

Repairing the Display Driver in a Philips CD160 CD Player (Part 1)

Foreword

The 4-digit TIME/TRACK display and status indicators on the CD160 front panel are controlled by an integrated decoder/driver chip bonded to the rear of the small printed-circuit board carrying the display. This display module, designated NSM4202A, was manufactured by National Semiconductor and was also used in various other Philips models. The display on these players seems prone to either partial or complete failure. This may or may not be due to overheating of the chip, which is covered by a blob of black (probably epoxy resin) encapsulant.

In many cases, it is likely that the display itself remains fully functional and if some means could be found to drive it externally, then it would avoid having to replace the whole module, which is difficult to find, expensive and may possibly fail again in the future. Fortunately, there is a device available which is capable of both decoding the serial data stream from the control circuit and driving the display and status indicators directly: the Micrel MM5450. This device is available in a 40-pin DIL package (MM5450YN) or in a 44-pin PLCC package. For ease of handling and construction, the DIL version has been used in this instance.

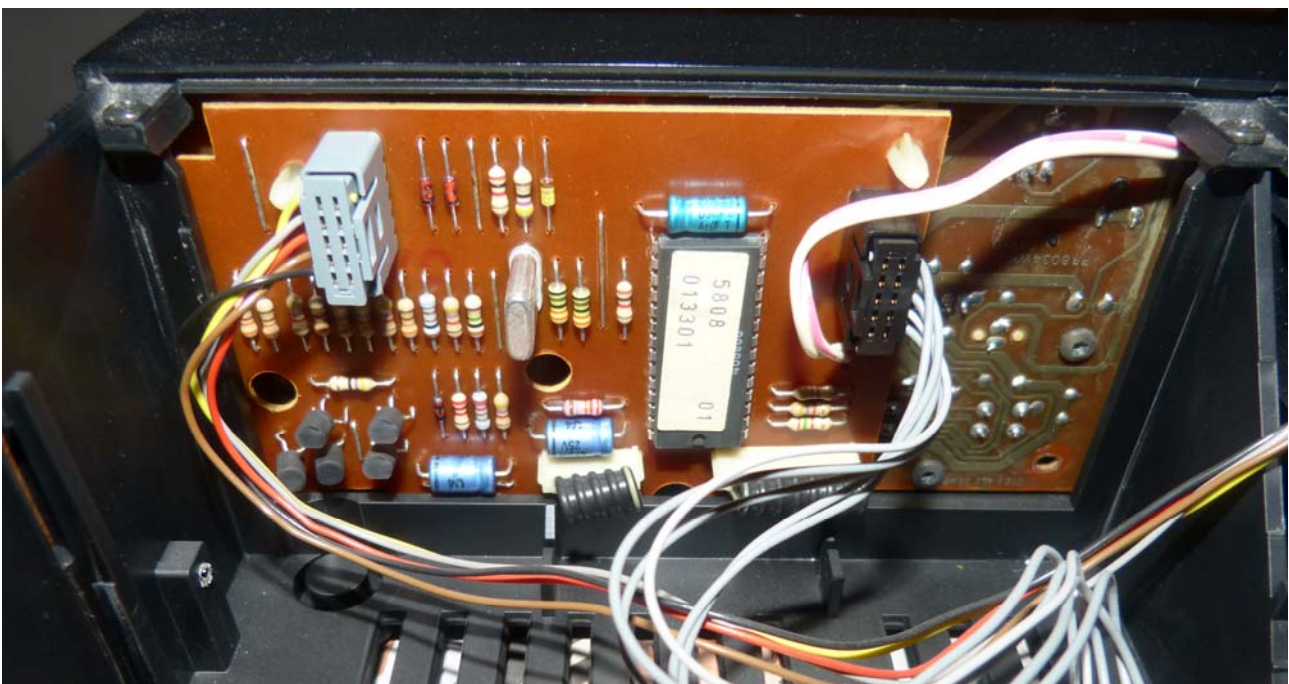
It is assumed that the repairer has some electronic knowledge, so this guide isn't written in intricate detail or with lengthy explanations. A T10 Torx screwdriver and a small soldering iron will be needed.

