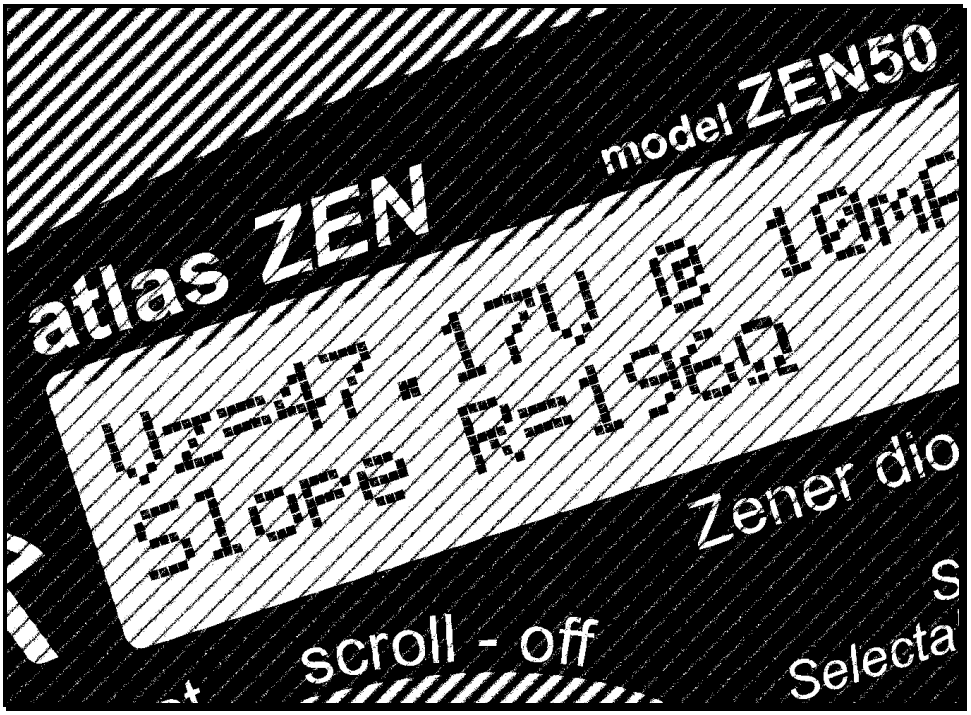
GB50-01

Atlas ZEN

Zener Diode Analyser
Model ZEN50



Designed and manufactured with pride in the UK

User Guide

In the interests of development, information in this guide is subject to change without notice - E&OE

CE

PEAK®
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Want to use it now?

We understand that you want to use your ***Atlas ZEN*** 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 very important notices on page 4!

Contents Page

Introduction

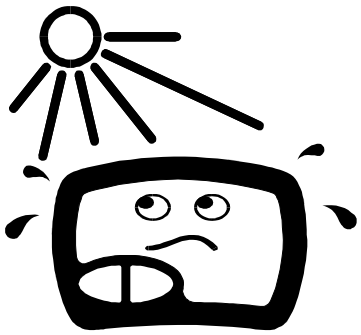
The ***Peak Atlas ZEN*** is an intelligent Zener Diode analyser that offers great features together with ease of use.

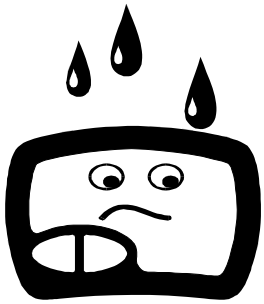
Summary Features:

- Supports the following components:
  - Zener diodes and Avalanche diodes.
  - Shunt voltage references.
  - Conventional diodes and LEDs (for V_F measurement and slope resistance measurement). **WARNING: Reverse bias testing <u>will</u> break your LED**.
  - VDRs, TVSs, Transorbs, etc. (up to 50V).
- Selectable test currents: 2mA, 5mA, 10mA and 15mA.
- Measure Zener Voltage (V_Z).
- Measure Forward voltage drop for forward connected diodes.
- Display of selected test current.
- Measure Slope Resistance (sometimes called dynamic resistance or differential resistance).
- Advanced voltage boost to support testing up to 50V at 15mA.
- Constant test conditions regardless of battery level (V_{BAT} down to 1V).
- Low test duty cycle to minimize Zener power dissipation.
- Continuous measurements (typically 3 samples per second).
- Gold plated crocodile clip probes for low contact resistance.
- Automatic and manual power-off.

