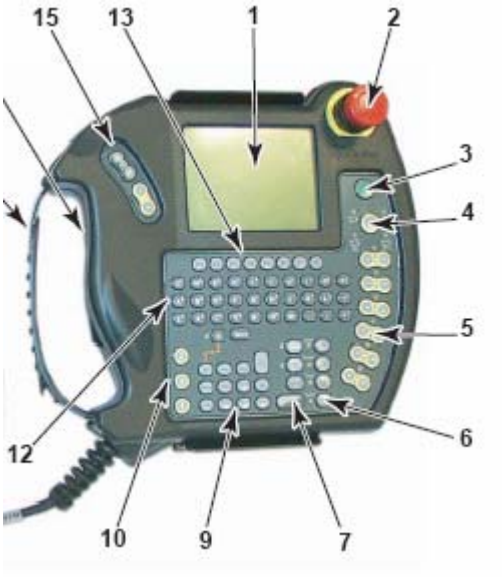
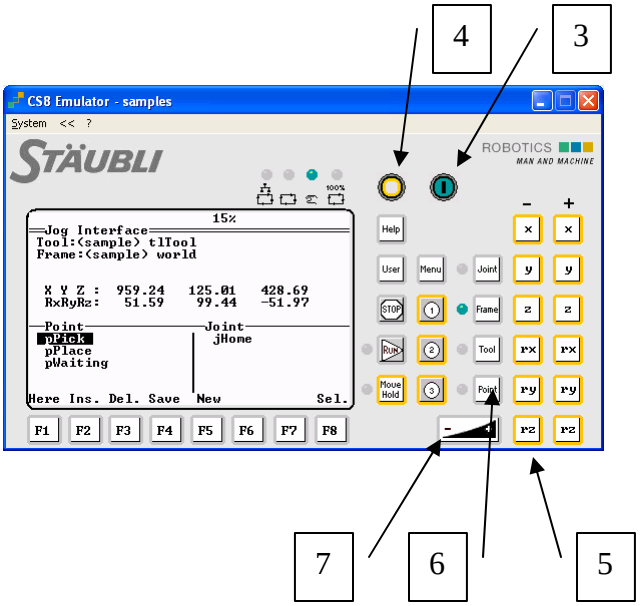
Teaching interface

VAL3 version 5.2.1

The purpose of this document is to explain the use of the teaching / jogging interface on the Staubli SP1 pendant. It uses VAL3 version 5.2.1, but other versions are similar. The illustrations shown are from the PC emulator. The actual pendant has a different keyboard layout. See the diagram below comparing the two.

