

Running your Program Files on the Kuka Robot

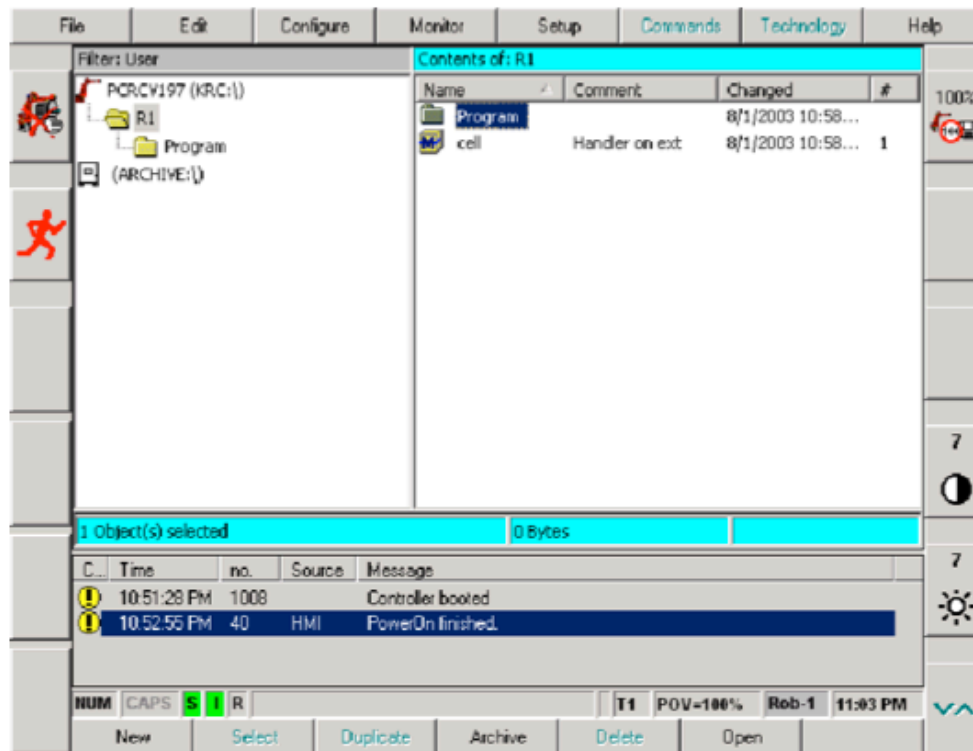
Digital Media Tutorial
Written by Eric Kurzenberger

Now that you've creating your milling toolpath in Powermill and created the program files in Codebreaker using the previous **Milling with Powermill on the Kuka Robot** tutorial, you're ready to copy those .src program files to the robot and run them.

I. Turning on the Robot

If it's not already on, turn on the Kuka robot using the two large switches on the wall to the left of the robot computer, turning on the far left switch first. **Make sure the robot is on before logging in to the robot workstation.**

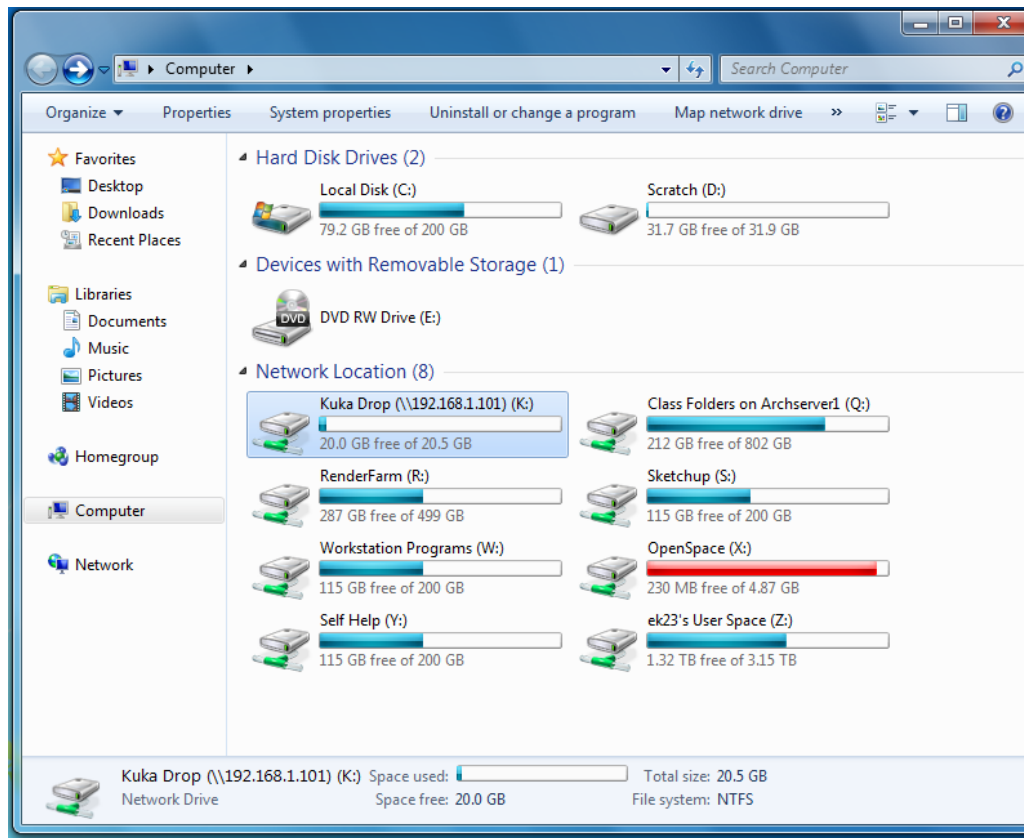
Once the robot has powered on, you'll see the **Navigator** screen on the robot controller (also known as the pendant), along with a message in the bottom pane of the Navigator screen saying "PowerOn finished."



