

80E Voltage Divider

Instruction Manual

P/N 293860
March 1965



WARRANTY

Notwithstanding any provision of any agreement the following warranty is exclusive:

The JOHN FLUKE MFG. CO., INC., warrants each instrument it manufactures to be free from defects in material and workmanship under normal use and service for the period of 1 year from date of purchase. This warranty extends only to the original purchaser. This warranty shall not apply to fuses, disposable batteries (rechargeable type batteries are warranted for 90 days), or any product or parts which have been subject to misuse, neglect, accident, or abnormal conditions of operations.

In the event of failure of a product covered by this warranty, John Fluke Mfg. Co., Inc., will repair and calibrate an instrument returned to an authorized Service Facility within 1 year of the original purchase; provided the warrantor's examination discloses to its satisfaction that the product was defective. The warrantor may, at its option, replace the product in lieu of repair. With regard to any instrument returned within 1 year of the original purchase, said repairs or replacement will be made without charge. If the failure has been caused by misuse, neglect, accident, or abnormal conditions of operations, repairs will be billed at a nominal cost. In such case, an estimate will be submitted before work is started, if requested.

THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS, OR ADEQUACY FOR ANY PARTICULAR PURPOSE OR USE. JOHN FLUKE MFG. CO., INC., SHALL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER IN CONTRACT, TORT, OR OTHERWISE.

If any failure occurs, the following steps should be taken:

1. Notify the JOHN FLUKE MFG. CO., INC., or nearest Service facility, giving full details of the difficulty, and include the model number, type number, and serial number. On receipt of this information, service data, or shipping instructions will be forwarded to you.
2. On receipt of the shipping instructions, forward the instrument, transportation prepaid. Repairs will be made at the Service Facility and the instrument returned, transportation prepaid.

SHIPPING TO MANUFACTURER FOR REPAIR OR ADJUSTMENT

All shipments of JOHN FLUKE MFG. CO., INC., instruments should be made via United Parcel Service or "Best Way" prepaid. The instrument should be shipped in the original packing carton; or if it is not available, use any suitable container that is rigid and of adequate size. If a substitute container is used, the instrument should be wrapped in paper and surrounded with at least four inches of excelsior or similar shock-absorbing material.

CLAIM FOR DAMAGE IN SHIPMENT TO ORIGINAL PURCHASER

The instrument should be thoroughly inspected immediately upon original delivery to purchaser. All material in the container should be checked against the enclosed packing list. The manufacturer will not be responsible for shortages against the packing sheet unless notified immediately. If the instrument is damaged in any way, a claim should be filed with the carrier immediately. (To obtain a quotation to repair shipment damage, contact the nearest Fluke Technical Center.) Final claim and negotiations with the carrier must be completed by the customer.

The JOHN FLUKE MFG. CO., INC., will be happy to answer all applications or use questions, which will enhance your use of this instrument. Please address your requests or correspondence to: JOHN FLUKE MFG. CO., INC., P.O. BOX C9090, EVERETT, WASHINGTON 98206, ATTN: Sales Dept. For European Customers: Fluke (Holland) B.V., P.O. Box 5053, 5004 EB, Tilburg, The Netherlands.

*For European customers, Air Freight prepaid.

John Fluke Mfg. Co., Inc., P.O. Box C9090, Everett, Washington 98206

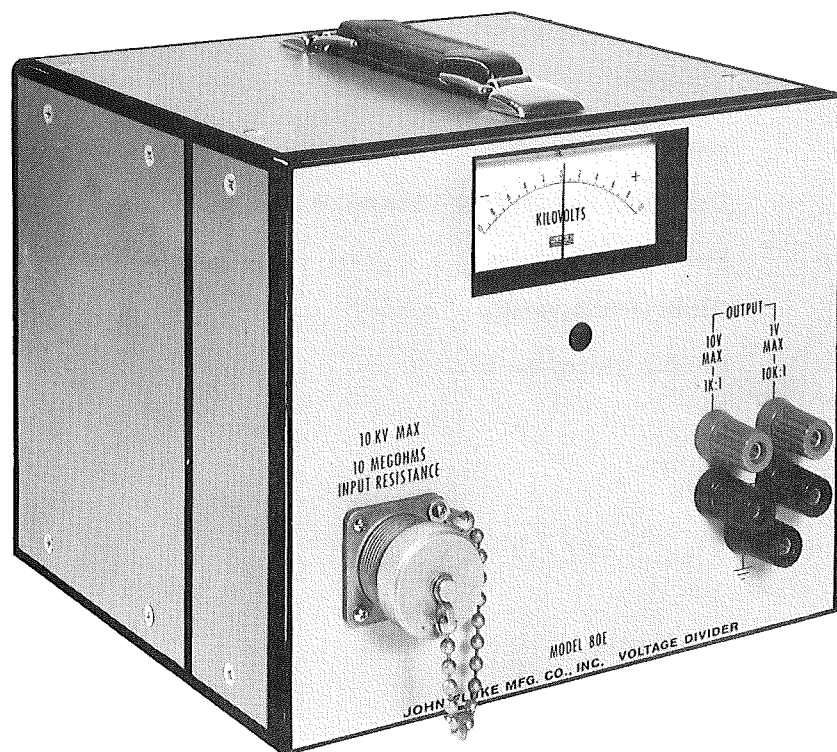
Rev. 6/81

TABLE OF CONTENTS

Section	Title	Page
I	INTRODUCTION AND SPECIFICATIONS	1-1
	1-1. Introduction	1-1
	1-5. Specifications	1-1
	1-6. Electrical	1-1
	1-7. Mechanical	1-1
II	OPERATING INSTRUCTIONS	2-1
	2-1. Operating Procedure	2-1
III	THEORY OF OPERATION	3-1
	3-1. Theory of Operation	3-1
IV	MAINTENANCE	4-1
	4-1. Introduction	4-1
	4-2. Troubleshooting	4-1
	4-5. Calibration of 80E-10.	4-1
	4-7. Calibration of 80E-5	4-2
V	LIST OF REPLACEABLE PARTS	5-1
	5-1. Introduction	5-1
	5-2. How to Obtain Parts	5-1
	5-3. Use Code Effectivity	5-5
	WARRANTY	
	CIRCUIT DIAGRAM	

