

Polar Instruments Ltd.
Garenne Park
Rue de la Cache
St. Sampson
Guernsey
Channel Islands
GY2 4AF
England

Fax: 44 (0)1481 52476

MAN 149-9603

TONEOHM 550A OPERATOR MANUAL

TONEOHM 550A SHORTS LOCATOR OPERATOR MANUAL

WARRANTY

For a period of one year from its date of purchase new and undamaged from Polar Instruments Ltd, POLAR INSTRUMENTS LTD or its authorized distributors will, without charge, repair or replace at its option, this product if found to be defective in materials or workmanship, and if returned to POLAR INSTRUMENTS LTD or its authorized distributors transport prepaid. This warranty is expressly conditioned upon the product having been used only in normal usage and service in accordance with instructions of POLAR INSTRUMENTS LTD and not having been altered in any way or subject to misuse, negligence or damage, and not having been repaired or attempted to be repaired by any other than POLAR INSTRUMENTS LTD or its authorized distributors. EXCEPT FOR THE FOREGOING EXPRESS WARRANTY OF REPAIR OR REPLACEMENT POLAR INSTRUMENTS LTD MAKES NO WARRANTY OF ANY KIND, INCLUDING BUT NOT LIMITED TO, ANY EXPRESS OR IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE, AND POLAR INSTRUMENTS LTD SHALL NOT BE LIABLE FOR ANY DAMAGES, WHETHER DIRECT OR NOT OR OTHERWISE, BEYOND REPAIR OR REPLACING THIS PRODUCT.

ELECTROMAGNETIC COMPATIBILITY

European Community Directive Conformance Statement

This product is in conformity with the protection requirements of EC Council Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility.

A declaration of conformity with the requirements of the Directive has been signed by

POLAR INSTRUMENTS (UK) LTD
11 College Place
London Road
Southampton
England
SO1 2FE

This product satisfies EN50081-1:92 and EN 50082-1:92

SAFETY

WARNING

The LIVE and NEUTRAL lines on this unit are BOTH fused.

This unit contains no user-serviceable parts. When the unit is connected to its supply, the opening of covers or removal of panels is likely to expose dangerous voltages. To maintain operator safety, do not operate the unit unless the enclosure is complete and securely assembled.

GROUNDING

This unit must be earthed (grounded); do not operate the instrument with the safety earth disconnected. Ensure the instrument is connected to an outlet with an effective protective conductor terminal (earth). Do not negate this protective action by using an extension cord without a protective conductor.

Note: This instrument is fitted with 3-wire grounding type plug designed to fit only into a grounding type power outlet. If a special local plug must be fitted to the power cord ensure this operation is performed by a skilled electronics technician and that the protective ground connection is maintained. The plug that is cut off from the power cord must be safely disposed of.

Power cord color codes are as follows:

Europe

brown	live
blue	neutral
green/yellow	earth (ground)

United States

black	live
white	neutral
green	ground

POWER SUPPLY

Check that the indicated line voltage setting corresponds with the local mains power supply. See the rear panel for line voltage settings.

To change the line voltage settings refer the instrument to a skilled electronics technician. Instructions for changing the line voltage settings are contained in the TONEOHM 550A Service Manual published by Polar Instruments.

TONEOHM 550A OPERATION

This manual contains instructions and warnings which must be observed by the user to ensure safe operation. Operating this instrument in ways other than detailed in this manual may impair the protection provided by the instrument and may result in the instrument becoming unsafe. Retain these instructions for later use.

The TONEOHM 550A is designed for use indoors in an electrical workshop environment at a stable work station comprising a bench or similar work surface.

Use only the accessories (e.g. test probes and clips) provided by Polar Instruments.

The TONEOHM 550A must be maintained and repaired by a skilled electronics technician in accordance with the manufacturer's instructions.

If it is likely that the protection has been impaired the instrument must be made inoperative, secured against unintended operation and referred to qualified service personnel. Protection may be impaired if, for example, the instrument:

- Shows signs of physical damage
- Fails to operate normally when the operating instructions are followed
- Has been stored for prolonged periods under unfavourable conditions
- Has been subjected to excessive transport stresses
- Has been exposed to rain or water or been subject to liquid spills

CAUTIONS

Electrical Isolation

The TONEOHM 550A must not be connected to a powered board. Make sure that the item under test is isolated from all other sources of electrical power. External power could damage the tester.

