Getting started
Thank you for purchasing a Logic Rail Technologies product! Please familiarize yourself with all the instructions prior to installing this board. The Grade Crossing Pro/2 (versions GCP/2, GCP/2-IR, and GCP/2-X) provides prototypical operation of a grade crossing. The crossing signal outputs can be used with common anode LED signals (e.g., Tomar, NJ International, Walthers and others) or older bulb types. There is a separate output for an end-of-gate-arm light. Outputs are provided for 1-2 Tortoise motors and servo motors to drive the gate arms. Four sensors (photocells or infrared emitters and detectors) are used for bidirectional train detection. External detectors (available from other suppliers) can also be used. The layout of the sensors is illustrated below. You MUST install the sensors in the exact order (WF-WN-EN-EF) shown!

What is different from the original version of the Grade Crossing Pro (GCP and GCP-IR)?

- Signal outputs are turned on in sequence (Left → Right → End-of-gate arm), briefly, when power is first applied to the board. This gives you a quick test of the signals to make sure all the connections are correct and the signals work!
- There are individual sensor status indicators on the circuit board. These not only help you when first setting up the board but are also active when in “operating” mode.
- There is no need to swap chips on the board if you want to use a photocell, infrared between-the-rails, infrared across-the-rails, and external detectors. However, you will need to decide which sensor type (photocell or infrared), if any, you want at the time of purchase. Both sensor types are still available separately (#PCELL or #BTR-IR4) if you want to change types!
- The board is also offered without sensors (version GCP/2-X) for use with other brands of external detectors.
- The infrared detection method has been improved and no longer has strict limits on the incoming voltage. **NOTE: the IR emitter wiring is different from the previous generation product!!! Please pay close attention to this.**
- We added an End-of-Gate arm LED output which is on continuously when the signals are flashing.
- We added support for servo motors to operate gate arms; there are separate outputs for Tortoise ™ motors.
- The board has a socket for a grade crossing bell module. We are offering different versions (classic, electronic, fast, Griswold) under our own brand. The bell sound will fade off as the signals stop flashing.
- There are different “timing” options for lowering the gates and when the bell should be ringing.
- Use the Grade Crossing Pro/2 Expander to handle an additional track for multi-track crossings.

How does it work?
An eastbound (left to right) train will cause the signals to begin flashing when the WF sensor is activated. If a bell module is attached it will start ringing then too. If crossing gates are being used (GATES USED switch ON) then after a short delay (see GATE DELAY switch description further down) the gate motor outputs will turn on and the gates will lower. The signals will continue to flash even if the rear end of the train clears the WF sensor as long as the front end of the train reaches the WN sensor within 35 seconds. Assuming the train does this and then subsequently reaches the EN sensor the signals will continue flashing. Approximately 2 seconds after the rear end of the train clears the EN sensor the gate motor outputs will shut off and the gates will begin to rise. Approximately 3 seconds later the signals will stop flashing and the bell will stop ringing. If no gates are used (GATES USED switch OFF) then the signals will stop flashing and the bell will stop ringing approximately 2 seconds after the rear end of the train clears the EN sensor. There are other “timing” options related to the operation of the bell (BELL MODE and BELL SHUTOFF switches); these are described later in these instructions.
If the train had not reached the WN sensor within 35 seconds of clearing the WF sensor then the Grade Crossing Pro/2 will assume the train has reversed. This “timeout” will cause the “action” to shut off as previously described above. Similar behavior exists for a westbound train with respect to sensors EF, EN and WN (shut off occurs after the last car clears the WN sensor). The WF and EF sensors may be located as far away from the crossing as you would like. If you are installing gates then putting these farther out will give the gates enough time to lower before the train reaches the crossing. An HO scale train running a scale 40 MPH would cover 12 inches in about 1.5 seconds. You will likely choose to have your gates lower in approximately 4 seconds. So, that would suggest that you should locate WF and EF around 36 inches from the crossing; consider more distance if you’re running faster trains or less distance if you’re running slower trains! If you are NOT installing gates then you can choose to place WF and EF wherever convenient and whatever amount of advance notice you want to give your scale motorists before the train reaches the crossing!

