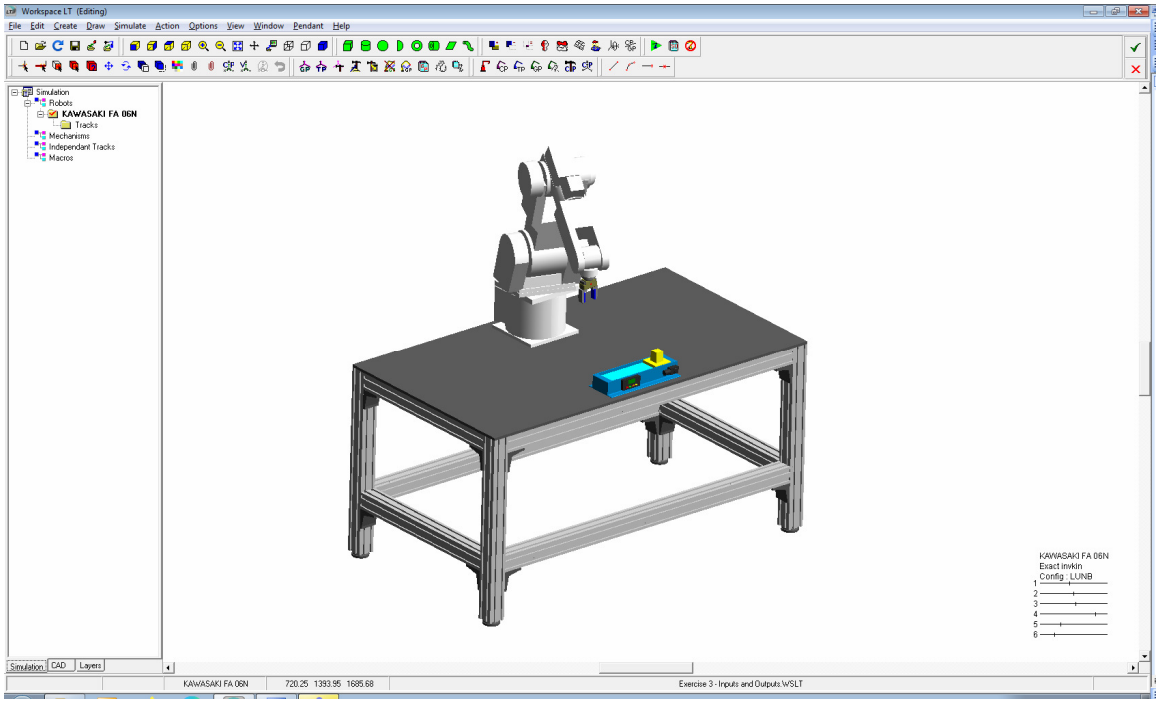
Workspace LT (Editing)
File Edit Create Draw Simulate Action Options View Window Pendant Help
Simulation
Robots
KAWASAKI FA 06N
Tracks
Mechanisms
Independant Tracks
Macros
Simulation CAD Layers
KAWASAKI FA 06N
720.25 1393.95 1685.68
Exercise 3 - Inputs and Outputs.WSLT
KAWASAKI FA 06N
Exact invkin
Config : LUNB
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Exercise 3 - Inputs and Outputs

Objectives:

- Create basic robot programs in simulation.
- Create a basic "independent" program in simulation
- Using an end of arm gripper to manipulate parts.
- Simulation of a conveyor in the model.
- Declare and use inputs and outputs in simulation.
- Create an AVI for future observation.

Materials;

- Workspace LT© simulation software.
- Workspace LT© project file "Exercise 3 - Inputs and Outputs.WSLT"
- Manual "Workspace LT© User Guide.pdf".

Helpful Hint; Before starting this exercise, review the User Guide sections;

- 6.3 - Comments and Workspace commands
- 6.5 - System Variables
- 8.2 - Signals.
- 9.3.2 - WAIT FOR
- 11 - Macros.
- 12.1.3 - Executing Multiple Tracks.

