

CV#	Function/Default Value		CV#	Function/Default Value	
28	reserved	-	73	Servo 3 Behavior	0
29	Decoder Configuration	0	74	Servo 4 Behavior	0
30	reserved	-	75	Output Flash	0
31	Ops Mode Loco Address	1	76	reserved	-
32	reserved	-	77	Route group 1-8 Address	0
33	Pwr On State - Servos 1-4	255	78	Route group 1-8 Address Adder	0
34	Pwr On State - Outputs 5-8	170	79	Route group 9-16 Address	0
35	Pri Input 1 Route Number	0	80	Route group 9-16 Address Adder	0
36	Pri Input 1 Action	22	81	Route 1 Selection	0
37	Pri Input 2 Route Number	0	82	Route 1 Switch State	0
38	Pri Input 2 Action	38	83	Route 2 Selection	0
39	Pri Input 3 Route Number	0	84	Route 2 Switch State	0
40	Pri Input 3 Action	54	85	Route 3 Selection	0
41	Pri Input 4 Route Number	0	86	Route 3 Switch State	0
42	Pri Input 4 Action	70	87	Route 4 Selection	0
43	Sec Input 1 Route Number	0	88	Route 4 Switch State	0
44	Sec Input 1 Action	86	89	Route 5 Selection	0
45	Sec Input 2 Route Number	0	90	Route 5 Switch State	0
46	Sec Input 2 Action	102	91	Route 6 Selection	0
47	Sec Input 3 Route Number	0	92	Route 6 Switch State	0
48	Sec Input 3 Action	118	93	Route 7 Selection	0
49	Sec Input 4 Route Number	0	94	Route 7 Switch State	0
50	Sec Input 4 Action	134	95	Route 8 Selection	0
51	reserved	-	96	Route 8 Switch State	0
52	reserved	-	97	Route 9 Selection	0
53	reserved	-	98	Route 9 Switch State	0
54	reserved	-	99	Route 10 Selection	0
55	reserved	-	100	Route 10 Switch State	0
56	reserved	-	101	Route 11 Selection	0
57	reserved	-	102	Route 11 Switch State	0
58	reserved	-	103	Route 12 Selection	0
59	Servo 1 Dash Pot Speed	40	104	Route 12 Switch State	0
60	Servo 2 Dash Pot Speed	40	105	Route 13 Selection	0
61	Servo 3 Dash Pot Speed	40	106	Route 13 Switch State	0
62	Servo 4 Dash Pot Speed	40	107	Route 14 Selection	0
63	Servo 1 Move Speed Direction 1	18	108	Route 14 Switch State	0
64	Servo 2 Move Speed Direction 1	18	109	Route 15 Selection	0
65	Servo 3 Move Speed Direction 1	18	110	Route 15 Switch State	0
66	Servo 4 Move Speed Direction 1	18	111	Route 16 Selection	0
67	Servo 1 Move Speed Direction 2	18	112	Route 16 Switch State	0
68	Servo 2 Move Speed Direction 2	18	113	reserved	-
69	Servo 3 Move Speed Direction 2	18	114	reserved	-
70	Servo 4 Move Speed Direction 2	18	115	reserved	-
71	Servo 1 Behavior	0	116	reserved	-
72	Servo 2 Behavior	0			

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



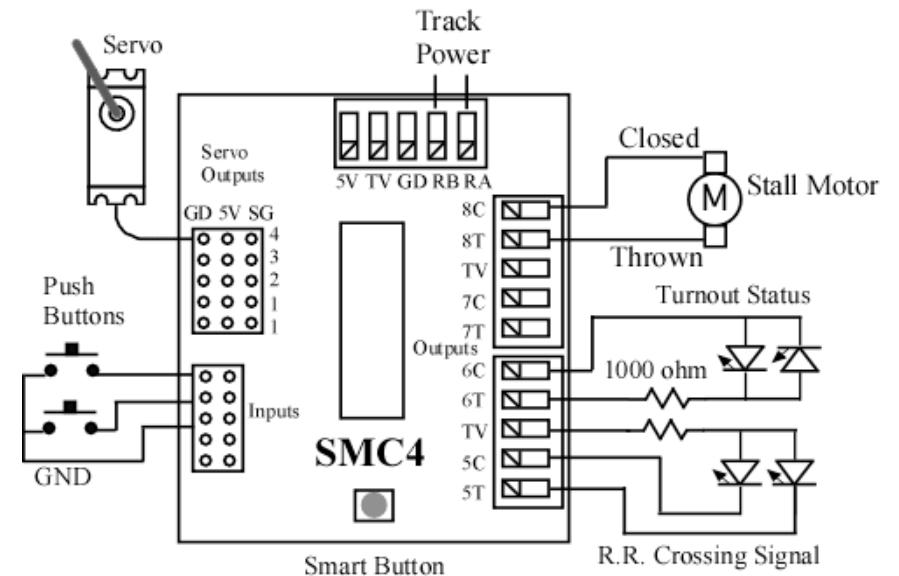
TEAM DIGITAL

Improving the world of DCC

SMC4 Servo & Motor Controller

Animate your layout with semaphores, crossing gates and roundhouse doors. Move turnouts at prototypical speed. All controlled via DCC with the SMC4.

