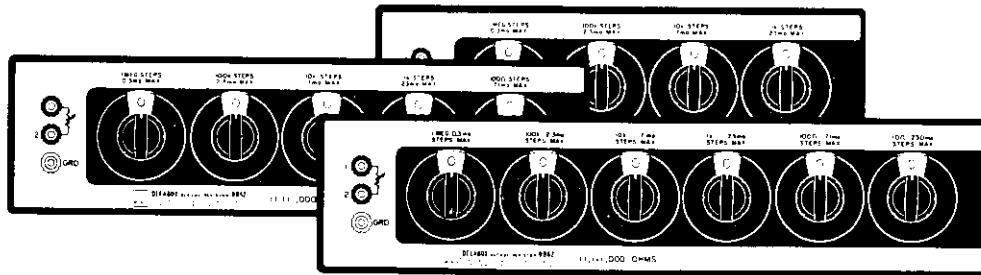


MODELS DB42, DB52, DB62

IN-LINE DEKABOX[®] DECADE RESISTORS

Instruction Manual

Part Number 7275 December 1976



13900 N.W. Science Park Drive • Portland, Oregon 97229 • Telephone: (503) 641-4141 • Telex: 15-1246

The following table lists the most recent revision of each page at the present date of printing:

<u>PAGES</u>	<u>DATES</u>
Title	12/76
A	12/76
i	11/69
ii	9/66
1-1 and 1-2	9/66
2-1 and 2-2	9/64
3-1 thru 3-3	9/64
4-1	3/65
4-2	8/64
4-3	12/76
5-1	3/65
5-2	9/66

The following are registered trademarks of Electro Scientific Industries, Inc.:

ESI[®] Electro Scientific Industries, Inc.
ESIAC[®] Algebraic Computer
ESIPOT[®] Potentiometer
DEKABOX[®] Decade Resistors and Capacitors
DEKABRIDGE[®] Bridge Circuit
DEKADIAL[®] Decade Dials
DEKAMATIC[®] Automatic Unit
DEKAPOT[®] Decade Potentiometers
DEKASTAT[®] Decade Rheostat
DEKAPACITOR[®] Decade Capacitor
DEKAVIDER[®] Decade Voltage Divider
KELVIN KLIPS[®] Four-terminal Clips
KELVIN KLAMPS[®] Four-terminal Clamps
PORTAMETRIC[®] Portable Measuring Instrument
PVB[®] Potentiometric Voltmeter Bridge

©Copyright 1964, 1965, 1966, 1969, 1972,
1976 Electro Scientific Industries, Inc.

TABLE OF CONTENTS

I	INTRODUCTION	
	1.1 Purpose of Equipment	1-1
	1.2 Description	1-1
	1.3 Specifications	1-1
II	OPERATION	
	2.1 Operation Instructions	2-1
	2.2 Theory of Operation	2-1
III	PREVENTIVE MAINTENANCE	
	3.1 Visual Inspection	3-1
	3.2 Removing the Case	3-1
	3.3 Cleaning and Lubrication	3-1
	3.4 Replacing the Case	3-2
IV	PARTS LIST	4-1
V	CALIBRATION	
	5.1 Accuracy	5-1
	5.2 Recommended Test Equipment	5-1
	5.3 Calibration Procedure	5-1
	5.4 Service and Repair	5-2

I INTRODUCTION

1.1 Purpose of Equipment

The in-line DEKABOX[®] decade resistors are adjustable resistors that can be easily set to a resistance value for precision dc and audio frequency use.

1.2 Description

There are three models of Dekabox, Model DB 42 has four resistance decades, Model DB 52 has five, and Model DB 62 has six. Each unit consists of a metal case, three binding posts, and four, five, or six decade resistance switch assemblies. Figure 1-1 shows panel arrangement and dimensions of all models.

