NEMTEK
Electric Fencing Products

FenceScope Multitool

User Manual



Contents

Company Profile 2
Nemtek Contact Details 2
Foreword 3
Components 3
Getting Started 4
a. Turning the FenceScope On/Off 4
b. Turning on the display backlight 4
c. Navigation through the menus 5
The Four Key Functions 5
a. Probe Function 5
b. Energy Function 7
c. Scope Function 9
d. Noise Function 10
Battery Replacement 10
Specifications 11
Appendix A - Some background information 12
IEC Safety Information 15
Warranty 16
Limitation of Warranty 16
Exclusive Remedies 16
Document revision history 16

Company Profile

The NEMTEK Group of Companies manufacture and distribute intelligent electronic agricultural fencing systems, security and perimeter control systems and have been involved in the security industry since 1990.

We have our own research and development team, designing and manufacturing a full range of globally competitive electric fence energizers and related products.

NEMTEK is continually updating its products according to South African and international standards in order to ensure the highest quality products and continuous customer satisfaction.

Warning

Electric fences are dangerous, approach with extreme caution and never under the influence of alcohol. Be aware that it may be possible to receive a shock when using the FenceScope due to improper use or damage.

Nemtek Contact Details

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Foreword

We hope you enjoy using our product. We are passionate about what we do and hopefully this becomes apparent when you are using this multi-tool.

It will enable you to evaluate electric fence installations, electric fence energizers, and also be an indispensable diagnostic tool. Used properly it will allow the user to reduce losses associated with fence installation and, if energizer model options allow, choose the appropriate operating voltage of the energizer for the most effective results.

We would appreciate feedback regarding this instrument in order for us to tailor equipment to suit customer requirements: fencescope@nemtek.com

Kindly visit our website, www.nemtek.com, to view other electric fencing related products.

Components

FenceScope



Leads and Clips
Positive & Negative



1000Ω
Load Resistor



Getting Started

a. Turning the FenceScope On/Off

Turning ON: Press the key and the Nemtek logo screen will appear.
If no FenceScope function is chosen within 5 seconds the **Help Menu** will appear on the screen.

Turning OFF: The unit will automatically turn itself off if not used after a short time delay. The delay period is a function of the last function used. Inadvertently turning the unit **ON** will result in a turn **OFF** delay of 15 seconds for example, while a "**Freeze Display**" will have a turn **OFF** delay of 5 minutes.



Alternatively, using the or key, return to the logo screen and press the key briefly.

b. Turning on the display backlight

Press and hold the key until the backlight comes on.

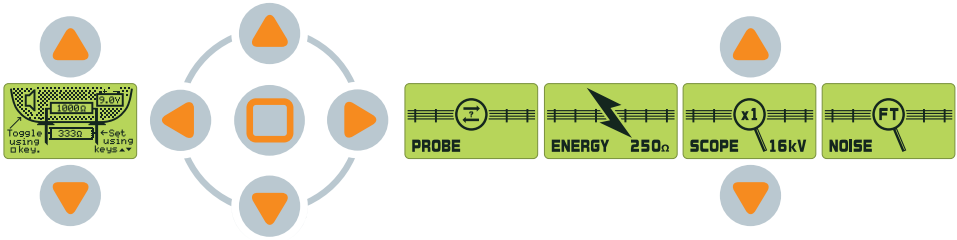
Press and hold the same button to switch the backlight off again.



Note: The FenceScope can be used for routine checking and maintenance of an electric fence. Typically indicating fence voltage, current amplitude and direction and pulse repetition rate. It can give an audible indication, with pitch proportional to fence voltage, which is useful under poor lighting conditions or awkward loctions.

Getting Started

c. Navigation through the menus



The ⊡ key is the **Enter** (Accept) key.
After navigating to the desired function, press the ⊡ key. The countdown timer screen will be displayed. If no pulse is received within the allowed period the "**No Impulse Detected**" screen will be displayed for 2 seconds followed by the original measurement function that was selected. Press the ⊡ key again to repeat the measurement.

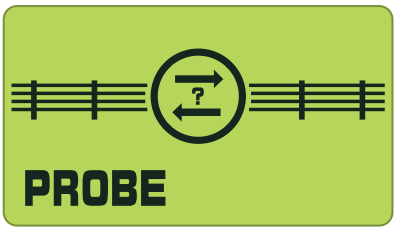
To abort a measurement or to go to another function press either the ◀ or ▶ key.

