Program Control

In This Chapter...

Memory Map for Inputs from CTRIO to CPU 4–2
Memory Map for Outputs from CPU to CTRIO 4–3
CTRIO Input Parameter Definitions 4–4
Function Status and Control Bit Definitions 4–5
Runtime Changes to the Preset Tables 4–6
Addressing Conventions 4–9
Pulse Output Commands 4–10
Pulse Output Profiles 4–12

Memory Map for Inputs from CTRIO to CPU

The following table shows which memory locations are used for memory transfers from the CTRIO module to the CPU. The starting memory location is defined by the user in the I/O Map within CTRIO Workbench. If you are using the D2-240 or D2-250 CPU, you will use the memory address offsets in the second column. If you are using an H2-WinPLC in the CPU slot, you will use the non-PLC offsets in column one.

Data Type and Offset WinPLC & EBC	*Address for Inputs (DirectLOGIC)*	*Definition*	*Format*	*Bytes*
dwX0	n+0	Ch 1/Fn 1 Parameter 1	DWord	4
dwX1	n+2	Ch 1/Fn 1 Parameter 2	DWord	4
dwX2	n+4	Ch 1/Fn 2 Parameter 1	DWord	4
dwX3	n+6	Ch 1/Fn 2 Parameter 2	DWord	4
dwX4	n+10	Ch 2/Fn 1 Parameter 1	DWord	4
dwX5	n+12	Ch 2/Fn 1 Parameter 2	DWord	4
dwX6	n+14	Ch 2/Fn 2 Parameter 1	DWord	4
dwX7	n+16	Ch 2/Fn 2 Parameter 2	DWord	4
bX0...7 bX8...15	n+20	Ch 1/Fn 1 Status (Low Byte) Ch 1/Fn 2 Status (High Byte)	Word	2
bX16...23 bX24...31	n+21	Ch 2/Fn 1 Status (Low Byte) Ch 2/Fn 2 Status (High Byte)	Word	2
bX32...39 bX40...47	n+22	Output 0 Status (Low Byte) Output 1 Status (High Byte)	Word	2
bX48...55 bX56...63	n+23	Output 2 Status (Low Byte) Output 3 Status (High Byte)	Word	2

For DirectSOFT32 users: the I/O Map dialog displays the exact memory locations in use by the CTRIO module. Within the I/O Map dialog you can print out a report of memory loctions in use.

Memory Map for Outputs from CPU to CTRIO

The following table shows which memory locations are used for memory transfers from the CPU module to the CTRIO. The starting memory location is defined by the user in the I/O Map within CTRIO Workbench. If you are using the D2-240 or D2-250 CPU, you will use the memory address offsets in the second column. If you are using an H2-WinPLC in the CPU slot, you will use the non-PLC offsets in column one.

Data Type and Offset WinPLC & EBC	*Addr. for Inputs (DirectLOGIC)*	*Definition*	*Format*	*Bytes*
dwY0	n+0	Output 0 Parameter 3	DWord	4
dwY1	n+2	Output 1 Parameter 3	DWord	4
dwY2	n+4	Output 2 Parameter 3	DWord	4
dwY3	n+6	Output 3 Parameter 3	DWord	4
wY0	n+10	Output 0 Command	Word	2
wY1	n+11	Output 0 Parameter 1	Word	2
wY2	n+12	Output 0 Parameter 2	Word	2
wY3	n+13	Output 1 Command	Word	2
wY4	n+14	Output 1 Parameter 1	Word	2
wY5	n+15	Output 1 Parameter 2	Word	2
wY6	n+16	Output 2 Command	Word	2
wY7	n+17	Output 2 Parameter 1	Word	2
wY8	n+20	Output 2 Parameter 2	Word	2
wY9	n+21	Output 3 Command	Word	2
wY10	n+22	Output 3 Parameter 1	Word	2
wY11	n+23	Output 3 Parameter 2	Word	2
bY0...7 bY8...15	n+24	Ch 1/Fn 1 Status (Low Byte) Ch 1/Fn 2 Status (High Byte)	Word	2
bY16...23 bY24...31	n+25	Ch 2/Fn 1 Status (Low Byte) Ch 2/Fn 2 Status (High Byte)	Word	2
bY32...39 bY40...47	n+26	Output 0 Status (Low Byte) Output 1 Status (High Byte)	Word	2
bY48...55 bY56...63	n+27	Output 2 Status (Low Byte) Output 3 Status (High Byte)	Word	2

For DirectSOFT32 users: the I/O Map dialog displays the exact memory locations in use by the CTRIO module. Within the I/O Map dialog you can print out a report of memory loctions in use.

