The Wabbit™ REV III (5/20/11)

A Unique, Intelligent Stationery Decoder for 2, Stall Motor, Switch Machines!
Designed by Larry Maier, Instructions by Don Fiehmann
US Patent 7,810,760 and 7,810,761

The Wabbit™ is a dual version of our popular Hare Intelligent Accessory Decoder. This decoder has two fully functional intelligent decoders on one printed circuit board. The two decoders operate independently and each one has all of the advance features of the Hare.

Wabbit

Auto Throw™ Automatically throws points when a train is approaching against the points!

Auto Throw™ Timer: Provides for timing the auto throw function to prevent two trains from colliding.

Auto Return™: Automatically returns the points after a preset interval for any/all operational events.

Smart Route ™ Sets up to 28 routes by simple address programming in addition to the primary address.

Dispatcher Over-Ride ™: Allows the Dispatcher to lock out any or all other switch commands.

Lock Block Protection: ™ Overrides the WABBITS operation if a designated block is occupied.

Locked Route Control ™: Provides for only one route direction response for a Throw or Clear command.

Switch Speed Control ™: Allows you to control the stall motor speed.

Smart Default Ops™: Upon Power-up, Wabbits return to either last position or a programmed default.

Operate Switch Signals or Panel LED Indicators.

Manual Pushbutton or Toggle Switch: Allows button or toggle switch manual control of the points.

System Reset: CV 63=42 sets all Addresses and CVs to original factory values.

Direct Current Ops: The WABBIT will operate on DC using Manual Push Button Control Option.

Semaphore/Gate Ops: Uses a stall motor for triggered control of a semaphore or crossing gate.

Automates Reverse Loop Turnouts. Using Auto Throw feature.

Wabbit (FB) all the above + Feed Back

Feed Back, Turnout Position Reporting to: Digitrax (LocoNet), Lenz (ExprssNet) and NCE (CabBus)

A) Quick Start:

You can proceed directly to Step (1)-(3), below for a "Quick Test" of Operation. This will show you how simple it is to install the Wabbit and operate on DCC!

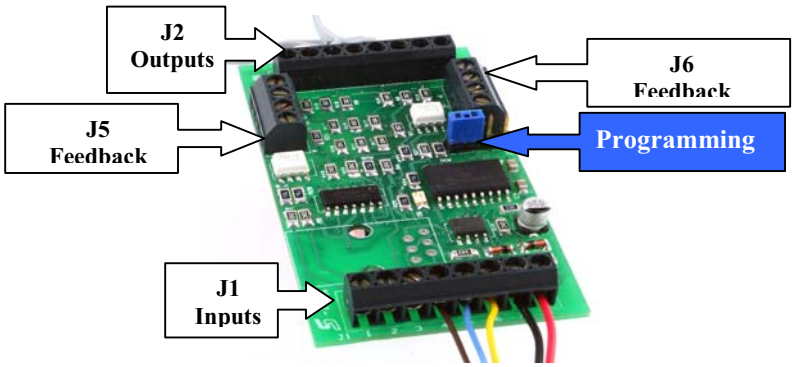
1) Connect DCC Power to screw terminals, 7 and 8 of J1.
Caution, connecting power to other terminals will damage Wabbit!

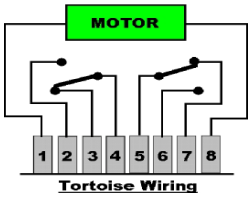
2) Connect J2, Pins 5 and 6 to 1st Tortoise Pins 1 and 8 and for 2nd Tortoise connect J2, pins 7 and 8 to Pins 1 and 8

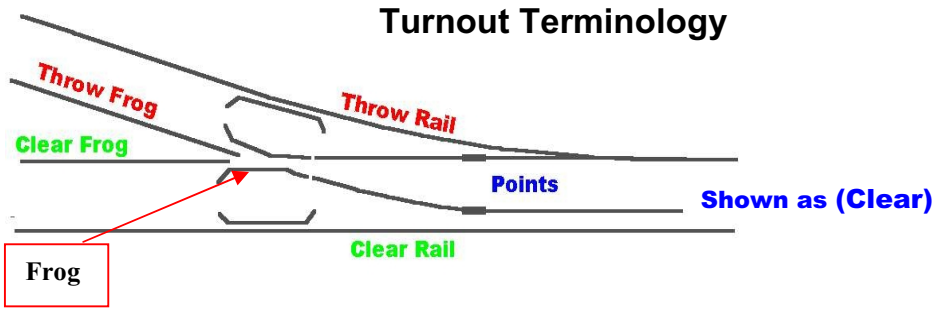
3) Test your DCC setup by operating, use primary default address, (1) or (2) for this test.

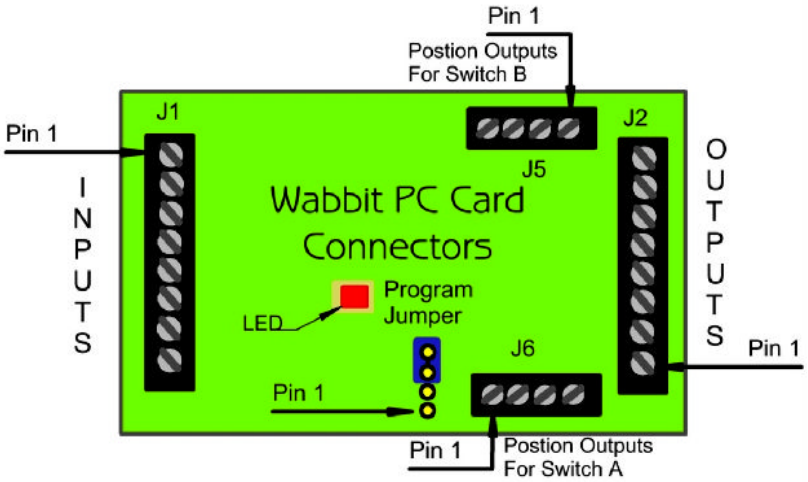
Digitrax users should review the configuration of the Digitrax DCS-100/200 prior to operating and or programming. It is important that the DCS-100 /200 has the switching (Turnout) control enabled to operate Stationery Decoders.

B) The Wabbit at a Glance





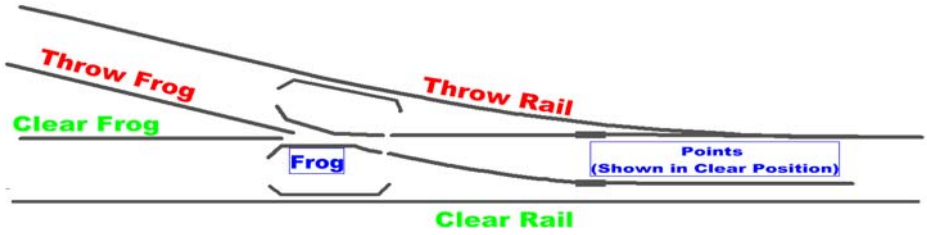




C1) Basic: Run on DCC using only DCC Throttle Control:

1) Before starting you need to understand and determine the following terms to use all the *Wabbits* features.

A Switch Position: Which way is the **Clear** route thru the turnout? The Wabbit has to know how it is connected to the Tortoise and how the Tortoise is oriented to the Turnout. For the primary address CV49 determines this, see Tortoise pictures and Switch Positions below.



B Turnout Frog Type: Is the turnout **Frog** an **Insulated** type, Insulfrog or a **Solid** Frog, Electrofrog?

C Turnout Address: What will the turnout addresses be when installed? Range 3-2044. Do not use (1) or (2). They are the Default Addresss and all un-programmed Wabbits will respond to one (1) and (2). All Smart Route Default Addresses are 2044.

Switch Positions and CV49
Determine which direction the Tortoise actuator arm is positioned when the path is set for the **Clear** operating path, see picture below. The chart on page 17 can be used as an aid in setting up the primary and Smart Route addresses when you determine the switch positions you want.

If you make a mistake, don't worry, the turnout will work opposite to the command you have issued and it is easy to re-program CV49. See also, Pg 10.

The Two Switch Positions are Clear and Thrown. We will use **Clear** or **Thrown** for these instructions.
The Table below shows how the DCC Manufactures identify Clear and Thrown

System	Clear (Wabbit)	Thrown (Wabbit)
Digitrax	**c** or Closed	**t** or Thrown
Lenz	**+**	**-**
MRC	**ON**	**OFF**
NCE	Normal/ON/ **1**	Reverse/OFF/ **2**

1) Connect DCC Power to J1, Pins 7and 8 The DCC polarity on the throw rail should go to screw terminal 8 of J1 and the DCC polarity on the clear rail should go to screw terminal 7 of J1.
Caution, connecting DCC power to other terminals will damage the Wabbit!

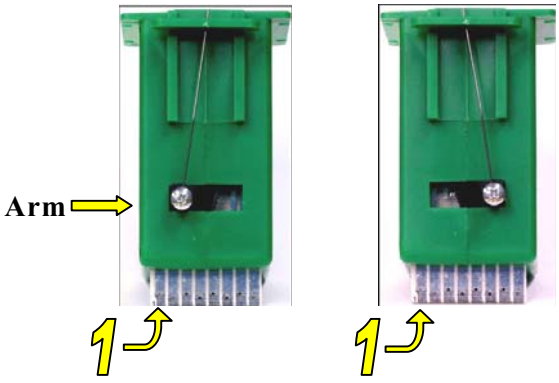
2) Connect J2, Pins 5 and 6 to 1st Tortoise Pins 1 and 8 and for 2nd Tortoise connect J2, pins 7 and 8 to Tortoise Pins 1 and 8

3) Test your DCC setup by following the switch operation directions for your system. Use the default address (1).

4) Program Primary Addresses and CV49. See pg-13

Determine CV49 values only when your Turnout is set for the Clear Route.