LIST OF ILLUSTRATIONS

Figure	Title	Page
Frontispiece	80E Voltage Divider.	iv
4-1.	Equipment Required for Calibration	4-1
5-1.	Final Assembly.	5-1
5-2.	Calibration Assembly	5-3
5-3.	Divider Assembly.	5-4



MODEL 80E VOLTAGE DIVIDER

SECTION I

INTRODUCTION AND SPECIFICATIONS

1-1. INTRODUCTION

1-2. The Model 80E Voltage Dividers extend the measuring range of Fluke differential voltmeters. The Model 80E-10 has a maximum input voltage of 10KV. The Model 80E-5 has a maximum input voltage of 5KV. Other input voltages are available on request. Both 10V and 1V output terminals are provided, which permit use of the 80E with Fluke differential voltmeters, or a null-type potentiometer.

1-3. A center zero panel meter permits observation of the approximate magnitude and polarity of the unknown voltage. In order to ensure maximum accuracy and long life, properly aged, wirewound resistors, having a very low temperature coefficient, are used throughout the instrument. The case of the instrument is suitable for either bench use or rack mounting.

1-4. This instrument has been thoroughly checked and tested before being shipped from the factory. Immediately after receiving the instrument, carefully inspect for any damage which may have occurred during transit. If any damage is noted, refer to the instructions outlined in the back of this manual.

1-5. SPECIFICATIONS

1-6. ELECTRICAL

ACCURACY: $\pm 0.01\%$ for both division ratios over a temperature range from 18°C to 28°C and for any input voltage up to rated maximum. Derate at $2\text{ ppm}/^{\circ}\text{C}$ outside this temperature range to 0°C and 50°C .

STABILITY OF DIVISION RATIO: $\pm 0.01\%$ per year (recalibrated by internal adjustment).

METER: Center zero panel meter for indicating approximate magnitude and polarity of unknown high voltage.

1-7. MECHANICAL

INPUT CONNECTOR: MS3102A-18-16S on front panel (mating connector supplied).

OUTPUT CONNECTORS: Two binding posts on $3/4''$ centers for each of two outputs. One side of each output is common to chassis. Separate binding post for grounding case. All output connectors located on front of instrument.

TEMPERATURE RANGE:
 0°C to 50°C (32°F to 122°F) operating
 -35°C to 70°C (-31°F to 158°F) storage

HUMIDITY:
 0 to 80% (to 28°C)
 0 to 60% (to 50°C)

ALTITUDE:
 0 to $10,000$ feet operating
 0 to $50,000$ feet non-operating

VIBRATION:
MIL-T-945A.

SHOCK: Meets half sine (20g's, 11 milliseconds) shock and bench handling requirements of MIL-E-4970A.

SIZE:
 $7''$ high x $8-1/2''$ wide x $8''$ deep.

WEIGHT: Approximately 6 pounds.

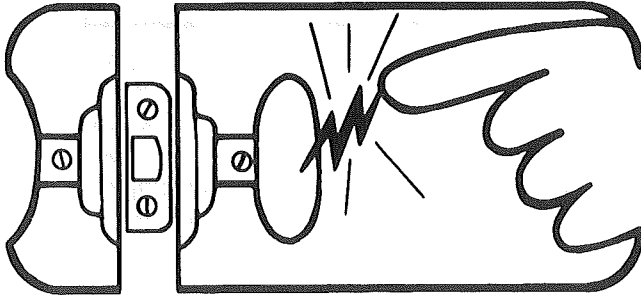
Model	Division Ratio		Maximum Input	Current Drawn at Maximum Input	Total Input Resistance
	10V Max	1V Max			
80E-5	500:1	5,000:1	5 KV	1 ma	5 Meg
80E-10	1000:1	10,000:1	10 KV	1 ma	10 Meg



static awareness



A Message From
John Fluke Mfg. Co., Inc.

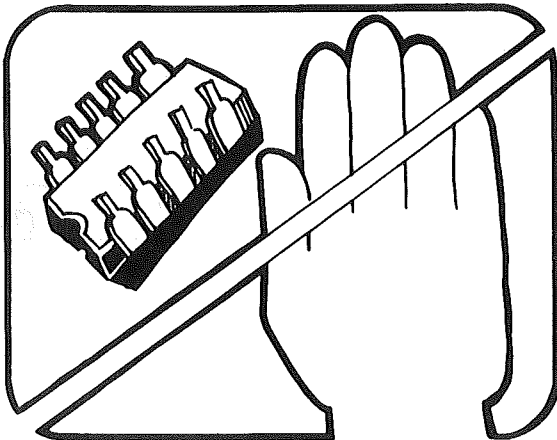


Some semiconductors and custom IC's can be damaged by electrostatic discharge during handling. This notice explains how you can minimize the chances of destroying such devices by:

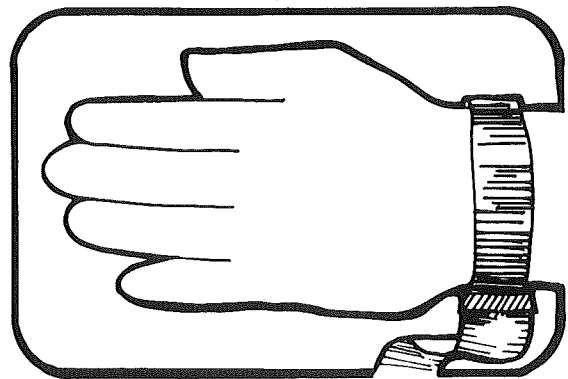
1. Knowing that there is a problem.
2. Learning the guidelines for handling them.
3. Using the procedures, and packaging and bench techniques that are recommended.

