


This Application Note is pertinent to the
Unidrive SP, Commander GP20, SK and Affinity Families

Accessing all Inputs of an SM-I/O32 Module

The SM-I/O32 is an expansion module that can provide up to 32 additional digital inputs or outputs. The module uses a 37pin D cable and DIN rail mounted breakout board that provides terminal strip connections to external devices.



SM-I/O 32 digital outputs
Each group of 4 outputs can supply a total of 16mA, so each output is able to supply at least 4mA. A digital output can supply up to a maximum of 16mA as long as the total output current for the group does not exceed 16mA, (for example, one digital I/O set as an output and the other three digital I/O in the group set to inputs).

Recommended relay
TYCO Electronics Schrack ST3P2LC4

[= output group

PL1	
Digital Input/Output 1	1
Digital Input/Output 2	2
Digital Input/Output 3	3
Digital Input/Output 4	4
Digital Input/Output 5	5
Digital Input/Output 6	6
Digital Input/Output 7	7
Digital Input/Output 8	8
Digital Input/Output 9	9
Digital Input/Output 10	10
Digital Input/Output 11	11
Digital Input/Output 12	12
Digital Input/Output 13	13
Digital Input/Output 14	14
Digital Input/Output 15	15
Digital Input/Output 16	16
Digital Input/Output 17	17
Digital Input/Output 18	18
Digital Input/Output 19	19
Digital Input/Output 20	20
Digital Input/Output 21	21
Digital Input/Output 22	22
Digital Input/Output 23	23
Digital Input/Output 24	24
Digital Input/Output 25	25
Digital Input/Output 26	26
Digital Input/Output 27	27
Digital Input/Output 28	28
Digital Input/Output 29	29
Digital Input/Output 30	30
Digital Input/Output 31	31
Digital Input/Output 32	32
+24V Out	33
OV	34
OV	35
OV	36
OV	37

The first 8 pins of are directly usable as one would with any other module I/O

However, to gain full access

SM-I/O 32

This module provides expanded digital I/O.

- 32 Digital Inputs/Outputs
- Includes Breakout Board and Cable
- Access to all I/O requires the use of SyPTLite or SyPTPro software



This application note will provide more insight into how to gain control of these additional inputs using SyPT Lite. There is an example program which will also serve as a test program for the module and interconnecting wiring.

Implementation

As a first step I decided to use SyPT Lite to create a test program for all 32 inputs of the I/O32 module. When doing so one must setup the Data Direction register which is parameter xx.43.

Commander SK

In a Commander SK the module menu is menu 15 so the Data Direction register is #15.43. By setting it to a 0 all terminals are configured as Inputs. With Commander SK these inputs can be accessed at the a fixed position- parameter #20.21. This is a 32 bit register which is capable of holding the status of all of the 32 input bits.

PL1

Digital Input/Output 1	1
Digital Input/Output 2	2
Digital Input/Output 3	3
Digital Input/Output 4	4
Digital Input/Output 5	5
Digital Input/Output 6	6
Digital Input/Output 7	7
Digital Input/Output 8	8
Digital Input/Output 9	9
Digital Input/Output 10	10
Digital Input/Output 11	11
Digital Input/Output 12	12
Digital Input/Output 13	13
Digital Input/Output 14	14
Digital Input/Output 15	15
Digital Input/Output 16	16
Digital Input/Output 17	17
Digital Input/Output 18	18
Digital Input/Output 19	19
Digital Input/Output 20	20
Digital Input/Output 21	21
Digital Input/Output 22	22
Digital Input/Output 23	23
Digital Input/Output 24	24
Digital Input/Output 25	25
Digital Input/Output 26	26
Digital Input/Output 27	27
Digital Input/Output 28	28
Digital Input/Output 29	29
Digital Input/Output 30	30
Digital Input/Output 31	31
Digital Input/Output 32	32

Bit #20.21.00 = Terminal 1

Bit #20.21.01 = Terminal 2

And so on up to

Bit #20.21.31 = Terminal 32

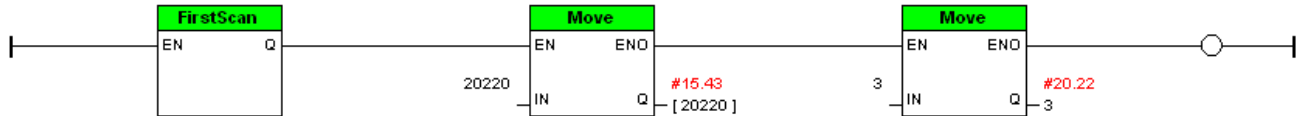
To check the inputs I just connected a wire to Term 33 (+24vdc) and then to each input terminal 1-32 and listen for the drive relay to click.

