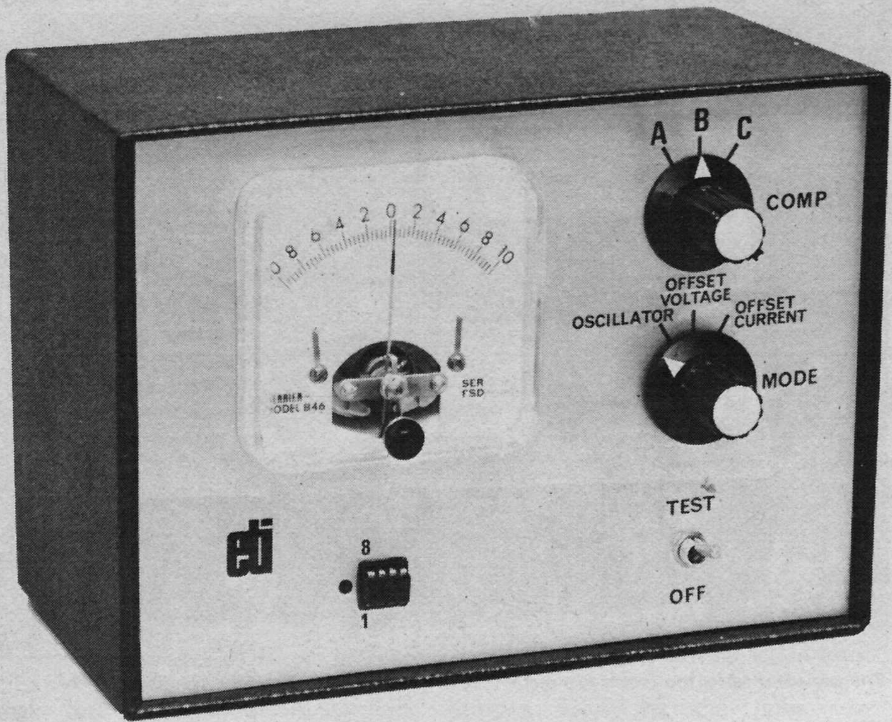
LINEAR IC TESTER



ETI PROJECT 115

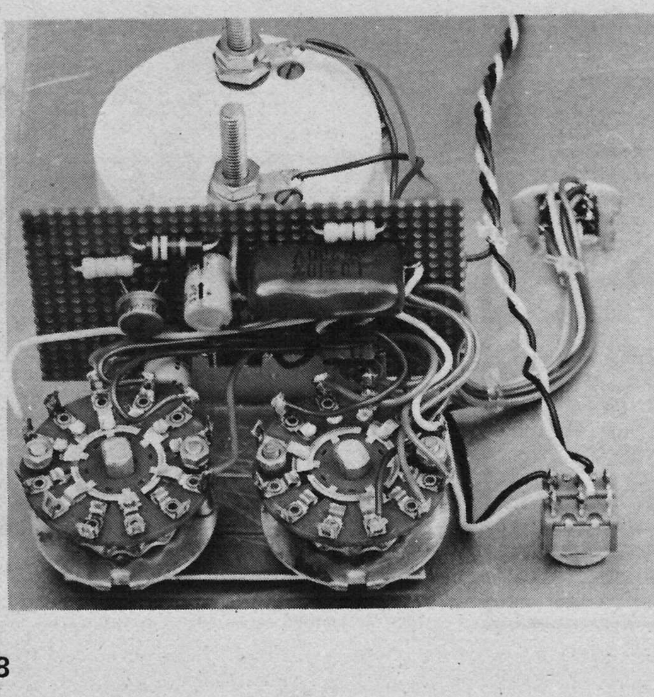
Test all commonly available operational amplifiers for three vital parameters.

LINEAR integrated circuits are available today at prices little higher than those of discrete transistors. As they offer far better performance parameters, and greater versatility than transistors they are being used in new designs in ever increasing numbers.

Most linear ICs are now built into a standard 8-pin, dual-in-line plastic pack, have the same pin connections and very similar characteristics. Hence as the only real difference is in the associated frequency compensation network, a universal, linear — IC tester is quite a feasible proposition.

