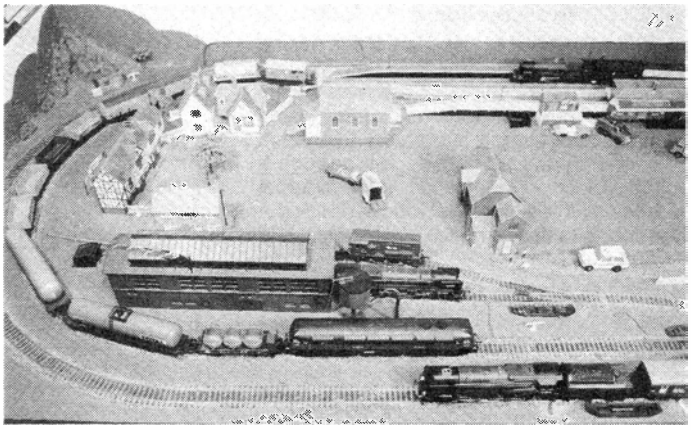
MODEL TRAIN PROJECTS



- ★ **Train Head and Tail Lamp Control**
- ★ **Automatic Loop Control**
- ★ **Track Circuiting**

by Robert Kirsch

This article describes several circuits that may be added to a layout using the digital control system described in issues 2 and 3 of Electronics (order numbers XA02C and XA03D). These circuits have been in use on the authors 00 gauge outdoor layout for some time, and have been found to improve the realism and enjoyment of the railway greatly.

Train Head and Tail Lamp Control

This circuit enables the head and tail lamps to be operated automatically from the receiver unit fitted in the locomotive and controlled by the direction of travel.

This unit may be fitted to dual ended locomotives to enable the headlamps to light only in the directioin of travel, or to a complete train that is to operate in both directions, for example an H.S.T. set, providing white lights at the front and red lights at the rear whichever way the train is moving.

The circuit is fed from the output of the decoder in the receiver module described in issue 2 figure 5.

When a receiver is selected by the control unit and the speed control advanced, pulses appear at one of the two outputs of the decoder, the number of pulses being dependent on the speed setting. These pulses are fed via R1 and D1 (figure 1) to C1, causing it to charge rapidly. It is prevented from discharging when the input goes low by D1 being reverse biassed.

The voltage developed across C1 is used to turn TR1 on, via R2, and in so doing causes current to flow through the lamp in the collector circuit. R3 reduces the voltage to enable a 12V lamp to be used. The lamp and the LED are effectively in series across the supply, so that when TR1 is on the LED is extinguished, and when it is off the LED will light via the resistance of the bulb filament. The lamp will not light because the LED only draws about 10mA as R4 is in series with it.

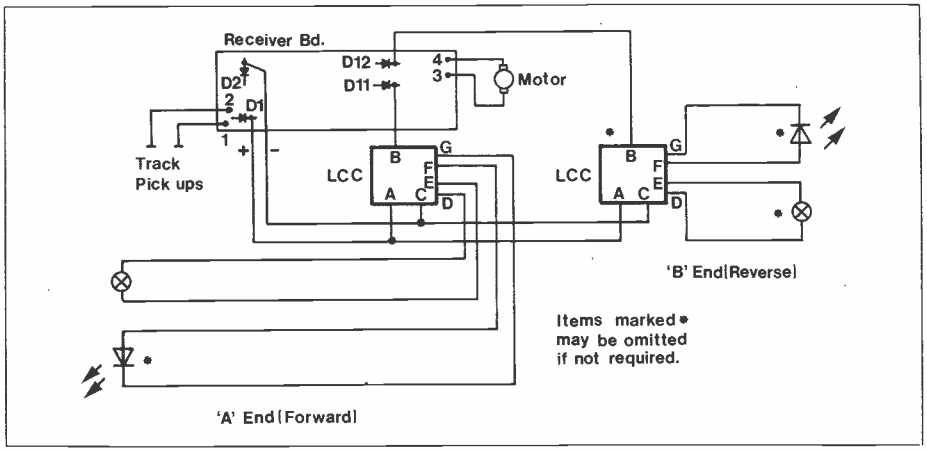


Figure 2. Typical locomotive installation

Installation

Examples of installation for various applications are shown in figures 2 and 3. It will be seen that to control headlamps at both ends of a locomotive two control circuits will be needed. In the case of a complete train it is necessary to electrically couple all vehicles together. This is useful as it enables several track pick-ups to be made along the length of the train, also making carriage lighting possible.