Input Test Program when used with the Commander SK

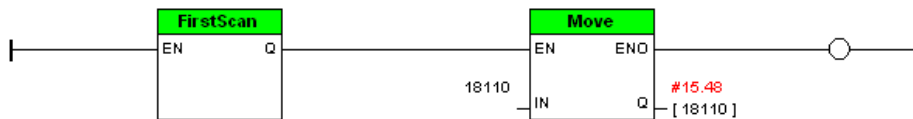
This program is intended for Commander SK with an SM I/O32 module. It configures the module so that one can test all 32 inputs by connecting a wire to Term 33 (+24vdc) and touching to each pin 1-32. If the input is functional you should hear the drive relay click for audible verification.

The program also serves as an example of how to set up the Data Direction Register and mask. In this example, I used a mask of 3 (binary 11) which sets Term 1 and 2 as outputs. Then I set Pr 61 so that you could go there and enter 0,1, 2 or 3 to activate Term 1 or 2 or both based on this number. To verify you could hear the relay or measure the terminals 1 & 2 for +24v.

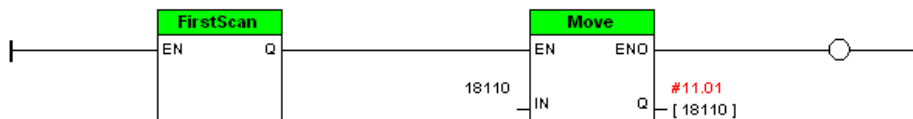
⚡ Setting parameter #15.43 DDRP to #20.22 . This parameter will be the direction register mask and will set all the I/O lines as inputs except with a 3, Term 1 & 2 will be outputs ⚡)



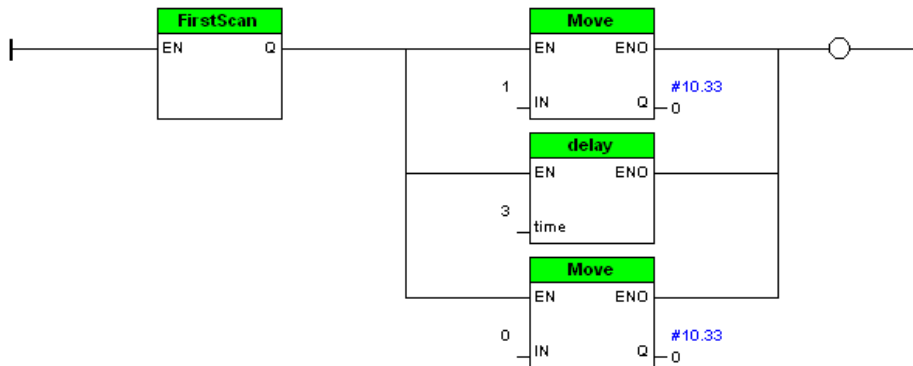
⚡ Set up the Write Register reference pointer to #18.11 - valid values would be 0-3 ⚡)



⚡ Setup Pr61 so that you can change values to provide output control of Term1 and 2 ⚡)



⚡ Double-click to enter a rung comment ⚡)



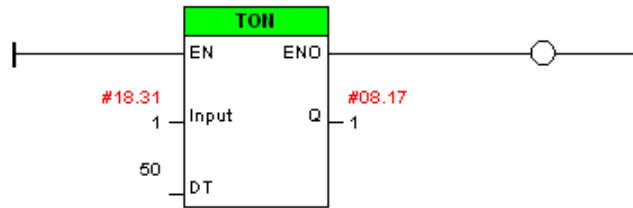
The code above is what would be executed on a power up first scan of the ladder. Normally this would be placed under one FirstScan rung (like the 4th rung above) but I broke them out so each step could be commented.

On the 1st rung the Data Direction register is set so that all I/O points are set up as Inputs except Terminals 1 & 2 . This is done by setting the DDR as a 3 or binary 11.