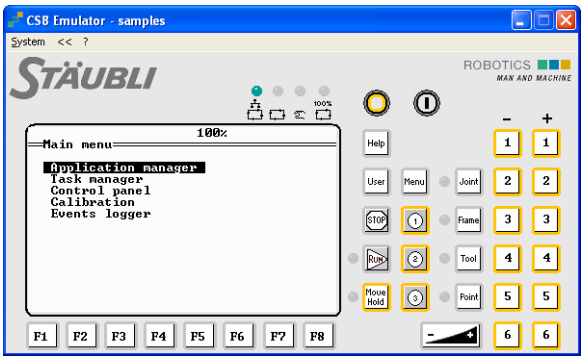


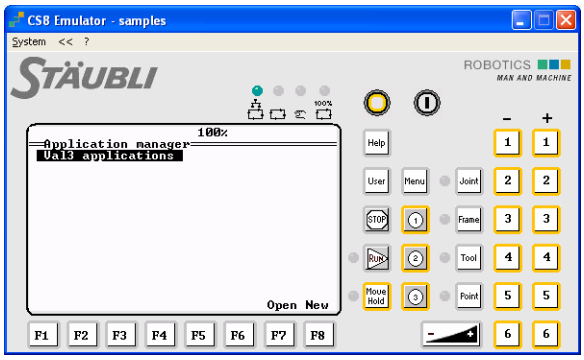


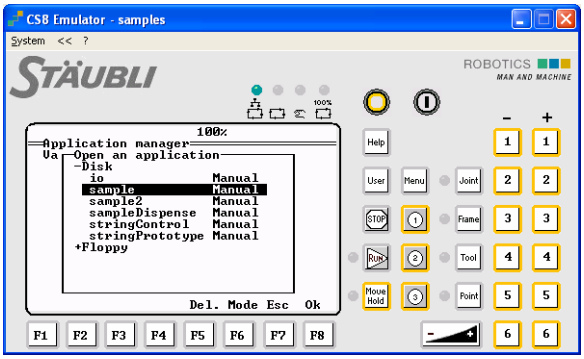
Loading an Application

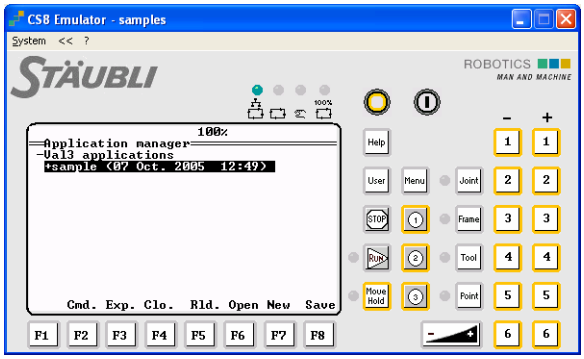
To enter the teaching interface, you must have an application already loaded. Most customers have applications set to auto start so it will already be loaded. While teaching can be done with an application running, it is better to stop the application. If an application is not loaded, please load it at this time as shown below.

Press menu until the main menu is displayed. Use the up and down arrow to highlight the Application Manager. Press the right arrow or enter key. Press the F7 open key. Press Right arrow to expand the disk entry. Arrow down to highlight your application and press the F8 OK key.



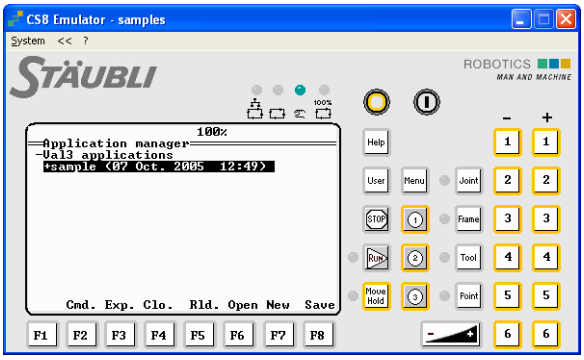


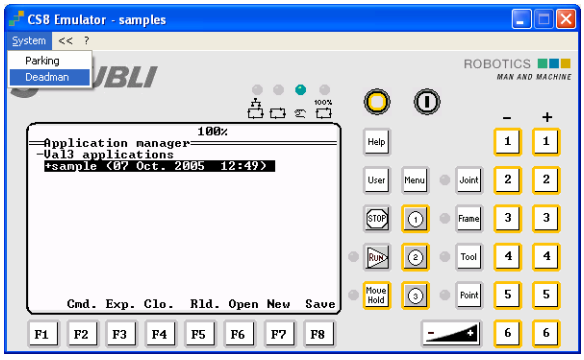


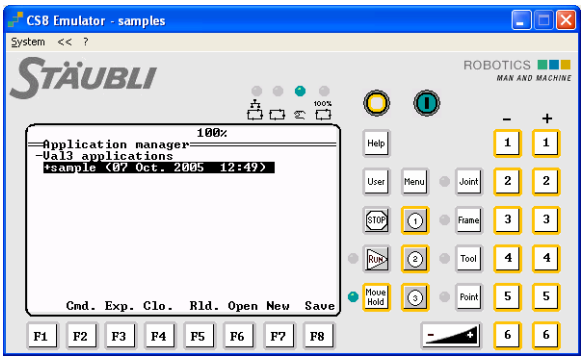


Manual Mode and Arm Power

Teaching locations is done in manual mode. Switch to manual mode by pressing the mode select button until the manual LED is light up. The manual symbol is a picture of a hand. Remove the pendant from its holding cradle. Release and reapply the robot enabling device (deadman switch) and press the arm power button. On the emulator click on the “System” menu. Uncheck Parking and check deadman, then press the arm power button. Arm power should come on in 2 to 3 seconds. If it does not there will be a pop up message, for example an open e-stop, stating why arm power did not come.

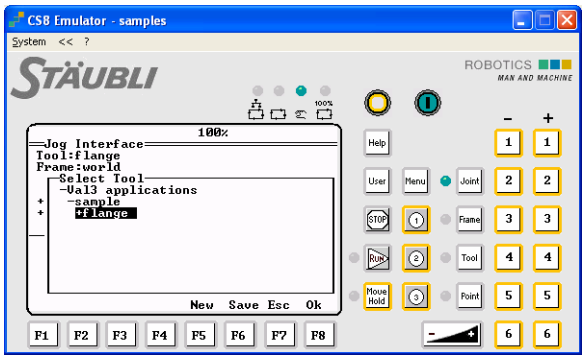






Jogging Mode

Press one of the four jogging mode buttons on the pendant. They are joint, frame, tool and point. The LED beside the chosen mode will illuminate.