CTRIO Input Parameter Definitions

The following table defines the meaning of Parameter 1 and Parameter 2 under different configuration settings. The functions listed in column one are defined by the user in CTRIO Workbench.

Configured Function from CTRIO Workbench	***Parameter 1 Contents*** ***DWORD***	***Parameter 2 Contents*** ***DWORD***
Non-scaled Counter	Raw Input Value	Not Used
Scaled Counter	Scaled Value (pos. or rate)	Raw Value
Non-scaled Counter with Capture	Raw Value	Captured Value
Scaled Counter with Capture	Scaled Value (pos. or rate)	Captured Value
Non-scaled Timer	Previous Time (us)	In Progress Time (us)
Scaled Timer	Scaled Interval (rate)	In Progress Time (us)
Pulse Catch	Not Used	Not Used

Function Status and Control Bit Definitions

The table below defines the bit locations for control and status of user configured functions. The functions are configured in CTRIO Workbench and can be controlled or monitored from your control program. EBC users see note on page 3-20.

Control Bit (transfers from CPU to CTRIO)	***Bit Offsets WinPLC & EBC***	***V-memory Offsets DirectLOGIC PLCs***
Enable Count Capture	0, 8, 16, 24	24.0, 24.8, 25.0, 25.8
Scaled Counter	0, 8, 16, 24	24.0, 24.8, 25.0, 25.8
Enable Pulse Catch	0, 8, 16, 24	24.0, 24.8, 25.0, 25.8
Reset	1, 9, 17, 25	24.1, 24.9, 25.1, 25.9
Status Bit (transfers from CTRIO to CPU)	***Bit Offsets WinPLC & EBC***	***V-memory Offsets DirectLOGIC PLCs***
Count Capture Complete Bit	0, 8, 16, 24	20.0, 20.8, 21.0, 21.8
Timer Capture Start	0, 8, 16, 24	20.0, 20.8, 21.0, 21.8
Timer Capture Complete (Timing) OR At Reset Value (Counting)	1, 9, 17, 25	20.1, 20.9, 21.1, 21.9
Pulse Catch Output Pulse State	0, 8, 16, 24	20.0, 20.8, 21.0, 21.8
Pulse Catch Start	1, 9, 17, 25	20.1, 20.9, 21.1, 21.9

Runtime Changes to the Preset Tables

Presets and preset tables can be set up entirely within CTRIO Workbench. You can also make runtime edits to presets 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 preconfigured table).

Command Codes are passed to the CTRIO 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 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 module.

Some changes require a combination of Command Codes so those changes must follow the steps above for each Command Code processed.

Control Bit	***Bit Y Offsets WinPLC & EBC***	***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	***Bit X Offsets WinPLC & EBC***	***V-memory Offsets DirectLOGIC PLCs***
Count Capture Complete Bit	38, 46, 54, 62	22.6, 22.14, 23.6, 23.14
Timer Capture Start	39, 47, 55, 63	22.7, 22.15, 23.7, 23.15

Runtime Changes Cont'd

Command DirectLOGIC n+10	*Code Hex/BCD*	*Parameter 1 (Word) DirectLOGIC n+11*	*Parameter 2 (Word) DirectLOGIC n+12 (decimal)*	*Parameter 3 (DWord) DirectLOGIC n+0/n+1 (decimal)*
Load Table from RAM	10	File Number (decimal)	-	-
Clear RAM Table	11	-	-	-
Initialize RAM Table	12	Entry Type (decimal)	Pulse Time[1]	Preset Count/Time[4]
Add Table Entry	13	Entry Type (decimal)	Pulse Time[1]	Preset Count/Time[4]
Edit Table Entry	File &[2] 14	Entry Num. &[2] Entry Type[3] (Hex/BCD)	Pulse Time[1]	Preset Count/Time[4]
Write RAM to ROM	99[5]	-	-	-
Edit and Reload	File &[2] 15	Entry Num. &[2] Entry Type[3] (Hex/BCD)	Pulse Time[1]	Preset Count/Time[4]
Edit Level Response	30	Level Behavior (decimal)	Deadband	Level Rate Setting

[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 4-9).

