# **DS64**

# All Scales Track Voltage Up to 22 Volts

Stationary Decoder for use with 4 slow motion, solenoid, or bi-polar turnout machines

#### **Features**

- Simple to hook up and configure
- Control 4 individual turnout machines, EITHER
  - 4 Slow motion turnout machines, such as Tortoise<sup>TM</sup> by Circuitron or Switchmaster<sup>TM</sup>

OR

- 4 Solenoid-type turnout machines such as three wire (twin coil type) Peco or Atlas Snap Switches or two wire bi-polar type turnout machines such as Kato Unitrack, AristoCraft, or LGB turnouts with capacitive discharge capability
- Support for up to 8 routes
- Screw terminals make installation easy
- Use with any LocoNet Compatible System
- Compatible with non-LocoNet DCC systems
- FCC Class B compliant

# Introduction

The DS64 is a state-of-the-art stationary decoder that can control multiple types of turnout machines and other stationary accessory motors and lighting. The DS64 accepts commands from LocoNet Compatible Command Stations & Throttles (via LocoNet), DCC Command Stations & Throttles (via the rails), a computer (via LocoNet), or via eight manual inputs. Each output can handle up to two devices simultaneously.



# QuickStart

Your DS64, as shipped from the factory, is set up for **solenoid or bipolar turnout operation**. Three wire (twin coil type)  $Peco^{\text{TM}}$  or Atlas Snap Switches<sup>TM</sup> or two wire bi-polar type turnout machines such as Kato Unitrack<sup>TM</sup>, AristoCraft<sup>TM</sup>, or LGB<sup>TM</sup> turnouts are all supported and ready to use *right out of the box!* Follow these steps to get up and running quickly\*:

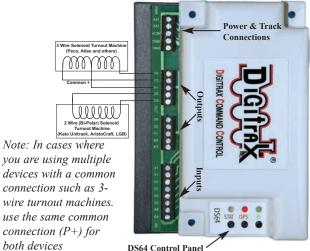
Unpack the DS64 and mount it in a location with easy access to the turnouts you want to control.

Connect the DS64's 'TRKA' and 'TRKB' terminals to your track.

If you are using LocoNet, connect one end of an RJ12 cable to either of the DS64's LocoNet sockets and connect the other end of the cable to your existing LocoNet network.

Wire your turnouts to the DS64 using the Figure below as your guide.

That's it! Your DS64's default turnout addresses are 01, 02, 03 and 04. Using any DCC throttle capable of switch commands, you can now operate your turnouts.



This diagram shows how sole-noid and bi-polar machines can be connected on your layout. You can use any combination of machine types shown here.

See a larger version of this diagram on page 6.

\*NOTE: If you are using a slow motion type of turnout machine, please refer to page 5 for setting up this type of turnout.



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#### **Powering Your DS64**

The DS64 can be powered directly from the rail power source via TRKA and TRKB, or from an external DC power source via AX1(-) and AX2(+), or from a AC or DC power supply via the modular power connector.

When using multiple DS64s, we recommend using an auxiliary power supply to insure satisfactory operation.

Auxiliary power can be added to the DS64 in two ways:

- 1. Plug a PS14 power supply (or equivalent) into the modular socket provided on the back of the DS64.
- 2. Connect a 12-14vdc, 300ma power supply to the AX1(-) and AX2(+) terminals on the front of the DS64.

The maximum power required by a single DS64 is 300ma at 14vdc.

NOTE: If your DS64 is powered by an auxiliary power supply, the static output voltage for use with slow motion turnouts will be approximately the voltage supplied by that power supply. If your DS64 is powered by the track (TRKA & TRKB), then the static output voltage will be equal to the track voltage. For the pulse output mode for use with solenoid and bi-polar turnouts, the voltage is always approximately 20 volts.