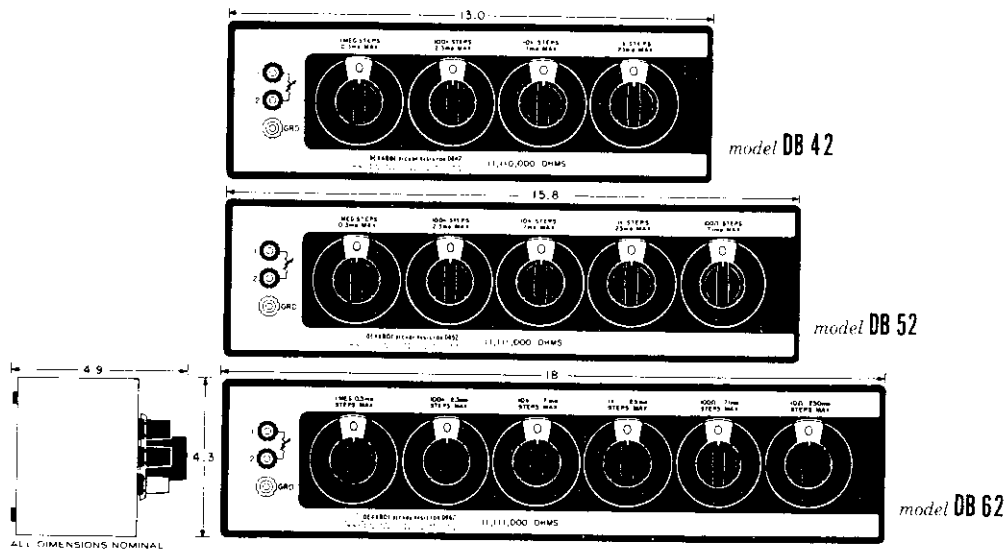


Figure 1-1 Dekabox Outlines

1.3 Specifications

INITIAL ACCURACY OF RESISTANCE CHANGE FROM ZERO SETTING:
 $\pm(0.01\% + 0.0005 \text{ ohm per decade})$ at 23°C

LONG-TERM STABILITY: $\pm(0.02\% + 0.001 \text{ ohm per decade})$ per year

APPROXIMATE ZERO RESISTANCE: 0.002 ohms per decade

RATING PER RESISTOR: See Table 1-1.

TEMPERATURE COEFFICIENT: See Table 1-1.

POWER COEFFICIENT: See Table 1-1.

NUMBER OF DECADES: DB 42, four; DB 52, five; DB 62, six

BREAKDOWN VOLTAGE: See Table 1-1

WEIGHT: DB 42, DB 52, DB 62 -- 4 lbs net. 10 lbs packed for shipping

MAXIMUM CURRENT PER RESISTOR: See Table 1-1

RESISTANCE PER DECADE (Ω)	RESISTANCE VALUE R* (Ω)	ACCURACY		COEFFICIENTS		MEASUREMENT DUTY MAXIMUM RATINGS		PEAK VOLTAGE (V/step)
		INITIAL (%)	LONG-TERM (%)	TEMPERATURE (ppm/°C)	POWER (ppm/mW/step)	POWER (mW/step)	CURRENT (mA)	
10 M	1 M	0.01	0.02	5	0.15	100	0.3	300
1 M	100 k	0.01	0.02	5	0.15	1000	3.2	300
100 k	10 k	0.01	0.02	5	0.15	1000	10	1500
10 k	1 k	0.01	0.02	5	0.15	1000	32	1500
1 k	100	0.01	0.02	5	0.15	1000	100	1500
100	10	0.012	0.025	15	0.45	1000	320	1500
10	1	0.03	0.07	20	0.6	1000	1000	1500
1	0.1	0.2	0.5	60	3	500	2200	1500
0.1	0.01	2	5	400	60	160	4000	1500

Table 1-1 Ratings Per Step for Each Decade

TOTAL RESISTANCE AND MINIMUM STEP RESISTANCE AVAILABLE:
Shown in Table 1-2.

MODEL	TOTAL RESISTANCE	OHMS PER STEP
DB 42	111.1Ω	0.01Ω
	1,111 Ω	0.1 Ω
	11,110 Ω	1 Ω
	111,100 Ω	10 Ω
	1,111,000 Ω	100 Ω
	11,110,000 Ω	1 k
DB 52	1,111.1Ω	0.01Ω
	11,111 Ω	0.1 Ω
	111,110 Ω	1 Ω
	1,111,100 Ω	10 Ω
	11,111,000 Ω	100 Ω
DB 62	11,111.1Ω	0.01Ω
	111,111 Ω	0.1 Ω
	1,111,110 Ω	1 Ω
	11,111,100 Ω	10 Ω

Table 1-2 Total Resistance and Minimum Step Resistance

II OPERATION

2.1 Operating Instructions

Three binding posts are provided for connections on the panel of each Dekabox. The GRD binding post is connected to the metal case which forms a shield for the unit.