Important Considerations

- This instrument must NEVER be connected to powered equipment/components or equipment/components with any stored energy (e.g. charged capacitors). Failure to comply with this warning may result in personal injury, damage to the equipment under test, damage to the ***Atlas ZEN*** and invalidation of the manufacturer's warranty.
- The ***Atlas ZEN*** is designed to analyse Zeners that are not in-circuit, complex circuit effects can result in erroneous measurements. Additionally, testing in-circuit can expose your circuit to unexpectedly high voltages that may damage it, **YOU HAVE BEEN WARNED.**
- The voltages generated by the ***Atlas ZEN*** can damage non-Zener components (for example, reverse bias testing LEDs **will damage your LEDs**). It is your responsibility to ensure the voltages/currents are suitable for your component and that they are correctly connected.
- Avoid rough treatment or hard knocks.
- This unit is not waterproof.
- Only use a good quality Alkaline AAA battery.





Testing Zeners

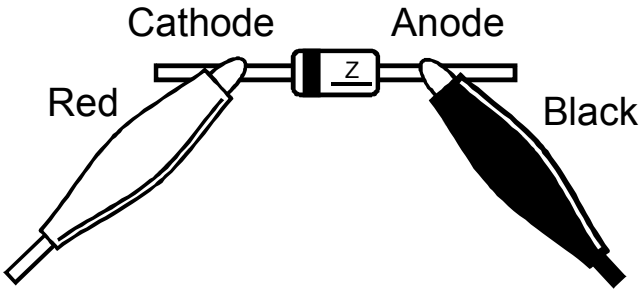
The ***Atlas ZEN*** is primarily designed to analyse Zener diodes (including Avalanche diodes). Often, Avalanche diodes are referred to as Zener diodes because they are used in a similar way.

As well as testing Zeners, the ***Atlas ZEN*** is great for measuring the conduction characteristics for many other components types:

- Normal diodes (measuring V_F at various forward currents).
- LEDs (measuring V_F at various forward currents). **Do not attempt to test an LED in reverse, you <u>will</u> break it.**
- Transient suppressors such as VDRs, TVSs and Transorbs (measuring the breakdown/clamping voltage at various forward or reverse currents).
- Shunt Voltage Regulators (measuring V_F at various forward currents).

A Zener diode is normally used in the reverse biased mode. If you use it in the forward biased mode then you will see a conventional diode behaviour.

To test a Zener diode, connect it as shown here:

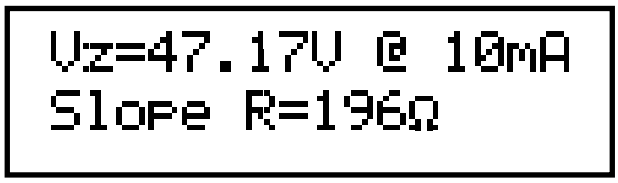


The ***Atlas ZEN*** will start its analysis shortly after the **on-test** button is pressed and the start-up screen is shown. It will then continue to perform regular measurements and show the results on the LCD screen.

Testing Zeners continued

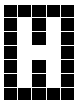
The display is updated at a rate of approximately 3 times per second. Please allow a few seconds for readings to settle however.

The display will show all the key parameters at the same time.



The top line shows the measured voltage across the probes at the selected test current (10mA in this case). Note that the test current is applied in short pulses, so the displayed voltage won't be present across the component continuously.

The bottom line shows the slope resistance of the Zener. This is calculated at the same nominal test current as the V_Z measurement and is based on a span of test currents.

At any time, you can pause (Hold) the displayed values by briefly pressing the **on-test** button. This can be useful if you want to remove the component being tested but still want to see the measurement results. When the unit is in Hold mode, the following symbol will be displayed: 

Although the ***Atlas ZEN*** will switch itself off if left unattended, you can manually switch the unit off by holding down the **scroll-off** button for a couple of seconds.

