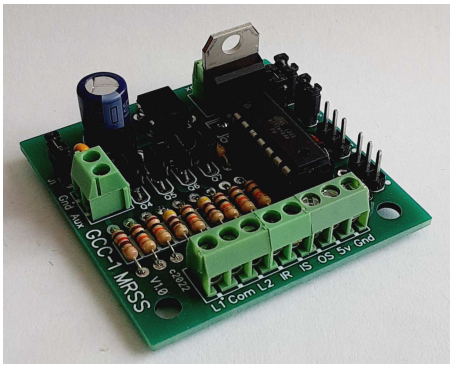
.: Model Railroad Signal Systems

GCC-1 Grade Crossing Controller Installation & Operating Instructions

Board Version 1.0



Features:

- Supports common anode, common cathode and back to back led crossing signals
- Drives 2 servo motors for automated gates
- Gates can be turned off or on
- **Simulates** led or incandescent type lamps ** Does not support incandescent bulbs **
- Has auxiliary output to control other devices such as a bell circuit or traffic lights
- Auto infrared light sensing
- 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.

Grade Crossing Signal Operations

Once the installation and set up of your GCC-1 module is complete, the circuit will operate as follows:

Upon power up of the module, the sensors will monitor the amount of infrared light present in the room and will adjust the mode of the sensors accordingly. This process takes about 4 seconds. Ensure there is no rolling stock over any of the sensors during initial power up.

Under normal operations, the train moves towards the crossing and will first trip one of the outer sensors activating the signals. If servo motors are installed, the gates will go down 2 seconds after the signals have been activated.

The gates will remain down and the signals will continue to operate as long as one of the inner sensors is tripped. Once the train passes over and then clears the second inner sensor, the gates will rise and the signals will then shut off.

The outer sensors will then remain inactive for 3 seconds after the last outer sensor has been cleared so the signals are not false triggered.

If a train approaches and trips one of the outer sensors then stops, the crossing signals and gates will activate as usual. However, if the train does not approach and trip one of the inner sensors within 8 seconds of tripping the outer sensor, the gates will rise and the signals will then shut off.

Once the train continues to move forward, the signals will once again activate if the outer sensor has had time to clear and re trip or if any of the inner sensors next to the roadbed is tripped. The shut down sequence remains the same as before.

If servo motors have been installed and you do not wish to have them operate for any reason, removal of Jumper J3 will disable the servo motors. The jumper can be replaced with wires to a SPST switch on the face of your layout if you wish to control the gates from there.

Flashing Mode

The flashing leds at your crossing can be set to operate in one of two modes.

With Jumper **J4** installed, the flashing leds will simulate incandescent bulbs by rapidly fading on then rapidly fading off. This feature works best when the leds at the crossing signals are wired in the back to back configuration. See **Figure 3**.

With Jumper **J4** off, the signals will operate like led signal lights, either on or off. The jumper can also be replaced with wires to a SPST switch on the face of your layout.

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.

STEP 1 – Mounting the GCC-1 board

Choose an area under your layout that is suitable for mounting the GCC-1 board. Keep in mind the length of your sensor leads and servo motor leads when mounting the board. You will want to mount the circuit board as close to the grade crossing as possible.

STEP 2 – Mounting Optical Sensors

Mount the sensors at the locations shown in **Figure 1**. There are two outer sensors wired in parallel and two inner sensors wired in parallel. The two inner sensors should be placed next to the roadway at the crossing while the outer sensors should be between 9 to 12 inches away from the road.