Three wires are required to enable headlamp control. A bridge rectifier and control circuit are required at the non-driving end of the train, the pulse

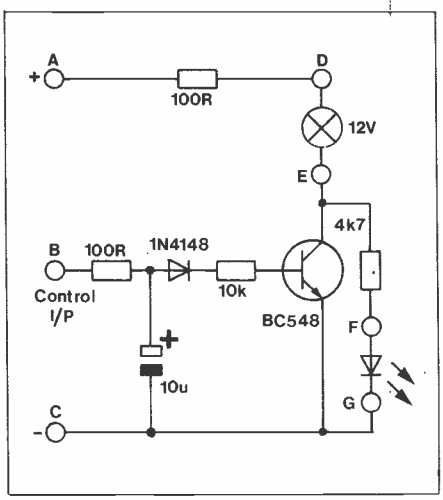


Figure 1. LCC schematic

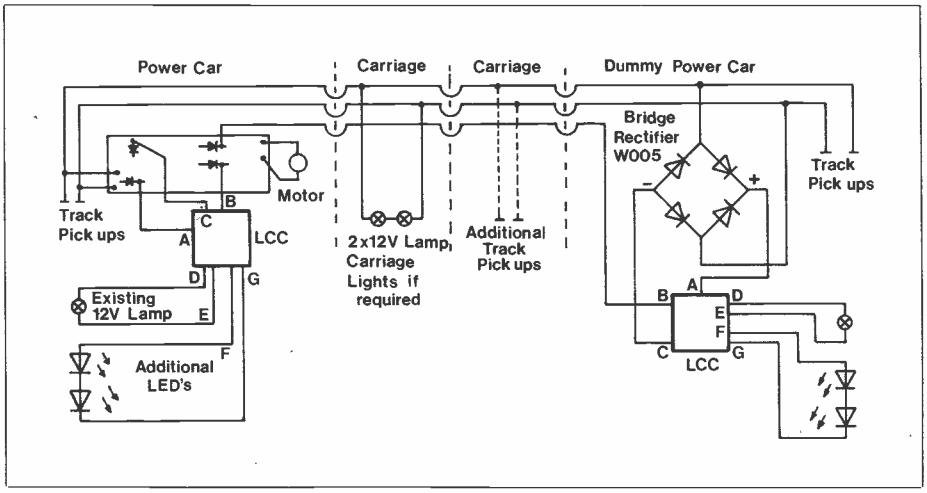


Figure 3. Installation in HST set

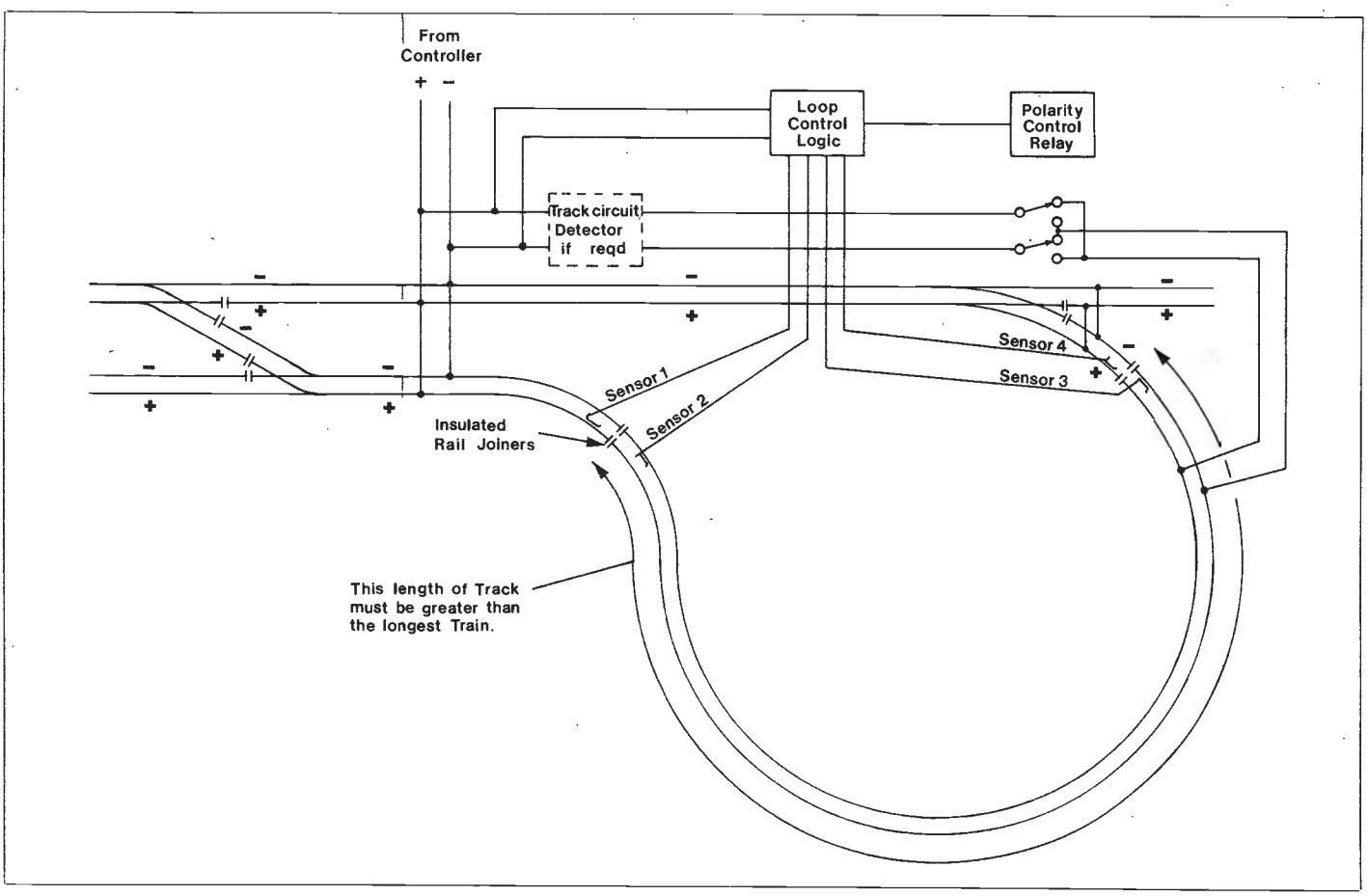
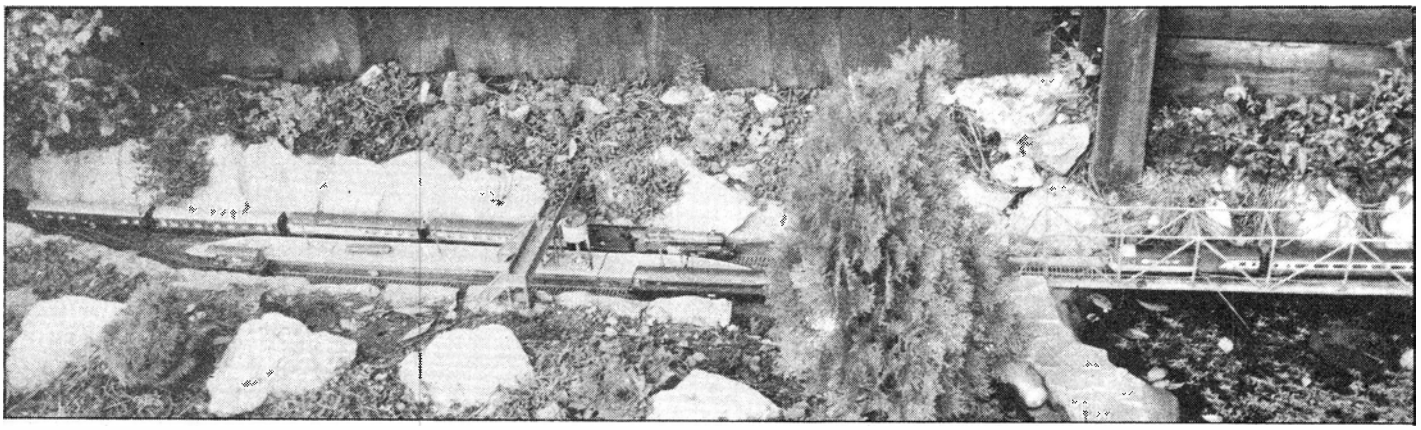


