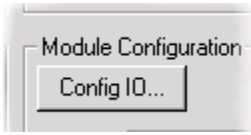
CHAPTER 5

CONFIGURING THE OUTPUTS USING CTRIO WORKBENCH

In This Chapter...

Configure IO Dialog Overview

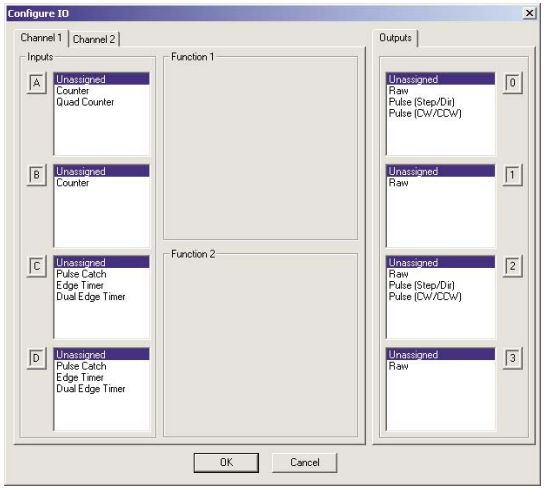


The Configure IO dialog is the location where input and output functions are assigned to the module. The choice of input and output functions determines which options are available.

The input and output function boxes prompt you with selections for supported functions. The Workbench software disallows any unsupported configurations.

From the main CTRIO Workbench window, click on the "Go to PROGRAM Mode" button. Then, click on the "Config I/O" button to arrive at a dialog shown to the right. Notice that the window has a tab for each input Channel. Channel 1 and Channel 2 offer the same configuration options. Remember that the H0-CTRIO only has one input channel.

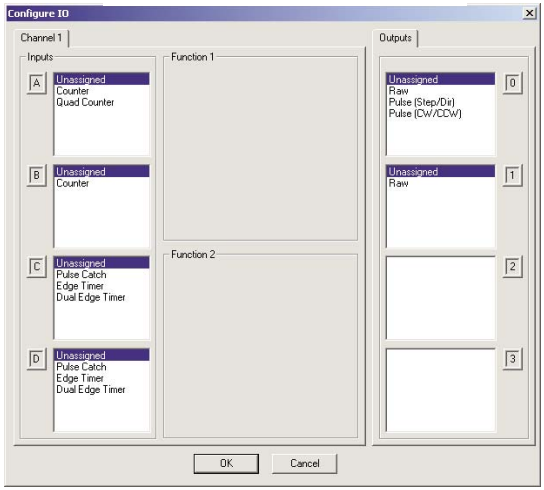
H2, H4, T1H-CTRIO Configure I/O Dialog



The input options are listed by function. Four boxes labeled A, B, C, and D correspond to the input terminals on the face of the module (1A-1D or 2A-2D; A-D for the H0-CTRIO).

The Output functions are listed as 0, 1, 2, and 3. These numbers correspond to the markings beside the module's output terminals (Y0-Y3; Y0-Y1 for the H0-CTRIO).

H0-CTRIO Configure I/O Dialog



For example, you might click on "Discrete Output" in the "0" box, then OK to return to the main Workbench window. Once you arrive back at the main window, you must click "Write Module" to save your selection to the module. The module will need to be in Program Mode to perform the Write Module operation. If you do not perform the Write Module operation (or a Write File operation) your configuration will be lost upon quitting Workbench. This applies to all changes to the module configuration.

Output Function Selections

Supported Functions

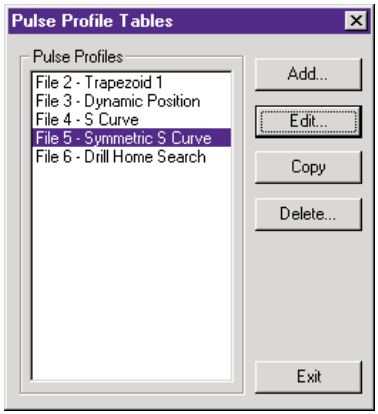
The module supports four output functions:

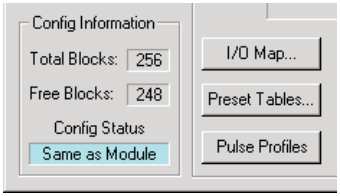
- Raw
- Pulse (Step/Direction)
- Pulse (CW/CCW)
- Discrete Ch(1,2)/Fn(1,2)

Each function uses one or two output terminals for making connections to field devices (plus a common). Combinations of the listed functions are possible. CTRIO Workbench disallows any unsupported configurations.