There are two possible positions for the Tortoise actuator Arm. If your Tortoise Arm is positioned as shown in the **Right** picture below then set **CV49 to 0** (factory default).

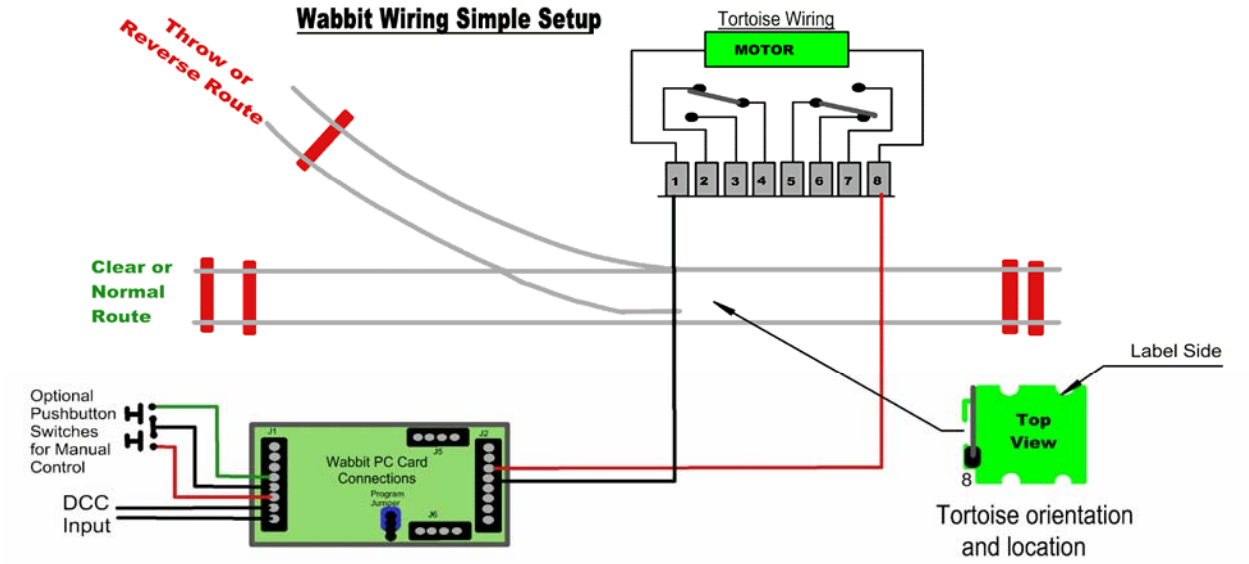


If your Tortoise arm is positioned as above **Left** when the points are aligned to the **Clear** route, then set **CV49 to 1.**

C2) Basic + Panel/Signal LEDS and Button/DPDT Control

The Pushbutton or SPDT switches are optional and can be used for manual control instead of DCC control.

Also, **a center-off toggle switch** can be used in place of the 2 pushbuttons. When in the center off position the Wabbit will operate normally. When the toggle switch is positioned for either the clear or thrown route positions, it will lock the switch in that position. See also CV71 to select either, single push button or DPDT Toggle Switch / 2 Buttons modes! If you are using a single push button set CV71=1 and wire only the common and the clear terminals.

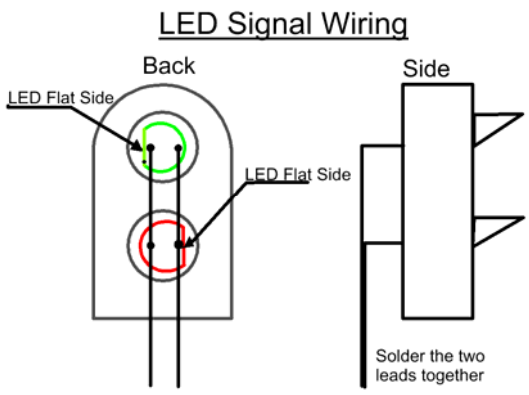


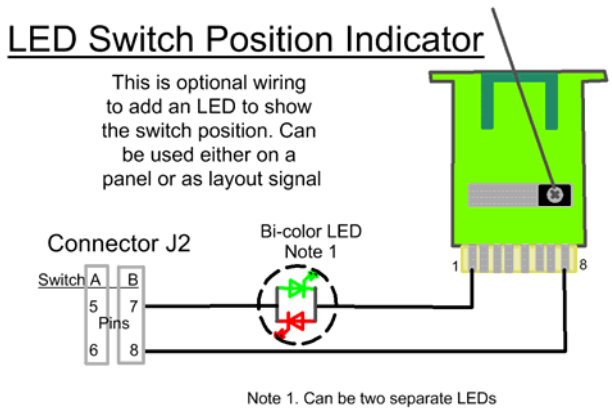
See also CV71 to select either push button or toggle switch modes!

(Tortoise Side View is shown on page 3)

Switch Position Indication:

LEDs can be use to indicate the switch position for control panels or signals. Use either a single bi-color red/green LED or two LEDs wired back to back.

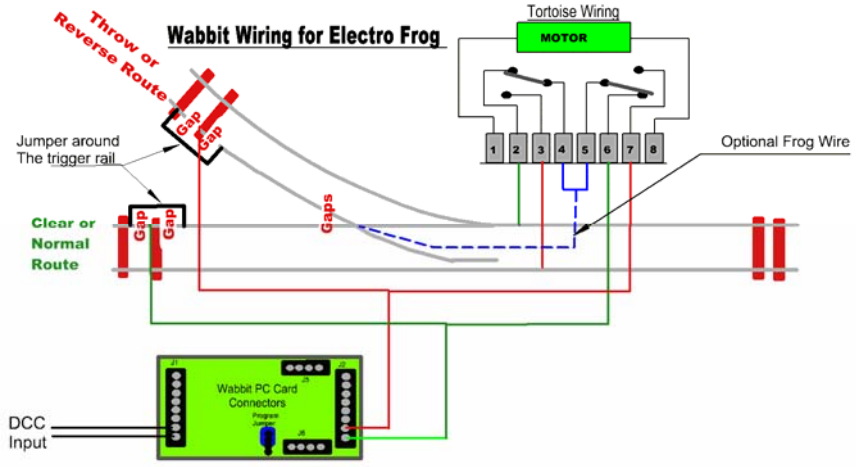




C3) Implement Auto-Throw:

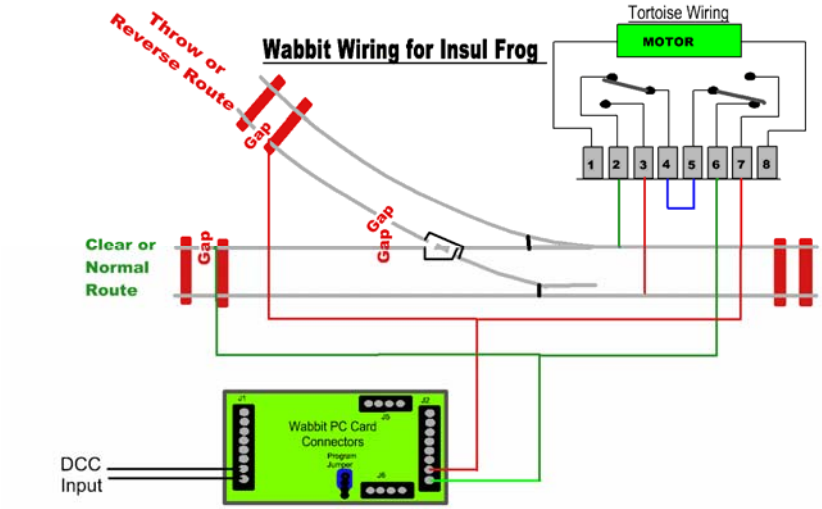
The 1st diagram below shows the turnout set for the clear route. For the Wabbit to know the existing position of a switch, feedback is needed via the Tortoise contacts . The Wabbit is triggered to change positions when a wheel makes a connection between the gap of the **Trigger Rails** and the powered rails. When a connection occurs on the clear route **(Green Line)** nothing happens as DCC power is feed through the contacts and applies power to the trigger rail.

If a wheel contacts the trigger rail on the throw route, **Red Trigger Rail**, there is no power from the Tortoise contacts and the connection caused by the wheel on the throw route **(Red Line)** applies DCC power to the other trigger rail input to the Wabbit. This means that power is on BOTH of the trigger rail inputs at the same time. When DCC power is applied to both of the Wabbit's trigger rail connections at the same time the Wabbit throws the switch. Once the switch is thrown, DCC power is only applied to the other trigger input. The Wabbit has many programmable features that use Auto-Throw to provide a range of unique automation options. See pg 13-17.



The Trigger Rail is made by using a rotary tool with a fine cut off blade or a fine back saw and cutting thru the rail to make a small isolated rail section. The length of the isolated rail section can vary as you choose. An insul-frog generally requires a single cut or insulator and an electro-frog requires two. The insul-frog itself creates the 1st gap, therefore, either or both frog rails can become Trigger Rails, see diagrams below. For additional Auto-Throw options, see pg 7-10.

