GCX GRADE CROSSING EXPANDER

By

The Signaling Solution, Inc.

PO Box 37

Shelburn, IN 47879

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1. INTRODUCTION

Your GCX Grade Crossing Expander is used to add an additional track to a grade crossing controlled by our GCC Grade Crossing Controller. The GCC performs train detection of the first track, controls the gates and cross-bucks, and generates an audio output with the bell sound. Each GCX performs train detection on an additional track and sends messages to the GCC that indicate the need for cross-buck, bell and gate action.

The first GCX sends its messages directly to the GCC over a single pair of wires. As you add an additional GCX board, it will send its messages to the previous GCX for forwarding to the GCC. Thus, should you create a crossing with 8 tracks, the 8th track's GCX will send its messages to the 7th track's GCX, which will forward them to the 6th track's GCX, and so on, with all messages eventually reaching the GCC.

The following list of features is provided by your GCX. A GCX performs all of the functions of the GCC except for gate and cross-buck control, and bell sound generation.

- The GCX will provide train detection for additional tracks after the first track in your grade crossing scene.
- Train detection by current sensing - your GCX will see your train no matter how long or short or how twisted your track is in the blocks.
- Works with your layout control system - use DC Cab control or Digital Command Control, or even AC - your GCX will work with any of them.
- When merged with your train detection and signaling system, the GCX will combine its train detection with the overlapping signaling blocks and output both OCCUPIED and VACANT status for the merged blocks- you can operate two aspect signals with no additional hardware.
- Uses the GCC Power supply
- Output flexibility - you can operate LED's, incandescent bulbs or relays
- Modularity – add one additional GCX Grade Crossing Expander for each additional track crossing the road, to a total of 8 tracks.
- Furnished assembled and tested - no need to understand electronics. Use the mounting hardware and card edge connector included with each unit, and follow the instructions, and you will have a state of the art train detection and grade crossing control system. Just add the GCC, gates, crossbucks and loudspeaker of your choice.
- Cost: THERE IS NO OTHER WAY TO CONTROL GRADE CROSSINGS WITH ALL OF THESE FEATURES – AT ANY PRICE!

If you have any suggestions or recommendations, please share them with us. We are happy to hear from you, and are committed to being **THE SUPPLIER** of the finest, most cost-effective model railroad signaling and control devices available to the serious hobbyist.

FOR A FAST START:

This manual is divided into a number of logical sections, each intended to answer specific questions or to provide help of a specific type. So, to help you to find the information you need, here are some suggestions.

a. To see a description of the features and functions of your GCC Grade Crossing Controller Board, read Section 2, GCC Operational Features.
b. Section 3, INSTALLING YOUR shows you exactly how to install your GCC with the minimum effort and risk. Only read this section if you want it to work right the first time you turn it on.
c. For test as you go instructions, or trouble-shooting help at any time, read Section 3.4, TESTING YOUR GCX
d. If all else fails, for emergency relief read Section 4, CUSTOMER SUPPORT.

Because of the similarities of the GCX to the GCC, we will not be repeating the identical information in this GCX manual. Consult your GCC manual chapters 2 and 3 for additional information about planning your crossing and the connections to the gates, cross-bucks and bell. These are all handled by the GCC and do not apply to the GCX.

2. SCENE TRACK CONFIGURATIONS

There are six track configurations supported by the GCC. The figures in the next few paragraphs show you how to identify your specific track configuration and set up the GCC to handle it.

2.1 Basic Scene without Signaling

If you don't have a signaling system, you can use the GCX in its simplest form. In this case, just connect the GCC to the two approach and one road block for train detection. This scene is shown in Figure 2-1 GC Scene without Signaling. For this case, you need not install any track configuration connections on the GCC connector.

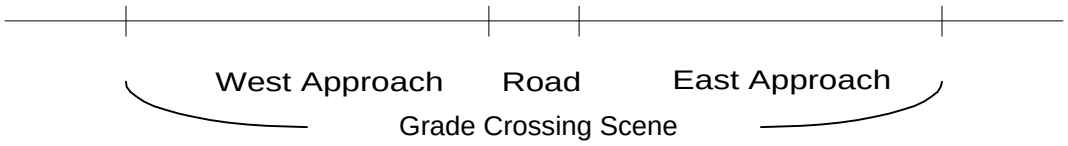

Figure 2-1 GC Scene without Signaling

2.1.1 Grade Crossing Scene with Signaling

The GCX board always handles primary detection of trains within the grade crossing scene for the tracks they are assigned to. However, when the GCX is used with a train detection and signaling system, external detectors are used to monitor signaling blocks that overlap the scene. The external detectors must be merged with the GCX detection to give proper operation of both the grade crossing and the signaling system. The prototype does this, and we have to also. Because of functions performed by the GCX, it's not as difficult as you might imagine.

The next five paragraphs illustrate the different track configurations supported by the GCX. You need only select which track arrangement best describes your situation, and then connect a few wires to the GCX to get the job done.