Figure 4: Loop control schematic.



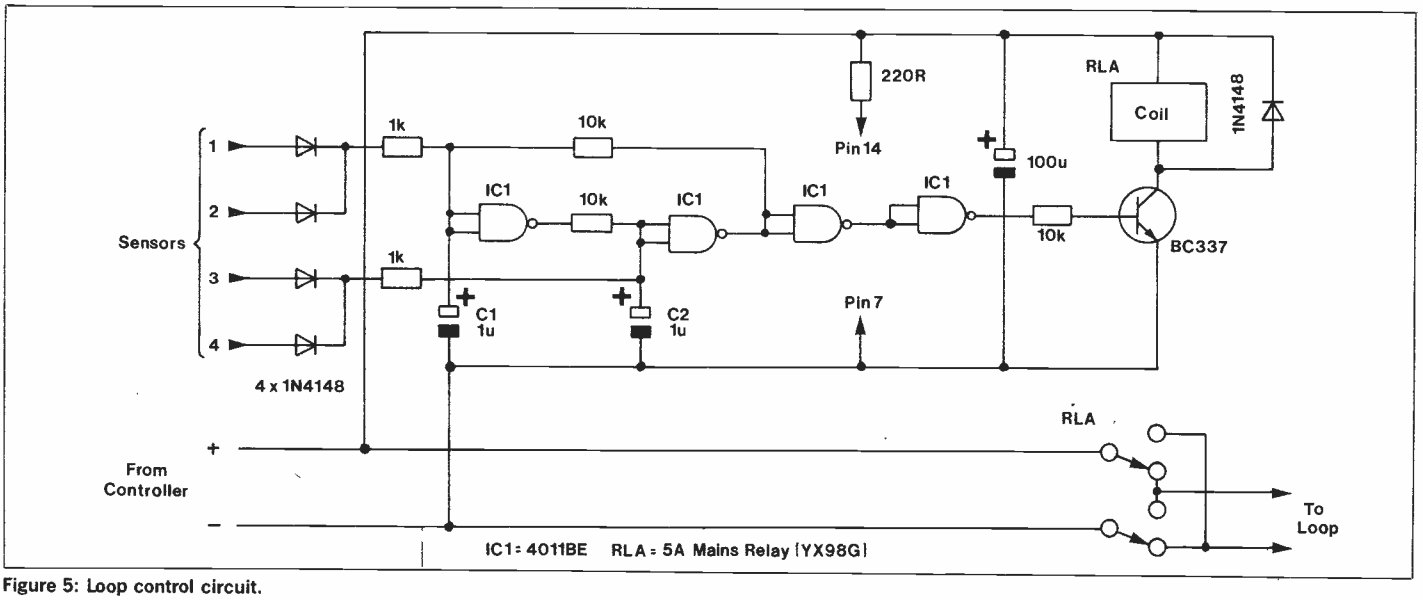
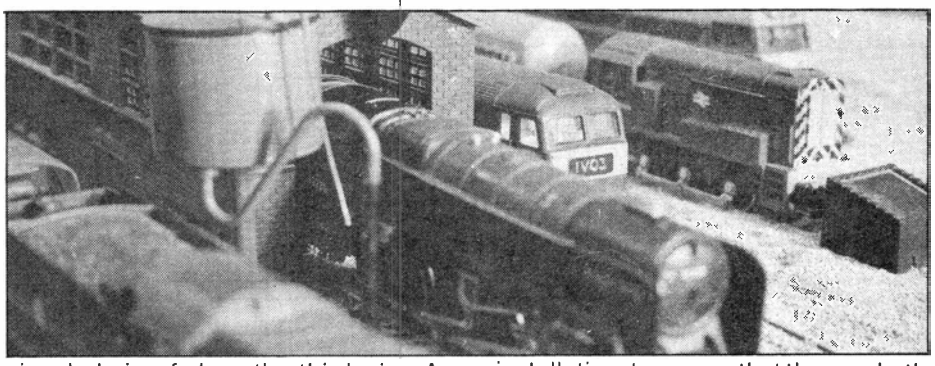


