

# Cross Hare Installation Guide

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**Introduction:** The Cross Hare is designed to provide all of the functions you need to control a one or two track grade crossing in a prototypical manner. The Cross Hare uses up to 8 optical sensors for train detection and to control the sequencing of the crossing. While the Cross Hare is designed to work with a dual track crossing, you can also use it with a single track crossing by only using 4 of the sensors. The Cross Hare will automatically detect whether it needs to watch one or two tracks. Should you not want to use the optical sensors, the Cross Hare will also operate using a simple on/off input such as from a block detector output (e.g. DCC Specialties Block Watcher).

## The Cross Hare for Gates Kit includes:

- 1 Cross Hare Control Board
- 1 Cross Hare Interface Board
- 1 Connection Wire Harness [Connect Cross Hare to Interface Board]
- 1 Tomar H-863B Crossing Gate Signal Kit
- 1 TDS 28mm Bass Speaker
- Tort Conn Edge Connector
- Circuitron Tortoise 800-6000
- Circuitron Activator 800-8100
- Circuitron Actuator 800-8101
- 4 Optic Cross Hare sensors. More can be purchased separately for double track configurations.



## Mounting the Crossing Gate Signals

Drill a 1/8" hole and glue the signal in place on the layout. The prototype is located with the gate 90 degrees to the highway and placed 12-17 scale feet from the center line of tracks and 24" minimum clearance from the highway curb.

Follow Circuitron's instructions for mounting the motor, activator and actuator.

## Adding Decals:

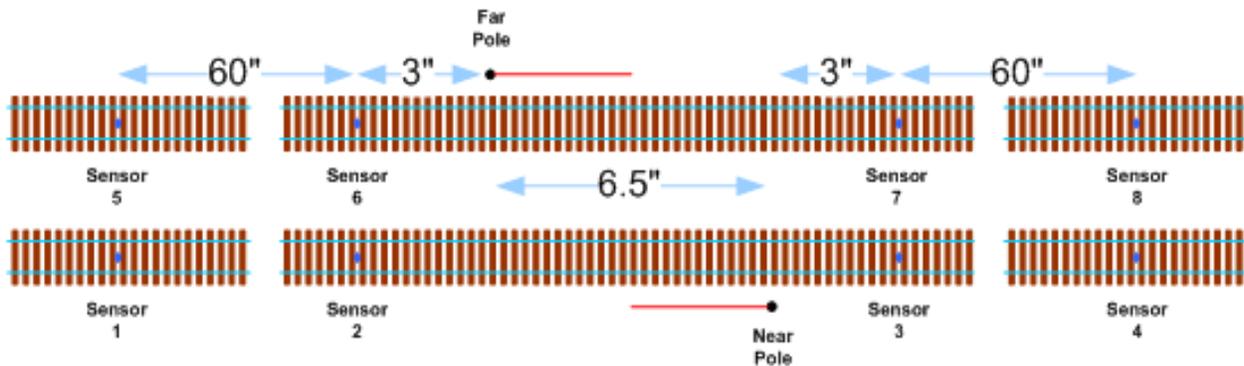
- Tomar has supplied these Crossing Signals with Red/White and Black/White decals for the gates and the number of tracks in order to give the modeler a choice of color and numbers to accommodate their railroad needs.
- The decals will have to be cut in two length wise strips. The decals are slightly oversized. They should be cut to fit width and length of the gate. Use a decal setting solution for adhering the decal to the gate.

# Working with the Cross Hare

The normal usage of the Cross Hare is to simply run a train through the crossing and watch the Cross Hare do its job. The initiation sequence takes approximately 8.5 seconds to complete, and it starts when an outer sensor is crossed. Hence, with the outer sensor 60" out, **you do not want to approach the crossing at anything more than 35 SMPH (scale miles per hour), otherwise your train will enter the roadway before the gates are fully down.** You won't hurt anything, but it does not look realistic. Conversely, the Cross Hare allows you 50 seconds to make the nearest gate. This time limit is to allow you to simulate prototype performance in which an active crossing will go inactive if the train stops short of the crossing. Hence, you have to go 60" in no more than 50 seconds, for a minimum speed through the crossing of 6 SMPH. If you stay within these speed limits and run through the crossing, the Cross Hare will give you an excellent simulation of the prototype.