[3] Entry types are defined below.

[4] Follows format of Input DWord Parameter 1.

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

Entry Number and Entry Type for Edit Table Entry Command

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.

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	5	-
Toggle Output	4	-
Reset Function	5	Edits preset that resets count

Edit Level Response Command

If a Counter or Timer function is scaled to produce a rate, alarm level settings can be used to trigger discrete outputs at values predetermined by the user. The alarm levels can be set within CTRIO Workbench or from the user's control program.

Additionally, a deadband percentage (in tenths of a percent) can be set to prevent the output from changing too frequently near the Rate Level threshold. Consider a Discrete Output set to turn ON when a level gets to 100 with a 10% deadband. The output will turn ON when the level gets to 100. If the level drops, the output will stay on until the level drops below 90, where it will turn OFF.

Edit the behavior of a Discrete Output triggered by a Rate Level by using the "Edit Level Response Command" (Command Code 30Hex).

The Level Behavior setting for Parameter 1 is given in the table below:

Level Behavior for Discrete Output	***Parameter 1 Contents***	***Notes***
ON when greater than Level Rate setting	0000 Hex	-
ON when less than Level Rate setting	0001 Hex	-
OFF when greater than Level Rate setting	0080 Hex	-
OFF when less than Level Rate setting	0081 Hex	-

The Deadband is written to Parameter 2 as a x10 integer (one implied decimal position). To achieve a 10.0% deadband, the control program needs to write 100 decimal (64 Hex) to Parameter 2.

The Level Rate setting is written to Parameter 3 in the same format as Input Parameter 1 of the CTRIO Function to which this Discrete Output has been assigned.

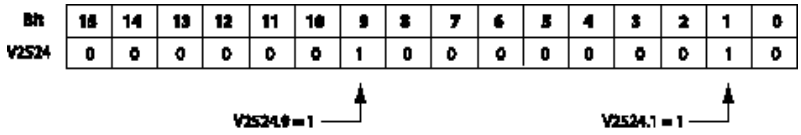
Addressing Conventions (with V-memory Examples for DirectLOGIC PLCs)

Example for Bit-accessed Data in PLC CPUs

In this example, the V-memory location V2524 contains a value equal to 514 in decimal.

514 decimal = 0202 Hex = 0000 0010 0000 0010 binary

The bit V2524.1 refers to the 2nd to the least significant bit (set to 1 in this example). Likewise, V2524.9 refers to bit number 9, the 10th from the least significant bit (also set to 1 in this example).



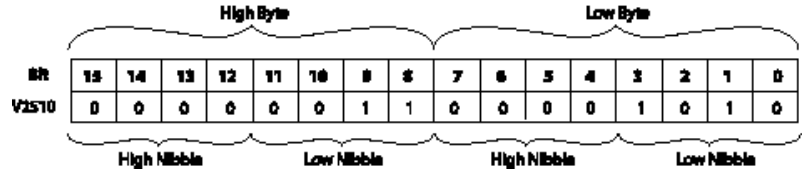
Addressing High and Low Byte of Word Parameters

In the following example, the V-memory location V2510 contains a value equal to 3 (decimal) in the high byte and 10 (decimal) in the low byte.

3 decimal = 03 Hex = 0000 0011 binary in the high byte, and

10 decimal = 0A Hex = 0000 1010 binary in the low byte.