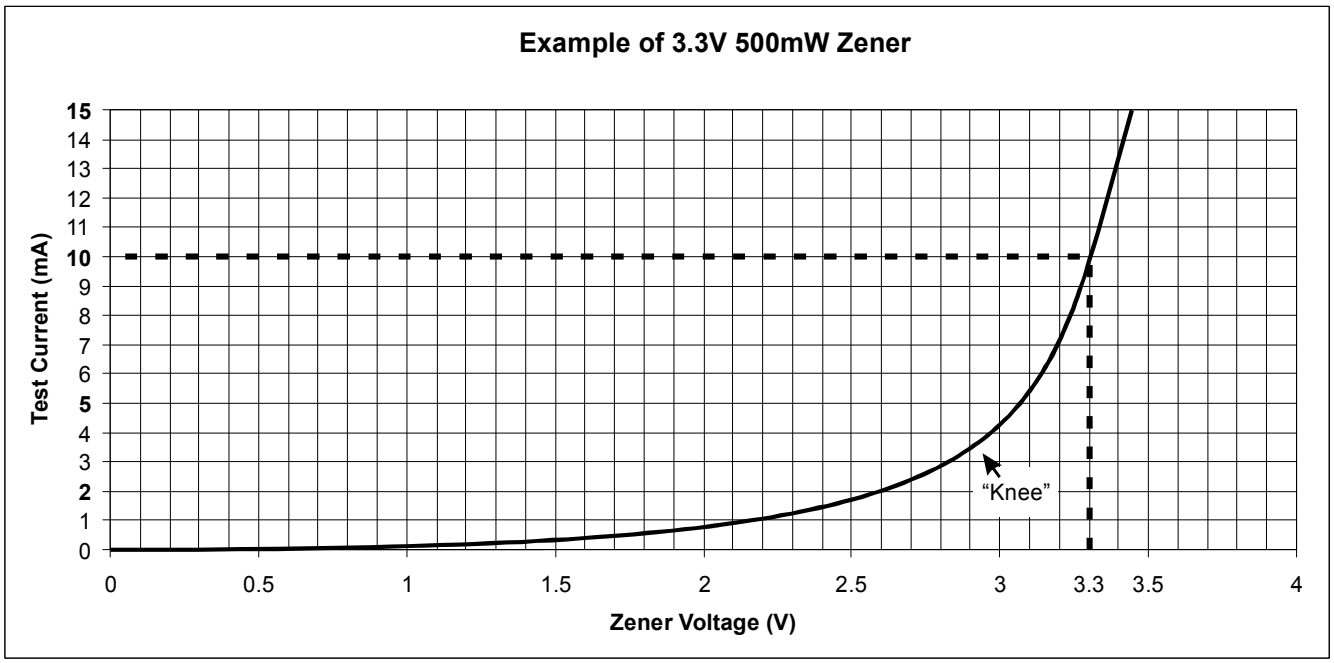
Changing Test Currents

The characteristics of Zeners (and other devices) will change depending on the current flowing through the component. For Zeners in particular, it is common to see that the Zener voltage specified by the manufacturer is quoted at a certain test current. All Zeners will exhibit an increase in the Zener voltage as test current rises.

You can select different test currents for your device by briefly pressing the **scroll-off** button:

Range	Test Current
1	2mA
2	5mA
3	10mA
4	15mA

The following graph shows that a typical Zener exhibits the manufacturer's stated voltage of 3.3V at 10mA, but rises if the test current is higher.



Many Zeners, particularly higher voltage ones, will have a sharper "knee" than this particular example.

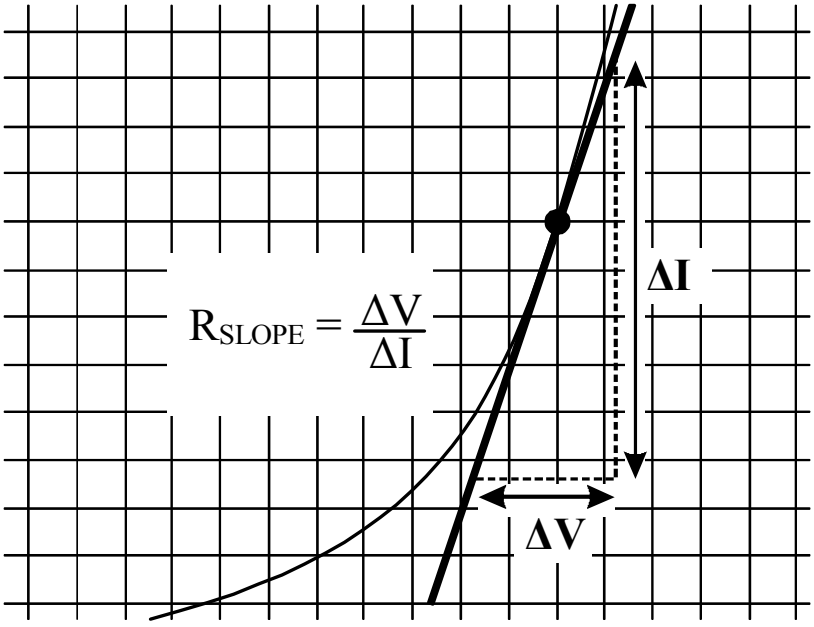
Slope Resistance

An ideal Zener diode would yield a constant Zener voltage regardless of the current flowing through it.

