
SEMINAR WORKBOOK OF

ROBOT BRIEFING

for KUKA System Software V5.x

OPERATOR

Workbook MO1 01.06.00



© Copyright 2006

**KUKA Roboter GmbH
Zugspitzstraße 140
D-86165 Augsburg**

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 claims 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.

KUKA Roboter GmbH accepts no liability whatsoever for any errors in technical information communicated orally or in writing in the training courses or contained in the documentation. Nor will liability be accepted for any resultant damage or consequential damage.

Responsible for this training documentation: College Development (WSC-IC)

Contents

1. The robot system	5
1.1. Robot system basics	5
1.2. System overview	9
2. Operation and coordinate systems	13
2.1. Operation of the KUKA Control Panel (KCP)	13
2.2. Coordinate systems of the robot	25
2.3. Jogging axis specific	27
2.4. WORLD coordinate system	29
2.5. Choice of a coordinate system	33
3. Setup	35
3.1. Mastering	35
3.2. Activate a tool	37
3.3. Activate a base	39
4. Programming	41
4.1. Motion programming	41
4.2. PTP – Motion	43
5. Navigator	47
6. Automatic external mode	51
7. Exercises	53

1. The robot system

1.1. Robot system basics

Components of a complete KUKA robot system



KUKA robot
(e.g. KR 180)



KUKA Control Panel
(KCP)



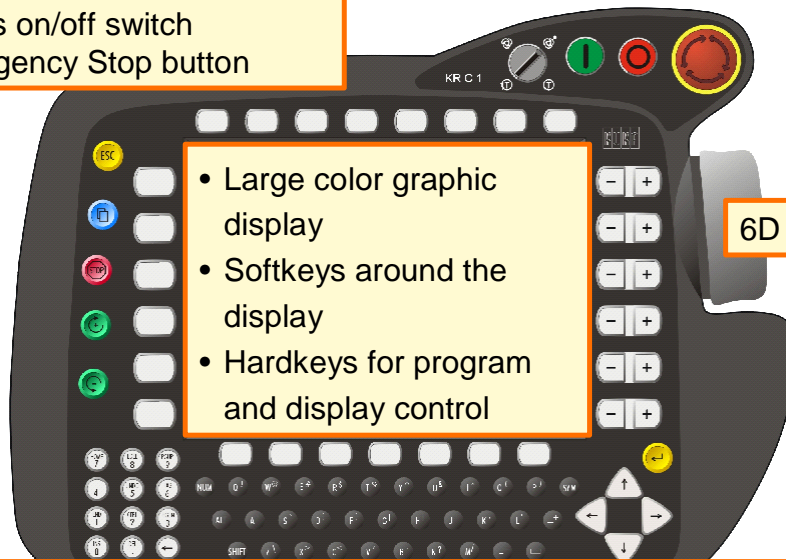
KUKA
robot controller

01/2006 1
mo1_robot_basics_en.ppt
© Copyright by KUKA Roboter GmbH College



KUKA Control Panel (KCP)

- Keyswitch for mode selection
- Drives on/off switch
- Emergency Stop button



- Large color graphic display
- Softkeys around the display
- Hardkeys for program and display control

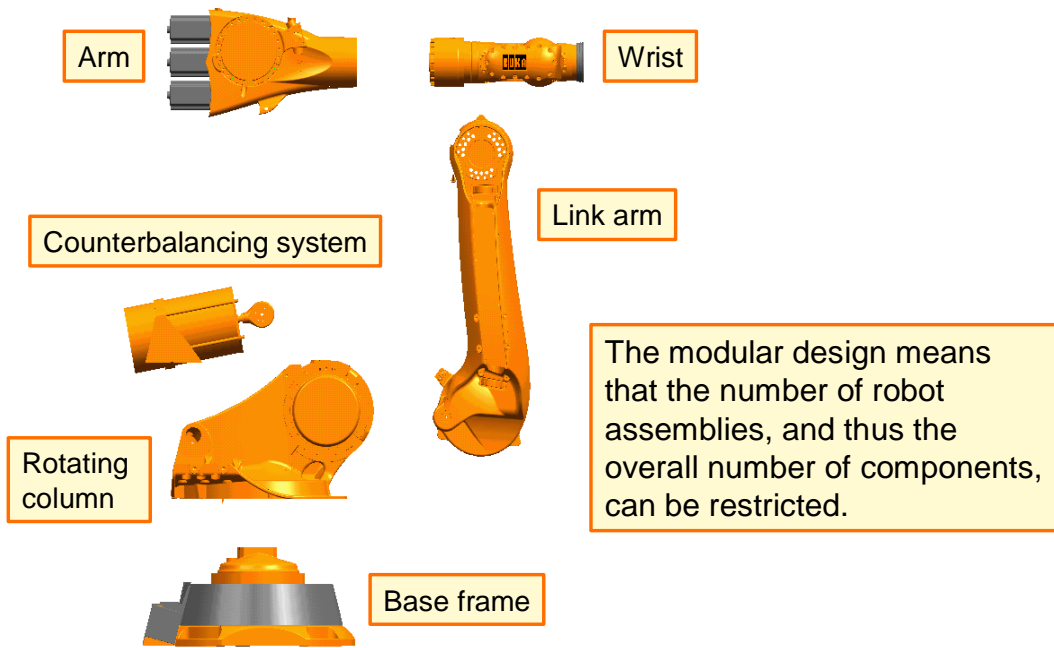
6D mouse

Numeric keypad, alphabetic keypad, cursor block with Enter key

01/2006 2
mo1_robot_basics_en.ppt
© Copyright by KUKA Roboter GmbH College



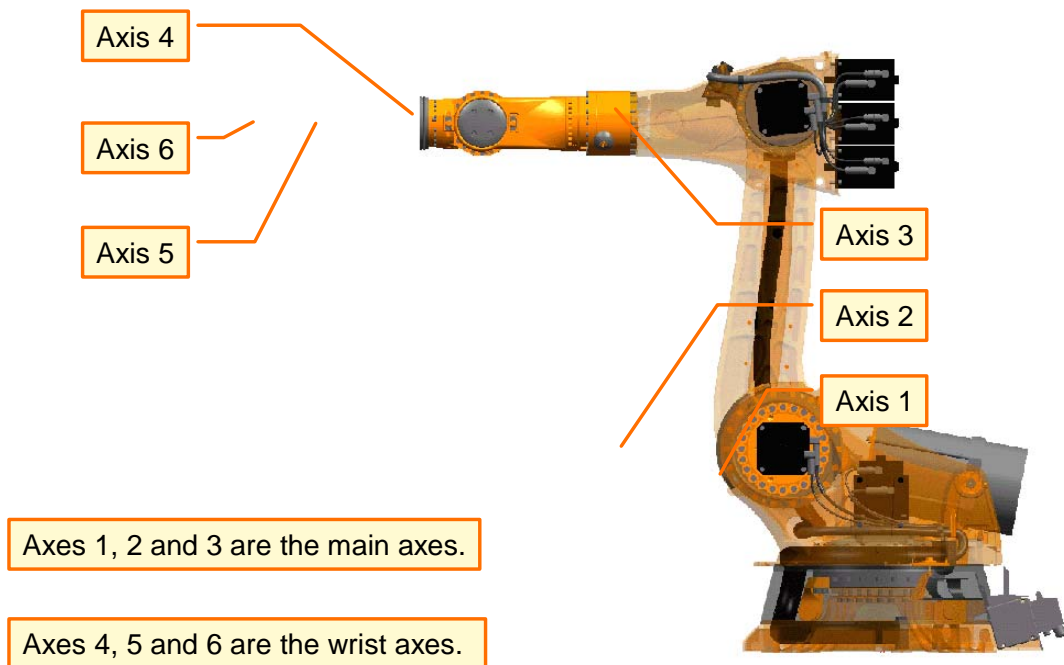
Mechanical construction of a KUKA robot



01/2006 3
 mo1_robot_basics_en.ppt
 © Copyright by KUKA Roboter GmbH College



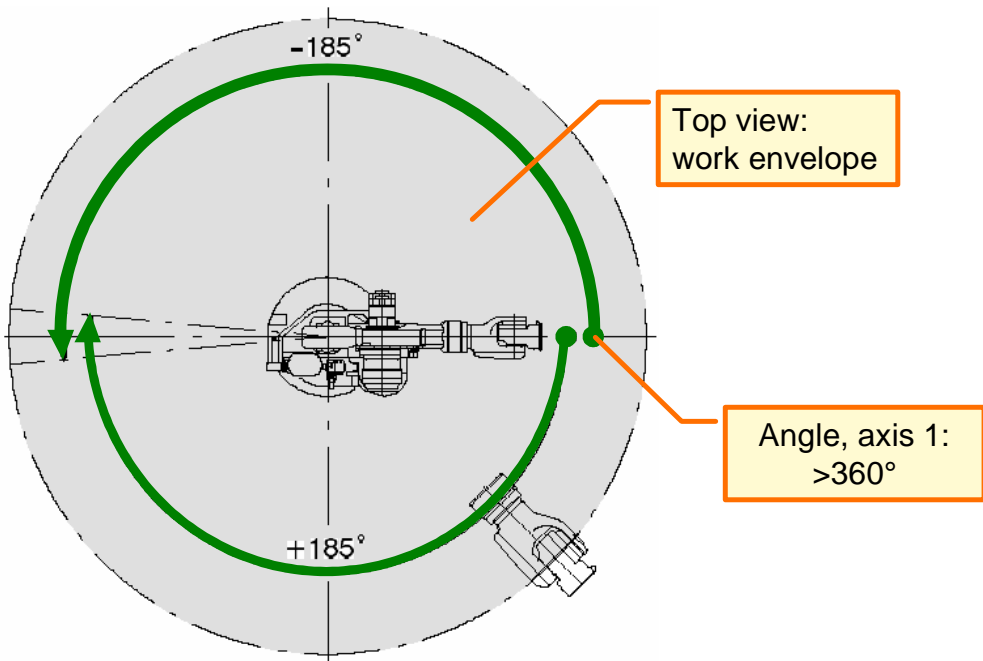
Axis designations of a KUKA robot



01/2006 4
 mo1_robot_basics_en.ppt
 © Copyright by KUKA Roboter GmbH College



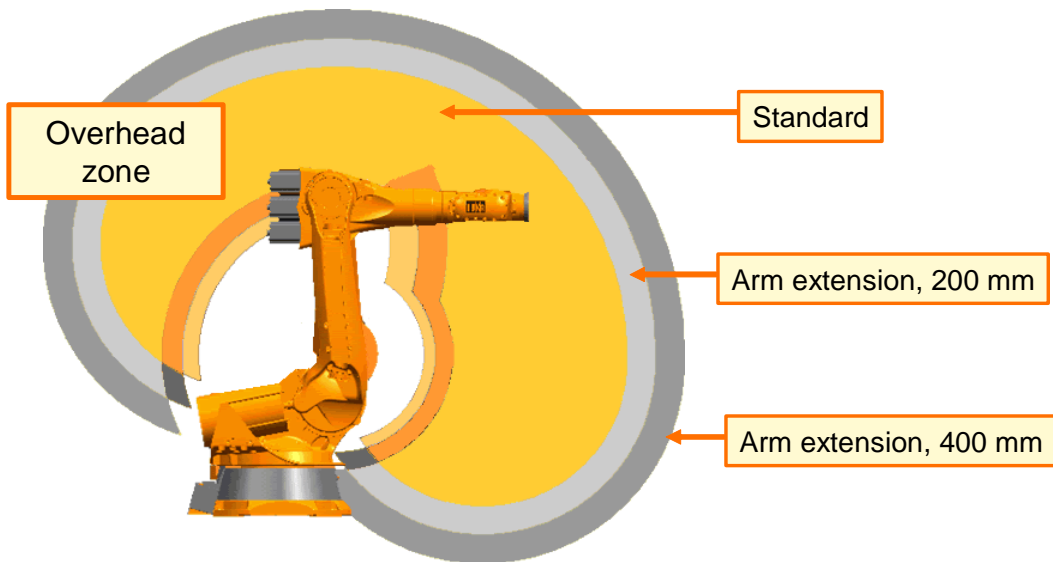
The work envelope of a KUKA robot (top view)



