

The Grapevine

The State of the Art
for
Signaling and Control
on
Your Model Railroad

Installation Instructions

ProTrak/Grapevine

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INSTALLING YOUR GRAPEVINE

We are going to install a simple Grapevine system, and get it working. We will test your installation by:

- * checking the Grapevine cable connections in software;
- * turning some signals, on and off, green and red.

For additional information about installing the Grapevine, including photographs and drawings, please refer to the ProTrak website at www.protrak.cc.

Boards, Functions and The Grapevine

Optional overview....

A. Data leaves your computer through the computer's serial port to the Interface Board. At the Interface Board the electrical format (RS232) is converted to a format for long wires (RS 485).

B. You string a 6-wire cable (The Grapevine Cable) from the Interface Board to the first Grapevine Node. Then you string additional lengths of Grapevine Cable from Grapevine Node to Grapevine Node for as many Grapevine Nodes as you have. The six wires in the cable are:

- two wires to send data "out" to the Nodes;
- two wires to bring data "in" to the computer
- two wires for "ground".

C. At the last Grapevine Node you stick a Grapevine Tail in the output connector. The Grapevine Tail completes the loop.

- All data goes in a loop from the computer, from Node to Node to Node to the last Node, then directly back to the computer.
- Each Node acts on any commands for it and passes on the others.
- Each Node, with data to send, adds data to the message stream.
- Commands not acted on by any Node, and error messages, are returned to the computer.

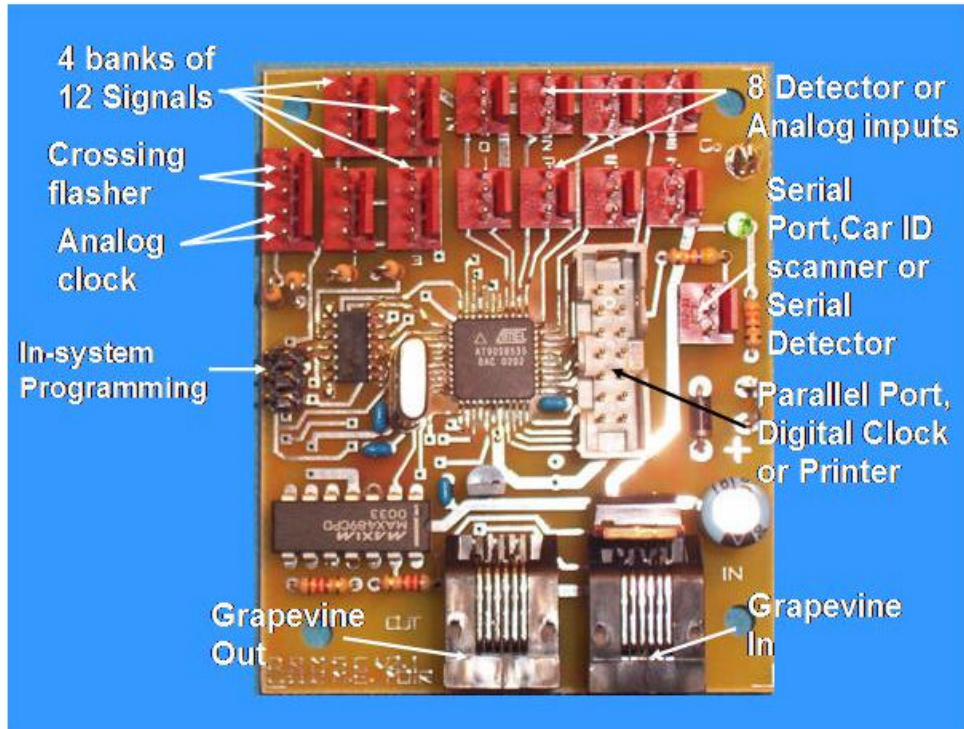
D. Each Node has special connectors for

- Driver Boards. There can be four Driver Boards on each Node, with 12 outputs on each Driver Board.
- the Serial Detector Board. There can be one Serial Detector on each Node. Each Serial Detector Board contains 8 block occupancy detectors.
- Parallel Detector Boards, or other "analog" inputs such as levers and on/off switches. There are connectors for 8 Parallel Detectors.
- analog fastlocks and highway crossing flashers
- a printer or multi-character display.

Software in the Grapevine Node can be updated using the "In-system programming" connector.

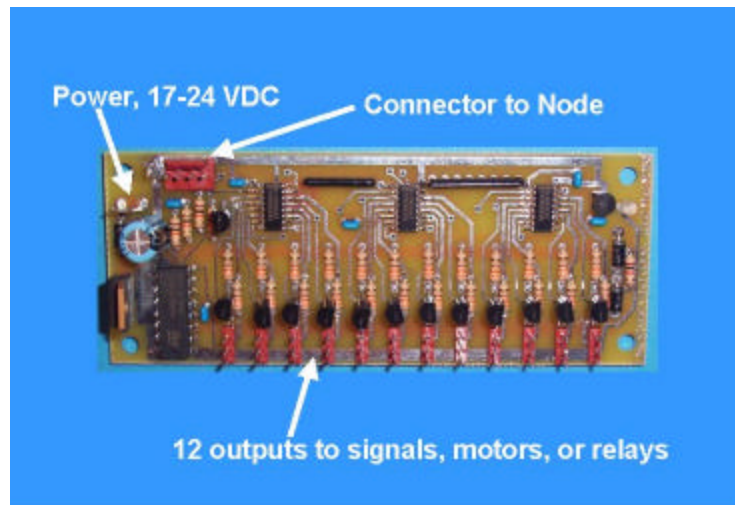
The Grapevine Node

The Grapevine Node is shown below. The Grapevine connects at the connectors at the bottom of the photograph. Power connects by the lugs marked G and + on the right hand side.



The Driver Board

The Driver Board is shown below. The output ports (3-pin connectors) to signal LEDs or switch motors are along the lower edge in this photograph. Data from the Grapevine Node comes through the 4-pin connector.



