# Train-Tech
Model Technology Made Easy

# Sensor Signals

## *Please handle the signal carefully & read these instructions before using!!*

Sensor Signals are easy to use, but care needs to be taken to install them properly to make them work reliably and safely, so please take time to read these instructions first. Particular care needs to be taken to ensure that the small sensor or any wires do not touch the rails or anything else otherwise permanent damage to the signal will result, *so always install with all Controller and Track Power OFF*.
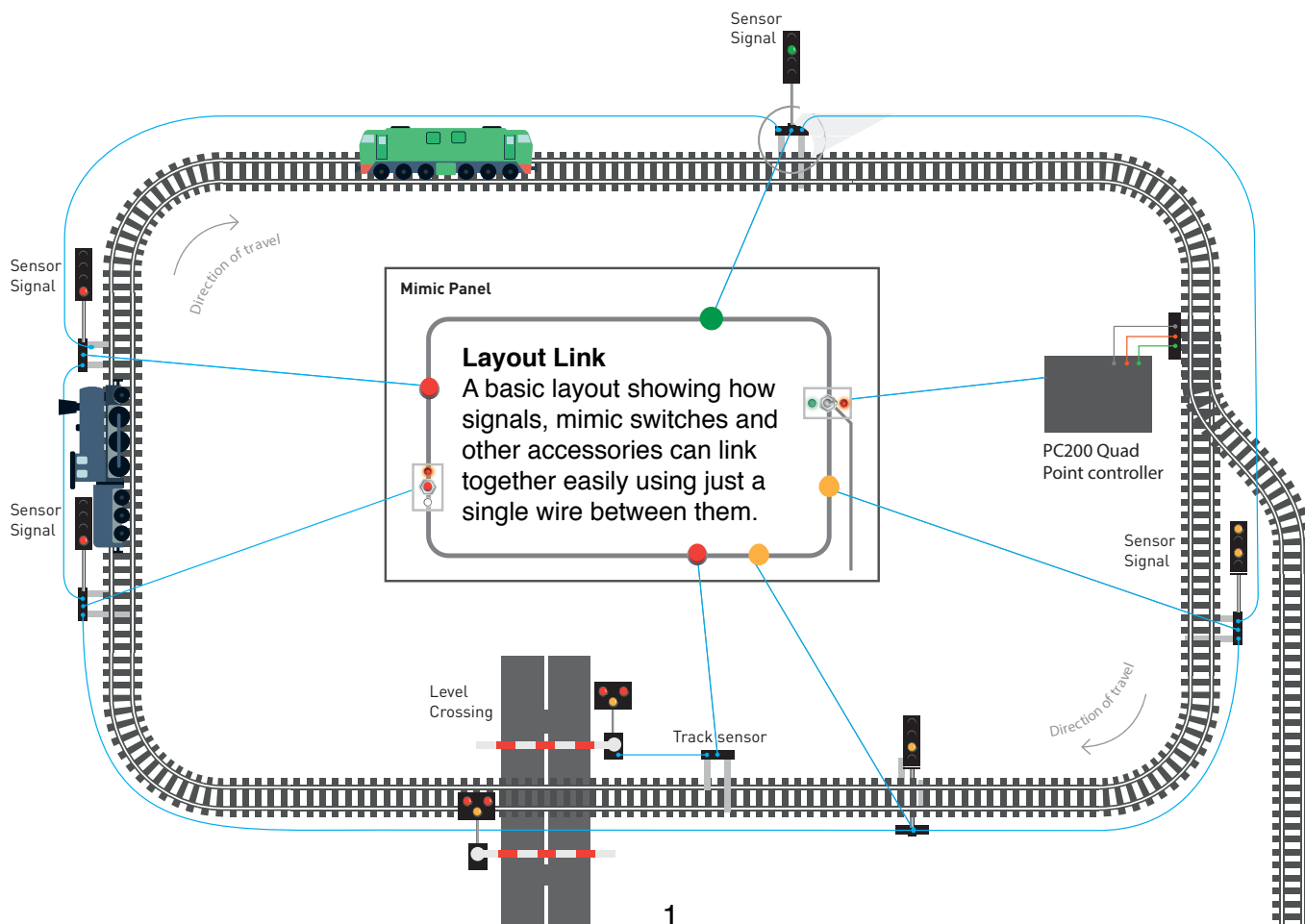Our Signals are precision scale models and so are correspondingly fragile - handle with care!

**Sensor Signals** incorporate an infrared sensor which automatically changes the signal when a train passes to signal danger to following trains. When used on their own they gradually change back to green a short time after the last part of the train has crossed over the signal, but when linked to other Sensor Signals (using just a single wire) they all work together to provide fully automatic block working, each signal protecting the following block by staying at danger until the train has left the block.
We developed Sensor Signals recognising that most modellers run their layouts on their own most of the time and so do not have time to be signalmen as well as train drivers! However much of the 'real' railways main lines use automatic signalling and Sensor Signals work in a very similar way.

