

## BlockMaster Application Note #3 Signaling a single crossover

One of the most common track arrangements found on model and prototype railroads is a single crossover between parallel tracks. Using two *BlockMaster* boards you can signal this track arrangement in a prototypical way. This application note should be used as a **supplement** to the *BlockMaster* Installation Guide. You will utilize *BlockMaster* Track Configuration 4.

The first part of this application note details a crossover that goes from the upper left to the lower right; later you will find the details for a crossover that goes from the lower left to the upper right. Figure 1 below shows two *BlockMasters* laid out for the first type of crossover.

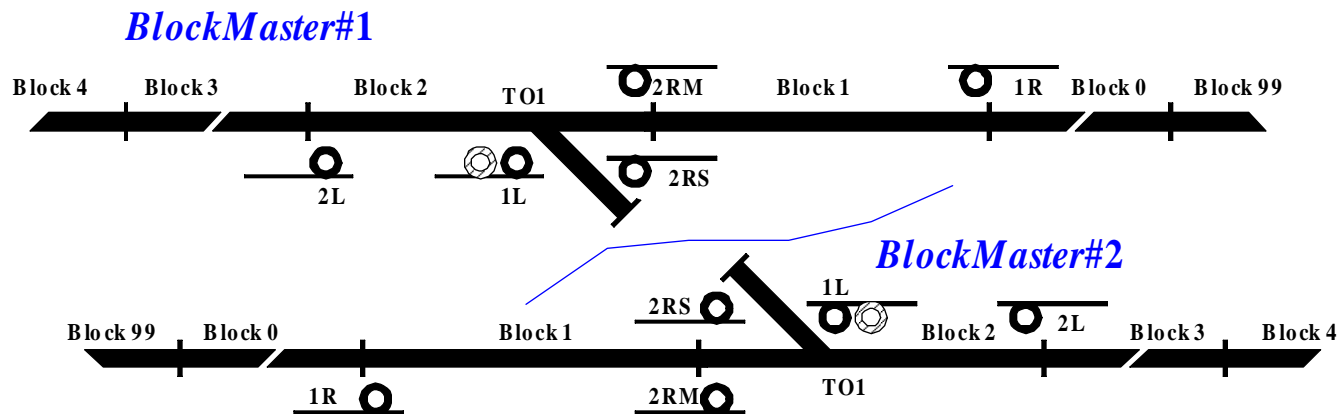
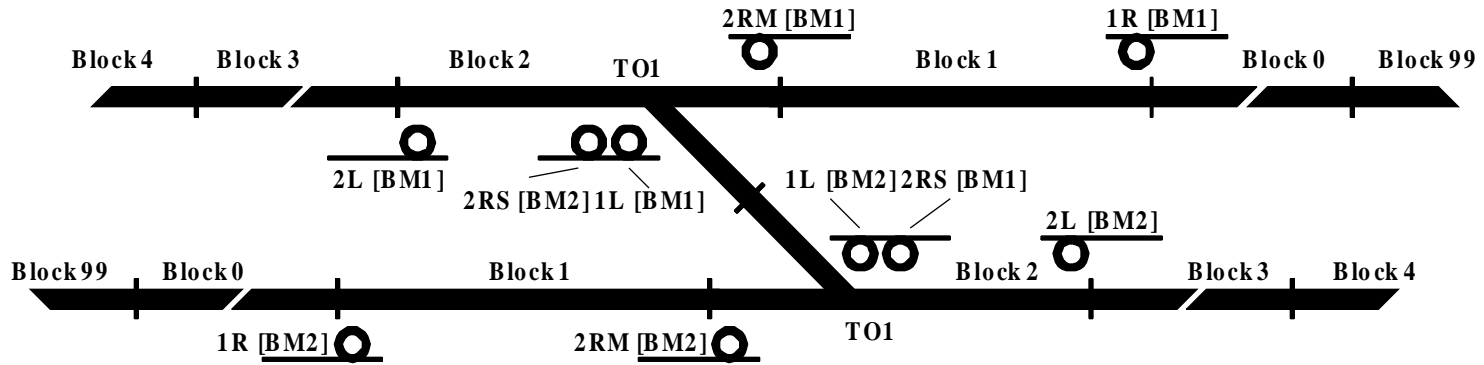


