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MAN156–9604

TONEOHM 550A SERVICE MANUAL

TONEOHM 550A SERVICE 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.

DECLARATIONS

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 service instructions contained in this manual are for use by qualified electronic service personnel only.

WARNING

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

When the unit is connected to its supply, the opening of covers or removal of panels is likely to expose dangerous voltages.

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. Instruments with a serial number prefixed with a letter (e.g. A1234) are configured for 90 – 110 Volts only.

Changing the line voltage settings on this instrument must only be performed by a skilled electronics technician. Instructions for changing the line voltage settings are contained in Section 5.

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 unit 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 instrument 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

CAUTION

Electrical Isolation

Always disconnect the board under test from the local mains supply (including ground) before using this instrument.

Static Sensitive Devices

This unit contains Static Sensitive Devices. Static discharge can damage some electronic components. Care must be taken when handling these components. Observe appropriate precautions to avoid damage.

SPECIFICATIONS

Ranges	
Number of Ranges	5
Hi sensitivity Ω	Approx. 40mΩ, uncalibrated
200mΩ	200mΩ, 4%
2Ω	2Ω, 4%
200Ω	200Ω, 4%
20kΩ	20kΩ, 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

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)

Power Requirements

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

Fuses

230V 50mAT
115V 100mAT

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.)

SYMBOLS

⚠ REFER TO MANUAL	These sockets are for connecting only Polar Instruments probes and connectors for use as described in the Operator Manual. 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.

ACCESSORIES

Standard Accessories

Needle Probe set	ACC152
Operator manual	MAN149

CONTENTS

SECTION 1 – PERFORMANCE CHECK

MAINTENANCE AND CALIBRATION OF INSTRUMENTS

For most of Polar Instruments' products there are two maintenance procedures — the **Performance Check** and the **Adjustment Procedure.** Some instruments may have a single (combined) procedure.

Performance Check

The Performance Check (or Checkout Procedure) is used to verify the basic functions of the instrument. This does not usually require the removal of instrument covers, but may require the use of external test equipment. This procedure is not intended to verify the calibration of the instrument.

Adjustment Procedure

The Adjustment Procedure (or Calibration Procedure) is used to check and, if necessary, adjust the instrument's calibration settings. Before carrying out the Adjustment Procedure the instrument's Performance Check (if applicable) should be carried out, and any detected defects should be rectified. *The Adjustment Procedure and rectification of defects should only be carried out by qualified technician.*

Recommendations for Routine Maintenance

Where a Performance Check is available for an instrument this may be used as required to confirm the basic operation of the product.

To maintain the calibration of an instrument it is recommended that its Calibration/Adjustment Procedure is carried out at intervals not exceeding 12 months.

550A PERFORMANCE CHECK

> *NOTE If no probes are connected the performance of the instrument is not defined and any sounds or readings should be ignored.*

Equipment Required:

High tolerance resistors of the following values:

10KΩ 1KΩ 100Ω 1Ω and 0.1Ω.

It will be easier to measure the test resistors if they are soldered to a piece of prototyping circuit board. Note that the 1KΩ and 1Ω resistors need to be connected in series.

Procedure

1. Connect the needle probes and turn on and allow 20 minute warm up.
2. Select 20KΩ range and connect the probes to the 10KΩ resistor . Check for a reading of 10KΩ ± 4%
   A warble *may* be generated in this range.
3. Select 200Ω range and measure the 100Ω resistor. Check for a reading of 100R ± 4%
4. Select 2Ω range and measure the 1Ω resistor Check for a reading of 1Ω ± 4%
5. Measure the 100mΩ resistor using the 200mΩ range and check for a reading within 4%. Note that contact pressure can affect the readings.

SECTION 2 – CALIBRATION

550A CALIBRATION PROCEDURE

Hazardous voltages are exposed on the PCB when the cover is removed. This procedure should only be performed by a technically qualified person aware of the hazards and taking all reasonable care.

Equipment Required

High Tolerance (0.1%) 100Ω Resistor
Digital Voltmeter

1. Remove the two screws at the rear that retain the cover. Lift the rear of the cover and remove.

2. Turn on the instrument and allow 20 minutes to warm up.

3. Set DVM to 200mV range (DC).

4. Connect probes to the 550A and set it to 2Ω range.

5. Apply probes to DVM and adjust R64 for a reading of 55mV ± 3mV

6. Change the 550A range to 200Ω and connect the probes to the 100Ω test resistor.

7. Adjust R301 for a reading of 100.0 ± 0.5. (R301 is accessed through the hole in the front panel PCB between the two ribbon cables at the speaker end.)

