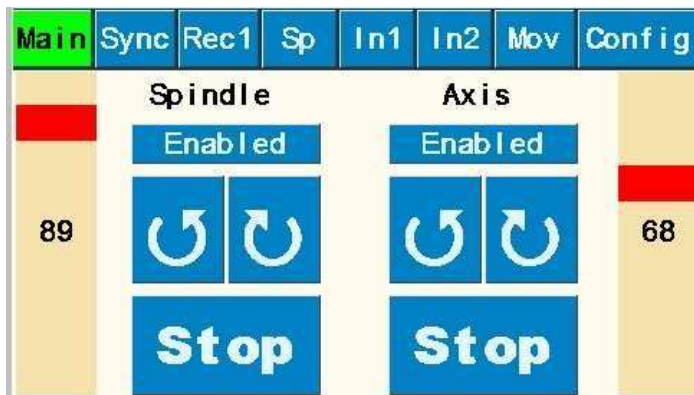# Nextion Multiple Stepper Control Screen Descriptions

## As used for 2-Axis Driver Board

Main Screen

Purpose: Allows direct control of spindle speed and direction and auxiliary axis speed and direction independent of one another. Typically used for continuous spindle and/or continuous Axis motion (turning or facing cuts, continuous rose engine patterns on cylindrical or face surfaces., etc.).

Buttons explanation:
- "Enabled" shows status (either "Enabled" or "Disabled") of either Spindle stepper motor or Axis stepper motor as selected. If enabled, the motor is in locked status; if disabled, the selected motor can be repositioned.
- Counterclockwise and clockwise rotational arrows indicate direction of the Spindle and Axis. Rotation continues until "Stop" is pushed.
- Right and left speed bars (for Spindle and Axis, respectively, are shown as a percentage of maximum speeds set on the **Configuration Screen** for "Main" and "Z Axis", respectively.

Synchronization Screen
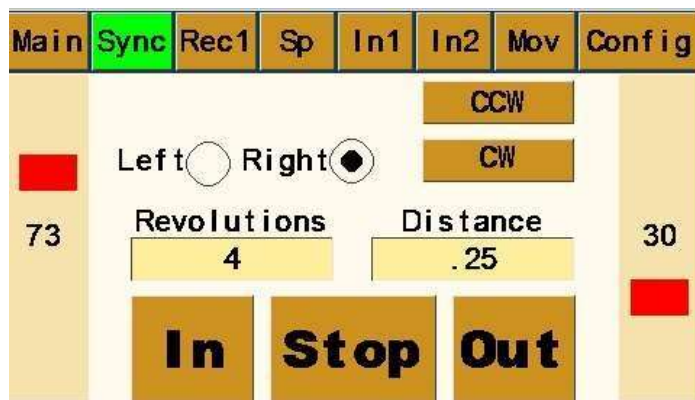
Purpose: Synchronizes the Spindle and Auxiliary Axis to produce helical patterns or threads on cylindrical surface of workpiece or to produce spirals on a face surface.

Buttons explanation:
- "Left" and "Right" determine whether helix runs clockwise or counterclockwise on the piece.

- "CW" (Clockwise) and "CCW" (Counterclockwise) index the spindle for the next cut path – either clockwise or counterclockwise per user design. Amount the spindle will index uses the value in "Size" set in the box on the **Index #1 Screen** (this value could be either in divisions of a circle or degrees depending upon which option is toggled on **Index #1 Screen**).
- "Revolutions" variable value determines how far around the piece the helix will travel based on the spindle rotating. The value of .5 illustrated will rotate spindle 360x.5=180 degrees.
- "Distance" variable value determines the cut length (amount of Z axis movement) and is dependent upon value entered in **Setup Screen** for "Distance/360".
- Right and left speed bars (for Spindle and Axis, respectively, are shown as a percentage of maximum speeds set on the **Configuration Screen** for "Sync" and "Z Axis", respectively. Note that slowest value on speed bars will "control" the other value.
- "In" and "Out" determine whether cut is made toward or away from headstock.   Pattern will run the pre-determined "Distance" and then stop and wait for return direction instruction. User chooses whether to cut in both directions or retract cutter and return to start without cutting.
- Warning Note: If "Stop" is pushed while the operation is in progress, the program will stop at that point and reset the pattern start point to that spot. In other words, controller will lose track of the original start point.
- See below for procedure for using the **Synchronization Screen** for thread cutting.

