NightScope™ Infrared Detector Application Guide

The ***NightScope*™ Infrared Detector** is extremely flexible and can reliably detect engines and rolling stock for model railroad signaling and assorted electronic systems. This guide shows how easy it is to wire a Detector for many common applications.

I. Basic Connection to Any Target System

The ***NightScope*™ Infrared Detector's** four color-coded wires are listed in Table 1.

Table 1: NightScope™ Infrared Detector Wiring

Wire Color	Name	Function
Red	Power	+5 to +16 Volts DC
Black	Ground	Common with other electronics
Blue	Detect High	Detector output pulled to Power (sources up to 200 mA max.) when train is detected; Otherwise pulled to Ground thru 4.7k ohms.
Yellow	Detect Low	Grounded when train is detected (sinks up to 200 mA max.) when train is detected; Otherwise pulled to Power thru 4.7k ohms.

Basic connection to other model railroad electronics (target systems) and power supply is shown in Figure 1.

The BLACK Ground wire is connected to the Target System and Power Supply ground. This establishes a common voltage reference point between the Detector and the Target System.

The RED Power wire connects to a filtered DC power source supplying 5 to 16 volts. This is typically either 1) a terminal on the target system or 2) a separate positive power supply that is also ground-connected with the target system (as shown in the figure). ***Warning: Do not exceed 16 volts DC or apply AC power as this will damage the Detector.***

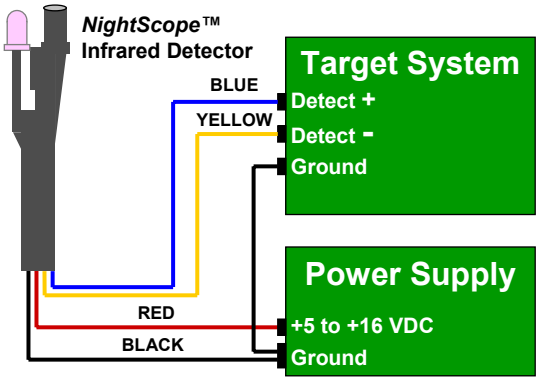


Figure 1: Basic Connections

The Detector provides both a positive and negative sense outputs: the BLUE wire (Detect High) connects to targets requiring a positive voltage when a train is detected; the YELLOW wire (Detect Low) connects to targets requiring a negative voltage upon detection. While Figure 1 shows both BLUE and YELLOW wires connected, target systems typically require either one or the other but not both.

Detect High can supply up to 200 mA and Detect Low can sink up to 200 mA upon detection. With no train present, both outputs are weakly pulled to the opposite voltage as noted in the table. (See the **NightScope™ Infrared Detector** Technical Specification for details.) With both positive and negative outputs at these current levels, the Detector can drive a variety of model railroad electronics.

Warning: Do not exceed these maximum current ratings for Detect High or Detect Low as this will damage the Detector.

© 2009 Boulder Creek Engineering, LLC

II. Connecting Electronic Components

With its flexible high current outputs, the **NightScope™ Infrared Detector** can easily drive other electronic components such as LEDs, relays, and switch motors. Applications in this section work with both the **Instant Response (NS-340)** and **Delayed Response (NS-342)** models.

A. Driving LEDs for Display

The **NightScope™ Infrared Detector** can drive one or more LEDs to indicate the presence or absence of trains. Either Detect High (BLUE) or Detect Low (YELLOW) outputs – or both – can drive one or more LEDs when a train is detected as shown in Figure LED-1.