## Signalling basics
The most basic signals are 2 aspect Home (red & green) and Distant (yellow & green). A Distant signal is installed ahead of a home signal to give early warning to the driver of what the next signal is, so if the Distant signal is green he knows the next signal is also green, but if it is showing yellow he knows the next signal will be red. There are also 3 aspect Home-Distant signals with yellow lights as well as the Red & Green which are called Home-Distant, and on high speed main lines there are 4 aspect Outer-Distant signals with red, green and 2 yellow distant lights which give an even earlier indication of the next 2 signals to the train driver. Much of the 'real' railways main lines actually use automatic signalling and Sensor Signals work in a very similar way. We cannot cover any real detail of signal planning and operation here, but there are many good books and websites (eg  www.signalbox.org) dedicated to the subject. The illustrations in this guide mainly show 4 aspect Sensor Signals, but the same principles apply to all variations of Train-Tech signals.

Sensor Signal

Sensor Signal

Direction of travel

**Mimic Panel**

**Layout Link**
A basic layout showing how signals, mimic switches and other accessories can link together easily using just a single wire between them.

PC200 Quad Point controller

Sensor Signal

Sensor Signal

Sensor Signal

Level Crossing

Track sensor
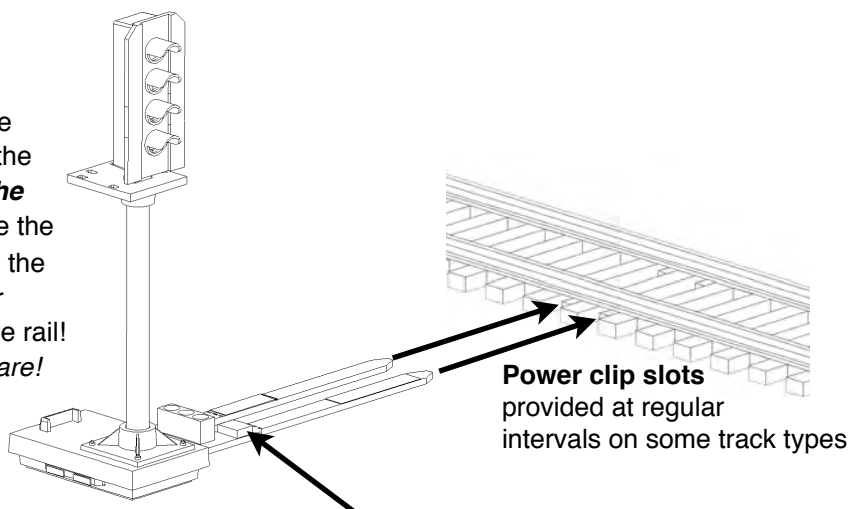
Direction of travel

# FITTING YOUR SIGNAL    *Switch off power before installing!*

Firstly you need to choose your location, ideally not on a sharp curve because the optical sensor needs to 'see' the train above it and long wheelbase stock like coaches could either knock the signal or miss the sensor if on a curve. Next you need to provide the Sensor Signal with power:

## • **Sliding Signal into the track**    *suitable for DCC layouts only*

DCC layouts have power on the tracks all of the time and so Sensor Signals may take their power straight from the track by sliding contact fingers into the slots which some track has for power clips. **Note** this is only suitable for some track such as Hornby and Bachmann fixed track and a *very good connection* must be made at all times for reliable operation. Some Peco track also has slots but they are much wider and will need packing to make a solid reliable connection. If in any doubt we recommend wiring directly to the signal - see below.

**To fit signal into the track**, locate the power clip slots in the track between the rails and the sleepers and, ***holding the signal BASE***, carefully align and slide the signal contact fingers into the slots all the way until the signal stops - the sensor should be close to but not touching the rail! *This may be a tight fit so take great care!*

**Power clip slots** provided at regular intervals on some track types

**Sensor -** careful never to let the sensor pins to touch the rail or signal will be damaged!

**!** **Always hold and push the signal by its base, NEVER by the post or head!**

## • **Wiring the Signal**       *suitable for both DC and DCC layouts*

If your layout is conventional DC, or you have DCC but do not like the slide in fingers or do not have suitable track with power clip slots as above, you can wire your Sensor Signal to your layout supply by cutting off the track fingers and soldering two wires - see below.
Signals can be powered by DC or DCC and require a voltage of 12-16 Volts max and current of approx 0.05A each *(note they should **never** be powered by an AC or unsmoothed DC supply)*. Recommended supply for DC use is Gaugemaster Model GMC-WM4 12 V 1.25A Power Supply

Using a sharp pair of wire sidecutters or modelling cutters, carefully trim off the fingers *exactly* along the dotted lines marked - - -   - - - on the signal circuit base, taking great care not to touch or damage the small black sensor or any of its wires as this will cause permanent damage to the sensor signal! Carefully solder 2 thin pretinned wires into the holes marked P P on the signal circuit base & drawing, **making sure that any loose strands or whiskers of wire do not touch any other contact or component!** On DC layouts connect these wires to a 12-16V DC supply and on DCC layouts connect them to the nearest rails, DCC Bus bar or direct to the DCC controller output.

