# Output Functions

## In This Chapter...

Runtime Changes to CTRIO Configured Preset Tables (DL PLCs) ..... 9–2
Pulse Output Profiles (DL PLCs) ..... 9–5
Trapezoid Profile ..... 9–6
S-Curve Profile ..... 9–7
Symmetrical S-Curve Profile ..... 9–8
Home Search Profile ..... 9–9
Free Form Profile ..... 9–12
Pulse Output Status/Control Bits and Command Codes (DL PLCs) ..... 9–13
*Direct*LOGIC Programming Examples Overview ..... 9–19
Trapezoid with Limits Profile ..... 9–20
Trapezoid with Limits (CTRIO2) Profile ..... 9–21
Pulse Output Status/Control Bits and Command Codes (DL PLCs) ..... 9–24
Trapezoid Plus (CTRIO2) Profile ..... 9–28
Pulse Output Status/Control Bits and Command Codes (DL PLCs) ..... 9–30
Load and Run a Trapezoid Plus Profile ..... 9–33
Dynamic Positioning Plus and Dynamic Positioning Profiles ..... 9–34
Dynamic Positioning Plus (CTRIO2) Profile ..... 9–35
Pulse Output Status/Control Bits and Command Codes (DL PLCs) ..... 9–36
Dynamic Velocity Profile ..... 9–42
Pulse Output Status/Control Bits and Command Codes (DL PLCs) ..... 9–43
Velocity Mode ..... 9–48
Pulse Output Status/Control Bits and Command Codes (DL PLCs) ..... 9–49

Run to Limit Mode ..... 9–54
Pulse Output Status/Control Bits and Command Codes (DL PLCs) ..... 9–55
Run to Position Mode ..... 9–61
Pulse Output Status/Control Bits and Command Codes (DL PLCs) ..... 9–62
Run to Position Mode with DirectSOFT IBox Instructions ..... 9–67
Raw Output ..... 9–69
Pulse Output Status/Control Bits and Command Codes (DL PLCs) ..... 9–70

# Runtime Changes to CTRIO Configured Preset Tables (DL PLCs)

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Presets and preset tables can be set up entirely within CTRIO Workbench so that no program control is necessary to assign discrete Preset Tables to CTRIO Input Functions.

You can make runtime edits to presets/preset tables from your control program. To make a runtime change, a series of commands must be executed which will pass new values to a preset table or call a different pre-configured table.

Command Codes are passed to the CTRIO(2) module to effect the required edit. Each Command Code has its own syntax, and all Command Codes must be presented in a particular sequence:

- The command code and associated parameters must be loaded into the appropriate memory locations.
- A Process Command instruction must be passed to the CTRIO(2) module.
- A Command Complete signal must be received and the Command Error bit must stay at zero.
- Finally, the Enable Output instruction must be passed to the CTRIO(2) module.

Some changes require a combination of Command Codes so those changes must follow the steps above for each Command Code processed (Output Control and Status Offsets are listed in order of Output 0 - Output 3).

| Control Bit (Transfers from CPU to CTRIO(2)) | Bit Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets DirectLOGIC PLCs |
|---|---|---|
| Enable Output | 32, 40, 48, 56 | 26.0, 26.8, 27.0, 27.8 |
| Process Command | 39, 47, 55, 63 | 26.7, 26.15, 27.7, 27.15 |

| Status Bit (Transfers from CTRIO(2) to CPU) | Bit Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets DirectLOGIC PLCs |
|---|---|---|
| Command Error | 38, 46, 54, 62 | 22.6, 22.14, 23.6, 23.14 |
| Command Complete | 39, 47, 55, 63 | 22.7, 22.15, 23.7, 23.15 |

In order to process a command, first the program must load the Command and Required Word and DWord Parameters. Then the program should turn ON the Process Command bit and look for the CTRIO(2) module to acknowledge the command with the Command Complete bit. Finally the program should reset the Process Command bit and set the Enable Output bit when appropriate. If the Command Error bit is received, the CTRIO(2) module was unable to process the command due to an illegal value in either the Command Code or Parameter fields.

| Word Control CPU to CTRIO(2) | Word Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) |
|---|---|---|
| Command Code | 0, 6 | 10, 16 |
| Word Parameter 1 | 1, 7 | 11, 17 |
| Word Parameter 2 | 2, 8 | 12, 20 |
| DWord Parameter 3 | 0, 2 | 0, 4 |

| Command | See Topic in Manual | Code (hex) | Parameter 1 (Word) | Parameter 2 (Word) | Parameter 3 (Word) |
|---|---|---|---|---|---|
| *Direct*LOGIC n+10 | | | *Direct*LOGIC n+11 | *Direct*LOGIC n+12 | *Direct*LOGIC n+0/n+1 |
| Load File | **Load Table**, Load a Pulse Profile (Trapezoid, S-Curve, Symmetrical S-Curve, Home Search, Free Form) | 10 | File No. (decimal) | N/A | N/A |
| Load File | Trapezoid with Limits | 10 | File No. (decimal) | N/A | Stop Position, Optional (decimal) |
| Load File | Trapezoid Plus | 10 | File No. (decimal) | N/A | Target Position (decimal) |
| Load File | Dynamic Positioning, Dynamic Positioning Plus | 10 | File No. (decimal) | N/A | Target Position (decimal) |
| Load File | Dynamic Velocity | 10 | File No. (decimal) | N/A | Target Velocity (decimal) |
| Clear Preset Table | Clear Preset Table | 11 | N/A | N/A | N/A |
| Create Preset Table | Create Preset Table | 12 | Entry Type (decimal) | Pulse Time[1] | N/A |
| Add Table Entry[7] | Add Entry to Preset Table | 13 | Entry Type (decimal) | Pulse Time[1] | Preset Count[5] (decimal) |
| Edit Table Entry[7] | Edit Preset Table Entry | File No. &[2] 14 | Entry Number[3] &[2] Entry Type[4] (hex) | Pulse Time[1] (decimal) | Preset Count[5] (decimal) |
| Edit and Reload[7] | Edit Preset Table Entry and Reload | File No. &[2] 15 | Entry Number[3] &[2] Entry Type[4] (hex) | Pulse Time[1] (decimal) | Preset Count[5] (decimal) |
| Initialize Table on Reset[7] | Create Preset Table on Reset | 16 | Entry Type (decimal) | Pulse Time[1] (decimal) | N/A |
| Pulse at Velocity | Velocity Mode | 20 | Frequency (decimal) | Duty Cycle (decimal) | Number of Pulses |

[1] If appropriate for Entry Type (in ms).

[2] Field entries separated by an "&" are to be loaded in the high byte and low byte of that word. See example on page 9-15.

[3] Entry numbers are defined below.

[4] Entry types are defined below.

[5] Follows format of Input DWord Parameter 1.

[6] Flash ROM is rated for 100,000 writes.

[7] Counter/Quad Counter Reset must be ON to perform the Edit.

| Command | See Topic in Manual | Code (hex) | Parameter 1 (Word) | Parameter 2 (Word) | Parameter 3 (Word) |
|---|---|---|---|---|---|
| *Direct*LOGIC n+10 | | | *Direct*LOGIC n+11 | *Direct*LOGIC n+12 | *Direct*LOGIC n+0/n+1 |
| Run to Limit | Run to Limit | 21 | Frequency (decimal) | Input /Edge &[2] Duty Cycle (0 - 99)* (Hex/BCD) | N/A |
| Run to Position[7] | Run to Position | 22 | Frequency (decimal) | Function (hex) & Duty Cycle | Target Position (decimal) |
| Edit Level Response[7] | Update Level | 30 | Function (hex) | Deadband (decimal) | Scaled Level (decimal) |
| Write RAM to ROM[7] | Write File to ROM | 99[6] | N/A | N/A | N/A |

* A value of 0 will generate a duty cycle of 50%.

[1] If appropriate for Entry Type (in ms).

[2] Field entries separated by an "&" are to be loaded in the high byte and low byte of that word. See example on page 9-15.

[3] Entry numbers are defined below.

[4] Entry types are defined below.

[5] Follows format of Input DWord Parameter 1.

[6] Flash ROM is rated for 100,000 writes.

[7] Counter/Quad Counter Reset must be ON to perform the Edit.

## Entry Number for Edit Table Entry Commands

The Entry Number refers to the position of the preset in the table sequence. The first preset is Entry Number 0, the second preset is 1 and so forth.

## Entry Type for Edit Table Entry Commands

The Entry Type is defined according to the table below.

| Entry Type | Code | Notes |
|---|---|---|
| Write Output ON (Set) | 0 | - |
| Write Output OFF (Reset) | 1 | - |
| Pulse Output ON | 2 | - |
| Pulse Output OFF | 3 | - |
| Toggle Output | 4 | - |
| Reset Function | 5 | Edits preset that resets count |

# Pulse Output Profiles (DL PLCs)

The two charts below summarize the capabilities and requirements of the various Pulse Output Profiles. Information on each is found in this chapter.

| Options | Position Source | Change target position on the fly | Accel/decel ramps | Maximum pulse rate | Encoder Feedback Possible | Requires CTRIO2 | See Page(s) |
|---|---|---|---|---|---|---|---|
| Dynamic Positioning Plus | From controller | Yes | Specify separately | 250kHz | Yes | Yes | 9-34 |
| Trapezoid Plus | | | | | | | 9-28 |
| Dynamic Positioning | | No | One setting for both | 65kHz[1] | No | No | 9-34 |
| S-Curve | Hard-coded in pulse profile | No | Specify separately | | | | 9-7 |
| Symmetrical S-Curve | | | One setting for both | | | | 9-8 |
| Trapezoid | | | Specify separately | | | | 9-6 |
| Free Form | | | None | | | | 9-12 |

[1] *The older CTRIO outputs can only achieve 25kHz maximum. CTRIO2 outputs are limited to 65kHz when using these profiles.*

| Profile | Accel and Decel Ramps | Creep to second limit or position | Change velocity manually on the fly | Multiple limits or triggers on a single home search | Single input can act as multiple triggers | Profile defined in CTRIO Workbench | Requires CTRIO2 | See Page(s) |
|---|---|---|---|---|---|---|---|---|
| Trapezoid with Limits | Yes | Yes | No | Yes | Yes | Yes | Yes | 9-21 |
| Home Search | No | No | | | No | | No | 9-9 |
| Run to Limit | | | Yes | No | | No | | 9-54 |

## Fixed, Predefined Profiles

Trapezoid, S-Curve, Symmetrical S-Curve, Home Search and Free Form profiles are the most basic. The parameters for these profiles are defined in CTRIO Workbench and cannot be changed programmatically.

# Trapezoid Profile

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

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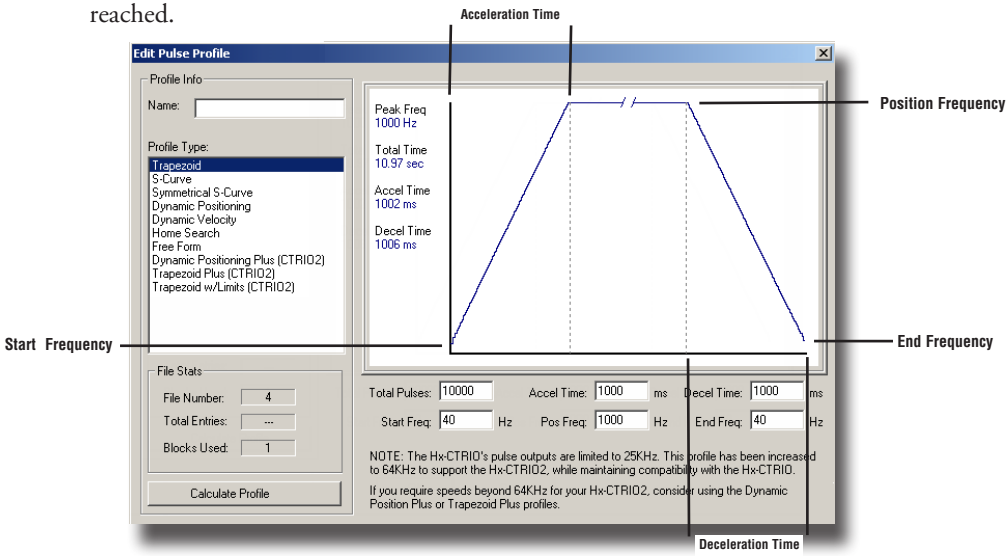


- **Total Pulses:** The total number of output pulses that will be generated during the Trapezoid profile.
- **Accel Time:** The amount of time required for the Start Frequency to ramp up to the Position Frequency.
- **Decel Time:** The amount of time required for the Position Frequency to ramp down to the End Frequency.
- **Start Freq:** The frequency at which the Trapezoid profile will begin.
- **Pos Freq:** The maximum steady state frequency the profile can attain during a move.
- **End Freq:** The lowest Frequency of movement during deceleration. The Frequency drops to zero upon reaching this value.

# S-Curve Profile

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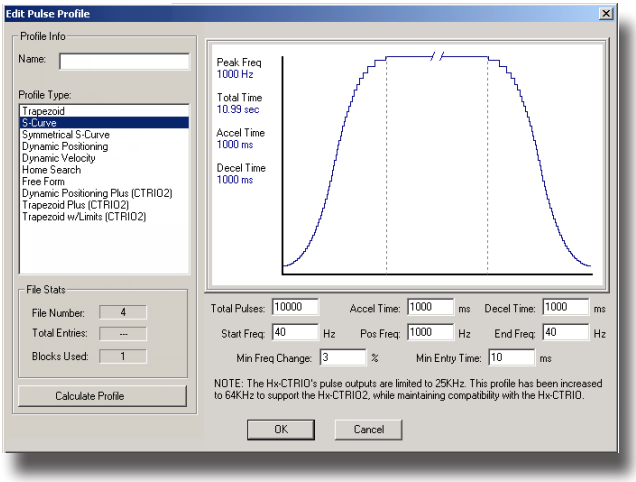
The S-Curve profile can be used for applications that are sensitive to sudden changes in the rate of acceleration.




- **Total Pulses:** The total number of output pulses that will be generated during the S-Curve 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 S-Curve profile will begin.
- **Pos Freq:** The maximum steady state frequency the profile can attain during a move.
- **End Freq:** The lowest Frequency of movement during deceleration. The Frequency drops to zero upon reaching this value.
- **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 the rate of acceleration.

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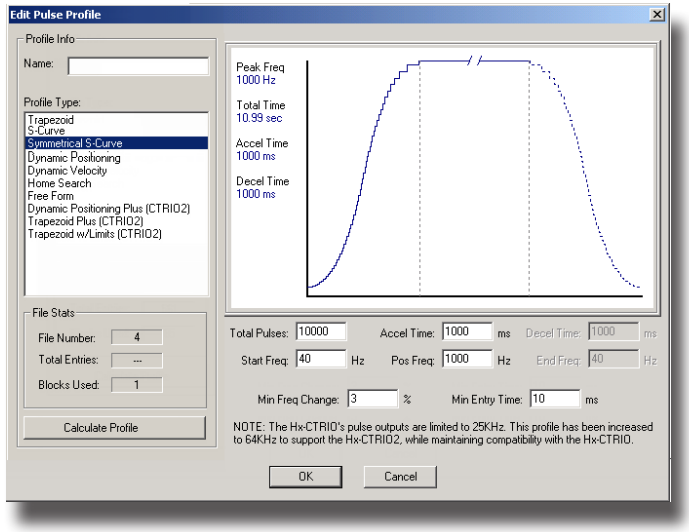
The S-Curve and Symmetrical S-Curve profiles differ in that the Symmetrical S-Curve has symmetrical acceleration and deceleration profiles. The Decel Time and End Frequency are determined by the Accel Time and Start Frequency. The Symmetrical S-Curve uses less memory than the S-Curve profile.




- **Total Pulses:** The total number of output pulses that will be generated during the Symmetrical S-Curve 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 Symmetrical S-Curve profile will begin. This also represents the End Frequency.
- **Pos Freq:** The maximum steady state frequency the profile can attain during a move.
- **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.

# Home Search Profile

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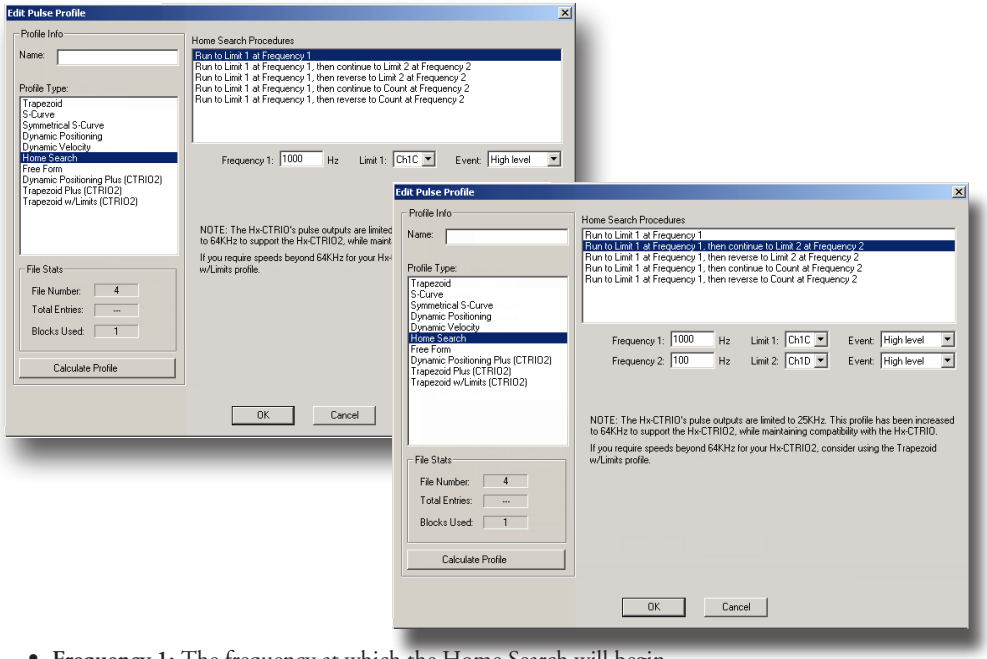
The Home Search profile is used to "*find the home position*", which is usually a reference point to which the object being moved can return upon command at any time during or after the execution of a positioning profile.

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(2) 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(2) input.

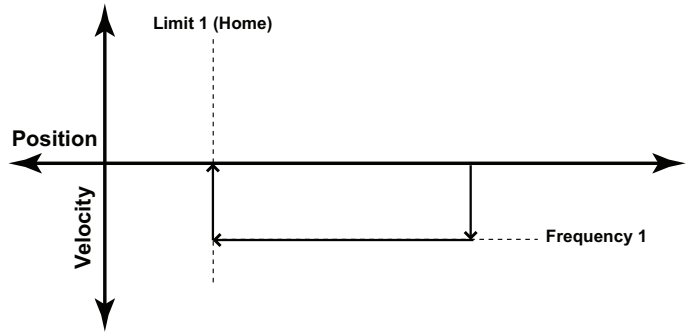
***NOTE:*** *The Home Search profile requires that CTRIO(2) inputs C and/or D are configured for Limit Out 0 or Limit 2. This is done using the Configure IO dialog.*



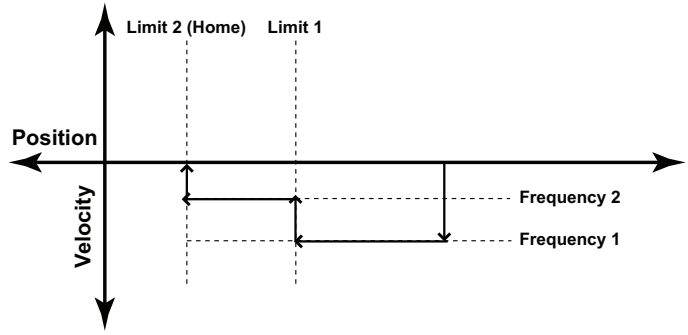

- **Frequency 1:** The frequency at which the Home Search will begin.
- **Limit 1:** Home Search Frequency 1 will run to CTRIO(2) input Limit 1 and stop unless Frequency 2 is enabled.
- **Frequency 2:** (if enabled) Once Limit 1 is reached, the pulse output will continue at Frequency 2 until CTRIO(2) Limit 2 is reached or pulse Count is reached at Frequency 2.
- **Limit 2:** (if enabled) Home Search Frequency 2 will run to CTRIO(2) input Limit 2 and stop.
- **Count:** (if enabled) The number of output pulse counts generated at Frequency 2 before terminating.
- **Event:** Specifies the condition that will terminate this leg of the Home Search.

## Home Search Routines

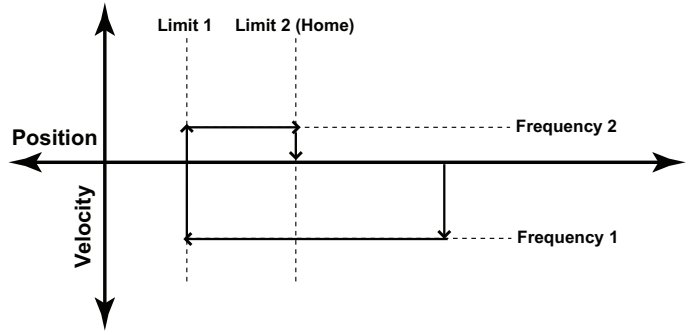
1: Run to Limit 1 at Frequency 1.



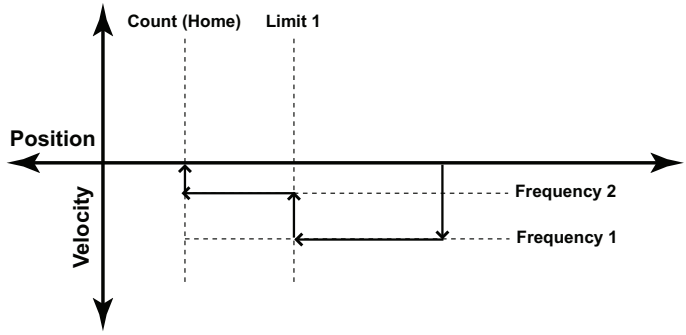

2: Run to Limit 1 at Frequency 1, then continue to Limit 2 at Frequency 2.



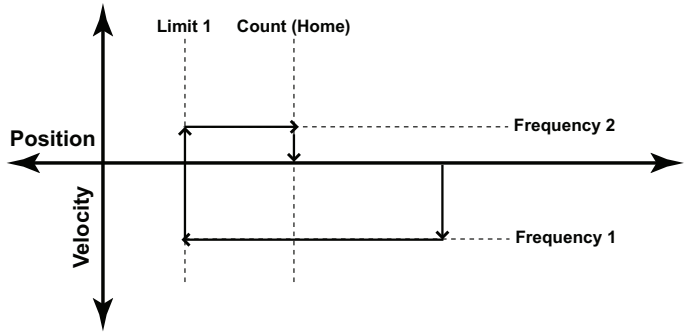

3: Run to Limit 1 at Frequency 1, then reverse to Limit 2 at Frequency 2.



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.



# Free Form Profile

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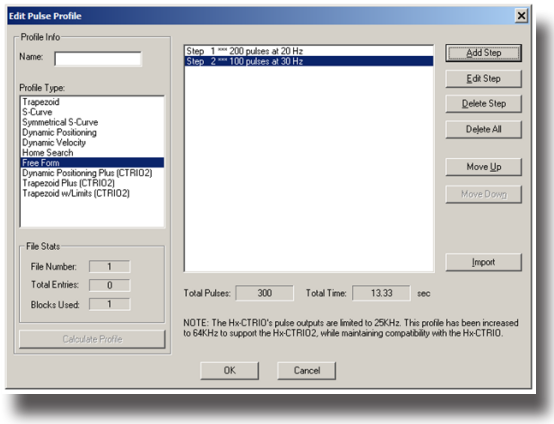
The Free Form profile allows for stepping between output frequencies with no acceleration or deceleration ramps. Profiles, up to 256 steps, can be imported from a CSV file.




