OrangeApps

PointLoader 1.1

User documentation

As of 02/05/2020

Document Version 1.6

Software Version KRC2: V1.1.1 or higher

Software Version KRC4: V1.1.11 or higher

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The contents of this document have been tested with the described software. Since deviations cannot be excluded, no guarantee for full compliance can be taken.

History of document versions

Version	Date	Author	Reason for change / Comment
1.0	11/15/2017	Christian Mayer	First release for KRC2 and KRC4
1.1	05/18/2018	Christian Mayer	Command HALT implemented
1.2	06/18/2018	Christian Mayer	Chapter 4 update, Chapter 9.1.1 new
1.3	02/28/2019	Christian Mayer	New version PointLoader V1.1 for KRC4
1.4	11/09/2019	Christian Mayer	New version PointLoader V1.1 for KRC2
1.5	11/12/2019	Christian Mayer	IF,WHILE,REPEAT,LOOP,SWITCH,FOR command (Implementation in KRC2 and KRC4)
1.6	02/02/2020	Christian Mayer	Chapter. 11, External-Interface

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1 Initiation

1.1 Target group

This documentation is intended for users with the following skills:

- Advanced KRL programming skills
- Advanced knowledge of the robot controller system

1.2 Representation of information

These notes indicate that death or severe personal injury will be safe or very likely to occur if precautions are not taken.

These notes indicate that death or serious bodily injury could occur if precautions are not taken.

These notes indicate that minor personal injury can result if precautions are not taken.

These notes indicate that damage may occur if precautions are not taken.

This manual contains useful tips or special information for the current topic.

1.3 Terminology used

Term	Description
HMI	The Human-Machine Interface (HMI) is an interface that a person communicates via a machine.
KSS	KUKA System Software
SmartPad	Robot control terminal
KRL	KUKA Robot Language

1.4

1.5 Symbols and fonts

The following symbols and fonts are used in the syntax descriptions:

Syntax element	Representation
KRL-Code	▪ Font Courier New ▪ Upper case letters Examples: `GLOBAL`; `ANIN ON`; `OFFSET`
Elements that must be replaced by program-specific entry	▪ Italics ▪ Upper/lower case letters Examples: *State*; *Value*;
Optional elements	▪ In angle brackets Example: <*Check*>
Elements that are mutually exclusive	▪ Separated by the symbol "|" Example: `IN |OUT`

1.6 Trademarks

. NET Framework is a trademark of Microsoft Corporation.

Windows is a trademark of Microsoft Corporation.

2 Product Description

PointLoader is a tool to continuously reload positions and technology commands from an externally generated file into a KRL-module during the robot is running. The software package consists basically of four parts:

1. Plugin for reading and loading the commands from the CAD/CAM file
2. HMI to display various parameters
3. KRL module for interaction with the plugin and for the call of routines for movements and technology actions
4. KRL module containing technology routines

2.1 Characteristics

- Memory Optimized loading of a CAD/CAM file (* .src or .txt) into the robot controller with more than 3 million points
- Movement types PTP, LIN, CIRC, Joint, SPTP, SLIN, SCIRC, SPL
- Indication of external axes E1-E6 in the CAD/CAM file is supported
- Time-optimized continuous loading and running the points in the KRL motion program (50 points <500ms)
- From the main menu, and from the machining program callable HMI for interaction with the operator
- freely programmable velocity parameters (changeable during runtime)
- HMI with estimation of the completion time
- Multilingualism of the HMI (delivery English and German, can be extended by user)
- Automatic Setup to install and uninstall (KUKA Options Package)
- Fully reinstallation when running a KSS update
- License mechanism for operating the software on selected robots
- Runs under KSS 8.2 / 8.3 (KRC4) and KSS 5.5/5.6 (KRC2)
- Available in the modes T1, T2, AUT, EXT
- External interface

2.2 Scope of delivery

The software is delivered as technology package for easy installation on the robot. It includes all the necessary components for installation and operation:

2.3 Application area / environment

The software runs on all KUKA robots with KSS8.2 or 8.3 without CPC protection.

2.4 CPC

If the software should be used on robots with CPC protection, a CPC certificate is required before installation. This can be created on demand.

2.5 Requirements for running the software

Hardware

- KUKA robots KRC4
- KUKA robots KRC2

Software

- KUKA KSS 8.2 / 8.3 / 8.5 (KRC4) or KSS 5.5 / 5.6 (KRC2 ed05)
- Runtime license

3 Safety

The software described in this document is for reloading externally generated CAD/CAM files into the KUKA robot controller KRC4. It is designed according to the prior art.

The software may be used according to specification, safety-conscious. The use must be in compliance with this document and license agreements.

Unauthorized use can cause damage to the robot, the environment and the health of persons.

4 Installation, Uninstallation, Update

The installation/uninstallation is done via the *additional software* option. This function is located in the main menu under *start-up*.

Make a complete backup of your robot before installation, uninstallation or upgrade of the software!

4.1 KRC4

4.1.1 System requirements for installation

Minimum Hardware Requirements

- KUKA System Software 8.2 / 8.3 / 8.5

If KUKA.CPC is used on the robot a software certificate is required in order to install PointLoader. In this case please contact our customer service (Email to info@orangeapps.de) before buying the software.

4.1.2 Install PointLoader or upgrade to new version

Requirement

- User group Expert
- Operation Mode T1 or T2

For installation on the three systems, real Robot, Office Lite and Office PC follow these steps:

Method

1. Extract the .Zip file
2. Copy the installation folder ***OrangeApps.PointLoader***containing the setup files to a USB stick or directly to a drive on the target system (for example, d: \).
3. If you are already in possession of a valid license file, copy it to the files in the installation folder. The license file is automatically detected and installed during setup. Alternatively, you can manually install the license file after installation.
4. When installing from a USB stick, connect this to the controlling PC or the SmartPad.
5. Choose ***Start-up→ Additional software*** from the main menu.
6. Click the button ***New software***.
7. You'll get a list of available software for installation. If there's no entry ***OrangeApps.PointLoader***in the list, click ***Refresh***. If now the entry appears, go to step 10
8. If the entry does not appear, the drive from where to install must be configured first. To do this, choose ***Configuration***. In the new window you now have the option to select the path where to find the folder ***OrangeApps.PointLoader.***
9. Select an empty cell in the ***installation paths for options*** and click ***path selection***. The available drives are displayed. Select the drive on which the folder ***OrangeApps.PointLoader***is located and save your selection with ***Save***. The window

closes. ***OrangeApps.PointLoader***should now appear as an entry in the list. If this is not the case, press ***Refresh*** and/or repeat steps 7 to 8

10. Highlight the entry ***OrangeApps.PointLoader***and press ***Install***. Confirm the security prompt with ***Yes***.
11. Read the license agreement carefully. Explain your agreement to the license terms by clicking ***I Accept*** and continue the installation by clicking ***Continue***. If you do not agree with the license terms, please cancel the installation by clicking ***Cancel***.
12. The installation will be prepared now. To perform the final installation the control PC has to be restarted. This can immediately be executed by clicking ***Reboot Control PC now*** or later by clicking ***later***.
13. If you select ***later***, the window is closed. In order finalize the installation proceed with step 14. If you select ***Reboot Control PC now***, a restart of the control PC will be performed. Step 15 is then executed.
14. Perform a shutdown of the control PC by clicking ***shutdown*** in the main menu.
15. During reboot of the control PC PointLoader will be installed on the computer.
16. Remove the USB stick from the PC.

4.1.3 Uninstall PointLoader

Requirement

- User group Expert

Method

1. Choose ***commissioning→ Additional software*** from the main menu.
2. Highlight the ***OrangeApps.PointLoader***and click ***Uninstall***. Answer the security prompt with ***Yes***. The uninstallation is prepared. After completion of the preparatory work, a message box appears. To perform the final installation the control PC has to be restarted. To perform the final installation the control PC has to be restarted. This can immediately be executed by clicking ***Reboot Control PC now*** or later by clicking ***later.***
3. If you select ***later***, the window is closed. In order finalize the uninstallation proceed with step 4. If you select ***Reboot Control PC now***, a restart of the control PC will be performed. Step 5 is then executed.
4. Perform a shutdown of the control PC by clicking ***shutdown*** in the main menu.
5. During reboot of the control PC PointLoader will be uninstalled from the computer.