To "**Freeze**" a measurement or waveform briefly press the ⊡ key.

The Four Key Functions

a. Probe Function

For a quick measurement of fence voltage and current parameters do not attach any leads to the FenceScope.



After turning the FenceScope on, from the logo screen press ▶ and the **PROBE** display will show.
Press ⊡ to activate the measurement.
The display will show a decrementing counter.

Hook the metal clip of the FenceScope onto a live strand of the fence as illustrated in**Figure 1** and on receiving an impulse, the fence voltage and current amplitude and polarity will be displayed.

a. Probe Function (continued)



Figure 1: Position of live strand in Probe Function

If an accurate voltage measurement is required, connect the negative (black terminal at the bottom of the FenceScope) to the earth strand of the fence as shown in Figure 2.

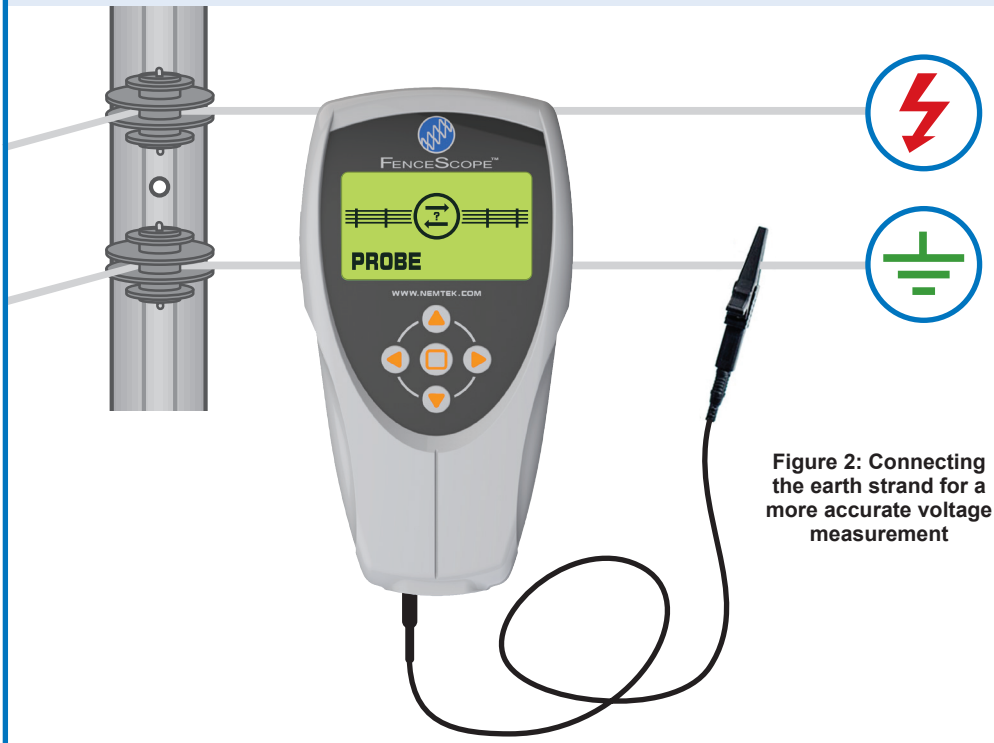


Figure 2: Connecting the earth strand for a more accurate voltage measurement

b. Energy Function

This enables the measurement and calculation of:

- **Voltage**
- **Current through load**
- **Energy dissipated in load**

Both leads must be connected to the FenceScope, Figure 3, and connected to the fence. A 1000 Ohm load is present between the red and black terminals of the instrument.

Procedure: Insert the leads into the FenceScope first. It is advisable to turn the energizer off, attach the FenceScope leads to the fence and then turn the energizer on again. Repeat the procedure for removing the leads.

If you are prepared to follow this procedure, always connect the live lead last and remove it first to reduce the likelihood of receiving a shock. If unsure of the excitation of the fence wires use the FenceScope as a probe initially. This enable the user to identify the live and earth strands.

