

SOFTWARE

KR C2 / KR C3

Appendix

KUKA System Software (KSS)

Release 5.2

Issued: 22 Nov 2004 Version: 01

© Copyright **KUKA Roboter GmbH**

This documentation or excerpts therefrom may not be reproduced or disclosed to third parties without the express permission of the publishers. Other functions not described in this documentation may be operable in the controller. The user has no claim to these functions, however, in the case of a replacement or service work.

We have checked the content of this documentation for conformity with the hardware and software described. Nevertheless, discrepancies cannot be precluded, for which reason we are not able to guarantee total conformity. The information in this documentation is checked on a regular basis, however, and necessary corrections will be incorporated in subsequent editions.

Subject to technical alterations without an effect on the function.

PD Interleaf

Contents

1	Glossary	5
1.1	Symbols	5
1.2	A	5
1.3	B	6
1.4	C	7
1.5	D	8
1.6	E	10
1.7	F	11
1.8	G	11
1.9	H	12
1.10	I	12
1.11	J	13
1.12	K	13
1.13	L	13
1.14	M	14
1.15	N	15
1.16	O	15
1.17	P	16
1.18	R	17
1.19	S	18
1.20	T	20
1.21	U	21
1.22	V	21
1.23	W	22
1.24	X	23
2	Operating Handbook history from V5.1 -> V5.2	25
2.1	Introduction	25
2.2	Safety	25
2.3	Operator control	25
2.4	Start-up	26
2.5	Configuration -> see Programming Handbook	26
2.6	User Programming	26
2.7	Expert Programming -> see Programming Handbook	26
2.8	Additional Functions -> see Programming Handbook	26
2.9	Applications -> see Programming Handbook	27



Appendix

2.10	Appendix	27
3	Overall index	28

1 Glossary

KUKA-specific terms from the software documentation are briefly explained in this section.

1.1 Symbols

\$...

More detailed information on this can be found in the chapter **[Appendix]** under “System variables”

#...

Variables of the enumeration type “Enum”

*

Placeholder, e.g. *.src – valid for all files with the ending “.src”

->*Text*

The term *Text* is explained elsewhere in the glossary

1.2 A

A B C – 2 Point

Tool calibration program which first determines the working direction of the tool and then a point in the XY plane.

A B C – World

Tool calibration program in which the coordinate system of the tool is aligned parallel to the world coordinate system.

ACC (Acceleration)

Specifies how quickly the corresponding axes reach their maximum set velocity.

Acknowledgment message

Information in the status window, e.g. EMERGENCY STOP, which must be acknowledged.

Actual position

->*Cartesian*, ->*Joint* or ->*Incremental* display.

Advance run

The computer can process ahead of the motion command currently being executed in order to eliminate the computing time at the end of the motion command which would otherwise be required for execution of the next motion command.

Advance run stop

Certain instructions stop the advance run until the arrival of the main run (e.g. setting an output).

Air conditioner

Special ->*Control cabinet* with additional cooling for special applications.

Alt key

Used for entering certain control functions.

Analog input

Can be connected to a voltage between +10 V and –10 V.

**Analog output**

Output with variable output voltage (e.g. from 0...9999 mV).

Approximate positioning (VE)

The robot moves, for example, from P1 to P3 via P2 without *->Exact positioning* at P2; the robot takes a shortcut, so to speak, in that it only approaches the point in question before moving on to the next point.

Archive

Saves data to floppy disk or network.

Array

Grouping of objects of the same data type to form a data object.

Attributes display

Window in the Navigator with additional information regarding a selected file.

Automatic External mode

Control of the robot is taken over by a PLC.

Automatic mode

In this operating mode, the robot executes its program automatically.

Axis acceleration

The acceleration of an axis given as a percentage of the maximum value defined in the machine data.

Axis-specific (joint) coordinate system

Here, the linear offsets (for translational axes) or the rotational offsets (for rotational axes) are specified for each robot axis.

Axis-specific (joint) display

Rotation of each individual axis in degrees relative to its mechanical zero position determined during *->Mastering*.

Axis velocity

The velocity at which an axis is moved given as a percentage of the maximum value defined in the machine data.

1.3 B

Base coordinate system

This is used as the reference system to define the position of the workpiece. It has the world coordinate system as its reference coordinate system.

Base-related interpolation

When interpolating the motion path, the robot controller calculates the current position (\$POS_ACT) in relation to the \$BASE coordinate system.

Battery monitoring

The serviceability of the batteries in the control cabinet is checked when the system is shut down.

BCO (block coincidence)

Correspondence between the robot position and the coordinates of the motion block.

Binary output

Binary coded output.

Block functions

Editing operations to ->*Cut*, ->*Copy*, ->*Paste*, ->*Find* and ->*Delete*.

Block pointer

Colored marker in the program window indicating the block currently selected in the program.

BS A/F

->*Time-distance function* for setting outputs or ->*Flags*.

BS bin/ana

->*Time-distance function* for the output of binary or analog signals.

1.4 C

Calibration

The dimensions of a tool or workpiece are entered into the robot controller.

Caller Stack

Display of the statuses of the advance run and main run pointers.

Cartesian coordinate system

Rectangular coordinate system with an X, Y and Z axis.

Cartesian display

Difference between the tool center point and the world coordinate system.

CD-ROM drive

Drive for reading data from compact disks.

CellProj

External program which allows easy modification of the file "Cell.src".

Check

Checks the ->*Mastering* of a tool mounted on the robot.

CIRC (Circular)

Motion command for circular motions.

Clipboard

An area in the main memory of a computer which other programs may access under certain conditions.

Cold start

The computer system is switched off and back on again. The state of the system prior to the deactivation of the system is not restored. This state is restored in the event of a ->*Warm start*.

COM1

Connection for an external serial computer mouse.

Comment

Additional information allowing easier recognition of program contents by the operator.

Compiler

Translates the program code, legible to humans, into machine code and carries out a syntax check.

Configuration

Miscellaneous system settings affecting inputs/outputs, I/O drivers, language, etc.

Continuous-path motions

The start point and end point are specified here. The TCP moves along a linear or circular path between these points.

Control cabinet

Houses the components necessary for controlling the robot, such as ->*Processor unit* and ->*Power module*.

Control ON

LED underneath the flap on the control cabinet displaying the status of the computer.

Coordinate system

The robot motions are always executed relative to the system currently set; e.g. joint, world, etc.

Coordinate transformation

Axis-specific (joint) coordinates are transformed to Cartesian coordinates and vice versa.

Copy

Data are copied to the ->*Clipboard*.

Counter

Incrementation function with a settable start value.

Crash

Collision between the robot and a tool, workpiece or device which makes ->*Mastering* necessary.

Cross

The "Kuka-Cross" program which runs in the background.

Cross logbook

Displays the data from the Kuka-Cross program which runs in the background.

CTRL key

Control key for program-specific commands.

Cursor key

Operator control element allowing movement of the edit cursor or the focus in the display.

Cut

A selected area of text is deleted from the current position and copied to the ->*Clipboard*.

1.5 D**Data list**

The "DAT" file (item list) belonging to a program.