You should make all of the connections to the Grade Crossing Pro/2 before applying power to it. You can mount the Grade Crossing Pro/2 anywhere it is convenient underneath your layout using the four mounting holes provided. The holes will accept #4 screws; do not enlarge the holes as damage to the circuit board can result and your warranty will be voided!

The Grade Crossing Pro/2 board has a set of 9 configuration switches on it. Each switch is briefly described below with more details later in these instructions.

<table>
<thead>
<tr>
<th>Switch Name</th>
<th>Meaning when OFF/OPEN</th>
<th>Meaning when ON/CLOSED</th>
</tr>
</thead>
<tbody>
<tr>
<td>SETUP</td>
<td>GCP/2 is in normal operating mode</td>
<td>GCP/2 is in sensor setup mode</td>
</tr>
<tr>
<td>TRUE LAMP2</td>
<td>Signals don’t fade on/off (like modern signals)</td>
<td>Signals fade on and off (like older signals)</td>
</tr>
<tr>
<td>SEN TYPE</td>
<td>Sensors are photocells or external current detectors</td>
<td>Sensors are infrared</td>
</tr>
<tr>
<td>SEN POL</td>
<td>See text in the Sensor Modes section</td>
<td>See text in the Sensor Modes section</td>
</tr>
<tr>
<td>FLASH RATE</td>
<td>Normal flashing rate</td>
<td>Fast (2X) flashing rate (see page 3)</td>
</tr>
<tr>
<td>GATES USED</td>
<td>Crossing gates are NOT used</td>
<td>Crossing gates are used</td>
</tr>
<tr>
<td>GATE DELAY</td>
<td>Signals flash for ~3 seconds before gates lower</td>
<td>Signals flash for ~1.5 seconds before gates lower</td>
</tr>
<tr>
<td>BELL MODE</td>
<td>The bell rings continuously while the signals are flashing</td>
<td>The bell rings only when the gates are moving up or down (must also have GATES USED ON)</td>
</tr>
<tr>
<td>BELL SHUTOFF</td>
<td>The bell shuts off when the flashing stops</td>
<td>See text in the Bell section</td>
</tr>
</tbody>
</table>

**Wiring Tomar’s LED-based crossing signals**

Tomar’s LED-based crossing signals are pre-wired in a common anode (positive) manner. Since these are dual-sided signals (i.e. LEDs on both sides of each signal mast) there are 2 yellow and 2 red wires (one from each LED’s cathode) and one common white wire. Figure 1 below shows you how to wire ONE signal. The Grade Crossing Pro/2 will support two dual-sided signals; if you are using two signals then simply replicate the wiring shown for the second signal. Note that EACH LED connection requires a current limiting resistor. The value of the resistor is dependent upon the voltage applied to the GCP. You can use Table 1 to determine the MINIMUM resistor value. You can always substitute a ½ watt resistor for a ¼ watt resistor. You can always use a higher value resistor (i.e. more OHMS!) if your signals are too bright to your liking.

<table>
<thead>
<tr>
<th>Voltage supplied to GCP/2</th>
<th>Minimum Resistor Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>9V DC</td>
<td>390 ohm, 1/4W</td>
</tr>
<tr>
<td>12V DC</td>
<td>470 ohm, 1/4W</td>
</tr>
<tr>
<td>14V DC</td>
<td>680 ohm, 1/4W</td>
</tr>
<tr>
<td>7V AC</td>
<td>390 ohm, 1/4W</td>
</tr>
<tr>
<td>9V AC</td>
<td>560 ohm, 1/4W</td>
</tr>
<tr>
<td>12V AC</td>
<td>1K ohm, 1/4W</td>
</tr>
<tr>
<td>16V AC</td>
<td>1.2K ohm, 1/4W</td>
</tr>
</tbody>
</table>

Table 1 – Current limiting resistors
Wiring other LED-based crossing signals (including Walthers)