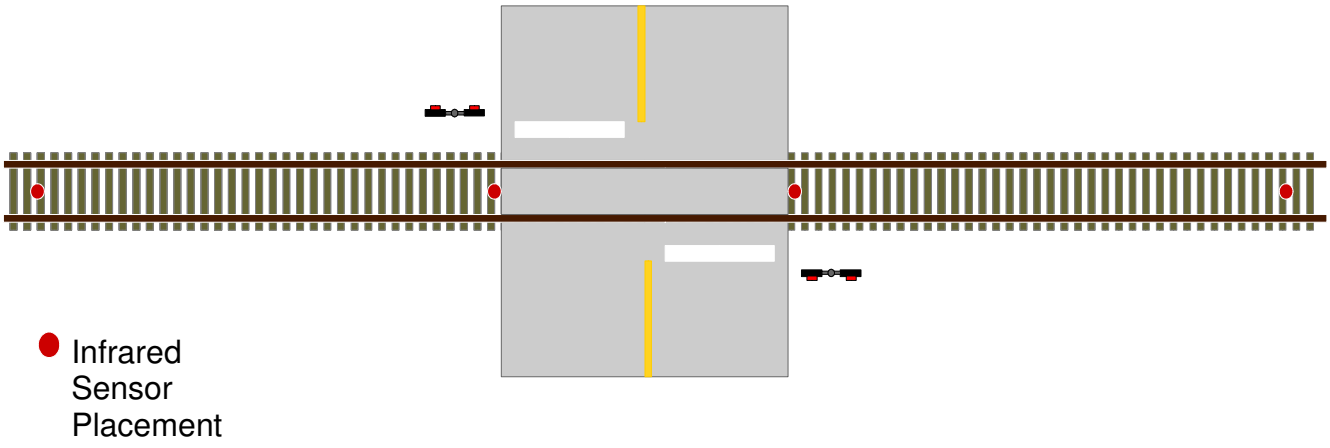


Figure 1

The connections of the FC-51 sensor are shown below in **Figure 2**. There are a total of four sensors to be connected. The outer and inner sensor white wires each have separate connections to the board labled OS (outer sensor) and IS (inner sensor). The black, red and yellow leads are all connected in parallel.

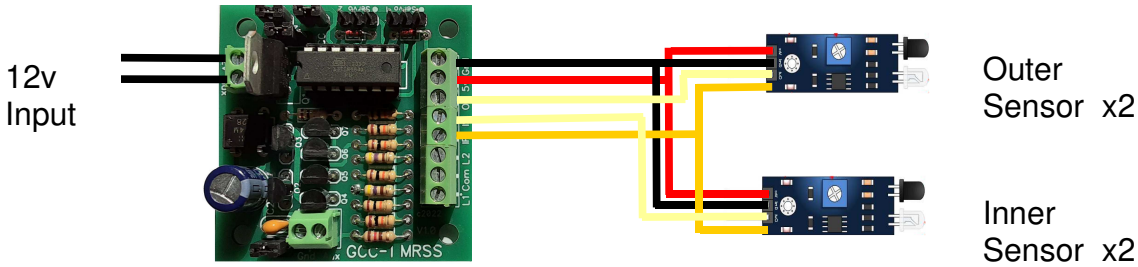


Figure 2

STEP 3 – Connecting the crossing signals

This circuit was designed to drive **LEDs** only. The maximum current draw for each led terminal should not exceed 100mA of current. This should be plenty to drive up to 8 leds per terminal. **Do not connect incandescent bulbs to these terminals.** Doing so will damage to the circuit.

Although current limiting resistors are built onto the GCC-1, it is recommend to use external 100 ohm resistors to each led when connecting multiple leds in parallel.

The GCC-1 supports three types of led connections. Common anode(+), Common cathode (-) or a back to back led configuration. The GCC-1 also simulates led or incandescent style lighting. Jumper **J2** sets the leds for common cathode (CC) or common anode (CA). The position of **J2** does not matter when using the back to back led configuration. Use only one configuration when connecting the signals.

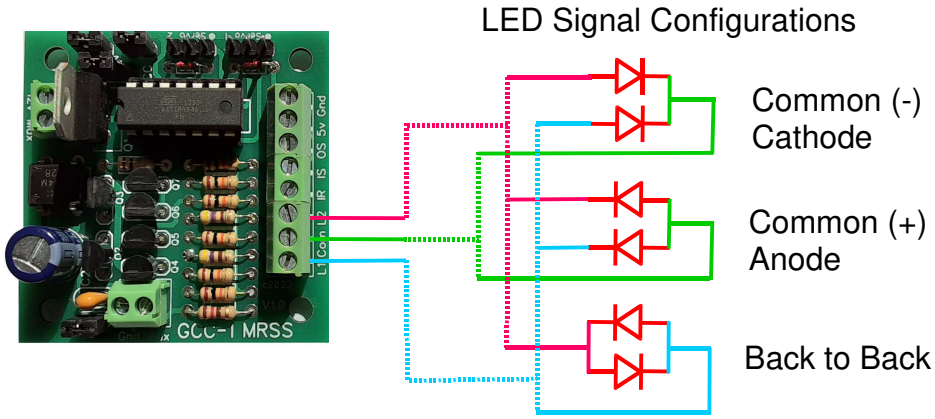


Figure 3

STEP 4 – Mounting Servo Motors

If you did not purchase servo motors with your GCC-1 board, you may skip this step. Model SG90 servo motors can be purchased and added at a later date if desired. If you did not purchase servo motors, ensure Jumper **J3** is not bridged across the pins.