The resistance of the unit corresponds to the setting of the in-line dials. The resistance per step of each decade switch is marked above the dial.

Note that switch positions correspond to clock number positions of the bar knobs: 1 is at one o'clock, 2 at two o'clock, and TEN at ten o'clock. This feature allows an operator to set the resistance by feel without looking at the unit.

2.2 Theory of Operation

The circuit consists of resistors switched in a series circuit. Figure 2-1 illustrates schematically the circuit of the Model DB 62. Models DB 42 and 52 are identical except for the number of decades.

Resistance values are related to the total resistance of the unit; these values are listed in Table 2-1.

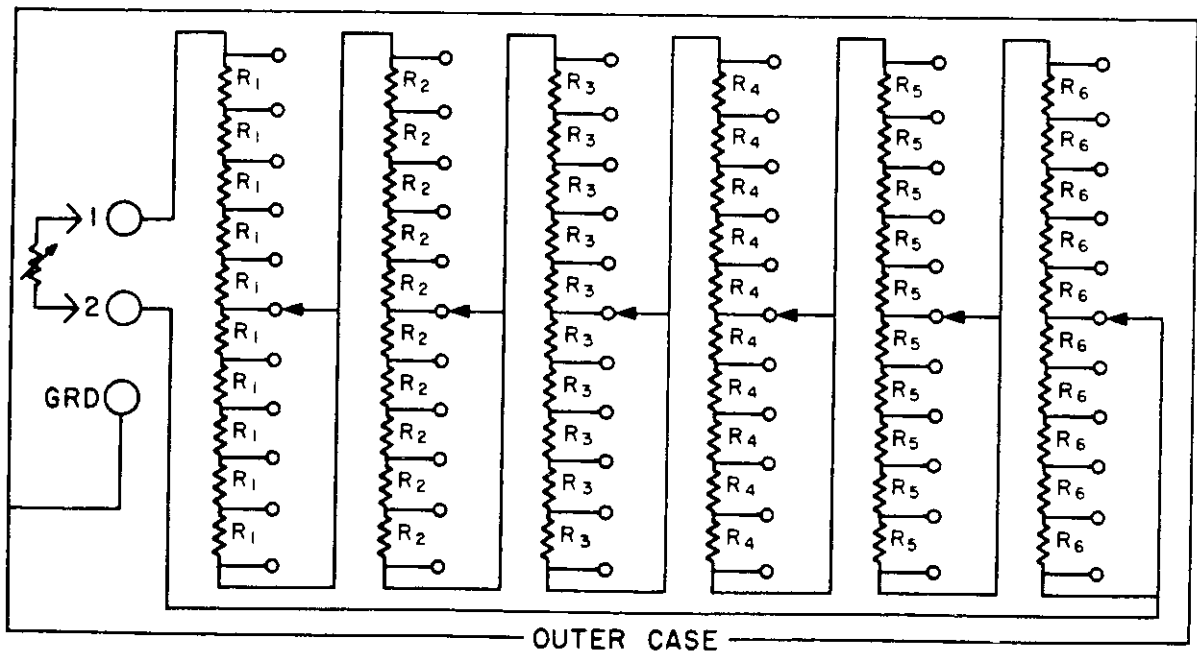


Figure 2-1 Dekabox Schematic Diagram

MODEL	TOTAL RESISTANCE	OHMS PER STEP	RESISTOR VALUES					
			R ₁	R ₂	R ₃	R ₄	R ₅	R ₆
DB 42	111.1Ω	0.01Ω	10Ω	1Ω	0.1Ω	0.01Ω		
	1,111 Ω	0.1 Ω	100Ω	1 Ω	0.1 Ω			
	11,110 Ω	1 Ω	100Ω	10 Ω	1 Ω			
	111,100 Ω	10 Ω	1k	100 Ω	10 Ω			
	1,111,000 Ω	100 Ω	10k	1 k	100 Ω			
11,110,000 Ω	1 k	1 MEG	10 k	1 k				
DB 52	1,111.1Ω	0.01Ω	100Ω	10Ω	1 Ω	0.1 Ω		
	11,111 Ω	0.1 Ω	100Ω	10 Ω	1 Ω			
	111,110 Ω	1 Ω	1k	100 Ω	10 Ω			
	1,111,100 Ω	10 Ω	10k	1 k	100 Ω			
	11,111,000 Ω	100 Ω	1 MEG	10 k	1 k			
DB 62	11,111.1Ω	0.01Ω	1k	100Ω	10 Ω	1 Ω		
	111,111 Ω	0.1 Ω	10k	1k	100 Ω			
	1,111,110 Ω	1 Ω	100k	10k	1 k			
	11,111,100 Ω	10 Ω	1 MEG	100k	10 k			

Table 2-1 Resistance Values

III PREVENTIVE MAINTENANCE

The following procedures should be performed periodically (approximately once a year) to insure maximum accuracy and reliability from the Dekabox in-line decade resistors.