- > DCC compatible accessory decoder
- > Controls 4 servos and 4 stall type motors
- > Programmable position, range and speed of servos
- > “Speed_to_Position”
- > Inputs for local control of servos and motors
- > Dash Pot (buffer cylinder) Speed Feature
- > “Smart” & “Dynamic” Programming



TEAM DIGITAL, LLC
3111 Timber Valley Dr
Kokomo IN 46902
www.teamdigital1.com

1 Introduction

The SMC4 is a DCC compatible accessory decoder capable of driving four servo motors and four stall motor type switch machines. Each output can individually be assigned any address from 1 to 2040. It has eight inputs for local control of the outputs and 16 programmable routes. There are several modes of operation. The modes are grouped into two basic configurations based on how the servo is used.

The first basic configuration is moving servos to two positions.

Mode 1 - The servo outputs and stall motor outputs can be used for turnout control. There is a separate address for each output so they can be controlled individually. There are a total of eight switch addresses. In this mode a servo could also be used for crossing gates. An option allows for stall motor output 5 to flash LEDs in relation to servo 1.

Mode 2 - The servo outputs and stall motor outputs can be used for turnout control. The servo outputs and stall motor outputs have the same address. There are a total of four switch addresses. The stall motor outputs can be used to drive LEDs to show the state of the servo outputs or drive a relay for turnout frog power routing.

The second basic configuration is for moving servos to three positions.

Mode 3 - The servo outputs can be used for semaphore control and the stall motor outputs can be used for turnout control. There are a total of 16 switch addresses. 12 addresses for the servo outputs and four addresses for stall motor outputs.

In this mode three addresses are used to control each servo, address A(throw) will command the servo to one end, address A+1(throw) will command it to the center and address A+2(throw) will command it to the other end. An optional behavior for each servo is available to use only a single address A(throw) to sequence or rotate through all three positions. Each time that address command is issued the servo moves to the next position (red > yellow > green > red ..etc).

Mode 4 - The servo outputs are used for semaphore control and the stall motor outputs can be used for turnout control. Four switch addresses control the stall motor outputs. The servo outputs are ONLY controlled by inputs (two inputs per servo output). This provides for direct control of 4 semaphores by block detectors for 2 blocks of bi-directional travel or 4 block for single direction travel. More block detectors and SMC4s can be ganged together in this way to easily expand the system.

“Speed_to_Position” is an optional behavior that allows the throttle to variably control the position of the servo. Just as the throttle can be used to change an engine’s speed, so can it be used to control the position of a servo. The throttle speed step must be set to 128.

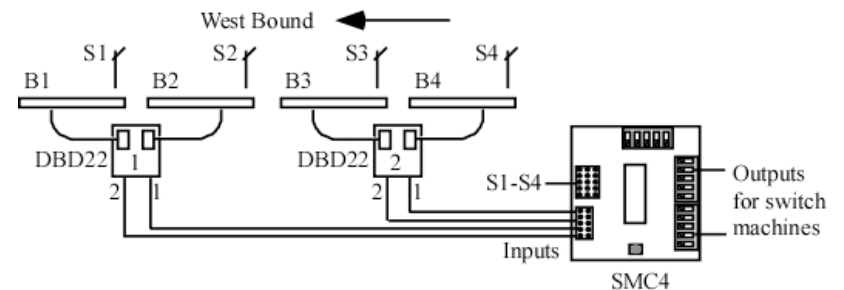
Two types of route control are supported. The remote controlled routes are controlled from the throttle just like a single switch is, except that multiple switches may be activated. The local routes are activated by using the inputs. Routes are configured by programming the respective CVs as to which outputs are selected in the route and the output state. Remote controlled routes are in two groups of eight. Each group has a group address to allow the throttle to access it.

Caution! For their size, servos have a lot of power. We recommend you initially center the servo’s rotation before linking it to a device. Semaphores and other devices can be easily damaged.

You can easily implement a 4 block control system with 2 DBD22s and a SMC4. Here are the connections of the DBD22s to a SMC4 for west bound travel. A detailed wiring diagram can be seen on Team Digital’s website.