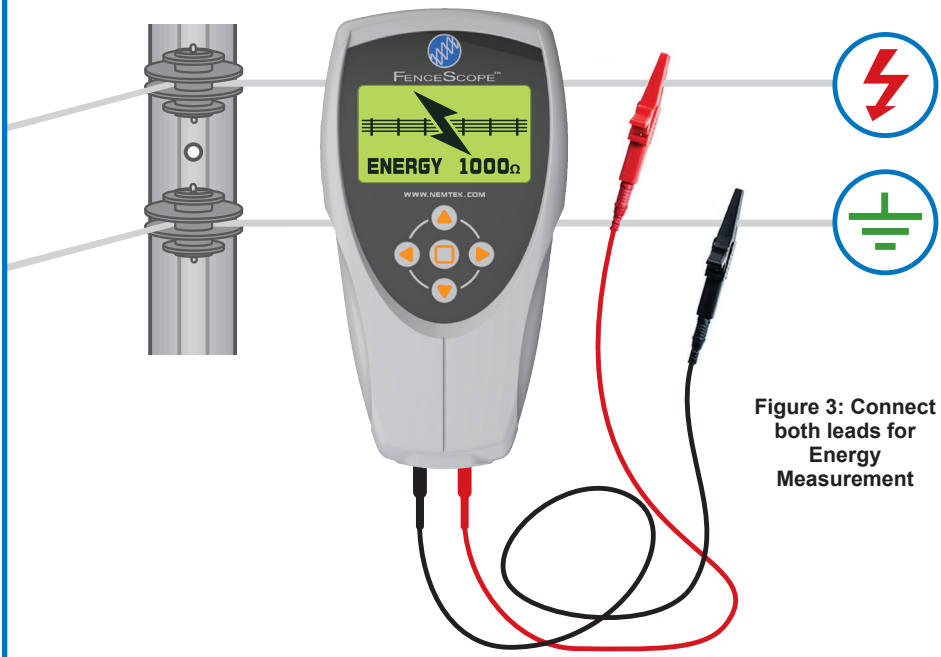


Figure 3: Connect both leads for Energy Measurement

b. Energy Function (continued)

Energy Measurement (legal specification: 500 Ohms)

Turn the energizer off before connecting or disconnecting the supplied external 1000 Ohm load resistor. This resistor is in the grey cylinder with red and black wires at either end.It must be connected in parallel, red wire to red clip and black wire to black clip, to the fence, see Figure 4.

Turn the energizer on and press the ◀ key. The Setup display will appear.

Press the ▲ or ▼ keys until the word "**None**" on the Setup screen is replaced with a value of 1000Ω. Press the ▶ key 3 times to show the **ENERGY** display. The equivalent load resistance of 500Ω will be displayed.

Press □ to start the measurement. When an impulse is received the energy, voltage and current through the load is displayed.

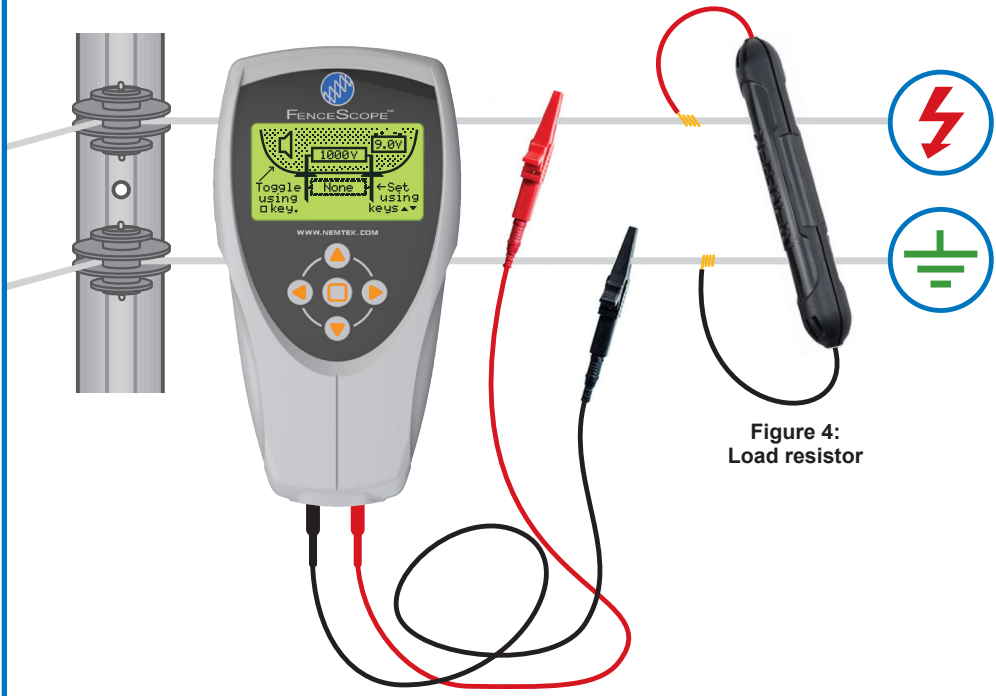
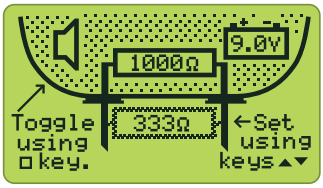