Number Pad Screen
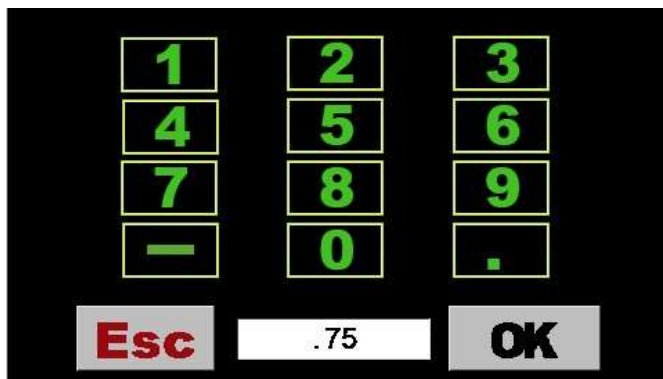
Purpose: This screen appears whenever any numerical value on any screen is tapped. Revise the number in the box by tapping the box multiple times to "backspace" over each digit or decimal point, and then re-enter the new value using the number pad buttons. Pressing "OK" saves the number back to the value box on the previous screen and returns user to that screen.

Reciprocation – Axis Screen

Purpose: Synchronizes Spindle and Auxiliary Axis to produce a sharp-pointed reciprocating pattern along the longitudinal cylindrical surface of workpiece: /\/\/\/\/\/\.   Works by reversing spindle direction alternately while Z axis continues in the same direction.

Buttons explanation
- "Z Axis" toggled "on" is the default screen under the "Rec1" header. Toggle to "Spindle" for **Reciprocation - Spindle Screen** (see below) Spindle and Z Axis radio buttons control which page is active.
- "CW" (Clockwise) and "CCW" (Counterclockwise) index the spindle for the next reciprocating cut path – either clockwise or counterclockwise per user design or desire. Amount the spindle will index uses the value set in the "Size" box on the **Index #1 Screen** (this value could be either in divisions of a circle or degrees depending upon which option is toggled on **Index #1 Screen**).
- "Acceleration" and "Speed" values for this screen are set here for both Spindle and Z Axis. See notes on value limitations under **Configuration Screen** explanation. Because of synchronization of the Spindle and Z Axis speeds, one of the maximum speeds will control the other.
- "Wave Count" variable sets number of individual waves /\ to be cut along the cylinder.
- "Amplitude" variable sets "height" of each wave in degrees of rotation.
- "Distance" variable determines the cut length for entire pattern (amount of Z axis movement) and is dependent upon value entered in **Setup Screen** for "Distance/360".
- "In" and "Out" determine whether cut is made toward or away from headstock. Note that "In" starts with a downward move and "Out" starts with an upward move (test your individual machine and apparatus to verify – your results may vary). Pattern will run the pre-determined "Distance" and then stop and wait for return direction instruction. User chooses whether to cut in both directions or retract cutter and return to start without cutting.
- Warning Note: If "Stop" is pushed while the operation is in progress, the program will stop at that point and reset the pattern start point to that spot. In other words, controller will lose track of the original start point.

Reciprocation – Spindle Screen

Purpose: Synchronizes Spindle and Auxiliary Axis to produce a sharp-pointed reciprocating pattern along the circumferential surface of a cylindrical workpiece:
It works by alternately reversing Z axis direction while spindle continues rotating in the same direction.