Connections from DBD22 outputs to SMC4 inputs, SMC4 outputs to Signals		
DBD22 Outputs	SMC4 Inputs	SMC4 Outputs
DBD22 - 1 Output 2 from block 1	Pri Input 1 & Sec Input 2	Servo 1
DBD22 - 1 Output 1 from block 2	Pri Input 2 & Sec Input 3	Servo 2
DBD22 - 2 Output 2 from block 3	Pri Input 3 & Sec Input 4	Servo 3
DBD22 - 2 Output 1 from block 4	Pri Input 4	Servo 4

Note: In SMC4 mode 4 the special feature described in section 2.1 to adjust servo position does not work. You can use the special feature to adjust the servo and then enter mode 4.



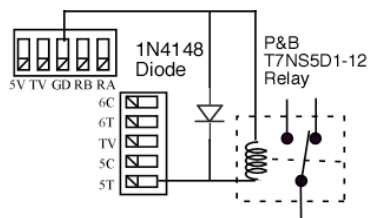
7 Summary of Configuration Variables

CV#	Function/Default Value	CV#	Function/Default Value
1	Servo 1 Address	14	Servo 2 Address
2	reserved	15	Servo 2 Address Adder
3	Servo 1 Move Range	16	Servo 3 Address
4	Servo 2 Move Range	17	Servo 3 Address Adder
5	Servo 3 Move Range	18	Servo 4 Address
6	Servo 4 Move Range	19	Servo 4 Address Adder
7	Manufacturer Version No.	20	Output 5 Address
8	Manufacturer ID	21	Output 5 Address Adder
9	Servo 1 Address Adder	22	Output 6 Address
10	Servo 1 Center Position	23	Output 6 Address Adder
11	Servo 2 Center Position	24	Output 7 Address
12	Servo 3 Center Position	25	Output 7 Address Adder
13	Servo 4 Center Position	26	Output 8 Address
		27	Output 8 Address Adder

CVs continued on next page.

6.2 Output Drive

If servos are being used for switch machines, you can use the corresponding output to drive power routing relays. The SMC4 must be set to Mode 2. Maximum output drive source current is 30 ma so the relay coil minimum resistance is 400 ohms. The P&B T7NS5D1-12 DigiKey PB380 will work. The contacts are rated at 10 amps. In this mode the outputs can also be used for turnout status.



Output 5 can be used to drive R.R. crossing signals such as the Tomar H-862. See the diagram on the front page.

6.3 External 5 Volt Power

In some applications where one or more servos have a heavy load, ie. they are drawing a lot of current, it may necessary to use an external 5 volt power supply. If the servos draw too much current, the SMC4's internal regulator will over heat and shut the SMC4 down. This will more likely happen if the SMC4 "power save" option is disabled. Connect the external 5 volt power supply to the 5V and GD (ground) terminals of the SMC4 power connector.

6.4 Input Semaphore Control

The primary input connector provides a 5 volt source, so DBD22s (block detectors) can be powered and when connected to an input a route or switch can be controlled.

By setting the SMC4 to Mode 4, you can use the inputs connected to DBD22s to move the servos to three positions. This provides an easy way to implement ABS signal control with semaphores.

The chart below shows the input state in relation to the servo position. The position is shown as red, yellow and green. Yellow is the center position and red and green is either end of servo travel depending on how you have the servo behavior set.

Input - Output Relationship		
Input State	Servo Position	
Pri Input 1 Lo, Sec Input 1 Hi	Red	Servo 1
Pri Input 1 Hi, Sec Input 1 Lo	Yellow	
Pri Input 1 Hi, Sec Input 1 Hi	Green	
Pri Input 2 Lo, Sec Input 2 Hi	Red	Servo 2
Pri Input 2 Hi, Sec Input 2 Lo	Yellow	
Pri Input 2 Hi, Sec Input 2 Hi	Green	
Pri Input 3 Lo, Sec Input 3 Hi	Red	Servo 3
Pri Input 3 Hi, Sec Input 3 Lo	Yellow	
Pri Input 3 Hi, Sec Input 3 Hi	Green	
Pri Input 4 Lo, Sec Input 4 Hi	Red	Servo 4
Pri Input 4 Hi, Sec Input 4 Lo	Yellow	
Pri Input 4 Hi, Sec Input 4 Hi	Green	

2 Getting Started

The SMC4 comes from the factory ready to use in mode 1 with all eight outputs set for turnout control. Plug servos into outputs 1 to 4 and connect stall motor machines to outputs 5 to 8 (the actual circuit board is labeled 1T, 1C ... 4T, 4C). Connect RAIL A and RAIL B terminals to the track power. The connections locations are shown on the diagram on the front page. You are now ready to control your switches from the throttle. The default outputs addresses are 1 to 8 for outputs 1 to 8 respectively. See adjusting servo below.

You can control the outputs from fascia buttons by connecting them to the primary or the secondary inputs. The four primary inputs, when grounded, will toggle outputs 1 to 4 respectively. Similarly the four secondary inputs will toggle outputs 5 to 8 respectively.