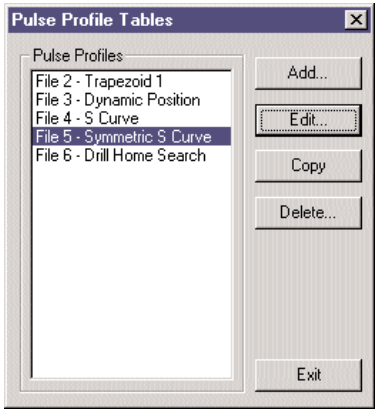
This example could represent the Command Code "Edit Table Entry." The value 03 (Hex) would represent the File number in the high byte, and the 0A (Hex) would represent the remainder of the Command Code in the low byte.



Addressing High and Low Word of DWord Parameters

Double Word parameters are addressed in a similar fashion to the high and low bytes of a Word Parameter. For example, a DWord that begins in V2300 consumes both V2300 and V2301. The Low Word is V2300, and the High Word is V2301.

Pulse Output Commands



The CTRIO module can generate Pulse Outputs based on predefined user profiles. Using program control techniques, the Pulse Profiles can also be changed dynamically during runtime.

CTRIO Workbench can create a maximum of 255 predefined Pulse Profiles. The total number of Pulse Profiles available is 255 minus the number of predefined Preset Tables. Pulse Profiles and Preset Tables are saved as File 1 through File 255.

Based on the Workbench configuration, either of the two Pulse Output channels can output Pulses and Direction, or Up Pulses and Down Pulses.

Control Bit CPU to CTRIO	*Bit Offsets*	*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
Direction	36, 52	26.4, 27.4	Level
Process Command	39, 55	26.7, 27.7	Rising Edge

Status Bit CTRIO to CPU	*Bit Offsets*	*V memory Offsets from Input Start (octal)*
Output Enabled	32, 48	22.0, 23.0
Position Loaded	33, 49	22.1, 23.1
Output Active	34, 50	22.4, 23.4
Output Stalled	35, 51	22.5, 23.5
Command Error	38, 54	22.6, 23.6
Command Complete	39, 55	22.7, 23.7

Word Control CPU to CTRIO	*Word Offsets*	*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	*Word Offsets*	*V-memory Offsets from Output Start (octal)*
DWord Parameter 1	0, 2	0, 4

Cont'd

Command	*Code (Hex/BCD)*	*Word Parameter 1 (decimal)*	*Word Parameter 2*	*DWord Parameter 3 (decimal)*
Load Profile from ROM	10	Trapezoid or S-curve File Number	-	-
Load Profile from ROM	10	Dynamic Positioning File Number	-	New Position
Pulse Output at Velocity	20	Run Frequency (20Hz - 25KHz)	Duty Cycle (0 to 99)* (decimal)	Number of Pulses
Pulse Output to Limit	21	Run Frequency (20Hz - 25KHz)	Edge & Duty Cycle (0 to 99)* (Hex/BCD)	-
Pulse Output to Position	22	Run Frequency (20Hz - 25KHz)	Compare Function & Duty Cycle (0 to 99)* (Hex/BCD)	Desired Input Function Value

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

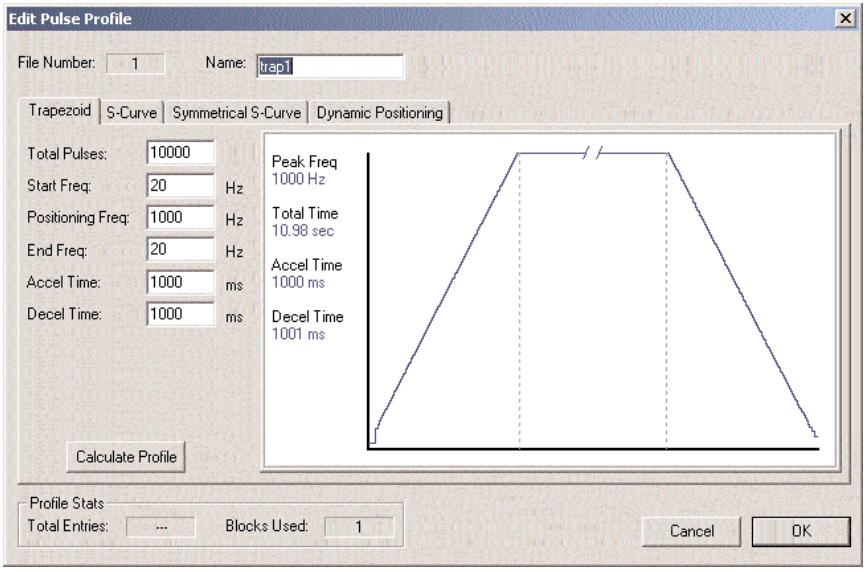
Fields above separated by an "&" indicate a code with different definitions for each byte (high byte and low byte). For example, to enter the Pulse Output to Limit command, set the high byte of the Word Parameter 2 to the edge you wish to terminate the output pulses (see definition following), and set 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. Then the program should drive the Process Command bit to a 1 and look for the CTRIO to acknowledge the command with the Command Complete bit. Finally, the program should remove the Process Command bit and set the Enable Output bit when appropriate. If the Command Error bit is received, the CTRIO was unable to process the command due to n illegal value in either the Command Code or parameter files.