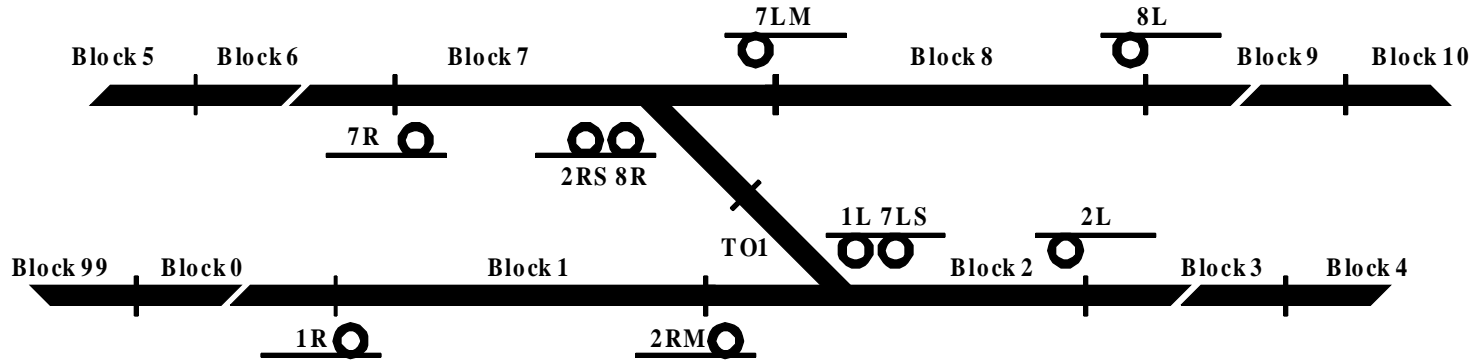
Figure 1 – *BlockMasters* before “joining”

Hopefully you can visualize “joining” two instances of this track configuration together to create a single crossover shown in Figure 2. In Figure 2 we’ve done this and have added some labels to indicate the signals associated with each *BlockMaster*. Where you see [BM1] it indicates that *BlockMaster* #1 handles the signal. Likewise, where you see [BM2] it indicates that *BlockMaster* #2 handles the signal.



**Figure 2 – Merged *BlockMasters***

In Figure 3 we've renumbered the blocks and signals to reflect the combination.



**Figure 3 – Combined *BlockMaster* labeling**

### BlockMaster Application Note #3: Signaling a single crossover

We will now attempt to take some of the mystery out of the interconnections required to make this all work. First, make your power connections per the *BlockMaster* installation manual. We've illustrated the detection diode, track and ground connections in Figure 4. If you're using conventional DC throttles you'll need to wire the S rails as described in the *BlockMaster* installation manual. If you're using command control you don't have to cut the gaps in the S rail. However, you will have to gap the crossover itself accordingly.

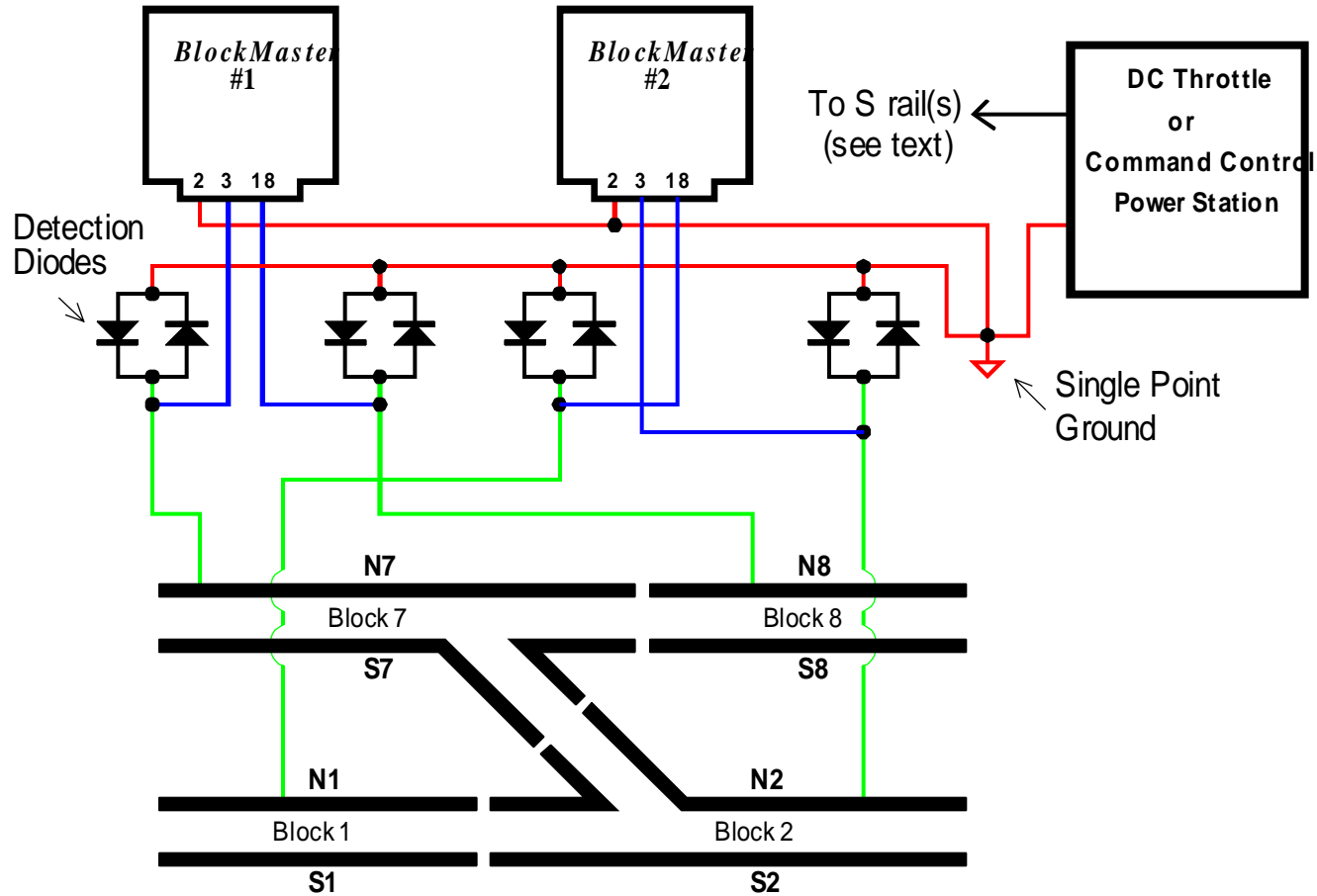
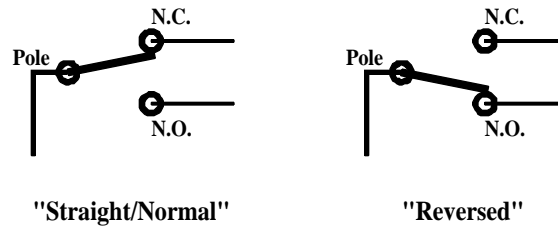


