CV#	Function/Default Value			Function/Default Value	
119	Logic Cell 10 - Output Control	0	172	Logic Cell 18 - Element B Type	160
120	Logic Cell 11 - Element A Address	104	173	Logic Cell 18 - Element C Address	0
121	Logic Cell 11 - Element A Type	96	174	Logic Cell 18 - Element C Type	0
122	Logic Cell 11 - Element B Address	110	175	Logic Cell 18 - Output Control	0
123	Logic Cell 11 - Element B Type	150	176	Logic Cell 19 - Element A Address	4
124	Logic Cell 11 - Element C Address	0	177	Logic Cell 19 - Element A Type	96
125	Logic Cell 11 - Element C Type	0	178	Logic Cell 19 - Element B Address	0
126	Logic Cell 11 - Output Control	0	179	Logic Cell 19 - Element B Type	0
127	Logic Cell 12 - Element A Address	110	180	Logic Cell 19 - Element C Address	0
128	Logic Cell 12 - Element A Type	32	181	Logic Cell 19 - Element C Type	0
129	Logic Cell 12 - Element B Address	111	182	Logic Cell 19 - Output Control	0
130	Logic Cell 12 - Element B Type	160	183	Logic Cell 20 - Element A Address	0
131	Logic Cell 12 - Element C Address	0	184	Logic Cell 20 - Element A Type	96
132	Logic Cell 12 - Element C Type	0	185	Logic Cell 20 - Element B Address	119
133	Logic Cell 12 - Output Control	0	186	Logic Cell 20 - Element B Type	160
134	Logic Cell 13 - Element A Address	3	187	Logic Cell 20 - Element C Address	0
135	Logic Cell 13 - Element A Type	96	188	Logic Cell 20 - Element C Type	0
136	Logic Cell 13 - Element B Address	0	189	Logic Cell 20 - Output Control	0
137	Logic Cell 13 - Element B Type	0	190	Logic Cell 21 - Element A Address	119
138	Logic Cell 13 - Element C Address	0	191	Logic Cell 21 - Element A Type	32
139	Logic Cell 13 - Element C Type	0	192	Logic Cell 21 - Element B Address	120
140	Logic Cell 13 - Output Control	0	193	Logic Cell 21 - Element B Type	160
141	Logic Cell 14 - Element A Address	119	194	Logic Cell 21 - Element C Address	0
142	Logic Cell 14 - Element A Type	96	195	Logic Cell 21 - Element C Type	0
143	Logic Cell 14 - Element B Address	113	196	Logic Cell 21 - Output Control	0
144	Logic Cell 14 - Element B Type	160	197	Logic Cell 22 - Element A Address	4
145	Logic Cell 14 - Element C Address	0	198	Logic Cell 22 - Element A Type	96
146	Logic Cell 14 - Element C Type	0	199	Logic Cell 22 - Element B Address	0
147	Logic Cell 14 - Output Control	0	200	Logic Cell 22 - Element B Type	0
148	Logic Cell 15 - Element A Address	113	201	Logic Cell 22 - Element C Address	0
149	Logic Cell 15 - Element A Type	32	202	Logic Cell 22 - Element C Type	0
150	Logic Cell 15 - Element B Address	114	203	Logic Cell 22 - Output Control	0
151	Logic Cell 15 - Element B Type	160	204	Logic Cell 23 - Element A Address	116
152	Logic Cell 15 - Element C Address	0	205	Logic Cell 23 - Element A Type	96
153	Logic Cell 15 - Element C Type	0	206	Logic Cell 23 - Element B Address	122
154	Logic Cell 15 - Output Control	0	207	Logic Cell 23 - Element B Type	160
155	Logic Cell 16 - Element A Address	3	208	Logic Cell 23 - Element C Address	0
156	Logic Cell 16 - Element A Type	96	209	Logic Cell 23 - Element C Type	0
157	Logic Cell 16 - Element B Address	0	210	Logic Cell 23 - Output Control	0
158	Logic Cell 16 - Element B Type	0	211	Logic Cell 24 - Element A Address	122
159	Logic Cell 16 - Element C Address	0	212	Logic Cell 24 - Element A Type	32
160	Logic Cell 16 - Element C Type	0	213	Logic Cell 24 - Element B Address	123
161	Logic Cell 16 - Output Control	0	214	Logic Cell 24 - Element B Type	160
162	Logic Cell 17 - Element A Address	110	215	Logic Cell 24 - Element C Address	0
163	Logic Cell 17 - Element A Type	96	216	Logic Cell 24 - Element C Type	0
164	Logic Cell 17 - Element B Address	116	217	Logic Cell 24 - Output Control	0
165	Logic Cell 17 - Element B Type	160	..	reserved	-
166	Logic Cell 17 - Element C Address	0	..	reserved	-
167	Logic Cell 17 - Element C Type	0	..	reserved	-
168	Logic Cell 17 - Output Control	0	..	reserved	-
169	Logic Cell 18 - Element A Address	116	..	reserved	-
170	Logic Cell 18 - Element A Type	32	..	reserved	-
171	Logic Cell 18 - Element B Address	117	255	Start up delay x .256 seconds	8

WARNING: This product contains a chemical known to the state of California to cause cancer, birth defects or other reproductive harm.
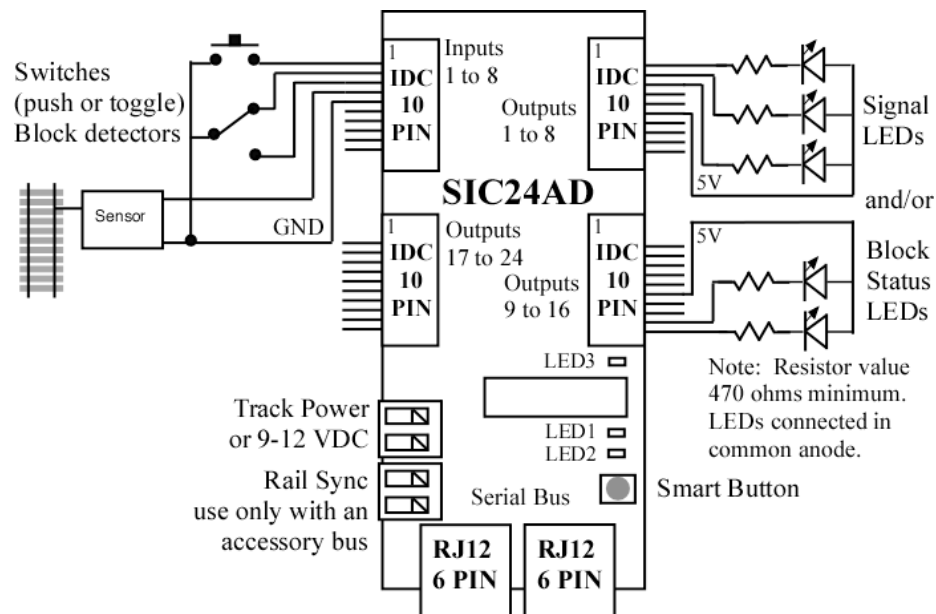
TEAM DIGITAL

Improving the world of DCC

SIC24 AD
Switch & Indicator Controller

> Control signals on your layout
> Control indicators on your layout and CTC panel
> Control crossing gates with flashing lights
> Eight inputs for sensors
> 24 outputs to drive LEDs
> Customizable logic
> Featuring "Smart" Programming
> DCC gateway to serial bus
> LocoNet® compatible

Note: Resistor value 470 ohms minimum. LEDs connected in common anode.

1 Features

The SIC24AD (Signal and Indicator Controller) is uniquely suited to control various types of signals and indicators on a layout or a CTC panel. It can be used as a signal controller, to indicate block occupancy and turnout position, and as a grade crossing gate controller with flashing signals. It can be used as a general input/output device for use with PC software like JMRI.