The GCX has four outputs: VAC1, OCC1, VAC2 and OCC2. These outputs are used to output block status when the crossing scene blocks are merged with other, overlapping signaling blocks. These are open collector closure to ground outputs capable of carrying 200 milliamps when on, and withstanding 16 volts DC when off.

Depending on the signaling block arrangement, you will connect certain pins on the GCX connector. Make these connections using a small gauge wire, something between 22 and 30 gauge.

2.1.1.1 Grade Crossing Scene within a Single Signaling Block

With the signaling block arranged as shown in Figure 2-2 GC Scene Totally within One Signaling Block, you will provide detection gaps to divide the signaling block as shown below. If the signaling block boundary is immediately at the left end of the west approach, or the right end of the east approach, the either the small block X1 or X2, or both, will not exist at all.

Connect the "occupied" output of the external detectors, if any, to the X1 and X2 inputs. If either or both external blocks do not exist, connect nothing to the X1 and X2 inputs. This would be the situation if the signaling block

were the same as the three-combined grade crossing blocks. In any case, the GCX will provide outputs VAC1 and OCC1 to indicate that the signaling block is vacant or occupied, respectively.

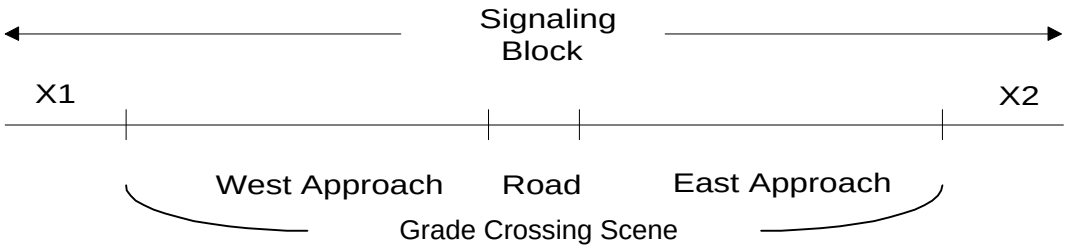

Figure 2-2 GC Scene Totally within One Signaling Block

To use this configuration, connect pins M and B on the connector.

2.1.1.2 Signaling Block Boundary in West Approach

This track configuration handles a signaling block boundary located within the west approach block for the grade crossing scene. In this case, there are three external detectors needed. Detectors X1 and X2 provide detection for the portions of signaling block 1 that appear outside and inside the west approach respectively. The GCX provides detection for the rest of the scene, all of which is contained in signaling block 2. External detector X3 provides detection for the portion of signaling block 2, if any, which exists outside the GC scene.

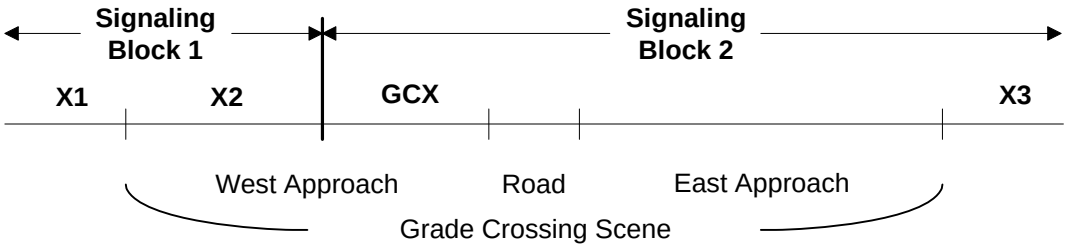

Figure 2-3 Signal Block Boundary in West Approach

To use this configuration, connect pins M and C on the connector.

The OCC1 and VAC1 outputs provide the occupied and vacant outputs for signaling block 1; OCC2 and VAC2 provide the occupied and vacant outputs for signaling block 2.

2.1.1.3 Signaling Block Boundary West of Road

This track configuration handles a signaling block boundary located at the West End of the road block in the GC scene. In this case, two external detectors are needed. Detector X1 detects the portion of signaling block 1 outside the west approach; detector X2 does the same for the portion of signaling block 2 which is outside the road and east approach blocks.

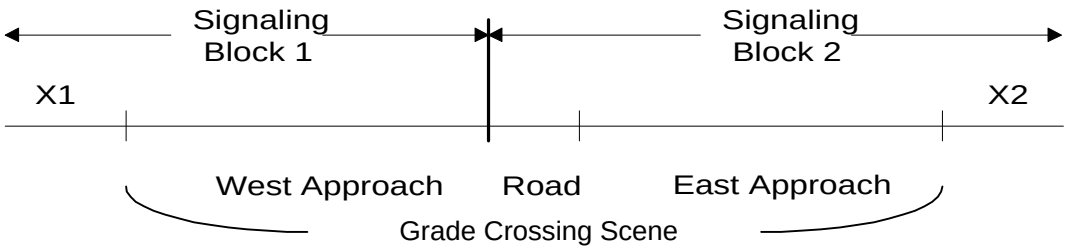

Figure 2-4 Signaling Block Boundary at West End of Road Block

To use this configuration, connect pins M, B and C on the connector.

