Using the Android teach-pad with ROBWIN 7 and ROBOFORTH II v15/16

Components
The components of the system are:
7 inch hand-held tablet
Android software (apk or "app") already loaded.
Bluetooth adaptor
Serial port on rear of controller with internal cable
Version 15 or 16 RoboForth
Nexus RoboForth extension file NEXUS5x or 6x already loaded but also on CD.

Installation
For installation of controller hardware (as an upgrade) see end of this document.

Plug the bluetooth adaptor in to the 9-way plug on the rear of the controller. There are 2 9-way plugs. Choose the one nearest to the power connector.
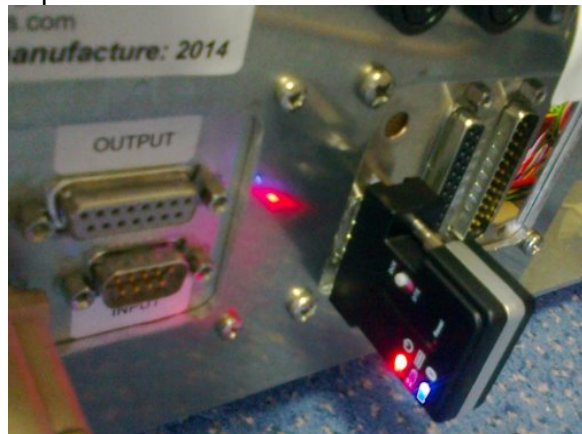
When you switch on the controller the red power LED will light and the blue light should start flashing. Check that the little switch is set to DCE.

How to use it.
Switch on the tablet and unlock.
Open the apps screen – usually the center right, typically a circle with 6 dots in it.
Press the Android robot icon. You may have to swipe to see it.
At this point the teachpad screen will appear. The blue light on the adaptor will stop flashing. The stop button on the screen will change to red.

If you need to re-connect with the serial adaptor:
        Press settings,
        Bluetooth – turn to ON if not already on.
        Bluetooth again to list available devices.
        You should see "serial adaptor" listed. Select that.
        Bluetooth pairing request, enter the PIN which is 1234 then press Done then ok.
        Press back (bottom left icon) two times to get back to the desktop.
Once you have paired with the adaptor the above 6 steps should not be necessary in future.
   Press the robot icon.
If you launch the teachpad before you have switched on the controller (or before you connected the adaptor), then once the controller and adaptor are on and powered touch the **connect** button.

Using the Android teach-pad

How to use it, continued.

Enter BLUETOOTH then **press the J button (Jog) on the computer.** The computer asks for an increment which defaults to 10mm. Ignore this. (You can instead enter BLUETOOTH JOG but the *tick and cross buttons will not work*.) It saves time to make a BLUETOOTH macro button in RobWin – see the RobWin7 manual. Each time you enter BLUETOOTH or click the button it toggles bluetooth mode on/off. Alternatively enter NEXPAD from the command line (see below). A text box "waiting for controller" will appear. Just leave it there.

To **exit** Bluetooth Jog click the escape button on the PC or press the escape key. A text box "waiting for controller" will appear. Pres stop button; the text box will disappear and you will see STOP and OK in the command window. To exit NEXPAD just tap the stop button on the pad; the text box will disappear and you will see STOP and OK in the command window.