1) Procedure: Create the Robot track
   a) Open Workspace LT simulation software.
   b) Open the project file "Exercise 3 - Inputs and Outputs.WSLT".
   Add a track for the robot "Kawasaki FA 06N". Enter the Track Name "Robot" and select the Language "KAREL 2". Using the mouse pointer select OK when completed entering and selecting the information.
   c) Visually determine where the tool frame is located. Activate the "Tool Frame Display". On the tool bar and using the mouse select Options, from the drop down menu using the mouse select Robot Utilities, from the slide out menu using the mouse select Robot options... , Set the Tool frame display and accept OK. Place a new tool frame at POS(0,0,125,0,0,0,").
   d) To Place a new tool frame at POS(0,0,125,0,0,0,"). Select the Action menu located on the menu bar. The user menu Action will appear, using the mouse , select Variables , the Variables Menu will appear. Using the mouse , select Assign System Variable. Using the mouse , from the "Select

variable" menu, select $UTOOL. For "Value for $UTOOL?" enter the value "POS(0,0,125,0,0,0,")". Select OK to accept the data input.

e) Test the tool frame by moving the robot using the follow CP Function. Open the pendent by selecting the function Pendant located on the tool bar. The Pendent menu will appear. Using the mouse select the check box labeled FollowCP. Move the robot by placing the CP in front of the robot. Do this by placing the mouse near the EOAT gripper and clinking the left mouse button. The CP will move to this position and the Robot will follow placing the tool frame at the new CP position.

f) Begin recording a track using the newly created "Robot.KL" file previously created.
   i) If the menu box appears presenting the question "Are you sure you want to record over Robot.KL?", select OK.
   ii) When the menu box appears presenting the question "Do you want to save", select No.

g) The Action menu appears, select Begin to start recording.

h) The Action menu expands the command options.

i) To place a new tool frame at POS(0,0,125,0,0,0,"), select the Variables command , the Variables Menu will appear. Using the mouse , select Assign System Variable. Using the mouse , from the "Select variable" menu, select $UTOOL. For "Value for $UTOOL?" enter the value "POS(0,0,125,0,0,0,")". Select OK to accept the data input. This action will record the new tool frame. "$UTOOL=POS(0,0,125.0,0,0,0,")" in the track file.

j) From the Action Menu box, select Robot Move Commands. Once selected the Robot Move Commands menu appears.

k) Using the mouse , select the command Move Home. This Project's robot has a predefined home position. This move has now been recorded in the Track.

l) Using the mouse , select the GP "CONVEYORCLR1". From the Robot Move Commands menu, select GP Move. The robot will position the gripper on a pounce position over the part for confirmation. A Confirm menu will pop open, confirm this position OK. The robot will re-position the tool frame at this GP, recording this new position in the track program.

m) From the Robot Move Commands menu box select Move Relative. The "Relative" dialogue box will appear, enter the value Z -125 in the Z field and select OK to accept. This position is now recorded in the track as a "Relative VEC" move command. The robot has now placed the gripper over the yellow object labeled "PART1"

n) Using the mouse , select the object labeled "Part1". From the Action menu select Gripper Commands, the Gripper Com... menu will appear. From this menu box select Close Hand and a Confirm menu box will appear, select Yes. The gripper will now close and the object "PART!" will now be

attached to the gripper. In simulation, the gripper has grasped the part. The following lines have been recorded;

i) CLOSE HAND 1

ii) -- ! GRASPOBJ 'PART1'

o) From the Action menu box, select Move Away. The MOVE AWAY dialog box will appear, enter Displacement 125 in the Displacement field and select OK to accept.

p) Using the mouse, select the GP "CONVEYORCLR2". From the Robot Move Commands menu, select GP Move. The robot will position the gripper on a pounce position over the conveyer load position. Confirmation will be require as is true for all GP moves.

q) From the Robot Move Commands menu box select Move Relative. The "Relative" dialogue box will appear, enter the value Z -125 in the Z field and select OK to accept. This position is now recorded in the track as a "Relative VEC" move command. The robot has now placed the object "PART1" on the conveyor belt.

r) From the Action menu select Gripper Commands, the Gripper Com... menu will appear. From this menu box select Open Hand the gripper will open and the object "PART1" will be detached from the gripper. In simulation, the gripper has released the part. The following line has been recorded;

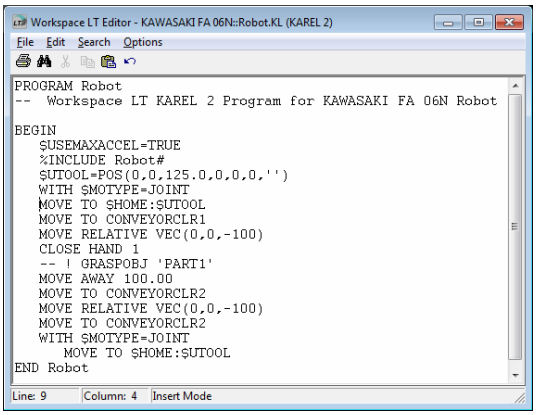
i) OPEN HAND 1

s) From the Action menu box, select Move Away. The MOVE AWAY dialog box will appear, enter Displacement 125 in the Displacement field and select OK to accept.