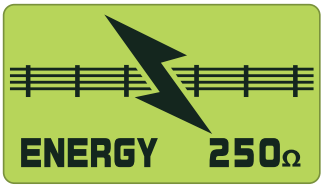
Figure 4:
Load resistor

b. Energy Function (continued)

Energy Measurement (other load values)

A load resistance of between 500Ω and 20 000Ω may be used externally for energizer characterization purpose. Example: 3 external 1000Ω resistor tubes can be used in parallel with the FenceScope. With parameter setting 333Ω on the setup screen, 250Ω will be displayed on the energy screen.



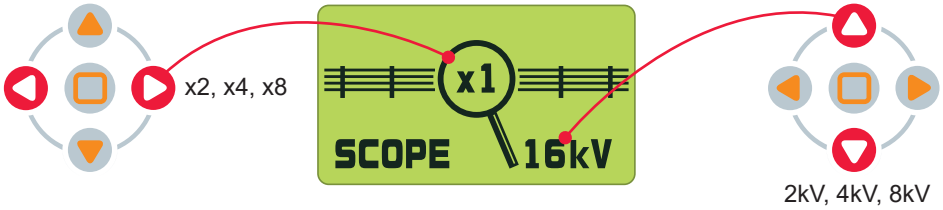


c. Scope Function

The Scope function displays the measured high voltage pulse wave shape. This function is useful in identifying arcing, which typically causes the fence voltage to collapse.

Displaying the Fence Waveform

Turn the unit On and by pressing the ▶ key 3 times the **SCOPE** display will appear.Note that a number of horizontal scales, waveform stretch in time, may be selected (x1, x2 etc.) by using the ◀ and ▶ keys. The maximum display voltage (kV) may be altered by pressing the ▲ and ▼ keys. Press the ◻ key to capture and display the waveform.



Push ◻ to capture and view the waveform

Tip: If the fence voltage appears to be erratic, look at the Fence Waveform over a period of time. Arcing on the fence becomes apparent by the sudden collapse in voltage.

The Four Key Functions

b. Noise Function

Turn the unit On and press repeatedly until the Noise display appears.
Press the key.

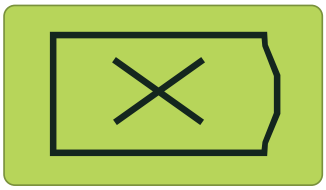
The FenceScope has the ability to indicate the frequency components of a waveform. High frequency components may cause harmful interference. Electromagnetic interference that is produced is a function of energizer design and fence condition. Arcing on a fence is to be avoided.



Tip: Connect the FenceScope directly to the energizer with no fence attachment and measure the noise. Repeat the measurement with the fence attached. The source of the noise may be determined. Artificially introduce an arc on the fence for comparative readings.

Battery Replacement

The battery voltage is displayed on the setup screen. If the low battery indicator appears on the screen, replace the internal battery before proceeding.



Replace battery screen

Disconnect the unit from all other equipment and remove the 6 recessed Phillips screws located on the underside.

Gently remove the back cover, disconnect the old battery and replace it. Put the cover back into position and tighten the screws. Discard the old battery in a responsible manner.