Power

P
P

Power

**Take care** not to let the rail touch these sensor wires or any other contacts or components!
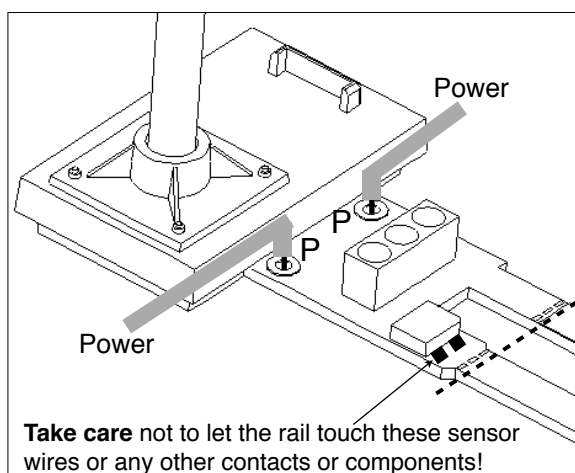
# • Using a sensor signal on its own

As soon as the power is switched on your signal should light green. If it does not light at all check the power connections thoroughly - see previous page.
To test push a wagon or coach past the signal. The sensor should detect it and the signal should change from green to red (or to yellow on a distant signal).
Several seconds after the train has passed the signal it will change back to green (via yellow if it is a home-distant type signal). Note that the signal will only change back to green after it has not seen any train over it for several seconds, so if you have a long train it will stay at danger for as long as a train is moving over it. A signal used on its own can only ever work in this way because it does not know how far ahead the train is, but if multiple Sensor Signals are linked together the first signal will stay at danger until a train has cleared the following block and so on through the block sections protected by other sensor signals - see page 4.

The sensor uses infrared and is quite tolerant of varied lighting conditions, but for reliable operation avoid strong lights (such as the sun, bright or flickering lights) or shadows directly onto the sensor.
The sensor should detect most locomotives and rolling stock, but if a particularly tall or dark train passes undetected a small label or dab of white paint underneath will help reflect the infrared more consistently.

*Avoid bright light or the sun shining directly at sensor*

**Train Sensor**

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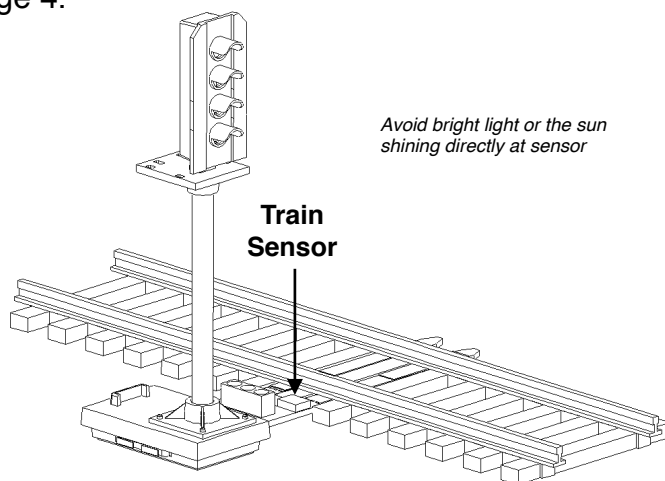
# • Manual override of a single Sensor Signal

Although Sensor Signals will work completely autonomously, you can manually override them to force a signal to stop/caution using either a Mimic Switch or a DCC command. On the real railway these are called semi-automatic signals and exist so that a central signal box can stop trains in the event of an emergency like a tree which has fallen on the line or for other operational reasons.