The tester, described here provides a quick check of vital operating parameters. Checks are provided for offset voltage (max ±10mV), offset current (max ± 1000 nA) and of operation in an actual circuit configuation.

It is a most valuable instrument; saving an experimenter time that would otherwise be spent tracing down faulty ICs.



Showing the internal construction of the tester. Note that matrix board holds the majority of the components.

CONSTRUCTION

We chose to mount our circuitry on a small piece of matrix board, rather than a printed circuit board, as there are relatively few components used.

Make sure that IC1 is orientated correctly (note pins 1, 5 and 8 are not used). The wires from the compensation switch (SW2) should be as short as possible in order to minimise the chance of unstable operation.

The test socket should be glued into place (taking care not to get glue down the pins) and, after the wires to the socket are soldered on, these should also be held to the panel with glue or a metal clamp.

The wires to the socket must be supported in some way, as detailed above, to prevent the rather fragile pins breaking off.

HOW TO USE

The parameters of commonly-available ICs are detailed in Table 1. An IC on test should not exceed these figures. Those that do exceed these values may not operate correctly in some circuits and should be discarded.

To test an IC, plug it into the test socket making sure that it is orientated correctly. Select the appropriate equalization as detailed in column 4 of Table 1 and switch the unit on. Select 'OSCILLATOR' mode and observe that the meter should sweep up and down the scale at about 1 Hz.

Now switch to 'OFFSET VOLTAGE' mode and read the meter which is calibrated at 10 mV full scale deflection.

Next switch to 'OFFSET CURRENT'. In this mode the meter is calibrated at 1000 nA (1 microamp) full scale deflection.

Discard any IC that does not oscillate or has excessive offset current or voltage.

TABLE 1

TYPE	MAX OFFSET CURRENT	MAX OFFSET VOLTAGE	COMPENSATION
301	50 nA	±7.5 mV	C
307	50 nA	±7.5 mV	A
308	1 nA	±7.5 mV	C
709	500 nA	±7.5 mV	B
741	200 nA	±6 mV	A
748	200 nA	±6 mV	C
777	20 nA	±5 mV	C
1456	30 nA	±12 mV	A

PARTS LIST ETI 115

R1,2	Resistor	100	5% ½W
R3,5	"	2.2M	" "
R4	"	1 M	" "
R6	"	22 k	" "
R7	"	1.5 k	" "
R8	"	3.9 k	" "
R9	"	33 k	" "
R10	"	150 k	" "
C1	Capacitor	1μF polyester	
C2	"	0.0047μF polyester	
C3	"	33pF	ceramic
C4	"	220pF	"
C5,6	"	10μF 16V electrolytic	

IC1 integrated circuit μA741

M1 meter 0.5 mA — 0 — 0.5 mA
Ferrier Instruments model B46 or similar

SW1 Switch 2 pole, 3 position rotary
SW2 " 2 pole, 3 position rotary
SW3 " 2 pole on-off toggle.

Metal box approx. 150 x 180 x 90mm.
(Aust. Trans 70-50-40) or similar.
2 x 9V battery (type 216 or similar).