The **stop button** is active even when using commands on the PC. Providing it is showing in red then it should stop the robot moving at any time. However the Bluetooth adapter must be plugged in to the rear of the controller. Note: this is not an approved safety feature.
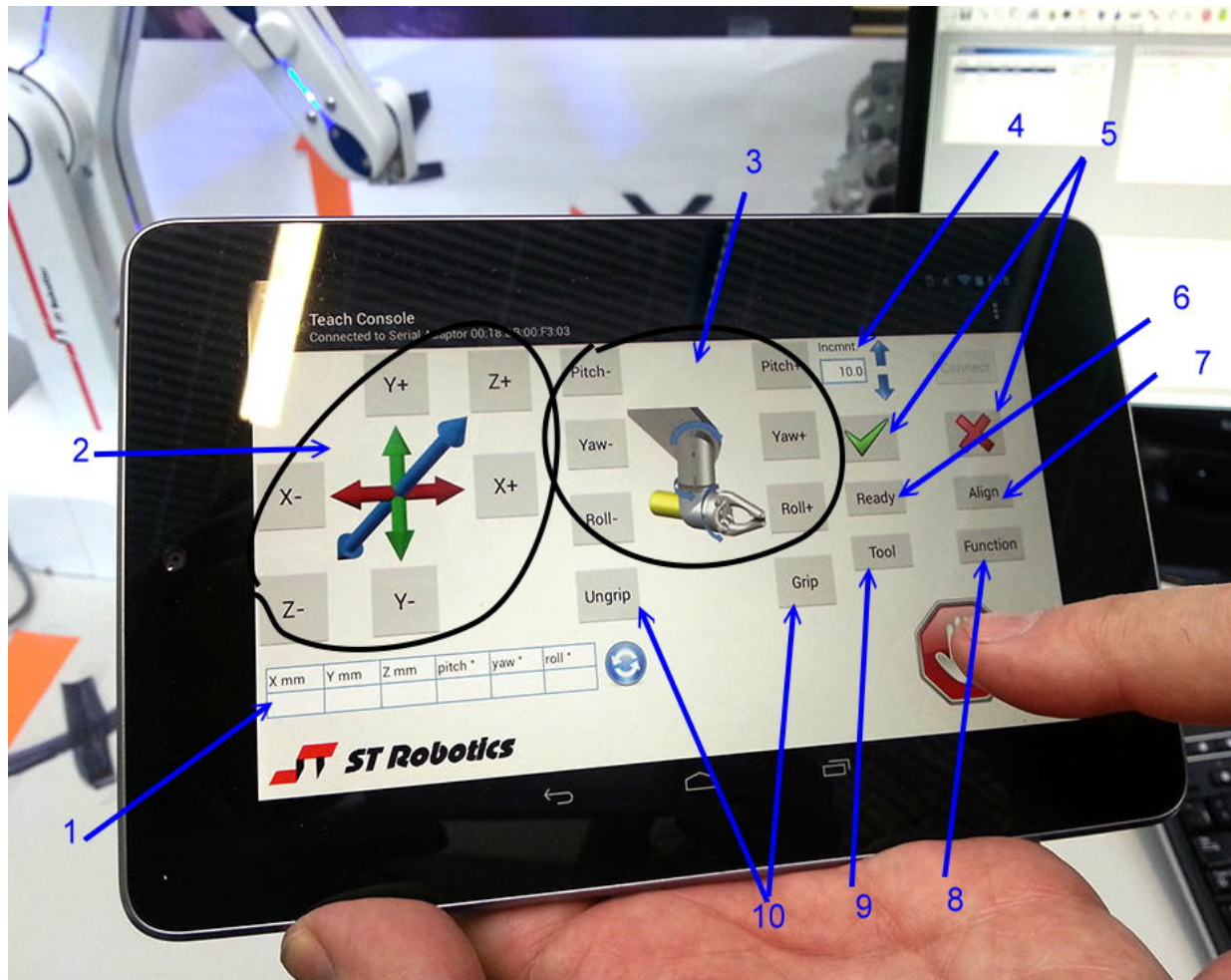
See functions on next page.

Using the Android teach-pad

1 This is the current Cartesian position displayed on the screen at bottom left. You can update this position by pressing the **blue refresh icon** next to the display.

6 If not already in that position you can press the **Ready** button to send the robot to the useful READY position. On an R19 the Ready button sends the robot to home position.

2 On the left you will see a red green blue directions Icon with **X+**, **X-**, **Y+**, **Y-**, **Z+** and **Z-**. When you press one of these the robot moves in that axis by the increment shown on screen. After each movement the current position of the robot is displayed on screen below the direction icon.

3 In the center you will see an image of the hand from a 6-axis R12 and around it are 6 more buttons. To move the hand or wrist press **Pitch+** or **Pitch-** or **Roll+** or **Roll-**. The set increment is now in degrees. **Yaw+** and **Yaw-** are for 6-axis version. On the R19 only **Yaw+** and **Yaw-** are active.

4 At the top of the screen you will see a box marked **increment**. This increment is in mm where linear moves are used, or in degrees when angular moves are used. To increase the increment press the **blue up-arrow**, to decrease press the **blue down-arrow**.

Messages

When the controller sends a message to the tablet it appears center-screen. Once read just press ok Messages include "CAN'T REACH" which appears if you try to move beyond the reach of the robot or try to move too close to the shoulder axis.

Note: the can't reach error is non fatal (system does not quit) while using the tablet or teachpad.