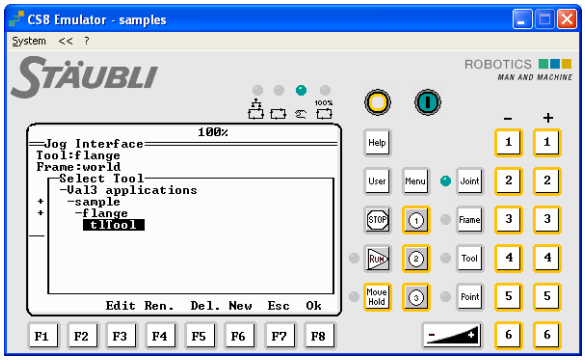


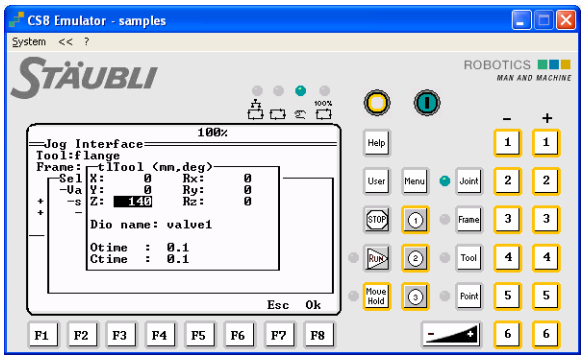
Tool Selection

The first time you go in to the jogging screen will be asked to select a tool to be used for teaching. You will have to expand the “flange” listing to see the tools variables. If there is more then one application loaded in memory, the tool you select will determine which application’s locations you will see and teach.

If you need to modify a tool variable, you can open a tool for editing from this screen by press the F3 edit key. Use the arrows keys to select the value you want to change and press enter to edit. For numbers, the system will automatically set shift lock to on. If you leave and return to the jogging screen, it will remember the last tool and frame used.

It is also possible to create new tool variables by pressing the F6 new key or delete existing tool variables by pressing the F5 del key. You cannot delete a variable if it is used in your application.

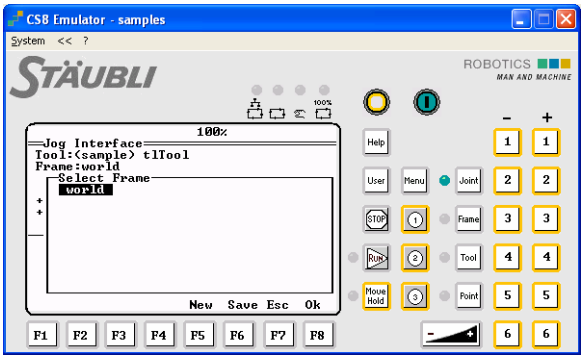




Frame Selection

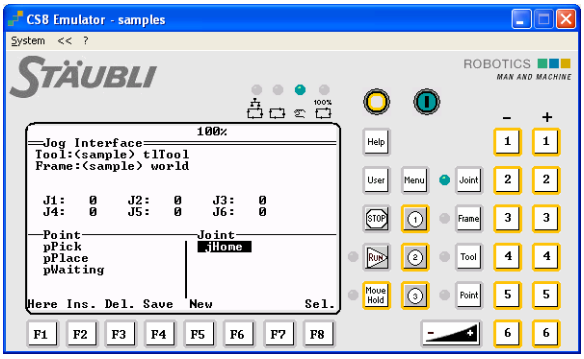
Next you will be asked to select a frame for jogging. If you have frame variables in your application, you can expand the world entry to see them.

It is also possible to create new frame variables by pressing the F6 new key or delete existing frame variables by pressing the F5 del key. You cannot delete a variable if it is used in your application.



Selecting Another Tool or Frame

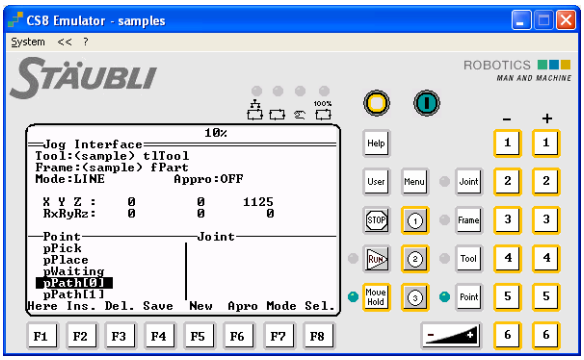
If your tool selection is incorrect or if you want to select another frame, press the F8 select button on the interface. Do not teach points with the wrong tool selected. If you have joint, frame, or tool selected, only points in the selected frame will be shown in the teaching interface.