- DAT file
Data list which can be seen at expert level.
- Degrees of freedom
Limitation of the number of axes which can be moved simultaneously using the Space Mouse.
- Delay
Delay of certain commands, e.g. for adhesive applications.
- Delete
A selected area or file is permanently removed.
- DEL key
Deletes the character to the right of the ->*Edit cursor* .
- Diagnosis
Functions for checking the statuses of the system.
- Dial gauge
Tool for robot ->*Mastering*.
- Dialog message
Safety query generated by the system which must be answered.
- Directory
A kind of "Drawer" for organizing files.
- Directory list
Display of directories in the ->*Navigator* window.
- Directory structure
Window for displaying ->*Drives* and ->*Directories* in the ->*Navigator*.
- Display
The graphical user interface which is displayed on the LCD screen of the (V)KCP.
- Dominant axis
Movement of just one axis using the Space Mouse.
- Drive
Data storage medium for loading and saving data.
- Driver
Program for the correct control of hardware components.
- Drives ON / OFF
Buttons for activating or deactivating the drives.
- DSEAT (Digital servo-electronics)
This module is responsible for digital control of the robot axes and the servo ->*Power module*.
- Duplicate
A copy is made of a selected area or file.

1.6 E

Edit cursor

The cursor located in the position at which characters can be entered or deleted and which indicates the current position in the program.

Editor

Program section for editing text or program lines.

EMERGENCY STOP

Immediate stoppage of the robot if the red EMERGENCY STOP button is pressed or a safety gate is opened during operation.

EMT

Electronic measuring tool necessary for ->*Mastering* the robot.

Enabling switch

Button on the back of the ->(V)KCP which must be pressed in order to carry out certain actions, e.g. manual traversing or program start.

End key

This is situated in the numeric keypad and moves the ->*Edit cursor* to the last character in the program line.

End stop

Buffer which reduces the impact of a robot axis.

Enter key

Operator control element for completing inputs or confirming queries, etc.

Error display

Display in a ->*Status window* of the errors that have occurred in a program.

Error list

->*Softkey* which calls the error display.

ESC (Electronic Safety Circuit)

Safety system which provides permanent monitoring of certain safety modules (e.g. Emergency Stop, operator safety, etc.).

Escape key

Operator control element used to cancel an action.

Exact positioning

The robot moves exactly to the point.

Expert level

->*User group*.

Extension

->*File extension*.

External axes

Additional axes, e.g. axis 7 for movement of the entire robot.

External kinematics

e.g. a turntable, which moves while the robot works on a part clamped on it.

External tool

A tool which is not mounted on the robot.

1.7 F**FALSE**

Corresponds to the state “false” or bit “0” set.

File

A program or data created by a program.

File extension (e.g. Test.SRC)

Generally the last three characters of a file, which are used by a program in order to identify its own data.

File list

Display of files in the *->Navigator* window.

Filter

Limits the display to files of certain kinds; only available at expert level.

First Mastery

->Mastering of the robot without load or additional load.

Flag

A status (comparable to a switch) which can be switched on or off via the “Monitor” menu or during program execution; it is evaluated the moment it is assigned.

Focus

Colored marking which can be used for selecting *->Drives*, *->Directories*, *->Files*, *->Menu* entries and input boxes *->Inline forms*.

Folge

Program comprising a *->SRC* file and a *->DAT* file.

Format floppy

Completely delete the contents of a floppy disk.

Formatting

The storage medium (e.g. floppy disk, hard disk) is reorganized and all data on it are deleted.

Forward transformation

Conversion from axis-specific to Cartesian coordinates.

1.8 G**Gauge cartridge**

This is used to hold a *->Dial gauge* or *->EMT* for *->Mastering* the robot.

Go

->Program run mode.

Graphical user interface

Graphic display of the KUKA software on the LCD screen of the (V)KCP.

GUI (Graphical User Interface)

The (V)KCP display contains the menu and softkey bars, the status key bars, the program window, the inline forms, the status and message windows and a status line.

1.9 H

Hand programming unit.

->(V)KCP

Header

The bar at the top of the ->Navigator.

Hexadecimal system

Base 16 system: digits 0-9 and A-F.

Home key

This is situated in the numeric keypad and moves the ->Edit cursor to the first character in the current program line.

Home run

The first motion instruction in a program.

1.10 I

I-Step

->Program run mode.

Icon

Graphic representation of operational steps, hints, warnings, etc.

IconEditor

Optional extra module which can be used to create programs using pictograms.

Incremental display

Values for the angular momentum delivered by the axis drives are displayed.

Inline form

Input mask for program commands.

Input box

Area in the ->GUI in which data (e.g. numbers or letters) can be entered.

Insert mode

When characters are entered, the text at the edit cursor position is shifted to the right.

INS key

Switches to insert mode in which characters already present in a text are shifted to the right.

Installation

The loading of a program onto the hard drive of a computer from which it can then be run; its configuration is also changed in this procedure.

Interface

Connection between hardware and other hardware or software.

Interrupt

An asynchronous event which interrupts the current program execution and continues with a program assigned to the event in question. Once this program has been executed, execution of the previously interrupted program is resumed. The program interrupt can be caused by the operator, error messages, safety devices, etc.

1.11 J

Jog mode

->*Operating mode.*

1.12 K

KCIRC

Special motion command for circular motions in adhesive applications.

KCP (KUKA Control Panel)

Robot controller control panel equipped with operator control elements and a ->*Display* for displaying the contents of the user interface (->*GUI*).

Key CD

CD-ROM which must be situated in the CD-ROM drive in order to access expert level.

Keyboard

Entry of letters, control functions and special characters.

KLIN

Linear motion command for adhesive applications.

KR C (KUKA Robot Control)

Designation for the KUKA robot controller, consisting of the control panel and control cabinet.

KRL (KUKA Robot Language)

Programming language developed especially for robot controllers.

KUKA VGA card

Standard VGA card with interface for (V)KCP color display.

1.13 L

LDEL key

Deletes the line in which the ->*Edit cursor* is positioned.

Learn Tool

->*Mastering* of the robot with a tool or ->*Additional load*.

Left-arrow key

The character to the left of the ->*Edit cursor* is deleted.

LIN

Linear motion command for the shortest distance between two points at a defined velocity.

Linear motion

Motion in a straight line from one point to another.

Linkage editor

Internal program which checks for modules containing errors.

Log book

Output of a chronological list of operator actions and error messages to a window on the ->*GUI* or to the ->*Printer*.

Logic operators

These are used for logic operations (AND, OR, etc.) with boolean variables, constants and simple logic expressions.

Long text

Additional comment for inputs and outputs making identification easier.

Loop

A program section which is continuously repeated.

LPT1

Interface for connecting an external printer.

1.14 M**Macro**

Combination of frequently-used ->*PLC commands*.

Main axes

Axes A1, A2 and A3 of the robot.

Main switch

Operator control element on the front of the control cabinet for switching the robot system on or off.

Manual override (HOV)

Manual traversing velocity can be reduced.

Manual/test mode

The operating modes T1 and T2 allow manual/test traversing of the robot with reduced velocity or process velocity.