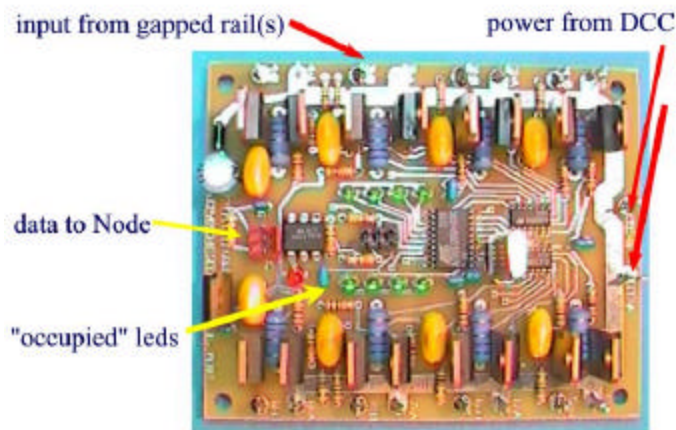
Outputs to signals LEDs are through the middle and outer pins, as described later. Outputs to switch motors are through the middle and inner pins, also described later. Use a 3-pin connector for either, using two or just one of the sockets.

The Serial Detector Board (8 blocks)

The 8-block Serial Detector is shown below. The inputs from the block gapped rails are arranged 4 on one side, 4 on the other side, through the lugs. You can gap either one rail (“common rail wiring”) or both rails. The detector board comes prepared for use with common rail wiring¹. If you wish to gap both rails you will have to install additional lugs in the “A” locations for each detector.

The output to the Grapevine Node is through the 3-pin connector. The 8 green “occupied” LEDs cycle, showing that the detector is working. When a block is occupied the LED stays on.

The Detector Board is powered from the DCC through the two lugs on the right edge (in this photograph). The A (lower in photograph) lug is the common rail. The B lug is the return wire for the blocked rails.



¹ No adjustments are required for gapping both rails.

Parts

The Grapevine boards come assembled. All you may need to buy and assemble are connectors and cable. The connectors are standard, common, off the shelf types. You can get them at your local electronics supply house. Another suggested source is “Mouser” at “www.mouser.com” or 1-800-346-6873.

Item	Mouser Part No.	Description
2-pin connectors:	538-22-01-3027	Molex KK Series 0.100”, 12 cents ² each in 100’s
3-pin connectors:	538-22-01-3037	Molex KK Series 0.100”, 15 cents each in 100’s
4-pin connectors:	538-22-01-3047	Molex KK Series 0.100”, 19 cents each in 100’s
5-pin connectors:	538-22-01-3057	Molex KK Series 0.100”, 23 cents each in 100’s
Pins for connectors ³ :	538-08-50-0114	5 cents each in 100s, 4 cents each in 500s
“Large” lugs:	571-6409171	Amp: 0.187”, red, 15 cents each in 100s
“Small” lugs:	571-6409291	Amp: 0.100”, blue, 19 cents each in 100s

“Standoffs”, “spacers” or “bushings” can be made from ¼” styrene tubing from your hobby shop. A part available from Mouser is:

¼” nylon bushing	561-MP-1010	5.2 cents each in 100s
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² Prices as listed Mouser Catalogue 616, Fall 2003

³ Connectors are just plastic housings. Pins are required.

Instructions

There are five steps:

- 1) Mount the Grapevine boards around the railroad
- 2) Connect the Grapevine boards to a suitable power supply
- 3) Connect the Grapevine Interface Board to your computer
- 4) Connect the Driver Boards to the Nodes, and connect the signals to the Driver Boards
- 5) Set the ProTrak software settings.

Installing Detectors, Fast-clocks and Highways Crossing Flashers and Gates are also covered.

1: Mounting the Grapevine Boards

“Standoffs”

The Grapevine boards have (somewhat sensitive) parts that can pick up stray voltages running through your benchwork. It is best to mount them using plastic or nylon “standoffs” that hold the board a small distance off the wood of your benchwork.

Screws

Use 5/8” to 3/4” #6 roundhead woodscrews. Do not overtighten the screws – just almost snug tight.

Locations

- 1) Mount the Interface Board within 6 feet of the back of your computer.
- 2) Mount the first Driver Board near the signals to be controlled, or near the fastclock that will be nearest to your computer.

<p>Note:</p> <ol style="list-style-type: none">a) The leads to the signals themselves can be quite long, up to 10 or 15 feet.b) The leads to an analog fastclock should not be more than about 6 feet long.c) The Digital Fastclock can be 6 to 8 feet from the fastclock driver board.
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- 3) Mount the first Grapevine Node Board within 4 to 6 ft of the Driver board.
- 4) Mount any Digital Fastclock display board within 10” of the Grapevine Node board.
- 5) Detectors can be mounted 6 feet from their Grapevine Node board.

2: Power supply

Requirements for Grapevine Node and Driver boards

Each board (except the Detectors) in the Grapevine system needs external power. Each board in the Grapevine system has an onboard 5-volt or 15-volt regulator which converts filtered DC into smooth 5 volts or 15 volts. These regulators (7805 and 7815) have a minimum required input voltage to work. Higher voltages make these chips run hotter.

Power Supply Recommendation

For the Grapevine Node the simplest power supply is a commercial wall plug power supply providing 9 to 15 Volts DC.

For the Driver board a filtered power supply of at least 17 VDC is required but no more than 24 VDC is permissible. The power supply must be capable of supplying sufficient current to drive the LEDs, switch machines, and/or relays. See the “Example Power Budget” section below.

The same supply voltage can be used for all boards. However, there are advantages to having “power zones” with each zone having its own power supply.

Maximum Supply Voltage

A 12.6 AC transformer filtered to 17.5 volts is permissible. If you use this type of supply or one of a higher voltage, check the operating temperatures of the 7805 chips, and add heatsinks if necessary.

Use a minimum 2.5 amp transformer filtered with a minimum of 4000 uF. Install fuses.

Power Bus

The power bus for the Grapevine consists of two wires: the ground wire and the ~+17 volt line.