t) From the Robot Move Commands, select the command Move Home.

u) From the Action menu box select End to end recording.

v) To view your program track, using the mouse pointer, select the "Robot.KL" twice in rapid successions. this will open the program editor. From the instructions above, your program will list as below;



2) Procedure: Create the Conveyor track

a) Add an independent track for the conveyor. Place the mouse over "Independant Tacks" and select using the "Right" mouse key. A menu will appear, select "Add Track".

b) Enter the Track Name "Conveyor" and select the Language "KAREL 2". Using the mouse select OK when completed entering and selecting the information.

c) Begin recording a track using the newly created "Conveyor.KL track.

   i) Place the mouse over the independant tracks" and select using the "Right" mouse key. A menu will appear, select "Record Track".

   ii) If the menu box appears presenting the question "Are you sure you want to record over Robot.KL?", select OK.

   iii) When the menu box appears presenting the question "Do you want to save", select No.

d) The Action menu appears, select Begin to start recording.

e) The Action menu will change selections, using the mouse select Object Commands. The menu Object Commands appears.

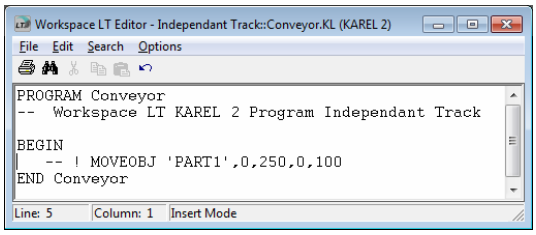
f) Using the mouse select the object "PART1". From the Object Commands menu, select Moveobj. Press the Q key on the keyboard for the Enter Relative CP Position dialogue box to appear.

g) Enter Y 250 in the Y field then select OK. Press the Enter key to accept the object's new position (where the robot removes part from conveyor).

h) Once the Enter key is pressed to accept the objects new position, an Input dialogue box will appear. Enter Velocity 100 representing millimeters per second. Select OK.

i) From the Action menu box select End to end recording.

j) To view your program track, using the mouse , select the "Conveyor.KL" twice in rapid successions. this will open the program editor. From the instructions above, the conveyor program will list as below;



k) Before continuing to part 3 of this exercise save the project and test each track separately in simulation.

   i) Set the "Robot.KL" track active. Using the mouse select the track using the right Mouse key. A dialogue box will appear, select Active. The file will now indicate it is active Robot.KL.

ii) Set the "Conveyor.KL" independant track in-active. Using the mouse select the track using the right Mouse key. A dialogue box will appear, select Active. The file will now indicate it is in-active Conveyor.KL.

iii) Using the mouse select (Play simulation) and observe the robot. The robot will pickup the object labeled "PART1" and place this object at the beginning of the conveyor and release. The robot will return to the home position.

iv) Set the "Robot.KL" track in-active. Using the mouse select the track using the right Mouse key. A dialogue box will appear, select Active. The file will now indicate it is in-active Robot.KL.

v) Set the "Conveyor.KL" independant track active. Using the mouse select the track using the right Mouse key. A dialogue box will appear, select Active. The file will now indicate it is active **Conveyor.KL**.

vi) Using the mouse select (Play simulation) and observe the conveyor. The object labeled "PART1" will move to the end of the conveyor, position X = 700, Y = 125.3349, Z = 979.225.

vii) Save the project model.

3) Procedure: Inputs and Outputs.

a) Activate each track **Robot.KL** and **Conveyor.KL**.

b) View the "Robot.KL" program track in the Text editor. Using the mouse, select the " Robot.KL" twice in rapid successions. this will open the track in the text editor.

c) Enter the following lines of text before the "BEGIN" statement;

i) --! SIGNALDEF DOUT[1]

ii) --! SIGNALDEF DIN[1],Conveyor.KL,1

(1) The "--" indicates the text that follows is a comment and will be ignored by Karel 2.

(2) The "!" following the comment instruction is indicating a workspace only function. Workspace will execute the function that follows. In this example the first command, SIGNALDEF is declaring a signal and the signal is DOUT[1], a digital output at port 1.

(3) The second command, SIGNALDEF is declaring a signal and the signal is DIN[1], a digital input at port 1 and the signal is to come from the track "Conveyor.KL" and from its port 1.