The OCC1 and VAC1 outputs provide the occupied and vacant outputs for signaling block 1; OCC2 and VAC2 provide the occupied and vacant outputs for signaling block 2.

2.1.1.4 Signaling Block Boundary East of Road

This arrangement is very similar to the previous signaling track configuration. It works in the equivalent manner.

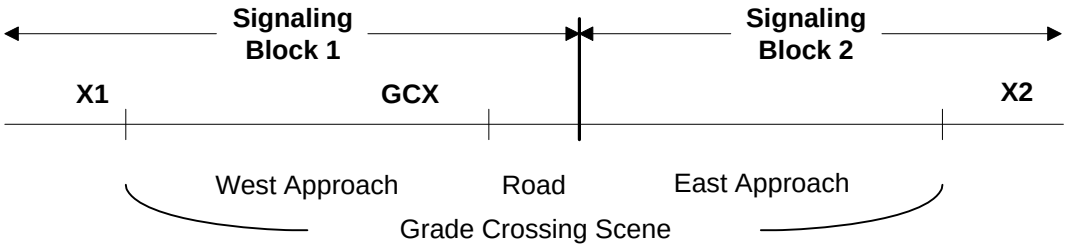

Figure 2-5 Signaling Block Boundary at East End of Road Block

To use this configuration, connect pins M and D on the connector.

The OCC1 and VAC1 outputs provide the occupied and vacant outputs for signaling block 1; OCC2 and VAC2 provide the occupied and vacant outputs for signaling block 2.

2.1.1.5 Signaling Block Boundary in East Approach

The final signaling block configuration has the signaling block boundary located in the east approach block. Again, three external detectors are required. X1 detects the portion of signaling block 1 that is outside the GC scene; X2 detects the portion of signaling block 2 that forms part of the east approach; X3 detects the portion of signaling block 2 that is outside the scene.

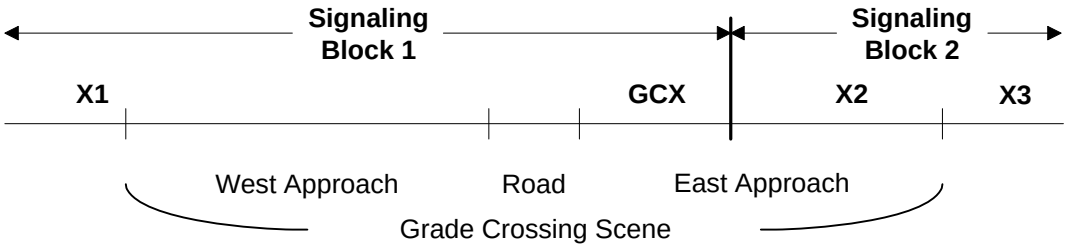

Figure 2-6 Signal Block Boundary in East Approach

To use this configuration, connect pins M, B and D on the connector.

The OCC1 and VAC1 outputs provide the occupied and vacant outputs for signaling block 1; OCC2 and VAC2 provide the occupied and vacant outputs for signaling block 2.

3. INSTALLING YOUR GCX

Installation of your GCX is very simple, and is almost exactly the same as the installation of your GCC. Very little wiring is required, and the instructions below should provide everything needed to get a normal system working perfectly.

There are a few electrical connections to make. Use a small soldering iron, no more than 40 watts. A 25-watt iron would be ideal. Remember that you only have to connect one end of one wire at a time. Do that enough times, and the installation is done! Even the pros that wire the space shuttle do it that way.

Figure 3-1 below shows how your GCX and related items will look when ready for installation. For your reference, the major items are identified individually. The board activity indicator LED (item 2) is the only board mounted part of interest to you.

You will find packed in a small bag the following hardware

- Pan-head #4-40 Stainless steel machine screws (2), item 9
- Stainless steel #4 flat washer (4), item 8
- Stainless steel #4 internal tooth lock washer (2), item 7
- Stainless steel #4 hex nut (2), item 6
- Angle brackets (2), item 11.

