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Robotic Additive Manufacturing Project – RAM

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1. Robotic Arm Jogging and Alignment

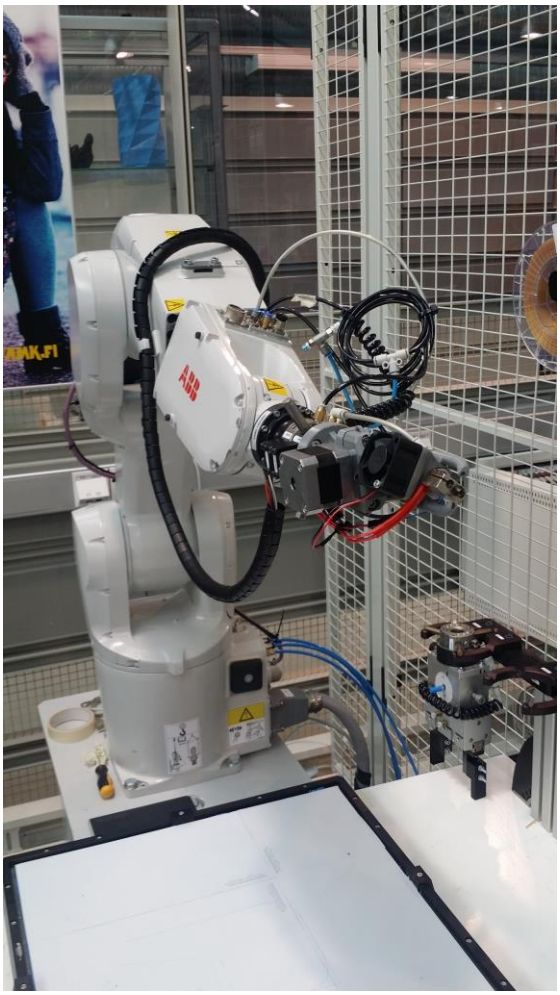

Figure 1. Robot in non-aligned position

In Figure 1, the robot is set in a non-aligned position with the extrusion mechanism attached.

Figure 2. Robot in manually Aligned Position

In Figure 2, the robot is set in an aligned position with the extrusion mechanism still attached.

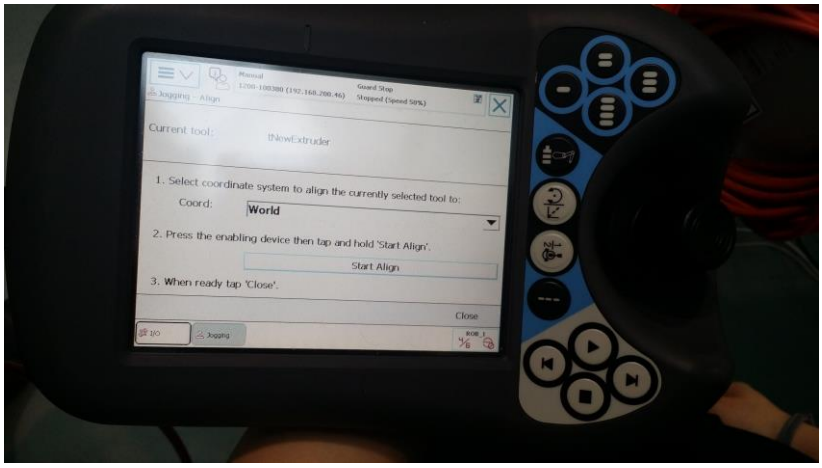

Figure 3. Align Robot to World

In Figure 3, the robot is being configured from the flex-pendant to an aligned position relative to the world.

- On the flex-pendant navigate to the jogging menu, from where there is an option at the bottom of the window called align and from which the user presses and holds the align option to align all the six hinges.

Figure 4 below shows an aligned robotic arm with the extrusion mechanism at the tip.

Figure 4. Robot is Aligned to World

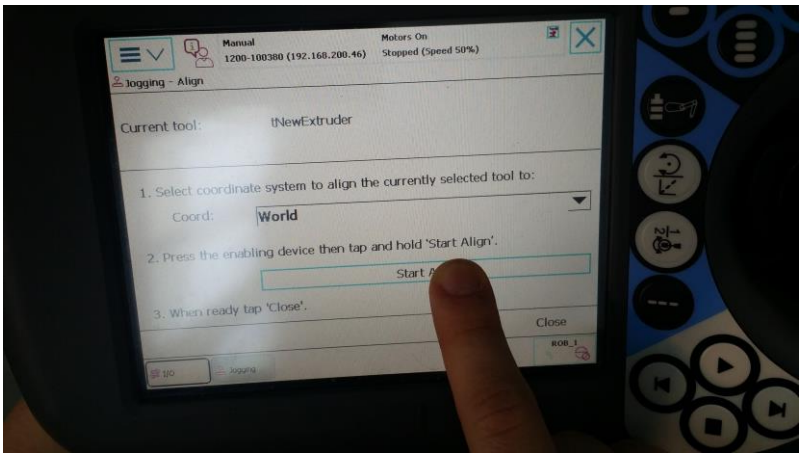

Figure 5. The Align option Under Jogging Menu

In Figure 6 below, there is a sub-menu called “Position Format” in the Jogging menu from where the original positions of the robot may be formatted.

