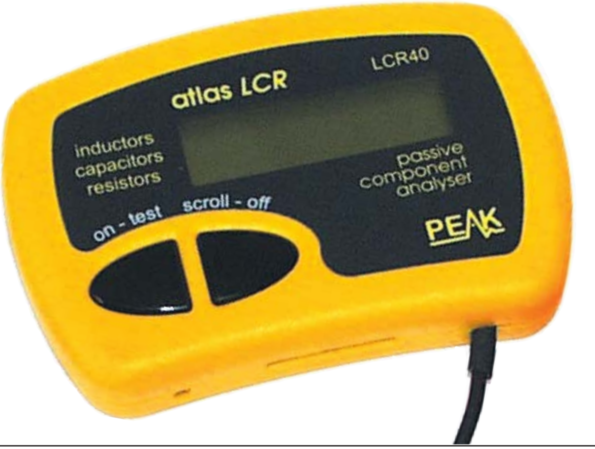
Special Review

LCR PASSIVE COMPONENT ANALYSER



ANDY FLIND

Anyone requiring a quick and simple means of measuring resistors, capacitors and inductors of all types will find that Peak's Atlas LCR Analyser represents superb value.

THE Atlas LCR Passive Component Analyser is the latest item of test equipment to be produced by Peak Electronic Design, and is claimed to test and measure all types of passive components including resistors, capacitors and inductors. It complements their Atlas Component Analyser which tests most types of discrete semiconductors, such as diodes, transistors and various f.e.t. devices. The author reviewed this some time ago and found it so useful that it has been in regular use in the workshop ever since, so the opportunity to review this new product from Peak was welcomed with much enthusiasm.

TASK FORCE . . .
Inductance Range: 1µH to 10H
Capacitance Range: 1pF to 10,000µF
Resistance range: 1Ω to 2MΩ
Basic Accuracy: 1%
Test Signals: 1V, 3mA max

The Atlas LCR arrived in a stout cardboard box accompanied by a small manual and a folded sheet of paper describing the procedure for "probe compensation". First impressions were of the similarity to the earlier unit since it even uses the same plastic case, but this time it is moulded in bright yellow plastic, pleasing to the eye and, more important for such a small device, easy to locate on an untidy workbench!

The display is again a 2-line by 16-character l.c.d., but is smaller than that used on the earlier unit. It's actually easier to read however since it is of the greenish variety which have better contrast and a wider viewing angle than the silver types. The probes are small clip-on types in red and black, attached to a short screened lead from the case with tiny plugs and sockets.

On The Inside

A quick inspection of the interior revealed a surprisingly high component count, nearly all of the surface-mount type, laid out on a single neat printed circuit board – see photograph. There is a "PSU corner" with two i.c.s, some electrolytics and an inductor, set a short distance apart from most of the rest of the components.

The heart of the unit is, not surprisingly, one of the PIC family, in this case a PIC16F873 accompanied by an 8MHz crystal. Jeremy Siddons of Peak Electronic Design says that one of the most important aspects of the design is the purity of the sinewave signals used for testing reactive components, and that these signals are generated by the PIC and then shaped by 5th-order Chebyshev filters constructed with op.amps. Two LPV324 quad op.amps can be seen accompanied by plenty of passive components so they are probably these filters. Several other i.c.s bring the total count to nine.

The two control buttons and the display are mounted directly to the opposite side of the board and even the battery, a miniature 12V alkaline type, fits between two contacts at each end of a rectangular hole cut into the p.c.b. The assembled unit is very light and robust and would probably survive the odd fall from the workbench although such testing is not recommended!

The Atlas LCR Passive Component Analyser from Peak Electronic Design.

Simplicity Itself

The Atlas LCR is so simple to use that there is a risk that purchasers may simply not bother to read the manual! However two points should be noted before commencing use.

The first concerns probe compensation which should be done if measurements are to be accurate. This is probably why Peak includes the separate sheet describing the procedure, since it is repeated in the manual.