Figure 4 – Track connections

## Interlocking Connections

For the sake of simplicity we'll assume that the only interlocking function of interest is the position of the crossover. In other words, we won't consider things like control panel direction switches, etc. For interlocking with the crossover position you'll need to use a full set of SPDT (Single Pole Double Throw) auxiliary contacts from one of the two switch machines/motors; we are assuming that both turnouts that make up the crossover are thrown in tandem and cannot be thrown independently of one another. When the crossover is aligned for the straight/normal routes then the center pole of the SPDT contact set will be connected to the normally closed (N.C.) terminal. Since the center pole is connected to ground (see *BlockMaster* manual) this will cause the N.C. contact to also be connected to ground. Conversely, the normally open (N.O.) terminal will be disconnected from the center pole so it will be an open-circuit. When the crossover is aligned for the reverse route (i.e. crossover from one track to the other) then the center pole of the contacts will be connected to the normally open terminal. Since the center pole is connected to ground this will cause the N.O. contact to also be connected to ground. Conversely, the normally closed terminal will be disconnected from the center pole so it will be an open-circuit. These two cases are illustrated in Figure 5 below.



**Figure 5 – Switch machine/motor auxiliary contacts**

For example, if you're using Circuitron's **Tortoise**™ switch motor then you should consider its terminal #4 as the center pole (connect to *BlockMaster* ground), terminal #3 as the N.C. contact and terminal #2 as the N.O. contact. Depending upon how you mount the Tortoise you may have to switch the connections to terminals 2 & 3; if possible use an ohmmeter to determine which contact is normally closed. Since the Tortoise has two sets of SPDT contacts you could alternatively select terminals 5, 7 & 6, respectively.

Tables 1 & 2 list the interlocking status connections for each of the two *BlockMasters*. The nomenclature TO1NC means the Normally Closed terminal on the auxiliary contacts for the switch machine/motor that is handling turnout 1; TO1NO is the Normally Open terminal.

Description	BlockMaster #1	Switch machine/motor
Interlocking status for signal 7LM	J1-24	TO1NO
Interlocking status for signal 7LS	J1-10	TO1NC
Interlocking status for signal 8R	J1-22	TO1NO

**Table 1 – Interlocking status connections for BlockMaster #1**

<b>Description</b>	<b>BlockMaster #2</b>	<b>Switch machine/motor</b>
Interlocking status for signal 1L	J1-22	TO1NO
Interlocking status for signal 2RM	J1-24	TO1NO
Interlocking status for signal 2RS	J1-10	TO1NC

**Table 2 – Interlocking status connections for BlockMaster #2**

**Next Block Connections**

Tables 3 & 4 describe the Next Block connections for each of the two *BlockMasters*. The Next Block status will come from the detection circuit in blocks before or after the four blocks covered by these two boards. Note that if those other blocks have any interlocking connections defined then you will have to incorporate that into the connections below using diode logic (contact us if you cannot make sense of this from the *BlockMaster* manual!

