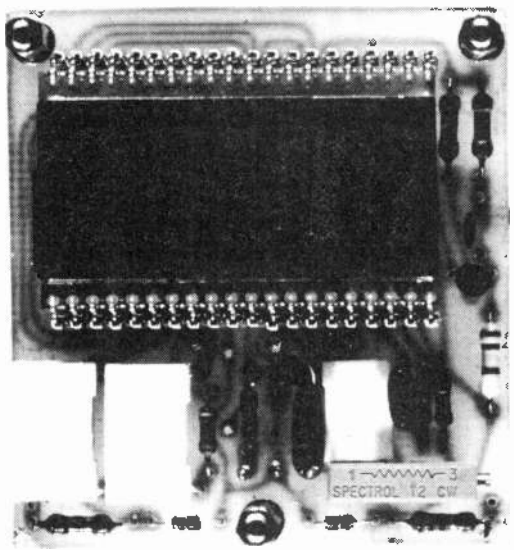
# LCD PANEL METER



**This simple, economical yet highly accurate voltmeter uses a large liquid crystal display for easy reading and low power consumption. It will be the basis of future projects as well as being a useful meter in its own right.**

WE INITIALLY purchased a number of Intersil evaluation kits for our own use but soon realised that while they were very good electronically, the physical layout wasn't too hot. We therefore redesigned the PCB, reducing the size dramatically, adding the decimal point drive circuitry and some dropping resistors and zener diodes to allow the board to run from a dual power supply of +/— 5V or more (e.g. with op-amps). This resulted in a very useful device which we decided to run as a project. While it is basically a panel meter suitable for DC voltages and current (with a shunt) it will be the display module for several future projects.

## Construction

To save on real estate, the main IC is mounted under the display. We used the Soldercon pins supplied with the evaluation kit for the display and soldered the IC directly into the board. If you want to mount the IC in a socket a low profile type should be used, with a high one for the display. As a socket is not available for the display a standard 40 pin one can be cut up to fit.

However before fitting either the display sockets or the IC, fit all the other components first. The overlay in Fig. 2 shows the positioning of the components. Most of the components come with the evaluation kit. The large capacitors are laid on their side to minimise height. ▶

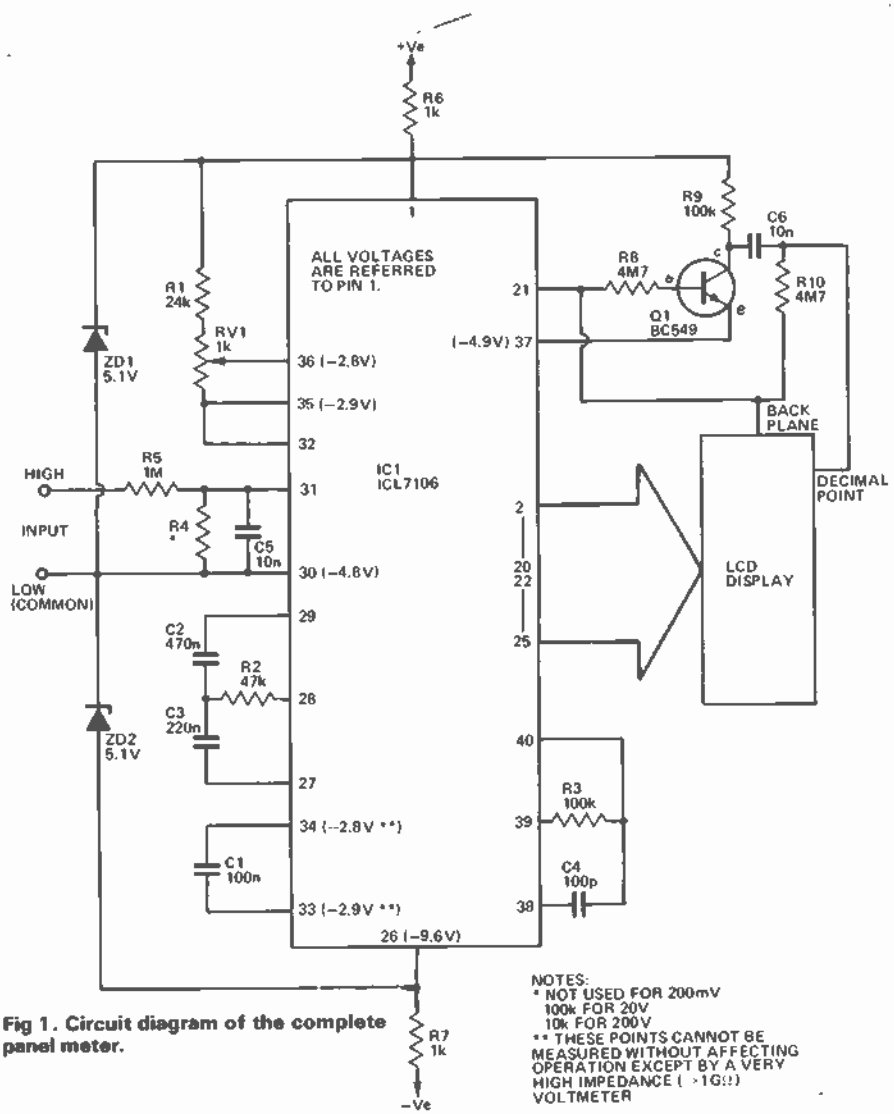
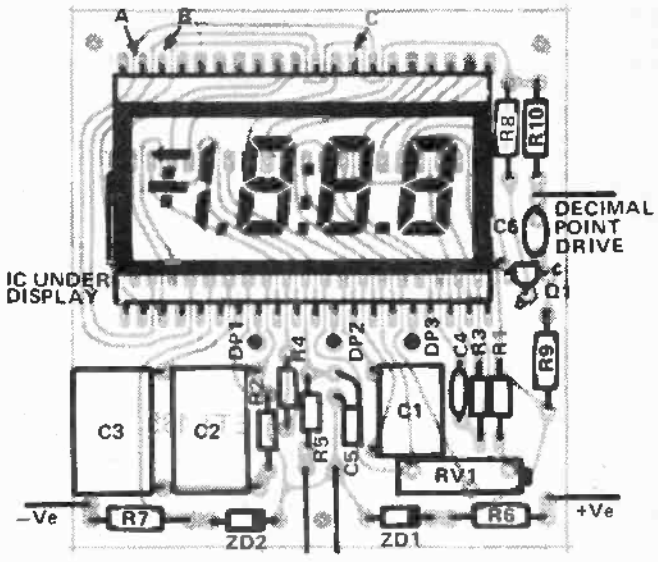