Mastering

The robot axes are moved to the mechanical zero position.

Mechanical zero position

This position represents an assignment to the axis drive angle and is defined by a reference notch or mark.

Menu

Collection of commands grouped together.

Menu bar

Row of keys at the top of the (V)KCP display for selecting menus.

Menu key

Individual keys at the top of the (V)KCP display which, together, form the ->*Menu bar*.

Merker (notices)

Links between ->*PLC commands* which are cyclically evaluated.

Message window

Display of notification, error and status messages, etc.

MFC (Multi-function card)

This is situated in the processor unit of the ->*Control cabinet* and contains an Ethernet connection and a Device-Net/Can bus connection; it constitutes the interface between the ->*PC* and the ->(V)*KCP* and can hold up to two ->*DSEATs*.

Mirror

Here, programmed points in the path are mirrored in the X-Z plane of the robot coordinate system.

Module

Program at ->*User level* comprising a *.src file and a *.dat file.

1.15 N**Navigator**

Directory/file manager for program management and creation which is active by default after the controller has run up.

Notification message

Display of information in the message window, e.g. information regarding operator actions or programming errors.

Numeric input

Tool calibration program in which tool data are entered manually via the (V)*KCP* or an external keyboard.

Numeric keypad

Used for numeric input or ->*Cursor control functions*.

Num key

Used for switching the numeric keypad between numeric input and ->*Cursor control functions*.

1.16 O**Office-GUI**

Symbols in the (V)*KCP* display which can be switched on in order to be able to operate control elements such as the enabling switch or start key using the mouse.

Offline

The system is not ready for operation.

Offset external kinematic

Calibration program for moving the distance between the origin of the external kinematic system to the tool located on the external kinematic system.

Offset numeric

Manual entry of ->*Offset external kinematic*.

Online

The system is ready for operation.

Online help

Displays brief descriptions of certain topics and problems.

Operating mode

The robot is traversed in test/manual mode (T1 or T2), "Automatic" or "Automatic External" mode.

Oscilloscope

Recording and display of motion data and signal states.

Overhead area

If the x-value of the wrist root point, expressed in the A1 coordinate system, is negative, the robot is in the overhead area.

Override

See *->Manual override* and *->Program override*.

Overwrite mode

When text is entered at the edit cursor position, the existing text already there is deleted.

1.17 P

Parameter

Additional information transferred to a program when it is started.

Parameter list

Configuration window in some inline form boxes.

Passive stop

The *->Stop key* was pressed while a program was running in *->Automatic External mode*.

Paste

Data from the *->Clipboard* are inserted at the current cursor position.

Path velocity (VB)

The velocity with which the robot, or the tool or workpiece, moves along the programmed path.

Periphery

Additional hardware, e.g. Interbus module.

PGDN key

Scrolls a page further down the window, where possible.

PGUP key

Scrolls a page back up the window, where possible.

PLC instructions

Programmable Logic Controller instructions.

Power module

The actual power unit for robot operation, comprising the supply module, the servo output stages and the logic module.

Power unit

->Power module.

Pre-mastering position

Position indicated by markings to which the robot axes are moved before *->Mastering*.

Processor unit

Standard personal computer with KUKA-specific equipment, housed in the *->Control cabinet*.

ProgrammMaker

External utility program for the creation and modification of existing application programs.

Program override (POV)

The process velocity can be reduced.

Program pointer

Colored pointer in the program window which indicates where the robot is or where it should be moved to.

Program run mode

Specifies how a program should be executed in manual mode. The options "Single Step" (step by step), "I-Step" (line by line), "Go" (continuous) and "Backwards" are available for selection.

Program start backwards

Operator control element for starting a selected program in the reverse direction.

Program start forwards

Operator control element for starting a selected program in the normal direction.

Program window

Displays the program that is selected and can be modified.

PTP

Motion command for point-to-point motion by the quickest route.

Pulse outputs

Outputs can be set or reset for a specified period.

1.18 R

Rapid gauging

The KR C1 DSEAT inputs, channels 1 - 4 (125 μ s cycle), are used here.

Rating plate

Sticker with the serial number of the controller or robot.

RDW (Resolver Digital Converter - RDC)

Located in the base of the robot and connected to the \rightarrow DSE ; it is responsible for resolver power supply, R/D conversion and monitoring of the motor temperature.

Reference point

Known reference point for \rightarrow Calibration.

Relational operators

These operators (equal to, not equal to, greater than, ...) can be used to form logical expressions. The result of a comparison is therefore always of the data type BOOL, since a comparison can only ever be (TRUE) or (FALSE).

Rename

Change the name of a file.

Reset

\rightarrow Reset program.

**Reset program**

The selected program is reset ready for restarting, i.e. returned to the state it had directly after it was selected.

Resolver

Reads the motor pulses and sends them to the *->RDW*.

Restore

Data are written back onto the hard drive having previously been saved to floppy disk or the network using the command *->Archive*.

Restore

->Mastering of the robot with any load.

Return key

->Enter key.

Reverse transformation

Conversion from Cartesian to axis-specific coordinates.

Reverse traversing

Execution of the program towards the start of the program.

Robot coordinate system

This is located in the base of the robot and serves as the reference coordinate system for the mechanical construction of the robot. It, in turn, is derived from the *->World coordinate system*.

Robot mastering

->Mastering.

Robot name

Name given to the robot in a system.

Root point

Distance from the world coordinate system to the origin of an external kinematic system.

Root point numeric

Manual entry of the *->Root point*.

1.19 S**Select**

A program is loaded into the main memory and displayed in the *->Editor* ready for editing. The program can subsequently be restarted using *->Program start forwards*.

Selection list

->Filter.

Selection window

Input line in which a preset value can be selected.

Serial number

Number used by manufacturers to identify their products.

Serial number

The *->Serial number* of the *->Control cabinet* or robot.

Setup

->*Installation.*

Shift key

For switching between upper and lower case characters.

Simple data types

These types are Integer, Real, Bool and Character.

Single Step

->*Program run mode.*

Softkey

One of the keys in the softkey bar which is pressed in order to trigger the function assigned to it.

Softkey bar

The softkey bar is formed by the lower softkeys.

Software limit switch

When a certain axis angle is reached the axis affected is immediately deactivated.

Software-Update

Install current program version.

Space Mouse

Operator control element for moving up to 6 robot axes simultaneously.

SRC file

Program file which can be seen at expert level.

SStep(T1) and SStep(T2)

->*Operating mode.*

Stand-by device

Spare device that can be quickly brought into operation if another device fails.

Start key

Operator control element used to execute the program currently selected. A distinction is made between ->*Operating modes* "T1", "T2" and "Automatic".

Status LED

->*Control ON.*

Status key

Keys on the left and right-hand sides of the (V)KCP display which, together, form the ->*Status key bar.* System settings can be modified here, for example.

Status key bar

Rows of keys on the left and right-hand sides of the (V)KCP display.

Status line

Display of important system information such as operating mode, program status and program name.

Status message

Information displayed in the ->*Message window* in the event of certain system states, e.g. "EMERGENCY STOP". The message is automatically deleted when the status that triggered it is no longer applicable.