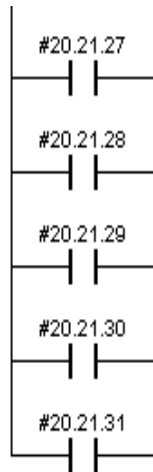
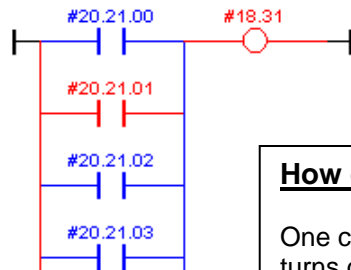
The 2nd rung sets #18.11 as the Write Data Register and the 3rd rung sets Pr61 to #18.11 so that one could go to Pr61 and cause outputs on Terminals 1 & 2 by setting Pr61 =0,1,2 or 3. This can be verified by measuring these terminals with a voltmeter and/or listening for the drives relay click.

The 4th rung merely causes a Drive Reset so that all the previous items are setup.

(* 50mSec of contact debounce (optional) - OR gate is trigger- toggle drive Relay as audible indicator*)



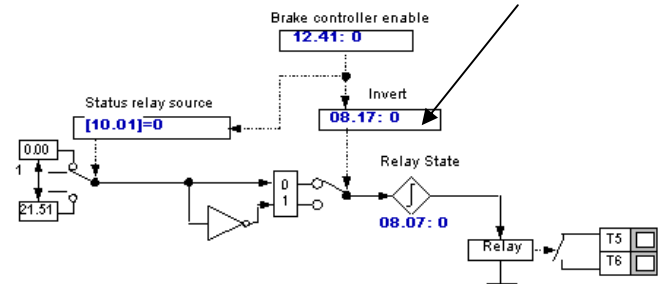
(* Big OR gate Bit xx.yy.00 = Terminal 1 xx.yy.31 = Terminal 32 #20.21 is Input Read Register *)



How does this work ?

One can see that there is a 32 input OR gate which if any input is seen it turns on #18.31.

The TON rung is optional. It takes #18.31 and creates a 50mSec debounce of any input before setting #8.17. This eliminated some chatter caused by activating the inputs with a bare piece of wire touched to the terminal inputs.



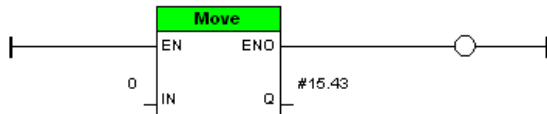
#8.17 is the inversion bit for the drives relay on T5 and T6. This will provide and audible indication (or visible if one connected a light) when any input terminal is connected to +24v (terminal 33).

To obtain a copy of this example program click here → [CTSL011a.dpl](#)

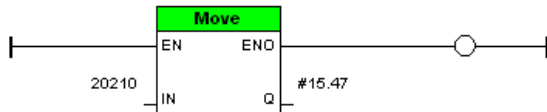
Unidrive SP, Commander GP20, Affinity

In these drives the I/O module can be placed in any un-used slot, the Data Direction register is #xx.43. The Input data word is not fixed and can be directed to a register of ones choosing by setting the Data Register pointer #xx.47. In this example I chose, #20.21 to hold the Input data.

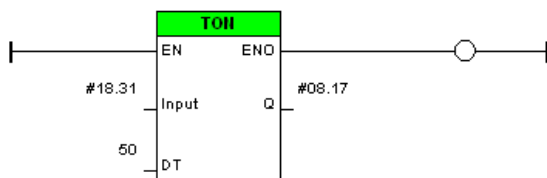
([Ⓢ] Initializing parameter #15.43 to 0. This parameter will be assigned as the direction register and will set all the I/O lines as input. This program assumes I032 module in Slot 1 *)



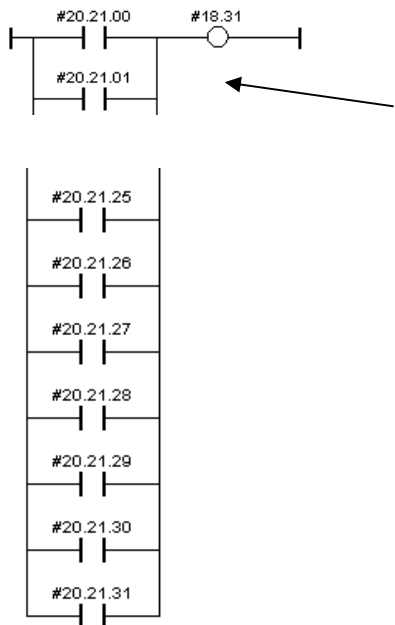
([Ⓢ] Making #20.21 as the read register by storing a value of 20210 (x1000) in #x.47. Any data seen by the module through the I/O lines can be read in #20.21 *)