4.1.4 KSS Update

When updating the KSS software within the KSS versions 8.2/8.3 PointLoader is automatically reinstalled. The current state of KRL Module “RunPointLoader” will be saved and automatically restored after the KSS update.

4.1.5 Installed files

To operate the software, the following files are installed:

File	Files	Function
C:\KRC\SmartHMI	SmartHMI.exe.PointLoader.config PointLoader.dll	Plugin
C:\KRC\DATA	Pointloader.kxr PointloaderUser.kxr	Language database for plugin Language database for user parameters
C:\KRC\ROBOTER\KRC\R1\TP\PointLoader	CadCommands (src und dat) PointLoaderMain (src and dat) PointLoaderData.dat	KRL-motion module
C:\KRC\ROBOTER\KRC\R1\TP\PointLoader	PointLoaderUser (src and dat)	"User Module" User interface for parameters and user actions
C:\KRC\ROBOTER\KRC\R1\TP\PointLoader	PointloaderSub (src and dat)	"Submit-Module" External interface to start the program via the IO-interface
C:\KRC\R1\Program	RunPointLoader (src and dat)	Userprogram to load and run CAD/CAM file
D:\	ExamplePosFile.src ExamplePosFile.txt	CAD/CAM file with examples

4.2 KRC2

4.2.1 System requirements for installation

Minimum Hardware Requirements

- Installation on KRC2: KUKA System Software >=5.5

If KUKA.CPC is used on the robot a software certificate is required in order to install PointLoader. In this case please contact our customer service (Email to info@orangeapps.de) before buying the software.

4.2.2 Install PointLoader or upgrade to new version on KRC2

Condition

- Expert group
- Operation Mode T1 or T2

For installation on the three systems, real Robot, Office Lite and Office PC follow these steps:

Method

Installation is done via ***Setup → install additional software*** in the main menu.

1. Extract the .Zip file
2. Copy the installation folder ***OrangeApps.PointLoader*** containing the setup files to a USB stick or directly to a drive on the target system (for example, d: \).
3. When installing from a USB stick, connect this to the controlling PC or the SmartPad.
4. Choose ***Setup → install additional software*** from the main menu.
5. Click the button ***New SW***.
6. You'll get a list of available software for installation. If there's no entry ***OrangeApps.PointLoader*** in the list, click ***Refresh***. If now the entry appears, go to step 9.
7. If the entry does not appear, the drive from where to install must be configured first. To do this, choose ***Config***. In the new window you now have the option to select the path where to find the folder ***OrangeApps.PointLoader.***
8. Select an empty cell in the ***installation paths for additional software*** and click ***Browse***. The available drives are displayed. Select the drive on which the folder ***OrangeApps.PointLoader*** is located and save your selection with ***Apply***. Close the window with ***Apply***. The entry ***OrangeApps.PointLoader*** should now appear in the list. If this is not the case, press ***refresh*** and/or repeat steps 7 to 8
9. Highlight the entry ***OrangeApps.PointLoader*** and press ***Install***. Confirm the security prompt with ***Yes***.
10. Read the license agreement carefully. Explain your agreement to the license terms by clicking ***I Accept*** and continue the installation by clicking ***Continue***. If you do not agree with the license terms, please cancel the installation by clicking ***Cancel***. **Use the Softkeys on the bottom of the KCP to click a button.**
11. The installation will be prepared now. To perform the final installation the control PC has to be restarted. This can immediately be executed by clicking ***Reboot Controller*** or later by clicking ***Later***.

12. If you select ***Later***, the window is closed. In order to finalize the installation proceed with step 13. If you select ***Reboot Control PC now***, a restart of the control PC will be performed. Step 14 is then executed.
13. Perform a shutdown of the control PC. During reboot of the control PC PointLoader will be installed on the computer.
14. Remove the USB stick from the PC.

Entry in the main menu

To open HMI: ***Monitor → PointLoader***

Entry in the Info window

After successful installation the entry "OrangeApps.PointLoader" is displayed in the menu ***Help→Info→Options***,

Modified robot system files

None

4.2.3 Uninstall PointLoader

Condition

- Expert groups

Method

1. Choose ***commissioning → Additional software*** from the main menu.
2. Highlight the ***OrangeApps.PointLoader*** and click ***Uninstall***. Answer the security prompt with ***Yes***. The uninstallation is prepared. After completion of the preparatory work, a message box appears. To perform the final installation the control PC has to be restarted. To perform the final installation the control PC has to be restarted. This can immediately be executed by clicking ***Reboot Control PC now*** or later by clicking ***later.***
3. If you select ***later***, the window is closed. In order to finalize the uninstallation proceed with step 4. If you select ***Reboot Control PC now***, a restart of the control PC will be performed. Step 5 is then executed.
4. Perform a shutdown of the control PC by clicking ***shutdown*** in the main menu.
5. During reboot of the control PC PointLoader will be uninstalled from the computer.

4.2.4 KSS Update

When updating the KSS software within the KSS versions 5.5/5.6 Pointloader is automatically reinstalled. The current state of KRL Module “RunPointLoader” will be saved and automatically restored after the KSS update.

4.2.5 Installed files

To operate the software, the following files are installed:

File	Files	Function
C:\KRC\TP\Pointloader	PointLoader.dll PointLoader.mdb	Plugin Language Database
C:\KRC\ROBOTER\KRC\R1\TP\PointLoader	PointLoaderLoad (src and dat) PointLoaderMain (src and dat) PointLoaderData.dat	KRL-motion module
C:\KRC\ROBOTER\KRC\R1\TP\PointLoader	PointLoaderUser (src and dat)	“User Module” User interface for parameters and user actions
C:\KRC\R1\TP\PointLoader\Lic	PointLoader_*.lic	Runtime License
C:\KRC\ROBOTER\KRC\R1\Program	RunPointLoader (src und dat)	Userprogram to load and run CAD/CAM file
D:\	Example.src Example.txt	Example CAD/CAM file showing all available commands

5 Licensing

To use PointLoader, a license file is required for each robot serial number. A license file is also required for office computer and Office Lite.

Characteristics

- The licensing mechanism includes a time-limited emergency mode in the event of a robotic exchange. Within 14 days a new license file must be created and applied to the license folder.

5.1 Licenses for robots, Office Lite office computer and

Trial licenses can be obtained directly at www.orangeapps.de. Runtime licenses are delivered on receipt of the license fee.

5.1.1 Robot license

In order to obtain a valid license, you need the serial number of the robot. These can be found on the rating plate of the robot or in the robot software in the Help menu ***Help→Info→Robot→Serial number***.

5.2 Use license file

5.2.1 Before installing PointLoader

If the license file is available before installation, copy the license file to the setup folder.

5.2.2 After installing PointLoader

If the license file is available after installation, copy the license file manually to the folder "C:\KRC\TP\PointLoader\Lic \"

6 Quick start

The program “RunPointLoader” is the main user program. This program starts the loading of the CAD/CAM file and starts the execution of the working program.

Method KRC4

- Create a CAD/CAM file according to the available commands and copy to a drive on the robot or a network drive
- Open the HMI from the Main Menu (PointLoader → Full or Halfscreen)
- Click on to select the CAD/CAM file
- Click on to start the loading of the selected CAD/ CAM file.

➔ After successful loading the program “RunPointLoader” is automatically selected

- Select the operation mode and start the program

Method KRC2

- Create a CAD/CAM file according to the available commands and copy to a drive on the robot or a network drive
- Open the HMI from the Main Menu (PointLoader → Full or Halfscreen)
- Click on „File open“ to select the CAD/CAM file
- Click on “Load file” to start the loading of the CAD/CAM file.

