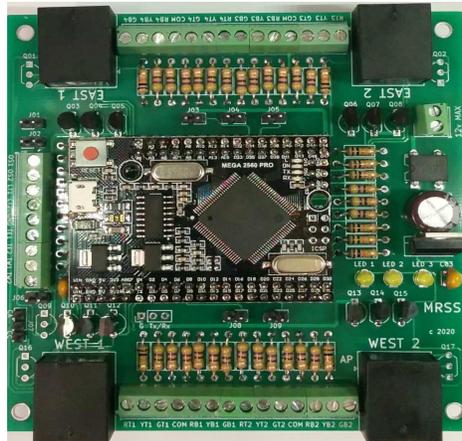


.: Model Railroad Signal Systems

CSM-2 Crossover Signal Modul



**CSM-2 Crossover Signal Module
(Signal Cascade)**

- The **CSM-2** Module has been designed to route occupancy signal bus information through a crossover protected by signals.
- Designed as a Modular Signal System Cascade to be used at a crossover with signals.
- Designed for the Modular Signal System used on Free-mo modules.
- Can be used on any layout, not just Free-mo.

Please read these instructions before you begin to ensure the installation is done correctly. Failure to properly connect the board may result in damage to the circuitry. Ensure all power is turned off before you begin the installation.

Handling of the circuit board

Use care when handling the circuit board. Most electronic circuits are sensitive to static electricity and can easily be damage. Be sure work in an area where static is not an issue.

Crossover Configurations

The 4 types of crossover configurations supported are shown in Figures 1 to 4.

The recommended placement of the signals are shown on each configuration. The turnouts are numbered so that connections to the CSM-2 Module are made correctly. The suggested infrared occupancy sensor locations are at either WEST 1 and WEST 2 or EAST 1 and EAST 2. This way a train will be detected by the infrared sensors no matter which route is selected.