**Total Pulses:** Provided by the utility, the total number of output pulses that will be generated during the profile.

**Total Time:** The total time required for the profile to run to completion.

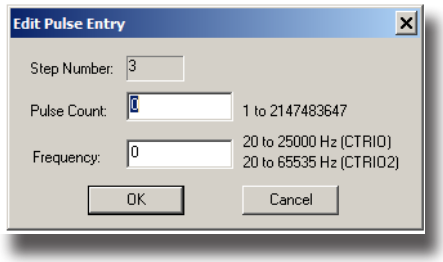
**Import:** Opens a dialog that allows importing a CSV file. Importing the CSV replaces the existing entries. The contents of a CSV file used to create the profile seen above would appear like this:

200,20

100,30

**Add or Edit Step:** Will invoke the Edit Pulse Entry dialog above. This window will allow you to modify or create pulse entries.

- Pulse Count: The number of pulses to generate for this step.
- Frequency: The frequency of pulses during this step.



# Pulse Output Status/Control Bits and Command Codes (DL PLCs)

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## Output Status Bit Definitions (Pulse Output)

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

| Status Bit CTRIO(2) to CPU | Bit Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Input Start (octal) |
|---|---|---|
| Output Enabled | 32, 48 | 22.0, 23.0 |
| Position Loaded | 33, 49 | 22.1, 23.1 |
| Output Suspended | 34, 50 | 22.2, 23.2 |
| Output Active | 36, 52 | 22.4, 23.4 |
| Output Stalled | 37, 53 | 22.5, 23.5 |
| Command Error | 38, 54 | 22.6, 23.6 |
| Command Complete | 39, 55 | 22.7, 23.7 |

## Output Control Bit Definitions (Pulse Output)

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

| Control Bit CPU to CTRIO(2) | Bit Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) | Read as: |
|---|---|---|---|
| Enable Output | 32, 48 | 26.0, 27.0 | Level |
| Go to Position | 33, 49 | 26.1, 27.1 | Rising Edge |
| Suspend Output | 34, 50 | 26.2, 27.2 | Level |
| Direction | 36, 52 | 26.4, 27.4 | Level |
| Process Command | 39, 55 | 26.7, 27.7 | Rising Edge |

## Output Control (D)Words (Pulse Output)

| Word Control CPU to CTRIO(2) | Word Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) |
|---|---|---|
| Command Code | 0, 6 | 10, 16 |
| Word Parameter 1 | 1, 7 | 11, 17 |
| Word Parameter 2 | 2, 8 | 12, 20 |

| DWord Control CPU to CTRIO(2) | Word Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) |
|---|---|---|
| DWord Parameter 3 | 0, 2 | 0, 4 |

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

## Trapezoid, S-Curve, Symmetrical S-Curve, Home Search, Free Form Profiles

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For predefined Trapezoid, S-Curve, Symmetrical S-Curve, Home Search and Free Form profiles, the program must prepare the Load Table command (see table on next page), by selecting Command Code = 0010 Hex/BCD and setting Word Parameter 1 to the File number of the profile (example: File 1 Trapezoid 1). Then the program sets the process **Command** bit and watches for the **Command Complete** bit. Then the program will clear the process **Command** bit and set the **Direction** bit (if necessary) and finally the **Enable Output** bit to start the output pulses.

Clearing the **Enable Output** bit will always suspend pulsing and reset any profile in progress to it's beginning. Once complete, the profile remains loaded and can be restarted by clearing the **Enable Output**, changing the **Direction** bit (if desired), and again setting the **Enable Output**.

For the Home Search routine, a CTRIO(2) input must be assigned to Limit by the CTRIO Workbench *Configure I/O* dialog.

***NOTE:*** *For a Home Search Profile, if you are at the home position and the Home Search profile is initiated, there will not be any pulse outputs.*

A Pulse Profile programming example, that loads and runs a pulse profile implementing the bit/(D)Word addressing suggested in the table on the page 9-16, is discussed in pages following.

## Command Code and Parameter Definitions

| Command | Code (Hex/BCD) | Word Parameter 1 (decimal) | Word Parameter 2 | DWord Parameter 3 |
|---|---|---|---|---|
| Load File from ROM | 10 | File Number<br>Trapezoid or S-curve<br>Symmetrical S-Curve<br>Home Search | N/A | N/A |
| Load File from ROM | 10 | File Number<br>Dynamic Positioning | | Target Position (decimal) |
| Load File from ROM | 10 | File Number<br>Dynamic Velocity | | Target Velocity (decimal) |
| Velocity Mode | 20 | Run Frequency<br>(CTRIO: 20Hz - 25KHz<br>CTRIO2: 20Hz - 64KHz) | Duty Cycle (0 to 99)*<br>(decimal) | Number of Pulses (decimal) |
| Run to Limit Mode | 21 | Run Frequency<br>(CTRIO: 20Hz - 25KHz<br>CTRIO2: 20Hz - 64KHz) | Input / Edge &<br>Duty Cycle (0 to 99)*<br>(Hex/BCD) | N/A |
| Run to Position Mode | 22 | Run Frequency<br>(CTRIO: 20Hz - 25KHz<br>CTRIO2: 20Hz - 64KHz) | Compare Function &<br>Duty Cycle (0 to 99)*<br>(Hex/BCD) | Desired Input Function Value<br>(decimal) |

* A value of 0 will generate a duty cycle of 50%

Where the fields of the Parameters in the table above are separated by an "&" character, this indicates a code with different definitions for each byte (high byte and low byte). For example, to enter the **Pulse Output to Limit** command, set the high byte of the *Word Parameter 2* to the Edge used to terminate the output pulses (see definition following), and set the low byte to the desired duty cycle.

In order to process a command, first the program must load the **Command Code** and required DWord, Word, and bit parameters (DWord and Word values for pulse outputs are unsigned integers). Then the program will turn ON the process **Command** bit and look for the CTRIO(2) module to acknowledge the command with the **Command Complete** bit. Finally, the program will reset the process **Command** bit and set the **Enable Output** bit when appropriate. If the **Command Error** bit is received, the CTRIO(2) module was unable to process the command due to an illegal value in either the **Command Code** or parameter files.

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## Running a Trapezoid, S-Curve, Symmetrical S-Curve Profile, Home Search or Free Form Profile on CTRIO(2) Y0 & Y1

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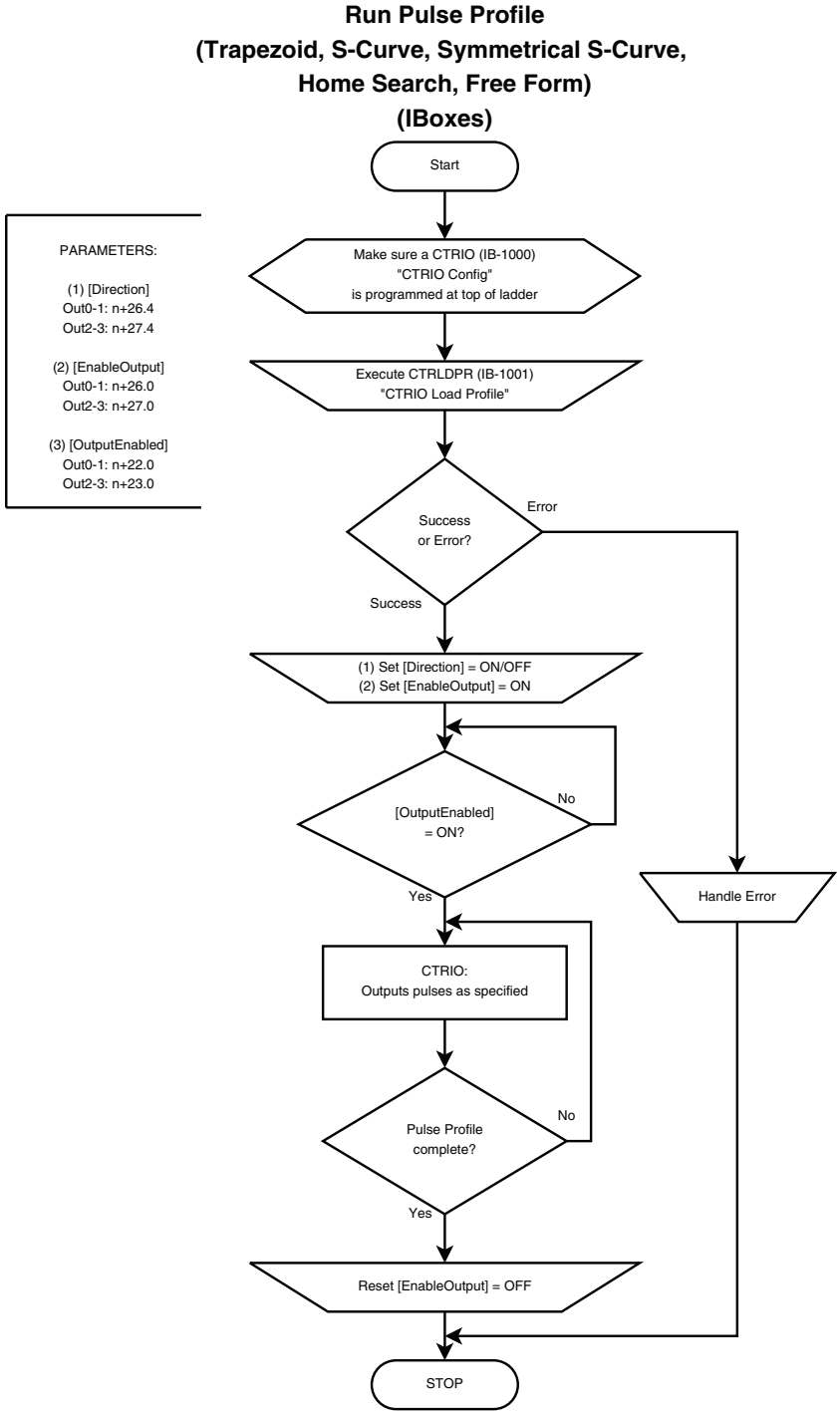
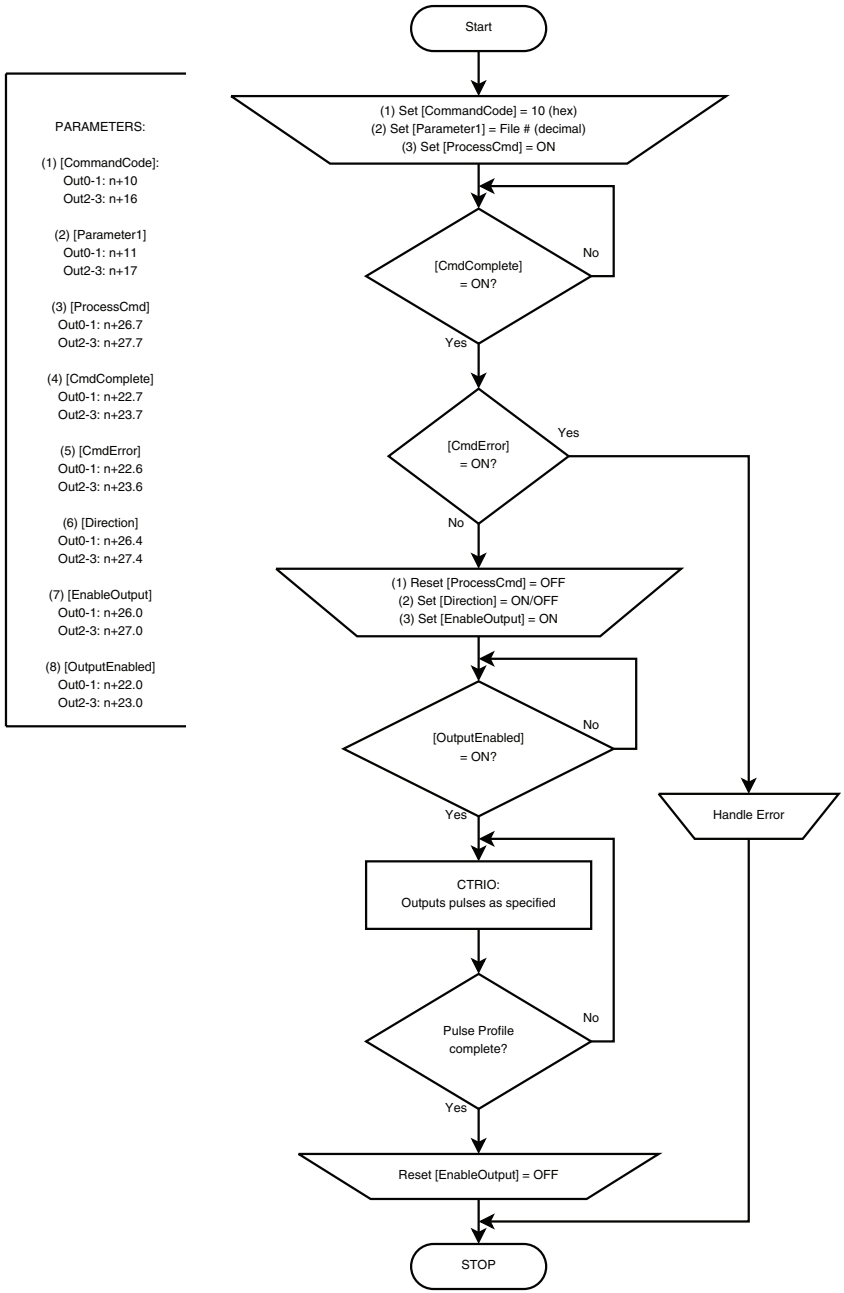
The required basic steps for a DL-PLC to run a Trapezoid, S-Curve, Symmetrical S-Curve profile, Home Search or Free Form profile are outlined in this table. The steps coordinate with the flow chart steps on page 9-21 (left hand side). Pulse Output Status/Control Bits are shown on the following page.

| Steps | Name | PLC Control Outputs Base Addr = V2030 (Bit-of-Word) | PLC Status Inputs Base Addr = V2000 (Bit-of-Word) | PLC Control Outputs Base Addr = V2030 (Control Relay) D2-240 | PLC Status Inputs Base Addr = V2000 (Control Relay) D2-240 | Action |
|---|---|---|---|---|---|---|
| 1 | Command Code | V2040 | N/A | V2040 | N/A | Set to 10 (Load Stored Profile) |
| 2 | Parameter 1 | V2041 | | V2041 | | File # of stored profile, determined by user |
| | Parameter 3 | V2031 - V2030 | | V2031 - V2030 | | Target Position: User Defined (DWord)<br>Target Position is only used with Trapezoid Plus and Trapezoid with Limits |
| 3 | Process Command | V2056.7 | | C227 | | Turn ON until Command Complete status bit is returned (see step 4) |
| 4 | Command Complete Status | N/A | V2022.7 | N/A | C127 | When ON, Profile is now loaded, clear Process Command bit (step 3) |
| 5 | Command Error | | V2022.6 | | C126 | ON if Command or Parameters are invalid |
| 6 | Set Direction | V2056.4 | N/A | C224 | N/A | Set ON or OFF for Direction of Rotation |
| 7 | Enable Output | V2056.0 | | C220 | | Turn ON to start pulses |
| 8 | Output Enable Status | N/A | V2022.0 | N/A | C120 | When ON, module is confirming Enable Output |
| 9 | Output Active Status | | V2022.4 | | C124 | When ON, module is pulsing, OFF with Enable Status ON = profile has completed |
| 10 | Disable Output | V2056.0 | N/A | C220 | N/A | Turn OFF when pulse status is OFF and Enable Status is ON |
| 11 | Suspend Output | V2056.2 | | C222 | | Turn ON to “pause” output pulses without resetting pulse count |
| 12 | Output Suspended | N/A | V2022.2 | N/A | C122 | ON when out pulse train has been suspended |


Run Pulse Profile
(Trapezoid, S-Curve, Symmetrical S-Curve,
Home Search, Free Form)
(IBoxes)
Start
PARAMETERS:
(1) [Direction]
Out0-1: n+26.4
Out2-3: n+27.4
(2) [EnableOutput]
Out0-1: n+26.0
Out2-3: n+27.0
(3) [OutputEnabled]
Out0-1: n+22.0
Out2-3: n+23.0
Make sure a CTRIO (IB-1000)
"CTRIO Config"
is programmed at top of ladder
Execute CTRLDPR (IB-1001)
"CTRIO Load Profile"
Success
or Error?
Error
Success
(1) Set [Direction] = ON/OFF
(2) Set [EnableOutput] = ON
[OutputEnabled]
= ON?
No
Yes
Handle Error
CTRIO:
Outputs pulses as specified
Pulse Profile
complete?
No
Yes
Reset [EnableOutput] = OFF
STOP

**Run Pulse Profile**
**(Trapezoid, S-Curve, Symmetrical S-Curve,**
**Home Search, Free Form)**
**(DL-PLC)**



# DirectLOGIC Programming Examples Overview

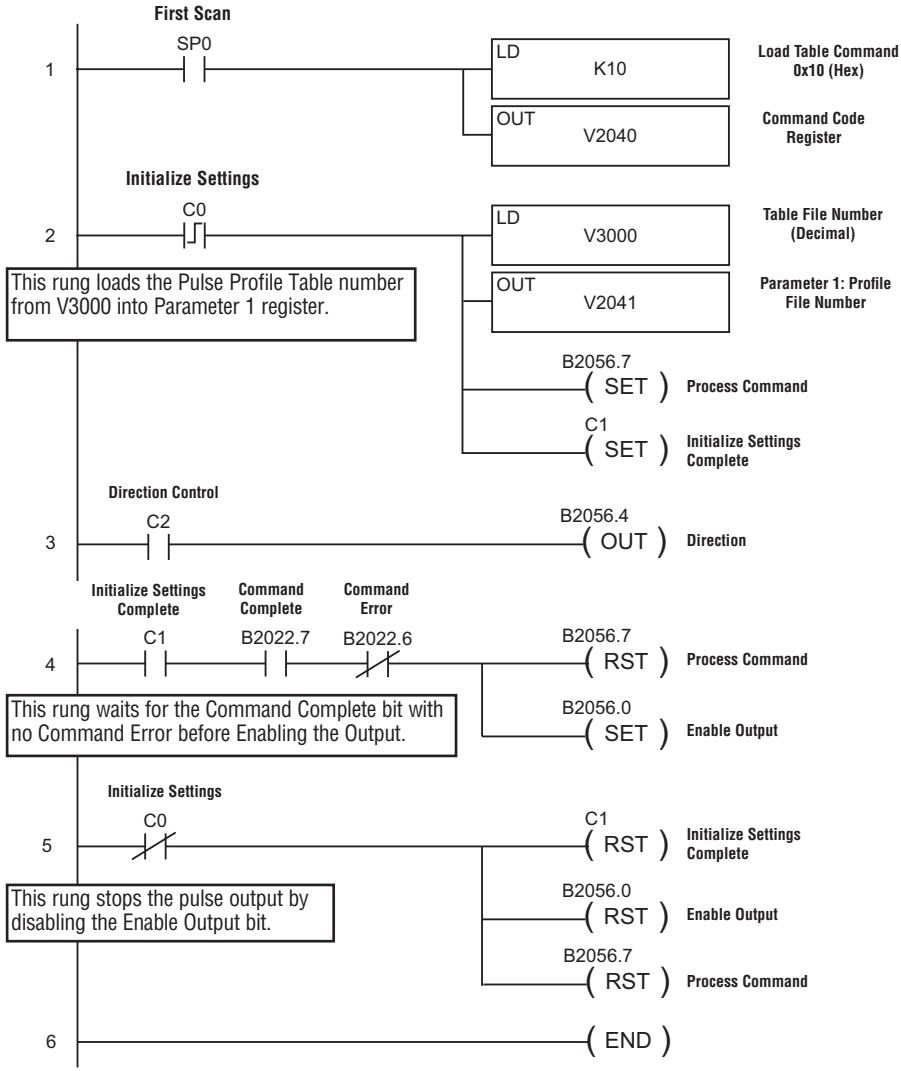
***NOTE:*** *The **Direct**SOFT programming examples provided on the following pages are simple examples that are intended to assist you in the basics of loading and running various output pulse profiles. The examples are complete enough to load a profile, process the command and load the Parameter registers necessary to execute the profile. Two System Functions examples are also provided.*

## Load and Run a Pulse Profile

☑ DL
☒ Win
☒ NI

Example: You will need to have a Trapezoid, S-Curve, Symmetrical S-Curve, Home Search or Free Form profile configured using the Configure I/O dialog. You will also need to have the appropriate Pulse Profile Table File Number (decimal) stored in V3000 for this example. You must turn C0 on to load and run the pulse profile. C2 controls the pulse output direction.

The example program on the following page loads and executes a Pulse Profile that was created using CTRIO Workbench Pulse Profiles dialog. This example can be used for Trapezoid, S-Curve, Symmetrical S-Curve, Home Search and Free Form profiles (Home Search requires that CTRIO inputs C and/or D are configured for Limit Out 0 and/or Limit Out 2). The Pulse Profile number is stored in V3000 for this example. Turning on C0 will load and run the pulse profile.




# Trapezoid with Limits Profile

Trapezoid with Limits is used for homing an axis by stopping a movement based on limit inputs tied to one or two input channels of the CTRIO2. Several combinations of input events are available to trigger the deceleration to the creep frequency and to trigger the actual stop. One of the possible stop triggers is position. If used, indicate the desired stop position in Parameter 3.

# Trapezoid with Limits (CTRIO2) Profile

☑ DL
☑ Win
☑ NI

Trapezoid with Limits (CTRIO2) profile is only available when using a CTRIO2 module. Trapezoid with Limits is a homing routine, typically used to find a hard reference point for the axis. There are other routines to home an axis, but this is typically the one to use. The profile is a homing routine similar to Home Search but has five additional features:

1. The profile is trapezoidal (has linear accel and decel rates), allowing for faster homing routines without stalling the stepper.
2. The profile can be asymmetrical. (Accel and Decel rates are separate)
3. Encoder Feedback can be added, useful for correcting excessive lash or slippage in the system.
4. Allows output rates up to 250kHz.
5. When Stop Trigger is position, it is a variable (parameter 3 in the output memory map), set by the base controller.

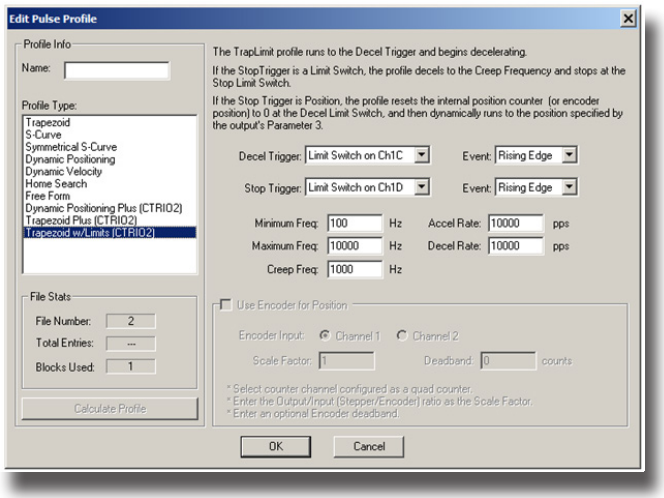
***NOTE:*** *When using an input channel as the Stop Trigger with this profile, the Stop Trigger must be beyond the first limit in the same direction. The output cannot change direction to reach the second limit. Use Home Search if the output must Reverse to Limit 2.*

This profile offers several routines using a Decel Trigger and Stop Trigger. Specify the Decel Trigger as the rising or falling edge of a CTRIO2 input. The Stop Trigger can be a position relative to the Decel Trigger, the opposite edge of the Decel Trigger or the rising or falling edge of another CTRIO2 input.