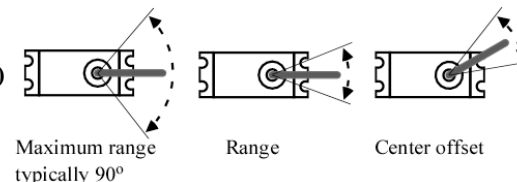
Two routes have been programmed. Throwing switch 101 will cause all the outputs to be thrown and closing switch 101 will cause all the outputs to be closed.

If you want to change the mode or some of the output addresses see the "Smart" Programming section. If you want to customize the SMC4 such as implementing custom routes or enable "Speed_to_Position", see the Configuration Variables section.

2.1 Adjusting Servo Movement

The total movement or range of a servo is typically much more than is required for turnout or semaphore control. For this reason the range of the servo may need to be adjusted for the specific application. In addition the center of movement or center offset may need to be changed. The SMC4 has a built in feature that allows the servos to be positioned while programming the making the adjustments. All these CVs can be programmed in ops mode (on the main programming) while directly observing the results.

Before linking the servo arm (horn) to the semaphore or turnout, manually position the servo to the center of it's rotation.



1. Use the "Smart" button to put the SMC4 into ops mode as described in section 4.
2. Use your throttle to enter ops mode with a loco address of one (1). One is the SMC4 default ops address. The servos may twitch or jump during adjustment.
3. Program CV7 with a value of 2 to put all the servos in the center position.
4. Program CV10, 11, 12 and 13 for servo 1, 2, 3 and 4 respectively to change the center offset. Start with a value of 60 and repeat with small changes until the desired center is reached. You may only want to connect one servo at a time.
5. Program CV7 with a value of 4 to move all the servos to one end. Program CV7 with a value of 5 to move all the servos to the other end.
6. Program CV3, 4, 5 and 6 for servo 1, 2, 3 and 4 respectively to set the desired range. Start with a value of 20 (increase range with higher numbers) and repeat with small changes as needed.
7. When finished adjusting the servos, program CV7 with a value of 1 to restart the SMC4.

3 “Smart” Programming

“Smart” programming is a term used to describe a method to program Configuration Variables (CVs) using switch addresses. This method is a much easier way to program CVs. With “Smart” programming, you can set the output addresses, the modes and options.

To program in “Smart” mode, connect the SMC4 RAIL A and RAIL B terminals to the track power. Turn on power and wait until the LED1 (typically red) turns off. To change the output addresses follow these steps.

1. Press the “Smart” program button and hold it down for approximately one second until LED1 (typically red) starts to flash. Then release it. The SMC4 is now ready to have the output addresses changed.

2. Using the throttle select the switch address you want for output 1 and issue a throw (reverse) command. LED2 (typically green) will flash briefly. LED1 now flashes twice with a pause and then repeats indicating that the output 2 address is ready to be programmed.

3. Again using the throttle select the switch address you want for output 2 and issue a throw (reverse) command. LED1 flashes three times with a pause and then repeats indicating that the output 3 address is ready to be programmed.

4. Repeat step three until you have programmed all the output addresses. The LED flashes increase indicating the output number. LED2 is on and LED1 is flashing. At any time you can exit “Smart” mode by pressing the button for approximately one second until LED1 stops flashing.

To change the SMC4 mode and CV29 options start from one of these places.

1a. Continue from step 4 above. When all the output addresses have been programmed LED2 (typically green) will turn on and LED1 will flash.
1b. Press the “Smart” program button and hold down for approximately three seconds until LED2 turns on. Then release it. LED1 will be flashing.

2. Using the throttle select the switch address correspond to the desired mode.

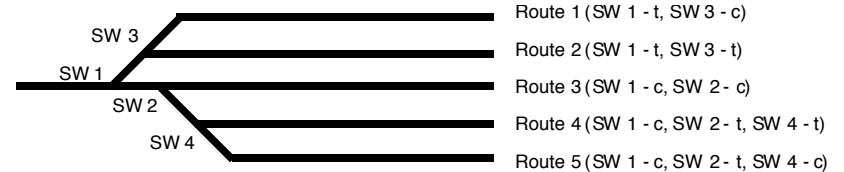
Smart Programming of SMC4 Mode	Address
Mode 1 - Servos 2 positions, all outputs have unique address	1
Mode 2 - Servos 2 positions, outputs 5 to 8 have servo address	2
Mode 3 - Servos 3 positions, all outputs have unique address	3
Mode 4 - Inputs control servos, outputs 5 to 8 have unique address	4
Mode 1 with flashing output 5, servo cw	5
Mode 1 with flashing output 5, servo ccw	6
Mode 3 with sequencing servo behavior	7

Issue a throw command to select the mode. At this point, LED2 turns off. LED1 now flashes twice with a pause and then repeats indicating that option 1 is ready to be set.