8. Remove the power cable and reassemble the instrument.

SECTION 3 – CIRCUIT DESCRIPTION

550A CIRCUIT DESCRIPTION

Note: Versions below serial number 10559 may not have some of the EMC control components fitted.

Input and Switching

Refer to the "550A Input and Switching" schematic.
U6 is a chopper stabilised op-amp whose overall gain is set by R_i R47 and R_f R52. This is the x100 gain to the display DVM chip. Incorporated into the feedback path of the amp is an additional non-linear network which modifies the drive to the sound generator. All signal connections to the DIN sockets J1 and J2 are decoupled to ground to divert RF picked up on cables.

Tone Generator

Refer to the "550A Tone Generator" schematic.
U3D and Q1 form a voltage controlled oscillator whose output frequency is determined by the collector current of Q1.

U4A divides the output of U3D by 2 to provide a symmetrical squarewave which is amplified by U5 to drive the loudspeaker.

The voltages applied to the VCO are controlled by U2, U9B, U3A, U3B, U3C and the output voltage of U6.

U2C and U2D are held off and U2B is on, coupling U6 output to R117. For very low readings U3B output goes high allowing U3C oscillator to run. This pulses U4A to cause a pulsing tone.

Power Supply

Refer to the "550A Power Supply" schematic.

Resistance drive
U9A and Transistors Q2 and Q3 form a voltage follower capable of driving a load to ground. The voltage set on R64 (approximately 55mV) is used to drive the current limiting resistor selected by the range switch. D27 protects for +ve transients and D82 shuts off the current if a –ve overload is applied.

Power Supply
The other transformer secondary is rectified and smoothed to supply 5V regulator U11. C400 pumps charge into C401 to supply the –ve regulator U400.

Note that Line and Neutral are both fused.

DVM

Refer to "550A DVM" schematic.
U300 is a dual slope DVM chip which drives the LCD. U301 is used to convert the DC decimal point levels from the range switch to the squarewaves necessary for the LCD.

SECTION 4 – DISMANTLING INSTRUCTIONS

TONEOHM 550A DISMANTLING INSTRUCTIONS

Disconnect the power cord from the rear of the instrument before commencing.

Remove the two screws from the rear of the instrument and lift the cover at the rear first and remove.

Removing the PCBs

- To remove the PCBs first remove the two screws retaining the power inlet connector and lift this off the lugs.
- Remove the power switch button (pull off).
- Remove the two screws from the DIN socket board and remove from its mounting lugs.
- Remove the 8 screws retaining the main board and then those holding the front panel board.
- Remove the Volume knob (pull off) and then withdraw the boards from the enclosure by lifting the rear of the main board first (hold the switch hard in) and move backwards a few cm.
- Remove the front panel board then lift the assembly out.

SECTION 5 – LINE VOLTAGE AND FUSE CHANGING

WARNING: There are hazardous voltages inside the instrument when connected to its power supply. REMOVE THE POWER CORD before touching any part of the line input circuit. Note that high voltages may continue to be present for 2 minutes after power is removed until internal capacitors discharge.

LINE VOLTAGE SELECTION AND FUSE CHANGING

- Remove the two screws holding the cover on and lift it off.
- Locate the line selector links adjacent to the power transformer and remove using suitable pliers.
- For 230V operation fit the links in the location(s) marked 230V (240V). (Note that early instruments have only one link used for 230V and that the PCB may be marked 240V).

  For 115V operation fit two links at the locations marked 115V (or 110V).
- Remove the supply fuses (early instruments only have one) and replace with the values listed in SPECIFICATIONS.
- Replace the instrument cover and replace the screws.
- Obscure the original setting on the rear panel label and mark the new setting clearly.
- Connect to a supply at the new voltage and confirm operation.

SECTION 6 – FAULT DIAGNOSIS

WARNING: Hazardous voltages are exposed on the PCB when the cover is removed. These procedures should only be performed by a technically qualified person aware of the hazards and taking all reasonable care.

TROUBLESHOOTING HINTS

- Using a DVM, check the power supplies at the marked test pads. Note that 0VDS, +5VDS and +12VDS are not connected.
- If the Ohms ranges are not working correctly first check the open circuit voltage at the probe tips in 2Ω range. This should be approximately 55mV.
- Locate the circuit block in which the fault exists and troubleshoot from the circuit diagrams.

SECTION 7 – MAINTENANCE AND CLEANING

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 Ltd. at the address at the front of this manual.