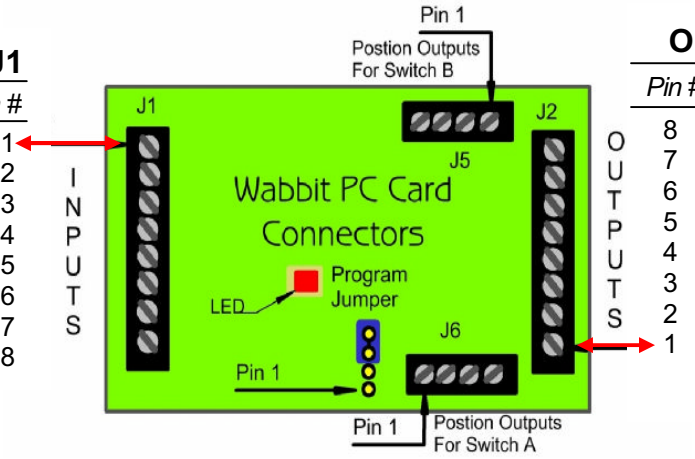
Insul-Frog



D) Wiring, Connections and Special Features:

Inputs: Connector J1

Signal Name	Pin #
Switch B ManualClear	1
Switch B Common	2
Switch B Manual Throw	3
Switch A Manual Clear	4
Switch A Common	5
Switch A Manual Throw	6
DCC Power (A)	7
DCC Power (B)	8



Outputs: Connector J2

Pin #	Signal Name
8	Switch B Tortoise Pin #8
7	Switch B Tortoise Pin #1
6	Switch A Tortoise Pin #8
5	Switch A Tortoise Pin #1
4	Switch B Frog Throw Rail
3	Switch B Frog Clear Rail
2	Switch A Frog Throw Rail
1	Switch A Frog Clear Rail

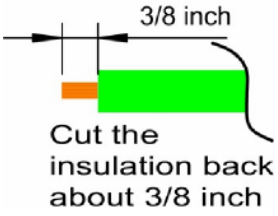
The Wabbit card has all the input and output connections. You only need a small screwdriver to make connections. The **LED** is used to indicate activity on the Wabbit. It will flash when programmed or when addressed. The Program Jumper is used to set switch A or B to the programming mode or for normal operations. See pg-13.

Connections by Switch A and Switch B

SWITCH A		SWITCH B	
Pin	**Signal**	**Pin**	**Signal**
J1-6	Switch A Manual Throw	J1-3	Switch B Manual Throw
J1-5	Switch A Common	J1-2	Switch B Common
J1- 4	Switch A Manual Clear	J1-1	Switch B Manual Clear
J2-1	Switch A Frog Clear Rail	J2-3	Switch B Frog Clear Rail
J2-2	Switch A Frog Throw Rail	J2-4	Switch B Frog Throw Rail
J2-5	Switch A Tortoise Pin #1	J2-7	Switch B Tortoise Pin #1
J2-6	Switch A Tortoise Pin #8	J2-8	Switch B Tortoise Pin #8

Caution:
The "B" Switch outputs use J2, pins 7&8 please use caution that you do not connect the input DCC that connects to, J1 pins 7-8 to the "B" Switch outputs or the decoder will be damaged

Wiring Hints: Most of the wire used with the Wabbit can be fairly small, like 20 to 26 gauge. Lighter wire will work, but it is harder to use in the Wabbit connectors. The only exceptions are the frog wires. These are the only wires that carry much current. The frog wires would be better at 18 to 20 gauge. Remove about 3/8 inch of the insulation when inserting in the Wabbit connectors. Stranded wire works better than solid.



It is easier to wire the up the Wabbit on the bench before installing it on the layout. Cut the wires a bit longer than needed and then cut to length when installing. If you use the 8 pin connectors for the Tortoise, see pg-12, the Wabbit can be connected to a spare Tortoise and tested before installing. The spare Tortoise can also be used to hold the connector when soldering wires to the connector. Wiring before installing also makes programming easier and also allows you to run tests. Using wires of different colors, ribbon cable or using tags on the wires can help to identify wire locations when installing on the layout. Note, the 8 pin connector is a little longer than the printed circuit board it plugs into. Gluing a flat toothpick in each end of the inside of the connector, as a shim, will keep the connector and Tortoise in better alignment. See pg-12.

Switch Status Outputs for Feedback

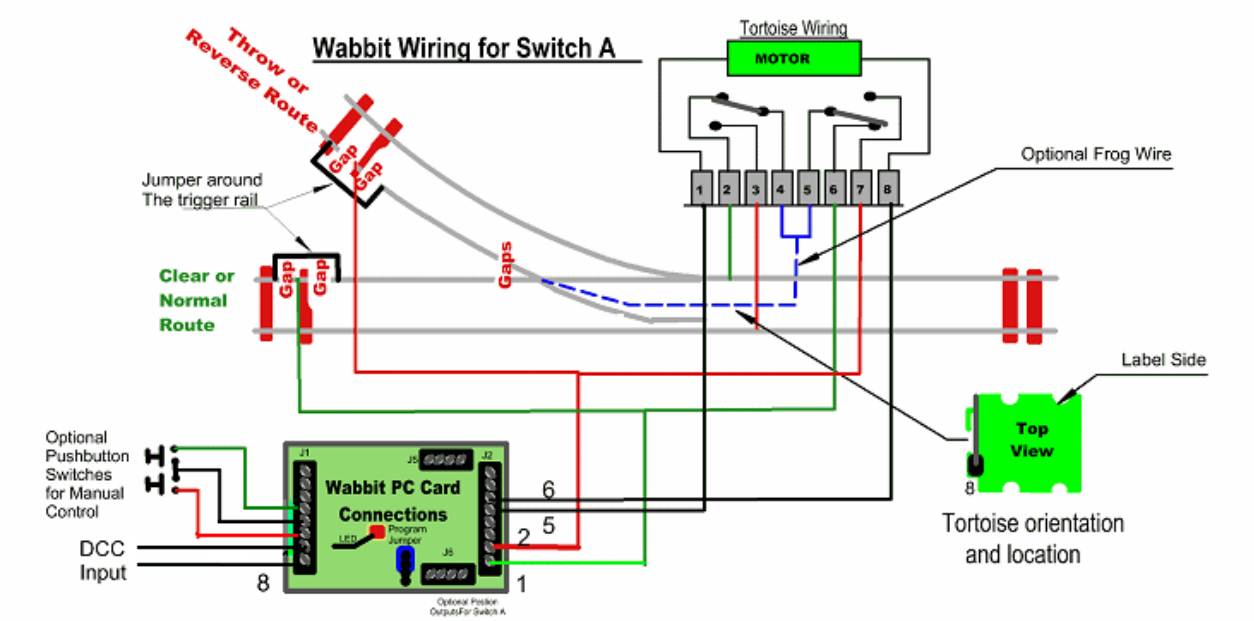
Connector J6 Switch A Position		Connector J5 Switch B Position	
Pin #	Signal Name	Pin #	Signal Name
J6-1	Clear Plus A	J5-1	Clear Plus B
J6-2	Clear Minus A	J5-2	Clear Minus B
J6- 3	Throw Plus A	J5-3	Throw Plus B
J6-4	Throw Minus A	J5-4	Throw Minus B

Program Jumper J3 Settings

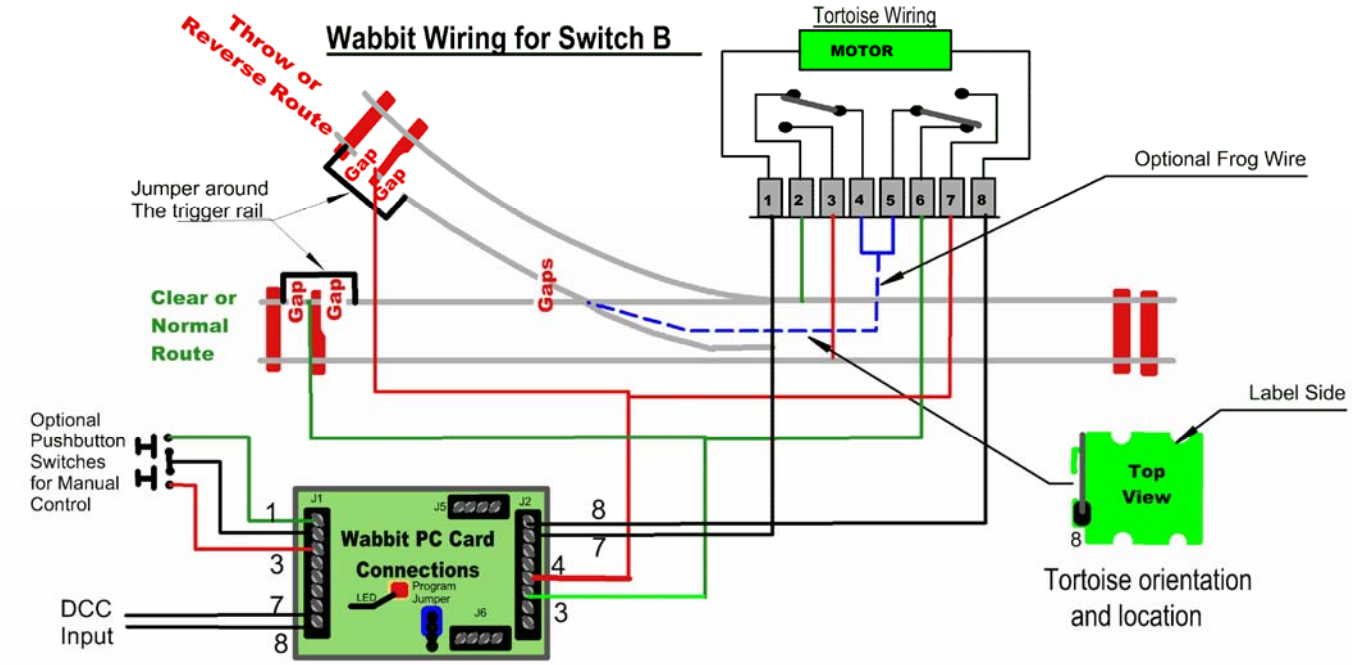
1-2	Program Switch A
2-3	Program Switch B
3-4	Normal Operation

See pg-14

D) Wiring, Connections and Special Features Continued:

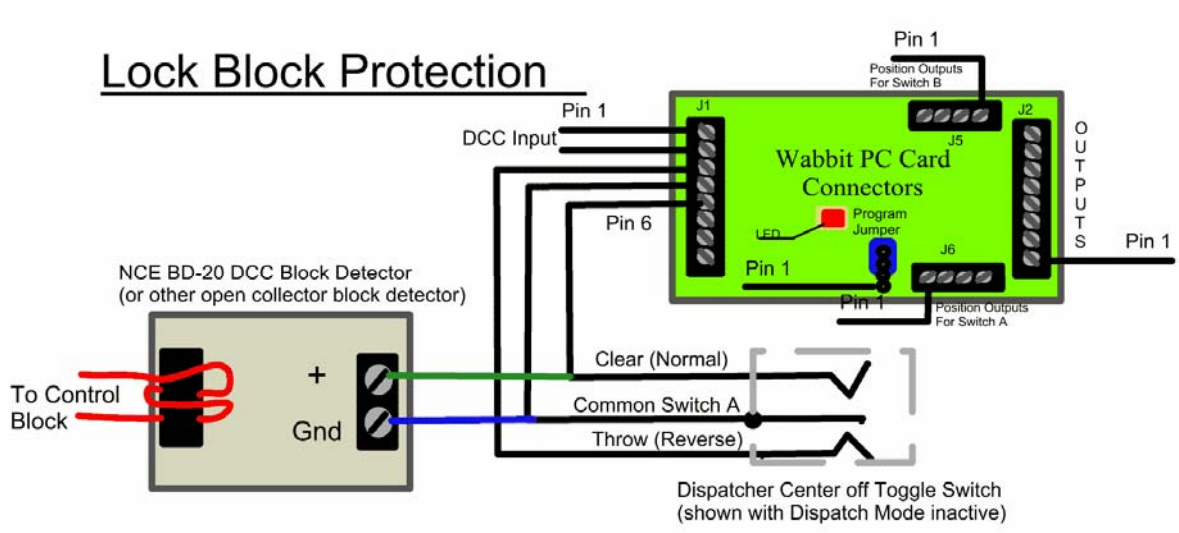


The wiring for switch A and B are similar. The difference is the pin connections on the Wabbit. (Wiring for switch B is shown below.)The Optional Frog Wire (blue dashed line) is used when you have a turnout with an electro frog that needs a power feed If the switch routes are in reverse of the diagram, the positions can be changed when you program CV-49.The pushbuttons are optional. Also, a **center-off toggle switch** (SPDT Center Off) can be used in place of the pushbuttons. When the SPDT is in the center off position the Wabbit will operate normally. When the toggle switch is in either clear or thrown route positions it will lock the switch in that position, see also CV66. **See also CV71 to select either push button or toggle switch modes, see pg-16 and pg-4.**



D) Wiring, Connections and Special Features Continued:

Lock Block Protection:
Automatic Entry Direction into a Reverse Loop or Align a Spur:
Using Auto Throw with Layout Block Detectors Present:
Extending Auto Throw Trigger Rail Distances for Close Positioned Turnouts:
Auto Throw with Auto Reversing for Complete Reverse Loop Automation:



Under some conditions, you may want to prevent auto-throw or some other Hare function when a train is occupying a track block. One example might be that a train from a diverging route is inhibited from tripping the auto-throw if a train is occupying the mainline near the switch. This prevents the lower priority train from moving the points under the mainline train.

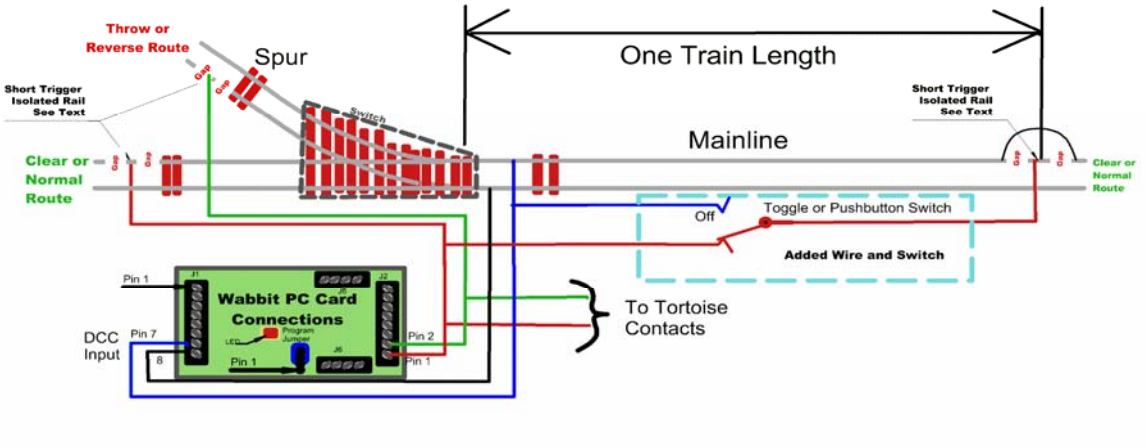
This function can be accomplished by using a block detector with an open collector output. A suitable device is the NCE BD-20, although any unit with an open collector output that is isolated from the track power can be used. The ground of the output is connected to Hare J1 pin 11. The open collector is connected to Hare J1 pin 10. Any time a train occupies the detected block, the Hare will enter the Dispatch Mode and move the switch points to the clear position. In the Dispatch Mode, CV66 specifies which functions are inhibited. Setting bit 0 inhibits DCC operation, bit 1 inhibits auto-throw, and bit 2 inhibits manual throw. The default is that all functions are inhibited during the Dispatch Mode. While the connections shown will force the switch to clear when the block is occupied, moving the wire from J1 pin 10 to J1 pin 9 will force the points to the throw position when the block is occupied with the same Dispatch Mode lockouts as for the wiring shown.

The diagram shows the dispatcher's switch in the center off position, indicating that the dispatcher is not in control. If the dispatcher's switch is active, then the dispatcher's switch will control the position of the points regardless of the status of the block detector. Triggering the block detector while the dispatcher's switch is active may result in any attached signal lights turning off then on, but the position of the points will follow the dispatcher's switch. If you don't want any interaction between the block detector and the dispatcher's switch, simply use a switch (or a set of switch contacts on the dispatcher's switch) to open the GND lead of the block detector when the dispatcher's switch is active.

D) Wiring, Connections and Special Features Continued:

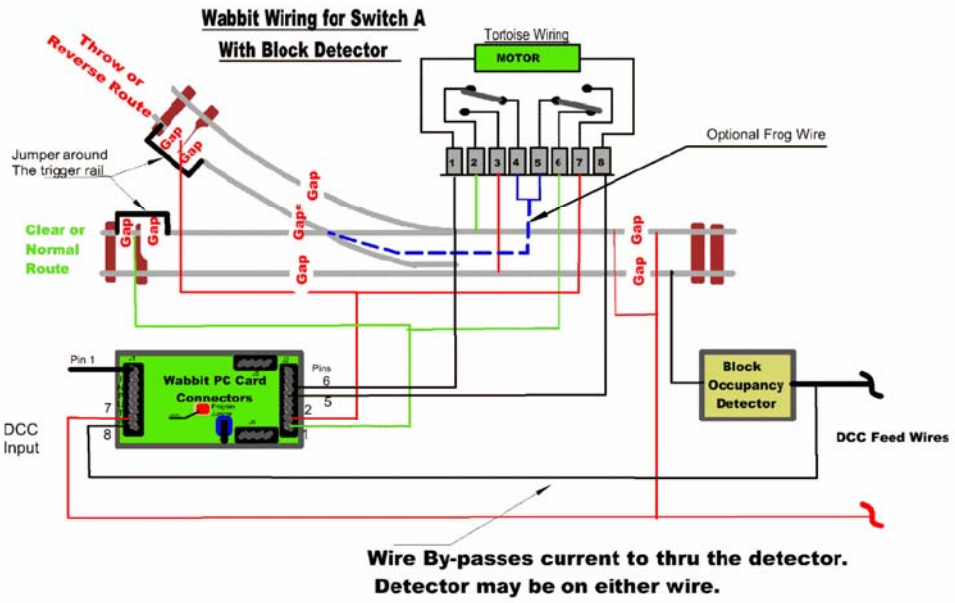
Auto Throw can set Automatic Entry Direction into a Reverse Loop or Align a Spur!

The figure below shows how to extend the clear trigger rail ahead of the switch into a reverse loop. When the train approaches, it will always trigger the clear route, resulting in a consistent entry direction into the reverse loop. The distance must be at least the train length, otherwise the switch will auto throw under the train leaving the reverse loop. If you cannot get a long enough distance between the switch and the incoming trigger rail, you can use the auto throw timer to inhibit the auto throw function for a specified number of seconds after the train enters the reverse loop. In this way, the auto throw can be disabled after lining the points for the entry into the reverse loop. As long as it remains disabled until the train clears the points, auto throw will not throw the points under the exiting train. This method can also be used to always align a spur with the main to prevent unexpected freight deliveries if a switch is accidentally left aligned with the spur. To access the spur, the switch is thrown after the train clears the main line trigger rail one train length from the switch.