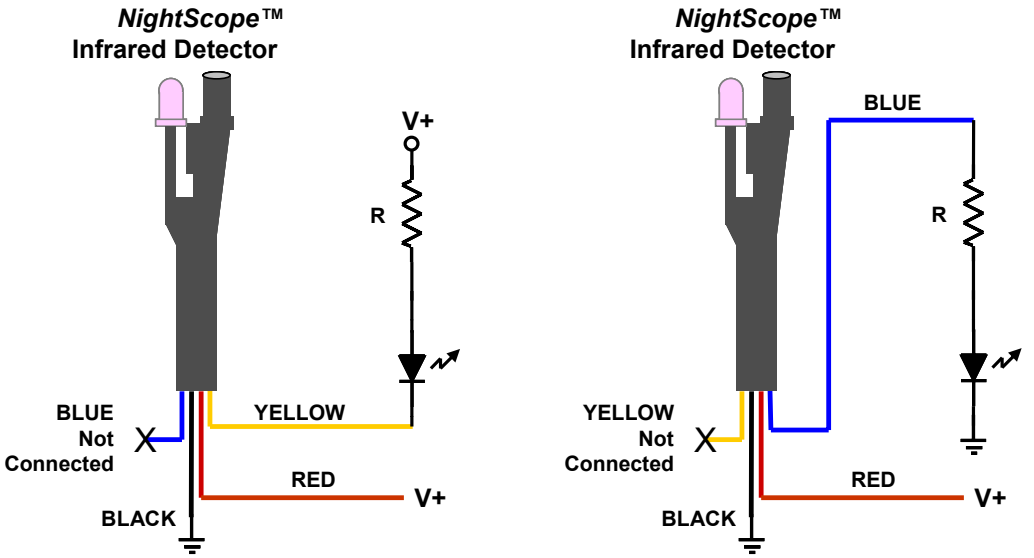


Figure LED-1

Resistor is ¼ Watt:

For V+ = 12 Volts,
R = 1k ohms

For V+ = 5 Volts,
R = 330 ohms

LED off when no train present.
Upon detection, LED is lit.

Resistor values recommendations are based on power supply voltage for one LED. Driving additional LEDs will require different resistance and possibly power values.

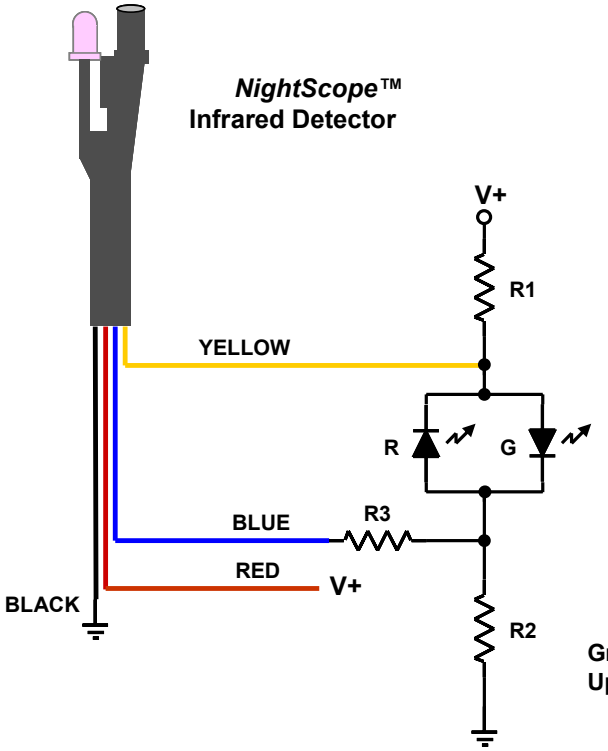


Figure LED-2

All Resistors are ¼ Watt:

For V+ = 12 Volts,
R1 = 680 ohms
R2 = 330 ohms
R3 = 680 ohms

For V+ = 5 Volts,
R1 = 220 ohms
R2 = 100 ohms
R3 = 100 ohms

Green LED lit when no train present.
Upon detection, Red LED is lit.

Figure LED-2 shows how to connect a 2-color LED for Red (train detected) and Green (no train) indication. Individual red and green LEDs may also be used.

Again, driving additional LEDs will require different resistance and possibly power values.

© 2009 Boulder Creek Engineering, LLC

B. Driving Relays for Power Control

For controlling very high currents or control signals such as DCC track signals, a relay is hard to beat.

One or More Relays

The **NightScope™ Infrared Detector** can drive one or more relays as shown in Figure Relay-1. You can connect as many relays to Detect Low (YELLOW) as desired up to a maximum of 200 mA total coil current. (The SPDT relays shown are examples – contact configuration has no effect on Infrared Detector connection.)