Figure 5: Loop control circuit.



signals being fed on the third wire. A very flexible type of wire should be used between carriages, and the wire used in telephone cords has been found suitable for 00 gauge applications. Enough slack must be left to allow for negotiation of sharp curves. A single lamp may be used for the headlamps, and flexible light guide (XR56L) can be used to transfer the light to the front of the vehicle. The ends of the light guide may be shaped into a lens by holding it near a heat source and allowing the plastic to melt and form a small dome. Two LEDs may be used if required by connecting them in series, although it may be necessary to try several LEDs before installation, to ensure that they are both of the same brightness.

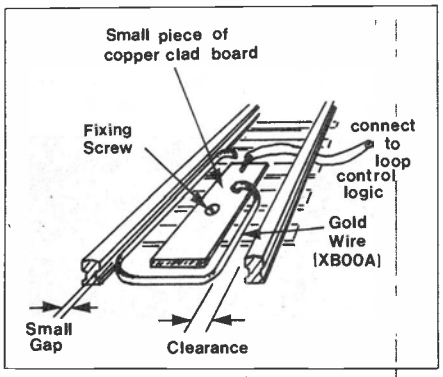


Figure 6: Track sensor detail.

Automatic Loop Control

Loops on model railway systems present a problem due to the confliction of track polarity when entering or leaving the loop. The system described here automatically detects when a train is entering or leaving the loop and sets the polarity accordingly. The receivers used in locomotives are fed from a bridge rectifier, and are therefore not affected by the change in polarity of the track, thus there is no pause during switching.

Figure 4 shows a typical loop arrangement with the four sensors, two placed at each end of the loop. These sensors are simply made from gold plated wire and arranged so that the wheel flanges of the train make contact between one running rail and the sensor wire. This arrangement has been found very reliable in practice, and may be used in other applications where accurate train position detection is required.

Figure 5 shows the circuit of the automatic loop control and it can be seen that a positive input from any of the track sensors will cause the bistable, formed by gates 1 and 2 of the IC, to change to one state or the other, depending on the sensor activated. The inputs from the sensors are decoupled by C1 and C2, to prevent false operation due to inevitable voltage spikes found on model railway systems.