If you go too slow or stop short of the roadway, the Cross Hare will raise the gates after about 50 seconds. After the gates go up, the crossing will remain inactive until one of the inner sensors (Sensor 2, Sensor 3, Sensor 6, or Sensor 7) is covered. If one of these sensors covers, then the crossing will go active again. When this happens, the sensor delays are set to their maximum values to allow you to run switching operations through the crossing at slow speeds. One thing to remember: there is always a background timer that expires 2 minutes after there is no sensor cover/uncover activity. This is to allow a train to enter the crossing section, stop, and then reverse and leave without moving across the roadway. After 2 minutes, the crossing automatically resets and is waiting for the next train.

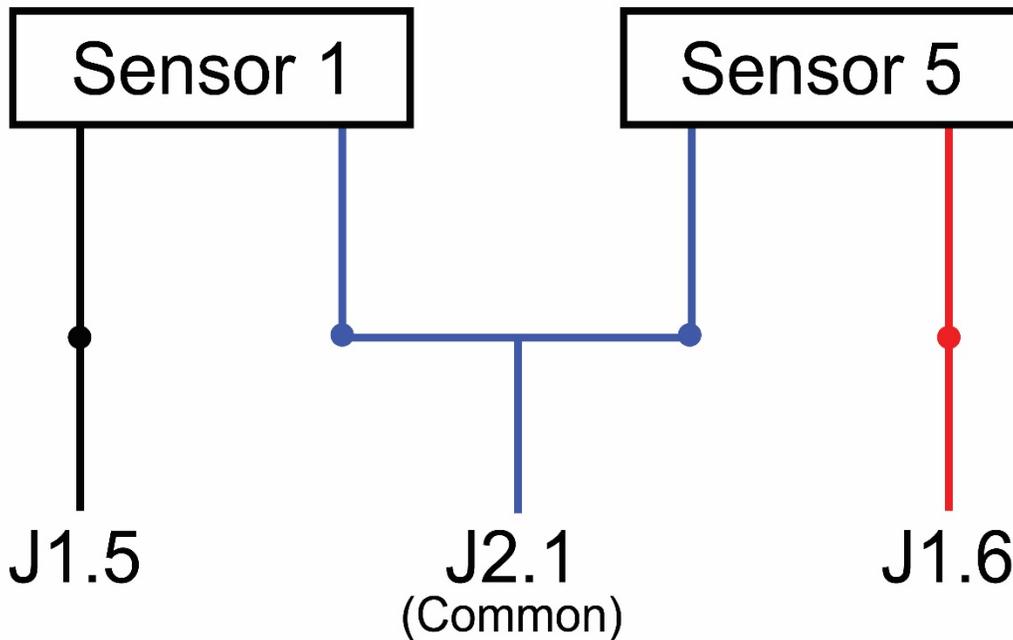
**Figure 1. Double Track Grade Crossing**



- 1) There are many ways to install the crossing gates depending on the road configuration that is passing over the tracks.
  - a) Figure 1 shows how to orient the optical sensors relative to the crossing gate poles.
  - b) Regardless of how you place the gates relative to each other, Sensor 2 (6) wants to be 3" to the left of the far pole position
  - c) Sensor 3 (7) wants to be 3" to the right of the near pole position as shown in Figure 1.
  - d) Sensor 1 (5) should be placed 60" to the left of Sensor 2 (6)
  - e) Sensor 4 (8) should be placed 60" to the right of Sensor 3 (7).
- 2) You can use either Sensor group for either track
- 3) Either group can be used for a single track crossing.

