Standard RLL and Intelligent Box Instructions

In This Chapter...

Introduction

DL05 Micro PLCs offer a wide variety of instructions to perform many different types of operations. This chapter shows you how to use each standard Relay Ladder Logic (RLL) instruction. In addition to these instructions, you may also need to refer to the Drum instruction in Chapter 6, or the Stage programming instructions in Chapter 7.

There are two ways to quickly find the instruction you need.

- If you know the instruction category (Boolean, Comparative Boolean, etc.) just use the title at the top of the page to find the pages that discuss the instructions in that category.
- If you know the individual instruction name, use the following table to find the page(s) that discusses the instruction.

Using Boolean Instructions

Do you ever wonder why so many PLC manufacturers always quote the scan time for a 1K Boolean program? Simple. Most all programs utilize many Boolean instructions. These are typically very simple instructions designed to join input and output contacts in various series and parallel combinations. Our *Direct*SOFT software is a similar program. It uses graphic symbols to develop a program; therefore, you don't necessarily have to know the instruction mnemonics in order to develop your program. However, knowledge of mnemonics will be helpful, whenever it becomes necessary to troubleshoot a program using a handheld programmer (HPP).

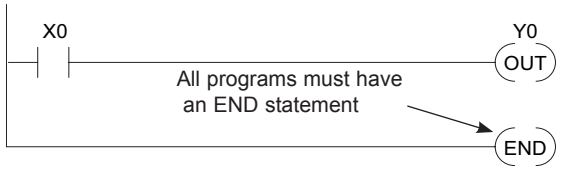
Many of the instructions in this chapter are not program instructions used in *Direct*SOFT, but are implied. In other words, they are not actually keyboard commands, however, they can be seen in a Mnemonic View of the program once the *Direct*SOFT program has been developed and accepted (compiled). Each instruction listed in this chapter will have a small chart to indicate how the instruction is used with *Direct*SOFT and the HPP.

DS5	Implied
HPP	Used

The following paragraphs show how these instructions are used to build simple ladder programs.

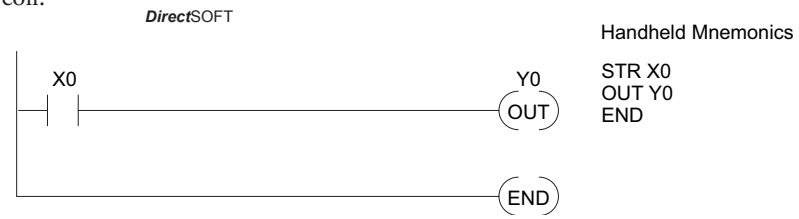
END Statement

All DL05 programs require an END statement as the last instruction. This tells the CPU that this is the end of the program. Normally, any instructions placed after the END statement will not be executed. There are exceptions to this such as interrupt routines, etc.. This chapter will discuss the instruction set in detail.



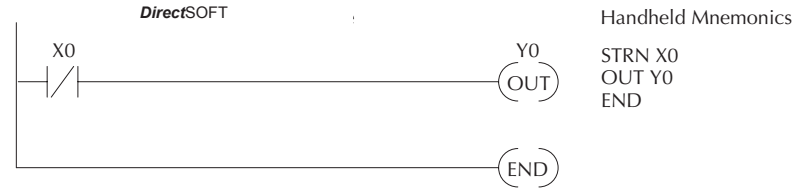
Simple Rungs

You use a contact to start rungs that contain both contacts and coils. The boolean instruction that does this is called a Store or, STR instruction. The output point is represented by the Output or, OUT instruction. The following example shows how to enter a single contact and a single output coil.



Normally Closed Contact

Normally closed contacts are also very common. This is accomplished with the Store Not or, STRN instruction. The following example shows a simple rung with a normally closed contact.

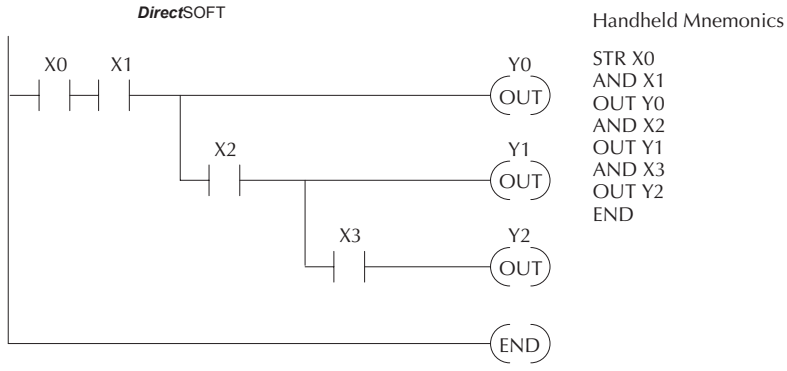


Contacts in Series

Use the AND instruction to join two or more contacts in series. The following example shows two contacts in series and a single output coil. The instructions used would be STR X0, AND X1, followed by OUT Y0.

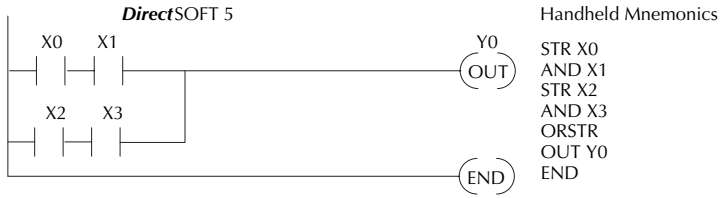
Midline Outputs

Sometimes it is necessary to use midline outputs to get additional outputs that are conditional on other contacts. The following example shows how you can use the AND instruction to continue a rung with more conditional outputs.



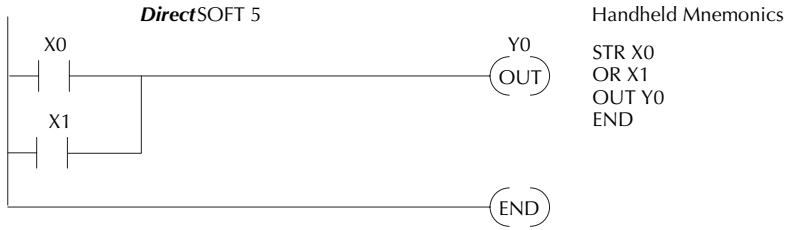
Parallel Elements

You also have to join contacts in parallel. The OR instruction allows you to do this. The following example shows two contacts in parallel and a single output coil. The instructions would be STR X0, OR X1, followed by OUT Y0.



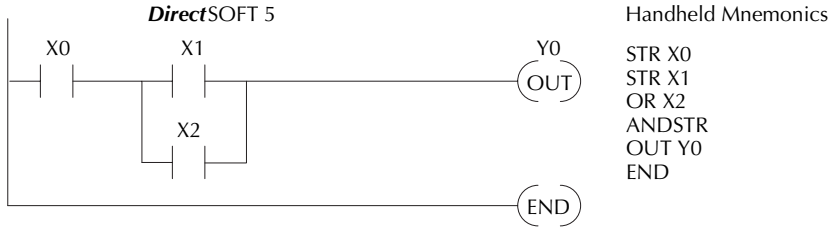
Joining Series Branches in Parallel

Quite often it is necessary to join several groups of series elements in parallel. The Or Store (ORSTR) instruction allows this operation. The following example shows a simple network consisting of series elements joined in parallel.



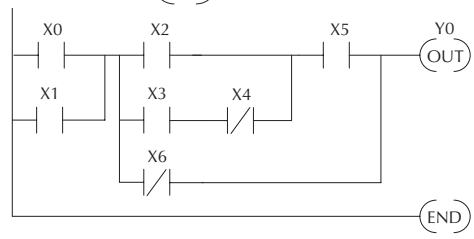
Joining Parallel Branches in Series

You can also join one or more parallel branches in series. The And Store (ANDSTR) instruction allows this operation. The following example shows a simple network with contact branches in series with parallel contacts.



Combination Networks

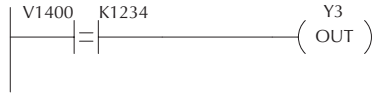
You can combine the various types of series and parallel branches to solve most any application problem. The following example shows a simple combination network.



Comparative Boolean

Some PLC manufacturers make it really difficult to do a simple comparison of two numbers. Some of them require you to move the data all over the place before you can actually perform the comparison. The DL05 Micro PLCs provide Comparative Boolean instructions that allow you to quickly and easily solve this problem. The Comparative Boolean provides evaluation of two 4-digit values using boolean contacts. The valid evaluations are: equal to, not equal to, equal to or greater than, and less than.

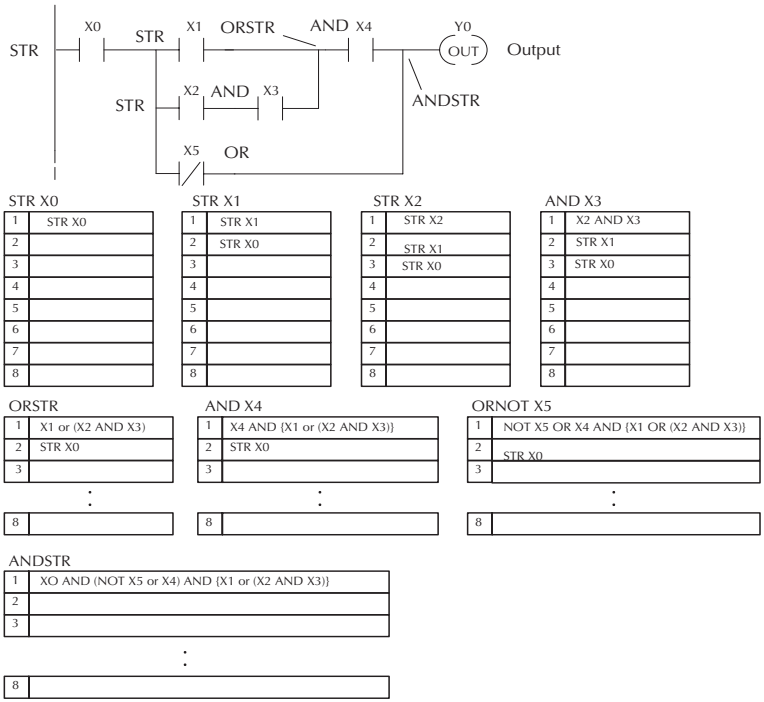
In this example when the value in V-memory location V1400 is equal to the constant value 1234, Y3 will energize.



Boolean Stack

There are limits to how many elements you can include in a rung. This is because the DL05 PLCs use an 8-level boolean stack to evaluate the various logic elements. The boolean stack is a temporary storage area that solves the logic for the rung. Each time the program encounters a STR instruction, the instruction is placed on the top of the stack. Any other STR instructions already on the boolean stack are pushed down a level. The ANDSTR, and ORSTR instructions combine levels of the boolean stack when they are encountered. An error will occur during program compilation if the CPU encounters a rung that uses more than the eight levels of the boolean stack.

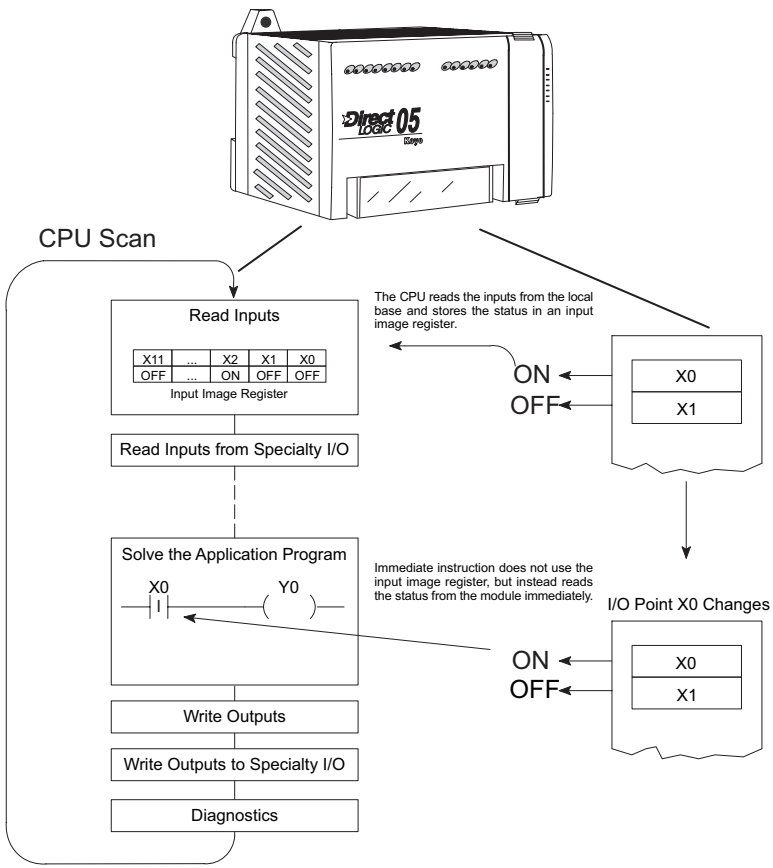
The following example shows how the boolean stack is used to solve boolean logic.



Immediate Boolean

The DL05 Micro PLCs can usually complete an operation cycle in a matter of milliseconds. However, in some applications you may not be able to wait a few milliseconds until the next I/O update occurs. The DL05 PLCs offer Immediate input and outputs which are special boolean instructions that allow reading directly from inputs and writing directly to outputs during the program execution portion of the CPU cycle. You may recall that this is normally done during the input or output update portion of the CPU cycle. The immediate instructions take longer to execute because the program execution is interrupted while the CPU reads or writes the I/O point. This function is not normally done until the read inputs or the write outputs portion of the CPU cycle.

***NOTE**: Even though the immediate input instruction reads the most current status from the input point, it only uses the results to solve that one instruction. It does not use the new status to update the image register. Therefore, any regular instructions that follow will still use the image register values. Any immediate instructions that follow will access the I/O again to update the status. The immediate output instruction will write the status to the I/O and update the image register.*



Boolean Instructions

Store (STR)

DS5	Implied
HPP	Used

The Store instruction begins a new rung or an additional branch in a rung with a normally open contact. Status of the contact will be the same state as the associated image register point or memory location.

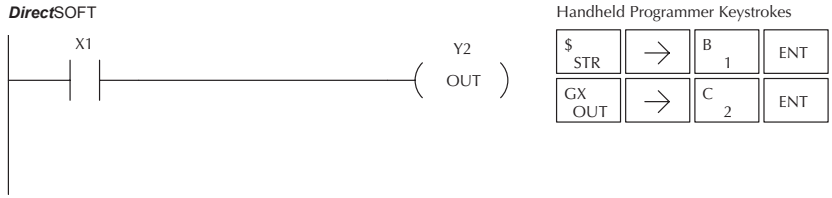
Store Not (STRN)

DS5	Implied
HPP	Used

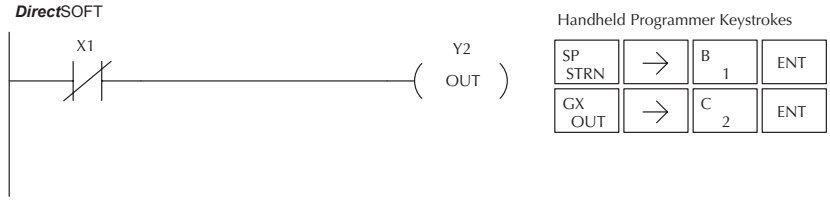
The Store Not instruction begins a new rung or an additional branch in a rung with a normally closed contact. Status of the contact will be opposite the state of the associated image register point or memory location.

Operand Data Type		DL05 Range
	A	aaa
Inputs	X	0–377
Outputs	Y	0–377
Control Relays	C	0–777
Stage	S	0–377
Timer	T	0–177
Counter C	T	0–177
Special Relay	SP	0–777

In the following Store example, when input X1 is on, output Y2 will energize.



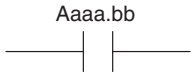
In the following Store Not example, when input X1 is off output Y2 will energize.



Store Bit-of-Word (STRB)

DS5	Implied
HPP	Used

The Store Bit-of-Word instruction begins a new rung or an additional branch in a rung with a normally open contact. Status of the contact will be the same state as the bit referenced in the associated memory location.



Store Not Bit-of-Word (STRNB)

DS5	Implied
HPP	Used

The Store Not Bit-of-Word instruction begins a new rung or an additional branch in a rung with a normally closed contact. Status of the contact will be opposite the state of the bit referenced in the associated memory location.

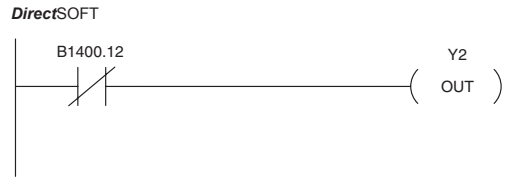
Operand Data Type		DL05 Range	
	A	aaa	bb
V-memory	B	See memory map	BCD, 0 to 15
Pointer	PB	See memory map	BCD, 0 to 15

In the following Store Bit-of-Word example, when bit 12 of V-memory location V1400 is on, output Y2 will energize.

Handheld Programmer Keystrokes

STR	SHFT	B	→	V	1	4	0	0
→	K	1	2	ENT				
OUT	→	2	ENT					

In the following Store Not Bit-of-Word example, when bit 12 of V-memory location V1400 is off, output Y2 will energize.



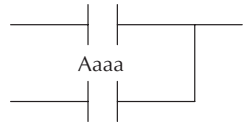
Handheld Programmer Keystrokes

STRN	SHFT	B	→	V	1	4	0	0
→	K	1	2	ENT				
OUT	→	2	ENT					

Or (OR)

DS5	Implied
HPP	Used

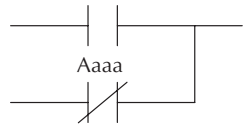
The Or instruction logically ors a normally open contact in parallel with another contact in a rung. The status of the contact will be the same state as the associated image register point or memory location.



Or Not (ORN)

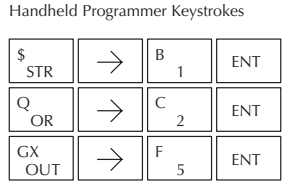
DS5	Implied
HPP	Used

The Or Not instruction logically ors a normally closed contact in parallel with another contact in a rung. The status of the contact will be opposite the state of the associated image register point or memory location.

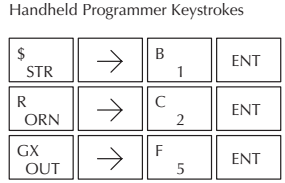


Operand Data Type		DL05 Range
	A	aaa
Inputs	X	0–377
Outputs	Y	0–377
Control Relays	C	0–777
Stage	S	0–377
Timer	T	0–177
Counter	CT	0–177
Special Relay	SP	0–777

In the following Or example, when input X1 or X2 is on, output Y5 will energize.



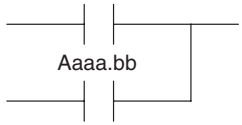
In the following Or Not example, when input X1 is on or X2 is off, output Y5 will energize.



Or Bit-of-Word (ORB)

DS5	Implied
HPP	Used

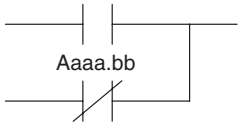
The Or Bit-of-Word instruction logically ors a normally open contact in parallel with another contact in a rung. Status of the contact will be the same state as the bit referenced in the associated memory location.



Or Not Bit-of-Word (ORNB)

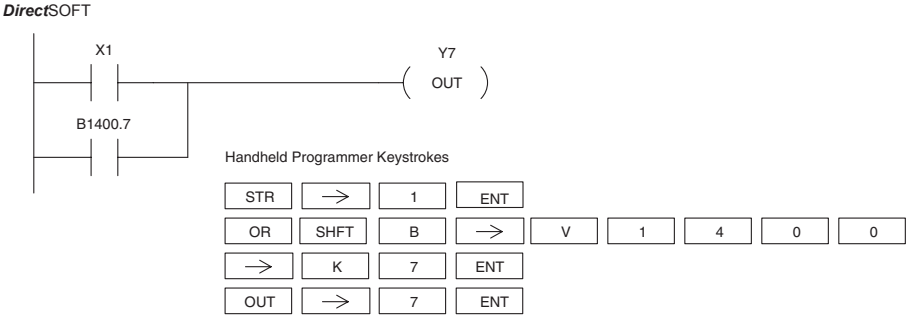
DS5	Implied
HPP	Used

The Or Not Bit-of-Word instruction logically ors a normally closed contact in parallel with another contact in a rung. Status of the contact will be opposite the state of the bit referenced in the associated memory location.

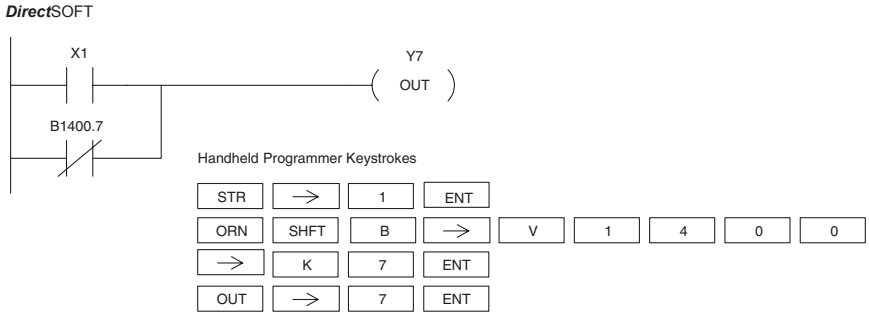


Operand Data Type		DL05 Range	
	A	aaa	bb
V-memory	B	See memory map	BCD, 0 to 15
Pointer	PB	See memory map	BCD, 0 to 15

In the following Or Bit-of-Word example, when input X1 or bit 7 of V1400 is on, output Y7 will energize.



In the following Or Bit-of-Word example, when input X1 is on or bit 7 of V1400 is off, output Y7 will energize.



And (AND)

DS5	Implied
HPP	Used

The And instruction logically ands a normally open contact in series with another contact in a rung. The status of the contact will be the same state as the associated image register point or memory location.

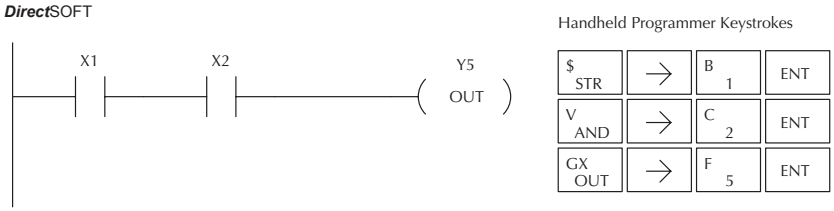
And Not (ANDN)

DS5	Implied
HPP	Used

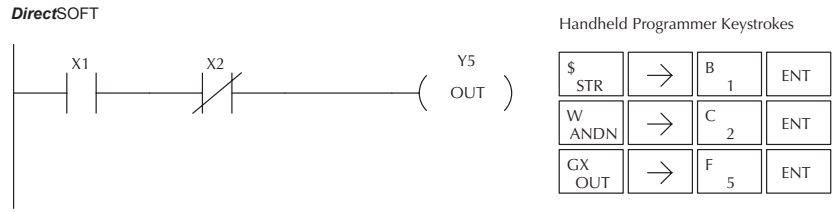
The And Not instruction logically ands a normally closed contact in series with another contact in a rung. The status of the contact will be opposite the state of the associated image register point or memory location.

Operand Data Type		DL05 Range
	A	aaa
Inputs	X	0–377
Outputs	Y	0–377
Control Relays	C	0–777
Stage	S	0–377
Timer	T	0–177
Counter	CT	0–177
Special Relay	SP	0–777

In the following And example, when input X1 and X2 are on output Y5 will energize.



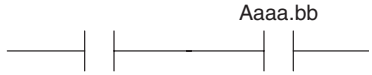
In the following And Not example, when input X1 is on and X2 is off output Y5 will energize.



And Bit-of-Word (ANDB)

DS5	Implied
HPP	Used

The And Bit-of-Word instruction logically ands a normally open contact in series with another contact in a rung. The status of the contact will be the same state as the bit referenced in the associated memory location.



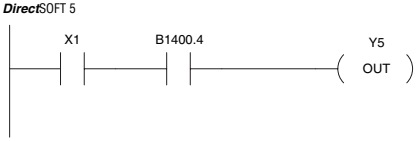
And Not Bit-of-Word (ANDNB)

DS5	Implied
HPP	Used

The And Not Bit-of-Word instruction logically ands a normally closed contact in series with another contact in a rung. The status of the contact will be opposite the state of the bit referenced in the associated memory location.

Operand Data Type		DL05 Range	
	A	aaa	bb
V-memory	B	See memory map	BCD, 0 to 15
Pointer	PB	See memory map	BCD, 0 to 15

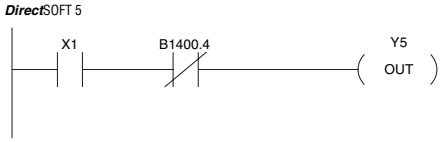
In the following And Bit-of-Word example, when input X1 and bit 4 of V1400 is on output Y5 will energize.



Handheld Programmer Keystrokes

STR	→	1	ENT					
AND	SHFT	B	→	V	1	4	0	0
→	K	4	ENT					
OUT	→	5	ENT					

In the following And Not Bit-of-Word example, when input X1 is on and bit 4 of V1400 is off output Y5 will energize.



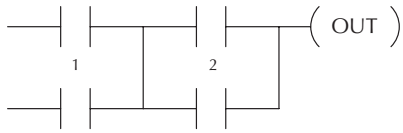
Handheld Programmer Keystrokes

STR	→	1	ENT					
ANDN	SHFT	B	→	V	1	4	0	0
→	K	4	ENT					
OUT	→	5	ENT					

And Store (AND STR)

DS5	Implied
HPP	Used

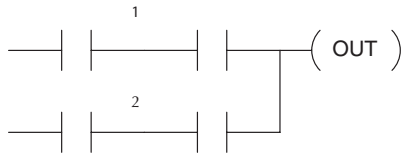
The And Store instruction logically ands two branches of a rung in series. Both branches must begin with the Store instruction.



Or Store (OR STR)

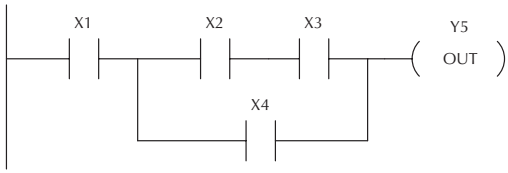
DS5	Implied
HPP	Used

The Or Store instruction logically ors two branches of a rung in parallel. Both branches must begin with the Store instruction.



In the following And Store example, the branch consisting of contacts X2, X3, and X4 have been anded with the branch consisting of contact X1.

DirectSOFT

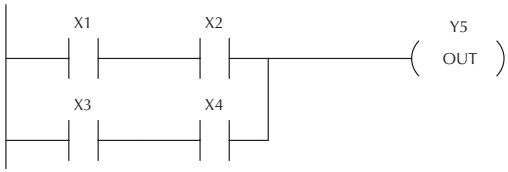


Handheld Programmer Keystrokes

$ STR	→	B 1	ENT
$ STR	→	C 2	ENT
V AND	→	D 3	ENT
Q OR	→	E 4	ENT
L ANDST	ENT		
GX OUT	→	F 5	ENT

In the following Or Store example, the branch consisting of X1 and X2 have been ORed with the branch consisting of X3 and X4.

DirectSOFT



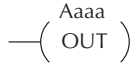
Handheld Programmer Keystrokes

$ STR	→	B 1	ENT
V AND	→	C 2	ENT
$ STR	→	D 3	ENT
V AND	→	E 4	ENT
M ORST	ENT		
GX OUT	→	F 5	ENT

Out (OUT)

DS5	Used
HPP	Used

The Out instruction reflects the status of the rung (on/off) and outputs the discrete (on/off) state to the specified image register point or memory location.



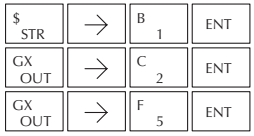
Multiple Out instructions referencing the same discrete location should not be used since only the last Out instruction in the program will control the physical output point. Instead, use the next instruction, the Or Out.

Operand Data Type		DL05 Range
	A	aaa
Inputs	X	0–377
Outputs	Y	0–377
Control Relays	C	0–777

In the following Out example, when input X1 is on, output Y2 and Y5 will energize.

*Direct*SOFT

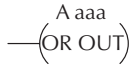
Handheld Programmer Keystrokes



DS5	Used
HPP	Used

Or Out (OROUT)

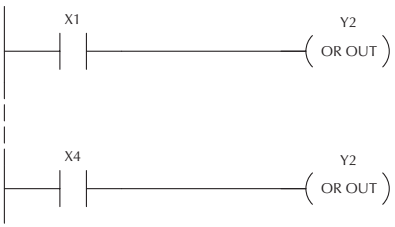
The Or Out instruction allows more than one rung of discrete logic to control a single output. Multiple Or Out instructions referencing the same output coil may be used, since *all* contacts controlling the output are logically ORed together. If the status of *any* rung is on, the output will also be on.



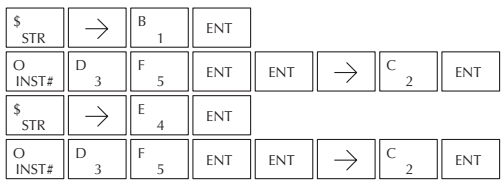
Operand Data Type		DL05 Range
	A	aaa
Inputs	X	0–177
Outputs	Y	0–177
Control Relays	C	0–777

In the following example, when X1 or X4 is on, Y2 will energize.

*Direct*SOFT



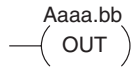
Handheld Programmer Keystrokes



Out Bit-of-Word (OUTB)

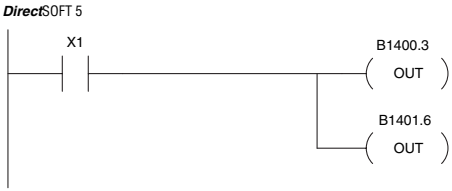
DS5	Used
HPP	Used

The Out Bit-of-Word instruction reflects the status of the rung (on/off) and outputs the discrete (on/off) state to the specified bit in the referenced memory location. Multiple Out Bit-of-Word instructions referencing the same bit of the same word generally should not be used since only the last Out instruction in the program will control the status of the bit.



Operand Data Type	DL05 Range		
	A	aaa	bb
V-memory	B	See memory map	BCD, 0 to 15
Pointer	PB	See memory map	BCD, 0 to 15

In the following Out Bit-of-Word example, when input X1 is on, bit 3 of V1400 and bit 6 of V1401 will turn on.

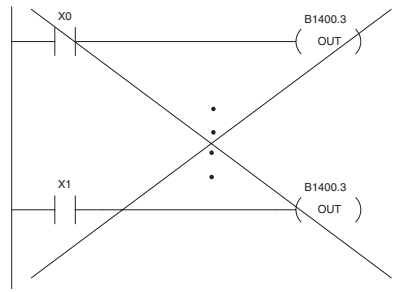


Handheld Programmer Keystrokes

STR	→	1	ENT					
OUT	SHFT	B	→	V	1	4	0	0
→	K	3	ENT					
OUT	SHFT	B	→	V	1	4	0	1
→	K	6	ENT					

The following Out Bit-of-Word example contains two Out Bit-of-Word instructions using the same bit in the same memory word. The final state bit 3 of V1400 is ultimately controlled by the last rung of logic referencing it. X1 will override the logic state controlled by X0. To avoid this situation, multiple outputs using the same location must not be used in programming.

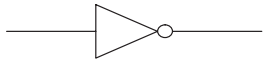
location must not be used in programming.



Not (NOT)

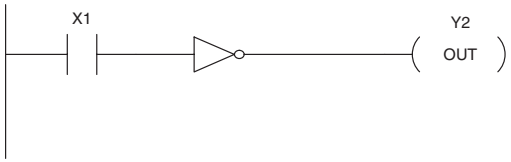
DS5	Used
HPP	Used

The Not instruction inverts the status of the rung at the point of the instruction.

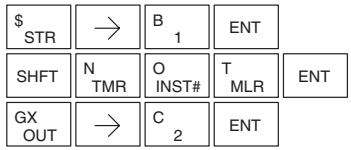


In the following example when X1 is off, Y2 will energize. This is because the Not instruction inverts the status of the rung at the Not instruction.

*Direct*SOFT



Handheld Programmer Keystrokes

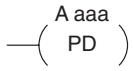


***NOTE**: **Direct**SOFT Release 1.1i and later supports the use of the NOT instruction. The above example rung is merely intended to show the visual representation of the NOT instruction. The rung cannot be created or displayed in **Direct**SOFT versions earlier than 1.1i.*

Positive Differential (PD)

DS5	Used
HPP	Used

The Positive Differential instruction is typically known as a one shot. When the input logic produces an off to on transition, the output will energize for one CPU scan.

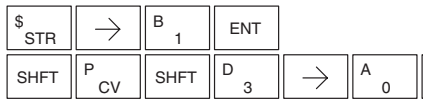


Operand Data Type	DL05 Range
A	aaa
Inputs	X	0–377
Outputs	Y	0–377
Control Relays	C	0–777

In the following example, every time X1 makes an off to on transition, C0 will energize for one scan.

*Direct*SOFT

Handheld Programmer Keystrokes



Store Positive Differential (STRPD)

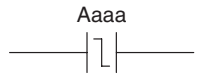
DS5	Used
HPP	Used

The Store Positive Differential instruction begins a new rung or an additional branch in a rung with a normally open contact. The contact closes for one CPU scan when the state of the associated image register point makes an Off-to-On transition. Thereafter, the contact remains open until the next Off-to-On transition (the symbol inside the contact represents the transition). This function is sometimes called a "one-shot". This contact will also close on a program-to-run transition if it is within a retentative range and on before the PLC mode transition.

Store Negative Differential (STRND)

DS5	Used
HPP	Used

The Store Negative Differential instruction begins a new rung or an additional branch in a rung with a normally closed contact. The contact closes for one CPU scan when the state of the associated image register point makes an On-to-Off transition. Thereafter, the contact remains open until the next On-to-Off transition (the symbol inside the contact represents the transition).



Operand Data Type		DL05 Range
	A	aaa
Inputs	X	0–377
Outputs	Y	0–377
Control Relays	C	0–777
Stage	S	0–377
Timer	T	0–177
Counter	CT	0–177

In the following example, each time X1 is makes an Off-to-On transition, Y4 will energize for one scan.

*Direct*SOFT

Handheld Programmer Keystrokes

$ STR	SHFT	P CV	D 3	→	B 1	ENT
GX OUT	→	E 4	ENT			

In the following example, each time X1 is makes an On-to-Off transition, Y4 will energize for one scan.

*Direct*SOFT

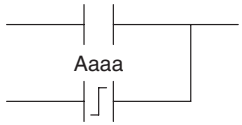
Handheld Programmer Keystrokes

$ STR	SHFT	N TMR	D 3	→	B 1	ENT
GX OUT	→	E 4	ENT			

Or Positive Differential (ORPD)

DS5	Implied
HPP	Used

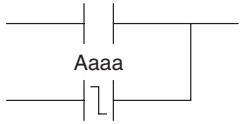
The Or Positive Differential instruction logically ors a contact in parallel with another contact in a rung. The status of the contact will be open until the associated image register point makes an Off-to-On transition, closing it for one CPU scan. Thereafter, it remains open until another Off-to-On transition.



Or Negative Differential (ORND)

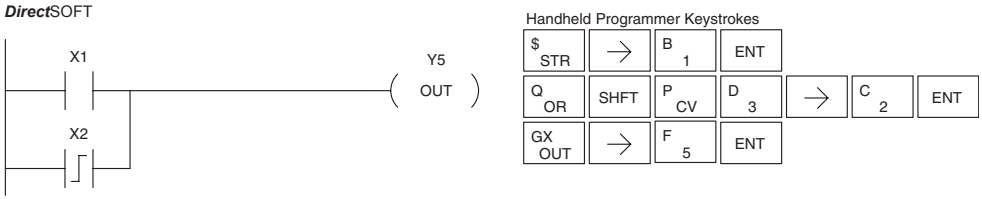
DS5	Implied
HPP	Used

The Or Negative Differential instruction logically ors a contact in parallel with another contact in a rung. The status of the contact will be open until the associated image register point makes an On-to-Off transition, closing it for one CPU scan. Thereafter, it remains open until another On-to-Off transition.

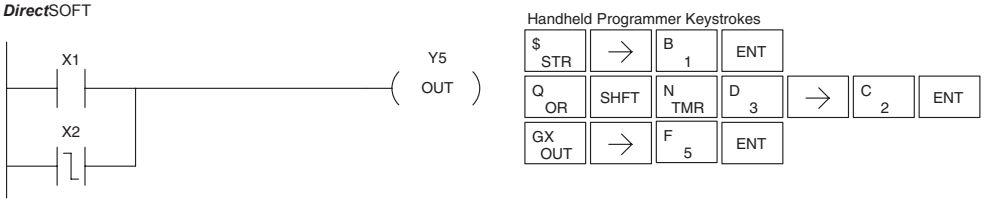


Operand Data Type		DL05 Range
	A	aaa
Inputs	X	0–377
Outputs	Y	0–377
Control Relays	C	0–777
Stage	S	0–377
Timer	T	0–177
Counter	CT	0–177

In the following example, Y 5 will energize whenever X1 is on, or for one CPU scan when X2 transitions from Off to On.



In the following example, Y 5 will energize whenever X1 is on, or for one CPU scan when X2 transitions from On to Off.



And Positive Differential (ANDPD)

DS5	Implied
HPP	Used

The And Positive Differential instruction logically ands a contact in series with another contact in a rung. The status of the contact will be open until the associated image register point makes an Off-to-On transition, closing it for one CPU scan. Thereafter, it remains open until another Off-to-On transition.

And Negative Differential (ANDND)

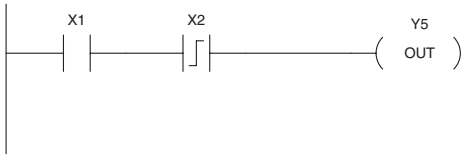
DS5	Implied
HPP	Used

The And Negative Differential instruction logically ands a contact in series with another contact in a rung. The status of the contact will be open until the associated image register point makes an On-to-Off transition, closing it for one CPU scan. Thereafter, it remains open until another On-to-Off transition.

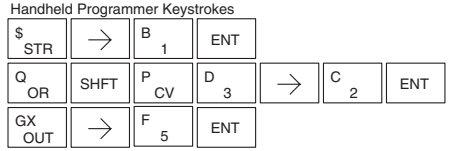
Operand Data Type		DL05 Range
	A	aaa
Inputs	X	0–377
Outputs	Y	0–377
Control Relays	C	0–777
Stage	S	0–377
Timer	T	0–177
Counter	CT	0–177

In the following example, Y5 will energize for one CPU scan whenever X1 is on and X2 transitions from Off to On.

DirectSOFT

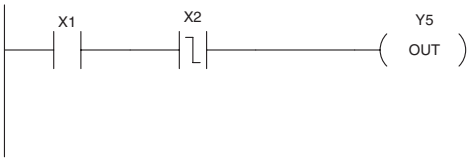


Handheld Programmer Keystrokes

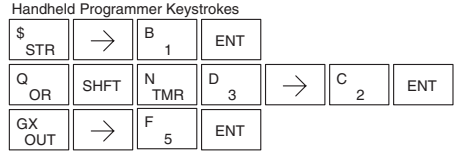


In the following example, Y5 will energize for one CPU scan whenever X1 is on and X2 transitions from On to Off.

DirectSOFT



Handheld Programmer Keystrokes



Set (SET)

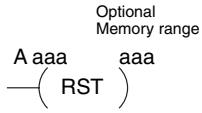
DS5	Used
HPP	Used

The Set instruction sets or turns on an image register point/memory location or a consecutive range of image register points/memory locations. Once the point/location is set it will remain on until it is reset using the Reset instruction. It is not necessary for the input controlling the Set instruction to remain on.

Reset (RST)

DS5	Used
HPP	Used

The Reset instruction resets or turns off an image register point/memory location or a range of image registers points/memory locations. Once the point/location is reset it is not necessary for the input to remain on.

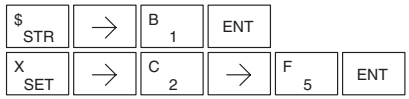


Operand Data Type		DL05 Range
	A	aaa
Inputs	X	0–377
Outputs	Y	0–377
Control Relays	C	0–777
Stage	S	0–377
Timer	T	0–177
Counter	CT	0–177

In the following example when X1 is on, Y2 through Y5 will energize.

DirectSOFT32
DirectSOFT

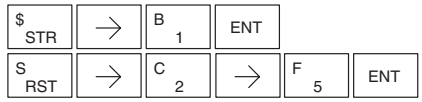
Handheld Programmer Keystrokes



In the following example when X1 is on, Y2 through Y5 will be reset or de–energized.

DirectSOFT

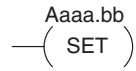
Handheld Programmer Keystrokes



Set Bit-of-Word (SETB)

DS5	Used
HPP	Used

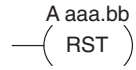
The Set Bit-of-Word instruction sets or turns on a bit in a V-memory location. Once the bit is set it will remain on until it is reset using the Reset Bit-of-Word instruction. It is not necessary for the input controlling the Set Bit-of-Word instruction to remain on.



Reset Bit-of-Word (RSTB)

DS5	Used
HPP	Used

The Reset Bit-of-Word instruction resets or turns off a bit in a V-memory location. Once the bit is reset it is not necessary for the input to remain on.



Operand Data Type		DL05 Range	
	A	aaa	bb
V-memory	B	See memory map	BCD, 0 to 15
Pointer	PB	See memory map	BCD, 0 to 15

In the following example when X1 turns on, bit 1 in V1400 is set to the on state.

DirectSOFT

Handheld Programmer Keystrokes

STR	→	1	ENT					
SET	SHFT	B	→	V	1	4	0	0
→	K	1	ENT					

In the following example when X2 turns on, bit 1 in V1400 is reset to the off state.

DirectSOFT

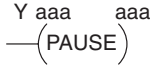
Handheld Programmer Keystrokes

STR	→	2	ENT					
RST	SHFT	B	→	V	1	4	0	0
→	K	1	ENT					

Pause (PAUSE)

DS5	Used
HPP	Used

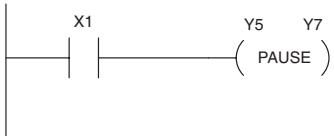
The Pause instruction disables the output update on a range of outputs. The ladder program will continue to run and update the image register. However, the outputs in the range specified in the Pause instruction will be turned off at the output points.



Operand Data Type		DL05 Range
		aaa
Outputs	Y	0–377

In the following example, when X1 is ON, Y5-Y7 will be turned OFF. The execution of the ladder program will not be affected.

*Direct*SOFT



Since the D2–HPP Handheld Programmer does not have a specific Pause key, you can use the corresponding instruction number for entry (#960), or type each letter of the command.

Handheld Programmer Keystrokes

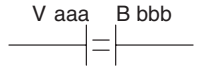
In some cases, you may want certain output points in the specified pause range to operate normally. In that case, use Aux 58 to over-ride the Pause instruction.

Comparative Boolean

Store If Equal (STRE)

DS5	Used
HPP	Used

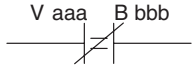
The Store If Equal instruction begins a new rung or additional branch in a rung with a normally open comparative contact. The contact will be on when Vaaa is equal toBbbb .



Store If Not Equal (STRNE)

DS5	Used
HPP	Used

The Store If Not Equal instruction begins a new rung or additional branch in a rung with a normally closed comparative contact. The contact will be on when Vaaa does not equal Bbbb.

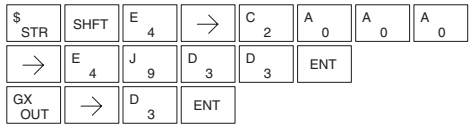


Operand Data Type	DL05 Range	
B	aaa	bbb
V-memory	V	All (See page 3–28)	All (See page 3–28)
Pointer	P	All (See page 3–28)	All (See page 3–28)
Constant	K	—	0–9999

In the following example, when the value in V-memory location V2000 = 4933, Y3 will energize.

DirectSOFT

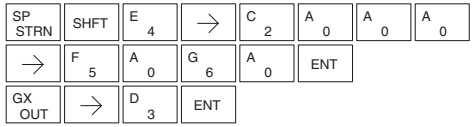
Handheld Programmer Keystrokes



In the following example, when the value in V-memory location V2000 is not equal to 5060, Y3 will energize.

DirectSOFT

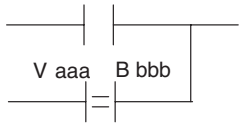
Handheld Programmer Keystrokes



Or If Equal (ORE)

DS5	Implied
HPP	Used

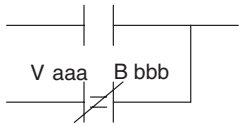
The Or If Equal instruction connects a normally open comparative contact in parallel with another contact. The contact will be on when Vaaa is equal to Bbbb.



Or If Not Equal (ORNE)

DS5	Implied
HPP	Used

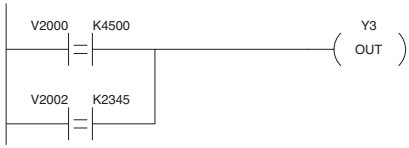
The Or If Not Equal instruction connects a normally closed comparative contact in parallel with another contact. The contact will be on when Vaaa does not equal Bbbb.



Operand Data Type		DL05 Range	
	B	aaa	bbb
V-memory	V	All (See page 3–28)	All (See page 3–28)
Pointer	P	All (See page 3–28)	All (See page 3–28)
Constant	K	—	0–9999

In the following example, when the value in V-memory location V2000 = 4500 or V2002 = 2345 , Y3 will energize.

DirectSOFT

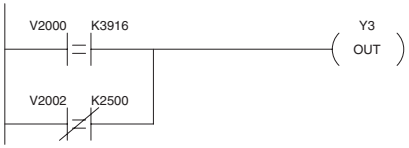


Handheld Programmer Keystrokes

$ STR	SHFT	E 4	→	C 2	A 0	A 0	A 0	→
E 4	F 5	A 0	A 0	ENT				
Q OR	SHFT	E 4	→	C 2	A 0	A 0	C 2	→
C 2	D 3	E 4	F 5	ENT				
GX OUT	→	D 3	ENT					

In the following example, when the value in V-memory location V2000 = 3916 or V2002 is not equal to 2500, Y3 will energize.

DirectSOFT



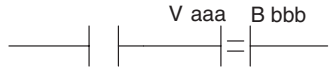
Handheld Programmer Keystrokes

$ STR	SHFT	E 4	→	C 2	A 0	A 0	A 0	→
D 3	J 9	B 1	G 6	ENT				
R ORN	SHFT	E 4	→	C 2	A 0	A 0	C 2	→
C 2	F 5	A 0	A 0	ENT				
GX OUT	→	D 3	ENT					

And If Equal (ANDE)

DS5	Implied
HPP	Used

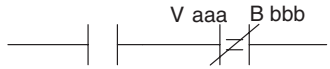
The And If Equal instruction connects a normally open comparative contact in series with another contact. The contact will be on when Vaaa is equal to Bbbb.



And If Not Equal (ANDNE)

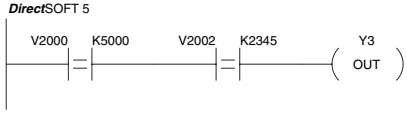
DS5	Implied
HPP	Used

The And If Not Equal instruction connects a normally closed comparative contact in series with another contact. The contact will be on when Vaaa does not equal Bbbb



Operand Data Type		DL05 Range	
	A/B	aaa	bbb
V-memory	V	All (See page 3–28)	All (See page 3–28)
Pointer	P	All (See page 3–28)	All (See page 3–28)
Constant	K	—	0–9999

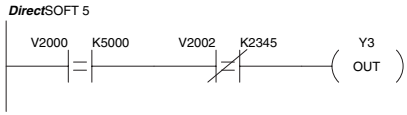
In the following example, when the value in V-memory location V2000 = 5000 and V2002 = 2345, Y3 will energize.



Handheld Programmer Keystrokes

$ STR	SHFT	E 4	→	C 2	A 0	A 0	A 0	→
F 5	A 0	A 0	A 0	ENT				
V AND	SHFT	E 4	→	C 2	A 0	A 0	C 2	→
C 2	D 3	E 4	F 5	ENT				
GX OUT	→	D 3	ENT					

In the following example, when the value in V-memory location V2000 = 2550 and V2002 does not equal 2345, Y3 will energize.



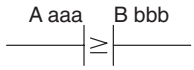
Handheld Programmer Keystrokes

$ STR	SHFT	E 4	→	C 2	A 0	A 0	A 0	→
F 5	A 0	A 0	A 0	ENT				
V AND	SHFT	E 4	→	C 2	A 0	A 0	C 2	→
C 2	D 3	E 4	F 5	ENT				
GX OUT	→	D 3	ENT					

Store (STR)

DS5	Used
HPP	Used

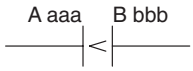
The Comparative Store instruction begins a new rung or additional branch in a rung with a normally open comparative contact. The contact will be on when Aaaa is equal to or greater than Bbbb.



Store Not (STRN)

DS5	Used
HPP	Used

The Comparative Store Not instruction begins a new rung or additional branch in a rung with a normally closed comparative contact. The contact will be on when Aaaa is less than Bbbb.

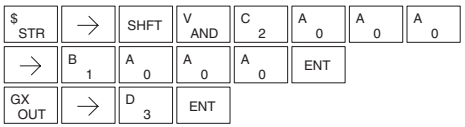


Operand Data Type		DL05 Range	
	A/B	aaa	bbb
V-memory	V	All (See page 3–28)	All (See page 3–28)
Pointer	p	All (See page 3–28)	All (See page 3–28)
Constant	K	—	0–9999
Timer	T	0–177	
Counter	CT	0–177	

In the following example, when the value in V-memory location V2000 ≥ 1000, Y3 will energize.

DirectSOFT

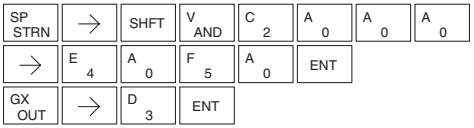
Handheld Programmer Keystrokes



In the following example, when the value in V-memory location V2000 < 4050, Y3 will energize.

DirectSOFT

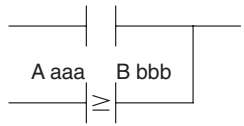
Handheld Programmer Keystrokes



Or (OR)

DS5	Implied
HPP	Used

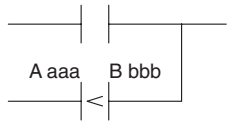
The Comparative Or instruction connects a normally open comparative contact in parallel with another contact. The contact will be on when Aaaa is equal to or greater than Bbbb.



Or Not (ORN)

DS5	Implied
HPP	Used

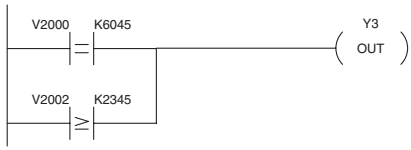
The Comparative Or Not instruction connects a normally open comparative contact in parallel with another contact. The contact will be on when Aaaa is less than Bbbb.



Operand Data Type		DL05 Range	
	A/B	aaa	bbb
V-memory	V	All (See page 3–28)	All (See page 3–28)
Pointer	p	All (See page 3–28)	All (See page 3–28)
Constant	K	—	0–9999
Timer	T	0–177	
Counter	CT	0–177	

In the following example, when the value in V-memory location V2000 = 6045 or V2002 ≥ 2345, Y3 will energize.

DirectSOFT

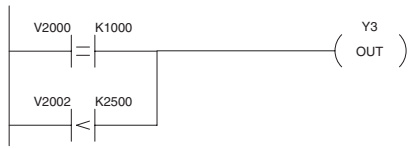


Handheld Programmer Keystrokes

$ STR	SHFT	E 4	→	C 2	A 0	A 0	A 0	→
G 6	A 0	E 4	F 5	ENT				
Q OR	→	SHFT	V AND	C 2	A 0	A 0	C 2	→
C 2	D 3	E 4	F 5	ENT				
GX OUT	→	D 3	ENT					

In the following example when the value in V-memory location V2000 = 1000 or V2002 < 2500, Y3 will energize.

DirectSOFT



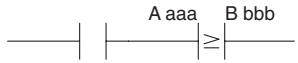
Handheld Programmer Keystrokes

$ STR	SHFT	E 4	→	C 2	A 0	A 0	A 0	→
B 1	A 0	A 0	A 0	ENT				
R ORN	→	SHFT	V AND	C 2	A 0	A 0	C 2	→
C 2	F 5	A 0	A 0	ENT				
GX OUT	→	D 3	ENT					

And (AND)

DS5	Implied
HPP	Used

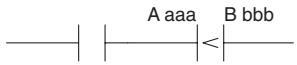
The Comparative And instruction connects a normally open comparative contact in series with another contact. The contact will be on when Aaaa is equal to or greater than Bbbb.



And Not (ANDN)

DS5	Implied
HPP	Used

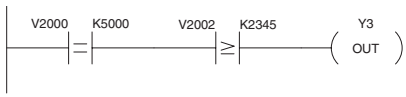
The Comparative And Not instruction connects a normally open comparative contact in parallel with another contact. The contact will be on when Aaaa is less than Bbbb.



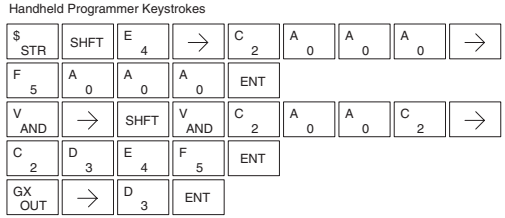
Operand Data Type		DL05 Range	
	A/B	aaa	bbb
V-memory	V	All (See page 3–28)	All (See page 3–28)
Pointer	p	All (See page 3–28)	All (See page 3–28)
Constant	K	—	0–9999
Timer	T	0–177	
Counter	CT	0–177	

In the following example, when the value in V-memory location V2000 = 5000, and V2002 ≥ 2345, Y3 will energize.

DirectSOFT

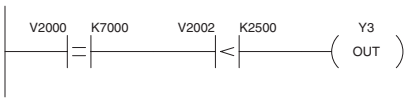


Handheld Programmer Keystrokes

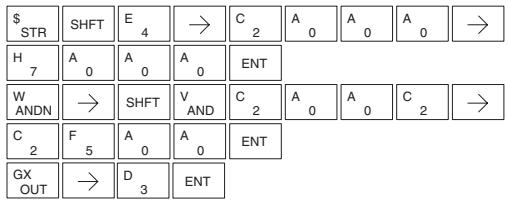


In the following example, when the value in V-memory location V2000 = 7000 and V2002 < 050, Y3 will energize.

DirectSOFT



Handheld Programmer Keystrokes

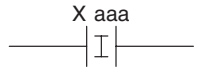


Immediate Instructions

Store Immediate (STRI)

DS5	Used
HPP	Used

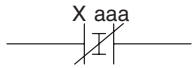
The Store Immediate instruction begins a new rung or additional branch in a rung. The status of the contact will be the same as the status of the associated input point *at the time the instruction is executed*. The image register is not updated.



Store Not Immediate (STRNI)

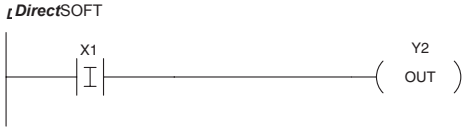
DS5	Used
HPP	Used

The Store Not Immediate instruction begins a new rung or additional branch in a rung. The status of the contact will be opposite the status of the associated input point *at the time the instruction is executed*. The image register is not updated.



Operand Data Type		DL05 Range
		aaa
Inputs	X	0–377

In the following example when X1 is on, Y2 will energize.



Handheld Programmer Keystrokes

$ STR	SHFT	I 8	→	B 1	ENT
GX OUT	→	C 2	ENT		

In the following example when X1 is off, Y2 will energize.

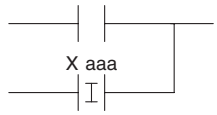
Handheld Programmer Keystrokes

SP STRN	SHFT	I 8	→	B 1	ENT
GX OUT	→	C 2	ENT		

Or Immediate (ORI)

DS5	Implied
HPP	Used

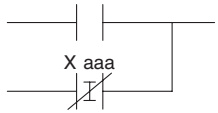
The Or Immediate connects two contacts in parallel. The status of the contact will be the same as the status of the associated input point *at the time the instruction is executed*. The image register is not updated.



Or Not Immediate (ORNI)

DS5	Implied
HPP	Used

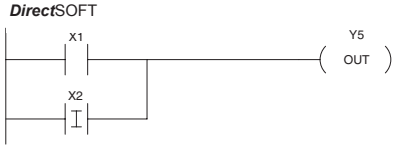
The Or Not Immediate connects two contacts in parallel. The status of the contact will be opposite the status of the associated input point *at the time the instruction is executed*. The image register is not updated.

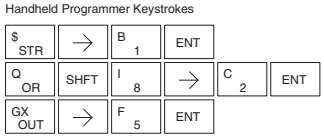


OR Immediate Instructions (cont'd)

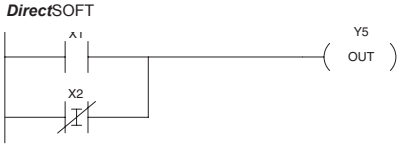
Operand Data Type		DL05 Range
		aaa
Inputs	X	0–377

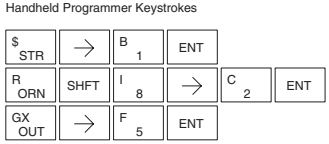
In the following example, when X1 or X2 is on, Y5 will energize.





In the following example, when X1 is on or X2 is off, Y5 will energize.

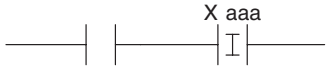




And Immediate (ANDI)

DS5	Implied
HPP	Used

The And Immediate connects two contacts in series. The status of the contact will be the same as the status of the associated input point *at the time the instruction is executed*. The image register is not updated.



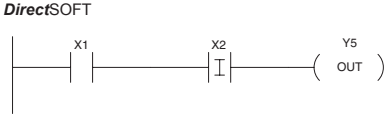
And Not Immediate (ANDNI)

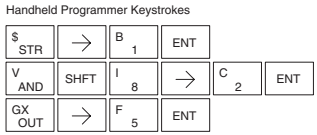
DS5	Implied
HPP	Used

The And Not Immediate connects two contacts in series. The status of the contact will be opposite the status of the associated input point *at the time the instruction is executed*. The image register is not updated.

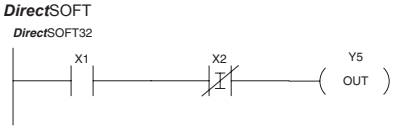
Operand Data Type		DL05 Range
		aaa
Inputs	X	0–377

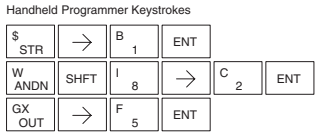
In the following example, when X1 and X2 are on, Y5 will energize.





In the following example, when X1 is on and X2 is off, Y5 will energize.

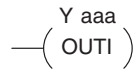




Out Immediate (OUTI)

DS5	Used
HPP	Used

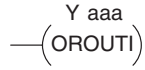
The Out Immediate instruction reflects the status of the rung (on/off) and outputs the discrete (on/off) status to the specified module output point and the image register *at the time the instruction is executed*. If multiple Out Immediate instructions referencing the same discrete point are used it is possible for the module output status to change multiple times in a CPU scan. See Or Out Immediate.



Or Out Immediate (OROUTI)

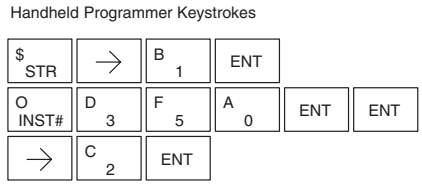
DS5	Used
HPP	Used

The Or Out Immediate instruction has been designed to use more than 1 rung of discrete logic to control a single output. Multiple Or Out Immediate instructions referencing the same output coil may be used, since all contacts controlling the output are ored together. If the status of any rung is on *at the time the instruction is executed*, the output will also be on.

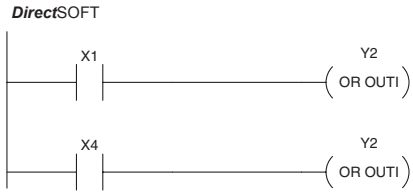


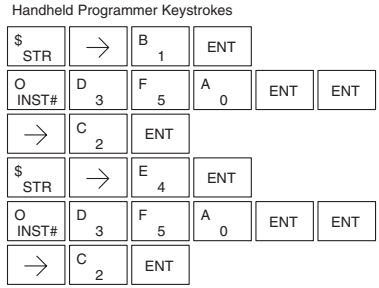
Operand Data Type		DL05 Range
		aaa
Outputs	Y	0–377

In the following example, when X1 is on, output point Y2 on the output module will turn on. For instruction entry on the Handheld Programmer, you can use the instruction number (#350) as shown, or type each letter of the command.



In the following example, when X1 or X4 is on, Y2 will energize.

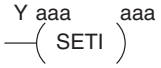




Set Immediate (SETI)

DS5	Used
HPP	Used

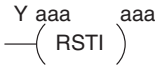
The Set Immediate instruction immediately sets, or turns on an output or a range of outputs in the image register and the corresponding output point(s) *at the time the instruction is executed*. Once the outputs are set it is not necessary for the input to remain on. The Reset Immediate instruction can be used to reset the outputs.



Reset Immediate (RSTI)

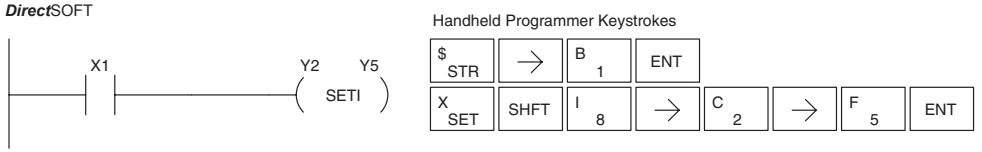
DS5	Used
HPP	Used

The Reset Immediate instruction immediately resets, or turns off an output or a range of outputs in the image register and the output point(s) *at the time the instruction is executed*. Once the outputs are reset it is not necessary for the input to remain on.

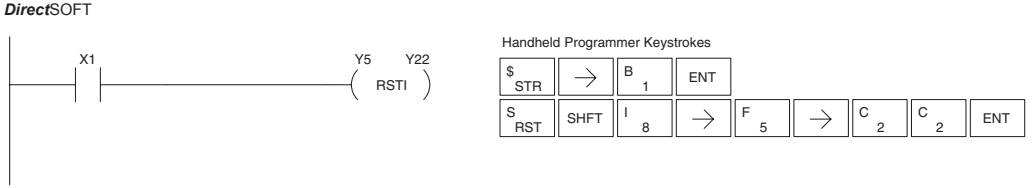


Operand Data Type		DL05 Range
		aaa
Outputs	Y	0–377

In the following example, when X1 is on, Y2 through Y5 will be set on in the image register and on the corresponding output points.