➔ The program “RunPointLoader” is automatically selected if the loading was successful

- Select the operation mode and start the program

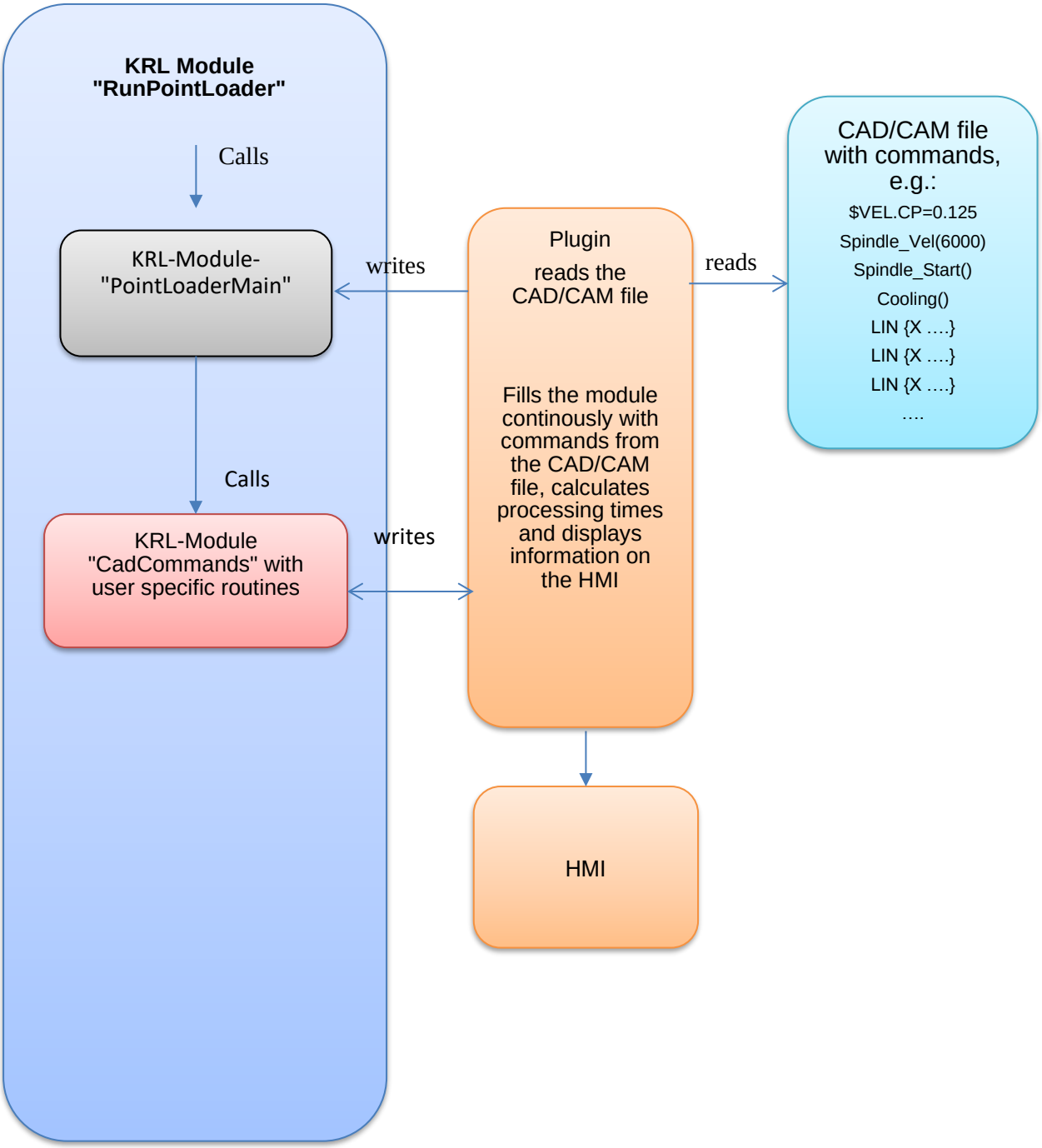
After every loading of a CAD/CAM program the file D:\PLSkippedLines.txt is generated. This file contains all lines of the CAD/CAM program that PointLoader can not execute.

7 Operation

7.1 Survey

The software consists of KRL modules and a plugin (dll) which interact with each other. The movements and commands are executed in a KRL-module which is continuously filled by the plugin with command information. The commands are read line by line from a CAD/CAM file by the plugin before start of the movement. The whole information is stored memory optimized in an internal list.

Schematic representation



The selection and loading of the CAD/CAM file is done via the HMI buttons. After successful loading, the KRL module "RunPointLoader" is automatically selected. From there, the working program can be started by the operator. In order for the buttons on the HMI to be active, no program may be selected in the robot.

7.2 KRL module “RunPointLoader”

This program is the main program for the user. From here the module “PointLoaderMain” is called.

7.3 KRL-Modul "PointloaderMain"

This modul is the production program. It is filled continuously with data from the memory.

7.4 KRL-Modul "CadCommands"

During loading of the CAD/CAM file all "non-motion" commands are written into the file CadCommands.src by the plugin. Local declarations are written to the file CadCommands.dat. For this to work, markers are inserted in both files. These markers may not be removed or modified.

If called functions or variables are not available or used incorrectly, compilation errors occur in this file.

The markers in the file may not be modified or removed.

7.5 CAD/CAM file

The complete CAD/CAM file is sequentially read by the plugin. The determined commands and parameters such as movement types, coordinates, speed, etc. are stored and later continuously written to two arrays of the KRL-module “PointLoaderMain”.

The CAD/CAM file must follow specific rules shown in the next chapters.

7.5.1 File Name

The file name is arbitrary. The file extension must be *.src”. The KRL-specific information in the header can be omitted.

7.5.2 Location

The file can be located directly on the robot or on a network drive. For faster reading the file should be located on the robot’s hard drive.

7.5.3 Available commands

In the CAD/CAM file different commands can be used. These commands are interpreted by the plugin and written continuously into arrays. Comment lines and unsupported commands and lines are not imported and are therefore not available to the work program.

All other commands, such as User-specific instructions or program calls are automatically entered in the CadCommands.src file during laoding.

Unsupported commands are skipped. The file D:\KRC\Roboter\Log\PLSkippedLines.txt" shows all lines of the CAD/CAM file which have been skipped.

The KRL-variable "PISkippedLines" shows the number of skipped lines.

7.5.3.1 Commands for movements

Following commands are available:

- PTP $POS_ACT
- PTP xHOME
- PTP {X …,Y …,,,,,C …,E1…,….E6, S …, T …} C_DIS
- PTP {A1 …,A2 …,,,,,A6 …,E1…,….E6} C_DIS
- LIN {X …,Y …,,,,,,C …,E1…,….E6} C_DIS
- CIRC {X …,Y …,,,,,,C …,E1…,….E6},{X …,Y …,,,,,,C …,E1…,….E6} C_DIS
- SPTP {X …,Y …,,,,C …,E1…,….E6} C_DIS
- SLIN {X …,Y …,,,,,,C …,E1…,….E6} C_DIS
- SCIRC {X …,Y …,,,,,,C …,E1…,….E6},{X …,Y …,,,,,,C …,E1…,….E6} C_DIS

The specification of the external axes, Status and Turn, and the approximation parameters is optional.

7.5.3.2 Approximation parameters

For approximation the parameters C_DIS,C_VEL,C_PTP or C_ORI can be used. For each movement command only one parameter can be given.

7.5.3.3 Unsupported commands

Unsupported commands are all logic commands for loops and program branches:

- Goto

If this keyword is found, the loading of the CAD/CAM file is aborted.

7.5.3.4 Unsupported keywords and characters

Lines starting with certain keywords are ignored:

- DEF
- DEFFCT
- ;
- &
- END
- GLOBAL

- ENDFCT

7.5.3.5 Subroutines

No local or global subprograms may be defined in the CAD/CAM file.