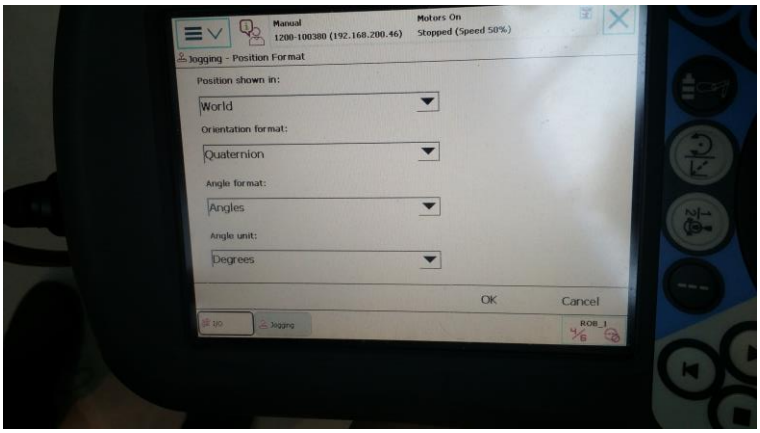

Figure 6. Position Format Sub-Menu

Figure 7 shows the jogging main menu with options and positions. From this menu, the user may modify several parameters including; motion mode, tool mechanism, work object, position and also align the robot.

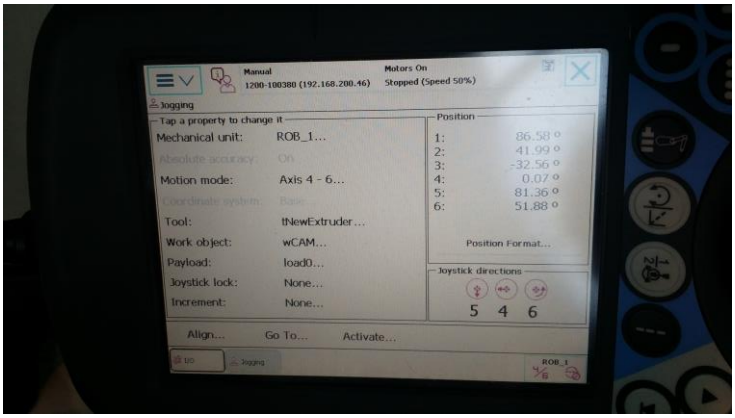

Figure 7. The Jogging Main Menu with Options and Positions

In Figure 8, the position format box used here shows the nearest values when the robot is properly aligned. These numbers and their corresponding positions are the recommended settings.

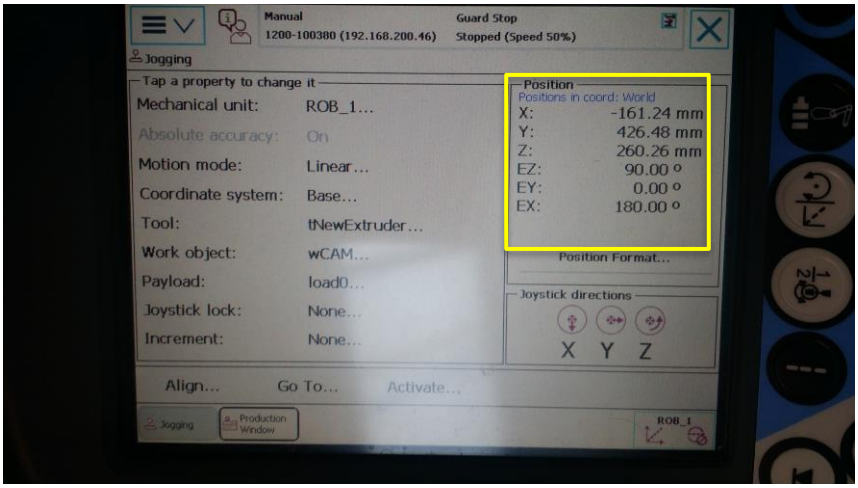

Figure 8. Position Formatting in Jogging Menu

Figure 9 shows the motion mode sub-menu which is found below the window in the jogging menu. Here, the motion mode can be selected and, in the figure, we have the Linear mode active.

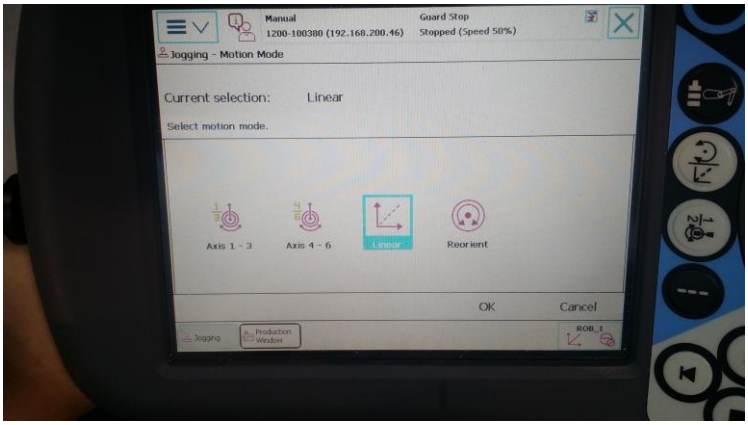

Figure 9. Motion Mode Selection

2. Three-Point Calibration

The purpose of this three-point calibration is to determine the optimal z-axis (vertical) position using three points on the platform as references.

Step 1 – Click on work object option in the jogging menu.

