WARNING

- The human body can generate static electricity which can damage electronic equipment – AVOID TOUCHING THE TOP OF THE TT300 CIRCUIT BOARD!
- For INDOOR use only.
- The TT300 is not suitable for use by children under 14 years of age unless supervised by an adult.

GETTING STARTED

Refer to fig. 1

The TT300 will operate a model railway point (turnout), of up to GAUGE 1 size, using either *digital command control* (DCC) or "conventional" operation using a direct-current (DC) power supply.

Once correctly installed, the unit requires NO mechanical adjustment as the end of travel of the point is automatically detected and the point *blades* are held against the *stock rails* with a moderate force.

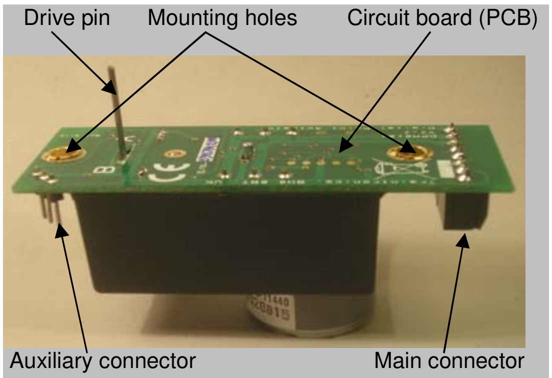


Fig 1: TT300 General Arrangement

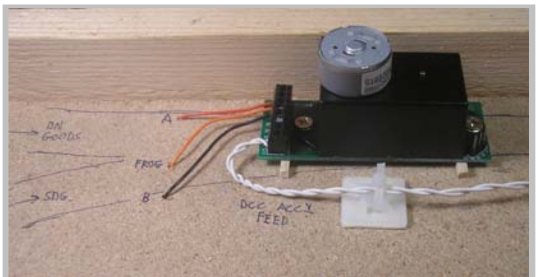
Installing the unit – see also notes on page 2

The TT300 is usually mounted to the underside of the *track bed*, directly underneath the point, using two 3.5mm diameter wood screws as shown in fig. 2a. This provides the simplest mounting arrangement with the drive pin engaging directly with the throw bar on the point as shown in the sectional side view – fig.2b.

We recommend the use of two spacers, positioned as shown in fig. 2, to provide stability and clearance as the mounting screws are tightened. A suitable material is 3mm (1/8") square balsa wood strip. The drive pin is a push fit into an internal plastic arm and may be removed for cutting to length.

WARNING

- **DO NOT apply power to the TT300 if the drive pin is removed – internal damage could result!**
- The TT300 MUST NOT make contact with any electrically-conductive parts!
- DO NOT OVERTIGHTEN the mounting screws. **Under no circumstances must the circuit board be flexed or distorted!!**



(note outline of point – could be turned 180°)

Fig.2a: TT300 Installation – underside view

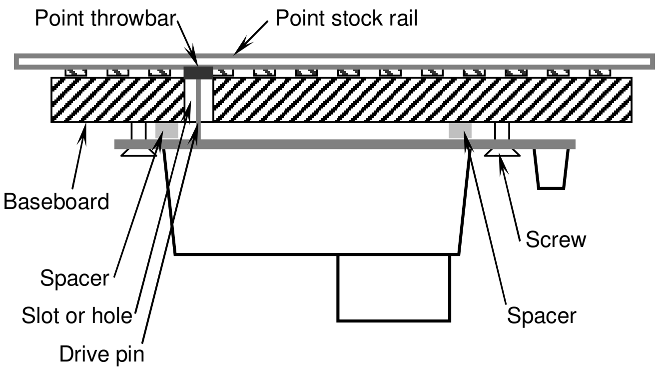


Fig.2b: Sectional view through point & baseboard

Installation Tips

We recommend that the following advice and photographs are followed to ensure trouble-free installation and operation:-

1 Centre the drive pin………

Move the drive pin to within about a millimetre of the centre of its slot, holding the pin as close as possible to the PCB.

You may or may not hear the internal gears moving. (The internal parts are pressed together and the tightness of fit varies between units).

Centring the drive pin ensures that there is adequate movement available in both directions.

Ensure that the baseboard has a hole or slot cut under the point throwbar and that the TT300 drive pin has sufficient clearance within this hole.

NOTE: The drive pin can be removed for replacement or cutting but **DO NOT apply power to the unit with the pin removed !**

2 Align the TT300 and drill the mounting holes……….

Insert the drive pin through the slot in the baseboard and then into the point *throwbar*. Once the drive pin is engaged in the throwbar, move the TT300 sideways slightly aiming to centre the point blades mid-way between the stock rails.

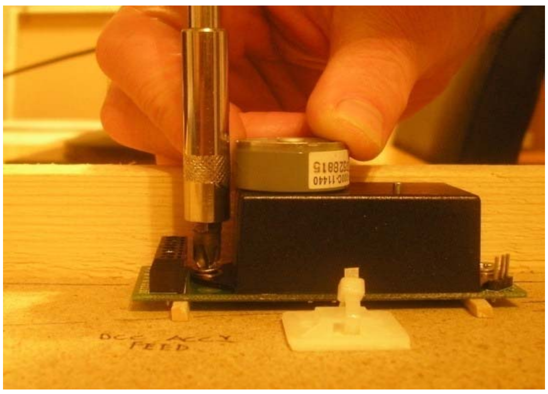
Hold the TT300 against the baseboard ensuring that its drive pin slot is aligned parallel to the line of the point throwbar (see picture).

"Spot through" the mounting holes with a pencil, as shown, to mark their positions on the baseboard.

Remove the TT300 and drill a *pilot hole,* at the centre of each pencil mark, using a 2.5mm drill bit.

NOTE: The drive pin should be cut to length at this stage – do not forget to add 3mm to allow for the spacers!

3 Install and secure the TT300……………



Remove the unit from the baseboard and clean away any sawdust or other debris.

Re-install the TT300, adding the 3mm spacers, and secure in position using two 3.5mm diameter *countersunk* woodscrews. DO NOT OVER-TIGHTEN THE SCREWS!