- The ground wire must be run between all boards (except the detectors).
- Groups of boards can be powered from several separate power supplies (the +17).

Installation

- 1) Attach the power supply leads to the lug connectors on each Grapevine Board. Note that the larger (red) lug is for +, and the smaller (blue) plug is for – (Ground).
- 2) Turn on the power supply for the Grapevine. A green LED should light on each Grapevine Node Board. The power LED for each Driver board is a bicolor (Red/Green) LED. If the power LED does NOT come on, turn off the power supply and correct the wiring.
- 3) Turn off the power supply for the Grapevine.

Note:

The DCC detector boards are powered from the DCC on the rails. The red “power on” and green “occupied” LEDs will only come on when the DCC system is on.

Make sure every board (except the detector boards) is showing a “power on” LED. If not, correct the power supply wiring now.

Example Power Budget (Amps)

Add up the number of LEDs and multiple by 20, and add up the number of switchmotors and multiple by 10 (current draw in ma). Then add 100 ma for each board. Divide by 1000 for current in amps, and add 25%.

For example, if you have 4 driver boards, on one Node:

- $4 * 12 = 48$ LEDs * 20 = 960 ma
- 6 boards (4 Drivers, 1 Node, 1 Interface) * 100 = 600 ma
- Total is $960 + 600 = 1560$ ma
- $1560 / 1000 = 1.56$ amps
- Plus 25% = 1.95 amps
- Next size up is 2 amps
- Use a 2 amp transformer minimum.

For future expansion, consider using multiple power zones of 2.5 to 3 amps each.

Important Safety Note:

If you are building your own power supply remember to install properly sized fuses. If you use commercially available power supplies do not exceed the manufacturer’s recommended maximum current.

3: Connecting Grapevine Boards to your computer

Making Grapevine cable

Grapevine cable is quality 6-wire phone wire with standard 6-wire phone plugs crimped to each end. The orientation of the plugs on each end of the cable is important. If your Grapevine does not respond properly the first thing to check is Grapevine cable plug orientation.

- 1) With both plugs the same side up, hold both ends of the cable close together side-by-side pointing away from you. The correct cable orientation has the colored wires in the same order left to right. To get this orientation, the cable must have a half twist (be flipped)⁴.
- 2) If the orientation is correct and the Grapevine still does not respond, make sure that the plugs are crimped properly so that there is good electrical contact between the each end of the cable.

Connecting The Interface Board

- 1) Turn your computer off.
- 2) Find the serial port on your computer. The serial port is a connector about 3/4" wide with two rows of pins. There are 5 pins on the top row and 4 pins on the lower row. The serial port is the only connector on the back of your computer that looks like this.
- 3) Plug the Grapevine serial cable into this port.
- 4) Plug the other end of the serial cable into the 3-pin connector on the Grapevine Interface Board.

Connecting The Grapevine Nodes

- 1) Plug a Grapevine cable into the 6-pin phone type socket on the Interface Board.
- 2) Plug the other end of the Grape cable into the input socket on the first Grapevine Node Board;
- 3) Plug the other end of the Grape cable into the input socket on the next Grapevine Node Board; **or**
- 4) Plug the GrapevineTail into the output socket on the last Grapevine Node Board on your system.

Test The Grapevine Cable

Enter data describing each Node into ProTrak. See Section 6 of these Instructions.

Data for each Node is done at "Signals/Grapevine Node properties". As a minimum for this testing step:

- Click on "Set computer Serial port" and select the correct serial port. Click "OK".

⁴ Phone cable with connectors installed won't work --- it doesn't have the "half flip".

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- Create new Grapevine Nodes at “Edit/New Grapevine Node.
 - Set the addresses for each Grapevine Node⁵. Save the data by clicking “OK”
 - Turn the Grapevine power supply “On”.
 - Click “Check Grapevine Cables”.
 - If **all** the connections are correct, the message “Hello Grapevine” will appear on-screen.

If the message “Hello Grapevine” appears, turn off your Grapevine power supply and proceed to the next step.

Debugging

If another message appears, we need to correct the serial port and/or some wiring.

- First, try other serial ports. Change the port to 2, 1, 3 or 4. Click OK. Repeat the “Check Grapevine cables”. This usually gets it.
- Second, check each and every Grapevine cable. Remove a cable and
 - make sure the connector is crimped tightly on the cable
 - check the orientation of the connectors
 - re-install the cables and make sure the connectors are well seated.
 - Check that the Inbound cable is in the IN, and the Outbound cable to the next Node is in the OUT connector.
 - Check that the Grapevine Tail is properly inserted.
 - Repeat the “Check Grapevine cables”.
- Third, remove the connector from the Interface Board that goes to the back of the computer. Check that there are no loose threads of fine wire shorting across the pins. Reinstall this connector carefully, and re-test the “Check Grapevine cables”.
- Fourth, reduce your Grapevine to one Grapevine Node, and re-test the “Check Grapevine cables”. Do each Node in turn, with just one Node in the circuit, until you find the Node that is not functioning. “Based on experience” (mine!) you will likely find a busted connector or a reversed connector.
- Fifth, check your computer and make sure it has a functioning serial port.
- Sixth, email us for help.

⁵ For now, leave the other data as “No device present” and the checkboxes unchecked. “Set up as a 2000 Node” is for users of the original Grapevine. You are using 2002 Grapevine Nodes.