If you are using another brand of LED-based crossing signals, or are scratch-building your own, you MUST wire them in a common anode (positive) manner. **NOTE:** some manufacturers use a black wire for the common wire but that does NOT mean that it is a negative or ground wire! Figure 2 at right shows you how to wire ONE single-sided signal; if you are using multiple signals, or dual-sided signals, simply duplicate the wiring shown for the additional LEDs. Each of the Grade Crossing Pro/2’s signal outputs can handle loads up 180mA (~12 LEDs). Note that EACH LED connection requires a current limiting resistor. The value of the resistor is dependent upon the voltage applied to the Grade Crossing Pro/2. You can use Table 1 above to determine the minimum resistor value. Note that some of the resistors can be ¼ watt whereas others must be ½ watt. You can always substitute a ½ watt resistor for a ¼ watt resistor but you CANNOT substitute a ¼ watt resistor for a ½ watt resistor!

Wiring bulb-based crossing signals (e.g. NJ International)

Crossing signals constructed with bulbs do not have a polarity like LED-based signals do. However, some bulb-based signals may be pre-wired with a common wire. If your signal does not, then you will simply create a common connection from one lead of each bulb (it doesn’t matter which lead is used). Figure 3 at right shows you how to wire ONE single-sided bulb-based signal. The Grade Crossing Pro/2 will support two dual-sided signals; if you are using multiple signals, or dual-sided signals, simply duplicate the wiring shown for the additional bulbs. Note that current limiting resistors are shown. These are only required IF the voltage provided to the Grade Crossing Pro/2 is greater than the rating on the bulbs; most bulbs are rated at 12V AC or DC but you should check the instructions that come with the signal. If the Grade Crossing Pro/2 voltage source exceeds the bulb rating then add current limiting resistors as shown; we recommend a value of 100Ω, ¼ watt.

Flashing effects (True Lamp2 and Flash Rate)

As shown in the table on page 2 the Grade Crossing Pro/2 has two configuration switches related to the crossing flasher outputs (LO and RO). The first is **TRUE LAMP2.** When this switch (#2) is in the ON position the LO and RO outputs will fade on and off which emulates older prototype crossing signals (when they used light bulbs). When this switch is OFF the LO and RO outputs will simply turn on and off during the flashing activity; this setting emulates newer prototype crossing signals which may use LEDs. If you are using bulb-type model railroad crossing signals we strongly suggest that you keep this switch OFF.

The other flashing effect is the flash rate itself. The normal flash rate is selected when the FLASH RATE switch (#5) is in the OFF position. If you prefer the faster (2X speed) rate you MUST have BOTH the FLASH RATE switch in the ON position AND have the TRUE LAMP2 switch in the OFF position. As such you CANNOT have the faster flash rate and the signal on/off fading effect at the same time.

End-of-Gate (EOG) LED

The Grade Crossing Pro/2 has a separate output (EOG) which can be used to turn on an LED wired to the end (tip) of a crossing gate. Like the prototype crossing gates, this output will be active (on) whenever the signals are flashing. It will be on steady (the True Lamp2 configuration switch setting does not affect it). You will wire this LED just like the LO or RO LEDs shown in Figures 1 and 2. Don’t forget the current limiting resistor! This output can handle loads up 180mA (~12 LEDs).
Wiring a slow motion motor to drive a crossing gate

The *Grade Crossing Pro/2* will directly drive a slow motion motor that is typically used with crossing gates such as those from Tomar. Figure 4 shows how the *Grade Crossing Pro/2* is connected to a motor; the *Grade Crossing Pro/2* can drive a max of two motors (one per gate if you prefer to use separate motors). If the gates are raised when the signals are flashing and lower when the signals are not flashing then you simply need to reverse the motor connections. You can adjust the speed of the gate motor on the *Grade Crossing Pro/2*. Using a flat blade screwdriver insert it into the gate speed adjustment pot (from the top of the circuit board). Turning the screwdriver clockwise will increase the gate speed while turning the screwdriver counter-clockwise will decrease the gate speed. You **MUST** have the GATES USED configuration switch in the ON position!

**NOTE:** You must check the instructions for your gate motor to determine the maximum voltage that the motor can accept. For example, Tomar uses Circuitron’s Tortoise™ which has a maximum voltage rating of 12V DC or AC. If the voltage provided to the GCP is greater than the rating on the motor then you will need to add a current limiting resistor (we recommend a value of 390Ω, ½ watt) in the connection path between one of the *GCP/2’s* GM outputs and the turnout motor.