5 Add/delete line to route.

These two keys only work when in Jog **J** mode. In NEXPAD mode they are inactive.

You must first create or select a route before pressing **J**. A route must be active for this to work. Open the route on the computer so you can see its contents.

Now invoke the tablet. Move the robot to the first position you wish to learn. When satisfied with the position press the green √ key. This learns the position into the currently selected route. You will see it appear on the PC. To delete the last line learned press the red **X** key. You will see it removed from the list on the computer screen.

7 Align

In cases where this applies the **Align** button invokes ALIGN mode (see RoboForth manuals). In the case of a 5-axis robot if the hand is vertical then wrist roll will adjust and maintain its angle to the XY axes as the robot moves about. In the case of a 6 axis robot yaw will adjust. This can only work if the tool is approximately vertical for 5-axis, horizontal for 6-axis otherwise it has no meaning. If you make a move with align mode set where the tool is too far from vertical you will get an error message. It is a non fatal error but best to touch **align** again to cancel the mode.

8 Function

This key is programmable. Suppose you would like the Function key to send the robot HOME. Enter

SET FN HOME

then invoke the tablet. From there on when you press the Function key the robot goes HOME. Or if you have some other word, for example TASK then

SET FN TASK

then invoke the tablet. From there on when you press the Function key TASK is executed.

10 Gripper

To operate the gripper press **Grip** to close and **Ungrip** to open. Wait for the gripper to operate before sending another command.

9 Tool

This button toggles between TOOL and WORLD modes. Tap once and you will see TOOL MODE displayed. Press OK.

Press Tool a second time to exit this mode. You will see WORLD MODE displayed. Press ok.

On an R19 before you use TOOL mode you must use ALIGN and set required angle first.

World Coordinates

Normally the system is in WORLD mode so, for example when you press **Z+** the robot goes up, **Z-** it goes down; X is left/right and Y is towards/away as normal Cartesian mode.
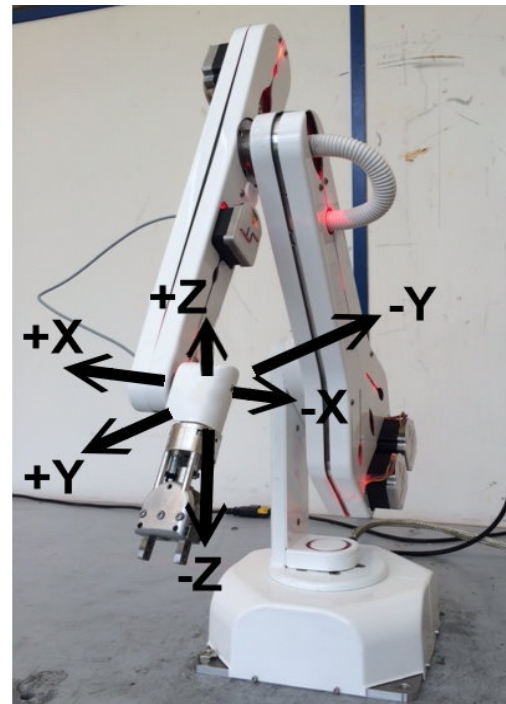
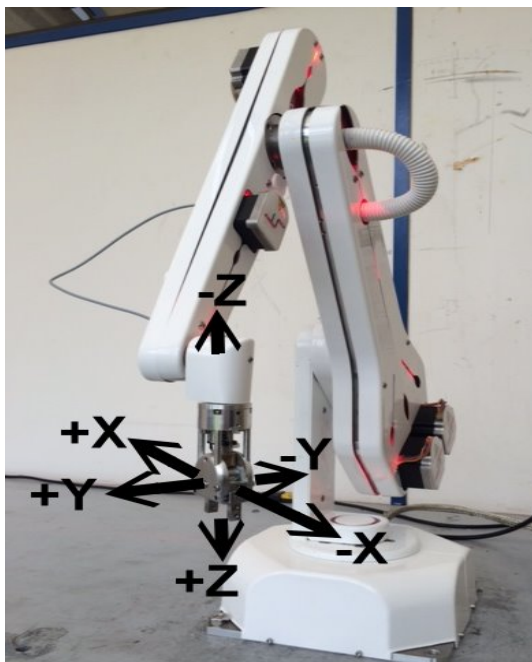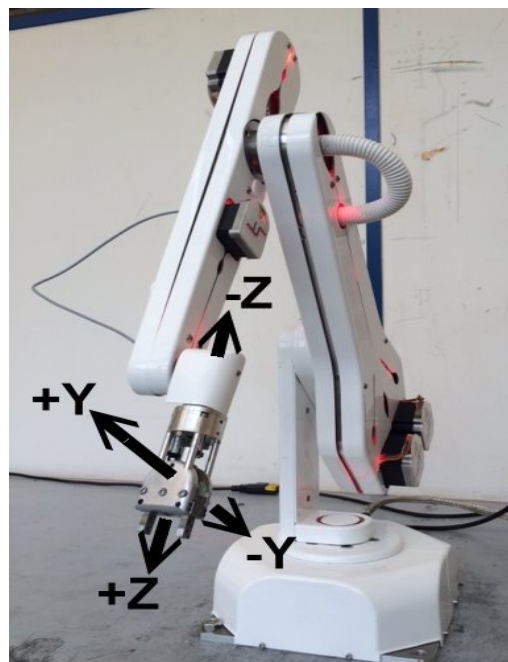**Normal World coordinates**