8 Production

8.1 Start of a working program

First the HMI is opened from the main menu., In the HMI a CAD/CAM file is selected via the file selection dialog. The path to this file is stored in a KRL variable and displayed in the HMI. When a file is selected the loading button in the HMI can be used to start the import of the CAD/CAM file. For the buttons to be active in the HMI, no program may be selected. After successful loading of a file, the program "RunPointLoader" is automatically selected. This program can now be started in all operating modes. It runs until all commands of the CAD/CAM file have been processed.

After approaching the home position, the actual processing program is started via the function call "*PointLoaderMain (int TOOL, int BASE*)". The specification of a tool and base number is optional if tool and base are specified in the CAD/CAM file.

The specification of tool and base is only necessary if no tool and base data are set in the CAD / CAM file.

9 HMI

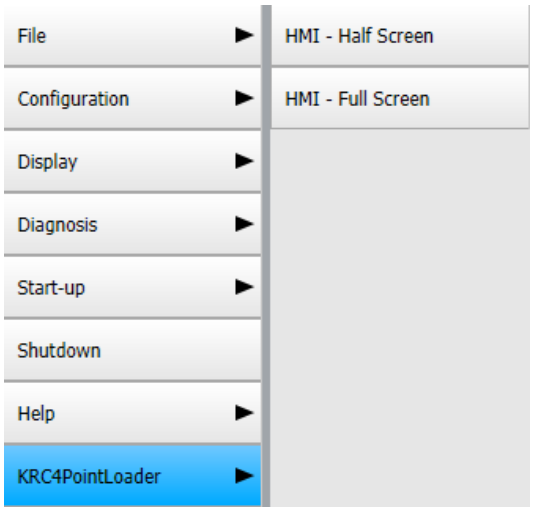
The HMI is used to display various robot parameters. In addition, the progress of the current machining program is displayed.

In the HMI a file open dialog is available to select the desired CAD/CAM file

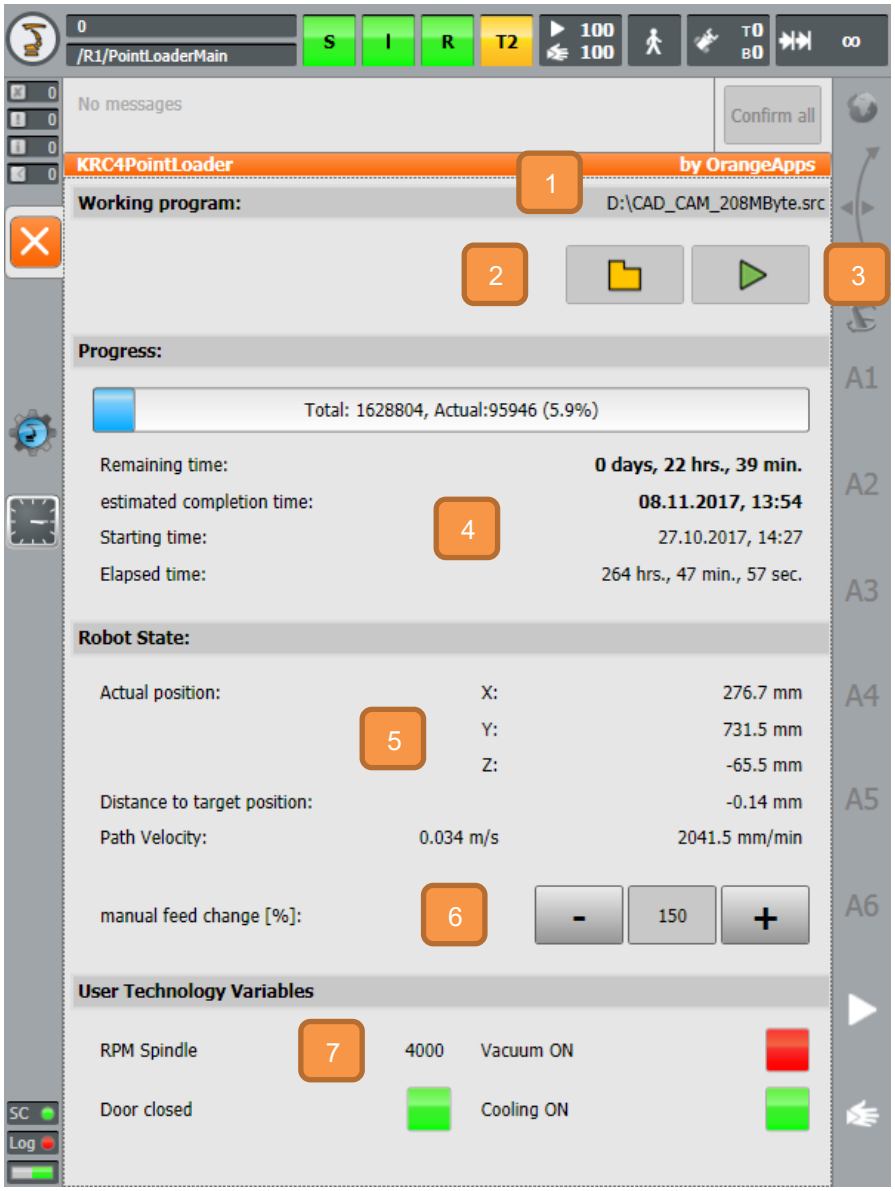
9.1 HMI KRC4

The HMI can be opened from the main menu under the entry "PointLoader" as a half or full page window or automatically by the call to load the CAD/CAM file

Called from the main menu:



View



1	Name and Path of actual CAD/CAM file
2	Button to open the File-Open-dialog. Only active if no program is running
3	Button to load the selected CAD/Cam file into the memory. Only active if no program is running
4	The progress bar shows the number of commands of the CAD/CAM file and the number of the current command. While loading a CAD/CAM file, the loading progress is displayed. More information: ▪ Starting time ▪ Elapsed time since start

	▪ Remaining time and resulting completition time
5	Display of: ▪ Actual TCP position ▪ Distance ton ext target position ▪ Path velocity of TCP in m/s and mm/min (during PTP movements the velocity gets 0!)
6	The currently set feed rate can be changed with the plus-minus key in the range 50 ... .150%. The new value becomes valid after reaching the next point.
7	Value of the `HMIUserVarBool1, HMIUserVarBool2, HMIUserVarBool3, HMIUserVarReal1` For the bool variables: Red = the value of the variable is FALSE Green = the value of the variable is TRUE The label of the variable can be adjusted in the file PointLoaderUser.kxr in the directory C: \ KRC \ DATA. After an adjustment, the system must be restarted.

9.1.1 File-Open-Dialog

After clicking on the folder icon, the File-Open dialog appears. There, the CAD/CAM file to be loaded can be selected. The shown path can be preset via the KRL variable "DefaultPath" in the module "PointLoaderData.dat". On delivery, drive D: is preset. In order not to preset a path and display all drives accessible by the robot, the line

DefaultPath[]=“D:\“ can either be outcommented or

DefaultPath [] = " " is set. Note the space between the quotation marks. Otherwise, a compilation error occurs.

9.1.2 User Technology Variables

The user can use this variables anywhere on the robot to show their value on the HMI.

Representation

Elements	Type
HMIUserVarReal1	Real Value
HMIUserVarBool1	bool
HMIUserVarBool2	bool
HMIUserVarBool3	bool

The variables are defined in C:\KRC\Roboter\R1\TP\POintLoader\PointLoaderUser.dat

9.1.2.1 Labeling of the variables in the HMI

The labelling of these variables in the HMI is multilingual. When changing the language of the HMI, the text of the label is translated into the actual language of the HMI if a key is found in the language database. To change or add a labeling modify the language database "C:\KRC\DATA\PointLoaderUser.kxr".

Default languages in this file are German and English.

Changes in this file take effect after a restart of the robot.