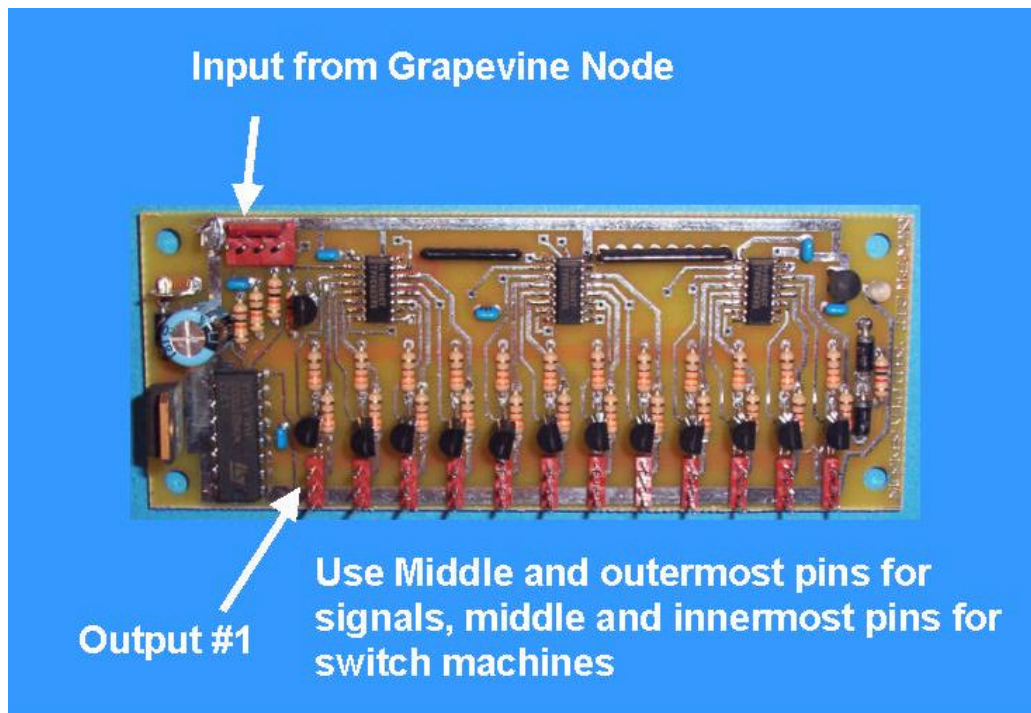
4: Connecting the Driver Boards to the Grapevine Nodes

Each Driver Board get data from the Node by connecting to one of the four “output” connectors on the Node. Each output connector is called a “Bank” in ProTrak/Grapevine.

The cable connecting the Grapevine Node and the Driver Board uses 4 wires. This cable can be up to 6 feet long.⁶

The cable connecting an output port to a signal uses 2 wires⁷. Each of the 12 output ports has three pins. The signals/LEDs use the two outer pins of each port, but use 3-pin connectors. The two inner pins are used to drive slow-motion switch machine motors. Check the figure below and follow these instructions.

- 1) Make up a Node->Driver cable.
- 2) Plug one end of the cable into the socket on the Grapevine Node Board
- 3) Plug the other end of this cable into the control socket on the Driver Board. This is the only 4-pin connector on the Driver board.
- 4) Make up a signal cable and attach the leads from a signal⁸ to one or more of the port connectors on the Driver Board.
- 5) Repeat this for other signals.



⁶ The wires to the signals from the Driver board can be any reasonable length, so signals can be 10, 20 or even 50 feet from the controlling Node. However to keep the wiring neat, reliable and easy to understand, we recommend that signals be within 10 feet of their controlling Grapevine Node.

⁷ Use **3-pin connectors**, as listed in “Parts”.

⁸ A 2-lead bi-color LED (1 signal head) in a searchlight type signal will use just 2 wires. Other styles of signals may use more wires and more ports.

Note:

- a) All 12 signal outputs on a single Driver Board have a common return side. If the signal heads are on the same mast and share a common return -the mast- you only need to run 1 control wire from one of the signal outputs on the Driver board to the mast.
- b) The single control wire goes to the middle pin. Use a two-pin connector, but use only 1 pin.
- c) All signal heads sharing a common mast must be on the same Driver board.

VERY IMPORTANT NOTE:

The signal common return is **NOT** a ground wire. Damage to the signal driver board will occur if the signal mast return wire is attached to the Grapevine power supply ground wire.

5: ProTrak Software and settings

ProTrak installed

- 1) Install ProTrak Lifetime on your computer.

Latest Build, ProTrak software

- 2) Go to the ProTrak website, and click on the User's Updates menu item. Check the ProTrak website at "User's Updates" for the latest Build Number, and compare with the Build you have installed on your computer at "Help/About ProTrak". You must have the latest Build. If the Update is newer by Build Number, or Release Date, download the Update and install it following the directions on the ProTrak website.
- 3) After you install an Update, check "Help/About ProTrak" to confirm that the Update was installed properly.
- 4) For best performance you should keep your ProTrak up-to-date.

Serial Port

- 1) In ProTrak, go to "Signals/Set Grapevine Node properties" and click on the "Set computer serial port " button. Select the correct serial port for your computer.
- 2) Which one? If the serial port is on the back of your computer, then it is probably COM1. If it is on the front of your computer and labeled, for example, "Digital Camera Port", such as on the recent HP desktops, it is probably COM2.
- 3) Occasionally the computer mouse is on a serial port, which is usually COM1. You will have to use COM2 for your Grapevine.
- 4) If all your serial ports are in use, you can buy add-on serial port boards, that can give you up to 10 serial ports. Boards with an additional 2 to 4 ports are quite inexpensive.

Grapevine Node Address

- 1) Go to "Signals/Set Grapevine Node properties". Double-click on the first line of the list, which opens the usual ProTrak data input template. Or, if this is a new Grapevine Node, click on the "Edit/New Grapevine Node" menu option.
- 2) Select and enter the address as printed on the microprocessor on the Grapevine Node Board in the Edit Node template.
 - a. If unmarked, the address is "1". Set up a new Node in ProTrak at address "1".
 - b. Change the address to any other address (on the "Edit Node" template).
 - c. Keep address "1" unused, for new Nodes being added to your system.
- 3) Select the location, the station closest to where you installed the Grapevine Node – so you can find this Grapevine Node board next year.
- 4) Hit "OK".
- 5) Repeat for your other Grapevine Nodes.

Test The Grapevine Cable

Before proceeding you must check that the Grapevine cables are wired and connected to the Grapevine Nodes correctly.