Tool Coordinates

When you touch **Tool** the message TOOL MODE is displayed. Press ok.

In TOOL mode when you press **Z+** the end effector (gripper) moves in the direction it is pointing i.e. along the center-line of the roll axis. See PLUNGE in the RoboForth manual. Press **Z-** and the end effector moves back.

5-axis tool coordinates (hand vertical)

5-axis tool coordinates (hand pitched)

Press **Y+** or **Y-** and the end effector moves at right angles to the roll axis.
Press **X+** or **X-** for motion in the X axis relative to tool position.

The X direction only works when the hand is vertical (as in ALIGN mode). See picture above, left. Whatever angle the hand is set to X and Y relate to that i.e. if you rotate the hand then the X-Y coordinates rotate with it. Z is up/down but +Z goes down not up.

On a 5-axis robot, when the hand is not vertical as in (b) you can not move sideways in X because the lack of 6th axis prevents it. As you rotate the hand the Y axis rotates with it. The Z axis is in the direction the hand is pointing.

On a 6-axis robot the end effector must be within angular limits to work.

6-axis tool coordinates examples

At READY

At READY with ROLL 45.0 deg.

PITCH and ROLL at 45.0 deg.

YAW, PITCH, ROLL at 45.0 deg.

ST Robotics

Instead of the **J** button you can enter
NEXPAD
This behaves in a similar way to JOG but *the tick and cross are disabled*.
There is no need to enter BLUETOOTH first.
When you have the robot in a desired position and wish to learn it on the PC press the stop button on the pad to return to the PC. Then learn or edit the position as necessary on the PC. When finished with the PC enter NEXPAD again to continue.

It can be helpful to add BLUETOOTH and NEXPAD to the macro buttons in RobWin (see robwin7.pdf).
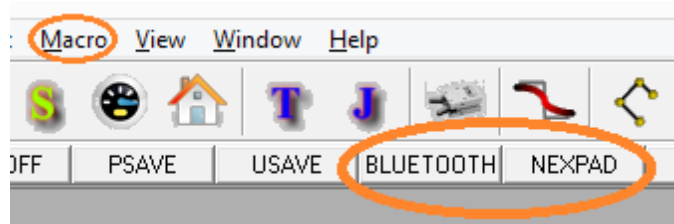
1. click macro
2. click edit
3. you can see a list of existing buttons if any.
4. click new to add a new button
5. enter the name of the button BLUETOOTH that will appear on the actual button
6. in the lower box enter the text that will be sent to the controller. This is also BLUETOOTH
7. click ok
8. click new to add a new button
9. enter the name of the button NEXPAD that will appear on the actual button
10. in the lower box enter the text that will be sent to the controller. This is also NEXPAD
11. click ok
12 click close
13 click macro, file save.

Reminder: the **stop button** is active even when using commands on the PC. Providing it is showing in red then it should stop the robot moving at any time. The bluetooth stop button **must not be relied upon** as a primary class 2 safety stop.