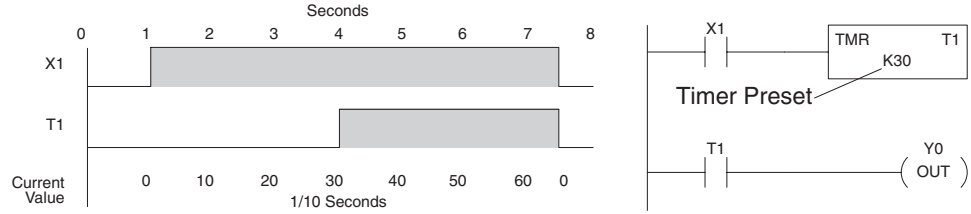
In the following example, when X1 is on, Y5 through Y22 will be reset (off) in the image register and on the corresponding output module(s).



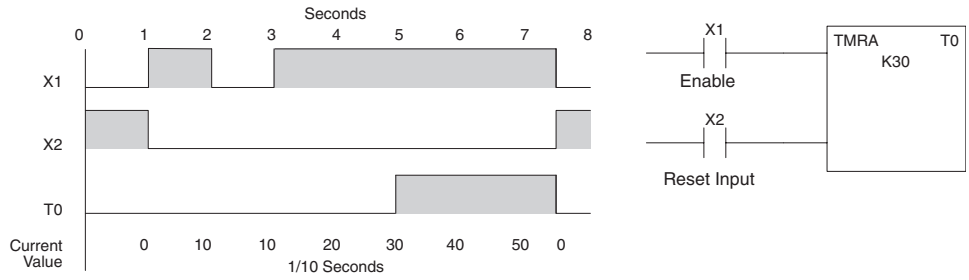
Timer, Counter and Shift Register Instructions

Using Timers

Timers are used to time an event for a desired length of time. The single input timer will time as long as the input is on. When the input changes from on to off the timer current value is reset to 0. There is a tenth of a second and a hundredth of a second timer available with a maximum time of 999.9 and 99.99 seconds respectively. There is a discrete bit associated with each timer to indicate that the current value is equal to or greater than the preset value. The timing diagram below shows the relationship between the timer input, associated discrete bit, current value, and timer preset.



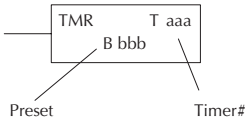
There are those applications that need an accumulating timer, meaning it has the ability to time, stop, and then resume from where it previously stopped. The accumulating timer works similarly to the regular timer, but two inputs are required. The start/stop input starts and stops the timer. When the timer stops, the elapsed time is maintained. When the timer starts again, the timing continues from the elapsed time. When the reset input is turned on, the elapsed time is cleared and the timer will start at 0 when it is restarted. There is a tenth of a second and a hundredth of a second timer available with a maximum time of 9999999.9 and 999999.99 seconds respectively. The timing diagram below shows the relationship between the timer input, timer reset, associated discrete bit, current value, and timer preset.

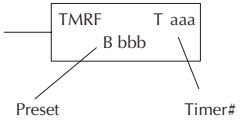


Timer (TMR) and Timer Fast (TMRF)

DS5	Used
HPP	Used

The Timer instruction is a 0.1 second single input timer that times to a maximum of 999.9 seconds. The Timer Fast instruction is a 0.01 second single input timer that times up to a maximum of 99.99 seconds. These timers will be enabled if the input logic is true (on) and will be reset to 0 if the input logic is false (off).





The timer discrete status bit and the current value are not specified in the timer instruction

Instruction Specifications

Timer Reference (Taaa): Specifies the timer number.

Preset Value (Bbbb): Constant value (K) or a V-memory location.

Current Value: Timer current values (BCD) are accessed by referencing the associated V or T memory location*. For example, the timer current value for T3 physically resides in V-memory location V3 as a BCD value.

Discrete Status Bit: The discrete status bit is referenced by the associated T memory location. Operating as a "timer done bit", it will be on if the current value is equal to or greater than the preset value. For example, the discrete status bit for Timer 2 is TA2.

***NOTE**: Timer preset constants (K) may be changed by using a handheld programmer, even when the CPU is in Run Mode. Therefore, a V-memory preset is required only if the ladder program must change the preset.*

Operand Data Type		DL05 Range	
	A/B	aaa	bbb
Timers	T	0–177	—
V-memory for preset values	V	—	1200–7377 7400–7577*
Pointers (preset only)	P	—	1200–7377 7400–7577
Constants (preset only)	K	—	0–9999
Timer discrete status bits	T/V	0–177 or V41100–41107	
Timer current values	V /T**	0–177	

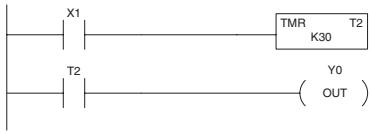
***NOTE**: * May be non-volatile if MOV instruction is used.*
*** With the HPP, both the Timer discrete status bits and current value are accessed with the same data reference. **Direct**SOFT uses separate references, such as "T2" for discrete status bit for Timer T2, and "TA2" for the current value of Timer T2.*

You can perform functions when the timer reaches the specified preset using the discrete status bit. Or, use comparative contacts to perform functions at different time intervals, based on one timer. The examples on the following page show these two methods of programming timers.

Timer Example Using Discrete Status Bits

In the following example, a single input timer is used with a preset of 3 seconds. The timer discrete status bit (T2) will turn on when the timer has timed for 3 seconds. The timer is reset when X1 turns off, turns off the discrete status bit and resets the timer current value to 0.

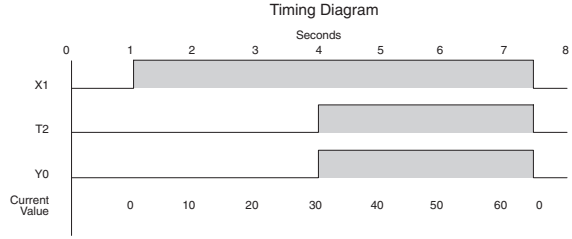
DirectSOFT



Handheld Programmer Keystrokes

$ STR	→	B 1	ENT								
N TMR	→	C 2	→	D 3	A 0	ENT					
$ STR	→	SHFT	T MLR	C 2	ENT						
GX OUT	→	A 0	ENT								

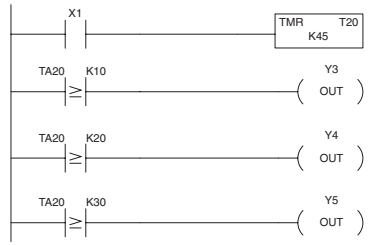
Timing Diagram



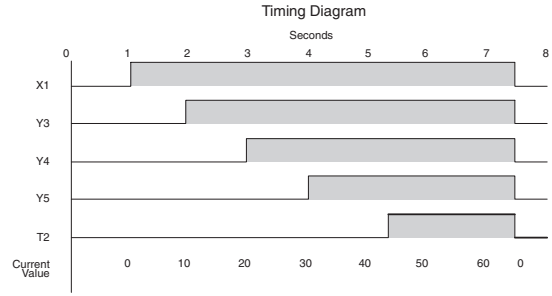
Timer Example Using Comparative Contacts

In the following example, a single input timer is used with a preset of 4.5 seconds. Comparative contacts are used to energize Y3, Y4, and Y5 at one second intervals respectively. When X1 is turned off the timer will be reset to 0 and the comparative contacts will turn off Y3, Y4, and Y5.

DirectSOFT



Timing Diagram



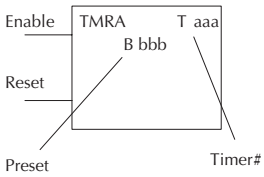
Handheld Programmer Keystrokes

$ STR	→	B 1	ENT											
N TMR	→	C 2	A 0	→	E 4	F 5	ENT							
$ STR	→	SHFT	T MLR	C 2	A 0	→	B 1	A 0	ENT					
GX OUT	→	D 3	ENT											
$ STR	→	SHFT	T MLR	C 2	A 0	→	C 2	A 0	ENT					
GX OUT	→	E 4	ENT											
$ STR	→	SHFT	T MLR	C 2	A 0	→	D 3	A 0	ENT					
GX OUT	→	F 5	ENT											

Accumulating Timer (TMRA)

DS5	Used
HPP	Used

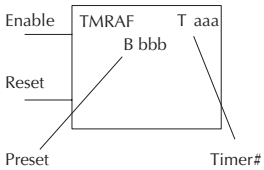
The Accumulating Timer is a 0.1 second two input timer that will time to a maximum of 9999999.9.



Accumulating Fast Timer (TMRAF)

DS5	Used
HPP	Used

The Accumulating Fast Timer is a 0.01 second two-input timer that will time to a maximum of 99999.99. *Each one uses two timer registers in V-memory*. These timers have two inputs, an enable and a reset. The timer starts timing when the enable is on and stops when the enable is off (without resetting the count). The reset will reset the timer when on and allow the timer to time when off.



The timer discrete status bit and the current value are not specified in the timer instruction

Instruction Specifications

Timer Reference (Taaa): Specifies the timer number.

Preset Value (Bbbb): Constant value (K) or a V-memory location.

Current Value: Timer current values (BCD) are accessed by referencing the associated V or T memory location*. For example, the timer current value for T3 resides in V-memory location V3 as a BCD value.

Discrete Status Bit: The discrete status bit is accessed by referencing the associated T memory location. Operating as a "timer done bit", it will be on if the current value is equal to or greater than the preset value. For example the discrete status bit for timer 2 would be T2.

NOTE: *The accumulating type timer uses* ***two consecutive V-memory locations*** *for the 8-digit value, and therefore two consecutive timer locations. For example, if TMR 1 is used, the next available timer number is TMR 3.*

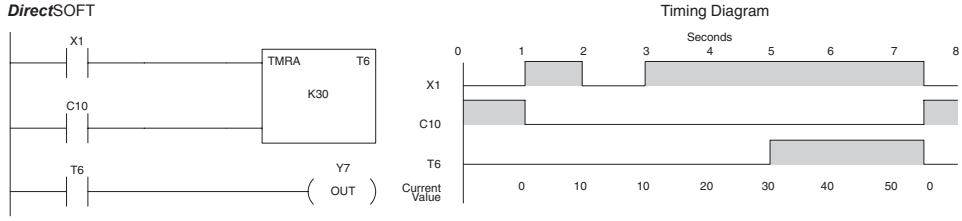
Operand Data Type		DL05 Range	
	A/B	aaa	bbb
Timers	T	0–176	—
V-memory for preset values	V	—	1200–7377/7400–7577*
Pointers (preset only)	P	—	1200–7377/7400–7577
Constants (preset only)	K	—	0–99999999
Timer discrete status bits	T/V	0–176 or V41100–41107	
Timer current values	V /T**	0–176	

NOTE*: * May be non-volatile if MOV instruction is used.*
*** With the HPP, both the Timer discrete status bits and current value are accessed with the same data reference.* ***Direct****SOFT uses separate references, such as "T2" for discrete status bit for Timer T2, and "TA2" for the current value of Timer T2.*

The following examples show two methods of programming timers. One performs functions when the timer reaches the preset value using the discrete status bit, or use comparative contacts to perform functions at different time intervals.

Accumulating Timer Example using Discrete Status Bits

In the following example, a two input timer (accumulating timer) is used with a preset of 3 seconds. The timer discrete status bit (T6) will turn on when the timer has timed for 3 seconds. Notice in this example that the timer times for 1 second, stops for one second, then resumes timing. The timer will reset when C10 turns on, turning the discrete status bit off and resetting the timer current value to 0.



Handheld Programmer Keystrokes

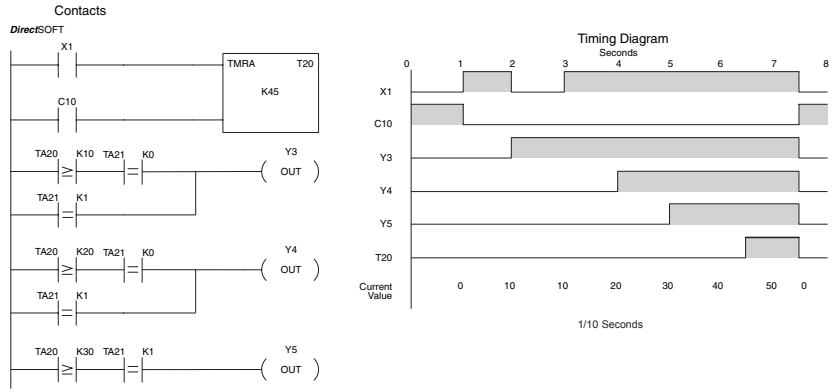
$ STR	→	B 1	ENT			
$ STR	→	SHFT	C 2	B 1	A 0	ENT
N TMR	SHFT	A 0	→	G 6	→	

Handheld Programmer Keystrokes (cont)

D 3	A 0	ENT				
$ STR	→	SHFT	T MLR	G 6	ENT	
GX OUT	→	B 1	A 0	ENT		

Accumulator Timer Example Using Comparative Contacts

In the following example, a single input timer is used with a preset of 4.5 seconds. Comparative contacts are used to energized Y3, Y4, and Y5 at one second intervals respectively. The comparative contacts will turn off when the timer is reset.



Handheld Programmer Keystrokes

$ STR	→	B 1	ENT						
$ STR	→	SHFT	C 2	B 1	A 0	ENT			
N TMR	SHFT	A 0	→	C 2	A 0	→	E 4	F 5	ENT
$ STR	→	SHFT	T MLR	C 2	A 0	→	B 1	A 0	ENT
V AND	SHFT	E 4	→	SHFT	T MLR	C 2	B 1	→	A 0	ENT
Q OR	SHFT	E 4	→	SHFT	T MLR	C 2	B 1	→	B 1	ENT
GX OUT	→	D 3	ENT							

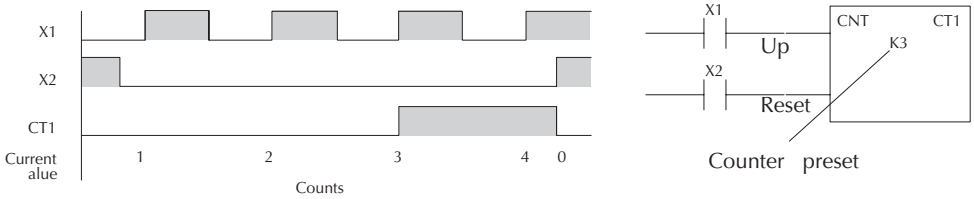
Handheld Programmer Keystrokes (cont'd)

$ STR	→	SHFT	T MLR	C 2	A 0	→	C 2	A 0	ENT	
V AND	SHFT	E 4	→	SHFT	T MLR	C 2	B 1	→	A 0	ENT
Q OR	SHFT	E 4	→	SHFT	T MLR	C 2	B 1	→	B 1	ENT
GX OUT	→	E 4	ENT							
$ STR	→	SHFT	T MLR	C 2	A 0	→	D 3	A 0	ENT	
V AND	SHFT	E 4	→	SHFT	T MLR	C 2	B 1	→	B 1	ENT
GX OUT	→	F 5	ENT							

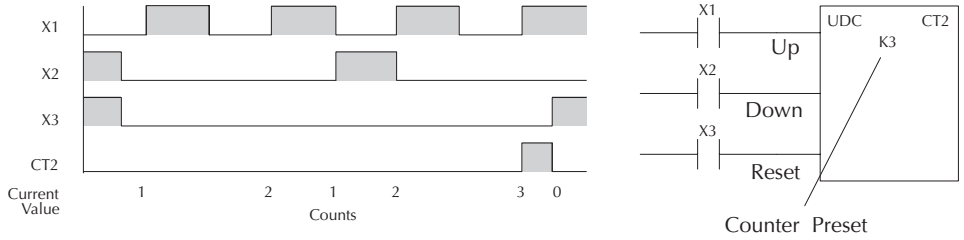
Using Counters

Counters are used to count events. The counters available are up counters, up/down counters, and stage counters (used with RLL*PLUS* programming).

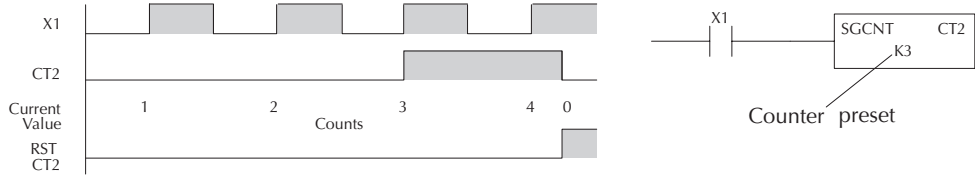
The up counter has two inputs, a count input and a reset input. The maximum count value is 9999. The timing diagram below shows the relationship between the counter input, counter reset, associated discrete bit, current value, and counter preset.



The up down counter has three inputs, a count up input, count down input and reset input. The maximum count value is 99999999. The timing diagram below shows the relationship between the counter input, counter reset, associated discrete bit, current value, and counter preset.



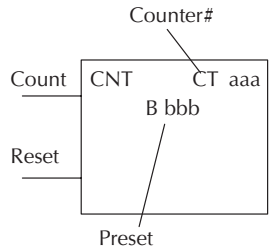
The stage counter has a count input and is reset by the RST instruction. This instruction is useful when programming using the RLL*PLUS* structured programming. The maximum count value is 9999. The timing diagram below shows the relationship between the counter input, associated discrete bit, current value, counter preset and reset instruction.



Counter (CNT)

DS5	Used
HPP	Used

The Counter is a two input counter that increments when the count input logic transitions from off to on. When the counter reset input is on the counter resets to 0. When the current value equals the preset value, the counter status bit comes on and the counter continues to count up to a maximum count of 9999. The maximum value will be held until the counter is reset.



The counter discrete status bit and the current value are not specified in the counter instruction.

Instruction Specifications

Counter Reference (CTaaa): Specifies the counter number.

Preset Value (Bbbb): Constant value (K) or a V-memory location as a BCD value.

Current Values: Counter current values are accessed by referencing the associated V or CT memory locations*. The V-memory location is the counter location + 1000. For example, the counter current value for CT3 resides in V-memory location V1003 as a BCD value.

Discrete Status Bit: The discrete status bit is accessed by referencing the associated CT memory location. It will be on if the value is equal to or greater than the preset value. For example the discrete status bit for counter 2 would be CT2.

***NOTE**: Counter preset constants (K) may be changed by using a programming device, even when the CPU is in Run Mode. Therefore, a V-memory preset is required only if the ladder program must change the preset.*

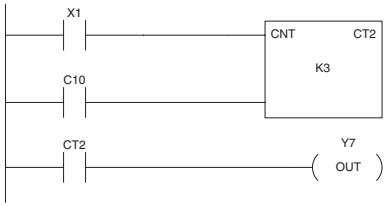
Operand Data Type		DL05 Range	
	A/B	aaa	bbb
Counters	CT	0–177	—
V-memory (preset only)	V	—	1200–7377 7400–7577*
Pointers (preset only)	P	—	1200–7377 7400–7577
Constants (preset only)	K	—	0–9999
Counter discrete status bits	CT/V	0–177 or V41140–41147	
Counter current values	V /CT**	0–177	

***NOTE**: * May be non-volatile if MOV instruction is used.*
*** With the HPP, both the Counter discrete status bits and current value are accessed with the same data reference. **Direct**SOFT uses separate references, such as "CT2" for discrete status bit for Counter CT2, and "CTA2" for the current value of Counter CT2.*

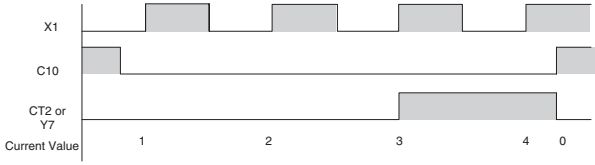
Counter Example Using Discrete Status Bits

In the following example, when X1 makes an off to on transition, counter CT2 will increment by one. When the current value reaches the preset value of 3, the counter status bit CT2 will turn on and energize Y7. When the reset C10 turns on, the counter status bit will turn off and the current value will be 0. The current value for counter CT2 will be held in V-memory location V1002.

DirectSOFT



Counting diagram



Handheld Programmer Keystrokes

$ STR	→	B 1	ENT			
$ STR	→	SHFT	C 2	B 1	A 0	ENT
GY CNT	→	C 2	→	D 3	ENT	

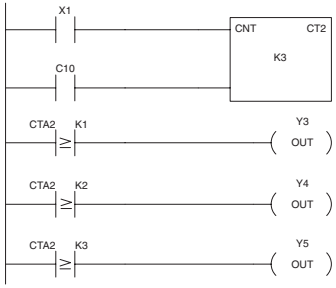
Handheld Programmer Keystrokes (cont)

$ STR	→	SHFT	C 2	SHFT	T MLR	C 2	ENT	
GX OUT	→	B 1	A 0	ENT				

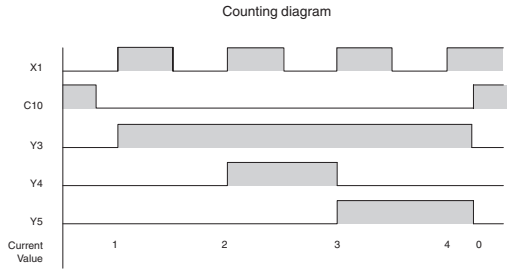
Counter Example Using Comparative Contacts

In the following example, when X1 makes an off to on transition, counter CT2 will increment by one. Comparative contacts are used to energize Y3, Y4, and Y5 at different counts. When the reset C10 turns on, the counter status bit will turn off and the counter current value will be 0, and the comparative contacts will turn off.

DirectSOFT



Counting diagram



Handheld Programmer Keystrokes

$ STR	→	B 1	ENT				
$ STR	→	SHFT	C 2	B 1	A 0	ENT	
GY CNT	→	C 2	→	D 3	ENT		
$ STR	→	SHFT	C 2	SHFT	T MLR	C 2	
→	B 1	ENT					
GX OUT	→	D 3	ENT				

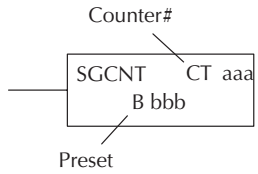
Handheld Programmer Keystrokes (cont)

$ STR	→	SHFT	C 2	SHFT	T MLR	C 2
→	C 2	ENT				
GX OUT	→	E 4	ENT			
$ STR	→	SHFT	C 2	SHFT	T MLR	C 2
→	D 3	ENT				
GX OUT	→	F 5	ENT			

Stage Counter (SGCNT)

DS5	Used
HPP	Used

The Stage Counter is a single input counter that increments when the input logic transitions from off to on. This counter differs from other counters since it will hold its current value until reset using the RST instruction. The Stage Counter is designed for use in RLL*PLUS* programs but can be used in relay ladder logic programs. When the current value equals the preset value, the counter status bit turns on and the counter continues to count up to a maximum count of 9999. The maximum value will be held until the counter is reset.



The counter discrete status bit and the current value are not specified in the counter instruction.

Instruction Specifications

Counter Reference (CTaaa): Specifies the counter number.

Preset Value (Bbbb): Constant value (K) or a V-memory location.

Current Values: Counter current values are accessed by referencing the associated V or CT memory locations*. The V-memory location is the counter location + 1000. For example, the counter current value for CT3 resides in V-memory location V1003.

Discrete Status Bit: The discrete status bit is accessed by referencing the associated CT memory location. It will be on if the value is equal to or greater than the preset value. For example the discrete status bit for counter 2 would be CT2.

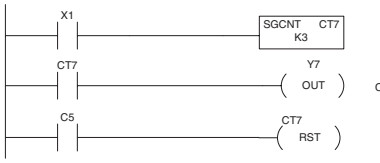
Operand Data Type		DL05 Range	
	A/B	aaa	bbb
Counters	CT	0–177	—
V-memory (preset only)	V	—	1200–7377 7400–7577*
Pointers (preset only)	P	—	1200–7377 7400–7577
Constants (preset only)	K	—	0–9999
Counter discrete status bits	CT/V	0–177 or V41140–41147	
Counter current values	V /CT**	1000–1177	

NOTE: ** May be non-volatile if MOV instruction is used.*
*** With the HPP, both the Counter discrete status bits and current value are accessed with the same data reference.* ***Direct****SOFT uses separate references, such as "CT2" for discrete status bit for Counter CT2, and "CTA2" for the current value of Counter CT2.*

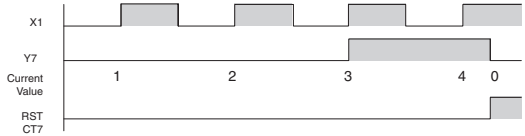
Stage Counter Example Using Discrete Status Bits

In the following example, when X1 makes an off to on transition, stage counter CT7 will increment by one. When the current value reaches 3, the counter status bit CT7 will turn on and energize Y7. The counter status bit CT7 will remain on until the counter is reset using the RST instruction. When the counter is reset, the counter status bit will turn off and the counter current value will be 0. The current value for counter CT7 will be held in V-memory location V1007.

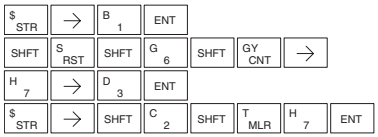
DirectSOFT



Counting diagram



Handheld Programmer Keystrokes

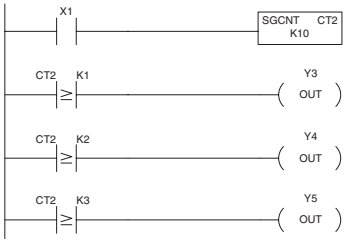


Handheld Programmer Keystrokes (cont)

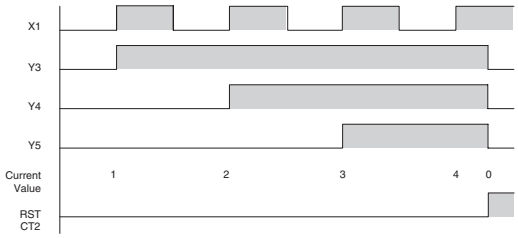
Stage Counter Example Using Comparative Contacts

In the following example, when X1 makes an off to on transition, counter CT2 will increment by one. Comparative contacts are used to energize Y3, Y4, and Y5 at different counts. Although this is not shown in the example, when the counter is reset using the Reset instruction, the counter status bit will turn off and the current value will be 0. The current value for counter CT2 will be held in V-memory location V1002.

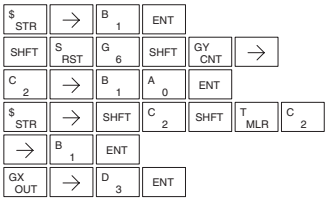
DirectSOFT



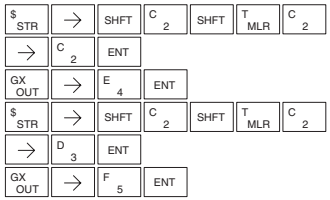
Counting diagram



Handheld Programmer Keystrokes



Handheld Programmer Keystrokes (cont)



Up Down Counter (UDC)

DS5	Used
HPP	Used

This Up/Down Counter counts up on each off to on transition of the Up input and counts down on each off to on transition of the Down input. The counter is reset to 0 when the Reset input is on. The count range is 0–99999999. The count input not being used must be off in order for the active count input to function.

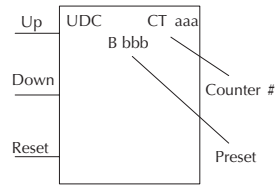
Instruction Specification

Counter Reference (CTaaa): Specifies the counter number.

Preset Value (Bbbb): Constant value (K) or two consecutive V-memory locations as a BCD value.

Current Values: Current count is a double word value accessed by referencing the associated V or CT memory locations*. The V-memory location is the counter location + 1000. For example, the counter current value for CT5 resides in V-memory location V1005 and V1006 as a BCD value.

Discrete Status Bit: The discrete status bit is accessed by referencing the associated CT memory location. Operating as a "counter done bit" it will be on if the value is equal to or greater than the preset value. For example the discrete status bit for counter 2 would be CT2.



Caution: The UDC uses two V-memory locations for the 8 digit current value. This means that the UDC uses two consecutive counter locations. If UDC CT1 is used in the program, the next available counter is CT3.

The counter discrete status bit and the current value are not specified in the counter instruction

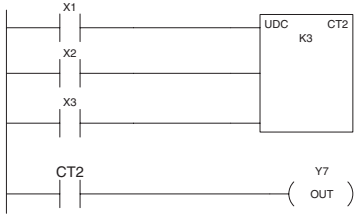
Operand Data Type		DL05 Range	
	A/B	aaa	bbb
Counters	CT	0–176	—
V-memory (preset only)	V	—	1200–7377 7400–7577*
Pointers (preset only)	P	—	1200–7377 7400–7577
Constants (preset only)	K	—	0–99999999
Counter discrete status bits	CT/V	0–176 or V41140–41147	
Counter current values	V /CT**	0–176	

NOTE: ** May be non-volatile if MOV instruction is used.*
*** With the HPP, both the Counter discrete status bits and current value are accessed with the same data reference.* ***Direct****SOFT uses separate references, such as "CT2" for discrete status bit for Counter CT2, and "CTA2" for the current value of Counter CT2.*

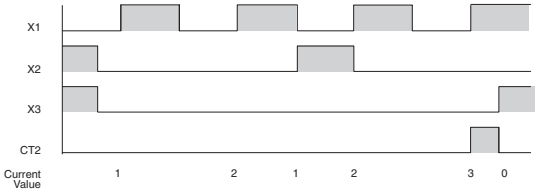
Up / Down Counter Example Using Discrete Status Bits

In the following example if X2 and X3 are off ,when X1 toggles from off to on the counter will increment by one. If X1 and X3 are off the counter will decrement by one when X2 toggles from off to on. When the count value reaches the preset value of 3, the counter status bit will turn on. When the reset X3 turns on, the counter status bit will turn off and the current value will be 0.

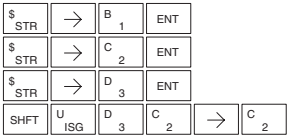
*Direct*SOFT



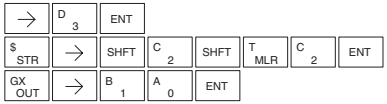
Counting Diagram



Handheld Programmer Keystrokes



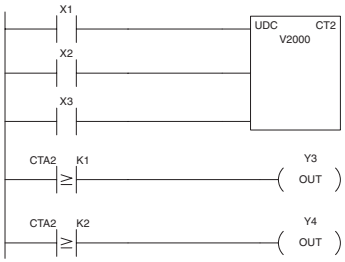
Handheld Programmer Keystrokes (cont)



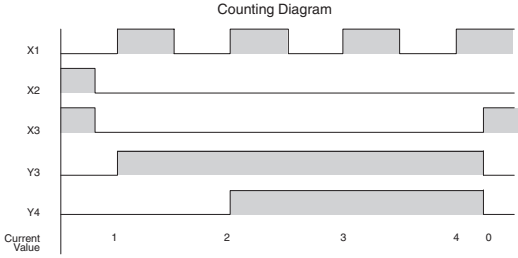
Up / Down Counter Example Using Comparative Contacts

In the following example, when X1 makes an off to on transition, counter CT2 will increment by one. Comparative contacts are used to energize Y3 and Y4 at different counts. When the reset (X3) turns on, the counter status bit will turn off, the current value will be 0, and the comparative contacts will turn off.

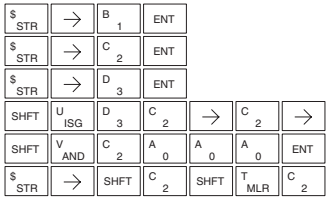
*Direct*SOFT



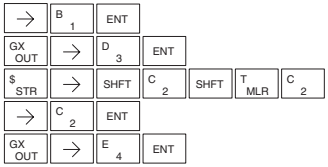
Counting Diagram



Handheld Programmer Keystrokes



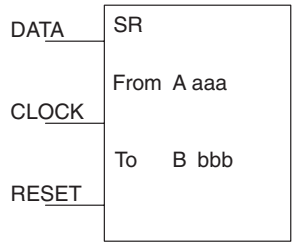
Handheld Programmer Keystrokes (cont)



Shift Register (SR)

DS5	Used
HPP	Used

The Shift Register instruction shifts data through a predefined number of control relays. The control ranges in the shift register block must start at the beginning of an 8 bit boundary use 8-bit blocks.



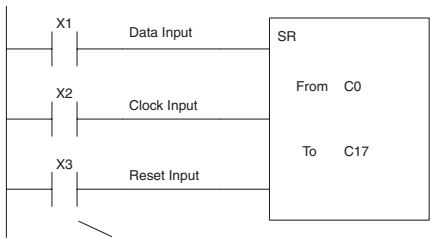
The Shift Register has three contacts.

- Data — determines the value (1 or 0) that will enter the register
- Clock — shifts the bits one position on each low to high transition
- Reset —resets the Shift Register to all zeros.

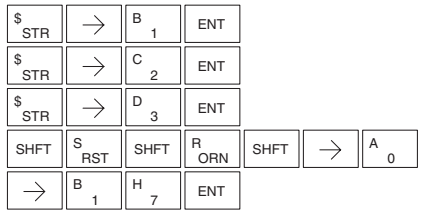
With each off to on transition of the clock input, the bits which make up the shift register block are shifted by one bit position and the status of the data input is placed into the starting bit position in the shift register. The direction of the shift depends on the entry in the From and To fields. From C0 to C17 would define a block of sixteen bits to be shifted from left to right. From C17 to C0 would define a block of sixteen bits, to be shifted from right to left. The maximum size of the shift register block depends on the number of available control relays. The minimum block size is 8 control relays.

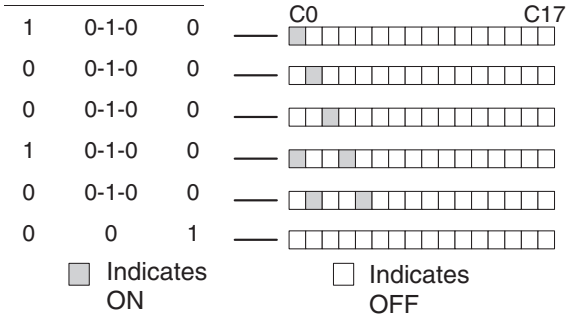
Operand Data Type	DL05 Range	
	A/B	aaa	bbb
Control Relay	C	0–777	0–777

DirectSOFT



Handheld Programmer Keystrokes





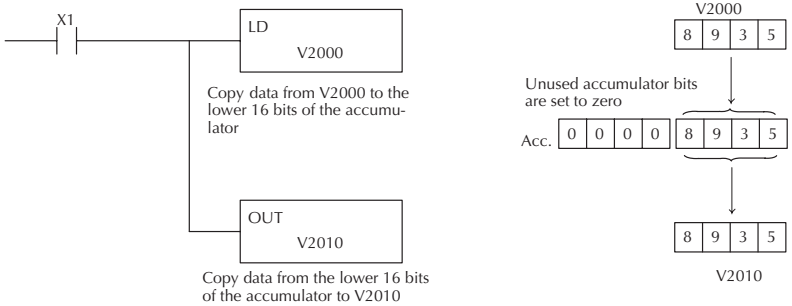
Accumulator/Stack Load and Output Data Instructions

Using the Accumulator

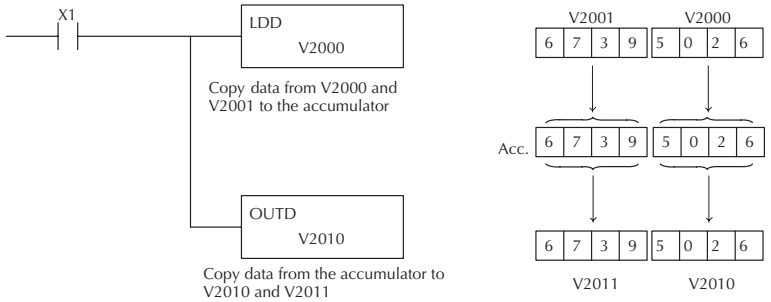
The accumulator in the DL05 internal CPUs is a 32 bit register which is used as a temporary storage location for data that is being copied or manipulated in some manor. For example, you have to use the accumulator to perform math operations such as add, subtract, multiply, etc. Since there are 32 bits, you can use up to an 8-digit BCD number. The accumulator is reset to 0 at the end of every CPU scan.

Copying Data to the Accumulator

The Load and Out instructions and their variations are used to copy data from a V-memory location to the accumulator, or, to copy data from the accumulator to V-memory. The following example copies data from V-memory location V2000 to V-memory location V2010.

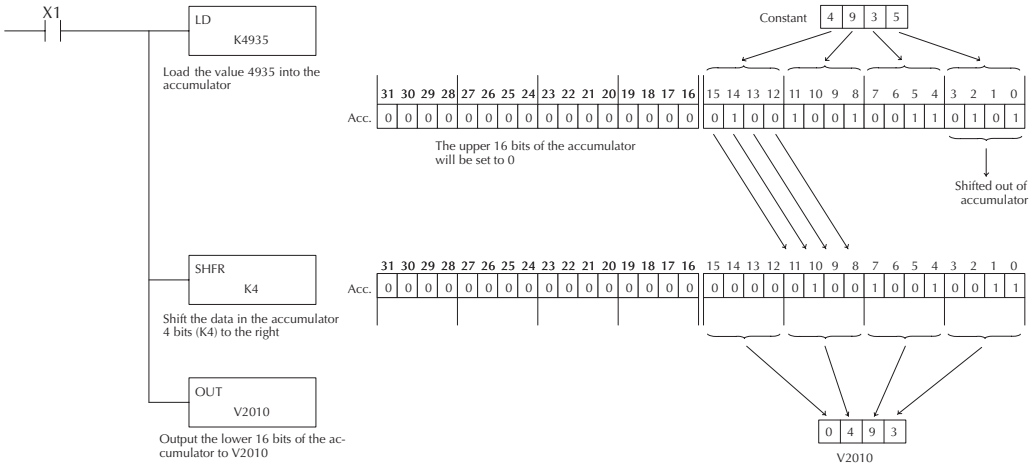


Since the accumulator is 32 bits and V-memory locations are 16 bits the Load Double and Out Double (or variations thereof) use two consecutive V-memory locations or 8 digit BCD constants to copy data either to the accumulator from a V-memory address or from a V-memory address to the accumulator. For example if you wanted to copy data from V2000 and V2001 to V2010 and V2011 the most efficient way to perform this function would be as follows:



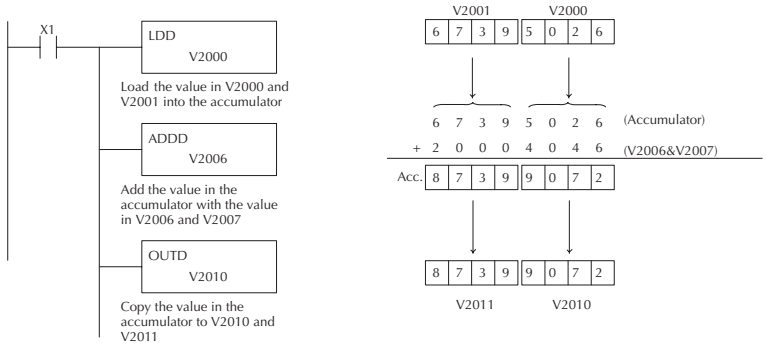
Changing the Accumulator Data

Instructions that manipulate data also use the accumulator. The result of the manipulated data resides in the accumulator. The data that was being manipulated is cleared from the accumulator. The following example loads the constant value 4935 into the accumulator, shifts the data right 4 bits, and outputs the result to V2010.



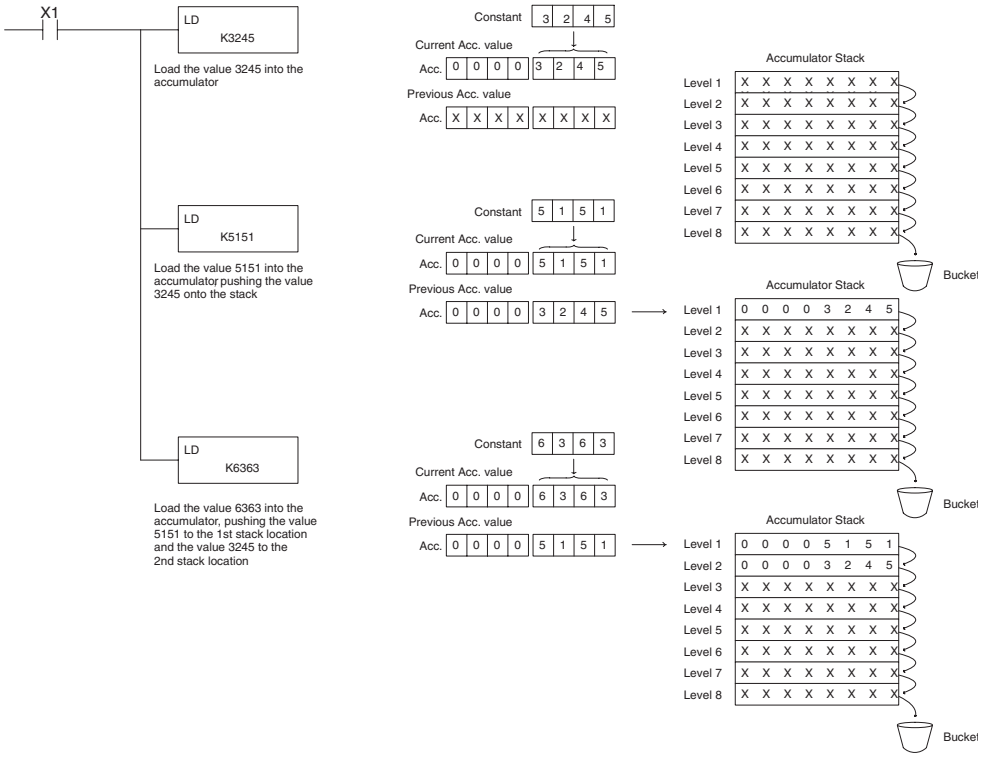
Some of the data manipulation instructions use 32 bits. They use two consecutive V-memory locations or an 8 digit BCD constant to manipulate data in the accumulator.

In the following example, when X1 is on, the value in V2000 and V2001 will be loaded into the accumulator using the Load Double instruction. The value in the accumulator is added with the value in V2006 and V2007 using the Add Double instruction. The value in the accumulator is copied to V2010 and V2011 using the Out Double instruction.

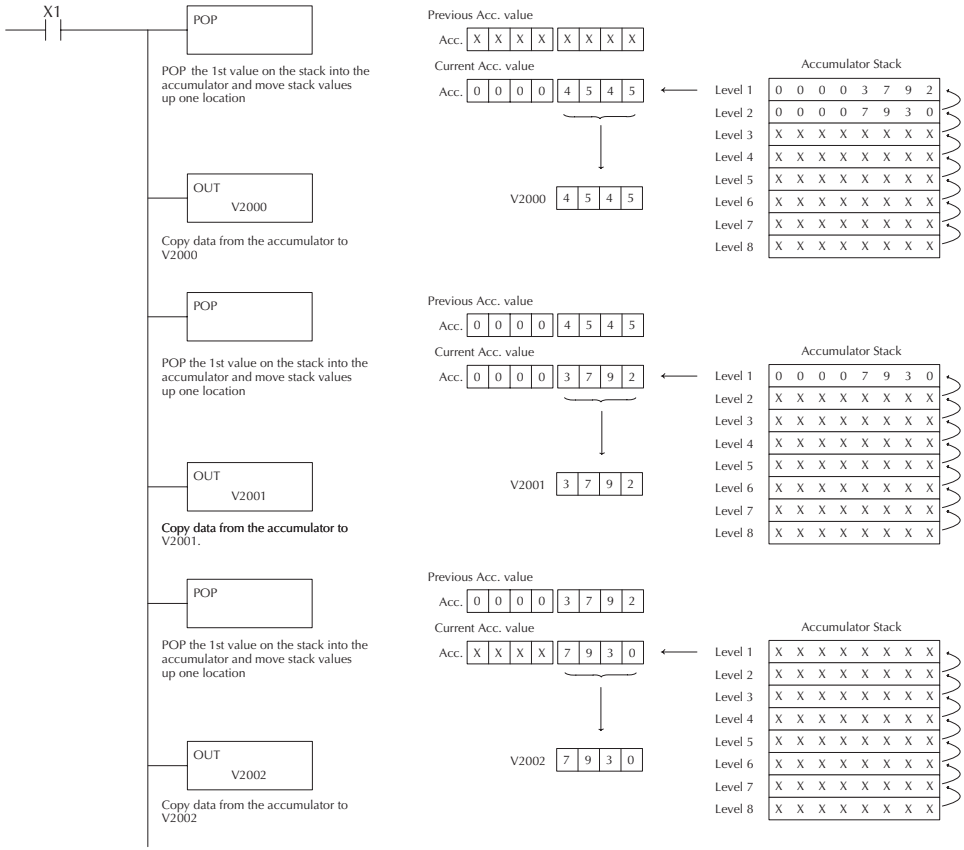


Using the Accumulator Stack

The accumulator stack is used for instructions that require more than one parameter to execute a function or for user defined functionality. The accumulator stack is used when more than one Load instruction is executed without the use of an Out instruction. The first load instruction in the scan places a value into the accumulator. Every Load instruction thereafter without the use of an Out instruction places a value into the accumulator and the value that was in the accumulator is placed onto the accumulator stack. The Out instruction nullifies the previous load instruction and does not place the value that was in the accumulator onto the accumulator stack when the next load instruction is executed. Every time a value is placed onto the accumulator stack the other values in the stack are pushed down one location. The accumulator is eight levels deep (eight 32 bit registers). If there is a value in the eighth location when a new value is placed onto the stack, the value in the eighth location is pushed off the stack and cannot be recovered.



The POP instruction rotates values upward through the stack into the accumulator. When a POP is executed the value which was in the accumulator is cleared and the value that was on top of the stack is in the accumulator. The values in the stack are shifted up one position in the stack.

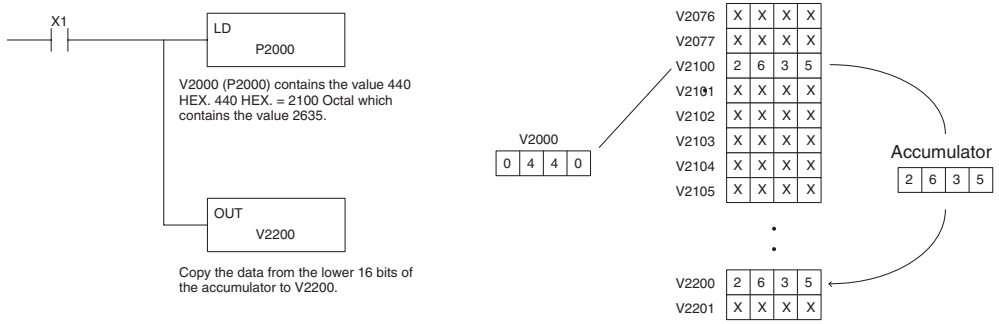


Using Pointers

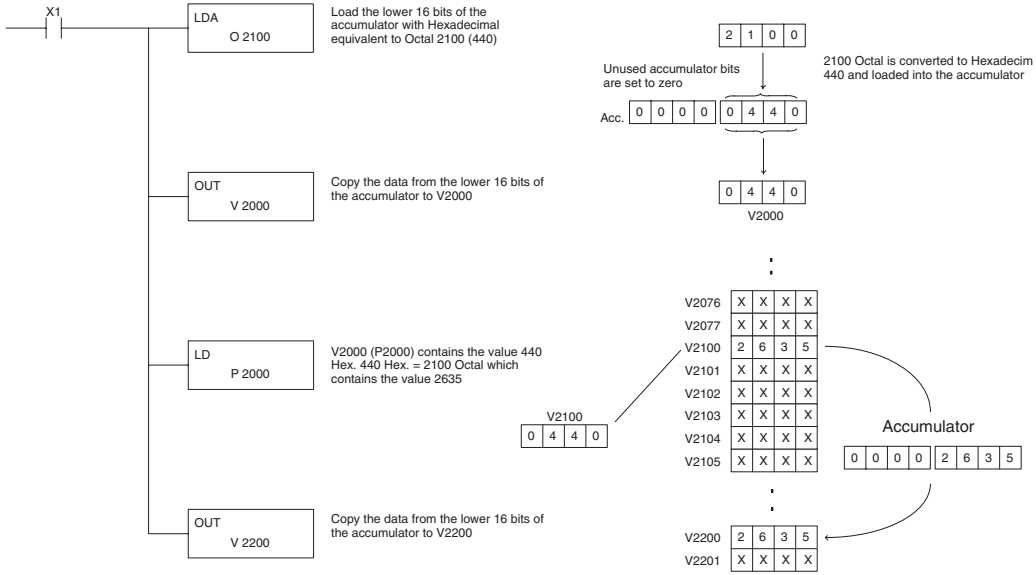
Many of the DL05 series instructions will allow V-memory pointers as a operand (commonly known as indirect addressing). Pointers allow instructions to obtain data from V-memory locations referenced by the pointer value.

***NOTE**: DL05 V-memory addressing is in octal. However, the pointers reference a V-memory location with values viewed as HEX. Use the Load Address (LDA) instruction to move an address into the pointer location. This instruction performs the Octal to Hexadecimal conversion automatically.*

In the following simple example we are using a pointer operand in a Load instruction. V-memory location 2000 is being used as the pointer location. V2000 contains the value 440 which the CPU views as the Hex equivalent of the Octal address V-memory location V2100. The CPU will copy the data from V2100 which in this example contains the value 2635 into the lower word of the accumulator.



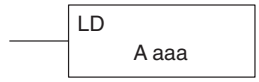
The following example is identical to the one above with one exception. The LDA (Load Address) instruction automatically converts the Octal address to Hex.



Load (LD)

DS5	Used
HPP	Used

The Load instruction is a 16 bit instruction that loads the value (Aaaa), which is either a V-memory location or a 4 digit constant, into the lower 16 bits of the accumulator. The upper 16 bits of the accumulator are set to 0.



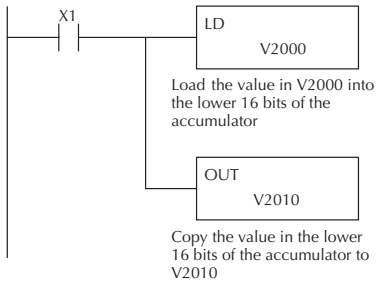
Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Pointer	P	See memory map
Constant	K	0–FFFF

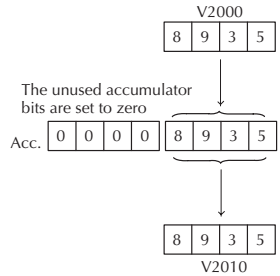
Discrete Bit Flags	Description
SP53	On when the pointer is outside of the available range.
SP70	On anytime the value in the accumulator is negative.
SP76	On when the value loaded into the accumulator is zero.

***NOTE**: Two consecutive Load instructions will place the value of the first load instruction onto the accumulator stack.*

In the following example, when X1 is on, the value in V2000 will be loaded into the accumulator and output to V2010.

DirectSOFT





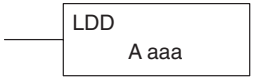
Handheld Programmer Keystrokes

$ STR	→	B 1	X SET					
SHFT	L ANDST	D 3	→					
C 2	A 0	A 0	A 0	ENT				
GX OUT	→	SHFT	V AND	C 2	A 0	B 1	A 0	ENT

Load Double (LDD)

DS5	Used
HPP	Used

The Load Double instruction is a 32 bit instruction that loads the value (Aaaa), which is either two consecutive V-memory locations or an 8 digit constant value, into the accumulator.



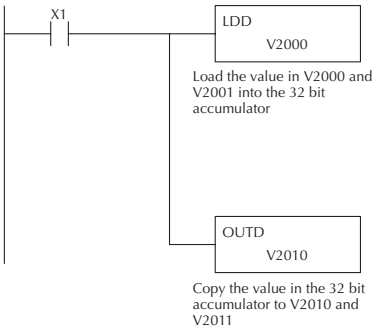
Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Pointer	P	See memory map
Constant	K	0–FFFF

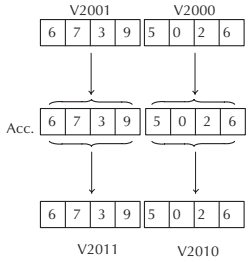
Discrete Bit Flags	Description
SP53	On when the pointer is outside of the available range.
SP70	On anytime the value in the accumulator is negative.
SP76	On when the value loaded into the accumulator by any instruction is zero.

***NOTE**: Two consecutive Load instructions will place the value of the first load instruction onto the accumulator stack.*

In the following example, when X1 is on, the 32 bit value in V2000 and V2001 will be loaded into the accumulator and output to V2010 and V2011.

DirectSOFT





Handheld Programmer Keystrokes

$ STR	→	B 1	ENT	
SHFT	L ANDST	D 3	D 3	→
C 2	A 0	A 0	A 0	ENT
GX OUT	SHFT	D 3	→	
C 2	A 0	B 1	A 0	ENT

Load Formatted (LDF)

DS5	Used
HPP	Used

The Load Formatted instruction loads 1–32 consecutive bits from discrete memory locations into the accumulator. The instruction requires a starting location (Aaaa) and the number of bits (Kbbb) to be loaded. Unused accumulator bit locations are set to zero.

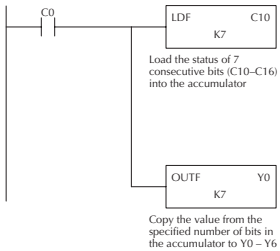
Operand Data Type		DL05 Range	
A		aaa	bbb
Inputs	X	0–377	—
Outputs	Y	0–377	—
Control Relays	C	0–777	—
Stage Bits	S	0–377	—
Timer Bits	T	0–177	—
Counter Bits	CT	0–177	—
Special Relays	SP	0–777	—
Constant	K	—	1–32

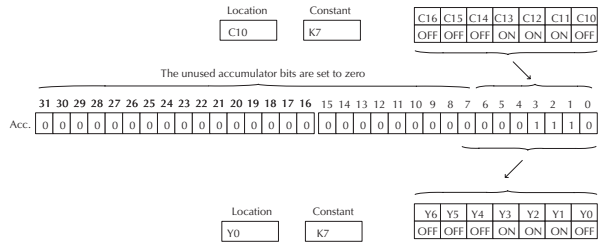
Discrete Bit Flags	Description
SP70	On anytime the value in the accumulator is negative.
SP76	On when the value loaded into the accumulator by any instruction is zero.

NOTE: *Two consecutive Load instructions will place the value of the first load instruction onto the accumulator stack.*

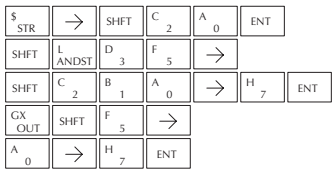
In the following example, when C0 is on, the binary pattern of C10–C16 (7 bits) will be loaded into the accumulator using the Load Formatted instruction. The lower 7 bits of the accumulator are output to Y0–Y6 using the Out Formatted instruction.

DirectSOFT





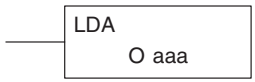
Handheld Programmer Keystrokes



Load Address (LDA)

DS5	Used
HPP	Used

The Load Address instruction is a 16 bit instruction. It converts any octal value or address to the HEX equivalent value and loads the HEX value into the accumulator. This instruction is useful when an address parameter is required since all addresses for the DL05 system are in octal.



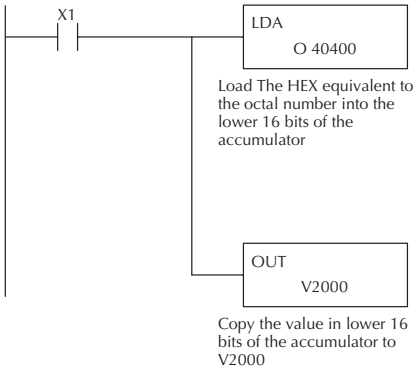
Operand Data Type		DL05 Range
		aaa
Octal Address	O	See memory map

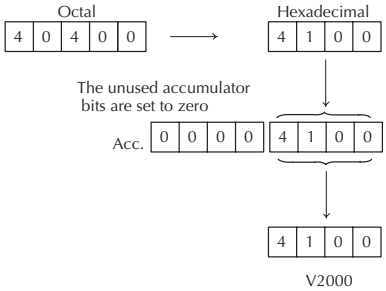
Discrete Bit Flags	Description
SP70	On anytime the value in the accumulator is negative.
SP76	On when the value loaded into the accumulator by any instruction is zero.

***NOTE**: Two consecutive Load instructions will place the value of the first load instruction onto the accumulator stack.*

In the following example when X1 is on, the octal number 40400 will be converted to a HEX 4100 and loaded into the accumulator using the Load Address instruction. The value in the lower 16 bits of the accumulator is copied to V2000 using the Out instruction.

DirectSOFT





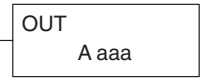
Handheld Programmer Keystrokes

$ STR	→	B 1	ENT					
SHFT	L ANDST	D 3	A 0	→				
E 4	A 0	E 4	A 0	A 0	ENT			
GX OUT	→	SHFT	V AND	C 2	A 0	A 0	A 0	ENT

Out (OUT)

DS5	Used
HPP	Used

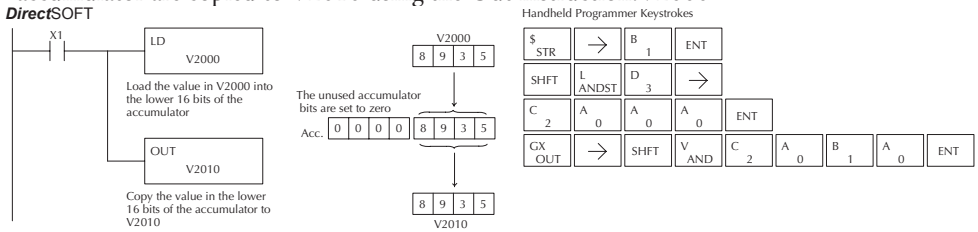
The Out instruction is a 16 bit instruction that copies the value in the lower 16 bits of the accumulator to a specified V-memory location (Aaaa).



Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Pointer	P	See memory map

Discrete Bit Flags	Description
SP53	On when the pointer is outside of the available range.

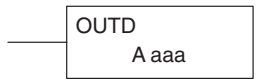
In the following example, when X1 is on, the value in V2000 will be loaded into the lower 16 bits of the accumulator using the Load instruction. The value in the lower 16 bits of the accumulator are copied to V2010 using the Out instruction.V2000



Out Double (OUTD)

DS5	Used
HPP	Used

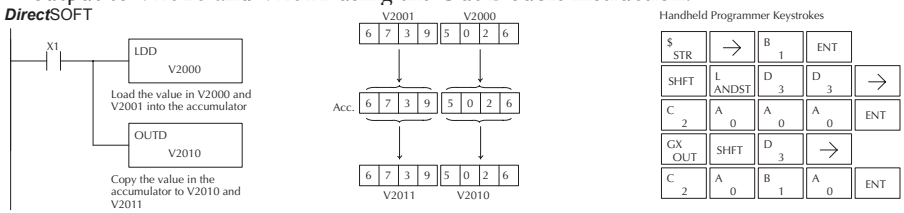
The Out Double instruction is a 32 bit instruction that copies the value in the accumulator to two consecutive V memory locations at a specified starting location (Aaaa).



Operand Data Type		DL05 Range
	A	aaa
V-memory	V	All (See page 4–28)
Pointer	P	All V-memory (See page 4–28)

Discrete Bit Flags	Description
SP53	On when the pointer is outside of the available range.

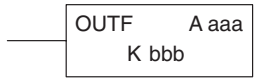
In the following example, when X1 is on, the 32 bit value in V2000 and V2001 will be loaded into the accumulator using the Load Double instruction. The value in the accumulator is output to V2010 and V2011 using the Out Double instruction.



Out Formatted (OUTF)

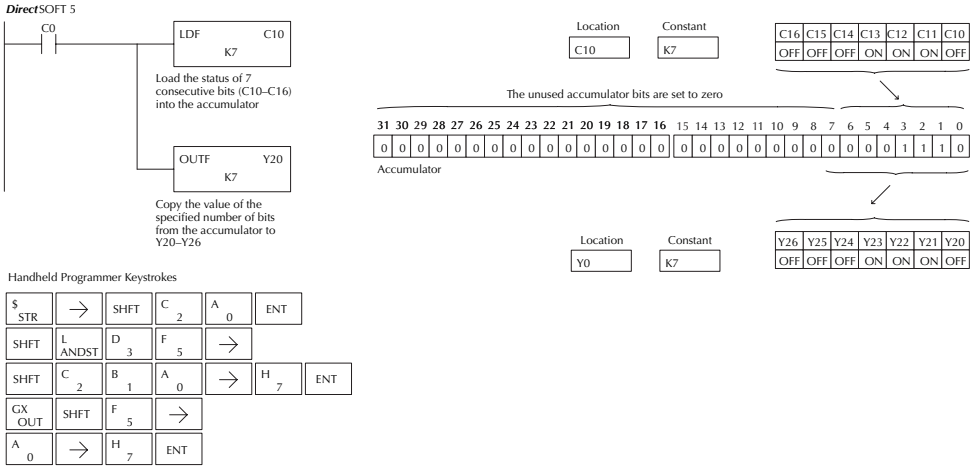
DS5	Used
HPP	Used

The Out Formatted instruction outputs 1–32 bits from the accumulator to the specified discrete memory locations. The instruction requires a starting location (Aaaa) for the destination and the number of bits (Kbbb) to be output.



Operand Data Type		DL05 Range	
	A	aaa	bbb
Inputs	X	0–377	—
Outputs	Y	0–377	—
Control Relays	C	0–777	—
Constant	K	—	1–32

In the following example, when C0 is on, the binary pattern of C10–C16 (7 bits) will be loaded into the accumulator using the Load Formatted instruction. The lower 7 bits of the accumulator are output to Y0–Y6 using the Out Formatted instruction.



POP

DS5	Used
HPP	Used

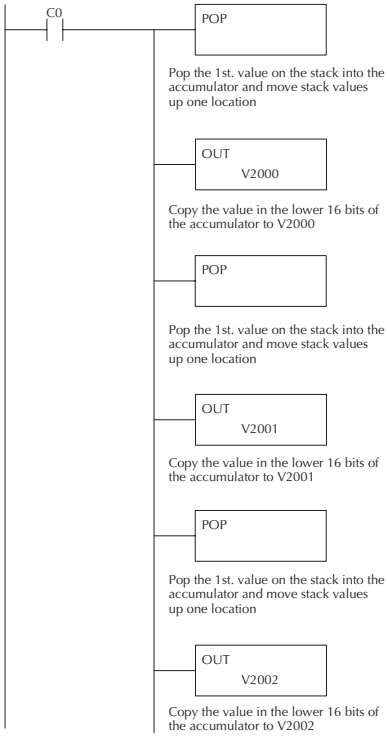
The POP instruction moves the value from the first level of the accumulator stack (32 bits) to the accumulator and shifts each value in the stack up one level.