Buttons explanation

- To navigate to this screen, start with "Rec1" and toggle from (default) "Z Axis" to "Spindle".
- "In" and "Out" move the Z Axis to the next pattern starting position. Z Axis movement will be the value of "Distance" set on the Move Screen.
- "Return" button rotates the spindle to the pattern start point.
- "Acceleration" and "Speed" values for this screen are set here for both Spindle and Z Axis. See notes on value limitations under **Configuration Screen** explanation. Because of synchronization of the spindle and Z Axis speeds, one of the maximum speeds will control the other.
- "Wave Count" variable sets number of individual waves (>) to be cut along the cylinder.
- "Degrees" variable sets the circumferential distance around the cylinder for the total pattern. Entering 360 would wrap the pattern all the way around the cylinder; entering 90 would condense the whole pattern around just 90 degrees of the cylinder.
- "Amplitude" variable sets "height" (distance along Z Axis) of each wave and is dependent upon value entered in **Setup Screen** for "Distance/360".
- The counterclockwise and clockwise rotational arrows determine the direction of cut around the spindle. Pattern will run the pre-determined "Degrees" around spindle and then stop and wait for return direction instruction. User chooses whether to cut in both directions (either on the same cut path or on subsequent path) or retract cutter and return to the origin point without cutting.
- Warning Note: If "Stop" is pushed while the operation is in progress, the program will stop at that point and reset the pattern start point to that spot. In other words, controller will lose track of the original start point.

Spindle Screen
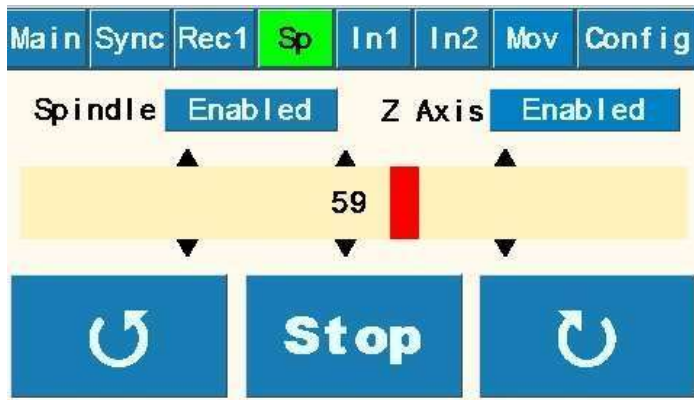
Purpose: Allows control of spindle speed and direction. Useful for allowing manual control of the Z Axis (or other movement) while spindle rotates to set speed and direction. Also useful for secondary spindle operation such as higher or lower speed functions than the Main Screen.

Buttons explanation

- "Enabled" shows status (either "Enabled" or "Disabled") of either Spindle stepper motor or Z Axis stepper motor as selected. If enabled, the motor is in locked status; if disabled, the selected motor can be repositioned.
- Counterclockwise and clockwise rotational arrows indicate direction of the Spindle. Rotation continues until "Stop" is pushed.
- Speed bar is shown as a percentage of maximum speeds set on the **Configuration Screen** for "Sp2".

Index #1 Screen

Purpose: Allows indexing spindle for use in index work or other uses.

Buttons explanation
- "Div" radio button sets the indexing to number of divisions of a full rotation, toggling to "Deg" sets the indexing to number of degrees.
- "Enabled" shows status (either "Enabled" or "Disabled") of spindle stepper motor. If enabled, the motor is in locked status; if disabled, the motor can be repositioned. If repositioned, and then re-enabled, all subsequent indexing will use that point as the new origin.
- "Index" box keeps a running "count" of the number of indexing moves.
- "Size" variable is in either "Divisions" of a circle or "Degrees", depending upon which is toggled.

- Speed bar is shown as a percentage of maximum speeds set on the **Configuration Screen** for "Index".
- Note that the "Size" value on the Index #1 Screen is used by the "CW" and "CCW" indexing movements on the **Synchronization Screen** and the **Reciprocation – Axis Screen** in either "Divisions" or "Degrees", depending upon which is toggled.