**A Mimic Switch** is an easy way to override a Sensor Signal and also offers other benefits such as an LED showing the colour of the signal and another LED which lights when the train passes the signal, as well as controlling a route indicator etc. Wiring is simple too with just one wire from the signal to the mimic switch and it works on both DC and DCC layouts. (details on a following page)
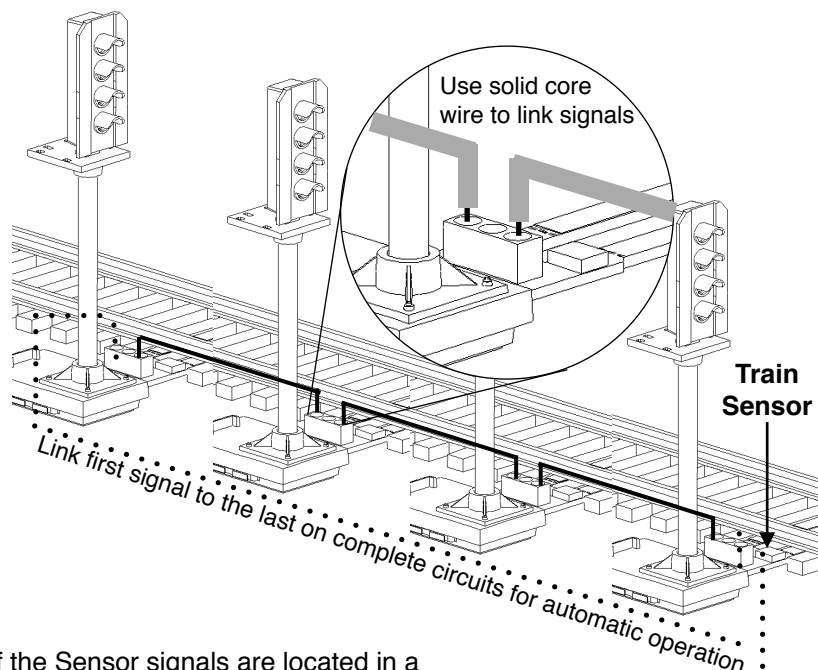
Signal colour LED

Mimic Switch
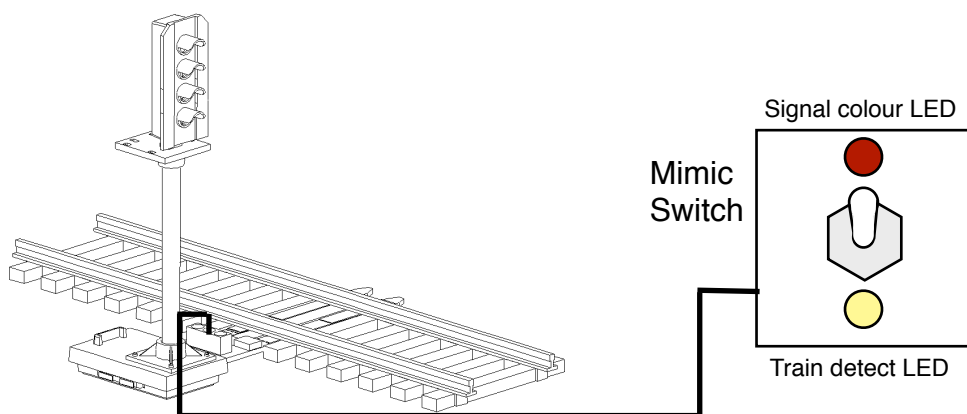
Train detect LED

A Mimic switch connects to a Sensor Signal using just one wire and allows manual override of the signal as well as LEDs which show signal state and train detection, etc

**DCC override**
If you are using the Sensor Signal on a DCC layout you can override the signal to stop/caution using a single command to an address you set up using One-Touch DCC - see page 6. (Make sure that you choose an address not used on anything else on your layout!)

# • Using multiple Sensor Signals

Sensor Signals really come into their own when you link several together because they all sequence as a complete block section system automatically! Our examples show 4 aspect signals but different types may be mixed and will all work together, including distant only signals which show yellow when the next signal is red. The example below shows 4 signals linked, although in practice you can run virtually any number of signals connected in this way as long as you have sufficient power to supply them all (each signal needs approximately 0.05A).



Use solid core wire to link signals

**Train Sensor**

Link first signal to the last on complete circuits for automatic operation

If the Sensor signals are located in a continuous circuit of track then you can link every signal to each other front to back in a loop for fully automatic block signalling around the track.
*Tip* - careful not to obstruct the sensor 'view' with the link wires

Wiring is easy because you just need one wire between each signal, the output of one to the input of the next one as shown. **Always use Single core wire** (1/0.6mm type is best) stripped 3-4mm at each end which just plugs into the signal sockets - you can either hide wires under your baseboard or run them on the top alongside the track - just like the real thing!

If you are using the Sensor Signals on a complete circuit, you can link every signal to each other to make each section automatic. If it is an 'end to end' type layout the last signal will turn green a short while after the end of the train has passed the signal.

If the signals are used on a single line which has trains running in both directions you can signal both sides, but only link together signals running in the same direction. If a train runs backwards the signals will turn red (or yellow on a distant signal), then after a short time cycle back to green.

# • Manual override of multiple Sensor Signals

Multiple Sensor Signals can be overridden to show stop / caution in the same way as a single signal can, and because they are linked they also control any distant signals located in front of them to correctly display yellow or double yellow etc.