CTRIO Memory Usage: Pulse Profiles and Preset Tables

CTRIO Workbench can create a maximum of 255 predefined Pulse Profiles. The total number of Pulse Profiles available is 255 minus the number of predefined Preset Tables. Pulse Profiles and Preset Tables are saved as File 1 through File 255. The module has 256 Total Blocks of memory allocated for Pulse Profiles and Preset Tables usage. The number of memory blocks used varies between Pulse Profiles and Preset Tables.



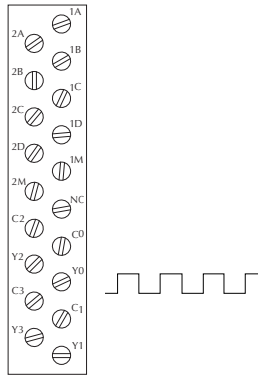


Raw Output

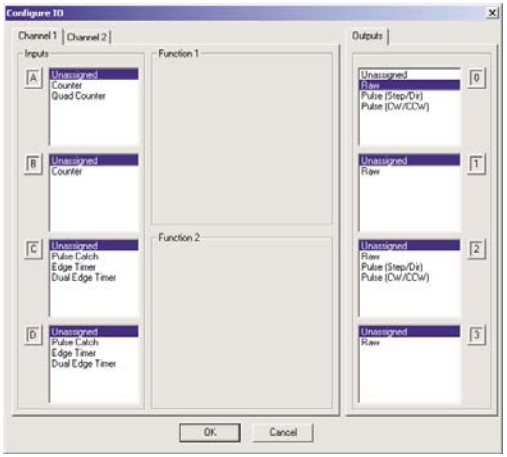
The CTRIO module supports Raw output mode. This mode allows the CPU/controller program to have direct access to the module's output points. Each output can be configured for Raw output mode and each will have a unique control bit.

NOTE: *To insure proper operation, the field device wiring and the configuration must be compatible. For wiring information see Chapter 2.*

Refer to "Output Control Bit Definitions (Raw Mode)" on page 6-5 for Raw output control bit addressing.

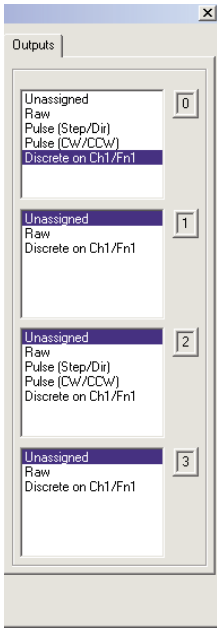


The module's output terminals are represented by the 0, 1, 2, and 3 boxes (0 and 1 for the H0-CTRIO) on the right side of this dialog.



Discrete Outputs

The CTRIO module has four discrete outputs numbered Y0-Y3 (Y0-Y1 for the H0-CTRIO). The outputs respond to presets assigned by the user in the Configure IO dialog.

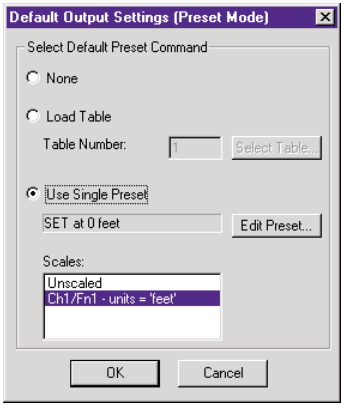


The presets are assigned based on the scaled value of an input, or the raw value if it has no scaled value. The four outputs can all be assigned to one function, or they can be grouped within functions and within channels in any manner selected by the user.