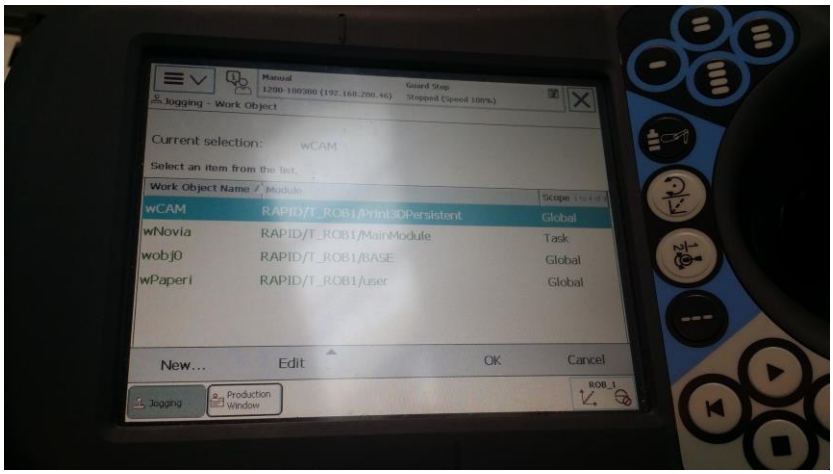

Figure 10. Starting Calibration From Work Object Sub-Menu

Step 2 – Choose the option “RAPID/T_ROB1/Print3DPersistent”. Next, choose “Edit” option at the bottom then click the define tool to navigate to the calibration window.

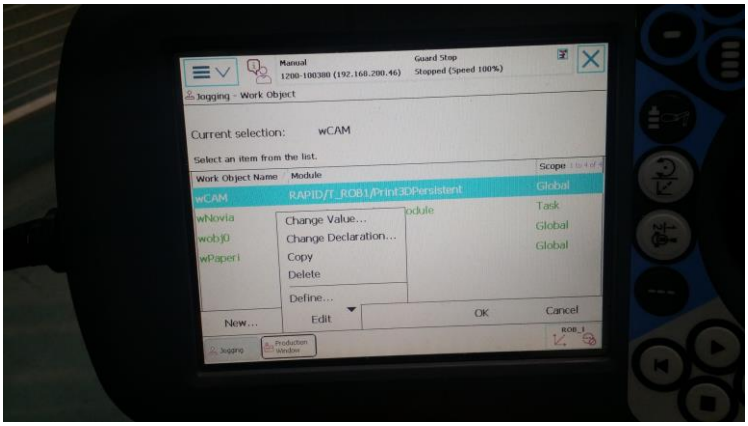

Figure 11. Using the Edit and Define tools in Work Object

Step 3 – In the User Method drop down menu, select “3 points” to indicate the preference for three points calibration. Next, the three options of Y 1, X 1 and X 2 appears.

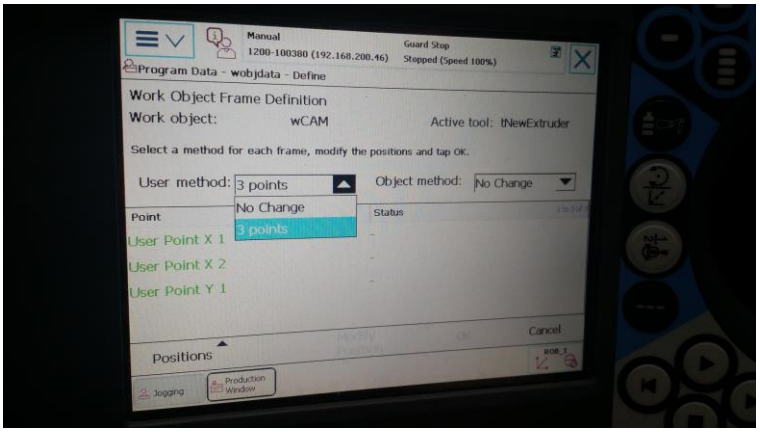

Figure 12. Choosing 3 Point Calibration

Step 4 – Calibrate the first point Y 1. The three points are determined manually, then click on "modify"

