### *The New DCC "Block Watcher"*™ (Rev G)
### An Intelligent Block Detector for all Scales
### Developed by DCC Specialties & Integrated Signal Systems
#### Designed by Larry Maier
#### Instructions by Don Fiehmann          5/20/11

The "**Block Watcher**™" is a new concept in block detection. This detector puts the power of a microprocessor to work analyzing the current feed to the rails. This detector has been designed to eliminate many of the installation problems associated with the installation of signal systems. The Block Watcher comes ready to install, all you have to do is to connect it between the DCC Booster or Circuit Breaker and the rails. Then connect the detector output switch to your signal system.
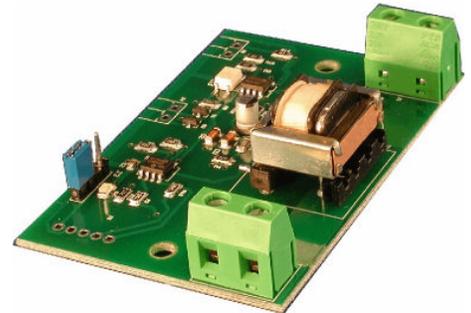
The "**Block Watcher** ™ has many uses and applications. It can not only be used as the basis of signaling systems, but can also be used to indicate occupied blocks or triggers for "Stop-On-DCC" decoders. The Block Watcher is powered from the DCC input power and eliminates the need for an added external power supply. The output is optically isolated so the signaling system can be separate from the DCC signal and thus minimize the interference with operation of the signal circuits. The detector will handle up to 20 amps of DCC current. An automatic adjustment for leakage current up to 130mA is provided. Detection output terminals are available for a switched output and remote LED block detect indication. The bi-polar output can be used with any signaling system using less than 30 volts and will switch up to 1 amp of current.

*All Solid State Operation:* **Fast, all solid-state design with reliable quiet electronics.**
*No Power Supply Needed:*  **Develops power from the DCC input connections.**
*Very Low Voltage Drop:* **The resistance is less than 0.060 ohms, very small voltage drops.**
*Adaptive Block Leakage Detection:* **Electronically determines the amount of leakage current in the block when power is turned on. The current can also be set with a CV value up to about 130 mA.**
*Stabilized Setting for Current Trip Level:* **This prevents the block detection from fluttering on and off when the current is near the trip level.**
*Block Detection Option:* **Block detection can be turned on with an Accessory Command for testing signals even with nothing in the block. This feature can also be used to turn the signals red to protect a crossing.**
*Block Detection Output Isolated from Track Power:* **The output switch is totally isolated from the track power. This eliminates many wiring problems when combining signal circuits and track power.**
*Outputs for LED Indicator:* **A single LED output can be used for a remote location.**

## Installation:

The Block Watcher™ connects between the DCC Booster or Circuit Breaker and the rails of the block to be detected. Large screw terminals are provided for **J1** and **J2**. J1 is the input side of the detector from the Booster and J2 is the output to the track. It is important to maintain the same polarity for the input and output. There are two holes thru the board for mounting. Use, #4 Screws.
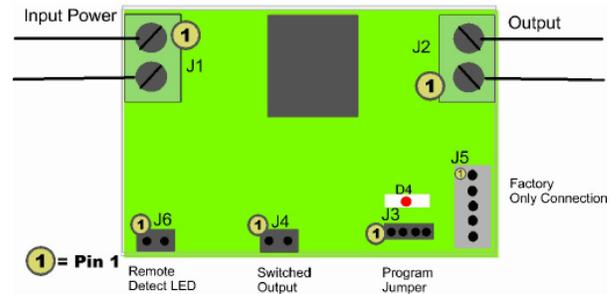
## Wiring and Connections

**J3** is the **DCC Programming Connector.** It is also used to set up for advance features. The jumper settings are:

Pin  1-2  <mark>Connected when Programming the Block Watcher.</mark>
Pin  2-3  <mark>Connected for the Automatic Setting of the Leakage Current.</mark>
Pin  3-4  <mark>Connected when the Leakage Current is set with the CV</mark>.

