

THE DIGITAL MODEL TRAIN

PART 12 – ADDRESS DISPLAY

by T. Wigmore

The address display is a small extension unit that is used in conjunction with the mother board. It indicates to what locomotive address a given controller is set and whether a given locomotive controller is active.

The address display, which may be fitted to each and every locomotive controller, improves the ease of operation of the system. It is not strictly essential, but will be found very useful with concentrated multi-train operation.

If addresses in the locomotive controllers have been set via the RS232 interface, that is, not by hardware, it is convenient if the address setting is displayed to indicate that it has been set correctly.

Furthermore, the address display indicates whether a given locomotive controller is active. When a controller is taken out of action or when the control of the relevant locomotive is taken over by the serial interface, the corresponding address display is quenched, except in one condition. When the system is in the stop mode and a locomotive address is set via the RS232 interface, the display will indicate that address although the controller is inactive.

Because of this arrangement, addresses may be set in the controllers via the RS232 interface and checked while the system is still in the stop mode. When the system is then actuated, the displays of all non-active controllers will go out.

A controller is not active if:

- it is not connected to the mother board;
- the operating switches are in position "out of action" (high impedance at pins 4 and 5 of the DIN connector);
- a controller with higher priority has been set to the same address;
- the locomotive with the relevant address is given a control instruction via the RS232 interface.

The last condition needs amplification. Any control instructions to locomotives via the RS232 interface will deactivate the controllers



that serve the locomotives with the same address. The control of any locomotive that is operated via the RS232 interface may be reverted to manual by the locomotive enable command <37>. When this instruction is given, the display of the associated controller will light again.

Circuit description

As is clear from Fig.79, the circuit of the address display is simplicity itself, because the control is provided by the mother board.

The circuit proper consists of two BCD-to-7-segment decoders with integral register and the displays.

The decoders are connected to the identically-named locomotive address bus on the mother board via lines LA0-LA7 (LA = locomotive address).

Line Sn carries the selection signal that becomes active as soon as a given controller is selected. The selection causes a certain locomotive address set by hardware to be read and then to be written into the registers of the BCD-to-7-segment decoders.

If there is no controller connected, the display is quenched at once by the system writing FFH to it. The display is also quenched if the system signals a controller with higher priority, that is, a higher controller number, which is set to the same address or if the locomotive with the associated address is controlled via the serial interface.

If no address has been set by hardware, the system verifies whether an address for the relevant controller has been given via the RS232 interface. If so, the address that has been converted to BCD format is sent to the display circuit. It is for this reason that the buffer for reading the locomotive address (IC₁ on the mother board) must be a bidirectional type.

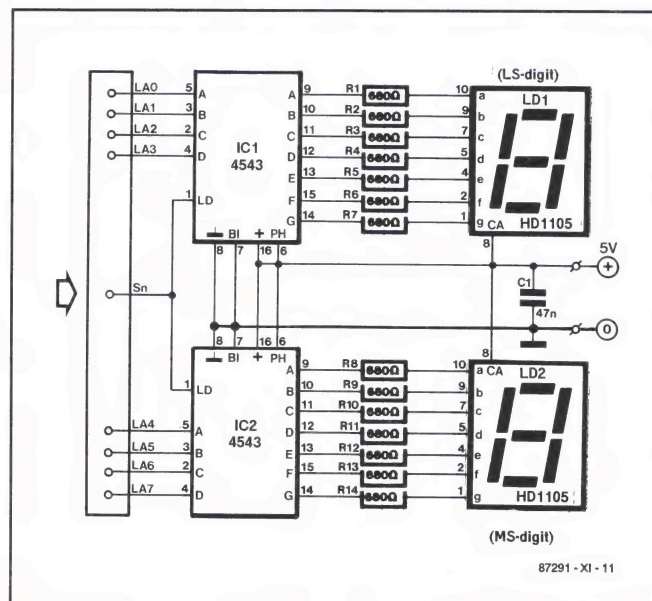


Fig.79. The circuit of the address display is simplicity itself.

