Atlas *ESR*

Equivalent Series Resistance Analyser
Model ESR60

User Guide

CE

PEAK
electronic design ltd

Want to use it now?

We understand that you want to use your Atlas *ESR* right now. The unit is ready to go and you should have little need to refer to this user guide, but please make sure that you do at least take a look at the notices on page 4!

Contents Page

Introduction

The ***Atlas ESR*** is an advanced instrument designed specifically for the analysis of capacitor equivalent series resistance (in *or* out of circuit). In addition it will, where possible, display the capacitance of the device under test.

Summary Features:

- ESR range 0 to 10Ω.
- ESR resolution as low as 0.01Ω
- Capacitance range 1μF…22mF (22,000μF).
- Built-in protection circuitry means risk of damage to the unit due to residual charge is greatly reduced.
- Integrated discharge circuitry reduces the need for the user to manually discharge capacitors before test.[1]
- Use in or out of circuit for ESR measurement.
- Automatic and manual power-off.

Note:

1. The discharge circuitry exists to ensure that a charged capacitor is less likely to damage the unit. For example, if the capacitor under test has a potential of a few tens of volts across it, the charge is removed automatically.
   It is the user's responsibility to ensure that any dangerously charged capacitors are safely discharged before connection to the unit.

Safety Considerations

WARNING:

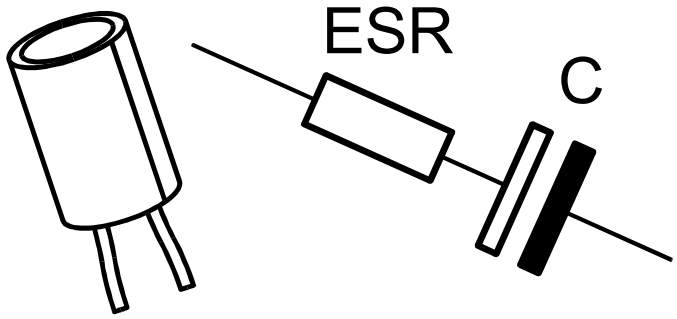
This instrument must NEVER be connected to powered equipment/components.

It is the user's responsibility to ensure that any dangerously charged capacitors are safely discharged before connection to the unit.

To allow the self-protection mechanism to function, always ensure that the *Atlas ESR* has completed any analysis before connecting the test probes to a component.

Failure to comply with these warnings may result in personal injury, damage to the equipment under test, damage to the *Atlas ESR* and invalidation of the manufacturer's warranty.

Notes on ESR



ESR (Equivalent Series Resistance), as it's acronym implies, is the value of resistance that is effectively in series with an ideal capacitor.

No capacitor is ideal of course, the detailed equivalent circuit of a typical capacitor is very complex. For many electrolytic capacitors however, the most important parameters regarding the capacitor's performance is the capacitance and the ESR.

An increase in ESR (due to age, abuse or temperature cycling) can result in poor capacitor performance. The capacitor becomes less "ideal" and starts to dissipate more power, an ideal capacitor of course dissipates zero power.

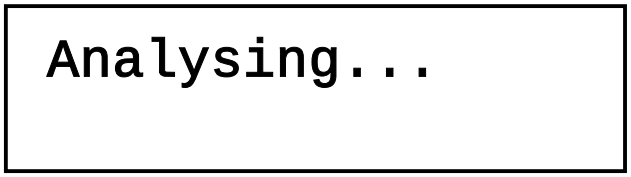
Capacitor manufacturers typically quote the ESR of their products at 100kHz, which is the same test frequency used by the ***Atlas ESR.***

Analysing Capacitors

The ***Peak Atlas ESR*** is designed to analyse capacitor ESR in or out of circuit. The two test probes can be connected to the component any way around. Remember though that in-circuit testing can result in less accurate readings.

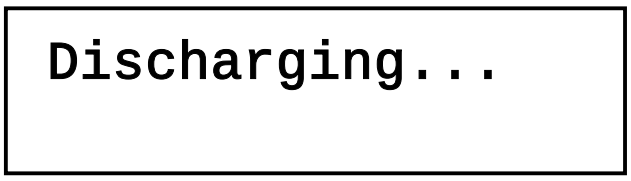
Important: To minimise risk of damage to the unit, make sure that the ***Atlas ESR*** has completed any previous analysis before attaching the test probes to the capacitor. This ensures that the built-in protection circuit is ready for any charge that may be present on the capacitor.