The probes and their leads have some resistance, capacitance and inductance of their own and this procedure enables the unit to read the values of these and store them in non-volatile RAM in the PIC for subtraction from subsequent readings. The procedure is fully automatic and takes just seconds to complete, indeed the proverbial child of three could do it!

It does not need to be carried out every time the unit is used, and a quick check as to whether it is required can be made at any time by taking readings for open-circuit and short-circuited probes.

Take Charge

The other essential observation is that damage could be caused by connecting the probes to an external potential. This obviously includes charged capacitors, so it is most important to ensure that these, especially electrolytic types, are fully discharged *before* testing.

In most cases momentarily bridging the connections with a metal object is sufficient, though a large, well-charged electrolytic or high-voltage type is perhaps better discharged through a resistor to avoid pyrotechnic displays and possible damage to the capacitor!

Taking Book

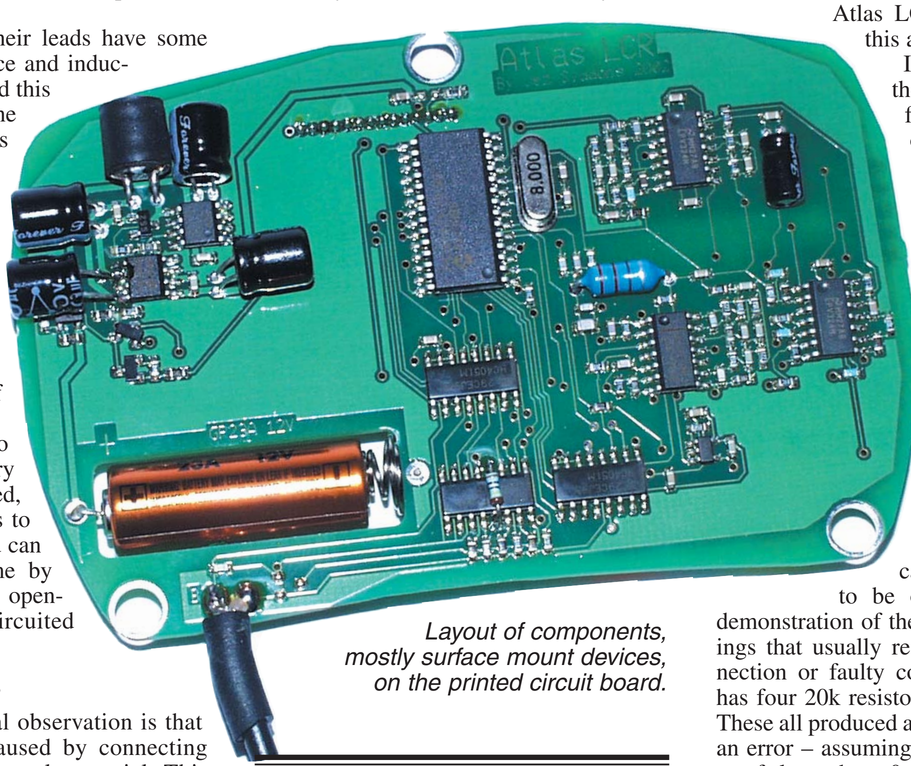
The manual is small, concise and very easy to follow and provides plenty of interesting information regarding the measurement techniques employed and the criteria used in deciding what type of component the unit is connected to. It is well worth taking the small amount of time required to read it in order to understand how some of these decisions are taken.

For instance, some 230V solenoid coils from the author's collection were interpreted as resistors. The reason for this became obvious when it was understood that anything with a resistance greater than 1k will not be recognised as an inductor!

Small capacitors and inductors are tested with a.c. signals of 1kHz, 15kHz or 200kHz, the appropriate frequency being selected automatically. Resistors and larger capacitors are tested using a d.c. technique. The type of measurement used can usually be found by scrolling through the displays.

On Display

Using the Atlas LCR is simplicity itself. A press of the left-hand button produces a brief message about due date for the next full calibration (more on this later) followed by a five-second countdown during which the probes can be placed against the connections of the component to be tested. If the probes are already connected another press of the button cancels this countdown and analysis commences immediately.