01/2006 5
mo1_robot_basics_en.ppt
© Copyright by KUKA Roboter GmbH College



Working range extension



01/2006 6
mo1_robot_basics_en.ppt
© Copyright by KUKA Roboter GmbH College



1.2. System overview

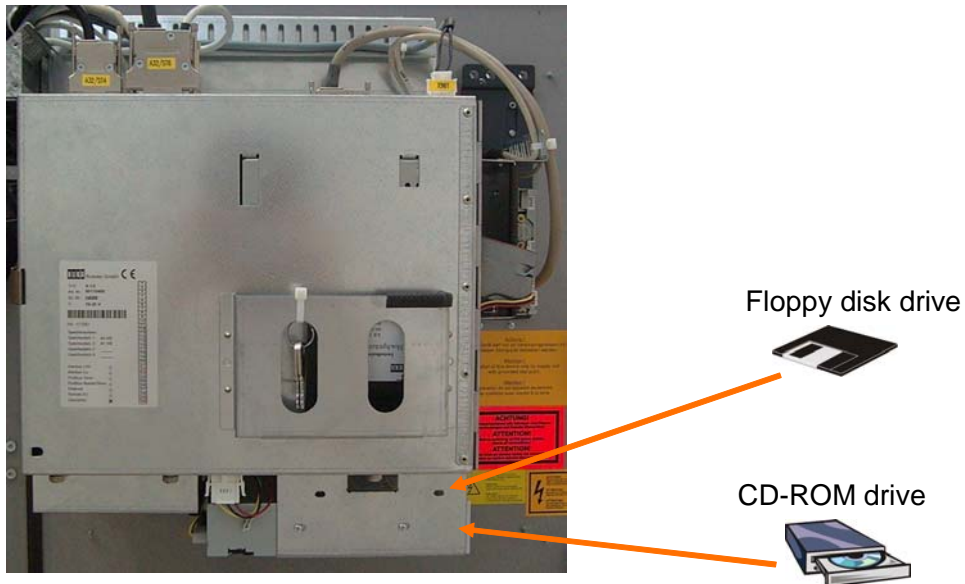
KR C2 control cabinet for max. 8 axes



01/2006 1
mo1_system_overview_en.ppt
© Copyright by KUKA Roboter GmbH College



PC chassis - KR C2



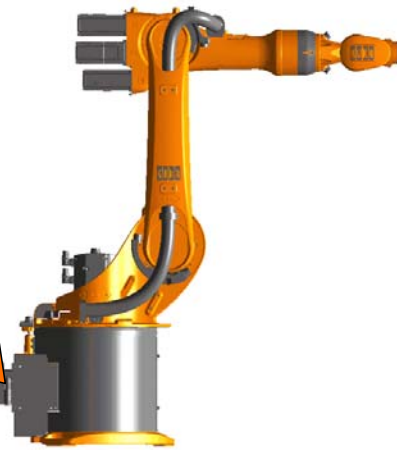
01/2006 2
mo1_system_overview_en.ppt
© Copyright by KUKA Roboter GmbH College



Robot serial number

KUKA Roboter GmbH			KUKA
Augsburg / Germany			
Typ	Type	Type:	KR16
Werk-Nr.	Serial-No.	No. Série	858057
Baujahr	Date	Année de. Fab.	2003
Zeich.Nr.	Draw No.	Plan No.	394.029
Gewicht	Weight	Poids	235 kg

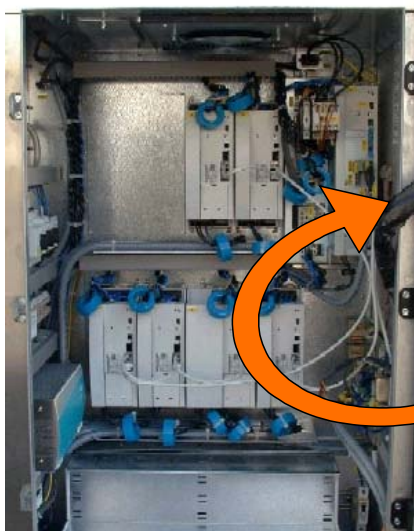
D/GB/F



Serial number



Control cabinet serial number



KUKA Roboter GmbH			Augsburg/Germany
 			KUKA
Typ	Type	Type	
Werk-Nr.	Serial-No.	No. de série	00008
Artikel-Nr.	Artikel-No.	No. d'article	00106204
Baujahr	Date	Année de fabric.	2000
Plan-Nr.	Plan-No.	No. de dessin	abade
Anschlußspg.	Supply Volt.	Tension	3x400V
Netzfrequenz	Frequency	Fréquence	50/60Hz
Nennstrom	Rated Current	Courant nominal	8A
Netzsicherung	Mainfuse	Fusible secteur	16A
Gewicht	Weight	Poids	

Serial number



User groups

- Configuration of the robot controller (external axes, technology packages)
- Configuration of the robot system (field buses, vision systems, etc.)
- User-defined technology commands with UserTECH



Administrator

- Advanced programming using the KRL programming language
- Complex application programs (subprograms, interrupt programming, loops, program branches)
- Numeric motion programming

Expert



- Start-up tasks (mastering, tool calibration)
- Simple application programs (programming using inline forms, motion commands, technology commands, limit value checking, no syntax errors)



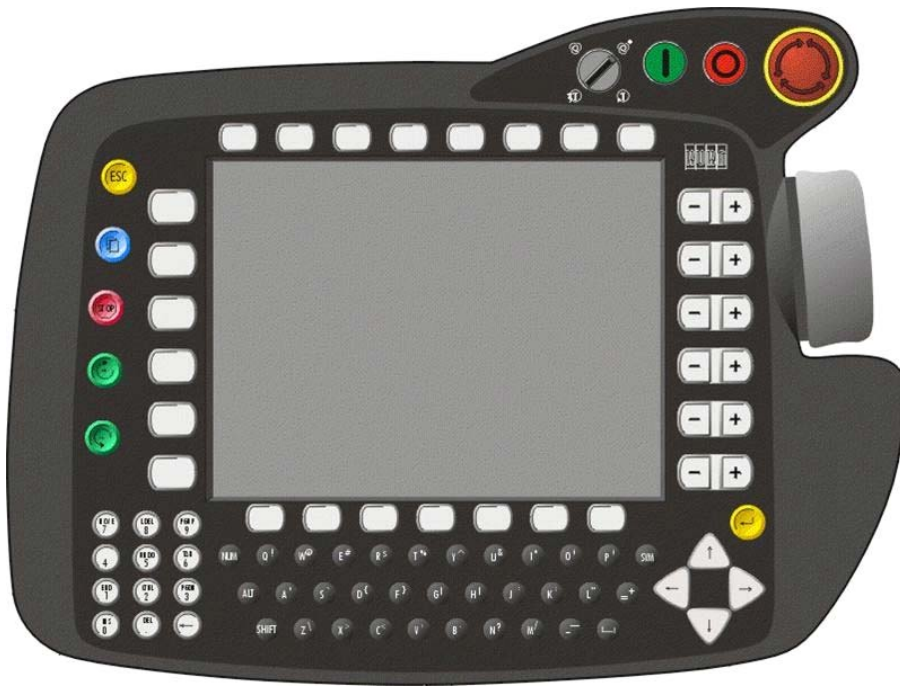
User



2. Operation and coordinate systems

2.1. Operation of the KUKA Control Panel (KCP)

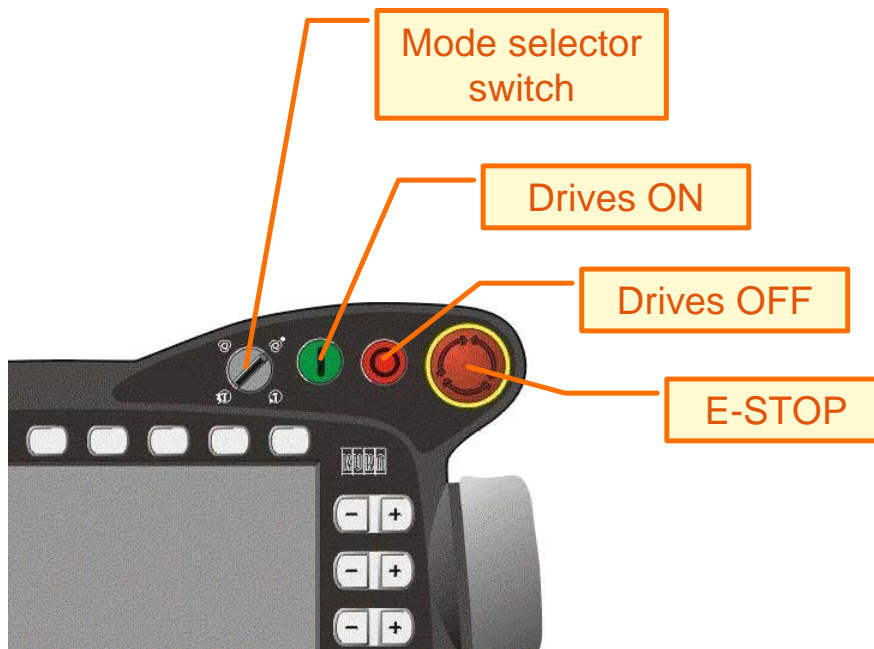
KUKA Control Panel (KCP)