Signal colour LED

**Mimic Switches**

Occupancy LED
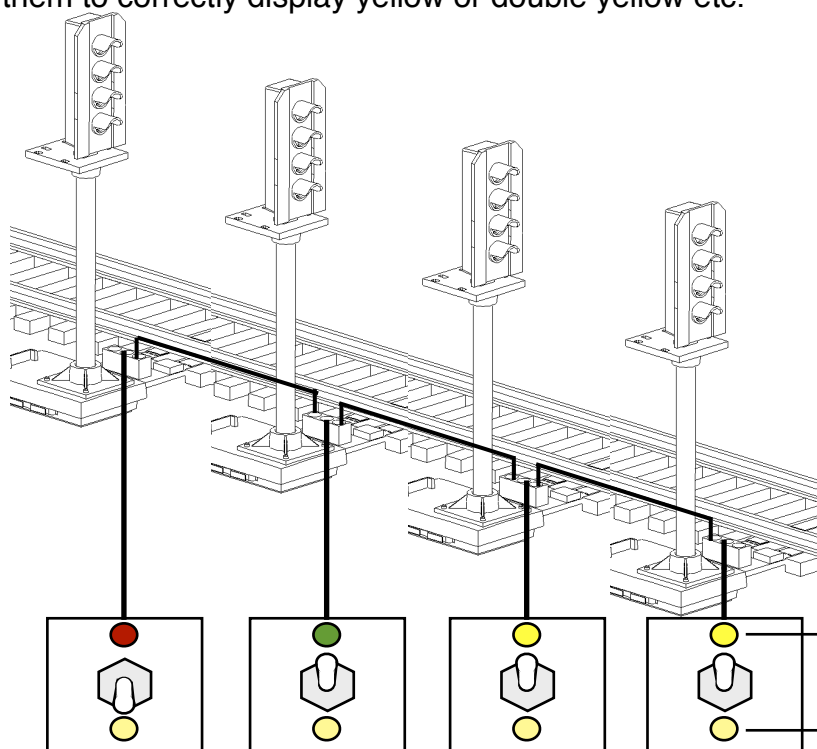
**Mimic switches** can be wired to one or more linked Sensor Signals using just a single wire.
The top LED lights the same colour as the signal. The bottom LED flashes as a train goes past a signal and lights continuously while a train is still in the following section to show block occupancy - ideal for a control panel to show where trains are on your layout.

If your layout is digital you can also manually override any signal to red using a DCC command - see page 6
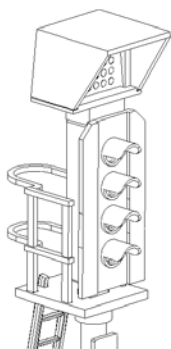
# • Route Indicator Signals

Sensor Signals are also available with 'Feather' and 'Theatre' type route indicators which can be switched on and off using either DCC or a Mimic Switch as shown later.

Route indicators advise the train driver which route or platform etc they are going and are often dictated by how points are set.
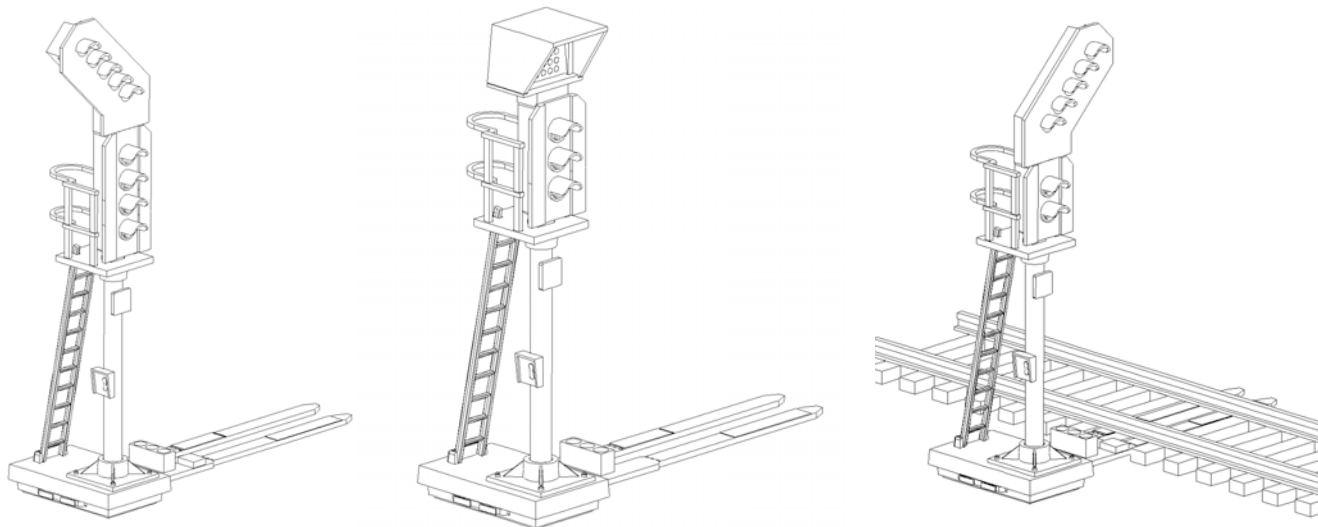
## Theatre Indicator - creating your own character