([Ⓢ] 50mSec of contact debounce (optional) - OR gate is trigger toggle drive Relay as audible indicator*)



([Ⓢ] Big OR gate Bit xx.yy.00 = Terminal 1 xx.yy.31 = Terminal 32 Equivalent Decimal value of InputWord can be read at #20.21 up to Terminal 24*)

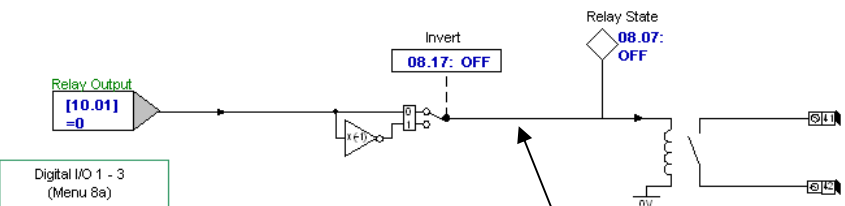


How does this work ?

One can see that there is a 32 input OR gate which if any input is seen it turns on #18.31.

On the 2nd rung the Data Direction register is set so that all I/O points are set up as Inputs. (This could have be done once vs left in the ladder scan by putting this on a FirstScan rung)

The 3rd rung is optional. It takes #18.31 and creates a 50mSec debounce of any input before setting #8.17. This eliminates some chatter caused by activating the inputs with a bare piece of wire to the terminal inputs.



#8.17 is the inversion bit for the drives relay on T5 and T6. This will provide and audible indication (or visible if one connected a light) when any input terminal is connected to +24v (terminal 33).

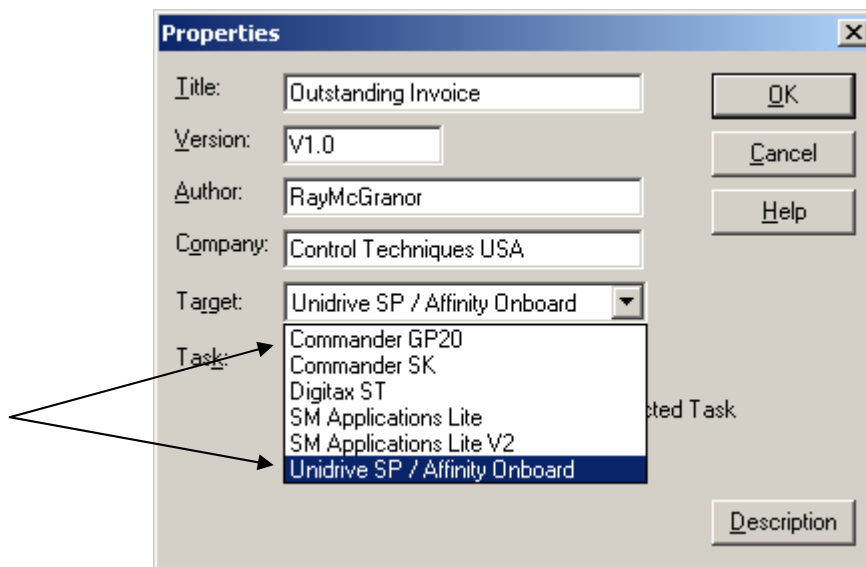
To obtain a copy of this example program click here → [CTSL011b.dpl](#)

Using these programs

One would merely open this program using SyPT Lite and select the proper Drive Target type after clicking on the rightmost Toolbar icon.



This would be: **Unidrive SP/Affinity On Board** or **Commander GP20** or **Commander SK**



Then you would merely click on the Lightning Bolt to compile and download into the drive.



An Input and Output Example

Typically applications tend to need more inputs than outputs. The SM-I/O32 is ideal for this situation as there are 32 I/O. However, there are output drive limitations that must be obeyed. The User Guide cites a recommended relay for use with the SM-I/O 32 module as a Tyco/Electronics/Schrack relay with manufacturer's part number ST3P2LC4. This relay requires 8mA to operate.