The Static Sensitive (S.S.) devices are identified in the Fluke technical manual parts list with the symbol "⊗"

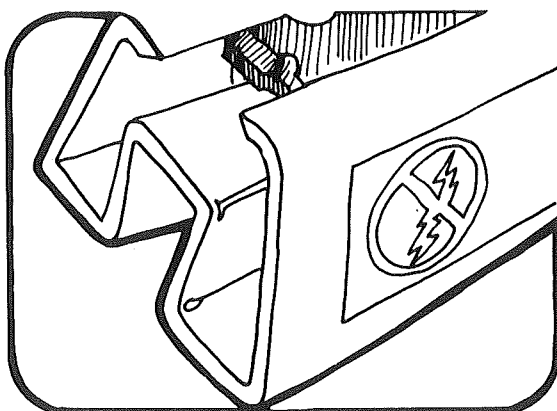
The following practices should be followed to minimize damage to S.S. devices.



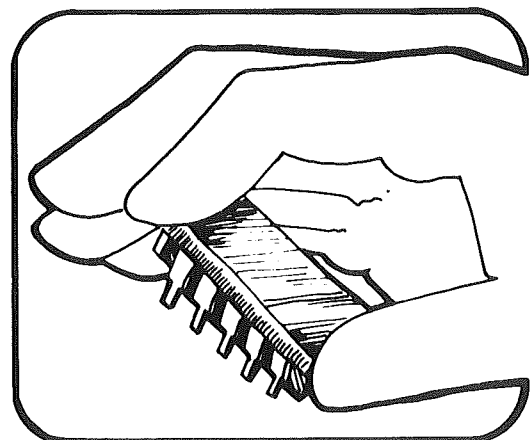
1. MINIMIZE HANDLING



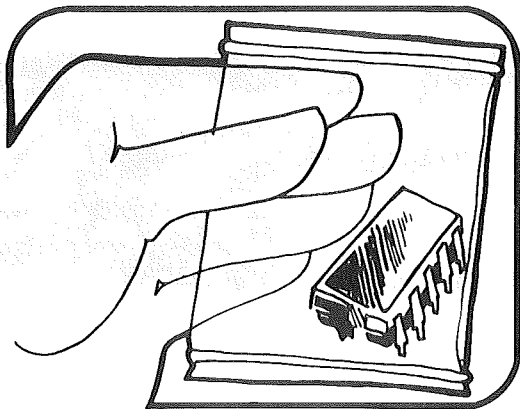
3. DISCHARGE PERSONAL STATIC BEFORE HANDLING DEVICES. USE A HIGH RESISTANCE GROUNDING WRIST STRAP.



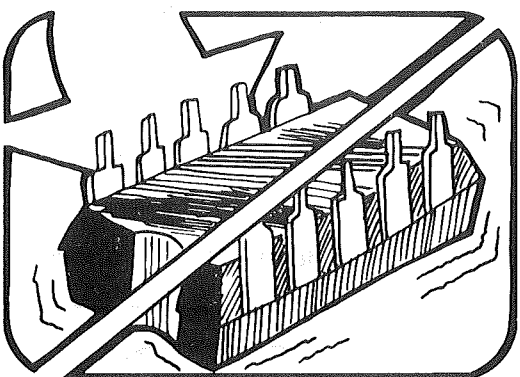
2. KEEP PARTS IN ORIGINAL CONTAINERS UNTIL READY FOR USE.



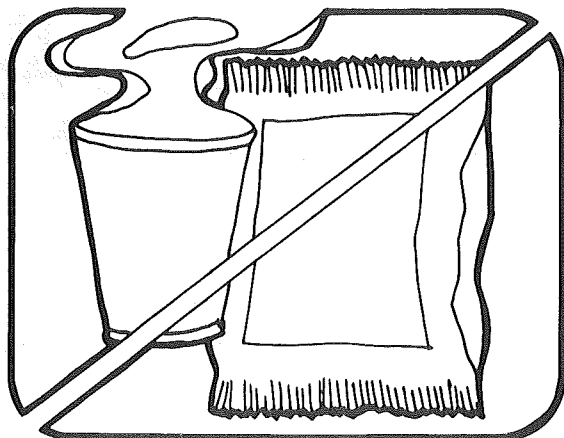
4. HANDLE S.S. DEVICES BY THE BODY



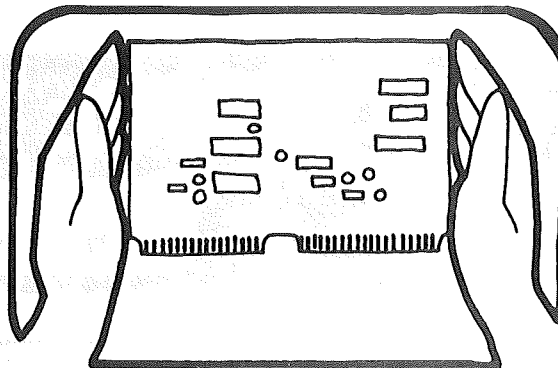
5. USE STATIC SHIELDING CONTAINERS FOR HANDLING AND TRANSPORT



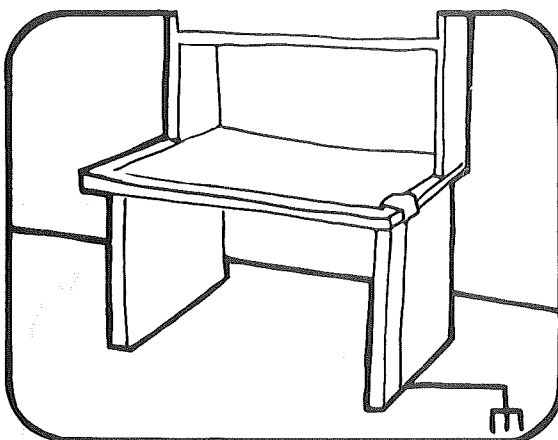
6. DO NOT SLIDE S.S. DEVICES OVER ANY SURFACE