***NOTE:*** *This profile requires that CTRIO2 inputs C and/or D are configured for Limit Out X, where X is the output channel being used.*

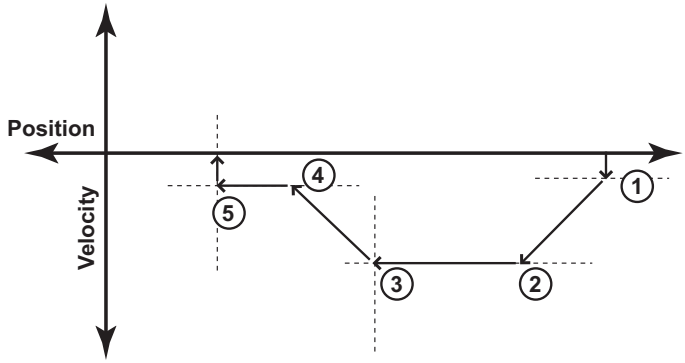
**Decel Trigger:** The CTRIO2 input used as the Decel Trigger. Hitting this limit during the move will either reset counts to 0 (if Stop Trigger is position) or initiate deceleration to the Creep Frequency (if Stop Trigger is a CTRIO2 input).
Event: The edge of the limit switch used as the Decel Trigger.

**Stop Trigger:** The CTRIO2 input or position that stops the output. If Position is selected, Parameter 3 in the output memory map defines the target position. This is relative to 0, which is clocked in when the Decel Trigger Event condition is met. Position can be positive or negative.
Event: The edge of the limit switch used as the Stop Trigger.



- **Minimum Freq:** The frequency at which the profile will begin and end.
- **Maximum Freq:** The maximum steady state frequency the profile can attain during a move.
- **Accel Rate:** The rate at which the output frequency will increase during the acceleration period.
- **Decel Rate:** The rate at which the output frequency will decrease when Decel Trigger is reached.
- **Creep Freq:** The (slower) rate to use between the Decel Trigger and the Stop Trigger.
- **Encoder Input:** Select the channel where the encoder is connected.
- **Scale Factor:** This is the output to input resolution (stepper/encoder) ratio. In other words, if the stepper motor being used is a 1000 ppr (pulses per revolution) and the encoder is 800 ppr, then the scale factor would be 1000/800 = 1.25.
- **Deadband:** This is the number of position counts away from the target position that causes no action. This can reduce "hunting" or "ringing" as the profile attempts to get to the target position. Be sure to include a deadband when the encoder has a higher resolution than the stepper.

**Example: Trapezoid with Limits using a limit switch for the Stop Trigger.**




1: Move starts at the Minimum Freq and accelerates at Accel Rate.

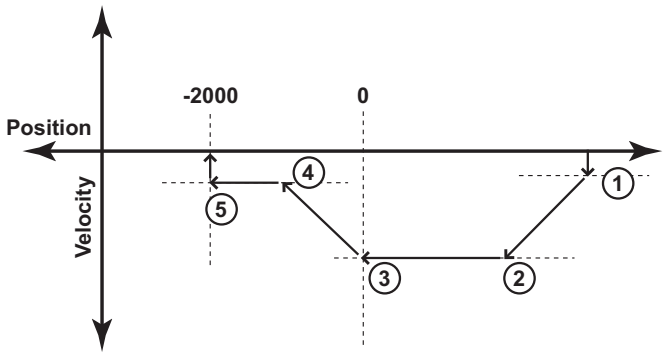
2: Acceleration ends at Maximum Freq and move continues at Maximum Freq.

3: When the Decel Trigger is reached, the position register is zeroed out and the output begins to slow down at Decel Rate.

4: Deceleration ends at Creep Freq and the move continues towards the Stop Trigger, a limit switch.

5: When the Stop Trigger is reached, the output stops.

**Example: Trapezoid with Limits using a position for the Stop Trigger. The Stop Trigger position does not require change of direction.**




1: Move starts at the Minimum Freq and accelerates at Accel Rate.

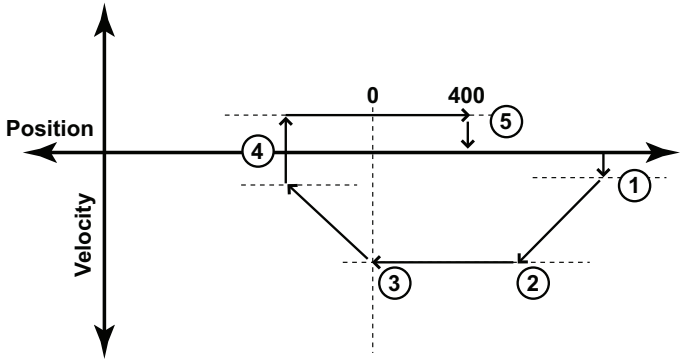
2: Acceleration ends at Maximum Freq and move continues at that rate.

3: When the Decel Trigger is reached, the position register is zeroed out and the output begins to slow down at Decel Rate.

4: Deceleration ends at Creep Freq and the move continues towards the Stop Trigger, a position relative to the Decel Trigger. The Stop Trigger is the position -2000 in this example.

5: When the Stop Trigger is reached, the output stops.

**Example: Trapezoid with Limits using a position for the Stop Trigger. The Stop Trigger position requires change of direction.**




1: Move starts at the Minimum Freq and accelerates at Accel Rate.

2: Acceleration ends at Maximum Freq and move continues at that rate.

3: When the Decel Trigger is reached, the position register is zeroed out and the output begins to slow down at Decel Rate.

4: Deceleration ends at Minimum Freq and the move changes direction to move back towards the Stop Trigger, a position relative to the Decel Trigger.

5: When the Stop Trigger is reached (position 400 in this example), the output stops.

# Pulse Output Status/Control Bits and Command Codes (DL PLCs)

☑ DL
☑ Win
☑ NI

## Output Status Bit Definitions (Pulse Output)

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

| Status Bit CTRIO(2) to CPU | Bit Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Input Start (octal) |
|---|---|---|
| Output Enabled | 32, 48 | 22.0, 23.0 |
| Position Loaded | 33, 49 | 22.1, 23.1 |
| Output Suspended | 34, 50 | 22.2, 23.2 |
| Output Active | 36, 52 | 22.4, 23.4 |
| Output Stalled | 37, 53 | 22.5, 23.5 |
| Command Error | 38, 54 | 22.6, 23.6 |
| Command Complete | 39, 55 | 22.7, 23.7 |

## Output Control Bit Definitions (Pulse Output)

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

| Control Bit CPU to CTRIO(2) | Bit Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) | Read as: |
|---|---|---|---|
| Enable Output | 32, 48 | 26.0, 27.0 | Level |
| Go to Position | 33, 49 | 26.1, 27.1 | Rising Edge |
| Suspend Output | 34, 50 | 26.2, 27.2 | Level |
| Direction | 36, 52 | 26.4, 27.4 | Level |
| Process Command | 39, 55 | 26.7, 27.7 | Rising Edge |

## Output Control (D)Words (Pulse Output)

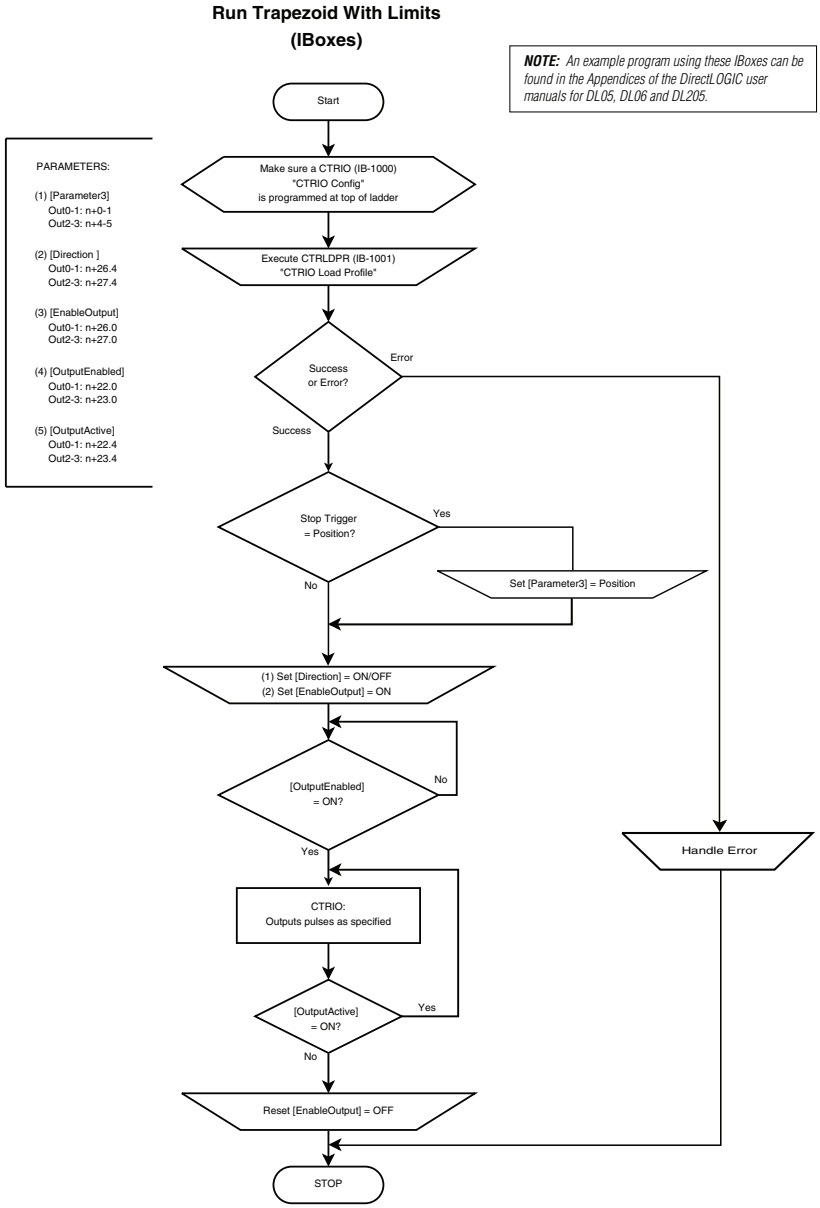
| Word Control CPU to CTRIO(2) | Word Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) |
|---|---|---|
| Command Code | 0, 6 | 10, 16 |
| Word Parameter 1 | 1, 7 | 11, 17 |
| Word Parameter 2 | 2, 8 | 12, 20 |

| DWord Control CPU to CTRIO(2) | Word Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) |
|---|---|---|
| DWord Parameter 3 | 0, 2 | 0, 4 |

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

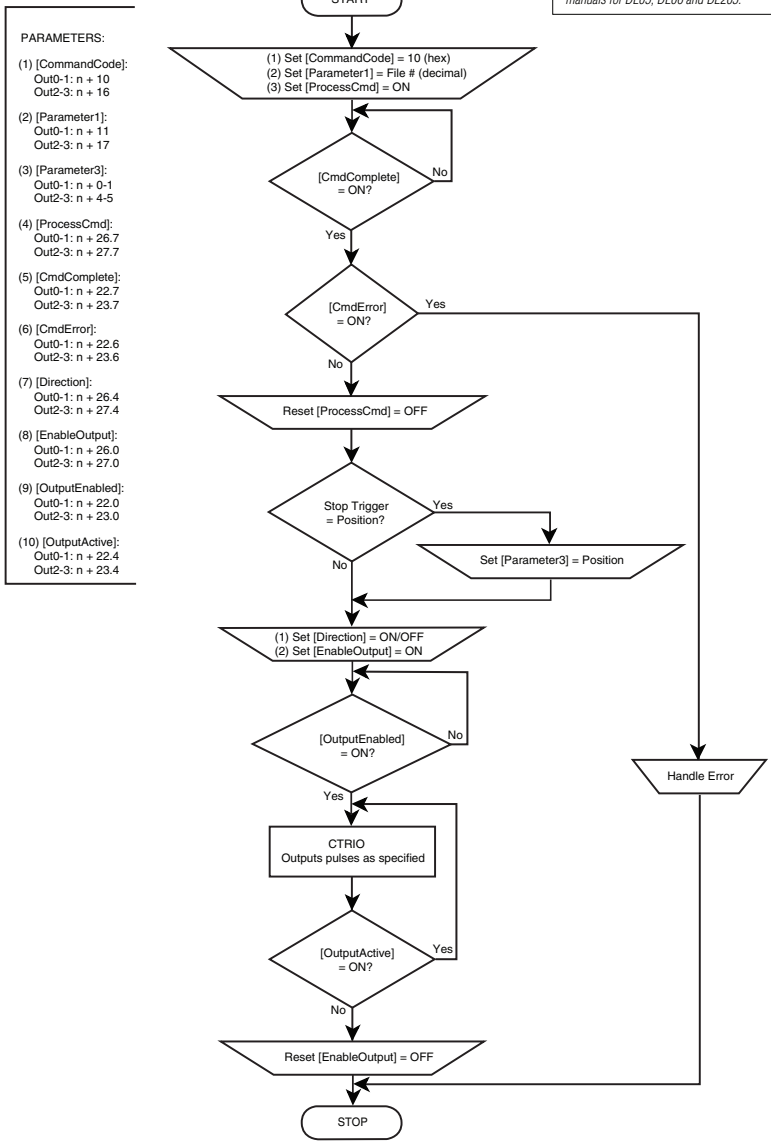
## Load and Run a Trapezoid with Limits Profile

Example: You will need to have a Trapezoid Plus or Trapezoid with Limits profile configured using the Configure I/O dialog. You will also need to have the appropriate Pulse Profile Table File Number (decimal) stored in V3000 for this example. You must turn C0 on to load and run the pulse profile.



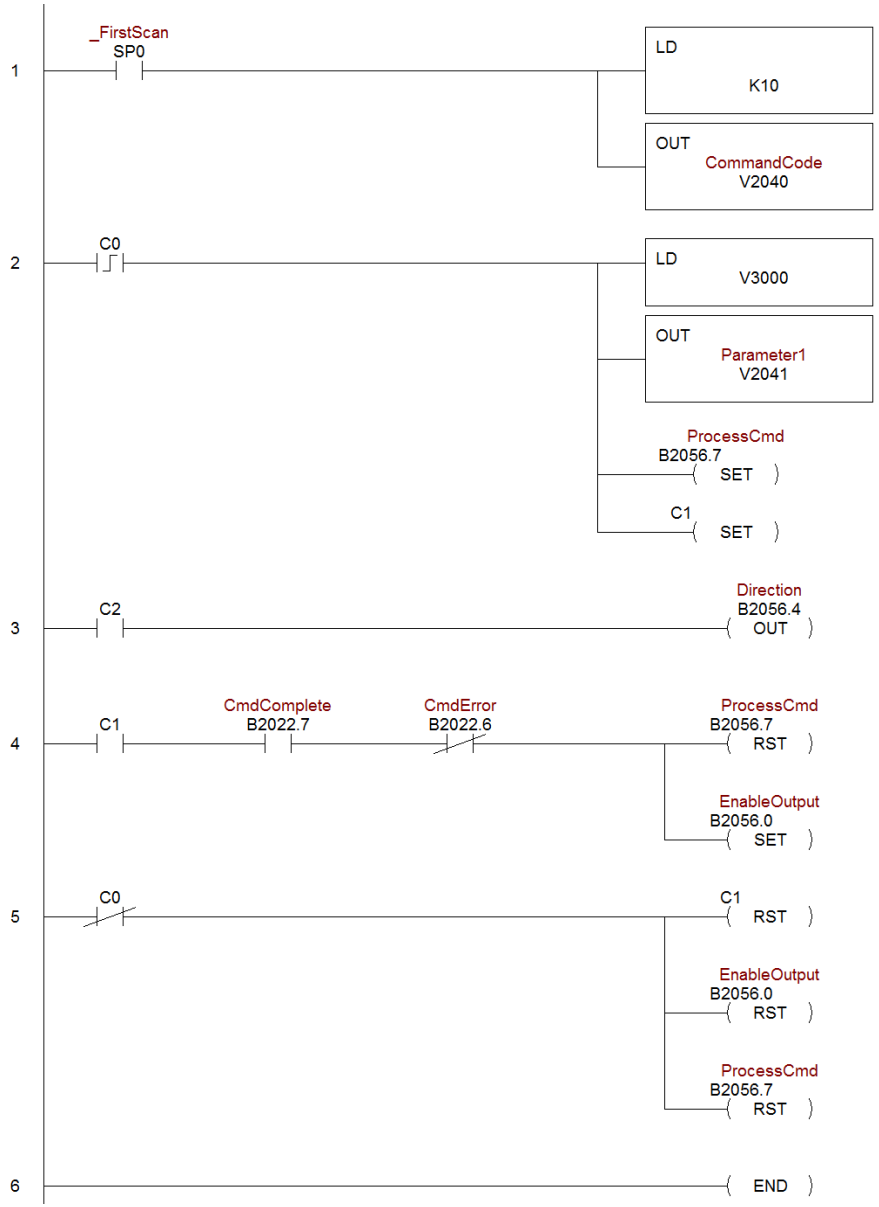
## Run Trapezoid With Limits (DL-PLC)

***NOTE:*** *An example program using these IBoxes can be found in the Appendices of the DirectLOGIC user manuals for DL05, DL06 and DL205.*



☑ DL
☒ Win
☒ NI

The following example program loads and executes a Trapezoid with Limits Profile that was created using CTRIO Workbench Pulse Profiles dialog. These profiles can only be used with a CTRIO2 module. The Pulse Profile number is stored in V3000. Turning on C0 will load the pulse profile and target position, and run the profile.



# Trapezoid Plus (CTRIO2) Profile

## Trapezoid Plus

☑ DL
☑ Win
☑ NI

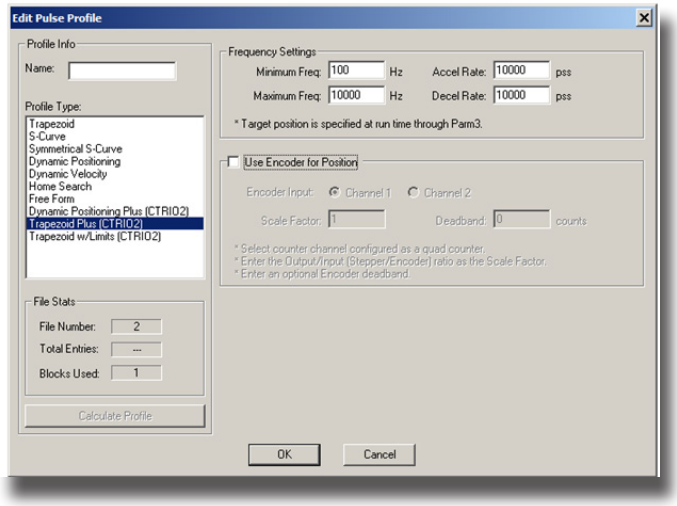
Trapezoid Plus is used for executing trapezoidal moves to a position value. The desired position is specified in Parameter 3. The sign of the value of the Target Position (Parameter 3) determines the direction of the pulse train ouptut. This profile allows for different acceleration and deceleration rates. Also, Trapezoid Plus will accept a new target position to be entered while the output is in motion. The proper sequence of events for using this profile can be found in the previous flow charts and those that follow.

The Trapezoid Plus (CTRIO2) profile is only available when using a CTRIO2 module. See Trapezoid description for a general description of this profile. The profile resembles Trapezoid Profile, but has four additional features:

1: The target position is a variable (Parameter 3 in the output memory map) set by the base controller, instead of a constant specified in the profile.

2: The profile can be asymmetrical (Accel and Decel rates are separate).

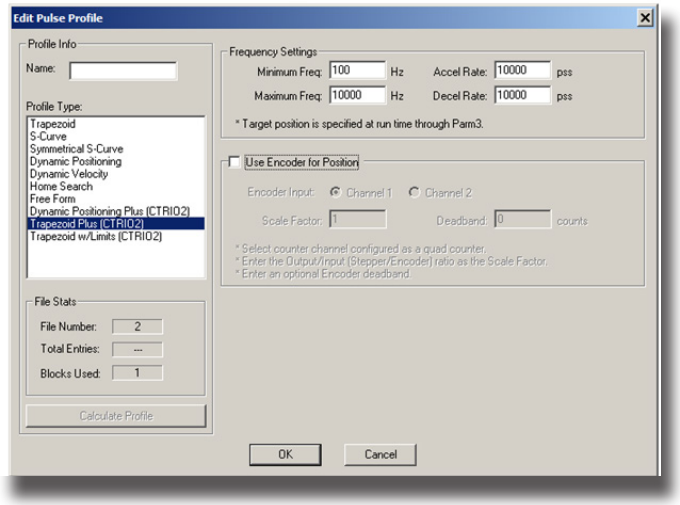
3: Encoder Feedback can be added, useful for correcting excessive lash or slippage in the system.




4: Allows output rates up to 250kHz.

## Trapezoid Plus, cont'd

When **Use Encoder for Position** is enabled, the target position is specified in units of the encoder. Encoder feedback determines when deceleration of a move should begin and determines when the move should stop. If **Scale Factor** is set incorrectly, the output could overshoot the target position, or start decelerating too soon.




- **Minimum Freq:** The frequency at which the profile will begin and end.
- **Maximum Freq:** The maximum steady state frequency the profile can attain during a move.
- **Accel Rate:** The rate at which the output frequency will increase during the acceleration period.
- **Decel Rate:** The rate at which the output frequency will decrease during the deceleration period.
- **Encoder Input:** Select the channel where the encoder is connected. The inputs for the encoder (A&B) must be configured for Quad Counter.
- **Scale Factor:** This is the output to input resolution (stepper/encoder) ratio. In other words, if the stepper motor being used is a 1000 ppr (pulses per revolution) and the encoder is 800 ppr, then the scale factor would be 1000/800 = 1.25.
- **Deadband:** This is the number of position counts away from the target position that causes no action. This can reduce "hunting" or "ringing" as the profile attempts to get to the target position. Be sure to include a deadband when the encoder has a higher resolution than the stepper.

# Pulse Output Status/Control Bits and Command Codes (DL PLCs)

## Output Status Bit Definitions (Pulse Output)

☑ DL
☑ Win
☑ NI

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

| Status Bit CTRIO(2) to CPU | Bit Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Input Start (octal) |
|---|---|---|
| Output Enabled | 32, 48 | 22.0, 23.0 |
| Position Loaded | 33, 49 | 22.1, 23.1 |
| Output Suspended | 34, 50 | 22.2, 23.2 |
| Output Active | 36, 52 | 22.4, 23.4 |
| Output Stalled | 37, 53 | 22.5, 23.5 |
| Command Error | 38, 54 | 22.6, 23.6 |
| Command Complete | 39, 55 | 22.7, 23.7 |

## Output Control Bit Definitions (Pulse Output)

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

| Control Bit CPU to CTRIO(2) | Bit Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) | Read as: |
|---|---|---|---|
| Enable Output | 32, 48 | 26.0, 27.0 | Level |
| Go to Position | 33, 49 | 26.1, 27.1 | Rising Edge |
| Suspend Output | 34, 50 | 26.2, 27.2 | Level |
| Direction* | 36, 52 | 26.4, 27.4 | Level |
| Process Command | 39, 55 | 26.7, 27.7 | Rising Edge |

* Not used in ladder. Controlled by the sign of the Target Position (Parameter 3) value.