Instrument repair

If it becomes necessary to repair the instrument, in the first instance contact the Polar Instruments distributor in your country. In case of difficulty contact Polar Instruments Ltd. at the address at the front of this manual. *Do not send the instrument until shipping instructions have been received from the repairer.*

SECTION 8 – REPLACEMENT PARTS

To ensure correct parts are supplied, orders for replacements should include the following details:

Instrument type
Instrument serial number
Firmware version (if applicable)
Circuit reference (if applicable) and description

Note: Parts marked with an asterisk (*) have been subject to modification in later instruments.

Safety critical parts (listed in bold type) must be replaced with parts obtained from Polar Instruments Ltd or your Polar Instruments distributor to ensure continued safe operation.

ELECTRICAL PARTS

PART Nº.	Qty	Description	Circuit Reference
CEA103	1	10µF 16V Radial	C6
CEA105	4	220µF 35V Radial	C18, C52, *C19, C40
CEA129	2	470µF 35V Radial	C400, C401
CVD101	6	0.1µF 100V Radial Polyester	C5, C31, C32, C33, C34, C35
CVD102	3	0.01µF 400V Radial Polyester	C7, C16, C41
CVD116	1	100pF 63V Ceramic	C301
CVD119	1	270pF 100V Ceramic	C30
CVD140	15	0.1µF 63V Ceramic Axial	C24, C25
CVD143	1	0.1µF Poly Box	C36
CVD146	1	1nF Polyester	C42
CVD147	1	4n7 Polyester	C408
CVD149	1	0.01µF Skeleton Poly	C302
CVD150	1	0.1µF 100V Skeleton Poly	C300
CVD151	2	0.22µF 100V Skeleton Poly	C303, C304
CVD154	2	2n2 Polyester	C409, C410
CVD155	5	470pF Polypropylene	C402, C403, C404, C405, C406
CVD157	1	0.047 Polyester	C407
DSP101	21	IN4148 150mA 75V	D18, D25, D26, D28, D29, D30, D31, D32, D33, D34, D35, D36, D63, D64, D65, D66, D67, D80, D81, D82, D701
DSP102	7	IN4007	D27, *D17, D105 – D108, D400, D401
DZA312	1	ZENER DIODE 3.3V	D70
FCA103	(2)	100mA T Fuse	F1, F2 110V
FCA125	2	50mA T Fuse	F1, F2 230V
ICA106	1	LM339	U3
ICA116	1	4016B	U2
ICA122	1	4013B	U4
ICA125	1	ICL7650	U6
ICA128	1	7805	U11
ICA129	1	ICL7106CPL	U300
ICA130	1	MC14070BCP	U301
ICA162	1	LF353N	U9
ICA187	1	LM386N-1	U5
ICA280	1	79L05	U400
LDD125	1	3.5 DIGIT LCD	
LED115	5	LED Red	D54 – D58