Control signals on your layout
• Built-in logic for automatically controlling signals using block detection
• Configurable to model many signaling systems
• Computer not required

Control indicators on your layout or CTC panel
• Block detection
• Turnout status
• Crossing gate and flashers

Provides 24 outputs
• Drives up to eight 3 LED signal heads with common anode or common cathode
• Drives Bi-color LED searchlights with 2 or 3 leads.
• Drives Tortoise™ switch machines for turnout control
• Drives Tortoise™ switch machines for semaphore signal control including the middle yellow aspect.

Provides 8 inputs
• For local turnout control.
• For occupancy sensors
• For turnout feedback sensors

Simple inter-board wiring
• Serial bus reduces system wiring
• Digitrax LocoNet® compatible

Simple basic setup
• Built-in setup configuration options
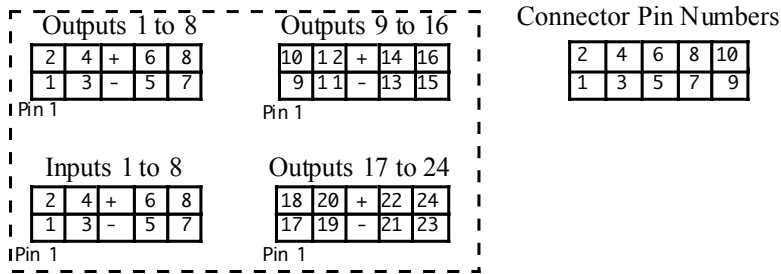• "Smart Programming" in conjunction with self programming

The SIC24AD sends and receives switch command, switch position feedback and sensor/block detection messages. It uses these same type messages to communicate between multiple SIC24ADs and to determine signal states. Since all communication is done over a serial bus, the number of wires to implement a signal system is greatly reduced. The serial bus is based on Digitrax's LocoNet® and some features are unique to a Digitrax system. However, a Digitrax DCC system is not required for operation or programming. The SIC24AD is compatible with LocoNet® block detectors such as the Digitrax BDL168 or detectors connected to its inputs such as the Team Digital DBD22.

The block diagram on the front page shows the general features with examples of various input and output devices.

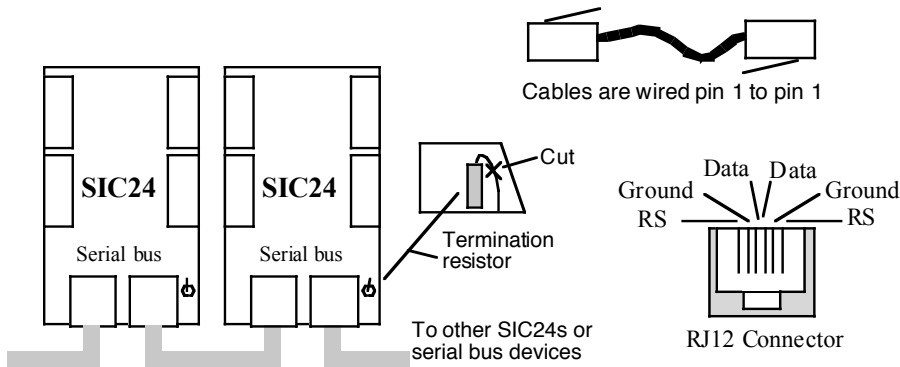## Cont. Summary of Configuration Variables

CV#	Function/Default Value		CV#	Function/Default Value	
15	Input 2 Control - Primary Address	2	67	Logic Cell 3 - Element B Type	160
16	Input 2 Primary Type	160	68	Logic Cell 3 - Element C Address	0
17	Input 2 Transition	3	69	Logic Cell 3 - Element C Type	0
18	Input 2 Secondary Address	0	70	Logic Cell 3 - Output Control	0
19	Input 2 Secondary Type	0	71	Logic Cell 4 - Element A Address	1
20	Input 3 Control - Primary Address	3	72	Logic Cell 4 - Element A Type	96
21	Input 3 Primary Type	160	73	Logic Cell 4 - Element B Address	0
22	Input 3 Transition	3	74	Logic Cell 4 - Element B Type	0
23	Input 3 Secondary Address	0	75	Logic Cell 4 - Element C Address	0
24	Input 3 Secondary Type	0	76	Logic Cell 4 - Element C Type	0
25	Input 4 Control - Primary Address	4	77	Logic Cell 4 - Output Control	0
26	Input 4 Primary Type	160	78	Logic Cell 5 - Element A Address	0
27	Input 4 Transition	3	79	Logic Cell 5 - Element A Type	96
28	Input 4 Secondary Address	0	80	Logic Cell 5 - Element B Address	104
29	Input 4 Secondary Type	0	81	Logic Cell 5 - Element B Type	160
30	Input 5 Control - Primary Address	4	82	Logic Cell 5 - Element C Address	0
31	Input 5 Primary Type	160	83	Logic Cell 5 - Element C Type	0
32	Input 5 Transition	3	84	Logic Cell 5 - Output Control	0
33	Input 5 Secondary Address	0	85	Logic Cell 6 - Element A Address	104
34	Input 5 Secondary Type	0	86	Logic Cell 6 - Element A Type	32
35	Input 6 Control - Primary Address	0	87	Logic Cell 6 - Element B Address	105
36	Input 6 Primary Type	0	88	Logic Cell 6 - Element B Type	160
37	Input 6 Transition	0	89	Logic Cell 6 - Element C Address	0
38	Input 6 Secondary Address	0	90	Logic Cell 6 - Element C Type	0
39	Input 6 Secondary Type	0	91	Logic Cell 6 - Output Control	0
40	Input 7 Control - Primary Address	0	92	Logic Cell 7 - Element A Address	2
41	Input 7 Primary Type	0	93	Logic Cell 7 - Element A Type	96
42	Input 7 Transition	0	94	Logic Cell 7 - Element B Address	0
43	Input 7 Secondary Address	0	95	Logic Cell 7 - Element B Type	0
44	Input 7 Secondary Type	0	96	Logic Cell 7 - Element C Address	0
45	Input 8 Control - Primary Address	0	97	Logic Cell 7 - Element C Type	0
46	Input 8 Primary Type	0	98	Logic Cell 7 - Output Control	0
47	Input 8 Transition	0	99	Logic Cell 8 - Element A Address	113
48	Input 8 Secondary Address	0	100	Logic Cell 8 - Element A Type	96
49	Input 8 Secondary Type	0	101	Logic Cell 8 - Element B Address	107
50	Logic Cell 1 - Element A Address	1	102	Logic Cell 8 - Element B Type	160
51	Logic Cell 1 - Element A Type	96	103	Logic Cell 8 - Element C Address	0
52	Logic Cell 1 - Element B Address	0	104	Logic Cell 8 - Element C Type	0
53	Logic Cell 1 - Element B Type	0	105	Logic Cell 8 - Output Control	0
54	Logic Cell 1 - Element C Address	0	106	Logic Cell 9 - Element A Address	107
55	Logic Cell 1 - Element C Type	0	107	Logic Cell 9 - Element A Type	32
56	Logic Cell 1 - Output Control	0	108	Logic Cell 9 - Element B Address	108
57	Logic Cell 2 - Element A Address	107	109	Logic Cell 9 - Element B Type	160
58	Logic Cell 2 - Element A Type	96	110	Logic Cell 9 - Element C Address	0
59	Logic Cell 2 - Element B Address	101	111	Logic Cell 9 - Element C Type	0
60	Logic Cell 2 - Element B Type	160	112	Logic Cell 9 - Output Control	0
61	Logic Cell 2 - Element C Address	0	113	Logic Cell 10 - Element A Address	2
62	Logic Cell 2 - Element C Type	0	114	Logic Cell 10 - Element A Type	96
63	Logic Cell 2 - Output Control	0	115	Logic Cell 10 - Element B Address	0
64	Logic Cell 3 - Element A Address	101	116	Logic Cell 10 - Element B Type	0
65	Logic Cell 3 - Element A Type	32	117	Logic Cell 10 - Element C Address	0
66	Logic Cell 3 - Element B Address	102	118	Logic Cell 10 - Element C Type	0

Top view of connectors. Serial bus connectors are on the right.

