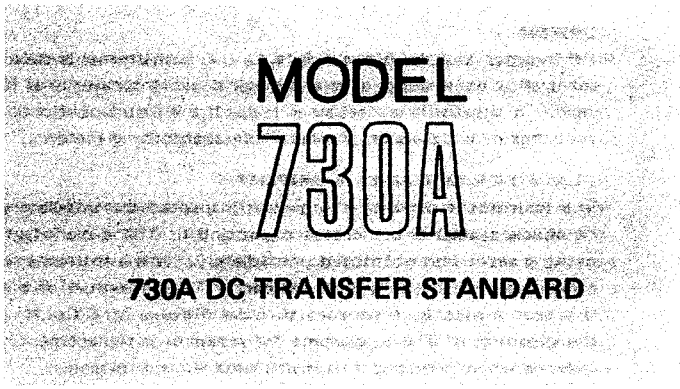
JOHN FLUKE MFG. CO., INC.

P. O. Box 7428

Seattle, Washington 98133



MODEL 730A, SERIAL NO. _____ AND ON.

warranty

The JOHN FLUKE MFG. CO., INC. warrants each instrument manufactured by them to be free from defects in material and workmanship. Their obligation under this Warranty is limited to servicing or adjusting an instrument returned to the factory for that purpose, and to making good at the factory any part or parts thereof; except tubes, fuses, choppers and batteries, which shall, within one year after making delivery to the original purchaser, be returned by the original purchaser with transportation charges prepaid, and which upon their examination shall disclose to their satisfaction to have been thus defective. If the fault has been caused by misuse or abnormal conditions of operation, repairs will be billed at a nominal cost. In this case, an estimate will be submitted before work is started, if requested.

If any fault develops, the following steps should be taken:

1. Notify the John Fluke Mfg. Co., Inc., 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 forewarded to you.

2. On receipt of the shipping instructions, forward the instrument prepaid, and repairs will be made at the factory. If requested, an estimate of the charges will be made before the work begins, provided the instrument is not covered by the Warranty.

SHIPPING

All shipments of John Fluke Mfg. Co., Inc. instruments should be made via Railway Express prepaid. The instrument should be shipped in the original packing carton; or if it is not available, use any suitable container that is rigid. 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

The instrument should be thoroughly inspected immediately upon receipt. 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 fails to operate properly, or is damaged in any way, a claim should be filed with the carrier. A full report of the damage should be obtained by the claim agent, and this report should be forwarded to John Fluke Mfg. Co., Inc. Upon receipt of this report you will be advised of the disposition of the equipment for repair or replacement. Include the model number, type number, and serial number when referring to this instrument for any reason.

The John Fluke Mfg. Co., Inc. will be happy to answer all application questions which will enhance your use of this instrument. Please address your requests to: JOHN FLUKE MFG. CO., INC., P.O. BOX 7428, SEATTLE, WASHINGTON 98133.

ERRATA
MODEL 730A
DC TRANSFER STANDARD

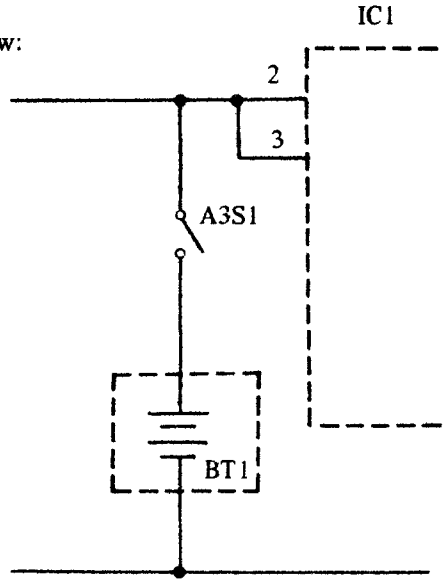
Page 2-2, Figure 2-1

Switch designated "115/250V switch" should be "115/230V switch".

Page 5-10

R15 should be Res, met film, 31.6K ±1%, ½w, STOCK NO. 291146.
R16 should be Res, met film, 8.06K ±1%, ½w, STOCK NO. 291153.

Schematic No. 1
Add switch to schematic as shown below:



Change the designation of R15 to R16.
Change the designation of R16 to R15.

Page 4-3, Figure 4-2

Reverse connections to Standard Cell so that "+" terminal of Standard Cell connects to "+" terminal of 730A.

Page 4-4, Paragraph 4-22(b)

Change to read:
"b. Connect the negative output terminal of the 341A to the guard terminal of the 730A and the positive output terminal of the 341A to case (ground) of the 730A."

Page 4-6, Table 4-2

STEP 6: Change 1.0199999 to 1.0199990.

STEP 7: Change R1 to R5.

Page 5-12

Add the following parts information to table:

FLUKE STOCK NO.	MFR.	MFR. PART NO.
291823	58474	DF31WTC
292771	89536	292771

Page 5-11, Figure 5-4

Change reference designation "R24" to "R21".

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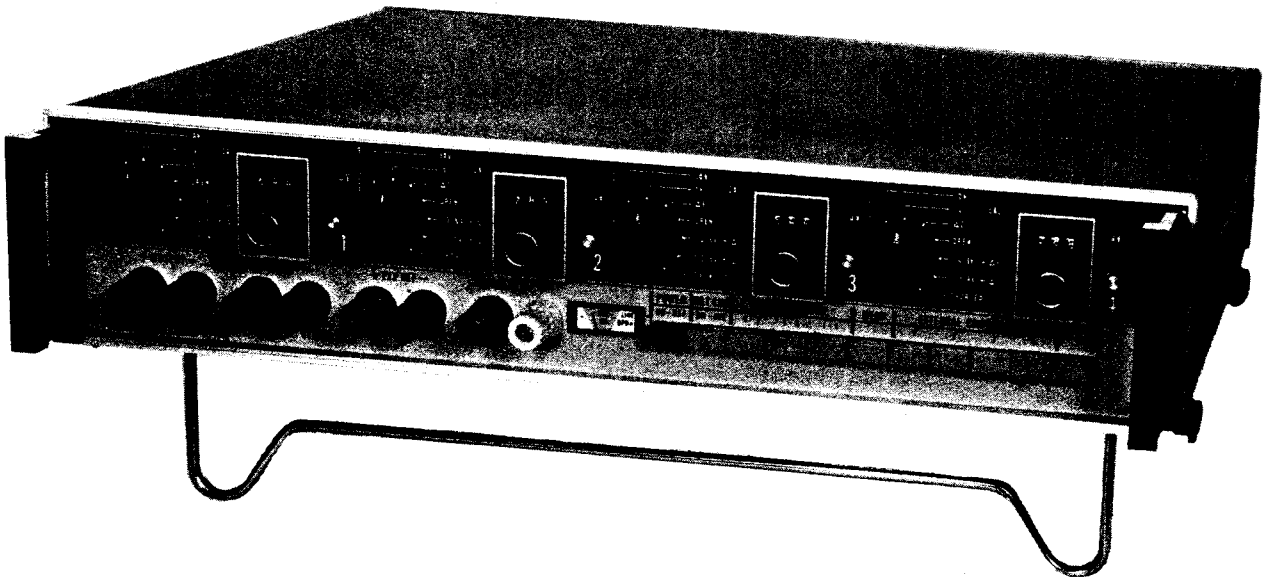


MODEL 730A DC TRANSFER STANDARD

Section 1

Introduction & Specifications

1-1. INTRODUCTION

1-2. The Model 730A DC Transfer Standard is a versatile instrument providing a variety of precision voltages with standard cell accuracy. The instrument incorporates four identical, isolated reference supplies. They each may be operated individually to provide basic outputs of 10 volts, 1 volt, 1.018 volts + ΔE, 1.019 volts + ΔE, and ΔE (0 to 999 uv). The four supplies can also be connected in series or parallel via front panel controls to provide numerous voltage combinations.

1-3. The ΔE control is a precision 10 turn linear potentiometer which has a 3-digit direct reading dial. Resolution of the control is 1 microvolt, thus allowing 1 microvolt steps (to 999 uv) to be added to the 1.018 and 1.019 volt outputs. The ΔE output may be selected independently as well.

1-4. The primary reference element in the 730A is a reference amplifier with precisely known characteristics. The device is a zener diode with active circuitry added to provide a voltage reference with a very low temperature coefficient over a 55°C temperature range. Output voltage stability is better than 10 ppm/month; transfer accuracy is 2 ppm/month between standard cells; and in parallel operation (all supply outputs paralleled), the arithmetic mean output will be within 1.0 ppm of a straight line for 90 days.

1-5. Each supply is separately powered by its own rechargeable battery pack. State of charge is indicated on a front panel meter.

1-6. ELECTRICAL SPECIFICATIONS

Output Voltage:	10.000 volts dc 1.000 volts dc (1.018 + ΔE) volts dc (1.019 + ΔE) volts dc ΔE: +0.0 to 999 uv in 1 uv steps
Transfer Accuracy:	2 ppm between standard cells. 3 ppm between standard cell and 1 volt output. 5 ppm between standard cell and 10 volt output.
ΔE Resolution and Accuracy:	1 uv
Reference Stability:	Better than 10 ppm per month after 30 minute warmup. Mean of four outputs within 1 ppm of a straight line for 90 days.
Line Regulation:	Less than 1 ppm/±10% line variation.
Output Impedance:	Less than 1.1 kΩ for 1v, 1.018v, 1.019v and 10v positions. Less than 150Ω for ΔE (0.0 to 999 uv) positions.
Ripple & Noise:	Less than 1 ppm p-p from dc to 1 Hz. Less than 20 uv rms from 1 Hz to 1 MHz.

Common Mode Rejection:	120 db at dc 100 db at 60 Hz 85 db at 400 Hz
Output Current:	5 ma (maximum) per reference element with output shorted. No instrument damage from shorted output.
Isolation:	Output may be floated up to 1000 vdc between chassis ground and guard.
Calibration	Separate internal adjustments for the five output voltages. Front panel adjustment common to all voltages including the 10.000v output. Calibrate at 90-day intervals. Basic reference adjustments accessible from front panel.

1-7. ENVIRONMENTAL SPECIFICATIONS

Temperature Range:	+0°C to +55°C operating –40°C to +60°C storage

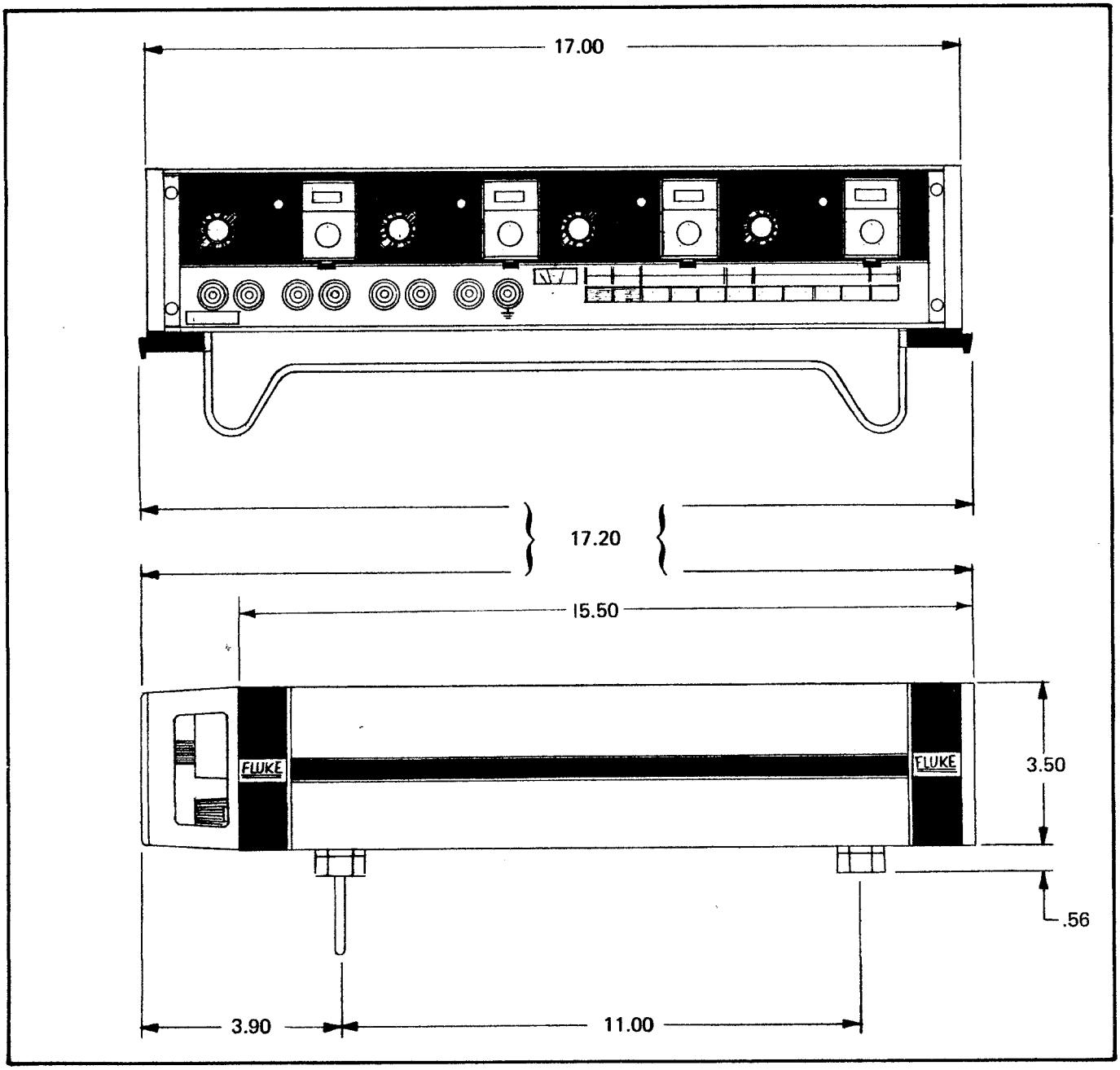


Figure 1-1. MODEL 730A OUTLINE DRAWING

Temperature Coefficient:	Less than 0.5 ppm/°C from 20°C to 30°C. Less than 1 ppm/°C from 4°C to 40°C. Less than 1.5 ppm/°C from 0°C to 4°C and 40°C to 55°C.
Shock and Vibration:	Meets requirements of MIL-T-21200H.

1-8. GENERAL SPECIFICATIONS

Terminals:	Eight five-way binding posts for positive, negative, guard, chassis ground, positive and negative external reference, and positive and negative external voltmeter. All positive and negative terminals are solid copper with gold flash
Battery Operation:	Rechargeable nickel–cadmium batteries provided at least 50 hours of continuous operation.
Input Power	115v or 230v ± 10v ac, 50 to 400 Hz single phase or internal battery operation.
Size:	3.5" high x 17" wide x 15.5" deep. (See outline drawing, Figure 1-1).
Weight:	20 pounds.

Section 2
Operating Instructions

2-1. INTRODUCTION

2-2. This section contains operating instructions and applications information for the Model 730A. If any problem is encountered in operating the instrument, contact the nearest John Fluke sales representative or write directly to John Fluke Mfg. Co., Inc. Please include the instrument serial number when writing.

2-3. INSTALLATION

2-4. The 730A is supplied with non-marring feet and tilt-down bail for bench or field use. Rack mounting kits are available for installation of the instrument in a standard 19-inch rack. Kit M03-200-306 provides rack ears, kit MEE 8078 provides 18-inch chassis slides, and kit MEE 8079 provides 24-inch chassis slides. Each kit contains necessary hardware and detailed installation instructions.