Status window

Certain states, e.g. coordinates and the assignment of inputs/outputs, are displayed in this window.

Stop key

Operator control element for stopping a program in “Automatic” or “Automatic External” mode.

Structures

Using the declaration statement STRUC, different data types which have been previously defined or are predefined data types are combined to form a new composite data type.

SUBMIT interpreter

A program running cyclically in the background which can take over robot operator and control tasks. The SUBMIT interpreter can monitor the cooling water circuit or safety devices, for example.

Subprogram

Part of a program which can be called more than once to save space.

Supplementary load

Additional weight on axis 3.

Sym key

For entering special characters via the keyboard of the $\rightarrow(V)KCP$.

System variables

Certain variables which cannot be modified by the user.

1.20 T

Tab key

Tabulation.

TCP (Tool Center Point)

The reference point of the tool that has been set (e.g. the tip of the tool).

Technologies

Combination of additional software and hardware, for example “ARC Tech 10”.

Test/manual mode

The robot can be moved manually or a program can be executed in \rightarrow Operating mode T1 or T2. One of the \rightarrow Enabling switches on the back of the (V)KCP must be held down. Program execution continues as long as the \rightarrow Start key is held down.

Three-dimensional array

Corresponds to several two-dimensional matrices situated one behind the other.

Time-distance functions

Functions for binary/analog outputs and for setting outputs and \rightarrow Flags.

Timer

This function can be compared with a stopwatch for which the start value can be altered.

Tool

\rightarrow TOOL.

Tool center point

->*TCP*.

Tool coordinate system

This has its origin at the tip of the tool (Tool Center Point: TCP). If the tool center point is moved, the tool coordinate system is moved with it. It has the world coordinate system as its reference coordinate system.

TOOL coordinate system

The robot moves in the ->*Coordinate system* of the mounted tool.

Tool load data

Manual entry of the mass, the center of mass, the orientation and the moments of inertia of a tool.

Top-mounted cabinet

An additional ->*Control cabinet* which can be installed on top of another one.

Transport position

Configuration of the axes which allows the robot to be transported safely – varies according to the robot type. The robot must be brought into the transport position before the mounting base bolts are slackened.

Traversing keys

Operator control element for the manual traversing of each individual robot axis.

Traversing mode

Determines whether the robot can be moved using the ->*Space Mouse* or the ->*Traversing keys* or whether ->*Manual traversing* is not possible at all.

Trigger

Activation of ->*Time-distance functions* at a determined distance or a given amount of time before the target point is reached.

TRUE

Corresponds to the state “true” or bit “1” set.

1.21 U

Unmastering

The ->*Mastering* of the robot is deleted in order to be able to carry out a new mastering procedure.

USER

->*KRL* function call with parameter transfer.

User group

Depending on the operator (e.g. “User”, “Expert”), different functions are available on the KUKA program interface.

User level

->*User group*.

1.22 V

VB

->*Path velocity*.

VE

->*Approximate positioning.*

Vernier

Scale on the axes of certain robot models enabling ->*Mastering* to be carried out without a ->*Dial gauge* or ->*EMT*.

Version number

Number used by manufacturers to identify their programs; the higher the number, the more up to date the program in question.

(V)KCP (VW KUKA Control Panel)

Hand-held unit and interface for operation and control of the robot.

VK-Editor

External utility program for loading, displaying and editing files.

(V)KR C1

Robot controller comprising the ->*Control cabinet* and the ->(V)*KCP*.

1.23 W

Waiting condition

The program waits until the corresponding states have been reached (e.g. input present, output set, etc.).

Wait message

Output in the message window if a waiting condition is executed while a program is running.

Warm start

When the system is switched back on and rebooted, the state prior to deactivation is restored (e.g. program position, outputs, etc.).

Weave

Superpositioning of a path motion with one of the weave patterns available for selection, e.g. triangle, trapezoid, etc.

Window selection key

Operator control element for toggling between different windows.

Workpiece

->*BASE*.

World coordinate system

This is a fixed coordinate system, which serves as the underlying coordinate system for a robot system (robot, component support or tool). It represents the reference system for the robot system and the peripheral equipment of the cell.

Wrist axes

Axes A4, A5 and A6 of the robot.

Wrist root point

Intersection of the ->*Wrist axes*.

1.24 X

X Y Z - 4 Point

Tool calibration program in which a reference point is addressed by a tool from four different directions.

X Y Z - Reference

Tool calibration program in which a known reference point is addressed first by a calibrated tool and then by an uncalibrated tool.



2 Operating Handbook history from V5.1 -> V5.2

- Modifications to menus, softkeys, message windows and status windows throughout the documentation.

2.1 Introduction

KUKA Roboter GmbH

- Addresses updated

About this documentation

Service

Stop press

2.2 Safety

2.3 Operator control

Running up / shutting down the controller

- Additions to section on deactivating the user outputs

The KUKA Control Panel (KCP)

- Operator control elements expanded

Coordinate systems

- ROBROOT coordinate system

Jogging the robot

- Generally reworked

Navigator

- Drives list and pop-up menu expanded
- Check robot name when archiving
- Version conflict information
- Delete R1 directory during restore function
- Functions "Paste" and "Delete" adapted

Executing, stopping and resetting a program

- Symbols in the program window updated
- Protecting the motors against overheating

- Limitation of the POV value when switching to “T2” mode
- Changes to the section on automatic program execution

Monitor

- New status windows for analog inputs/outputs
- New section “Hardware Info”
- Online help and Info updated

Menu structure

- Menus and brief descriptions adapted

2.4 Start-up

Robot mastering/unmastering

- New section “Save mastering data”
- Modification of the menus for KR 3 mastering
- Section “Reference point mastering”

Calibration - Tools and Workpieces

- Adapted to modified user interface

Calibration - External kinematics

- Adapted to modified user interface

Robot data

- Additional information displayed in the status window

2.5 Configuration -> see Programming Handbook

2.6 User Programming

Program editing

- Additions to block functions

Program commands

- Program response expanded (e.g. “Save”)
- Extensive expansion of the WAITFOR command

2.7 Expert Programming -> see Programming Handbook

2.8 Additional Functions -> see Programming Handbook

2.9 Applications -> see Programming Handbook

2.10 Appendix

Glossary

History

- The file you are currently reading...

