Description of configuration variables (CVs)

The factory default value is in parenthesis after the description

Decoder Reset CV
CV128 – Setting this CV to a value of 170 will reset the decoder to factory defaults

The valid range for the following 3 CVs is 0-28
CV132 – Function number that controls the W/G output in loco address mode (0)
CV133 – Function number that controls the Y output in loco address mode (1)
CV134 – Function number that controls the R output in loco address mode (2)

It is not useful to program this CV
CV136 – remembers the last command received so that it will be in effect during power outages

Valid range for the following three CVs is 0-15
CV137 – remembers the lighting effect for the white output in loco or accessory mode (1)
CV138 – remembers the lighting effect for the yellow output in loco or accessory mode (1)
CV139 – remembers the lighting effect for the red output in loco or accessory mode (1)

Valid range for the following three CVs is 0 (off) to 255 (maximum brightness)
CV140 – remembers the brightness of the W/G output in all DCC modes of operation (255)
CV141 – remembers the brightness of the Y output in all DCC modes of operation (255)
CV142 – remembers the brightness of the R output in all DCC modes of operation (255)

It is not useful to program the following 2 CVs as it will confuse the decoder
CV143 – the low order byte of the decoder address is stored here (3)
CV144 – the high order byte of the decoder address is stored here (0)

Valid range for the following 16 CVs is 0-15
CV145 – Signal lighting effect to use when the decoder receives aspect 0   (0)
CV146 – Signal lighting effect to use when the decoder receives aspect 1   (1)
CV147 – Signal lighting effect to use when the decoder receives aspect 2   (2)
CV148 – Signal lighting effect to use when the decoder receives aspect 3   (3)
CV149 – Signal lighting effect to use when the decoder receives aspect 4   (4)
CV150 – Signal lighting effect to use when the decoder receives aspect 5   (5)
CV151 – Signal lighting effect to use when the decoder receives aspect 6   (6)
CV152 – Signal lighting effect to use when the decoder receives aspect 7   (7)
CV153 – Signal lighting effect to use when the decoder receives aspect 8   (8)
CV154 – Signal lighting effect to use when the decoder receives aspect 9   (9)
CV155 – Signal lighting effect to use when the decoder receives aspect 10   (10)
CV156 – Signal lighting effect to use when the decoder receives aspect 11   (11)
CV157 – Signal lighting effect to use when the decoder receives aspect 12   (12)
CV158 – Signal lighting effect to use when the decoder receives aspect 13   (13)
CV159 – Signal lighting effect to use when the decoder receives aspect 14   (14)
CV160 – Signal lighting effect to use when the decoder receives aspect 15   (15)

NOTES:
If the decoder has an accessory address only Accessory (or loco) Ops mode programming can be used to set CVs.
If the decoder has a signal address only Signal (or loco) Ops programming can be used.

Decoder Warranty
This decoder is fully factory tested and warranted against manufacturing defects for a period of 1 year. As the circumstances under which this decoder is installed can not be controlled, failure of the decoder due to installation problems can not be warranted. This includes misuse, miswiring, operation under loads beyond the design range of the decoder or short circuits in the external wiring. If the decoder fails for non-warranted reasons NCE will replace the Illuminator, no questions asked, for $6 U.S. plus $2 shipping. For warranty or non-warranty replacement send the decoder (and any payment, if required) to:
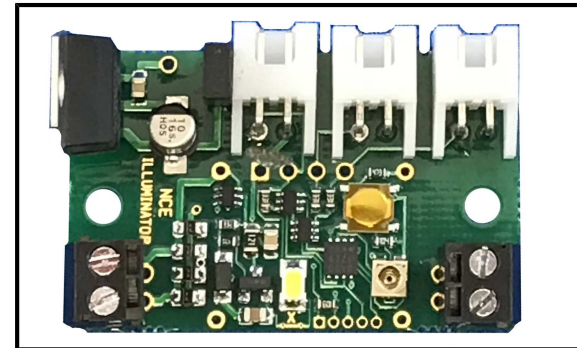
NCE Warranty Center
82 Main Street
Webster, New York 14580

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NCE
The Power of DCC

Illuminator

Lighting decoder compatible with Woodland Scenics Just Plug™ and other lighting accessories with built in resistors

Features of this decoder:
- Works with DCC or DC (limited operation on DC)
- Includes mating connectors with 100mm long wires
- Built-In Warm white LED (can be disabled)
- Up to 3 Just Plug accessories may be controlled separately
- Supplies the correct 12 Volts to Just Plug products
- Can have different lighting effects each output
- Each output individually dimmable