Using Auto Throw with Layout Block Detectors Present:

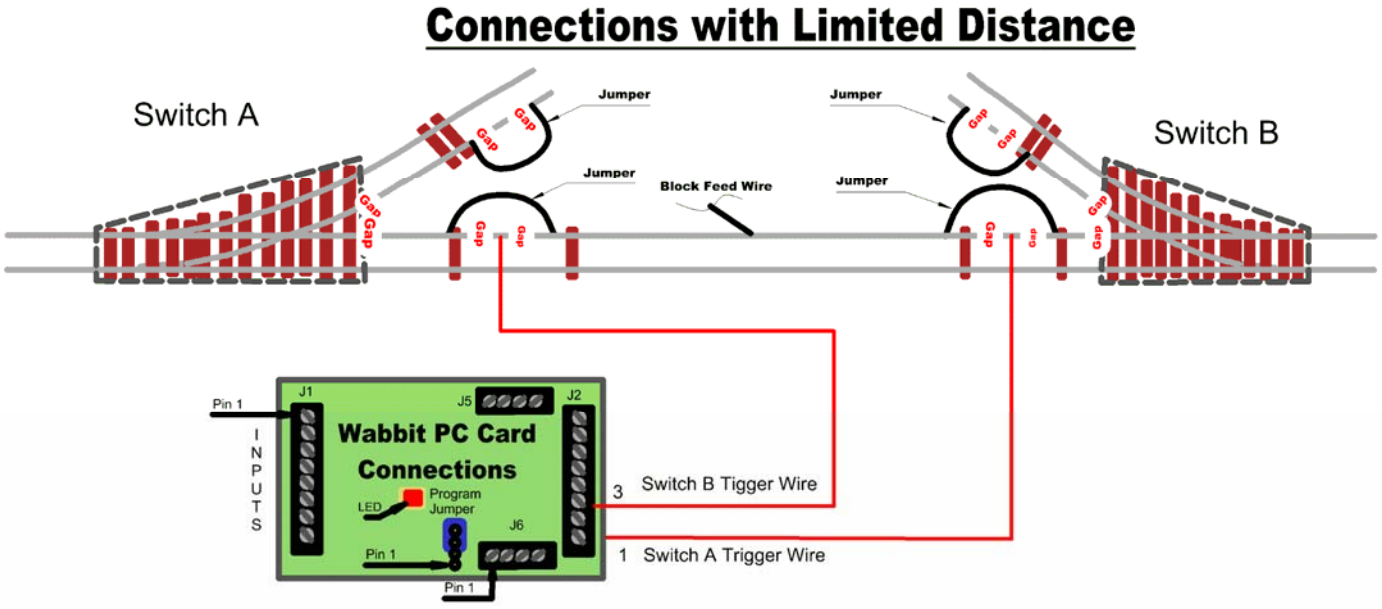
The Hare does draw some power from block in which it is connected. Some block detectors may sense this current and connections and identify the block as occupied even when it is clear. The following figures show how to maintain proper block detection operation with the Hare installed and configured for auto throw. One figure shows Insul-Frog connections, while the other shows Electro-Frog



D) Wiring, Connections and Special Features Continued:

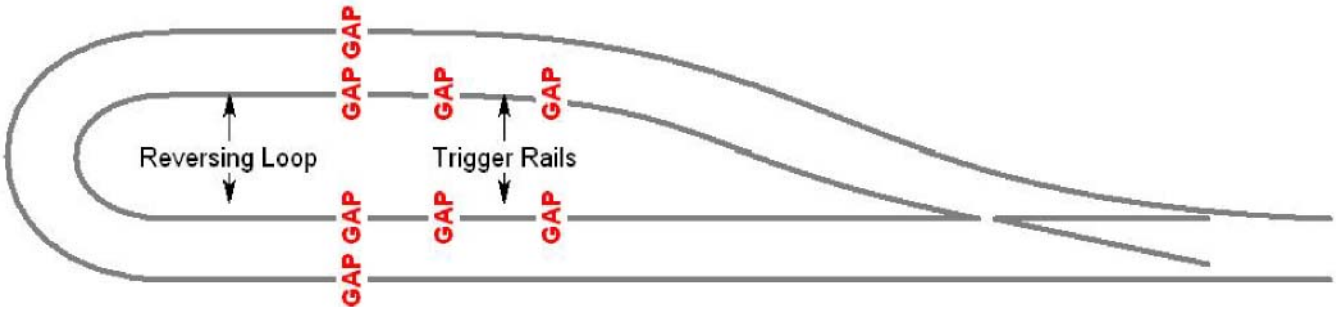
Extending Auto Throw Trigger Rail Distances:

In some track configurations, it is difficult to separate the trigger rails from the switch points. The figure below shows one possible solution. This gives the switch points more time to move before a train enters the switch. At 60 scale miles per hour, your train will move about 2 feet in the time it takes the Tortoise to completely move the points from one position to the other.



Auto Throw with Auto Reversing:

In order to successfully use the Wabbit on the end of a reverse loop it is recommended that you have the Trigger Rails not directly adjacent to the reversing section. Having a short section of track powered from outside of the reversing section ensures that the auto-reversing module will work properly and the Wabbit will not short out due to the Reverser not having swapped the polarity in time. This arrangement does take up more space, but it ensures that the Wabbit and the Auto-Reverser will not interfere with one another. It is important that all trigger rails be powered from the associated switch clear or throw rail and that intervening rails be the same polarity as the trigger rails. Otherwise, auto throw may not work or you may end up with a short circuit.



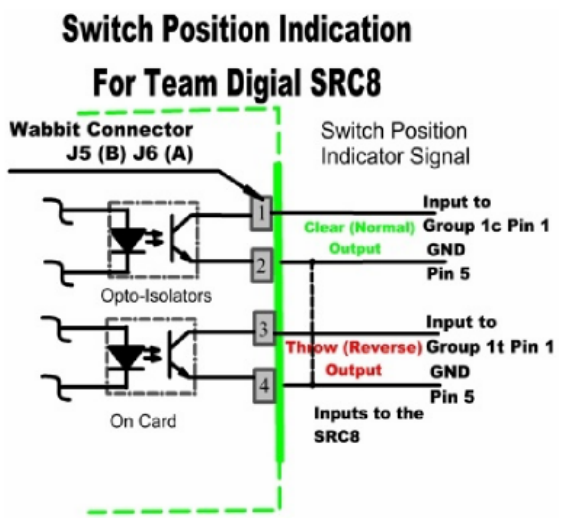
D) Wiring, Connections and Special Features Continued:

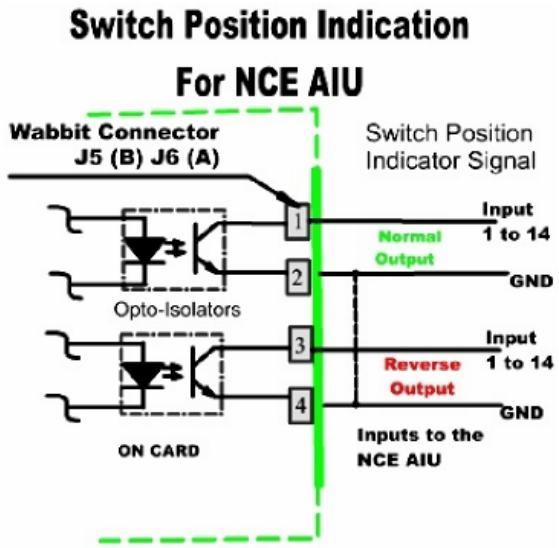
Feedback:

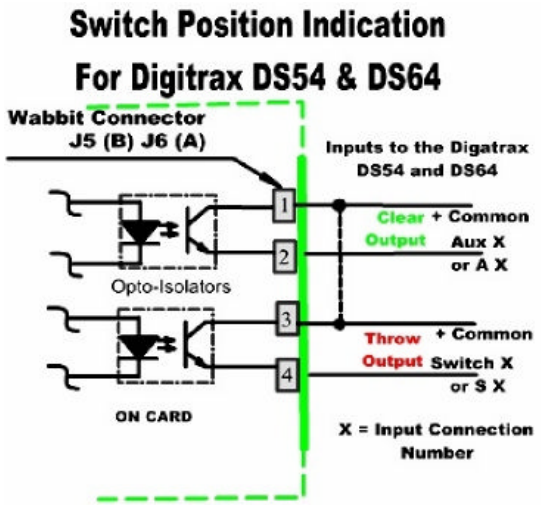
If you use computer interface to control a layout, the computer needs to know the position of the switches. If a computer issues a command to the switch, it knows the switch position. But with the Auto-Throw feature and/or the pushbutton switches, the switch position can be changed without a command from the computer. This is why position feedback is needed to report up to date information back to the computer. Each DCC system has it's own way of sampling the position information. There are two opto-isolators for each Wabbit output, one for the clear and the other for the throw position.

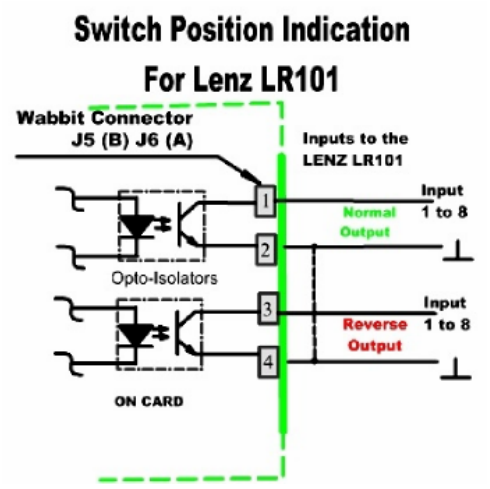
Interfacing to Digitax Loco Net, NCE Cab Bus and Lens XpressNet

The Wabbit has optional outputs that allow you to convey the clear or thrown status of the Wabbit to your: NCE Cab Bus, Lenz XpressNet, Digitrax Loconet. These connections are made via hardware available from the respective system manufacturers. The diagrams show you these connections. Follow your manufacturers directions for use of the data. The Team Digital, SRC8 is a lower cost Digitrax option.









