Tool[1] Base[0]
```

The robot has reached P4 with exact positioning

- Program run modes

| Designation | Status Indicator | Descriptions |
|---|---|---|
| Go<br>#GO |  | The program is executed through to the end without stopping. |
| Motion<br>#MSTEP |  | The program is executed with a stop at each point, including auxiliary points and the points of a spline segment. The Start key must be pressed again for each point. The program is executed without advance processing. |
| Single Step<br>#ISTEP |  | The program is executed with a stop after each program line. |

# Operating (advanced)

- Starting a program forwards (manual)

**Precondition**

- A program is selected.
- Operating mode T1 or T2

**Procedure**

1. Select the program run mode.
2. Hold the enabling switch down and wait until the status bar indicates

“Drives ready”:

3. Carry out a BCO run: Press Start key and hold it down until the message

“Programmed path reached (BCO)” is displayed in the message window. The robot stops.

4. Press Start key and hold it down.

The program is executed with or without stops, depending on the program run mode.

To stop a program that has been started manually, release the Start key.

**⚠ CAUTION** The BCO run is executed as a LIN or PTP motion from the actual position to the target position. The velocity is automatically reduced. The path of the motion cannot be predicted reliably. Observe the motion during the BCO run so that the robot can be stopped in time if a collision becomes imminent.

# Operating (advanced)

- Carrying out a block selection

**Description**

A program can be started at any point by means of a block selection.

**Precondition**

- A program is selected.
- Operating mode T1 or T2

**Procedure**

1. Select the program run mode.

2. Select the motion block at which the program is to be started.

3. Press Block selection. The block pointer indicates the motion block.

4. Hold the enabling switch down and wait until the status bar indicates

“Drives ready”:

5. Carry out a BCO run: Press the Start key and hold it down until the message

“Programmed path reached (BCO)” is displayed in the message window.

The robot stops.

6. The program can now be started manually or automatically. It is not necessary to carry out a BCO run again.

**⚠ CAUTION** The BCO run is executed as a LIN or PTP motion from the actual position to the target position. The velocity is automatically reduced. The path of the motion cannot be predicted reliably. Observe the motion during the BCO run so that the robot can be stopped in time if a collision becomes imminent.

# Operating (advanced)

- Resetting a program

**Description**

In order to restart an interrupted program from the beginning, it must be reset.

This returns the program to the initial state.

**Precondition**

- Program is selected.

**Procedure**

- Select the menu sequence Edit > Reset program.

**Alternative procedure**

- In the status bar, touch the **Robot interpreter** status indicator. A window opens. Select **Reset program**.