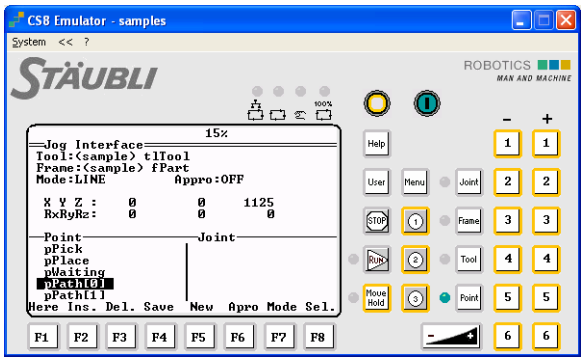


Speed

How fast and how far the arm moves when you jog depends on the speed you have set. It is shown on the top line of the display and can be changed using the black and white - / + buttons on the pendant. The value shown is a percentage. The maximum speed possible in manual mode is limited to no more then 250 mm per second at 100%. At the slowest speed the arm may not appear to be moving, but it is.

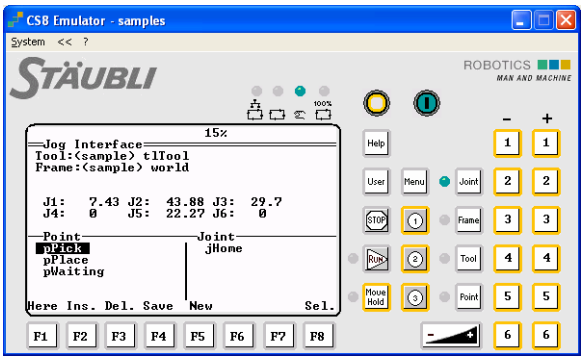
Pressing the + and - keys takes you through a predefined sequence of speeds; 0.1, 0.2, 0.5, 1, 2, 5, 10, 25, 50, 75, and 100%. You can also press and hold the shift key while pressing the speed + and - keys. This will cause the percentage to move up or down by 1%. On the emulator use the F11 key instead of shift.





Joint Jogging Mode

In joint mode you can use the twelve keys marked -1 to -6 and +1 to +6 to jog each joint of the robot arm separately. How fast and how far each joint moves when you press the jog key depends on the speed selected. It is possible to jog more then one axis at a time by pressing more then one key at a time. The 6 joint angles are displayed in the center of the screen and will change as the arm moves.

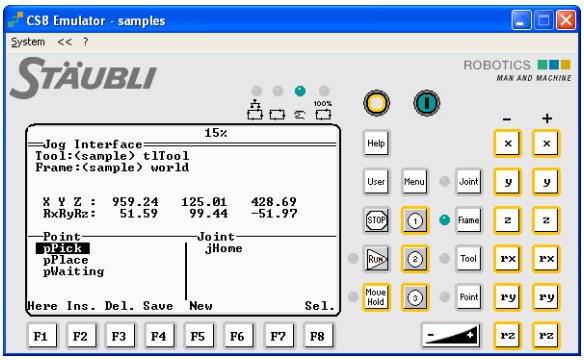


Frame Jogging Mode

In Frame mode you can use the keys jog the arm along the X, Y, Z axes and rotate around those axes, RX, RY, and RZ, in the selected frame. For the world frame X+ move the arm “forward”, Y+ moves the arm to the “left”, and Z+ move the arm “up”. These directions are for some standing behind (where the interconnect cable attaches to the “back” of the arm) a floor mounted arm.

Rotations are applied to the selected tool center point. If the tool center point is at the end of the tooling, it should pivot about the end of the tooling when jogging in RX, RY, or RZ. The origin, or location where X, Y and Z are all 0 is inside arm (the center of joint 1 at the height of joint 2). An orientation with RX, RY, and RZ all set at zero, will have the tool center point going straight up (for a floor mounted arm). Frame variables often have orientations different from the world frame.

You will only see point variables displayed for the frame you have selected. How fast and how far the arm moves each time you press a jog button depends on the speed you have set. The transformation values are shown in the center of the display.