Connector J6 Switch A Position		Connector J5 Switch B Position	
Pin #	Signal Name	Pin #	Signal Name
J6-1	Clear Plus A	J5-1	Clear Plus B
J6-2	Clear Minus A	J5-2	Clear Minus B
J6- 3	Throw Plus A	J5-3	Throw Plus B
J6-4	Throw Minus A	J5-4	Throw Minus B

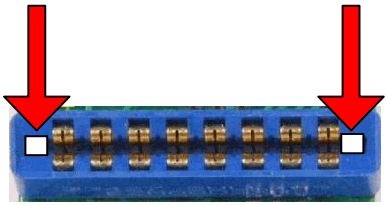
D) Wiring, Connections and Special Features Continued:

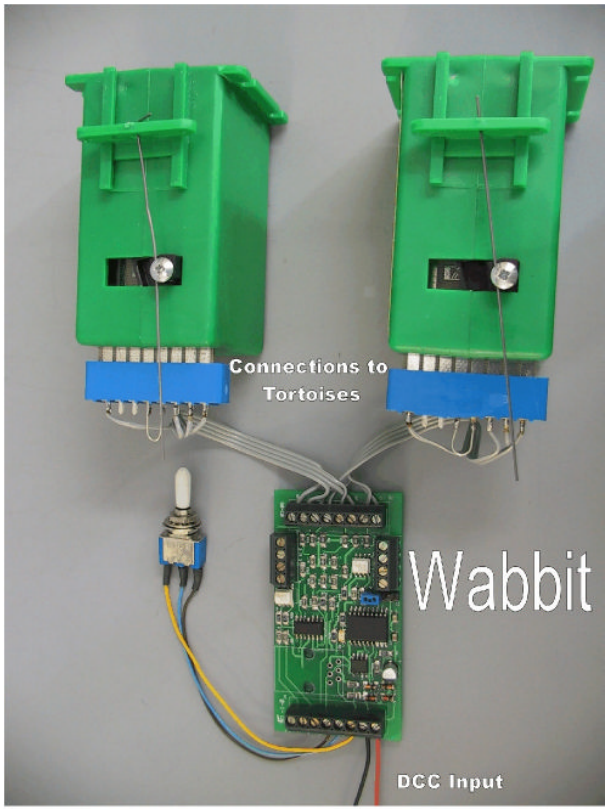
Wiring Suggestions:

The photo below shows one way to setup the Wabbit for a bench test. The Connectors on the Tortoise are available from your dealer, p/n: TortConn

Note: The Tortoise Connector may have some additional side to side clearance.

When the Tortoise Connectors are plugged into the Tortoise there may be too much clearance between the Tortoise Connector and the Tortoise Board Edge Connector, shims such as a flat toothpick can be added or you can visually align the contacts. In any case, ensure that the contacts in the Connector align with the contact surfaces of the Tortoise. The figure to the right shows where to add shims to the Tortoise Connector to reduce the amount of play when mated to the Tortoise. The wiring shown below is ribbon cable that is available at Radio Shack the length is to suit your application.





Blue Connectors and Ribbon Wire Shown above are optional Items.

E) Setting Addresses and Programming CV's:

(1) Do Not Use Program Track!

(2) The Wabbit's addresses are SET by moving the program jumper as described below and issuing Accessory Commands…….operating the turn-out by using your DCC Throttle. Pg 19-20.

(3) Configuration CV's are Programmed in Ops Mode, "on the main", also by moving the programming jumper as described below see Pg 19-20

(4) It is important to remember that Addresses are Set and CV's are Programmed!

Special Programming Instructions:

Specific DCC Systems need to follow specific programming sequences to reliably program the ***Wabbit*, see also *Pg 19-20***

NCE and MRC: Do not use the Accessory Programming Mode, only use Ops Mode for CV's see also *Pg 19-20*

Digitrax: See also *Pg 19-20*

The Digitrax Command Station sends out up to eight accessory addresses every time you use your throttle to turn track power on and/or you reboot the system and have track power set for auto turn on. If you connect the Wabbit to the Digitrax system with the ***Wabbit jumpers*** set to the programming mode, these eight addresses will be programmed. It is recommended for Digitrax that the Setting of Addresses and Programming of CV's be done at the same time to avoid the accidental Setting of Addresses as described above. See pg 19-20.

(a) One solution is to turn on the command station and wait a minute before connecting the ***Wabbit*** so that the ***Wabbit*** will not see these addresses.

(b) The better solution is to follow the directions above for setting the ***Wabbit*** to the programming mode and then turn on the Digitrax system. The eight addresses will be stored. Simply use OPS mode programming to set CV63 to 0, whichresets to default settings, and the ***Wabbit*** is ready to program normally. This does mean that you want to be careful if you have already programmed some addresses. These can be over-written by the Digitrax system. Your best bet is to keep a list of the address set in each ***Wabbit***, when you want to add addresses, you will have to set CV63 to 0 and then re-program the original addresses before adding the new ones.

(c) Also, Digitrax users should review the settings of the Digitrax, DCS-100/200 prior to programming a Wabbit. It is important that the DCS-100/200 has the switching control enabled otherwise it will not operate Stationery Decoders

Lenz: See also *Pg 19-20*

The Lenz system sends repeat accessory commands as long as you hold down the 1 or 4 command key. This ensures that the accessory decoder sees the message, but can result in the same address stored multiple times while programming the ***Wabbit*** The solution is simple. Hold the 1 or 4 key down for only a short time. Once you see D10 flash indicating an address has been stored, release the control key. If you see multiple flashes, you have stored the same address more than once. Since the ***Wabbit*** will flash D10 each time you send it an accessory address, you can easily get a feel for the timing involved. In the normal operating mode (not programming mode), select an accessory address that has not been programmed into the ***Wabbit.*** Send an accessory command to this address and hold down the 1 or 4 control key. D10 will flash each time the command station repeats the accessory address. This will give you a feel of how long to hold the control key while you are programming to avoid multiple address storage.

E) Setting Address and Programming CV's (Continued)

Moving the programming Jumper for Setting Addresses and Programming CV's.

The right figure shows the location of the program jumper on the Wabbit. When the jumper is connecting **J3-3 to J3-4**, the Wabbit will operate **normally**.

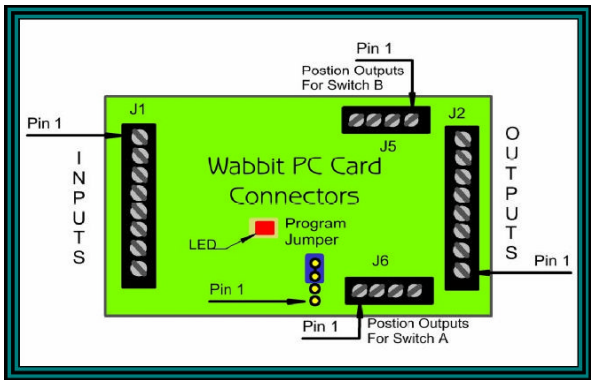
To program the **Wabbit Switch A**, remove power, move the jumper so that it connects **J3-1 to J3-2** (terminal numbers are indicated on the board), and then restore power.

To program the **Wabbit Switch B**, remove power, move the jumper so that it connects **J3-2 to J3-3**, and then restore power.

Note, the Digitrax caution above and pg 19-20.

When The Wabbit is in the programming mode, It will remain so until power is removed and the jumper is returned to **J3-3 to J1-4** and then power is restored.

In the programming mode, you can Set Address/ Routes, and Program CV values. Below are the specific CVs that can be programmed, acceptable values to program, and what each value does.



Setting Addresses: Do not use Ops Mode, See also **Smart Routes, pg-15**
The default primary address of the ***Wabbit*** is (1) and (2). The default Smart Route address of all 28 routes is 2044. This means that out of the box, the Hare should respond to addresses 1, 2 and 2044. Upon moving the Jumper to enter the address setting mode CV63 is automatically set to 0 so that it is pointing to the primary address of the ***Wabbit***. The next accessory address issued by the Command Station via your throttle will be stored as the primary address. To issue an accessory address you must select the address on your throttle then issue a clear or throw command (see your throttle directions for specific instructions on controlling accessories). You may continue issuing accessory addresses up to a total of 28 (one primary and 28 **Smart Routes).** Once you have issued the maximum number of accessory addresses, the Hare will no longer store addresses, even if more are received. In the programming mode you will see the LED D5 flash briefly each time an accessory address is issued. This indicates that the address has been correctly received and stored. While the primary address of the ***Wabbit*** is always the first address, the other addresses for **Smart Routes** can be issued in any order. You do not have to enter **Smart Route™** addresses in any particular order, but you need to record the position in which you entered each address so that you can set the associated switch direction CV correctly. There are no provisions to read back values in CVs. If you want to set a specific route address without having to step through the primary and all the other route addresses, simply set CV63 to point to the address (0 though 28) that you want to program and then issue an accessory command at the desired address.

Programming CVs: Use Ops Mode
CVs 49 to 68 are also programmed by moving the Hare's programming jumper as discussed above. These CVs are programmed using the **Program-on-the-Main** (Pom or OPS mode) function of your command station. Follow your command station instructions for entering the Program-on-the-Main mode. Once in the OPS mode, the Command Station will ask for an address of the "engine" to be programmed. Since the ***Wabbit*** is an accessory decoder, it does not use mobile decoder (engine) addresses, so enter any value for the address since it is not used by the ***Wabbit***. Pick any address that is not currently in use on the layout. A good choice might be 9999, or 9984 for Digitrax The Command Station will then ask for which CV to program. Enter the CV number (49 to 68) to be programmed. Then enter the value to be programmed into the CV. **If you make a mistake, don't worry, just go back and program the CV to the desired value. If you are hopelessly lost, set CV63 to 42 and you can start over again with factory default values.** You may **Set Address** values and **Program CV** values in any order. For CVs use the OPS mode programming, and for addresses, use normal train running mode and issue accessory addresses. Exit the Program-on-the-Main (OPS) mode to restore the command station to normal operation. Once you have finished programming the Wabbit, remove power from the unit and return the programming jumper to the normal operation position..

CV49 is used to control which direction the Hare sees as the **Clear** and **Thrown** switch positions. It will accept a value of 0 (default) or 1. A value of 0 will cause the hare to operate as normal (right hand picture on page 3), and a value of 1 will cause the hare to respond in reverse of default operation (left hand picture on page 3). Make sure you determine values for CV49 only when the switch points are in the **Clear** position.

E) Setting Address and Programming CV's (Continued)

Implement Smart Route feature: See Setting Addresses above.