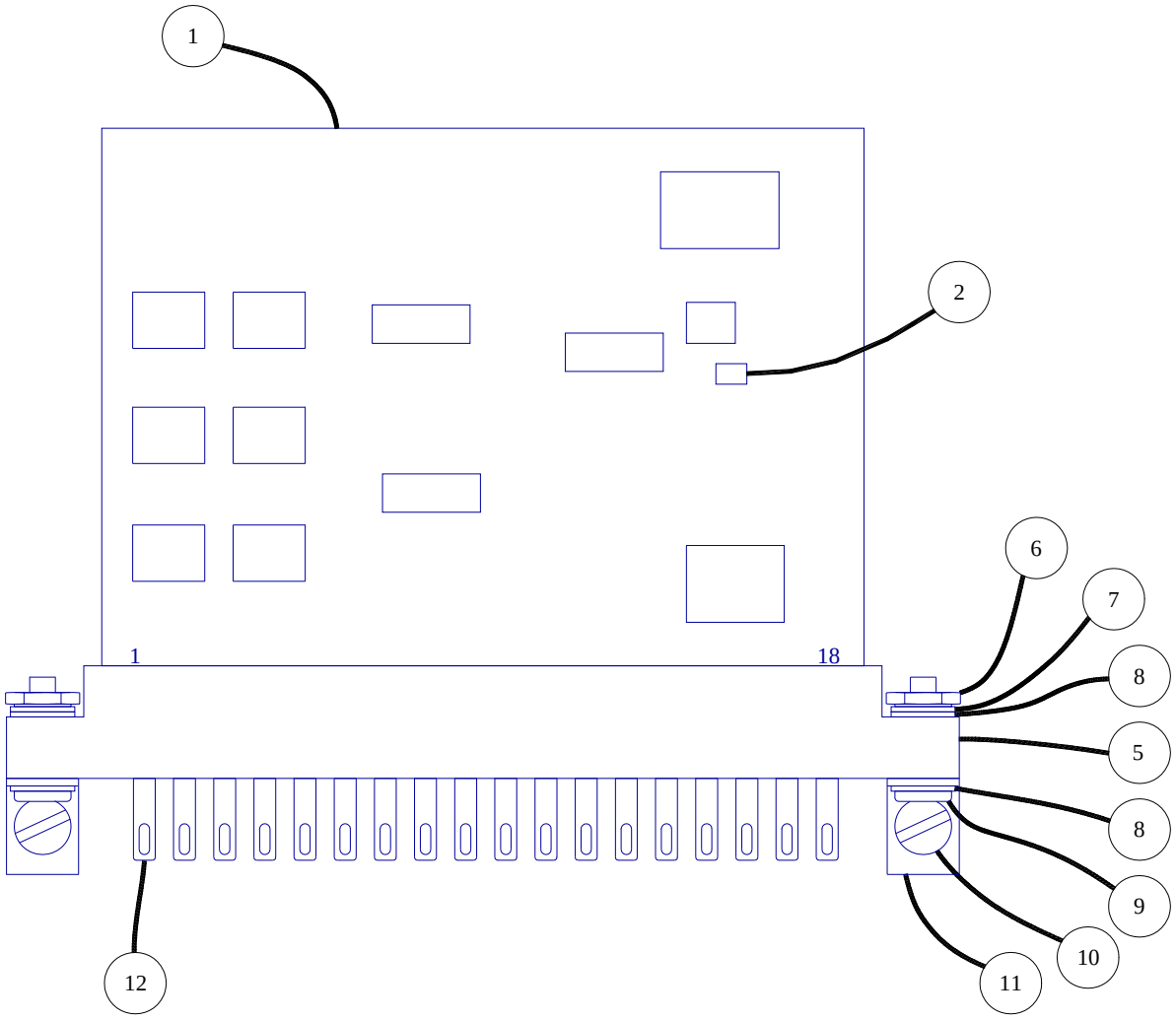

Figure 3-1 GCX Assembly and Parts

The board activity indicator is a LED which blinks about 2 times per second whenever power is applied to the GCX. If the LED is out completely, the power supply is either not connected, or the 5-volt supply on the board is shorted to ground by a connection to pin 16. If it is on, but not flashing, then the processor is not functioning. Turn off the power to the board by unplugging the AC adapter provided for about 10 seconds. Then plug it back in. If the LED still does not blink, the board may not be working. Please contact us to arrange for a repair.

3.1 Physical Installation of the GCX Board

Decide on a location to mount the GCX board. We recommend that you mount your first GCX on the same mounting board as the GCC, and just to its right. Each additional GCX should be mounted just to the right of the previous one. This plan will simplify the wiring from each additional board to the previous one. Since each of these board, with its mounting connector, is about 4 inches wide, a plywood panel 10” high or piece of 1” x 10” that’s 4” long for each of the boards you need to mount will work just fine. You can do much of the wiring while this panel is on your workbench. Then install the board near the grade crossing beneath the layout and connect the wires to the track, cross-bucks, and motor drives.