Age **14+**

p/n 05240164

8 16757 01167 7

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

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Description:

The Illuminator can be used for general layout scenic lighting in buildings, lamp posts, for constant lighting in passenger cars and cabooses, or as a DCC decoder for one signal head. The Illuminator includes one on board white LED to simplify scenic lighting situations, just add DC (up to 14V) or DCC power at the 'LR' and 'RR' holes and you have an effective structure lighting solution. **The Illuminator will not work with Grain-of-Wheat or other small incandescent lamps.**

Capabilities and limitations of the Illuminator:

When operating on DC power:
- Select between 15 different lighting effects
- Brightness is easily adjustable
- The Illuminator will remember the chosen lighting function after power is removed

When operating as a DCC mobile decoder using loco addresses:
- The Illuminator can be programmed to any loco address (short or long)
- Consist addressing also works
- All 3 LED outputs can have different (15 to choose from) lighting effects
- Uses loco function buttons to activate each output independently
- Each output can be mapped to function F0-F28
- Lighting effects are non-directional (on in both directions of travel).
- The brightness of each output is individually CV programmable
- Loco Ops mode programming is used to set CV values

When operating as a DCC accessory decoder using accessory addresses:
- The Illuminator can be programmed to any accessory address (1-2043)
- All 3 LED outputs can have different (15 to choose from) lighting effects
- All 3 outputs are controlled simultaneously with accessory on/off (open/thrown) commands
- The brightness of each output is individually CV programmable
- Accessory Ops Mode or Loco Ops mode programming is used to set CV values

When operating as a DCC signal decoder using signal addresses:
- The Illuminator can be programmed to any signal address (1-2043)
- 18 different effects specifically for signal heads available
- Different lighting effects can be mapped to each NMRA aspect
- All 3 outputs are controlled simultaneously by signal aspect commands
- The brightness of each output is individually CV programmable
- Signal Ops Mode or Loco Ops mode programming is used to set CV values

Electrical and technical limitations of the Illuminator

The voltage supply for the LEDs is 12 volts DC and the total current available for lighting is about 100mA. The Illuminator has built-in 330 Ohm resistors which will not limit current enough for direct connection of individual LEDs so *an additional resistor should be used when directly connecting LEDs* to the Illuminator. Woodland Scenics Just Plug™ products already have this additional resistor installed. It is possible to use up to 4 red, yellow or green LEDs or up to 3 white or blue LEDs **in series** on an output with a suitable additional resistor. See the diagram at the bottom of the next page.

Illuminators may be 'daisy chained' as shown in the diagram below.
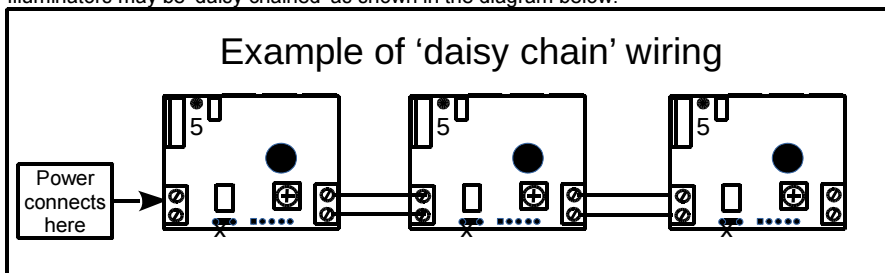
NOTES for this decoder			
CV	My value	My description	default
132			0
133			1
134			2
137			1
138			1
139			1
140			255
141			255
142			255
145			0
146			1
147			2
148			3
149			4
150			5
151			6
152			7
153			8
154			9
155			10
156			11
157			12
158			13
159			14
160			15

Example of 'daisy chain' wiring

Power connects here

Signal Address programming:

The Illuminator cannot be programmed on your programming track. It is always programmed while connected to the DCC track power. This decoder can be programmed by all systems that support NMRA DCC signal control using the procedure below (at this time only NCE systems issue signal control from the handheld cab – other systems use their respective computer interfaces).