Wiring a servo motor to drive a crossing gate

Sensor modes

The *Grade Crossing Pro/2* supports four different sensor (detector) modes: photocell, between-the-rails infrared, across-the-rails infrared, and external detector. When you purchased this product it either came with photocells, infrared components or neither (board only, for use with external detectors). The sensor mode is selected using the switches labeled SEN_TYPE and SEN POL as depicted in Table 2 below.

<table>
<thead>
<tr>
<th>Sensor Mode</th>
<th>SEN_TYPE</th>
<th>SEN POL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Photocell</td>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>Between-the-rails Infrared</td>
<td>ON</td>
<td>ON</td>
</tr>
<tr>
<td>Across-the-rails Infrared</td>
<td>ON</td>
<td>OFF</td>
</tr>
<tr>
<td>External Detector</td>
<td>OFF</td>
<td>ON</td>
</tr>
</tbody>
</table>

**Table 2 – Sensor mode selection**
Using photocells for train detection

The photocells should be mounted between the rails in the general area where you will locate the signal. Drill a 9/64” hole through the ballast, roadbed, and sub-roadbed. For the smaller scales this drilling may end up hitting the ties. Take your time so you don’t mangle them! Figure 5 illustrates the placement of a photocell in between the rails. Insert the leads of the photocell into the hole from the top of your layout. One of the photocell leads has a piece of insulation on it so be sure the two leads don't touch each other! If the leads do not protrude enough from the underside of your layout then it will be necessary to extend the leads; soldering wires to them is the most common method; make sure you insulate any connections you make to the photocell leads so that they don't short out. Once you have wired the photocells to the Grade Crossing Pro/2 and verified their operation you may wish to put a dab of white glue under the photocell to hold it in place; make sure you don't get glue on the top surface of the photocell as this may prevent it from operating properly. Figure 6 illustrates the photocell wiring; make sure you have the photocells in the correct order as shown at the top of page 1. Photocells do not have any polarity so you can connect either lead to the GND terminal and connect the remaining lead to the appropriate photocell input.

Photocells require a light source above them to function properly. On most layouts the room lighting should be sufficient. However, if the photocells are located in an area that doesn't get much overhead lighting or if you have simulated "nighttime" operations then it will be necessary to locate light sources on the layout near the photocells. Streetlights and yard lights are common light sources. Locate the light sources slightly to the left or right of the photocells and not directly over them; this will allow the Grade Crossing Pro/2 to still properly detect a train that has stopped over any photocell with the gap between cars over a photocell.

Photocell sensitivity setup

You can adjust the sensitivity of each photocell on the circuit board using a small slotted head screwdriver. Along one each of the board are four potentiometers (or “pots”) that are labeled "WF", “WN”, “EN” and “EF”. The Grade Crossing Pro/2 supports a SETUP mode to make this adjustment process easier. To enable this mode, you must have the switch labeled SETUP in the ON/CLOSED position as shown in Figure 7. In this mode the signals will not flash. The Grade Crossing Pro/2 circuit board contains four sensor status LEDs; one near each of the four adjustment pots. These LEDs will assist you in setting the photocell sensitivity.

Now follow these steps after you have connected power (see page 9) to the board:

1. Remove all obstacles that may be covering the photocells or blocking overhead light to them.
2. Insert the blade of the screwdriver (from the edge of the circuit board, not from the center of the board) into the adjustment pots, one at a time. Turn the screwdriver completely counter-clockwise (left) in all FOUR of the pots.
3. For the adjustment pot labeled WF turn the screwdriver clockwise (right) until the red LED near the pot just lights up. Then turn the screwdriver back counter-clockwise until that LED goes out.
4. Repeat step 3 for the three remaining pots with corresponding LEDs.
5. Exit SETUP mode by putting the SETUP switch in the OFF/OPEN position (“operational” mode). The flashing and other action should now operate properly. It may be necessary to repeat this procedure if layout lighting conditions change significantly. Note that the Grade Crossing Pro/2 will activate the sensor status LEDs when the associated sensor detects a train in “operational” mode; this is different from the previous generation Grade Crossing Pro!