**J4** is the switched output. If the LED is *on,* the detector is detecting, and J4 is switched on (closed). The output is isolated and will switch up to 30 volts at one amp. When on, J4-1 is connected to J4-2 and will conduct AC, DC, or DCC. It is not polarity sensitive.

**J5** is used for programming the microprocessor and is not used by the installer.

**J6** is a remote LED output and used for fascia or control panel mounted LED occupancy indication. A current limiting resistor is installed onboard so the LED can be directly wired. Pin 1 is the positive (Anode) connection for the LED.



LEDs need the correct polarity
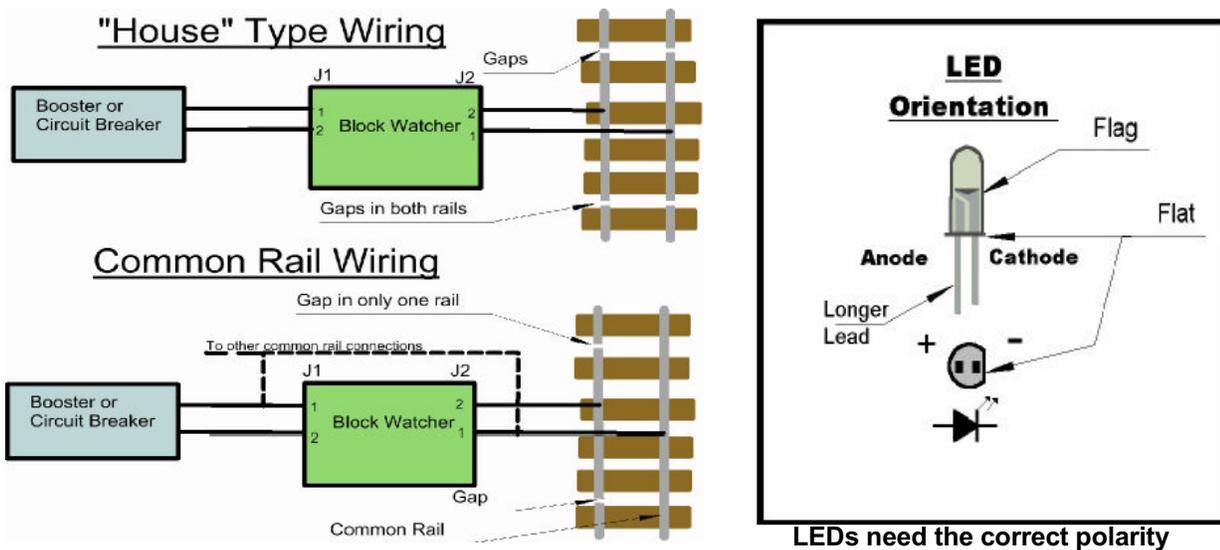
## Note:

If you are using "house" type wiring (two wires to each block) the two wires connect to J1and out on J2.
But I f you are using common rail wiring, you need to connect both wires to J1 in order
to power the Block Watcher. The current flow to the block is detected using the J1-2 to J2-2 path

## CV's for the BlockWatcher: See also Pg3,4.

**CV50** Allows you to invert the output logic.CV50 = 255 is normally open, CV50=0 is normally closed. **Not Active Yet!**

**CV51** Sets the turn on delay in seconds. The turn on delay is the amount of time that the Block Watcher will wait before it turns the J4 output ON after the block has been recognized as "occupied" (see CV53). The value is the number of seconds to wait before J4 is turned ON after the block is "occupied". The allowable values are 0 - 255 seconds.

**CV52** Sets the turn off delay in seconds. The turn off delay is the amount of time that the Block Watcher will hold the J4 output ON after the block has been recognized as "unoccupied" (see CV53). The value is the number of seconds to hold J4 ON after the block is "unoccupied". The allowable values are 0 - 255 seconds.

**CV53** Sets the delay in milliseconds that the block current must exceed the "occupied" recognition level before the Block Watcher will recognize a block as "occupied". It is also the turn-off delay for the amount of time the block current must be below "unoccupied" recognition level before the Block Watcher will recognize a block as "unoccupied". The default value is 32 ms. Although you normally will not need to adjust this value, any value from 1 to 255 is acceptable.