Entry in C:\KRC\DATA\PointLoaderUser.kxr

```
<uiText key="strHMIUserVarReal1">
   <text xml:lang="de-DE">HMIUserVarReal1</text>
   <text xml:lang="en-US">HMIUserVarReal1</text>
 </uiText>
 <uiText key="strHMIUserVarBool1">
   <text xml:lang="de-DE">HMIUserVarBool1</text>
   <text xml:lang="en-US">HMIUserVarBool1</text>
 </uiText>
 <uiText key="strHMIUserVarBool2">
   <text xml:lang="de-DE">HMIUserVarBool2</text>
   <text xml:lang="en-US">HMIUserVarBool2</text>
 </uiText>
 <uiText key="strHMIUserVarBool3">
   <text xml:lang="de-DE">HMIUserVarBool3</text>
   <text xml:lang="en-US">HMIUserVarBool3</text>
 </uiText>
```

de-DE: german translation

en-US: english translation

Modfiy or add keys according to the following countries character table to show your own text on the labels.

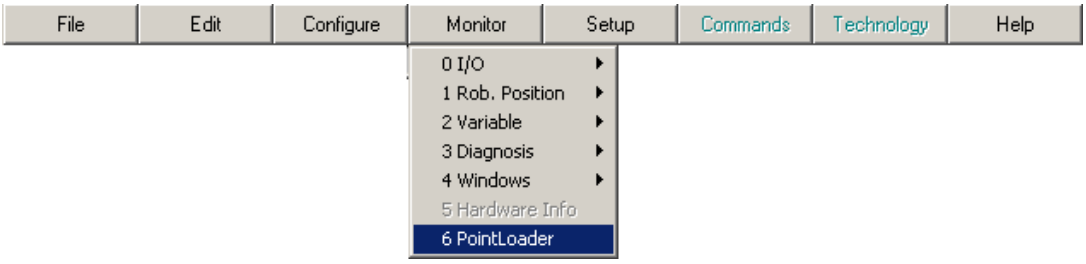
Country codes

Elements	Language	Elements	Language
cs	Czech	sk	Slovak
dk	Danish	sl	Slovenian
de	German	fi	Finnish
en	English	tr	Turkish
it	Spanish	el	Greek
fr	French	ru	Russian
it	Italian	ko	Korean
ugh	Hungarian	sk	Slovak
nl	Dutch	sl	Slovenian
pl	Polish	fi	Finnish
pt	Portuguese	sv	Swedish
ro	Romanian	tr	Turkish

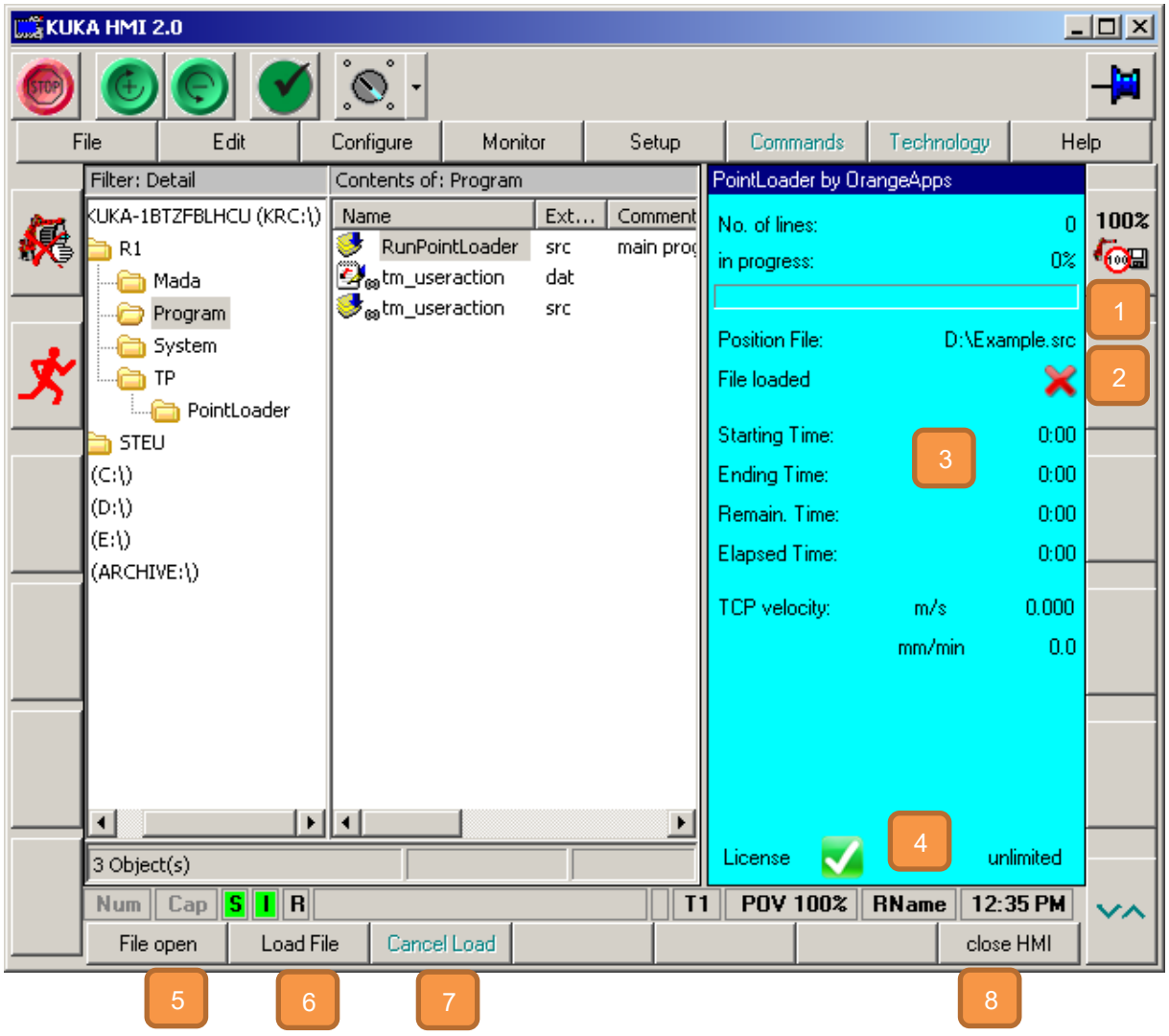
9.2 HMI KRC2

To open the HMI click on the entry „PointLoader“ in the main menu folder „Display“

Menu entry



View



1	Name and Path of actual CAD/CAM file
2	Shows if the actual CAD/CAM file is loaded not loaded loaded
3	Further information: ▪ Progress bar ▪ Starting time ▪ Elapsed time since start ▪ Remaining time and resulting completion time ▪ Path velocity of TCP in m/s and mm/min (during PTP movements the velocity gets 0!)
4	License information
5	Button to select a CAD/CAM-file. Opens the file-open.dialog. Only active if no KRL-program is selected.
6	Button to load the actual CAD/CAM file. After successful loading the user program "RunPointLoader" is automatically selected.
7	Button to abort the loading. Only active during loading.
8	Button to close the HMI

Procedure to start a program::

- Open HMI
- Deselect any KRL-program selected
- Press ***File open***
- Select a CAD/CAM-file
- Press ***Load file*** → If the loading is successful, the program “RunPointLoader” is automatically selected
- Start the program

9.2.1 Select CAD/CAM file

After clicking the button "Load file" the file selection dialog opens. There, the CAD/CAM file to be loaded can be selected. The default file path can be preset via the KRL variable "DefaultPath" in the module "PointLoaderData.dat".. In the delivery state, drive D: is preset. In order not to preset a file path to show all the drives accessible by the robot the line

DefaultPath [] = "D: \" either can be commented out or set to

DefaultPath [] = " ". Note the space between the quotation marks. Otherwise, a compilation error occurs.

