Quickguide

Operating of the robot

KUKA Roboter

KSS Release 8.x

Farbkennzeichnungen/Color coding:

Bedienung des Roboters/(**O**)perating of the robot

Mechaniktabellen/(**M**)echanical tables

Service Elektrik/(**E**)lectrical equipment

Wichtige KRL-Syntax/Important KRL-(**S**)yntax

Feldbustechnologie/(**F**)ield bus technology

Querschnittstechnologie/Cross Sectional Technology–Robo(**T**)eam

Querschnittstechnologie/Cross Sectional Technology–SafeOperatio(N)

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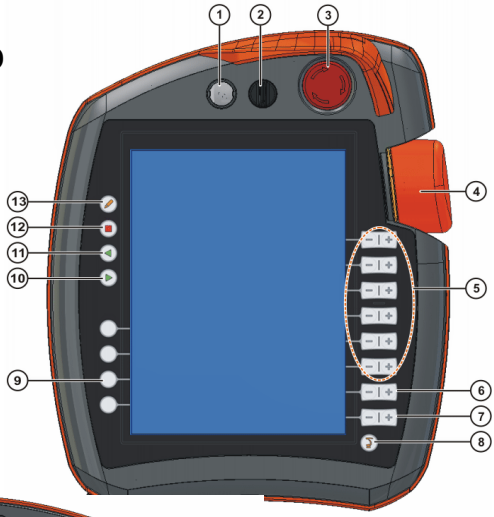
Contents – Operator Control

KUKA smartPAD

Front view



Rear view

Legend for front view:

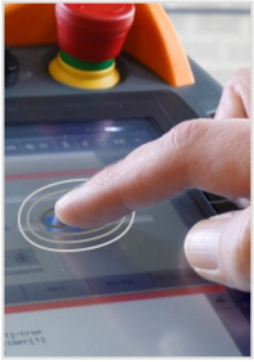
Item	Element	Description
1	Request button for disconnecting the smartPAD	Must be pressed if the smartPAD is to be disconnected.
2	Keyswitch	For calling the connection manager, in which the operating mode can be selected.
3	E-STOP pushbutton	Stopping the robot in a dangerous situation
4	Space Mouse	For jogging the robot
5	+/- jog keys	For jogging the robot
6	+/- key	Setting the program override
7	+/- key	Setting the jog override
8	Main menu key	Displaying the main menu
9	Status keys	Setting parameters in technology packages
10	Start key	Starting the selected program
11	Start backwards key	Executing the program backwards motion by motion
12	STOP key for stopping a program	Stopping the robot in Automatic mode
13	Show keyboard	Displaying the touch pad keyboard

Legend for rear view:

Item	Element	Description
1	Enabling switch	Switching on the drives
2	Start key	Starting the selected program
3	Enabling switch	Switching on the drives
4	USB connection	For archiving
5	Enabling switch	Switching on the drives
6	Identification plate	Serial number

Handling the smartPAD user interface

Opening and closing operator control elements



Objects on the smartPAD interface are opened and closed by tapping on the element.

Menu items are opened by tapping on the menu and closed again by tapping on the red **X**.

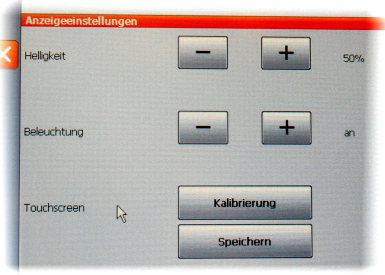
In this Quick Guide, elements that have to be tapped to open objects or menu items are ringed in red.

Setting contrast and brightness

1) Open the connection manager

2) Press the main menu key

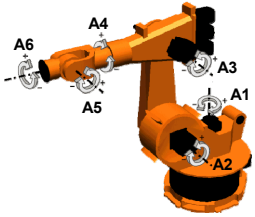
3) Select “Display”
4) Make display settings



Coordinate systems

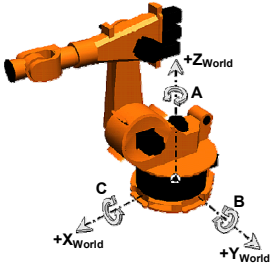
Axis-specific coordinate system

Each axis can be moved individually in a positive or negative direction.
Area of application: Rough setting-up. Only way of moving an unmastered robot. Moving away from a software limit switch or a singularity.



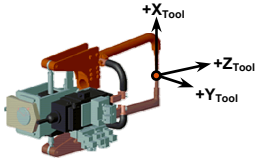
World coordinate system

Fixed coordinate system whose origin is located at the base of the robot.
Area of application: Motion of the robot to any point in space using the +/- keys or 6D mouse. Tool and BASE calibration.



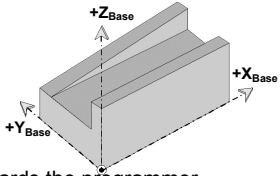
Tool coordinate system

Coordinate system whose origin is located in the robot tool.
Area of application: Motion with the tool along a straight line if the orientation of the tool is inclined. Spot welding on the workpiece. Gripper functions on the workpiece.



Base coordinate system

Coordinate system whose origin is located in the workpiece.
Area of application: Motion of workpiece with calibrated base. Intuitive Space Mouse jogging on the workpiece if the positive X axis of the BASE coordinate system is pointing towards the programmer.