Parts required: Micrel MM5450YN, 40-way DIL socket, 6.8k Ω resistor, 1nF capacitor, 100nF capacitor, mounting board, spacers (preferably insulated), thin wire or ribbon cable.

Dismantling

- 1) Remove the two self-tapping screws along each side of the top cover and the machine screw at the back, then withdrawing it backwards, lift off the cover.

The CD160 was manufactured with two variants of control and display boards, types A & B (see photos). The repair procedure is identical for both.



CD160 control board type A



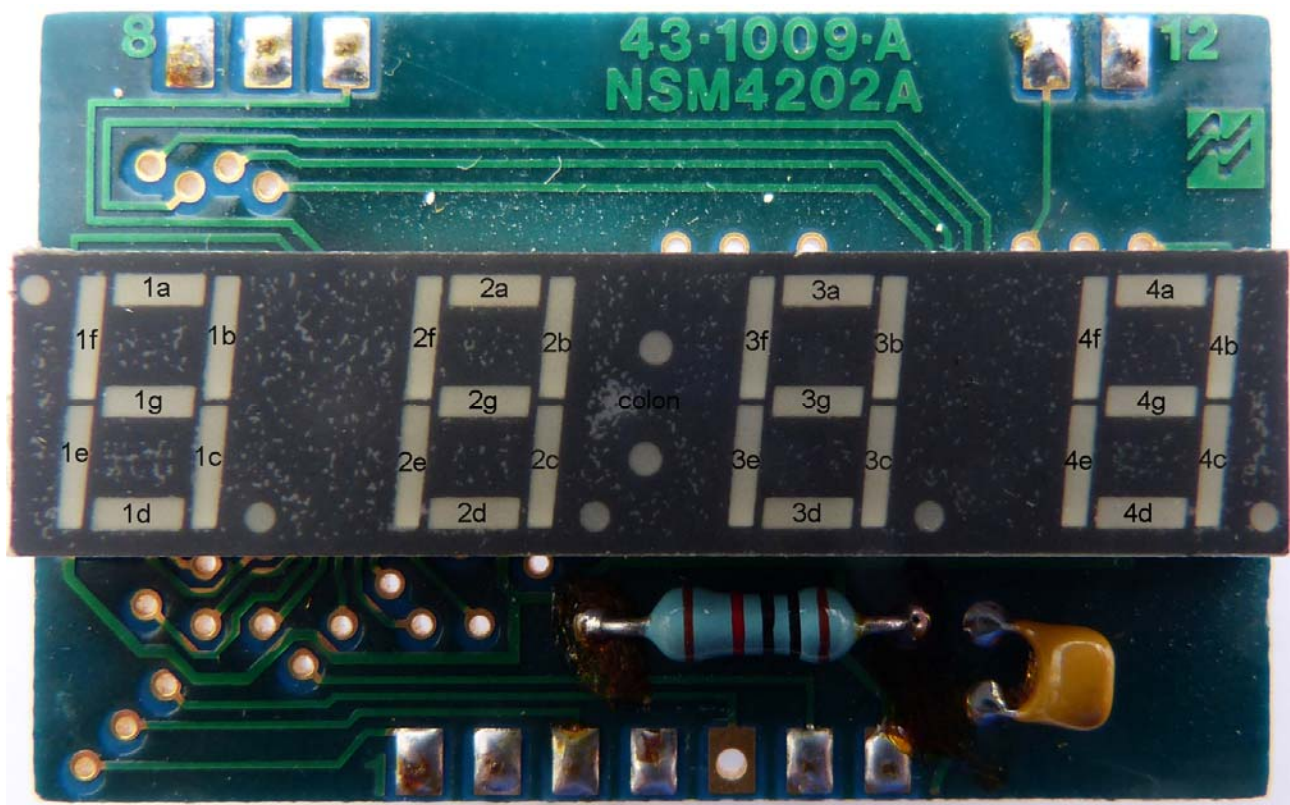
CD160 control board type B

- 2) Unplug the two connectors (they have locking tabs, which need to be bent back slightly).
- 3) Remove the three self-tapping screws along the top of the front panel, which attach it to the case. Tilt the front panel forwards and downwards until the bottom clips disengage. The case can now be put to one side.
- 4) Working on the front panel, the CD tray illumination LED is soldered to a small PCB. This can be wiggled from its slot on the front panel. It's likely that the brittle plastic prongs which clip the wires to the front panel will break, but they're not vital.
- 5) Self-tapping screws secure the control/display board assembly to the front panel. Two of these are accessible through holes in the control board. Remove all five screws and lift off the control/display board assembly. Note that the top edge of the display board is located in a slot. The front panel can now be set aside.
- 6) Pull off the white plastic clip holding the control and display boards together at the bottom, then using a small pair of pliers, squeeze in the locking tongues on the two stand-off pillars in turn and separate the boards. The ribbon cables are flexible enough to allow unrestricted work on the display board.
- 7) The NSM4202A module, seated on a black plastic frame, is soldered to the display board via stand-off pins. Using a desoldering tool or 'solder-wick', unsolder the 11 stand-off pins from the display board and then lift off the display module. Pins 1-7 are along the bottom of the board and 8-12 along the top. Pin 5 is absent.

Testing and repairing the display

The 4-digit display is a common-anode type and the anodes of all four digits are connected together to stand-off pin 7. The cathodes of the individual segments in each digit are connected to the driver chip via through-plated PCB tracks. This arrangement offers a convenient means of checking the operation of all the digits.

The segment identifications and location of each cathode connection are illustrated in the following photographs. Depending on the spread of the black encapsulating blob, not all the through-plated holes may be accessible. Fortunately, pads have been allocated to the most susceptible ones to allow for testing at the factory and some of these are labelled (in parentheses) in the second photograph, along with their corresponding holes.