NOTE – The TT300 may be mounted the opposite way round to that shown if your baseboard structure, or track layout, demands it. You can change the *operating sense* of the unit as described on pages 4 and 10.

Don't forget the spacers !!

Wiring

Fig. 3 shows how to make electrical connections to the **main** connector of the TT300. Use stranded insulated wire, of 7/0.2mm size, with about 6mm of insulation stripped from the end. However, for scales larger than OO (or HO) gauge, we recommend using 16/0.2mm wire for the “A”, “B” and “F” (frog supply) connections as the wire will need to carry a larger current. Your Traintronics dealer should stock suitable wire. MAKE FIRM CONNECTIONS BUT DO NOT TRAP THE WIRE INSULATION!

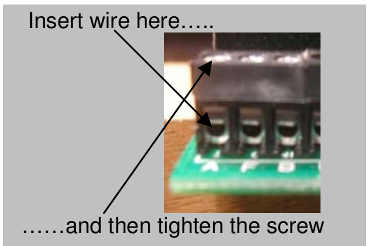


Fig. 3: Making connections

Wiring Information – (terminals are labelled with white on the PCB).

The *main* terminals are:	“D1”	- Power, or **DCC**, input
	“D2”	- Power, or **DCC**, input
	“G”	- **Ground** or *common return* for indicators
	“N”	- **Normal** indicator (LED) output
	“R”	- **Reversed** indicator (LED) output
	“B”	- Rail **B** power input (for live frog power – see pages 5 & 6)
	“F”	- Output supplying live **frog** (see pages 5 & 6)
	“A”	- Rail **A** power input (for live frog power – see pages 5 & 6)
The *auxiliary* terminals are:	“r”	- Output indicating “point **reversed**”
	“G”	- **Ground** or *common return* for “C” input
	“C”	- **Control** input for manual override or in-situ programming

The TT300 will draw very little current from your layout – no more than 20mA (0.02A) when *idling* and less than 100mA (0.1A) when driving between *normal/reversed* (*closed/thrown*) positions.

Fig. 4 shows a basic configuration for operation under DCC where the point state (i.e. normal/closed or reversed/thrown) is selected by sending *accessory* instructions from your DCC *command station*.

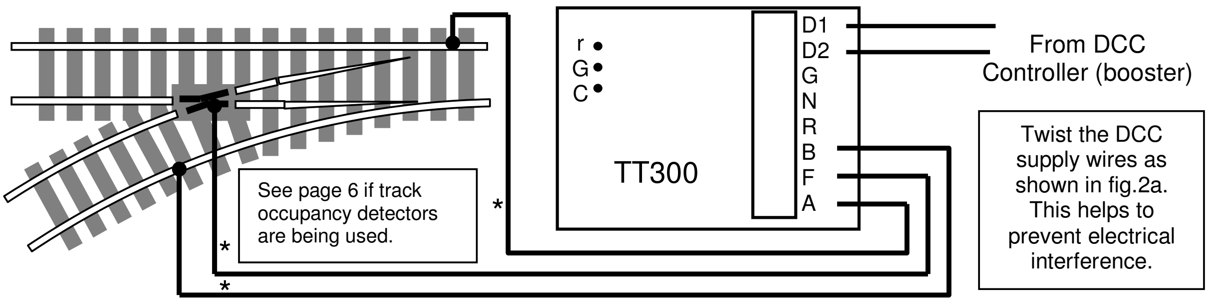


Fig. 4: Wiring for basic DCC control (connections marked “*” are for “live” frogs and are optional)

Fig. 5 shows operation **without DCC**, using DC power and a *double-pole/double-throw (DPDT)* switch. In this case, the point state is determined by the *polarity* of the DC power supply – if the “D2” terminal is *positive*, the TT300 will drive towards “A” (marked on the PCB in white) and it will drive to “B” when “D2” is *negative*.

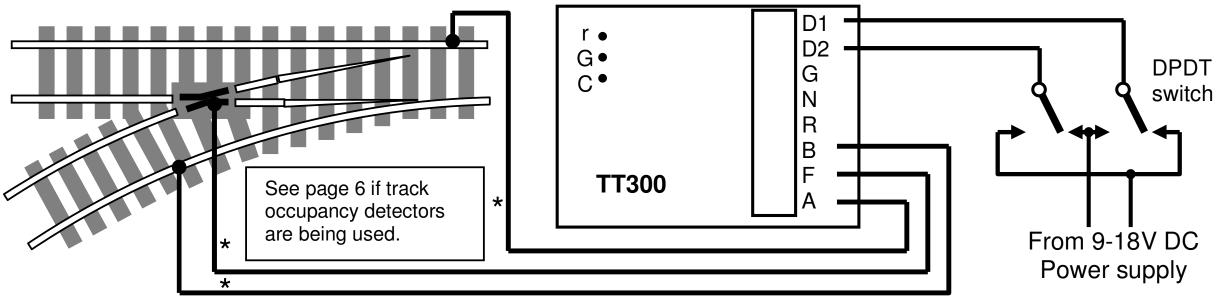


Fig. 5: Wiring for operation without DCC – (connections marked “*” are for “live” frogs and are optional)

OPERATING

DCC Operation

This section assumes that you have a DCC system – including a *command station*, *booster* and *decoder programmer* (often combined in one unit) – which is fully compliant with the *National Model Railroad Association* (NMRA) DCC Standards and Recommended Practices. As all DCC systems vary in their exact operating methods, please read the following instructions in conjunction with your DCC system manual.

Initial testing

With the unit wired as shown in fig. 4, turn on the DCC controller.

Refer to your DCC system manual and perform the following actions:-

- Select *accessory* (“point”, “switch” or “turnout”) NUMBER 1 on the controller.
- Send a single “POINT NORMAL” (or “turnout/switch” “closed/on”) command.

The TT300 should drive its output pin towards the “A” mark on the PCB and then stop. If the unit is already installed, then the point blades should be driven in the “A” direction until one blade is closed firmly against its associated stock rail. (This assumes that the drive pin is initially centred – see page 2)

See the “Troubleshooting” section on page 15 if the above action does not occur.

