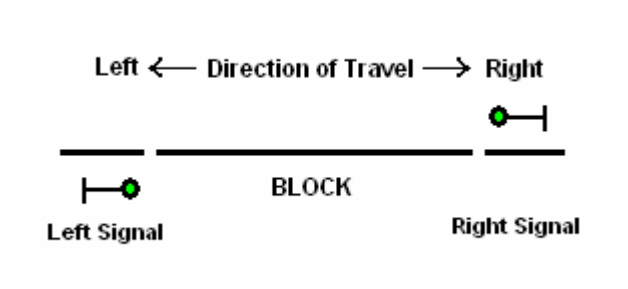
Establishing LEFT and RIGHT Directions on the Layout

This is where the real fun begins! Signals are located at the boundary of a block. There will be one at the **LEFT** boundary and one at the **RIGHT** boundary of the block. On a single track main where trains can run on the track in opposite directions, signals must be placed according to the direction of travel in order to protect the block from collisions between trains. Also protection must be made for trains going in the same direction so that one train does not run into the back of another. That is what signals are for on railroads. They indicate to the engineer that the next block is safe for the train to enter.

To establish direction on your layout go back to your track diagram. Decide which direction will be **LEFT** and which direction will be **RIGHT.** Which way is which does not matter. It is totally up to you. It can get a little tricky the way our roads wind around and back on themselves. The easiest way is to put your finger on a rail and follow it along in areas that seem confusing. Mark LEFT and RIGHT on the diagram. You may want to place **LEFT** and **RIGHT** indications on your layout itself to keep things straight. The diagram below shows a block diagram.

Fig. 8



Now that you have established the direction of travel you can install your system.

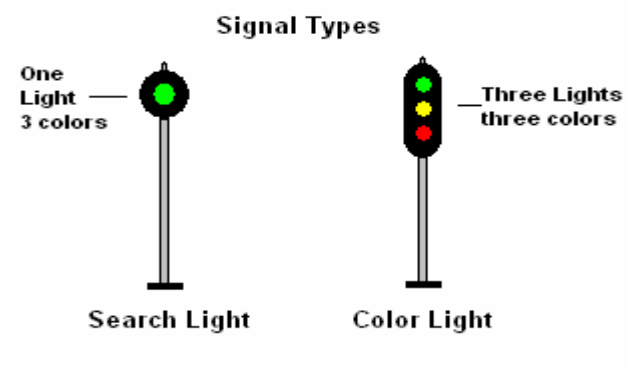
Installing Signals on your layout

There are two types of signals that the DSD can drive: S-Type signals and D-Type signals.

S-Type signals are called search light signals. There is one light per target which can display three aspects – Red, Yellow, or Green.

D-Type signals have three lights per target. Each aspect has a different color light - Red, Yellow, and Green

Fig. 9



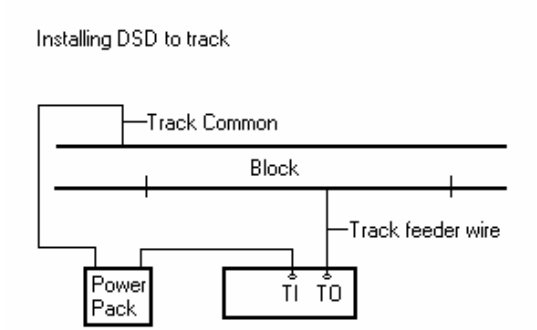
The DSD is capable of driving either the color light or search light signals. I assume that you have already decided which type of signal you want to use. The installation of each type to the DSD is different. Installing them on your layout is the same. I assume that you have purchased South Bend Signal's S or D type signals. If not, there are some things you need to know. If you are using **South Bend Signal Company** signals, then you can skip this next part.

Color light signals -The DSD drives LEDS only. **You cannot use incandescent bulbs**. For the color light signal, the LEDS must have a common anode (+) to work properly with the DSD. Common Anode means that the positive power is the common and connected to the positive side of the LED. LEDS are polarized. This means that the positive (**+**) terminal from the power supply must be connected to the (**+**) (anode) terminal on the LED and the ground or negative (-) terminal of the power supply must be connected to the (-) (cathode) terminal on the LED. If you purchase other color light signals to use with the DSD, make sure that they are common anode wired.

Search Light Signals – the DSD drives bicolor 3 wire LEDS. Some models of search light signals use a 2 lead LED to display the colors Red, Yellow, and Green. **This type of LED signal is not compatible with the DSD.** Now that this is straight you can install the signals on your layout.

You will be concerned with **TI** and **TO** for this part of the installation. Connect the lead from the throttle power supply which you are using for track Block power to the **TI** terminal of the DSD. Run a wire from the TO terminal to the block feeder wire for this block.