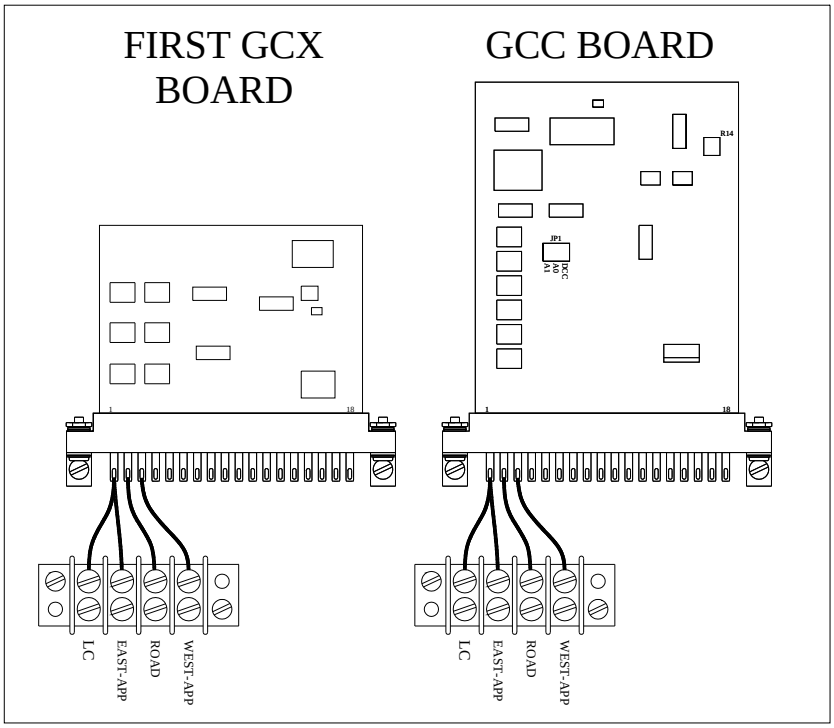

Figure 3-2 GCX Board Installation

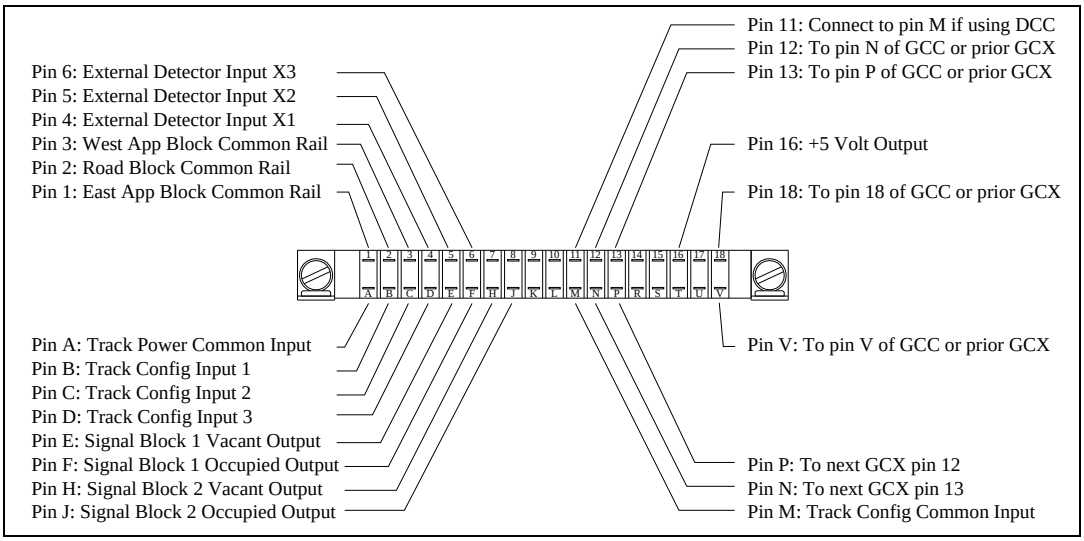

Figure 3-3 Card Edge Connector Pin Diagram

Make sure that you have adequate light and room to work. We all know it's often awkward and uncomfortable working under a layout. Try to make it as convenient as possible. Also, you will be making a number of connections to pins on the card edge connector. While each pin is labeled on the connector, they can be difficult to read in dim light, at a bad angle, with less than a fighter pilot's eyes.

To help with this, Figure 3-3 Card Edge Connector Pin Diagram is provided showing all of the pins, and identifying them for your convenience. Note that the top row of pins is numbered from 1 to 18. The bottom row are lettered as follows: A, B, C, D, E, F, H, J, K, L, M, N, P, R, S, T, U, and V.

Mounting hardware is provided with the GCX to give you all you need to install the board as described. Just mount the connector as shown in Figure 3-2 GCX Board Installation. When the wiring is done, plug in the GCX board with the components on the circuit board facing you, and you're done.

Figure 3-2 shows an optional barrier strip used to strain relief the four wires required to connect the GCX to the train running circuits. If the length of these wires is fairly short, less than about 5 or 6 feet, and your trains don't draw much current, less than an amp or so, you can probably wire the track circuits using 20 or 22 gauge wire. The connector pins can handle such wires. Make sure you install a strain relief of some kind near where the barrier strip is shown. This simple precaution will prevent damage to the connector if someone accidentally pulls on the wires. In fact, it is always good practice to provide a strain relief for wiring going to connectors. The strain reliefs are very cheap; connectors are very expensive and time-consuming to replace.

Most wiring to train tracks will be heavier and longer. Because the pins on the connector are limited to 20-gauge wire, you will need a convenient place to convert from the heavy track wires to short, small gauge wires that go to the connector. A barrier strip like this is a good, professional way to do it. A four-circuit barrier strip is available from many sources. One good example would be a product by Cinch-Jones called the model 4-140 Barrier Strip. It's available from Digikey (1-800-344-4539) for less than $2.00. You may not need this, or you may have other methods you prefer, but you are limited to 20-gauge wires to the connector.

3.2 Connecting the Detection Circuit to Your Layout

In most cases, connecting the GCX to your layout is very simple. The basic wiring diagram is shown in Figure 3-4 Basic Wiring of the GCX. As you can see, most of the wiring is connected to the crossbucks and gate motors.