For a real Zener diode, the voltage across it will change slightly for changes of test current.

The Slope Resistance is the apparent resistance that results in the small change of Zener voltage due to changes in Zener current. Slope Resistance for a particular Zener is not a fixed value over different test currents because the voltage/current graph is not a straight line.

The graph here shows a close-up of the previous example. A straight-line tangent has been drawn on the curve at the point the Slope Resistance is determined. The gradient of that line is the inverse of the Slope Resistance.



Generally, as the current through a Zener increases, the Slope Resistance decreases (the V/I curve becomes steeper).

Slope Resistance continued

The ***Atlas ZEN*** determines the Slope Resistance by automatically adjusting the test current (50% below and 50% above the selected current) and measuring the small change in Zener voltage that occurs. The instrument chooses 3 currents for calculating Slope Resistance:

Your selected nominal test current

Range	Lower Test Current*	Middle Test Current	Upper Test Current*
1	1mA	**2mA**	3mA
2	2.5mA	**5mA**	7.5mA
3	5mA	**10mA**	15mA
4	7.5mA	**15mA**	22.5mA

The Voltage/Current curve for a Zener diode is not a straight line so it's not very accurate to calculate the Slope Resistance using just the lower and upper current and voltage readings.

The ***Atlas ZEN*** uses 3 sets of current and voltage readings to derive a curve that fits 3 points on the graph. The gradient of the curve is then calculated at the selected nominal test current using a differentiated version of the curve. This gives a much more accurate gradient measurement at the actual selected nominal test current compared to the average (straight line) gradient between the upper and lower test currents.

The resolution (step size) of displayed Slope Resistance is ultimately limited by the small changes of Zener voltage that result from the change in Zener current. The displayed resolutions are as follows:

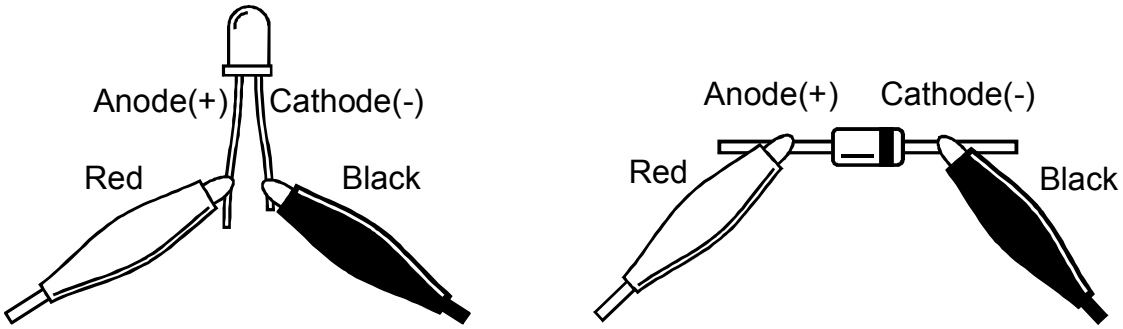
Range	Nominal Test Current	Displayed Resolution*
1	2mA	5Ω
2	5mA	2Ω
3	10mA	1Ω
4	15mA	1Ω

* Subject to revision.

Testing LEDs and other diodes

The ***Atlas ZEN*** can measure the **forward** voltage drop of LEDs and other diodes.

Take care to connect the LED or diode the right way round to ensure that it is not exposed to large reverse voltages. **Do not attempt to test an LED in reverse with this instrument, even for a split second, you <u>will</u> break your LED.** See the next page for information about the probe voltages.



The Anode(+) of the LED or diode should be connected to the red probe.
The Cathode(-) of the LED or diode should be connected to the black probe.

The unit will happily test almost any LED type, regardless of the LED's forward voltage requirements. The current is controlled by the instrument and the voltage across the LED will automatically settle to the LED's normal operating voltage (up to a maximum of 50V for long LED strings).