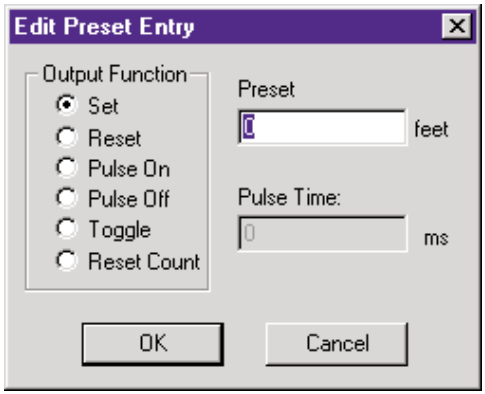
To assign output presets, begin by selecting the ouput on the Configure IO dialog. The outputs are identified based on terminal number. In the example to the right, output terminal "0" is designated for a discrete output.

Once the output selection is made, a new button appears on the Configure IO dialog. The button is labeled as shown to the right. The leading numeral represents the number of the output terminal. Clicking on the Preset button causes the Default Output Settings dialog to pop up. Default settings are loaded on power-up.

On the Output Settings dialog, select "Use Single Preset." We will discuss Preset Tables later in this chapter. Now, click OK to arrive at the Edit Preset Entry dialog.



Six output functions are available (as shown in the figure below). Set the preset value in engineering units if the signal has been scaled. Set the preset value in raw count if the signal has not been scaled. We discuss scaling in chapter 4. Pulse ON and Pulse OFF require a Pulse Time setting. The Pulse Time is set in msec (1,000 sec = 1 msec)

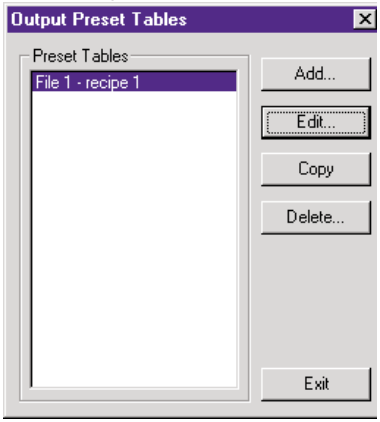


Output Function Definitions	
Set	Writes output ON (maintained)
Reset	Writes output above OFF
Pulse On	Writes output ON for specified time
Pulse Off	Writes output OFF for specified time
Toggle	Changes state of output
Reset Count	Resets the count to Preset Value

Creating and Using the Output Preset Tables

Preset tables can be used only when the corresponding input is configured for a timer or quad/counter that is not scaled or if a counter is set to Position scaling.

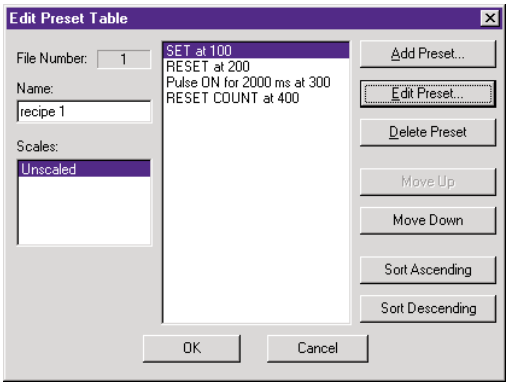
To create tables of presets, click the Preset Tables button on the main Workbench dialog. This will open the Output Preset Tables dialog. To create a new table, click Add (or Edit). This will open the Edit Preset Table dialog.



Build a Preset Table by adding preset entries one at a time. Click Add Preset (or Edit Preset) to open the Edit Preset Entry dialog.