2-5. REPACKAGING FOR SHIPMENT

2-6. This instrument was packed and shipped in a foam-backed cardboard carton. If reshipment is required, the original container should be used, if available. Upon request, a new container can be obtained from the John Fluke Mfg. Co., Inc. Please include the instrument model number when requesting a new container.

2-7. INPUT POWER REQUIREMENTS

2-8. The 730A operates on 115 or 230 volt, 50 to 400 Hz ac power. To convert the instrument from one type of operation to another, place the 115/230 volt switch (located at rear of instrument) in the desired position and select the proper fuse: ½ ampere for 115 volt operation and ¼ ampere for 230 volt operation.

WARNING!

The round pin on the polarized three-prong plug connects the instrument case to power system ground. If a three-to-two-wire adapter is used, ensure that the ground wire is connected to a high quality earth ground.

2-9. OPERATING FEATURES

2-10. The function of controls, terminals, and indicators is given in Figure 2-1.

2-11. USING THE 730A.

2-12. Table 2-1 gives instructions for using the 730A.

2-13. APPLICATIONS

2-14. Standard Cell Transfer

2-15. Each of the four supplies in the 730A may be individually standardized to a standard cell by the procedure given in Table 2-1. The standardized output of each

supply will be within 2 ppm of the standard cell voltage and will remain so within 10 ppm per month. In parallel operation (MEAN), all supply outputs are paralleled. The output will then be the arithmetic mean of the individual reference supply outputs and the stability will be within 1 ppm of a straight line for 90 days.

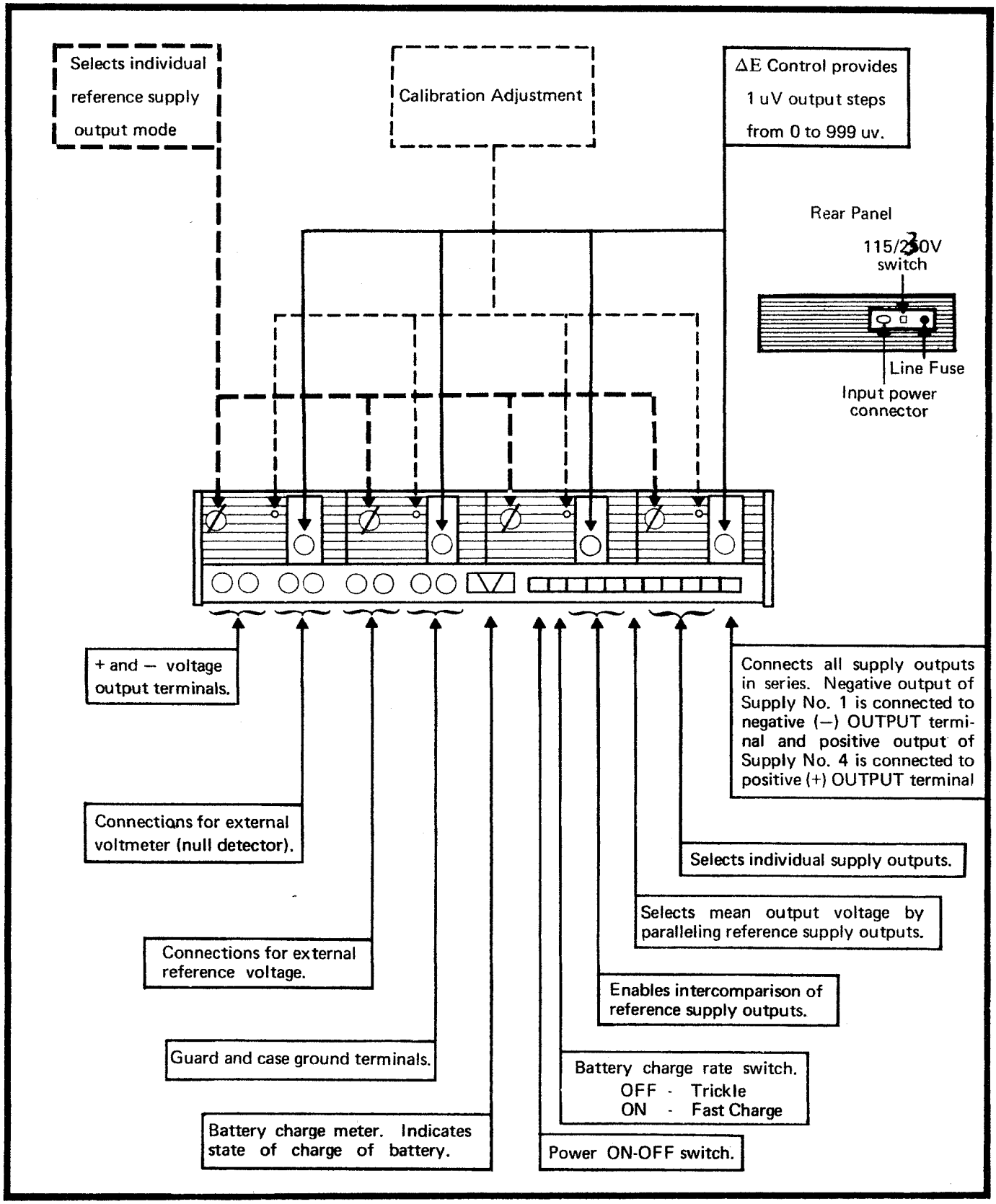


Figure 2-1. CONTROLS, TERMINALS AND INDICATORS.

Table 2-1. 730A OPERATING INSTRUCTIONS

OPERATION		730A FUNCTION	730A OUTPUT (PUSHBUTTON) SELECTION	730A CONNECTIONS	REMARKS
Battery charge		Any	BAT CHG	None required	Batteries are fast charged when the BAT CHG button is pressed; otherwise, they are automatically trickle charged. The front panel meter indicates the state of charge of the battery during battery operation. During line operation, the meter pointer deflects to the right to indicate that the batteries are charging.
Comparison of internal supply outputs		Any voltage setting	INTERNAL COMP. 1-2, 1-3, or 1-4	Connect sensitive dc voltmeter such as Fluke 845AB to 730A OUTPUT terminals.	Voltmeter will indicate difference between output voltages of (selected) supplies.
Transfer standard	Single Supply Operation	Set selected supply output to 1.018 +ΔE or 1.019 +ΔE depending on standard cell voltage	EXTERNAL COMP/OUTPUT 1, 2, 3 or 4	Connect standard cell to EXT REF terminals and voltmeter to VM terminals	1. Adjust ΔE control until function switch setting plus ΔE microvolts equal standard cell voltage 2. Adjust CAL control for null with voltmeter on most sensitive range. 3. Disconnect standard cell.
	Parallel Supply Operation	Set all supply outputs to (1.018 + ΔE) or (1.019 + ΔE) depending on standard cell voltage.	MEAN	Mean output of four supplies is available at OUTPUT terminals	Set each set of function and ΔE controls to equal standard cell voltage. *NOTE!* *Individual supplies should have been previously calibrated to same standard cell.*
Series output		Set individual supplies to provide any series combination of output voltages including shorted output	SERIES	Combined output voltage is available at OUTPUT terminals.	Output is the total of individual supply settings. Negative output of supply no. 1 is connected to – OUTPUT terminal and positive output of supply no. 4 is connected to + OUTPUT terminal (See Figure 2-2).

2-16. Precision Voltage Source

2-17. The 730A can provide a variety of discrete output voltages through series connection of the four internal supplies. This is accomplished at the front panel by simply pressing the SERIES switch and setting the individual function switches to provide the desired output. For example, if each reference supply function switch were set to the ΔE position, the 730A output would be 0 to 3996 microvolts in 1 microvolt steps. Whenever series operation is selected, the reference supply outputs are connected to the 730A OUTPUT terminals as shown in Figure 2-2. Maximum output, with all supplies at 10V, is 40 volts.

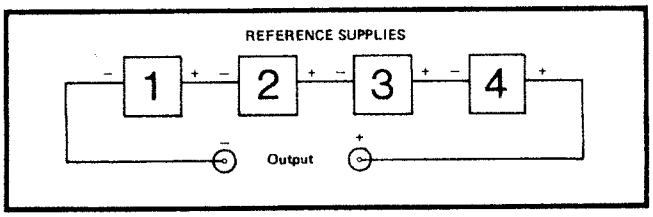


Figure 2-2. INTERNAL REFERENCE SUPPLY CONNECTIONS DURING SERIES OPERATION.

2-18. OPERATING NOTES

2-19. Guarded Operation

2-20. Complete isolation of the 730A circuitry is provided by the guard chassis in the instrument. The guard is brought out to the front panel GUARD terminal. In general, guarded operation will be necessary under the following conditions:

a. When differences of potential exist between equipment power line grounds.

b. When long connecting leads are used and load impedance is high.

c. When the equipment is operating in the presence of high level radiated noise, the most common example of which is stray fields at the power line frequency.

2-21. One of the most common cases requiring guarding is that of differences in power line grounds. When the 730A is connected to another instrument, both instruments grounded through their respective power cords, a potential difference may exist between the power line grounds of these two instruments. This potential difference can cause circulating ground currents which could cause errors in the output voltage. To prevent these errors from occuring, the 730A is equipped with a guard which completely encloses sensitive instrument circuitry. When properly connected to the load, the guard provides a separate path for the circulating ground currents, thus eliminating possible errors in the output voltage. For proper connection, connect the GUARD terminal directly to the grounded side of the load, at the load. Figure 2-3 illustrates the correct GUARD terminal connection and the rerouted ground currents.

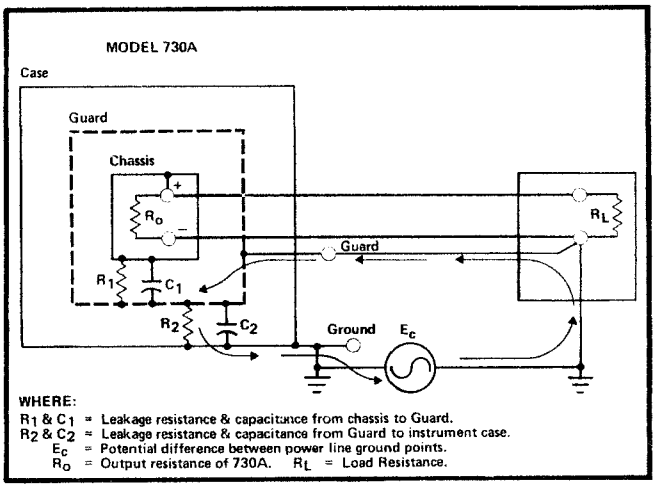


Figure 2-3. PROPER GUARD CONNECTION WHEN POTENTIAL DIFFERENCES EXIST BETWEEN POWER LINE GROUNDS.

2-22. Battery Operation

2-23. The rechargeable nickel-cadmium batteries provide at least 50 hours of continuous operation before recharging is required. The batteries are automatically trickle charged whenever the instrument is operating from the ac line. They may be fast charged by pressing the BAT CHG switch. Recharging of completely discharged batteries requires 100 hours of trickle charging or 10 hours of fast charging.

Section 3
Theory of Operation

3-1. INTRODUCTION

3-2. This section contains the theory of operation of the Model 730A. In the general discussion, the instrument function is examined at the block diagram level. The detailed circuit description is keyed to the schematics at the back of the manual.

3-3. GENERAL

3-4. The 730A is composed of four isolated, identical dc power supplies connected as shown in Figure 3-1. AC power is supplied to the charging circuits of the supplies via separate secondary windings on the power transformer. These circuits provide preregulated dc for the ultra-stable reference supplies. The reference supplies are in effect precision temperature-compensated dc sources combined with drift-free operational amplifiers. Reference supply outputs are selected in the divider by front panel function and ΔE controls and are supplied to the switching network where various combinations of the four supply outputs are called by front panel push-buttons.

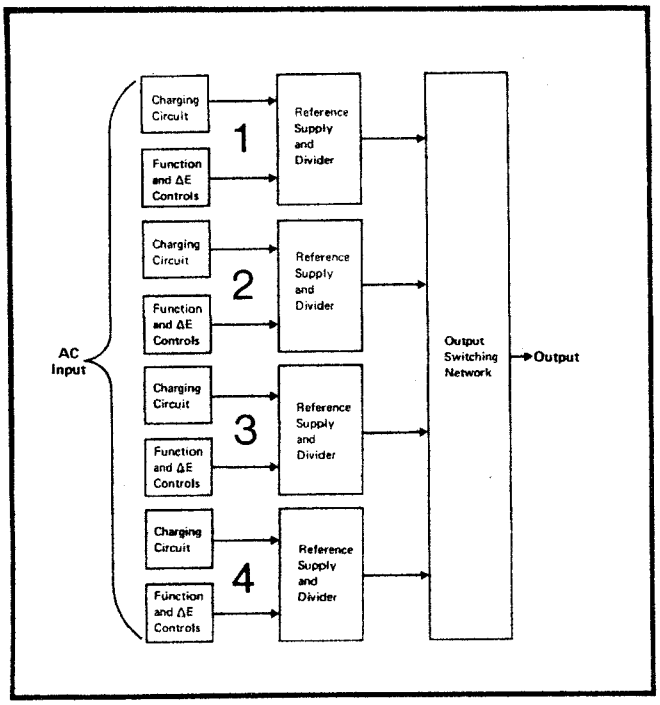


Figure 3-1. MODEL 730A BLOCK DIAGRAM

3-5. CIRCUIT DESCRIPTION

3-6. Charging Circuit

3-7. Input ac from the power transformer is rectified in a full-wave bridge composed of CR1, CR2, CR3, and CR4. Bridge output is applied through R1 to trickle charge battery BT1 or through ballast lamp DS1, if the BAT CHG button is pressed, to fast charge BT1. The ballast lamp regulates or limits battery charging current to ensure a safe level of charging current regardless of battery condition. Battery output is connected directly to series pass regulator IC1, which provides preregulated voltage to the reference supply.

3-8. The meter circuit, consisting of meter M1, diode CR5, and resistor R5 is connected across the battery in supply No. 2 only. It is calibrated to indicate the state of charge of the battery during battery operation. During line operation the meter pointer deflects to the right to indicate that the batteries are charging.

3-9. Reference Supply

3-10. Reference amplifier Q4 functions as the primary reference element for the supply. Q4 is a silicon NPN transistor connected in series with a zener diode. Both devices are mounted on a common substrate and enclosed in a single envelope, thereby achieving extremely close thermal coupling. The reference voltage, V_{REF}, (see Figure 3-2) is the sum of the zener voltage, V_Z and the transistor base-to-emitter voltage, V_{be}. Temperature variations affecting V_Z are compensated for by corresponding changes in V_{be}. The result is a precision, temperature-compensated dc source.

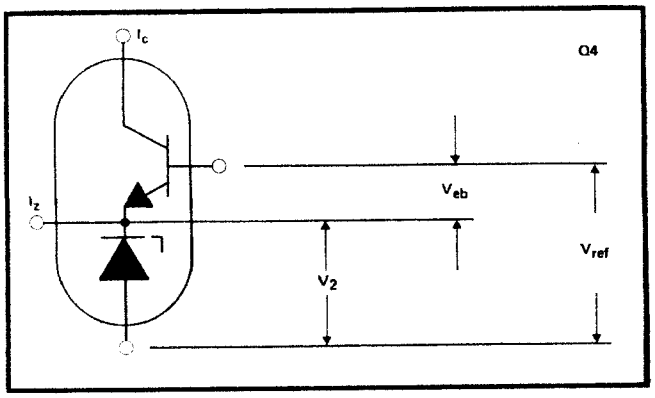


Figure 3-2. REFERENCE AMPLIFIER

3-11. Supply output voltage variations are sensed at the base of Q4, amplified, and applied to a differential pair, Q3. The amplified output of Q3 is applied to the input of a Darlington pair, Q1 and Q2, which varies the conduction of Q2 to maintain a constant output voltage. Potentiometer R13 is the primary calibration adjustment and is set to provide exactly 10 volts at the reference supply output. Subsequent division and control of the output is provided by the divider circuitry.