NOTE: The needle probes are manufactured from very hard steel to ensure that they stay sharp. If they are used on anything other than PCBs or solder joints, take care not to press them too hard or they may snap.

ENVIRONMENTAL OPERATING CONDITIONS

The instrument is designed for indoor use only under the following environmental conditions:

Altitude	Up to 2000m
Temperature	+5°C to +40°C ambient
Relative humidity	RH 80% maximum at 31°C — derate linearly to 50% at 40°C
Mains borne transients	As defined by Installation Category II (Overvoltage Category II) in IEC664
Pollution Degree	2 (IEC664)

SPECIFICATIONS

Ranges	
Number of Ranges	5
Hi sensitivity Ω	Approx. 40m Ω , uncalibrated
200m Ω	200m Ω , 4%
2 Ω	2 Ω , 4%
200 Ω	200 Ω , 4%
20k Ω	20k Ω , 4%
Probe tip voltage	60mV max.
Probe Protection	Momentary contact to 100V
Display	0.7", 3½ digit Liquid Crystal Display
Tone	Internal speaker, headphone socket, adjustable volume
Power Cord	Detachable

Power Requirements

230V \pm 10%, 115V \pm 10% or 100V \pm 10% at 50/60Hz, 15VA.

Physical characteristics (excluding accessories)

Dimensions 300 mm (11.8 in.) wide
 110 mm (4.4 in.) high
 260 mm (10.3 in.) deep

Weight 1.5 kg (3.3 lb.)

ACCESSORIES

Standard Accessories

Probe set ACC152
Operator manual MAN149

SYMBOLS



CAUTION — To prevent damage to this product and to ensure its safe use observe the specifications given in this manual when connecting to terminals marked with this symbol.

CONTENTS

DECLARATIONS	i
ELECTROMAGNETIC COMPATIBILITY.....	ii
European Community Directive Conformance Statement.....	ii
SAFETY	iii
WARNING.....	iii
GROUNDING.....	iii
POWER SUPPLY.....	iv
TONEOHM 550A OPERATION.....	iv
CAUTIONS.....	v
ENVIRONMENTAL OPERATING CONDITIONS.....	v
SPECIFICATIONS	vi
ACCESSORIES.....	vii
Standard Accessories.....	vii
SYMBOLS.....	vii
SECTION 1 – INTRODUCTION	1-1
THE TONEOHM 550A SHORTS LOCATOR.....	1-1
1-1 Introduction to the TONEOHM 550A.....	1-1
1-2 Areas of application.....	1-1
SECTION 2 – GENERAL DESCRIPTION	2-1
PRINCIPLES OF OPERATION.....	2-1
2-1 Locating short circuits.....	2-1
2-2 TONEOHM 550A stimulus features.....	2-2
2-3 Controls, connectors and probes.....	2-2
Controls.....	2-2
RESISTANCE range switches.....	2-2
VOLUME control.....	2-2
Audio tone output.....	2-2
Connectors.....	2-2
Headphone socket.....	2-2
Probes.....	2-3
Needle probes.....	2-3
2-4 Rear Panel controls and connectors.....	2-3
SECTION 3 – INSTALLATION AND SET-UP	3-1
PREPARATION FOR USE.....	3-1
3-1 Unpacking.....	3-1
3-2 Connecting the TONEOHM 550A to a power supply.....	3-1

SECTION 4 – OPERATION	4-1
SYSTEM OPERATION.....	4-1
4-1 Locating short circuits.....	4-1
4-2 Using headphones	4-2
Short location example	4-3
SECTION 5 – SIMPLE MAINTENANCE AND CLEANING	5-1
Cleaning	5-1
Technical Support	5-1
USER GUIDE (FRENCH)	
USER GUIDE (GERMAN)	
USER GUIDE (ITALIAN)	

SECTION 1 – INTRODUCTION

THE TONEOHM 550A SHORTS LOCATOR

1-1 Introduction to the TONEOHM 550A

The TONEOHM 550A Shorts Locator is a precision milliohmeter incorporating a unique resistance-dependent, variable-frequency audio tone output.

This provides a fast and efficient means of pin-pointing the physical location of short circuits, both on PC boards in isolation and within circuit wiring.

In many cases, short circuits may be pin-pointed to within 0.2 inches of actual fault location without the need to disconnect associated components or wiring.