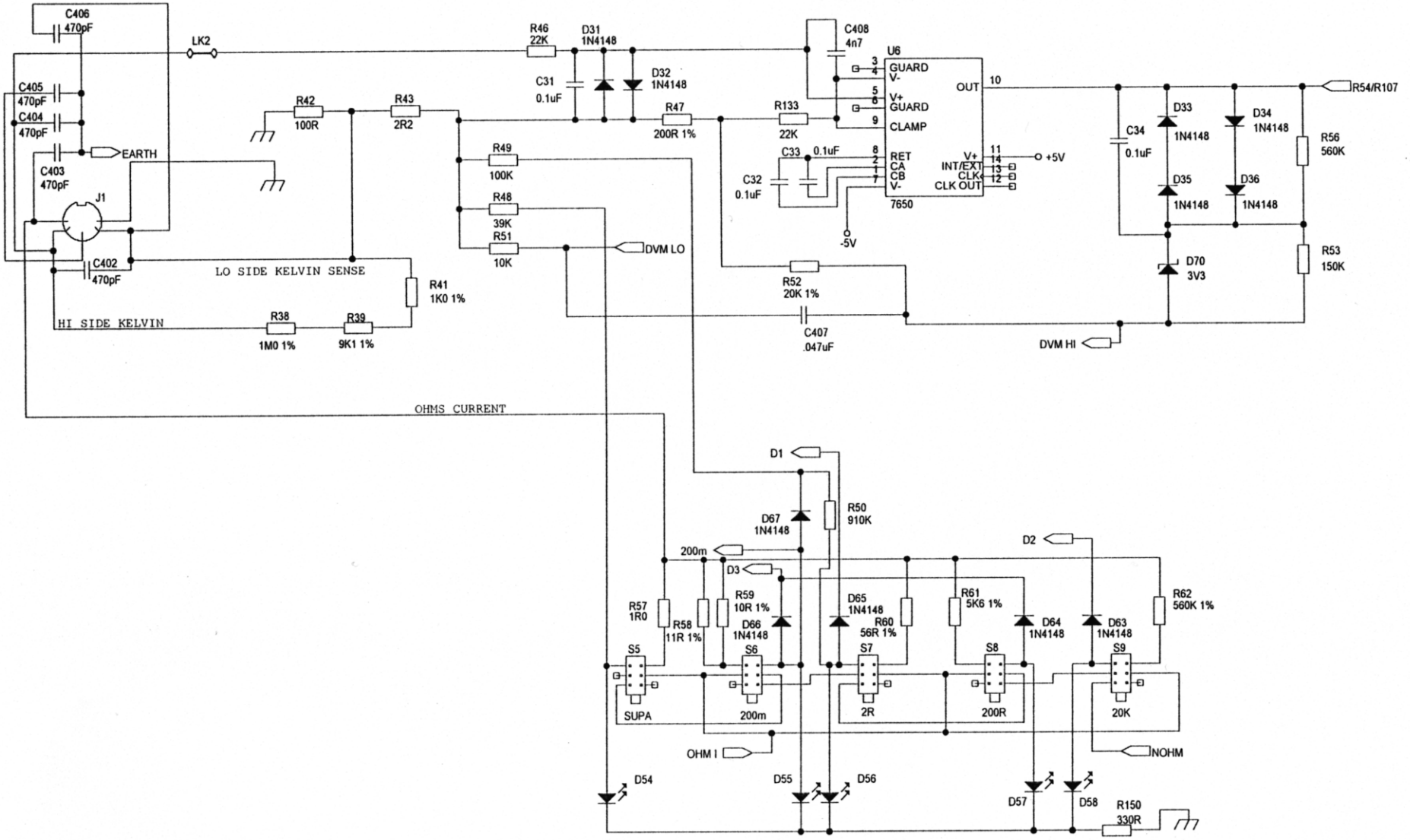
MAA123	2	FUSEHOLDER PCB			F1, F2
MPCD1016	1	Main PCB			
MPCD1017	1	Panel PCB			
MPCD1020	1	DIN PCB			
MPP122	1	CABLE TIE			
MPP200	5	LED Spacers			
MQX154	2	DIN SOCKET 5 x 45`			
MQX222	1	3.5MM STEREO JACK SKT			
MQX238	2	LCD Connector			
MQX259p2	1	2 x 1 Pin Header			
MQX299	2	LINK			
MQX300	5	LINK SOCKETS			
QNN304	1	2N3904			Q2
QPP102	1	2N3906			Q1
QPP103	1	MJE350			Q3
RCF000	1	Link			LK2, LK4
RCF100K	7	100K	1/4W	5%	R54, R68, R109, R111, R114, R115, R303
RCF100R	1	100R	1/4W	5%	R42
RCF10K	7	10K	1/4W	5%	R51, R92, R101, R105, R116, R125, R135
RCF10R	2	10R	1/4W	5%	R151, R152
RCF12K	1	12K	1/4W	5%	R130
RCF150K	2	150K	1/4W	5%	R53, R49
RCF1K0	1	1K0	1/4W	5%	R67
RCF1K2	2	1K2	1/4W	5%	R110, R112
RCF1K8	1	1K8	1/4W	5%	R121
RCF1M0	7	1M0	1/4W	5%	R63, R120, R153, R302, R305, R307, R308
RCF1R0	1	1R0	1/4W	5%	R57
RCF22K	8	22K	1/4W	5%	R46, R102, R106, R107, R117, R118, R133, R300
RCF270R	1	270R	1/4W	5%	R122
RCF2M2	1	2M2	1/4W	5%	R127
RCF2R2	2	2R2	1/4W	5%	R43, R160
RCF330R	1	330R	1/4W	5%	R150
RCF3K3	1	3K3	1/4W	5%	R66
RCF470K	2	470K	1/4W	5%	R104, R113
RCF47K	5	47K	1/4W	5%	R48, R70, R123, R124, R304
RCF560K	1	560K	1/4W	5%	R56
RCF5K6	2	5K6	1/4W	5%	R103, R119