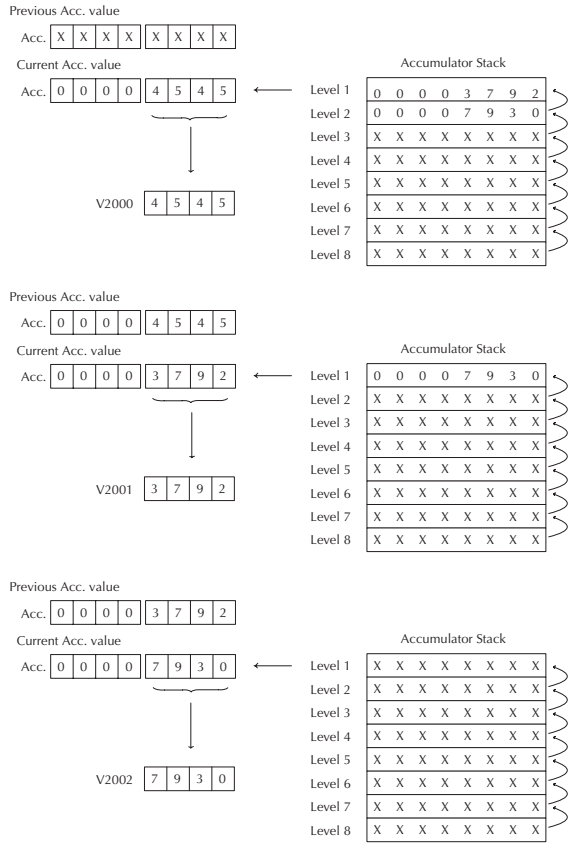
Discrete Bit Flags	Description
SP63	On when the result of the instruction causes the value in the accumulator to be zero.

Pop Instruction (cont'd)

In the example below, when C0 is on, the value 4545 that was on top of the stack is moved into the accumulator using the Pop instruction The value is output to V2000 using the Out instruction. The next Pop moves the value 3792 into the accumulator and outputs the value to V2001. The last Pop moves the value 7930 into the accumulator and outputs the value to V2002. Please note if the value in the stack were greater than 16 bits (4 digits) the Out Double instruction would be used and two V-memory locations for each Out Double must be allocated.

DirectSOFT





Handheld Programmer Keystrokes

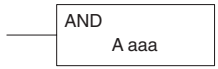
$ STR	→	SHFT	C 2	A 0	ENT			
SHFT	P CV	SHFT	O INST#	P CV	ENT			
GX OUT	→	SHFT	V AND	C 2	A 0	A 0	A 0	ENT
SHFT	P CV	SHFT	O INST#	P CV	ENT			
GX OUT	→	SHFT	V AND	C 2	A 0	A 0	B 1	ENT
SHFT	P CV	SHFT	O INST#	P CV	ENT			
GX OUT	→	SHFT	V AND	C 2	A 0	A 0	C 2	ENT

Logical Instructions (Accumulator)

And (AND)

DS5	Used
HPP	Used

The And instruction is a 16 bit instruction that logically ands the value in the lower 16 bits of the accumulator with a specified V-memory location (Aaaa). The result resides in the accumulator. The discrete status flag indicates if the result of the And is zero.



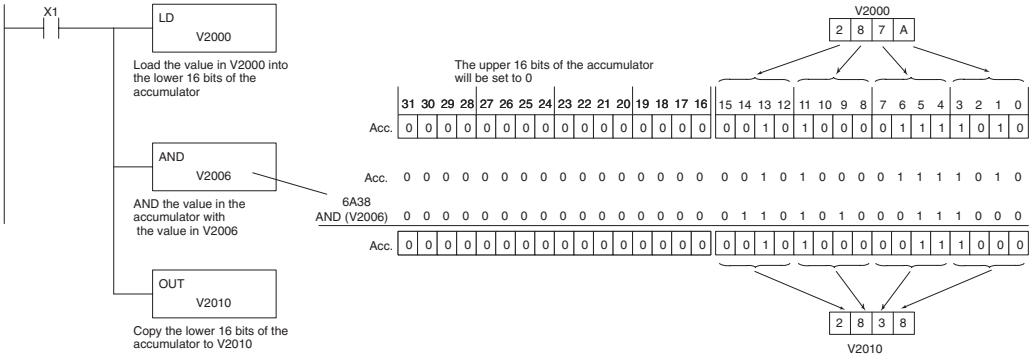
Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Pointer	P	See memory map

Discrete Bit Flags	Description
SP63	On if the result in the accumulator is zero.
SP70	On anytime the value in the accumulator is negative.

***NOTE**: The status flags are only valid until another instruction that uses the same flags is executed.*

In the following example, when X1 is on, the value in V2000 will be loaded into the accumulator using the Load instruction. The value in the accumulator is anded with the value in V2006 using the And instruction. The value in the lower 16 bits of the accumulator is output to V2010 using the Out instruction.

DirectSOFT



Handheld Programmer Keystrokes

$ STR	→	B 1	ENT					
SHFT	L ANDST	D 3	→	C 2	A 0	A 0	A 0	ENT
V AND	→	SHFT	V AND	C 2	A 0	A 0	G 6	ENT
GX OUT	→	SHFT	V AND	C 2	A 0	B 1	A 0	ENT

And Double (ANDD)

DS5	Used
HPP	Used

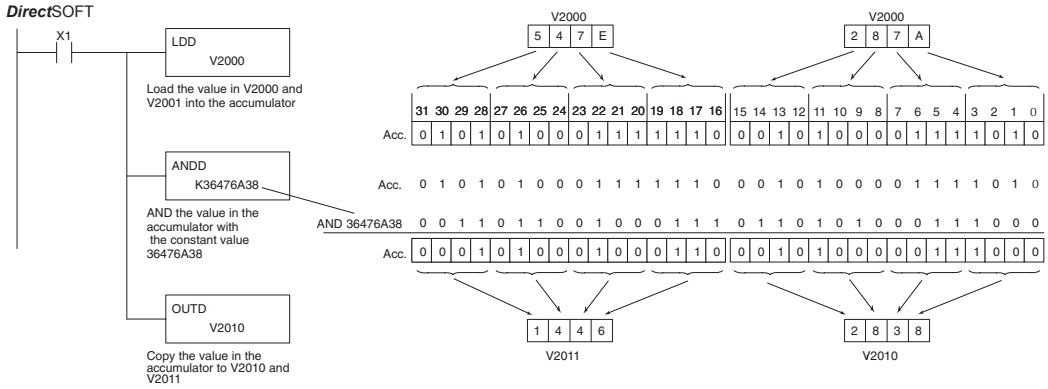
The And Double is a 32 bit instruction that logically ands the value in the accumulator with two consecutive V-memory locations or an 8 digit (max.) constant value (Aaaa). The result resides in the accumulator. Discrete status flags indicate if the result of the And Double is zero or a negative number (the most significant bit is on).

Operand Data Type		DL05 Range
		aaa
V-memory	V	See memory map
Pointer	P	See memory map
Constant	K	0–FFFFFFFF

Discrete Bit Flags	Description
SP63	On if the result in the accumulator is zero.
SP70	On anytime the value in the accumulator is negative

***NOTE**: The status flags are only valid until another instruction that uses the same flags is executed.*

In the following example, when X1 is on, the value in V2000 and V2001 will be loaded into the accumulator using the Load Double instruction. The value in the accumulator is anded with 36476A38 using the And double instruction. The value in the accumulator is output to V2010 and V2011 using the Out Double instruction.



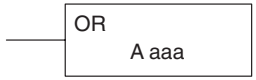
Handheld Programmer Keystrokes

$ STR	→	B 1	ENT																				
SHFT	L ANDST	D 3	D 3	→	C 2	A 0	A 0	A 0	ENT														
V AND	SHFT	D 3	→	SHFT	K JMP	D 3	G 6	E 4	H 7	G 6	SHFT	A 0	SHFT	D 3	I 8	ENT							
GX OUT	SHFT	D 3	→	C 2	A 0	B 1	A 0	ENT															

Or (OR)

DS5	Used
HPP	Used

The Or instruction is a 16 bit instruction that logically ors the value in the lower 16 bits of the accumulator with a specified V-memory location (Aaaa). The result resides in the accumulator. The discrete status flag indicates if the result of the OR is zero.

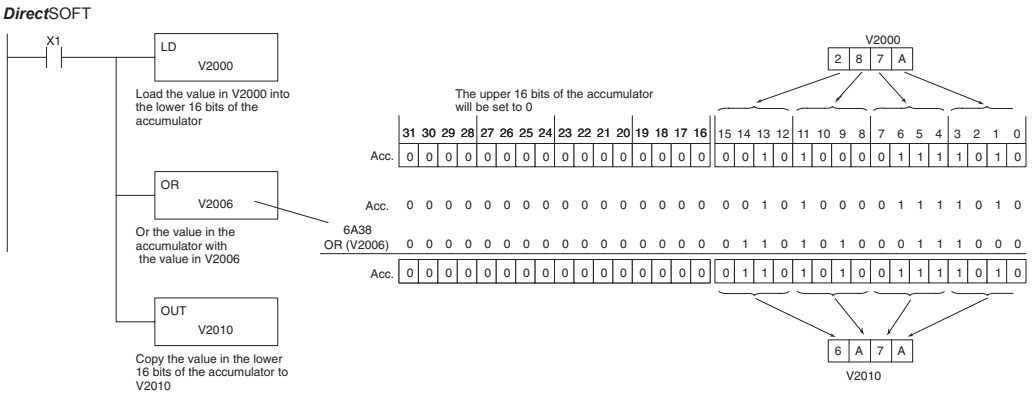


Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Pointer	P	See memory map

Discrete Bit Flags	Description
SP63	On if the result in the accumulator is zero.
SP70	On anytime the value in the accumulator is negative.

***NOTE**: The status flags are only valid until another instruction that uses the same flags is executed.*

In the following example, when X1 is on, the value in V2000 will be loaded into the accumulator using the Load instruction. The value in the accumulator is OR'ed with V2006 using the Or instruction. The value in the lower 16 bits of the accumulator are output to V2010 using the Out instruction.



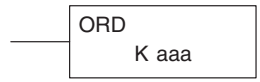
Handheld Programmer Keystrokes

$ STR	→	B 1	ENT					
SHFT	L ANDST	D 3	→	C 2	A 0	A 0	A 0	ENT
Q OR	→	SHFT	V AND	C 2	A 0	A 0	G 6	ENT
GX OUT	→	SHFT	V AND	C 2	A 0	B 1	A 0	ENT

Or Double (ORD)

DS5	Used
HPP	Used

The Or Double is a 32 bit instruction that ors the value in the accumulator with the value (Aaaa), which is either two consecutive V-memory locations or an 8 digit (max.) constant value. The result resides in the accumulator. Discrete status flags indicate if the result of the Or Double is zero or a negative number (the most significant bit is on).

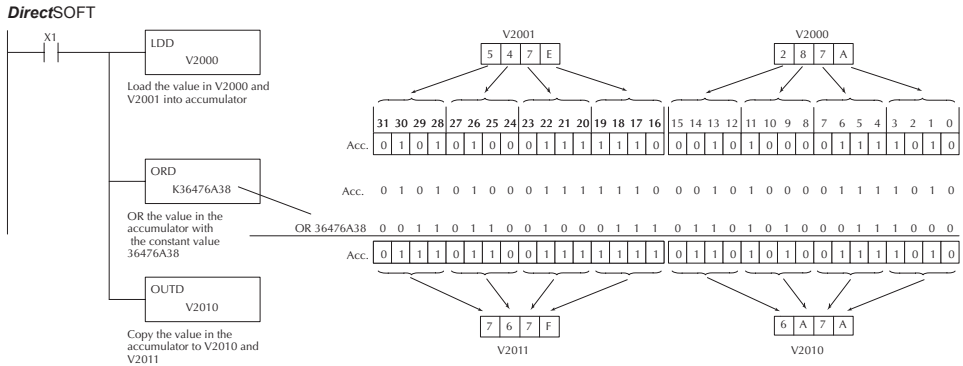


Operand Data Type		DL05 Range
		aaa
V-memory	V	See memory map
Pointer	P	See memory map
Constant	K	0–FFFFFFFF

Discrete Bit Flags	Description
SP63	On if the result in the accumulator is zero.
SP70	On anytime the value in the accumulator is negative.

***NOTE**: The status flags are only valid until another instruction that uses the same flags is executed.*

In the following example, when X1 is on, the value in V2000 and V2001 will be loaded into the accumulator using the Load Double instruction. The value in the accumulator is OR'ed with 36476A38 using the Or Double instruction. The value in the accumulator is output to V2010 and V2011 using the Out Double instruction.



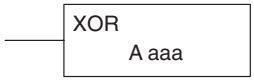
Handheld Programmer Keystrokes

$ STR	→	B 1	ENT																
SHFT	L ANDST	D 3	D 3	→	C 2	A 0	A 0	A 0	ENT										
Q OR	SHFT	D 3	→	SHFT	K JMP	D 3	G 6	E 4	H 7	G 6	SHFT	A 0	SHFT	D 3	I 8	ENT			
GX OUT	SHFT	D 3	→	C 2	A 0	B 1	A 0	ENT											

Exclusive Or (XOR)

DS5	Used
HPP	Used

The Exclusive Or instruction is a 16 bit instruction that performs an exclusive or of the value in the lower 16 bits of the accumulator and a specified V-memory location (Aaaa). The result resides in the in the accumulator. The discrete status flag indicates if the result of the XOR is zero.

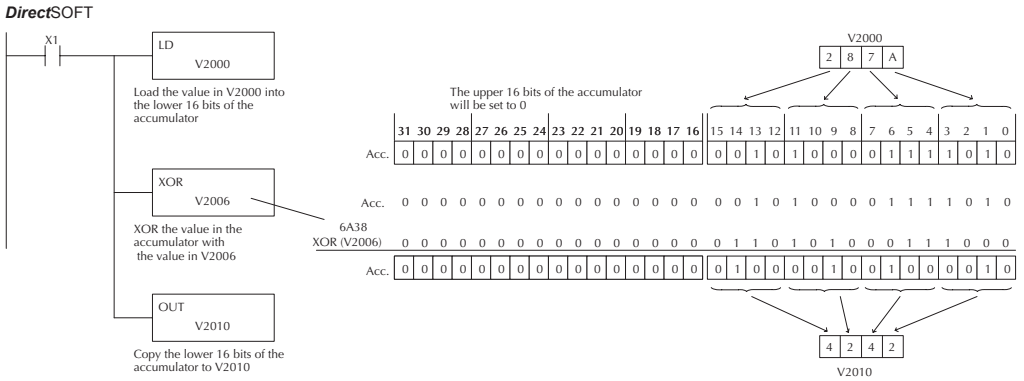


Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Pointer	P	See memory map

Discrete Bit Flags	Description
SP63	On if the result in the accumulator is zero.
SP70	On anytime the value in the accumulator is negative.

***NOTE**: The status flags are only valid until another instruction that uses the same flags is executed.*

In the following example, when X1 is on, the value in V2000 will be loaded into the accumulator using the Load instruction. The value in the accumulator is exclusive OR'ed with V2006 using the Exclusive Or instruction. The value in the lower 16 bits of the accumulator are output to V2010 using the Out instruction.



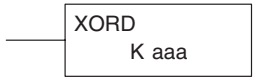
Handheld Programmer Keystrokes

$ STR	→	SHFT	X SET	B 1	ENT					
SHFT	L ANDST	D 3	→	SHFT	V AND	C 2	A 0	A 0	A 0	ENT
SHFT	X SET	SHFT	Q OR	→	SHFT	V AND	C 2	A 0	A 0	G 6	ENT
GX OUT	→	SHFT	V AND	C 2	A 0	B 1	A 0	ENT		

Exclusive Or Double (XORD)

DS5	Used
HPP	Used

The Exclusive OR Double is a 32 bit instruction that performs an exclusive or of the value in the accumulator and the value (Aaaa), which is either two consecutive V-memory locations or an 8 digit (max.) constant. The result resides in the accumulator. Discrete status flags indicate if the result of the Exclusive Or Double is zero or a negative number (the most significant bit is on).

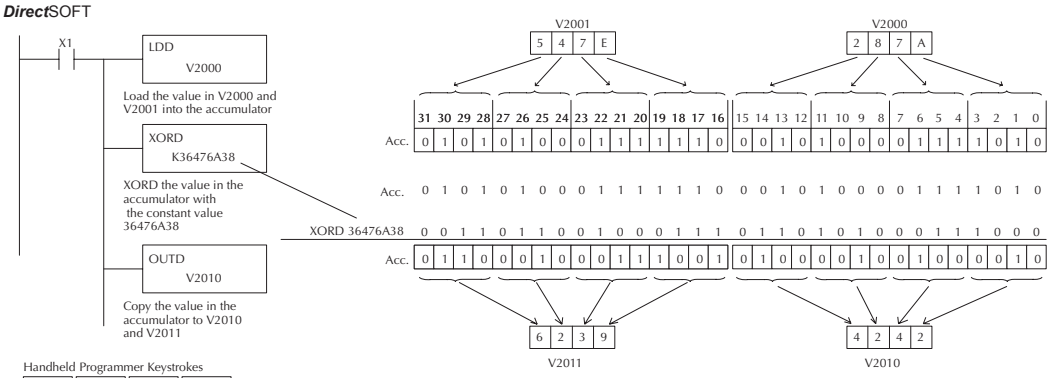


Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Pointer	P	See memory map
Constant	K	0–FFFFFFFF

Discrete Bit Flags	Description
SP63	On if the result in the accumulator is zero.
SP70	On anytime the value in the accumulator is negative.

***NOTE**: The status flags are only valid until another instruction that uses the same flags is executed.*

In the following example, when X1 is on, the value in V2000 and V2001 will be loaded into the accumulator using the Load Double instruction. The value in the accumulator is exclusively OR'ed with 36476A38 using the Exclusive Or Double instruction. The value in the accumulator is output to V2010 and V2011 using the Out Double instruction.



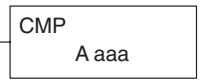
Handheld Programmer Keystrokes

$ STR	→	B 1	ENT												
SHFT	L ANDST	D 3	D 3	→	C 2	A 0	A 0	A 0	ENT						
SHFT	X SET	Q OR	SHFT	D 3	→	SHFT	K JMP								
D 3	G 6	E 4	H 7	G 6	SHFT	A 0	SHFT	D 3	I 8	ENT					
GX OUT	SHFT	D 3	→	C 2	A 0	B 1	A 0	ENT							

Compare (CMP)

DS5	Used
HPP	Used

The compare instruction is a 16 bit instruction that compares the value in the lower 16 bits of the accumulator with the value in a specified V-memory location (Aaaa). The corresponding status flag will be turned on indicating the result of the comparison.



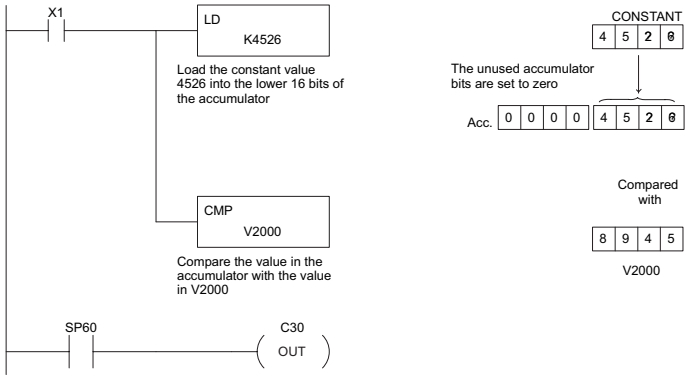
Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Pointer	P	See memory map

Discrete Bit Flags	Description
SP60	On when the value in the accumulator is less than the instruction value.
SP61	On when the value in the accumulator is equal to the instruction value.
SP62	On when the value in the accumulator is greater than the instruction value.

***NOTE**: The status flags are only valid until another instruction that uses the same flags is executed.*

In the following example when X1 is on, the constant 4526 will be loaded into the lower 16 bits of the accumulator using the Load instruction. The value in the accumulator is compared with the value in V2000 using the Compare instruction. The corresponding discrete status flag will be turned on indicating the result of the comparison. In this example, if the value in the accumulator is less than the value specified in the Compare instruction, SP60 will turn on energizing C30.

DirectSOFT



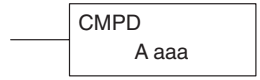
Handheld Programmer Keystrokes

$ STR	→	B 1	ENT							
SHFT	L ANDST	D 3	→	SHFT	K JMP	E 4	F 5	C 2	G 6	ENT
SHFT	C 2	SHFT	M ORST	P CV	→	C 2	A 0	A 0	A 0	ENT
$ STR	→	SHFT	SP STRN	G 6	A 0	ENT				
GX OUT	→	SHFT	C 2	D 3	A 0	ENT				

Compare Double (CMPD)

DS5	Used
HPP	Used

The Compare Double instruction is a 32–bit instruction that compares the value in the accumulator with the value (Aaaa), which is either two consecutive V-memory locations or an 8–digit (max.) constant. The corresponding status flag will be turned on indicating the result of the comparison.

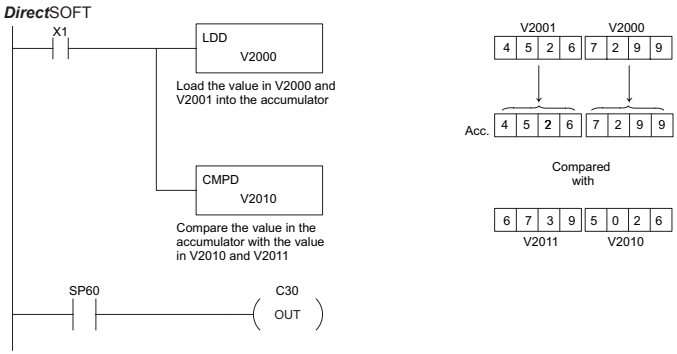


Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Pointer	P	See memory map
Constant	K	0–FFFFFFFF

Discrete Bit Flags	Description
SP60	On when the value in the accumulator is less than the instruction value.
SP61	On when the value in the accumulator is equal to the instruction value.
SP62	On when the value in the accumulator is greater than the instruction value.

***NOTE**: The status flags are only valid until another instruction that uses the same flags is executed.*

In the following example when X1 is on, the value in V2000 and V2001 will be loaded into the accumulator using the Load Double instruction. The value in the accumulator is compared with the value in V2010 and V2011 using the CMPD instruction. The corresponding discrete status flag will be turned on indicating the result of the comparison. In this example, if the value in the accumulator is less than the value specified in the Compare instruction, SP60 will turn on energizing C30.



Handheld Programmer Keystrokes

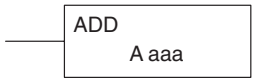
$ STR	→	B 1	ENT										
SHFT	L ANDST	D 3	D 3	→	C 2	A 0	A 0	A 0	ENT				
SHFT	C 2	SHFT	M ORST	P CV	D 3	→	C 2	A 0	B 1	A 0	ENT		
$ STR	→	SHFT	SP STRN	G 6	A 0	ENT							
GX OUT	→	SHFT	C 2	D 3	A 0	ENT							

Math Instructions

Add (ADD)

DS5	Used
HPP	Used

Add is a 16 bit instruction that adds a BCD value in the accumulator with a BCD value in a V-memory location (Aaaa). The result resides in the accumulator.



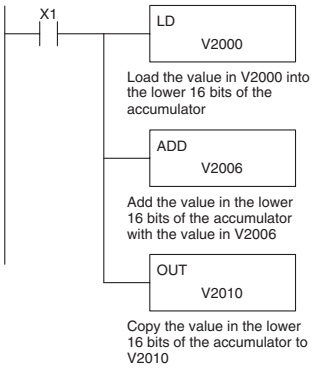
Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Pointer	P	See memory map

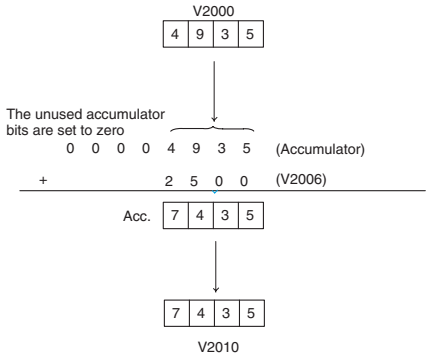
Discrete Bit Flags	Description
SP63	On when the result of the instruction causes the value in the accumulator to be zero.
SP66	On when the 16 bit addition instruction results in a carry.
SP67	On when the 32 bit addition instruction results in a carry.
SP70	On anytime the value in the accumulator is negative.
SP75	On when a BCD instruction is executed and a NON–BCD number was encountered.

***NOTE**: The status flags are only valid until another instruction that uses the same flags is executed.*

In the following example, when X1 is on, the value in V2000 will be loaded into the accumulator using the Load instruction. The value in the lower 16 bits of the accumulator are added to the value in V2006 using the Add instruction. The value in the accumulator is copied to V2010 using the Out instruction.

DirectSOFT





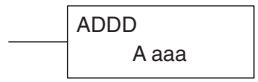
Handheld Programmer Keystrokes

$ STR	→	B 1	ENT						
SHFT	L ANDST	D 3	→	C 2	A 0	A 0	A 0	ENT	
SHFT	A 0	D 3	D 3	→	C 2	A 0	A 0	G 6	ENT
GX OUT	→	SHFT	V AND	C 2	A 0	B 1	A 0	ENT	

Add Double (ADDD)

DS5	Used
HPP	Used

Add Double is a 32 bit instruction that adds the BCD value in the accumulator with a BCD value (Aaaa), which is either two consecutive V-memory locations or an 8–digit (max.) BCD constant. The result resides in the accumulator.

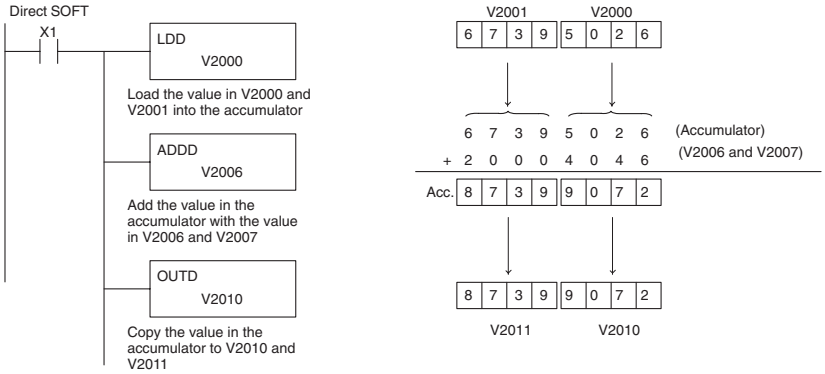


Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Pointer	P	See memory map
Constant	K	0–99999999

Discrete Bit Flags	Description
SP63	On when the result of the instruction causes the value in the accumulator to be zero.
SP66	On when the 16 bit addition instruction results in a carry.
SP67	On when the 32 bit addition instruction results in a carry.
SP70	On anytime the value in the accumulator is negative.
SP75	On when a BCD instruction is executed and a NON–BCD number was encountered.

***NOTE**: The status flags are only valid until another instruction that uses the same flags is executed.*

In the following example, when X1 is on, the value in V2000 and V2001 will be loaded into the accumulator using the Load Double instruction. The value in the accumulator is added with the value in V2006 and V2007 using the Add Double instruction. The value in the accumulator is copied to V2010 and V2011 using the Out Double instruction.



Handheld Programmer Keystrokes

$ STR	→	B 1	ENT							
SHFT	L ANDST	D 3	D 3	→	C 2	A 0	A 0	A 0	ENT	
SHFT	A 0	D 3	D 3	D 3	→	C 2	A 0	A 0	G 6	ENT
GX OUT	SHFT	D 3	→	SHFT	V AND	C 2	A 0	B 1	A 0	ENT

Subtract (SUB)

DS5	Used
HPP	Used

Subtract is a 16 bit instruction that subtracts the BCD value (Aaaa) in a V-memory location from the BCD value in the lower 16 bits of the accumulator. The result resides in the accumulator.

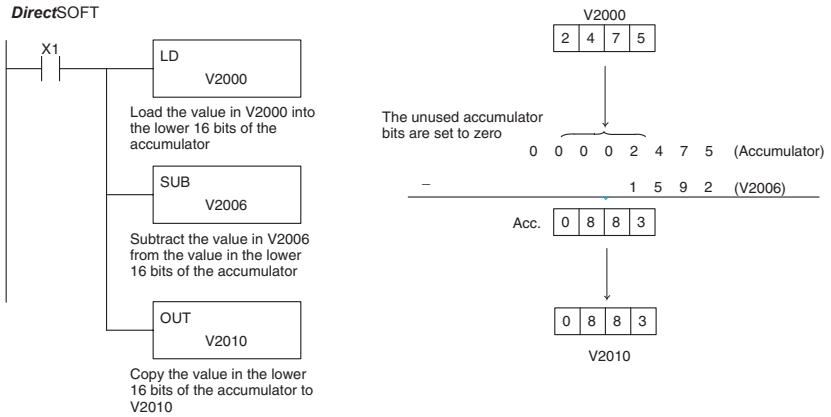
SUB
A aaa

Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Pointer	P	See memory map

Discrete Bit Flags	Description
SP63	On when the result of the instruction causes the value in the accumulator to be zero.
SP64	On when the 16 bit addition instruction results in a borrow
SP65	On when the 32 bit addition instruction results in a borrow
SP70	On anytime the value in the accumulator is negative.
SP75	On when a BCD instruction is executed and a NON–BCD number was encountered.

***NOTE**: The status flags are only valid until another instruction that uses the same flags is executed.*

In the following example, when X1 is on, the value in V2000 will be loaded into the accumulator using the Load instruction. The value in V2006 is subtracted from the value in the accumulator using the Subtract instruction. The value in the accumulator is copied to V2010 using the Out instruction.



Handheld Programmer Keystrokes

$ STR	→	B 1	ENT										
SHFT	L ANDST	D 3	→	C 2	A 0	A 0	A 0	ENT					
SHFT	S RST	U ISG	B 1	→	SHFT	V AND	C 2	A 0	A 0	G 6	ENT		
GX OUT	→	SHFT	V AND	C 2	A 0	B 1	A 0	ENT					

Subtract Double (SUBD)

DS5	Used
HPP	Used

SUBD
A aaa

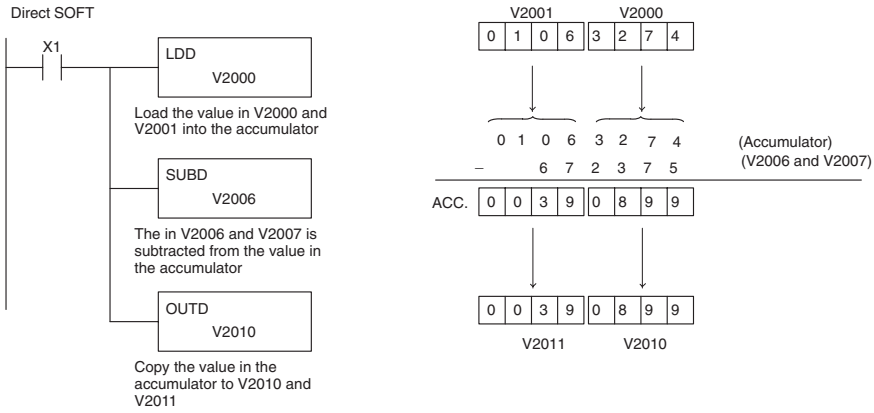
Subtract Double is a 32 bit instruction that subtracts the BCD value (Aaaa), which is either two consecutive V-memory locations or an 8-digit (max.) constant, from the BCD value in the accumulator.

Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Pointer	P	See memory map
Constant	K	0–99999999

Discrete Bit Flags	Description
SP63	On when the result of the instruction causes the value in the accumulator to be zero.
SP64	On when the 16 bit addition instruction results in a borrow
SP65	On when the 32 bit addition instruction results in a borrow
SP70	On anytime the value in the accumulator is negative.
SP75	On when a BCD instruction is executed and a NON–BCD number was encountered.

***NOTE**: The status flags are only valid until another instruction that uses the same flags is executed.*

In the following example, when X1 is on, the value in V2000 and V2001 will be loaded into the accumulator using the Load Double instruction. The value in V2006 and V2007 is subtracted from the value in the accumulator. The value in the accumulator is copied to V2010 and V2011 using the Out Double instruction.



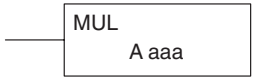
Handheld Programmer Keystrokes

$ STR	→	B 1	ENT								
SHFT	L ANDST	D 3	D 3	→	C 2	A 0	A 0	A 0	ENT		
SHFT	S RST	SHFT	U ISG	B 1	D 3	→	C 2	A 0	A 0	G 6	ENT
GX OUT	SHFT	D 3	→	C 2	A 0	B 1	A 0	ENT			

Multiply (MUL)

DS5	Used
HPP	Used

Multiply is a 16 bit instruction that multiplies the BCD value (Aaaa), which is either a V-memory location or a 4–digit (max.) constant, by the BCD value in the lower 16 bits of the accumulator The result can be up to 8 digits and resides in the accumulator.

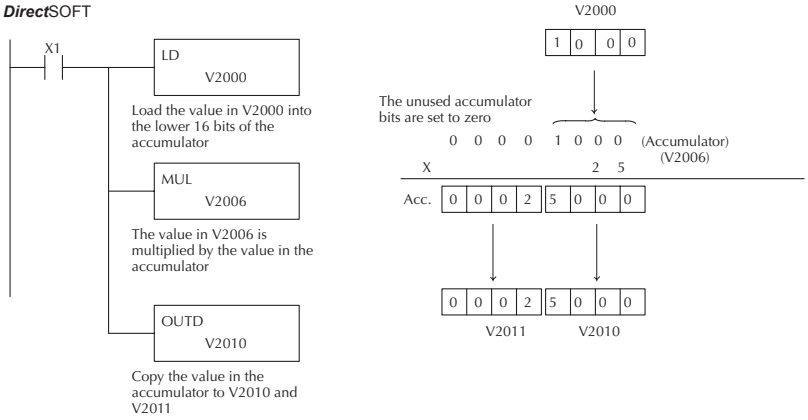


Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Pointer	P	See memory map
Constant	K	0–9999

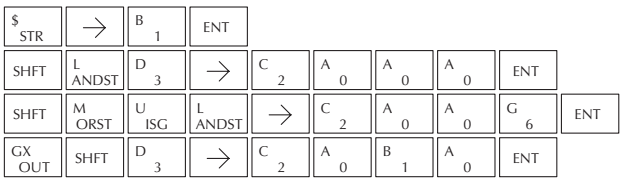
Discrete Bit Flags	Description
SP63	On when the result of the instruction causes the value in the accumulator to be zero.
SP70	On anytime the value in the accumulator is negative.
SP75	On when a BCD instruction is executed and a NON–BCD number was encountered.

***NOTE**: The status flags are only valid until another instruction that uses the same flags is executed.*

In the following example, when X1 is on, the value in V2000 will be loaded into the accumulator using the Load instruction. The value in V2006 is multiplied by the value in the accumulator. The value in the accumulator is copied to V2010 and V2011 using the Out Double instruction.



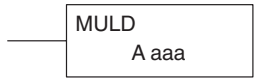
Handheld Programmer Keystrokes



Multiply Double (MULD)

DS5	Used
HPP	Used

Multiply Double is a 32 bit instruction that multiplies the 8-digit BCD value in the accumulator by the 8-digit BCD value in the two consecutive V-memory locations specified in the instruction. The lower 8 digits of the results reside in the accumulator. Upper digits of the result reside in the accumulator stack.

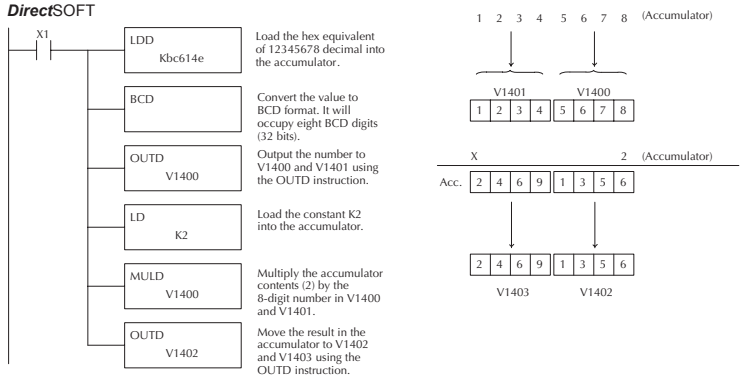


Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Pointer	P	See memory map

Discrete Bit Flags	Description
SP63	On when the result of the instruction causes the value in the accumulator to be zero.
SP70	On anytime the value in the accumulator is negative.
SP75	On when a BCD instruction is executed and a NON–BCD number was encountered.

***NOTE**: Status flags are valid only until another instruction uses the same flag.*

In the following example, when X1 is on, the constant Kbc614e hex will be loaded into the accumulator. When converted to BCD the number is ”12345678”. That number is stored in V1400 and V1401. After loading the constant K2 into the accumulator, we multiply it times 12345678, which is 24691356.



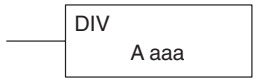
Handheld Programmer Keystrokes

$ STR	→	B 1	ENT																
SHFT	L ANDST	D 3	D 3	→	PREV	SHFT	B 1	C 2	SHFT	G 6	B 1	E 4	SHFT	E 4	ENT				
SHFT	B 1	C 2	D 3	ENT															
GX OUT	SHFT	D 3	→	B 1	E 4	A 0	A 0	ENT											
SHFT	L ANDST	D 3	→	PREV	C 2	ENT													
SHFT	M ORST	U ISG	L ANDST	D 3	→	B 1	E 4	A 0	A 0	ENT									
GX OUT	SHFT	D 3	→	B 1	E 4	A 0	C 2	ENT											

Divide (DIV)

DS5	Used
HPP	Used

Divide is a 16 bit instruction that divides the BCD value in the accumulator by a BCD value (Aaaa), which is either a V-memory location or a 4-digit (max.) constant. The first part of the quotient resides in the accumulator and the remainder resides in the first stack location.

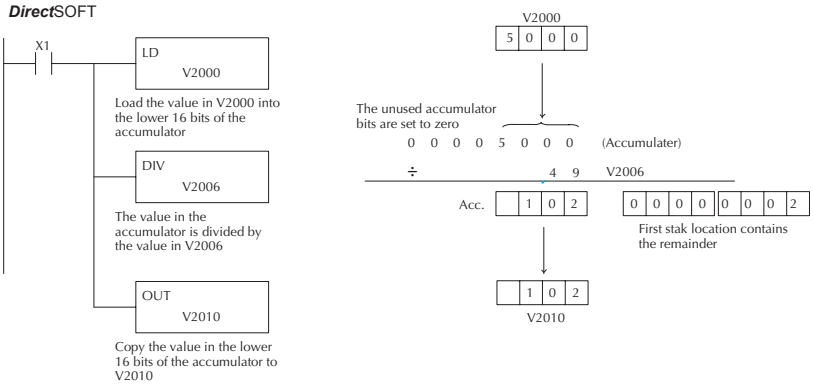


Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Pointer	P	See memory map
Constant	K	0–9999

Discrete Bit Flags	Description
SP53	On when the value of the operand is larger than the accumulator can work with.
SP63	On when the result of the instruction causes the value in the accumulator to be zero.
SP70	On anytime the value in the accumulator is negative.
SP75	On when a BCD instruction is executed and a NON–BCD number was encountered.

***NOTE**: The status flags are only valid until another instruction that uses the same flags is executed.*

In the following example, when X1 is on, the value in V2000 will be loaded into the accumulator using the Load instruction. The value in the accumulator will be divided by the value in V2006 using the Divide instruction. The value in the accumulator is copied to V2010 using the Out instruction.



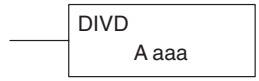
Handheld Programmer Keystrokes

$ STR	→	B 1	ENT						
SHFT	L ANDST	D 3	→	C 2	A 0	A 0	A 0	ENT	
SHFT	D 3	I 8	V AND	→	C 2	A 0	A 0	G 6	ENT
GX OUT	→	SHFT	V AND	C 2	A 0	B 1	A 0	ENT	

Divide Double (DIVD)

DS5	Used
HPP	Used

Divide Double is a 32 bit instruction that divides the BCD value in the accumulator by a BCD value (Aaaa), which must be obtained from two consecutive V-memory locations. (You cannot use a constant as the parameter in the box.) The first part of the quotient resides in the accumulator and the remainder resides in the first stack location.

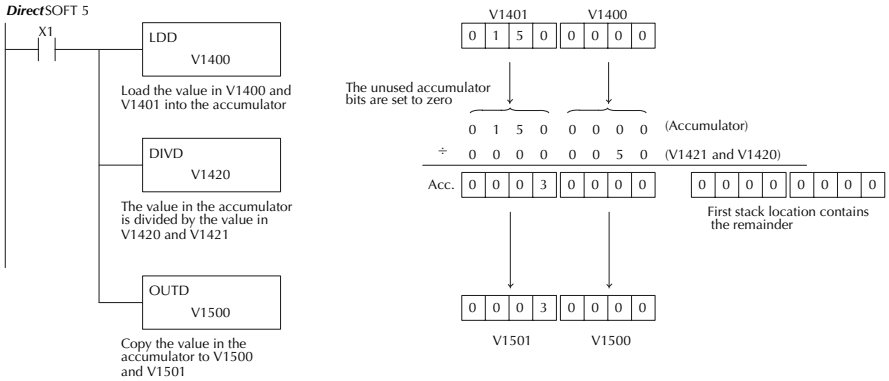


Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Pointer	P	See memory map

Discrete Bit Flags	Description
SP53	On when the value of the operand is larger than the accumulator can work with.
SP63	On when the result of the instruction causes the value in the accumulator to be zero.
SP70	On anytime the value in the accumulator is negative.
SP75	On when a BCD instruction is executed and a NON–BCD number was encountered.

***NOTE**: Status flags are valid only until another instruction uses the same flag.*

In the following example, when X1 is on, the value in V1400 and V1401 will be loaded into the accumulator using the Load Double instruction. The value in the accumulator is divided by the value in V1420 and V1421 using the Divide Double instruction. The first part of the quotient resides in the accumulator an the remainder resides in the first stack location. The value in the accumulator is copied to V1500 and V1501 using the Out Double instruction.



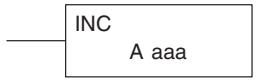
Handheld Programmer Keystrokes

$ STR	→	B 1	ENT	SHFT	L ANDST	D 3	D 3	→
B 1	E 4	A 0	A 0	ENT	SHFT	D 3	I 8	V AND
→	B 1	E 4	C 2	A 0	ENT	GX OUT	SHFT	D 3
→	B 1	F 5	A 0	A 0	ENT			

Increment (INC)

DS5	Used
HPP	Used

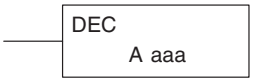
The Increment instruction increments a BCD value in a specified V-memory location by "1" each time the instruction is executed.



Decrement (DEC)

DS5	Used
HPP	Used

The Decrement instruction decrements a BCD value in a specified V-memory location by "1" each time the instruction is executed.

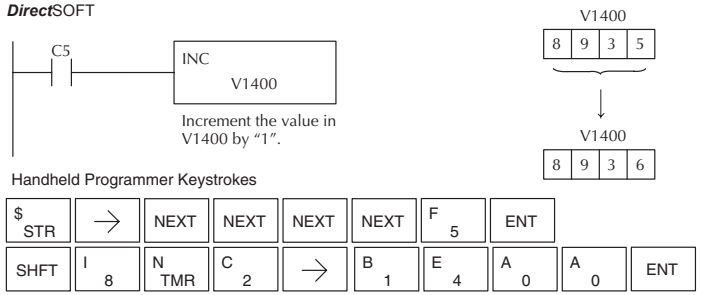


Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Pointer	P	See memory map

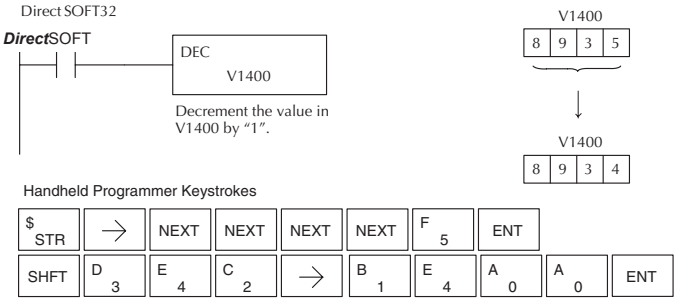
Discrete Bit Flags	Description
SP63	On when the result of the instruction causes the value in the accumulator to be zero.
SP75	On when a BCD instruction is executed and a NON–BCD number was encountered.

***NOTE**: Status flags are valid only until another instruction uses the same flag.*

In the following increment example, when C5 is on the value in V1400 increases by one.



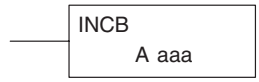
In the following decrement example, when C5 is on the value in V1400 is decreased by one.



Increment Binary (INCB)

DS5	Used
HPP	Used

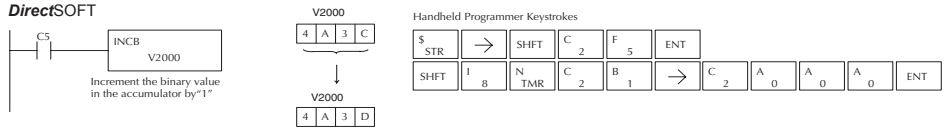
The Increment Binary instruction increments a binary value in a specified V-memory location by "1" each time the instruction is executed.



Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Pointer	P	See memory map

Discrete Bit Flags	Description
SP63	On when the result of the instruction causes the value in the accumulator to be zero.

In the following example when C5 is on, the binary value in V2000 is increased by 1.



DS5	Used
HPP	Used

Decrement Binary (DECB)

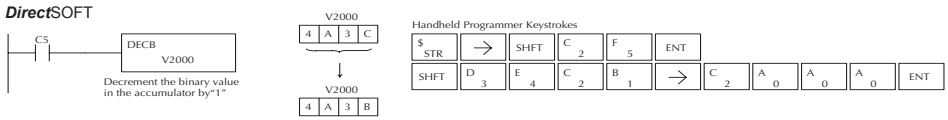
The Decrement Binary instruction decrements a binary value in a specified V-memory location by "1" each time the instruction is executed.

Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Pointer	P	See memory map

Discrete Bit Flags	Description
SP63	On when the result of the instruction causes the value in the accumulator to be zero.

***NOTE**: The status flags are only valid until another instruction that uses the same flags is executed.*

In the following example when C5 is on, the value in V2000 is decreased by 1.



Add Binary (ADDB)

DS5	Used
HPP	Used

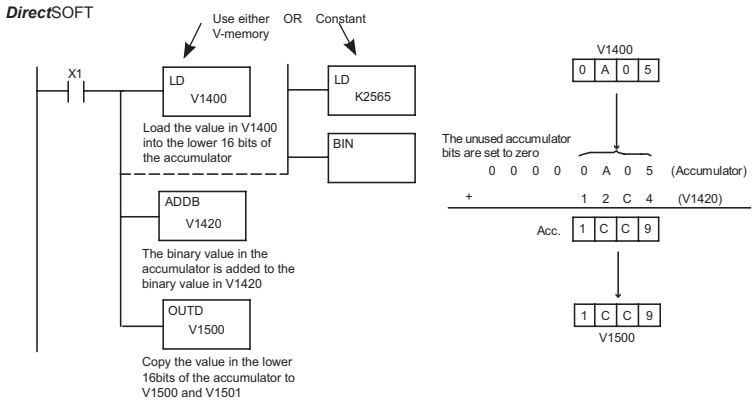
Add Binary is a 16 bit instruction that adds the binary value in the lower 16 bits of the accumulator with a binary value (Aaaa), which is either a V-memory location or a 16-bit constant. The result can be up to 32 bits and resides in the accumulator.

Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Pointer	P	See memory map
Constant	K	0–FFFF

Discrete Bit Flags	Description
SP63	On when the result of the instruction causes the value in the accumulator to be zero.
SP66	On when the 16 bit addition instruction results in a carry.
SP67	On when the 32 bit addition instruction results in a carry.
SP70	On anytime the value in the accumulator is negative.
SP73	On when a signed addition or subtraction results in a incorrect sign bit.

***NOTE**: Status flags are valid only until another instruction uses the same flag.*

In the following example, when X1 is on, the value in V1400 will be loaded into the accumulator using the Load instruction. The binary value in the accumulator will be added to the binary value in V1420 using the Add Binary instruction. The value in the accumulator is copied to V1500 and V1501 using the Out Double instruction.



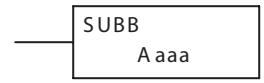
Handheld Programmer Keystrokes

STR	→	X(IN)	1	ENT							
SHFT	L	D	V	1	4	0	0	ENT			
SHFT	A	D	D	B	→	V	1	4	2	0	ENT
OUT	SHFT	D	→	V	1	5	0	0	ENT		

Subtract Binary (SUBB)

DS5	Used
HPP	Used

Subtract Binary is a 16 bit instruction that subtracts the binary value (Aaaa), which is either a V-memory location or a 4-digit (max.) binary constant, from the binary value in the accumulator. The result resides in the accumulator.

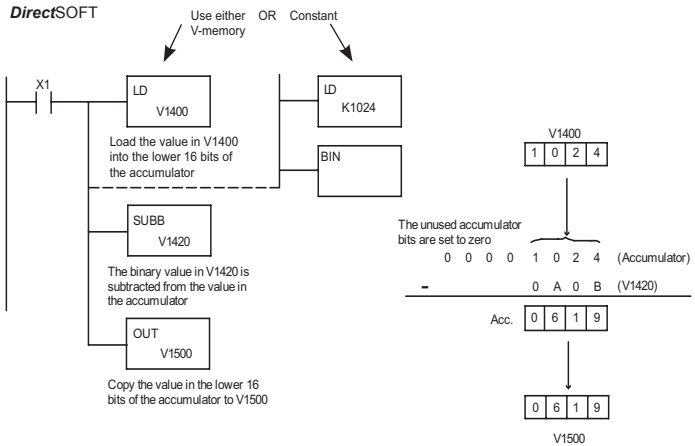


Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Pointer	P	See memory map
Constant	K	0–FFFF

Discrete Bit Flags	Description
SP63	On when the result of the instruction causes the value in the accumulator to be zero.
SP64	On when the 16 bit addition instruction results in a borrow
SP65	On when the 32 bit addition instruction results in a borrow
SP70	On any time the value in the accumulator is negative.

***NOTE**: Status flags are valid only until another instruction uses the same flag.*

In the following example, when X1 is on, the value in V1400 will be loaded into the accumulator using the Load instruction. The binary value in V1420 is subtracted from the binary value in the accumulator using the Subtract Binary instruction. The value in the accumulator is copied to V1500 using the Out instruction.



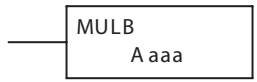
Handheld Programmer Keystrokes

STR	→	X(IN)	1	ENT				
SHFT	L	D	V	1	4	0	0	ENT
SHFT	S	SHFT	U	B	B	→		
V	1	4	2	0	ENT			
OUT	SHFT	D	→	V	1	5	0	0	ENT

Multiply Binary (MULB)

DS5	Used
HPP	Used

Multiply Binary is a 16 bit instruction that multiplies the binary value (Aaaa), which is either a V-memory location or a 4-digit (max.) binary constant, by the binary value in the accumulator. The result can be up to 32 bits and resides in the accumulator.

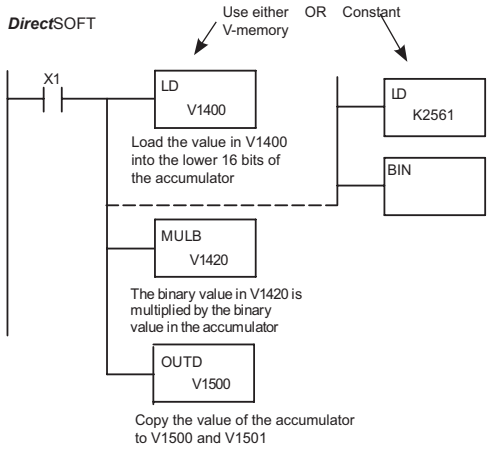


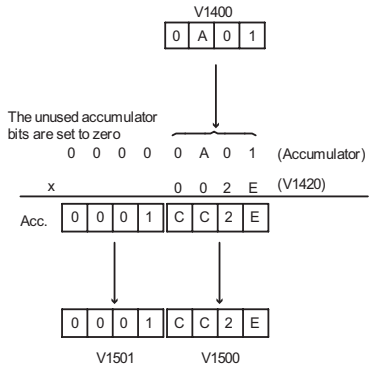
Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Pointer	P	See memory map
Constant	K	1–FFFF

Discrete Bit Flags	Description
SP63	On when the result of the instruction causes the value in the accumulator to be zero.
SP70	On any time the value in the accumulator is negative.

***NOTE**: Status flags are valid only until another instruction uses the same flag.*

In the following example, when X1 is on, the value in V1400 will be loaded into the accumulator using the Load instruction. The binary value in V1420 is multiplied by the binary value in the accumulator using the Multiply Binary instruction. The value in the accumulator is copied to V1500 and V1501 using the Out Double instruction.





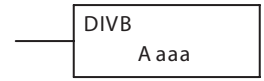
Handheld Programmer Keystrokes

STR	→	X	1	ENT							
SHFT	L	D	V	1	4	0	0	ENT			
SHFT	M	U	L	B	→	V	1	4	2	0	ENT
OUT	SHFT	D	→	V	1	5	0	0	ENT		

Divide Binary (DIVB)

DS5	Used
HPP	Used

Divide Binary is a 16 bit instruction that divides the binary value in the accumulator by a binary value (Aaaa), which is either a V-memory location or a 16-bit (max.) binary constant. The first part of the quotient resides in the accumulator and the remainder resides in the first stack location.

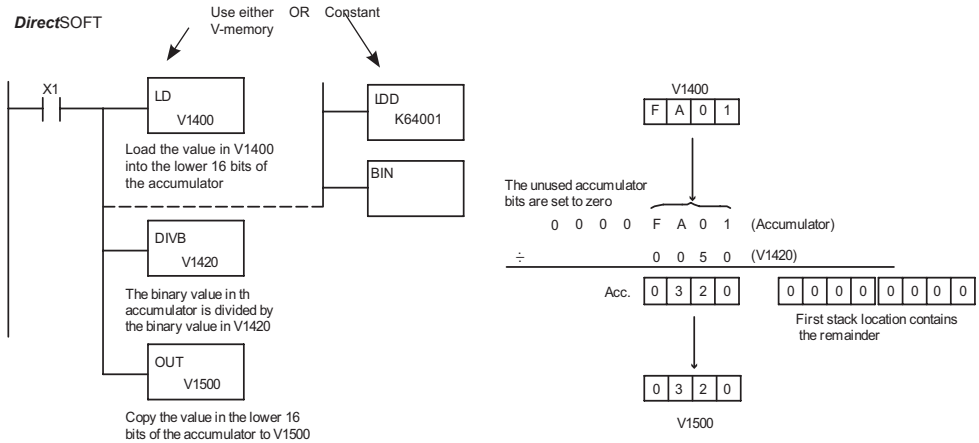


Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Pointer	P	See memory map
Constant	K	0–FFFF

Discrete Bit Flags	Description
SP53	On when the value of the operand is larger than the accumulator can work with.
SP63	On when the result of the instruction causes the value in the accumulator to be zero.
SP70	On anytime the value in the accumulator is negative.

***NOTE**: Status flags are valid only until another instruction uses the same flag.*

In the following example, when X1 is on, the value in V1400 will be loaded into the accumulator using the Load instruction. The binary value in the accumulator is divided by the binary value in V1420 using the Divide Binary instruction. The value in the accumulator is copied to V1500 using the Out instruction.



Handheld Programmer Keystrokes

STR	→	X	1	ENT							
SHFT	L	D	V	1	4	0	0	ENT			
SHFT	D	I	V	B	→	V	1	4	2	0	ENT
OUT	SHFT	D	→	V	1	5	0	0	ENT		

Bit Operation Instructions

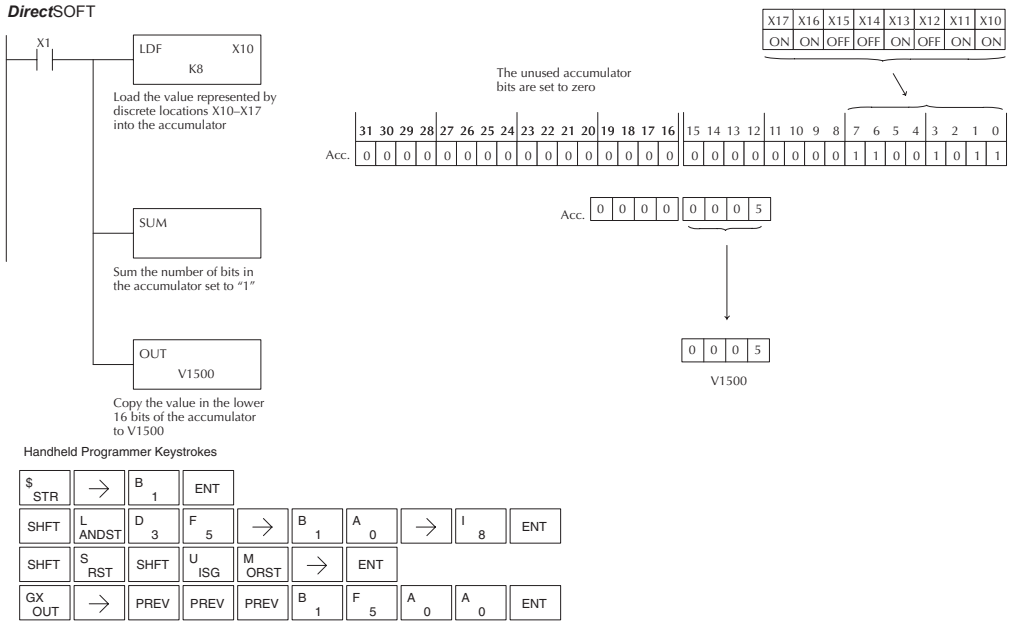
Sum (SUM)

DS5	Used
HPP	Used

The Sum instruction counts number of bits that are set to "1" in the accumulator. The HEX result resides in the accumulator.

Discrete Bit Flags	Description
SP63	On when the result of the instruction causes the value in the accumulator to be zero.

In the following example, when X1 is on, the value formed by discrete locations X10–X17 is loaded into the accumulator using the Load Formatted instruction. The number of bits in the accumulator set to "1" is counted using the Sum instruction. The value in the accumulator is copied to V1500 using the Out instruction.



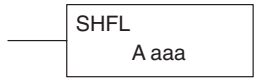
Handheld Programmer Keystrokes

$ STR	→	B 1	ENT						
SHFT	L ANDST	D 3	F 5	→	B 1	A 0	→	I 8	ENT
SHFT	S RST	SHFT	U ISG	M ORST	→	ENT			
GX OUT	→	PREV	PREV	PREV	B 1	F 5	A 0	A 0	ENT

Shift Left (SHFL)

DS5	Used
HPP	Used

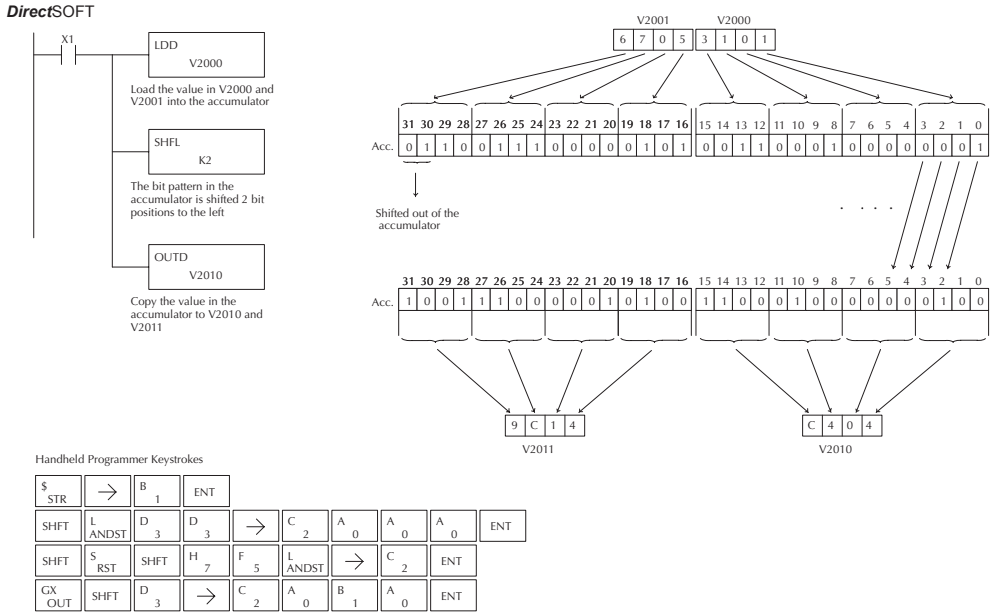
Shift Left is a 32 bit instruction that shifts the bits in the accumulator a specified number (Aaaa) of places to the left. The vacant positions are filled with zeros and the bits shifted out of the accumulator are discarded.



Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Constant	K	1-32

Discrete Bit Flags	Description
SP63	On when the result of the instruction causes the value in the accumulator to be zero.
SP70	On anytime the value in the accumulator is negative.

In the following example, when X1 is on, the value in V2000 and V2001 will be loaded into the accumulator using the Load Double instruction. The bit pattern in the accumulator is shifted 2 bits to the left using the Shift Left instruction. The value in the accumulator is copied to V2010 and V2011 using the Out Double instruction.



Handheld Programmer Keystrokes

$ STR	→	B 1	ENT						
SHFT	L ANDST	D 3	D 3	→	C 2	A 0	A 0	A 0	ENT
SHFT	S RST	SHFT	H 7	F 5	L ANDST	→	C 2	ENT	
GX OUT	SHFT	D 3	→	C 2	A 0	B 1	A 0	ENT	

Shift Right (SHFR)

DS5	Used
HPP	Used

Shift Right is a 32 bit instruction that shifts the bits in the accumulator a specified number (Aaaa) of places to the right. The vacant positions are filled with zeros and the bits shifted out of the accumulator are lost.

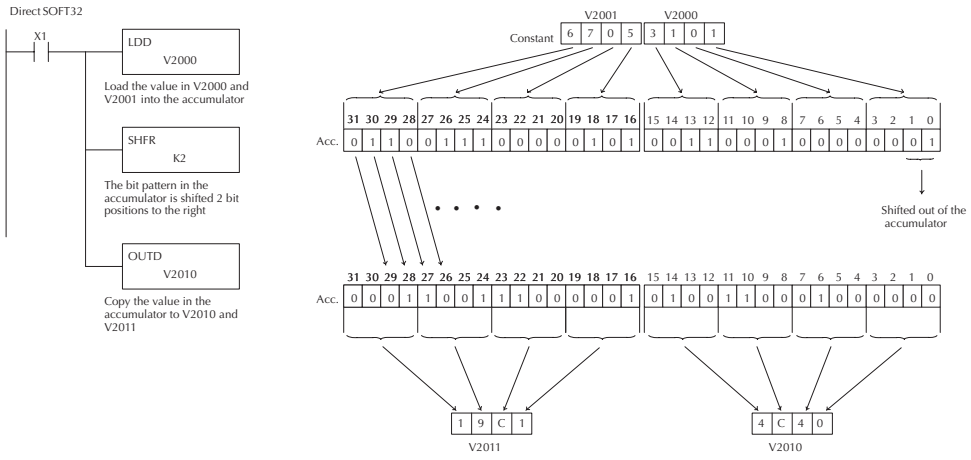
SHFR
A aaa

Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Constant	K	1-32

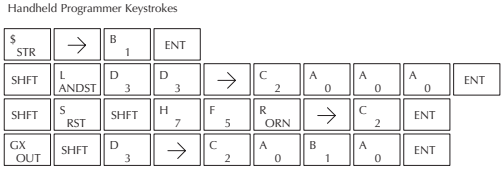
Discrete Bit Flags	Description
SP63	On when the result of the instruction causes the value in the accumulator to be zero.
SP70	On anytime the value in the accumulator is negative.