Outputs 1 to 8						Outputs 9 to 16				
2	4	+	6	8		10	12	+	14	16
1	3	-	5	7		9	11	-	13	15
Pin 1						Pin 1				

Connector Pin Numbers

2	4	6	8	10
1	3	5	7	9

Inputs 1 to 8						Outputs 17 to 24				
2	4	+	6	8		18	20	+	22	24
1	3	-	5	7		17	19	-	21	23
Pin 1						Pin 1				

6.5 Serial Bus
The SIC24AD has two RJ12 connectors for ease in making connections as shown below. In a Digitrax system the data pins are LocoNet® and the RS pins are Rail Sync. RS is not used by the SIC24 and is only passed through to the other RJ12 connector and to the Rail Sync connector. In a system where more than 10 SIC24s are used the bus terminating resistor should be cut on any additional devices.

Cables are wired pin 1 to pin 1

SIC24   **SIC24**

Serial bus   Serial bus

Cut

Termination resistor

To other SIC24s or serial bus devices

Ground   Data   Data   Ground
RS   RS

RJ12 Connector

7 Summary of Configuration Variables

CV#	Function/Default Value		CV#	Function/Default Value	
1	Ops Mode Loco Address	1	8	Manufacturer ID	25
2	reserved	-	9	Decoder Configuration	0
3	Base Address	101	10	Input 1 Control - Primary Address	1
4	Base Address Adder	0	11	Input 1 Primary Type	160
5	Secondary Output Address	1	12	Input 1 Transition	3
6	Secondary Output Address Adder	0	13	Input 1 Secondary Address	0
7	Manufacturer Version No.	-	14	Input 1 Secondary Type	0

2 Getting Started
You can start using the SIC24AD without doing any programming. The SIC24AD comes from the factory programmed to implement up to a four block Automatic Block Signaling (ABS) system (Figure 2). If you want to use the SIC24AD for some other signal or indicator arrangement, go to section 3 "Smart Programming" to see if there is a setup that meets your requirements. If there is not a setup that does exactly what you want, go on to section 4 Operation and section 5 Configuration Variables to learn how the SIC24AD works and program your custom implementation.

To start using the SIC24AD for an ABS system, you will need to connect block sensors to the inputs and LEDs to the outputs. Connect up to four block sensors to the first four inputs. Connect as many signal LEDs to the outputs as needed for the number of blocks you will be using. Starting with output number 1. Each LED requires a resistor as shown in the diagram on the front page. The relationship between the signal LED and the SIC24AD output number is shown in figure 2. The color LED location used in the signals in figure 2 is shown in figure 1. See section 6 Connections for hooking up power and the relationship between input and output number and the SIC24AD pin number.

In this Setup the output of the block detector connected to a SIC24AD input must go low indicating the block is occupied. If you are using Team Digital's DBD22 for block detectors, see its manual for connecting to the SIC24AD.

3 "Smart" Programming
"Smart" programming is a term used to describe an easy way to program the SIC24AD. The throttle is used to issue switch or accessory commands just like controlling switches (turnouts). If you are not familiar with controlling turnouts, you will need to check your DCC systems manual.

Before using "Smart" Programming" look through this section and determine which Setup you want to use. In addition this requires determining the base address, various other addresses, number of blocks, use of inputs and how LEDs are connected to the outputs (common anode or cathode).

The outputs of the SIC24AD are numbered 1 to 24. See section 6 Connections for the relationship between the connector, the connector pin number, and the output number. The base address is the address assigned to output 1. The rest of the addresses sequentially follow the output numbers. See the diagram on the front page for connector location.

To program in "Smart" mode, connect the SIC24AD power terminals to track power. Connection to the serial bus (LocoNet® in Digitrax system) is not used. Turn on power.

Press the "Smart" program button and hold it down for approximately one second until LED1 (typically red) starts to flash. Then release it. The SIC24AD is now ready for the Setup steps.

Using the throttle select the switch or accessory number which is the base address. Depending on the setup you have selected issue the switch command by selecting either the 't' (throw) or 'c' (close) option.. LED2 (typically green) will flash briefly.
LED1 now flashes twice with a pause and then repeats indicating step 2.

As you progress through the "Smart" programming steps, LED1 flashes the number of times indicating which step is ready to be programmed.

On the seventh step, enter the number of the Setup you want the SIC24AD to implement. If the Setup is implemented the logic is calculated and the SIC24AD is automatically programmed. The SIC24AD will then reset and the Setup is ready to use.
Note: For proper operation all the steps must be completed.

Below is an example showing how to implement Setup 1.
Once the "Smart" button is pressed for one second, the LED flashes.
To execute step 1 issue 101 (switch/accessory address) t (option) from the throttle.
Once step 1 is executed, the LED flashes two times indicating ready for step 2.
To execute step 2 issue 1 (switch/accessory address) t (option) from the throttle.
Once step 2 is executed, the LED flashes three times indicating ready for step 3.
.... and so on, until all steps are completed.

Block Signal Setup				User input	
Step	Description	t option	c option	Switch address	option
1	Base address of outputs Enable output messages is required	enable output messages	disable output messages	101	t
	Step 1 - 101 t is issued from the throttle *This sets the base address to 101 with output messages enabled.*				
2	Address of first block Enable inputs Input 1 is assigned to the first block	enable inputs	disable inputs	1	t
3	Number of block - Maximum of 4 Common anode or cathode LEDs	anode	cathode	4	t
	Step 3 - 4 t is issued from the throttle *This sets the number of blocks to 4 and the outputs for common anode.*				
4	Address of west block ahead of first block	accept	don't use	4 doesn't matter	c not used
5	Address of east block following last block	accept	don't use	4 doesn't matter	c not used
6	Address of switch 1 of siding	accept	don't use	4 doesn't matter	c not used
	Step 6 - 4 c is issued from the throttle *It does not matter what the switch address is since the siding switch option is disabled.*				
7	Setup number = 1 See section 5.2 for gateway info	enable gateway	disable gateway	1	c

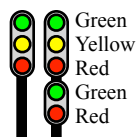Figure 1 shows the color location of each LED as used in the Setups.

Green
Yellow
Red
Green
Red

Figure 1

Switch (Turnout) Terminology		
This manual	throw or t	close or c
Digitrax	throw or t	close or c
NCE	reverse or OFF or 2	normal or ON or 1
Lenz	-	+
MRC	OFF	ON

This table shows some DCC manufactures and their terminology for turnout state.

5.7 Secondary Output Address
These CVs determine the secondary output address. When an output changes status a sensor type message is sent over the serial bus. These messages are typically used by the internal logic. If more sophisticated logic is required a secondary switch type message can be sent when an output changes state. See section 4 & 5.2 for more details.
CV5 - base address, a value of 0 to 1. Default is 1. CV6 - address adder.