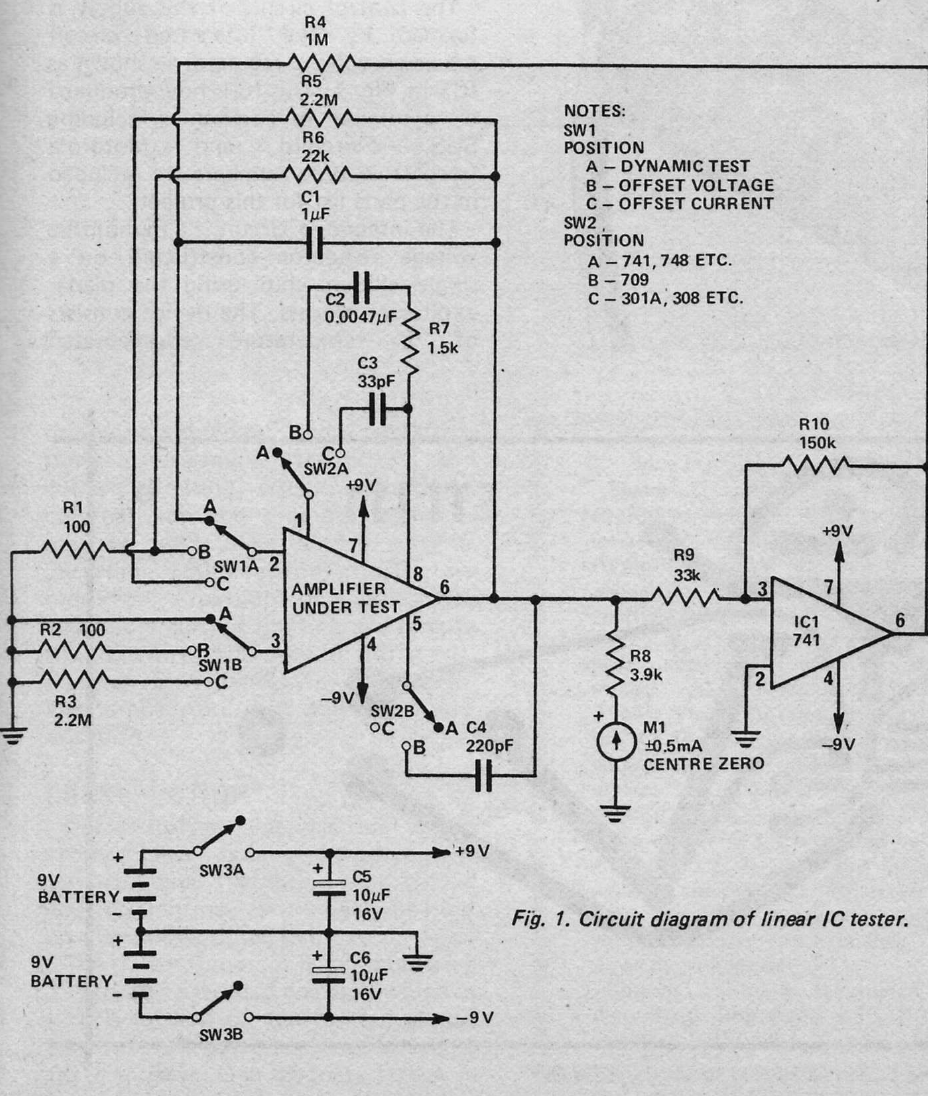


Fig. 1. Circuit diagram of linear IC tester.

HOW IT WORKS – ETI 115

Centre-zero meter M1, via resistor R8, indicates the output voltage from the IC under test. The frequency compensation components for the particular IC under test are selected by SW2, and the test mode is selected by SW1.

In position "C", of SW1, a 2.2 megohm resistor is connected from the output (pin 6) of the IC under test to the inverting input (pin 2), and a 2.2 megohm resistor from the non-inverting input (pin 3) to ground. Current is drawn by both pin 2 and pin 3 of the IC and, if these currents are equal, the output voltage will be zero. Any difference in input currents will therefore be indicated as an output voltage on meter M1.

In position B the resistor from pin 6 to pin 2 is reduced to 22k and a 100 ohm resistor, R1, is connected from pin 2 to ground. This results in the IC having a voltage gain of 220. Resistor R2 is also made 100 Ω so that offset current does not affect the operation in this mode. Hence the IC will now amplify any offset voltage between pin 2 and pin3 (that is, it is operating in the linear mode) by 220 and the meter deflection will be proportional to the offset voltage.

If either offset voltage or offset current are excessive the meter will read off scale and the IC should be discarded.

In mode A the IC is connected as a triangular wave oscillator having an operating frequency of 1Hz. Integrated circuit IC1 is connected as a Schmitt trigger where the output of the Schmitt goes high if its input drops below -1.5 volts, and will go low if the input exceeds 1.5 volts. The output of IC1 is taken, via a 1 megohm resistor, to the input of the IC under test and the output of the Test IC becomes the input of the Schmitt trigger. An integrating capacitor, C1, is connected across the IC under test. The effect of this is to cause the output of the test IC to rise at 7 volts per second until +1.5 volts is reached. At this point the Schmitt operates and the output of the test IC now commences to fall at the same rate. When -1.5 volts is reached the direction reverses again and the cycle repeats. Thus we have an oscillator with a frequency low enough to be followed by the output meter as an indication of correct operation.