The Theatre route indicator on your signal can be set to display almost any single character or symbol of your choice; If you lift the Theatre hood you will see that there is a square of 25 (5 x 5) small holes which are lit from behind using a miniature LED built into the signal. Carefully mask the holes you do not want to light from behind using narrow strips of black insulating tape or BluTack, Black Tack etc and then replace the hood. When the route is activated light will shine through the unmasked holes and display your character.

You could use a pencil on the blank templates below to decide on which holes you need to block to create your own character or symbol.
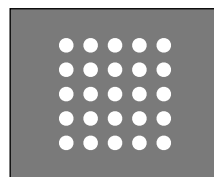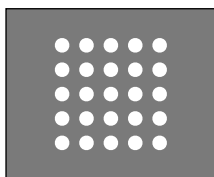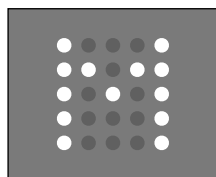
This is called a 'dot matrix display' and is how many theatre and other signs and displays are created on the real railway.

## DCC Control of a Signal Route Indicator

Feather or Theatre route indicators can either be on or off and are all controlled in the same way, much like the main signal control. If you are controlling your points using DCC you can give the route the same address so that it lights automatically when the point(s) are set to the selected route. To set the route address, set your chosen accessory address on your controller and then touch the Learn contacts together **twice** until the feather or theatre flashes. Then send a ◀ / ▶ Direction or 1 / 2 command from your controller to set the address for your route indicator to be on.  (NB: if you want the route to synchronise to a point operation, ensure the same command used also sets the point to that route).

More information on the DCC control page 6.

*Note that the signal automatically turns off a route indicator if the signal is at Red.*

# • Using Mimic Switches with Sensor Signals

Sensor signals may be used on their own but Train-Tech Mimic Switches and Mimic Lights are a great way of both controlling and monitoring your signals and trains on a control panel.
Mimic switches can override a Sensor Signal to show stop/caution or switch on a route indicator and they come supplied with 2 plug-in LEDs to show the red, green or yellow state of the signal they are connected to, as well as train presence and occupancy of the following block. It is easy to mount using a single mounting hole and easy to connect having just a single wire to the signal and 2 wires to the same DC or DCC supply that you are supplying the signals from.
Mimic Switches come in two versions fitted with either a 3 way toggle switch or push button and there is also a Mimic Light version which has just the indicator lights and no control. Mimic switches can also be used to control and monitor other Layout Link compatible products such as points and level crossings - full instructions supplied with each Mimic product or see Train-Tech.com

## Mimic Switch Wiring and Functions

**LIGHT FUNCTIONS:**

**LED A** mimics the signal status:
Red, Yellow or Green
Pulsing red if on Manual override

**LED B** Train passing & occupancy:
Pulses as train goes past signal
Constant while train is in following block

**LED C (**optional - no LED socket fitted)
Mimics signal's route indicator
(if a feather or theatre version)

**LED D (**optional - no LED socket fitted)
Lights as train passes the sensor

**LED E (**optional - no LED socket fitted)
Mimics the 2nd yellow (if fitted on signal)
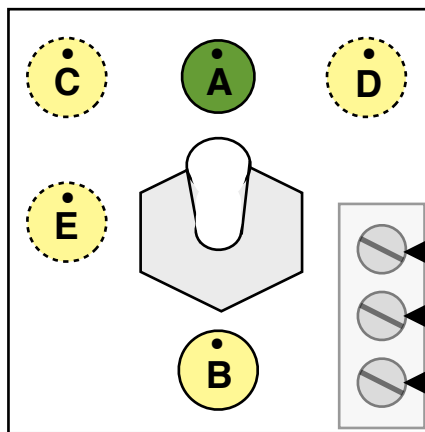
**SWITCH FUNCTIONS**:

1: Route indicator (if fitted on signal)
2: Automatic
3: Manual override - signal stop/caution

**CONNECTIONS**:

DC / DCC power (same supply as signal)

To centre socket of the Sensor Signal

DC / DCC power (same supply as signal)