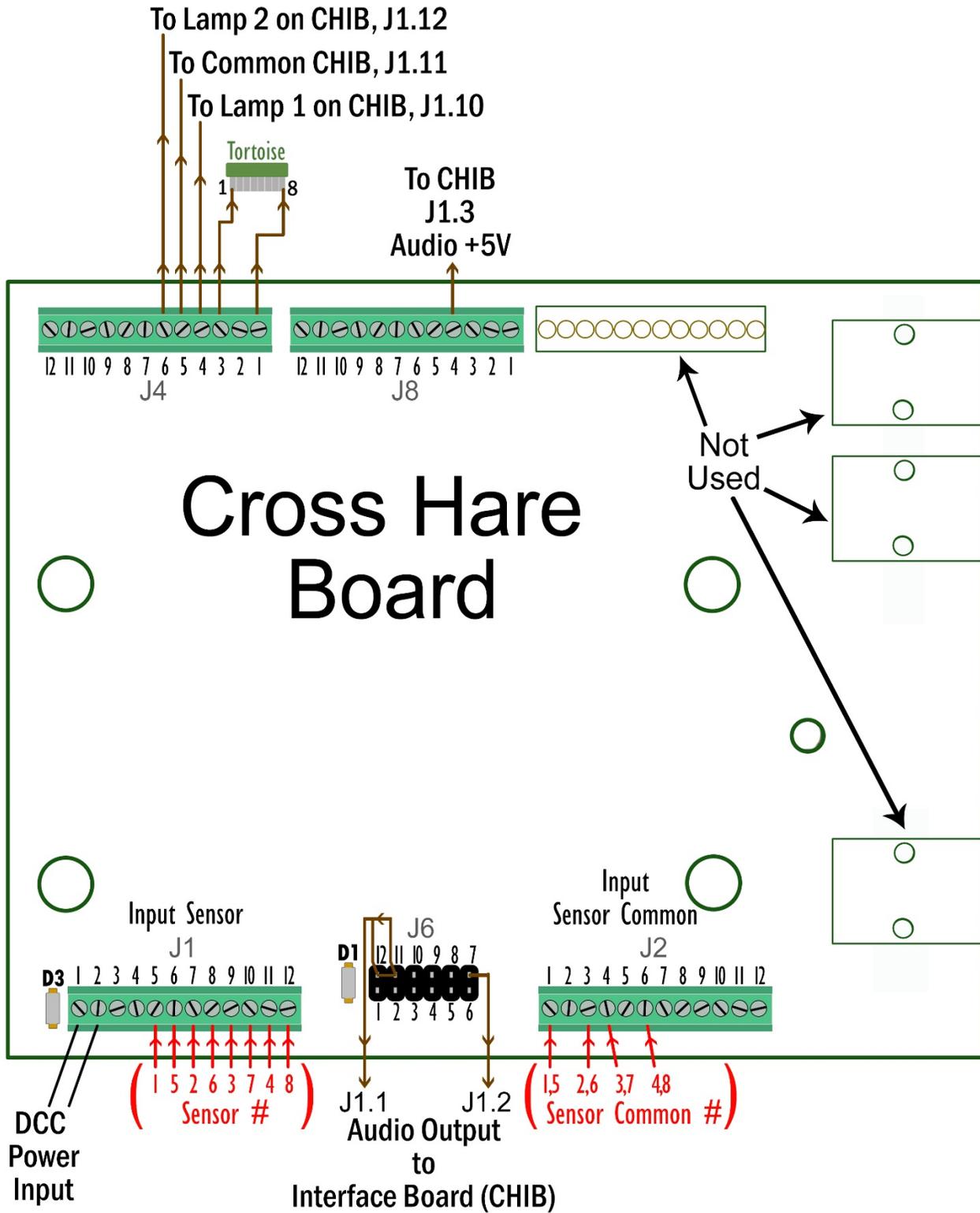
- 4) You can invert the sensor sequence (e.g. 4, 3, 2, 1 from left to right) as long as they remain in either ascending or descending order.
- 5) The distances given are not critical, but you should attempt to match them within a tie or two because the Cross Hare uses the known position of the sensors to sequence the crossing correctly. The same is true of the rail distance between the two gate poles. Try to keep it at around 6.5 inches, but an inch or two either way should be OK.
- 6) The sensors are mounted between the ties of the track. If your room is reasonably bright, or if you provide auxiliary light at each sensor (such as a street light, platform light, etc.) it is possible to cover the sensors with a thin layer of ballast to hide them. Generally, you probably won't notice them even if they are exposed to room light, which will give the best performance.
  - a) Use a #60 drill to create two holes through the roadbed that are about 0.10" (3/32") inches apart and roughly centered between the rails.
  - b) Insert the sensor leads in the holes and gently press the sensor between the ties.
  - c) You can then either solder a wire to each sensor lead or use a socket strip (Digikey part 952-1938-ND) to plug onto the sensor leads. Either way, you want to use a twisted pair of wires (single track) or three wires twisted together (two tracks) for each sensor position.
  - d) The easiest way to get twisted wires is to use a drill.
  - e) Select your three wires slightly longer than you need
  - f) Chuck them in a drill and have a friend or bench vise hold the other end.
  - g) Run the drill until you get about 6 twists per foot.
  - h) Select a color for the common wire, another for Sensor 1 and the remaining color for Sensor 5