Segment identities

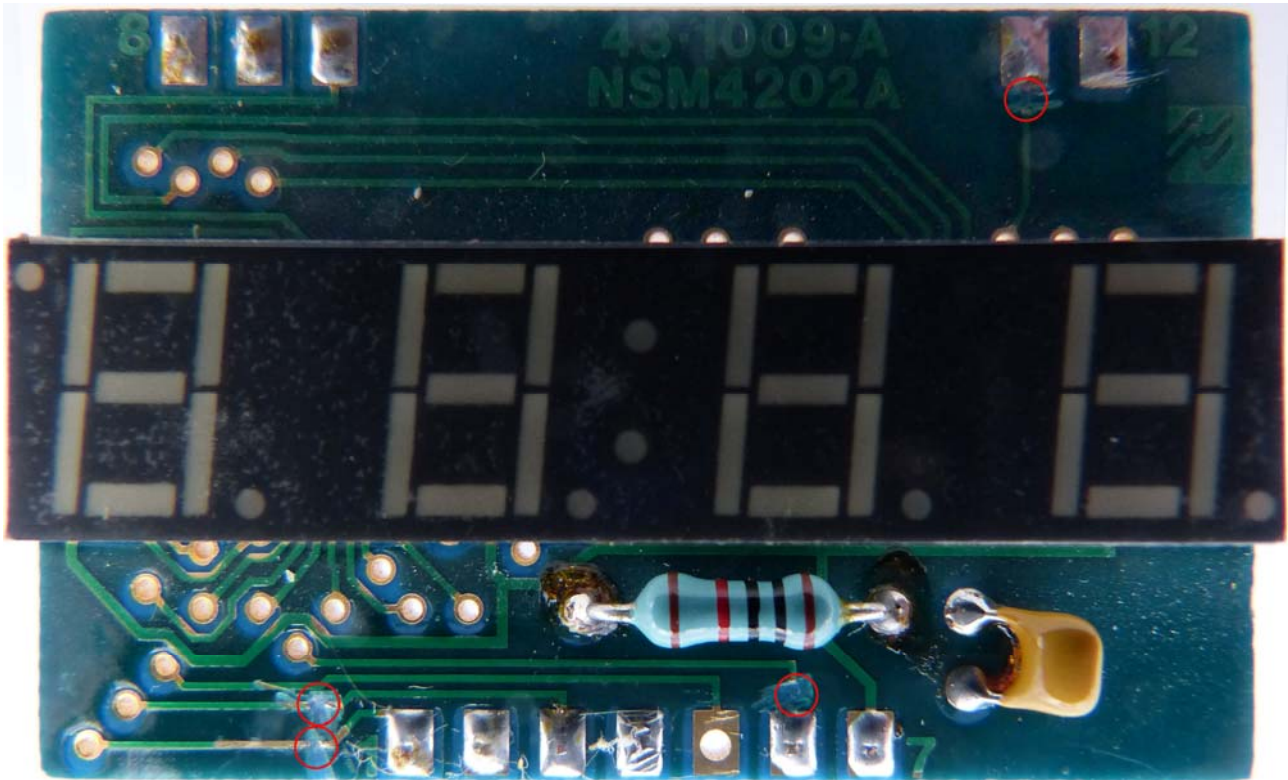


Holes (and pads) connected to each cathode and holes connected to stand-off pins

Before commencing repairs on the display, connect the positive of a d.c. power source to stand-off pin 7, via a resistor (330Ω for 5V, 680Ω for 9V, 1kΩ for 12V or 1.2kΩ for 15V). Using a wire attached to the negative terminal of the power source, touch it against each segment's through-hole (or pad, where appropriate) on the PCB and check that the corresponding segment lights. On the display used for writing this guide, segment 1f was faulty. However, it wasn't important because the player was only ever used for displaying

track numbers and few, if any, CDs would have had more than 39 tracks. If any key segments have failed, then it shouldn't be difficult to fabricate a replacement board using four separate displays, two individual LEDs for the colon and a square-pad perforated board or home-made PCB.

Assuming the display is working and the board can be reused, it will not be necessary to remove the old decoder/driver chip. However, it should be disconnected from the rest of the circuit by cutting through some of the tracks on both sides of the board. The appropriate tracks are ringed in the following photographs.