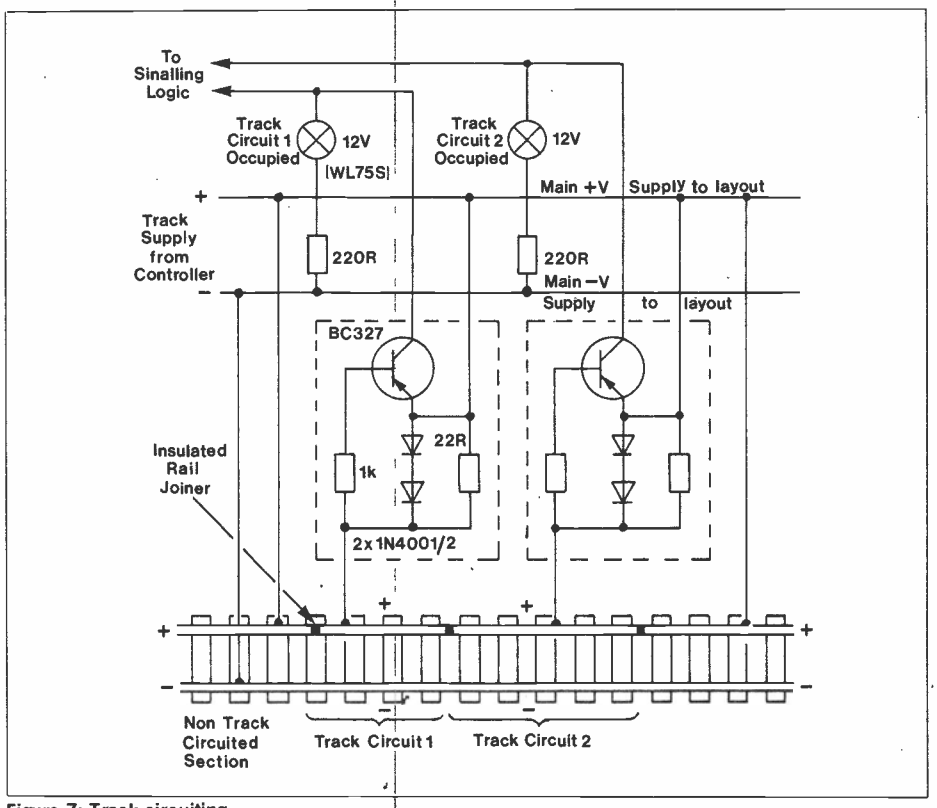


Figure 7: Track circuiting.

Installation

The system should be installed referring to figure 4 as a guide, but do not worry at this stage about the polarity of the connections to the loop section. When the sensors are in position check their operation by shorting them to the appropriate running rail with a screwdriver blade, to ensure that sensors 1 and 2 cause the relay to operate and 3 and 4 cause it to release.

The polarity can now be tested by driving a train into the loop, if the protection circuit on the controller trips as soon as the train enters the isolated section the connections to the loop must be reversed, and a further test carried out to ensure that all is now correct. It will be noted that the distance between the two inner sensors must be greater than the longest train that is likely to use the loop, to prevent both sets of sensors being activated at the same time.

Track Circuiting

The circuit shown in figure 7 provides a means of detecting when a train is in a particular section of the track. This information may be used to provide an indication on a track layout diagram, as well as being interfaced with signalling equipment.

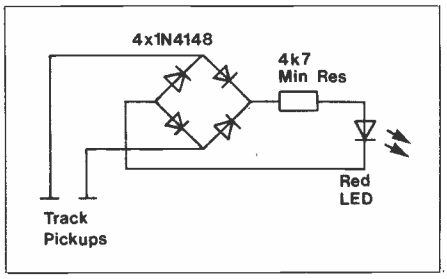


Figure 8: Tail lamp circuit.

The individual sections of track which need to be equipped must be isolated at both ends on the positive rail only, and fed by the common supply from the controller via the detector circuit. A single wire feeds from each detector and is connected via a 12V bulb to the negative supply (EARTH). The lamp lights when current is drawn from the track due to TR1 (figure 7) being turned on by the volt drop across D1 and D2. The two diodes only allow a reduction of about 1.4V, and do not affect the operation of the system. It should be noted that only vehicles that draw current through their wheels will be detected by the track circuiting so it is necessary to provide track pickups at both ends of the train. This may be accomplished by connecting a resistor of about 470 ohms between both wheels on an axle of the last vehicle, or a tail lamp may be provided using the circuit shown in figure 8.