01/2006 1
mo1_kcp_en.ppt
© Copyright by KUKA Roboter GmbH College



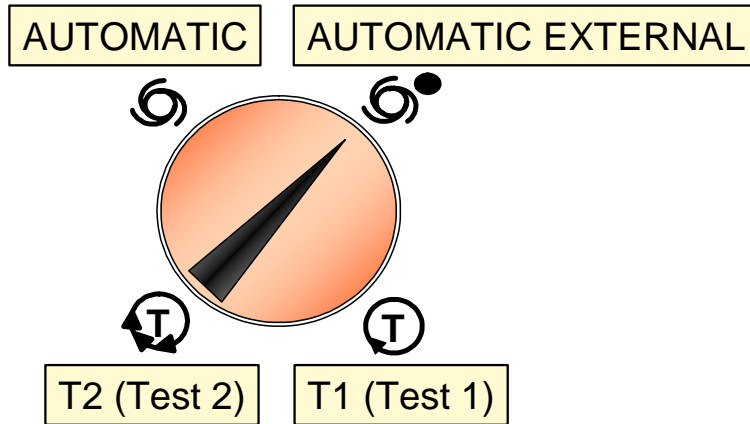
Operator control elements





01/2006 2
mo1_kcp_en.ppt
© Copyright by KUKA Roboter GmbH College



Mode selector switch



Mode table

Mode selector switch	T1	T2	AUTOMATIC	AUTOMATIC EXTERNAL
Jogging using keys or Space Mouse HOV 	250 mm/s Enabling switch (dead man function)	250 mm/s Enabling switch (dead man function)	Jogging not active	Jogging not active
Program execution POV 	250 mm/s Enabling switch (dead man function) START key pressed	Prog. velocity Enabling switch (dead man function) START key pressed	Prog. velocity Drives ON START key --> PULSE	Prog. velocity Drives ON external External start



CAN bus operator control elements



01/2006 5
mo1_kcp_en.ppt
© Copyright by KUKA Roboter GmbH College



Display window

The screenshot shows the KUKA control display interface. It features a menu bar at the top with options: Datei, Bearbeiten, Konfiguration, Anzeige, Inbetriebn., Befehle, Technologie, Hilfe. The main display area is divided into three windows:

- Programming window (red border):** Shows a list of program lines:


```

1 DEF CELL ( )
2 ;EXT EXAMPLE1 ( )
3 ;EXT EXAMPLE2 ( )
4 ;EXT EXAMPLE3 ( )
5
6 INIT
7 BASISTECH INI
            
```
- Status window (yellow border):** Shows a table of outputs:

SYS	Ausgänge
1	Ausgang
2	Ausgang
3	Ausgang
4	Ausgang
8	Ausgang
9	Ausgang
10	Ausgang
11	Ausgang
12	Ausgang
13	Ausgang
14	Ausgang
15	Ausgang
- Message window (blue border):** Shows a log of messages:

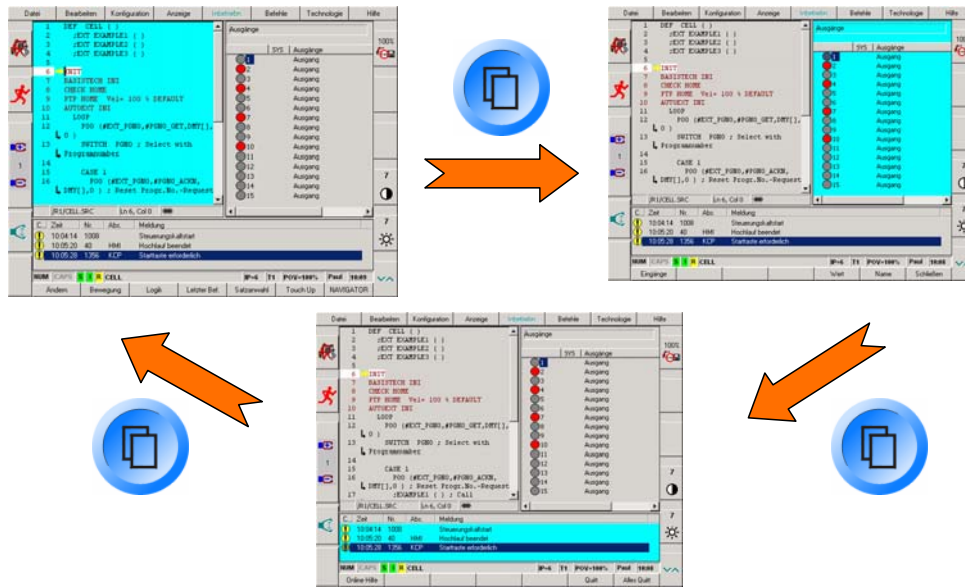
Zeit	Nr.	Abs.	Meldung
10:04:14	1008		
10:05:20	40	HMI	
10:05:28	1356	KCP	

At the bottom of the screen, there is a status bar with information: HUM, CAPS, S, I, R, CELL, IP=6, T1, POV=100%, Paul, 10:09, and a row of icons: Ändern, Bewegung, Logik, Letzter Bef., Satzanwahl, Touch Up, NAVIGATOR.

01/2006 6
mo1_kcp_en.ppt
© Copyright by KUKA Roboter GmbH College



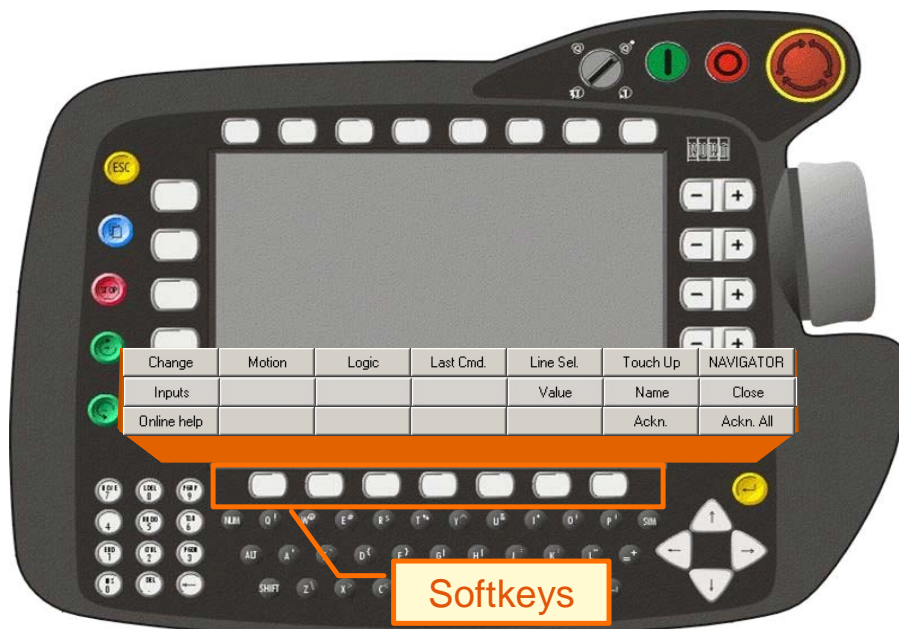
Window selection key



01/2006 7
 mo1_kcp_en.ppt
 © Copyright by KUKA Roboter GmbH College



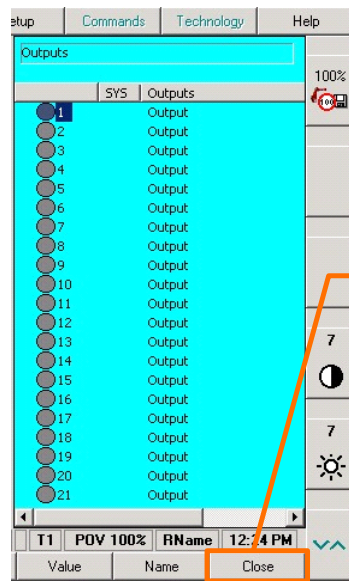
Softkeys



01/2006 8
 mo1_kcp_en.ppt
 © Copyright by KUKA Roboter GmbH College



Status window



The status window is displayed as required and can be closed at any time.



Message window

The controller communicates with the operator via the message window.

C...	Time	no.	Source	Message
!	12:37:59 PM	1008		Controller booted
!	12:38:50 PM	0	TPUS...	Initialization in progress
!	12:38:52 PM	0	TPUS...	Initialization finished
!	1:09:39 PM	1356	KCP	Start key required

Num	Cap	S	I	R	GLUE_ORDER	IP= 1	T1	POV 100%	RName	1:16 PM
Online help										Ackn. Ackn. All

Softkeys for acknowledging messages



Message types



Notify - e.g. "Start key required"



Status - e.g. "EMERGENCY STOP"



Acknowl. - e.g. "Ackn. EMERGENCY STOP"



Wait - e.g. "Wait for \$IN[1]==True"



Dialog - e.g. "Do you want to teach point?"

01/2006 11
mo1_kcp_en.ppt
© Copyright by KUKA Roboter GmbH College



Online help

The screenshot shows the KUKA control interface with a menu bar (File, Program, Configure, Monitor, Setup, Commands, Technology, Help) and a toolbar. A yellow help window titled "Start key required" is open, displaying the following information:

- Cause:**
 - Execution of the command requires the Start key to be pressed.
 - The "Start" command has been entered textually.
- Effect:** Robot is stationary.
- Remedy:**
 - Press the Start key.
 - In the case of an external computer: check job identification.