RCF6K8	1	6K8	1/4W	5%	R65
RCF680R	1	680R	1/4W	5%	R309
RCF910K	1	910K	1/4W	5%	R50
RCT10R	1	10R	1/4W	1%	R59
RCT11R0	1	11R0	1/4W	1%	R58
RCT1K	1	1K	1/4W	1%	R41
RCT1M0	1	1M0	1/4W	1%	R38
RCT200R	1	200R	1/4W	1%	R47
RCT20K	1	20K	1/4W	1%	R52
RCT560K	1	560K	1/4W	1%	R62
RCT56R	1	56R	1/4W	1%	R60
RCT5K6	1	5K6	1/4W	1%	R61
RCT9K1	1	9K1	1/4W	1%	R39
RVB319	1	PRESET		10K	R64
RVB311	1	PRESET		470R	R301
RVP114	1	PANEL POT		100K	R128
SWB133	1	POWER SWITCH			S11
SWB157	1	RANGE SWITCH			S5 – S9
TXM136	**1**	**TRANSFORMER**			**T1**
TXM114	**1**	**TRANSFORMER**			***T1**

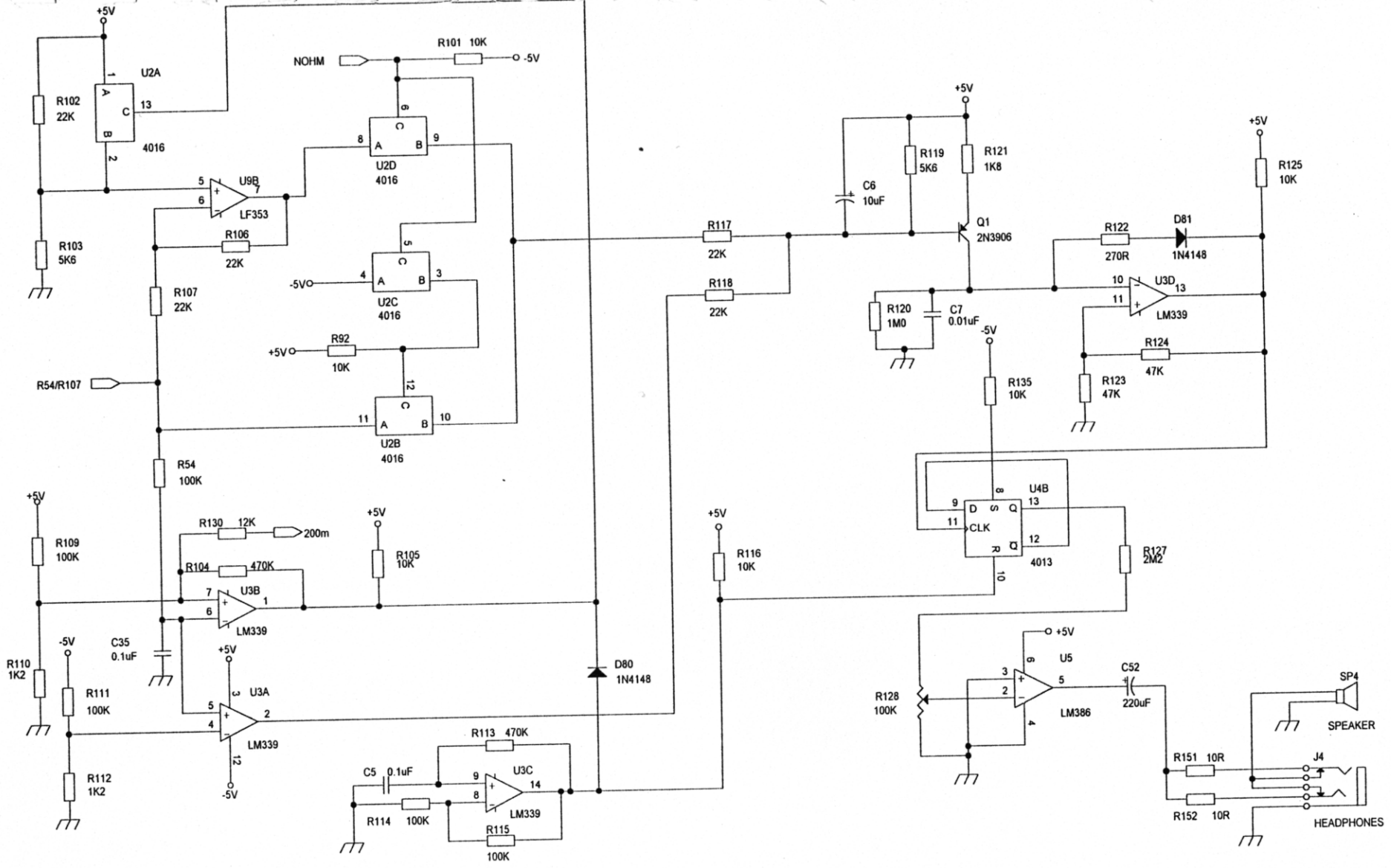
MECHANICAL PARTS

Part Nº.	Qty	Description
EPM117	1	LOUDSPEAKER (0.5W)
MCA138	1	ENCLOSURE TOP