Changing the point address

By re-programming *configuration variable* (CV) **1** the *address* of the point can be changed. CV1 may be set to any number between 1 and 255 inclusive (See page 10 in the “Advanced Features” section for higher values of address).

Again, refer to your DCC system manual for details. The programmer – or the programming output of a combined command station and programmer – should be connected to the “D1” and “D2” terminals of the TT300.

NOTE: Some DCC system instructions refer to decoder *registers* rather than *CV numbers.* In this case, the point address is set in **register 1** and a value between 1 and 255 (inclusive) is, again, allowed.

Controlling the point

In order to change the point state, perform the following actions:-

- On the DCC controller, select the *accessory* (“point”, “switch” or “turnout”) number corresponding to the value programmed into *CV1* (or *register 1*).

- Send a “POINT NORMAL” (or “closed/on”) command to drive in the “A” direction.

Or:-

- Send a “POINT REVERSED” (or “thrown/off”) command to drive in the “B” direction.

Reversing the operating sense

Depending upon whether your point is left or right hand, and depending upon the orientation of the TT300, you may need to reverse the *operating sense.* This means that a “POINT NORMAL” (or “closed/on”) command will drive the unit in the “B” direction and a “POINT REVERSED” (or “thrown/off”) command will drive in the “A” direction.

Increasing ***CV2*** by **128** gives this *alternative* operating sense (and reducing by 128 restores the *original* sense).

See the “Advanced Features” section of this guide for further information.

Non-DCC Operation

Provided that the TT300 has not had the configuration variable *CV2* changed under DCC programming, it will operate using "traditional" power, without DCC, as follows:-

Power Supply

As shown in fig. 5, a power supply must be connected to the "D1" and "D2" terminals through a double-pole-double-throw (DPDT) switch as shown in fig. 6. The characteristics of the power supply are:-

- It must produce *direct current* (DC).
- Normal voltage between 9 to 18 volts. DO NOT EXCEED 25 VOLTS UNDER ANY CIRCUMSTANCES !!
- Available current 0.1amp (100mA) for each TT300 supplied.

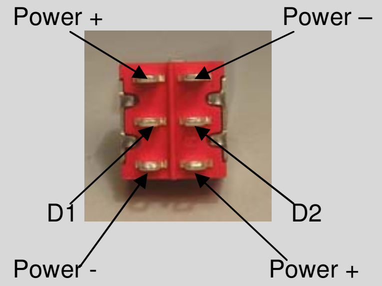


Fig. 6: Switch for non-DCC use

Examples of suitable power sources are:-

- "Maplin Electronics" wall plug supply – stock code GS75S or L82BF.
- "Rapid Electronics" – stock code 85-2902 or 85-3902.
- Gaugemaster – stock code T1 DC (requires case and wiring).

Examples of suitable switches are:-

- "Maplin Electronics" – stock code FH04E or FH39N.
- "Rapid Electronics" – stock code 75-0097 or 75-0213.
- Gaugemaster – stock code GM506.

Point Control

Simply change the switch position and the TT300 will drive to the opposite state. You can reverse the "D1"/"D2" connections from the switch, or change the orientation of the switch in your control panel, if you need to reverse the operating sense.

Consult the "Troubleshooting" section of this guide if point control can not be satisfactorily obtained.

Notes on *operating sense* and "Live Frog" Wiring

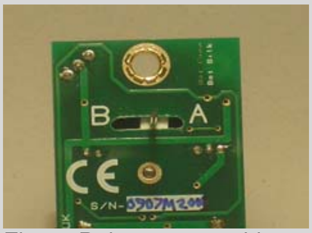


Fig. 7: Point state markings

Fig. 7 shows the *point state* markings, "A" and "B", on the TT300 PCB.

In the *original* (as supplied) operating sense, the NORMAL (or "closed") point state corresponds to "A" and REVERSED (or "thrown") corresponds to "B".

In the *alternative* operating sense, the NORMAL (or "closed") point state corresponds to "B" and REVERSED (or "thrown") corresponds to "A".

Regardless of your chosen operating sense, the point stock rail above the "A" mark is ALWAYS denoted **"rail A"** and the stock rail above the "B" mark is ALWAYS denoted **"rail B"**.

Referring to the main connector terminals:-

"A" is internally connected to "F" when the drive pin is held in the "A" direction (either at the end of its slot in the PCB or when a point blade meets its respective stock rail).

"B" is connected to "F" when the drive pin is held in the "B" direction.

This completes the "Getting Started" section of this guide.

The TT300has several extra features which are described in the following sections.

ADVANCED FEATURES

The TT300 incorporates a DCC accessory decoder as defined by the NMRA. It obtains power and control information from your DCC booster via the “D1” and “D2” terminals as indicated in fig. 4. Most DCC accessory decoders will drive up to four points (or other devices) but, as the TT300 is a completely self-contained unit, its internal decoder is dedicated to a single point.

The TT300 will “recognise” a valid DCC signal when supplied to the “D1” and “D2” terminals and will run under DCC commands. ***Non-DCC*** mode is automatically entered when the unit is supplied with direct current (DC) and the operation is then as described on page 5. However, non-DCC mode can be disabled as explained in the section on “CV setting” (page 10).

Some features of the TT300 work in both DCC and non-DCC modes whilst others are applicable to DCC operation only. All advanced features are described in the following sections.

GENERAL ADDITIONAL FEATURES (applicable in DCC and non-DCC modes)

“Live Frog” Switching

This feature is explained briefly on page 5 and the associated wiring is shown below in fig.8.

Note that the use of the frog switching feature is optional and depends upon the type of points in use. Commercially-available (“ready to run”) points have either *insulated* or *conductive* frogs and it is generally considered preferable to use the conductive, or “live”, type for improved running reliability (especially with locomotives that have a limited number of electrical pick-ups).