Programming the signal address using any NCE DCC system:
1) Connect wires from the track to the decoder DCC terminals.
2) Push the Program button (notice the LED flashes now). When the LED is flashing you have one minute to complete the next steps or the decoder will exit programming mode.
3) Press SHIFT and CLEAR (at same time) to bring up the Select Signal menu entry.
4) Type the address you want the decoder to accept as its new signal address and press ENTER.
5) Type 0 when prompted for the aspect followed by ENTER
6) The decoder will accept the new signal address stop flashing the LED

Programming Signal CVs

There are two methods for programming the CVs when the decoder is programmed with a signal address. The preferred method is **Extended Decoder Control Packet for Ops Mode Programming.** NCE systems call it "Prog Sig On Main" or "Ops Prog Sig CVs"

Programming Signal CVs using an NCE system:
● Connect wires from the track to the decoder DCC terminals.
● Press PROG/ESC followed by "0" to enter the "OPS PROG SIG CV" menu
● Type the address of the decoder to program followed by ENTER.
● Type in the CV number you want to program followed by ENTER
● Type in the value for the CV followed by ENTER
● The decoder will accept the CV value.

Programming Signal CVs using loco Ops mode any DCC system:
● Connect wires from the track to the decoder DCC terminals.
● Push the Program button (notice the LED flashes now). When the display is flashing you have one minute to complete the next steps or the decoder will exit programming mode.
● On your DCC system enter Locomotive Ops mode programming
● Enter any unused locomotive address (we don't want any unwanted loco programming here).
● Enter the CV number you want to program
● Enter the value for the CV
● The decoder will accept the CV value and stop flashing the LED.
● The button must be pressed for each CV to be programmed with loco Ops mode.

Note: The LED will only flash for about 1 minute. When it stops flashing the Illuminator will not accept programming. If it times out and stops flashing before you finish programming just press programming button again.

Controlling Brightness:
Each output has a separate brightness CV. Values of 0 to 255 are accepted with 255 being full brightness.
CV140 controls the brightness of the W/G output.
CV141 controls the brightness of the Y output.
CV142 controls the brightness of the R output.

Installation Notes:

This decoder is requires power wires to be connected to the decoder circuit board. You do not need to use heavy wire to connect the Illuminator to power or external LEDs. Number 24 AWG is more than sufficient with 26, 28 or even 30 gauge preferred to make it easier to handle and solder the wires to the small holes on the Illuminator. It takes 32 Illuminators, fully loaded with 3 LEDs each to use just 1 Amp of DCC power.
Connecting power to the Illuminator:
Connect DCC track power or 12-14VDC to either of the 2 pin screw terminal blocks.

General layout and features of the Illuminator
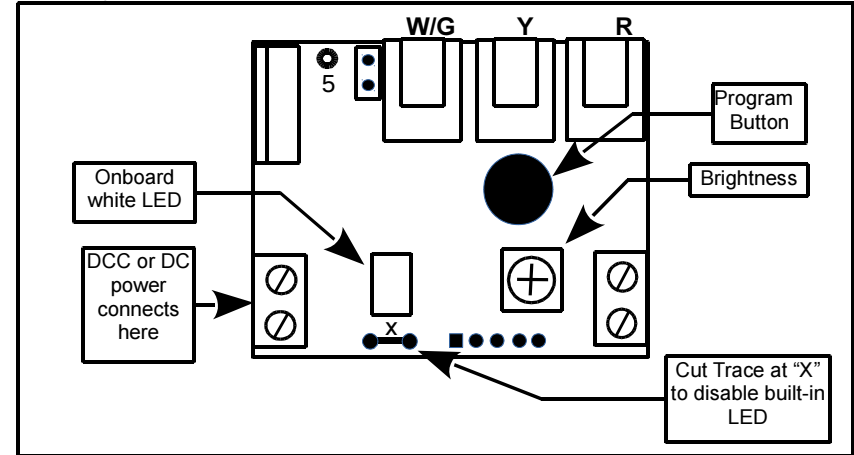
Connecting Woodland Scenics Just Plug™ products:
Connect Just Plug™ products directly to the Illuminator use the Linker Plug that is supplied with the Just Plug products. Woodland Scenics products already have a built in resistor,

Connecting your own individual LEDS:
When wiring your own LEDs to the Illuminator be sure to observe the correct polarity. The diagram above shows the correct polarity for connection of typical LEDs to the Illuminator. **Notice that contrary to normal convention the *red wire is negative and black wire is positive.***