MCA139	1	ENCLOSURE BOTTOM
MCA162	1	FRONT MOULDING
MKB128	1	KNOB – Grey push on
MKB129	5	KNOB – Grey button
MKB127	1	KNOB – Cap grey
MKB153	1	Black Button
MMP152	0.01	CLOTH (SPEAKER)
MMP187	2	LOUDSPEAKER BRACKET
MNS107	12	K30 X 6 Self Tap
MNS117	4	M3 x 10mm
MNS163	4	M3 x 12 CSK
MNS166	4	STARLOCK
MNS175	4	M3 Flangenut
MNS176	6	K30 x 8 Self Tap
MPA164	.045m	2.4mm Heatshrink
MPP191	2	TILT LEG
MPP193	4	STICK ON FEET
MPP198	2	TILT BASE
MPP230	1	Tie Wrap
MPP231	2	Insert Cover
MQX254	**1**	**POWER INLET**
MWP156	1	SERIAL Nº LABEL
MWPD1024	1	LABEL – 550A
MWP1056	1	REAR LABEL
WMA102	0.06	Blue Wire
WMA103	0.06	Brown Wire
WMA104	0.06	GREEN/YELLOW WIRE
WMA197	1	Speaker Lead
WMA293	3	10 WAY LINK
WMA302	1	5 WAY LINK