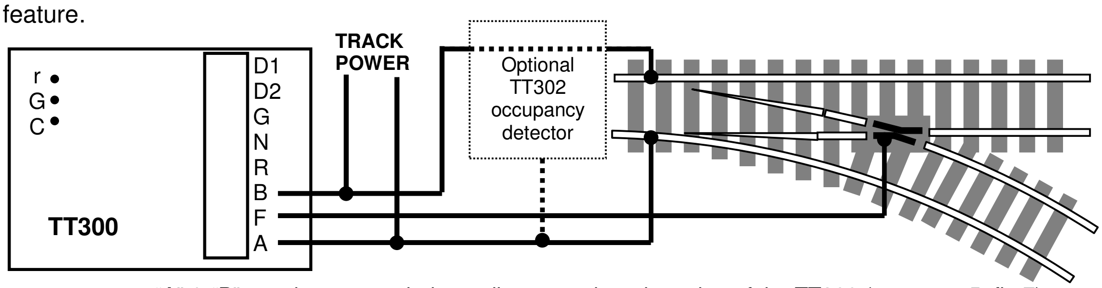
The TT300 uses a pair of internal *micro-switches* to switch frog power and a current of up to 5A may be switched at a voltage of up to 30V. The type of electrical power supplied to the point is not critical – AC, DC, pulsed DC or DCC sources may all be used without affecting the operation of the TT300.

The micro-switches are connected between the “A”, “F” and “B” terminals on the main connector of the TT300 and one switch is used for each point state. Note that either micro-switch is only closed (i.e. passing current) when the drive pin reaches its “end stop” (i.e. when the point blade reaches its stock rail). This ensures that the frog is “dead” when the point blades are travelling.

Remember:-

Terminal “A” is connected to “F” when the TT300 is driven in the “A” direction.
Terminal “B” is connected to “F” when the TT300 is driven in the “B” direction.

If your points are “scratch built” then it is a simple matter to arrange for their frogs to be isolated from the other rails and then use a TT300 on each point to switch power to its frog. Commercially-built “live frog” points have their blades and frog wired together so that power is conducted to the frog when a blade makes contact with its respective stock rail. Some modellers prefer to modify these points, in order to electrically isolate the frog/blade assembly, when using a frog switch. Such modification is not necessary when using the TT300 frog switching feature.



“A” & “B” may be reversed, depending upon the orientation of the TT300 (see page 5, fig.7).

NOTE: If track *occupancy detection* is employed (e.g. using TT302s), the “A” & “B” terminals of the TT300 must not be connected directly to the track (otherwise false occupancy detection will result).

Fig. 8: “Live Frog” Wiring

Indication ("N" & "R") Outputs

The "N" and "R" outputs are intended to drive *light emitting diode* (LED) indicators which can be mounted on a control panel or track diagram in order to indicate point state. Fig.9 shows the required wiring.

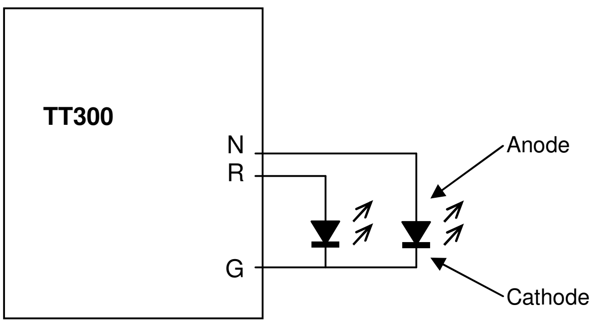


Fig.9a: Connection of LEDs for point state indication.

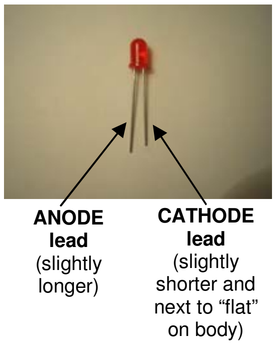


Fig.9b: A typical LED.

NOTE:-

- The "N" and "R" outputs will only supply a limited current (around 10mA).
- The current limiting resistors required for LEDs are built in to the TT300.
- DO NOT INTERCONNECT THE "G" TERMINALS BETWEEN TWO OR MORE TT300s.

The "N" LED will be on if the point is NORMAL and the "R" LED will be on if the point is REVERSED.

The TT300 is set to ORIGINAL operating sense when supplied but he unit can be changed, under DCC programming, to ALTERNATIVE operating sense – see page 10.

In ORIGINAL operating sense:-

- Point NORMAL state corresponds to the unit being driven in the "A" direction.
- Point REVERSED state corresponds to the unit being driven in the "B" direction.

In ALTERNATIVE operating sense:-

- Point NORMAL state corresponds to the unit being driven in the "B" direction.
- Point REVERSED state corresponds to the unit being driven in the "A" direction.

State signal ("r") Output

Referring to the *auxiliary connector* (see fig.1), the "r" terminal is connected to the "G" terminal by an internal electronic switch whenever the point is REVERSED. This output can be used to drive a route indicator on a colour-light signal in order to provide automatic route indication as the point is changed. Alternatively the "r" output can be used to drive a relay, or other electrical device, for indication or layout control purposes.

Examples of the use of the "r" output are shown on page 8.

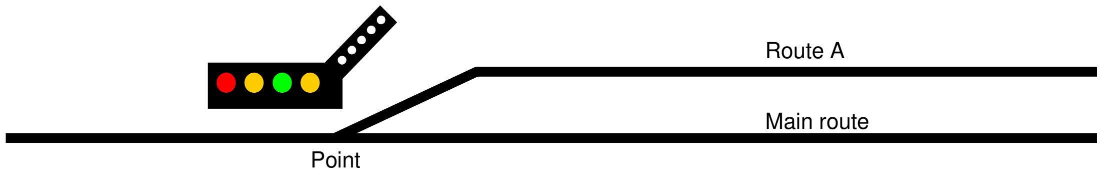
NOTE:-

- A direct current (DC) power source needs to be provided in order to drive an external device.
- The "r" terminal must always be POSITIVE with respect to the "G" terminal.
- The voltage between "r" and "G" must be no greater than the voltage supplied to "D1" and "D2".
- The current drawn through the "r" terminal must be no greater than 200mA (0.2A).
- A suitable lead for the auxiliary connector is available from Traintronics stockists.