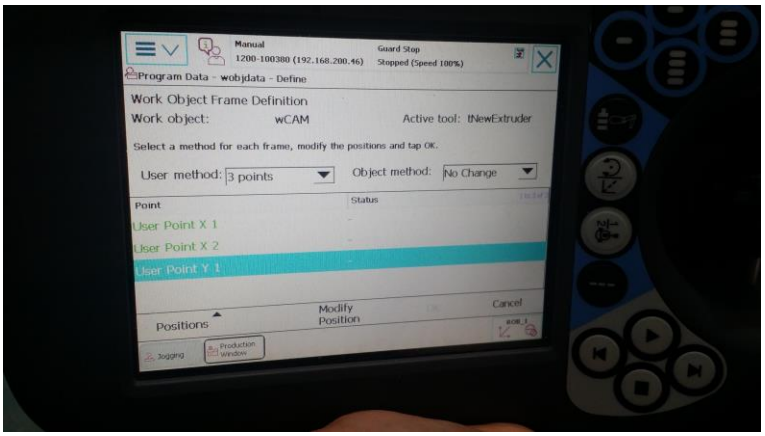

Figure 13. Calibrating the First Point

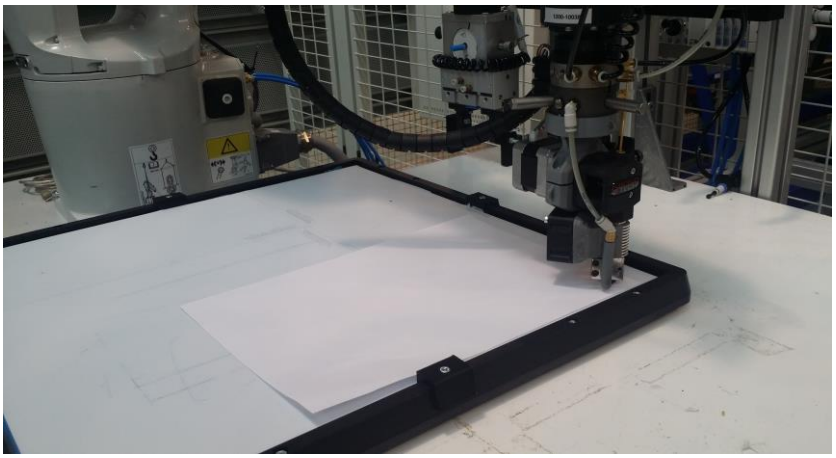

Figure 14. Calibrating the First Point

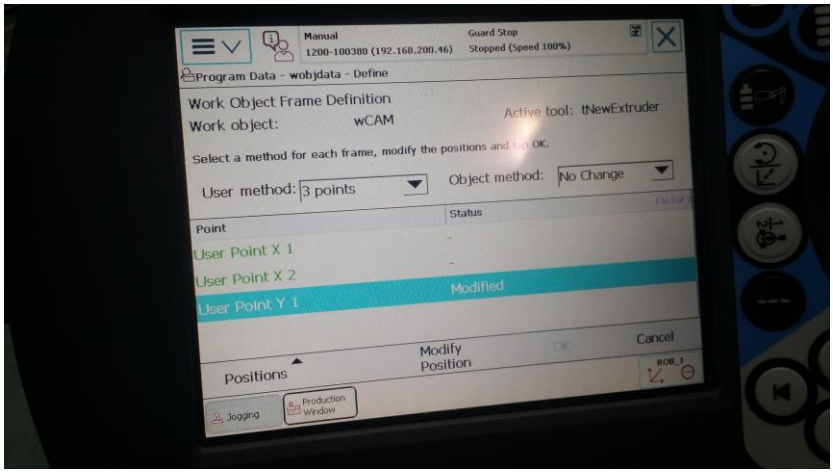

Figure 15. First Point is Modified

Step 5 – The Second point of calibration is X 1.

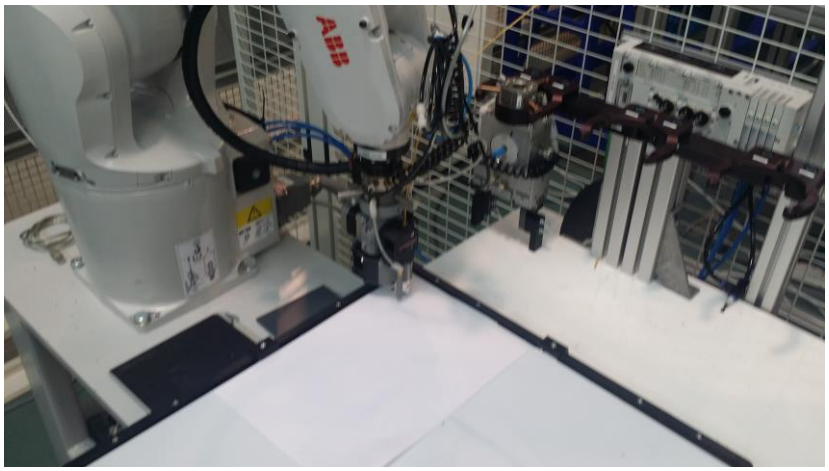

Figure 16. Calibrating the Second Point

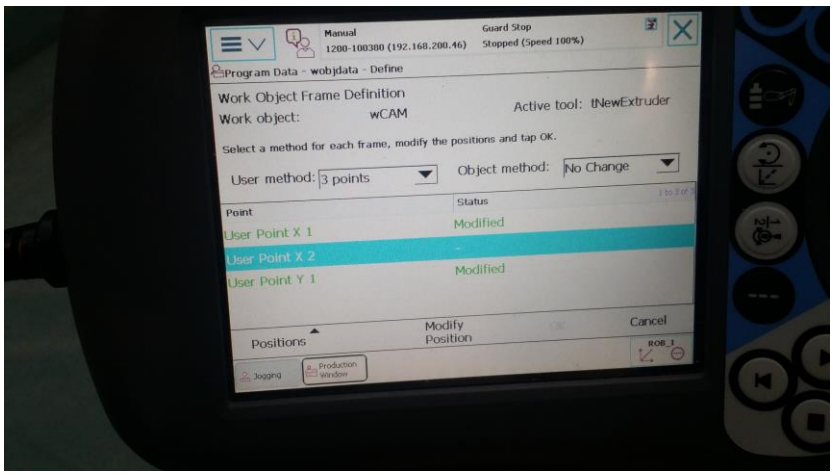

Figure 17. Second Point is Modified

Step 6 – The Third point of calibration is X 2.

