

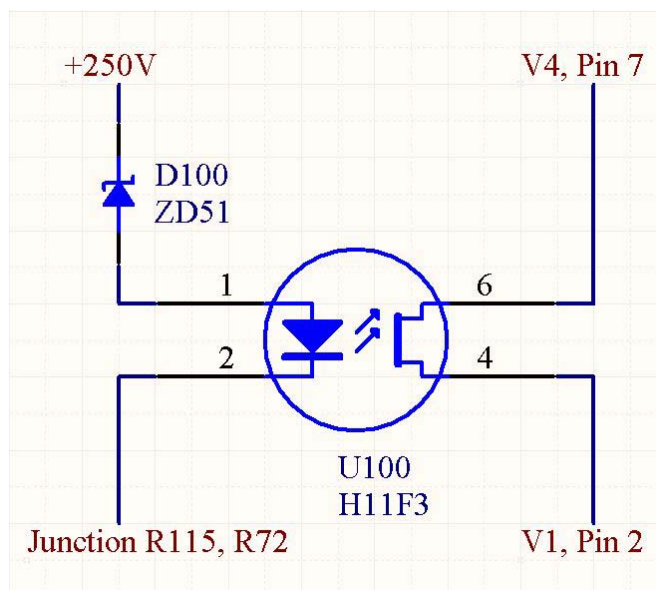
## Hewlett-Packard Model 405CR Repair Notes

### 1 Photocoupler replacement

If the voltmeter does not zero and its display is nearly constant regardless of input signal or range the photocoupler formed by neon lamp DS7 and photoresistor V23 may be defective. First check the signals according to the voltmeter's manual page 8, figure 4-2, to be sure that internal timing is correct. While DS7 can be checked easily by observing its flashing light, the photoresistor switches small signals in a high impedance environment. Check V23 off the circuit.

Loose the two wires to V23 and make sure they don't contact to any other part or the chassis. Connect an ohmmeter across the pins of V23. Connect one end of a resistor (47k $\Omega$ , 2W) to the junction of DS7 and R72. Be sure that the other end has no contact with other parts. Power-on the voltmeter and check the dark resistance of V23 which should be higher than 3 M $\Omega$ . Connect the added resistor's open end to ground (chassis) to force DS7 to light. The resistance of V23 should now drop to less than 5 k $\Omega$ .

If these values are not met, the photoresistor is aged or defective. Usually a direct replacement part is not available, so you have to use a solid state alternative. Remove DS7, V23 and the black mounting box from the circuit. Add a photocoupler Fairchild H11F3 plus a zener diode (zener voltage between 47V ... 56V, power dissipation >1,3W) as shown below:



Please note that the H11F3 is the only photocoupler that will do the job. Standard photocouplers with transistor output do have a collector-emitter voltage while the H11F3 output is "pure resistive".

## **2 Ramp gate diode replacement**

Replacement of the ramp diodes CR5, CR6, CR7, CR8 is critical as mentioned in the manual and the original parts are not longer available. These diodes must have a very low reverse current, so standard types as the 1N4148 won't work. Good replacements are 1N3595, FDH300, 1N486B, BAV21. Replace all ramp diodes with new ones even if only one diode was defective to ensure good matching of their characteristics.

## **3 Inrush current limiter**

It's good practice to add an ptc at the power transformer's primary winding. Please refer to the document "ptc.pdf" for further information.