6 Connections

6.1 Power
The SIC24AD can be powered from the track (accessory decoder operation) or a filtered DC voltage (9 to 12 VDC) power supply. Most analog 'Power Packs' will not work because they do not provide smooth (filtered) DC power. The SIC24AD power connector is non polarized and either terminal can be connected to plus or minus of the DC power supply. The power supply should be isolated from the system ground. That is, not connected to ground (booster ground, house wiring ground, etc). When multiple SIC24ADs are used they can be all connected to one power supply. The power supply must be able to supply the current for all the SIC24ADs. The plus and minus of the power supply must be connected to the same power input terminal on each SIC24AD. The rail sync terminals can be used to connect power to other SIC24ADs when using an accessory bus. Do NOT use the rail sync terminals in a standard Digitrax system if the SIC24ADs are connected to the main LocoNet bus. See Team Digital website for more information on using an accessory bus.

6.2 Input Interface
Each input is at 5 volts when no device is connect. This is a hi or true state. When the input is connected to ground by a push button switch or block sensor the state is low or false.

6.3 Output Drive
The output supplies about 5 volts to drive LEDs and other low current devices such as stall type switch machines. The SIC24AD has been tested with a Tortoise™ switch machine.

If LEDs are used current limiting resistors are required and should not be less than 470 ohms. This is a general guide line for a typical LED. The current limit for any single output is 20 ma and the total of any connector group of eight outputs is 50 ma.

6.4 10 PIN Input and Output
Input and output connectors have the same pin definitions. Connections can be made using our terminal strip adapter (TSA) or our Connector Cable Kit. You can build your own by using flat ribbon cable Insulation Displacement (IDC) and connectors from Jameco. The mating connector is #138377. 10 ft of gray flat ribbon cable is #643794. 10 ft of multicolor flat ribbon cable is #639672. See the diagram on the front page for connector location.

Warning: Do not connect the power supply ground (minus) to the ground (minus) pin of the 10 pin IDC connector. Do not connect any outputs together or to other SIC24 outputs.

```
Conn        --------- Outputs 1 to 8 ------------      --------- Outputs 9 to 16 ----------
Pin #       1   2   3   4   5   6   7   8   9   10      1   2   3   4   5   6   7   8   9   10
Output#     1   2   3   4   -   +   5   6   7   8       9   10  11  12  -   +   13  14  15  16

Conn        --------- Inputs 1 to 8 -------------      --------- Outputs 17 to 24 -----------
Pin #       1   2   3   4   5   6   7   8   9   10      1   2   3   4   5   6   7   8   9   10
Input#      1   2   3   4   -   +   5   6   7   8       17  18  19  20  -   +   21  22  23  24
Output#
```

Output Control		
Output Control CV	**Value**	**Select**
Invert the state as defined in Option 8 CV9	128	Select
Normal state	0	One
Bi-color phase 2	96	Select
Bi-color phase 1	32	
Bi-color not used	0	One
Effect, dynamic flash	24	Select
Effect, flash	16	
Effect, delay	8	
No effect	0	One
Reciprocal or alternate (use with flash effect only)	4	
Duration time, use with effect (see duration table)	0 - 3	
Program this value into the appropriate output control CV		

To change all outputs to drive common cathode LEDs set Option 8 CV9 (Decoder Configuration). To change a single output select the invert state. Do not use the invert state with two lead bicolor LEDs.

Bi-color LEDs with two leads require two outputs as shown in figure 11. Set one of the output control CVs to phase 1 and the other to phase 2. This gives the SIC24AD the ability to display three colors.

There are two types of flash effects. Flash causes the output to flash whenever the logic cell is true. Dynamic flash works only with logic element C. If the logic cell is true due to either logic element A or B the output will be on. If logic element C becomes true then the output will flash. This can be used to implement a flashing yellow aspect signal.

The delay effect causes the output to delay turn on once the logic cell is true. This can be used to delay the grade crossing gate lowering from the time the flashers start.

Reciprocal is used only with the flash effect to cause two outputs to flash alternately. Both outputs have to be selected to flash with the same duration. One of the outputs is selected for reciprocal. This can be used for grade crossing flashers.
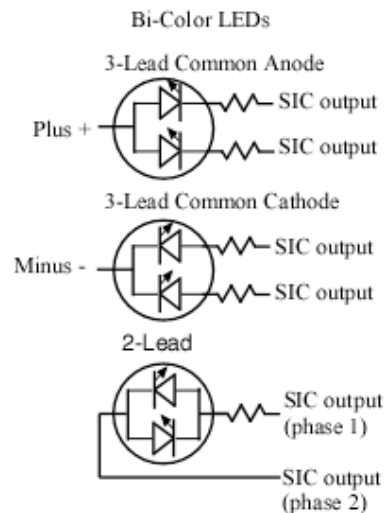
The duration of time works only when one of the effects is selected. It determines the flash rate and delay time. See the table to get the value for selection based on the time.

Figure 11

Duration Time		
Value	**Flash**	**Delay**
0	.5 sec	5 sec
1	1 sec	10 sec
2	2 sec	20 sec
3	4 sec	40 sec

3.1 Setup 1 - Block Signal

This setup implements up to four blocks of 3 vertical aspect signals using ABS logic. The SIC24AD comes pre-programmed with setup 1 implemented with a base address of 101 and four blocks numbered 1 to 4. Figure 2 shows the block arrangement and how the signal LEDs are assigned to and wired to each output. Figure 3 shows the assigned address of each output. SIC24ADs are designed to work together by knowing information about each other. This is done with the output address. If you are going to use more than four blocks the address of the red LEDs for both the west and east block signals are required. These addresses are the output addresses of the other SIC24ADs used for those blocks.
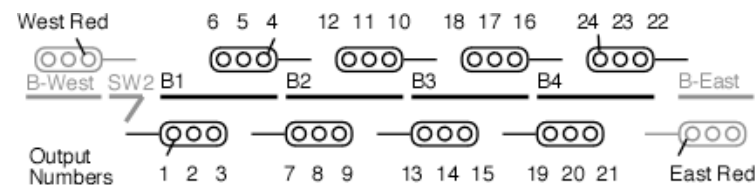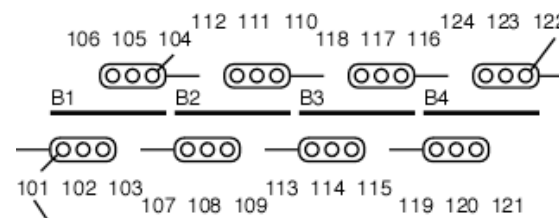

Figure 2

Figure 3

Block Signal Setup				
Step	Description	t option	c option	User input
1	Base address of outputs Enable output messages is required	enable output messages	disable output messages	
2	Address of first block Enable inputs if they are connected to block sensors Input 1 is assigned to the first block	enable inputs	disable inputs	
3	Number of blocks - Maximum of 4 Common anode or cathode LEDs	anode	cathode	
4	Address of west red signal ahead of first block	accept	don't use	
5	Address of east red signal following last block	accept	don't use	
6	Address of switch 2 of siding (see Setup 2)	accept	don't use	
7	Setup number = 1 See section 5.2 for gateway info	enable gateway	disable gateway	

As an example of how SIC24ADs are connected together using output addresses, lets look at setting up signals for seven blocks. This requires two SIC24ADs. Figure 4 shows how they could be assigned and the table shows how each could be programmed. Notice that SIC24 - 1 is given information about SIC24 - 2 in step 5 and SIC24 - 2 is given information about SIC24 - 1 in step 4. In this example the SIC24 inputs are enabled for block sensors.

Example of siding "Smart" programming		
Step	SIC24 - 1	SIC24 - 2
1	101 t	125 t
2	1 t	5 t
3	4 t	3 t
4	1 c - don't use	122 t
5	125 t	1 c - don't use
6	1 c - don't use	1 c - don't use
7	1 t	1 t

Figure 4

If you are going to use this setup 1 with the siding setup 2, the switch number for switch 2 is required in step 6. The position of switch 2 determines the signals for blocks 1 and 2 as a function of the mainline or the siding. See setup 2 for more information. If an address is entered for switch 2 in step 6 then when switch 2 is thrown, block 1 east signal will be red.