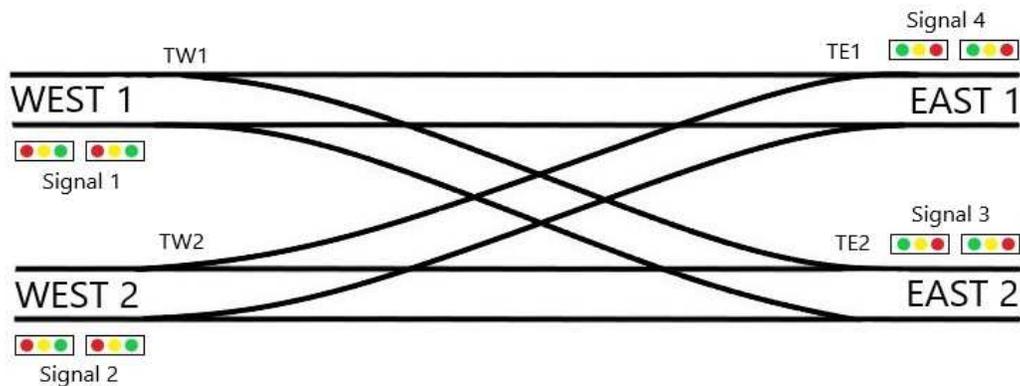


Figure 1

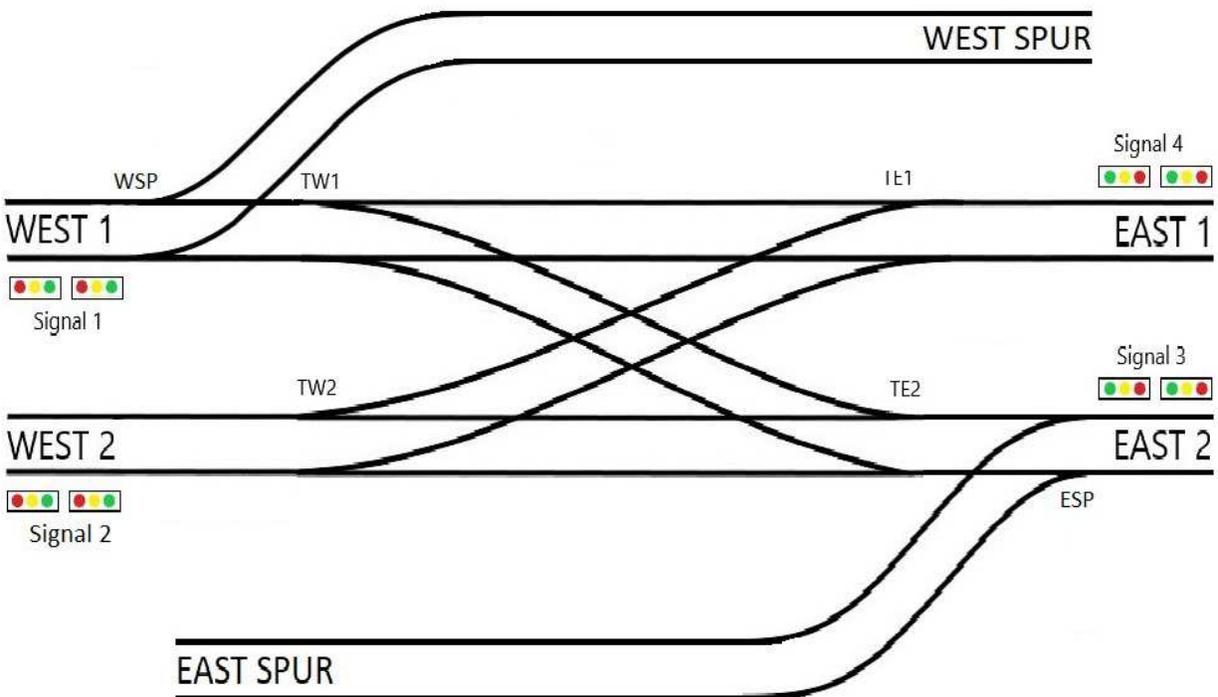


Figure 2

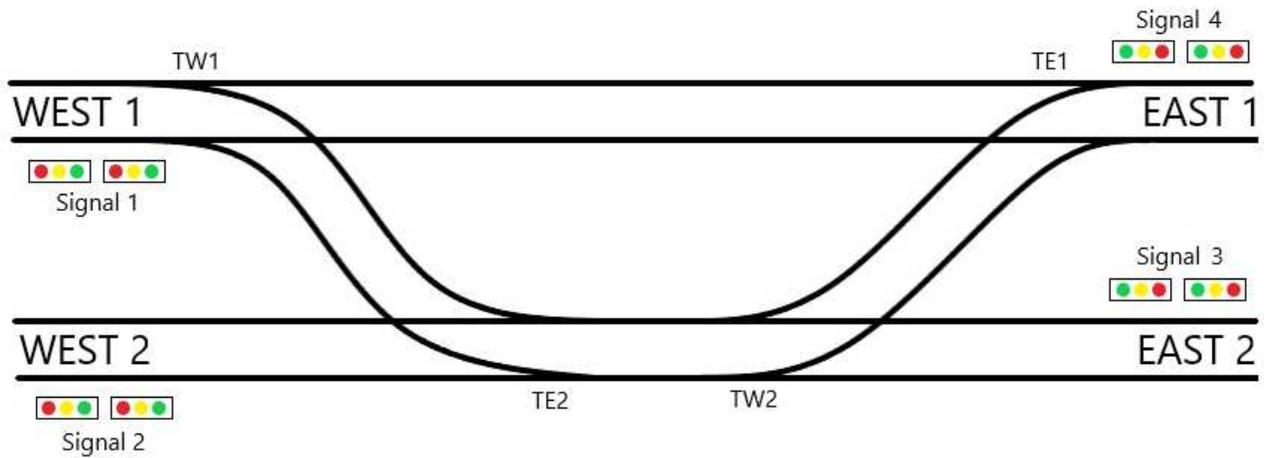


Figure 3

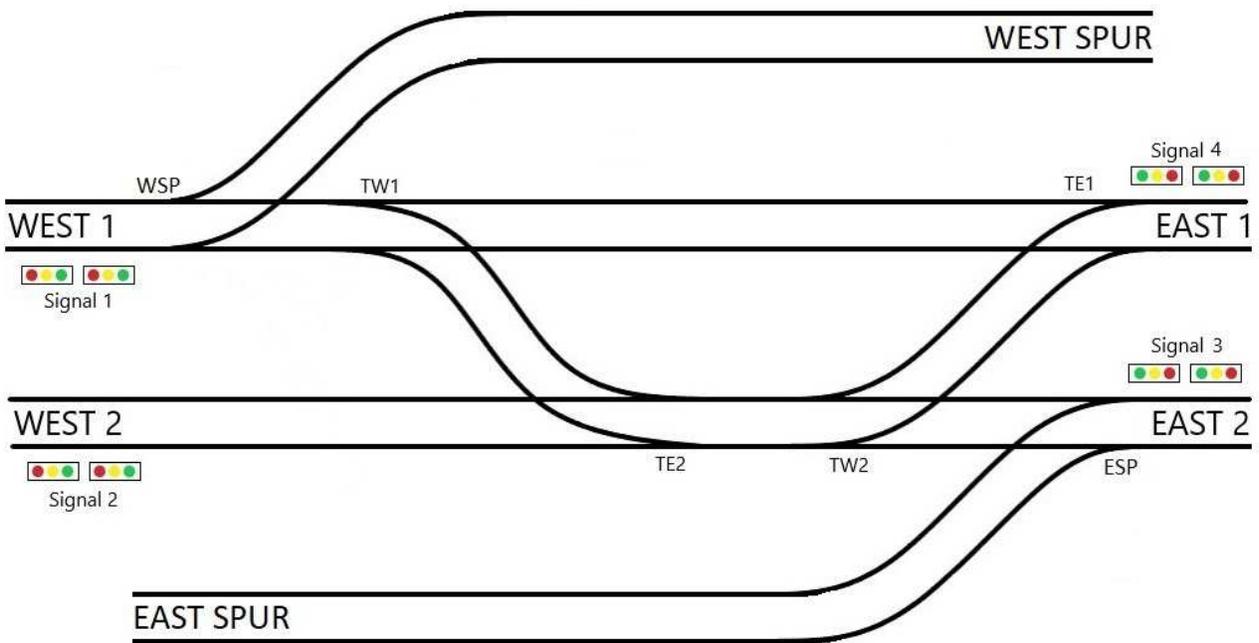


Figure 4

STEP 1 – Jumper Settings

There are nine jumpers on the CSM-2, Crossover Signal Module. The chart in Table 1 lists the different signal types and the settings for each jumper. If the jumpers are not set correctly, your signals will not operate properly.

Note:

Do not place a jumper on J01 or J02 when using OPB704WZ or modified FC-51 sensors supplied with the CSM-2 board. Doing so will burn out the IR LED within the sensor. This option is for a different style of IR sensor with built in current limiting resistors.

1	2	3	4	5	6	7	8	9	Jumper Number
On									Full 5 volts to IR sensor 2 when Jumper is on. *
	On								Full 5 volts to IR sensor 2 when Jumper is on. *
		On							2 Wire LED Signal Head (NJ International Signals)
			On						3 LED Signal Heads
			Off						2 LED Signal Heads
				On					Approach Diverging Enabled.
				Off					Approach Diverging Disabled.
					On				Approach Diverging MSS V2.0 Enabled. (Future)
					Off				Approach Diverging MSS V2.0 Disabled. (Future)
						On			Signal Heads are common lead is negative (-)
						Off			Signal Heads are common lead is positive (+)
							On		Spur siding signal feature enabled
							Off		Spur siding signal feature disabled
									Jumper 9 is for future options

Table 1

STEP 2 – Mounting the CSM-2 board

Choose an area under your Free-mo module or layout that is suitable for mounting the CSM-2 board. Keep in mind the length of your signal leads. Under or near the crossover is most likely the best place.