3-12. Divider

3-13. The reference supply output is selected by means of function switch S1 and associated components, which make up a resistive divider network at the reference supply output. In 10 volt mode, the basic reference supply output is connected directly to the output switching network. The 1 volt, 1.018 volt, 1.019 volt, and 0 to 999 microvolt outputs are derived from the 10 volt output. The 1 volt output is adjusted by R25 and the 1.018 volt and 1.019 volt outputs are separately adjusted by calibration controls R17 and R18, respectively. The 1.018 and 1.019 volt outputs may be increased by a maximum of 999 microvolts by the front panel ΔE control in 1 microvolt steps. The ΔE control together with associated resistors provide also a separate output of 0 to 999 microvolts.

3-14. Switching Network

3-15. The switching network is composed of nine front panel pushbutton switches, S3 through S11. These switches enable the user to intercompare the four reference supply outputs and connect them in series or parallel to provide a variety of output voltages. Switches S3 through S5 permit comparison of the reference supply outputs. Switch S6 connects all four supply outputs in parallel to provide an output equal to the arithmetic mean of the supplies. Switches S7 through S10 enable selection of each of the individual supply outputs separately. Switch S11 places all four supply outputs in series.

Section 4
Maintenance

4-1. INTRODUCTION

4-2. This section contains information and instructions concerning preventive and corrective maintenance for the Model 730A DC Transfer Standard. Preventive maintenance consists primarily of cleaning the instrument and should be performed as often as operating conditions require. Corrective maintenance consists of performance testing, troubleshooting, and calibration procedures, which are designed to aid in maintaining instrument operation within specifications. A calibration interval of 90 days is recommended to ensure instrument operation within the specifications stated in Section I of the manual.

4-3. SERVICE INFORMATION

4-4. Each instrument manufactured by the John Fluke Manufacturing Company is warranted for a period of one year upon delivery to the original purchaser. Complete warranty information is contained in the Warranty page located at the front of the manual. Factory authorized calibration and repair service for all Fluke instruments is available at various world wide locations. A complete list of factory authorized service centers is located at the rear of the manual. If requested, an estimate will be provided to the customer before any repair work is begun on instruments which are beyond the warranty period.

4-5. TEST EQUIPMENT

4-6. The equipment recommended for maintenance of the 730A is listed in Table 4-1. If the recommended equipment is not available, other equivalent equipment may be used.

Table 4-1. TEST EQUIPMENT.

EQUIPMENT TYPE	RECOMMENDED EQUIPMENT	FUNCTION
Null Detector	Fluke Model 845AB	Performance Testing and Calibration
DC Differential Voltmeter	Fluke Model 895A	Performance Testing and Calibration
True RMS Differential Voltmeter	Fluke Model 931B	Performance Testing.
DC Voltage Source	Fluke Model 341A DVM Calibrator	Performance Testing and Calibration
Standard Cell	Guildline Instruments Model 9152/P4	Performance Testing and Calibration
X1000 Amplifier	----	Performance Testing.
Resistor (Fig. 4-4)	1000Ω	Performance Testing.
Voltage Divider	Fluke Model 720A Kelvin-Varley Voltage Divider	Calibration
Low-Thermal Switch	Leeds & Northrup Type 3702 Tapping Key	Calibration

4-7. GENERAL MAINTENANCE

4-8. Access/Disassembly

4-9. The following procedure should be used to gain access to various portions of the instrument (see Figure 4-1).

a. Remove the top and bottom dust covers and guard covers.

b. The plug-in Reference Supply boards may be removed by lifting them carefully out of their board-mounted connectors.

c. The balance of the components will be accessible after removing the Reference Supply boards.

d. Batteries are replaced by removing the battery straps, unsoldering the battery leads from the main pcb, and lifting the batteries out of their compartment.

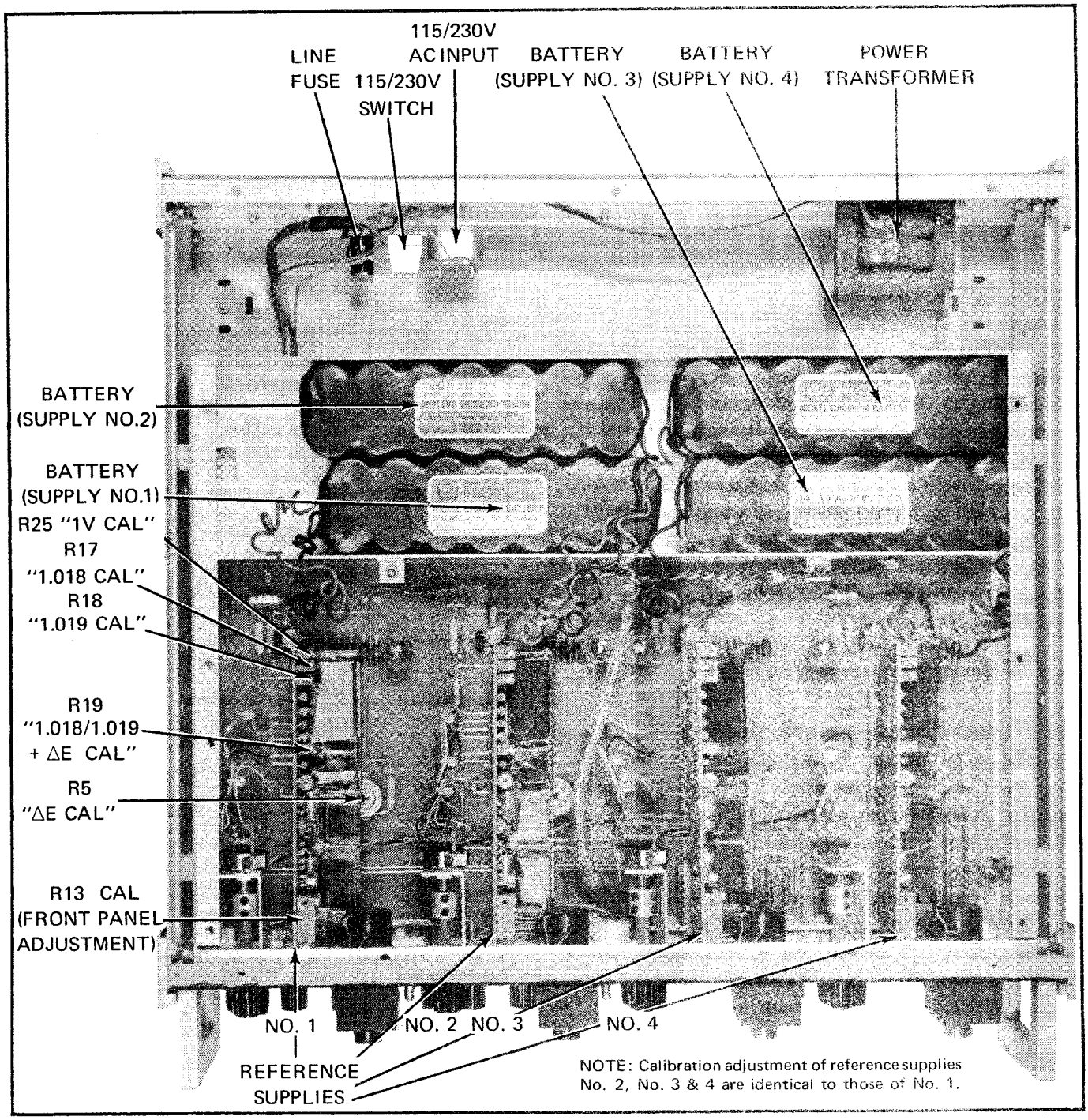


Figure 4-1. 730A INTERNAL LAYOUT

4-10. Fuse Replacement

4-11. The line fuse is mounted in a fuse holder which is accessible at the rear of the instrument. The fuse is rated as follows:

115 Volt Operation – ½ Ampere
230 Volt Operation – ¼ Ampere

4-12. 115/230 Volt Conversion

4-13. The 730A may be operated from either 115 or 230 volt ac power, depending upon the connection of the power transformer primary winding. Convert the 730A from one type of power line operation to the other by the following procedure:

a. Disconnect the 730A from the power line.

b. Place the 115/230 slide switch, located at the rear of the instrument, in the position which corresponds to the desired operating voltage.

c. Ensure that the proper line fuse for the selected voltage is installed (paragraph 4-10) before operating the instrument.

4-14. Cleaning

4-15. The instrument should be cleaned periodically to remove dust, grease, and other contamination. The following procedure should be adhered to when cleaning the instrument:

a. Remove loose contamination with low-pressure, clean, dry air. Pay particular attention to the front panel binding posts and binding post wiring.

b. The front panel and exterior surfaces may be cleaned using anhydrous ethyl alcohol or a soft cloth dampened in a mild solution of detergent and water.

CAUTION!

Do not use aromatic hydrocarbons or chlorinated solvents on the front panel, because they will react with the Lexan binding posts.

c. Printed circuit boards can be cleaned by first spraying with Freon TF Degreaser (MS180 Miller Stephenson Chemical Co., Inc.) followed by application of low pressure, clean, dry air.

4-16. PERFORMANCE TESTS

4-17. The following tests are intended for use in performance testing of the 730A. The tests are especially suited to acceptance testing of new instruments. Tests should be conducted under the following conditions: ambient temperature 25°C ±5°C, relative humidity less than 70%.

4-18. Line Regulation

a. Connect equipment as shown in Figure 4-2.

b. Set line voltage to 115 volts and allow instrument to warm up for approximately 30 minutes.

c. Zero the 845AB on the 1 microvolt range then set it to the 10 microvolt range.

d. With the switch open, adjust 730A reference supply output No. 1 to equal the Standard Cell Voltage.

e. close the switch and adjust the 730A output for null on the 845AB.

f. Vary the autotransformer from 115 to 105 volts ac and from 115 to 125 volts ac. The 845AB indication should not change more than ±1 microvolt.

g. Repeat steps (d) through (f) for reference supplies 2, 3 and 4.

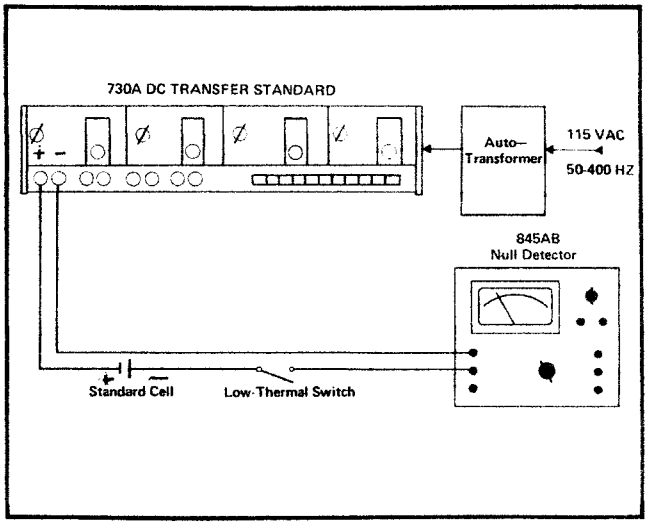


Figure 4-2. EQUIPMENT CONNECTIONS FOR LINE REGULATION, DC TO 1 Hz OUTPUT NOISE, TRANSFER ACCURACY, AND TURN OFF – TURN ON TESTS.

4-19. Output Noise, DC to 1 Hz

a. Connect equipment as shown in Figure 4-2.

b. Zero the 845AB on the 1 microvolt range, then set it to the 10 microvolt range.

c. Adjust 730A reference supply No. 1 output for null on the 845AB.

d. Observe the random voltage excursions indicated on the 845AB over a 10 second period. The excursions should be less than 1 microvolt peak to peak.

e. Repeat steps (c) and (d) for reference supplies 2, 3 and 4.

4-20. Output Noise, 1 Hz to 1 MHz

a. Connect equipment as shown in Figure 4-3.

b. Set the 931B range to 100 millivolts, mode switch to TVM X1, and readout dials to zero.

c. Set 730A reference supply No. 1 output to 1.018000. The 931B should indicate less than 100 millivolts rms, which represents 100 microvolts rms output from the 730A.

d. Repeat step (c) for reference supplies 2, 3 and 4.

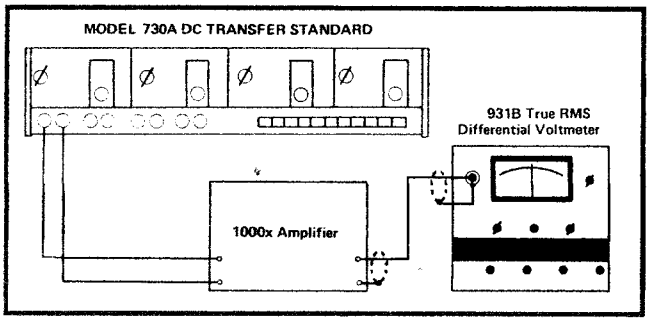


Figure 4-3. EQUIPMENT CONNECTIONS FOR 1 Hz TO 1 MHz OUTPUT NOISE TEST.

4-21. Common-Mode Rejection

a. Connect equipment as shown in Figure 4-4.

b. Set the 341A for zero volts output.

c. Set 730A reference supply No. 1 output to 1.018000 volts.

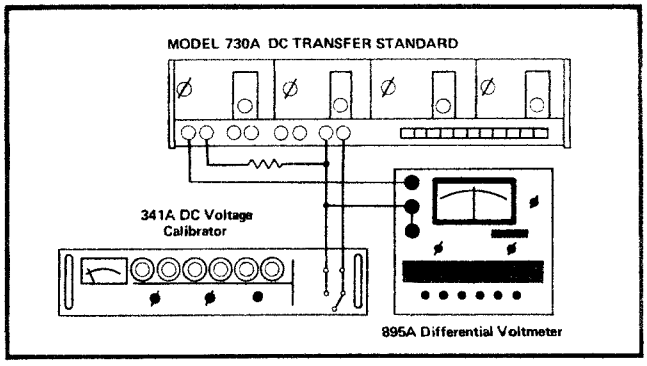


Figure 4-4. EQUIPMENT CONNECTIONS FOR COMMON-MODE REJECTION TEST.

d. Set the 895A range to 1 volt, null sensitivity to 100 microvolts, and readout dials for null indication.

e. Set the 341A output to 100 volts. The 895A meter indication should be zero ±100 microvolts.

f. Repeat steps (b) through (e) for reference supplies 2, 3 and 4.

4-22. Isolation

a. Set the 730A for output from reference supply No. 1 then turn the 730A off.

b. Connect the negative output terminal of the 341A to the guard terminal of the 730A. and the positive output terminal of the 341A to case(ground) of the 730A.

c. Set the 341A output to 500 volts. The 341A meter should indicate no discernable current flow.

d. Repeat steps (b) and (c) for the negative output terminal of the 730A.

e. Repeat steps (b) and (c) for the positive output terminal of the 730A.

f. Repeat steps (a) through (e) for reference supplies 2, 3 and 4.