7. AVOID PLASTIC, VINYL AND STYROFOAM® IN WORK AREA



8. WHEN REMOVING PLUG-IN ASSEMBLIES, HANDLE ONLY BY NON-CONDUCTIVE EDGES AND NEVER TOUCH OPEN EDGE CONNECTOR EXCEPT AT STATIC-FREE WORK STATION. PLACING SHORTING STRIPS ON EDGE CONNECTOR HELPS TO PROTECT INSTALLED SS DEVICES.



9. HANDLE S.S. DEVICES ONLY AT A STATIC-FREE WORK STATION
10. ONLY ANTI-STATIC TYPE SOLDER-SUCKERS SHOULD BE USED.
11. ONLY GROUNDED TIP SOLDERING IRONS SHOULD BE USED.

A complete line of static shielding bags and accessories is available from Fluke Parts Department, Telephone 800-526-4731 or write to:

JOHN FLUKE MFG. CO., INC.
PARTS DEPT. M/S 86
9028 EVERGREEN WAY
EVERETT, WA 98204

PORTIONS REPRINTED
WITH PERMISSION FROM TEKTRONIX, INC.
AND GENERAL DYNAMICS, POMONA DIV.

SECTION II

OPERATING INSTRUCTIONS

2-1. OPERATING PROCEDURE

- a. Connect the ground side of the voltage to be measured to the ground terminal on the front panel. Please note that the shell of the large input connector is also connected to chassis ground.
- b. Connect the voltage to be measured to the large input connector.
- c. Connect a Fluke 800 series differential voltmeter to either set of output terminals. Voltages marked by

the OUTPUT terminals (10V and 1V) refer to the output voltage at maximum indicated input.

- d. Null the voltmeter to indicate the magnitude of the unknown voltage.

- e. If desired, instead of using the Fluke voltmeter in step c, a Leeds & Northrup Type K-3 Potentiometer may be connected to the 1V OUTPUT terminal, and adjusted to indicate the unknown voltage.