6 Applications

6.1 Routes

Depending on the SMC4 mode you could use all eight outputs for switches (turnouts) in a route or any combination of outputs. The following shows an example of five routes using four switches being control with the servo outputs. The route CV values were determined using the information in sections 4.8 and 4.9. One very nice tool that makes custom programming much easier is JMRI DecoderPro.



Route Group 1 - 8 address CV 77 = 101

SW 1 to 4 connected to SMC4 outputs 1 to 4 respectively

Route 1 CV 81 = 5, CV 82 = 1 execute with 101t

Route 2 CV 83 = 5, CV 84 = 5 execute with 101c

Route 3 CV 85 = 3, CV 86 = 0 execute with 102t

Route 4 CV 87 = 11, CV 88 = 10 execute with 102c

Route 5 CV 89 = 11, CV 90 = 2 execute with 103t

It may be necessary to have routes with more switches than you have assigned to one SMC4. Multiple SMC4s can be programmed to operate together to execute a route with one command. Lets say you have a number of routes involving 7 switches. This would require two SMC4s if you are using the servos for something other than switch control. Outputs 5 to 8 of each SMC4 are being used to control switches 1 to 7.

The first SMC4 controls switches 1 to 4 and the second SMC4 controls switches 5 to 7. Make sure each output has it’s own address because you still may want to control each switch individually. The SMC4 output addresses are independent of the route addresses.

CV77 & 78 should be the same for both SMC4s because when you execute the route with one switch command both SMC4s will respond.

CV81 & 82 of the first SMC4 will determine how switches 1 to 4 operate in route 1. CV81 & 82 of the second SMC4 will determine how switches 5 to 7 operate in route 1.

CV83 & 84 of the first SMC4 will determine how switches 1 to 4 operate in route 2. CV83 & 84 of the second SMC4 will determine how switches 5 to 7 operate in route 2.etc

This applies for routes 1 to 8 because the CV77 & CV78 values are the same for both SMC4s. If you want routes 9 to 16 in both SMC4s to function together then the CV79 & CV80 values must be the same for both SMC4s.

4.12 Ops Mode Loco Address

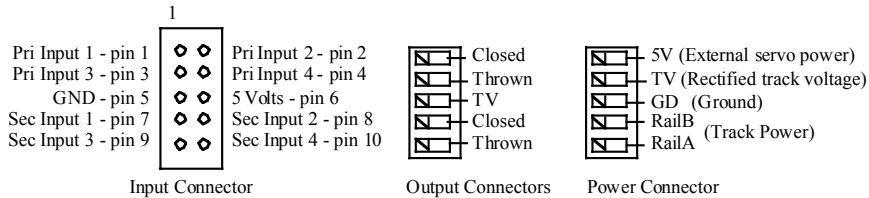
This CV sets the operations mode program address. Program the SMC4 just like you would a loco in ops mode. This is a loco 2 digit address and therefore must be unique among locomotive addresses. Option 2 must be enabled to use this address for programming on the main. The programming track is not required once this address and option 2 have been set. TIP: If the “Smart” program button is pressed when power is turned on, option 2 is enable until power is removed. This is useful if you do not want to have ops mode enabled all the time.

CV31 - Ops mode address, a value of 1 to 127. Default is one (1).

5 Connections

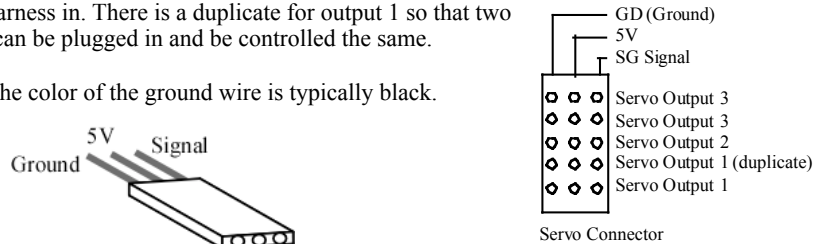
The input connector is a 10 pin flat ribbon cable (IDC) type. Jameco #138376 will work as the mating connector. 10 ft of gray flat ribbon cable is #135538. 10 ft of multicolor flat ribbon cable is #112547. If you want screw terminals for the primary inputs you can use our terminal strip adapter (TSA). The power and outputs connectors are spring type terminals. Use a small screw driver to push in on the slotted button and insert the bare wire into the terminal.

The TV terminal is rectified track voltage (DC) and can be used to power LEDs (see diagram on front page) and relays for example. For HO scale this about 14 volts and for N scale about 12 volts. See the application section for more information.



The servo connector is made so that you can just plug the servo harness in. There is a duplicate for output 1 so that two servos can be plugged in and be controlled the same.

Note: The color of the ground wire is typically black.



Typical servo harness wire color:
Ground - black or brown
5 V - red
Signal - yellow, white or orange

3. Using the throttle select any switch address you want, issue a throw command to set Option 1 (default output state) or a close command to clear it. LED1 now flashes three times with a pause and then repeats indicating that option 2 is ready to be set.