4-23. Transfer Accuracy

a. Connect equipment as shown in Figure 4-2.

b. Zero the 845B on the 1 microvolt range, then set it to the 10 microvolt range.

c. With the switch open, adjust 730A reference supply output No. 1 to equal the Standard Cell Voltage.

d. Close the switch and adjust the 730A output for null on the 845AB.

e. Repeat steps (b) through (d) for reference supplies 2, 3 and 4.

f. Lock the ΔE control son the 730A.

g. Open the switch, remove all test leads from the setup, and allow the 730A to operate for 20 minutes.

h. Reconnect the equipment and check each reference supply for null against the Standard Cell. The 845AB should indicate less than ±2 microvolts deviation from null (zero) in each case.

4-24. Turn Off — Turn On.

a. Connect equipment as shown in Figure 4-2.

b. Zero the 845AB on the 1 microvolt range then set it to the 10 microvolt range.

c. With the switch open, adjust 730A reference supply output No. 1 to equal the Standard Cell Voltage.

d. Close the switch and adjust the 730A output for null on the 845AB.

e. Repeat steps (c) and (d) for reference supplies 2, 3 and 4.

f. Turn off the 730A and allow it to remain inoperative for a 24-hour period.

g. Turn on the 730A and allow 4 hours for warmup. Check each reference supply for null against the Standard Cell. The 845AB should indicate less than +3 microvolts deviation from null in each case.

4-25. TROUBLESHOOTING

4-26. Because the 730A is composed of four identical supplies, substitituon is a convenient and practical method of trouble isolation. If a supply is not functioning properly first try substituting a Reference Supply board that is known to be good. If the trouble persists, the fault is not in the Reference Supply, which leaves only the

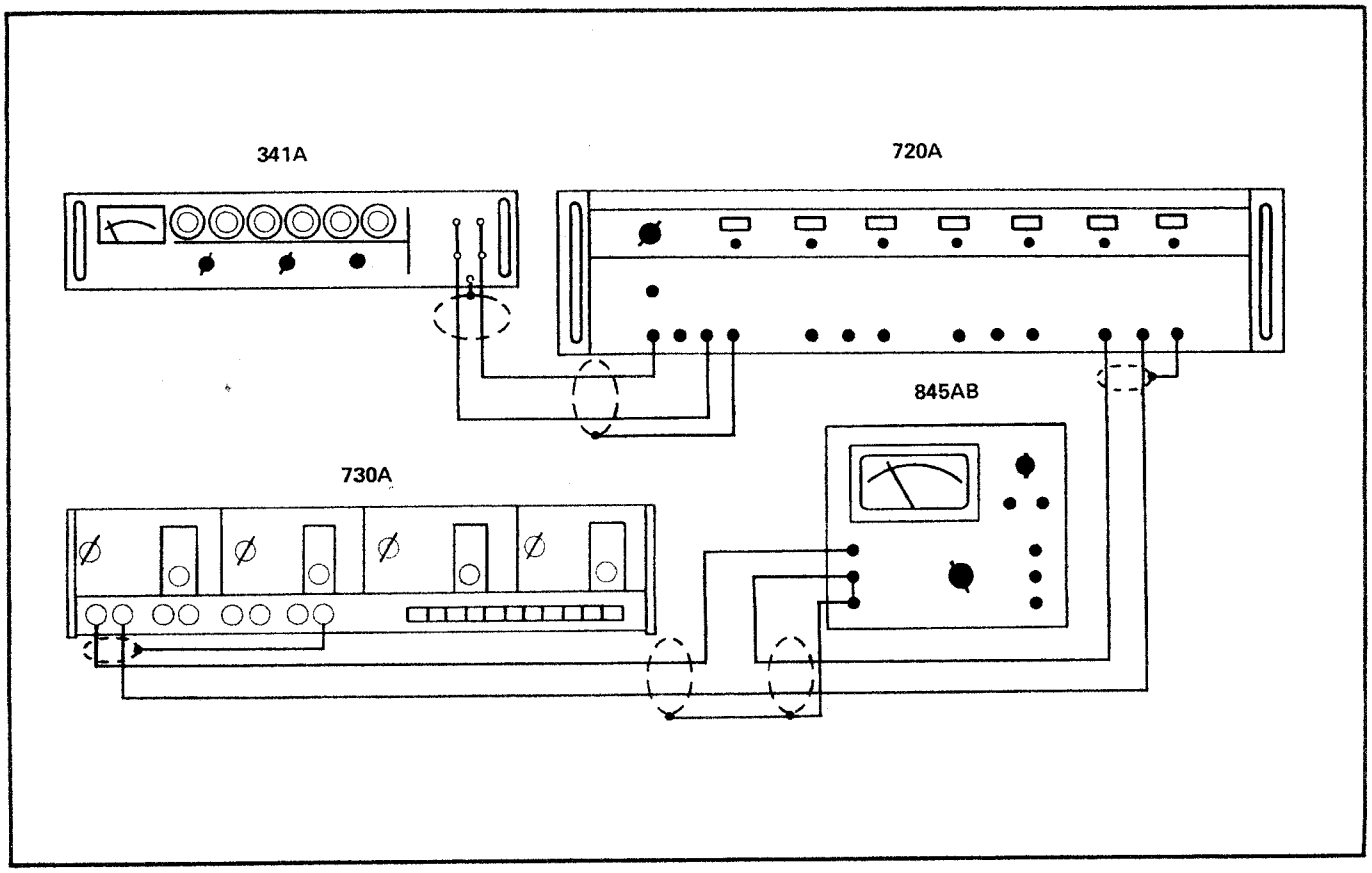


Figure 4-5. DIVIDER ADJUSTMENT - EQUIPMENT CONNECTIONS.

Charging Circuit or ac input circuitry. At this point, it might be practical to check the suspect circuit voltages by comparison with those of another Charging Circuit that is known to be good.

4-27. CALIBRATION

4-28. The calibration procedure for the 730A is given in Table 4-2. A description of the equipment required for calibration is given in Table 4-1. Calibration should be performed under the following test conditions: ambient temperature 25°C ±5°C, relative humidity less than 70%. Adjustment locations are shown in Figure 4-1.

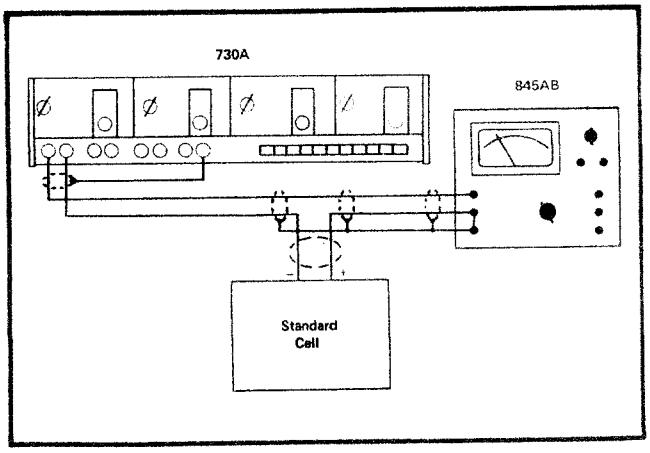


Figure 4-6. ABSOLUTE VOLTAGE ADJUSTMENT EQUIPMENT CONNECTIONS.

Table 4-2. MODEL 730A CALIBRATION.

STEP	EQUIPMENT CONNECTIONS	730A CONTROL SETTINGS			720A DIAL SETTINGS	845AB RANGE	341A OUTPUT (VDC)	CALIBRATION INSTRUCTIONS
		FUNCTION	ΔE	OUTPUT (PUSH-BUTTONS)				
1	Figure 4-5	10V	Any	EXTERNAL COMP/ OUTPUT 1	1.0000000	10 uV	11	Adjust 341A output for zero (±10 uV) on the 845AB
2		1V			.1000000	1 uV	As set in step (1).	Adjust the "1V Cal" control (R25) for zero (±1 uV) on the 845AB.
3		1V			1.0000000	1 uV	1.1	Adjust 341A output for zero (±1 uV) on the 845AB.
4		1.018 +ΔE	000		1.0180000	1 uV	As set in step (3).	Adjust the "1.018 Cal" control (R17) for zero (±1 uV) on the 845AB.
5		1.019 +ΔE			1.0190000	1 uV	As set in step (3).	Adjust the "1.019 Cal" control (R18) for zero (±1 uV) on the 845AB.
6		1.019 +ΔE	999		1.0199999 1.019999C	1 uV	As set in step (3).	Adjust the "1.018/ 1.019 +ΔE Cal" control (R19) for zero (±1 uV) on the 845AB.
7		ΔE			.0010000	1 uV	As set in step (3).	Adjust "ΔE Cal" control ~~(R1)~~ R5 for zero (±1 uV) on the 845AB.
8	Figure 4-6	Set to standard cell voltage.			-----	1 uV	---	Adjust front panel "CAL" control for zero (±1 uV) on the 845AB.
9	Repeat steps (1) through (8) for supplies 2, 3, and 4.							

Section 5
List of Replaceable Parts

5-1. INTRODUCTION

5-2. This section of the manual is a complete illustrated parts list breakdown itemizing all assemblies and their components for this instrument. Illustrations for each listing aid in locating the assemblies and components. A Cross Reference List of Fluke stock numbers to original manufacturers' part numbers is included at the rear of this section.

5-3. Assemblies and subassemblies are identified by a reference designation beginning with the letter A followed by a number (e.g., A1 etc). Electrical components appearing on the schematic diagram are identified by their schematic diagram reference designation. Components not appearing on the schematic diagram are identified by Fluke stock numbers on the illustrations. Flagnotes are sometimes used and refer to special ordering explanations.

5-4. PARTS LIST COLUMN DESCRIPTIONS

a. The REF DESIG column idnexes the item description to the associated illustration. In general the reference designations are listed under each assembly in alpha-numeric order. Subassemblies of minor proportions are sometimes listed with the assembly of which they are a part. In this case, the reference designations for the components of the subassembly may appear out of order.

b. The DESCRIPTION column describes the salient characteristics of the component. Indention of the description indicates the relationship to other assemblies, components, etc. In many cases it is necessary to abbreviate in this column. For abbreviations and symbols used, refer to Appendix B located at the rear of the manual.

c. The six-digit part number, by which the item is identified at the John Fluke Mfg. Co., is listed in the STOCK NO. column. Use this number when ordering parts from the factory or authorized representatives.

d. The TOT QTY column lists the total quantity of the items used in the instrument and reflects the latest Use Code. Second and subsequent listings of the same item are referenced to the first listing with the abbreviation REF. The TOT QTY column lists the total quantity of the item in that particular assembly.

e. Entries in the REC QTY column indicate the recommended number of spare parts necessary to support one to five instruments for a period of two years. This list presumes an availability of common electronic parts at the maintenance site. For maintenance for one year or more at an isolated site, it is recommended that at least one of every part in the instrument be stocked. In the case of optional subassemblies, plug-ins, etc. that are not always part of the instrument, or are deviations from the basic instrument model. The REC QTY column lists the recommended quantity of the item in that particular assembly.

The USE CODE column identifies certain parts which have been added, deleted or modified during the production of the instrument. Each part for which a Use Code has been assigned may be identified with a particular instrument serial number by consulting the Serial Number Effectivity List, paragraph 5-9. Sometimes when a part is changed, the new part can and should be used as a replacement for the original part. In this event a parenthetical note is added in the DESCRIPTION column.

5-5. MANUFACTURERS' CROSS REFERENCE LIST COLUMN DESCRIPTIONS

a. The six-digit part number, by which the item is identified at the John Fluke Mfg. Co., is listed in the FLUKE STOCK NO. column. Use this number when ordering parts from the factory or authorized representatives.

b. The Federal Supply Code for the item manufacturer is listed in the MFG column. An abbreviated list of Federal Supply Codes is included in the Appendix.

c. The part number which uniquely identifies the item to the original manufacturer is listed in the MFG PART NO. column. If a component must be ordered by description, the type number is listed.

5-6. HOW TO OBTAIN PARTS

5-7. Standard components have been used wherever possible. Standard components may be ordered directly from the manufacturer by using the manufacturer's part number, or parts may be ordered from the John Fluke Mfg. Co. factory or authorized representative by using the Fluke part number. In the event the part you order has been replaced by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions, if necessary.

5-8. You can insure prompt and efficient handling of your order to the John Fluke Mfg. Co., if you include the following information:

a. Quantity.

b. FLUKE Stock Number.

c. Description.

d. Reference Designation.

e. Instrument model and serial number.

Example: 1 each, 203547, Diode, 1N759A, A3CR5 for 730A, S/N 123.

If you must order structural parts not listed in the parts list, describe the part as completely as possible. A sketch of the part, showing its location to other parts of the instrument, is usually most helpful.

5-9. SERIAL NUMBER EFFECTIVITY

5-10. A Use Code column is provided to identify certain parts that have been added, deleted, or modified during production of the Model 730A. Each part for which a use code has been assigned may be identified with a particular instrument serial number by consulting the Use Code Effectivity List below. All parts with no code are used on all instruments with serial numbers above 123.

USE CODE	EFFECTIVITY
NONE	Model 730A serial number 123 and on.

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
	DC TRANSFER STANDARD - Figure 5-1	**730A**			
A1	Front Panel Assembly (See Figure 5-2)		1		
A2	Rear Panel Assembly (See Figure 5-1)		1		
A3	Main PCB Assembly (See Figure 5-3)	297457	1		
A3A1 thru A3A4	Reference Supply Assembly (See Figure 5-4)	297465	4		
BT1	Battery pack, rechargeable, Ni-Cad, 16.8v	295634	4	1	
	Cover, bottom	297416	1		
	Cover, top	297390	1		
	Foot	292870	4		
	Line cord	226100	1		
	Power cable	297481	1	1	
	Tilt stand	231407	1		