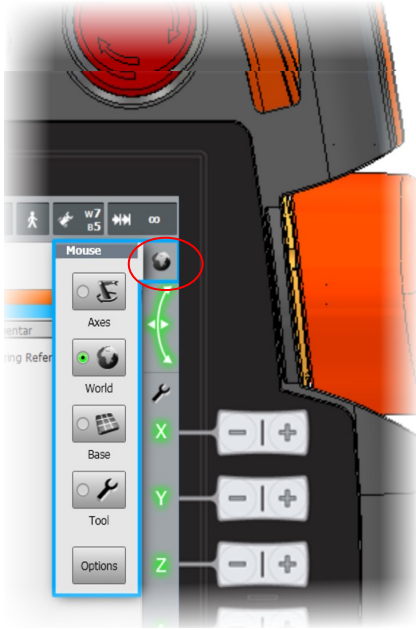


Jogging

+/- keys and Space Mouse

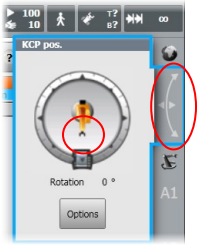
A separate coordinate system can be defined independently for the +/- keys and the Space Mouse.

Coordinate systems for +/- keys



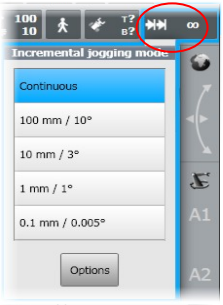
Coordinate systems for Space Mouse

Setting the mouse position



Select/deselect by tapping.
The position is set in 45° steps.

Incremental jogging



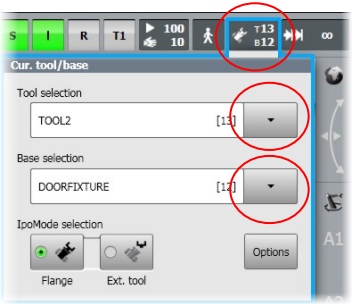
Make the desired setting for jogging.
In this example, “Continuous” is active (button highlighted in blue).

Status	Description
Continuous	Incremental jogging switched off
100 mm/10°	Increment = 100 mm or 10°
10 mm/3°	Increment = 10 mm or 3°
1 mm/1°	Increment = 1 mm or 1°
0.1 mm/0.005°	Increment = 0.1 mm or 0.005°
Options	See page 14

Increments in	Description
millimeters [mm]	Valid for Cartesian jogging in the X, Y or Z direction
degrees [°]	Valid for Cartesian jogging in the A, B or C direction and axis-specific jogging

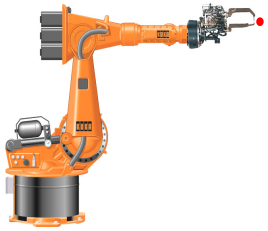
Setting the tool and base

These settings only apply to jogging.

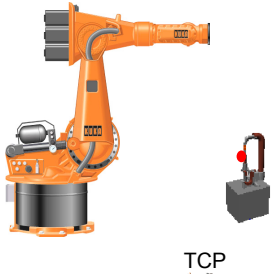


IpoMode selection	Description
Flange	Reference point for tool and base is the TCP on the flange or the calibrated TCP of the tool mounted on the flange.
External tool	Reference point for tool and base is the TCP on the externally calibrated tool.

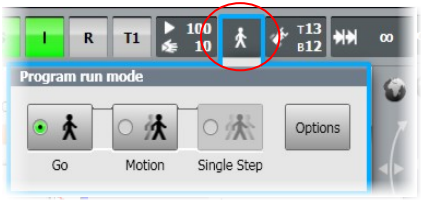
Flange:



Ext. tool:



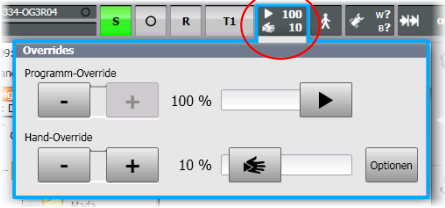
Program run modes



Element	Program run mode	Description
	Go	The program runs continuously to the end of the program. In test mode, the Start key must be held down.
	Motion	Each motion command is executed individually. At the end of each motion, the Start key must be pressed again.
	Single Step	The program is executed line by line (irrespective of the contents of the individual lines). The Start key must be pressed again after every line. ISTEP is only available to the user group “Expert” or higher.
	Options	See page 14

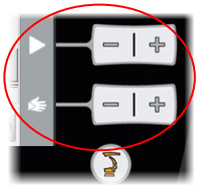
Motion velocities (overrides)

Setting the jog velocity (HOV)
Setting the program velocity (POV)



The velocities can be set using either the +/- touch buttons or the sliders.

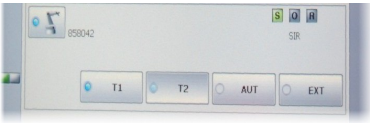
Element	Term	Range of values	Description
	Jog velocity (HOV)	0 … 100%	Motion velocity of the robot during jogging. Maximum velocity 250 mm/s.
	Program velocity (POV)	0 ... 100%	Motion velocity of the robot during program execution. Maximum velocity in T1 250 mm/s. Maximum process velocity in T2, AUT and EXT.



It is also possible to use the +/- keys to set HOV and POV on a 6-axis robot.
However, the set value is visually displayed in the above view only.

Selecting the operating mode

1.) Open the connection manager by turning the switch



2.) Select the operating mode in the connection manager.

3.) Return the switch for the connection manager to its original position.

The selected operating mode is displayed in the status bar of the smartPAD.