Connecting your own LEDs to the supplied 2 pin harness

Connecting multiple LEDs to the supplied 2 pin harness
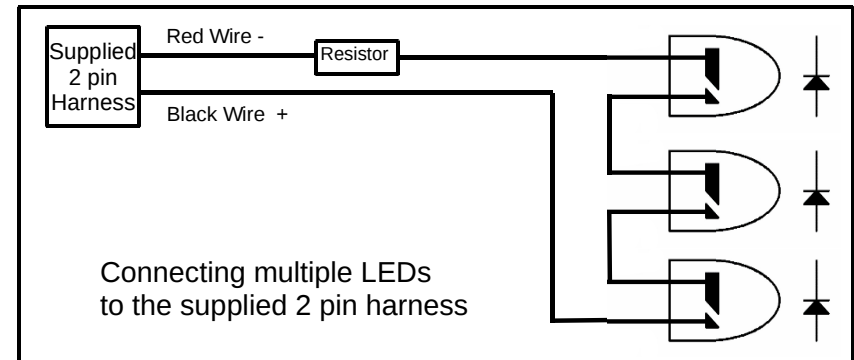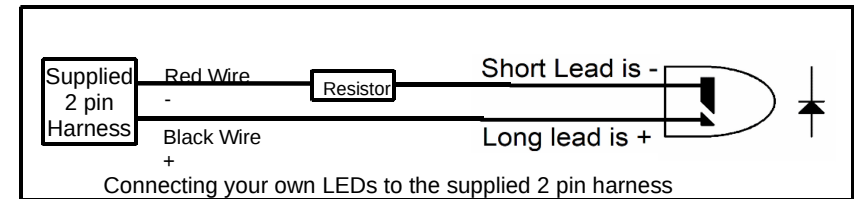
Disabling the on board white LED:

The on board white LED is powered by the W/G output. If you connect an external LED to the W/G hole the on board LED will interfere with the external LED. In this case you will want to disable the on-board LED. To disable it use a sharp pointed hobby knife to cut the gold colored circuit 'trace' indicated by the in the diagram above.

Using the Illuminator on DC power

When connected to DC power the push button is used to select between 16 lighting effects and a small Phillips screwdriver is used to control the brightness. Some of these lighting effects will also make use of the extra LED outputs 'W/G', 'Y' and 'R' as marked on the bottom of the circuit board. Several of the lighting effects may be better served if you disable the on board LED (see above) and substitute a different color LED. The built-In white LED can be disabled by cutting the circuit trace marked "X" (use a sharp, pointy hobby knife) and replaced with a different LED that is connected it to the +5 and G holes.

Select between 15 different lighting effects:
Each push of the small gold colored button on the Illuminator will change the lighting effect. There are 15 different effects plus off. All three outputs will display the same effect except for effect number 9 which will set the W/G and R outputs to be one half of a railroad 'crossbuck' and the Y output will be the other half to get alternately flashing lights. Even though all three outputs are set to the same lighting effect many of these effects are random (such as random on-off structure lights) so all three outputs will appear to be independent. When you get to effect 15 the next push of the button will start over again at effect 0.

List of lighting effects in DC operation:
  Effect 0 – off (all outputs off)
  Effect 1 – Steady on
  Effect 2 – Slow flashing
  Effect 3 – Fluorescent flicker A, more on than off
  Effect 4 – Fluorescent flicker B, more off then on
  Effect 5 – Fluorescent flicker C, a definitely dying fluorescent tube
  Effect 6 – Single strobe light (every 2 seconds)
  Effect 7 – Double strobe light (every 2 seconds)
  Effect 8 – Rotary beacon
  Effect 9 – Railroad crossing signal phase A
  Effect 10 – Railroad crossing signal phase B
  Effect 11 – Random on/off (times from 4 seconds to 1 minute)
  Effect 12 – Random on/off (times from 4 seconds to 2 minutes)
  Effect 13 – Random on/off (times from 8 seconds to 4 minutes)
  Effect 14 – Mercury vapor street light coming on (takes about 30 seconds to full brightness)
  Effect 15 – Rapid flash (lets you know this is the end of the list)

Controlling brightness of the outputs:
Use a small phillips screw drive to *carefully* turn the brightness potentiometer on the Illuminator.
The brightness potentiometer is only active when used on DC. It is not active when used with DCC.

Using the Illuminator as an NMRA conforming signal decoder

The Illuminator will accept NMRA signal addresses and display up to 18 different lighting effects on one 3 LED signal head. The decoder responds to aspects 0-15 plus 30 and 31 which allows all 18 effects to be available for your signal heads. Only Aspect 0 (absolute stop) is defined by the NMRA standards. Table 1 below describes each lighting effect and its mapping to an aspect number. It is possible to change the aspect mapping (see Description of configuration variables) for aspects 0-15. Aspects 30 and 31 are 'hard coded' into the decoder as they are not the kind of lighting effect normally displayed on a real signal.