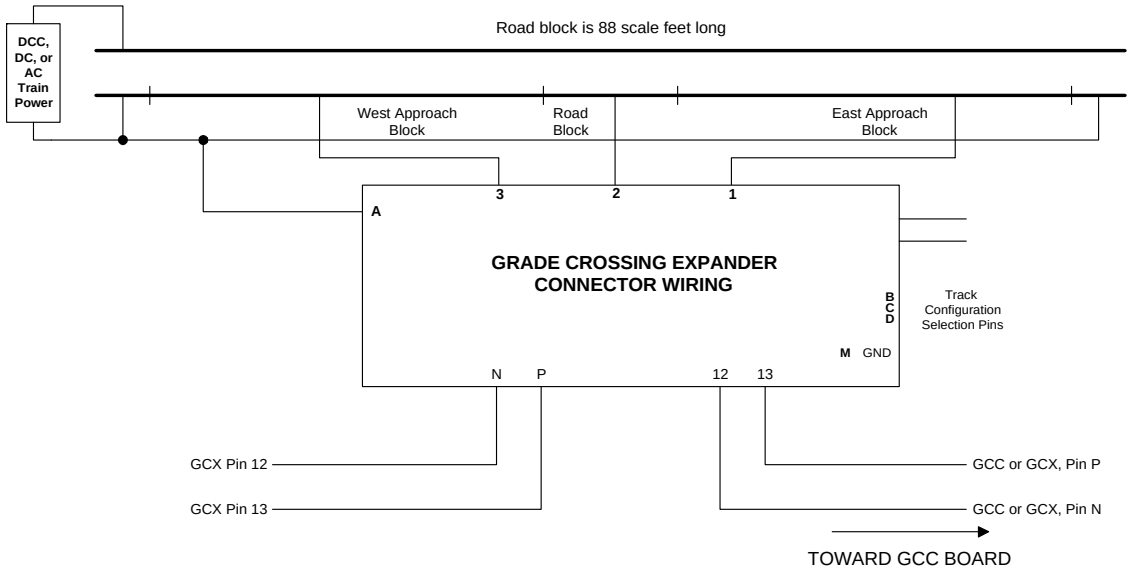

Figure 3-4 Basic Wiring of the GCX

The first step is to wire the GCX detection circuits in to the track in your grade crossing scene. Based on the planning you did when installing your GCC, you will be electrically isolating one rail of the two approach blocks and the road block from the rest of the control wiring. Then, we will reconnect the three blocks, through the GCX detectors. We will do this one block at a time, and test as we go, to keep from creating any big problems.

Begin by isolating the three scene blocks. To do this, you will have to cut the four gaps in the common rail as shown above. Then disconnect the existing wires from these rails to isolate then from the rest of the layout. Incidentally, you may want to leave the feed wires connected to the rails, and just cut them off a few inches below the roadbed. Leave enough wire so you can use them to reconnect to the rail.

Test this step by trying to run a train through the scene. If it runs in any of the three scene blocks, then you have at least one feed wire still connected to the block. Keep looking for it until your train no longer runs in the three scene blocks, but does run everywhere else.

When the common rail has been isolated, connect all of the rail feeds for the east approach block together and then run a single wire to the GCX connector pin 1. Then test run a train through the scene. It should run only in the east approach block, and stop in the road block and west approach. You will need to plug the GCX board into the connector to run this test, but its power need not be turned on.

Repeat the process for the road block, connecting its common rail feed to pin 2. And finish by connecting the west approach common to pin 3. Test each of these blocks as you go. As each block is finished, your test train should run through the newly connected track.

3.3 Connecting the Signaling System Outputs

Only a few additional wires are needed to connect the GCX to your signaling system. First, select the type of overlap you have between the grade crossing scene and your signaling blocks. Then, connect the proper jumpers as described in 2.1.1.

Next, connect the occupied outputs from the external detectors to the proper GCX inputs as shown below. Then, connect the GCX signaling outputs to the signaling system. This is done in exactly the same way as you wired your GCC board. Simple, isn't it?

The external detectors need an output that is 0 volts when its block is occupied, and an open circuit or 5 volts when its block is vacant. Our line of Block Occupancy Detectors, the BD8 and BD16 handle 8 and 16 blocks each, respectively, will work perfectly; other block detectors may work as well. If you have something specific in mind that you would like to use, we'll be happy to look into it to see if it will work.