If the need for major repairs is apparent, it is recommended that the unit be sent to the factory for service. The service department will be glad to furnish the necessary information for repairs as well as any replacement parts. However, unauthorized repairs will invalidate the instrument warranty. If the instrument is more than one year old when returned to the factory, a reasonable charge may be expected for replacement of parts or complete reconditioning.

3.1 Visual Inspection

Inspect the unit for dial orientation and damage to binding posts and binding post caps. Also check for dirt around the binding post insulators. Then remove the case as described in Paragraph 3.2 and inspect the unit for possible internal defects. These defects include such things as loose or broken connections, damaged or dirty switch contacts, and heat damaged resistors.

3.2 Removing the Case

Prepare a soft, clean place to set the instrument. Be sure that no projections or pointed objects will be underneath the panel. See that there are no metal filings in the area.

Place the unit face down on the prepared surface. Loosen the screws on the back of the instrument and carefully slide the case off.

3.3 Cleaning and Lubrication

Clean the front panel with a soft, dry, lint-free cloth, being particularly careful to remove all dirt from around the binding post insulators. The only internal components that require cleaning and lubrication are the switch decks.

The switch decks are carefully lubricated at the time of manufacture and are protected from contamination by the instrument case. They should rarely, if ever, require maintenance. It is recommended that they be cleaned or lubricated only if it is determined that they are not making good electrical contact. If the switch decks are in need of cleaning or lubrication, proceed as follows:

- a) Apply solvent (Freon printed circuit solvent or equivalent) to the contact surfaces with a small brush or pipe cleaner.
- b) Wipe surfaces with clean, dry brush or dry with low pressure air.

- c) Apply a thin coating of lubricant (Oak #2008 or equivalent) to the contact surfaces with a hypodermic needle.
- d) Apply two drops of the same oil to each of the switch bearings and detent mechanisms.
- e) Remove excess oil with a clean, dry cloth and remove all traces of lint with a soft brush.

3.4 Replacing the Case

Be sure that the interior of the case is completely clear of all foreign material.

Slip the case over the unit being careful not to touch any resistors with the cover. Replace the screws.

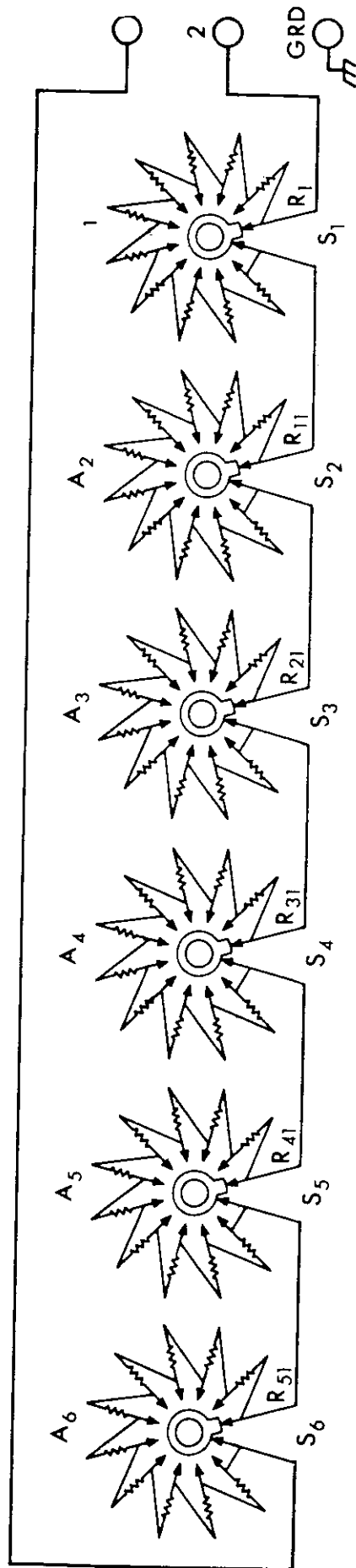


Figure 3-1 Wiring Diagram (DB 62 shown, DB 52 and DB 42 are identical except for A₅ and A₆)

IV PARTS LIST

The following tables list the replacement parts for the several types of Dekabox in-line decade resistors. Resistor switch assemblies vary in the value per step of the resistance. Table 4-1 lists the step resistance and part number of the assemblies in each type of Dekabox; the Dekaboxes are listed by model and total resistance, and the assemblies are listed by reference designation.