Overall index

- Updated version

3 Overall index

Symbols

\$POS_ACT: *Appendix - Operating Handbook* 6

Numbers

3-Point: *Operator Control* 157; *Start-up* 55

5D: *Start-up* 45, 74, 78

6D: *Start-up* 47, 75, 79

A

A B C - 2-Point: *Start-up* 33, 34, 41

A B C - World: *Operator Control* 157; *Start-up* 33, 45

A B C - World (5D): *Start-up* 34

A B C - World (6D): *Start-up* 34

A B C -2-Point: *Operator Control* 157

A, B, C: *Start-up* 31, 53, 83, 85, 96, 101

Absolute encoder: *Start-up* 25

Acceleration: *User Programming* 19, 23, 25, 27, 29

Accelerations: *Safety* 14

Accessories: *Safety* 11

Accident: *Safety* 7

Accident prevention: *Safety* 17

Adaptation: *Safety* 8

Additional equipment: *Safety* 11

Adjustment: *Safety* 8

Adjustment work: *Safety* 19

ALT key: *Operator Control* 22

Alter factory mastering: *Operator Control* 159; *Start-up* 24

Analog output: *User Programming* 46

Analog outputs: *Operator Control* 113, 152

Application: *Introduction* 9

Approximate positioning: *User Programming* 16

Approximation distance: *User Programming* 19, 23, 25, 27, 29

archiving: *Operator Control* 73

Arrow key: *Operator Control* 21

Arrow keys: *Operator Control* 19; *Start-up* 38, 49, 96, 101

ASCII Mode: *Operator Control* 150

at: *User Programming* 41, 44

Attributes: *Operator Control* 61, 80, 140

Attributes display: *Operator Control* 53, 56

Aut: *Operator Control* 31

Automatic External: *Operator Control* 115, 148

Automatic program execution: *Operator Control* 107

Auxiliary substances: *Safety* 20

Axis jog keys: *Start-up* 35

Axis-specific: *Operator Control* 119, 152
Axisconfigurator: *Operator Control* 160

B

Backward move: *Operator Control* 98
Backwards key: *Operator Control* 19
Base: *Operator Control* 157; *Start-up* 55, 98
BASE coordinate system: *Operator Control* 33, 41; *Start-up* 98
Base type: *Operator Control* 149, 158
BCO run: *Operator Control* 102, 107
Block coincidence: *Operator Control* 102
Block pointer: *Operator Control* 26, 30, 92
BOF Reinitialization: *Operator Control* 150
Bold: *Introduction* 8
Braking ramp: *Operator Control* 95
Brightness: *Operator Control* 24

C

Cabinet lock: *Operator Control* 7
Cable cross-section: *Safety* 18
Caller Stack: *Operator Control* 153
Cancel program: *Operator Control* 109
Carrying capacity: *Safety* 18
Cartesian: *Operator Control* 118, 152
Caution: *Introduction* 6
CD-ROM drive: *Operator Control* 7
Ch.: *Introduction* 8
Change password: *Operator Control* 150
Check: *Start-up* 19
Check mastering: *Operator Control* 159
CIRC: *Operator Control* 161; *User Programming* 16, 26
CIRC motion with approximate positioning: *User Programming* 26
CIRC motion with exact positioning: *User Programming* 26
Circular motion: *User Programming* 26
Climbing aid: *Safety* 20
Close editor: *User Programming* 13
Clothing: *Safety* 18
CMD: *User Programming* 46
Collision protection: *Safety* 16
Commands: *Operator Control* 136, 161
Comment: *Operator Control* 69, 83; *User Programming* 45, 49
Commutation: *Operator Control* 159; *Start-up* 23
Computer drives: *Operator Control* 7
ConfigMon.ini: *Operator Control* 122
Configure: *Operator Control* 136, 147
Connecting cables: *Safety* 5, 13
Construction: *Safety* 14

Consumables: *Safety* 11, 20
CONT: *User Programming* 16, 19, 20, 23, 24, 27, 28, 38, 39
Continuing a program: *Operator Control* 106, 108
Contrast: *Operator Control* 24
Control cabinet: *Safety* 5; *Operator Control* 7
Controller: *Introduction* 9
Controller serial number: *Introduction* 9
Conversion: *Safety* 11
Conveyor: *Safety* 10, 16
Coordinate systems: *Operator Control* 33, 41
Coordinate systems TOOL, BASE, WORLD: *Operator Control* 50
Coordinates: *Start-up* 86
Copy: *Operator Control* 81
Counter: *Operator Control* 153
Counterbalancing system: *Safety* 9, 18
Coupling and decoupling an IBUS segment: *Operator Control* 162
Coupling of the wrist axes: *Start-up* 26
CPDAT1: *User Programming* 23
Cross logbook: *Operator Control* 153
Cross reference
 Ch.: *Introduction* 8
 HB: *Introduction* 8
 MC: *Introduction* 8
 Section: *Introduction* 8
Cross references: *Introduction* 8
CTRL key: *Operator Control* 21
Current selection: *Operator Control* 138
Current value: *Operator Control* 121
Cut: *Operator Control* 82
Cycle Time Optimizer: *Operator Control* 150
Cyclical flags: *Operator Control* 123, 153

D

Damage to the robot system: *Safety* 7
Danger: *Safety* 8
Danger zones: *Safety* 9
Data list: *Operator Control* 66, 138
DEF-line: *Operator Control* 150
Default: *Start-up* 53, 85
Defects: *Safety* 19
Degrees of freedom of the Space Mouse: *Operator Control* 45
DEL key: *Operator Control* 21
Delay: *User Programming* 41, 44
Delay value: *User Programming* 48
Delete: *Operator Control* 67, 82; *User Programming* 12
Deleting a comment line: *User Programming* 50
Deleting a program: *User Programming* 6

Description of the problem: *Introduction* 9
Designated use: *Safety* 6
Designation labels: *Safety* 13
Detail view: *Operator Control* 55
Detailed information: *Start-up* 88
Device type: *Introduction* 10
Dial: *Operator Control* 159
dial gauge: *Start-up* 5
Digital Inputs: *Operator Control* 152
Digital outputs: *Operator Control* 152
Direct measuring: *Start-up* 64
Direction indicator: *Operator Control* 93
Directory list: *Operator Control* 53, 59
Directory structure: *Operator Control* 53, 55
Dirt entering the control cabinet: *Safety* 18
Disable PowerOff Delay: *Operator Control* 150
Display: *Operator Control* 136
Dominant axis: *Operator Control* 47
Dominant axis activated: *Operator Control* 48
Dominant axis not activated: *Operator Control* 48
Drives: *Operator Control* 54
Drives OFF: *Operator Control* 16, 107
Drives ON: *Operator Control* 16
DSE: *Start-up* 103
DSE - RDC: *Operator Control* 160
Duplicate: *Operator Control* 83; *User Programming* 6
Dynamic: *Operator Control* 162
Dynamic braking: *Operator Control* 96

E

E-STOP: *Start-up* 6
EC low voltage directive: *Safety* 5
EC machinery directives: *Safety* 5
Edit: *Operator Control* 81
Edit cursor: *Operator Control* 93; *User Programming* 16, 31, 46
Edit I/O configuration: *Operator Control* 148
"Edit" menu: *Operator Control* 81
Edit mode: *Operator Control* 140
Editing: *User Programming* 6
Editor: *Operator Control* 150
Electromagnetic compatibility: *Safety* 5
Emergency axis override device: *Safety* 12
EMERGENCY STOP: *Safety* 11, 14, 16
EMERGENCY STOP button: *Operator Control* 15
EMERGENCY STOP system: *Safety* 16
Employment for a purpose other than the intended one: *Safety* 5
EMT: *Operator Control* 159