The Navigator Screen

II. Copying your Program Files to the Robot

Log in to robot workstation with your net ID and password. If the robot is on, you'll see the **Kuka Drop** folder mapped to the K drive. This is the shared drive that is used to pass files to the robot.



Navigate to the the “Kuka Drop” folder on the K drive and delete any files currently in the folder, then copy your **.src** files outputted from Codebreaker into the folder.

Your program files are now on the shared drive of the Kuka’s embedded computer, but you’ll need to copy them to the Kuka’s **NC Programs** folder to run them.

Using the Pendant

On the Kuka pendant, the controller buttons around the screen correspond to the menus and buttons displayed directly next to them on the screen. For example, to select the **File** menu, which is at the top left of the screen, you would press the leftmost button in the row of control buttons that runs along the top of the pendant face.

The arrow buttons at the bottom right of the pendant face are used to navigate through menus, and the yellow **Enter** button next to the arrows is used to select. In the menus in the Kuka interface, if a number is displayed next to a menu item, you can use that number in the keypad to select that item as well.

The blue **Tab** button is used to cycle through the three panes of the Navigator window.

Setting the User Mode

To see the mapped **Kuka Drop** folder in the Kuka interface, you need to make sure you're in **Expert** user mode. To put the Kuka in expert mode, select **Configure** from the top menu using the corresponding top control button, then use the arrows to select **Configure > User Group** to open the **User Group** window.

In the **User Group** window, select the bottom control button that corresponds to **Expert** and enter the password "kuka" when prompted.

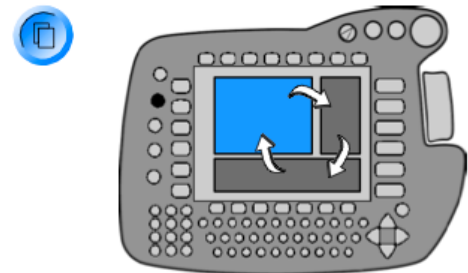
Copying files to NC Programs

In the top left pane of the Navigator screen, use the arrow keys to navigate to the **Kuka Drop** folder in the **KUKA_DATA (D:)** drive. Using the **Shift** key, highlight all of your files and select **Edit > Cut** to move them from this folder.

Navigate to the **Programs** folder in the **R1** directory. Select the files currently in the Programs folder and delete them using **Edit > Delete**, then copy your files into the folder using **Edit > Paste**.



Window selection key



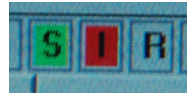
III. Homing the Kuka and Changing the Tool

Homing the Kuka

Before running any programs on the Kuka robot, you should always send it to its home position to avoid problems or collisions.