9.2.2 Load CAD/CAM file and start processing

Pressing the "Load file" button starts the import of the CAD/CAM file. After error-free reading in, signaled by the icon , the KRL program "RunPointLoader" is started automatically. This program can be started in all operating modes (T1, T2, AUT and EXT). The execution of this program in turn starts the complete processing of the imported CAD/CAM file. As long as the CAD/CAM file is loaded, the program "RunPointLoader" can be started again and again even after a reset.

9.2.3 Stop loading

By clicking on the button "Stop loading" the import of the current CAD/CAM file can be stopped.

10 Logging

After every loading of a CAD/CAM file two text files are created in the folder C:\KRC\Roboter\Log.

The file “PLSkippedLines.txt” shows all lines which PointLoader could read but does not have a command for it and therefore has skipped these lines.

The number of skipped lines are represented by the KRL-variable “PLSkippedLines”.

The file “PlLastReadLIne.txt” shows the last read line of the CAD/CAM file.

11 External Interface (only KRC4)

Starting with version v1.1.14, the software includes an external interface for loading and starting of CAD/CAM programs in the operating mode EXT via the IO-interface.

Basic function:

By a program number and an input the software is signaled to load a CAD/CAM program. Based on the program number the software then searches in a user written text file for the CAD/CAM file to be loaded. Analogous to the manual mode, after successful loading the program specified in the PointLoaderRunPrg [] variable is selected. Using further inputs, the processing of the selected program can be started, stopped and deselected.

Thus the inputs and outputs of the EA interface are evaluated or set the module PointLoaderSub must called cyclically in the submit interpreter. Necessary entry in the file SPS.sub:

```
PointLoaderSub()
```

The configuration of the IO-Interface is done in the file "PointLoaderSub.dat".

In addition, in WorkVisual the IO's must be defined and connected accordingly.

11.1 Inputs and outputs

In the file PointLoaderSub.dat the inputs and outputs can be configured. The number of the respective input and output is given as an integer value.

11.1.1 Inputs

Inputs are indicated by "PL_di _.....".

```
INT PL_di_LoadProg=999
INT PL_di_StopProg=999
INT PL_di_CancelProg=999
INT PL_di_QuitErrorFlag=999
SIGNAL PL_di_ProgNo $ IN [999] TO $ IN [1000]
```

Input	Description
PL_di_LoadProg	Starts loading the CAD / CAM file
PL_di_StopProg	Stops the execution of the current program
PL_di_CancelProg	Cancels the current program
PL_di_QuitErrorFlag	Acknowledge of pending error bits (outputs) of Point Loader
PL_di_ProgNo	program number (for text file)

11.1.2 Outputs

Outputs are indicated by "PL_do _.....".

```
INT PL_do_ProgFree=999
INT PL_do_ProgRunning=999
INT PL_do_ProgReset=999
INT PL_do_ProgStopped=999
INT PL_do_ProgEnd=999
INT PL_do_FileLoadingActive=999
INT PL_do_FileLoadingReady=999
INT PL_do_StopProgAck=999
INT PL_do_DeSelectProgAck=999
INT PL_do_ErrProgNoNotFound=999
INT PL_do_ErrProgNotExist=999
INT PL_do_ErrFileLoading=999
INT PL_do_ErrFileNotExist=999 ; File in PL_ExtFileList [] does not
exist
SIGNAL PL_do_ProgNo $ OUT [999] TO $ OUT [1000]
SIGNAL PL_do_PointsToBeDone $ OUT [999] TO $ OUT [1000] ; Must be at
least 32 bits = 4294967295
SIGNAL PL_do_PointID $ OUT [999] TO $ OUT [1000] ; Must be at least
32 bits = 4294967295
```

output	description
PL_do_ProgFree	No program selected
PL_do_ProgRunning	Program execution is running
PL_do_ProgReset	Program execution is reset
PL_do_ProgStopped	Program execution is stopped
PL_do_ProgEnd	Program end has been reached
PL_do_FileLoadingActive	Loading of the CAD/CAM file active
PL_do_FileLoadingReady	Loading the CAD/CAM file completed
PL_do_StopProgAck	Not used
PL_do_DeSelectProgAck	Not used
PL_do_ErrProgNoNotFound	Program number was not found in the text file
PL_do_ErrProgNotExist	For the actual program number no CAD/CAM file is specified in the text file
PL_do_ErrFileLoading	When loading the CAD/CAM file, an error occurred
PL_do_ErrFileNotExist	The CAD/CAM file does not exist

PL_do_ProgNo	Reflection of signal Pl_di_ProgNo
PL_do_PointsToBeDone	Number of scanned program lines
PL_do_PointID	Currently executed program line

The signal PL_do_PointsToBeDone and PL_do_PointID should at least 32 bits to avoid overflow error.

11.2 Text file with program number and location of the CAD/CAM file

Which CAD / CAM file is to be loaded is specified in a text file. This text file must be located on a drive accessible by the robot system. Each time a loading progress is started, the entry of the corresponding program number is searched in the file.

During installation of the software the file "PL_ExtFileList.txt" installed on drive D:. This file can be used as a template. The name and location of the file can freely be selected and needs to be specified in the variable "`PL_ExtFileList[]`".

```
PL_ExtFileList []="D: \ PL_ExtFileList.txt"
```

The format of the entries must comply with the following structure:

Program Number: blank path

Example:

```
10: D:\Example.src
20: E:\CADCAM_Server\CAD1.src
25: ...
30: ...
```

The program number is specified by the variable PL_di_ProgNo.

In case of an error when reading the text file or during loading some error bits are set according to the following table:

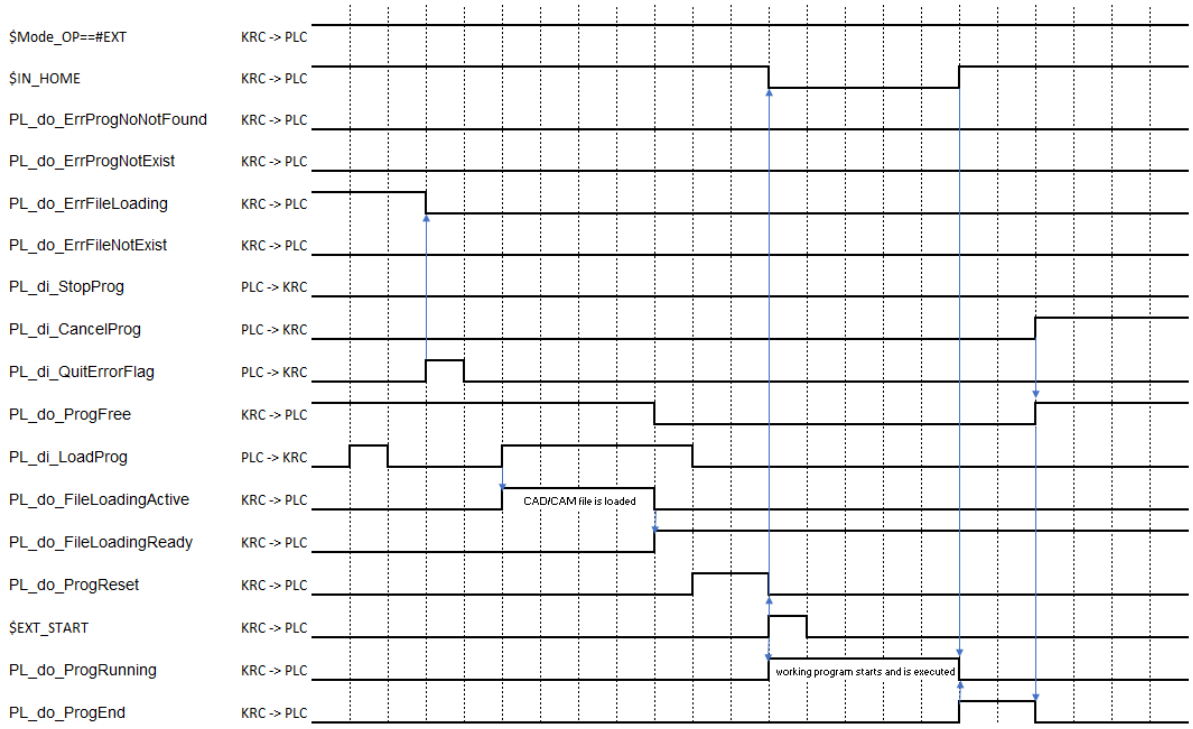
Output	Description
PL_do_ErrProgNoNotFound	Program number was not found in the text file
PL_do_ErrProgNotExist	For the program number no CAD/CAM file is specified in the text file
PL_do_ErrFileLoading	When loading the CAD/CAM file, an error occurred
PL_do_ErrFileNotExist	The CAD/CAM file does not exist