Mount one servo motor under each crossing gate. Connect the servo motors to the GCC-1 board. Pay close attention to the orientation of the harness. The orange wire on the harness must match up to the white dot on the circuit board. Double check this connection with that shown in **Figure 4** below. Failure to properly connect the servo motors may damage the circuitry. Ensure jumper **J3** is in place to enable the servos.

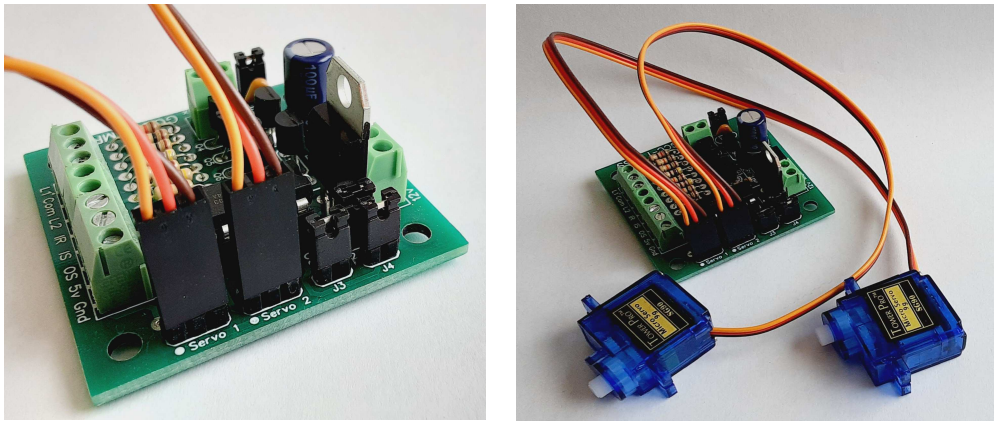


Figure 4

** Do not attach the armatures to the motors at this time. **

STEP 5 – Auxiliary Output (if used)

The GCC-1 Module has two terminals that can be used to turn on an external bell sound module, an led on a remote panel or trip a traffic light module at a near by intersection. The output is set up as an open collector configuration which means it switches a grounded signal only. It does not provide any power to drive other devices. The switched current is limited to 150mA. **Figure 5** shows how this output can be connected to external devices.

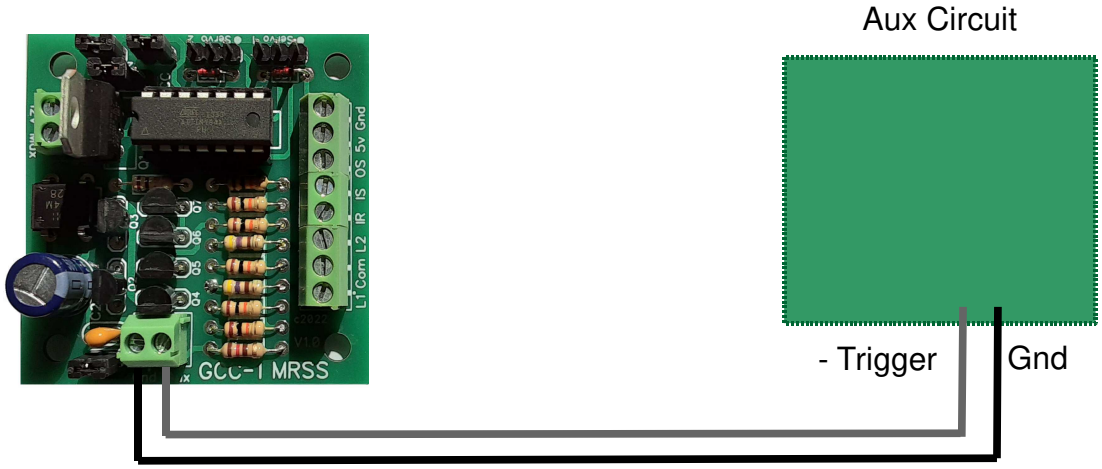


Figure 5

STEP 6 – Power Connections

The GCC-1 Module has been designed to accept the following power supplies.

