FM-3 Quick Start Guide

The quick start guide provides information on the basic operation and functions of the FM-3. The quick start steps cover only the most basic steps required to setup a FM-3 for use with a drive. For details on other functionality, please refer to the FM-3 Reference Manual (P/N 400508-01).

Step 1: Opening a new Configuration Window

To open a new configuration window, click either on the New File icon at the left end of the Power Tools FM-3 Toolbar, or click on File – New from the pull down menu as shown in Figure 1.
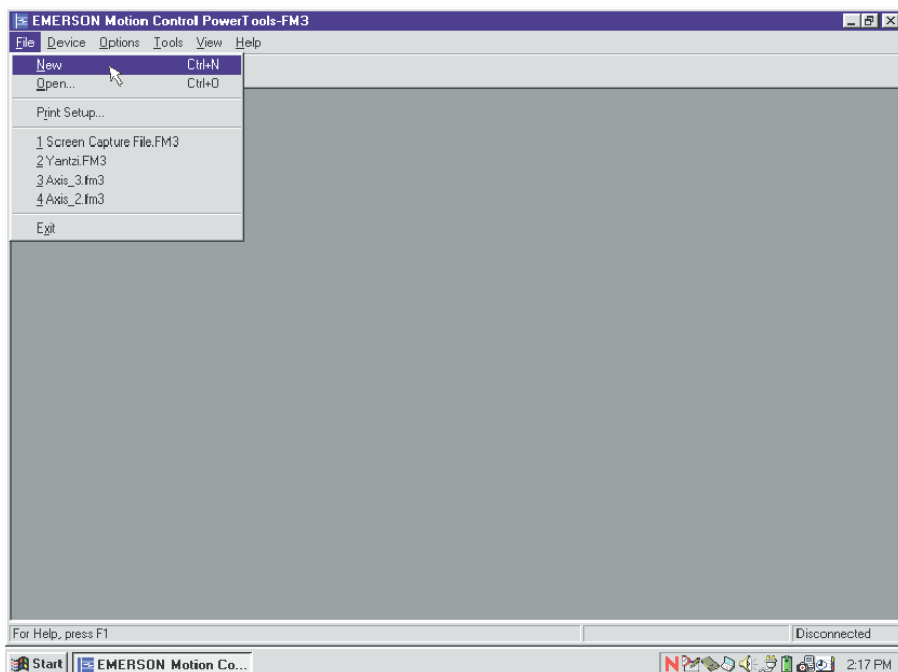

Figure 1: Opening a new Configuration Window

This opens a new offline configuration window allowing you to setup all FM-3 parameters. The communication status remains "offline" until the configuring is complete and you download the application to the FM-3.

Step 2: Enter All Setup Data

General Setup Screen

The FM-3 software view is broken up into two areas. The left side view contains the configuration hierarchy window, which acts as a navigation frame. Some elements in the hierarchy can be expanded to show more detailed setup screens. Elements with a "+" icon to the left of them may be expanded for added detail.

To expand the element, place your mouse pointer over the "+" symbol and click on it using the left mouse button. The group then expands to show the setup screens underneath it. To collapse the expanded group, click on the "-" symbol located to the left of the group heading.

To select one of the individual setup screens, click on the element in the hierarchy view. The element will then be highlighted, and the right side of the screen will show all setup parameters for that subject. Figure 2 shows the Setup view selected.
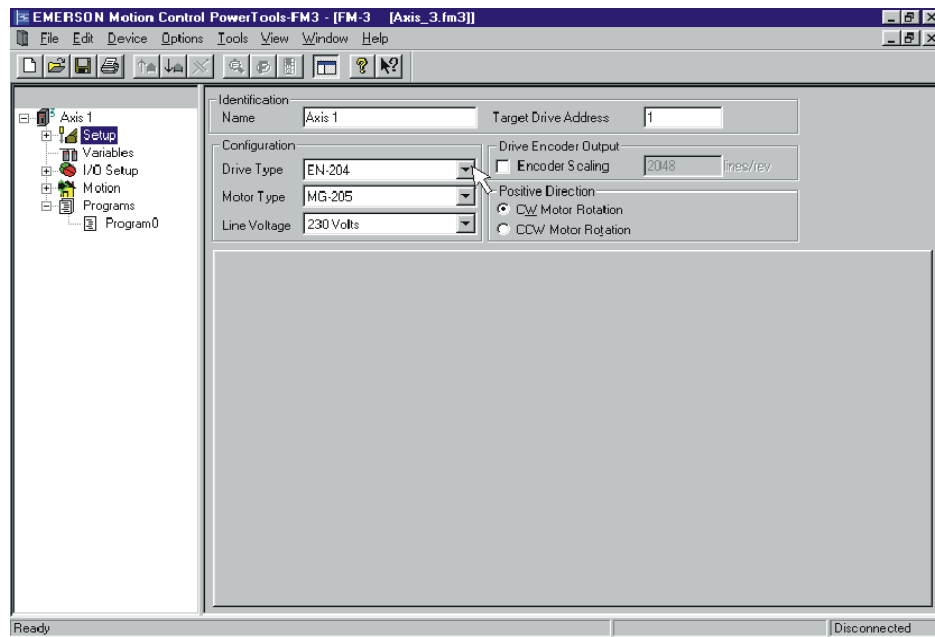

Figure 2: General Setup Screen

On this screen, you must enter the following parameters before entering other setup screens:

Drive Type – Select, from the list box, the type of drive to which the FM-3 is attached.

Motor Type – Select, from the list box, the type of motor being used in this application.

Line Voltage – Select, from the list box, the line voltage applied (115VAC or 230VAC).

Target Drive Address – Enter the Modbus address for this drive/FM-3 system. Power Tools FM-3 will download the configuration to that specific drive only.

Please take the time to check that these parameters are correct.

User Units Screen

Determine which types of units the drive should use to measure motion and enter them on this screen. Figure 3 shows the Setup group in the hierarchy expanded with the User Units element selected.
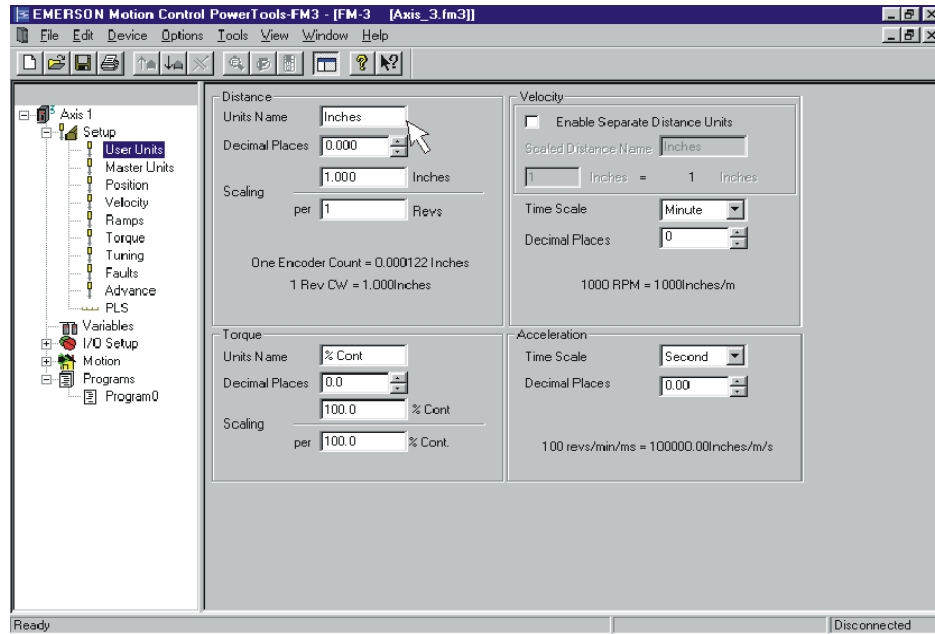

Figure 3: User Units Screen

Now setup the parameters in the Distance group on the User Units screen. The Tab key is used to easily jump through the available parameters. After entering data in a field, press the Tab key to move to the next parameter. The parameters you must fill out are as follows:

Units Name – Enter the character string you wish to use for your distance units.