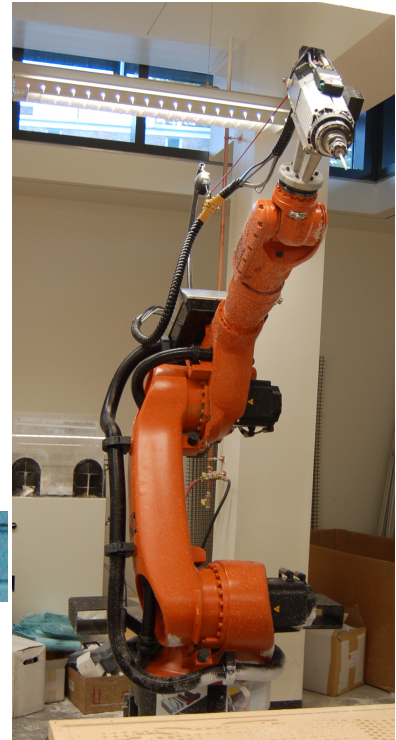
Navigate to the **NC Utilities** folder, highlight the **gohome** program, and press the yellow enter button to open it. Once the program opens, squeeze the grey deadman switch until it's partially (but not completely) depressed. You'll know the deadman is active when the red letter I at the bottom left of the screen becomes green.

Press the uppermost green button on the left side of the pendant to run the program (the letter R will also turn green, showing the program is running).



The robot should now move to its initial home position. You can change the speed settings on the right side of the pendant screen by toggling the corresponding button.

Once the Robot is at the home position, select **Program > Cancel Program** to cancel out of the program and close that program window.



The robot in home position

Changing the Tool

In the **NC Utilities** folder, open the **changetool** program. In the program, use the arrows keys to move the cursor to the line in the program which precedes the line for your tool change and press **Line Select**. (For example, if you're using tool #5, scroll down to the line above the line for tool 5,1).

With the proper line is selected, hold down one of the deadman buttons on the underside of the pendant and press the uppermost green **Start** button to start the tool change. Note, the deadman needs to be continually held down when running any program, including tool changes, unless you're in auto mode. Releasing the deadman will immediately cause the robot to stop.

Once the robot moves to the toolbox and the toolbox opens, press the **Start** button again, all the while holding down the deadman. The robot will exchange the tool it's currently holding with your desired tool, then measure the tooltip using the laser. This will take anywhere between 30 and 60 seconds and require the tool to move up and down in the laser bracket several times. It is important to make sure you do not let go of the deadman or the go button during this time.

Once the tool is measured, cancel the **changetool** program to close it.

IV. Setting Your Base

Next, you need to tell the Kuka where your base point is located. Remember, your base is the fixed point where all movements in your toolpath are measured from, so it's crucial that this is set correctly.

To set your base, you'll need to manually move the robot using the control buttons.

Moving the Robot Manually

Change to manual control mode by toggling the control button in the upper left corner until the robot icon looks like the picture to the right (by default, manual control of the robot is turned off, and this icon will have a red X through it).

Toggle the control button corresponding to the running man icon until the running man is red (if he's not already). This isn't necessary for manually controlling the robot, but is necessary for running your programs later.

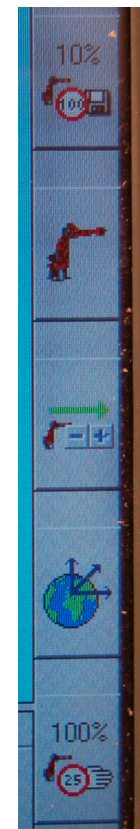
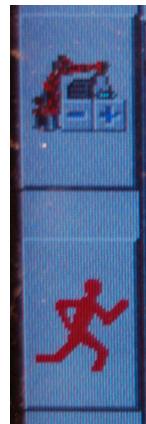
When in manual mode, the icons on the right of the Navigator screen will change. These icons represent the speed and manner in which the robot will move. For setting your base, you want to set the robot to world mode: toggle the fourth control button down on the right until you see a globe icon with arrows on it (as shown in the diagram on the right).

Since this is your first time running the robot, you'll want to run it at half-speed or slower. Adjust the manual speed control button (the bottom icon in the diagram on the right) until the icon reads 50%.

Activate the deadman. When the deadman is active, the icons on the right will change again to read X, Y, Z and A, B, C with +/- signs (if they say something like A1, A2, etc., you're not in world mode). X, Y, Z correspond to the axes of the robot (hitting +X will move the robot in the positive X axis) and A, B, C correspond to the drill head.

Experiment with moving the robot manually by holding down the deadman and toggling these buttons. Make sure you're running at half-speed or slower, and take extreme care not to hit anything.

Now that you're comfortable with moving the robot, you can measure your base.



Measuring your Base

Select **Setup > Measure > Base > 3 Point**

You will be asked to choose a **base number** and **name**. Set the base number to the same base number you set previously in Codebreaker. If you'll be using this base again later, you can give it a name for identifying purposes, then select **OK**.

Next, you'll be asked to enter your **Measurement tool number**, which is the number of the tool you've changed to and will be using in your milling job. Enter the number, then select **OK**.