<b>Description</b>	<b>BlockMaster #1</b>	<b>From</b>
Next Block status for signal 8R	J1-27	-BO9
Next Block status for signal 7LM/7LS	J1-28	-BO6

**Table 3 – Next Block status connections for BlockMaster #1**

<b>Description</b>	<b>BlockMaster #2</b>	<b>From</b>
Next Block status for signal 1L	J1-27	-BO0
Next Block status for signal 2RM/2RS	J1-28	-BO3

**Table 4 – Next Block status connections for BlockMaster #2**

The Next Block status for the other signal heads not listed is handled internal to the *BlockMasters*.

## **BlockMaster Application Note #3: Signaling a single crossover**

### **Additional Features**

If you aren't interested in the Flashing Yellow (i.e. Approach Medium) or Approach Lighting features of the **BlockMaster** you can skip to the section on signal head connections. However, if you are interested in either or both features you'll need to make more connections.

### **Flashing Yellow**

Tables 5 & 6 address the 2<sup>nd</sup> Next Block connections necessary to support Flashing Yellow.

<b>Description</b>	<b>BlockMaster #1</b>	<b>From</b>
2 <sup>nd</sup> Next Block status for signal 8R	J1-29	-BO10
2 <sup>nd</sup> Next Block status for signal 7LM/7LS	J1-30	-BO5

**Table 5 – 2<sup>nd</sup> Next Block status connections for BlockMaster #1**

<b>Description</b>	<b>BlockMaster #2</b>	<b>From</b>
2 <sup>nd</sup> Next Block status for signal 1L	J1-29	-BO99
2 <sup>nd</sup> Next Block status for signal 2RM/2RS	J1-30	-BO4

**Table 6 – 2<sup>nd</sup> Next Block status connections for BlockMaster #2**

### **Approach Lighting**

Tables 7 & 8 describe the Previous Block connections for each of the two **BlockMasters**. For each row in the table make the connection shown in column 2 to the appropriate edge connector pin on the **BlockMaster** in column 1.

<b>Description</b>	<b>BlockMaster #1</b>	<b>From</b>
Previous Block status for signal 7R	J1-9	-BO6
Previous Block status for signal 7LS	J1-8	-BO2
Previous Block status for signal 8L	J1-7	-BO9

**Table 7 – Previous Block status connections for BlockMaster #1**

## BlockMaster Application Note #3: Signaling a single crossover

Description	BlockMaster #1	From
Previous Block status for signal 2L	J1-9	-BO3
Previous Block status for signal 2RS	J1-8	-BO7
Previous Block status for signal 1R	J1-7	-BO0

**Table 8 – Previous Block status connections for BlockMaster #2**

The Previous Block status for the other signal heads not listed is handled internal to the *BlockMasters*.

### Signal head connections

The following tables describe the signal head connections (using the ribbon cables) for the two *BlockMasters*. Table 9 covers searchlight signals and Table 10 covers 3-light signals. Don't forget current limiting resistors!

Pin #	BlockMaster #1	BlockMaster #2
1	Red, signal 8L	Red, signal 1R
2	Grn, signal 8L	Grn, signal 1R
3	not used	not used
4	not used	not used
5	not used	not used
6	not used	not used
7	not used	not used
8	not used	not used
9	Red, signal 8R	Red, signal 1L
10	Grn, signal 8R	Grn, signal 1L
11	Red, signal 7LS	Red, signal 2RS
12	Grn, signal 7LS	Grn, signal 2RS
13	Red, signal 7LM	Red, signal 2RM
14	Grn, signal 7LM	Grn, signal 2RM
15	Red, signal 7R	Red, signal 2L
16	Grn, signal 7R	Grn, signal 2L

**Table 9 – Searchlight signal head connections**

Pin #	<i>BlockMaster</i> #1	<i>BlockMaster</i> #2
1	SSEL8R	SSEL1L
2	SSEL8L	SSEL1R
3	SSEL7R	SSEL2L
4	SSEL7L	SSEL2R
5	not used	not used
6	not used	not used
7	not used	not used
8	not used	not used
9	GRN-M	GRN-M
10	YEL-M	YEL-M
11	RED-M	RED-M
12	not used	not used
13	GRN-S	GRN-S
14	YEL-S	YEL-S
15	RED-S	RED-S
16	not used	not used

**Table 10 – 3-light signal head connections**

### BlockMaster Application Note #3: Signaling a single crossover

Figure 6 below shows two *BlockMasters* laid out for the second type of crossover.