Decimal Places – Enter the number of digits after the decimal place you wish to use in all distance parameters throughout the software (i.e. index distances/positions, PLS On/Off points). Use the spinner window Up/down buttons to increase or decrease the number of digits.

Distance Units Scaling – Enter the number of User Units the motor/load travels for each revolution of the motor. You must enter the numerator and the denominator for this scaling factor.

Master Units Screen

Use this screen if you wish to set parameters for synchronized motion.

Position Screen

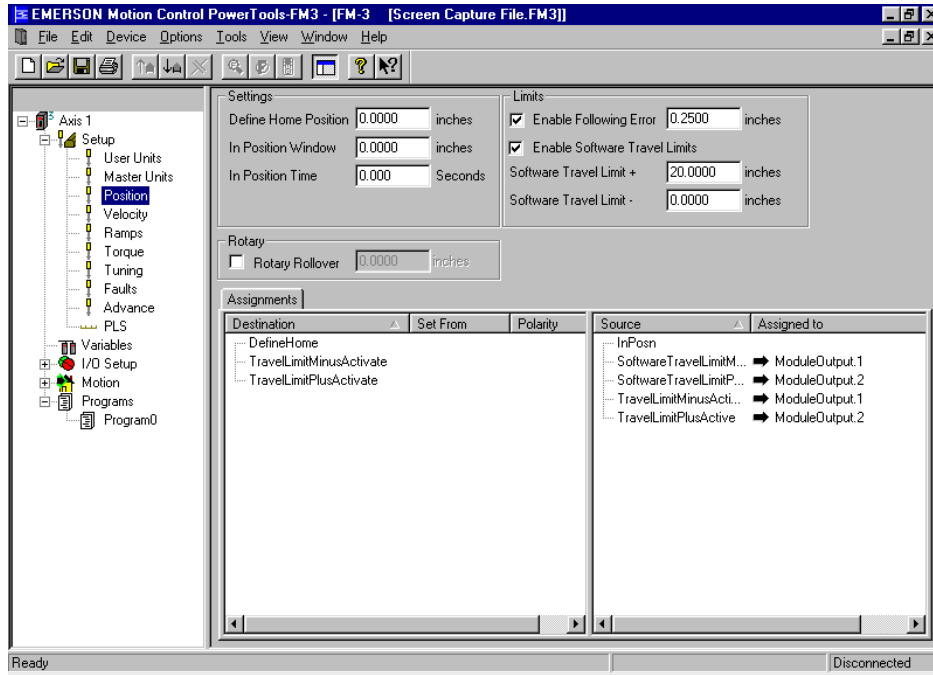The Settings group on this screen sets the Define Home Position.

Figure 4: Position Screen

To setup following error limit and software travel limits, fill out the following parameters in the **Limits Group**:

Enable Following Error – This checkbox enables (when checked) and disables the following error fault capability. If checked, a following error fault is generated whenever following error exceeds the value entered in the parameter box. If unchecked, a following error fault will never be generated.

Following Error Limit – If Following Error meets or exceeds this value, a Following Error Fault will be generated.

Enable Software Travel Limits - This checkbox enables (when checked) and disables the software travel limits. If enabled, the software travel limits are not active unless the Absolute Position Valid Source is active. (For more information please see Software Travel Limits information in the Setting Up Parameters section of the Reference Manual.)

Software Travel Limit + and - - If the position feedback ever exceeds these values when traveling in a positive or negative direction, the motor will come to a stop at the Travel Limit Decel rate defined on the Ramps screen.

Velocity Screen

This screen sets up the feedrate override velocity. If your application does not call for an overall scaling factor, leave this at the default of 100%.

Ramps Screen

You must setup the deceleration rate to be used on the Ramps screen if a travel limit is encountered.
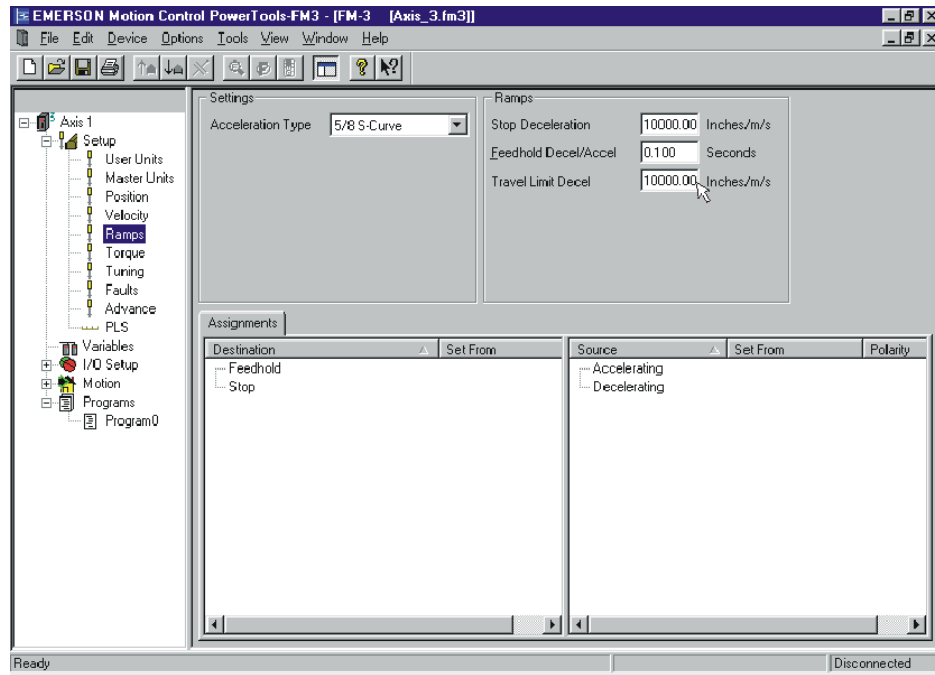

Figure 5: Ramps Screen

Travel Limit Decel – The deceleration ramp is used if either a Software or Hardware Travel Limit is encountered. The deceleration units of the ramp are defined in the User Units setup screen under the Acceleration group.

Torque Screen

If your application calls for specific torque levels and limits, use the parameters on this screen.

Tuning Screen

EN Series Drives are designed to handle a 10:1 inertia mismatch without a tuning requirement. If you have calculated and know the inertia mismatch, the value can be entered on the Tuning screen for ideal drive response and velocity regulation.
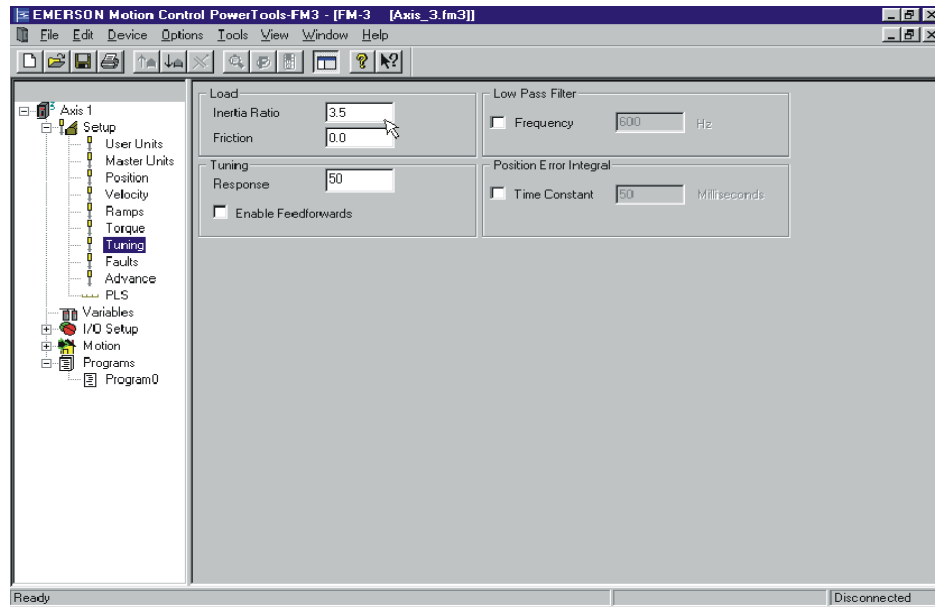
Figure 6: Tuning Screen

Inertia Ratio - This parameter is the ratio between the reflected inertia of the load and the inertia of the motor rotor. For assistance in calculating the Inertia ratio, see the Determining Tuning Parameter Values section of the FM-3 Reference Manual.