**Fig 1. Circuit diagram of the complete panel meter.**

# SPECIFICATION

| | |
|---|---|
| Full scale reading | 200mV |
| Resolution | 100μV |
| Accuracy | <1 digit |
| Display | 3½ digit LCD |
| Input impedance | $>10^{12}$ ohms |
| Input bias current | ≈2 pA |
| Polarity | automatic |
| Conversion method | dual slope |
| Reference | internal |
| Power supply | ±5V to ±15V DC<br>1mA @ ±5V |

Fig 2. Component overlay with the display in place. Points marked A, B and C are the unused display segments — the vertical part of the + sign, the arrow and the semicolon respectively.




# BUYLINES

The Intersil Evaluation kit is available from Rapid Recall, 9 Betterton Street, Drury Lane, London WC2H 9BS at a cost of £23.29 all inc. If you want to just build the ETI version, Doram and Marshalls stock the chips and display, Watford stock everything as a kit. The PCB is available from all the 'usual' suppliers e.g. Ramar, Tamtronik etc.

# PARTS LIST

RESISTORS all ½ W 5%

| | |
|---|---|
| R1* | 24k |
| R2* | 47k |
| R3*, 9* | 100k |
| R4 | See circuit diagram |
| R5* | 1M |
| R6,7 | 1k |
| R8,10 | 4M7 |

POTENTIOMETER

| | |
|---|---|
| RV1* | 1k 10 turn type |

CAPACITORS

| | |
|---|---|
| C1* | 100n Polycarbonate |
| C2* | 470n Polycarbonate |
| C3* | 220n Polycarbonate |
| C4* | 100p Ceramic |
| C5*, 6 | 10n Ceramic |

SEMICONDUCTORS

| | |
|---|---|
| IC1* | ICL7106 |
| Q1 | BC549 or similar |
| ZD1,2 | 5V1 400 mW |

MISCELLANEOUS

PCB, LCD 3½ digit display*, soldercon pins*.

* These components are supplied with the Intersil evaluation kit.