*Fit long wire of LEDs to top marked socket •*

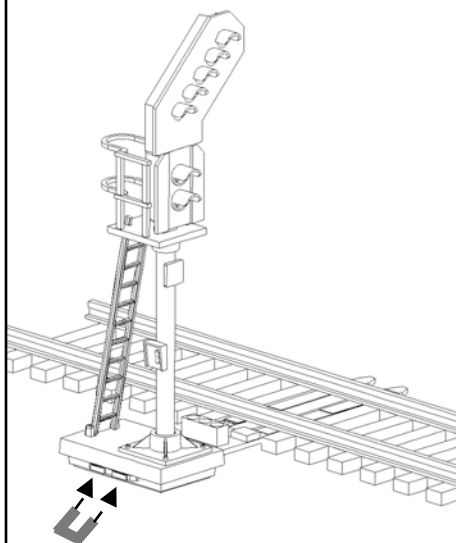# • Using DCC to control a Sensor Signal

In addition to using a mimic switch you can use DCC to override a signal and/or control a route indicator. Train-Tech products use a unique system called One-Touch DCC to easily set up any DCC accessory - note you must set controller to *DCC Accessory* control mode, not loco mode.

**Two 'Learn' Contacts**
Touch together the two contacts under the base to set signal DCC addresses

**To Setup a Sensor Signal for DCC manual override control**
To setup your signal for DCC manual override, use a short link of insulated wire to briefly touch together the two hidden 'Learn' contacts (see picture) until the signal lights flash, then send a Direction ◄ / ► or a 1 / 2 (depending on the make of your controller) on the *accessory address* you want to use to manually override your Sensor Signal. The signal will stop flashing and your Automatic signal can now be overridden at any time using the command and address you chose - change it between override / automatic using ◄ / ► or 1 / 2 command on your address. Other Sensor Signals linked to this signal will react correctly too, so for example a distant will display yellow when the following signal is red. Make sure you choose an address which is not used by anything else on your layout!

**To set up DCC control of a Feather or Theatre indicator on a Sensor Signal**
To setup a signal with a Route Indicator, use a short link of insulated wire to briefly touch together the two hidden 'Learn' contacts (see picture) until the signal lights flash, then touch them again and the Route indicator should flash.
Send a Direction ◄ / ► or a 1 / 2 (depending on your controller) on the *accessory* address you want to use to use to turn the Route on. The Route will stop flashing and will now light using the command and address you chose. You can use the same address as a DCC controlled point so that it changes with the point - note that the route indicator always lights with the same ◄ / ► or 1 / 2 you used to set up, so use the same as the point to make them work together.

# • Detailing your signal

The signal is supplied with a sprue of plastic parts for you to add optional details like ladder, handrails, phone and location board if you wish (as shown on several signal illustrations). These parts are extremely small & fragile, so we recommend using the following to remove and fit them:

We recommend that you first remove ladder and main parts by carefully cutting the thicker supports first - after cutting these they should break away from the other parts by gently 'rocking' and you can then trim away the fine supports. Parts may be cut from the supports using a knife on a cutting mat or by using precision cutters - they are available from model shops or from www.dcpexpress.com
You will also find that fine nose pliers or tweezers are useful for fitting parts. Parts can be glued in place using model adhesives such as Liquid poly or cynoacrylate 'superglue' etc.

You can use the Location board (the small square sign) to show the DCC address of the signal by cutting out and glueing the number from table printed opposite. The lower sign with a horizontal bar is for a Semi-automatic signal.

You can weather or paint the signal and add scatter material or ballast etc around the base but take care not to cover the Sensor, Learn or contact fingers and **never** let liquid get into base of the signal as this contains sensitive electronics which will be permanently damaged by moisture.

**We recommend** first cutting the thicker supports to release main parts, then trimming off the small parts from the supports
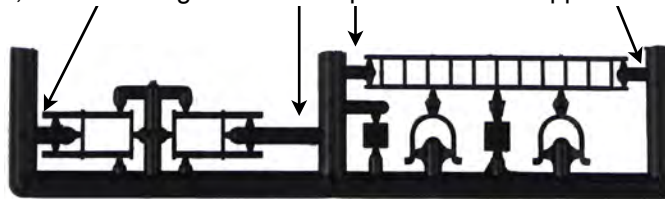
**Location board labels**

```
 1   2   3   4   5   6   7   8   9   10
11  12  13  14  15  16  17  18  19  20
21  22  23  24  25  26  27  28  29  30
31  32  33  34  35  36  37  38  39  40
41  42  43  44  45  46  47  48  49  50
51  52  53  54  55  56  57  58  59  60
61  62  63  64  65  66  67  68  69  70
71  72  73  74  75  76  77  78  79  80
81  82  83  84  85  86  87  88  89  90
91  92  93  94  95  96  97  98  99  100
AD  CA  DA  ES  EN  GE  GY  MY  PN  NW
ABCDEFGHIJKLMNOPQRSTUVWXYZ
ABCDEFGHIJKLMNOPQRSTUVWXYZ
```

# • Troubleshooting….

• When powered one of the signal lights should always be lit and not flickering. If not and locos run correctly track check signal power connections - if using signal contact fingers for connection check they are clean and tightly fitted between the track sleeper and rail - clean if necessary or consider wiring the signal instead of using slide in fingers. The power connections to every Sensor Signal linked together *must be very good and consistent* to ensure reliable operation.