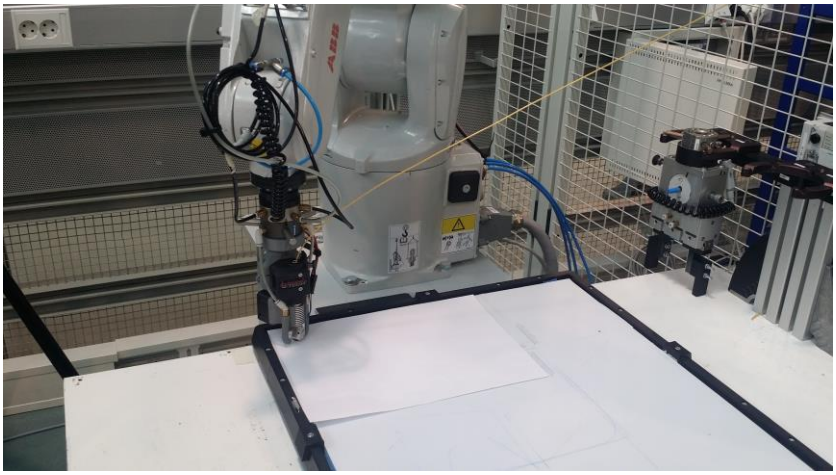

Figure 18. Calibrating the Third Point

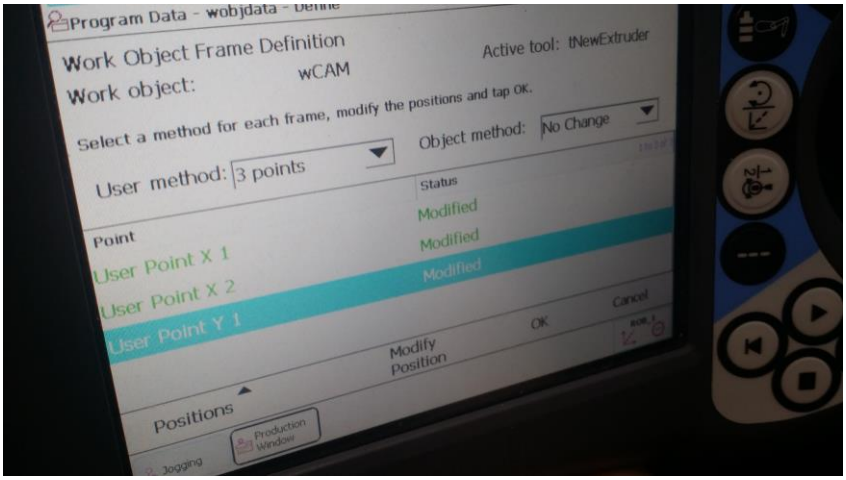

Figure 19. Third Point is Modified

Step 7 – Click Ok at the bottom of the window. Click No (You do not need to save).

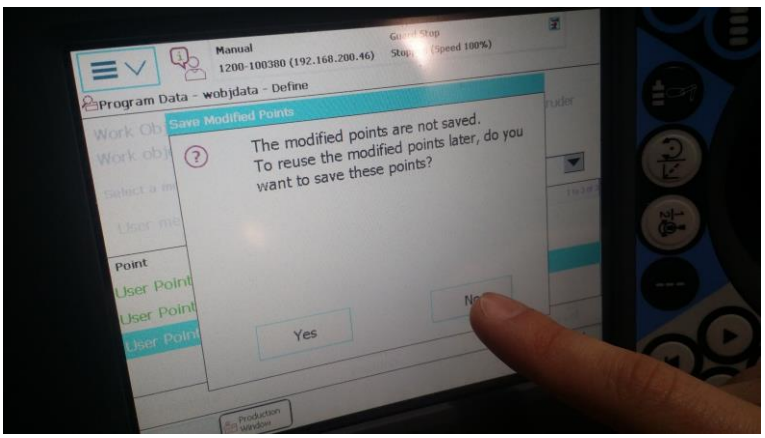

Figure 20. Saving Modified Point

Step 8 – Click Ok to confirm the result.

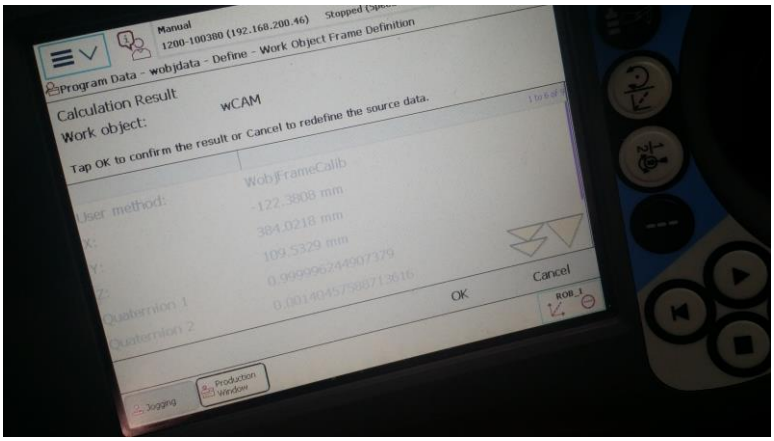

Figure 21. Final Confirmation of Results

Robot is in Home Position in Figure 22 below.