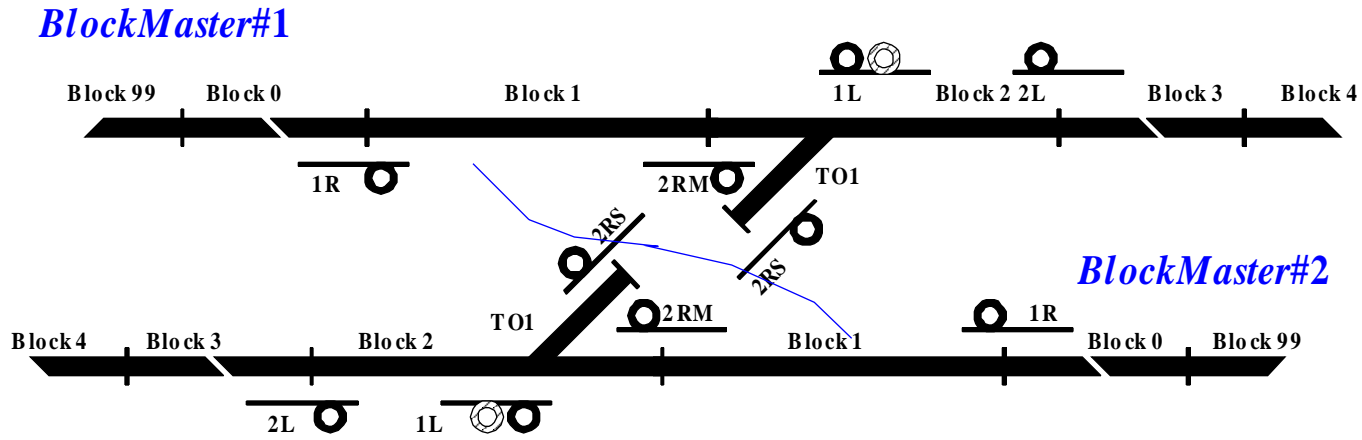
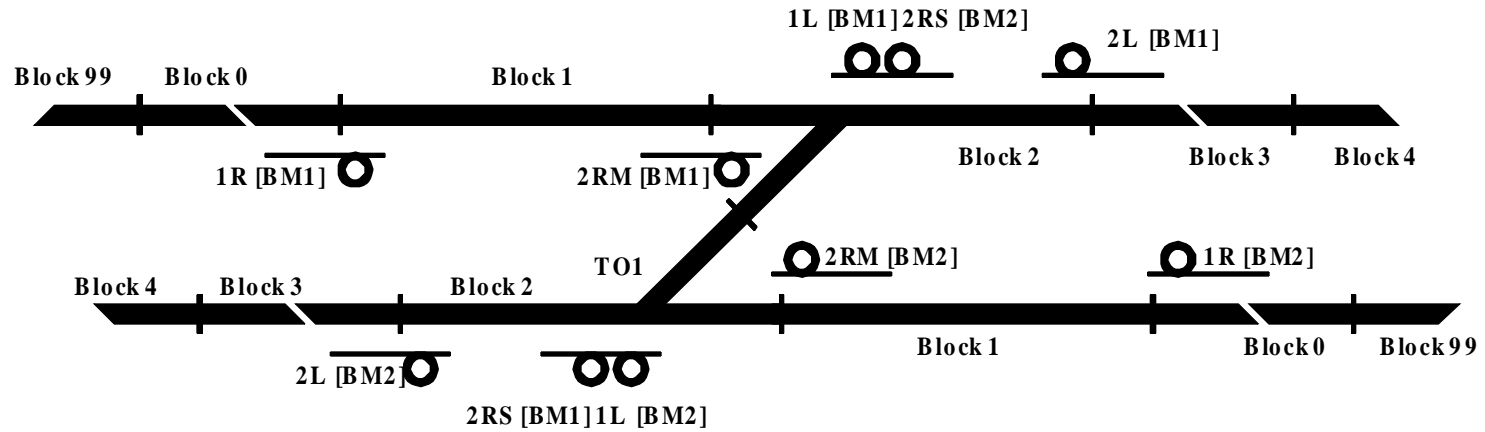