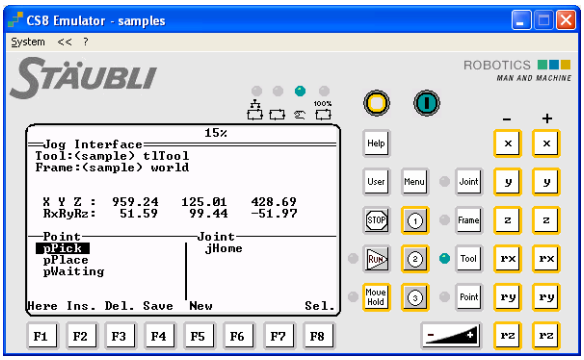


Tool Jogging Mode

In Tool mode we will still jog the arm in X, Y, Z, RX, RY, and RZ, but the direction of axes is no longer based on the world or frame variables. Instead they are based on the location of the tool center point. +Z is the direction to tool is pointing. For the flange, Z is out from the flange and the X axis is the direction of the witness mark on the flange.

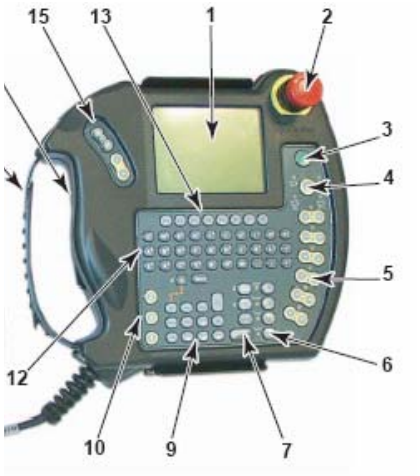
A good test of the transformation values in your tool variable is to rotate in RX, RY, and RZ to verify that the tool pivots around tool center point, then do a Z+ and see if the tool moves in the direction your tool is pointed.

You will only see point variables displayed for the frame you have selected. How fast and how far the arm moves each time you press a jog button depends on the speed you have set. The transformation values are shown in the center of the display.



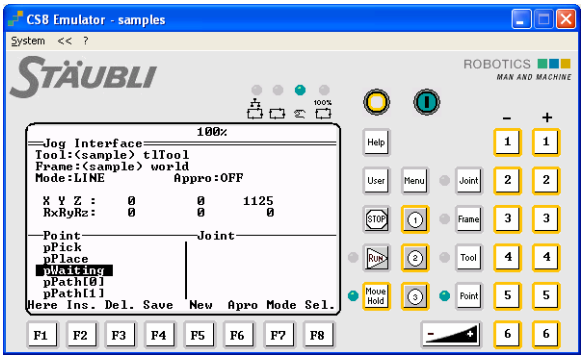
One Handed Jogging

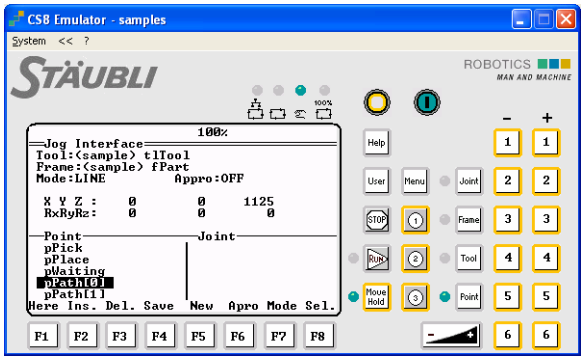
On the left hand corner of the actual pendant, not the emulator, there are two sets of buttons to allow one handed jogging (index 15 shown below). Your left thumb should be near these controls. Using it you can select a joint or axes with the top set and jog in + or – with the bottom set. An LED will illuminate above one of axes buttons (index5) to show which you have selected.



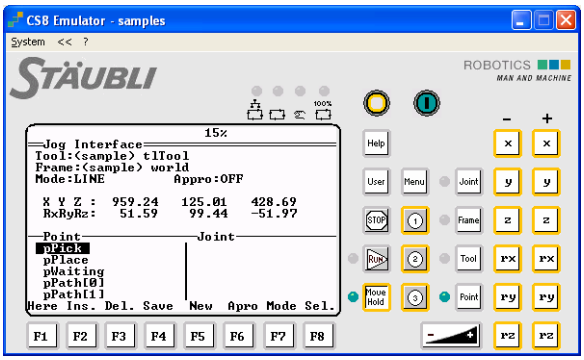
Point Jogging Mode

If you have point selected and line or joint mode set, all points will be shown in the interface. In that case, by using the arrow keys to select a point, you will also select that point's frame. You will only see joint variables displayed if you have joint mode selected. You can change modes by press the F7 key.