3.2 Setup 2 - Block Signal With Siding
This setup implements a two block mainline with a single block siding of 3 vertical aspect signals.   Figure 5 shows the block arrangement and how the signal LEDs are assigned to and wired to each output. If you are going to use more mainline blocks the address of the red LEDs for both the west and east block signals are needed. These addresses are the output addresses of the other SIC24ADs used for those blocks. See setup 1 to add more blocks. Switch 1 and 2 are required to have sequential numbers. When you enter the address for switch 1, say 50, then switch 2 is assigned 51. The switch position determines how the signals respond. In general if the switches are closed then block 3 occupancy determines their color. It they are thrown, then block 2 occupancy determines their color.

In Digitrax systems when a switch is thrown from the throttle, a switch type message appears on the serial bus and the SIC24AD responds accordingly. In non-Digitrax systems the gateway option (section 5.2) will provide the same operation. If you want to know switch position at power on or if moved manually, you will need a micro switch attached to the switch mechanism or switch machine contacts connected to a SIC24AD input. See the example a the end of this section for programming CVs.

The SIC24AD with Setup 2 does not control the two LEDs in the lower head. They need to be controlled from the switch machine moving the switch, a micro switch connected to the switch mechanism (could be the same mentioned above) or another SIC24AD.

Note: Switch commands from the throttle only appear on the serial bus in a Digitrax system.

Now lets control logic cell 2 as a result of logic cell 1 and block 2. From section 5.1 we saw that the base address of the SIC24AD sets the address of the logic cells. In this example the address of logic cell 1 has been set to 101. We want logic cell 2 to be true when logic cell 1 is false AND block 2 is occupied. Logic element A will be used to respond to the state of logic cell 1 and logic element B will be used to respond to the state of block 2. From the table the CV values are as follows.
Logic element A
*Element Address CV = 101
*Element Type CV = 32 (false state = 0, sensor message = 32, 0 + 32 = 32)

Logic element B
*Element Address CV = 2
*Element Type CV = 224 (AND logic = 128, true state = 64, sensor message = 32, 128 + 64 + 32 = 224)
In summary, when output 1 is off AND block 2 is occupied, turn on output 2.

Warning: When defining logic cells, be very careful not to create infinite loops (recursive). Otherwise various unexplained problems will occur. For example, if one of the elements is assigned the same address as it's output.

Now lets see how to control a low current stall type switch machine. We will give it an address of 60. Each machine requires two output logic cells with each motor terminal connected to an output. To implement a motor drive, program one of the logic cells with a address so it is true (close). Program the other logic cell with the same address so it is false (throw). Now the motor moves one way or the other depending on the state of the received message. From the table the CV values are as follows:
Logic cell 10 - Logic element A (the logic cell numbers are arbitrary)
*Element Address CV = 60
*Element Type CV = 96 (true state = 64, sensor message = 32, 64 + 32 = 96)

Logic cell 11 - Logic element A
*Element Address CV = 60
*Element Type CV = 32 (false state = 0, sensor message = 32, 0 + 32 = 32)

5.6 Output Control
This CV determines how the output will respond when the logic cell is true. There is an output control CV for each logic cell. See section 7 for CV numbers.

By default an outputs goes low (ground) when the logic cell is true. This will drive common anode LEDs. For common cathode LEDs set Option 8 CV9 (Decoder Configuration).

The following table shows how each output control is defined and the value of each selection. Add the value of the selections together to determine the value to program the CV. In some cases only one of several selections are possible and are shown by a box as "Select one".

Logic Element B

Element Address CV	Value	Select
Address	1 - 255	
Program this value into the appropriate address CV		

Element Type CV	Value	Select
Logic, AND	128	Select one
Logic, OR	0	
State, true (close or hi)	64	Select one
State, false (NOT true) (throw or low)	0	
Message type, sensor	32	Select
Message type, feedback (actual turnout position)	16	
Message type, switch/turnout (commanded position)	0	one
Address adder (see the address adder table for amount to add)	0 - 9	
Program this value into the appropriate type CV		

Logic Element C

Element Address CV	Value	Select
Address	1 - 255	
Program this value into the appropriate address CV		

Element Type CV	Value	Select
Logic, AND	128	Select one
Logic, OR	0	
State, true (close or hi)	64	Select one
State, false (NOT true) (throw or low)	0	
Message type, sensor	32	Select
Message type, feedback (actual turnout position)	16	
Message type, switch/turnout (commanded position)	0	one
Address adder (see the address adder table for amount to add)	0 - 9	
Program this value into the appropriate type CV		

Lets look at some examples to see how to use the logic cells. We want output 1 to turn on a LED when block 1 becomes occupied. When block 1 become occupied a hi (true) type sensor message is sent. When this condition happens logic cell 1 must be true in order to make output 1 turn on. So we will set logic element A to respond to this condition. From the table the CV values are as follows.
Logic element A
*Element Address CV = 1
*Element Type CV = 96 (true state = 64, sensor message = 32, 64 + 32 = 96)

Going on, lets say we also want output 1 to turn on the LED when switch (turnout) number 61 is thrown. When switch 61 is thrown a throw (false) type switch message is sent. When this condition happens logic cell 1 must be true in order to make output 1 turn on. So we will set logic element B to respond to this condition. From the table the CV values are as follows.
Logic element B
*Element Address CV = 61
*Element Type CV = 0 (OR logic = 0, false state = 0, switch message = 0, 0 + 0 + 0 = 0)
In summary, when block 1 is occupied OR switch 61 is thrown, turn on output 1.

Block Signal with Siding Setup

| Step	Description	t option	c option	User input
1	Base address of outputs Enable output messages is required	enable output messages	disable output messages	
2	Address of first block Enable inputs if they are connected to block sensors Input 1 is assigned to the first block	enable inputs	disable inputs	
3	Number of block - Maximum of 3 Common anode or cathode LEDs	anode	cathode	
4	Address of west red signal ahead of first block	accept	don't use	
5	Address of east red signal following last block	accept	don't use	
6	Address of switch 1 of siding	accept	accept	
7	Setup number = 2 See section 5.2 for gateway info	enable gateway	disable gateway	
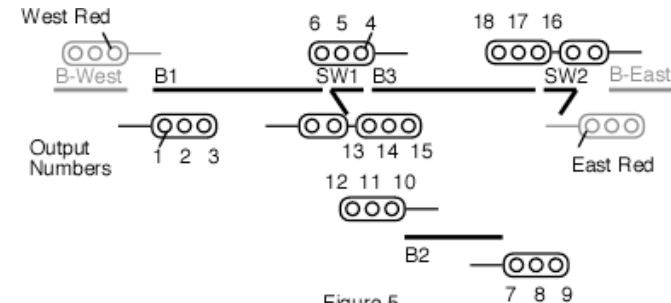
Figure 5

By using two SIC24ADs, you can have signals for up to six main line blocks and one siding. Implement Setup 2 in one SIC24AD and Setup 1 in the other. Figure 6 shows how they work together and the table shows an example of how they could be programmed. It is important to note that a SIC24AD always uses an address space of 24 regardless if all outputs are used or not.

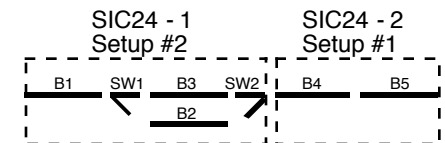| Example of siding "Smart" programming		
Step	SIC24 - 1	SIC24 - 2
1	101 t	125 t
2	1 t	4 t
3	3 t	2 t
4	1 c - don't use	116 t
5	125 t	1 c - don't use
6	50 t	51 t
7	2 t	1 t

Figure 6

Example of CV values if using a micro switch or switch machine contacts connected to SIC24AD inputs. Use inputs 5 and 6 for switches 50 and 51 respectively. Program the CVs as follows. See section 5.4 for input control CV specifics.