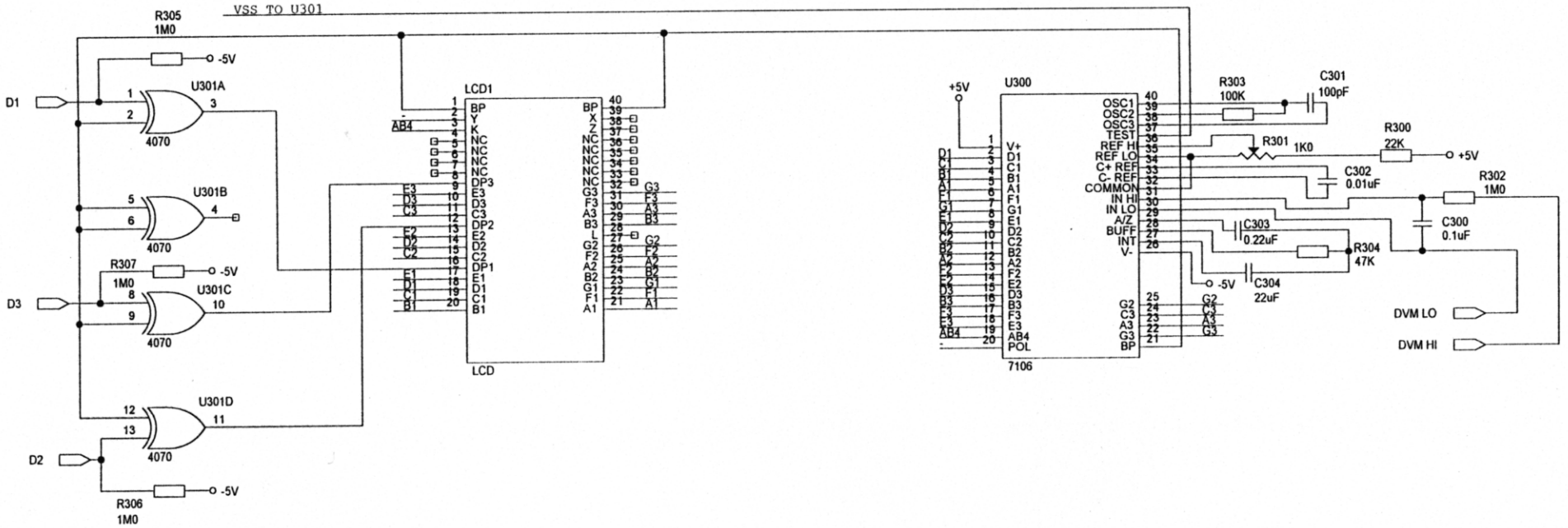
SECTION 9 – SCHEMATIC DIAGRAMS



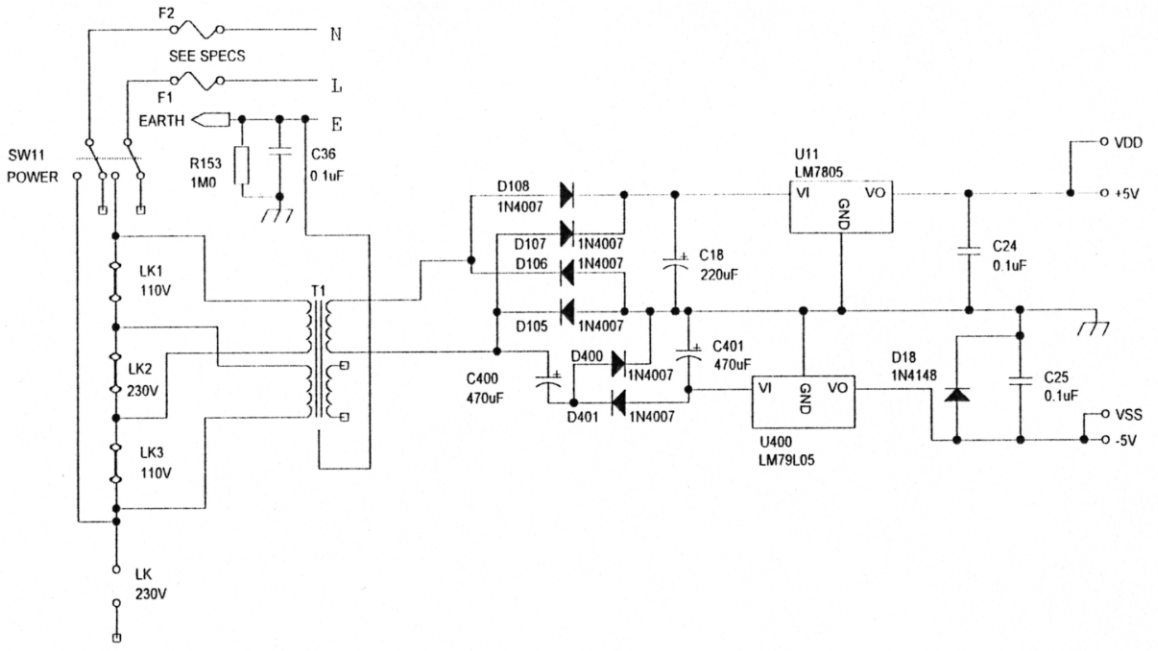
Polar Instruments Ltd
550A Input and Switching
Rev Code 1126