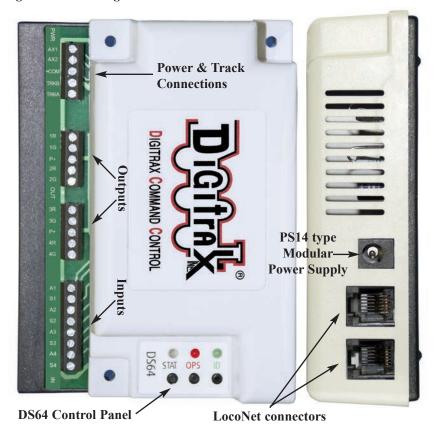
## **Connecting Your DS64 To LocoNet**

The RJ12 sockets on the back of DS64 are LocoNet Ports for connecting your DS64 to LocoNet.

## **Connecting Your DS64 To Your Layout**

The terminals labeled TRKA and TRKB on the front of DS64 connect directly to your layout's rail 'A' and rail 'B' bus respectively. When connecting multiple DS64s make sure you keep the connections with respect to Rail A and Rail B consistent.

Figure 1: DS64 Diagram



#### **DS64 Control Panel Buttons**

- **STAT** is used for setting up routes and for setting the DS64 board ID for use with the DS64's Inputs.
- **OPS** is used for setting up how the DS64 works (for setting Option Switches).
- **ID** is used for programming the Switch Addresses of the DS64's Outputs.



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## Setting Up DS64 to Operate Slow Motion (Stall Motor) Type Turnouts

At the factory, your DS64 was set to control solenoid type turnout machines that use a single pulse output for operation. If you are using slow motion turnout machines, like the Tortoise or Switchmaster, that need a static type output to operate, you'll need to reconfigure the DS64's outputs before hooking up your turnouts.

#### To set up your DS64 to operate stall motor type turnouts:

- 1. Connect the DS64's 'TRKA' and 'TRKB' terminals to your track. No turnouts should be connected to the DS64 at this time.
- 2. On the DS64 press and hold the OPS button down for about 3 seconds until the red OPS LED and green ID LED begin to blink alternately. This indicates that the DS64 is ready to change the option switches. To run the type of turnout you have chosen, you'll need to follow step 3 to change Option Switch 1 to closed to operate a slow motion type turnout.
- 3. Using your DCC throttle, select Switch Address 01 and send a Closed command. This will set your DS64 to operate slow motion type turnouts. Refer to your DCC throttle's operating guide for specific instructions for selecting switch addresses and sending switch commands.
- 4. Exit the set up mode by again pressing and holding the OPS button on the DS64 until the red LED stops blinking.

# Setting Up DS64 to Operate Snap Switch (Solenoid) Type Turnouts

At the factory, your DS64 was set to control solenoid type turnout machines that use a single pulse output for operation. If you are using solenoid type turnouts, you can install the DS64 "out of the box." If for some reason you did reconfigure your DS64 for stall motor type turnouts and wanted to go back to solenoid type turnouts, simply follow the directions above and at step 3, select **Switch Address 01** and send a **Thrown** command.

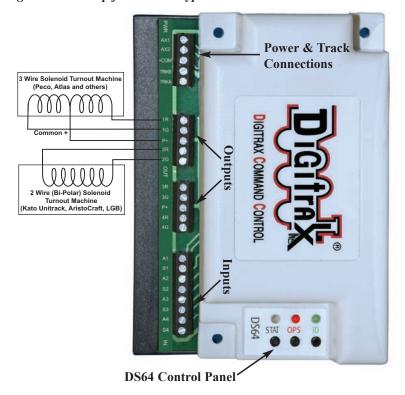


## **Connecting Your Turnouts to the DS64**

Once you have set up your DS64 to operate the type of turnouts you will use, the next step is to hook up the turnouts to the outputs of the DS64. Each type of turnout machine has specific requirements for wiring.

Note: Your DS64 has been configured either for solenoid turnouts OR slow motion turnouts. Only one type of turnout can be used on any particular DS64.

Figure 2: Hook up for solenoid type turnout machines.