The sensitivity of the TONEOHM 550A allows it to be used for a wide variety of applications requiring low resistance measurements:

- Continuity testing
- Relay and switch contact measurements
- Detecting and measuring high-resistance connections
- Measurement of transformer winding resistance
- Testing for shorts and partial shorts between transformer windings

1-2 Areas of application

The TONEOHM 550A is an ideal instrument for a wide range of applications:

- Manufacturing – goods inwards testing and troubleshooting.
- PCB manufacture – locating track bridges
- Field Service – fault finding.
- Education – fault finding and troubleshooting training.

SECTION 2 – GENERAL DESCRIPTION

PRINCIPLES OF OPERATION

2-1 Locating short circuits

The TONEOHM 550A Shorts Locator is a precision milliohmmeter incorporating:

- A resistance-dependent, variable-frequency audio tone output.
- A liquid crystal display (LCD) screen providing an indication of the resistance being measured.
- Kelvin probes to minimise measurement errors.
- Low probe tip injection voltage to safeguard sensitive semiconductor devices

The variable-frequency audio tone output of the TONEOHM 550A makes it especially suitable for locating for short circuits between the tracks of a PCB where hairline bridges between tracks may be hidden beneath components or even buried below the surface of the board.

Using the TONEOHM 550A the technician can locate a short circuit between two tracks of a printed circuit board tracks by positioning the two Kelvin probes on the two tracks and listening for an audio tone. A tone indicates the presence of a short circuit between the tracks.

The frequency of the audio tone is dependent on the resistance between the two Kelvin probes.

Moving one of the probes along its track will cause the resistance between the probes to change and cause a corresponding change in the frequency of the audible tone.

By moving the probe along the track until the tone reaches its highest pitch the technician will quickly locate the precise position of the short.

2-2 TONEOHM 550A stimulus features

The low probe injection voltage of the TONEOHM 550A (maximum 60mV, typically 5mV) prevents possible damage to sensitive semiconductor components within the circuit under test.

The TONEOHM 550A's DC voltage injection avoids measurement errors which could result from stray currents flowing through capacitors connected in parallel with the circuits under test.

The use of Kelvin probes minimises lead loss in the measurement path.

2-3 Controls, connectors and probes

Controls

RESISTANCE range switches

The RESISTANCE ranges (Ω , 200m Ω and 2 Ω). are used to locate low resistance shorts. When locating faults on heavier tracks, use the Ω range to gain more sensitivity and resolution.

Use the 200 Ω , 20K Ω ranges for general resistance measurements.

When using the milliohmmeter ranges, the open circuit probe tip voltage is limited to a maximum of 60mV to prevent any damage to sensitive components.

VOLUME control

The VOLUME control varies the sound level of the audible tone. Rotate the VOLUME control clockwise to increase the sound level.

Audio tone output

The TONEOHM 550A incorporates a variable-frequency audio tone output to enable the operator to maintain continuous visual contact with the circuit under test.

Connectors

Probe Socket

Connect the Needle Probes into this socket when locating short circuits between printed circuit board tracks.

Headphone socket

When the headphones are connected to this socket the internal speaker is switched off and the tone switched to the headphones. Use only 3.5mm stereo jack plugs in this socket.

Probes

Needle probes

Place the Needle Probes across PCB tracks to locate short circuits between the tracks.

2-4 Rear Panel controls and connectors

The rear panel accommodates the push button (push-on/push-off) ON/OFF mains power switch and the IEC mains inlet connector.

SECTION 3 – INSTALLATION AND SET-UP

PREPARATION FOR USE

3-1 Unpacking

The instrument is shipped in a sturdy transit pack. Open the pack carefully and remove the instrument and its accessories.

If the instrument is damaged in any way contact the local distributor or supplier.

Retain the pack for possible future use.

The TONEOHM 550A pack should contain:

- TONEOHM 550A
- Power cord
- Pair of probes
- Operator manual

Note: If the instrument has been shipped or stored in a cold environment, allow the instrument to reach the temperature of its new location before applying power.

3-2 Connecting the TONEOHM 550A to a power supply

Refer to the voltage label on the rear panel of the instrument and make sure that the marked rating is suitable for the local mains power supply.

If the rating on the label is not suitable for the local power supply refer the instrument to a skilled electronics technician. Instructions for changing the line voltage settings are contained in the TONEOHM 550A Service Manual.

Note: If a special local plug must be fitted to the power cord ensure this operation is performed by a skilled electronics technician and that the protective ground connection is maintained. The plug that is cut off from the power cord must be safely disposed of.