SECTION III

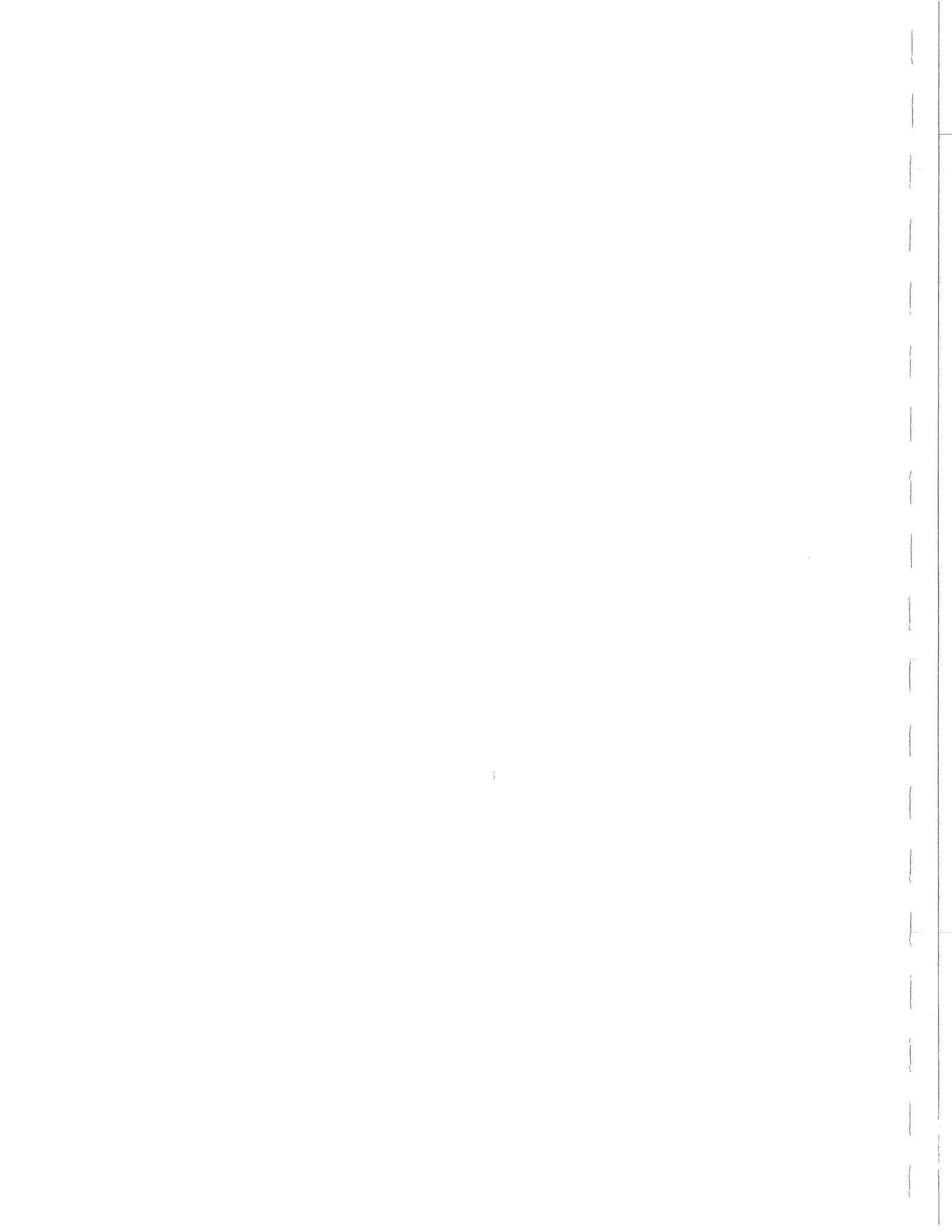
THEORY OF OPERATION

3-1. THEORY OF OPERATION

3-2. The 80E is a standard type of potentiometric voltage divider. Specified accuracy of the division ratio is obtained only when the instrument connected to the output terminals of the 80E has infinite input impedance. A voltmeter having 10 megohms input resistance will "load" the 10V output of the divider, causing an error of approximately 0.1%. Fluke differential voltmeters present infinite input impedance to the voltage divider at null, and consequently, cause no loading error.

3-3. Resistors used in the 80E are precision wirewound units having a low temperature coefficient, which promotes instrument accuracy and stability.

3-4. The overall accuracy of the panel meter, including the effects of series resistance, is approximately 3% of full scale. The meter is useful for indicating the approximate magnitude and polarity of the unknown voltage.



SECTION IV

MAINTENANCE

4-1. INTRODUCTION

4-2. The Model 80E Voltage Divider requires a minimum of maintenance. Occasionally, dust should be removed from the instrument by clean, dry, pressurized air. The front panel connectors may be cleaned using anhydrous alcohol. If the circuit boards require cleaning, they can also be cleaned with anhydrous alcohol.

4-2. TROUBLESHOOTING

4-3. The following two items are the only usual sources of trouble in the 80E:

- a. Instability of the output voltage, which is usually caused by a short in one or more resistors.
- b. Output voltage out-of-tolerance, which is usually caused by:
 - (1) Dirty output connectors.
 - (2) Dusty printed circuit boards.
 - (3) A change in value of a resistor.

4-4. The remedy, as suggested by the preceeding paragraph, is to clean the dusty or dirty surface, and/or replace the defective resistor.

4-5. CALIBRATION OF 80E-10

4-6. The division ratio accuracy of the 80E should be checked approximately every six months. The equipment required for calibration is listed in Figure 4-1.

NOTE

Full input voltage should be applied to the 80E for a minimum of 30 minutes prior to calibration.

a. CALIBRATION OF IV OUTPUT

(1) Connect the positive output terminal of the 301E to the 30V terminal of the 9700A and to the 10V OUTPUT terminal of the 80E. The connecting leads must be equal in length.

(2) Connect the 840A galvanometer between the 3V terminal of the 9700A and the 1V OUTPUT terminal of the 80E. Set the 840A to the 300-0-300 nanoampere range.

(3) Set the output of the 301E to 10V.

(4) Adjust R3, located on the calibration board, to null the 840A. As null is approached, the 840A may be set to a more sensitive range.

b. METER CALIBRATION

(1) Disconnect the Model 301E, and connect the positive output of a Fluke Model 410A to the large input connector of the 80E.

(2) Set the 410A for 10KV output.

(3) Adjust R4 for full-scale deflection of the panel meter.

c. CALIBRATION OF 10V OUTPUT

(1) Connect the positive output of the 410A to the 1500V terminal of the 9700A and to the 80E input connector. The connecting leads must be equal in length.

EQUIPMENT	SPECIFICATIONS
DC Power Supplies, Fluke Models 301E and 410A or equivalent.	Must provide stable outputs of 10V, and up to 10KV, respectively.
Galvanometer, Fluke Model 840A.	Null Detector. Sensitivities of 2 na per division and 20 na per division.
Volt Box, Sensitive Research, Type 9700A or equivalent.	Division ratios of 1,000 to 1 and 10,000 to 1. (500 to 1 and 5,000 to 1 for the 80E-5).

Figure 4-1. EQUIPMENT REQUIRED FOR CALIBRATION

(2) Connect the 840A between the 1.5V terminal of the 9700A and the 10V OUTPUT terminal of the 80E. Set the 840A to the 3-0-3 microampere range.

(3) Set the 410A for 750V output.

(4) Adjust R5, and then R6, to null the 840A. As null is approached, the 840A may be set to more sensitive ranges. If R5 and R6 do not provide sufficient resistance, the jumpers across R7, R8, and/or R9 can be removed.

4-7. CALIBRATION OF 80E-5

NOTE

Full input voltage should be applied to the 80E for a minimum of 30 minutes prior to calibration.

a. CALIBRATION OF IV OUTPUT

(1) Perform the steps indicated in paragraph 4-6a.

b. METER CALIBRATION

(1) Disconnect the Model 301E, and connect the positive output of a Fluke Model 410A to the large input connector of the 80E.

(2) Set the 410A for 5KV output.

(3) Adjust R4 for full-scale deflection of the panel meter.

c. CALIBRATION OF 10V OUTPUT

(1) Connect the positive 410A output terminal to the 1500V terminal of the 9700A and to the input terminal of the 80E-5. The connecting leads must be equal in length.

(2) Connect the 840A between the 3V terminal of the 9700A and the 10V OUTPUT terminal of the 80E. Set the 840A to the 3-0-3 microampere range.

(3) Set the 410A for 750V output.

(4) Adjust R5, and then R6, to null the 840A. As null is approached, the 840A may be set to more sensitive ranges. If R5 and R6 do not provide sufficient resistance, the jumpers across R7, R8, and/or R9 can be removed.

✓

SECTION V

LIST OF REPLACEABLE PARTS

5-1. INTRODUCTION

The following list describes all normally replaceable parts of the Model 80E Voltage Divider. Parts are identified on the list by reference designations from the schematic diagram.