Enabling switch: *Operator Control* 23; *Start-up* 13, 14, 15, 17, 19, 21
Enabling switches: *Safety* 12; *Operator Control* 17
END key: *Operator Control* 21
Enter key: *Operator Control* 19, 83
EPROMs: *Safety* 18
Error diagnosis: *Operator Control* 62
Error display: *Operator Control* 62
Error handling: *Start-up* 88
Error list: *Operator Control* 63, 138
Error message: *Start-up* 44
ESC key: *Operator Control* 18
Escape key: *Operator Control* 18
ESD directives: *Safety* 21
Exact positioning: *User Programming* 16, 22
Example: *Introduction* 7
Exchange: *Safety* 8
Exchange work: *Safety* 19
Executing program lines: *Operator Control* 103
Executing, stopping and resetting a program: *Operator Control* 91
Expert level: *Operator Control* 56
Ext: *Operator Control* 31
External axes: *Introduction* 9; *Operator Control* 40
External axis: *Operator Control* 158
External editor: *Operator Control* 160
External EMERGENCY STOP: *Safety* 12
External enabling switch: *Safety* 12
External kinematic: *Start-up* 85
External kinematic systems: *Operator Control* 40
External Machine: *Operator Control* 158
External measuring device: *Start-up* 31

F

Feed devices: *Safety* 10
File: *Operator Control* 68, 136, 137, 138
File list: *Operator Control* 53, 59
File manager: *Operator Control* 53
"File" menu: *Operator Control* 68
File name: *Operator Control* 61
File operations: *Operator Control* 136
Filter: *Operator Control* 58, 80
Find: *User Programming* 12
First mastering: *Operator Control* 159
Fixed safety devices: *Safety* 14
Fixed tool: *Operator Control* 157; *Start-up* 64
Flags: *Operator Control* 153
Flange center point: *Start-up* 30
Floppy disk drive: *Operator Control* 7

Folder: *Operator Control* 138
Force cold start: *Operator Control* 150
Foreign bodies: *Safety* 19
Foreword: *Introduction* 5
Form: *Operator Control* 27
Format floppy disk: *Operator Control* 79
Foundations: *Safety* 14
Frame: *Start-up* 31
Frequency: *Safety* 18
Frequency of the fault: *Introduction* 9
"Frontsight/rearsight" marker: *Start-up* 6
Full circle: *User Programming* 30
Function parameters: *Operator Control* 142
Fusing: *Safety* 18

G

Gate position switches: *Safety* 14
Glossary: *Appendix - Operating Handbook* 5
Go: *Operator Control* 98
Graphical user interface: *Operator Control* 53
Gripper: *Safety* 10
Guard interlock (operator safety): *Safety* 12
GUI: *Operator Control* 24
Gun: *Operator Control* 152

H

HB: *Introduction* 8
Header: *Operator Control* 53, 55
Help: *Operator Control* 127, 136, 163
Help with service requests: *Introduction* 5
History, Operating Handbook: *Appendix - Operating Handbook* 25
HOME key: *Operator Control* 21
HOV: *Start-up* 98
How to use this documentation: *Introduction* 6

I

I-Step: *Operator Control* 98
I/O Driver Reset: *Operator Control* 148
I/O State: *Operator Control* 148
IBUS Segment on/off: *User Programming* 45
Icons: *Introduction* 6, 7; *Operator Control* 54
 Example: *Introduction* 7
 Info: *Introduction* 7
 Modifications or entries not permissible: *Introduction* 7
 Modifications or entries required: *Introduction* 7
 Note: *Introduction* 7

See also: *Introduction* 7
Tip: *Introduction* 7
Identification plate: *Safety* 13
KR C3: *Introduction* 11
Linear unit: *Introduction* 10
Robot: *Introduction* 10
Identification plates: *Introduction* 10
Improper use: *Safety* 5
Incremental: *Operator Control* 119, 152
Incremental jogging: *Operator Control* 51
Incremental Step: *Operator Control* 98
Increments: *Operator Control* 119
Indicator light: *Operator Control* 151
Indirect: *Operator Control* 157; *Start-up* 55, 59
Indirect measuring: *Start-up* 68
Industrial robot: *Safety* 5
Infinitely rotating axes: *User Programming* 17
Info: *Introduction* 7; *Operator Control* 132
Injury: *Safety* 7
Inline form: *Operator Control* 28
Input mark: *Operator Control* 93
Inputs/outputs: *Operator Control* 110
INS key: *Operator Control* 21
Installation: *Safety* 8, 18
Interface characteristics: *Safety* 16
Interrupts: *Operator Control* 153
Introduction: *Start-up* 30
Italics: *Introduction* 8

J

Jog keys: *Operator Control* 40, 49
Jog mode: *Operator Control* 31, 39, 40, 98
Jog OV: *Start-up* 35
Jog OV Steps: *Operator Control* 42, 149
Jog override: *Operator Control* 42, 149
Jog velocity: *Safety* 10; *Start-up* 35
Jogging: *Operator Control* 40
Jogging the robot: *Operator Control* 39
Joint coordinate system: *Operator Control* 33, 41, 49
JX, JY, JZ: *Start-up* 53, 85

K

KCP connection: *Operator Control* 8
KCP, rear: *Operator Control* 23
Keyboard: *Operator Control* 21
Kinematic number: *Start-up* 92
KR 3: *Start-up* 22

KUKA Robot Group: *Introduction* 5

L

Language: *Operator Control* 150
Last command: *User Programming* 15
LDEL key: *Operator Control* 21
Learn: *Start-up* 16
Liability: *Safety* 5
Lifting gear: *Safety* 18
Light barriers: *Safety* 14
Light curtain: *Safety* 14, 16
LIN: *Operator Control* 161; *User Programming* 16, 22
LIN motion with approximate positioning: *User Programming* 22
LIN motions with exact positioning: *User Programming* 22
Line breaks: *Operator Control* 93, 150
Line/column: *Operator Control* 94
Linear unit: *Introduction* 9
Load correction: *Operator Control* 159
Load data determination: *Operator Control* 160
Load ratings: *Safety* 14
Loading and saving programs: *User Programming* 6
Log book: *Operator Control* 138, 153
Log Data: *Operator Control* 74
Logic: *User Programming* 31
Long text: *Operator Control* 160; *User Programming* 37, 39, 40, 44

M

M: *Start-up* 53, 85
Main axes: *Operator Control* 45
Main switch: *Safety* 8; *Operator Control* 7
Mains connection conditions: *Safety* 18
Maintenance: *Safety* 8
Maintenance cycles: *Safety* 11
Maintenance specifications: *Safety* 6
Maintenance work: *Safety* 19
Manual mode: *Operator Control* 31
Manual program execution: *Operator Control* 98
Manufacturer's declaration: *Safety* 5, 6
Master load: *Operator Control* 159
Master/Slave: *Operator Control* 152
Master/slave display: *Operator Control* 119
Mastering: *Start-up* 6, 11
Mastering on the KR 3: *Start-up* 22
Mastering with consideration of the load: *Start-up* 10
Mastering with the dial gauge: *Start-up* 7
Mastering with the EMT: *Start-up* 9
Mastering without consideration of the load: *Start-up* 10