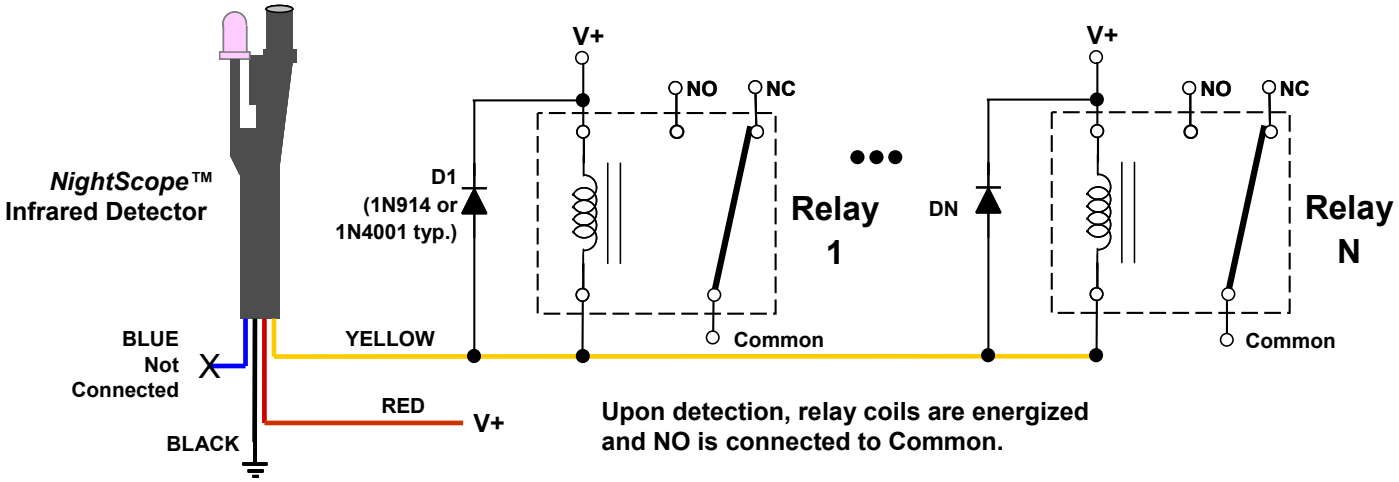


Figure Relay-1

You can also use Detect High (BLUE) to drive one or more relays up to 200 mA of coil current as shown in Figure Relay-2.

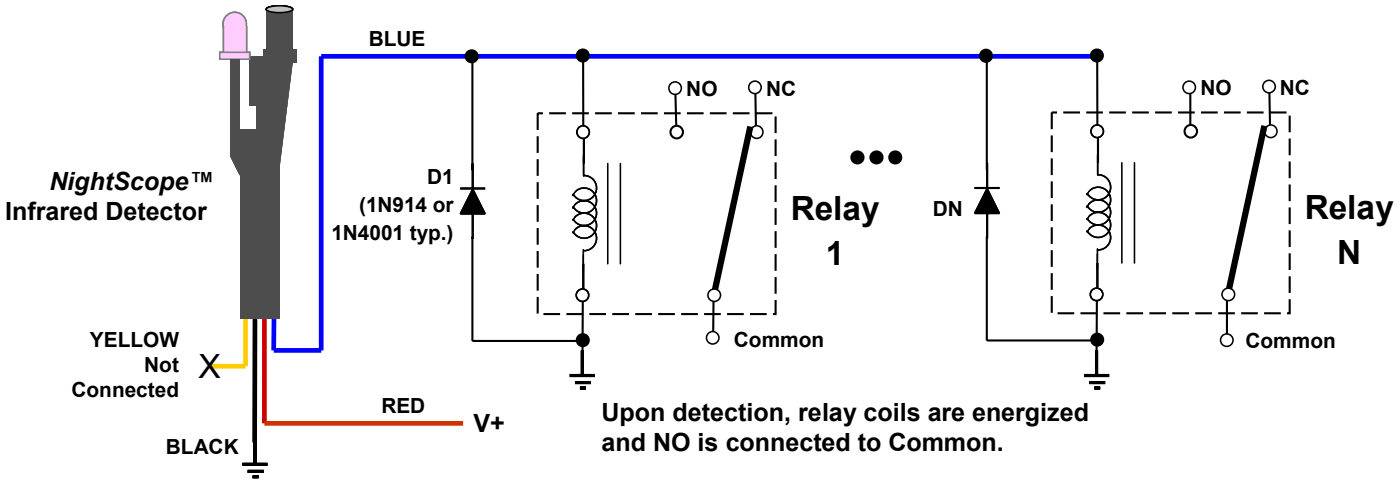


Figure Relay-2

Since the Detect High (BLUE) and Detect Low (YELLOW) outputs can drive up to 200 mA each, you can combine Figure Relay-1 and Figure Relay-2 to drive two banks of relay coils totaling 400 mA!

© 2009 Boulder Creek Engineering, LLC

More Than One Detector

NightScope™ Infrared Detector outputs can be connected in a "wired-or" configuration. That means you can connect more than one Detector to one or more relays, and if at least one detects a train, the relay coils will be energized. Figure Relay-3 shows this configuration for Detect Low (YELLOW) outputs.