For input 5   For input 6   Note: input goes hi, switch close message sent
CV 30 = 50   CV 35 = 51   input goes low, switch thrown message sent
CV 31 = 0   CV 36 = 0
CV 32 = 3   CV 37 = 3

3.3 Setup 3 - Block Occupancy Indication or General Input/Output

This setup can be used in two different ways. The first implements up to 24 blocks of occupancy indication with one LED indicator per block. An output is on if the block is occupied. Output 1 is assigned the first block address and the rest of the outputs are sequential block addresses up to the number of blocks. If the inputs are connected to block sensors, input 1 is assigned the first block address. Up to eight input can be used. Since there is no logic needed to indicate block occupancy, logic cell status output messages are not needed and can be disabled in step 1. In this case the base address can be any number.

You can also choose to have two indicator LEDs per block. Perhaps red to show occupied and green to show unoccupied. The maximum number of blocks is now 12. Odd numbered outputs will be on when the respective block is occupied otherwise even numbered outputs will be on. In this setup, outputs are set to drive common anode type LEDs, see figure 11.

	Block Occupancy Indication Setup			
Step	Description	t option	c option	User input
1	Base address of outputs Disable output messages is recommended	enable output messages	disable output messages	
2	Address of first block Enable inputs if they are connected to block sensors Input 1 is assigned to the first block	enable inputs	disable inputs	
3	Number of outputs used to indicate blocks Maximum of 12 or 24 based on step 4 Common anode or cathode LEDs	anode	cathode	
4	Number of indicator LEDs per block (1 or 2)	accept	N/A	
5	Not used	skip	skip	
6	Not used	skip	skip	
7	Setup number = 3 See section 5.2 for gateway info	enable gateway	disable gateway	

The second implements a general input/output device. The only difference is how the outputs respond. Steps 3 and 4 below are reworded to help select the way the outputs respond. If you are using a computer with software like JMRI then you can set the SIC24AD to respond to switch command from JMRI for signal applications.

3	Number of outputs to use Maximum of 12 or 24 based on step 4 Common anode or cathode LEDs	anode	cathode	
4	Number of outputs per address (1 or 2) Outputs respond to sensor state or switch commands	sensor	switch	

5.5 Logic Cell

These CVs determine how each of the logic cells are defined. There are six CVs for each cell. See section 7 for CV numbers. Two CVs for each logic element. See figure 10 for a diagram of the logic cell. Each logic element has an address CV and a type CV which determine the address, type and state of the message that will cause the element to be true. When the SIC24AD receives a message that matches the element definition, the element is true. The element will stay true until a message matches the element definition with the opposite state. The element will then be false. All three elements do not have to be used. An element is not defined and thus not used when it's address is zero and it's logic set to OR. If only element A is used, the logic cell will be true and it's output on when element A is true. **Note:** If an element's address is zero and it's logic set to AND, the element will always be false since there are no messages with an address of zero. **Avoid this condition!**

Logic elements B and C can be combined with logic element A in AND and OR logic combinations by using the logic selection in elements B and C. When the logic combination is satisfied, the logic cell is true.

Logic Combination	B Logic	C Logic
A OR B OR C	OR	OR
(A OR B) AND C	OR	AND
(A AND B) OR C	AND	OR
A AND B AND C	AND	AND

The following tables show how each of the logic elements are defined and the value of each selection. Add the value of the selections together to determine the value to program the CV. In some cases only one of several selections are possible and are shown by a box as "Select one".

Logic Element A		
Element Address CV	Value	Select
Address	1 - 255	
Program this value into the appropriate address CV		
Element Type CV	Value	Select
State, true (close or hi)	64	Select one
State, false (NOT true) (throw or low)	0	
Message type, sensor	32	Select one
Message type, feedback (actual turnout position)	16	
Message type, switch/turnout (commanded position)	0	
Address adder (see the address adder table for amount to add)	0 - 9	
Program this value into the appropriate type CV		

When an input transition occurs one or two messages can be sent. There is a primary and secondary message for each input. Two CVs for each message determine the message address and the type of message. The transition CV determines if a message will be sent and what transition will initiate the message.

When a block detector is connected to an input, a sensor type message is normally sent on both a rising and falling edge. Most block detectors compatible with the SIC24AD go low when the block is occupied. The input control must be programmed to send a hi (true) sensor type message when the input is low. This means the input control must be inverted from the normal state. As an example lets determine the value of the input control CVs for block 1 using the Input Control table.

*Primary Address CV = 1
*Primary Type CV = 160 (Invert normal state = 128, sensor message = 32, 128 + 32 = 160)
*Transition CV = 3   (Send primary message on both edges = 3)
*Secondary Address CV = 0
*Secondary Type CV = 0

As another example lets say you want to close switch (turnout) number 60 when block 1 becomes occupied, but do nothing with the switch when the block becomes unoccupied. The secondary address can be used for this. The switch address is 60, the transition is set to falling edge (block becomes occupied) with state inverted (send a true when input is lo) and switch type message. The input control CV values are now the following.
*Primary Address CV = 1
*Primary Type CV = 160
*Transition CV = 11   (Send primary message on both edges = 3, Send secondary message on falling edge = 8, 3 + 8 = 11)
*Secondary Address CV = 60
*Secondary Type CV = 0

The largest number you can have for the address is 255. In some cases the address of a switch or logic cell may be greater than 255. In these cases the address adder has to be used to go beyond the 255 limit. The value of the Address adder CV can be any number from 0 to 9. Select the value based on the amount you want to add to the address from the table in section 5.1.

Tip: To send a message with a true (close or hi) state when the input goes false (low), use the invert normal state selection. See above example.

Note: An input transition is when the voltage on a input goes from high to low (falling edge) or from low to high (rising edge). Example - If a push button is connected to an input and ground when it is pressed the input is grounded. This causes a high to low transition. When the button is released this causes a low to high transition.
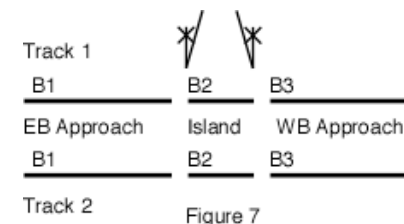
3.4 Setup 4 - Grade Crossing

This setup implements a three block grade crossing with one or two tracks. The signal, bell and delayed gate lowering are initiated upon entering an approach. When the island is cleared the signal and bell stop and the gate is raised. The capability to activate two bell sounds is provided. Bell 1 is activated when the approach block is occupied and bell 2 takes over when the island block is occupied. See figure 7 for the approach and island arrangement.

For proper operation the approach block must be occupied as long as the train is in it or the signal flashing will not work correctly. This can be achieved if each train is not longer than the approach block or the train has enough resistive wheels sets. Also, the approach block must be occupied when the island block becomes occupied. Bell 2 operation for the island block will not work correctly if a train enters the island block and then backs up leaving the island block. Bell 2 also requires the inputs to be used for block sensors because secondary messages are utilized. See section 5.4 to learn about input control and secondary messages.

All logic cells are used to implement the grade crossing logic. However, most of the logic cell outputs are unused except for those controlling the flashing LEDs, crossing gate motor, and bells. There are also two outputs connected to inputs as part of the logic. These inputs are in addition to the inputs used as block sensors. To change the gate lowing delay, change the value in CV 196. See section 5.6 on what values to use.