PLS Screen

Use this screen to setup Programmable Limit Switches (PLS), if your application requires them. They are assigned in the same way as the Assignments screens in Step 3 of this guide.

Step 3: Making Assignments

The Assignments screen is found by expanding the I/O Setup group in the hierarchy. The Assignments define how the system operates. Sources, located on the left side of the screen, are functions or events that activate based on drive/motor activity. Destinations, located on the right side of the screen, are functions that need to be triggered or activated (i.e. Index Initiate, Program Initiate, etc.).

The example application requires initiating three indexes using three separate hardware inputs. Therefore, the Input sources need to be assigned to the Index Initiate destinations.

To make an assignment, position your mouse pointer over the source you wish to assign to a destination, click and hold the left mouse button. While still holding the button, drag your pointer over the destination where you wish to assign this

source, and release the button. The "Assigned To" and the "Set From" columns should then reflect the assignment that has been made. Figure 7 shows how these assignments are made.
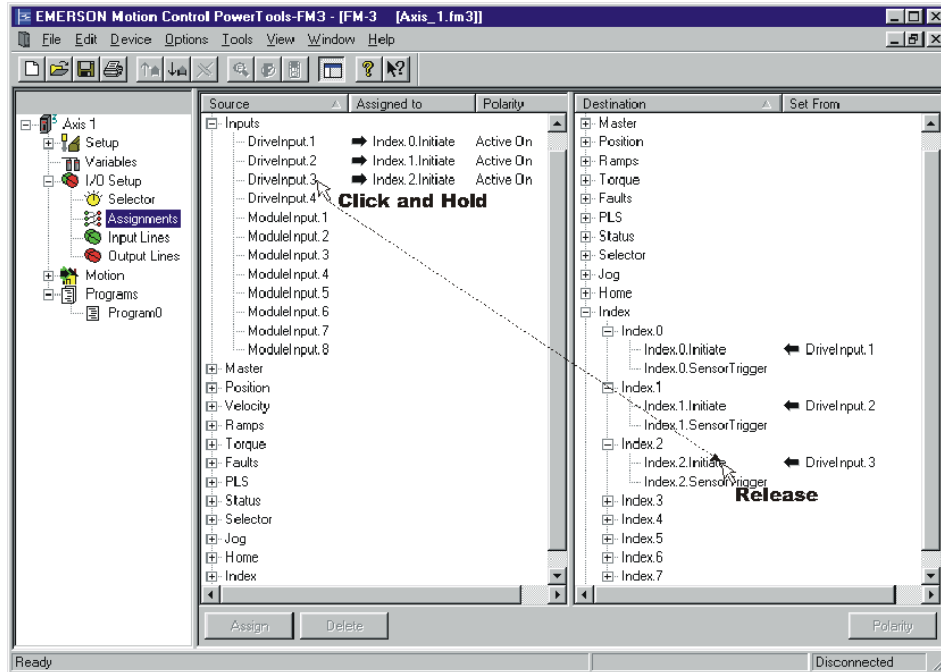

Figure 7: Making Assignments

Notice that a Name can be associated to each input line. Each input line can also have a debounce time.

Name – This 12-character string allows a descriptive name assigned to an input line. This makes the configuration easier to follow.

Debounce – This is the minimum time a specific input must be on, for recognition by the drive/FM-3. This helps prevent false triggering for applications in electrically noisy environments. The units for this parameter are seconds, with resolution of 0.001 seconds.

The **Output Lines** screen shows assignments that have been made to the Outputs group of Destinations in the assignment screen. Assignments to this screen are made in the same way as assignments to the Input Lines screen. After all assignments have been made, the Output Lines screen may look like Figure 8.
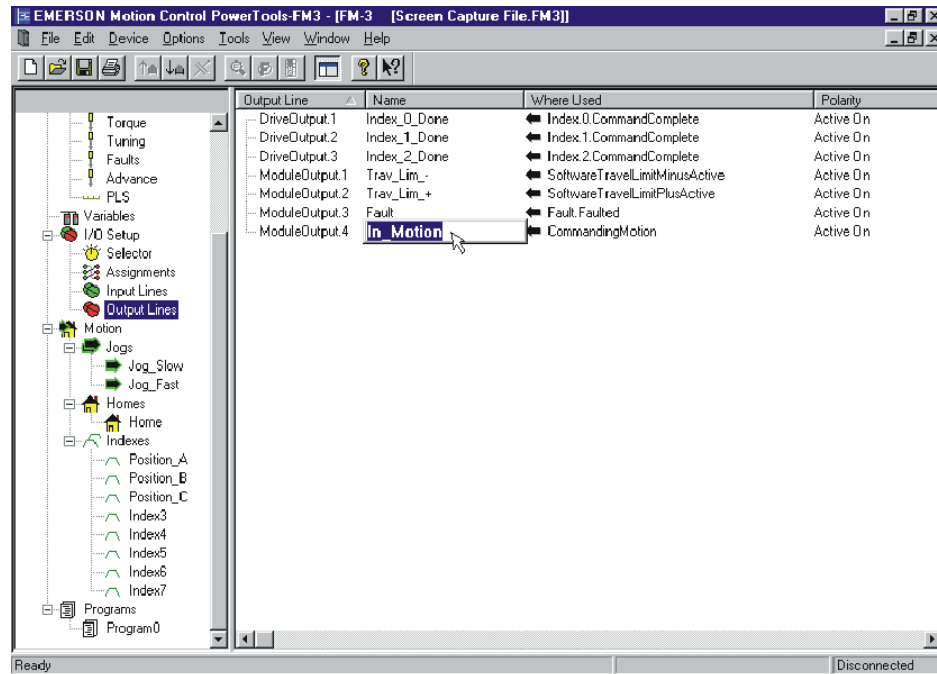
Figure 8: Output Lines Screen

A name can also be given to each hardware output line. Figure 8 shows how to enter a name for an individual output line.

Name – This 12-character string allows a descriptive name assignment to an output line. This makes the configuration easier to follow.

Step 4: Setting Up Motion Parameters

Now that all of the assignments have been made, you next setup the jog, home, and index definitions. To do this, it is necessary to expand the Motion group in the hierarchy window.

Jog Setup

The Jog screens allow you to setup any jogs required by your application. Select either the **Jog0** or **Jog1** to enter the specific Jog parameters. Figure 11 shows **Jog1** setup screen (renamed Jog Fast). Once in the individual jog screens, the up and down arrows next to the Jog Number parameter can be used to scroll between the jog screens (see Figure 9). The following jog parameters have been defined on this screen:

Jog Name - **Jog0** has been named **Jog Slow** and **Jog1** named **Jog Fast**. This is a 12-character string that allows you to give a descriptive name to a jog profile.

Jog Velocity – Is the target velocity for the Jog profile. If the Jog.Select0 destination is inactive, the **Jog0** velocity is the target velocity, if Jog.Select0 is active, then Jog1 velocity is used.