In the following example, when X1 is on, the value in V2000 and V2001 will be loaded into the accumulator using the Load Double instruction. The bit pattern in the accumulator is shifted 2 bits to the right using the Shift Right instruction. The value in the accumulator is copied to V2010 and V2011 using the Out Double instruction.

DirectSOFT



Handheld Programmer Keystrokes



Encode (ENCO)

DS5	Used
HPP	Used

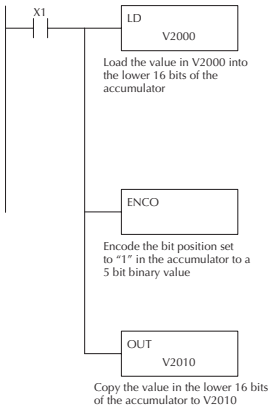
The Encode instruction encodes the bit position in the accumulator having a value of 1, and returns the appropriate binary representation. If the most significant bit is set to 1 (Bit 31), the Encode instruction would place the value HEX 1F (decimal 31) in the accumulator. If the value to be encoded is 0000 or 0001, the instruction will place a zero in the accumulator. If the value to be encoded has more than one bit position set to a "1", the least significant "1" will be encoded and SP53 will be set on.

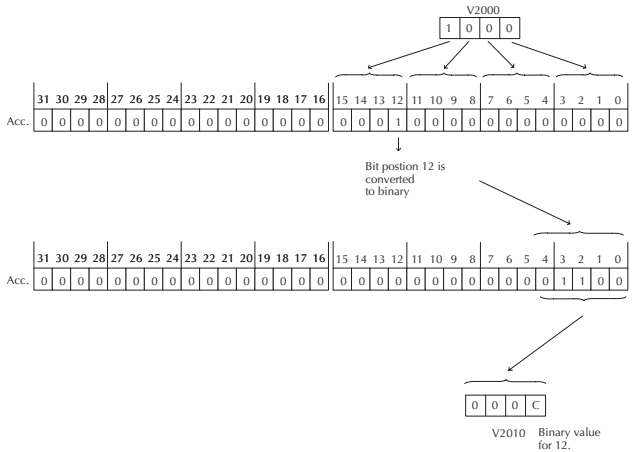
Discrete Bit Flags	Description
SP63	On when the result of the instruction causes the value in the accumulator to be zero.
SP70	On anytime the value in the accumulator is negative.

***NOTE**: The status flags are only valid until another instruction that uses the same flags is executed.*

In the following example, when X1 is on, The value in V2000 is loaded into the accumulator using the Load instruction. The bit position set to a "1" in the accumulator is encoded to the corresponding 5 bit binary value using the Encode instruction. The value in the lower 16 bits of the accumulator is copied to V2010 using the Out instruction.

DirectSOFT





Handheld Programmer Keystrokes

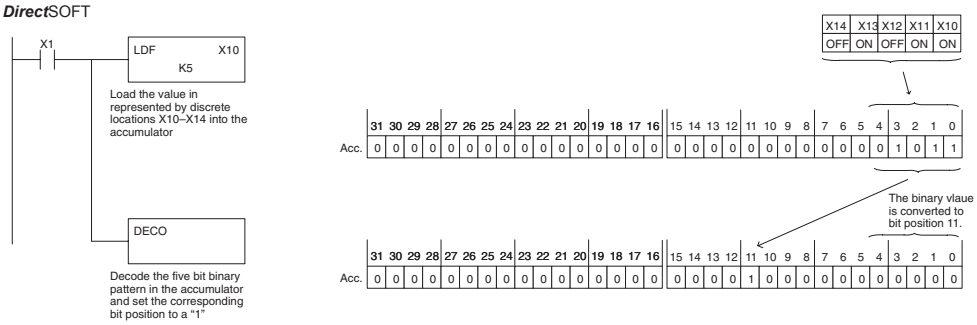
$ STR	→	B 1	ENT					
SHFT	L ANDST	D 3	→	C 2	A 0	A 0	A 0	ENT
SHFT	E 4	N TMR	C 2	O INST#	ENT			
GX OUT	→	SHFT	V AND	C 2	A 0	B 1	A 0	ENT

Decode (DECO)

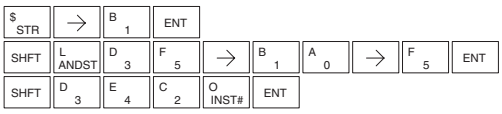
DS5	Used
HPP	Used

The Decode instruction decodes a 5 bit binary value of 0–31 (0–1F HEX) in the accumulator by setting the appropriate bit position to a 1. If the accumulator contains the value F (HEX), bit 15 will be set in the accumulator. If the value to be decoded is greater than 31, the number is divided by 32 until the value is less than 32 and then the value is decoded.

In the following example when X1 is on, the value formed by discrete locations X10–X14 is loaded into the accumulator using the Load Formatted instruction. The five bit binary pattern in the accumulator is decoded by setting the corresponding bit position to a "1" using the Decode instruction.



Handheld Programmer Keystrokes



Number Conversion Instructions (Accumulator)

Binary (BIN)

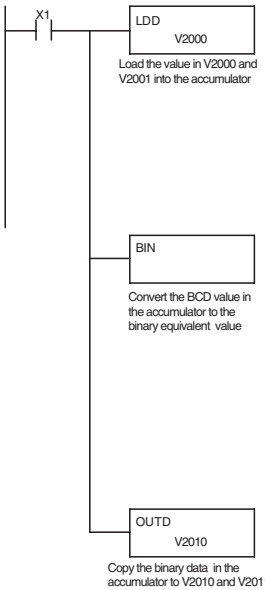
DS5	Used
HPP	Used

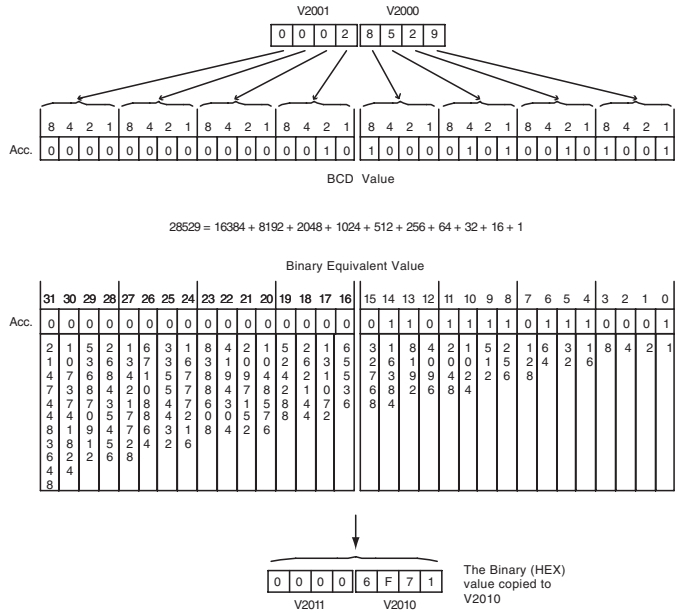
The Binary instruction converts a BCD value in the accumulator to the equivalent binary value. The result resides in the accumulator.

In the following example, when X1 is on, the value in V2000 and V2001 is loaded into the accumulator using the Load Double instruction. The BCD value in the accumulator is converted to the binary (HEX) equivalent using the BIN instruction. The binary value in the accumulator is copied to V2010 and V2011 using the Out Double instruction. (The handheld programmer will display the binary value in V2010 and V2011 as a HEX value.)

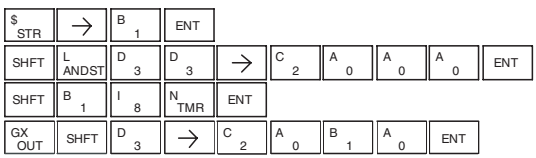
Discrete Bit Flags	Description
SP63	On when the result of the instruction causes the value in the accumulator to be zero.
SP70	On anytime the value in the accumulator is negative.
SP75	On when a BCD instruction is executed and a NON–BCD number was encountered.

***Direct*SOFT**





Handheld Programmer Keystrokes



Binary Coded Decimal (BCD)

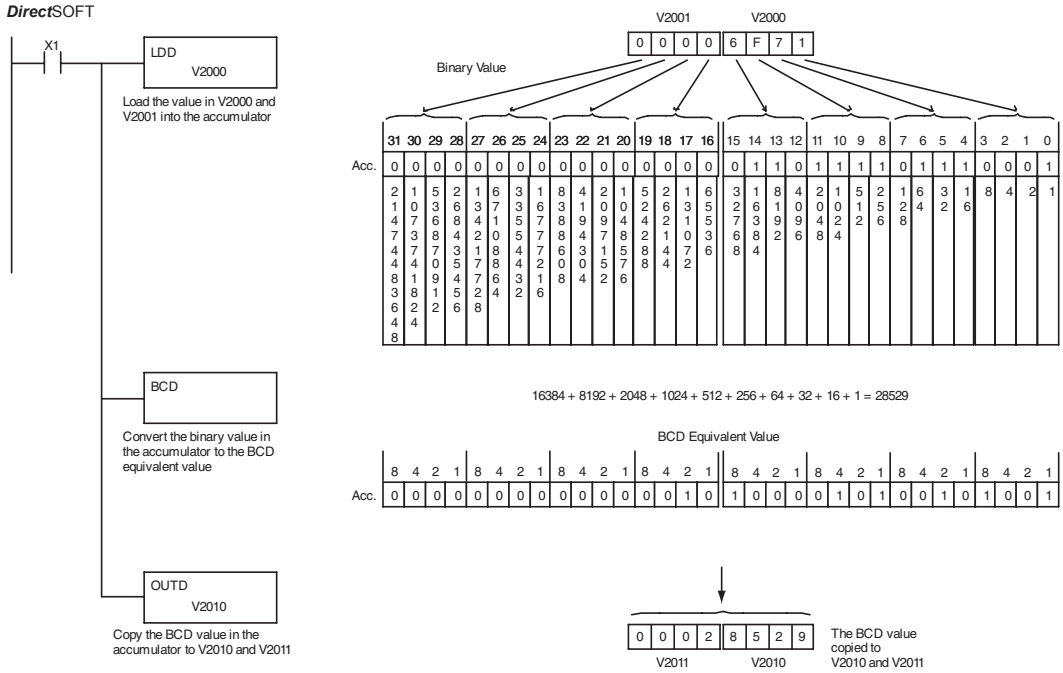
DS5	Used
HPP	Used

The Binary Coded Decimal instruction converts a binary value in the accumulator to the equivalent BCD value. The result resides in the accumulator.

BCD

In the following example, when X1 is on, the binary (HEX) value in V2000 and V2001 is loaded into the accumulator using the Load Double instruction. The binary value in the accumulator is converted to the BCD equivalent value using the BCD instruction. The BCD value in the accumulator is copied to V2010 and V2011 using the Out Double instruction.

Discrete Bit Flags	Description
SP63	On when the result of the instruction causes the value in the accumulator to be zero.
SP70	On anytime the value in the accumulator is negative.



Handheld Programmer Keystrokes

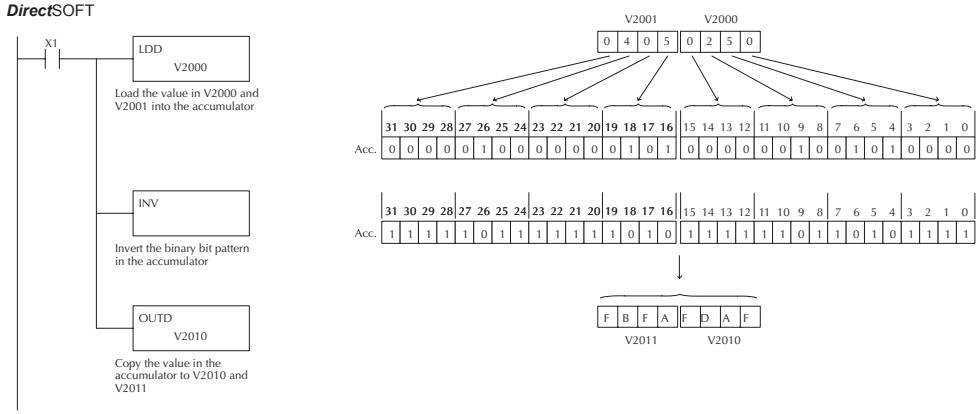
$ STR	→	B 1	ENT						
SHFT	L ANDST	D 3	D 3	→	C 2	A 0	A 0	A 0	ENT
SHFT	B 1	C 2	D 3	ENT					
GX OUT	SHFT	D 3	→	C 2	A 0	B 1	A 0	ENT	

Invert (INV)

DS5	Used
HPP	Used

The Invert instruction inverts or takes the one's complement of the 32 bit value in the accumulator. The result resides in the accumulator.

In the following example, when X1 is on, the value in V2000 and V2001 will be loaded into the accumulator using the Load Double instruction. The value in the accumulator is inverted using the Invert instruction. The value in the accumulator is copied to V2010 and V2011 using the Out Double instruction.



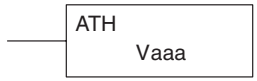
Handheld Programmer Keystrokes

$ STR	→	B 1	ENT						
SHFT	L ANDST	D 3	D 3	→	C 2	A 0	A 0	A 0	ENT
SHFT	I 8	N TMR	V AND	ENT					
GX OUT	SHFT	D 3	→	C 2	A 0	B 1	A 0	ENT	

ASCII to HEX (ATH)

DS5	Used
HPP	Used

The ASCII TO HEX instruction converts a table of ASCII values to a specified table of HEX values. ASCII values are two digits and their HEX equivalents are one digit. This means an ASCII table of four V-memory locations would only require two V-memory locations for the equivalent HEX table. The function parameters are loaded into the accumulator stack and the accumulator by two additional instructions. Listed below are the steps necessary to program an ASCII to HEX table function. The example on the following page shows a program for the ASCII to HEX table function.



Step 1: — Load the number of V-memory locations for the ASCII table into the first level of the accumulator stack.

Step 2: — Load the starting V-memory location for the ASCII table into the accumulator. This parameter must be a HEX value.

Step 3: — Specify the starting V-memory location (Vaaa) for the HEX table in the ATH instruction.

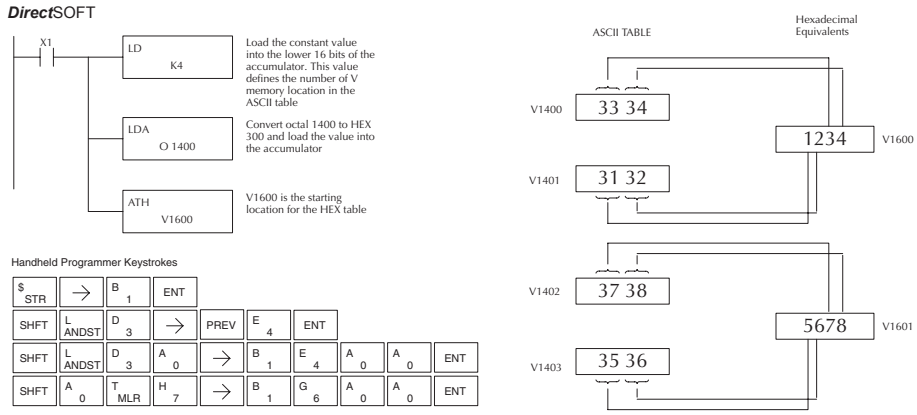
Helpful Hint: — For parameters that require HEX values when referencing memory locations, the LDA instruction can be used to convert an octal address to the HEX equivalent and load the value into the accumulator.

Operand Data Type		DL05 Range
		aaa
V-memory	V	See memory map

Discrete Bit Flags	Description
SP53	On when the value of the operand is larger than the accumulator can work with.

In the example on the following page, when X1 is ON the constant (K4) is loaded into the accumulator using the Load instruction and will be placed in the first level of the accumulator stack when the next Load instruction is executed. The starting location for the ASCII table (V1400) is loaded into the accumulator using the Load Address instruction. The starting location for the HEX table (V1600) is specified in the ASCII to HEX instruction. The table below lists valid ASCII values for ATH conversion.

ASCII Values Valid for ATH Conversion			
ASCII Value	HEX Value	ASCII Value	HEX Value
30	0	38	8
31	1	39	9
32	2	41	A
33	3	42	B
34	4	43	C
35	5	44	D
36	6	45	E
37	7	46	F



HEX to ASCII (HTA)

DS5	Used
HPP	Used

The HEX to ASCII instruction converts a table of HEX values to a specified table of ASCII values. HEX values are one digit and their ASCII equivalents are two digits.

This means a HEX table of two V-memory locations would require four V-memory locations for the equivalent ASCII table. The function parameters are loaded into the accumulator stack and the accumulator by two additional instructions. Listed below are the steps necessary to program a HEX to ASCII table function. The example on the following page shows a program for the HEX to ASCII table function.

Step 1: — Load the number of V-memory locations in the HEX table into the first level of the accumulator stack.

Step 2: — Load the starting V-memory location for the HEX table into the accumulator. This parameter must be a HEX value.

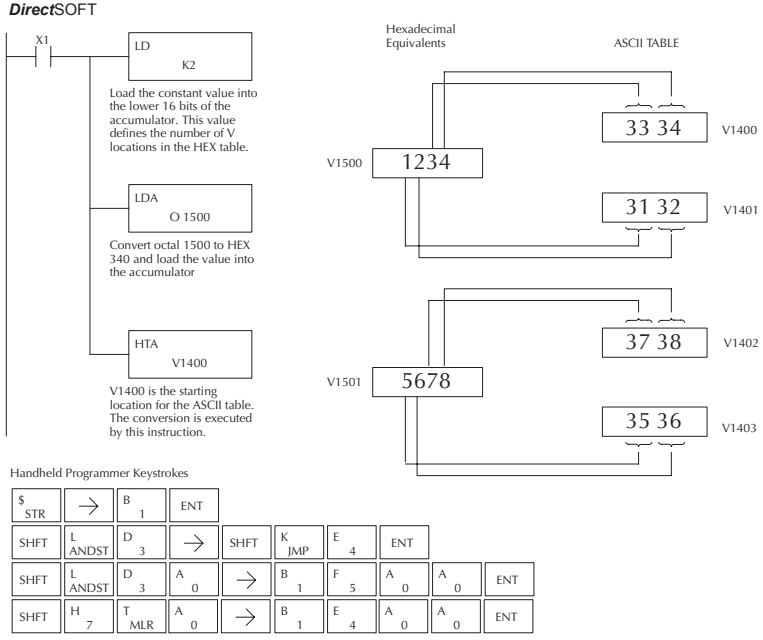
Step 3: — Specify the starting V-memory location (Vaaa) for the ASCII table in the HTA instruction.

Helpful Hint: — For parameters that require HEX values when referencing memory locations, the LDA instruction can be used to convert an octal address to the HEX equivalent and load the value into the accumulator.

Operand Data Type		DL05 Range
		aaa
V-memory	V	See memory map

Discrete Bit Flags	Description
SP53	On when the value of the operand is larger than the accumulator can work with.

In the following example, when X1 is ON the constant (K2) is loaded into the accumulator using the Load instruction. The starting location for the HEX table (V1500) is loaded into the accumulator using the Load Address instruction. The starting location for the ASCII table (V1400) is specified in the HEX to ASCII instruction.



The table below lists valid ASCII values for HTA conversion.

ASCII Values Valid for HTA Conversion			
Hex Value	ASCII Value	Hex Value	ASCII Value
0	30	8	38
1	31	9	39
2	32	A	41
3	33	B	42
4	34	C	43
5	35	D	44
6	36	E	45
7	37	F	46

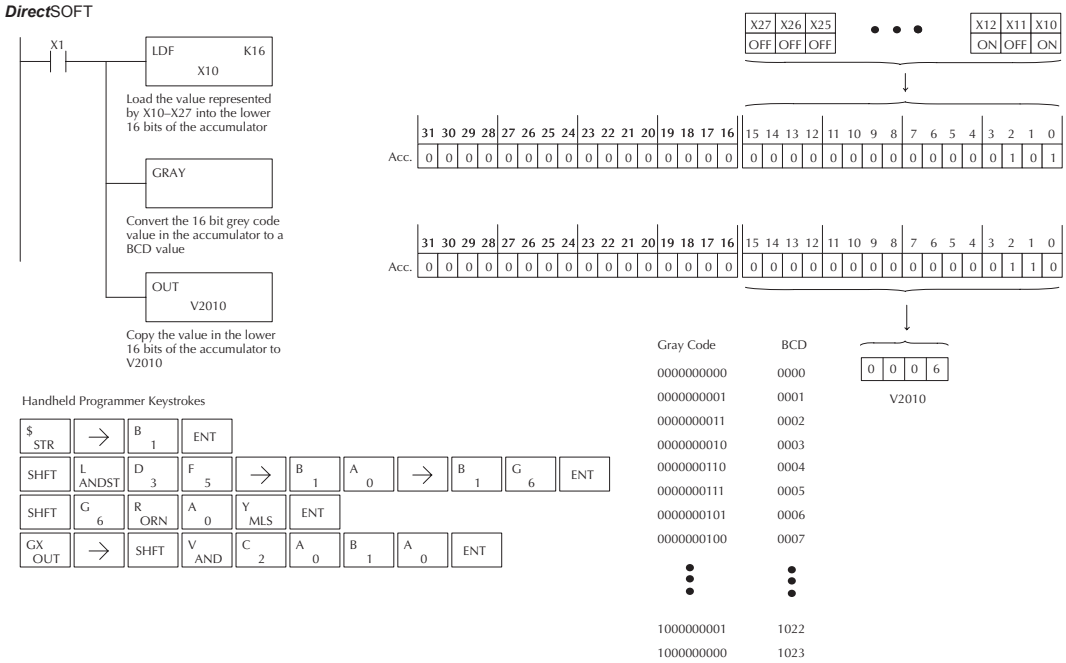
Gray Code (GRAY)

DS5	Used
HPP	Used

The Gray code instruction converts a 16 bit gray code value to a BCD value. The BCD conversion requires 10 bits of the accumulator. The upper 22 bits are set to "0". This instruction is designed for use with devices (typically encoders) that use the grey code numbering scheme. The Gray Code instruction will directly convert a gray code number to a BCD number for devices having a resolution of 512 or 1024 counts per revolution. If a device having a resolution of 360 counts per revolution is to be used you must subtract a BCD value of 76 from the converted value to obtain the proper result. For a device having a resolution of 720 counts per revolution you must subtract a BCD value of 152.

In the following example, when X1 is ON the binary value represented by X10–X27 is loaded into the accumulator using the Load Formatted instruction. The gray code value in the accumulator is converted to BCD using the Gray Code instruction. The value in the lower 16 bits of the accumulator is copied to V2010.

Discrete Bit Flags	Description
SP63	On when the result of the instruction causes the value in the accumulator to be zero.
SP70	On anytime the value in the accumulator is negative.



Shuffle Digits (SFLDGT)

DS5	Used
HPP	Used

SFLDGT

The Shuffle Digits instruction shuffles a maximum of 8 digits rearranging them in a specified order. This function requires parameters to be loaded into the first level of the accumulator stack and the accumulator with two additional instructions. Listed below are the steps necessary to use the shuffle digit function. The example on the following page shows a program for the Shuffle Digits function.

Step 1:— Load the value (digits) to be shuffled into the first level of the accumulator stack.

Step 2:— Load the order that the digits will be shuffled to into the accumulator.

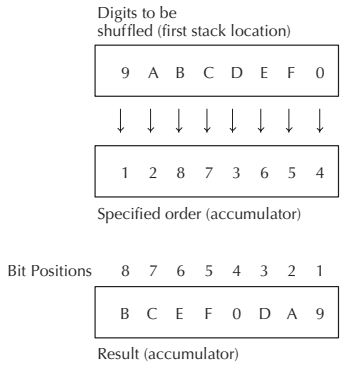
Step 3:— Insert the SFLDGT instruction.

NOTE: *If the number used to specify the order contains a 0 or 9-F, the corresponding position will be set to 0.*

Discrete Bit Flags	Description
SP63	On when the result of the instruction causes the value in the accumulator to be zero.
SP70	On anytime the value in the accumulator is negative.

Shuffle Digits Block Diagram

There are a maximum of 8 digits that can be shuffled. The bit positions in the first level of the accumulator stack defines the digits to be shuffled. They correspond to the bit positions in the accumulator that define the order the digits will be shuffled. The digits are shuffled and the result resides in the accumulator.

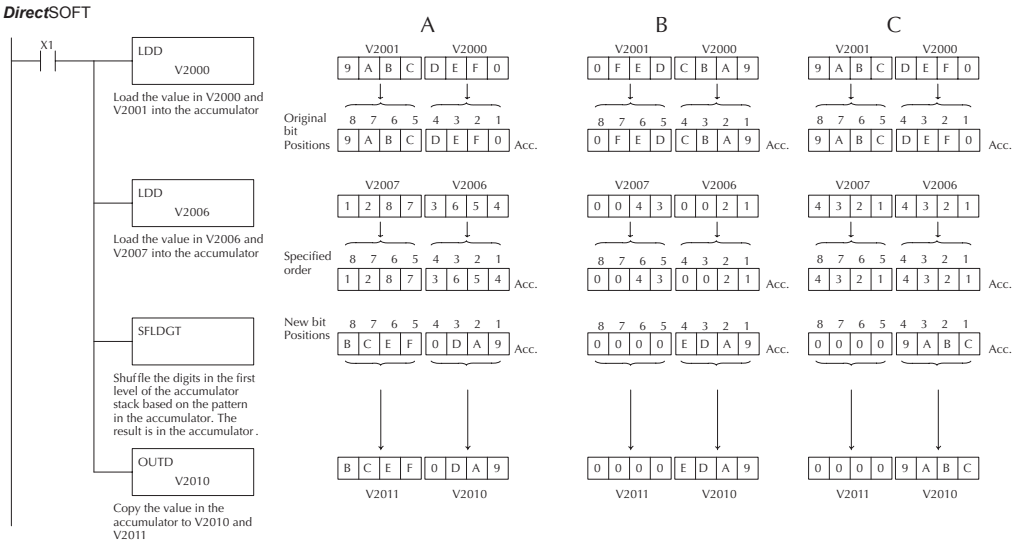


In the following example when X1 is on, The value in the first level of the accumulator stack will be reorganized in the order specified by the value in the accumulator.

Example A shows how the shuffle digits works when 0 or 9 –F is not used when specifying the order the digits are to be shuffled. Also, there are no duplicate numbers in the specified order.

Example B shows how the shuffle digits works when a 0 or 9–F is used when specifying the order the digits are to be shuffled. Notice when the Shuffle Digits instruction is executed, the bit positions in the first stack location that had a corresponding 0 or 9–F in the accumulator (order specified) are set to "0".

Example C shows how the shuffle digits works when duplicate numbers are used specifying the order the digits are to be shuffled. Notice when the Shuffle Digits instruction is executed, the most significant duplicate number in the order specified is used in the result.



Handheld Programmer Keystrokes

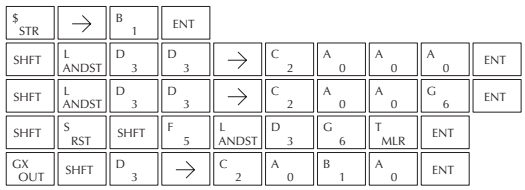
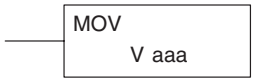


Table Instructions

Move (MOV)

DS5	Used
HPP	Used



The Move instruction moves the values from a V-memory table to another V-memory table the same length (a table is a consecutive group of V-memory locations). The function parameters are loaded into the first level of the accumulator stack and the accumulator by two additional instructions. The MOV instruction can be used to write data to non-volatile V-memory (see Appendix F). Listed below are the steps necessary to program the MOV function.

Step 1:— Load the number of V-memory locations to be moved into the first level of the accumulator stack. This parameter is a HEX value (K40 max, 100 octal).

Step 2:— Load the starting V-memory location for the locations to be moved into the accumulator. This parameter is a HEX value.

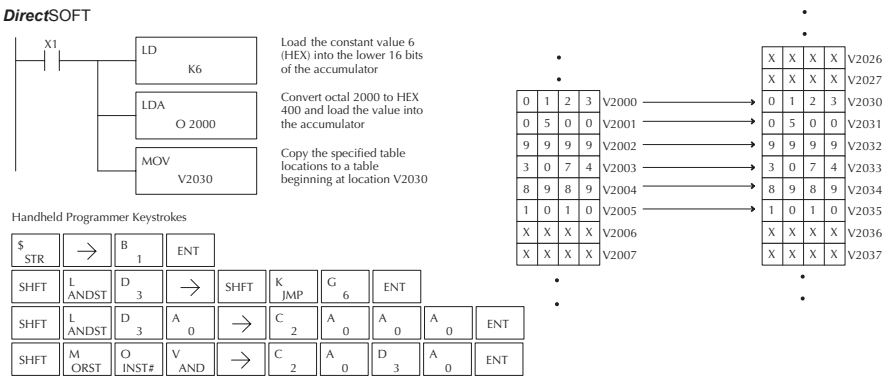
Step 3:— Insert the MOVE instruction which specifies starting V-memory location (Vaaa) for the destination table.

Helpful Hint: — For parameters that require HEX values when referencing memory locations, the LDA instruction can be used to convert an octal address to the HEX equivalent and load the value into the accumulator.

Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Pointer	P	See memory map

Discrete Bit Flags	Description
SP53	On when the value of the operand is larger than the accumulator can work with.

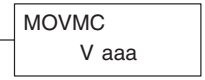
In the following example, when X1 is on, the constant value (K6) is loaded into the accumulator using the Load instruction. This value specifies the length of the table and is placed in the first stack location after the Load Address instruction is executed. The octal address 2000 (V2000), the starting location for the source table is loaded into the accumulator. The destination table location (V2030) is specified in the Move instruction.



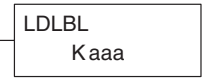
Move Memory Cartridge (MOVMC) and Load Label (LDLBL)

DS5	Used
HPP	Used

The Move Memory Cartridge and the Load Label instructions are used to copy data from program ladder memory to V-memory. The Load Label instruction is used with the MOVMC instruction when copying data *from* program ladder memory to V-memory.



To copy data from the program ladder memory to V-memory, the function parameters are loaded into the first two levels of the accumulator stack and the accumulator by two additional instructions. Listed below are the steps necessary to program the Move Memory Cartridge and Load Label functions.



Step 1:— Load the number of words to be copied into the second level of the accumulator stack.

Step 2:— Load the offset for the data label area in ladder memory and the beginning of the V-memory block into the first level of the stack.

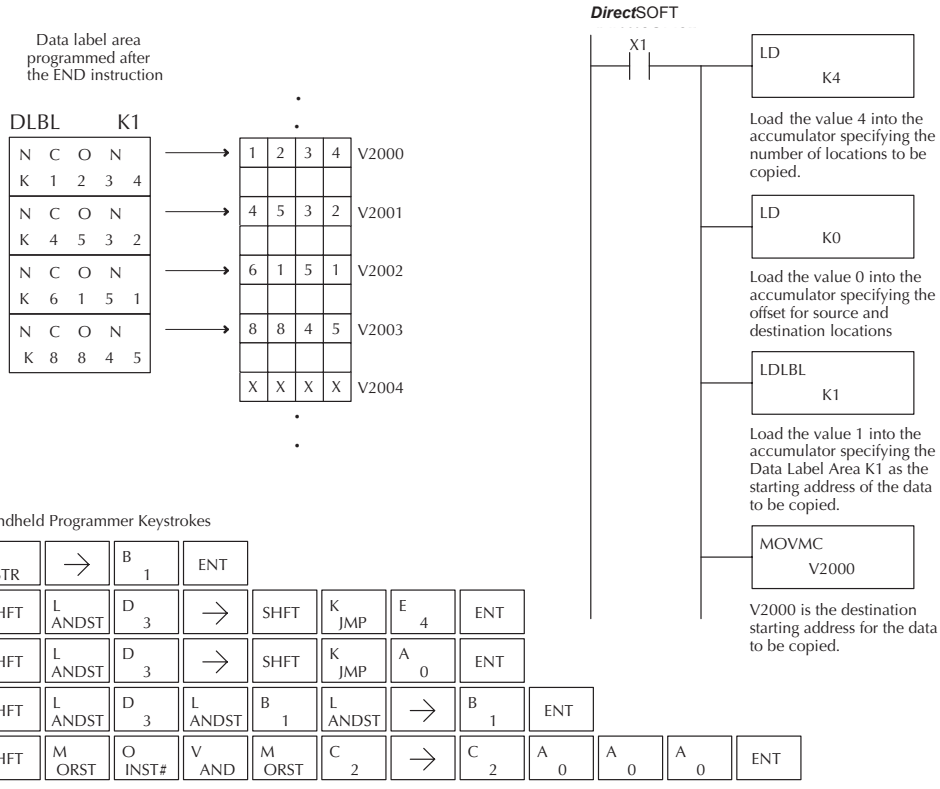
Step 3:— Load the source data label (LDLBL Kaaa) into the accumulator when copying data from ladder memory to V-memory. This is the source location of the value.

Step 4:— Insert the MOVMC instruction which specifies destination in V-memory (Vaaa). This is the copy destination.

Operand Data Type		DL05 Range
	A	**aaa**
V-memory	V	See memory map

Copy Data From a Data Label Area to V-memory

In the example to the right, data is copied from a Data Label Area to V-memory. When X1 is on, the constant value (K4) is loaded into the accumulator using the Load instruction. This value specifies the length of the table and is placed in the second stack location after the next Load and Load Label (LDLBL) instructions are executed. The constant value (K0) is loaded into the accumulator, specifying the offset for the source and destination data. It is placed in the first stack location after the LDLBL instruction is executed. The source address where data is being copied from is loaded into the accumulator using the LDLBL instruction. The MOVMC instruction specifies the destination starting location and executes the copying of data from the Data Label Area to V-memory.



CPU Control Instructions

No Operation (NOP)

DS5	Used
HPP	N/A

The No Operation is an empty (not programmed) memory location.

—(NOP)

*Direct*SOFT

Handheld Programmer Keystrokes

SHFT	N TMR	O INST#	P CV	ENT

End (END)

DS5	Used
HPP	N/A

The End instruction marks the termination point of the normal program scan. An End instruction is required at the end of the main program body. If the End instruction is omitted an error will occur and the CPU will not enter the Run Mode. Data labels, subroutines and interrupt routines are placed after the End instruction. The End instruction is not conditional; therefore, no input contact is allowed.

—(END)

*Direct*SOFT

Handheld Programmer Keystrokes

SHFT	E 4	N TMR	D 3	ENT

Stop (STOP)

DS5	Used
HPP	N/A

The Stop instruction changes the operational mode of the CPU from Run to Program (Stop) mode. This instruction is typically used to stop PLC operation in an error condition.

—(STOP)

In the following example, when C0 turns on, the CPU will stop operation and switch to the program mode.

*Direct*SOFT

Handheld Programmer Keystrokes

$ STR	→	SHFT	C 2	A 0	ENT	
SHFT	S RST	SHFT	T MLR	O INST#	P CV	ENT

Discrete Bit Flags	Description
SP16	On when the DL05 goes into the TERM_PRG mode.
SP53	On when the DL05 goes into the PRG mode.

Reset Watch Dog Timer (RSTWT)

DS5	Used
HPP	N/A

The Reset Watch Dog Timer instruction resets the CPU scan timer. The default setting for the watch dog timer is 200ms. Scan times very seldom exceed 200ms, but it is possible. For/next loops, subroutines, interrupt routines, and table instructions can be programmed such that the scan becomes longer than 200ms. When instructions are used in a manner that could exceed the watch dog timer setting, this instruction can be used to reset the timer.

A software timeout error (E003) will occur and the CPU will enter the program mode if the scan time exceeds the watch dog timer setting. Placement of the RSTWT instruction in the program is very important. The instruction has to be executed before the scan time exceeds the watch dog timer's setting.

If the scan time is consistently longer than the watch dog timer's setting, the timeout value may be permanently increased from the default value of 200ms by AUX 55 on the HPP or the appropriate auxiliary function in your programming package. This eliminates the need for the RSTWT instruction.

In the following example the CPU scan timer will be reset to 0 when the RSTWT instruction is executed. See the For/Next instruction for a detailed example.

DirectSOFT

Handheld Programmer Keystrokes

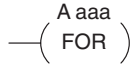
SHFT	R ORN	S RST	T MLR	W ANDN	T MLR	ENT

Program Control Instructions

For / Next (FOR) (NEXT)

DS5	Used
HPP	Used

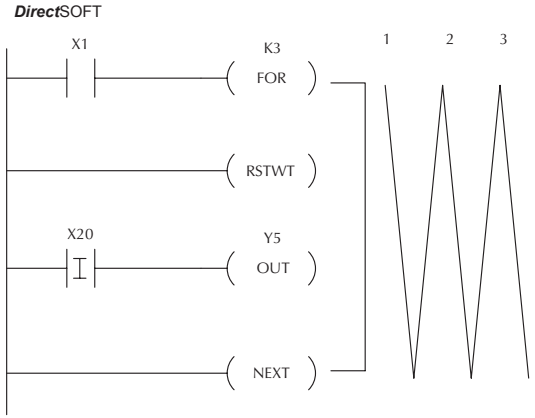
The For and Next instructions are used to execute a section of ladder logic between the For and Next instruction a specified numbers of times. When the For instruction is enabled, the program will loop the specified number of times. If the For instruction is not energized the section of ladder logic between the For and Next instructions is not executed.



For / Next instructions cannot be nested. The normal I/O update and CPU housekeeping is suspended while executing the For / Next loop. The program scan can increase significantly, depending on the amount of times the logic between the For and Next instruction is executed. With the exception of immediate I/O instructions, I/O will not be updated until the program execution is completed for that scan. Depending on the length of time required to complete the program execution, it may be necessary to reset the watch dog timer inside of the For / Next loop using the RSTWT instruction.

Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Constant	K	1-9999

In the following example, when X1 is on, the application program inside the For / Next loop will be executed three times. If X1 is off the program inside the loop will not be executed. The immediate instructions may or may not be necessary depending on your application. Also, The RSTWT instruction is not necessary if the For / Next loop does not extend the scan time larger the Watch Dog Timer setting. For more information on the Watch Dog Timer, refer to the RSTWT instruction.



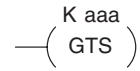
Handheld Programmer Keystrokes

$ STR	→	B 1	ENT			
SHFT	F 5	O INST#	R ORN	→	D 3	ENT
SHFT	R ORN	S RST	T MLR	W ANDN	T MLR	ENT
$ STR	SHFT	I 8	→	C 2	A 0	ENT
GX OUT	→	F 5	ENT			
SHFT	N TMR	E 4	X SET	T MLR	ENT	

Goto Subroutine (GTS) (SBR)

DS5	Used
HPP	Used

The Goto Subroutine instruction allows a section of ladder logic to be placed outside the main body of the program execute only when needed. There can be a maximum of 64 GTS instructions and 64 SBR instructions used in a program. The GTS instructions can be nested up to 8 levels. An error E412 will occur if the maximum limits are exceeded. Typically this will be used in an application where a block of program logic may be slow to execute and is not required to execute every scan. The subroutine label and all associated logic is placed after the End statement in the program. When the subroutine is called from the main program, the CPU will execute the subroutine (SBR) with the same constant number (K) as the GTS instruction which called the subroutine.



By placing code in a subroutine it is only scanned and executed when needed since it resides after the End instruction. Code which is not scanned does not impact the overall scan time of the program.

Operand Data Type		DL05 Range
	A	aaa
Constant	K	1-FFFF

Subroutine Return (RT)

DS5	Used
HPP	Used

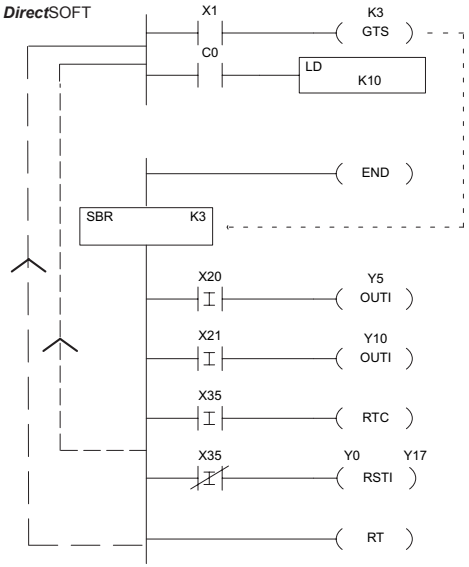
When a Subroutine Return is executed in the subroutine the CPU will return to the point in the main body of the program from which it was called. The Subroutine Return is used as termination of the subroutine which must be the last instruction in the subroutine and is a stand alone instruction (no input contact on the rung).

Subroutine Return Conditional (RTC)

DS5	Used
HPP	Used

The Subroutine Return Conditional instruction is a optional instruction used with a input contact to implement a conditional return from the subroutine. The Subroutine Return (RT) is still required for termination of the Subroutine.

In the following example, when X1 is on, Subroutine K3 will be called. The CPU will jump to the Subroutine Label K3 and the ladder logic in the subroutine will be executed. If X35 is on the CPU will return to the main program at the RTC instruction. If X35 is not on Y0–Y17 will be reset to off and then the CPU will return to the main body of the program.



Handheld Programmer Keystrokes

$ STR	→	B 1	ENT					
SHFT	G 6	T MLR	S RST	→	D 3	ENT		
? ?								
SHFT	E 4	N TMR	D 3	ENT				
SHFT	S RST	SHFT	B 1	R ORN	→	D 3	ENT	
$ STR	SHFT	I 8	→	C 2	A 0	ENT		
GX OUT	SHFT	I 8	→	F 5	ENT			
$ STR	SHFT	I 8	→	C 2	B 1	ENT		
GX OUT	SHFT	I 8	→	B 1	A 0	ENT		
$ STR	SHFT	I 8	→	D 3	F 5	ENT		
SHFT	R ORN	T MLR	C 2	ENT				
SP STRN	SHFT	I 8	→	D 3	F 5	ENT		
S RST	SHFT	I 8	→	A 0	→	B 1	H 7	ENT
SHFT	R ORN	T MLR	ENT					

In the following example, when X1 is on, Subroutine K3 will be called. The CPU will jump to the Subroutine Label K3 and the ladder logic in the subroutine will be executed. The CPU will return to the main body of the program after the RT instruction is executed.

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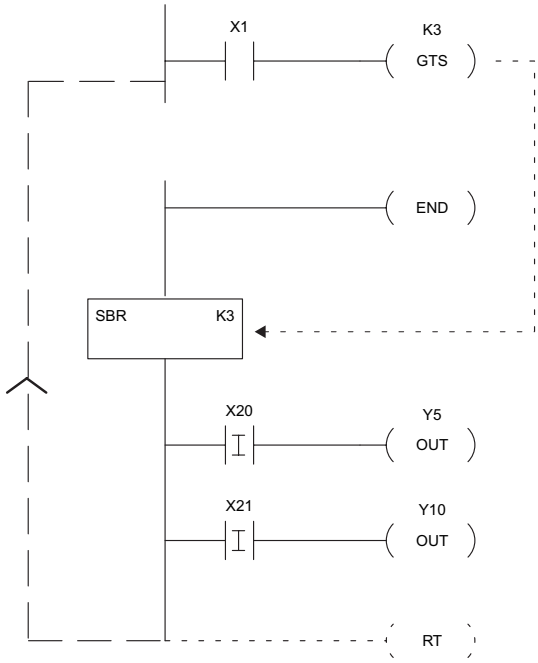


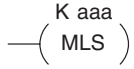
Handheld Programmer Keystrokes

$ STR	→	B 1	ENT				
SHFT	G 6	T MLR	S RST	→	D 3	ENT	
•							
•							
•							
SHFT	E 4	N TMR	D 3	ENT			
SHFT	S RST	SHFT	B 1	R ORN	→	D 3	ENT
$ STR	SHFT	I 8	→	C 2	A 0	ENT	
GX OUT	→	F 5	ENT				
$ STR	SHFT	I 8	→	C 2	B 1	ENT	
GX OUT	→	B 1	A 0	ENT			
SHFT	R ORN	T MLR	ENT				

Master Line Set (MLS)

DS5	Used
HPP	Used

The Master Line Set instruction allows the program to control sections of ladder logic by forming a new power rail controlled by the main left power rail. The main left rail is always master line 0. When a MLS K1 instruction is used, a new power rail is created at level 1. Master Line Sets and Master Line Resets can be used to nest power rails up to seven levels deep.

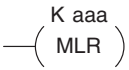


Operand Data Type		DL05 Range
	A	aaa
Constant	K	1-7

DS5	Used
HPP	Used

Master Line Reset (MLR)

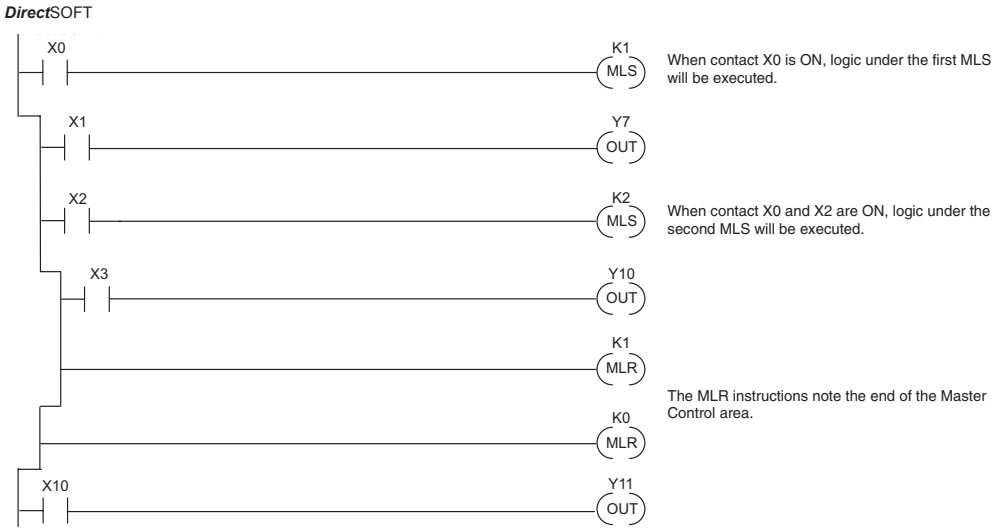
The Master Line Reset instruction marks the end of control for the corresponding MLS instruction. The MLR reference is one less than the corresponding MLS.



Operand Data Type		DL05 Range
	A	aaa
Constant	K	0-7

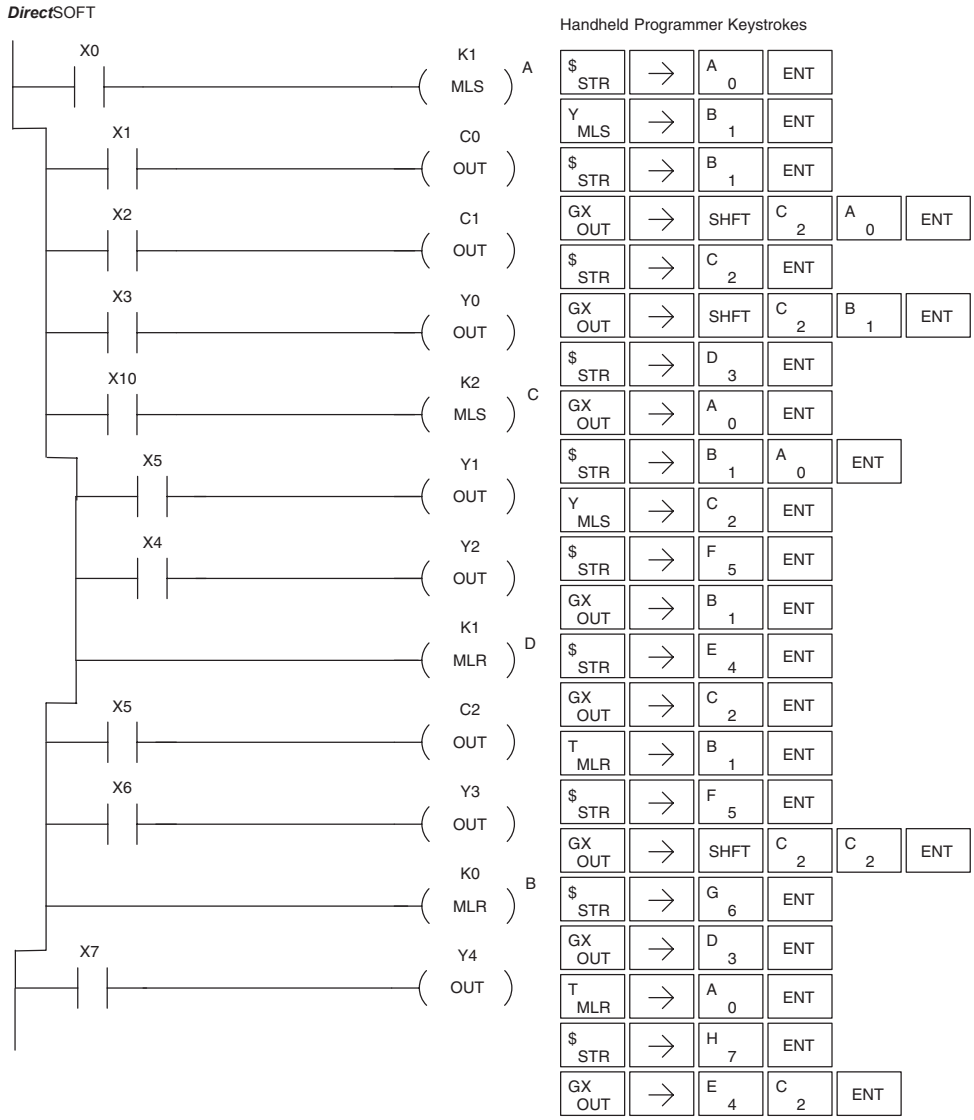
Understanding Master Control Relays

The Master Line Set (MLS) and Master Line Reset (MLR) instructions allow you to quickly enable (or disable) sections of the RLL program. This provides program control flexibility. The following example shows how the MLS and MLR instructions operate by creating a sub power rail for control logic.



MLS/MLR Example

In the following MLS/MLR example logic between the first MLS K1 (A) and MLR K0 (B) will function only if input X0 is on. The logic between the MLS K2 (C) and MLR K1 (D) will function only if input X10 and X0 is on. The last rung is not controlled by either of the MLS coils.

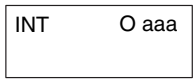


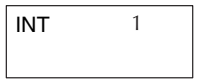
Interrupt Instructions

Interrupt (INT)

DS5	Used
HPP	Used

The Interrupt instruction allows a section of ladder logic to be placed below the main body of the program and executed only when needed. High-Speed I/O Modes 10, 20, and 40 can generate an interrupt. With Mode 40, you may select an external interrupt (input X0), or a time-based interrupt (5–999 ms).





Typically, interrupts are used in an application when a fast response to an input is needed or a program section must execute faster than the normal CPU scan. The interrupt label and all associated logic must be placed after the End statement in the program. When an interrupt occurs, the CPU will complete execution of the current instruction it is processing in ladder logic, then execute the interrupt routine. After interrupt routine execution, the ladder program resumes from the point at which it was interrupted.

See Chapter 3, the section on Mode 40 (Interrupt) Operation for more details on interrupt configuration. In the DL05, only one hardware interrupt is available.

Operand Data Type		DL05 Range
Constant	O	0, 1

Interrupt Return (IRT)

DS5	Used
HPP	Used

An Interrupt Return is normally executed as the last instruction in the interrupt routine. It returns the CPU to the point in the main program from which it was called. The Interrupt Return is a stand-alone instruction (no input contact on the rung).

Interrupt Return Conditional (IRTC)

DS5	Used
HPP	Used

The Interrupt Return Conditional instruction is a optional instruction used with an input contact to implement a conditional return from the interrupt routine. The Interrupt Return is required to terminate the interrupt routine.

Enable Interrupts (ENI)

DS5	Used
HPP	Used

The Enable Interrupt instruction is placed in the main ladder program (before the End instruction), enabling the interrupt. The interrupt remains enabled until the program executes a Disable Interrupt instruction.

Disable Interrupts (DISI)

DS5	Used
HPP	Used

A Disable Interrupt instruction in the main body of the application program (before the End instruction) will disable the interrupt (either external or timed). The interrupt remains disabled until the program executes an Enable Interrupt instruction.

External Interrupt Program Example

In the following example, we do some initialization on the first scan, using the first-scan contact SP0. The interrupt feature is the HSIO Mode 40. Then we configure X0 as the external interrupt by writing to its configuration register, V7634. See Chapter 3, Mode 40 Operation for more details.

During program execution, when X2 is on the interrupt is enabled. When X2 is off the interrupt will be disabled. When an interrupt signal (X0) occurs the CPU will jump to the interrupt label INT O 0. The application ladder logic in the interrupt routine will be performed. The CPU will return to the main body of the program after the IRT instruction is executed.

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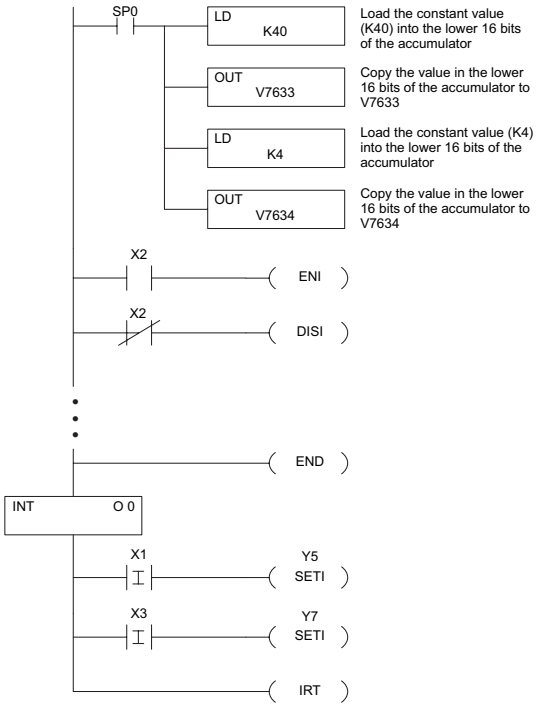
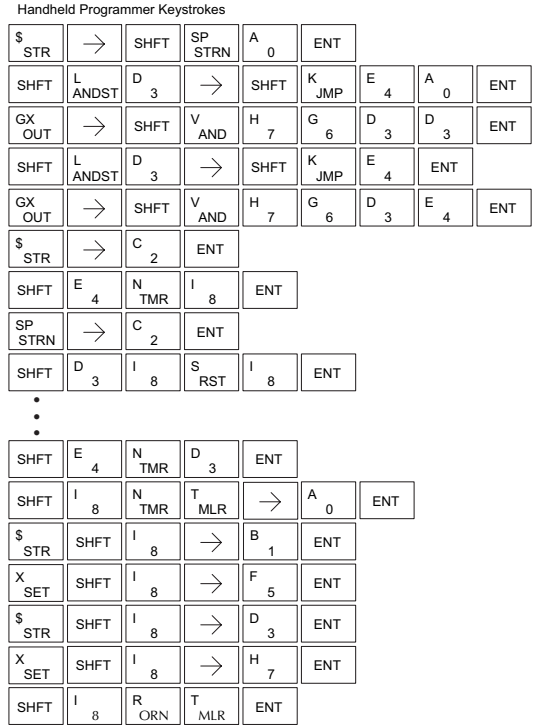


Handheld Programmer Keystrokes



Timed Interrupt Program Example

In the following example, we do some initialization on the first scan, using the first-scan contact SP0. The interrupt feature is the HSIO Mode 40. Then we configure the HSIO timer as a 10 ms interrupt by writing K104 to the configuration register for X0 (V7634). See Chapter 3, Mode 40 Operation for more details.

When X4 turns on, the interrupt will be enabled. When X4 turns off, the interrupt will be disabled. Every 10 ms the CPU will jump to the interrupt label INT O 0. The application ladder logic in the interrupt routine will be performed. If X3 is not on Y0–Y7 will be reset to off and then the CPU will return to the main body of the program.

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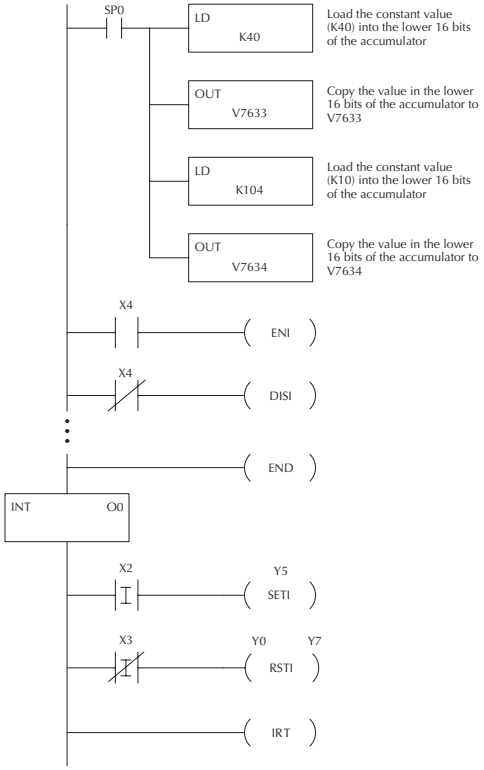
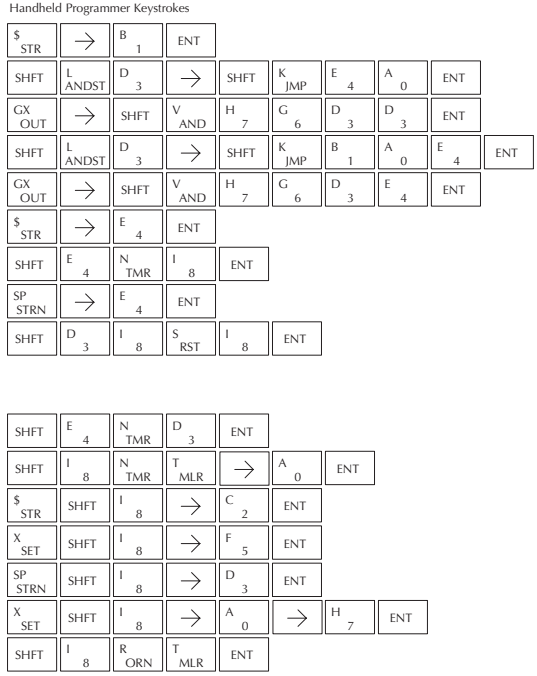


Handheld Programmer Keystrokes



Independent Timed Interrupt

Interrupt O1 is also available as an interrupt. This interrupt is independent of the HSIO features. Interrupt O1 uses an internal timer that is configured in V-memory location V7647. The interrupt period can be adjusted from 5 to 9999 ms. Once the interrupt period is set and the interrupt is enabled in the program, the CPU will continuously call the interrupt routine based on the time setting in V7647.

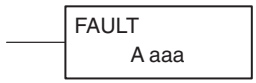
Input	Configuration Register	Function	Hex Code Required
–	V7647	High-Speed Timed Interrupt	xxxx (xxxx = timer setting) 5–9999 ms (BCD)

Message Instructions

Fault (FAULT)

DS5	Used
HPP	Used

The Fault instruction is used to display a message on the handheld programmer or in the *Direct*SOFT status bar. The message has a maximum of 23 characters and can be either V-memory data, numerical constant data or ASCII text.



To display the value in a V-memory location, specify the V-memory location in the instruction. To display the data in ACON (ASCII constant) or NCON (Numerical constant) instructions, specify the constant (K) value for the corresponding data label area.

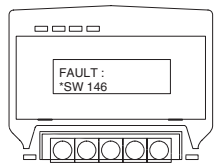
Operand Data Type		DL05 Range
	A	aaa
V-memory	V	See memory map
Constant	K	1-FFFF

Discrete Bit Flags	Description
SP50	On when the FAULT instruction is executed

Fault Example

DS5	Used
HPP	Used

In the following example when X1 is on, the message SW 146 will display on the handheld programmer. The NCONs use the HEX ASCII equivalent of the text to be displayed. (The HEX ASCII for a blank is 20, a 1 is 31, 4 is 34 ...)



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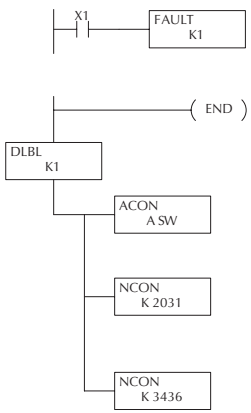


Handheld Programmer Keystrokes

$ STR	→	B 1	ENT					
SHFT	F 5	A 0	U ISG	L ANDST	T MLR	→	B 1	ENT

SHFT	E 4	N TMR	D 3	ENT						
SHFT	D 3	L ANDST	B 1	L ANDST	→	B 1	ENT			
SHFT	A 0	C 2	O INST#	N TMR	→	S RST	W ANDN	ENT		
SHFT	N TMR	C 2	O INST#	N TMR	→	C 2	A 0	D 3	B 1	ENT
SHFT	N TMR	C 2	O INST#	N TMR	→	D 3	E 4	D 3	G 6	ENT

Data Label (DLBL)

DS5	Used
HPP	Used

The Data Label instruction marks the beginning of an ASCII/numeric data area. DLBLs are programmed after the End statement. A maximum of 64 DLBL instructions can be used in a program. Multiple NCONs and ACONs can be used in a DLBL area.

```
DLBL      K aaa
```

Operand Data Type		DL05 Range
	A	aaa
Constant	K	1-FFFF

ASCII Constant (ACON)

DS5	Used
HPP	Used

The ASCII Constant instruction is used with the DLBL instruction to store ASCII text for use with other instructions. Two ASCII characters can be stored in an ACON instruction. If only one character is stored in an ACON a leading space will be inserted.

```
ACON
      A aaa
```

Operand Data Type		DL05 Range
		aaa
Constant	A	0-9 A-Z

Numerical Constant (NCON)

DS5	Used
HPP	Used

The Numerical Constant instruction is used with the DLBL instruction to store the HEX ASCII equivalent of numerical data for use with other instructions. Two digits can be stored in an NCON instruction.

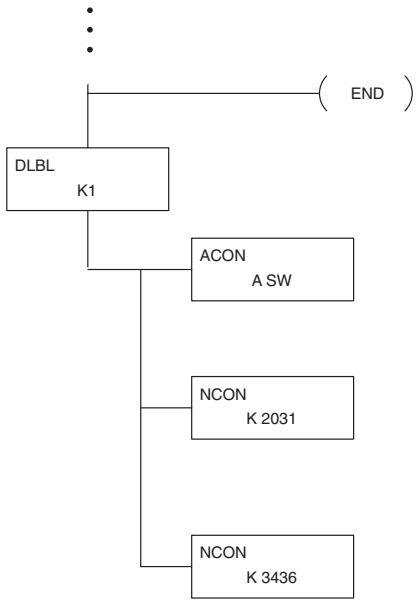
```
NCON
      K aaa
```

Operand Data Type		DL05 Range
		aaa
Constant	K	0-FFFF

Data Label Example

In the following example, an ACON and two NCON instructions are used within a DLBL instruction to build a text message. See the FAULT instruction for information on displaying messages. The DV-1000 Manual also has information on displaying messages.

