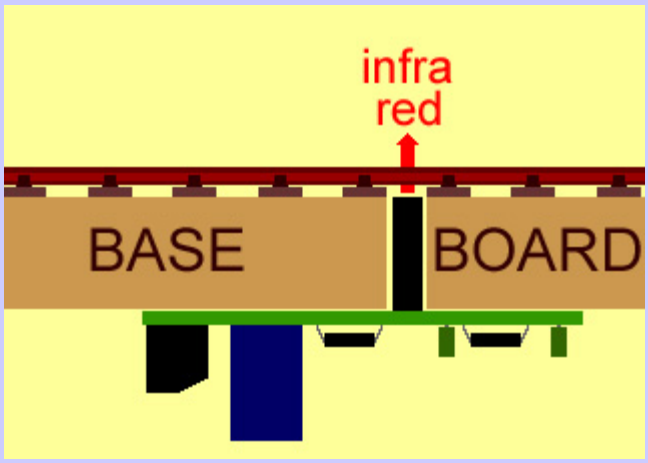
HOW INFRARED DETECTION WORKS

Our eyes only see a limited range of colours. Some animals see a wider range than we do. Infrared is the colour before red in the spectrum and it is invisible to us but behaves in the same way as visible light. Some phone cameras can be switched to see infrared.

Our system of train detection works by shining a beam of infrared upwards from the track. If anything is above the beam it will reflect some of the infrared back. When our boards see this reflected infrared they know rolling stock is above.

The electronic circuit board filters out background infrared and electrical noise.



Extending 22mm from our boards are an infrared emitter and an infrared detector, these emit and detect the infra red. Both emitter and detector are the size of a 3mm diameter LED. They fit between and level with the bottom of the sleepers. Operation is not noticeably affected by the sleepers partially obscuring the infrared devices and even with Z gauge they work satisfactorily with the standard sleeper spacing. The detection range depends upon the colour and reflectivity of the object above but is typically 40mm (1 1/2 inches).

Where it is difficult to fit the detector due to baseboards thicker than 22mm or cross beams under the baseboard the units can be supplied with the infrared emitter and detector connected to the board with wires. These boards are distinguished from standard ones by having EW added on the end (EW stands for Extended Wire).

A glossy white surface reflects more infrared than a matt black surface and so the glossy white surface will be detected from a greater distance. Although rolling stock has a matt black underside it is usually detected without any problems. If detection is erratic a white self adhesive paper label or similar can be fastened to the underside. Tunnel ceilings above detectors may need painting matt black if they are a light colour to prevent them being detected. All materials reflect infrared in varying amounts. Rolling stock of any colour, constructed of plastic, metal or card is detected.

The sensitivity can also be adjusted by allowing more or less infrared be emmitted. Heat shrink tubing covers the emitter and detector. Its purpose is to prevent the infrared going sideways from emitter to detector. If this is trimmed back more infrared will be emitted and the range increased. However be carefull not to expose both emitter and detector as the infrared will then travel sideways making the detector think it is permantly detecting a train. If longer pieces are shrunk over the top the range will be reduced.

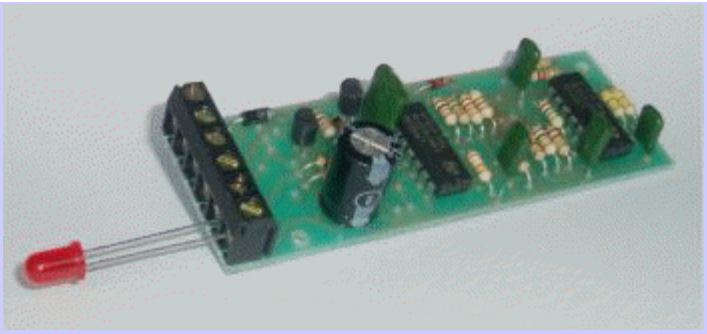
Normally none of these measures are required and the units work satisfactorily as supplied.

As the infrared is supplied by the units themselves infrared detection works equally well in light and in dark.

The diagram shows the IRDOT-1 fixed to the underside of the baseboard. The tips of the emitter and sensor are positioned level with the bottom of the sleepers.