**CV54** Sets the current value below which the Block Watcher will recognize the block as "unoccupied". In combination with CV55, it will also determine the current value above which the Block Watcher will determine that the block is "occupied". The default value for CV54 is 0, which means that any current over about 2mA will cause the Block Watcher to recognize a block as "occupied". Note, however, that by increasing the value of CV54, you can tell the Block Watcher to ignore currents that may flow into a block due to lights, switch machines, or other constant current loads.

While you can set the value of CV54 manually, the Block Watcher will set it automatically for you. To automatically set CV54, turn off the layout and move the J3 jumper so that it connects pins 2 and 3. Now turn on the layout. The LED on the Block Watcher will turn on and will remain on while the Block Watcher determines the correct value for CV54. During the time that the LED is on, the Block Watcher will assume that any current it measures is "normal" and hence should not cause the Block Watcher to recognize an "occupied" condition. Once the LED goes out, the Block Watcher is finished setting CV54. You can either return the J3 jumper to pins 3 and 4 (in which case the value you just set will be used any time you turn on the layout) or you can leave the J3 jumper on pins 2 and 3 (in which case the Block Watcher will set the CV54 "normal" current <u>every</u> time you turn your layout on. If you do this, remember that a train left in the block will get counted as "normal" the next time the layout is turned on).

The Block Watcher will determine the "unoccupied" current as any current less than (3 + CV54). The Block Watcher will determine the "occupied" current as any current greater than (3 + CV54 + CV55). The current scaling of these values is approximately 0.534 mA per bit. For example, if CV54=5 and CV55=2, then the "occupied" recognition current would be about 5.34 mA, and the "unoccupied" recognition current would be about 4.27 mA. The hysteresis would be 1.07 mA.

The maximum value you can set in CV54 depends on the value set in CV55. The maximum CV54 value is (254 – CV55 – 3). If you use the maximum value, the "occupied" recognition current will be about 130 mA.

**CV55** Sets the hysterisis (difference) between "occupied" and "unoccupied" recognition currents (see also CV54). Hysterisis means that the current required to recognize that a block is "occupied" is larger than the current required to recognize that a block is "unoccupied". Once the current is above the "occupied" current, it must fall below the "unoccupied" level before the Block Watcher will determine that the block is "unoccupied". If the current is varying near the "occupied" recognition current, this will prevent the Block Watcher output from chattering on and off. The CV55 default value is 1. CV55 would not normally be adjusted unless you are experiencing chattering problems. In this case, gradually increase CV55 1 count at a time until you find the lowest value that eliminates the chatter problem. Normally a value increase to 2 or 3 should solve the problem. Values greater than 30 should not be required.

**CV63** Can reset everything (address and CV values) to the factory defaults. Simply write the value 42 to CV63 and it will restore the factory settings.

# Setting Addresses and Programming CV's: Optional/Not Required!

The easiest way to program the BlockWatcher is on-the-bench. Connect pins J 1-1 and J 1-2 to the output of your DCC system. There is a small red LED, D4, on the BlockWatcher that will blink each time a command is accepted. After programming, return the program jumper back to the RUN position. If you make a mistake, 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 defaults.

*(1 )Do Not Use Program Track!*

*(2)The BW's addresses are SET by moving the program jumper and issuing Accessory Commands……like operating an accessory by using your DCC Throttle, see also Pg-4.*

| The Table to the right shows how the DCC Manufactures identify the Normal (Clear) and/or the Thrown Route to operate accessories. |
|---|

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

*(3) Configuration CV's are Programmed in Ops Mode, "on the main", also by moving the programming jumper, see below, use any non-loco address, except defaults, to initiate Ops Mode.*

*(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 *BW's* see Pg-4

**NCE and MRC:** Do not use the Accessory Programming Mode, only use Ops Mode for CV's see Pg-4

**Digitrax:** See also Pg-4

Digitrax users should review the settings of the Digitrax, DCS-100/200 prior to programming a BW'S. It is important that the DCS-100/200 has the Switching (Accessory) Control enabled otherwise it will not operate Stationery Decoders or Accessories like the BW'S's. Caution,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 BW'S to the Digitrax system with the BW's 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-4

**One Solution:**

Turn on the command station and wait a minute before connecting the *BW'S's* so that it will not see these addresses.