The ***Atlas ESR*** will start component analysis when the **on-test** button is pressed.

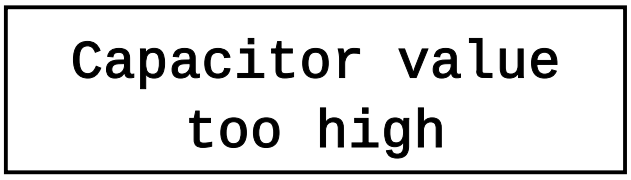


The analysis typically takes under 10 seconds to complete, depending on the characteristics of the capacitor.

If the capacitor is charged prior to testing, the ***Atlas ESR*** will attempt to discharge the capacitor while showing the following message:



If the ***Atlas ESR*** cannot recognise the component connected to the test probes, or the capacitance is out of range, one the following messages may be displayed:



Analysing Capacitors continued…

Once a valid ESR reading has been obtained, the results are displayed.

If the presence of external circuitry did not adversely affect the capacitance measurement, the capacitor value will also be shown.

```
C   = 476.6µF
ESR = 0.21Ω
```

If the capacitance could not be determined, the display will only show the value of ESR measured.

```
In Circuit
ESR = 0.21Ω
```

In the event that ESR exceeds the maximum that can be measured, the display may show:

```
C   = 476.6µF
ESR > 10.0Ω
```

or

```
In Circuit
ESR > 10.0Ω
```

The ESR measurement range is automatically determined during the analysis. Typically, the resolution for ESR measurement is as shown in the table below:

ESR Value	Resolution
0.00 Ω – 1.00 Ω	0.01 Ω
1.0 Ω – 10.0 Ω	0.1 Ω

Although the measurement resolution is generally determined by the absolute value of the ESR (as shown in the above table), low capacitance values can result in a poorer ESR measurement resolution.

Typical Values of ESR

It is not possible to provide a definitive rule for values of ESR that are acceptable for all situations.

The expected value of ESR largely depends on the capacitance value and the voltage rating of the capacitor but also depends on temperature ratings and other factors. Some capacitors are manufactured to exhibit very low ESR values, whilst conventional low cost parts are likely to exhibit higher values but still be acceptable.

As a rough guide only, the following table shows "typical" values of ESR for a range of different capacitance and voltage ratings.

	10V	16V	25V	35V	63V	150V	250V
1µF			5.0Ω	4.0Ω	6.0Ω	>10.0Ω	>10.0Ω
2.2µF			2.5Ω	3.2Ω	4.4Ω	9.5Ω	>10.0Ω
4.7µF			6.0Ω	2.8Ω	2.5Ω	4.0Ω	6.5Ω
10µF		1.5Ω	1.6Ω	1.7Ω	2.0Ω	3.1 Ω	6.2Ω
22µF	3.0Ω	0.9Ω	2.0Ω	1.2Ω	1.00Ω	1.8Ω	3.5Ω
47µF	1.2Ω	1.1Ω	1.00Ω	1.00Ω	0.90Ω	1.1Ω	2.5Ω
100µF	0.70Ω	0.90Ω	0.50Ω	0.50Ω	0.50Ω	0.55Ω	1.10Ω
220µF	0.40Ω	0.40Ω	0.40Ω	0.30Ω	0.25Ω	0.25Ω	0.55Ω
470µF	0.16Ω	0.20Ω	0.25Ω	0.20Ω	0.20Ω	0.20Ω	0.25Ω
1000µF	0.12Ω	0.11Ω	0.10Ω	0.05Ω	0.06Ω	0.14Ω	
4,700µF	0.06Ω	0.06Ω	0.06Ω	0.06Ω	0.06Ω		
10,000µF	0.05Ω	0.04Ω	0.04Ω	0.04Ω			

Please note that the above figures are only typical figures for standard grade electrolytics at room temperature, please verify readings against expected values for the particular type of capacitor you are testing.

Probe Compensation

To ensure good repeatable readings, particularly for low values of ESR, it may be necessary to periodically perform a simple Probe Compensation procedure.