Jog Acceleration – Is the average acceleration rate used when accelerating to the target velocity.
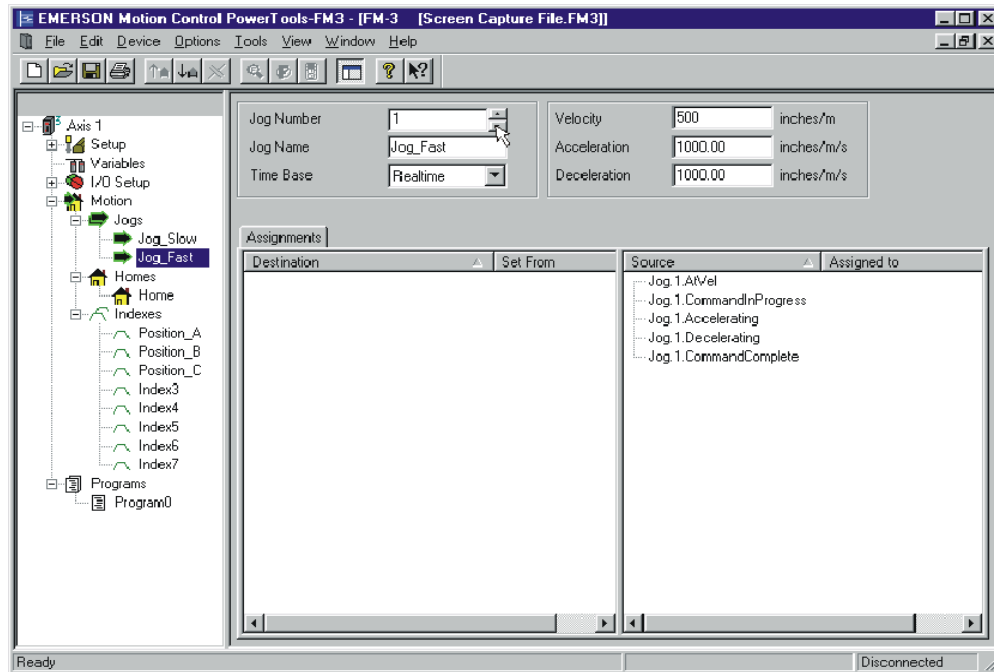

Figure 9: Jog Setup Screen

Jog Deceleration - Is the average deceleration rate used when decelerating to zero speed or to the new target velocity.

Home Setup

Next, select the Home screen from the hierarchy window. Figure 10 shows the Home screen and its associated home parameters.

Home Reference – Determines what signal is used as the home reference. The available options are an external sensor, the encoder marker pulse, or both. If sensor is selected, the home profile will travel at its target velocity until the Home.0.SensorTrigger is activated.

Velocity – Is the target velocity for the home move. The home move travels at this velocity, until the home reference is seen and then stops. If the motor overshoots the sensor, a reverse move is initiated. Other functions may cause additional motion.

Acceleration – Is the average acceleration rate used to accelerate to the target velocity.
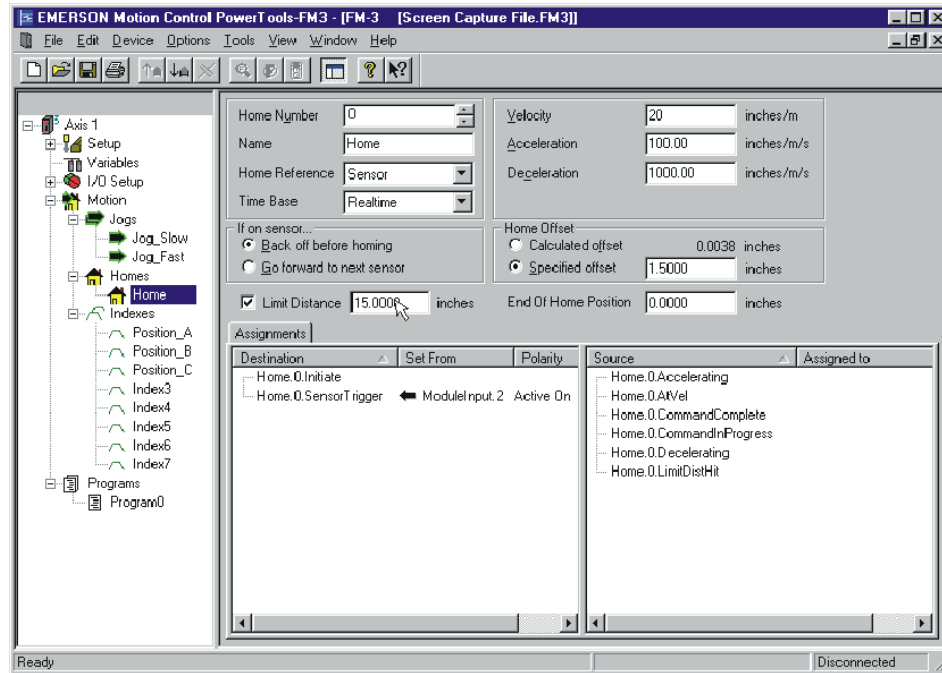

Figure 10: Home Setup Screen

Deceleration - Is the average deceleration rate used to decelerate from the target velocity to zero velocity at the completion of the home.

Home Offset – By selecting a specified offset, the home will travel at a set velocity until the home reference signal is detected, then travel an additional set distance, before coming to a stop. The deceleration ramp begins at the proper time, to ensure the home completes precisely at the specified offset distance after the home reference was detected. In order to decelerate to a stop immediately upon detecting the home reference, select the "Calculated Offset" radio box.

Limit Distance – Is the maximum incremental distance the home move will travel without seeing a home reference signal. If the home move does travel this distance without seeing a home reference, it will come to a stop exactly at this point, and the Home.0.LimitDistHit source will activate. If the box is left unchecked, the home move will continue without limit, until a home reference is seen.

Index Setup

Next, setup any indexes required by your application. Select one of the indexes from the hierarchy window. Figure 11 shows Index0 (renamed Position A).
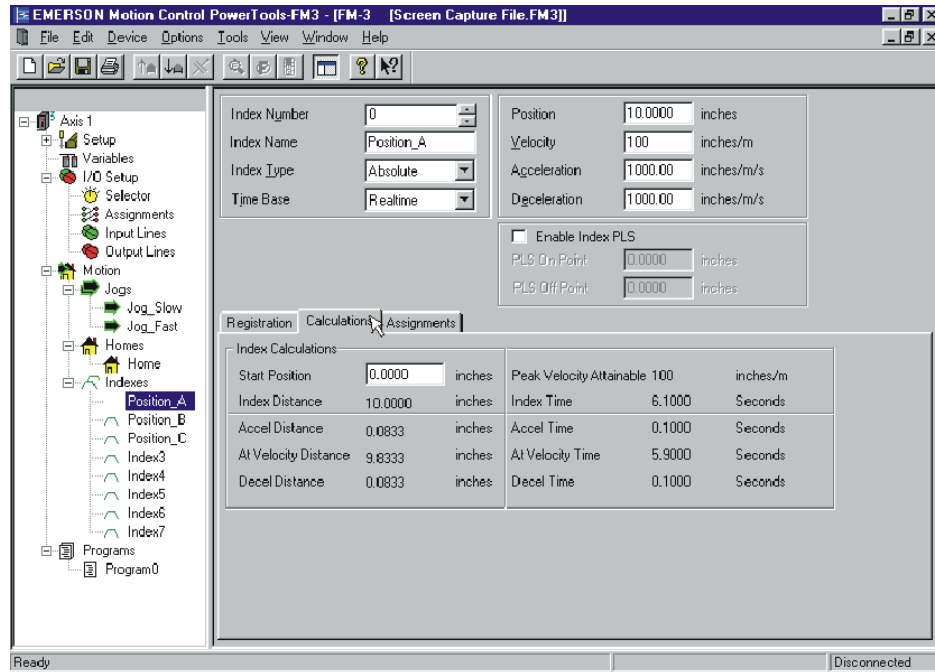
Figure 11: Index Setup Screen (Absolute Type)

Indexes use the following parameters:

Index Name - Is a 12-character string that gives a descriptive name to an index.