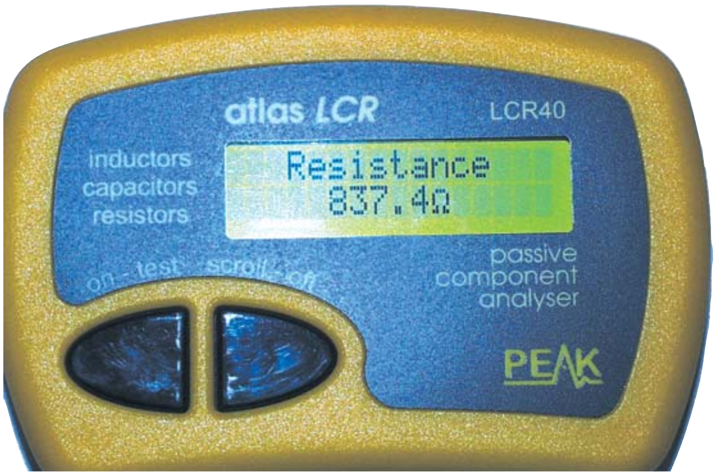
Layout of components, mostly surface mount devices, on the printed circuit board.

"Astonishingly, this little unit seems to pack most of the punch of a large and very expensive automated LCR bridge into its tiny plastic case."

After a few more seconds, the type of component and its value are displayed and presses of the right-hand button will scroll through the test frequency used, and in the case of inductance, the d.c. resistance of the component. The measurement procedure can be repeated at any time by another press of the left-hand button. The unit powers down automatically after a few seconds, but can be switched off manually if required by holding down the right-hand button.

Testing Time

The author spent a most interesting couple of hours putting this little unit through its paces on a large number of components ranging from modern types to, frankly, old junk! Most people involved with electronics will have a digital



Resistance measurement readout.

"It is definitely the most useful addition made to the author's workshop equipment in a very long time, and can be thoroughly recommended . . ."

voltmeter at the very least and most of these can measure resistance, but they tend not to be so accurate for low values so the Atlas LCR will have uses in this area.

In addition it displays the resistor's inductance for values below 10 ohms, which may be significant in the case of the wirewound types which these sometimes are. In fact, Peak warn that such types may fool the Atlas into indicating that the component is an inductor, but nothing in the author's collection managed to cause this!

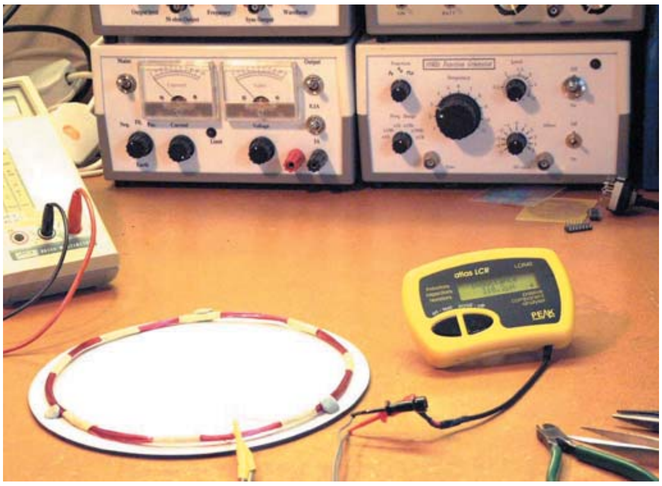
One resistor that consistently read as a few picofarads of capacitance was found to be open-circuit, the first demonstration of the obviously false readings that usually result from a poor connection or faulty component. The author has four 20k resistors of 0·01% tolerance. These all produced an indication of 20·06k, an error – assuming they are still accurate – of less than 0·3%, well within the claimed 1% accuracy of the Atlas.

Peak Practice

Some DVMs these days can also measure capacitance but their ranges tend to be limited and probe inconsistencies would make low-value readings unreliable. The Atlas LCR, by contrast, automatically covers a huge capacitance range, from half a picofarad to 10,000μF.