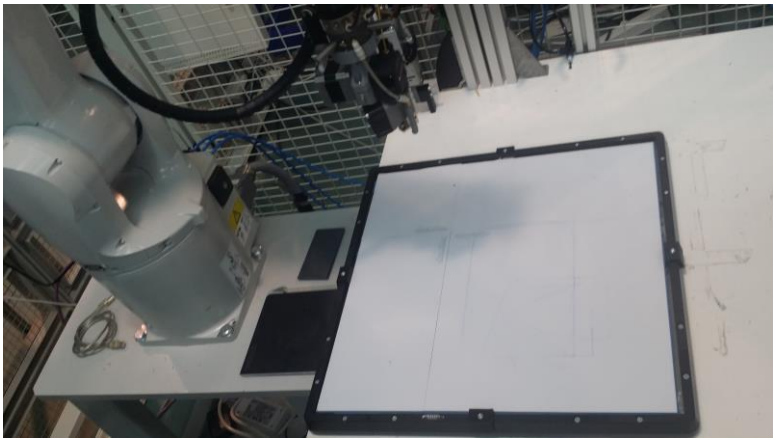

Figure 22. Robot in Home Position.

3. Production Window (Using PP to Main Command)

Main window of ABB's IRP-1200-100380 flex-pendant.

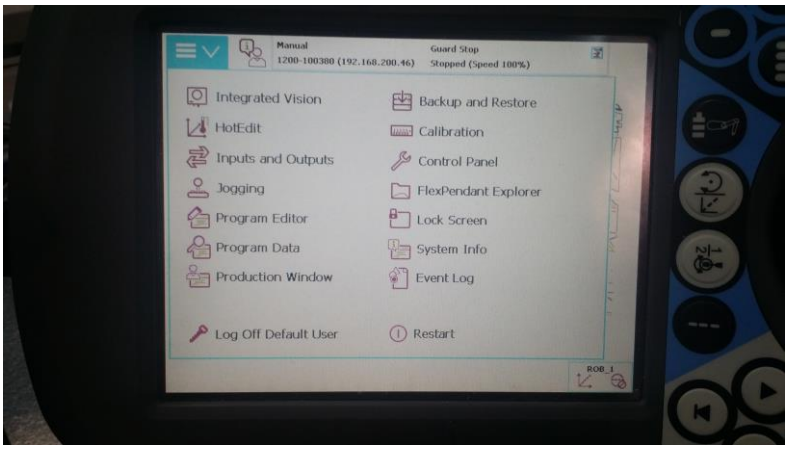

Figure 23. Main Window of Flex Pendant

Step 1 – Click on the Production Window menu. Next, click on "PP to Main" and acknowledge "Yes".

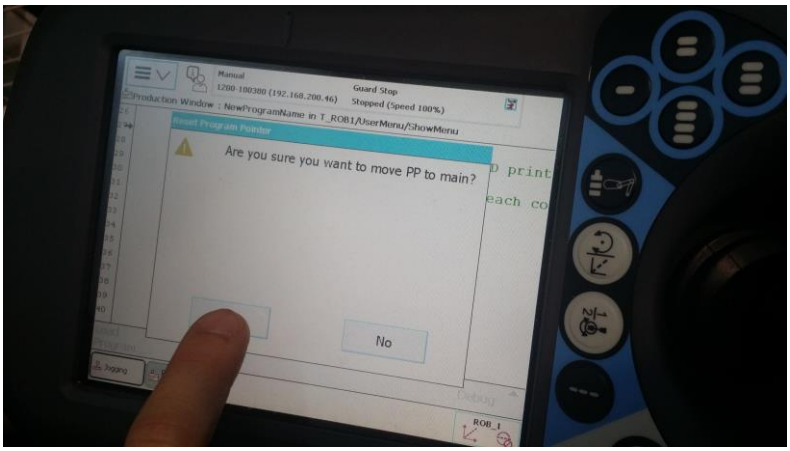

Figure 24. PP to Main Confirmation

Step 2 – Click the play button on the flex pendant.

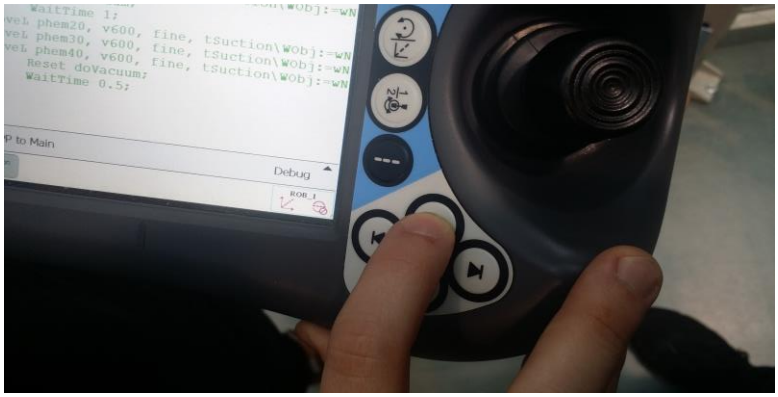

Figure 25. Play PP to Main Command

Step 3 – Acknowledge the calibration reminder.

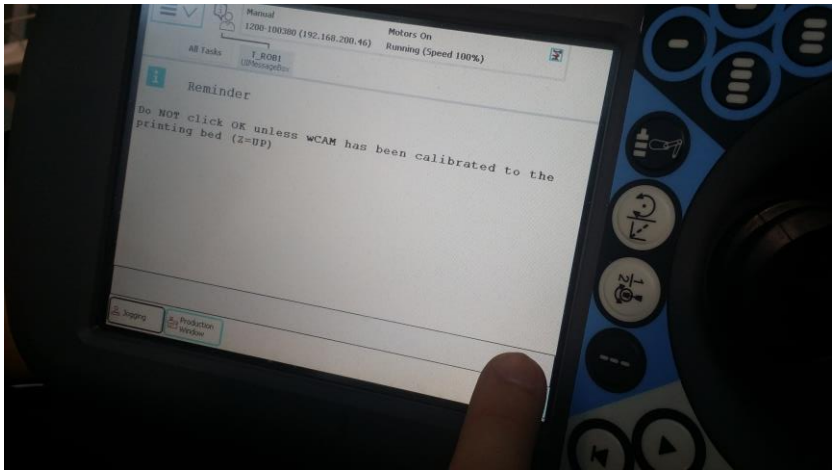

Figure 26. Calibration Reminder

Step 4 – Choose among the five options which one to execute. The example below uses “Reach Corners” and can be done in both manual and automatic modes.