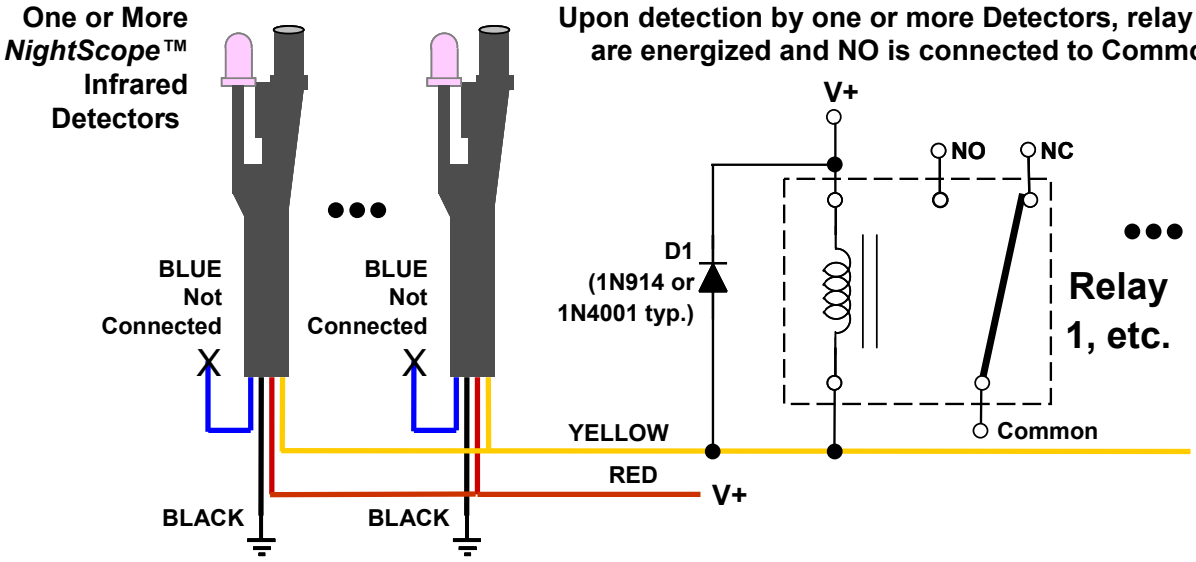


Figure Relay-3

You can also make wired-or connections with Detect High (BLUE) outputs.

Warning: Do not connect Detect Highs (BLUE) and Detect Lows (YELLOW) together as this will damage the Detectors.

© 2009 Boulder Creek Engineering, LLC

III. Connecting to Model Railroad Electronic Systems

The following sections show how to wire the **NightScope™ Infrared Detector** as an input to several popular model railroad electronic systems. All applications are for the **Instant Response (NS-340)** model.

A. SE8C Signal Decoder from Digitrax

The ***NightScope*™ Infrared Detector** connects as an occupancy detector to the Digitrax SE8C Signal Decoder as shown in Figure SE8C. Connect the BLUE wire (Detect High) output from Detector to a DS0 (one of DS01 - DS08) pin on the SE8C edge connector. While only two Detectors are shown in the figure, up to 8 Detectors can be connected to one SE8C in this manner. See the "Installing Turnouts and Feedback Input" in the SE8C manual for a complete discussion of the Signal Decoder's inputs.

Note that the x is powered directly from the SE8C connections to +VE and -VE.