Index #2 Screen

Purpose: Allows indexing spindle for use in index work or other uses. Since it's independent from other screens, it can be useful secondary index function between patterns created by other screens that use the values in the **Index #1 Screen**.

Buttons explanation
- "Div" radio button sets the indexing to number of divisions of a full rotation, toggling to "Deg" sets the indexing to number of degrees.
- "Enabled" shows status (either "Enabled" or "Disabled") of Spindle stepper motor. If enabled, the motor spindle is in locked status; if disabled, the motor can be repositioned. If repositioned, and then re-enabled, all subsequent indexing will use that point as the new origin.
- "Index" box keeps a running "count" of the number of indexing moves.
- "Size" variable is in either "Divisions" of a circle or "Degrees", depending upon which is toggled.
- Speed bar is shown as a percentage of maximum speeds set on the **Configuration Screen** for "Index".

Index #2 Screen with microSD enabled

Purpose: Allows variable index sizes to be retrieved sequentially from a file stored on a microSD card. This feature could be used to place evenly spaced features (such as barleycorns) around the circumference of an
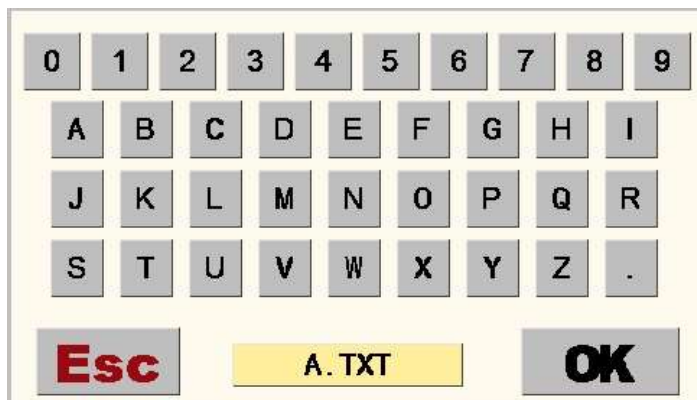
ellipse (i.e. equal division of the ellipse), with the angular movement in degrees precalculated using a CAD program.

Note that this screen will only be shown if there is a valid microSD card in the reader; otherwise, selecting **In2** on the top menu header will default to the "standard" **Index #2 Screen** as shown in previous example. If "Fixed" radio button is selected, the "Size" setting is used for indexing the same as the default **Index #2 Screen**. Selecting the "File" radio button looks for a file on the microSD card with a file name the user enters in the "Filename" window using **Keypad** below.

The file format is ASCII text (numbers and decimal only) with each number on a new line, saved to the microSD card using a separate computer. Because the SD Card library only supports the 8.3 or Short File Name convention, the file name must be a maximum 8 characters + a period + three-character extension (thus the 8.3); the name is not case sensitive. It's not necessary to have the extension, but the limit for the name is 8 characters when no extension is used. Multiple files can be loaded onto the microSD card for use on one or more work pieces as desired.

The counterclockwise and clockwise arrows determine direction of spindle movement during indexing. When using the "File" version, each successive index will read successive file numbers off the microSD card (in either "Div" or "Deg" as selected on this screen). When the end of the file is reached, "Size" will be reset to 0. The "Index" value will be increased when indexing clockwise and decreased when indexing counterclockwise. The read position of the file can also be set by editing the "Index" value.
The "Div" and "Deg" radio buttons and the "Enabled" button work the same as on the other **Index** screens above.

Keypad

Purpose: Entering the "Filename" for **Index #2 Screen with microSD enabled**. See **Number Pad Screen** for usage. Press "OK" when finished.

Move Screen

Purpose: Moves the Z Axis a specific distance and direction. This could be used to cut a flute or other element along Z Axis of specific length, or used on the end face of a cylinder if set up to drive the X Axis, to move a specific distance to produce rose engine basket weave or other repeating design element on the cylindrical surface of the workpiece, or to plunge in and out of cylindrical surface to do index work if set up for X Axis.