STEP 3– Turnout Contacts

The CSM-2 board has 4 inputs to monitor turnout positions by using contacts on the turnouts. TE1, TE2, TW1 & TW2. The contacts can be a part of the turnout motor, or any other circuit that provides a set of **closed contacts** when the turnout is in the diverted route position.

The turnout contacts are what allows the CSM-2 to divert the occupancy bus information from the approach side of each turnout to the diverted route providing your signals with realistic operation. Figures 5 and 6 show how the board should be connected to the turnout contacts depending on which track option is selected.

When Jumper 8 is not installed, track configurations shown in Figure 1 and 3 will be wired as shown in Figure 5. When Jumper 8 is installed, the signals can also be controlled by the position of the spur siding turnouts and therefore Figure 6 should be used when installing spur sidings next to the cross over.

When jumper J8 is not installed, wiring to the turnouts is as follows:

- Board TE1 to east turnout, TE1 on track 1
- Board TE2 to east turnout, TE2 on track 2
- Board TW1 to west turnout, TW1 on track 1
- Board TW2 to west turnout, TW2 on track 2

In the above configuration, all the turnout positions within the crossover are monitored individually by the CSM-2. All four inputs are required to control the signals and display the correct signal aspects when any of the four turnouts are thrown.

When Jumper J8 is installed, wiring to the turnouts is as follows:

- Board TE1 to east turnout, TE1 on track 1 and to west turnout TW2 on track 2
- Board TE2 to east spur turnout, ESP on track 2
- Board TW1 to west turnout, TW1 on track 1 and to east turnout TE2 on track 2
- Board TW2 to west spur turnout, WSP on track 1

In this configuration, the contacts of turnout TE1 and contacts of turnout TW2 are wired in parallel to CSM-2 input, TE1. The contacts for turnout TW1 and contacts of turnout TE2 are connected in parallel to the CSM-2 TW1 input.

The motors or solenoids for the grouped turnouts should also be wired in parallel so they operate together. For example, the west turnout on track 1 should operate at the same time as the east turnout on track 2 and the east turnout on track 1 should operate at the same time as the west turnout on track 2. This will ensure the points will be set correctly for the conditions displayed on the signals protecting the cross over.

If only one spur siding is used, leave the unused input to the CSM-2 disconnected. TW2 is to be connected to the spur siding turnout on the west side of track 1 and the TE2 input is to be connected to the spur siding turnout on the east side of track 2.

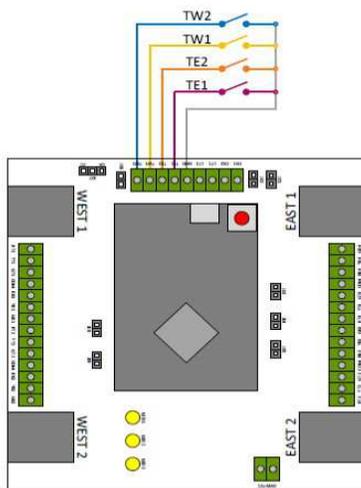


Figure 5

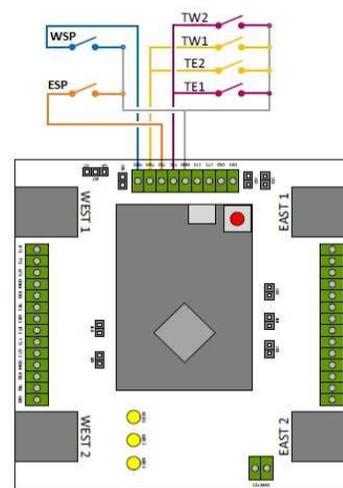


Figure 6

When the spur siding option is enabled (Jumper J8 on) The lower red signal ahead of the spur turnout will flash red when the spur turnout is thrown or a solid red aspect if the diverging turnout is not thrown. With J8 off, the lower red signal will display signal aspects for the crossover diverging route only.