- Turn the Grapevine power supply “On”.
- Click “Check Grapevine Cables”.
- If **all** the connections are correct, the message “Hello Grapevine” will appear on-screen.

If the message “Hello Grapevine” appears, turn off your Grapevine power supply and proceed to the next step.

If another message appears, we need to correct the serial port and/or some wiring.

- First, try other serial ports. Change the port to 2, 1, 3 or 4. Click OK. Repeat the “Check Grapevine cables”. This usually gets it.
- Second, check each and every Grapevine cable. Remove a cable and
 - make sure the connector is crimped tightly on the cable
 - check the orientation of the connectors
 - re-install the cables and make sure the connectors are well seated.
 - Check that the Inbound cable is in the IN, and the Outbound cable to the next Node is in the OUT connector.
 - Check that the Grapevine Tail is properly inserted.
 - Repeat the “Check Grapevine cables”.
- Third, remove the connector from the Interface Board that goes to the back of the computer. Check that there are no loose threads of fine wire shorting across the pins. Reinstall this connector carefully, and re-test the “Check Grapevine cables”.
- Fourth, reduce your Grapevine to one Grapevine Node, and re-test the “Check Grapevine cables”. Do each Node in turn, with just one Node in 7th circuit, until you find the Node that is not functioning. “Based on experience” (mine!) you will likely find a busted connector or a reversed connector.
- Fifth, check your computer and make sure it has a functioning serial port.
- Sixth, email us for help.

Testing a Signal Driver Board and Signal

You can create, change and test signals at many places in ProTrak. What we want to do here is test a connection to the signal you installed above. The easiest place to do this in:

- 1) Click Signals/Signaling system/Change or test Signals”. This opens a list of all the signals, assigned to a block or not assigned.
- 2) Click “Edit/New signal”, which adds a new to the list of signals. You will be able to assign this signal or delete this signal later. The “Edit Signal” template opens.
 - a) The signal has been defined, by default (startup) as a Block signal with one head. A searchlight type of signal is assumed (with a single two-lead bi-color LED).
 - b) Select a Node from the dropdown list.
 - c) Leave the number of heads as “1”.

- d) Leave the bank number and port numbers as “1”. This assumes you attached the Driver Board to Bank connector #1, and the signal cable to the #1 port
- e) Click “Apply”.
- f) Turn your Grapevine power supply “ON”.
- g) In the right hand window “Test Aspect”, click the “Green” button, and click on the “Top” button⁹. The signal should go “Green”.

If the signal goes green, then everything is wired properly. You know how to install signals with Grapevine and ProTrak.

Continue installing signals and entering data in ProTrak. Test as you go along.

Debugging

If the signal goes “Red”, select “Red” and click “Top”. If the signal goes green, the signal polarity is reversed relative to the settings in ProTrak. You have two choices, change the wiring at the Driver Port¹⁰ or change the software “Polarity” setting.

If the signal stays dark, then:

- 1) Is the green power LED on? If not, check and correct the power wiring.
- 2) Make sure the signal itself is working. Use a multimeter to check the LEDs and wiring in the signal. Especially make sure the solder joint at the LED lead-to-mast is working.
- 3) Check the wiring to the signal from the Drive Board.
- 4) Check the settings in ProTrak. Compare the connections – which bank connector and which port connector is used, and, as necessary, change the port number and the bank connector.
 - a) Bank #1 is at the upper left (see Photograph) on the Grapevine Node.
 - b) Port #1 is at the left, next to regulator/capacitor (see Photograph, arrow is pointing at Port #1) on the Driver Board.

⁹ If you select “2” heads the middle button becomes active. If you select “3” heads the “Bottom” button also becomes active.

¹⁰ Or at the signal. This is usually not an option; change the wiring at the Driver Board connector.

7: Signals

Where Signal data is found and entered in ProTrak

Where the signal data is entered in ProTrak depends on whether the signals are for:

- train order signals (first at Stations, and modified at “Signals/Dispatcher/Train order signals”), or
- for block/ interlocking signals (all data at “Signals/Signaling system/Blocks and signals”), or
- highway crossing flashers (“Signals/Grapevine Node properties”).

Train order signals are entered through a “Train Order signal” template, which is accessed from the Station Edit template.

Block and interlocking signals can be created at “Signaling/Signaling system/Change or Test signals” or through the “Block” edit template at “Signaling/Signaling system/Blocks and Signals”. Select a block and in the “Create or Change Signals box” click on one of the “Show” radio buttons.

Block signals require detectors to work, so block signals are described after the section on “Installing Detectors”.

8: Train order Signals

New Train Order signals

- 1) Go to The Railroad, and select and open the data template for the station where the train order signal is located.
- 2) Go down to the Services datafield, and from the dropdown list select “Train order station, bulletins and clock”. Even if this data was previously and is currently selected, re-click on this data option. This is the only place where a Train order signal can be created.
- 3) Hit “OK”.
- 4) The Train order signal template appears. If not, repeat “Step #2” above.
- 5) Select the Grapevine Node address from the dropdown list. If this is a new Grapevine system, there is probably only 1 Grapevine Node on this list.
- 6) Select the port numbers. Valid bank numbers are “1” to “4” (which bank connector is the Driver Board attached to on the Node) and valid port numbers are “1” to “12” (which output port on the Driver Board is the signal cable attached to).
 - a. The signal test can be used also to find the correct ports. If you are not sure, try 1 and 2, or 11 and 12.
 - b. If the Node, Bank and Port numbers are not zero, the “Test Aspects” window appears. If it is not showing, select a Node or Bank or Port and click “Apply”.
 - c. Click the “Green” radio button, and hit “Top” (or Middle or Bottom). Did the signal go green? If yes, you have the correct port. If signal does not light change

the (bank and) port numbers and hit the “test” buttons until you find the correct port.