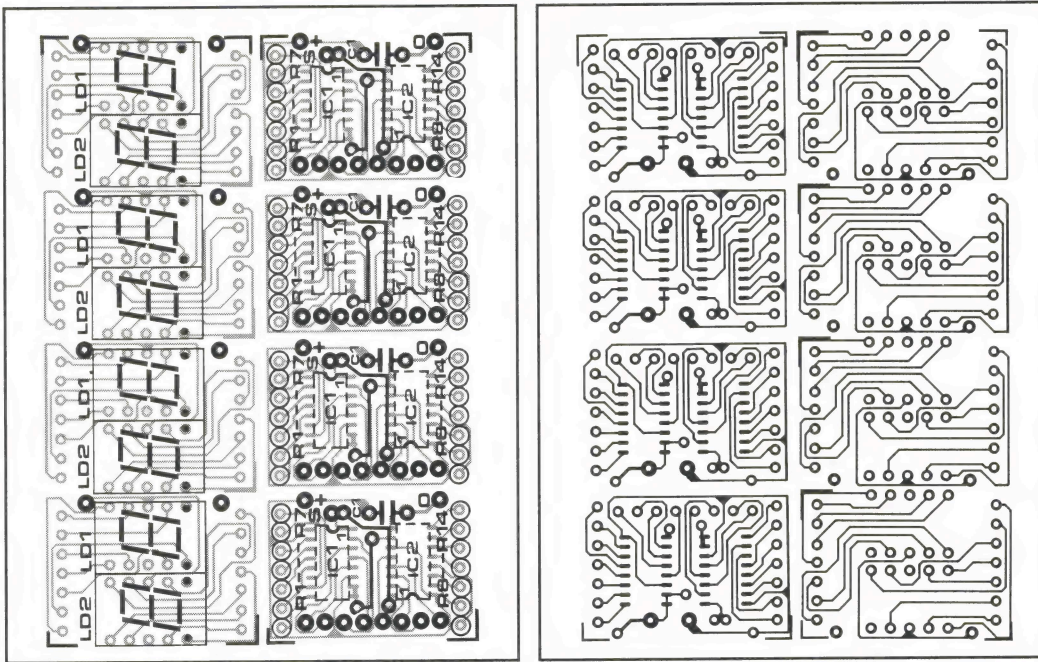


Fig. 80. The printed circuit board is designed for building up to four address display units.

PARTS LIST

R1–R14 = 680R (small types)
 C1 = 47 n (preferably SMA type)
 IC1, IC2 = 4543 (SMA type)
 LD1, LD2 = HD1105 (red)
 PCB 87291-9

Construction

The construction of the display involves some rather fiddly work, because to keep the unit small, the components should, if at all possible, be very small or of the SMA (surface mount assembly) type. In the case of the ICs, there is no choice: they must be SMA types.

The boards are not wider than the displays to enable a number of units to be mounted side by side (unless only one locomotive controller is used, of course).

Furthermore, the most convenient type of construction is the sandwich type in which the resistors are used for making the necessary connexions.

The printed-circuit board in Fig. 80 allows up to four display units to be constructed. The mother board can handle up to 16 displays, so that if the maximum is chosen four PCBs are required.

Before the construction proper can be started, the board must be cut (lengthwise) into two identical strips if four adjacent units are wanted or into eight parts if four discrete units are required. The following notes apply to the building of one unit only.

- Some assembly instructions are given in the caption of Fig. 81.
- Mount both 7-segment displays on to the top "wafer".
- Fit both right-angle wire links to the non-copper side of the lower "wafer".
- Mount decoupling capacitor C_1 at the copper side of the upper "wafer". If an SMD type proves unobtainable, use a small ceramic type and mount this as shown in Fig. 81a.
- Mount IC_1 and IC_2 at the copper side. Pins 1–8 are located at the bevelled side of the devices. These sides should point to one another.
- Connect the two wafers together with the aid of the resistors as shown in Fig. 81b. The copper side of each wafer should face downwards. The resistors should be of the smallest commercial type to ensure a compact unit.
- Loop the power lines in between the two wafers (top right and underneath LD_1) with the aid of two short lengths of equipment wire as shown in Fig. 81c.