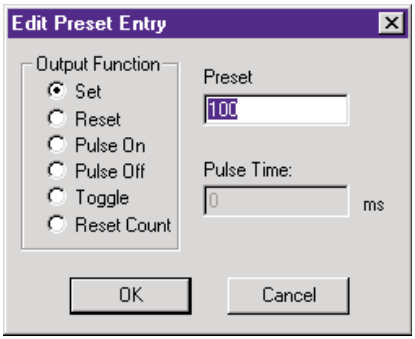
NOTE: *The preset tables work similiar to an event drum, not a programmable limit switch. For example, in the Edit Preset Table dialog below, the output is SET at count 100. Once the output is SET, if the count drops below 100, the output will not go OFF, it will remain SET. Once a step is complete, the focus is on the next step and that step only.*

On the Edit Preset Entry dialog, select one of the six Output Functions. Set the preset value in engineering units if the signal has been scaled. Set the preset value in raw count if the signal has not been scaled. We discuss scaling elsewhere in this chapter. Pulse ON and Pulse OFF require a Pulse Time setting.



The Pulse Time is set in ms (1,000 ms = 1 sec). For a description of the Output Functions see page 5-6.

To set a particular table as the default table, use the Default Output Settings dialog described on page 5-6.

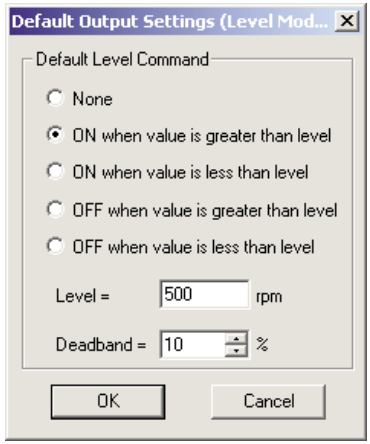


Using the Discrete Outputs in Level Mode

If a Counter or Timer function is scaled to produce a rate, alarm level settings can be used to trigger discrete outputs at values predetermined by the user.

Click the Level button on the Configure I/O dialog. This will open the Default Output Settings (Level Mode)dialog.

The alarm level is set within the Default Output Settings (Level Mode) dialog.

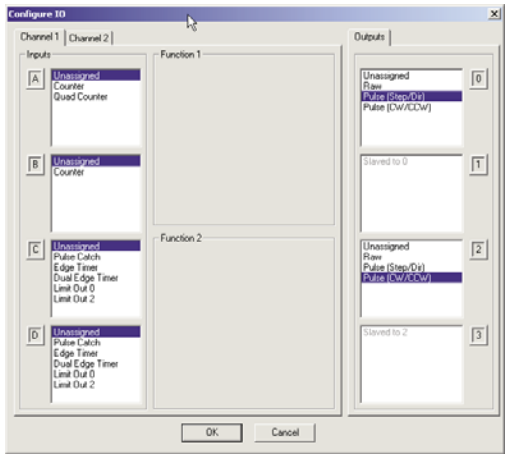


Also, a deadband percentage (in tenths of a percent) can be set to prevent the output from changing too frequently (chattering) near the Rate Level threshold.

"ON when greater" condition example:
Consider a Discrete Output set to turn ON when a level gets to 500 rpm with a 10% deadband. The output will turn ON when the level gets to 100. If the level drops, the output will stay on until the level drops below 450 rpm, where it will turn OFF.

"OFF when less" condition example:
Consider a Discrete Output set to turn "OFF when less"at 500. When the level gets to 500, the output turns OFF. If the level rises again, the output will stay OFF until the level gets to 550, where it will turn ON.

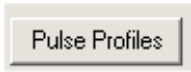
Pulse Outputs



The CTRIO module offers up to two axes of motion control (Y0 and Y1 as an axis and/or Y2 and Y3 as an axis). The H0-CTRIO has one axis of motion control (Y0 and Y1). The outputs can be configured for CW/CCW, or step and direction operation. The outputs respond to profiles defined by the user and called by the user control program. The following pulse profiles are supported:

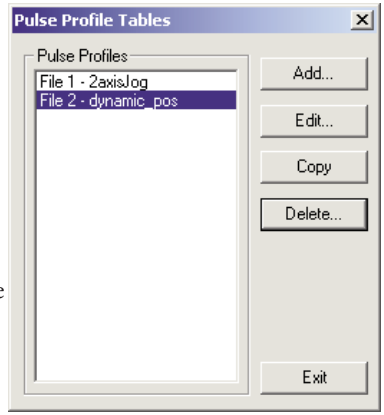
- Trapezoid
- S-Curve
- Symetrical S-Curve
- Dynamic Positioning
- Dynamic Velocity
- Home Search

There are three additional pulse profiles that are available to use that are not created using the Pulse Ouput Profiles Tables. These profiles: Velocity Mode, Run to Limit Mode and Run to Position Mode are discussed at the end of this chapter.