4. Using the throttle select any switch address you want, issue a throw command to set Option 2 (power save off) or a close command to clear it (power save on). LED1 now flashes four times with a pause and then repeats indicating that option 3 is ready to be set.

5. Using the throttle select any switch address you want, issue a throw command to set Option 3 (ops mode) or a close command to clear it.

This concluded the “Smart” programming. At anytime you can exit “Smart” programming by holding down the “Smart” button until the LEDs turn off. Any programming that was done will be save.

Smart Programming Summary			
#Flashes	Description	t	c
<i>To start - Press the “Smart” button until LED1 starts to flash</i>			
1	Output 1 address - Servo	accept	accept
2	Output 2 address - Servo	accept	accept
3	Output 3 address - Servo	accept	accept
4	Output 4 address - Servo	accept	accept
5	Output 5 address	accept	accept
6	Output 6 address	accept	accept
7	Output 7 address	accept	accept
8	Output 8 address	accept	accept
<i>To start here - Press the “Smart” button until LED2 lights</i>			
1	Mode selection - 1 to 7 see chart above	accept	accept
2	CV29 Option 1 - enable fixed output state at power on	set	clear
3	CV29 Option 2 - disable power save	set	clear
4	CV29 Option 3 - enable ops (on the main) mode programming	set	clear

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

4 Configuration Variables (CVs)

The SMC4 supports **Paged Mode Programming in Service Mode and Ops Mode**. To program in paged mode, connect terminals Rail A and Rail B 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 SMC4 does not have built in feedback like a mobile decoder. Because of this, 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. Now connect terminals Rail A & B to the main track power.

Ops mode or “on the main” programming is very convenient because you can try out the CV changes almost immediately. In order to use this type of programming the ops mode loco address must be set in CV31 (default is 1) and option 3 must be set in CV29. **This is a loco address, so be careful when using this feature.** You can immediately start programming in “Power On” ops mode without programming CV29 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 SMC4 does not recognize the new values until power is turned off and then back on.

Programming CV7 with a value of 1 will restart the SMC4 so power need not be cycled when programming in “Power On” ops mode. This is the same as turning power off and then back on.

Programming CV7 with a value of 2 will cause all the servo to move to their center position. You can then program the center offset CVs if needed.
Programming CV7 with a value of 3 will cause all the servo to move from end to end of their range. You can then program the range CVs to easily adjust the servo’s movement.
Note: When adjusting servo position, be sure Speed_to_Position is disabled. Also if you program when the servo is moving it may jump erratically.

Programming CV7 with a value of 170 will “reset” all CV’s to the factory default value. In page mode this may not work with some systems as they do not keep power applied to the programming track long enough for all the CVs to be programmed.

A very easy way to “reset” to all factory defaults is to enter “Smart” programming and continue to hold the button down (at least 16 seconds) until both LEDs are alternately flashing.

Summary of ops mode programming commands for servo adjustment section 2.1.

To center the servos, program CV7 with 2.

To move the servos back-n-forth, program CV7 with 3 (range adjustment are not accurate with large range values or very slow speeds because end of travel may not be reached).

To move the servos to one end, program CV7 with 4.

To move the servos to the other end, program CV7 with 5.

To restart the SMC4 when finished with programming, program CV7 with 1.

4.10 Power On Output State

These CVs determine the state of each output at power on. The SMC4 automatic programs these CVs unless Option 1 is set. Outputs 5 to 8 do not function in this manner in Mode 2. If both are selected for the servo it will go the the center position. However this feature will not work correctly for the outputs 5 to 8. If neither throw or closed is selected the outputs may not work correctly at power on.

CV33 - Power on state for outputs 1 to 4 (Servos)

CV34 - Power on state for outputs 5 to 8 (Stall motors)

Outputs 1 to 4 - Servos	Value	Select
Output 1 throw	1	1
Output 1 close	2	
Output 2 throw	4	4
Output 2 close	8	
Output 3 throw	16	
Output 3 close	32	32
Output 4 throw	64	64
Output 4 close	128	
Program this value into CV33		101

Outputs 5 to 8	Value	Select
Output 5 throw	1	
Output 5 close	2	2
Output 6 throw	4	
Output 6 close	8	8
Output 7 throw	16	16
Output 7 close	32	
Output 8 throw	64	64
Output 8 close	128	
Program this value into CV34		90

Example: CV33 = 1 + 4 + 32 + 64 = 101, throw output 1, throw output 2, close output 3 and throw output 4

Example: CV34 = 2 + 8 + 16 + 64 = 90, close output 5, close output 6, throw output 6 and throw output 6 (example shown above in table)

Tip: An easy way to program CV33 and CV34.