Turning the pots clockwise adjusts for brighter overhead lighting conditions while turning the pots counter-clockwise adjusts for dimmer overhead lighting.
Using between-the-rails infrared

The IR components should be mounted between the rails. Drill two 11/64” holes, through the ballast, roadbed, and sub-roadbed. These holes should be located one tie apart (Figure 8a) and drilled at a slight angle from vertical (see Figure 8b). The benefit of mounting them at an angle is increased detection reliability in smaller scales or irregular bottoms on rolling stock. For the smaller scales this drilling may end up hitting the ties. Take your time so you do not mangle them! Insert the leads of one IR emitter (white and black wires) into one of the holes (it does not matter which one!) from the top of your layout. Repeat for the IR detector (blue and black wires). The tops of the components should sit no higher than the top of the ties for optimal IR performance; in some cases (e.g. false triggering) it may be necessary to locate the components a little below the ballast line. You can extend the leads with similar (or larger) wire. We recommend soldering and insulating these connections. We also recommend using terminal blocks/strips since you will have multiple +5V and GND connections to make. Once you have wired the IR components and verified their operation you may wish to put a dab of white glue or silicone caulk where the wires exit the holes underneath the layout. This will help to hold the components in place; make sure you do not get any substance (e.g. ballast or glue) on the top surface of the IR components as this may prevent them from operating properly. In extreme cases where you may be getting interference from overhead lighting you can mount the IR detector in some plastic or metal tubing. You can also recess the IR detector slightly below the ties and roadbed.

Using across-the-rails infrared

With this sensor mode and physical arrangement a train is detected when the infrared (IR) beam is broken by the train. The IR components should be located across the track as shown in Figure 9a and 9b; the distance between them has been tested up to 16 inches. The detectors (dark lens, blue and black wires) should be mounted with a slight downward angle in order to minimize the possibility of false triggering from visible light sources; this is illustrated in Figure 9a. We would also recommend that you angle the emitters and detectors across the track as shown in Figure 9b. This will minimize false “clear” situations due to the space between rolling stock. You can bend the IR emitter and detector components IF you are VERY careful and, preferably, use a pair of “smooth jaw” (no teeth/serration) pliers!! Make the bend on the IR component NO CLOSER than 0.5” from the tip. You don’t want to pierce the insulated heat shrink tubing and potentially cause a short.

In the event the leads do not reach the circuit board you can extend them with similar (or larger) wire. We recommend soldering these connections or using terminal blocks/ strips especially when you have multiple connections to make. Aligning the IR components for reliable detection might be a bit challenging. We recommend the use of a straight edge or ruler for initial “rough” alignment. You can tweak the final alignment once you are ready to test the circuit.

Since the IR components are located trackside, you will probably want to consider “hiding” them. There are numerous ways to do this such as using shrubbery, small equipment buildings or fixtures. We leave this exercise up to your imagination and creativity! We would strongly suggest that you get the circuitry working properly first, and then address the physical appearance.
Please note that the IR emitter wiring is DIFFERENT from the previous generation *Grade Crossing Pro*!

Figure 10 illustrates the wiring for ONE set of IR components (shown for sensor location “WF”). **REPLICATE the same wiring for the three remaining sensor inputs!** Four 68 ohm ¼ watt resistors (Blue-Gray-Black color bands) are included with the *Grade Crossing Pro/2*. When properly wired the emitters will have a very faint red glow. You can “see” the infrared light using your digital camera or smartphone camera! **For safety reasons do NOT point the IR emitter directly into your eye or stare at the IR emitter!!!** The *Grade Crossing Pro/2* supports a SETUP mode which can be used to verify proper operation of the sensors. To enable this mode, you must have the switch labeled SETUP in the ON/CLOSED position as shown in Figure 7. In this mode the signals will not flash. There are four sensor status LEDs; one near each of the four photocell sensitivity adjustment pots. **NOTE: The four adjustment pots have NO affect when using either infrared sensor mode!** Do the following after you have connected power (see page 9) to the board: With nothing over or blocking any of the IR components the red sensor status LEDs on the circuit board should all be OFF. Place a piece of rolling stock at each detection location, one at a time, and confirm that the associated red sensor status LED turns ON. Don’t forget to turn OFF the SETUP switch when finished!