Below the help window is a message log table:

C...	Time	no.	Source	Message
!	12:37:59 PM	1008	Controller	Controller booted
!	12:38:50 PM	0	TPUS...	Initialization in progress
!	12:38:52 PM	0	TPUS...	Initialization finished
!	1:09:39 PM	1356	KCP	Start key required

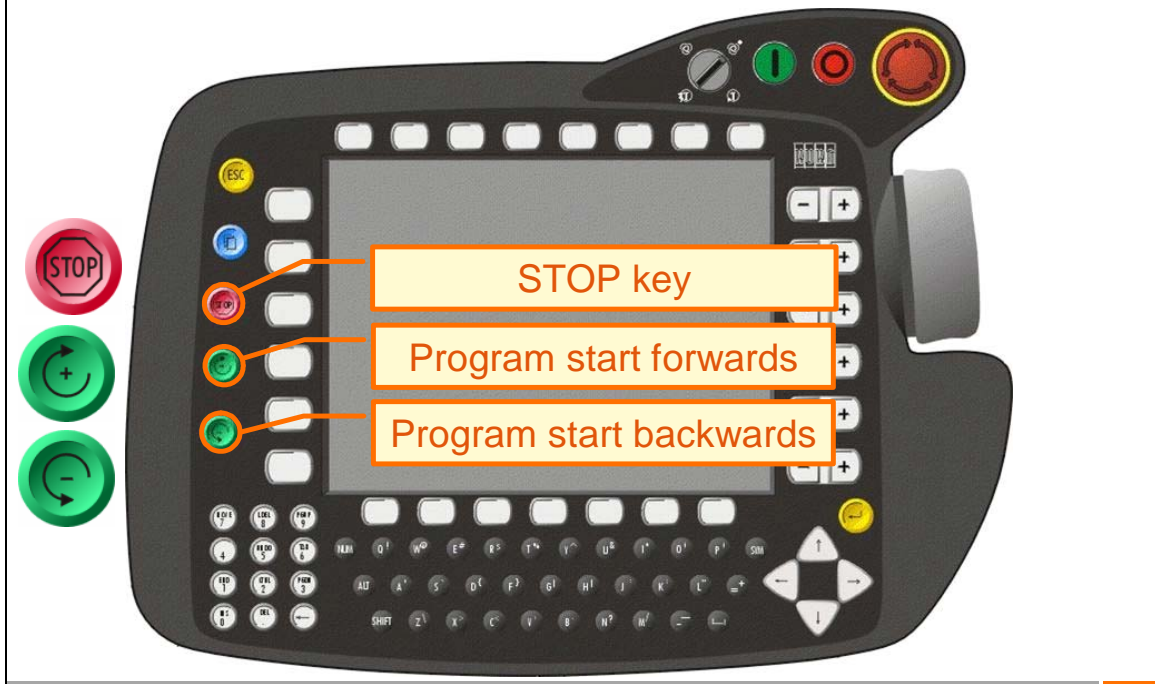
The "Start key required" message is highlighted in blue. A red arrow points from a directional keypad (up, down, left, right arrows) to the highlighted message. The "Online help" button is also visible at the bottom left of the interface.

Select a message text using the arrow keys; the "Online help" function will provide an explanation.

01/2006 12
mo1_kcp_en.ppt
© Copyright by KUKA Roboter GmbH College



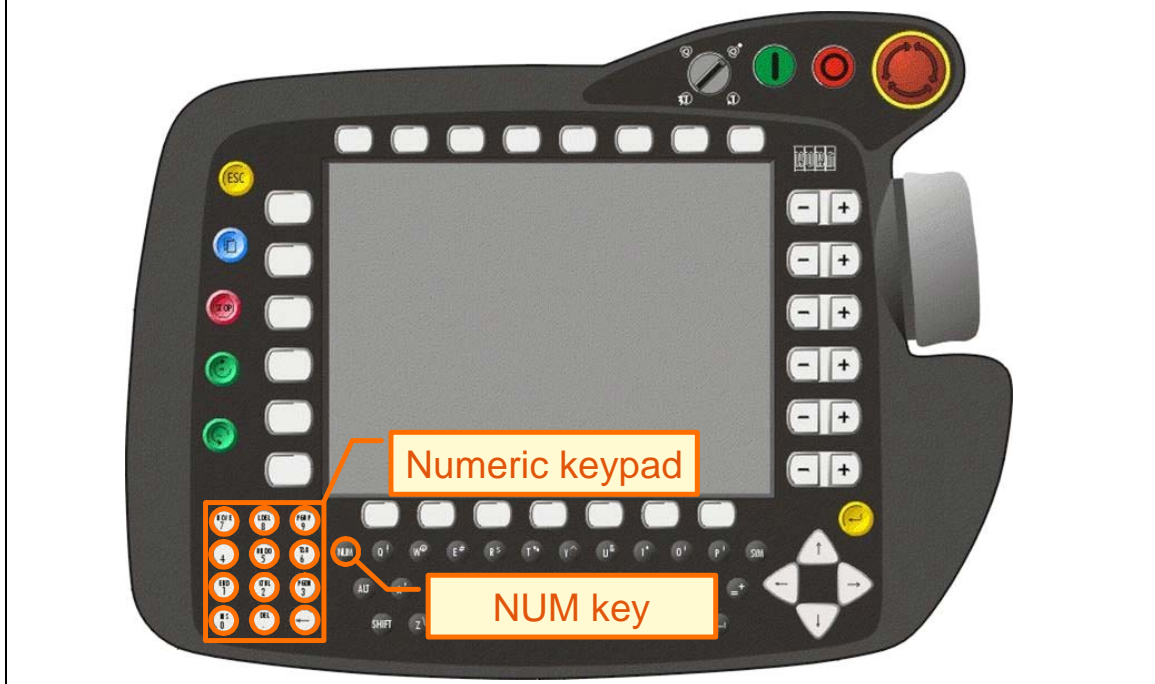
CAN bus operator control elements



01/2006 13
mo1_kcp_en.ppt
© Copyright by KUKA Roboter GmbH College



CAN bus operator control elements



01/2006 14
mo1_kcp_en.ppt
© Copyright by KUKA Roboter GmbH College



Numeric keypad

HOME
Jumps to the beginning of the line in which the edit cursor is positioned.

UNDO
Cancels the last entry.

END
Jumps to the end of the line in which the edit cursor is positioned.

INS
Switches between insert and overwrite modes.

LDEL
Deletes the line in which the edit cursor is positioned.

PGUP
Moves one screen towards the beginning of the file.

TAB
Tab jump

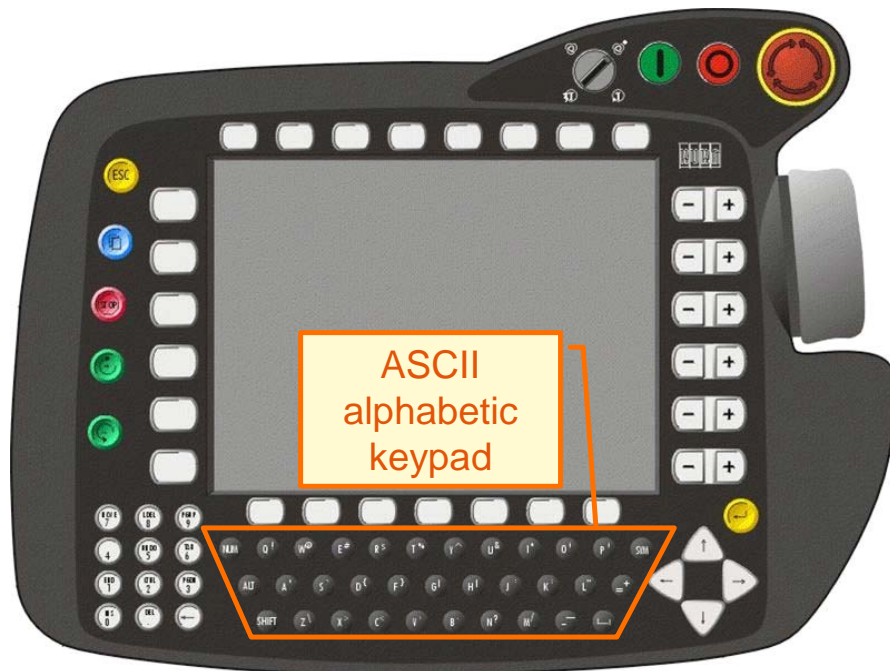
PGDN
Moves one screen towards the end of the file.

CTRL
Control key

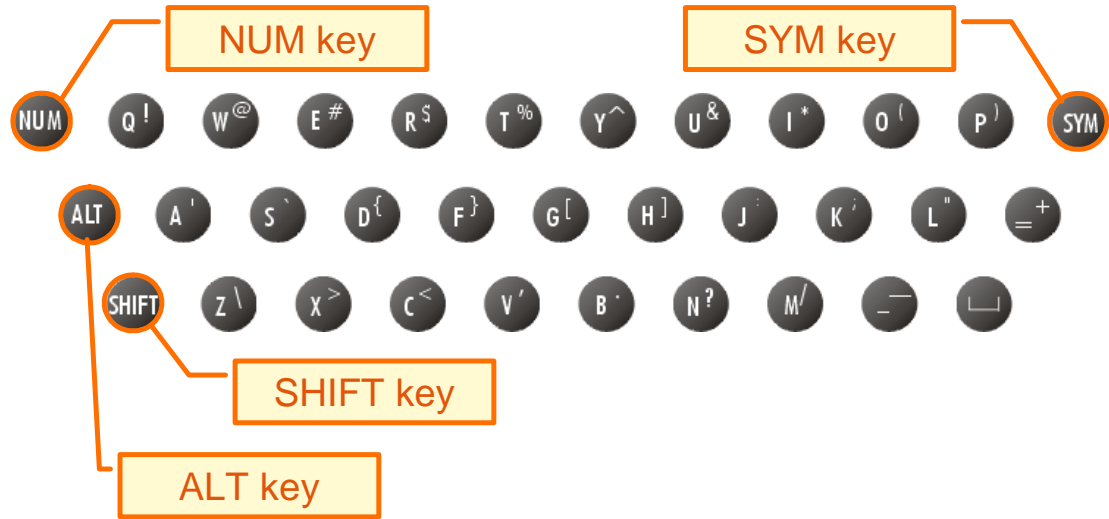
Arrow
Backspace key; deletes the character to the left of the edit cursor.