1. Enter normal operating mode and command each of the outputs to the desired state.
2. Enter programming mode and program CV29 (enable option 1).
3. Exit programming mode.

Now at each powered on, the outputs will go to the same state as set in step 1.

4.11 Output Flashing Effect

This CV determines if an output will flash. Output 5 is unique in that it is dependent on servo 1. It will cycle on/off based on the state of output 1.

CV75 - Output flash

Output Flashing	Value	Select
None	0	
Output 5 will flash when servo 1 is in the cw position	1	Select
Output 5 will flash when servo 1 is in the ccw position	2	One
Output 6 will flash when issued a throw command	4	
Output 7 will flash when issued a throw command	8	
Output 8 will flash when issued a throw command	16	
Program this value into the configuration CV		

4.7 Remote Control Route Address

These CVs determine the address of the route group and are independent of the SMC4 output addresses. Each output has two CVs, an address and an address adder, that makes up the address. See section 7 for CV numbers. If an address greater than 255 is needed then use the address adder. The address adder value represents a number that is added to the address value to give the 'actual' address. See section 4.1.

Note: The group 1-8 address should be at least four numbers apart from the group 9-16 address or the routes will not work correctly.

Example: CV77 = 101, CV78 = 0, throw switch 101 to execute route 1, close switch 101 to execute route 2.

Route Group 1-8 Execution Example								
Route	1	2	3	4	5	6	7	8
Switch address	101t	101c	102t	102c	103t	103c	104t	104c

4.8 Route Output Selection

These CVs determine which output is included in the route. Each of the eight outputs has its own value. To calculate the CV value, add up all the individual values of the outputs to be included (selected). An excluded output has a value of zero. See section 7 for CV numbers.

Example: For route 1, select outputs 1, 2, and 6. CV81 = 1+2+32 = 35.

Route Selection CV	Value	Select
Output 1	1	
Output 2	2	
Output 3	4	
Output 4	8	
Output 5	16	
Output 6	32	
Output 7	64	
Output 8	128	
Program this value into the appropriate selection CV		

4.9 Route Switch State

These CVs determine the state, closed or thrown, of the switch. Each of the eight outputs has a close and throw value. A close always has a zero ("0") value. A throw has a value greater than zero. To calculate the CV value, add up all the close and throw values. Even if an output is not selected, a close or throw value must be given.

Example: For remote route 1, close outputs 2, 4, 7 and 8, and throw outputs 1, 3, 5 and 6. CV82 = 1+4+16+32 = 53.

Switch State CV	Value	Select
Output 1 throw - not selected (0) closes	1	
Output 2 throw - not selected (0) closes	2	
Output 3 throw - not selected (0) closes	4	
Output 4 throw - not selected (0) closes	8	
Output 5 throw - not selected (0) closes	16	
Output 6 throw - not selected (0) closes	32	
Output 7 throw - not selected (0) closes	64	
Output 8 throw - not selected (0) closes	128	
Program this value into the appropriate state CV		

4.1 Output Address

These CVs determine the address of the outputs. Each output has two CVs, an address and an address adder, that makes up the address. See section 7 for CV numbers. If an address greater than 255 is needed then use the address adder. The address adder value represents a number that is added to the address value to give the 'actual' address. The following table shows the CV value to use for the adder. For easier programming see "Smart" Programming.

Address, a value from 0 to 255, Address adder, a value from 0 to 7

Example: Output 1 address of 20, set CV1 = 20 & CV9 = 0

Output 1 address of 524, set CV1 = 12 & CV9 = 2

Note: Some systems refer to CV1 as AD, AD2 or short address.

Address Adder								
CV value	0	1	2	3	4	5	6	7
Add	0	256	512	768	1024	1280	1536	1792

4.2 Servo Move Range

These CVs determine the servo's range or how far it moves.

CV3, 4, 5, 6 - Move Range, a maximum value of 127.

A typical value to move a turnout is probably between 15 and 25 depending on the mechanical connection from the servo to the turnout.

Timing: Output servo pulse: 1 ms - 2 ms with 8 us resolution. This pulse range will give a servo about a 90 degree move range. Many servos can physically move more than 90 degrees.

4.3 Servo Center Position

These CVs determine the servo's center position of the move range.

CV10, 11, 12, 13 - Center Position, a maximum value of 127.

If the value of these CVs are set too close to either zero or 127 than the range of movement as defined by the move range will not be available.

4.3 Servo Move Speed

These CVs determine the servo's speed when it moves.

CV63, 64, 65, 66 - Move Speed Direction 1, a maximum value of 127.

CV67, 68, 69, 70 - Move Speed Direction 2, a maximum value of 127.

The larger the number the slower the servo moves. A value of zero will cause the servo to move at its maximum speed.

Note: Reasons why you may see the servo move at maximum speed at power on even if the servo move speed has been set to a very slow value.