- 7) If none of the port settings work with the train order signals (you tried all ports from 1 up to 12) check that:
 - a. the “Check Grapevine cables” command returns “Hello Grapevine”. If the signal does not light (some color), then you need to correct the wiring for the signals.
 - b. If the signals do not light, then you probably need to adjust the Grapevine Node address and/or port settings.
 - a) Go to Signals/Dispatcher’s system/Train order signals”.
 - b) Double-click the correct signal and correct the Grapevine Node address.
 - c) Adjust the bank and port settings and test the aspects until the signals are working properly.
 - c. If there are no train order signals listed, or the correct signal does not exist:
 - a) Go to The Railroad and select the correct station (either from “Stations on the core segment”, or from “Stations on other subdivisions”).
 - b) Go down to the Services datafield, and from the dropdown list select “Train order station, bulletins and clock”. Even if this data is currently selected, click on this data option.
 - c) Hit “OK”.
 - d) Then set the Grapevine Node address, and the ports, and test the signal aspects.

Changing Train Order signal data

- 1) Go to Signals/Dispatcher/Train order signals.
- 2) Select the station/train order signal you want to change.
- 3) The Train order signal template appears.
- 4) Select the Grapevine Node address from the dropdown list.
- 5) Select the port numbers.

9: Hooking up Detectors to the track and the DCC bus

Have block signals, interlockings and/or Highway Crossing Flashers

If you are using block signals (ABS and/or APB), interlockings, CTC or have Highway Crossing Flashers you should read this section.

Detector power supply

The Grapevine detectors get their power from the DCC system¹¹. There is no power supply connection. The red LED will come on when the DCC power is, even if the Grapevine power supply is off.

Power comes from the heavy return wire to the DCC bus, and a light wire from the other DCC bus wire.

Detector Connections

- 1) Mount the detector board centrally to the blocks being detected. Make the DCC-to-detector board wire runs as short and as direct as possible.
- 2) The Detector-to-Grapevine Node wire runs can be reasonably long, but the detector and its Grapevine Node should be as close together as possible.

Note:

- a) The Grapevine Node that a block is attached to doesn't matter, as all the connection settings are in software in ProTrak.
- b) Attach the detector to the **closest** Grapevine Node.

- 3) The detectors have two sets of connectors:
 - a. to the Grapevine Node board using the 3-pin connector.
 - b. from the track/DCC bus using lugs. There are 3 different connections from the track/DCC to the detectors:
 1. 8 wires, one from each block to the B#- B lugs
 2. 1 common return power wire from the DCC-B lug (or a B#-B lug)
 3. 1 detector power supply wire to the other DCC bus to the DCC-A lug¹².
- 4) From the DCC bus that powers the gapped rail:
 - a. Drop a DCC-bus-sized (#10 to #14) wire from the closest point on that DCC bus
 - b. Crimp a blue lug connector on the detector end.
 - c. Push it onto the DCC-B lug.
- 5) From the **other** DCC bus:
 - a. Drop a #22 wire from the closest point on that DCC bus
 - b. Crimp a blue lug connector on the detector end.

¹¹ Or Railcommand. The Grapevine detectors work fine with Railcommand.

¹² NOTE: All the "A" lugs are attached to a common bus on the component side of the board.

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- c. Push this connector onto the DCC-A lug (next to the DCC-B lug)
 - 6) Drop and measure DCC-bus-sized (#10 to #14) wires from the gapped rail track blocks to the detectors.
 - a. Attach each wire to the blocked rail in its block
 - b. Crimp a red lug connector on the detector end
 - c. Push it onto one the B lugs.
 - 7) Test these connections:
 - a. Turn on your DCC system
 - b. The red power LED on the detector board must come on.
 1. If the red LED comes on, proceed with your installation.
 2. If NOT, correct the wiring making sure the DCC-A and DCC-B lugs come from opposite DCC power bus (wires).
 - c. Roll a detected car (one with 15K to 20K¹³ resistor axles) into one of the blocks
 1. The green “occupied” LED must come on and stay on.
 2. If NOT:
 1. check that the resistor is OK; or clean the resistor wheels
 2. Make sure the drop wire from the gapped rail is attached to a “B” lug
 - d. Turn off your DCC system.
 - 8) Make and install the Detector-to-Grapevine Node cables using the three-pin connectors.
 - 9) In ProTrak, record which block/detector is attached to which Grapevine Node detector port. See the following section.

Testing Detector connections in software

Grapevine and ProTrak are “event driven”. This means that as soon as some thing happens, The Grapevine actively sends data to ProTrak.

You can test that the detector data is being sent back to ProTrak:

- 1) click on “Signaling/Signaling system/Blocks and Signals”;
- 2) click “Test detectors”.
- 3) roll a car or engine into a detected block;
- 4) the Node and Detector port show “Occupied”.
- 5) roll the engine or car out of the block.
- 6) the Node and Detector port show “unoccupied”.

¹³ up to 70K. A finger placed across the rails will work too. DO NOT USE a screwdriver, pliers or other metal object.

10: Block signals

- A. Go to Signals/Signaling system/Blocks and signals.
- B. Signals and detectors are associated with a track block. **All the detector and signal data is entered with respect to a block.**
 - 1. First you create a block.
 - 2. Then you tell ProTrak what the detector node and port address is.
 - 3. Then you tell ProTrak what the signal node and port addresses are.
- C. Signals are entered by “mast” and by heads on that mast.
 - 1. Each mast is of a type (Interlocking, Block, or Dwarf); the aspect that a mast (signal) displays depends on what type it is.
 - 2. Each signal head on a mast has its own port address. All the signal heads on a signal mast must be driven by the same Driver Board, and therefore from the same Grapevine Node.

Note:

- a) The detector ports are on the Grapevine Serial Detector Board.
- b) The signal ports are on the Driver Board.

Note: Detector ports and signal ports for the same block can be on different Grapevine Nodes.

Blocks can be entered in any order. The “connections” between blocks are made by the “East connection” and “West Connection” datafields.

However: We suggest you enter the blocks from east to west. This will make your data easier for you to debug and understand.