## Output Control (D)Words (Pulse Output)

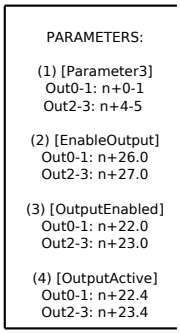
Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

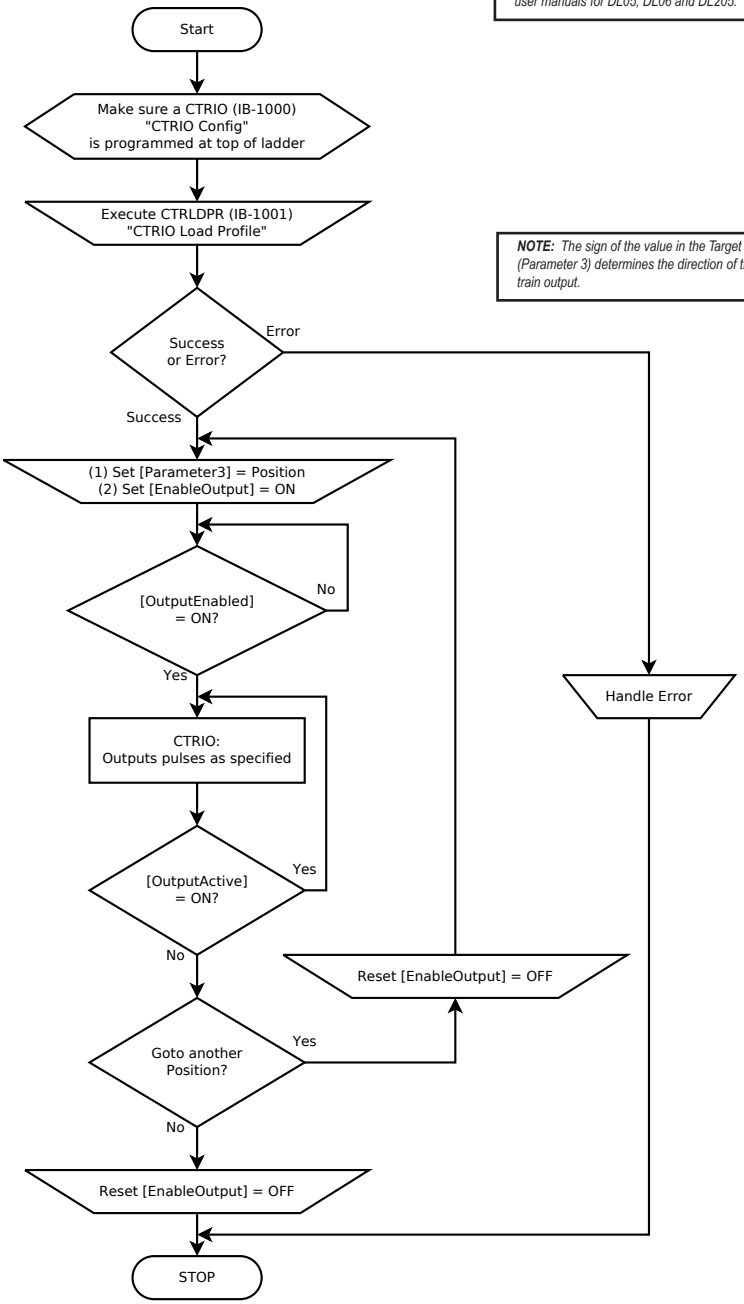
| Word Control CPU to CTRIO(2) | Word Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) |
|---|---|---|
| Command Code | 0, 6 | 10, 16 |
| Word Parameter 1 | 1, 7 | 11, 17 |
| Word Parameter 2 | 2, 8 | 12, 20 |

| DWord Control CPU to CTRIO(2) | Word Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) |
|---|---|---|
| DWord Parameter 3 | 0, 2 | 0, 4 |

## Run Trapezoid PLUS (IBoxes)

**NOTE:** *An example program using these IBoxes can be found in the Appendices of the DirectLOGIC user manuals for DL05, DL06 and DL205.*




**NOTE:** *The sign of the value in the Target Position (Parameter 3) determines the direction of the pulse train output.*

## Run Trapezoid PLUS (DL-PLC)

*NOTE: An example program using these IBoxes can be found in the Appendices of the DirectLOGIC user manuals for DL05, DL06 and DL205.*

PARAMETERS:

(1) [CommandCode]:
Out0-1: n+10
Out2-3: n+16

(2) [Parameter1]
Out0-1: n+11
Out2-3: n+17

(3) [Parameter3]
Out0-1: n+0-1
Out2-3: n+4-5

(4) [ProcessCmd]
Out0-1: n+26.7
Out2-3: n+27.7

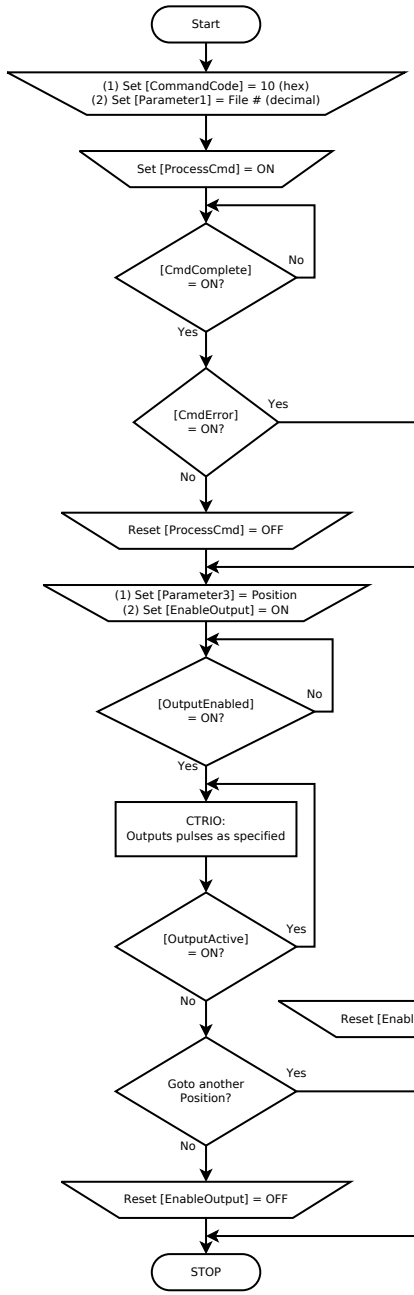
(5) [CmdComplete]
Out0-1: n+22.7
Out2-3: n+23.7

(6) [CmdError]
Out0-1: n+22.6
Out2-3: n+23.6

(7) [EnableOutput]
Out0-1: n+26.0
Out2-3: n+27.0

(8) [OutputEnabled]
Out0-1: n+22.0
Out2-3: n+23.0

(9) [OutputActive]
Out0-1: n+22.4
Out2-3: n+23.4

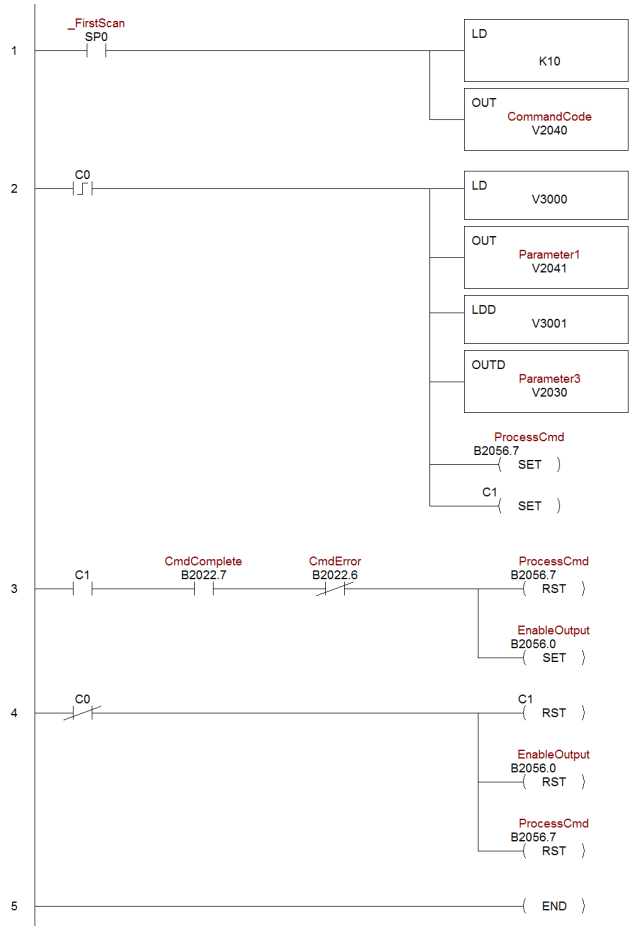



*NOTE: The sign of the value in the Target Position (Parameter 3) determines the direction of the pulse train output.*

# Load and Run a Trapezoid Plus Profile

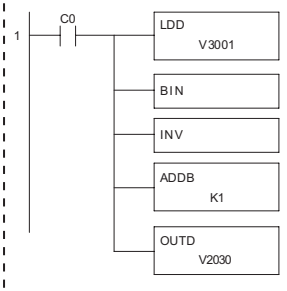
☑ DL
☒ Win
☒ NI

The following example program loads and executes a Trapezoid Plus or Trapezoid with Limits Profile that was created using CTRIO Workbench Pulse Profiles dialog. These profiles can only be used with a CTRIO2 module. The Pulse Profile number is stored in V3000 and the Target Position is stored in V3001-V3002. Turning on C0 will load the pulse profile and target position, and run the profile.




The sign of the value in the Target Position (Parameter 3) determines the direction of the pulse train output. In the *Direct*LOGIC programming example below, the value in V3001 (BCD DWORD) is converted to Signed Decimal DWORD in V2030 when C0 is turned ON.

***Direct***SOFT



# Dynamic Positioning Plus and Dynamic Positioning Profiles

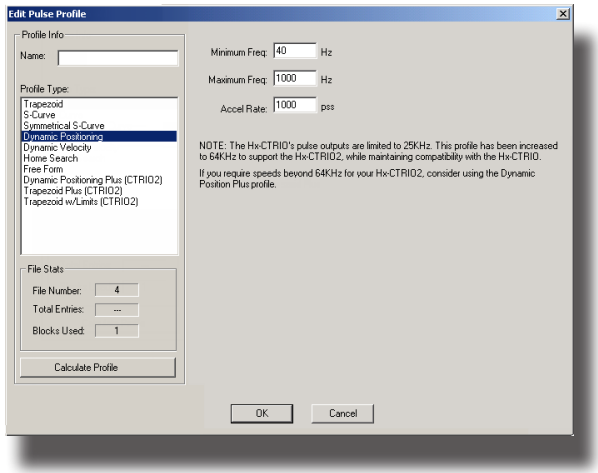
☑ DL
☑ Win
☑ NI

Dynamic Positioning Plus and Dynamic Positioning profiles are very similar and are covered together in this section. The table below summarizes their differences.

| Options | Position Source | Change target position on the fly | Accel/decel ramps | Maximum pulse rate | Encoder Feedback Possible | Requires CTRIO2 |
|---|---|---|---|---|---|---|
| Dynamic Positioning Plus | From controller | Yes | Specify separately | 250kHz | Yes | Yes |
| Dynamic Positioning | From controller | No | One setting for both | 65kHz[1] | No | No |

[1] *The older CTRIO outputs can only achieve 25kHz maximum. CTRIO2 outputs are limited to 65kHz when using these profiles.*

The Dynamic Positioning profile is a trapezoidal profile with identical acceleration/deceleration rates and identical starting/stopping 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.




- **Minimum Freq:** The frequency at which the profile will begin and stop.
- **Maximum Freq:** The maximum steady state frequency the profile can attain during a move.
- **Accel Rate:** The rate at which the output will ramp from the Minimum Frequency to the Maximum Frequency. This sets the deceleration rate as well.

# Dynamic Positioning Plus (CTRIO2) Profile

☑ DL
☑ Win
☑ NI

The Dynamic Positioning Plus (CTRIO2) profile is only available when using a CTRIO2 module. The profile resembles a Dynamic Positioning Profile, but adds three features:

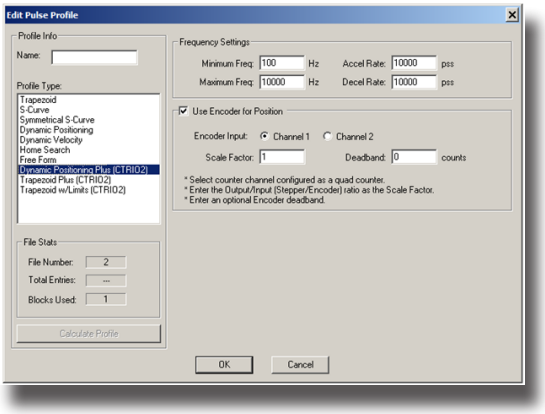
1: The profile can be asymmetrical (Accel and Decel Rates are separate).

2: Encoder Feedback can be added, useful for correcting excessive lash or slippage in the system.

3: Allows output rates up to 250kHz.

When **Use Encoder for Position** is enabled, the target position is specified in units of the encoder. Encoder feedback determines when deceleration of a move should begin and determines when the move should stop.

See Dynamic Positioning Profile for a general description of this profile.




- **Minimum Freq:** The frequency at which the profile will begin and end.
- **Maximum Freq:** The maximum steady state frequency the profile can attain during a move.
- **Accel Rate:** The rate at which the output frequency will increase during the acceleration period.
- **Decel Rate:** The rate at which the output frequency will decrease during the deceleration period.
- **Encoder Input:** Select the channel where the encoder is connected.
- **Scale Factor:** This is the output to input resolution (stepper/encoder) ratio. In other words, if the stepper motor being used is a 1000 ppr (pulses per revolution) and the encoder is 800 ppr, then the scale factor would be 1000/800 = 1.25.
- **Deadband:** This is the number of position counts away from the target position that causes no action. This can reduce "hunting" or "ringing" as the profile attempts to get to the target position. Be sure to include a deadband when the encoder has a higher resolution than the stepper.

# Pulse Output Status/Control Bits and Command Codes (DL PLCs)

☑ DL
☑ Win
☑ NI

## Output Status Bit Definitions (Pulse Output)

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

| Status Bit CTRIO(2) to CPU | Bit Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Input Start (octal) |
|---|---|---|
| Output Enabled | 32, 48 | 22.0, 23.0 |
| Position Loaded | 33, 49 | 22.1, 23.1 |
| Output Suspended | 34, 50 | 22.2, 23.2 |
| Output Active | 36, 52 | 22.4, 23.4 |
| Output Stalled | 37, 53 | 22.5, 23.5 |
| Command Error | 38, 54 | 22.6, 23.6 |
| Command Complete | 39, 55 | 22.7, 23.7 |

## Output Control Bit Definitions (Pulse Output)

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

| Control Bit CPU to CTRIO(2) | Bit Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) | Read as: |
|---|---|---|---|
| Enable Output | 32, 48 | 26.0, 27.0 | Level |
| Go to Position | 33, 49 | 26.1, 27.1 | Rising Edge |
| Suspend Output | 34, 50 | 26.2, 27.2 | Level |
| Direction | 36, 52 | 26.4, 27.4 | Level |
| Process Command | 39, 55 | 26.7, 27.7 | Rising Edge |

## Output Control (D)Words (Pulse Output)

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

| Word Control CPU to CTRIO(2) | Word Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) |
|---|---|---|
| Command Code | 0, 6 | 10, 16 |
| Word Parameter 1 | 1, 7 | 11, 17 |
| Word Parameter 2 | 2, 8 | 12, 20 |

| DWord Control CPU to CTRIO(2) | Word Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) |
|---|---|---|
| DWord Parameter 3 | 0, 2 | 0, 4 |

## Dynamic Positioning/Dynamic Positioning Plus, (cont'd)

☑ DL
☒ Win
☒ NI

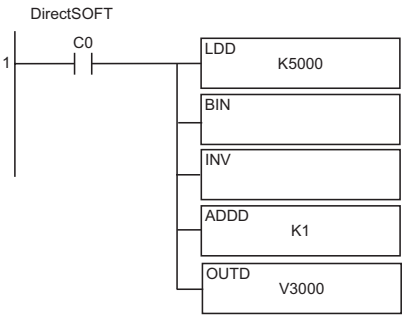
For Dynamic Positioning/Positioning Plus only, the motion limits of Min Frequency, Max Frequency, and Acceleration rate come from the CTRIO Workbench Profile. After loading a Dynamic Positioning/Positioning Plus Profile, setting the **Enable Output** causes the CTRIO(2) module to assume a position of 0 pulses. The program should write the target position in DWord Parameter 3, and set the **Go to Position** bit. This will cause the CTRIO(2) module to set both Pulses Active and the **New Position Loaded** bit, then begin to output pulses. The number of pulses and direction are determined by the CTRIO(2) module based on the difference between the current location and the specified target location.

The program can monitor the state of the **Pulses Active** bit and the **New Position Loaded** bit to determine when the new position has been attained. The **New Position Loaded** status bit will always follow the state of the Load/Seek New Position control bit. This status bit should be used to signal the program that the CTRIO(2) module has received the new state of the control bit. You do not have to wait on the CTRIO(2) module to complete a move that is in progress before loading the next target location. After the GoTo Position is acknowledged, the program can load the next position into the DWord Parameter 3. When **Pulses Active Status** goes to 0, then setting the **GoTo Position** control bit will again start the output toward the new position. The CTRIO(2) module moves to the new position relative to its previous position as long as the **Enable Output** control bit remains set. Clearing the **Enable Output** bit will disable output pulsing and reset the current position to 0.

| Position Loaded Status Bit V40622.1 or C441 | Pulses Active Status Bit V40622.0 or C440 | CTRIO(2) Pulse Output State |
|---|---|---|
| 0 | 0 | Idle |
| 1 | 1 | Go To Position Acknowledged, Pulsing |
| 0 | 1 | Still Pulsing, Go To Position Control Bit is OFF |
| 1 | 0 | Go To Position Acknowledged, Position Attained |

The following pages show a ***Direct***LOGIC programming example that executes a Dynamic Positioning/Positioning Plus pulse profile using the bit/(D)word addressing in the table on page 9-39.

The sign of the value in the Target Position register (Parameter 3) determines the direction of the pulse train output. In the ***Direct***LOGIC programming example to the right, BCD 5000 is converted to decimal -5000 when C0 is turned ON. You could load (LD) a V memory location instead of using a constant as shown in the example.



## Dynamic Positioning or Dynamic Positioning Plus Using the CTRIO(2) Y0 and Y1

☑ DL
☒ Win
☒ NI

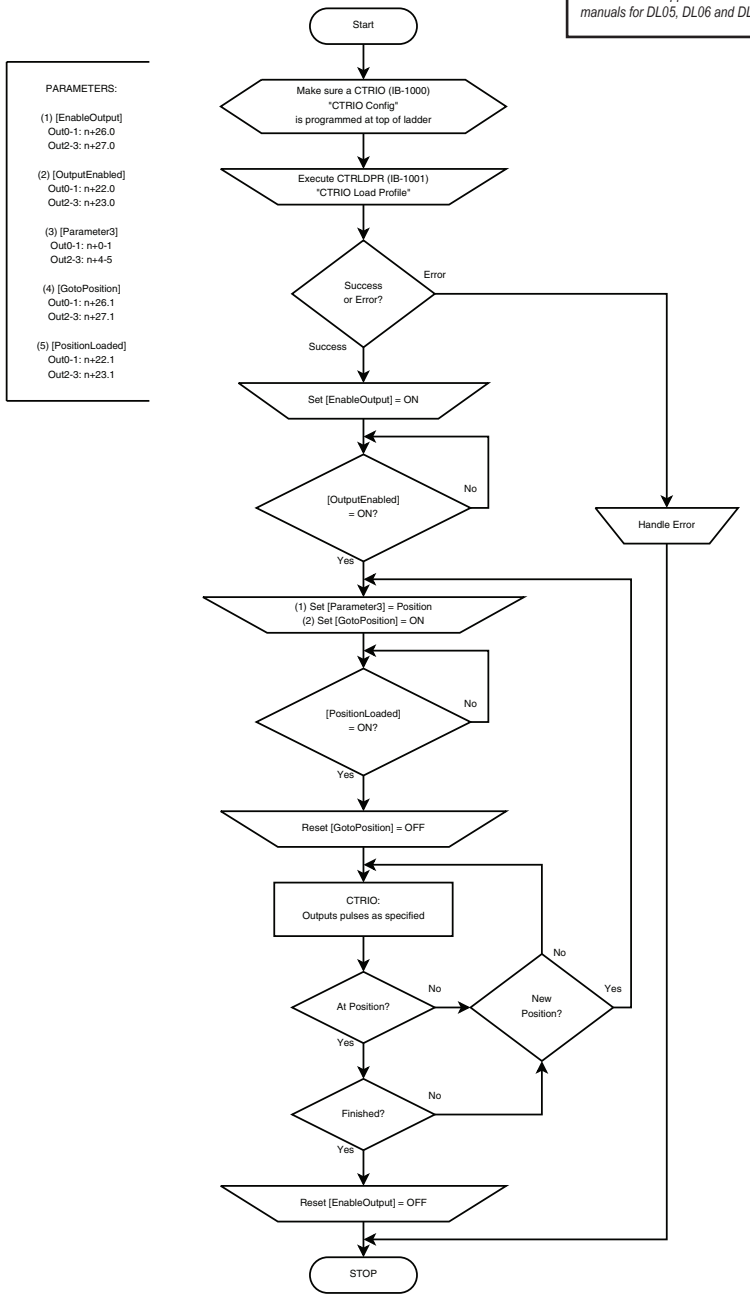
The required basic steps for a DL-PLC to run Dynamic Positioning or Dynamic Position Plus are outlined in this table. The steps describe the sequence and coordinate with the ladder code sequence on page 9-41.

| Steps | Name | PLC Control Outputs Base Addr = V2030 (Bit-of-Word) | PLC Status Inputs Base Addr = V2000 (Bit-of-Word) | PLC Control Outputs Base Addr = V2030 (Control Relay) D2-240 | PLC Status Inputs ase Addr = V2000 (Control Relay) D2-240 | Action |
|---|---|---|---|---|---|---|
| 1 | Command Code | V2040 | N/A | V2040 | N/A | Set to 10 (Load Stored Profile) |
| 2 | Parameter 1 | V2041 | | V2041 | | File # of desired Dynamic Positioning Profile |
| 3 | Process Command | V2056.7 | | C227 | | Turn ON until Command Complete status bit is returned (see step 4) |
| 4 | Command Complete Status | N/A | V2022.7 | N/A | C127 | When ON, Profile is now loaded, clear Process Command bit (step 3) |
| 5 | Command Error | | V2022.6 | | C126 | ON if Command or Parameters are invalid |
| 6 | Enable Output | V2056.0 | N/A | C220 | N/A | Turn ON to assume 0 position, Turn OFF to disable pulses and zero position |
| 7 | Output Enable Status | N/A | V2022.0 | N/A | C127 | When ON, pulses are now enabled and last position is retained |
| 8 | Parameter 3 | V2031 / V2030 | N/A | V2031 / V2030 | N/A | Target position: User defined (DWord) |
| 9 | Go To Position | V2056.1 | | C221 | | Starts pulses with direction to obtain the new position relative to previous position. |
| 10 | Position Loaded Status | N/A | V2022.1 | N/A | C121 | When ON, Go To position is acknowledged |
| 11 | Output Active Status | | V2022.4 | | C124 | When ON, module is pulsing, OFF with Position Loaded status ON = new position move has completed |
| 12 | Go To Position | V2056.1 | N/A | C221 | N/A | Turn OFF to be ready to load a new position |
| 13 | Suspend Output | V2056.2 | | C222 | | Turn ON to “pause” output pulses without resetting pulse count |
| 14 | Output Suspend | N/A | V2022.2 | N/A | C122 | ON when out pulse train has been suspended |

Repeat steps 7-10 to seek the next position.