There are several ways in which you can use the "r" output on the TT300 and it is not practical to consider all possibilities here. Contact Traintronics (see page 16) if you require any further advice.

Automatic Colour-Light Route Indication From Point (turnout) Setting

As an example, suppose you have the following track configuration……..



…… then you can drive a route indicator, on a colour-light signal, from the "r" output of a TT300 as shown below in fig. 10.

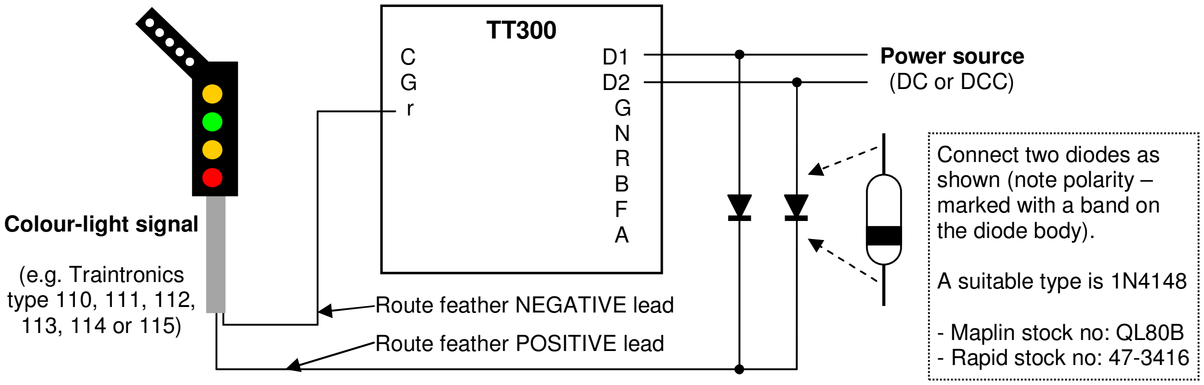


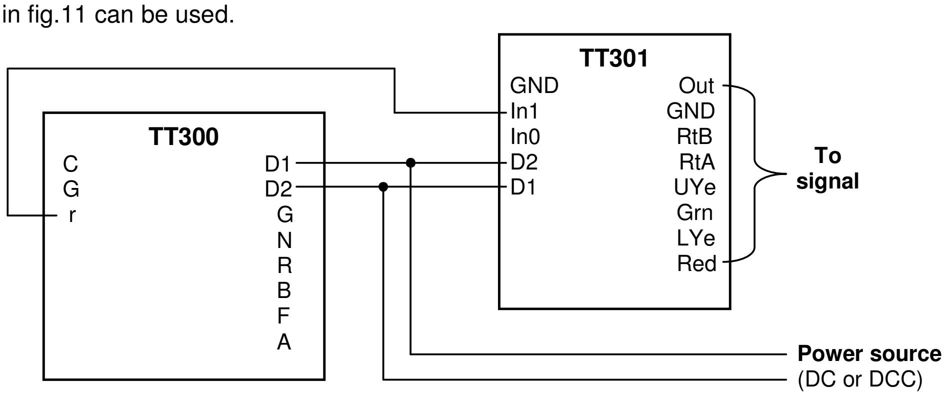
Fig.10: Automatic route display using the "r" output to drive the route feather on a colour-light signal

NOTE:-

- If the signal uses LEDs, and is not a Traintronics type, you may need a current limiting resistor in either the positive or negative route feather lead – consult your signal instruction sheet (Traintronics signals have resistors built in to the route feather).

Automatic Route Indication Using a Signal Decoder

If you are using a Traintronics TT301 Digital Colour-Light Signal Decoder to drive the signal, then the scheme shown below in fig.11 can be used.



NOTE: The TT300 and the TT301 should be powered from the SAME supply and a connection should NOT be made between "G" (TT300) and "GND" (TT301).

Fig.11: Automatic route display using "r" on a TT300 to drive "In1" on a TT301

ADDITIONAL DCC FEATURES

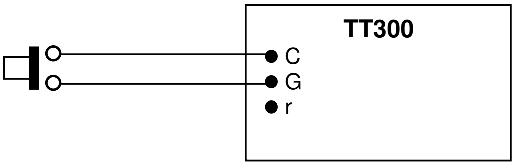
Remote control ("C") input

The "C" input on the auxiliary connector can be used, in DCC mode, to remotely operate the TT300 independently from DCC commands. Fig.12 below shows how to connect a *normally-open* push-button switch, between "C" and "G", in order to achieve this.

Pressing and releasing the push-button switch will override the last DCC command sent and will change the point setting to its opposite state.

Suitable switches:-

Maplin stock no: FH59P
Rapid stock no: 78-0030
Gaugemaster no: GM516



<u>Fig.12: Adding a push-button switch for remote point operation</u>

NOTE:-

- DO NOT INTERCONNECT THE "G" TERMINALS BETWEEN TWO OR MORE TT300s.
- The switch must be a ***momentary, normally-open*** type (i.e. spring-loaded to the OFF position).
- Operation from the "C" input can be disabled by changing ***CV2*** – see "CV Setting" below (page 10).

CV Setting (with a DCC programmer)

Configuration variables (CVs) are special numbers stored within the TT300's memory. The format is defined by the NMRA Recommended Practices. The *address,* operating modes and options of your point actuator can be changed by setting CVs **1**, **2**, **9 and 33 to 80** with the values indicated below – refer to your DCC system manual for details on how to program CVs. Once programmed, a CV will retain its value even when power is removed from the TT300.

Note that the TT300 will normally have CVs changed in *service mode*. This means that its "D1" and "D2" terminals should be connected to the *programming track* output of your DCC controller (or programmer). CVs can also be changed in *operations mode*, with the TT300 connected in your layout, BUT only if you have a DCC controller that is capable of sending *operations mode accessory programming* instructions. Currently most DCC systems cannot do this (their *operations mode CV access* capability is restricted to locomotives).