- 1) Go up to Edit on the main menu, and click “Add a Block”. This creates a new block, and opens up the usual ProTrak data entry template. This template is for a signal block.
- 2) For now, go down to the “Block is detected for” datafield, and from the dropdown list select “First track block”.
- 3) Go down to the “Grapevine node” datafield, and select the node from the dropdown list. If this is a new Grapevine system, there is probably only 1 node on this list – select it.
- 4) At the “Detector port number” datafield, enter “1”. (Let’s keep it simple. This is your first detector so let’s put it on Detector Port 1.) This is the connector port number on the Grapevine Serial Detector Board where you would connect the input from the power wire from this block.
- 5) Click the checkbox at “Signal protecting east end”. This opens a window on the right hand side. This window is used to enter data to describe the Grapevine Node and bank and port address for each signal head on the signal (mast) that is at the east end of this block.
 - a. Select the Grapevine Node number that the Driver board that drives this signal is attached to.

- b. Enter how many heads there on this mast. (Do not include ‘dummy’ heads that are always showing a red aspect – i.e. use a red LED, or to get the same red hue hardwire a bicolor LED to always show red.)
- c. Enter the Bank number (probably “1”).
- d. Enter the port number for the top signal head.
- e. Enter the port numbers for any other signal heads on this same mast.
- f. Select the radio button for the type of signal. (This tells ProTrak which aspect to use on this mast.)
- g. Hit the “Apply” button. Then “Close” or “Cancel”.

Now you can test the signal heads on this signal mast.

- 6) The signal when first turned on is dark.
- 7) Hit the “Green” radio button. Hit the “Top” button. The top signal head will go green. Try the other aspects. Repeat this for the other signal heads on this signal mast.
- 8) If the signal does not respond it is likely that
 - a) the bank and/or port was not selected correctly for a signal head. Change the port (and bank) number on this window to the correct one, so that the Top button changes the aspect of the top signal head.
 - b) If necessary, change the port numbers for the other signal heads on this signal mast.
 - c) The Grapevine Node address for the signal is not correct.
 - d) If none of the port settings work with this block/interlocking signal (you tried all ports from 1 up to 12) check that:
 1. the bank number matches the connector used on the Grapevine Node;
 2. the Grapevine Node address for the signal is correct.
 3. If the signals do not light at all, then you need to correct the wiring for the signals.

Entering Interlockings, Control Points (CP):

1. To enter a Control Point (CP) or interlocking, select “Control point” or another trackage arrangement from the dropdown for “Detected for” datafield.
2. If a CP is selected, enter data to describe “CP, switch points point to”. This data is required.
3. Enter signal data.

Connecting Blocks data

The “Block connected” datafields tell the program how the blocks are connected.

A block must exist before it can be selected. Create blocks, then come back and enter this data.

11: Fast Clocks

Number of clocks: Each Grapevine Node can drive 1 analog fastclock and 1 digital fastclock.

Analog Clock: Attach the leads from the analog fastclock to the Analog Clock pins on the Grapevine Node Board using a 5-pin connector. See the photograph of the Grapevine Node.

Digital Clock: Attach the ribbon cable from the display to the parallel port on the Grapevine Node board. See the photograph of the Grapevine Node.

Software Settings:

- 1) Go to Signals/Grapevine Node properties.
- 2) Double click on the Grapevine Node with the clock(s).
- 3) On the edit template, check the “analog clock” checkbox, and/or click the digital fastclock radio button.
- 4) Click “OK”.

Note: You can have **only 1** analog or digital fast clock on each node. If you want more analog fast clocks, you need more nodes.

Testing the Analog Fastclock:

- 1) If you have an analog fastclock, go to Signals/Fast clock settings. The default ratio is 6, and can be changed at any time. Leave it at 6, or move it do another ratio, for example, between 3 and 4.
- 2) Hit “Test clock”.
- 3) If there are several clocks on your system, double-click on the clock you want to test.
- 4) Hit “Start clock”. The clock should start moving.
- 5) Hit “Stop clock” to --- stop the clock.
- 6) If the clock does not start:
 - a. change the serial port. (“Check Grapevine cables”)
 - b. Then check that:
 - i. the clock leads are on the Analog Clock pins.
 - ii. in ProTrak, the Grapevine Node has the analog clock box checked. Go to “Signals/Grapevine Node properties”, select the correct Grapevine Node from the list and open the Grapevine Node data input template. If there is an analog fastclock, click the analog fastclock checkbox.

NOTE: The clock will run until you stop it, pause it or exit the Operations session, or turn off the Grapevine power supply.

Testing the Digital Fastclock:

- 1) If you have a digital fastclock, go to Signals/Fast clock settings. The default ratio is 6, and can be changed at any time. Leave it at 6, or move it to another ratio, for example, between 3 and 4.
- 2) Turn on the Grapevine power supply. When the Grapevine is turned on the digital clock will be flashing “33” with the trailing 2 digits off. If the clock is flashing “EE” it is upside down.
- 3) Hit “Test clock”.
- 4) If there are several clocks on your system, double-click on the clock you want to test. The current time is shown in the right hand window, and the clock display now shows that time. The clock is working properly.
- 5) Change the time, and hit the “Send” button. That time is displayed.
- 6) In the left hand window, hit the “Start clock” button. The clock will run until you stop it, pause it or exit the Operations session, or turn off the Grapevine power supply.
- 7) If the digital clock does not start, check that:
 - a. the ribbon cable from the Grapevine Node to the display board is on the parallel port connector on the Grapevine Node board.
 - b. in ProTrak, the Grapevine Node has the digital clock radio button checked. Go to “Signals/Grapevine node properties”, select the correct Grapevine Node from the list and open the Grapevine Node data input template. Click the Digital fastclock radio button.