**Figure 2. S1, S5 Sensor Wiring Diagram**



- i) Connect a lead from Sensor 5 to a lead from Sensor 1. It doesn't make any difference which lead you select; the sensors are not polarity sensitive.
- j) Connect the common color wire to the junction of the Sensor 1 and Sensor 5 leads.
- k) Connect the Sensor 1 color wire to the remaining Sensor 1 lead and the Sensor 5 color wire to the remaining Sensor 5 wire.

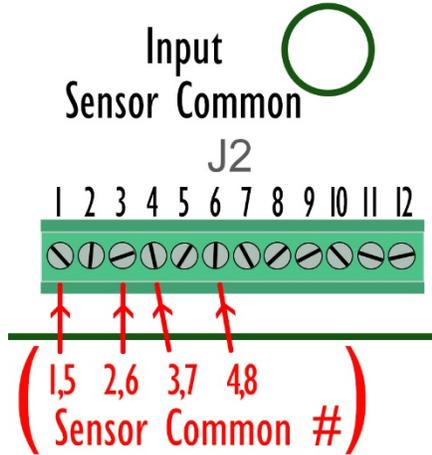
Figure 3. Cross Hare Diagram



- 7) Run the sensor cables to the Cross Hare and connect the common wire to J2-1.
  - a) If you are running wiring for a single track, connect either wire to J2-1.
  - b) Connect the Sensor 1 colored wire to J1-5 on the Cross Hare

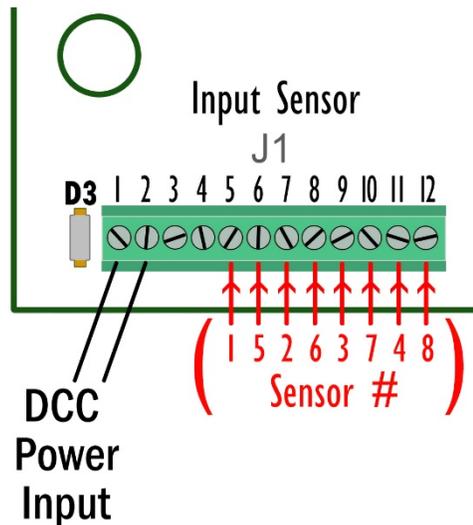
- c) Connect the Sensor 5 color wire to J1-6.
- 8) Repeat this for the remaining three groups (or individual) sensors.
  - a) The 2/6 common wire connects to J2-3.