Fig. 5

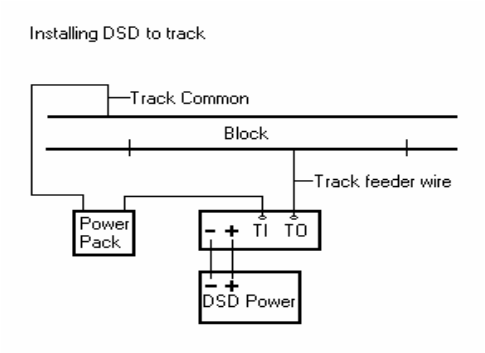


Test your connections by turning on your track power and putting a locomotive in the block. Turn your power pack on. The engine should run forward and reverse. Turn off the track power.

Next attach the DSD power supply. **Note: The DSD power supply is separate from the track power supply. It must be 12-18v DC.** Connect the **(+)** from the DSD power supply to the **(+)** terminal on the DSD. Connect the terminal **(–)** on the DSD to Gnd **(–)** lead on the power supply. Figure 6 above shows the proper installation.

Connecting the Signals to the DSD

There is a RED jumper block on the board labeled **Signal Select**. If you are using searchlight signals for this block, remove the red jumper block marked **Signal Select.** For color light signals leave the jumper block in place.



Color Light Signals – To connect these signals to the DSD, locate the terminals for the signals. The terminal is labeled like this:

Fig. 11

LEFT - W R Y G R Y G W - RIGHT
MAIN SIGNALS

Notice that there is a set of terminals for **LEFT** and **RIGHT for the MAIN and LEFT and Right for the Siding**. There is one terminal for each color and a common **W** for each signal (for color light signals). If you are not using **South Bend Signals,** then you will have to determine which lead from the signal goes with which color and which lead is the common.

Search Light Signals – To connect these signals to the DSD, locate the terminals for the signals (See Figure 12 above). Connect the signal to Green, Red and Yellow which is the common.

Connecting Signals to the DSD (MAIN) do the following:

[1] Run telephone wire from the DSD to the signal: one set from the LEFT signal and one set from the Right signal. Most phone wire today has six wires with an insulating cover. They are insulated with red, green, yellow, blue, white, and black insulation. The colors of the wires on South Bend signals are connected to LEDS with the same color wire as the color of the LED, which make installation easy. The white wire from the signal is the common wire for **color light signals** and should be connected to the **W** terminal on the DSD. For **searchlight signals** the **W** terminal is not used. The yellow wire is the common. Match the color of the wire with the leads on the signal and at the DSD end connect the same color to the labeled color on the terminals. It is a good idea install a strain relief to the wire by the signal as well as by the DSD. You also may want to label this wire at both ends for future reference. You may also want to give the signal a number and glue it to the number board on the signal if there is a number board. You can mark this same number on your track diagram for future reference. That is all there is to connecting the signals.

For a siding wire the boards and signals according to the diagram found on page 15. The siding signals are connected to the Siding terminals in the same manner as described above.

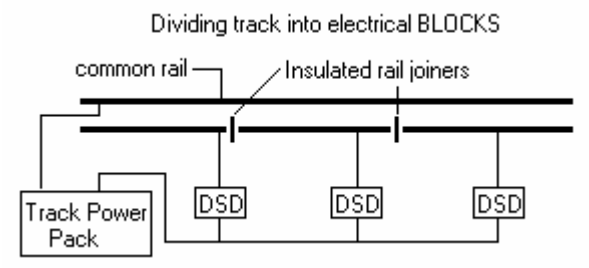
Preparing the Track for Installation

To create a signal system the track must be divided into blocks. A block is an electrically isolated section of track. The diagram below shows how the track is divided into blocks.

This is accomplished by cutting one rail of track into sections. Each section of track is then called a **BLOCK**. For **O** gauge, three-rail-track, cut the center rail. Insulated rail joiners can be used to connect the sections of track together. Notice that one lead from the track power goes to the uncut rail. This is called the track common. The other power connection goes to each cut section of track. It does not matter which rail is the common but make sure that when you divide the blocks that you divide the same rail around your entire layout.

Decide where you want each block to be on your layout. Make a drawing that indicates where each block will be. Label each block on your drawing. This will help you visualize your layout and helps to determine where blocks will be. This will also help you decide how many DSDS you need and how many signals are necessary for each block. It is not necessary to connect each block to the DSD system. Start with one block and add blocks as time and money permit. Your block diagram should now look something like this.