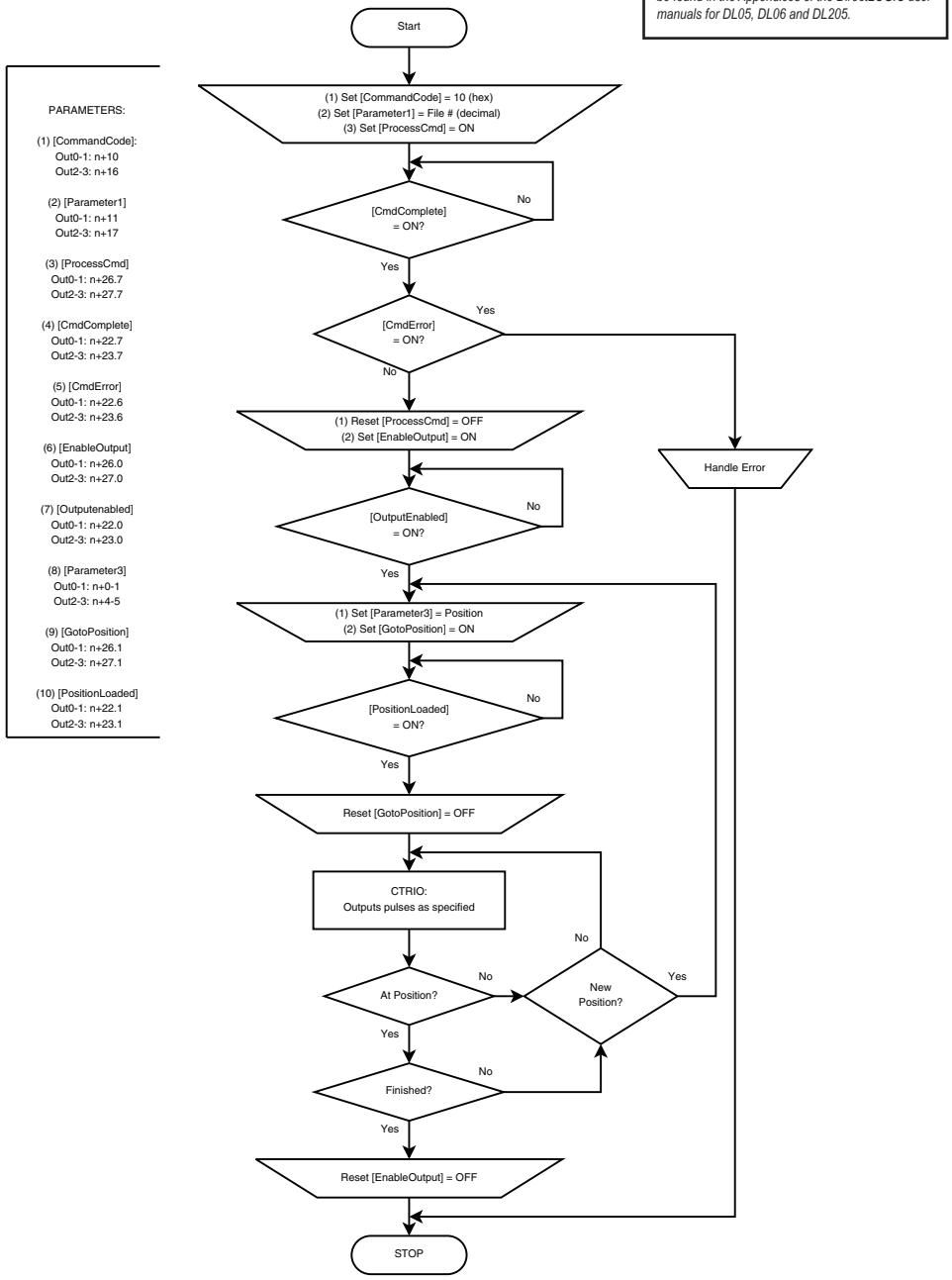
**Dynamic Position or Dynamic Position PLUS (IBoxes)**

*NOTE: An example program using these IBoxes can be found in the Appendices of the DirectLOGIC user manuals for DL05, DL06 and DL205.*



## Dynamic Position or Dynamic Position PLUS (DL-PLC)

*NOTE: An example program using these IBoxes can be found in the Appendices of the DirectLOGIC user manuals for DL05, DL06 and DL205.*

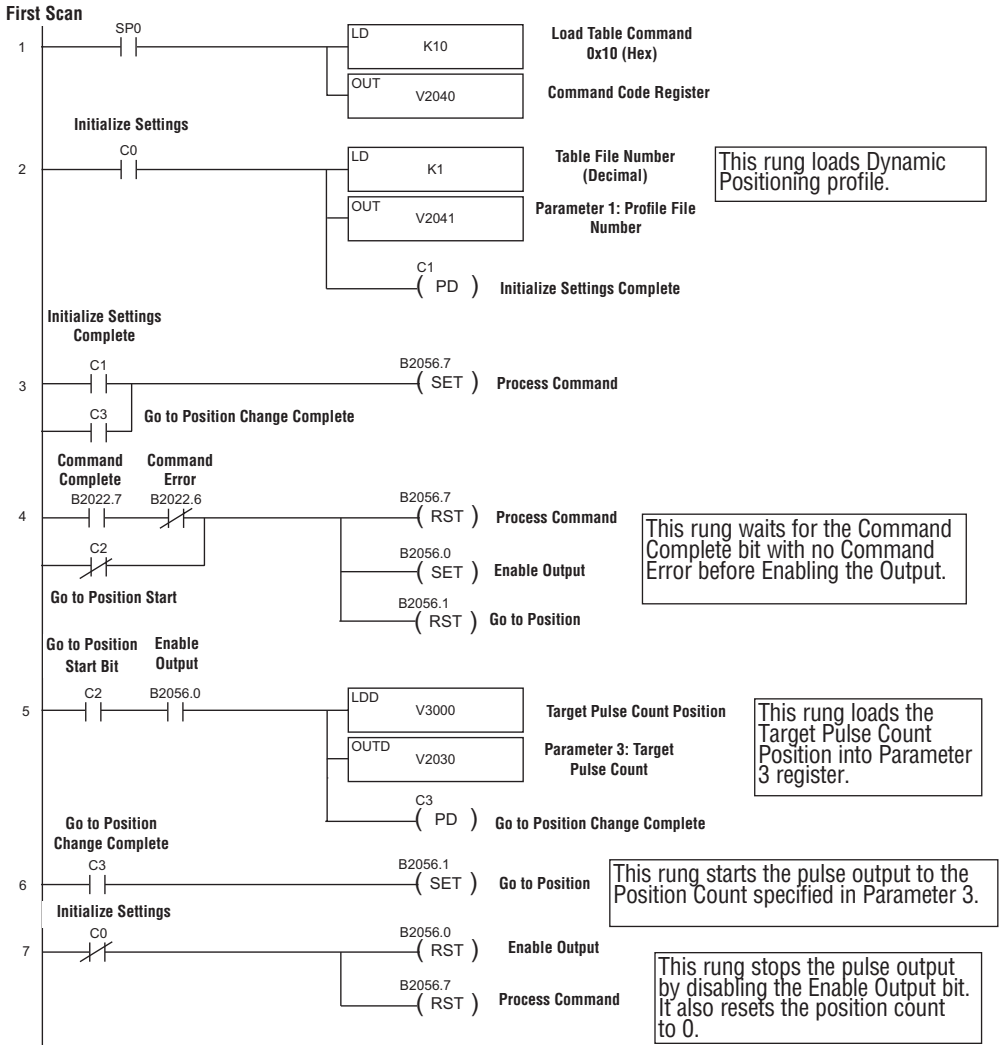


# Dynamic Positioning/Positioning Plus Example

☑ DL
☒ Win
☒ NI

The following example program runs a Dynamic Positioning/Positioning Plus pulse profile. Turn on C0 to load the profile number and process the command. The first move starts at position count = 0. Turning on C2 will start the pulse output to position specified in Parameter 3.

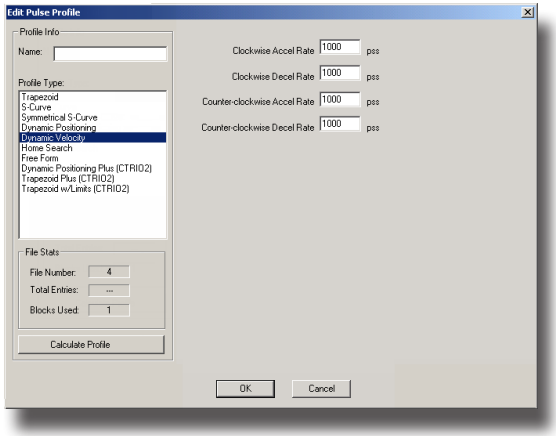
The output will move in whichever direction is appropriate to reach the position specified in Parameter 3. To make additional moves, wait for the current move to complete, load a new value into the Target Pulse Count register and set the Go to Position bit. Subsequent moves are still referenced to the same 0 location as the first move. Clearing the Enable Output bit will disable output pulsing and reset the current position to 0.



# Dynamic Velocity Profile

The Dynamic Velocity profile is a trapezoidal profile with the directional 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.

☑ DL
☑ Win
☑ NI




- **Clockwise Accel Rate:** The clockwise rate at which the output will ramp up from 0Hz 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 0Hz.
- **Counter-Clockwise Accel Rate:** The counter-clockwise rate at which the output will ramp up from 0Hz 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 0Hz.

## Dynamic Velocity Profile

For the E**xample that follows** you will need to have a Dynamic Velocity profile configured as Table File Number 1 using the Configure I/O dialog box. You will also need to have the appropriate Target Velocity (signed decimal) stored in V3000 for this example. You must turn C0 on to initialize the settings and enable the output.

# Pulse Output Status/Control Bits and Command Codes (DL PLCs)

## Output Status Bit Definitions (Pulse Output)

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

☑ DL
☑ Win
☑ NI

| Status Bit CTRIO(2) to CPU | Bit Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Input Start (octal) |
|---|---|---|
| Output Enabled | 32, 48 | 22.0, 23.0 |
| Position Loaded | 33, 49 | 22.1, 23.1 |
| Output Suspended | 34, 50 | 22.2, 23.2 |
| Output Active | 36, 52 | 22.4, 23.4 |
| Output Stalled | 37, 53 | 22.5, 23.5 |
| Command Error | 38, 54 | 22.6, 23.6 |
| Command Complete | 39, 55 | 22.7, 23.7 |

## Output Control Bit Definitions (Pulse Output)

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

## Output Control (D)Words (Pulse Output)

| Control Bit CPU to CTRIO(2) | Bit Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) | Read as: |
|---|---|---|---|
| Enable Output | 32, 48 | 26.0, 27.0 | Level |
| Go to Position | 33, 49 | 26.1, 27.1 | Rising Edge |
| Suspend Output | 34, 50 | 26.2, 27.2 | Level |
| Direction | 36, 52 | 26.4, 27.4 | Level |
| Process Command | 39, 55 | 26.7, 27.7 | Rising Edge |

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

| Word Control CPU to CTRIO(2) | Word Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) |
|---|---|---|
| Command Code | 0, 6 | 10, 16 |
| Word Parameter 1 | 1, 7 | 11, 17 |
| Word Parameter 2 | 2, 8 | 12, 20 |

| DWord Control CPU to CTRIO(2) | Word Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) |
|---|---|---|
| DWord Parameter 3 | 0, 2 | 0, 4 |

## Dynamic Velocity (cont'd)

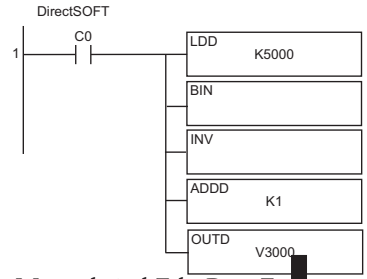
☑ DL
☑ Win
☑ NI

For Dynamic Velocity, the motion limits of clockwise acceleration and deceleration, and counter clockwise acceleration and deceleration come from the CTRIO Workbench Profile. The target velocity is stored in a register in the CPU/controller. The program needs to prepare the Load Table command by selecting Command Code = 0010 Hex/BCD, set Word Parameter 1 to the File number of the profile (example: File 3 Dynamic Velocity 1) and set Word Parameter 3 to the desired target velocity. Then the program can set the Process Command bit and watch for the Command Complete bit. Then the program should clear the Process Command bit. Set the Enable Output bit to start the output pulses. The velocity can be changed "on the fly" by entering a different value into the target velocity register and setting the Process Command bit. The velocity will ramp up/down to the new target velocity at the specified Accel/Decel rates. Clearing the Enable Output bit will always suspend pulsing. The following pages show a programming example that executes a Dynamic Velocity pulse profile using the bit/(D)word addressing in the table below.

## Dynamic Velocity using the CTRIO(2) Y0 and Y1

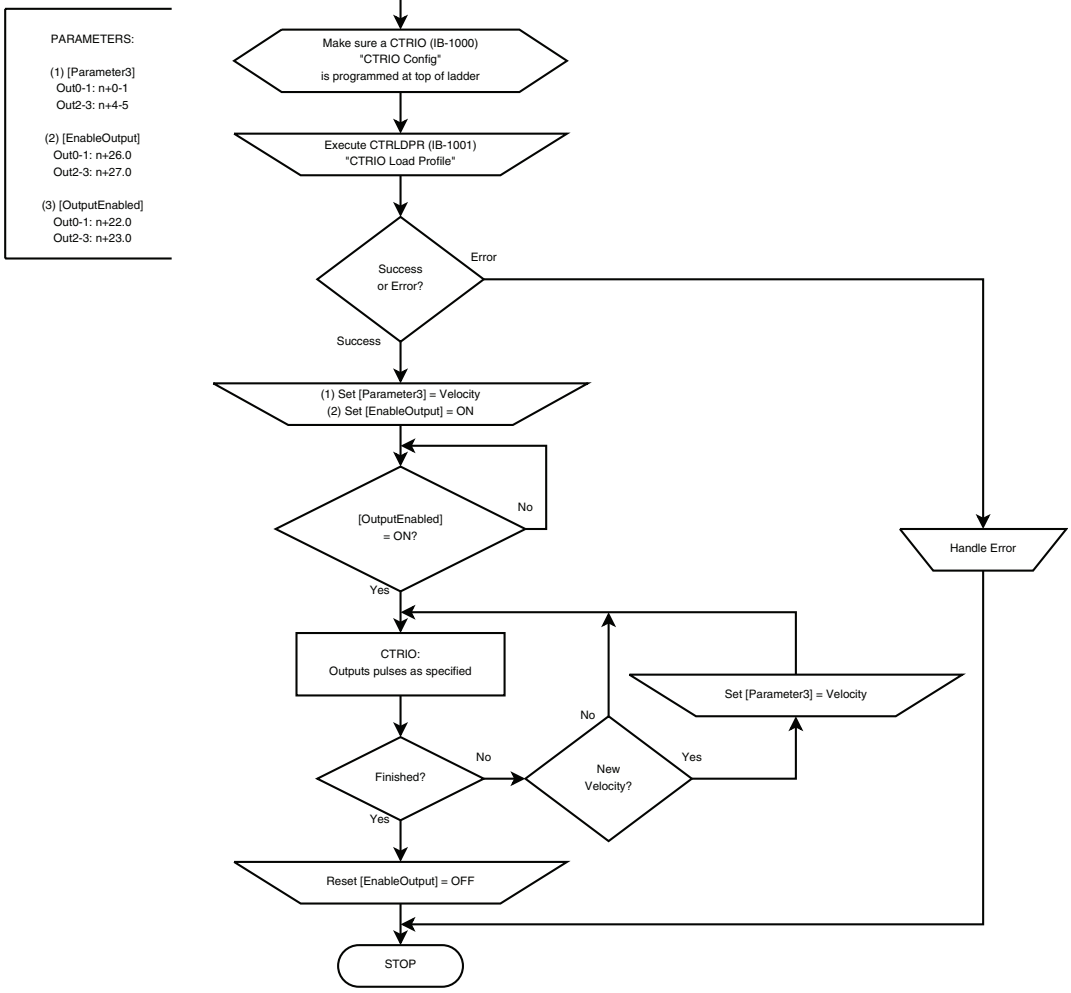
| Steps | Name | PLC Control Outputs Base Addr = V2030 (Bit-of-Word) | PLC Status Inputs Base Addr = V2000 (Bit-of-Word) | PLC Control Outputs Base Addr = V2030 (Control Relay) D2-240 | PLC Status Inputs Base Addr = V2000 (Control Relay) D2-240 | Action |
|---|---|---|---|---|---|---|
| 1 | Command Code | V2040 | N/A | V2040 | N/A | Set to 10 (Load Stored Profile) |
| 2 | Parameter 1 | V2041 | | V2041 | | File # containing CW accel/decel and CCW acccel/decel |
| 3 | Process Command | V2056.7 | | C227 | | Turn ON until Command Complete status bit is returned |
| 4 | Command Complete Status | N/A | V2022.7 | N/A | C127 | When ON, Profile is now loaded, clear Process Command bit |
| 5 | Command Error | | V2022.6 | | C126 | ON if Command or Parameters are invalid |
| 6 | Enable Output | V2056.0 | N/A | C220 | N/A | Turn ON to ramp to target velocity, Turn OFF to disable pulses. |
| 7 | Parameter 3 | V2031 / V2030 | N/A | V2031 / V2030 | | Target velocity: User defined (DWord) |
| 8 | Output Active Status | N/A | V2022.4 | N/A | C124 | When ON, module is pulsing |
| 9 | Suspend Output | V2056.2 | N/A | C222 | N/A | Turn ON to "pause" output pulses without resetting pulse count |
| 10 | Output Suspended | N/A | V2022.2 | N/A | C122 | ON when out pulse train has been suspended |

The sign of the value in the Target Velocity register (Parameter 3) determines the direction of the pulse train output. In the DirectLOGIC programming example to the right, BCD 5000 is converted to decimal -5000 when C0 is turned ON. You could load (LD) a V memory location instead of using a constant as shown in the example.



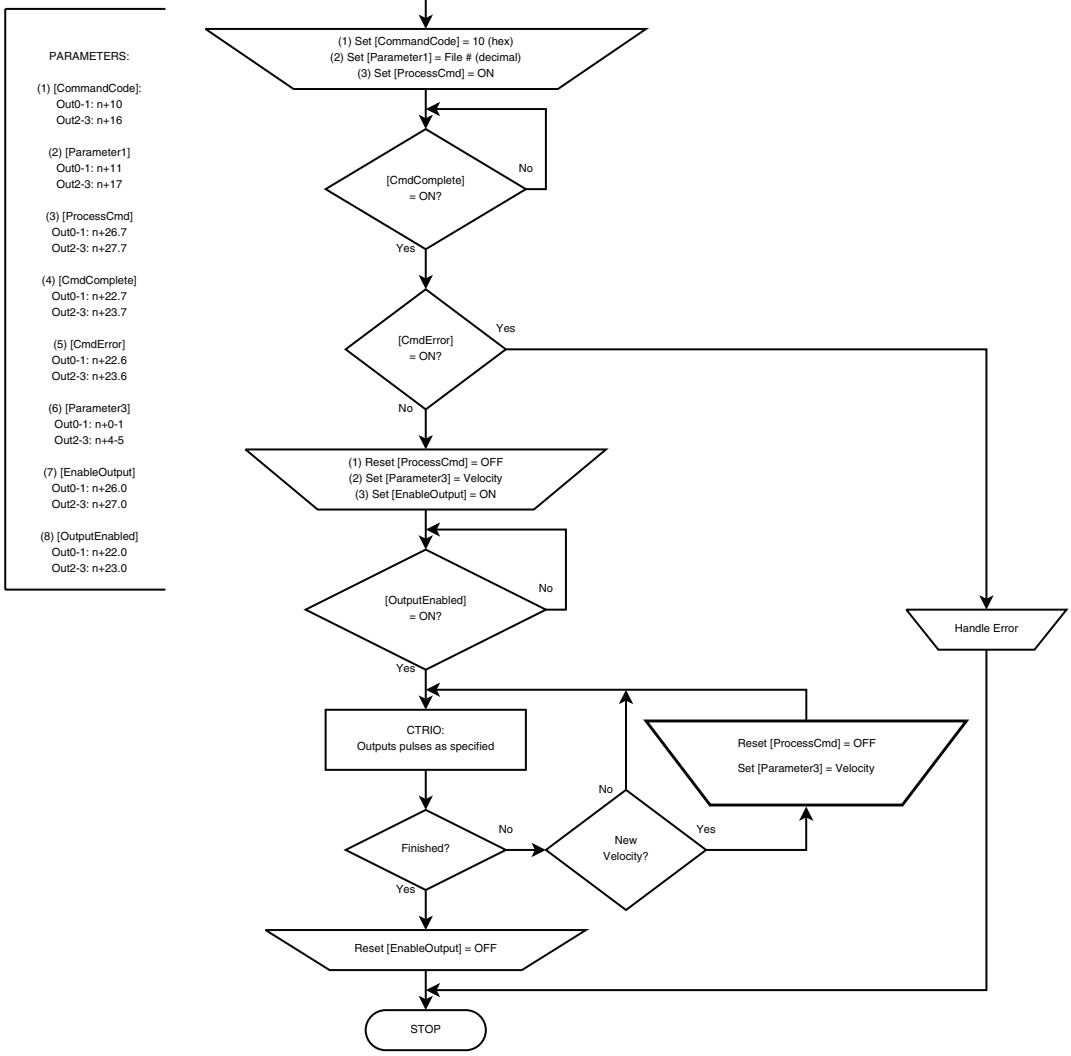
## Dynamic Velocity (IBoxes)

*NOTE: An example program using these IBoxes can be found in the Appendices of the DirectLOGIC user manuals for DL05, DL06 and DL205.*



## Dynamic Velocity (DL-PLC)

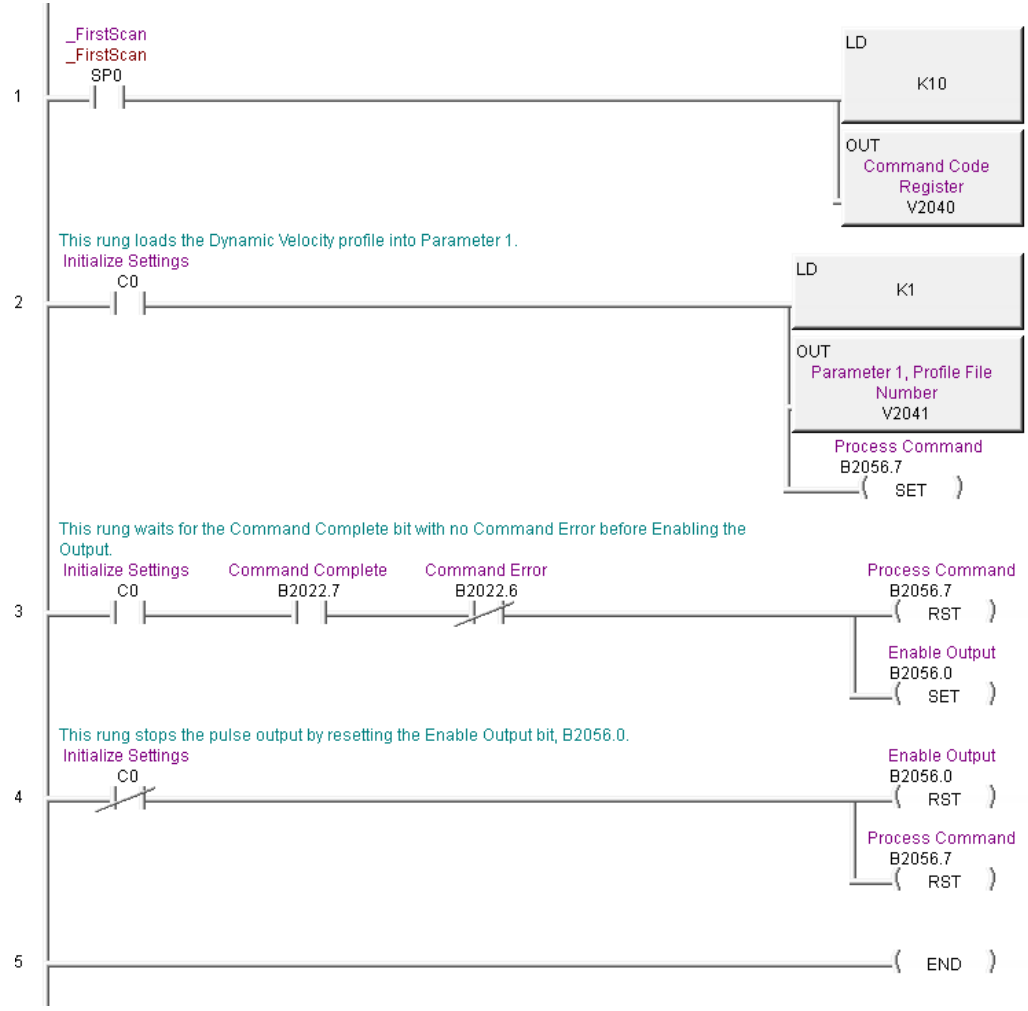
***NOTE:*** *An example program using these IBoxes can be found in the Appendices of the DirectLOGIC user manuals for DL05, DL06 and DL205.*



# Dynamic Velocity Example

☑ DL
☒ Win
☒ NI

The following example program executes a Dynamic Velocity pulse profile. Turn C0 on to load the profile number, process the command and enable the output. The Target Velocity needs to be specified inV2030. The velocity can be changed "on the fly" by entering a different value into V2030. The sign of the value in the target velocity register controls the pulse output direction. Clearing the Output Enable bit will always suspend pulsing.