12: Highway Crossing Flashers

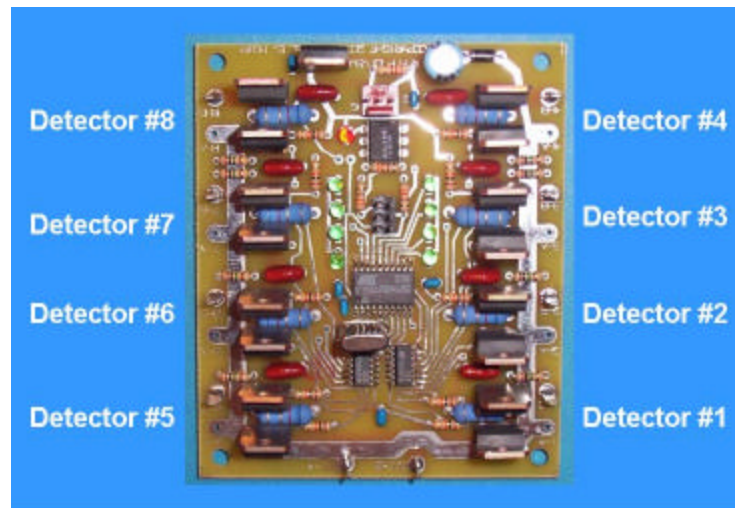
- A. Highway Crossing flashers use:
 - a. the “Flashers” output from the Grapevine Node Board; and,
 - b. two¹⁴ inputs to detectors on the Grapevine Detector Board.
- B. You must use specific outputs and inputs; no others will work.
- C. The detectors and flashers must **all** be attached to the **same** Grapevine Node.
- D. However, optional crossing gates, that go with a crossing flasher, can be on any Grapevine Node and Driver Board.

Flasher signals

The Highway Crossing Flashers use a special port on the Grapevine Node board. Use a 5-pin connector that is common with the connector for the analog clock.

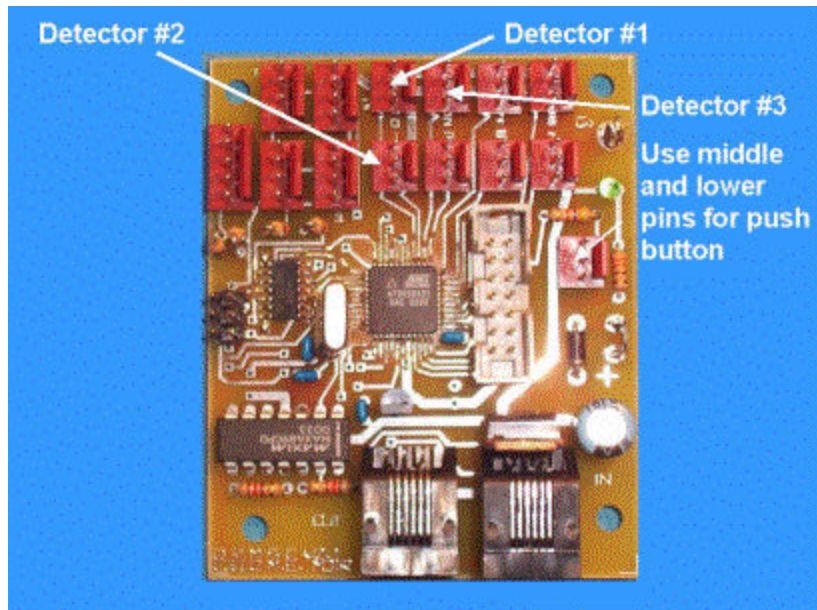
Detector inputs

- 1) The Highway crossing flashers use two detectors, the “highway” block and the surrounding block that provides the approach section. The approach block may be a block detector which is part of the signal system. If a Serial Detector board is installed on the Grapevine Node then Detectors #1 and #2 on the Serial Detector board are used for the Highway Crossing. See the photograph below for the location of these detectors.



¹⁴ Or more. The “approach block” can be adjacent blocks, as well as a single block surrounding the road block. As well you can have flashers driven by up to 4 parallel tracks.

- 2) If no Serial Detector board is installed then parallel Detectors #1 and #2 must be used for the Highway Crossing. The location of these headers on the Grapevine Node board is shown in the photograph below.



- 3) The detector for the approach block must be on Detector #1.
 4) The detector for the highway crossing proper (i.e. where the road is) must be Detector #2.
 5) Any block occupancy detector that has a digital (0, +5 V) output or a contact closure to ground can be used. It is strongly recommended that the input to the Grapevine Node be debounced.

Pushbutton and Indicator LED

- 6) You can install a pushbutton that will turn off the flasher signals when a train is in the approach block. The pushbutton uses a detector input. Connect the two wires from the pushbutton to Parallel Detector #3 on the Grapevine Node board.

Note:

The pushbutton uses 2 wires. The parallel detector port has 3 pins. Use the pins shown in the photograph above.

Crossing gates

If you are using crossing gates powered by slow-motion switch motors, attach the motors to a Grapevine Driver board. The Driver board can be attached to any Grapevine Node. The motors are driven from the 2 'inner' wires from 3-pin connectors on the Driver board.

Software settings for Highway Crossings

- 6) In ProTrak, go to “Signals/Set Grapevine node properties”.
- 7) Double-click line in the list for the Grapevine Node that flasher is connected to.
- 8) Click the check box for Highway Crossing.
- 9) For gates, click on “Highway Crossing with gates” and enter the Grapevine Node address and port number.
- 10) Enter the number of tracks.
- 11) Hit “OK”.
- 12) Close the Grapevine Node list.

Testing the Highway Crossing Flashers

- 1) When you turn on the power to the Grapevine system, the highway crossing flashers will flash with one LED.
- 2) To make the flashers work:
 - a. Start ProTrak.
 - b. Enter the Operations session
 - c. Click on Dispatcher/ABS signal system.
- 3) Roll a car or train into the approach block.
 - a. Check that the detector “occupied LED went on.
 - b. The flashers should start to flash.
- 4) Roll the car/train through, and **out of** the highway crossing.
 - a. The flashers will turn off.
- 5) Roll a car/train out of the approach block, and reverse back into the approach block. Do not enter the highway crossing block
 - a. The flashers should start to flash.
 - b. Press the pusbutton.
 - i. The flashers will turn off
 - c. Press the pusbutton.
 - i. The flashers will turn back on

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