STEP 4 – Signal Connections

There are several types of signals that can be connected to the CSM-2 Module. Refer to the information sheet that comes with your signals to determine which kind you have. Figure 7 below shows several different types that are compatible with the CSM-2 Module. If yours is not shown, please send me an email with your details.

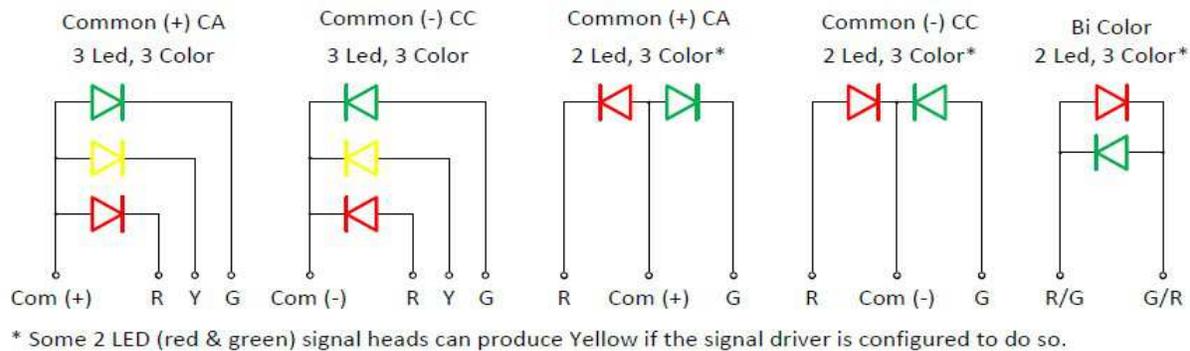


Figure 7

Terminal connections for the signals are as follows:

WEST 1 TRACK (Signal 1)

RT1 – Red led, through signal.

YT1 – Yellow led, through signal.

GT1 – Green led, through signal.

COM – Common signal wire for all 3 wire signals.

RB1 – Red led, diverging signal.

YB1 – Yellow led, diverging signal.

GB1 – Green led, diverging signal.

WEST 2 TRACK (Signal 2)

RT2 – Red led, through signal.

YT2 – Yellow led, through signal.

GT2 – Green led, through signal.

COM – Common signal wire for all 3 wire signals.

RB2 – Red led, diverging signal.

YB2 – Yellow led, diverging signal.

GB2 – Green led, diverging signal.

EAST 2 TRACK (Signal 3)

RT3 – Red led, through signal.

YT3 – Yellow led, through signal.

GT3 – Green led, through signal.

COM – Common signal wire for all 3 wire signals.

RB3 – Red led, diverging signal.

YB3 – Yellow led, diverging signal.

GB3 – Green led, diverging signal.

EAST 1 TRACK (Signal 4)

RT4 – Red led, through signal.

YT4 – Yellow led, through signal.

GT4 – Green led, through signal.

COM – Common signal wire for all 3 wire signals.

RB4 – Red led, diverging signal.

YB4 – Yellow led, diverging signal.

GB4 – Green led, diverging signal.

STEP 5 – Power Connections

The Crossover Signal Module has been designed to be powered from an AC adapter that can supply 12 volts AC or DC or a 12 volt battery. Connecting to the DCC bus for power is not recommended as this may caused false signal aspects to displayed.

Refer to Figure 8 when making power connections.

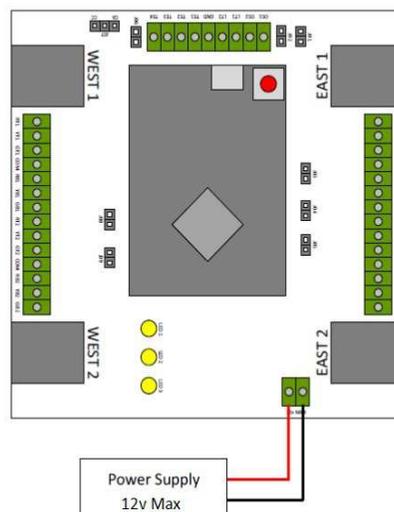


Figure 8

STEP 6 – Optical Sensor

The optical sensors are meant to be installed under the track at the approach end of each turnout just ahead of the points. Be sure not to cover the sensor with ballast or other objects otherwise the sensor will not work. Figure 9 is a cut away diagram displaying how the sensor should be mounted. Recommended location for the sensors is on the approach of the turnouts on both track 1 and 2. Both sensors should be either on the west or east side of the cross over.