1. Ensure the unit is switched off.

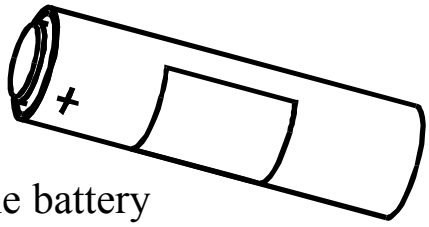
2. Clip the test probes to each other.

3. Press and hold down the **on-test** button for about 5 seconds until the following message is displayed:

After a short delay (if the probes are correctly shorted), the display will confirm that the procedure is complete and then switch off.

If the confirmation message is not displayed then the probes may not have been correctly shorted prior to entering the probe compensation screen.

Care of your Atlas *ESR*



The ***Peak Atlas ESR*** should provide many years of service if used in accordance with this user guide. Care should be taken not to expose your unit to excessive heat, shock or moisture. Additionally, the battery should be replaced at least every 12 months to reduce the risk of leak damage.

Low Battery

If a low battery warning message appears, replacement of the battery is mandatory.

Immediate replacement of the battery is EXTREMELY IMPORTANT as the built-in protection mechanism may not function correctly if the battery condition is poor and therefore render your unit susceptible to damage from even low energy charged capacitors.

The Atlas will not continue to operate if a low battery condition is encountered.

New batteries can be purchased from many retailers and directly from Peak Electronic Design Ltd or an authorised agent.

Battery types: Suitable battery types include 23A, V23A, GP23A, MN21 or a good quality 12V alkaline equivalent as used in many test instruments and automotive remote key fobs.

Battery access: To replace the battery, unscrew the three screws to remove the rear panel. Remove the old battery and insert a new one, taking care to observe the correct polarity. Carefully replace the rear panel, do not over-tighten the screws.

Peak Safe Battery Disposal Scheme: Please return your old analyser battery to Peak Electronic Design Ltd for safe and environmentally responsible disposal.

Appendix A - Technical Specifications

All values are at 25°C unless otherwise specified.

Parameter	Min	Typ	Max	Note
Peak test current into S/C		±20mA	±25mA	
Peak test voltage across O/C		±2.5V	±3.0V	
Capacitance measurement range	1µF		22,000µF	
Capacitance accuracy		±4% ±0.2µF		
ESR measurement range	0Ω		10Ω	2
ESR resolution for ESR < 1Ω	0.01Ω		0.02Ω	
ESR resolution for ESR > 1Ω	0.1Ω		0.2Ω	
ESR accuracy for ESR < 1Ω		±2% ±0.02Ω		
ESR accuracy for ESR > 1Ω		±2% ±0.2Ω		
Abuse voltage (for C < 10µF)			±400V	3
Abuse voltage (for C > 10µF)			±40V	3
Battery type		MN21/GP23A 12V Alkaline		2
Battery voltage range	8.5V	12V		
Battery voltage warning threshold		8.5V		
Inactivity power-down period		10 seconds		
Dimensions (excluding test leads)		103 x 70 x 20 mm		
Operating temperature range	10°C		40°C	1

Notes

1. Subject to acceptable LCD visibility.
2. Subject to revision.
3. Maximum abuse voltage rated limitation of internal protection electronics. Probes, leads and unit are not certified for high voltage use.

Warranty Information

Peak Satisfaction Guarantee

If for any reason you are not completely satisfied with the ***Peak Atlas ESR*** within 14 days of purchase you may return the unit to your distributor. You will receive a refund covering the full purchase price if the unit is returned in perfect condition.

Peak Warranty

The warranty is valid for 12 months from date of purchase. This warranty covers the cost of repair or replacement due to defects in materials and/or manufacturing faults.

The warranty does not cover malfunction or defects caused by:

a) Operation outside the scope of the user guide.
b) Unauthorised access or modification of the unit (except for battery replacement).
c) Accidental physical damage or abuse.

The customer's statutory rights are not affected by any of the above.

All claims must be accompanied by a proof of purchase.

At Peak Electronic Design Ltd we are committed to continual product development and improvement. The specifications of our products are therefore subject to change without notice.

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