Index Type – Selects the desired type of index from the list box. An Absolute index means the load will travel to an exact position with respect to the home reference point. This index will cause motion in either a positive or negative direction depending on current position of the load with respect to the home reference point. An Incremental index means that the load travels an exact distance from the start of the index.

Position/Distance – If using an absolute index, this is the desired final position after the index is complete. If using an incremental index, then this is the distance you want the load to move from the start of the index. This is a signed value.

Velocity – This is the target velocity of the index profile. The velocity parameter is unsigned and is always greater than zero. Direction of the index is not determined by the velocity, but by the Distance/Position parameter.

Acceleration – Is the average acceleration rate used when accelerating to the target index velocity.

Deceleration - Is the average deceleration rate used when decelerating to zero speed, or to the new target velocity.
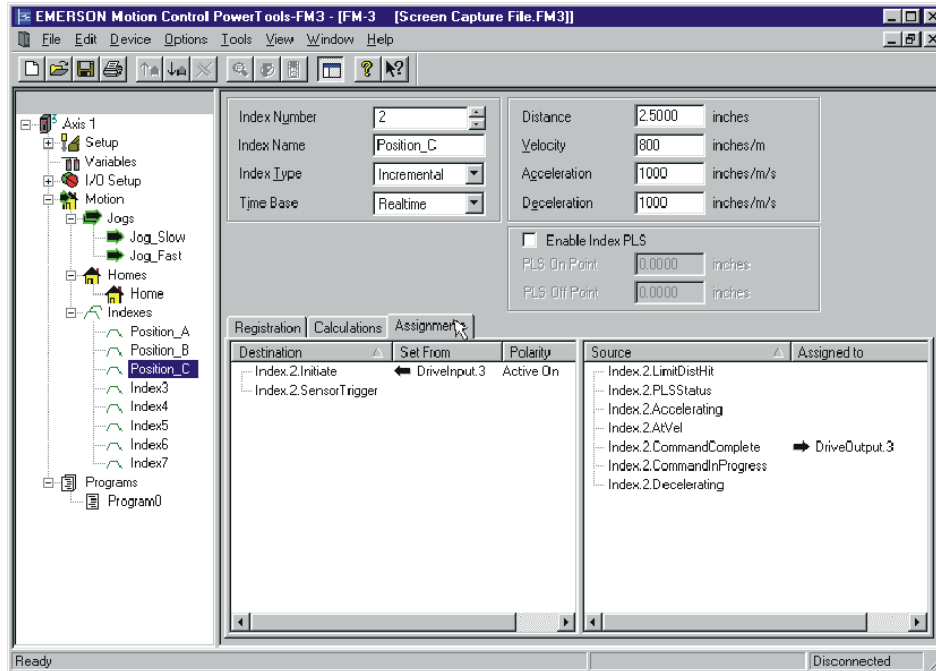
Figure 12: Index Setup Screen (Incremental Type)

Now that all of the motion parameters are setup, the jogs and indexes can be initiated through assignments to hardware inputs that were made on the assignment screen.

Step 4: Creating a Program

Now that the drive setup is complete, assignments are made, and motion profiles are defined, you are ready to create the program. To do this, expand the Program group in the hierarchy window, and select Program 0. Figure 13 shows the programming window and the available instructions.
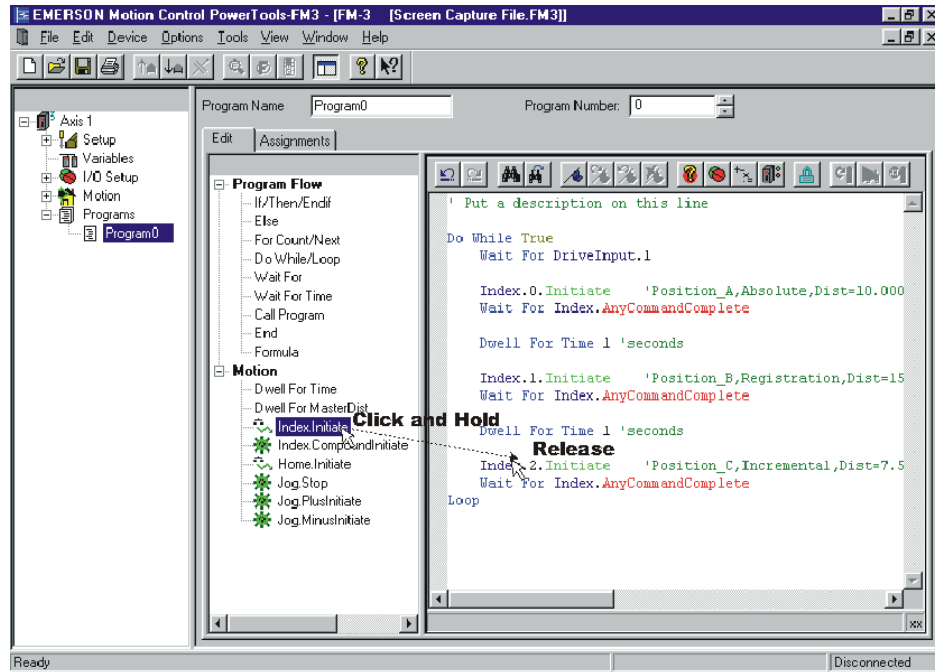
Figure 13: Program Screen

The window in the middle of the screen allows selection from a list of Program Flow and Motion instructions. To insert an instruction into the programming window, you can use the "drag-and-drop" method also used in making assignments. Simply position your mouse pointer over the instruction you wish to use, click the left mouse button and hold it down. While holding the button down, move your pointer into the programming window, and release the mouse button.

To expand the useable area of the programming screen, use the Hide/Show Hierarchy on the Power Tools FM3 toolbar. Figure 14 shows this utility. By clicking on the icon once, the hierarchy window will be hidden, allowing for a larger programming window. To show the hierarchy again, simply click on the icon a second time. Clicking on the icon alternates between showing and hiding the hierarchy view.

The Hide/Show Hierarchy icon can be used on any screen in the Power Tools FM3 software, but will primarily be of use in the Programs screen and the Assignments screens.
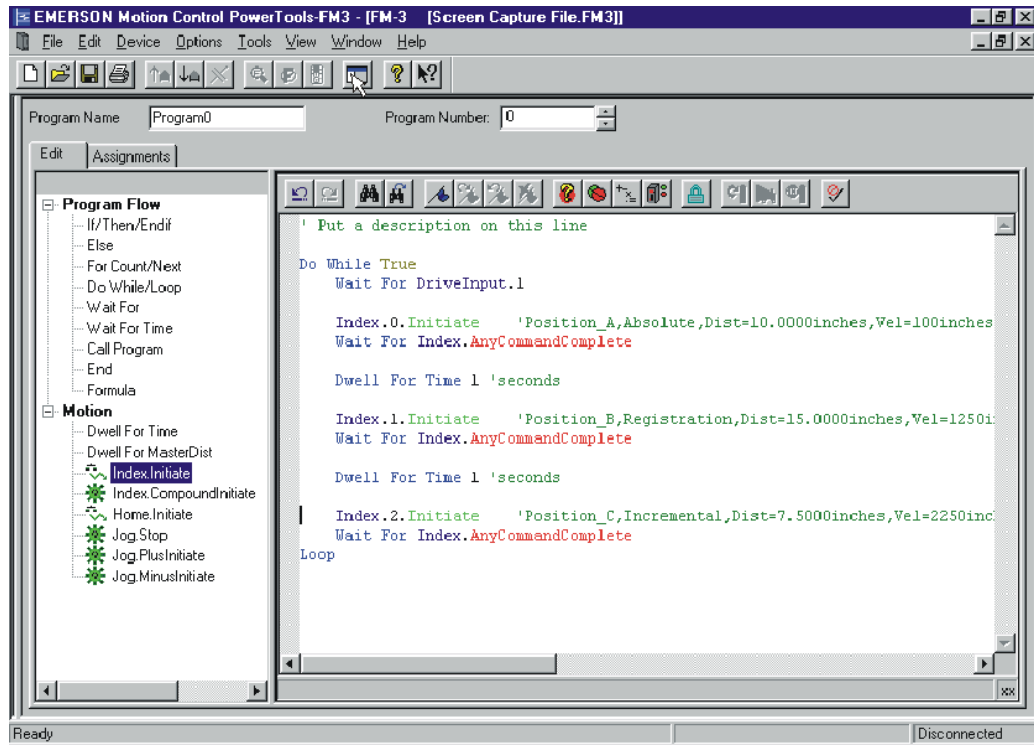
Figure 14: Program Screen (Expanded)

A comment is automatically inserted after the index instruction, which shows key data about the specific index. Notice comments start with the ' apostrophe character.