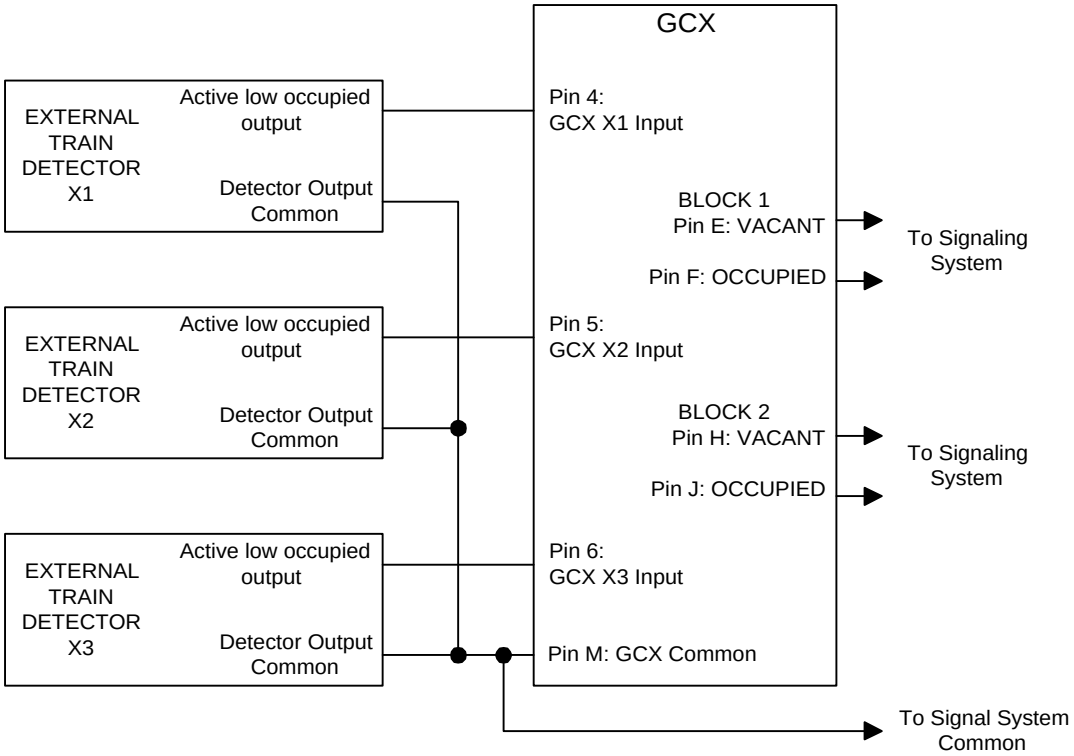

Figure 3-5 Connections to a Signaling System

3.4 TESTING YOUR GCX INSTALLATION

We thoroughly test each GCX before shipping it to you. If you have been connecting things, step by step, and described above, everything should be working.

Many of the tests will have been done as you work through the installation. For the final test, run a train. Start it outside the scene, and run it slowly through. The action should begin as soon as the engine enters the approach block. And the gates should begin to rise as soon as the train crosses the road. Watch closely to make sure that everything works properly. Take note of what doesn't and then go to the trouble-shooting section for additional help.

3.4.1 Trouble Shooting Suggestions

The step by step conversion and installation procedures described throughout this manual should help you avoid most problems, and quickly identify the rest as you go. The important thing is to make just one or two changes and see if everything is still working. If not, there is some problem with what you did since the last test. The more you do between tests, the harder it will be to locate the problem.

Another benefit of the do a little and test approach to this is that it helps you to build your confidence as you go. Success breeds success, and every time you see something that you did work right, no matter how simple or seemingly inconsequential, you will see that it's really not that difficult after all.

The next few paragraphs are a few additional suggestions for ways to prevent or at least identify problems.

The first step in trouble shooting your GCX is to make sure your GCC is working properly. So, before doing any of the steps below, check out your GCC. Also, your GCX boards receive power from the GCC power supply, so make sure it's plugged in and working.

3.4.1.1 The Train Doesn't Run Through Scene

Several simple things can cause this. First, have you turned on your train control system and is the GCX plugged in to its connector? These are obvious things to check.

If the train doesn't run in any of the GCX blocks, you may not have connected the train control common to pin A of the GCX. Or, you may not have connected the common rails from the 3 blocks to the pin 1, 2 and 3 inputs on the GCX.

Another possibility is that you still have one of your original common rail feed wires connected to the GCX detected blocks. In this case, the wire will cause the train running current to bypass the GCX.

If all else fails, go back to section 3.2 and follow the step-by-step procedure again.

3.4.1.2 The Gates, Cross-bucks and Bell Don't Operate

First, make sure that these things all work properly when a train moves through the scene on the track that's being detected by the GCC. If they aren't working for that track, begin by trouble shooting your GCC connections.

After you're sure the GCC is working, you can test your GCX. Only two wires are used to connect a GCX to the GCC, or to the GCX next in the chain closer to the GCC. Make sure these wires are connected to the proper pins. When a train enters an approach block detected by a GCX, it sends a message over these two wires to tell the GCC that a train is approaching. The GCC does everything after that. Later, when the GCX detects its train leaving the scene, it sends another message to the GCC to let it know that the track is clear.

3.4.1.3 Standing Trains are Not Detected

This may be a problem if you are using DC or AC to operate your trains. With these control systems, the track voltage is zero to stop the train. And current flow through the GCX detection circuits may not be taking place.

As long as your throttles do not short the rails together, you can use a low current AC source to cause a small voltage to be present even when the throttles are off. The circuit below will often solve the problem.