DirectSOFT



Handheld Programmer Keystrokes

SHFT	E 4	N TMR	D 3	ENT						
SHFT	D 3	L ANDST	B 1	L ANDST	→	B 1	ENT			
SHFT	A 0	C 2	O INST#	N TMR	→	S RST	W ANDN	ENT		
SHFT	N TMR	C 2	O INST#	N TMR	→	C 2	A 0	D 3	B 1	ENT
SHFT	N TMR	C 2	O INST#	N TMR	→	D 3	E 4	D 3	G 6	ENT

Print Message (PRINT)

DS5	Used
HPP	N/A

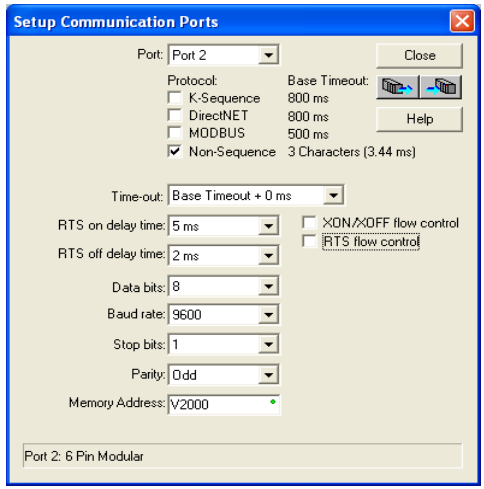
The Print Message instruction prints the embedded text or text/data variable message to the specified, configured, communications port (Port 2 on the DL05 CPU).

```
PRINT     A aaa
"Hello, this is a PLC message"
```

Operand Data Type		DL05 Range
	A	aaa
Constant	K	2

You may recall from the CPU specifications in Chapter 4 that the DL05's ports are capable of several protocols. Port 1 cannot be configured for the non-sequence protocol. To configure port 2 using the Handheld Programmer, use AUX 56 and follow the prompts, making the same choices as indicated below on this page. To configure a port in *Direct*SOFT, choose the PLC > Setup > Setup Secondary Comm Port.

- **Port**: From the port number list box at the top, choose "Port 2".
- **Protocol**: Click the check box to the left of "Non-sequence", and then you'll see the dialog box shown below.
- **Baud Rate**: Choose the baud rate that matches your printer.
- **Stop Bits, Parity**: Choose number of stop bits and parity setting to match your printer.
- **Memory Address**: Please choose a memory address with 64 words of contiguous free memory for use by the Non-Sequence Protocol.



NOTE: *See Chapter 4 for a detail of the non-sequence setup.*

Then click the button indicated to send the Port 2 configuration to the CPU, and click Close. Then see Chapter 3 for port wiring information, in order to connect your printer to the DL05.

Port 2 on the DL05 has standard RS232 levels, and should work with most printer serial input connections.

Text element – this is used for printing character strings. The character strings are defined as the character (more than 0) ranged by the double quotation marks. Two hex numbers preceded by the dollar sign means an 8-bit ASCII character code. Also, two characters preceded by the dollar sign is interpreted according to the following table:

#	Character code	Description
1	$$	Dollar sign ($)
2	$"	Double quotation (")
3	$L or $l	Line feed (LF)
4	$N or $n	Carriage return line feed (CRLF)
5	$P or $p	Form feed
6	$R or $r	Carriage return (CR)
7	$T or $t	Tab

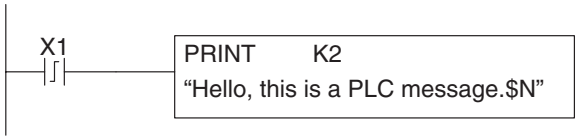
The following examples show various syntax conventions and the length of the output to the printer.

Example:

" "	Length 0 without character
"A"	Length 1 with character A
" "	Length 1 with blank
" $" "	Length 1 with double quotation mark
" $ R $ L "	Length 2 with one CR and one LF
" $ 0 D $ 0 A "	Length 2 with one CR and one LF
" $ $ "	Length 1 with one $ mark

In printing an ordinary line of text, you will need to include **double quotation** marks before and after the text string. Error code 499 will occur in the CPU when the print instruction contains invalid text or no quotations. It is important to test your PRINT instruction data during the application development.

The following example prints the message to port 2. We use a PD contact, which causes the message instruction to be active for just one scan. Note the $N at the end of the message, which produces a carriage return / line feed on the printer. This prepares the printer to print the next line, starting from the left margin.



Print the message to Port 2 when X1 makes an off-to-on transition.

V-memory element - this is used for printing V-memory contents in the integer format or real format. Use V-memory number or V-memory number with "-" and data type. The data types are shown in the table below. The Character code must be capital letters.

***NOTE**: There must be a space entered before and after the V-memory address to separate it from the text string. Failure to do this will result in an error code 499.*

#	Character code	Description
1	none	16-bit binary (decimal number)
2	: B	4 digit BCD
3	: D	32-bit binary (decimal number)
4	: D B	8 digit BCD

Example:

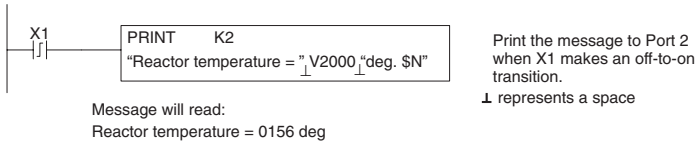
V2000 Print binary data in V2000 for decimal number

V2000 : B Print BCD data in V2000

V2000 : D Print binary number in V2000 and V2001 for decimal number

V2000 : D B Print BCD data in V2000 and V2001

Example: The following example prints a message containing text and a variable. The "reactor temperature" labels the data, which is at V2000. You can use the : B qualifier after the V2000 if the data is in BCD format, for example. The final string adds the units of degrees to the line of text, and the $N adds a carriage return / line feed.



V-memory text element ¨This is used for printing text stored in V-memory. Use the % followed by the number of characters after V-memory number for representing the text. If you assign "0" as the number of characters, the print function will read the character count from the first location. Then it will start at the next V-memory location and read that number of ASCII codes for the text from memory.

Example:

V2000 % 16 16 characters in V2000 to V2007 are printed.

V2000 % 0 The characters in V2001 to Vxxxx (determined by the number in V2000) will be printed.

Bit element – this is used for printing the state of the designated bit in V-memory or a relay bit. The bit element can be assigned by the designating point (.) and bit number preceded by the V-memory number or relay number. The output type is described as shown in the table below.

#	Data format	Description
1	none	Print 1 for an ON state, and 0 for an OFF state
2	: BOOL	Print "TRUE" for an ON state, and "FALSE" for an OFF state
3	: ONOFF	Print "ON" for an ON state, and "OFF" for an OFF state

Example:

V2000.15 **Prints the status of bit 15 in V2000, in 1/0 format**

C100 **Prints the status of C100 in 1/0 format**

C100 : BOOL **Prints the status of C100 in TRUE/FALSE format**

C100 : ON/OFF **Prints the status of C00 in ON/OFF format**

V2000.15 : BOOL **Prints the status of bit 15 in V2000 in TRUE/FALSE format**

The maximum numbers of characters you can print is 128. The number of characters for each element is listed in the table below:

Element Type	Maximum Characters
Text, 1 character	1
16 bit binary	6
32 bit binary	11
4 digit BCD	4
8 digit BCD	8
Floating point (real number)	12
Floating point (real with exponent)	12
V-memory/text	2
Bit (1/0 format)	1
Bit (TRUE/FALSE format)	5
Bit (ON/OFF format)	3

The handheld programmer's mnemonic is "PRINT," followed by the DEF field.

Special relay flags SP116 and SP117 indicate the status of the DL05 CPU ports (busy, or communications error). See the appendix on special relays for a description.

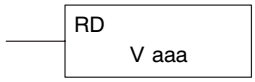
***NOTE**: You must use the appropriate special relay in conjunction with the PRINT command to ensure the ladder program does not try to PRINT to a port that is still busy from a previous PRINT or WX or RX instruction.*

Intelligent I/O Instructions

Read from Intelligent Module (RD)

DS32	Used
HPP	Used

The Read from Intelligent Module instruction reads a block of data (1-128 bytes maximum) from an intelligent I/O module into the CPU's V-memory. It loads the function parameters into the first and second level of the accumulator stack and the accumulator by three additional instructions.



Listed below are the steps to program the Read from Intelligent module function.

Step 1: — Load the base number (0-3) into the first byte and the slot number (0-7) into the second byte of the second level of the accumulator stack.

Step 2: — Load the number of bytes to be transferred into the first level of the accumulator stack (maximum of 128 bytes).

Step 3: — Load the address from which the data will be read into the accumulator. This parameter must be a HEX value.

Step 4: — Insert the RD instruction which specifies the starting V-memory location (Vaaa) where the data will be read into.

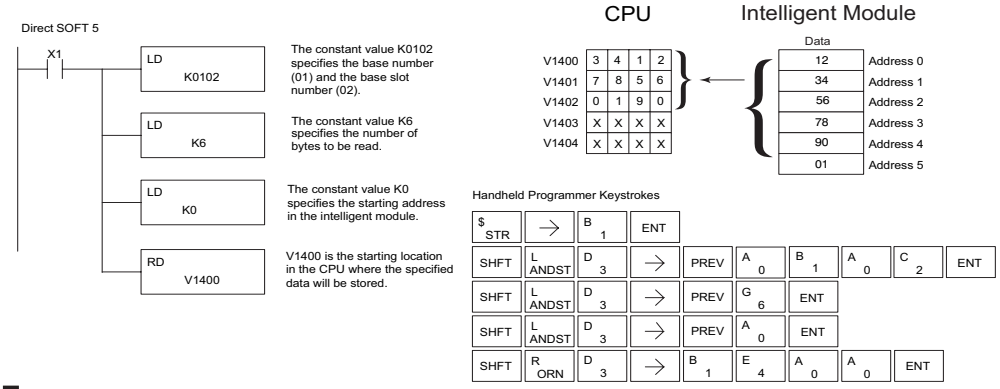
Helpful Hint: — Use the LDA instruction to convert an octal address to its HEX equivalent and load it into the accumulator when the HEX format is required.

Operand Data Type		DL06 Range
		aaa
V-memory	V	See memory map

Discrete Bit Flags	Description
SP54	On when RX, WX RD, WT instructions are executed with the wrong parameters.

NOTE: *Status flags are valid only until another instruction uses the same flag.*

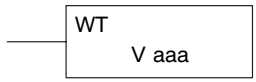
In the following example when X1 is ON, the RD instruction will read six bytes of data from a intelligent module in base 1, slot 2 starting at address 0 in the intelligent module and copy the information into V-memory loacations V1400-V1402.



Write to Intelligent Module (WT)

DS32	Used
HPP	Used

The Write to Intelligent Module instruction writes a block of data (1-128 bytes maximum) to an intelligent I/O module from a block of V-memory in the CPU. The function parameters are loaded into the first and second level of the accumulator stack and the accumulator by three additional instructions.



Listed below are the steps to program the Read from Intelligent module function.

Step 1: — Load the base number (0-3) into the first byte and the slot number (0-7) into the second byte of the second level of the accumulator stack.

Step 2: — Load the number of bytes to be transferred into the first level of the accumulator stack (maximum of 128 bytes).

Step 3: — Load the intelligent module address which will receive the data into the accumulator. This parameter must be a HEX value.

Step 4: — Insert the WT instruction which specifies the starting V-memory location (Vaaa) where the data will be written from in the CPU.

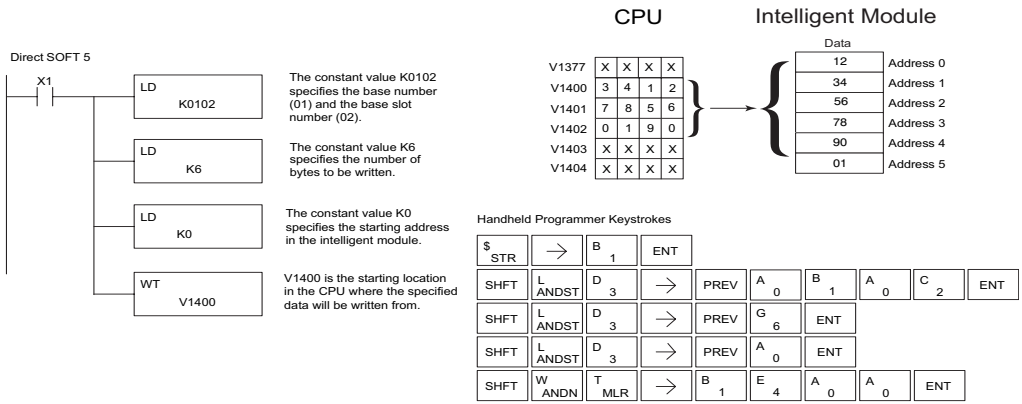
Helpful Hint: — Use the LDA instruction to convert an octal address to its HEX equivalent and load it into the accumulator when the HEX format is required.

Operand Data Type		DL06 Range
		aaa
V-memory	V	See memory map

Discrete Bit Flags	Description
SP54	On when RX, WX RD, WT instructions are executed with the wrong parameters.

NOTE: *Status flags are valid only until another instruction uses the same flag.*

In the following example, when X1 is on, the WT instruction will write six bytes of data to an intelligent module in base 1, slot 2 starting at address 0 in the intelligent module and copy the data from V-memory locations V1400-V1402.

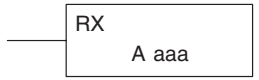


Network Instructions

Read from Network (RX)

DS5	Used
HPP	Used

The Read from Network instruction causes the master device on a network to read a block of data from a slave device on the same network. The function parameters are loaded into the accumulator and the first and second level of the stack. Listed below are the program steps necessary to execute the Read from Network function.



Step 1: — Load the slave address (0–90 BCD) into the low byte and "F2" into the high byte of the accumulator (the next two instructions push this word down to the second layer of the stack).

Step 2: — Load the number of bytes to be transferred into the accumulator, 2 - 128 bytes are allowed, (the next instruction pushes this word onto the top of the stack).

Step 3: — Load the starting Master CPU address into the accumulator. This is the memory location where the data read from the slave will be put. This parameter requires a HEX value.

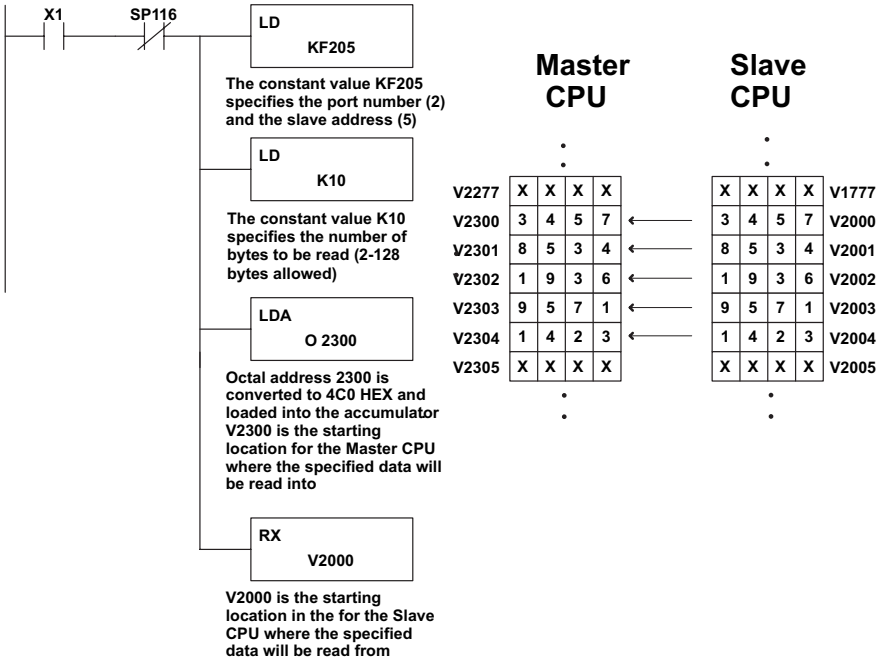
Step 4: — Insert the RX instruction which specifies the starting V-memory location (Aaaa) where the data will be read from in the slave.

Helpful Hint: For parameters that require HEX values, the LDA instruction can be used to convert an octal address to the HEX equivalent and load the value into the accumulator.

Operand Data Type		DL05 Range
	A	aaa
V-memory	V	All (See page 3–28)
Pointer	P	All V-memory. (See page 3–28)
Inputs	X	0–377
Outputs	Y	0–377
Control Relays	C	0–777
Stage	S	0–377
Timer	T	0–177
Counter	CT	0–177
Special Relay	SP	0–777
Program Memory	$	0–2047 (2K program mem.)

In the following example, when X1 is on and the port busy relay SP116 (see special relays) is not on, the RX instruction will access port 2 operating as a master. Ten consecutive bytes of data (V2000 – V2004) will be read from a CPU at station address 5 and copied into V-memory locations V2300–V2304 in the CPU with the master port.

*Direct*SOFT



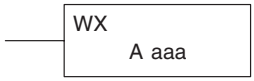
HandheldProgrammer Keystrokes

$ STR	→	B 1	ENT									
W ANDN	→	SHFT	SP STRN	B 1	B 1	G 6	ENT					
SHFT	L ANDST	D 3	→	SHFT	K JMP	SHFT	F 5	SHFT	C 2	A 0	F 5	ENT
SHFT	L ANDST	D 3	→	SHFT	K JMP	B 1	A 0	ENT				
SHFT	L ANDST	D 3	A 0	→	C 2	D 3	A 0	A 0	ENT			
SHFT	R ORN	X SET	→	C 2	A 0	A 0	A 0	ENT				

Write to Network (WX)

DS5	Used
HPP	Used

The Write to Network instruction is used to write a block of data from the master device to a slave device on the same network. The function parameters are loaded into the accumulator and the first and second level of the stack. Listed below are the program steps necessary to execute the Write to Network function.



Step 1: — Load the slave address (0–90 BCD) into the low byte and "F2" into the high byte of the accumulator (the next two instructions push this word down to the second layer of the stack).

Step 2: — Load the number of bytes to be transferred into the accumulator, 2-128 bytes are allowed, (the next instruction pushes this word onto the top of the stack).

Step 3: — Load the starting Master CPU address into the accumulator. This is the memory location where the data will be written from. This parameter requires a HEX value.

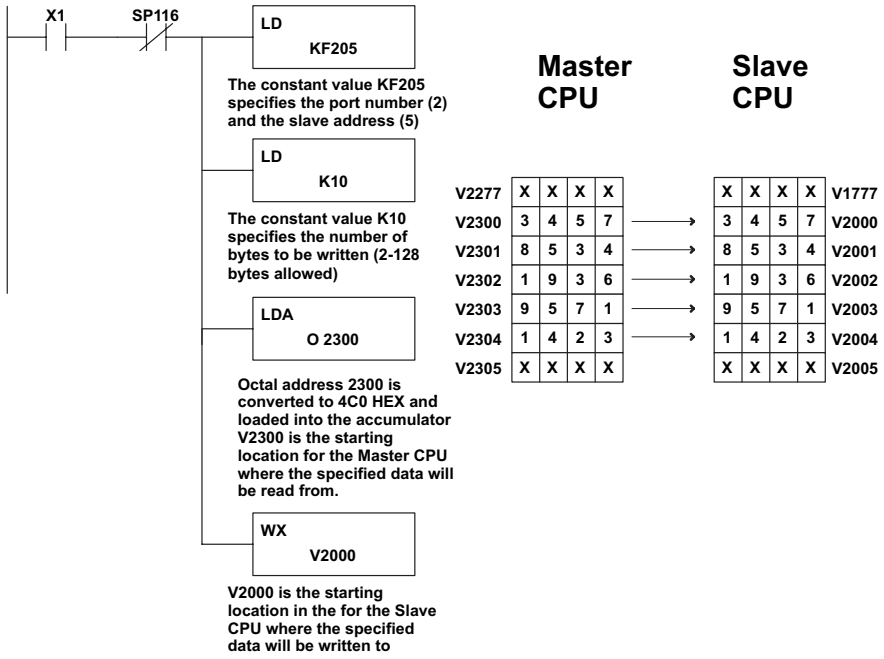
Step 4: — Insert the WX instruction which specifies the starting V-memory location (Aaaa) where the data will be written to in the slave.

Operand Data Type		DL05 Range
	A	**aaa**
V-memory	V	All (See page 3–28)
Pointer	P	All V-memory (See page 3–28)
Inputs	X	0–377
Outputs	Y	0–377
Control Relays	C	0–777
Stage	S	0–377
Timer	T	0–177
Counter	CT	0–177
Special Relay	SP	0–777
Program Memory	$	0–2048 (2K program mem.)

Helpful Hint: For parameters that require HEX values, the LDA instruction can be used to convert an octal address to the HEX equivalent and load the value into the accumulator.

In the following example when X1 is on and the module busy relay SP116 (see special relays) is not on, the WX instruction will access port 2 operating as a master. Ten consecutive bytes of data is read from the Master CPU and copied to V-memory locations V2000–V2004 in the slave CPU at station address 5.

*Direct*SOFT



HandheldProgrammer Keystrokes

$ STR	→	B 1	ENT																
W ANDN	→	SHFT	SP STRN	B 1	C 1	E 6	ENT												
SHFT	L ANDST	D 3	→	SHFT	K JMP	SHFT	F 5	SHFT	C 2	A 0	F 5	ENT							
SHFT	L ANDST	D 3	→	SHFT	K JMP	B 1	A 0	ENT											
SHFT	L ANDST	D 3	A 0	→	C 2	D 3	A 0	A 0	ENT										
SHFT	W ANDN	X SET	→	C 2	A 0	A 0	A 0	ENT											

Intelligent Box (IBox) Instructions

The Intelligent Box Instructions (commonly referred to as IBox Instructions) listed in this section are additional, and much different looking, instructions made available with the release of ***Direct***SOFT programming software. The DL05 PLC requires firmware version v5.10 or later to use the new ***Direct***SOFT features. For more information on ***Direct***SOFT, please visit our website at: **www.automationdirect.com**.

Analog Helper IBoxes		
Instruction	**Ibox #**	**Page**
Analog Input / Output Combo Module Pointer Setup (ANLGCMB)	IB-462	5-126
Analog Input Module Pointer Setup (ANLGIN)	IB-460	5-128
Analog Output Module Pointer Setup (ANLGOUT)	IB-461	5-130
Analog Scale 12 Bit BCD to BCD (ANSCL)	IB-423	5-132
Analog Scale 12 Bit Binary to Binary (ANSCLB)	IB-403	5-134
Filter Over Time - BCD (FILTER)	IB-422	5-136
Filter Over Time - Binary (FILTERB)	IB-402	5-138
Hi/Low Alarm - BCD (HILOAL)	IB-421	5-140
Hi/Low Alarm - Binary (HILOALB)	IB-401	5-142

Discrete Helper IBoxes		
Instruction	**Ibox #**	**Page**
Off Delay Timer (OFFDTMR)	IB-302	5-144
On Delay Timer (ONDTMR)	IB-301	5-146
One Shot (ONESHOT)	IB-303	5-148
Push On / Push Off Circuit (PONOFF)	IB-300	5-149

Memory IBoxes		
Instruction	**Ibox #**	**Page**
Move Single Word (MOVEW)	IB-200	5-150
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Math IBoxes		
Instruction	**Ibox #**	**Page**
Math - BCD (MATHBCD)	IB-521	5-152
Math - Binary (MATHBIN)	IB-501	5-154
Square BCD (SQUARE)	IB-523	5-156
Square Binary (SQUAREB)	IB-503	5-157
Sum BCD Numbers (SUMBCD)	IB-522	5-158
Sum Binary Numbers (SUMBIN)	IB-502	5-159

Communication IBoxes		
Instruction	**Ibox #**	**Page**
ECOM100 Configuration (ECOM100)	IB-710	5-160
ECOM100 Disable DHCP (ECDHCPD)	IB-736	5-162
ECOM100 Enable DHCP (ECDHCPE)	IB-735	5-164
ECOM100 Query DHCP Setting (ECDHCPQ)	IB-734	5-166
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ECOM100 Restore Default E-mail Setup (ECEMRDS)	IB-713	5-171
ECOM100 E-mail Setup (ECEMSUP)	IB-712	5-174
ECOM100 IP Setup (ECIPSUP)	IB-717	5-178
ECOM100 Read Description (ECRDDES)	IB-726	5-180
ECOM100 Read Gateway Address (ECRDGWA)	IB-730	5-182
ECOM100 Read IP Address (ECRDIP)	IB-722	5-184
ECOM100 Read Module ID (ECRDMID)	IB-720	5-186
ECOM100 Read Module Name (ECRDNAM)	IB-724	5-188
ECOM100 Read Subnet Mask (ECRDSNM)	IB-732	5-190
ECOM100 Write Description (ECWRDES)	IB-727	5-192
ECOM100 Write Gateway Address (ECWRGWA)	IB-731	5-194
ECOM100 Write IP Address (ECWRIP)	IB-723	5-196
ECOM100 Write Module ID (ECWRMID)	IB-721	5-198
ECOM100 Write Name (ECWRNAM)	IB-725	5-200
ECOM100 Write Subnet Mask (ECWRSNM)	IB-733	5-202
ECOM100 RX Network Read (ECRX)	IB-740	5-204
ECOM100 WX Network Write(ECWX)	IB-741	5-207
NETCFG Network Configuration (NETCFG)	IB-700	5-210
Network RX Read (NETRX)	IB-701	5-212
Network WX Write (NETWX)	IB-702	5-215

Counter I/O IBoxes (Work with H0-CTRIO and H0-CTRIO2)		
Instruction	**Ibox #**	**Page**
CTRIO Configuration (CTRIO)	IB-1000	5-218
CTRIO Add Entry to End of Preset Table (CTRADPT)	IB-1005	5-220
CTRIO Clear Preset Table (CTRCLRT)	IB-1007	5-223
CTRIO Edit Preset Table Entry (CTREDPT)	IB-1003	5-226
CTRIO Edit Preset Table Entry and Reload (CTREDRL)	IB-1002	5-230
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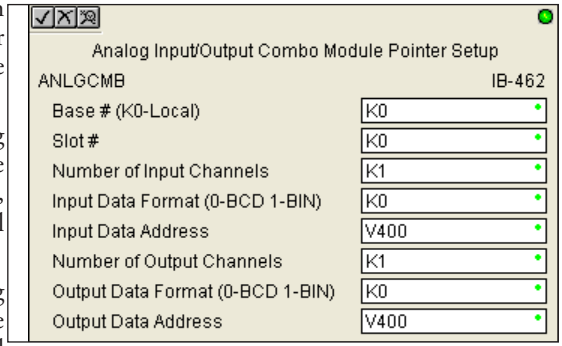
CTRIO Initialize Preset Table (CTRINTR)	IB-1010	5-238
CTRIO Load Profile (CTRLDPR)	IB-1001	5-242
CTRIO Read Error (CTRRDER)	IB-1014	5-244
CTRIO Run to Limit Mode (CTRRTLM)	IB-1011	5-246
CTRIO Run to Position Mode (CTRRTPM)	IB-1012	5-249
CTRIO Velocity Mode (CTRVELO)	IB-1013	5-251
CTRIO Write File to ROM (CTRWFTR)	IB-1006	5-254

Analog Input/Output Combo Module Pointer Setup (ANLGCMB) (IB-462)

DS5	Used
HPP	N/A

The Analog Input/Output Combo Module Pointer Setup instruction generates the logic to configure the pointer method for an analog input/output combination module on the first PLC scan following a Program to Run transition.

The ANLGCMB IBox instruction determines the data format and Pointer addresses based on the CPU type, the Base# and the module Slot#.



The Input Data Address is the starting location in user V-memory where the analog input data values will be stored, one location for each input channel enabled.

The Output Data Address is the starting location in user V-memory where the analog output data values will be placed by ladder code or external device, one location for each output channel enabled.

Since the IBox logic only executes on the first scan, the instruction cannot have any input logic.

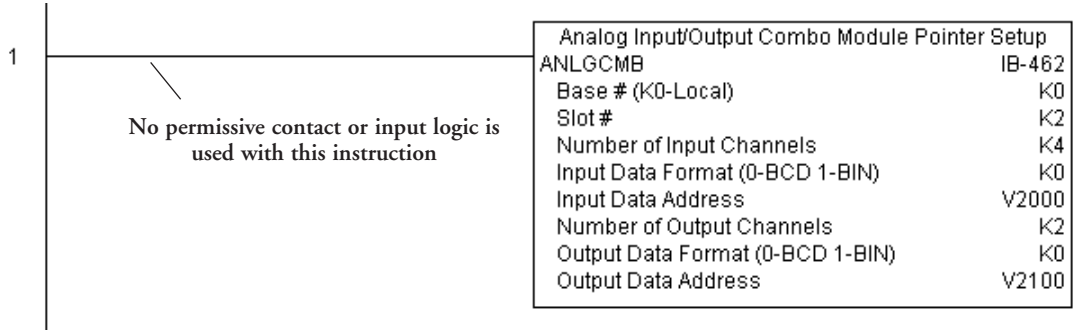
ANLGCMB Parameters

- Base # (K0-Local): must be 0 for DL05 PLC
- Slot #: specifies the single PLC option slot that is occupied by the module
- Number of Input Channels: specifies the number of analog input channels to scan
- Input Data Format (0-BCD 1-BIN): specifies the analog input data format (BCD or Binary) - the binary format may be used for displaying data on some OI panels
- Input Data Address: specifies the starting V-memory location that will be used to store the analog input data
- Number of Output Channels: specifies the number of analog output channels that will be used
- Output Data Format (0-BCD 1-BIN): specifies the format of the analog output data (BCD or Binary)
- Output Data Address: specifies the starting V-memory location that will be used to source the analog output data

Parameter		DL05 Range
Base # (K0-Local)	K	K0 (local base only)
Slot #	K	K1
Number of Input Channels	K	K1-8
Input Data Format (0-BCD 1-BIN)	K	BCD: K0; Binary: K1
Input Data Address	V	See DL05 V-memory map - Data Words
Number of Output Channels	K	K1-8
Output Data Format (0-BCD 1-BIN)	K	BCD: K0; Binary: K1
Output Data Address	V	See DL05 V-memory map - Data Words

ANLGCMB Example

In the following example, the ANLGCMB instruction is used to setup the pointer method for an analog I/O combination module that is installed in option slot 2. Four input channels are enabled and the analog data will be written to V2000 - V2003 in BCD format. Two output channels are enabled and the analog values will be read from V2100 - V2101 in BCD format.



Analog Input Module Pointer Setup (ANLGIN) (IB-460)

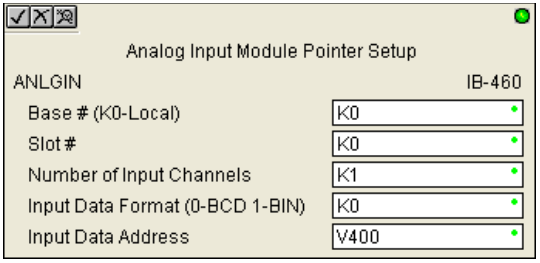
DS5	Used
HPP	N/A

Analog Input Module Pointer Setup generates the logic to configure the pointer method for one analog input module on the first PLC scan following a Program to Run transition.

This IBox determines the data format and Pointer addresses based on the CPU type, the Base#, and the Slot#.

The Input Data Address is the starting location in user V-memory where the analog input data values will be stored, one location for each input channel enabled.

Since this logic only executes on the first scan, this IBox cannot have any input logic.



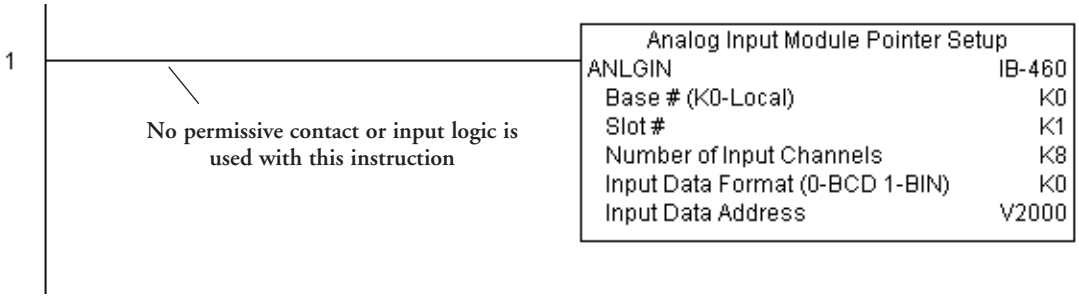
ANLGIN Parameters

- Base # (K0-Local): must be 0 for DL05 PLC
- Slot #: specifies the single PLC option slot that is occupied by the module
- Number of Input Channels: specifies the number of input channels to scan
- Input Data Format (0-BCD 1-BIN): specifies the analog input data format (BCD or Binary) - the binary format may be used for displaying data on some OI panels
- Input Data Address: specifies the starting V-memory location that will be used to store the analog input data

Parameter		DL05 Range
Base # (K0-Local)	K	K0 (local base only)
Slot #	K	K1
Number of Input Channels	K	K1-8
Input Data Format (0-BCD 1-BIN)	K	BCD: K0; Binary: K1
Input Data Address	V	See DL05 V-memory map - Data Words

ANLGIN Example

In the following example, the ANLGIN instruction is used to setup the pointer method for an analog input module that is installed in option slot 1. Eight input channels are enabled and the analog data will be written to V2000 - V2007 in BCD format.



Analog Output Module Pointer Setup (ANLGOUT) (IB-461)

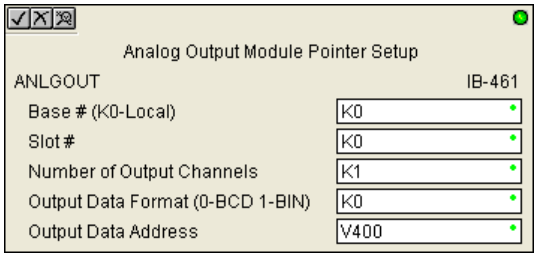
DS5	Used
HPP	N/A

Analog Output Module Pointer Setup generates the logic to configure the pointer method for one analog output module on the first PLC scan following a Program to Run transition.

This IBox determines the data format and Pointer addresses based on the CPU type, the Base#, and the Slot#.

The Output Data Address is the starting location in user V-memory where the analog output data values will be placed by ladder code or external device, one location for each output channel enabled.

Since this logic only executes on the first scan, this IBox cannot have any input logic.



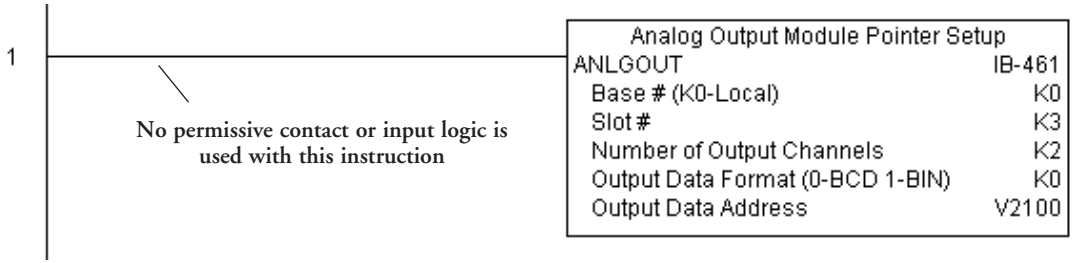
ANLGOUT Parameters

- Base # (K0-Local): must be 0 for DL05 PLC
- Slot #: specifies the single PLC option slot that is occupied by the module
- Number of Output Channels: specifies the number of analog output channels that will be used
- Output Data Format (0-BCD 1-BIN): specifies the format of the analog output data (BCD or Binary)
- Output Data Address: specifies the starting V-memory location that will be used to source the analog output data

Parameter		DL05 Range
Base # (K0-Local)	K	K0 (local base only)
Slot #	K	K1
Number of Output Channels	K	K1-8
Output Data Format (0-BCD 1-BIN)	K	BCD: K0; Binary: K1
Output Data Address	V	See DL05 V-memory map - Data Words

ANLGOUT Example

In the following example, the ANLGOUT instruction is used to setup the pointer method for an analog output module that is installed in option slot 3. Two output channels are enabled and the analog data will be read from V2100 – V2101 in BCD format.

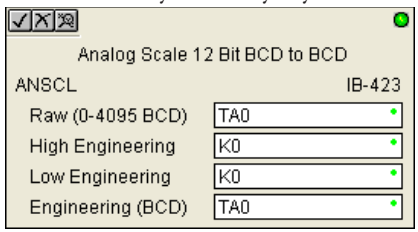


Analog Scale 12 Bit BCD to BCD (ANSCL) (IB-423)

DS5	Used
HPP	N/A

Analog Scale 12 Bit BCD to BCD scales a 12 bit BCD analog value (0-4095 BCD) into BCD engineering units. You specify the engineering unit high value (when raw is 4095), and the engineering low value (when raw is 0), and the output V memory address you want the to place the scaled engineering unit value. The engineering units are generated as BCD and can be the full range of 0 to 9999 (see ANSCLB - Analog Scale 12 Bit Binary to Binary if your raw units are in Binary format).

Note that this IBox only works with unipolar unsigned raw values. It does NOT work with bipolar or sign plus magnitude raw values.



ANSCL Parameters

- Raw (0-4095 BCD): specifies the V-memory location of the unipolar unsigned raw 0-4095 unscaled value
- High Engineering: specifies the high engineering value when the raw input is 4095
- Low Engineering: specifies the low engineering value when the raw input is 0
- Engineering (BCD): specifies the V-memory location where the scaled engineering BCD value will be placed

Parameter		DL05 Range
Raw (0-4095 BCD)	V,P	See DL05 V-memory map - Data Words
High Engineering	K	K0-9999
Low Engineering	K	K0-9999
Engineering (BCD)	V,P	See DL05 V-memory map - Data Words

ANSCL Example

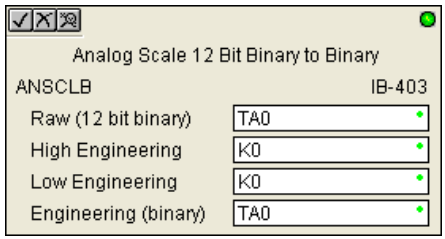
In the following example, the ANSCL instruction is used to scale a raw value (0-4095 BCD) that is in V2000. The engineering scaling range is set 0-100 (low engineering value - high engineering value). The scaled value will be placed in V2100 in BCD format.

Analog Scale 12-Bit Binary to Binary (ANSCLB) (IB-403)

DS5	Used
HPP	N/A

Analog Scale 12-bit Binary to Binary scales a 12-bit binary analog value (0-4095 decimal) into binary (decimal) engineering units. You specify the engineering unit high value (when raw is 4095), and the engineering low value (when raw is 0), and the output V-memory address you want to place the scaled engineering unit value. The engineering units are generated as binary and can be the full range of 0 to 65535 (see ANSCL - Analog Scale 12-Bit BCD to BCD if your raw units are in BCD format).

Note that this IBox only works with unipolar unsigned raw values. It does NOT work with bipolar, sign plus magnitude, or signed 2's complement raw values.



ANSCLB Parameters

- Raw (12-bit binary): specifies the V-memory location of the unipolar unsigned raw decimal unscaled value (12-bit binary = 0-4095 decimal)
- High Engineering: specifies the high engineering value when the raw input is 4095 decimal
- Low Engineering: specifies the low engineering value when the raw input is 0 decimal
- Engineering (binary): specifies the V-memory location where the scaled engineering decimal value will be placed

Parameter		DL05 Range
Raw (12 bit binary)	V,P	See DL05 V-memory map - Data Words
High Engineering	K	K0-65535
Low Engineering	K	K0-65535
Engineering (binary)	V,P	See DL05 V-memory map - Data Words

ANSCLB Example

In the following example, the ANSCLB instruction is used to scale a raw value (0-4095 binary) that is in V2000. The engineering scaling range is set 0-1000 (low engineering value - high engineering value). The scaled value will be placed in V2100 in binary format.

Filter Over Time - BCD (FILTER) (IB-422)

DS5	Used
HPP	N/A

Filter Over Time BCD will perform a first-order filter on the Raw Data on a defined time interval. The equation is:

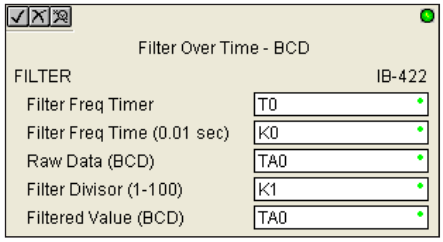
New = Old + [(Raw - Old) / FDC] where,

New: New Filtered Value

Old: Old Filtered Value

FDC: Filter Divisor Constant

Raw: Raw Data



The Filter Divisor Constant is an integer in the range K1 to K100, such that if it equaled K1 then no filtering would be done.

The rate at which the calculation is performed is specified by time in hundredths of a second (0.01 seconds) as the Filter Freq Time parameter. Note that this Timer instruction is embedded in the IBox and must NOT be used anywhere else in your program. Power flow controls whether the calculation is enabled. If it is disabled, the Filter Value is not updated. On the first scan from Program to Run mode, the Filter Value is initialized to 0 to give the calculation a consistent starting point.

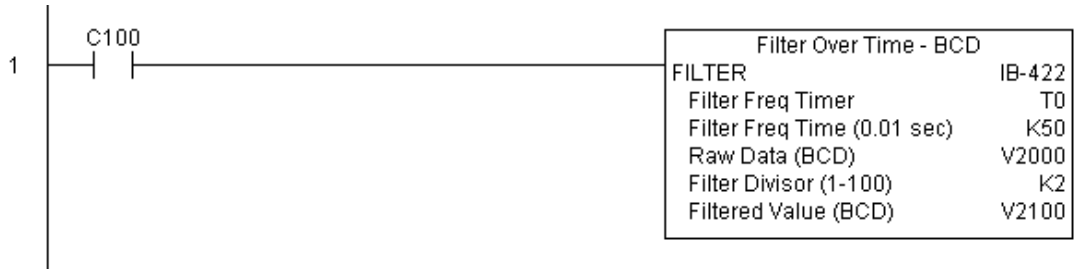
FILTER Parameters

- Filter Frequency Timer: specifies the Timer (T) number which is used by the Filter instruction
- Filter Frequency Time (0.01sec): specifies the rate at which the calculation is performed
- Raw Data (BCD): specifies the V-memory location of the raw unfiltered BCD value
- Filter Divisor (1-100): this constant used to control the filtering effect. A larger value will increase the smoothing effect of the filter. A value of 1 results with no filtering.
- Filtered Value (BCD): specifies the V-memory location where the filtered BCD value will be placed

Parameter		DL05 Range
Filter Frequency Timer	T	T0-177
Filter Frequency Time (0.01 sec)	K	K0-9999
Raw Data (BCD)	V	See DL05 V-memory map - Data Words
Filter Divisor (1-100)	K	K1-100
Filtered Value (BCD)	V	See DL05 V-memory map - Data Words

FILTER Example

In the following example, the Filter instruction is used to filter a BCD value that is in V2000. Timer(T0) is set to 0.5 sec, the rate at which the filter calculation will be performed. The filter constant is set to 2. A larger value will increase the smoothing effect of the filter. A value of 1 results with no filtering. The filtered value will be placed in V2100.



Filter Over Time - Binary (FILTERB) (IB-402)

DS5	Used
HPP	N/A

Filter Over Time in Binary (decimal) will perform a first-order filter on the Raw Data on a defined time interval. The equation is:

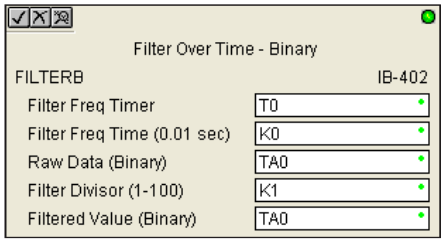
New = Old + [(Raw - Old) / FDC] where

New: New Filtered Value

Old: Old Filtered Value

FDC: Filter Divisor Constant

Raw: Raw Data



The Filter Divisor Constant is an integer in the range K1 to K100, such that if it equaled K1 then no filtering would be done.

The rate at which the calculation is performed is specified by time in hundredths of a second (0.01 seconds) as the Filter Freq Time parameter. Note that this Timer instruction is embedded in the IBox and must NOT be used anywhere else in your program. Power flow controls whether the calculation is enabled. If it is disabled, the Filter Value is not updated. On the first scan from Program to Run mode, the Filter Value is initialized to 0 to give the calculation a consistent starting point.

FILTERB Parameters

- Filter Frequency Timer: specifies the Timer (T) number which is used by the Filter instruction
- Filter Frequency Time (0.01sec): specifies the rate at which the calculation is performed
- Raw Data (Binary): specifies the V-memory location of the raw unfiltered binary (decimal) value
- Filter Divisor (1-100): this constant used to control the filtering effect. A larger value will increase the smoothing effect of the filter. A value of 1 results with no filtering.
- Filtered Value (Binary): specifies the V-memory location where the filtered binary (decimal) value will be placed

Parameter		DL05 Range
Filter Frequency Timer	T	T0-177
Filter Frequency Time (0.01 sec)	K	K0-9999
Raw Data (Binary)	V	See DL05 V-memory map - Data Words
Filter Divisor (1-100)	K	K1-100
Filtered Value (Binary)	V	See DL05 V-memory map - Data Words

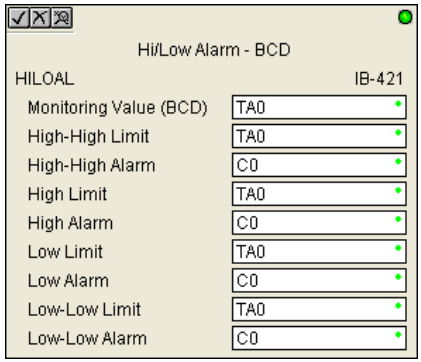
FILTERB Example

In the following example, the FILTERB instruction is used to filter a binary value that is in V2000. Timer(T1) is set to 0.5 sec, the rate at which the filter calculation will be performed. The filter constant is set to 3. A larger value will increase the smoothing effect of the filter. A value of 1 results with no filtering. The filtered value will be placed in V2100.

Hi/Low Alarm - BCD (HILOAL) (IB-421)

DS5	Used
HPP	N/A

Hi/Low Alarm - BCD monitors a BCD value V-memory location and sets four possible alarm states, High-High, High, Low, and Low-Low whenever the IBox has power flow. You enter the alarm thresholds as constant K BCD values (K0-K9999) and/or BCD value V-memory locations.



You must ensure that threshold limits are valid, that is HH >= H > L >= LL. Note that when the High-High or Low-Low alarm condition is true, that the High and Low alarms will also be set, respectively. This means you may use the same threshold limit and same alarm bit for the High-High and the High alarms in case you only need one "High" alarm. Also note that the boundary conditions are inclusive. That is, if the Low boundary is K50, and the Low-Low boundary is K10, and if the Monitoring Value equals 10, then the Low Alarm AND the Low-Low alarm will both be ON. If there is no power flow to the IBox, then all alarm bits will be turned off regardless of the value of the Monitoring Value parameter.

HILOAL Parameters

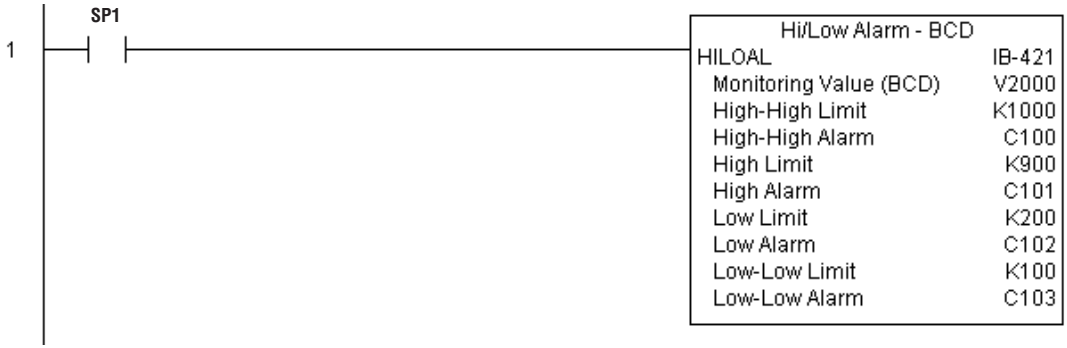
- Monitoring Value (BCD): specifies the V-memory location of the BCD value to be monitored
- High-High Limit: V-memory location or constant specifies the high-high alarm limit
- High-High Alarm: On when the high-high limit is reached
- High Limit: V-memory location or constant specifies the high alarm limit
- High Alarm: On when the high limit is reached
- Low Limit: V-memory location or constant specifies the low alarm limit
- Low Alarm: On when the low limit is reached
- Low-Low Limit: V-memory location or constant specifies the low-low alarm limit
- Low-Low Alarm: On when the low-low limit is reached

Parameter		DL05 Range
Monitoring Value (BCD)	V	See DL05 V-memory map - Data Words
High-High Limit	V, K	K0-9999; or see DL05 V-memory map - Data Words
High-High Alarm	X, Y, C, GX,GY, B	See DL05 V-memory map
High Limit	V, K	K0-9999; or see DL05 V-memory map - Data Words
High Alarm	X, Y, C, GX,GY, B	See DL05 V-memory map
Low Limit	V, K	K0-9999; or see DL05 V-memory map - Data Words
Low Alarm	X, Y, C, GX,GY,B	See DL05 V-memory map
Low-Low Limit	V, K	K0-9999; or see DL05 V-memory map - Data Words
Low-Low Alarm	X, Y, C, GX,GY, B	See DL05 V-memory map

HILOAL Example

In the following example, the HILOAL instruction is used to monitor a BCD value that is in V2000. If the value in V2000 meets/exceeds the high limit of K900, C101 will turn on. If the value continues to increase to meet/exceed the high-high limit, C100 will turn on. Both bits would be on in this case. The high and high-high limits and alarms can be set to the same value if one "high" limit or alarm is desired to be used.

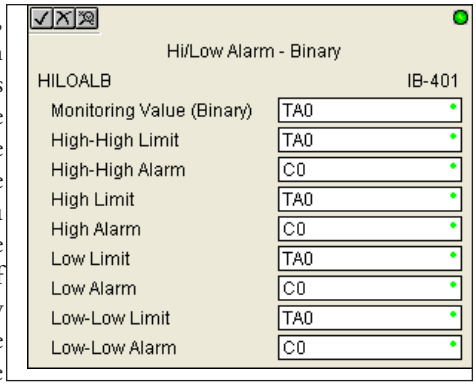
If the value in V2000 meets or falls below the low limit of K200, C102 will turn on. If the value continues to decrease to meet or fall below the low-low limit of K100, C103 will turn on. Both bits would be on in this case. The low and low-low limits and alarms can be set to the same value if one "low" limit or alarm is desired to be used.



Hi/Low Alarm - Binary (HILOALB) (IB-401)

DS5	Used
HPP	N/A

Hi/Low Alarm - Binary monitors a binary (decimal) V-memory location and sets four possible alarm states, High-High, High, Low, and Low-Low whenever the IBox has power flow. You enter the alarm thresholds as constant K decimal values (K0-K65535) and/or binary (decimal) V-memory locations.



You must ensure that threshold limits are valid, that is HH >= H > L >= LL. Note that when the High-High or Low-Low alarm condition is true, that the High and Low alarms will also be set, respectively. This means you may use the same threshold limit and same alarm bit for the High-High and the High alarms in case you only need one "High" alarm. Also note that the boundary conditions are inclusive. That is, if the Low boundary is K50, and the Low-Low boundary is K10, and if the Monitoring Value equals 10, then the Low Alarm AND the Low-Low alarm will both be ON. If there is no power flow to the IBox, then all alarm bits will be turned off regardless of the value of the Monitoring Value parameter.

HILOALB Parameters

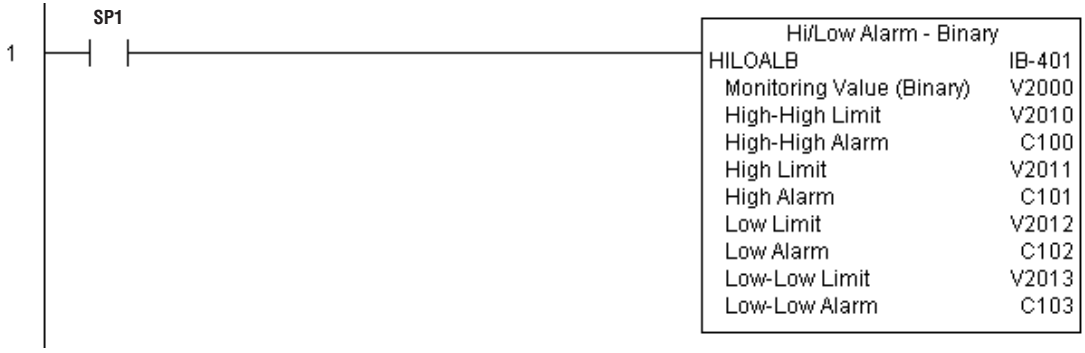
- Monitoring Value (Binary): specifies the V-memory location of the Binary value to be monitored
- High-High Limit: V-memory location or constant specifies the high-high alarm limit
- High-High Alarm: On when the high-high limit is reached
- High Limit: V-memory location or constant specifies the high alarm limit
- High Alarm: On when the high limit is reached
- Low Limit: V-memory location or constant specifies the low alarm limit
- Low Alarm: On when the low limit is reached
- Low-Low Limit: V-memory location or constant specifies the low-low alarm limit
- Low-Low Alarm: On when the low-low limit is reached

Parameter		DL05 Range
Monitoring Value (Binary)	V	See DL05 V-memory map - Data Words
High-High Limit	V, K	K0-65535; or see DL05 V-memory map - Data Words
High-High Alarm	X, Y, C, GX,GY, B	See DL05 V-memory map
High Limit	V, K	K0-65535; or see DL05 V-memory map - Data Words
High Alarm	X, Y, C, GX,GY, B	See DL05 V-memory map
Low Limit	V, K	K0-65535; or see DL05 V-memory map - Data Words
Low Alarm	X, Y, C, GX,GY,B	See DL05 V-memory map
Low-Low Limit	V, K	K0-65535; or see DL05 V-memory map - Data Words
Low-Low Alarm	X, Y, C, GX,GY, B	See DL05 V-memory map

HILOALB Example

In the following example, the HILOALB instruction is used to monitor a binary value that is in V2000. If the value in V2000 meets/exceeds the high limit of the binary value in V2011, C101 will turn on. If the value continues to increase to meet/exceed the high-high limit value in V2010, C100 will turn on. Both bits would be on in this case. The high and high-high limits and alarms can be set to the same V-memory location/value if one "high" limit or alarm is desired to be used.

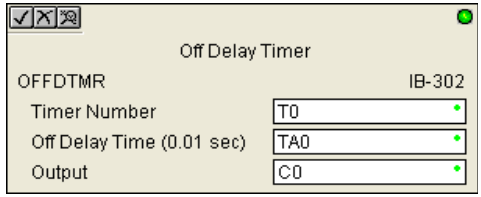
If the value in V2000 meets or falls below the low limit of the binary value in V2012, C102 will turn on. If the value continues to decrease to meet or fall below the low-low limit in V2013, C103 will turn on. Both bits would be on in this case. The low and low-low limits and alarms can be set to the same V-memory location/value if one "low" limit or alarm is desired to be used.



Off Delay Timer (OFFDTMR) (IB-302)

DS5	Used
HPP	N/A

Off Delay Timer will delay the "turning off" of the Output parameter by the specified Off Delay Time (in hundredths of a second) based on the power flow into the IBox. Once the IBox receives power, the Output bit will turn on immediately. When the power flow to the IBox turns off, the Output bit WILL REMAIN ON for the specified amount of time (in hundredths of a second). Once the Off Delay Time has expired, the output will turn Off. If the power flow to the IBox comes back on BEFORE the Off Delay Time, then the timer is RESET and the Output will remain On - so you must continuously have NO power flow to the IBox for AT LEAST the specified Off Delay Time before the Output will turn Off.



This IBox utilizes a Timer resource (TMRF), which cannot be used anywhere else in your program.

OFFDTMR Parameters

- Timer Number: specifies the Timer(TMRF) number which is used by the OFFDTMR instruction
- Off Delay Time (0.01sec): specifies how long the Output will remain on once power flow to the Ibox is removed
- Output: specifies the output that will be delayed "turning off" by the Off Delay Time.

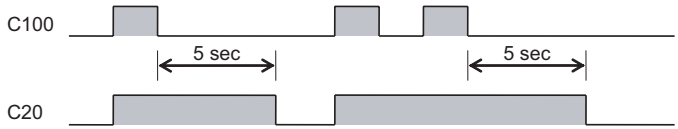
Parameter		DL05 Range
Timer Number	T	T0-177
Off Delay Time	K,V	K0-9999; See DL05 V-memory map - Data Words
Output	X, Y, C, GX,GY, B	See DL05 V-memory map

OFFDTMR Example

In the following example, the OFFDTMR instruction is used to delay the "turning off"of output C20. Timer 2 (T2) is set to 5 seconds, the "off-delay" period.

When C100 turns on, C20 turns on and will remain on while C100 is on. When C100 turns off, C20 will remain for the specified Off Delay Time (5s), and then turn off.

Example timing diagram

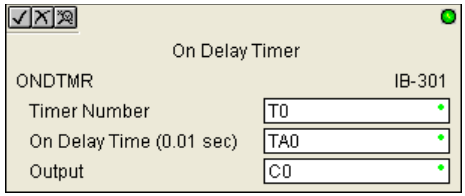


On Delay Timer (ONDTMR) (IB-301)

DS5	Used
HPP	N/A

On Delay Timer will delay the "turning on" of the Output parameter by the specified amount of time (in hundredths of a second) based on the power flow into the IBox. Once the IBox loses power, the Output is turned off immediately. If the power flow turns off BEFORE the On Delay Time, then the timer is RESET and the Output is never turned on, so you must have continuous power flow to the IBox for at least the specified On Delay Time before the Output turns On.

This IBox utilizes a Timer resource (TMRF), which cannot be used anywhere else in your program.



ONDTMR Parameters

- Timer Number: specifies the Timer(TMRF) number which is used by the ONDTMR instruction
- On Delay Time (0.01sec): specifies how long the Output will remain on once power flow to the Ibox is removed
- Output: specifies the output that will be delayed "turning on" by the On Delay Time.

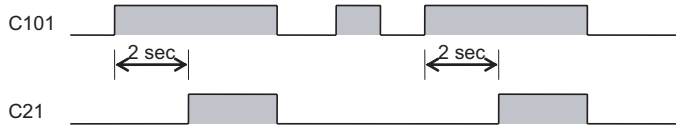
Parameter		DL05 Range
Timer Number	T	T0-177
On Delay Time	K,V	K0-9999; See DL05 V-memory map - Data Words
Output	X, Y, C, GX,GY, B	See DL05 V-memory map

ONDTMR Example

In the following example, the ONDTMR instruction is used to delay the "turning on" of output C21. Timer 1 (T1) is set to 2 seconds, the "on-delay" period.

When C101 turns on, C21 is delayed turning on by 2 seconds. When C101 turns off, C21 turns off immediately.

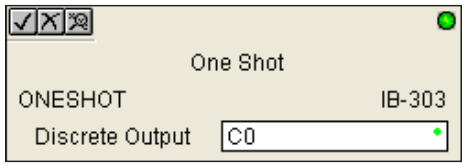
Example timing diagram



One Shot (ONESHOT) (IB-303)

DS5	Used
HPP	N/A

One Shot will turn on the given bit output parameter for one scan on an OFF to ON transition of the power flow into the IBox. This IBox is simply a different name for the PD Coil (Positive Differential).



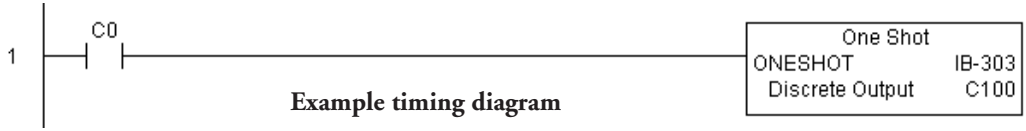
ONESHOT Parameters

- Discrete Output: specifies the output that will be on for one scan

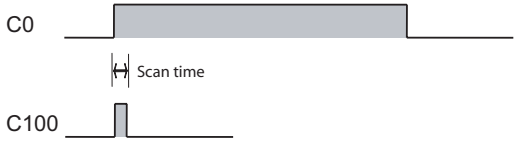
Parameter		DL05 Range
Discrete Output	X, Y, C	See DL05 V-memory map

ONESHOT Example

In the following example, the ONESHOT instruction is used to turn C100 on for one PLC scan after C0 goes from an off to on transition. The input logic must produce an off to on transition to execute the One Shot instruction.



Example timing diagram



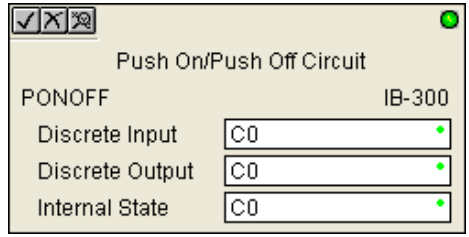
Push On / Push Off Circuit (PONOFF) (IB-300)

DS5	Used
HPP	N/A

Push On/Push Off Circuit toggles an output state whenever its input power flow transitions from off to on. Requires an extra bit parameter for scan-to-scan state information. This extra bit must NOT be used anywhere else in the program. This is also known as a "flip-flop circuit".

PONOFF Parameters

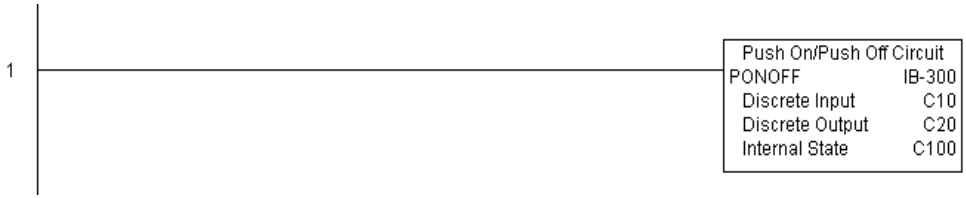
- Discrete Input: specifies the input that will toggle the specified output
- Discrete Output: specifies the output that will be "turned on/off" or toggled
- Internal State: specifies a work bit that is used by the instruction



Parameter		DL05 Range
Discrete Input	X,Y,C,S,T,CT,GX,GY,SP,B,PB	See DL05 V-memory map
Discrete Output	X,Y,C,GX,GY,B	See DL05 V-memory map
Internal State	X, Y, C	See DL05 V-memory map

PONOFF Example

In the following example, the PONOFF instruction is used to control the on and off states of the output C20 with a single input C10. When C10 is pressed once, C20 turns on. When C10 is pressed again, C20 turns off. C100 is an internal bit used by the instruction.



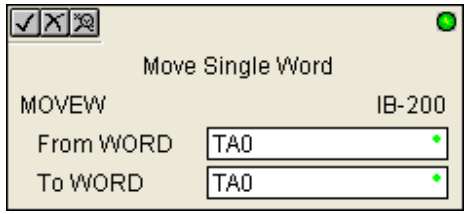
Move Single Word (MOVEW) (IB-200)

DS5	Used
HPP	N/A

Move Single Word moves (copies) a word to a memory location directly or indirectly via a pointer, either as a HEX constant, from a memory location, or indirectly through a pointer.

MOVEW Parameters

- From WORD: specifies the word that will be moved to another location
- To WORD: specifies the location where the "From WORD" will be move to



Parameter		DL05 Range
From WORD	V,P,K	K0-FFFF; See DL05 V-memory map - Data Words
To WORD	V,P	See DL05 V-memory map - Data Words

MOVEW Example

In the following example, the MOVEW instruction is used to move 16-bits of data from V2000 to V3000 when C100 turns on.