It is important to appreciate that the test currents applied by the ***Atlas ZEN*** are very short and will result in very low apparent brightness of your LED. This does no harm but it does mean that your LED will appear much dimmer than you expect at the selected test current.

Test Voltages

For all the test currents, the voltage developed across the probes can rise to about 60V*. This is to ensure that Zeners of up to 50V can be adequately tested. The test current is controlled to ensure that the same current flows regardless of the device under test (for the range of terminal voltages of 0V to 50V).

Although the current is electronically limited (to less than a peak of 35mA), it is important to be aware that 60V (across the open circuit probes) could potentially damage a sensitive component. For example, many LEDs can be damaged if the reverse voltage across them rises above 5V. There will be no problem when testing an LED in a forward direction (as the current is electronically limited and the voltage across the LED will automatically settle to the LED's operating voltage). But if an LED is accidentally connected in reverse across the probes then the voltage could easily reach 60V and the LED would be damaged.

In all cases, the voltage appearing across the probes will never be higher than 60V. Often the actual voltage will be limited by the device under test at the selected test current.

The test currents are applied in short pulses to minimise power consumption and to minimise power dissipation in your component (Zener voltage can change slightly with temperature due to self-heating). **For this reason, it is not possible to accurately test Zeners that have any load or significant capacitance across them**. See next page for more details on loading.**

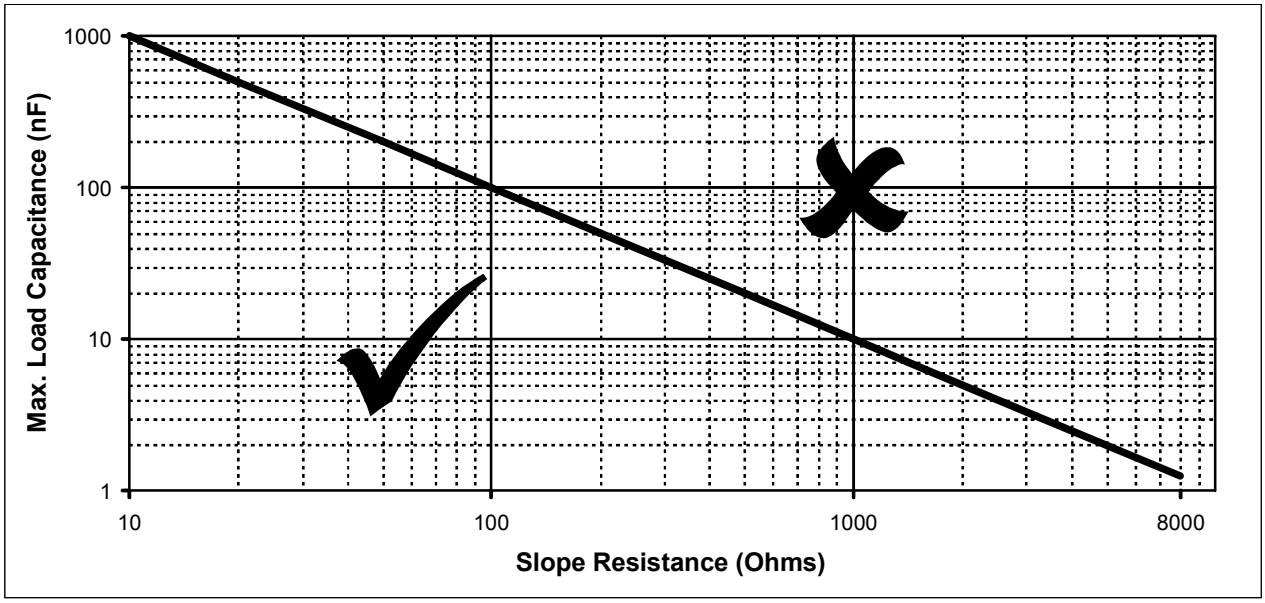
* 60V pulsed DC satisfies lower limit of 75V(DC) for Low Voltage Directive 2006/95/EC.