5-2. HOW TO OBTAIN PARTS

a. Most parts are standard components and can be obtained locally. All parts manufactured, altered, or

designed by Fluke are designated by an asterisk preceding the Fluke part number. All structural parts and all special parts should be ordered from your local Fluke representative or from the factory.

b. When ordering parts always include:

(1) Reference designation, description, and Fluke stock number.

(2) Instrument model and serial number.

c. Most structural parts are not listed in the following chart. To order these, give complete description, function and location of part.

REF DESIG	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
	Final Assembly - Figure 5-1						
	Calibration Assembly - Figure 5-2	1702-167163	89536	1702-167163	1		
R1	Res, ww, 1k, $\pm 0.01\%$, 1/2w	4707-166579	89536	4707-166579	1		A
R2	Res, ww, 8.998k $\pm 0.01\%$, 1/2w	4707-166587	89536	4707-166587	1		A
R1, R2	Resistor set, matched	4710-233072	89536	4710-233072	1		B
R3	Res, var, ww, $5\Omega \pm 20\%$, 1-1/4w	4702-166348	71450	Type 110	1		
R4	Res, var, ww, $200\Omega \pm 20\%$, 1-1/4w	4702-144766	71450	Type 110	1		
R5	Res, var, ww, $10k \pm 10\%$, 1/4w	4702-111641	80294	275-1-103	1		
R6	Res, var, ww, $100\Omega \pm 20\%$, 1-1/4w	4702-112797	71450	Type 110	1		
R7, R8, R9	Res, ww, $8k \pm 0.02\%$, 1w	4707-131946	89536	4707-131946	3		
R10	Res, ww, $482k \pm 0.1\%$, 1w	4707-166595	89536	4707-166595	1		

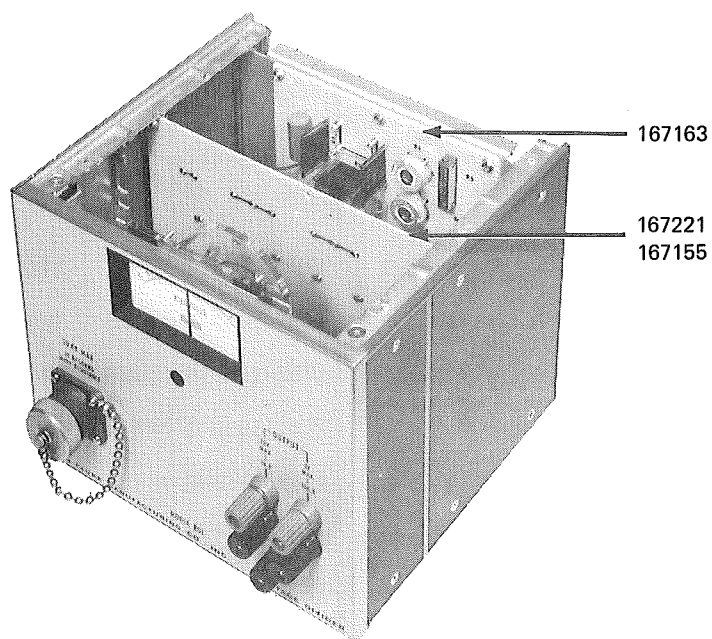
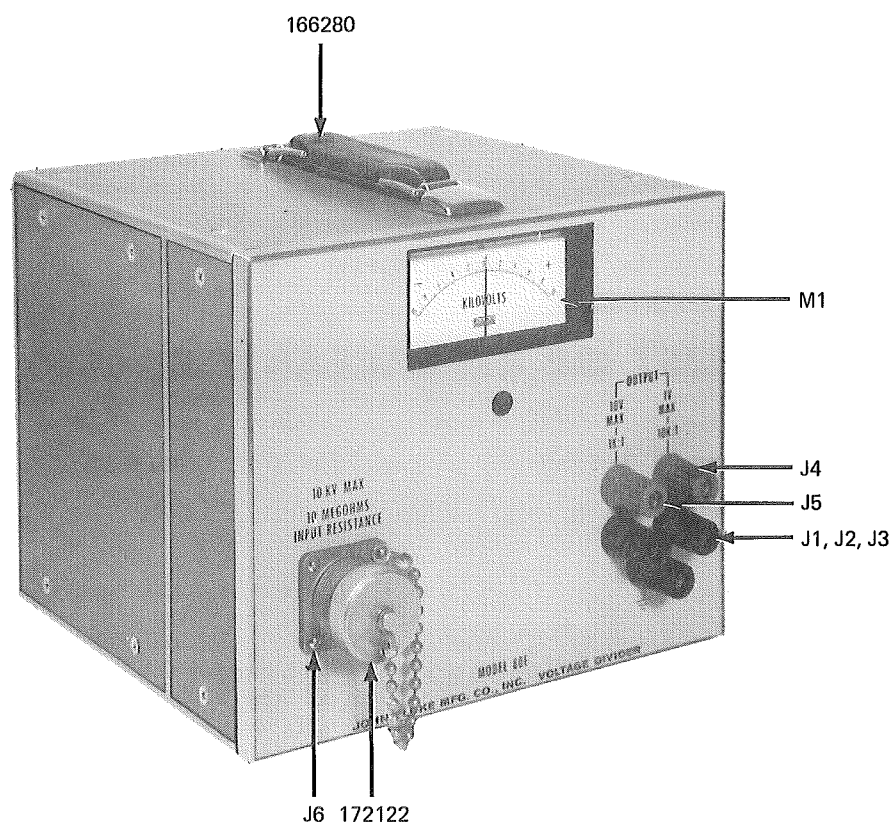