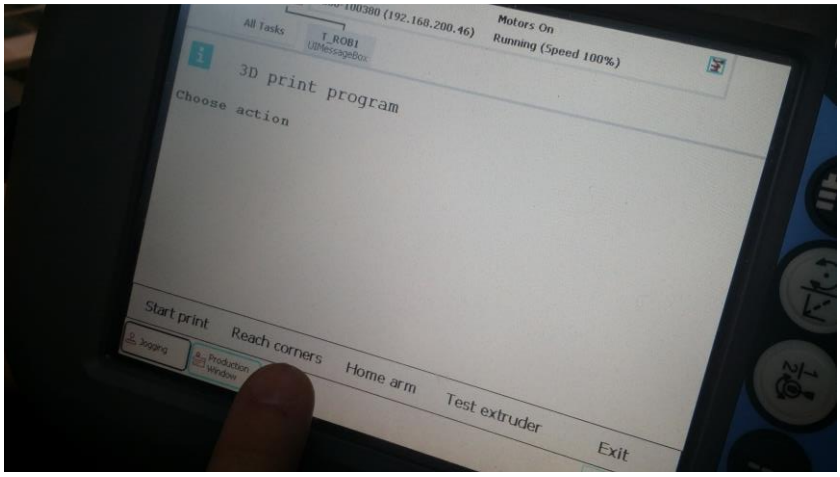

Figure 27. Reach Corners

4. How to Print in Automatic Mode

Step 1 – Switch to Automatic Mode

Figure 28. Switch to Automatic Mode

Step 2 – Click “ok” on the Automatic Mode notification on the flex-pendant

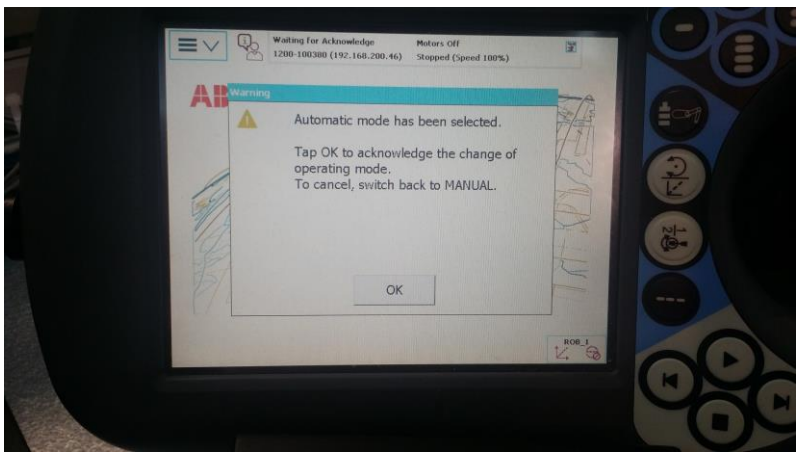

Figure 29. Automatic Mode Notification

Step 2 – Activate Automatic button on Robot's Base Station.

Figure 30. Activate Automatic Button

Step 3 – Use PP to Main as in Chapter 3. Next, click on "Start Print"

NOTE! You are in Automatic Mode.