# Velocity Mode

Velocity Mode is used to set the output to a frequency and duty cycle.

☑ DL
☑ Win
☑ NI

***NOTE:*** *Velocity Mode controls the pulse outputs directly from the CPU/controller program. No CTRIO Workbench Pulse Profile is required for this mode.*

Velocity Mode is not defined or created using the Pulse Profiles Table dialog in CTRIO Workbench. However, the output must be configured for Pulse (Step/Direction) or Pulse (CW/CCW) using the Configure IO dialog. The profile parameters are specified in CPU/controller memory registers. There are no acceleration ramps with Velocity Mode. The output will step directly to the specified frequency and to the specified duty cycle.

The 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. There is no ramping to the target frequency. With a step count of 0xFFFFFFFF, the pulse output will continue indefinitely until the control program disables the output.

Velocity Mode command (Command = 0020 Hex/BCD) allows a specified number of pulse output counts or the number of Pulses can be set to "FFFFFFFF" in Hex for unlimited pulse counts. Leaving the **Duty Cycle** set to 0 achieves the default (50%), otherwise it can be set in 1% increments by writing this value from 1 to 99 decimal. After this command is processed, the **Run Frequency** and **Duty Cycle** fields can be adjusted by direct access. In order to change directions from **Pulse Output** in "Velocity" mode, the **Enable Output** bit must first be cleared (which stops the Pulse Outputs). Then after the new **Direction** bit is written, the **Enable Output** bit can be set to resume pulsing. Refer to the following table for a ***Direct***LOGIC programming example that executes a Velocity Mode pulse profile using bit/(D)word addressing.

# Pulse Output Status/Control Bits and Command Codes (DL PLCs)

## Output Status Bit Definitions (Pulse Output)

☑ DL
☑ Win
☑ NI

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

| Status Bit CTRIO(2) to CPU | Bit Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Input Start (octal) |
|---|---|---|
| Output Enabled | 32, 48 | 22.0, 23.0 |
| Position Loaded | 33, 49 | 22.1, 23.1 |
| Output Suspended | 34, 50 | 22.2, 23.2 |
| Output Active | 36, 52 | 22.4, 23.4 |
| Output Stalled | 37, 53 | 22.5, 23.5 |
| Command Error | 38, 54 | 22.6, 23.6 |
| Command Complete | 39, 55 | 22.7, 23.7 |

## Output Control Bit Definitions (Pulse Output)

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

| Control Bit CPU to CTRIO(2) | Bit Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) | Read as: |
|---|---|---|---|
| Enable Output | 32, 48 | 26.0, 27.0 | Level |
| Go to Position | 33, 49 | 26.1, 27.1 | Rising Edge |
| Suspend Output | 34, 50 | 26.2, 27.2 | Level |
| Direction | 36, 52 | 26.4, 27.4 | Level |
| Process Command | 39, 55 | 26.7, 27.7 | Rising Edge |

## Output Control (D)Words (Pulse Output)

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

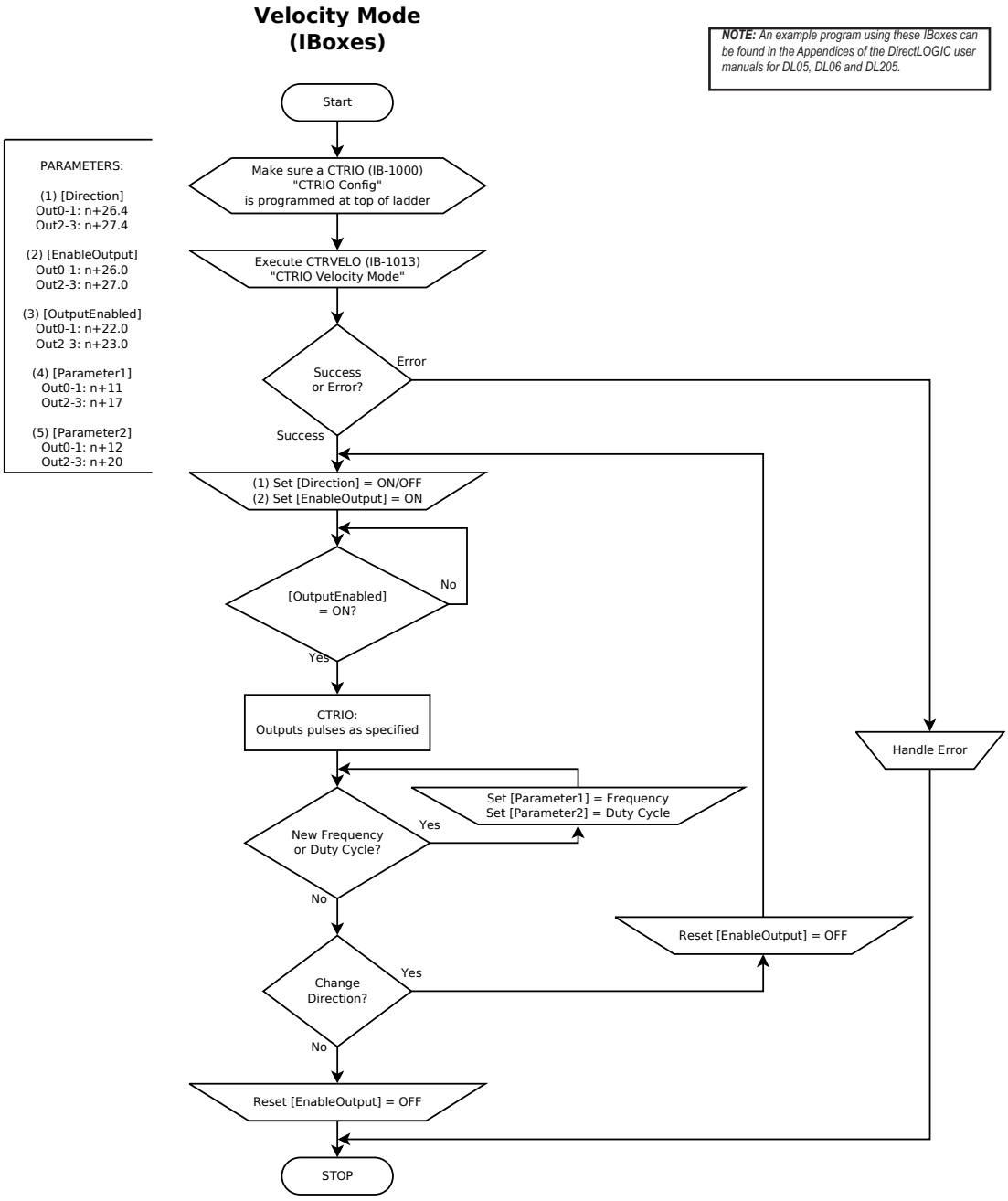
| Word Control CPU to CTRIO(2) | Word Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) |
|---|---|---|
| Command Code | 0, 6 | 10, 16 |
| Word Parameter 1 | 1, 7 | 11, 17 |
| Word Parameter 2 | 2, 8 | 12, 20 |

| DWord Control CPU to CTRIO(2) | Word Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) |
|---|---|---|
| DWord Parameter 3 | 0, 2 | 0, 4 |

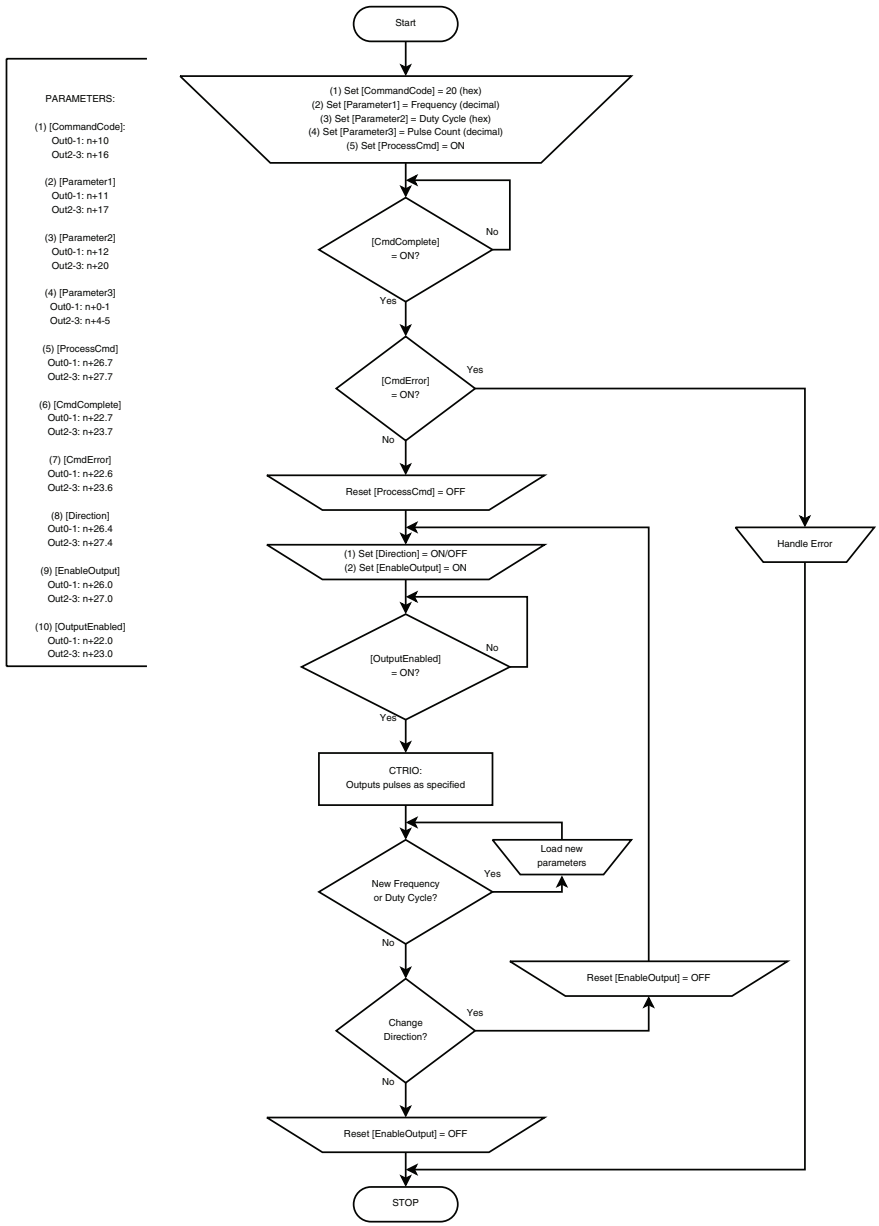
## Velocity Mode Control on CTRIO(2) Y0 and Y1

| Steps | Name | PLC Control Outputs Base Addr = V2030 (Bit-of-Word) | PLC Status Inputs Base Addr = V2000 (Bit-of-Word) | PLC Control Outputs Base Addr = V2030 (Control Relay) D2-240 | PLC Status Inputs Base Addr = V2000 (Control Relay) D2-240 | Action |
|---|---|---|---|---|---|---|
| 1 | Command Code | V2040 | N/A | V2040 | N/A | Set to 20 Hex (Pulse at Velocity) |
| 2 | Parameter 1 | V2041 | | V2041 | | Run frequency, decimal CTRIO: 20Hz-25000Hz CTRIO2: 20Hz-64000Hz |
| 3 | Parameter 2 | V2042 | | V2042 | | Duty cycle (1-99) (can leave 0 for 50%) decimal |
| 4 | Parameter 3 | V2031 / V2030 | | V2031 / V2030 | | Number of pulses (DWord); set to FFFFFFFF for no limit, Hex |
| 5 | Set Direction | V2056.4 | | C224 | | Set ON or OFF for Direction of Rotation |
| 6 | Process Command | V2056.7 | | C227 | | Turn ON Command Complete status bit is returned (see step 7) |
| 7 | Command Status | N/A | V2022.7 | N/A | C127 | When ON, command has been accepted, clear Process Command bit (step 6) |
| 8 | Command Error | | V2022.6 | | C126 | ON if Command or Parameters are invalid |
| 9 | Enable Output | V2056.0 | N/A | C220 | N/A | Turn ON to start pulses |
| 10 | Disable Output | V2056.0 | | C220 | | Turn OFF to start pulses |
| 11 | Suspend Output | V2056.2 | | C222 | | Turn ON to “pause” output pulses without resetting pulse count |
| 12 | Output Suspended | N/A | V2022.2 | N/A | C122 | ON when out pulse train has been suspended |

While Velocity Mode Control is running, **Run Frequency** (step 2) and **Duty Cycle** (step 3) may be actively changed simply by writing a new Parameter value. Since no Accel/Decel parameters are specified in this profile, the output change is a step response.


Velocity Mode
(IBoxes)
NOTE: An example program using these IBoxes can be found in the Appendices of the DirectLOGIC user manuals for DL05, DL06 and DL205.
PARAMETERS:
(1) [Direction]
Out0-1: n+26.4
Out2-3: n+27.4
(2) [EnableOutput]
Out0-1: n+26.0
Out2-3: n+27.0
(3) [OutputEnabled]
Out0-1: n+22.0
Out2-3: n+23.0
(4) [Parameter1]
Out0-1: n+11
Out2-3: n+17
(5) [Parameter2]
Out0-1: n+12
Out2-3: n+20
Start
Make sure a CTRIO (IB-1000) "CTRIO Config" is programmed at top of ladder
Execute CTRVELO (IB-1013) "CTRIO Velocity Mode"
Success or Error?
Error
Success
(1) Set [Direction] = ON/OFF
(2) Set [EnableOutput] = ON
[OutputEnabled] = ON?
No
Yes
CTRIO: Outputs pulses as specified
Handle Error
Set [Parameter1] = Frequency
Set [Parameter2] = Duty Cycle
New Frequency or Duty Cycle?
Yes
No
Reset [EnableOutput] = OFF
Change Direction?
Yes
No
Reset [EnableOutput] = OFF
STOP

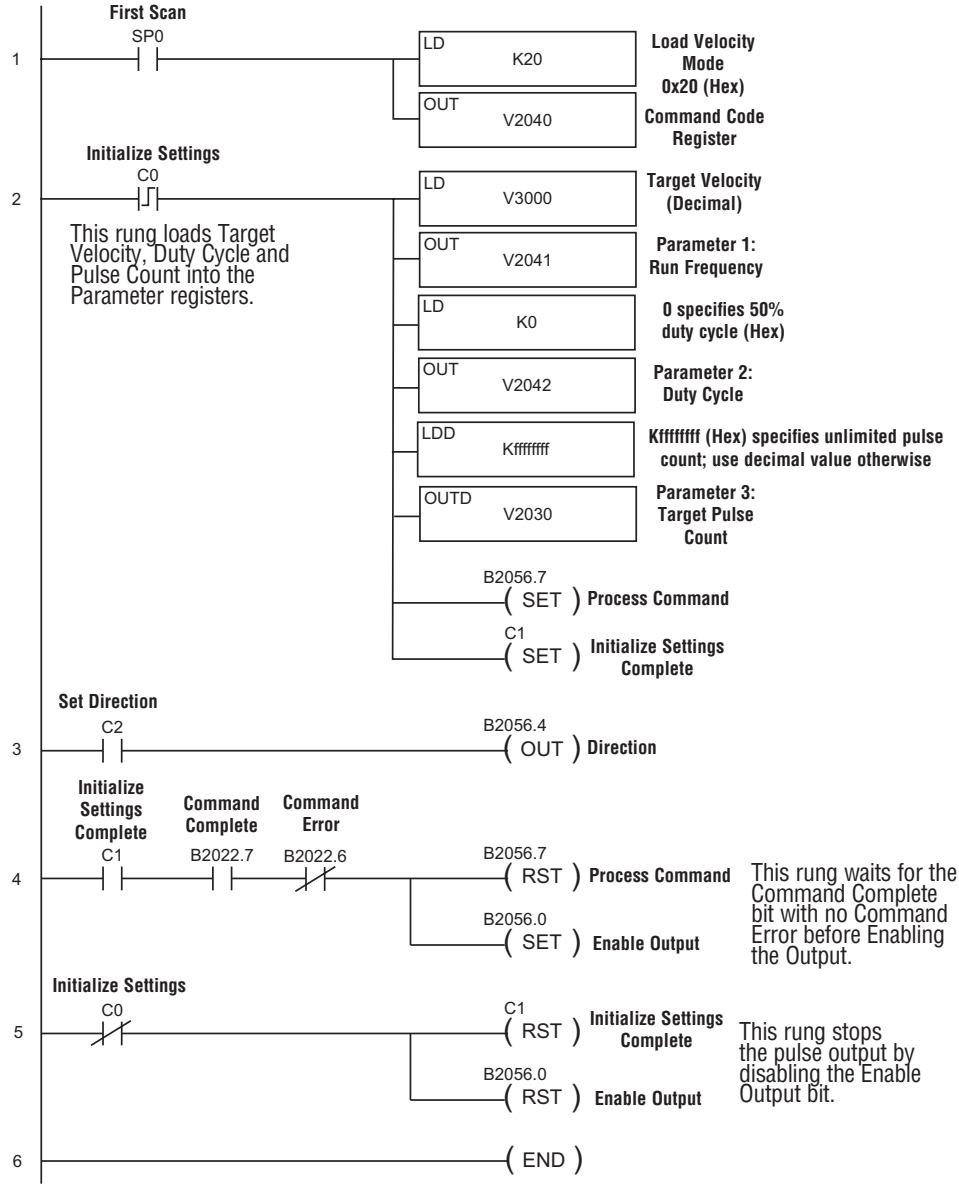
**Velocity Mode**
**(DL-PLC)**



# Velocity Mode Example

☑ DL
☒ Win
☒ NI

The following example program loads and executes a Velocity Mode pulse profile. For Parameter 3, a specific number of pulse output counts can be specified or if set to "ffffffff" Hex, the pulse output will remain ON at the specified Target Velocity until the output is disabled. Once running, velocity and duty cycle can be changed on the fly by loading new values into V2041 and V2042 respectively.



# Run to Limit Mode

☑ DL
☑ Win
☑ NI

Run to Limit is used to make a simple move to a limit input on the CTRIO(2) module. If using a CTRIO2 module, consider using Trapezoid with Limits instead.

Run to Limit Mode is not defined or created using the Pulse Profiles Table dialog in CTRIO Workbench. However, an output must be configured for Pulse (Step/Direction) or Pulse (CW/CCW) using the Configure IO dialog. Also, an input must be configured as a limit for the Output channel to be used. The profile parameters are specified in CPU/controller memory registers. There are no acceleration ramps with Run to Limit Mode. The output will step directly to the specified frequency and duty cycle.

The user specifies the frequency, pulse train duty cycle and which edge of which limit input to stop at. When the Limit is reached the pulse output is disabled.

***NOTE:*** *Run to Limit Mode controls the pulse outputs directly from the CPU/controller program. No CTRIO Workbench Pulse Profile is required for this mode.*

Set Word Parameter 1 to the desired Frequency. Set Word Parameter 2 Low Byte to the Duty Cycle and the High Byte to the appropriate Input and signal Edge. Leaving the Duty Cycle set to 0 achieves the default (50%), otherwise it can be set in 1% increments by writing this value from 1 to 99 Hex/BCD.