Figure 5-1. FINAL ASSEMBLY

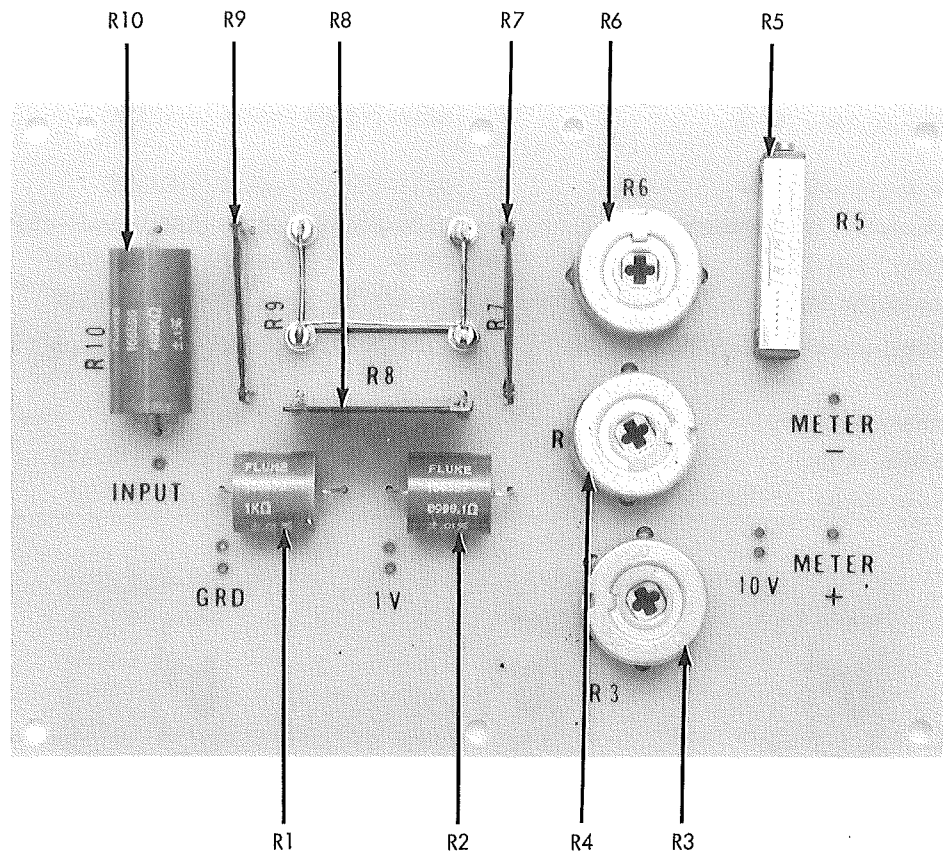


Figure 5-2. CALIBRATION ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
R11 thru R19	Driver Assembly - Figure 5-3						
	80E-5 only	1702-167221	89536	1702-167221	1		
	80E-10 only	1702-167155	89536	1702-167155	1		
	Res, ww, 500k $\pm 0.1\%$, 1w (80E-5 only) (R11/R12, R13/R14, R15/R16, R17/R18 must be replaced in pairs.) (R11 thru R19 may be ordered as a set, part number 4710-223685.)	4707-192773	89536	4707-192773	9		
R11 thru R29	Res, ww, 500k $\pm 0.1\%$, 1w (80E-10 only) (R11/R12, R13/R14, R15/R16, etc. must be replaced in pairs.) (R11 thru R29 may be ordered as a set, part number 4710-223701.)	4707-192773	89536	4707-192773	19		
J1, J2 J3	Binding post, black	2811-142984	58474	DF31BC	3		
J4, J5	Binding post, red	2811-142976	58474	DF31RC	2		
J6	Connector, high voltage	2104-208819	02660	MS3102A-18-16P	1		
M1	Meter, 1-0-1 ma	2901-167262	89536	2901-167262	1		
	Connector cap	3155-172122	89536	3155-172122	1		
	Mating connector (not illustrated)	2104-208827	02660	NS3106A-18- 16S	1		
	Rubber supports	2819-103309	77969	9102-W	4		
	Handle, 4 inch	2404-166280	12136	919-415-173	1		
	Cable clamp (AN3057-10)	2104-100149	02660	AN3057-10	1		