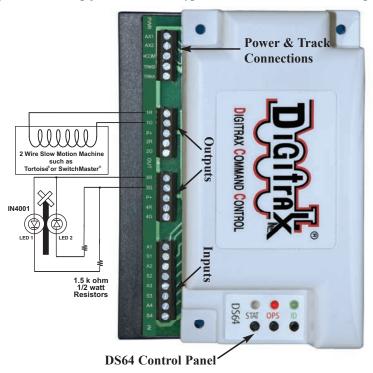


Note: Multiple turnout machines can be operated on a single DS64 output. For example, you can run 2 Peco or Atlas Snap Switches on a single DS64 output. Up to 4 Kato Unitrack switches (such as the Unitrack double crossover) can be operated a on a single DS64 output.

Note: If you find that your turnout is operating "backwards" simply switch the + & - wire connections to achieve correct operation.



Figure 3: Hook up for slow motion type turnout machines & crossing gates.



Note: Multiple turnout machines can be operated on a single DS64 output. For example, you can run 2 Tortoise or Switchmaster machines on a single DS64 output.

Note: If you find that your turnout is operating "backwards" simply switch the + & - wire connections to achieve correct operation.



#### **DS64 Address Programming**

Your DS64 has 4 Outputs labeled 1R & 1G, 2R & 2G, 3R & 3G, and 4R & 4G, which are shipped from the factory programmed as Switch Addresses 01, 02, 03, and 04 respectively. You can set the Switch Address of each of these four Outputs to any value from 01 - 2048.

Note: To change a single Switch Address, you must program all four Switch Addresses on a particular DS64. If you make a mistake while programming, you'll need to complete the programming cycle and then go back and start again. The DS64 does not timeout during programming so, you must program 4 switch addresses each time you enter the ID mode.

- 1. On the DS64's control panel, press and hold the ID button down for 3 seconds until the green LED slowly blinks on and off. This indicates that the DS64 is ready to accept address programming for the Outputs.
- 2. Using your DCC throttle in Switch mode, select the Switch Address you want to program for Output 1 and issue either a Closed OR Thrown command. The LEDs will start to blink faster indicating that your Output 1 is programmed to the Switch Address you selected.
- 3. Repeat step 2 to program the Switch Address for Output 2. The LEDs will blink faster indicating that Output 2 is programmed to the address you selected.
- 4. Repeat this process for Output 3 and Output 4. After Output 4 is programmed, the alternating lights will stop and you will see a single green 'heart beat' this is visual confirmation that all 4 Outputs have successfully been programmed to the Switch Addresses you selected.

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#### **Connecting Input Devices to Your DS64**

You can use the 8 inputs on the DS64 to control the operation of the 4 outputs that control your turnouts.

You will need to set the DS64's board ID if you are planning to use the DS64's 8 inputs with a computer, system throttle, or other 'smart' device on your layout that needs to know when a turnout has been manually thrown or closed via a particular DS64.

Keep track of the Board IDs you have programmed in the DS64s on your layout and make sure each one has a unique ID.

#### To set the DS64 Board ID for use with inputs

- 1. Press and hold the STAT button on the DS64's control panel down for approximately 10 seconds. The STAT LED will blink at a fast rate and after approximately 10 seconds it will change to a slow blink rate, alternating between red and green. To enter ID set up you must release the STAT button as soon as the blink rate changes or the DS64 will time out and you'll have to start again.
- 2. Use your DCC throttle in Switch mode and select a Switch address between 01-256 and send a Closed or Thrown command. The LEDs will go off indicating that the Board ID has been set. To exit this mode, you must set a board ID.