Operating mode	Use	Velocities
T1	For test operation	Program mode: Programmed velocity, maximum 250 mm/s
		Manual mode: Jog velocity, maximum 250 mm/s
T2	For test operation	Program mode: Programmed velocity
		Manual mode: Manual mode not possible
AUT	For robot systems without higher-level controllers	Program mode: Programmed velocity
		Manual mode: Manual mode not possible
EXT	For robot systems with higher-level controllers, e.g. PLC	Program mode: Programmed velocity
		Manual mode: Manual mode not possible

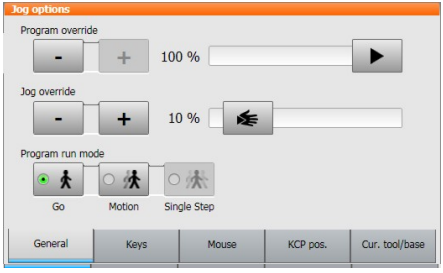
Program status

The color of the R indicates the current program status.

Element	Description
R	No program selected.
R	The block pointer is situated in the first block of the selected program.
R	The program is selected and is being executed.
R	The program is selected and has been stopped during execution.
R	The block pointer is situated at the end of the selected program.

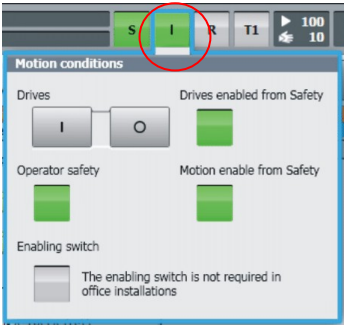
Furthermore it is possible to deselect and reset the program by opening the object.
If the program is open, this can also be done via:
Edit > Cancel program
Edit > Reset program

Options



All parameters for jogging the robot can be set in the “Jog options” window. The menu can only be called by means of the ***Options*** key for the individual parameters.

Drives status

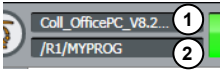


Element	Velocities
Drives	Drives I : Switch on O: Switch off
Operator safety	GREEN: Operator safety closed GRAY: Operator safety open
Enabling switch	GREEN: Enabling switch pressed GRAY: Enabling switch not pressed
Drives enabled from Safety	GREEN: The internal safety controller in the KRC has enabled the drives so that they can be switched on. GRAY: The internal safety controller in the KRC has not enabled the drives.
Motion enable from Safety	GREEN: Robot is under servo control and the internal safety controller in the KRC has set the motion enable signal. GRAY: Robot is under servo control and the internal safety controller in the KRC has not set the motion enable signal.

SUBMIT interpreter

Element	SUBMIT interpreter status
S	Start/select
S	Stop
S	Cancel

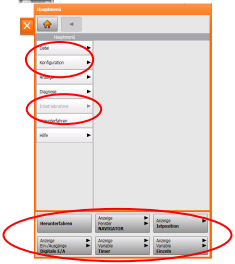
Displaying the robot name and the program



1.) The robot name is displayed which was entered under main menu key > Start-up > Robot data.
2.) The name (incl. path) of the selected module is displayed.

Main menu key

For displaying and hiding the main menu



Equivalent to the hardware key
Return to the main menu directly (house) or back one menu level at a time (arrow).

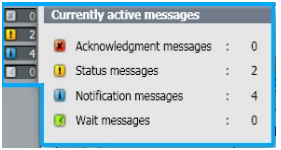
Open the submenus with the aid of the arrow keys.

History of the last six main menu items to be selected. They can be used as shortcut buttons.

Messages

The controller communicates with the operator via the message window.

Message types



A dialog message is displayed in addition to the currently active messages.

Icon	Message type	Description
	Acknowledgement message	The robot stops or does not start.
	Status message	Reports current controller states (e.g. Emergency Stop). It cannot be acknowledged.
	Notification message	Provides information for correct operator control of the robot (e.g. Start key required). It can be acknowledged.
	Wait message	Indicates the event that the controller is waiting for (status, signal or time). Wait messages can be canceled manually by pressing the “Simulate” button.
	Dialog message	Used for direct communication with the operator. A message window with buttons appears, offering various possible responses.

Dealing with messages

Messages are always displayed with the date and time in order to be able to trace the exact time of the event.

Procedure:

1.) Open:
Touch the message window (1) to open the message list.

2.) Acknowledge:
Acknowledge individual messages with “OK” (2).
Alternatively:
Acknowledge all acknowledgeable messages with “Confirm all” (3).

3.) Close:
Touching the top message again or the “X” at the left-hand edge of the screen closes the message list.

Tips:

- Read the messages attentively.
- Read older messages first. A more recent message could simply be a follow-up to an older message.

Common messages

Message:	**Start key required**
Cause:	Execution of a command requires the Start key to be pressed (e.g. mastering of an axis)
Remedy:	Hold the Start key down until the command has been executed.

Message:	**Programmed path reached (BCO)**
Cause:	BCO is reached after the first motion block in the application program or in the case of block selection.
Remedy:	Not required. The program can be resumed by releasing the Start key and pressing it again.

Message:	**Active commands inhibited**
Cause:	A state is present which inhibits active commands (e.g. EMERGENCY STOP pressed or drives not yet ready).
Remedy:	Release EMERGENCY STOP and/or acknowledge messages in the message window.

Message:	**Mastering notch not found**
Cause:	EMD could not find the mechanical zero position (notch).
Remedy:	Move correctly to premastering position.

Message:	**Impermissible start motion**
Cause:	The first motion block to be executed in a program must be a PTP motion. Not LIN or CIRC.
Remedy:	Correct program.

Message:	**Software limit switch –A5**
Cause:	The robot has moved to the software limit switch of the axis indicated (e.g. A5) in the direction indicated (+ or -).
Remedy:	Move the indicated axis in the opposite direction.