# Pulse Output Status/Control Bits and Command Codes (DL PLCs)

☑ DL
☑ Win
☑ NI

## Output Status Bit Definitions (Pulse Output)

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

| Status Bit CTRIO(2) to CPU | Bit Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Input Start (octal) |
|---|---|---|
| Output Enabled | 32, 48 | 22.0, 23.0 |
| Position Loaded | 33, 49 | 22.1, 23.1 |
| Output Suspended | 34, 50 | 22.2, 23.2 |
| Output Active | 36, 52 | 22.4, 23.4 |
| Output Stalled | 37, 53 | 22.5, 23.5 |
| Command Error | 38, 54 | 22.6, 23.6 |
| Command Complete | 39, 55 | 22.7, 23.7 |

## Output Control Bit Definitions (Pulse Output)

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

| Control Bit CPU to CTRIO(2) | Bit Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) | Read as: |
|---|---|---|---|
| Enable Output | 32, 48 | 26.0, 27.0 | Level |
| Go to Position | 33, 49 | 26.1, 27.1 | Rising Edge |
| Suspend Output | 34, 50 | 26.2, 27.2 | Level |
| Direction | 36, 52 | 26.4, 27.4 | Level |
| Process Command | 39, 55 | 26.7, 27.7 | Rising Edge |

## Output Control (D)Words (Pulse Output)

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

| Word Control CPU to CTRIO(2) | Word Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) |
|---|---|---|
| Command Code | 0, 6 | 10, 16 |
| Word Parameter 1 | 1, 7 | 11, 17 |
| Word Parameter 2 | 2, 8 | 12, 20 |

| DWord Control CPU to CTRIO(2) | Word Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) |
|---|---|---|
| DWord Parameter 3 | 0, 2 | 0, 4 |

# Run to Limit Mode, cont'd

**Parameter 2**

Word Parameter 2 defines three elements of the Run to Limit routine. Bits 13 and 12 determine which edge(s) to terminate Output Pulses and Bits 9 and 8 determine which CTRIO(2) module input terminal to use for the limit. The low byte specifies the duty cycle.

| Edge to Seek | Parameter 2 Bits 13 & 12 | Parameter 2 Bits 9 & 8 | Parameter 2 (Hex) (Duty cycle at 50%) |
|---|---|---|---|
| Rising Edge Ch1 C | 00 | 00 | 0000 |
| Falling Edge Ch1 C | 01 | 00 | 1000 |
| Both Edge Ch1 C | 10 | 00 | 2000 |
| Rising Edge Ch1 D | 00 | 01 | 0100 |
| Falling Edge Ch1 D | 01 | 01 | 1100 |
| Both Edge Ch1 D | 10 | 01 | 2100 |
| Rising Edge Ch2 C | 00 | 10 | 0200 |
| Falling Edge Ch2 C | 01 | 10 | 1200 |
| Both Edge Ch2 C | 10 | 10 | 2200 |
| Rising Edge Ch2 D | 00 | 11 | 0300 |
| Falling Edge Ch2 D | 01 | 11 | 1300 |
| Both Edge Ch2 D | 10 | 11 | 2300 |

| Edge(s) | Bits 15..12 | CTRIO Input | Bits 11..8 |
|---|---|---|---|
| Rising | 0000, 0Hex | Ch 1 C | 0000, 0Hex |
| Falling | 0001, 1Hex | Ch 1 D | 0001, 1Hex |
| Both | 0010, 2Hex | Ch 2 C | 0010, 2Hex |
| | | Ch 2 D | 0011, 3Hex |

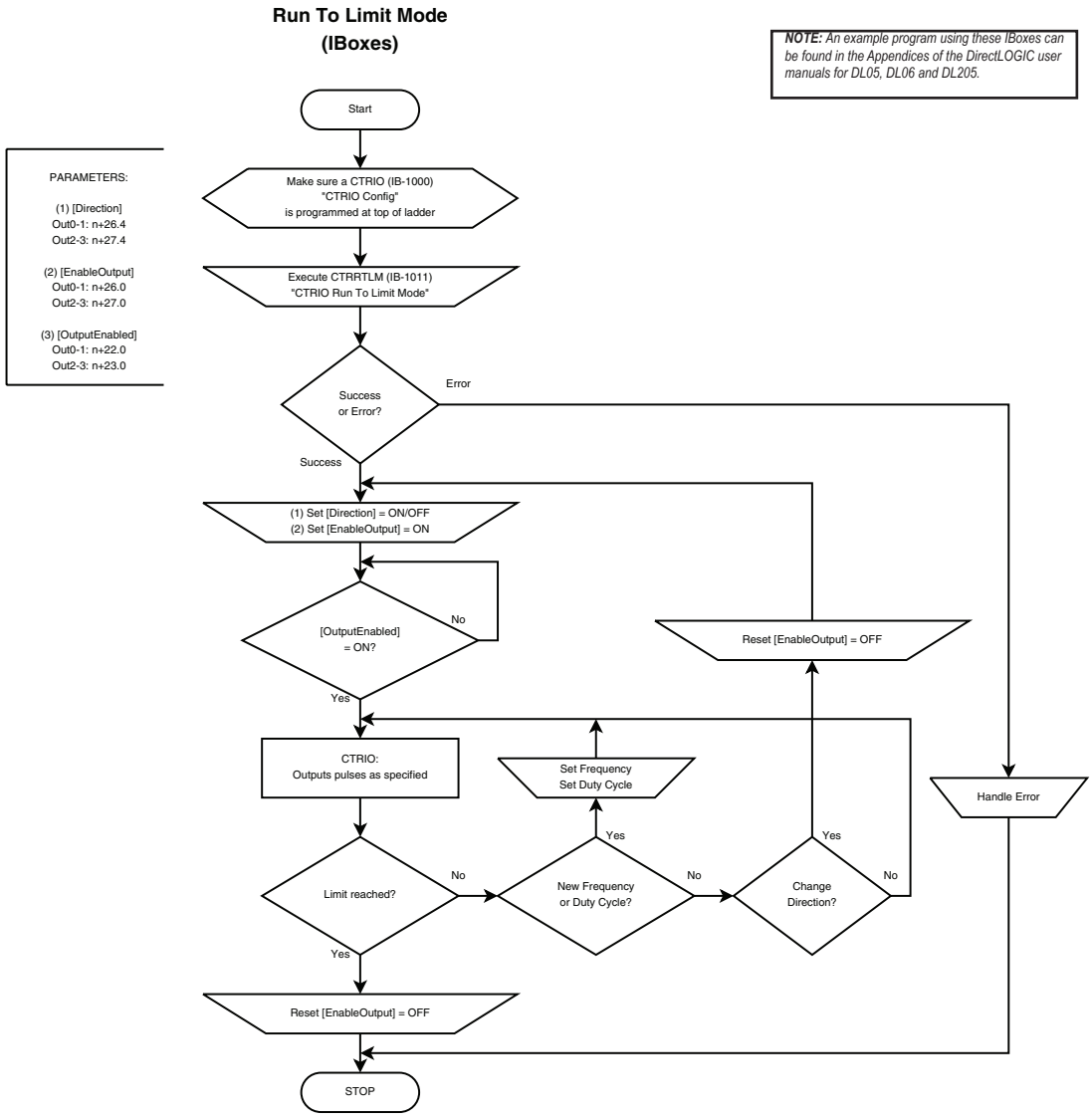
## Run at Velocity on CTRIO(2) Y0 and Y1 until Discrete Input Limit

## Dynamic Velocity Example

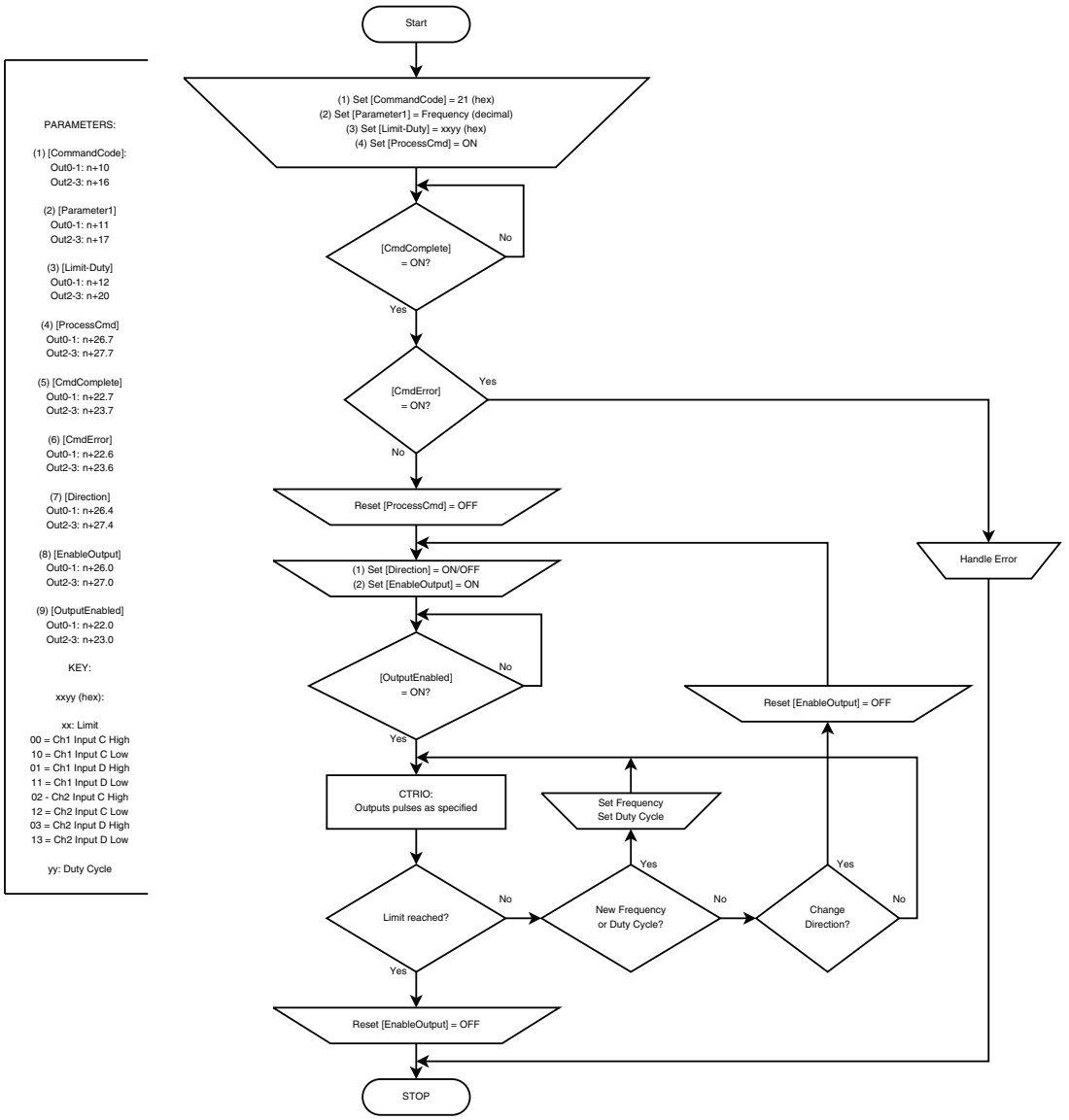
Example: You will need to have a Dynamic Velocity profile configured as Table File Number 1 using the Configure I/O dialog. You will also need to have the appropriate Target Velocity (signed decimal) stored in V3000 for this example. You must turn C0 on to initialize the settings and enable the output.

☑ DL
☒ Win
☒ NI

| Steps | Name | PLC Control Outputs Base Addr = V2030 (Bit-of-Word) | PLC Status Inputs Base Addr = V2000 (Bit-of-Word) | PLC Control Outputs Base Addr = V2030 (Control Relay) D2-240 | PLC Status Inputs Base Addr = V2000 (Control Relay) D2-240 | Action |
|---|---|---|---|---|---|---|
| 1 | Command Code | V2040 | N/A | V2040 | N/A | Set to 21 Hex (Run to Limit Mode) |
| 2 | Parameter 1 | V2041 | | V2041 | | Set initial run frequency, decimal CTRIO: 20Hz-25000Hz CTRIO2: 20Hz - 64000Hz |
| 3 | Parameter 2 | V2042 | | V2042 | | Select discrete input edge in high byte, low byte = duty cycle (1-99) Example: rising input 1D at Duty = 45%, set this parameter to 212D Hex |
| 4 | Set Direction | V2056.4 | | C224 | | Set ON or OFF for Direction of Rotation |
| 5 | Process Command | V2056.7 | | C227 | | Turn ON Command Complete status bit is returned (see step 6) |
| 6 | Command Status | N/A | V2022.7 | N/A | C127 | When ON, command has been accepted, clear Process Command bit (step 5) |
| 7 | Command Error | | V2022.6 | | C126 | ON if Command or Parameters are invalid |
| 8 | Enable Output | V2056.0 | N/A | C220 | N/A | Turn ON to start pulses |
| 9 | Output Active Status | N/A | V2022.4 | N/A | C124 | ON while pulsing, OFF when limit has stopped pulsing |
| 10 | Suspend Output | V2056.2 | N/A | C222 | N/A | Turn ON to “pause” output pulses without resetting pulse count |
| 11 | Output Suspended | N/A | V2022.2 | N/A | C122 | ON when out pulse train has been suspended |


Run To Limit Mode
(IBoxes)
NOTE: An example program using these IBoxes can be found in the Appendices of the DirectLOGIC user manuals for DL05, DL06 and DL205.
PARAMETERS:
(1) [Direction]
Out0-1: n+26.4
Out2-3: n+27.4
(2) [EnableOutput]
Out0-1: n+26.0
Out2-3: n+27.0
(3) [OutputEnabled]
Out0-1: n+22.0
Out2-3: n+23.0
Start
Make sure a CTRIO (IB-1000) "CTRIO Config" is programmed at top of ladder
Execute CTRRTLM (IB-1011) "CTRIO Run To Limit Mode"
Success or Error?
Error
Success
(1) Set [Direction] = ON/OFF
(2) Set [EnableOutput] = ON
[OutputEnabled] = ON?
No
Yes
Reset [EnableOutput] = OFF
CTRIO: Outputs pulses as specified
Set Frequency
Set Duty Cycle
Handle Error
Limit reached?
New Frequency or Duty Cycle?
Change Direction?
Yes
No
Reset [EnableOutput] = OFF
STOP

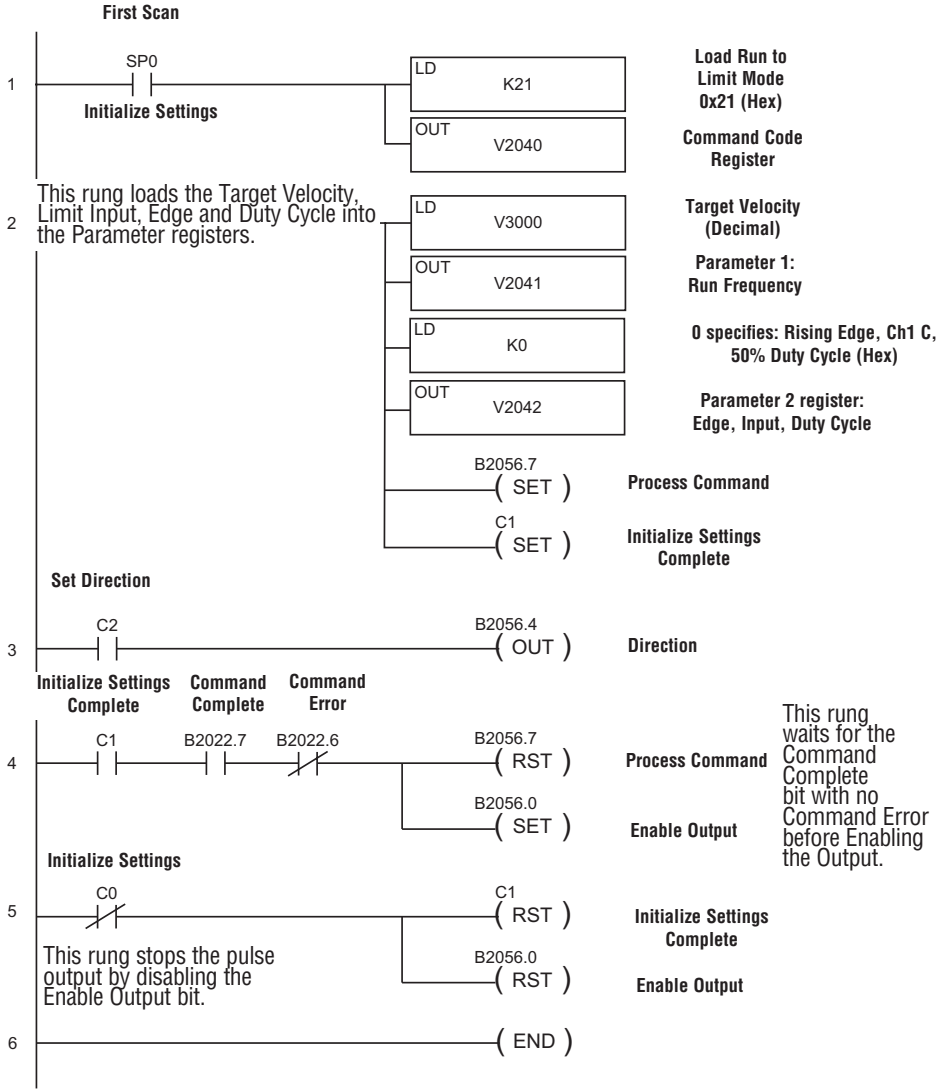
**Run To Limit Mode**
**(DL-PLC)**



# Run to Limit Mode Example

The following example program loads and executes a Run to Limit Mode pulse profile. Turn on C0 to run the profile. CTRIO input C or D must be assigned to Limit for this profile. Once running, velocity and duty cycle can be changed on the fly by loading new values into V2041 and V2042 respectively.

☑ DL ☒ Win ☒ NI



# Run to Position Mode

☑ DL
☑ Win
☑ NI

Run to Position is used to make a simple move to a new position. If using a CTRIO2 module, consider using Dynamic Positioning Plus instead. Dynamic Positioning Plus is almost always the better choice.

Run to Position Mode is not defined or created using the Pulse Profiles Table dialog in CTRIO Workbench. However, an output must be configured for Pulse (Step/Direction) or Pulse (CW/CCW) using the Configure IO dialog. Also, an input must be configured as a counter. The profile parameters are specified in CPU/controller memory registers. There are no acceleration ramps with Run to Limit Mode. The output will step directly to the specified frequency and duty cycle. Use caution when choosing the frequency to avoid stalling a stepper.

The user specifies the target frequency, pulse train duty cycle, input function to compare, direction and target position. The current position is obtained from the specified Input Function (i.e. Quadrature counter). When the current position satisfies the comparison specified, the pulse output is disabled. The comparison of the current and target positions can be based on greater than or equal to or less than operators.

***NOTE:*** *Run to Position Mode controls the pulse outputs directly from the CPU/controller program. No CTRIO Workbench Pulse Profile is required for this mode.*

The Run to Position Mode command (Command = 0022Hex/BCD) allows generating output pulses at a steady frequency until some value has been reached on a counter input. Select the direction using the direction bit. Set Word Parameter 1 to the desired Frequency. Set Word Parameter 2 Low Byte to the Duty Cycle and the High Byte to the Compare Functions as defined below. Leaving the Duty Cycle set to 0 achieves the default (50%), otherwise it can be set in 1% increments by writing this value from 1 to 99 Hex/BCD.

Word Parameter 3 specifies the value that Input Function will compare against.

# Pulse Output Status/Control Bits and Command Codes (DL PLCs)

☑ DL
☑ Win
☑ NI

## Output Status Bit Definitions (Pulse Output)

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

| Status Bit CTRIO(2) to CPU | Bit Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Input Start (octal) |
|---|---|---|
| Output Enabled | 32, 48 | 22.0, 23.0 |
| Position Loaded | 33, 49 | 22.1, 23.1 |
| Output Suspended | 34, 50 | 22.2, 23.2 |
| Output Active | 36, 52 | 22.4, 23.4 |
| Output Stalled | 37, 53 | 22.5, 23.5 |
| Command Error | 38, 54 | 22.6, 23.6 |
| Command Complete | 39, 55 | 22.7, 23.7 |

## Output Control Bit Definitions (Pulse Output)

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

| Control Bit CPU to CTRIO(2) | Bit Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) | Read as: |
|---|---|---|---|
| Enable Output | 32, 48 | 26.0, 27.0 | Level |
| Go to Position | 33, 49 | 26.1, 27.1 | Rising Edge |
| Suspend Output | 34, 50 | 26.2, 27.2 | Level |
| Direction | 36, 52 | 26.4, 27.4 | Level |
| Process Command | 39, 55 | 26.7, 27.7 | Rising Edge |

## Output Control (D)Words (Pulse Output)

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

| Word Control CPU to CTRIO(2) | Word Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) |
|---|---|---|
| Command Code | 0, 6 | 10, 16 |
| Word Parameter 1 | 1, 7 | 11, 17 |
| Word Parameter 2 | 2, 8 | 12, 20 |

| DWord Control CPU to CTRIO(2) | Word Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) |
|---|---|---|
| DWord Parameter 3 | 0, 2 | 0, 4 |

## Parameter 2

Word Parameter 2 defines three elements of the Run to Position routine. Bit 12 determines if the specified position is "greater than or equal" or "less than" the current Input Function position value. Bits 9 and 8 determine which Input Function to use for the comparison. The low byte specifies the duty cycle.

| Specified Position (Parameter 3) is: | Parameter 2 Bit 12 | Parameter 2 Bits 9 & 8 | Parameter 2 (Hex) (Duty cycle at 50%) |
|---|---|---|---|
| Less than Ch1/Fn1 | 0 | 00 | 0000 |
| Greater than Ch1/Fn1 | 1 | 00 | 1000 |
| Less than Ch1/Fn2 | 0 | 01 | 0100 |
| Greater than Ch1/Fn2 | 1 | 01 | 1100 |
| Less than Ch2/Fn1 | 0 | 10 | 0200 |
| Greater than Ch2/Fn1 | 1 | 10 | 1200 |
| Less than Ch2/Fn2 | 0 | 11 | 0300 |
| Greater than Ch2/Fn2 | 1 | 11 | 1300 |

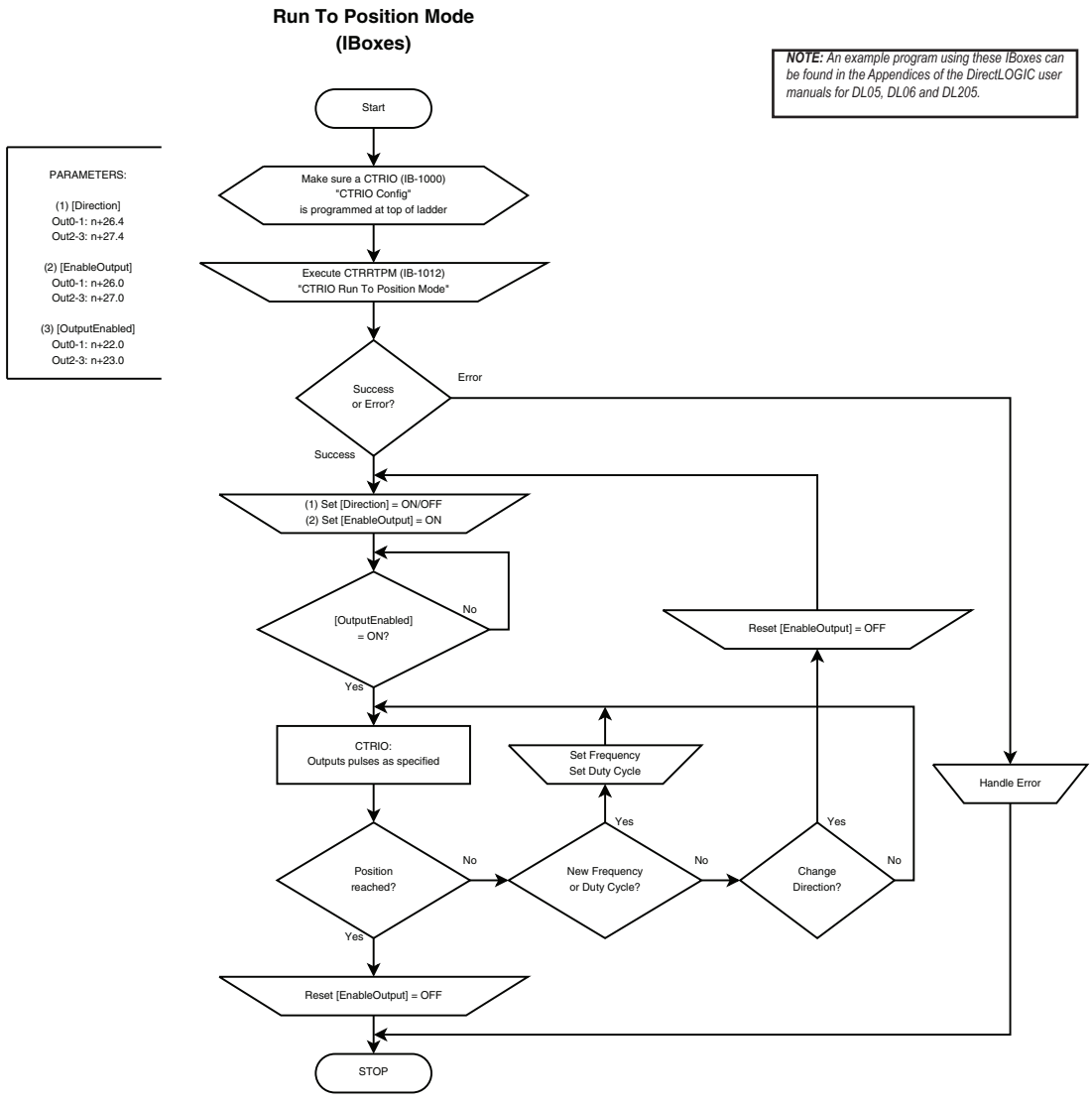
| Comparison | Bits 15..12 |
|---|---|
| Greater Than or Equal | 0001, 1Hex |
| Less Than | 0000, 0Hex |

| Input Function | Bits 11..8 |
|---|---|
| Ch 1 Fn 1 | 0000, 0Hex |
| Ch 1 Fn 2 | 0001, 1Hex |
| Ch 2 Fn 1 | 0010, 2Hex |
| Ch 2 Fn 2 | 0011, 3Hex |