Next, you'll be asked for your origin. Using the manual controls, jog the robot to where the origin of your block would be. If you've set the base to a top corner of your block, this will just be an approximation to verify your toolpath, so the placement doesn't need to be exact. If you've set the base to a bottom corner of your block, you should mark this point on the floor or workbench so that you can align your block exactly to this point when you set up your block.

Select **OK** once you've moved the tool to the right location.

NOTE: it's crucial that your base point is set to this same point on your block in Powermill. If your base point is set to a bottom corner of your block in Powermill, you should move the tool to where the bottom corner of your block will be placed; if you used a top corner, you should move the tool to the point in space where the top corner of your block will be. If your base in Powermill is set incorrectly, the robot will begin milling in the wrong location.

Next, you'll be asked for a positive X sampling. Jog the robot a few inches in the positive x direction and select **OK**.

Next, do the same for positive Y and select **OK**.

Once you have input this information, select **Save**. Then send the robot home using the **gohome** program as described previously.

Base system (3 points)		
Base No.	1	
Base system name:		
Select the base system to measure		
X [mm]:	1661.049	A [°]: 0.019355
Y [mm]:	1141.533	B [°]: 0.14832
Z [mm]:	1128.575	C [°]: -0.106184

V. Testing and Running Your Job

The next step will be to run a test of your job without using any material, to verify that your toolpath starts correctly without running the risk of damaging your block.

Because this is a test, set the program speed to 30% or lower. If there's an issue with the base point or model orientation in your program, the robot could attempt to go somewhere unexpected and cause damage, so you want to run the program at a slow speed when starting so that you can stop it if necessary (the robot moves faster than you might expect).

Navigate to your job in the **R1 > Programs** folder and find the .src file that is labeled **Main**. This is the main "control" program which calls the other sub-programs as needed. Highlight the **Main** program and open it using the yellow enter button.

Hold down the deadman, then hold down the green **Start** button to start running your program. While holding the deadman you may have to press the **Start** button a couple of times after the robot's initial plunge move.

Continue to hold the **Start** button and the deadman as your program runs and verify that the robot is running your toolpath properly.

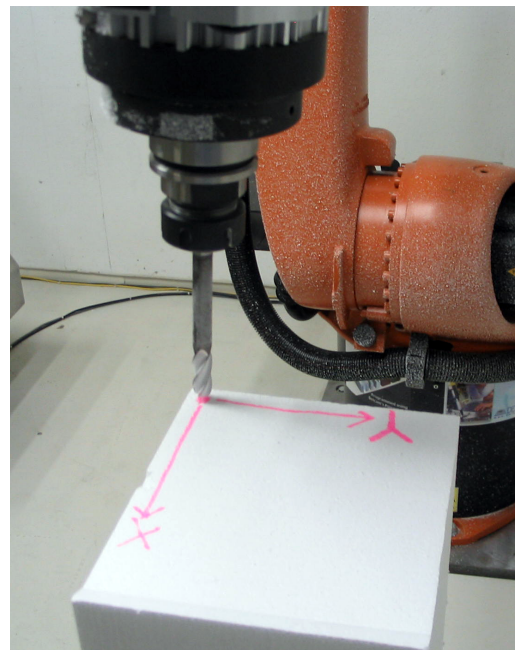
Load your block and begin cutting

Now it's time to begin cutting your model. Load your block, making sure to clamp it down securely on all four sides. Also make sure that your clamps are not in the cutting path of your model. If you set your base to a bottom corner of your block, make sure to align your block to the base you marked previously. If not, set the base point again following the instructions outlined above, making sure to bring the tool tip right to the surface of your piece so it's touching.

Again, **make sure this corresponds to your model's base point in Powermill.**

Launch your program as described above and run it again. The robot will begin cutting your block.

Once you're sure the cut is going properly and your feeds and speeds are correct, you can increase the speed to 100% and put the robot in **Auto** mode so that you don't need to keep holding the deadman.



Switch to Auto mode

Let go of the deadman: the job will stop and so will the spindle.

On the lower left side of the robot cabinet, there is a key which is in **T2** mode. Turn it one notch to the right to **AUTO**.



Next, reset the invisible fence by pressing the blue **Reset** button on the robot cabinet. When pushed, the button will light up blue. If the fence becomes tripped again by someone moving through it, the blue light will turn off and need to be pressed again.

On the pendant, tab down to the bottom window and press Acknowledge All” to acknowledge operator safety, then press the **Auto-mode Acknowledge** button with the vertical line at the top right corner of the pendant.



A red message will pop up asking if you would like to restart the spindle: click YES.

Once the spindle has started, press the green **Go** button on the pendant once to start milling again.