Message:	**BCO run executed as LIN motion**
Cause:	Block selection has been made to a CIRC motion.
Remedy:	Acknowledge message. When the Start key is pressed, the robot is moved linearly to the end point of the CIRC motion.

Message:	**Approximate positioning not possible**
Cause:	The advance run of the computer has been stopped ($ADVANCE=0). Two consecutive motion blocks in the program have the same coordinates. An advance run stop has been triggered in the program (e.g. by setting an output).
Remedy:	Set computer advance run ($ADVANCE) to at least 1. Correct program.

Message:	**Command not allowed outside a spline block**
Cause:	Spline segments SPL are inserted outside a spline block.
Remedy:	Open spline block and insert spline segments between SPLINE and ENDSPLINE.

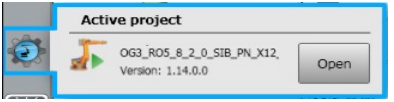
Message:	**Sequence of instructions that cannot be approximated**
Cause:	Approximate positioning is not possible from motion commands such as PTP, LIN or CIRC to a spline block.
Remedy:	Insert a SCIRC or SLIN motion before the spline block.

Message:	**Start continue not possible**
Cause:	Program execution has been completed.
Remedy:	Reset program.

Message:	**Command velocity A4**
Cause:	In continuous path motion, for example, axes 4 and 6 are in alignment (α5).
Remedy:	Set the orientation control of this motion to “Wrist PTP”.

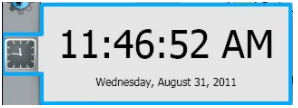
Note:
If the robot can no longer be jogged and no messages are active, please check whether the mouse and keys are activated in the respective settings in the Options menu (page 13)

Active project

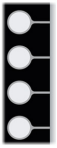


Currently loaded project created in Work Visual.

Clock

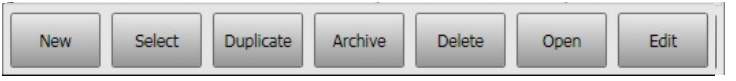


Status keys



The status keys are used primarily for setting parameters in technology packages.
Their exact function depends on the technology packages installed.

Button bar



Element	Description
New	Create a new module/folder
Select	Select a module
Duplicate	Reproduce a module
Archive	Archive the selected elements
Delete	Delete a module
Open	Open a module in the edit mode
Edit	Edit functions of the Navigator window

Start-up

Unmastering
For specific remastering of individual or multiple axes, they must first be unmastered. To do so, select the following:
main menu key > Start-up > Master > Unmaster

Warning!
The software limit switches of an unmastered robot are deactivated.
The robot can now only be moved in axis-specific mode.

Mastering
For teaching the mechanical zero position, mastering is carried out with the aid of the EMD or the dial gauge.
Using the EMD:

1.) Move robot to the pre-mastering position.
2.) Screw EMD onto gauge cartridge
3.) Attach signal cable to the EMD and connector X32 on the robot junction box.
4.) Carry out mastering

Warning!
Do not move the robot while the EMD is screwed in, as there is a risk that the gauge pin would be damaged.

Standard mastering:
Main menu key > Start-up > Master > EMD > Standard > Set mastering

Checking the mastering: (these mastering values can be adopted)
Main menu key > Start-up > Master > EMD > Standard > Check mastering

Load mastering:
Main menu key > Start-up > Master > EMD > With load correction > First mastering > Teach offset > Load mastering > With offset

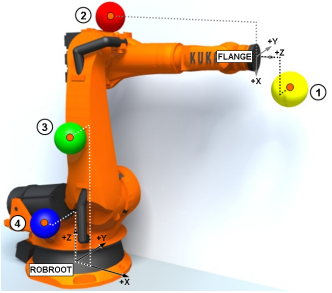
Load data

The load data define the load and serve as the basis for adapting the acceleration.

Parameter		Unit
Mass	**M**	kg
Center of gravity	L_X, L_Y, L_Z	mm
Mass moments of inertia at the center of gravity	I_{XX}, I_{YY}, I_{ZZ} *)	kg m^2

*) Mass moments of inertia about the principal inertia axes through the center of gravity

The following loads can be mounted on the robot:



1 – Payload
2 – Supplementary load on axis 3
3 – Supplementary load on axis 2
4 – Supplementary load on axis 1

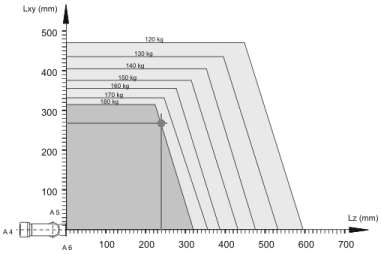
The payload consists of the tool load and workpiece load. All loads added together give the overall load.

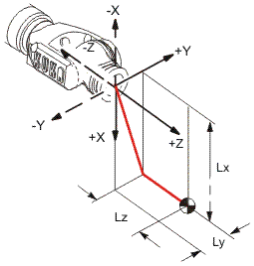
Load	Reference system
Payload	FLANGE coordinate system
Supplementary load A1	ROBROOT coordinate system
Supplementary load A2	ROBROOT coordinate system A2 = -90°
Supplementary load A3 (e.g. external energy supply system)	FLANGE coordinate system A4 = 0°, A5 = 0°, A6 = 0°

Warning!
Operating a robot with incorrect load data, or with loads for which it is not suitable, results in damage to the robot system.

Payload diagram
The payload diagram can be used to check in advance whether the robot is suitable for the desired payload. The diagram is not, however, a substitute for checking the payload with KUKA.Load (available at www.kuka-roboter.de → Downloads).