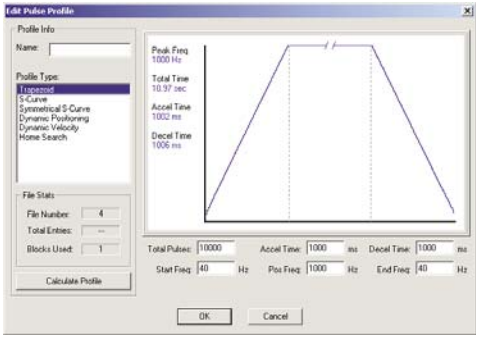


Creating Pulse Output Profile Tables

To create Pulse profiles, click the Pulse Profiles button on the main Workbench dialog. This will open the Pulse Profiles Tables dialog. To create a new profile, click Add (or Edit). This will open the Edit Pulse Profile dialog.

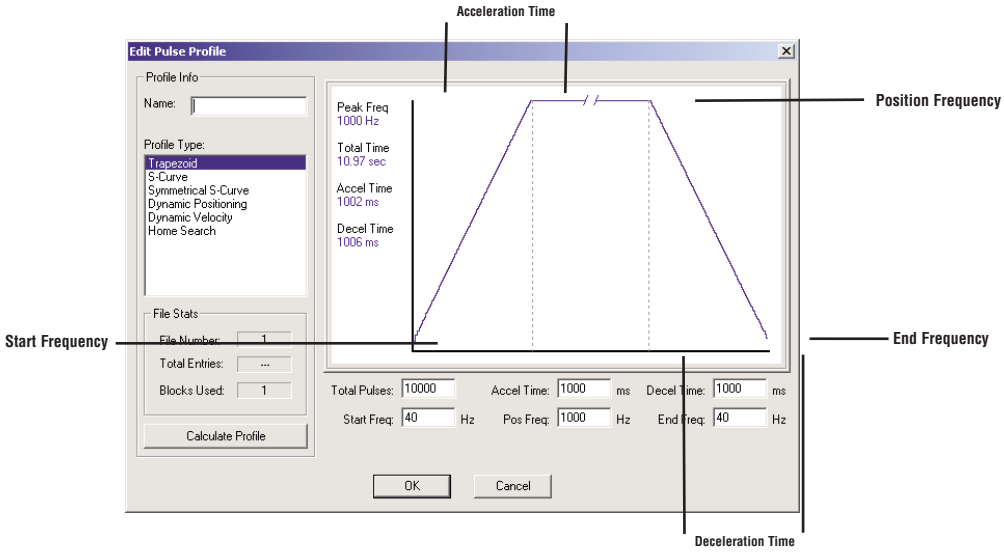


On the Edit Pulse Profile dialog, select one of the six Pulse Profile Types.This dialog is used to name and define the pulse profile parameters. The various parameter fields contain typical default values. Workbench will disallow any invalid parametrer entries.



Trapezoidal Profile

The Trapezoidal profile changes the velocity in a linear fashion from the specified Start Frequency until the specified target Position Frequency is reached. During decelerating, the velocity changes in a linear fashion from the specified Position Frequency until the specified End Frequency and Total Pulses is reached.



Total Pulses: The total amount of output pulses that will be generated during the Trapezoidal profile.

Accel Time: The amount of time required for the Start Frequency to ramp up the Position Frequency.

Decel Time: The amount of time required for the Position Frequency to ramp down to the End Frequency.