CAN bus operator control elements



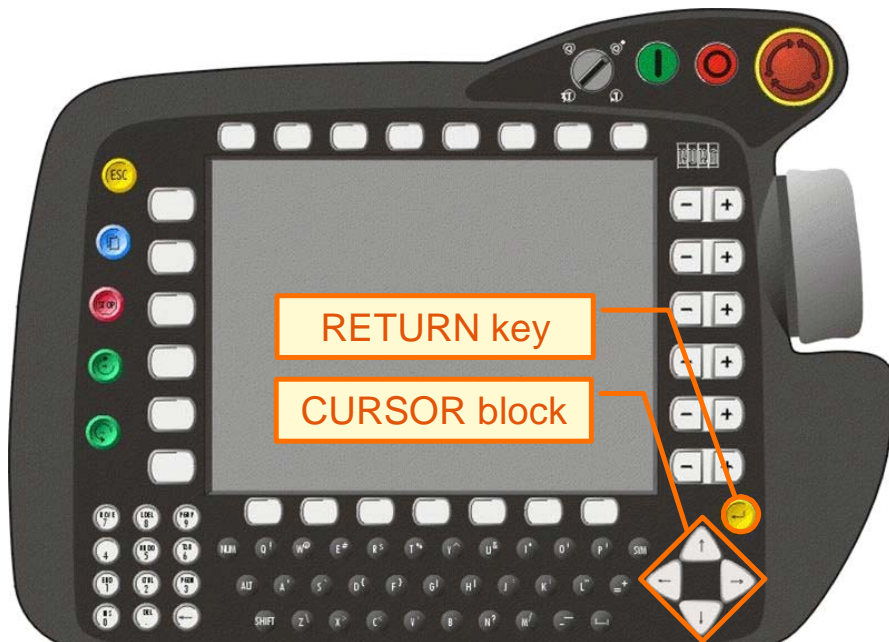
ASCII alphabetic keypad



01/2006 17
 mo1_kcp_en.ppt
 © Copyright by KUKA Roboter GmbH College



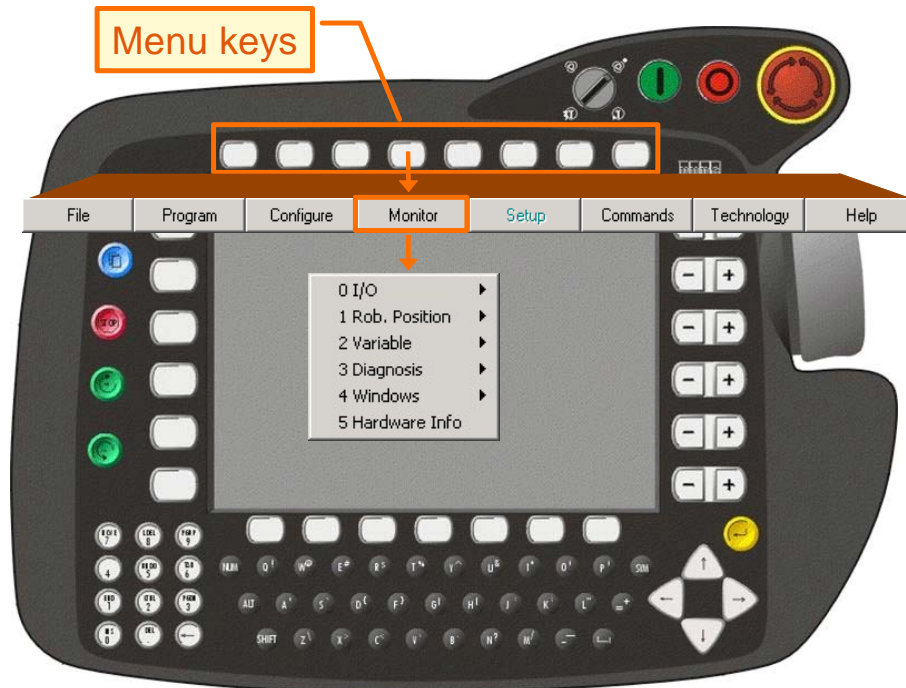
CAN bus operator control elements



01/2006 18
 mo1_kcp_en.ppt
 © Copyright by KUKA Roboter GmbH College



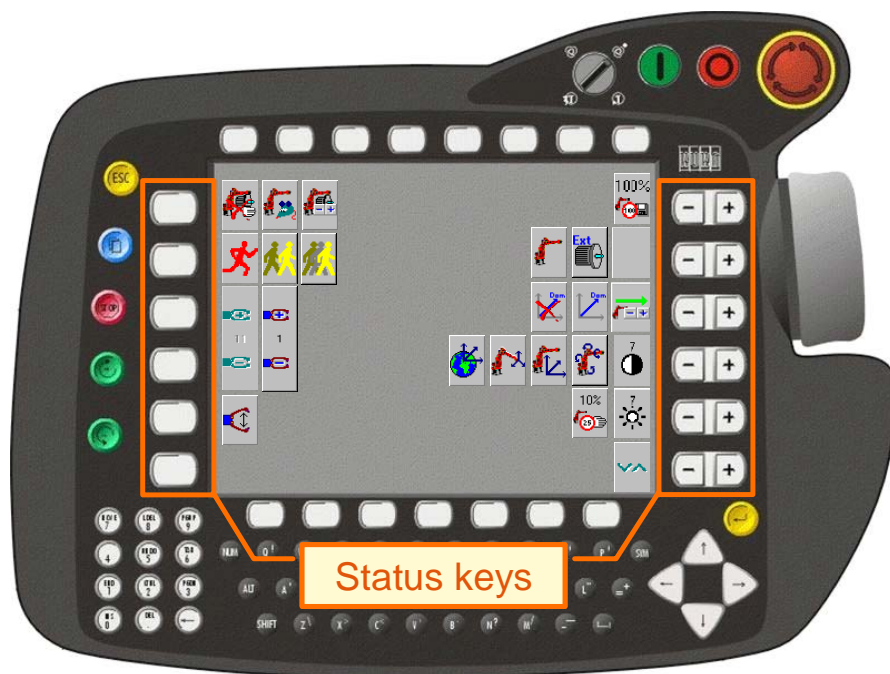
Menu keys



01/2006 19
 mo1_kcp_en.ppt
 © Copyright by KUKA Roboter GmbH College



Status keys



01/2006 20
 mo1_kcp_en.ppt
 © Copyright by KUKA Roboter GmbH College



Status bar

The status bar contains the following fields: NUM, CAPS, S, I, R, CELL, IP=6, T1, POV=100%, Paul, 10:09.

- Numeric keypad**: Points to the NUM field.
- Upper/lower-case letters**: Points to the CAPS field.
- Time**: Points to the 10:09 field.
- Robot name**: Points to the Paul field.
- Selected program**: Points to the S, I, R fields.
- Current block number**: Points to the IP=6 field.
- Override**: Points to the T1 field.
- Operating mode**: Points to the POV=100% field.

01/2006 21
mo1_kcp_en.ppt
© Copyright by KUKA Roboter GmbH College

Status bar

The status bar contains the following fields: NUM, CAPS, S, I, R, CELL, IP=6, T1, POV=100%, Paul, 10:09.

- Drives not ready**: Points to the red 'O' icon in the S field.
- Drives ready (approx. 1 s)**: Points to the green 'I' icon in the I field.
- Submit interpreter deselected**: Points to the grey 'S' icon in the S field.
- Submit interpreter stopped**: Points to the red 'S' icon in the S field.
- Submit interpreter running**: Points to the green 'S' icon in the S field.

01/2006 22
mo1_kcp_en.ppt
© Copyright by KUKA Roboter GmbH College

2.2. Coordinate systems of the robot

Coordinate systems



- **Axis-specific motion**

Each robot axis can be moved individually in a positive or negative direction.



- **WORLD coordinate system**

Fixed, rectangular coordinate system whose origin is located at the base of the robot.



- **TOOL coordinate system**

Rectangular coordinate system, whose origin is located in the tool.



- **BASE coordinate system**

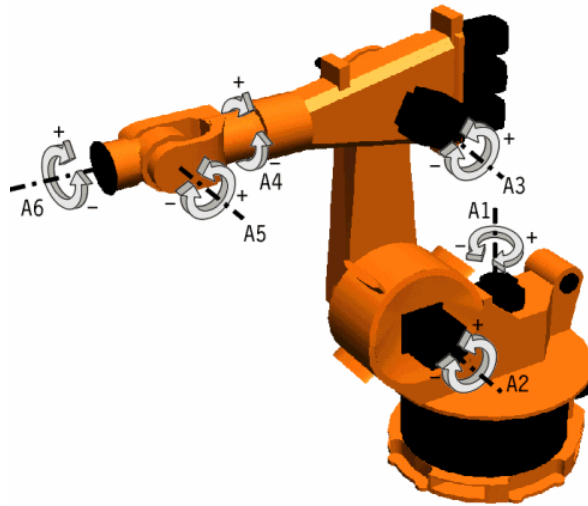
Rectangular coordinate system which has its origin on the workpiece that is to be processed.

2.3. Jogging axis specific

Axis-specific jogging



Each robot axis can be moved individually in a positive or negative direction.

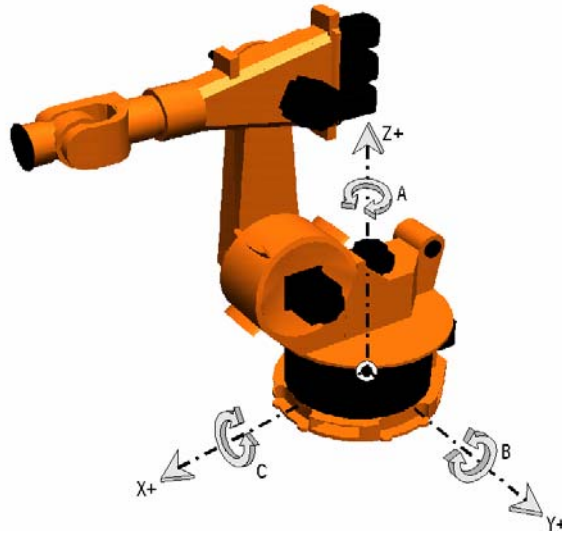


2.4. WORLD coordinate system

WORLD coordinate system



Fixed, rectangular coordinate system whose origin is located at the base of the robot.

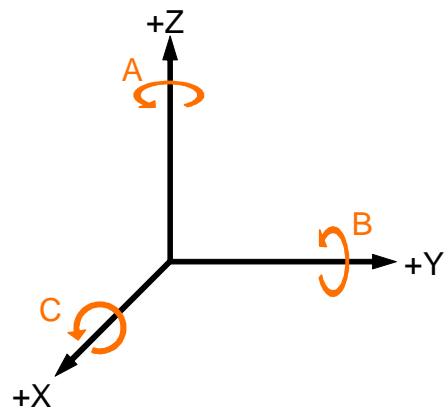
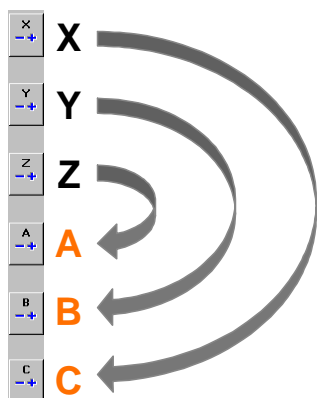


01/2006 1
 mo1_coordinate_systems_world_en.ppt
 © Copyright by KUKA Roboter GmbH College