Power cord color codes are as follows:

Europe

brown	live
blue	neutral
green/yellow	earth (ground)

United States

black	live
white	neutral
green	ground

Check that the TONEOHM 550A mains switch (on the rear panel) is OFF.

Plug the power cable into the receptacle on the rear panel of the TONEOHM 550A.

Plug the other end into a wall outlet.

SECTION 4 – OPERATION

SYSTEM OPERATION

CAUTION: Disconnect power from the board under test before making measurements with the TONEOHM 550A Shorts Locator.

4-1 Locating short circuits

- Switch the TONEOHM 550A on.
- Rotate the VOLUME control fully clockwise.
- Select the desired sensitivity by pushing the associated range switch — in most cases the 200 mΩ range will be found appropriate for locating short circuits.
- Locate the suspect tracks and position a probe on each track.
- If a short exists a tone should be heard — if a tone is not heard, select a higher range to reduce the sensitivity until a tone is heard. If no tone results, the two tracks are not shorted.
- If a tone is heard, move one of the probes along its track — an increasing tone frequency indicates that the probe is moving *towards* the short, a decreasing tone frequency indicates that the probe is *away* from the short.
- Continue moving the probe in a direction that produces a higher frequency tone (and thus a lower reading), increasing the sensitivity as necessary.
- At the point of maximum tone frequency and minimum meter reading the probe should be within a few millimetres of the short. Visual inspection can now be employed to locate and correct the fault.

In many cases it will probably be found more convenient to locate the short initially by using the tone, then use the meter for the final resolution.

In situations where tracks are heavy, more sensitivity and resolution can be gained using the lowest range.

To obtain the best results and minimise damage to the track, hold the probes at right angles to the PCB and apply sufficient pressure to pierce flux and solder resist.

Probe the track at different points rather than scraping the probe along its length.

It is not unusual for a fault to be located between two parallel tracks where there is no visual sign of a short, even using an eyeglass. This often happens if the board is covered with solder resist, masking a hairline “whisker” short. Use a scalpel to cut

between the tracks through the solder resist and the short. An open circuit reading confirms that the fault has been cleared.

A typical fault situation is shown diagrammatically in Fig 4-1.

4-2 Using headphones

The TONEOHM 550A incorporates the facility to output the audio tone to headphones if preferred. When the headphones are connected to this socket the internal speaker is switched off. Use only 3.5mm stereo jack plugs in this socket. A stereo to mono adapter is required for use with an earpiece.

Short location example

In the example circuit in Fig 4-1, a short circuit exists between the output of U1 and the input of U2. Board power is disconnected, and the Needle Probes are placed at A and E. The resistance of the tracks via the short gives a reading and a tone.

Moving the probe from A to B gives a lower reading and a *higher* tone. This indicates that the probe has moved *closer* to the short.

Moving the probe from B to C gives a higher reading and a *lower* tone, indicating that the probe has moved *beyond* the fault.

This implies that the fault is between B and C.

Now move the other probe from E to give the lowest reading and the highest frequency tone. When the reading is below about 15 m Ω , the probes should be within a few millimetres of the short and the tone changes to a warble.

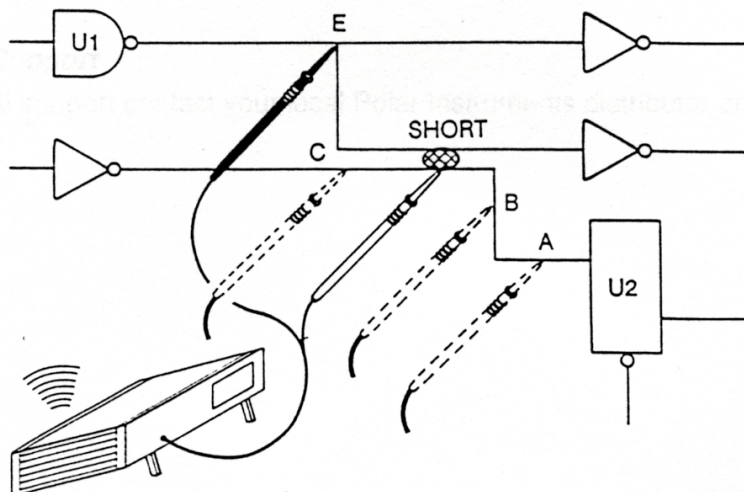


Fig 4-1 Locating a short circuit

SECTION 5 – SIMPLE MAINTENANCE AND CLEANING

WARNING: This instrument should only be serviced by a qualified electronics technician.