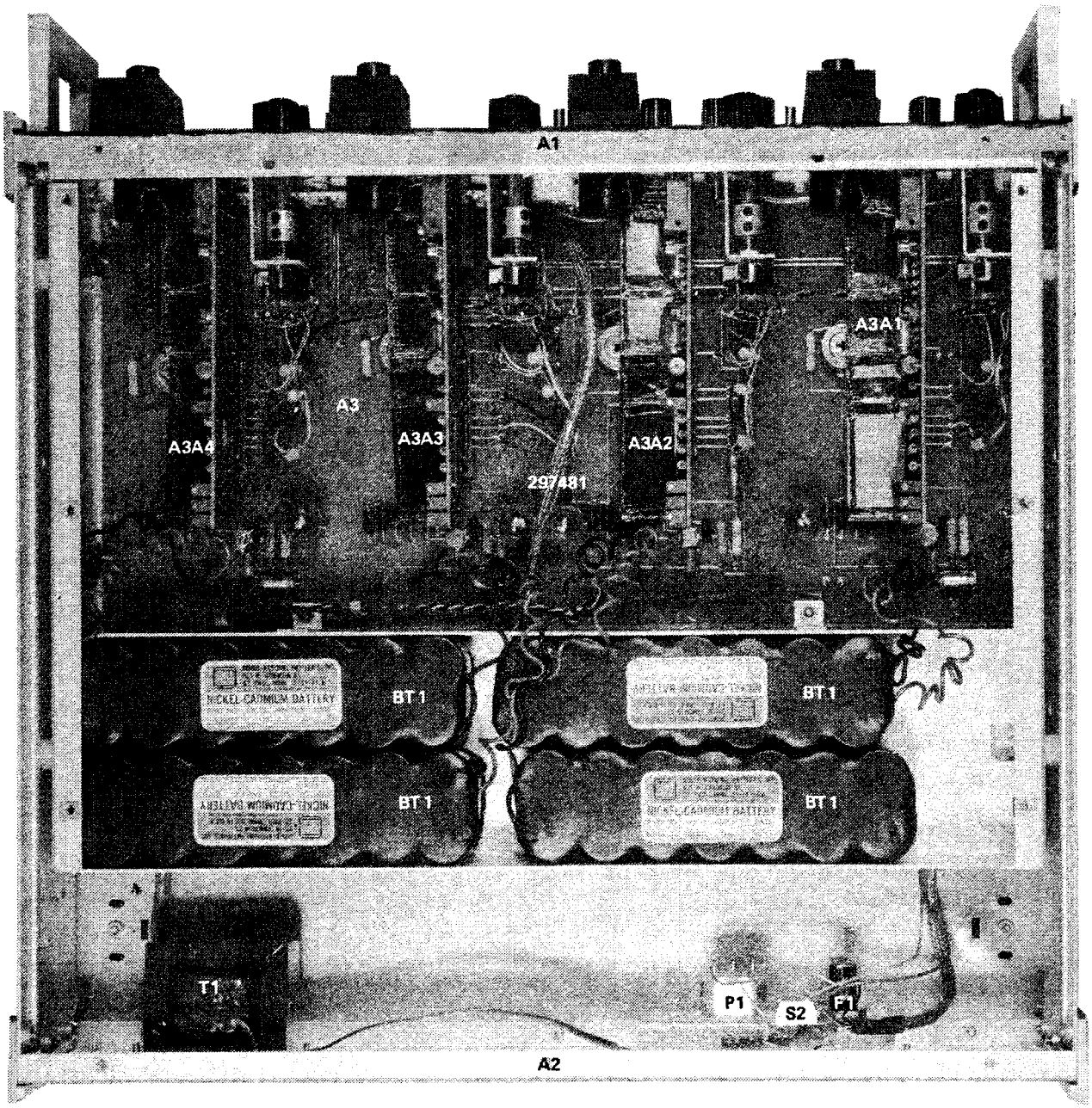


Figure 5-1. MODEL 730A DC TRANSFER STANDARD

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A1	**FRONT PANEL ASSEMBLY - Figure 5-2**		REF		
J1, J3, J5	Binding post, red	142976	3		
J2, J4, J6	Binding post, black	142984	3		
J7	Binding post, blue	233833	1		
J8	Binding post, white	291823	1		
M1	Meter, 0-1 ma	266494	1		
R1	Res, var, ww, 5k ±5%, 100v	295626	4		
	Counting dial	295642	4	1	
	Handle	295659	2		
	Knob	158956	4		
	Push-button, green	268862	2	1	
	Push-button, gray	268896	9	2	

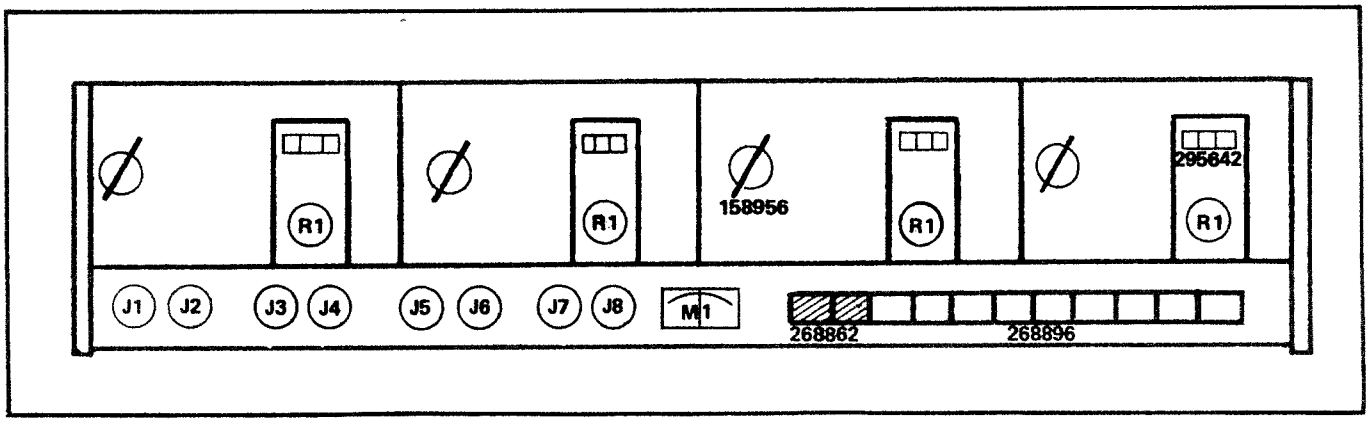


Figure 5-2. FRONT PANEL ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A2	**REAR PANEL ASSEMBLY - (See Figure 5-1)**		REF		
F1	Fuse, fast acting, ½amp, 250v (for 115v operation)	153858	1	1	
F1	Fuse, fast acting, ¼amp, 250v (for 230v operation)	109314	1		
P1	Connector, male, 3 contact	222612	1		
S2	Switch, slide	226274	1		
T1	Transformer, power	291047	1	1	
XF1	Fuse holder	100107	1		

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A3	**MAIN PCB ASSEMBLY - Figure 5-3**	297457	REF		
A3A1 thru A3A4	Reference Supply Assembly (See Figure 5-4)	297465	REF		
C1	Cap, plstc, 0.1 uf ±10%, 250v	161992	4		
C2	Cap, mica, 47 pf ±5%, 500v	148536	4		
C3	Cap, elect, 2 uf +100/-10%, 50v	105197	4		
CR1 thru CR4	Diode, silicon, 1 amp, 100 piv	116111	16		
CR5	Diode, zener, 12v	203547	1		
DS1	Lamp, incandescent, 24v	218354	4	1	
IC1	IC, voltage regulator	291211	4		
R1	Res, comp, 510 Ω ±5%, ½w	108951	4		
R2	Res, comp, 10 Ω ±10%, ½w	108092	4		
R3	Res, met flm, 10k ±1%, ½w	151274	4		
R4	Res, met flm, 1.5k ±1%, ½w	192930	4		
R5	Res, var, ww, 10 Ω ±10%, 1-1 ¼w	112672	4		
R6	Res, met flm, 732k ±1%, ½w	261164	4		
R7	Res, met flm, 130 Ω ±1%, ½w	151134	4		
R8	Res, comp, 10k ±5%, ¼w	109165	1		
S1 thru S11	Switch Assembly	289421	1		
	Connector, female, 20 contact	292912	4		

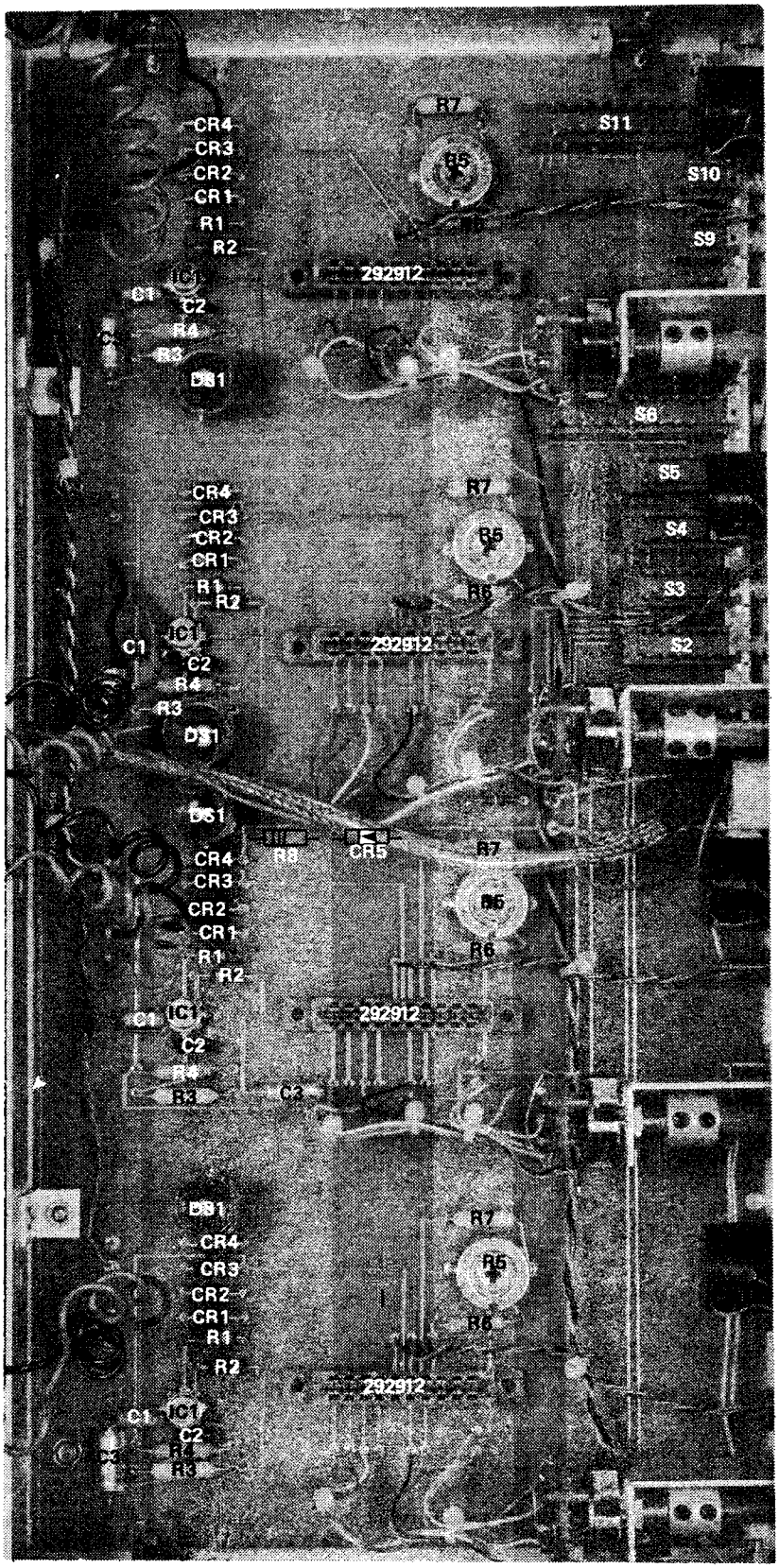


Figure 5-3. MAIN PCB ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	TOT QTY	REC QTY	USE CODE
A3A1 thru A3A4	**REFERENCE SUPPLY ASSEMBLY** **Figure 5-4**	297465	REF		
C1	Cap, plstc, 0.22 uf ±10%, 80v	159392	1		
C2	Cap, elect, 5 uf +75/-10%, 25v	152009	1		
C3	Cap, elect, 100 uf +75/-10%, 15v	175059	1		
Q1	Tstr, silicon, NPN	168716	1		
Q2	Tstr, silicon, NPN	179374	1		
Q3	Tstr, silicon, NPN	288662	1		
Q4, R9, R11 R12, R24	Reference Amplifier Set 	297473	1		
R1, R3	Res, comp, 30k ±5%, ¼w	193417	2		
R2	Res, comp, 2.7 Ω ±5%, ¼w	246744	1		
R4	Res, met flm, 4.22k ±1%, 1/8w	168245	1		
R5	Res, met flm, 10k ±1%, 1/8w	168260	1		
R6	Res, met flm, 12.1k ±1%, 1/8w	234997	1		
R7	Res, met flm, 54.9k ±1%, 1/8w	271353	1		
R8	Res, met flm, 1.27k ±1%, 1/8w	234997	1		
R10	Res, ww, tapped, 12k/5.9k ±0.05%, 1w	292763	1	1	
R13, R25	Res, var, cermet 10 Ω ±30%, 3v	186205	2		
R14	Res, met flm, 412k ±1%, ½w	291138	1		
R15	Res, met flm, ~~8.06k~~ 31.6k ±1%, ½w	291146 ~~291153~~	1		
R16	Res, met flm, ~~31.6k~~ 8.06k ±1%, ½w	291153 ~~291146~~	1		
R17 thru R19	Res, var, cermet, 10k ±20%, 100v	159913	3		
R20	Res, met flm, 1k ±1%, ½w	151324	1		
R21	Res, ww, tapped, 856 Ω / 8.995k ±0.05%, 1w	292771	1	1	
R22	Res, ww, 146 Ω ±5%, ½w	213728	1		
R23	Res, met flm, 732k ±1%, ½w	261164	1		

Q4, R9, R11, R12 and R24 are a factory selected and matched set. For replacement order the entire Reference Amplifier Set, part number 297473.

MANUFACTURERS' CROSS REFERENCE LIST

FLUKE STOCK NO.	MFR.	MFR. PART NO.
100107	71400	HKP
105197	56289	30D205G050BA4
108092	01121	EB1001
108951	01121	EB5115
109165	01121	EB1035
109314	71400	Type AGC
112672	71450	Type 110
116111	05277	1N4817
142976	58474	DF31RC
142984	58474	DF31BC
148536	14655	CD15E470J
151134	91637	Type MFF ½
151274	91637	Type MFF ½
151324	91637	Type MFF ½
152009	56289	30D505G025BA4
153858	71400	Type AGC
158956	89536	158956
159392	56289	192P2249R8
159913	73138	78PR10K
161992	73445	C280AEA100K
168245	91637	Type MFF 1/8
168260	91637	Type MFF 1/8
168716	07263	S19254
175059	56289	30D107G015DC4
179374	07263	2N2218
186205	73138	78PR10
192930	91637	Type MFF ½
193417	01121	CB3035
203547	07910	1N759A
213728	89536	213728
218354	08806	1252
222612	82389	AC3G
226100	70903	17258
226274	82389	46256-LF
231407	89536	231407
233833	58474	DF31BLC
234997	91637	Type MFF 1/8
246744	01121	CB27G5
261164	91637	Type MFF ½
266494	89536	266494
268862	71590	J61993
268896	71590	J52304
271353	91637	Type MFF 1/8
288662	15818	SA2920
289421	89536	289421
291047	89536	291047
291138	91637	Type MFF ½
291146	91637	Type MFF ½
291153	91637	Type MFF ½
291211	12040	LM305
292763	89536	292763
292870	89536	292870
292912	02660	225-21024-110
295626	80294	3509S-1-502
295626	80294	3509S-1-502
295634	06860	Type 1.2 SCL
295642	02660	Type 1380
295659	89536	295659
297390	89536	297390
297416	89536	297416
297457	89536	297457
297465	89536	297465

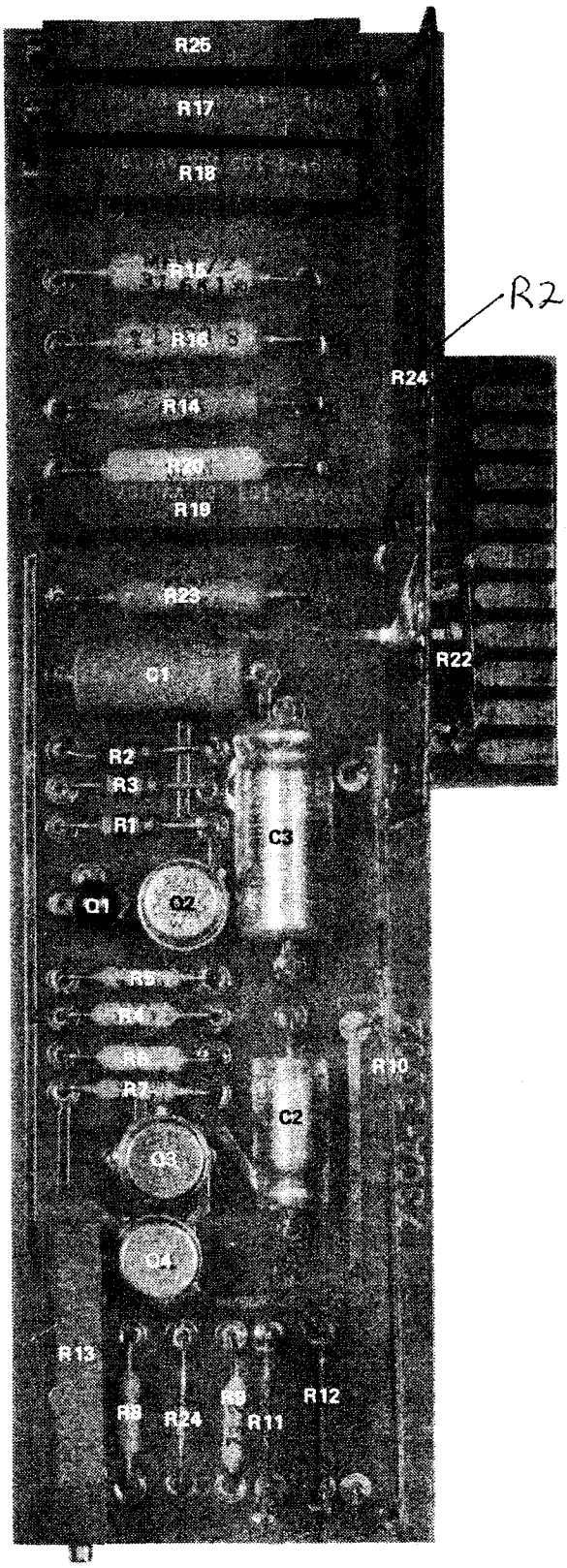


Figure 5-4. REFERENCE SUPPLY ASSEMBLY

MANUFACTURERS' CROSS REFERENCE LIST

FLUKE STOCK NO.	MFR.	MFR. PART NO.
297473	89536	297473
291823	58474	DF31WTC
292771	89536	292771

FLUKE STOCK NO.	MFR.	MFR. PART NO.
297481	89536	297481

Appendix A

Federal Supply Code for Manufacturers

A-1. CODE TO NAME

A-2. The following five-digit code numbers are listed in numerical sequence along with the manufacturer's name and address to which the code has been assigned. The Federal Supply Code has been taken from Cataloging Handbook H 4-2, Code to Name.