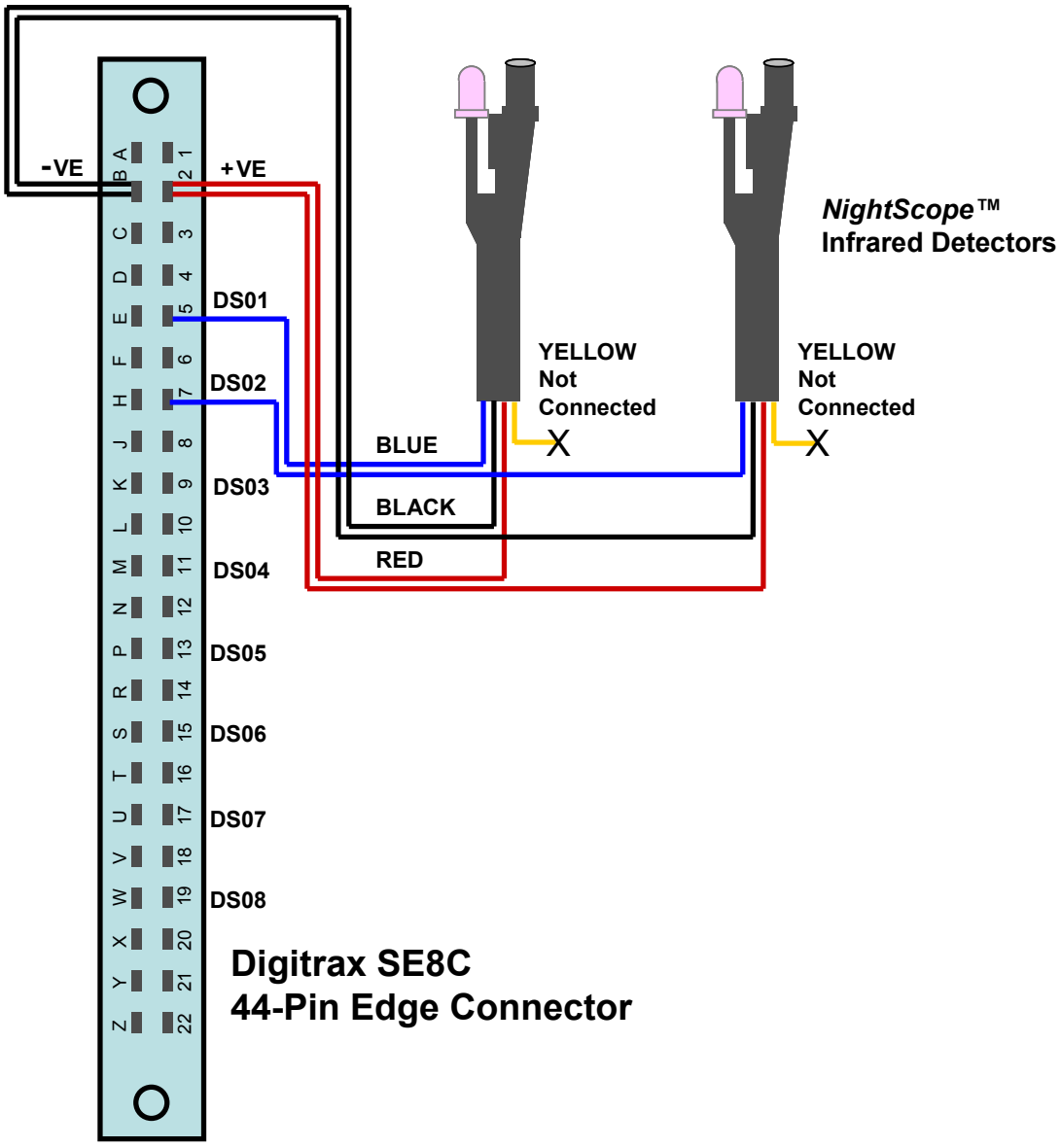


Figure SE8C

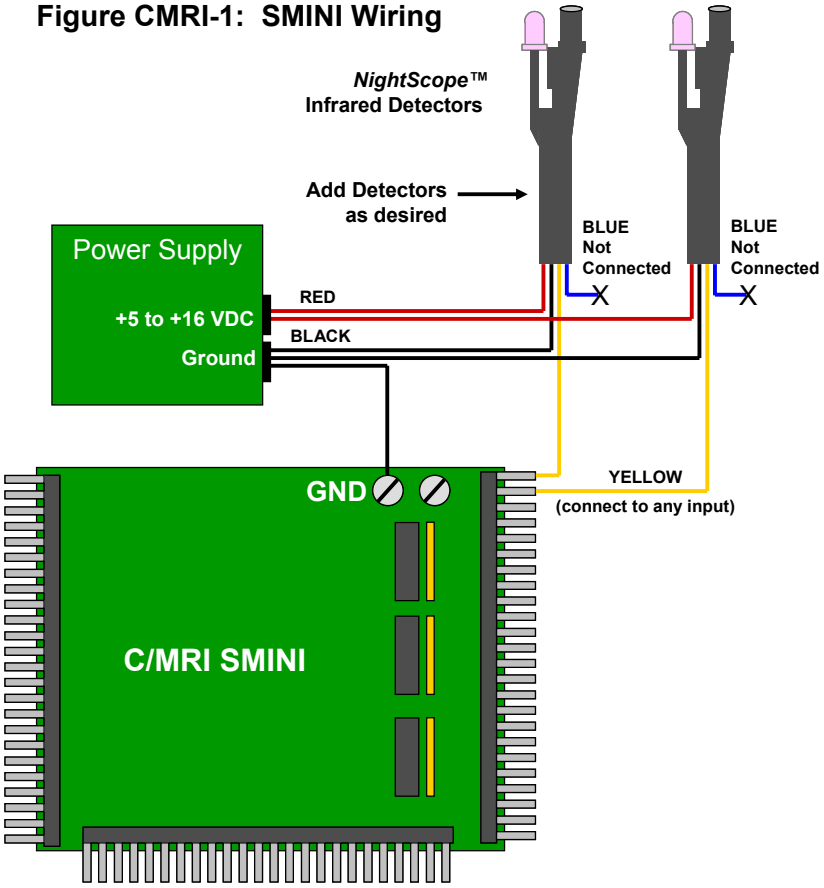
© 2009 Boulder Creek Engineering, LLC

B. Computer/Model Railroad Interface (CMRI) from JLC Enterprises

The ***NightScope*™ Infrared Detector** connects directly with inputs on both the Super Mini-node (SMINI) and the DIN32 digital I/O card. See Figures CMRI-1 and CMRI-2 for wiring Detectors to the SMINI and DIN32 respectively. Note that the BLUE (Detect High) wire is not connected – clip it short and insulate it. When a train is detected, the Detector will drive the C/MRI input LOW.

Both figures show a separate power supply for the Detectors. For example, this could be a separate +12 Volt DC supply. As an alternative, you could run the Detectors and C/MRI from a shared +5 volt DC supply. (See your C/MRI documentation for power supply wiring instructions.)