Caution: Smart Routes can only be implemented by programming CV 74. CV74=number of smart route addresses to enable. Default =0 (primary address only), Maximum=13

Any un-programmed Smart Route turnouts will respond to ADD 2044. The ***Wabbit*** has a normal DCC address that can be programmed with a DCC system. Added to this are 13 additional addresses for each switch that can be used to setup **Routes** with a feature called **Smart Routes**™ This allows setting up multiple switch machines with the same address so you can send out one command and have as many switches operate as needed to set a route. If you are setting up multiple machines you should also determine the addresses for the routes that include this switch. If you do not have any routes setup yet, these route numbers can be programmed later. Along with the route number you will need to know which way to position the switch points, See Pg-3,

CV50 to CV62 and CV73 to CV87 are used to indicate the **Clear** or **Thrown** Switch Positions for the **Smart Route** turnouts. They will accept values of **0** (default), **1**, **2**, or **3**. A value of **0** will cause the points to move in the same direction of the DCC Accessory Command. A value of **1** will cause the points to move in the opposite direction the of the DCC Accessory Command. A value of **2** will cause the points to always go the **Thrown** position regardless of the commanded direction of the DCC Accessory Command. A value of **3** will cause the points to always go to the **Clear** position regardless of the direction of the DCC Accessory Command. This allows you to have Routes that either can be activated in both directions, or you can have a route that throws only in one direction to eliminate the need to remember which route takes which command. Note that if you are using the feature (Locked Route Control), you will need to use the primary address of the Hare to change the points from the route commanded position or you must define a different route that moves the points to the opposite position. *To visualize this assume that your route is set to activate on the **Clear** Command. Any turnouts in the route that would require a **Thrown** position would be the Reverse of the **Clear** Command and require the **Switch Position** CV for that route to be programmed to **1 or 2. See Steps below***

Step 1: Select the desired ***Smart Route*** address.
Step 2: Select the command you want to use to activate the ***Smart Route*** *(i.e.* clear or throw)
Step 3: For each turnout in the ***Smart Route,*** decide if you want the switch position to follow the route command or reverse the route command to form the desired ***Smart Route.***
Step 4: For each switch in the ***Smart Route,*** program the switch position CV associated with the route address to 0 (follow the route command) or 1 (reverse the route command).

Address Setting CV63 has two functions. It is used indirectly to set the **Primary** address and the **28** route addresses during Address Setting. It is also used in CV programming to reset all addresses and CVs to their factory default values. It defaults to 0 when you move the program jumper to enter the address setting mode and automatically advances from 0 to 28 as the route addresses are entered by Accessory Commands. A value of 0 points to the primary address and 1 to 28 points to the **Smart Route** addresses. If you have already programmed some route addresses and don't want to disturb them, then set CV63 to point to the next available address that you want to program and you can access it directly. **Programming CV63 to a value of 42 will reset the *Wabbit*** to factory default settings. (See the chart in back for more details, Pg-17.

CV64 Smart Default sets the position of the switch points when power is turned on/off. It will accept values of **0** (default), **2**, and **3**. A value of **0** will cause the ***Wabbit*** to ensure that the points are in the same position as the last point movement command before power was removed from the layout. Note that auto throw is not considered a commanded position, so the points may not return to the last position if it was caused by an auto throw operation. A value of **2** will cause the Hare always to move to the **Clear** position when power is applied. A value of **3** will cause the Hare always to move to the **Thrown** position when power is applied. **Note: Digitrax users please follow the specific programming instructions on Pg 13, 19-20.**

CV64, (CV69 Auto Return Enable) and (CV70 Auto Return Delay) returns the points to a defined position after a fixed time interval. It is controlled by three CVs. **CV64** determines the **"home" position** of the points. This is the position to which the Hare will return the points after the desired waiting period following a point movement. **0** (the default) will return the points to the Clear position. A value of **2** will return to the Clear position and set the points to clear at power on. A value of **3** will return the points to the Throw position and set the points to Throw at power on. **CV70** sets the **Auto Return Delay** time between the start of the point movement and the time that the Hare automatically returns the points to the programmed position. The value to enter into the CV is the desired delay in seconds. Values of **1** – **255** are valid, the default is **15**. **CV69 is Auto Return Enable** control . It sets which functions will activate. **1** enables Auto Return after a DCC command, **2** enables Auto Return after an Auto Throw, **4** enables Auto Return after a manual pushbutton operation, and **8** enables Auto Return in the Semaphore Ops mode. You can enable multiple Auto Returns by adding the individual numbers together to get the final CV value (e.g. 15 will enable Auto Return after any points movement).

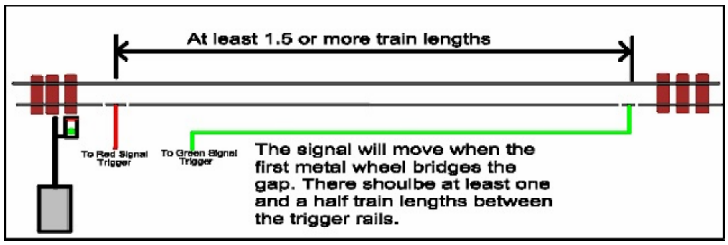
E) Setting Address and Programming CV's (Continued)

CV65 Switch Speed Control. Valid values for CV65 are **0** to **15** (default)**.** A value of **15** will cause the points to move at normal full speed (about 2 seconds Tortoise transit time). A value of **0** will result in the slowest speed (about 12 seconds Tortoise transit time). Values in between will result in proportionally faster or slower transit times. The very slow speed may show some loss of torque while the points are moving. At the end of the movement, full holding torque is applied to the Tortoise.

CV66 Dispatcher Override is for disabling the Auto-Throw feature when **Dispatcher Over-Ride™** has been activated. You may select which functions are inhibited during the Dispatch Mode. This is controlled by CV66. A value of **1** will inhibit DCC operation during Dispatch Mode, **2** will inhibit Auto Throw during Dispatch Mode, and **4** will inhibit the manual pushbutton during Dispatch Mode. For multiple inhibits, simply add the individual values together (i.e. a value of 7 will inhibit all functions during dispatch mode – this is the default). If you have a control function enabled during Dispatch Mode and it moves the points (e.g. Auto Throw), the points will be out of position with respect to the Dispatcher switch. This situation is corrected by disabling/enabling the dispatcher switch, or simply toggling the Dispatcher switch to the opposite position and then returning it to the desired position. Auto throw is always enabled, regardless of CV66 value, when the Wabbit is not in the Dispatcher mode.

CV67 Auto Throw Timer allows you to set a variable time after an auto throw event during which the auto-throw function is inhibited. This feature is designed for situations in which a train could bridge two auto throw trigger sections (or an approaching train could move the points under a train already occupying the switch). The first auto throw would align the points correctly, but the second one could throw the points under the train causing a wreck. The auto throw inhibit allows you to set a variable time from **0 to 255** seconds after the points have moved in response to an auto throw trigger during which neither trigger rail will activate the auto throw function. At the end of the programmed time period, auto throw is enabled and operates normally. Valid values for CV67 are **0** (default) through **255**. **0** will allow auto throw to function any time the auto throw is enabled (see CV66). Any other value is the time in seconds that auto throw is inhibited after auto throw has moved the points.

CV68 is used to enable **Semaphore** (crossing gate) operations. Valid values are **0** (default) and **1**. When CV68 = 0, all normal Hare switch control functions are active. Some modelers use the Tortoise to control the motion of semaphore signals or crossing gates. The Tortoise does an excellent job of moving these accessories due to its low speed operation. If CV68 is set to **1**, then the semaphore mode is activated. In this mode, the Throw trigger rail, when tripped, will move the Tortoise to the Throw position and turn on the red LED output. If the Clear trigger rail is tripped, the Tortoise will move to the Clear position and turn on the green LED output. In this mode, you **DO NOT** route power to the trigger rail sections. The trigger rails are short sections of rail completely isolated from the layout power (that is, a short section of rail with an isolating gap at each end). The trigger rail should be no longer than half the length of your shortest engine. The trigger rails are placed an appropriate distance from the signal or crossing gate to give the appropriate time response to an approaching train. The trigger rails may be in either leg of the track, but both should be in the same leg of the track. Note that once the Hare is triggered, it will remain in the new position until the opposite trigger rail is activated by a metal wheel shorting the trigger rail to the adjacent layout power rail. Power on defaults (CV64) are still active in this mode, and accessory DCC signals can be used to change the position of the signal or crossing gate in the same manner as moving the points of a Turnout. Auto Return is available for use in this mode. You can also setup a timed red signal. Connect the green trigger to DCC power without the trigger rail. Then set CV-67 for the number of seconds before the signal returns to green. When the red trigger is activated the signal will go red. When the Wabbit times out the signal will return to green. Early train signals used time instead of occupancy for signaling. There was a ball with a rope hung along side the tracks and the engineer would pull the rope to lower the ball. A clock mechanism would then pull the ball back to the high position. This is where we get the expression "Hi-ball" as the ball in the high position meant full speed ahead! Power on defaults (CV64) are still active in this mode, and accessory DCC signals can be used to change the position of the signal or crossing gate in the same manner as moving the points of a Turnout.