** Worst case is Vz=50V, Rslope=8000Ω. 1.2nF in parallel gives 1% Vz error and 3% Rslope error.

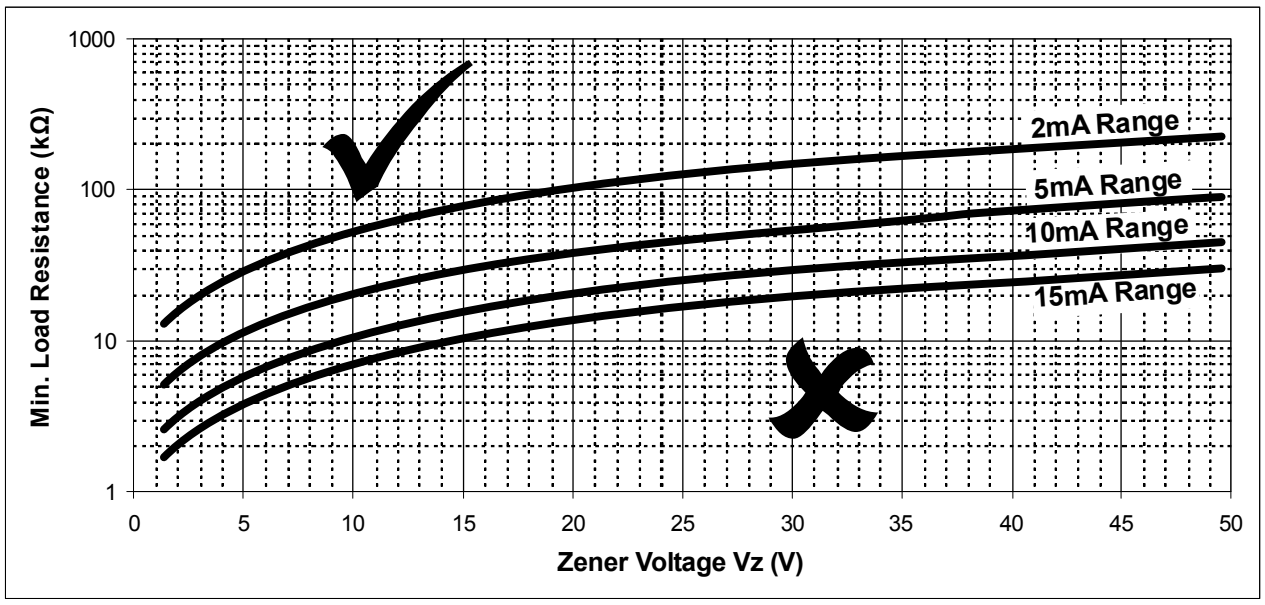
Loading Limitations

To keep power dissipation very low in your component, the ***Atlas ZEN*** uses short pulses to measure the characteristics. This means that accuracy can be influenced by capacitive (and resistive loading).

Capacitive Loading - Depending on the Zener's slope resistance, the following capacitive loads will influence Vz measurements by 1% or more:



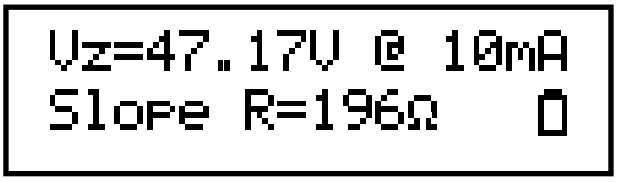
Resistive Loading - Depending on the selected test current range, the following resistive loads will influence Vz measurements by 1% or more:



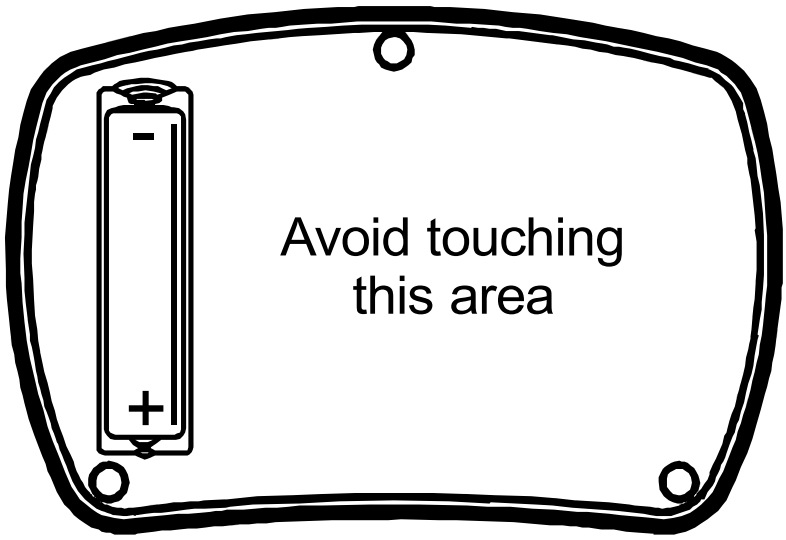
Care of your *Atlas ZEN*

The ***Atlas ZEN*** 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.