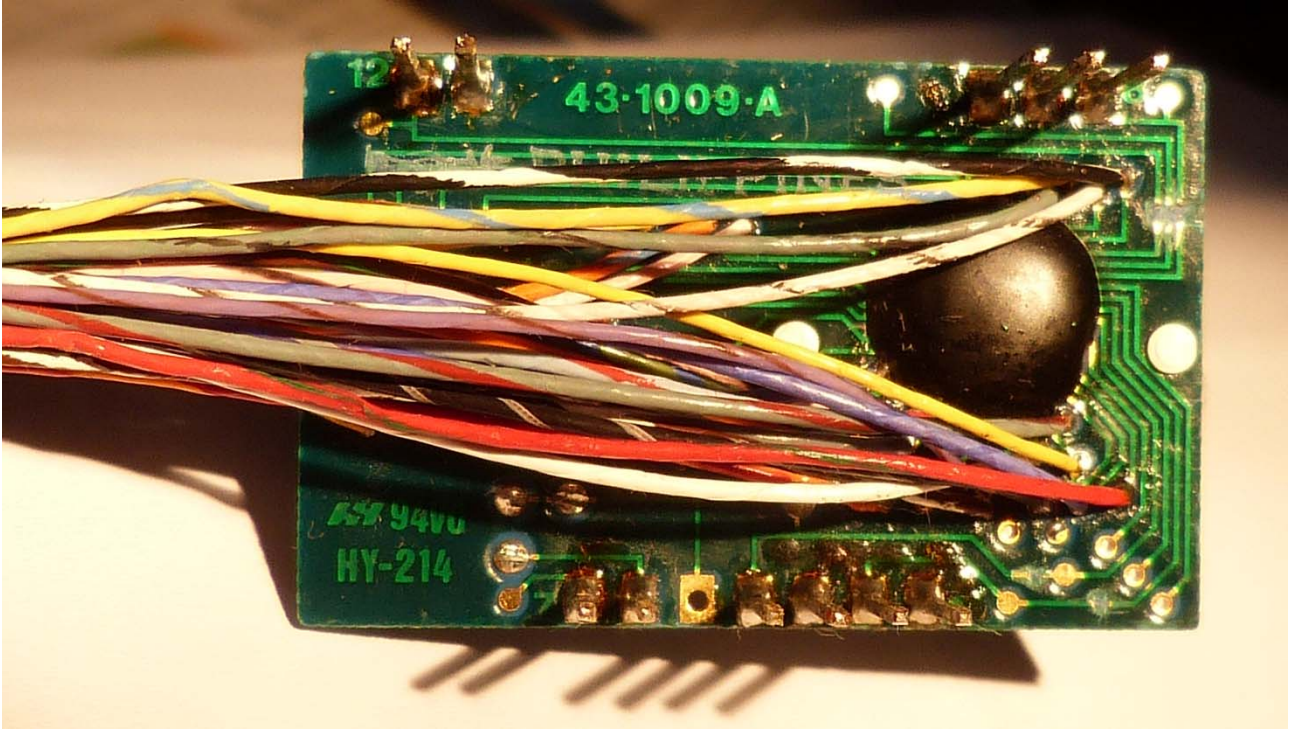


Cutting points for four tracks on the front

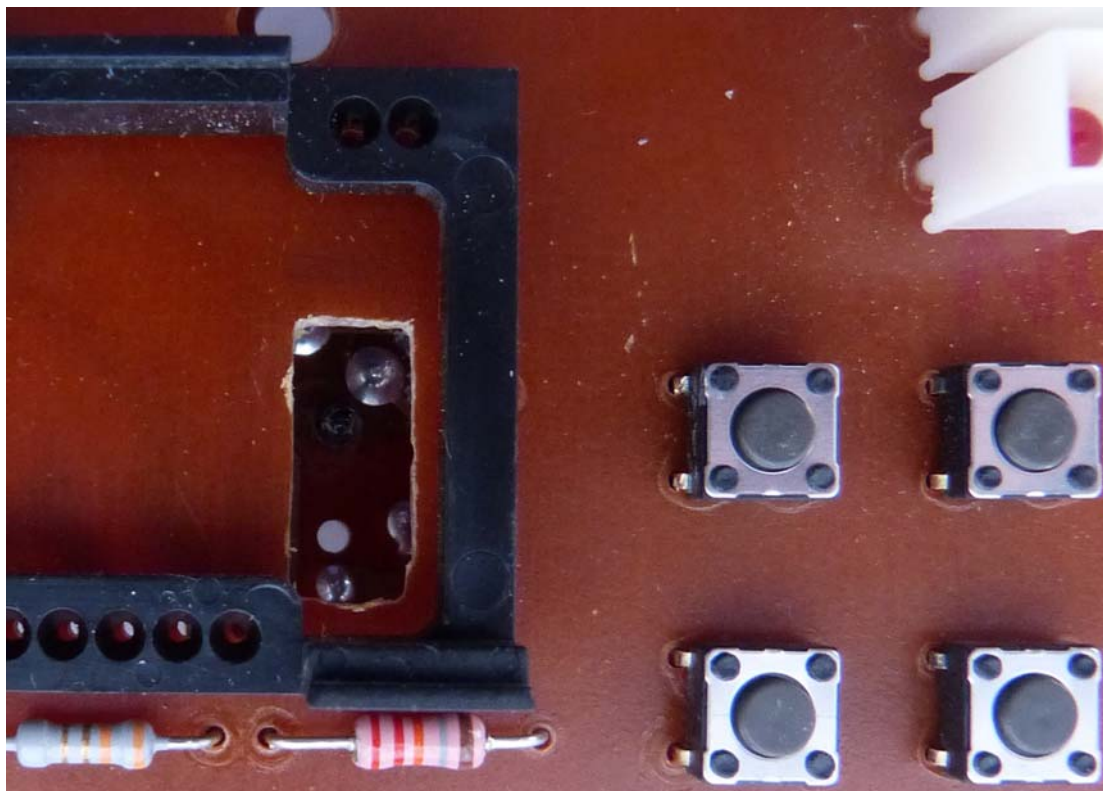


Cutting points for five tracks on the back

It will be necessary to solder 29 thin, stranded wires to the contacts at the back of the board, using a very small soldering iron. The use of a non-acidic soldering flux, such as Coraline, will help to achieve good, compact joints. Where the through-holes are accessible, about 1.5mm of insulation needs to be stripped from the end of each wire, the wire pre-tinned, then poked into each segment's through-hole and soldered into place. Either individual wires or ribbon cable could be used. Where a through-hole has been obscured by encapsulant, the wire should be soldered to the appropriate pad instead. When this has been completed, re-test the segments through the new wiring.



The wires need to be passed around the back of the display board; the simplest method of doing this is to cut a hole in the board, beneath the module (avoiding any tracks). There is plenty of room for this.



Hole cut in display board beneath the module position