00213 Sage Electronics Corp.
Rochester, New York

00327 Welwyn International, Inc.
Westlake, Ohio

00656 Aerovox Corp.
New Bedford, Massachusetts

00779 AMP Inc.
Harrisberg, Pennsylvania

01121 Allen-Bradley Co.
Milwaukee, Wisconsin

01281 TRW Semiconductors
Lawndale, California

01295 Texas Instruments, Inc.
Semiconductor Components Div.
Dallas, Texas

01686 RCL Electronics Inc.
Manchester, New Hampshire

01730 Deleted

01884 Dearborn Electronics Inc.
Orlando, Florida

02114 Ferroxcube Corp.
Saugerties, New York

02606 Replaced by 15801

02660 Amphenol-Borg Elect. Corp.
Broadview, Illinois

02799 Arco Capacitors, Inc.
Los Angeles, California

03614 Replaced by 71400

03651 Replaced by 44655

03797 Eldema Corp.
Compton, California

03877 Transitron Electronic Corp.
Wakefield, Massachusetts

03888 Pyrofilm Resistor Co., Inc.
Cedar Knolls, New Jersey

03911 Clairex Corp.
New York, New York

03980 Muirhead Instruments, Inc.
Mountainside, New Jersey

04009 Arrow Hart and Hegemen
Electronic Company
Hartford, Connecticut

04062 Replaced by 72136

04202 Replaced by 81312

04217 Essex Wire Corp.
Wire & Cable Div.
Anaheim, California

04221 Aemco
Div. of Midtex Inc.
Mankato, Minnesota

04645 Replaced by 75376

04713 Motorola Semiconductor
Products Inc.
Phoenix, Arizona

05082 Replaced by 94154

05236 Jonathan Mfg. Co.
Fullerton, California

05277 Westinghouse Electric Corp.
Semiconductor Dept.
Youngwood, Pennsylvania

05278 Replaced by 43543

05397 Union Carbide Corp.
Electronics Div.
Cleveland, Ohio

05571 Sprague Electric Co
Pacific Div.
Los Angeles, California

05704 Alac, Inc.
Glendale, California

05820 Wakefield Engineering Ind.
Wakefield, Massachusetts

06001 General Electric Company
Capacitor Department
Irmo, South Carolina

06136 Replaced by 63743

06473 Amphenol Space & Missile Sys.
Chatsworth, California

06555 Beede Electrical Instrument Co.
Penacook, New Hampshire

06739 Electron Corp.
Littletown, Colorado

06743 Clevite Corp.
Cleveland, Ohio

06751 Semcor Div. Components
Phoenix, Arizona

06860 Gould National Batteries Inc.
City of Industry, California

06980 Eitel-McCullough, Inc.
San Carlos, California

07115 Replaced by 14674

07138 Westinghouse Electric Corp.
Electronic Tube Div.
Elmira, New York

07263 Fairchild Semiconductor
Div. of Fairchild Camera
& Instrument Corp.
Mountain View, California

07344 Bircher Co., Inc.
Rochester, New York

07792 Lerma Engineering Corp.
Northampton, Massachusetts

07910 Continental Device Corp.
Hawthorne, California

08530 Reliance Mica Corp.
Brooklyn, New York

08792 CBS Electronics Semiconductor
Operations-Div. of CBS Inc.
Lowell, Massachusetts

08806 General Electric Co.
Miniature Lamp Dept.
Cleveland, Ohio

08863 Nylomatic Corp.
Norrisville, Pennsylvania

08988 Skottie Electronics Inc.
Archbald, Pennsylvania

09922 Burndy Corp.
Norwalk, Connecticut

11237 Chicago Telephone of Calif. Inc.
South Pasadena, California

11358 CBS Electronics
Div. of CBS Inc.
Newburyport, Massachusetts

11403 Best Products Co.
Chicago, Illinois

11503 Keystone Mfg.
Div. of Avis Industrial Corp.
Warren, Michigan

12014 Chicago Rivet & Machine Co.
Bellwood, Illinois

12040 National Semiconductor Corp.
Danburry, Connecticut

12060 Diodes, Inc.
Chatsworth, California

12136 Philadelphia Handle Co.
Camden, New Jersey

12323 Presin Co., Inc.
Shelton, Connecticut

12327 Freeway Washer & Stamping Co.
Cleveland, Ohio

12400 Replaced by 75042

12617 Hamlin Inc.
Lake Mills, Wisconsin

12697 Clarostat Mfg. Co.
Dover, New Hampshire

12749 James Electronics
Chicago, Illinois

12856 Micrometals
Sierra Madre, California

12954 Dickson Electronics Corp.
Scottsdale, Arizona

13606 Sprague Electric Co.
Transistor Div.
Concord, New Hampshire

13839 Replaced by 23732

14099 Semtech Corp.
Newbury Park, California

14193 California Resistor Corp.
Santa Monica, California

14298 American Components, Inc.
Conshohocken, Pennsylvania

14655 Cornell-Dubilier Electronics
Newark, New Jersey

14674 Corning Glass Works
Corning, New York

14752 Electro Cube Inc.
San Gabriel, California

14869 Replaced by 96853

15636 Elec-Trol Inc.
Northridge, California

15801 Fenwal Electronics Inc.
Framingham, Massachusetts

15818 Amelco Semiconductor
Div. of Teledyne Inc.
Mountain View, California

15849 Useco, Inc.
Mt. Vernon, New York

15909 Replaced by 17870

16332 Replaced by 28478

16473 Cambridge Scientific Ind. Inc.
Cambridge, Maryland

16742 Paramount Plastics
Downey, California

16758 Delco Radio
Div. of General Motors
Kokomo, Indiana

17069 Circuit Structures Lab.
Upland, California

17856 Siliconix, Inc.
Sunnyvale, California

17870 Daven-Div. of Thomas A. Edison
Ind. --McGraw-Edison Co.
Manchester, New Hampshire

18083 Deleted

18178 Vactec Inc.
Maryland Heights, Missouri

18736 Voltronics Corp.
Hanover, New Jersey

19429 Montronics, Inc.
Seattle, Washington

19451 Perine Machinery & Supply Co.
Seattle, Washington

19701 Electra Mfg. Co.
Independence, Kansas

20584 Enochs Mfg. Co.
Indianapolis, Indiana

22767 ITT Semiconductors
Div. of ITT
Palo Alto, California

23732 Tracor
Rockville, Maryland

24248 Southco
Div. of South Chester Corp.
Lester, Pennsylvania

24655 General Radio Co.
West Concord, Massachusetts

25403 Amperex Electronic Corp
Semiconductor & Receiving
Tube Division
Slatersville, Rhode Island

28478 Deltrol Controls Corp.
Milwaukee, Wisconsin

28520 Heyman Mfg. Co.
Kenilworth, New Jersey

30323 Illinois Tool Works Inc.
Chicago, Illinois

33173 General Electric Co.
Tube Dept.
Owensboro, Kentucky

37942 Mallory, P. R., & Co., Inc.
Indianapolis, Indiana

38315 Honeywell Inc.
Precision Meter Div.
Manchester, New Hampshire

42498 National Company
Melrose, Massachusetts

43543 Nytronics Inc.
Transformer Co. Div.
Alpha, New Jersey

44655 Ohmite Mfg. Co.
Skokie, Illinois

49671 Radio Corp. of America
New York, New York

49956 Raytheon Company
Lexington, Maine

53021 Sangamo Electric Co.
Springfield, Illinois

55026 Simpson Electric Company
Chicago, Illinois

56289 Sprague Electric Co.
North Adams, Massachusetts

58474 Superior Electric Co.
Bristol, Connecticut

60399 Torrington Mfg. Co.
Torrington, Connecticut

62460 Deleted

63743 Ward Leonard Electric Co.
Mount Vernon, New York

64834 West Mfg. Co.
San Francisco, California

65092 Weston Instruments Inc.
Newark, New Jersey

66150 Winslow Tele-Tronics Inc.
Asbury Park, New Jersey

70563 Amperite Company
Union City, New Jersey

70903 Belden Mfg. Co.
Chicago, Illinois

71002 Birnbach Radio Co., Inc.
New York, New York

71400 Bussmann Mfg.
Div. of McGraw-Edison Co.
St. Louis, Missouri

71450 CTS Corp.
Elkhart, Indiana

71468 ITT Cannon Electric Inc.
Los Angeles, California

71482 Clare, C. P. & Co.
Chicago, Illinois

71590 Centralab
Div. of Globe Union Inc.
Milwaukee, Wisconsin

71707 Coto Coil Co., Inc.
Providence, Rhode Island

71744 Chicago Miniature Lamp Works
Chicago, Illinois

71785 Cinch Mfg. Co. & Howard
B. Jones Div.
Chicago, Illinois

72005 Driver, Wilbur B., Co.
Newark, New Jersey

72092 Replaced by 06980

72136 Electro Motive Mfg. Co.
Willimantic, Connecticut

72259 Nytronics Inc.
Berkeley Heights, New Jersey

72354 Deleted

72619 Dialight Corp
Brooklyn, New York

72653 G. C. Electronics
Rockford, Illinois

72665 Replaced by 90303

72794 Dzus Fastener Co., Inc.
West Islip, New York

72928 Gudeman Co.