Table 1:

Aspect	Effect Number	Lighting effect
0	0	Red
1	1	Yellow
2	2	Green
3	3	flash red
4	4	flash yellow
5	5	flash green
6	6	red+yellow
7	7	flash red+yellow
8	8	red+flash yellow
9	9	red+green
10	10	flash red+green
11	11	red+flash green
12	12	yellow+green
13	13	flash yellow+green
14	14	yellow+flash green
15	15	effect 15=all on
30	--	all flash
31	--	all off

Since we cannot control which LEDs (and therefore the brightness) manufacturers use in their signals we provide a CV to control the brightness of each LED. The brightness ranges from 0 (off) to 255 (max) with 255 being the factory default for brightness. For the CV numbers see "Description of configuration variables" later in this manual.

Setting other CV options in the Illuminator:
There are two methods for programming the CVs when the decoder is programmed with an accessory address. The preferred method is **Accessory Decoder Configuration Variable Access Instruction.** NCE systems call it "OPS PROG ACCY CV"

Programming Accessory CVs using an NCE system:
- Connect wires from the track to the decoder DCC terminals.
- Press PROG/ESC followed by "7" to enter the "OPS PROG ACCY CV" menu
- Type the address of the decoder followed by ENTER.
- Type in the CV number you want to program followed by ENTER
- Type in the value for the CV by ENTER
- The decoder will accept the CV value

Programming CVs with systems that don't support Accessory OPs mode programming:
- Connect wires from the track to the decoder DCC terminals.
- Push the Program button (notice the LED flashes now). When the display is flashing you have one minute to complete the next steps or the decoder will exit programming mode.
- On your DCC system enter Locomotive Ops mode programming
- Enter any unused locomotive address (we don't want any unwanted loco programming here).
- Enter the CV number you want to program
- Enter the value for the CV
- The decoder will accept the CV value and stop flashing the LED.
- The button must be pressed for each CV to be programmed with loco Ops mode.
-

Note: The LED will only flash for about 1 minute. When it stops flashing the Illuminator will not accept programming. If it times out and stops flashing before you finish programming just press programming button again.

Controlling Brightness:
Each output has a separate brightness CV. Values of 0 to 255 are accepted with 255 being full brightness.
CV140 controls the brightness of the W/G output.
CV141 controls the brightness of the Y output.
CV142 controls the brightness of the R output.

Lighting Effects:
Each output can have a different light effect. Values of 0 through 15 are valid.
CV137 controls the effect for the W/G output.
CV138 controls the effect for the Y output.
CV139 controls the effect for the R output.

List of lighting effects in DCC operation when using an accessory address:
  Effect 0 – off (all outputs off)
  Effect 1 – Steady on
  Effect 2 – Slow flashing
  Effect 3 – Fluorescent flicker A, more on than off
  Effect 4 – Fluorescent flicker B, more off then on
  Effect 5 – Fluorescent flicker C, a definitely dying fluorescent tube
  Effect 6 – Single strobe light (every 2 seconds)
  Effect 7 – Double strobe light (every 2 seconds)
  Effect 8 – Rotary beacon
  Effect 9 – Railroad crossing signal phase A
  Effect 10 – Railroad crossing signal phase B
  Effect 11 – Random on/off (times from 4 seconds to 1 minute)
  Effect 12 – Random on/off (times from 4 seconds to 2 minutes)
  Effect 13 – Random on/off (times from 8 seconds to 4 minutes)
  Effect 14 – Mercury vapor street light coming on (takes about 30 seconds to full brightness)
  Effect 15 – Rapid flash

Using the Illuminator as a mobile (loco) decoder

The Illuminator comes from the factory preset with the (short) Loco Address of 3. Loco function commands are used to control the outputs when using the Illuminator with a loco address.

Now let's test the decoder:
First get power to the decoder by connecting wires to the RR (Right Rail) and LR (Left Rail) holes on the decoder then to DCC track power. There are two sets of RR and LR holes. You may use either set. The other set makes it easy to 'daisy chain' multiple Illuminators (diagram on page 2). Once the Illuminator is powered up it is time to test. Unless you've already changed the decoder address it will be 3 and functions 0, 1 and 2 will control the three outputs. Pressing the headlight button (F0) on your controller should turn the white LED on and off.