Output connections: (see section 5.6 Output Control to learn how to flash LEDs)
outputs 17 & 18 normal flash LEDs, outputs 19 &20 reciprocal flash LEDs
outputs 21 & 22, crossing gate motor - 22 is opposite polarity for motor
output 23, bell
output 24, bell 2 - island activated
output 8 to input 7, for track 1 operation of bell 2
output 16 to input 8, for track 2 operation of bell 2

Input connections:
inputs 1 thru 3, track 1 B1 thru B3 block sensors
inputs 4 thru 6, track 2 B1 thru B3 block sensors

Figure 7

Grade Crossing Setup				
Step	Description	t option	c option	User input
1	Base address of outputs Enable output messages is required	enable output messages	disable output messages	
2	Address of first block - Track 1 Enable inputs required and connected to block sensors for bell 2 operation Input 1 is assigned to the first block	enable inputs	disable inputs	
3	Number of blocks - Enter 3 Common anode or cathode LEDs	anode	cathode	
4	Address of first block - Track 1 Input 4 is assigned to the first block	accept	don't use	
5	Number of bell sounds (1 or 3)	accept	N/A	
6	Not used	skip	skip	
7	Setup number = 4 See section 5.2 for gateway info	enable gateway	disable gateway	

3.5 Setup 5 - Block Signal, Searchlight

This setup implements up to four blocks of searchlight signals using ABS logic. Figure 8 shows the block arrangement and how the signal LEDs are assigned to each output. Only two outputs are connected to LEDs since bicolor LEDs are used. The lower numbered output of the two is connected to the red section of the LED and the other connected to the green section. So for signal S1E, output 2 is connected to red and output 3 connected to green. Yellow is achieved when both red and green are on. However, as in setup 1, **each signal is associated with three outputs.** Even though output 1 is not connected to S1E, it is still used internally as part of the logic. This output is the 'logic red' and its address is used in connecting SIC24ADs together as explained in section 3.1. Each signal has a 'logic red' output which is the dimmed number shown in figure 8. To implement searchlight signals for more than four blocks see the example in section 3.1.
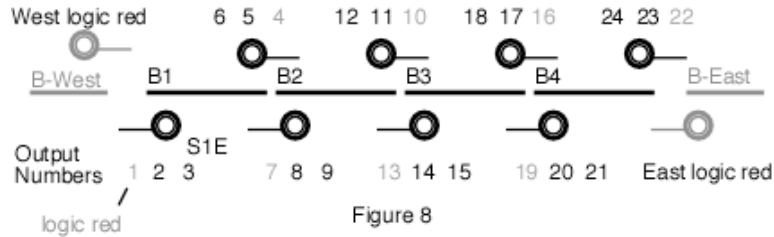

Figure 8

Block Signal (Searchlight) Setup

Step	Description	t option	c option	User input
1	Base address of outputs Disable output messages is recommended	enable output messages	disable output messages	
2	Address of first block Enable inputs if they are connected to block sensors Input 1 is assigned to the first block	enable inputs	disable inputs	
3	Number of blocks - Maximum of 4 Common anode or cathode LEDs	anode	cathode	
4	Address of west 'logic red' signal ahead of first block	accept	don't use	
5	Address of east 'logic red' signal following last block	accept	don't use	
6	Not used	skip	skip	
7	Setup number = 5 See section 5.2 for gateway info	enable gateway	disable gateway	

5.4 Input Control

These CVs determine how each of the inputs respond when activated. There are five CVs for each input. See section 7 for CV numbers.

The following table shows how each CV is defined and the value of each selection. Add the value of the selections together to determine the value to program the CV. In some cases only one of several selections are possible and are shown by a box as "Select one".

Input Control		
Primary Address CV	Value	Select
Address	1 - 255	
Program this value into the appropriate address CV		
Primary Type CV	Value	Select
Invert the normal state	128	
Normal state	0	
Toggle state (only if switch type)	64	
Message type, sensor	32	
Message type, feedback (actual switch position)	16	
Message type, switch (commanded switch position)	0	
Address adder (see the address adder table for amount to add)	0 - 9	
Program this value into the appropriate type CV		
Transition CV	Value	Select
Send primary message on change transition	3	
Send primary message on hi to low transition	2	
Send primary message on low to hi transition	1	
Disable primary message	0	
Send secondary message on change transition	12	
Send secondary message on hi to low transition	8	
Send secondary message on low to hi transition	4	
Disable secondary message	0	
Program this value into the appropriate transition CV		
Secondary Address CV	Value	Select
Address	1 - 255	
Program this value into the appropriate address CV		
Secondary Type CV	Value	Select
Invert the normal state	128	
Normal state	0	
Reserved	-	
Message type, sensor	32	
Message type, feedback (actual switch position)	16	
Message type, switch (commanded switch position)	0	
Address adder (see the address adder table for amount to add)	0 - 9	
Program this value into the appropriate type CV		

Select one markers in the image appear to the right of the table grouping:
- Primary Type CV: "Select one" for (Invert/Normal/Toggle), "Select one" for (message types)
- Transition CV: "Select One" for primary, "Select One" for secondary
- Secondary Type CV: "Select one" for (Invert/Normal), "Select one" for (message types)

5.2 Configuration

This CV determines the configuration which consists of several options.

CV9 - Configuration.

Option 1 - Ops Mode Programming. Allows Operations mode (On the Main) programming using a Loco address to be enabled all the time. See section 5.3.

Option 2 - Output message control. Disable the sending of all logic cell output state messages. In some cases like block occupancy indication these messages are not needed.

Option 3 - DCC to bus gateway. Allows DCC switch command packets to be put on the serial bus. Any device connected to the bus will have access to these DCC commands. **Note:** If there are more than one SIC24AD or other Gateway capable devices, only one should have the gateway enabled. In a Digitrax system **DO NOT** connect the SIC24AD to the throttle LocoNet® if the gateway is enabled. This could cause an endless sending of switch commands from the track to LocoNet® and back to the track.

Option 4 - Secondary switch type throw messages are sent on the serial bus when a logic cell goes true. These messages are in addition to the normal logic cell output messages.

Option 5 - Secondary switch type close messages are sent on the serial bus when a logic cell goes false. These messages are in addition to the normal logic cell output messages.

Option 7 - Input state messages are sent on the serial bus when a Digitrax interrogation command is received.

Option 8 - Common cathode LEDs. Allows common cathode connection of LEDs to the outputs.

To combine any of the options, add their values together. Example: Set options 1 and 3
To calculate the value of CV9, add up the values. CV9 = 1 + 4 = 5

Decoder Configuration CV	Value	Select
No options	0	
Option 1 - Ops mode programming enabled	1	
Option 2 - Logic cell output messages **DISABLED**	2	
Option 3 - DCC to bus gateway enabled	4	
Option 4 - Switch throw message on logic cell true enabled	8	
Option 5 - Switch close message on logic cell false enabled	16	
Option 6 - reserved	-	
Option 7 - Input interrogation enabled	64	
Option 8 - Common cathode LEDs	128	
Program this value into the configuration CV		

5.3 Operations Mode Loco Address

This CV sets the operations mode program address. Program the SIC24AD just like you would a loco in ops mode. This is a loco 2 digit address and therefore must be unique among locomotive addresses. Option 1 must be enabled to use this address for programming on the main. The programming track is not required once this address and option 1 have been set. **TIP:** If the "Smart" program button is pressed when power is turned on, option 1 is enable until power is removed. This is useful if you do not want to have ops mode enabled all the time.

CV1 - Ops mode address, a value of 1 to 99. Default is one (1).