Chicago, Illinois

72982 Erie Tech. Products Inc.
Erie, Pennsylvania

73138 Beckman Instruments Inc.
Helipot Division
Fullerton, California

73293 Hughes Aircraft Co.
Electron Dynamics Div.
Newport Beach, California

73445 Amperex Electronic Corp.
Hicksville, New York

73559 Carling Electric Inc.
Hartford, Connecticut

73586 Circle F Industries
Trenton, New Jersey

73734 Federal Screw Products, Inc.
Chicago, Illinois

73743 Fischer Special Mfg. Co.
Cincinnati, Ohio

73899 JFD Electronics Co.
Brooklyn, New York

73949 Guardian Electric Mfg. Co.
Chicago, Illinois

74199 Quam Nichols Co.
Chicago, Illinois

74217 Radio Switch Corp.
Marlboro, New Jersey

74276 Signalite Inc.
Neptune, New Jersey

74306 Piezo Crystal Co.
Carlisle, Pennsylvania

74542 Hoyt Elect. Instr. Works
Penacook, New Hampshire

74970 Johnson, E. F., Co.
Waseca, Minnesota

75042 IRC Inc.
Philadelphia, Pennsylvania

75376 Kurz-Kasch, Inc.
Dayton, Ohio

75382 Kulka Electric Corp.
Mt. Vernon, New York

75915 Littlefuse Inc.
Des Plaines, Illinois

76854 Oak Mfg. Co.
Crystal Lake, Illinois

77342 Potter & Brumfield
Div. of Amer. Machine & Foundry
Princeton, Indiana

77969 Rubbercraft Corp. of Calif. LTD.
Torrance, California

78189 Shakeproof
Div. of Illinois Tool Works
Elgin, Illinois

78277 Sigma Instruments, Inc.
South Braintree, Massachusetts

78488 Stackpole Carbon Co.
St. Marys, Pennsylvania

78553 Tinnerman Products
Cleveland, Ohio

79136 Waldes Kohinoor Inc.
Long Island City, New York

79497 Western Rubber Company
Goshen, Indiana

79963 Zierick Mfg. Corp.
New Rochelle, New York

80031 Mepco
Div. of Sessions Clock Co.
Morristown, New Jersey

80145 API Instruments Co.
Chesterland, Ohio

80183 Sprague Products
North Adams, Massachusetts

80294 Bourns Inc.
Riverside, California

80583 Hammarlund Co., Inc.
Mars Hill, North Carolina

80640 Stevens, Arnold Inc.
Boston, Massachusetts

81073 Grayhill Inc.
La Grange, Illinois

81312 Winchester Electronics
Div. of Litton Industries
Oakville, Connecticut

81439 Therm-O-Disc Inc.
Mansfield, Ohio

81483 International Rectifier Corp.
El Segundo, California

81590 Korry Mfg. Co.
Seattle, Washington

82376 Deleted

82389 Switchcraft Inc.
Chicago, Illinois

82415 Price Electric Corp.
Frederick, Maryland

82872 Roanwell Corp.
New York, New York

82877 Rotron Mfg. Co., Inc.
Woodstock, New York

82879 ITT Wire & Cable Div.
Pawtucket, Rhode Island

83003 Varo Inc.
Garland, Texas

83298 Bendix Corp.
Electric Power Division
Eatontown, New Jersey

83330 Smith, Herman H., Inc.
Brooklyn, New York

83478 Rubbercraft Corp. of America
New Haven, Connecticut

83594 Burroughs Corp.
Electronic Components Div.
Plainfield, New Jersey

83740 Union Carbide Corp.
Consumer Products Div.
New York, New York

84171 Arco Electronics, Inc.
Great Neck, New York

84411 TRW
Ogallala, Nebraska

86577 Precision Metal Products
Stoneham, Massachusetts

86684 Radio Corp. of America
Electronic Components &
Devices
Harrison, New Jersey

86689 Deleted

87034 Marco-Oak Inc.
Anaheim, California

88419 Use 14655

88690 Replaced by 04217

89536 Fluke, John Mfg. Co., Inc.
Seattle, Washington

89730 Replaced by 08806

90201 Mallory Capacitor Co.
Indianapolis, Indiana

90215 Best Stamp & Mfg. Co.
Kansas City, Missouri

90211 Square D Co.
Chicago, Illinois

90303 Mallory Battery Co.
Tarrytown, New York

91293 Johanson Mfg. Co.
Boonton, New Jersey

91407 Replaced by 58474

91637 Dale Electronics Inc.
Columbus, Nebraska

91662 Elco Corp.
Willow Grove, Pennsylvania

91737 Gremar Mfg. Co., Inc.
Wakefield, Massachusetts

91802 Industrial Devices, Inc.
Edgewater, New Jersey

91836 King's Electronics
Tuckahoe, New York

91929 Honeywell Inc.
Micro Switch Div.
Freeport, Illinois

91934 Miller Electric Co., Inc.
Pawtucket, Rhode Island

93332 Sylvania Electric Products
Semiconductor Products Div.
Woburn, Massachusetts

94145 Replaced by 49956

94154 Tung-Sol
Div. of Wagner Electric Corp.
Newark, New Jersey

95146 Alco Electronics Products Inc.
Lawrence, Massachusetts

95263 Leecraft Mfg. Co.
Long Island City, New York

95264 Replaced by 98278

95275 Vitramon Inc.
Bridgeport, Connecticut

95303 Radio Corp. of America
Solid State & Receiving Tube Div.
Cincinnati, Ohio

95354 Methode Mfg. Corp.
Rolling Meadows, Illinois

95712 Dage Electric Co., Inc.
Franklin, Indiana

95987 Weckesser Co., Inc.
Chicago, Illinois

96733 San Fernando Electric Mfg. Co.
San Fernando, California

96853 Rustrak Instrument Co.
Manchester, New Hampshire

96881 Thomson Industries, Inc.
Manhasset, New York

97540 Master Mobile Mounts
Div. of Whitehall Electronics Corp.
Los Angeles, California

97913 Industrial Electronic Hdware Corp.
New York, New York

97945 White, S. S. Co.
Plastics Div.
New York, New York

97966 Replaced by 11358

98094 Replaced by 49956

98278 Microdot Inc.
Pasadena, California

98291 Sealectro Corp.
Conhex Div
Mamaroneck, New York

98388 Accurate Rubber & Plastics
Culver City, California

98743 Replaced by 12749

98925 Deleted

99120 Plastic Capacitors, Inc.
Chicago, Illinois

99217 Southern Electronics Corp.
Burbank, California

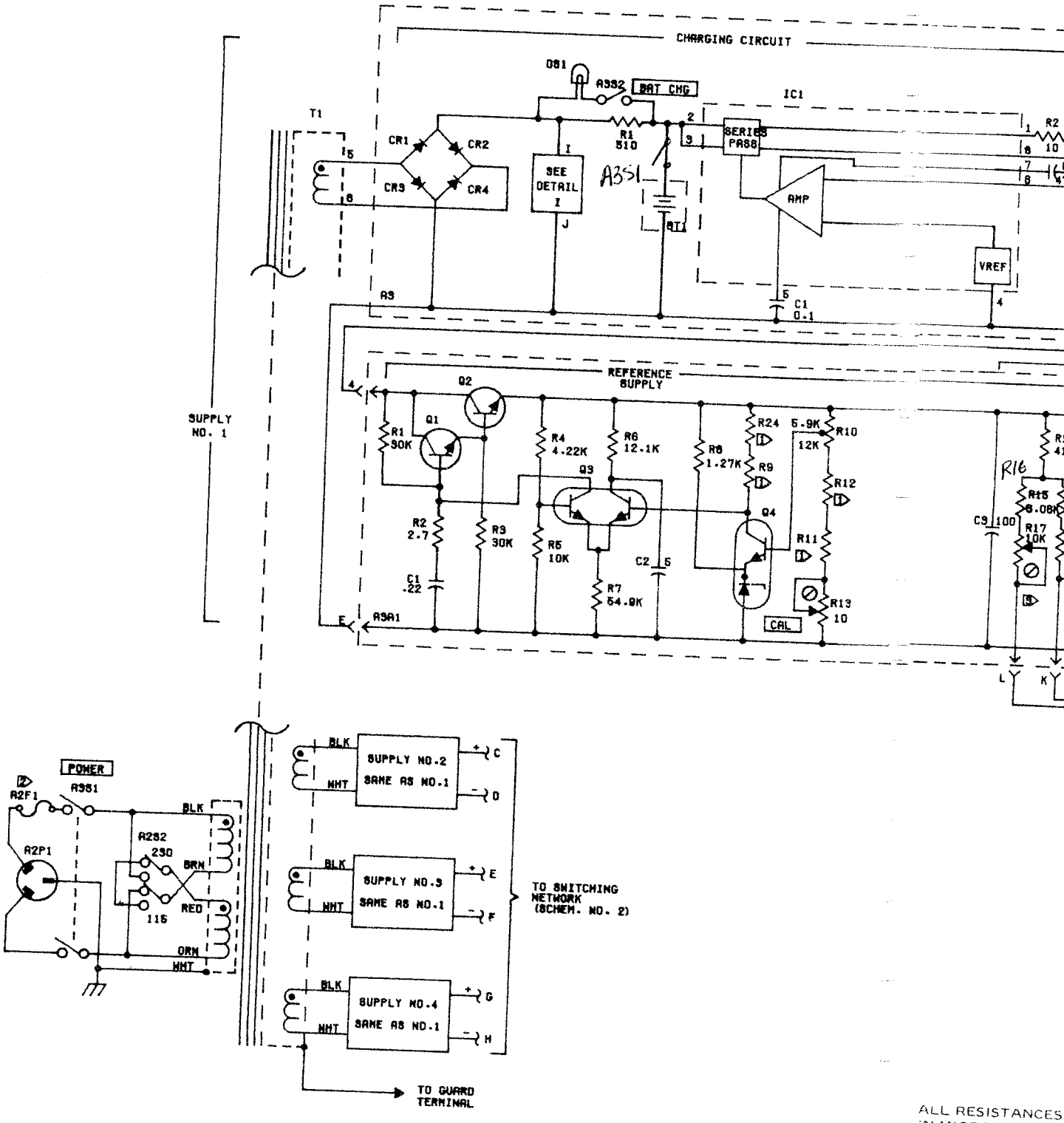
99515 Marshall Industries
Capacitor Div.
Monrovia, California

Revised August 1, 1968
Using H4-1 and H4-2
Dated June, 1968

Appendix B

List of Abbreviations

a, amp	ampere
ampl	amplifier
ac	alternating current
assy	assembly
BCD	binary coded decimal
cap	capacitor
car	carbon
cm	centimeter
C	centigrade
cer	ceramic
cw	clockwise
CMRR	common mode rejection ratio
comp	composition
CCW	counterclockwise
conn	connector
CRT	cathode ray tube
cps	cycles per second
db	decibel
dvm	digital voltmeter
dc	direct current
dpdt	double-pole, double-throw
dpst	double-pole, single-throw
elect	electrolytic
ext	external
F	fahrenheit
f	farad
FET	field effect transistor
flm	film
Ge	germanium
g	giga or 10^9
gnd	ground
gmv	guaranteed minimum value
grd	guard
h	henry
Hz	hertz
hf	high frequency
IC	integrated circuit
if	intermediate frequency
int	internal
kc	kilocycle
k	kilo (10^3)
lf	low frequency
mc	megacycle
M	meg or mega (10^6)
met	metal
MOS	metal oxide silicon
μ	micro or 10^{-6}
m	milli or 10^{-3}
mm	millimeter
n	nano or 10^{-9}
neg	negative
Ω	ohm
osc	oscilloscope
ppm	parts per million
piv	peak inverse voltage
p-p	peak to peak
p	pico or 10^{-12}
plstc	plastic
$\pm$	plus or minus
pos	positive
pps	pulses per second
PCB	printed circuit board
QTY	quantity
rf	radio frequency
rfi	radio frequency interference
REC	recommended
REF	reference
RH	relative humidity
res	resistor
rms	root mean square
rtry	rotary
sec	second
sect	section
S/N	serial number
Si	silicon
scr	silicon controlled rectifier
spdt	single-pole, double-throw
spst	single-pole, single-throw
sw	switch
Ta	tantalum
TC	temperature coefficient
t	tera or 10^{12}
xfmr	transformer
tstr	transistor
tvm	transistor voltmeter
uhf	ultra high frequency
vtvm	vacuum tube voltmeter
var	variable
vhf	very high frequency
vlf	very low frequency
v	volt
VCO	voltage controlled oscillator
w	watt
ww	wire wound



ALL RESISTANCES IN MICROFARADS

DENOTES SC

DENOTES FR

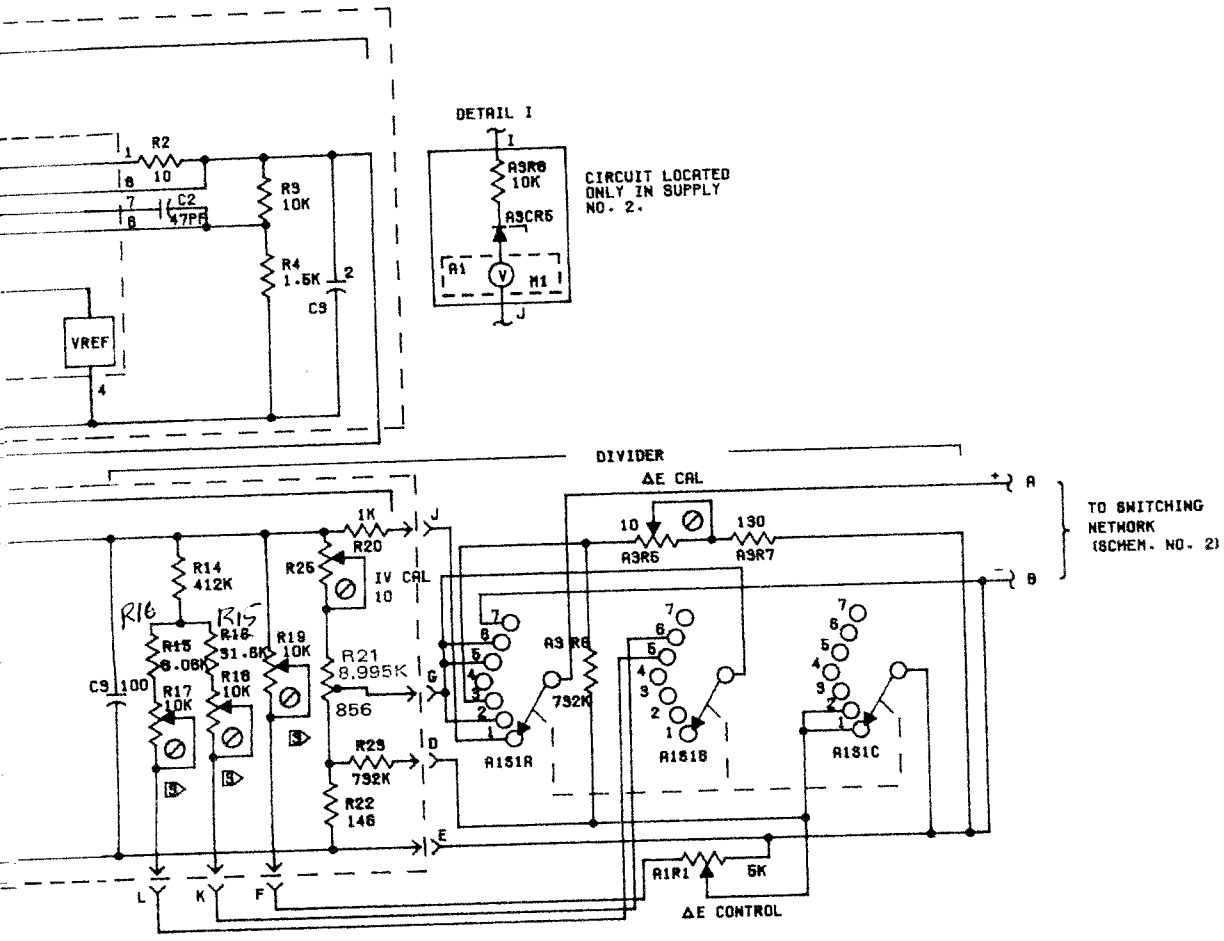
DENOTES SEL

½A @ 115 VA
¼A @ 230 VA

R17 - 1.018 CA
R18 - 1.019 CA
R19 - 1.018/1.0

730A

IC NO. 1



NOTES:

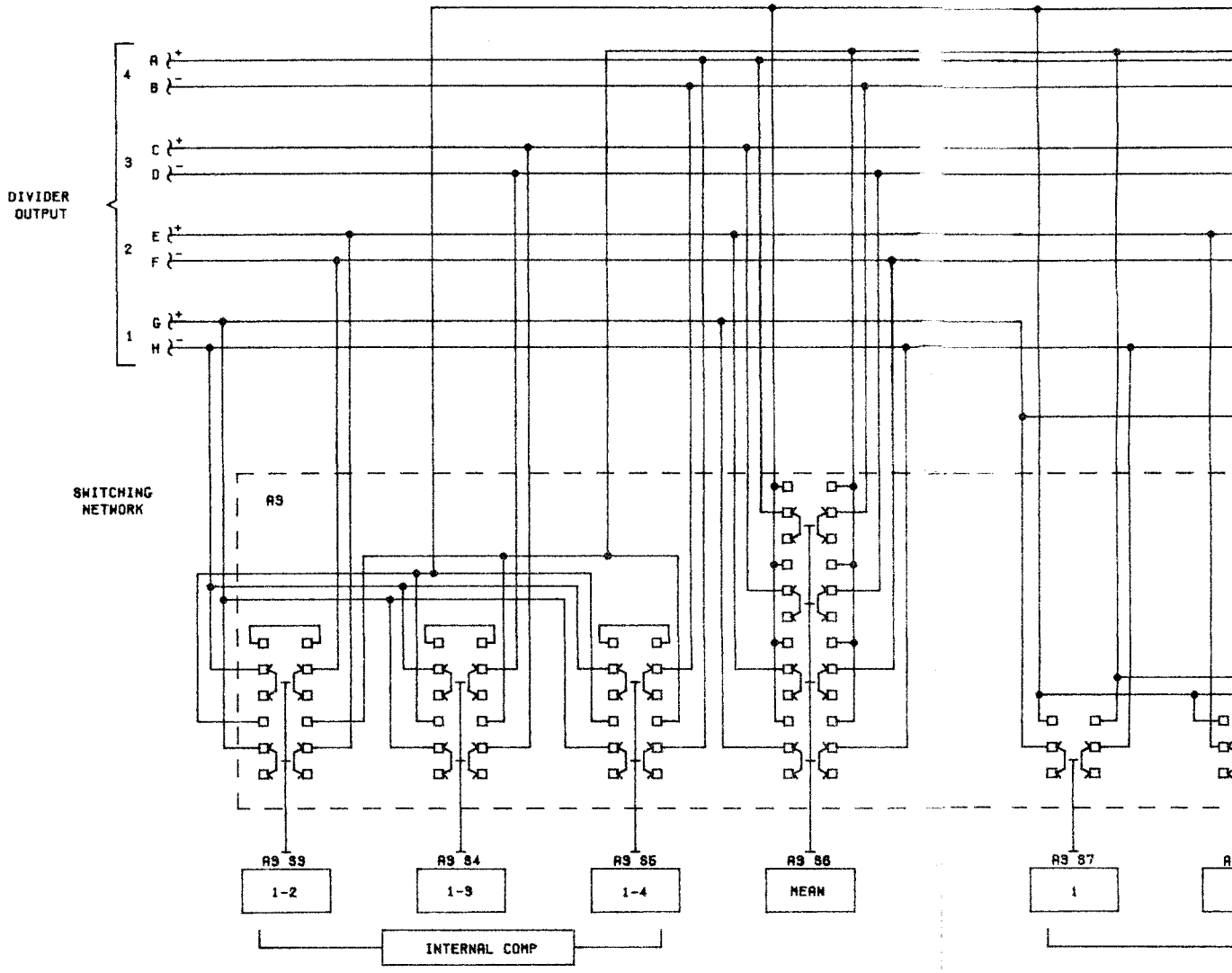
ALL RESISTANCES IN OHMS AND ALL CAPACITANCES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.