### Using an external detector

Use this sensor mode if you would prefer to use a different type of detector such as an NCE BD20 current sensing detector. Any brand of detector should work provided that its output is an open collector, “active low” polarity, which means that when a train is detected the output is pulled to ground. When no train is sensed the detector output is an open circuit or “floating.” You will need 3 detection blocks or zones. Figure 11 shows how they would be partitioned. Figure 12 shows how simple it is to connect the BD20 block detectors to the *Grade Crossing Pro/2*. **NOTE: The four adjustment pots have NO affect when using this mode!**

![Figure 10 – IR component wiring](image)

**Figure 10 – IR component wiring**

(WF input shown; replicate for WN, EN and EF inputs respectively)

![Figure 11 – External detector zone partitioning](image)

**Figure 11 – External detector zone partitioning**
Grade crossing bell

The Grade Crossing Pro/2 can control a grade crossing bell sound module in two ways. The preferred way, and less expensive option, is to plug in one of the bell modules we offer (#BELL-CL, #BELL-MD, #BELL-FA, #BELL-GS). If you use one of these modules the Grade Crossing Pro/2 will fade the sound off when shutting off the bell. There are two sockets on the board to accept the module as shown in Figure 13a below. Carefully install the bell module by lining up the pins on the bottom of the module to the mating sockets on the Grade Crossing Pro/2 board. Note that when the module is properly installed the bell module label will have the printing oriented in the same direction as the Grade Crossing Pro/2’s main chip. Also, there will be two open socket locations along the top end of the lefthand socket. A properly installed bell module is shown in Figure 13b below. The bell module requires an 8Ω speaker connected to the SPKR outputs as shown in Figure 13b. You can adjust the volume of the bell sound using the potentiometer labeled VOLUME next to the SPKR terminals.

Figure 13a - Location for bell module

Figure 13b – Bell module installed

Figure 14 shows the wiring for an external grade crossing bell sound module. Shown is the ITT sound module version from 2018 through the date on this document; contact us if you have a different version! You will need a 6 conductor ribbon cable (available from us, part number X-CABLE) to make the connections. The black connector end plugs onto the 6 pin header labeled “EXPAND” on the Grade Crossing Pro/2 board. Make sure that the red stripe on the cable is closest to the edge of the board; there is a white stripe printed on the board to the left of the 6 pin header as a hint! Pin 1 (red stripe) of the cable provides +DC power to the bell module while pin 6 of the cable provides the “ground” connection to the bell module when it is turned on by the Grade Crossing Pro/2. Note that you must install a small wire jumper between the two terminals on the bell module labeled SW. Finally, connect any 8 ohm speaker to the bell module. The ITT sound modules have their own volume control; the volume control on the Grade Crossing Pro/2 does NOT affect an external bell module!
Gate and bell timing options

The *Grade Crossing Pro/2* has three configuration switches which give you several options for the timing of the gates lowering and ringing the bell (if a bell module is installed or attached externally). The crossing gate motor outputs will activate (i.e. to lower the gate arms) either approximately 3 seconds after the signals start flashing (GATE DELAY switch in the OFF position) or approximately 1.5 seconds after the signals start flashing (GATE DELAY switch in the ON position). There are examples of prototype crossing gate behaving either way!

The bell module will always be turned on as soon as the signals start flashing. When the bell rings after that is based on the combination of the GATES USED, BELL MODE and BELL SHUTOFF switches. The behavior is described below.

<table>
<thead>
<tr>
<th>GATES USED</th>
<th>BELL MODE</th>
<th>BELL SHUTOFF</th>
<th>Bell behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>(doesn’t matter)</td>
<td>(doesn’t matter)</td>
<td>Rings continuously while signals are flashing</td>
</tr>
<tr>
<td>ON</td>
<td>OFF</td>
<td>OFF</td>
<td>Rings continuously while signals are flashing</td>
</tr>
<tr>
<td>ON</td>
<td>OFF</td>
<td>ON</td>
<td>Stops ringing as the train clears but before flashing stops</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>Only rings while gates are lowering or raising</td>
</tr>
<tr>
<td>ON</td>
<td>ON</td>
<td>ON</td>
<td>Only rings while gates are lowering; no ringing when gates rise!</td>
</tr>
</tbody>
</table>

Once again there are examples of prototype crossing bells behaving in each of these ways!