4 Operation

The SIC24AD has 24 outputs. Each output can drive an LED and can be assigned a specific function. For signal control, a three color aspect signal will require three outputs if each aspect is to be individually controlled. Typical signal control is based on some set of rules or logic to turn each LED on. Consequently, some logic is required to turn on and off each output. In order to accomplish this, the SIC24AD has a logic cell that controls each output. The logic cell determines if it's output will be on or off. When the logic cell is true the output is on. When it is false the output is off. The logic cell contains three logic elements, A, B and C. When all the logic elements are true, the logic cell is true and the output is on. Otherwise, the logic cell is false and the output is off. Each logic element can be assigned to be a block state, a switch state or a signal state. The concept of the logic cell allows the SIC24AD to drive a variety of signal types. See figure 9 for a diagram of a basic logic cell.
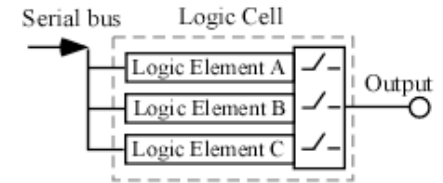
Figure 9

An illustration of Automatic Block Signaling (ABS) using a three color aspect signal can show how the logic cell works. For any given direction, when a block is occupied its signal is red and the following block signal is yellow if the following block is not occupied. If neither of the blocks is occupied, then the signal is green.

Here is a simple example of ABS block signal logic using B and S to represent block and signal respectively. B2 is the block after B1. That is, the train is traveling from B1 to B2.

S1 is red when B1 is occupied.
S1 is yellow when S2 is red and S1 is not red.
S1 is green when S1 is not yellow and not red.
S2 is red when B2 is occupied.

Six outputs of the SIC24AD are assigned for the two signals. Three outputs for each signal. Each output driving an LED.
Output 1 – S1R – signal one red
Output 2 – S1Y – signal one yellow
Output 3 - S1G – signal one green
Output 4 – S2R – signal two red
Output 5 – S2Y – signal two yellow
Output 6 – S2G – signal two green

A logic cell controls each output. So each logic cell is configured to cause the output to respond to the conditions as defined above. When all logic elements that have been defined are true, the logic cell is true and the output is turned on lighting the LED. The following shows how each logic element is defined.

Logic Cell 1 (output 1, S1R)
   Logic element A – B1 occupied
   Logic element B – NU
   Logic element C – NU
Logic Cell 2 (output 2, S1Y)
   Logic element A – output 1, S1R not on
   Logic element B – output 4, S2R on
   Logic element C - NU
Logic Cell 3 (output 3, S1G)
   Logic element A – output 1, S1R not on
   Logic element B – output 2, S1Y not on
   Logic element C - NU

Logic Cell 4 (output 4, S2R)
   Logic element A – B2 occupied
   Logic element B – NU
   Logic element C - NU
Logic Cell 5 (output 5, S2Y) **
   Logic element A – NU
   Logic element B – NU
   Logic element C - NU
Logic Cell 6 (output 6, S2G)
   Logic element A – output 1, S2R not on
   Logic element B – output 2, S2Y not on
   Logic element C - NU

** this output is not used in this example

Each of the SIC24AD outputs is assigned an address, so whenever an output changes state a sensor type serial bus message is sent with the address and state. So a logic cell can use the logic state of an output as part of its logic.

Some of the logic cells in the above example required more than one logic element to achieve the desired response. Both the conditions for element A AND element B had to be met before the output was on. As in the case of Logic Cell 2 (output 2, S1Y) in order for it to be true (on), output 1 had to be false (NOT on) and output 4 had to be true (on). These two elements are combined by AND logic. All three logic elements can be combined with one of four different logic schemes. The four combination are A OR B OR C, (A OR B) AND C, (A AND B) OR C and A AND B AND C.

An additional feature provides for control of the output. The output can be controlled so that when the logic cell is true the output is immediately on, has a delayed turn on, is inverted or flashes. See figure 10 for a diagram of the complete logic cell with output control. It is important to note that when the logic cell tells the output to be on, that simply enables the output control to define what the output actual does. For example, it the output control is set to flash, the output will flash when the logic cell is true. The logic cell does not cycle from true to false each time the output flashes. The same holds true for a delay. The logic cell output is not delayed, only the output itself.
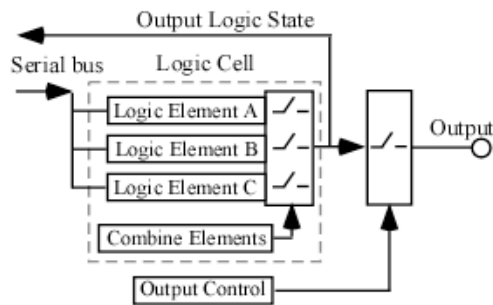

Figure 10

In some cases three logic elements in each logic cell may not be enough to implement the required logic. In these cases the logic cell of one or more unused outputs can be utilized for addition logic capability.

The SIC24AD has eight inputs. Each input can be configured to send a switch command, switch position feedback or sensor/block detection serial bus message. The inputs are compatible with many stand-alone block detectors with noise filtering. Each input can be configured to send a message on a rising, a falling or a change of state signal.

Unique signal schemes can be implemented using the SIC24AD by connecting outputs to inputs, particularly if an input is configured to send a message on a rising or falling state.

5 Configuration Variables (CVs)

The SIC24AD supports **Paged Mode Programming in Service Mode** and **Operations (Ops) Mode** programming. To program in paged mode, connect the track power terminals to the programming track. See diagram on the front page. When power is applied, LED 1 will come on and LED 2 will flash when programming is successful. Some systems only apply power during actual programming, so LED1 will only be on during that time. The SIC24AD does not have built in feedback like a mobile decoder. Therefore, some systems may show a "no decoder on track" error or "can not read CV". However it still is programmed. To enter normal operation, disconnect from the program track and connect as defined is section 6.1.

Ops mode or "on the main" programming is very convenient because you can try out the CV changes almost immediately. To program in ops mode, a loco address must be set in CV1 (default is 1) and option 3 must be set in CV9. **This is a loco address, so be careful when using this feature**. You can immediately start programming in "Power On" ops mode without programming CV9 by holding down the Smart button just before power is turned on. When LED2 turns on release the button then wait until LED1 turns off. This temporarily sets option 3 until power is turned off. **When using ops mode to change CV values, the SIC24AD does not recognize the new values of CV 1 - 9 until power is turned off and then back on.** A quick way to do this is by programming CV7 with a value of 1. This will restart the SIC24AD so power need not be cycled.

In a Digitrax system **DO NOT** program the SIC24AD from DCC (connected to track power) while LocoNet® is plugged into the SIC24AD. It can be program via LocoNet® (only in ops mode) in which case use a DC power supply to power the SIC24AD.

To "reset" the SIC24AD to the factory defaults enter "Smart" programming and continue to hold the button down (at least 16 seconds) until both LEDs (1&2) are alternately flashing.

5.1 SIC24AD Address
These CVs determine the base address. Each of the 24 logic cells are assigned a sequential address starting with the base address. If the base address is 101, than the address of logic cell one is 101 and the address of logic cell 24 is 124. See figures 2 and 3 to see the relationship between the output number and address. Whenever a logic cell changes state, a sensor type message is sent with it's address. The SIC24AD is pre-programmed with a base address of 101.
Note: A SIC24AD always uses an address space of 24 even if some outputs are not used. CV3 - base address, a value of 0 to 255. Default is 101. CV4 - address adder.

If an address greater than 255 is needed then use the address adder. The following table shows the CV value to use for the adder.
Example: Address of 101, set CV3 = 101 & CV4 = 0
Address of 901, set CV3 = 133 & CV4 = 3

Address Adder										
CV Value	0	1	2	3	4	5	6	7	8	9
ADD	0	256	512	768	1024	1280	1536	1792	2048	2304