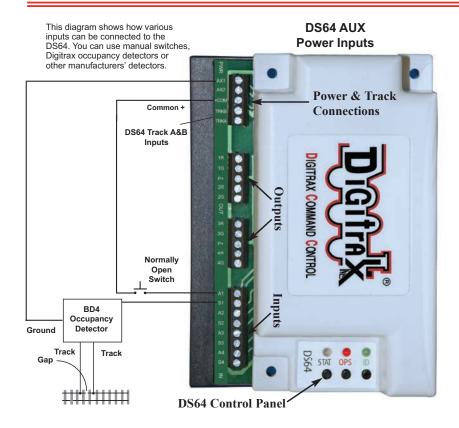


Figure 4: Connecting Input Devices to Your DS64

## Using Option Switches to Control Turnouts with Your DS64

The DS64 gives you many options for how you can control the turnouts and other stationary features on your layout. By setting the DS64's option switches you can configure it for many different possibilities.

The Option Switches (OpSw) are configuration switches that control features via software within the DS64. The option switches are generally set during the configuration process and then left alone. The DS64 is designed to 'remember' the OpSw switch settings you set.

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## How to change the settings of your DS64's Option Switches (OpSw)

- 1. Begin with your DS64 powered up and connected to the track. Turnouts can be either connected or not.
- 2. On the DS64 press and hold the OPS button down for about 3 seconds until the red OPS LED and green ID LED begin to blink alternately. This indicates that the DS64 is ready to change the option switches
- 3. Using your DCC throttle, select the Switch Address that corresponds to the OpSw number and send the Closed or Thrown command corresponding to the setting you have chosen. Refer to your DCC throttle's operating guide for specific instructions for selecting switch addresses and sending switch commands.
- 4. Exit the set up mode by again pressing and holding the OPS button on the DS64 until the red LED stops blinking.

The following table shows the factory default settings (Thrown) for the DS64.

	OpSw Table S	ettings for the DS64
OpSw	Description Thrown State (Factory Default)	Description Closed State
01	Pulse Enabled for Solenoid Devices	Static Output for Slow Motion Devices
02	Disabled	Pulse Timeout 200ms
03	Disabled	Pulse Timeout 400ms
04	Disabled	Pulse Timeout 800ms
05	Disabled	Pulse Timeout 1600ms
06	Output Auto Power Up	Disabled
07	N/A	Reset to Factory Default
08	Regular Startup Delay 65ms x Output #1 Address	Startup Delay Doubled
09	Timeout disabled	16 second timeout for static output
10	Throttle and computer commands accepted	Computer commands only accepted
11	Route commands from throttle or computer only	Enable route commands from local inputs
12	The "A" input is set for Sensor only The "S" input toggles the Output	The "A" input if High, forces the Output to Thrown, the "S" input if High, forces the Output to Closed.
13	Disabled	All Inputs are Set for Sensors & also control Outputs per OpSw 12 setting
14	Allow commands from LocoNet and Track	Allow Commands from Track Only
15	Function not yet implemented	
16	Enable operation of routes	Disable operation of routes
17	Disabled	Enable Crossing Gate Function for Output '1'
18	Disabled	Enable Crossing Gate Function for Output '2'
19	Disabled	Enable Crossing Gate Function for Output '3'
20	Disabled	Enable Crossing Gate Function for Output '4'
21	Generate LocoNet General Sensor messages	Generate LocoNet Turnout State messages



## **Option Switch 01-Determines The Type of Turnouts You Can Operate**

**OpSw 01** defines the output type (static or pulse) for the decoder.

**Thrown** (factory default) for pulse output mode to operate three wire (twin coil type) Peco™ or Atlas Snap Switches™ or two wire bi-polar type turnout machines such as Kato Unitrack™, AristoCraft™, or LGB™.

**Closed** for static output mode to operate slow motion (stall motor) type turnouts such as Tortoise™ or Switchmaster™.

# Option Switches 02, 03, 04, and 05-Set the Pulse Length or Timing of Crossing Gate Flashing

**Op Switches 02, 03, 04, and 05:** When in solenoid mode (OpSw 01=Thrown) these OpSw define pulse length values. When in slow motion mode (OpSw 01= Closed) they define the timing of crossing gate light flashing.

The factory default for these Op Switches is Thrown, meaning that this feature is not active.

All, or any combination of these OpSw switch values can be combined to create pulse widths from 200 milliseconds (ms) to 3000 ms (3 seconds) in length.