**Figure 4.**



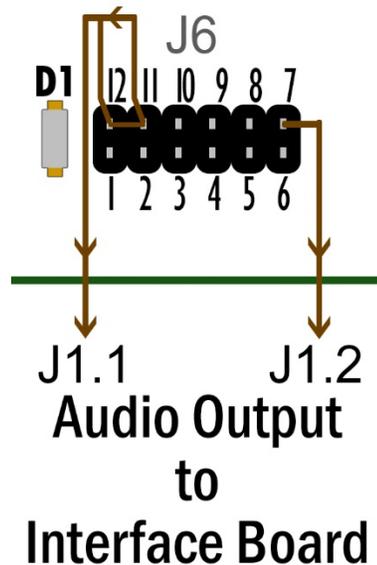
- b) The 3/7 common wire connects to J2-4.
- c) The 4/8 common wire connects to J2-6.
- d) Sensor 2 connects to J1-7
- e) Sensor 6 connects to J1-8
- f) Sensor 3 connects to J1-9
- g) Sensor 7 connects to J1-10
- h) Sensor 4 connects to J1-11
- i) Sensor 8 connects to J1-12.
- 9) The sensor group 1, 2, 3, and 4 connects to J1-5, J1-7, J1-9 and J1-11 in order.

**Figure 5.**



- 10) The sensor group 5, 6, 7, and 8 connects to J1-6, J1-8, J1-10, and J1-12 in order. If you are wiring a single track crossing, you can use either group on the J1 connector.
- 11) The J6 Audio Output is connected to the Interface Board via the Wire Connection Harness. See Diagram below.