It really does measure low values accurately, a 2·7pF ceramic capacitor was checked with no problems at all. Air-spaced tuning capacitors were also easy to test and could even be set to precise values quite readily, which might have its uses.

Checking-out the value of a suspect electrolytic capacitor.



Checking the inductance of a metal detector pulse induction search coil.

More to the point it can measure both maximum and minimum values of those little preset trimming capacitors which never seem to be clearly marked.

The inter-track capacitance of stripboard can be measured, which is useful as it is often sufficient to cause problems in some circuits, and even a home-made capacitor of a few picofarads made by twisting two pieces of wire together was readily measurable.

A bunch of 1% tolerance capacitors all produced the expected results, but this raises a new possibility. Capacitors of this tolerance are occasionally required in designs but they seem to be increasingly hard to find and expensive. With this instrument to hand a bunch of cheaper types could be checked to find an accurate one.

At the other end of the scale Peak state that since testing of electrolytics is done with no more than 1V of test voltage it is unnecessary to observe polarity. The author tested some twice, reversing the polarity of the probe connections, and received consistent readings both ways. A couple of really big electrolytics were tested, one of 22,000µF, twice the official maximum range. The "analysis" took a little longer than usual, but up came a clear reading, "21·22mF" (millifarads).

Inductors

Finally, the unit was tested with a wide selection of inductors. This is where it really comes into its own.

Inductors rarely seem to bear any useful markings, and are the most difficult of the passive components to measure. The traditional method is an "inductance bridge", but these are less common than DVMs and much more difficult to operate. Automated LCR measuring instruments are available but are generally very expensive and often require the user to decide what the component actually is.

Items tested with the Atlas by the author included r.f. coils, from three turns of thick wire on a small former, probably from a VHF radio, which measured at 0·8µH, to coils of many turns on ferrite rods. The primaries of transformers measuring several henries were tried, along with lots of small chokes and inductors intended for use in things like filters and small switch-mode power supplies.

As a long-time enthusiast of metal detector design, the author has a collection of experimental air-cored coils of large cross-section used in the design of search heads. All of these were unfailingly recognised as inductors and their values and d.c. resistances were clearly indicated.

A couple of the smaller inductors with values of a few millihenries were also checked on an old Marconi TF2000 Universal Bridge, an instrument renowned in its day for accuracy, and the results corresponded accurately with those from the Atlas. It should be said that operating the bridge was far more tricky and time-consuming than using the Atlas, since a "null" had to be found using a combination of four controls and a range switch, with the value being read from two of them.

A far cry from just connecting and pressing a button! It is probably safe to say that, with the introduction of the Atlas LCR, Peak have put an end to the difficulties of inductance measurement.

Extras

In addition to the standard probes supplied with the Atlas LCR, Peak plan to offer a range of extras in the near future. Tweezers for simple testing of leadless surface mount components are already available and details of more accessories will, we understand, be released just as this issue of *EPE* appears on the bookstalls.

A carrying case is available, which may be useful to those in the service industries. A re-calibration service is also available for anyone needing guaranteed accuracy, and certification of this to recognised standards can be supplied where required.

Summing Up

Astonishingly, this little unit seems to pack most of the punch of a large and very expensive automated LCR bridge into its tiny plastic case. For anyone requiring a quick and simple means of measuring resistors, capacitors and inductors of all types to a basic accuracy of 1%, it represents superb value with its ease of use, low cost, and ready availability.

It is definitely the most useful addition made to the author's workshop equipment in a very long time, and can be thoroughly recommended to any fellow enthusiasts wishing to make such measurements.

Available directly from Peak, the *Atlas LCR Passive Component Analyser* costs £79, including VAT and p&p. For further details contact: ***Peak Electronic Design Ltd., Dept EPE, Atlas House, Kiln Lane, Harpur Hill Industrial Estate, Buxton, Derbyshire, SK17 9JL.*** Phone 01298 70012. Fax 01298 70046.

Web: **www.peakelec.co.uk**.

Email: **sales@peakelec.co.uk**.