**Better solution:**

Follow the directions above for setting the *BW'S's* to the programming mode by moving the jumper and then turn on the Digitrax system. The eight addresses will be stored. Select and use OPS mode programming to set CV63 to 0, which resets to default settings, and the *BW'S's* 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 record of the address set in each, when you change addresses, you will have to set CV63 to 0 and then re-program the addresses.

**Lenz:** See Pg-4

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, 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.

**There is One (1) Accessory Address:**

The accessory address lets you turn the output track power from the BlockWatcher on and off. (Default address 2044).The accessory address can be between 1 and 2044. Choose a value that is not used by another accessory.

**Setting the Accessory Address:**

Addresses are set by moving the programming jumper, J3 to positions 1-2 for the program mode with the power *off.* Turn power *on* and the **first** accessory command issued by the DCC system will be stored as the **first address** (track on/off). Remember to power *off* and put the program jumper back to 2-3, unless you are going to program CV settings. Note: When changing from *run* to *program* mode, wait about 1 minute before turning power back on to the BW'S. note the special cautions for Digitrax

**Programming CV's:**

Programming the CV's is done using the Programming-on-the-Main (POM) function. Turn power *off,* put the programming jumper on pins 1-2, then turn power back *on*. Observe Digitrax Caution. Then go into the Program-on-the-main mode. You will need to setup a "fake" loco address in order to get to the CV setting operation. Put in any address. **(Not** an address that is in use on the layout.) Hit enter, then you can start entering the CV numbers followed by the values. When done, turn power off and replace the program jumper to pins 2-3. See Sequential instructions Pg-4.

**False Trigger Solved:**

I did have one very usually problem where one block was turning on intermittently when a train was in anotherblock. There was no wiring connection between the two blocks. The puzzle was solved when I looked at the BlockWatcher and noticed that the power wire feeding the block, that had the false indication, was routed just above the top of the small transformer on the BW. I moved the wire an inch or so and the problem went away.

**Block Watcher with Relays:**
If you are connecting the Block Watcher to relays you need to add a diode, like a 1N4001 or 1N914, to the relay coil. This will prevent the voltage kick back that occurs when the relay is turned off from damaging the Block Watcher output device.
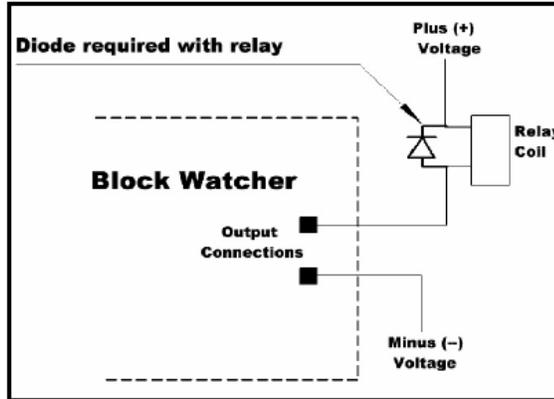