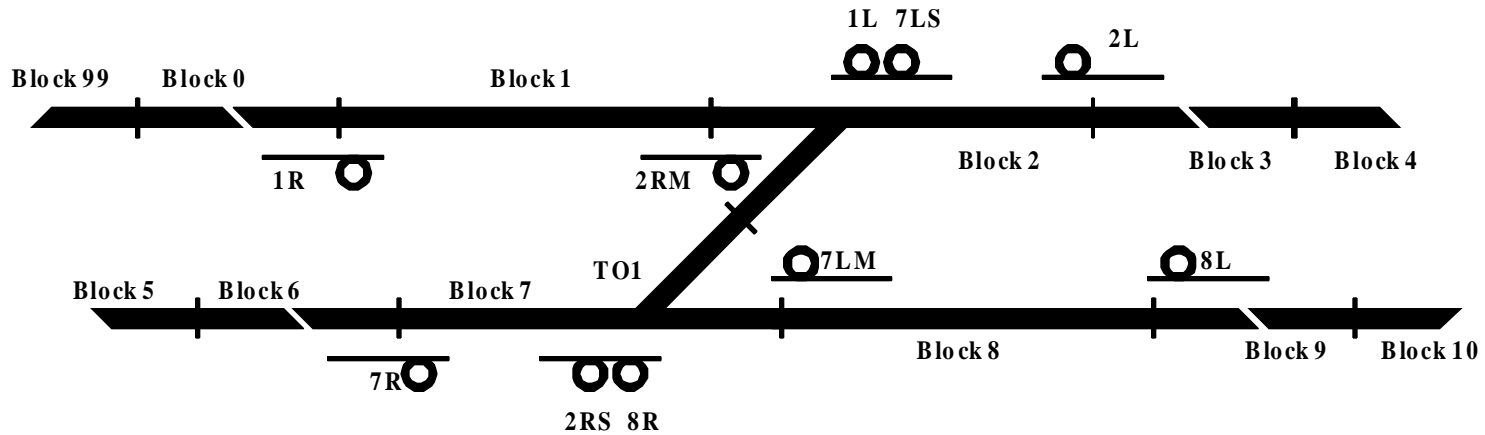
Figure 6 – *BlockMasters* before “joining”

Hopefully you can visualize “joining” two instances of this track configuration together to create a single crossover shown in Figure 7. In Figure 7 we’ve done this and have added some labels to indicate the signals associated with each *BlockMaster*. Where you see [BM1] it indicates that *BlockMaster* #1 handles the signal. Likewise, where you see [BM2] it indicates that *BlockMaster* #2 handles the signal.



**Figure 7 – Merged *BlockMasters***

In Figure 8 we've renumbered the blocks and signals to reflect the combination.



**Figure 8 – Combined *BlockMaster* labeling**

## BlockMaster Application Note #3: Signaling a single crossover

We will now attempt to take some of the mystery out of the interconnections required to make this all work. First, make your power connections per the *BlockMaster* installation manual. We've illustrated the detection diode, track and ground connections in Figure 9. If you're using conventional DC throttles you'll need to wire the S rails as described in the *BlockMaster* installation manual. If you're using command control you don't have to cut the gaps in the S rail. However, you will have to gap the crossover itself accordingly.

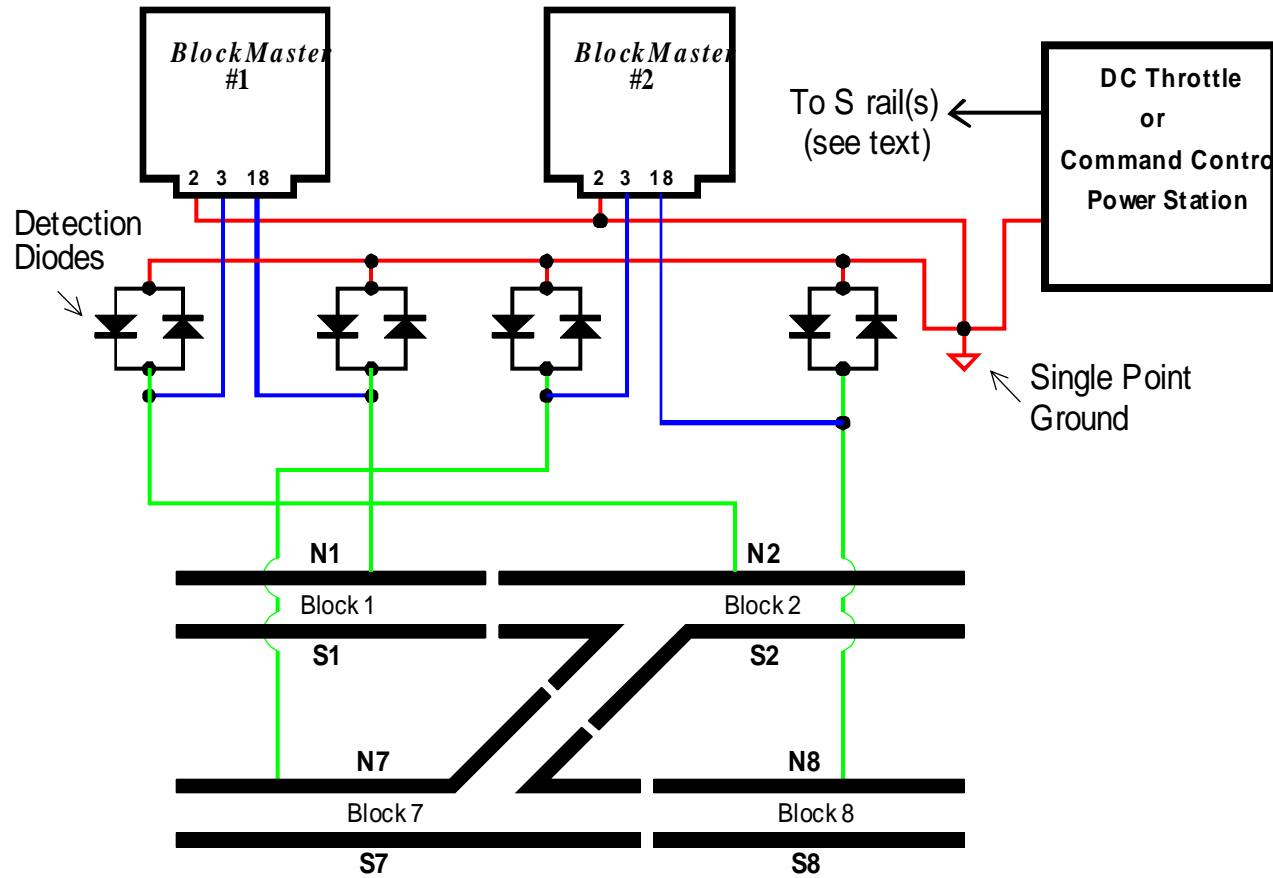
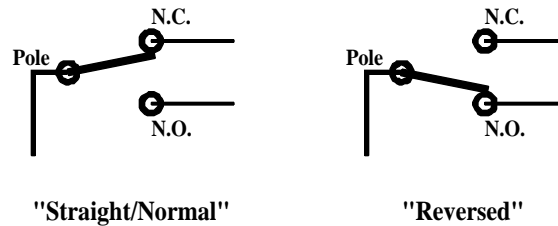