1. If the servo position is changed during power off.
2. Some servos twitch, jump or move erratically when power is first applied to them.
3. If the fixed state of the servos at power on (Option 1) has been enabled and the state at power off does not match that state.

These occur because at power on the SMC4 does not know where the servo position actually is and commands the servo to move to the position stored in CV33.

Dash Pot Move Speed

CV59, 60, 61, 62 - Move Speed, a maximum value of 127.

The servo speed for the last 25% of movement can be adjusted. See section 4.4.

4.4 Servo Behaviors

These CVs determine various servo behaviors.

CV71, 72, 73, 74 - Behaviors

A value of 1 causes the servo to use only a single address A(throw) to sequence or rotate through all three positions. The SMC8 must be in mode 3.

A value of 2 enables Speed_To_Position. The SMC4 now uses the selected servo's address as a loco address. Speed steps must be set to 128 for this to work. Do not try and use this address as an accessory address at the same time.

A value of 4 and 8 enables the dash pot speed for the last 25% of the servo movement for move direction 1 and 2 respectively. See section 4.3.

A value of 128 reverses the servo position in response to commands. For example if the servo moved cw (clockwise) when issued a close command, it will now move ccw. This has the same result as reversing the wires that power a stall motor. To enable reverse with another behavior add the values together.

Servo Behaviors	Value	Select
None	0	
Sequence or rotate	1	Select
Speed To Position	2	
Dash Pot Speed Direction 1	4	
Dash Pot Speed Direction 2	8	One
Reverse	128	
Program this value into the configuration CV		

4.5 Decoder Configuration

This CV determines the decoder configuration options.

CV29 - Configuration

See section 1 for a detailed description of the modes.

Option 1 - At power on, after about five seconds, each output will be set to the state as determined by CV33 and CV34. You must program CV33 and CV34 to the desired state at power on.

Option 2 - Normally the SMC4 stops the control signal (pulse) to the servos after they have completed their move. With this option the control signal is always on. This will draw more power from the track based on servo load.

Option 3 - Ops mode programming. Allows Operations mode (On the Main) programming using a Loco address to be enabled all the time. The "Smart" button is no longer required to enter Ops mode. See section 4.12.

To combine options add their value together. In the case where only one selection is possible a box shows "Select one".

Configuration CV	Value	Select
SMC4 Mode 1 - Servos 2 positions, all outputs have unique address	0	Select
SMC4 Mode 2 - Servos 2 positions, outputs 5 to 8 have servo address	1	
SMC4 Mode 3 - Servos 3 positions, all outputs have unique address	2	
SMC4 Mode 4 - Inputs control servos, outputs 5 to 8 have unique address	4	One
Option 1 - enable fixed output state at power on	8	
Option 2 - disable power save	16	
Option 3 - enable ops mode programming**	32	
Program this value into the configuration CV		

** If power save is disabled, option 2, there will be erratic servo movement whenever a CV is programmed. Therefore, program all CVs before setting option 2.

4.6 Input Control

These CVs determine what action the inputs will have when activated. There are two CVs for each input. A route number of one of the routes and an action. See section 7 for CV numbers.

There are 8 physical input terminals. Four primary and four secondary. The secondary inputs are dependent on the primary ones. See below.

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. To select a given output multiply its number (1-8) by 16. In some cases only one of several selections are possible and are shown by a box as "Select one".

Pri & Sec Input Control			
Route Number CV	Value	Select	
Route Disabled	0	0	Select
Route Number (result of transition if selected)	1 to 16		One
Program this value into the appropriate route number CV			
		0	
Action CV	Value	Select	
Input disabled	0		Select
On low to high transition**	1		
On high to low transition	2	2	
On change transition (both low to high and high to low)**	3		one
Result of transition if route number CV value is (0) zero			
Transition toggles output***	4	4	Select
Transition closes the output	0		
Transition throws the output	8		One
Output number times 16	# X 16	16	
	1 X 16		
Program this value into the appropriate action CV			
		22	

** Not recommended for secondary inputs

*** If the SMC4 is in mode 3 then each button press moves the servo to the next position.

In order for an input to cause an action, a transition must be selected. Each input has a 'pul-lup' resistor connected to 5 volts, so the input is normally at 5 volts. An input transition is when the voltage on an input goes from high to low (falling edge) or from low to high (rising edge). For 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.

When a primary input is grounded, it's corresponding secondary input is nonfunctional. For example when primary input 1 in grounded, secondary input 1 will not work.

Example: Primary input 1 when grounded will toggle output 1.

Route number CV35=0, Action CV36=2+4+16=22 (example shown above in table)

Example: Primary input 2 when grounded will execute route 2.

Route number CV37=2, Action CV38=2+32=34 (Since a route is enabled, that disables the close, throw, toggle and output number regardless of how they are selected.)

Tip: Use ops mode to quickly experiment with input settings.