A "Wait For Index.AnyCommandComplete" instruction is automatically inserted after each Index.Initiate. This ensures that the index has completed before the program continues on to the next line of code.

Once all of the program instructions have been inserted, your program window may look like Figure 14.

Now the program is complete, and is ready to be run. In order to run the program, the drive must be enabled and the setup parameters must be downloaded. Once the download is complete, verify the drive is enabled and initiate your program.

Example Application Start Up

Software Travel Limits

0   20

Home Prox
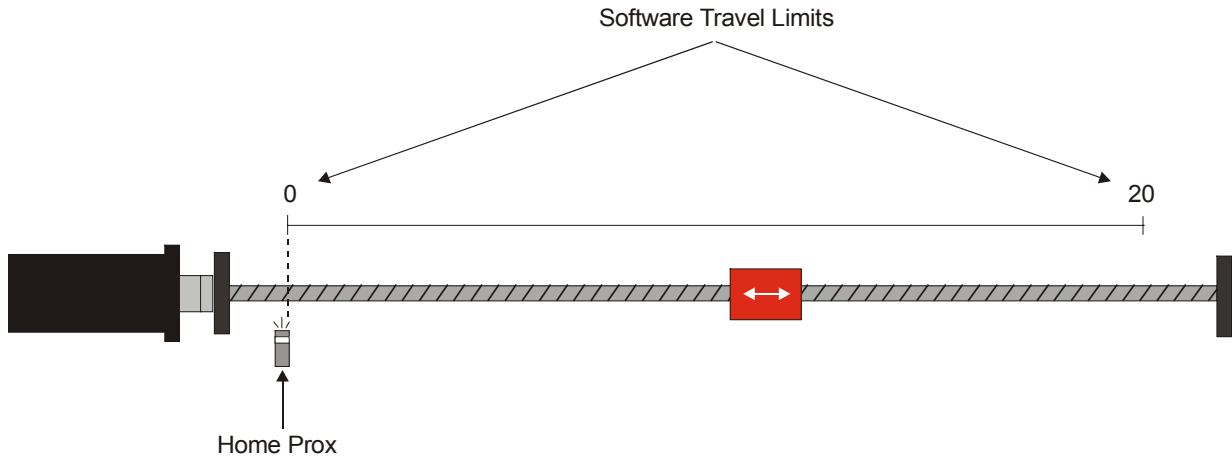
In order to make the setup easier to understand in this guide, the guide will use an example setup. The example application used in the quick start guide is a ball screw application (see the drawing above).

The example uses these functions:
3 Indexes (Initiated through Assignments or through a Program)
2 Jogs
1 Home (to Sensor)
1 Program
Software Travel Limits
Following Error Limit

Several Setup Screens do not require any setup for this example application, and therefore have been skipped. After opening a new Configuration Window and inputting information on the Setup screen, move to the User Units screen.

User Units Screen

This example requires use of distance units "Inches" versus the default units "revs". The example has a linear device that moves 1.00 Inch per 1 motor Revolution. Figure 3 shows the Setup group in the hierarchy expanded with the User Units element selected.

The parameters you must fill out are as follows:

Units Name – Enter the character string you wish to use for your distance units, such as "Inches" for this example.

Decimal Places – Enter the number of digits after the decimal place you wish to use in all distance parameters throughout the software (i.e. index

distances/positions). The example selects three digits allowing resolution of 0.001 Inches on all distance variables. Use the spinner window Up/down buttons.

Distance Units Scaling – Enter the number of User Units the motor/load travels for each revolution of the motor. You must enter the numerator and the denominator for this scaling factor, but for this example, the denominator (bottom portion of the ratio) is at 1.

Position Screen

The example wishes to limit the Following Error to 0.25 Inches or one motor revolution, and the Software Travel Limits of +20 and 0 Inches.

To setup following error limit and software travel limits, fill out the following parameters in the **Limits Group**:

Enable Following Error – Enable this checkbox.

Following Error Limit – The example uses a limit of 0.25 Inches.

Enable Software Travel Limits – Enable this checkbox.

Software Travel Limit + and - - If the position feedback ever exceeds these values when traveling in a positive or negative direction, the motor will come to a stop at the Travel Limit Decel rate defined on the Ramps screen

Tuning Screen

This example application has an inertia mismatch of 3.5:1 and has been entered as seen in Figure 6.

Making Assignments

Using this process, three individual assignments are made. The example application wants to turn on an output when each index completes. Therefore, Index Complete sources will be assigned to the hardware Output destinations. Figure 15 shows this process.
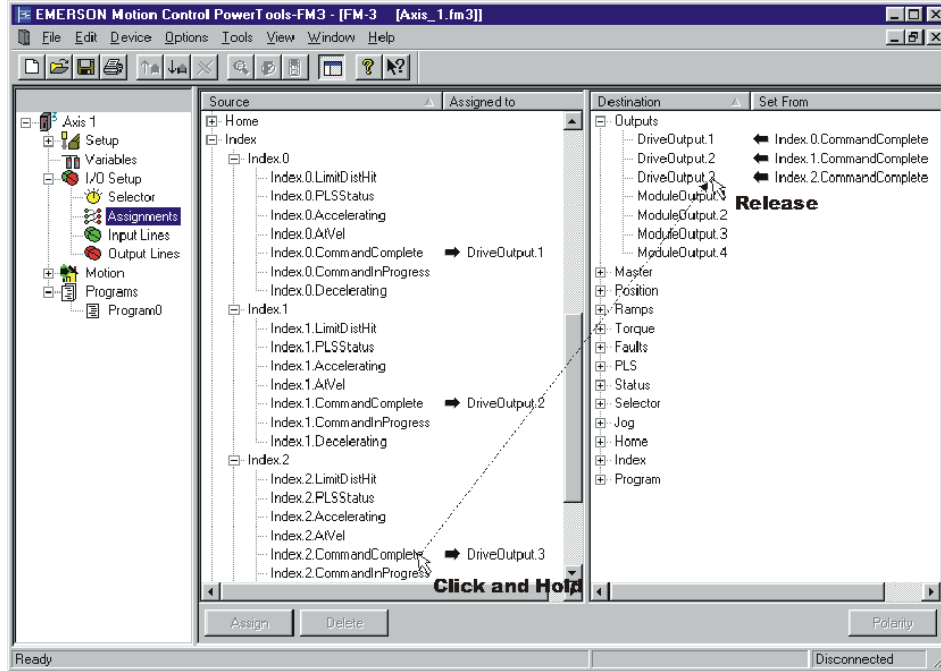
Figure 15: Assignments Screen