A data sheet for the recommended relay can be found at the link below:
http://relays.tycoelectronics.com/schrack/pdf/Package_SNR.pdf

The digital outputs on the SM-I/O 32 are arranged in eight groups of four outputs.

Group	Digital Output
1	1 to 4
2	5 to 8
3	9 to 12
4	13 to 16
5	17 to 20
6	21 to 24
7	25 to 28
8	29 to 32

Each group of 4 outputs can supply a total of 16mA, so each output is able to supply at least 4mA. A digital output can supply up to a maximum of 16mA as long as the total output current for the group does not exceed 16mA, (for example, one digital I/O set as an output and the other three digital I/O in the group set to inputs or unused).

The total output current that can be drawn from the digital outputs on the SM-I/O 32 module (excluding the 24V user output) is 128mA. The maximum output current that can be drawn from the 24V user output is 100mA. The total output current that can be drawn from the SM-I/O 32 is 228mA (128mA from the digital outputs and 100mA from the 24V user output).

Therefore, the SMI/O 32 option module can drive a maximum of 16 of these relays at a time; i.e. two relays per group of four digital outputs, drawing a total current of 128mA. Although a relay can be connected to each digital output in a group of four digital outputs, only two of these relays should be energized at the same time. If more than two relays in a group are active at the same time then the drive will trip on SLX.Er with error code 1 in Pr **x.51**.

I/O Example:

If one has a Unidrive SP and needs say 4 additional outputs and perhaps 6 inputs what would be a setup strategy ?

I decided lay out my I/O as shown below:

PL1	
Digital Input/Output 1	1
Digital Input/Output 2	2
Digital Input/Output 3	3
Digital Input/Output 4	4
Digital Input/Output 5	5
Digital Input/Output 6	6
Digital Input/Output 7	7
Digital Input/Output 8	8
Digital Input/Output 9	9
Digital Input/Output 10	10
Digital Input/Output 11	11
Digital Input/Output 12	12
Digital Input/Output 13	13
Digital Input/Output 14	14
Digital Input/Output 15	15
Digital Input/Output 16	16
Digital Input/Output 17	17
Digital Input/Output 18	18
Digital Input/Output 19	19
Digital Input/Output 20	20
Digital Input/Output 21	21
Digital Input/Output 22	22
Digital Input/Output 23	23
Digital Input/Output 24	24
Digital Input/Output 25	25
Digital Input/Output 26	26
Digital Input/Output 27	27
Digital Input/Output 28	28
Digital Input/Output 29	29
Digital Input/Output 30	30
Digital Input/Output 31	31
Digital Input/Output 32	32

Input 1 Bit #18.12.00 = Terminal 1
 Input 2 Bit #18.12.01 = Terminal 2
 Input 3 Bit #18.12.02 = Terminal 3
 Input 4 Bit #18.12.03 = Terminal 4
 Input 5 Bit #18.12.04 = Terminal 5
 Input 6 Bit #18.12.05 = Terminal 6

Output 1 Bit #18.13.08 = Terminal 9
 Output 2 Bit #18.13.09 = Terminal 10

Output 3 Bit #18.13.12 = Terminal 13
 Output 4 Bit #18.13.13 = Terminal 14

The rationale was that since my total I/O count was less than 16 (even if I allow for a little "after the fact" expansion) I decided to keep the data in a 16 bit register such as in Menu 18 or 19 vs Menu 20 which are 32 bit registers.

Notice that I spread the outputs that will be driving the recommended relay to span over 2 groups of 4 to keep the total group drive down to 16mA (8mA per Relay)