Example KR 180-2:
Permissible mass inertia at the design point (L_{xy} = 270 mm, L_z = 240 mm)
90 kg m^2





The load center of gravity P is specified relative to the robot flange coordinate system.

Payload data can be entered via the following menu:
Main menu key > Start-up > Calibrate > Tool > Tool load data

Supplementary load data can be entered via the following menu:
Main menu key > Start-up > Calibrate > Supplementary load data

KUKA.Load Detect
The program KUKA.Load Detect can be used to determine payload data exactly. The mass, center of gravity and the mass inertia at the center of gravity are determined exactly by means of pendulum motions. KUKA.Load Detect can only be used for payloads over 40% of the rated payload.

Calibration

Tool

To allow work relative to a tool, the tool must be calibrated. Tool calibration consists of 2 steps:

Step	Description
1	Definition of the origin of the tool coordinate system (TCP) ***Main menu key > Start-up > Calibrate > Tool > XYZ 4-point*** or ***> XYZ Reference***
2	Definition of the orientation of the tool coordinate system ***Main menu key > Start-up > Calibrate > Tool > ABC World*** or ***> ABC 2-point***
Alternatively	Numeric input of the data ***Main menu key > Start-up > Calibrate > Tool > Numeric input***

Base

To allow work relative to a base, the base must be calibrated. The coordinate origin and the coordinate directions are determined in a single calibration step:

Step	Description
1	Determination of the coordinate origin: ***Main menu key > Start-up > Calibrate > Base > 3-point*** or ***> Indirect method***
Alternatively	Numeric input of the data ***Main menu key > Start-up > Calibrate > Base > Numeric input***

Fixed tool
A fixed tool must be calibrated before work can be carried out in relation to it.
Calibration of the fixed tool consists of 2 steps executed out within a single menu item:

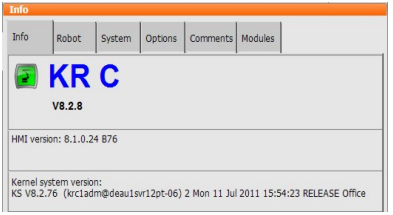
Step	Description
1	Calculation of the distance between the external TCP and the origin of the world coordinate system. ***Main menu key > Start-up > Calibrate > Fixed tool > Tool***
2	Definition of the orientation of the coordinate system at the external TCP. Variant ***5D***: Align **+** X_{Base} parallel to $-Z_{Flange}$ Variant ***6D***: Align **+** X_{Base} parallel to $-Z_{Flange}$ **+** Y_{Base} parallel to $+Y_{Flange}$ **+** Z_{Base} parallel to $+X_{Flange}$

Robot-guided workpiece
A robot-guided workpiece must be calibrated before it can be moved along the workpiece edge in relation to the external TCP.

Step	Description
1	Determination of the coordinate system on the workpiece: ***Main menu key > Start-up > Calibrate > Fixed tool > Workpiece > Direct calibration***

Main menu

System information



The Info menu can be called up to obtain information about the installed software version, machine data, etc.
Main menu key > Help > Info

Archiving

The menu item:

Main menu key > File > Archive > USB (KCP) > All
> USB (cabinet) > All
> Network > All

is used to save all the data that are required to restore the robot system. These include:

- machine data
- tool/base data
- all applications

The ***Archive*** button can be used to save individual programs/files.

Warning!
If you try to add an existing file to an archive, a check is carried out. The robot name in the archive is compared with the name that is set in the controller. If the two names are different, a request for confirmation is generated asking if you really wish to overwrite the existing archive.

Restoring data
The menu item:

Main menu key > File > Restore > USB (KCP) > All
> USB (cabinet) > All
> Network > All

is used to restore all files except LOG files.

Once the system has been restored, it must be rebooted with a cold start.
Main menu key > Shutdown
The check mark for ***Reload files*** must be set at the same time.

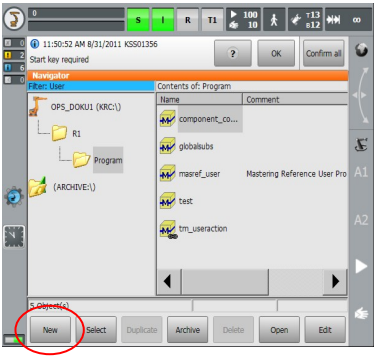
After selecting the archive, individual programs/files can be restored using the ***Restore*** button.

Program start from PLC

1) Select CELL.SRC
2) Set program override to 100% (individual value).
3) Carry out a BCO run.
4) Select “Automatic External (EXT)” mode.
5) Start the program from a higher-level controller (PLC).

Navigator

	Robot drive
	Back-up drive
	Directory
	Open directory
	Module
	Module with error
	Archive file



Creating a new module

1) Press ***New***
2) Assign a module name (possibly with a comment)
3) Press ***Cmd OK***

Gripper programming

The application-specific status keys can be selected by means of ***main menu key > Configuration > Status keys***.

Gripper operation with KUKA.GripperTech

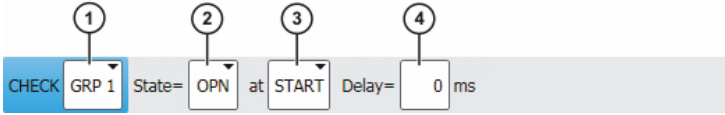
Selection of the active gun for manual operation.
The choice of gun has no effect on a program.

Toggle between the gripper states (e.g. open or close).