How to load a new version of the tablet software that runs in the controller
1. Enter
FORGET AX
2. Click file, download and choose NEXUS5x or NEXUS 6x (no extension)
3. You will see rows of chevrons >>>>> etc. Once you see OK try the functions above.
4. If loaded correctly enter
PSAVE

Installation of the controller hardware:

The installation kit comprises a cable with a 6-way blue HE connector at one and and a 9-way D-sub connector at the other end.
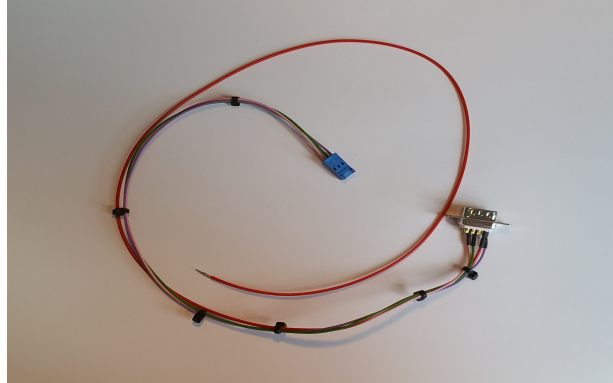

The 9-way D-sub may be mounted to a connector panel. There is also a red wire with a push-connector at one end.

1. Unscrew and temporarily remove the DSP card revealing the bottom card which is the CPU card.
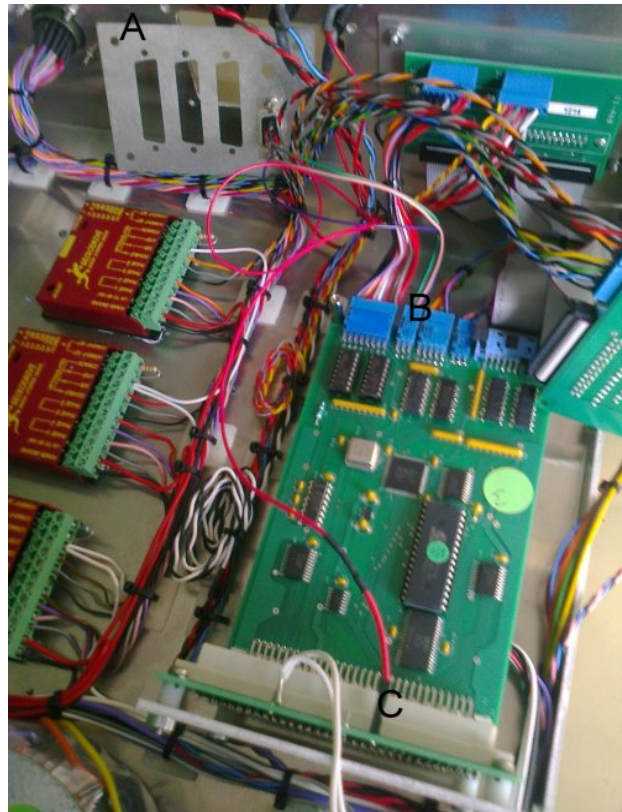
2. Remove the rear blanking panel and fit the one supplied with a single 9-way connector as shown in A in above picture. It should fill the aperture in the back of the controller as in the picture below.
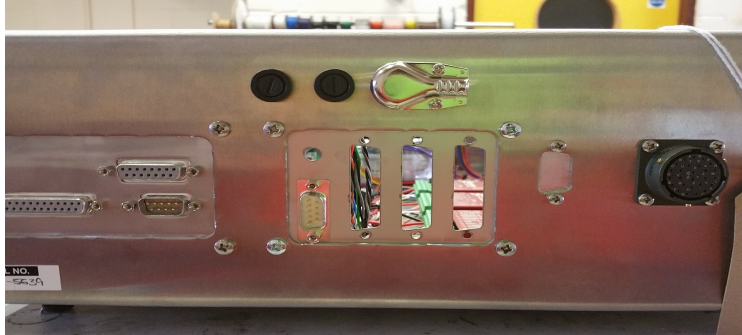
3. Plug the 3-wire blue connector into the empty socket on the CPU card at B
4. Push the red wire connector onto test point 3 as shown at C . If there is already a wire on that pin then you will need to remove the connector from the red wire, remove the sleeving from the existing wire and solder the new wire onto the pin together with the existing wire.
5. Refit the DSP card
6. Do a cold start and install the latest software version 16.x as explained in help sheet 1E on your CD. Check everything works and if so use PSAVE.
7. Click file, download and choose NEXUS5A or NEXUS6A for 5 or 6 axis.
8. Once loaded enter PSAVE.