

Test report:

The Peak Atlas ESR tester

Electrolytic capacitor ESR testing has done a lot to help and to speed up CE equipment servicing in recent years. Peak has recently introduced a new tester, Model ESR60, with several interesting features. Eugene Trundle has given one an extended test



The Peak Atlas ESR tester Model ESR60.

In the past few years electrolytic capacitor ESR (Effective Series Resistance) testing has become a common topic in this magazine. There have been articles and constructional projects, amongst which there was an excellent practical design by Alan Willcox in last December's issue. This is the one I have been using in my workshop lately, with great success.

In practice the ESR of an electrolytic capacitor is much more significant than its actual capacitance value, especially in the signal-coupling and supply-decoupling roles such capacitors perform in the sort of equipment we handle. Once you've got used to working with an ESR tester you would never want to be without one. A testimony to the usefulness of an ESR tester is that I and others in our workshop are often able to short-circuit (!) the business

of conventional fault diagnosis by testing all, or most, relevant electrolytic capacitors in a piece of equipment and replacing any that produce an excessive resistance reading. Very often this will cure a fault that could be producing very strange symptoms – ones that, especially in digital equipment, you might not readily attribute to a faulty electrolytic capacitor. Typical examples might be DVD players and satellite set-top boxes for which we have no service manual or circuit diagram.

Electrolytic capacitor failure is becoming one of the most common causes of breakdown in consumer electronic equipment as plugs, sockets, switches and similar connectors are designed out, as mechanics are simplified, as ICs and their jointing become more reliable and as competition and price-cutting demand ever

more cost-effective designs. But equipment designers seem to have a blind spot when it comes to the physical design, component specification and layout of chopper power supplies. The combination of a relatively cheap capacitor, a high ripple current and the close proximity of hot components will often lead to failure sooner or later, despite the fact that the equipment gets out of the factory door OK and usually survives through the one-year warranty period! Experienced technicians have learnt what type of capacitor, in which place (usually the power-supply section), to go for first in carrying out a general test with an ESR meter.

Apart from the DIY designs that have appeared in this magazine, I know of two sorts which are available commercially: the analogue-meter reading Capacitor Wizard that

costs about £145, and the Electronic Design Specialist type, with a 20-segment LED readout, that costs about £175. Both are effective, though with the former, care is required to discharge the capacitors before connecting them for test. I don't know of any that have a digital readout or a facility for measuring the capacitance of the component being tested.

Description

Peak Electronic Design has been making small test equipment items for some years, in hand-held form. They come in curvy little cases, size 10 x 7cm, with a digital-readout panel. A colour-coding system is used for different functions, generally red for cable testing, yellow for LCR checking, orange for triacs and blue for semiconductor devices. This one, as the accompanying picture shows, is purple. It's powered by an internal 12V alkaline battery, of the sort used in car-security fobs.

There is only one control, an on key that initialises the instrument. After that it takes a few seconds to go through a test cycle. Any DC charge (within reason, see the specification table) is first removed, after which the meter takes about eight seconds to calculate the electrolytic's ESR and capacitance values, which are then shown simultaneously in the two-line LCD panel. The instrument shuts down automatically after a further twenty seconds – there's no need for an off switch! ESR from 0-10Ω can be read, with a resolution of 0.01Ω below 1Ω and 0.1Ω above 1Ω. The capacitance measuring range is 1-22,000μF, with an accuracy of about ±4%. The test frequency is 100kHz, current 20mA (short-circuit) and voltage 2.5V (open-circuit).

The test leads supplied are 450mm long, and each has two conductors, one to apply the test waveform and one to measure the result. This Kelvin arrangement increases the accuracy by removing the effect of lead inductance. Inside the unit I found a rugged construction on a fibreglass PCB, with half a dozen ICs, a precision crystal, the LCD panel and a handful of other items. The only internal parts that appear to have a finite life-span are, ironically, a couple of surface-mounted, 100μF, 16V electrolytic capacitors! They would be easy to replace should this ever be necessary.

The instrument can be connected to the capacitor under test either way round, and will test capacitors in or out of circuit for ESR. Capacitance

measurement is more likely to be accurate with the component isolated. For further details, see Table 1.

On test

This little gizmo kept me company on the bench and in the field for several weeks. At the end of the assessment I took a bunch of good and duff electrolytic capacitors home and played with the meter at length. I found it satisfactory in every way, once I had made some needle-pointed test probes to connect to the mini-crocodile clips provided – these probes facilitated easier connection to capacitors in situ. The long test leads supplied were appreciated in use with, for example, a large-screen TV set, especially in the field where the instrument needs to be out in the light for easy reading. For situations like this an 'eyes-off' indication of low ESR, in the form of a bleep, would have been useful, cutting in at say resistance values below 1Ω or 0.5Ω. It would also have been good to have had ESR readings of up to 20Ω, to take into account low-value, high-voltage capacitors such as the 1μF and 2.2μF, 100-400V types typically found in the 'kick-start' circuit in a chopper power supply – they often fail. These are minor points however.

The meter performed very well in all respects. I have no reason to doubt the accuracy of either the ESR or the capacitance readings, and the simplicity of operation is a great benefit. The analyser's ability to read capacitance as well as ESR showed clearly that an electrolytic capacitor's value in μF can remain correct though its internal resistance is excessively high. But I found a few capacitors, mainly old ones, whose value had decreased as their series

resistance had increased.

When I came to check the tester's vulnerability to damage from a charged capacitor, I used a bench power supply to charge an out-of-circuit capacitor to just the specified 'abuse' level. I then connected it, with some trepidation, to the tester. No harm came from this, but it's obviously best to ensure that the capacitor being tested has been discharged. The internal discharge should, I feel, be regarded as emergency protection rather than being relied on for each test, especially as there's a limit of 40V with capacitors of value higher than 10μF. Better safe than sorry!

Verdict

The introduction of the Peak Atlas ESR60 will, I believe, force a rethink amongst makers and sellers of ESR testers that cost twice as much or more. This one is smaller, lighter, has more features and is more useful. I never thought that anything would prise me away from my trusty analogue ESR tester, but this one has done it!

Excellent indeed, and designed and priced for the service technician – unlike some pieces of test equipment that have come to my notice lately.

Availability

The Peak Atlas ESR tester Model ESR60 costs, with delivery, £67.23 plus VAT, a total of £79. A one-year guarantee is included. It's available from Peak Electronic Design Ltd., Buxton, Derbyshire. The phone number is 01298 70 012 and the email address sales@peakelec.co.uk

There's a website at www.peakelec.co.uk

Table 1: Peak Atlas ESR60 specification

ESR measuring range	0-10Ω
Resolution	<1Ω, 0.01Ω; >1Ω, 0.1Ω
Accuracy	<1Ω, ±2%, ±0.02Ω; >1Ω, ±2%, ±0.2Ω
Capacitance range	1-22,000μF
Accuracy	±4%, ±0.2μF
Peak test current into s/c	20mA
Peak test voltage across o/c	2.5V
Operating frequency	100kHz
Abuse voltage	<10μF, ±400V; >10μF, 40V
Battery	GP23A 12V alkaline
Battery voltage range	12-8.5V, with low-battery warning at 8.5V
Inactivity time-out	10 seconds
Dimensions	103 x 70 x 20mm (w x h x d)
Operating temperature range	10-40°C
Accessories supplied	Battery, leads and instruction book with ESR value table