Table 4-2 lists replacement parts alphabetically by name of part. All parts listed herein are manufactured by Electro Scientific Industries, and may be ordered from the factory. When ordering parts, include the following information:

Model, serial number, and total resistance of the instrument

Electro Scientific Industries part number

Description of part

Manufacturer's Federal Stock Code (FSC)

11837

Electro Scientific Industries, Inc.
Portland, Oregon

Table 4-1 Resistor Switch Assemblies

MODEL	TOTAL RESISTANCE	ASSEMBLY NO.					
		A ₁	A ₂	A ₃	A ₄	A ₅	A ₆
DB 42	111.1	10Ω 7548	1Ω 7549	0.1Ω 7550C	0.01Ω 7591B		
	1,111	100Ω 7547	10Ω 7548	1Ω 7549	0.1Ω 7550C		
	11,110	1k 7546	100Ω 7547	10Ω 7548	1Ω 7549		
	111,100	10k 7545	1k 7546	100Ω 7547	10Ω 7548		
	1,111,000	100k 7544	10k 7545	1k 7546	100Ω 7547		
	11,110,000	1 MEG 7557	100k 7544	10k 7545	1k 7546		
DB 52	1,111.1	100Ω 7547	10Ω 7548	1Ω 7549	0.1Ω 7550C	0.01Ω 7591B	
	11,111	1k 7546	100Ω 7547	10Ω 7548	1Ω 7549	0.1Ω 7550C	
	111,110	10k 7545	1k 7546	100Ω 7547	10Ω 7548	1Ω 7549	
	1,111,100	100k 7544	10k 7545	1k 7546	100Ω 7547	10Ω 7548	
	11,111,000	1MEG 7557	100k 7544	10k 7545	1k 7546	100Ω 7547	
DB 62	11,111.1	1k 7546	100Ω 7547	10Ω 7548	1Ω 7549	0.1Ω 7550C	0.01Ω 7591B
	111,111	10k 7545	1k 7546	100Ω 7547	10Ω 7548	1Ω 7549	0.1Ω 7550C
	1,111,110	100k 7544	10k 7545	1k 7546	100Ω 7547	10Ω 7548	1Ω 7549
	11,111,100	1MEG 7557	100k 7544	10k 7545	1k 7546	100Ω 7547	10Ω 7548

Table 4-2 Parts List

DESCRIPTION	ESI PART NO.	QUANTITY USED		
		DB 42	DB 52	DB 62
Assembly, Resistor switch, 1 Megohm per step	7557	*	*	*
Resistor, 1 Megohm	7558	10	10	10
Assembly, Resistor switch, 100k per step	7544	*	*	*
Resistor, 100k	7543	10	10	10
Assembly, Resistor switch, 10k per step	7545	*	*	*
Resistor, 10k	7542	10	10	10
Assembly, Resistor switch, 1k per step	7546	*	*	*
Resistor, 1k	7541	10	10	10
Assembly, Resistor switch, 100 Ω per step	7547	*	*	*
Resistor, 100 Ω	7540	10	10	10
Assembly, Resistor switch, 10 Ω per step	7548	*	*	*
Resistor, 10 Ω	7539	10	10	10
Assembly, Resistor switch, 1 Ω per step	7549	*	*	*
Resistor, 1 Ω	7538	10	10	10
Assembly, Resistor switch, 0.1 Ω per step	7550C	*	*	*
Assembly, Resistor switch, 0.01 Ω per step	7591B	*	*	*
Cap, Binding post, black	1170	2	2	2
Cap, Binding post, gray**	1476			
Cap, Binding post, gold-plated	1172	1	1	1
Dial knob, black	7524	4	5	6
Dial knob, gray**	27524			

*One each where used; see Table 4-1.

**Later units have black binding post caps and knobs.

NOTE: The 0.01 Ω /step and 0.1 Ω /step decades are not constructed with individual resistors. When repairing switch assemblies 7550C and 7591B the entire assembly should be replaced.