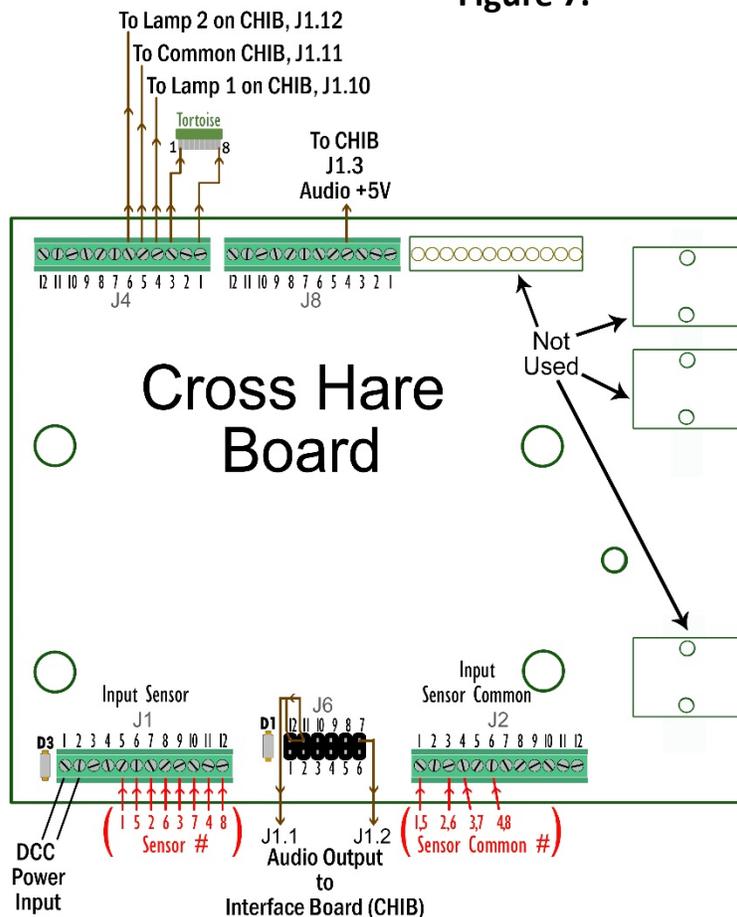
**Figure 6.**



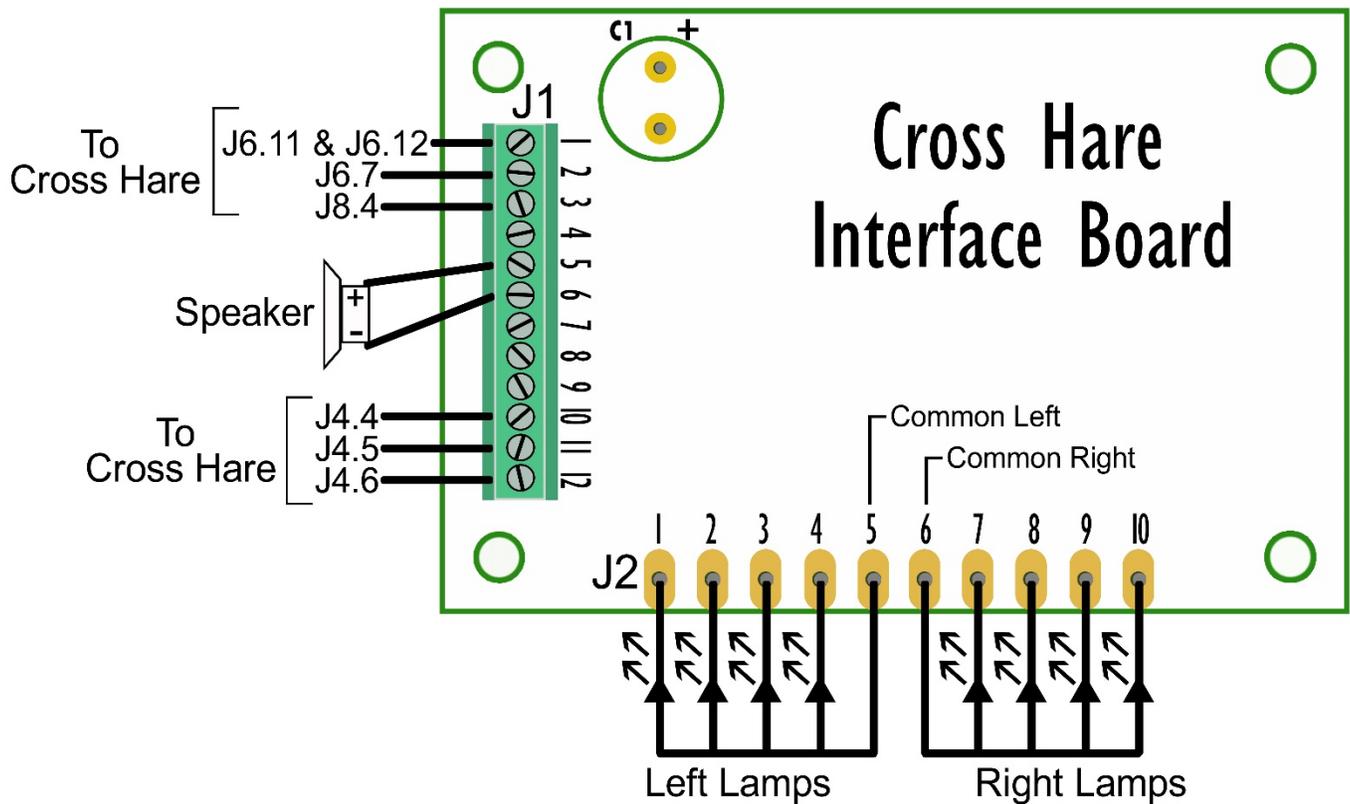
- 12) The Cross Hare has a provision to help you check your sensor wiring.
  - a) Install the small jumper connector on the SWD pair of pins on the J6 connector.
  - b) Apply power to the Cross Hare by connecting DCC1 and DCC 2 (pins 1 and 2 of J1) to either a DCC or approximately 12VDC power source.
  - c) D3 should come on indicating power is present, but D1 should be off.
  - d) Use a railcar (or your hand, or any other light blocking device) to cover Sensor 1. D1 should turn on.
  - e) Now remove the covering device and D1 should go out.
  - f) Repeat the cover/uncover sequence a couple of times and make sure that D1 flashes on and off in synch with your covering/uncovering the sensor.
  - g) Repeat the test for each of the sensors that you installed.
  - h) If a sensor does not work, check its wiring. If you have an ohmmeter, you can also check your sensor wiring. In normal room light, the sensors will read between 400 and 1000 ohms. When you cover them, it should increase by a factor of 10 or more, depending on how well you cover them.
- 13) Option Selection: The Cross Hare has three “option enable” connections. Connecting an option input to any one of these connections will enable the option. The option enable connections are J2-2, J2-5, and J2-11.
  - a) By default, the crossing flashers will simulate incandescent lamps. They will quickly fade on and then slowly fade off. If you want the flashers to simulate more modern LED lamps, then connect an option enable to J2-12.
    - i) For example, connect J2-2 to J2-12. With this connection, the flashers will turn hard on and then hard off.