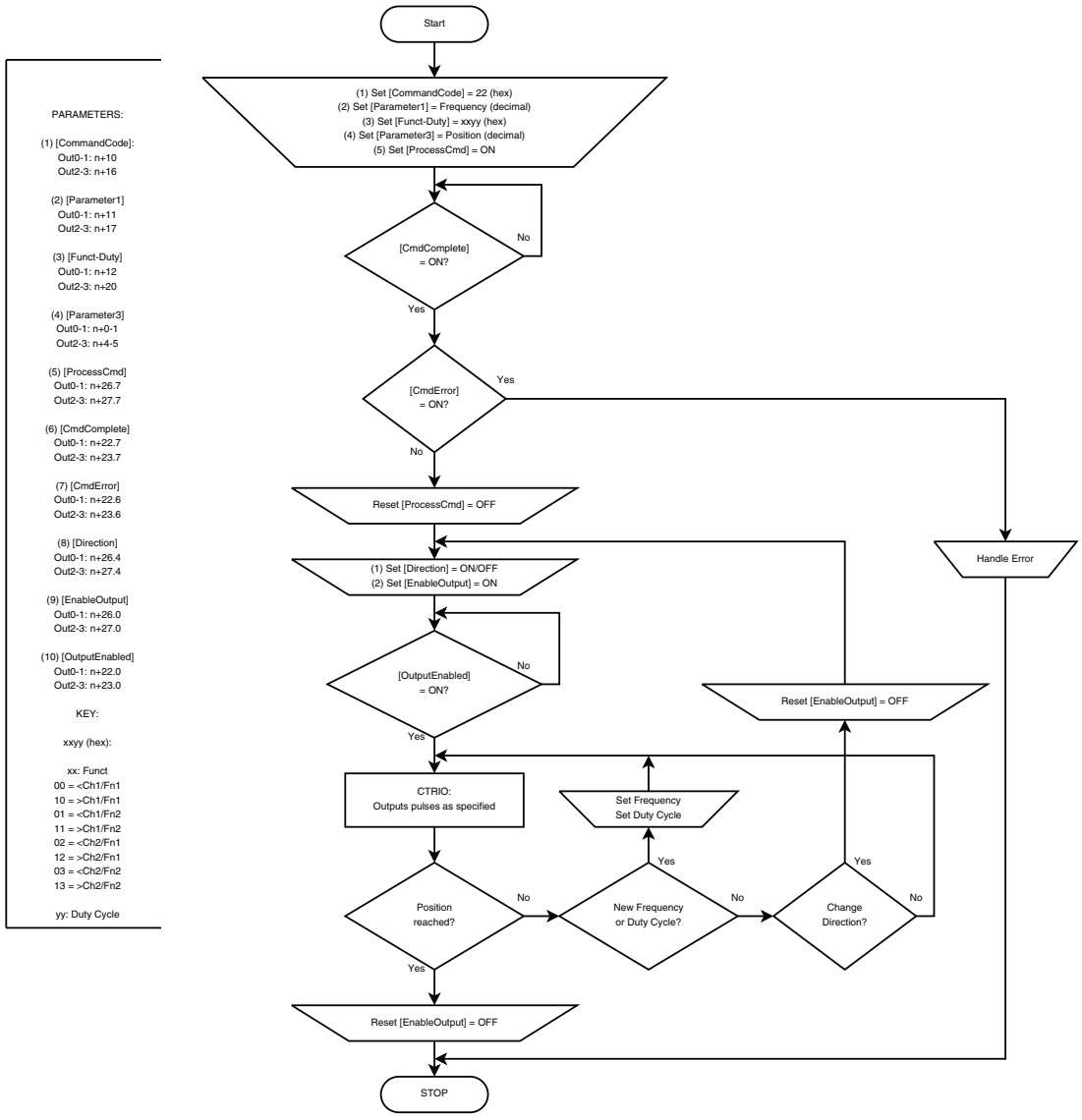
## Run at Velocity on CTRIO(2) until Input Function Value Position

☑ DL
☒ Win
☒ NI

| Steps | Name | PLC Control Outputs Base Addr = V2030 (Bit-of-Word) | PLC Status Inputs Base Addr = V2000 (Bit-of-Word) | PLC Control Outputs Base Addr = V2030 (Control Relay) D2-240 | PLC Status Inputs Base Addr = V2000 (Control Relay) D2-240 | Action |
|---|---|---|---|---|---|---|
| 1 | Command Code | V2040 | N/A | V2040 | N/A | Set to 22 Hex (Pulse at velocity until Function Input Limit) |
| 2 | Parameter 1 | V2041 | | V2041 | | Set initial run frequency, decimal<br>CTRIO: 20Hz-25000Hz<br>CTRIO2: 20Hz - 64000Hz |
| 3 | Parameter 2 | V2042 | | V2042 | | Bits 15-12: Comparison<br>Bits 11-8: Input Function to use<br>Low Byte: Duty cycle (1-99) (can leave 0 for 50%) Hex |
| 4 | Parameter 3 | V2031 / V2030 | | V2031 / V2030 | | Specified position for Input Function DWord to compare against, decimal |
| 5 | Set Direction | V2056.4 | | C224 | | Set ON or OFF for Direction of Rotation |
| 6 | Process Command | V2056.7 | | C227 | | Turn ON Command Complete status bit is returned (see step 7) |
| 7 | Command Status | N/A | V2022.7 | N/A | C127 | When ON, command has been accepted, clear Process Command bit (step 6) |
| 8 | Command Error | | V2022.6 | | C126 | ON if Command or Parameters are invalid |
| 9 | Enable Output | V2056.0 | N/A | C220 | N/A | Turn ON to start pulses |
| 10 | Output Active Status | N/A | V2022.4 | N/A | C124 | ON while pulsing, OFF when position is reached |
| 11 | Suspend Output | V2056.2 | N/A | C222 | N/A | Turn ON to “pause” output pulses without resetting pulse count |
| 12 | Output Suspended | N/A | V2022.2 | N/A | C122 | ON when out pulse train has been suspended |


Run To Position Mode
(IBoxes)
NOTE: An example program using these IBoxes can be found in the Appendices of the DirectLOGIC user manuals for DL05, DL06 and DL205.
PARAMETERS:
(1) [Direction]
Out0-1: n+26.4
Out2-3: n+27.4
(2) [EnableOutput]
Out0-1: n+26.0
Out2-3: n+27.0
(3) [OutputEnabled]
Out0-1: n+22.0
Out2-3: n+23.0
Start
Make sure a CTRIO (IB-1000) "CTRIO Config" is programmed at top of ladder
Execute CTRRTPM (IB-1012) "CTRIO Run To Position Mode"
Success or Error?
Error
Success
(1) Set [Direction] = ON/OFF
(2) Set [EnableOutput] = ON
[OutputEnabled] = ON?
No
Yes
Reset [EnableOutput] = OFF
CTRIO: Outputs pulses as specified
Set Frequency
Set Duty Cycle
Handle Error
Position reached?
New Frequency or Duty Cycle?
Change Direction?
Yes
No
Reset [EnableOutput] = OFF
STOP

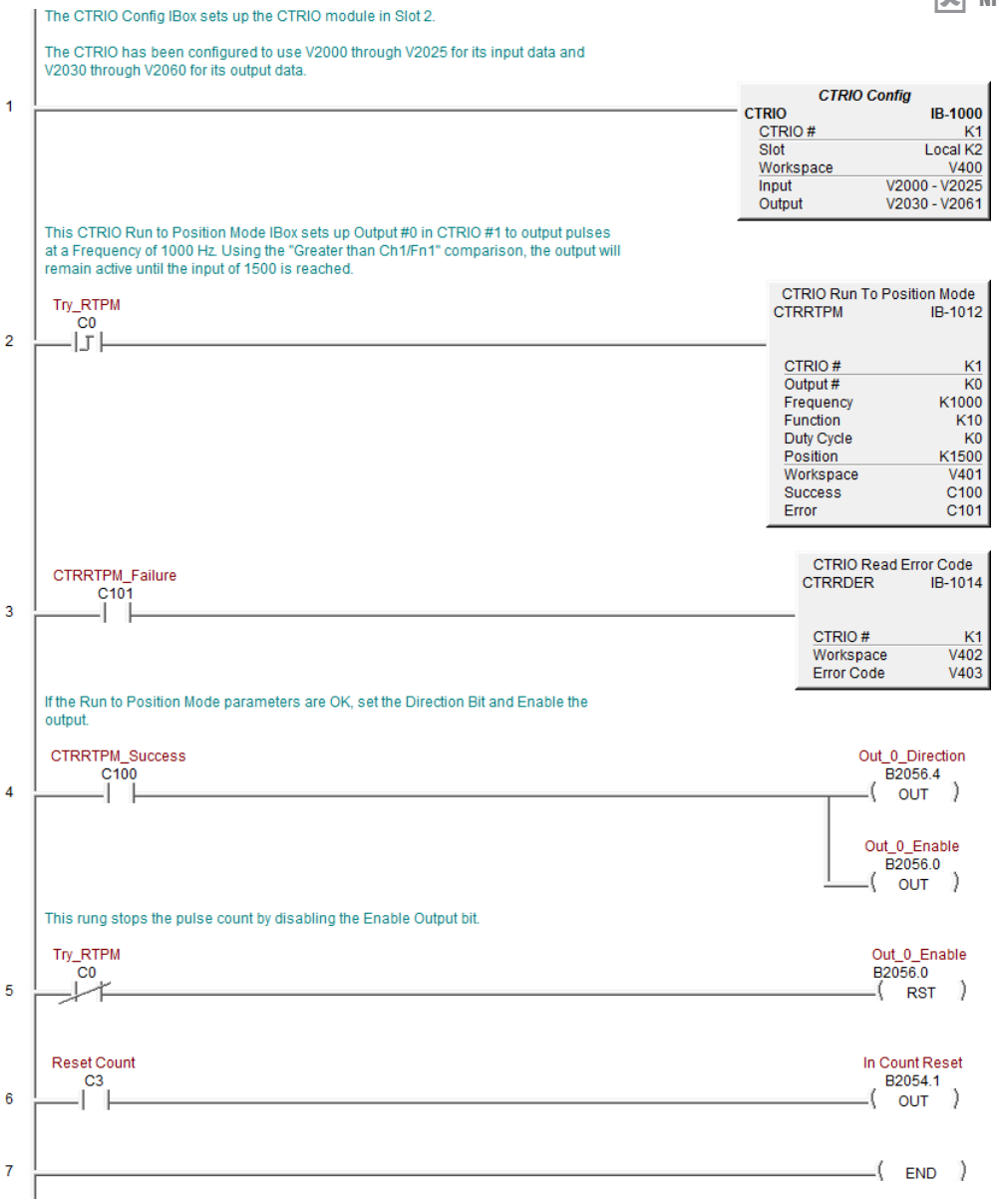
**Run To Position Mode**
**(DL-PLC)**



# Run to Position Mode with DirectSOFT IBox Instructions

This is the equivalent ladder using IBox instructions in ***Direct***SOFT to the ladder shown on the previous page. Turn on C0 to run the pulse profile. Once running, velocity and duty cycle can be changed on the fly by loading new values into V2041 and V2042 respectively.

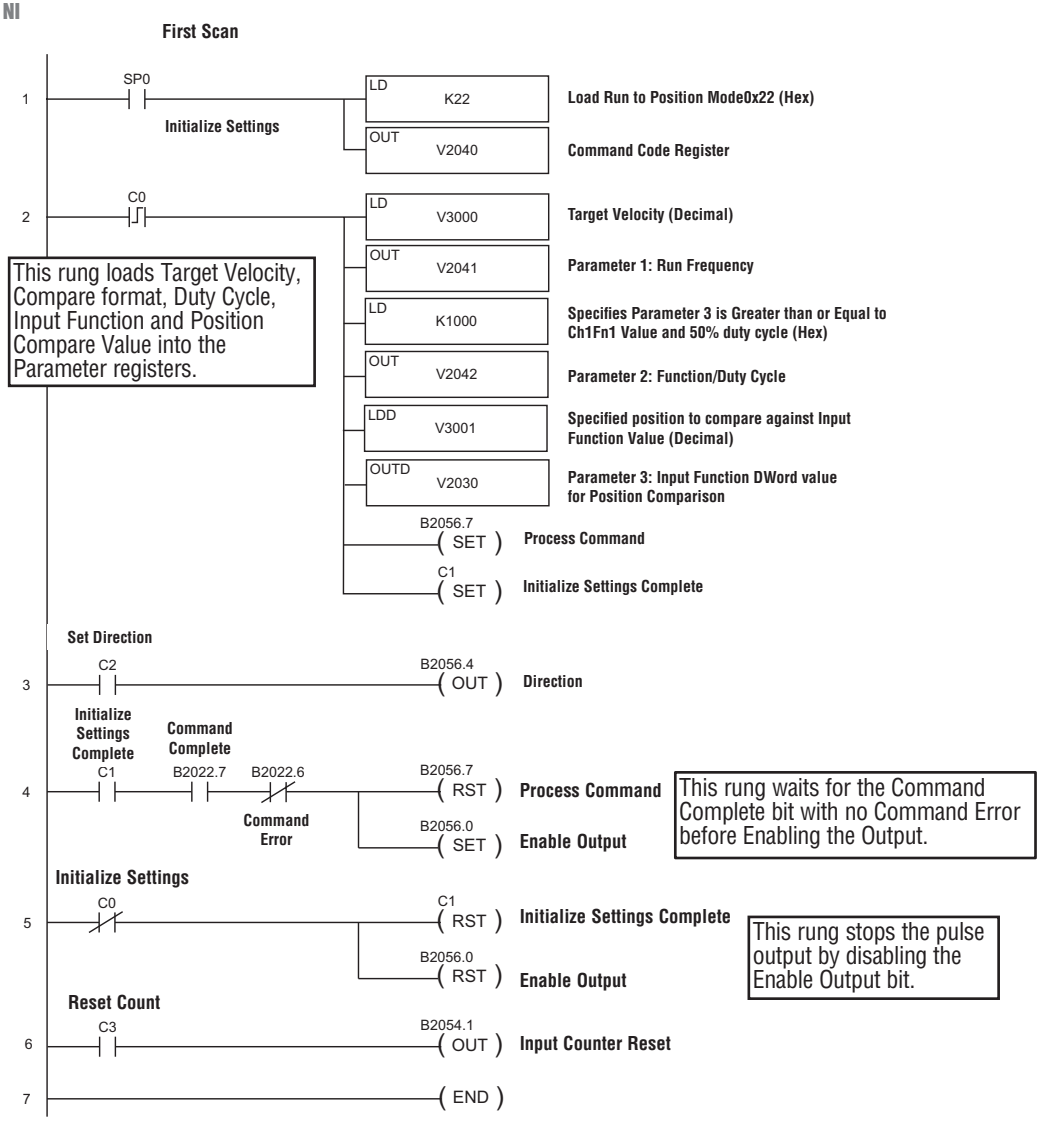
☑ DL ☒ Win ☒ NI



# Run to Position Mode Example

☑ DL
☒ Win
☒ NI

The following example program loads and executes a Run to Position Mode pulse profile. Turn on C0 to run the pulse profile. Once running, velocity and duty cycle can be changed on the fly by loading new values into V2041 and V2042 respectively.

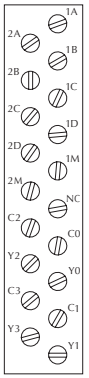


# Raw Output

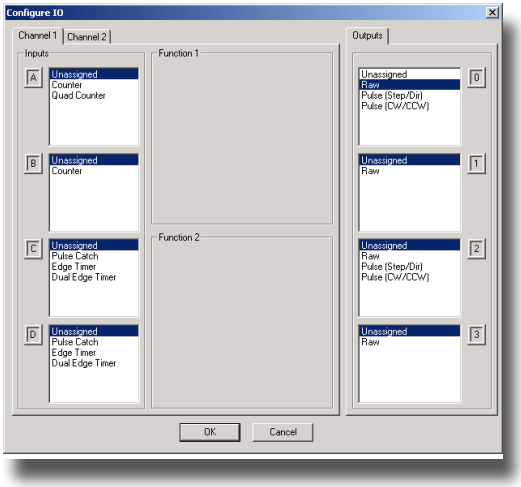
☑ DL
☑ Win
☑ NI

The CTRIO(2) 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.

Refer to *Output Control Bit Definitions (Raw Mode)* in Appendix A for Raw output control bit addressing.



The module output terminals are represented by the 0, 1, 2, and 3 boxes (0 and 1 for the H0-CTRIO(2)) on the Outputs tab at the right side of this Configure IO dialog box.



# Pulse Output Status/Control Bits and Command Codes (DL PLCs)

☑ DL
☑ Win
☑ NI

## Output Status Bit Definitions (Pulse Output)

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

| Status Bit CTRIO(2) to CPU | Bit Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Input Start (octal) |
|---|---|---|
| Output Enabled | 32, 48 | 22.0, 23.0 |
| Position Loaded | 33, 49 | 22.1, 23.1 |
| Output Suspended | 34, 50 | 22.2, 23.2 |
| Output Active | 36, 52 | 22.4, 23.4 |
| Output Stalled | 37, 53 | 22.5, 23.5 |
| Command Error | 38, 54 | 22.6, 23.6 |
| Command Complete | 39, 55 | 22.7, 23.7 |

## Output Control Bit Definitions (Pulse Output)

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

| Control Bit CPU to CTRIO(2) | Bit Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) | Read as: |
|---|---|---|---|
| Enable Output | 32, 48 | 26.0/26.8, 27.0/27.8 | Level |
| Go to Position | 33, 49 | 26.1, 27.1 | Rising Edge |
| Suspend Output | 34, 50 | 26.2, 27.2 | Level |
| Direction | 36, 52 | 26.4, 27.4 | Level |
| Process Command | 39, 55 | 26.7, 27.7 | Rising Edge |

## Output Control (D)Words (Pulse Output)

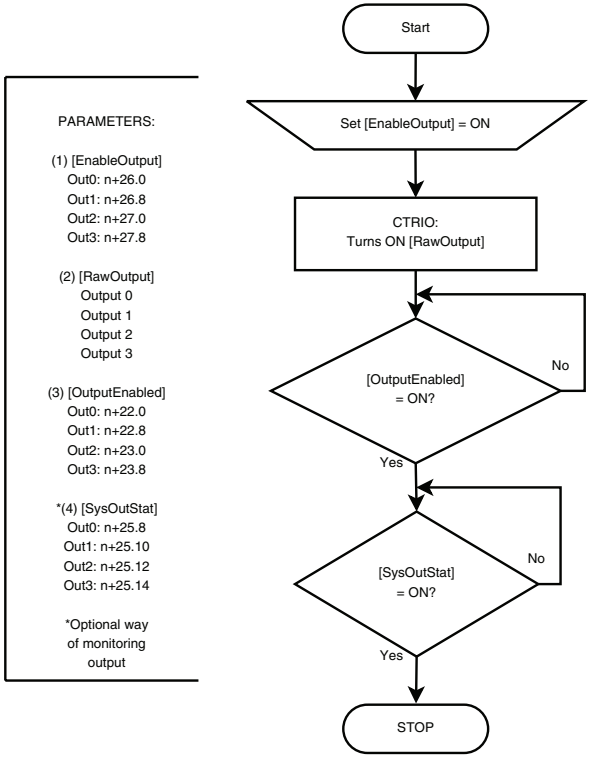
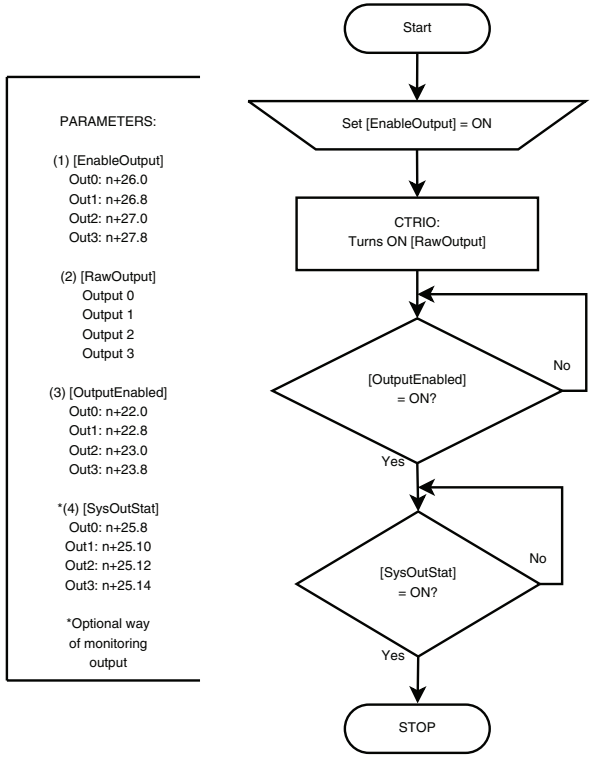
| Word Control CPU to CTRIO(2) | Word Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) |
|---|---|---|
| Command Code | 0, 6 | 10, 16 |
| Word Parameter 1 | 1, 7 | 11, 17 |
| Word Parameter 2 | 2, 8 | 12, 20 |

| DWord Control CPU to CTRIO(2) | Word Offsets: WinPLC, EBC, PBC, DEVNETS, MODBUS | V-memory Offsets from Output Start (octal) |
|---|---|---|
| DWord Parameter 3 | 0, 2 | 0, 4 |

Pulse output control Offsets are listed in the order of Outputs 0/1, 2/3.

## Raw Output (IBoxes)

*NOTE: An example program using these IBoxes can be found in the Appendices of the DirectLOGIC user manuals for DL05, DL06 and DL205.*



**Raw Output**
**(DL-PLC)**