-- A separate AC adapter that can supply between 9 and 12 volts AC or DC.
-- A 12 volt battery.

The power connection is shown in **Figure 2**.

STEP 7 – Applying power

The next step is to turn on the power and setup your sensors and servo motors. Ensure the armatures are not installed to the motors at this time. Double check all your connections prior to applying power. A second look can save you a lot of frustration if connections are made incorrectly.

STEP 8 – Adjusting the FC-51 sensors

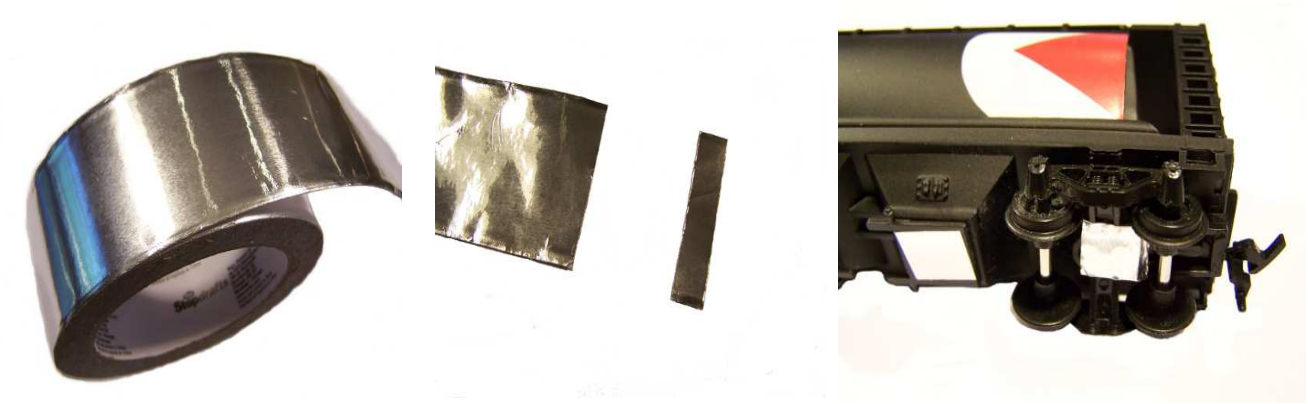
Jumper **J1** when installed, provides 5 volts to the IR terminal. With the jumper removed, the voltage passes through a current limiting resistor. This is required when using sensors that do not have current limiting resistors protecting the infrared led. For the modified FC-51 sensors provided, current limiting is required and therefor ensure there is no jumper across **J1**.

There is a small potentiometer on each FC-51 sensor board which will need to be set. It is best to make these adjustments with a minimum amount of infrared light present. (from other light sources). Start by turning the potentiometer until the occupied led is off. Using a box car, roll it over the sensor and then adjust the potentiometer until the status led on the sensor board comes on. This may need to be adjusted several times using different rolling stock. Repeat the process on all four sensors to ensure they trip with the presence of rolling stock over the sensor.

Using passive IR sensors

Passive infrared sensors have a limited range and don't trigger as easily. If you choose to use an alternate sensor such as the OPB704WZ which is not adjustable, this tip will most likely be helpful.

Most rolling stock have a dark non reflective surface which greatly reduces a passive 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 passive optical sensors. This is shown in the three photos in Figure 6.



Roll of silver tape | Cut strips from roll | Cut into cubes and stick to underside of rolling stock.

Figure 6

Auto Infrared sensing

Upon power up, the GCC-1 board will for 4 seconds, 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 sensors will work in beam break mode. If no external infrared light is present on any sensor, the sensors will work in beam reflect mode. The circuit will not function correctly if some sensors are detecting external sources of infrared light while the others are not. All the sensors should have the same exposure to ambient light for the circuit to function correctly.

STEP 9 – Setting up the Servo Motors

Ensure **Jumper J3** is in place on the GCC-1 module.

Once power has been applied to the circuit, and your sensors have been properly adjusted, trip the sensors at least twice to set the servo motors to their default position. Once the servos have gone through the sequence of operation twice, you can attach the armatures to the servo motors and run through the sequence again. Pay attention to the resting and operated position of the armatures to ensure the range of operation will be in line with the gate's range of operation. Once you are satisfied that the armatures are in the correct position, you may install the rod connecting the servo armatures to the gates.

Run the train through the crossing once more, the gates should open and close their full range. Adjustments may be required to the connecting rod positions to achieve smooth operation of the gates.

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.