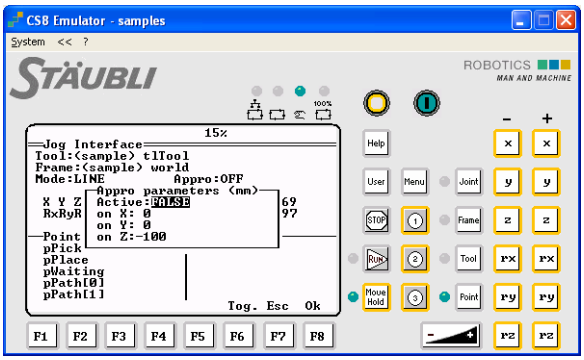
If you are in point mode you can use the arrows keys to highlight a point or joint variable then press and hold the move / hold button. This will cause the arm to move to that location. If the mode is set to joint, we will make a joint interpolated move to the point or joint location. If the mode is set to line, we will make a linear move to the point. In line, or linear, mode the joint variables will not be shown. How fast we move depends on the speed that is set.

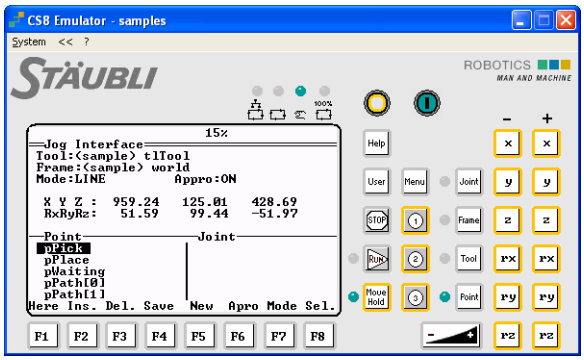


Approach

You can also choose to move to a user defined approach relative to a point variable. Press the F6 Apro key. This will open a window where you can toggle the approach on and off and modify the values. Using this method you can set up a relative approach point in X, Y, and Z. You cannot use it for rotations. The default setting is -100 mm in Z. This setting will but the approach point 100 above the point variable. This is not a shift of -100 mm in the frame Z, it is -100 mm in the Z of the point. As most points are taught with the tool pointed down, -100 mm in Z moves the tool back up.

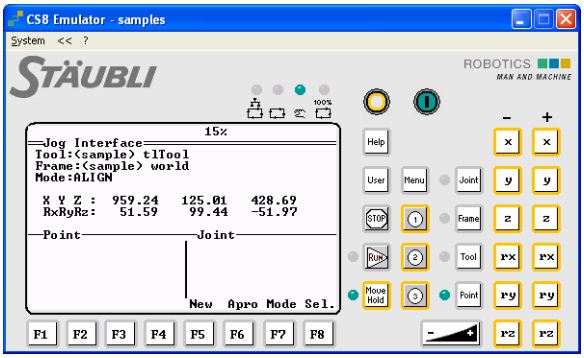
After moving to the approach point you can toggle it off and move to the point. The values set in apro are not part of the point variable nor are they part of your application. It simply provides a method of manually moving to approach relative to a point when jogging.