 $\mathbf{OpSw}\ \mathbf{02} = \mathbf{Closed}$  the pulse width is 200ms (milliseconds).

**OpSw 03 = Closed**, the pulse width is 400ms.

**OpSw 04 = Closed**, the pulse width is 800ms.

**OpSw 05 = Closed**, the pulse width is 1600ms.

# Option Switch 06-Power Management Options for DS64 Outputs

**OpSw 06** determines whether the DS64's outputs power up automatically.

**Thrown**(factory default) at power on, all DS64s and their 4 outputs power up automatically to their last state.

**Closed** at power on, the DS64 powers up and the 4outputs do not power up until they receive a command.

# **Option Switch 07-Reset DS64 To Factory Default Setting**

**OpSw 07** is normally Thrown (factory default). Setting OpSw 07 to **Closed** resets the DS64 to its default factory settings, which is all OpSw=Thrown, with Outputs 1-4 set to Switch Addresses 01-04 respectively. All Routes are erased.



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## Option Switch 08-Startup delay and power management issues

**OpSw 08** doubles the DS64's startup delay. The startup delay tells the DS64 to wait for a certain amount of time after the layout is powered up before 'waking up'.

**Thrown** (factory default) the DS64's startup delay is **65** milliseconds *times* the Switch Address programmed for Output 1.

**Closed**, the startup delay becomes **130** milliseconds times the Switch Address programmed for Output 1.

As an example, if Output 1 on your DS64 is programmed as Switch Address 41, then the startup delay for that DS64 will be 2665 milliseconds (Switch address 41 x 65ms). Closing OpSw 08 will double this delay to 5330ms.

This feature prevents multiple DS64s on your layout from powering up at the same instant and overwhelming your layout's power supply. This is important if you have multiple track powered DS64s on your layout. If you use external power supplies with multiple DS64s, or if you are only using a single DS64, then this feature is not needed.

## Option Switch 09-Setting the Static Time Out Length

**OpSw 09** sets the static timeout length when OpSw 01 is set to Closed for slow motion turnout operation

Thrown (factory default) Outputs do not shut off

Closed Outputs shut off after 16 seconds.

This is useful for power management when you are running multiple slow motion turnouts.

# Option Switches 10 through 15-Controlling DS64's Inputs A1-S4

Option switches 10 through 15 are used to determine how your switch outputs behave when the eight wired inputs (A1-S4) on the DS64 decoder are used.

# Option Switch 10-Computer and/or Throttle Inputs?

 $\mathbf{OpSw}\ \mathbf{10}$  used to set up DS64 for use with a computer.

**Thrown** (factory default) the DS64 accepts both throttle and computer commands.

Closed, the DS64 accepts computer commands only.

DCS100 owners - this is also known as the *Bushby bit*.



## **Option Switch 11-Operate Local Routes Using DS64 Inputs**

**OpSw11** Operate Local Routes Using DS64 Inputs - OpSw11 gives you the option to operate local routes using the DS64's Inputs.

**Thrown:** Route commands from throttle/computer only

Closed: Enable route commands from local inputs

#### **Option Switch 12-Forced Output on High**

OpSw 12 determines whether the local inputs are set to toggle a turnout from one state to the other or to force the state to closed or to thrown.

**Thrown:** (factory default) The local "S" input toggles the state of the output with each trigger (high) between CLOSED and THROWN.

The local "A" input if high will send a General Sensor Message to LocoNet. A trigger on "A" does not have any effect on the output.

**Closed:** The local "S" input if high will force the output state to "CLOSED." The local "A" input if high will force the output state to "THROWN". No sensor capability is available with this setting.

# Option Switch 13-Set Inputs for Sensor Message and Turnout Setting

Thrown: (factory default) Disabled.

Closed: All 8 inputs "A" and "S" are set for sensor messages to LocoNet. As an example, if input S2 goes high, then a LocoNet message is sent. When that input goes low, another LocoNet message is sent. All 8 inputs work the same way. These sensor messages can be used with DCC software such as Winlok, Railroad&Co., etc. to generate an action such as updating a display based on track occupancy or manually with a local push button.