Assignment of the angles of rotation in Cartesian coordinates

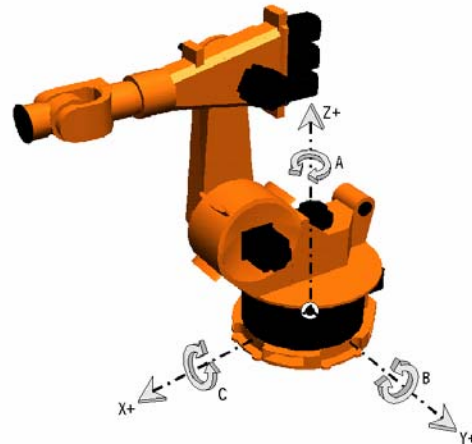
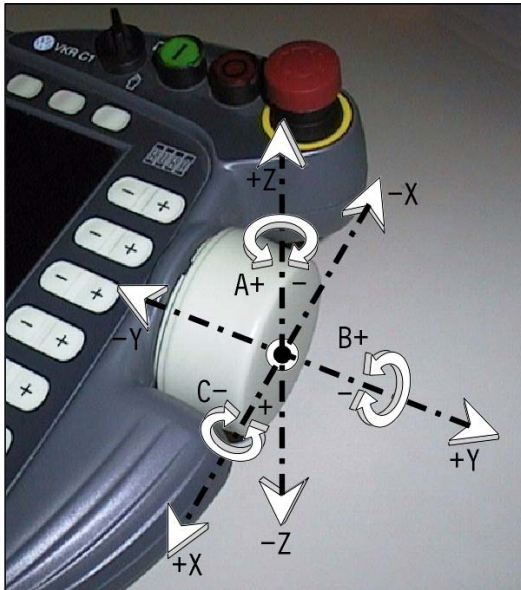
- Angle **A** ⇨ Rotation about the **Z** axis
- Angle **B** ⇨ Rotation about the **Y** axis
- Angle **C** ⇨ Rotation about the **X** axis



01/2006 2
 mo1_coordinate_systems_world_en.ppt
 © Copyright by KUKA Roboter GmbH College



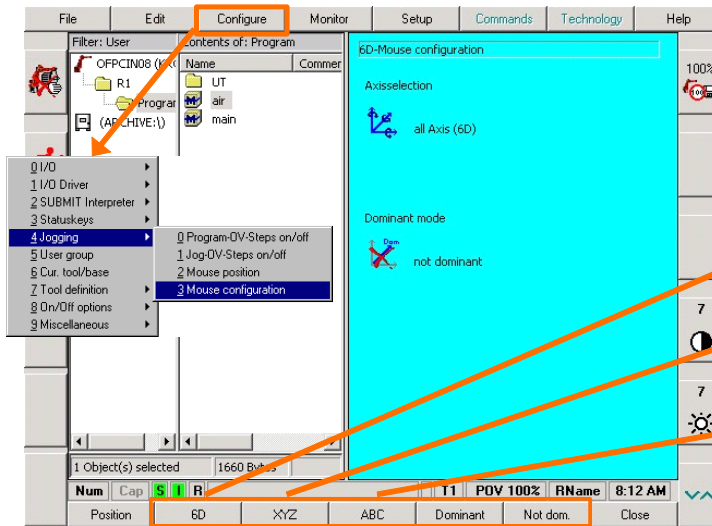
Cartesian motion with the 6D mouse






01/2006 3
 mo1_coordinate_systems_world_en.ppt
 © Copyright by KUKA Roboter GmbH College



Mouse configuration - Degrees of freedom of the mouse



Degrees of freedom of the mouse

-  Unlimited functionality
-  Only linear motions
-  Only rotational motions

The menu item "Mouse configuration" allows you to set the degrees of freedom and adapt the dominance of the mouse.

01/2006 4
 mo1_coordinate_systems_world_en.ppt
 © Copyright by KUKA Roboter GmbH College

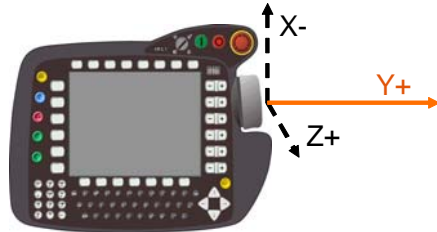


Mouse configuration - Dominant axis

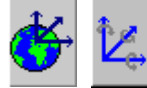
Dominant axis activated



When this function is switched on, only the coordinate axis with the greatest deflection of the mouse is moved. In this example only the Y axis is moved.



Current setting:



Dominant axis not activated



This function allows a superposed motion. Depending on the setting of the degrees of freedom, either 3 or 6 axes can be moved simultaneously. In this example, motion is possible in the X, Y and Z directions (the velocity depends on the deflection).

2.5. Choice of a coordinate system

Selecting a coordinate system

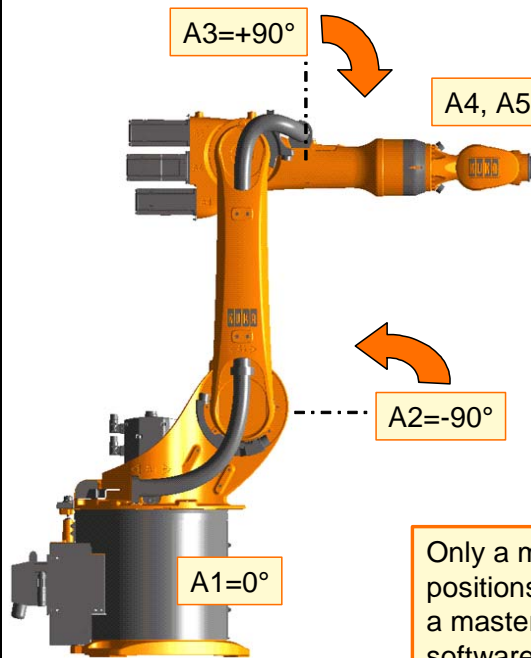
The diagram shows a KUKA control panel with two callout boxes. The top box, titled 'Select jog mode', points to a button with a robot icon and lists 'Jog keys' and 'Jogging with the mouse'. The bottom box, titled 'Select the coordinate system', points to a button with a globe icon and lists 'Axis-specific jogging', 'WORLD coordinate system', 'TOOL coordinate system', and 'BASE coordinate system'. The globe button is circled in orange on the panel.

- Select jog mode
 - Jog keys
 - Jogging with the mouse
- Select the coordinate system
 - Axis-specific jogging
 - WORLD coordinate system
 - TOOL coordinate system
 - BASE coordinate system

3. Setup

3.1. Mastering

Why is mastering carried out?



- When the robot is mastered, the axes are moved into a defined mechanical position, the so-called **mechanical zero position**.
- Once the robot is in this mechanical zero position, the absolute encoder value for each axis is saved.

Only a mastered robot can move to programmed positions and be moved using Cartesian coordinates; a mastered robot also knows the positions of the software limit switches.


01/2006 1
mo1_mastering_en.ppt
© Copyright by KUKA Roboter GmbH College



Mastering equipment



Electronic measuring tool (EMT)

-  In EMT mastering, the axis is automatically moved by the robot controller to the mechanical zero position. If a dial gauge is being used, this must be carried out manually in axis-specific mode.

Dial gauge

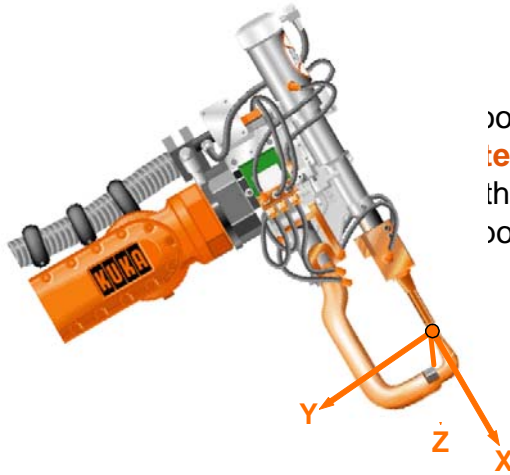
01/2006 2
mo1_mastering_en.ppt
© Copyright by KUKA Roboter GmbH College



3.2. Activate a tool

Tool calibration

What happens during tool calibration?



Tool receives a user-defined **笛卡尔坐标系** with its origin at a reference joint specified by the user.



Activating the tool

- Configure
- 0 I/O
- 1 I/O Driver
- 2 SUBMIT Interpreter
- 3 Statuskeys
- 4 Jogging
- 5 User group
- 6 Cur. tool/base**
- 7 Tool definition
- 8 On/Off options
- 9 Miscellaneous

Current tool/base

Tool no.

Tool name:

PEN

Base No.

Base system name:
(\$NULLFRAME)

Select the tool and base to be activated.

Tool name is displayed

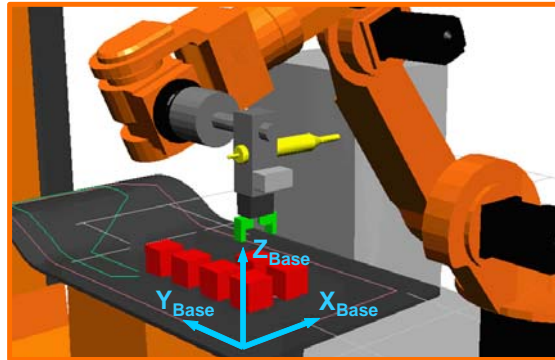
Enter the tool number
1 - 16



3.3. Activate a base

Base calibration

The work surface (pallet, clamping table, workpiece...) receives a user-defined Cartesian coordinate system with its origin at a reference point specified by the user.



01/2006 1
mo1_base_en.ppt
© Copyright by KUKA Roboter GmbH College



Activating a base

- Configure
- 0 I/O
- 1 Driver
- 2 SUBMIT Interpreter
- 3 Statuskeys
- 4 Jogging
- 5 User group
- 6 Cur. tool/base
- 7 Tool definition
- 8 On/Off options
- 9 Miscellaneous

Current tool/base

Tool no.

Tool name: PEN

Base No.

Base system name: blue base

Select the tool and base to be activated.

Name of the base is displayed

Enter the number of the base
BASE_DATA[1-32]

01/2006 2
mo1_base_en.ppt
© Copyright by KUKA Roboter GmbH College



4. Programming

4.1. Motion programming

KUKA robot motion types (interpolation types)

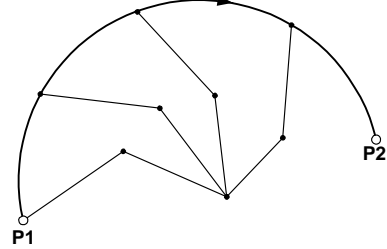
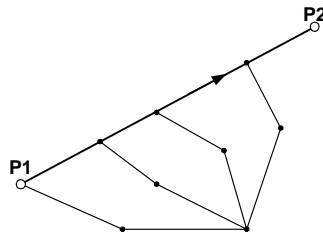
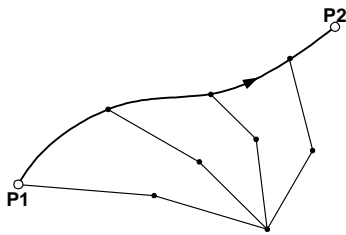
Axis-specific motion

Path-related motions

PTP (Point-to-point):
The tool is moved along the quickest path to an end point.