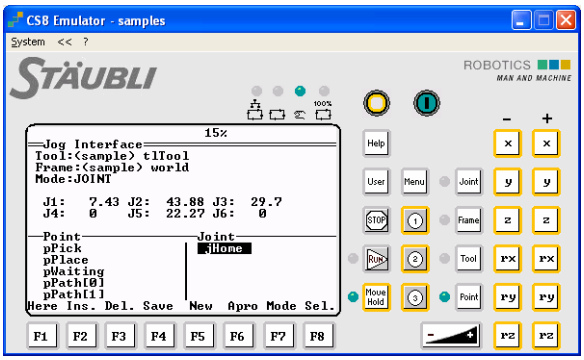
Align

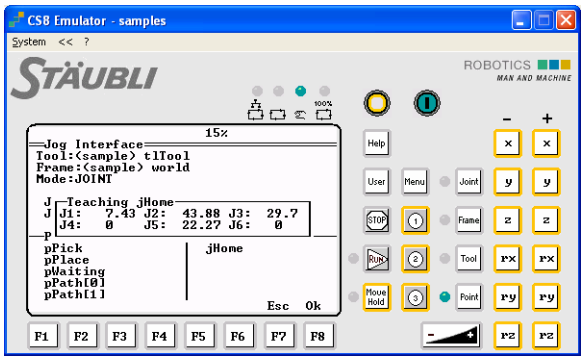
If you are in point and chose the align mode, you can press and hold the move / hold button and the tool will align itself to the selected frame. The Z axis of selected tool will end up parallel to one of the selected frames axes. This means you will want to roughly align the tool first. Otherwise you could end up parallel to the X or Y axis when you want to be aligned with Z. This is often done prior to teaching points to “square” the tooling up so your points will be “flat” when taught. In align, there will not be any location variables displayed.



Teaching Joint Locations

Once the robot is at a location you can teach the location. Use the arrow keys to highlight the joint variable name. For a joint variable, it will be update with the current arm’s joint values when you press the here button. These values are displayed and you can press ok to update the variable or esc to cancel the teaching and leave the original variable values unchanged.



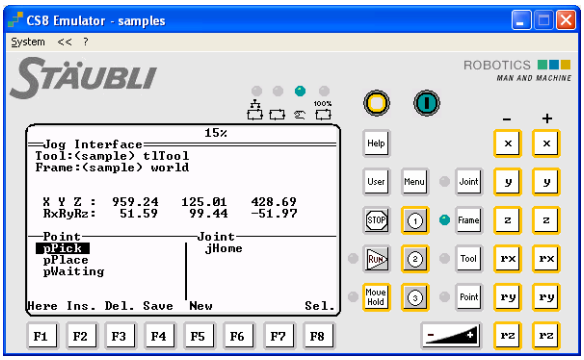


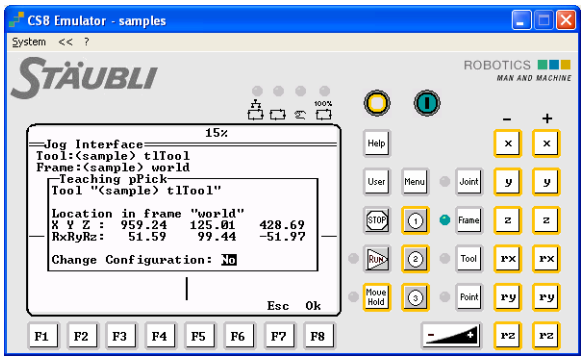
Teaching Point Locations

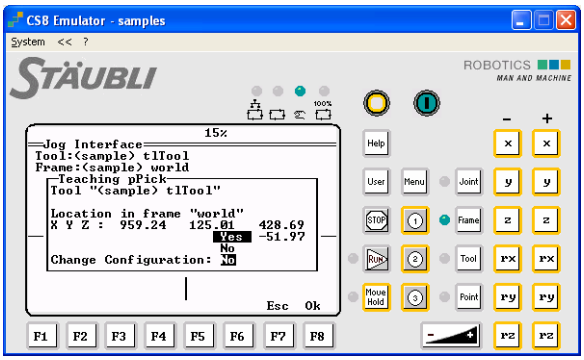
Teaching point variables is similar to teaching joint variables. Use the arrow keys to highlight the point name. Make sure you have the correct tool selected. You will be teaching the location of the tool center point. Press the here button and you will see the current transformation values.

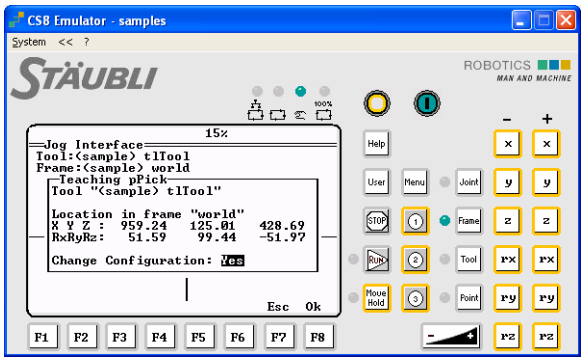
There is a setting for change configuration. The default setting is no. This means that the configuration portion of the point variable will not be changed, only the transformation section will be updated. You can press enter to bring a selection menu and change it from no to yes. Now you will update both the configuration and the transformation sections of the point variable.

To accept the new values press ok, or press esc to leave the point variable unchanged.