The **Input Lines** screen shows all of the assignments that have been made to the
Inputs group of Sources. After all assignments for the example application have
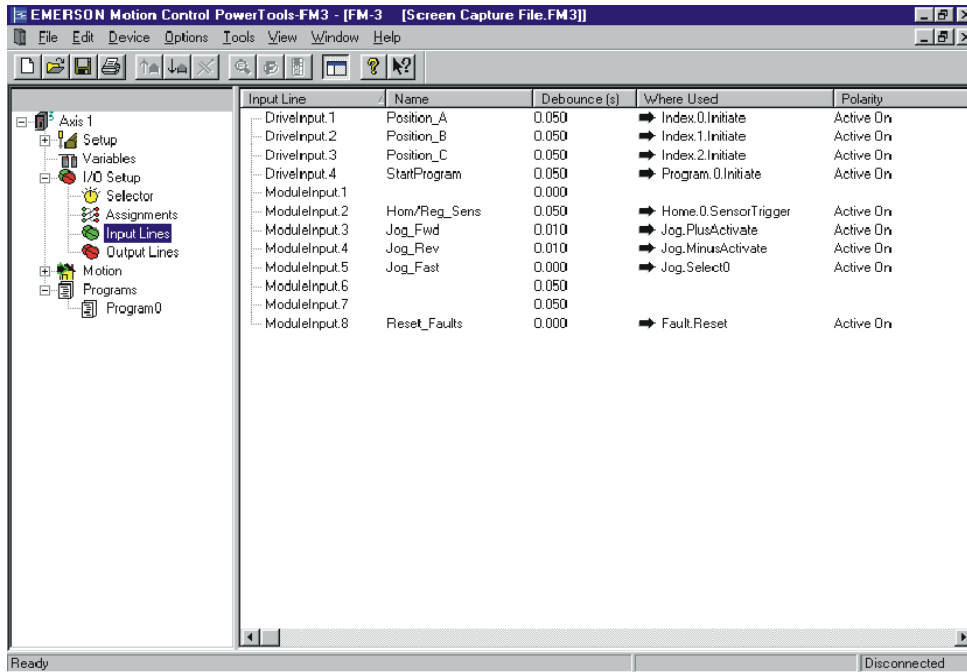been made, the Input Lines screen should look like Figure 16.

Figure 16: Input Lines Screen

Notice that a Name can be associated to each input line. Each input line can also have a debounce time. Figure 16 demonstrates how to enter a debounce time for an input line. The following parameters have been filled in for each input line:

The **Output Lines** screen shows assignments that have been made to the Outputs group of Destinations in the assignment screen. Assignments to this screen are made in the same way as assignments to the Input Lines screen. After all assignments have been made for the example application, the Output Lines screen will look like Figure 17.
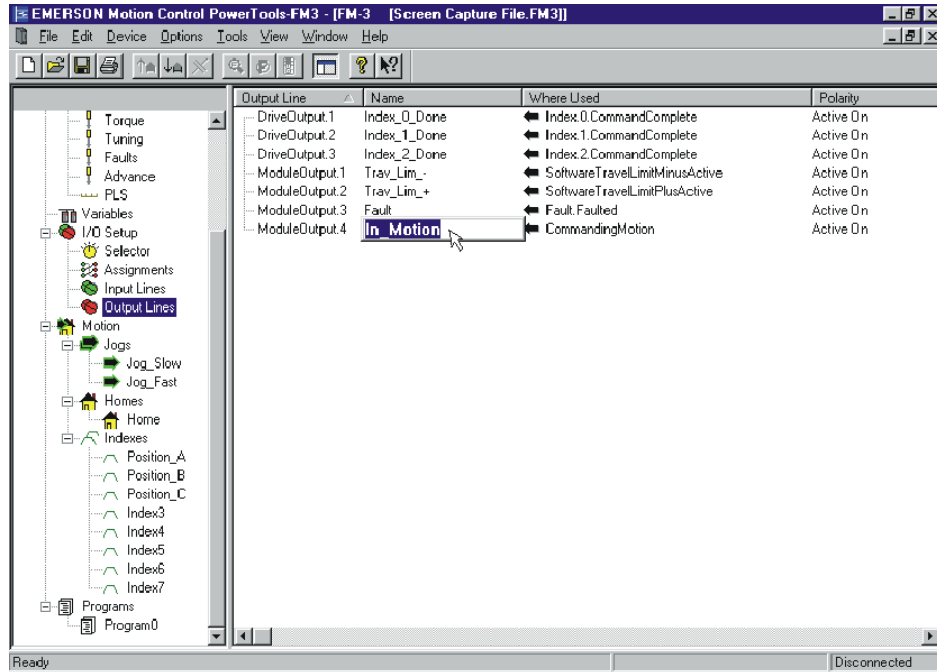

Figure 17: Output Lines Screen

Home Setup

The example application calls for setup of the following parameters:

Home Reference –The example calls for a Home to Sensor; therefore, "Sensor" is selected as the home reference. Because of this selection, the home profile will travel at its target velocity until the Home.0.SensorTrigger is activated. Figure 16, shows the Home.0.Sensor Trigger has been assigned to ModuleInput.2.

Velocity – The home move travels at this velocity, until the home reference is seen and then stops. If the motor overshoots the sensor, a reverse move is initiated. Other functions may cause additional motion. The example application uses a Home Velocity of 20 inches/min.

Acceleration – Is the average acceleration rate used to accelerate to the target velocity. The example uses an acceleration rate of 100 inches/min/sec.

Index Setup

The example application calls for two Absolute Indexes, and one Incremental Index. Select one of the indexes from the hierarchy window. Figure 18 shows Index0 (renamed Position A).
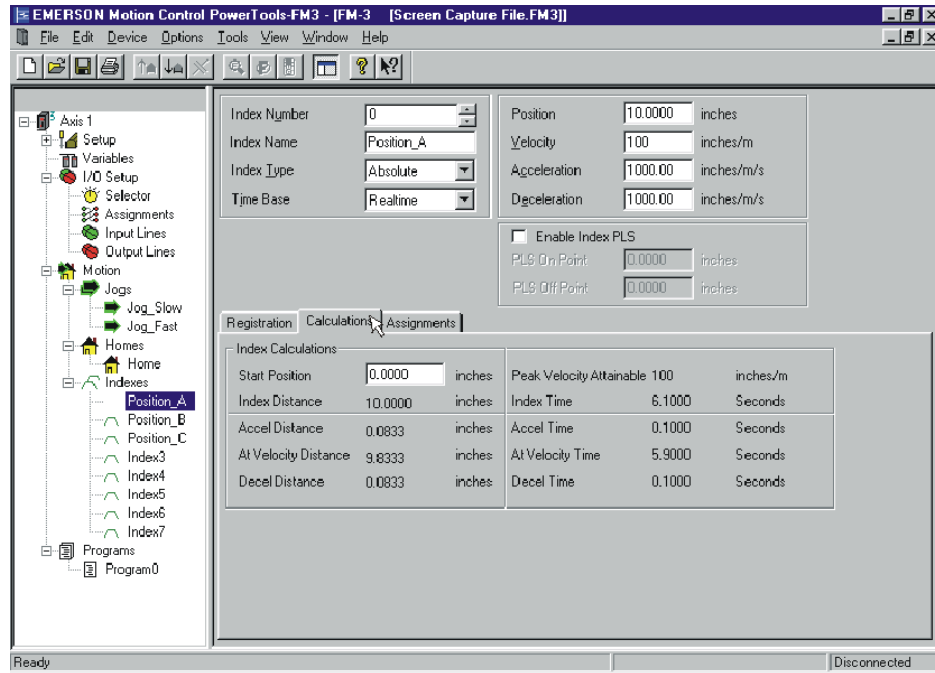
Absolute Index

Figure 18: Index Setup Screen (Absolute Type)

Indexes 0 and 1 are both Absolute type indexes and use the following parameters:

Index Name - Is a 12-character string that gives a descriptive name to an index. Index0 has been named Position A, and Index1 Position B as seen in Figure 18.