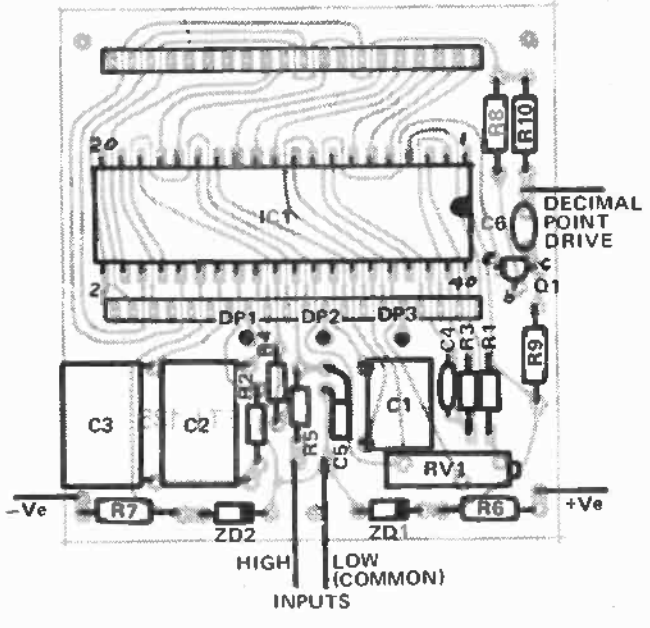
# HOW IT WORKS

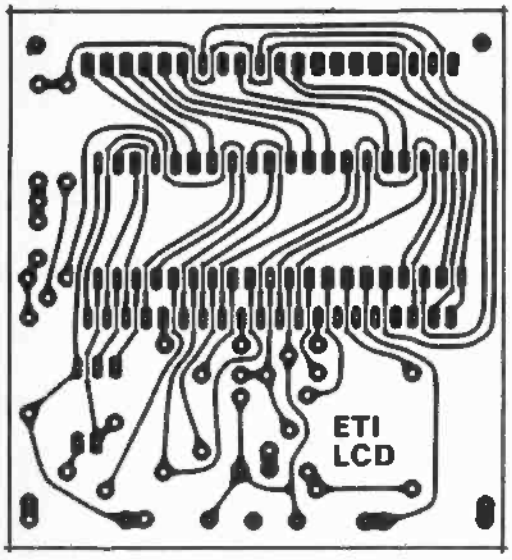
Not much can be said on how this project works as everything is done by one IC and if anything goes wrong it is usually the IC. We have included some waveform diagrams and voltages for reference purposes. The conversion works on the dual-slope integration technique, which is the most reliable of the simple methods available. A capacitor is charged up at a rate proportional to the input voltage for a predetermined time (in this case 1000 clock pulses), then it is discharged at a constant rate until it reaches the starting point again. The time taken to do this (i.e. the number of clock pulses) is proportional to the input voltage.

It is a true dual polarity system where the integration direction depends on the polarity of the input voltage. Provided AC ripple on the input averages to zero over 1000 clock pulses it will be rejected, hence where 50Hz mains is to be rejected a 50 kHz clock should be used, giving 80 ms sample time (4 cycles of 50 Hz). The clock can be adjusted by varying R3 if desired.

For further details of the IC see the data sheet in this issue.

Fig 3. The component overlay without the display showing the positioning of the integrated circuit.






Foil pattern for LCD panel meter, shown full size. (65 x 70 mm).

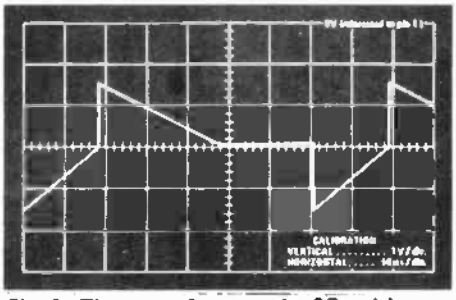


Fig 4. The waveformat pin 27 with a negative input of 170mV.

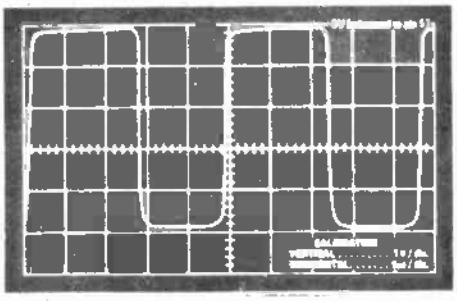


Fig 5. The waveform at pin 27 with a positive input of 170mV.

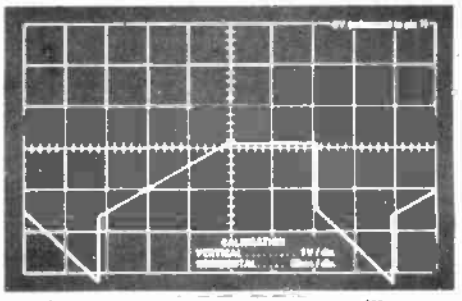


Fig 6. The output of the master oscillator on pin 38.

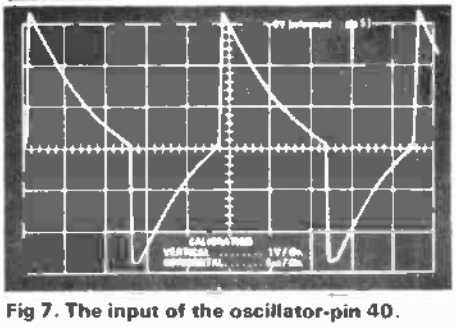


Fig 7. The input of the oscillator-pin 40.

When fitting the IC solder pins 1 and 26 first (the power supply pins) so that the protection diodes on the inputs can operate, thus preventing damage by static electricity. It is necessary that a small tipped iron and fine solder be used to prevent bridging tracks. The IC sockets can now be fitted in two strips of 20 with the top connecting pieces being broken off using long nosed pliers after they are soldered in.

As there are no polarity marks on the display it is necessary to hold it at an angle to the light and look for the outline of the digits. The full format of the display is shown in Fig. 3. In this unit the arrow, semicolon and the vertical part of the + sign are not used. ETI