Fig. 2

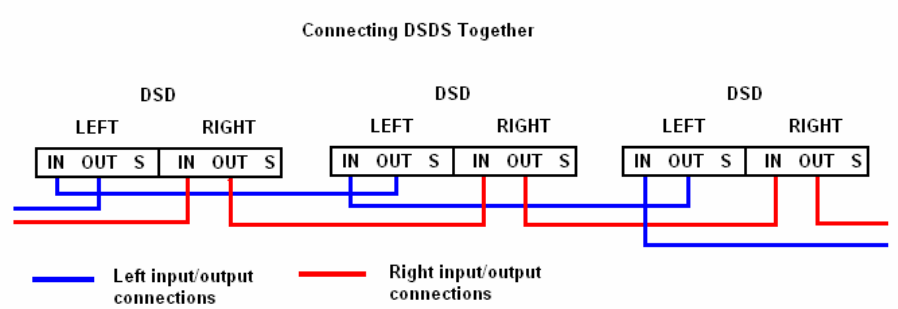


Solder a wire from the cut rail and run it through a hole drilled next to the track under the bench work. Check your track as you go to make sure everything is running correctly. Once all this work is done, you are ready to add DSDS to each block.

To connect two or more blocks with DSD together, connect terminal **OUT (LEFT)** to the next DSD terminal **IN (LEFT)**. Connect terminal **OUT (RIGHT)** to the next DSD terminal **IN (RIGHT)**. Look at Fig.15. Connecting DSDS together is easy if you remember to think of other DSDS being LEFT or RIGHT from the DSD to which you are currently connecting wires. Once you have connected three or more DSDS together, you should see the various aspects at the signals- Red, Yellow, or Green depending on the occupancy status of the block. Run a train to see if the signals are working properly. If not, recheck your wiring and try again.

Fig.15

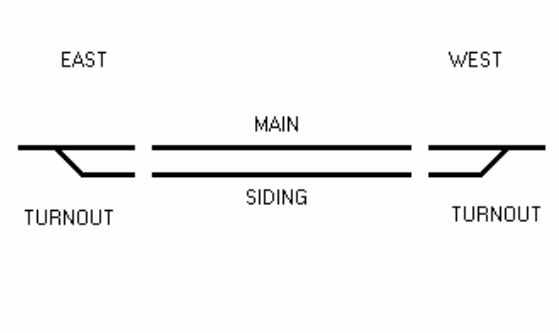
CONNECTING DSD TOGETHER (3 DSDS illustrated)



Connecting DSDS with Sidings or Spurs

Sidings involve turnouts (switches) which allow a train to take a diverging route. In order for signals to display the proper aspect, some additional wiring must be done. Below is a passing siding.

Fig.16



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Caution: The DSD converts 12-18v DC to 5v regulated DC. The voltage regulator on board may get warm. This is normal for the device. Do not cover up the DSD. It needs air to keep the regulator at a save operating temperature.

Truth Table for DSD (Input/Outputs)

Terminal	IO Type	Logic STATE low(-) high (+)
IN	**Input**	**next block occupied = low next block clear = high**
O	**Output**	**This block occupied = low This block clear = high**
S	**Input**	**Low from switch machine Switch reversed**

This logic is called interlocking because the signals are locked depending on the position of the turnout as well as the status of the current block and the next block (clear or occupied).

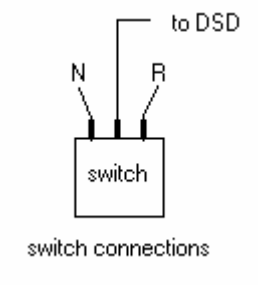
So how do we get all this to work correctly? Follow these steps to interlock sidings or spur tracks.

[1] The MAIN and the SIDING have to have a DSD connected as described earlier. After these two DSDS are connected properly, you should get red on the indicator light when either two blocks are occupied when a locomotive is in the MAIN or SIDING.
[2] Install all the signals as per the diagram on page 15. The differences are those double target signals on the **MAIN** facing the block at each end. The upper target connects to **MAIN DSD**. The lower target connects to the **SIDING DSD**. For color light signals, connect the lower target to green and red. There are only two targets on the lower head. There is no yellow connection.

Connecting a Turnout to DSD

[3] To connect a switch, you need a single pole/double throw switch. This can be the auxiliary contacts on a Tortoise or other similar switch machine or a separate switch which controls the turnouts. The ground (-) from the signal power supply is connected to the center terminal on the switch. The other two terminals of the switch become the indicators for normal (**N**) and reversed (**R**). If the switch is thrown to normal, then the terminal for reverse should be connected to ground and vise versa. Use a voltmeter or a 12v bulb with one side connected to (+) to check the connections of (**N**) and (**R**).

Fig.19



switch connections

[4] The terminal for (**N**) is connected to the input terminal marked **S (LEFT)** or **S (RIGHT)** on the **MAIN DSD** depending on which end of the siding the turnout resides. The (**R**) is connected to the DSD terminal marked **S (LEFT)** or **S (RIGHT)** of the **SIDING DSD**. See page 15 for wiring details.