Commands > GripperTech > CheckGripper can be used to check the status of the gripper.

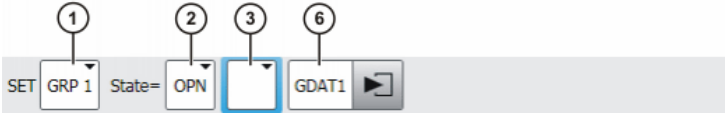
> Gripper can be used to program the gripper function.

Inline form “Check Gripper”

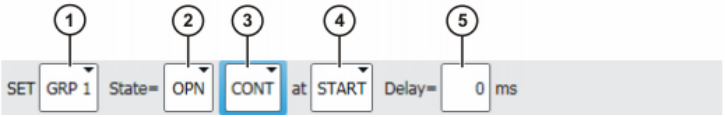


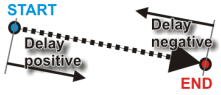
Item	Description
1	Select the gripper.
2	Select the switching state of the gripper.
3	Select the time at which the sensor interrogation is executed. START: The gripper action is executed at the start point of the motion. END: The gripper action is executed at the end point of the motion.
4	Define a wait time, relative to the start or end point of the motion, for execution of the gripper action. -200 ... 200 ms

Inline form for gripper without approximate positioning



Inline form for gripper with approximate positioning

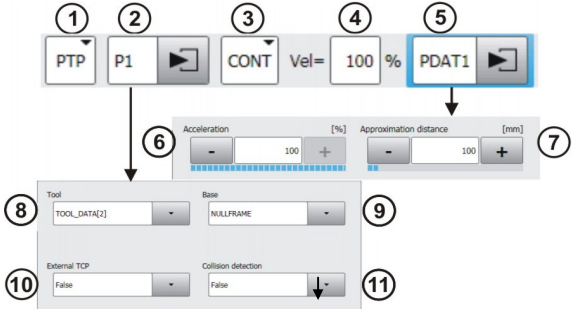


Item	Description
1	Select the gripper.
2	Select the switching state of the gripper.
3	Approximate positioning characteristics Empty: Execution with advance run stop CONT: without advance run stop
4	Box only available if CONT selected. START: The gripper action is executed at the start point of the motion. END: The gripper action is executed at the end point of the motion.
5	Box only available if CONT selected. Define a wait time, relative to the start or end point of the motion, for execution of the gripper action. -200 ... 200 ms 
6	Data set with gripper parameters

The KUKA.GripperTech inline forms only function if the outputs via which the sensor is switched and the inputs to which the proximity switches send back their signals are defined under ***Configuration > Inputs/outputs > Gripper***. Furthermore, the gripper type must be specified.

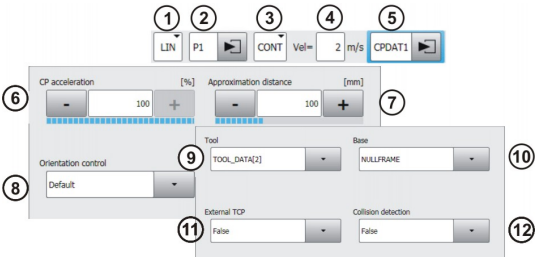
Motion programming

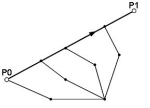
PTP – Point-to-point motion



Item	Parameter	Description
1	Type of motion	PTP: Fastest route between 2 points
2	Point name	Assigned automatically or individually
3	Approximation parameter	Empty: Exact positioning point CONT: Approximate positioning point
4	Velocity	1 ... 100%
5	Motion data set	Calling the motion data sets
6	Acceleration	1 ... 100%
7	Approximation distance	1 ... 1000 mm or 1 … 100%
8	Tool	Selection of tool coordinate system Range of values: Null frame, Tool_Data[1] ... [16] or user-defined name
9	Base	Selection of workpiece coordinate system Range of values: Null frame, Base_Data[1] ... [32] or user-defined name
10	External TCP	False: Robot guides tool. True: Robot guides workpiece.
11	Collision detection	Monitoring of axis torques False: Monitoring off True: Monitoring on