Index Type – Select the desired type of index from the list box. Index0 has been defined as an Absolute type of index. This means the load will travel to an exact position with respect to the home reference point. This index will cause motion in either a positive or negative direction depending on current position of the load with respect to the home reference point.

Position – Is a signed value that specifies the absolute position for the load at the completion of the index. For absolute indexes, direction of travel is determined by the starting position of the index. Index 0 has a Position of 10 Inches, and Index 1 has a Position of 0 Inches.

Velocity – Is the target velocity of the index profile. The velocity parameter is unsigned and is always greater than zero. Direction of the index is not determined

by the velocity, but by the Distance/Position parameter. Velocity of the indexes in the example are 100 inches/min.

Acceleration – Is the average acceleration rate used when accelerating to the target index velocity.

Deceleration - Is the average deceleration rate used when decelerating to zero speed, or to the new target velocity.

Incremental Index

The following parameters were setup for Index2:

Index Name - Is a 12-character string that gives a descriptive name to an index. Index2 has been named Position C as seen in Figure 19.

Index Type – Select the desired type of index from the list box. Index2 has been defined as an Incremental type of index. This means that the load travels an exact distance from the start of the index.

Distance – The distance is a <u>signed</u> value that specifies the distance the load will travel from the start position. The <u>sign</u> of this parameter determines direction of travel for the load. The distance of Position C has been set to 2.5 inches.

Velocity – Is the target velocity of the index profile. The velocity parameter is unsigned and is always greater than zero. Direction of the index is determined not by the velocity, but by the Distance/Position parameter.

Acceleration – Is the average acceleration rate used when accelerating to the target index velocity.

Deceleration - Is the average deceleration rate used when decelerating to zero speed, or to the new target velocity.
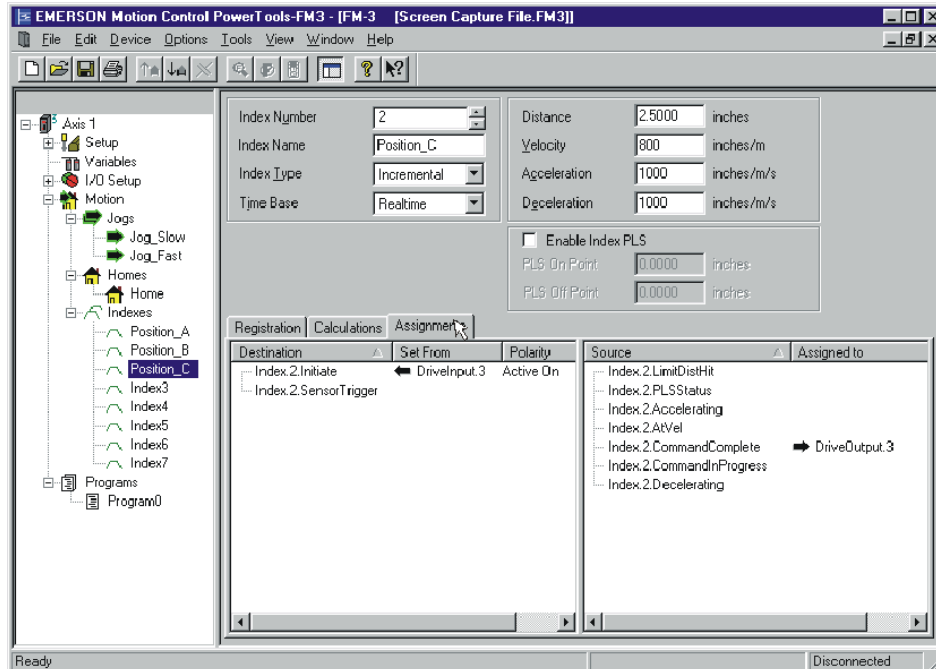
Figure 19: Index Setup Screen (Incremental Type)

Now that all of the motion parameters are setup, the jogs and indexes can be initiated through assignments to hardware inputs that were made on the assignment screen. See Figure 16 to determine which input is used to activate which functions.

This example specifies that the indexes must be initiated from assignments, as well as from a program. So a program must be created using Step 4 of this guide.

Upon initiating the program, it will wait until DriveInput.1 is activated, then run all three indexes with a 1 second dwell in between each, and then loop back to the top of the program. The program will run continuously, or until the Stop destination is activated.

The example program uses the following instructions:

Do While / Loop – This program instruction is used to repeat a sequence of code as long as a test expression is true. The test expression is validated before the loop is entered. If the test expression is evaluated as False (0), then the code inside the loop will be skipped over. If the expression is evaluated as True (1), then the code inside the loop will be performed. Upon reaching the Loop instruction, the program flow returns to the Do While instruction, and the expression is evaluated again. The example program uses an expression of TRUE, which is always evaluated as True (1). Therefore the program will run continuously.

Wait For – This program instruction halts program execution until the expression becomes True. Once True, the program continues with the next line of code. The example program uses a Wait For DriveInput.1 so that the program will wait until DriveInput.1 is activated, then continue on.

Index.Initiate – This program instruction is used to initiate a single index. When using this instruction, an Index Selection Box will appear allowing you to select the index you wish to initiate. This selection box is shown in Figure 20.
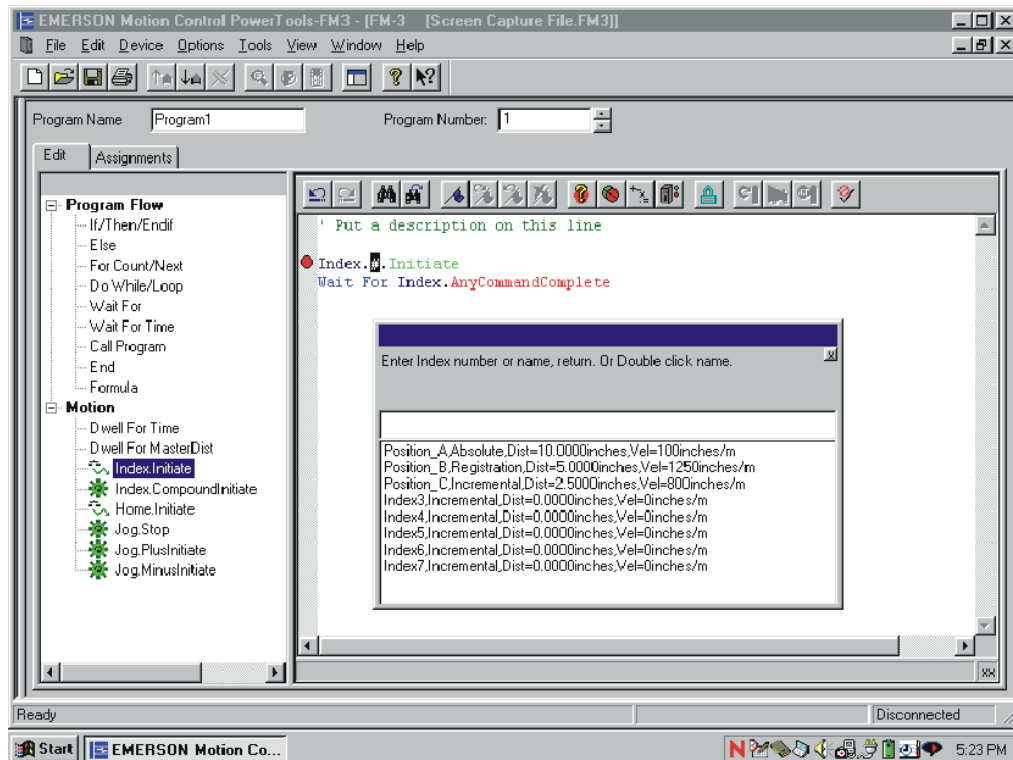

Figure 20: Index Selection Box

The program is initiated using DriveInput.4 (see Figure 16).

The setup is now complete, and the example is ready to be downloaded.