- b) Use of the warning bell varies in different parts of the country. In the northeast, many crossings sound the warning bell continuously as long as the crossing is active. This is the default warning bell operation of the Cross Hare. In other parts of the country, the warning bell will sound until the gates are fully down, and then it will stop. The bell will remain silent until the gates start up again. The warning bell will then sound until the gates are fully up. If you prefer this type of operation, then connect an option enable from J2-5 to J2-10.
- 14) In some track configurations, there may be a need to trigger the crossing from some other track such as a siding or yard in addition to the main route through the crossing. In this case, you can add a sensor in series with Sensor 1, Sensor 4, Sensor 5, and/or Sensor 8 as required to accommodate these extra tracks. If you do add extra sensors, connect an option enable from J2-11 to J2-9. This tells the Cross Hare that it needs to look for two sensors at these locations. In an extreme case, you can double up on all eight sensors to cover a four track main. If you do this, the Cross Hare may not be quite as tolerant of lighting variations, but it will work fine with normal room lighting.
- 15) If you do not want to install all of the optical sensors, you can still operate the Cross Hare from a single discrete. The discrete trigger + terminal is J2-8, and the discrete – terminal is J2-7. If you do not have sensors installed, connecting these two points together through a switch (block detector, JMRI controlled switch, etc.) will activate the crossing. Opening the switch will cause the crossing to deactivate.
- 16) If you have at least four optical sensors installed, then the J2-7 to J2-8 connection will reset the crossing if the connection is closed (it should normally remain open in this case). The reset will place the Cross Hare into its initial condition of waiting for one of the outer sensors to cover indicating that a train is coming. The reset can be controlled manually, by a block detector, or any other method that creates a connection.

**Figure 7.**



**Figure 8. Cross Hare Interface Board (CHIB)**



### Cross Hare Interface Board

- 17) The Cross Hare Interface Board [CHIB] is designed so the user can connect the Cross Hare's light and audio outputs in a convenient and organized manner. The CHIB's J1 terminal is used for the outputs from the Cross Hare.
- 18) Cross Hare Terminal J4 connections:
  - a) Cross Hare J4.6 to CHIB J1.12
  - b) Cross Hare J4.5 to CHIB J1.11
  - c) Cross Hare J4.4 to CHIB J1.10
- 19) Cross Hare Terminal J8 connections:
  - a) Cross Hare J8.4 to CHIB J1.3
- 20) Cross Hare Terminal J6 connections:
  - a) Cross Hare J6.7 to CHIB J1.2
  - b) Cross Hare J6.11 & J6.12 to CHIB J1.1
- 21) The CHIB's J2 terminal is used for the lighting outputs. The Cross Hare's lighting output is designed to drive 3v. No resistors are necessary when using the Tomar Highway Grade Crossing kits.
- 22) Pins J2.1, J2.2, J2.3, J2.4 are Left Lamp Negative [-]
- 23) Pin J2.5 is Left Light Common [+]
- 24) Pins J2.7, J2.8, J2.9, J2.10 are Right Lamp Negative [-]
- 25) Pin J2.6 is Right Light Common [+]
- 26) The CHIB's J1.5 [+] and J1.6 [-] pins are the speaker outputs.