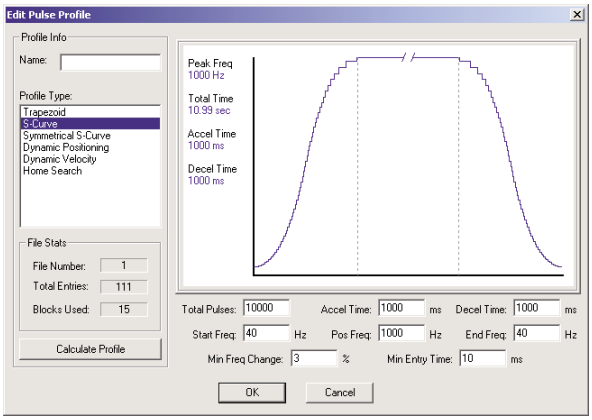
Start Freq: The frequency at which the Trapezoidal profile will begin.

Pos Freq: The target frequency to which the Start Frequency rises.

End Freq: The frequency to which the Position Frequency falls.

S-Curve Profile

The S-Curve profile can be used for applications that are sensitive to sudden changes in position or velocity, resulting with vibrations or jerky reactions. The S-Curve profile provides more controlled acceleration and deceleration periods than the Trapezoidal profile by increasing the transistion times.



Total Pulses: The total amount of output pulses that will be generated during the Trapezoidal profile.

Accel Time: The amount of time required for the Start Frequency to ramp up the Position Frequency.

Decel Time: The amount of time required for the Position Frequency to ramp down to the End Frequency.

Start Freq: The frequency at which the Trapezoidal profile will begin.

Pos Freq: The target frequency to which the Start Frequency rises.

End Freq: The frequency to which the Position Frequency falls.

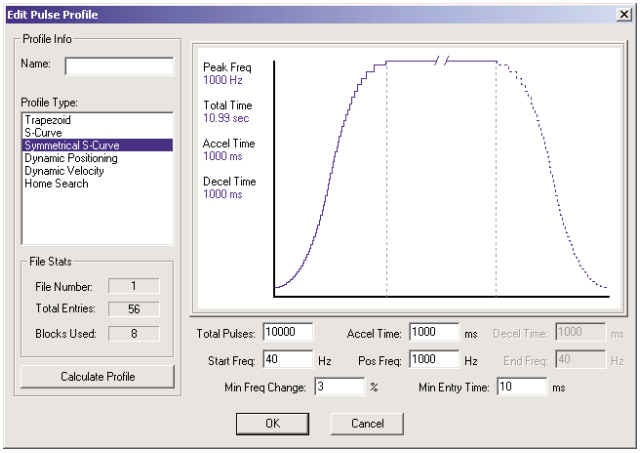
Min Freq Change: The amount of calculated frequency change that must take place before stepping to the next frequency.

Min Entry Time: The amount of time spent in each step.

Symmetrical S-Curve Profile

The Symmetrical S-Curve profile can also be used for applications that are sensitive to sudden changes in position or velocity, resulting with vibrations or jerky reactions. The Symmetrical S-Curve provides more controlled acceleration and deceleration periods than a Trapezoidal profile by increasing the transistion times.

The S-Curve and Symmetrical S-Curve profiles differ in that the Symmetrical S-Curve has symmetrical acceleration and deceleration profiles. The Decel Time and End Frequency are determined by the Accel Time and Start Frequency. The Symmetrical S-Curve uses less memory than the S-Curve profile.



Total Pulses: The total amount of output pulses that will be generated during the Trapezoidal profile.

Accel Time: The amount of time required for the Start Frequency to ramp up the Position Frequency. This also represents the deceleration time.

Start Freq: The frequency at which the Trapezoidal profile will begin. This also represents the end frequency.

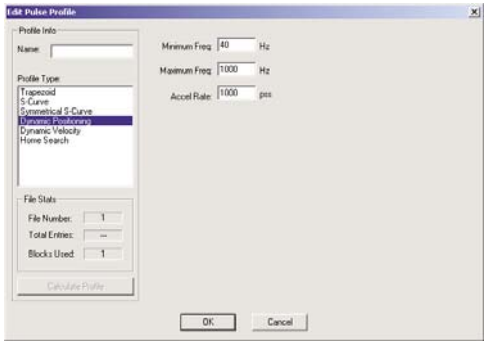
Pos Freq: The target frequency to which the Start Frequency rises.