Material damage: *Introduction* 6
Maximum braking: *Operator Control* 96
MC: *Introduction* 8
Measurement points: *Operator Control* 158; *Start-up* 86
Mechanical zero position: *Start-up* 5
Mechanical zero position reached: *Start-up* 5
Memory dump: *Introduction* 9
Menu bar: *Operator Control* 25, 136
Menu key: *Introduction* 8; *Operator Control* 136
Menu keys: *Operator Control* 20
Menu structure: *Operator Control* 136
Merker (notices): *Operator Control* 123, 153
Message window: *Operator Control* 27
Messages in the status bar: *Operator Control* 30
Mode selector switch: *Operator Control* 16, 39
Modification: *Safety* 11
Modifications or entries not permissible: *Introduction* 7
Modifications or entries required: *Introduction* 7
Module: *Operator Control* 121
Module info: *Operator Control* 57
Modules: *Operator Control* 55
Monitor: *Operator Control* 86, 110, 136
"Monitor" menu: *Operator Control* 86
Motion: *User Programming* 16, 45
Motion commands: *User Programming* 16
Motion parameters: *User Programming* 30
Motion programming: *User Programming* 16
Mouse configuration: *Operator Control* 45, 47, 149
Mouse position: *Operator Control* 43, 149
Move to reference mark: *Start-up* 94

N

Name: *Operator Control* 83, 121, 124
Navigator: *Operator Control* 53
New: *Operator Control* 58, 68
New name: *User Programming* 50
New text: *User Programming* 49, 50
New time: *User Programming* 50
New Value: *Operator Control* 121
Normal: *User Programming* 49, 50
Note: *Introduction* 7; *Safety* 7
NUM: *Operator Control* 57
NUM key: *Operator Control* 21
Numeric Input: *Start-up* 33, 34, 49, 55, 61, 64, 82
Numeric input: *Operator Control* 157, 158
Numeric keypad: *Operator Control* 20

O

Office option: *Operator Control* 150
 Offset: *Start-up* 91, 97
 Offset (numeric): *Start-up* 91, 100
 Offset external kinematic: *Operator Control* 158; *Start-up* 64, 77, 102
 Offset voltage: *User Programming* 48
 On/off switch: *Operator Control* 9
 Online help: *Operator Control* 127, 130
 Open: *Operator Control* 66, 70; *User Programming* 6
 Operating instructions: *Safety* 5
 Operating mode: *Operator Control* 31
 Operation: *Safety* 18, 19
 Operator control: *Safety* 8
 Operator control elements: *Operator Control* 15
 Orientation: *Start-up* 30; *User Programming* 22, 26
 Orientation control: *User Programming* 23, 25, 27, 29
 Orientation determination: *Start-up* 33
 Oscilloscope: *Operator Control* 153
 OUT: *Operator Control* 162; *User Programming* 37, 38, 40
 Outputs: *Operator Control* 111
 Overloading: *Start-up* 52

P

Padlock: *Safety* 8
 Paint markings: *Safety* 9
 Parameter: *Operator Control* 57, 142
 Parameter list: *Operator Control* 27
 Parameters: *Operator Control* 84
 Parts catalog: *Safety* 11
 Paste: *Operator Control* 81
 PATH: *User Programming* 41, 45
 Path-maintaining braking in event of operator safety violation: *Operator Control* 97
 Path-maintaining Emergency Stop: *Operator Control* 95
 Payload: *Safety* 10
 Payload data: *Start-up* 33, 52
 PDAT1: *User Programming* 19, 27
 Personal injury: *Introduction* 6
 Personal protection: *Safety* 18
 PGDN key: *Operator Control* 21
 PGUP key: *Operator Control* 21
 Planning: *Safety* 14
 Plates: *Safety* 13
 PlugIn Configuration: *Operator Control* 150
 Point: *Operator Control* 144
 Position: *Start-up* 30
 Position determination: *Start-up* 33
 Position marks: *Safety* 13

POV: *Operator Control* 31
Power failure: *Operator Control* 11
Pre-mastering position: *Start-up* 6, 11
Presetting of outputs: *Safety* 17
Print: *Operator Control* 72
Program: *Operator Control* 136; *User Programming* 5
Program creation: *Operator Control* 136; *User Programming* 5
Program editor: *User Programming* 12
Program key: *Introduction* 8
Program name: *Operator Control* 94
Program OV Steps: *Operator Control* 149
Program override: *Operator Control* 31, 95, 149
Program pointer: *Operator Control* 92
Program run mode: *Operator Control* 98
Program start backwards: *Operator Control* 98, 104
Program start backwards key: *Operator Control* 19
Program start forwards: *Start-up* 13, 14, 15, 17, 19, 21
Program start forwards key: *Operator Control* 18, 23
Program stop key: *Operator Control* 18
Program velocity: *Operator Control* 95
Program window: *Operator Control* 26, 92
Program/Edit: *Operator Control* 141
Programming: *User Programming* 31, 46
Programming a LIN motion: *User Programming* 23
Programming a PTP motion: *User Programming* 19
Protection from dirt: *Safety* 18
Protection from dirt and UV radiation: *Safety* 18
Protective barriers: *Safety* 14
Protective cap: *Start-up* 5
Protective clothing: *Safety* 11, 18
PTP: *Operator Control* 161; *User Programming* 16, 18
PTP motion with approximate positioning: *User Programming* 19
PTP motions with exact positioning: *User Programming* 18
PULSE: *Operator Control* 162; *User Programming* 37, 38, 39, 44
Put into operation: *Safety* 6

Q

Quotation marks: *Introduction* 8

R

Ramp-down braking: *Operator Control* 95
Range limit switches: *Safety* 16
RDC: *Start-up* 103
Reactivation: *Operator Control* 11
Reconfigure I/O Driver: *Operator Control* 148
Reference point: *Start-up* 32
Reference point mastering: *Start-up* 25

Reference tool: *Start-up* 33, 93
Regulations: *Safety* 17
Reinit: *Operator Control* 150
Release E-STOP: *Operator Control* 15
Rename: *Operator Control* 78
Repair: *Safety* 8
Repair work: *Safety* 19
Reset: *Operator Control* 9, 106, 108
Reset program: *Operator Control* 106, 108
Restore: *Operator Control* 75
Restricted envelope – working space limitation: *Safety* 11
Risk to life and limb: *Safety* 5
Robot: *Safety* 5
Robot coordinate system: *Start-up* 30
Robot coordinates: *User Programming* 22, 25, 30
Robot data: *Start-up* 103
Robot flange coordinate system: *Start-up* 30
Robot mastering: *Operator Control* 159; *Start-up* 5, 23
Robot position: *Operator Control* 118
Robot serial number: *Introduction* 9
Robot system: *Safety* 5
Root point: *Operator Control* 158; *Start-up* 91, 92
Root point (numeric): *Start-up* 91, 95
Rotation about the X axis: *Start-up* 30
Rotation about the Y axis: *Start-up* 30
Rotation about the Z axis: *Start-up* 30
Running up the controller: *Operator Control* 7, 9