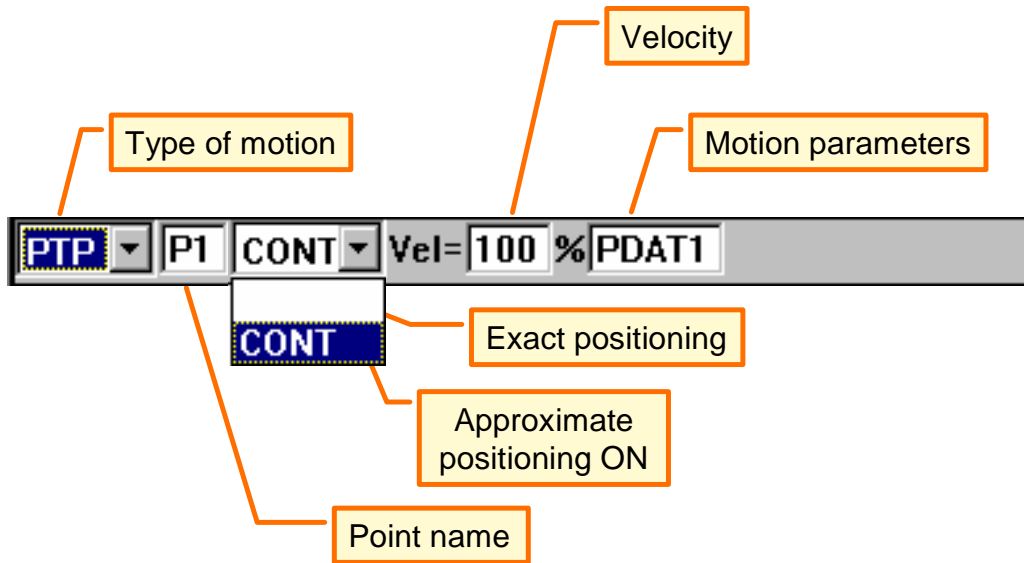
LIN (Linear):
The tool is guided at a defined velocity along a straight line.

CIRC (Circular):
The tool is guided at a defined velocity along a circular path.



4.2. PTP – Motion

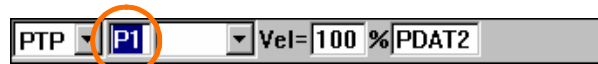
Programming a PTP motion



01/2006 1
 mo1_motion_ptp_en.ppt
 © Copyright by KUKA Roboter GmbH College



Programming a PTP motion



Frames 1/1

Tool
 TOOL_DATA[4]

Base
 NULLFRAME

External TCP
 False

- Tool**
 Tool selection
 Tool_Data[1]..[16], Nullframe
- Base**
 Workpiece coordinate system selection
 Base_Data[1]..[32], Nullframe
- External TCP**
 Robot guiding tool: False
 Robot guiding workpiece: True

01/2006 2
 mo1_motion_ptp_en.ppt
 © Copyright by KUKA Roboter GmbH College



Programming a PTP motion

PTP P1 CONT Vel=100 % PDAT2

CONT

Motion parameter 1/1

Acceleration

1 100 % 100

Approximation distance

0 100 % 100

Acceleration
 Acceleration used for the motion.
 Range of values: 1..100%

Approximation distance^{*)}
 Size of approximate positioning range for the motion.
 Range of values: 0..100%

*) The parameter "Approximation distance" is displayed if approximate positioning has been selected (CONT).



BCO run - part 1

For the purpose of ensuring that the robot position corresponds to the coordinates of the current program point, a so-called **BCO run** (block coincidence) is executed.

File Program Configure Monitor Setup Commands Technology Help

```

1 DEF nrc( )
2 INI
3
4 PTP HOME Vel= 100 % DEFAULT
5
6 PTP HOME Vel= 100 % DEFAULT
7
8 END
    
```

KRC:R1|PROGRAM|AIR_SRC |Ln 4, Col 0

C.	Time	no.	Source	Message
!	7:59:43 AM	1350		Programmed path reached (BCD)

Num Cap [G] [I] [AIR] IP= 4 T1 POV 100% RName 7:59 AM

Change Motion Logic Last Cmd Line Sel Touch Up NAVIGATOR

Block pointer (program pointer)

This is carried out at reduced velocity. The robot is moved to the coordinates of the motion block in which the block pointer is situated.



BCO run - part 2

This is done:

- after a program reset by means of a BCO run to the home position
- after block selection to the coordinates of the point at which the block pointer is situated
- after selection of the “CELL” program before the Automatic External mode can be started
- after a new program has been selected
- after modifying a command
- after jogging in programming mode



A HOME run is recommended for both the first and final motions as this represents an unambiguously defined uncritical position.

BCO run - part 3

1. This is done by holding down the Start key after selecting the program
2. The robot moves automatically at reduced velocity
3. Once the robot has reached the programmed path, the program can be continued by pressing the Start key again



A BCO run always takes place by the direct route from the current position to the destination position. It is therefore important to make sure that there are no obstacles on this path in order to avoid damage to components, tools or the robot!



No BCO run is carried out in Automatic External mode!

5. Navigator

Navigator (user)

Header

The screenshot shows the Navigator interface with two main panes. The left pane, titled 'Filter: User', displays a directory tree with 'R1' selected. The right pane, titled 'Contents of: R1', shows a table of files and folders. Below the panes is a status bar indicating '2 Object(s)'.

Name	Comment	Changed	#
Program		21.05.01 16:12:52	
cell	HANDLER on ex...	22.05.01 13:20:48	1

Directory structure

Directory or file list

Status line



Navigation using the keyboard

The screenshot shows the Navigator interface with the 'Program' directory selected. The file list shows several files, with 'base_k2' highlighted. A label 'Focus' points to this file. The status bar indicates '7 Object(s)'.

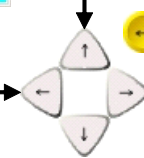
Name	Comment	Changed	#
bahn_3d		05.04.2002 08:47:34	
bahncont		05.04.2002 08:47:46	
bas_d		05.04.2002 08:49:18	
base_k1		05.04.2002 08:49:38	
base_k2		05.04.2002 08:49:44	
bau_cont		05.04.2002 08:48:54	
bautteil		05.04.2002 08:48:42	

Focus

Toggle between directory structure / file list



Select drive, directory or file

Open drive, directory or file



Program run modes

USER

Run mode	Description
GO 	GO mode All instructions in the program are executed up to the end of the program without a STOP.
MSTEP 	Motion Step (motion block) The program is executed one motion instruction at a time, i.e. with a STOP before each motion instruction. The program is executed without advance processing.

01/2006 3
 mo1_navigator_user_en.ppt
 © Copyright by KUKA Roboter GmbH College



Archive

This function allows you to save important data to floppy disk. All files are saved in compressed form as ZIP files.

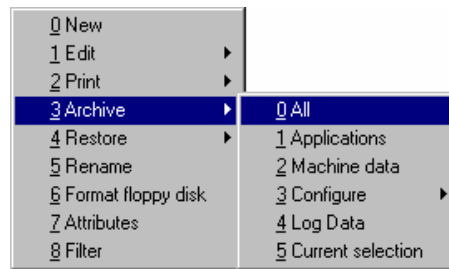


If you try to insert a file in an existing archive, the robot name is checked. The robot name in the archive is compared with the name that is set in the controller. If the two names are different, a request for confirmation is generated asking if you really wish to overwrite the existing archive.

01/2006 4
 mo1_navigator_user_en.ppt
 © Copyright by KUKA Roboter GmbH College



Archive All

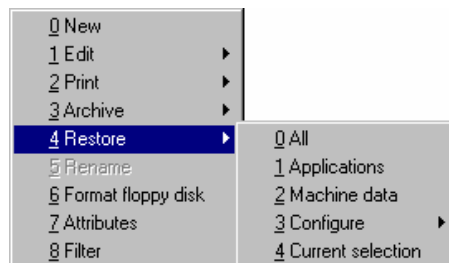


The menu item Archive → “All” is used to save to floppy disk all the data that are required to restore the robot system.

These include

- machine data
- tool/base data
- all applications
- etc.

Restore All



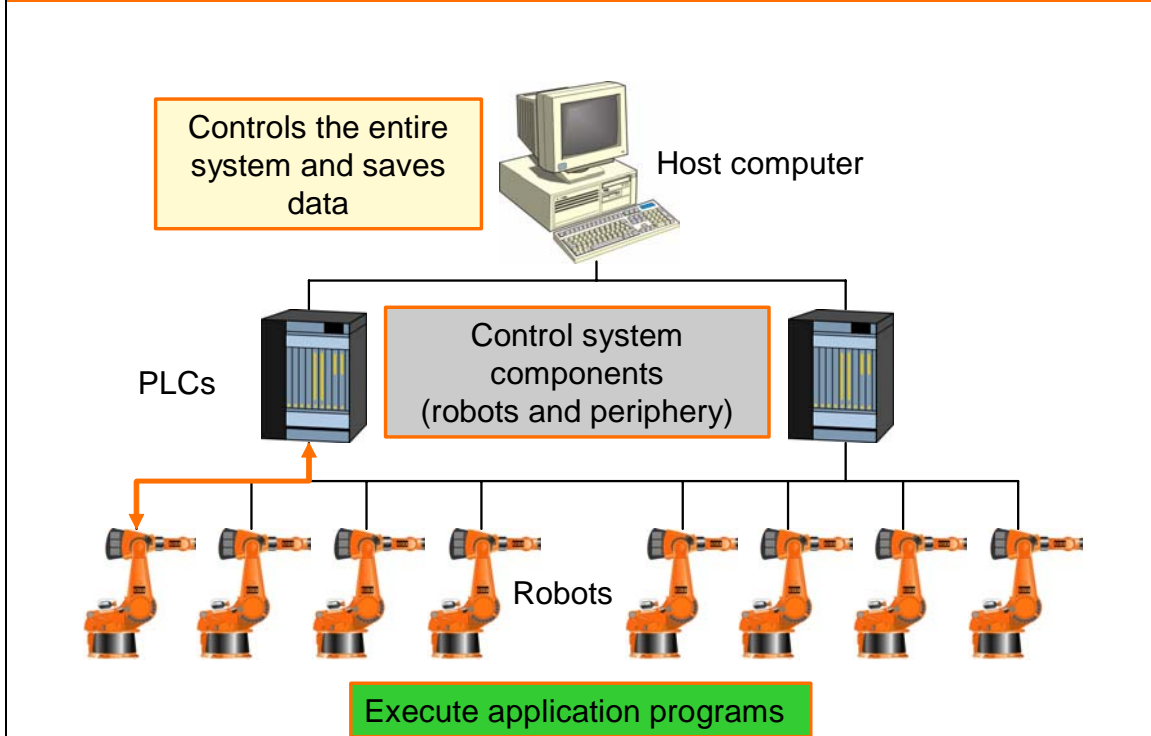
All files, with the exception of log files, are loaded back onto the hard disk.