Buttons explanation:
- "Enabled" shows status (either "Enabled" or "Disabled") of Axis stepper motor. If enabled, the motor is in locked status; if disabled, the motor can be repositioned. If repositioned, and then re-enabled, all subsequent Moves will use that point as the new origin.
- "Distance" variable sets amount of movement along Z Axis and is controlled by **Setup Screen** Value "Distance/360".
- "Count" tracks the number of moves.
- "Total" tracks total distance of movement (adding in one direction, subtracting in the other.
- "In" and "Out" indicate direction of the Axis movement. Movement will continue for "Distance" set and then stop and wait for another move instruction, either repeating move or returning to origin.
- Warning Note: If "Stop" is pushed while the operation is in progress, the program will stop at that point and reset the move start point to that spot. In other words, controller will lose track of the original start point.
- Speed bar is shown as a percentage of maximum speed set on the **Configuration Screen** for "Z Axis".

Configuration Screen

Purpose: The speeds and acceleration values set on this screen control most other screens except for the **Reciprocation Screens**.

Buttons explanation:
- Set "MaxSpd" and "Accel" values for each of the screens listed. The upper rows control the lathe spindle in each screen, the lower rows control the Axis. Note that if you use different pieces of apparatus (such as a cross-slide, a spherical or a curvilinear apparatus, etc) with the Z Axis settings, it will probably be desirable to reset the MaxSpd for some uses. Keep a record of different settingd used for each piece of apparatus. Generally speaking, the "MaxSpd" settings can be set anywhere between 100 and 50000 with 10000 being a safe starting point. Acceleration can be set between 100 and 500000 with 1000 being a good starting point.
- "Show Config" runs a routine to return the current settings stored on the Teensy. Settings are also stored on the Nextion and can be out of sync when new software is loaded on either the Teensy or the Nextion. Running "Show Config" should be done each time new software is loaded into either the Teensy or the Nextion.
- "Setup" activates the Setup Screen.
- Preliminary testing by the prototyping group for initial settings (assuming a 2" diameter workpiece) resulted in the following recommendations:
  - For roughing out a cylindrical workpiece (planing cut) using **Main Screen** (use 100% on speed bars), set MaxSpd on Sync to 5000, Accel to 500.
  - For finish cut, lower the Axis speed bar to usable speed for smooth cut.
  - For Helical cut along cylinder using **Sync Screen**, set MaxSpd for **Sync** to 250, MaxSpd on **Z Axis** to 500.

Setup Screen

Purpose: The factors on this screen control how speeds and distances are determined.

Buttons explanation:
- The software is currently set up for 32 Microsteps, 200 Steps/360, and 9 Gear Ratio for the spindle. This assumes a stepper motor with 200 steps per revolution and the "standard" configuration for the MDF Rose Engine with a 12 tooth spindle motor drive pulley and 108 tooth driven pulley yielding a Gear Ratio of 9. Once set, the values for the Spindle will most likely remain the same unless changes are made to spindle drive setup.
- Likewise, the software assumes that Z axis is 32 Microsteps, and that you are using a stepper motor with 200 Steps/360. The 32 and 200 values for Axis will most likely remain the same.