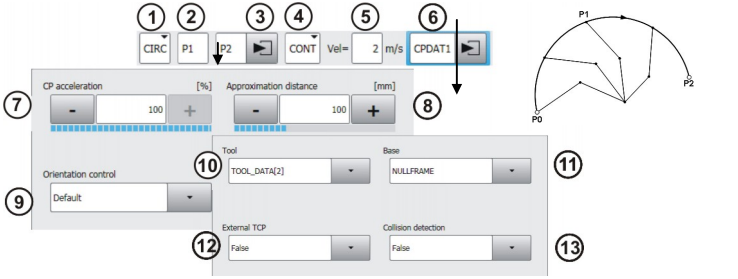
LIN – Linear motion





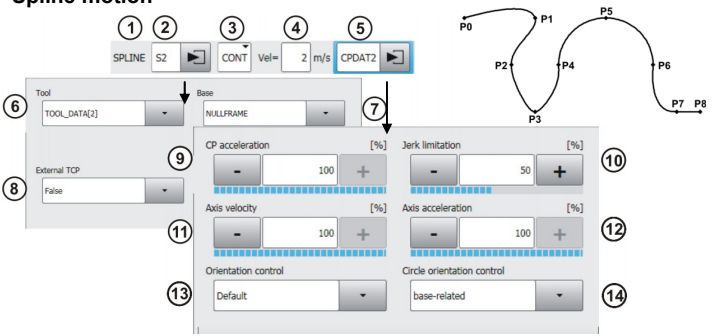
Item	Parameter	Description
1	Type of motion	LIN: Shortest route between 2 points
2	Point name	Assigned automatically or individually
3	Approximation parameter	Empty: Exact positioning point CONT: Approximate positioning point
4	Velocity	0.001 ... 2 m/s
5	Motion data set	Calling the motion data sets
6	CP acceleration	1 ... 100%
7	Approximation distance	1 ... 300 mm
8	Orientation control	Selection: Standard, Wrist PTP and Constant.
9	Tool	Selection of tool coordinate system Range of values: Null frame, Tool_Data[1] ... [16] or user-defined name
10	Base	Selection of workpiece coordinate system Range of values: Null frame, Base_Data[1] ... [32] or user-defined name
11	External TCP	False: Robot guides tool. True: Robot guides workpiece.
12	Collision detection	Monitoring of axis torques False: Monitoring off True: Monitoring on

CIRC – Circular motion



Item	Parameter	Description
1	Type of motion	CIRC: Arc through auxiliary point
2	Point name of auxiliary point	Assigned automatically or individually
3	Point name of end point	Assigned automatically or individually
4	Approximation parameter	Empty: Exact positioning point CONT: Approximate positioning point
5	Velocity	0.001 ... 2 m/s
6	Motion data set	Calling the motion data sets
7	CP acceleration	1 ... 100%
8	Approximation distance	1 ... 300 mm
9	Orientation control	Selection: Standard, Wrist PTP and Constant.
10	Tool	Selection of tool coordinate system Range of values: Null frame, Tool_Data[1] ... [16] or user-defined name
11	Base	Selection of workpiece coordinate system Range of values: Null frame, Base_Data[1] ... [32] or user-defined name
12	External TCP	False: Robot guides tool. True: Robot guides workpiece.
13	Collision detection	Monitoring of axis torques False: Monitoring off True: Monitoring on

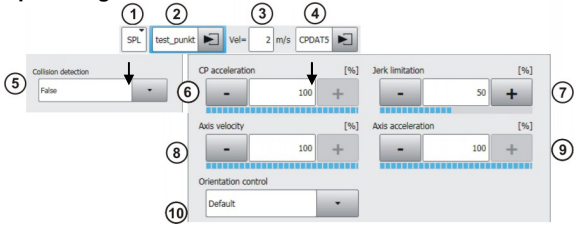
Spline motion



Item	Parameter	Description
1	Type of motion	SPLINE: Motion along a complex curved path
2	Point name	Assigned automatically or individually
3	Approximation parameter	Empty: Exact positioning point CONT: Approximate positioning point
4	Velocity	0.001 ... 2 m/s
5	Motion data set	Calling the motion data sets
6	Tool	Selection of tool coordinate system Range of values: Null frame, Tool_Data[1] ... [16] or user-defined name
7	Base	Selection of workpiece coordinate system Range of values: Null frame, Base_Data[1] ... [32] or user-defined name
8	External TCP	False: Robot guides tool. True: Robot guides workpiece.
9	CP acceleration	1 ... 100%
10	Jerk limitation	1 ... 100%
11	Axis velocity	1 ... 100%
12	Axis acceleration	1 ... 100%
13	Orientation control	Selection: Standard, Wrist PTP, Constant
14	Circle orientation control	Only for spline block and SCIRC segments Selection: base-oriented, path-oriented

Spline programming always requires one spline block and at least one spline segment.
In order to be able to insert spline segments into the spline block, the spline block must be opened with the ***Open/close fold*** key in the bottom softkey bar.
The velocity and motion parameters of the spline segment can be displayed and hidden with ***Toggle parameters***.

Spline segment



Item	Parameter	Description
1	Type of motion	SPL
2	Point name	Assigned automatically or individually
3	Velocity	0.001 ... 2 m/s
4	Motion data set	Calling the motion data sets
5	Collision detection	Monitoring of axis torques False: Monitoring off True: Monitoring on
6	CP acceleration	1 ... 100%
7	Jerk limitation	1 ... 100%
8	Axis velocity	1 ... 100%
9	Axis acceleration	1 ... 100%
10	Orientation control	Selection: Standard, Wrist PTP, Constant

SPL: Interpolated connection of two points within a spline block
SLIN: Shortest connection of two points within a spline block
SCIRC: Circular motion within a spline block

Unlike in the standard circular motion CIRC, the orientation of the auxiliary point is taken into consideration in the path planning for SCIRC.

Program correction

Modifying block parameters in the inline form

1) Move the edit cursor to the line that is to be modified.
2) Press the ***Change*** button.
3) Make the desired changes.
4) Finish the procedure with the ***Cmd OK*** button.
5) Only the content of the inline form is changed, not the coordinates.

Block selection

1) Move the edit cursor to the line that is to be modified.
2) Press the ***Block selection*** button.
3) The block pointer ➡ jumps to the selected block.
4) When the program is started, a BCO run is carried out.

Correcting the coordinates

1) Move the edit cursor to the line that is to be modified.
2) Press the ***Touch-up*** button to save the current coordinates.
3) Confirm the request for confirmation with ***Yes***.
4) The current coordinates of the position of the selected TCP are saved in every case.

Modifying tool or base

1) Move to the point coordinates.
2) Open the inline form by pressing ***Change***.
3) Modify tool or base.
4) Confirm with ***Cmd OK***.
5) Press ***Touch-up*** to save the current coordinates of the TCP in relation to the new settings.

Deleting a block

1) Move the edit cursor to the block that is to be deleted.
2) Select ***main menu key > Edit > Delete***.
3) Answer request for confirmation with “Yes”.
4) Lines cannot be restored once they have been deleted!
5) Modify tool or base.