Additionally the input will also control the output state per OpSw12. If OpSw 12=thrown, the "S" input will toggle the output. If OpSw 12=closed, input "S" will force the output state to CLOSED while the "A" input will force the output state to THROWN.

Important Note: The Closed Setting will only work if OpSw 15 is thrown (Disabled).



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## **Option Switch 14-Command Priority to LocoNet or Track**

**OpSw 14** determines whether LocoNet or Track commands have priority. This is useful when using DS64 with a non-LocoNet DCC systems.

**Thrown** (factory default) the DS64 obeys switch commands as a priority from LocoNet or alternately the TRKA and TRKB terminals if LocoNet is not connected.

**Closed** the DS64 obeys switch commands from the DCC TRKA and TRKB terminals only.

## **Option Switch 15-Set Inputs for Sensor Message Only**

**OpSw 15** This option is not yet implemented. Do not change.

## Option Switch 16-Enable/Disable Local Routes

**Thrown** (factory default) enables operation of routes.

Closed disables operation of routes.

## Option Switches 17-20 Setting Up a Crossing Gate

A crossing gate can be set up using a DS64 in slow motion mode (OpSw 01 = Closed). See Figure 3 for hook up diagram.

## OpSw 17

Thrown (factory default) the Crossing Gate feature is disabled.

**Closed** a high on *either* of the Inputs (A1 or S1) related to Output '1' causes output '1' to blink at a rate defined in OpSw Op Switches 02-05.

# OpSw 18

**Thrown** (factory default) the Crossing Gate feature is disabled.

**Closed** a high on *either* of the inputs of output '2' (A2 or S2) causes output '2' to blink at a rate defined in Op Switches 02-05.

## OpSw 19

**Thrown** (factory default) the Crossing Gate feature is disabled.

**Closed**, a high on *either* of the inputs of output '3' (A3 or S3) causes output '3' to blink at a rate defined in Op Switches 02-05.

## OpSw 20

**Thrown** (factory default) the Crossing Gate feature is disabled.

**Closed**, a high on *either* of the inputs of output '4' (A4 or S4) causes output '4' to blink at a rate defined in Op Switches 02-05.



DS64 allows for throttles to operate crossing gates:

- 1. In Switch Mode, select the address of the crossing gate
- 2. A closed command starts crossing gate operation
- 3. A thrown command stops crossing gate operation

If a throttle is used to start a crossing gate, you must use a throttle to stop that crossing gate, inputs will not stop the crossing gate operation if it was started by a throttle. If inputs are used to operate the crossing gate, then a throttle should not be used in this way.

OpSw 21 determines which kind of sensor messages are sent.

**Thrown** (factory default) **B2** Sensor messages (General Sensor Reporting) are sent for reporting.

**Closed**, **B1** Sensor messages (Turnout Sensor State Reporting) are sent for reporting.

#### **Routes**

Routes are a way of operating a preset combination of turnouts to pre-defined positions using a single Switch command. Route tables hold the Switch Address and position information that make up the Route that operates when a single command is issued. The DS64 has a route table that can hold up to 8 routes and each route can contain up to 8 turnouts.

## How To Set Up Routes Using Your DS64

- 1. Press and hold down the STAT button on your DS64 until the green LED begins to blink quickly. You are now ready to set up a Route.
- 2. To program the DS64 Route Number, use your DCC throttle in Switch mode to select a Switch Address from 1 through 8 and issue a Closed or Thrown command. This lets the DS64 know which of the 8 available routes you are setting up. This is NOT the address you use to operate the route.
- 3. Next, the first switch address that you enter is called the <u>top address</u>. It will operate the route you have defined when you send a closed or thrown command (depending on your setup). To set up the switch address and position that will control the operation of the route, use your DCC throttle to select the Switch Address you want to use (from 01 through 2048) and issue either a Closed or Thrown command depending on the turnout position you want to use when the Route is run.