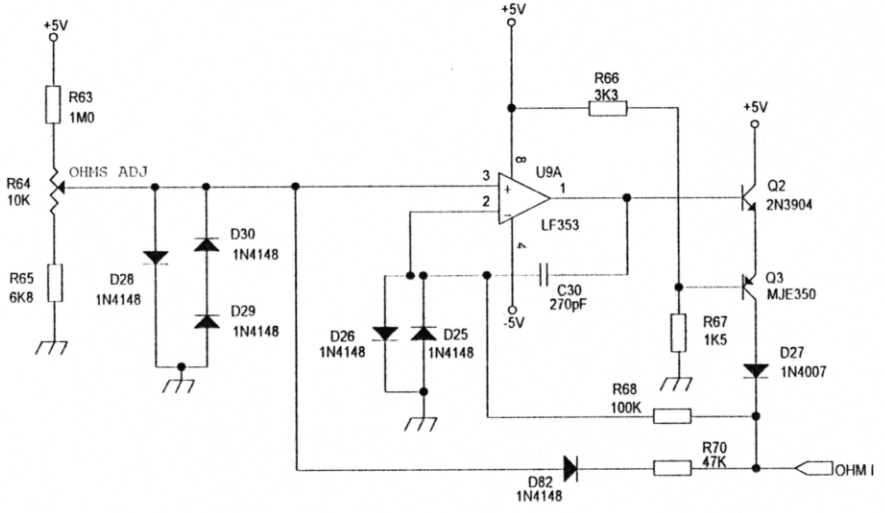


Polar Instruments Ltd
550A Tone Generator
Rev Code 1126

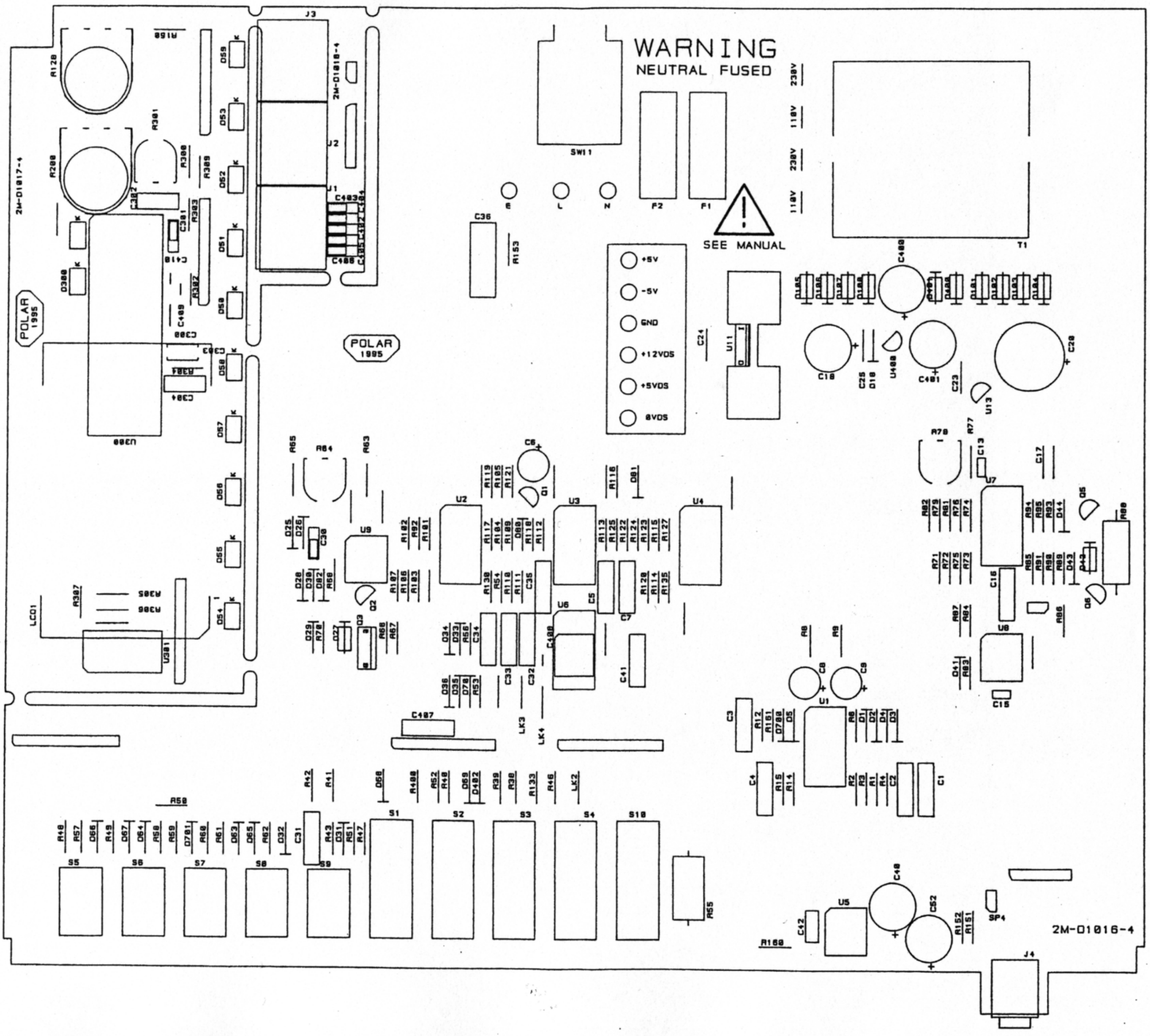


Polar Instruments Ltd
550A DVM
RevCode 1126





Polar Instruments Ltd
550A Power Supply
Rev Code 1126



WARNING
NEUTRAL FUSED
SEE MANUAL
POLAR
1995
POLAR
1995
2M-01016-4
2M-01017-4
2M-01018-4
SW11
F2
F1
T1
J1
J2
J3
J4
230V
110V
230V
110V
+5V
-5V
GND
+12VDS
+5VDS
0VDS
U1
U2
U3
U4
U5
U6
U7
U8
U9
U11
U13
U300
U301
LCD1
S1
S2
S3
S4
S5
S6
S7
S8
S9
S10
SP4
LK2
LK3
LK4