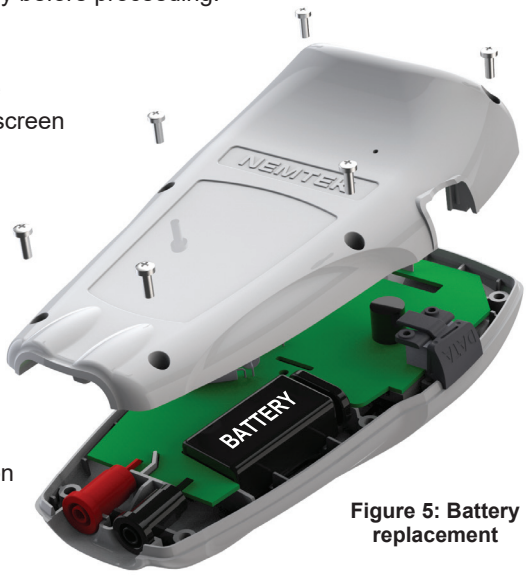


Figure 5: Battery replacement

Specifications

Physical Specifications

Display (LCD)	**128 x 64 pixels, 1 bit/pixels colour depth**
Orientation	**Landscape**
Operating Temperature	**-10ºC to +50ºC**
Storage Temperature	**-20ºC to +60ºC**
Battery Type	**9V alkaline, 6LR6 / PP3, (17mm x 26mm x 38mm)**
Unit Size	**102mm W x 50mm H x 192mm L**
Weight	**298g with battery, 251g without battery**

Refer to the sleeve cover supplied with the box for exact specifications or visit **www.nemtek.co.za**

The FenceScope is not designed for measuring waveforms other than those defined by the IEC 60335-2-76 standard.

Nemtek reserves the right to alter specifications at any time without prior notification or warning.

Appendix

Some background information

In order to understand the operation of an electric fence it is often easier to use an analogy. In this case the garden hosepipe attached to A tap that is wide open but the other end is sealed.

In this analogy, water pressure is equivalent to voltage and water flow rate is equivalent to current. A hole in the pipe results in loss of pressure and the reduction in the total flow available at the end of the pipe. This is equivalent to a resistance to earth.

Under ideal circumstances there are no leaks anywhere along the pipe and the pipe is under considerable pressure. If a leak should occur at any point along the pipe, the loss of water through that leak is a function of the pressure inside the pipe.

In order for an electric fence to be effective it must be capable of supplying sufficient current (flow) at the appropriate voltage (pressure).

If an electric fence is not performing effectively:

- Is the fence the problem?
- Is the energizer the problem?

In reality there is one very important constraint. Insulators are designed to withstand a certain voltage. The maximum voltage that an energizer should produce is typically constrained by insulator limitations. In other words the maximum pressure at the start of the pipe is constrained. The analogy to arcing on a fence is the bursting of a hosepipe. If the pressure in the pipe is increased (voltage on the fence) beyond it's design limitation, the pipe bursts (fence arcs) and there is very little flow and pressure (voltage) and resultantly, energy, a the end of the pipe.

A fence problem will be related to either losses to ground (leaks) or losses within the fence (pipe diameter is to small)

Appendix

Finding losses to ground

An electric fence ideally operates at a few thousand volts, typically 7000 Volts (security applications) and greater than 3000 Volts (agricultural applications). Firstly, it helps to find the significant leaks on the fence. Tip: Insert the 1000 Ohm load resistor supplied with the FenceScope, between the live wire and earth at the end of the fence farthest away from the energizer output terminal. Use the FenceScope as a voltage and current probe. This effectively causes a significant flow of current along the fence, reducing the effects of minor leakages and enables the dominant losses along the fence (reduction in current) to be determined as one probes along the fence from the energizer output terminal towards the end of the fence where the load resistor is located.

In an ideal wold, the current along the fence would remain constant. Note that these losses are very dependent on the operating voltage of the fence. Deposits and moisture on insulators, particularly in coastal areas, and can significantly reduce the performance of insulators, i.e. breakdown voltage. In such cases a slight reduction in fence voltage may reduce fence losses significantly.