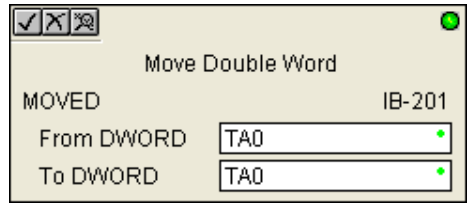
Move Double Word (MOVED) (IB-201)

DS5	Used
HPP	N/A

Move Double Word moves (copies) a double word to two consecutive memory locations directly or indirectly via a pointer, either as a double HEX constant, from a double memory location, or indirectly through a pointer to a double memory location.

MOVED Parameters

- From DWORD: specifies the double word that will be moved to another location
- To DWORD: specifies the location where the "From DWORD" will be moved to.



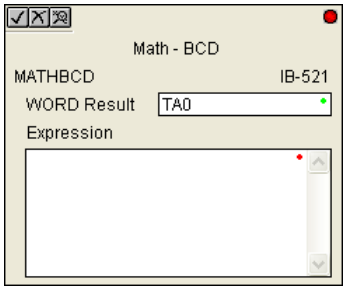
Parameter		DL05 Range
From DWORD	V,P,K	K0-FFFFFFFF; See DL05 V-memory map - Data Words
To DWORD	V,P	See DL05 V-memory map - Data Words

MOVED Example

In the following example, the MOVED instruction is used to move 32-bits of data from V2000 and V2001 to V3000 and V3001 when C100 turns on.

Math - BCD (MATHBCD) (IB-521)

DS5	Used
HPP	N/A



Math - BCD Format lets you enter complex mathematical expressions like you would in Visual Basic, Excel, or C++ to do complex calculations, nesting parentheses up to 4 levels deep. In addition to + - * /, you can do Modulo (% aka Remainder), Bit-wise And (&) Or (|) Xor (^), and some BCD functions - Convert to BCD (BCD), Convert to Binary (BIN), BCD Complement (BCDCPL), Convert from Gray Code (GRAY), Invert Bits (INV), and BCD/HEX to Seven Segment Display (SEG).

Example: ((V2000 + V2001) / (V2003 - K100)) * GRAY(V3000 & K001F)

Every V-memory reference MUST be to a single word BCD formatted value. Intermediate results can go up to 32-bit values, but as long as the final result fits in a 16-bit BCD word, the calculation is valid. Typical example of this is scaling using multiply then divide, (V2000 * K1000) / K4095. The multiply term most likely will exceed 9999 but fits within 32 bits. The divide operation will divide 4095 into the 32-bit accumulator, yielding a result that will always fit in 16 bits.

You can reference binary V-memory values by using the BCD conversion function on a V-memory location but NOT an expression. That is BCD(V2000) is okay and will convert V2000 from Binary to BCD, but BCD(V2000 + V3000) will add V2000 as BCD, to V3000 as BCD, then interpret the result as Binary and convert it to BCD - NOT GOOD.

Also, the final result is a 16-bit BCD number and so you could do BIN around the entire operation to store the result as Binary.

MATHBCD Parameters

- WORD Result: specifies the location where the BCD result of the mathematical expression will be placed (result must fit into 16 bit single V-memory location)
- Expression: specifies the mathematical expression to be executed and the result is stored in specified WORD Result. Each V-memory location used in the expression must be in BCD format.

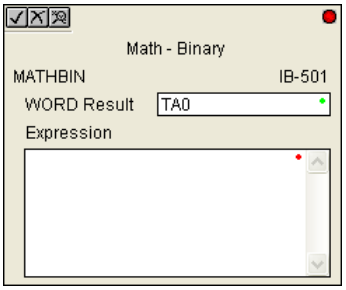
Parameter		DL05 Range
WORD Result	V	See DL05 V-memory map - Data Words
Expression		Text

MATHBCD Example

In the following example, the MATHBCD instruction is used to calculate the math expression which multiplies the BCD value in V1200 by 1000 then divides by 4095 and loads the resulting value in V2000.

Math - Binary (MATHBIN) (IB-501)

DS5	Used
HPP	N/A



Math - Binary Format lets you enter complex mathematical expressions like you would in Visual Basic, Excel, or C++ to do complex calculations, nesting parentheses up to 4 levels deep. In addition to + - * /, you can do Modulo (% aka Remainder), Shift Right (>>) and Shift Left (<<), Bit-wise And (&) Or (|) Xor (^), and some binary functions - Convert to BCD (BCD), Convert to Binary (BIN), Decode Bits (DECO), Encode Bits (ENCO), Invert Bits (INV), HEX to Seven Segment Display (SEG), and Sum Bits (SUM).

Example: ((V2000 + V2001) / (V2003 - K10)) * SUM(V3000 & K001F)

Every V-memory reference MUST be to a single word binary formatted value. Intermediate results can go up to 32-bit values, but as long as the final result fits in a 16 bit binary word, the calculation is valid. Typical example of this is scaling using multiply then divide, (V2000 * K1000) / K4095. The multiply term most likely will exceed 65535 but fits within 32 bits. The divide operation will divide 4095 into the 32-bit accumulator, yielding a result that will always fit in 16 bits.

You can reference BCD V-memory values by using the BIN conversion function on a V-memory location but NOT an expression. That is, BIN(V2000) is okay and will convert V2000 from BCD to Binary, but BIN(V2000 + V3000) will add V2000 as Binary, to V3000 as Binary, then interpret the result as BCD and convert it to Binary - NOT GOOD.

Also, the final result is a 16-bit binary number and so you could do BCD around the entire operation to store the result as BCD.

MATHBIN Parameters

- WORD Result: specifies the location where the binary result of the mathematical expression will be placed (result must fit into 16-bit single V-memory location)
- Expression: specifies the mathematical expression to be executed and the result is stored in specified WORD Result. Each V-memory location used in the expression must be in binary format.

Parameter		DL05 Range
WORD Result	V	See DL05 V-memory map - Data Words
Expression		Text

MATHBIN Example

In the following example, the MATHBIN instruction is used to calculate the math expression which multiplies the Binary value in V1200 by 1000 then divides by 4095 and loads the resulting value in V2000.

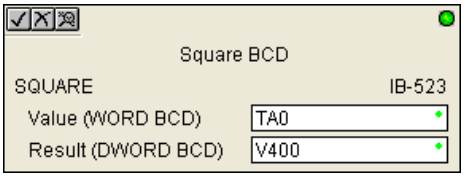
Square BCD (SQUARE) (IB-523)

DS5	Used
HPP	N/A

Square BCD squares the given 4-digit WORD BCD number and writes it in as an 8-digit DWORD BCD result.

SQUARE Parameters

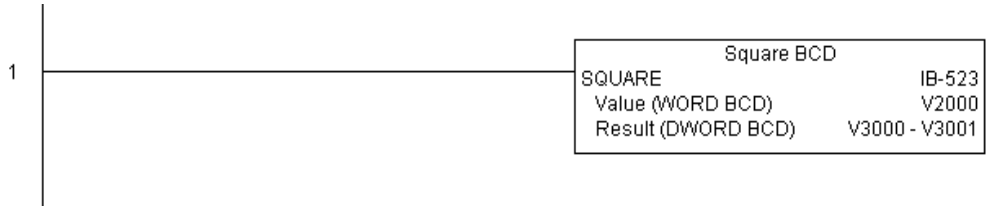
- Value (WORD BCD): specifies the BCD Word or constant that will be squared
- Result (DWORD BCD): specifies the location where the squared DWORD BCD value will be placed



Parameter		DL05 Range
Value (WORD BCD)	V,P,K	K0-9999 ; See DL05 V-memory map - Data Words
Result (DWORD BCD)	V	See DL05 V-memory map - Data Words

SQUARE Example

In the following example, the SQUARE instruction is used to square the 4-digit BCD value in V2000 and store the 8-digit double word BCD result in V3000 and V3001



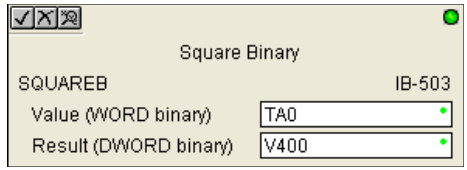
Square Binary (SQUAREB) (IB-503)

DS5	Used
HPP	N/A

Square Binary squares the given 16-bit WORD Binary number and writes it as a 32-bit DWORD Binary result.

SQUAREB Parameters

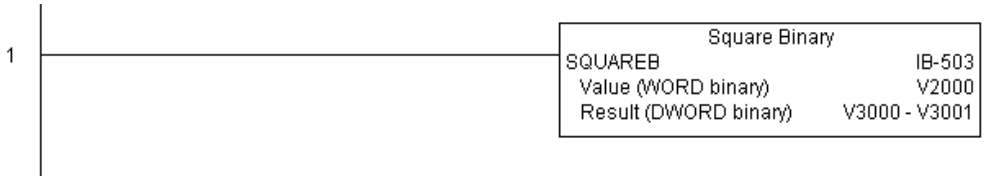
- Value (WORD Binary): specifies the binary Word or constant that will be squared
- Result (DWORD Binary): specifies the location where the squared DWORD binary value will be placed



Parameter		DL05 Range
Value (WORD Binary)	V,P,K	K0-65535; See DL05 V-memory map - Data Words
Result (DWORD Binary)	V	See DL05 V-memory map - Data Words

SQUAREB Example

In the following example, the SQUAREB instruction is used to square the single word Binary value in V2000 and store the 8-digit double word Binary result in V3000 and V3001.



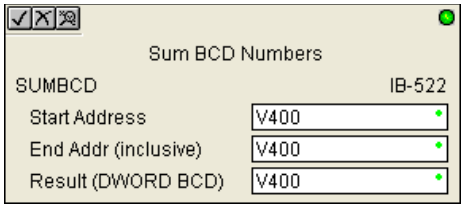
Sum BCD Numbers (SUMBCD) (IB-522)

DS5	Used
HPP	N/A

Sum BCD Numbers sums up a list of consecutive 4-digit WORD BCD numbers into an 8-digit DWORD BCD result.

You specify the group's starting and ending V- memory addresses (inclusive). When enabled, this instruction will add up all the numbers in the group (so you may want to place a differential contact driving the enable).

SUMBCD could be used as the first part of calculating an average.



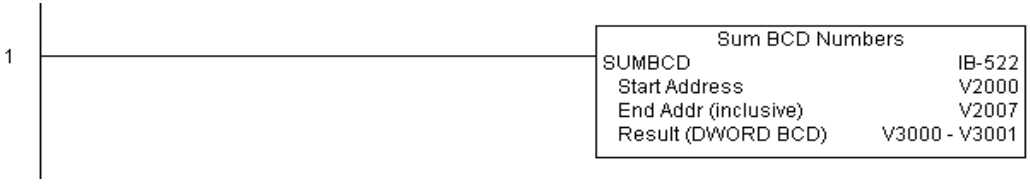
SUMBCD Parameters

- Start Address: specifies the starting address of a block of V-memory location values to be added together (BCD)
- End Addr (inclusive): specifies the ending address of a block of V-memory location values to be added together (BCD)
- Result (DWORD BCD): specifies the location where the sum of the block of V-memory BCD values will be placed.

Parameter		DL05 Range
Start Address	V	See DL05 V-memory map - Data Words
End Address (inclusive)	V	See DL05 V-memory map - Data Words
Result (DWORD BCD)	V	See DL05 V-memory map - Data Words

SUMBCD Example

In the following example, the SUMBCD instruction is used to total the sum of all BCD values in words V2000 thru V2007 and store the resulting 8-digit double word BCD value in V3000 and V3001.



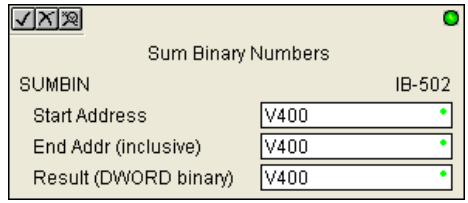
Sum Binary Numbers (SUMBIN) (IB-502)

DS5	Used
HPP	N/A

Sum Binary Numbers sums up a list of consecutive 16-bit WORD Binary numbers into a 32-bit DWORD binary result.

You specify the group's starting and ending V- memory addresses (inclusive). When enabled, this instruction will add up all the numbers in the group (so you may want to place a differential contact driving the enable).

SUMBIN could be used as the first part of calculating an average.



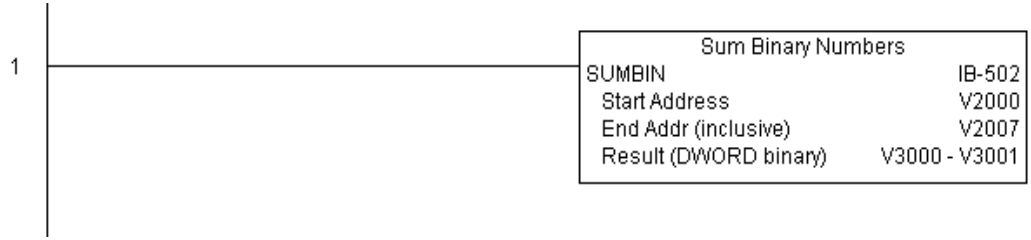
SUMBIN Parameters

- Start Address: specifies the starting address of a block of V-memory location values to be added together (Binary)
- End Addr (inclusive): specifies the ending address of a block of V-memory location values to be added together (Binary)
- Result (DWORD Binary): specifies the location where the sum of the block of V-memory binary values will be placed

Parameter		DL05 Range
Start Address	V	See DL05 V-memory map - Data Words
End Address (inclusive)	V	See DL05 V-memory map - Data Words
Result (DWORD Binary)	V	See DL05 V-memory map - Data Words

SUMBIN Example

In the following example, the SUMBIN instruction is used to total the sum of all Binary values in words V2000 thru V2007 and store the resulting 8-digit double word Binary value in V3000 and V3001.

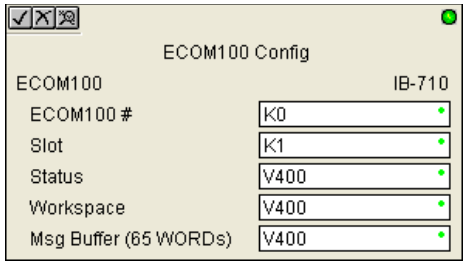


ECOM100 Configuration (ECOM100) (IB-710)

DS5	Used
HPP	N/A

ECOM100 Configuration defines all the common information for one specific ECOM100 module which is used by the other ECOM100 IBoxes; for example, ECRX - ECOM100 Network Read , ECEMAIL - ECOM100 Send EMail, ECIPSUP - ECOM100 IP Setup, etc.

You MUST have the ECOM100 Configuration IBox at the top of your ladder/ stage program with any other configuration IBoxes. The Message Buffer parameter specifies the starting address of a 65 WORD buffer. This is 101 Octal addresses (e.g. V1400 thru V1500).



If you have more than one ECOM100 in your PLC, you must have a different ECOM100 Configuration IBox for EACH ECOM100 module in your system that utilizes any ECOM IBox instructions.

The Workspace and Status parameters and the entire Message Buffer are internal, private registers used by the ECOM100 Configuration IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

In order for MOST ECOM100 IBoxes to function, you must turn ON dip switch 7 on the ECOM100 circuit board. You can keep dip switch 7 off if you are ONLY using ECOM100 Network Read and Write IBoxes (ECRX, ECWX).

ECOM100 Parameters

- ECOM100#: this is a logical number associated with this specific ECOM100 module in the specified slot. All other ECxxxx IBoxes that need to reference this ECOM100 module must reference this logical number
- Slot: specifies the option slot the module occupies
- Status: specifies a V-memory location that will be used by the instruction
- Workspace: specifies a V-memory location that will be used by the instruction
- Msg Buffer: specifies the starting address of a 65 word buffer that will be used by the module for configuration

Parameter		DL05 Range
ECOM100#	K	K0-255
Slot	K	K1-4
Status	V	See DL05 V-memory map - Data Words
Workspace	V	See DL05 V-memory map - Data Words
Msg Buffer (65 words used)	V	See DL05 V-memory map - Data Words

ECOM100 Example

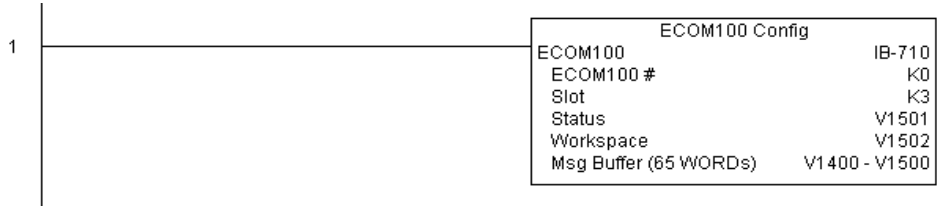
The ECOM100 Config IBox coordinates all of the interaction with other ECOM100 based IBoxes (ECxxxx). You must have an ECOM100 Config IBox for each ECOM100 module in your system. Configuration IBoxes must be at the top of your program and must execute every scan.

This IBox defines ECOM100# K0 to be in slot 3. Any ECOM100 IBoxes that need to reference this specific module (such as ECEMAIL, ECRX, ...) would enter K0 for their ECOM100# parameter.

The Status register is for reporting any completion or error information to other ECOM100 IBoxes. This V-memory register must not be used anywhere else in the entire program.

The Workspace register is used to maintain state information about the ECOM100, along with proper sharing and interlocking with the other ECOM100 IBoxes in the program. This V-memory register must not be used anywhere else in the entire program.

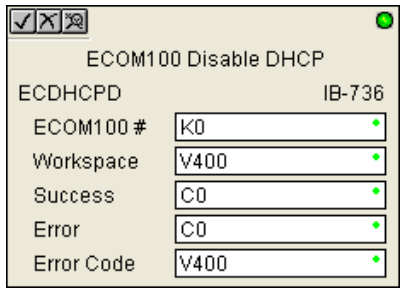
The Message Buffer of 65 words (130 bytes) is a common pool of memory that is used by other ECOM100 IBoxes (such as ECEMAIL). This way, you can have a bunch of ECEMAIL IBoxes, but only need 1 common buffer for generating and sending each EMail. These V-memory registers must not be used anywhere else in your entire program.



ECOM100 Disable DHCP (ECDHCPD) (IB-736)

DS5	Used
HPP	N/A

ECOM100 Disable DHCP will setup the ECOM100 to use its internal TCP/IP settings on a leading edge transition to the IBox. To configure the ECOM100's TCP/IP settings manually, use the NetEdit3 utility, or you can do it programmatically from your PLC program using the ECOM100 IP Setup (ECIPSUP), or the individual ECOM100 IBoxes: ECOM Write IP Address (ECWRIP), ECOM Write Gateway Address (ECWRGWA), and ECOM100 Write Subnet Mask (ECWRSNM).



The Workspace parameter is an internal, private register used by this IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Either the Success or Error bit parameter will turn on once the command is complete. If there is an error, the Error Code parameter will report an ECOM100 error code (less than 100), or a PLC logic error (greater than 1000).

The "Disable DHCP" setting is stored in Flash-ROM in the ECOM100 and the execution of this IBox will disable the ECOM100 module for at least a half second until it writes the Flash-ROM. Therefore, it is HIGHLY RECOMMENDED that you only execute this IBox ONCE, on second scan. Since it requires a LEADING edge to execute, use a NORMALLY CLOSED SP0 (STR NOT First Scan) to drive the power flow to the IBox.

In order for this ECOM100 IBox to function, you must turn ON dip switch 7 on the ECOM100 circuit board.

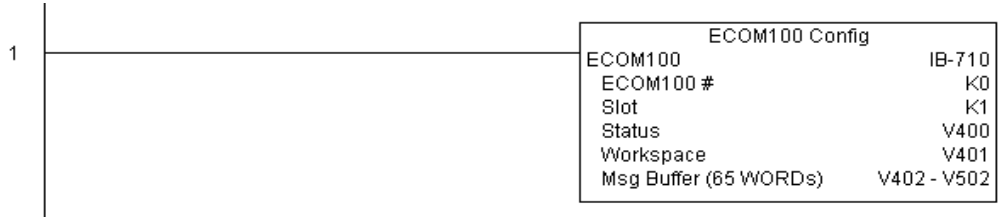
ECDHCPD Parameters

- ECOM100#: this is a logical number associated with this specific ECOM100 module in the specified slot. All other ECxxxx IBoxes that need to reference this ECOM100 module must reference this logical number
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the request is completed successfully
- Error: specifies a bit that will turn on if the instruction is not successfully completed
- Error Code: specifies the location where the Error Code will be written

Parameter		DL05 Range
ECOM100#	K	K0-255
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map
Error Code	V	See DL05 V-memory map - Data Words

ECDHCPD Example

Rung 1: The ECOM100 Config IBox is responsible for coordination/interlocking of all ECOM100 type IBoxes for one specific ECOM100 module. Tag the ECOM100 in slot 1 as ECOM100# K0. All other ECxxxx IBoxes refer to this module # as K0. If you need to move the module in the base to a different slot, then you only need to change this one IBox. V400 is used as a global result status register for the other ECxxxx IBoxes using this specific ECOM100 module. V401 is used to coordinate/interlock the logic in all of the other ECxxxx IBoxes using this specific ECOM100 module. V402-V502 is a common 130 byte buffer available for use by the other ECxxxx IBoxes using this specific ECOM100 module.



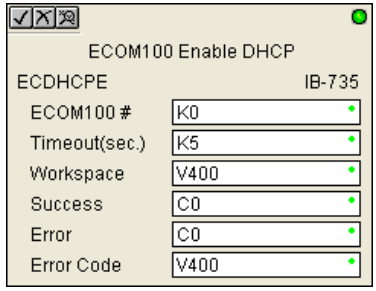
Rung 2: On the 2nd scan, disable DHCP in the ECOM100. DHCP is the same protocol used by PCs for using a DHCP Server to automatically assign the ECOM100's IP Address, Gateway Address, and Subnet Mask. Typically disabling DHCP is done by assigning a hard-coded IP Address either in NetEdit or using one of the ECOM100 IP Setup IBoxes, but this IBox allows you to disable DHCP in the ECOM100 using your ladder program. The ECDHCPD is leading edge triggered, not power-flow driven (similar to a counter input leg). The command to disable DHCP will be sent to the ECOM100 whenever the power flow into the IBox goes from OFF to ON. If successful, turn on C100. If there is a failure, turn on C101. If it fails, you can look at V2000 for the specific error code.

ECOM100 Enable DHCP (ECDHCPE) (IB-735)

DS5	Used
HPP	N/A

ECOM100 Enable DHCP will tell the ECOM100 to obtain its TCP/IP setup from a DHCP Server on a leading edge transition to the IBox.

The IBox will be successful once the ECOM100 has received its TCP/IP settings from the DHCP server. Since it is possible for the DHCP server to be unavailable, a Timeout parameter is provided so the IBox can complete, but with an Error (Error Code = 1004 decimal).



See also the ECOM100 IP Setup (ECIPSUP) IBox 717 to directly setup ALL of the TCP/IP parameters in a single instruction - IP Address, Subnet Mask, and Gateway Address.

The Workspace parameter is an internal, private register used by this IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Either the Success or Error bit parameter will turn on once the command is complete. If there is an error, the Error Code parameter will report an ECOM100 error code (less than 100), or a PLC logic error (greater than 1000).

The "Enable DHCP" setting is stored in Flash-ROM in the ECOM100 and the execution of this IBox will disable the ECOM100 module for at least a half second until it writes the Flash-ROM. Therefore, it is HIGHLY RECOMMENDED that you only execute this IBox ONCE, on second scan. Since it requires a LEADING edge to execute, use a NORMALLY CLOSED SP0 (STR NOT First Scan) to drive the power flow to the IBox.

In order for this ECOM100 IBox to function, you must turn ON dip switch 7 on the ECOM100 circuit board.

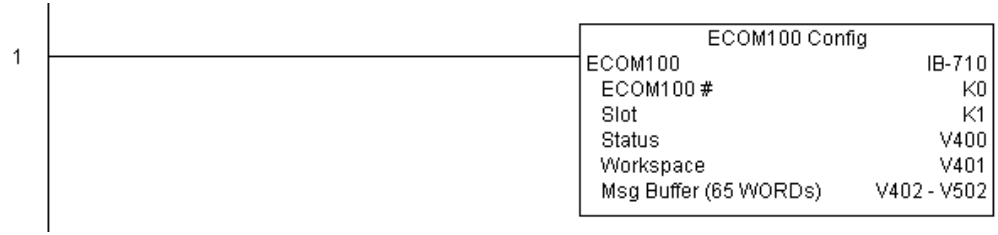
ECDHCPE Parameters

- ECOM100#: this is a logical number associated with this specific ECOM100 module in the specified slot. All other ECxxxx IBoxes that need to reference this ECOM100 module must reference this logical number
- Timeout(sec): specifies a timeout period so that the instruction may have time to complete
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the request is completed successfully
- Error: specifies a bit that will turn on if the instruction is not successfully completed
- Error Code: specifies the location where the Error Code will be written

Parameter		DL05 Range
ECOM100#	K	K0-255
Timeout (sec)	K	K5-127
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map
Error Code	V	See DL05 V-memory map - Data Words

ECDHCPE Example

Rung 1: The ECOM100 Config IBox is responsible for coordination/interlocking of all ECOM100 type IBoxes for one specific ECOM100 module. Tag the ECOM100 in slot 1 as ECOM100# K0. All other ECxxxx IBoxes refer to this module # as K0. If you need to move the module in the base to a different slot, then you only need to change this one IBox. V400 is used as a global result status register for the other ECxxxx IBoxes using this specific ECOM100 module. V401 is used to coordinate/interlock the logic in all of the other ECxxxx IBoxes using this specific ECOM100 module. V402-V502 is a common 130 byte buffer available for use by the other ECxxxx IBoxes using this specific ECOM100 module.



Rung 2: On the 2nd scan, enable DHCP in the ECOM100. DHCP is the same protocol used by PCs for using a DHCP Server to automatically assign the ECOM100's IP Address, Gateway Address, and Subnet Mask. Typically this is done using NetEdit, but this IBox allows you to enable DHCP in the ECOM100 using your ladder program. The ECDHCPE is leading edge triggered, not power-flow driven (similar to a counter input leg). The commands to enable DHCP will be sent to the ECOM100 whenever the power flow into the IBox goes from OFF to ON. The ECDHCPE does more than just set the bit to enable DHCP in the ECOM100, but it then polls the ECOM100 once every second to see if the ECOM100 has found a DHCP server and has a valid IP Address. Therefore, a timeout parameter is needed in case the ECOM100 cannot find a DHCP server. If a timeout does occur, the Error bit will turn on and the error code will be 1005 decimal. The Success bit will turn on only if the ECOM100 finds a DHCP Server and is assigned a valid IP Address. If successful, turn on C100. If there is a failure, turn on C101. If it fails, you can look at V2000 for the specific error code.

ECOM100 Query DHCP Setting (ECDHCPQ) (IB-734)

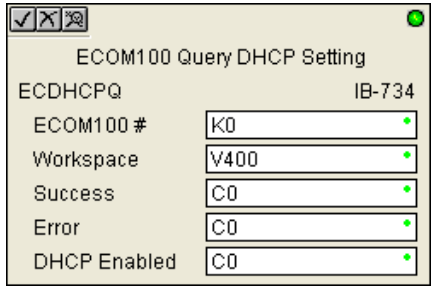
DS5	Used
HPP	N/A

ECOM100 Query DHCP Setting will determine if DHCP is enabled in the ECOM100 on a leading edge transition to the IBox. The DHCP Enabled bit parameter will be ON if DHCP is enabled, OFF if disabled.

The Workspace parameter is an internal, private register used by this IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Either the Success or Error bit parameter will turn on once the command is complete.

In order for this ECOM100 IBox to function, you must turn ON dip switch 7 on the ECOM100 circuit board.



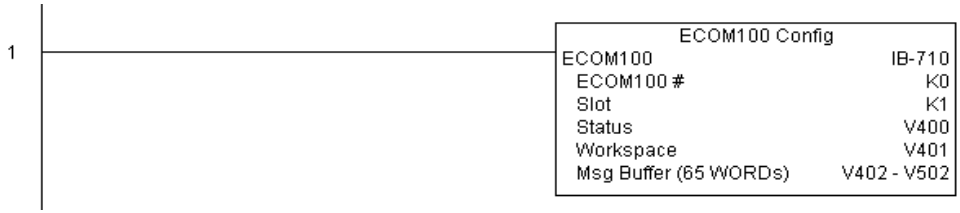
ECDHCPQ Parameters

- ECOM100#: this is a logical number associated with this specific ECOM100 module in the specified slot. All other ECxxxx IBoxes that need to reference this ECOM100 module must reference this logical number
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the instruction is completed successfully
- Error: specifies a bit that will turn on if the instruction is not successfully completed
- DHCP Enabled: specifies a bit that will turn on if the ECOM100's DHCP is enabled or remain off if disabled - after instruction query, be sure to check the state of the Success/ Error bit state along with DHCP Enabled bit state to confirm a successful module query

Parameter		DL05 Range
ECOM100#	K	K0-255
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map
DHCP Enabled	X,Y,C,GX,GY,B	See DL05 V-memory map

ECDHCPQ Example

Rung 1: The ECOM100 Config IBox is responsible for coordination/interlocking of all ECOM100 type IBoxes for one specific ECOM100 module. Tag the ECOM100 in slot 1 as ECOM100# K0. All other ECxxxx IBoxes refer to this module # as K0. If you need to move the module in the base to a different slot, then you only need to change this one IBox. V400 is used as a global result status register for the other ECxxxx IBoxes using this specific ECOM100 module. V401 is used to coordinate/interlock the logic in all of the other ECxxxx IBoxes using this specific ECOM100 module. V402-V502 is a common 130 byte buffer available for use by the other ECxxxx IBoxes using this specific ECOM100 module.

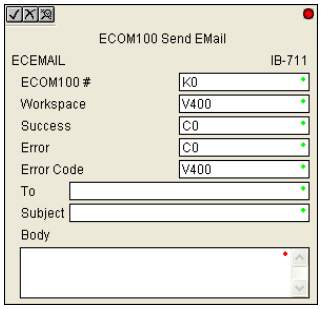


Rung 2: On the 2nd scan, read whether DHCP is enabled or disabled in the ECOM100 and store it in C5. DHCP is the same protocol used by PCs for using a DHCP Server to automatically assign the ECOM100's IP Address, Gateway Address, and Subnet Mask. The ECDHCPQ is leading edge triggered, not power-flow driven (similar to a counter input leg). The command to read (Query) whether DHCP is enabled or not will be sent to the ECOM100 whenever the power flow into the IBox goes from OFF to ON. If successful, turn on C100. If there is a failure, turn on C101.

ECOM100 Send E-mail (ECEMAIL) (IB-711)

DS5	Used
HPP	N/A

ECOM100 Send EMail, on a leading edge transition, will behave as an EMail client and send an SMTP request to your SMTP Server to send the EMail message to the EMail addresses in the To: field and also to those listed in the Cc: list hard coded in the ECOM100. It will send the SMTP request based on the specified ECOM100#, which corresponds to a specific unique ECOM100 Configuration (ECOM100) at the top of your program.



The Body: field supports what the PRINT and VPRINT instructions support for text and embedded variables, allowing you to embed real-time data in your EMail (e.g. “V2000 = “ V2000:B).

The Workspace parameter is an internal, private register used by this IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Either the Success or Error bit parameter will turn on once the request is complete. If there is an error, the Error Code parameter will report an ECOM100 error code (less than 100), an SMPT protocol error (between 100 and 999), or a PLC logic error (greater than 1000).

Since the ECOM100 is only an EMail Client and requires access to an SMTP Server, you MUST have the SMTP parameters configured properly in the ECOM100 via the ECOM100’s Home Page and/or the EMail Setup instruction (ECEMSUP). To get to the ECOM100’s Home Page, use your favorite Internet browser and browse to the ECOM100’s IP Address, e.g. http://192.168.12.86

You are limited to approximately 100 characters of message data for the entire instruction, including the To: Subject: and Body: fields. To save space, the ECOM100 supports a hard coded list of EMail addresses for the Carbon Copy field (cc:) so that you can configure those IN the ECOM100, and keep the To: field small (or even empty), to leave more room for the Subject: and Body: fields.

In order for this ECOM100 IBox to function, you must turn ON dip switch 7 on the ECOM100 circuit board.

ECEMAIL Parameters

- ECOM100#: this is a logical number associated with this specific ECOM100 module in the specified slot. All other ECxxxx IBoxes that need to reference this ECOM100 module must reference this logical number
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the request is completed successfully
- Error: specifies a bit that will turn on if the instruction is not successfully completed
- Error Code: specifies the location where the Error Code will be written
- To: specifies an E-mail address that the message will be sent to
- Subject: subject of the e-mail message
- Body: supports what the PRINT and VPRINT instructions support for text and embedded variables, allowing you to embed real-time data in the EMail message

Parameter		DL05 Range
ECOM100#	K	K0-255
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map
Error Code	V	See DL05 V-memory map
To:		Text
Subject:		Text
Body:		See PRINT and VPRINT instructions

ECEMAIL Decimal Status Codes

This list of status codes is based on the list in the *ECOM100 Mock Slave Address 89 Command Specification.*

ECOM100 Status codes can be classified into four different areas based on its **decimal** value:

ECOM100 Status Codes Areas	
0-1	Normal Status - no error
2-99	Internal ECOM100 errors
100-999	Standard TCP/IP protocol errors (SMTP, HTTP, etc.)
1000+	IBox ladder logic assigned errors (SP Slot Error, etc.)

For the ECOM100 Send EMail IBox, the status codes below are specific to this IBox:

Normal Status 0 - 1

ECOM100 Send EMAIL IBOX Status Codes	
0-1	Success - ECEMAIL completed successfully
1	Busy - ECEMAIL IBoxlogic sets the Error register to this value when the ECEMAIL starts a new request

Internal ECOM100 Errors (2-99)

Internal ECOM100 100 Errors (2-99)	
10-19	Timeout Errors- last digit shows where in ECOM100's SMTP state logic the timeout occured; regardless of the last digit, the SMTP conversation with the SMTPServer timed out
	SMTP Internal Errors (20-29)
20	TCP Write Error
21	No Sendee
22	Invalid State
23	Invalid Data
24	Invalid SMTP Configuration
25	Memory Allocation Error

ECEMAIL IBox Ladder Logic Assigned Errors (1000+)

Internal ECOM100 100 Errors (2-99)	
10-19	SP SLot Error - The SP error bit for the ECOM100's slot turned on. Possibly using RX or WX instructions on the ECOM100 and walking on the ECEMAIL execution. User should use ECRX and ECWX IBoxes.

ECEMAIL IBox Ladder Logic Assigned Errors (1000+)

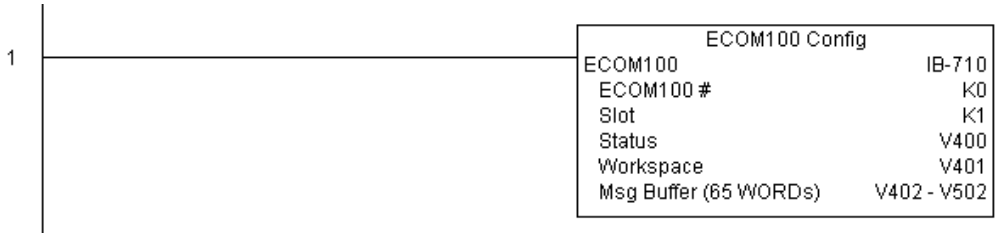
SMTP Protocol Errors - SMTP (100-999)	
1xx	***Informational replies***
2xx	***Success replies***
200	(Non-standard success response.)
211	System Status, or system help reply
214	Help message
220	<domain> Service ready - Ready to start TLS
221	<domain> Service closing transmission channel
*250	OK, queuing for node <node> started Requested mail action okay, completed
251	OK, no messages waiting for node <node> User not local will to <forward-path>
252	OK, pending messages for node <node> started Cannot VRFY (e.g. info is not local), but will take message for this user and attempt delivery
253	OK, message pending messages for node <node> started
3xx	***(re)direction replies***
354	Start mail input; end with <CRLF> <CRLF>
355	Octet-offset is the transaction offset
4xx	***Client / request error replies***
421	<domain> Service not available, closing transmission channel
432	A password transition is needed
450	Requested mail action not taken: mailbox unavailable ATRN request refused
451	Requested action aborted: local error in processing Unable to process ATRN request now
452	Requested action not taken: insufficient system storage
453	You have no mail
454	TLS not available due to temporary reason - Encryption required for requested authentication mechanism
458	Unable to queue messages for node <node>
459	Node <node> not allowed: <reason>
5xx	***Server / process error replies***
500	Syntax error, command unrecognized Syntax error
501	Syntax error in parameter or arguments
502	Command not implemented
NOTE: *250 is success in SMTP. **ECOM100 reports this as a status code of 0**, success.	

Continued on next page

SMTP Protocol Errors - SMTP (100-999) cont'd	
503	Bad sequence of commands
504	Command parameter not implemented
521	<domain> Does not accept mail
530	Access denied - Must issue a STARTTLS command first" Encryption required for requested authentication mechanism
534	Authentication mechanism too weak
538	Encryption required for requested authentication mechanism
550	Requested action not taken: mailbox unavailable
551	User not local; please try <forward path>
552	Requested mail action aborted: exceeded storage allocation
553	Requested action not taken: mailbox name not allowed
554	Transaction failed

ECEMAIL Example

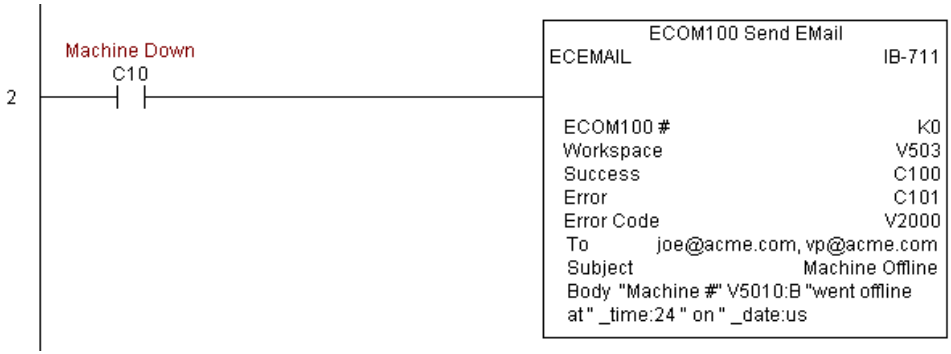
Rung 1: The ECOM100 Config IBox is responsible for coordination/interlocking of all ECOM100 type IBoxes for one specific ECOM100 module. Tag the ECOM100 in slot 1 as ECOM100# K0. All other ECxxxx IBoxes refer to this module # as K0. If you need to move the module in the base to a different slot, then you only need to change this one IBox. V400 is used as a global result status register for the other ECxxxx IBoxes using this specific ECOM100 module. V401 is used to coordinate/interlock the logic in all of the other ECxxxx IBoxes using this specific ECOM100 module. V402-V502 is a common 130 byte buffer available for use by the other ECxxxx IBoxes using this specific ECOM100 module.



Rung 2: When a machine goes down, send an email to Joe in maintenance and to the VP over production showing what machine is down along with the date/time stamp of when it went down.

The ECEMAIL is leading edge triggered, not power-flow driven (similar to a counter input leg). An email will be sent whenever the power flow into the IBox goes from OFF to ON. This helps prevent self inflicted spamming.

If the EMail is sent, turn on C100. If there is a failure, turn on C101. If it fails, you can look at V2000 for the SMTP error code or other possible error codes.

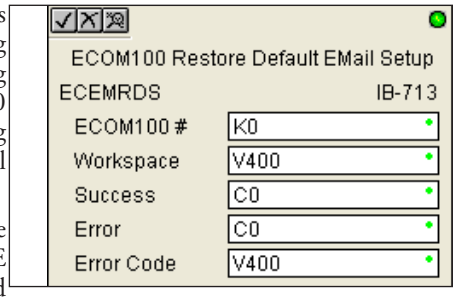


ECOM100 Restore Default E-mail Setup (ECEMRDS) (IB-713)

DS5	Used
HPP	N/A

ECOM100 Restore Default EMail Setup, on a leading edge transition, will restore the original EMail Setup data stored in the ECOM100 back to the working copy based on the specified ECOM100#, which corresponds to a specific unique ECOM100 Configuration (ECOM100) at the top of your program.

When the ECOM100 is first powered up, it copies the EMail setup data stored in ROM to the working copy in RAM. You can then modify this working copy from your program using the ECOM100 EMail Setup (ECEMSUP) IBox. After modifying the working copy, you can later restore the original setup data via your program by using this IBox.



The Workspace parameter is an internal, private register used by this IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Either the Success or Error bit parameter will turn on once the command is complete. If there is an error, the Error Code parameter will report an ECOM100 error code (less than 100), or a PLC logic error (greater than 1000).

In order for this ECOM100 IBox to function, you must turn ON dip switch 7 on the ECOM100 circuit board.

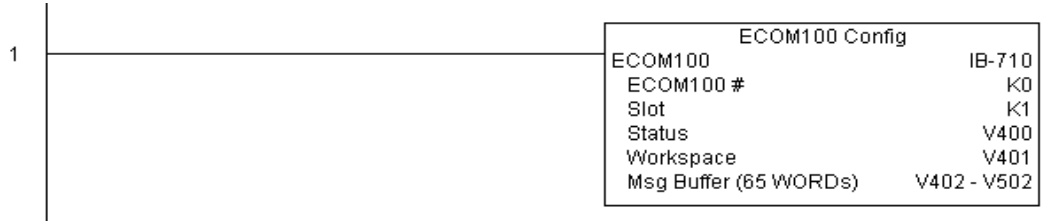
ECEMRDS Parameters

- ECOM100#: this is a logical number associated with this specific ECOM100 module in the specified slot. All other ECxxxx IBoxes that need to reference this ECOM100 module must reference this logical number
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the request is completed successfully
- Error: specifies a bit that will turn on if the instruction is not successfully completed
- Error Code: specifies the location where the Error Code will be written

Parameter		DL05 Range
ECOM100#	K	K0-255
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map
Error Code	V	See DL05 V-memory map - Data Words

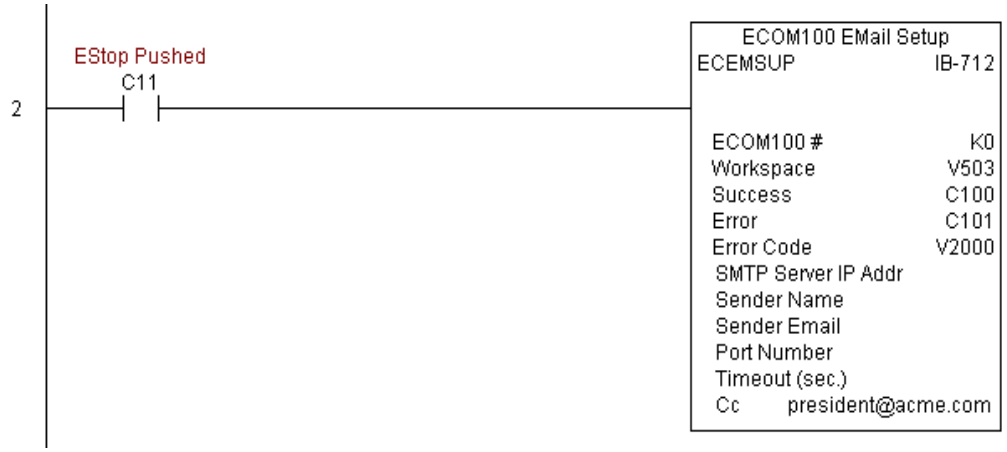
ECEMRDS Example

Rung 1: The ECOM100 Config IBox is responsible for coordination/interlocking of all ECOM100 type IBoxes for one specific ECOM100 module. Tag the ECOM100 in slot 1 as ECOM100# K0. All other ECxxxx IBoxes refer to this module # as K0. If you need to move the module in the base to a different slot, then you only need to change this one IBox. V400 is used as a global result status register for the other ECxxxx IBoxes using this specific ECOM100 module. V401 is used to coordinate/interlock the logic in all of the other ECxxxx IBoxes using this specific ECOM100 module. V402-V502 is a common 130 byte buffer available for use by the other ECxxxx IBoxes using this specific ECOM100 module.



Rung 2: Whenever an EStop is pushed, ensure that president of the company gets copies of all EMails being sent.

The ECOM100 EMail Setup IBox allows you to set/change the SMTP EMail settings stored in the ECOM100.

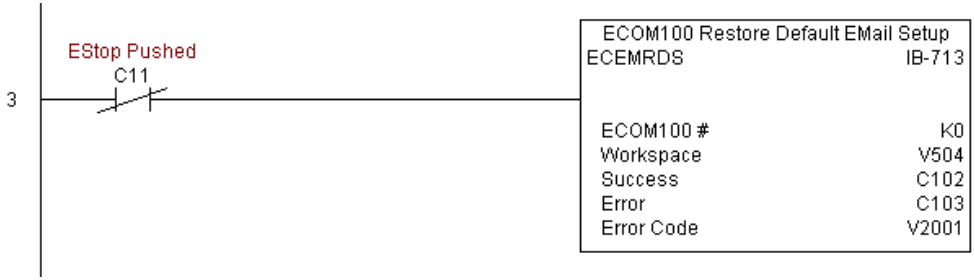


ECEMRDS Example

Rung 3: Once the EStop is pulled out, take the president off the cc: list by restoring the default EMail setup in the ECOM100.

The ECEMRDS is leading edge triggered, not power-flow driven (similar to a counter input leg). The ROM based EMail configuration stored in the ECOM100 will be copied over the "working copy" whenever the power flow into the IBox goes from OFF to ON (the working copy can be changed by using the ECEMSUP IBox).

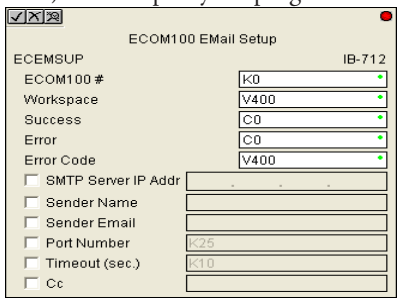
If successful, turn on C102. If there is a failure, turn on C103. If it fails, you can look at V2001 for the specific error code.



ECOM100 E-mail Setup (ECEMSUP) (IB-712)

DS5	Used
HPP	N/A

ECOM100 EMail Setup, on a leading edge transition, will modify the working copy of the EMail setup currently in the ECOM100 based on the specified ECOM100#, which corresponds to a specific unique ECOM100 Configuration (ECOM100) at the top of your program.



You may pick and choose any or all fields to be modified using this instruction. Note that these changes are cumulative: if you execute multiple ECOM100 EMail Setup IBoxes, then all of the changes are made in the order they are executed. Also note that you can restore the original ECOM100 EMail Setup that is stored in the ECOM100 to the working copy by using the ECOM100 Restore Default EMail Setup (ECEMRDS) IBox.

The Workspace parameter is an internal, private register used by this IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Either the Success or Error bit parameter will turn on once the command is complete. If there is an error, the Error Code parameter will report an ECOM100 error code (less than 100), or a PLC logic error (greater than 1000).

You are limited to approximately 100 characters/bytes of setup data for the entire instruction. So if needed, you could divide the entire setup across multiple ECEMSUP IBoxes on a field-by-field basis, for example do the Carbon Copy (cc:) field in one ECEMSUP IBox and the remaining setup parameters in another.

In order for this ECOM100 IBox to function, you must turn ON dip switch 7 on the ECOM100 circuit board.

ECEMSUP Parameters

- ECOM100#: this is a logical number associated with this specific ECOM100 module in the specified slot. All other ECxxxx IBoxes that need to reference this ECOM100 module must reference this logical number
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the request is completed successfully
- Error: specifies a bit that will turn on if the instruction is not successfully completed
- Error Code: specifies the location where the Error Code will be written
- SMTP Server IP Addr: optional parameter that specifies the IP Address of the SMTP Server on the ECOM100's network
- Sender Name: optional parameter that specifies the sender name that will appear in the "From:" field to those who receive the e-mail
- Sender EMail: optional parameter that specifies the sender EMail address that will appear in the "From:" field to those who receive the e-mail

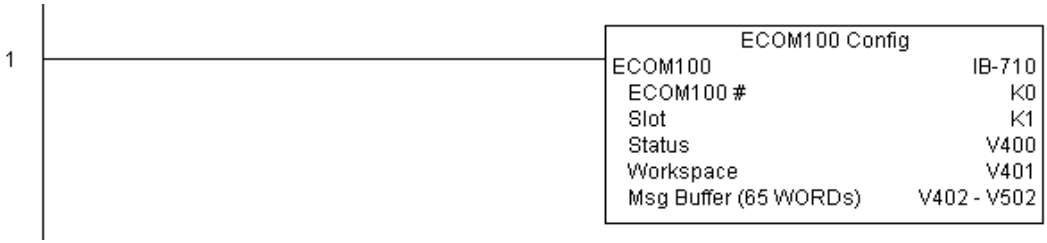
ECEMSUP Parameters

- Port Number: optional parameter that specifies the TCP/IP Port Number to send SMTP requests; usually this does not to be configured (see your network administrator for information on this setting)
- Timeout (sec): optional parameter that specifies the number of seconds to wait for the SMTP Server to send the EMail to all the recipients
- Cc: optional parameter that specifies a list of "carbon copy" Email addresses to send all EMails to.

Parameter		DL05 Range
ECOM100#	K	K0-255
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map
Error Code	V	See DL05 V-memory map - Data Words

ECEMSUP Example

Rung 1: The ECOM100 Config IBox is responsible for coordination/interlocking of all ECOM100 type IBoxes for one specific ECOM100 module. Tag the ECOM100 in slot 1 as ECOM100# K0. All other ECxxxx IBoxes refer to this module # as K0. If you need to move the module in the base to a different slot, then you only need to change this one IBox. V400 is used as a global result status register for the other ECxxxx IBoxes using this specific ECOM100 module. V401 is used to coordinate/interlock the logic in all of the other ECxxxx IBoxes using this specific ECOM100 module. V402-V502 is a common 130 byte buffer available for use by the other ECxxxx IBoxes using this specific ECOM100 module.



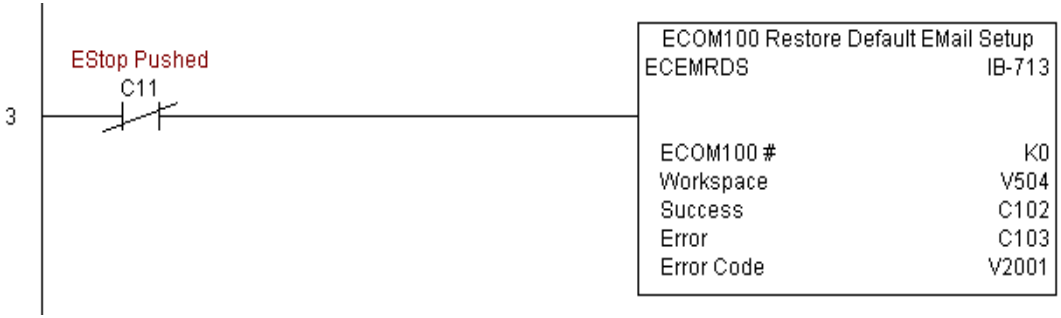
ECEMSUP Example

Rung 2: Whenever an EStop is pushed, ensure that president of the company gets copies of all EMails being sent.The ECOM100 EMail Setup IBox allows you to set/change the SMTP EMail settings stored in the ECOM100. The ECEMSUP is leading edge triggered, not power-flow driven (similar to a counter input leg). At power-up, the ROM based EMail configuration stored in the ECOM100 is copied to a RAM based "working copy". You can change this working copy by using the ECEMSUP IBox. To restore the original ROM based configuration, use the Restore Default EMail Setup ECEMRDS IBox.

If successful, turn on C100. If there is a failure, turn on C101. If it fails, you can look at V2000

for the specific error code.

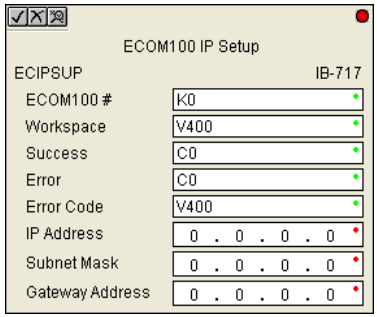
Rung 3: Once the EStop is pulled out, take the president off the cc: list by restoring the default EMail setup in the ECOM100.



ECOM100 IP Setup (ECIPSUP) (IB-717)

DS5	Used
HPP	N/A

ECOM100 IP Setup will configure the three TCP/IP parameters in the ECOM100: IP Address, Subnet Mask, and Gateway Address, on a leading edge transition to the IBox. The ECOM100 is specified by the ECOM100#, which corresponds to a specific unique ECOM100 Configuration (ECOM100) IBox at the top of your program.



The Workspace parameter is an internal, private register used by this IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Either the Success or Error bit parameter will turn on once the command is complete. If there is an error, the Error Code parameter will report an ECOM100 error code (less than 100), or a PLC logic error (greater than 1000).

This setup data is stored in Flash-ROM in the ECOM100 and will disable the ECOM100 module for at least a half second until it writes the Flash-ROM. Therefore, it is HIGHLY RECOMMENDED that you only execute this IBox ONCE on second scan. Since it requires a LEADING edge to execute, use a NORMALLY CLOSED SP0 (NOT First Scan) to drive the power flow to the IBox.

In order for this ECOM100 IBox to function, you must turn ON dip switch 7 on the ECOM100 circuit board.

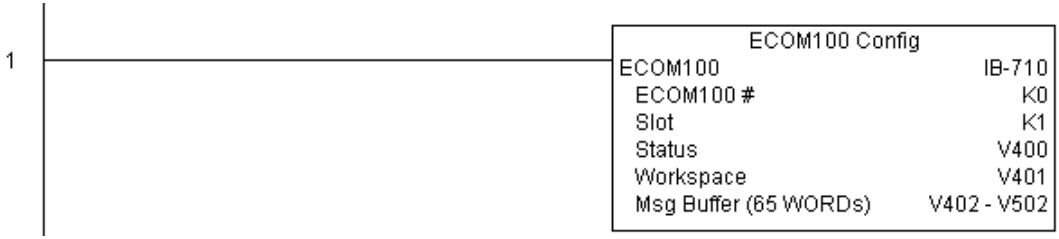
ECIPSUP Parameters

- ECOM100#: this is a logical number associated with this specific ECOM100 module in the specified slot. All other ECxxxx IBoxes that need to reference this ECOM100 module must reference this logical number
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the request is completed successfully
- Error: specifies a bit that will turn on if the instruction is not successfully completed
- Error Code: specifies the location where the Error Code will be written
- IP Address: specifies the module's IP Address
- Subnet Mask: specifies the Subnet Mask for the module to use
- Gateway Address: specifies the Gateway Address for the module to use

Parameter		DL05 Range
ECOM100#	K	K0-255
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map
Error Code	V	See DL05 V-memory map - Data Words
IP Address	IP Address	0.0.0.1. to 255.255.255.254
Subnet Mask Address	IP Address Mask	0.0.0.1. to 255.255.255.254
Gateway Address	IP Address	0.0.0.1. to 255.255.255.254

ECIPSUP Example

Rung 1: The ECOM100 Config IBox is responsible for coordination/interlocking of all ECOM100 type IBoxes for one specific ECOM100 module. Tag the ECOM100 in slot 1 as ECOM100# K0. All other ECxxxx IBoxes refer to this module # as K0. If you need to move the module in the base to a different slot, then you only need to change this one IBox. V400 is used as a global result status register for the other ECxxxx IBoxes using this specific ECOM100 module.V401 is used to coordinate/interlock the logic in all of the other ECxxxx IBoxes using this specific ECOM100 module. V402-V502 is a common 130 byte buffer available for use by the other ECxxxx IBoxes using this specific ECOM100 module.

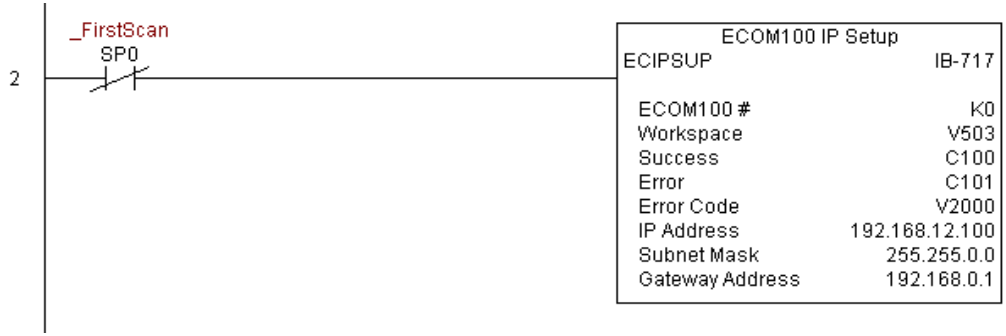


Rung 2: On the 2nd scan, configure all of the TCP/IP parameters in the ECOM100:

IP Address:	192.168. 12.100
Subnet Mask:	255.255. 0. 0
Gateway Address:	192.168. 0. 1

The ECIPSUP is leading edge triggered, not power-flow driven (similar to a counter input leg). The command to write the TCP/IP configuration parameters will be sent to the ECOM100 whenever the power flow into the IBox goes from OFF to ON.

If successful, turn on C100. If there is a failure, turn on C101. If it fails, you can look at V2000 for the specific error code.



ECOM100 Read Description (ECRDDES) (IB-726)

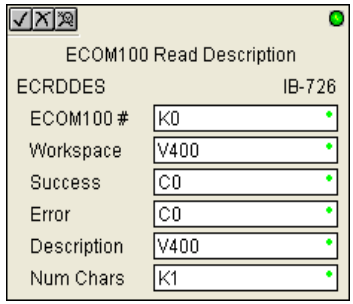
DS5	Used
HPP	N/A

ECOM100 Read Description will read the ECOM100's Description field up to the number of specified characters on a leading edge transition to the IBox.

The Workspace parameter is an internal, private register used by this IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Either the Success or Error bit parameter will turn on once the command is complete.

In order for this ECOM100 IBox to function, you must turn ON dip switch 7 on the ECOM100 circuit board.



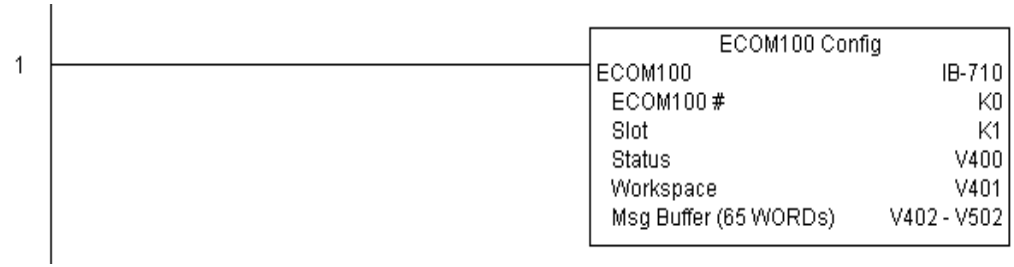
ECRDDES Parameters

- ECOM100#: this is a logical number associated with this specific ECOM100 module in the specified slot. All other ECxxxx IBoxes that need to reference this ECOM100 module must reference this logical number
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the request is completed successfully
- Error: specifies a bit that will turn on if the instruction is not successfully completed
- Description: specifies the starting buffer location where the ECOM100's Module Name will be placed
- Num Char: specifies the number of characters (bytes) to read from the ECOM100's Description field

Parameter		DL05 Range
ECOM100#	K	K0-255
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map
Description	V	See DL05 V-memory map - Data Words
Num Chars	K	K1-128

ECRDDES Example

Rung 1: The ECOM100 Config IBox is responsible for coordination/interlocking of all ECOM100 type IBoxes for one specific ECOM100 module. Tag the ECOM100 in slot 1 as ECOM100# K0. All other ECxxxx IBoxes refer to this module # as K0. If you need to move the module in the base to a different slot, then you only need to change this one IBox. V400 is used as a global result status register for the other ECxxxx IBoxes using this specific ECOM100 module.V401 is used to coordinate/interlock the logic in all of the other ECxxxx IBoxes using this specific ECOM100 module. V402-V502 is a common 130 byte buffer available for use by the other ECxxxx IBoxes using this specific ECOM100 module.



Rung 2: On the 2nd scan, read the Module Description of the ECOM100 and store it in V3000 thru V3007 (16 characters). This text can be displayed by an HMI.

The ECRDDES is leading edge triggered, not power-flow driven (similar to a counter input leg). The command to read the module description will be sent to the ECOM100 whenever the power flow into the IBox goes from OFF to ON.

If successful, turn on C100. If there is a failure, turn on C101.

ECOM100 Read Gateway Address (ECRDGWA) (IB-730)

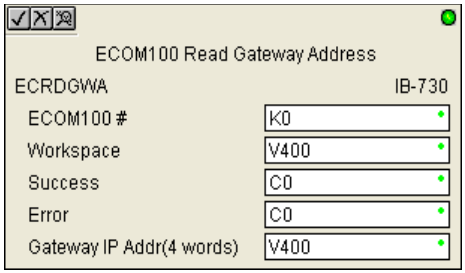
DS5	Used
HPP	N/A

ECOM100 Read Gateway Address will read the 4 parts of the Gateway IP address and store them in 4 consecutive V-memory locations in decimal format, on a leading edge transition to the IBox.

The Workspace parameter is an internal, private register used by this IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Either the Success or Error bit parameter will turn on once the command is complete.

In order for this ECOM100 IBox to function, you must turn ON dip switch 7 on the ECOM100 circuit board.



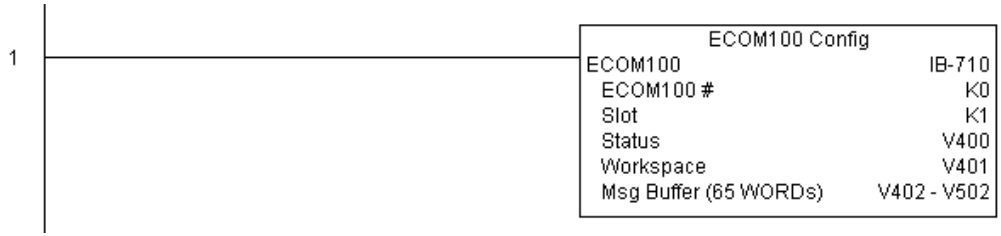
ECRDGWA Parameters

- ECOM100#: this is a logical number associated with this specific ECOM100 module in the specified slot. All other ECxxxx IBoxes that need to reference this ECOM100 module must reference this logical number
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the request is completed successfully
- Error: specifies a bit that will turn on if the instruction is not successfully completed
- Gateway IP Addr: specifies the starting address where the ECOM100's Gateway Address will be placed in 4 consecutive V-memory locations

Parameter		DL05 Range
ECOM100#	K	K0-255
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map
Gateway IP Address (4 Words)	V	See DL05 V-memory map - Data Words

ECRDGWA Example

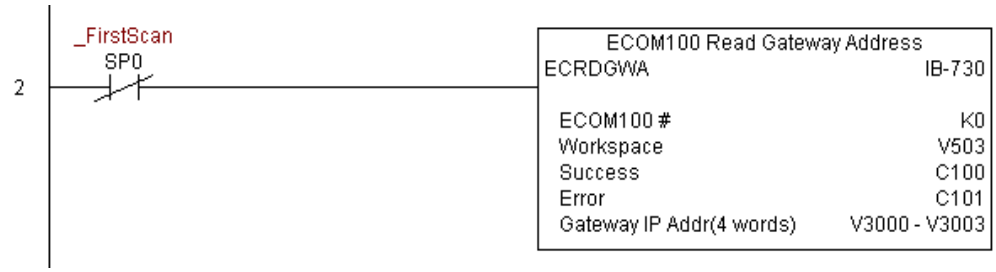
Rung 1: The ECOM100 Config IBox is responsible for coordination/interlocking of all ECOM100 type IBoxes for one specific ECOM100 module. Tag the ECOM100 in slot 1 as ECOM100# K0. All other ECxxxx IBoxes refer to this module # as K0. If you need to move the module in the base to a different slot, then you only need to change this one IBox. V400 is used as a global result status register for the other ECxxxx IBoxes using this specific ECOM100 module. V401 is used to coordinate/interlock the logic in all of the other ECxxxx IBoxes using this specific ECOM100 module. V402-V502 is a common 130 byte buffer available for use by the other ECxxxx IBoxes using this specific ECOM100 module.