11.3 Requirements for loading a CAD/CAM file

To start the loading of a CAD/CAM file with a positive edge of the input PL_di_LoadProg, the following requirements must be met:

- Operation mode EXT ($MODE_OP==# EXT)
- No program selected (PL_do_ProgFree==TRUE)
- No loading of a CAD/CAM file active (PL_do_FileLoadingActive==FALSE)
- Robots in home position ($IN_HOME==TRUE)
- no error bit set (PL_do_ErrProgNoNotFound, PL_do_ErrProgNotExist, PL_do_ErrFileLo ading, PL_do_ErrFileNotExist)
- Inputs Pl_di_StopProg and Pl_di_CancelProg reset
- Submit interpreter is running
- Text file exists
- To the program number related CAD/CAM file is existing

11.4 Signal diagram to laod and start a CAD/CAM file



11.5 Requirements for starting a loaded CAD / CAM file

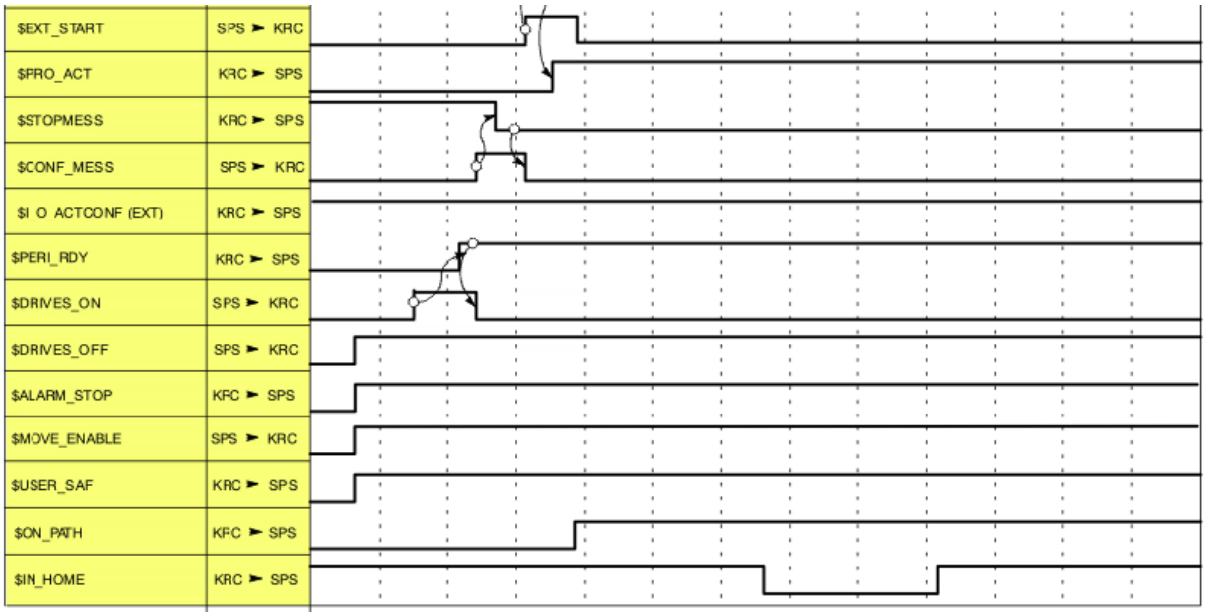
Starting a selected program requires certain conditions of signals of the automatic external interface. Just some of them are listed below. A detailed description can be found in the KUKA documentation "operating and programming instructions for system integrators".

- External interface active ($ I_O_Act == TRUE)
- Driving release available ($ MOVE_ENABLE == TRUE)
- Drives turned on ($ PERI_RDY == TRUE)
- Operator protection available ($ USER_SAF == TRUE)
- No emergency stop ($ Alarm_Stop == FALSE)
- Positive edge of $ EXT_START signal

The automatic external interface is configured via an user interface.

Opening the user interface: Main Menu → Configuration → Inputs/Outputs → Automatic External

Excerpt from the KUKA documentation:



11.6 Stopping a program

The positive edge of the input PL_di_StopProg stops the running program. Requirement:

- Operation mode EXT ($MODE_OP==# EXT)
- Program is running (PL_do_ProgRunning==TRUE)
- Inputs Pl_di_LoadProg and Pl_di_CancelProg are FALSE
- Submit interpreter is running

11.7 Canceling a program

The positive edge of the input PL_di_CancelProg cancels the current program. Requirement:

- Operation mode EXT ($MODE_OP==# EXT)
- Program is reset (PL_do_ProgReset==TRUE) **OR**
- Program end has been reached (PL_do_ProgEnd==TRUE) **OR**
- Program is stopped (PL_do_ProgStopped==TRUE)
- Inputs Pl_di_LoadProg and Pl_di_StopProg are FALSE
- Submit interpreter is running

11.8 Example configuration of the IO-interface

EA interface Point Loader:

```
; OutPuts
INT PL_do_ProgFree=1
INT PL_do_ProgRunning=2
INT PL_do_ProgReset=3
INT PL_do_ProgStopped=4
INT PL_do_ProgEnd=5
INT PL_do_FileLoadingActive=6
INT PL_do_FileLoadingReady=7
INT PL_do_StopProgAck=999
INT PL_do_DeSelectProgAck=999
INT PL_do_ErrProgNoNotFound=8th
INT PL_do_ErrProgNotExist=9
INT PL_do_ErrFileLoading=10
INT PL_do_ErrFileNotExist=11; File in PL_ExtFileList [] does not
exist
SIGNAL PL_do_ProgNo $ OUT [12] TO $ OUT [15]
SIGNAL PL_do_PointsToBeDone $ OUT [16] TO $ OUT [47] ; Must be at
least 32 bits = 4294967295
SIGNAL PL_do_PointID $ OUT [48] TO $ OUT [79] ; Must be at least 32
bits = 4294967295

; inputs
INT PL_di_LoadProg=1
INT PL_di_StopProg=2
INT PL_di_CancelProg=3
INT PL_di_QuitErrorFlag=4
SIGNAL PL_di_ProgNo $ IN [5] TO $ IN [8]

CHAR PL_ExtFileList [256]
PL_ExtFileList []="D: \ PL_ExtFileList.txt"
```