V CALIBRATION

5.1 Accuracy

The accuracy of an In-Line DEKABOX[®] decade resistor should be verified as frequently as stability records indicate and prior to use in special test circuits where ambient temperature and/or dissipated power exceeds normal laboratory conditions.

5.2 Recommended Test Equipment

- 1) ESI[®] Model 242A Resistance Measuring System
- 2) ESI Model SR 1010 Resistance Transfer Standard, 1 Ω /step
- 3) ESI Model SR 1010 Resistance Transfer Standard, 10 Ω /step
- 4) ESI Model SR 1010 Resistance Transfer Standard, 100 Ω /step
- 5) ESI Model SR 1010 Resistance Transfer Standard, 1k/step
- 6) ESI Model SR 1010 Resistance Transfer Standard, 10k/step
- 7) ESI Model SR 1010 Resistance Transfer Standard, 100k/step
- 8) ESI Model PC 101 Parallel Compensating Network
- 9) ESI Model SPC 102 Series-Parallel Compensating Network
- 10) ESI Model SB 103 Shorting Bars (1 pair)
- 11) Thomas Pattern 1 Ω Standard Resistor

The DEKABOX should be calibrated with a Resistance Bridge that has an accuracy of at least $\pm(0.01\% + 0.0005 \text{ ohm})$ such as the Electro Scientific Industries Model 242A Resistance Measuring System which can be calibrated to an accuracy of $\pm 0.001\%$ with a set of ESI Model SR 1010 Resistance Transfer Standards and a Standard Resistor calibrated by the National Bureau of Standards.

5.3 Calibration Procedure

For maximum accuracy, the DEKABOX should be calibrated at 23°C with negligible power (e.g. 25 milliwatts) applied to its terminals. At any other ambient temperatures or input power greater than 100 milliwatts, temperature and power coefficients, unless accounted for, will adversely affect the calibration accuracy of the DEKABOX.

- a) Perform the preventive maintenance as described in Section III before calibrating the DEKABOX.
- b) Connect the DEKABOX to the Resistance Bridge.
- c) Measure the resistance with all DEKABOX dials set to zero. This zero resistance will be subtracted from all of the other resistance readings.
- d) Measure and record the resistance of the unit at the ten positions of each decade.
- e) Subtract the zero resistance (found in Step c above) from each reading.
- f) Record the ambient temperature and power applied to the terminals of the DEKABOX. Calculate and record the allowable changes in resistance value due to Temperature and Power Coefficients, whichever is

predominant. Sometimes both effects are appreciable, under given conditions.

- g) Verify that the DEKABOX has the desired accuracy or meets the specifications listed in Paragraph 1.3 by subtracting the results in Step f from Step e.

5.4 Service and Repair

As part of its Customer Service Program, Electro Scientific Industries provides field-factory service by experienced technical specialists and field sales engineers. Repair and recalibration servicing facilities at our factory in Portland, Oregon permit a turn-around time of one to two weeks, maximum. Spare parts are available from our factory, only, with delivery from stock to ten days after receipt of order.

Prior to returning the item to our factory, please correspond with us, requesting shipping instructions and stating the problem to be solved. Model Number, Serial Number and approximate date of purchase is helpful information.

WARRANTY OF QUALITY

Electro Scientific Industries, Inc., warrants its products to be free from defects in material and workmanship. Rigorous quality control permits the following standard warranties:

1. Two years for components and instruments utilizing passive circuitry. One year on repairs of out-of-warranty items.
2. One year on components and instruments utilizing active circuitry as identified in the price list. Six months on repair of out-of-warranty items.

During the in-warranty periods, we will service or, at our option, replace any device that fails in normal use to meet its published specifications. Batteries, tubes and relays that have given normal service are excepted. Special systems will have warranty periods as listed in their quotation.

DISCLAIMER OF IMPLIED WARRANTIES

THE FOREGOING WARRANTY OF ESI® IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED. ESI SPECIFICALLY DISCLAIMS ANY IMPLIED WARRANTIES OR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. In no event will ESI be liable for special or consequential damages. Purchaser's sole and exclusive remedy in the event any item fails to comply with the foregoing express warranty of ESI shall be to return the item to ESI, shipping charges prepaid, and at the option of ESI obtain a replacement item or a refund of the purchase price.



Electro Scientific Industries, Inc.