Figure CMRI-1: SMINI Wiring



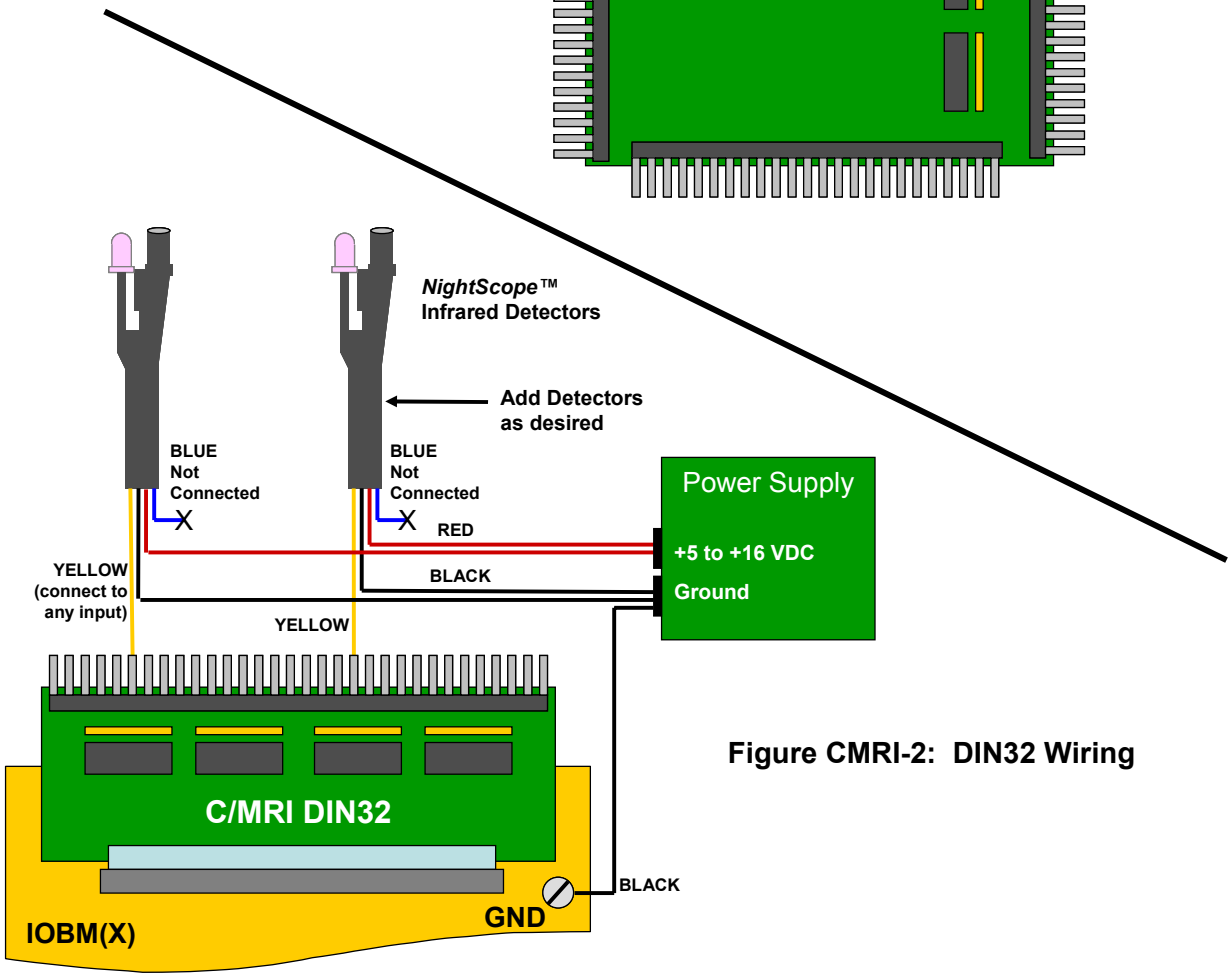


Figure CMRI-2: DIN32 Wiring

© 2009 Boulder Creek Engineering, LLC

C. Grade Crossing Pro from Logic Rail Technologies

The Logic Rail Technologies Grade Crossing Pro (GCP) requires four Detectors. Figure GCP shows how to connect ***NightScope*™ Infrared Detectors** to GCP for reliable infrared detection. Note that the YELLOW (Detect Low) wire is not connected – clip it short an d insulate it.

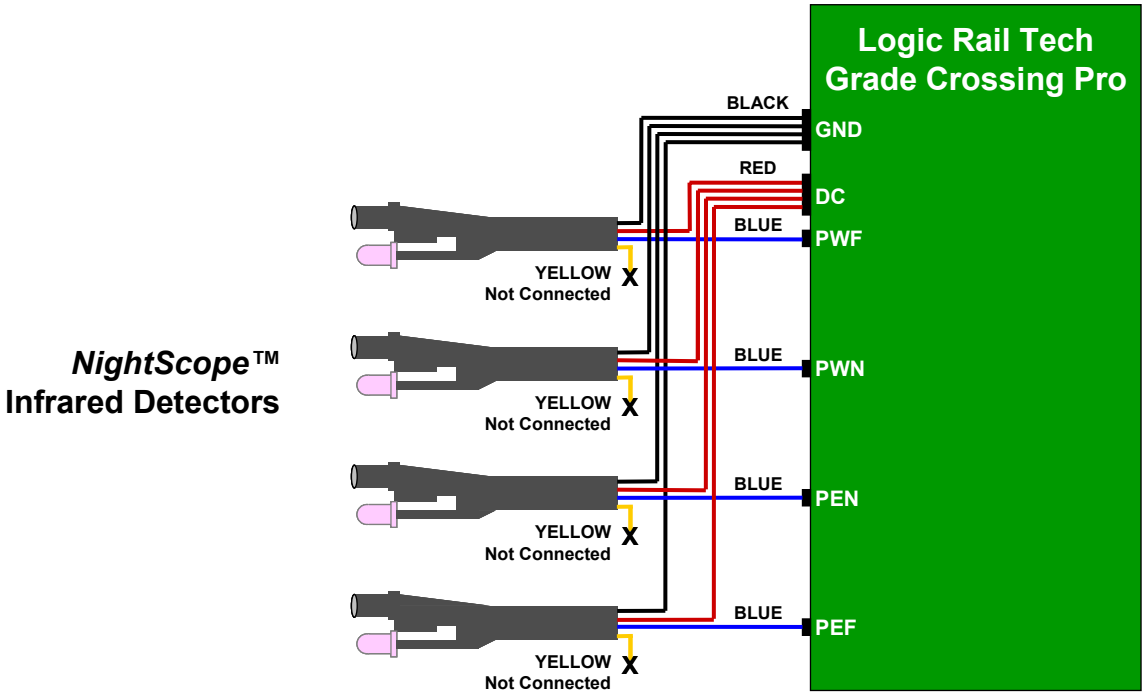


Figure GCP: Single Track and Cascaded Grade Crossing Pro Wiring

Logic Rail Technologies suggests cascading two or more GCPs (one for each track) for multi-track public road crossings. (See the Logic Rail Technologies website for multi-track recommendations.) Each GCP will require its own Detectors – simply connect four Detectors to each GCP as shown in Figure GCP.

After installing and wiring your Detectors, you will need to adjust the GCP inputs (PWF, PWN, PEN, PEF) as described in Logic Rail Tech's instructions.

© 2009 Boulder Creek Engineering, LLC

D. Sound Effect Modules from Innovative Train Technology (ITT)

The ***NightScope*™ Infrared Detector** acts as an "external open collector circuit" for ITT's HQ Sound Effect Modules. One or more Detectors can be wired to activate the HQ module as shown in Figure ITT-1. (Figure ITT-1 shows connections for the 2009 version of the HQ module – connect the YELLOW and BLACK wires to your HQ Module vintage as shown for "Your external Open collector Circuit" in your ITT instructions.) Note that the BLUE (Detect High) wire is not connected – clip it short and insulate it. In this configuration, if either Detector detects a train, the HQ module will be activated.