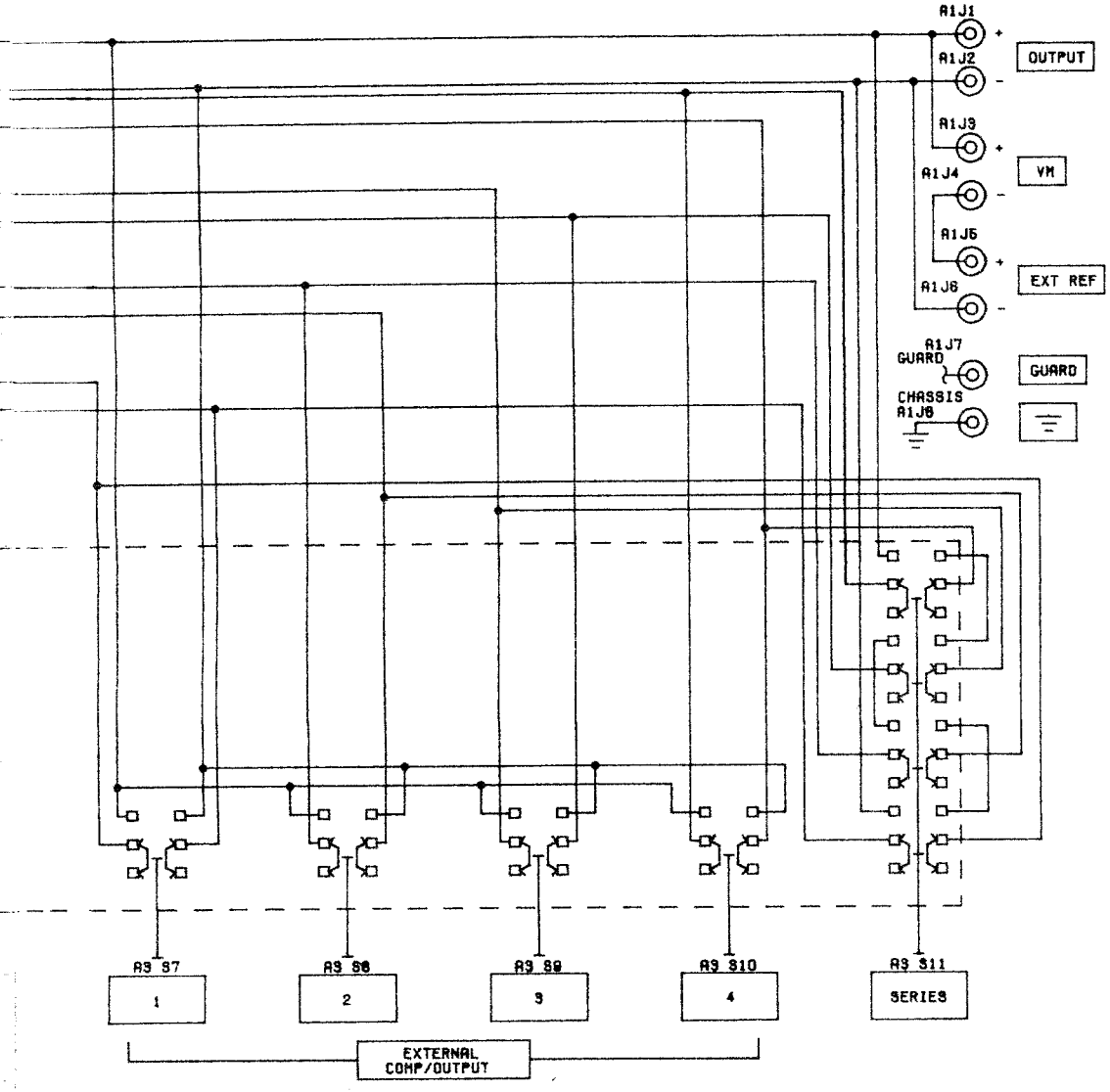
- ⌀ DENOTES SCREWDRIVER ADJUSTMENT.
- ▭ DENOTES FRONT PANEL LOCATION.
- ⟨1⟩ DENOTES SELECTED COMPONENT.
- ⟨5⟩ ½A @ 115 VAC. ⅛A @ 230 VAC
- ⟨3⟩ R17 - 1.018 CAL
  R18 - 1.019 CAL
  R19 - 1.018/1.019 + ΔE CAL

SWITCH S1 POSITION	FUNCTION
1	10V
2	1V
3	ΔE
4	OPEN
5	1.018V + ΔE
6	1.019V + ΔE
7	SHORTED

FUNCTIONAL SCHEMATIC DIAGRAM	
MODEL 730A SCHEMATIC NO. 1	
SER. NO. 123 & ON	REV. a

FLUKE JOHN FLUKE MFG. CO., INC.
P.O. Box 7428 Seattle, Washington 98133


DIVIDER OUTPUT
4
3
2
1
A +
B −
C +
D −
E +
F −
G +
H −
SWITCHING NETWORK
A9
A9 S3
1-2
A9 S4
1-3
A9 S5
1-4
A9 S6
MEAN
A9 S7
1
INTERNAL COMP



REF. DESIG. PREFIX	ASSEMBLY NAME	NEXT HIGHER ASSEMBLY
NONE	CHASSIS	NONE
A1	FRONT PANEL	CHASSIS
A2	REAR PANEL	CHASSIS
A3	MAIN PCB	CHASSIS
A3A1	REFERENCE SUPPLY NO.1	A3
A3A2	REFERENCE SUPPLY NO. 2	A3
A3A3	REFERENCE SUPPLY NO. 3	A3
A3A4	REFERENCE SUPPLY NO. 4	A3

FUNCTIONAL SCHEMATIC DIAGRAM

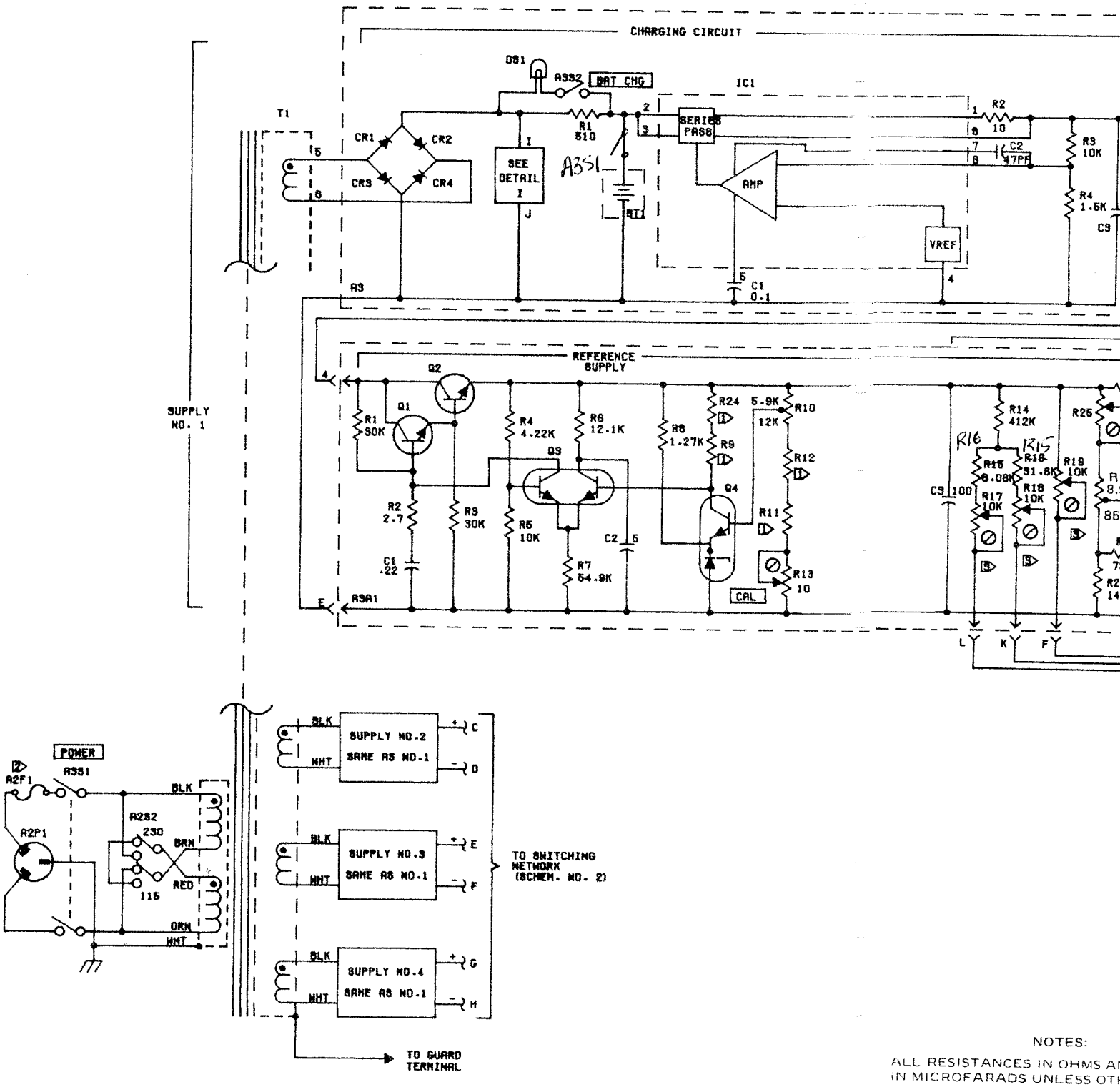
MODEL 730A

SCHEMATIC NO. 2

SER. NO. 123 & ON

REV a

FLUKE JOHN FLUKE MFG. CO., INC.
P.O. Box 7428 Seattle, Washington 98133



NOTES:

ALL RESISTANCES IN OHMS AN
IN MICROFARADS UNLESS OTH

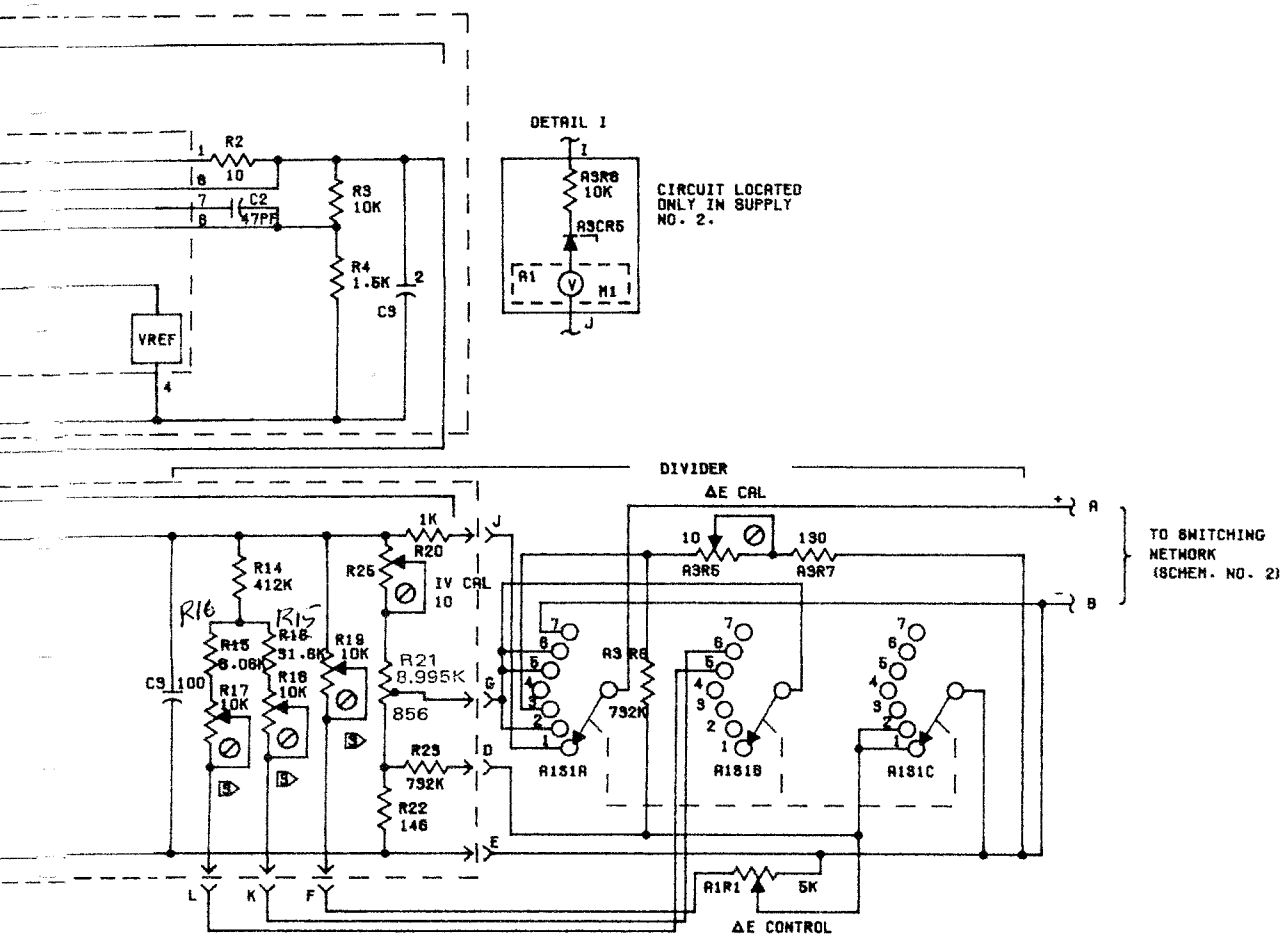
⌀ DENOTES SCREWDRIVER

DENOTES FRONT PANEL

(1) DENOTES SELECTED CO

(2) ½A @ 115 VAC.
¼A @ 230 VAC

(3) R17 - 1.018 CAL
R18 - 1.019 CAL
R19 - 1.018/1.019 + ΔE CA



NOTES:

ALL RESISTANCES IN OHMS AND ALL CAPACITANCES IN MICROFARADS UNLESS OTHERWISE SPECIFIED.

- ⌀ DENOTES SCREWDRIVER ADJUSTMENT.
- ▭ DENOTES FRONT PANEL LOCATION.
- ⟨1⟩ DENOTES SELECTED COMPONENT.
- ⟨2⟩ ½A @ 115 VAC. ¼A @ 230 VAC
- ⟨3⟩ R17 - 1.018 CAL
  R18 - 1.019 CAL
  R19 - 1.018/1.019 + ΔE CAL

SWITCH S1 POSITION	FUNCTION
1	10V
2	1V
3	ΔE
4	OPEN
5	1.018V + ΔE
6	1.019V + ΔE
7	SHORTED

FUNCTIONAL SCHEMATIC DIAGRAM

MODEL 730A

SCHEMATIC NO. 1

SER. NO. 123 & ON

REV a

FLUKE JOHN FLUKE MFG. CO., INC.
P.O. Box 7428 Seattle, Washington 98133