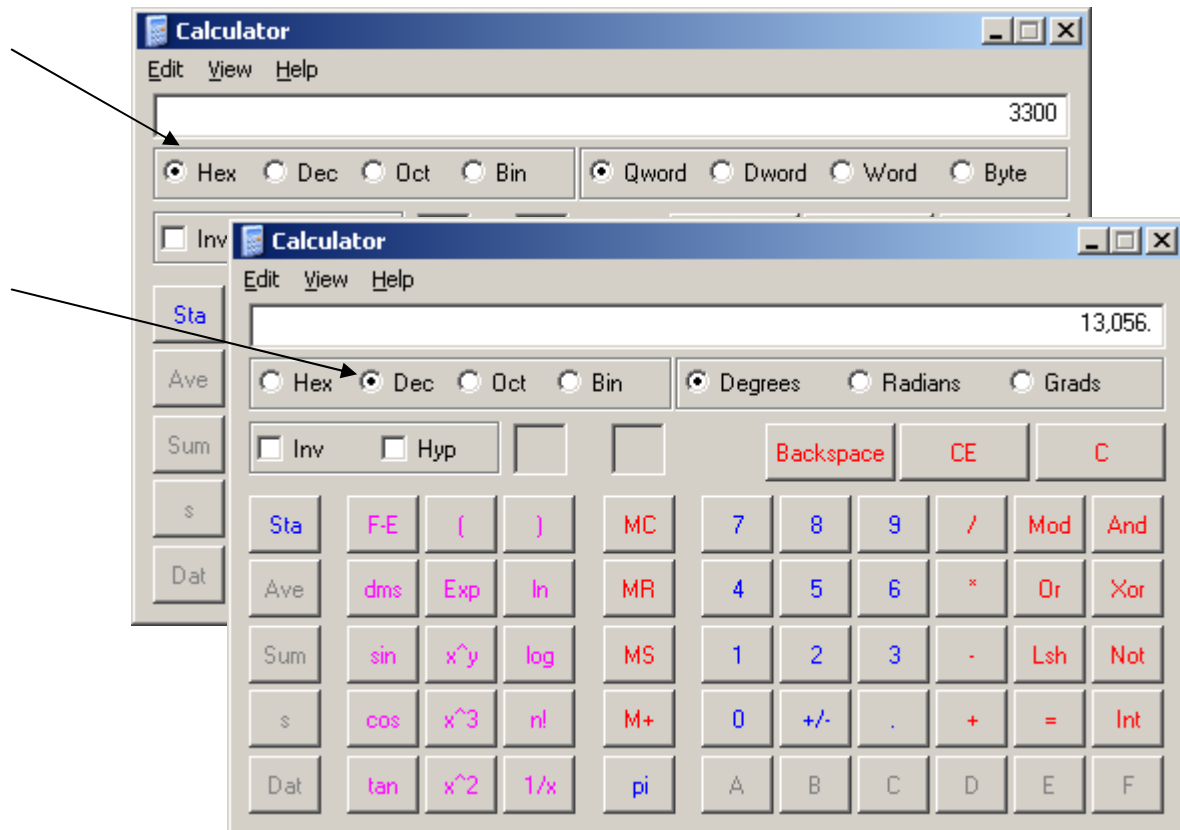
So now we need to setup the Data Direction Register which is #xx.43 for the Unidrive SP (where xx is the slot number where the SM-I/O32 module is placed –either #15.43, #16.43 or #17.43)

Remember, 0 = Input 1 = Output

Term #	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
	X	X	1	1	X	X	1	1	X	X	0	0	0	0	0	0	X = don't care - so we'll set as 0
	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	
	3				3				0				0 ₁₆				= 13056 ₁₀

So the Data Direction Register mask becomes 13056 in decimal

To convert the hexadecimal value of 3300 you can use the Scientific Calculator built into Window™. Select Hex, enter the base 16 number, then click on Dec (decimal) to convert.



So if the SM-I/O32 was placed in Slot 2 the DDRP (Data Direction Register Pointer) would be #16.43.

I picked a 16bit register that will reference the DDRP to be #18.11
 Similarly, the Read Register Pointer is #16.47 which I picked #18.12 and
 the Write Register Pointer is #16.48 which I picked #18.13

So we would set #16.43 = 18.11

#16.47 = 18.12

And #16.48 = 18.13

Then we would place the mask of 13056 into #18.11

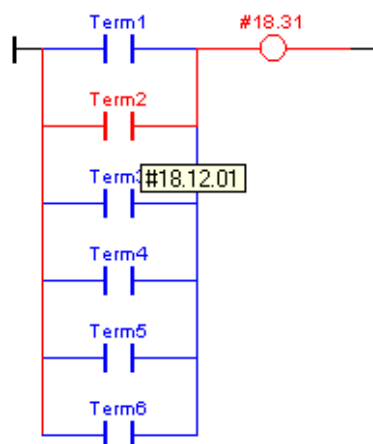
We should be able to read our inputs at #18.12 and control our relay outputs using #18.13

Resultant Program

Alias Assignments

Relay1	#18.13.08
Relay2	#18.13.09
Relay3	#18.13.12
Term1	#18.12.00
Relay4	#18.13.13
Term2	#18.12.01
Term3	#18.12.02
Term4	#18.12.03
Term5	#18.12.04
Term6	#18.12.05