The NMRA has defined four methods of changing CVs in service mode: i.e. *address only, register, paged and direct.* You do not need to understand how these work – you simply need to be aware that the TT300 supports all four techniques. Refer to your DCC system manual to determine the most appropriate method. (The TT300 automatically responds to whichever CV access instructions are received by it).

"Read only" CVs (5, 7 & 8)

The following CVs cannot be changed. They are required by the NMRA Recommended Practices and they contain data on the TT300.

CV (or REGISTER) NUMBER	VALUE	DATA (meaning of value)
29 (Register 5)	192	ACCESSORY decoder – OUTPUT address method (single point) – BASIC addressing ("simple" accessory control) – no bi-directional communication
7 (Register 7)	33	Software version (currently V3.3 at 28 Nov 2010)
8 (Register 8)	46	Manufacturer I.D. (GFB Designs – designers)

Changing The Point *Address* (CVs 1 & 9)

The TT300 may be set to any address between **1** and **2044** inclusive. Note, however, that the TT300 will ALWAYS respond to addresses 2041, 2042, 2043 and 2044 regardless of the values set in CVs 1 and 9. These special addresses are known as *broadcast addresses* as recommended by the NMRA.

To set the address between 1 and 255 inclusive (recommended for simplicity):-

- Ensure that **CV9** is set to **0** (as supplied – *default* value).
- Set **CV1 (register 1)** to the **required address**.

Example: For address 78 - CV9 = 0; CV1 = 78

To set the address between 256 and 2044 inclusive (more complex – NOTE: the register method can not be used to set addresses in this range):-

- Working in WHOLE NUMBERS, divide your required address by **256**.
- Set **CV9** to the **whole number result** of the division.
- Set **CV1** to the **remainder** from the division.

Examples:	For address 256 -	256 / 256 = 1 remainder 0	so….	CV9 = 1; CV1 = 0
	For address 257 -	257 / 256 = 1 remainder 1	so….	CV9 = 1; CV1 = 1
	For address 511 -	511 / 256 = 1 remainder 255	so….	CV9 = 1; CV1 = 255
	For address 1453 -	1453 / 256 = 5 remainder 173	so….	CV9 = 5; CV1 = 173
	For address 1792 -	1792 / 256 = 7 remainder 0	so….	CV9 = 7; CV1 = 0

Setting Operating Modes And Options (CV2)

To set the value of CV2 (register 2), perform the following calculation:-

- Start with a value of **0** (zero).

- Add: **0** to **disable** the **"C"** input
  or: **1** to **enable** the **"C"** input

- Now add: **0** to **disable non-DCC** mode
  or: **2** to **enable non-DCC** mode

- Now add: **0** to select **original operating sense** – i.e. a NORMAL command drives to "A"
  or: **128** to select **alternative sense** – i.e. a NORMAL command drives to "B"

- Set **CV2 (register 2)** to the value you have calculated.

For example:-

The TT300 is supplied with CV2 set to a value of **3** (the *default* value). This configures the unit as follows:-

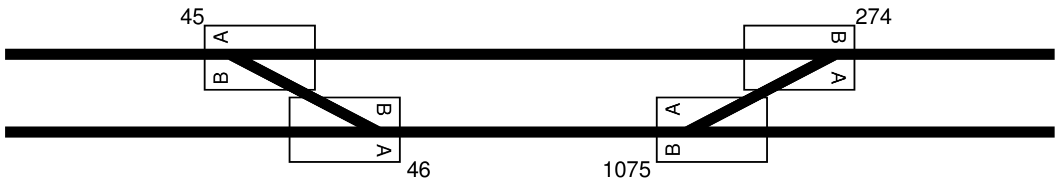
Control "C" input enabled	**(1)**
Non-DCC mode enabled	**(+ 2 = 3)**
Original operating sense	**(+ 0 = 3)**

Now suppose that you wish to change to **alternative** operating sense and **disable** remote control from the "C" input. CV2 needs to have a value of **130** so that:-

Control "C" input disabled	**(0)**
Non-DCC mode enabled	**(+ 2 = 2)**
Alternative operating sense	**(+ 128 = 130)**

Route Setting Using Secondary Addresses (CVs 33 to 80)

Consider the following track configuration with each point having its own TT300 with addresses of 45, 46, 274 and 1075. Assume that the TT300s are orientated as shown:-

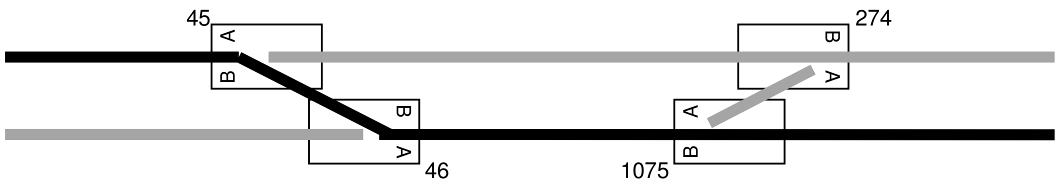


Now, if both roads are bi-directional, then the following routes can be set up:-

Route 1:-

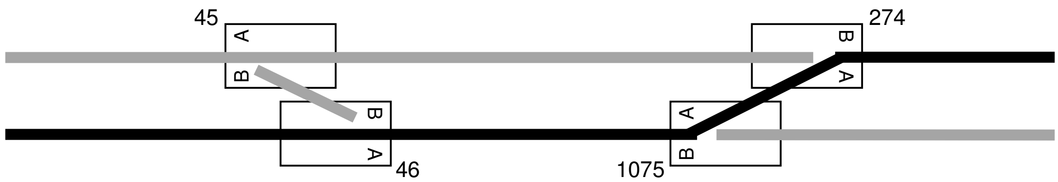
To set this route, the point states must be: **45 to B; 46 to B; 274 to A; 1075 to A**.

Route 2:-



To set this route, the point states must be: **45 to A; 46 to A; 274 to A; 1075 to A**.