12 Examples of commands in CAD/CAM file

```
DEF Example()
ENUM MotState ON,OFF
STRUC Engine REAL Velocity, MotState Motor
DECL Engine GunEngine
DECL INT myINT
DECL BOOL myBool
Signal myOutput $OUT[999]
GunEngine.Motor=#ON
GunEngine.Velocity=65.7
myBool=TRUE
myINT=10
$VEL.CP=-1 ;if $vel.CP=-1 , -2, or -3 then $vel.cp is set to the
value of the KRL-variable pl_RapidFeed, pl_ContactFeed, pl_WorkFeed
$VEL.CP=0.002
$ACC.CP=2.0 ;calls the routine AccCP and set $Acc.CP to 2.0
$VEL_AXIS[1]=20 ;$Vel_AXIS[Number]=Value
$ACC_AXIS[1]=100 ;$ACC_AXIS[Number]=Value
$VEL_EXTAX[1]=20 ;$Vel_EXTAX[Number]=Value
$ACC_EXTAX[1]=100 ;$ACC_EXTAX[Number]=Value
;SET LIN AND ARC MOTION VARIABLES
$VEL.ORI1=200
$VEL.ORI2=200
$ACC.ORI1=100
$ACC.ORI2=100
$IPO_Mode=#Base ;#TCP, calls the routine SetIpoMode and sets
$IPO_Mode
$OV_PRO=50 ;sets program override
HALT ;stops working program
$ORI_TYPE=#VAR ;Orientierungsuehrung
Spindle_Stop(1) ;calls the routine spindle_stop
ToolChange(1,2) ;calls the routine ToolChange
ToolBase(1,2)   ;calls the routine ToolBase and sets the $tool to
tool_data[1] and $base to base_data[2]
Spindle_Vel(4000,1) ;calls the routine Spindle_Vel
Cooling(1,0) ;calls the routine Cooling
Vacuum(1,1) ;calls the routine Vacuum
Spindle_Stop(1)  ;calls the routine Spindle_Stop
Spindle_Start(1) ;calls the routine Spindle_Start

IF (myBool == FALSE) THEN
$ANOUT[32]=0.35
ELSE
$ANOUT[32]=0.0
  IF (myBOOl AND (myINT==15)) THEN
    $ANOUT[32]=1.0
  ENDIF
  LOOP
  myINT=myINT+1
  IF myINT==12 THEN
    EXIT
  ENDIF
  ENDLOOP
ENDIF

FOR myINT=1 TO 5

ENDFOR

Switch myINT
case 1
```

```
HALT
case 5
HALT
ENDSWITCH

myINT=0
Repeat
  HALT
  myINT=myINT+1
UNTIL myINT==2

LOOP
  HALT
  myINT=myINT+1
  IF myINT==3 THEN
    EXIT
  ENDIF
ENDLOOP

;external kinematic : $BASE =
EK(MACHINE_DEF[No].ROOT,MACHINE_DEF[No].MECH_TYPE,BASE_DATA[No])
;Option 1:
$BASE = EK(MACHINE_DEF[2].ROOT,MACHINE_DEF[2].MECH_TYPE,{x 0,y 0,z
0,a 0,b 0,c 0}:BASE_DATA[1]:{x 0,y 0,z 0,a 0,b 0,c 0})
;Option 2:
$BASE =
EK(MACHINE_DEF[2].ROOT,MACHINE_DEF[2].MECH_TYPE,BASE_DATA[1]:{x 0,y
0,z 0,a 0,b 0,c 0})
;Option 3:
$BASE = EK(MACHINE_DEF[2].ROOT,MACHINE_DEF[2].MECH_TYPE,{x 0,y 0,z
0,a 0,b 0,c 0}:BASE_DATA[1])
;Option 4:
$BASE =
EK(MACHINE_DEF[2].ROOT,MACHINE_DEF[2].MECH_TYPE,BASE_DATA[1])
; Frames must be given as aggregate like {x ...,y ...,z ...,a ...,b
...,c ...}!!! No variables allowed.


$BASE=BASE_DATA[15]  ;calls the routine Base and sets the $base to
base_data[15]
$TOOL=TOOL_DATA[15]  ;calls the routine Tool and sets the $tool to
tool_data[15]
$TOOL={X 10, Y 20, Z 30, A 0, B -90, c 0} ;sets $tool to specific
data
$BASE={X 1000, Y 20, Z 30, A 0, B 0, c 0} ;sets $base to specific
data

$ANOUT[1]=1.8 ;$Anout[Nr]=Value

PTP xHOME
PTP $POS_ACT
PTP {A1 0, A2 -90, A3 90, A4 0, A5 -45, A6 0, E1 0}
PTP {X 1450, Y 110, Z 2000, A 9.952, B 0, c 0, E1 1000, E2 0, E3 0,
E4 0, E5 0, E6 0} C_DIS ;movements wih upto 6 external axis
PTP {X 1450, Y 110, Z 2000, A 9.952, B 0, c 0, E1 0, E2 0, S
'B110',T 'B110011'} C_DIS ;PTP with Status and Turn binary
PTP {X 1450, Y 110, Z 2000, A 9.952, B 0, c 0, E1 0, E2 0, S 6,T 51}
;PTP with Status and Turn decimal

$VEL.CP=0.167  ;calls the routine VelCp and sets $vel_cp to 0.167

INTERRUPT OFF 3 ;calls the routine InterruptOnOff and switches off
the interrupt with given number
```

```
INTERRUPT ON 3 ;calls the routine InterruptOnOff and switches on the
interrupt with given number

WAIT FOR $IN[1]==FALSE ;calls the routine WaitIN and waits for the
given value off an input
$OUT[1]=TRUE ;calls the routine SetOutPut and sets the output 1 to
True

LIN {X 1501, Y 110, Z 2000, A 9.952, B 0, c 0} C_DIS
CIRC {X 1507.5, Y 105, Z 2000, A 9.952, B 0, c 0},{X 1508, Y 108, Z
2000, A 9.952, B 0, c 0} C_DIS
CIRC {X 1508.5, Y 109, Z 2005, A 9.952, B 0, c 0},{X 1509, Y 111, Z
2005, A 9.952, B 0, c 0} C_DIS
LIN {X 1508.8, Y 110, Z 2000, A 9.952, B 0, c 0}
$OUT[2]=TRUE
$advance=3
WAIT FOR $IN[1]==False
$ACC.CP=2
Spindle_Vel(6000,0)
Spindle_Start(1)
```

13 Messages

13.1 License

Message	Description
Dialog message: License for the product PointLoader invalid or expired. Contact your system integrator.	The license file is invalid, for example, wrong serial number, or a term expiring license has expired. A new license file fixes the problem.
Quit message: The generated file CadCommands.src has errors. Please check! RunPointLoader can't be selected.	Commands were used in the CAD/CAM file which lead to compilation errors in the CadCommands file.
Dialog message: No license for the product PointLoader available. Contact your system integrator.	There is no license file on the system. A new license file fixes the problem.
Status message: X days left to expire license	Appears in time limited licenses if the remaining period is <15 days.
Status message: No license file for robot X available	No license file found for the robot with the serial number X (X = serial number). A new license file fixes the problem.
Status message: License for robot X invalid or expired	No valid license for the robot with the serial number X (X = serial number). A new license file fixes the problem.
Info message: Date has been manipulated. License has been reset!	When using a run-length limited license is detected that the date of the robotic system was changed. The license is valid. A new license file fixes the problem.

13.2 Program execution

Message	Description
Info message: Unknown file extension	The file format of the CAD/CAM file is not ".src" or “.txt”
Info message: No position file selected	Loading a CAD/CAM file has been triggered, but no file was selected. The variable FilePath[] is empty.
Dialog message: File *filename* could not be found	The CAD/CAM file *filename* could not be found. Check the path.
Quit message: Error reading the position data *filename*	When reading the CAD/CAM file an error has occurred. Check contents of the file. The file C:\KRC\Roboter\Log\PLLastReadLine.txt shows the last read line. This line maybe gives a hint why an error occurred.
Info message: Error position download	The positions could not be loaded into the Array
Info message: Loading of file *filename* started.	Loading of the CAD/CAM file *filename* was started.
Info message: Loading in process: ... read%	Progress Indicator loading the CAD/CAM file
Info message: Loading of file *filename* aborted	The loading of the CAD/CAM file has been aborted. Maybe the stop button has been pushed.
Info message: Loading of file *filename* completed	The loading of the CAD/CAM file has been completed
Info message: Error calculating time display.	When calculating the time display an error has occurred. Make screenshot of the time display, create, archive, record and report errors to OrangeApps.
Info message: Error writing KRL data.	The commands read by the plugin could not be written to the arrays in PointLoader.src. Maybe the command in the CAD/CAM file is wrong.
The generated file CadCommands has errors. Please check!	Check the commands CAD/CAM file