- The "Distance/360" is the distance the Z axis carriage moves in one revolution of its stepper motor. It is a value arrived at empirically by measuring the movement of the Z Axis using a dial indicator or other appropriate device while the stepper motor revolves a set number of turns. This can be accomplished by entering a value in "Distance/360" such as 1, then using the **Move Screen** to move a "Distance" of 20 while measuring. This should turn the motor through 20 full revolutions. Divide the distance traveled by 20 and enter calculated value into "Distance/360". If the total distance moved in 20 revolutions is insignificant, use a larger "Distance" number like 50 (or even 100). Note that best practice is to remove backlash from the Axis mechanism prior to the measurement run by moving the axis in the same direction. It may be possible to get a starting point for Distance/360 by calculation calculating the stepper pulley to driven pulley ratio, and/or the thread pitch.
  Finally, it's important to note that if you use different pieces of apparatus (such as a cross-slide, a spherical or a curvilinear apparatus) with the Z Axis, each will likely have a different value for Distance/360, so keep track of these separately for each piece of apparatus.
- The Enable "High" and "Low" radio buttons for both Spindle and Z Axis are set to "Low" by default, which is the correct setting when using the DRV8825 Stepper Drivers. The "High" setting is for use for some external stepper drivers.
- "Hand" should be set to the thread direction of the axis leadscrew. If using a Hardinge compound sliderest with a left-hand thread, for example, set "Hand" to "L". If using an apparatus with a right-hand threaded rod, for example, set "Hand" to "R". Test to verify.
- "Show Setup": See Config page "Show Config" description.
- "Config" button returns you to the Configuration Screen.

General Notes:

1. When first setting up or when updating Teensy or Nextion software, go to each screen in turn and refresh all settings by entering new or current values in the text boxes and pressing "OK", cycling the radio buttons, and moving the speed sliders.
2. X and Z axes for the lathe in descriptions above use the standard shown here:
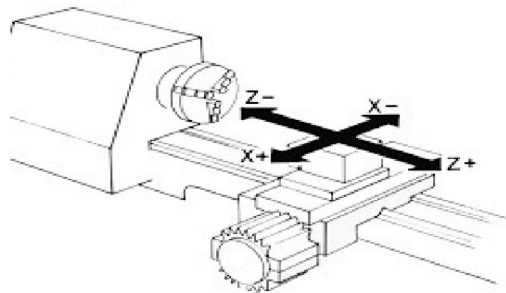
Exercises

I.   Thread Cutting for Boxes with the **Synchronization Screen**:

Note: refer to instructions in other resources (such as "Turning Threaded Boxes" by John Swanson, Schiffer Publishing, 1999) for box threading tips and techniques.

Example 1: Single-start thread of 16 threads per inch (1/16" pitch).

1. Set "Revolutions" to number of threads to be cut around the cylinder. Suggest using "4" as a starting point.
2. Set "Distance" to .25 (four threads at 1/16" = ¼").
3. With a 60-degree double angle cutter running in a drilling frame set parallel to the lathe's spindle and driven by the overhead, test and adjust Spindle and Axis speed bars as necessary to get a usable combination of feed and speed (not so fast as to bog down cutter, not so slow as to burn the wood). If necessary, adjust "MaxSpd" setting on **Configuration Screen** to get usable combination.
4. Test "Left" and "Right" radio buttons to determine which type of thread will be cut (left hand or right hand).
5. Choose whether to cut "In" or "Out" based on what makes sense for your piece.
6. Cut thread. Typical good practice uses roughing and final cuts for each thread. If wood tends to fuzz up or chip out, it's common practice to flow some CA glue into the rough threads and let it cure prior to the final cut.

Example 2: Four-start thread of 16 threads per inch (1/16" pitch, ¼" lead)

1. Set "Revolutions" to number of threads (of each start) to be cut around the cylinder. Suggest using "1" as a starting point.
2. Set "Distance" to .25 (1/4" lead). This will cut one continuous thread traveling ¼" as it goes once around cylinder.
3. Got to **Index #1 Screen**. Select "Div" toggle and set value in "Size" box to "4". Note: would also work to select "Deg" toggle and set value in "Size" box to "90".
4. Follow steps 3, 4, 5 & 6 in Example 1 above.
5. Return to starting point with cutter retracted from work using "In" or "Out" as appropriate.
6. Index spindle using either CW or CCW based on personal preference to get to starting point of next thread start. Re-engage cutter and repeat cutting process(es) in step 6 in Example 1 for Start #2. Retract cutter and return to start point of Start #2.
7. Repeat indexing and cutting procedures for Starts #3 and #4.