Rung 2: On the 2nd scan, read the Gateway Address of the ECOM100 and store it in V3000 thru V3003 (4 decimal numbers). The ECOM100's Gateway Address could be displayed by an HMI.

The ECRDGWA is leading edge triggered, not power-flow driven (similar to a counter input leg). The command to read the Gateway Address will be sent to the ECOM100 whenever the power flow into the IBox goes from OFF to ON.

If successful, turn on C100. If there is a failure, turn on C101.



ECOM100 Read IP Address (ECRDIP) (IB-722)

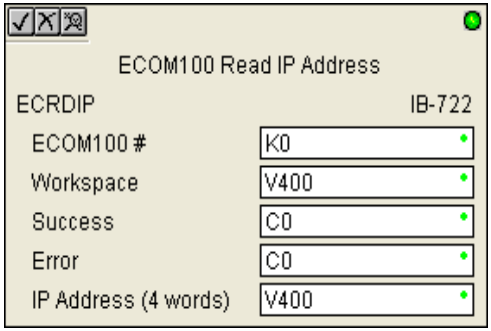
DS5	Used
HPP	N/A

ECOM100 Read IP Address will read the 4 parts of the IP address and store them in 4 consecutive V-memory locations in decimal format, on a leading edge transition to the IBox.

The Workspace parameter is an internal, private register used by this IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Either the Success or Error bit parameter will turn on once the command is complete.

In order for this ECOM100 IBox to function, you must turn ON dip switch 7 on the ECOM100 circuit board.



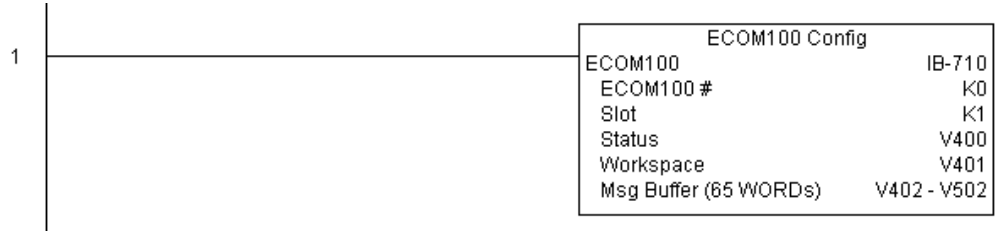
ECRDIP Parameters

- ECOM100#: this is a logical number associated with this specific ECOM100 module in the specified slot. All other ECxxxx IBoxes that need to reference this ECOM100 module must reference this logical number
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the request is completed successfully
- Error: specifies a bit that will turn on if the instruction is not successfully completed
- IP Address: specifies the starting address where the ECOM100's IP Address will be placed in 4 consecutive V-memory locations

Parameter		DL05 Range
ECOM100#	K	K0-255
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map
IP Address (4 Words)	V	See DL05 V-memory map - Data Words

ECRDIP Example

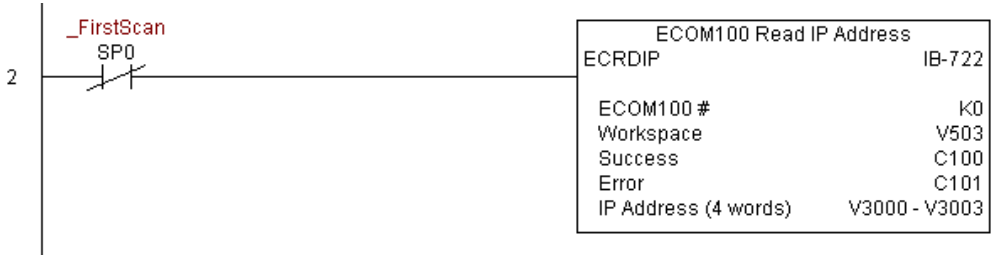
Rung 1: The ECOM100 Config IBox is responsible for coordination/interlocking of all ECOM100 type IBoxes for one specific ECOM100 module. Tag the ECOM100 in slot 1 as ECOM100# K0. All other ECxxxx IBoxes refer to this module # as K0. If you need to move the module in the base to a different slot, then you only need to change this one IBox. V400 is used as a global result status register for the other ECxxxx IBoxes using this specific ECOM100 module. V401 is used to coordinate/interlock the logic in all of the other ECxxxx IBoxes using this specific ECOM100 module. V402-V502 is a common 130 byte buffer available for use by the other ECxxxx IBoxes using this specific ECOM100 module.



Rung 2: On the 2nd scan, read the IP Address of the ECOM100 and store it in V3000 thru V3003 (4 decimal numbers). The ECOM100's IP Address could be displayed by an HMI.

The ECRDIP is leading edge triggered, not power-flow driven (similar to a counter input leg). The command to read the IP Address will be sent to the ECOM100 whenever the power flow into the IBox goes from OFF to ON.

If successful, turn on C100. If there is a failure, turn on C101.



ECOM100 Read Module ID (ECRDMID) (IB-720)

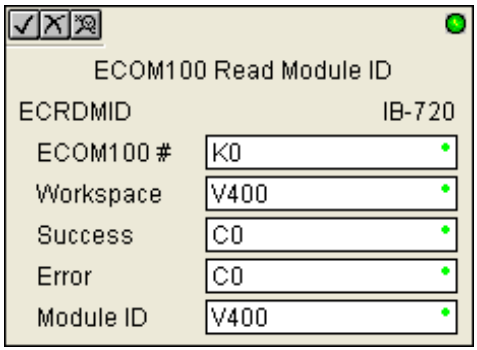
DS5	Used
HPP	N/A

ECOM100 Read Module ID will read the binary (decimal) WORD sized Module ID on a leading edge transition to the IBox.

The Workspace parameter is an internal, private register used by this IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Either the Success or Error bit parameter will turn on once the command is complete.

In order for this ECOM100 IBox to function, you must turn ON dip switch 7 on the ECOM100 circuit board.



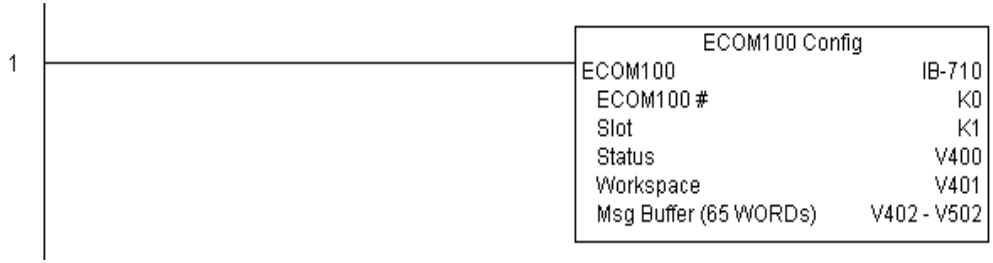
ECRDMID Parameters

- ECOM100#: this is a logical number associated with this specific ECOM100 module in the specified slot. All other ECxxxx IBoxes that need to reference this ECOM100 module must reference this logical number
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the request is completed successfully
- Error: specifies a bit that will turn on if the instruction is not successfully completed
- Module ID: specifies the location where the ECOM100's Module ID (decimal) will be placed

Parameter		DL05 Range
ECOM100#	K	K0-255
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map
Module ID	V	See DL05 V-memory map - Data Words

ECRDMID Example

Rung 1: The ECOM100 Config IBox is responsible for coordination/interlocking of all ECOM100 type IBoxes for one specific ECOM100 module. Tag the ECOM100 in slot 1 as ECOM100# K0. All other ECxxxx IBoxes refer to this module # as K0. If you need to move the module in the base to a different slot, then you only need to change this one IBox. V400 is used as a global result status register for the other ECxxxx IBoxes using this specific ECOM100 module.V401 is used to coordinate/interlock the logic in all of the other ECxxxx IBoxes using this specific ECOM100 module. V402-V502 is a common 130 byte buffer available for use by the other ECxxxx IBoxes using this specific ECOM100 module.



Rung 2: On the 2nd scan, read the Module ID of the ECOM100 and store it in V2000.

The ECRDMID is leading edge triggered, not power-flow driven (similar to a counter input leg). The command to read the module ID will be sent to the ECOM100 whenever the power flow into the IBox goes from OFF to ON.

If successful, turn on C100. If there is a failure, turn on C101.

ECOM100 Read Module Name (ECRDNAM) (IB-724)

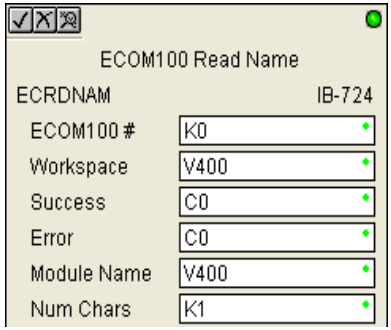
DS5	Used
HPP	N/A

ECOM100 Read Name will read the Module Name up to the number of specified characters on a leading edge transition to the IBox.

The Workspace parameter is an internal, private register used by this IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Either the Success or Error bit parameter will turn on once the command is complete.

In order for this ECOM100 IBox to function, you must turn ON dip switch 7 on the ECOM100 circuit board.



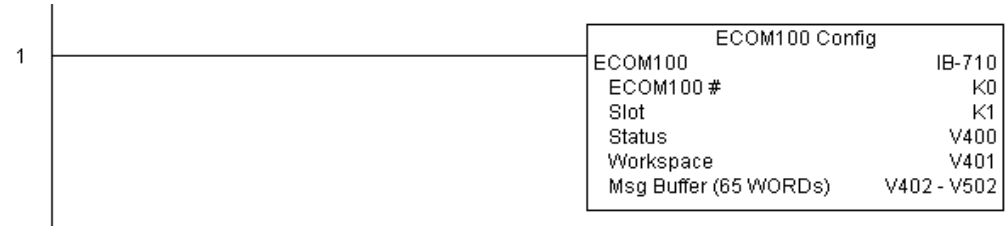
ECRDNAM Parameters

- ECOM100#: this is a logical number associated with this specific ECOM100 module in the specified slot. All other ECxxxx IBoxes that need to reference this ECOM100 module must reference this logical number
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the request is completed successfully
- Error: specifies a bit that will turn on if the instruction is not successfully completed
- Module Name: specifies the starting buffer location where the ECOM100's Module Name will be placed
- Num Chars: specifies the number of characters (bytes) to read from the ECOM100's Name field

Parameter		DL05 Range
ECOM100#	K	K0-255
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map
Module Name	V	See DL05 V-memory map - Data Words
Num Chars	K	K1-128

ECRDNAM Example

Rung 1: The ECOM100 Config IBox is responsible for coordination/interlocking of all ECOM100 type IBoxes for one specific ECOM100 module. Tag the ECOM100 in slot 1 as ECOM100# K0. All other ECxxxx IBoxes refer to this module # as K0. If you need to move the module in the base to a different slot, then you only need to change this one IBox. V400 is used as a global result status register for the other ECxxxx IBoxes using this specific ECOM100 module. V401 is used to coordinate/interlock the logic in all of the other ECxxxx IBoxes using this specific ECOM100 module. V402-V502 is a common 130 byte buffer available for use by the other ECxxxx IBoxes using this specific ECOM100 module.



Rung 2: On the 2nd scan, read the Module Name of the ECOM100 and store it in V3000 thru V3003 (8 characters). This text can be displayed by an HMI.

The ECRDNAM is leading edge triggered, not power-flow driven (similar to a counter input leg). The command to read the module name will be sent to the ECOM100 whenever the power flow into the IBox goes from OFF to ON.

If successful, turn on C100. If there is a failure, turn on C101.

ECOM100 Read Subnet Mask (ECRDSNM) (IB-732)

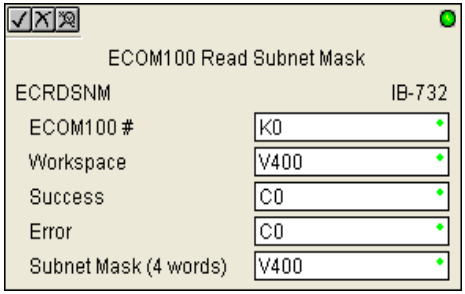
DS5	Used
HPP	N/A

ECOM100 Read Subnet Mask will read the 4 parts of the Subnet Mask and store them in 4 consecutive V-memory locations in decimal format, on a leading edge transition to the IBox.

The Workspace parameter is an internal, private register used by this IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Either the Success or Error bit parameter will turn on once the command is complete.

In order for this ECOM100 IBox to function, you must turn ON dip switch 7 on the ECOM100 circuit board.



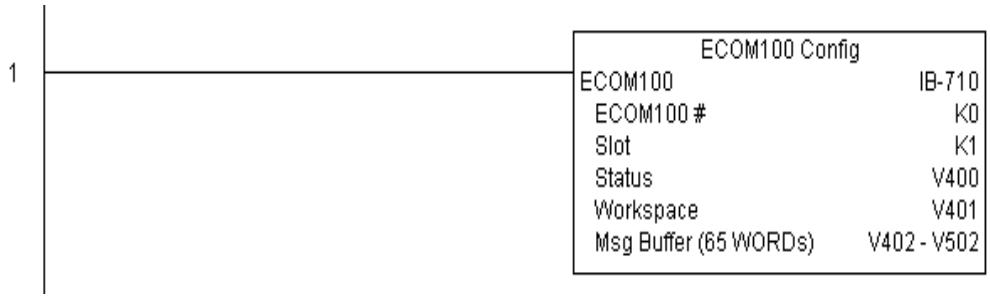
ECRDSNM Parameters

- ECOM100#: this is a logical number associated with this specific ECOM100 module in the specified slot. All other ECxxxx IBoxes that need to reference this ECOM100 module must reference this logical number
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the request is completed successfully
- Error: specifies a bit that will turn on if the instruction is not successfully completed
- Subnet Mask: specifies the starting address where the ECOM100's Subnet Mask will be placed in 4 consecutive V-memory locations

Parameter		DL05 Range
ECOM100#	K	K0-255
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map
Subnet Mask (4 Words)	V	See DL05 V-memory map - Data Words

ECRDSNM Example

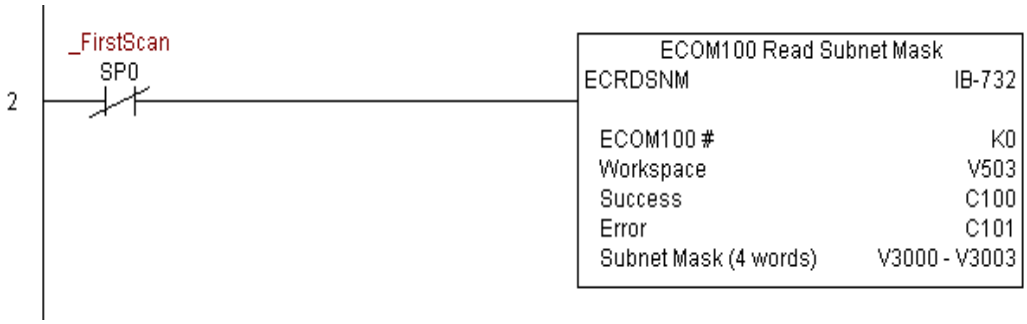
Rung 1: The ECOM100 Config IBox is responsible for coordination/interlocking of all ECOM100 type IBoxes for one specific ECOM100 module. Tag the ECOM100 in slot 1 as ECOM100# K0. All other ECxxxx IBoxes refer to this module # as K0. If you need to move the module in the base to a different slot, then you only need to change this one IBox. V400 is used as a global result status register for the other ECxxxx IBoxes using this specific ECOM100 module. V401 is used to coordinate/interlock the logic in all of the other ECxxxx IBoxes using this specific ECOM100 module. V402-V502 is a common 130 byte buffer available for use by the other ECxxxx IBoxes using this specific ECOM100 module.



Rung 2: On the 2nd scan, read the Subnet Mask of the ECOM100 and store it in V3000 thru V3003 (4 decimal numbers). The ECOM100's Subnet Mask could be displayed by an HMI.

The ECRDSNM is leading edge triggered, not power-flow driven (similar to a counter input leg). The command to read the Subnet Mask will be sent to the ECOM100 whenever the power flow into the IBox goes from OFF to ON.

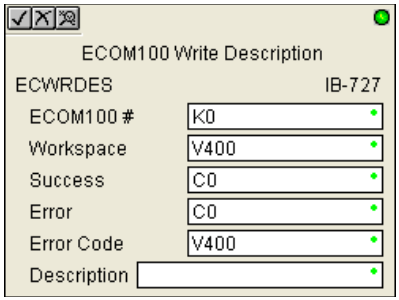
If successful, turn on C100. If there is a failure, turn on C101.



ECOM100 Write Description (ECWRDES) (IB-727)

DS5	Used
HPP	N/A

ECOM100 Write Description will write the given Description to the ECOM100 module on a leading edge transition to the IBox. If you use a dollar sign ($) or double quote (“), use the PRINT/VPRINT escape sequence of TWO dollar signs ($$) for a single dollar sign or dollar sign-double quote ($”) for a double quote character.



The Workspace parameter is an internal, private register used by this IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Either the Success or Error bit parameter will turn on once the command is complete. If there is an error, the Error Code parameter will report an ECOM100 error code (less than 100), or a PLC logic error (greater than 1000).

The Description is stored in Flash-ROM in the ECOM100 and the execution of this IBox will disable the ECOM100 module for at least a half second until it writes the Flash-ROM. Therefore, it is HIGHLY RECOMMENDED that you only execute this IBox ONCE on second scan. Since it requires a LEADING edge to execute, use a NORMALLY CLOSED SP0 (STR NOT First Scan) to drive the power flow to the IBox.

In order for this ECOM100 IBox to function, you must turn ON dip switch 7 on the ECOM100 circuit board.

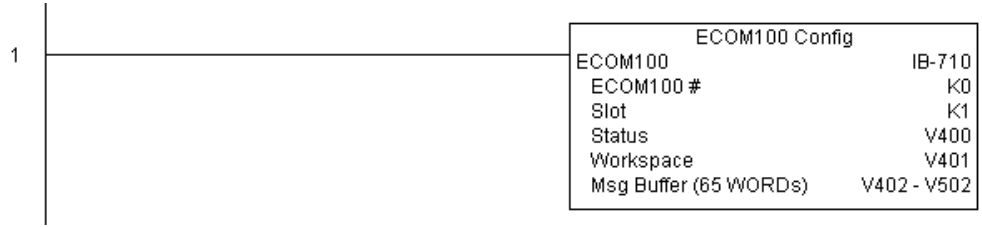
ECWRDES Parameters

- ECOM100#: this is a logical number associated with this specific ECOM100 module in the specified slot. All other ECxxxx IBoxes that need to reference this ECOM100 module must reference this logical number
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the request is completed successfully
- Error: specifies a bit that will turn on if the instruction is not successfully completed
- Error Code: specifies the location where the Error Code will be written
- Description: specifies the Description that will be written to the module

Parameter		DL05 Range
ECOM100#	K	K0-255
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map
Error Code	V	See DL05 V-memory map - Data Words
Description		Text

ECWRDES Example

Rung 1: The ECOM100 Config IBox is responsible for coordination/interlocking of all ECOM100 type IBoxes for one specific ECOM100 module. Tag the ECOM100 in slot 1 as ECOM100# K0. All other ECxxxx IBoxes refer to this module # as K0. If you need to move the module in the base to a different slot, then you only need to change this one IBox. V400 is used as a global result status register for the other ECxxxx IBoxes using this specific ECOM100 module. V401 is used to coordinate/interlock the logic in all of the other ECxxxx IBoxes using this specific ECOM100 module. V402-V502 is a common 130 byte buffer available for use by the other ECxxxx IBoxes using this specific ECOM100 module.



Rung 2: On the 2nd scan, set the Module Description of the ECOM100. Typically this is done using NetEdit, but this IBox allows you to configure the module description in the ECOM100 using your ladder program.

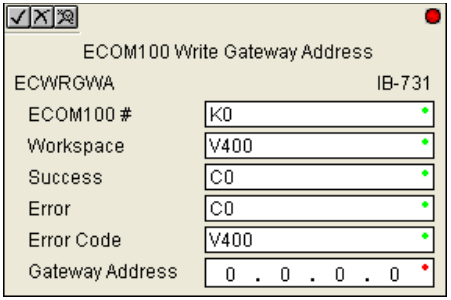
The EWRDES is leading edge triggered, not power-flow driven (similar to a counter input leg). The command to write the module description will be sent to the ECOM100 whenever the power flow into the IBox goes from OFF to ON.

If successful, turn on C100. If there is a failure, turn on C101. If it fails, you can look at V2000 for the specific error code.

ECOM100 Write Gateway Address (ECWRGWA) (IB-731)

DS5	Used
HPP	N/A

ECOM100 Write Gateway Address will write the given Gateway IP Address to the ECOM100 module on a leading edge transition to the IBox. See also ECOM100 IP Setup (ECIPSUP) IBox 717 to setup ALL of the TCP/IP parameters in a single instruction - IP Address, Subnet Mask, and Gateway Address.



The Workspace parameter is an internal, private register used by this IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Either the Success or Error bit parameter will turn on once the command is complete. If there is an error, the Error Code parameter will report an ECOM100 error code (less than 100), or a PLC logic error (greater than 1000).

The Gateway Address is stored in Flash-ROM in the ECOM100 and the execution of this IBox will disable the ECOM100 module for at least a half second until it writes the Flash-ROM. Therefore, it is HIGHLY RECOMMENDED that you only execute this IBox ONCE, on second scan. Since it requires a LEADING edge to execute, use a NORMALLY CLOSED SP0 (STR NOT First Scan) to drive the power flow to the IBox.

In order for this ECOM100 IBox to function, you must turn ON dip switch 7 on the ECOM100 circuit board.

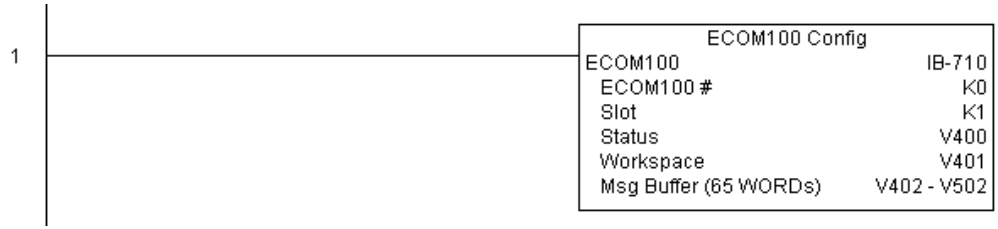
ECWRGWA Parameters

- ECOM100#: this is a logical number associated with this specific ECOM100 module in the specified slot. All other ECxxxx IBoxes that need to reference this ECOM100 module must reference this logical number
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the request is completed successfully
- Error: specifies a bit that will turn on if the instruction is not successfully completed
- Error Code: specifies the location where the Error Code will be written
- Gateway Address: specifies the Gateway IP Address that will be written to the module

Parameter		DL05 Range
ECOM100#	K	K0-255
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map
Error Code	V	See DL05 V-memory map - Data Words
Gateway Address		0.0.0.1. to 255.255.255.254

ECWRGWA Example

Rung 1: The ECOM100 Config IBox is responsible for coordination/interlocking of all ECOM100 type IBoxes for one specific ECOM100 module. Tag the ECOM100 in slot 1 as ECOM100# K0. All other ECxxxx IBoxes refer to this module # as K0. If you need to move the module in the base to a different slot, then you only need to change this one IBox. V400 is used as a global result status register for the other ECxxxx IBoxes using this specific ECOM100 module. V401 is used to coordinate/interlock the logic in all of the other ECxxxx IBoxes using this specific ECOM100 module. V402-V502 is a common 130 byte buffer available for use by the other ECxxxx IBoxes using this specific ECOM100 module.

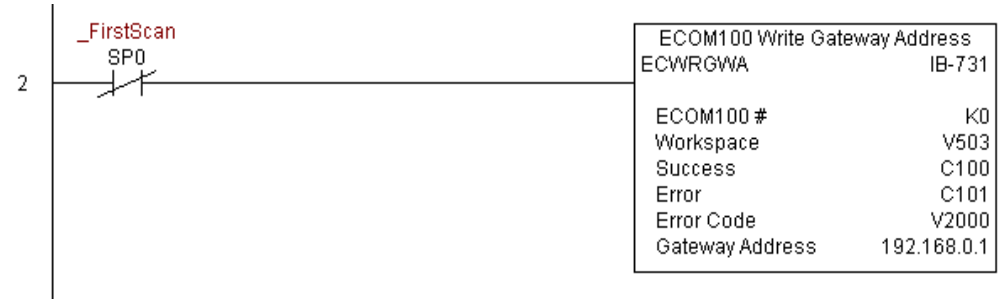


Rung 2: On the 2nd scan, assign the Gateway Address of the ECOM100 to 192.168.0.1

The ECWRGWA is leading edge triggered, not power-flow driven (similar to a counter input leg). The command to write the Gateway Address will be sent to the ECOM100 whenever the power flow into the IBox goes from OFF to ON.

If successful, turn on C100. If there is a failure, turn on C101. If it fails, you can look at V2000 for the specific error code.

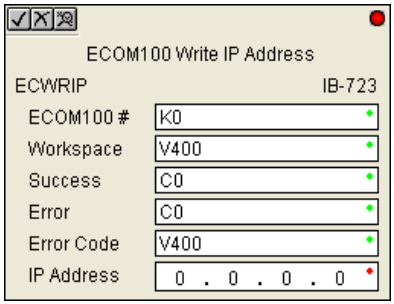
To configure all of the ECOM100 TCP/IP parameters in one IBox, see the ECOM100 IP Setup (ECIPSUP) IBox.



ECOM100 Write IP Address (ECWRIP) (IB-723)

DS5	Used
HPP	N/A

ECOM100 Write IP Address will write the given IP Address to the ECOM100 module on a leading edge transition to the IBox. See also ECOM100 IP Setup (ECIPSUP) IBox 717 to setup ALL of the TCP/IP parameters in a single instruction - IP Address, Subnet Mask, and Gateway Address.



The Workspace parameter is an internal, private register used by this IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Either the Success or Error bit parameter will turn on once the command is complete. If there is an error, the Error Code parameter will report an ECOM100 error code (less than 100), or a PLC logic error (greater than 1000).

The IP Address is stored in Flash-ROM in the ECOM100 and the execution of this IBox will disable the ECOM100 module for at least a half second until it writes the Flash-ROM. Therefore, it is HIGHLY RECOMMENDED that you only execute this IBox ONCE on second scan. Since it requires a LEADING edge to execute, use a NORMALLY CLOSED SP0 (STR NOT First Scan) to drive the power flow to the IBox.

In order for this ECOM100 IBox to function, you must turn ON dip switch 7 on the ECOM100 circuit board.

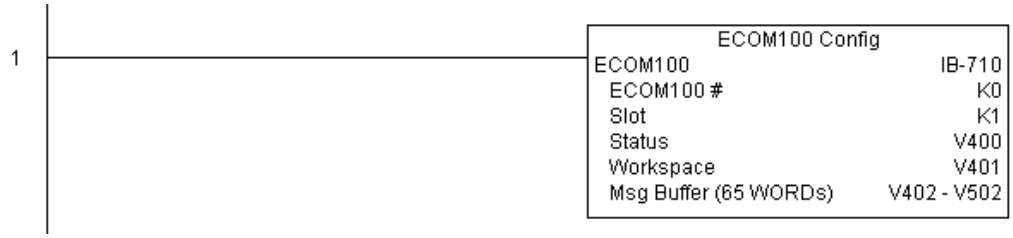
ECWRIP Parameters

- ECOM100#: this is a logical number associated with this specific ECOM100 module in the specified slot. All other ECxxxx IBoxes that need to reference this ECOM100 module must reference this logical number
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the request is completed successfully
- Error: specifies a bit that will turn on if the instruction is not successfully completed
- Error Code: specifies the location where the Error Code will be written
- IP Address: specifies the IP Address that will be written to the module

Parameter		DL05 Range
ECOM100#	K	K0-255
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map
Error Code	V	See DL05 V-memory map - Data Words
IP Address		0.0.0.1. to 255.255.255.254

ECWRIP Example

Rung 1: The ECOM100 Config IBox is responsible for coordination/interlocking of all ECOM100 type IBoxes for one specific ECOM100 module. Tag the ECOM100 in slot 1 as ECOM100# K0. All other ECxxxx IBoxes refer to this module # as K0. If you need to move the module in the base to a different slot, then you only need to change this one IBox. V400 is used as a global result status register for the other ECxxxx IBoxes using this specific ECOM100 module. V401 is used to coordinate/interlock the logic in all of the other ECxxxx IBoxes using this specific ECOM100 module. V402-V502 is a common 130 byte buffer available for use by the other ECxxxx IBoxes using this specific ECOM100 module.



Rung 2: On the 2nd scan, assign the IP Address of the ECOM100 to 192.168.12.100

The ECWRIP is leading edge triggered, not power-flow driven (similar to a counter input leg). The command to write the IP Address will be sent to the ECOM100 whenever the power flow into the IBox goes from OFF to ON.

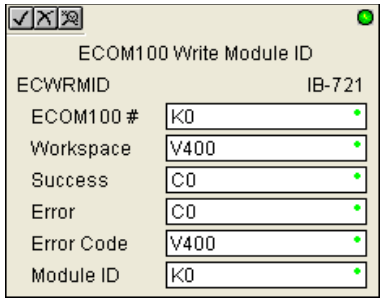
If successful, turn on C100. If there is a failure, turn on C101. If it fails, you can look at V2000 for the specific error code.

To configure all of the ECOM100 TCP/IP parameters in one IBox, see the ECOM100 IP Setup (ECIPSUP) IBox.

ECOM100 Write Module ID (ECWRMID) (IB-721)

DS5	Used
HPP	N/A

ECOM100 Write Module ID will write the given Module ID on a leading edge transition to the IBox



If the Module ID is set in the hardware using the dipswitches, this IBox will fail and return error code 1005 (decimal).

The Workspace parameter is an internal, private register used by this IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Either the Success or Error bit parameter will turn on once the command is complete. If there is an error, the Error Code parameter will report an ECOM100 error code (less than 100), or a PLC logic error (greater than 1000).

The Module ID is stored in Flash-ROM in the ECOM100 and the execution of this IBox will disable the ECOM100 module for at least a half second until it writes the Flash-ROM. Therefore, it is HIGHLY RECOMMENDED that you only execute this IBox ONCE on second scan. Since it requires a LEADING edge to execute, use a NORMALLY CLOSED SP0 (STR NOT First Scan) to drive the power flow to the IBox.

In order for this ECOM100 IBox to function, you must turn ON dip switch 7 on the ECOM100 circuit board.

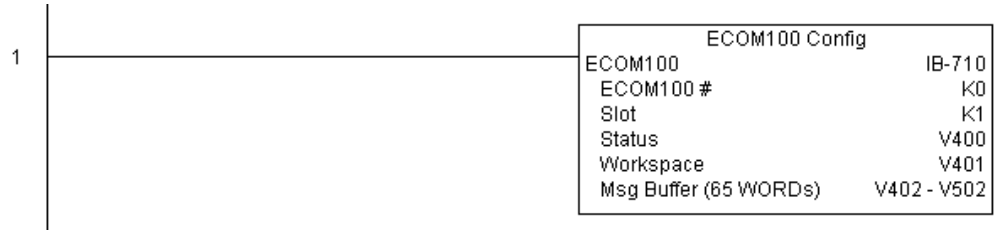
ECWRMID Parameters

- ECOM100#: this is a logical number associated with this specific ECOM100 module in the specified slot. All other ECxxxx IBoxes that need to reference this ECOM100 module must reference this logical number
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the request is completed successfully
- Error: specifies a bit that will turn on if the instruction is not successfully completed
- Error Code: specifies the location where the Error Code will be written
- Module ID: specifies the Module ID that will be written to the module

Parameter		DL05 Range
ECOM100#	K	K0-255
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map
Error Code	V	See DL05 V-memory map - Data Words
Module ID		K0-65535

ECWRMID Example

Rung 1: The ECOM100 Config IBox is responsible for coordination/interlocking of all ECOM100 type IBoxes for one specific ECOM100 module. Tag the ECOM100 in slot 1 as ECOM100# K0. All other ECxxxx IBoxes refer to this module # as K0. If you need to move the module in the base to a different slot, then you only need to change this one IBox. V400 is used as a global result status register for the other ECxxxx IBoxes using this specific ECOM100 module. V401 is used to coordinate/interlock the logic in all of the other ECxxxx IBoxes using this specific ECOM100 module. V402-V502 is a common 130 byte buffer available for use by the other ECxxxx IBoxes using this specific ECOM100 module.



Rung 2: On the 2nd scan, set the Module ID of the ECOM100. Typically this is done using NetEdit, but this IBox allows you to configure the module ID of the ECOM100 using your ladder program.

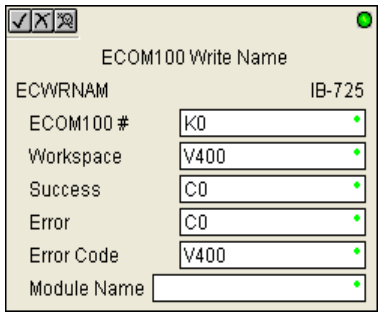
The EWRMID is leading edge triggered, not power-flow driven (similar to a counter input leg). The command to write the module ID will be sent to the ECOM100 whenever the power flow into the IBox goes from OFF to ON.

If successful, turn on C100. If there is a failure, turn on C101. If it fails, you can look at V2000 for the specific error code.

ECOM100 Write Name (ECWRNAM) (IB-725)

DS5	Used
HPP	N/A

ECOM100 Write Name will write the given Name to the ECOM100 module on a leading edge transition to the IBox. If you use a dollar sign ($) or double quote (“), use the PRINT/VPRINT escape sequence of TWO dollar signs ($$) for a single dollar sign or dollar sign-double quote ($”) for a double quote character.



The Workspace parameter is an internal, private register used by this IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Either the Success or Error bit parameter will turn on once the command is complete. If there is an error, the Error Code parameter will report an ECOM100 error code (less than 100), or a PLC logic error (greater than 1000).

The Name is stored in Flash-ROM in the ECOM100 and the execution of this IBox will disable the ECOM100 module for at least a half second until it writes the Flash-ROM. Therefore, it is HIGHLY RECOMMENDED that you only execute this IBox ONCE on second scan. Since it requires a LEADING edge to execute, use a NORMALLY CLOSED SP0 (STR NOT First Scan) to drive the power flow to the IBox.

In order for this ECOM100 IBox to function, you must turn ON dip switch 7 on the ECOM100 circuit board.

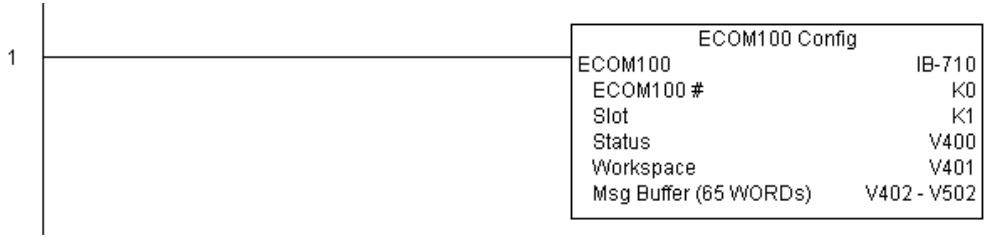
ECWRNAM Parameters

- ECOM100#: this is a logical number associated with this specific ECOM100 module in the specified slot. All other ECxxxx IBoxes that need to reference this ECOM100 module must reference this logical number
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the request is completed successfully
- Error: specifies a bit that will turn on if the instruction is not successfully completed
- Error Code: specifies the location where the Error Code will be written
- Module Name: specifies the Name that will be written to the module

Parameter		DL05 Range
ECOM100#	K	K0-255
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map
Error Code	V	See DL05 V-memory map - Data Words
Module Name		Text

ECWRNAM Example

Rung 1: The ECOM100 Config IBox is responsible for coordination/interlocking of all ECOM100 type IBoxes for one specific ECOM100 module. Tag the ECOM100 in slot 1 as ECOM100# K0. All other ECxxxx IBoxes refer to this module # as K0. If you need to move the module in the base to a different slot, then you only need to change this one IBox. V400 is used as a global result status register for the other ECxxxx IBoxes using this specific ECOM100 module. V401 is used to coordinate/interlock the logic in all of the other ECxxxx IBoxes using this specific ECOM100 module. V402-V502 is a common 130 byte buffer available for use by the other ECxxxx IBoxes using this specific ECOM100 module.



Rung 2: On the 2nd scan, set the Module Name of the ECOM100. Typically this is done using NetEdit, but this IBox allows you to configure the module name of the ECOM100 using your ladder program.

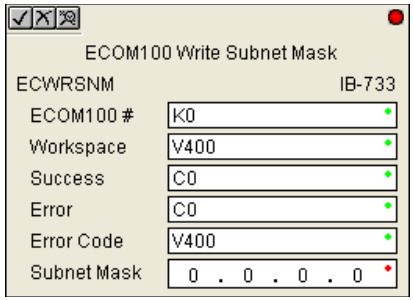
The EWRNAM is leading edge triggered, not power-flow driven (similar to a counter input leg). The command to write the module name will be sent to the ECOM100 whenever the power flow into the IBox goes from OFF to ON.

If successful, turn on C100. If there is a failure, turn on C101. If it fails, you can look at V2000 for the specific error code.

ECOM100 Write Subnet Mask (ECWRSNM) (IB-733)

DS5	Used
HPP	N/A

ECOM100 Write Subnet Mask will write the given Subnet Mask to the ECOM100 module on a leading edge transition to the IBox. See also ECOM100 IP Setup (ECIPSUP) IBox 717 to setup ALL of the TCP/IP parameters in a single instruction - IP Address, Subnet Mask, and Gateway Address.



The Workspace parameter is an internal, private register used by this IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Either the Success or Error bit parameter will turn on once the command is complete. If there is an error, the Error Code parameter will report an ECOM100 error code (less than 100), or a PLC logic error (greater than 1000).

The Subnet Mask is stored in Flash-ROM in the ECOM100 and the execution of this IBox will disable the ECOM100 module for at least a half second until it writes the Flash-ROM. Therefore, it is HIGHLY RECOMMENDED that you only execute this IBox ONCE on second scan. Since it requires a LEADING edge to execute, use a NORMALLY CLOSED SP0 (STR NOT First Scan) to drive the power flow to the IBox.

In order for this ECOM100 IBox to function, you must turn ON dip switch 7 on the ECOM100 circuit board.

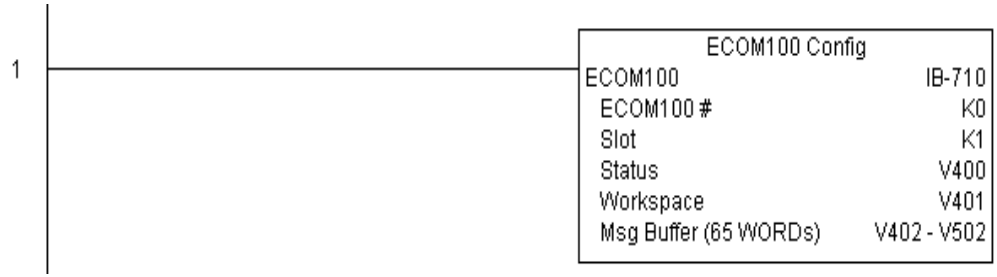
ECWRSNM Parameters

- ECOM100#: this is a logical number associated with this specific ECOM100 module in the specified slot. All other ECxxxx IBoxes that need to reference this ECOM100 module must reference this logical number
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the request is completed successfully
- Error: specifies a bit that will turn on if the instruction is not successfully completed
- Error Code: specifies the location where the Error Code will be written
- Subnet Mask: specifies the Subnet Mask that will be written to the module

Parameter		DL05 Range
ECOM100#	K	K0-255
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map
Error Code	V	See DL05 V-memory map - Data Words
Subnet Mask		Masked IP Address

ECWRSNM Example

Rung 1: The ECOM100 Config IBox is responsible for coordination/interlocking of all ECOM100 type IBoxes for one specific ECOM100 module. Tag the ECOM100 in slot 1 as ECOM100# K0. All other ECxxxx IBoxes refer to this module # as K0. If you need to move the module in the base to a different slot, then you only need to change this one IBox. V400 is used as a global result status register for the other ECxxxx IBoxes using this specific ECOM100 module. V401 is used to coordinate/interlock the logic in all of the other ECxxxx IBoxes using this specific ECOM100 module. V402-V502 is a common 130 byte buffer available for use by the other ECxxxx IBoxes using this specific ECOM100 module.



Rung 2: On the 2nd scan, assign the Subnet Mask of the ECOM100 to 255.255.0.0

The ECWRSNM is leading edge triggered, not power-flow driven (similar to a counter input leg). The command to write the Subnet Mask will be sent to the ECOM100 whenever the power flow into the IBox goes from OFF to ON.

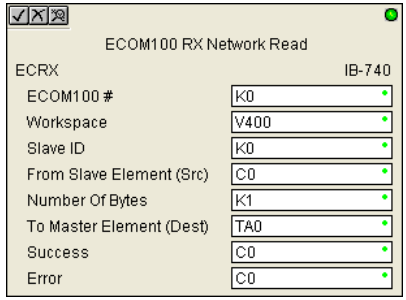
If successful, turn on C100. If there is a failure, turn on C101. If it fails, you can look at V2000 for the specific error code.

To configure all of the ECOM100 TCP/IP parameters in one IBox, see the ECOM100 IP Setup (ECIPSUP) IBox.

ECOM100 RX Network Read (ECRX) (IB-740)

DS5	Used
HPP	N/A

ECOM100 RX Network Read performs the RX instruction with built-in interlocking with all other ECOM100 RX (ECRX) and ECOM100 WX (ECWX) IBoxes in your program to simplify communications networking. It will perform the RX on the specified ECOM100#'s network, which corresponds to a specific unique ECOM100 Configuration (ECOM100) IBox at the top of your program.



The Workspace parameter is an internal, private register used by this IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Whenever this IBox has power, it will read element data from the specified slave into the given destination V-memory buffer, giving other ECOM100 RX and ECOM100 WX IBoxes on that ECOM100# network a chance to execute.

For example, if you wish to read and write data continuously from 5 different slaves, you can have all of these ECRX and ECWX instructions in ONE RUNG driven by SP1 (Always On). They will execute round-robin style, automatically.

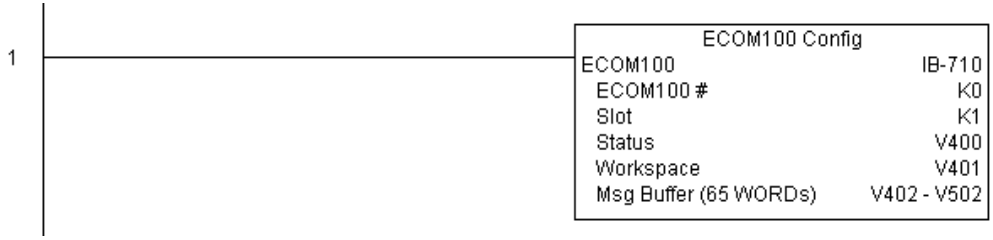
ECRX Parameters

- ECOM100#: this is a logical number associated with this specific ECOM100 module in the specified slot. All other ECxxxx IBoxes that need to reference this ECOM100 module must reference this logical number
- Workspace: specifies a V-memory location that will be used by the instruction
- Slave ID: specifies the slave ECOM(100) PLC that will be targeted by the ECRX instruction
- From Slave Element (Src): specifies the slave address of the data to be read
- Number of Bytes: specifies the number of bytes to read from the slave ECOM(100) PLC
- To Master Element (Dest): specifies the location where the slave data will be placed in the master ECOM100 PLC
- Success: specifies a bit that will turn on once the request is completed successfully
- Error: specifies a bit that will turn on if the instruction is not successfully completed

Parameter		DL05 Range
ECOM100#	K	K0-255
Workspace	V	See DL05 V-memory map - Data Words
Slave ID	K	K0-90
From Slave Element (Src)	X,Y,C,S,T,CT,GX,GY,V,P	See DL05 V-memory map
Number of Bytes	K	K1-128
To Master Element (Dest)	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map

ECRX Example

Rung 1: The ECOM100 Config IBox is responsible for coordination/interlocking of all ECOM100 type IBoxes for one specific ECOM100 module. Tag the ECOM100 in slot 1 as ECOM100# K0. All other ECxxxx IBoxes refer to this module # as K0. If you need to move the module in the base to a different slot, then you only need to change this one IBox. V400 is used as a global result status register for the other ECxxxx IBoxes using this specific ECOM100 module. V401 is used to coordinate/interlock the logic in all of the other ECxxxx IBoxes using this specific ECOM100 module. V402-V502 is a common 130 byte buffer available for use by the other ECxxxx IBoxes using this specific ECOM100 module.



(example continued on next page)

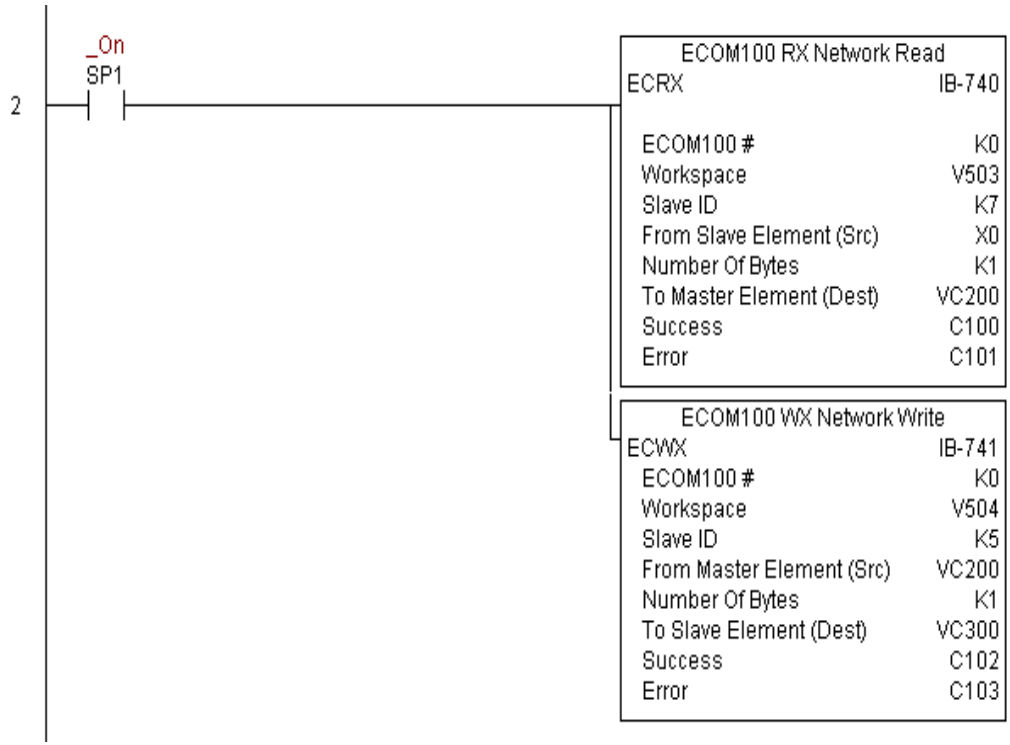
ECRX Example (cont'd)

Rung 2: Using ECOM100# K0, read X0-X7 from Slave K7 and write them to slave K5 as fast as possible. Store them in this local PLC in C200-C207, and write them to C300-C307 in slave K5.

Both the ECRX and ECWX work with the ECOM100 Config IBox to simplify all networking by handling all of the interlocks and proper resource sharing. They also provide very simplified error reporting. You no longer need to worry about any SP "busy bits" or "error bits", or what slot number a module is in, or have any counters or shift registers or any other interlocks for resource management.

In this example, SP1 (always ON) is driving both the ECRX and ECWX IBoxes in the same rung. On the scan that the Network Read completes, the Network Write will start that same scan. As soon as the Network Write completes, any pending operations below it in the program would get a turn. If there are no pending ECOM100 IBoxes below the ECWX, then the very next scan the ECRX would start its request again.

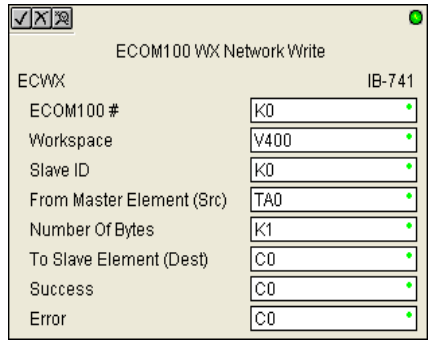
Using the ECRX and ECWX for all of your ECOM100 network reads and writes is the fastest the PLC can do networking. For local Serial Ports, DCM modules, or the original ECOM modules, use the NETCFG and NETRX/NETWX IBoxes.



ECOM100 WX Network Write(ECWX) (IB-741)

DS5	Used
HPP	N/A

ECOM100 WX Network Write performs the WX instruction with built-in interlocking with all other ECOM100 RX (ECRX) and ECOM100 WX (ECWX) IBoxes in your program to simplify communications networking. It will perform the WX on the specified ECOM100#'s network, which corresponds to a specific unique ECOM100 Configuration (ECOM100) IBox at the top of your program.



The Workspace parameter is an internal, private register used by this IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Whenever this IBox has power, it will write data from the master's V-memory buffer to the specified slave starting with the given slave element, giving other ECOM100 RX and ECOM100 WX IBoxes on that ECOM100# network a chance to execute.

For example, if you wish to read and write data continuously from 5 different slaves, you can have all of these ECRX and ECWX instructions in ONE RUNG driven by SP1 (Always On). They will execute round-robin style, automatically.

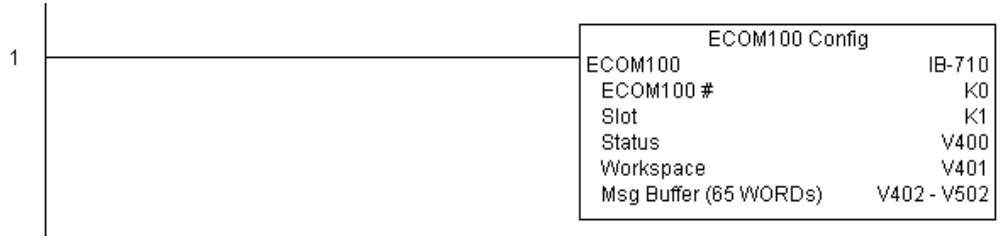
ECWX Parameters

- ECOM100#: this is a logical number associated with this specific ECOM100 module in the specified slot. All other ECxxxx IBoxes that need to reference this ECOM100 module must reference this logical number
- Workspace: specifies a V-memory location that will be used by the instruction
- Slave ID: specifies the slave ECOM(100) PLC that will be targeted by the ECWX instruction
- From Master Element (Src): specifies the location in the master ECOM100 PLC where the data will be sourced from
- Number of Bytes: specifies the number of bytes to write to the slave ECOM(100) PLC
- To Slave Element (Dest): specifies the slave address the data will be written to
- Success: specifies a bit that will turn on once the request is completed successfully
- Error: specifies a bit that will turn on if the instruction is not successfully completed

Parameter		DL05 Range
ECOM100#	K	K0-255
Workspace	V	See DL05 V-memory map - Data Words
Slave ID	K	K0-90
From Master Element (Src)	V	See DL05 V-memory map - Data Words
Number of Bytes	K	K1-128
To Slave Element (Dest)	X,Y,C,S,T,CT,GX,GY,V,P	See DL05 V-memory map
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map

ECWX Example

Rung 1: The ECOM100 Config IBox is responsible for coordination/interlocking of all ECOM100 type IBoxes for one specific ECOM100 module. Tag the ECOM100 in slot 1 as ECOM100# K0. All other ECxxxx IBoxes refer to this module # as K0. If you need to move the module in the base to a different slot, then you only need to change this one IBox. V400 is used as a global result status register for the other ECxxxx IBoxes using this specific ECOM100 module. V401 is used to coordinate/interlock the logic in all of the other ECxxxx IBoxes using this specific ECOM100 module. V402-V502 is a common 130 byte buffer available for use by the other ECxxxx IBoxes using this specific ECOM100 module.



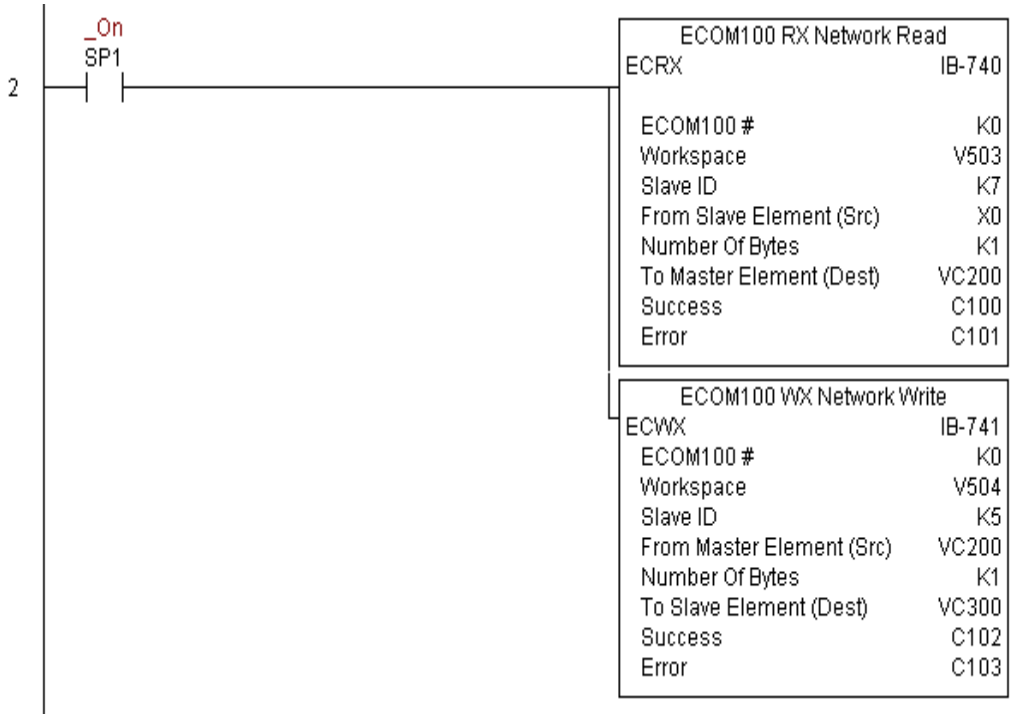
ECWX Example

Rung 2: Using ECOM100# K0, read X0-X7 from Slave K7 and write them to slave K5 as fast as possible. Store them in this local PLC in C200-C207, and write them to C300-C307 in slave K5.

Both the ECRX and ECWX work with the ECOM100 Config IBox to simplify all networking by handling all of the interlocks and proper resource sharing. They also provide very simplified error reporting. You no longer need to worry about any SP "busy bits" or "error bits", or what slot number a module is in, or have any counters or shift registers or any other interlocks for resource management.

In this example, SP1 (always ON) is driving both the ECRX and ECWX IBoxes in the same rung. On the scan that the Network Read completes, the Network Write will start that same scan. As soon as the Network Write completes, any pending operations below it in the program would get a turn. If there are no pending ECOM100 IBoxes below the ECWX, then the very next scan the ECRX would start its request again.

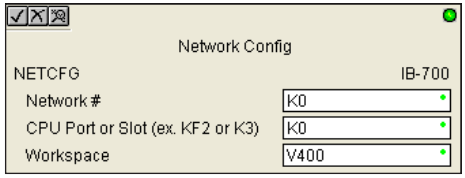
Using the ECRX and ECWX for all of your ECOM100 network reads and writes is the fastest the PLC can do networking. For local Serial Ports, DCM modules, or the original ECOM modules, use the NETCFG and NETRX/NETWX IBoxes.



NETCFG Network Configuration (NETCFG) (IB-700)

DS5	Used
HPP	N/A

Network Config defines all the common information necessary for performing RX/WX Networking using the NETRX and NETWX IBox instructions via a local CPU serial port, DCM or ECOM module.



You must have the Network Config instruction at the top of your ladder/stage program with any other configuration IBoxes.

If you use more than one local serial port, DCM or ECOM in your PLC for RX/WX Networking, you must have a different Network Config instruction for EACH RX/WX network in your system that utilizes any NETRX/NETWX IBox instructions.

The Workspace parameter is an internal, private register used by the Network Config IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

The 2nd parameter "CPU Port or Slot" is the same value as in the high byte of the first LD instruction if you were coding the RX or WX rung yourself. This value is CPU and port specific (check your PLC manual). Use KF2 for the DL05 CPU serial port 2. If using a DCM or ECOM module, use K1 for slot 1.

NETCFG Parameters

- Network#: specifies a unique # for each ECOM(100) or DCM network to use
- CPU Port or Slot: specifies the CPU port number or slot number of DCM/ECOM(100) used
- Workspace: specifies a V-memory location that will be used by the instruction

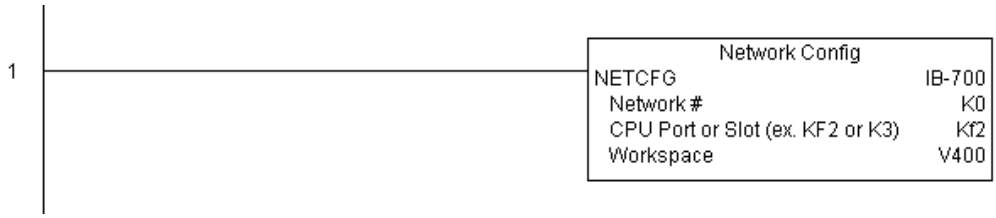
Parameter		DL05 Range
Network#	K	K0-255
CPU Port or Slot	K	K0-FF
Workspace	V	See DL05 V-memory map - Data Words

NETCFG Example

The Network Configuration IBox coordinates all of the interaction with other Network IBoxes (NETRX/NETWX). You must have a Network Configuration IBox for each serial port network, DCM module network, or original ECOM module network in your system. Configuration IBoxes must be at the top of your program and must execute every scan.

This IBox defines Network# K0 to be for the local CPU serial port #2 (KF2). For local CPU serial ports or DCM/ECOM modules, use the same value you would use in the most significant byte of the first LD instruction in a normal RX/WX rung to reference the port or module. Any NETRX or NETWX IBoxes that need to reference this specific network would enter K0 for their Network# parameter.

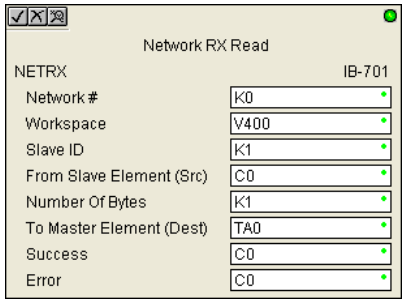
The Workspace register is used to maintain state information about the port or module, along with proper sharing and interlocking with the other NETRX and NETWX IBoxes in the program. This V-memory register must not be used anywhere else in the entire program.



Network RX Read (NETRX) (IB-701)

DS5	Used
HPP	N/A

Network RX Read performs the RX instruction with built-in interlocking with all other Network RX (NETRX) and Network WX (NETWX) IBoxes in your program to simplify communications networking. It will perform the RX on the specified Network #, which corresponds to a specific unique Network Configuration (NETCFG) at the top of your program.



The Workspace parameter is an internal, private register used by this IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Whenever this IBox has power, it will read element data from the specified slave into the given destination V-memory buffer, giving other Network RX and Network WX IBoxes on that Network # a chance to execute.

For example, if you wish to read and write data continuously from 5 different slaves, you can have all of these NETRX and NETWX instructions in ONE RUNG driven by SP1 (Always On). They will execute round-robin style, automatically.

NETRX Parameters

- Network#: specifies the (CPU port's, DCM's, ECOM's) Network # defined by the NETCFG instruction
- Workspace: specifies a V-memory location that will be used by the instruction
- Slave ID: specifies the slave PLC that will be targeted by the NETRX instruction
- From Slave Element (Src): specifies the slave address of the data to be read
- Number of Bytes: specifies the number of bytes to read from the slave device
- To Master Element (Dest): specifies the location where the slave data will be placed in the master PLC
- Success: specifies a bit that will turn on once the request is completed successfully
- Error: specifies a bit that will turn on if the instruction is not successfully completed

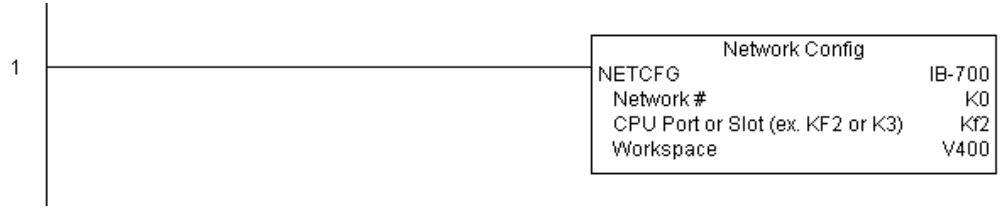
Parameter		DL05 Range
Network#	K	K0-255
Workspace	V	See DL05 V-memory map - Data Words
Slave ID	K	K0-90
From Slave Element (Src)	X,Y,C,S,T,CT,GX,GY,V,P	See DL05 V-memory map
Number of Bytes	K	K1-128
To Master Element (Dest)	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map

NETRX Example

Rung 1: The Network Configuration IBox coordinates all of the interaction with other Network IBoxes (NETRX/NETWX). You must have a Network Configuration IBox for each serial port network, DCM module network, or original ECOM module network in your system. Configuration IBoxes must be at the top of your program and must execute every scan.

This IBox defines Network# K0 to be for the local CPU serial port #2 (KF2). For local CPU serial ports or DCM/ECOM modules, use the same value you would use in the most significant byte of the first LD instruction in a normal RX/WX rung to reference the port or module. Any NETRX or NETWX IBoxes that need to reference this specific network would enter K0 for their Network# parameter.

The Workspace register is used to maintain state information about the port or module, along with proper sharing and interlocking with the other NETRX and NETWX IBoxes in the program. This V-memory register must not be used anywhere else in the entire program.