Min Freq Change: The amount of calculated frequency change that must take place before stepping to the next frequency

Min Entry Time: The amount of time spent in each step.

Dynamic Positioning Profile

The Dynamic Positioning profile is a trapezoidal profile with identical acceleration/deceleration rates and identical starting/stoping frequencies. The maximum target frequency is specified. The target position (# of output pulses) is located in a memory register in the CPU/controller. Once the position is reached, the output is disabled and a new target position can be specified in the memory register.



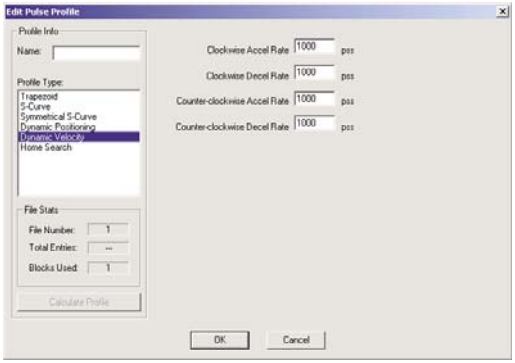
Accel Rate: The rate at which the Minimum Frequency will to ramp up the Maximum Frequency. This sets the deceleration rate as well.

Minimum Freq: The frequency at which the profile will begin.

Maximum Freq: The target frequency to which the Minimum Frequency rises.

Dynamic Velocity Profile

The Dynamic Velocity profile is a trapezoidal profile with the direction acceleration and deceleration rates specified. The target velocity is located in a memory register in the CPU/controller. Once the CPU/controller initiates the profile, output pulses will be generated at the target velocity until the CPU/controller disables the output pulses.



Clockwise Accel Rate: The clockwise rate at which the output will ramp up from 0pss to the target velocity that is specified in the CPU/controller memory register.

Clockwise Decel Rate: The clockwise rate at which the output will ramp down from the target velocity that is specified in the CPU/controller memory register to 0pss.

Counter-Clockwise Accel Rate: The counter-clockwise rate at which the output will ramp up from 0pss to the target velocity that is specified in the CPU/controller memory register.

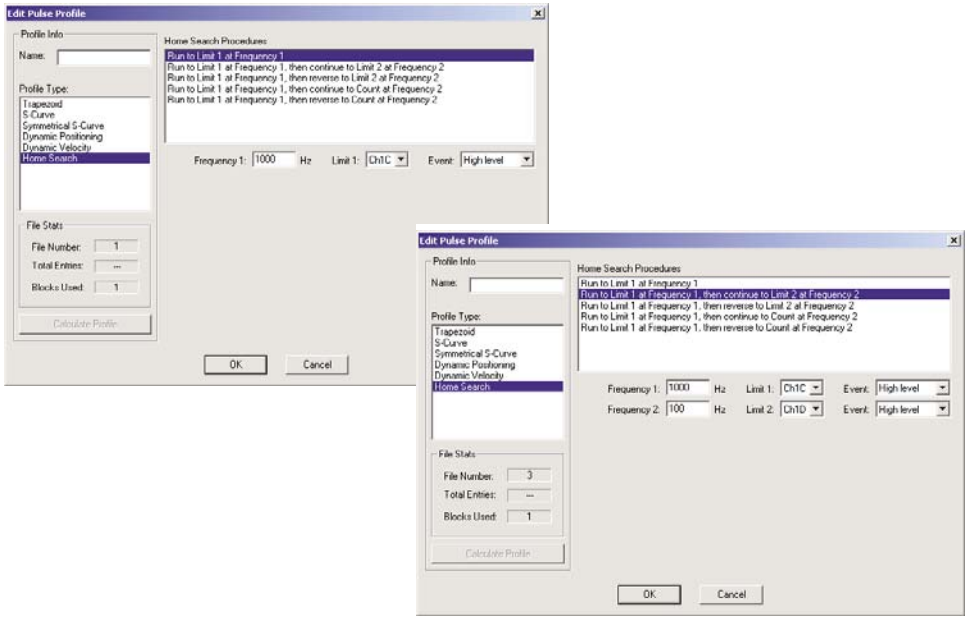
Counter-Clockwise Decel Rate: The counter-clockwise rate at which the output will ramp down from the target velocity that is specified in the CPU/controller memory register to 0pss.