Multiple use of points

1) Open the inline form by pressing ***Change***.
2) Move the edit cursor to the point name.
3) Enter the name of the point that is to be used again.
4) Confirm with ***Cmd OK***.
5) The following confirmation prompt will appear:

   Point “point_name” already exists –- overwrite?

6) Answering ***No*** means the already existing coordinates of the point are retained.

7) Answering ***Yes*** means the current coordinates of the TCP are saved.

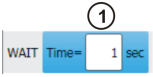
Inserting a new motion block

1) Move the edit cursor to the block after which the new block is to be inserted.
2) Insert a new motion block in the program using the ***Motion*** button.
3) Confirm with the ***Cmd OK*** button.

Logic programming

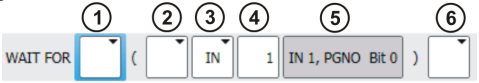
The menu item:
Commands > Logic
can be used to insert logic statements into a program.

WAIT
WAIT is used to program a wait time. The robot motion is stopped for the time entered. This refers to the previous motion block and triggers an advance run stop. Approximate positioning is not possible.



Item	Parameter	Description
1	Wait time	Wait time in seconds

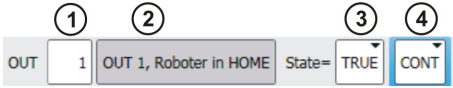
WAIT FOR
WAIT FOR is a signal-dependent wait function.
If required, several signals (maximum 12) can be linked together. If a logic operation is added, additional boxes are displayed in the inline form for the additional signals.



Item	Parameter	Description
1	External logic operation	The operator is situated between the bracketed expressions. Selection: AND, OR, EXOR, NOT
2	Internal logic operation	The operator is situated inside the bracketed expressions. Selection: AND, OR, EXOR, NOT
3	Signal	Signal for which the system is waiting Selection: IN, OUT, CYCFLAG, TIMER, FLAG
4	Signal number	1 ... 4096
5	Signal name	If a name exists, this name is displayed. Entries are possible via the Long text button in the “Expert” user group.
6	Advance run pointer behavior	Empty: Advance run stop CONT: Check with the advance run pointer

OUT

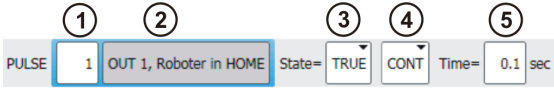
OUT is a simple switching function that sets a digital output. The reference point is the previous motion block.



Item	Parameter	Description
1	Signal number	1 ... 4096
2	Signal name	If a name exists, this name is displayed. User entries are possible via the Long text button in the “Expert” user group.
3	Signal state	State to which the output is switched Selection: TRUE, FALSE
4	Advance run pointer behavior	Empty: Advance run stop CONT: Switch with the advance run pointer

PULSE

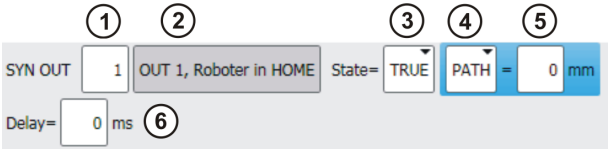
PULSE is a simple switching function that controls an output for a defined time. The reference point is the previous motion block.



Item	Parameter	Description
1	Signal number	1 ... 4096
2	Signal name	If a name exists, this name is displayed. User entries are possible via the Long text button in the “Expert” user group.
3	Signal state	State to which the output is switched Selection: TRUE, FALSE
4	Advance run pointer behavior	Empty: Advance run stop CONT: Switch with the advance run pointer
5	Pulse length	0.1 ... 3 s

SYN OUT

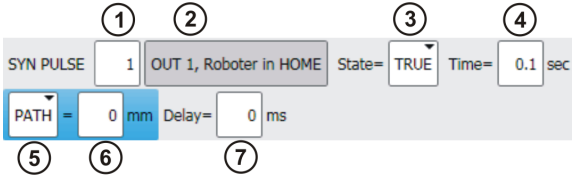
SYN OUT is used to switch outputs at a defined place or at a defined time concurrently with robot motion.



Item	Parameter	Description
1	Signal number	1 ... 4096
2	Signal name	If a name exists, this name is displayed. User entries are possible via the “Long text” softkey in the “Expert” user group.
3	Signal state	State to which the output is switched Selection: TRUE, FALSE
4	Switching point	Point at which the output is to be switched Selection: START, END, PATH
5	Switching point distance	Distance of the switching point from the end point This box is only displayed if PATH is selected as the switching point. -2000 ... +2000 mm
6	Switching point delay	Switching action delay -1000 ... +1000 ms The switching action is always offset by the distance first and then by the delay time.

SYN PULSE

SYN PULSE is a path-dependent switching function that is relative to the start or end point of a motion block and controls an output for a defined time. It can be delayed or brought forward and/or shifted in space.



Item	Parameter	Description
1	Signal number	1 ... 4096
2	Signal name	If a name exists, this name is displayed. User entries are possible via the “Long text” softkey in the “Expert” user group.
3	Signal state	State to which the output is switched Selection: TRUE, FALSE
4	Pulse duration	0.1 ... 3 s
5	Switching point	Point at which the output is to be switched Selection: START, END, PATH
6	Switching point distance	Distance of the switching point from the end point This box is only displayed if PATH is selected as the switching point. -2000 ... +2000 mm
7	Switching point delay	Switching action delay -1000 ... +1000 ms The switching action is always offset by the distance first and then by the delay time.