If a low battery message appears (during start-up) or a battery symbol appears while you're using your instrument, then immediate replacement of the battery is recommended as measured parameters may be affected. The unit may however continue to operate.



The battery can be replaced by placing the instrument "face down" and then removing the three screws from the rear of the unit. Take care not to touch the electronics.



We recommend that the battery is replaced with a high quality battery equivalent to an **Alkaline AAA**, LR03 or MN2400 (1.5V). Replacement Alkaline AAA batteries are available from many retail outlets.

DO NOT OVER-TIGHTEN THE SCREWS

Self Test Procedure

Each time the ***Atlas ZEN*** is powered up, a self test procedure is performed. In addition to a battery voltage test, the unit measures the performance of many internal functions such as the voltage and current sources, amplifiers and the analogue to digital converters. If any of these function measurements fall outside tight performance limits, a message will be displayed and the instrument will switch off automatically.

If the problem was caused by a temporary condition on the test clips, such as applying power to the test clips, then simply re-starting the ***Atlas ZEN*** may clear the problem.

If a persistent problem does arise, it is likely that damage has been caused by an external event such as excessive power being applied to the test clips or a large static discharge taking place. If the problem persists, please contact us for further advice, quoting the displayed fault code.

If there is a low battery condition, the automatic self test procedure may not be performed. For this reason, it is highly recommended that the battery is replaced as soon as possible following a “Low Battery” warning.

Appendix A - Technical Specifications

All values are at 25°C unless otherwise specified.

Parameter	Min.	Typ.	Max.	Notes
Zener voltage range (Vz)	0.0V		50.0V	
Nominal test currents (Iz)	2mA, 5mA, 10mA, 15mA			
Set test current accuracy	±1% ±0.2mA			
Zener voltage accuracy	±1% ±40mV			
Zener voltage resolution	20mV		40mV	
O/C test voltage (pulsed)			60V	1
S/C test current (pulsed)			35mA	
Test current duty cycle	0.1%	1%	5%	2
External abuse voltage			±50V	
Slope resistance range	0Ω 0Ω 0Ω 0Ω		8000Ω 3200Ω 1600Ω 1000Ω	Iz=2mA Iz=5mA Iz=10mA Iz=15mA
Displayed Slope resistance resolution		5Ω 2Ω 1Ω 1Ω		Iz=2mA Iz=5mA Iz=10mA Iz=15mA
Slope resistance accuracy		±1% ±10Ω ±1% ±4Ω ±1% ±2Ω ±1% ±2Ω		Iz=2mA Iz=5mA Iz=10mA Iz=15mA
Slope res. current span	(Iz-50%) to (Iz+50%)			
Slope resistance measurement method	Differentiation of curve that fits: ($Iz-50\%,Vz_1$), (Iz,Vz_2) and ($Iz+50\%,Vz_3$)			
Measurement rate		3Hz		
Auto-off period		60 seconds		
Battery type	AAA Alkaline			
Battery voltage range	0.9V		1.6V	
Low battery warning	1.0V ± 0.05V			
Dimensions (excl. leads)	103x70x20mm			
Operating temperature	10°C		40°C	

1. 60V pulsed DC satisfies lower limit of 75V(DC) for Low Voltage Directive 2006/95/EC.
2. Duty cycle of test current designed to keep power dissipation of Zener under test to very low levels.

Appendix B – Warranty Information

Peak Warranty

The warranty is valid for 24 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.
d) Normal wear and tear.

All claims must be accompanied by a proof of purchase.

Appendix C – Disposal Information

WEEE (Waste of Electrical and Electronic Equipment), Recycling of Electrical and Electronic Products

In 2006 the European Union introduced regulations (WEEE) for the collection and recycling of all waste electrical and electronic equipment. It is no longer permissible to simply throw away electrical and electronic equipment. Instead, these products must enter the recycling process. Each individual EU member state has implemented the WEEE regulations into national law in slightly different ways. Please follow your national law when you want to dispose of any electrical or electronic products.

More details can be obtained from your national WEEE recycling agency.

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.

Designed and manufactured in the UK
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