Home Search Profile

The Home Search profile is used to "*find the home position*", which is usually a reference point to which the object being moved can return upon command at any time during or after the execution of a positioning profile.

There are several Home Search routines to choose from, all with the option to designate whether you want Limit 1 and/or Limit 2 (a CTRIO discrete input) to register on the rising edge, falling edge, high level or low level signal. Limit 1 and Limit 2 can be the opposite edges of the same physical CTRIO input.

NOTE: *The Home Search profile requires that CTRIO inputs C and/or D are configured for Limit Out 0 or Limit 2. This is done using the Configure I/O dialog.*



Frequency 1: The frequency at which the Home Search will begin.

Limit 1: Home Search Frequency 1 will run to CTRIO input Limit 1 and stop unless Frequency 2 is enabled.

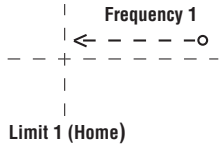
Frequency 2: (if enabled) Once Limit 1 is reached, the pulse output will continue at Frequency 2 until CTRIO Limit 2 is reached or pulse Count is reached at Frequency 2.

Limit 2: (if enabled) Home Search Frequency 2 will run to CTRIO input Limit 2 and stop.

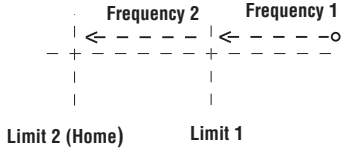
Count: (if enabled) The number of output pulse counts generated at Frequency 2 before terminating.

Home Search Routines

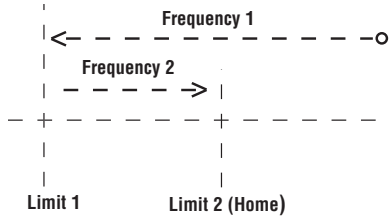
1. Run to Limit 1 at Frequency 1.



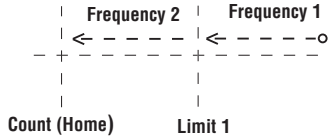
2. Run to Limit 1 at Frequency 1, then continue to Limit 2 at Frequency 2.



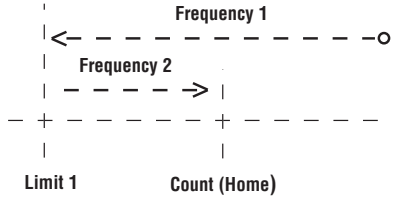
3. Run to Limit 1 at Frequency 1, then reverse to Limit 2 at Frequency 2.



4. Run to Limit 1 at Frequency 1, then continue to Count at Frequency 2.



5. Run to Limit 1 at Frequency 1, then reverse to Count at Frequency 2.



Additional Pulse Profiles

Three additional pulse profiles are available to use that are *not* defined or created using the Pulse Profiles Table dialog, however the output(s) must be configured for Pulse (Step/Direction) or Pulse (CW/CCW) using the Configure I/O dialog. The profile parameters are stored in the CPU/controller memory registers. The profiles are briefly described below and will be discussed in detail in Chapter 6. With all three profiles, the output is a step response output to the specified target frequency, thus no acceleration/deceleration parameters are configured.

Velocity Mode: User specifies the target frequency, pulse train duty cycle and the step count. Once initiated, the output will begin pulsing at the target frequency and continue until the step count is reached. With a step count of 0xFFFFFFFF, the pulse output will continue indefinetly until the control program disables the output.

Run to Limit Mode: User specifies target frequency and pulse train duty cycle. A CTRIO module input (C or D) must be configured as a Limit input. When the Limit is reached the pulse output is disabled.

Run to Position Mode: User specifies target frequency, pulse train duty cycle and target position. The current position is obtained from the specified Input Function (i.e. Quadrature counter). When the current position reaches the specified target position, the pulse output is disabled. The comparing of the current and target position can be based on “greater than or equal to” or “less than” values.