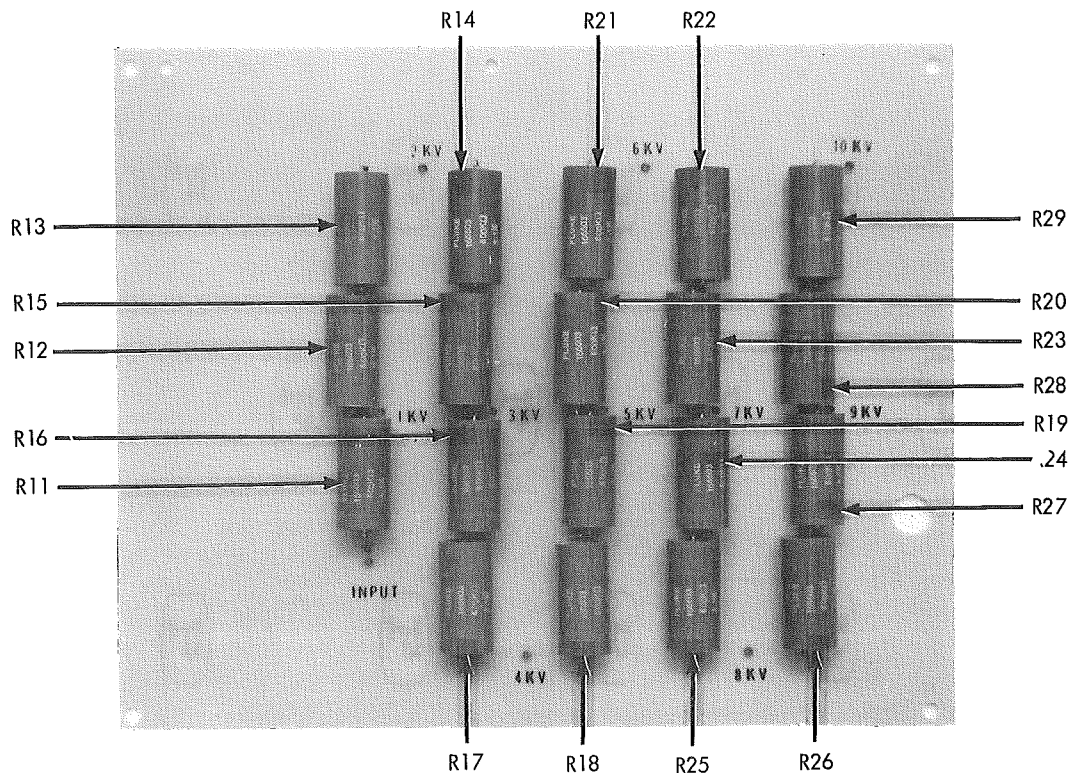


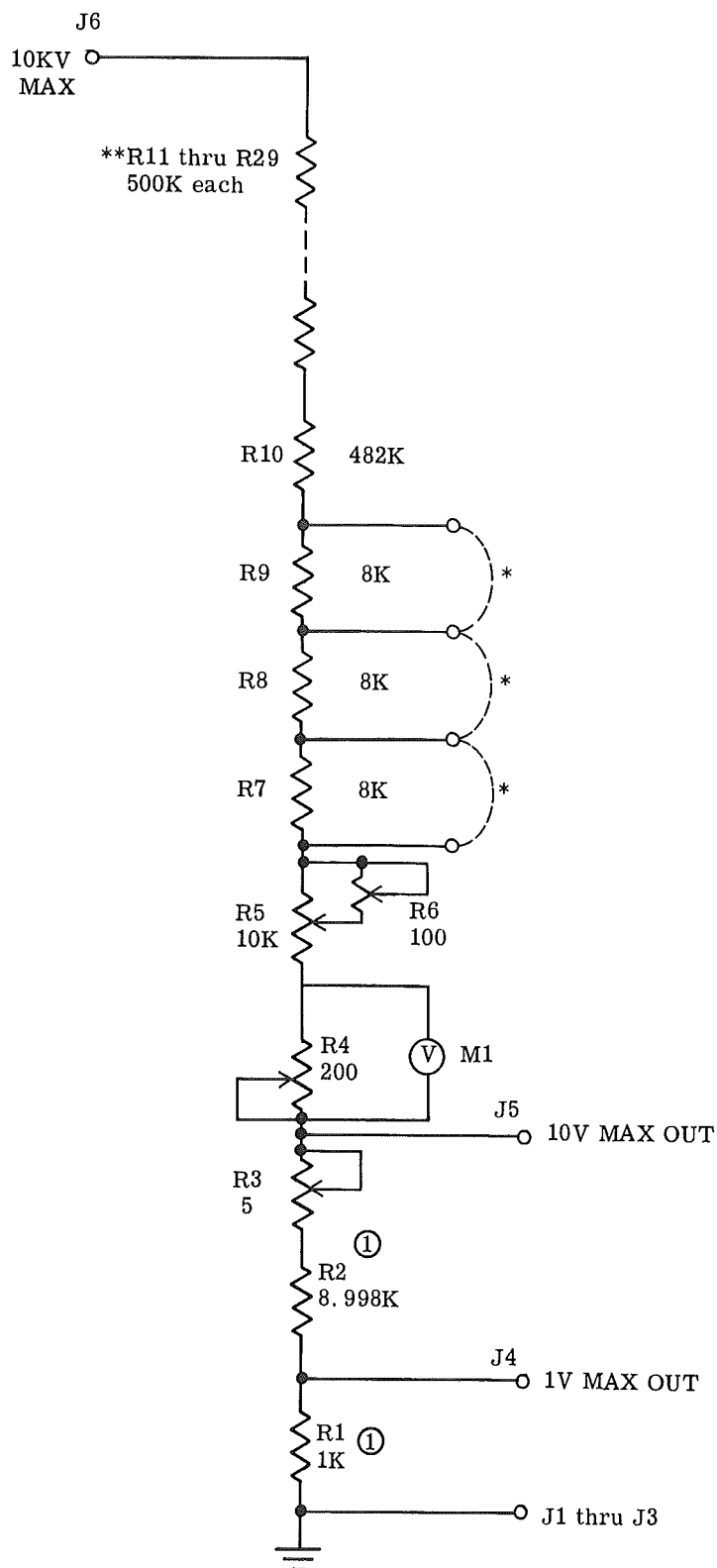
Figure 5-3. DIVIDER ASSEMBLY

5-3. USE CODE EFFECTIVITY

The following list of use codes is intended to allow the customer to determine the effectivity of all replaceable parts. All parts with no code are used on all instruments with serial numbers above 123. New codes will be added as necessary.

USE CODE	EFFECTIVITY
No Code	Model 80E serial number 123 and on
A	Model 80E serial number 123 to 459
B	Model 80E serial number 460 and on





*Calibration jumper

**Note: R20 thru R29 not
used on 80E-5

① For Model 80E-5 & 80E-10
serial number 460 and on
R1 & R2 changed to matched
set

All resistors are in ohms and
all capacitors are in microfarads
unless otherwise noted.

FUNCTIONAL SCHEMATIC

**MODEL 80E-5
MODEL 80E-10**

VOLTAGE DIVIDER

MODEL 80E-5	SER. NO. 123 & ON
MODEL 80E-10	SER. NO. 123 & ON

FLUKE JOHN FLUKE MFG. CO., INC.