Figure 9 – Track connections

**Interlocking Connections**

For the sake of simplicity we'll assume that the only interlocking function of interest is the position of the crossover. In other words, we won't consider things like control panel direction switches, etc. For interlocking with the crossover position you'll need to use a full set of SPDT (Single Pole Double Throw) auxiliary contacts from one of the two switch machines/motors; we are assuming that both turnouts that make up the crossover are thrown in tandem and cannot be thrown independently of one another. When the crossover is aligned for the straight/normal routes then the center pole of the SPDT contact set will be connected to the normally closed (N.C.) terminal. Since the center pole is connected to ground (see *BlockMaster* manual) this will cause the N.C. contact to also be connected to ground. Conversely, the normally open (N.O.) terminal will be disconnected from the center pole so it will be an open-circuit. When the crossover is aligned for the reverse route (i.e. crossover from one track to the other) then the center pole of the contacts will be connected to the normally open terminal. Since the center pole is connected to ground this will cause the N.O. contact to also be connected to ground. Conversely, the normally closed terminal will be disconnected from the center pole so it will be an open-circuit. These two cases are illustrated in Figure 10 below.



**Figure 10 – Switch machine/motor auxiliary contacts**

For example, if you're using Circuitron's **Tortoise**™ switch motor then you should consider its terminal #4 as the center pole (connect to *BlockMaster* ground), terminal #3 as the N.C. contact and terminal #2 as the N.O. contact. Depending upon how you mount the Tortoise you may have to switch the connections to terminals 2 & 3; if possible use an ohmmeter to determine which contact is normally closed. Since the Tortoise has two sets of SPDT contacts you could alternatively select terminals 5, 7 & 6, respectively.

Tables 11 & 12 list the interlocking status connections for each of the two *BlockMasters*. The nomenclature TO1NC means the Normally Closed terminal on the auxiliary contacts for the switch machine/motor that is handling turnout 1; TO1NO is the Normally Open terminal.

<b>Description</b>	<b>BlockMaster #1</b>	<b>Switch machine/motor</b>
Interlocking status for signal 2RM	J1-24	TO1NO
Interlocking status for signal 2RS	J1-10	TO1NC
Interlocking status for signal 1L	J1-22	TO1NO

**Table 11 – Interlocking status connections for BlockMaster #1**

<b>Description</b>	<b>BlockMaster #2</b>	<b>Switch machine/motor</b>
Interlocking status for signal 8R	J1-22	TO1NO
Interlocking status for signal 7LM	J1-24	TO1NO
Interlocking status for signal 7LS	J1-10	TO1NC

**Table 12 – Interlocking status connections for BlockMaster #2**

**Next Block Connections**

Tables 13 & 14 describe the Next Block connections for each of the two *BlockMasters*. The Next Block status will come from the detection circuit in blocks before or after the four blocks covered by these two boards. Note that if those other blocks have any interlocking connections defined then you will have to incorporate that into the connections below using diode logic (contact us if you cannot make sense of this from the *BlockMaster* manual!