The Illuminator CANNOT be programmed on your programming track. It is always programmed while connected to DCC track power. This decoder can be programmed by all systems that support locomotive Program On the Main (also called Loco Ops mode programming) using the EXACT procedure below. :
- Press the gold colored program button on the Illuminator (the Illuminator LED starts flashing)
- Decide what address you want the Illuminator to have.
- Select that address on your throttle.
- Call up Program on the Main (also called OPs mode on some DCC systems) on your throttle
- Program CV1 to a value of 1.
- The flashing of the LED should stop indicating the Illuminator has accepted the new address.

NOTE: The LED will flash for about 60 seconds then return normal operations if the Illuminator doesn't receive any programming. If you were too slow just push the button again to start another attempt.

Consisting:
The Illuminator will accept normal NMRA consisting commands. This makes it easy to control several Illuminators together such as when they are used in passenger cars for lighting. The consist address will not work for for changing CVs instead use the 'main' address.

Controlling Brightness:
Each output has a separate brightness CV. CV140 controls the W/G output. Values of 0 to 255 are accepted with 255 being full brightness. CV141 and CV142 control the brightness of the Y and R outputs respectively.

Lighting Effects:
Each output can have a different light effect. Values of 0 – 15 are valid.
CV137 controls the effect for the W/G output.
CV138 controls the Y output.
CV139 controls the R output.

List of lighting effects in DCC operation when using a loco address:
  Effect 0 – off (all outputs off)
  Effect 1 – Steady on
  Effect 2 – Slow flashing
  Effect 3 – Fluorescent flicker A, more on than off
  Effect 4 – Fluorescent flicker B, more off then on
  Effect 5 – Fluorescent flicker C, a definitely dying fluorescent tube
  Effect 6 – Single strobe light (every 2 seconds)
  Effect 7 – Double strobe light (every 2 seconds)
  Effect 8 – Rotary beacon
  Effect 9 – RR crossing signal phase A (will not be in sync when used with loco address)
  Effect 10 – RR crossing signal phase B (will not be in sync when used with loco address)
  Effect 11 – Random on/off (times from 4 seconds to 1 minute)
  Effect 12 – Random on/off (times from 4 seconds to 2 minutes)
  Effect 13 – Random on/off (times from 8 seconds to 4 minutes)
  Effect 14 – Mercury vapor street light coming on (takes about 30 seconds to full brightness)
  Effect 15 – Rapid flash

Function mapping when using a loco address:
Each output may be programmed (mapped) to a function number. CV132 controls which function number for the W/G output. CV133 and CV134 control which function number operates the Y and R outputs respectively. Only values of 0 to 28 will work.

Using the Illuminator as an NMRA conforming Accessory decoder

The Illuminator will accept all NMRA accessory addresses and display up to 16 different lighting effects. All three LED outputs will be on when the Accessory is ON (Closed) and all three will be off when the Accessory is OFF (Open).

Programming the Illuminator to work with an accessory address:
The Illuminator CANNOT be programmed on your programming track. It is always programmed while connected to DCC track power. This decoder can be programmed by all systems that support accessory control using the procedure below.

To program the Illuminator to a new accessory address using any DCC system:
- Connect wires from the track to the decoder power terminals.
- Push the programming button on the decoder. The LED will start flashing.
- When the display is flashing you have about one minute to complete the next step or the decoder will exit programming mode.
- Decide what the new address for the Illuminator will be.
- Use your DCC system to select (using the new address) and operate the switch (see throwing switches below). The decoder will accept that switch address as its new address

The instructions below can be used for throwing a switch depending on which DCC system you have:

To throw a switch using the NCE system:
Press 'SEL ACCY'
Type in the desired accessory number followed by 'ENTER'
Push "1" (or "2") to throw the switch.

To throw a switch using a Digitrax system:
Press 'SWCH'
Type in the desired accessory number
Push "OPTN" to throw the switch.

To throw a switch using a Lenz system:
Press 'F'
Press '5'
Type in the desired accessory number followed by 'ENTER'
Push '+' (or '-')

To throw a switch using the MRC system:
Press 'SEL ACCY'
Type in the desired accessory number followed by 'ENTER'
Push "1" to throw the switch.

If throwing the switch one way doesn't do anything, try the other direction. You should be rewarded with the LED of the Illuminator turning on.

You will notice the White LED is very bright. There are CVs to control the brightness of each of the 3 LED outputs. There are also CVs to set the lighting effect for each LED output. These are covered on the next page