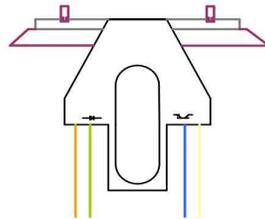


Figure 9

There are two types of sensors that may be used with the CSM-2 board. The original sensors included with the CSM-2 were the OPB704WZ as shown in Figure 10 below.

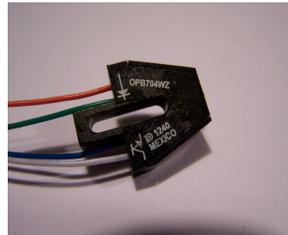


Figure 10

Connecting the OPB704WZ optical sensors should be done as follows:

- | | |
|-------------------------------------|------------------|
| Track 1 sensor output lead – White | To OS1 terminal. |
| Track 1 sensor output lead – Blue | To GND terminal. |
| Track 1 sensors power lead – Orange | To LT1 terminal. |
| Track 1 sensors ground lead – Green | To GND terminal. |
| Track 2 sensor output lead – White | To OS2 terminal. |
| Track 2 sensor output lead – Blue | To GND terminal. |
| Track 2 sensors power lead – Orange | To LT2 terminal. |
| Track 2 sensors ground lead – Green | To GND terminal. |

The second sensor included on later versions of the CSM-2 board is the FC-51 as shown below in Figure 11.

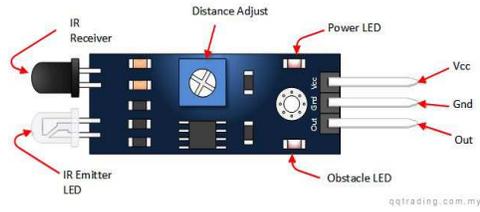


Figure 11

This sensor is connected as follows:

- | | |
|------------------------------------|-----------------------|
| Track 1 sensor output lead – White | To OS1 terminal. |
| Track 1 sensor ground lead – Black | To GND terminal. |
| Track 1 sensors power lead – Red | To Jumper J6 Pigtail. |
| Track 1 sensors Led lead – Yellow | To LT1 terminal. |
| Track 2 sensor output lead – White | To OS2 terminal. |
| Track 2 sensor ground lead – Black | To GND terminal. |
| Track 2 sensors power lead – Red | To Jumper J6 Pigtail. |
| Track 2 sensors Led lead – Yellow | To LT2 terminal. |

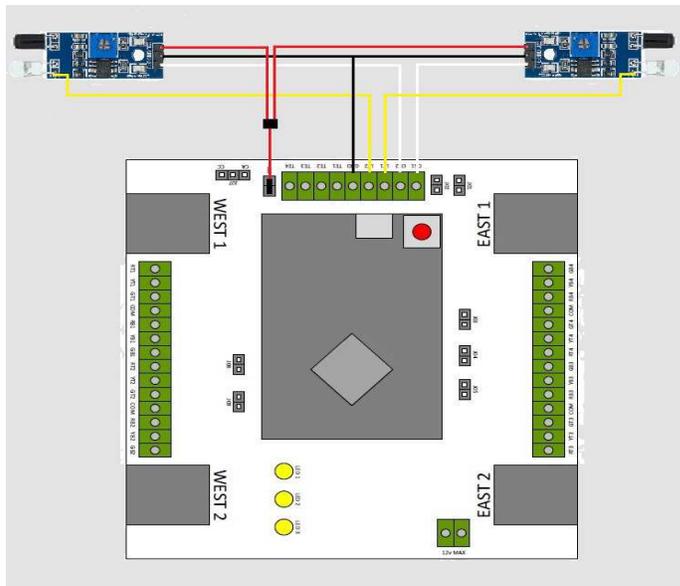


Figure 12

Auto Infrared sensing

Upon power up, the board will read the optical sensor for external sources of infrared light. (Ensure there are no trains covering the sensors during power up in order for this feature to work properly). If an external source of infrared light is present, the sensor will work in beam break mode. The infrared led on the sensor will need to be disabled by turning it off by an external switch. If no external infrared light is present, the sensor will work in beam reflect mode.