Once the system has been restored, it must be shut down and rebooted.

6. Automatic external mode

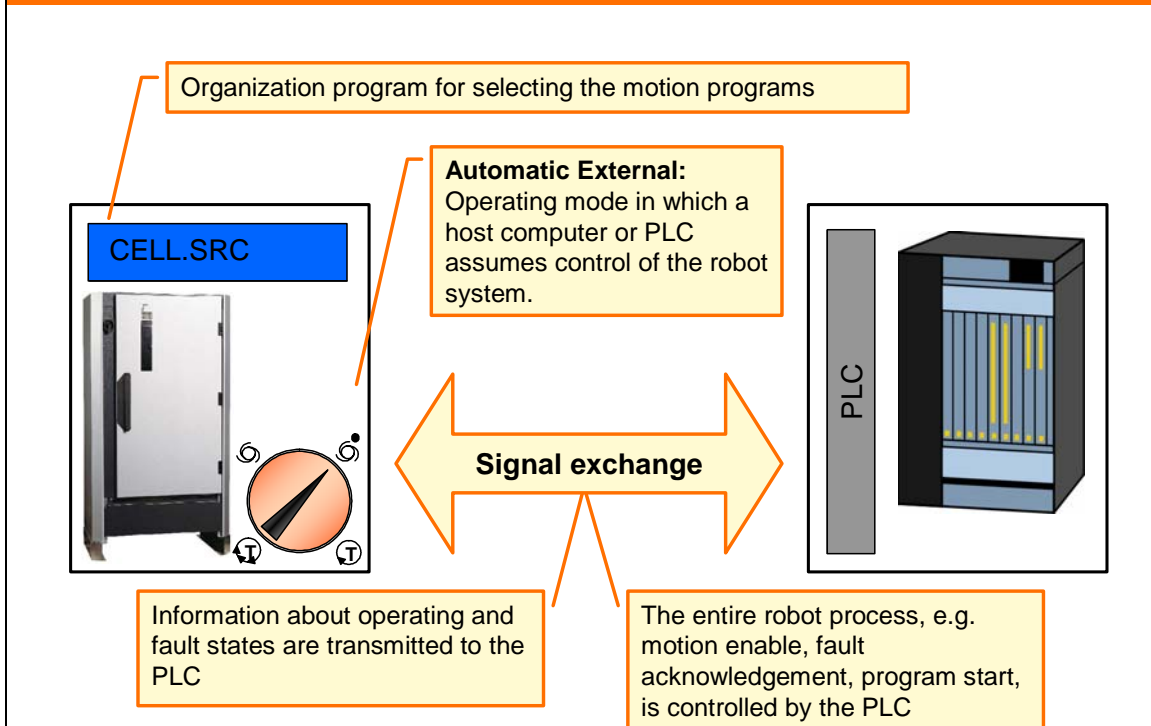
System structure



01/2006 1
 mo1_automatic_external_en.ppt
 © Copyright by KUKA Roboter GmbH College



System structure: KRC - SPS



01/2006 2
 mo1_automatic_external_en.ppt
 © Copyright by KUKA Roboter GmbH College



7. Exercises

Exercise: Operator control, jogging	54
Exercise: "In-air" program (PTP motion)	56

Exercise: Operator control, jogging

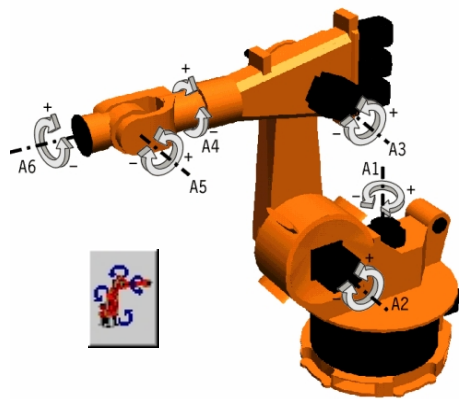
Aim of the exercise:

On successful completion of this exercise, you will be able to carry out the following activities:

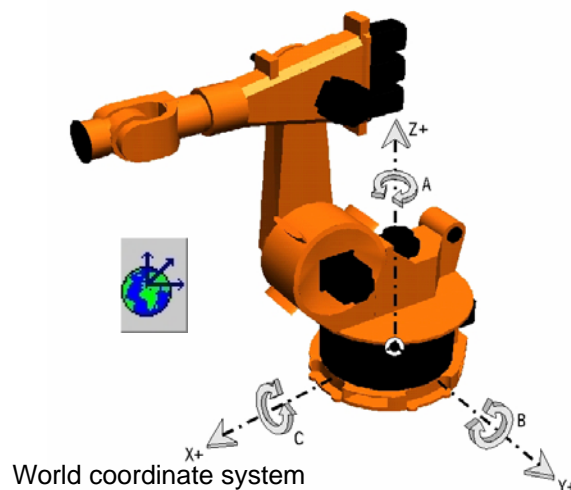
- Switch the controller on/off
- Basic operator control of the robot using the KCP
- Jog the robot (Joint, World coordinate system) by means of the jog keys and Space Mouse
- Initial interpretation of messages and troubleshooting

Prerequisites:

- Have received and understood KUKA College safety instructions
- Theoretical knowledge of the general operator control of a KUKA industrial robot
- Axis-specific jogging and motion in the World coordinate system.



Axis-specific jogging



World coordinate system

Necessary equipment:

- Training robot cell

Reading materials:

Standard documentation:

- Operating Handbook Release 5.x – chapter “Operator control”

Training documentation:

- Workbook “Safety Instruction” Release 5.x – chapter “General Safety & KUKA College”
- Workbook “Robot Briefing” Release 5.x – chapter “Operator control using the KUKA Control Panel”
- Workbook “Robot Briefing” Release 5.x – chapter “The coordinate systems of the robot”

Tasks:

- Switch the control cabinet on and wait for the system to boot
- Check the robot type and software version
- Release and acknowledge the EMERGENCY STOP
- Make sure that the mode selector switch is set to T1
- Activate axis-specific jogging
- Move the robot in joint (axis-specific) mode with various different jog override settings (HOV) using the jog keys and Space Mouse
- Explore the range of motion of the individual axes. Be careful to avoid any obstacles present, such as a table or cube magazine with fixed tool (accessibility investigation)
- On reaching the software limit switches, observe the message window
- In joint (axis-specific) mode, move the gripper to the reference tool (black metal tip) from several different directions
- Repeat this procedure in the World coordinate system

Exercise: "In-air" program (PTP motion)

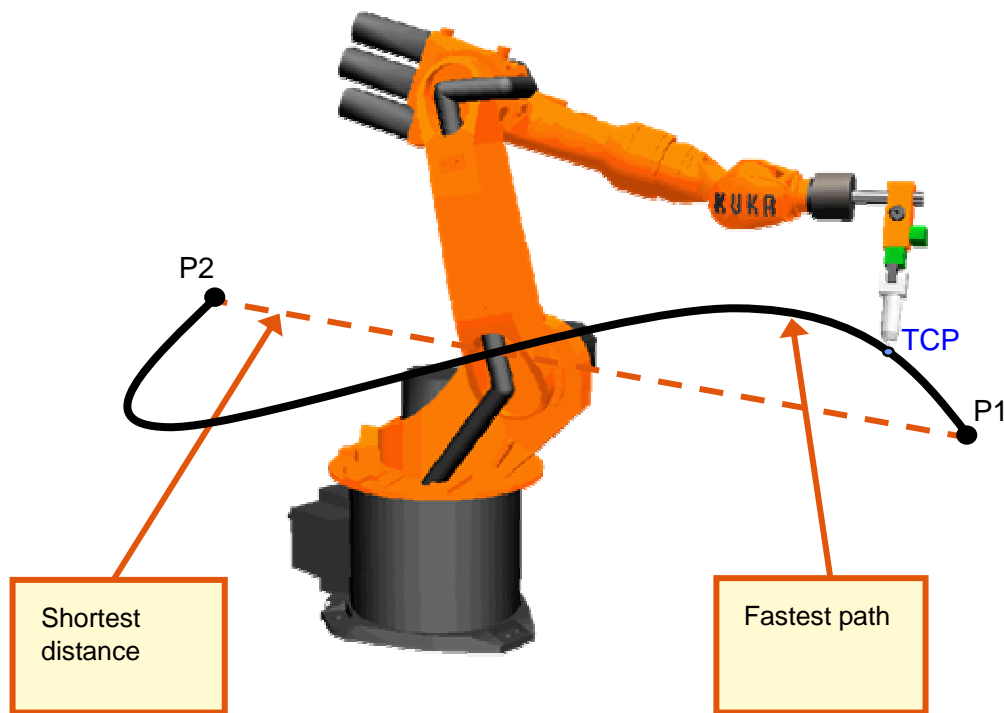
Aim of the exercise:

On successful completion of this exercise, you will be able to carry out the following activities:

- Create a new robot program (program folder / program)
- Select a robot program and execute, stop and reset it in the required operating modes
- Move between points in space by means of programmed PTP motion commands
- Change the program run mode and step-by-step movement to programmed points
- Carry out a BCO run (block selection)

Prerequisites:

- Theoretical knowledge of the PTP motion type
- Knowledge of the Navigator



Necessary equipment:

- Training robot cell

Reading materials:

Standard documentation:

- Operating Handbook, chapter "Operator control"
- Operating Handbook, chapter "User Programming"

Training documentation:

- Workbook, chapter "Motion programming on the robot (PTP motion)"
- Workbook, chapter "The Navigator"

Tasks:

a) Program selection / program test

- Select the program with the name "Air"
- Test your program in the mode T1 with different Program overrides (POV). Observe the relevant safety instructions.
- Test your program in the mode T2 with different Program overrides (POV). Observe the relevant safety instructions.
- Test your program in the mode Automatic. Observe the relevant safety instructions.

b) Program correction

- Correct some positions by using the softkey TouchUp
- Set various velocities for your space points
- Call the same point several times in the program
- Delete the motion blocks and insert new ones at a different point in the program
- Carry out a block selection
- Stop your program during the test run and use the function "Program start backwards" (green Minus-Key).
- Test your program in the modes T1, T2 and Automatic. Observe the relevant safety instructions.