**Power**

The *Grade Crossing Pro/2* accepts AC or DC power (7 - 16V). Power consumption, including the signals, ranges from ~90 mA (photocell version) to ~225 mA (infrared version). If you are only using a single board then you can use the AC terminals to provide power as shown in Figure 15a. You can use the accessory terminals on your throttle/power pack. If you are using more than one *Grade Crossing Pro/2* (for example, if you’re interlocking with turnout positions) then you should consider powering them all from a single DC source as shown in Figure 15b. Watch the polarity and make sure you know what is positive! Contact us if you are uncertain! When power is first applied the signal outputs will turn on briefly in sequence (Left → Right → End-of-gate-arm).
Multi-track grade crossings (using photocell detection)

There is an obvious tendency to just add additional photocells to handle additional tracks when you have a multi-track grade crossing. The problem with this implementation is that the **Grade Crossing Pro/2** cannot differentiate between two trains traveling in opposite directions on different tracks. As such it could easily get “confused” and not provide the prototypical sequencing (i.e. the action starts when the train covers a far photocell and the action stops when the train clears the near photocell on the other side of the crossing). If you will have multiple trains traveling through the crossing area (with outer boundaries defined by the far photocells) at the same time then you must use one **Grade Crossing Pro/2** for the first track and a **Grade Crossing Pro/2 Expander** for each additional track. See the next section for details on how to connect the **Grade Crossing Pro/2 Expander(s)**. IF you operate your trains such that only ONE train can possibly go through the crossing area at a time then you CAN simply add additional photocells (part number PCELL; $2.00 each available from us) for the additional tracks. In this implementation you will wire the additional photocells in series with their counterparts on adjacent tracks. Figure 16 below illustrates the photocell wiring for a two-track crossing. You MUST go through the photocell sensitivity adjustment process on pages 5. Do NOT use more than 3 photocells in series for each sensor input (i.e. 3 tracks) as we cannot guarantee reliable operation!

![Figure 16 – Two track crossing using extra photocells](image)

Multi-track grade crossings (using between-the-rail infrared detection)

There is an obvious tendency to just add additional sensors to handle additional tracks when you have a multi-track grade crossing. The problem with this implementation is that the **Grade Crossing Pro/2** cannot differentiate between two trains traveling in opposite directions on different tracks. As such it could easily get “confused” and not provide the prototypical sequencing (i.e. the action starts when the train covers a far sensor and the action stops when the train clears the near sensor on the other side of the crossing). If you will have multiple trains traveling through the crossing area (with outer boundaries defined by the far sensors), at the same time, then you must use one **Grade Crossing Pro/2** for the first track and a **Grade Crossing Pro/2 Expander** for each additional track. See the next section for details on how to connect the **Grade Crossing Pro/2 Expander(s)**. IF you operate your trains such that only ONE train can possibly go through the crossing area at a time then you CAN simply add additional sensor sets (available from us) for the additional tracks. In this implementation you will wire the additional sensors the same way you did for their counterparts on the first track (i.e. per Figure 10). For example, the blue wire from ALL of the WN detectors will connect to the WN terminal on the **Grade Crossing Pro/2**.