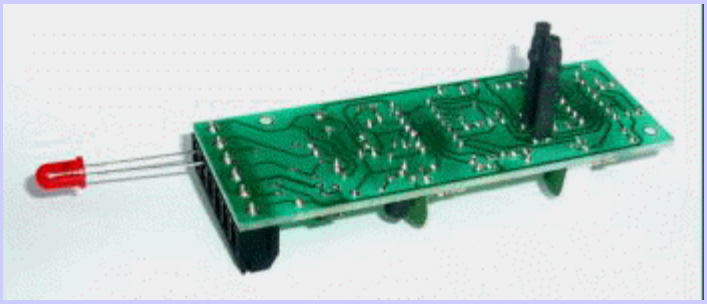
The two photos below show the two sides of the IRDOT -1

The top image above shows the component side of the IRDOT-1. The LED is shown in the position as supplied before being wired to the control panel. The image shows the detection side of the IRDOT-1. This side is fixed to the underside of the baseboard. The two vertical projections are the infrared emitter and



detector which fit into a predrilled hole in the baseboard. When correctly located the tip of the detection device is level with the bottom of the sleeper.

ADVANTAGES OF INFRARED DETECTION



Infrared train detection has the following advantages. The units detect all rolling stock in a train. This is particularly useful when trains such as DMU's run in reverse. The infrared detectors are inconspicuous and are usually fitted with the circuit board under the baseboard.They are simple to install and can be fitted to existing track. No modifications are necessary to the track wiring or the rolling stock. They are electrically separate from the track. This makes wiring simple. They work in both light and dark. The detectors are suitable for Z, N, HO, OO and O gauge.

POWER SUPPLY

All our modules can be powered from 12 to 16 Volts AC or DC. We stock a suitable 12 Volts DC supply alternatively a controller accessory output is a suitable power source. The low power consumption of the units (less than 20ma for the IRDOT-1) allows many modules to be powered from the same supply.

INSTALLATION OF INFRARED DETECTION MODULES

Units with built in infrared detection are designed to be screwed to the underside of the baseboard with the infrared emitter and detector located in a hole between sleepers. See diagram at the top of the page. It is easiest to install the units after the track is laid. Drill a small pilot hole between the sleepers. Fit an 8mm drill bit marked with tape for slightly less than the base board thickness. Drill from underneath the baseboard following the pilot hole. Cut or file the small amount of baseboard material left between the sleepers. Install the unit and then fill the remainder of the hole with modelling material. Blu-Tack will hold the units in place temporarily. Use 1.2mm holes for the self-tapping screws that hold the units permanently in place. When fitted to Z or N gauge track the gap between sleepers will be less than the diameter of the infrared detector and emitter. However, the modules work well provided they are adjusted to fit close to the sleepers. This positioning prevents reflections off the sleepers causing detection. For base boards thicker than 22mm (i.e. the height of the infrared devices), or where there are obstructions, the units can be supplied with the infrared emitter and detector fitted to extended wires up to 400mm / 18 inches long. They can also operate on their sides.

TYPES OF UNIT

The infrared emitter and detector unit is built into many of our circuit boards including IRDOTs (**I**nfra**R**ed **D**etection **O**f **T**rains) , IRDASCs (InfraRed Detection And Signal Control), MAS-Sequencer (Multiple Aspect Signalling), the SIMPLE SHUTTLE, etc.We manufacture the following Infrared Units:

IRDOT-1

The basic unit. This lights a (control panel) LED. It has an electronic train detected switch to activate our other units or operate a second green not detected LED. It is also possible to operate a bicolour LED to give for example green not occupied, red occupied. The switch may also operate a relay or opto-isolator for interfacing to a computer etc. Main Uses:

Train detection and indication of trains in fiddleyards, hidden sidings, inside stations with overall roofs, engine sheds etc.

Train detection for our SA range of shuttles, passing loops, station stops, block sections etc. The advantages over reed switches are that no magnets need to be fitted to the engine and the detector can be positioned where the front of the train is meant to stop rather than where the train mounted magnet will finish.

Train detection for uncouplers. When uncoupling at a distance from the controller it is difficult to judge when the couplings are aligned over the uncoupling magnet. The gaps between the vehicles can be detected by positioning the IRDOT-1 between the sleepers on the outside of the rails, these sleepers being adjacent to the magnet fitted within the rails. Can

IRDOT-1D

Outputs are identical to the IRDOT-1. It detects the train immediately but has a 4 second delay before indicating the train has left. This provides continuous detection of the train. As a train crosses the IRDOT-1 the LED will flicker off at each gap between wagons or coaches , the IRDOT-1D's LED will remain lit during these gaps due to the 4 second delay. Main Uses:

To detect the whole of a moving train without the LED flickering. This can simplify design of computer software and home made signalling and control systems.