**Block Watcher with PSX-AR, PSX-1:**

If you need detection with a block connected to a PSX-AR auto reverser/ breaker, the Block Watcher should be connected to the output of the PSX-AR. The PSX-AR will change the phase (polarity) of the DCC, but this will not affect the Block Watcher. Since the Switched Output is opto-isolated there is no problem with the phase reversal. If you install the Block Watcher before the PSX-AR current used by the PSX-AR may look like an occupied block.
I have three tracks in a reversing loop. By having the Block Watcher connected to the loop I can select one of the tracks and "see" if it is occupied using the remote LED.
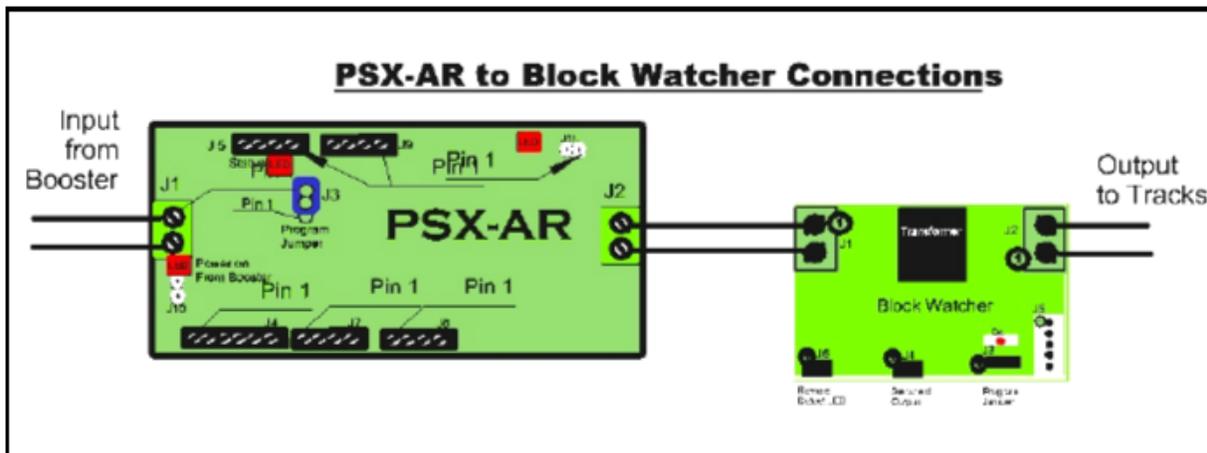


**Conclusion:**
If you need to detect equipment in a block, regardless of scale, the Block Watcher is certainly the best choice presently available. The flexibility and reliability of the USA made Block Watcher has made it the choice of professional layout installers.

# Sequential Programming Instruction for <span style="color:red">Setting the Address</span> and <span style="color:green">Programming CV's</span>

## Digitrax: Using the DT-400/402

**Setting BW'S Addresses:**
1. Disconnect BW'S from DCC power
2. Move BW'S 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 BW'S 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 BW'S using the switch commands.

**Programming BW'S CVs**: **Do Setting Addresses First, See Above**
1. Disconnect  BW'S from DCC power.
2. Move BW'S Jumper to Program Position
3. Turn DCC power on "PWR" " Y+"
4. After a few seconds, connect DCC power to the BW'S
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 # and the RH throttle for the CV value.
8. Press, "ENTER"
9. Repeat steps 7 & 8 until all the CV values e set.
10. Press "EXIT"

## Lenz:  Using the LH100:

**Setting BW'S1's Addresses:**
1. Turn DCC power off.
2. Move BW'S- 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 e set.
9. Press "ESC" key to return to normal.
10. Turn DCC power off.
11. Move BW'S- 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 BW'S1's CVs**:
1. Turn DCC power off.
2. Move BW'S- 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 BW'S- 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 BW' using the switch commands.

## NCE: Using the Pro Cab or Power Cab

**Setting BW'S1's Addresses:**
1. Turn DCC Power off.
2. Move BW'S- 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 e set.
8. Turn DCC Power off.
9. Move BW'S- Jumper to Run Position.
10. Turn DCC Power on.
Test the switch setting using the SELECT ACCY key.

**Programming BW'S1's CVs:**
1. Turn DCC Power off.
2. Move BW'S- 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 any 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, put the BW'S- Program Jumper into the Run position.
13. Turn power on.
Test the BW'S- using the SELECT ACCY key.

## MRC:  Using the Prodigy Advance Cab:

**Setting BW'S1's Addresses:**
1. Turn DCC Power off.
2. Move BW'S- 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 e set.
8. Turn DCC Power off.
9. Move BW'S- Jumper to Run Position.
10. Turn DCC Power on.
Test the switch setting using the ACCY key.

**Programming BW'S1's CVs**:
1. Turn DCC Power off.
2. Move BW'S- 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 BW'S- Program Jumper into the Run     position.
12. Turn DCC power on.
Test the BW' using the ACCY key.