Multi-track grade crossings (using across-the-rail infrared detection)

There is an obvious tendency to just space out the IR emitters and detectors such that they span all tracks for a multi-track grade crossing. The problem with this implementation is that the **Grade Crossing Pro/2** cannot differentiate between two trains traveling in opposite directions on different tracks. As such it could easily get “confused” and not provide the prototypical sequencing (i.e. the action starts when the train covers a far sensor and the action stops when the train clears the near sensor on the other side of the crossing). To avoid this situation you will need to use one **Grade Crossing Pro/2** for the first track and a **Grade Crossing Pro/2 Expander** for each additional track. See the next section for details on how to connect the **Grade Crossing Pro/2 Expander(s)**.
Multi-track grade crossings using the Grade Crossing Pro/2 Expander

For the most realistic, “no operational exceptions” grade crossing behavior you will need one Grade Crossing Pro/2 Expander for each additional track beyond the first one. The Grade Crossing Pro/2 Expander connects to the Grade Crossing Pro/2 with a single cable which is included with each Grade Crossing Pro/2 Expander. Connect one end of the cable, with the red stripe aligned to the left edge of the circuit board, as shown in Figure 17a, to the lower 6-pin header on the Grade Crossing Pro/2 Expander board; use the upper 6-pin header to connect any additional Grade Crossing Pro/2 Expander boards. Connect the other end of the cable to the 6-pin header on the Grade Crossing Pro/2 board; again, align the red stripe to the left edge of the board as shown. Zoomed in views are shown in Figures 17b and 17c. Please refer to the Grade Crossing Pro/2 Expander instructions for all other details on wiring, switch configuration and setup.

Figure 17a – Connecting the GCP/2 and GCP/2 Expander

Figure 17b – GCP/2 Expander with cable attached

Figure 17c – GCP/2 with cable attached

Troubleshooting – photocell sensing

If your signals do not flash when the sensors are covered or flash all the time you can perform the following tests. First, verify that you have the sensor mode configured correctly (see Table 2 on page 4). Second, revisit the photocell sensitivity adjustment process on pages 5. A loose or missing wire connection on a photocell will cause its status LED to stay on all the time!

Troubleshooting – Between-the-rails infrared sensing

If your signals always flash even when no train is present then you will probably see one or more of the red sensor LEDs lit up on the Grade Crossing Pro/2 board. You may have the IR components sitting too high. Make sure they are no higher than the top of the railroad ties otherwise the IR “light” can leak across and be seen by the detector. Also make sure that none of the detector blue and black wires are touching each other. This would be will be interpreted as an activated sensor.

If your signals fail to flash yet one or more of the red sensor LEDs is lit up then double check the signal wiring. A typical error is assuming that the common wire connects to ground (GND); it doesn’t! The common wire must connect to the DC terminal regardless of the color of that wire!

If your signals fail to flash when you cover a particular sensor location then double-check your sensor wiring. A missing sensor connection (missing wire or open circuit) will be interpreted as a cleared sensor. Verify the glow of the IR emitters using a digital camera or smartphone camera. Also verify that you have the sensor mode configured correctly (see Table 2 on page 4).

You can determine if the sensor inputs are working correctly by TEMPORARILY disconnecting all blue sensor wires from the board. If any of the red sensor LEDs are lit then the main chip on the board may be at fault. Contact us for further help. Otherwise, connect each sensor input (WF, WN, EN, EF) to GND, ONE sensor input at a time. An activated sensor appears to the board like a low voltage connection so you are, in effect, mimicking an activated sensor with this test. If the sensor’s associated red LED does NOT come on when you make that temporary connection then you may have a problem with the board and you should contact us. If the sensor red LED did light up with the temporary connection then you may have a defective IR detector.
Troubleshooting – Across-the-rails infrared sensing

[Warranty]

This product is warranted to be free from defects in materials or workmanship for a period of one year from the date of purchase. Logic Rail Technologies reserves the right to repair or replace a defective product. The product must be returned to Logic Rail Technologies in satisfactory condition. This warranty covers all defects incurred during normal use of this product. This warranty is void under the following conditions:

1) If damage to the product results from mishandling or abuse.
2) If the product has been altered in any way (e.g. soldering to the circuit board).
3) If the current or voltage limitations of the product have been exceeded.

Requests for warranty service must include a dated proof of purchase, a written description of the problem, and return shipping and handling ($8.00 inside U.S./$20.00 outside U.S. - U.S. funds only). Except as written above, no other warranty or guarantee, either expressed or implied by any other person, firm or corporation, applies to this product.

Technical Support

We hope the preceding instructions sufficiently answer any questions you might have about the installation of this product. However, technical support is available should you need it. You can reach us via phone or email; our contact information can be found on the top of page 1.