Typically, the resistors would be 5K to 10K ohms, ¼ watt. One such resistor should be connected to the power rain in every block with train detection.

This circuit is not needed when you are using DCC or other forms of command control. If you are, make sure that the command control power station or booster is on and putting out power to the track.

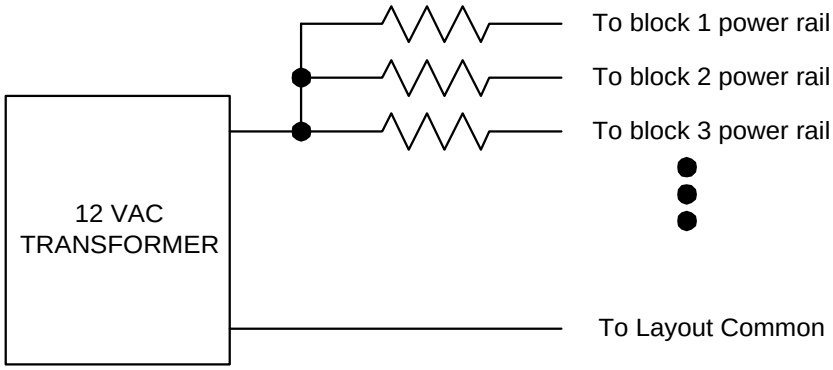

Figure 3-6 Standing Train Detection Circuit

3.4.1.4 Action Starts When Train Reaches Road

If the action only starts when the train reaches the road block, check the wiring of the approach block. Also, if you are using the GCX with a signaling system, check the track configuration wires to pins B, C and D. And, make sure that the external detectors are wired in correctly.

You may want to use a test lead and connect between pin V and the X1 (pin 4), X2 (pin 5) and X3 (pin 6) inputs as appropriate. When you do, you simulate an occupied signal from the external detector. If the action starts this way, then check the external detector wiring and the detector itself. Also, the detector output common, perhaps called a "ground" connection, must be wired to the GCX pin M. If this connection is missing, the external detector output will not be seen by the GCX.

3.4.1.5 External Signaling Operates Incorrectly

First, check to see that the external detectors are connected to the proper GCX inputs. Then, make sure that you are using the proper GCX outputs. Look at Figure 3-5 and make sure that you have wired things in this way.

3.4.1.6 When All Else Fails

When you have done everything you know how to do, and have followed the installation and test suggestions in this manual, and still things aren't working, please contact us. We will do all we can to help solve the problem.

We have always been able to help our customers get everything working properly. We'll help you, too.

4. CUSTOMER SUPPORT

We understand that many model railroaders have limited experience or training in electronics, and may be somewhat apprehensive about installing train detection and signaling systems. Our goal is to make our expertise available to those in the hobby who could benefit. We are doing this by developing products, and associated manuals, which

take care of as many of the details as possible, and explain clearly how you can finish your installation and enjoy the additional operational features which are now possible.

If you have questions, or recommendations, please write. We will do our best to help you get the most satisfaction available from your investment in your GCC and GCX.

4.1 TECHNICAL ASSISTANCE

We are available to provide reasonable assistance to help you get the greatest possible benefit from your GCX Grade Crossing Expander. Feel free to write to us with any questions or comments you may have. Please enclose a large SASE if you are expecting a reply. We will do our best to clear up any issues you may raise about the use of the GCX.

We welcome any suggestions you may have for improvements to the GCX, or for any related products you would like to see available. All such recommendations will be considered as we plan our future product offerings.

You can write to us at:

The Signaling Solution, Inc.
PO Box 37
Shelburn, IN 47879
VOICE: 812-533-1047 (9-4 edt)
FAX: 708-570-6140

4.2 LIMITED WARRANTY

Your satisfaction with your new GCX is our primary concern. The GCX Grade Crossing Expander is warranted free of defects in materials and workmanship for a period of 90 days from date of purchase. This does not cover damage due to misuse-use, improper installation, or connection to excessive voltages or currents. We will, at our option, repair or replace any defective unit.

The GCX Grade Crossing Expander is further warranted for 30 days to perform in a satisfactory manner when connected as described in this manual. Should you feel that your GCX is not performing as you would expect, simply write to us, describing your difficulty. Tell us what you expect of the GCX, and how it appears to fall short. If we cannot clear up any problems you have, we will refund your full purchase price upon return of your GCX in good working order.

Naturally, we cannot be responsible for units that have been damaged by misuse-use, improper installation or connection.

OTHER SIGNALING AND LAYOUT CONTROL PRODUCTS WE SUPPLY

BD16 Block Occupancy Detector for 16 blocks
BD8 Block Occupancy Detector for 8 blocks
MSC Master Signal Controller
GCC Grade Crossing Controller
GCX Grade Crossing Expander
Detectable Wheel Sets
Signal Mounting Adapters
TOMAR Signals, switch stands, crossing gates and flashing cross bucks
Sunrise signals for N-scale and HO-scale
Oregon Rail Supply signals and signal kits

And our new CLICS™ System

COMPLETE LAYOUT INTEGRATED CONTROL SYSTEM