DWord and Word values for pulse outputs are considered unsigned integers.

Pulse Output Profiles

Loading a profile is the easiest method for pulse output motion control (Command Code = 0010 Hex/BCD). All the characteristics of acceleration, run frequency, and total pulse count are entered in the CTRIO Workbench Pulse Profile entry window. The profile can be a Trapezoid, Velocity S-Curve, or program controlled Dynamic Positioning.



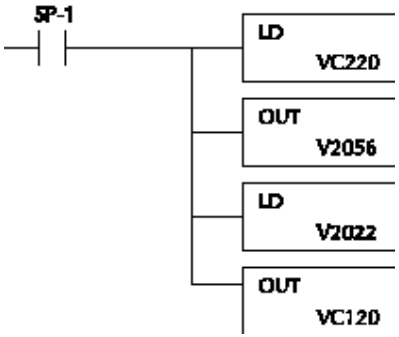
Status Registers, using V2000 as base input address (status bit received from CTRIO)

Name	*PLC Example 1: Bit-of-Word (see note 2) D2-250 CPU only*	*PLC Example 2: Control Relay (see note 1) D2-240/250 PUs*	*Value*
Output Enabled	V2022.0	C120	ON when Enable Output is ON
Position Loaded	V2022.1	C121	Used for Dynamic Positioning
Output Active	V2022.4	C124	ON when Output is Pulsing
Output Stalled	V2022.5	C125	CTRIO Output Fault (should never be ON)
Command Error	V2022.6	C126	ON if Command or Parameters are invalid
Command Complete	V2022.7	C127	ON if Module Receives Process Command

Control Registers, using V2030 as base output address (control DWords, Words, and bits sent from CPU to CTRIO)

Name	*PLC Example 1: Bit-of-Word (see note 2) D2-250 CPU only*	*PLC Example 2: Control Relay (see note 1) D2-240/250 CPUs*	*# Format*
Command Code	V2040	V2040	Hex/BCD
Parameter 1	V2041	V2041	Decimal
Parameter 2	V2042	V2042	Decimal
Parameter 3	V2031 - V2030	V2031 - V2030	Signed Decimal
Enable Output	V2056.0	C220	Bit
Go to Position	V2056.1	C221	Bit
Direction	V2056.4	C224	Bit
Process Command	V2056.7	C227	Bit

Note 1:
The D2-240 CPU does not support bit-of-word addressing. The status and control bits must be mapped to control relay words. An example of mapping code is shown below.



Note 2:
DirectSoft32 uses B2022.2 in the ladder code to indicate that you are addressing the third bit of V-memory register 2022. The "B" prefix indicates bit-of-word addressing.

Trapezoid or S-Curve

For predefined Trapezoid or S-Curve profiles, the program needs to prepare the Load Table command 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 can set the Process Command bit and watch for the Command Complete bit. Then the program should clear the Process Command bit and set the Direction bit 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 buy clearing the Enable Output, changing the direction bit (if desired), and again setting the Enable Output.

Easy step examples are given for PLCs with CTRIO I/O date mapped in the word and CR bit areas of CPU menmory.