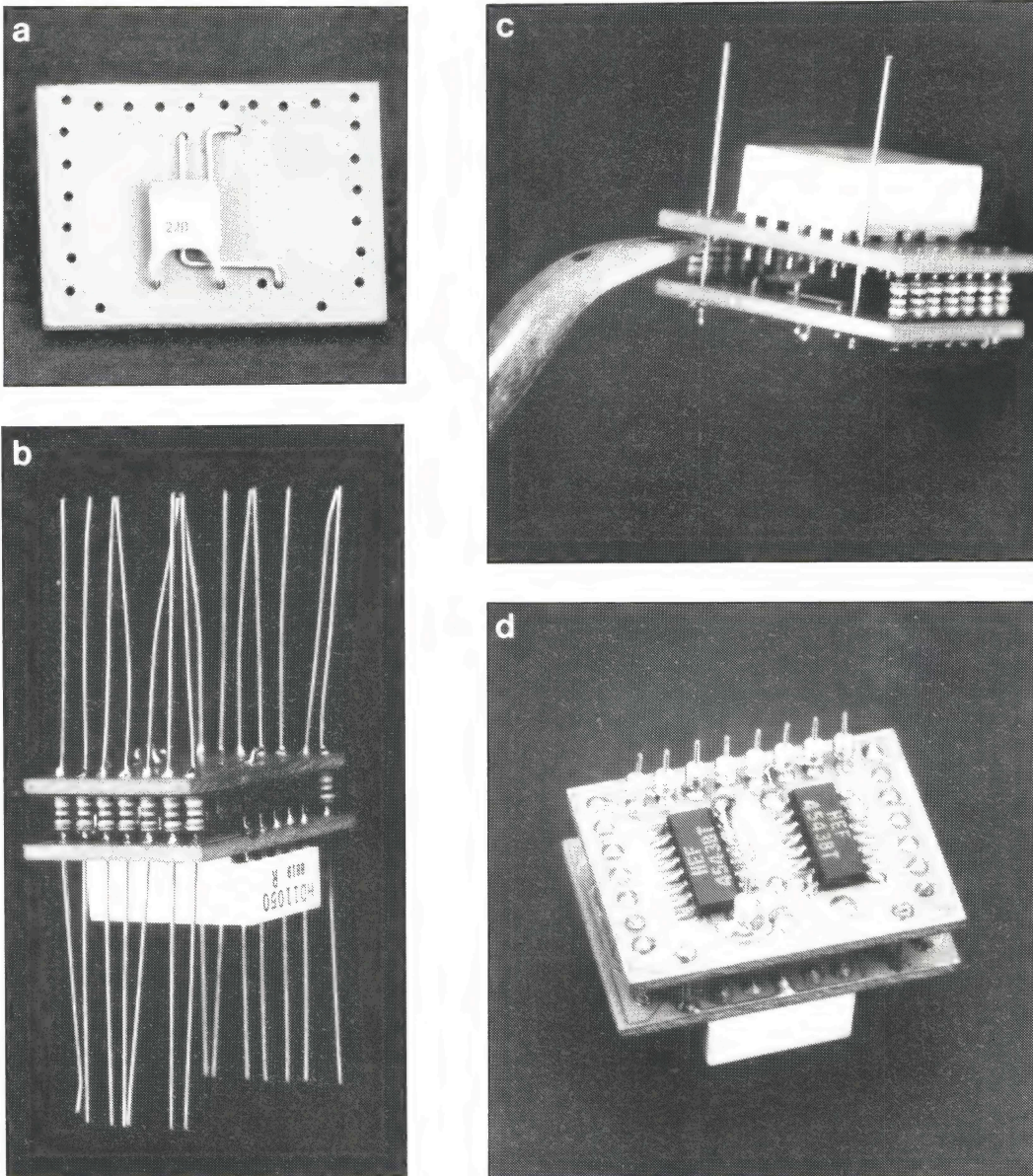


Fig. 81. Construction of the boards as a sandwich: 81a – the decoupling capacitor is laid flat on the board; 81b – through connexions are made with the aid of the resistors; 81c – the power lines are looped through; 81d – the sandwich is ready for connexion to the mother board.

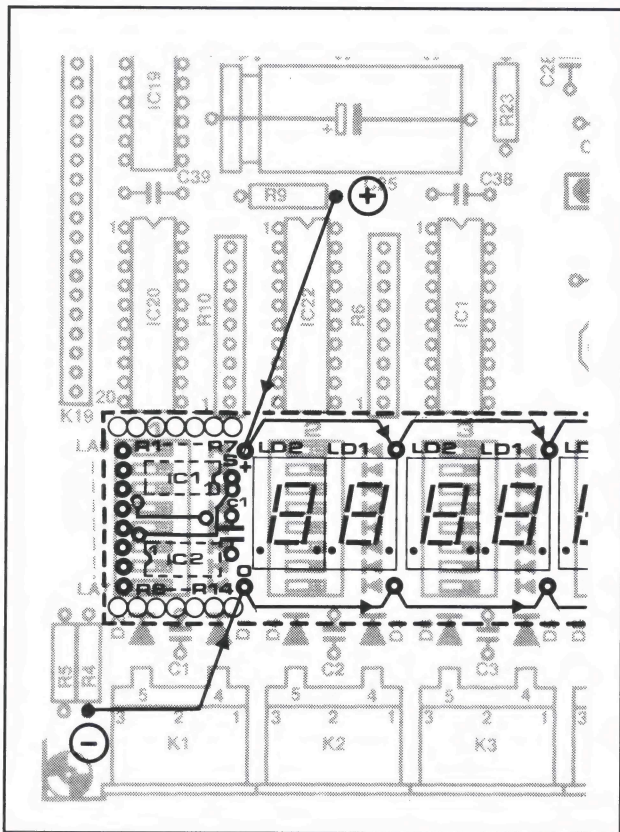


Fig. 82. Showing where connexions from the display unit are made on the mother board.