<b>Description</b>	<b>BlockMaster #1</b>	<b>From</b>
Next Block status for signal 1L	J1-27	-BO0
Next Block status for signal 2RM/2RS	J1-28	-BO3

**Table 13 – Next Block status connections for BlockMaster #1**

<b>Description</b>	<b>BlockMaster #2</b>	<b>From</b>
Next Block status for signal 8R	J1-27	-BO9
Next Block status for signal 7LM/7LS	J1-28	-BO6

**Table 14 – Next Block status connections for BlockMaster #2**

The Next Block status for the other signal heads not listed is handled internal to the *BlockMasters*.

## ***BlockMaster* Application Note #3: Signaling a single crossover**

### **Additional Features**

If you aren't interested in the Flashing Yellow (i.e. Approach Medium) or Approach Lighting features of the ***BlockMaster*** you can skip to the section on signal head connections. However, if you are interested in either or both features you'll need to make more connections.

### **Flashing Yellow**

Tables 15 & 16 address the 2<sup>nd</sup> Next Block connections necessary to support Flashing Yellow.

<b>Description</b>	<b><i>BlockMaster</i> #1</b>	<b>From</b>
2 <sup>nd</sup> Next Block status for signal 1L	J1-29	-BO99
2 <sup>nd</sup> Next Block status for signal 2RM/2RS	J1-30	-BO4

**Table 15 – 2<sup>nd</sup> Next Block status connections for *BlockMaster* #1**

<b>Description</b>	<b><i>BlockMaster</i> #2</b>	<b>From</b>
2 <sup>nd</sup> Next Block status for signal 8R	J1-29	-BO10
2 <sup>nd</sup> Next Block status for signal 7LM/7LS	J1-30	-BO5

**Table 16 – 2<sup>nd</sup> Next Block status connections for *BlockMaster* #2**

### **Approach Lighting**

Tables 17 & 18 describe the Previous Block connections for each of the two ***BlockMasters***. For each row in the table make the connection shown in column 2 to the appropriate edge connector pin on the ***BlockMaster*** in column 1.

<b>Description</b>	<b><i>BlockMaster</i> #1</b>	<b>From</b>
Previous Block status for signal 2L	J1-9	-BO3
Previous Block status for signal 2RS	J1-8	-BO7
Previous Block status for signal 1R	J1-7	-BO0

**Table 17 – Previous Block status connections for *BlockMaster* #1**

Description	BlockMaster #1	From
Previous Block status for signal 7R	J1-9	-BO6
Previous Block status for signal 7LS	J1-8	-BO2
Previous Block status for signal 8L	J1-7	-BO9

**Table 18 – Previous Block status connections for BlockMaster #2**

The Previous Block status for the other signal heads not listed is handled internal to the *BlockMasters*.

**Signal head connections**

The following tables describe the signal head connections (using the ribbon cables) for the two *BlockMasters*. Table 19 covers searchlight signals and Table 20 covers 3-light signals. Don't forget current limiting resistors!

Pin #	BlockMaster #1	BlockMaster #2
1	Red, signal 1R	Red, signal 8L
2	Grn, signal 1R	Grn, signal 8L
3	not used	not used
4	not used	not used
5	not used	not used
6	not used	not used
7	not used	not used
8	not used	not used
9	Red, signal 1L	Red, signal 8R
10	Grn, signal 1L	Grn, signal 8R
11	Red, signal 2RS	Red, signal 7LS
12	Grn, signal 2RS	Grn, signal 7LS
13	Red, signal 2RM	Red, signal 7LM
14	Grn, signal 2RM	Grn, signal 7LM
15	Red, signal 2L	Red, signal 7R
16	Grn, signal 2L	Grn, signal 7R

**Table 19 – Searchlight signal head connections**

Pin #	<i>BlockMaster</i> #1	<i>BlockMaster</i> #2
1	SSEL1L	SSEL8R
2	SSEL1R	SSEL8L
3	SSEL2L	SSEL7R
4	SSEL2R	SSEL7L
5	not used	not used
6	not used	not used
7	not used	not used
8	not used	not used
9	GRN-M	GRN-M
10	YEL-M	YEL-M
11	RED-M	RED-M
12	not used	not used
13	GRN-S	GRN-S
14	YEL-S	YEL-S
15	RED-S	RED-S
16	not used	not used

**Table 20 – 3-light signal head connections**

**If you have any questions about this application note please contact us via email, fax, or phone.**