Running a Trapezoid or S-Curve Profile on CTRIO Y0 & 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)*	*PLC Status Inputs Base Addr = V2000 (Control Relay)*	*Action*
1	Command Code	V2040		V2040		Set to 10 (Load Stored Profile)
2	Parameter 1	V2041		V2041		File # of stored profile, determined by user
3	Process Command	V2056.7		C227		Turn ON until Command Complete status bit is returned (see step 4)
4	Command Status		V2022.7		C127	When ON, Profile is now loaded, clear Process Command bit (step 3)
5	Set Direction	V2056.4	V2022.7	C224		Set ON or OFF for Direction of Rotation
6	Enable Output	V2056.0		C220		Turn ON to start pulses
7	Enable Status		V2022.0		C120	When ON, module is confirming Enable Output
8	Output Status		V2022.4		C124	When ON, module is pulsing, OFF with Enable Status ON = profile has completed
9	Disable Output	V2056.0		C220		Turn OFF when pulse status is OFF and Enable Status is ON

To re-launch a loaded profile, repeat steps 5-9

Dynamic Positioning

For Dynamic Positioning, only the motion limits of Min Frequency, Max Frequency, and Max Acceleration come from the CTRIO Workbench Profile. After loading a Dynamic Position Profile per the above paragraph, setting the Enable Output causes the CTRIO module to assume a position of 0 pulses. The program should write the next target position in DWord Parameter 3, and set the Load/Seek Position bit. This will cause the CTRIO to set both the Pulses Active and the New Position Loaded bit and begin output pulses (with the proper direction setting) to achieve the new position.

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 s tate of the Load/Seek New Position control bit. This status bit should be used to signal the program that the CTRIO has received the new state of the control bit.

Position Loaded Status Bit V40622.1 or C441	*Pulses Active Status Bit V40622.0 or c440*	*CTRIO Dynamic Position 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

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 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.

Dynamic Positioning using the CTRIO 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)*	*PLC Status Inputs Base Addr = V2000 (Control Relay)*	*Action*
1	Command Code	V2040		V2040		Set to 10 (Load Stored Profile)
2	Parameter 1	V2041		V2041		File # containing Vmin, Vmax, and Accel
3	Process Command	V2056.7		C227		Turn ON until Command Complete status bit is returned (see step 4)
4	Command Status		V2022.7		C127	When ON, Profile is now loaded, clear Process Command bit (step 3)
5	Enable Output	V2056.0		C220		Turn ON to assume 0 position, Turn OFF to disable pulses and zero position
6	Enable Status		V2022.7		C127	When ON, pulses are now enabled and last position is retained
7	Parameter 3	V2031 / V2030		V2031 / V2030		Target position: User defined (DWord)
8	Go To Position	V2056.1		C221		Starts pulses with direction to obtain the new position relative to previous position.
9	Position Loaded Status		V2022.1		C121	When ON, Go To position is acknowledged
10	Output Active Status		V2022.4		C124	When ON, module is pulsing, OFF with Position Loaded status ON = new position move has completed
11	Go To Position	V2056.1		C221		Turn OFF to be ready to load a new position

To seek the next position, repeat steps 7-10.

Pulse Output at Velocity

For motion control directly from the CPU/controller program, use the Pulse Output at Velocity command (Command = 0020 Hex/BCD). 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.

Steps: PLC Address V40650and module channel 1 is used for the CTRIO base output address for all examples in this Doc.

Run Velocity control on CTRIO Y0 & 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)*	*PLC Status Inputs Base Addr = V2000 (Control Relay)*	*Action*
1	Command Code	V2040		V2040		Set to 20 (Pulse at Velocity)
2	Parameter 1	V2041		V2041		Set initial run frequency (20Hz-25000Hz)
3	Parameter 2	V2042		V2042		Duty cycle (1-99) (can leave 0 for 50%)
4	Parameter 3	V2031 / V2030		V2031 / V2030		Number of pulses (DWord) set to FFFF FFFF for no limit
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 4)
7	Command Status		V2022.7		C127	When ON, command has been accepted, clear Process Command bit (step 3)
8	Enable Output	V2056.0		C220		Turn ON to start pulses
9	Disable Output	V2056.0		C220		Turn OFF to start pulses

While Velocity Control is running, Run Frequency (step 2) and Duty Cycle (step 3) may be actively adjusted simply by writing the variable.