Determining losses within the fence

If a calibrated hole (known resistance) was inserted at a point along the hosepipe, the distance of the resulting spray and volume of water flowing out of the hole (energy) would give a very good indication of the overall condition of the hosepipe and the available pressure. Having previously 'eliminated' the leaks along the fence (losses to ground) it is time to address losses within the fence itself. The FenceScope, when used as an energy measuring instrument, presents a known load of 1000 Ohms (calibrated hole) on the fence and measure the energy flowing through the hole at that point.

By measuring the available energy at the energizer output terminal and then progressively moving away from the energizer along the fence, the reduction in available energy is attributed to losses within the fence itself. If significant, the options are to increase wire diameter or increase the number of parallel live strands (security implications).

Appendix

Energizer problems

One cannot reiterate enough the importance of the proper installation and maintenance on an electric fence. Losses do occur along a fence and at some point the suitability of the energizer must be questioned for a given installation. The resulting spray from a pin hole in the hosepipe may be impressive but what happens when the hole is increased in diameter. FenceScope enables the resistive load (size of the calibrated hole) to be altered. Energizer manufacturers are constrained by output voltage (the insulator breakdown problem) and safety considerations. Typically energizers try and maintain a given output voltage irrespective of load resistance while staying within safety requirements.

There are fundamentally 2 types of energizers

- Energizers designed for agricultural applications
- Energizers designed for security applications

Use the FenceScope to determine what the optimal load is for a particular energizer. Remove the energizer from the fence. Systematically increase the calibrated hole size (reduce resistance by using known external parallel resistors with the FenceScope connected to the energizer terminals) and measure the energy dissipation. A point will be reached when the energy no longer increases as a function of decreasing load resistance. For that particular energize the output is now at its constrained, optimal, limits for that particular load. Record the Vrms voltage on the energy measurement display. This load resistance is at the optimum for the energizer to transfer maximum energy.

Agricultural energizers

These are designed for a lot of leakage due to vegetation and often multiple feces attached in parallel to one energizer. Attached the FenceScope to the energizer terminals with no other external load resistors and measure the energy. Connect the fence(s) to the terminals of the energizer. If the Vrms voltage is below the value recorded, with no fences connected and the optimal load resistance, the energizer is adequately rated for the application and fence condition. The energizer could raise the voltage if required to do so.

Appendix

Security energizers

These are designed to deliver maximum energy into the typical human body impedance of 500 Ohms, this same value is used as the legal qualification of energizers. Security energizers typically produce a higher voltage pulse (more pressure) than agricultural units and are therefore better at delivering more energy to any person touching a series connected security fence.

IEC Safety Information

- **There are no user serviceable parts inside an energizer.**
- **If the supply cord is damaged, it must be replaced by the manufacturer, its service agent, or similar qualified persons in order to avoid a hazard.**
- **This appliance is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety.**
- **Electric fencing can be lethal. Avoid head contact with the fence. Ask the installer to explain the options of current limiting resistors, the programmable output energy levels as well as the low-voltage operation of the energizer.**

WARRANTY

Each FenceScope has a one year warranty for defects in materials and workmanship. The warranty does not cover disposable batteries, leads, modification to the unit, damage from neglect, contamination, exposure to excessive moisture, misuse, accident or abnormal conditions of operation or handling, including failure caused by use outside of the product's specifications, or normal wear and tear of mechanical components. Nemtek will, at it's discretion, repair at no charge, replace or refund the purchase price of a defective product purchased through a Nemtek authorized sales outlet and at the applicable international price. Nemtek reserves the right to charge importation costs of repair/replacement parts if the product purchased in one country has to be sent elsewhere for repair.

LIMITATION OF WARRANTY

This warranty is your only remedy, no other warranties, such as fitness for a particular purpose, are expressed or implied, Nemtek shall not be liable for any special, indirect, incidental or consequential damages or losses arising from any cause or theory.

EXCLUSIVE REMEDIES

The remedies provided herein are Nemtek (Pty) Ltd's sole liability and the buyers sole and exclusive remedies for breach of warranty. Nemtek (Pty) Ltd shall not be liable for any special, incidental, consequential, direct or indirect damages, whether based on contract, tort, or any other legal theory. The foregoing warranty is in lieu of any and all other warranties, whether expressed, implied, or statutory, including but not limited to warranties of merchantability and suitability for a particular purpose.

NEMTEK
Electric Fencing Products

Rev 1.1, 7 April 2026
Manual design updated