• If powering your Sensor Signal from DC it must be a Smooth DC supply between 12 and 16 volts DC maximum - we can recommend the Gaugemaster GMC-WM4 power pack as ideal, being 12 volt Smooth & Regulated DC @1.25A.

• If the signal stays on one colour, not changing as the train passes, check that signal is pushed in around the sleepers and the sensor is close to the rail (but NOT touching!) so that it can 'see' the train moving over it and that there is no bright light or sun shining directly onto the sensor to prevent it from working. We do not recommend mounting Sensor Signals on curves because long stock can miss the sensor on outside curves or crash into the signal on inside curves.

• If signal stays on red (or yellow on a distant signal) check you have not sent an override command inadvertently - note that Sensor Signals are set to a Test DCC address at the factory and this might be the same address as something else on your layout, so if in doubt give it your own unique address even if you do not intend using DCC override - see page 6

• If sensing is unreliable on some trains you can add a white label or white paint under the train to improve reflectivity, but it should work with most stock. Do not get the signal wet or cover the sensor with paint or any other scenic material.

• If your signal does not respond to DCC, double check that your controller is in *accessory* addressing mode (*not regular locomotive addressing)* to set up & operate (this will be explained in your controllers instructions).

• If these steps fail please contact your supplier or us direct: www.train-tech.com   sales@dcpmicro.com  01953 457800

**Computer and advanced control systems**
Some DCC controllers can be connected to a PC or tablet to enable computer control of locomotives and accessories - for full details on compatibility consult your controller supplier. Some controllers have Railcom® or Railcom Plus® and although our Sensor Signals will work with this system on if you are not using Railcom it is best to turn it off.

**Signal design**
Our signals are based on colour light signals in Norfolk which we photographed, CAD, tooled and make in the UK.
As well as Sensor signals we also make DCC fitted and switch controlled signals with Feathers & Theatres, plus a wide range of easy to use signal and point controllers, lighting and sound effect products. Ask for our latest free brochure.

**Caution**
This product is not a toy but a precision model kit and as such contains small parts which may choke or harm a child. Always take special care when using tools, electricity, adhesives and paints, especially if children or pets are nearby.

# Train Tech overview - *ask for free catalogue*

**Signal kits** - OO/HO low cost easy to make signals for DC

**Sensor Signals** - easy automatic block signalling - DCC or DC

**Smart Lights** - small effects built in - DC/DCC - just 2 wires:
Arc welding • Emergency vehicle • TV • Fire effect • Party disco

**Automatic Coach Lights** - motion - no pickups or wiring:
Older Warm White • Modern Cool White • Tail Light • Spark Arc

**Automatic Tail Lights** - motion - easy, no wires - lantern LED:
Flickering flame oil lamp • Modern Flashing • Constant light

**Track Tester** - quickly tests DC polarity or DCC - N-TT-HO-OO

**SFX+ Sound capsules** - no wires! - real trains - DC or DCC
Steam • Diesel • DMU • Passenger coach • Shunted stock

**Buffer Light** - clip in lights for buffer stops - N or OO - DC/DCC

**LFX Lighting effects** - DC/DCC - screw terminals - with LEDs:
Home & Shop lighting • Welding • Flashing Effects • Fire

**Traffic Lights** - fully assembled - just connect to DC or DCC

**Level Crossings** - assembled - N & OO versions - DC / DCC

**DCC fitted signals** - slide in the track - easy one touch setup:
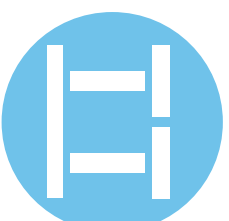2 aspect • 3 aspect • 4 aspect • Dual head • Feathers • Theatre

**DCC Point Controllers** - easy to connect - one touch setup

**DCC Signal Controllers** - easy to connect - one touch setup
For Colour light signals • Dapol Semaphore signals

**LEDs, battery boxes, connectors , switches, tools....**

**COMPREHENSIVE CATALOGUE FREE ON REQUEST**

## www.train-tech.com

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# Train-Tech
## Model Technology Made Easy

**Automatic Sensor Signal**
**DC & DCC compatible**

• Detailing
kit included

• **Signal slides in track
like a power clip!**
or connect 2 wires

**Built-in Sensor** detects
trains & changes
signals automatically
+ Auto Block working!

## www.Train-Tech.com