(4) Save the track changes and exit the editor.

d) View the "Conveyor.KL" program track in the Text editor. Using the mouse, select the " Conveyor.KL" twice in rapid successions. this will open the track in the text editor.

e) Enter the following lines of text using the same instructions as previously explained;

i) --! SIGNALDEF DOUT[1]

ii) --! SIGNALDEF DIN[1], Robot.KL,1

f) Save the track changes and exit the editor.

g) Reload the program to reset the simulation. Save the project model.

h) View the "Robot.KL" program track in the Text editor.
i) Edit the program to reflect the changes as shown in the following program list

```
PROGRAM Robot
--  Workspace LT KAREL 2 Program for KAWASAKI FA 06N Robot

  --! SIGNALDEF DOUT[1]
  --! SIGNALDEF DIN[1],Conveyor.KL,1

BEGIN
  $USEMAXACCEL=TRUE
  %INCLUDE Robot#
  $UTOOL=POS(0,0,125.0,0,0,0,")
  $MOTYPE=LINEAR
Repeat
  Wait for DIN[1]=ON
  MOVE TO CONVEYORCLR1
  MOVE RELATIVE VEC(0,0,-100)
  CLOSE HAND 1
  -- ! GRASPOBJ 'PART1'
  MOVE AWAY 100.00
  MOVE TO CONVEYORCLR2
  MOVE RELATIVE VEC(0,0,-100)
  OPEN HAND 1
  MOVE AWAY 100.00
  DOUT[1]=ON
  MOVE TO $HOME:$UTOOL
  DOUT[1]=OFF
Until False
END Robot
```

j) Save the track changes and exit the editor.
k) View the "Conveyor.KL" program track in the Text editor.
l) Edit the program to reflect the changes as shown in the following program list.

```
PROGRAM Conveyor
--  Workspace LT KAREL 2 Program Independant Track

--! SIGNALDEF DOUT[1]
--! SIGNALDEF DIN[1],Robot.KL,1

BEGIN
REPEAT
  -- Signal Robot Ready For Unload
  DOUT[1]=ON
  -- Wait for Robot load
  WAIT FOR DIN[1]=ON
```

```
    DOUT[1]=OFF
    -- Index PART1 to end of conveyor
    --! MOVEOBJ 'PART1',0,250,0,35
  UNTIL FALSE
  END Conveyor
```

Note: In KAREL 2, text which follows "--" is considered a comment. All text following the "--" is ignored when the program runs.

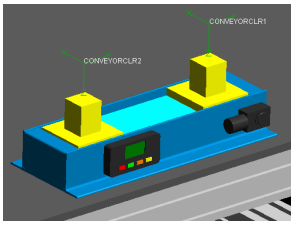
m) Save the project model .

n) View the "Robot.KL" program track in the Text editor. Add comments similar to track Conveyor.KL to explain the robot's programming functions.

o) Save the project model .

p) Using the mouse select (Play simulation) and observe the robot. The robot will pickup the object labeled "PART1" and place this object at the beginning of the conveyor, release "PART1" and return to it's "home" position. The conveyor will index "Part1" 250mm. The simulation will continue until the Esc key is pressed.

q) Copy "PART1" and place the new part "PART2" at the beginning of the conveyor, model position X = 700, Y = -124.6651, Z = 979.225.



r) Edit the tracks "Robot.KL" and Conveyor.KL to complete the following tasks;
   i) Robot moves from home position "CONVEYORCLR1".
   ii) Robot waits for unload request from conveyor. Robot unloads "PART1" then clears the conveyor's unload position.
   iii) Robot signals Conveyor to index "PART2".
   iv) Conveyor indexes "PART2" 250mm (end of the conveyor).
   v) Robot moves to "CONVEYORCLR2" position, waits for a conveyor "clear to load" signal. Robot loads " PART1" onto the conveyor belt.
   vi) Robot clears conveyor and moves to "CONVEYORCLR1"
   vii) Robot waits for an unload request from the conveyor. Robot unloads "PART2" then clears the conveyor's unload position.
   viii) Robot moves to "CONVEYORCLR2" position, waits for a conveyor "clear to load" signal. Robot loads " PART2" onto the conveyor belt.
   ix) Robot clears conveyor and the programs repeat.

s) Comment the Track programs for clarity.

t) Save the project model .

u) Using the mouse select (Play simulation) and observe.

4) Procedure: Create an AVI
   a) Using the mouse select Simulate found on the tool bar. This will open a drop down menu.
   b) from the drop down menu, using the mouse select Run Simulation and Create Animation.
   c) The "Rename" dialogue box will appear, using the mouse select Open to accept the default values. The "Video Compression" menu box will open.
   d) Using the mouse change the "Compressor" field to Microsoft Video 1.
   e) Using the mouse select OK to begin the process of replaying the simulation and creating an AVI.
   f) After the simulation has run a few cycles of the robot unloading and loading the conveyor, press the Esc key to end the recording.
   g) The AVI can now be replayed in any Windows compatible media player program.