CV71 controls the operating mode of the manual switches. A value of **0** is Dispatch Mode operation with a **SPDT** center off switch or 2, buttons This is the default. A value of **1** enables the **single pushbutton** control mode. In the single pushbutton control mode mode, the Dispatcher Operations are not available. If you are using a single push button set CV71=1 and wire only the common and the clear terminals. **CV74** See Pg 17

F) Forms for Address and Configuration Assignments

Be sure to keep a record of the setting for the Hare. You may remember them today, but it is easy to forget. If this is in a club there should be a record as reference for other members. There is also a PDF online, DCCSpecialties.com

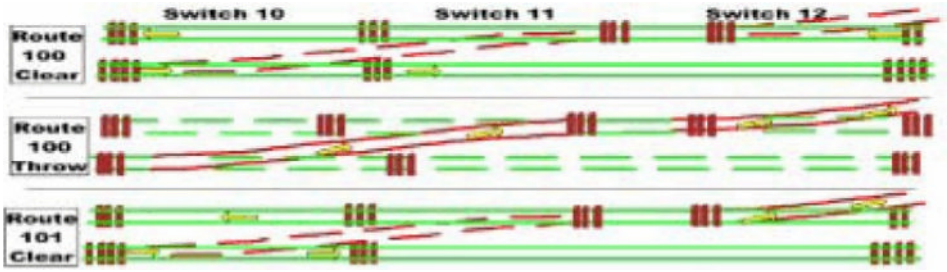
Caution: Smart Routes can only be implemented by programming CV 74. CV74=number of smart Route addresses to enable. Default =0 (primary address only). Range=1 to 13

Chart for Switch Address **Location or Turnout** _____ **Date** _____

Primary Address	Address Number	**Smart Route** Command **Clear** or **Thrown**	Follow or Reverse Smart Route Command, Always **Thrown,** or Always **Clear**	CV Value	CV	CV Values used
Primary Address			N/A		49	0,1
#1 Route Address					50	0,1,2,3
#2 Route Address					51	0,1,2,3
#3 Route Address					52	0,1,2,3
#4 Route Address					53	0,1,2,3
#5 Route Address					54	0,1,2,3
#6 Route Address					55	0,1,2,3
#7 Route Address					56	0,1,2,3
#8 Route Address					57	0,1,2,3
#9 Route Address					58	0,1,2,3
#10 Route Address					59	0,1,2,3
#11 Route Address					60	0,1,2,3
#12 Route Address					61	0,1,2,3
#13 Route Address					62	0,1,2,3
			Pointer and Reset		63	0-28,42
			Power up Position (Smart Default)		64	0,2,3
			Programmable Point Speed		65	0-15
			Dispatcher Over-Ride (Auto-Throw Lock-Out)		66	0,1,2,4
			Auto Throw Timer (auto throw inhibit time)		67	0-255
			Semaphore OPS mode		68	0,1
			Auto Return Enable		69	0,1,2,4,8
			Auto Return Delay		70	0-255
			Manual Switch Ops: Toggle or Push Button		71	0,1

G) Route Planning and Programming Example:

Shown below are three switches. In the first set, all switches are aligned to clear and allow travel on parallel mainline tracks. The second arrangement shows a route from the lower main, across the adjacent main, and onto a divergent route from these second main. The third arrangement shows a cross-over from one main to the other.



Assume the primary address of the left-most switch is 10, the middle primary address is 11, and the right-most switch primary address is 12. All three switch arrangements can be accessed by programming two routes. Assume the first route has address 100 and the such as address 101. The programming tables for each switch are shown below.

Address	*Programmed Address*	*Route Command*	*Follow or Reverse Command*	*Route/ Switch Position CV*	*Programmed CV Value*
Primary	12			49	
#1 Route	100	Clear	Follow	50	0
#2 Route	101	Throw	Reverse	51	1

Address	*Programmed Address*	*Route Command*	*Follow or Reverse Command*	*Route/ Switch Position CV*	*Programmed CV Value*
Primary	10			49	
#1 Route	100	Clear	Follow	50	0
#2 Route	101	Throw	Follow	51	0

Address	*Programmed Address*	*Route Command*	*Follow or Reverse Command*	*Route/ Switch Position CV*	*Programmed CV Value*
Primary	11			49	
#1 Route	100	Clear	Follow	50	0
#2 Route	101	Throw	Follow	51	0

For each switch, the switch points will follow the accessory command any time that the primary address is accessed. To align the switches as shown in the first configuration, issue a Clear command to address 100. All three switches will align to the clear position. To align the switches as shown in the middle (second) configuration, issue a Throw command to address 100. All switches will move to the throw position. To align the switches as shown in the final (third) configuration, issue a Throw command to address 101. Switches primary address 10 and primary address 11 will move to the throw position, while switch primary address 12 will move to the clear position. Note that if a Clear command is issued to address 101, primary address 10 and primary address 11 will move to the clear position, while switch primary address 12 will move to the throw position. This may or may not be a useful route. This illustrates that you will normally set your routes to operate on either a Clear or Throw command, not both. The example for address 100 illustrates that under some conditions, both the route Throw and route Clear commands may be useful. At other times, only a throw or clear command may make sense.

H) Sequential Programming Instruction for Setting the Address and Programming CV's

Digitrax: Using the DT-400/402

Setting Wabbit Addresses:

1. Disconnect Wabbit from DCC power
2. Move Wabbit Jumper to Program Position
3. Turn DCC power on "PWR"+ " Y+"
4. After 30 seconds, reconnect DCC power Program CV's at this time (see below)

First, In CV 63, enter a value of 42 to reset. Then set any other CV's needed. Do not Move Programming jumper or turn off power. .Exit program mode and go to step 5.

5. Press "SWCH" key to enter Switch Mode
6. Select the switch number to be set using the keypad or RH knob.
7. Press either the "OPTN" or "CLOC" key to set address.
8. Repeat steps 6 and 7 until all addresses set.
9. Press "EXIT" key to return to LOCO mode.
10. Turn DCC power off "PWR" " N –".
11. Move Wabbit Jumper to Run Position
12. Turn track power on. Test the switch address setting by using the "SWCH" key and switch addresses.
13. Turn power off and put the program jumper into the Run position.
14. Turn DCC power on. Test the Wabbit using the switch commands.

Programming Wabbit CVs: Do Setting Addresses First, See Above

1. Disconnect Wabbit from DCC power.
2. Move Wabbit Jumper to Program Position
3. Turn DCC power on "PWR" " Y+"
4. After a few seconds, connect DCC power to the Wabbit
5. Select an unused locomotive number with the keypad or RH knob.
6. Press "PROG " key until you get from Pg to Po
7. Use LH throttle to set, dial the CV number and the RH throttle for the CV value.
8. Press, "ENTER"
9. Repeat steps 7 & 8 until all the CV values are set.
10. Press "EXIT"

NCE: Using the Pro Cab or Power Cab

Setting Wabbit Addresses:

1. Turn DCC Power off
2. Move Wabbit Jumper to Program Position
3. Turn DCC Power on
4. Press SELECT ACCY
5. Then use the keypad to enter the new switch number.
6. Press ENTER then press either 1 or 2 to set the address.
7. Repeat steps 4 thru 6 until all of the switch addresses are set.
8. Turn DCC Power off.
9. Move Wabbit Jumper to Run Position.
10. Turn DCC Power on

Test the switch setting using the SELECT ACCY key

Programming Wabbit CVs:

1. Turn DCC Power off
2. Move Wabbit Jumper to Program Position
3. Turn DCC Power on
4. Use SELECT LOCO to address an unused locomotive number
5. Press PROG/ESC key to enter PROGRAM ON MAIN mode.
6. Key ENTER to select the unused locomotive number, then ENTER again.
7. Key 2 to enter PROG CV NUM
8. Enter CV number then ENTER
9. Enter value to be stored then ENTER.
10. Repeat steps 8 and 9 until finished.
11. Press PROG/ESC to return to normal operation.
12. Turn power off and put the Wabbit Program Jumper into the Run position.
13. Turn power on

Test the Wabbit using the SELECT ACCY key.

H) Sequential Programming Instruction for Setting the Address and Programming CV's

Lenz: Using the LH100:

Setting Wabbit Addresses:

1. Turn DCC power off.
2. Move Wabbit Jumper to Program Position
3. Turn DCC power on
4. Press "F5" key to select "SW" mode.
5. Enter the switch number to be set using the keypad, then press ENTER.
6. Press either the "+" or " – " key to set the address. Let LED blink once.
7. To enter another address press the "CI" key.
8. Repeat steps 5-7 until all addresses are set.
9. Press "ESC" key to return to normal.
10. Turn DCC power off.
11. Move Wabbit Jumper to Run Position
12. Turn track power on.
13. Test the switch address setting using "SW" mode and the new switch address(es).

Programming Wabbit CVs:

1. Turn DCC power off.
2. Move Wabbit Jumper to Program Position
3. Turn DCC power on.
4. Select a locomotive number with the keypad that is unused on your layout.
5. Press the "F" keys and the "+" or "– " key to select "PoM" mode then hit "Enter".
6. Press "+" or "–" until "CV" is displayed then press "Enter".
7. Key in the desired CV number then press "Enter"
8. Enter the CV value to change, then press "Enter".
9. The display will show the CV number and value to be programmed.
10. Hit "Enter" to program the CV, note the LED on the Wabbit flashes when the key is released
11. Press "Esc" key to return to Step 7) or press "Esc" three times to exit CV programming
12. Turn power off and put the Program jumper into the Run position.
13. Turn DCC power on.

Test the Wabbit using the switch commands.

MRC: Using the Prodigy Advance Cab:

Setting Wabbit Addresses:

1. Turn DCC Power off
2. Move Wabbit Jumper to Program Position
3. Turn DCC Power on
4. Press ACCY key
5. Then use the keypad to enter the new switch number.
6. Press ENTER then press either 1 or 2 to set the address.
7. Repeat steps 4 thru 6 until all of the CV value are set.
8. Turn DCC Power off
9. Move Wabbit Jumper to Run Position.
10. Turn DCC Power on

Test the switch setting using the ACCY key.

Programming Wabbit CVs:

1. Turn DCC Power off
2. Move Wabbit Jumper to Program Position
3. Turn DCC Power on
4. Press LOCO to address an key in an unused locomotive number.
5. Press PROG key to enter PROG MAIN TRACK mode, then press ENTER.
6. Continue to press ENTER until CV# is in the display.
7. Enter the CV number then ENTER
8. Enter the value to be stored in the CV then ENTER.
9. Repeat steps 8 and 9 until finished.
10. Press ENTER to return to normal operation.
11. Turn power off and put the Wabbit Program Jumper into the Run position.
12. Turn DCC power on.

Test the Wabbit using the ACCY key.