After you select the top address and send a thrown or closed command, the STAT LED will begin to blink at a slower rate.

4. To set up the rest of the switch addresses and positions for the route, select

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the Switch Address (from 01 through 2048) and issue either a Closed or Thrown command depending on the turnout position you want when the Route is run. As you select the switch addresses and send thrown or closed commands you will notice that the STAT LED's blink rate will increase for Switch #1, #2, #3 & #4. When Switch #5 is set up, the STAT LED will

2	3		4		5		9				8	
Adr Pos	Adr	Pos										

**DS64 Route Table** 



change color and as Switches #6, #7 & #8 are set up, the red blink rate will increase. When you reach 8 switch addresses and positions, the DS64 will automatically exit route set up and the STAT LED will go OFF.

5. To exit route set up if you want to enter fewer than 8 switch addresses and positions in a route, simply repeat the last entry for a switch address and position and the DS64 will automatically exit route set up and the STAT LED will go OFF.

#### To Run a DS64 Route

- Select the Switch Address that corresponds to the Top Address of the route you want to run.
- 2. Issue a Closed or Thrown command depending on which you set up in the route table. Note that if you are using an actual switch address as your top address and you send the opposite closed or thrown command from that set up in the route; you will operate that switch address only and not the route.
  - A "Virtual" top address can be used to avoid conflicts with actual turnout addresses and other routes. To create a virtual top address use a switch address for your top address that is not used to operate an actual turnout on the layout. The advantage of this is that you can consistently use either the "thrown" or "closed" command to operate all routes, making it easier to remember which position goes with which route to make them work. Since DS64 routes can only be 8 addresses deep, if you use a "virtual" top address, you will only be able to operate 7 actual turnouts with each route.

For example: If you set up Switch Address 50 as your Top Address by sending a Thrown command, you'll need to send a Thrown command to run the route. If you send a Closed command you will operate switch address 50 to the closed position if it is an actual switch address. If Switch address 50 is a virtual top address, nothing will happen if you send a Closed command.

3. Turnout route commands are stored in a buffer that holds up to 8 commands. The commands are executed in the order received at approximately 1 second intervals. Because it takes more energy to throw solenoid type turnouts, the DS64 needs approximately 1 second capacitive discharge time between switch commands to operate solenoid type turnout machines.

Note: If your route includes switch addresses from more than one DS64, they must both be connected to LocoNet or the route will not run.

To reset the turnouts in any Route to their original position, simply set up a second Route that reverses the positions set up in the first route.

For larger routes, you can set up Cascading Routes by using multiple DS64's as explained in detail in our on-line "DS64 application note". (www.digitrax.com/ds64) Important Note: You cannot cascade routes within the same DS64 route table.

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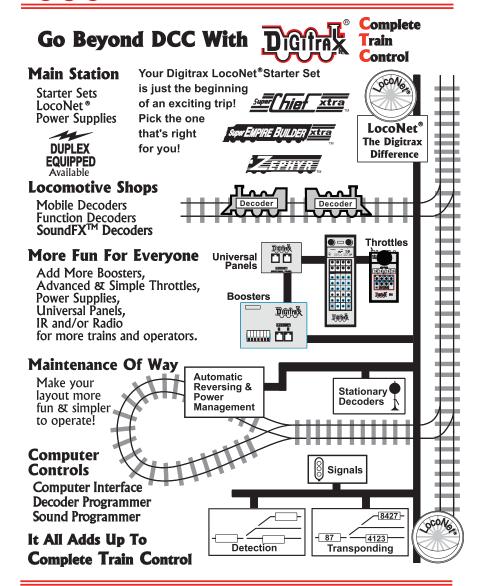
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## **DS64**

Stationary Decoder for use with 4 slow motion solenoid, or bi-polar turnout machines





Made In USA **C €** 

2443 Transmitter Road Panama City, FL 32404



306-DS64-INS