Route 3:-



To set this route, the point states must be: **45 to B; 46 to B; 274 to B; 1075 to B**.

Route 4:-

To set this route, the point states must be: **45 to A; 46 to A; 274 to B; 1075 to B**.

(Now see the next page to program the four TT300s for these routes)

How to set the secondary addresses:-

To program the route-setting shown above on page 11, the TT300s need to have their CVs set as follows:-

Unit 45:-	Unit 46:-	Unit 274:-	Unit 1075:-	
CV1 = 45	CV1 = 46	CV1 = 18	CV1 = 51	
CV2 = 131	CV2 = 131	CV2 = 3	CV2 = 3	
CV9 = 0	CV9 = 0	CV9 = 1	CV9 = 4	
CV33 = 1	CV33 = 1	CV33 = 129	CV33 = 129	(Route address 1)
CV34 = 130	CV34 = 130	CV34 = 130	CV34 = 130	(Route address 2)
CV35 = 3	CV35 = 3	CV35 = 3	CV35 = 3	(Route address 3)
CV36 = 132	CV36 = 132	CV36 = 4	CV36 = 4	(Route address 4)
CV37 = 0	CV37 = 0	CV37 = 0	CV37 = 0	

(All CVs 38 to 80 will be set to zero unless previously programmed for other routes)

With these settings:-

- Each point will respond INDIVIDUALLY to its primary address.
- The values of CV2 ensure that NORMAL commands correctly set individual points "straight through".
- To set a route, send a REVERSED command to the address of the relevant route – i.e. 1, 2, 3 or 4.

How it works……….

The TT300 will not only respond to the ***primary address***, set in CV1 and CV9, but also to any ***secondary address*** set in CVs 33 to 80. Up to 48 secondary addresses may be set and EACH secondary address has its own *operating sense* assigned to it.

- Secondary addresses can have a value of between **1 and 124**.
- A value between 1 and 124 (set in any of the CVs 33-80) will set the **original** operating sense for *that particular address.*
- To set the **alternative** operating sense for a particular secondary address, the value of that address is **increased by 128**.

For example:-

Suppose the point needs to respond to addresses **10, 32 and 119** in addition to its primary address. Suppose also that we require the **original** operating sense for address **32** and the **alternative** operating sense for addresses **10 and 119**.CVs 33 to 36 should be set as follows:-

CV33 = 138	(10 + 128)
CV34 = 32	
CV35 = 247	(119 + 128)
CV36 = 0	

When the TT300 receives a valid *accessory* instruction it compares the *received* address with its *own primary* address, stored in CVs 1 and 9. The instruction will be executed if these addresses match, otherwise a search is performed on the *secondary* addresses, CVs 33 to 80, in order (33, 34, 35, …….. , 79, 80).

The search through CVs 33 to 80 stops in any of the following circumstances:-

- A match is found between the received address and a stored secondary address (*the instruction will be executed*).
- As soon as a value of 0 (zero) is found in any of the CVs 33 to 80 (*instruction will be ignored*).
- All 48 secondary addresses (i.e. all CVs 33 to 80 inclusive) have been checked (*instruction ignored*).

THEREFORE, A SERIES OF SECONDARY ADDRESSES SHOULD ALWAYS BE PROGRAMMED, WITHOUT GAPS, STARTING WITH CV33 AND ENDING WITH A VALUE OF ZERO.

Note that the TT300 is supplied with CVs 33 to 80 all set to zero.

“In-situ” Programming (ISP)

DCC accessory programming is normally performed in *service mode* where ALL decoders will respond to programming commands, irrespective of their current address. This means that ANY decoder connected to the DCC source would be re-programmed along with the particular unit being “targeted”! The TT300 *can* be programmed in *operations mode*, which avoids this problem, BUT only if your DCC controller supports operations mode *accessory* programming (most systems only allow operations mode programming for locomotives).

In-situ programming overcomes this inconvenience by providing a means of selecting/changing primary and secondary point addresses, along with setting the operating sense for each address - without using a DCC programmer - and without having to disconnect or remove the TT300 from your layout.

To enter In-situ programming mode, the **“C” and the “G”** terminals must be connected together for at least **two seconds** and the unit will stay in the mode whilst “C” and “G” are interconnected. Once the connection is broken between “C” and “G”, the TT300 will revert to normal operating mode. Either a switch (e.g. a push button switch normally used for remote operation) or a wire link may be used for the connection.

If you are using point state indication, as described on page 7, then the LEDs connected to the “N” and “R” outputs provide valuable “status” indication during In-situ programming. The process can still be performed without the indicators, however, but no acknowledgement of each stage of the process will be provided.

Once in In-situ programming mode, the addresses and operating senses are set by issuing standard DCC accessory commands from your controller. The “D1” and “D2” terminals, therefore, need to be supplied from a DCC source (as will be the case when the unit is installed on a DCC layout).

The In-situ programming process works as follows:-

- Connect “C” to “G”
- After 2 seconds, the “N” and “R” LEDs will start flashing rapidly – the TT300 is now in ISP mode.
- All secondary addresses (CVs 33-80) are automatically reset to zero.

- The TT300 is now waiting to program its **primary** address. Using your DCC controller, send a **“point change**” command to the address that you wish to set as the primary address. The *operating sense* for this address is set according to whether a normal (closed/on) or a reversed (thrown/off) command is sent.

  Example 1: To set the primary address to **10**, with the **original** operating sense, send a point **normal (closed/on)** command to address **10**.

  The **“R”** LED will go OFF for about one second to acknowledge the programming.

  Example 2: To set the primary address to **1789**, with the **alternative** operating sense, send a point **reversed (thrown/off)** command to address **1789**.

  The **“N”** LED will go OFF for about one second to acknowledge the programming.

  This operation automatically sets CVs 1, 9 and 2 accordingly and both LEDs then continue flashing.

- The TT300 is now waiting to program its first **secondary** address (i.e. CV33). This is performed in the same manner to the primary address – i.e. send a “point change” command to the address **(between 1 and 124)** that you wish to set as a secondary. The operating sense, *for this specific address*, is set according whether a normal (closed/on) or a reversed (thrown/off) command is sent.