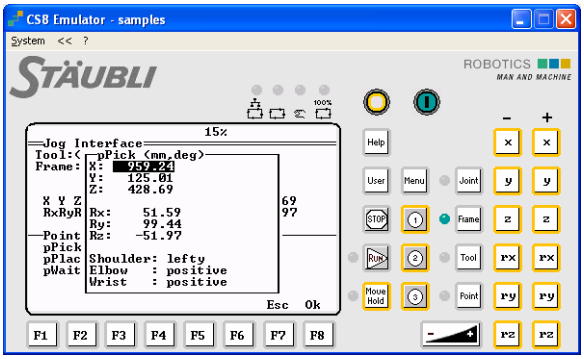






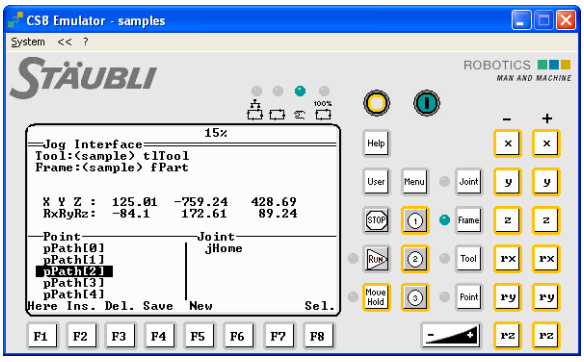
Edit Locations

You can manually edit a point or joint variable by using the arrow keys to highlight it and pressing enter. You can use the arrow keys to select a value you want to change and press enter to modify it. Once you are done either press ok to accept or esc to discard your modifications.

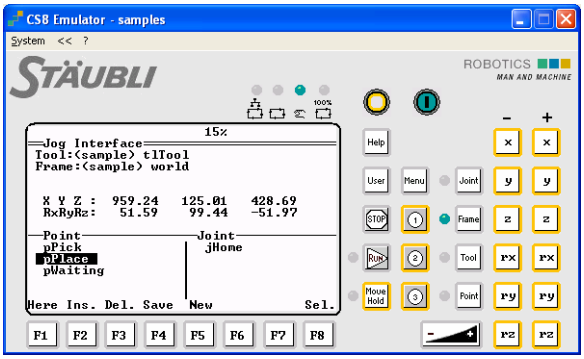


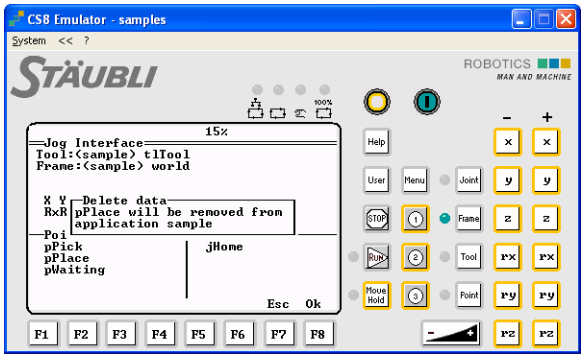
Insert or Delete Locations

You can insert or delete varaibles from arrays using the ins and del keys (F2 and F3). Insert adds a new variable to your array after the highlighted index. The del key removes the highlighted index. If the variable is being used in your application you will not be able to delete it. Inserting an index to an existing single value variable will convert it in to an array. Deleting an index from an array of two will convert it to a single value variable.



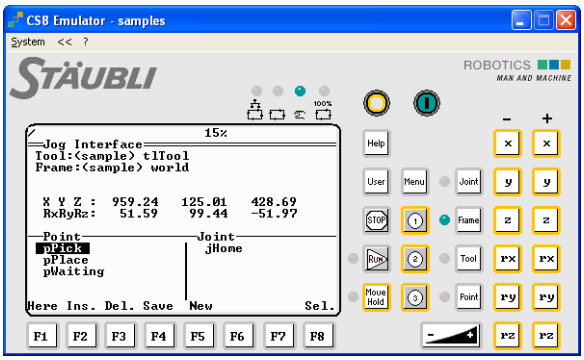
You can delete unused point and joint variables using the del key. If the variable is being used in your application you will not be able to delete it.





Saving

You can save your application, including the location you have taught, as you are teaching by pressing the save button. The spinning bar in the upper left corner shows that the system is saving.



Exit the Jogging Screen

To exit the teaching interface screen either press the user button to go to the user page or the menu button to go to the main menus. This will leave you in the selected jogging mode and you can still move the arm. It only changes the screen being displayed.

To exit jogging altogether press the button for the currently selected mode , joint, frame, tool, or point, to turn it off. The arm cannot move under program control if one of the four jogging modes is selected.