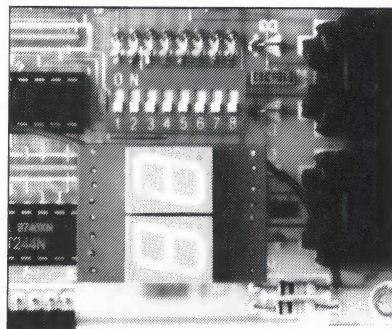
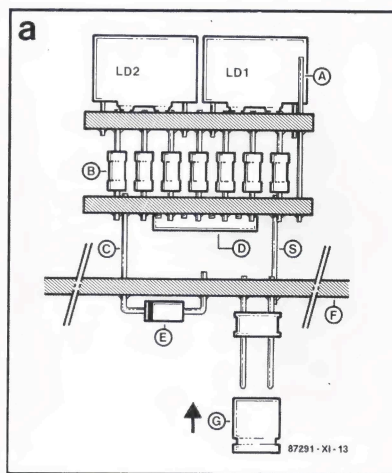
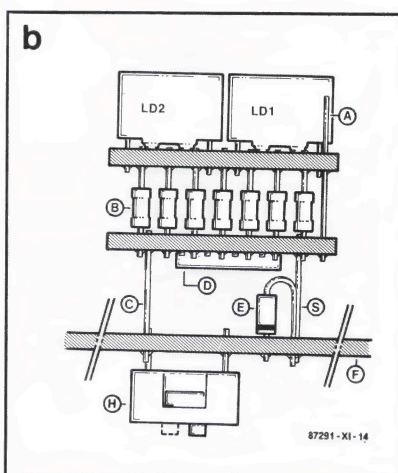


Fig. 83. Combination of an address display and hardware for setting locomotive addresses.



- A - supply line earth
- B - current limiting resistors
- C - connexion loc address bus
- D - SMD-type IC
- E - diodes for loc addressing
- F - mother board
- G - jumper
- H - DIL switch

Interconnexions

Apart from the power lines, there are nine connexions between the address display and the mother board—see Fig. 82.

The power lines (0 V and +5 V) may be looped to other display units via lengths of normal equipment wire.

Each and every display unit may be used in conjunction with hardware for setting the locomotive addresses—see also

“locomotive addresses” in Parts 7 and 8. If that is done, it is convenient to remove certain parts to the track side of the mother board. Two possibilities are shown in Fig. 83.

In the first (Fig. 83a), the eight diodes are fitted at the track side. The connexions to the cathodes may be used for connecting lines LA0-LA7 to the display unit. To make the whole easily removable, the display unit may be provided with a “semi IC

socket”. The setting of the loc addresses may be effected by fixed wire links or jumpers at the track side of the mother board.

The second design (see Fig. 83b) uses an 8-pole DIL switch at the track side of the mother board for setting the addresses.

Bear in mind that if an address is set by hardware, a locomotive controller can no longer be allocated an address via the serial interface.

PROTECTED QUAD POWER DRIVERS

Providing interface between low-level signal processing circuits and power loads, Sprague's UDN2547B and UDN2547EB quad power drivers combine logic gates and high-current bipolar outputs with complete output protection.

Each of the four outputs will sink 600 mA in the ON state. The outputs have a minimum breakdown voltage of 60 V and a sustaining voltage of 40 V. The inputs are compatible with TTL and 5V CMOS logic systems and include internal pull-down resistors to ensure that the outputs remain OFF when the inputs are open-circuited.

Over-current protection for each channel has been designed into the devices and is actuated at about 1.3 A. It protects each output from short circuits with supply voltages up to 25 V. When a maximum driver output current is reached, that output drive is reduced linearly, maintaining a constant load current. If

the over-current or short-circuit conditions continue, each channel has an independent thermal limit circuit that will sense the rise in junction temperature and turn OFF the individual channel that is at fault. Foldback circuitry decreases the output current if excessive voltage is present across the output and assists in keeping the device within its SOA (safe operating area).

Each output also includes diagnostics for increased device protection. If any output is shorted or opened, the diagnostics can signal the controlling circuitry through a common FAULT pin.

The UDN2547B/EB can be used to drive various resistive loads including incandescent lamps (without warming or limiting resistors). With the addition of external output clamp diodes, it may be used to drive inductive loads, such as relays, stepping motors, or solenoids.

The UDN2547B is a 16-lead power DIP, while the UDN2547EB is a 28-lead power PLCC for surface-mount applications. Both packages are of batwing construction to provide maximum power dissipation over the temperature range of -20° C to +85° C.

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