(* Monitor input terminals 1-6 *)



(* Using Input 1 to turn on Relay 1 Output *)



(* Using Input 2 to turn on Relay 2 Output *)



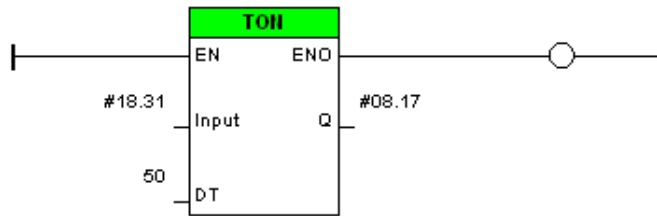
(* Using Input 3 to turn on Relay 3 Output *)



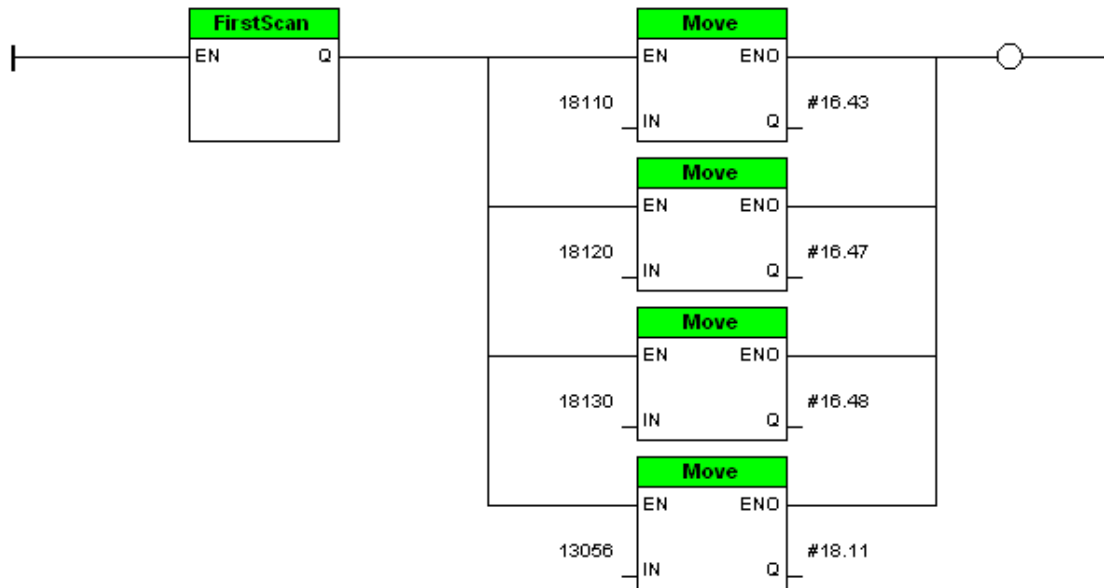
(* Using Input 4 to turn on Relay 4 Output *)



(* Using drive relay as audible indication w/ 50 mSec debounce *)



(* Set up I/O Module pointer reference registers & setup the Data Dir Reg mask *)



To obtain a copy of this example program click here → [CTSL011c.dpl](#)

Notes

Drive Software Version

The SM-I/O 32 can only be used with the following drive software versions or later:

Unidrive SP: V01.14.00
Digitax ST: V01.01.00
Commander GP20: V01.04.00
Affinity: V01.01.00
Commander SK: Any

If the SM-I/O 32 module is fitted to a drive with a software version earlier than stated above, it will show all the parameters in the Solutions Module menu including the unused ones. The unused parameters are masked in the software versions listed above and higher. On any version of Commander SK, the unused parameters are not masked.

Use with SM-EZmotion Module

If you use one SM-I/O 32 module with an SM-EZ Motion module, it will internally use #20.38, #20.39 & #20.40 registers. If you use these registers for any other purpose, there will be erroneous values in those registers.

If you happen to use a second SM-IO 32 module with an SM-EZ Motion, the EZ Motion will use up the #20.35, #20.36 & #20.37 registers. These registers should not be used for any other purposes.

To obtain the Free software SyPT Lite program that can be utilized by our Unidrive SP, Commander SK, Commander GP20 and Affinity drives click here→ [SyPT Lite](#)





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