Pulse Output to Input Limit

The Pulse Output to Limit (Command = 0021Hex/BCD) can be used for Home Search routines where a relatively low frequency is used to seek a CTRIO discrete input. The CTRIO input must be assigned for Limit by the CTRIO Workbench utility.

As with Pulse Output at Velocity, set Word Parameter 1 to the desired frequency, Word Parameter 2 Low Byte to the Duty Cycle, and the High Byte to the Edge to Seek.

The Edge to Seek field reads Word Parameter 2 bits 13 and 12 to determine the edge(s) on which to terminate Output Pulses, and bits 9 and 8 to determine which CTRIO Input terminal to use.

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 Velocity on CTRIO Y0 & Y1 until Discrete Input Limit

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)*	*PLC Status Inputs Base Addr = V2000 (Control Relay)*	*Action*
1	Command Code	V2040		V2040		Set to 21 (Pulse at velocity until discret input limit))
2	Parameter 1	V2041		V2041		Set initial run frequency (20Hz-25000Hz)
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		C221		Set ON or OFF for Direction of Rotation
5	Process Command	V2056.7		C227		Turn ON until Command Complete status bit is returned (see step 4)
6	Command Status		V2022.7		C127	When ON, command has been accepted, clear Process Command bit (step 3)
7	Enable Output	V2056.0		C220		Turn ON to start pulses
8	Output Active Status		V2022.4		C124	ON while pulsing, OFF when limit has stopped pulsing

Pulse Output to Input Limit Examples

Example 1: To run to a Rising Edge Limit on Channel 1's C Input at 50% Duty Cycle, use Word Parameter 2 = 0000 Hex. (Duty Cycle = 00 also creates 50% duty)

Example 2: To run to a Falling Edge Limit on Channel 2's C Input at 20% Duty Cycle, use Word Parameter 2 = 1214 Hex.

Pulse Output to Position

The Pulse Output to Position command (Command = 0022Hex/BCD) allows Pulse Outputs that terminate when a specific Input Function Value is obtained. Set Word Parameter 1 to the desired Frequency (As with Velocity and Run to Limit). Set Word Parameter 2 Low Byte to the Duty Cycle and the High Byte to the Compare Function as defined below.

The Compare Function field defines either greater or less than any of the four CTRIO Input Function Values. The compare will take place against Input DWord Parameter 1 of the selected Function. The CTRIO reads command code bit 12 to determine if the compare is "greater than or equal" or "less than". It reads bits 9 and 8 to determine the Input Function to use for comparison.

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

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 Velocity on CTRIO until Function Input Value

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)***	***PLC Status Inputs Base Addr = V2000 (Control Relay)***	***Action***
1	Command Code	V2040		V2040		Set to 22 (Pulse at velocity until Function Input Limit)
2	Parameter 1	V2041		V2041		Set initial run frequency (20Hz-25000Hz)
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	Parameter 3	V2031 / V2030		V2031 / V2030		Function DWord value for comparison
5	Set Direction	V2056.4		C224		Set ON or OFF for Direction of Rotation
6	Process Command	V2056.7		C227		Turn ON until Command Complete status bit is returned (see step 4)
7	Command Status		V2022.7		C127	When ON, command has been accepted, clear Process Command bit (step 3)
8	Enable Output	V2056.0		C220		Turn ON to start pulses
9	Output Active Status		V2022.4		C124	ON while pulsing, OFF when limit has stopped pulsing

Run Velocity until Function Value Example

While Run Velocity to Function Input Value is running, Run Frequency (Step 2) and Duty Cycle(Step 3) may be actively adjusted simply by writing the variable.

Example: To run a Pulse Output at 30% duty until Ch2 Fn 1 is at 100,000, write 100,000 to DWord Parameter 3, set the desired Frequency in Word Parameter 1, set Word Parameter 2 to 1E Hex (Hex 1E = 30% Decimal), set the proper direction bit, then load and execute Command Code = 22, and finally set the Enable Output bit. The Output will Pulse until Ch2 Fn1's Input DWord Parameter 1 gets to 100,000.