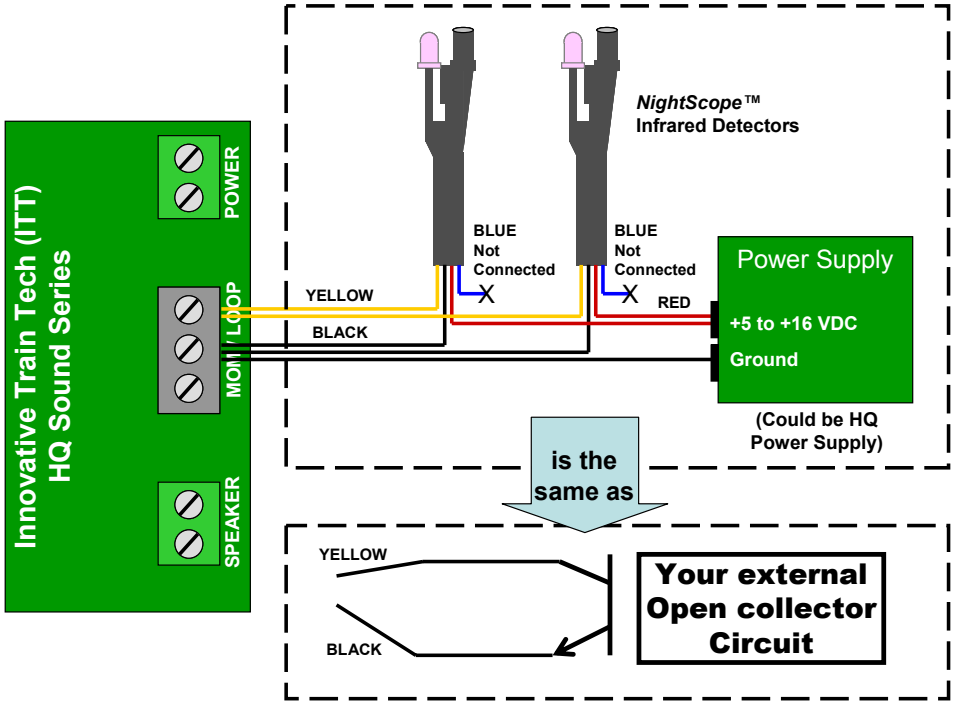


Figure ITT-1: HQ Sound Module Wiring

The ITT LT100 Thunder & Lightning module has a slightly different layout. Figure ITT-2 shows how to connect one or two Detectors to trigger a storm. See the ITT website for options to enable or disable the built-in LT100 timer. As in the HQ example, the LT100 will be activated by either Detector.

The Detector(s) and the ITT sound modules have similar power supply requirements. While the figures show a separate power supply for the Detectors, you can run the Detectors and the ITT modules from the same supply if the supply fits the requirements for both. For example, a +12 Volt DC supply could be shared. See your ITT Sound Effect Module documentation for power supply wiring instructions.

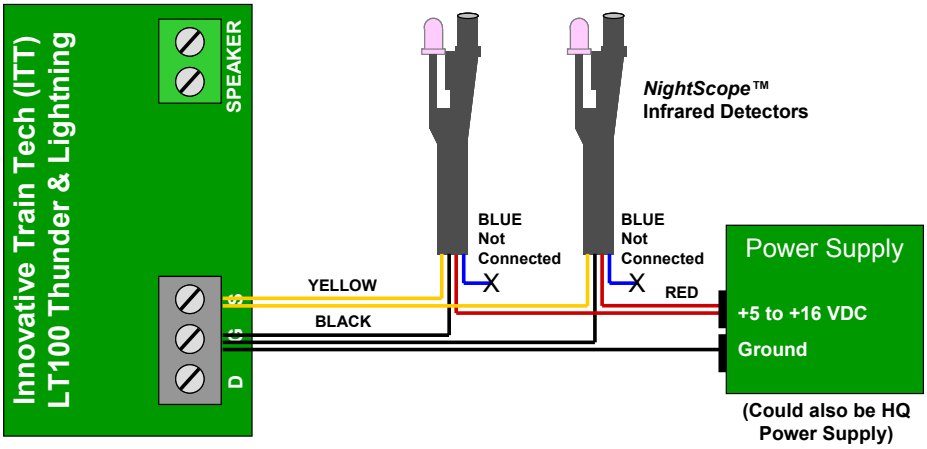


Figure ITT-2: LT100 Thunder & Lightning Wiring

© 2009 Boulder Creek Engineering, LLC