  Acknowledgement of the programming is indicated, again, by a brief extinguishing of either the “N” or the “R” LED (according to whether a normal or reversed instruction was sent). CV33 is now set.

- Repeat the above operation for each subsequent secondary address (up to a further 47) that you wish to program. CVs 34, 35, 36, ……. etc. will be set in turn, until you stop sending point instructions.

- Finally, remove the “C”-“G” connection. The LEDs will stop flashing, indicating that the TT300 is back in normal operating mode.

BASIC DOs AND DON'Ts

DO.........

- Read and follow these instructions carefully.
- Handle the unit by the circuit board edges only.
- Mount the unit on an INSULATING surface.
- Tighten the screws on the connector terminal strips firmly (at positions with wires inserted).
- Check all wiring carefully before applying power to the unit.
- Work within any electrical limitations stated in these instructions.
- Contact Traintronics for advice if you are unsure of ANY technical issues.

DON'T..........

- Excessively handle the unit.
- Touch the top of the circuit board.
- Attempt to use the TT300 where moisture is present.
- Over-tighten the mounting screws.
- Crush or over-stress any wires (e.g. by stapling them to your baseboard).
- Apply a voltage between the "D1" and "D2" inputs greater than 24 volts.
- Apply a voltage between the "G" and the "C" inputs greater than 5 volts.
- Apply any power source to the "N" or "R" output(s).
- Attempt to dismantle or repair the unit yourself.

TT300 Technical Specifications (hardware version 2.2 & software version 3.3)

DESCRIPTION:		A fully integrated motorised model railway point actuator, incorporating a DCC decoder – compliant with applicable parts of the National Model Railroad Association Standards and Recommended Practices S-9.1, S-9.2, RP-9.2.1, RP-9.2.2, RP-9.2.3 and RP-9.2.4.
CURRENT CONSUMPTION:		No greater than 20mA idling and less than 100mA operating.
INPUTS	- "D1" & "D2":	Accept DCC (compliant with NMRA S-9.1) or DC. **Voltage range: 7.0V to 25.0V peak (abs. max. 27V peak).**
	- "A" & "B":	Accept power from point stock rails - voltage **between -30V to +30V** (relative to "G") AC or DC (any waveform) – **max 5A**
	- "C":	"Active low" logic input. Requires a "potential-free" switch to "G" which must sink at least 4mA (Attains +5V relative to "G" when open-circuit)
OUTPUTS	- "F":	Power for "live frog". **Max 5A**. Connected to "A" or "B" (via internal microswitch) when the drive pin is at the end of the point travel.
	- "N" & "R":	Voltage source with 273ohm series resistor. 0V relative to "G" when OFF; +5V (open circuit) relative to "G" when ON (approx. 18mA short-circuit).
	- "r":	"MOSFET" switch to "G" (i.e. active low). **Max. 200mA** sink current. "Flywheel" diode between "r" and internal DC rail.
DCC ADDRESSING MODES:		BASIC mode only – OUTPUT address method (see NMRA RP-9.2.1).
CV PROGRAMMING MODES:		SERVICE and OPERATIONS MODES supported. In service mode ADDRESS ONLY, REGISTER, PAGED and DIRECT methods may be used.
DRIVE PIN TRAVEL:		Max. 5mm either side of centre – approx. 18% linearity.
OPERATING/HOLDING FORCE:		Between 180gram to 300gram.
SIZE & WEIGHT:		82 X 32 X 42mm ± 1mm (overall, exc. drive pin). Weight approx. 50gram.

TROUBLESHOOTING

The following table gives guidance on resolving some of the problems that you may encounter when becoming familiar with the TT300. Before using this table, please ensure that:-

- You have followed all the above instructions that are relevant (i.e. for DCC or non-DCC operation).
- The unit is wired exactly as shown in these instructions, as appropriate for your application.
- All electrical connections are sound. Ensure that you have not trapped wire insulation in screw terminals!
- All wiring is undamaged.

PROBLEM	PROBABLE CAUSE(ES)	SOLUTION(S)
No response to DCC commands.	Incorrect address set.	Check and correct setting of CVs.
	Invalid accessory command being sent.	Consult your DCC system manual for the correct operation of accessories.
	Command being overridden by “C” input.	Remove any connections from “C” terminal and re-test. If the signal now works, ensure that you only have a *momentary* connection between “C” and “G”.
No response to “C” input when using a DCC supply.	Manual override disabled.	Check and correct setting of CV2.
No response to DC supply.	Non-DCC mode disabled.	Check and correct setting of CV2.
	Wrong type of power supply.	Ensure that you are using a steady, DC supply of between 9 to 18 volts.
	Power supply polarity not being reversed.	Check that you are using the correct type of switch (see fig.5) and that it is wired correctly.
Point blades “stop short” of stock rail.	Movement of drive pin restricted.	Check slot in baseboard under the point throwbar. Ensure that the TT300 drive pin is free to move over the full travel of the point blades.
	TT300 is misaligned.	Check that……… The drive pin of the TT300 is not touching the end of the slot in the PCB. If so, the TT300 needs moving sideways slightly. The slot in the TT300 PCB (within which the drive pin runs) is lined up with the point throwbar. If not, the TT300 needs rotating (on a “straight” point, the long sides of the TT300 PCB should be parallel to the straight stock rail on the point).
Motor continues to run when point blade has stopped against stock rail.	PCB mounted too close against baseboard (trapping the end of the lay-shaft).	Ensure that spacers are fitted between the PCB and your layout baseboard.
	Internal fault.	Contact Traintronics for advice.
“State” indication LEDs will not illuminate.	LED(s) not connected correctly.	Ensure that the “normal” LED is connected between “N” and “G” and the “reversed” LED is connected between “R” and “G”.
	LED polarity incorrect.	Check that the LED *anode* is connected to “N” or “R” and that its *cathode* is connected to “G”.

CONSULT TRAINTRONICS IF THE ABOVE SUGGESTIONS DO NOT HELP.