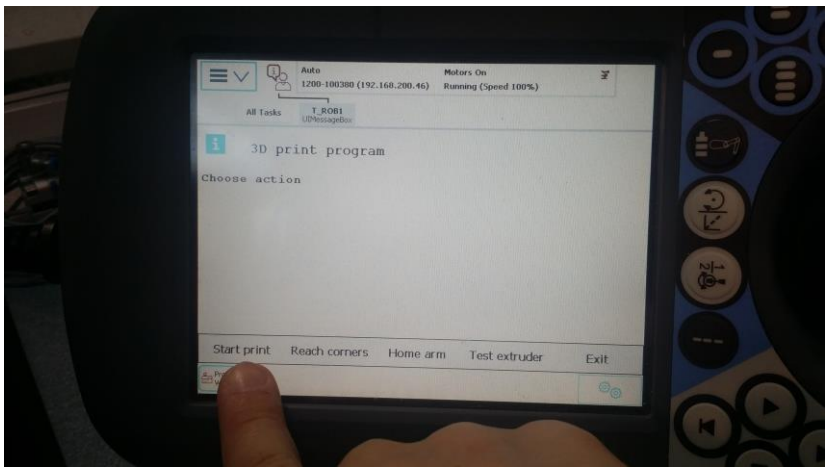

Figure 31. Start Print

Step 4 – Select the .gcode file you want to print from the “All Tasks” List

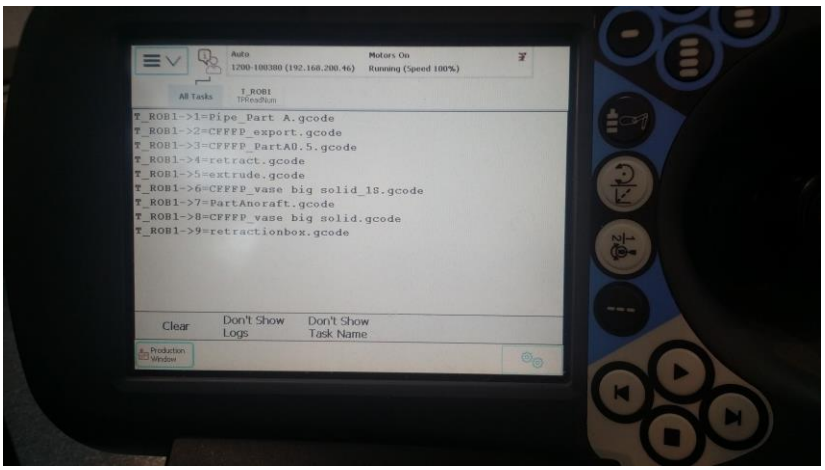

Figure 32. All Tasks List

Step 5 – Click “Ok”

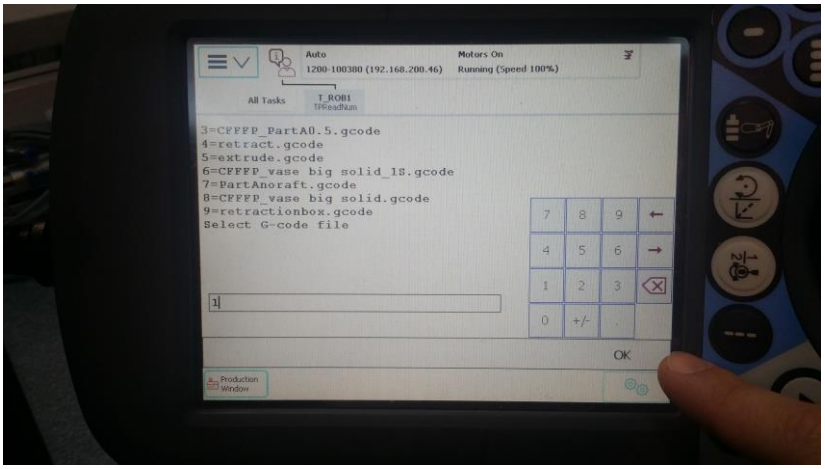

Figure 33. Confirm .gcode Selection

Step 6 – Wait for print to start in five seconds.

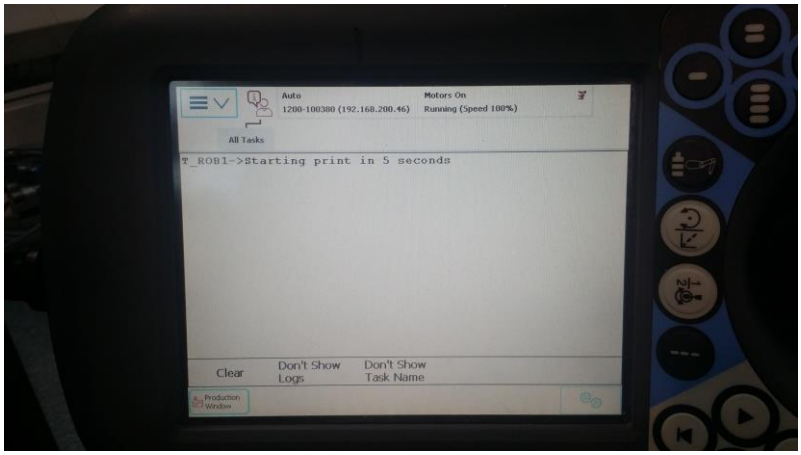

Figure 34. Initializing Print

5. How to Change Extruder Tool

Step 1 – Go to “Inputs and Outputs menu.

Step 2 – Click on “View” at the bottom right corner and select “Digital Outputs”.

Step 3 – Select “doToolchange” and click on “1” command at the bottom of the window.

NOTE! The extruder mechanism will suddenly pop out upon executing this command. Therefore, be careful to have a colleague hold it to avoid damage or injury.

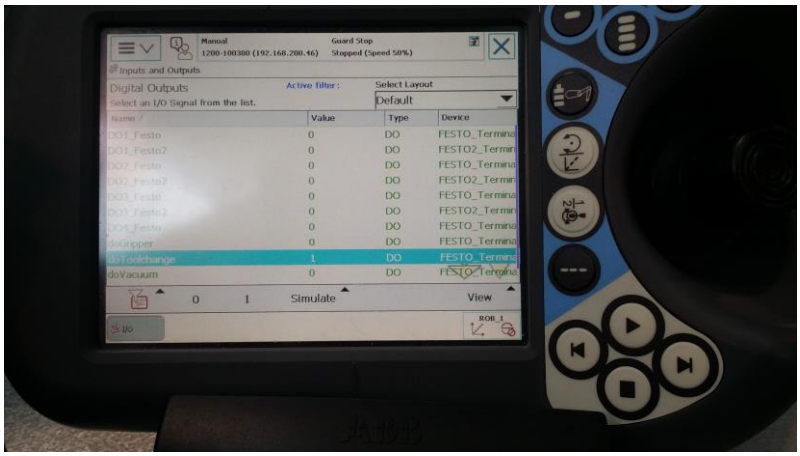

Figure 35. Tool Change