Refer all servicing to qualified service personnel. Polar Instruments publishes a TONEOHM 550A Service Manual to assist the service technician.

Cleaning

Clean the TONEOHM 550A with a cloth lightly moistened with water with a small amount of mild detergent.

Alternatively, a cloth lightly moistened with alcohol (ethanol or methylated spirit) or isopropyl alcohol (IPA) may be used.

Do not spray cleaners directly onto the instrument.

Technical Support

For technical support contact your local Polar Instruments distributor or Polar Instruments.

TONEOHM 550A USER GUIDE

CAUTION: Disconnect power from the board under test before making measurements with the TONEOHM 550A Shorts Locator.

Introduction

The TONEOHM 550A Shorts Locator is a precision milliohmmeter incorporating:

- A resistance-dependent, variable-frequency audio tone output.
- A liquid crystal display (LCD) screen providing an indication of the resistance being measured.

The operator locates short circuits between two tracks of a printed circuit board by connecting a probe to each track and listening for an audio tone. A tone indicates the presence of a short circuit between the tracks. The frequency of the tone is dependent on the resistance between the probes. Moving one of the probes along its track will cause the resistance between the probes to change and cause a corresponding change in the frequency of the tone. The probe is moved along the track until the tone reaches its highest pitch, which is the position of the short.

Connecting the TONEOHM 550A to a power supply

Refer to the voltage label on the rear panel of the instrument and make sure that the marked rating is suitable for the local mains power supply.

Check that the TONEOHM 550A mains switch (on the rear panel) is OFF. Plug the power cable into the receptacle on the rear panel of the TONEOHM 550A. Plug the other end into a wall outlet.

Connecting the Probes

Connect the Kelvin Probes supplied with the instrument into the Probe Socket.

Using the headphone socket

When the headphones are connected to this socket the internal speaker is switched off and the tone switched to the headphones. Use only 3.5mm stereo jack plugs in this socket. A stereo to mono adapter is required for use with an earpiece.

Selecting the range

Use the Ω , 200m Ω and 2 Ω ranges to locate low resistance shorts. When locating faults on heavier tracks, use the Ω range to gain more sensitivity and resolution. Use the 200 Ω , 20K Ω ranges for general resistance measurements.

Locating short circuits

- Switch the TONEOHM 550A on.
- Rotate the VOLUME control fully clockwise.
- Select the desired sensitivity by pushing the associated range switch — in most cases the 200 m Ω range will be found appropriate for locating short circuits.
- Locate the suspect tracks and position a probe on each track.
- If a short exists a tone should be heard — if a tone is not heard, select a higher range to reduce the sensitivity until a tone is heard. If no tone results, the two tracks are not shorted.
- If a tone is heard, move one of the probes along its track — an increasing tone frequency indicates that the probe is moving *towards* the short, a decreasing tone frequency indicates that the probe is *away* from the short.
- Continue moving the probes in a direction that produces a higher frequency tone (and thus a lower reading), increasing the sensitivity as necessary.
- At the point of highest pitch and minimum meter reading the probes should be within a few millimetres of the short. Visual inspection can now be employed to locate and correct the fault.

It is usually most convenient to locate the short initially by using the tone, then use the meter for the final resolution.

In situations where tracks are heavy, more sensitivity and resolution can be gained using the Ω range.

To obtain the best results and minimise damage to the track, hold the probes at right angles to the PCB and apply sufficient pressure to pierce flux and solder resist. Probe the track at different points rather than scraping the probe along its length.

To remove the short use a scalpel to cut between the tracks through the solder resist and the short. An open circuit reading confirms that the fault has been cleared.

Short location example

In the example circuit in Fig 1, a short circuit exists between the output of U1 and the input of U2. Board power is disconnected, and the Needle Probes are placed at A and E. The resistance of the tracks via the short gives a reading and a tone.

Moving the probe from A to B gives a lower reading and a *higher* tone. This indicates that the probe has moved *closer* to the short.

Moving the probe from B to C gives a higher reading and a *lower* tone, indicating that the probe has moved *beyond* the fault.

This implies that the fault is between B and C.

Now move the other probe from E to give the lowest reading and the highest frequency tone. When the reading is below about 15 m Ω , the probes should be within a few millimetres of the short and the tone changes to a warble.

Fig 1 Locating a short circuit