S

Safety (exclusion) zones: *Safety* 14
Safety circuit: *Operator Control* 153
Safety equipment: *Safety* 10, 19
Safety fences: *Safety* 14
Safety footwear: *Safety* 18
Safety functions: *Safety* 11
Safety instruction: *Safety* 11
Safety Instructions: *Operator Control* 97
Safety instructions: *Safety* 8
Safety labeling: *Safety* 13
Safety mat: *Safety* 16
Safety mats: *Safety* 16
Safety measures: *Safety* 8, 19
Safety regulations: *Safety* 19
Safety symbols: *Introduction* 6; *Safety* 7, 13
 Caution: *Introduction* 6
 Warning: *Introduction* 6
Save: *Start-up* 19

Save the point: *Start-up* 94
Saving current coordinates: *User Programming* 22, 25, 26, 30
Screwed connections: *Safety* 20
Searching: *User Programming* 9
Section: *Introduction* 8
See also: *Introduction* 7
Select: *Operator Control* 84, 91
Select/open/save a program: *User Programming* 5
Selecting and opening a program: *Operator Control* 91
Selecting the kinematic system: *Operator Control* 40
Selection list: *Operator Control* 53, 58
Sensor-assisted operation: *Safety* 10
Serial Communication: *Operator Control* 148
Serial number: *Introduction* 10; *Safety* 6; *Start-up* 103
Serif: *Introduction* 8
Serif bold: *Introduction* 8
Service centers: *Introduction* 14
Service requests: *Introduction* 9
Set mastering: *Operator Control* 159
Setup: *Operator Control* 136, 155
SHIFT key: *Operator Control* 22
Short-circuit braking: *Operator Control* 96
Shut-down: *Safety* 19
Shutting down the controller: *Operator Control* 10
Signal states: *Operator Control* 111, 112
Signs: *Safety* 9
Simultaneous motion: *Operator Control* 33
Single Step: *Operator Control* 98
Skeleton program: *Operator Control* 70, 71
Skilled electrician: *Safety* 9
Softkey: *Introduction* 8
Softkey bar: *Operator Control* 26
Softkeys: *Operator Control* 20
Software: *Safety* 19
Software limit switches: *Operator Control* 39
Software version numbers: *Introduction* 12
Space Mouse: *Operator Control* 17, 40, 43; *Start-up* 35
Square brackets: *Introduction* 8
Stamp: *Operator Control* 162; *User Programming* 49
Standard concerning the safety of industrial robots: *Safety* 8
START key: *Operator Control* 18
Start key: *Start-up* 13, 14, 15, 16, 19, 20
Start-up: *Safety* 19
State: *User Programming* 38, 39, 41, 44
Static: *Operator Control* 162
Status bar: *Operator Control* 30
Status key bars: *Operator Control* 26
Status keys: *Operator Control* 20

Status line: *Operator Control* 16, 28, 53, 61, 94
Status window: *Operator Control* 27, 40
STOP key: *Operator Control* 18
Stop reactions: *Operator Control* 95
Stopping program execution: *Operator Control* 106, 107
Submenu key: *Introduction* 8
Substructures: *Safety* 14
Superposed motion: *Operator Control* 48
Supplementary load data: *Operator Control* 158; *Start-up* 84
Suspended loads: *Safety* 18
SYM key: *Operator Control* 22
Symbol: *Operator Control* 94
Symbols: *Operator Control* 54
Symbols in the program window: *Operator Control* 92
SYN OUT: *Operator Control* 162; *User Programming* 40
SYN PULSE: *Operator Control* 162; *User Programming* 43, 44
SYNOUT: *User Programming* 37, 44
SYNPULSE: *User Programming* 39, 40
System time: *Operator Control* 31

T

T1: *Operator Control* 31, 39
T2: *Operator Control* 31, 39
TAB key: *Operator Control* 21
TCP: *Start-up* 31, 34, 98
Teach offset: *Operator Control* 159
Technical data: *Safety* 6
Technology: *Operator Control* 136, 162
Technology parameters: *User Programming* 48
Technology-dependent: *User Programming* 47
Templates: *Operator Control* 58
Test (T1): *Start-up* 7, 12, 13, 15, 16, 18, 20
Text emphasis: *Introduction* 6
Text style
 Bold: *Introduction* 8
 Italics: *Introduction* 8
 Quotation marks: *Introduction* 8
 Serif: *Introduction* 8
 Serif bold: *Introduction* 8
 Square brackets: *Introduction* 8
Text styles: *Introduction* 8
Time: *User Programming* 39, 44
Timer: *Operator Control* 153
Tip: *Introduction* 7
Tolerance limits: *Start-up* 87
Tolerances: *Operator Control* 158; *Start-up* 87
Tool: *Operator Control* 157; *Start-up* 64, 73

Tool Center Point: *Start-up* 31
Tool center point: *Start-up* 31, 98
Tool change: *Safety* 16
TOOL coordinate system: *Operator Control* 33, 41
Tool load data: *Operator Control* 157
Tool number: *Start-up* 34
Tool type: *Operator Control* 149, 158
Torques: *Safety* 14
Trade association: *Safety* 17, 18
Transport position: *Safety* 18
Transportation: *Safety* 18
Types of motion: *User Programming* 16

U

Unauthorized start-up: *Safety* 19
UNDO key: *Operator Control* 21
UnMaster: *Start-up* 6
Unmastering an axis: *Start-up* 26
User levels: *Operator Control* 149

V

Variables: *Operator Control* 121
Vel: *User Programming* 19, 23, 27
Velocity: *Start-up* 35
Velocity parameters: *User Programming* 48
Velocity-dependent: *User Programming* 47
Vernier: *Start-up* 5
Version numbers of the software: *Introduction* 9
Viruses: *Safety* 19
Voltage: *Safety* 18

W

WAIT: *Operator Control* 162; *User Programming* 31
WAIT FOR: *User Programming* 32
Wait functions: *User Programming* 31
WAITFOR: *Operator Control* 162
Warning: *Introduction* 6
Warning and safety instructions: *Operator Control* 97
Warning labels: *Safety* 13
Warning remarks: *Safety* 11
Web Diagnosis: *Operator Control* 153
Weight difference: *Start-up* 10
Weights: *Safety* 14
Window selection key: *Operator Control* 18, 68
With offset: *Operator Control* 159
Without offset: *Operator Control* 159

Working direction: *Start-up* 41
Working platforms: *Safety* 20
Working range limitation: *Safety* 14
Working with the product documentation: *Introduction* 5
Working zones: *Safety* 14
Workpiece: *Operator Control* 157; *Start-up* 64
Workspace monitoring: *Operator Control* 150
WORLD coordinate system: *Operator Control* 33, 41
World coordinate system: *Start-up* 30
Wrist axes: *Operator Control* 46

X

X axis: *Operator Control* 36
X Y Z - 4-Point: *Operator Control* 157; *Start-up* 33, 34
X Y Z - Reference: *Operator Control* 157; *Start-up* 33, 37
X, Y, Z: *Start-up* 31, 38, 50, 53, 82, 85, 96, 101
X32: *Start-up* 5

Z

Z-Y-X Euler angles: *Start-up* 30
Zone scanners: *Safety* 14