(example continued on next page)

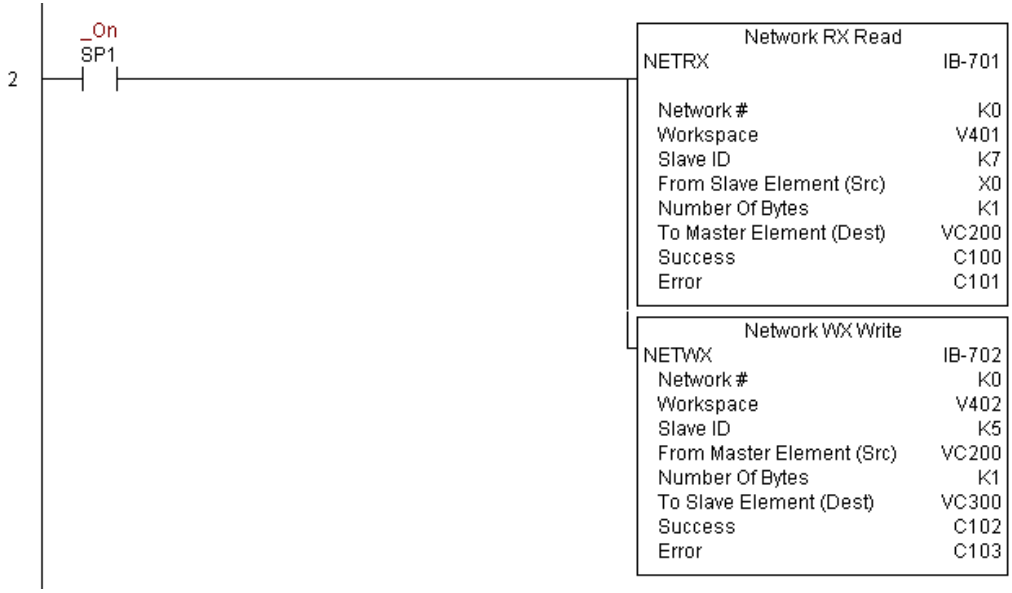
NETRX Example (cont'd)

Rung 2: Using Network# K0, read X0-X7 from Slave K7 and write them to slave K5 as fast as possible. Store them in this local PLC in C200-C207, and write them to C300-C307 in slave K5.

Both the NETRX and NETWX work with the Network Config IBox to simplify all networking by handling all of the interlocks and proper resource sharing. They also provide very simplified error reporting. You no longer need to worry about any SP "busy bits" or "error bits", or what port number or slot number a module is in, or have any counters or shift registers or any other interlocks for resource management.

In this example, SP1 (always ON) is driving both the NETRX and NETWX IBoxes in the same rung. On the scan that the Network Read completes, the Network Write will start that same scan. As soon as the Network Write completes, any pending operations below it in the program would get a turn. If there are no pending NETRX or NETWX IBoxes below this IBox, then the very next scan the NETRX would start its request again.

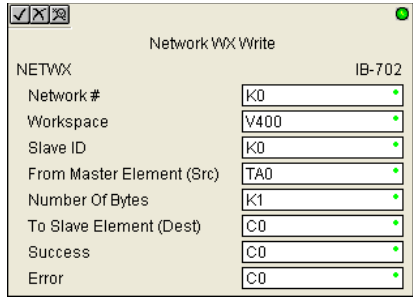
Using the NETRX and NETWX for all of your serial port, DCM, or original ECOM network reads and writes is the fastest the PLC can do networking. For ECOM100 modules, use the ECOM100 and ECRX/ECWX IBoxes.



Network WX Write (NETWX) (IB-702)

DS5	Used
HPP	N/A

Network WX Write performs the WX instruction with built-in interlocking with all other Network RX (NETRX) and Network WX (NETWX) IBoxes in your program to simplify communications networking. It will perform the WX on the specified Network #, which corresponds to a specific unique Network Configuration (NETCFG) at the top of your program.



The Workspace parameter is an internal, private register used by this IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

Whenever this IBox has power, it will write data from the master's V-memory buffer to the specified slave starting with the given slave element, giving other Network RX and Network WX IBoxes on that Network # a chance to execute.

For example, if you wish to read and write data continuously from 5 different slaves, you can have all of these NETRX and NETWX instructions in ONE RUNG driven by SP1 (Always On). They will execute round-robin style, automatically.

NETWX Parameters

- Network#: specifies the (CPU port's, DCM's, ECOM's) Network # defined by the NETCFG instruction
- Workspace: specifies a V-memory location that will be used by the instruction
- Slave ID: specifies the slave PLC that will be targeted by the NETWX instruction
- From Master Element (Src): specifies the location in the master PLC where the data will be sourced from
- Number of Bytes: specifies the number of bytes to write to the slave PLC
- To Slave Element (Dest): specifies the slave address the data will be written to
- Success: specifies a bit that will turn on once the request is completed successfully
- Error: specifies a bit that will turn on if the instruction is not successfully completed

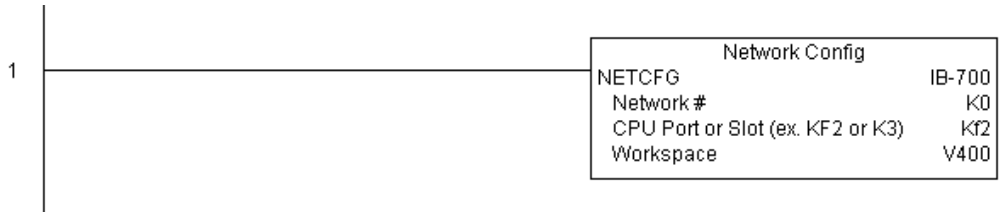
Parameter		DL05 Range
Network#	K	K0-255
Workspace	V	See DL05 V-memory map - Data Words
Slave ID	K	K0-90
From Master Element (Src)	V	See DL05 V-memory map - Data Words
Number of Bytes	K	K1-128
To Slave Element (Dest)	X,Y,C,S,T,CT,GX,GY,V,P	See DL05 V-memory map
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map

NETWX Example

Rung 1: The Network Configuration IBox coordinates all of the interaction with other Network IBoxes (NETRX/NETWX). You must have a Network Configuration IBox for each serial port network, DCM module network, or original ECOM module network in your system. Configuration IBoxes must be at the top of your program and must execute every scan.

This IBox defines Network# K0 to be for the local CPU serial port #2 (KF2). For local CPU serial ports or DCM/ECOM modules, use the same value you would use in the most significant byte of the first LD instruction in a normal RX/WX rung to reference the port or module. Any NETRX or NETWX IBoxes that need to reference this specific network would enter K0 for their Network# parameter.

The Workspace register is used to maintain state information about the port or module, along with proper sharing and interlocking with the other NETRX and NETWX IBoxes in the program. This V-memory register must not be used anywhere else in the entire program.



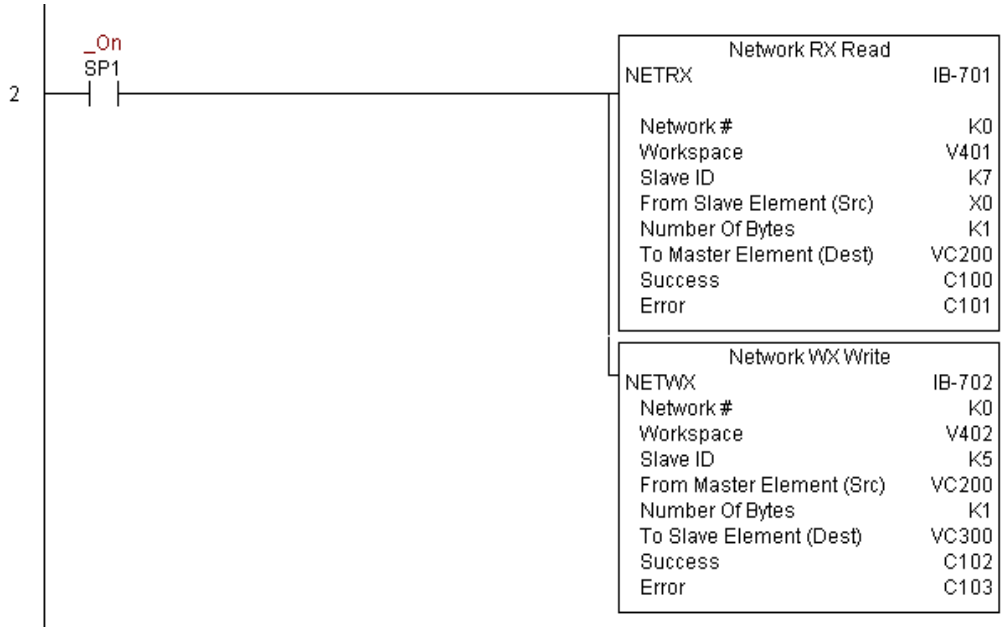
NETWX Example

Rung 2: Using Network# K0, read X0-X7 from Slave K7 and write them to slave K5 as fast as possible. Store them in this local PLC in C200-C207, and write them to C300-C307 in slave K5.

Both the NETRX and NETWX work with the Network Config IBox to simplify all networking by handling all of the interlocks and proper resource sharing. They also provide very simplified error reporting. You no longer need to worry about any SP "busy bits" or "error bits", or what port number or slot number a module is in, or have any counters or shift registers or any other interlocks for resource management.

In this example, SP1 (always ON) is driving both the NETRX and NETWX IBoxes in the same rung. On the scan that the Network Read completes, the Network Write will start that same scan. As soon as the Network Write completes, any pending operations below it in the program would get a turn. If there are no pending NETRX or NETWX IBoxes below this IBox, then the very next scan the NETRX would start its request again.

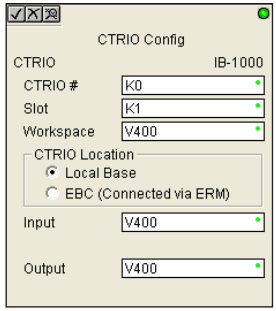
Using the NETRX and NETWX for all of your serial port, DCM, or original ECOM network reads and writes is the fastest the PLC can do networking. For ECOM100 modules, use the ECOM100 and ECRX/ECWX IBoxes.



CTRIO Configuration (CTRIO) (IB-1000)

DS5	Used
HPP	N/A

CTRIO Config defines all the common information for one specific CTRIO module which is used by the other CTRIO IBox instructions (for example, CTRLDPR - CTRIO Load Profile, CTREDRL - CTRIO Edit and Reload Preset Table, CTRRTLM - CTRIO Run to Limit Mode, ...).



The Input/Output parameters for this instruction can be copied directly from the CTRIO Workbench configuration for this CTRIO module. Since the behavior is slightly different when the CTRIO module is in an EBC Base via an ERM, you must specify whether the CTRIO module is in a local base or in an EBC base. The DL05 PLC only supports local base operation at this time.

You must have the CTRIO Config IBox at the top of your ladder/stage program along with any other configuration IBoxes.

If you have more than one CTRIO in your PLC, you must have a different CTRIO Config IBox for EACH CTRIO module in your system that utilizes any CTRIO IBox instructions. Each CTRIO Config IBox must have a UNIQUE CTRIO# value. This is how the CTRIO IBoxes differentiate between the different CTRIO modules in your system.

The Workspace parameter is an internal, private register used by the CTRIO Config IBox and MUST BE UNIQUE in this one instruction and MUST NOT be used anywhere else in your program.

CTRIO Parameters

- CTRIO#: specifies a specific CTRIO module based on a user defined number
- Slot: specifies the single PLC option slot the CTRIO module occupies
- Workspace: specifies a V-memory location that will be used by the instruction
- CTRIO Location: specifies where the module is located (local base only for DL05)
- Input: This needs to be set to the same V-memory register as is specified in CTRIO Workbench as 'Starting V address for inputs' for this unique CTRIO.
- Output: This needs to be set to the same V-memory register as is specified in CTRIO Workbench as 'Starting V address for outputs' for this unique CTRIO.

Parameter		DL05 Range
CTRIO#	K	K0-255
Slot	K	K1
Workspace	V	See DL05 V-memory map - Data Words
Input	V	See DL05 V-memory map - Data Words
Output	V	See DL05 V-memory map - Data Words

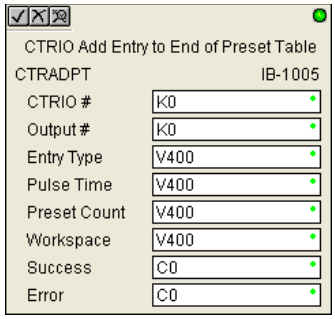
CTRIO Example

Rung 1: This sets up the CTRIO card in slot 2 of the local base. Each CTRIO in the system will need a separate CTRIO I-box before any CTRxxxx I-boxes can be used for them. The CTRIO has been configured to use V2000 through V2025 for its input data, and V2030 through V2061 for its output data.

CTRIO Add Entry to End of Preset Table (CTRADPT) (IB-1005)

DS5	Used
HPP	N/A

CTRIO Add Entry to End of Preset Table, on a leading edge transition to this IBox, will append an entry to the end of a memory based Preset Table on a specific CTRIO Output resource. This IBox will take more than 1 PLC scan to execute. Either the Success or Error bit will turn on when the command is complete. If the Error Bit is on, you can use the CTRIO Read Error Code (CTRRDER) IBox to get extended error information.



Entry Type:

K0: Set

K1: Reset

K2: Pulse On (uses Pulse Time)

K3: Pulse Off (uses Pulse Time)

K4: Toggle

K5: Reset Count

Note that the Pulse Time parameter is ignored by some Entry Types.

The Workspace register is for internal use by this IBox instruction and MUST NOT be used anywhere else in your program.

CTRAPT Parameters

- CTRIO#: specifies a specific CTRIO module based on a user defined number (see CTRIO Config)
- Output#: specifies a CTRIO output to be used by the instruction
- Entry Type: specifies the Entry Type to be added to the end of a Preset Table
- Pulse Time: specifies a pulse time for the Pulse On and Pulse Off Entry Types
- Preset Count: specifies an initial count value to begin at after Reset
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the instruction has successfully completed
- Error: specifies a bit that will turn on if the instruction does not complete successfully

Parameter		DL05 Range
CTRIO#	K	K0-255
Output#	K	K0-3
Entry Type	V,K	K0-5; See DL05 V-memory map - Data Words
Pulse Time	V,K	K0-65535; See DL05 V-memory map - Data Words
Preset Count	V,K	K0-2147434528; See DL05 V-memory map
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map

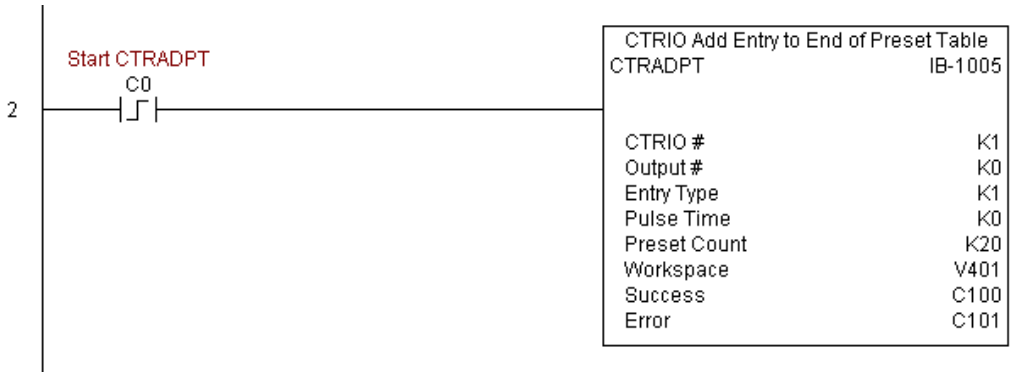
CTRADPT Example

Rung 1: This sets up the CTRIO card in slot 2 of the local base. Each CTRIO in the system will need a separate CTRIO I-box before any CTRxxxx I-boxes can be used for them. The CTRIO has been configured to use V2000 through V2025 for its input data, and V2030 through V2061 for its output data.

Rung 2: This rung is a sample method for enabling the CTRADPT command. A C-bit is used to allow the programmer to control the command from Data View for testing purposes.

Turning on C0 will cause the CTRADPT instruction to add a new preset to the preset table for output #0 on the CTRIO in slot 2. The new preset will be a command to RESET (entry type K1=reset), pulse time is left at zero as the reset type does not use this, and the count at which it will reset will be 20.

Operating procedure for this example code is to load the CTRADPT_ex1.cwb file to your CTRIO, then enter the code shown here, change to RUN mode, enable output #0 by turning on C2 in dataview, turn encoder on CTRIO to value above 10 and output #0 light will come on and stay on for all counts past 10. Now reset the counter with C1, enable C0 to execute CTRADPT command to add a reset for output #0 at a count of 20, turn on C2 to enable output #0, then turn encoder to value of 10+ (output #0 should turn on) and then continue on to count of 20+ (output #0 should turn off).



(Example continued on next page)

CTRADPT Example (cont'd)

Rung 3: This rung allows the programmer to reset the counter from the ladder logic.

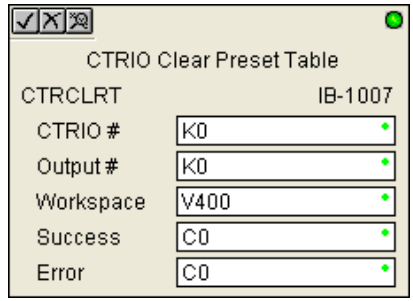
Rung 4: This rung allows the operator to enable output #0 from the ladder code.

CTRIO Clear Preset Table (CTRCLRT) (IB-1007)

DS5	Used
HPP	N/A

CTRIO Clear Preset Table will clear the RAM based Preset Table on a leading edge transition to this IBox. This IBox will take more than 1 PLC scan to execute. Either the Success or Error bit will turn on when the command is complete. If the Error Bit is on, you can use the CTRIO Read Error Code (CTRRDER) IBox to get extended error information.

The Workspace register is for internal use by this IBox instruction and MUST NOT be used anywhere else in your program.



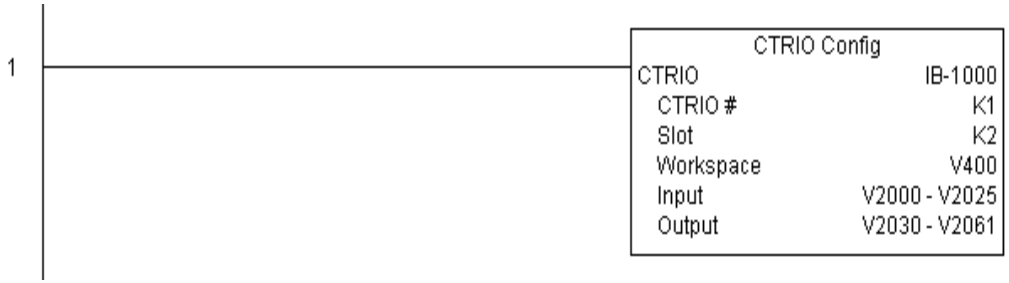
CTRCLRT Parameters

- CTRIO#: specifies a specific CTRIO module based on a user defined number (see CTRIO Config)
- Output#: specifies a CTRIO output to be used by the instruction
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the instruction has successfully completed
- Error: specifies a bit that will turn on if the instruction does not complete successfully

Parameter		DL05 Range
CTRIO#	K	K0-255
Output#	K	K0-3
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map

CTRCLRT Example

Rung 1: This sets up the CTRIO card in slot 2 of the local base. Each CTRIO in the system will need a separate CTRIO I-box before any CTRxxxx I-boxes can be used for them. The CTRIO has been configured to use V2000 through V2025 for its input data, and V2030 through V2061 for its output data.



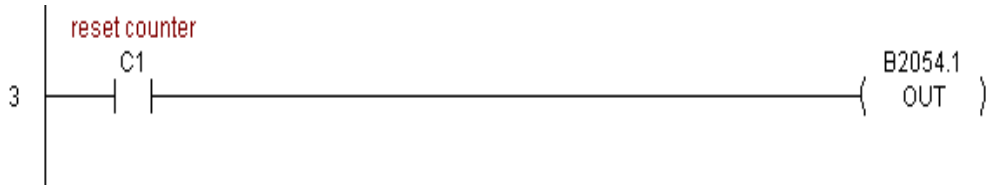
Rung 2: This rung is a sample method for enabling the CTRCLRT command. A C-bit is used to allow the programmer to control the command from Data View for testing purposes.

Turning on C0 will cause the CTRCLRT instruction to clear the preset table for output #0 on the CTRIO in slot 2.

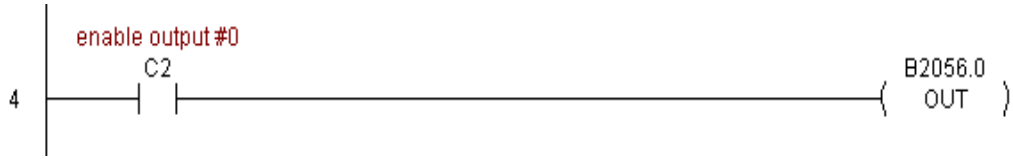
Operating procedure for this example code is to load the CTRCLRT_ex1.cwb file to your CTRIO, then enter the code shown here, change to RUN mode, enable output #0 by turning on C2 in Data View, turn encoder on CTRIO to value above 10 and output #0 light will come on and stay on until a count of 20 is reached, where it will turn off. Now reset the counter with C1, enable C0 to execute CTRCLRT command to clear the preset table, turn on C2 to enable output #0, then turn encoder to value of 10+ (output #0 should NOT turn on).

CTRCLRT Example

Rung 3: This rung allows the programmer to reset the counter from the ladder logic.



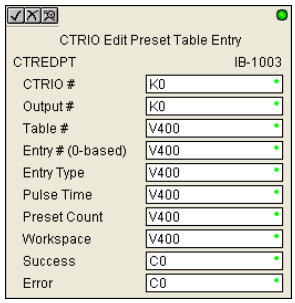
Rung 4: This rung allows the operator to enable output #0 from the ladder code.



CTRIO Edit Preset Table Entry (CTREDPT) (IB-1003)

DS5	Used
HPP	N/A

CTRIO Edit Preset Table Entry, on a leading edge transition to this IBox, will edit a single entry in a Preset Table on a specific CTRIO Output resource. This IBox is good if you are editing more than one entry in a file at a time. If you wish to do just one edit and then reload the table immediately, see the CTRIO Edit and Reload Preset Table Entry (CTREDRL) IBox. This IBox will take more than 1 PLC scan to execute. Either the Success or Error bit will turn on when the command is complete. If the Error Bit is on, you can use the CTRIO Read Error Code (CTRRDER) IBox to get extended error information.



Entry Type:

K0: Set

K1: Reset

K2: Pulse On (uses Pulse Time)

K3: Pulse Off (uses Pulse Time)

K4: Toggle

K5: Reset Count

Note that the Pulse Time parameter is ignored by some Entry Types.

The Workspace register is for internal use by this IBox instruction and MUST NOT be used anywhere else in your program.

CTREDPT Parameters

- CTRIO#: specifies a specific CTRIO module based on a user defined number (see CTRIO Config Ibox)
- Output#: specifies a CTRIO output to be used by the instruction
- Table#: specifies the Table number of which an Entry is to be edited
- Entry#: specifies the Entry location in the Preset Table to be edited
- Entry Type: specifies the Entry Type to add during the edit
- Pulse Time: specifies a pulse time for the Pulse On and Pulse Off Entry Types
- Preset Count: specifies an initial count value to begin at after Reset
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the instruction has successfully completed
- Error: specifies a bit that will turn on if the instruction does not complete successfully

Parameter		DL05 Range
CTRIO#	K	K0-255
Output#	K	K0-3
Table#	V,K	K0-255; See DL05 V-memory map - Data Words
Entry#	V,K	K0-255; See DL05 V-memory map - Data Words
Entry Type	V,K	K0-5; See DL05 V-memory map - Data Words
Pulse Time	V,K	K0-65535; See DL05 V-memory map - Data Words
Preset Count	V,K	K0-2147434528; See DL05 V-memory map
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map

CTREDPT Example

Rung 1: This sets up the CTRIO card in slot 2 of the local base. Each CTRIO in the system will need a separate CTRIO I-box before any CTRxxxx I-boxes can be used for them. The CTRIO has been configured to use V2000 through V2025 for its input data, and V2030 through V2061 for its output data.

(Example continued on next page)

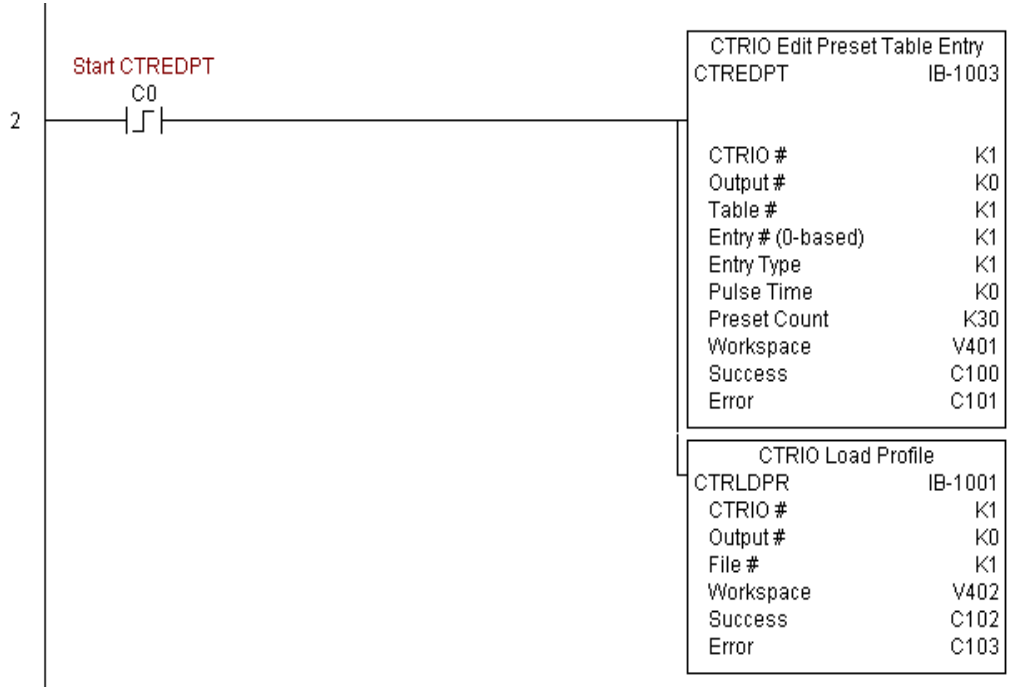
CTREDPT Example (cont'd)

Rung 2: This rung is a sample method for enabling the CTREDPT command. A C-bit is used to allow the programmer to control the command from Data View for testing purposes.

Turning on C0 will cause the CTREDPT instruction to change the second preset from a reset at a count of 20 to a reset at a count of 30 for output #0 on the CTRIO in slot 2.

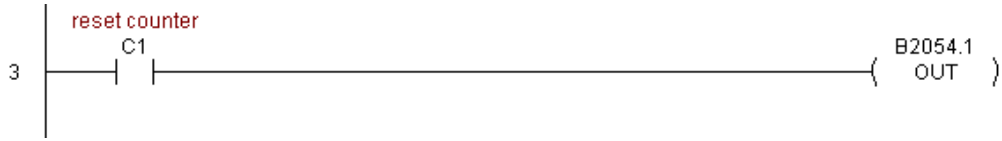
Operating procedure for this example code is to load the CTREDPT_ex1.cwb file to your CTRIO, then enter the code shown here, change to RUN mode, enable output #0 by turning on C2 in Data View, turn encoder on CTRIO to value above 10 and output #0 light will come on and stay on until a count of 20 is reached, where it will turn off. Now reset the counter with C1, enable C0 to execute CTREDPT command to change the second preset, turn on C2 to enable output #0, then turn encoder to value of 10+ (output #0 should turn on) and then continue past a count of 30 (output #0 should turn off).

Note that we must also reload the profile after changing the preset(s), this is why the CTRLDPR command follows the CTREDPT command in this example.



CTREDPT Example

Rung 3: This rung allows the programmer to reset the counter from the ladder logic.

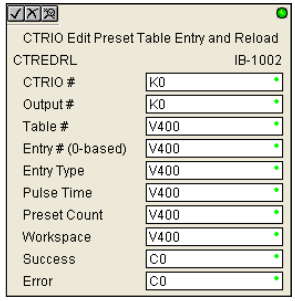


Rung 4: This rung allows the operator to enable output #0 from the ladder code.

CTRIO Edit Preset Table Entry and Reload (CTREDRL) (IB-1002)

DS5	Used
HPP	N/A

CTRIO Edit Preset Table Entry and Reload, on a leading edge transition to this IBox, will perform this dual operation to a CTRIO Output resource in one CTRIO command. This IBox will take more than 1 PLC scan to execute. Either the Success or Error bit will turn on when the command is complete. If the Error Bit is on, you can use the CTRIO Read Error Code (CTRRDER) IBox to get extended error information.



Entry Type:

K0: Set

K1: Reset

K2: Pulse On (uses Pulse Time)

K3: Pulse Off (uses Pulse Time)

K4: Toggle

K5: Reset Count

Note that the Pulse Time parameter is ignored by some Entry Types.

The Workspace register is for internal use by this IBox instruction and MUST NOT be used anywhere else in your program.

CTREDRL Parameters

- CTRIO#: specifies a specific CTRIO module based on a user defined number (see CTRIO Config Ibox)
- Output#: specifies a CTRIO output to be used by the instruction
- Table#: specifies the Table number of which an Entry is to be edited
- Entry#: specifies the Entry location in the Preset Table to be edited
- Entry Type: specifies the Entry Type to add during the edit
- Pulse Time: specifies a pulse time for the Pulse On and Pulse Off Entry Types
- Preset Count: specifies an initial count value to begin at after Reset
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the instruction has successfully completed
- Error: specifies a bit that will turn on if the instruction does not complete successfully

Parameter		DL05 Range
CTRIO#	K	K0-255
Output#	K	K0-3
Table#	V,K	K0-255; See DL05 V-memory map - Data Words
Entry#	V,K	K0-255; See DL05 V-memory map - Data Words
Entry Type	V,K	K0-5; See DL05 V-memory map - Data Words
Pulse Time	V,K	K0-65535; See DL05 V-memory map - Data Words
Preset Count	V,K	K0-2147434528; See DL05 V-memory map
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map

CTREDRL Example

Rung 1: This sets up the CTRIO card in slot 2 of the local base. Each CTRIO in the system will need a separate CTRIO I-box before any CTRxxxx I-boxes can be used for them. The CTRIO has been configured to use V2000 through V2025 for its input data, and V2030 through V2061 for its output data.

(example continued on next page)

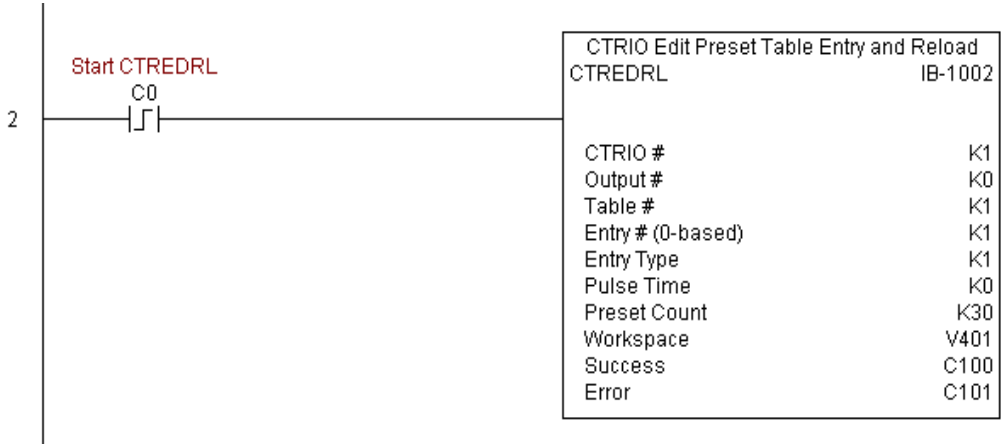
CTREDRL Example (cont'd)

Rung 2: This rung is a sample method for enabling the CTREDRL command. A C-bit is used to allow the programmer to control the command from Data View for testing purposes.

Turning on C0 will cause the CTREDRL instruction to change the second preset in file 1 from a reset at a value of 20 to a reset at a value of 30.

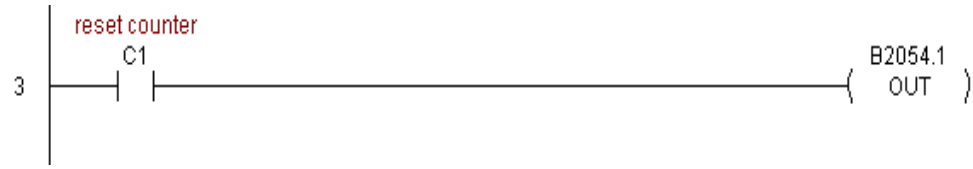
Operating procedure for this example code is to load the CTREDRL_ex1.cwb file to your CTRIO, then enter the code shown here, change to RUN mode, enable output #0 by turning on C2 in Data View, turn encoder on CTRIO to value above 10 and output #0 light will come on, continue to a count above 20 and the output #0 light will turn off. Now reset the counter with C1, enable C0 to execute CTREDRL command to change the second preset count value to 30, then turn encoder to value of 10+ (output #0 should turn on) and continue on to a value of 30+ and the output #0 light will turn off.

Note that it is not necessary to reload this file separately, however, the command can only change one value at a time.



CTREDRL Example

Rung 3: This rung allows the programmer to reset the counter from the ladder logic.

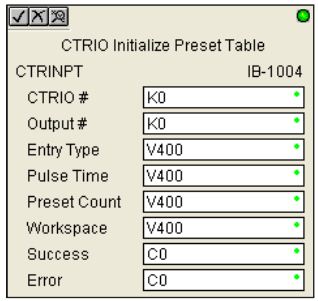


Rung 4: This rung allows the operator to enable output #0 from the ladder code.

CTRIO Initialize Preset Table (CTRINPT) (IB-1004)

DS5	Used
HPP	N/A

CTRIO Initialize Preset Table, on a leading edge transition to this IBox, will create a single entry Preset Table in memory but not as a file, on a specific CTRIO Output resource. This IBox will take more than 1 PLC scan to execute. Either the Success or Error bit will turn on when the command is complete. If the Error Bit is on, you can use the CTRIO Read Error Code (CTRRDER) IBox to get extended error information.



Entry Type:

K0: Set

K1: Reset

K2: Pulse On (uses Pulse Time)

K3: Pulse Off (uses Pulse Time)

K4: Toggle

K5: Reset Count

Note that the Pulse Time parameter is ignored by some Entry Types.

The Workspace register is for internal use by this IBox instruction and MUST NOT be used anywhere else in your program.

CTRINPT Parameters

- CTRIO#: specifies a specific CTRIO module based on a user defined number (see CTRIO Config Ibox)
- Output#: specifies a CTRIO output to be used by the instruction
- Entry Type: specifies the Entry Type to add during the edit
- Pulse Time: specifies a pulse time for the Pulse On and Pulse Off Entry Types
- Preset Count: specifies an initial count value to begin at after Reset
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the instruction has successfully completed
- Error: specifies a bit that will turn on if the instruction does not complete successfully

Parameter		DL05 Range
CTRIO#	K	K0-255
Output#	K	K0-3
Entry Type	V,K	K0-5; See DL05 V-memory map - Data Words
Pulse Time	V,K	K0-65535; See DL05 V-memory map - Data Words
Preset Count	V,K	K0-2147434528; See DL05 V-memory map
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map

CTRINPT Example

Rung 1: This sets up the CTRIO card in slot 2 of the local base. Each CTRIO in the system will need a separate CTRIO I-box before any CTRxxxx I-boxes can be used for them. The CTRIO has been configured to use V2000 through V2025 for its input data, and V2030 through V2061 for its output data.

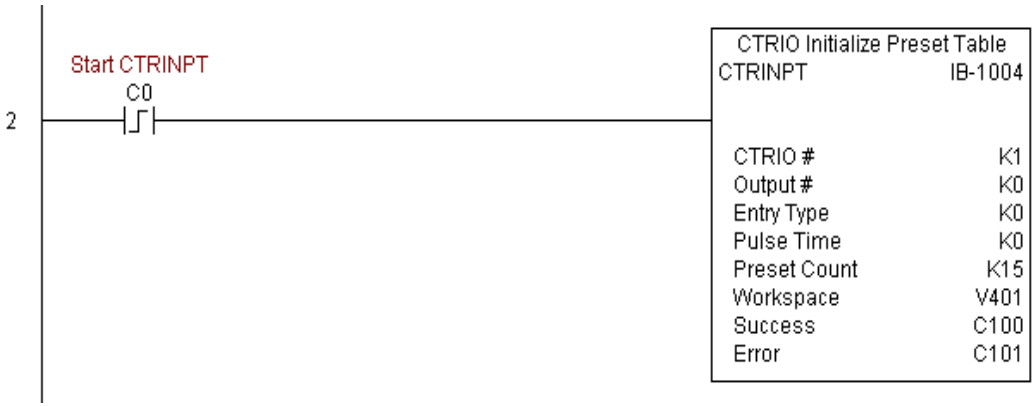
(Example continued on next page)

CTRINPT Example (cont'd)

Rung 2: This rung is a sample method for enabling the CTRINPT command. A C-bit is used to allow the programmer to control the command from Data View for testing purposes.

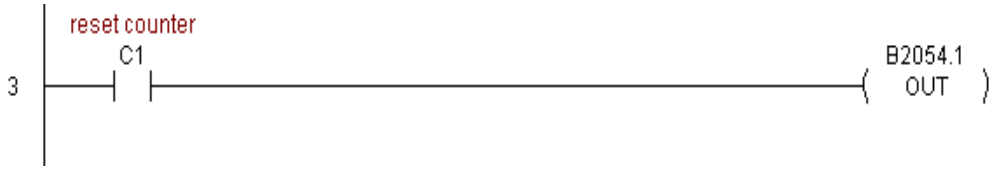
Turning on C0 will cause the CTRINPT instruction to create a single entry preset table, but not as a file, and use it for the output #0. In this case the single preset will be a set at a count of 15 for output #0.

Operating procedure for this example code is to load the CTRINPT_ex1.cwb file to your CTRIO, then enter the code shown here, change to RUN mode, enable output #0 by turning on C2 in Data View, turn encoder on CTRIO to value above 15 and output #0 light will not come on. Now reset the counter with C1, enable C0 to execute CTRINPT command to create a single preset table with a preset to set output#0 at a count of 15, then turn encoder to value of 15+ (output #0 should turn on).



CTRINPT Example

Rung 3: This rung allows the programmer to reset the counter from the ladder logic.

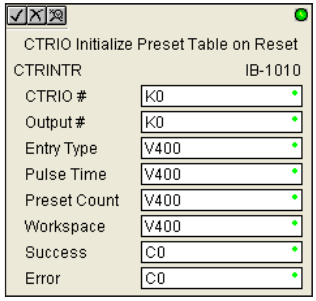


Rung 4: This rung allows the operator to enable output #0 from the ladder code.

CTRIO Initialize Preset Table (CTRINTR) (IB-1010)

DS5	Used
HPP	N/A

CTRIO Initialize Preset Table, on a leading edge transition to this IBox, will create a single entry Preset Table in memory but not as a file, on a specific CTRIO Output resource.This IBox will take more than 1 PLC scan to execute. Either the Success or Error bit will turn on when the command is complete. If the Error Bit is on, you can use the CTRIO Read Error Code (CTRRDER) IBox to get extended error information.



Entry Type:

K0: Set

K1: Reset

K2: Pulse On (uses Pulse Time)

K3: Pulse Off (uses Pulse Time)

K4: Toggle

K5: Reset Count

Note that the Pulse Time parameter is ignored by some Entry Types.

The Workspace register is for internal use by this IBox instruction and MUST NOT be used anywhere else in your program.

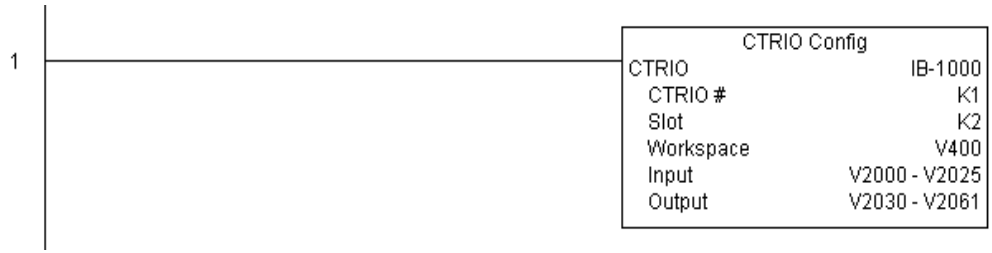
CTRINTR Parameters

- CTRIO#: specifies a specific CTRIO module based on a user defined number (see CTRIO Config Ibox)
- Output#: specifies a CTRIO output to be used by the instruction
- Entry Type: specifies the Entry Type to add during the edit
- Pulse Time: specifies a pulse time for the Pulse On and Pulse Off Entry Types
- Preset Count: specifies an initial count value to begin at after Reset
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the instruction has successfully completed
- Error: specifies a bit that will turn on if the instruction does not complete successfully

Parameter		DL05 Range
CTRIO#	K	K0-255
Output#	K	K0-3
Entry Type	V,K	K0-5; See DL05 V-memory map - Data Words
Pulse Time	V,K	K0-65535; See DL05 V-memory map - Data Words
Preset Count	V,K	K0-2147434528; See DL05 V-memory map
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map

CTRINTR Example

Rung 1: This sets up the CTRIO card in slot 2 of the local base. Each CTRIO in the system will need a separate CTRIO I-box before any CTRxxxx I-boxes can be used for them. The CTRIO has been configured to use V2000 through V2025 for its input data, and V2030 through V2061 for its output data.



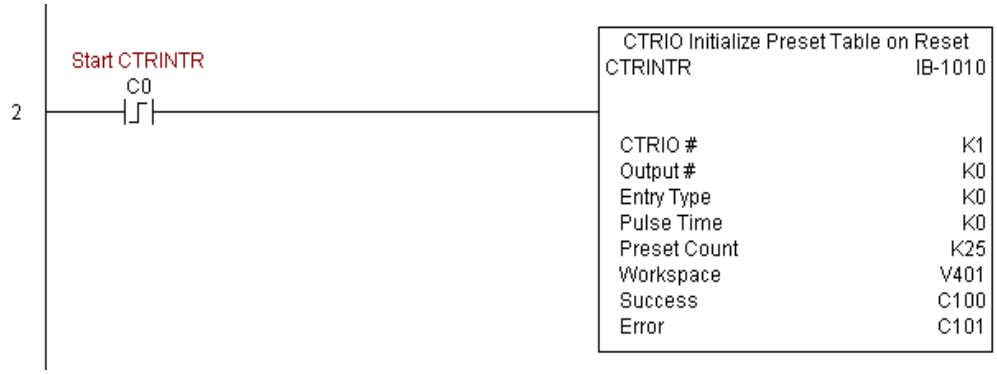
(Example continued on next page)

CTRINTR Example (cont'd)

Rung 2: This rung is a sample method for enabling the CTRINTR command. A C-bit is used to allow the programmer to control the command from Data View for testing purposes.

Turning on C0 will cause the CTRINTR instruction to create a single entry preset table, but not as a file, and use it for output #0, the new preset will be loaded when the current count is reset. In this case the single preset will be a set at a count of 25 for output #0.

Operating procedure for this example code is to load the CTRINTR_ex1.cwb file to your CTRIO, then enter the code shown here, change to RUN mode, enable output #0 by turning on C2 in Data View, turn encoder on CTRIO to value above 10 and output #0 light will come on. Now turn on C0 to execute the CTRINTR command, reset the counter with C1, then turn encoder to value of 25+ (output #0 should turn on).



CTRINTR Example

Rung 3: This rung allows the programmer to reset the counter from the ladder logic.

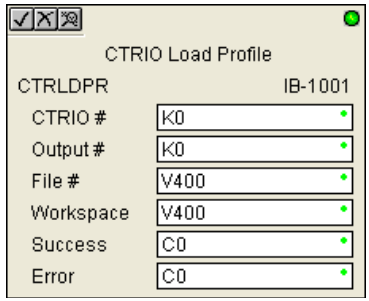
Rung 4: This rung allows the operator to enable output #0 from the ladder code.

CTRIO Load Profile (CTRLDPR) (IB-1001)

DS5	Used
HPP	N/A

CTRIO Load Profile loads a CTRIO Profile File to a CTRIO Output resource on a leading edge transition to this IBox. This IBox will take more than 1 PLC scan to execute. Either the Success or Error bit will turn on when the command is complete. If the Error Bit is on, you can use the CTRIO Read Error Code (CTRRDER) IBox to get extended error information.

The Workspace register is for internal use by this IBox instruction and MUST NOT be used anywhere else in your program.



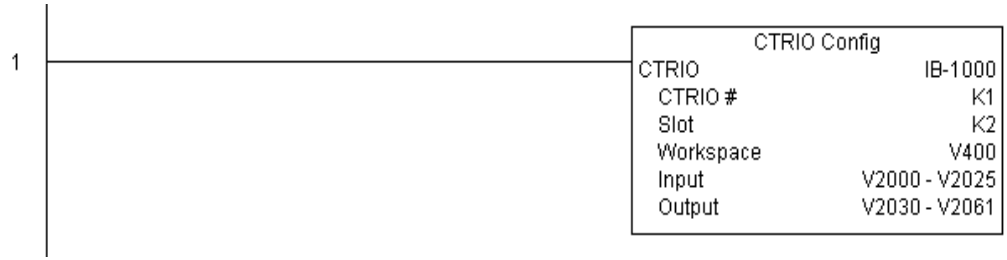
CTRLDPR Parameters

- CTRIO#: specifies a specific CTRIO module based on a user defined number (see CTRIO Config)
- Output#: specifies a CTRIO output to be used by the instruction
- File#: specifies a CTRIO profile File number to be loaded
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the instruction has successfully completed
- Error: specifies a bit that will turn on if the instruction does not complete successfully

Parameter		DL05 Range
CTRIO#	K	K0-255
Output#	K	K0-3
File#	V,K	K0-255; See DL05 V-memory map - Data Words
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map

CTRLDPR Example

Rung 1: This sets up the CTRIO card in slot 2 of the local base. Each CTRIO in the system will need a separate CTRIO I-box before any CTRxxxx I-boxes can be used for them. The CTRIO has been configured to use V2000 through V2025 for its input data, and V2030 through V2061 for its output data.



Rung 2: This CTRIO Load Profile IBox will load File #1 into the working memory of Output 0 in CTRIO #1. This example program requires that you load CTRLDPR_IBox.cwb into your Hx-CTRIO(2) module.

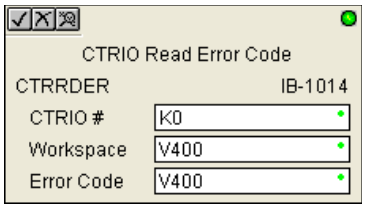
Rung 3: If the file is successfully loaded, set Profile_Loaded.

CTRIO Read Error (CTRRDER) (IB-1014)

DS5	Used
HPP	N/A

CTRIO Read Error Code will get the decimal error code value from the CTRIO module (listed below) and place it into the given Error Code register, on a leading edge transition to the IBox

Since the Error Code in the CTRIO is only maintained until another CTRIO command is given, you must use this instruction immediately after the CTRIO IBox that reports an error via its Error bit parameter.



The Workspace register is for internal use by this IBox instruction and MUST NOT be used anywhere else in your program.

Error Codes:

0: No Error

100: Specified command code is unknown or unsupported

101: File number not found in the file system

102: File type is incorrect for specified output function

103: Profile type is unknown

104: Specified input is not configured as a limit on this output

105: Specified limit input edge is out of range

106: Specified input function is unconfigured or invalid

107: Specified input function number is out of range

108: Specified preset function is invalid

109: Preset table is full

110: Specified Table entry is out of range

111: Specified register number is out of range

112: Specified register is an unconfigured input or output

2001: Error reading Error Code - cannot access CTRIO via ERM

CTRRDER Parameters

- CTRIO#: specifies a specific CTRIO module based on a user defined number (see CTRIO Config)
- Workspace: specifies a V-memory location that will be used by the instruction
- Error Code: specifies the location where the Error Code will be written

Parameter		DL05 Range
CTRIO#	K	K0-255
Workspace	V	See DL05 V-memory map - Data Words
Error Code	V	See DL05 V-memory map - Data Words

CTRRDER Example

Rung 1: This sets up the CTRIO card in slot 2 of the local base. Each CTRIO in the system will need a separate CTRIO I-box before any CTRxxxx I-boxes can be used for them. The CTRIO has been configured to use V2000 through V2025 for its input data, and V2030 through V2061 for its output data.

Rung 2: This CTRIO Read Error Code IBox will read the Extended Error information from CTRIO #1. This example program requires that you load CTRRDER_IBox.cwb into your Hx-CTRIO(2) module.

CTRIO Run to Limit Mode (CTRRTLM) (IB-1011)

DS5	Used
HPP	N/A

CTRIO Run To Limit Mode, on a leading edge transition to this IBox, loads the Run to Limit command and given parameters on a specific Output resource. The CTRIO's Input(s) must be configured as Limit(s) for this function to work.

Valid Hexadecimal Limit Values:

K00 - Rising Edge of Ch1/C

K10 - Falling Edge of Ch1/C

K20 - Both Edges of Ch1/C

K01 - Rising Edge of Ch1/D

K11 - Falling Edge of Ch1/D

K21 - Both Edges of Ch1/D

K02 - Rising Edge of Ch2/C

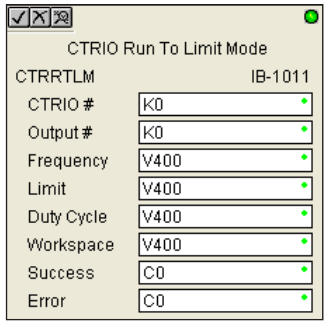
K12 - Falling Edge of Ch2/C

K22 - Both Edges of Ch2/C

K03 - Rising Edge of Ch2/D

K13 - Falling Edge of Ch2/D

K23 - Both Edges of Ch2/D



This IBox will take more than 1 PLC scan to execute. Either the Success or Error bit will turn on when the command is complete. If the Error Bit is on, you can use the CTRIO Read Error Code (CTRRDER) IBox to get extended error information.

The Workspace register is for internal use by this IBox instruction and MUST NOT be used anywhere else in your program.

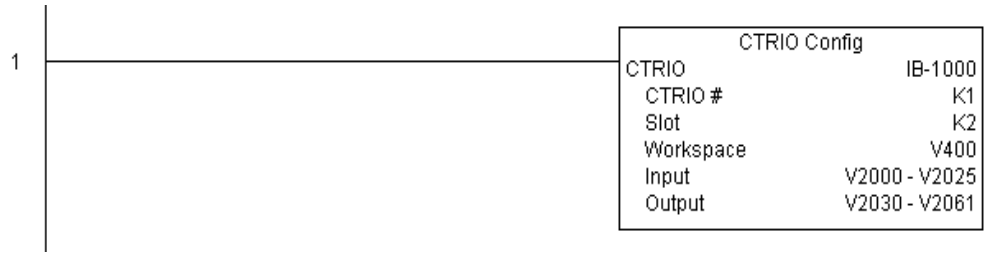
CTRRTLM Parameters

- CTRIO#: specifies a specific CTRIO module based on a user defined number (see CTRIO Config Ibox)
- Output#: specifies a CTRIO output to be used by the instruction
- Frequency: specifies the output pulse rate (H0-CTRIO: 20Hz - 25kHz / H0-CTRIO2: 20Hz - 250kHz)
- Limit: the CTRIO's Input(s) must be configured as Limit(s) for this function to operate
- Duty Cycle: specifies the % of on time versus off time. This is a hex number. Default of 0 is 50%, also entering 50 will yield 50%. 50% duty cycle is defined as on half the time and off half the time
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the instruction has successfully completed
- Error: specifies a bit that will turn on if the instruction does not complete successfully

Parameter		DL05 Range
CTRIO#	K	K0-255
Output#	K	K0-3
Frequency	V,K	K20-20000; See DL05 V-memory map - Data Words
Limit	V,K	K0-FF; See DL05 V-memory map - Data Words
Duty Cycle	V,K	K0-99; See DL05 V-memory map - Data Words
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map

CTRRTLM Example

Rung 1: This sets up the CTRIO card in slot 2 of the local base. Each CTRIO in the system will need a separate CTRIO I-box before any CTRxxxx I-boxes can be used for them. The CTRIO has been configured to use V2000 through V2025 for its input data, and V2030 through V2061 for its output data.



Rung 2: This CTRIO Run To Limit Mode IBox sets up Output #0 in CTRIO #1 to output pulses at a Frequency of 1000 Hz until Llimit #0 comes on. This example program requires that you load CTRRTLM_IBox.cwb into your Hx-CTRIO(2) module.

(example continued on next page)

CTRRTLM Example (cont'd)

Rung 3: If the Run To Limit Mode parameters are OK, set the Direction Bit and Enable the output.

CTRIO Run to Position Mode (CTRRTPM) (IB-1012)

DS5	Used
HPP	N/A

CTRIO Run To Position Mode, on a leading edge transition to this IBox, loads the Run to Position command and given parameters on a specific Output resource.

Valid Function Values are:

00: Less Than Ch1/Fn1

10: Greater Than Ch1/Fn1

01: Less Than Ch1/Fn2

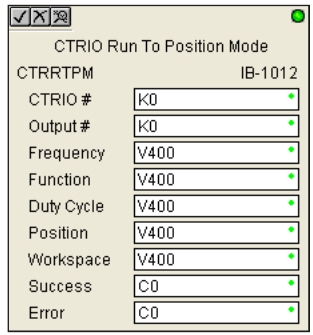
11: Greater Than Ch1/Fn2

02: Less Than Ch2/Fn1

12: Greater Than Ch2/Fn1

03: Less Than Ch2/Fn2

13: Greater Than Ch2/Fn2



This IBox will take more than 1 PLC scan to execute. Either the Success or Error bit will turn on when the command is complete. If the Error Bit is on, you can use the CTRIO Read Error Code (CTRRDER) IBox to get extended error information.

The Workspace register is for internal use by this IBox instruction and MUST NOT be used anywhere else in your program.

CTRRTPM Parameters

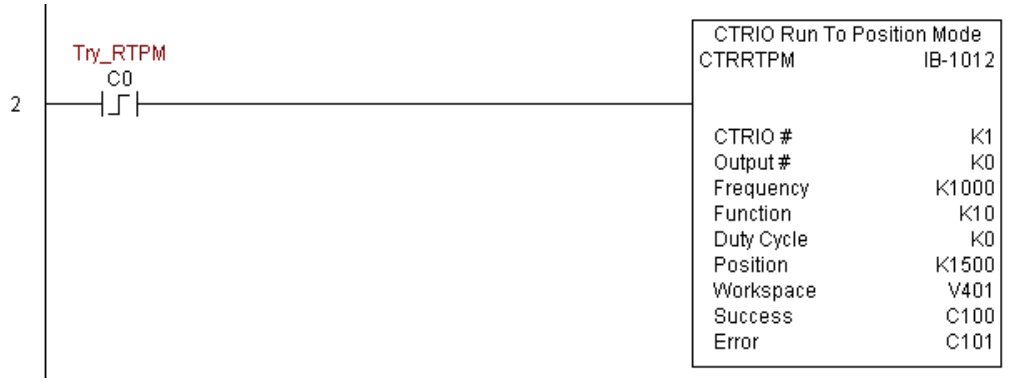
- CTRIO#: specifies a specific CTRIO module based on a user defined number (see CTRIO Config Ibox)
- Output#: specifies a CTRIO output to be used by the instruction
- Frequency: specifies the output pulse rate (H0-CTRIO: 20Hz - 25KHz / H0-CTRIO2: 20Hz - 250 KHz)
- Duty Cycle: specifies the % of on time versus off time. This is a hex number. Default of 0 is 50%, also entering 50 will yield 50%. 50% duty cycle is defined as on half the time and off half the time
- Position: specifies the count value, as measured on the encoder input, at which the output pulse train will be turned off
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the instruction has successfully completed
- Error: specifies a bit that will turn on if the instruction does not complete successfully

Parameter		DL05 Range
CTRIO#	K	K0-255
Output#	K	K0-3
Frequency	V,K	K20-20000; See DL05 V-memory map - Data Words
Duty Cycle	V,K	K0-99; See DL05 V-memory map
Position	V,K	K0-2147434528; See DL05 V-memory map
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map

CTRRTPM Example

Rung 1: This sets up the CTRIO card in slot 2 of the local base. Each CTRIO in the system will need a separate CTRIO I-box before any CTRxxxx I-boxes can be used for them. The CTRIO has been configured to use V2000 through V2025 for its input data, and V2030 through V2061 for its output data.

Rung 2: This CTRIO Run To Position Mode IBox sets up Output #0 in CTRIO #1 to output pulses at a Frequency of 1000Hz, use the 'Greater than Ch1/Fn1' comparison operator, until the input position of 1500 is reached. This example program requires that you load CTRRTPM_IBox.cwb into your Hx-CTRIO(2) module.

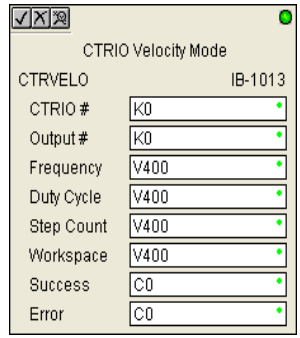


Rung 3: If the Run To Position Mode parameters are OK, set the Direction Bit and Enable the output.

CTRIO Velocity Mode (CTRVELO) (IB-1013)

DS5	Used
HPP	N/A

CTRIO Velocity Mode loads the Velocity command and given parameters on a specific Output resource on a leading edge transition to this IBox.



This IBox will take more than 1 PLC scan to execute. Either the Success or Error bit will turn on when the command is complete. If the Error Bit is on, you can use the CTRIO Read Error Code (CTRRDER) IBox to get extended error information.

The Workspace register is for internal use by this IBox instruction and MUST NOT be used anywhere else in your program.

CTRVELO Parameters

- CTRIO#: specifies a specific CTRIO module based on a user defined number (see CTRIO Config Ibox)
- Output#: specifies a CTRIO output to be used by the instruction
- Frequency: specifies the output pulse rate (H0-CTRIO: 20Hz - 25kHz / H0-CTRIO2: 20Hz–250kHz)
- Duty Cycle: specifies the % of on time versus off time. This is a hex number. Default of 0 is 50%, also entering 50 will yield 50%. 50% duty cycle is defined as on half the time and off half the time
- Step Count: This DWORD values specifies the number of pulses to output. A Step Count value of -1 (or 0xFFFFFFFF) causes the CTRIO to output pulses continuously. Negative Step Count values must be V-Memory references.
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the instruction has successfully completed
- Error: specifies a bit that will turn on if the instruction does not complete successfully

Parameter		DL05 Range
CTRIO#	K	K0-255
Output#	K	K0-3
Frequency	V,K	K20-20000; See DL05 V-memory map - Data Words
Duty Cycle	V,K	K0-99; See DL05 V-memory map
Step Count	V,K	K0-2147434528; See DL05 V-memory map
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map

CTRVELO Example

Rung 1: This sets up the CTRIO card in slot 2 of the local base. Each CTRIO in the system will need a separate CTRIO I-box before any CTRxxxx I-boxes can be used for them. The CTRIO has been configured to use V2000 through V2025 for its input data, and V2030 through V2061 for its output data.

Rung 2: This CTRIO Velocity Mode IBox sets up Output #0 in CTRIO #1 to output 10,000 pulses at a Frequency of 1000Hz. This example program requires that you load CTRVELO_IBox.cwb into your Hx-CTRIO(2) module.

CTRVELO Example

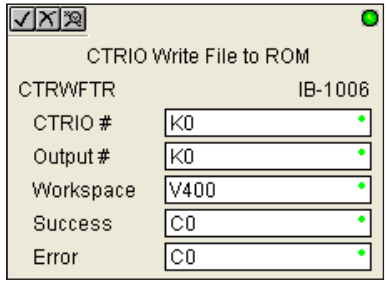
Rung 3: If the Velocity Mode parameters are OK, set the Direction Bit and Enable the output.

CTRIO Write File to ROM (CTRWFTR) (IB-1006)

DS5	Used
HPP	N/A

CTRIO Write File to ROM writes the runtime changes made to a loaded CTRIO Preset Table back to Flash ROM on a leading edge transition to this IBox. This IBox will take more than 1 PLC scan to execute. Either the Success or Error bit will turn on when the command is complete. If the Error Bit is on, you can use the CTRIO Read Error Code (CTRRDER) IBox to get extended error information.

The Workspace register is for internal use by this IBox instruction and MUST NOT be used anywhere else in your program.



CTRWFTR Parameters

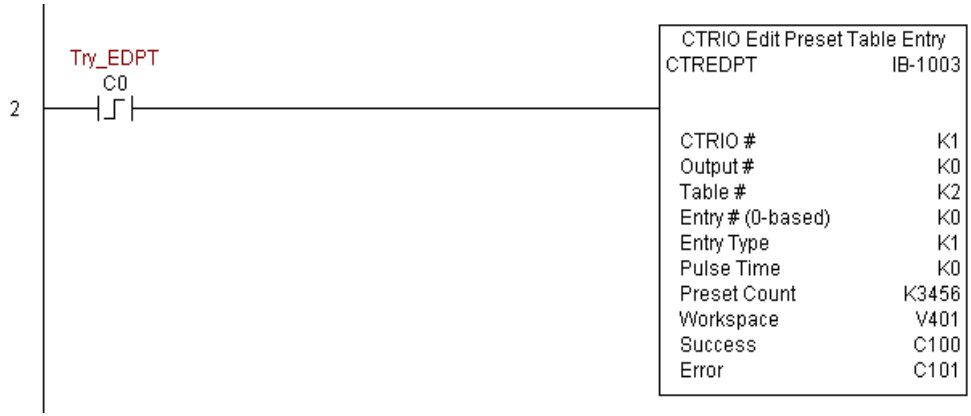
- CTRIO#: specifies a specific CTRIO module based on a user defined number (see CTRIO Config Ibox)
- Output#: specifies a CTRIO output to be used by the instruction
- Workspace: specifies a V-memory location that will be used by the instruction
- Success: specifies a bit that will turn on once the instruction has successfully completed
- Error: specifies a bit that will turn on if the instruction does not complete successfully

Parameter		DL05 Range
CTRIO#	K	K0-255
Output#	K	K0-3
Workspace	V	See DL05 V-memory map - Data Words
Success	X,Y,C,GX,GY,B	See DL05 V-memory map
Error	X,Y,C,GX,GY,B	See DL05 V-memory map

CTRWFTR Example

Rung 1: This sets up the CTRIO card in slot 2 of the local base. Each CTRIO in the system will need a separate CTRIO I-box before any CTRxxxx I-boxes can be used for them. The CTRIO has been configured to use V2000 through V2025 for its input data, and V2030 through V2061 for its output data.

Rung 2: This CTRIO Edit Preset Table Entry IBox will change Entry 0 in Table #2 to be a RESET at Count 3456. This example program requires that you load CTRWFTR_IBox.cwb into your Hx-CTRIO(2) module.



(Example continued on next page)

CTRWFTR Example (cont'd)

Rung 3: If the file is successfully edited, use a Write File To ROM IBox to save the edited table back to the CTRIO's ROM, thereby making the changes retentive.