IRDOT-2

This operates an LED and built-in changeover contacts. The contacts are electrically separate from the IRDOT-2's power. Main Uses:

Automatic isolation of trains in storage sidings.

Replacement for reed switches.

The relay contacts provide electrical isolation to enable interfacing to computers, programmable logic controllers, etc. As well as detecting trains they have been used as proximity detectors for movement of model crane arms, turntables etc.

IRDOT-2D

This has the same outputs as the IRDOT-2, but also has a 4 second undetect delay to prevent the LED flickering and the relay repeatedly switching as the train travels over it. Some uses are:

System of moving up trains in storage sidings.

Operation of lineside accessories as the train passes.

Providing indication of train position to computers, programmable logic controllers, etc where a single pulse is required for the whole train.

IRDOT-3

This has double contacts and will operate either detect and undetect LED's or a bicolour LED. The bicolour LED changes colour from green for no train detected to red when a train is detected. Main Uses:

The same as the IRDOT-2 where a bicolour display is required.

The first set of relay contacts can be used for automatic stopping, the second set for interfacing with a computer or completely seperate electrical circuit.

IRDOT-3D

As the above with the addition of the following selectable delays: 3, 6, 9, 12, 15, 18, 21, and 24 seconds. These are selectable by connections to the terminal block. Main Uses:

The same as the IRDOT-2D where a bicolour display is required.

Longer delay can be used to isolate a crossing line to prevent collisions.

Longer delay can be used as a switch for level crossing lights. Simple 2 Aspect signalling. The unit is placed ahead of the signal and timing is selected to be long enough to keep the signal at green until the train has passed.

Useful for use with "brake on DC" for gradual slowing of DCC trains.

The following units use infrared detection to control signals and points

IRDOT-P

This operates solenoid (PECO SEEP HORNBY etc) point motors on detecting a train. It also has a train detected LED. These units can be used to operate automatic reverse loops and storage sidings.

MAS- Sequencer

This operates a 2, 3 or 4 aspect signal on an adjustable time system. A feature is its very simple wiring.

IRDASC-4

These units operate 2,3 or 4 aspect signals. The signal aspect depends upon the aspect of the next signal or the presence of a train in the next section. The unit may either follow a MAS-SEQUENCER or be part of a chain of IRDASC-4 units.

IRDASC-4RI

Works as IRDASC-4 with addition of control for a route indicator/feather.

IRDASC-5

This works as described for the IRDASC-4 with the addition of contacts to provide track isolation when the signal is at red.

IRDASC-5RI

This works as described for the IRDASC-4 with the addition of contacts to provide track isolation when the signal is at red and control

for a route indicator/feather.

IRDASC-1

These operate 2 aspect common negative LED signals. The signal is normally at red until train approaches. Provides sophisticated control with interlocking to points and the next block sections.

IRDASC-2

These units operate 2 aspect bulb, LED and can control semaphore signals where they are actuated by servos and servo controllers, slow motion point motors or memory (muscle) wire. The signal is normally at danger until the train approaches. Provides sophisticated control with interlocking to points and the next block sections.

IRDASC-3

These units operate as described for the IRDASC 2 but have contacts which may be wired to isolate a section of track before the signal when the signal is at danger.

IRDASC-DSS

These units operate Dapol semaphore signals. The signal is normally at danger until the train approaches. Provides sophisticated control with interlocking to points and the next block sections.

SEMAPHORE SEQUENCER

These units operate Dapol semaphore sequencer on an adjustable timing basis. The signal is at danger until it is detected approaching the signal. Once clear of the detector the signal returns to danger at the end of the adjustable timing period. Designed for simple wiring.

SIMPLE STATION STOP

Upon detecting the train the train is stopped and departs after an adjustable time.

SIMPLE SHUTTLE

This is located at one end of a branchline and used in conjunction with an IRDOT-1 located at the other end to make a train travel backwards and forwards along a line with an adjustable timed stop at each end.