Most rolling stock have a dark non reflective surface which greatly reduces the optical sensor's ability to reflect back the infrared light it produces. This can lead to a non detected train even though the train is sitting directly over the optical sensor. There is a simple way to correct this problem. Hardware stores sell a roll of silver tape that is normally used to seal cracks in HVAC ducts. Cutting small strips off the roll and sticking them to the under side of your rolling stock provides an excellent reflective surface for the optical sensor. This is shown in the three photos in Figure 13.



Roll of silver tape



Cut strips from roll



Cut into cubes and stick to underside of rolling stock.

Figure 13

STEP 7 – Occupancy Bus

The RJ45 jacks are used to connect your Free-mo Turnout Module to other boards such as block detectors or cascade modules. This is called the Occupancy Bus. The cable type to be used between modules must be a Cat 5 cross over Ethernet cable. The use of just a strait through cable will not allow your signals to function properly.

If the module next to yours does not have a signal bus, you can extend your cable with a strait through cable as long as there is an odd number of cross over cables between circuit modules.

STEP 8 – Applying Power

The last step is to turn on the power and test your module. Double check all your connections prior to applying power. A second look can save you a lot of frustration if connections are made incorrectly.

Notes – MSS V2.0 – Occupancy Bus Pin 8

The release of MSS v2.0 has implemented a few changes to the occupancy bus. The Approach Diverging function has been added to pin 8 where prior versions of MSS has this pin tied to ground. **Please note that none of the boards created by Model Railroad Signal Systems have pin 8 tied to ground.** Pin 8 simply connects from one RJ45 Jack to the next RJ45 jack on v1.0 boards.

CAUTION: Enabling the approach diverging feature for pin 8 will cause a short if using on other MSS products that connect pin 8 to ground. This will cause damage to some of the components on the CSM board.

Notes – Approach Diverging

The CSM-2, v1.0, board can be used to display an Approach Diverging aspect on an approach signal cascade that support MSS v2. This feature is still being fine tuned and will be available at a later date through a software upgrade.

The CSM-2 board also supports approach diverging with hardware designed for previous MSS versions. This feature can be activated by adding the on board jumper J5. When the diverging route is selected, the signal for that route will display an approach aspect (not clear) as long as the block in front of the signal is not occupied. Otherwise if the block is occupied, a stop aspect will be displayed. When an approach aspect is displayed for the diverging route, an advance approach aspect will be displayed at the previous signal.

Disclaimer

All the circuits designed and posted on the Model Railroad Signal Systems website have been designed and created as a hobby. Many hours of research and development have gone into the design of each circuit so that they will operate as described without any problems.

The circuits will work as designed and will not be dangerous to persons or property when used in their intended manner. However, if you choose not to follow the installation instructions as stated above and use the circuits in any other fashion, you may pose a risk to yourself and property.

I am not responsible for any injuries or damages whatsoever that may arise from the use or misuse of these circuits as I have no control over the actions of the user or installer.

Warranty

All the circuits here are inspected and tested before they are shipped. If there is a defect due to manufacturing or programming, I will gladly replace your board for a new one within 90 days of purchase.

Misuse, abuse, or the use of cheap power supply to power these circuits which will cause damage to the board, is not covered by warranty. If you have any doubts about the use of any type of power supply, please contact me before applying power to your board.

Questions or Comments

If you have any questions or comments please send them to me by using the email address on the Model Railroad Signal Systems Website.