13900 N.W. Science Park Drive • Portland, Oregon 97229 • Telephone: (503) 641-4141

WARRANTY OF TRACEABILITY

The reference standards of measurement of Electro Scientific Industries, Inc., are compared with the U.S. National Standards through frequent tests by the U.S. National Bureau of Standards. The ESI working standards and testing apparatus used are calibrated against the reference standards in a rigorously maintained program of measurement control.

The manufacture and final calibration of all ESI instruments are controlled by the use of ESI reference and working standards and testing apparatus in accordance with established procedures and with documented results. (Reference MIL-STD 45662)

Final calibration of this instrument was performed with reference to the mean values of the ESI reference standards or to ratio devices that were verified at the time and place of use.

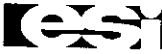
DISCLAIMER OF IMPLIED WARRANTIES

THE FOREGOING WARRANTY OF ESI® IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED. ESI SPECIFICALLY DISCLAIMS ANY IMPLIED WARRANTIES OR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. In no event will ESI be liable for special or consequential damages. Purchaser's sole and exclusive remedy in the event any item fails to comply with the foregoing express warranty of ESI shall be to return the item to ESI, shipping charges prepaid, and at the option of ESI obtain a replacement item or a refund of the purchase price.



Electro Scientific Industries, Inc.

13900 N.W. Science Park Drive • Portland, Oregon 97229 • Telephone: (503) 641-4141



ESI technical publications

ESI wants to provide you with instruction manuals that contain the information you need to do your job. That is why we have devised this survey. Your answers will help us as we revise the manuals you are now using and help us plan better manuals in the future.

First, we need to know something about you. We need to know a little about your job, your background, and your experience. This will help us to better understand your comments about a specific manual and to better design our manuals to satisfy your needs. The second part of this survey asks for your comments about a specific manual.

This survey form is bound in the back of every ESI manual. Please, let us know how we're doing.

When completed, fold, staple, and mail to ESI. The address and postage are included on the reverse side.

NAME _____

COMPANY _____

ADDRESS _____

CITY _____ STATE/COUNTRY _____ ZIP _____

User survey

1. What is your job title and function? (setup, service, operation, site management, etc.) _____
2. What is your background?
 - a. Your education/training/degree? _____
 - b. Your area of specialization? _____
3. Is your place of employment Small (less than 500 employees) Large (more than 500 employees) An academic institution
4. Is this your first experience with ESI instrumentation? YES NO
(If NO, which other products (model number) _____, how many years of such experience _____)
5. Rate your familiarity with electronic repair and troubleshooting
 POOR AVERAGE GOOD EXCELLENT
6. Is English your native language? YES NO
If NO, rate your English reading skill
 POOR AVERAGE GOOD EXCELLENT

Instruments manual evaluation

1. Manual title and part number _____
2. How long have you had this manual? _____
3. Your initial reaction to this manual was
 POOR FAIR GOOD EXCELLENT
4. How frequently do you use this manual?
 ONCE A LITTLE FAIRLY OFTEN OFTEN
5. Did the manual contain the information you needed? YES NO
If NO, what would you add _____
6. Did the organization of the manual help you locate the information you needed?
 YES NO
7. Were there too many or too few examples?
 TOO MANY TOO FEW ABOUT RIGHT
8. Did the examples help you understand the information? YES NO
9. Was the writing in the manual
 HARD TO UNDERSTAND AVERAGE EASY TO UNDERSTAND
10. Was the tone of the manual
 STILTED NEUTRAL FRIENDLY PATRONIZING
11. Was the level of the information
 OVERSIMPLIFIED ABOUT RIGHT TOO TECHNICAL
12. Was the organization of the manual
 ILLOGICAL, HARD TO FOLLOW LOGICAL, EASY TO FOLLOW
13. Did you like the binding of the manual? YES NO
If NO, what would you prefer _____
14. Did you find any defects in the printing or binding of the manual?
 YES NO
If YES, what were the problems _____
15. How would you compare ESI's manuals with those of other manufacturers?
 WORSE SAME BETTER CANNOT COMPARE
Compared to which manufacturer? _____

e/s/i, form no. 929 4-82



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES



BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. A-649 PORTLAND, OR. U.S.A.



POSTAGE WILL BE PAID BY ADDRESSEE

Electro Scientific Industries, Inc.

13900 N.W. Science Park Drive
Portland, Oregon 97229

